MEDDELELSER OM GRØNLAND

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UDGIVNE AF

KOMMISSIONEN FOR
LEDELSEN AF DE GEOLOGISKE OG GEOGRAFISKE
UNDERSØGELSER I GRØNLAND

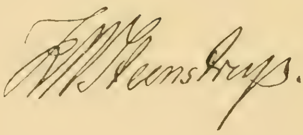
BIND LI

MED ET FOTOTYPI, 15 FIGURBLADE OG 13 TAVLER

KØBENHAVN
I KOMMISSION HOS C. A. REITZEL
BIANCO LUNOS BOGTRYKKERI
1915

INDHOLD

Fotografi. Fred. Riise. Fototypi. Pacht & Crone.



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Knud Johannes Vogelius Steenstrup.

Den 6. Maj 1913 døde Dr. phil. K. J. V. Steenstrup og ved dette Dødsfald mistede Commissionen et skattet Medlem, Grønlandsforskningen en af sine Ypperste. Steenstrup, der var født d. 27. September 1842, var en Brodersøn af den berømte Naturforsker Japetus Steenstrup; efter i 1863 at have taget farmaceutisk Examen, blev han i 1866 ansat som Assistent ved Mineralogisk Musæum, og herved kom han ind paa at sysle med det, der senere blev hans Livsopgave nemlig Grønlandsforskningen.

I 1871 gjorde Steenstrup sin første Rejse til Grønland; i dette Aar sendtes en svensk Expedition under Commandeurkapitain von Otter til Disko for at afhente de Jernblokke, som Nordenskiøld Aaret i Forvejen havde fundet ved Uifak, og Steenstrup blev sendt med for at varetage Mineralogisk Musæums Interesser. 1872 gik Steenstrup igjen til Disko og besøgte ligesom det foregaaende Aar Basaltterrænet og Kulformationen. Resultatet af disse to Aars Undersøgelser var, at Steenstrup bestred Nordenskiøld's Opfattelse af Jernblokkene som Meteorer, og erklærede disse at være af tellurisk Oprindelse, for hvilket han i senere Afhandlinger førte meget fyldestgørende Bevis; denne Steenstrup's Opdagelse vakte en stor Opsigt i den videnskabelige Verden; men foruden nævnte Resultat havde disse to Ophold paa Disko en afgørende Betydning for hans Liv, idet under dem skabtes hans levende Interesse for Grønlands Natur og Befolkning.

I 1874 foretog Steenstrup sin 3. Rejse til Grønland; paa denne ledsagede han Professor Johnstrup til Ivigtut og besøgte de bekendte Minerafindesteder Kangerdluarsuk og andre Fjorde i Julianehaab-Distrikt.

Paa sin 4. Rejse til Grønland i 1876, hvor han var ledsaget af daværende Pr. Lieut. G. Holm og Docent Kornerup, besøgte han de samme Egne som i 74 og hjembragte fra begge Rejser overordentlig værdifulde Samlinger af Mineralier, og undersøgte yderligere paa sin sidste Rejse en Del Ruiner fra Østerbygden.

I 1877 paa sin 5. Rejse til Grønland, hvor han var assisteret af daværende Pr. Lieut. J. A. D. Jensen, kaartlagdes Egnen omkring Frederikshaab fra Tigsaluk til Tiningnertok samt foretoges Maalinger af Isbræernes Bevægelse m. m. i de derliggende Fjorde.

De her nævnte Rejser blev foretagne for Midler bevilgede af Rigsdagen, og da Rejserne havde vakt megen Interesse, blev paa Forslag af afdøde Professor Johnstrup »Commissionen for de geologiske og geografiske Undersøgelser i Grønland« oprettet og fik sin aarlige Bevilling opført paa Finantsloven.

Af nævnte Commission blev Steenstrup i 1878 sendt paa sin 6. Rejse til Grønland, hvor han forblev i 2½ Aar; han undersøgte Torsukatak- og Umanak-Fjord Isstrømme, Kulformationen ved Vaigat, Jernets Forekomst i Basalten; paa Disko og Nugsuak-Halvø indsamlede han Planteforsteninger fra Kridt- og Tertiærtiden og foretog ethnografiske Undersøgelser og Indsamlinger.

Sin 7. Rejse foretog Steenstrup i 1882 ledsaget af Botanikeren Kolderup Rosenvinge for at berejse Strækningen fra Godthaab til Julianehaab og for at indsamle Mineralier i Sodalith-Syeniten til Erstatning for den Samling, der var gaaet tabt ved Christiansborg-Slots Brand; tillige havde Steenstrup den Opgave at indsamle Eudialyt til Kryolithselskabet.

I 1889 blev Steenstrup ansat som Statsgeolog ved »Danmarks geologiske Undersøgelse«, i hvilken Tjeneste han forblev til 1895 og tog et Par Aar senere atter fat paa sine Grønlandsrejser, efter i 1896 at være bleven Medlem af Commissionen.

I 1898 gik Steenstrup paa sin 8. Rejse til Grønland ledsaget af Botanikeren M. Porsild og Maleren Grev H. Moltke for at undersøge det Indre af Disko.

I 1899 gik Steenstrup paa sin 9. og sidste Rejse til Grønland ledsaget af Cand. polyt. Theilgaard for at fortsætte den i 1888 foretagne Indsamling af Eudialyt i Kangerdluarsuk og undersøge den røde Sandsten i Igaliko- og Tunugdliarfik-Fjord.

Med sine 9 Rejser til Grønland og sine Ophold der, har Steenstrup sat Record blandt alle de Officerer og Naturforskere, der har deltaget i de grønlandske Undersøgelser. Resultatet af de 6 sidste Rejser foreligger i »Meddelelserne« og har bidraget deres til den Anseelse, denne Publication nyder.

Blandt de Emner af Grønlands Natur, Befolkning og Historie, Steenstrup har beskæftiget sig med, og til hvis Belysning han har givet særlig værdifulde Bidrag, maa nævnes Kulformationen og Basalten paa Disko og Omegn, Sodalith-Syeniten og den røde Sandsten i Julianehaab-Distrikt, denne Egns geologiske Forhold, Undersøgelse af Gletschere og Isfjelde og — blandt hans historiske Arbejder — Østerbygdens Beliggenhed; som Exempel paa hans Ihærdighed i at samle Oplysninger til de Emner, han behandlede, kan nævnes hans biografiske Meddelelser om Giesecke. I Alt hvad der angik Grønland i Fortid og Nutid var Steenstrup ved sine indgaaende Studier et levende Lexicon, men paa Grund af sin Ulyst til at skrive, er megen Kundskab om grønlandske Forhold gaaet tabt med ham.

Hans Betydning for Danmarks Geologi skal ikke nævnes her, men er betydelig, og i saa Henseende skal kun citeres, hvad der udtales i hans Nekrolog i »Meddelelser fra Dansk Geologisk Forening«:

»Selv om han ikke har skrevet meget om Danmarks Geologi, har disse hans Rejser dog uhyre Betydning ved de mange Indsamlinger, navnlig af Forsteninger, han har foretaget; disse Indsamlinger danner paa flere Punkter et væsentlig Grundlag for Kendskabet til de geologiske Formationer her i Landet«.

Saavel fra Ind- som Udland har Steenstrup modtaget talrige Beviser paa den videnskabelige Agtelse og Anseelse han nød.

I Commissionen var Steenstrup et skattet Medlem paa Grund af sit enestaaende Kendskab til Grønland og grønlandske Forhold; stærkt kritisk og discuterlysten som han var, gjorde han tidt Opposition, men man vidste, at det altid gjaldt Sagen, aldrig personlig Interesse. Uegennytte og Gaaen op i sin Opgave var hans Kendetegn, Selviskhed ham en Vederstyggelighed, og i sin Kritik kunde han med de mest sviende Bemærkninger ramme denne Egenskab hos andre, tidt med megen Humor.

I Commissionen efterlader han et dybt Savn

C. F. Wandel.

A STUDY OF THE DIET AND METABOLISM OF ESKIMOS UNDERTAKEN IN 1908 ON AN EXPEDITION TO GREENLAND

BY

AUGUST KROGH AND MARIE KROGH

1913

Introductory and Narrative of the Expedition.

The investigations described in the present paper were undertaken in 1908 primarily with a view to elucidate if possible a certain point connected with the catabolism of protein, namely the probable splitting up of the protein in a nitrogenous and a non nitrogenous part and the possibility of storing the latter for later use in the organism according to its needs.

We thought that some insight into this process might possibly be gained if the nitrogen and CO_2 output and the oxygen intake were determined in short consecutive periods after the ingestion of large quantities of albumin.

We should then be able to calculate the amount of carbon retained and from the corresponding respiratory quotients conclusions might be drawn with regard to the form in which it was stored. For obvious reasons it would be preferable if such experiments could be made on man, and if it were possible to feed a subject with albumin in excess of his energy requirements we considered that we had a reasonable chance of obtaining definite information.

We had every reason to think that it would be possible to make such experiments on Eskimos. We were told that the Eskimo was able to eat a tremendous amount of pure meat in a very short time (15 pounds in less than 14 hours) and the observations, which one of us had occasion to make during a stay in Greenland several years ago, seemed to corroborate such statements. If they were only approximately correct the complete metabolism of such a quantity in 24 hours appeared inconceivable and it would appear possible to ascertain the form in which the material was stored.

We were for a long time detained from attempting such an investigation by the large difficulties inseparable from making physiological experiments of such a kind in an Arctic country with very bad communications and on subjects who could at best be described as semi-civilized. The very large number of analyses of food, urine and respiratory gases which it would be necessary to make acted also as a deterrent.

In the spring of 1907, however, Dr. Benedict of the Carnegie Nutrition Laboratory visited Copenhagen. One of us had a consultation with him on the plans which we entertained. He was very interested in the plan and offered to have all the samples which could be preserved analysed for us in his large laboratory.

In 1906 a Danish Arctic Station for biological research had been erected near Godhavn on the island Disco (lat. 69°15′ N. long. 53° W.) in West-Greenland. Here was a laboratory which, though not equipped for physiological work, could render assistance on a large number of points. It was managed by our friend, the botanist M. P. Porsild and we were most kindly invited to live and work at the Station.

The whole expedition and investigation was finally made possible by a grant of kr. 4500 from the Danish Carlsberg Fund.

We wish to express our sincerest thanks to the Carlsberg Fund for its liberal grant of money, to Dr. Benedict, Director of the Nutrition Laboratory of Boston for the great aid given us with regard to the analysis of our samples and for valuable advice on a number of points, to Mr. M. P. Porsild, Director of the Danish Arctic Station for his great hospitality and his help in dealing with the natives, to Mr. Nygaard Assistant of the Arctic Station, whose ingenuity and technical skill helped us to overcome several serious difficulties encountered during the erection of our apparatus, and finally to the Administration of the Colonies in Greenland who did all in their power to further our work.

Our final plans were as follows: We would go up to the Arctic Station in the spring and there erect in the open a respiration apparatus constructed beforehand and capable of accomodating two subjects. By means of this chamber we would make experiments of 4—5 days duration with determinations in two to three-hour periods of oxygen intake and CO_2 output. The urine should be collected in similar intervals, measured and samples preserved. The subjects should be fed chiefly on sealmeat, their favourite food, and samples both of the food and the feces collected for subsequent analyses.

These plans were carried through, practically completely, and though we failed to obtain clear and conclusive evidence on the point which we had specially set out to study, the data collected may nevertheless be of some value. They represent the one extremity of that range of dietaries on which man can live and work, namely a diet which is practically exclusively of animal origin and contains an enormous amount of N and a minimum only of carbohydrates, and our observations go to show how little the diet matters after all.

We may perhaps be justified in giving a brief general narrative of the expedition which will show some of the difficulties with which one has to contend in experiments of this kind and explain to some extent why we were unable to accomplish more than we did.

We started from Copenhagen on the 30th of May 1908 in the S/S "Hans Egede" and after visiting several of the trading-stations along the coast we arrived in Egedesminde (Lat. 68°25′ N.) on the 23th of June. By "kayak" the Arctic Station lying 50 miles northwards across the Disco Bay was informed, and three days later in the early morning Mr. Porsild arrived in the motorboat belonging to the Station. The same day we left for Disco. Owing to the bulk of our luggage it was necessary to load a smaller boat with some of it and take it in tow. It became very foggy during the passage and suddenly it was discovered that this boat had become filled and was on the verge of sinking. The goods were immediately transferred to the motorboat but some of our apparatus was damaged and certain pieces belonging to the respiration chamber drifted away in the mist. In the same moment the screw of the motorboat got fouled and we lay helpless.

Fig. 1. The Arctic Station with the respiration chamber in course of construction.

Happily a group of small islets were not far off to leeward. These we succeeded in reaching by sail. The screw and machinery were cleared again, a depot of our apparatus was left, covered over with canvas and after some hours delay we set out again for Godhavn; this time reaching our destination without further mishap. Eskimos were afterwards sent out in kayaks to search for the missing things and by good luck and accurate knowledge of the currents found them.

The Danish Arctic Station distant about a mile from the trading station Godhavn — the residence of the Governor of North Greenland — consists of a small group of buildings. It is intended for biological and chiefly botanical research and not specially adapted for physiological work. It possesses however a small chemical laboratory in which our gas analysis apparatus could be fitted up. The respiration chamber itself was erected near the Station on a piece of comparatively level ground. It was a small hut 2 m × 1.8 m square and 1.85 m high in front. Inside it was fitted up like a real Eskimo hut. The only furniture consisted of a broad couch of boards covered with furs. It was painted in bright colours and gaily decorated everywhere with cheap coloured pictures to keep the subjects in good spirits during their confinement. The front was covered with a tent to protect it and the gas sampling apparatus against rain. Behind the chamber were two tents of which one was used as a laboratory, while the other was to be occupied by our Eskimo assistant and interpreter and a cook to prepare the food of the subjects so far in accordance with their taste as the experimental conditions would allow. The chamber was ventilated by means of a large gas meter acting as a pump and driven by means of the water wheel partly shown on figure 2 which proved to be an efficient and very constant motor. The Arctic Station possessed a sort of water works consisting simply of a barrel put up in a brook about 50 feet above the house. The water main from this vessel was close at hand behind the respiration chamber and provided water for the wheel. The whole of the camp had to be hedged in to protect it against the Eskimo dogs which were lurking about everywhere and whose appetite is not limited to substances generally admitted as eatable. Our chief anxiety was that they might break into the camp at night and eat the leather string connecting the water-wheel with the meter, thereby stopping ventilation. To provide against this contingency a special electric signal was put up which would ring a bell as soon as the string was torn away from the meter. The dogs never got inside the hedge but it was torn away once by a gust of wind.

As we had not had time to put the chamber together before we left Copenhagen we found of course that it was faulty in certain respects and several serious difficulties were encountered. By the resourcefulness of Mr. Nygaard, the assistant at the Arctic Station, all difficulties were overcome and in a fortnight the whole camp was completed and the experiments could begin.

Now arose the problem of getting suitable subjects. It was arranged from the outset to experiment on two persons simultaneously because it was considered impossible to persuade any Eskimo to be alone in the chamber. We offered high wages, but the Eskimos were very unwilling to accept our offers, though the prospect of having only to sit quietly in a hut for four days and getting all they would eat should of itself be rather tempting to them. The difficulty was that the whole affair could not avoid to appear in an extremely comical ligth to the natives. Anybody taking part in it would be sure to

Fig. 2. The respiration chamber with locks and air sampling apparatus. The protecting tent is rolled back on the roof. To the right are the air pipes, mixing vessel, gas meter and part of the water wheel. The two tents and part of the hedge are seen behind. A hose for irrigating the roof with cold water leads from the water main on to the chamber. It was used for cooling purposes when the temperature inside would become uncomfortably high.

be the laughing stock of the place for a long time, and the Eskimos fear being laughed at more than anything else.

Fortunately Godhavn was visited for a day by the famous Arctic traveller Mr. KNUD RASMUSSEN who understands the Eskimo language and the Eskimo mind perfectly and knew personally most of the inhabitants and possessed their confidence. He gave the natives an explanation of the object we had in view which was perhaps slightly beside the point, but which they thought they could understand and appreciate. It was something in the direction of our finding out how it came about that the Eskimos though living chiefly on meat never become gouty like the Europeans.

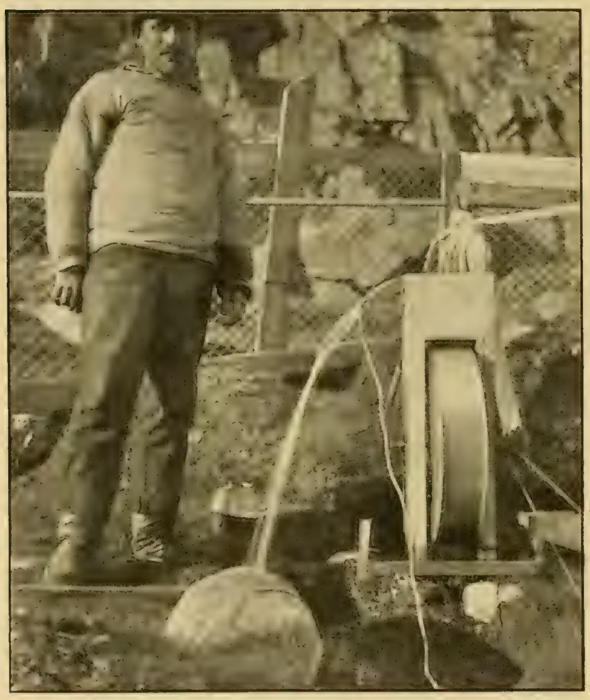

Fig. 3. The Greenland interpreter and assistant standing at the water wheel.

Anyhow he succeeded in persuading them that it was not our intention to make fun of them, and subjects were then forthcoming. Still they had to be treated with a certain consideration and caution and some of the conditions which would have been desirable from the point of view of the experimental results had to be abandoned. They could not for instance be prevailed upon to void urine at stated intervals.

In order both to keep them in good spirits and to produce a copious flow of urine they had a liberal allowance of weak coffee. They were informed beforehand that when they behaved well the stipulated wages would be supplemented by some valuable presents and that, we believe, had a good effect. On the whole we must say that the natives behaved admirably and did their part of the work very carefully, and this applies especially to our interpreter and assistant FR. THYGESEN who had indeed no easy task in explaining to the subjects all our incomprehensible instructions and preventing the rise of misunderstandings between them and us.

We made four series of experiments, each on two subjects. Our first two subjects were females, the other males. During each series the subjects were confined in the respiration chamber for the whole of the time, that is about 4 days. The first series showed some defects in the arrangements and working, and we found especially that on sunny days with little wind the temperature in the chamber might rise to such a height as to be uncomfortable. A cooling arrangement was therefore provided. During the three last series everything went well. The amount of work which we had to perform during the experiments was rather large, and we could not do so much as we wished to. A regular watch was held throughout the day but during the

Fig. 4. before going in — The female subjects — Fig. 5. after coming out.

night one respiration period was arranged to last from about 10 to about 3, and during that time one of us slept in a sleeping bag in the laboratory tent.

In addition to the work of attending the experiment, sampling and weighing foods, urine etc., about 20 gas analyses of the greatest possible accuracy had to be made each day during the experiment, while about 40—50 samples were left for analysis afterwards. We made, moreover, a considerable number of urea determinations on the urine by means of the Esbach method in order to obtain a provisional idea of the results and also with a view to utilizing them in case some of the samples should be lost during the long transport from Greenland to Copenhagen and from here to Boston.

During the first three series we had the advantage of the continuous arctic day and a comparatively high temperature but during the last experiment we were obliged to use artificial light at night. On one night we had a considerable fall of snow and on another the temperature came so near to zero that we began to entertain fears for the water in the gas meter. The increasing darkness and the fall in temperature prevented us from doing any more experiments.

When on the 15th August we began to take down the camp and pack the samples for shipment we could, moreover, expect the steamer on which we should return almost any day. It arrived in fact on the 20th but was then on its way North to Umanak and it was not before the 29th that we embarked for Copenhagen.

Fig. 6. Two male subjects A. M. and B. W.

The arctic mosquitos deserve to be specially mentioned because they obstructed and hampered the work a great deal. On still and hot days during July they will surround every man or animal as a thick cloud and they are a very blood-thirsty and cunning race. If for instance one attempts to protect the hands with gloves they will speedily find the stitches and work in rows along the seams. It is exceedingly difficult to concentrate the attention on making accurate observations and readings in the presence of any considerable number of these animals.

The dietary and normal metabolism of Eskimos.

The Eskimos are probably the most exquisitely carnivorous people on earth, living, as most of them do, almost exclusively on meat and fish. At the Danish trading stations bread and flour can be bought, but the Eskimos living at a distance from these places use very little of it and may for long periods be absolutely without vegetable food. The only indigenous food plants are whortle berries (*Vaccinium uliginosum*), *Angelica officinalis* and a few seaweeds. The whortle berries ripen about the end of August and are sometimes eaten in considerable quantities during the autumn but as a rule they are swallowed like pills and pass through the intestines almost or wholly unaltered. Of *Angelica* the young shoots are eaten as a delicacy in July. It is of no importance quantitatively. Seaweeds (*Laminaria* and some *Rhodophyceae*) are eaten together with mussels when no other food is obtainable but "to live off the beach" means to be utterly destitute. A few Eskimos like seaweeds and eat them when they can get them. When we have mentioned further that the half digested debris of plants found in the stomach of the Reindeer is much liked by the Eskimos, but comparatively seldom obtainable, we have exhausted the list of Eskimo vegetables.

Their chief and favourite food the Eskimos get from the seals. They eat the meat, the liver[1], the blood and some of the blubber. The seal meat is very dark, almost black (probably from a large content of hæmoglobin). It contains in the fresh state about 19 $^0/_0$ albumin. It may be rich in glycogen (2—4 $^0/_0$)[2] and it contains very little visible, but, as Dr. Benedicts' analyses go to show, a large percentage of invisible fat (6—10 $^0/_0$). The Eskimos simply boil it together with a little blubber (sometimes in sea water) by which process it contracts and loses weight. 1 kg fresh seal meat will give 0.77 kg boiled meat. It is generally eaten without addition of any kind. Besides the seals the Eskimos eat the meat of Reindeer, Walruses and Whales. Whales abound but are not regularly caught. It is customary to shoot at any whale coming near enough. There is always the chance that it may die from the wounds and the carcass drift on to the shore and be found. The skin of young whales is considered a special delicacy. It has been examined recently by Bertelsen[3] and found to contain an extraordinary large proportion of glycogen.

[1] The liver of one of the seals (*Phoca barbata*) and also of the Polar Bear are rejected by the Eskimos because they are poisonous, and the dogs likewise will not eat them. Cases of poisoning with bear liver have been observed repeatedly by arctic travellers and the clinical symptoms have been studied by Lindhard on the Danish Expedition to the North East coast of Greenland and described (in Danish) in Hospitalstidende *1910*, p. 338—44. 19 men became ill after eating bear liver — to try if it were poisonous — showing symptoms pointing to a primary affection of the central nervous system and probably also of the skin (desquamation of epidermis after 2 to 3 days). This last named symptom has been observed repeatedly and also after eating the liver of *Phoca barbata*. According to recent experience by the arctic travellers Mikkelsen and Iversen the liver of dogs (Eskimo dogs) appears to possess the same poisonous qualities. A toxicological examination of these livers would be of considerable interest.

[2] We have no direct determinations of the glycogen, but when we compare the heats of combustion of the samples with the amounts of N and crude fat found in them we find an excess of energy which must probably be ascribed to glycogen.

[3] Hospitalstidende, Bd. *54*, 1911, p. 537: Animalske Antiscorbutica i Grønland. The epidermis of Narwhale and Whitewhale (*Monodon monoceros* and *Beluga leucas*) is 12—15 mm. thick. In the stratum corneum of 2—3 mm. thickness and also in the deepest layer round the papillæ there is comparatively little glycogen. But in the middle layers the cells are filled with glycogen granulations

Of birds they get a number, chiefly eiderducks and gulls and in the season they sometimes eat enormous quantities of eggs of these birds. The eggs are eaten raw, and it does not matter at all if they have been brooded for a considerable time; the birds are boiled, generally together with a little barley.

The principal food fishes are: Salmon, Cod, Greenland Halibut and Sea scorpion, but above all the Capelan (*Mallotus arcticus*, Eskimo: Angmagsset) a small fish belonging to the salmon family which visits the shores in enormous numbers for a short time in July and which is then taken by hand or by means of very simple catchers used from the shore. Rather considerable quantities of these fishes are dried on the cliffs without undergoing any preparation and are stored for use in times of scarcity.

Of stimulants the Eskimos get very little. They are extremely fond of coffee the consumption of which has risen from 2,4 kg. pro adult pro year in 1855 to over 4 kg. in 1900. Alcohol is much appreciated by the men but thanks to the provisions of a paternal and well intentioned government they are not allowed to obtain it except on rare occasions and in very small quantities.

In 1855 Rink made a statistical study of the food consumed during a year by the Eskimos in the Southern Inspectorate in Greenland comprising the coast from Cape Farewell to about 67° N. In this district there are practically no domesticated animals to share the food, while in the North, where dog sledges are extensively used, it would be impossible to say how much had been eaten by dogs and how much by men.

It is is obvious that the difficulties inseparable from such a research must be very great and the accuracy cannot be considerable, but it must be remembered on the other hand that Rink was an extremely careful observer and had the best information obtainable at his disposal[1].

According to Rink there were in 1855 6100 Eskimos in the Southern Inspectorate of which about 40 % were below 15 years while only about 3 % were above 60 years. 48 % were males and 52 females. The indigenous food available during the year, after deduction of the quantities sold, amounted to 2.200000 kg. meat and fat, of which 1.750000 kg. were seal meat, further 2.000000 kg. fish, of which 1.250000 kg. capelan (Angmagsset), 200000 eggs and about 100000 kg. berries (*Vaccinium*). The quantities of mussels, seaweeds and "kvan" (Angelica) were uncontrollable.

and concretions. These layers and also the raw liver of seals have been recognized by the Eskimos as sure means against scorbut and their therepeutical value has been fully confirmed by the medical officers in Greenland.

[1] The account given is taken from the Danish edition of Rink's book: Grønland, Bd. II. Det sydlige Inspektorat, Kbhvn. 1857. Corresponding but not so detailed data are given in: Rink: Danish Greenland. London 1877.

The European food bought amounted to:

50000 kg bread and flour
10000 kg barley and peas
10000 kg sugar
12000 kg coffee

If we take the population (6100) as corresponding to 5000 adults we find for one individual:

	pro year kg.	per day gr.
Seal meat	350	960
Other meat	90	250
Capelan	250	690
Other fish	150	410
Eggs (à 50 gr.)	2	6
Berries	20	55
Bread	10	27
Beans	2	6
Sugar	2	6
Coffee	2,4	6,5

The quantities of native food must be considered as the available quantities from which something must be deduced to account for bones etc. and for waste in the preparation and during preservation in the case of fish. In the table given below the list of articles is somewhat simplified and what we consider as probable figures for the food actually eaten are put in. With regard to the fish especially the assumed loss of about 50 % is of course somewhat uncertain. The capelans are eaten with bones, skin and all, and the loss should consequently be small but of these fishes a considerable part is no doubt lost during the time they are kept in a preserved state. Other fishes are eaten fresh and prepared in about the same manner as among civilized people. The loss is therefore probably about the same.

The compositions given in the table have been calculated partly from our analyses of the seal meat and allowing for the fact that some blubber is eaten along with the meat. This correction is somewhat uncertain and the quantities of fat eaten may have been underestimated. The composition of the bread is that usually assumed. With regard to the fish the protein content cannot be far wrong as that is practically the same in all food fishes. The percentage of fat is rather doubtful. We have analysed a sample of capelan taken during the breeding season and found only 1 % ether extract, but some of the other food fishes, especially salmon and Greenland halibut, contain a large proportion of fat.

Though the figures here given may easily be 10 % and possibly even 20 % wrong or more, the main result cannot be doubted. The food of the Eskimos, while containing a normal amount of energy, is extremely rich in protein and fat, and contains an exceedingly small amount of carbohydrate, of which moreover about ½ is represented by glycogen contained in the meat[1].

	Album. %	Fat %	Carbo-hydr. %	Weight eaten gr.	Total gr. Album. gr.	Fat gr.	Carbo-hydr. gr.	Calories
Meat	19	12	3	1000	190	120	30	....
Fish	18	3	...	500	90	15	..	....
Bread	6	1	50	36	2	...	18	....
Sugar	..	..	100	6	...	...	6	....
					282	135	54	2640

The food of the Eskimos is by no means regularly forthcoming but times of abundance alternate with periods when seals are scarce or even unobtainable. The other sources of supply may also give out occassionally in winter and, as the Eskimos are extremely improvident, times of actual, though never complete, starvation are not unfrequent. The Eskimos prepare for such times chiefly by laying up stores of fat in their bodies during the time of plenty. Rink expresses the opinion that young and robust people may during several months when seals are abundant eat 4 kg. meat per day or even more.

The dietary habits of Eskimos present an extremely close analogy to those of the large carnivorous animals. An Eskimo seal hunter will rise early in the morning and take no food except a cup of water, soup or nowadays generally coffee. He will go out to hunt either without food or provided with a small lump of dried or frozen meat. He will return in the afternoon (generally about 3 or 4) and as soon as the meat can be got ready he will fill himself to the limit of his capacity and then lie down to sleep for a couple of hours. After that he will talk and enjoy himself and generally he will take another meal before turning in and for this last meal of the day fish is often preferred even if meat is at hand.

On sledge journeys during the winter in the North the same dietary habits are observed. The provisions on such journeys consist of dry or frozen meat and blubber. When a full meal of frozen meat (tp. —30° C. or lower) is taken at night the first effect is a feeling of extreme cold with much shivering but half an hour later the heat producing

[1] Since Rink's time the use of bread as an article of diet has steadily increased among the Eskimos, and the average consumption of bread would now probably amount to 200 gr. per day.

effects begin to manifest themselves, and the Eskimos and their dogs, which are fed in the same way and with the same results, are able to sleep in the open on such nights with only the sledges put up as a shelter against the wind. The increased metabolism due to the albuminous substances and independent of muscular actions may be of vital importance to the organism on such occasions.

It may be of some interest to examine the mental and bodily qualities of the Eskimos, to see whether any influence of the peculiar diet is detectable.

They are of short stature (Mean height men 1.60 m., women 1.50 m.) well built and with a distinct disposition to become fat. They are capable of hard and prolonged muscular work but not mentally disposed for it. They possess an extraordinary power of enduring cold and hardships but this must no doubt be ascribed chiefly to the climatic and social conditions and only to a limited extent to the diet.

The state of health in Greenland is on the whole rather good though the climate and the extremely unhygienic native dwellings are responsible for a great deal of rheumatism, affecting muscles and nerves, and also for some more serious diseases.

With regard to diseases which can be or must be connected with the diet it is especially noteworthy that uric acid diseases are practically absent in spite of the animal and nuclein rich food.

Periods with abundant food are characterised by outbreaks of furunculosis, and it has been noticed further by medical officers and also by the natives themselves that in such periods many of them become extremely liable to profuse and frequent bleedings from the nose[1].

With regard to the mental faculties it is a notable feature that the Eskimos are probably the most peaceful and unwarlike race in the world. It is hardly in accordance with common belief that the corollary of a carnivorous diet and a hunting life should be the absolute mental incapability of dealing a blow to a fellow man, but so it is in Greenland. As far as can be ascertained they quarrel very little among themselves and that any quarrel, even the most serious, should lead to blows is absolutely unthinkable in Greenland. If an Eskimo becomes disgusted with another he will simply avoid him and if necessary go away and fix his abode elsewhere. Formerly it was customary to meet together at great feasts and there to settle quarrels by songs, in which each characterized the other part according to his ability. The man who could get his adversary most laughed at by the audience was the victor, but even such performances never led to blows.

[1] We are indebted to Dr. Deichmann, late medical officer in Greenland, for most valuable information with regard to the diet of Eskimos and its influence upon health.

Methodics.

1. The respiration experiments.

Our respiration chamber was constructed mainly on the Jaquet principle. A current of air was sucked out at an approximately constant rate, while fresh air was allowed to enter through the leaks in the chamber, which was so far tightened that a slight negative pressure of about 1 mm. water was maintained. The air current was produced and measured by the revolutions of a large gas meter. Continuous samples representing the average composition of the outgoing air for certain periods were collected and afterwards analysed for carbon dioxide and oxygen, and from these analyses, combined with the analyses of the atmospheric air entering the chamber and the corresponding volumes of air, the respiratory exchange of the subjects was calculated. As however our respiration chamber was rather large (5.2 m³.) we found it necessary to take into account also the changes in composition of the air in the chamber. Intermediate samples showing the composition of the air in the chamber at the moment were therefore drawn at the end of each period.

Fig. 7. The respiration chamber in course of erection.

By the construction of the apparatus it had to be borne in mind that it should be erected in the open and had to be carried by hand over rough ground for a considerable distance. The chamber was therefore made of a framework of wood covered with large plates of painted compoboard. These were put on with a large number of screws and tightened by rubber bands and by means of a special substance known under the technical name of ruberine. Windows were provided in front and on both sides. The entrance was effected through an air lock sufficiently large to hold one person, and a smaller lock (about 1 cb. foot) served for the introduction of food etc. To guard against the possibility of the internal doors of the locks being opened by the subjects without permission or order these doors were connected with an electric signal.

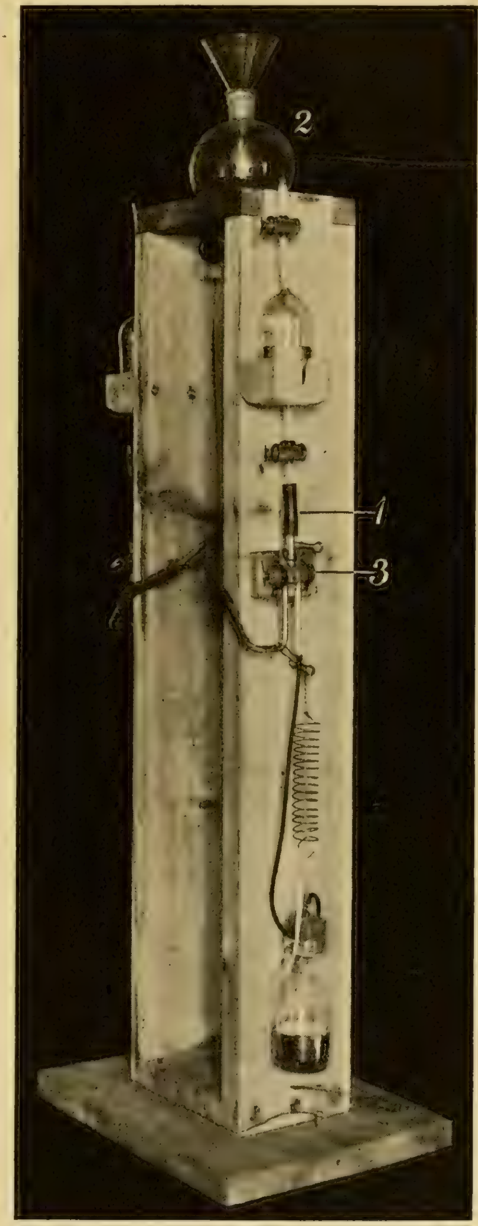

Fig. 8. The gas sampling apparatus.

In the chamber was placed wet and dry bulb thermometers which could be read through one of the windows. The air was sucked out through two 1½ inch openings placed on opposite walls one near the floor and the other at the ceiling. The two pipes led to a cylindrical vessel of about 30 l. capacity where the currents were mixed and surplus of water vapour condensed. A short tube also of 1½ inch diameter connected this vessel with the gas meter. The meter was an ordinary 50 candle wet meter, the drum of which was carefully calibrated to take 4 cb. foot per revolution. It could be read to 1 cb. foot. A constant level was maintained throughout by means of a fine jet of water and an overflow opening. The shaft of the drum was prolonged and provided with a large pulley, and the meter worked as a pump and was driven by the water wheel. This was fed from a small constant level reservoir. The meter was protected against direct sunlight but could not of course be kept at a constant temperature. On account of the large quantity of water in it, the changes were, however, comparatively slow. From the pipe between the mixing vessel and the meter a piece of very narrow lead-tubing led to a sampling vessel. The sampling apparatus consisted of two sampling vessels of 100 cc. capacity each, mounted on a stand (fig. 8). The vessels could be inserted in the short pieces of rubber tubing (1) and filled from the receiver (2) through the three-way tap (3). Through the second boring of this tap connection was established with a narrow rubber tube ending in a finely pointed glass tube through which the mercury could flow out. The resistance in the point of the tube was regulated in such a way that the 100 cc. of mercury would take a suitable time (2—6 hours) to flow out. In order to maintain a constant rate of flow the glass tube was inserted in the cork of a bottle in which the outflowing mercury was collected and each bottle was suspended by means of a spring. The weight of the mercury would lengthen the spring to such an extent that the vertical distance between the level of mercury in the sampling vessel and the bottle would remain practically unaltered. When the bottle was so far lowered that the sampling vessel was nearly empty it would make an electric contact and ring a bell. By this signal the operator was called and the corresponding period of the respiration experiment was then brought to a close. The sampling vessel was closed and the lead tube transferred to that on the other side. The thermometers in the chamber and the meter were read. The meter itself was read and the exact time noted. Samples of atmospheric air and samples of the air in the chamber were taken immediately afterwards. These samples were taken in dry medicine bottles of 30 and 50 cc. capacity. By means of the arrangement shown in fig. 9 a current of air was passed through them. The glass tube was narrowed to such an extent that a considerable pressure was obtained in the blower. The bottle was accordingly washed out by a uniform but comparatively slow current of the air to be sampled and a cork soaked in paraffin wax inserted immediately on withdrawal of the tube. It is essential when taking samples in this manner, of air, differing in composition from the surrounding atmosphere, that the current at the mouth of the tube is slow and uniform. Otherwise it will on withdrawal act as a jet, and the sample in the bottle will be-

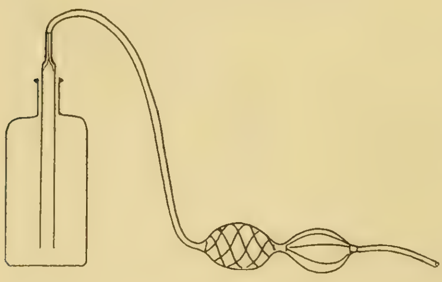

Fig. 9.

come more or less vitiated by atmospheric air. The sample of air from the chamber was taken from the outgoing pipe, a special trial having shown that an average sample was best obtained in this way.

The gas samples were analysed by means of the HALDANE apparatus which one of us has employed for a number of years. It is read to 0.005 % and the accuracy corresponds to about 0.01 % both for oxygen and carbon dioxide. The analyses of the continuous samples were always made in duplicate and repeated anew if the agreement was not satisfactory. From the samples taken in medicine bottles only single analyses were made.

During a series of analyses some dirt will accumulate in the burette while the amount of moisture will become diminished. This causes small errors and the first and last analysis of a series of 20 or 30 are not strictly comparable. To avoid serious errors on this account the analyses of the outside air were in most cases taken alternately with the corresponding analyses of air from the sampling apparatus, while the samples from the chamber were analysed in a single series after the close of each complete experiment.

2. The calculation of the respiratory exchange.

The data from which to calculate the respiratory exchange of the subjects during a period are:

1. The quantity of air shown by the meter to have passed through the chamber during the period. This quantity reduced to 0°, 760 mm. and dryness is denoted B.

2. The volumes of air enclosed in the chamber at the beginning and end of each period are likewise reduced to 0°, 760 mm. and dryness, but allowance must be made in this case for the fact that the air is not saturated with moisture. For this purpose the psychrometric table in LANDOLT BÖRNSTEIN: Physikalisch Chem. Tabellen was employed. The reduced quantities are denoted C and D respectively.

3. The percentage of O_2, CO_2 and N_2 in the outgoing air (B). The results of the duplicate analyses are calculated to three decimal places and averaged. The percentages are denoted o_B, c_B and n_B.

4. The percentages of O_2, CO_2 and N_2 in the outside air o_A, c_A, n_A. To find these, curves are constructed from all the analyses and smoothed graphically. The percentages to be used in each period are taken from the curves[1].

5. The percentages of the gases in the samples from the chamber are denoted o_C, c_C, n_C and o_D, c_D and n_D.

[1] The variations observed in the composition of the atmospheric air are small (not exceeding 0.02 during one experiment) but even as they are they may very possibly be unreal.

The calculation of the respiratory exchange is complicated by the fact that the quantity of air entering the chamber from outside A is not identical with the quantity found as outgoing, because the volume of CO_2 produced is generally different from the volume of O_2 consumed. As however the quantity of nitrogen is not affected by the respiratory processes it becomes possible to calculate the volume of outside air which must have entered in order to make up the quantity present.

We have therefore:

$$A \times n_A = B n_B + D n_D - C n_C$$

or

$$A = B \frac{n_B}{n_A} + D \frac{n_D}{n_A} - C \frac{n_C}{n_A}.$$

The quantity of CO_2 produced during a period must be the difference between the quantities in the outgoing and ingoing air as expressed by:

$$B c_B - A c_A + D c_D - C c_C$$

or when the above value for A is put in:

$$B \left(c_B - c_A \frac{n_B}{n_A}\right) + D c_D + C c_C + c_A \left(D \frac{n_D}{n_A} - C \frac{n_C}{n_A}\right).$$

As however c_A is always very small (about 0.03) and practically constant and as the factor $\frac{n_B}{n_A}$ and the analogous can vary only between 0.9994 and 1.003 we may with quite sufficient accuracy put the CO_2 as equal to:

$$B (c_B - c_A) + D c_D - C c_C.$$

The quantity of oxygen consumed is expressed by:

$$A o_A - B o_B + C o_C - D o_D$$

$$= B \left(\frac{n_B}{n_A} o_A - o_B\right) + D \left(\frac{n_D}{n_A} o_A - o_D\right) - C \left(\frac{n_C}{n_A} o_A - o_C\right).$$

The expression $\frac{n_B}{n_A} o_A - o_B$ and the analogous are transformed by addition and subtraction of o_A to:

$$o_A - o_B + o_A \left(\frac{n_B}{n_A} - 1\right) \text{ and the analogous.}$$

A small table has been worked out showing the values of the last term corresponding to the different values which n_B, n_C and n_D may assume and we have therefore the amount of oxygen consumed as:

$$B (o_A - o_B + \text{corr.}_1) + D (o_A - o_D + \text{corr.}_2) - C (o_A - o_C + \text{corr.}_3)$$

where the corrections are put in from the table.

From the quantities of O_2 and CO_2 consumed and produced during a period the corresponding quantities per hour are calculated and also the respiratory quotient.

3. Accuracy and sources of error in the respiration experiments.

As the respiration chamber was scarcely completed when we had to start for Greenland we were unfortunately prevented from carrying out any experimental tests at home. We attempted to test it in Greenland but the resources there at our disposal did not allow any very effective tests being made.

We tried to determine the CO_2 and the O_2 deficit arising from the combustion of a definite quantity of alcohol, but failed because the combustion was not quite complete and the traces of alcohol vapour present in the air made accurate gas analyses absolutely impossible.

We produced a certain amount of CO_2 inside the chamber from acid and bicarbonate of soda and found it again in the outgoing air with only a slight absolute error, but the quantity evolved was altogether too small for the test to be conclusive.

We have therefore since our return made some test experiments on a smaller apparatus constructed and worked on the same principles as that used in Greenland. We have used a box of about 200 liters capacity out of which we have sucked a current of air of about 17 liter per minute by means of a gasmeter acting as a pump, thereby causing a negative pressure amounting to 1.2—1.4 mm. of water. CO_2 was admitted into the box and measured by means of a small meter. The current of CO_2 was varied extensively during the experiments to imitate as far as possible the actual experimental conditions.

The sampling of the air in the box was performed as in the Greenland experiments with this difference only that the analyses of the air in the box at the beginning and end of each period were done in duplicate because the box was much larger in proportion to the ventilation during each period than was the case in Greenland. The mixing of the air produced in actual experiments by the respirations and movements of the subjects was in the test experiments performed by a small electric fan.

The table shows the presense of a systematic error amounting to about 2.5 % and accidental errors of 1—1.5 %. The systematic error must be due to diffusion of CO_2 out from the box, while the accidental correspond closely to the unavoidable inaccuracies of the gas analyses.

The systematic error caused by diffusion in the Greenland experiments is unknown but it may safely be assumed to be less than 2.5 % and is probably something like 1 %.

Table of test experiments.

Time	Ventilation liters	CO_2 in surrounding air %	CO_2 in chamber %	CO_2 in outgoing air %	CO_2 found liters	CO_2 admitted l.	% found
1^{46}	.....	0.06, 0.05	0.052				
	511.2	......	......	0.960	7.024	7.30	96.2
2^{16}	.....	0·05	1.345				
	426.0	......	......	1.265	5.024	5.10	98.5
2^{41}	.....	0.04	1.260				
	596.4	......	......	1.945	13.89	14.19	97.7
3^{16}	.....	0.055	2.675				
		0.052		1.4	25.94	26.59	97.6

Loss of CO_2 per hour 0.43.

The surface of the respiration chamber was about 10 times that of the box and the mean percentage of CO about 0.6 %. The actual loss per hour through identical walls should therefore be $\frac{4.3 \times 0.6}{1.4}$ 1.84 liter, but as the walls were about 4 times thicker and of much tighter material it cannot be put higher than 0.5 l. or 1 % of the mean production of CO_2 per hour.

It is probable that there is a similar systematic error in the oxygen values but on this point we have no experimental evidence. If the O_2 diffusion is different from that of CO_2 a systematic error in the respiratory quotient must result, but such an error will obviously be very small.

The accidental errors in the test experiments are caused exclusively by the analytical errors as both the air current and the sampling were absolutely uniform. In the Greenland experiments the analytical errors were smaller absolutely, but in relation to the percentage of CO_2 they were of about the same magnitude. Errors of about 1—2 % must therefore be expected but, besides these, slight errors may arise from want of correspondence between the meter and the sampling arrangement. The revolutions of the meter ought to have governed the sampling after the manner adopted by Zuntz. We had the sampling independent of the meter and could only obtain quite accurate results if both were working at a uniform rate. The influence of even large deviations is however surprisingly small.

If we assume f. inst. that during an experimental period of 2 hours the ventilation is suddenly increased 20 per cent after 1 hour, while the gas exchange and sampling remain constant, the resulting error in the gas exchange for the whole period is less than 1 per cent. If the gas exchange rises 20 % the error becomes nil and if it falls

20 % the error becomes 2 %, and if we assume on the other hand that the ventilation is constant while the sampling after 1 hour becomes so much slower that the period lasts 3 hours instead of two this will have no influence whatever if the respiratory exchange remains constant and an influence of 3—4 per cent only if the exchange rises or falls 20 per cent just at the moment when the sampling becomes slower. In the Greenland experiments the water wheel actuating the meter worked with such regularity that errors from this source are in all cases negligible, while the sampling was never absolutely uniform, the rate of outflow of mercury through a capillary point being generally slightly slower each time it is used and sometimes considerably slower. The largest alteration observed in the time of outflow of 100 cc. of mercury through the same capillary is however from 2 hours to 3 hours and the maximum error from this source may be taken as 4 per cent. Errors arising from this source of 1—2 % may be of rather frequent occurrence.

The meter was very carefully calibrated and its error cannot exceed ± 0.3 %.

As the temperature of the meter was read only at the beginning and end of each period the assumed mean temperature may be incorrect. The largest error possible in one or two cases is 1° corresponding to an error in the measured volume of 0.5 %. In almost all cases the error cannot exceed 0.2° and is therefore negligible.

Summary of errors in respiration experiments.

	Influence of errors on O_2 and CO_2
Calibration of meter ± 0.3 % systematic	equal
Diffusion of CO_2 and O_2 — 0.5 to — 2 % probably — 1 % systematic	probably about equal
Sampling errors 0 to ± 4 % generally 1 to 2 % accidental	equal
Temperature errors 0 to ± 1 % gener. negligible accidental	equal
Analytical errors 0 to ± 3 % gener. 1 to 2 % accidental	Larger on O_2 than on CO_2

4. Other determinations.

The food was weighed before each meal for each of the subjects separately and a sample representing 1/10 of the weight eaten was secured each time. As the food was not reduced to homogeneity, the samples could not of course be very representative and it is obvious when the results of the analyses are compared that large deviations must exist in certain cases.

The food samples for each subject and each day were placed in à 500 cc. glass jar and were dried for 24 hours in a drying oven at about 100—110° in order to remove most of the water and to preserve the contents. The jars were closed air tight while still hot.

Certain food stuffs the composition of which is very constant viz. sugar, butter, alcohol and coffee were not included in the dayly samples, but special samples were preserved for analysis and the quantities given weighed each time.

The samples of food have been analysed in the Nutrition Laboratory. "The partially dried material was ground as best could be in a small hand mill, but it was necessary in some samples to pulverize as finely as possible in the mortar. The sticky, gluey nature of some of the materials made this very difficult and the excessive amount of fat in certain of the foods made it difficult to secure a fair composite sample. Every precaution was taken however to secure as even a sample as possible in taking out the portions for weighing for analysis.

The analyses were made on the partially dried basis and then computed on to the fresh weight as determined in Greenland. Determinations were made of nitrogen, heat of combustion and crude fat (ether extract). The crude fat determinations are of course much less reliable than the determinations of nitrogen and heat of combustion".

From the analytical data a table (p. 27) has been compiled showing the quantities of the separate food stuffs for each day and the corresponding amount of nitrogen, fat and available energy. As the energy of the urine has been determined on a few samples only we have deduced 10 Calories per gr. nitrogen in order to obtain the available energy of the nitrogenous substances. The accuracy of the final energy values is of course comparatively small.

We could not induce our subjects to void urine at prescribed intervals which would have simplified the calculations a great deal but it was fortunate that they almost invariably did it simultaneously. The quantities were each time measured accurately and samples of at least $\frac{1}{2}$ the volume were preserved in medicine bottles the corks of which were soaked in paraffin wax. To these were added about 1 volume $^0/_{00}$ of the commercial 40 $^0/_0$ solution of formaldehyde. We experienced at first some difficulties from the growth of moulds in the urine samples, but heating to about 60° in stoppered bottles did away with this. The samples were analysed in the Nutrition Laboratory. Nitrogen determinations were made on all of them and on some the heat of combustion was also determined after drying in vacuo at ordinary temperature. A number of the samples sent were distributed on two bottles labelled *a* and *b*. These were analysed as separate samples. The discrepancies are extremely small, ranging from 0 to 0.05 gr. N in the whole quantity of urine, which shows both that the analyses have been very accurately made and also that the preservation has had either a constant effect or no effect at all upon the nitrogen percentage.

A large number of urea determinations after the clinical method elaborated by Esbach[1] were made in Greenland on the fresh urines partly for guidance during the experiments and partly also for comparison with the accurate Kjeldahl determinations. The results of these comparisons will be discussed in detail later. Here it is only necessary to state that the agreement between the Esbach and Kjeldahl results was on the whole remarkably good.

Of the 250 samples brought to Copenhagen from Greenland and sent on to America 2 were broken during the transport but the nitrogen could without appreciable error be calculated from the corresponding Esbach determinations.

The feces were voided in jars of 1 liter which could be closed hermetically. They were partially dried at 110° for 24 hours in Greenland and sent in this state.

We attempted separation of feces from the different diets employed by means of raisin and fig seeds, but owing to our lack of experience and some want of forethought we gave these fruits too often and at too short intervals, with the result that both kinds of seeds were present in a number of the feces.

Nevertheless we have succeeded in most cases in roughly separating the feces belonging to the different diets and are able therefore to draw certain, though not very precise, conclusions with regard to the utilization of the different diets.

Determinations have been made of the nitrogen, heat of combustion, crude fat and total ether extract after splitting up of the soaps with hydrochloric acid and alcohol. These last determinations show the quantities of fatty acids present as such and in combinations as soaps.

General review of experiments made.

Exp. I. Two female subjects *M. D.* age 32, weight 58,5 kg. and *C. W.* age 28, weight 63.6 kg. Both subjects were in perfect health. The experiment began on the $^{10}/_{7}$ at 12 md. and was concluded on the $^{13}/_{7}$ at 2 p. m. The subjects were fed on the first day on non nitrogenous food. Thereupon for two days almost exclusively on meat of which the amounts consumed by both were 2700 gr. on the first day and 2300 gr. on the second. On the last day they were again fed chiefly on carbohydrate. The determinations of respiratory exchange made during this experiment are untrustworthy and have not been included. During the exp. the subjects did a small amount of work chiefly sewing. Their weights at the end of the exp. were 58.9 kg. and 63.4 kg. respectively.

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[1] We did not use the baroscope and Esbachs tables but determined pressure and temperature in the ordinary way and calculated the weight of nitrogen in the samples.

Exp. II. Two male subjects *A. S.* age 48, weight 73.1 kg. Apparently healthy but some bronchial ronchi. *N. D.* age 55, weigh 61.8 kg. Apparently healthy. Slight ronchi. The exp. began on the $^{20}/_{7}$ at 4.30 p. m. and was concluded on the $^{24}/_{7}$ at 11 a. m. The subjects were fed on carbohydrates on the first and second day, on meat on the third and again on carbohydrates on the fourth and fifth. On the meat day *A. S.* consumed 1800 gr. and *N. D.* 1700 gr. The subjects were occupied during most of the time with carving in ivory. They slept from 11 to 5 or 6. Final weights 73.7 kg. and 63.0 resp.

Exp. III. Two male subjects *B. W.* age 57, weight 65 .5 kg. Healthy. *A. M.* age 28, weight 74 kg. Healthy. The exp. began on the $^{1}/_{8}$ at 3 p. m. and was concluded on the $^{5}/_{8}$ at 3 p. m. The subjects were fed on meat for three consecutive days $^{2}/_{8}$—$^{4}/_{8}$ and on carbohydrates on the first and last day. *B. W.* consumed on the three days 1247, 1156 and 830 gr. and *A. M.* 1268, 1287 and 874 gr.

These subjects were very quiet and extremely regular in their habits. They did no work, except playing cards, and slept with great regularity from 10—6. Final weights 65.5 kg. and 73.3 kg. resp.

Exp. IV. Subjects *A. S.* and *N. D.* same as in Exp. II. The exp. began on the $^{11}/_{8}$ 11 a. m. and was concluded $^{14}/_{8}$ 5 p. m.

The subjects were given very little food on the 11th. On the 12th they had a large meal of meat in the forenoon (each about 1000 gr.) and again on the 13th at 5 in the afternoon (750 gr.). On the last day they were fed regularly chiefly on carbohydrates. The subjects were occupied with making a model of the respiration chamber and worked lightly during most of the day time. They slept regularly from 10—6.

In the three last experiments complete determinations were made of the respiratory exchange (Appendix IV, Tables II, III, IV).

The food totals for each experiment and each individual are given below (Table 2).

The food turned out, as shown by the analyses, to be of a more mixed character than we had expected and especially to contain on the meat days a very large amount of fat. The seal meat used in most cases contained on an average according to the analyses of the boiled meat 4.1 % nitrogen and about 10 % fat (ether extract) while the heat of combustion per gr. amounted to 2.2 Calories. From a comparison of the ascertained heat of combustion with the chemical analyses we find that it must have contained a considerable proportion of glycogen varying from 1.1—4 % (Average 2.5 %). We found by one determination in Greenland that the loss of weight on boiling amounted to 23 % of the fresh weight.

The raw meat must therefore have contained 3.15 % *N.* = 19.8 % protein, 8 % fat and 2 % glycogen.

Table 2. Food consumed.

Experiment I.

Date	Subject M. D. — Ingredients gr.	Nitrogen gr.	Fat. gr.	Calories	Subject C. W. — Ingredients gr.	Nitrogen gr.	Fat. gr.	Calories
10/7 p. m.	Bread 241, Butter 25, Sugar 41, Raisins 108, Coffee 600	4	26	1400	Bread 254, Butter 25, Sugar 41, Raisins 108, Coffee 600	4	25	1420
11/7	Boiled Seal meat 1284, Figs 90, Sugar 50, Coffee 1000	57	192	3800	Boiled Seal meat 1417, Figs 90, Sugar 50, Coffee 1000	54	116	3660
12/7	Meat 1066, Bread 65, Butter 10, Sugar 52, Raisins 108, Coffee 800	55	67	2500	Meat 1236, Bread 85, Butter 10, Sugar 52, Raisins 108, Coffee 800	54	61	2480
13/7 — 5 p. m.	Bread 248, Butter 20, Figs 90, Pancake 269, Sugar 90, Coffee 600	6	30	2010	Bread 244, Butter 17, Figs 90, Pancake 337, Sugar 84, Coffee 600	8	27	2140

Experiment II.

Date	Subject A. S. — Ingredients gr.	Nitrogen gr.	Fat. gr.	Calories	Subject N. D. — Ingredients gr.	Nitrogen gr.	Fat. gr.	Calories
20/7 fr. 5 p. m.	Bread 280, Butter 25, Sugar 24, Raisins 120, Coffee 200	4	25	1340	Bread 293, Butter 25, Sugar 23, Raisins 120, Coffee 200	4	26	1420
21/7	Bread 346, Butter 35, Raisins 200, Pancake 500, Sugar 114, Alcohol 12, Coffee 1000	11	48	3460	Bread 344, Butter 35, Raisins 200, Pancake 500, Sugar 115, Alcohol 12, Coffee 1000	11	47	3440
22/7	Meat 1804, Figs 100, Raisins 50, Sugar 49, Alcohol 9, Coffee 1000	85	218	4880	Meat 1691, Figs 100, Raisins 50, Sugar 49, Aloohol 9, Coffee 1000	79	157	4210
23/7	Bread 574, Butter 52, Figs 123, Pancake 308, Sugar 156, Alcohol 9, Coffee 1000	11	54	3620	Bread 580, Butter 52, Figs 124, Pancake 305, Sugar 151, Alcohol 9, Coffee 1000	11	55	3650
24/7 — 9 a. m.	Bread 221, Butter 18, Sugar 32, Coffee 400	3	18	860	Bread 210, Butter 18, Sugar 32, Coffee 400	3	17	820

Experiment III.

Date	Subject B. W. — Ingredients gr.	Nitrogen gr.	Fat. gr.	Calories	Subject A. M. — Ingredients gr.	Nitrogen gr.	Fat. gr.	Calories
1/8 p. m.	Bread 600, Butter 40, Sugar 52, Raisins 120, Coffee 400	9	39	2430	Bread 583, Butter 40, Sugar 52, Raisins 120, Coffee 400	8	45	2350
2/8	Meat 1247, Figs 100, Sugar 52, Coffee 1000	54	139	3260	Meat 1268, Figs 100, Sugar 52, Coffee 1000	53	159	3400
3/8	Meat 1156, Sugar 63, Alcohol 9, Coffee 1000	48	96	2450	Meat 1287, Sugar 63, Alcohol 9, Coffee 1000	54	114	2840
4/8	Meat 830, Sugar 67, Alcohol 9, Coffee 1000	34	68	1890	Meat 874, Sugar 67, Alcohol 9, Coffee 1000	33	52	1820
5/8 a. m.	Bread 555, Butter 45, Figs 170, Sugar 70, Alcohol 12, Coffee 600	8	47	2660	Bread 609, Butter 45, Figs 170, Sugar 69, Alcohol 12, Coffee 600	10	44	2770

Experiment IV.

Date	Subject A. S. — Ingredients gr.	Nitrogen gr.	Fat. gr.	Calories	Subject N. D. — Ingredients gr.	Nitrogen gr.	Fat. gr.	Calories
11/8 p. m.	Figs 100, Sugar 84, Alcohol 9, Coffee 800	1	2	660	Figs 100, Sugar 84, Alcohol 9, Coffee 800	1	1	680
12/8	Seal meat 407, Tinned beef 591, Sugar 66, Coffee 1000	42	35	1710	Seal meat 290, Tinned beef 550, Sugar 66, Coffee 1000	35	15	1340
13/8	Tinned beef 733, Sugar 68, Alcohol 9, Coffee 1000	35	27	1510	Tinned beef 776, Sugar 68, Alcohol 9, Coffee 1000	36	32	1560
14/8 — 3 p. m.	Bread 348, Butter 20, Figs 90, Sugar 87, Raisins 150, Alcohol 9, Coffee 800	6	20	2310	Bread 380, Butter 20, Figs 90, Sugar 86, Raisins 150, Alcohol 9, Coffee 800	7	23	2440

The protein intake on the meat days fell considerably short of our expectations but still we believe it to be the highest on record for man.

The weights and compositions of the feces voided by each individual during the experiments and for one to two days afterwards are shown in the appended table I. The figures for the feces which we consider as belonging to the meat days are printed in **larger type.** The figures for feces belonging to the carbohydrate days are printed in *italics.* The meat feces are characterized by a somewhat higher percentage of nitrogen varying between 1.20 and 2.89 — mean 1.63 %, while the mean for a diet containing a small proportion of nitrogen only was about 1.3 %.

In the case of *A. M.* the percentage of fat, saponified as well as well as unsaponified, was distinctly higher in the meat feces than in the other, but for the other subjects this is not so and considered per day the quantity of fat in the feces is by no means always higher after the intake of large amounts of that substance together with protein. On the whole the feces contain rather much fat of which generally about one half is present as soaps and consequently not extractable with ether before treatment with acid.

The energy content of the feces per gr. N is apparently slightly lower after meat than after carbohydrate.

On the whole the analyses show that the excessive amounts of protein and fat taken on the meat days are remarkably well utilized in the intestines of Eskimos; the loss of energy in the feces amounting on an average to about 350 Cal. per meat day or 7 to 10 % of energy of the food.

The nitrogen balance.

Table 3 shows the amount of nitrogen ingested with the food on each separate day reckoned from midnight to midnight. On the first and last day of each experiment the subjects have not been confined for the whole of the 24 hours and the corresponding quantities of N are put in brackets.

The second column shows the amounts of N in the corresponding feces. It must be borne in mind that these figures are not wholly reliable as the separation of the feces was rather incomplete. It is obvious however that even the largest amounts of nitrogenous food are practically completely digested and absorbed. The quantities of N in the feces belonging to the meat days are only slightly if at all higher than those belonging to carbohydrate. The figures on which this conclusion can be based are *A. S.* $^{21}/_{7}$ and $^{22}/_{7}$ showing nitrogen in food of 11 and 83 gr. and in feces of 2.8 and 3.2 gr. The corresponding figures for *N. D.* are 11 gr., 79 gr., 2.6 gr. and 6.2 gr. showing a distinct rise in the excretion of N after the meat. In most of the

Table 3. Nitrogen in food, feces and urine per day.

Date	Nitrogen in food	Nitrogen in feces	Difference	N. in urine	Balance	Nitrogen in food	Nitrogen in feces	Difference	N. in urine	Balance
	Experiment I.									
	Subject M. D.					Subject C. W.				
$^{10}/_7$	(4)	3.7	..	18.9	..	(4)	4.1	..	20.2	
$^{11}/_7$	57	3	54	39.6	+ 14	54	3	54	45.3	+ 9
$^{12}/_7$	55	3	52	46.7	+ 5	54	3	54	41.4	+ 13
$^{13}/_7$	(6)	..	..	..	..	(8)				
	Experiment II.									
	Subject A. S.					Subject N. D.				
$^{20}/_7$	(4)	1.7	..	22	..	(4)	2.1	..	21	
$^{21}/_7$	11	2.8	8.2	16.4	− 8	11	2.6	8.4	16.7	− 8
$^{22}/_7$	85	3.2	81.8	53.1	+ 29	79	6.2	72.8	50.4	+ 22
$^{23}/_7$	11	(2.8)	8.2	26.0	− 18	11	2.6	8.4	25.2	− 17
$^{24}/_7$	(3)	..	..	..	..	(3)				
	Experiment III.									
	Subject B. W.					Subject A. M.				
$^{1}/_8$	(9)	6.1	..	12	..	(8)	2.2?	..	28.8	
$^{2}/_8$	54	4.2	49.8	28.5	+ 21	53	3.8	49	44.7	+ 4
$^{3}/_8$	48	4.2	43.8	41.7	+ 2	54	3.8	50	51.1	− 1
$^{4}/_8$	34	4.2	29.8	35.5	− 6	33	3.8	29	40.5	− 11
$^{5}/_8$	(8)	..	..	..	..	(10)				
	Experiment IV.									
	Subject A. S.					Subject N. D.				
$^{1}/_8$	(1)	..	..	28.5	..	(1)	..	..	26.3	
$^{12}/_8$	42	5.4	37	41.5	− 5	35	(5)	30	28.4	+ 2
$^{13}/_8$	35	5.4	30	40.5	..	36	(5)	31	33.2	
$^{14}/_8$	(6)	..	..	..	..	(7)				

other experiments it is apparent from the urine values that the subjects have lived before the experiments on a diet rich in nitrogen and the comparison of the feces belonging to the meat days with those from the preceding diet is therefore of little value.

B. W. in exp. III is an exception. The nitrogen content of the urine shows that he has not lived on a meat diet on the two days preceding the experiment and the feces for this period show 6.1 gr. N per day as compared with 4.2 gr. for the meat days.

The nitrogen excretion through the gut is on almost all days higher than that observed on civilized people.

Column 5 shows the amount of N per day available for catabolism and col. 6 the amount found in the corresponding urine. The ingestion of food began in all cases except exp. IV $^{13}/_8$ at about 9 a. m. and the excretion of N in the urine began to rise shortly afterwards (at 11 to 12), but the increase was not considerable at first. The 24 hours nitrogen values for the urine are therefore reckoned from 12 md. to 12 md. in exp. I, and from 2 p. m. — 2 p. m. in exp. II, III and IV. It is of course not absolutely certain, though in our opinion extremely probable, that the absorption of the nitrogenous food is practically completed within the 24 hours, and when that is the case the figures show a very considerable retention of nitrogen within the organism in those subjects who had had but little nitrogenous food for at least two days, namely

	N in meat gr.	N in urine gr.	Balance gr.	
Exp. II: A. S.	82	53	29	35 %
N. D.	73	50	23	32 %
Exp. III: B. W.	50	29	21	42 %

When nitrogen amounting to 20—30 gr. is retained (beyond 24 hours) there can in our opinion be very little doubt that it must be retained chiefly in the form of protein though the extract N is undoubtedly increased also. We think it highly improbable that the concentration of urea and allied substances in the body could rise sufficiently to explain a retention of the magnitude observed by us.

When large amounts of protein can be stored there is no reason why the catabolism should not take place according to the energy requirements of the body. We look upon the specific dynamic action of protein as a consequence of its being incompletely catabolized (deaminized) immediately after absorption and in cells which do not require and therefore cannot utilize the energy liberated in the process. When protein is stored as such it may be carried to cells which are able to utilize the energy liberated by deaminization and use the protein as an equivalent of any other source of energy, and if that is so we must expect that the specific dynamic action of the stored material should disappear, or at all events become greatly reduced. As will be shown below we have in our experiments found a remarkably low specific dynamic action of the protein.

The Urine Excretion.

The excretion of nitrogen in the urine has been followed from hour to hour in order to compare the nitrogen metabolism with the corresponding respiratory exchange. The curves obtained indicate, however, very distinctly that the excretion of N does not run parallel to the metabolism and probably not even to the formation of urea, but is strongly influenced by various other factors. This has been observed before by Neumann [1] who found that consumption of large quantities of water will produce a considerable increase in the excretion of nitrogen. Frank and Trommsdorff [2] lay great stress upon

[1] Arch. f. Hygiene, Bd. 36, 1899.
[2] Zeitschr. f. Biol., Bd. 43, 1902.

the fact that there is always a retardation in the excretion of urea as compared with its formation. They think that the CO_2 produced in the catabolism of protein will appear earlier in the expired air than the urea in the urine.

Our curves bear out the observations of our predecessors and give some additional information. As the subjects could not be induced to urinate at stated intervals we were obliged to take the samples as we could get them and then calculate the excretions per hour for each period.

In the curves we have given the excretion of water in cc. and of nitrogen in gr. per hour and we have added a third curve showing

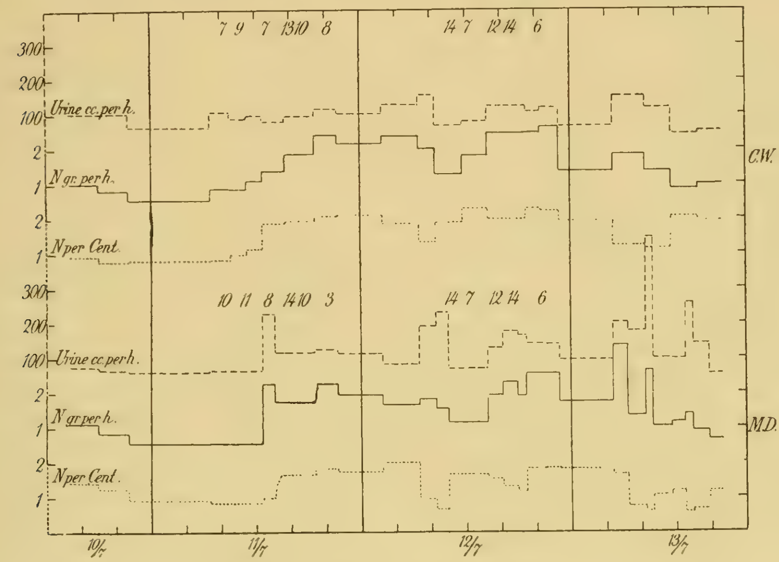

Fig. 10. Exp. I. Urine curves.

the concentration of N in each sample of urine (gr. N in 100 cc.). The figures put on the top of each curve are placed against the time of the nitrogen meals and indicate the number of gr. N taken.

We would draw attention to the following facts concerning the curves:

1. The general similarity of the curves for the two subjects in the same experiment. This similarity is very apparent in exp. II, III and IV, much less so in exp. I in which the individual excretions have been influenced by the irregular drinking of water.

2. The nitrogen metabolism begins immediately after absorption, and Oppenheim[1] has found that the excretion begins to rise in the second hour after a nitrogen meal.

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[1] Pfl. Arch., 23, 1880, 446.

In our experiments also the excretion of nitrogen generally begins to rise very soon after the nitrogen meals (curves I *C. W.*, II, III, IV A. S.), but there are some exceptions to this rule and the rise may be postponed for 5 to 10 hours (curves I *M. D.* ,IV *N. D.*). In IV *N. D.* large quantities of *N* were taken at 10 and 12, and in the period from 12—8 there is a distinct fall in *N* excretion. The excretion of water falls still more while the concentration rises. There has un-

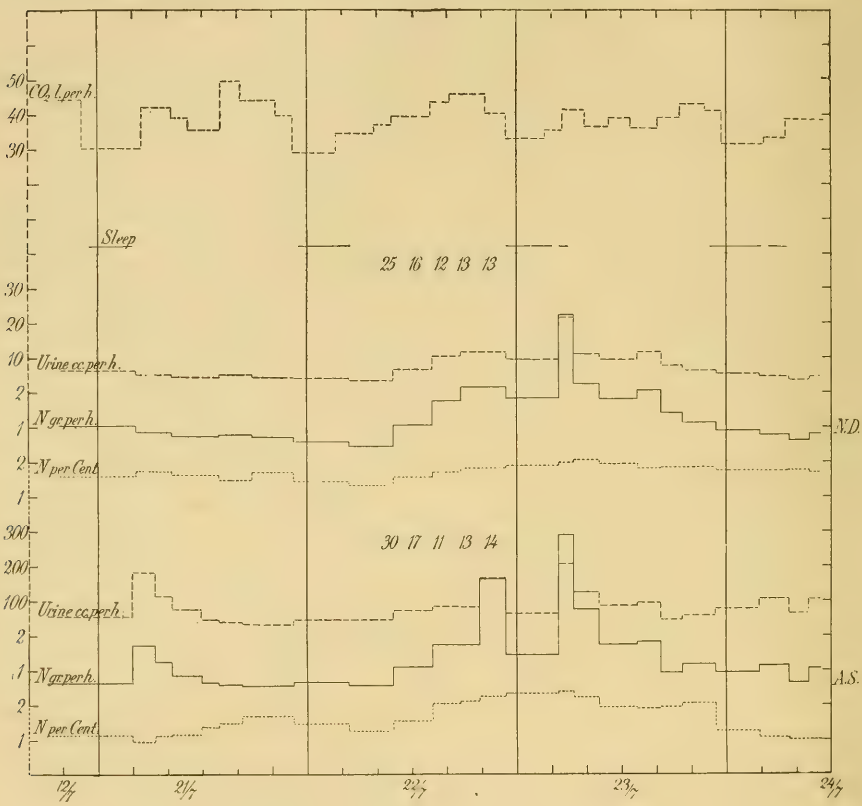


Fig. 11. Exp. II. Curves for urine and output of CO_2.

doubtedly been retention of *N* due to lack of water for its excretion, and we find that the excretion both of water and *N* rises suddenly between 8 and 10 and reaches extremely high figures: 300 cc. of water and 4.55 gr. *N* per hour. In exp. I *M. D.* the excretion of *N* rises suddenly 4 hours after the intake of *N*, but up to this the *N* excretion is extremely low and the concentration falling. The retention of *N* cannot therefore in this case have been due to lack of water in the organism.

3. The mutual interdependence of water excretion and *N* excretion is shown very distinctly by our curves. Almost every time

the excretion of *N* rises or falls, the excretion of water rises or falls also and the two curves for the same individual are consequently very similar in appearance. In some cases it is obvious that we have a washing out of *N* because a large amount of water has to be got rid of as f. inst. several times in curve I *M. D.* These cases are characterized by a more or less considerable fall in *N* concentration. At 9 a. m. on the $^{13}/_{7}$ we find an excretion amounting to 445 cc. with 2.6 gr.

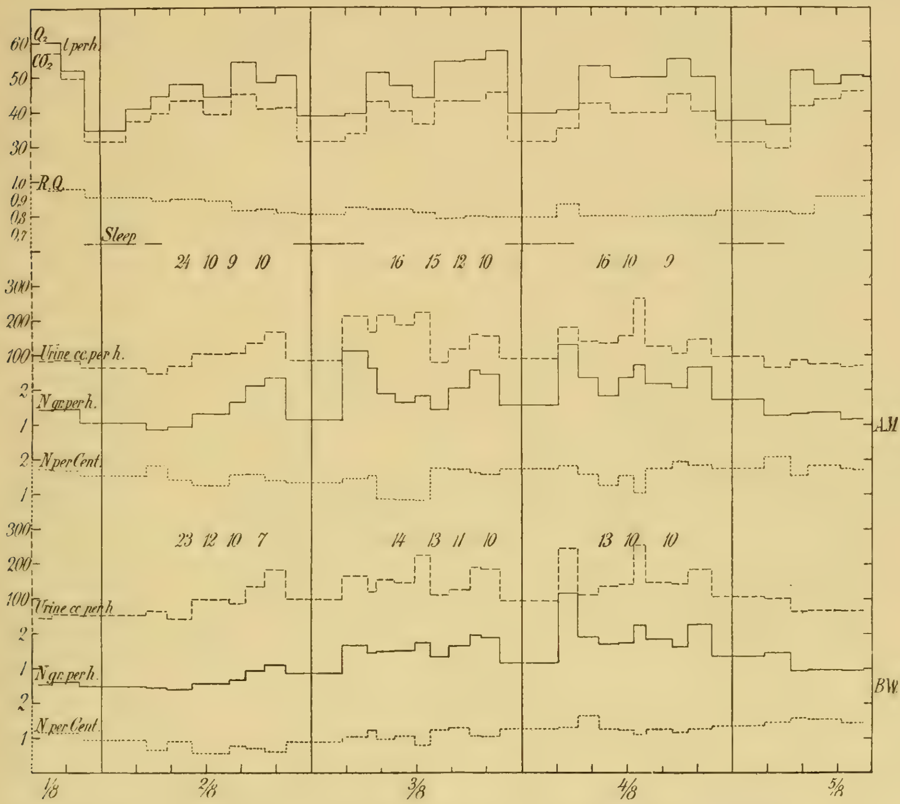


Fig. 12. Exp. III. Curves for urine and respiratory exchange.

N per hour (concentration only 0.6) but this enormous elimination of water was maintained only for 40 minutes. Corresponding instances of a decrease in *N* excretion from lack of water characterized by a fall in the excretion of water and *N* and a considerable rise in concentration are also present (exp. III *B. W.* $^{3}/_{8}$ 6.20 a. m.) but are naturally much less pronounced.

In a number of instances on the other hand we have an increase in concentration along with an increase in the total quantity of nitrogen excreted. In these cases the rise in *N* excretion must be the primary factor which involves also an increase in diuresis. The nitrogen concentration of the urine will for some reason or other very seldom rise more than a little above 2 gr. per cent. The highest concentration observed by us is 2.4 gr. in 100 cc. (curve II *A. S.* $^{23}/_{7}$ 4 a. m.) and the largest excretion of *N* is 4.55 gr. per hour maintained for very nearly two hours (IV *N. D.* $^{12}/_{8}$ 8—10 p. m.) with a corresponding elimination of very nearly 300 cc. water per hour.

4. The most conspicuous feature of the curves is the fall in excretion taking place during the first 5—6 hours of the nights after

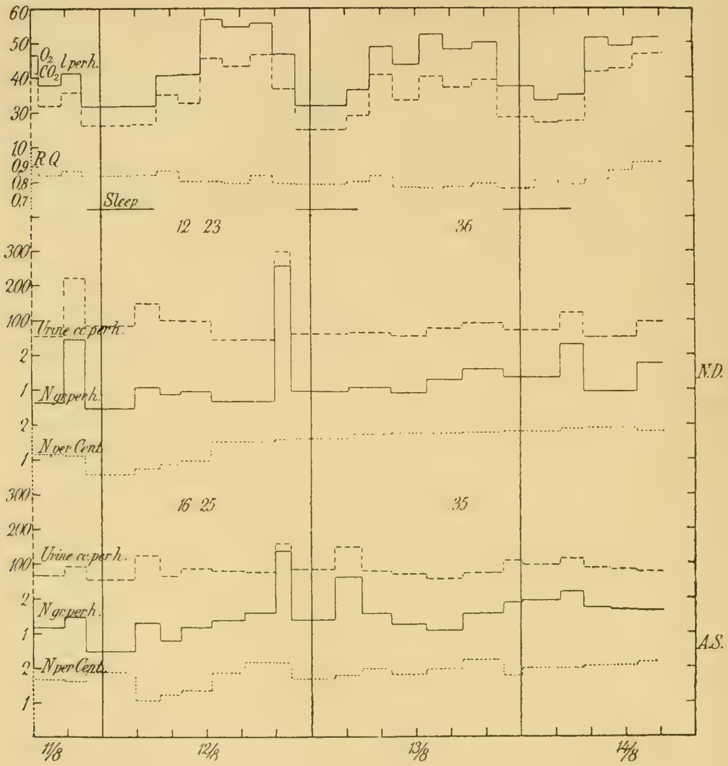


Fig. 13. Exp. IV. Curves for urine and respiratory exchange.

meat days generally between 10 p. m. and 4 a. m. and the often enormous increase found during the last 2 hours of sleep. After carbohydrates we find nothing of this, the excretion both of water and *N* being fairly uniform night and day (see exp. II $^{21}{}_{7}/$—$^{22}/_{7}$).

It is a constant feature that after much meat the subjects woke up at about 4 and urinated, and they then slept on again for about two hours. They did not drink anything during the night, and it can easily be demonstrated from the respiration curves that they really slept again from about 4 to about 6.

During the first 6 hours of sleep the excretion both of *N* and of water is diminished, and then the whole quantity retained is disposed of in a very short time. The values for the 8 hours from 10—6 at night (see table 6, p. 39) are only slightly lower than for the day periods.

Somewhat similar, though much smaller, variations in the N excretion have been observed before by ROSEMANN[1] and by FREDERICQ[2]. In their cases, however, the rise took place later namely 2 to 3 hours after the sleep and might be due to some influence of the morning meal, though it appeared also when no food was taken in the morning. FREDERICQ thinks that the rise may be produced by the custom of having a morning meal at a certain hour. ROSEMANN however gives the same explanation as we have accepted as the most probable viz.: that the functional activity of the kidneys is diminished during the night and that consequently there is a retention both of water and of the specific urinary substances. In our experiments any influence of habitual morning meals is excluded, as it is not customary for the Eskimos to take food in the morning, and the rise moreover took place during the last hours of the sleep and at a time when the subjects would usually be asleep.

It must be noted that we have observed a slight increase in the respiratory exchange and especially in the excretion of CO_2 during the two hours of increased renal activity (4—6) (see the curves II $^{23}/_{7}$, III $^{3}/_{8}$ and $^{4}/_{8}$, IV $^{13}/_{8}$). When the excretion of nitrogen is not increased the respiratory exchange between 4 and 6 in the morning is as a rule not higher than during the rest of the night, though there is one very pronounced exception to this rule (curve III $^{2}/_{8}$).

In table 4 are shown 24 hour values for volume of urine and N excretion. For some of the individuals experimented upon we have been able to add also figures showing approximately the amounts of urea + ammonia nitrogen for the 24 hours. These figures have been calculated from the determinations made by means of ESBACHS hypobromite method. One of us[3] has investigated this method closely and found that when certain precautions are observed it can be made fairly accurate. The quantity of gas evolved from urea or ammonia by hypobromite of sodium in alkaline solution depends principally upon the ratio of bromine to $Na\,OH$ in the reagent[4]. The reagent

[1] Pfl. Arch., Bd. 65, 1892.

[2] Biochem. Zeitschr. Festband f. H. J. HAMBURGER, 1908, 277.

[3] MARIE KROGH: K. D. Vidensk. Selsk. Oversigter 1913.

[4] The oxidizing power of the reagent is increased with increasing quantity of bromine but this involves a decrease in the production of gaseous nitrogen because a part of the substance acted upon is oxidized to nitric compounds. By employing a reagent with 1 cc. bromine to 196 cc. 30 % $Na\,OH$ the volume of gas evolved from urea amounts to 100 % of the nitrogen present but it has been found that only 99.4 % of the gas is N_2 while 0.6 % is carbon monoxide. The oxidation is so feeble that almost the whole of the nitrogen is liberated as gas while a small part of the carbon is oxidized to CO instead of CO_2.

Table 4. Excretion of urine and nitrogen in 24 hour periods.

Date	Urine cc (a)	Total nitrogen gr. (b)	Urea + Am. nitrogen % (c)	Urea + Am. nitrogen gr. (d = b × c)	"Endogenous" nitrogen gr. (e = b − d)	Urine cc (a)	Total nitrogen gr. (b)	Urea + Am. nitrogen % (c)	Urea + Am. nitrogen gr. (d = b × c)	"Endogenous" nitrogen gr. (e = b − d)
Experiment I. 12 md. — 12 md.	M. D.					C. W.				
10/7-11/7	1640	18.9	83.6	15.8	3.1	2210	20.2	86.6	17.5	2.7
11/7-12/7	2760	39.6	91.7	36.3	3.3	2400	45.3	92.0	41.7	3.6
12/7-13/7	3400	46.7	91.6	42.8	3.9	2490	41.4	92.0	38.1	3.3
Experiment II. 2 p. m. — 2 p. m.	A. S.					N. D.				
20/7-21/7	2100	22.0	87.7	19.3	2.7	1300	21.0			
21/7-22/7	1133	16.4	87.8	14.4	2.0	1097	16.7			
22/7-23/7	2485	53.1	92.5	49.1	4.0	2666	50.4			
23/7-24/7	1520	26.0	88.5	23.0	3.0	1420	25.2			
Experiment III. 2 p. m. — 2 p. m.	B. W.					A. M.				
1/8-2/8	1418	12.0	..	..	..	1927	28.8	88.2	25.4	3.4
2/8-3/8	3269	28.5	..	..	..	3597	44.7	92.1	41.1	3.6
3/8-4/8	3360	41.7	..	..	..	3253	51.1	92.0	47.0	4.1
4/8-5/8	2621	35.5	..	..	..	2310	40.5	92.0	37.3	3.2
Experiment IV. 2 p. m. — 2 p. m.	A. S.					N. D.				
11/8-12/8	2070	28.5	88.4	25.2	3.3	2820	26.3			
12/8-13/8	2206	41.5	92.2	38.3	3.2	1775	28.4			
13/8-14/8	2043	40.5	92.4	37.4	3.1	1839	33.3			

employed by us in Greenland was found to yield in the Esbach tube 90.6 % of the nitrogen in urea and 95.5 % from ammonia.

Of the other nitrogenous compounds present in urine some will react with hypobromite and yield gaseous nitrogen while others will not. The quantities of gas produced depend to a certain extent on the composition of the reagent, but they are in all cases far below the total N and as a rule lie between 15 and 40 %[1].

In accordance with the fact that only part of the nitrogen is liberated from urine by hypobromite we find by comparison of the Kjel-

[1] Creatine gives 53.6 %, creatinine 13.7 %. Oxyproteic acid and allantoin are said by Mørner to give about 20 %. Uric acid will ultimately yield about 38 % but reacts very slowly with hypobromite. Hippuric acid, amino acids and polypeptides do not yield any gaseous nitrogen.

DAHL and ESBACH determinations[1] that the latter give lower results than the former, and since the percentage of urea increases with increase of total nitrogen the ratio $\frac{\text{Kjeldahl } N}{\text{Esbach } N}$ is diminished on the days with a large excretion of nitrogen. Table 5 shows the relations between the nitrogen excretion and the ratio $\frac{\text{Kjeldahl } N}{\text{Esbach } N}$ on the separate days examined.

Table 5.

Date	Subject	Total nitrogen gr.	$\frac{\text{Kjeldahl-}N.}{\text{Esbach-}N.}$
10/7-11/7	M. D.	18.9	1.26
10/7-11/7	C. W.	20.2	1.23
20/7-21/7	A. S.	22.0	1.22
21/7-22/7	A. S.	16.4	1.22
23/7-24/7	A. S.	26.0	1.21
11/8-12/8	A. S.	28.5	1.21
11/8-12/8	A. M.	28.8	1.21
11/7-12/7	M. D.	39.6	1.18
12/7-13/7	M. D.	46.7	1.18
11/7-12/7	C. W.	45.3	1.17
12/7-13/7	C. W.	41.4	1.17
22/7-23/7	A. S.	53.1	1.17
12/7-13/8	A. S.	41.5	1.17
13/8-14/8	A. S.	40.5	1.17
2/8-3/8	A. M.	44.7	1.17
3/8-4/8	A. M.	51.1	1.17
4/8-5/8	A. M.	40.5	1.17

As mentioned above the reagent employed would liberate 90.6 % N from urea and 95.5 % from ammonia. If we take the quantity of ammonia nitrogen as 4 % of the urea nitrogen we have for both taken together a yield af 90.8 %. We estimate the average yield from all other nitrogenous substances at 20 %. The reasons for adopting this estimate are given in the paper quoted above, but it is obvious that since the relative quantities of these different substances is not quite constant the estimate can only be approximative. Putting the quantity of urea + ammonia nitrogen = x and the endogenous nitrogen = y we have on the above assumptions:

[1] In the ESBACH determinations we have not used the baroscope, which is a very unreliable instrument, but we have calculated the weight of nitrogen from the volume and pressure of the gas and the temperature of the waterbath employed.

$$x + y = \text{Kjeldahl } N$$
$$0.908x + 0.2y = \text{Esbach } N$$

anh we can compute values for x and y from these equations. The figures for urea + ammonia nitrogen and "endogenous" nitrogen given in table 4 have been obtained in this manner. The excretion of "endogenous" nitrogen is found to vary between 2 gr. with a total nitrogen output of 16.4 gr. and 4 gr. with a total output above 50 gr.

The respiratory exchange.

Curves representing the respiratory exchange for the two subjects taken together and each period of the experiments are shown in figs. 11, 12 and 13 for exp. II, III and IV. For exp. II the CO_2 values only are given. Owing to an airbubble of variable size in the absorption pipette for O_2 the individual O_2 analyses of this experiment became unreliable, though the mean for a larger number must deviate very little from the true mean. The oxygen has therefore been calculated for 8 hour periods only.

The curves give very little definite information but show the general character of the variations in metabolism. We find low and fairly constant values for the hours of the night (from 10 to 6). In the day time there are large and irregular variations due partly to the intake of food partly to muscular movements. We had hoped to be able to obtain some information about the movements by letting the subjects wear pedometers and reading these at the end of each period, but the results were very unsatisfactory. There appeared to be no relation whatever between the indications of the pedometers and the metabolism found. We are inclined to think that the subjects have used the pedometers as convenient playthings.

The respiratory quotient varies on the whole regularly in accordance with the nature of the food taken, being high 0.95—0.98 on a carbohydrate diet, and low (about 0.8) on a diet of protein and fat, but sometimes we observe, when the subjects are on this latter diet, a sudden rise of short duration in the quotient. Sudden deviations from the level curve in the opposite direction have not been noticed.

In order to compare the nitrogen excretion with the corresponding total metabolism we have computed 8 hour values for N_2 output, CO_2 output and O_2 intake. We have selected the hours from 10 to 6 at night, 6—2 in the forenoon and 2—10 in the afternoon as corresponding as closely as possible with the changes in activity of the subjects and the hours at which the changes in diet should make themselves felt on the excretions and metabolism. During the hours from 10—6 the subjects were in almost all cases asleep or at least lying down, and at 2 in the afternoon the effect of the food taken during the forenoon would generally begin to appear. The results are

Table 6. Metabolism in 8 hour periods (both subjects together).

Experiment II.

Date	Hours	N in urine gr. a	CO_2 l. b	O_2 l. c	RQ d	RQ of non protein metabolism e	Calories calculated f	Cal. per kg and hour g	Cal. from protein $a \times 24.98$ h	Cal. from protein % 100 h : f i
20/7	10— 6	15.12	257	286	0.90	0.94	1360	1.26	378	28
21/7	6— 2	13.90	307	349	0.88	0.905	1674	1.55	348	21
"	2—10	10.55	355	370	0.96	0.99	1818	1.69	264	14.5
"	10— 6	9.70	248	270	0.92	0.95	1307	1.21	243	18.5
22/7	6— 2	12.78	303	322	0.94	0.985	1561	1.45	319	20.5
"	2—10	33.28	352	409	0.86	0.915	1888	1.75	831	44
"	10— 6	35.65	281	315	0.89	1.09	1395	1.28	890	64
23/7	6— 2	35.60	305	334	0.91	1.11	1495	1.37	888	59.5
"	2—10	22.40	327	334	0.98	1.095	1597	1.47	560	35
"	10— 6	15.42	260	265	0.98	1.07	1276	1.17	385	30
					Experiment III.					
1/8	10— 6	12.11	276	302	0.91	0.95	1456	1.31	303	21
2/8	6— 2	12.63	333	369	0.90	0.93	1779	1.60	316	18
"	2—10	22.33	338	405	0.84	0.85	1900	1.71	557	29.5
"	10— 6	22.85	262	318	0.83	0.84	1466	1.32	571	39
3/8	6— 2	27.96	319	380	0.84	0.85	1756	1.58	699	40
"	2—10	30.08	348	439	0.80	0.79	2020	1.80	752	37
"	10— 6	28.89	267	328	0.81	0.825	1490	1.34	722	48.5
4/8	6— 2	33.81	326	407	0.80	0.80	1852	1.66	845	45.5
"	2—10	34.93	331	405	0.82	0.835	1844	1.66	873	47.5
"	10— 6	22.74	248	299	0.83	0.84	1374	1.24	568	41.5
5/8	6— 2	18.34	337	388	0.87	0.89	1830	1.64	458	25
					Experiment IV.					
11/8	2—10	28.44	289	334	0.87	0.93	1547	1.44	711	46
"	10— 6	10.47	210	253	0.83	0.84	1200	1.12	262	22
12/8	6— 2	15.88	296	361	0.82	0.825	1704	1.59	396	23
"	2—10	28.77	340	422	0.81	0.81	1948	1.82	718	37
"	10— 6	22.52	209	265	0.79	0.775	1203	1.12	563	47
13/8	6— 2	18.55	297	375	0.79	0.785	1753	1.64	464	26.5
"	2—10	22.38	304	392	0.78	0.76	1852	1.73	594	32
"	10— 6	27.32	222	285	0.78	0.75	1281	1.19	683	53.5
14/8	6— 2	24.01	319	381	0.84	0.86	1778	1.20	600	34

given in table 6. From the data of the respiratory exchange combined with the nitrogen excretion we have calculated further the total metabolism in accordance with the principles laid down by Zuntz. We have assumed that the protein corresponding to the N found in the urine is completely catabolized during each 8 hour period producing 24.98 Calories per gr. N and combining with 5.92 l. oxygen to form 4.74 l. CO_2 ($R.\ Q.$ 0.803). After deducing the oxygen and

CO_2 corresponding to the protein catabolism from the totals for these gases we have calculated the *R. Q.* of the non protein metabolism and from this and the oxygen the heat produced, using the table of respiratory quotients and corresponding caloric values of oxygen given by Zuntz[1]. Zuntz's table covers only the respiratory quotients between 0.7 and 1.0, but we have observed in a series of periods in exp. II that the respiratory quotient of the non protein metabolism rose above unity indicating a formation of fat from carbohydrate. In these cases we have extrapolated the caloric values of the oxygen from Zuntz' table, but we are fully aware that the resulting figures for total metabolism cannot be very accurate.

Table 7 shows the average intake of calories with the food and the corresponding metabolism and N excretion per day for each subject. The food is calculated for days reckoned from midnight to midnight and no reduction has been made for the calories lost with the feces. The figures for catabolic heat production and excretion of N are for days reckoned from 2 p. m. to 2 p. m., which will correspond well to the period of absorption and catabolism of the food. In exp. II the food has on all days been in excess of the requirements[2]. In exp. III there has been an excess only on the first day, and in exp. IV the food has on all days been insufficient. The metabolism is low in all cases as might be expected from the confinement and the small amount of muscular work done. The production of heat is lower in exp. II than in exp. IV in the same subjects in spite of the abundant food in the former exp., but this is easily explicable from the difference in work performed. There is no clear evidence in the figures for 24 hours metabolism of any specific dynamic action of the protein in the diet.

Table 7. Energy balance in 24 hour periods.

Calories in food	Calories produced	N in urine gr.
Experiment II.		
3450	2343	16.5
4550	2389	51.7
3650	(2274)	25.6
Experiment III.		
3300	2561	36.6
2650	2681	46.4
1850	2524	48.0
Experiment IV.		
(1000)	2226	27.4
1500	2452	34.9
1500	2456	36.8

When we consider the separate 8 hour periods we find fairly low and uniform figures for the metabolism during the 8 hours when the subjects were asleep or at all events generally lying down and attempting to sleep.

[1] Zuntz & Loewy: Lehrbuch d. Physiologie, 1909, p. 663.

[2] For the third day in exp. II the resp. exch. of the last period 6—2 was not available. The figure for the corresponding period of a previous day ($^{21}/_{7}$ 6—2) has been utilized. In exp. IV the amount of food taken on the first day is not exactly known. It has exceeded 700 Cal. but cannot have been more than 1200.

Exp. II: 1.26, 1.21, 1.28, 1.17 Cal. per kg. and hour, mean 1.23.
Exp. III: 1.31, 1.32, 1.34, 1.24 Cal. per kg. and hour, mean 1.302.
Exp. IV: 1.12, 1.12, 1.19 Cal. per kg. and hour, mean 1.143.

During exp. II the subjects slept for shorter hours (from 11 instead of 10) than in exp. IV, which explains the somewhat higher metabolism, while the two subjects employed in exp. III would appear to possess normally a higher basal metabolism ("Grundumsatz").

During the hours of the day the metabolism is of course much more variable but we find in almost all cases lower values for the forenoon (6—2) than for the afternoon (2—10). The mean for all subjects and the hours 6—2 is 1.57, while for the hours 2—10 it is 1.70 Calories per kg. and hour.

In exp. II the excess of food led to a production of fat as evidenced by the rise of the respiratory quotient of the non protein metabolism above unity. It is of some interest to note that the quotient did not rise above unity during the first and second day when an excess of carbohydrate was given, but only during the latter half of the third day when the diet consisted chiefly of protein and fat. The respiratory exchange of this day taken as a whole indicates apart from the protein catabolized an intake of 428 l. O_2 and an output of 432 l. CO_2 corresponding to a catabolization of 516 gr. glycogen (both subjects together) while only about 400 gr. were available from the food of the day. This would indicate probably that the quotient for the protein catabolized had not really been 0.803 but higher, indicating a formation of fat direct from the protein, but we do not think that the evidence for such a formation is binding, as an excess of carbohydrate may have been available from the supplies of the preceding day. In exp. III and IV the respiratory quotients do not present any peculiarities which would allow definite conclusions to be drawn.

The specific dynamic action of the food cannot be quantitatively measured in our experiments but on the point of the specific dynamic action of the protein inferences of some interest may be drawn.

The production of heat per kg. and hour during the night periods is in all cases higher than it would be when no food was being digested and absorbed, but as we do not know the basal metabolism of our subjects a quantitative comparison cannot be made. In exp. IV we find the lowest figure 1.12 Cal. per kg. and hour.

With regard to the dynamic action of the protein it must be borne in mind that in all our experimental periods the N excretion is high compared with what is usual for civilized people, while in some it is excessive (lowest value for 8 hours and both subjects 9.7 gr. N and highest 35.6 gr.). We can only study therefore the influence of an excessive catabolization of protein as compared with one which is already considerable.

An inspection of the figures in table 6 shows that the influence cannot be estimated from individual periods because the production of heat has been too varied under the influence of other factors (muscular movements etc.). In order to get a result it is necessary to treat the material statistically. We have done this by first reducing the heat produced during each period to a common standard of rest. For each experiment and each group of corresponding periods we have calculated the mean production of heat per kg. and hour as shown in the adjoined table:

	II	III	IV
10— 6	1.23	1.302	1.143
6— 2	1.453	1.62	1.63
2—10	1.72	1.723	1.663

We have then divided the actual production of heat in each period with the mean of the group and multiplied with the lowest mean available viz. 1.143. The resulting figures, which are strictly comparable, have been tabulated together with the corresponding excretions of N in two groups (N in urine below 22.5 gr. and N in urine above 22.5 gr.). The means for each group and the corresponding mean errors of the heat production have been computed.

We find:

N in urine gr.	Reduced metabolism Calories	N in urine gr.	Reduced metabolism Calories
15.12	1264	35.65	1297)
9.70	1214	22.85	1287
15.42	1186)	28.89	1309
12.11	1278	22.94	1207
10.47	1200	22.52	1203
13.90	1318	27.32	1281
12.78	1229	35.60	1177)
12.63	1254	27.96	1238
18.34	1290	33.81	1306
15.88	1195	24.01	1247
18.55	1229	33.28	1318
10.55	1270	30.08	1340
22.40	1114)*	34.93	1223
22.33	1260	28.44	1063*
22.38	1272	28.77	1338
Mean 14.0	1238.2 ± 13.2	27.2	1255.6 ± 19
Mean deviation of one determination	± 51	....	± 73.8

The result indicates a slight and not very distinct specific dynamic action of the protein since the difference between the two means is less than the mean error on the larger of them. In each group however one figure deviates more than double the mean error from the rest, marked *. If these are excluded according to the usual rules[1] and if we exclude further the periods in which the resp. quotient of the non protein metabolism has been above 1 and in which the production of heat is rather uncertain, marked), we obtain, after reduction of the observed calories as before, the following series:

N in urine gr.	Reduced metabolism Calories	N in urine gr.	Reduced metabolism Calories
15.12	1259	22.85	1287
9.70	1210	28.89	1309
12.11	1278	22.74	1207
10.47	1200	22.52	1203
13.90	1276	27.32	1281
12.78	1190	27.96	1238
12.63	1254	33.81	1306
18.34	1290	24.01	1247
15.88	1195	33.28	1254
18.55	1229	30.08	1340
10.55	1208	34.93	1223
22.38	1193	28.77	1254
22.33	1260		
Mean 14.98	1234 ± 10.1	28.1	1262.4 ± 12.9
Mean deviation of one determination	± 36.4		± 42.8

An increase in N excretion of 13.1 gr. corresponds therefore in our experiments to an increase in metabolism of 28.4 ± 16.4 Cal. or 2.16 ± 1.25 Cal. per gr. N in the urine or 8.6 ± 5.0 % of the total energy corresponding to 1 gr. N. This figure for the specific dynamic action of nitrogen is remarkably low, and if we attempt a calculation from the night values alone we find it lower still. We do not think it advisable, however, to draw far reaching conclusions from the result. It appears to be very natural for people who have been exclusively carnivorous through untold generations and who possess the power of retaining large amounts of protein for periods exceeding 24 hours but it will have to be tested by laboratory experiments in which the conditions can be better defined and enforced[2].

[1] Davenport: Statistical Methods 2 ed., 1904, p. 12.

[2] When the printing of the present paper was practically completed a series of very important papers by Lusk, Riche and Williams (Journ. of Biol. Chem. Vol. XII to XIII) came to hand. These writers have, with a technique far superior to ours, studied the metabolism in short consecutive periods in a dog after much meat and also after the administration of individual amino acids. They have demonstrated clearly a retention of carbon from protein in the form of carbohydrate, and they find further that in the dog the ingestion of meat or certain amino acids causes a very considerable rise in the total metabolism by stimulating the catabolic activity of the organism.

Summary.

The normal diet of Eskimos contains an excessive amount of animal protein (280 gr.) and much fat (135 gr.) while the quantity of carbohydrate is extremely small (54 gr. of which more than ½ is derived as glycogen from the meat eaten). Their dietary habits are vey like those of the carnivorous animals.

The diet does not appear to have any injurious effects whatever upon the people. They are capable of prolonged work and extremely enduring with regard to cold and hardships. Uric acid diseases are very rare among them if they occur at all.

In our feeding experiments made under absolute control within the respiratory chamber we observed a maximum intake on one day of 1804 gr. boiled seal meat, containing 85 gr. nitrogen and 218 gr. fat, but this is far below the quantities recorded for Eskimos in the free state.

The large quantities of meat are well absorbed and utilized by the Eskimos. The loss of nitrogen in the feces amounts to 3—5 gr. per day and the loss of energy to less than 10 % of the food.

The maximum quantity of nitrogen found in the urine of one day was 53 gr. When meat was given after a diet poor in nitrogen, only about 60 % of the nitrogen were excreted during the first 24 hours (from 5 hours after the first meal of meat to 18 hours after the last), 40 % (20—30 gr.) being retained.

The urine curves show very distinctly the interdependence of nitrogen and water excretion. During the nights after much meat there is a retention of nitrogen and also of water until about 4 in the morning but the quantity retained is excreted in bulk during the next two (to three) hours. In this case we have undoubtedly a retention of urea owing to decreased functional activity of the kidneys.

For some of the subjects the urea + ammonia nitrogen has been determined in 24 hour periods. The ratio $\frac{\text{urea} + \text{amm. } N}{\text{total } N}$ varies with the total excretion between 83.6 % (total N 16.4 gr.) and 92.5 % (total N above 50 gr.). The variations in "endogenous" nitrogen are small (from 2 to 4 gr.).

The respiratory exchange as determined in our experiments varies irregularly during the day but is always higher during the afternoon (from 2 to 10) than during the forenoon (6—2). During the night it is almost constant and practically independent of the

nature of the substances catabolized. The metabolism during sleep per kg. and hour is slightly different for the different pairs of subjects (1.30—1.14 calories).

The specific dynamic action of the protein catabolized has been calculated from all the 8 hour periods taken in two groups and works out as $8.6 \pm 5.0\,\%$ of the caloric value of the protein catabolized.

According to our experiments the Eskimos would appear therefore to be able to retain a large amount of protein for a certain period exceeding 24 hours and to utilize it as a source of energy with very little loss.

APPENDIX.

Tables showing composition of feces, excretion of urine and nitrogen, heat of combustion of some urines and data of respiration experiments.

Table I. Analyses of feces.

Time voided	Fresh weight gr.	Nitrogen		Crude fat							Heat of combustion		
		% fresh	gr.	unsaponified %	saponified %	total %	unsaponified gr.	saponified gr.	total gr.	unsaponified %	Calories per gr. fresh	total energy	energy per gr. N.
	a	b	c a×b	d	e	f d+e	g a×d	h a×e	i a×f	j g:i	k	l a×k	m l:b
Experiment I: M. D.													
$^{11}/_{7}$ 12^{40} p. m.	276	1.34	3.70	2.38	2.22	4.60	6.57	6.13	12.70	48.3	1.217	336	91
$^{12}/_{7}$ 8^{30} a. m.	181	1.39	2.52	1.95	1.41	3.36	3.53	2.55	6.08	41.9	1.112	201	80
$^{13}/_{7}$ 8^{30} a. m.	193	1.65	3.18	1.87	1.31	3.18	3.61	2.53	6.14	41.2	1.153	223	70
$^{14}/_{7}$ p. m.	188	1.20	2.26	2.08	1.26	3.34	3.91	2.37	6.28	37.7	1.270	239	106
Experiment I: C. W.													
$^{11}/_{7}$ 6^{45} p. m.	198	2.06	4.08	3.03	3.89	6.92	6.00	7.70	13.70	56.2	1.699	336	82
$^{13}/_{7}$ 2^{30} p. m.	210	1.86	3.91	3.38	3.02	6.40	7.10	6.34	13.44	47.2	1.837	386	99
$^{14}/_{7}$ p. m.	162	1.27	2.06	3.07	1.95	5.02	4.97	3.16	8.13	38.9	1.225	198	96
Experiment II: A. S.													
$^{21}/_{7}$ 8^{18} a. m.	37	1.58	0.58	3.23	2.18	5.41	1.19	0.81	2.00	40.5	1.471	54	94
$^{21}/_{7}$ 5^{00} p. m.	68	1.66	1.13	3.86	2.25	6.11	2.62	1.53	4.15	36.9	1.564	106	94
$^{22}/_{7}$ 8^{00} a. m.	102	1.51	1.54	4.04	2.48	6.52	4.12	2.53	6.65	38.1	1.559	159	103
$^{22}/_{7}$ 4^{21} p. m.	114	1.43	1.63	3.91	2.55	6.46	4.46	2.90	7.36	39.4	1.600	182	112
$^{23}/_{7}$ 7^{20} a. m.	207	1.24	2.57	2.81	3.65	6.46	5.82	7.55	13.37	56.5	1.613	334	130
$^{24}/_{7}$ 9^{27} a. m.	131	1.45	1.90	4.01	3.31	7.32	5.25	4.34	9.59	45.3	1.724	226	119
$^{24}/_{7}$ 4^{00} p. m.	80	1.66	1.33	4.02	2.79	6.81	3.22	2.23	5.40	40.9	1.675	134	101
Experiment II: N. D.													
$^{21}/_{7}$ 9^{30} a. m.	41	2.56	1.05	7.66	1.33	8.99	3.14	0.55	3.69	14.9	2.050	84	80
7^{05} p. m	48	2.07	0.99	7.21	1.15	8.36	3.46	0.55	4.01	13.7	1.805	85	85
$^{22}/_{7}$ 4^{21} p. m.	124	1.96	2.43	7.76	2.40	10.16	9.62	2.98	12.60	23.7	1.923	238	98
$^{23}/_{7}$ 7^{20} a. m.	171	1.71	2.92	6.19	3.52	9.71	10.58	6.02	16.60	36.3	1.923	329	113
$^{24}/_{7}$ 3^{50} a. m.	309	1.53	4.73	4.42	3.18	7.60	13.66	9.82	23.48	41.8	1.602	495	105
4^{00} p. m.	86	1.71	1.47	4.18	2.38	6.56	3.59	2.05	5.64	36.4	1.551	133	91
Experiment III: B. W.													
$^{1}/_{8}$ 6^{25} p. m.	69	1.62	1.12	6.81	0.87	7.68	4.70	0.60	5.30	11.3	1.559	108	96
$^{2}/_{8}$ 7^{35} a. m.	295	1.26	3.72	4.01	1.51	5.52	11.83	4.45	16.28	27.3	1.258	371	100
4^{30} p. m.	229	1.04	2.38	2.63	1.34	3.97	6.02	3.07	9.09	33.8	1.018	233	98
$^{3}/_{8}$ 7^{30} a. m.	91	1.20	1.09	3.05	1.98	5.03	2.74	1.81	4.58	39.5	1.230	112	103
3^{40} p. m.	103	1.67	1.72	3.91	1.00	4.91	4.03	1.03	5.06	20.4	1.323	136	79
9^{30} p. m.	66	1.62	1.07	3.22	1.61	4.83	2.12	1.07	3.19	33.5	1.166	77	72
$^{4}/_{8}$ 8^{45} a. m.	82	1.88	1.54	3.39	0.77	4.16	2.78	0.63	3.41	18.5	1.299	107	69
$^{5}/_{8}$ 6^{35} a. m.	24	2.63	0.63	5.05	3.00	8.05	1.21	0.72	1.93	37.3	1.828	44	70
4^{00} p. m.	69	2.36	1.63	4.78	1.04	5.82	3.30	0.72	4.02	17.9	1.683	116	71
$^{6}/_{8}$ a. m.	203	1.57	3.19	3.19	1.80	4.99	6.48	3.65	10.13	36.0	1.288	261	82
p. m.	?	..	1.89	..	..	..	2.81	2.41	5.22	46.2	..	187	99
Experiment III: A. M.													
$^{1}/_{8}$ 6^{25} p. m.	36	2.20	0.79	4.98	[1]	..	1.79	..	..	..	1.495	54	68
$^{2}/_{8}$ 7^{35} a. m.	648	1.37	8.88	5.15	0.95	6.10	33.27	6.25	39.52	15.8	1.269	822	93
4^{30} p. m.	124	1.48	1.84	9.90	1.77	11.67	12.28	2.19	14.47	15.1	1.942	241	131
$^{3}/_{8}$ 7^{30} a. m.	27	1.54	0.42	12.89	2.04	14.93	3.48	0.55	4.03	13.7	2.298	62	148
3^{40} p. m.	109	1.36	1.48	12.28	2.88	15.16	13.38	3.14	16.52	19.0	2.169	236	160
9^{30} p. m.	21	2.89	0.61	22.63	5.57	28.20	4.75	1.17	5.92	19.8	4.175	88	144
$^{4}/_{8}$ 8^{45} a. m.	60	1.58	0.95	8.08	2.46	10.54	4.85	1.47	6.32	23.3	1.789	107	113
$^{5}/_{8}$ 8^{35} a. m.	26	2.22	0.58	5.83	[1]	..	1.52	..	..	..	1.804	47	81
1^{45} a. m.	63	1.71	1.08	6.29	2.52	8.81	3.96	1.59	5.55	28.7	1.670	105	97
6^{00} p. m.	60	1.63	0.98	5.51	1.86	7.37	3.31	1.11	4.42	25.1	1.596	96	98
$^{6}/_{8}$ a. m.	189	1.71	3.23	4.42	2.03	6.45	8.35	3.84	12.19	31.5	1.428	270	84
p. m.	?	..	2.36	..	..	..	3.63	3.72	7.35	49.4	..	236	100

[1] Not enough material for analysis.

Table I (continued). *Experiment IV:* A. S.

Time voided	Fresh weight gr.	Nitrogen % fresh	Nitrogen gr.	Crude fat unsaponified %	Crude fat saponified %	Crude fat total %	Crude fat unsaponified gr.	Crude fat saponified gr.	Crude fat total gr.	Crude fat unsaponified %	Heat of combustion Calories per gr. fresh	Heat of combustion total energy	Heat of combustion energy per gr. N.
	a	b	c a×b	d	e	f d+e	g a×d	h a×e	i a×f	j g:i	k	l a×k	m l:b
12/8 2^{05} p. m.	178	1.56	2.78	3.37	2.55	5.92	6.00	4.54	10.54	43.1	1.590	283	102
14/8 1^{05} p. m.	214	1.74	3.72	3.60	3.07	6.67	7.70	6.57	14.27	46.0	1.650	353	95
15/8 8^{00} a. m.	175	1.76	3.08	3.59	2.29	5.88	6.28	4.01	10.29	39.0	1.538	269	87
10^{00} a. m.	193	2.09	4.03	2.67	1.56	4.23	5.15	3.01	8.16	36.9	1.394	269	67
2^{00} p. m.	185	1.53	2.83	1.78	1.58	3.36	3.29	2.93	6.22	47.1	1.029	190	67
						Experiment IV: N. D.							
15/8 2^{00} p. m.	143	1.45	2.07	3.15	1.39	4.54	4.50	1.99	6.49	30.7	1.199	171	83
6^{00} p. m.	241	1.14	2.75	3.14	1.69	4.83	7.57	4.07	11.64	35.0	1.036	250	91

Table II. Excretion of urine and nitrogen.

Experiment I.

M. D.

Time	Volume passed cc.	*N* gr.	*N* %	Interval hours	Vol. per hour	*N* per hour
	a	b	c b:a	d	e a:d	f b:d
10/7 5^{52} . . .	256	3.66	1.43	3.30	78	1.11
9^{25} . . .	240	3.03	1.26	3.55	68	0.85
11/7 6^{50} . . .	565	5.30	0.94	9.42	60	0.56
12^{40} . . .	380	3.27	0.86	5.83	65	0.56
2^{10} . . .	340	3.39	1.00	1.50	227	2.26
6^{45} . . .	485	7.95	1.64	4.58	106	1.74
9^{20} . . .	320	5.81	1.81	2.58	124	2.25
12/7 2^{30} . . .	580	10.02	1.73	5.17	112	1.97
6^{40} . . .	342	6.86	2.00	4.17	82	1.64
8^{30} . . .	350	3.32	0.95	1.83	191	1.82
9^{58} . . .	338	2.25	0.67	1.47	230	1.53
2^{30} . . .	315	5.16	1.64	4.53	69	1.14
4^{10} . . .	212	3.20	1.51	1.67	127	1.92
5^{55} . . .	308	4.00	1.30	1.75	176	2.30
6^{56} . . .	165	1.93	1.17	1.02	162	1.90
9^{00} . . .	290	5.27	1.82	2.07	140	2.54
10^{40} . . .	230	4.24	1.84	1.67	138	2.54
13/7 4^{50} . . .	583	10.54	1.81	6.17	94	1.74
6^{30} . . .	335	5.59	1.67	1.67	201	3.35
8^{30} . . .	373	2.69	0.72	2.00	186	1.34
9^{20} . . .	370	2.18	0.59	0.83	446	2.63
11^{30} . . .	215	2.21	1.03	2.17	99	1.02
1^{02} . . .	150	1.74	1.16	1.53	98	1.14
1^{53} . . .	218	1.17	0.54	0.85	257	1.38
3^{45} . . .	262	1.67	0.64	1.87	140	0.89
5^{15} . . .	80	0.94	1.17	1.50	53	0.63

C. W.

Time	Volume passed cc	*N* gr.	*N* %	Interval hours	Vol. per hour	*N* per hour
	a	b	c b:a	d	e a:d	f b:d
10/7 2^{34} . . .	285	3.43	1.20			
5^{52} . . .	350	3.34	0.95	3.30	106	1.01
9^{25} . . .	375	2.91	0.78	3.55	106	0.82
11/7 6^{50} . . .	625	4.97	0.80	9.42	66	0.53
9^{03} . . .	240	1.96	0.82	2.22	108	0.88
10^{57} . . .	168	1.66	0.99	1.90	88	0.87
12^{40} . . .	170	1.90	1.12	1.72	99	1.10
3^{20} . . .	213	3.97	1.86	2.67	80	1.49
6^{45} . . .	328	6.40	1.95	3.42	96	1.87
9^{20} . . .	300	6.20	2.07	2.58	116	2.40
12/7 2^{30} . . .	523	10.98	2.10	5.17	101	2.16
6^{40} . . .	540	9.98	1.85	4.17	129	2.39
8^{30} . . .	282	3.69	1.31	1.83	154	2.01
11^{40} . . .	215	4.10	1.90	3.17	68	1.29
2^{30} . . .	225	5.15	2.29	2.83	80	1.82
6^{50} . . .	520	10.36	1.99	4.20	124	2.46
8^{25} . . .	170	3.87	2.28	1.58	107	2.45
10^{40} . . .	265	5.90	2.22	2.25	118	2.62
13/7 4^{50} . . .	403	8.37	1.94	6.17	65	1.35
8^{30} . . .	553	6.67	1.21	3.67	151	1.82
11^{30} . . .	352	4.08	1.16	3.00	117	1.36
2^{30} . . .	123	2.51	2.04	3.00	41	0.84
5^{15} . . .	140	2.69	1.92	2.75	51	0.98

Experiment II.

A. S.

Time	Volume passed cc.	*N* gr.	*N* %	Interval hours	Vol. per hour	*N* per hour
20/7 6^{10} . . .	293					
21/7 4^{00} . . .	560	6.25	1.12	9.83	58	0.64
6^{35} . . .	470	4.42	0.94	2.58	182	1.72
8^{30} . . .	218	2.42	1.11	1.92	114	1.26

N. D.

Time	Volume passed cc	*N* gr.	*N* %	Interval hours	Vol. per hour	*N* per hour
20/7 7^{35} . . .	410	6.66	1.62			
21/7 4^{15} . . .	574	9.14	1.59	8.67	66	1.05
8^{30} . . .	216	3.78	1.75	4.25	51	0.89
1^{55} . . .	244	3.94	1.61	5.42	45	0.73

Table II (continued).

Time	Volume passed cc. a	N gr. b	N % c b:a	Interval hours d	Vol. per hour e a:d	N per hour f b:d
21/7 11^{50}	260	2.93	1.13	3.33	78	0.88
1^{55}	101	1.39	1.38	2.08	49	0.67
4^{37}	108	1.60	1.48	2.70	40	0.59
10^{27}	188	3.16	1.68	5.83	32	0.54
22/7 4^{45}	290	4.24	1.46	6.30	46	0.67
9^{55}	235	2.92	1.24	5.17	45	0.57
2^{20}	316	4.85	1.53	4.42	71	1.10
5^{35}	278	5.61	2.02	3.25	85	1.72
7^{50}	187	3.93	2.10	2.25	83	1.75
10^{50}	488	10.91	2.24	3.00	163	3.63
23/7 4^{45}	370	8.61	2.32	5.92	62	1.46
6^{30}	360	8.58	2.38	1.75	206	4.91
9^{25}	367	8.13	2.21	2.92	126	2.78
1^{50}	395	7.69	1.95	4.42	89	1.74
4^{25}	248	4.73	1.91	2.58	96	1.81
7^{00}	122	2.40	1.97	2.58	47	0.93
10^{55}	227	4.63	2.04	3.92	58	1.18
24/7 3^{50}	387	4.76	1.23	4.92	79	0.97
7^{10}	355	3.76	1.06	3.33	106	1.13
9^{27}	145	1.44	1.00	2.28	54	0.63
10^{55}	153	1.54	1.00	1.47	104	1.05

Time	Volume passed cc. a	N gr. b	N % c b:a	Interval hours d	Vol. per hour e a:d	N per hour f b:d
21/7 5^{44}	189	2.99	1.58	3.82	50	0.78
10^{27}	198	3.36	1.70	4.72	42	0.71
22/7 4^{45}	260	3.73	1.43	6.30	41	0.59
9^{55}	175	2.31	1.32	5.17	34	0.45
2^{20}	298	4.69	1.57	4.42	67	1.06
5^{35}	332	5.68	1.71	3.25	102	1.75
10^{50}	616	11.26	1.83	5.25	117	2.15
23/7 4^{45}	569	10.82	1.91	5.92	96	1.83
6^{30}	370	7.36	1.99	1.75	212	4.21
9^{25}	322	6.57	2.04	2.92	110	2.25
1^{50}	415	8.02	1.93	4.42	94	1.81
4^{25}	295	5.33	1.81	2.58	114	2.06
7^{00}	198	3.65	1.84	2.58	77	1.41
10^{55}	240	4.41	1.84	3.92	61	1.12
24/7 3^{50}	255	4.44	1.74	4.92	52	0.90
7^{10}	149	2.58	1.73	3.33	45	0.78
9^{27}	79	1.39	1.76	2.28	35	0.61
10^{55}	69	1.17	1.70	1.47	47	0.80

B. W. *Experiment III.* A. M.

Time	Volume passed cc. a	N gr. b	N % c b:a	Interval hours d	Vol. per hour e a:d	N per hour f b:d
1/8 4^{40}	153	1.42	0.93			
6^{25}	78	0.91	1.17	1.75	45	0.52
9^{25}	164	1.80	1.16	3.00	55	0.60
2/8 5^{05}	395	3.74	0.95	7.67	52	0.49
7^{35}	160	1.05	0.66	2.50	64	0.42
10^{20}	114	1.03	0.90	2.75	41	0.38
2^{40}	430	2.44	0.57	4.33	99	0.57
4^{30}	158	1.23	0.78	1.83	86	0.67
6^{40}	292	2.02	0.70	2.17	135	0.93
9^{06}	442	2.67	0.60	2.43	182	1.10
3/8 3^{35}	640	5.72	0.89	6.48	99	0.88
6^{25}	465	4.75	1.02	2.83	164	1.68
7^{30}	130	1.58	1.21	1.08	120	1.46
9^{25}	294	2.86	0.97	1.92	153	1.49
11^{50}	352	3.64	1.03	2.42	146	1.51
1^{35}	394	3.06	0.78	1.75	225	1.75
3^{40}	230	2.78	1.21	2.08	110	1.34
6^{05}	305	3.96	1.30	2.42	126	1.64
7^{20}	239	2.48	1.04	1.25	191	1.98
9^{30}	403	4.10	1.02	2.17	186	1.89
4/8 4^{08}	625	7.72	1.24	6.63	94	1.17
6^{30}	585	7.53	1.29	2.37	247	3.17
8^{45}	250	4.08	1.63	2.25	111	1.91
11^{05}	321	3.97	1.24	2.33	138	1.70
12^{47}	240	2.92	1.22	1.70	141	1.72
2^{10}	350	3.08	0.88	1.38	254	2.24
5^{05}	428	5.36	1.25	2.92	147	1.83
6^{55}	260	2.95	1.14	1.83	142	1.61
9^{40}	505	6.26	1.24	2.75	184	2.28
5/8 3^{40}	620	8.17	1.32	6.00	103	1.36
6^{40}	300	4.31	1.44	3.00	100	1.44
8^{35}	120	1.86	1.55	1.92	62	0.92
12^{30}	248	3.78	1.52	3.92	63	0.97
3^{05}	169	2.44	1.44	2.58	65	0.95

Time	Volume passed cc. a	N gr. b	N % c b:a	Interval hours d	Vol. per hour e a:d	N per hour f b:d
1/8 4^{40}	332	4.15	1.25			
6^{25}	146	2.50	1.71	1.75	83	1.43
9^{25}	260	4.39	1.69	3.00	87	1.47
2/8 5^{05}	498	8.07	1.62	7.67	65	1.05
7^{35}	120	2.19	1.82	2.50	48	0.88
10^{20}	190	2.68	1.41	2.75	69	0.97
2^{40}	450	5.68	1.26	4.33	104	1.31
4^{30}	195	3.06	1.57	1.83	106	1.67
6^{40}	290	4.57	1.58	2.17	134	2.11
9^{06}	408	5.70	1.40	3.43	168	2.35
3/8 3^{35}	555	7.40	1.33	6.48	86	1.14
6^{25}	603	8.81	1.46	2.83	213	3.11
7^{30}	182	2.82	1.55	1.08	169	2.62
9^{25}	414	3.65	0.88	1.92	216	1.90
11^{50}	458	3.98	0.87	2.42	189	1.64
1^{35}	390	3.22	0.83	1.75	223	1.84
3^{40}	167	2.96	1.77	2.08	80	1.43
6^{05}	238	5.01	1.74	2.42	119	2.07
7^{20}	200	3.24	1.62	1.25	160	2.59
9^{30}	340	5.36	1.58	2.17	157	2.47
4/8 4^{08}	600	10.37	1.73	6.63	91	1.56
6^{30}	430	7.87	1.83	2.37	181	3.31
8^{45}	335	5.32	1.59	2.25	149	2.37
11^{05}	340	4.26	1.25	2.32	146	1.83
12^{47}	265	4.02	1.52	1.70	156	2.36
2^{10}	365	3.73	1.02	1.38	264	2.71
5^{05}	360	6.39	1.77	2.92	123	2.19
6^{55}	196	3.78	1.93	1.83	107	2.07
9^{40}	395	7.35	1.86	2.75	144	2.67
5/8 3^{40}	580	10.27	1.77	6.00	97	1.71
6^{40}	183	3.82	2.09	3.00	61	1.27
8^{35}	163	2.50	1.53	1.92	85	1.30
12^{30}	290	5.25	1.81	3.92	74	1.34
1^{45}	82	1.43	1.75	1.25	66	1.14
3^{05}	90	1.53	1.70	1.33	68	1.15

Table II (continued).

Experiment IV.

A. S.

Time	Volume passed cc. a	N gr. b	N % c b:a	Interval hours d	Vol. per hour e a:d	N per hour f b:d
11/8 4^{10}....	390	6.70	1.72			
7^{40}....	225	3.78	1.68	3.30	68	1.15
10^{02}....	219	3.54	1.62	2.37	92	1.49
12/8 3^{50}....	310	2.76	0.89	5.80	53	0.48
6^{40}....	349	3.66	1.05	2.83	123	1.30
9^{02}....	154	1.87	1.21	2.37	65	0.79
12^{35}....	308	4.13	1.34	3.55	87	1.16
4^{23}....	300	5.54	1.85	3.80	79	1.46
7^{48}....	276	5.94	2.15	3.75	74	1.58
9^{40}....	293	6.23	2.12	1.87	157	3.33
13/8 2^{40}....	408	6.81	1.67	5.00	82	1.36
5^{45}....	452	8.00	1.77	3.08	147	2.60
9^{13}....	271	5.32	1.96	3.47	78	1.53
1^{15}....	275	4.92	1.79	4.03	68	1.22
5^{20}....	221	4.26	1.93	4.08	54	1.05
10^{00}....	327	7.19	2.20	4.67	70	1.54
14/8 2^{05}....	433	7.68	1.77	4.08	106	1.88
4^{30}....	233	4.66	1.98	2.42	97	1.92
7^{10}....	295	5.84	1.98	2.67	111	2.19
10^{20}....	275	5.46	2.02	3.17	87	1.72
1^{20}....	246	5.06	2.05	3.00	82	1.68
4^{25}....	234	5.02	2.14	3.08	76	1.63

N. D.

Time	Volume passed cc. a	N gr. b	N % c b:a	Interval hours d	Vol. per hour e a:d	N per hour f b:d
11/8 4^{10}....	564	6.57	1.17			
7^{40}....	175	2.05	1.17	3.30	53	0.62
10^{02}....	524	5.80	1.11	2.37	221	2.45
12/8 3^{50}....	492	2.70	0.55	5.80	85	0.47
6^{40}....	420	2.99	0.71	2.83	148	1.06
9^{02}....	239	2.08	0.87	2.37	100	0.88
12^{30}....	340	3.22	0.95	3.47	98	0.93
7^{48}....	317	4.77	1.50	7.30	43	0.66
9^{40}....	557	8.56	1.54	1.87	298	4.57
13/8 4^{20}....	400	6.34	1.58	6.67	60	0.95
9^{13}....	300	5.09	1.70	4.88	62	1.05
1^{15}....	210	3.62	1.72	4.03	52	0.90
5^{20}....	305	5.25	1.72	4.08	75	1.29
10^{00}....	426	7.42	1.74	4.67	91	1.59
14/8 4^{30}....	460	8.24	1.79	6.50	71	1.37
7^{10}....	324	6.13	1.89	2.67	121	2.30
1^{20}....	315	6.00	1.90	6.17	51	0.97
4^{25}....	300	5.41	1.80	3.08	97	1.76

Table III. Heat of combustion of some Eskimo urines.

Label of Sample	Total N (grams)	N %	Total Energy Calories	Energy per gr. N
A. S. 22/7, 5^{35} p. m.	5.61	2.02	44	7.9
A. S. 23/7, 10^{55} p. m.	4.63	2.04	39	8.4
B. W. 1/8, 4^{40} p. m.	1.42	0.93	16	11.6
A. M. 1/8, 4^{40} p. m.	4.15	1.25	35	8.4
B. W. 3/8, 3^{35} a. m.	5.73	0.89	51	8.8
A. M. 3/8, 3^{35} a. m.	7.40	1.33	52	7.0
B. W. 3/8, 6^{05} p. m.	3.96	1.30	33	8.4
A. M. 3/8, 6^{05} p. m.	5.01	1.74	39	7.7
B. W. 4/8, 6^{55} p. m.	2.95	1.14	25	8.3
A. M. 4/8, 6^{55} p. m.	3.78	1.93	28	7.4
A. S. 11/8, 10^{02} p. m.	3.54	1.62	31	8.6
N. D. 11/8, 10^{02} p. m.	5.80	1.11	53	9.2
N. D. 12/8, 7^{48} p. m.	4.77	1.50	39	8.2

Table IV. The respiratory exchange in experiments II, III and IV.

Experiment II.

Time	Ventilation cb. m.	Bar.	Tp.	Outside air CO_2%	Outside air O_2%	Air from chamber continuous samples CO_2%	Air from chamber continuous samples O_2%	Tp. in chamber dry bulb	Tp. in chamber wet bulb	Air from chamber intermediate samples CO_2%	Air from chamber intermediate samples O_2%	CO_2 produced l. per h.	O_2 absorbed l. per h.	R. Q.
20/7 7^{32}	..	757	6.2	..	..	..	..	13.3	11.8	0.910	19.931			
	24.0	..	..	0.040	20.910	0.633	20.274	..	..	..	..	44.3		
10^{14}	..	758.5	5.8	..	..	..	..	11.4	10.0	0.508	20.407			
	60.0	..	..	0.040	20.910	0.407	20.530	..	..	..	..	30.3		
21/7 5^{02}	..	759.5	5.2	..	..	..	..	11.1	9.4	0.351	20.564			
	26.8	..	..	0.033	20.915	0.517	20.349	..	..	..	..	42.0		
8^{25}	..	759.5	8.1	..	..	..	..	16.2	14.4	0.749	20.126			
	10.9	..	..	0.025	20.915	0.765	..	..	..	..	..	39.1		
10^{20}	..	759.5	9.2	..	..	..	..	18.5	16.7	0.715	20.126			
	16.4	..	..	0.029	20.915	0.827	20.027	..	..	..	..	35.3		
2^{06}	..	759	10.1	..	..	..	..	18.6	16.9	0.915	19.940			
	15.4	..	..	0.033	20.913	0.794	..	..	..	..	..	49.5		
4^{12}	..	759	10.1	..	..	..	..	18.0	16.3	0.744	20.188			
	29.9	..	..	0.033	20.910	0.704	20.269	..	..	..	..	44.1		
8^{21}	..	758.5	10.5	..	..	..	..	16.6	15.1	0.573	20.343			
	13.4	..	..	0.035	20.910	0.615	20.333	..	..	..	..	39.6		
10^{18}	..	758.5	9.8	..	..	..	..	16.7	15.0	0.659	20.249			
	45.3	..	..	0.035	20.910	0.404	20.580	..	..	..	..	29.0		
22/7 3^{14}	..	759	10.5	..	..	..	..	14.7	13.2	0.297	20.602			
	42.0	..	..	0.030	20.915	0.383	20.570	..	..	..	..	34.3		
7^{35}	..	758.5	11.0	..	..	..	..	17.4	15.3	0.498	20.456			
	17.8	..	..	0.030	20.918	0.490	20.464	..	..	..	..	37.1		
9^{37}	..	758.5	13.4	..	..	..	..	20.4	18.3	0.468	20.485			
	37.8	..	..	0.030	20.925	0.516	20.390	..	..	..	..	39.4		
2^{02}	..	757.5	13.4	..	..	..	..	22.1	19.9	0.538	20.358			
	17.8	..	..	0.030	20.927	0.614	20.305	..	..	..	..	43.7		
4^{19}	..	757	14.7	..	..	..	..	21.0	19.2	0.609				
	34.8	..	..	0.032	20.922	0.604	20.299	..	..	..	..	45.9		
8^{21}	..	756	14.3	..	..	..	..	18.8	17.3	0.604	20.301			
	19.0	..	..	0.037	20.917	0.602	20.287	..	..	..	..	40.2		
10^{48}	..	756	13.6	..	..	..	..	17.4	15.8	0.568	20.312			
	24.2	..	..	0.037	20.917	0.669	20.246	..	..	..	..	33.2		
23/7 3^{11}	..	755.5	12.2	..	..	..	..	15.6	14.1	0.638	20.245			
	10.7	..	..	0.034	20.920	0.688	20.227	..	..	..	..	35.2		
5^{09}	..	755.5	12.1	..	..	..	..	16.7	15.2	0.729	20.159			
	15.9	..	..	0.032	20.925	0.764	20.123	..	..	..	..	41.4		
7^{45}	..	756.5	12.2	..	..	..	..	19.3	18.0	0.709	20.209			
	19.9	..	..	0.030	20.930	0.607	20.299	..	..	..	..	36.7		
10^{30}	..	757	11.1	..	..	..	..	15.5	14.1	0.538	20.351			
	18.1	..	..	0.030	20.927	0.603	20.339	..	..	..	..	39.0		
1^{02}	..	757	10.1	..	..	..	..	15.3	13.9	0.553	20.383			
	21.4	..	..	0.028	20.920	0.566	20.416	..	..	..	..	36.1		
4^{04}	..	757	9.2	..	..	..	..	13.8	12.2	0.540	20.395			
	16.9	..	..	0.026	20.917	0.644	20.303	..	..	..	..	39.2		
6^{38}	..	756	8.9	..	..	..	..	12.8	11.6	0.649	20.281			
	19.2	..	..	0.026	20.915	0.692	20.272	..	..	..	..	43.1		
9^{30}	..	755	8.1	..	..	..	..	13.2	11.7	0.689	20.232			
	13.0	..	..	0.027	20.915	0.667	20.282	..	..	..	..	41.0		
11^{24}	..	754.5	8.1	..	..	..	..	11.8	10.6	0.659	20.265			
	32.7	..	..	0.029	20.920	0.528	20.429	..	..	..	..	31.8		
24/7 4^{15}	..	754.5	7.1	..	..	..	..	11.3	10.0	0.613	20.334			
	17.1	..	..	0.037	20.920	0.554	20.405	..	..	..	..	33.4		
6^{47}	..	754.5	7.0	..	..	..	..	13.4	12.0	0.619	20.366			
	29.2	..	..	0.040	20.917	0.645	20.227	..	..	..	..	38.6		
11^{13}	..	754	7.3	..	..	..	..	15.1	13.5	0.619	20.267			

Table IV (continued). *Experiment III.*

Time	Ventilation cb. m.	Bar.	Tp.	Outside air CO_2 %	Outside air O_2 %	Air from chamber continous samples CO_2 %	Air from chamber continous samples O_2 %	Tp. in chamber dry bulb	Tp. in chamber wet bulb	Air from chamber intermediate samples CO_2 %	Air from chamber intermediate samples O_2 %	CO_2 produced l. per h.	O_2 absorbed l. per h.	R. Q.
1/8 5^{34}....	..	753.5	10.9	..	..	..	..	21.0	19.1	0.621	20.293			
	17.2	..	..	0.031	20.946	0.697	20.240	..	..	..	..	57.0	60.2	0.95
7^{30}....	..	752.5	10.4	..	..	..	..	19.1	17.3	0.693	20.278			
	24.8	..	..	0.035	20.948	0.646	20.316	..	..	..	..	49.8	52.0	0.96
10^{17}....	..	751.5	9.4	..	..	..	..	14.2	12.7	0.592	20.381			
	40.1	..	..	0.041	20.950	0.444	20.516	..	..	..	..	31.5	34.6	0.91
2/8 2^{57}....	..	750	8.8	..	..	..	..	12.4	11.0	0.440	20.538			
	26.1	..	..	0.045	20.950	0.457	20.510	..	..	..	..	37.4	40.9	0.915
5^{47}....	..	749.5	8.4	..	..	..	..	13.1	11.7	0.531	20.428			
	20.4	..	..	0.045	20.950	6.460	20.483	..	..	..	..	39.7	44.6	0.885
7^{55}....	..	748.5	8.7	..	..	..	..	15.7	14.2	0.632	20.363			
	37.0	..	..	0.043	20.952	0.556	20.403	..	..	..	..	43.3	48.0	0.90
11^{49}....	..	748.5	10.0	..	..	..	..	18.8	17.3	0.441	20.511			
	30.8	..	..	0.040	20.957	0.460	20.497	..	..	..	..	39.4	44.3	0.89
2^{55}....	..	748.5	10.0	..	..	..	..	16.0	14.2	0.456	20.497			
	29.3	..	..	0.037	20.964	0.503	20.427	..	..	..	..	45.1	54.3	0.83
5^{48}....	..	748	10.3	..	..	..	..	17.7	16.0	0.506	20.417			
	12.5	..	..	0.034	20.972	0.740	20.150	..	..	..	..	40.8	48.5	0.84
8^{07}....	..	751	9.2	..	..	..	..	14.5	13.2	0.747	20.159			
	14.1	..	..	0.032	20.976	0.752	20.134	..	..	..	..	41.2	50.4	0.82
10^{26}....	..	751	8.3	..	..	..	..	12.5	11.2	0.727	20.158			
	30.0	..	..	0.033	20.973	0.660	20.233	..	..	..	..	31.6	38.9	0.81
3/8 3^{55}....	..	754.5	7.7	..	..	..	..	12.5	11.0	0.623	20.266			
	13.1	..	..	0.035	20.968	0.685	20.224	..	..	..	..	33.7	39.5	0.855
6^{20}....	..	756	6.8	..	..	..	..	12.3	10.4	0.632	20.266			
	14.4	..	..	0.035	20.964	0.814	20.076	..	..	..	..	43.0	51.3	0.84
8^{58}....	..	758.5	6.0	..	..	..	..	11.4	10.0	0.732	20.121			
	14.8	..	..	0.035	20.962	0.785	20.093	..	..	..	..	40.3	47.6	0.845
11^{38}....	..	759	5.6	..	..	..	..	11.4	10.0	0.742	20.139			
	13.7	..	..	0.035	20.960	0.722	20.148	..	..	..	..	36.4	44.1	0.845
2^{08}....	..	760	5.7	..	..	..	..	11.4	10.4	0.737	20.168			
	19.2	..	..	0.035	20.960	0.816	20.027	..	..	..	..	43.1	54.6	0.79
5^{37}....	..	761	5.2	..	..	..	..	11.5	10.3	0.823	20.018			
	13.6	..	..	0.035	20.960	0.834	20.000	..	..	..	..	43.0	54.8	0.785
8^{02}....	..	761	4.8	..	..	..	..	10.4	9.1	0.778	20.073			
	13.8	..	..	0.035	20.960	0.846	19.980	..	..	..	..	45.6	57.4	0.795
10^{30}....	..	761	3.8	..	..	..	..	9.9	8.8	0.833	20.013			
	31.0	..	..	0.033	20.960	0.658	20.210	..	..	..	..	31.5	39.7	0.795
4/8 4^{03}....	..	759	3.8	..	..	..	..	7.0	5.9	0.531	20.352			
	15.1	..	..	0.032	20.960	0.593	20.329	..	..	..	..	35.3	40.6	0.87
6^{35}....	..	757.5	5.5	..	..	..	..	12.4	11.0	0.687	20.186			
	21.0	..	..	0.030	20.960	0.771	20.074	..	..	..	..	42.6	53.2	0.80
10^{09}....	..	753	9.0	..	..	..	..	17.3	15.7	0.788	20.064			
	13.0	..	..	0.030	20.960	0.794	20.040	..	..	..	..	39.7	49.9	0.795
12^{28}....	..	750.5	10.0	..	..	..	..	21.2	19.3	0.783	20.069			
	21.6	..	..	0.030	20.958	0.865	19.951	..	..	..	..	39.8	50.1	0.795
4^{39}....	..	745.5	10.7	..	..	..	..	19.9	17.8	0.748	20.108			
	15.5	..	..	0.030	20.955	0.832	19.993	..	..	..	..	45.0	56.2	0.80
7^{26}....	..	746.5	10.6	..	..	..	..	17.0	15.4	0.883	19.951			
	14.9	..	..	0.030	20.953	0.825	20.011	..	..	..	..	40.0	50.0	0.80
10^{09}....	..	748	9.1	..	..	..	..	13.2	11.7	0.819	19.996			
	31.4	..	..	0.030	20.953	0.663	20.213	..	..	..	..	31.2	37.4	0.835
5/8 3^{57}....	..	754	7.0	..	..	..	..	10.3	9.1	0.648	20.244			
	14.5	..	..	0.032	20.957	0.610	20.281	..	..	..	..	29.6	36.2	0.815
6^{45}....	..	757	6.2	..	..	..	..	11.4	10.1	0.688	20.178			
	20.6	..	..	0.034	20.962	0.617	20.265	..	..	..	..	41.7	51.8	0.805
9^{25}....	..	759	6.0	..	..	..	..	11.9	10.4	0.601	20.298			
	21.2	..	..	0.035	20.966	0.666	20.274	..	..	..	..	43.6	47.8	0.91
12^{27}....	..	761.5	5.3	..	..	..	..	12.1	10.6	0.652	20.298			
	18.5	..	..	0.032	20.968	0.702	20.247	..	..	..	..	45.7	50.3	0.91
3^{10}....	..	763.5	5.0	..	..	..	..	13.0	11.4	0.723	20.215			

Table IV (continued). *Experiment IV.*

Time	Ventilation cb. m.	Bar.	Tp.	Outside air CO_2 %	Outside air O_2 %	Air from chamber continous samples CO_2 %	Air from chamber continous samples O_2 %	Tp. in chamber dry bulb	Tp. in chamber wet bulb	Air from chamber intermediate samples CO_2 %	Air from chamber intermediate samples O_2 %	CO_2 produced l. per h.	O_2 absorbed l. per h.	R. Q.
11/8 2^{19}	..	756	9.2	..	..	..	..	21.8	19.1	0.890	20.025			
	15.9	..	..	0.035	20.964	0.808	20.118	..	..	..	..	41.3	46.5	0.89
4^{52}	..	757	9.1	..	..	..	..	19.4	17.2	0.638	20.287			
	15.9	..	..	0.035	20.964	0.615	20.298	..	..	..	..	31.8	37.9	0.84
7^{30}	..	758	8.0	..	..	..	..	15.0	13.2	0.528	20.400			
	15.2	..	..	0.035	20.961	0.595	20.329	..	..	..	..	35.5	41.1	0.865
9^{50}	..	758.5	7.1	..	..	..	..	10.3	9.2	0.534	20.387			
	39.8	..	..	0.035	20.958	0.445	20.480	..	..	..	..	26.2	31.6	0.83
12/8 3^{37}	..	760	5.0	..	..	..	..	8.3	7.0	0.386	20.558			
	19.4	..	..	0.037	20.956	0.432	20.502	..	..	..	..	26.5	31.7	0.835
6^{26}	..	760.5	4.8	..	..	..	..	8.5	7.5	0.382	20.542			
	17.3	..	..	0.039	20.957	0.532	20.400	..	..	..	..	35.1	40.6	0.865
8^{56}	..	761.4	4.4	..	..	..	..	10.6	9.2	0.508	20.447			
	18.5	..	..	0.040	20.960	0.501	20.416	..	..	..	..	32.7	40.8	0.80
11^{33}	..	761.7	4.4	..	..	..	..	11.9	10.3	0.558	20.356			
	17.5	..	..	0.037	20.965	0.679	20.198	..	..	..	..	45.5	56.8	0.80
2^{03}	..	762	5.0	..	..	..	..	14.5	13.0	0.654	20.230			
	22.0	..	..	0.035	20.967	0.671	20.197	..	..	..	..	43.2	54.6	0.79
5^{14}	..	762	5.0	..	..	..	..	14.2	12.9	0.684	20.203			
	18.4	..	..	0.033	20.971	0.696	20.204	..	..	..	..	46.7	55.7	0.84
7^{46}	..	762	5.0	..	..	..	..	12.4	11.0	0.669	20.225			
	17.6	..	..	0.031	20.974	0.596	20.294	..	..	..	..	36.8	46.8	0.79
10^{18}	..	762	4.7	..	..	..	..	10.2	8.8	0.583	20.302			
	34.4	..	..	0.032	20.970	0.491	20.409	..	..	..	..	25.0	31.9	0.785
13/8 4^{15}	..	762.5	4.1	..	..	..	..	7.3	6.2	0.463	20.451			
	14.7	..	..	0.032	20.963	0.532	20.367	..	..	..	..	29.1	36.4	0.80
6^{49}	..	762.5	4.3	..	..	..	..	11.3	9.7	0.532	20.355			
	14.7	..	..	0.031	20.962	0.721	20.162	..	..	..	..	40.8	49.0	0.835
9^{27}	..	762.5	5.0	..	..	..	..	13.9	12.6	0.708	20.157			
	16.9	..	..	0.030	20.970	0.689	20.158	..	..	..	..	33.6	43.9	0.765
12^{30}	..	762.5	5.3	..	..	..	..	16.2	14.8	0.589	20.290			
	15.6	..	..	0.030	20.978	0.721	20.155	..	..	..	..	40.3	52.6	0.765
3^{17}	..	762	6.0	..	..	..	..	16.3	14.9	0.734	20.115			
	18.4	..	..	0.030	20.975	0.726	20.120	..	..	..	..	37.3	48.3	0.77
6^{37}	..	761	6.4	..	..	..	..	17.2	15.8	0.738	20.087			
	16.5	..	..	0.033	20.967	0.745	20.095	..	..	..	..	39.5	50.2	0.79
9^{28}	..	760.5	6.0	..	..	..	..	12.5	11.2	0.698	20.158			
	25.2	..	..	0.035	20.964	0.570	20.295	..	..	..	..	28.6	37.6	0.76
14/8 1^{42}	..	759	5.2	..	..	..	..	10.2	8.5	0.472	20.436			
	16.4	..	..	0.035	20.963	0.498	20.413	..	..	..	..	27.1	33.5	0.81
4^{22}	..	758.5	5.1	..	..	..	..	8.3	7.2	0.447	20.462			
	18.4	..	..	0.035	20.963	0.506	20.387	..	..	..	..	27.5	35.1	0.78
7^{32}	..	757.5	5.8	..	..	..	..	11.5	10.3	0.517	20.376			
	15.7	..	..	0.035	20.963	0.697	20.164	..	..	..	..	41.7	51.5	0.81
10^{14}	..	756.5	6.1	..	..	..	..	14.6	12.2	0.783	20.103			
	15.5	..	..	0.035	20.963	0.804	20.091	..	..	..	..	42.6	49.2	0.87
12^{58}	..	756.5	7.0	..	..	..	..	17.2	15.6	0.834	20.072			
	18.9	..	..	0.035	20.963	0.883	20.036	..	..	..	..	46.8	51.4	0.91
4^{21}	..	758	6.9	..	..	..	..	15.5	14.2	0.924	20.022			

II.

ACCOUNT OF THE CRUSTACEA AND THE PYCNOGONIDA COLLECTED BY DR. V. NORDMANN IN THE SUMMER OF 1911 FROM NORTHERN STRÖMFJORD AND GIESECKE LAKE IN WEST GREENLAND

BY

K. STEPHENSEN

In the summer of 1911 the Commission for the Direction of Geological and Geographical Exploration in Greenland appointed Dr. V. Nordmann to make a zoological investigation of Northern Strømfjord and Giesecke Lake in West Greenland.

This investigation is the first of a series of investigations of the animal life of the fjords of Greenland and consequently is of very great interest. That honour is due to Denmark for having made far more extensive investigations in Greenland waters than all the other nations taken together, will be evident from my list (which will shortly be published as a part of Conspectus Faunæ Groenlandicæ in Meddel. om Grønland, vol. 22) of all the habitats, known up to the present, of Greenland Crustacea and Pycnogonida; but no systematic investigation of the animal life at, as far as possible, all depths within a limited area has been made until now.

Previous expeditions have usually kept to rather shallow water or confined themselves to making scattered dredgings in deeper water; the Ingolf Expedition during the two summers 1895—96 had to investigate as far as possible all Greenland waters, and therefore naturally was not able to devote its attention to a single area. The Tjalfe Expedition of 1908—09 was confident that it had proved that the fjords of southern Greenland could be divided into two groups, viz. those in which the warm water of the Atlantic Ocean extends right to the head, and those which are cut off from Davis Strait by a ridge at the mouth so that the water of the Atlantic Ocean is kept out and the bottom water becomes arctic; therefore the Commission previously mentioned was of opinion that it was important to have these types of fjords investigated. As an example of the Arctic type Northern Strømfjord near Holstensborg was chosen, as mentioned above, and the result shows that all the Crustacea are true arctic or boreo-arctic species.

Last summer (1912) the Commission did me the honour of sending me to Greenland to investigate some fjords of the Atlantic type; as examples of such, Kvanefjord near Frederikshaab and Bredefjord and Skovfjord between Ivigtut and Julianehaab were chosen. Bredefjord, owing to its greater depth (above 900 metres), especially proved to be extremely interesting; an account of the results will probably soon be published.

But there are yet other Greenland fjords, the investigation of which will unquestionably yield very interesting results; first and foremost, Umanak Fjord which, although it is situated 5 degrees of latitude north of the ridge in Davis Strait yet, according to the Tjalfe Expedition, has bottom water of a temperature above freezing point.

The most interesting investigation will, however, be that of the great depth in Baffin Bay, as it is a vexed question, how far the fauna there is Arctic or Atlantic. Dr. Th. Mortensen thinks that he can prove, especially on the basis of the Echinodermata (Meddel. om Grønland, vol. 45, 1910 (1912), pp. 292—93) that the fauna is boreal, while the Malacostraca and the Pycnogonida appear to show that it is arctic with an admixture of a few boreal species (K. Stephensen, Meddel. om Grønland, vol. 45, 1912, pp. 565—66); as, however, there are about five times as many Malacostraca as Echinodermata in Greenland we may be justified in concluding that the Malacostraca give the more reliable result as regards this point.

The present paper deals with 70 species in all. (In the following list the figures before the names of the species indicate the number allotted to each species).

Two species are new to science, viz.

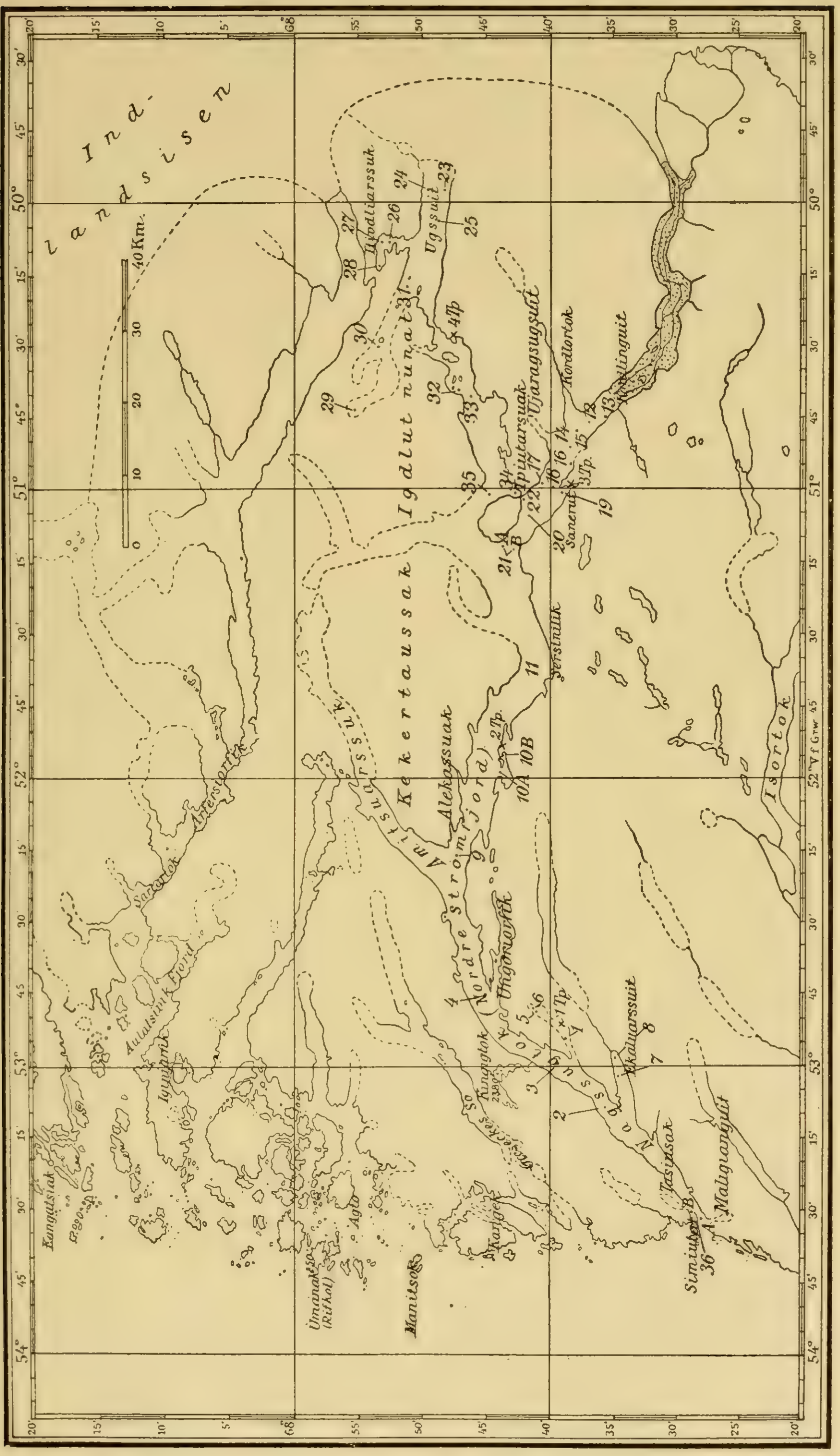
44. Janira Vilhelminæ and
62. Monstrilla Wandelii.

In addition to these, the following eight species are new to Greenland: —

19. Orchomenella pinguis,
23. Metopa leptocarpa,
36. Podocerus pusillus,
50. Balanus Hameri,
51. Lepas anatifera,
56. Centropages hamatus,
60. Ameira sp.,
61. Amphiascus Giesbrechtii.

Moreover, the following species should be noted, regarding whose distribution in Greenland only very little was known previously.

1 b. Brachyura larva (Hyas coarctatus?),
11. Spirontocaris microceros,
32. Haploops setosa,
39. Paradulichia typica,
42. Mesidothea Sabinei,
45. Janthe libbeyi,
46. Nebalia bipes,
55. Pseudocalanus elongatus (adult and Copepodites),
57. Acartia longiremis,
70. Diaptomus minutus.



Map of Northern Strømfjord. 1 Tp.—4 Tp. = 1.—4. tenting ground.

1. Northern Strømfjord.

List of the stations and of the Crustacea from each station.

A. Benthos.

St. 1. Depth 41—21 m.; temp. — 0.5° to + 0.5°; salinity 33.3 ‰; bottom clayey sand.

Hyas coarctatus 1 spec.
Eupagurus pubescens 1 spec.
Spirontocaris spinus 2 spec.
— Fabricii 2 spec.
Opisa Eschrichtii 2 spec.
Ampelisca macrocephala 1 spec.
Haploops setosa 35 spec.
— tubicola 1 spec.
Paradulichia typica 1 spec.
Herpyllobius arcticus 1 spec.
Balanus porcatus 3 spec.

St. 3 A. 325—330 m.; — 0.1°; salinity 33.3 ‰; clay?

Hyas coarctatus 1 spec.
Eupagurus pubescens 2 spec.
Spirontocaris spinus 1 spec.
Aristias tumidus 4 spec.
Haploops setosa 8 spec.
Melita dentata 1 spec.
Podocerus latipes 4 spec.
— pusillus 2 spec.
Parapleustes pulchellus 2 spec.

St. 3 B. 14—38 m.; + 0.3° to + 0.2°; salinity 31.9 ‰.

Eupagurus pubescens 1 spec.
Spirontocaris groenlandica 1 spec.
— Gaimardii 1 spec.
Aristias tumidus 2 spec.
Metopa leptocarpa 1 spec.
Janthe libbeyi 1 spec.
Balanus Hameri 1 spec.
— crenatus 8 spec.

St. 3 C. 200—240 m.

Eupagurus pubescens 4 spec.
Spirontocaris Gaimardii 3 spec.
Metopa pollexiana 12 spec.
Herpyllobius arcticus 1 spec.
Balanus porcatus 9 spec.
Pseudopallene circularis 1 spec.

St. 4 A. 400—410 m.; — 0.7°; mud and stones.

Eupagurus pubescens 8 spec.
Spirontocaris spinus 2 spec.
Stegocephalus inflatus 1 spec.
Acanthozone cuspidata 1 spec.
Acanthonotosoma serratum 1 spec.
Haploops tubicola 4 spec.
— setosa about 30 spec.
Janira Vilhelminæ n. sp. 22 spec.

St. 4 B. 48—46 m.; — 0.2°; stony bottom.

Eupagurus pubescens 3 spec.
Nectocrangon lar 1 spec.
Haploops setosa 1 spec.

St. 5.

Eupagurus pubescens 1 spec.
Sclerocrangon boreas 1 spec.
Spirontocaris spinus 1 spec.
Ampelisca macrocephala 1 spec.

St. 6.

Hyas coarctatus 1 spec.
Spirontocaris Fabricii 1 spec.

St. 7. 51—54 m.; salinity 32.2 ‰; clayey sand bottom.
Eupagurus pubescens 2 spec.
Nectocrangon lar 5 spec.
Spirontocaris spinus 1 spec.

St. 8. 12—29 m.; + 4° to + 1.4°; salinity 31.4 ‰; sandy mud and numerous Laminariæ.
Eupagurus pubescens 1 spec.
Nectocrangon lar 2 spec.
Spirontocaris Fabricii 1 spec.
— Gaimardii 1 spec.
— polaris 4 spec.
Anonyx nugax 1 spec.
Nebalia bipes 10 spec.
Balanus crenatus 4 spec.
Diastylis scorpioides 1 spec.

St. 9 B. 44—64 m.; salinity 31.9 ‰; stony and rocky bottom.
Eupagurus pubescens 2 spec.
Haploops setosa 1 spec.
Aristias tumidus 25 spec.

St. 10 A. 58 m.; + 1.0°(?); salinity 32.5 ‰; sand, somewhat clayey.
Eupagurus pubescens 1 spec.
Nectocrangon lar 4 spec.
Sclerocrangon boreas 1 spec.
Spirontocaris spinus 1 spec.
Rhoda Raschii 2 spec.
Haploops tubicola about 50 spec.
Anonyx lagena 2 spec.
— nugax 1 spec.
Paroediceros lynceus 3 spec.
Diastylis scorpioides 4 spec.
— Rathkei 5 spec.
Nebalia bipes 1 spec.

St. 10 B. 5 m.; + 5°; salinity 31.9 ‰; bottom of black, sandy, evil-smelling mud with rotten sea-weed.
Orchomenella pinguis 1 spec.

St. 11 C. 65—98 m.; — 0.7°; salinity 33.3 ‰; stony bottom.
Eupagurus pubescens 1 spec.

St. 11 D. 380—360 m.; — 1.5°.
Eupagurus pubescens 1 spec.
Haploops setosa 16 spec.
— tubicola 350 spec.
Unciola leucopis 65 spec.
Erichthonius megalops 4 spec.
Eudorella emarginata 2 spec.

St. 13. 60—38 m.; — 1.2° to + 1.0°; salinity 33.3 ‰; gray clay.
Pontoporeia femorata 10 spec.
Gammarus locusta 22 spec.
Mesidothea Sabinei 1 spec.
Balanus balanoides about 20 spec.

St. 14. 40—45 m.; + 0.2° to 0°; salinity 32.2 ‰; gray clay.
Mesidothea Sabinei 4 spec.

St. 17. 56 m.; 0°; salinity 33.3 ‰; gray clay with a few stones.
Pontoporeia femorata 1 spec.
Mesidothea Sabinei 4 spec.

St. 18. 225—240 m.; — 1.5°; salinity 33.3 ‰; partly gray clay bottom, partly hard bottom.
Mesidothea Sabinei 15 spec.

St. 19. 40—20 m.; + 5°; salinity 33.5 ‰; gray clay and stones.
Nectocrangon lar 1 spec.
Sclerocrangon boreas 1 spec.
Spirontocaris Gaimardii 1 spec.
— microceros 1 spec.
Haploops tubicola 18 spec.

St. 21 B. 325 m.; — 1.0°.
Mesidothea Sabinei 1 spec.

St. 23. 50—52 m.; + 0.1° to + 0.2°; salinity 32.3 ‰; fine gray clay.
Eupagurus pubescens 1 spec.

St. 24. 6—18 m.; + 1.0° to + 0.5°; salinity 30.9 ‰; gray bole.
Eupagurus pubescens 1 spec.
Nectocrangon lar 1 spec.

St. 26. 33—50 m.; salinity 32.3 ‰; stones.
Spirontocaris spinus 2 spec.
— Fabricii 1 spec.
Eupagurus pubescens 7 spec.
Balanus porcatus 2 spec.

St. 27. 77 m.; — 1.2°; salinity 32.3 ‰; fine clay.
Spirontocaris Gaimardii 1 spec.
Haploops tubicola 2 spec.

St. 28. 28—36 m.; + 0.8°; salinity 32.3 ‰; clay with stones.
Spirontocaris spinus 3 spec.
— Gaimardii 2 spec.
Eupagurus pubescens 6 spec.

St. 29. 16 m.; + 1.5° to + 1.2°; salinity 32.7 %; sandy clay with stones.
Eupagurus pubescens 3 spec.
Acanthozone hystrix 2 spec.
Socarnes bidenticulatus 1 spec.

St. 31. 46—35 m.; + 1°; small stones.
Eupagurus pubescens 2 spec.
Nectocrangon lar 2 spec.
Sabinea septemcarinata 1 spec.

St. 32. 35—20 (16?) m.; + 0.7° to + 0.2°; salinity 34.3 ‰.
Eupagurus pubescens 4 spec.
Spirontocaris Gaimardii 2 spec.
— polaris 1 spec.
— Fabricii 3 spec.
Nectocrangon lar 3 spec.
Nymphon serratum 1 spec.
— grossipes 2 spec.

St. 33. 150 m.; — 1.1°; salinity 34.3 ‰.
Eupagurus pubescens 1 spec.
Spirontocaris groenlandica 1 spec.
Ægina spinosissima 1 spec.
Arcturus Baffini 1 spec.

St. 34. 8—21 m.; + 1° to + 0.5°; salinity 32.5 ‰; clayey sand bottom with Laminariæ and other algæ.
Eupagurus pubescens 2 spec.
Nectocrangon lar 2 spec.
Sclerocrangon boreas 1 spec.
Spirontocaris Fabricii 3 spec
Haploops tubicola 1 spec.
Diastylis scorpioides 9 spec.
— Rathkei 5 spec.

St. 35. 225—210 m.; — 1.2°; salinity 35.1 ‰.
Haploops tubicola 16 spec.

St. 36 A. 170—200 m.; salinity 33.5 ‰; shelly bottom.
Ischyrocerus anguipes 14 spec.
Caprella septentrionalis 8 spec.

St. 36 B. 21—24 m.; + 2°; stones and Laminariæ.
Hyas coarctatus 1 spec.

1. tenting ground.
Gammarus locusta, between high- and low-water marks, about 10 sp.
Balanus crenatus about 20 spec.

4. tenting ground.
Socarnes bidenticulatus 1 spec.

B. Plankton.

Between St. 2 and the mouth of the fjord, about 14 miles, 3.30 p. m. to 6 p. m., surface, Steenstrup's apparatus.
Brachyura larva (same species as that recorded from the Tjalfe Expedition); a few spec. (see p. 64).
Pseudocalanus elongatus, adult and Copepodites.
Acartia longiremis, some spec.
Centropages hamatus
Cirripedia: Cypris stages and Nauplii.

St. 2. 0—2 m.; + 3.5°.
Nauplii
Pseudocalanus elongatus: Copepodites.
A few scarcely determinable Copepoda.

St. 2. 300—240 m. (Nansen-net).
Pseudocalanus elongatus, both adult and Copepodites; numerous.
Calanus finmarchicus; a few.

St. 3. Surface.
Calanus finmarchicus; a few.
Pseudocalanus elongatus; numer.
Ameira sp., 1 spec.
Amphiascus Giesbrechtii, 1 spec.
Monstrilla Wandelii n. sp., 1 spec.
Cirripede Nauplii.

St. 3. 250—190 m. (Nansen-net); about 0°.
Calanus finmarchicus; numerous.
— hyperboreus; a few.
Pseudocalanus elongatus; Copepodites.
Metridia longa; a few.
Nauplii; numerous.

St. 4. 0—2 m.
Pseudocalanus elongatus; a few Copepodites.
a few Nauplii.

St. 4. 300—250 m. (Nansen-net); about 0°.

Pseudocalanus elongatus; a few Copepodites.	Metridia longa; a few. A few Nauplii.

St. 9.

Calanus finmarchicus; a few. — hyperboreus; a single specimen.	Pseudocalanus elongatus; numer. Metridia longa, 20—30 spec. Cirripede Nauplii.

St. 14. 0—1 m. (Steenstrup's apparatus).
A few Nauplii, or else no specimens.

St. 18.

Calanus hyperboreus, 1 ♀. — finmarchicus; a few. Pseudocalanus elongatus; numer.	Metridia longa, about 20. Cirripede Nauplii.

St. 33. 0—1 m.

Some hardly full-grown (about 1 mm. long) and therefore scarcely determinable *Calanidæ*; the supposition that they are not full-grown is based on the fact that they have neither sexual organs nor distinct female sexual opening.

Some Nauplii.	3 Cirripedia in Cypris-stage.

St. 33. 100—45 m. (Nansen-net); — 1°.

Pseudocalanus elongatus; many adult and a few Copepodites.	Metridia longa; a few.

Between St. 35 and St. 11. Surface, two hours (Steenstrup's apparatus) sunshine, 6 p. m. to 8 p. m.

Pseudocalanus elongatus, Copepodites. Several Harpactidæ (Idyæa sp.?).	Cirripedia: Cypris stages and Nauplii.

At the head of the fjord, across the two bays near Itivdliarsuk, surface (Steenstrup's apparatus); + 6°.

Acartia longiremis; numerous. Cirripede Nauplii and Cyprides.	Other Nauplii.

List of the Species.

The majority of the species mentioned here have been previously recorded from Greenland; as regards references to literature and distribution, so far as these species are concerned, the reader is referred to my list of the Greenland Crustacea and Pycnogonida in Conspectus Faunæ Groenlandicæ (Meddel. om Grønland, vol. 22, 1913); as this work is just now going through the press, it is unfortunately impossible for me at the present time to make references to the pages upon which the species are mentioned, but as the work in question will be provided with a list of species in alphabetical order, any information desired will be easily found.

Only in connection with those species which have not previously been recorded from Greenland, or where other circumstances make it desirable, will any references to literature be made. New, or in other ways interesting, species are marked with ×.

Decapoda.

1. **Hyas coarctatus** Leach.

St. 1. 1 spec.; St. 3A. 1 spec.; St. 6. 1 spec.; St. 36B. 1 spec.

× **Brachyurid-larva** (**Hyas coarctatus** Leach?).

Between St. 2 and the mouth of the fjord a few specimens of the same *Brachyurid* larva which I have described in the report of the Tjalfe Expedition (Vid. Meddel. Naturh. Foren., Kbhvn., vol. 64, 1912 (1913), p. 127, fig. 33) were taken in the surface Plankton. In the place above cited I mention that it greatly resembles the larva of *Hyas araneus*, from which it differs, however, in some respects. Now, we have here before us the interesting case, that of the three crabs which are found in Greenland (*Chionoecetes opilio*, *Hyas araneus* and *H. coarctatus*), Dr. Nordmann's collections only contain specimens of the one species, *Hyas coarctatus*, and as both the other species are larger forms, it is inconceivable that they should not have been included in his material if they really occur in the fjord. True, the larva was found at the mouth of the fjord, so that it is possible that the specimens originated from adult crabs from Baffin Bay; but yet I think, on account of the close resemblance to the larva of *Hyas araneus*, that there is little doubt that the larva in question is that of *Hyas coarctatus*.

2. **Eupagurus pubescens** Kr.

St. 1. 1 spec.; St. 3A. 2 spec.; St. 3B. 4 spec.; St. 3C. 4 spec.; St. 4A. 8 spec.; St. 4B. 3 spec.; St. 5. 1 spec.; St. 7. 2 spec.; St. 8. 1 spec.; St. 9B. 2 spec.; St. 10A. 1 spec.; St. 11C. 11 spec.; St. 11D. 1 spec.; St. 23. 1 spec.; St. 24. 1 spec.; St. 26. 7 spec.; St. 28. 6 spec.; St. 29. 3 spec.; St. 31. 2 spec.; St. 32. 4 spec.; St. 33. 1 spec.; St. 34. 1 spec.

3. **Sclerocrangon boreas** Phipps.

St. 5. 1 spec.; St. 10A. 1 spec.; St. 19. 1 spec.; St. 34. 1 spec.

4. **Sabinea septemcarinata** Sabine.

St. 31. 1 spec.

5. **Nectocrangon lar** Owen.

St. 4B. 1 spec.; St. 7. 5 spec.; St. 8. 1 spec.; St. 10. 4 spec.; St. 18. 1 spec.; St. 19. 1 spec.; St. 24. 1 spec.; St. 31. 2 spec.; St. 32. 3 spec.; St. 34. 2 spec.

6. **Spirontocaris Fabricii** Kr.

St. 1. 2 spec.; St. 6. 1 spec.; St. 9B. 1 spec.; St. 26. 1 spec.; St. 32. 3 spec.; St. 34. 3 spec.

7. **Spirontocaris Gaimardii** M.Edw.

St. 3B. 1 spec.; St. 3C. 3 spec.; St. 8. 1 spec.; St. 19. 1 spec.; St. 27. 1 spec.; St. 28. 2 spec.; St. 32. 2 spec.

8. **Spirontocaris polaris** Sabine.

St. 9B. 4 spec.; St. 32. 1 spec.

9. **Spirontocaris groenlandica** J. C. Fabr.

St. 3B. 1 spec.; St. 33. 1 spec.

10. **Spirontocaris spinus** Sow.

St. 1. 1 spec.; St. 2. 1 spec.; St. 3A. 1 spec.; St. 4A. 2 spec.; St. 5. 1 spec.; St. 7. 1 spec.; St. 10A. 1 spec.; St. 26. 2 spec.; St. 28. 3 spec.

× 11. **Spirontocaris microceros** Kr.

St. 19. 1 spec.

The finding of this species is one of the most interesting results of the Expedition. In our zoological museum there are some 50 old specimens of this Greenland species, from four localities in West Greenland, ranging from Nanortalik (60°8′ N.) to Prøven (72°23′ N.) (see H. J. Hansen's list from 1887, p. 49). Since the publication of H. J. Hansen's paper it has not been found by any Danish or any foreign expedition, until now that it has been taken in N. Strømfjord; and it has never been found out of West Greenland. As, according to its last habitat, it appears to be a coast-form (Dr. Nordmann obtained it from a depth of 40—20 metres; in connection with the specimens previously known nothing is stated regarding the depth) it is very strange that so little is known regarding its distribution.

Euphausiacea.

12. **Rhoda Raschii** M. Sars.

St. 10A. 2 spec.

Cumacea.

13. **Diastylis scorpioides** Lepech.

St. 8. 1 spec.; St. 10A. 4 spec.; St. 34. 9 spec.

14. **Diastylis Rathkei** Kr.

St. 10A. 5 spec.; St. 34. 5 spec.

15. **Eudorella emarginata** Kr.

St. 11D. 2 spec.

Amphipoda.

16. **Socarnes bidenticulatus** Bate.

St. 29. 1 spec.; 4. tenting ground, 1 spec.

17. **Aristias tumidus** Kr.
St. 3A. 4 spec.; St. 3B. 2 spec.; St. 9B. 25 spec.

18. **Anonyx lagena** Kr. + **A. nugax** Phipps.
St. 8. 1 spec. (*A. nugax*); St. 10A. 2 spec. (*A. lagena*) + 1 spec. (*A. nugax*).

In Conspectus Faunæ Groenlandicæ I briefly explain that *A. lagena* and *A. nugax* are without doubt synonyms.

× 19. **Orchomenella pinguis** A. Boeck.
Anonyx pinguis A. Boeck, Forhandl. 8. Skand. Naturforskermøde, 1861, p. 642.
Orchomene pinguis, — Skand. og Arkt. Amphip., 1876, vol. 1, Pl. 5, fig. 1, vol. 2, p. 176.
* Orchomenella — G. O. Sars, Account, vol. 1, 1895, pp. 67 and 683, Pl. 24, fig. 2.
— — Stebbing, Tierreich, 1906, p. 82 (ubi lit. et syn).
St. 10B. 1 spec. New to Greenland.

Previously recorded distribution: Arctic Ocean, northern Atlantic Ocean, North Sea, Skagerak, Siberia, S. and W. Norway, Malangenfjord in Finmark and Mediterranean (Stebbing, l. c.).

20. **Opisa Eschrichtii** Kr.
St. 1. 1 spec.

21. **Pontoporeia femorata** Kr.
St. 13. 10 spec.; St. 17. 1 spec.

22. **Stegocephalus inflatus** Kr.
St. 4A. 1 spec.

× 23. **Metopa leptocarpa** G. O. Sars.
Metopa leptocarpa G. O. Sars, Oversigt af Norges Crust. 1, Christiania Vid. Selsk. Forhandl., 1882, No. 18, p. 91, Pl. 4, fig. 3.
* — — G. O. Sars, Account, vol. 1, 1895, p. 265, Pl. 93, fig. 2.
— — Stebbing, Tierreich, 1906, p. 178.

Sars writes (l. c. 1895) "I have only seen a solitary specimen, an ovigerous female, of this interesting form. It was collected, many years ago, at Christianssund, west coast of Norway, from a depth of 60—80 fathoms. Out of Norway, it has not yet been recorded."

St. 3B. 1 spec. New to Greenland. The specimen agrees exactly with Sars's description and figures.

24. **Metopa pollexiana** Bate.
St. 3C. 12 spec.

25. **Paroediceros lynceus** M. Sars.
St. 10A. 3 spec.

26. **Parapleustes pulchellus** G. O. Sars.
St. 3A. 2 spec.

27. **Acanthonotosoma serratum** O. Fabr.
St. 4A. 1 spec.

28. **Acanthozone hystrix** Kr. (= **A. cuspidata** Lepech.).
St. 4A. 1 spec.; St. 29. 2 spec.

29. **Gammarus locusta** L.
St. 13. 22 spec.; 1. tenting ground, between high- and low-water marks, about 10 spec.

30. **Melita dentata** Kr.
St. 3A. 1 spec.

31. **Ampelisca macrocephala** Lillj.
St. 1. 1 spec.; St. 5. 1 spec.

32. **Haploops setosa** Boeck.
St. 2. 35 spec.; St. 4A. about 30 spec.; St. 4B. 1 spec.; St. 9B. 1 spec.; St. 11D. 16 spec. This species appears otherwise to be rather rare in Greenland.

33. **Haploops tubicola** Lillj.
St. 2. 1 spec.; St. 4A. 4 spec.; St. 10A. about 50 spec.; St. 11D. about 350 spec.; St. 19. about 20 spec.; St. 27. 2 spec.; St. 34. 1 spec.; St. 35. 16 spec.

34. **Podocerus (Ischyrocerus) anguipes** Kr.
St. 36A. 14 spec.

35. **Ischyrocerus latipes** Kr.
St. 3A. 4 spec.

× 36. **Podocerus pusillus** G. O. Sars.
(partim) Podocerus falcatus A. Boeck, Skand. og Arkt. Amphip., 1876, vol. 2, p. 605, Pl. 28, fig. 2.
* Podocerus pusillus G. O. Sars, Account, vol. 1, 1895, p. 596, Pl. 212, fig. 1.
Jassa pusilla Stebbing, Tierreich, 1906, p. 655 (ubi lit. et syn.).
St. 3A. 2 spec. New to Greenland.
Previously recorded distribution: Arctic Ocean, northern Atlantic Ocean, Irish Sea, Skagerak, S. and W. Norway (37—188 m. on Hydroids), British Isles, and France (Stebbing, l. c.).

37. **Erichthonius megalops** G. O. Sars.
St. 4A. 8 spec.; St. 11D. 4 spec.

38. **Unciola leucopis** Kr.
St. 11D. 65 spec.

× 39. **Paradulichia typica** Boeck.

St. 2. 1 spec.

This otherwise rather rare species has previously been found only once in Greenland, viz. in Olrik Bay, north of Cape York at 15—20 fathoms (Ortmann, 1901).

40. **Ægina spinosissima** Stimpson.

St. 33. 1 spec.

41. **Caprella septentrionalis** Kr.

St. 36A. 8 spec.

Isopoda.

42. **Mesidothea Sabinei** Kr.

St. 13. 1 spec.; St. 14. 4 spec.; St. 17. 4 spec.; St. 18. 15 spec., of which the largest (a ♂) was 98 mm. long; St. 21B. 1 spec.. These localities are of great interest, the species previously having been known only from four localities in West Greenland (not from East Greenland).

43. **Arcturus Baffini** Sab.

St. 33. 1 spec.

× 44. **Janira Vilhelminæ** n. sp. (Pl. 1—2).

St. 4A. 22 spec. (♂ and ♀).

At this station Dr. Nordmann took an *Asellot*, the determination of which has given me some difficulty. As may be seen from the figure, it has a striking resemblance to *Janthe speciosa* Bovallius (Janthe, a new genus of Isopoda; Bihang Kgl. Vet. Akad. Handb., vol. 6, No. 4, 1881, p. 5, Pl. 1—3) if we imagine the dorsal spines to be absent and the lateral processes of the head and of the segments to be somewhat more rounded at the apex. *Janthe speciosa* Bovallius again stands near to *Janthe spinosa* Harger (Marine Isop. New England; Report U. S. Commission Fish and Fisheries, pt. 6, for 1878, p. 323, Pl. 2, fig. 10) and nearer still to *Jolella glabra* H. Richardson (Some New Isopoda Aselloidea from N. America; Proc. U. S. Nat. Mus., vol. 35, 1908, p. 71, fig. 1). The resemblance to the latter species is especially striking; we know that Asellote Isopods can vary highly (see, e. g. *Iæra marina* in H. J. Hansen, Revider. Fortegn. over Danmarks marine Arter af Isop., Tanaid., Cumac., Mysid. and Euphaus.; Vid. Meddel. Naturh. Foren., Kbhvn., 1909 (1910), p. 208, figs. 1—6). Of the species mentioned, the present one stands unquestionably nearest to *Jolella glabra* Richardson, and at first I thought it was a somewhat divergent form of that species. Miss Richardson has only had a single specimen for investigation; she gives but a short description of it without mentioning its size, and only one, not particularly good, figure of it; but my specimens agree perfectly with her description, when she ends by saying: "This species is very similar to *Jolella spinosa* (Harger) and differs chiefly from that species in lacking spines on the dorsal surface of the body."

Of the species mentioned, the only one whose limbs are figured is *Janthe speciosa* Bovallius. This species has been established on a single large specimen (♂) and resembles *Janira spinosa* Harger so closely that H. J. Hansen (West Greenland, 1887, p. 191) unites them into one species. Miss Richardson on the other hand regards them as two species in her Monograph Isop. N. America, 1905, pp. 458 and 460, and writes in addition (ibid. footnote p. 460) "This species (*Jolella speciosa*) is considered by Hansen and Ortmann to be a synonym of the preceding species (*Jolella spinosa*). Since my manuscript went to press, the types of *J. spinosa* have been sent me from Yale University, and I find it distinct from *J. speciosa*."

I find it unnecessary to give a complete description of the species taken by Dr. Nordmann as all details may be seen in the figures; only I think that the following characters should be pointed out: — Flagellum of first antenna has, in the ♂, about 45 joints and in the ♀ about 30 joints; in second antenna the flagellum has about 225 joints. The eyes are oblong as are those in the species established by Harger and by Bovallius, not round as in *J. glabra*. The length is 14 mm.

Although on account of the absence of dorsal spines the specimens most resemble *J. glabra*, yet they cannot be this species; this belief is based partly on the fact of the eyes being oblong and not round, and partly on the habitat. *Jolella glabra* has been taken off Cape Hatteras, at 888 fathoms, in blue mud and fine sand, and consequently belongs to the Atlantic-boreal deep-sea fauna. But the species in question was taken in a true arctic locality and the Malacôstraca which originate from the same station (see above in the list of the stations) are all good arctic or boreo-arctic species; at any rate none of them is a boreal deep-sea species (see my zoo-geographical account of the Greenland Malacostraca and Pycnogonida of the Danmark Expedition; Meddel. om Grønland, vol. 45, 1912, pp. 554 sqq.).

It is practically impossible that an Atlantic deep-sea species could possibly be found in arctic conditions north of the ridge in Davis Strait and the few cases known to me where this happens with regard to the Greenland Malacostraca and Pycnogonida are the following: — *Pandalus borealis* and *Pseudomma parvum* (Danmark Expedition, l. c. pp. 566 and 579) extend really right into Umanak Fjord; but here the water is not arctic, registering + 1° at the bottom; besides as regards *Pandalus borealis*, it is extremely eurythermic. Whether this is also true of *Pseudomma parvum* cannot be decided now that it is only known from S.W. Ireland (Tattersall, 1911) as well as from the head of Umanak Fjord. On the other hand *Aconthoniscus typhlops* has been taken south of the ridge in Davis Strait (63°24′ N., 53°10′ W.; 892 m.) and west of the Lofoten, consequently, north of the ridge in the Atlantic Ocean (68°21′ N., 10°41′ E.; 457 fathoms; — 0.70°) (Danmark Expedition, l. c. p. 615). Very much the same applies to *Janthe laciniata*: its West Greenland habitat is, however, situated so far north (66°45′ N., 56°30′ W.; 200 fathoms) that it must almost be said to occur upon the ridge. Still harder it is to understand the case of *Cordylochele* (*Pallene*) *malleolata* which, besides having been found in the cold area of the North Sea, is also said to have been taken by the Ingolf Expedition not only in Davis Strait, but also right out in the Atlantic Ocean (64°18′ N., 27°0′ W., 295 fathoms; 5.8°) (Danmark Expedition, l. c. p. 616); at any rate as regards the last habitat it can apparently be explained only by the fact that an erroneous locality has been recorded on the label; for that the animal in question (a young specimen) has been correctly determined I have convinced myself by personal observation. I am quite unable to understand the case of *Acanthoniscus typhlops* and *Janthe laciniata*; the specimens determined by me (Malac., Tjalfe Expedition; Vid. Meddel. Naturh. Foren., Kbhvn., vol. 64, 1912 (1913), p. 99) do not differ in any point from Sars's drawings.

Janira Vilhelminæ I have had much pleasure in naming after Mrs. V. Nordmann, who helped her husband to collect the animals in Greenland.

× 45. **Janthe libbeyi** Ortmann (Pl. 3).

Jolanthe libbeyi Ortmann, Princeton University Bulletin, vol. 11, No. 3, 1900, p. 39.
* Tole — — , Proc. Acad. Nat. Sc. Philadelphia, 1901, p. 157, with fig.
Janthe — Richardson, Monograph Isop. N. America, 1905, p. 463, fig. 518 (Reproduced from Ortmann l. c. 1901).
— — K. Stephensen, Danmark-Exp., 1912, p. 583.

St. 3B. 1 spec.

The description which Ortmann has given of this species agrees excellently with the specimen taken by Dr. Nordmann. As Ortmann's figure is, however, very incomplete, I have thought it of importance to give some more detailed drawings; these will be found in Pl. 3. Ortmann does not mention that each of the lateral angulations on the head terminates in a spine which is articulated into it; similar spines are also found upon all the lateral angulations of the segments and especially on the pleon. As the whole dorsal surface of the animal is quite smooth without any sculpture whatever I have regarded it as sufficient to give a mere outline of the entire animal.

The locality is very interesting; previously the species has been known only from Cape Alexander, north of Cape York; 27 fathoms (Ortmann).

Leptostraca.

× 46. **Nebalia bipes** O. Fabr.

St. 8. 9 spec.; St. 10A. 1 spec.

Nebalia has previously been known, on the whole, from only some ten Greenland localities; therefore these new habitats are of great interest, as they show, as do my own investigations in some fjords in Greenland last summer (1912), that the species is in reality far more widely distributed than has previously been known.

Cirripedia.

47. **Balanus porcatus** da Costa.
St. 1. 3 spec.; St. 3C. 4 spec.; St. 26. 2 spec..

48. **Balanus balanoides** L.
St. 13. about 20 spec.

49. **Balanus arenatus** Brug.
St. 3B. 8 spec.; St. 9B. 4 spec.; 1. tenting place, about 20 spec.

× 50. **Balanus Hameri** Ascanius.
Lepas Hameri Ascanius, Icones rerum naturalium 1767, Pl. 10.
* Balanus — Darwin, Monogr. Cirriped., Balanidæ, 1854, p. 277, Pl. 7, fig. 5.
St. 3B. A large living specimen. The species is new to Greenland.

× 51. **Lepas anatifera** L.
Lepas anatifera Linné, Systema Naturæ, ed. 12, vol. 1, pt. 2, 1767, p. 1109.
* — — Darwin, Monogr. Cirrip., Lepadidæ, 1851, p. 73, Pl. 1, fig. 1.

This species has been included here, although it does not originate from Dr. Nordmann's collections; but Porsild has given some specimens to our Museum, which were obtained, Oct. 1910, from drift wood at the Danish Arctic Station in Godhavn, Disco. The species is new to Greenland; hitherto it has been recorded only from Arctic Seas (teste Hoek in Nord. Plankton) from Spitzbergen (Weltner, Fauna arctica, vol. 1, 1900).

Cirripede nauplii and *Cypris stages* have been taken in several places (see list of localities).

Copepoda.

52. **Herpyllobius arcticus** Steenstrup & Lütken.
St. 1. 1 spec.; St. 3C. 1 spec.

53. **Calanus finmarchicus** Gunnerus.
St. 2. 300—240 m.; St. 3, surface; St. 3. 250—190 m.; St. 9; St. 18.

54. **Calanus hyperboreus** Kr.
St. 3. 250—190 m.; St. 9; St. 18.

× 55. **Pseudocalanus elongatus** Boeck (Pl. 4—5: 3rd Copepodite).
Between St. 2 and the mouth of the fjord, surface, adult and Copepodites; St. 2. 0—2 m., Copepodites; St. 2. 300—240 m., adult and Copepodites; St. 3, surface; St. 3. 250—190 m., Copepodites; St. 4. 0—2 m., Copepodites; St. 4. 300—350 m., Copepodites; St. 9; St. 33.

100—45 m., adult and Copepodites. Between St. 35 and St. 11, surface, Copepodites.

This species is an excellent example of how insufficiently the Plankton of the Greenland seas is known. Vanhøffen (1897) was the first to record it as Greenlandic (from Lesser Karajak Fjord in Umanak Fjord, West Greenland). Since then it has only been recorded from Greenland Seas from the following places in East Greenland: 74°15′ N., 18°15′ W., 250 m. (Cleve, 1900) and 77°35½′ N., 18°12′ W., 75 m. (and from a few places in the neighbourhood; but the determination is not reliable) (Duc d'Orléans, 1909). According to the above it is the most common Copepod at any rate in Northern Strømfjord.

The material contained not only adults but also many in the Copepodite stages, chiefly in the 3rd stage. The Copepodites are very easily distinguishable by their urosomes which seen from the side are rather rounded in the middle (see Pl. 4). Oberg has given a fairly exhaustive description of the development of this species in Wiss. Meeresuntersuch. d. Deutsch. Meere, Abt. Kiel, vol. 9, 1906, pp. 40, 46, 47, 48, 49, etc., Pl. 1; Pl. 6, fig. 3A—D; Pl. 7, fig. 5A (also in his thesis for a doctor's degree, which bears the title: Die Metamorphose d. Plankton-Copepoden d. Kieler-Bucht, 1906; but here all the plates are omitted). A record, accompanied by the more important figures is found in v. Breemen, Nordisches Plankton, vol. 8, 1908, p. 231; some notes on the growth, etc., are given by F. Kraefft in Ueber das Plankton in Ost- u. Nordsee etc. mit bes. Berucksichtigung der Copepoden; Wiss. Meersuntersuchungen, K. Komm., Abt. Kiel, vol. 11. As Oberg, however, does not give drawings of all the limbs of any single stage, I have in the accompanying Pl. 4—5 given figures of the entire animal and drawings of all the limbs in the 3rd Copepodite stage, to which stage almost all the specimens in hand appear to belong. I think it unnecessary to give descriptions of the figures; for these I refer the reader to Oberg.

× 56. **Centropages hamatus** Lilljeborg.

Ichthyophorba hamata Lilljeborg, De Crust. ex ordinibus tribus Clad., Ostrac., Copep., 1853, p. 185, Pl. 21, 26, figs. 9—12.

Centropages hamatus Giesbrecht u. Schmeil, Tierreich, 1898, p. 56 (ubi lit. et syn.).

* — — G. O. Sars, Account, vol. 4, 1903, p. 76, Pl. 52.

Between St. 2 and the mouth of the fjord, surface. New to Greenland. Previously recorded distribution: North Atlantic Ocean with adjacent waters between 41° and 66° N., but chiefly the European side (Sars, l. c.).

× 57. **Acartia longiremis** Lilljeborg.

Between St. 2 and the mouth of the fjord, surface; at the head of the fjord, across the two bays near Itivdliarsuk, surface.

This species also is an example of our deficient knowledge of the Plankton of Greenland; from Greenland it has hitherto been recorded only by Vanhøffen (1897).

58. **Metridia longa**
St. 4. 300—250 m.; St. 9; St. 18; St. 33. 100—45 m.

59. **Idyæa** sp.?
Between St. 35 and St. 11, surface.

× 60. **Ameira** sp.
St. 3, surface. The genus is new to Greenland.

× 61. **Amphiascus Giesbrechtii** G. O. Sars.
Amphiascus Giesbrechtii G. O. Sars, Account, vol. 5, 1911, p. 157, Pl. 98.
Stenhelia ima Giesbrecht (teste Sars l. c.; as Giesbrecht (also according to Sars) has recorded it from Kielerfjord, the species is probably established by Giesbrecht in his paper: "Die Freileb. Copep. d. Kieler Føhrde," 1882; but I have not had access to this paper.
St. 3, surface, 1 spec. New to Greenland.
Previously known distribution: Norway (Sars), Kielerfjord (Giesbrecht).

× 62. **Monstrilla Wandelii** n. sp. (Pl. 6).
St. 3, surface, 1 spec. (♀).

In the above locality a single specimen of a *Monstrilla*, ♀, 2 mm. long, has been taken. The specimen is very defective, the greater part of the right antenna is missing, and several of the hairs are wanting; thus, on the right branch of the furca there are 5, and on the left 4 only, and the apex is wanting from all of them except from the small dorsal hair.

In Nordisches Plankton, vol. 8 (Lief. 7), 1908, pp. 201, seqq., v. Breemen has given an account of the few known northern Monstrillas. Since then only 10 species more (A. Scott, Siboga-Copep. 1, 1909, pp. 234—41, Pl. 57 and 58) have been described, but none of them agrees with the new Greenland species. It agrees closest with *Monstrilla anglica* Lubbock (see v. Breemen, l. c., p. 209, figs. 221—22 and Th. Scott, 22 Ann. Report Fishery Board f. Scotland, pt. 3, 1904, p. 246, Pl. 13, fig. 13; Pl. 14, figs. 12—14), but that it is not this species may be seen, among other things, from the fact that p. 5 has an entirely different form with a fairly large inner branch, and there are hairs on the furca. That the specimen from Greenland has only 5 pairs of furcal hairs is of less significance, as the one pair is perhaps lost (besides, on the right branch there is one more than on the left); but the dorsal hair is seated on the outer side and not above the parting between the two innermost hairs. Moreover, the carapace of the new species is reticulated (see Pl. 6, fig.: Ceph. retic.); of species with reticulation, as far as I know, there exists only one, viz. *M. longipes* (A. Scott l. c., 1909, p. 238, Pl. 58, figs. 3—4) and that species is in other respects quite different.

For these reasons I think that there can be no doubt that it is really a new species; in the figures I have indicated all I have been able to see.

This species I have ventured to name after his Excellency, Vice Admiral C. F. Wandel who, both as the Head of the Commission for Greenland, and also in several other ways has rendered great services with regard to the exploration of Greenland.

Pycnogonida.

63. **Pseudopallene circularis** Goodseer.
St. 3C. 1 spec.

64. **Nymphon serratum** G. O. Sars.
St. 32. 1 spec.

65. **Nymphon grossipes** Fabr. var. **mixta** Kr.
St. 32. 2 spec.

2. Giesecke Lake (Giesecke-Sø).

Giesecke lake is situated north of, and also parallel with, the outermost part of N. Strømfjord. As the surface of the water is situated at a level of only about 10 metres above that of the sea there was reason to believe that its fauna would include relicts. Whether such have been found belonging to the other groups of animals I do not know, as they have not as yet been worked out; but all the Crustacea are typical freshwater species.

List of the localities investigated and the animals from each locality.

1. Just off the mouth of Ekalugssuit Bay, 43 m. (bottom) to 0 m., surface 9° (10. 8. 1911).
Bosmina obtusirostris, about 10 specimens (with young).
?Daphnia pulex, 1 defective specimen.
Cyclops strenuus, ♀ with eggs.
Diaptomus minutus, many hundreds including many ♀ with eggs.
2. Between the eastern point of Ekalugssuit Bay and the shell-bank, 0—2 m., 7½° to 12½° (4. 8. 1911).
Bosmina obtusirostris, a few, including some with eggs in the ephippium.
Diaptomus minutus, many hundreds, but none with eggs.
Copepode Nauplii.

3. Ekalugssuit Bay, 0—1 m., 10 minutes of rowing, 9° (10. 8. 1911).
   Bosmina obtusirostris, a few (with eggs).
   Diaptomus minutus, thousands, a few with eggs.
   Cyclops sp. jun. 1 specimen.
   Nauplii.
4. Quite shallow water (about 30 cm.) between the shell-bank and the mouth of the stream, 12½° to 15° (4. 8. 1911).
   Bottom sample (sand, fragments of leaves and suchlike), in which occurred one Cyclops sp. jun.
5. From the shell-bank to Fotografipynten, 0—1 m. below the surface, 8° (4. 8. 1911).
   Diaptomus minutus, some hundreds, none with eggs.
   Copepode Nauplii.
6. 85—0 m., surface, 6½° (9. 8. 1911).
   Diaptomus minutus, a few specimens without eggs, or else no specimens.
7. 40—0 m., about 40 to 6½° (9. 8. 1911).
   Bosmina obtusirostris, a few specimens with eggs.
   Diaptomus minutus, some hundred specimens, a few with eggs.
   Cyclops sp. jun., 1 specimen.
8. 85—0 m., 4° to 6½° (9. 8. 1911).
   One very defective specimen of Bosmina sp.?
   Diaptomus minutus, about 100, a few with eggs.
   Cyclops sp. jun., 1 specimen.
   Copepode Nauplii.
9. From Fotografipynten across the bay, 0—1 m., 8°, 15 minutes of rowing (4. 8. 1911).
   Bosmina obtusirostris, a few (without eggs).
   Diaptomus minutus, several thousands, only a very few with eggs.
   Cyclops sp. jun., 1 specimen.
   A few Copepode Nauplii.
10. From Maagefjældet to Fotografipynten, 20 minutes of rowing, 0—2 m., about 7° (5. 8. 1911).
    Ceriodaphnia quandrangula, 1 specimen.
11. From Fotografipynten to the S.E. of the bay, 15 minutes of rowing, 0—1 m., 7½° (5. 8. 1911).
    ?Bosmina obtusirostris, a few specimens.
    Diaptomus minutus, several thousands, including a few with eggs.
    Cyclops strenuus, 1 specimen.
    Copepode Nauplii, numerous.
12. Somewhat outside the mouth of Ekalugsuit Bay, 20 m. (bottom) to 0 m., surface 9° (10. 8. 1911).
    Bosmina obtusirostris, a few (with eggs).
    Cyclops sp. jun., a few specimens.
    Some Copepode Nauplii.

13. From the S.E. of the bay to Maagefjældet, 15 minutes of rowing, 0—1 m., 7½° (5. 8. 1911).
Bosmina obtusirostris, 1 specimen with eggs.
Diaptomus minutus, several thousands.
Cyclops sp. jun., 1 specimen.
14. Ekalugsuit Bay, 0—2 m., 9°, 10 minutes of rowing (10. 8. 1911).
Bosmina obtusirostris, a few, including some with eggs.
Diaptomus minutus, several thousands, a few with eggs.
Copepode Nauplii.

List of the species.

Cladocera.

66. **Bosmina obtusirostris** G. O. Sars.

? 67. **Daphnia pulex** de Geer.

68. **Ceriodaphnia quadrangula** O. Fr. Müller.

Copepoda.

69. **Cyclops strenuus** Fischer.

× 70. **Diaptomus minutus** Lilljeborg (Pl. 7—8).

Diaptomus minutus Lilljeborg, in Guerne et Richard, Révision des Calanides d'eau douce; Mém. Soc. Zool. de France, vol. 2, 1889, pp. 50—51, Pl. 1, figs. 5, 6, 14; Pl. 3, fig. 25.
— — Marsh, On the deepwater Crust. of Green lake; Transact. Wisconsin Acad. of Sc., Arts and Letters, Madison, vol. 8, 1891, p. 212.
— — Marsh, On the Cyclopidæ and Calanidæ of Central Wisconsin; ibid. vol. 9, 1893, pp. 199—200, Pl. 4, figs. 1, 2, 3.
— — Herrick & Turner, Synopsis of the Entomostraca of Minnesota; Geol. & Nat. Hist. Survey, Minnesota, 2. Report, State Zoologist, 1895, p. 59, Pl. 8, fig. 9.
— — Schacht, The North American Species of Diaptomus; Bull. Illinois State Laboratory of Nat. Hist., Urbana, vol. 5, 1897, pp. 156—58, Pl. 30, figs. 5—8.
— — Giesbrecht u. Schmeil, Copep., Tierreich, 1898, p. 79.
— — Marsh, Revision of the North American species of Diaptomus; Transact. Wisconsin Acad. of Sc., Arts & Letters, vol. 15, pt. 2, Madison, 1907, pp. 426—28, Pl. 17, figs. 7, 11; Pl. 18, figs. 1, 7.

? Diaptomus silicis var. imperfectus Forbes, On some Lake Superior Entomostraca; Report U. S. Comm. Fish and Fisheries, 1887, p. 703 (teste Marsh l. c. 1897, p. 8, and Giesbrecht u. Schmeil l. c. 1898).

The above list contains everything I have been able to find in literature about this species with the exception of a short note by GUERNE & RICHARD in Compt. Rend., 1889 (Sur la faune des eaux douces du Groenland) where it is just mentioned that it has been taken in some places in Greenland.

In the following I shall give a short list of the contents of the papers cited, especially of the figures.

Lilljeborg, 1889: Description; p. 5, ♂ (Pl. 1, fig. 5); p. 5, ♀ (fig. 6); apex of right antenna, ♂ (fig. 14); abdomen ♀ (Pl. 3, fig. 25).

Marsh, 1891: Short note.

— 1893: Short note; p. 5, ♂ (Pl. 4, fig. 1); p. 5, ♀ (fig. 2); apex of right antenna 1, ♂ (fig. 3).

— 1897: Short note; p. 5, ♂ (Pl. 7, fig. 3, taken from Marsh, 1893, Pl. 4, fig. 1); p. 5, ♀ (fig. 4).

Herrich & Turner, 1895: I have not had access to this paper.

Schacht, 1897: Reproduction of Lilljeborg's description and copies of his figures.

Giesbrecht u. Schmeil, 1898: Description.

Marsh, 1907: Description; p. 5, ♀ (Pl. 17, fig. 7); apex of right antenna 1, ♂ (fig. 11); abdomen ♀ (Pl. 18, fig. 1); p. 5, ♂ (Pl. 18, fig. 7).

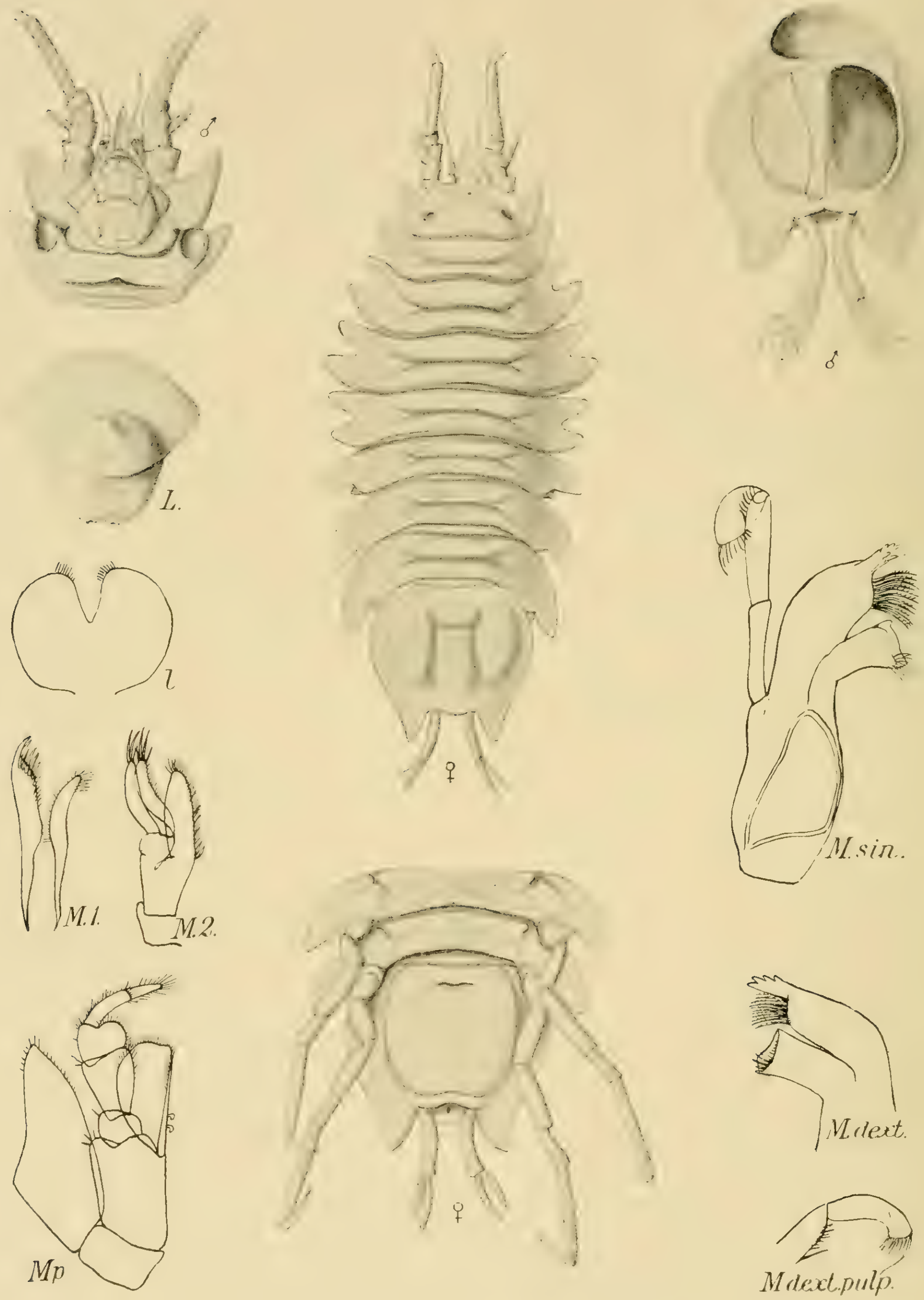
As may be seen, it is nearly always the same limbs which are figured. *Diaptomus silicis* var. *imperfectus* Forbes is regarded by MARSH (l. c. 1897) and GIESBRECHT u. SCHMEIL, 1898, as a synonym of this species (the two last, however, with a ?); but SCHACHT (l. c. 1897, p. 158) says that this form is probably not synonymous with *D. minutus*, but with *D. ashlandi* Marsh.

Consequently, as there are no figures of the entire animal I have given in Pl. 7—8 figures of the entire animal and drawings of all the limbs. On the whole my specimens agree excellently with the descriptions of LILLJEBORG (1889) and MARSH (1907); but I have not been able to find the small spine on either side of the genital segment of the ♀.

LILLJEBORG mentions that the ♀ has only two eggs, but MARSH says, that six is the usual number. Almost all my specimens have six eggs, lying in one plane, as seen in the figure in dorsal view; in the figure of a ♀ seen from the side, they have been pressed into another position by the cover-glass.

Several ♀ specimens had a long spermatophore; a single of these specimens was however abnormal as the genital segment was divided into two (see Fig. on Pl. 7 ♀ Uros. abn.).

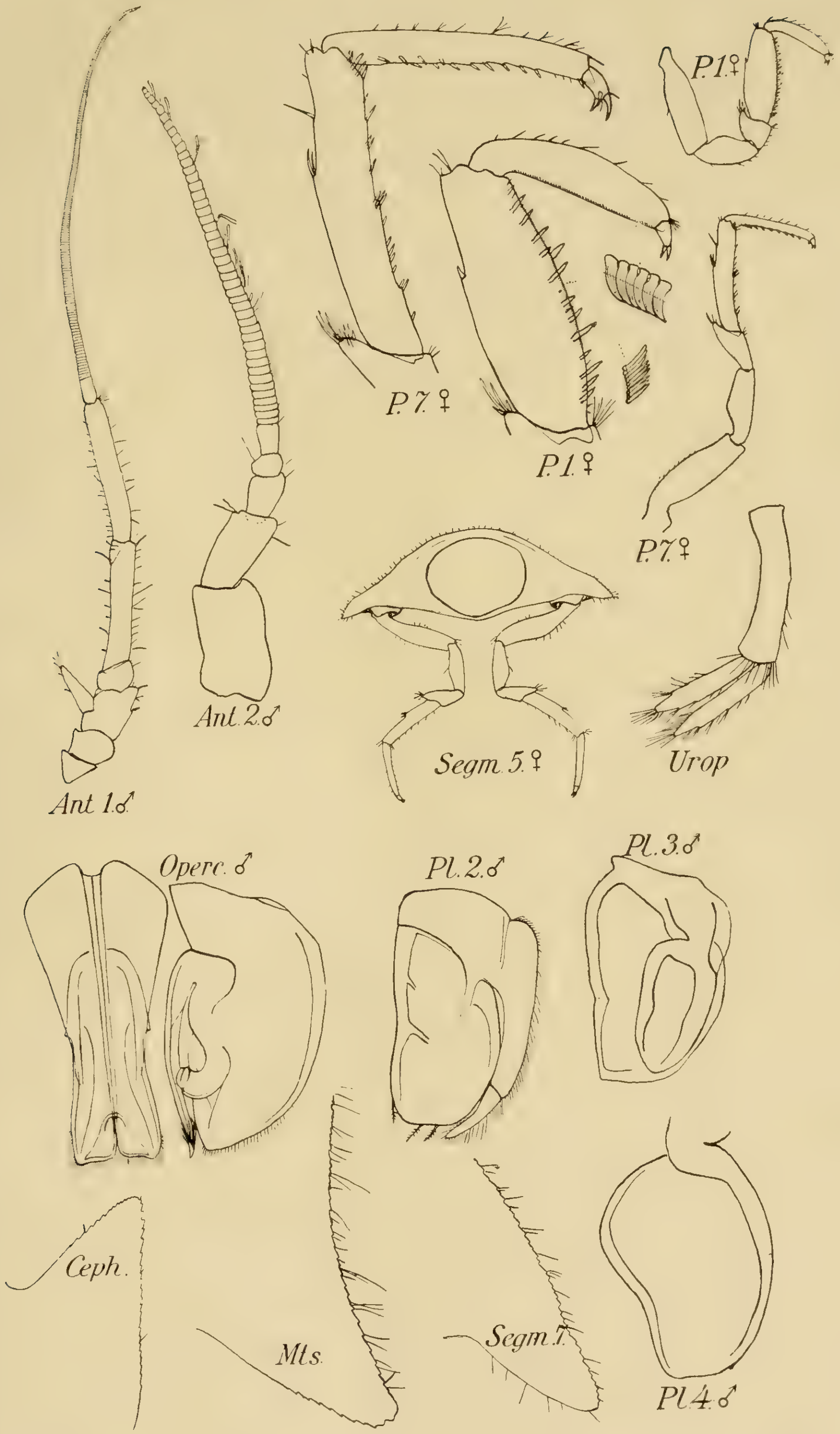
In the other cases it will suffice for me to refer to my figures.



K. Stephensen del.

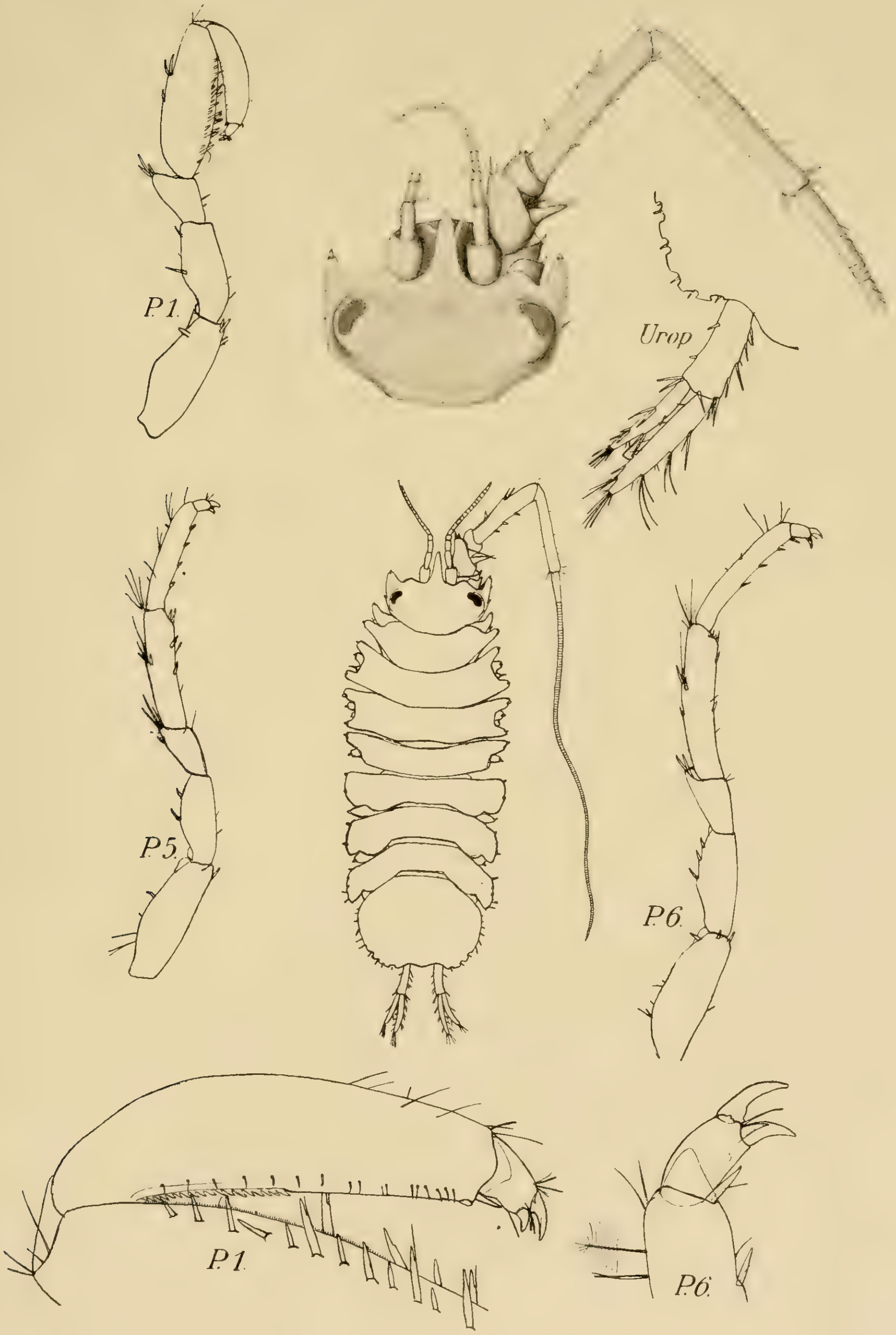
Janira Vilhelminæ n. sp. (No. 44, p. 68).
(*M. dext. pulp.* = the palp of M. dext).

Typ. Bianco Luno.



K. Stephensen del. Typ. Bianco Luno.

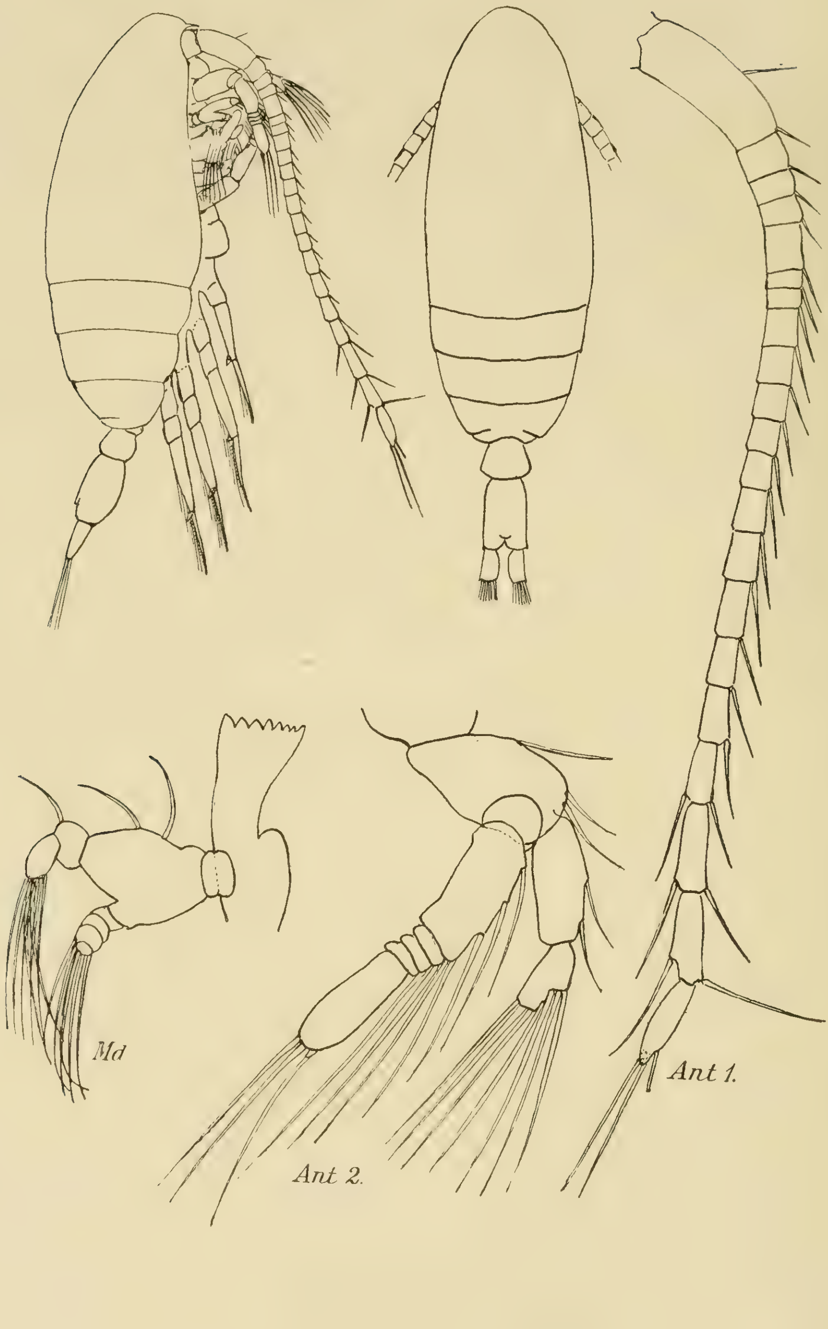
Janira Vilhelminæ n. sp. (No. 44, p. 68).



K. Stephensen del.

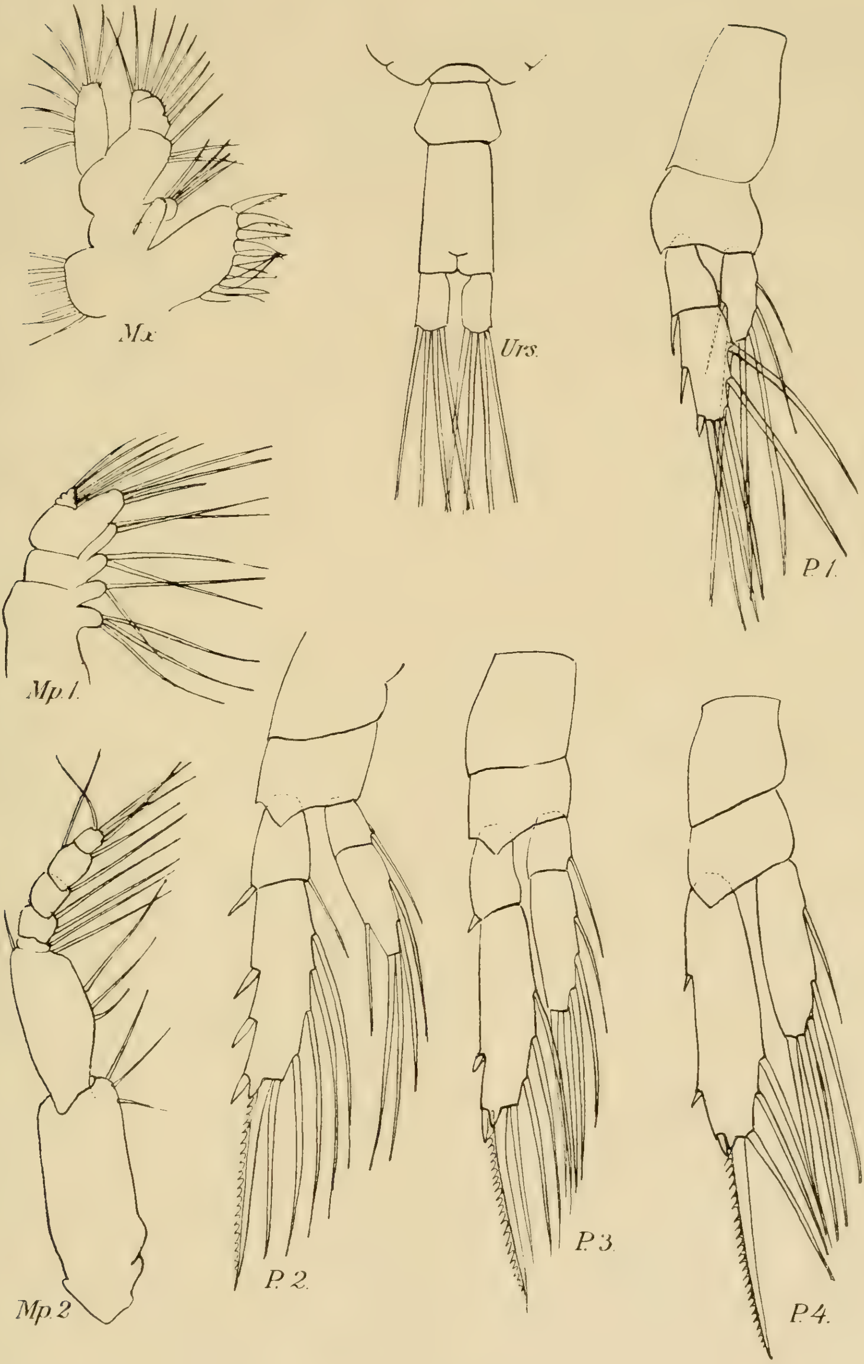
Typ. Bianco Luno.

Janthe libbeyi Ortm. (No. 45, p. 70).



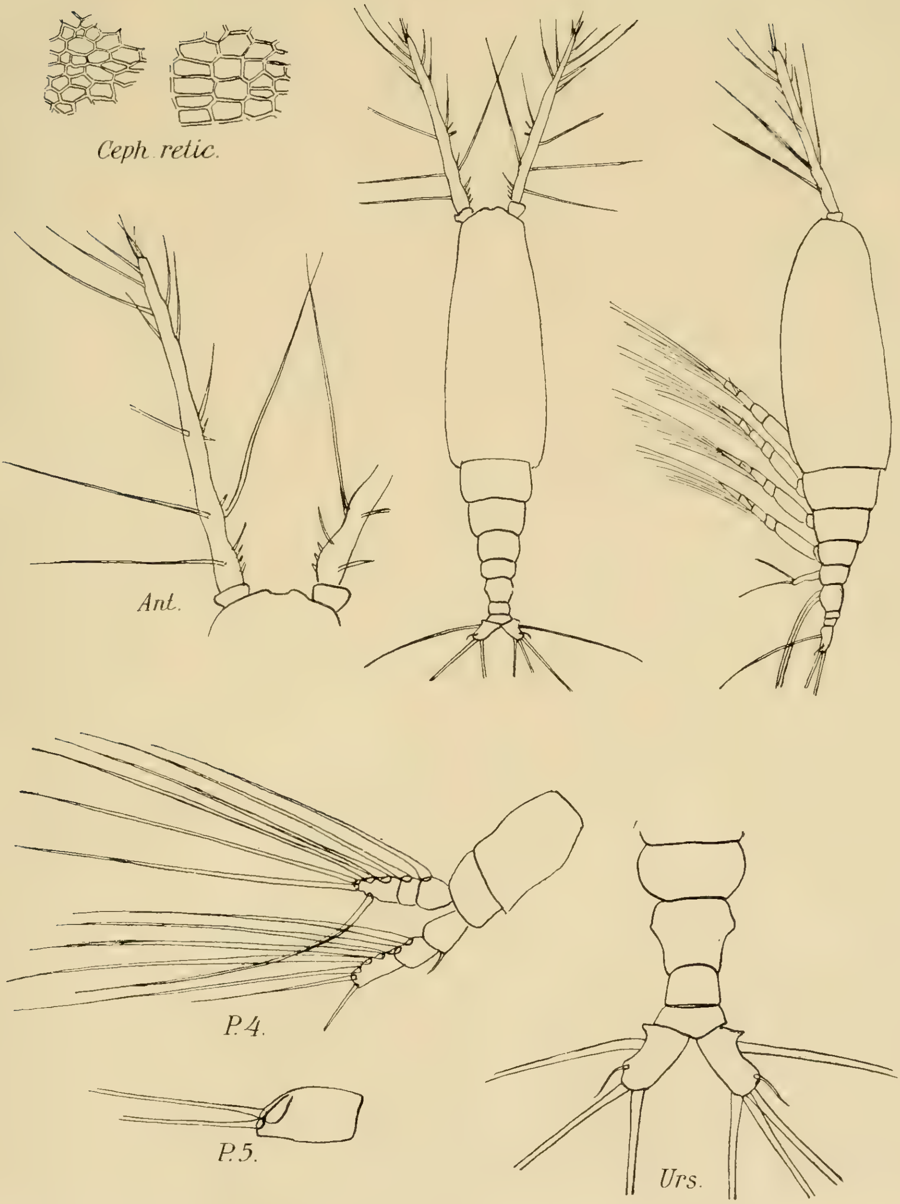
K. Stephensen del. Typ. Bianco Luno.

Pseudocalanus elongatus Boeck, 3rd Copepodite (No. 55, p. 71).



K. Stephensen del. Typ. Bianco Luno.

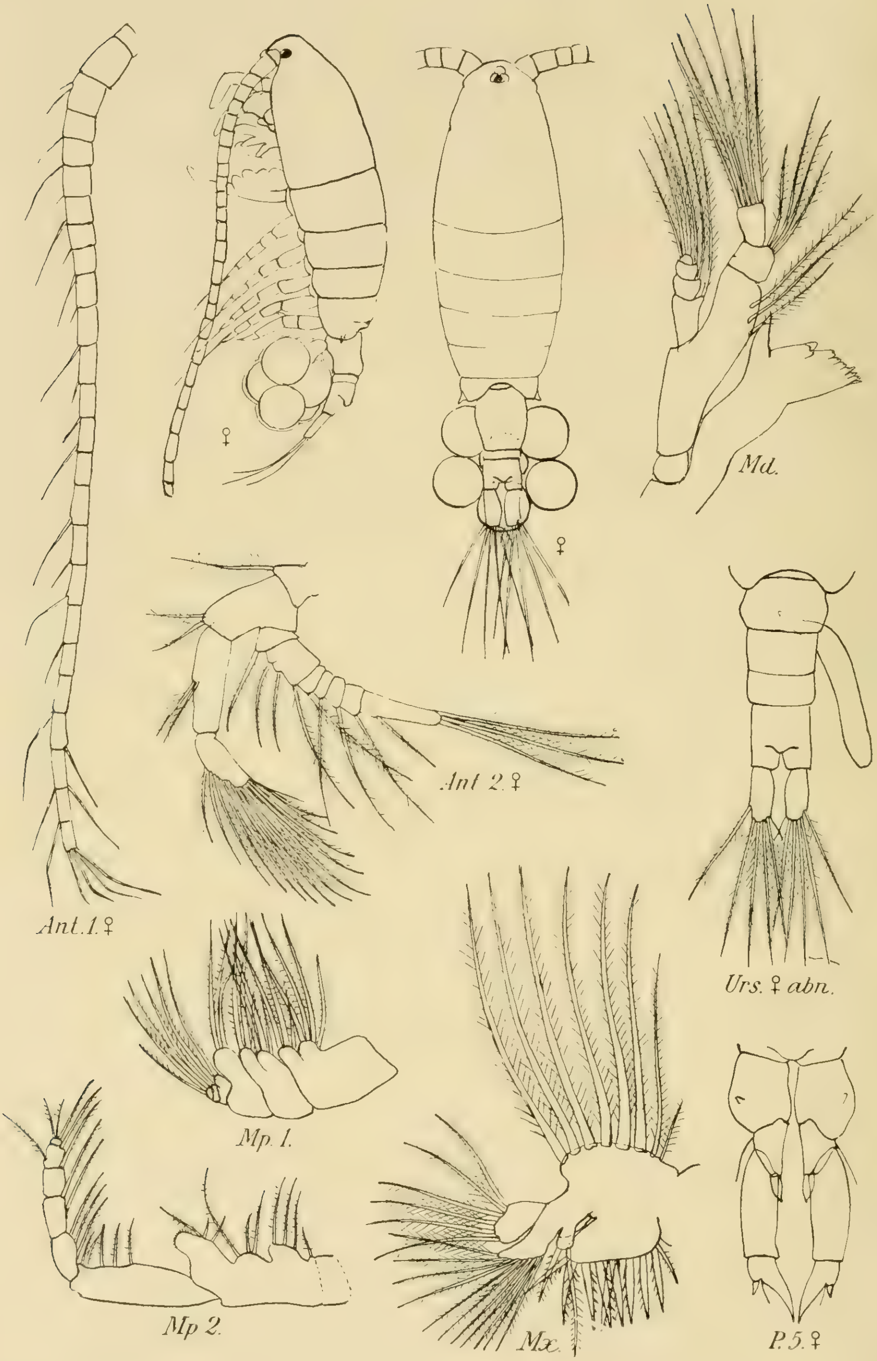
Pseudocalanus elongatus Boeck, 3rd Copepodite (No. 55, p. 71).



K. Stephensen del.

Typ. Bianco Luno.

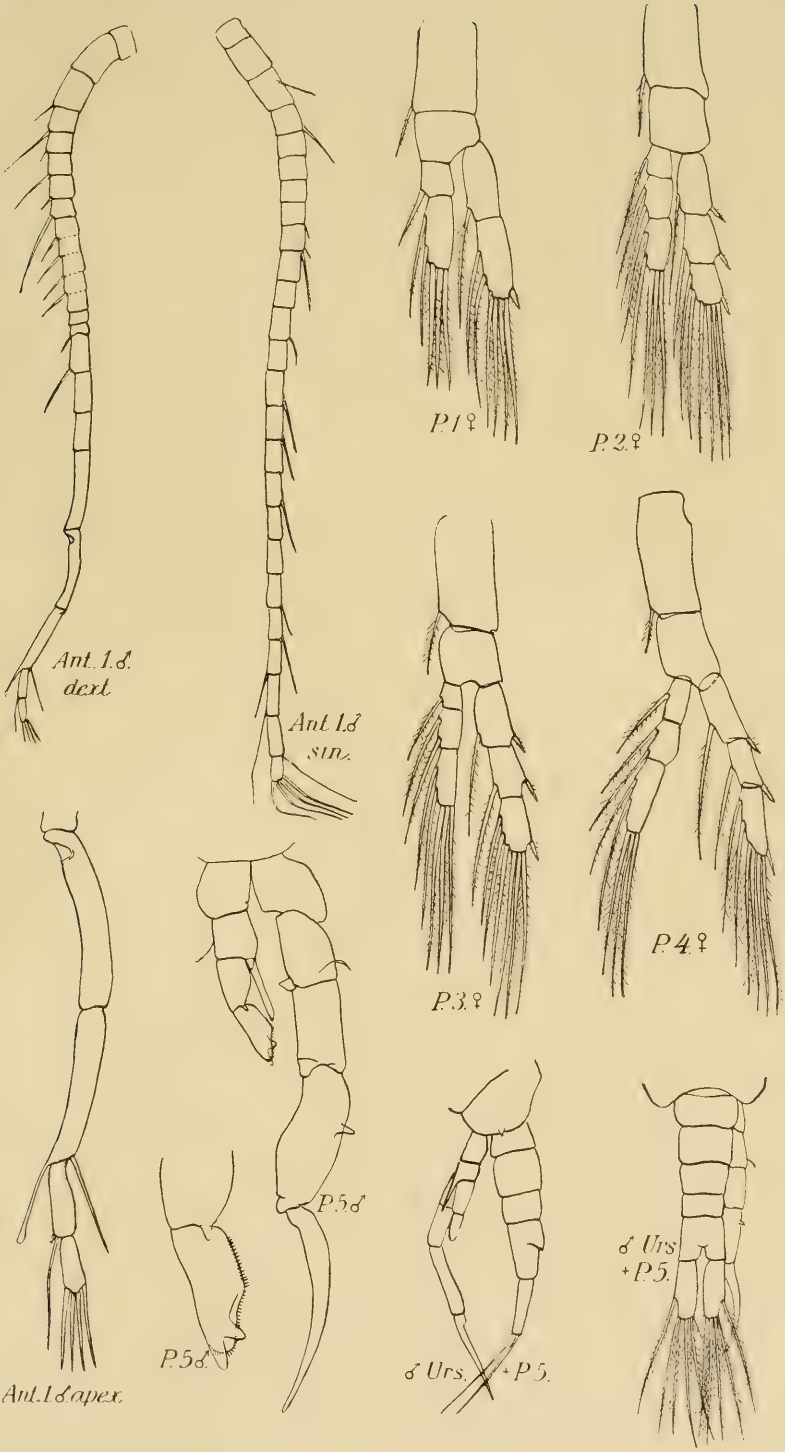
Monstrilla Wandelii n. sp. (No. 62, p. 73).
(*Ceph. retic.* = the reticulation of the carapace).



K. Stephensen del.

Diaptomus minutus Lilljb. (No. 70, p. 76).
(*Urs.* ♀ *abn.* = abnormal urosome of ♀ with spermatophore).

Typ. Bianco Luno.



K. Stephensen del. Typ. Bianco Luno.

Diaptomus minutus Lilljb. (No. 70, p. 76).

III.

NYE FUND AF NORDBORUINER I ØSTERBYGDEN OG BEMÆRKNINGER OM NOGLE AF DE GAMMELKENDTE

AF

K. STEPHENSEN

1913

I Fjor Sommer (1912) blev Forf. af disse Linjer sammen med Baadsmand i Marinen N. PETERSEN og stud. mag. K. BIRKET-SMITH sendt til Grønland for at foretage zoologisk Undersøgelse af Kvanefjord ved Frederikshaab og de to Fjorde Bredefjord og Skovfjord N. f. Julianehaab.

Uagtet de to sidstnævnte Fjorde ligger i Nordboernes Østerbygd, tog jeg ingen Literatur om Nordboerne med hjemmefra, idet jeg mente, at der ikke vilde blive Brug derfor. Heldigvis blev Forholdene i Virkeligheden gunstigere end beregnet; ikke blot blev Sommeren saa god, som den ikke i Mands Minde har været i Syd-Grønland: men ogsaa blev der Lejlighed til at se forskellige Nordboruiner. Desværre kom jeg herved i høj Grad til at savne Literaturen; thi i Ivigtut, hvor vi havde vore Depoter, fandtes Meddel. om Grønl. ikke, saa at jeg kun ved Velvilje fra Driftsbestyrer ENGELHARDT kunde laane forskellige Arbejder af DANIEL BRUUN og CLEMMENSEN af Driftsbestyrerens private Bibliotek, hvad jeg maatte være ham meget taknemmelig for; men det er klart, at jeg i høj Grad maatte savne de to Hovedværker af HOLM og BRUUN om deres store Undersøgelser. Som det efterfølgende vil vise, var dette Savn meget føleligt.

Vort zoologiske Arbejde gjorde, at vi foruden Motorbaaden „Rink“ maatte medføre baade en stor Depotbaad og en Jolle. Vi valgte da som „Havnepladser“ saadanne indelukkede Bugter, hvor vi kunde ligge om Natten uden at være udsatte for at blive generet af Isen, og hvor vor Depotbaad uden Risiko kunde efterlades om Dagen, naar vi sejlede ud for at arbejde paa Fjorden. Da nu Nordboruinerne ofte ligger inde i Bugter, valgte vi, naar Forholdene ellers tillod det, netop saadanne Bugter, hvor der fandtes Ruiner; derved opnaaede vi, at vi om Aftenen, naar vi var færdige med vort Arbejde, kunde se paa Ruinerne, uden at dette i mindste Maade greb forstyrrende ind i vor Hovedopgave.

Til Udgravninger var vi ikke udrustede, da man kan gaa ud fra, at en Ikke-Fagmand let vil kunne gøre stor Skade ved at grave paa en forkert Maade; og desuden vilde vor Tid heller ikke have tilladt noget saadant.

Derfor har jeg indskrænket mig til at tegne Kort af, hvad der kunde ses, men vil blot minde om, hvad D. Bruun mange Gange fremhæver, og hvad jeg ogsaa selv har haft Lejlighed til at erfare, at Ruinerne ofte er saa sammenfaldne eller overgroede, at det er umuligt at tegne ordentlige Planer uden Udgravning. Planerne af Ruinerne er tegnet paa Grundlag af Opmaaling eller ved Skridt (ved de daarlige); men Kortskitserne er kun tegnet ved Skridttælling og paa Øjemaal.

Naar jeg har bedt Kommissionen om at lade disse Optegnelser trykke, er det, fordi jeg mener, at selv mindre Meddelelser om Nordboruinerne har deres Interesse; men skulde noget heraf, — hvad ingen kan være mere forberedt paa end jeg selv —, ved senere Undersøgelser vise sig ikke at være aldeles rigtigt, haaber jeg paa Overbærenhed, idet jeg jo ikke er Arkæolog, men Zoolog, saa at det hele ligger ganske uden for mit Fag; de følgende Meddelelser er kun og maa kun opfattes som Optegnelser af en interesseret Amatør.

I et Tillæg har jeg medtaget forskellige Oplysninger væsentlig om Ruiner, som jeg ikke selv har set, men som jeg har faaet fra andre. Særlig skylder jeg i Ivigtut Driftsbestyrer Engelhardt og i Julianehaab Distriktslæge Bentsen, Kolonibestyrer Ibsen og Pastor Jespersen Tak for mange værdifulde Oplysninger. Endvidere kan jeg ikke afslutte disse indledende Bemærkninger uden at mindes det højt fortjente, nylig afdøde Medlem af Kommissionen Dr. K. J. V. Steenstrup, der har skrevet flere Arbejder om Nordboruinerne her i Meddelelserne. Skønt Geolog af Fag havde han stor Interesse for alt vedrørende Arkæologien, og gennem en halv Snes Aars Bekendtskab til ham har jeg faaet mange Vink, der paa Stederne er kommet mig til god Nytte.

Ruiner i og ved Bredefjord (Ikersuak).

I Grønlands Histor. Mindesmrk., vol. 3, 1845, p. 830 staar der nævnt 4 Ruingrupper, som skal findes ved Fjordens Nordside (refereret af Daniel Bruun p. 248). Stedernes Navne er Tunno, Kangerdluak, Nulok og Kapitarmiut. Dan. Bruun giver en kort Beskrivelse af disse Ruiner paa Grundlag af Meddelelser af Grønlændere fra Tugdlarunat, men han har ikke selv set dem.

Da jeg selv var i Bredefjord, havde jeg af de ovenfor anførte Grunde ikke andre literære Hjælpemidler ved Haanden end Clemmensens Arbejde, og heri staar der ikke andet (p. 357), end at der vides at ligge Ruiner „i den store Bugt med de mange Bræer ved Nordenden af Ikersuak (Bredefjord) lige vest for Bopladsen Tugdlarunat“; de Grønlændere, som vi selv havde med (fra Kagsimiut), kendte intet hertil.

Paa det Kort, der findes i Grønlands Hist. Mindesmrk. vol. 3 (Pl. 11), er denne Del af Bredefjord, hvor Ruinerne er afsatte, tegnet paa en saadan Maade, at det er umuligt at identificere Stederne ved Hjælp af det nyere Kort („Sydgrønland fra Kagsimiut til Julianehaab“) i Meddel. om Grønl. vol. 16, der var vort Arbejdskort. Da jeg imidlertid paa hele vor Rejse har set efter Lokaliteter, der kunde se ud til at indeholde Nordboruiner, selv om vore Arbejdsforhold umuliggjorde Landing og dertil hørende Undersøgelse, har jeg dog lagt Mærke til, at der flere Steder i disse Egne var typiske Nordbolokaliteter, hvor eventuelle senere Expeditioner maaske burde søge; saaledes husker jeg det midterste Parti af Øen Kangek (paa Kortet i Meddel. om Gr. vol. 16 fejlagtig kaldt Kekertarsuak), den dybe Bugt og Landtangen paa Sydenden af Nulugssuak, og endelig Nordenden af Øen Nuk (se Kortet Fig. 1). De to Ender af Kangek dannes hver af et ret højt Fjæld; men hele Midten af Øen dannes af en stor flad Græsslette, som det ligefrem er utænkeligt, at Nordboerne ikke skulde have benyttet. I Bugten paa Nulugssuak saas fra Vandet nogle ranunkelbevoksede Højder, som vore Grønlændere sagde var Grønlænderruiner; saa vidt man kunde se fra Søen, var der et Vandløb. Men da Forholdene i det hele var stærkt „nordboagtige“, anser jeg det for aldeles givet, at der virkelig findes Nordboruiner her; skulde dette Sted ikke være det, der i Grønl. Hist. Mindesmrk. kaldes Nulok? Sammenlignet med Forholdene andre Steder har der næppe ligget nogen Gaard paa Kangek (der er f. Eks., saa vidt man kan se fra Søen, ikke Vand); men denne Ø har sikkert været Græsning for en af de nærmeste Gaarde, f. Eks. den paa Isua eller Nulugssuak. — Saa meget er i hvert Fald sikkert, at af de 4 nævnte Ruingrupper svarer ingen til de af os undersøgte,

Ved at rejse i Nordboegnene paatvinger sig den Tanke, som jeg iøvrigt oprindelig skylder Pastor Jespersen i Julianehaab, at alle brugbare Egne er taget i Brug af Nordboerne; paa det Tidspunkt, da de blev udryddede, var de utvivlsomt naaet saa vidt i Tal, at der ikke var Mulighed for, at Jorden kunde ernære flere Mennesker; derfor føler jeg det ogsaa som min Overbevisning, at Eftersøgning vil kunne give gode Resultater paa alle de endnu ikke undersøgte flade, blot nogenlunde græsbevoksede Lokaliteter. De næsten 120 Ruingrupper, der er beskrevet foreløbig fra Østerbygden. er jo ogsaa et forbavsende stort Tal, naar man tænker paa, at de væsentlig hidrører fra kun 2 Somres Undersøgelser.

I nedenstaaende Beskrivelser har jeg givet Ruingrupperne Numre, idet jeg har fortsat D. Bruuns og Clemmensens Nummerrække.

Ruingruppe Nr. 122.

Inderst i den lille Fjord, der skærer sig ind midt i Sydsiden af Kidtluakitssok, ligger tilhøjre en lille Nordbogaard bestaaende af

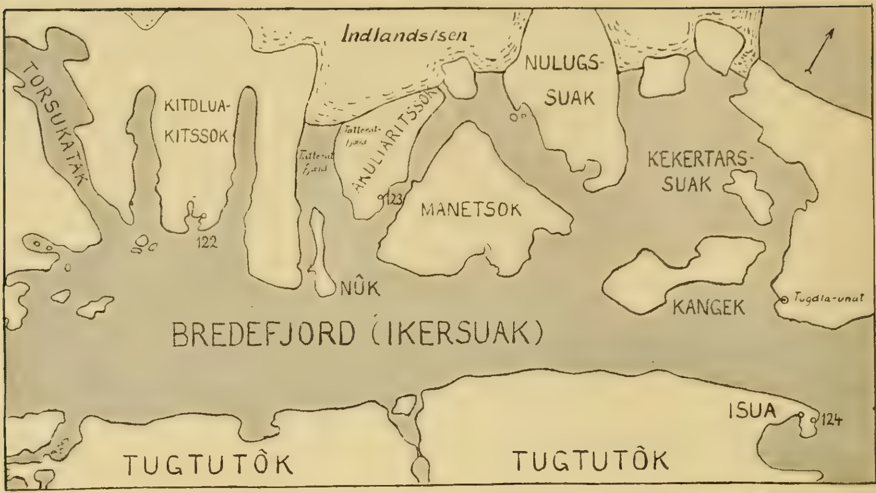


Fig. 1. Kort over den inderste Halvdel af Bredefjord med Ruingrupperne 122—24. Pilen angiver N.-S. Det paa Kortet gengivne Parti er ca. 40 km langt.

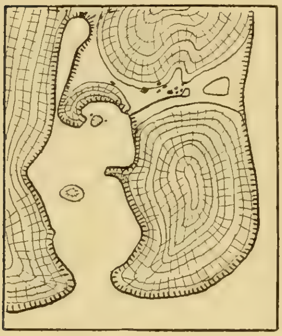


Fig. 2. Skitse af Bugten paa Halvøen Kidtluakitssok med Ruingruppe 122 (omkring Elven).

mindst 13 Bygninger. Af det ene Hus, et Forraadshus, der vil blive omtalt som Nr. 12, findes et Fotografi i Dan. Bruun: De gamle Nordbokolonier i Grønland (Studier af Nordboernes Kulturliv, vol. 3. Hæfte 5; Særtryk af Tidsskrift for Landøkonomi) 1905, p. 40. Billedet bærer følgende Underskrift „Nordboruin (Forraadshus) fra Østerbygden. Udhus bygget alene af Sten med Dør i Gavlen. (Efter Fotografi af Pastor P. Vibæk)". I Teksten nævnes denne Gaard ikke, og da heller ikke Clemmensen har afsat den paa sit Kort, tør jeg gaa ud fra, at han ikke har kendt den.

I Bugtens NV.lige Hjørne skærer en ret lang Fjordarm sig ind, men den er ikke afsat paa det eksisterende Kort, rimeligvis fordi den ikke kan ses ude fra Fjorden; dens Indløb er kun nogle faa Meter bredt, saa at Tidevandet stadig

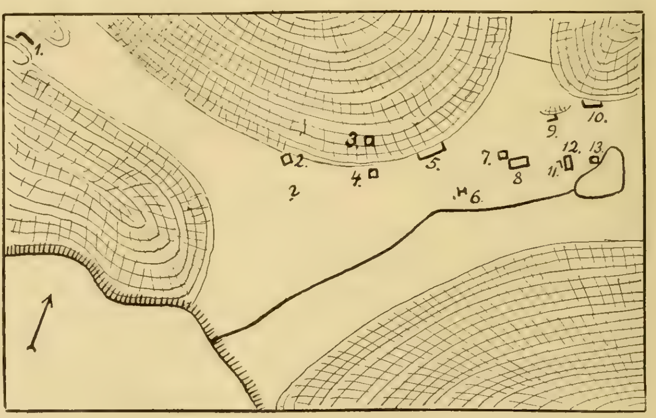


Fig. 3. Kortskitse af Ruingruppe 122.

frembringer en meget stærk Strøm. Den vedføjede Kortskitse giver et lille Begreb om Forholdene; men den er kun løst skitseret (tegnet udelukkende paa Øjemaal) og gør derfor selvfølgelig ikke Fordring paa andet end at fremstille Forholdene rent skematisk.

Fig. 4. Bugten ved Kidtluakitssok set fra Højderne Syd for Ruin Nr. 1 (K. St. fot. 26-VII-1913).

Fjordsiderne er gennemgaaende ikke gode for Landing; kun ved den Bæk, der løber ned inderst i den østlige Side, kan en Baad uden Vanskelighed lægge til. Som Skitsen viser, løber denne Bæk midt ned gennem en Lavning; øverst oppe ender den i en Sø, og et Stykke længer mod Ø. ligger en lidt større Sø. Det er omkring denne Bæk, at Gaardens Bygninger er fordelte. Lavningen er bevokset med Pil, Dværgbirk, Kvane, Campanula, Ranunkel, Gederams, Bregner (Aspidium Phegopteris og Blechnum spicant (?)) og Enebær og gør mange Steder et ret frodigt Indtryk. Andre Steder er der Carexeng og Kæruld. Da vi var paa Stedet (i Slutn. af Juli), var der kun meget lidt Vand i Bækken; men dette skyldes muligvis den meget tørre Sommer (i de 3½ Maaned, vi var i Grønland (Midten af Juni til Beg. af Oktbr.) regnede det kun i ca. 14 Dage).

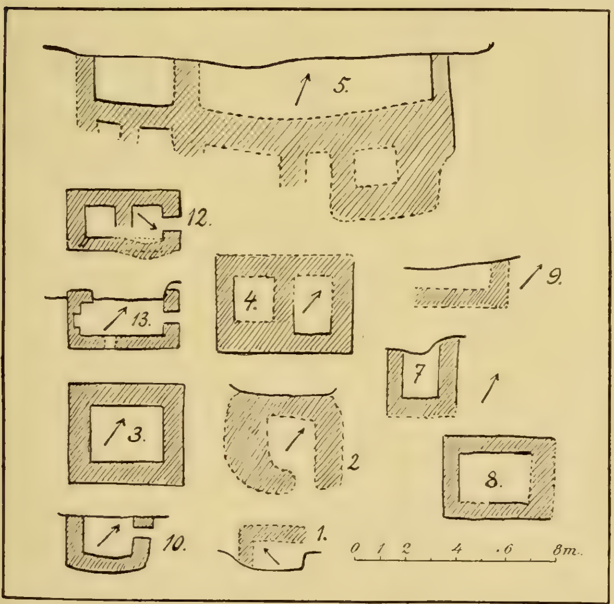


Fig. 5. Planer af de enkelte Ruiner i Gruppe 122. Pilen betegner N.-S.

Da jeg meget hurtig blev klar over, at det vilde være umuligt for en Familie at leve paa dette Sted, hvis der ikke fandtes Græsning andre Steder end omkring Bygningerne, søgte jeg efter Græsgange andre Steder. Ø. for Søen fandtes næppe brugbart Græs; derimod findes der en ret stor Carexeng i det lave Parti Ø. for den smalle nordlige Fjordarm, og ved at søge efter Bygninger her lykkedes det mig at finde den lille Ruin (Nr. 1) i den højtliggende Kløft, som forbinder de to Græsomraader.

Ruin Nr. 1 ligger op ad en Fjældvæg og er af Sten. Væggene er $^1/_4$—$^1/_2$ m høje, og de udvendige Maal er ca. 1 × 1,8 m. Har vel sagtens været Høhus.

Nr. 2 er en meget tvivlsom Ruin, der ligger op ad en græsklædt Skraaning. De største indvendige Maal er 2 × 2,3 m. Væggene hviler paa den naturlige Klippe og er meget sammenfaldne; Højden er ca. $^1/_2$ m. Det hele leder nærmest Tanken hen paa de ofte omtalte Stenringe. Ved ? er der en bevokset Forhøjning, hvori Rester af en Ruin synes at skjule sig.

Nr. 3 er en ganske godt bevaret Ruin helt bygget af Sten; den ligger et Stykke oppe paa Skraaningen. De udvendige Maal er 4 × 4,3 m. Det indre er opfyldt af nedfaldne Stene; alligevel varierer Murhøjden mellem 0,5 og 1,3 m. Til Trods for, at Grundplanen er saa godt bevaret, at den kan tegnes med absolut Sikkerhed, er der mærkelig nok ikke Spor af nogen Dør.

Nr. 4 ligger nedenfor Nr. 3. Dens udvendige Maal er 4,5 × 5,5 m; den synes at have indeholdt 2 Rum, men flere Steder er den saa sammenfalden, at en sikker Grundplan ikke kan tegnes.

Nr. 5 maa have været en Faarefold; Bagvæggen er en 1,5 à 2 m høj lodret Fjældvæg. Den udvendige Længde har været ca. 15 m; men desværre er de fleste Vægge stærkt sammenfaldne og overgroede. Ved en Tværvæg er den delt i 2 Rum. Den indvendige Bredde har været ca. $2^1/_2$ m eller lidt mere. At det har været en Fold netop for Faar mener jeg at kunne udlede af følgende. For det første passer Bredden med, hvad Dan. Bruun opgiver som det sædvanlige (M. o. G. vol. 16, p. 429), nemlig 8 à 10 Fod; for det andet er Græsset paa Stedet af en saadan Art, at Køer umulig vilde kunne have levet der. Foran Folden (sammenbygget med den) ligger aldeles overgroede Bygningsrester; disse maa have været et Høhus, der netop (cf. D. Bruun) ofte ligger i Vinkel med Faarefolden.

Nr. 6 er nogle Bygningsrester saa daarligt bevarede, at jeg ikke har kunnet tegne eller maale dem.

Nr. 7 og 8 er to Bygninger, der støder tæt sammen ved et af Hjørnerne. De udvendige Maal er henholdsvis ca. 2,75 × 3 og 4,3 × 3,7 m. Ruin 7 ligger opad en lav Fjældvæg, 0,6 m høj; men denne Væg er forhøjet til 1,3 m ved, at der er lagt Sten ovenpaa den. Iøvrigt er Murene 0,25—1 m høje. Maaske har der været en Dør i Sydvæggen paa Nr. 8.

Nr. 9 er en lille Ruin af Form som Nr. 1, men lidt større.

Nr. 10 ligger opad en lodret, men ovenpaa flad 1,6 m høj Væg;

de udvendige Maal er ca. 1,8×3 m. I Østvæggen, der iøvrigt er meget lav, synes der at have været en Dør; i hvert Fald er der paa det paagældende Sted flad Brolægning. Iøvrigt er Væggenes Højde udvendig ca. 1 m, indvendig kun ca. 0,5 m, da Rummet er opfyldt af Stene.

Nr. 11 er et Bygningshjørne.

Nr. 12 er saa godt bevaret, at den fortjener en mere grundig Beskrivelse. Som ovenfor anført, har D. Bruun allerede 1905 givet

Fig. 6. Ruin Nr. 12 i Gruppe 122. Bag Ruinen ses den lille Sø; bagest ses de høje Fjælde paa den ikke-benævnte lange Halvø Ø. for Kidtluakitssok. (K. St. fot. 26-VII-1912.)

et Billede af den efter Fotografi af den daværende Præst i Julianehaab, Pastor Vibæk. Ruinen ligger lige ovenfor den Skraaning, der langs Bækken fører ned til Fjorden; derfor ser man den næsten straks, naar man er kommet op over det nederste, ret stejle Stykke helt nede ved Vandet. Betegnende er det ogsaa, at dette er den eneste Ruin, som den Grønlænder (Boas fra Karmak), der viste os Vej, syntes at kende. Der fandtes ikke Spor af Jord mellem Stenene, og disse er passet ganske godt sammen. I den korte Nordside findes en Dør, 1,30 m høj, 0,50 m bred. Overliggeren ligger endnu paa Plads. Langsidernes ydre Maal er 4,2 m, deres indre Maal 3 m; deres største Højde er ca. 1,5 m. Gavlsiden med Døren: ydre Længde

2 m, indre Længde 1,2 m. Væggene er altsaa her forholdsvis tyndere (ca. 0,4 m), end hvor jeg ellers har maalt dem (0,6—1 m); men dette staar sikkert i Forbindelse med, at Væggene som ovenfor sagt er byggede af overordentlig godt sammenpassede Stene. Indvendig er Huset delt i 2 Rum ved en Tværvæg med Dør. Bagvæggen og venstre Sidevæg (regnet fra Døren) er en Del sammenfaldne og skredet noget ud, og begge Rum er fyldte med Sten; andre Sten er maaske benyttet til 3 eskimoiske Rævefælder tæt foran Døren. Efter Mængden af nedfaldne Stene synes Væggene næppe at have været over 2 m høje. Den øverste Del af Gavlvæggene viser ikke noget om en mulig Taghældning.

Nr. 13. Ogsaa denne Ruin er bygget udelukkende af Stene, særdeles vel sammenpassede. De ydre Maal er 4 × 2 m, de indre 2,75 × 1,4 m. Den ene Sidevæg er en naturlig, lidt indadhældende 0,9 m høj Klippevæg. I den ene Endevæg findes Levninger af en Dør, 0,6 m bred. Midt i Bagvæggen findes en indvendig „Niche", mindende om de „Nicher", Clemmensen (M. o. G. vol. 47, p. 304) omtaler i Kakortokkirken, og omtrent midt i den fritstaaende Sidevæg findes 0,4 m over Jorden et „Vindue", ca. 0,3 m paa hver Led; da Begrænsningen saavel af Nichen som af Vinduet er meget uregelmæssig, skyldes begge Dele muligvis kun udfaldne Sten. Væggenes Højde er ca. 1,2 m.

Flere end de her nævnte Bygninger lykkedes det ikke at finde, ligesaa lidt som det lykkedes med Bestemthed at paavise Beboelseshuset. Flere Steder fandtes som ovenfor nævnt Ranunkler, men intet Steds i saadanne Mængder, at de kunde opfattes som Bevis paa en Mødding. Bortset fra den forreste overgroede Del af Faarefolden var de mest overgroede Ruiner Nr. 4 og 7—8, fordi disse saavel som Nr. 2 var de eneste, der var byggede af baade Jord og Stene; derfor maa Beboelseshuset vel være Nr. 4, 7 eller 8 eller muligvis 7 og 8 i Forening. —

Inderst i den Bugt, der skyder sig ind N. f. Øen Nûk, og som ender med en stor Bræ, findes 2 Tatteratfjælde; det første (paa vestre Side) er ikke ret stort, men det andet (paa østre Side, stødende næsten op til Bræen) indeholder umaadelige Mængder af Tatteratter. Mange af Rederne sidder saa lavt, at man kan naa dem fra en Baad, og det er vel rimeligt at antage, at Beboerne af Gaarden har søgt herhen for at faa Forstærkning for det sikkert ikke altfor overdaadigt udstyrede Spisekammer.

Ruin Nr. 123.

Paa Akuliaritssok overfor Øen Manetsok findes den meget mærkelige Ruin, som den vedføjede Tegning giver et Grundrids af. Murene er byggede af en Blanding af Jord og Sten; indvendig i det ret store Værelse er Væggene temmelig omhyggelig byggede af nogenlunde sammenpassede Sten med meget lidt Jord imellem. Udvendig fra ligner Væggene nærmest Jordvolde, men er til Trods for den ret stærke Tilgroning særlig med Ranunkler alligevel forholdsvis lette at tegne Kort af.

Ruinen ligger paa en Rundklippe, der med en ret stejl Væg (mod Ø.) støder ud til Fjorden; den er anbragt saa yderligt, som det overhovedet har været muligt. Grundplanen som Helhed har intet til fælles med, hvad der mig bekendt hidtil er fundet af Nordboruiner; derfor anser jeg den ogsaa med megen Tvivl som hidrørende

Fig. 7. Ruin Nr. 123 paa Akuliaritssok. Ruinen er den bevoksede Forhøjning i Forgrunden omtrent midt imellem Motorbaaden og Billedets højre Kant. (K. St. fot. 3-VIII-1912.)

fra Nordboerne; men Birket-Smith fastholder paa den anden Side bestemt, at den ikke er grønlandsk.

Murene er ca. 0,5 m høje. Den østlige „Væg" har, i hvert Fald i sin største Udstrækning, næppe været højere end nu; ovenpaa det nordøstlige Hjørne bærer den Spor af et Murhjørne, men iøvrigt ligger Stenene ovenpaa saa regelmæssigt, at de nærmest ligner en Brolægning. Den Tanke paatvinger sig uvægerligt, at dette har været Gulv, saa at altsaa den østlige Del af Værelset har haft Gulvet liggende højere end den vestlige Del. Maaske har det været en Sovebriks, saaledes som D. Bruun omtaler (M. o. G., vol. 16, p. 427).

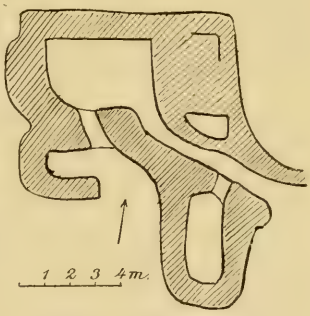


Fig. 8. Ruin Nr. 123.

Ruinens Plads lige ved Vandet er heller ikke meget „nordbo-agtig“; men Forholdene paa Stedet modsiger ellers ingenlunde, at den kan hidrøre fra Nordboer. Tæt bag Ruinen ligger ganske vist et ret højt Fjæld; men vinkelret paa Kysten gaar en ret frodig Lavning ind tværs over Halvøen med nogle Smaasøer og et lille Vandløb. Nogen selvstændig Beboelse kan den ikke have været, og andre Huse fandtes ikke trods ret omhyggelig Eftersøgning; den maa vel nærmest opfattes som en Sæter fra en nærliggende Nordbogaard, og den nærmeste (kendte) bliver da den ovenfor omtalte, Nr. 122.

Sandsynligheden synes mig at tale for, at det virkelig er en oprindelig Nordboruin, men at Husgangen og de andre Udbygninger paa Sydsiden er senere grønlandske Tilføjelser.

Bag ved Ruinen fandtes bl. a. en eskimoisk Kødgrav og nogle Stene, der saa ud til at være Rester af en Teltring.

Lidt længere borte, tæt op ad en lav Klippevæg, fandtes en meget sammenfalden Grav. Uagtet Graven var stærkt ødelagt, syntes den at have været saa lille, at den umulig kan have rummet Liget af et voksent Menneske; foruden et ganske ubestemmeligt lille Benstykke fandtes af Skeletdele kun et Stykke, der saa vidt jeg har kunnet bestemme var af et Mellemhaands- eller Mellemfodsben. Derimod fandtes der de to Bengenstande, som jeg har tegnet paa vedføjede Figur. Figuren gør Rede for alt, hvad man kan se; det smalle, lidt buede og noget forvredne Stykke har et Hul i hver Ende, det halvmaaneformede Stykke et Hul i Midten. Begge Stykker er kun 1—2 mm tykke. Birket-Smith har meddelt mig, at de umulig kan hidrøre fra Grønlændere; men lignende Genstande er ikke beskrevet tidligere som fundne paa Nordbopladserne og findes heller ikke i Nationalmuseets Samling. Den konvekse Kant af det smalle Stykke passer til den konkave Kant af det andet; men dette er maaske tilfældigt.

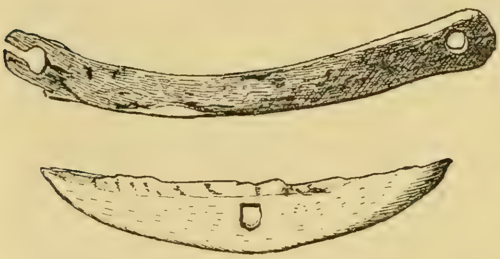


Fig. 9. Gravfund ved Ruin Nr. 123.
($^5/_6$ nat. Stør.)

Ruingruppen paa Isua, Nr. 124 (se Kortet Fig. 1).

Sydsiden af den inderste Halvdel af Bredefjord dannes af den lange Ø Tugtutôk, Nordboernes Langey (efter Finnur Jonsson); paa Øens Sydside ligger de tidligere beskrevne Ruingrupper 15 og 16. Øens nordøstligste Hjørne hedder Isua. — I Forbigaaende skal blot bemærkes, at de to Bugter, der skærer sig ind midt paa Øen fra Nord og Syd, efter hvad vore Grønlændere har meddelt, er forbundne

Fig. 10. Bugten ved Isua. Ruingruppe 124 ligger indenfor den lille Bugt t. v. i Forgrunden. (K. St. fot. 6-VIII-1912.)

ved et Løb, der tillader en Kajak ved Højvande at sejle tværs over Øen. Vi har selv været et Stykke inde i den nordlige Bugt, og paa dens Vestside var der ret frodigt, saa at der maaske har været Nordboere ogsaa der.

Den Landtunge, der skyder sig ud paa Isua, danner en særdeles god Havneplads; selve Landtungen er ret lav med enkelte højere Partier, og bagved (mod V.) hæver det høje Land sig. Inderst i Bugten ligger en Del gamle meget interessante Grønlænderruiner af Kap-York-Typen, som i en nær Fremtid vil blive beskrevet af BIRKET-SMITH; men sammen med dem findes en Del gode Nordboruiner, ikke blot inderst i Bugten, men ogsaa paa den Side af Landtungen, der vender over mod Ilimausak. En enhelt findes helt ude paa Tangens Sydspids; i alt er der ca. 15 Nordboruiner. Inde i Bugten er der af „Nordlyset" rejst et Par Ankermærker i 1903; det ene staar midt i en af Ruinerne!

Paa dette Sted vil jeg ikke nægte mig selv den Fornøjelse at fortælle et for Grønlændere meget karakteristisk Træk; det er en Bekræftelse paa den gammelkendte Regel, at man aldrig kan tro paa, hvad en Grønlænder siger, hvis han først har opdaget, i hvilken Retning ens Interesse gaar.

Ruinerne er saa gode, at man tydelig ser dem fra Søen; derfor skyndte jeg mig i Land med Baadsmand PETERSEN for at se paa dem. BIRKET-SMITH havde derimod noget at gøre om Bord, saa at han først kom i Land senere sammen med vore Grønlændere. Ogsaa han gav sig naturligvis straks til at se paa Ruinerne; men da han talte med Grønlænderne derom, erklærede de øjeblikkelig alle Ruinerne for at være grønlandske (de vidste nemlig, at han interesserer sig mest for Grønlænderruiner). Nogle Dage senere var vi i Narssak for at købe noget i Butikken; her benyttede jeg Lejligheden til at tale med den grønlandske Kateket TOBIAS BERTHELSEN

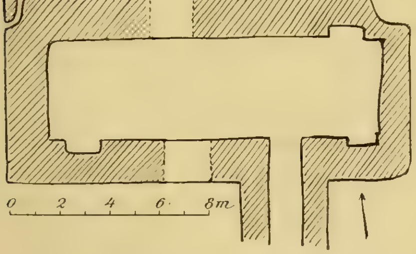


Fig. 11. Plan af „Kirken" i Ruingruppe 124.

og spurgte ham, om han kendte noget til Nordboruinerne, hvilket han bekræftede. Denne Samtale hørte en af vore Grønlændere; Resultatet var, at samme Dag, da vi kom tilbage til Isua, var nogle af Ruinerne blevet Nordboruiner, og i Løbet af faa Dage var alle Ruinerne, ogsaa de sikre grønlandske, blevet Nordboruiner, blot fordi min Interesse gik i den Retning! —

Lidt ovenfor Ruinerne ligger et Par smaa Vandhuller; Vandløb findes ikke. Grønlandske Grave, Rævefælder og Kødgrave er spredt rundt omkring; ogsaa en Kajaksætning findes, men her skal kun tales om Nordboruinerne. Bevoksningen er den sædvanlige for Nordbo-

Fig. 12. Stensætning (Ildsted?) ved Ruingruppe 124.
(K. St. fot. 6-viii-1912.)

lokaliteter; særlig Smørblomsterne er meget frodige, og under vort Ophold kom der to Gange Konebaade over fra Narssak for at slaa Hø til Kateketens Køer. Den bedst bevoksede Ruin er den, der er tegnet paa foranstaaende Kortskitse; det er den, hvorom Kornerup i sin Oversigt 1913 (p. 66 nederst) efter et Brev fra mig skriver „en af Stephensen og Birket-Smith funden Ruin ved Isua paa Tugtutôk er muligvis Isafjords Kirke". Efter at jeg nu grundig har gennemgaaet Finnur Jonssons Oversigt over Nordbostednavnene tør jeg ikke længer holde paa denne Ide, selv om jeg ikke absolut kan opgive den.

Bygningens Retning er næsten lige Ø—V; den er paa det nærmeste dobbelt saa lang som bred og har paa Sydsiden ud mod Vandet en Dør med en kort Gang foran. Murene er af Jord og Sten; et Par

Steder kan man se, at Murenes Yder- og Inderside er sat hver for sig af Sten med Jord imellem, medens Murenes mellemste Del bestaar af Fyld af Jord og smaa Stene; noget lignende, men uden Jordfylden, har jeg iagttaget i den bedst bevarede Ruin (Nr. 6) i Gruppen paa Øen Kanguê (Ruingruppe 121) i Skovfjord, og samme Byggemaade har vi set i et Grønlænderhus, der var under Bygning i Kagsimiut. Tre Steder synes der at være Nicher indvendig i Rummet; to Steder var Væggen lavere end ellers, saa at der maaske har været Vinduer; men det kan ogsaa godt være, at Væggen kun var faldet særlig meget ned paa disse Steder. Murene er gennemgaaende 0,5—1 m høje. I Døraabningen ligger den oprindelige Stenoverligger; Længden er 1,32 m., Bredden 0,26—0,33 m, og Tykkelsen er omtrent som Bredden. Paa den ene Kant er der slaaet nogle Fliser af; dette maa absolut hidrøre fra Tilhugning og kan ikke være nogen naturlig Dannelse. Under det Græs, der nu danner Gulvet, ligger et Lag hoved-store Stene, der synes at være det oprindelige Gulv.

At det er en Nordboruin, kan der næppe være nogen Tvivl om. Dens Kompasretning og Forholdet mellem Længde og Bredde kunde godt tyde paa, at det er en Kirke, til Trods for den ringe Størrelse; derimod er der ikke mindste Spor af Kirkegaardsgærde. Derfor tør jeg ikke nu mere holde paa, at det virkelig er en Kirke, og skal heller ikke gøre Forsøg paa at tyde, hvilken af de kendte Kirker det kan have været. Dog vil jeg blot anføre, at Stedet ikke passer paa noget af de af Finnur Jonsson anførte Steder.

Omkring Ruinen findes flere andre Nordboruiner; især bør fremhæves en, der er en ren Labyrint af firkantede Rum og Gange; en Udgravning her vilde sikkert kunne give interessante Resultater.

Tæt V. f. „Kirken" findes bl. a. en Stensætning: en med flade Stene brolagt Plads omgiven af lidt højere Stene. Uagtet den ikke ligger i en Ruin, synes den at have været Ildsted; den ligner meget Figurerne paa p. 218—19 i D. Bruuns Arbejde.

Ruingruppe Nr. 1 i Tasiusak, Bredefjords Sermilik.

(Se D. Bruun, M. o. G. vol. 16, p. 206—16 (med Figurer) og Clemmensen, ibid., vol. 47, p. 322.)

Da det eksisterende Kort over Tasiusak, gengivet i D. Bruuns Arbejde paa Pl. 19 er i meget lille Maalestok, er det umuligt ved Hjælp af Kortet at genfinde den af ham anførte Lokalitet. Da jeg desuden ikke havde D. Bruuns Arbejde ved Haanden under mit Ophold i Tasiusak, men kun Clemmensens Arbejde med Gengivelse af Bruuns Kort, var jeg altsaa nødt til at lede uden noget som helst fast Holdepunkt. Men ud fra den Tanke, at der i denne Fjordarm ikke fandtes nye Ruiner, idet alt maatte være gammelkendt (hvilket, som nedenstaaende viser, i Virkeligheden ikke er Tilfældet), gjorde jeg ingen Optegnelser paa Stedet udover at maale det nedenfor omtalte lille Hus.

En Maaned senere var jeg imidlertid nødt til at opholde mig nogle Dage i Julianehaab paa Grund af Regn og benyttede da Tiden til at gaa Sagen efter ved Hjælp af M. o. G.; derved saa jeg, at de af mig sete Ruiner ikke tidligere er beskrevet. Nedenstaaende er altsaa nedskrevet efter Hukommelsen, og mulige Fejl maa derfor tilskrives Fejlhuskning.

Fjældene i den inderste Del af Tasiusak bestaar af den røde Igalikosandsten (se f. Eks. Ussings Kort, Pl. 2 i M. o. G. vol. 38). Fra Bunden af Tasiusak udgaar en Del parallele Længdedale, hvis Dannelse skyldes Erosion i Sandstenen. Denne ligger nemlig ikke i vandrette Lag, men derimod stærkt skraat med Hældning mod S. Som Følge heraf er Nordsiden i alle Dalene skraanende mod S, men med jævn Overflade, medens Sydsiden gerne dannes af en nogenlunde lodret (i hvert Fald næsten overalt temmelig stejl) Væg, under hvilken der som Regel ligger store Mængder af nedstyrtede Blokke; enkelte Steder staar Dalene dog i indbyrdes Forbindelse. For Tydeligheds Skyld giver jeg Dalene fortløbende Numre, idet Nr. 1 er den sydligste; men man bedes erindre, at det hele er opskrevet efter Hukommelsen, saa at Fejl ikke er udelukkede.

Dal Nr. 1 har temmelig høje og stejle Sider og er meget lang og smal. Den indeholder en lang smal Fjordarm, der synes at gaa meget langt over ad Kagsiarsuk til. I denne Dal har jeg ikke været nede, da man oppe fra Nordsiden kan se, at den efter hele sin Karakter ikke kan indeholde Nordboruiner; at Vandet i dens Bund ikke er nogen Sø, men derimod en Fjordarm, støtter jeg paa, at da jeg var paa Stedet (i Beg. af August), indeholdt den nogle mindre Isfjælde. Dal Nr. 2 er noget bredere; Bunden er bevokset næsten udelukkende med Rensdyrlav, og Dalen hæver sig kun ganske svagt indefter. Inderst inde ligger en temmelig stor Sø. Paa Dalens Nordside, omtrent 5 Minuters Gang fra Fjorden, ligger oven over hinanden to ganske smaa Bygninger, udelukkende af store Stene; de er ikke lette at finde, da hele Nordsiden er bevokset med tæt Pilekrat. Jeg har fundet dem ved at komme fra den nordlige Dal og da bogstavelig talt falde ned i dem. I Dal Nr. 3 løber en Bæk, der danner Afløb for en lille Sø. Dalbunden er meget frodig; men da vi har været paa Stedet i 4—5 Dage, og jeg hver Dag har søgt meget nøje efter Ruiner, men stadig med negativt Resultat, tror jeg med Sikkerhed at kunne sige, at der her ikke findes Ruiner. Mellem Dal 1—2 og 2—3 findes i Mundingen ganske smaa Landtunger; derimod gaar der en temmelig lang Tunge ud i Fjorden mellem Dal 3 og 5, og ovenpaa denne ret frodige Landtunge ligger Dal 4, i hvis yderste Ende der er en Mose med Kæruld. Tæt ved Mundingen af Dal 3 gaar der paa Nordsiden en bred lav Kløft over til Dal 4. Paa Nordsiden af denne Dal ligger der (Ø. f. den omtalte Kløft) en lille, udmærket bevaret Nordboruin. Den er bygget af naturlige Spaltestykker af den røde

Sandsten (særlig ved Ruinens Nordside ligger store Mængder af ganske lignende Spaltestykker), og Murene har næsten overalt en Højde af omkring 1 m; der er intet Spor af Jord mellem Stenene. Bagvæg findes ikke, idet Huset er støttet op til en lille Klippeknold med lodret Væg mod Ruinen. Huset er paa det nærmeste rektangulært og har to Rum inden for hinanden med en Dør imellem. Yderdøren, der sidder skraat for Døren i Skillevæggen, mangler sin Overligger, og dens højre Side er noget medtaget, saa at dens Bredde ikke med Sikkerhed kan bestemmes. Iøvrigt har Ruinen følgende Maal: udvendig Længde 3 m, udvendig Bredde 2 m, indvendig Bredde 1 m; forreste og bageste Rum hvert ca. 0,9 m langt. Døren mellem de to Rum har endnu Overligger og er 0,4 m bred, 0,7 m høj; dog har den rimeligvis oprindelig været lidt højere, idet Gulvet, der nu er dækket af nedfaldne (?) Stene og Mos, synes tidligere at have ligget noget lavere. Murtykkelsen er 0,5—0,7 m. Bestemmelsen med dette Hus synes meget gaadefuld; thi hvad kan Meningen have været med at dele et saa lille Hus i to Rum? Desuden er Døren jo ogsaa paafaldende lav; men væsentlig højere kan den absolut ikke have været. Noget tilsvarende til denne Ruin er det ikke lykkedes mig at finde hverken hos Holm eller Bruun.

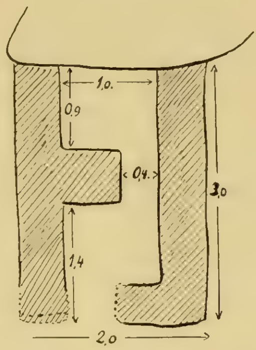


Fig. 13. Plan af en lille Ruin i Gruppe 1 i Tasiusak i Bredefjords Sermilik. Maalene er i Meter.

Fra Dal Nr. 4 falder Terrainet mod N. stejlt (flere Steder næsten lodret) ned mod Dal 5, der ligger i Bunden af en ret dyb Bugt.

Naar man nu skal stedfæste disse Dale og Ruiner i Forhold til det af Bruun beskrevne og kortlagte Omraade (Bruun's Kort p. 206), er dette meget vanskeligt for ikke at sige umuligt. Da Dal Nr. 1 er en Fortsættelse af den sydligste af Tasiusaks inderste Vige, kan Ruingruppe Nr. 1 altsaa ikke ligge Syd herfor; Gruppen findes heller ikke i Dal 2, 3 eller 4. Dal 5 har jeg ikke været nede i, saa at Ruingruppen muligvis ligger her; men under alle Omstændigheder tør jeg sige med Sikkerhed, at Gruppen ikke ligger, hvor Bruun har afsat den paa sit Kort (M. o. G. vol. 16, Pl. 19; aftrykt af Clemmensen i vol. 47, Pl. 25); heller ikke kan jeg genkende Stedet efter den Beskrivelse, som Bruun og Clemmensen giver deraf (henholdsvis p. 206 og 322).

Ruingruppen paa Kanguê i Skovfjord (Nr. 121).

Clemmensen siger (1911, p. 355), at Pastor Wagner har fundet nogle Ruiner paa Øen Kanguê, og afsætter dem paa Kortet som Nr. 121. For at være sikker paa at finde den rigtige Dal, havde jeg en Grønlænder, Boas, med fra Kanguês Boplads for at vise Vej.

Dette viste sig senere at være absolut nødvendigt; thi dels har Øen en helt anden Form end paa Kortet, idet den bl. a. i Virkeligheden er delt i mindst 3 Øer, og dels er Ruingruppen afsat langt fra sin virkelige Plads; i Forbigaaende skal blot bemærkes, at den dybe Bugt paa Øens Sydside er meget bredere, men mindre dyb end paa Kortet.

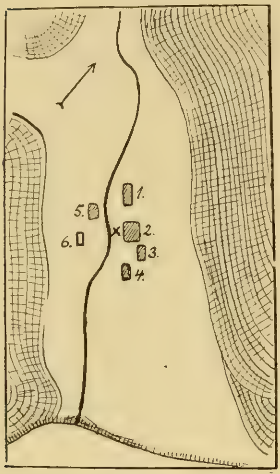


Fig. 14. Kortskitse af Ruingruppe 121 paa Kanguê. Pilen betegner N.—S.

Den Dal, hvori Ruinen ligger, er fra Søen ikke vanskelig at kende, idet der ligger temmelig højt Land paa dens vestlige Side; Kysten er stejl, saa at Bækken styrter ned som et lille Vandfald. Det er muligt, at man ved nøjere Undersøgelse vilde kunne finde flere end de af Clemmensen omtalte 6 Ruiner. Alle Ruinerne med Undtagelse af Nr. 6 er meget slet bevarede og er i Virkeligheden kun Stenhobe. De bestaar af utilhugne, oftest skarpkantede Stene; at tegne Kort af dem er umuligt uden Udgravning (ganske vist ser man enkelte Steder endnu et Murhjørne staa), og det er vist mere end tvivlsomt, hvorvidt Udgravning vilde give et Resultat, der stod i blot nogenlunde rimeligt Forhold til Arbejdet.

3 af Bygningerne er meget store: Nr. 1 er 22×10 (maaske 22×17) Skridt; Nr. 2 35×33 Skridt; Nr. 3 14×21 Skridt; de øvrige er mindre (Nr. 4 15×12(?) Skridt, Nr. 5 14×14 Skridt). Nr. 2 har sikkert været Beboelseshuset; thi mellem denne Ruin og Bækken er Vegetationen særlig kraftig (f. Eks. højt Græs, Ranunkler), saa at her maa Møddingen have været (× paa Kortet). Beboelseshuset maa efter Stenbunkens Form have været af den Type, som Gudmundsson angiver er den yngste, nemlig med Værelserne grupperede uden om en Midtergang. Ruin Nr. 6 er den eneste, som er nogenlunde bevaret: den strækker sig i Dalens Længderetning og er 4×8 m (udvendig Maal). Den er bygget af store butkantede Stene uden Jord imellem; Væggenes Yder- og Inderside er dannet af store, nogenlunde regelmæssigt formede Stene, saaledes at der midt i Væggen er et Mellemrum opfyldt med mindre Stene. Murtykkelsen er gennemgaaende 1 m og Murens Højde ½ m. Der er en Dør i Væggen over mod Beboelseshuset (Nr. 2).

Fig. 15. Kort af Øen Kanguê i Skovfjord. Med de punkterede Linier er skitseret de Sunde, der deler Øen i flere Dele.

Som ovenfor sagt er det sandsynligt, at man ved nøjere Undersøgelse, end jeg har haft Tid til, vil kunne finde mange flere Ruiner; Dalbunden er nemlig tæt bevokset, særlig med Rævling og Pilekrat, og op mod de stejle Dalsider findes overordentlig mange nedfaldne Sten; ved grundig Eftersøgning særlig op ad Dalens Sidevægge vilde muligvis en Del kunne findes. CLEMMENSEN siger: ,,Fra Sletten strækker sig en Dal ind i Øen; ovenfor den skal der være en Slette, hvor der rimeligvis ligger flere Ruiner". Dette Spørgsmaal har Tiden ikke tilladt mig at løse; derimod bør det fremhæves, at næsten hele den Del af Øen, der ligger Ø. for Ruinerne, er ganske lav og ret flad og beklædt med (ganske vist tarveligt) Græs. Det er rimeligvis dette, CLEMMENSEN sigter til; under alle Omstændigheder maa det anses for givet, at Gaardens Kreaturer ikke har nøjes med det Græs, der findes om Ruinerne i Dalen. Nu findes der ikke Laks i Elven, rimeligvis fordi de ikke kan springe op over den stejle Kyst; om Forholdene har været de samme i Nordbotiden, er vel næppe sandsynligt, thi det er meget rimeligt, at den stejle Kyst er dannet efter Nordboernes Tid, idet Havet ogsaa paa dette Sted synes at æde meget kraftigt af Landet.

Paa det vedføjede lille Kort af Øen, som jeg har kopieret efter Kortet over Bredefjord og Skovfjord i Meddelelserne vol. 16, har jeg med en punkteret Linie angivet de Sunde, der deler Øen i flere Dele; men nøjagtigt har jeg ikke kunnet tegne dem, og det hele burde tegnes helt om paa Grundlag af nye Opmaalinger. Langs den Kyst, paa hvis Midte Bopladsen ligger, gaar et lavt smalt Fjældparti; inden for dette og parallelt med den omtalte Kyststrækning ligger en græsbevokset Dal, N. f. hvilken Øens højeste Del ligger. Lige ved Dalens sydligste Ende og helt ude ved Kysten ligger den mærkelige Ruin, som jeg paa Kortet har kaldt Nr. 121 a. Murene, der er af Jord og Sten, er udvendig indtil 2 m høje, men indvendig kun $^{1}/_{2}$ m, da Gulvet ligger meget højt. Hele Ruinen er paa den længste Led 25 Skridt lang. Den er stærkt overgroet med Græs, men iøvrigt saa tydelig, at selv efter Udgravning vilde Kortskitsen næppe vise sig at være meget forkert. Der synes at have været Stald i den vestlige Del.

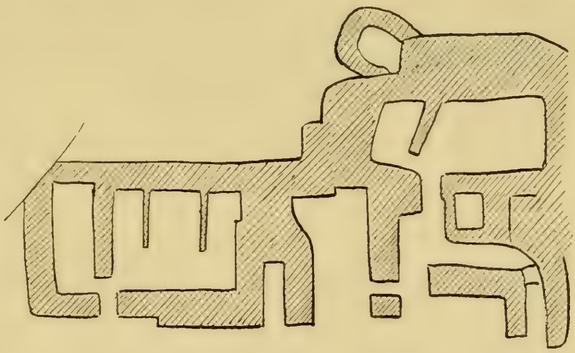


Fig. 16. Plan af Ruin 121 a paa Kanguê i Skovfjord.

Tillæg.

Dels under mit Ophold i Grønland, dels herhjemme har jeg af forskellige faaet Oplysninger om andre Nordboruiner. Da disse Ting ikke er uden Interesse og maaske kan faa Betydning ved fremtidige Undersøgelser, anfører jeg dem her sammen med andre mindre Optegnelser.

Igaliko. I sit Arbejde om Angmagsalik (M. o. G. vol. 10, 1888, Fodnote p. 80—81) siger HOLM, at „Bjørnefælden“ ved Igaliko (Grønl. Hist. Mindesmærker, vol. 3, p. 816) muligvis er grønlandsk, idet man fra Østkysten bl. a. har Sagn om, at man der har fanget Bjørne i Fælder; iøvrigt nævner HOLM 3 saadanne, endnu eksisterende Fælder ved Angmagsalik, men de benyttes nu ikke mere.

Fig. 17. Ruinen „Brattahlid“ i Igaliko set udvendig fra. Længst t. h. sidder stud. mag. K. BIRKET-SMITH. I Forgrunden er Hø udbredt til Tørring. (K. ST. fot. 25-IX-1912).

I 1912 er der i Igaliko indviet et nyt Kapel, hvortil Stenene naturligvis er taget fra Nordboruinerne, der saaledes efterhaanden gaar deres Undergang i Møde. Mærkværdig nok synes den bedst bevarede Ruin (HOLM's Nr. 3, afbildet hos HOLM paa Pl. 27) ikke at have taget nogen Skade. Den eneste Forandring, den synes at være undergaaet siden HOLM's Billede blev tegnet, er, at Døren til højre paa Billedet her er gjort betydelig mindre ved at være delvis opfyldt af mindre Stene, da Ruinen nu bruges til Høhus; dette var maaske allerede Tilfældet, da HOLM's Billede blev tegnet (der siges i Teksten, at den benyttes til Hø), men udeladt paa Figuren, da disse Tilføjelser ikke stammer fra Nordbotiden.

Af den Ruin, der tidligere blev kaldt „Brattahlid“, har GROTH givet en Tegning i HOLM's Arbejde (Fig. 8, p. 111); Ruinen er set indvendig fra, men Tegningen er ikke videre god og giver navnlig ikke noget særlig tydeligt Indtryk af, hvor store de Stene er, som den er bygget af. For at vise dette tydeligere har jeg taget det vedføjede Fotografi af Langsiden udvendig.

Ruingrupperne 64 a-b, beskrevet af Pastor JESPERSEN i vol. 50, p. 97—104, ligger i en Dal, hvis nordlige Munding karakteriseres af det høje, stejle, stærkt furede Fjæld, der fremtræder meget tydeligt midt paa Billedet i D. BRUUNS Arbejde i vol. 16, p. 369.

Kagsiasuk i Igaliko-Fjord, Gruppe 66 (HOLM vol. 6, p. 113 ff., Pl. 28—31; BRUUN vol. 16, p. 368; CLEMMENSEN vol. 47, p. 341 ff.). Naar man fra den forholdsvis godt bevarede Ruin med Gavlen (Ruin Nr. 1) gaar ca. 100 m langs Strandkanten udefter mod Fjordmundingen, finder man en lille Ruin af Jord og Stene, 6×5 Skridt lang; paa Siden ud mod Fjorden er der en Dør. Murene er kun ca. $^1/_4$ m høje. Denne Ruin er ikke omtalt af nogen af dem, der tidligere har været paa Stedet.

Kakortok. Lige S. f. den godt bevarede Ruin (HOLMS Nr. 5, Pl. 17) ligger en meget stor Ruin med flere smaa Rum, men iøvrigt daarligt bevaret, saa at der ikke kan tegnes Kort deraf; den bestaar væsentlig af afrundede Stene.

Om **Ruinerne paa Akia,** der nævnes i Grønl. Hist. Mindesmærker vol. 3, p. 799 som „af ringe Betydenhed“, og som ikke er genfundet senere, har Kolonibestyrer IBSEN i Julianehaab meddelt mig, at han har set nogle Ruiner paa Øen engang for mange Aar siden; nu har han kun et meget uklart Indtryk deraf, men mener dog bl. a. at kunne huske, at der var en stor Indhegning.

Ved **Ruingruppen N. f. Narssak (Gr. 18)** skal der, ifølge Meddelelse af Ingeniør cand. polyt. FR. HELWEG findes en Brønd ude i Elven. For Fuldstændigheds Skyld skal det blot tilføjes, at HELWEG er Geolog, saa at der ikke kan være Tale om en Jættegryde, da saadanne undertiden af Grønlænderne skal opgives som Brønde eller „Vandfade“ fra Nordbotiden.

Ved **Bredefjords nordre Sermilik (Sermitsialik),** hvor der skal findes Nordboruiner, har Grønlænderen KASPAR fra Kagsimiut meddelt, at der skal være en Nordbograv med mange Lig, aldeles som man ofte finder i Grønlændergrave (bl. a. N. f. Frederikshaab har vi aabnet en Grønlændergrav med Rester af mindst 50 Lig). Denne Meddelelse bør dog opfattes med stort Forbehold, idet flere af den samme Grønlænders Meddelelser ved nøjere Undersøgelser har vist sig ikke at passe; f. Eks. var det ham, der var allermest overbevist om, at de ovenfor omtalte Nordboruiner ved Isua alle var grønlandske!

Om **Ruinerne ved Arsuk-Fjord** har Driftsbestyrer ENGELHARDT i Ivigtut fortalt mig, at den Nordbovarde, der tidligere fandtes paa Fjældet over Ivigtut, nu ikke eksisterer mere, idet nogle Arbejdere fra Kryolitbruddet for nogle Aar siden har revet den ned, idet de troede, at der var skjult noget værdifuldt i den (om dette er den samme Varde, hvis Nedrivning FANØE omtaler i Aarbøger f. Nord.

Oldk., 1873, p. 97, har jeg ikke kunnet konstatere). — Desuden har Driftsbestyreren fortalt, at han 1911 har fundet en ret stor Fold, delt i 2 Rum, inderst i den vestlige Side af Christianshavn mellem Ivigtut og Arsuk; efter et Fotografi, han har vist mig, maa den være særdeles godt bevaret, idet den paa Fotografiet fremtræder langt tydeligere, end Ruiner ellers plejer.

En meget interessant Opgave vilde det være at gennemgaa samtlige Ruingruppers Byggeplan og undersøge, om man ikke derigennem kunde faa Oplysninger om Landets Bebyggelse ɔ: se, om de gode Egne først var bebygget og derefter de daarlige, eller om noget saadant ikke er Tilfældet. Absolut sikre Resultater i denne Henseende vil man dog næppe kunne komme til, da man vel maa kunne gaa ud fra, at i de ca. 400 Aar, Nordbotiden har varet, har man sikkert bygget om paa de gamle Huse.

Der kan vel nu ikke mere være Tvivl om, at Erik den Røde har boet paa det Sted, man nu anser for at have været hans Bolig i Kagsiarsuk (Gruppe 29; Holm p. 79, Pl. 2—3; D. Bruun p. 287). Derfor er det meget interessant, at Beboelseshuset i netop denne Gaard (D. Bruun fig. p. 288—90) tilhører den yngste af de islandske Gaardtyper. I „Privatboligen på Island i sagatiden" (Kbhvn. 1889) skriver V. Gudmundsson om denne Type p. 79 øverst „efter året 1000 ses den, for så vidt man kan forlade sig på sagaernes vidnesbyrd, at være bleven den almindeligste. Jo længere man kommer ned i tiden, desto sjældnere bliver de to andre sammenstillingsformer, indtil de helt fortrænges af denne som den fuldkomneste og mest praktiske". Dette gælder ikke Grønland; thi ved at gennemblade Holm's og Bruun's Grundplaner vil man se, at man mellem Nordboruinerne kun finder meget faa af denne Art, og det synes gennemgaaende kun at være Gaardene paa de bedste Steder, der har haft denne Form. —

Et andet Spørgsmaal burde ogsaa klares, hvis det kan lade sig gøre, nemlig hvorvidt Klimaet har forværret sig siden Nordbotiden. Sikre Beviser for Klimatforværring inden for et saa kort Tidsomraade findes mig bekendt ikke; men forskelligt synes mig at tyde paa, at det alligevel er Tilfældet med Grønland. I „Geographisk Undersøgelse af Grønlands sydligste Del" i M. o. G. vol. 6 skriver Holm nemlig (p. 173), at inderst i Tasermiut, ved hvis Kyst Ruingrupperne 102—05 ligger, og hvor nu en Bræ gaar helt ud i Fjorden, skal „efter Grønlændernes Udsigende paa det Sted, hvor denne Bræ nu ligger, tidligere have været en Kirkegaard fra Nordboernes Tid". Muligvis skal denne Udtalelse opfattes med en vis Reservation; men er den rigtig, kan den næppe forklares ved andet end Klimatforværring. Ganske vist er det jo et forlængst kendt Træk fra alle Alpelande, at Bræerne rykker frem og tilbage periodevis; men det kan vel næppe tænkes, at Nordboerne skulde have lagt en Kirkegaard paa et Sted, hvor de maatte vide, at den ikke kunde ligge i Sikkerhed for Bræen.

Inderst i Tasiusak (i Bredefjords Sermilik) hvorfra jeg ovenfor har beskrevet den lille Nordboruin ved Gruppe 1, findes der en stor Mængde temmelig tykke Birkestammer, men alle døde. Nu til Dags vokser der kun lavt Birke- og Pilekrat; men hvorfor er alle de store Birke døde, hvis Klimatforholdene paa Stedet endnu er lige saa gode, som da de voksede der?

IV.

USSINGIT, ET NYT MINERAL FRA KANGERDLUARSUK

AF

O. B. BØGGILD

1913

Fra sin Rejse i Grønland i Aaret 1888 hjembragte K. J. V. Steenstrup et enkelt Stykke, der indeholdt et hidtil ukendt Mineral af en smuk, lys violetrød Farve; som Findested staar paa Etiketten angivet Kangerdluarsuk. Stykkets Form synes at tyde paa, at det er fundet som løs Sten; og det er denne, der i den følgende, udførligere Beskrivelse af Forekomstmaaden er betegnet som Nr. 1. Af Etiketten fremgaar det, at N. V. Ussing har paabegyndt en Undersøgelse af Mineralet, men ikke har faaet den fuldført, hvorfor han har givet Mineralet Betegnelsen »Ubekendt«.

Et større Materiale af samme Mineral, om end af væsentlig andet Udseende, fandt Ussing paa sin Rejse i Grønland i Aaret 1908. Dette Materiale bestaar af en løs Sten med Etiketten »Lille Elv« (dette Navn er af Ussing givet en Elv, der løber ud i den inderste Ende af Kangerdluarsuk). Det nye Mineral herfra, der udmærker sig ved sin kraftige violetrøde Farve, er senere beskrevet som Nr. 2.

Paa den samme Ekspedition og paa samme Dato (14. Juli) fandt Ingeniør Fr. Helweg, der var Ussings Assistent paa Turen, en Sten af noget lignende Beskaffenhed som den af Ussing fundne. Det nye Mineral, der her er af en væsentlig mørkere Farve, er i det følgende beskrevet som Nr. 3. Som Forekomststed er kun anført Kangerdluarsuk.

Ved den Undersøgelse jeg har foretaget af Mineralet, har det vist sig ikke alene at være nyt, men ogsaa at staa ret isoleret, idet det hverken ved sine fysiske eller kemiske Egenskaber er nærmere beslægtet med noget andet kendt Mineral. Til Minde om Ussing har jeg givet det ovenstaaende Navn.

Krystalform og fysiske Egenskaber. Ussingiten er triklin og udpræget pseudomonoklin; den er ikke nogensinde fundet i Besiddelse af Krystalflader, da den i alle Tilfælde er enten yngre end eller af samme Alder som de omgivende Mineraler. Krystalformen er bestemt ved Spalteligheden i Forbindelse med de optiske Forhold. Der er tre Spaltningsretninger, der, som det er vist paa Fig. 1, er opstillede som c $\{001\}$, m $\{110\}$ og M $\{1\bar{1}0\}$, ved hvilken Orientering Overensstemmelsen med den monokline Symmetri paa den naturligste Maade opretholdes. Spalteligheden efter c maa betegnes som fuldkommen og er oftest ledsaget af en udpræget Perlemorglans; i de to andre Retninger er Spalteligheden derimod svag. Imidlertid bliver Spaltningsfladerne, selv den efter c, mindre iøjnefaldende, end de ellers vilde være, paa Grund af Mineralets overordentlig uregelmæssige indre Bygning; hvert Hovedindivid er sammensat af en Mængde Smaapartier i omtrent parallel Sammenvoksning, saa at Spaltningsfladerne bliver i høj Grad facetterede; dog kan Spaltningsfladerne efter c være ret fuldkomment plane i en Udstrækning af nogle faa Millimeter. Paa saadanne Stykker bliver da ogsaa de andre Spaltningsflader nogenlunde synlige, men de er dog altid stærkt afbrudte.

For Maalingens Skyld har jeg polarstillet udvalgte Spaltningsstykker efter c og har da fundet:

$$\rho\ (m) = 70°21'\ (69°20'—70°45')$$
$$\rho\ (M) = 71°30'\ (70°55'—71°50')$$
$$\varphi\,(m) - \varphi\,(M) = 97°23'\ (96°31'—98°50')$$

eller, hvad der vil sige det samme:

$$c : m = 70°21' \qquad c : M = 71°30' \qquad m : M = 90°28'$$

Der kan i enkelte Tilfælde være Mulighed for at forveksle m og M, da Værdierne for dem grænser nær til hinanden, og den almindelige Tvillingdannelse efter $\{010\}$ kan bringe dem til at bytte Plads; dog kan de nogenlunde skelnes fra hinanden, ikke alene ved at Vinkelen mellem c og m er mindre end den mellem c og M, men ogsaa ved at Spalteligheden efter m er kendeligt kraftigere end efter M, saa at den førstnævnte Flade gennemgaaende giver bedre Reflekser. Det vilde dog næppe være muligt sikkert at konstatere Mineralets Henhøren til det trikline System uden ved Hjælp af de optiske Forhold.

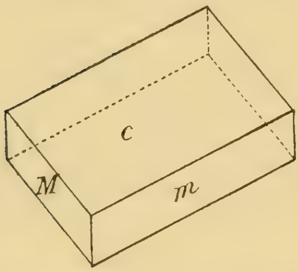


Fig. 1. Ussingit; Spaltelighedsskema.

Glansen er Glasglans, paa $\{001\}$ svag Perlemorglans; Farven er violetrød i forskellige Nuancer, fra næsten helt hvid til temmelig mørk; den minder ofte en hel Del om den Farve, som Sodaliten fra samme Forekomst er i Besiddelse af, naar den første Gang kommer frem for Lyset; men mens Sodaliten fuldstændig mister den røde Farve efter en kortere Tids Udsættelse for Dagslyset[1]), synes Ussingiten at være fuldstændig holdbar. Paa Yderfladerne af Stenene er den vel nok noget lysere end i de indre Partier af dem; men dette Forhold kan vistnok lige saa godt bero paa en Forvitring eller Udvaskning som paa Indvirkning af Lyset. Der er ingen kendelig Pleokroisme. Vægtfylden af det ganske rene Materiale er 2,495; Haardheden er mellem 6 og 7.

[1]) Her skal dog bemærkes, at Museet er i Besiddelse af et enkelt Stykke grønlandsk Sodalit af en holdbar, smukt rosenrød Farve. Sodaliten findes sammen med Analcim og Natrolit; det rødfarvede Parti strækker sig kun ca. 1 cm til alle Sider, og i den øvrige Del af Stykket er Sodaliten som sædvanlig, naar den har været udsat for Lyset, farveløs.

Lysbrydningen er svag, Dobbeltbrydningen derimod meget stærk, saa at de fleste Snit er i Besiddelse af kraftige Interferensfarver, hvorved Mineralet i Tyndsnit meget let kan kendes fra alle de andre Mineraler, der findes i Pegmatitgangene ved Kangerdluarsuk. Paa en kunstig slebet og poleret Flade er Lysbrydningen maalt ved Totalreflektometer:

$$\alpha = 1{,}5037$$
$$\beta = 1{,}5082$$
$$\gamma = 1{,}5454$$

heraf:

$$2V = 39°4'$$
$$2E = 60°34'$$

For denne sidste Værdi er i forskellige Snit iagttaget Værdier mellem 54°30′ og 62°40′.

I Snit efter $\{001\}$ viser de fleste Stykker sig i Besiddelse af Tvillingstribning; denne er ofte ret uregelmæssig, men undertiden findes dog nogenlunde parallele Tvillinggrænser; et af de regelmæssigere Partier er afbildet paa Tavle IX, Fig. 1. I de Tilfælde, hvor Grænserne er retlinede, halverer de paa det nærmeste den stumpe Vinkel mellem Sporene af $\{110\}$ og $\{1\bar{1}0\}$, og det er derfor naturligt at antage $\{010\}$ som Tvillingflade. Forskellen i Udslukningsretning mellem de to Lameller er 10—12°; Udslukningsskævheden altsaa 5—6°; til hvilken Side denne Skævhed er orienteret i Krystallen, kan ikke angives. I konvergent Lys ses Spor af et Aksebillede, med selve Akserne liggende et Stykke udenfor Synsfeltet, og tilsyneladende begge lige langt udenfor. Vinkelen mellem den spidse Halveringslinie, $\mathfrak{c}$, og Normalen paa $\{001\}$ ses i Snit efter $\{010\}$ at være omtrent + 33°. I et Snit omtrent vinkelret paa $\{001\}$ og $\{010\}$ ses en lignende Tvillingstribning som i basiske Snit; men Udslukningsskævheden er noget mindre (ca. 4°). Dobbeltbrydningen i Snit efter $\{001\}$ kan efter de ovenstaaende Data beregnes til at være ca. 0,0162; ved Maaling med Kompensator er fundet 0,0156.

Kemiske Forhold. Mineralet er analyseret af cand. polyt. Chr. Christensen med følgende Resultat:

SiO_2	58,74
Al_2O_3	17,73
Na_2O	19,91
H_2O	4,19
	100,57

Disse Værdier svarer nærmest til Formlen $HNa_2Al(SiO_3)_3$, der kræver: 59,6 SiO_2, 16,9 Al_2O_3, 20,5 Na_2O, 3,0 H_2O. Den fundne Vandmængde er vel noget for stor; men det er ikke nødvendigt at antage, at alt Vandet er Bestanddel af Molekulet. Efter ovenstaaende Formel er Mineralet et udpræget Metasilikat; men det staar i øvrigt ikke i kemisk Henseende i nærmere Slægtskab med noget andet Mineral. Særlig paafaldende er den store Natronmængde; der eksisterer ikke noget andet rent Silikat med saa mange pCt. Na_2O; kun nogle af Sodalitgruppens Mineraler staar i den Retning højere.

Ved Ophedning forholder Ussingiten sig fuldstændig som en typisk Zeolit, idet den smelter overordentlig let under stærk Opblæring. Den sønderdeles af Saltsyre under Gelédannelse. Selv om Mineralet ved disse Egenskaber minder stærkt om Zeoliterne, er der dog ikke tilstrækkelig Grund til at henføre det til denne Gruppe. For det første er Vandmængden væsentlig mindre end hos Zeoliterne, og for det andet afviger Forekomstmaaden i Pegmatit og navnlig Sammenvoksningen med Sodalit og Feldspat, som nedenfor skal omtales nærmere, i høj Grad fra hvad der er typisk hos Zeoliterne.

Forekomstmaade. Som nævnt i Indledningen, er Ussingiten kun fundet i tre løst liggende Sten af 1—2 dm's Diameter. Der kan dog ikke være nogen Tvivl om Forekomsten, idet de ledsagende Mineraler tydelig viser, at Stenene er Brudstykker af Naujaitens[1]) Pegmatitgange; i den ene af Stenene findes ogsaa et Parti af selve Naujaiten. De tre Sten viser i øvrigt saa store indbyrdes Forskelligheder, baade i Henseende til Ussingitens egne Egenskaber og til dens Forekomstmaade, at de i det følgende skal behandles hver for sig.

Nr. 1. Denne, den mindste af Stenene, har leveret næsten alt Materialet til den fysiske og kemiske Undersøgelse af Mineralet, da dette her optræder i særdeles ren Tilstand. Den ene Del af Stenen udgøres af Naujait, der her væsentlig bestaar af et enkelt, stort Arfvedsonitindivid, der som sædvanlig er tæt spækket med ærtestore Sodalitkrystaller; den anden Del udgøres væsentlig af ret storkornet Ussingit, hvis enkelte Individer naar en Diameter af over 1 Centimeter. Denne Ussingit er af en ganske lys rødviolet Farve og er gennemgaaende meget ren; dog findes den, navnlig i Nærheden af Grænsen mod Naujaiten, blandet med en Del forskellige Mineraler, nemlig Ægirin, Steenstrupin, Apatit, Feldspat og Sodalit. Af disse er de tre førstnævnte afgjort ældre end Ussingiten; Ægirinen optræder dels som større Krystaller, dels som tynde, næsten mikroskopiske Naale, der gennemtrænger visse Partier af Ussingiten, der derved faar en grønlig Tone; nogle af disse ses i Tavle IX, Fig. 3. Steenstrupinen findes ret sparsomt i Form af smaa (højest 4 mm store) som sædvanlig fuldstændig begrænsede Krystaller. Apatiten ses i Snittene i Form af smaa Korn, af hvilke to ses i den nævnte Figur; ogsaa dette Mineral har i det mindste delvis fuldstændig Krystalbegrænsning mod Ussingiten; i et enkelt Tilfælde ses en ret stor Krystal gennemtrukket med Spalter, der er udfyldte med Ussingit. Sodaliten og Feldspaten er derimod nærmest dannede samtidig med Ussingiten, og de findes begge i meget intim Sammenvoksning med dette Mineral. For Sodalitens Vedkommende gennemtrænger den Ussingiten poikilitisk.

[1]) Angaaende denne Bjærgart, den tidligere saak. Sodalitsyenit, henvises til Ussing: Medd. om Grønl. 38, 1911, S. 32 ff. og 143 ff.

Størrelsen af de enkelte Korn kan variere fra Brøkdele af en Millimeter til ca. 3 Millimeter. Grænserne mellem de to Mineraler er altid ganske uregelmæssig, saaledes som det vil fremgaa af Tavle IX, Fig. 4, der fremstiller det samme Parti som Fig. 3, men i polariseret Lys. Sammenvoksningen mellem Ussingit og Feldspat er fuldstændig skriftgranitisk, idet større Partier udgøres af een Krystal af hvert Mineral, der er voksede igennem hinanden paa en meget indviklet Maade; et Eksempel herpaa ses paa Tavle IX, Fig. 5 og 6, der viser det samme Parti, henholdsvis i almindeligt og i polariseret Lys. Paa det første Billede ses Grænselinierne mellem de to Mineraler tydelig paa Grund af Ussingitens svagere Lysbrydning; det ses, at Grænserne er ganske uregelmæssige. Paa det andet Billede ses Mikroklinens to Individer, det ene sort, det andet hvidt, mens Ussingiten fremtræder graa. Grænsen mellem de to Mikroklinindivider er oftest nogenlunde regelmæssig, parallel med $\{010\}$; sjældent findes Spor af Krydsstribning. Der er ikke det mindste Spor af Albit i denne Mikroklin. Der synes ikke at være nogen bestemt Regelmæssighed i den indbyrdes Orientering af Mikroklinen og Ussingiten.

Nr. 2. Den anden Sten bestaar af en helt igennem ensartet Pegmatitmasse, der dog ikke er særlig storkornet, idet de enkelte Individer højest naar en Diameter af 2 cm, men i Reglen er langt mindre. Bestanddelene er Ussingit, Steenstrupin, Ægirin, Sodalit, Epistolit og Feldspat, ordnede efter den Mængde, hvori de optræder. Rækkefølgen, hvori Mineralerne er dannede, er som i foregaaende Tilfælde; saaledes er altid Steenstrupinen, Epistoliten og Ægirinen ældre end de andre Bestanddele, og navnlig Steenstrupinen optræder som smukke og regelmæssige Krystaller af nogle faa Millimeters Størrelse. Ussingiten, der udgør næsten Halvdelen af hele Massen er af en ret kraftig violetrød Farve, væsentlig mørkere end Type 1. Selv om den nok kan optræde som ret store samlede Masser, er de enkelte Individer dog altid langt mindre end i foregaaende Tilfælde, undertiden ogsaa overordentlig smaa. I Tyndsnit er den meget forskellig; undertiden kan den være ligesaa ren og gennemsigtig som Type 1, men oftest er den fuld af en Masse, ganske smaa Indeslutninger, hvis nærmere Natur vanskelig lader sig sikkert udrede; man kan se af den Maade, paa hvilken de forsvinder og viser sig igen ved Omdrejning af Præparatet, at de har en Lysbrydning omtrent som Ussingitens α og β, og det er sandsynligt, at de bestaar af Sodalit; der er ogsaa alle mulige Overgange mellem Korn, der er saa store, at man tydelig kan se, at de er enkeltbrydende, til saadanne, der er saa smaa, at de ikke kan ses tydelig, selv med stærk Forstørrelse; de ligger oftest ordnede i regelmæssige Rader. Sodaliten forekommer makroskopisk i Form af hvide, tilsyneladende finkornede eller tætte Partier, der i Udseende afviger stærkt fra, hvad der er almindeligt for dette Mineral. Rundt omkring i Præparaterne ses ogsaa større, uregelmæssig begrænsede Korn af dette Mineral, spredt omkring i Ussingiten; det er paafaldende, at Sodaliten meget almindelig sidder paa Overfladen af

Steenstrupinkrystallerne, i hvilket Tilfælde den altsaa er lidt ældre end Ussingiten. Feldspaten forekommer ligeledes i uregelmæssig begrænsede Korn rundt omkring i Ussingiten og viser i enkelte Tilfælde en udpræget Tendens til at sætte sig umiddelbart paa Fladerne af Steenstrupin og Ægirin. Nogen særlig udpræget Skriftgranitstruktur er ikke fundet i dette Tilfælde.

Nr. 3. Hovedmassen af denne Sten bestaar af en Mineralkombination af de samme Bestanddele som i foregaaende Tilfælde, om end i andet Forhold, idet Ussingiten her findes i noget mindre Mængde. Ussingiten selv afviger fra den foregaaende ved at være væsentlig mørkere, saa at Farven maa betegnes som mørk violetrød; i Tyndsnit viser den sig at indeholde de samme Interpositioner som før nævnt, men i væsentlig større Mængde. De enkelte Individer af Ussingiten er gennemgaaende mindre, og ofte findes Mineralet i fuldstændig tæt Form med Individstørrelse af 0,01 mm eller endnu mindre. Et Billede af Forekomsten ses paa Tavle IX, Fig. 2, der i og for sig lige saa godt kunde forestille Type 2; Krystaller af Steenstrupin med regelmæssig Krystalbegrænsning er omgivne af Ussingit; dog ses ogsaa tydelig paa nogle af Fladerne uregelmæssig formede Masser af Sodalit, som ovenfor omtalt. De Striber, der er synlige i Ussingiten, hidrører fra de før omtalte Rækker af Interpositioner; den overordentlig finkornede Ussingit ses ikke paa dette Billede.

Den væsentligste Forskel mellem denne Sten og de foregaaende er dog den store Mængde Analcim, der findes i den, og som er ejendommelig ved, at det er det samme Individ, der strækker sig gennem hele Stenen, hvad der let kan ses ved Hjælp af den for denne Analcim (Eudnofit) karakteristiske Spaltelighed efter Tærningfladerne. I den ovenfor beskrevne Hovedmasse af Stenen er Analcimen kun til Stede i mindre Mængde i Form af hvidlige Partier, der i Tyndsnit viser sig at bestaa af en tæt Blanding af Analcim med et stærkere lysbrydende, isotropt Mineral, der ikke lader sig nærmere bestemme. I de ydre Dele af Stenen findes derimod overvejende Analcim, der her er langt mere ren, graalig og halvgennemsigtig, men dog indeholder en meget stor Mængde forskellige Mineraler indesluttede i Størrelser, der varierer fra ca. 1 cm ned til overordentlig smaa, mikroskopiske Dimensioner. Der er fundet følgende Mineraler: Ægirin, Arfvedsonit, Steenstrupin, Sodalit, Feldspat, Schizolit, Epistolit, Zinkblende, Eudialyt og Ussingit. Dette sidste Mineral er her makroskopisk ret sparsomt og tilmed af en meget lys Farve der gør, at det ikke er meget fremtrædende ved Siden af Analcimen; i Tyndsnit viser det sig dog at være betydelig mere udbredt. Sodaliten er ofte af en karakteristisk gulgrøn Farve.

TAVLE IX.

TAVLE IX.

Fig. 1. Ussingit med Tvillingstribning; polariseret Lys. × 50.
Fig. 2. Ussingit med Steenstrupin og Sodalit. × 17.
Fig. 3. Ussingit med Sodalit, Ægirin og Apatit. × 34.
Fig. 4. Samme Parti som foregaaende i polariseret Lys. × 30.
Fig. 5. Ussingit og Feldspat. × 55.
Fig. 6. Samme Parti som foregaaende i polariseret Lys. × 50.

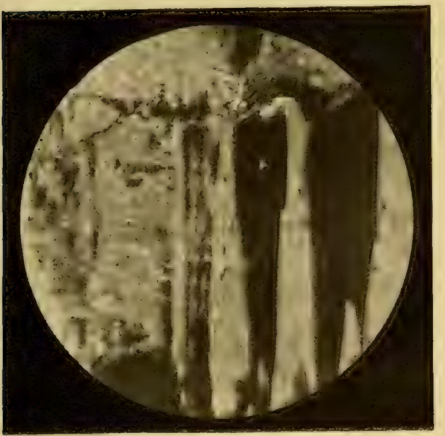


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

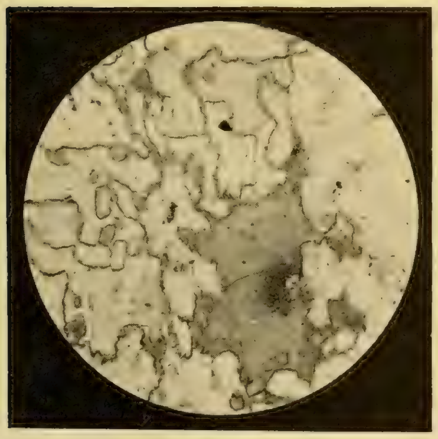


Fig. 5.

Fig. 6.

ARBEJDER FRA
DEN DANSKE ARKTISKE STATION PAA DISKO Nr. 7

V.

STUDIES ON THE MATERIAL CULTURE OF THE ESKIMO IN WEST GREENLAND

BY

MORTEN P. PORSILD

1914

Introduction.

During two hundred years Eskimo antiquities have been collected in Danish West Greenland, and yet, they are still to be found wherever the old site of a house exists, and in every grave not previously examined. The Greenlanders of our own time collect them when they come across them and bring them to the Europeans for sale. But only rarely do they search for them, and, to look for them, especially in old graves, is not considered to be an entirely respectable means of livelihood; hence the reason why graves are rarely stated to be the place of discovery. "I found them in the ground" is generally the first answer one receives.

Since I have settled down among the Greenlanders I have procured a small collection in this way. I myself have found only a very few of the objects; and, as my real field of work lies in another department, I have never had time to make excavations personally. For some of the objects I am indebted to the resident Danes, more especially to Mr. C. Fleischer, Qeqertaq; Mr. O. Mathiesen, Ritenbenk, the superintendent of the settlement; and to the Rev. H. Mortensen, Godhavn.

Usually, the finder had full knowledge of what he found; and in doubtful cases I have consulted others, for instance a great many Greenlanders, who have helped me with articles difficult to explain. In this respect I am more particularly indebted to the native head-catechist and hunter, Mr. G. Kleist of Godhavn, for the excellent help he has given me as regards the explanation of the objects and of their correct Greenland names; and also for some drawings illustrating old modes of hunting. All the implements, and even all the details of them have old, fixed and long established names, which are often interesting enough in themselves, but become even more so from the fact that they often recur in tribes which are now separated from each other by vast distances. Some of the most essential of these words are already found grouped in C. Ryberg's "Dansk-Grønlandsk Tolk," Kjøbenhavn, 1891; others I have found in S. Kleinschmidt's "Den Grønlandske Ordbog," Kjøbenhavn, 1871, or in its supplement (in Kjer & Rasmussen's "Dansk-grønlandsk Ordbog," Kjøbenhavn, 1893).

As KLEINSCHMIDT's dictionary is only partially arranged in alphabetical order, and as the derivatives must be sought for under the stems from which they are derived, I — following the example given by RYBERG in his above-mentioned book — have added, after those words which occur in the dictionary in question, the number of the page of the dictionary or of its supplement. There the readers who may seek such information will find the etymology and the real significance of the words. In cases where the words are not to be found in KLEINSCHMIDT, I have tried, as far as possible, to discover their etymology, or their stem; and have then referred to this. Herein I have had an indefatigable co-worker in the Rev. H. MORTENSEN of Godhavn, and I wish to express my best thanks to him for his kind assistance.

The reason why I have not referred to the numerous dictionaries of the other Eskimo dialects already existing is simply that they have not been accessible to me here.

In case the Greenland terms here mentioned should be used by the reader for comparison with terms from other Eskimo tribes, I want to emphasize the fact that, as a rule, I only give the names of independent articles in the objective form, under which form the word should be looked for in the dictionaries. The parts and accessories which pertain to the articles and do not occur— or are not used — independently I give with the possessive-suffix; in which case the name of the principal object, in the genetive case, must, consequently, always be understood to stand in front. This is in accordance with Eskimo usage of language and train of thought, and thus the Eskimo will name the article on inquiry, — with many words only the form with the suffix exists. But the consequence, namely that to those who are not familiar with the structure of the language some of these words will appear to differ from those in the dictionary, cannot be avoided.

The following example will best serve to illustrate my method: —

Under harpoon, *tũkaq*, will be found: —
the blade, *ulua*, 392.
the barb, *akinga*, 18.
the line-holes, *qingai*, 146.
the shaft-socket, *itsiornera*, 115.
the toggling butt, *pamiâ*. 271.

On the pages referred to will then be found the objective-forms: — *ulo*, a knife; *iteq*, a rumphole; *akik*, a barb of a hook; *qingaq*, a nostril; *pamiaq*, a tail-likeness, etc. The possessive-forms given should consequently be translated: its knife, its barb, its nostrils, its worked rumphole, its tail-likeness, and everywhere *tũkap*, the harpoon's, must be understood before the words.

As I am not familiar with the methods used by linguists for the transcription of the Greenland words into phonetic characters (for instance, W. Thalbitzer's method) I have followed the Kleinschmidt orthography with the exception that, following Rink, Boas and others, I have altered the uvular *k* to *q*.

While writing the following notes I have often felt the lack of several standard works upon the present question, which ought to have been consulted. I have particularly missed a number of papers by Boas, Egede, Fabricius, Mason, Murdoch, Solberg and others. Such works of the above authors, and of others, as have been accessible to me I have given in the bibliography. When, instead of simply delivering these objects to a museum as others have done with those they have collected, I have preferred to forward them accompanied by an explanation, the chief reason is that I am fortunate enough to live in the midst of the people who have produced and used these articles, and can, therefore, easily ascertain their opinion regarding them. It appears to me that authors have sometimes neglected to hear the Eskimo's own explanation, and have, thereby, been led to perpetrate errors, and to advance opinions and theories which are based upon wrong suppositions, and are, therefore, misleading. In order to have an opportunity of correcting such mistakes before they circulate further, and also because the study of the implements of the West Greenlanders has been greatly neglected during the latter decades, I feel justified in publishing these notes in spite of their casual and fragmentary character.

Unless otherwise stated the figures are from the author's own drawings and photographs.

Disco, Greenland, November 1911.

I. Historical Notes. Method of investigation. The Eskimo Missile Weapons: Definitions and Classification.

Historical Notes.

Nowhere is the ability of the Eskimo to construct ingeniously complicated implements from deficient materials and with primitive tools more developed than in the construction of their hunting-weapons. It is therefore very natural that these ingenious implements greatly attracted the attention of the travellers, investigators and missionaries who first came across them. Ever since the earliest accounts of Eskimo culture we find hunting weapons most exhaustively described, and it is these which are usually illustrated and most commonly collected for the museums.

Owing to the fact that the Eskimo culture which has developed in West Greenland was the earliest and most easy of access, that form of it has been the first to come under investigation. Through the descriptions we have from the first missionaries, and especially through HANS EGEDE's famous "Perlustration" with its numerous translations and DAVID CRANZ's "Historie von Groenland" — written in a universally current language — the leading features of this form of culture were established and an interest in it created; and, thus, the culture of the Eskimo of West Greenland has to a certain degree been the standard and the basis for all subsequent studies in Eskimo culture.

But these two authors gave only the leading features of the subject in question, and in CRANZ's work there are many errors and mistakes. Later, the clergyman, naturalist and philologist, OTTO FABRICIUS contributed a series of notes on the material culture of the West Greenlanders, which, as regards accuracy and profound understanding, far surpasses the works of his predecessors and of many later authors. FABRICIUS's abilities were especially suited for this work; because, besides his knowledge of natural science and of languages, he had, for the accomplishment of this work, the invaluable advantage of being himself able to hunt in the Eskimo manner: to manage his kayak, and to use the special Eskimo hunting weapons. Therefore, as regards this point, no one has been able to distinguish, as he could, between what was essential and what was incidental.

FABRICIUS's works should therefore be the classic for every one who studies this subject. That they have, unfortunately, not become so is due to several circumstances, and, in particular, to the fact that they are written in Danish and that they occur scattered, in the form of numerous small treatises, and often even as unimportant supplements to, or parts of, purely zoological works. They are, moreover, very sparingly illustrated, and the drawings are not happy, being faulty as regards measurements, etc.[1] It is much to be wished that a complete edition of all FABRICIUS's ethnological papers could be published in a universally current language and illustrated with modern drawings of the objects which he describes, large collections of which are contained in the National Museum in Copenhagen.

Since the days of FABRICIUS no thorough and original studies of West Greenland implements are to hand. A good, popular description of their main features is to be found in RINK's well-known book "De

[1] That FABRICIUS's works were also forgotten in Denmark at an early period may be seen from the fact that C. C. RAFN, when writing a report of antiquities given to what was afterwards the National Museum, based that report on the works of CRANZ, PARRY, and several others without mentioning those of FABRICIUS, and explains the implements illustrated by him quite incorrectly (Antiquarisk Tidsskrift, 1854).

danske Handelsdistrikter i Grønland."[1] Kayak-hunting and its implements are described by F. Nansen in his book "Eskimoliv", which contains excellent illustrations. Lastly, G. Swenander has recently published an exhaustive description of the harpoons, and lance and dart points, which are to be found in the rich collections contained in the Stockholm Museum. The work is especially valuable because its numerous illustrations are perfect representations of these objects. W. Thalbitzer has lately directed attention to, and illustrated, some individual West Greenland implements for comparison with those of East Greenland.

As regards the East Greenland implements the conditions are far more favourable. Since the publication of G. Holm's classical, exhaustive, richly and well illustrated description of the material culture of the Angmagsalingmiut, almost every fragment and article from East-Greenland, which has subsequently been found, has been described and illustrated (by Ryder and Thalbitzer).

On the other hand we still lack a thorough description of the kayak with all its hundred and one individual parts, and its peculiarities of construction. The alterations and new adaptations consequent on the introduction of fire-arms have been loosely mentioned, but are described for the first time in the following pages; and, what is very astonishing, a kayak weapon commonly used in West Greenland is here mentioned for the first time! And, strangely enough, another culminating point of the creative ingenuity of Eskimo culture, the dog-sledge with its appurtenances, harness, etc., has never been described from Greenland; simply because the first missionaries wrote their books in South Greenland where sledge culture does not occur. If we would seek information in literature as regards the Eskimo dog-sledge, we must resort to English and American authors' descriptions of conditions in other tribes, and that in spite of Danish officials in Greenland having themselves used the dog-sledge for 200 years, and of their being fully able to compete with the Eskimo in the use of it.

Method of Investigation.

Of late years no question has occupied the Eskimo-investigators so much as the question regarding the origin of the Eskimo and the routes along which they may have migrated. Anthropologists, linguists and ethnologists have all been equally interested in its solution. During latter years, authors, especially American authors, have brought together large collections of a single kind of implement for monographic treatment,

[1] English edition: H. Rink: Danish Greenland, its People and its Products. London, 1877.

they have tried to classify them into types, and from the presumed relationship of the types have tried to draw conclusions as to the presumed routes, and their directions, along which the tribes may have migrated. SWENANDER's work may be characterized as an attempt in the same direction. We must admit the merit of the intention which underlies these monographs; but, at the same time, it is to be regretted that the authors have often had no clear idea of what was essential in the implement in question, and what non-essential and therefore subject to the capricious alterations of the maker. It often strikes one that the authors have not sufficiently understood the purpose and the use of the implements, especially those authors who, as Museum officials, have no doubt had a large material at their disposal, but have never had an opportunity of seeing the individual parts of this material in use. Proper attention has not always been paid to the information given by the collectors, but the material has been treated as if it originated from a form of culture so entirely extinct that any guess-work was permissible. The result is that confusion has arisen between entirely different implements: very ancient ones being regarded as modern, and vice-versa. The conclusions and deductions which are thus derived are of no more value than if we, for instance, took a modern axe and hammer, called them types of the same implement, and arrived at the conclusion that he who uses an axe stands on a higher, more developed stage of culture than he who uses a hammer. By way of example I may mention that in MASON's monograph "Aboriginal American Harpoons" the most heterogeneous articles have been confused under "harpoons," and the author is quite at fault as regards the age and purpose of the Greenland forms. SWENANDER also, influenced by MASON, regards all his harpoons from the same point of view; considers them as one and the same implement; does not conceive that they may possibly differ as regards their purpose and use; but, deriving and developing the one "type" from the other, thus draws conclusions as to the age of the Eskimo culture in Greenland!

Accordingly it will be necessary to begin by giving a clear definition of what is, and what is not a harpoon. I am not blind to the difficulties and dangers of trying to give such definitions in a language which is not my own. That my classification and division are right in the main I conclude from the fact that they agree with the Eskimo, that is to say the West Greenland, terminology. I also hope that the English terms chosen express in some measure the corresponding Eskimo conceptions, since they are in accordance with the expressions used by the majority of the English-speaking authors who have studied the conditions at first hand; though, on the other hand, they do not agree with — for example — MASON's terminology and definitions.

But first I think it right shortly to mention the principles on which I have based the classification, or what comes to the same thing the method,[1] which I have followed in the investigation not only of the weapons but also of the other implements. In the investigation of any implement, be it a weapon, a tool or a toy, and regardless of the culture from which it originates, an endeavour should be made to solve the following questions: —

1) What is the object aimed at with the implement?
2) How is it used in order to gain this object?
3) How is the form of the implement adapted to this use?
4) How far has the quality of the material and tools influenced the form, so that it is not, perhaps, the ideal one?

Not until these questions have been answered as minutely as possible can we proceed to an investigation as to whether some individual parts remain which are of no real "use," but are due to style, to the use and wont of the district, or to a sudden and casual caprice of the maker. Hereby is understood all ornamentation.

So long as we have no sure knowledge of the age of the individual tribe in the region where we now meet it, all the points which are cleared up by the solution of the above four questions are, evidently, of little or no value as starting points for conclusions regarding the origin and the migrations of the particular type of culture in question, or for tracing influences from elsewhere. When the matter in question concerns Eskimo tribes from West Greenland, regarding whom we know with fair certainty that they have at different times wandered into the country over Ellesmereland and Smith Sound, then we may take it for granted that numerous implements which could not be used so far northwards must, so to say, have been invented and perfected several times, namely, every time the tribe came to a region where the implement was needed. Of special interest in this connection is the kayak with all its accessories which, as will subsequently be shown, in certain peculiarities of form still bears testimony to what has just been said.

In order to carry out an investigation according to the principles on which the above-mentioned questions have been based — to put it shortly I will call them technological principles — one should preferably be able to use the implement which is to be investigated, and preferably, also, be able to make it oneself from the materials, and with the tools used by the aborigines. Because, not until we ourselves have made use of a complicated implement do we

[1] A more exhaustive description of the method will be given in the Zeitschrift für Ethnologie, Berlin, 1912.

fully understand all its small details, which, at first sight, we either do not notice at all, or regard as unimportant for the purpose of the implement, and therefore readily consider them to be peculiarities of style belonging to a certain district or tribe. This I have specially experienced when studying the Greenland dog-sledge with its appurtenances. My first sledge I bought ready-made; the sledges I afterwards wanted I built myself, and both my successful and unsuccessful attempts towards emancipating myself from the forms which are in vogue in the neighbourhood of my home have taught me the intention of many small details which, at first, I did not even notice; and also, that individual parts occurred which were solely due to old-established use of material of inferior quality and could, therefore, be very well replaced by something better. By simultaneously studying sledge-types owned by clever sledge-drivers, Greenlanders and Danes, I got an eye for differences which were adaptations to local conditions, for example, the occurrence of much or little hummocky ice; much or little overland driving; etc. Thus, I can fairly well distinguish sledges from the different settlements near Disco Bay. Whereby I think I have gained knowledge which enables me better to estimate the type of sledges, intended to be drawn by dogs, from entirely different regions; for instance, those of the Samoieds and the Indians. At first these appeared to differ so greatly from those of the Eskimo, that they could not at all be compared with the latter, but now their form mainly serves to inform me of the conditions of climate and of the supply of material in the region in question.

The above-mentioned ideal end, viz., personally to be able to form an opinion of the implement as a user, we can, however, only rarely attain. In the majority of cases it must suffice us to observe the use of the implement and to try to supplement our observations by questioning the user himself. But here it should be remembered that we cannot put any question we please. If an Eskimo hunter is asked why his harpoon is as it is, he no more has an answer ready at hand than a cultivated person would have if, for instance, he were asked why a pair of scissors has the form it has. If, on the other hand, the hunter is asked why his harpoon has this or that detail, wherein it differs from all others, then information as good and well-founded may be expected as would be had on asking a tailor why a particular pair of scissors has just a special peculiarity.

It may now be asked: will nothing be left which cannot be solved by technological investigations? In the majority of cases the answer will be in the negative, unless there are ornamentations. But sometimes there will be differences of construction also, which the technological investigation cannot explain, and which then, in return, often have considerable interest of another kind. Firstly, we must here remember that the same end may be reached in several ways, and this may result in an implement having several ideal forms which individually are equally good. By way of example, I choose the two forms which the shaft of the kayak harpoon has all over Greenland: —

ernangnaq (71), short and light, with "feathers" of bone plates, the throwing stick acts on the rear end.
unâq (395), longer and heavier, without "feathers," but often with a bone knob, the throwing stick is applied somewhat behind the centre.

In some settlements the *unâq*'s are in the majority, in others the *ernangnaq*'s, but nobody uses more than the one kind. It is easy enough to get the significance of the details of the individual harpoons explained; and rational, well-founded opinions as to the superiority of the one over the other may also be had; but nobody can give any rational reason for the fact that both forms are to be found, reasons which might signify local adaptations to the custom of the district or the supply of material. If the one were in several respects better than the other, then the less perfect one would naturally be abandoned. As there is a rather essential shade of difference in the throw, it can be understood that the hunter who, from his childhood, has been accustomed to practise the one kind (namely his father's) continues to do so; his living being dependent on the result of his throw. For instance, if we have accustomed ourselves to write with a broad-pointed pen we should find it awkward suddenly to have to write with a fine-pointed one. Consequently, we here appear to have two ideal forms before us, which have perhaps come into existence and been developed at different times, and afterwards, by intercourse, have been scattered all over the country.

Another example is the form of the kayak, which has been lightly touched upon above. It has often been mentioned that there is a characteristic difference in the West Greenlander's kayaks in the southern and northern districts; for example, in the northern kayaks the stern is bent upwards, so here the deck forms an angle. Now Schultz-Lorentzen (p. 311) has recently demonstrated that, in the southern type, two subtypes may be distinguished, one of which from southernmost Greenland differs from the type which is found near Godthaab and approaches the East Greenland type. To this I can add that, in the northern form also, at least two subtypes occur, viz., one around Disco Bay (and at Ũmánaq?) and another at the two northernmost settlements, Pröven and Upernavik. On a trip last year the latter type struck me as extraordinary from the fact that the stern almost formed a right angle with the deck, but my companion, a hunter and kayak builder from Disco, told me that there were many other and far more decisive differences in the construction of the frame-work than the one mentioned above.

To these four West Greenland kayak-forms the East Greenland one comes fairly near, while the Smith-Sound Eskimo's lately invented, clumsy form, which is so primitive that no West Greenland hunter would be able to use it, differs widely from them. A skilful investigation of these six types will undoubtedly prove that many of the details are only adaptations to the various external conditions in the different localities. But there will unquestionably be things left which cannot be explained in this manner and, more particularly, details regarding the construction of the frame-work, the outer style, etc., which bear witness to the different periods and tribes which have produced them, and that this is more than probable is proved by the fact that their distribution coincides with the distribution of the six main dialects of Greenland.

It is not always that one can carry out a technological investigation of an Eskimo implement in the same way. The arrangement of the succession of the questions set forth above for solution is the one most suitable for the treatment of a highly specialized implement for a very special purpose. If the implement in question is more of a universal implement, then more satisfactory results will be arrived at by first trying to understand its form, and especially by trying to find out whether, in a large collection of forms, there might be expressed an attempt at a certain ideal form. With other implements it is not the form which is of interest, but only the material; or, of interest is the difficulty which the Eskimo has had to overcome. Here I must leave it to the reader to decide whether the method in question is not, after all, useful; and to exemplify the two above-mentioned cases, I shall be content to refer to my treatment of the bow (see pp. 158 sqq.) and of the woman's knife (see pp. 203 sqq.) in the present paper.

Where an implement has been set aside because a new culture has produced another and better implement, it will naturally be more difficult to form an opinion of it technologically. In this respect I am thinking of weapons such as bows and arrows which of course are immediately abandoned when guns can be obtained. The earliest travellers who came across such implements while they were still in use have generally given us too scanty information as regards their use; usually, we are not even told for which sort of game this or that particular arrow is intended. Here we must try to gain what information we can through the traditions existing amongst the descendants of the people who made and used the implement. That, in this way, valuable information may still be obtained I have shown in my previously published description of the curious, highly specialized arrow point for Caribou hunting (see bibliography). The introduction of iron also influences the form of the implements; at first only slightly, because iron is no more than a better stone, but afterwards the technological differences of the two substances became more clear to primitive man, and what had previously been the ideal form in an implement need not be so any longer. Here I refer the reader to my description of harpoons with stone and iron blades (pp. 128 sqq.).

Now we pass on to the numerous implements or, strictly speaking, the parts of implements composed of stone. As is well-known, archæologists have long ago created a system of names such as "arrow-points," "scrapers," "tranchants," "perforateurs," etc. for the thousands of stone implements which have been brought to light from remains of extinct forms of culture in Europe and elsewhere. It would be easy to fit the stone implements of the Eskimo and other uncivilized people into this system, as the forms are often identical. But it is doubtful whether anything will be gained by doing so. All these names imply a use which is perhaps right in some cases, but regarding which we know absolutely nothing. And archæologists have even had courage enough to call certain bone implements from the Madéleine culture "bâtons de commandement," a name which implies a use to which no investigation, but only our imagination, can lead us.

Here it would certainly be better to take the converse course and try to rescue from the aborigines, through their traditions, what is still left to be rescued. Certainly they must have a better understanding of their own stone implements than we can have! At any rate it has impressed me strongly, when laying before a Greenlander a collection of Eskimo "arrow-points" of stone, to see how, without hesitation, he sorted them out in different knife and lance-forms; and how, afterwards, another Greenlander, independently of the former, identified them in almost the same manner.

It cannot be emphasized too strongly that the majority of the stone implements are not complete, but only component parts. When the primitive man is so far developed that he can cleave the flint into the form aimed at, he can also master the far easier task of providing the piece chipped off with a suitable and convenient handle. Therefore it appears to me to be a waste of acumen to try to show from the form of the so-called "humpbacked-knives" that primitive man, also, was right or left-handed (see Wilson, Arrowpoints, p. 952). How complicated the implement of which a small piece of flint forms a part may be will be shown subsequently under the description of the Eskimo "Man's Tools" (pp. 191 sqq.). This example shows not only that tradition can throw light upon the use of a stone-age implement, but also that the method of work itself, adapted to the stone age implement, may be preserved after the stone implement has been replaced with iron.

It appears to me that these examples suffice to show that among savages and their descendants now alive information is to be had which may at some time help us to a better technological understanding of the remains of implements belonging to our own ancient culture.

Classification of the Eskimo Missile Weapons.

We shall now try on purely technological principles to classify the different forms of Eskimo missiles. I give the following generic definitions: —

A **Harpoon** *is a pointed and barbed weapon for hunting aquatic game; attached to a line; and thrown by the hand* (*in modern times shot from a gun*) *or thrust by means of a shaft; intended to fix the game to a float, a buoy, a boat or to the ice or the hunter himself.*

A **Dart** *is a pointed and barbed weapon thrown by the hand; intended to pierce the game and to fix it to the weapon itself.*

A **Spear** *is a pointed and barbed weapon thrust by the hand*; *intended to pierce the game and to fix it to the weapon itself.*

An **Arrow** *is a blunt or pointed and sometimes also barbed weapon; shot from a bow; intended to kill the game by the blow, or to pierce it or fix it to the weapon itself.*

A **Lance** *is a pointed, but not barbed weapon, thrown or thrust by the hand; intended to pierce and kill the game.*

It is at once seen from the above definition and from the Synoptic Table on p. 125 that in contradistinction to the majority of authors I use the word harpoon to indicate only that part which the others call "the detachable point of the harpoon." Here I am in agreement with the Eskimo train of thought and language, which has for the part in question a generic designation: *tũkaq*, while the shaft, according to its intended use, occurs in many various specific modifications, each under its own name. Therefore, I am naturally also in agreement with those authors (FABRICIUS, KLEINSCHMIDT, RYBERG) who base their classification, as I do, on that of the Eskimo.

Under these generic terminologies I therefore comprise the various specific ones; so far, that is to say, as they concern our subject — the culture of the Eskimo.

1. Harpoons.
   a) Throwing harpoons for hunting seals, walruses and small whales from kayak.
   b) Thrusting harpoons for the various forms of ice-hunting.
   c) The little-known harpoons for fishing.
   d) Other little-known harpoons for Right Whale hunting.

Synoptic Table to facilitate the definition of Eskimo Missile Weapons.

Barbed: with the intention of preventing the game from escaping, especially by diving	the toggling device by means of a line attached to the hunter or to a float or a vessel, the shaft, when present, being totally detached: harpoons:	for thrusting: ice-harpoons. for throwing: kayak-harpoons. for shooting: modern whaling harpoons.
	the toggling device in various ways attached to a shaft to which the game is to be fixed:	for thrusting: spears. for throwing: darts. for shooting: barbed arrows.
Not barbed: with the intention of killing the game		for thrusting: the small kayak-lances, daggers, knives for despatching. for throwing: the large kayak-lances. for shooting: blunt arrows, or arrows with cutting, but not barbed points.

2. Darts.
   a) The Eskimo bird-darts for killing sea-fowl.
   b) The various forms of bladder-darts for hunting seals, sea-otters and other aquatic game.

3. Spears.
   Fish-spears for catching various kinds of fish.

4. Arrows.
   a) The various forms of blunt, pointed or barbed arrows for various kinds of hunting on land.
   b) The peculiar sea-otter arrows, which were used by the Western Eskimo. They form a transition to darts.

5. Lances.
   a) The large kayak lances with movable, but not detachable foreshafts.
   b) Lances with detachable points used for hunting deer in ponds, or as reserve weapons, on harpoon shafts.
   c) The large, but little-known whale lances.
   d) The small kayak lances without movable or detachable points or foreshafts. They form an easy transition to daggers or knives.

II. Harpoons (*tũkaq*, 375, plur. *tũkait*).

Morphology and Terminology. Different authors have applied various principles in the orientation of the harpoon. I use here the following nomenclature, which appears to me to be the clearest and most comprehensible, and is also in all essentials in accordance with that of MASON and SWENANDER. I call the end where the blade is inserted the fore end and the other the hinder end. I call the plane which passes between the line holes the vertical plane. As the majority of harpoons are symmetrical this plane may in addition be referred to as a symmetrical or median plane (for an exception, see Fig. 1, *D*). The plane at right angles to the vertical plane I call the horizontal plane; it divides the harpoon into a dorsal and a ventral part, hence I can speak of a dorsal, ventral and lateral face. Fig. 1 shows four typical forms of harpoons, of which *A*—*C* are symmetrical. The corresponding diagrammatic orientation of the planes is shown in Fig. 2.

The main object of the harpoon is to fix the game struck to a line, and thereby to a float, a boat, the ice or the hunter. In the case of small game the intention is that the harpoon should simultaneously wound the animal severely; but the latter is a secondary object. From a boat the harpoon is thrown. For this it is necessary that it should be furnished with a shaft, but as soon as it has struck the game the shaft has done its part, and must be got out of the way, so that it does not become entangled in the line or broken by the movements of the animal. From firm ground the harpoon is thrust into the game. The

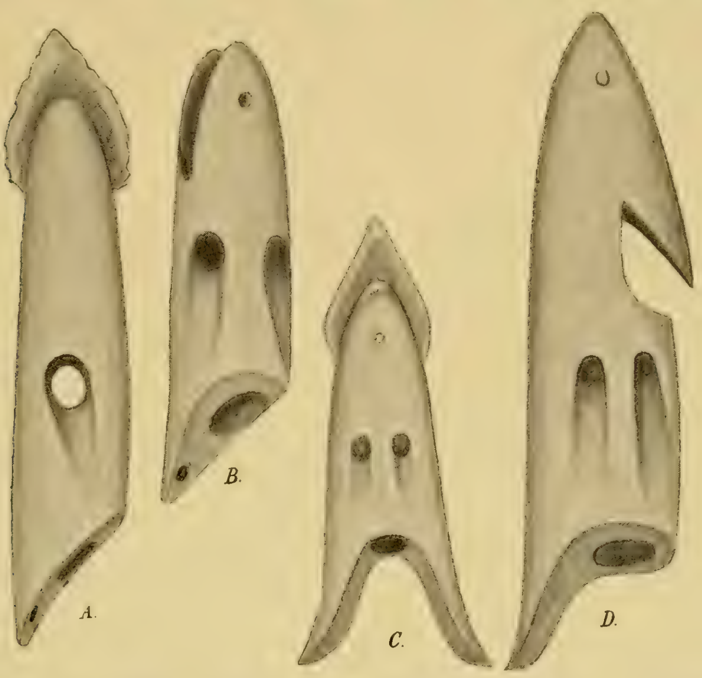


Fig. 1. Typical West Greenland forms of harpoon and their orientation. A, Symmetrical; blade-slit vertical; blade of stone; line hole situated about the middle of the bone piece minus the blade; toggling butt undivided, dorsal. B, Symmetrical; blade-slit horizontal; blade of metal; line hole ventral; toggling butt undivided, dorsal. C, An almost bisymmetrical little form; toggling butt divided laterally; in other respects resembling B. D, Large unsymmetrical form; the blade was of metal, but rather small, but the wound was enlarged by a lateral barb with a cutting fore-edge. This barb is sufficient to hold the harpoon fast in a seal, while with Narwhal and White Whale the harpoon should be driven so far in that the undivided toggling butt can perform its function.

length and arrangement of the shaft is regulated according to the various conditions under which the harpoons are used.

In order that the harpoon (Figs. 1 and 2) may perform its main function its hinder end is cut aslant; it may, moreover, be undivided, situated on the dorsal side, or be unilateral or divided laterally. The way in which the strap of the line is placed may also contribute to an easier and more effective toggling. The line hole may run directly through the harpoon, or lie in the horizontal plane preferably somewhat down the ventral side reverse to the toggling butt, but this may easily interfere with the strength of the harpoon. In order, here, to preserve the greatest strength possible the hole is led in a highly complicated roundabout way (see Figs. 1 and 2). But, here, it must again be taken into consideration that it does not prevent the shaft being detached in due time in the case of a throwing harpoon, wherefore we here find the symmetrical, well-balanced harpoons with complicated line holes, while this danger is not present in the case of a thrusting harpoon, which may have any appearance if only its main object, the toggling, is secured.

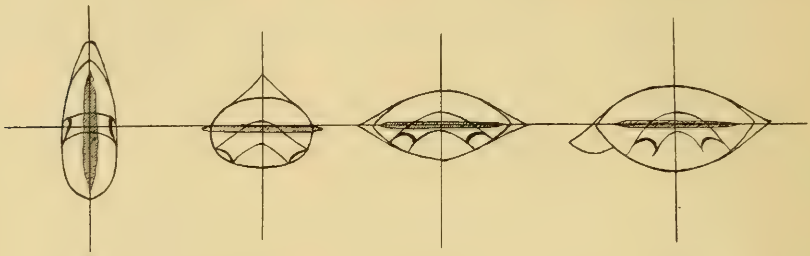


Fig. 2. Diagrammatic orientation of the planes in Fig. 1.
The horizontal line indicates the horizontal plane; the perpendicular lines the vertical planes. The position of the blade, the line hole and the toggling butt is indicated.

The inserted blade may lie in the vertical or in the horizontal plane. The former (cf. Fig. 1, *A*) SWENANDER (p. 5) considers to be an old, primitive form which he regards as unpractical on account of the position of the blade and the limited strength of the harpoon. It is true that the harpoon is old, but it is too widely distributed and occurs in too great numbers to permit of its being called, as a matter of course, unpractical; nor do the reasons given by SWENANDER for this conclusion hold good. The harpoon is a thrusting harpoon; the fact of its being compressed in the vertical plane is just what gives it strength, and being a thrusting harpoon the line hole may be placed almost as high up towards the dorsal side as wished, without risking failure with the toggling. The position of the blade is far from unpractical. If the blade had been a riveted, cutting, metal blade, it might have been feared that, while revolving in the animal, it would cut itself loose. But SWENANDER (and as it appears all other authors before him) seems to have overlooked the fact that the blade in this type was a loosely inserted stone blade. And, if so, it is the most practical way of placing it; because, during the process of toggling, the delicate blade runs no risk of being broken, which it undoubtedly would if it were placed in the horizontal plane. Perhaps it will be forced out of its slit, but then the misfortune is not great; it may afterwards be taken out of the wound and be re-inserted.

In all harpoons of this type the line hole is situated rather far back. The length of the blade is not reckoned with in the toggling part, therefore the bone part in front of the hole is comparatively long.

I am aware that harpoons of this type occur in which the blade is of iron. SWENANDER figures one from Port Clarence, on p. 39, which he thinks is made merely for sale, and states as his ground of argument that the iron blade is not riveted. This is, however, no reason to prevent its being used. I dare not deny that harpoons might be found occasionally with fixed metal blades in the vertical plane, but they are transitional forms of rare occurrence and such harpoons, I admit, are unpractical.

The material for the bone part of the harpoons is taken by preference from walrus-tusk or from antlers. The latter material is very proof against breakage and is easier to work; it is not cold-short nor is it apt to split, but it has the drawback that only the peripheral part possesses the good properties of the material. The core is spongy, and as the shaft socket must be placed there, it may easily happen that the foreshaft can bore itself fast and make its withdrawal difficult. In the case of a thrusting harpoon this is of no consequence, nor is the thrust so violent here; but it is very important in the case of a throwing harpoon. But walrus-tusk is not available everywhere, and it is not the whole of the tusk that can be used. Certain parts of it are apt to split, nor is it very proof against breakage; on the other hand it is imperishable as regards thrusting. Here the user must adapt his form to the material at his disposal and to the use he especially expects to make of his harpoon.

The parts of the harpoon. The bone-piece has no special name; it is the harpoon itself according to Eskimo train of thought. The fore end was often sharpened and pointed; there was, consequently, no special blade. This feature is still to be met with in thrusting harpoons. The blade (*ulua*, 392) formerly consisted of a chipped and often polished stone — here, at Disco Bay, of chalcedony or jasper (*angmâq*, 35) — which was set tightly into the slit, without lashing, as this would impede the entrance of the harpoon into the game. In the latter case the blade is inserted in the vertical plane, in order that it shall not break during the rotation of the harpoon in the animal. Tellurian iron has also been used, and, in the absence of anything better, a blade of a harder piece of bone than the rest of the harpoon. Afterwards the blade was of metal, iron or steel, and then it was placed in the horizontal plane. At first the material was expensive and difficult to obtain. They economized in the use of it, the blade was small, but as a compensation the harpoon was provided with one or two lateral barbs (*akinga*, 18). The fore-edges of the latter were sharp and served to widen the wound inflicted by the blade; on the other hand they were of less importance as a toggling apparatus, as the effective toggling was accomplished by the terminal barb only. Sometimes, but rarely, a ventral barb occurred. The line hole is simplest in those harpoons which have their greatest width in the vertical plane, where it simply cuts straight through the harpoon (see Fig. 1, *A*). Then there are only slight indications of grooves running obliquely backwards. In the harpoons which have their greatest width in the horizontal plane the line holes (*qingai*, 146, its nostrils or *íssai*, Supplement, p. 17, its goggles) are on the ventral side, and distinct grooves extend from them backwards. The line hole runs obliquely inward and upward. Thereby a more effective toggling is attained without loss of strength (see diagrams, Fig. 2). The shaft-socket (*itsiornera* from *iteq*, 115; *-iorpoq*, 421) is well-rounded at the edges so that the shaft does not fit tightly into it. The toggling butt is often just cut aslant in such a manner that the terminal barb is situated in the middle on the dorsal side. It may also be unsymmetrical, being prolonged obliquely behind. In such a case there is nearly always a lateral barb on the opposite side (see Fig. 1, *D*). In a throwing harpoon the toggling butt is usually divided symmetrically, formed like a fish-tail, and placed on the dorsal side so as to allow ample space for the movable foreshaft. It is called *pamiâ*, 271. Sometimes the bipartite symmetrical terminal barb may have its two points placed almost in the vertical plane (see Fig. 1, *C*). It is used especially with small harpoons. In thrusting harpoons, but rarely in throwing harpoons, there is a small hole in the terminal barb in which a small piece of line may be attached that may help in hauling the harpoon out of the wound.[1]

The size of the harpoon. At Disco Bay the rule is that a harpoon for universal use must be capable of being hidden in the hand, so that only the blade protrudes. But if a hunter expects to catch White Whale or Narwhal frequently, this size is too small; the strength of these animals and the loose consistency of their skin require a large harpoon, otherwise it will be torn out.[2] On the other hand, it is often difficult to throw a common harpoon so that it pierces through the thick and strong skin of the walrus. Here a small harpoon is more suitable; as, if only it is capable of resisting breakage it will not be torn out, but will hold as well as the line and the float, nothwithstanding the enormous strength of the walrus. The thrusting harpoons, also (*kapissiniutit* or *kapissiutit*, plural of *kapissiniut; kapissiut*, derived from *kapivâ*, he stabs it, 169),

[1] The reason why this practical little contrivance is not found in every thrusting harpoon is a psychological one. Only if the hunter by his skilfulness has proved that he needs it, i. e. that he frequently catches several seals in succession, will he be able to avoid ironical remarks such as: "Why, I see you intend catching many seals. I do hope you will not empty the sea entirely!"

[2] This is especially seen in the two forms of harpoons Steensby (Polar Eskimos, p. 350) figures from Smith Sound. One, small and made entirely of iron, for seals and walruses; another, large and of bone with iron blades for whales.

are of very different sizes, according to the mode of hunting employed, and the animal pursued (see below). They are used from firm ground — from the ice. As the majority of the methods of hunting on ice by help of the *kapissiniutit* have either entirely gone out of use, or are of less importance owing to the fact that the new methods which have developed after colonisation are far more profitable, the hunter now usually uses his thrusting harpoon only when, on rare occasions, he employs one of the old methods.

Methods and implements for hunting on ice.

The chief methods of hunting on ice in former and recent times have been described repeatedly, but never quite fully. The most exhaustive descriptions are given by Rink in his previously mentioned, well-known work.

As the Eskimo names mentioned below for the different methods of hunting on ice can be translated in part only, the West Greenland version of the names is given. But before proceeding further it will be appropriate to give a few elements of the structure of the Eskimo language. The suffixes *-poq* and *-voq* attached to a verbal root denote that the third person singular is the subject of the verb in the present indicative. For instance, *qâgtarpoq*, he catches (seals) with a net. The suffixes *-pâ* and *-vâ* signify the same tense and subject, but, in addition, denote a third person as object. For instance, *qâgtarpâ* he catches it with a net. The suffixes *-toq* or *-soq* attached to a verbal root denote a substantive: he who performs the action in question. For instance, *qâgtartoq* a hunter who catches (seals) with a net. The suffix *-neq*, also, denotes a substantive, viz. the action expressed in the verb. For instance, *qâgtarneq* net-catching. As it is the form for the third person singular, indicative, which usually occurs in dictionaries, it is often this form which authors have employed when they have wanted to use Eskimo names for hunting on ice. But the above shows that such a formation of words as "*máupoq*-hunting," "*máupoq*-hunter," "*máupoq*-method," etc., is a linguistic monstrosity which should not be used. If one wants to use these terms for the action itself — in this case the mode of hunting — the substantive word for it should be used.

A. Hunting of Phoca foetida at breathing holes on firm ice.

1. *Máuneq.* (Fig. 3). When the sea is frozen everywhere, the seal must make, and keep constantly open, some holes where it can come up for air (*agdlo*, 2). Here a dome of thin, cracked ice is formed, which rises above the surrounding surface of ice, but is often hidden by drifting snow. When the hunter has found the breathing hole, often by the aid of a dog trained for the purpose, he sits down upon a small three-legged stool, and puts his feet upon a skin or upon another and lower stool and watches for the seal to come up to blow. The harpoon shaft with the thrusting harpoon attached, and with a short line, often lies

ready on two forked pegs fixed in the snow. A small snow mound is often built for shelter from the wind. This mode of hunting requires great patience and perseverance. *máuneq* (the "*maupok*-hunting" of the authors) is the most laborious and least profitable method of hunting on ice. It is found only in places where large stretches of sea are frozen over, and only so long as no better expedient exists, but as soon as there are openings in the ice, or when there is a possibility of making nets, the method is immediately abandoned. The Central Eskimo have a number of "seal-indicators," "ear-trumpets," etc., for help when hunting (see BOAS, LYON, PARRY, AMUNDSEN and others). The harpoon shaft is short, at the other end it has an iron pick with which to widen the hole; such a harpoon shaft with an iron pick is the so-called ice-universal-tool *tôq*. This method of hunting is illustrated by HANS EGEDE in his "Perlustration," p. 59.[1] An excellent drawing by LYON is found in PARRY, p. 172.[2]

Fig. 3 (see text).
From a drawing by G. KLEIST.

The hunter is called *máutoq* from *máupoq*, 205, who hunts in this way.

This mode of hunting is now quite obsolete in West Greenland. A form allied to it is still occasionally used: —

2. *Nigparneq.* (Fig. 4) The hunter does not make so many preparations. He takes no stool to sit upon; but does, sometimes, take a low foot-stool to stand upon. He builds no mound of snow for a shelter, but simply stations himself at the breathing hole with the harpoon on the *tôq* in one hand, and the line in the other. Sometimes the line which terminates in a loop is laid on the ice. As soon as the seal is struck, the *tôq* is turned round and the iron pick is driven through the loop into the ice, and this gives an excellent hold on the seal. In contradistinction

Fig. 4 (see text).
From a drawing by G. KLEIST.

[1] FABRICIUS (see "Om de grønlandske Sæle II", p. 86) is my authority for the statement, as I have not access to EGEDE's work.

[2] Neither PARRY nor LYON has descriptions of the methods of hunting which are illustrated so excellently in their drawings.

to *máuneq*, which under the prevailing primitive conditions is the Eskimo's last means of extorting food from the ice-bound sea, *nigparneq* is a chance which is occasionally taken in addition, but is one on which too much preparation is not wasted.

The hunter is called *nigpartoq* from *nigparpoq*, 248, who hunts in this way; *nigparniarpoq*, he is out on this hunt.

Fig. 5 shows the seat of a stool from Hunde Eiland used for *máuneq* or for *nigparneq*. It is made of one piece of board, and incipient cracks have several times been repaired with lashings of sinew thread. The legs have been fastened in by the help of bone wedges.

3. *Itsuarneq.* (Fig. 6). For this two hunters are required. The one lies down on a skin or a sledge on the ice, by the side of a rather large hole, and covers his head with a skin to exclude the day-light. Now he can see the seal in the water and can make signs to his comrade when the seal is below the hole. Usually he makes a certain movement with the one foot (sometimes, and rarely, he cries *qâ*, *qâ!* or *kê*, *kê!*) The other holds a small harpoon with a very long pole, 10—12 metres, in a smaller hole next to the large hole. At the base of the shaft there must be some small pieces of bone, which allure the seal by their movements. *Itsuarneq* is practised in places where it is not very deep, especially in small sounds between islands where currents are felt, and where, consequently, there is much animal-life. It is in a way only a transformed method of fishing, the spear being provided with a loose head and a line, corresponding to the larger and stronger animals which are to be caught.

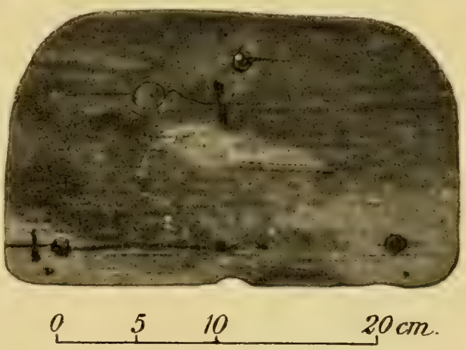


Fig 5. Seat of a stool for *máuneq* or *nigparneq*.

According to Holm, for this mode of hunting a special harpoon is used on the east coast, which differs in its construction from all the other known forms by the toggling piece being hinged (see Holm, Pl. XVI.) At Disco Bay, small almost bisymmetrical forms such as those shown in Fig. 11, k—m have especially been used. This mode of hunting is no longer practised at Disco Bay, but is said to be still in use in the northernmost parts of Danish West Greenland. On the other hand, a harpoon on an improvised long pole is sometimes used here to catch *Hippoglossus vulgaris* from a boat in comparatively shallow water.

The hunters are called *itsuartut*, from *itsuarpoq*, 116, he peeps through a narrow hole into something wider. *itsuartorpoq* or *itsuarniarpoq*, he is in the act of hunting by this method. The long harpoon pole is called *itsuartût*.

4. *Quasasiorneq* or *quasalineq.* Hunting on glassy ice. When suddenly extremely cold weather and calm sets in, for instance at the heads of fjords or off the coasts, when the ice there had been broken up and had drifted away, then the new ice immediately becomes dry and quite glassy, so that no snow can accumulate upon it. Then the breathing holes are easily found, and as there is no snow to creak under the feet, the seal cannot hear the footsteps, especially if shoes with the hairy part outside are worn over the boots. Then several hunters in company place themselves at various breathing holes, each with a *tôq* and a thrusting harpoon with a short line attached. A hunter can run to and fro between several holes. The gain is divided among the hunters when the day's work is finished. This method can give very good results and is therefore still used whenever an opportunity presents itself. But a hunter may very well use his common kayak-harpoon for this.

Fig. 6. An *itsuarneq*.
From a drawing by G. KLEIST.

Figured by EGEDE (l. c.); moreover, an excellent illustration by LYON is to be found in PARRY, p. 173.

The hunters are called *quasasiortut* from *quasasiorpoq*, 154, he practises hunting on glassy ice.

5. *Aorneq.* In the spring, when the sun is higher in the heavens and the ice is thick, and its surface, in addition, covered with a thick layer of snow, the seal widens its breathing hole and comes up upon the ice, partly to be delivered of its young, but more particularly to sun itself. Formerly the hunter tried to creep up to it and thrust the harpoon into it. The harpoon shaft was fastened to a small sledge which had often a small screen of white skin to hide the hunter. Or, also, he tried to imitate the movements and the appearance of the seal, and took with him, for instance, the paw of a seal, or an artificial seal claw, with which to scratch upon the ice. As the whole thing was a slow affair, which, after all, in the majority of cases ended in the seal

becoming suspicious and disappearing in its hole, this method has now, since the introduction of rifles, been entirely abandoned, and is replaced by *ũtorniarneq*, described below.

Figured by EGEDE (l. c.); moreover, an excellent illustration by LYON is to be found in PARRY, p. 173.

The hunter is called *aortoq* or *aorniartoq*, one who goes out on this hunting expedition, from *aorpoq*, 37.

6. *Ũtorniarneq*. Otok-hunting (from *ũtoq*, 406, designation for a seal that has come up upon the ice in spring). (Fig. 7).

The hunter has his rifle lashed securely to the pushing sledge with its screen adapted to the use of the rifle. (Description is given below on

Fig. 7. A *tâlutartoq*. Otok hunter with shooting screen creeping on the ice.

pp. 179 sqq). He approaches as near as possible to the seal, makes frequent halts, and observes it with a telescope. Finally he lies down, pushes the sledge before him until he is within convenient distance of the seal and then shoots, using the pushing sledge as a rest for the gun. This mode of hunting — in which the harpoon is no longer used — gives good results and is used everywhere in the northern part of West Greenland.

B. *Qâgtarneq* (from *qâgtarpoq*, 125) or *napîtorneq* (from *napîtorpoq*, Supplement, 32, he catches seals with a net under the surface of the ice).

Net-hunting on ice. The harpoon is not used in this mode of hunting either; it is mentioned here for the sake of completeness, and because it is at present by far the most lucrative of all the methods of hunting employed in the northern part of Danish West Greenland, and there determines the greater collective and individual prosperity of the inhabitants in comparison with those of the southern districts. The ice-net is from 5—8 metres in length and from 2—3 metres in width and is made of the cheapest string available, so as to be of very little value, because it is very liable to get lost; but, on the other hand, it is paid for if it catches a seal once only. At the lower edge of the net a few stone sinkers are fastened, and at the upper edge there is a fairly thick line. The net is often set at right angles to the coast, especially off headlands, where currents occur, or in the neighbourhood of openings in the ice caused by currents or around the foot of icebergs of moderate size. In order to set the net three holes are made with the *tôq*, the upper line of the net is tied securely to the blade of the *tôq*, and then the latter is thrust into one of the holes and is given a push in the direction of one of the other holes. If the buoyancy of the shaft is properly calculated in relation to the weight of the iron, the point of the shaft appears by itself out of the hole, and in this way one can "sew" from hole to hole, even if the ice be above one metre thick. The net hangs down like a curtain, and the free ends of the upper line as well as a cord from the middle of the net are fastened to a small fragment of ice, or to a small lump of snow upon which water is poured to cause it to freeze fast. Every other day the net should be inspected, which is done by breaking open one of the holes. When a seal is caught it is taken out, and the net is reset, unless it has got so entangled that this cannot be done in the severe cold. This mode of hunting can be practised by everybody, and with the help of sledges and several nets one hunter may utilize large areas. Besides *Phoca foetida*, the ground seal, *Phoca barbata* is also sometimes caught in these nets.

C. Hunting of seals and small whales at the ice-edge and in openings and cracks in the ice.

1. *Savssarneq*. (Pl. X). When severe cold sets in suddenly, and with calm weather, it frequently happens that a shoal of White Whale or Narwhal is cut off from the open water by a broad belt of ice. The whales soon become exhausted owing to the difficulty of breathing, and if they find an opening in the ice they all resort to it, and cannot leave it again. Here, from 20 to several hundred animals may be found at such an opening. If this opening is small the animals may lie closely together; the Narwhals, for instance, pushing their way to the edge and placing their tusks upon the ice. In calm weather their moaning may be heard for miles round, and the steam from their breathing rises from the hole into the air, so that such a *savssat* is soon discovered. According to the hunting by-laws in force it is the joint property of the surrounding settlements, and the finder gets a reward at the

A *savssat* off Godhavn.

The Narwhals have gathered in two small openings in the ice, and people are busy securing for themselves the right of possession by thrusting harpoons into them; killing them; drawing them up; and driving the blubber home on sledges. In the background, to the right, sledges are coming from the settlement at Skansen. (From a drawing by G. Kleist.)

public expense, and everybody may secure for himself the right of possession by thrusting a harpoon into an animal. As the animal cannot get away, the form of the harpoon is quite immaterial, and it is only

Fig. 8 (see text). From a drawing by G. Kleist.

Fig. 9. A *qamaneq*. From a drawing by G. Kleist.

necessary that a small piece of line be attached to it in order to identify it. One by one the animals are killed — formerly with lances now usually with guns — drawn up, and driven away on sledges, and this may be continued till the whole flock is captured, or till the weather turns and the ice is broken up, when the animals are set free.

A hunter who practises this mode of hunting is called *savssartoq*, from *savssarpoq*, 315, he practises *savssarneq*.

2. An old and now abandoned method of hunting seals in openings in the ice and in "current-holes" consisted in the one hunter trying from the edge of the opening to attract the attention of the seal by scratching on the ice, whistling, etc., while the other, in a kayak, stole upon it from behind and harpooned it (Fig. 8).

3. *Qamaneq*, 129. Stalking at the edge of the ice. (Fig. 9). The hunter hides himself at the edge of the ice among the hummocks or behind a cover of piled-up ice floes, and waits there till the seal appears, when he shoots it and carries it off in a kayak. This method gives good results where *Phoca barbata* is concerned.

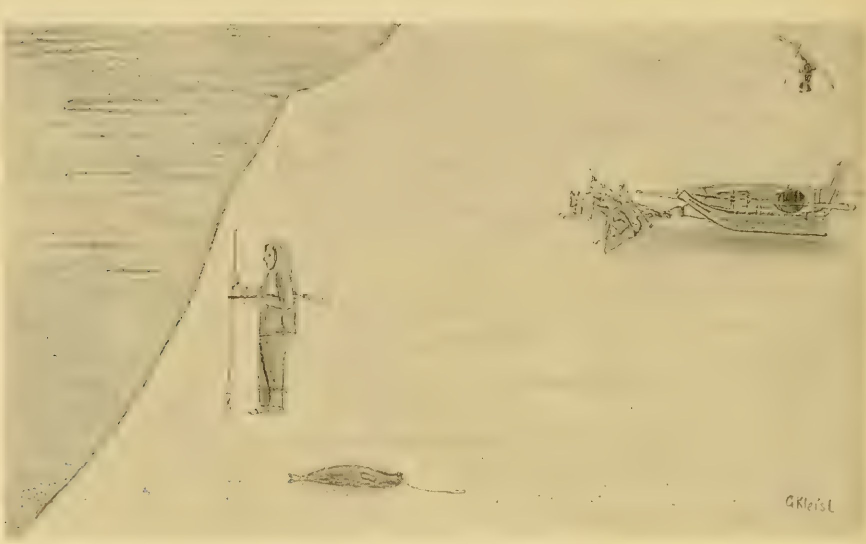


Fig. 10. A *sinâliarneq*. From a drawing by G. KLEIST.

He is lying in wait for seals is called *qamavoq*, 128, the hunter thus hiding *qamassoq*.

Exactly the same names are used in other districts of the country for hunting *Phoca groenlandica*, but that takes place in open water. In places where the saddleback seal usually lives, a cover of stone and peat is made at the coast, often upon a projecting rocky point, from which the sea opposite and the bays on either side can be fired upon. A locality suitable for this mode of hunting is called *qamavik*, 128, and the latter is a common place-name on the west coast.

4. *Sinâliarneq*. Hunting at the ice edge (Fig. 10) is the method, next to net-hunting on ice, which gives the greatest returns in the northern part of Danish Greenland. Conditions suitable for this kind of hunting

arise every time stormy weather makes rents in the otherwise continuous covering of sea-ice, so that a narrower or broader belt of firm ice is formed along the shore. But it is especially when the ice has become old and thick, so that it is difficult for the seal (*Phoca foetida*) to keep its breathing holes open, that it resorts to such channels. That is to say, spring time is most favourable for this kind of hunting, and the conditions are mostly found at those settlements which face the open sea. Normally the conditions are not found within the fjords, here *otok*-hunting is practised, but during spring the ice-edge moves further towards land every stormy day. *Sinâliarneq* is employed in the capture of not only *Phoca foetida*, but also *Phoca barbata*, walrus, White Whale and Narwhal.

When hunting at the ice-edge is being carried on, netting is suspended. Partly because it is too insecure to use nets, and partly because the hunting gives too small returns, as the seals now live in the openings in the ice; besides, the thick ice makes it difficult to look to the nets.

For hunting at the ice-edge the kayak can rarely be dispensed with. It is only rarely that the hunter goes out into the openings in the ice to pursue kayak-hunting with harpoon and float, but the kayak is necessary to cross the open places and the cracks, and to fetch the animal shot, etc. The hunter carries the kayak on his head to the edge of the ice. Such a man is called *maqigtoq*, 195. Or, if he has dogs and sledge and the ice is not too closely packed, he drives the kayak to the ice-edge.

As it often happens that the edge of the ice is blocked up with a regular range of loose floes of larger and smaller size which are often piled up into huge, irregular heaps, courage, cleverness and experience are here necessary in order to be able to make one's way and to convey the fragile kayak, and accidents frequently occur. Often the catch is so valuable, and the conditions of transport so bad, that the hunter must refrain from carrying the whole animal with him, and be content to take the skin and the blubber which can be realized for cash.

A hunter who hunts at the edge of the ice is called *sinâliartoq* from the verb *sinâliorpoq*, 327.

5. Hunting in Ice-fjords.

In fjords where the in-land ice pushes out to sea as calving glaciers, the conditions are suitable for quite a similar mode of hunting. By the continuous breaking off and falling down of the end of the glacier a channel is kept open here, while the remaining and outer part of the fjord may very well be covered with firm ice for a longer period. As there are excellent conditions of life for molluscs and fishes in front of such a glacier the place is also frequented by seals, which resort to the channel in front of the glacier instead of making breathing holes. It is natural that the ice here is very much packed, and the danger of making one's way is increased by the ever threatening edge of the glacier, which, by constantly breaking off and falling down, causes general disturbance. Furthermore, these localities are usually situated at a great distance from the fixed winter dwellings, so that the game has to be transported a long way. Owing to these reasons this mode of hunting is probably not turned fully to account, even though it is nowhere neglected; but it is usually abandoned as soon as there are possibilities of other modes of hunting, and the hunter who carries on ice-fjord-hunting is well nigh regarded as a specialist.

6. *Qâgtarneq, napîtorneq.* Net hunting in openings in the ice caused by currents. In large openings in the ice which are caused by currents, and which may consequently be expected to be kept open the whole winter, there are possibilities for practising all the various kinds of hunting which are carried on in openings in the ice. But, in addition, there are here conditions for net-hunting: both of seals of all kinds and of White Whale and Narwhal. But as this hunting requires large nets which involve a considerable outlay of capital, and some risk, it is only exceptionally that the Greenland hunter can practise the method. It is usually carried on by well-to-do natives who are in the employment of the administration or of the trading service, and sometimes by Danes.

Description of old thrusting and throwing harpoons from West Greenland.

Figure 11, *a* is a very carefully made harpoon, perhaps for hunting on ice, or, what is more probable, for hunting White Whale from kayaks. The ventral side is slightly, and the dorsal side markedly, carinate, so that a transverse section below the line holes shows a pointed arch. Line holes ventral. Toggling butt slanting upwards, forming a short, pointed, undivided terminal barb. Shaft-socket large, edges not much rounded. Blade horizontal, riveted, seems to be made of native telluric iron. Antler. Disco Fjord, in an old grave.

Fig. 11, *b*, A large and somewhat clumsily made thrusting harpoon of antler. The blade is of iron, almost eaten away by rust, horizontal. The line hole runs through the harpoon in the horizontal plane. The toggling butt is cut aslant, undivided, worn and damaged, so the shaft-socket is irregular.[1] Sarqaq, the district of Ritenbenk.

Fig. 11, *c*, A large, well-made White-Whale-harpoon, no doubt of a whale's bone. The blade, which had been of iron, was intentionally removed before the harpoon was discarded. One lateral barb, fragmentary, and on the opposite side, an oblique, terminal barb. Line holes ventral. Sarqaq.

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[1] A similar harpoon from West Greenland is illustrated by THALBITZER (Fig. 101), but has been misunderstood, being taken for a head-piece of an adze.

Fig. 11, *d*, A large, well made White-Whale-harpoon (of a whale's bone?). Large lanceolate iron blade, two lateral barbs, toggling butt fish-tail shaped. Kronprins Eiland.

Fig. 11, *e*, *f*, *g*, *h*, Small symmetrical throwing harpoons for seals,

Fig. 11. Various throwing and thrusting harpoons found in graves or in ruins of houses in the districts around Disco Bay. For further particulars see text.

of antler, without lateral barbs, and with short, bipartite terminal barb. They have all had iron blades; *e* is cracked at the shaft-socket and has been repaired with a lashing of sinew thread, which was sunk in a deep groove. Later on a splint has gone from the back so that the line hole has become bared. Then the iron blade was removed and replaced with one of bone, and the harpoon became a boy's practising harpoon. Hunde Eiland, Disco Bay.

Fig. 11, *i*, A small harpoon of very rare form, doubtless of ivory. The hinder end below the shaft-socket is cut across, with the exception of a thin point directed obliquely backwards. It has had a blade which has been intentionally removed after a fracture had been made by boring, so the blade must be supposed to have been of stone, and to have been riveted. None of the Greenlanders with whom I have spoken had previously seen similar forms; but in "Antiquarisk Tidsskrift" for 1852—54, part 3, there is on p. 427 a figure of a similar harpoon, belonging to the National Museum in Copenhagen, which is however wrongly recorded as being a lance-point. It has also a stone blade which is riveted. Nothing is stated about its size; but to judge from a throwing harpoon of the usual size which is figured by the side of it, the specimen in the National Museum must be considerably larger than the one figured here. Greenlanders surmise that my specimen has been used for salmon catching or for *itsuarneq*.

Fig. 11, *k*, *l*, *m*, Three small harpoons of a form which was very common around Disco Bay; *k*, especially, is very small. With the exception of the line hole there are two symmetrical planes in them. They have all had iron blades. Similar specimens are figured by SWENANDER and MASON. Greenlanders are of opinion that they have been used for *itsuarneq*, perhaps, also, for salmon catching. *k*, ivory, Disco Fjord. *l*, *m*, antler, Hunde Eiland.

Fig. 11, *n*, A carelessly made harpoon without blade, for practice by boys. Sarqaq.

Fig. 11, *o*, A small greatly damaged thrusting harpoon of similar type as *b*. Whale's bone. Hunde Eiland.

Fig. 11, *p* is the hinder end of a rather large, well-made throwing harpoon; it has had lateral barbs similar to those on *d*, but has probably been broken in the making, as it does not appear to have been used. Sarqaq.

Fig. 11, *q*, *r*, Unfinished harpoons, discarded before they were finished. Shaft-socket is entirely wanting. *q*, Hunde Eiland, *r*, Ujarassugssuk.

A shooting harpoon for use on kayak.

While Greenlanders are usually very conservative and afraid of trying anything new, there is one family GEISLER on Disco who err in the opposite direction. The present head of the family, LUDVIG

Geisler, has more Danish than Eskimo blood in him, but he speaks only the Eskimo language and lives and thinks as an Eskimo. He is clever at all kinds of work in which an Eskimo hunter is expected to be an expert; but, in addition, does not shrink from any kind of European handicraft, not even the repairing of watches. His specialities are ivory-carving and inlaying in wood, and the technique and patterns employed are of his own invention. The majority of his tools are old-fashioned Eskimo ones; for instance, he still uses a bow-drill. Ludvig is also an excellent hunter of White Whale. Quite recently he has constructed an iron harpoon with hinged point to be discharged from an old short-barelled muzzle-loading gun, exactly like the modern whaling harpoons, the stem being bipartite, and the line fastened to a ring, etc. It has been tried, and can be discharged to a greater distance than a throwing harpoon can be thrown, but requires skill on the part of the kayaker. It seems as if the only difficulty is to get a suitable line. Rawhide lines are not long enough, and hemp lines do not run easily enough from the line-rack. He intends to try a thin metal-wire.

Though Ludvig Geisler's invention, concequently, is not quite finished, I mention it here thinking it may be of interest in the future. Many of the improvements in kayak and sledge made by the Geisler family have gradually spread, and perhaps this new harpoon will also prove a success.

Harpoons for hunting Right Whales [*Balæna mysticetus*]. (*Tūkait arfangniutit*).

As is well known the West Greenlanders, before colonization, had hunted big whales from *umiaq* like their ancestors in Cumberland Sound and Alaska. The earlier authors describe the hunting rather exhaustively, for instance Egede (cited *in extenso* by Mason on p. 239). Fabricius has described *Megaptera boops* hunting (Zoologiske Bidrag, p. 63), but as regards *Balæna*-hunting he refers to Egede, as he himself has not witnessed it.

So far as I know, the special implements used for this kind of hunting have never been mentioned from West Greenland;[1] still less have they been described. They have been collected, however, as in the Museum für Völkerkunde in Leipzig I have seen whaling harpoons — collected in West Greenland by the Moravian Brethren — quite similar to those which I shall describe in the following pages; and, if I remember rightly, I have also seen them in the National Museum in Copenhagen. Moreover, Thalbitzer has recently figured and described a

[1] Holm (p 84) describes the hunting of whales by East Greenlanders, and says that for this "bone points two feet in length and stone points 8 inches in length" were used as harpoons. Are not hereby meant foreshaft and harpoon with stone edge, respectively?

specimen from *Nûssaq* (western end of the peninsula of *Nugssuaq*, north of Disco) which is found in Pfaff's collection in the Stockholm Museum. THALBITZER (Fig. 102) has characterized his piece "head-piece of an adze" and though his description is incomplete, so that neither from the figure nor the description can it be seen if there has been a shaft-socket, yet I am convinced that the piece in question is a Right Whale harpoon.

Of my two specimens (see Fig. 12), A originates from Hunde Eiland and B from Kronprinsens Eiland, both in Disco Bay. Both are of whale's bone, and both are old and their surfaces partially corroded. They are both rather dark in colour and have been lying in a morass.

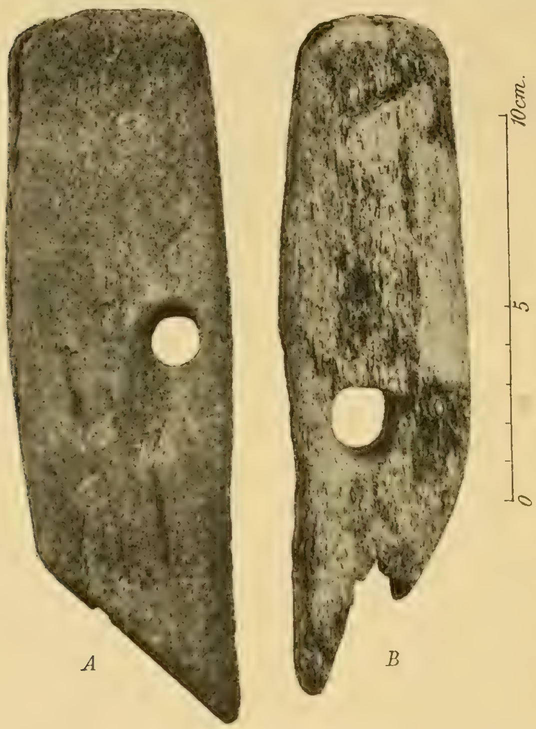


Fig. 12. Two whaling harpoons. Disco Bay.

On A, the side which has been photographed and the toggling butt are best preserved. The dorsal edge is 18 cm. in length, the ventral edge, 14; the point where it is thickest, which point lies in the ventral half, is about 2.5 cm. The line hole is advanced close up to the dorsal edge, and here there is a distinct line groove directed obliquely backwards, the hole is 22 mm. in diameter, edges well rounded, especially in those furthest back. The shaft-socket is advanced close up to the ventral edge; it is 14 mm. in diameter, about 3 cm. deep and well rounded at the bottom. The toggling butt is cut aslant. The blade slit lies in the vertical plane. The blade has been neither riveted nor lashed, but merely set tightly into the slit, and, from the pressure of the blade, the harpoon has at last cracked on the ventral side.

On B, the side worse preserved has been photographed. It is somewhat narrower and thicker than the former one. Here, also, the line hole is situated nearer to the dorsal side, but not so near as in A. Of the oblique surface of the toggling butt only the part from the ventral side and up to the shaft-socket is preserved. Here have been no line grooves, but the line holes have their backward and downward directed edges — not the others — carefully rounded. The blade slit with the part around it is entirely preserved; it is 2.5 cm. deep and 3—4 mm. wide. Here, also, have been neither rivets nor lashing.

Hitherto, I have in vain sought information of the Greenlanders living around me as to what the wanting parts, the blade, line, etc., look like. The hunting of Right Whales by the Greenlanders declined shortly after the beginning of the colonization; as the Danes erected some whaling stations furnished with modern implements. Yet I have no doubt that traditions still exist, and persons who are expected to have knowledge of the subject have been mentioned to me by name, but hitherto I have had no opportunity of meeting them. Everybody knows the main features of the hunting: The umiaq was rowed by men with kayak paddles, who faced the bow. The numerous large bladders lay inflated in the boat, they often consisted of whole skins of *Phoca barbata*, either singly or two or more tied together. The harpoon was thrust from the boat and the hunters tried continually from boat and kayak to attach more and more floats till the whale became so exhausted that it could be killed with lances. Consequently, the hunting is conducted in very much the same manner as that described by MURDOCH (p. 101) from Point Barrow.[1]

In his book "The Eskimo of Baffin Land and Hudson Bay" BOAS figures from Cumberland Sound a very interesting old whaling harpoon with its accessories which is, consequently from Eskimo tribes whose material culture must be said to agree most closely with that of the Greenland tribe. BOAS does not describe it very fully, but refers to a model previously described by him. This paper is not accessible to me, but his figure is so excellent that almost all details can be seen on it. I take the liberty of reproducing it here (Fig. 13).

This big harpoon, which is about 18 cm. long, is very interesting. As with the Greenland harpoons described above the line hole is advanced close up to the dorsal edge; and, as shown in my Fig. 12, B, it is situated rather far backwards. The hinder end is extended into a notched barb. While the hinder part of the harpoon has its greatest width in the vertical plane, the fore end is wider in the horizontal plane, with edges

[1] Besides the floats intended to be used for the harpoons there was a layer of common bladders which were intended to keep the umiaq afloat in case it should be upset or broken to pieces by the whale. This is also mentioned by the older authors who have been eyewitnesses of the Greenlanders' whale hunt, and is told by Greenlanders even to-day. But STEENSBY (Eskimokulturen, p. 65) declares that this "must beyond doubt be due to misunderstanding," "because an umiaq can do without such an improvement," and "that such circumspection is quite imprecedented among the Eskimos."

Against this] it may justly be argued, that it is a very strange thought that such people as EGEDE, SAABYE and FABRICIUS should not understand the Greenlanders, that a wet boat-skin sinks like a stone, and that, really, the Eskimo do not thoughtlessly sacrifice their lives any more than other living creatures do.

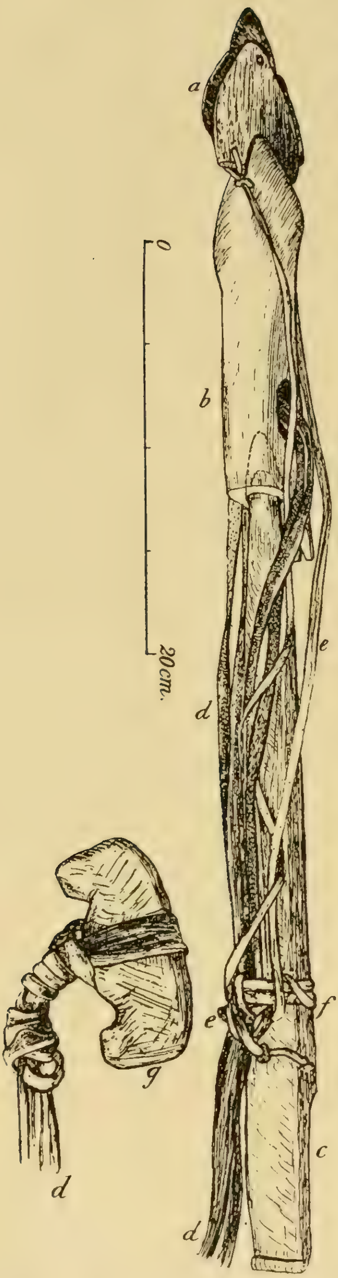


Fig. 13. Whaling harpoon with foreshaft, Cumberland Sound (After F. BOAS). *a*, Blade of bone or ivory with cutting edges made of three pieces of iron; *b*, harpoon with dilating edges; double harpoon-line of strong rawhide thongs, fixed to a strong toggle (*g*) which is fastened to a number of sealfloats and to a large drag; *e* is a light thong for securing the loosely inserted blade.

sloping forward. Then a loose blade is inserted at right angles to the fore-edge of the harpoon, and, consequently, again in the vertical plane. The blade appears to be of bone and in the edge of this are inserted three cutting edges of metal (or stone?). With the thrust, therefore, the first result is a long vertical wound the edges of which are immediately dilated by the fore-edge of the harpoon itself, so that ample room is made for the large harpoon. The blade is neither riveted nor lashed, but loosely inserted; in order that it should not be lost a line is spliced at each corner. The harpoon-line itself is of very thick, double rawhide-thongs 2.18 metres in length. It terminates in a very strong toggle of peculiar shape. The foreshaft consists of a piece of bone about 40 cm in length. The author merely states that it is spliced to the wooden shaft which is 2.60 metres in length, but how this can be achieved cannot be seen from the figure. If it has been lashed, as the prominent ridge at the bottom might indicate, then this fastening of the main line by aid of the blade line is impossible, but perhaps this has been done merely for the purpose of putting it by, or for transport. But if it has been done intentionally, then the foreshaft cannot be attached to the wooden shaft, but must be loosened together with the harpoon and remain attached to the latter. The floats have been held together by a line which has been fastened to the toggle by means of a loop; some indentations in the toggle preventing the loop from slipping off unintentionally.

III. Harpoon shafts, Throwing sticks and various other Accessories of kayak weapons.

For throwing harpoons which are flung from kayaks two different forms of shafts are used: —

1. *Ernangnaq*, 71, the feathered shaft or little shaft, lighter and shorter than the following, and provided at the hinder end with two parallel plates of bone to balance and steer it.

2. *Unâq*, 395, the knobbed shaft or long shaft, generally longer and heavier than the foregoing, without feathers at the hinder end, but often with a bone knob to balance it. In some districts *unâq* is as short and thick as a lance-shaft.

Both these harpoon shafts are made preferably of red drift-wood (*pingeq*, *Larix* sp.), while that of the shorter and thicker form of *unâq* is often made of paler coloured and also lighter wood (*Picea* sp.).

Shafts for bladder-dart and bird-dart are always made of light, and also pale coloured wood (*unarsivik*, 395, *Picea* sp.), lance-shafts of any kind of wood at hand.

All these shafts with the most important of their accessories and the terms for these, are described fairly explicitly by FABRICIUS, and later, amongst several others, by NANSEN. Collocations of the Greenland terms are found in RYBERG.

In order to enable one to throw these weapons far and surely a throwing stick, (*norssaq*, 255) which is a sort of sling contrivance and increases the length of the arm, is used. The form and construction of the throwing sticks vary, partly according to the shaft for which they are intended, partly according to the use and wont of the district concerned and the caprice of the user. In accordance with the shaft for which they are intended, two main types, connected with an intermediate type, can be distinguished. A little behind the centre the long and heavy *unâq* has two ivory pegs which fit tightly into a couple of holes in the throwing stick, so that a jerk is necessary to loosen the throwing stick when the weapon is thrown (see below description to Fig. 14, *A*). Ordinarily nowadays, this throwing stick also fits the lance, but this is often thrown without a throwing stick, and then various finger-rests of bone are fixed in the shaft, and thus it was formerly with the *unâq* also. This throwing stick has, then, two holes and a groove running through its entire length for the reception of the shaft.

The light darts must be such that they can be thrown further, and the bird-dart, especially, such that it can be thrown high. At the hinder end they are provided with a button of hard bone, upon which the throwing stick has to act. Consequently, the upper end of the stick is curved slightly upwards, and here is inserted a bone nail, the point of which acts on the rear button of the shaft. The remainder of the throwing stick has a groove in which the shaft lies; but there is no peg in the shaft and, therefore, no hole either in the throwing stick. Consequently, a dart-shaft cannot balance in the groove of the throwing stick without being held fast with the fingers. This a *unâq* can do, as the friction of the pegs is great enough to hold it. In order to save space on the kayak the throwing stick always fits both forms of dart.

To the *ernangnaq* belongs a throwing stick the upper end of which is arranged as on the throwing stick for a dart, while the other end is provided with a hole just as on throwing sticks for *unâq*. The upper end then acts upon a piece of bone situated at the root of the feathers. Sometimes, however, an *ernangnaq* is also seen provided with a *unâq*-throwing stick, but then it is a little heavier than usual.

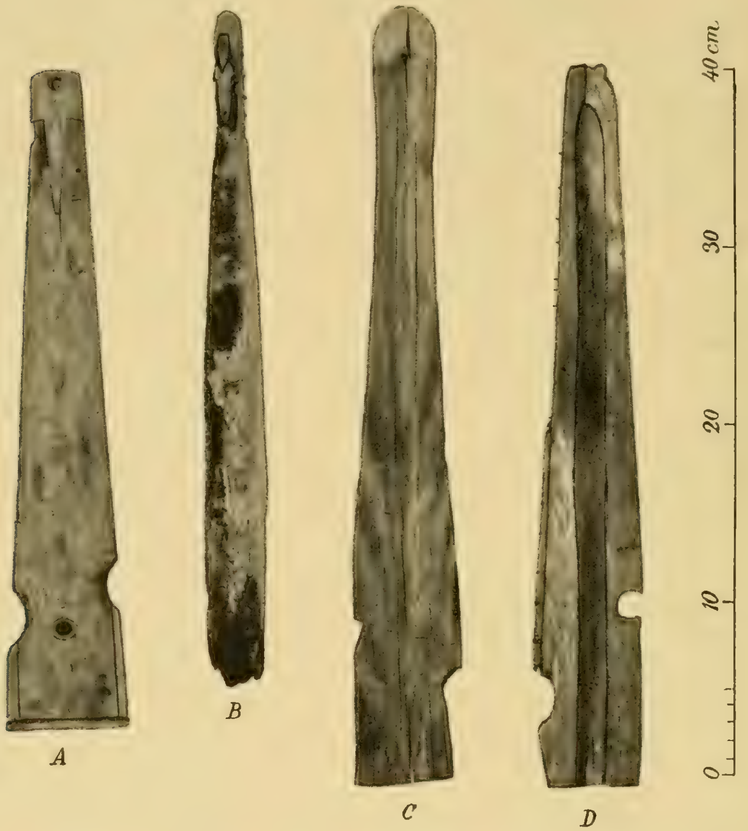


Fig. 14. Throwing sticks. A for *unâq;* B-D for darts.

There is, then, a decided relation between the weight of the shaft and the length of the throw on the one hand and the type of the throwing stick on the other hand. I am not in a position to offer any information as to why this must be so, as I cannot use these instruments myself, and the Greenlanders, when questioned, cannot explain it either, but content themselves with declaring that it must be so.

The richer or poorer ornamentation of the throwing sticks with bone edgings, the arrangement of finger-rests and the details of construction vary according to the user's supply of bone of superior quality, his working ability and taste, and according to local use and wont.

Figure 14, *A* shows a somewhat old and very well manufactured throwing stick of drift-wood intended for *unâq*. The form is the one most general here-about for the time. Here, on the whole, *unâq* is mainly used; in other districts chiefly *ernangnaq;* but both can also be seen indiscriminately used in the same settlement.

The terminal bone-piece (*qulâ*, 159) is of a whale's bone, it has a long tenon which is held fast to the stick by three bone pegs placed transversely. The hole is U-shaped, and the top edge is carefully rounded, so that it can easily release the bone peg on the shaft. The shaft groove (*ilugdlinera*, 92) is about 1 cm. deep, and carefully finished, both in wood and in bone mountings. The handle (*tigordla* of *tiguleq*, 363) has two well rounded notches to receive the thumb and forefinger. From these, downwards, the edges have mountings of bone bands, and on the lower part is an end-piece (*kingora*, 182) all of a whale's bone, and riveted with bone nails. The hole (*putua*, 303) is oblong, with its greatest diameter across, in it is fixed a bone ring which is also held fast with bone pegs. Sometimes this hole is lined with shreds of gull quills, which are sewn through a circle of small holes round the larger hole.

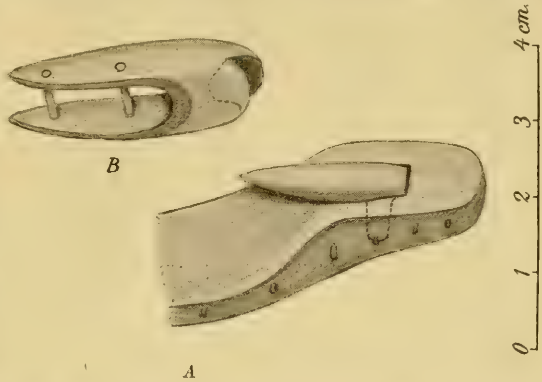


Fig. 15. Divergent construction of *qilik* (A) belonging to the throwing stick B in the preceding figure, and of its *qaquiseq* (B) on the hinder end of the dart shaft.

North-west Disco, on the shore; this throwing stick has drifted for a long time, as there are large holes in it from the boring of *Pholas*.

Figure 14, *B* is a greatly damaged throwing stick for darts. The lower end is entirely missing and the under side is very moss-grown. The upper end differs greatly in construction from the usual forms, in which the throwing stick simply has a bone pin (*qilinga*, 143) fixed obliquely, which acts on a bone button cut transversely, or at most slightly indented, at the end of the shaft (*qaquisâ*, 123). Here, on the contrary, the *qilik* (Fig. 15, *A*) is provided with a right-angled branch which goes down into the stick, which here, therefore, is not exposed to the danger of splitting, and the *qaquiseq* (Fig. 15, *B*) is shaped like opened lips, with a rounded hollow between them. Both the ends and the edges have had bone mountings, the bone pegs of which still remain. Hunde Eiland, in an old grave.

Figure 14, *C* is a not particularly well-made throwing stick for a dart. The *qilik* has split the stick and has fallen out, and there seems to have been no other bone mountings. The throwing stick, however, is of interest in another way. It had been found somewhere here at Disco Bay on the remains of a kayak deposited at an old grave; whence the finder had transferred it to his own kayak, where it had been put in a hidden place as an amulet which should insure a good haul. He

Fig. 16. Various implements for use on the kayak and details of same. For further particulars see text.

was dissatisfied because an older relative, whom he had to regard, demanded that it should be produced. He was discontented at having to part with it, and with the lecture on paganism and superstition which his older relative gave him in exchange.

Fig. 14, *D* is a greatly damaged throwing stick for darts, intended for a left-handed person. It has been very well executed and has had bone edgings the whole way round. The furrow is deep, the *qilik* has fallen out and the notch for the forefinger is so deep that the finger almost entirely disappears in it. A transition to the forms where this hole lies quite inside the edge, which occurs with special frequency among the American tribes.[1]

Hunde Eiland in an old grave.

Fig. 16, *a—e* are some forms of old "feathers" (*sulûssai*, 346) for *ernangnaq*, all of a whale's bone. All have holes for the nails which held them in place, and some, in addition, have a hole above for a strong bone nail, thereby adding increased strength. The hindmost point is often ornamented, in that, here, a circular dial is marked out, or else it is cleft like a fish-tail or a seal's hind-quarter. The lowest point of the stem, also, is frequently more complicated, and so arranged as to be partly grooved down into the shaft. On *d* the stem is broken, on *e* the fore end is sharpened, and the *sulûssaq* is used in that form as a skin scraper (*kiliortût*, 177).

a, The shore, North Disco; *b—c*, Hunde Eiland; *d*, Skansen; *e*, Sarqaq.

Fig. 16, *f—h* are various forms of ice-beaters for kayak (*sermîaut* or *sermêrsiut*, 319) all of whale's bone, *i* is the broken off handle of a fourth. Often, for fun, they have the form of a sabre, see for instance Fig. 16, *h*. Sometimes they were shaped like a dagger and were then also used for giving the *coup de grâce* to the wounded game.

f—g. Hunde Eiland; *h—i*. Kronprinsens Eiland.

Fig. 16, *k* is the right leg (*niulua*, 250) for a line rack (*asatdlut*, 43). This is of wood, below is a crook for the harpoon-shaft to rest on, above, it is cleft for the reception of the bone ring (*qiláungussâ*, 142) of the rack. Disco Fjord.

Fig. 16, *l* is the one piece of that angle of bone (*pâguai*, 269), which lies beneath the great bladder (*avataq*, 62). The two rods have been riveted together with iron nails. Into the other end goes that piece of line which holds it to the bladder, out of a terminal hole with well-rounded edges, while the knot is kept in a lateral hole. This peculiar construction has great significance, because the angle of bone has been inserted under that cross-strap of the kayak which lies just behind the hunter, and cannot from here be washed down by the beat of the waves; but immediately the harpoon has struck, the bladder must be thrown out, and in such a manner that no obstruction is possible. Broken, disinterred pieces of a *pâguaq* are sometimes misinterpreted for the handle of a bow-drill (as by Ryder, p. 323), but a drill-handle has not this construction, the holes being simply lateral.

Hunde Eiland. Whale's bone.

[1] Throwing sticks with a hole inside the edge for the insertion of the forefinger are also found in Greenland. But although they give a firmer grip of the throwing stick, they are not liked, especially in the northern parts of the country, because the hunter prefers to keep on his mitten in throwing.

Fig. 16, *m—p* are various pieces of end-mountings (*kavdluat*, 172) for the paddle (*pautit*, 273). The long, narrow socket is mainly produced by boring. The paddle-blade (*mulinga*, 214) has here a tenon (*kâgúnera* from *kâgúpâ*, 171, he connects two things by inserting the one into the other) which is held fast with bone pegs. At the side are two smaller holes, into which the edge-mountings of the blade (*sinaussait*, 327) are mortised.

All are of whale's bone, *m*, however, is more compact in structure than is general with this material.

m, *o*, *p* — good workmanship, Disco Fjord; *n* — clumsy, Kronprins Eiland.

The paddle to which *o* and *p* belong has been found by an old grave in Disco Fjord. It is 1.8 metre long, the handle (*tigulê*, 363; *tasiait*, Supplement, 48) is elliptical in transverse section, 2 × 3.5 cm. thick, the blade at the *kavdlo* is 6 cm. broad in the wood, and 8 cm. including the edge-mounting. The paddle with all its bone mountings weighs, when dry, 700 grammes!

On paddles from the Central Eskimo a circular band is sometimes seen at the junction of the blade and the handle. It has to keep off from the mitten the drip from the blade. For the same purpose, I have sometimes seen here a small ring of skin or bone.

Fig. 16, *q*, *r*, *s* are three movable foreshafts (*igimaq*, 74) for harpoon-shafts; *s* has two line holes which is the regulation number, the others have had three, *q* being broken. The latter has been fastened in an unusual manner, as the uppermost hole on the one side and the lowermost on the other have enlargements for a knot. Otherwise the lashing (*tavssutai*, 358) which secures the *igimaq* is usually fastened lower down round the shaft (see, e. g. NANSEN's figure, p. 31). The pieces *r* and *s* have a tenon (*tuviussâ* from *tuve*, 378 a shoulder) below, which has fitted down into a hollow in the end mounting of hard bone on the shaft of the harpoon (*qârqa*, 135). If one has a piece of bone for *igimaq*, which is big enough, it is preferable to make a hollow in the foot-piece of the *igimaq*, pierce the *qâteq*, and drive in a bone tenon which then fits the hollow.

With a thrusting harpoon, of whatever kind it may be, a movable foreshaft is naturally not used, as the seal, after the harpoon has struck, is immediately released from the shaft, and then hangs only on the line. The contrary has been wrongly maintained by STEENSBY (Eskimokulturen, p. 200). Cf. same author, "Polar Eskimos," p. 355.

q. Hunde Eiland, whale's bone; *r*, *s*. Disco Fjord, Narwhal ivory. The latter material is preferred by all for *igimaq*.

Fig. 17 shows various small objects belonging to the implements of the kayak. *a—c* are three swivels for lines (*qivssarut*, 149), all of extremely careful workmanship. On all three the revolving bone piece has been forced into its position when the bone had been heated in boiling water; so it cannot fall off. *a* is a rather large, not particularly old and slightly ornamented swivel. (Cf. Mason's figure, p. 206 from Cumberland Sound). There are two holes for making the line fast, principally by sewing with sinew-thread. *b* also has had two holes, but the stem is broken. In spite of its diminutiveness care has been taken that there shall be ample bone round the uppermost hole. Fig. 17, *c* is of a somewhat different type. The uppermost piece has been repaired with a lashing, and the lowermost is pointed and has been inserted in the split line before the sewing. All of ivory.

a and *b*, Hunde Eiland; *c* Disco Fjord.

Figure 17, *d* is a *sîguíkut*, 321, a small bone button placed on the front of the kayak-hunter's waterproof frock, at its lower edge. A

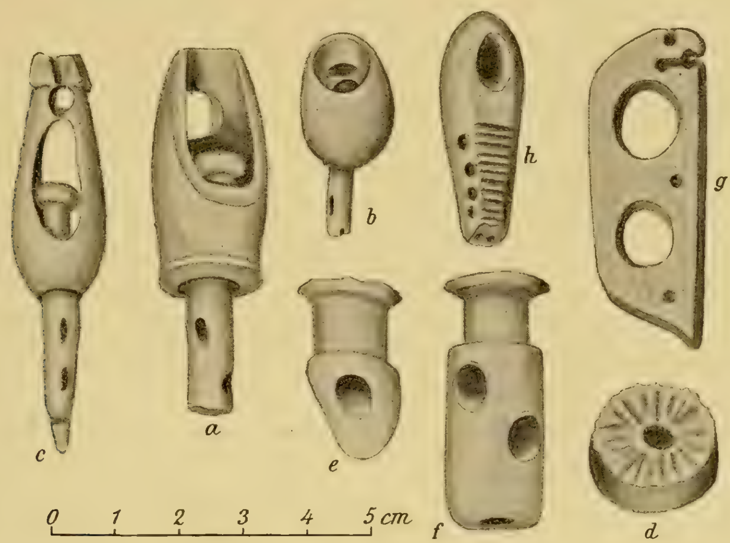


Fig. 17. Various small objects belonging to the implements of the kayak. For further particulars see text.

drawstring inclosed in a fold, runs round the lower edge of the frock, and merges with both ends through the single hole, or with one end through each of the two holes of the *sîguíkut*. By tightening or loosening the drawstring the width of the lower edge of the frock can be so regulated that the edge is just able to slip over the hoop of the man-hole of the kayak. It has been cleft off by boring.

Fig. 17, *e* is a broken and *f* a complete mouth piece (*puerfik*, 298) for a towing bladder (for description see below). The line was led in through the end hole and made fast with a knot which was held by the centre hole. The bladder was inflated through the upper hole and this was then closed with a wooden plug which had been previously placed in the mouth and then inserted with the teeth. The bladder was lashed fast round the narrow end.

Fig. 17, *g* and *h* are a couple of forms for eyelets (*savigfik* from *savigpâ*, 317) on the line. They are sewn fast with sinew thread through the small holes. They serve for buttoning onto a peg on the harpoon shaft when the harpoon has to be set in order before the throw. *g* has two holes, in order, here, to permit an adjustment in the event of the line gradually stretching.

IV. Darts.

A. The Bird-dart (*nugfit*, 256). The West Greenland bird-dart as used to this day in South Greenland consists of a light shaft which is provided at the fore end with a long, thin point of iron — in old days it was of bone (*sâguâ* or *sûgâ*, 340), with or without barbs. This point is either stuck into the shaft direct, or — especially in earlier days when iron was more valuable — first inserted in a small piece of bone (*torrutâ*, 374) which was then fixed into the wooden shaft and provided with a piece of line which could hold it up to the shaft if this should break. Lower down on the shaft there are three or four curved points of bone (*âq*, plur. *ai*, 12) which generally have barbs on that edge which faces the shaft. Their object is to catch a bone or a wing of the bird if the main point itself should not strike. The weapon is thrown only from kayaks, at seafowl, and with the aid of the special throwing stick. Fabricius (II, pp. 242 *sqq*) has an excellent description of the bird-dart with all its details; and an excellent illustration is found in Nansen, amongst others.

This is the principle of the bird-dart of all Eskimo tribes, and, in the same form, it has been adopted by the coast Chukchi. Evidently there is no room for improvement, nor for new constructions in the principle. There will, however, be small deviations as access is had to new material, until the entire implement gives way before the more effective weapon supplied by civilization, as is the case here in the northern part of the West coast, where the bird-dart has everywhere vanished before the shot-gun. There may also be small deviations in the execution of the original details; the lateral branches may be secured with two lashings, or their lower ends may be mortised into the wood, when one lashing is enough; or they may be mortised in addition to being secured with two lashings. Schultz Lorenzen, in a treatise which seeks to establish the relationship of the East Greenlanders with the most southern tribes on the west coast, has also brought to light certain features in the construction of their implements; amongst others that the lateral branches of the bird-dart on the east and south coasts are mortised and have only one lashing, while further up on the west coast they have two, and also, that at the first mentioned place they form a more acute angle with the shaft. It appears to me doubtful, however, that anything whatsoever can be deduced from such a detail. Even Fabricius diffusely describes the mortising of the basal-piece. On the accompanying figure (Fig. 18, from Disco Fjord), is also seen a heel to the mortise, and the angle here is just as acute as on the east coast — 20 degrees at the most. A mortise is also found on the bird-darts of the Chukchi (see e. g. figure in Nordenskiöld: Vega's Färd, etc., II, p. 109). The object of the upper lashing was not to hold the branches to the shaft, but to secure their mutual positions, which can very well be attained by mortising alone, if only the materials are adapted thereto.

Figure 18, *a* shows a lateral branch; *b* a terminal point of bone for a bird-dart, *c* a basal-piece for dart-iron in a bird-dart or bladder-dart. All of antler. Disco Fjord.

B. The Bladder-dart (*agdligaq*, 18; the word means simply "provided with barbs").

As will be seen from the above it is not exactly the bladder which in the Eskimo conception is the characteristic feature of the implement. The main thing is that it shall be a missile for the hunting of marine mammals, where the prey is secured to the implement which is such that it resists the animal's efforts to swim or dive away. The marine mammals which are pursued with darts are various kinds of small seals besides, in Alaska, sea-otters, and as certain habits are peculiar to every kind of seal and to every stage in the development of seals of similar kind, we already have herein ample scope for multiplicity of form. The greatest variety of forms and the highest development of these darts is found with the West Eskimo, and this is not so strange, as here occurs an abundant and multifarious fauna as well as a freer choice in, and easier access to, adaptable materials.

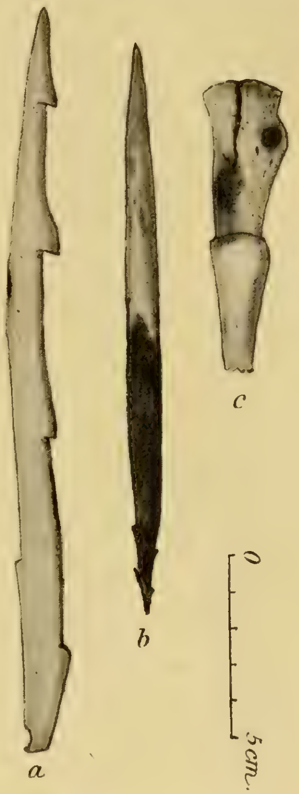


Fig. 18. *a*, Lateral branch; *b*, terminal point of bird-dart; *c*, a *torrutâ* for dart with iron point.

In conformity with the nature of the various animals there are two things in particular which vary, viz., first, that part of the instrument which serves to hold the animal fast, and second, that part which offers resistance to the animal's efforts to escape.

These diversities, however, will be discussed in a later section; here, only the bladder-dart in its West Greenland forms shall be mentioned. Of this instrument, also, we find in Fabricius a full description, and the details which he mentions will be found sufficiently well illustrated in his figures; but, as usual, these are very unsuccessful in their relative scale proportions, so that they give only a false representation of how the weapon looked. CRANZ's illustration, (Tab. V) is a good deal better, and from more recent times we have illustrations in NANSEN, p. 29 and NORDENSKIÖLD, p. 480. The last two illustrations are of specimens from South Greenland where the bladder-dart is still in use; reciprocally they agree well with each other, but seem to differ in the form and placing of the bladder from the description of FABRICIUS. As his also originates from South Greenland a slight development seems to have taken place in this respect; but as I have not before me the South Greenland form or illustrations of details from more recent times, I shall not enter further into this matter.

Here, on the northern part of the coast, the instrument is no longer used, and only very old people from certain remote-lying districts have in their childhood and youth used the bladder-dart, before a rifle could be afforded and before they could be trusted to handle a harpoon and large buoy. An old hunter, here on Disco, has made me a full-sized model, and, therefore, an instrument which, though it has never been used for hunting, yet might so be used, and which represents that form which the bladder-dart had here at the time when it ceased to be employed.

An illustration of this model (Fig. 27, *g*) will be found in a later section, with scale attached, also some details on a rather larger scale. The shaft is of fir, very light, and tapering backwards while the rear-end itself is somewhat thickened. Here is inserted a piece of bone with a slight depression (*qaquisâ*, 123). The fore end is secured from splitting by sinew-thread lashing, here a hole with rounded edges is bored into which the basal-piece (*torrutâ*, 374) of the iron point fits with a tang. The iron point (*sûgâ* or *sâguâ*, 340) has been bought in the shop and matches that of the bird-dart. In the side of the *torrutaq* there is an eye though which passes a line (*isugdlua*, 111) connecting this piece with the shaft.

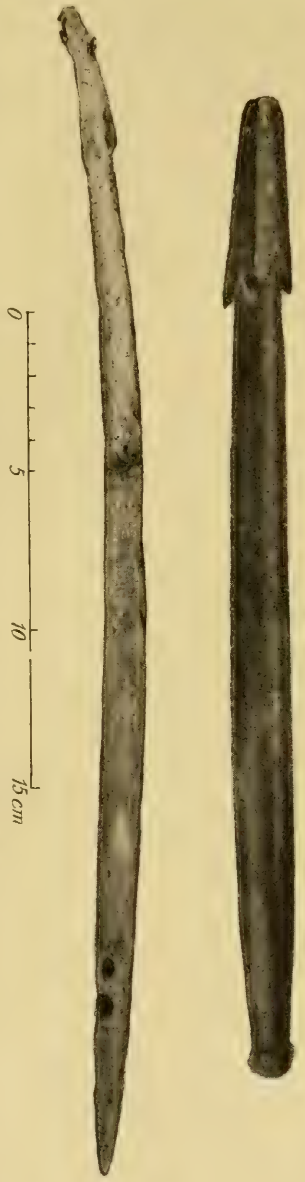
At about half its length the shaft is pierced by the line which afterwards passes through the one end of the curving bone tube (*suvdluligssâ*, from *suvdlulik*, provided with a tube, 347) and down again through the shaft where it ends in a knot. The bladder (*nakerutâ*, 222) is made from the gullet of a large bird: a cormorant or a gull; and sometimes of a seal. It is elongated, slightly curved and points backwards, and is so fixed that it forms part of a very steep spiral. The loose end is held in to the shaft by a thin ring of split quills (*tavsiâ*, 361); whalebone, also, is sometimes used for this. This ring goes through a fissure in the outer edge of the shaft.

The throwing stick is the same as that of the bird-dart; on the whole, it will be seen that many of the details together with their designations are identical as regards these two darts.

When the bladder-dart is to be used, the *torrutaq* is placed in the shaft-hole, and is turned round until the line offers resistance, after which, this is still further tightened by being fastened round a bone peg. When the dart has struck, the point is immediately loosened and the line unwound, whereupon the shaft and bladder offer resistance to the seal's attempt to dive. The bladder assists the steering ability of the dart when this is thrown, and imparts to the weapon a rotary movement about its longitudinal axis; whence its name *nakerutâ* "its means for straight steering."

The bladder-dart is used in South Greenland for small seals only and especially for a kind of "battue" (*malerssorneq*, 198) by several hunters together of young *Phoca groenlandica*, and also for *Phoca vitulina* which latter being extremely shy can only with difficulty be approached so closely as to be harpooned. To attach the weapon to a large seal is considered senseless, as either it will break, or the seal will go off with it.

Before the manufactured iron darts were accessible bone points were used, sometimes with inserted blades of iron. Of the articles found two types, which must have been common at Disco Bay, may be distinguished. The one type comprises heavy bone points of antler, 30—40 cm. long and 15—18 mm. thick (see Fig. 19; Fig. 27, *h*, 1; and Swenander's Tab. 4). Fig. 19, A from Ujarassugssuk at the Vaigat terminates below in a swollen knob and slightly above are three line holes connected by a deep furrow. The upper end is square and has four barbs which, evidently have been too small, for which reason a slanting hole has been bored in one of them, and here a bone tooth, which has since fallen out, has been inserted. It has had an iron blade. The other, B, from Hunde Eiland is longer and more slender, but also more disintegrated; here a little of the blade is still preserved, it seems to be of telluric iron (from Uivfak?).



B *A*

Fig. 19. Two heavy bone points for bladder-darts.

Particularly as regards the barbs there has been a rich variation of forms, of which Swenander's excellent illustrations afford good information. There have been forms with square points, with two whorls each consisting of four barbs (see Fig. 27, *h*, 1); others have had 3—5 large barbs down along the sides, either all on one side, or divided on two opposite sides. Some have been of bone entirely.

The second type is much smaller, formed of flat pieces of antler, with a varying number of serial barbs; sometimes, also with an iron blade, (see Fig. 27, *h*, 2). Fine illustrations of them are to be found also in Swenander (Tab. 3, Nos. 119—127). They often resemble heavy arrowpoints from which, however, they can be distinguished by having one or more line holes just above the lowest point.

Both these types of points are certainly very old. Hitherto I have not met anybody who could tell me anything else about those illustrated here nor of those figured by Swenander but that they were *sâguaq*'s for bladder-darts. Whether this difference in the form of the point has been determined by difference in application or purpose cannot, therefore, be shown at present. For such heavy points as the first mentioned type the other parts, shaft, bladder, etc., must also have corresponded, and they may possibly have been used for larger seals. Perhaps we find the explanation of the difference in the size of the types — which otherwise are connected by easy transitions, as Swenander's illustrations show — in Fabricius's simple statement that large points for the bladder-dart are made for big and strong hunters, smaller points are made for less strong hunters, and very small ones for young people.

V. Bows and Arrows.

The bow is the common property of all mankind and is found amongst the aborigines of all climates. The object, use and primitive form of the bow is so well known that we need not discuss it, but here it is the solution of our fourth question, how has the quality of the materials and the implements influenced the form? which gives the most interesting result.

All other uncivilized people live close to, or within, the limit of trees, and no matter of what sort or size the trees may be, they will always be capable of supplying a material adequate to the relatively simple demands made by a bow. But the Eskimo has his home north of the limit of trees and his own country provides no timber. What he must have for use the ocean must carry to him, or he must make long and costly business journeys to fetch it from hostile tribes. The drift-wood from the ocean is most often found only in small pieces, or in stems so cracked that they are fissured through their entire length; it often originates from the most northern outposts of the forest and is often distorted and always of coniferous wood. It has lain in the ocean for a long time, and in addition is required for numerous other purposes. From his own hunting the Eskimo furnishes whalebone, which in many respects is a capital material, being elastic and tough while it does not absorb water and is not brittle when cold, but is, on the other hand, too pliable. Even when several layers are put together sufficient rigidity cannot be obtained to allow of an arrow for big game attaining such speed that it kills. Nor can bone and ivory, the Eskimo's most important material render substance for a bow fit for use; they are sufficiently rigid, but not sufficiently elastic, and only in the shape of the jaws or ribs of whales might pieces be found which were sufficiently large and straight; but even if holes by the hundred had been bored here a piece for a bow could hardly be split out without its breaking.

Forced by this deficiency of material the Eskimo then makes an invention which, in its genial simplicity, seems to me fully worthy of being placed on a level with the greatest inventions of our time. As he cannot get sufficient elasticity in the bow-stave itself he entirely removes from the bow-stave the element which produces elasticity. He makes his bow-stave of a suitable length by patching it together with bits of such materials as he has at hand: wood, whalebone, bone; and this bow-stave, which need not have any elasticity at all, is backed with a series of strings of braided sinew-thread, or, failing this, thin, selected lines of rawhide. These strings are fastened to the bow-stave by lashings. The sinew-thread and the rawhide line have more than enough of elasticity and toughness, but no rigidity whatsoever; the bow-stave has now to furnish this, while the main task — elasticity — is transferred to the backing. In this construction, the Eskimo bow differs fundamentally from all other bows. In its principle it somewhat reminds one of the common hand-saw used by carpenters.

Complete Eskimo bows are not often to be met with in collections. It is the first instrument to be superseded by the rifle; and it is only in the most remote districts of Arctic America that Eskimo who still use bows may, perhaps, still be found. Complete bow-staves, or pieces of these, are found often enough in ruins and graves, but the sinew backing has rottened or been eaten away by animals. Here, round Disco Bay, the hunting of Caribou has also played an important rôle, and even on the island itself, where to-day no deer is to be found, one often comes across implements for the hunting of Caribou; shooting screens, also, and land-marks to point the way.

From north-west Disco, in 1902, I brought home a couple of bow-staves without sinew backings, they have been delivered to the National Museum in Copenhagen, and now I can only mention them according to memory and scarce notes. Since then I have not succeeded in finding complete bow-staves, only pieces of these and fragments of arrows. Fabricius had before him a complete bow with its appurtenances, and has given an exhaustive description and a bad illustration of this, but with American authors we find descriptions and good figures of bows from the tribes dwelling there, which in all essential details are similar to those of West Greenland.

The bow-stave is made in one piece only in rare cases, although round Disco Bay drift-wood has often been found which was sufficiently long and straight for this purpose. It is generally patched together with, at least, three pieces, one middle-piece, and two end-pieces; frequently with five pieces, when the end-pieces are lengthened further with a piece of good wood or bone for the fastening of string and backing. Sometimes the middle-piece is strengthened with a splint of bone, wood or whalebone. The manner in which the centre- and end-pieces are mortised together (see Fig. 20) without rivets shows plainly that the the object of the the bow-stave is only to give rigidity. The bows were from 1.0—1.3 metres long and the wood at the back 3—4 cm. broad, and a fraction thinner.

The bow when ready for use is called *pisigse* or *pisigseq*, 296, the bow-stave alone *sáneriâ*, (Supplement, 42) or *pisigsitâ*, 296. The end-

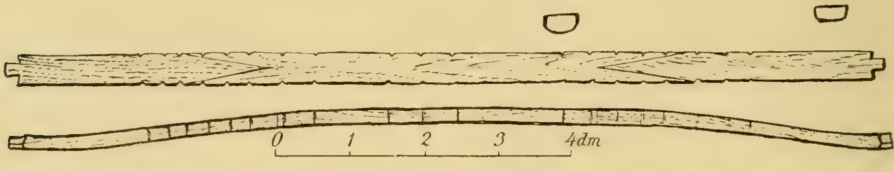


Fig. 20. Bow-stave made of three pieces of drift-wood. Seen from the edge, and from the back, and in transverse section.

piece with the notch for reception of the string, *inûssâ*, 102, "its doll" or "its man-likeness;" the central projecting part of the end-piece to which the backing and string are fastened, *noqartarfia* from *noqarpâ*, 254, "its place for stretching."

The backing, (*kujâ*, 189) is first formed like a long cord which is wound round both the *noqartarfik* pieces, so that all the strands get to lie on the back of the bow. The number of strands varies from 12—20 or perhaps more. In order to keep all the strands on the back, the bow-stave is in some places lashed with sinew-thread, whereby care is at the same time taken to join the pieces of wood from which it is made. In order to prevent the lashing from slipping there are small notches in the edge of the bow, and, besides, the lashing cord often makes a turn between the strands of the backing. The lashing is called *qilernera*, 143. Finally the whole, the backing and the lashing, is wound round with yet another cord, *nerma*, 249, which is laid in ordinary whipping.

The bow-string (*noqartâ*, 254) also consists of cord which is braided first and afterwards wound round with sinews. It has loops to fasten round the end tenons when the bow has to be used. When by wear or through moisture the backing becomes too slack, a small implement of bone is inserted between the two parts which are formed by the strands, and these are now twisted round each other until sufficient elasticity

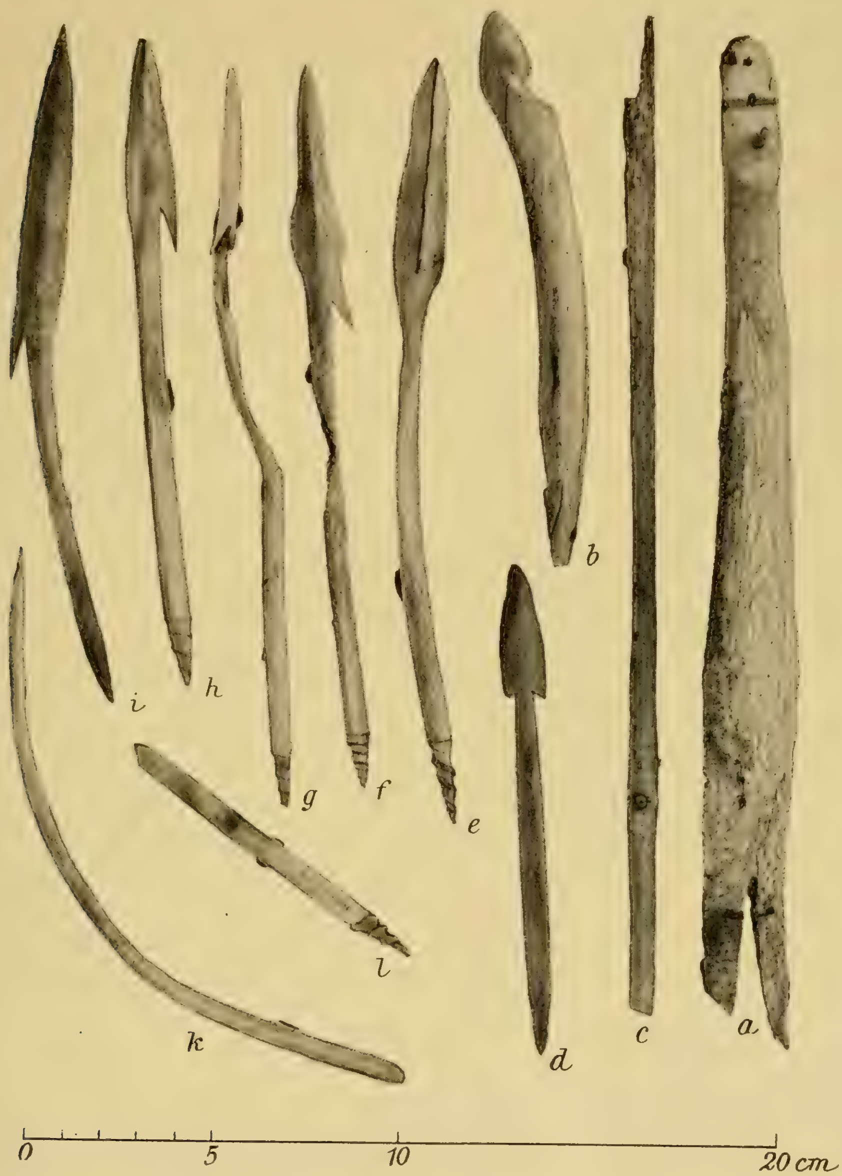


Fig. 21. *a*, *b*, Two pieces of an old bow; *c*, a wooden arrow-shaft; *d—l*, various bone points for arrows. For further particulars see text.

is obtained. In order to prevent the strands from untwisting, the centre, where the twister has acted, is buttoned to a small bone peg in the bow-stave, or the tension is made secure with a new lashing.

Fig. 21, *a* and *b* are a couple of pieces belonging to a bow-stave from a grave at Disco Fjord; they have been gathered at the junction with three bone nails of which one still remains. Round the notch which should connect them with the centre piece there are holes with countersunk grooves for the sewing with sinew-thread. The piece is overgrown with fruit-bearing crustaceous lichens and is very old.

The arrows of these bows (*qarssoq*, 134) were about one metre long. They consisted of a very light wooden shaft of *unarsivik* (*Picea* sp.) and a bone point, (*narqua*, 237) sometimes with an inserted blade, (*ulua*). Above, the shaft was provided with a socket for the bone-point, *narqulerfia* "its place for applying the point," below, with a notch (*eqia*, 66) for the string, both ends being secured against splitting with a lashing of sinew thread, (*nerma*, 249). In addition the lower end was provided with two feathers, (*sulue*, 345) of raven, or on the smaller arrows, of ptarmigan. The tip and half of the vane were cut off so that the feather rib came near the shaft, to which it was fastened with two lashings.

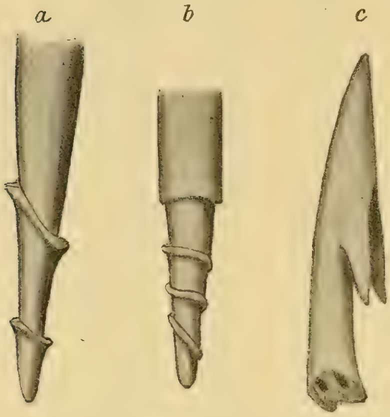


Fig. 22. *a*, *b*, Two examples of spiral ridges or slanting knobs on the hinder end of the bone point of arrows; *c*, the extreme portion of a *pangaligtoq* with double barbs.

The form of the bone points varied greatly, they were ordinarily blunt for ptarmigan, but otherwise were double-edged, cutting, with or without barbs or points and with several barbs in unilateral succession, the one above the other. Some good illustrations are to be found in NORDENSKIÖLD's "Den andra Dicksonska expedition till Grönland," p. 481.

C. RYDER has already pointed out (loc. cit. p. 310) that bone arrow-points from Scoresby Sound in East Greenland were fixed in their wooden shafts by means of tangs having small slanting knobs and that the knobs form part of the thread of a lefthanded screw. The same author has also stated that such attempts at screws are frequently found on West-Greenland arrowpoints, in some cases with a complete thread of a screw in high-relief, and has given an explanation of the method of the manufacture of these screws.

Other examples are mentioned by W. THALBITZER (loc. cit. p. 365).

Around Disco Bay arrowpoints with screw-bearing tenons are very common and I may add that I have seen similar specimens in the hands of other collectors from the districts of Egedesminde, Holstenborg and Godthaab (see Fig. 22).

This seems a very interesting fact as it has sometimes been said that primitive man only knew two ways of uniting rigid objects in protraction of each other, viz. by securing the bevelled ends of the objects either by nails or by lashings.[1]

Fig. 21, *c* is an arrow-shaft found on the top of a mountain in the interior of North Disco; *d—e* are various bone points, all of antler and greatly warped from having lain in the ground. All are very carefully constructed and have, for instance, been very smooth with keen edges and sharp points.

Fig. 21, *d—g*, Hunde Eiland.
— *h* , Kronprinsens Eiland.
— *i* , Ujarassugssuk.
— *k* , Disco Fjord.

Figure 23 shows an arrow-point which by its smallness differs from all with which I am familiar both from literature and life. It is of ivory with an inserted iron-blade. It has been most carefully constructed, too carefully for the possibility of its being a toy. It is said to have been used for the shooting of ptarmigan on the snow. (Disco Fjord).

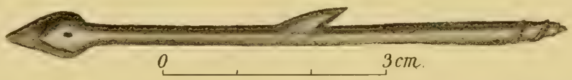


Fig. 23. An uncommonly small, well-made arrowpoint for ptarmigan shooting on the snow.

I have procured a new specimen of the peculiar arrow-point for shooting Caribou, which is termed *pangaligtoq* (from *pangaligpoq*, 272), and the use of which I have previously described (Arb. f. d. Danske Arktiske Station, No. 5). It is only the point itself, and, like the former point, of ivory, but differs in that the downward pointed barbs are double (see Fig. 22, *c*). Its "automatic" penetration must have been still more effectively insured.

VI. Lances.

The object of the lance is to give the mortal wound to the animal previously harpooned, or shot with the rifle. Moreover it is this weapon, and not the harpoon, as some authors write, which is employed when attacking non-diving animals like Caribou or Polar bears in the water from a kayak or boat. For the hunting of seals from the ice, on the contrary, the lance is not used; it is superfluous, as here man is far superior to the seal and can kill it with anything at hand, and without possessing any special implement for the purpose.

In West Greenland two forms of lances are known.

[1] A fuller account of the subject will appear elsewhere.

The large kayak-lance, (*anguvigaq*, 37) is well known. It is fully described in FABRICIUS and well illustrated in NANSEN. It consists of a rather heavy shaft which is capped with a piece of bone cut transversely with a smooth level surface (*qârqa*, 135) in the centre of which is a knob.[1] Then comes a somewhat long rod of strong bone (*ipuligâ*, 108) slightly concave below, often formed by the riveting together of two pieces of antler. At its upper end it carries the fast riveted blade (*ulua*, 392) and below it has a socket for the reception of the knob; it is fixed to the shaft by two straps (*tavssutai*, 358) of rawhide line, so that it may be bent to one side or the other without breaking: a construction quite similar to that which connects the shaft of the kayak-harpoon with its loose foreshaft, *igimaq*. The lance may be so made that it can be thrown by hand, in which case some bone handrests (*tikâgutâ*, 364) are inserted, or it may have pegs to enable it to fit onto the throwing stick of the harpoon shaft. There may be some slight variation in the length of the straps and of the shaft. If it has to be thrown with a throwing stick, that is to say from a long distance at large and dangerous game, the shaft is longer and more slender than when only the shooting of small seals is anticipated, when it is safe to approach the animal and throw by hand.

In other respects there is no room for variations. The object and the use are identical and the implement is finished. It is also used in essentially the same form on the coasts of both East and West Greenland, and by those of the Central Eskimo among whom the culture of the kayak is on about the same level as in Greenland. Owing to lack of literature I am unable to give any information as regards the appearance of the Alaskan lance.

Moreover, a short, slender lance (*kapût*, from *kapivâ*, 169) which consisted only of a long knife-blade immovably fixed onto a wooden shaft was always used formerly and is still used at times. It is employed to give the animal its death-stroke when one comes so close to the animal that the long throwing lance becomes unmanageable, as is implied by its Greenland name "something to stab with." Since the introduction of the rifle it has in some measure disappeared, or, to be more correct, has become shorter and been converted into a long-handled knife which is stuck into a sheath on the deck of the kayak. If the bullet does not entirely finish off the animal, the small lance is finally used, and particularly to give the cuts necessary for the attachment of the various towing tackle, for which reason it is also called *sanarfit*, 312, "that to fashion it with."

Yet another term for a lance may be found, *qalugiaq*, 128. From KLEINSCHMIDT's manner of specifying it in his dictionary it looks as if he considers the word as an original one, and not as derived from

[1] Sometimes, the *qàteq* has a socket in the centre and the *ipuligaq* ends in a tenon fitting into it.

any other root. The word is now only used to denote the European large whale-lance of iron on a short shaft. But possibly it is the term for the old Eskimo whale-lance which has been transferred to this object.[1]

One form of lance still exists, however, which strangely enough seems to be quite unknown, since, so far as information goes, it has never been mentioned by those authors who have dealt with the material culture of the West Greenlanders. Yet in certain districts it is generally distributed, and in other districts, where it is not used because there is no reason to do so, it is known to everyone. In accordance with its purpose it might be termed the West Greenland reserve-lance.

Here, the implement is called *savgútartoq*, or *qajaqatâ*. The word *savgútartoq* is perhaps just comprehensible for European train of thought, but hardly capable of being translated exactly. According to the Rev. H. Mortensen the derivation is as follows:—

savik, 316, iron, knife.

savigpâ, 317, "he puts on something sharp", for instance, "he sets the harpoon on the shaft in order to have it ready for the throw."

The word comprises, moreover, the suffixes *-ut*, 458," the means wherewith" or *-upâ*, 457, which indicates, among other things, that the action expressed in the main word is for the benefit of some part otherwise unconcerned; and also *-tarpoq*, 450 "what is usual," "what frequently," "what sometimes."

Thus the word becomes an intransitive noun-participle of a verb *savgútarpâ*, and may perhaps be freely rendered by "that thing which sometimes by being set upon another thing makes this sharp."

Words of kindred origin which are not to be found in Kleinschmidt's dictionary either, are for instance *savgutaq*, that piece of the harpoon line, which reaches from the harpoon and down to the eyelet of bone, and which is buttoned to a peg on the harpoon-shaft; *savgútarfik* "the place where one puts on something sharp," that is before going out to the open sea, the name of a small island in Disco Bay.

The word *qajaqat* is derived from *qâjaq*, a kayak, and the suffix *-qat*, *qatâ*, 424, "his with —," "his in the company of" and Mr. G. Kleist thinks that it is meant to express that the implement shall be a necessary safeguard for each individual man to carry when he goes out singly on dangerous hunting in contradistinction to when several go together. A free rendering of the word is "the thing which he usually has with him when in the kayak."

The reserve-lance (Fig. 24) consists of an ellipsoidal piece of hard and strong bone, preferably ivory, into which an ordinary steel lance blade is fixed with an iron nail. Behind it is well rounded and has a hollowing; at the side of this, two line holes have been bored up through the under edge and out through the side, where they are widened so as to receive the knot of a line which is not too thick, so that this

[1] Fabricius, also, (Zool. Bidrag, p. 77) is in doubt whether the word is original or is a new formation. Perhaps it is derived from *qaluvâ*, 126, "he bales it out," "he bales the fluid matter out from it," for instance, from a boat or a tub, and thus is only a translation of the Danish (Dutch?) term for the lance — "Lænser", a baler — generally used in Greenland.

cannot protrude and impede the entrance. The weapon is adjusted for being fixed onto the movable foreshaft of the harpoon shaft, and the two short line-ends are then made fast to the *igimaq* down in the lashings (see Fig. 24). This lance is used mainly by hunters who hunt the hooded seal (*Cystophora cristata.*) The hooded seal is a large and strong animal which at once becomes aggressive in the open sea when wounded. Naturally, after having harpooned it, one tries to shoot it or stab it with the large lance; but the furious animal bites the implements to pieces, and should it happen that it succeeds in breaking the lance, or, as may also happen, that the point of the lance gets fixed in a bone, the kayak hunter may incur great danger. He now fixes the *savgútartoq* to his harpoon shaft and has almost as effective a lance.

The reserve-lance shown in Fig. 25, *A* is from Kronprinsen Eiland where every hunter has one in his kayak.

It is strange that FABRICIUS, who lived in districts where the hooded seal was hunted, does not know this implement. From his book "Om

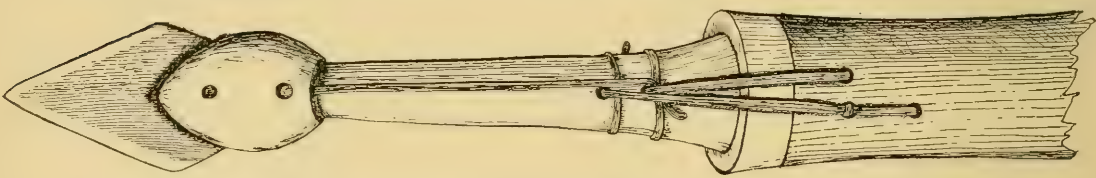


Fig. 24. A *savgútartog* (reserve lance-head) set on the *igimaq* of a harpoon shaft.

de grønlandske Sæle" it appears that he knew the hunting of the seal on drift-ice best. This method is preferred in South Greenland because it involves least danger, as out in open water, the seal breaks all implements to pieces. In the Table in his paper on the hunting of seals a figure (4. g.) is to be found which FABRICIUS describes as a thrusting harpoon for hunting on ice. It seems somewhat strange to him that this "small harpoon" has no barbs at all, but as he does not know hunting on ice from personal experience, he thinks that perhaps they are unnecessary; as here the seal has but little time to act in self-defence. Probably, therefore, FABRICIUS has seen such a lance, but has not had its purpose explained to him, because, as a harpoon, it is quite impossible; it is constructed specially for the object in view — namely to allow of its being easily withdrawn.

The reserve lance or as American authors call it "the loose lance-head" is a well-known weapon among the Central Eskimo. From Cumberland Sound KUMLIEN has brought home some specimens, his book, however, gives no information about their use, beyond that which lies in the name. Some of KUMLIEN's specimens are excellently reproduced in MASON, who in his monograph on the harpoons treats them together with a number of other not relevant implements. Nevertheless he every-

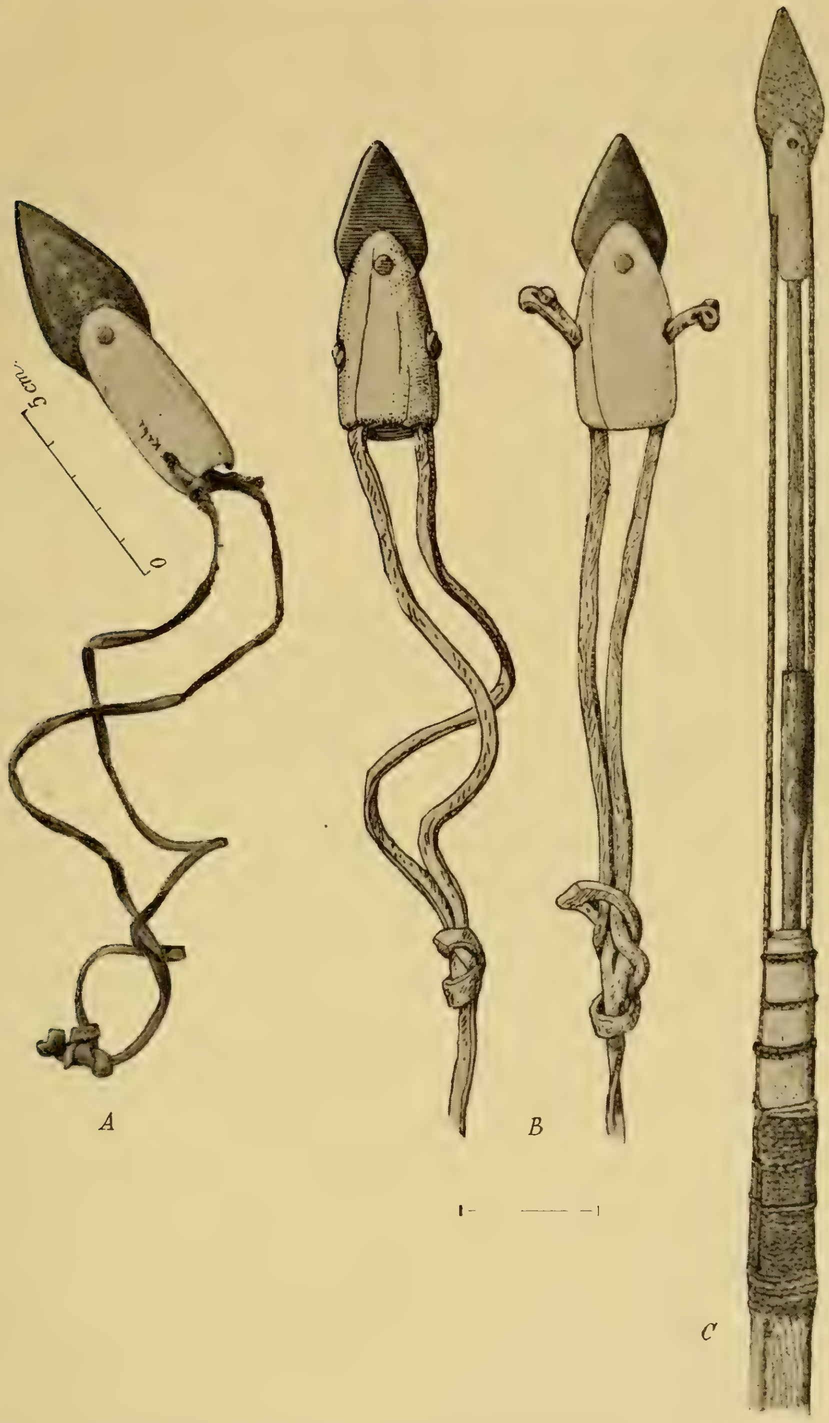


Fig. 25. *A*, *savgútartoq* from Kronprinsen Eiland, Disco Bay. *B*, two loose lance heads from Cumberland Sound collected by KUMLIEN (After O. T. MASON) (The scale is 1 inch.). *C*, a caribou-lance from Aivilik, Central Eskimo; length of fore-shaft and point 35 cm. (After F. BOAS).

where designates them correctly "loose lance heads." MASON writes about them: "A loose head of a lance is given in Fig. 53. A careful inspection of this specimen, and others like it, will show that it lacks the essential qualities of a harpoon, namely of being hinged to the end of the shaft and of retrieving. There is neither barb nor toggle on this specimen or others of the same class. The hinged lance, either in the form of a weapon to be thrust or of one to be thrown from hand or bow or throwing stick, is exceedingly rare. Only in the areas where immense sea mammals are hunted, is it thought necessary to guard in this way against breaking the shaft. Indeed, it will be found that the Eskimo on the other side of the continent do not hinge the lance head, but merely socket it and leave it in the animal stabbed."

From the above it is seen that MASON, strangely enough, has the idea that the weapon should be left in the animal, but a careful inspection of his figures shows that two pieces of line invariably issue from the specimens figured and this fact plainly shows that no such idea as that suggested by him could ever occur to an Eskimo.

SWENANDER, also, has been misled by MASON's erroneous interpretation. He describes one of KUMLIEN's figures in his comments about the distribution of harpoon forms, and says (p. 40) "The conical points with line holes opening into the rear end, figured by BOAS and MASON, seem to be distinctly characteristic of the tribes at Cumberland Sound. I have at least not been able to find these features described elsewhere."

As this is said in a discussion about the distribution of harpoons, while the author elsewhere in his work mentions lances, it is evident that he has entirely overlooked the fact that both the authors he quotes distinctly call them "lances."

The fact is that in BOAS's book "The Eskimo of Baffin Land and Hudson Bay," we find in Fig. 7 a whole lance like that illustrated, and on p. 14 he writes regarding it "The lance with detachable point is much used in hunting Caribou in ponds." From the wording of this statement I take it for granted that it is also mentioned in BOAS's chief work "The Central Eskimo," which is inaccessible to me, but which SWENANDER knows and quotes. It is interesting that it is here mentioned that the lance is used for hunting Caribou, because the ordinary large kayak lance also occurs in the same district, and has the same name, *anguvigaq*, as in Greenland.

Further west, among the tribe which is often called "Kinipetu," we also meet with the weapon, and employed for the same kind of hunting. BOAS has a figure 113 which I permit myself to reproduce here. (Fig. 25, *C*). It is true he calls it "a Caribou-harpoon with detachable point," but if there is no mistake in the drawing it must be a lance. There is no trace of barbs to be seen, and, as mentioned above, there is no advantage whatever in harpooning a Caribou in the water; it can neither swim nor dive away from the hunter. As the lance with a fixed point on a movable foreshaft occurs here in any case in the neighbourhood, on Southampton Island for instance, it seems that the lance with the detachable point is regarded as particularly adapted to Caribou hunting.

Whether the Greenlanders brought it with them as a special weapon for hunting Caribou and discovered only when meeting with the hooded seal that it might adapt itself in their case also, or whether for Caribou hunting they on the whole preferred it to the ordinary kayak lance is very difficult to ascertain. That they hunted Caribou in lakes and at the heads of the fjords where the animals were driven out by systematic "driving" is well known, and it may happen occasionally still. It has also been mentioned before, for instance by FABRICIUS, II. p. 239, and is said to be illustrated even by EGEDE. STEENSBY, therefore, is incorrect when he states the contrary (Eskimokulturen, p. 67 and other places).

VII. Spears.

I have not much to say about the fishing spear (*kakiak* or *kakíssat*, 163). Both the commonly distributed forms, the bifurcated as well as the trifurcated one, as they are figured by HOLM from the east coast for instance, are well known to the West Greenlanders but are not used here, and have hardly ever been of much importance here at Disco Bay where no doubt they have mostly been used for *Cyclopterus*. For catching trout (*Salmo alpinus*) a far more effective method was employed in bygone times, namely damming the rivers with rows of stones. Perhaps they were used sometimes in the winter for trout catching in the open holes of rivers and lakes (cf. M. P. PORSILD: Hvor opholder den grønlandske Laks sig om Vinteren? Arb. f. den Danske Arktiske Station paa Disco No. 1).

VIII. The Evolution of the Types of Missile Weapons of the Eskimo.

We have previously seen how, by adopting a purely technological point of view we get the Eskimo missile weapons grouped in a series of generic and specific types. It now remains for us to examine how these types stand in relationship to one another and how, technologically regarded, they have evolved from one another.

We begin with the bow and arrow. Taken jointly they certainly cannot be termed a simple thing, but constitute a veritable machine; but in some measure it is natural to begin here, as this weapon is common to all mankind; moreover we find among the arrows here some of the most simple forms: a stick with a stone in one end and a feather in

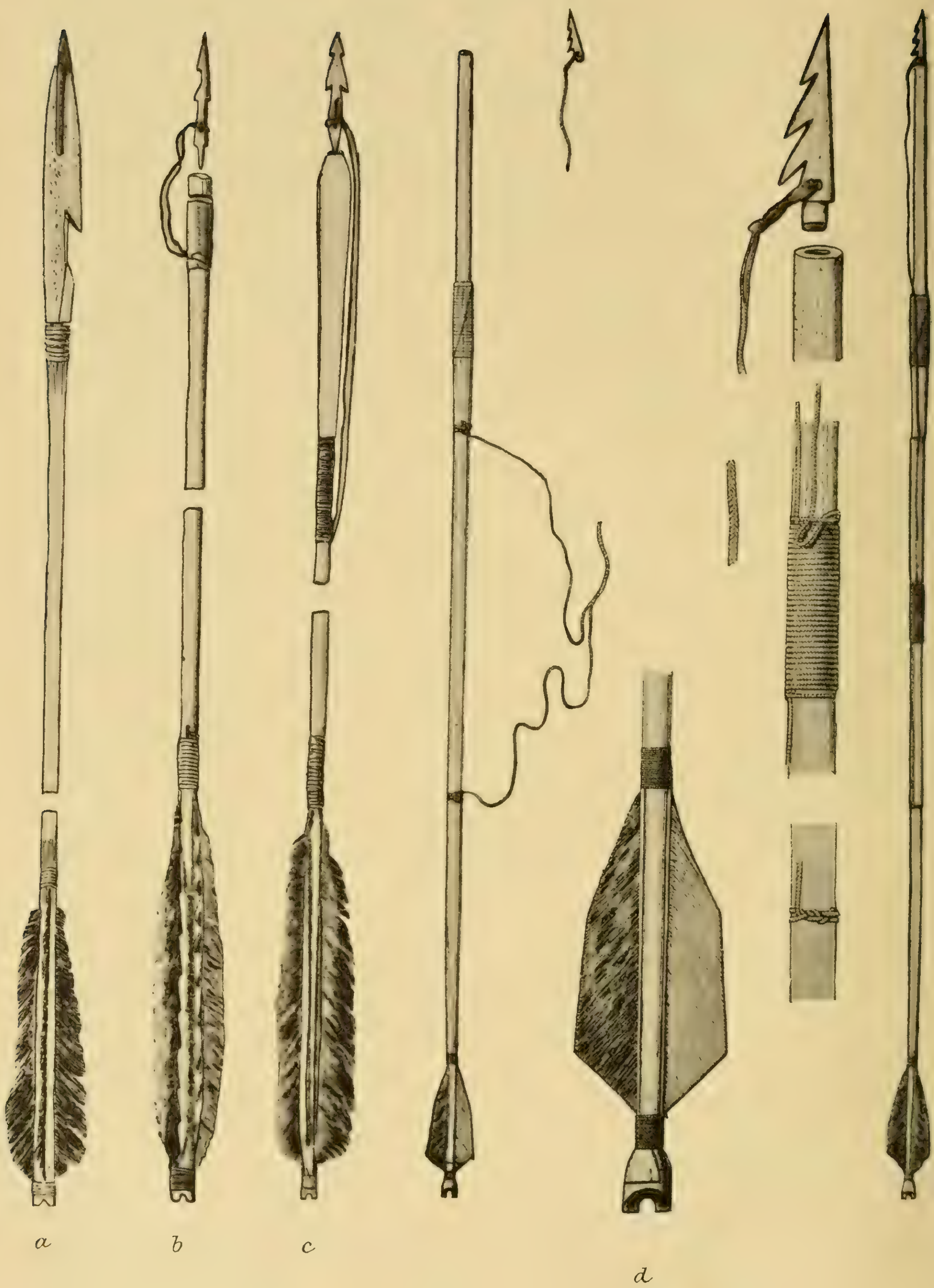


Fig. 26. To illustrate the technological development of darts from Arrows. *a—d*, Arrows for hunting sea-otter, Alaska (After O. T. MASON).

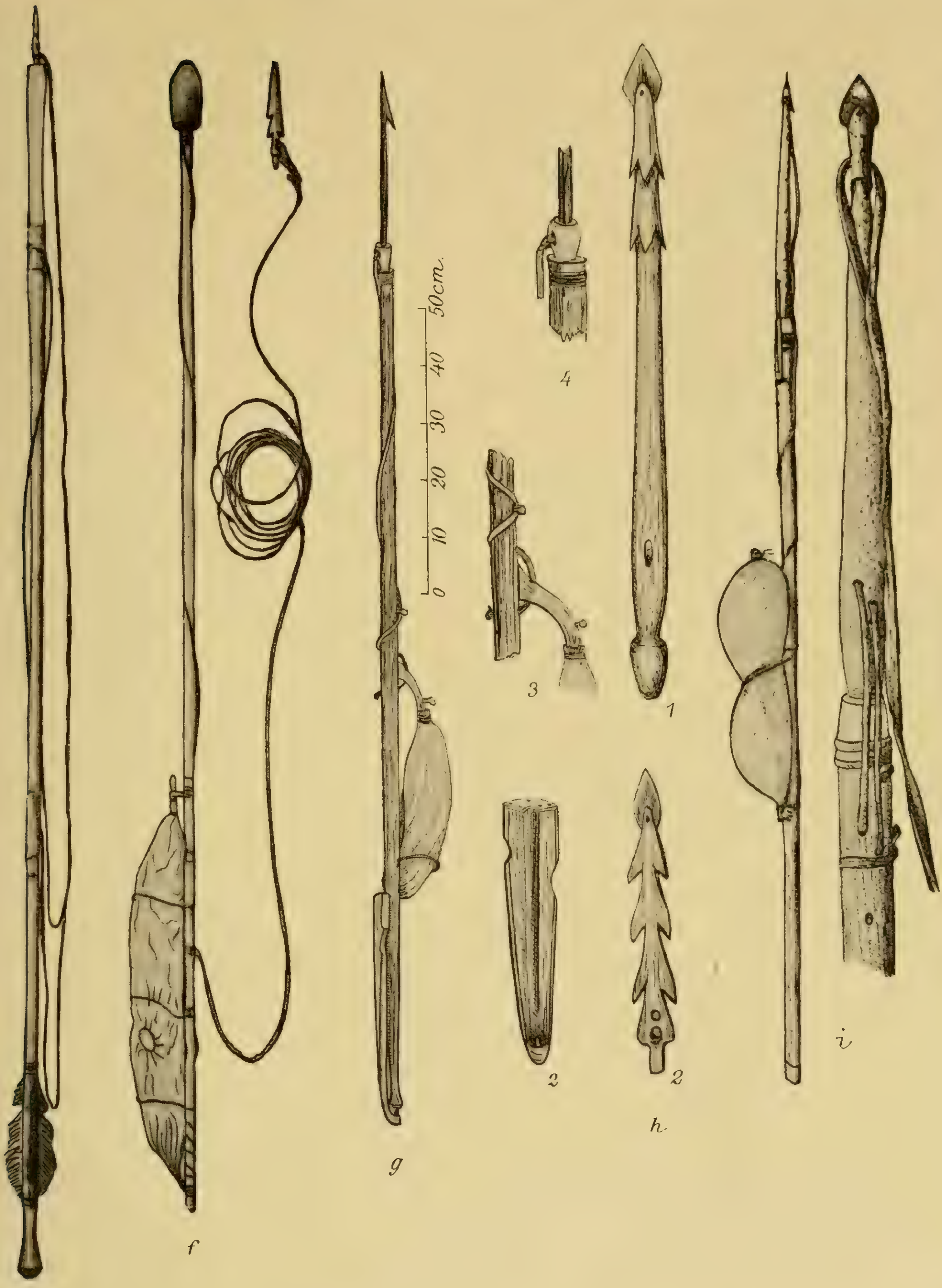


Fig. 27. To illustrate the technological development of darts from Arrows. *e*, *f*, darts for hunting sea-otter, Alaska (After O. T. Mason); *g*, light form of bladder-dart from West Greenland with details; *h*, 1 and 2 ancient forms of points of bladderdarts from West Greenland; *i*, strong and heavy bladderdart with small harpoon-like point, total length 160 cm., from Cumberland Sound (After F. Boas). For further particulars see text, pp. 173 sqq.

the other. But at the same time we find included in the Eskimo arrows for shooting on land a wealth of specialized forms, all designed with a view to the particular animal to be slain or to the method of hunting to be employed. To what extent the specialization in form and use may go, is shown by the peculiar Caribou arrows, *pangaligtoq*, which I have previously described (see bibliography). But we still lack such detailed information about the employment of the majority of these as might make the form comprehensible. The travellers who came across them in use, were content to call them "arrows," at the best "arrows for shooting on land;" now they are not used any more, and we must be satisfied with the explanation which rests on tradition. Some of the peculiarities in the form will naturally, here also, be due to local conditions: for example quality of material.

Now, however, in one single Eskimo tribe a whole series of types of weapons occurs, which technologically differ somewhat in their extreme points though all have served for hunting the same animal, viz., the sea-otter. Some illustrations are to be found in older works, such as Dall's "Alaska and its Resources," but newer and more copious figures occur in Mason "Aboriginal American Harpoons." In the literature which is accessible to me I have not been able to find further information about the details of their employment, but the figures are so good that I shall venture to try to explain this from their form.

Before this it is however necessary to refer to the main features of the habits of the prey; they are described, amongst others, by Nelson and Petrof who partially cite the oldest description, that given by Vitus Bering. The sea-otter, *Enhydra lutris*, is a powerful animal. In a full-grown individual the length of the body may exceed one metre, and the weight may rise to 40 kilograms. Now it is almost exterminated by the indiscriminate, rapacious hunting to which it has been subjected, and is confined to quite a small area near the east end of the Aleutian chain, while formerly it was distributed over the whole of the Bering Sea, and far down along the coasts of both continents. Now it is very shy and almost entirely pelagic and may be met with as far as 80 miles from the nearest coast, and may be found asleep in a drifting attitude with its belly upwards; indeed, one may come across the female drifting in this position with her young between her fore-paws. Only rarely does it come up on land on remote skerries, and only in rough weather. Otherwise it takes its rest on drifting kelp, where perhaps also, now, copulation and the birth of the young takes place. Formerly the shores were the normal resting and sleeping place of the animal, and it was not particularly shy. Bering describes the sea-otter as a very pleasant and playful animal, and so easy to hunt that he and his party lived on it while in winter quarters, and he is of the opinion that it would have been easy to tame.

To-day the animal is shot with long-range rifles from land or a vessel, and white men take part in the work of extermination. Formerly sea-otter hunting was the principal support of the natives. They killed the animals partly with clubs on land, when they lay asleep during storms, and could be surprised because the surf deadened the sound of the hunter's steps, partly with bow and arrows which were shot at the animals when, being startled, they resorted to the sea or approached the coast in order to go ashore. The last form of native hunting, before the introduction of the rifle, was carried out with the help of darts flung from open boats, which by organized "driving" surrounded the animal.

Fig. 26, *a—d* and Fig. 27, *e—f* show six different types of original weapons for hunting sea-otter, all copied from MASON's work, which, besides, contains others which form the intermediate forms of these.

Fig. 26, *a* is an arrow from Alaska Peninsula. It is a heavy, firmly fixed bone point with an inserted stone (or metal?) blade. The plane of the blade is at right angles to the plane through the two edges of the bone point. These cannot have been meant to cut, but only to distend, because a barb is found in one of them. Here, then, we have the same principle which has already been shown in the whale harpoon from Cumberland Sound (Fig. 13). The size and form of the point shows that the arrow must have been used at close quarters, and the intention was to wound the animal vitally or kill it outright by the shot itself. For this reason the point is not detachable and there are no contrivances to protect the shaft from the animal. MASON has several forms of this type.

Fig. 26, *b—c* is from the same place. Here the point is not for the purpose of killing, but is detachable, and is only intended to fix the animal to the shaft, which then offers resistance to its movements in the water. In *b* the point is fastened only into the upper end, in *c* somewhat lower down, so that the shaft lies athwart in the water. Besides, here, between shaft and point a line is inserted, which unwinds when the point has struck. Hereby the shaft is removed from the wounded animal. Figure 26, *c* is thus a more perfect type.

Fig. 26, *d* from the same place is still more complete. Here the line is bipartite and fastened to the shaft in two places, so that it is less exposed to the danger of breakage from the drag of the animal when diving. The detached figures show the smart winding and jamming of the line before the discharge.

Fig. 27, *e* is a dart from Unalaska meant to be thrown with a throwing stick, and is therefore much larger and heavier than the previous one, of which, in other respects, it is a repetition as regards principle and mode of employment. It has even, what is unusual with darts, kept the steering-feather of the arrow.

Fig. 27, *f* is a dart from Bristol Bay. It is still larger and heavier, yet meant for the same animal. It is also thrown with a throwing stick not shown in the figure. Here the shaft is provided with a fairly large, but light, bladder, which very considerably increases the resistance of the shaft in the water. In order to give the weapon weight and balance proportionate to the bladder, which also acts as a steering apparatus, the fore end is provided with a heavy bone knob, into which the small point is pushed. The line is very long and is fastened to the shaft at the bladder. Hereby the shaft is to some extent kept out of the animal's way but it also becomes easier to get hold of it, as the length of the line becomes the radius of the circle within which the animal tosses itself about during its efforts to escape.

Here, therefore, we have in this series of weapons for hunting the same animal the easiest transitions from the arrow to the dart, and even to the dart with a bladder, which, with all Eskimo tribes having open water, plays such an important part in hunting seals. For this purpose, however, the implement has to be considerably re-modelled. The seal is bigger and stronger than the sea-otter, and is very persevering in diving. Here the development proceeds in two ways, the terminal points of which are shown in *g* and *i*.

Fig. 27, *g* is the last form of the bladder dart in West Greenland before it disappears entirely. The point is of thin iron and its object is not so much to wound the animal as to attach it firmly to the shaft. The line is only so long as to secure the safety of the shaft, because this implement is supplemented by another implement which kills: the lance. As this is also thrown from the kayak it is not necessary to get so close to the animal that one can catch hold of the line; besides it would be too risky for the hunter. Figure 27, *h*, 2 shows that formerly much smaller points of a form similar to that from Alaska were used in West Greenland.

Fig. 27, *i*, (after BOAS l. c.) shows the bladder darts of the Central Eskimo (from Cumberland Sound) which are so heavy that RINK may justly say about these forms that "their monstrous shape would amaze a Greenlander." The detachable point is here a veritable harpoon, the loosening of which, besides, is secured by the movable foreshaft, which by its weight, moreover, balances the large bladder.

Whether this form was known in Greenland in earlier times is doubtful, and can only be decided by some happy discovery, because the single points and foreshafts would scarcely be capable of being distinguished from harpoons and *igimaq*'s of harpoon shafts. That there have been far heavier bone-points with fixed, inserted blades has been previously mentioned, and is shown in Fig. 27, *h*, 1, which is drawn on the same scale as the small bone point below.

From the bladder dart figure 27, *i* the development again proceeds in two directions, the terminal points of which give entirely different weapons. With the omittance of the toggling butt of the detachable point of *i* we get the lance with detachable head of the Central Eskimo which has previously been mentioned and illustrated (Fig. 25, *C*). Here, naturally, the bladder, which only impedes its use, is dispensed with. The other extreme characteristic is that the point is not fixed to the shaft, but, by the aid of a long line, to a float which varies in form; in the majority of cases it takes the shape of a great bladder, which with the line lies by itself on the kayak.

The Greenland kayak lance, on the other hand, which occurs also with other tribes, the Central Eskimo for instance, has the blade fixed into the foreshaft (*ipuligaq*, 108) and is in a way a further development of Fig. 27, *h*, 1 with the barbs omitted and the fastening of the shaft altered. The loose lance point has, on the contrary, here become a reserve implement, an accessory to the harpoon shaft (see Fig. 24).

Arrows shot from a bow at birds on land are generally blunt, as the shock alone is sufficient to kill or stun the game. But for shooting sea-fowl the bow is unsuitable, and the arrow is replaced by the bird-dart. For this no bladder is needed, as even the lightest shaft affords sufficient resistance to the diving ability of a bird. As the hunter is always close by in the easily movable kayak, and as in this case he incurs no danger in approaching his prey, the main object of this dart is only to hold the prey fast, and its effective radius is increased by the lateral branches.

On firm ground, from the ice, the bladder no longer has any significance, whether the animal be pursued at the edge of an opening in the ice or under it. Here it is far safer for the hunter to hold on to the line, because here he is in his own element and his superiority over the marine animal is so overwhelming that even such a colossus as the walrus can be caught by a single hunter (see e. g. the excellent figure in Parry, p. 172). Also the movable foreshaft for the thrusting harpoon is a hinderance, and the shaft can be altered for other purposes, especially as a support for the indispensable ice implement the *tôq*.

Should the prey be smaller and weaker, namely a moderately sized fish, the line may even be dispensed with. The point is made fast to the pole and the prey hauled up with this. Here we have the principle of the fish spear, the effective radius of which is increased by doubling or trebling the point. But if the fish is too large and strong, e. g. *Somniosus microcephalus* or *Hippoglossus vulgaris*, thrusting harpoons with lines must also be used.

In considering the development of these types of weapons we have had only the technological view in our minds: adaptation to purpose and use. Here no attempt will be made to explain the chronological development of the implements. It is possible that this has sometimes gone in the same direction, sometimes in the opposite, but as to this we can probably never get any reliable information. All the extreme points mentioned here are practically speaking of the same age and all have been in use at the same period, though not in the same place, because the conditions for hunting differed. Some have now become obsolete, being supplanted by the easier and more effective fire-arms with which civilization has provided the Eskimo, and probably they will all vanish because the modern weapons also affect the stock of game and change its habits. Yet we should like to establish the fact that we have no need to borrow from foreign forms of culture in order to develop all these types and forms of weapons. If the "primeval Eskimo" had had only the idea of a bow and arrow with him when he came to the happy hunting grounds where the whole of his wonderful culture has flourished in full, then he would have had herein a basis sufficient to allow of the development of all that might be of use to him. But, the idea of a bow and arrow, which is a weapon common to all mankind, was I think, conceived in a milder zone.

IX. Other Hunting Implements.

A Sealing net of Whalebone Strings.

As is well known, doubt has prevailed as to whether the net-catching of seal and white whale could have been introduced into Greenland by Europeans, or whether it is indigenous. Formerly the view that net-catching was of European origin found most favour, but, by degrees, so many facts have become known, that the other view now seems to be best founded. The different opinions have been compared by STEENSBY (pp. 64—65). Here only those of greatest importance will be considered.

DAVIS has the peculiar statement about the West Greenlanders: "They make nets to take their fish of the finne of the whales." This statement, however, appears to have been heeded only lately, (by PARRY's quotation of it?). In 1821 PARRY found a net of whalebone at a deserted settlement in Lyon Inlet in the home of the Central Eskimo. In 1843 a sealing net of whalebone is said to have been delivered to the National Museum in Copenhagen from the district of Julianehaab, and it is likely that Inspector HOLBØLL in 1856 refers to this net when he states in his report that about 20 years ago a net of whalebone is said to have been found hanging on an iceberg in the vicinity of Julianehaab. As none of the conditions for Right Whale hunting exist here this net must originally have come from the east coast, and HOLM also relates that in tales he has heard the use of nets of whalebone mentioned. To this may then be added that FABRICIUS (II, p. 248) relates that for hunting Guillemots nets of whalebone were sometimes used.

At Point Barrow, also, the net-catching of seal is carried on on a large scale and even if it is asserted that homogeneous conditions of hunting easily originate homogeneous methods of hunting, if only the means for the accomplishment of this are present, there is one feature in the description of the methods from Point Barrow which speaks somewhat in favour of net-catching being an old invention common to the Eskimo. MURDOCH, in the section "Natural History" in RAY's Report of the International Polar Expedition to Point Barrow, Alaska, Washington, 1885, p. 96, amongst the methods employed for net-catching describes several features which the Greenlanders do not know at all; on the other hand the manner in which the net is set is mentioned: three serial holes, of which the largest is in the centre and through which the net is let down — quite as in Greenland. It is namely not absolutely necessary to do it thus, even if it must be admitted that for nets of a certain size it is the most practical way.

When the Greenlanders are asked their opinion on this question the majority here reply that "the ancients" certainly knew seal nets before the arrival of Europeans, and that the first nets were made of whalebone is a fact known to everyone. As opposed to this Mr. G. KLEIST, who is himself from Julianehaab where nets are not used, objects that if this is so, nets must also be mentioned in the old legends, which he does not remember hearing. As mentioned above it was in old-time tales that HOLM heard about nets from the east coast.

There is hardly any doubt that the use of whalebone for nets ceased immediately colonization began. It was an enormously troublesome task to split the whalebone for nets, and it did not offer the very least advantage over nets of twine; and what is of more significance, whalebone, ever since trade with Greenland began, has always been one of the articles most desired, so that the merchants would quickly see their interests advanced by supplying twine for net-making.

The same argument is not quite so applicable as regards fish lines of whalebone. Even if they were troublesome to produce and fragile in comparison with hemp lines, yet they had certain advantages which the hemp line can never attain. Whalebone does not absorb much water, does not become heavy, is easily dried and does not become rigid from frost, and its peculiar quality of elasticity makes it easier for the fisherman to "feel" a bite in deep water with a line of whalebone than with one of hemp. But none of these advantages is of any consequence with a seal net.

From the foregoing remarks it will be seen that it is exceedingly interesting that a couple of years ago an old seal net of whalebone was found in an old grave at Rode Bay, north of Jakobshavn near Disco Bay. Mr. O. MATHIESEN, manager of the colony in Ritenbenk, who obtained it from the Greenlander in question has kindly presented it to me. I here wish to repeat my thanks for this rare article. It is twisted up into a small bundle. One of the small pebbles which has served as a sinker is still attached. On that side of the bundle which has faced the open air — the net has probably been inserted in a fissure between the stones of the grave — there is an incipient vegetation of lichen-soredia. It is very frail, and I have not dared to try and

Fig. 28. Seal net for use under the ice, of whalebone strings, with one of the sinkers attached.

unfold it entirely. Out of the best preserved part, which was turned downwards, I have carefully got enough unravelled to allow of my seing

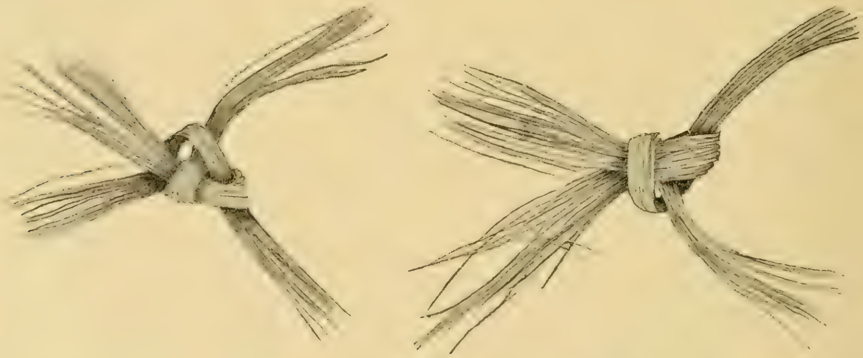


Fig. 29. A knot of the seal net shown in Fig. 28; seen from two sides.

the size of the mesh, which was from 8—10 cm. This is certainly smaller than the size of the mesh of far the greater number of nets made for hunting *Phoca foetida* nowadays. Nevertheless, none of the

Greenlanders to whom I have shown it doubt its having been an ice net for just such hunting as this. The upper rope which is of thin rawhide-line without floats also speaks in favour of this.

The net is made of strings which are not twisted. In each string there are from 20—30 fibres. By soaking a couple of knots (Fig. 29) in warm water with a little alkali added it was seen that the net had been knotted with knots quite identical to those which are in use at the present day; it is therefore made from one long continuous piece of line. That net which Parry found is described as "a curious kind of net having large open meshes of about two inches diameter, and entirely composed of small, strong hoops or rings of whalebone firmly lashed together with thongs of the same material." The measure indicated, "two inches," is certainly absurdly small for a seal net if it is not a misprint, which the expression "large open meshes" might suggest. The method in which it is knotted is, as will be seen, much more primitive than the Greenland method. As regards the net in the museum in Copenhagen, I have not been able to find any information regarding its size or the method of its knotting.

Shooting Screens.

As mentioned above under "methods of hunting on ice" for *aorneq* a small sledge was often used, to which was fixed the shaft of the thrusting harpoon and on the sledge was fastened a small screen, (*tâlutaq*, 351) behind which the hunter could conceal himself. The Greenland tradition says that the idea of this trick is supposed to have originated from watching the Polar bear, which, so the natives insist, sometimes pushes a piece of ice in front of it when it wants to steal upon a seal. Before colonization the screen naturally consisted of thin white skin, now thin linen is always used for the purpose.

When, with the introduction of the rifle *aorneq* fell into disuse, and was succeeded by *ũtorneq*, the sledge had to be re-fashioned for the use of the rifle. This, however, scarcely took place all at once. In E. K. Kane: Arctic Explorations, I, p. 243, a figure is given which is supposed to represent Hans Hendrik, the Greenlander, with shooting sledge and screen. Perhaps the figure has been drawn later, from memory, or else the sledge has been improvised, because, as shown in the figure, it is very unpractical. The form which a sledge with a screen now has seems to be fairly perfect, and is everywhere essentially the same, the small deviations which occur being due to the personal skill or taste of the owner.

The shooting screen must be capable of giving sufficient cover, of being easily pushed forward in a creeping position, of providing a good rest for the rifle at any time, and finally of being easily taken to pieces, so that it can be packed together in a small space on the dog sledge.

The sledge (*qamutaussat*, 129) (Fig. 30) has two runners (*qamutitai*, 129) which are 25—35 cm. in length, 7—10 cm. in height. These runners are furnished with strips of shaggy skin (*perdlait*, 293) to prevent any crackling in the frozen snow. In front the runners terminate in a couple of down-turned crooks (*nigsik*, 247), which have to grip the lower cross-beam of the screen. The runners are connected by two cross-beams (*naput*, 237) and into each of these is mortised a perpendicular piece of wood (*napariussai*, from *napariaq*, 235 and *-ussaq*, 458), with a notch at the top for the rifle-barrel. These two pieces are again connected by a horizontal piece, round the ends of which the lashing which holds the rifle-barrel to the sledge is secured.

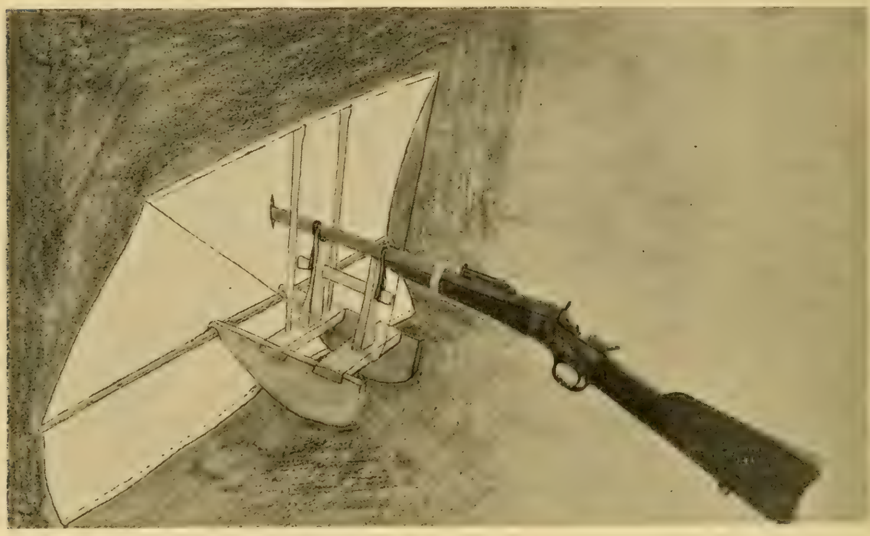


Fig. 30. Shooting screen for seal hunting on ice, mounted on a small sledge and with a rifle attached, ready for use.

For use on ice the screen itself (*tâlutaq*, 351) is 80—100 cm. in width and 40—50 cm. in height. The top edge of this is sewn round a cylindrical cross-beam (*sanerutâ*, 313), the ends of which project slightly, and at the height of about 10—12 cm. from the lower edge a similar cross-beam is attached by some stitches to the back of the screen. That piece of the screen which hangs below the lower cross-beam (*uniakalâ*, Supl. 52) is weighted at its bottom edge by sewing some shot into it. In the centre line of the screen is a vertical slit for the barrel, large enough to allow one to take aim with the rifle.

When the hunter goes out otok-hunting, the shooting sledge is suspended from the cross-beam of the uprights of the dog sledge, while the screen with its stretchers is rolled up and put into a skin casing, which is fastened to one of the uprights. When he arrives on the hunting ground, the rifle is lashed on to the shooting sledge, the lower cross-beam of the screen is attached to the crooks of the sledge, a couple of stretchers (*naparqutai*, 235) with holes at the top are stuck in under the upper cross-beam, their lower, pointed ends being pushed down into a depression in the front cross-beam of the sledge, while the screen is tightened so as to slope slightly backward by an adjustible line, which hooks on to a peg on the hind edge of the sledge.

From this shooting screen (Fig. 30), which is therefore an old invention, but remodelled since the introduction of the rifle, the shooting screen for kayak use (Fig. 31) has developed, which is of rather recent date, but nowadays so common in the northern part of Danish Greenland that hardly a kayak is without it. The screen is built in a similar manner, but is smaller, being about 70 cm. broad and 30 cm. high. In the centre the lower portion is cut out for the fore end of the kayak. Instead of the sledge here is a wooden block with a dovetailed slot which fits the kayak, the fore end of which

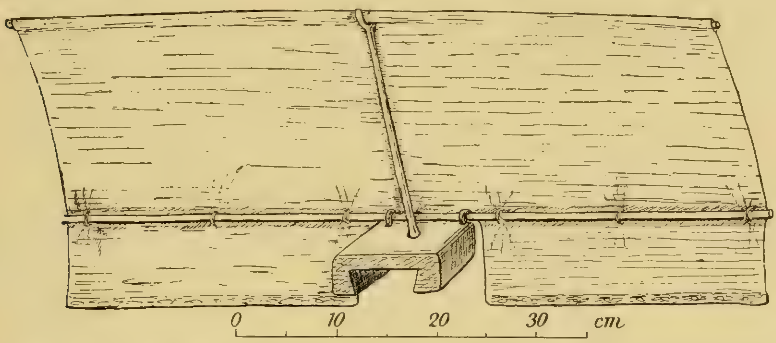


Fig. 31. Shooting screen for kayak, seen from the hunter's place.

in transverse section forms an inverted isosceles triangle. This piece of wood (*tâlutarfik*, place for *tâlutaq*) has on its front edge two hooks which grip the lower cross-beam, on the top there are holes into which one or two stretchers fit tightly, so that a tightening-line can be avoided. The screen therefore is held fast only by the tension of the cross-beams.

This small shooting screen cannot hide the kayak and hunter entirely, but when it is in use the hunter has a white linen blouse outside his other clothes; it only reaches to the middle of his chest. Further he has a white cover for his cap, and in recent times it has become more and more common to paint the skin covering of the kayak with white oil colour, which prevents the skin from absorbing so much water and becoming so heavy and also increases its durability. A white-clad hunter in a white painted kayak with shooting screen may thus, seen from the front, astonishingly resemble a block of ice.

If the wind becomes too strong, so that the shooting screen is in the way, the hunter can rid himself of it by pushing the *tâlutarfik* down with the end of his paddle. Then he picks it up, takes it to pieces, and stows it out of the way. If he wishes it put on in open water it is put together and the lance point is inserted into the rear edge of the *tâlutarfik*; he can then pull it in over the bow of the kayak, and the jerk which is necessary to pull the lance point out is sufficient to fix the piece of wood.

The shooting screen on the kayak has necessitated a new alteration of the latter, viz: the drift rudder, (*aqûta*, 13). It consists of a small piece of wood, 20—30 cm. long the form of which is clearly shown in the figure (Fig. 32). Originally it was simply tied round the stern of the kayak, but the above mentioned family GEISLER here made a small improvement by cutting a couple of incisions in the keel timber of the kayak, before the skin was drawn on. When, during the process of drying, the skin shrinks, a hole for the lashing appears between the skin and that strip of bone which at this point strengthens the

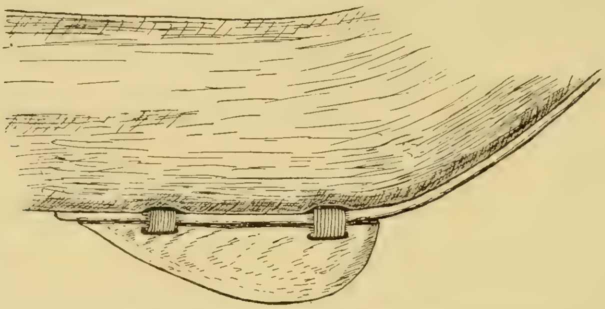


Fig. 32. Drift rudder attached to the keel of the kayak.

kayak, and which acts as the runner when the kayak is pushed across the ice. When one steals upon a seal the rudder has to counteract the effect of the wind catching the shooting screen which may force the kayak out of the desired direction, or it has to counteract the effect of the last stroke of the paddle which would otherwise cause the kayak to veer and render concealment illusory. The lashing is just sufficiently tight to keep the rudder in a vertical position, but not too tight to permit its folding up without breaking when, on landing, the kayak takes the ground.

The Rifle-bag for the kayak.

In the early days which followed the introduction of the rifle, this was carried lying between the legs of the hunter in the kayak, but as the rifle was a muzzle-loader the charge could not be extracted, and by reason of the lack of space in the kayak the rifle had to lie with its barrel pointing backward. This involved numerous accidents, and by degrees the rifle bag (*pôrtaq*, 301[1]) came into existence on the deck of the kayak, which, now, in several districts is enjoined under penalty by the native administration.

The rifle-bag consists of old stiff boat-skin; at its pointed end there is a strap which is buttoned to a small bone-toggle which is secured to a line sewn fast to the deck of the kayak; sometimes a small bone hook is preferred which catches in a small loop. The opening is stiffened with a ring of iron or wood; it rests on a low tripod of wood which has its place under the line-rack, where it is in various ways fixed to one of the cross-straps of the kayak. This tripod has to raise the opening of the bag sufficiently to prevent the sea from washing into it.

In the winter the rifle-bag is removed; it is released from ring and tripod and carried in this form on the dog-sledge, or it is provided

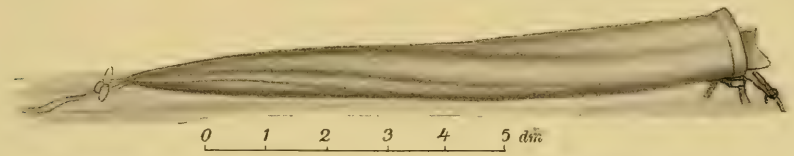


Fig. 33. Rifle-bag with tripod, attached to the deck of the kayak.

with a carrying-strap when the hunter hunts afoot on land or ice. Like everything else the rifle is ordinarily carried with the carrying-strap across the forehead.

Towing Implements and Drags.

Having laid low his prey the Eskimo kayak hunter wants to take it home with him. Birds and fish he puts on the kayak, merely thrusting them under the straps; a small seal is taken home in the same manner if the man is clever and the weather not too bad. But if the seal is large or if the prey consists of walrus or white whale it has to be towed, and for this a set of towing tackle is required.

The object is the same everywhere, namely to fasten the seal to the kayak so securely that it shall not get loose of its own accord, and yet in such a way that the hunter, if he wishes, can free himself of it by a few movements of his hand, at the same time guarding against its loss when loosened, and to secure it in such a position as to offer the least possible resistance in the water, while causing no list of the kayak. Just as the object of the implement is everywhere the same, so is the principle of its construction. But that does not prevent the individual details from varying somewhat ac-

[1] This word was originally used to indicate the skin bag in which the bow was carried in order to protect the sinew backing from getting wetted.

cording to the size of the animal, the conditions of the sea where these implements have to be used, and the personal taste and skill of the user.

As the individual bone pieces naturally are found in ruins and graves, just like all other implements and as they have sometimes been misinterpreted, being conceived as entirely different implements, even as weapons, it will perhaps be appropriate to describe the implement in its entirety. True, FABRICIUS has already done this and done it just as excellently as he has described the weapons, but partly because his drawings are so bad that they are only really comprehensible to one who has some previous knowledge of the subject, and partly because the details and names mentioned in connection with them disagree somewhat with those here at Disco Bay, I prefer to describe the towing tackle as it is most commonly used here.

The complete implement (see Fig. 34) is called *kalutit*, 165. It consists of a heavy rawhide-line 2.5—3 metres long, which carries at both ends a spindle-shaped piece of bone, 12—18 cm. long, the neck-piece (*a*) (*malasiut*, from *malaq*, 198, the front of the neck; in FABRICIUS it is called *mangiʋsiut*) and a semi-globular and sometimes almost disc-shaped bone-block (*b*) which is called *nagtoraq*, 217. What is meant to be understood by this root-word is that something is bent, so that the sea-eagle, from the shape of its beak can be called *nagtoralik*, "the one provided with *nagtoraq*," which might suggest that at other times, or in other places, the implement had quite another form.[1] *Malasiut* and *nagtoraq* are connected in various ways, two of which are shown in the drawing. Generally, however, at least two, and sometimes three, pieces of line connect them.

The one *malasiut* is thrust under the skin and turned cross-wise almost at the upper end of the breast bone, the other is placed in a similar manner right out at the point of the lower jaw, and the two *nagtoraq*-pieces are thrust below the cross straps which cross the deck of the kayak just in front of the man-hole. In order, later, easily to withdraw the *malasiut*, this is provided at the short end with a bit of line (*c*) (*nusugtâ* from *nusugpâ* "he pulls it towards him," 258; in FABRICIUS *nuitsiut* of the same root), which may often be provided with a small bone knob to give a better hold when the line is greasy, or when the mittens are very wet.

Midway along the line are placed two other implements, the navel piece (*d*) *kingugdlersiut*, "that which enters into that which is further back in succession," in Fabricius *ikiûtinguaq*, "a small expedient" and (*e*) *qissugtaussaq*, "the one which resembles that wooden stopple (*qissugtaq*, 150) round which the openings of the large bladder

[1] Even when the *nagtoraq* is not at all bent, but is only a clumsily made block, it is nevertheless known by the same name.

are lashed." The navel piece is here always a hinged toggle of complicated construction, see figure; in Fabricius it is simply a bone staff of similar construction to that of the neck pieces. It is

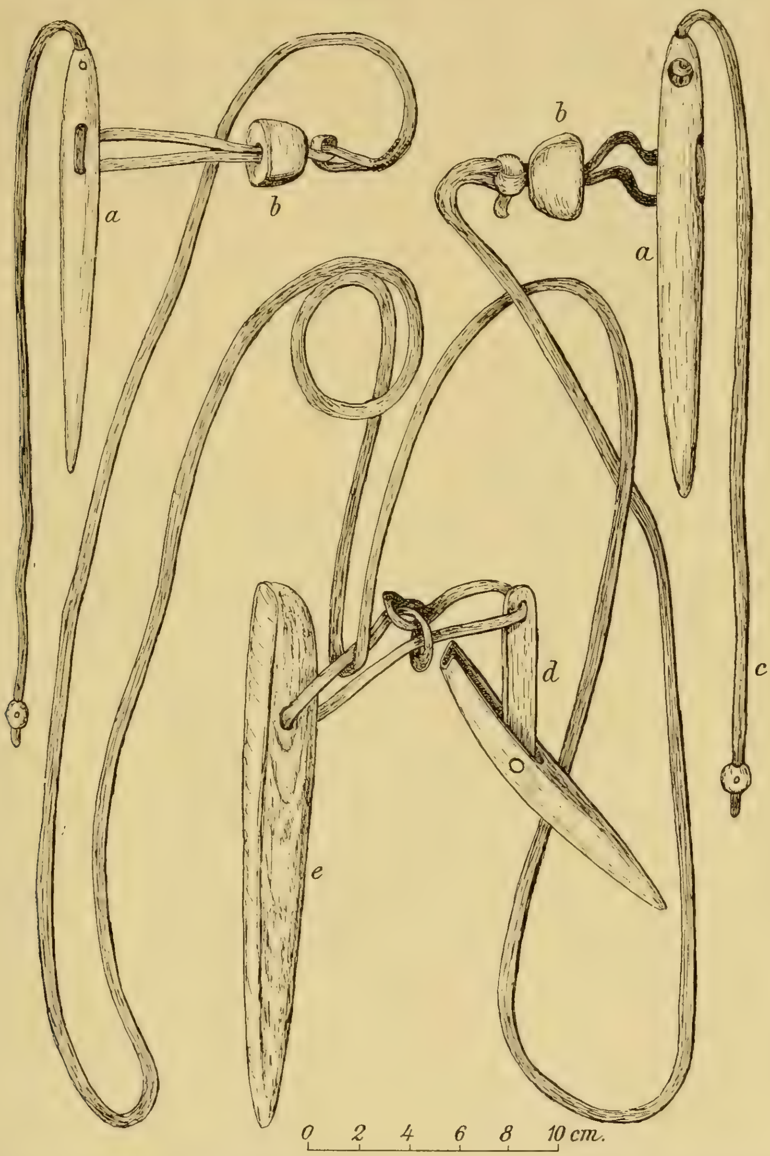


Fig. 34. Implements for towing seal from kayak. For further particulars see text.

thrust under the skin through a small incision at the navel, and the *qissugtaussaq* is placed under the strap behind the hole in the kayak. These two pieces are joined by a small bit of rawhide-line, and the manner in which it is done is sometimes a real puzzle (see figure). *Qissugtaussaq* is sometimes made of wood.

That the weight of the seal shall not cause the kayak to list, and that the hunter may secure himself from loss of the seal by sinking

Fig. 35. *a*, Float to attach to the seal while towing; *b*, seal-drag, used on ice; *c*, detail of toggle of the drag.

in case he should let it loose in order that he may go in pursuit of another, the seal is inflated through its natural openings, or is provided with a towing-bladder, *avataussaq*, 62 (see Fig. 35, *a*). It is frequently made from the stomach of a seal or porpoise. At one end it has a bone-piece, through which the bladder is inflated, *puerfik* (described above p. 153) and in which there is a toggle by which the bladder can be fixed either on the animal direct or between the two straps which connect the chin-piece with the *nagtoraq*. Here this toggle has almost always the form of a *kingugdlersiut*, only it is smaller. At the other end of the bladder there is a piece of line to wrap round it while it lies in the kayak.

When the seal is big an implement resembling that shown in Fig. 35, *b* is frequently used, only it is smaller, and has in particular a shorter line. Then it is called *talerorsiutínguaq* (from *taleroq*, 354, the fore paw of a seal), while the implement shown here is in reality the drag most generally used on the northern part of the west coast to drag the seal over the ice. In this form it is called *orsiut*, 267. It consists of a line about one metre long, which bears at its one end a lance-shaped, well pointed and sharpened needle of bone, which is here called *upássutâ* (probably from the same root as *upagpoq*, 399[1]) and in South Greenland — with the smaller implement — *nuissautâ*, 256. The large front paws of the seal are pierced with this needle and the line drawn through them so that both paws lie between the two pieces of bone at the other end, after which everything else is made fast, and in such a manner that the paws do not offer resistance. When the ice-drag is used the needle, on the other hand, is thrust through the seal's nostrils and out through its eye and the line is drawn after until the toggle at the other end is set cross-wise. This toggle is often simply a piece of bone with a hole in its centre; the one shown here has a particularly ingenious form in as much as it is a combination of two curved pieces, which are joined together at their blunt ends (see Fig. 35, *c*). The pull on the line places it cross-wise, and when it has to be extracted the line is relaxed so that the two pieces can be inclined towards each other, and withdrawn the same way, this saves the whole line having to be hauled back, which would be rendered difficult by the form of the central piece of bone.

The *orsiut* with its bone needle is sometimes also used for stringing fish.

The hunter often carries with him several sets of such towing and dragging tackle.

When the seal is being dragged over the ice a special man's harness is used for the purpose: a large strap of hide which is placed

[1] The root of *upagpoq* is surmised by KLEINSCHMIDT to be the interjection *upâ*! which is used in play with small children who are just beginning to take notice: "See here I am" (formerly I was hidden) or in English "peep-bo!" Consequently *upassutâ*, should signify something like "the one who gets it (the line) to come in sight after it was hidden."

Fig. 36. Details of towing implements and drags found in the earth.

round the forehead or over the breast and shoulder, and has at the back a bone ring of similar form to that used in dog harness, but generally of rather superior finish. A short trace is then attached to this with a bone cross-pin, as with a dog trace, and the other end is made fast to the *orsiut*. *Kalutit*, however, is often used for this, or one is content with *orsiut* alone, and fastens it in some strap or thong.

Fig. 36, *a—e* shows various neck-pieces for *kalutit*. Fig. 36 *a* is of a whale's bone, very substantial and of the same construction as those shown in Fig. 34, *a*. The others have three holes in the centre and there are grooves for the line between two holes on each side alternately. They have been joined to the *nagtoraq*-piece in a slightly different manner in that the line has formed three connecting pieces.[1]

a. A whale's bone, Kronprins Eiland.
b, *c*, *e*. Antler, Hunde Eiland.
d. Antler, Kronprins Eiland.

Fig. 36, *f* and *g* are navel-pieces. In *g* the handle is wanting. Both are of antler; Hunde Eiland.

Mason (pp. 237 sqq.) in his monograph on harpoons, explicitly mentions the peculiar hinged and riveted harpoons for *itsuarneq* and fishing described by Holm from Angmagsalik, and says, very correctly, that as regards their form they are unique in America. Mason then illustrates in his Fig. 23 an implement which he calls "hinged toggle head, East Greenland, after Gustav Holm." The figure is reproduced here (Fig. 37) and it will be seen that it is the navel-piece (*kingugdlersiut*) for a towing outfit, and that it has been more than once repaired by riveting. The figure does not appear in Holm and must be a drawing from a specimen in Washington Museum. It is strange that an implement of this kind can be regarded as a harpoon, because the movable piece, especially after its having been repaired, cannot here be turned far enough to become a prolongation of the handle, nor is it sufficiently pointed and when thrust invariably turns on one side and fails to

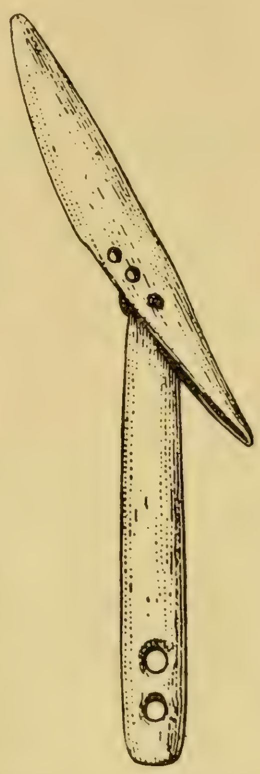


Fig. 37. Copy of a figure of a *kingugdlersuit* which Mason has erroneously published as a harpoon for *itsuarneq*. From East Greenland (After O. T. Mason).

[1] Swenander has amongst his harpoons an odd form where the line has been fastened with a knot in the harpoon itself and has afterwards passed through three serial holes with grooves on the sides alternately. Perhaps it is a *malasiut* which has been hastily (for *savssarneq*?) converted into a thrusting harpoon.

penetrate. A single glance at the harpoons excellently figured on HOLM's Table XVI, and described by him, will convince one that these are quite differently constructed.

Nevertheless, THALBITZER has made the same mistake. In Figs. 79 and 80 he has illustrated two navel-pieces from West Greenland and calls them "toggle harpoons for sealing or salmon spearing on ice," and on p. 355 the author states, in consequence, that the peculiar *itsuarneq*-harpoons of the Angmagsaliks have also been employed in West Greenland. But THALBITZER's figures show a couple of quite normal navel-pieces which could not possibly be used as harpoons. On the one the handle is curved and on the other it is so long and thin that it would immediately break when thrust into the prey.

The same author shows in his Fig. 81 the little hinged toggle which is fixed in the towing-bladder, but as regards this he says: "It can hardly have been used as a harpoon, but must have been employed to hold a sealskin float in the kayak." This explanation is equally strange. A hunter who attached his buoy to his kayak with such an automatically acting toggle would incur certain death.

Fig. 36, *h* is a *qissugtaussak* of wood; *i* a *upássut* of bone, remarkable for the little tenon which has to be spliced into the line. Authors sometimes call *upássut*-pieces "needles for stringing fish" and they can, ofcourse, also be used for this purpose. A needle which is specially made for this is generally not nearly so strong, and has no need to be so. Fig. 36, *j* is an undivided toggle for the rear end of an ice-drag. The hole is advanced close towards the one end, in order that the toggle may be more easily turned on one side when it has to be extracted.

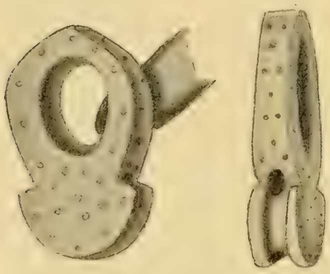


Fig. 38. An *orseq*, for a man's harness for dragging seal across the ice; side view and half-face view.

h—j. Hunde Eiland.

Fig. 38 shows a harness-ring, (*orseq*, 267) of ivory for a man's harness, from Kronprins Eiland. It is ornamented with some irregularly drilled holes. The hole for the toggle is large and rounded at the edges. The line-hole is specially complicated: care has been taken that there shall be a sufficient thickness of material; the splice is concealed below high edges, so that the toggle gets a free and smooth surface of bone upon which to turn. I do not hesitate to declare that this would be the strongest and most appropriate form of construction which an *orseq* for use with sledges could have; but I am told that no Greenlander would put so much into the making of an entire set of harness-rings for dog harness.

X. Man's Tools.

The Bow-drill.

The most important and most indispensable of the tools belonging to the Eskimo man are the knife and the bow-drill. They can be produced everywhere in the Arctic from the materials which are found or can be procured there: stone, bone and rawhide. The first Eskimo, who in primeval times came to the Arctic Sea, may have brought with him metals from happier regions, but when these were worn out a substitute could only be procured by lucky chance from wrecks or from meteoric, and in a single district in West Greenland, telluric iron. But these chances were so rare that they could not be depended on, and therefore we see stone implements employed on a large scale, even in the districts here in Disco Bay where telluric iron is found.

Not only are all the larger and smaller holes required by the implements for riveting, joining with bone nails, sewing with sinews and lashing with rawhide lines produced with the bow-drill, but also the row of holes which are preliminary to the separation of the small pieces of bone required from the large pieces. In a slightly altered form it is used to produce fire. With bow-drill and knife made from elementary materials all the complicated hunting weapons, vessels and sledges, harness, household articles and instruments for the dressing of skins for clothing can be produced.

Even to this day the cleverest and most expert workers in bone, wood and soapstone use the bow-drill, and often prefer it to European instruments which they could easily obtain if they would. Now, of course, the point itself is of iron or steel. The instrument consists of the handle (*niggit*, 250) — a piece of curved bone about a foot long, and generally of antler. In each end is a hole in which is fixed that piece of line which has to set the boring shaft in rotation. The drill, that is to say the point itself, (*niortût*, 250) which formerly consisted of bone or stone, is fixed in a shaft of wood or bone 15—20 cm. long. In the first instance this is often provided with a bone button at the upper end, in order here to lessen wear and friction. In order to guide the boring shaft and to give it the necessary pressure, a small piece with a hollow in which the upper end of it revolves is used. There is now always a casting of lead in the mouth-piece in order to lessen the friction, so that the specially required bone from the foot of a Caribou is no longer needed, and the upper end of boring shafts need no longer be capped with bone. This piece, which is held between the front teeth, (*oqûmiâ*, 266 or *kingmiâ*, 186) is often a special bone, of suitable shape, from the foot of a Caribou, but is often, also, a bone[1] fashioned for the purpose. Fig. 39 shows handle, mouth-piece and bone point; all of antler, Hunde Eiland.

Knives.

The word *savik*, 316, common to all Eskimo, everywhere means both iron and knife, a man's knife in particular. The question is, which meaning is the older. The idea that *savik* originally meant "something cutting" consequently "knife" is supported by KLEINSCHMIDT in his well-known dictionary, and as KLEINSCHMIDT indisputably is that author who has had the most profound understanding of the Eskimo language it might seem bold to hold other views. It seems to me, however, that the following circumstances speak in favour of the idea that *savik* originally meant iron.

1. In most of the derivatives of the word mentioned by KLEINSCHMIDT it is the iron and not something cutting which is thought of.

2. In the place-names which are generally very old words, and often contain archaic roots incomprehensible to the present generation, *savik* or forms of it are often found to be a designation for places where there is meteoric or telluric iron, but never for places where a special abundance of material for stone knives exists.

3. With implements and weapons where a cutting blade of harder material is inserted (arrows, harpoons, lances, etc.), for instance a blade of ivory, stone or metal, this blade is never called "*savia*" but always "*ulua*," so that the primary signification of "something cutting" seems to be the *ulo* which now is the designation of the woman's knife.

Fig. 39. Handle, mouth-piece and bone point of bow-drill.

[1] RYDER shows in his Fig. 22 a fragment of an implement from East Greenland which he understands to be the handle of a bow-drill. This however is scarcely correct. The line has gone out through a hole at the end of the piece and the edges of the bone hereabouts are rounded off, so that there is the least possible difference in thickness between the bone-piece and the line. All this is characteristic of a *pâguaq*, the side of the angle beneath the buoy. In the bow-drill this construction would be useless, and even detrimental to the line, here the holes are bored transversely near the end. I mention this because the V formed *pâguaq* used at Disco Bay is not mentioned by HOLM from Angmagsalik, while another implement also found on the bladders from South Greenland is indicated (Tab. XIV.).

4. Ancient appellations are to be found for the oldest, genuine forms of knives, stone knives in particular, and in them the word *savik* or derivations therefrom do not occur, for instance *sánat*, *sánardlit*; ancient implements resembling knives are likewise given appellations in which *savik* is not included, for instance that knife-like implement for removing ice from the kayak: *sermîaut* and the snow knife: *pana*, etc.

5. Newly formed words, also, are interesting in this connection, as they show the idea that lies at the back of them. In this way is formed the word *savequtâ* (some iron which is placed on a thing so that it is an essential or integral part of this, or some iron which makes the thing just what it is) from *savik* and the suffix *-qut*, 425. It is, for instance, the common term for the gun-lock, but it may also signify the engine in a steamer or motor-boat. In the latter meaning the form usually heard here is *savequtaussai*, in which, in addition, the suffix *-ussaq*, 458, (something which resembles a thing or is supposed to be a thing) is adopted, so that a fair rendering of the word would now be: "the pieces of iron applied to it which are so essential to it that they just make it into what it is."[1]

On the other hand a scythe is called *kivdlût* from *kivdlorpai*, 183, "he cuts a piece off the length of several simultaneously."

Nor does the fact of the name of the metal being transferred to the man's knife militate against this conception, because it has been beyond doubt first employed for this, just as there is no doubt that if we should deprive our present-day Greenlander of iron, the deprivation would nowhere be felt so keenly as in the production of a knife with which to make the rest of the implements.

How a stone knife was manipulated by the Eskimo.

In my collection of stone implements from West Greenland there is a considerable number of knives of all possible dimensions, ranging right down to tiny knives of rock crystal, which, according to the tradition among Greenlanders at Disco Bay are assumed to have been used for cutting boils. Some have a single-edged, others a double-edged blade, and there are, as with the other stone-implements (harpoon and lance-points, etc.), both polished and unpolished forms amongst them. As, however, I lack literary aid in this respect, I prefer to postpone the description of these things to some other occasion, and here to content

[1] It must not be thought that *savequtâ* has become a fixed term for the gun-lock and *savequtaussai* ditto for a boat-motor. No, the derivation given above is apprehended and understood by the Greenlanders of today just at the moment the word is spoken, but he can only understand the signification of it — for instance the one given here as an example — from the context of the conversation.

myself with describing their bone-handles, together with the manner in which these were employed. Just as it is true that the access to iron has been of epoch-making significance to the Eskimo, as to all other primitive people, and that the possession of iron has improved his implements and given him a step forward in civilization, so is it certain that all the essential and characteristic features of Eskimo culture have developed without the help of iron, for which reason, also, Eskimo culture, better than any other form of culture is adapted to serve as a basis for the study of the culture of those people of the stone-age who lived in Central Europe under climatic conditions corresponding with those of the Arctic regions of the present day.

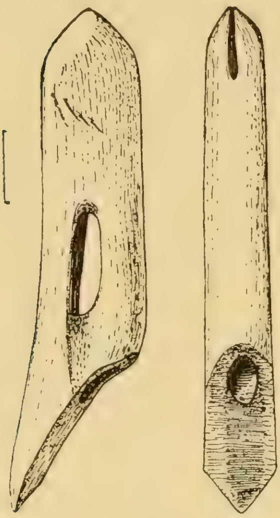


Fig. 40. Harpoon from West Greenland which MASON, on account of its form and regular execution, considers was made by machinery and imported: in reality it is a very old form and has even had a stone blade (After O. T. MASON).

In the literature it is not unusual to find the significance of iron overrated, or to find doubt expressed as to the possibility of this or that having been made with stone implements. As one example amongst many I shall choose one which closely touches this subject. MASON, in his often quoted book, frequently mentions machine-made harpoons which are first sold to the American Eskimo and afterwards bought by travellers, and finally piled up in museums to the despair of the investigator. Also, he fairly often uses the word "machine-made" about West Greenland harpoons. But, the fact is, there has never been any trade in ready-made harpoons in Greenland (not even the blades being sold in prepared condition), and I greatly doubt whether it would be possible to satisfy the individual demands as regards execution which would arise; the number of these would certainly coincide with that of the hunters. But the author is quite on the wrong track as regards what is old and what is new, when West Greenland harpoons are in question. Specimens are figured and stated in his book as being very old, but from their form they might just as well have been used at the present day as in past days. I allow myself to reproduce one of MASON's figures here, (Fig. 40) and to quote his report of it (p. 240).

"A modern toggle head of a whale harpoon from Greenland is seen in fig. 25. This unfinished specimen shows the last step in the development of the machine-made toggle head. Everything about the specimen demonstrates this: the mathematical form, the saw cut for the blade, the socket for the foreshaft, the angular barb, and especially the large line hole cut straight across the body of the toggle head. In the primitive examples this last feature cost the maker a great deal of trouble. He had to bore two holes slanting toward each other and meeting inside, to unite these by removing the rough surface, and to separately prepare grooves to receive the line."

The latter remark I do not understand, as it would seem that the complicated holes and grooves could be produced more easily with the help of machinery than with the Eskimo's primitive tools, so that even if the importance attaching to the various forms of the line holes was not comprehended, yet, at least, the less complicated form would have to be considered as being the more primitive one. But that the author's judgement in this matter is not wholly trustworthy appears from the fact, that this harpoon, notwithstanding the beauty and perfection of its execution is a thrusting harpoon (*kapissiniut*) of ancient form, and one which has actually had a stone blade! There is no rivet hole and if nothing more can be seen on the specimen in question than is to be seen on the drawing, I do not hesitate to declare that it may well have been made with stone tools.

If a man took an old stone knife and started cutting a walrus tooth with it in the same manner as he sharpens his pencil with a pen-knife it would be a most tedious task indeed before a harpoon was turned out. Even if the Eskimo had more time as well as more patience than we, I think, nevertheless, that he would hesitate before he began. But the Eskimo had another and more effective method of working. From the above statement by Mason, and from similar statements by other authors, I must presume that this method of working is not known at all, but neither my own knowledge nor the literature which I here have at my disposal allows me to speak with certainty regarding this point. Amongst the Greenlanders, however, the working method of the stone knife is not only well known, but the method itself and the grips are used to this very day; the old method from the stone-age has as a matter of course been found practical for, and has been converted to the use of the modern steel knife, and it is dispensed with only when a vice, a file and half a dozen other up to date tools can be afforded.

Before describing this method we must consider the handles of some knives which together with the bow-drill have been used as universal tools for the production from bone and wood of weapons and various parts of instruments.

Fig. 41 shows five different bone-handles for stone knives. Fig. 41, *A* is of antler, somewhat unfinished. At the one end an oval hole

Fig. 41. Five specimens of *sanardlit* from Disco Bay.
A, Handle of antler with deep, oblong socket for the blade, less deeply rounded socket for the guiding stick in the rear end. *B* is a similar handle of greatly weathered ivory. *C*, *D* and *E* of antler, have notches cut in them for lashing to the guiding stick. The stone blades have not been found together with the handles, but, from a large collection of blades, some which fitted into the existing sockets have been inserted according to the directions of a Greenlander. In *A*, *C* and *D* the blades are of greyish blue porcelain jasper; in *E* a double-edged piece of red and white stripped agate has been inserted into the very narrow, and only $1/2$ mm. deep, groove at the edge. The last knife-form has been used as an instrument partly for finishing large carvings and partly for the fashioning of lashes, lines, etc. from rawhide thongs.

has been bored for the blade and at the other there is a socket which is not deep, but well rounded at the edges, the importance of which we shall see later. On the one side are a couple of crescent-shaped incisions, which may be ornaments, but perhaps are there only to give a firmer grip for the hand. Disco Fjord.

Fig. 41, *B* is quite of the same type, but it is greatly weathered, flaky and fragile. Walrus tusk. Disco Fjord.

Fig. 41, *C* is quite another type. In the upper end is found the usual rather large hole for the end of the stone knife. It is oblong in transverse section and is made by boring. The other end is cut obliquely in two parallel cuts which do not lie in the same plane, but are connected by a notch cut like a step. The upper end of the shaft is well rounded and slightly constricted, in transverse section elliptical, and here a hole for fastening a piece of line is made at the edge. Antler, Disco Fjord.

Fig. 41, *D* most probably is the same type, but not so well preserved, most of the lower, slanting surface being wanting. There is no hole for the line, but there may have been one lower down. Disco Fjord.

Fig. 41, *E* again is a new type. Here also we have the bevelled surface in two steps, on the upper are still distinctly seen the marks of the instrument with which it has been fashioned, and here it is easy to see that it has been scraped with a stone. The traces are slightly rounded grooves, just as they would be if the work were done with the rounded edge originating from the conchoidal fracture in the stone. The lower surface is only partially preserved. Just above the upper bevelled surface there is a piece elliptical in transverse section and a hand's breadth in length, and here we have a line hole which goes straight through it. Above this handgrip the bone becomes considerably narrower, gets the form almost of a knife-blade and on the thinnest edge there is quite a narrow groove produced by scraping which is not a full millimetre broad nor much deeper.

Antler, Disco Fjord.

In a finished state, and therefore with a blade of stone inserted, these knives are here called *sanardlit*, plural *sanardlisit*. This word is not to be found in KLEINSCHMIDT's dictionary. It is formed from the verb *sanavâ*, 311 "he manipulates it" viz., "he cuts out" analogous with the word *sitdlit* "a whetstone" from *silivâ* "he whets it." On the other hand KLEINSCHMIDT has another word *sánat* from the same root, which he translates "a narrow long-handled knife which is sharpened from one side and slightly curved at its point (and is the Greenlander's principal tool)."

When working with *sanardlit* of the types C, D, E the bevelled end of the handle was lashed to a stick 20—30 cm. long and fashioned in the same manner. The lower end of this stick was fitted either into a small niche in the side-wall of the house or into the post exactly opposite the platform or sleeping bench; or else it fitted into a piece of hollowed wood, bone or a piece of old skin, which, with a righthanded person, was lashed round the right leg just above the knee (*serqorut*, from *serqaq* a knee). The right hand grips the handle and the knife now works in a manner half cutting and half scraping towards the worker. If the piece which is being manipulated is long enough, it is held with the left hand in such a way that its ends are supported by the left leg and the chest or chin respectively. If the piece is small, a harpoon for instance, the left hand would tire of holding it between the fingers, and it is therefore lashed in two places to a stick of suitable length, and the lashing is moved, little by little, as the work proceeds. When the cutting edge has become blunt, the piece of work is laid aside, and the knife is sharpened by means of the same grip and movement against a whetstone, which is now held in the left hand; it being understood, of course, that the edge consists of a material which can be whetted: slate or porcelain-jasper.

I invite the reader himself to try this working position; a European pocket-knife lashed to a stick can be used, and better still the half of a pair of scissors, the edge of which more resembles the edge of the stone knife or that of the Greenlander's iron knife. The reader will then be able to convince himself that the position for working and the method not only do not cause fatigue but are also effective, and in a high degree condusive to accurate workmanship. [1]

Nowadays the *sanardlit* or *sánat* of the West Greenlanders naturally differ somewhat in appearance. Poor people are satisfied with a blade consisting of a piece of hoop-iron, tapering towards the fore end, and turned slightly upwards at the apex. Those who are better off can afford a steel blade which has originally been intended for something else, for instance, a butcher's knife, the fore end of which is fashioned according to requirement. This blade is lashed to a semi-cylindrical shaft, 40—50 cm. in length, so that the sharply ground and bent part protrudes. The hinder part of the shaft may be fashioned in various ways, most frequently it is rounded, so that it does not wear and tear the trousers at the knee. For nowadays men rarely sit indoors without trousers on while working, and knee-protectors (*serqorut*) are very rarely used, while formerly they were a necessity, because the naked knee would otherwise have been galled.

[1] When a European boot-maker has to trim the edge of a boot-sole of thick and hard leather, he holds the boot on his left knee, and supports it with his

Consequently, the knife-blade, as far as its working part is concerned, now resembles the crooked carving knife of the other Eskimo tribes and of the North American Indians of our day.

For the handles *A*—*D*, the lanceolate, double-edged knives are mostly used, which in museum catalogues and archæological publications are often called "arrow-points." For the handle *E*, on the other hand, the sharp two-edged flakes of rock-crystal, chalcedon and jasper are used, and this, in transverse section, forms an isoscele triangle with very obtuse epical angle. In my collection there are several specimens which in a length of 3—4 cm. are only 5—6 mm. broad. The one edge of the flake is fixed in the socket of the bone shaft, where it is secured only by pressure against the elastic rim of bone, or, if necessary, with a couple of lashings with thread at the ends, or also with a kind of putty made of blood, oxidized lamp-oil and soot. Such flakes can be as sharp as razors, but the edge is naturally not particularly durable; they are used on hard materials for the final dressing and polishing only. The flakes are principally used for such work as the fashioning of whip-lashes and laces for boots or clothes, where it is, on the whole, a question of the rawhide being well rounded without loss of strength. The finished rawhide-line of the skin of the bearded seal is trapezoid in transverse section and rather hard and stiff, and here the edges are removed by a sort of planing, so that the transverse section becomes elliptical or round; but very sharp knives are required for this.

The knife-handles which are not cut aslant at the end, but which in place of this have a socket, were a sort of hand-knife intended mostly for the man's minor works in skin: for fashioning thongs, traces, etc., or for cutting; but they might also be used for carving. The guiding-stick was then merely pointed at both ends, the one end just being inserted in the socket of the handle; but its stability was not so good, which would be noticed especially in large carvings, though it had this advantage that by slight movements of the hand the blade could be placed at a slight angle to the longitudinal lie of the guiding-stick. If it could be afforded both forms would be kept.

Holm, in his table XVIII, has seven knives with stone blades, of which six are short and lanceolate while the seventh is longer with the shape of an oleander-leaf. A couple of the shafts are broken, and it cannot be seen from any of the others that they have been

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left hand and chin. The knife is held in the right hand, the right forearm rests on the right knee, and the cutting motion comes from his lifting his right heel off the ground. It is, then, a method of working which has this in common with the method described, that the knife is guided by something more than the mere hand.

so adjusted that they could be used with the guiding-stick. A couple of them, the two furthest to the right might, however, perhaps have been used in this manner.

BOAS illustrates from Aivilik a couple of double-edged stone knives (Fig. 125) set in bone handles prolonged with wood. From the form of this prolongation it would seem that they might suitably be lashed to a guiding-stick. The same author has in his Fig. 90 the bone handle for a *sanardlit* of the type Fig. 41, E with a small groove for the insertion of a sharp-edged flake. This handle also is cut aslant below, but not in the same plane as mine is, and has a number of holes which presumably have been used for fastening to the guiding-stick, but whether with nails or lashings cannot be seen from the figure.

Fig. 42 firstly shows four old handles for man's knives for free-hand carving.

A is from the bone of a whale (?), here the blade still remains, it is of iron and fastened with a copper nail. It is worthy of notice that the blade is not fastened in a slit or kerf, but in a narrow, bored out socket, so that the bone has retained its full strength. Disco Fjord.

B is of antler, the blade has been of iron, and has been fastened with two nails; the slit for it has been sawed. Sarqaq.

C is a long, rather thin, slightly curved, pentagonal handle of antler. The blade has been fastened in a rather large socket without the aid of a nail. Save for the presence of rust, the idea of a stone blade would suggest itself absolutely, but in all probability the blade has been a piece of unforged telluric iron. Later, by oxidation of the iron and by desiccation, the bone has split from the socket downwards. Possibly this has been the handle for a *sanardlit*. Disco Fjord.

D is a small knife-handle which broke when the socket for the blade was bored. It is decorated with the dot and circle ornamentation[1] known in so many districts and cultures. MASON (p. 296) says "this decoration, wherever found, is an emblem of the existence of steel tools." This is not strictly accurate. Very few pieces of flint or chalcedony need be chipped off before one finds a piece which, when turned can produce beautiful dots and circles in bone. But as a rule it happens that these figures do differ somewhat from those which are produced with steel tools, because the grooves and ridges are rounded, owing to the instrument being blunt. A sharp steel drill produces sharp edges and he who has steel instruments understands

[1] As regards the occurrence of this ornamentation in primitive art, see in addition, HOFFMANN's observations in "The Graphic Art of the Eskimo," pp. 800 sqq.

Fig. 42. *A—D*, Handles for man's knives; *E*, wooden handle probably for awl; *F—I*, knives of European origin found in the earth; *J*, richly carved handle for a knife, found in an Eskimo grave, but of European workmanship.

also how to sharpen them and does not purposely work with blunt instruments. Disco Fjord.

E is a wooden handle, probably for an awl. Above, sinew thread has been wound round it. Sarqaq.

F, *G*, *H*, *I* are knife blades of European manufacture, but found in graves together with other antiquities. The handle of *F* is thought to be of European manufacture, while the handle of the others are of local manufacture. *G* has a dot and circle ornamentation, which, here, is undoubtedly made with a steel instrument. The hollows are defined with quite sharp edges, and the fact of the bone not being quite plane has not troubled the maker in the execution of his ornamentation. All from Sarqaq.

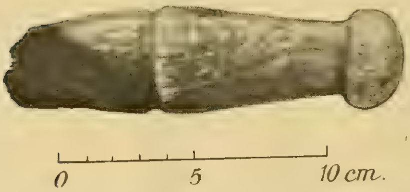

Fig. 43. Wooden handle which has had a blade at its rear end, and which has been lashed at its centre to a shaft and then served as an adze.

J is a richly ornamented handle for a knife, from a grave at Disco Fjord. The tang of the blade has gone right through it. It has been furnished with a ring, and the wood appears to be of oak. The carving which is very regular has no doubt been produced by turning. In short, the handle is of European (Norwegian?) workmanship, and has come here before the era of christianity.

Fig. 43 is the wooden handle probably of an adze.

Edge protectors.

Fig. 44 shows a couple of instruments which, so far as is known, have not been previously mentioned, and are not known either to

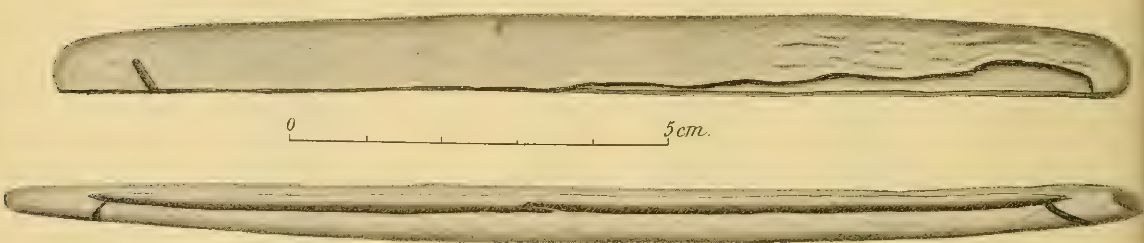

Fig. 44. Two pieces of wood intended for fastening on to adzes to protect the edges when travelling.

everybody here. They are narrow pieces of wood, oval in transverse section, with a deep groove in one side. At each end of the groove there is a small hole, and from this a small slit is directed obliquely upwards towards the side which has the deep groove. They were used to protect the edge of the adze during Caribou-hunting or other lengthy expeditions, and were made fast with straps of sinew thread. This object is to be found figured in Parry (p. 548), from the Central Eskimo. From the neighbourhood of Godthaab, also, I have seen similar old specimens in the possession of another collector. Here they are called *íkússivia*, formed from the verb *íkúpa*, 81, "he mortises or fits something into something else in such a way that it entirely fills the hole" and the termination — *vik* "the spot where this takes place," *ulimáutip* "of the adze" being implied herewith. Sarqaq.

XI. Woman's Tools and Household Implements.

The Ulo or Woman's Knife.

The most important implement of the Eskimo women is the Ulo — a knife with a curved blade. She uses it for cutting up and quartering game, and for cutting skins for the purpose of making clothing and foot-wear; in short, she uses it for everything. It serves her in the same way as the various large and small knives and scissors serve the European housewife. Therefore it is natural that such an important implement should have great interest for collectors and ethnographers. Specimens from all tribes have been brought home, and on the basis of the rich collections in the Washington Museum, supplemented by copies of some of G. Holm's figures of East Greenland forms, O. T. Mason has published a monograph on this implement with illustrations of about 75 specimens. Mason points out that the Ulo is almost as ancient as human culture — that, for instance, old Egyptian reliefs exist upon which a worker in leather is shown cutting skin with an Ulo exactly similar to that used by the Eskimo. He furthermore, and justly, points out that from the same Eskimo districts implements are found which differ in completeness a circumstance due without doubt to the individual ability or personality of the maker, and he also states that the influence of the white man has crept in to complicate the question. In his resumé the author makes (p. 412) the significant statement "In form alone the specimens from each typical area are unique. So much so that one who has handled a great many of them finds no difficulty in relegating a stray example to its proper companionships."

But even in Mason's first table, where he reproduces copies of some of Holm's figures from Angmagsalik, forms can be found which are comparable to the type specified by Mason as being characteristic of Mackenzie River. Mason solves this problem by stating that both show the result of contact with European whalers and fur traders. It is Nos. 4—6 in my Fig. 45 to which I here refer. But Holm has a type which MASON has not reproduced; in the present work it is figured in Fig. 45, No. 3 and corresponds with MASON's type from South Alaska: indeed from each individual district from which a series of specimens of ancient and recent times is forthcoming we can demonstrate all MASON's types, and thereby fully establish the inaccuracy of his deduction. And again his explanation of the influence of European whalers and traders on the forms from Angmagsalik cannot be accepted without question, as it is well known that such an influence had not been exerted there at the time when HOLM visited it.

We must therefore try to arrive at an understanding of the forms in some other way. By following our ordinary method we apparently get no further, as at the outset the first question "What is the object of the implement?" is not so readily answered, since the objects are so manifold; the implement before us being one for universal employment.

Hence, the question must be approached in a somewhat roundabout manner. We find that wherever the white man appears and establishes a regular trade with the Eskimo, a type of Ulo of a distinct form arises, shown in Fig. 45, 1, and it is immaterial which Eskimo tribe is under consideration, and also by whom the implements were supplied. For it is of course not the purveyor who decides how the article is to be fashioned, but the buyer or consumer, in this case the Eskimo woman. We can solely on this account designate this form as the ideal form; and all other forms are thus only attempts at reaching the ideal form which are more or less successful according to the possibility of access to suitable materials. On the other hand, the most primitive forms, produced before iron was accessible, are everywhere the same..

We will now try to get to the bottom of the purpose of the Ulo, especially in its ideal form, and request, for example, a skilled West Greenland housewife to cut up and quarter a seal in our presence, asking that it be done "in the proper manner." This little addition will cause her to place the seal on her newly-scoured wooden floor, and to put on her Sunday clothes. The sleeves of her newly-washed, gaily-coloured jacket of European stuff are rolled up above the elbow, her long boots of coloured skin have on the front fine embroidered ornaments of bits of coloured skin, and if she be young and unmarried she has round her knee a broad piece of fine white linen embroidered with coloured silk. It is now her aim to demonstrate that the whole of the cutting up and the quartering of the big animal can be accomplished without staining her garments with blood. We shall witness a work of dissection where each separate incision gives proof of the experience of generations, handed down from mother to daughter. The Ulo used is the ideal form bought ready-made in the shop, and very sharp. It is held in such a manner that the handle comes out between the third and fourth fingers.

The seal is laid on its back in the middle of the floor. With one single stroke, hide and blubber is cut through, in the mid line from the anus to the tip of the lower jaw. Seizing the edge with the left hand, the blubber is peeled from the muscle on the belly, the side and round to the middle line of the back, first on one and then on the other side. Now and then an incision is made in the muscle, with a stroke of the corner of the Ulo, so that one finger can grasp and support the body of the animal, while it, as it were, rolls out of the blubber. When the woman gets to the fore-limbs, she grasps the paw, makes a circular cut round the joint and breaks it, so that the paw remains in the skin. The belly is opened, and the intestines, stomach and smaller adhering organs are removed, with the exception of the liver. A piece of the rectum together with the urethra is left behind temporarily; the breast-bone is cut out by means of two parallel cuts, the Ulo being held so that it makes a rift with the corner rather than a proper cut. The lungs and liver are then removed, the heart is opened, the blood flows out into the breast and belly cavities and is scooped up in the palms of the hands which are held together. The chest is scored with the corner of the Ulo on the inside across the middle line of the ribs and is there broken. Then both sides are loosened along the backbone and the four flat pieces are now cut up into smaller pieces with two or three ribs in each, according to the size of the animal. Each "piece" is a share, but that is no hindrance to having more than one helping at a meal. The hindpaws are cut off like the forepaws; the pubic symphysis is cut through and the rectum and urethra are taken out. The pelvis is cut into "pieces," the back pieces having the kidneys attached, and the limbs are likewise cut up. When the back is divided up to the neck, the gullet and the windpipe are removed; also the head is flayed out, all but a tiny shred about the nostrils and whiskers. At last the masticatory muscles are cut through and the lower jaw broken off.

Intestines, stomach, blood and lungs are removed at once; the liver, as well as the numerous "pieces" of meat are left on the blubber till the quartering is completed. The woman keeps standing on her feet at the same side of the animal during the entire performance.

When thus in the course of 15—20 minutes the intestines and the blood of the seal have been taken out, and the flesh divided and removed, as well as the head and paws, the skin with the blubber attached is still left. Now the woman takes an edge of the skin between her front teeth, and the Ulo is forced down with its entire cutting edge, between blubber and skin while the left hand, with parted fingers, follows on the hairy side, and there ensures that the skin touches the entire blade of the knife, and yet prevents the pointed corners of the blade being caught in the skin and cutting holes in it. By a few peeling strokes from the edges towards the centre the blubber is loosened and then lies in one lump on the skin. Both skin and blubber are removed, and there is a wet spot on the floor, where the skin has been, but neither blood nor grease-spots.[1] The woman's hands are blood-stained and greasy to the middle of her forearm, but her garments and her boots are unstained.

During this performance the Ulo has executed a series of different movements and fulfilled many functions, viz. cutting movements, by pulling backwards and forwards, where sometimes the middle of the curve, sometimes half the edge, sometimes only the part next to the point has worked; scoring movements over the bones and ligaments, which later on have to be broken or torn; the making of holes in muscles or blubber in order to provide a grip for the left hand; and peeling movements, where the entire edge is forced through; but never rocking and forcing movements such as those made by the curved knife in a European kitchen. All these movements and functions depend upon the following facts: — that the handle gives a firm and secure grip, even when it is besmeared with blood and grease; that its length is equal to the width of the hand; that the cutting edge is sharp; and that its length slightly exceeds that of the handle, to allow freedom for the hand and a space between the handle and the cutting edge; and yet not so large a space that it prevents the Ulo from being turned in a narrow place, for instance in the inside of the animal. Only when the blade is fixed to the handle by a single slender stem, can the pliability of the wrist be fully utilized. During the removal of the blubber the blade must if possible lie level with the skin, therefore it is preferable for the stem to be in one piece with the blade and not riveted to it; in addition to this the blade must have a certain width between its curve and the stem, so as to produce an adequate surface for the use of the left hand.

When later on the skin is being prepared for clothing, the Ulo is used to scrape off the last remnants of fat. The upper edge of the skin is held with the left hand, the lower with the foot. For this

[1] If, however, the heart was damaged during the capture, all the blood collects in the thoracic cavity, and then it may be rather difficult to prevent some of it from trickling out upon the floor.

purpose the cutting edge of the Ulo must be blunt as the blade is pressed with force against the skin, and forms a considerably larger angle with it than during the removal of the blubber. For this purpose a special implement is often used, which may resemble an old-fashioned Ulo, *kiliortût*, 177, (see Fig. 47, F.), but the blade is less curved and no attempt has been made to obtain a particularly slender stem, or else the handle is fixed directly to the blade without a stem, which is of little importance here. Moreover, when the blade is of metal it has a slightly concave surface, to receive the fat which is scraped off (*mame*, 200) and which is eaten as a kind of delicacy. Therefore, a suitably large and strong mussel-shell makes the most natural scraper, and is used even at the present day whenever nothing better is obtainable.

When the skin is washed the same implements are used, a blunt Ulo or a scraper on the hairy side of the skin, in order, by the same movements, to squeeze water and dirt out of the fur. For this also a special implement is sometimes used, generally made of bone, shaped like a long, slightly curved knife with a handle which is a prolongation of the blade.

When the prepared skins are to be cut out for sewing, the sharp Ulo is again used, and the skin is cut against a firm foundation of wood or bone, the curved side of the edge being drawn along the skin. If particularly accurate and small pieces have to be cut out, as for example for skin embroidery, the points of the Ulo are used, or the blade is supported at the upper edge by the point of the third finger, which is just able to reach it. When pieces of furry skin are going to be joined together, care has to be taken that the fur lies naturally, and as all the hairs on the seal are bent from the fore-end backwards, the fur must not be damaged at the edges because in the finished garments the hairs must everywhere be bent downwards so that water and dirt may run off easily. If the skin has been cut carefully the hair-layers will be continued over the seams of the skin-pieces. The skin is therefore cut from the fleshy side and the woman cuts in a sitting posture, keeping the one end of the skin fixed between her abdomen and thigh, the other between the fingers of her left hand, so that the part of the skin which she cuts, is spread out over the palm of her left hand.

For European materials — cloth — a pair of scissors is always used, and never the Ulo.

We shall now consider a series of typical forms of the Ulo (Figs. 45 and 46). With the exception of Nos. 1 and 3 all are chosen from Mason's monograph, and the illustrations are all ob-

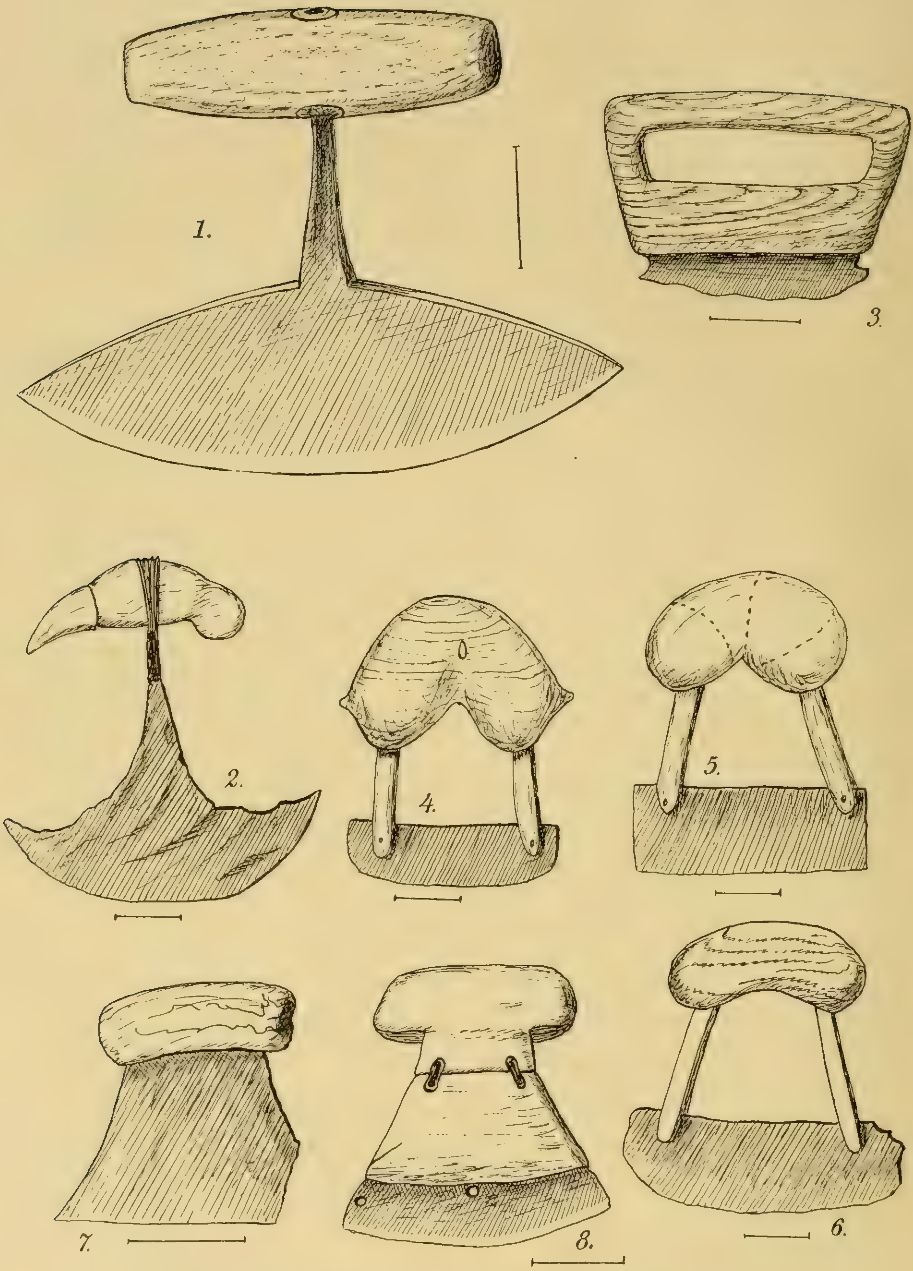

Fig. 45. Typical forms of Ulos or Woman's Knives.
1, West Greenland, European workmanship, original; 2—6, East Greenland, after G. HOLM; 7—8, from various Eskimo tribes, selected from the figures in O. T. MASON'S Monograph. — In all the figures the scale is one inch.

Fig. 46. Typical forms of Ulos or Woman's Knives.
9—21, From various Eskimo tribes, selected from the figures in O. T. MASON's Monograph. — In all the figures the scale is one inch.

tained by tracing the outlines of MASON's forms, after which they were reduced in the process of reproduction. In all the figures the subjoined scale denotes a length of one inch.

Fig. 45, *1* is the definite ideal form, as it appears everywhere, wherever regular trade with the Eskimo is carried on. The blade is broad lanceolate or has the shape of a double segment of a circle and is in one piece with the stem, which is made as slender as possible near the handle. The handle is made of wood or bone; it is barrel-shaped, and almost cylindrical, but somewhat flattened in vertical direction. The length of the handle is rather less than that of the blade, and is adapted to the width of the hand; the length of the stem is such, that the third finger can reach down and press upon the upper edge of the blade, while the rest of the hand grips the handle.

Made in Denmark to sell in the shops in Greenland.

Fig. 45, *2*. Similar in form to the preceding. Bought on the west coast by the East Greenlanders, before the colonisation, and altered, part of the upper edge being removed to procure material for the making of needles. East Greenland, Angmagsalik. After G. HOLM.

Fig. 45, *3*. East Greenland, Angmagsalik. After G. HOLM. The handle is of wood, and the blade of stone. The same shape is found in Alaska and southwards.

Fig. 45, *4—6*. East Greenland, Angmagsalik. After G. HOLM. The blade (*4—5* of hoop-iron and *6* of stone) is fastened to the handle by two stems.With the exception that the blade is of inferior make, this form is the one which, next to the ideal form, permits greatest freedom of movement.

Fig. 45, *7*. Blade of sheet iron fastened to an ivory handle; primitive form. West Greenland, Upernivik.

Fig. 45, *8*. North Greenland, Smith Sound. Blade of hoop-iron fastened to a bone handle. Notice how the shape of the handle causes a space to be left between the grip and the blade.

Fig. 46, *9*. West Greenland, Upernivik. Older form of European workmanship, less finished than the ideal form. As the upper edge of the blade is straight, the blade soon becomes, by wear, too narrow and short for handy use.

Fig. 46, *10—11*. Central Eskimo, Cumberland Sound. Forms similar to the preceding, but the stem is rivetted to the blade; much worn.

Fig. 46, *12*, *13*. Central Eskimo, Belly Bay and Ingloolik. More or less successful attempts to approach the ideal form. The blades are of stone and sheet iron. Native workmanship.

Fig. 46, *14*. Mackenzie Eskimo, Anderson River. The blade is of sheet iron, rivetted to two stems. Notice the shortness of the stems here caused by the relatively great height of the blade.

Fig. 46, *15, 16.* North Alaska, Point Barrow. Primitive types. Blades of hornstone and slate.

Fig. 46, *17.* West Alaska, Kotzebue Sound. Primitive type. Blade quadrant-shaped and of sheet iron.

Fig. 46, *18—19.* West Alaska, St. Michaels. One a primitive form with slate blade; the other a more modern form with iron blade. Both rather small.

Fig. 46, *20.* South Alaska, Kadiak. Primitive form with stone blade.

Fig, 46, *21.* Thlinkit Indians, Fort Wrangel, Alaska. The blade is of iron, forged into two points which are driven into a piece of wood, a method which differs remarkably from those of the Eskimo; it could not have been made by an Eskimo, because the only fire at the maker's disposal was the flame from a seal-oil lamp. The form obtained is however nearly the same as regards fitness for use.

All the forms figured here, can, together with all the others illustrated by Mason and other authors be comprised within a few types connected by very easy transitional stages: —

A. The primitive type; the blade sector- or quadrant-shaped,[1] frequently of stone, rarely of sheet-iron; fastened by various means in the centre of the sector to a piece of wood or bone. Examples Fig. 45, *7* and Fig. 46, *15*, *17*, *19* and *20*.

B. The blade ordinarily in form of a segment of a circle; sometimes nearly straight. Of stone or hoop-iron either first put into a backing of bone to give it firmness, or fastened with two stems direct to the handle. Examples Fig. 45, *3*, *4—6*, Fig. 46, *14*, *18*, *21*.

C. The last and best developed form, the blade frequently of iron, fastened with a single stem to the handle. As soon as the material permits, i. e. as soon as it is made of steel, stem and blade are of one piece, and the blade attains the final, ideal, broad lanceolate type. Examples Fig. 45, *1* and *2* and Fig. 46, *9—13*.

We may perhaps regard as a fourth type, an implement which Mason has included among his Ulos (Pl. LIX, 1; LXIV, 4. etc.): the

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[1] The form which most frequently occurs on splitting flint or flint-like stones.

blade is cresent-shaped, of stone or more rarely of metal, fastened to a backing of wood or bone which is prolonged at the back to form a handle. This handle is often decorated with carvings. This form is evidently frequent in Alaska, but it is also found at the other extremity: in West Greenland and at Angmagsalik. I am by no means certain of its really being an Ulo; and in West Greenland it is a frequently occurring form of a kind of scraper used to soften skin. These scrapers are sometimes, even today, made with stone blades (*tasitsaut* of *tasípâ*, 359); should not be confused with the *kiliortût*, see p. 207). At Angmagsalik it was, according to HOLM,

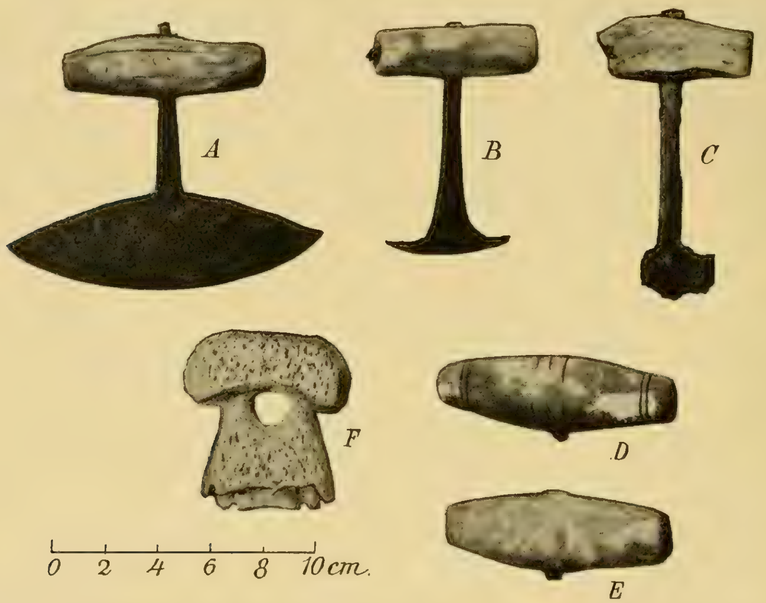


Fig. 47. *A*, *B*, *C*, *D* and *E* Ulos and handles of Ulos; *F* handle of a skin scraper.

a whetstone. But if it is really sharpened like an Ulo it must of course serve for all kinds of work in connection with the cutting out of skin, but then it cannot be of such universal use as the real Ulo, especially for the cutting and quartering of marine animals.

All these types are however found everywhere, among all Eskimo tribes, and have therefore no geographical, that is to say no regional, significance, but only a technological one. They are entirely dependent on the supply of suitable materials and tools available at the place and time.

Fig. 47, *A* is an Ulo of European manufacture, dropped or forgotten on an old site of a house near Skansen on Disco.

Fig. 47, *B* and *C* are old Ulos from Hunde Eiland, *B* is almost worn out; *C*, nearly eaten away by rust.

Fig. 47, *D*, Handle of Ulo (*kimagtût*, 178) of European manufacture. Hunde Eiland.

Fig. 47, *E* is another specimen from Sarqaq, made from the bone of a Caribou.

Various Tools, especially for Skin dressing.

Fig. 47, *F* is the handle of whale's bone of a skin scraper. (*kiliortût*, 177). The blade was of stone and was fitted into a groove by a lashing of sinew thread. At the back countersunk grooves proceed from the hole. Kronprinsens Eiland.

Fig. 48, *A* is a diminutive boot-stretcher (*kangmiut*, 166) of whale's bone, formed like a boot or rather like the conventional shape of a *tigussaut* (see below). It is intended for use when travelling, as for instance, when Caribou-hunting, when a large boot-stretcher of regular size would be cumbersome to carry. The tooth of a seal is tied by a piece of sinew thread to the boot-stretcher; it has been in use as *putugkisit* (see below) during necessary repairs to the boots. The boot-sole, after it has been dried, is daily moulded along its edge over the edge of the boot-stretcher.

As a couple of indispensable little tools for boot-sewing may here be mentioned — the sole-pucker (*tigussaut*, 363) and the loop-awl (*putugkisit* of *putuaq*, the loop on the edge of the boot-sole, through which the boot-lace is put, 303). The sole of a Greenland boot is formed like a barge, where the sides are so high, that wearing away of the seam, where it is joined to the upper-leather, is impossible. At the sides it is simply bent upwards, but in order to make it rise at the heel, and bend upwards and backwards at the toe, the edge has to be gathered into innumerable fine folds. Only a woman skilful in needle-work can perform this task so cleverly, that the boot in that place, becomes perfectly tight. These puckers are gathered with a *tigussaut*, which generally is made of the tusk of a walrus or of a sharpened and finely ground and polished stone. Fig. 48, *B*, *D*, *F* and *G* show some forms made of ivory; form *F* is especially common here. But as a rule, the form of the implement is rather immaterial; if the tool is too small, the fingers get too tired; and if it is too large, the woman has difficulty in seeing what she is doing. Only the edge is of importance; it must be absolutely flawless; it must not be able to cut, and yet be somewhat sharp. Hard varieties of bone are therefore preferable to metal. If the tool becomes blunt, it is sharpened on a fine-grained whetstone.

B. Tusk of walrus. Disco Fjord. In the ruins of a house.

D. Tusk of walrus. Sarqaq. Grave.

F. Whale's bone, has had the form of a boot, but the foot has disappeared by repeated sharpenings. Found in a ruin at Disco Fjord and again taken into use.

G. A thin lamella of the tusk of a walrus sharpened at the one end. By means of the different capacities of absorbing heated oil

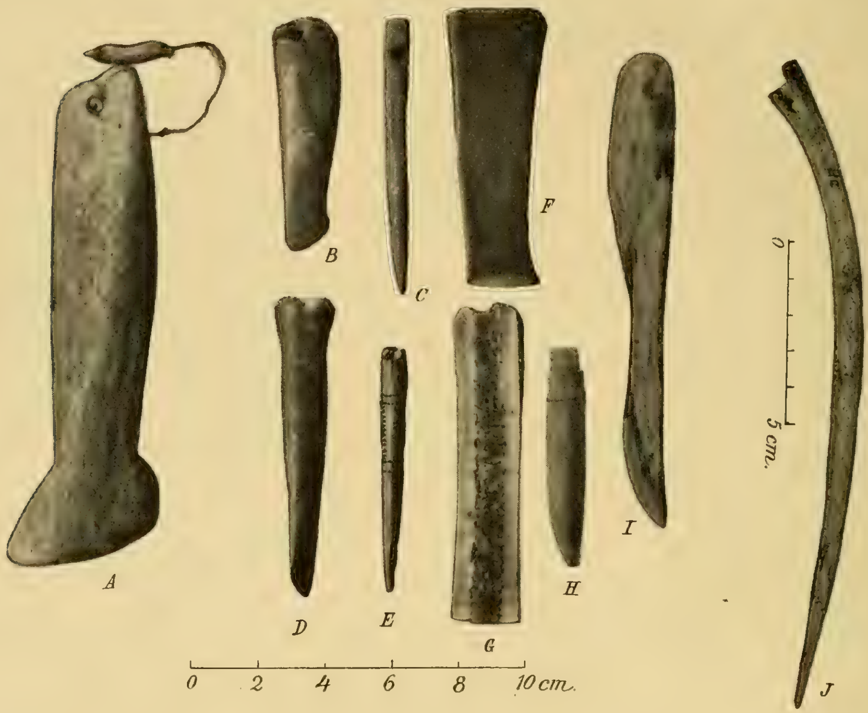


Fig. 48. *A*, Diminutive boot-stretcher for use when travelling; *B—G*, sole-puckers and loop-awls; *H*, case for sewing-needles of European origin; *I*, an *erisaut*, bone knife for removing hairs from hides; *J*, needle for stringing fish.

possessed by the different ivory-substances a kind of ornamentation has been formed. Disco Fjord. Modern.

Before the sole is sewn on to men's boots a couple of loops are made on the side of them at about the base of the toes. The pointed corner of the Ulo is put through, a little distance from the edge, and the hole thus produced is now, by the aid of a bone-bodkin, *putugkisit*, widened to a suitable size, after which the sole is sewn on below the loop. As the latter must be able to stand a strong pull from the boot-lace, the hole must not be cut full size, but just forced by the bodkin, to prevent cracks beginning to form. Another danger which should be avoided, is that the sole may let in water at this spot. As these two implements are always used for the same kind of work, and not for anything else, they are generally fastened together. Thus *B* and *C*, and *D* and *E* are two sets of these implements. *E* is ornamented with rows of small holes. Both sets are made of the tusks of a walrus.

As the way in which the sole of the boot is made, is alike in all Eskimo tribes,[1] these implements will also be found in other places, at any rate the *tigussaut.* I do not know whether they have been expressly mentioned; I have not been able to find any such mention in the literature accessible to me here, but sometimes there are figures of such implements, which have been — evidently wrongly — interpreted to be something else. Thus Boas has illustrated in his figures 41, 42 and 134, a number of implements which he calls "skin-scrapers", some of which undoubtedly are sole-puckers. While the edge of a scraper as a rule is sharpened on the one side only, unless the whole blade is curved, the edge of a *tigussaut* is sharpened alike on both sides. Several of Boas's specimens would also be too small for scrapers. A number are provided with a handle in such a manner that by its shape it can be seen, that the edge is to be held lengthwise, not crosswise. The "awls" and "marlinespikes" figured by several authors are exactly similar to the Greenland *putugkisit.*

H is a needlecase (*merqusivik*, 207) of wood for steel needles. The stopper has been made to screw on. It is perhaps of European workmanship. Sarqaq.

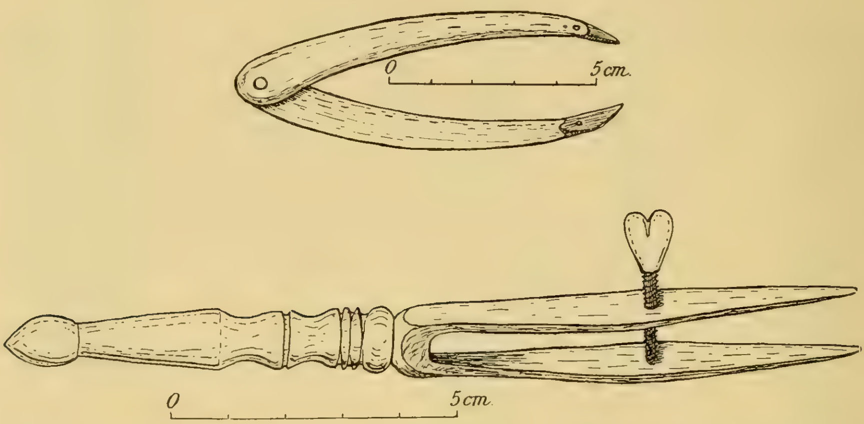
I is a bone knife (*erisaut*) for plucking the hairs from those sealskins which are to be made into waterproof leather (*erisâq*, 68). Now such a tool is doubtless out of date; any knife not too sharp, is now used for that purpose. Sarqaq.

J is a bone needle (*nuissaut*, 256) for stringing fish. Disco Fjord.

The national skin-embroidery of West Greenland, which is worked to regular patterns by sewing tiny square bits of coloured skin on

[1] See, e. g. the excellent figures in Mason: Primitive Travel and Transportation.

a dyed skin from which the hair has been removed has, since the colonisation of the country, been developed to great perfection. Civilization has introduced finer needles and thread, more freedom in the choice of colours, and has, perhaps, also sometimes unconsciously influenced artistic taste; each needle-woman indeed composes her own pattern, and chooses her own colours, but besides the embroidery which is made for the trimming of women's trousers and boots, for ornamentation on mittens or on young men's Sunday-boots, and the like, a great quantity is made for sale — not as a regular trade, but only in the form of fancy articles — for the Europeans in the country; and these latter, for instance, by constantly choosing the tasteful and discarding the ugly, have doubtless been instrumental



Figs. 49 and 50. Two forms of dividers for the accurate marking out of the pattern in skin embroideries.

in raising this art to a higher standard. In order to make these patterns regularly and accurately, a kind of compasses (*avdláutartut*, Supplement, 10) are used at the sewing on of certain bits in the pattern, while the intervening bits are afterwards sewn on according to judgment. Fig. 49 shows the most common form, a pair of curved compass-legs of bone with brass points. Fig. 50 is a later, not quite successful model, the idea is derived from a European spring bow-dividers; a common wood-screw moves the legs apart, while their elasticity will draw them in, when the screw is turned back. Tusk of walrus. Hunde Eiland.

The art of embroidery cannot be practised by everybody, but is on the point of becoming a specialized occupation. This art is carried on all over Danish West Greenland, but attains its highest perfection in the districts of Holstenborg and Sukkertoppen.

Fig. 51 shows a box, turned in wood, of European workmanship. It contains some glass beads, a brass clasp, and a pair of ear-

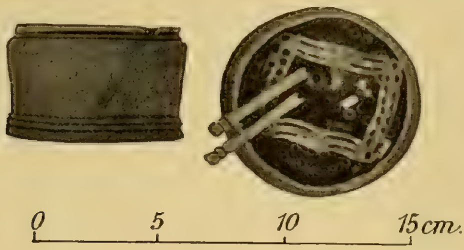


Fig. 51. Grave-find; a turned box with screw lid, containing glass beads, brass clasps and tin ear-pendants.

pendants of tin; the latter are made here. The rest are imported, before the Danish colonisation of the country, most likely by Dutch Whalers. Found in a woman's grave at Sarqaq.

Lamps for burning blubber oil.

The most important household article of the Eskimo is the lamp for burning blubber oil. Without that, he would not be able to live the life of the districts north of the forest-limit, or to endure the cold of the Polar winter, and its long period of darkness. The object of the lamp is to burn oil, obtained from blubber, by the aid of a wick of moss, and by this combustion to illuminate and heat the house or tent, to cook the meat and dry the clothes. As a makeshift any tolerably fireproof, slightly excavated piece of stone, etc. can be used, but soapstone (*uvkussigsaq*, material for a *uvkusik*, a pot, 405) is particularly in demand, because it is absolutely fireproof, tough and easily worked. Soapstone is also used for pots, and it was therefore a necessity to the Eskimo so much so indeed that he sometimes made journeys which lasted years, in order to obtain it.

Moreover, even where soapstone is plentiful, the Eskimo cannot with his primitive tools, secure the pieces suitable to his purpose: He must try to loosen the pieces that project among the harder rocks. They are nearly always oblong, and as the largest and best pieces are used for pots, these are consequently always oblong, very often rectangular. Such a pot is most economically heated by a straight flame, if that is possible, under the middle of the bottom. Therefore attempts are made to shape the lamp so, that the side intended for the wick, is straight. Moreover it is convenient, to have a spacious cavity, that it may contain plenty of blubber in the process of thawing and melting — for when the lamp is once started, the blubber must gradually melt itself to oil, as required. On the other hand, in a capacious lamp, the blubber can — if necessary — be removed from the flame, when the melting process is to be diminished. A lamp for heating and cooking purposes must therefore be flat, big, and with one side straight and one curved.

The material may often be insufficient for this, but then it may perhaps allow the reservoir to be deepened. In that case it is often provided with a ridge behind which the blubber can be placed. The ridge is pierced by one or more small holes, through which the oil flows into the space containing the wick. The ridge, in addition, increases the durability of the lamp. Such lamps are often elliptical or quite round.

In Arctic regions proper, train-oil is the only fuel, and there the lamps are large; where other fuel — heather, wood, peat or coal — is available, either the whole year round or only in the summer, the lamp used for burning blubber oil loses its importance as a heater, and is used solely for illuminating purposes. For this, small specimens may suffice. But a surplus of light and heat is inevitably connected with the Eskimo idea of luxury; therefore big lamps are also found in such regions. Even by the colonial Greenlanders of our own time a surplus of light and heat is considered necessary for birthdays, Christmas and other festivals: the more stearin candles are lighted the better. Conversely, small and rudely made lamps for burning blubber oil are found also in the regions of the Far North. The reason for this may either be lack of material, or these lamps may be intended for some particular purpose — for use on journeys or for illuminating the entrance or corners inside the house.

As soapstone is generally soft, free from nodules, and easily worked the quality of the tools has but slight influence on the form of the lamps. Of course the work is more finely finished when iron tools are available, but there is no essential difference between such lamps and those made with drill and stone-knives.

In the straight side intended for the wick, there is usually a small ledge for the support of the wick, so that it is easier to keep its tip at a fixed level. In West Greenland there are still a number of old stone lamps in use, but I have never seen a moss-wick; for this there is now always substituted a strip of linen, even in the poorest dwellings. As the linen wick can easily absorb the train-oil from the bottom of a deep lamp, the ledge mentioned above becomes a drawback and is therefore removed.

But neither in the one, nor in the other form is the soapstone lamp the ideal utensil, and even although many of them are still in use here, new ones are probably rare. As soon as it can be afforded, the stone lamp is replaced by a flat square metal basin from the shop. At the bottom of this small slices of blubber are placed at suitable distances. It burns a linen wick which is fixed at the one edge with pincers. But soapstone pots, on the other hand, have a real advantage over those made of cast iron; not only do they retain the heat a longer time, but the opinion is, that meat cooked in them tasts better.

Formerly, the blubber-oil lamp was the private property of the housewife, and there were at least as many lamps in a dwelling as there were housewives. Lamps are therefore found in women's graves together with their other personal belongings. They have no special religious significance, for instance, as "votive-lamps."

The Eskimo lamp for burning blubber oil has, on the basis of the rich collection found in the Washington Museum, been monographically treated in an excellent work by H. Hough. There, about a hundred different lamps, from all possible Eskimo regions have been described and illustrated. First-hand information from travellers and collectors is carefully recorded. As regards the general results, more attention has been paid to technological conditions than is usually the case, but they are not placed in the foreground, as has been done here. The author has so far tried to explain the adaptation of the forms to climatic conditions, as he maintains that big lamps are used in High Arctic regions, and small ones in more southern regions; but he seems, at the same time, to think it possible, that certain forms might have regional significance even if it is not possible to explain their regional occurrence from definite local conditions. It is probably because of this underlying thought that on the last plate, he illustrates 14 different typical outlines arranged geographically according to the Eskimo tribes. There is, however, in these typical forms, not a single one, with the exception of the form from St. Lawrence, which might not just as well be from West Greenland. On St. Lawrence Island and in Yukon Valley, soapstone and other suitable stone materials are absent, as Hough himself records, and the lamps are there made of clay. In this case therefore the form can be made according to desire and big forms occur which differ entirely from all others, with two or more edges for wicks, and therefore rectangular in outline. The forms from Kadiak and the Aleutian Islands, which are evenly rounded without a straight line for the wick, do not in reality differ from many small Greenland lamps. These lamps are principally intended for illuminating purposes, and not for giving heat under an oblong pot, therefore it is not necessary, that the wick should stand in a straight line.

It is a very interesting fact, pointed out by Hough, that in America the Eskimo are the only primitive people who are acquainted with lamps, whereas lamps are well known all over Asia and Europe. He says (p. 1039) "that the Eskimo before he migrated from his priscan home had the lamp, this utensil being a prerequisite to migration into high latitude"; and on the following page: "That the invention of the lamp took place on some seacoast, where fat of aquatic mammals of high fuel value was abundant, rather than in the interior, where the fat of land animals is of little value". The last sentence is undoubtedly correct, but I do not see why the idea of the lamp could not have originated on the coast of the Arctic ocean, as has that of all the other utensils, and why it should necessarily have been brought from "a priscan home."

There are lamps for burning blubber oil, which are very small in size, but which may be used all the same; they are playthings for

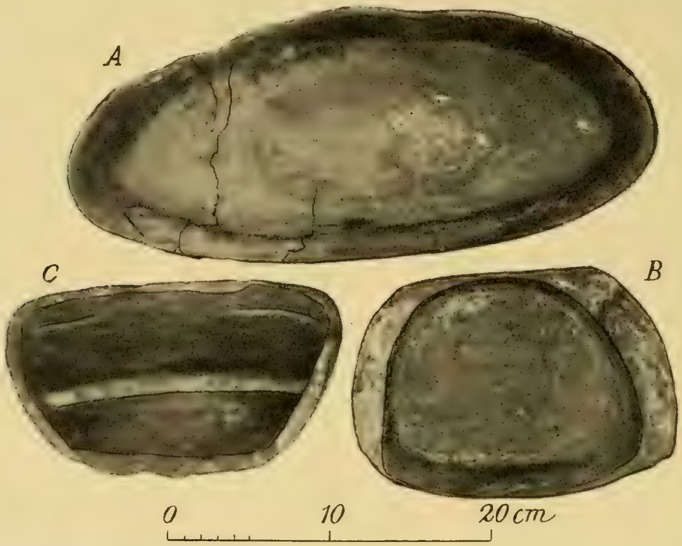


Fig. 52. Three typical soapstone lamps. For further particulars see text.

little girls, and formerly they were placed in the graves together with the other belongings of the child. Even very tiny soapstone lamps, stand and all are found, which represent, not the little girl's, but her doll's lamp.

On the east coast of Disco there is an old settlement *Qutdligssat*, "those things which can be used for lamps." It derives its name from a basalt which is here split, so that frequently slightly hollowed pieces are obtained which can be used for lamps.

Fig. 52, *A* is a large flat lamp, (*qutdleq*, 160) made with iron tools. The edge for the wick is slightly curved. The lamp being big and flat, there is no particular ledge for the wick, nor are there any ridges. The lamp has been broken in several places and has been lashed together again with string of hempen yarn, passed through holes. Ujarassugssuk at Vajgattet.

Fig. 52, *B* is a smaller lamp, rather flat inside, not at all shaped outside, and without any particular edge for the wick. It is very thick in substance, and a piece is sawn off from the back for use as a sinker for a fish-hook. Same locality as above.

Fig. 52, *C* is short, but deep; therefore it is provided both with a ridge which is pierced by a hole at the bottom, and also with a ledge for the wick in the longest side. The ledge has been afterwards removed from the middle of the long side, when the importance of the lamp — after a stove had been procured — was reduced, and its sole purpose was that of illumination; the moss wick was then replaced by a linen one. As the ridge strengthens the lamp, the walls are rather thin. Godhavn.

Various Household Articles.

Fig. 53 shows a couple of wick-trimmers (*tarqigssût*, 359) used for putting the wicks of the Eskimo soapstone lamp in order, so that

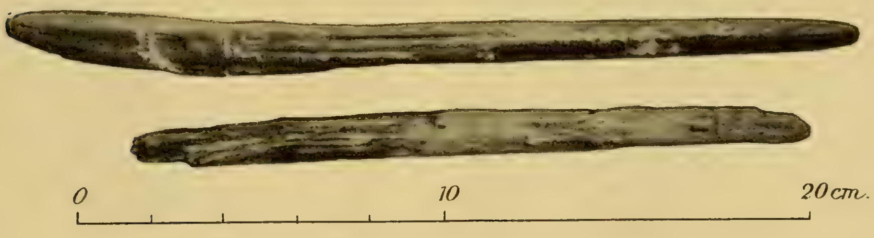


Fig. 53. Two wick-trimmers of asbestos.

they may burn properly. Some stick or other is usually used for one of these wick-trimmers and as it is always saturated with oil it is easily lighted and may be used provisionally as a taper (*naneruaq*, 231). Sticks of asbestos (*quvdlugaq*, 158) are in special demand on account of their durability, but they can be had in only a few places, so they are highly valued and often handed down through several generations, as also are good soapstone lamps. The asbestos trimmers illustrated here are from the settlement of Ivnalik in the district of Egedesminde.

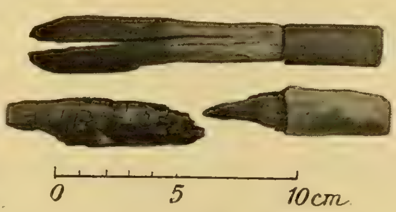


Fig. 54. Ancient fire-drills.

Wick trimmers of asbestos are also used by the Central Eskimo, as mentioned even by Parry (see p. 51). In the same place he records that the West Greenlanders use asbestos for the wicks, and cites Cranz as his authority. But this citation must be due to a misunderstanding, because Cranz (p. 75) writes: "Die gereinigten Fasern (vom Asbest) lassen sich auch als Docht in der Lampe brauchen. Man muss aber nicht denken, dass die Grönländer so sinnreich sind. Sie bedienen sich desselben blos in Thran eingetunkt, anstatt eines Hölzgens, Licht auzuzünden, indem der Stein, solang er ölicht ist, brennt and doch nicht verbrennt; um den Docht in ihren Lampen in Ordnung zu halten."

Fig. 54 illustrates two pieces of wood which have been used for making fire by boring (*ingnangniut*, 81). One of them is especially

Fig. 55. Various hooks; as regards their use, see text.

well-preserved; it is much charred at the bottom; above this there is a constriction to receive the cord which puts it into motion; at the top it is capped with a piece of antler in which there is a small socket. In other forms, the top part was pointed and rotated in a socket in the piece of wood or bone which was held above it, but in this implement the overlying piece must have had a tang.

Both of them were found in old house ruins on Hunde Eiland.

Fig. 55, *A* is a meat-hook (*qatdlût* of *qatdlúpâ*, Supplement, 19) used in the winter for hauling pieces of meat, out of the meat-pits. This made it possible to have only a very small opening at the top, through which no dog could enter, and which might be easily closed with a single stone. The handle is of wood; it has formerly been somewhat longer; along the one edge some notches have been cut to afford a better grip. The hook itself is of antler, carefully shaped into a point and sharpened along both edges. In order to strengthen it, a lashing of sinew thread has been passed through a hole in the handle and above the outer edge of the hook where there are a few notches. Fragments of the thread still adhere to the handle. Moreover, the hook is fitted into a slot and held in place with a bone nail.

Sarpaq. From an old meat-pit.

Similar implements are often called "blubber-hooks" by authors.

Fig. 55, *B* is a hook made from an antler. The stumps of a couple of divergent branches, and some notches along the edges, serve to give a grip to the hand. I have not been able to gain any information concerning the use of this implement. There is a hole at each of the two bends in the branch, and the holes are placed at the outer edge, so as not to weaken the strength of the bone, and there is also a hole midway in the handle. I think the hook may have been used for hauling large pieces of whale-blubber from the coast by several persons together. One would plant the hook in the blubber and pull at the handle, while the others would pull the lines or straps which would be passed through the three holes. When the strain came thus to act in the longitudinal direction of the hook, none of the holes in the implement would detract from its strength. It could not have been used as a meat hook like the preceding; it is too clumsy for that and the hook itself is too broad.

Fig. 56. Three marrow extractors.

Hunde Eiland. On the old site of a house.

Fig. 55, *C* is a *nigsiniut* (from *nigsipâ*, 247). No doubt it is either a less commonly used or else an improvised implement for hauling up sunken seals and White Whales from the bottom of the sea. It consists of a piece of whale's bone into which some large spikes have been driven, but the majority of these have been eaten away by rust. At the top there was a line-hole which has been broken by the strain. Kronprins Eiland.

Fig. 56 shows three marrow extractors (*patîaut* or *paterut*, 275); narrow semicylindrical pieces of antler, slightly hollowed at the one end. They have been frequently figured from other Eskimo tribes, but appear to have escaped attention in Greenland, though they were commonly used in districts where the Caribou live. I have seen old specimens near Godthaab. Usually they have had a hole in the one end, so as to be put on a string while travelling. This may perhaps result in their being mistaken for needles.

Disco Fjord, Hunde Eiland, Sarqaq.

Fig. 57 shows three meat dishes (*pûgutaq*, 301) each cut from a single piece of wood. A is rather large and heavy and has no bone

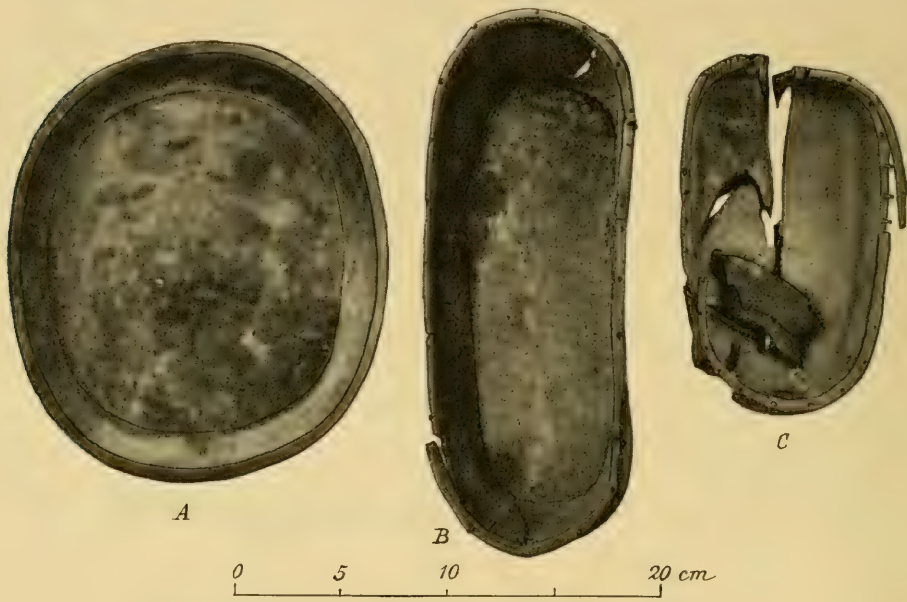


Fig. 57. Three wooden dishes for meat.

edgings, and does not appear to have been used long. It is however blackened by blood, soot and oil. Kronprins Eiland. From a grave. *B* and *C* are of smaller pieces of wood, and cut considerably thinner, therefore the upper edge is provided with beautifully made, bone mountings, riveted to the edge with bone nails. Sarqaq. Graves.

My collection contains in addition some tubs of coopers' work; among others, forms exactly similar to the type from East Greenland illustrated by THALBITZER in his Fig. 27; they are not well preserved, nor are they particularly characteristic, therefore they have not been figured.

Fig. 58, *A—D* are ladles for dispensing blood-soup (*qajûtaq*, 122); all are of wood and carefully made, especially *B*, which is not, however, well photographed. On *A*, *B* and *D* the short handle, by itself, is sufficient to show that they are of native workmanship, on *B* and *D* the handle, moreover, forms a fairly sharp angle with the

Fig. 58. Ladles and spoons of wood and bone.

bowl. *C* most resembles a European form, the handle was on a level with the bowl, but is broken, so that it cannot be seen how long it has been; as it appears to have been made of reddish coniferous wood (*Larix* sp.?), I think after all that it must have been made by a native.

Fig. 58, *A*, Sarqaq; grave. *B*, Kronprins Eiland; site of a house. *C* and *D*, Sarqaq.

Fig. 58, *E* and *F* are spoons for eating (*alugssaut*, 23). *E* is of bone (antler?); the handle has a hollow on the upper side for receiving the end of the thumb, and a hole through which is passed a cord for carrying it when travelling. Sarqaq; grave.

F is of wood, handsomely made, but badly preserved. The handle rises steeply. Hunde Eiland.

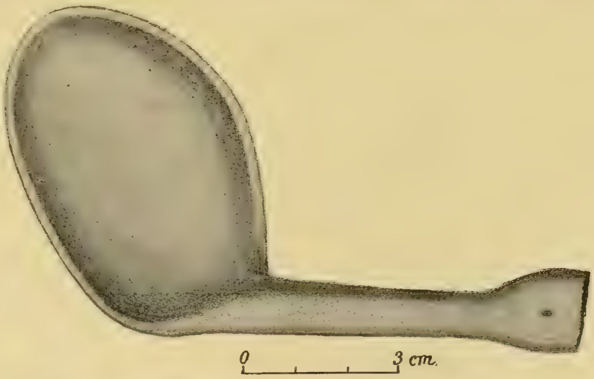


Fig. 59. Spoon for left-handed person or, perhaps a fish-ladle.

Fig. 59 is a rather rudely made spoon of bone from Hunde Eiland, peculiar in the fact that the handle is set at a sharp angle with the longitudinal axis of the bowl, so that the spoon can only be used with the left hand. There is no hole in the handle; perhaps it is not quite finished; or it may have been a fish-ladle.

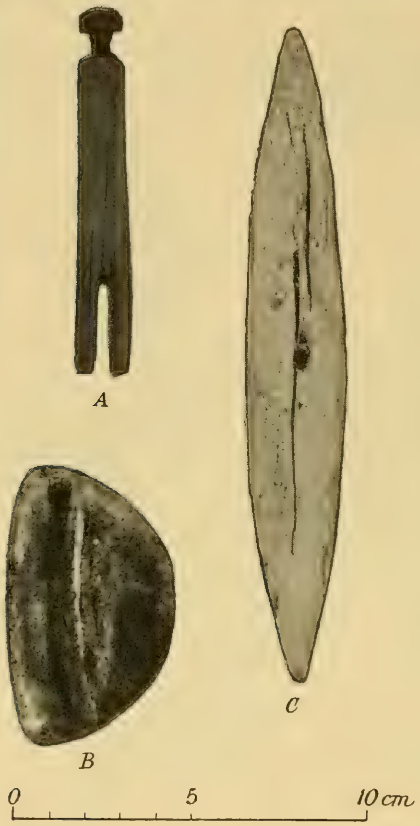


Fig. 60. Toys: Doll, lamp and kayak.

XII. Toys and Games.

Toys. Nowadays children in West Greenland often have European toys given to them. They naturally grasp at these odd, gaudily coloured objects with eagerness; but they do not last long. The more solid home-made toys which harmonize better with the imagination and the understanding of the child, than do the automobiles and the aeroplanes are still to be met with in the Eskimo homes and are often found in the graves of children of heathen parents.

The three specimens shown in Fig. 60 are all from graves. *A* is a female-doll — carved from a stick. It is peculiar on account of its form, which is the conventional one, well-known through HOLM's figures of toys from the east coast (e. g. Plates 28 and 38); the arms are wanting. That it represents a woman is seen from the huge knot of hair and the short legs. True, the latter feature offends the eye of the children of the present time, who now in drawings, indicate women by giving them unusually long legs. But ladies' fashions have changed in West Greenland since the beginning of the colonisation. Formerly, frocks worn by women reached to the knees; now, only to the hips. Disco Fjord.

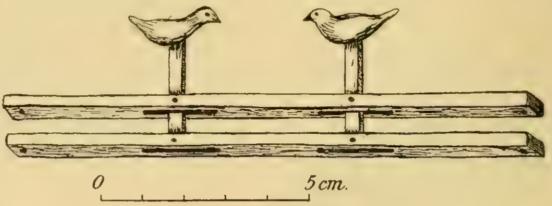


Fig. 61. Toy: Two pecking birds.

Fig. 60, *B* is a small soapstone lamp with ridges. Godhavn.

Fig. 60, *C* is a piece of wood carved as a kayak. North Disco.

The toy, figured by Holm (Pl. 27) from Angmagsalik, which represents two small birds picking up grain, is well known here at Disco Bay. I have often seen them in Greenland homes; some better finished, others made more rudely. The one illustrated in Fig. 61 is not a very handsome specimen. It is carved from a whale's bone at Hunde Eiland, and was intended for a child who died; then it was sold to me. There are holes at the end of the rods through which strings were to have been passed, so that the figures — they always represent snow-buntings, such being well-known to Greenland children from rhymes and verses — could be moved without the child being able to see how this was done.

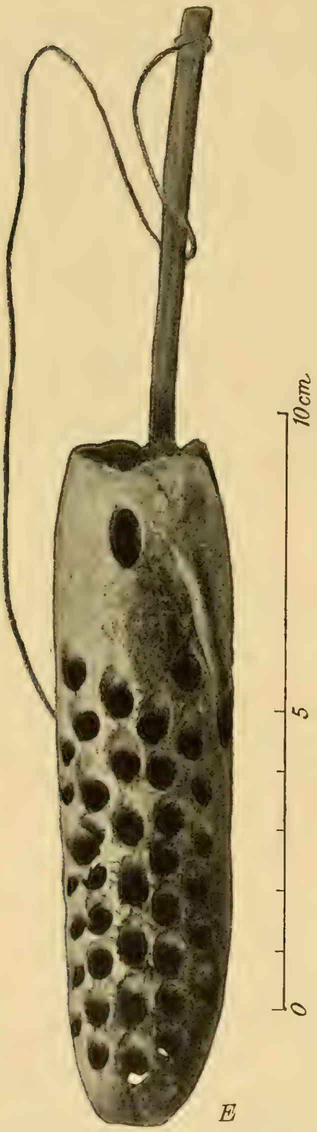
The game of *ajagarneq* appears to be widely spread among all the Eskimo tribes, and as far as I know, under the same name. Holm found it at Angmagsalik; and it has several times been brought home, and the implement figured, from American tribes. Poul Egede records that he saw it in West Greenland homes which he visited as a child. The implement used for the game (*ajagaq*, 16) is in its principle everywhere the same: some object with perforations, attached to a pointed stick or to a bone staff by a cord. The stick is held in the hand, and the object is swung out, and has to be caught upon the stick by a stabbing or thrusting movement away from the player. This movement is designated by the indicative third person singular, *ajagpoq*, and this word is an old root-word from which a great number of verbs and nouns are derived (see Kleinschmidt's dictionary).

Also in the workmanship of these *ajagaq* there are numerous points of resemblance. In West Greenland the *humerus* of a seal is used by preference, especially that of the hooded seal; or else the *humerus* of the dog, the cranium of a hare, or specially-fashioned pieces of wood or bone. From the Central Eskimo Boas records sometimes "shoulder-bones of seal" (but his figure on p. 113 shows that it is a *humerus*) and sometimes a barrel-shaped piece of horn of the musk-ox with some holes at one end. Holm's specimen from Angmagsalik resembles the latter. Turner illustrates on p. 256 a specially fashioned piece of wood, the form of which somewhat resembles that of the specimens represented here in Fig. 62, *A* and *B*; and he mentions the cranium of a hare as used for this purpose. Turner found the *ajagaq*, made on the same principle, among the Indians who, near Hudson Bay live close to the Eskimo, but with them the workmanship differed greatly from that of the Eskimo forms.

In Greenland the game is often a mere amusement or pastime for tedious hours, as for instance, during a journey, when weather-bound. But *ajagaq* is also used, or at any rate has been used, for playing games in earnest. I have not been able to ascertain the exact rules for these, either because they are really forgotten or because the Eskimo do not like to explain them to me, certain indecencies being also represented in the form of some of the specimens.

The holes have different values; those which are most difficult to hit count the highest. Small stakes may be played for, e. g. matches, percussion caps, shot, etc. But when the passion for gambling seizes them, larger articles are staked, such as nets, lines, dogs, guns, kayaks, umiaqs, and even house and wife are said to be sometimes gambled away: indeed, at times, the passion for gambling takes such a grip of them, when they have anything to stake, that once the authorities were obliged to prohibit gambling with cards.

Fig. 62, *A* (also represented in *E* in another position and on a larger scale) is a very old and much worn *ajagaq*. The stick and the cord are new, made by the seller for demonstration. The *ajagaq* is of whale's bone and very carefully made. On the back are bored two obliquely-placed holes to attach the cord. On the front are five rows of obliquely-placed holes, which all turn upwards; the uppermost one penetrates entirely so that there the stick can pass through to a large hole in the oblique terminal face. In the lower end there is a large hole surrounded by a circle of small ones, and slightly above there is an oblong hole from which a groove leads obliquely upwards, and another



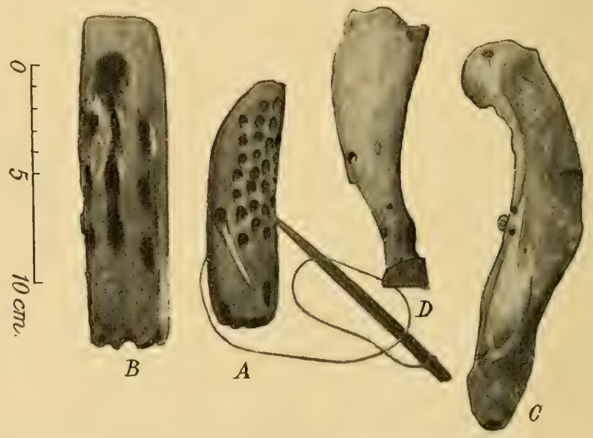


Fig. 62. *A—D*, Various specimens of *ajagaq*; *E* a larger representation of *A*.

similarly downwards. On the left side there is a hole which proceeds obliquely upwards, from which a deep steering groove leads downwards and forwards. Also from the other holes on the front side there are short downwardly-directed steering grooves.

Qeqertaq in the district of Ritenbenk.

Fig. 62, *B* is similar in form, but it is by no means so well made. The number of the holes on the front are seen on the figure. The uppermost one goes right through, and there is a hole in the upper oblique end. In the lower end there is a large hole surrounded by a circle of eight small ones. Here there is no lateral hole. This *ajagaq* is of wood and appears to have been made on some occasion when they wanted to play the game and had not an implement for it at hand. The holes are not bored, but are made partly by scraping out with a knife and partly by burning.

Hunde Eiland.

Fig. 62, *C* is the *humerus* of a hooded seal. The more awkward edges are removed, but even then it hits very hard upon the knuckles when one of the holes is not hit, as the bone is heavy. On the back are several pairs of holes for the reception of the cord; the situation of the latter has evidently been altered several times on account of the irregular form of the bone. Lastly, there has been inserted a small piece of bone with an eye which is fastened by a bone pin. Then several holes have been made at the ends and on the front besides the *foramen supracondylare* which has also been utilized. This *ajagaq* is also much worn and it was in use, like *A*, up to the time I obtained it. Yet it is very old, because in the upper end of the bone there are still remnants of the end of a weapon of bone and jasper.

Sarqaq at Vaigattet.

Fig. 64, *D* is a bone which has been fashioned into an *ajagaq* or to suit some purpose which I have not been able to determine. It does not appear to have been finished for the hole for the reception of the cord is so sharp at the edges that the cord would immediately be cut if it were used. In the upper end is a large hole; in the lower some holes with steering grooves; but here the bone is broken.

Hunde Eiland. On the old site of a house.

XIII. Various small articles and some implements of unknown use.

All fur-clad Polar people have to use some expedient or other to rid themselves of body-lice, especially when they become old and the arms become bent and stiff with rheumatism. Usually, for this purpose, a kind of rake is used, with which the insects are loosened, after which they are caught in a small trap and removed. The louse-trap usually consists of a small piece of hare or bear skin fastened to two cords with which it may be passed under the clothes. The louse-rake or back-scratcher may have various forms. BOAS illustrates one (Fig. 66) from Hudson Bay which consists of a piece of whale-bone the end of which is bent to a right angle and sharpened. My figure 63, *A* shows a more common form which I have seen figured elsewhere also, but I do not now remember where; it consists of a stick thrust through an oblong hole in a piece of oval-shaped, flat bone (antler), the edges of which are carefully sharpened. Into the end of the stick is inserted a wedge which is fastened with a bone nail. In the one direction the bone piece may somewhat alter the angle it forms with the handle. It is called *kúngut* (of *kumigpoq*, 192).

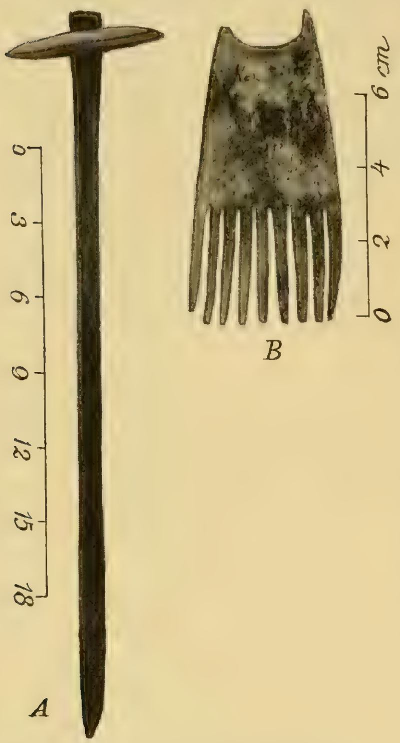


Fig. 63. A louse-rake (back-scratcher) and a comb.

Qeqertaq, in the district of Ritenbenk.

Fig. 63, *B* is a comb (*igdlaigutit*, 84) made from the hard shell of a piece of antler. Sarqaq.

Fig. 64, *A* is a bone button in the form of a toggle, intended to be buttoned in a bone ring or a strap. *B* is a small piece of bone which has been fastened to the end of a line so that the line could easily be caught hold of, even with mittens on, when it should be loosened. Both are from Hunde Eiland.

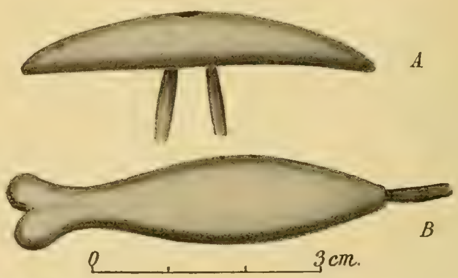


Fig. 64. A small bone toggle, and the fish-shaped butt of a line, worn on dress.

Fig. 65, *a* is a snuff-box (*sunôrsivik* ,346) made from a piece of walrus tusk and decorated with six rectangular figures in raised work. The bottom is of wood fastened with bone nails. The lid is also of wood capped with ivory. It is fastened with a couple of wooden pegs, which project so far out that they may easily be pulled out with the teeth. At the top there is a hole, fitted with a wooden stopper, through which the pinch of snuff is obtained. It is said to be very old, but it was used till the owner died recently. Compared with South Greenland the custom of taking snuff has not been so prevalent here.

Hunde Eiland.

Figure 65, *b* is a tube of antler-bone with an attached semitubular projection in which are two holes. The tube is sharp at the edge and carefully fashioned both inside and outside. The projection is broken at the bottom. It has been used as the mouth-piece of a bag for bullets for a muzzle-loader.

Figure 65, *c* shows a couple of peculiar splints of whale's bone which were found near Godhavn, at intervals of two years. They are flat on the one side and grooved on the other. The pattern of the grooves differs. The work is done with primitive tools (pocket knives?) and has been very laborious. The splints are pieces of bone rings intended for Angekok drums. The hide should have been stretched over the ring in a wet condition and have been lashed in the hollows of the grooves. The splints do not appear to have been used; they probably broke while being bent.

Figure 65, *d* is a flat piece of whale's bone which somewhat resembles the steering "feather" of a harpoon shaft. It is however a shoe for the fore end of the keel of an umiaq, to be placed outside the skin and partly lashed and partly rivetted to it.

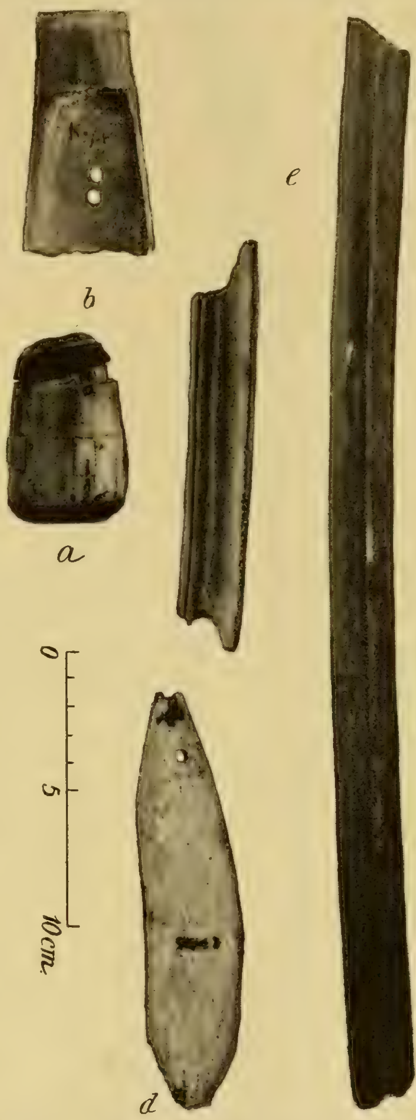


Fig. 65. *a*, Snuff box of walrus tusk with wooden lid and bottom; *b*, a bone ring with a broken semitubular projection still attached, serving as mouth-piece for a bullet-bag; *c*, two grooved splints of whale's bone intended for bone rings of Angekok-drums; *d*, a shoe of bone to be placed under the fore end of the keel of an umiaq.

Fig. 66. A thick, pointed bone staff, and a fragment of another one perhaps similar to it, probably foreshafts for an *isuartût*. For further particulars see text.

I have here given an illustration of a peculiar bone implement (see Fig. 66) which none of the Greenlanders hereabout exactly know. It is a slightly curved staff 65 cm. long, and almost circular in transverse section; at the bottom it is above 2 cm. thick and gradually diminishes in thickness upwards, but is not sharply pointed. The lower end is cut aslant, and in the centre of the oblique surface there is a hollow into which a short rounded tang of another piece could fit. Above the oblique surface, on the one side, are two holes obliquely bored so that they meet a little below the surface without weakening the piece of bone to any serious extent; the upper one is intended for the reception of a knot of rawhide-line, which should pass out of the lower hole and fasten the piece to something else. Of whale's bone. Hunde Eiland.

A similar but somewhat more slender implement has been illustrated by THALBITZER in his Fig. 53. Its lower end differs slightly, but the hole is constructed in the same manner. That both pieces are curved need not have any significance, because such a bone staff cannot lie upon the surface of the ground for a long time without becoming curved. On the concave side of THALBITZER's specimen are some small transverse grooves. If these have been made intentionally and are not produced by disintegration, then this implement undoubtedly differs rather widely from the one figured here which is quite round everywhere,

THALBITZER has — tentatively — identified his specimen as a "blubber-fork." But the Eskimo pots cannot contain large pieces of meat — for blubber in pots is out of the question — therefore such large forks are unnecessary. And then what is the good of the line? And cold blubber or meat is taken up with the bare hands, or with mittened hands, if it is too cold, or with a hook. If the piece is too large and too greasy to hold in the hand, only a rift need be cut in it and a convenient handle is at once produced. At the suggestion of an old hunter from Disco Fjord I think that these bone staves have been used as foreshafts for an *itsuartût* (cf. p. 133).

XIV. On incorrect Models and faked Antiquities from West Greenland.

Along the entire west coast of Greenland a great number of models are made yearly, especially of kayaks with hunting implements, also of umiaqs, dog-sledges, and summer tents, and more rarely of winter dwellings. From the district of Godhavn at least 50 models of kayaks and about 25 models of sledges are manufactured yearly, and probably about the same number from other districts. They are sold partly to the resident Europeans, who send them to their friends as knick-knacks, souvenirs of Greenland, etc., partly to ship's crews or to travellers. Some are beautifully made and may be called models in so far as they exhibit such peculiarities as are known to everybody: the loosening of the harpoon from the shaft, and the place and shape of the outer visible objects in rude form. But in the majority of points they do not merit the name of models. Firstly, the proportions are always quite wrong: the harpoon and line, for instance, are far too large in relation to the rest; also, they are intentionally deceptive as regards a number of features in connection with construction: the throwing stick is as a rule rivetted to the shaft, the frame of the kayak is not constructed as it is in reality, but there are too few ribs, and the sledge-runners and cross-bars are made of finely polished lamellæ of bone (tusks of walrus), which of course they never are in reality. The making of models has become a domestic industry, an art, which must be learnt as any other art. A man who can make an excellent kayak for use could not make a saleable kayak-model unless he had learnt to do so.

The reason for this is, that if these models were made correctly they could not fetch a price which would in any way repay the work spent on them; on the other hand, with a little practice, money may be earned by making a conventional "model" which is saleable if it looks nice, even if it is entirely wrong as regards proportions and details. One of the cleverest makers of models and kayaks once agreed to make a correct model, but asked the same price for it as if it were a real kayak; when he delivered it, he declared that he would never make one again for that price.

Finally, these "models" find their way to museums, just where they ought not to be, as generally, with a few exceptions, they are devoid of all scientific value.

I have never heard that Danes in Greenland were offered faked antiquities. On the other hand, imitations, natural size, of old implements no longer in use are often offered for sale. But it is always by persons who are regarded by their countrymen as experts in "old objects", and not the least attempt is made to pretend that they are anything else than what they really are. But many stories are told about all the faked antiquities which a few years ago were sold — together with some genuine objects — to some foreign collectors who were both inexperienced as regards these objects and too eager in their demands.

Summary.

In the present work an attempt has been made to carry out a technological investigation of some of the most important Eskimo weapons and implements. By means of this method a basis has been formed for the classification of the missile weapons and for definitions of the different types and forms. At the same time it has been demonstrated that all the types of weapons may be derived from arrows and darts by adaptation and remodelling to the special use sometimes of the point and sometimes of the shaft with its accessories. This remodelling and evolution of the types may very well have taken place and been carried through within the Arctic area itself, so that there is no need to postulate any borrowing from foreign civilizations except of the idea of a bow and arrow — the common property of all mankind.

During their wanderings, the various tribes lived in regions where some implement or other, or some method or other of hunting, has been inapplicable. When afterwards they came to other regions where the conditions of life were similar to those the tribe had originally left behind them they have, so to speak, been obliged to re-invent and perfect anew implements of which they retained only some vague notion (along with the names) from their former home. Thus the Greenland tribes on their immigration across Ellesmereland and Smith Sound were not able there to use the kayak with its accessories, and did not do so until they arrived at southern regions where it had to be re-constructed and perfected anew. This is still attested by the fact that the different main types of the Greenland kayak appear to have a regional distribution exactly similar to that of the main forms of the Greenland dialect.

A technological investigation of the various forms shown by the Ulo or Woman's Knife proves that there exist no regional forms of this implement, as has been suggested by Mason. The various well-known forms are all referable to a few types, which are of importance only from a technological point of view. These types were due to scantiness of material, and when this no longer existed, the form of the implement approached more and more a definite

ideal form such as that expressed in the forms with which the Eskimo are supplied through their trading connection with Europeans.

Neither, as regards stone lamps for the burning of seal oil, are there found any regional forms proper, to justify the statement that each tribe had its own form. The form, in this case, is primarily dependent on the accidental form of the raw material, and in a less degree on the object in view. There is, however, here, as shown by HOUGH, a certain degree of adaptation to local needs, in so far as large lamps are in the majority in the high Arctic regions and small ones in regions where the period of darkness is comparatively short, or where other fuel is used. But that does not preclude large lamps also being found in the latter localities because a surplus of light and heat is inevitably connected with the Eskimo idea of luxury.

Of the various, both ancient and modern, methods for hunting on ice in West Greenland a more exhaustive description is given here than has been given anywhere else, and in the case of each method an account is given of its dependence upon local, climatic and other conditions, as also of its economic importance.

A number of old, and several new implements are here described for the first time. Some of them have occasionally been mentioned previously from West Greenland, but have not been exhaustively described; and some have hitherto been known from other Eskimo tribes only. The following should especially be noticed: — Shooting harpoon for use on kayak; harpoons for hunting Arctic Right Whale; detachable lance-head for harpoon; a sealing net of whalebone strings; a shooting screen for hunting on ice and for use on kayaks; a drift rudder; a rifle bag for the kayak; marrow-extractors; a louserake (back scratcher); some specimens of *ajagaq*; and a stone knife for carving in bone and wood. Also, a description is given of the peculiar working method employed in the use of the stone knife.

Lastly, I wish once more to draw attention to the fact that the common "models" from West Greenland especially of kayaks, umiaqs, and sledges are not true models, but merely the products of a domestic industry and intended for sale to foreigners, and that all the proportions and peculiarities of construction usually differ greatly from those found in the real article. And as a closing remark I want to point out that though faked "antiquities" are very rare, yet they may sometimes be met with.

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Additional notes.

The manuscript of the present work was finished in November 1911 and was sent to Copenhagen in March 1912 for publication, and it is to be regretted that its publication has been so long delayed. In the meantime I have had the opportunity of studying a much larger material, belonging partly to my own collection, and partly to those of others. This has not, however, had the effect of changing my opinion on those points in which I differed from others, indeed, in some cases, I am now in a position to give better and fuller examples in support of my views.

Moreover, by the courtesy of Professor F. W. Putnam, Cambridge, Mass.; Professor F. Boas, New York; the Smithsonian Institution, Bureau of American Ethnology, Washington; and the American Museum of Natural History, New York, I have been able to consult some more recent American literature on the Eskimo tribes west of Greenland. It is here my pleasant duty to express my cordial thanks for this help.

As regards the material culture of the Greenlanders as indicated more particularly by their implements two important works have in the meantime been published. The one is H. P. Steensby: Etnografiske og antropogeografiske Rejsestudier i Nord-Grønland, 1909, Meddel. om Grønland, 50, 1912. In this the author has among other things described the Rifle Bag, the Drift Rudder and the Shooting Screen for Kayak, consequently, the description given by me in the present work cannot be called the first. As, however, it supplements that of Steensby in some points, especially, as regards the figures, I have let it stand.

The other is W. Thalbitzer's great and valuable work: The Ammassalik Eskimo, I, Meddel. om Grønland, 39, 1914, in which the author has firstly prepared and published a new edition, in English, of G. Holm's classical studies on the East Greenlanders, and of such works of other authors as are directly connected with them. Thalbitzer has thereby supplied a long-felt want and ethnologists outside Scandinavia will feel very grateful to him. Moreover, Thalbitzer has here given a most elaborate and copiously illustrated description of the implements of the East Greenlanders, based on all the available collections and on the author's own studies in the field. In this work THALBITZER has also taken the opportunity to correct some erroneous statements concerning West Greenland implements which he had made in a previous work, and which I have pointed out in the present work. But at the same time he happens to have made some fresh mistakes — probably owing to want of sufficient museum-material from West Greenland. In so far as they have reference to the particular subjects, of which I have been treating, I feel it my duty to correct these positive errors before they circulate further. Lastly, there are points regarding which THALBITZER's and my opinion do not coincide, because we regard the problems from different points of view, and try to solve them in different ways.

In consequence of all this I should have liked to rewrite some parts of the present work, but during the short space of time which intervenes in Greenland between the arrival and the departure of the steamer it has been impossible for me to do more than read through — in proof — that part of my MS. which had already been printed, and to write some scattered additional remarks to those parts of my work where they were most urgently needed owing to the new publications.

To page 126.

THALBITZER says (loc. cit. p. 425) "Which of the flat sides of the harpoon we should call the upper or under side, must depend upon how the Eskimo places the head on the harpoon shaft, when he lays it on the kaiak, or lifts it preparatory to casting." With this I can fully agree, but when the author "imagines, that in throwing the belly of the harpoon toggle looks upwards, — thus the basal barbs, produced by the bevelling of the base, lie in the plane of the under side," he is mistaken. Just the reverse is the case; during the throw the harpoon must be placed with its bevelled toggling butt above the foreshaft, and the loop of the line below, otherwise the loosening of the shaft will be impeded, as also the toggling movement of the harpoon. Therefore I call the side which faces upwards during the throw the dorsal side, and almost all my figures — and those of others also — show the harpoons as seen from the ventral side.

To page 130.

At the hinder end of the toggling butt of numerous harpoons of more primitive workmanship there is a number of small notches which THALBITZER (p. 432) supposes to be merely ornamental. They are, however, of decidedly technological importance, as without them the butt would slip from the layer of fat. Therefore, they are not found in the more highly developed harpoon-forms, where the toggling butt is acutely triangular or deeply bifurcated, because they are not wanted.

To page 152.

MASON is right when he describes foreshafts of harpoons and lances as sometimes having a socket at the base and sometimes a tenon, because both forms occur indiscriminately, although perhaps the former is now more common. Of ten specimens of *igimaq*'s which I have before me, three have tenons, six sockets, and one nothing at all, being simply cut straight off. And very much the same is the case with the foreshafts of the lances (cf. THALBITZER, p. 411, and my Fig. 16, *r*, *s*, where both specimens have tenons).

To page 146.

THALBITZER says p. 418 "With the *tikaagut* (lance thrown by hand) the cast is said to be longer than with the throwing stick." This must be a misapprehension, because just the reverse is the case, the throwing stick increasing the length of the arm and adding to its power. If a man has sufficient courage he may approach so close to the prey that he can throw with his hand alone; if not, or if the prey is dangerous, he must throw from a greater distance, and then a throwing stick is necessary. The throwing stick is one of the numerous precautionary measures found in the kayak.

To page 146.

I have lately had an opportunity of studying a collection of harpoons from a single settlement, viz. Hunde Eiland in Disco Bay. There were 46 pieces, no longer in use; the majority were of recent date. And either, because they were broken and could not very well be mended oftener, or because they had been lost by accident or had become useless owing to the violent death of their owner, they had been cast aside. A smaller number were found in old sites of houses, or at the coast, and of these some were undoubtedly old.

As regards form and size there were no two identical pieces in the whole collection. In all the newer harpoons the length of the bone piece, excluding the blade, varied from 7 to 10 cm. Among the older harpoons some were small in size, only 4—6 cm. long. Excepting a few, they have all had, or still have, iron blades. Taking the forms which I have illustrated in Fig. 11 (p. 141) as a starting point we may group them as follows:—

A. With two lateral barbs.

I. Cf. Fig. 11, *d*, *p*, *r*; toggling butt bifurcated; 9 pieces.
II. „ „ „ *q*; toggling butt undivided, pointed; 6 pieces.
III. Toggling butt with one large median point and two small points near base, or with three points of nearly equal size, or with a smaller median and larger basal point. Thus, this group contains fair transitions between the two former; 6 pieces.

B. Without lateral barbs.

IV. Cf. Fig. 1, C; toggling butt bifurcated; 10 pieces.
V. „ „ „, B; Fig. 11, *a*; toggling butt undivided. In this group several are very old; one may have had a stone blade. Most of them are probably harpoons for thrusting; 6 pieces.
VI. Transitional types between IV and V: toggling butt trifurcated; 2 pieces.

Thus, the harpoons hitherto mentioned form two quite parallel series. Besides these we found some groups diverging from those mentioned above.

VII. Small harpoons without lateral barbs, toggling butt bifurcated, not lying on the dorsal side, thus having two symmetrical planes (cf. Fig. 11. *m*). Several, and perhaps all, harpoons for thrusting; 4 pieces.

VIII. Without lateral barbs, toggling butt lateral, unsymmetrical. Cf. the hinder end of Fig. 11, *c*; 2 pieces.

IX. A rather unusual form, somewhat different from all forms actually known to me. One old specimen, having had, however, an iron blade.

After having examined this collection, I thought it would be interesting to see the harpoon forms which are in use at the present time at the same settlement, and seized the opportunity of doing so during one or two stormy days when all the kayaks were at home. I investigated some 60 kayaks with their accessories — it is one of the places where the kayak culture stands as high as in the southern part of the west coast. The investigation showed that the majority of the harpoon forms belonged to groups I—IV, but that within these limits the same rich variety occurred as in the collection from Hunde Eiland, so that here, also, no two identical forms occurred. In comparison with the conditions as they are known to me from other settlements hereabouts it struck me that the number of harpoons with lateral barbs was relatively large. The fact is, that in other places these harpoons are rare or totally absent, and type IV is the dominant one. But recently Mr. Karl Olrik of Rodebay, district of Jakobshavn (whom Steensby quotes as an authority on the history of the drift rudder), has in the Greenland periodical *Avangnarmioq*, 1914, No. 4, recommended his countrymen to retain it, and has, at the same time, drawn their attention to a new form which he thinks is not sufficiently known in North Greenland, and not at all in South Greenland. In the new form, instead of lateral barbs on the bone-piece, there is a small lateral barb on the iron blade itself. Mr. Karl Olrik first saw it some time "between 1870 and 1880" with a man from Nûgâq in the district of Ritenbenk, but he does not know who invented it, or how old it is; but he thinks it originally came from that district.

The object of this new form is as follows:— It is becoming more and more common to shoot the seal before it is harpooned. But as seals float only when in a certain state of nutrition a seal is often lost because the hunter does not succeed in reaching it quickly enough to attach it firmly to the harpoon. As a last resource the hunter tries to harpoon the sinking seal through the water, but as, in this case. the projections on the shaft offer great resistance, especially the *ernangnaq*-form. the throw does not reach far, and is not very effective. But if the hunter succeeds in getting a barb, be it ever so small, into a dead seal, he can thereby draw it up. If the seal is only wounded, then of course, in tossing about, it frees itself from the small barb. but then it must come to the surface to blow, whereupon it may be harpooned more effectively, so that the harpoon toggles.

To page 153.

As one of the advantages of the East Greenland double bladder Thalbitzer (p. 455) mentions that it "can keep two seals up, the other only one." But as is well-known the large bladder is not used to keep the dead seal afloat; for that purpose even the smallest towing bladder is sufficient, the specific gravity of the seal being only very slightly greater than that of the water. The resistance offered by the bladder to the wounded diving seal is simply dependent upon its volume, and the combined volume of an East

Greenland double bladder. judging from the figures, is not greater than that of the large North Greenland bladder.

To page 166.

I have subsequently seen a large number of reserve lances from the islands in Disco Bay. It appears that the majority of them have the two small lines fastened in a manner somewhat different from that shown in my Fig. 25, A. The bone piece is more cylindrical than in Fig. 25, A; and at the strongest point, midway between the socket for the foreshaft and the slit for the blade, there is a complicated system of boring which consists of four holes two on each side of the plane of the blade. From these holes grooves lead down towards the basal edge, and two small lines are spliced in a loop through the holes, one on each side. One specimen had a simple boring, enlarged on one side for the reception of a large knot; it has consequently been fastened with one line only.

They vary in size being from 8 to 13 cm. long, and in the majority the blade is relatively broader than in the specimen figured in the present work.

To page 181.

Steensby, in the paper mentioned above, has been able entirely to unravel the history of the drift rudder and to establish the fact that the shooting screen must have been developed by remodelling the far older shooting screen for hunting on ice. Of this view, which is in accordance with the opinion expressed by me on p. 181, I have additional proof. Among the shooting screens which occurred on the kayaks I examined on Hunde Eiland on the occasion mentioned above, there were two in which the *tâlutarfik* was shaped like a veritable little sledge, which, with the exception of its size, differed from the small sledge for the shooting screen for hunting on ice, only in having its runners bent inwards towards each other at the bottom, to fit the fore end of the kayak. These two specimens belonged to two of the oldest hunters, and one of them explained to me that they were thus in old days; while now, one was content with a simple wooden block with a dovetailed slot, because it was easier to make, and served the same purpose.

The Greenland editor, Lars Møller, in the article cited by Steensby, also says expressively (p. 142) that the shooting screen is mounted on "a kind of a small sledge." In the original stands *qamutaussaq* "something like a sledge" which is just the technical term for the shooting sledge for hunting on ice.

To page 211.

Thalbitzer, on p. 679, mentions that I have comprised all the Eskimo Ulo-forms within three main types, but I regret that he does not mention the technological reasons I had for doing so. According to Thalbitzer it appears that Solberg, whose work is unfortunately inaccessible to me, maintains that stone implements, which had formerly served as Ulos are wanting in West Greenland. This statement, if made, is wrong, and must be due to deficient material. Sector or quadrant shaped pieces sharpened along the curved edge are by no means rare, and lately I saw — in a collection belonging to another — a large crescent shaped Ulo-blade of grey porcelain jasper. It was 9 cm. in length, but one end was broken off, so that its entire length had been about 11 cm. In the middle it was 2.6 cm. broad. It had been polished on both sides, from slightly above the middle down to the convex cutting edge, while the upper, slightly concave edge had not been polished. Afterwards part of this polished surface was lost, having been split off by the action of frost, a fairly common phenomenon in Greenland stone implements (though its occurrence has scarcely been sufficiently taken into account by ethnologists!). The blade has doubtless been fastened into a groove of a piece of bone, which again has been fastened to the handle proper.

This specimen was found in a woman's grave on the island of Manîtsoq near Egedesminde.

That fewer forms of Ulo are now found in West than in East Greenland is of course quite natural. Access to better material has been far easier in the former region, consequently, the finished ideal form, which cannot be perfected any further, was able to come into existence far earlier there. Besides, we must remember that as yet, we have very little knowledge of the former, uninfluenced condition of the implements of the West Greenlanders. Formerly, their implements were not collected as have been those of the East Greenlanders.

When THALBITZER says that forms such as my Fig. 46, Nos. 12 and 18 are not found in Greenland, he is right as regards No. 18. The fact is that this piece is probably unique as regards its outline merely, which exists only in this specimen in Washington, being probably due to a casual caprice of the maker. But technologically it is very much the same as those from East Greenland, or one might call it a transitional form between these and what I call the ideal type: the fingers are distributed around the middle bar which is really superfluous here. On the other hand I have seen type No. 12 here, where it has probably occurred almost as frequently as elsewhere, this type is one of the final stages in the progression towards the ideal type, and in it the blade, for the sake of additional strength, is fastened to a bone piece; the blade may be of iron, but stone blades may also be advantageously secured thus. Moreover, THALBITZER says that forms such as my Fig. 45, Nos. 4—6, do not exist outside Greenland. He overlooks the fact that No. 14 (North West Canada) has precisely the same form, and that Nos. 18 (West Alaska) and 21 (Thlinkit Indians) are, technologically speaking, nearly the same.

I cannot understand why this Ulo-form which I call the ideal type may not be "a true Eskimo implement" because it is entirely, or partly, made from imported material. If it had been a European tool which the Eskimo had adopted for his work, as for instance a pair of scissors or a rifle, then I could have understood this statement, but it is, on the contrary, a form which the Eskimo is everywhere endeavouring to reach with more or less success according to the material at his disposal. But he cannot make it himself in its most perfect form, because for this he has neither tools nor forging fire. In its perfect form it is prepared especially for the Eskimo by those who deal with him, and of course according to his wishes.

On the other hand, when THALBITZER writes that my "intention seems only to expound the developmental types of the cutting ulos, not of the scrapers" he is quite right. My first object in the task I have set myself has been to try and find out as accurately as possible what is the purpose of each article, and how it is used, because then only can I hope to understand its form.

To page 219.

I have lately had an opportunity of studying a collection of West Greenland lamps and soapstone kettles — probably the largest collection which exists from a single district — belonging to Mr. THRON. the manager of Holstensborg. It contains at the present time about 150 specimens, the majority of which have been in use until now; but there are also many very ancient specimens from the ruins of houses and from graves; for instance, one is from a grave which, on account of the secular sinking af the coast, was almost washed away. All possible sizes occur, ranging from over 40 cm. in length down to little girls' lamps, or to quite tiny dolls' lamps, only about 3—4 cm. in length. In the whole collection no two identical forms occur. Taking HOUGH's typical outlines as a starting point, this great wealth of forms may be grouped around the following "types."

The forms most frequently met with are similar to HOUGH's Nos. 2 (Cumberland Gulf), 3 (Smith Sound) and 4 (Repulse Bay); then come the elliptical ones with flat reservoir such as HOUGH No. 6 (East Greenland) and semicircular such as HOUGH No. 9 (Kotzebue Sound). Moreover, trapezoid lamps with rounded angles occur frequently, of which there are no corresponding forms in HOUGH's outlines: others are circular such as HOUGH No. 12 (Bristol Bay) or slightly oblong such as HOUGH No. 14 (Aleutian Islands), the two latter types with deeply hollowed reservoir. Then there are types with ridges, similar to the one I have figured, and a great many rarer types, each of which is represented by only one or a few specimens, e. g. rectangular with elliptical reservoir, ditto with edge for the wick on the narrow side, elliptical or pear-shaped with edge for the wick on the narrow side, this form recalling that of HOUGH No. 13 (Kadiak).

Among the dolls' lamps there are three types which are of interest in so far as, owing to their small size, want of material has scarcely played any rôle. Here the maker has consequently been able to fashion the lamp as he liked. Here the most frequent forms are like HOUGH's Nos. 2—4 and 6, then comes No. 7, not because the ledge is of the least practical importance in such small lamps, but because the form with the ledge *(qutdleq oqalik)* is regarded as being the most correct one. Lastly, among the dolls' lamps of most recent date there frequently occurs a form which consists of a rectangular, rather high block, in which a reservoir is made. The fact being that it requires nothing special to stand on.

Moreover, the collection shows interesting examples of repairs, and of lamps made as a make-shift. For instance, there was a broken-off piece of a huge lamp of HOUGH's type No. 4, which the finder had provided with a square depression, and in this condition it served as a lamp when Mr. THRON acquired it. In another case, where the soapstone lamp was broken beyond repair, the wick was placed in the clumsy three-legged wooden cup, which had originally been intended to catch up the waste oil, and was used as a lamp until one side of it was entirely burnt down. These two examples show better than many words how few are the claims made by such lamps.

Several specimens showed distinctly the method employed in making them. As might be expected, the reservoir is first hollowed out, and then the outer part is formed. In many the latter part had not yet been executed, although the lamp had been in use for a fairly long time. Regarding this point Mr. THRON had obtained the interesting information that in such cases the maker had died before the work was finished. Then nobody else would finish the work; but the lamp could very well be used. In the majority of the flat lamps the bottom of the reservoir sloped towards the edge with the wick, and, often, also obliquely towards one side; but in a good many specimens it sloped away from the edge with the wick.

In some cases Mr. THRON had been able to get information regarding the history of the lamp during 3—4 generations, and often such specimens had with their changing owners made most extensive wanderings within West Greenland, so that they were obtained far from the place where they were made. In some cases, apart from the labels, it was possible on petrographical evidence alone to arrange them in groups around the localities, by no means numerous, where a serviceable soapstone occurs. But not even within a single such centre of production was it possible, either in form or in size, to demonstrate points which could be regarded as conventional or regional.

THALBITZER, on pp. 501 and 674, mentions whetstones with holes, and suggests that this is perhaps due to foreign influence. Here, at Disco Bay, almost all ancient whetstones have holes, while they are absent from the modern specimens, and, according to tradition, the explanation is simply this, that before Europeans came into the country there were no pockets in the trousers, and therefore a cord was necessary to carry the whetstone when travelling or hunting Caribou.

To THALBITZER, page 554.

Here, stave-vessels are extremely common in old graves and sites of houses, and I think there is no need to refer them to foreign influence. Besides, in some points they differ from European cooper's work.

To THALBITZER, page 574.

Frocks of bird's skins (*timiaq*'s) are commonly used also by women in West Greenland, even in our days.

To THALBITZER, page 677.

As has several times been mentioned, in West Greenland lances occur both with and without a throwing stick, and the author is doubtless right in regarding the latter form as the older. NANSEN's record of a harpoon thrown without a throwing stick is not due to misunderstanding. Such forms of *ũnâq* still occur, and used to be more common formerly.

THALBITZER has, on page 681, drawn attention to a statement of BEHRENS, otherwise undoubtedly quite overlooked, that at Umanaq a "skin basket and a kind of implement made of reindeer-horn" are used for gathering berries, and he "imagines that this implement may have been a comb." It is not. I possess two specimens, one of which, from Hunde Eiland, is very old, and much worn. It consists of a rather thin shell of antler, 22 cm. long and 6 cm. broad, rounded off and pierced with a hole at either end. The bone piece is moreover sufficiently curved to allow the handle, a 18 cm. long wooden stick, to protrude with its ends about one cm. through the holes, so that the whole implement resembles the hilt of a sword. The other specimen is from Skansen, on Disco Island; here the bow is made of whalebone and is slightly more curved. The implement is called *kumigaut* from the same root as *kumigpâ* (192), he scratches him or he louses him. The berries are scraped off in the autumn or winter after the frost has set in, and the name takes it origin from the fact that the berries are considered to be the louse of the earth. They are scraped off, not into a basket, but into a bag made of an old boat-skin. My specimen is 38 cm. high, and about 32 cm. in diameter; it is provided on one side with a carrying strap. The bottom is of thinner skin, and is provided with numerous small square holes for sifting the snow from the berries. It is called *kiligaut* from *kiligarpâ* (177), she scrapes berries in this way. As berry-gathering is no longer of any great importance here, these implements are scarcely used much nowadays; they are, however, known to everybody.

Thalbitzer summarizes on page 728 the provincialisms of the material culture of the Angmagsalik district, whereby it differs from that of the West Greenlanders, and mentions 39 objects in particular. It is seen, however, that almost one half of these are, or were, also found on the west coast, and future finds will probably bring others to light. Here I shall mention those regarding which my information is certain.

No. 2. Whip-lashes with ivory beads were, according to verbal information received from Mr. Thron and the native manager of the trading place Sarfanguaq, Mr. David Olsen, until a few years ago common in the district of Holstensborg.

No. 3. The whip-handle is also used in West Greenland as a brake when going down long, and not too steep, hills. The reason why it is no longer provided with a bone ferule for this purpose is that the handle is now of little value; it is however sometimes met with.

No. 4. Boat-hooks of bone on wooden poles have been used here for *umiaq*'s, and small tools for scraping the dirt out from between the skin of the boat and its wooden frame are used even today.

No. 6. The lance is frequently thrown with the throwing stick in West Greenland; and this is not quite a recent innovation.

No. 13. Men's finger protectors (*kuvdlorfik*, from *kuvdloq* (193), thumb) are used everywhere even today; formerly, knee protectors (*sêrqorut*, from *sêrqoq* (318), knee) were used everywhere, but these have gone out of use, since the custom of sitting naked indoor ceased.

No. 14. A thong smoother, of bone, pierced with many holes of various kinds, is quite an indispensable tool, even for Europeans who themselves drive dogs. Here also it is often made of the penis-bones of the large seals.

No. 15. Narrow three-barred drying frames for rawhide lines and whips are common here. They have a somewhat better form than those of the Angmagsalikers, the three bars being held in position by slightly angular or curved end pieces, which force the middle bar out of the plane of the other two, and thus promote the drying process materially. Besides the drying the intention is also that the wet line or whip-lash shall return to exactly the same coils as when it was new. The coils are therefore laid very carefully so that the hairy side everywhere turns outwards. Then the line can be replaced accurately in the line-rack, and run smoothly when the seal is hit. And a whip, which is not carefully treated after it has got wet, soon becomes useless. Here, the technical name of the implement is *ímussivik* from *ímuserpâ* (98), he places a rawhide line in exact coils, while *initsat* (100) is a more generic designation, which especially signifies the large drying rack for clothes and foot wear.

Four specimens of native workmanship which I have here before me are each about 50 cm. in length.

No. 16. Man's knives, see pp. 195 sqq.

No. 20. Bone needles for stringing fish are used in West Greenland; but, certainly, I have not heard of their being used for caplins.

No. 25. In a note (p. 753) the author mentions some examples from West Greenland of ivory relief-work nailed on wood. I have also seen some, and there has undoubtedly been much more formerly, but it is lost.

No. 27. Seal-tail ornaments are not rare in West Greenland, e. g. on small toggles, "feathers" for *ernangnaq*, etc.

No. 28. Serrated edges on buckles are very common, for instance on hunting bags.

No. 29. The dot and circle ornament is common; see for instance my Fig. 42, D.

No. 31. At Cape York, also, the men wear hair-bands, not halter-like as at Angmagsalik, it is true, but consisting of a single cord round the forehead. I have a carving in wood representing the bust of a man with thick, long hair which is held in place by a cord round the forehead. The piece appears to be very old. I found it in peat on a camping ground on the small island *Kavdlunait nunât*, east of Egedesminde. The name of the island: "the land of the white men, especially of the Danes" must not lead one to believe that there has ever been a Danish settlement there. The island is uninhabitable because it lacks drinking water; it belongs to the so-called "Peat islands," the whole island being covered with a homogeneous mass of peat. The name is an old Greenland joke because the island is quite flat.

No. 33. I doubt whether masks are really unknown in West Greenland. Here it is customary on Twelfth-night for children and young people to run about from house to house in strange grotesque disguises: skins with the hair outside, women in men's clothing, sometimes with large phallus-like appendages attached. They perform odd dances, must not talk, but only produce indistinct or inarticulate sounds such as hm! el. l. Usually they wear grotesque masks made of skin; on one occasion I saw one elaborately carved in wood. These masks do not at all resemble European shrove-tide masks which, though known to most of them, they have no desire to use for this purpose, but they far more closely resemble masks from Alaska. I have not been able to obtain any information as to the age of the custom; it is merely said to be "very old."

No. 37. Toys with nodding birds are common on the islands in Disco Bay (cf. p. 226).

No. 39. Slings (*igdlûtit*, 77) are commonly used by children.

I should like to conclude these additional notes by adding that the more minutely we study the material culture of the Eskimo, the more homogeneous we find it to be, a fact which accords well with the relatively great homogeneity of the conditions of life which nature offers to its children in the Arctic. Each object tells its own story of the difficulties due to stubborn material of inferior quality which have been conquered by an intelligent people with extremely poor tools. Where the needs, and the ways and means of satisfying these needs, are the same, there the implements too will, on the whole, be the same. But that does not prevent a wealth of form as in life itself presenting itself where we have a sufficiently large collection of the same implement, a wealth of form which should warn us against drawing too narrow limits as regards "types."

Disco, August 1914.

CONTENTS

CORRIGENDA

Page 135, line 10 from top and line 10 from bottom, for *pushing sledge* read *shooting sledge.*

VI.

NATURFREDNING I DANSK GRØNLAND

AF

MORTEN P. PORSILD

1914

DENNE Overskrift vil ved første Øjekast synes at indeholde en urimelig Tanke, da hver Indbygger i Vest-Grønland har over een Kvadratkilometer isfrit Kystland til Raadighed, og da den danske Stat har Monopol paa Besejling og Handel her, saa at det hele koloniserede Omraade til en vis Grad kan opfattes som et Stykke fredet Natur. Alligevel har den sparsomme Befolkning umiskendelig paavirket baade Landets og Havets Dyrebestand, i nogle Tilfælde stærkere, end godt er for Befolkningen selv. At faa Fredningsbestemmelser indført her, vil maaske blive nødvendigt, men det vil være forbundet med store Vanskeligheder at faa saadanne Bestemmelser iværksatte og respekterede.

Hvad her skal omtales, er imidlertid kun Fredningen af et Par Voksesteder for sjældne og interessante Planter, og den har været glædelig let at gennemføre.

Disko Sydkyst har fra gammel Tid været kendt som Sæde for talrige sjældne d. v. s. sydlige Planter, der antagelig som Levninger fra en Epoke med mildere Klima efter den store Istid holder sig her i smaa Samfund paa de allergunstigste Steder, især hyppig omkring de varme Kilder. Det har endog været Eskimoerne paafaldende, thi de har et Sagn, der giver Forklaringen derpaa: en Jætte har bugseret Øen derop fra Julianehaabs Egnen.

I den botaniske Literatur er særlig et Par Lokaliteter nær Godhavn blevne klassiske, nemlig Lyngmarken og Engelskmandens-Havn. Her har c. 30 danske, svenske, engelske, amerikanske og svejtsiske Botanikere og Amatørsamlere hentet Bidrag, og dog er der fundet nyt lige til den allernyeste Tid. Lyngmarken er et c. $1^1/_2$ Kvadratkilometer stort Dalstrøg, der ligger mellem Godhavns Havn og de høje Basaltfjælde bag ved. Den vandes dels af Smæltevandsbække fra Fjældet, dels af Afløbet fra en stor varm Kilde, Ûnartuarssuk, der kommer frem i Lyngmarkens østlige Parti, hvor Gnejsen ved Godhavn skarpt afgrænses fra Trapformationens nederste, haarde Tuflag (Palagonit?) ved en SSO. løbende Dislokation. Lige ved Udspringet er der ogsaa et lille Parti kulførende Sandsten — ikke afsat i Kortene —, der her træder frem i Dagen. Lyngmarkens Vegetation er stærkt medtaget ved Brændselssamling, navnlig er Pilekrattene kun en sørgelig Rest af, hvad der en Gang har været, og mulig er mere end et Voksested for sjældne Planter herved blevet ødelagt. En Fredning af dette Parti er dog ugørligt, det er altfor let tilgængeligt, baade Sommer og Vinter, og det har endnu stor Betydning for Befolkningen, saa at den ikke uden Savn vilde kunde undvære det. Anderledes ligger Forholdene i Engelskmandens-Havn. Herved forstaas en lille Vig, V. f. Godhavns Havn. Den er ubrugelig som Havn, den er altfor dyb, saa at de store Isfjælde kan komme derind og Sø fra SV. gaar derind med fuld Styrke.

Fig. 1. Engelskmandens-Havn, den inderste Vig. Helt i Forgrunden Udløbet af Elven fra Basaltfjældene, bag ved Ûnartorssuaq, Afløbet fra Kilderne oppe paa Gnejsterrassen; Baggrunden Basaltfjæld. Det er Højvande, og Havstokken er delvis dækket. Omtrent alle sydlige Planter vokser paa det smalle Forland mellem Havstokken og Gnejsklipperne.

Langs Bunden ligger der en mægtig Strandvold af store Gnejsrullesten. Indenfor Strandvolden er der en smal Strimmel Lavland, bag dette et vildt forrevet Parti af Gnejsklipper op til en Højde af et Par Hundrede Meter, hvor Gnejsen danner en Terrasse; bag denne følger Basaltfjældet. Her oppe, paa Grænsen mellem Gnejs og Basalt er der et stort Kompleks af varme Kilder, omgivne af en frodig Vegetation; tilsammen danner de en ret betydelig Elv, der i talrige Fald og Kaskader baner sig Vej ned gennem en Kløft i »Havnens« vestre Hjørne; den hedder Ûnartorssuaq. I det østre Hjørne er der ogsaa en vandrig Elv, der dels kommer fra Kilder, men som i Sommertiden dog faar sit Hovedtilløb af Smæltevand oppe fra Fjældet. Nede paa den smalle

Lavlandsstrimmel, mellem Udløbet af de to Elve, siver der desuden hele Aaret igennem varmt Vand frem af Sprækker i Gnejsen. Her kan man om Vinteren, i den koldeste Tid, naar Lufttemperaturen stundom synker ned til henimod —30° C. finde smaa Vandpytter, der maaler indtil +17° C.! Jorden fryser aldrig her, det tykke Snelag hviler kun hist og her paa Sten, ellers er der hult under det, og op gennem Snelaget danner der sig over de varmeste Steder skorstensagtige Huller, gennem hvilke en varm og fugtig Drivhusluft strømmer en imøde. Er der Lys nok, finder man Algehinder i fuld Vækst paa Vandpytterne, grønne Skud af højere Planter, paa Stenene overvintrer Ferskvandssnegle (*Vitrina Angelicae*) og Insekter (*Dorthesia Chiton*) i massevis, og i Vandet findes levende Regnorme (*Enchytræus* sp.) og Vandkalve (*Hydroporus atriceps*).

Om Sommeren er her ideale Betingelser for Plantevæksten. Det vender lige mod Syd, den Retning hvorfra det paa Syd-Disko Kyst saa godt som aldrig blæser, da de sydlige Vinde et Par Kvartmil uden for Kysten synes at bøje op ad for at komme over den høje Ø. Fra alle andre Sider er der Læ, mod Nord af Basaltfjældene, mod Øst og Vest af høje Gnejsklipper. Der samler sig derfor her rigeligt af uorganisk og organisk Støv, døde Blade og med dem naturligvis ogsaa Frø. Om Vinteren er her altid et tykt og jævnt, men ikke haardføget Snedække. Om Foraaret fremmer Beliggenheden Snesmæltningen, Vegetationen kan tidligere begynde her. Allerede sidst i Marts eller i April, mens endnu de lange Slædeveje ligger ubrudte over Havisen langs Kysterne, finder man her lange grønne Skud, og de ikke kælne rent arktiske Planter, der findes mellem de sydlige, blomstrer og sætter Frugt tidligere her end andet Steds.

Ogsaa her har Vegetationen lidt, om end ikke saa meget som i Lyngmarken. De gamle Espalierbirke og -Pile er alle knækkede, og skønt Kvanerne siges at være bittre, plejede Børn tidligere at rykke dem op, smage paa dem og saa kaste dem bort. Sandsynligt er det, at derved en eller anden sjælden Plante er bleven udryddet, da det ikke har været muligt, trods omhyggelig Eftersøgning, at genfinde alle af tidligere Samlere angivne Arter.

Plantevæksten spiller jo ingen stor Rolle for Grønlændere, navnlig for Kolonigrønlændere, der i fast Tjeneste eller ved Fangst og Skibsarbejde tilsammen ofte har en ret anselig aarlig Pengeindtægt, der giver Adgang til at købe baade Brød og andre Næringsmidler af Planteriget samt til Kul. Medens Bær tidligere indsamledes i store Kvantiteter, samles de nu kun til øjeblikkelig Fortæring eller til Salg til Danske, Kvaner ligesaa. Lyng og Ris samles nærmest mere end tidligere, fordi saa godt som alle har Kakkelovne, og Tranlampen har tabt sin Betydning som Varmekilde. Desuden skæres Tørv, undtagen i de Egne, hvor Kullene er lette at faa. Omkring alle ældre Bopladser er det derfor let at se, hvorledes Vegetationen er forandret ved Torveskæring, Lyng- og Rissamling. Det er jo ikke underligt, naar man betænker, at de Individer af Revling (*Empetrum*), Firkantlyng (*Cassiope tetragona*) og Pil (*Salix glauca*), der indsamles, som Regel er mindst 40—50 Aar gamle! Særlig tydeligt kan man se det her ved Godhavn, hvor Røde-Elv i Sommertiden ikke kan passeres uden Baad, og hvor derfor Lyngsamling paa dens østre Bred maa indskrænkes til den sene Foraars- og Efteraarstid, da Elven er tillagt og Lyngheden nogenlunde snebar. Her er Lyngheden endnu frodig og Lyngen høj, medens paa den vestre Side høj Lyng knapt kan findes mere.

I Engelskmandens Havn er der nok baade Lyng og Bær, men det er paa de ujævne Gnejsklipper, hvor det er besværligt at færdes; man foretrækker derfor de jævnere Strækninger i Basaltomraadet. Dertil kommer, at »Havnen« kun er tilgængelig fra Baad om Sommeren, endda kun naar Søen er rolig, og i normale Vintre skjules Pilene helt af Sneen. Men i snefattige Vintre eller sent om Foraaret, naar Brændselsbeholdningen er sluppet op, er de let tilgængelige og derfor truede, og da mange af de sydlige, sjældne Planter i Modsætning til de ægte arktiske Arter, er Skyggeplanter, trues de med Undergang, naar de høje Ris fjærnes.

Lige Øst for Godhavn er der en anden Lokalitet, som har vist sig særlig rig paa sjældne Planter. Her gaar der et lille Dalstrøg ud fra Lyngmarken, ned til Kysten, langs med den ovennævnte Dislokationslinie. Dalen, ved hvis Munding den arktiske Station ligger, kaldes af de danske Østerdal (Fig. 2); mod Nordøst begrænses den af en Tufvæg, der paa sine Steder rager c. 100 m op over Gnejsen. Fra denne Tuf kommer der flere Steder varme Kilder frem. Ned mod Dalen er der en mægtig Talus, dels dannet af nedstyrtede og nedskyllede Dele fra Tuffen, dels af tilføget organisk og uorganisk Materiale, som den fremherskende Vind har aflejret paa Læsiden. Denne stejle Talus — Østerli døbtes den, efter at Stationen var bygget — har ikke været omtalt i Botanisk Literatur tidligere; der skal dog nævnes, at den uden Tvivl er Originalfindestedet for *Arabis Holboelli.*

Bækken fra Kilderne løber ikke langs med Lien, men drejer ud i Dalen, og de nedre Dele af Lien vandes derfor væsentligst af Smæltevandet fra de mægtige Snefaner, der om Foraaret hænger ud over Væggens øvre Kant. Paa Eftersommeren er den derfor ret tør. Den har tidligere baaret en kraftig Lyng- og Kratbevoksning, men denne er nu næsten totalt forsvunden, thi Lien er let tilgængelig baade Sommer og Vinter, og den er paa Grund af sin gunstige Eksposition meget tidlig snebar.

Nogen æstetisk Glæde af Blomster havde Grønlænderne tidligere slet ikke, og de fleste har det heller ikke endnu. Alligevel ser man i stærkt blandede Familier, der jo med Forkærlighed efterligner danske Skikke, baade levende Planter i Urtepotter og Blomster i Glas. Ogsaa Gravene smykkes med store Buketter af Blomster, med hele blomstrende

Tuer eller med andre Genstande, som ved deres stærke Farver, ser »pæne« ud: Kvarts- og Feldspatstumper, farvede Glasstumper, Skaller af Blaamusling eller Kammusling, smaa Stumper rødt Garn eller Tøj bundet paa Kviste; en Gang har jeg set visne, hvidmalede Kvanstilke plantet som Pryd paa Grave. Og de unge Piger, der tjener i danske Huse, samler i deres Fritid Blomsterbuketter til deres Madmoders Hjem. Til disse Formaal foretrækkes altid rødt, det er jo de unge Pigers egen Livkulør paa Baandene om Haartoppene, paa Støvleskafter

Fig. 2. Stykke af Østerli: Tufvæggen ud mod Østerdal og dens Talus. De sjældne Planter vokser paa Skraaningen, især foroven ved Foden af Væggen.

og Bluser. Nu er jo Grønlands største Blomst: *Chamaenerium latifolium*, overalt saare almindelig, men derfor netop ikke søgt til saadanne Formaal, thi Grønlænderne har en levende Opfattelse af, at skal en Ting være smuk, maa den ogsaa være lidt ualmindelig; et Tøjmønster, som alle kan faa, vil ingen gaa med. Derfor forbigaas helst den almindelige Gederams, og man opsøger langt hellere den her sjældne smalbladede Gederams (*Ch. angustifolium*) eller Tjærenelliken (*Viscaria alpina*). Disse to Arter er netop et Par af Østerlis Karakterplanter; endnu er der nok af dem til at levere »rødt« i mange Aar, hvis de indsamledes med Maade, efter dansk Smag. Men grønlandsk

Smag er netop ikke »med Maade«; der indsamledes tværtimod vældige Koste, og derved truedes de to Arter særlig med Undergang, især da denne Art Gederams som bekendt slet ikke sætter Frugt i Grønland.

Det stod mig klart, at jeg burde forsøge at gøre noget for at værne i det mindste disse to Steder, og jeg forelagde Sagen for daværende Inspektør for Nord-Grønland, nuværende Direktør for Administrationen af Grønland, Hr. DAUGAARD-JENSEN, der raadede mig til at forhandle med Befolkningen derom og at tilbyde Godhavns Kommunekasse et lille aarligt Bidrag, for at det kommende Kommuneraad, der jo ogsaa skulde være lokal Underøvrighed, kunde faa den Pligt at skride ind, hvis den eventuelle Fredningsvedtægt ikke blev overholdt. Jeg indbød saa alle Husherrerne til et Møde Efteraaret 1909, søgte at forklare dem Sagen og mine Ønsker (»I véd, at jeg ikke efterstræber Jeres Sæler, men Planterne er mine Sæler« . . . .) og stillede mit Tilbud til Kommunekassen; men de ældste erklærede paa de andres Vegne, at Fredningen vilde gøre et saa ringe Indgreb i Befolkningens Interesse, at man ikke vilde modtage noget Vederlag derfor, man vilde hellere ganske

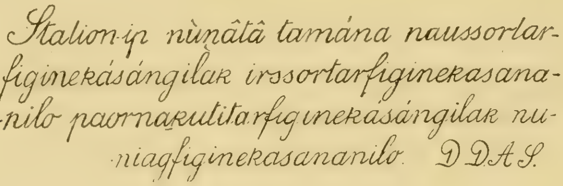


Fig. 3. En af Plakaterne.

frivilligt imødekomme mit ringe Ønske. Kommuneraadets Indblanding var overflødig, thi hver Husherre garanterede for sin Husstand. Jeg burde selv se efter, at Fredningen overholdtes o. s. v. Dog udtaltes et bestemt Ønske, at de fredede Partier skulde tydelig afmærkes og forsynes med Opslag, der angav, hvad man ikke maatte gøre.

Det sidste skete den paafølgende Vinter. Mit Udkast: »Godhavns Husherrer har lovet Stationen, at« o. s. v. omredigeredes under min Fraværelse i Danmark af de Grønlændere, der skar Plakatens Ordlyd i Træ, til det mere kategoriske: »Dette er Stationens Areal. Her maa ikke samles Blomster, skæres Tørv, samles Lyng eller Bær.« For lettere at gennemføre Sagen, havde jeg udtrykkelig sagt, at Fredningen ikke skulde medføre Forbud mod Færdsel de paagældende Steder, paa Jagt eller for at tilse Fælder.

I Engelskmandens-Havn er det fredede Parti kun det smalle Stykke Lavland mellem Havstok og Klipper, c. 200 m langt og 10—50 m bredt; Klipperne og Terrassen med Kilderne ovenfor er nemlig ikke truede. Af Østerli er fredet c. 350 m, d. v. s. saa langt som der tidligere har været Krat eller frodig Hede. Ovenfor ligger der et Stykke med nogle interessante Urtelier, der vel ikke er truede og næppe heller nogensinde bliver det, men som maaske lige saa godt kunde været inddraget under Fredningen.

Siden Fredningen blev etableret, har der ikke været Anledning til at paatale noget som helst Overgreb paa den. Der kan selvfølgelig ikke i den korte Tid paavises nogen Forandring i Vegetationen som Følge af Fredningen. Dertil vokser de arktiske Planter for langsomt. Derimod forekommer det mig at have nogen Interesse at give en Fortegnelse af de sydlige Plantearter, som hidtil er kendte fra de to Omraader tilligemed lidt Oplysninger om deres Udbredelse indenfor de fredede Partier og i deres nærmeste Omegn. Man vil da, naar et Spand af Aar er gaaet, kunne se, om de har taget til eller om der maaske er komne nye til. De almindelige her omkring forekommende arktiske Arter medtager jeg ikke i Fortegnelsen; de findes eller vil kunne findes indenfor det fredede Omraade uden anden Undtagelse, end den Bundens Beskaffenhed betinger. Der findes saaledes paa Østerli ingen Strandplanter, kun faa Kærplanter, begge Steder ingen egentlige Vandplanter.

Sandsynligvis vil der mellem Mosser og Laver kunne findes et lignende Udvalg af sydlige Arter, som fortrinsvis holder til her, men Udbredelsesforholdene indenfor disse Grupper er endnu alt for lidt kendt i Sammenligning med de højere Planters. Det lavere Dyreliv: Biller, Sommerfugle, Hvepse, Edderkopper, Regnorme, Snegle er repræsenteret her, men jeg kender for lidt dertil, til at jeg tør sige andet derom, end at jeg kun i de varme Kilders Omraade har truffet Regnorme og Ferskvands- eller Landsnegle.

Fortegnelse over de sydlige Plantetyper indenfor de fredede Omraader i Engelskmandens-Havn og Østerli.

Botrychium Lunaria (L.) Sw., trives bedst i Skygge under Pile. **Ø.**: ret hyppig, **E. H.**: sparsom; iøvrigt kun fundet et Sted til i Nærheden af Godhavn; paa Grønlands Fastland indtil 65° 10'.

Botrychium lanceolatum (Gmel.) Ångstr.

E. H.: eet Eksemplar, Aug. 1911 (Erling Porsild), rigeligt fruktificerende; paa Fastlandet til 63°.

Aspidium Dryopteris (L.) Baumg.

E. H.: almindelig, ofte i Skygge i Spalter; **Ø.**: sjælden; iøvrigt flere Steder paa Syd-Disko og i Disko-Fjord.

Aspidium spinulosum (Retz.) Sw.

subsp. *dilatatum* (Sw.) Roeper

E. H.: angivet af P. H. (Sørensen) Vibæk, men hverken fundet tidligere eller senere; paa Fastlandet til 66° 53'.

Aspidium Lonchitis (L.) Sw.

E. H.: almindelig; desuden kendt et Par Steder fra Syd-Disko.

Equisetum scirpoides Michx.
fundet faa Gange paa lignende Lokaliteter i Nærheden, men endnu ikke indenfor de fredede Omraader.

Equisetum silvaticum L.
angivet fra Godhavn af WALKER, ikke genfundet senere.

Lycopodium complanatum L.
var. *Chamaecyparissus* A. Br.
angivet fra Godhavn een Gang af P. H. (SØRENSEN) VIBÆK, ikke genfundet senere, derimod een Gang fundet paa Syd-Disko ved Skansen af M. RIKLI; paa Fastlandet til 64° 55′.

Lycopodium alpinum L.
Begge Steder ret almindelig, iøvrigt flere Steder paa Disko.

Phleum alpinum L.
Ved Udløbet fra Kilderne, begge Steder ret hyppig; desuden andre Steder paa Syd-Disko og i Disko-Fjord; moden Frugt er endnu ikke iagttaget paa Disko.

Calamagrostis confinis (Willd.) Nutt.
fundet et Par Gange, men udenfor det fredede Omraade; ogsaa sjælden paa Fastlandet, men dog fundet nordligere end Disko.

Calamagrostis Langsdorffii (Link)
angivet et Par Gange fra Godhavn, i den senere Tid ikke genfundet her, derimod paa Syd-Disko længere østpaa; paa Fastlandet til Disko-Bugt.

Aira flexuosa L.
var. *montana* Trin.
fundet et Par Gange, men udenfor det fredede Omraade; paa Fastlandet til 66° 58′.

Poa nemoralis L.
angivet fra Godhavn af WALKER, ikke senere genfundet; paa Fastlandet sikkert kendt til 67° og angivet nordligere.

Carex capitata Sol.
begge Steder sparsom; sydlig Type, dog fundet indtil 70° 40′ paa Fastlandet.

Carex Macloviana D'Urv.
begge Steder hyppig; paa Fastlandet lignende Udbredelse som foregaaende.

Carex bicolor All.
fundet i Nærheden af Ø., samt et Par Steder til paa Syd-Disko; sydlig Type, paa Fastlandet dog fundet endnu længere nordpaa.

Juncus trifidus L.
begge Steder, ikke sjælden, desuden flere Steder paa Syd-Disko; paa Fastlandet til 67° 15′.

Luzula parviflora (Ehrh.) Desf.
begge Steder Karakterplante; iøvrigt almindelig paa gunstige Steder paa den sydlige Halvdel af Disko; paa Fastlandet tvivlsom N. f. Disko.

Coralliorhiza innata R. Br.
een Gang angivet fra **E. H.** af P. H. (SØRENSEN) VIBÆK, ellers ikke fundet her hverken før eller senere. Desuden een Gang fundet i Disko-Fjord (Th. Fries); paa Fastlandet til 67° 15′.

Listera cordata (L.) R. Br.
E. H.: sparsom, blomstrer ikke hver Sommer, Frugtsætning tvivlsom; paa Fastlandet til 64°.

Habenaria hyperborea (L.) R. Br.
var. *major* Lange.
E. H.: almindelig og rigelig, desuden flere andre Steder paa Syd-Disko og i Disko-Fjord; paa Fastlandet til 65°.

Habenaria albida (L.) R. Br.
Udbredelse paa Disko omtrent som forrige; paa Fastlandet een Gang fundet ved 69° 10′, ellers til 65.

Sagina Linnaei Presl.
nær **Ø.**: sparsom; muligt overset andre Steder paa Syd-Disko; Nordgrænse paa Fastlandet ved 67° 15′.

Stellaria alpestris Hartm.
begge Steder, oftest i Skygge; desuden flere Steder paa Syd-Disko og i Disko-Fjord og Mellemfjord; paa Fastlandet til 68°.

Cerastium trigynum Vill.
begge Steder Karakterplante, især ved Kilderne; iøvrigt ikke sjælden paa gunstige Steder paa Disko; paa Fastlandet fundet ved Vaigat; Nordgrænse paa Hare-Ø.

Viscaria alpina (L.) Fenzl
Ø.: Karakterplante, **E. H.**: ikke sjælden; iøvrigt flere Steder paa Disko; sydlig Type, dog fundet et Par Breddegrader N. f. Disko.

Anemone Richardsoni Hook.
angives paa J. VAHL's trykte Etiketter indtil 69° 14′, hvilket netop er Godhavns Bredde. Eksemplaret findes ikke i Botanisk Museum i København; den er ikke senere fundet her; muligt er det en Fejltagelse, muligt er den udryddet; paa Fastlandet fundet til 67°.

Thalictrum alpinum L.
begge Steder almindelig, ofte i Skygge, desuden flere Steder paa Syd-Disko og i Disko-Fjord; sydlig Type, skønt den paa Fastlandet er fundet til omtrent 71°.

Arabis Holboelli Hornem.
Ø.: Karakterplante, antagelig Originalfindestedet; iøvrigt flere Steder paa Syd-Disko samt i det Indre; paa Fastlandet fundet til 70°.

Sedum villosum L.
Ø.: almindelig, **E. H.**: sparsom; iøvrigt flere Steder paa Syd-Disko og i Fjordene; paa Fastlandet til 70° 40′.

Potentilla alpestris Hall. fil.
begge Steder almindelig, iøvrigt flere Steder paa Disko; paa Fastlandet lidt nordligere end Disko, Hare-Ø.

Alchimilla alpina L.
angivet to Gange fra Godhavns Omegn (af TH. HOLM og TARR & MARTIN) forgæves eftersøgt senere; paa Fastlandet fundet til 67° 15′.

Alchimilla glomerulans Buser
begge Steder Karakterplante; desuden flere Steder paa Syd-Disko og i Fjordene; paa Fastlandet til 69° 13′.

Epilobium Hornemanni Reichenb.
Ø.: ret almindelig, **E. H.**: Karakterplante; desuden flere Steder paa Syd-Disko og i Fjordene; paa Fastlandet næppe N. f. Disko.

Epilobium lactiflorum Hausskn.
E. H.: sparsom, desuden et Par Steder paa Sydkysten og et i Mellemfjord; paa Fastlandet til 64° samt ved 70° 40′.

Epilobium palustre L.
var. *labradoricum* Hausskn.
E. H.: sparsom, desuden et Par Steder i Nærheden samt et paa Disko Vestkyst; paa Fastlandet til 64° 53′.

Chamaenerium angustifolium (L.) Spach.
Ø.: Karakterplante, **E. H.**: sparsom, desuden flere Steder paa Syd-Disko og Disko-Fjord; paa Fastlandet til 68°.
Sætter ikke Frugt i Grønland.

Chamaenerium ambiguum Th. Fr. et Lange (*Ch. angustifolium* × *latifolium?*)
Kun kendt fra Disko Sydkyst, fra flere Steder nær de fredede Omraader, samt et længere østpaa.

Archangelica officinalis Hoffm.
E. H.: almindelig, lidt Vest derfor rigelig, i Lyngmarken meget sparsom; mangler ved den største af Kilderne; mangler ligeledes i Østerdal, men er saaet ved Elven lige ved Stationen; paa den anden Side Røde-Elv flere Steder; iøvrigt almindelig, men ikke kontinuerlig udbredt over Syd-Disko, almindelig i Disko-Fjord, sjælden i Mellemfjord samt i de Dale, der fra Mudderbugt fører dybt ind i Landet; paa Fastlandet til 67°.

Cornus suecica L.
er een Gang angivet fra »Godhavn« af P. H. (SØRENSEN) VIBÆK, som ogsaa angiver den fra Egedesminde. Ingen af de nævnte Steder er den fundet tidligere, og jeg har i flere Aar forgæves søgt den begge Steder. Iøvrigt er den kendt til 65° 47′ og almindelig S. f. 62°.

Pirola minor L.
E. H.: sparsom, iøvrigt faa Steder paa Syd-Disko og i Fjordene; paa Fastlandet til 69° 13′.

Pirola secunda L.
subsp. *pumila* Cham. & Schlechtend.
Ø.: Karakterplante, **E. H.** ikke sjælden, oftest i Skygge under Pile eller høje Græsser, desuden et Par Steder paa Syd-Disko; paa Fastlandet til 66° 57′.

Vaccinium Vitis Idaea L.

var. *pumilum* Horn.

angivet fra Godhavn uden nærmere Angivelse af Fru M. Krarup-Smith, senere fundet paa en Plet af et Par Hundrede Kvadratmeters Størrelse nær **Ø.**; den sætter ikke Frugt her. Desuden findes den et Sted til paa Disko Sydkyst samt et i Diskofjord, paa Fastlandet indtil Disko-Bugt. Fruktificerer som Regel rigelig ved Christianshaab, 68° 45′.

Gentiana nivalis L.

E. H.: sparsom, **Ø.**: ovenfor det fredede rigelig; blomstrer sent og ikke alle Eksemplarer naar at sætte Frugt; paa Fastlandet til 68°.

Euphrasia latifolia Pursh.

Ø.: meget almindelig, **E. H.**: almindelig; iøvrigt ikke sjælden paa Syd-Disko og i Disko-Fjord. Sydlig Type, der dog paa Fastlandet naar til over 71°.

Bartschia alpina L.

Lignende Udbredelse som foregaaende; naar endnu længere nordpaa.

Veronica fruticans Crantz.

Ø.: almindelig, **E. H.**: ikke sjælden, desuden flere Steder paa Syd-Disko; paa Fastlandet til 70° 17′.

Pinguicula vulgaris L.

E. H.: almindelig, desuden flere Steder paa Disko; paa Fastlandet ogsaa N. f. Disko Bredde.

Antennaria intermedia (Rosenv.) Porsild.

Ø.: meget almindelig, **E. H.**: sparsom; paa Fastlandet til 70° 5′.

Gnaphalium supinum L.

begge Steder sparsom, desuden flere Steder paa Syd-Disko; paa Fastlandet kendt til over 70°.

Gnaphalium norvegicum Gunn.

begge Steder almindelig, desuden flere Steder paa Syd-Disko, i Disko-Fjord og Mellemfjord; paa Fastlandet til ca. 66°.

Februar 1914.

ARBEJDER FRA
DEN DANSKE ARKTISKE STATION PAA DISKO. Nr. 9

VII.

ON THE GENUS ANTENNARIA IN GREENLAND

BY

MORTEN P. PORSILD

1915

SINCE moving to Greenland in 1906, I have had ample opportunity of observing certain *Antennaria*-forms in my immediate neighbourhood, which have hitherto all been understood to be variations of *A. alpina* (L.) Gaertn. When studied growing under natural conditions, they show constant heredity and in consequence the genus must, here at least, be considered polymorphous. As I have only a very limited access to literature, the older especially, and scarcely any whatever to collections, I am well aware, that in trying to prove it, my view may be found defective. I may however at once point out, that the Botanical Museum at the University of Copenhagen has shown me the great courtesy of lending me for my studies the greater part of its collections of this genus, and I wish to thank the director for this exceptional favour, which is so much greater on account of the difficulties of communication between Greenland and Denmark.

When, in spite of these drawbacks, I nevertheless venture to state my views concerning these plants, it is in the hope of calling attention to them, so that a search may be made for them elsewhere, particularly in the parts of North America nearest Greenland.

From quotations by WILLDENOW and others, it appears, that LINNAEUS as well as prelinnean authors like BAUHIN, SCOPOLI and HALLER considered the plant, now called *Antennaria alpina* (L.) Gaertn., to be different from *A. dioeca*, which is so commonly distributed throughout Europe. The nearest successors to LINNAEUS, WILLDENOW, WAHLENBERG and others, kept the two species separate, at the same time doubting the correctness of doing so (WILLDENOW in LINNÉ, Spec. Plant. Ed. 4 post Reichardtianum 5, T. 3, P. 3, Berolini 1800, pag. 1883; WAHLENBERG: Flora Lapponica, Berolini 1812, pag. 202). WAHLENBERG says thus l. c., that he considers it a "*species mere facticia vel arbitraria*", and adds "*vix dubito quin sit sola degeneratio praecedentis* (*scil. A. dioecae*) *atque eodem mare gaudeat*". The fact of female flowers only being found, necessarily roused the doubts of earlier scientists; occasionally plants, apparently male plants, had already then been found, but on closer examination this was proved erroneus, and ROBERT BROWN was able to state positively (A supplement to the Append. to Capt. Parry's Voyage etc., London 1824, pag. CCIX): "*mascula a nobis nondum visa et nullibi, quantum scio, observata*", a sentence which, in spite of the newest statements, seems to me in the main valid to-day.

Since KERNER in 1876 had proved, that cultivated specimens of *A. alpina* produced fruits under circumstances excluding fertilization, and JUEL in 1898 had shown by cytological investigations, the development of the fruit to be apogam, no doubt can be left as to the right af *A. alpina* to be looked upon as a distinct and apogamous species.

We now know, that apogamy is often connected with polymorphy. Cases of this kind are well known in the genera *Alchimilla*, *Taraxacum* and *Hieracium*; reference may especially be made to the chapter on "Apogamy and its Relation to Polymorphy" in OSTENFELD's paper "Further Studies on the Apogamy and Hybridization of the Hieracia" (Zeitschrift f. indukt. Abstamm. u. Vererbungslehre, III. 1910), where this matter is treated very fully.

A great number of North American species of the genus *Antennaria* have been described of late years (by GREENE, FERNALD, RYDBERG, NELSON and others); I have however had no access to these descriptions, but have seen some dried specimens of the species in the collections of the Botanical Museum at Copenhagen. Although the relationship between f. inst. *A. dioeca* and many of these species is evident, yet, they differ much; and their great number might indicate, that the species is polymorphous in North America. On the other hand the variations both of *A. dioeca* and *alpina* in Europe and Asia, which have hitherto been described, seem to be ecological forms only, neither constant nor bound to any fixed geographical areas.

A. carpathica, taken by WAHLENBERG to be a distinct species, but considered by WILLDENOW and others to belong to *A. alpina*, is however an exception. In reality it is rather remote from this latter, and differs, in addition to the generally stated characteristics, also f. inst. by its pappus.

The species of *Antennaria* in Greenland have been determined by J. VAHL, as follows: "*A. dioeca* R. Br., 59°59′—66°50′, and *A. alpina* R. Br., 60°43′—72°48′".

Of the latter VAHL had moreover observed a var. *glabrata*, published by JOH. LANGE in Flora Danica, tab. 2768, fig. 4, with the following diagnosis: γ, *glabrata* J. Vahl mscr., *foliis utrinque viridibus.* A somewhat fuller diagnosis is given in J. LANGE "Conspectus Florae Groenlandicae": "*foliis utrinque viridibus, calathiis solitariis vel paucis, periclinio glabriusculo*".

When, in 1857, LANGE supplied a list of the plants of Greenland to RINK's book "Grønland" II, he altered VAHL's *A. dioeca* to *A. dioeca* var. *hyperborea* (Don), and since then all later authors, dealing with the flora of Greenland, have used these names for the three forms.

In the supplement to "Conspectus" (1887, pag. 225) LANGE includes under *A. alpina* three varieties, viz.: var. *ramosissima* Lange, var. *Frieseana* Trautv., and var. *Hansii* Kern. The first of these is probably an abnormity, as it has not been found since, and as regards the last Rosenvinge urges, in "Andet Tillæg" to "Conspectus Fl. Groenl.", pag. 699, that it is not Kerner's plant, but only an accidental form of *A. alpina.* After having seen the specimen myself, I am entirely of the same opinion; this also has not been found since. In the same paper Rosenvinge describes a new variety, *intermedia*, to which I shall refer more fully later.

I shall now deal with the occurrence of the species of *Antennaria*, to be met with in Greenland:

1. ***Antennaria alpina*** (L.) Gaertn. (See Figs. 1 d, 2 d, 3) is widely distributed; it is known throughout the Danish part of West-Greenland, where it is a common plant, at least in the two thirds of the most southerly part of the country. In southern Greenland Rosenvinge includes it among the plants characterising the "Urtelier" of the lowland, which however does not prevent its appearance high up in the mountains; it is even found 4100 feet above sea level on "Jensens Nunatakker". In the latitude of Disko the plant can still be found in elevated localities, but already here however its preference for the most sheltered and fertile spots in the lowland is quite evident, and this becomes still more pronounced in a latitude of 72° North. Nathorst found it even at Cape York, 76°7′, and Simmons on Grinnell Land at Hayes Sound 79°4′. On the East coast it has been found from the extreme South to 71°40′, where it is common in the better known localities; on the other hand it was not found by the "Danmarks Expedition" in North-eastern Greenland. Again it occurs at many places in the Arctic-American Archipelago, right up to Melville Island; also in the Arctic, Subarctic and Alpine parts of the North American Continent, besides in the Rocky Mountains, on both sides of Bering Strait, where it seems to be replaced by *A. carpathica*; it is found on the Altai Mountains and right out towards the Arctic Sea in Arctic Russia and Scandinavia; it appears on Kolgujew and in Iceland, but is not found on Jan Mayen, Spitzbergen, Franz Joseph Land and Novaia Zemlia. In other words *A. alpina* is an Arctic-alpine, almost circumpolar species, which however does not reach the utmost limits of vegetation.

A. alpina varies greatly in Greenland; besides the differences in size and in other respects apparently depending on the nature of the habitat, the variations are as follows:

Shoot-formation; the procumbent runner-like shoots are more or less developed, or sometimes quite missing.

Hairiness; sometimes the leaves are closely white-felted on their lower surfaces only (*A. alpina*, *α*, in J. Lange, Flora Danica, tab. 2786) and at other times on both surfaces (*β*, *canescens* J. Lange, ibid.);

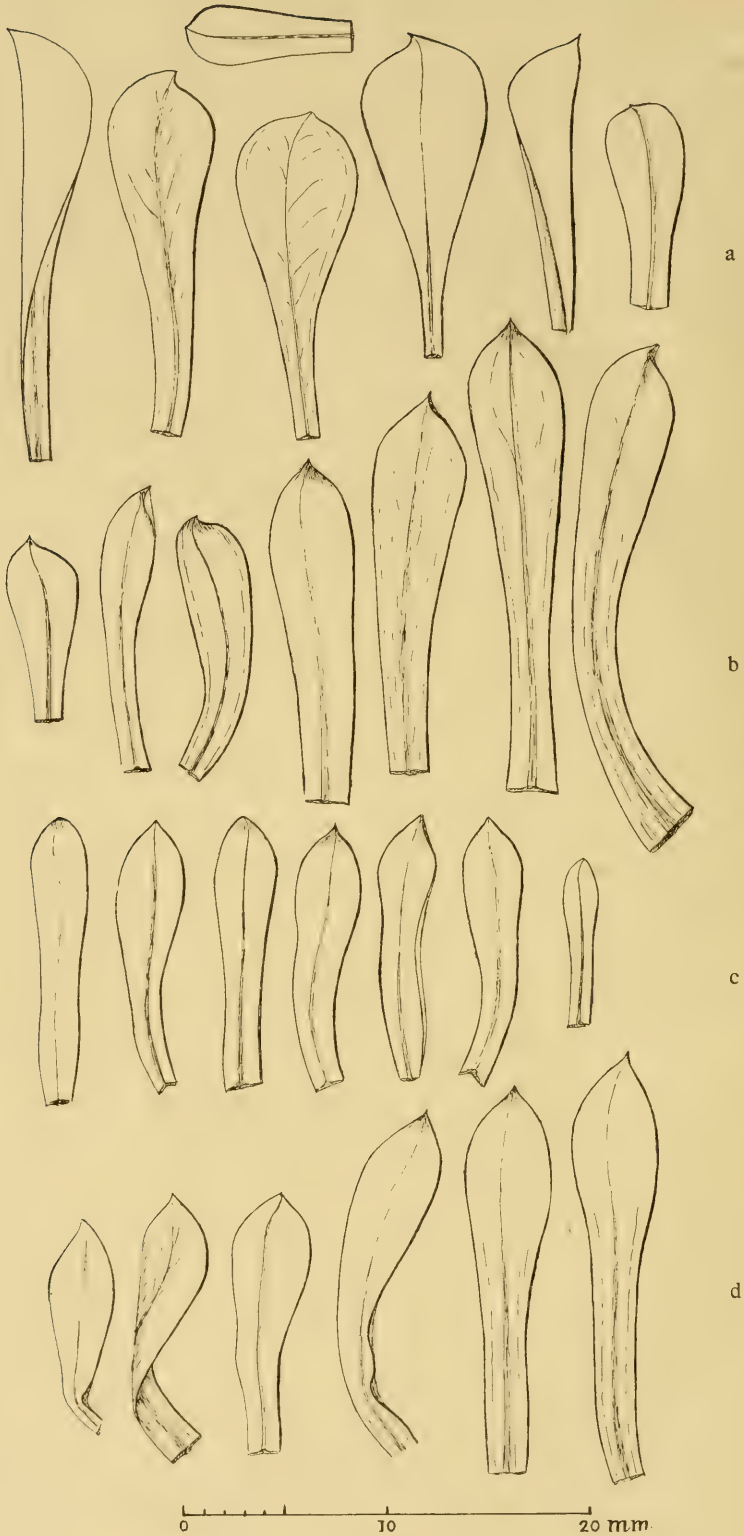


Fig. 1. Rosulate leaves of:
a, *Antennaria dioeca* var. *hyperborea* ♀. Engadin, Sassal Masone, leg. M. P. Porsild. — b, *A. intermedia*, Disko, Østerli near Godhavn, leg. Th. Porsild. — c, *A. glabrata*, Disko, Østerli near Godhavn, leg. Th. Porsild. — d, *A. alpina*, Disko, Østerli near Godhavn, leg. Th. Porsild.

or the felt can be more loose and tufted. Besides this, the seasons can influence the hairiness, the earliest shoots in spring often being more densely felted than those developed later.

The inflorescence; the number and size of the heads (capitula).

The colour of the involucre is generally darkly olive-brownish, but sometimes it can be more reddish. I have however never seen such light reddish-brown colours as are apparently common in Scandinavian specimens.

A var. *Frieseana* Trautv. (Syn. *A. monocephala* DC.) is most frequently mentioned in the literature, and differs by the absence of runners,

Fig. 2. Involucral bracts of:
a, *A. intermedia;* b, *A. dioeca* var. *hyperborea;* c, *A. glabrata;* d, *A. alpina;* the same specimens as in fig. 1.

by having single flower heads and dark brown involucres. It is especially common in East-Siberia, where, according to Kjellman, it is connected with the main species through numerous transition forms. It is also found in America and in Greenland, where apparently it is not rare. According to the above mentioned distinct characteristics it should form a transition to the following species. However, I do not believe such is the case, as I have never seen it growing in pure groups of common origin, so typical of *A. glabrata*.

Fig. 3. Antennaria alpina, natural size.
Østerli near Godhavn, leg. TH. PORSILD.

Male plants of *A. alpina* have not been found in Greenland, but good fruits are developed in abundance, in any case here on Disko, where seedlings are freely met with.

Fig. 4. Antennaria glabrata, natural size.
Hare Island, South Coast, leg. M. P. Porsild.

2. ***Antennaria glabrata*** (J. Vahl) n. sp.

Syn.: *A. alpina*, *γ*, *glabrata* J. Vahl: Flora Danica tab. 2786, fig. 4, 1869, pag. 9; Joh. Lange: "Conspectus florae Groenlandicae", Medd. om Grønland III, 1880, pag. 100. (See Figs. 1 c, 2 c, 4).

Caudex superficialis, caulibus vegetativis dense aggregatis, rosulatis, stolonibus prostratis nullis. Folia lanceolato-spathulata, saepe apiculo mucronata, 10—25 mm longa, 1—4 mm lata, glaberrima vel interdum pilis sparsis et rudimentariis munita, rarissime in pagina inferiore aliquot foliorum lanugo interrupta et perspicua araneoso-floccosa inventur. Caulis floralis 8—10 cm, rarissime ad 12 cm altus, glaberrimus, tenuissimus, calathio solitario vel binis. Calathia magna, diametro 8—12 mm. Folia involucri glaberrima, externa basi viridia, superne scariosa, obscure olivaceo-fusca, margine lacerata, interna tota longitudine scariosa. Flosculi feminei tantum. Pappi radii setiformes, 5—6 mm longi, 50—60 μ crassi, sat grosse denticulatis, dentibus arrecto-patentibus, maximis ad 60 μ longis. Generatio apogama, progenies in nature orta hereditarie constans.

Differt ab A. alpina proxima notis supra praedicatis.

A. glabrata is most often very conspicuous. As all the points which differentiate it from *A. alpina* are variable in the latter species, it might be considered incorrect to look upon it otherwise than a variation of *A. alpina*, and when I nevertheless take it as a distinct species, or at least as a species in the making, the reason is, that the plant under natural conditions keeps manifestly constant.

It is often found near or together with *A. alpina*, therefore its variations are not due to ecological conditions; when found in the same locality as *A. alpina*, it is always smaller and more slender; often it forms large, nearly pure colonies of a shape which plainly shows, that they have originated from one single plant, whence they have spread, regulated by the directions of the local winds, or by the flow of the melted snow.

VAHL's type specimen is from Lyngmarken near Godhavn on South-Disko, since then it has often been found there, and can still be met with. On the whole it is not rare on South-Disko, although considerably less frequent than *A. alpina*. In West-Greenland it is found in numerous localities between latitudes 64° and 72°20′, and in East-Greenland between 66° and 72°. As many of the most southerly parts of Greenland have been closely examined by investigators, who knew the plant, without their finding it, it is possible, that its distribution is not identical with that of *A. alpina*. As far as I know, it has so far not been reported from other countries than Greenland.

It flowers at about the same time as *A. alpina*, and develops fruits in abundance. Even small seedlings developed under natural conditions (2—3 years old, with 4—6 rosulate leaves) as well as by cultures (cotyledons and the first foliage leaf) differ from similar plants of *A. alpina* by the lack of felt.

3. ***Antennaria groenlandica*** n. nom.

Syn.: *A. dioeca* var. *hyperborea* Lange: Consp. fl. groenl., 1880, pag. 100, non *Gnaphalium hyperboreum* Don. (See Fig. 6).

Caudex adscendens, caulibus vegetativis partim aggregatis, rosulatis,

Fig. 5. Antennaria dioeca var. hyperborea, natural size.
Above: ♀ with purple bracts; beneath: ♂ with white bracts.
Engadin, Sassal Masone, leg. M. P. Porsild.

partim prostratis, stoloniformibus, apice erectiusculis, rosulatis. Folia ligulato-spathulata, 10—24 mm longa, 2—5 mm lata, interdum apiculo minuto instructa, utrinque tomentum densum et crassum gerentia. Tomentum haud niveum, sed levissime cinereo-viridescens. Caules florales simplices, erecti, 10—16, rare ad 20 cm alti, foliis angustioribus et minoribus. Inflorescentia cymosa, calathiis 3—7 brevipedicellatis, campanulatis, 5—8 mm longis. Squamae involucri obtusae, superiore parte scariosae, niveae vel rubrae, margine integerrimo vel levissime crenulato. Flosculi feminei tantum, 4—5 mm longi.

Pappi radii 30—40 μ crassi, superioribus partibus sat grosse denticulati, denticulis leviter sursum curvatis. Generatio apogama.

Differt ab A. dioeca generatione, omnibus partibus vegetativis minoribus, foliis angustioribus, pappi radiis subcrassioribus, grossius denticulatis, denique tomento, quod hic pannum novum, apud A. dioecam e contrario pannum detritum in memoriam reducit.

Fig. 6. Antennaria groenlandica, reduced to $^2/_3$. Ameragdla in Ameralik-Fjord, near Godthaab, leg. C. H. OSTENFELD, Herb. Mus. Bot. Copenh.

Under this name I will for the present indicate the *Antennaria* appearing in Southern Greenland, which LANGE and later authors have considered as a variety of *A. dioeca*. This new name has been chosen on the assumption, that the plant, which Don designates *hyperborea*, originates from Europe; this however I am not in position to verify[1]).

I have had no opportunity of studying *A. groenlandica* growing, so my opinion of it is based on the material belonging to the Botanical Museum at Copenhagen. It is certainly closely related to *A. dioeca*, but differs in the following[2]).

A. groenlandica is apogamous, male plants never having been found in Greenland although it seems to develop good fruits. Juel states, as regards *A. dioeca*, that it is, at least in Scandinavia, fertilized normally.

A. groenlandica is smaller in all its vegetative parts, than is the case with the European and Asiatic specimens of *A. dioeca*; the leaves especially are narrower even than those found on the forms of *A. dioeca* in the high mountain districts.

Hairiness: While *A. dioeca* varies somewhat as regards this character,

[1] In case the matter should be studied more closely by help of the older literature, to which the author has had no access, I have looked into some of his quotations, to avoid the names given by him to his *Antennaria* species being liable to alterations. It is correct, that *A. hyperborea* originally came from Europe. As far as I can ascertain, it was mentioned for the first time under the name of *Gnaphalium hyperboreum* by J. Donn in his "Hort. Cantabr.", of which I have only had access to ed. 7 (1812). The name is a *nomen nudum*, but the plant is described and pictured by D. Don in English Botany, Suppl. tab. 2640 (1831), who quotes just the above mentioned ed. 7 of Hort. Cantabr. and no earlier edition. Don says, he is convinced, after having had it under culture, that it is an independent species, and not a form of *A. dioeca*. It came from the Scotch mountains, and it seems to me an open question, if the form occurring in the Alps, which goes under the name of *A. dioeca* var. *hyperborea* (Don), is identical with the form of the Scotch mountains, and of which latter Porsild has had no specimen for comparison. His *A. groenlandica* is however undoubtedly different from both the European forms. C. H. Ostenfeld.

[2] For this comparison (see Figs. 1 a, 2 b, 5) I have been able to examine the following specimens of *A. dioeca* and its variety "*hyperborea*", mainly obtained from the Botanical Museum at Copenhagen:

Dalarne, leg. Hedlund (f. corymbosa Hartm.).
Jämtland, leg. Gelert.
Ny Sulitälma, leg. Neuman.
Lappland, leg. Laestadius; do. leg. Andersson.
Lule Lappmark, leg. Duurloo.
Archangelsk, ad ostium fl. Dwinae, leg. Pohle (var. hyperborea).
Kolgujew, leg. Pohle.
Tambow, leg. Schirajewsky (Herb. Fl. Ross. 367).
Kasan, leg. Korzschinsky.
Sibirien, Obdorsk, leg. Hage.
Simplon, leg. Marret, (Exsicc. de la Fl. du Valais et des Alpes Lemaniens 290, = var. hyperborea)
Engadin, Sassai Masone, Bernina, leg. Porsild (var. hyperborea).
Bellagio, leg. Lange (var. hyperborea).
Aigoual, Cévennes.
Grödnerthal, leg. Sterneck (var. hyperborea).
Hungaria, Transsilvania, leg. Richter et Gyorffy (Herb. Normale 5107).

the upper and lower surfaces of the leaves on *A. groenlandica* are nearly always evenly and closely felted; there is besides a rather characteristic difference as regards the appearance of the felt, difficult to describe, but fairly easily noticed, when first attention has been drawn to it. The felt of all specimens of *A. dioeca* examined by me, also those found in the high mountains as well as those in Subarctic regions, is pure white, almost shining, close, but fine, partly showing the unevenness of the under surfaces of the leaves; it resembles cloth, much worn. The felt of *A. groenlandica* (and of the following species, closely related to this) is, on the other hand, close and coarse, of a faint dull grey-yellow or grey-green tinge and resembling new cloth.

The bristles of the pappus are perceptibly thicker and more coarsely toothed than those of *A. dioeca*; it must however be noted, that in this respect a specimen of *A. dioeca* from Kolgujew resembled *A. groenlandica.*

A. groenlandica, probably nowhere common, is met with in the more southerly parts of Greenland, on the west coast in several places between 60° and 67°, more often in the more southerly of these latitudes; on the east coast it has been found twice at 61° and 66° respectively. FERNALD and SORNBORGER have mentioned in the Ottawa Naturalist, 1899, pag. 106 (Some recent additions to the Flora of Labrador) an "*A. hyperborea* Don", and this may very well be the same as ours, Labrador and the extreme south of Greenland having so many species in common.

On Iceland neither *A. dioeca* nor any species closely related to this is found (*A. alpina* is however represented), and this also proves that *A. groenlandica* is of American origin.

I have seen specimens from the following places:

Julianehaab, locis siccioribus, leg. VAHL.
— Elven, leg. MELDORF.
Tunugdliarfik, leg. ROSENVINGE.
Fiskernæs, leg. ROSENVINGE.
Ikatok, locis aridis, leg. VAHL.
Godthaab, Baals Revier, leg. VAHL.
— , Ameragdla, leg. OSTENFELD.

4. ***Antennaria intermedia*** (Rosenvinge) n. sp.

Syn.: *A. alpina* var. *intermedia* L. K. ROSENVINGE, Andet Tillæg til Grønlands Fanerogamer og Karsporeplanter; Medd. om Grl. III, Forts. 3, 1892, pag. 698, "*foliis periclinii obtusis, stylo saepe corolla breviore*"; *A. alpina* ♂, Th. Holm: Beiträge zur Flora Westgrönlands, Engler's Bot. Jahrb. 8, 1887, pag. 310. (See Figs. 1 b, 2 a, 7).

A. groenlandicae proxime affinis, abs qua notis sequentibus differt:

Inflorescentia dense aggregata, subglobosa, calathia numerosiora (8—14) et minora, subsessilia. Squamae involucri scariosis partibus obscure oli-

Fig. 7. Antennaria intermedia, natural size.
Disko, Østerli near Godhavn, leg. Th. Porsild.

vaceo-fuscae. Pappi radii 40—50 μ crassi, usque ad basin denticulati, denticuli basales squarrosi, versus apicem magis magisque arrecto-patentes. Apogama, progenies hereditarie constans.

Ab A. alpinae variationibus omnibus habitu, tomento, calathiis minutis, involucri squamis obtusis, integerrimis vel levissime crenulatis, pappi radiis subtenuioribus, denique distributione geographica et florendi tempore autumnali satis diversa.

This plant has so far only been found a few times. Specimens from the following places are preserved in the Botanical Museum at Copenhagen: Sarqaq, 70°, leg. VAHL (the type); Præstefjeldet near Holstensborg, 66°55′, by TH. HOLM; Tupersuatsiaq, 64°44′, leg. S. HANSEN; and Neriap Qingua, 61°45′, leg. N. HARTZ. It has been found several times since by G. KLEIST, J. NYGAARD and myself on South-Disko near Godhavn, 69°15′, and my son THORBJØRN PORSILD in particular has found it in different places in this neighbourhood, also at Ataneqerdluk on the peninsula Nugsuaq, 70°5′. Of the localities where it is found on Disko, I know best the one (Østerli) near the Arctic Station; it grows on a luxuriant slope facing the S/W, a place characterised by its richness in southerly species; here it most frequently forms large colonies, dominating all other vegetation for more than several square metres, and one of the largest colonies is so conspicuous at a certain period of summer, that it can be seen from the Station, a distance of about 175 metres.

When, in the short diagnosis concerning the specimens from Sarqaq, ROSENVINGE says "*stylo saepe corolla breviore*" and later (l. c.) doubts, whether the specimens from Holstensborg, considered by HOLM to be male plants, did actually develop fruits, it is due to the fact, that this species flowers extraordinarily late as compared with the other species of *Antennaria* in Greenland. While at Østerli the fruits of *A. alpina* and *A. glabrata* can be seen ready for dispersal as early as July, those of *A. intermedia* growing in the same position do not ripen till August, more often still later, and in unfavourable seasons perhaps not at all. This shows, that the species here is near its northern boundary, and the fact, that on Disko it grows in the localities which are most favoured and richest in southerly types, also indicates this. When the flower is in full bloom, the style is longer than the corolla as in other species.

The colonies of *A. intermedia*, known by me, plainly show, that they have come from one and the same origin, and have spread by the prevailing winds and the flow of water. Therefore I do not doubt, that the species is constant to heredity, but I cannot as yet distinguish with certainty the young seedlings from those of *A. alpina*, and my cultures have so far been unsuccessful on account of my having collected the fruits too early.

As regards the probable age of the above mentioned species of *Antennaria* in Greenland, *A. alpina* is so widely distributed, that it must be considered as belonging to the oldest types of the flora, which may have migrated over Smith Sound shortly after the glacial period, and which has later been ousted from a part of its territory in the North by the present period of more severe climate, which followed an earlier and milder postglacial climate.

Until *A. glabrata* has been found in other places, it is most natural to consider it a species of recent origin or perhaps still in the making, originated in Greenland, and consequently one of the very few endemic species of this big island. Perhaps the same is the case with *A. intermedia*, whereas its nearest relation *A. groenlandica* belongs to the large group of American species, which have also migrated to the South of Greenland; but all explanations of this migration are as yet only loose hypotheses.

Reference can here be made to the interesting treatment of this very important problem of the Arctic plant geography, recently given by H. G. Simmons in his paper "A Survey of the Phytogeography of the Arctic American Archipelago", Kgl. fysiograf. Sällsk. Handl. N. F. Bd. 24, No. 19, Lund, 1913.

Disko, Godhavn, Nov. 1913.

VIII.

REPORT

OF

THE FIRST THULE EXPEDITION 1912

BY

KNUD RASMUSSEN

The Arctic Station at Thule, North Star Bay, N. Greenland.

Before proceeding to the actual account of the expedition, it may perhaps not be out of place to preface the same with some introductory remarks as to my station at Thule in North Star Bay, N. Greenland, the most northerly permanent arctic station in the world. The reasons for founding this settlement were as follows:

Throughout all the years during which Admiral Peary from time to time visited the Cape York district, he availed himself, on his expeditions, of the services of the natives, requiting them with gifts, the products of civilisation, consisting mainly of arms and ammunition. In addition to this, he also traded with them, in consequence of which, the population gradually emerged from the palæolithic conditions under which they had hitherto been accustomed to live, and learned to regard certain extraneous commodities, especially in the way of tools and implements, as indispensable.

Admiral Peary's dealings with the natives were, it should be noted, invariably characterised by a sense of responsibility which I have frequently had occasion to admire.

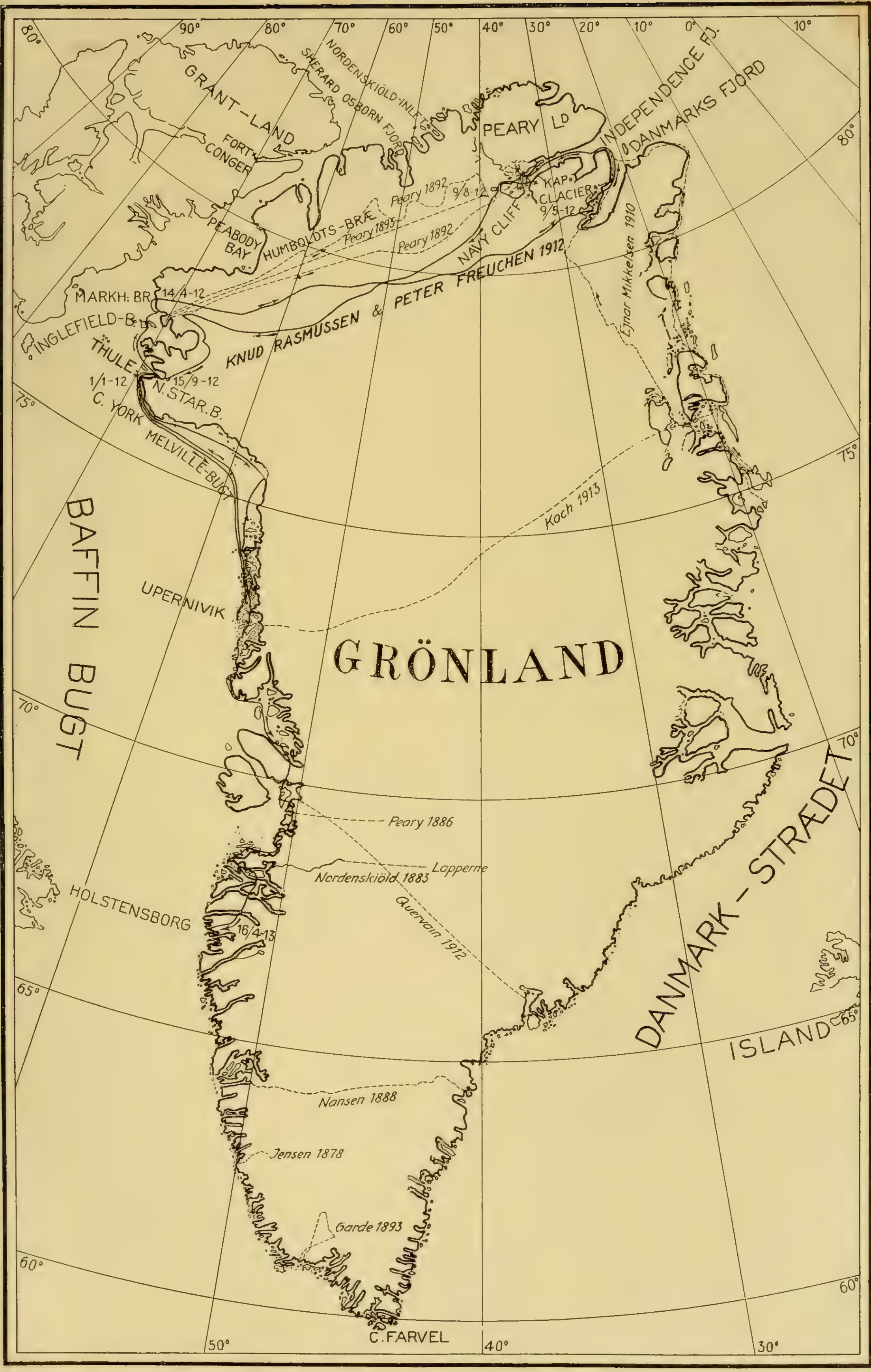
After Admiral Peary's last journey, however, in the course of which he reached the Pole, it seemed scarcely probable that he would again return, and some anxiety was felt lest the people with whom he had previously had intercourse in the district in question should now, being left to their own devices, and without responsible authority, fall a prey to demoralising influences. These considerations naturally gave rise to the idea of founding a settlement which should, on the one hand, benefit the natives by providing a link with civilisation, and at the same time, as a scientific research station, furnish a base of operations for sledging and other expeditions in North Greenland and Arctic North America, as well as a place of residence for scientists wishing to undertake local investigations.

The station was set up at the expense of private individuals, especially by contributions from the late Mr. Adam Biering, a Danish civil engineer then resident abroad, to whom I am most deeply indebted for his unstinting confidence and support.

The work of the station is carried on under my supervision, with Mr. PETER FREUCHEN as manager of the trading factory, the Danish affairs in connection therewith being in the hands of a committee, consisting of Mr. M. IB NYEBOE (Chairman), Mr. CHR. ERICHSEN and Mr. CHR. RASMUSSEN, to all of whom I am likewise greatly indebted for the keen disinterestedness with which they have furthered the work of the station, both as regards its expeditionary aims, and also in the task of providing the Eskimos with such goods as might be considered advisable and necessary for the general improvement of their condition.

Before starting out on my expedition in 1910, I applied to the committee in charge of the Greenland geological and geographical investigations, then consisting of His Excellency Admiral WANDEL, Kommandör G. HOLM, and Dr. K. J. V. STEENSTRUP, with the request that they would act as patrons. My object in so doing was to render myself morally bound to an institution, the importance of which in matters connected with Greenland can scarcely be over-estimated. I feel it incumbent upon me here to express my respectful thanks to the gentlemen in question for the very courteous encouragement afforded me on that occasion.

Prominent among the scientific objects of the expedition was that of exploring and surveying the supposed Peary Channel, which plan was ultimately realised in 1912, in the course of the undertaking known as the First Thule Expedition, to the expenses of which the Carlsberg Fund contributed the sum of 9700 Kroner.



Map showing routes of the various expeditions which have croised the inland ice.

The first Thule Expedition 1912.

Plan and Equipment.

Our original plan was to go northwards along the coast, as far up as Nordenskjölds Inlet, and commence investigations there. The news brought by our summer ship in 1911, however, induced us to make various alterations in the arrangements originally made, and as this subsequently proved of decisive importance to the expedition, it must be briefly referred to here.

The communication in question was to the effect that serious anxiety was entertained at home as to the fate of EINAR MIKKELSEN, and as it was presumed that he would, in the course of his journey round the north of Greenland, so arrange his route as to touch at our station, both FREUCHEN and I considered it our unquestionable duty as comrades to extend our original plan by the addition of a relief expedition on his behalf.

This extension of the previous scheme necessitated the making of two journeys:

1. A reconnoitring expedition in Melville Bay.

There was a possibility that we might, in the course of our search, make our way so far round on to the east coast that the homeward journey might thence be most easily accomplished by way of the inland ice, making the descent somewhere in Melville Bay. In such case, it would be of great importance to have gained some previous knowledge as to the conditions under which a descent there would have to be made.

In the course of this reconnaissance, which I made in company with the Eskimo QULUTANGUAQ during the months of October—November, I had the misfortune to be overtaken by a violent S. W. storm, which broke up the ice in Melville Bay. Finding ourselves thus prevented from making our way into the land, we were forced to take refuge on the inland ice. Here, close by a small nunatak, we managed to keep ourselves alive under somewhat hazardous conditions, aggravated by violent torrents of rain; one of the worst things to encounter when in winter kit. Fortunately, however, we had secured four bears before the storm came on, and had thus provisions both for ourselves and the dogs. We succeeded at last in making our way back once more, partly by way of the inland ice, and partly by crossing some few bays where the ice had not broken up; the reconnaissance, however, had taken us two months, instead of the fourteen days for which we had provided.

2. The second addition to our scheme as planned was a journey to Upernivik, some 900 km. to the south of our station.

The extension of the expedition involved the supplementing of our stores and gear, and this we were not prepared for at our newly established station. Thanks to the courtesy of Mr. HARRIES, the governor at Upernivik, we obtained all that we wanted there. On account of bad ice, however, and heavy falls of snow, it took us nearly three months to cover the 1800 km. or so, and we did not get back to the station until nearly the end of March, hardly three weeks before the date fixed for our start on the journey round the north of Greenland.

It need hardly be said that the dogs, worn out as they were by snow and hard work on their return, had to be well rested and generously fed before starting out on the long trail. It was thus not until the 9th of April that we assembled at NEQE, a place some 200 km. north of the station.

At Neqe (which means, in English, "meat") walrus are taken on the new ice from the very beginning of the light season, in March, and there is, as a rule, so great an abundance of meat to be had as to thoroughly justify the name.

This spring also, the walrus hunting had yielded excellent results, and we found enormous stores of meat collected there, which we procured by barter, giving in exchange the trade goods brought up from Upernivik. The meat was partly clean flesh and blubber, partly hides, intended to serve as dogs' food, and flayed off in large strips cut to the length and breadth of the sledges. Everything thus looked promising enough, and we were able to push on for the first part of our journey along the coast at good speed, without wasting time in search of game. Soon, however, an accident occured which seriously affected our plans and route: a regular hurricane came down on us from the northward, breaking up all the ice which we were to have crossed, and leaving us no choice but to haul up on to the inland ice and make our way across it down to Etah.

I therefore decided, after much consideration, to alter our course entirely, and going straight across the inland ice to the eastern edge, begin our journey along the coast from there. My reasons for so doing are set forth in the following report, despatched on the 13th of April to the committee for the direction of geological and geographical investigations in Greenland, correcting a communication sent in February.

"Violent and continual storms from the northward have delayed our progress, and, in addition, broken up the ice along the route we should have taken north, to such an extent that I have decided to alter our course entirely.

"My reasons for so doing are as follows: In keeping along the coast up to Fort Conger, and proceeding thence northward across the continent to Peary Channel, I should be acting solely out of regard to the possibility that Einar Mikkelsen might perhaps be at Fort Conger. This choice of route will, however, probably result in our being unable to carry out the journey to Peary Channel and back. And on closer consideration, the prospect of Einar Mikkelsen's now wintering for the third time at Fort Conger appears so slight, that I do not feel justified in risking the whole of my own expedition upon such vague grounds.

I have therefore decided upon the following plan: Going up on to the Clemens Markham glacier, I shall make for Danmarks Fjord, and go on through the fjord to Cape Glacier, where Mikkelsen must presumably have been: he would in such case doubtless have left a report in Mylius Erichsen's cairn. If we find word from him here to the effect that he has gone westward to Fort Conger, we will then, after making a survey of Peary Channel, follow the coast to there.

Should we, on the other hand, find no trace of him whatever either in Danmarks Fjord, at Cape Glacier, or in Peary Channel, we must suppose that he has gone back to Danmarks Havn without having reached so far. All endeavours to find him will then be in vain, and nothing remains for us but to make the best of our way back. Our route in such case will largely depend upon what game we are able to procure, and nothing can be said at present as to this".

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We had now as much in the way of provisions and equipment as was to be had. Of coffee, sugar, tea and tobacco we should, with economy, have sufficient for about a couple of years; there was bread enough to last out the journey over the inland ice, and the first few days on the east coast; we had two oil stoves with fully as much petroleum as we should require for the crossing of the inland ice and back; guns, and a two years' stock of ammunition, and in addition, tools of every kind, enabling us to do whatever carpentering might be required.

We trusted most of all, however, to the Eskimo part of our equipment, and it was this, on which the event of our expedition ultimately depended. We had, it should be remembered, not only to cross the inland ice; the real work did not begin until we had come down on the other side, and that, moreover, on a coast which was far from having any good repute. We had thus to be prepared for what might possibly prove to be a lengthy stay.

We therefore took with us everything which might enable us to live under approximately the same conditions as at home, always provided that game were to be found, and any anxiety we might have had in this respect was greatly allayed by the knowledge furnished by the Danmarks Expedition, that we should, in the neighbourhood of Danmarks Havn at any rate, find abundance of such game as we were accustomed to have in our own district. We took with us therefore harpoons, spears, bladders, lines and implements of all kinds, both those used in hunting on the ice and those for kayak work. We did not take a kayak, however, on account of the difficulty of transport; we could at any time improvise one with the aid of a sledge. In addition, we had a number of strong seal-hide lines, 15—20 fathoms long; these were intended partly as extra traces in reserve, and partly as lashings etc. in case of need. We had also skins of bladder-nose seal, reindeer, musk ox and bear to lie on, as well as the ordinary sleeping bags.

And finally, we had with us a big and very strong reindeer horn, from which Eskimo bows could be made; UVDLORIAQ was a practised archer, his experience dating back to the time when guns were yet unknown to his tribe.

All our dogs' food consisted of walrus hide; an excellent food as ballast, but involving large loads on account of its indigestibility. We had about 1500 kg. of this, besides considerable quantities of clean walrus meat and narwhal hide, intended as food for ourselves. All this heavy and awkward impedimenta meant loads for the sledges of some 5—600 kg. each according to the strength of the teams. We had four sledges for the work, and 53 dogs, divided into teams of 15, 14, and two of 12.

For sledging on the inland ice we used runners of walrus hide, about the same breadth as ordinary ski, stretched beneath the sledge and then shod, by means of snow and water, with a coating of ice. This is an old Eskimo trick, and gives wonderfully easy running. The ordinary runners of the sledges were of course iron shod as usual.

These walrus hide runners contributed, as it turned out, in so extraordinary a degree towards the progress made, that I will here describe in detail the manner in which they are made.

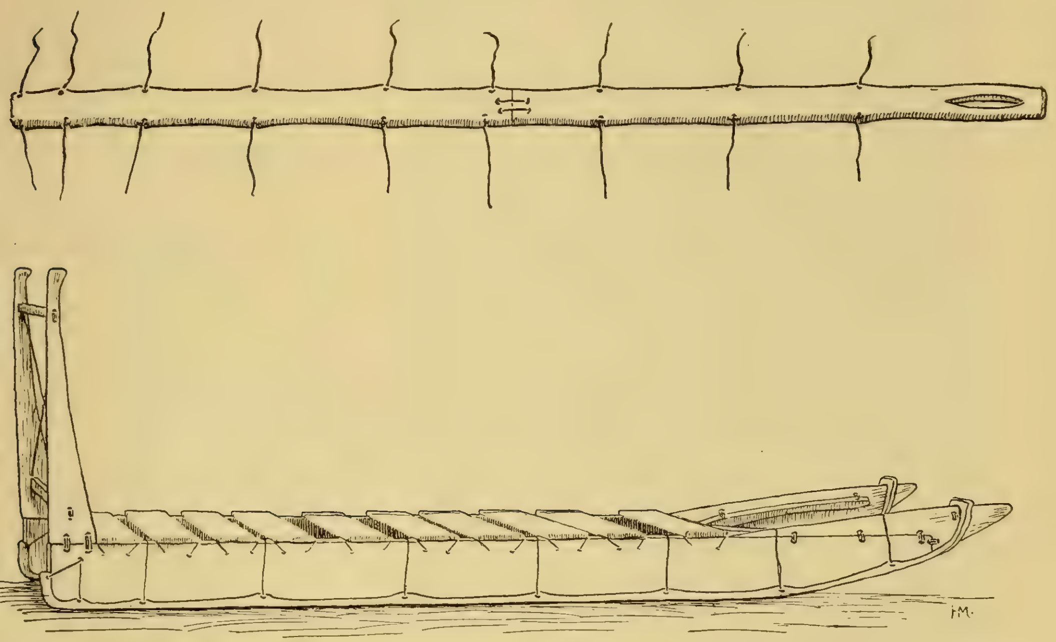
The walrus hide is cut into long stripes, of about the same breadth as the long Lapland ski, which are considerably narrower than the Norwegian pattern. If the available walrus hide happens to be of such dimensions that the strips are too short for the length of the sledge, they can easily be joined together by boring holes in the two ends to be joined and then tying or sewing them together with thin lashing. It is best to cut grooves in the hide, when the stitches of course freeze firmly in. These hide ski should be somewhat narrower at the back than at the front, in order to reduce the resistance offered to

Fig. 1. Eskimo dog team.

Fig. 2. Our Station at Thule, North Star Bay.

the snow. A hole is cut in the foremost end, through which the nose of the sledge runner can be thrust; the rear end of the ski, however, should preferably somewhat overlap the runner, projecting slightly up over the heel, which makes it easier to fix securely. Along the sides of the ski four or five holes are cut, close to the edge, in corresponding pairs; through these are drawn the hide lashings with which the ski is fastened to the runner.

After all these preparations have been made inside, in the warmth of the snow hut, the ski thus improvised is carried out to the sledge and laid under its runner in a soft, thawed state, and care is then



Walrus-hide runner, with same in position.

taken to see that it freezes firmly on, and exactly in the form desired. The fleshy side is of course laid inward to the runner.

The advantage of using walrus hide instead of wooden ski is firstly, that it is absolutely unbreakable, even with the heaviest load, and secondly, that the snow ice with which it is shod (the layer of ice over the skin) holds far more securely to the hairy surface of the hide than on a smooth slip of wood, which will, in colliding sharply with hard irregularities of the ground, often have the shoeing knocked off in big flakes.

As soon as the hide ski, which is as a rule an inch thick, has been firmly fixed to the runner of the sledge and frozen in the shape desired, the next thing to be done is to cover it with a layer of ice.

This is done by dipping snow in water, and plastering it over the hide ski, where it soon turns to ice. Great care must be taken to avoid laying on the snow in too large lumps at one time; as soon as they are placed on the runner they should be smeared down along its surface with a skin glove, preferably a piece of bearskin with long fur. This prevents air bubbles from forming in the mass and lessening its strength and solidity. To make the snow lie clean and firm in a compact mass in something of an art in itself.

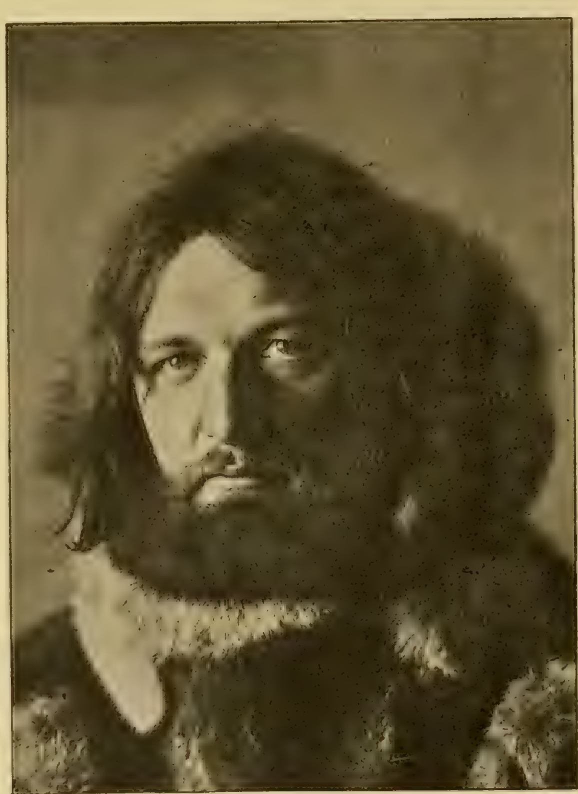
When this ice sheathing has attained a thickness of 4—5 cm., the work is finished, and with runners treated in this way, the dogs will trot and gallop easily with loads they otherwise could scarcely haul at a foot pace. This ice sheathing will, on walrus hide, last out four or five days sledging without being renewed, provided the snow is not too hard. At the end of that time the ice is smooth and polished like glass; moreover, the work of repairing after a few days journey, consists merely of patching up the worst worn places with new ice, a matter of a couple of hours.

This Eskimo ice-sheathing as here described is used on ground where there is plenty of snow, and no screw ice, as the hard ice would soon splinter the sheathing and render it useless. It is also impossible to use it over snow with a hard and brittle surface, where the ice layer would soon be worn away. On snow such as one encounters on the inland ice, away from the boundary zones, this "qârsaneq", as the Eskimos call it, is invaluable where rapid and easy progress is required. If fresh blood is available, a little may be mixed with the water used to dissolve the snow used for the shoeing; this renders the ice of the sheathing less brittle and tougher in wear.

As a protection against the weather in the many snowstorms which we knew we should have to encounter, we had brought a tent: in case of a continued spell of rough weather, however, it was our intention to build snow huts in the Eskimo fashion, the incomparable advantages of which cannot be too highly estimated under such conditions.

It takes as a rule about an hour and a half to build a snow hut capable of housing four or five men, making a matter of a couple of hours or so before one has moved in and is ready to set about preparing food and drink. This is of course no inconsiderable time to spend in setting up one's quarters; it is worth while, however, for the rest gained by getting out of one's clothes and lying down in a thoroughly warm shelter is worth many times that which can be obtained when one's teeth are chattering with cold, even though the latter be of far longer duration.

It is no easy matter to build one of these snow huts; they are not made by simply piling a number of blocks of snow one above the other. The work has to be done according to a certain definite plan, which the Eskimo builder follows with instinctive genius. The hut is built up in the form of a hive, the roof being thus, by an ingenious arrangement, made self-supporting. This is a thing which demands a great deal of practice, and a novice will not get far with his blocks before the whole collapses. The foundation of the house is laid by setting the blocks in a ring, sloping somewhat inwards. In placing the first block of the next ring, a cut is made in the block on which it rests, and the surface trimmed with the knife in such a fashion that the new circle about to be formed slopes inward slightly more than the first. By this means, the walls themselves narrow gradually inward in a spiral, which is finally closed with a single block. The house is then ready, built and roofed.



PETER FREUCHEN.

The blocks of which the house is to be built should be taken from drifts of hard, closely packed snow. Each block is a rule a little over 1 m. square by about $^1/_4$ m. thick. Larger blocks may of course be used if desired, but are naturally heavier to handle. The blocks are cut out of the drift with sharp knives, having a blade about $^3/_4$ m. long, or better still sawn out with a tenon saw. With four men to a hut, the work is generally divided by setting two to cut out the blocks, while the third at once commences building with the material handed to him by the fourth. It need hardly be said that the builder stands inside the ring, and ends, of course, by shutting himself in when the last block falls into place. It is best not to make the dome too high, as this makes it more difficult to keep warm in the hut.

As soon as the domed roof is completed, all cracks between the blocks are caulked with snow. It is best to light a small lamp inside the hut; the light then shows through all such crevices, making the work of locating and caulking them much easier, especially, of course, when it is dark outside.

The floor is then cut away from inside round the entrance hole, making a deep furrow in front of the bed place. This last takes up most of the room; it is also a good idea to have a couple of extra beds one at either side, leaving a space in the middle for the blubber lamps.

UVDLORIAQ.

A layer of sealskins is then laid on the beds, and over these, reindeer or musk ox hides, or whatever thick furs are available, making a warm and most comfortable bed. If one wishes to sleep perfectly naked, a great comfort, and easily practicable in a snow hut, all that is necessary is to lay one's sleeping bag on the bed and crawl in. When thoroughly tired out, no better couch could be desired.

As soon as the gear outside has been fixed up so as to prevent all risk of depredations on the part of the dogs, and these latter properly secured, one can move in. Two small Eskimo blubber lamps with long wicks of moss are then lit, and when finally the entrance has been carefully closed with a big block of snow, the place is as cosy and comfortable as any peasant's cottage at home.

On starting out over the inland ice with a more or less complete Eskimo equipment we were well aware that our undertaking was something of a departure from the methods hitherto regarded as traditional in such cases. The only previous inland journeys of any great extent were at that time those of Peary and Nansen, and both of these expeditions had been based upon portable provisions, of such a nature as to permit the traveller to carry as nearly as possible only the net weight of nourishment, avoiding all unnecessary loads. Our provisions on the other hand, consisting of walrus hide and narwhal and walrus meat, were not only extremely bulky, but very heavy in proportion to the amount of nourishment represented, owing to the high percentage of water contained. We were obliged to reckon with heavy loads; in spite of this, however, our journey across the inland ice must first and foremost be a matter of speed, as it is very difficult to carry more than a month's food for the dogs when the food consists, Eskimo fashion, of such natural produce as that we had brought with us.

Inukitsoq.

The distance which we had to cover across the inland ice to Danmarks Fjord was about 1000 km. In order to do this within the month, making due allowance for days lost on account of weather, we should have to reckon with daily stages at least twice the length of anything previously accomplished on the inland ice. Moreover, we should have to be careful not to over-fatigue the dogs, always bearing in mind the fact that our work could only begin in earnest after we had reached the east coast. The crossing of the inland ice was for us not an aim in itself, but merely the way by which we were to reach the actual scene of operations.

Our party consisted of four, and it would have been hard to find men who could better supplement each other than my comrades here.

There was PETER FREUCHEN, cartographer to the expedition, already known as a member of the earlier Danmarks Expedition. During the two winters we had previously spent together in Greenland, he had shown a quite unusual faculty of accomodating himself to the conditions of Eskimo life, and had on several occasions proved himself an excellent arctic worker.

Then there was UVDLORIAQ, an Eskimo of thirtyfive or six, the finest hunter and dog driver I have ever met. He possessed to perfection the perseverance and quick insight of the trainer, qualities which make the Eskimo driver a being unique, able to master and direct the animal forces at his command, and often making them do marvellous work. And as a hunter, he was not only a safe and keen-sighted shot, but possessed also, very fortunately, as it proved, for the expedition, the instinct of a retriever for finding game, with a doggedness which in time of need was proof against hunger, sleep or what fatigue soever.

Finally there was INUKITSOQ, a young Eskimo of four or five and twenty, who had taken part in all PEARY's late expeditions, and was known as a good hunter and driver. He was a cheery, good-humoured fellow, never at a loss, and as a young man who had yet to win his spurs, he had all the natural ambition of the Eskimo to distinguish himself as a hunter and traveller; a keenness which he maintained to the full throughout the whole of the expedition, and which therefore rendered him a very valuable acquisition to the party.

This was the first time that Eskimos had taken part in a journey right across the inland ice. It is generally supposed that their faculties are somewhat discounted as soon as they are called upon to work in regions with which they are not familiar. I therefore feel it incumbent upon me to say that my Eskimos never once allowed themselves to be awed by the huge monotonous desert of the inland ice, but carried out their daily marches and all such work as fell to their share in that cheerful spirit with which they are blessed from birth.

Fig. 3. Snow hut building.

Fig. 4. Tent with wall of snow blocks to keep off the wind.

Across the Inland Ice, from Clemens Markham's Glacier to Danmarks Fjord.

On the 14th of April, we found ourselves at last able to make the ascent on to the inland ice by way of Clemens Markham's Glacier, which slopes gently up from the sea ice. We had 35 sledges and 350 dogs for the work, and thanks to this adequate means of transport, we were able to get all up at a level trot, and make a run of 66 km. on the first day, with a rise of 1100 m.

On reaching our first camping ground, we at once sent back all the auxiliary sledges with the exception of nine. These were to serve as baggage sledges until we had reached the level at Humboldt Glacier, when they were to be driven out on to the sea ice, and remain for three weeks in Peabody Bay, or if possible, run up as far as Cape Forbes, where the party would halt in search of game, and ready to place themselves at the service of Capt. Mikkelsen in case he should have been in Grant's Land and then, according to his plan, be on his way southward towards us.

On the 19th April we took leave of this auxiliary sledge party, and shaped our course towards Danmarks Fjord.

The journey across the inland ice fell out in every respect according to our calculations. We covered the daily distances which were an indispensable factor for the realisation of our plan; the journey was, however, naturally little else but a treadmill round of monotonous toil. Freuchen has, in his report, furnished a detailed record of the observations made from day to day during this section of the expedition, so that these need not be referred to here.

Our method was to take on an average 20 working hours for every 4 or 5 of sleep; frequently, however, we worked for as many as 36 hours at a stretch without any extra rest. This of course only applies to such time as the weather served; we kept throughout consistently to the Eskimo rule of always getting ahead of bad weather by covering the greatest possible amount of distance as long as it is possible to go forward at all. There is always plenty of time to sleep when one is weatherbound, and we for our part certainly availed ourselves to the full of such opportunities.

The inland ice is a good and level road, the best one could wish for with Eskimo sledges and good teams. The soft snow which we encountered up in the interior of the inland ice did not trouble the dogs very much, as the sledges with their ice-shod walrus hide runners made very easy going. The great monotony of the country, however, seemed to have a depressing effect on beasts as well as men; always the same white depth ahead, with never the slightest change to furnish food for thought. This in itself makes each day's run a thing to be hurried through in an intensity of longing to force a way out through the dead, storm-lashed desert ahead. There are snow storms every day, but even these one grows accustomed to. The keen feeling of cold which we had experienced to begin with soon subsided, only our eyes still suffered a good deal, largely owing to the amount of ice which the fine, driving snow formed in the eyelashes.

Throughout the first half of the journey we built snow huts every evening, and literally thawed ourselves after having toiled all day through the storm. With the small blubber lamps burning on the beds and an oil stove in the middle of the floor we soon had the place warm enough. We lay as a rule half naked on the skin spread over the beds, enjoying a rest at the end of the day while we waited for our meal, reading an old newspaper or some book or other. Our load being so heavy that a slight additional weight was of no account, we had brought with us a small case of books and papers, a thing which I would recommend to all travellers in monotonous regions; it serves as a stimulant to the mind, and is often as valuable in its way as the physical stimulant of food and drink.

On the last part of the inland ice trip, when it was important to lose as little time as possible, we used the tent instead of building huts. Here also one can manage to be warm and comfortable enough despite 40 degrees of cold and a storm outside. The great thing is to cut out a hollow in the snow, and pitch the tent there, building a good solid mound beside to keep off the wind.

As our provisions consisted chiefly of meat, we found it best to eat the same food as the dogs; a staple diet of raw and frozen meat. Once one has become accustomed to this Eskimo fashion of feeding, it has an excellent effect. The food is splendidly adapted to satisfy the demands made by cold and great exertion on the constitution. It is not a diet for weak stomachs, however, as the lumps of meat are swallowed at a temperature of ÷ 30 to 40 degrees, and it is necessary to carefully breathe on them first, otherwise they will burn the month, and sticking to the lips and tongue, take off the skin. After a meal of this frozen meat, the first sensation is one of severe cold; gradually, however, as the meat thaws in the stomach, the natural heat of the body returns, and once thoroughly warm again, one always feels then far less susceptible to cold.

In addition to this principal meal of raw meat, we generally boiled a lump or so apiece each evening. This was a somewhat lengthy

Fig. 5. Ascent of the Inland ice.

Fig. 6. Ascent of the Inland ice.

business, however, as everything had to be thawed first: snow melted to water, water boiled, the meat again thawed in the hot water and likewise boiled. And hungry as we were after twelve or fourteen hours work, we naturally preferred to eat our fill of the frozen meat, regarding the cooked ration as something in the way of dessert. Moreover, it should be remembered, frozen meat is by no means bad eating; the cold takes away the taste of blood, and the effect is that of a rare and delicate iced dish. Owing to the well known arctic craving for fat, we also ate large quantities of blubber with the meat, and quenched the resulting thirst with huge draughts of tea; good hot tea, poured down to thaw the frozen lumps of meat. It had a wonderful effect, and however tired out we might be, these cups of tea always loosened our tongues and made us cheery and sociable, exactly as does wine at a dinner party. We always had our principal meal in the evening, before going to sleep, and though this perhaps is against the principles of healthy living, it was the most practical way for us to manage, as we could best afford the time for cooking after the day's run was over. And in any case, we never felt any the worse for it. In the morning, we contented ourselves as a rule with a cup of coffee, and never ate anything at all in the middle of the day while on the road. One soon grows accustomed to living on one meal a day, and if one does happen to get a little underfed, it is always possible to make up for it as soon as a spell of lying up weather comes along. As a matter of fact, as long as one eats plenty of blubber with the meat, there is no danger of underfeeding.

The dogs managed splendidly, in spite of the pretty rough time they had throughout the whole of the journey; snowstorms during a halt they did not mind at all, but simply lay down and let themselves be covered up, finding a warm and comfortable shelter in the drifts.

All our teams consisted of young, trained dogs, which had often been out for long stretches in our districts, and exposed to hardships in no way inferior to those which they were called upon to endure with us on the inland ice. Each team consisted of one tribe, i. e. one family brought up and trained to work together, an absolute requisite for any first class team. One can never get the sound temper and united effort which are indispensable for a continued succession of long distance runs when working with dogs taken from different teams, where a great amount of energy is generally expended in fights and the settling of personal differences. Unfortunately, the dogs used on expeditions are almost invariably mixed lots bought up indiscriminately: such teams are sooner worn out and readier to give up, having no canine *esprit de corps*. To make a dog work cheerfully, and not by fear of the whip, is an art; once this is attained, however, they will keep on day after day with the same willingness, the same astonishing resource of strength, whereas a whip, particularly in the hand of a novice, may spoil a team altogether in the course of a few days. The aim of a good driver is to get his team to work by encouraging shouts, a sort of hypnotic suggestion of forward progress, by which his will-power is conducted to their brains, until they cheerfully forge ahead all day because he wills it so. Once he falls back upon the whip alone, the game is up; for when the natural willingness of the beast has been thrashed out of its body, no lash in the world has power to bring it back.

All our dogs had the saw-points of the large fangs removed, in the manner customary among the Eskimos of the polar regions. This is done while the dogs are still quite young, and their teeth comparatively soft. The saw-points of the four fangs are filed off with an ordinary file. The object of this is to prevent them from eating their traces and harness, a thing dogs often do without being actually hungry. On long journeys, where such gear cannot be continually renewed, the operation is absolutely necessary; the dogs can eat as well as ever, as it does not prevent them from masticating their food, but only from gnawing through their harness. The filing takes only a couple of minutes; it is of course in itself an unpleasant thing to do, and is at any rate painful at the moment. Anyone who has ever had anything to do with Eskimo dogs, however, will at once realise that it saves the animals countless thrashings in the long run. Times out of number the dogs will, when bound or left to themselves, commit fatal depredations, the resultant punishment being as a rule the least serious part of the matter. Once the above-mentioned slight operation has been made, however, they can be tied up anywhere, either at night when their masters are asleep, or on hunting expeditions when they are away from camp, without the risk of losing gear which could not be replaced.

Our dogs' food consisted, as already mentioned, of walrus hide, cut into long strips suited to the length and breadth of the sledges, and flayed off in such a manner as to leave a portion of the blubber adhering. When using this fodder on a journey, the usual allowance is 4—5 pounds per head every other day, or twice the equivalent weight in pemmican. As this walrus hide is naturally frozen hard, it has to be taken into the snow hut and thawed before it can be cut. This thawing cost us a great deal of time and trouble, generally about four hours each day, the work being taken by pairs in turn, as the dogs were only fed on alternate days. Walrus hide is an excellent "ballast" food, being very indigestible and therefore remaining longer in the stomach. One can, therefore, when the teams are not over-worked, and one is obliged to lie up on account of weather or other circumstances, very well leave them a couple of days without food, provided this is not too often repeated, and they get their square meal

Fig. 7. Striking camp. Entrance holes of snow huts widened to facilitate work of getting out the gear.

Fig. 8. Snow huts in use. Entrance closed with blocks of snow for warmth.

every other day as a rule. Among the Eskimos at any rate, this is a common practice. We found, however, that we should have done better to vary the food a little more with meat and blubber, and I would therefore strongly advise others who may have occasion to travel under similar conditions, and using similar fodder, to bear this in mind. In the first place, meat and blubber are easier to manage, as both can be cut up without having to be previously thawed, in addition to which, I obtained the impression that walrus hide alone, when not generously eked out with blubber, offers too little actual nourishment, much of it passing quite undigested through the intestines. With regard to this point, however, I should add that the Eskimos, whose theories have been tested by the experience of generations, regard walrus hide as unsurpassed. My own opinion as stated above is based on the fact that our dogs collapsed in a surprisingly short time after we reached the coast, when they were obliged to live on short rations for the first few days owing to our not finding game.

Throughout the whole of the run over the inland ice, however, they were in splendid working form, and in spite of the daily stages without rests, we were able to increase the distances continually, the sledges, however, naturally growing lighter all the time. Our last seven days' runs, for instance, will show that we were not driving with worn out teams, the distances being 91, 70, 72, 66, 78, 88 km. and the time varying from 9 to 12 hours.

The greatest altitude reached was 2225 m. Unfortunately we were unable to note the lowest temperature encountered, as our spirit thermometer was broken, so that we could frequently make no record beyond the fact that the mercury was frozen.

On the 9th of May we reached the east coast at Danmarks Fjord on the 17th day's run and 25th day since our ascent of Clemens Markhams Glacier, having lain weatherbound for eight days in all. The distance covered was 1048 km., with an average speed of 62 km. per days run. I append a table showing the distances as covered from our station to the east coast.

We had some considerable difficulty in getting down from the inland ice to ground, being brought up short against a steep wall some 20 m. high. In making a descent there is always the risk of unforeseen obstacles, as it is frequently impossible to get a complete view of the lie of the ground before one has gone too far to turn back and try another way. We had thus no reasonable alternative to making an attempt at clearing the obstacle in question, as by going back, we ran the risk of wearing out the dogs in the ascent, only to encounter the same difficulties again, situated as we were in unknown country and with no maps to aid us.

It is no new thing, however, for an Eskimo traveller to lower himself down over the edge of a glacier. The method of proceeding

Distances covered by the first Thule Expedition over the inland ice from coast to coast.

Outward journey.

Date	Month	Place		No. of sledges	No. of dogs	km.	Notes	Hours
5	April	Iterdlagssuaq	(1)	Three slgs. covered this in one run on 6th April		48,6		9
-	—	Cape Parry	(2)			41,9	Odometer broken (estimated)	16
6	—	Kiatak	(3)			50,0		
8	—	Neqe	(4)			61,0		9
14	—	Inland ice	I	34	337	66,6	13,0 km. on sea ice[1]	12
16	—	—	II	13	153	53,1		14
18	—	—	III	13	—	54,2		7
19	—	—	IV	4	54	51,9		11
20	—	—	V	—	—	35,4	Halt to recover lost gear	6
23	—	—	VI	—	—	55,2		7½
23	—	—	VII	—	—	41,9	Halt for observat.	6
24	—	—	VIII	—	—	28,3	Day's run checked by snowstorm	4½
25	—	—	IX	—	—	75,7		11
27	—	—	X	—	—	57,5		10
29	—	—	XI	—	—	63,8		12
2	May	—	XII	—	—	90,9		12½
4	—	—	XIII	—	—	69,7		10
5	—	—	XIV	—	—	71,9		11
7	—	—	XV	—	53	66,1		11
8	—	—	XVI	—	52	78,0		11½
9	—	—	XVII	—	51	88,0	Obstacles on the moraine. Reach ld.	8½

26 days; total from Neqe .... 1048,2 kilometres in.... 165½

Per day 40,3 km. — Per hour 6,32 km. — Average per day's journey 61,7 km.

[1] The 13 km. on the sea ice included, to make up for the unmeasured distance of the descent, where the odometer was taken off.

is to hack out a good sound hole in the ice with knife or axe, and there fix the loop of a small, very sound seal-hide thong, through which the harpoon line used in lowering can run without risk of fraying against the sharp ice. The line is now passed through the loop, and made long enough to hang doubled. When men, dogs and gear are down, the line can then be hauled clear from below, all that need be left behind being the little loop through which it ran.

We were fortunately well supplied with very long harpoon lines of thick seal hide (ribbon seal), of the kind used for hunting walrus on the ice, and had therefore no difficulty in getting down beyond the trouble involved in lowering all our gear: sledges, dogs, baggage, and finally ourselves. It took us about twelve hours, and by the time it was done, we had worn out several pairs of mittens, and nearly flayed the palms of our hands in hauling and hanging on to the lines. It was blowing a gale, which came in heavy gusts down over the edge, so that we were hard put to it to keep our footing on the slippery

Fig. 9. Camp on the Inland ice, with auxiliary sledges.

Fig. 10. One of the sledges of the expedition, with full load of walrus meat and hide. Note walrus hide runners with ice sheathing.

ice. Freuchen and Uvdloriaq were lowered down first to take the things as they came down. Inukitsoq was posted a little way farther down, in a fissure, whence he could steer the dogs as they reached him; there was a jutting edge here, when they generally kicked about so much that we were afraid of getting the line hung up in some cracks running at right angles into the glacier wall. Once while I was at work here on the edge, there came a gust of wind so violent that it simply lifted all my dogs, as I was about to lower them down. They could no longer keep their foothold in the treacherous surface, and came whirling down towards me with their traces entangled, and with such force that they could not fail to dash me from my own slight footing down over the precipice. Seeing no other way of escape, I jumped down into a fissure close by, where there was snow enough, I hoped, to break my fall. The dogs followed instinctively, thus averting what might have been a fatal accident. I came off easily, as it turned out, with only the loss of three dogs. One was flung over the edge which we had just managed to escape; the two others were simply blown out over the curve of the glacier and down into a fissure, where they disappeared. We never succeeded in getting them up again. We could not see them, but we could hear their pitiful whining for several days. After toiling faithfully all through the hardships of the inland ice towards new land and new hunting grounds: it was a poor reward.

Through the Zig-Zag Valley towards Danmarks Fjord.

Reconnoitring.

On our descent, we found ourselves in country new and unknown to us all. At the time of our leaving home, the maps of the Danmarks Expedition had not yet been published, and our only guide on the journey over the inland ice had been one of the small ice charts issued by the Danish Meteorological Institute, covering the whole coast of Greenland, on which Danmarks Fjord was marked. There was no means of obtaining any information on the spot; all that we knew for the time being was, as our observations showed, that we had struck the east coast somewhere in the immediate vicinity of the base of Danmarks Fjord, on the northern side. This was, as a matter of fact, sufficient; we had, however, not the slightest idea as to what progress we might be able to make on our way down to the coast ice. Before moving down to our present camp, we had made a brief halt up in the drifts. from where we could see some heights away to the south-east, which might perhaps be taken as situated on the southern coast of Danmarks Fjord. We knew from the first, however, that it would in any case be a very risky thing to make a descent on unknown ground, and had therefore at once determined to try our luck on this glacier lake, where the rounded contours of the country with its lakes and valleys seemed likely to be a haunt of the musk ox which were our only hope of safety.

I shall in the following pages endeavour to give a brief sketch of the situation from time to time. The hunting which occupied us, as it turned out, through the whole of our stay on the east coast, proved in many respects a distinctive feature of the expedition, which, it will be remembered, was originally only provisioned for a month. On our arrival at Zig-Zag Valley we had only dogs' food enough for two meals, and our chances of getting forward therefore depended entirely on our procuring game.

We had been hard at work for some four and twenty hours by the time we got down on to the glacier lake which lay ahead of the spot where we had made the descent; the business of getting dogs, sledges and gear lowered down over a precipice 20 m. high had been particularly exciting and fatiguing. We had, moreover, naturally not been able to get a proper meal all the time, and were thus both hungry and sleepy when we swung out over a frozen watercourse on to the lake to find a suitable camping place. We sat drowsily on our sledges, dozing from time to time, and sometimes only waking when we were thrown off, or when the dogs, who soon discovered our condition, pulled up altogether and declined to work alone.

Our lethargic condition was further aggravated by the heat, which to us seemed nothing less than tropical. It was as if we had been suddenly transported from the heart of winter into the full blaze of summer. Accustomed as we were to the low temperature and continual snowstorms of the inland ice, the clean sun of the open country burned on our faces till they smarted, and each breeze poured heat in over our bodies. We enjoyed it thoroughly at first, and were keenly thankful for the warmth, flinging off our furs and shouting with delight at being able to sit half naked on the sledges in 12 degrees of cold, which seemed as 12 degrees of heat to men dressed, fed, and generally fixed up to the pitch of "mercury frozen". Soon, however, the warmth brought on a slackness, a painful feeling of heaviness, which made itself felt in every muscle, until we could scarcely keep our eyes open at all. All the power of resistance with which we had struggled against the inland ice throughout the month seemed ebbing out, yielding place to that improvident enjoyment of the moment, which one is always tempted to give way to at the first breath of spring after a hard winter.

There was much to be done, however, as we knew, before we could rest. We had to camp, secure the dogs, cook our meal, and eat, and even then, we should have to make a thorough reconnaissance of the surroundings before we could venture to sleep. It was necessary to ascertain as soon as possible what our new hunting grounds

Fig. 11. Sledging down slope of glacier. Dogs behind acting as brake.

Fig. 12. Descent from the Inland ice.

might have to offer. We therefore decided to set out at once in search of game, while the dogs, too weary as yet to feel hunger, gave themselves up to the drowziness which the warmth had laid upon us all.

A sudden discovery, however, put an end to all desire for sleep as far as we were concerned, and made us fresh and ready for another twelve hours of work. In a drift in the north side of the lake we saw tracks of musk ox thawing down, and in a moment the urgent demand of the situation was clear: meat, and that without delay, for ourselves and our crowd of dogs.

We had already noticed some excrements, apparently not very old, up on the moraines quite close to the inland ice, and these tracks in the snow told us clearly enough that it was now only a matter of time. True, the tracks were a month old, but even so, the animals need not be so very far away. We were all wide awake once more.

We found a sheltered corner in a small creek, where we drove in and pitched our camp. Our first objective was now reached; the mighty desert of the inland ice lay now between us and the rest of the world. It remained for us to show what stuff we were made of.

We soon disposed of our meal, the inevitable porridge, washed down with great draughts of coffee, and were ready to set out on our first tramp over the new country. Freuchen, who was suffering severely from snow blindness, was obliged to remain behind in the tent and look after the dogs in case they got loose. We others took a dog each with us, in order to have some means of checking the musk ox if we should happen to come across a big herd. At no great distance from the tent we had our first sight of game, a small hare, which was promptly despatched, and by the end of an hour we had four hares and three ptarmigan for the pot. We were all three looking forward so eagerly to a meal of fresh meat that for a moment we found it difficult to go any farther; we had our horde of hungry dogs to be considered, however, and they were at the moment in greater need of food than we ourselves. Recollecting that we had only a meal and a half to give them, we were thus obliged to go up over the hills in search of more. We set off each in a different direction, and each leading his dog behind.

It is a queer feeling, starting off in this fashion into a great unknown country, to be swallowed up by the gloomy monotony of the hills. There is a solemnity about these wastes which makes a deep impression on the mind. Hour after hour one walks, a man unspeakably alone, without sound or sight of any living thing, yet with every sense alert to hear and see and find — until at last the strain within and pressure from without create a tension so great that one starts at the noise of one's own footsteps.

At last, after toiling for six hours from hill to hill, down through rocky ravines and up over chaotic slopes, I reached a crest from where I could look out over the country. Almost at my feet, lying east and west, was a big lake, extending out through broad, steep-sided valleys into several smaller lakes. A broad river connected the lakes and valleys, the sides of the latter being formed of fairly high sandstone cliffs of a warm brown colour, and broad gentle slopes that seemed well suited to such vegetation as the musk ox seek. This was the place to explore; for it must be here that the beasts whose tracks I had seen all the way had their haunts. I had seen tracks of musk ox everywhere, in sand and clay, and here and there in snow drifts: none of them, however, had been fresh. We should now have to drive round behind the hill at the foot of which we had camped, in order to get down to the valley and there obtain food for the dogs. It was a long way, however, and we all needed a rest before starting. I reached the tent about the same time as my comrades, neither of whom had met with better luck. As far as the actual bag was concerned, the reconnaissance had been unsuccesful, still, we had made ourselves acquainted with our immediate surroundings, and knew now where to go.

When at last we turned in to rest in our little tent, it was with the deep satisfaction which follows upon 40 hours of uninterrupted toil and fatigue; sleep then is the extinction of all consciousness, dreamless and deep.

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Hunting. 10 May.

It was very early morning when we turned out to make ready for our first hunting expedition in the country we had seen the day before. Freuchen had been struck with snow blindness immediately after our descent from the inland ice, and had to be left behind. We placed food ready for him in a corner of the tent, and left him to his own devices for an indefinite time, being all of us thoroughly aware that we could not come back to camp before we had made a kill.

We started off at first along the glacier to its mouth in the inland ice, a little beyond the spot where we had lowered ourselves down the day before. Here, however, we met with a serious disappointment, which proved indeed, of more importance than we at first imagined. The lake, we found, on which we drove, flung itself down into the hollows towards which we were steering by mighty waterfalls, frozen and gleaming, in four "storeys", making in all some 180 m. sheer. We had thus to find another place at which to make the descent, and from what we had seen when out reconnoitring it seemed that the only possible way remaining was over a tongue of the inland ice projecting westward. This we should have to go up, and then, passing round behind a hill, get down into a deep ravine about a mile long, which cut at right angles into the main valley we sought to enter. It would be bitterly hard work now to drive the tired and hungry dogs up over broken ground and down through the stones and clay of the ravines, for there was no snow anywhere in the country we had to cross.

A couple of the dogs were now left behind with Freuchen, and the remainder formed into two sledge teams, 22 dogs to each. It was difficult going; the dogs seemed unable to get over their disappointment at finding that the naked land, brown, beautiful and free from snow, proved harder work than the inland ice had been.

The worst part of the journey was toiling up over slopes or through pathless rocky places; here the dogs simply bunched together, tangling up the huge length of traces, deaf to all our cries, and moving only when the merciless whip lash hissed through the air above them as they stood. But we had to get forward somehow; it was now more than ever a matter of life or death to them.

It took us all day to get up over the ice and down the hills into the ravine which led to the lake; the last stage was over a mighty mass of huge stones which made slow but perilous going. On one of the hill slopes we shot a hare, and as ill luck would have it, the creature came tumbling down in full view of the dogs. I shall never forget the moment when those two score of dogs dashed away at breakneck pace, sledges and all, to get at the hare. It was devoured in the twinkling of an eye, though we never saw a single dog actually chewing for a moment. The thing was simply gone, without a bone or a tuft of fur remaining.

Once down on the lake, where it was easier going, all went very well for a time; at any rate, we got along somehow without having to urge the teams. Later on in the evening, however, we reached a stony water course, where the dogs again had to put their shoulders to the work. And here it suddenly seemed as if the quiet, well-behaved creatures had been transformed into ravening beasts of prey: whenever one of their number lagged behind, or got hung up by catching its traces on a stone, the remainder flung themselves upon the unfortunate, ready to tear him in pieces as they had the hare. It was all we could do each time to save the poor beast from the greedy jaws of his comparisons, who seemed utterly regardless of the hail of blows that warned them to desist. We were horrified to see them in this state, a thing none of us had ever before experienced with any of our dogs. It was not the first time we had been forced to keep our teams hard at work for days on short rations; endeed, we had seen them suffer worse in both respects. But never before had we witnessed any such open attempt to allay their hunger by devouring their living comrades. Moreover, most of them did not appear to be unusually famished; I am inclined to believe that the whole thing was a psychic outbreak, a fit of desperation at being cheated of the rest and good sound feeding which they doubtless felt they had deserved.

We were now brought face to face with the difficulty which we had anticipated from the day when we first started out over the inland ice: if we failed to find game immediately on reaching the east coast, it would be necessary to promptly reduce our big teams. We therefore called a halt for that day, and held a brief council of war to decide what was to be done. Throughout the day we had ascended every little height which offered any view of the surrounding country, and carefully examined the place with our glasses. There were plenty of tracks to be seen, but not a single musk ox. In view of the precarious situation as regards game, we now decided to kill off some of the dogs at once, only, however, as many as could be eaten on the spot, to avoid waste of meat. On this day, therefore, six faithful workers were sacrificed for the good of their comrades and the expedition.

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On the following day we set out once more in search of game. It was blowing a stiff easterly gale, the wind rushing down from the ice and tearing through the valley with such fury as to send the small stones flying about our ears. Huge masses of sand from the banks were flung in greyish clouds over the water course we had to follow, the gusts frequently coming upon us so violently that the dogs could scarcely keep their feet. After driving for some hours along the river bed, we were forced to halt, as the dogs could be urged no farther. We found a small sheltered hollow where we tied up the dogs, and then set off on foot, in two parties, to see what we could find.

When we assembled in the evening it was with every expression of delight. UVDLORIAQ and I had got one bull, while INUKITSOQ had bagged no less than eight beasts altogether; five heifers and three yearling calves. Unfortunately, there is not much meat on a musk ox at this time of year, when they are in very poor condition; we could, however, face the coming week without anxiety.

Early on the morning of the 15th we set out for the glacier lake once more, keeping now, however, straight on towards the face of the ice and the waterfalls, in order to see if it were not possible to get up that way. None of us were anxious to make the long detour again round by the great rocky slopes and the height to the north west of our camping ground. Leaving the dogs and sledges at the end of the great lower lake by the foot of the ice wall, we started off, with slabs of meat on our backs, up over the cliff that formed one side of the waterfall, and finally reached the glacier lake and

Fig. 13. Musk ox at bay: a lone bull waiting the onslaught of the dogs.

Fig. 14. A sortie.

the camp, where FREUCHEN, it need hardly be said, was anxiously awaiting our return.

Down the great waterfalls. 11—16 May.

We have now to decide which route to take on leaving here. We have evidently not yet reached the base of Danmarks Fjord, where, as we know from JØRGEN BRØNLUND's diary, the descent is an easy matter enough. In order to get there, we shall have to move up on to the inland ice once more, and probably drive for about a day towards the south east. This would be the most satisfactory way to manage, and if only we had fresh dogs to work with we should not hesitate for a moment. Our teams are, however, at present so exhausted that it would be a very risky thing to ask of them now to haul up on to the inland ice again and a good way over it in order to reach the level where we could shape a course for the innermost base of the fiord; moreover, if we should happen to find ourselves weatherbound there, we should not have enough rations for the dogs. Had we but found game at once, and in sufficient quantities, so that they could have had a ten days' rest with plenty of fresh meat, it would be a different matter. As it is, we have spent eight days getting nine musk ox, a poor provision for some fifty hungry dogs. And instead of resting, they have been forced to haul the sledges over bare and difficult ground. No wonder, then, that they are out of form, and they will need nursing if we are to get forward at all, not to speak of getting home again.

We hold the usual council of war, and arrive at the unanimous conclusion that we must go down, over the waterfalls and the lakes, and through the great valley, which we have now called Zig-Zag Valley on account of its many twists and turns. The ground falls away so sharply down through the valley that it seems evident we are not far from the sea. Nevertheless we must be prepared for a hard fight to get there, as we have already learned that there is but little game to be found. It takes a long trudge and a keen search to hit on musk ox here. We comfort ourselves, however, with the thought that as long as we keep down on the land, there is always some chance of game. Moreover, the work of getting down over the waterfalls will not affect the dogs, but only ourselves, as everything will have to be lowered down, just as before, at the edge of the inland ice.

We have lost one day already since we came back after finding the musk ox, a snowstorm having, as usual, raged over the barren moraine country, keeping us weatherbound. Today it is calm, with snow falling, and we are glad of the change, which means better going over the bare plains. The smooth surface of the river too, will be none the worse for being a thought less slippery.

We have now reduced the number of our dogs to 40, which is still ample. I think too, we did well in sacrificing the others, as I have an idea that we have a hard time ahead. At this time of year, the big game is to be found down near the coasts, and not so far inland, as is also shown by the many old winter tracks we have found here. They keep to the coast lands in the spring, and we are hardly likely to find game in any quantity before we have reached sea ice.

Meantime, the best thing we can do is to set about getting there.

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It took us from six in the morning of the 18th to six in the morning of the 19th to get down over those waterfalls with all our gear. It was tiring work, but exciting, and dangerous into the bargain, as everything had to be lowered down into the gulf below the glacier, which now and again startled us by calving some hundreds of tons quite close to where we were. The lowering was done as before, by hacking a hole in the ice of the fall, and making the end of the lines fast there.

FREUCHEN's report gives a detailed account of the localities, both here and in the Zig-Zag Valley; I need not therefore do more than refer to this here.

Difficulties in the Zig-Zag Valley.

Diary notes.

As I thought. We had been looking forward to that last fall of snow, hoping that it might give us better going, and so it has. Gravel and stones are covered now, and we are making very decent progress on our way down. It took us only six or seven hours to get from the lower lake (Nedresø) to the place where INUKITSOQ made his bag of eight. This was much better than we could have hoped for.

We loosed the dogs as soon as we got there, and let them eat their fill of such meat as was left on the carcases, which was not a little. When at last they had finished, after quarrelling and fighting for several hours over the remains, all were visibly bigger about the waist.

Next day the weather was fine: not a breath of wind, and the heat vapours from the newly fallen snow quivering in the air. It was a beautiful sight looking out over the valley, the ground slashed everywhere with ravines running this way and that, gentle slopes covered with scattered growths of grass, heather and willow, and threaded with little watercourses from the many small lakes. It was proper musk ox country, and we could not but feel that things looked promising all round. The snow lay white and virgin over valley and hill, so gleamingly, glitteringly new that no trodden track could escape our eyes. There had been no wind since the snow first fell, so that even the big boulders, which can be so deceptive at times, lay still wrapped in white. Only one object shows up black and round in such a landscape; musk ox.

We came upon fresh fox tracks not far from the tent, and this gave us new hope that we were no great distance from the coast, as the arctic fox is rarely found far inland, its best ground being down close to the shore. We saw too, the slight, delicate impression made by a lemming trotting over the snow; prints about the size of a sparrow's, no more. And a little farther on, the elegant ermine had left witness of its agility in a gallop, the distance between the tracks showing what marvellous jumps the little creature must have made.

We were in high spirits now at the outset of our journey through this kindly landscape, beautiful in itself, and rich in promise at least of game. As we went on, however, the snow grew deeper and the ground rougher; the river bed proved impassable in places, and when at last we halted, after a fourteen hour's day, our total bag amounted to one little ptarmigan per man. This day the poor dogs had none. Time after time throughout the day we had turned aside to go in search of game up among the hills, but ever without result; all we could do for the present was to hope that all those valleys and ravines soon might prove more faithful to their promise.

The following day, however, brought but the same result, with only additional depth of snow and of disappointment. We pitched our tent, and bade our troubles leave us for a while to sleep.

— — — —

Once more we found ourselves obliged to hold a council of war. True to its name, the Zig-Zag Valley was giving us more trouble than we had found reason to expect. Our first delight at finding ourselves on open land was in danger of giving place to a longing for just one day on the firm, level surface on the inland ice, where we could mark off our course as with a ruler, and swallow up the miles in greedy gulps.

The Zig-Zag Valley has played us a mean trick. It began by running eastward, and now it has suddenly slewed round to the north, leading in through the hills in a direction we have not the least desire to take. We have reached a place where the river bed widens out, leading eastward again, but the snow is deeper now and heavier, the weather being warm, and the dogs are thoroughly sick of it. We must find a way out somehow. In spite of continual scouting expeditions both on foot and on ski up among the hills, and down the valleys and ravines on either hand, we have not sighted a single musk ox track, and even the hares, that came out so cheerfully to meet us up on the moraine, have now completely disappeared. The whole place seems absolutely devoid of game, and we may be thankful if we get a brace or so of ptarmigan a day for the pot.

After all, it is not so bad for us; we have coffee and tea, and up to now a bird apiece per day. And if the worst comes to the worst, we have still nearly a dozen pounds of the loveliest oatmeal — the thought of it makes our mouths water these days — but we are saving it for the homeward journey, and dare not touch it yet.

The dogs, however, are in a sad case: they have had no food for days and are utterly worn out with hauling through the deep snow. After talking matters over, therefore, we decide to further reduce the teams, and make shift with three sledges only. This also enables us to make ski out of the materials of the odd sledge. We had brought with us a pair of Norwegian ski and a pair of Canadian snow shoes, but these are not sufficient for our present needs, as three of us are generally obliged to be out hunting at the same time. Moreover, with such going as we have here, one of us must take the lead of the foremost team, to clear the way, and taking only three sledges leaves us one man to spare. UVDLORIAQ, INUKITSOQ and I therefore divide FREUCHEN's team among our own, and cut up his sledge, which enters on a new existence in the form of two pairs of first class ashen ski.

And now we are ready to tackle this pathless, gameless waste once more.

— — — — 20—22 May.

We ought by rights to have been up betimes today, but the toilsome trudging through the soft snow and the many detours in search of game among the hills are telling on our strength. We do not notice it as a rule until the day's march is done, and we are lying full length in our sleeping bags. Then, however, we seem to float out of existence, away from it all, and not until we wake after a heavy, unbroken sleep do we realise that the body has taken more than we had meant to give. And so it was today. UVDLORIAQ and I intended to have used the top of the morning before the sun had taken the freshness out of ourselves and the dogs, to get on ahead. As a matter of fact, however, the morning was no longer early when we at last got ready to start. We were now only 70 m. above sea level, so the coast could not be far off. INUKITSOQ and FREUCHEN stayed behind at the camp, with those of the dogs that were in poorest condition.

I had my ski on, and ran ahead of UVDLORIAQ's team all through the day and a part of the night; we were at it for twelve or fourteen hours, without covering any great distance, as the dogs were far from keen on the work, and made but slow progress through the snow. We pulled up at the foot of a hill which seemed to offer a good view of the open country beyond, where no further heights were to be seen, and tying up the dogs, started on a climb which we hoped might give us a sight of the ice ahead.

Thalassa! There lay the sea. Those Greeks could hardly have

Fig. 15. Cape Hjalmar Lundbohm, at base of Independence Fjord.

Fig. 16. Up over Cape Schmelck. Note Eskimo head strap for heavy loads.

been more delighted at the sight. True, it was still a long way off, and the intervening valleys seemed filled deep with snow. Still, we could see it, and the despairing uncertainty as to what obstacles lay between us and our goal was at an end. Danmarks Fjord was now not more than a day's journey away.

We got down to the sledges again, cooked a brace of ptarmigan and brewed a cup of coffee, extra strong, which further served to raise our spirits. Then Uvdloriaq lay down to rest on his sledge, while I indulged in a sleep, which I sorely needed.

Next day Inukitsoq and I set off on the track of the others. The dogs were better for the rest, but sorely weakened now by hunger. Things are looking bad as far as game is concerned, all our efforts in that direction having been utterly fruitless.

We toil on, slowly, step by step, the dogs with heads down and tails between their legs. Later on in the day we come up with the others, who have camped.

Uvdloriaq has got a musk ox!

Hooray!

— — — —

This little piece of good luck, however, meant but a feed for Uvdloriaq's own team and our four selves; the beast was in frightfully poor condition, and the meat as tough as gristle. We were therefore obliged to slaughter a couple more dogs, and start out on a new hunting expedition.

It was a weary business all through. For all our efforts, the bag was meagre: nine musk ox on the 12th, one more on the 25th, and after that, ceaseless wanderings over hill and dale, always two of us at least being out, with the final result that we got three more musk ox on the 27th; good beasts this time, three fat bulls. We found a carcase, too, down by the river, and were very glad to get it.

We could now give the dogs a few days' rest once more, and feed them up to rights; the musk ox meat, full of fat as it was, soon freshened them up. We fetched down some gear which we had left with a sledge farther up the river bed, and at last, on the 31st of March, we reached Danmarks Fjord.

Here I made the following entry in my diary:

We have now got through the Zig-Zag Valley at last, but its miserable 150 km. have taken us nearly as long to cover as the whole thousand across the inland ice, and have cost us far more dear. Apart from hunger and fatigue, the journey from the edge of the inland ice to the coast has lost us nearly a score of dogs.

Right opposite our camp a fine peak of warm and beautifully coloured sandstone juts out into Danmarks Fjord. This has been our goal for many days, beckoning us with its sun-gilt profile to leave the toilsome ravines and tread the level sea ice in their stead. And in our longing to reach so fair a landmark, we have vowed to find for it a fitting name.

At last we pitch our tent at its very foot, and true to our vow, christen it Cape Renaissance, promising one another that the spirit and the deeds which that name calls to mind shall be our beacon through the work that lies before us on the unknown coasts in the blue haze ahead.

The spring is now already far advanced. The sun is wreaking its will on snow and ice; its rays are loosening the fetters of the flood. Forward is the word, out over the ice as long as it will bear us, to find new fields and better hunting grounds.

High time to leave this Zig-Zag Vale behind, and see what lies beyond Cape Renaissance.

— — — — 27 May.

Danmarks Fjord.

Once out on the sea ice, which was firm and level, with just a few drifts here and there, the dogs picked up wonderfully, and soon fell into their old pace again. The sun was strong now, however; the skin simply peeled off our faces, and our eyes were dazzled to such a degree that we had to be very careful all the time to avoid snow-blindness.

On the very first day we sighted a couple of musk ox through the glass. Bulls they were; four kilometres away inshore. We called a halt at once, and went off in chase. We were extremely glad to get them, and the dogs, who had been well fed now for the past week, were soon in fine form.

About 1 km. inshore we found a piece of driftwood.

Next day we got a "Tiggak", an old fjord seal, which was lying out on the thick ice of the fjord, basking in the sun; its skin bore the marks of many a furious fight. This seal, and the circumstances under which it was captured, will be found mentioned in FREUCHEN's zoological report.

I may, however, in this connection, briefly refer to the methods we employed for hunting seal on this expedition: equipped as we were according to Eskimo principles, we naturally did our hunting in the traditional Eskimo fashion.

A seal sunning itself on the ice may be stalked; "ariardlungo" as the Eskimos say. The hunter, carrying nothing but his rifle or harpoon, crawls towards his game, taking care to imitate as far as possible the movement and sound made by a seal. The moment he finds himself observed, he endeavours to attract and retain the attention of the victim *in spe*, by scraping at the ice or snow, wallowing about, and uttering sealish noises; in a word, playing to the best of his ability the part of a seal newly emerged from the water. The

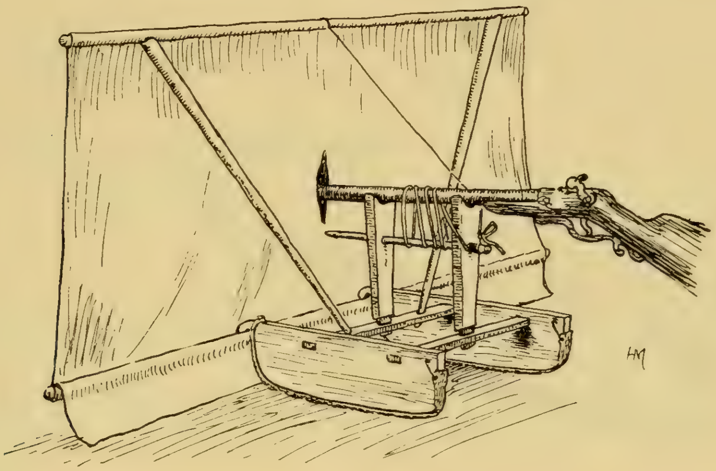
Fig. 17. Musk ox forming square to resist attack. (H. Moltke, from a photo.)

Fig. 18. Crossing the big stream at Nyeboes Glacier. Sledges fitted up as ferry. (H. Moltke, from a photo.)

seal itself will generally be nervous at first, and watch the stalker suspiciously for some time; in the case of a skilful performer, however, it will soon cease to interest itself in the newcomer, after which it is an easy matter to get within range. A clever hunter may even manage to come to close quarters, and take possession of the breathing hole itself, before the seal can escape.

This method, however, demands considerable practice, and a close acquaintance with the habits of the seal; it is therefore hardly to be recommended for explorers generally. A better way is to approach by means of a stalking sail, the use of which is illustrated by a couple of sketches in the text.

The miniature sledge, to which the gun is lashed, glides noiselessly

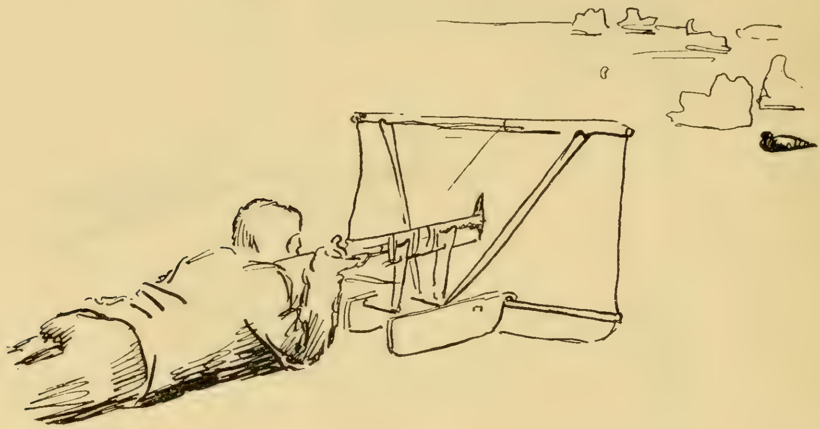


over the ice, provided the runners have been duly shod with skin; two strips of bearskin for preference, though sealskin may also be used. The sail of thin white canvas is hoisted on the sledge, and the whole contrivance pushed before the stalker as he advances, a hole in the sail, through which the barrel of the gun is thrust, affording also a means of watching the movement of the game. Needless to say, the seal take the white sail at a distance for a block of ice, thus enabling the hunter to approach within range.

It is said that the Eskimos themselves learned or adapted — this method from the ingenious practice of the polar bear; the latter will, they assert, when stalking seal, often push a block of ice before it, to cover its advance.

On the 4th of June we reached MYLIUS ERICHSEN's summer camp. A sledge runner, bent over a couple of small piles of stones, attracted our attention, and we halted to investigate. Going up to the spot, which was at the mouth of a stream, we found a number of minor objects which FREUCHEN recognised as having belonged to the Danmark Expedition, but no report. On the hills a little way inland we could see two small cairns, built for survey purposes, and finally, on a prominent point of rock a little distance away, a fairly high cairn dominating the rest. In spite of careful search we found still no report here, which greatly surprised us, as the nature and position of the cairn would certainly seem to suggest that it had been built to receive the report of an expedition, more especially as it was erected close to the spot where MYLIUS ERICHSEN and his two comrades had spent their fatal summer.

I then wrote a report stating the progress of our expedition up to date, adding in conclusion the following:



"The expedition started out with four sledges and 53 dogs. After reaching land the number of dogs was reduced to three teams, or 32 in all, on account of difficulties in the matter of food. These dogs are now in good condition, although the continual work and lack of rest have taxed their strength considerably.

We hope to survey and explore the Peary Channel in the course of July, after which we shall look out for a place whence we can get up on to the inland ice. In July the dogs should be rested and fed, and in August we set out again over the inland ice to Wolstenholmes Sound. No report was found in the cairn at this place, nor have we discovered any trace of MIKKELSEN and IVERSEN anywhere in the Fjord."

The fact that no report from EINAR MIKKELSEN was found in a prominent cairn built in such a conspicuous place which must necessarily be passed on the way to Peary Channel made it justifiable to suppose that he had not reached so far, it being a natural precaution and general custom among arctic explorers not to pass such a cairn without leaving a report. As we had now, on our way through Danmarks Fjord, found nothing of the kind, we were forced to conclude that they must have turned back before reaching the fjord. With no such information to act upon, it would be hopeless for us to go in search of them, as they might well have gone off, for instance, to the inhabited station at Angmagssalik. Should they, however, by some chance have passed the cairn without depositing any report, then we should, by continuing our way up to Peary Channel, be going in their direction.

It was not until my return home that I learned how EINAR MIKKELSEN *had* been in Danmarks Fjord, and had there found two reports from MYLIUS ERICHSEN.

In thus neglecting to leave a copy of the reports which he had found, together with a brief indication of his own recent and intended movements, EINAR MIKKELSEN acted imprudently. If he and IVERSEN had subsequently perished — a possibility which had to be considered — no trace of them would have been left, in addition to which, MYLIUS ERICHSEN's reports would have been lost altogether.

It will thus be understood that we had good reason for supposing that EINAR MIKKELSEN had never been in Danmarks Fjord at all.

We now followed the coast to about the mouth of Hagens Fjord, where we arrived on the 5th of June. With the exception of a seal shot close to Cape Kronborg, we had found no game since leaving Sjællands Sletten, although we had twice made excursions inland. The coast here was wild and desolate; a barren, melancholy place. It was newly formed land, all clay, without vegetation or game. We therefore decided to cross over to Peary Land, which we reached on the following day.

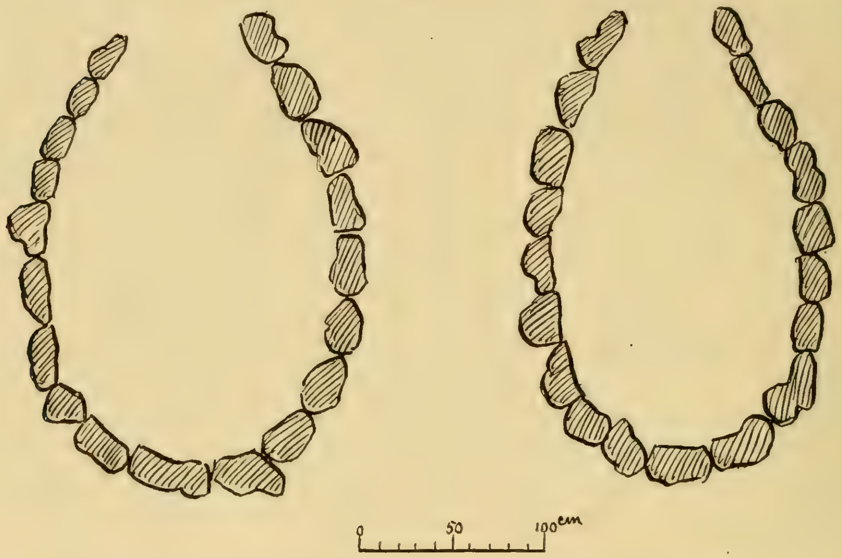
And here we found ourselves suddenly as it were transported to another quarter of the globe. We sighted musk ox even before reaching land, and our first impression, as soon as we had crossed the ice limit up on to the shore, was one of fertility and life. It was a real delight to see, not clay, nor rocks, nor gravel, but earth; mould, dotted everywhere with red blossoming saxifrage. Along the river banks were tracks of musk ox, hare, and lemming, and in the air above, the skuas shrieked out a welcome.

From the moment we started off along the coast of Peary Land, it was like new life to ourselves and the dogs. Save for one or two short spells of ill luck, we now found abundance both of musk ox and seal.

Naturally also, it was here that we made one of the most interesting discoveries of the expedition, encountering at several places old Eskimo tent rings as evidence of previous occupation.

The tent rings above referred to were all situated close to the mouth of Brønlunds Fjord, some on the eastern side, others on the west.

Those on the eastern side were of unusually small circumference, and the tents must thus either have been intended for merely temporary use, as for instance while on hunting expeditions, or possibly the builders may have lacked sufficient material — drift-wood or skins — to make them of the customary size. We found however, two pieces of drift wood deposited in one of the rings, where they had evidently been placed for safe keeping, as too valuable to be lost. One of these pieces measured 3.30 m. long, the other slightly less. The dimensions of the tent rings themselves were as follows: 1) 2.28 m. from entrance to back of bench, breadth of the bench itself 1.58 m. 2) 2.30 m. from



Eskimo tent rings. E. side of Brønlunds Fjord, Peary Land.

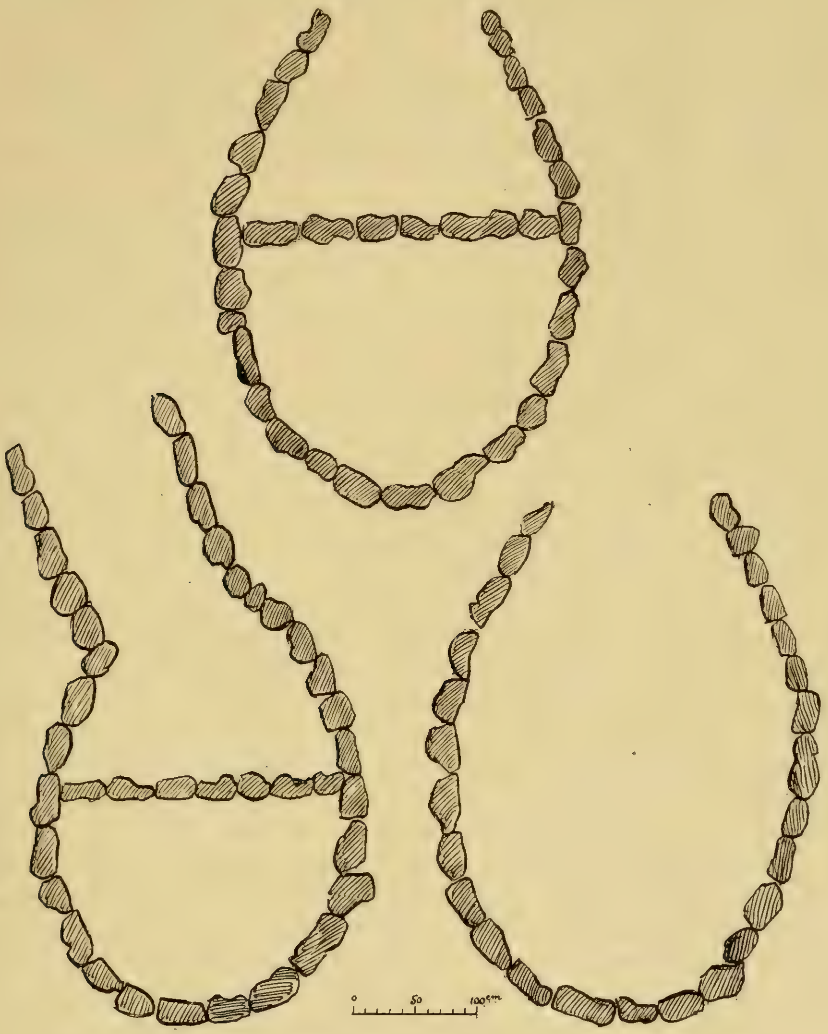
entrance to back of bench, breadth of the bench itself 1.30 m. (*vide* sketch with dimensions etc.).

The tents faced towards the north-east, the entrances looking out towards the fjord. The hunting grounds appeared to have been chosen with unerring instinct, for the fjord was full of seals basking in the sun, while in the uplands behind, musk ox, hare and ptarmigan abounded.

The tent rings on tbe western side of the fjord, numbering five in all, were considerably larger. The best-preserved specimen had an outer room or passage way measuring 1.80 by 1.15, the distance from inner end of this to back of bench being 3.10, and breadth of bench itself 2.30. A tent of this construction with the outer room or passage, is called by the Eskimos "qarnisalik" (*vide* sketch).

The largest of the well preserved rings measured 4 m. long by 2.70 broad.

The ground outside each of them was strewn with bones of musk ox and seal, showing that the tent-dwellers had not lacked meat.



Eskimo tent rings. W. side of Brønlunds Fjord, Peary Land.

Of winter houses no remain were found, although we explored the surrounding country in all directions.

The ice in Independence Fjord showed narrow fissures here and there, and in these we sometimes saw flocks of as many as thirty seals, some basking on the ice, others with only their heads above water. There were also a number of *ugtut* (seals that sleep on the ice) scattered about singly in various directions. Now and again a flock of barnacle geese winged over our heads, or a couple of startled eider duck turned suddenly from their course as a mark of respect on sighting us. Even the gulls came sailing idly down the air to look at us, while solitary hares, or a pair of small ptarmigan, forgot their joy of spring in momentary fright on seeing us advance along their silent coast.

We were now in the midst of the arctic spring, and it cheered our hearts to see. This was real country, with food abounding in case any unexpected obstacle should bar our progress round by the northward, and force us to winter here.

The weather too was fine and clear; our only trouble was the ice, which had responded to the warmth of the sun by forming small fine sharp needles everywhere, which cut up the dogs' paws. We were therefore obliged to halt, and make kamiks (small skin boots) for all the dogs, and each dog having four legs, it will be easily understood that it was no light task to shoe them all each time we moved. After we had passed Brønlunds Fjord, however, the ice improved considerably, and as the dogs at the same time began to feel the effects of all the good feeding and find their old energy and spirits once more, we began to believe in the possibility of making short work of the Peary Channel, and doing a rapid run home, according to the plan we had decided on when at the cairn.

Ever since the end of May we had had first rate weather, with a high sun, and the ice in Independence Fjord had suffered greatly in consequence. Real progress was only possible along by the shore; here, however, the going was all that could be desired, as long as the dogs had their kamiks on. Save for these, they would certainly have had their feet cut to ribbons, which would have taken months to heal, as it is a most difficult thing to make a dog lie still and give a wounded paw a chance to get well within a reasonable time.

These Eskimo dog kamiks may possibly be new to most arctic travellers. I will therefore give a brief description of them, as they are really indispensable. There are two kinds, one is sewn like a bag, into which the dog's foot is placed, when it is fastened a little above the joint. The best material to use is the skin of ataq or bottle-nosed seal with the hair on. This bag-shaped kamik is most useful in winter, when it is dry underfoot, and not in the spring, when there is water forming on the ice, as the stitches would soon burst with the wet. For travellers having no sealskin available I should imagine that ordinary duck might serve the purpose.

The kamiks we used in Independence Fjord, however, were of quite another sort. Each consisted of a flat round piece of sealskin, with lacing eyelets all round the edge, through which twine, or better, thin leather lashing is run, so that the whole can be drawn tight round the paw like an old-fashioned purse. Kamiks of this sort are used on the spring ice, when covered with water. Great care must be taken, however, not to tie these kamiks so tightly that the laces cut into the leg and form sores, which may easily happen. This will give the dogs as much trouble as the ice-splinters themselves, as the subsequent wading through snow will cause the sores to break out again, and make it almost impossible for them to heal. Finally, at every little halt, the kamiks must be loosened, as if the dogs are allowed to lie for but a quarter of an hour with the kamiks fastened over, their paws will at once begin to swell. It will thus be understood that the use of these kamiks is attended with considerable difficulty, as the fastening takes a great deal of time, especially with large teams. They are, however, as already mentioned, absolutely indispensable; we at least found them so, driving as we did all through the spring without having the dogs' paws hurt.

The water from the melting ice flowed down into all the fissures close into land, so that as long as we followed the coast, we had dry ice underfoot, save for a narrow belt between the fissures and the shore. When crossing bays, however, or some branch of a small fjord, we found ourselves wading through lakes of water, often reaching above the knee, to the detriment of our clothes and gear. From the middle of June the crossing of Independence Fjord was a matter of so great difficulty that we gave up the idea of going over to look for Mylius Erichsen's report at Cape Glacier. We had now, moreover, realised that he could not have touched at Cape Glacier itself, on account of the "sikussaq" (fragments of inland ice packed on the fjord in the course of years) which was absolutely impassable in the neighbourhood of Academy Glacier, owing to the enormous number of intercrossing fissures. With regard to this phenomenon, the reader is referred to Freuchen's report.

Having thus nothing definite to go upon as to where we should seek Mylius Erichsen's final cairn, which, from the nature of the ice, could not be at Cape Glacier, we thought it best not waste further time and energy in the search, but rather to proceed as rapidly as possible to deal with the main object of the expedition.

For some days now the appearance of the country about the base of Independence Fjord had gradually given us the impression that Independence Bay must be a fjord, having no connection with Nordenskjölds Inlet. We could not, however, yet come to any final conclusion; anyone who has travelled in Greenland will know how deceptive the apparent form of a landscape may be, with overlapping ness and point that render it impossible to judge what lies behind without actual investigation of the spot.

Not until the 17th of June did we reach the glacier which forms a barrier at the base of Independence Fjord. We made at the same time an excursion up into the hills, and looking down, saw an open stretch of snowless land just where the map showed the dotted line of a channel. Greenland was thus in unbroken connection with Peary Land.

For detailed description of the local conditions here, the reader is again referred to FREUCHEN's work; it will here suffice to mention the effect which this discovery had upon our plans for further progress.

Naturally enough, our first feeling was one of delight at the discovery; we were, however, by no means blind to the fact that the country which now lay before us would place considerable difficulties in our way.

Cape Schmelck and Nyeboes Glacier.

The task immediately before us was to get forward into the new country and do as much surveying there as we possibly could. This was not all, however. In order to make our way back to Thule, we should have to make connection with the great main glacier, which from our present position appeared extremely difficult of access. Nyboes Glacier ended abruptly in an unscalable precipice. Academy Glacier over on the other side was easier to tackle, or at least appeared so when viewed through the glass; this, however, did not help us much, as it was impossible to reach the edge of the glacier on account of a huge chaotic mass of sikussaq. And as for Danmarks Fjord, this was out of the question at the then late season of the year.

We had thus no alternative but to make our way up over a hill some 800 m. high, then down through hollows with ravines and big, rugged watercourses over a moraine country of stones and clay, some 20—25 miles in all, only a small part of the highest ground being covered with ice. Ascending this promontory, which we named Cape Schmelck, after the famous Norwegian chemist, we managed to get down some little way along Nyeboes Glacier, from where we could reach both on the new country and the main glacier, which was to be our high road home, always provided we succeeded in finding sufficient game to furnish provisions for the journey.

In the course of our reconnoitring excursions here UVDLORIAQ distinguished himself as a born pathfinder. Behind a wild and rugged hill crest, among chasms where all progress seemed impossible, he discovered a small ridge jutting out on to the glacier, just wide enough to allow a sledge to pass. We subsequently found that this was the only way of access to the main glacier, and the discovery thus saved us from having to winter in the Peary Channel.

Then followed a fortnight of hard work in getting our gear up over the rocky hill, which was entirely free from snow. Every bit of it we had to carry on our backs, sledges and all, first up and then down, over pathless ravines, and often wading in swift mountain torrents.

We came down on to the glacier through a ravine running toward

Fig. 19. Camp under the big rock, with tent. (H. Moltke, from a photo.)

Fig. 20. Peary's cairn at Navy Cliff.

south west. It was fertile ground, with water trickling down over all the hillside, and a resultant vegetation of surprising luxuriance, all now in full bloom. Numbers of musk ox had left their footprints here on the slope, hare and ptarmigan also abounded, and huge swarms of flies, crane flies, and butterflies added largely to the general effect of summer on the mountain side.

At last, on the 30th, we had once more ice underfoot, and all our gear up on Nyeboes Glacier. The next thing is to find game, both for ourselves and the dogs during our stay here, and for our homeward journey. At the moment, we are absolutely emptyhanded.

Adam Bierings Land.

Thus, at the end of June, we entered the new country, to the north of a big, broad valley, Valmuedalen (The Valley of Poppies). The hilly uplands fronting on to it we named Adam Bierings Land.

The valley seemed like a revelation of summer spread over the land, with its wealth of lovely yellow poppies from which we took its name. Here we remained until the 12th of July. On returning to the sledges, which we had left at Nyeboes Glacier, we built a cairn on a jutting point of rock facing the glacier, and there deposited the following report:

"Stayed here in Valmuedalen, Bierings Land, from 29 June till 12 July. Shot 17 musk ox, rested and fed the dogs, carried 36 joints of musk ox meat on our backs down to the sledges at Nyeboes Glacier, and are now going over to Navy Cliff.

Did not succeed in penetrating farther inland than to Tværdalen, the valley running east and west, owing to rain and fog which lasted throughout the whole of our stay.

We have now 28 dogs, all in excellent condition".

Later on, we obtained an excellent view from the glacier out over Adam Bierings Land, which stretches away into the haze of the horizon, threaded by valleys and ravines, small streams and a few local glaciers of no great extent. Away in the distance, a mountain rises like a bluish cloud shape, yet with outlines so distinct, that we can reckon it to be about 10 miles away, presumably in the vicinity of Nordenskjölds Inlet.

Looking out over the strange wide stretch of country I was sorely tempted to explore it further, but decided on consideration to turn homeward instead.

If we go inland again (which does not appear to be difficult from where we are up on the glacier), in order to get through to the charted coast on the west, it would take some considerable time. We have, moreover, already spent 12 days down in Valmuedalen, unable to take proper observations on account of rough weather. The dogs too, have already had to meet severe calls upon their strength. All things considered, such an excursion would render it hopeless to think of getting back home before next year's light period.

Practised hunters might I believe, easily manage to spent a summer and the following winter here in Adam Bierings Land and Peary Land, even when counting exclusively on game as food for man and beast. Still, under such conditions, it is not wise to go too near the limit of safety. And we had now already been out for a long time, and covered big distances, so that we might well be justified in taking some thought for ourselves and our dogs, and recollecting our duties at Thule.

Knowing the country here as we now do, and being to some extent acquainted with the conditions which one may expect to encounter at any time, the most natural way of making connection with our surveys of the east coast and Victoria Inlet would be from the west. In addition, the great stretch of open country, free from snow and ice, on the northern coast of Greenland, offers an excellent sphere for scientific investigations of a more detailed nature than we should now be able to make in the course of a hasty visit. These considerations give birth to new plans of exploration. With Thule as a starting point it would be possible at any time, and without very great expense, to send out an expedition which could complete, thoroughly and in detail, the work commenced and pursued by the many previous expeditions in these inaccessible regions.

Up over Nyeboes Glacier.

Having loaded our sledges with clean meat, we started off up Nyeboes Glacier to get across to the Navy Cliff country. The dogs were almost unrecognisable; the twelve days' rest in Valmuedalen had completely restored them, and they were now in such good condition that we were almost obliged to hold them in on the way up. It was very uneven going on the glacier, with continual ups and downs at abrupt angles, making it difficult to keep the sledge clear of the teams on a sudden downward turn; we managed to get one of the dogs run over as it was. We arrived soon after the streams had begun to break through the ice; only ten days before we had been able to look down from Bierings Land over a number of brightly flowing streams. By this time, however, most of them had emptied their waters into the Glacier lake elsewhere described by Freuchen, to that by making wide detours we were often able to get across by finding some place where the sledges could reach from one side to the other. Only once did we encounter a really broad stream, and that took us a whole day to get across. It was a regular river, not very deep, but broad, and as the bottom of these glacier streams is formed of smooth-worn, polished ice, it is so slippery as to make it almost impossible to stand upright on one's feet, even with the slightest stream. And if one happens to fall, and be carried down by the stream, then all is over.

The crossing of this big stream gave us once more occasion to make good use of the abundant supply of hide thongs (Kobberemme) and lashing. We fastened the three sledges together one on top of the other so as to make a ferry. A strong line of walrus hide was fastened to this improvised craft, and it was then thrust slantwise out into the river, with a man on board. After several attempts, we managed to get the thing to wash in on the opposite bank, enabling the passenger to jump ashore. Having thus established communication with the other side, all was easy enough, and the sledges could simply be hauled backwards and forwards. We thus got across dry shod, and without even wetting our gear; the dogs, however, did not escape a cold ducking, as we had to haul them over with a line.

It took us three days to get up over Nyboes Glacier, the weather being very bad. For the whole of the way one of us had to go ahead to find a path for the dogs. At last, in the afternoon of 15 July we reached the moraine country behind Navy Cliff.

At Navy Cliff.

With the supply of meat we had obtained in Valmuedalen, it would not take much to make up the quantum sufficient to carry us safely home over the 1000 km. of inland ice. The hunting could moreover be done while we were looking for Peary's cairn and the report at Navy Cliff.

Early on the morning of the 16th therefore, my two comrades started out in search of game, while I remained behind in the tent. For the last few days I had been suffering from pains in the leg, which Freuchen diagnosed as incipient ischias. I was therefore obliged to keep quiet for a little. After an absence of 12—14 hours the hunting party returned, having secured 11 head of musk ox, so that we could now look forward to the homeward journey without anxiety. The dogs, however, were in need of rest, and we could in any case not start until we had completed our investigations, so we decided to shift our camp farther inland. We pitched our tent in a ravine, half overhung by a huge rock, which gave us valuable shelter during the stormy days which followed. In front of us lay a valley, with a big lake, on the banks of which numbers of musk ox, to our great surprise, moved about every day without paying the slightest attention to our presence. It need hardly be said, that it was an enormous advantage thus to have our quarters in the midst of a living provision store, while waiting to start off over the inland ice.

On the 22nd Freuchen and Inukitsoq went out to find Peary's cairn, as my leg made it unwise for me to risk the hardships of the long and difficult march over the hills. I therefore contented myself with giving FREUCHEN a report as to the progress of our expedition up to date, leaving it to him to make such additions as might be necessary when they reached the cairn. By the afternoon of the 24th they were back again already with good news, having discovered Peary's report, and even found time to visit one of our musk ox depots, bringing back some beautifully air-dried steaks, which came in well as a festive meal for the occasion.

There was indeed a festive spirit in the camp when FREUCHEN produced the metal case and drew out Peary's twenty year old report.

It ran as follows:

North Greenland Expedition of 1891—92.
ROBERT E. PEARY, Civil Engineer, U. S. Navy.
July 5, 1892.

Have this day, with one companion, EIVIND ASTRUP, and eight dogs, reached this point via the Inland Ice from Mc Cormick Bay, Whale Sound. We have travelled over 500 miles, and both we and the dogs are in good condition.

I have named this Fjord "Independence", in honour of that day, July 4th, dear to all Americans, on which we looked down into it.

Have killed five musk oxen in the valley above and seen several others.

I start back for Whale Sound tomorrow.

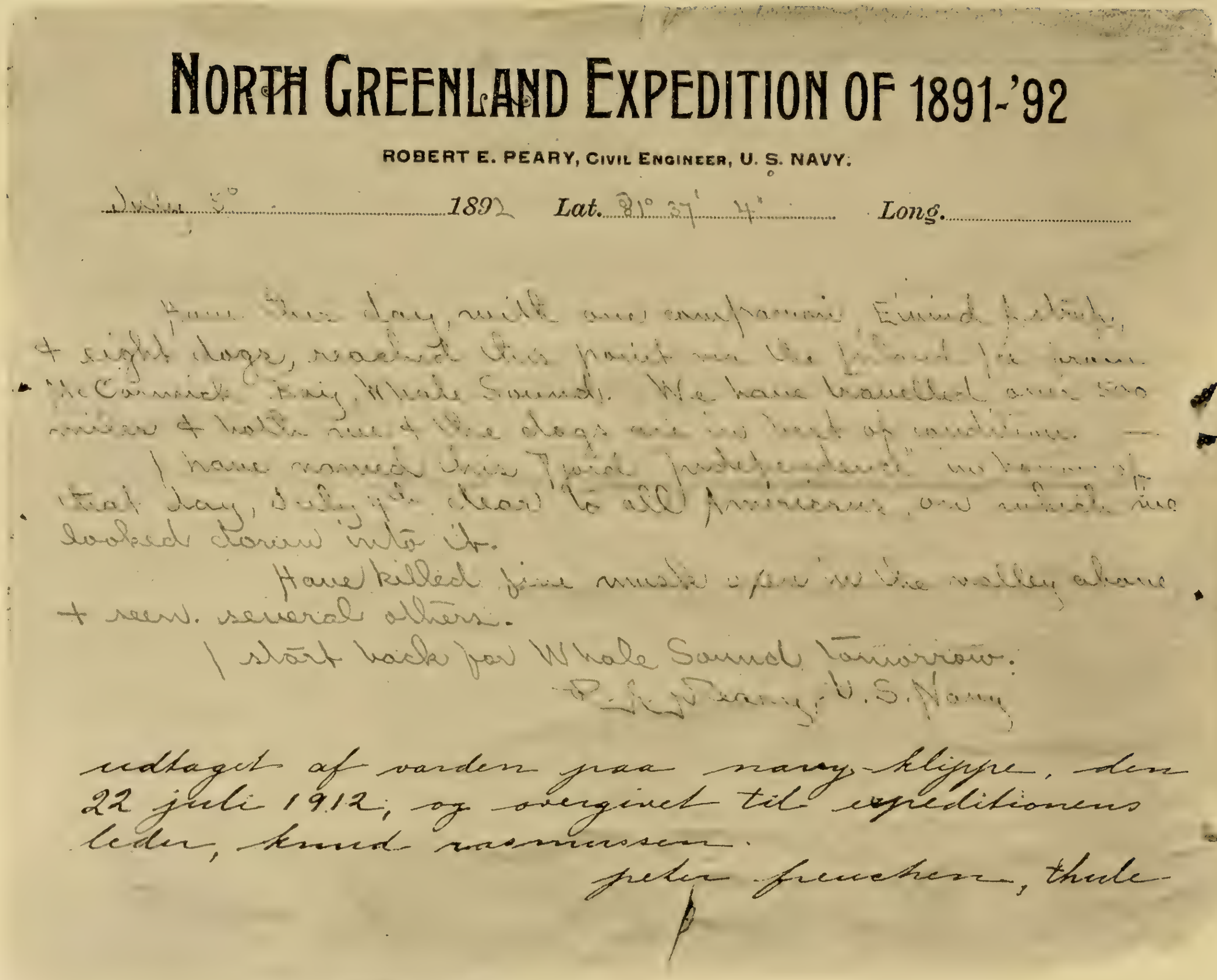
(sd.) R. E. PEARY, U. S. Navy.

In addition to this, the cairn had contained a couple of articles from an American paper concerning the Peary expedition.

As will be seen from the above, Admiral Peary makes no mention here of any channel, and even calls the place Independence Fjord. It must therefore have been at a later date that the idea arose as to a channel between North Greenland and Peary Land. In any case, it is found marked on all American maps under the name of Peary Channel. It is also impossible to see the base of the fjord from the point on Navy Cliff where the cairn was built: all that can be seen is that the ice from the fjord runs farther on inland. This, with the fact that a hollow runs through Valmuedalen over towards Nordenskjölds Inlet on the west, explains how the theory originated.

We had now reached Admiral PEARY's final cairn, and thus completed the task at present before us. A complete survey of the connecting country would have to be left to a later expedition, as the difficulties of travel which we had already encountered had shown us that there were limits to the demands which could in prudence be made upon ourselves and the dogs without intermission.

We learned, of course, on our return, of EINAR MIKKELSEN's find at the cairn in Danmarks Fjord, at MYLIUS ERICHSEN's summer camp



NORTH GREENLAND EXPEDITION OF 1891-'92

ROBERT E. PEARY, CIVIL ENGINEER, U. S. NAVY.

July 5 1892 Lat. 81° 37' 4" Long.

I have this day, with my companion Eivind Astrup, + eight dogs, reached this point via the Inland Ice from McCormick Bay, Whale Sound. We have travelled over 500 miles + both men + the dogs are in best of condition. —

I have named this fjord "Independence" in honor of that day, July 4th, dear to all Americans, on which we looked down into it.

Have killed five musk oxen in the valley above + seen several others.

I start back for Whale Sound tomorrow.

R. E. Peary, U.S. Navy

udtaget af varden paa navy-klippe, den 22 juli 1912, og overgivet til expeditionens leder, knud rasmussen.

peter freuchen, thule

Pearys report at Navy Cliff.

which we ourselves had searched; of this, however, we could know nothing at the time, as no new report has been deposited in place of that removed. This find showed that Mylius Erichsen had already, in 1907, discovered that the Peary Channel did not exist; he could not then, however, as we know, support his statement by actual survey of the base of the fjord, owing to the lateness of the season. And Einar Mikkelsen, who turned back and started for home on reaching the mouth of Danmarks Fjord, was likewise unable to carry out the work. To him must, however, be ascribed the credit of connecting Mylius Erichsen's name with the discovery, so dearly purchased by the Danmark Expedition.

It remained for Freuchen and myself to furnish, by our surveys, final proof as to the correctness of Mylius Erichsen's discovery; no one, however, can be more glad than we ourselves to give the honour to our old comrades who paid for it with their lives.

We were now ready to move off, but found ourselves forced to remain where we were until the 8th of August, owing to almost continual south-westerly gales with rain and snow. We had no lack of food, however, either for ourselves or the dogs, and did not even find it necessary to make inroads on the stores we had set apart for the homeward journey, as the musk ox still moved up and down through the valley, visible from the tent all the time, and all we had to do was to shoot one as occasion required. We kept nevertheless, strictly to the rule we had observed throughout, never to kill more than we required at any time.

During this period, which we referred to in our diaries as the "Camp under big rock", my leg grew worse, and for a time seemed likely to prove a serious affair. Since the 10th of July, when the ischias first appeared, I had been able to get about with the aid of a stick, and could even carry my share of meat up to the depots. After Freuchen's return from Peary's cairn, however, the pains increased to such an extent that I could no longer walk, and had sharp attacks of fever. Being unable to say how long this state of things might last, and fearing to become a burden to my companions, I suggested that they should leave me behind with Inukitsoq, if he were willing to stay, while Freuchen and Uvdloriaq went home, as it was important that they should get back as soon as possible. The idea was then that Inukitsoq and I, after wintering at some suitable spot, should make our way down along the edge of the inland ice to Nordenskjölds Inlet, descend there on to the sea ice, and follow the coast of Greenland thence to Thule.

Both Freuchen and Uvdloriaq, however, declined with such persistency all thought of leaving me behind, that this plan had to be relinquished.

As it turned out, I found myself within a week so far recovered as to be able to move about a little with the aid of a stick, and could thus look forward to venturing up on to the inland ice with my companions. And when we did set out, I managed for the first part

Eskimo Alamak of raw musk ox hide.

of the journey as passenger on UVDLORIAQ's sledge, his dogs being in excellent condition, and proving themselves so little inconvenienced by the extra weight, that he was able to take the lead all the time. For the second half, I was well enough to take part, albeit with some caution, in the ordinary work of the expedition.

At last, on the 8th of August, the weather being then clear and bright, we made our way up across the ravine to the edge of the glacier, ready for the final start. We built our last cairn here, and deposited a report as to the progress of the expedition. I quote the following extract:

"We have killed 30 head of musk ox in this country, all in one and the same valley, as food for the dogs and provision for the journey. At least as many more were seen.

The expedition starts today for home, by way of North Star Bay and across the inland ice. We have 27 dogs in excellent condition, and 3 sledges".

The hospitable country seemed anxious to oblige us to the very last; even from our camp on the edge of the inland ice we could see 6—7 big bulls moving about on the moist carpet of vegetation. We had thus no difficulty in obtaining fresh meat both for ourselves and the dogs before starting, and at this time, about the middle of August, the game are at their best, the flesh being found entirely covered with suet when flayed. We had therefore each of us a private stock of suet, some 50 pounds per man, by way of dessert while on the inland ice, a delicacy which was very highly appreciated.

Alamak, schematised.

We killed yet one more bull as a farewell feast for the dogs before starting out to tackle the inland ice. Our hunting was now at an end for the time being, but we had already had a fairly long spell of it, having been out after game almost without intermission ever since the 10th of May, and hard at it all the time.

There is one thing which I cannot refrain from mentioning here, as it proved of great service to us when out hunting, and on our continual excursions among the hills, and that is the Eskimo trick of using "Alamaks" to lengthen the life of footgear. When we had shot a musk ox, we cut out from the thickest part of the hide a strip somewhat larger than an ordinary sole, pierced holes all round the edge, and fastened the raw, soft skin over our boots. The advantage of this is twofold. In the first place it saved wearing out our soles and protected the boots all round. One pair of alamaks does not, it is true, last very many days on sharp stones, but all that need then be done is to make new ones. And in the second place, this rough ground is very apt to make the feet sore, which is largely avoided by the protection thus afforded. Brønlund's diary tells how the members of Mylius Erichsen's expedition found their boot soles at last worn quite through with continual hunting in this country where the sharp stones abound: had they but made use of this simple Eskimo trick, that dire misfortune would have been avoided. The number of musk ox which we shot gave us abundance of material, and where game is not so plentiful, the skin can very well be set aside as obtained for the purpose. No expedition working under such conditions as ours should be without these alamaks.

Homeward over the Inland Ice.

Our loads were now as big as we considered it prudent to take. Musk ox meat is, it is true, easier to handle than walrus meat, as it can be cut up without having to be previously thawed; on the other hand, however, it is disproportionally bulky, and we were well aware that it might prove difficult to keep the dogs on full rations if the journey should take longer than we had expected. We had each sufficient for 12 good feeds, or say 24 smaller meals, and we dared not increase the load, as this would involve the necessity of shortening the daily stages at first, until part of it was used up. In addition to this, we had no longer the walrus hide runners which had proved so invaluable on the outward journey; the hide must, as has been mentioned, be fresh and soft for making these, in order that it can then freeze hard in the form required. After reaching the open country; we had at once broken up the runners to serve as food for the dogs, as the sun dried them to such a degree as to render them unserviceable for the return trip. Our dogs' provision was of course clean meat, cut from shoulders and thighs, and in addition, each ration was lashed in a piece of musk ox hide with the hair cut off, so as to prevent the dogs from getting at it in case of any breaking loose; apart from which, these thick pieces of hide, with the fat adhering, would in themselves be of some value as food.

This homeward journey over the inland ice, while out of all comparison with the long daily stages of the outward run, proved nevertheless, in my opinion, a fine example of what Greenland dogs can do when decently handled. On the outward journey, we had made an average daily run of 62 km. whereas on the way back we were forced to put up with 43, this being, however, due to various circumstances of a peculiar nature. Had the snow been as good as in April and May, we should certainly have been able to cover the distance in a shorter space of time. Autumn is always a bad time for sledging, on account of the variable weather and frequent rain. We encountered a great deal of deep, soft snow, where the sledges were heavy hauling; sometimes, also, such snow would be covered with a thin, brittle crust, which broke beneath the dogs' feet, often cutting their paws. Under such adverse conditions, therefore, it was not surprising that the dogs, after having had their rest cut down to a minimum all through the four months' arduous work, now proved, despite their apparent soundness, less able to stand the strain than if they had started fresh. In addition to this, the poor beasts shed their coats at this season of the year, and in their thinned summer fur they suffered considerably under the snowstorms of the inland ice, which rage summer and winter alike. We were, however, not in a position to choose the season for our journey, and were forced to make it as best we could.

It may perhaps be worth while to give a rough idea of the way we managed from day to day under these sometimes difficult circumstances. I therefore take this section of the expedition in diary form, with a few brief remarks for each day.

Camp 1. 10 August.

Prevented from starting by thick fog over the ice. Towards evening it clears, and we move off at 10 p. m.

The inland ice rises gently from the moraine we have left, being far from level, however, at first. There are no fissures, but a number of deep dried-up watercourses greatly hinder progress. I am obliged for the present to play passenger on Uvdloriaq's sledge, my leg being still too weak for me to manage alone. Meanwhile, Freuchen is driving my sledge.

11 August.

We soon strike firm and level ice, and the dogs step out bravely, keen on making a new start. If the ice but last as it is, they will get along well enough all the way to Thule. We camp at 6 in the morning, after covering 49 km. in 8 hours, which is not bad work for our 27 dogs, seeing that we have been working uphill all the way, with very rugged ice at the start. Unfortunately, we cannot take our elevation on the homeward trip, having smashed our aneroid barometer going over one of the many watercourses.

12 August.

Lying up on account of snow and fog. Snow just now is anything but welcome. The sun comes out, however, in the afternoon, and we set off.

Camp 2. 13 August.

Started at 9 o'clock last evening, and kept on until half past five this morning, covering only 38 km., however, in the time. The sledges cut deep, and the dogs soon grow fatigued by toiling through the soft snow, where they can find no decent footing. Start off again at 11 p.m.

Camp 3. 14 August.

Snow not quite so deep as yesterday, but clogs the runners badly. It is heavy hauling for the dogs, and we sorely miss our walrus hide runners. Camp at 8.30, after a run of 53 km.

15 August.

Lying up. Snowstorm.

Camp 4.

Start at three in the morning, snow still driving down continually, but gale somewhat subsiding. Again heavy snow underfoot, making progress very difficult for thè dogs. Halt from 5 to 7, melt some snow, and give the runners a coating of ice, as we did before with the walrus hide. The ice does not of course stick on as well as it did then; hard, smooth iron is a very different thing to the rough and shaggy skin, but it should last out the day's run. And as a matter of fact, it does turn out very well indeed, but unfortunately we are forced to lie to again at 9 in the morning, a violent snowstorm coming up from the south west. We have thus made about 20 km. in 4 hours. Now and again we catch a glimpse of the sun; we have been going upwards all the time, and are now among the clouds, which drive over the tent. For a long time we are forced to keep awake, fearing lest the tent should carry away, and our gear go with it. Towards evening calmer.

Camp 5. 17 August.

Pitch tent at 11 a. m. for observations. Bright sunshine at last, and ice level as a tablecloth, but still heavy going.

Camp 6. 19 August.

We have for some time past had an idea that we were out in our dates, as the observations do not agree with our reckoning as to whereabouts. Talking the matter over after today's observations, we come to the conclusion that we must be a day behind. Such a mistake might easily occur living as we have done, especially when out after game, when we have often been at it for 36 hours at a stretch. We fancy, too, that we can trace the error back to the first days in the Zig-Zag Valley, when FREUCHEN was lying snowblind in the tent, and I was out hunting with the two Eskimos for six days. During this time, when we had but poor luck, we took no proper count of day or night, but simply kept on our feet as long as we could, and slept when we couldn't. And as ill fortune would have it, I had no diary at the time, having left my notebook in the tent. In spite of careful efforts to remember where we were, and subsequent comparing of notes with FREUCHEN, we must, it seems, have missed a day; at any rate, we now agree that this must be the 19th.

We are now driving uphill and down in long, easy slopes, with a crust of snow which unfortunately will bear neither sledge nor team.

We start at 9 a. m. and camp at 7 p. m. with a halt of two hours for observations, and cover 51 km. this day. We have struck better going the last part of the way, but the thin crust of snow is very troublesome, and soon wears away the ice sheathing of the runners.

Camp 7. 20 August.

Day's run 55 km., from 10 o'clock to 9, with 1½ hour's halt for observations. Heavy snow still calls for utmost efforts from the dogs, and what is worse, the brittle crust is beginning to hurt their paws. Not a cloud in the sky. Snow drifting lightly, with what the Eskimos call a "ground wind", i. e., a little breeze which shifts the fine snow without lifting it.

The continual heavy going is making us anxious for the dogs, and we have been talking over what we are to do if they prove to be quite worn out by the time we get to Inglefield Gulf, where there is a settlement on the southern side. Our Eskimos inform us that there are still some few reindeer to be found on a nunatak, Qaqujârssuaq, at the base of the bay; these we could fall back on in case of need. Having first procured such game as we could get, we should then build a kayak of our sledges, cover it with the canvas of the tent, and try to get across to the settlement. Uvdloriaq tells us that dog skin is the only kind of skin which is useless as a covering for kayaks, as the roots of the hair go so deeply into the hide that it will not keep watertight. This has been tried, he says, time after time by Eskimos who have drifted out to sea on the ice and have tried to ferry themselves across in boats covered with dog's hide.

Our chief anxiety, however, is for the dogs; we ourselves have provisions enough to go on with. All through our wanderings on the east coast we kept a stock of 20 lb. oatmeal in reserve, and this, mixed with musk ox suet, comes in very useful now. We have sufficient tea, too, for present needs, and tobacco as well, which is a great comfort when lying idle on account of weather.

21 August.

Wake to find snowstorm coming up. It is thawing now, weather being milder: thermometer at 0, which is about the worst thing that could happen under the circumstances. We must lie up.

22 August.

Violent snowstorm raging all night, worse even than usual. Gale slackens off somewhat, however, as the day draws on, and by 2 o'clock we are able to start.

Camp 8. 23 August.

Kept on till 1 o'clock at night, covering 52 km.

Sighted land NNW., which we take to be the country south of Sherard Osborne Fjord. The thaw has made the going worse than ever; it is getting more and more difficult to urge on the dogs at all.

Camp 9.

Covered 21 km. in five hours hauling over ground which gets steadily worse. Have thus no alternative but to break up one of the sledges and make runners for the other two; the sharp iron ones cut so deep that the ice sheathing is of very little use. By fixing ski runners under these, however, we get a broader surface, which can better bear up the weight, and will, moreover, take a thicker coating of ice, such as we laid on the walrus hide. This will save our having to renew it continually, which means a lot of time.

24 August.

A little snow bunting came flying from the south-west, circled round the camp and flew off again towards the country about Sherard Osborne Fjord. The visit caused great excitement, both to ourselves and the dogs, coming as a rich breath of life here in the white waste around.

Struck camp at nine in the evening.

Camp 10. 25 August.

Cover 41 km. in 12 hours. FREUCHEN and UVDLORIAQ forced to take it in turns to go ahead of the dogs, while INUKITSOQ and I relieve each other driving. The new ski runners are proving excellent with their thick coating of ice; the two sledges, however, now loaded for three, make heavy hauling in the deep snow.

Turning in about noon, we find on looking over stores that we have only cooking meat for three or four days more. When that is finished, we must begin to be economical with the oatmeal. As for the dogs, we have a scanty five feeds left, so prospects are not very bright. We have therefore made it a rule for the past few days that neither we nor the dogs get anything to eat while lying up, unless we are kept weatherbound for a whole day.

Camp 11. 26 August.

Started at 1 o'clock in the morning, but were forced to camp again a little after three, snow falling thickly. Temperature still very low, only ÷ 5.5. Covered only 10 km. this day.

Snow and sky are of one colour exactly; it is impossible to keep any direction, there being no object by which to steer. We try several times with compass in hand, or fixed to the ski, but the progress thus made is so awkward and slow, that we give it up. Sleep till seven in the evening and look out: snow still falling softly, and no wind.

By way of passing the time, we try our hand at drawing comic pictures in our notebooks, or tell hunting yarns from richer days. And being again forced to turn in supperless, UVDLORIAQ makes the appropriate remark, that it is astonishing how long a man can live without food when it comes to the pinch.

27 August.

Sleep again, and wake towards noon. Weather still as thick as ever; thermometer at 1.

Camp 12.

In the afternoon it cleared up to the south east, and we started off at 7 o'clock, FREUCHEN going ahead on ski for the first 11 km. The dogs are so run down now that we have to send a nurse on in front to tread out a track in the snow. UVDLORIAQ takes the next 5 km. and then suddenly INUKITSOQ's and my teams decide to manage without this formality. At the same time, the snow underfoot improves, being here and there hard enough to bear both team and sledge. We are going downhill now, it seems, and nearing regions that bear more traces of wind. We can see it from the snow, which is wind-furrowed now, giving not only better going, but also furnishing a valuable aid to direction. On the great plateau — "pingo" as the Eskimos call it — the weather appears to be mostly calm, and the snow in consequence deep and soft. We halt at 4 a. m. after a run of 50 km. It is freezing again now, 16 degrees.

One of UVDLORIAQ's team littered on the journey, dropping her pups at intervals all the way, and hauling between whiles as if nothing unusual had happened.

28 August.

Turned out about three. It is freezing now 24°, and the weather appears to be settling down at last.

Camp 13. 29 August.

Better going now, but newly fallen snow, which covers everything, still making it difficult to shape a course. It always looks as though there were a wall or a precipice just ahead. Managed, with difficulty, to cover 53 km. from eight in the evening of the 28th to five in the morning of the 29th.

Camp 14. 30 August.

Covered 53 km. from 1 a. m. to 11 a. m. It is now freezing 25°, with the usual "ground wind". It is good firm going now, and we seem to be getting into regions where the soft snow does not lie long.

On the way we saw five skuas flying towards the west.

Camp 15. 31 August.

Turn out at midnight, FREUCHEN starting off at three to mark out the track. We follow at five, and come up with him after doing 15 km. Today again we are obliged to relieve each other at the lead. At last, by 6 p. m. we have covered our 50 km. The snow is now firm and packed by the wind, making excellent going; unfortunately, however, the dogs are now so worn out by what they have had to go through already, that the improvement does not help us as much as it might have done.

In the morning, as we started out, we saw a snow bunting fly over the tent, making towards the east. And at midday, when we halted for observations, another came and sat down just in front of the dogs.

Camp 16. 1 September.

The dogs are now so utterly dispirited that they merely bunch together with their heads in the snow if we do not give them a track to follow. With this to lead them on, however, they trot along at a good, level pace, an soon come up with the man ahead. We have now arranged to send out one of our number each morning with a good long start, and here FREUCHEN proves himself a steady, staying runner, both on ski and on foot. From the first time we hit on this as a regular thing, he has been constantly chosen for the work. Today, for instance, he started out at 7.30, the rest of us following three hours later, and overtaking him at midday, when we halt for observations. By eleven in the evening we have made our 50 km.; the distance we have set ourselves to cover each day weather permitting. It is now fine firm going underfoot, and the sledges are easy to haul, their loads consisting now of little beyond our clothes and gear. The dogs ought by rights to do their daily run at a rapid trot, but this they simply decline to do. As long as they have a track to follow, they will keep on at a pace two or three times that of a good walker, so it is not a question of weakness. What they lack is simply temper and spirit; the will to get on.

We reckon the distance now to Inglefield Gulf at about 250 km.

Camp 17.

Make our usual 50 km. in sunshine, with "ground wind". The snow is now so firm underfoot that we are able to lay aside our ski. Today, however, the wind furrows were deeper than was desirable. Saw another snow bunting.

Camp 18. 3 September.

Covered 40 km., starting at 4.30 and finishing at 12, when we were obliged to halt, a gale coming up from SW. The high wind ridges have now disappeared, and the snow is level and firm. For the last few days we have been forced to take the poorest of the dogs to feed their comrades.

Camp 19. 4—5 September.

Sighted land to the southward soon after starting; it is unrecognisable from where we are, most of the peaks being wrapped in mist, but we take it to be the country due North of Melville Bay, about Sidebriks Fjord and Cape Melville. There is also a glimpse of land visible ahead, and to the northward.

It is excellent going now, and we make 52 km. in 12 hours.

There is a remarkably fine moonlight effect visible from the camp, with wondrously delicate yellow tints to the north-east, and huge blue-black land clouds ahead, making a most picturesque contrast.

Camp 20. 4 September.

We had not got more than 10 km. out today when we sighted land, a whole broad view of it rising above the horizon right ahead. Despite all our attempts, we do not succeed in recognizing it, partly because the outlines are somewhat hidden by the mist, and partly because we are more accustomed to see it from the other side, and not from behind, as here. We very soon realise, however, that we must be out of our course somehow. Despite the awkwardness of the situation thus revealed, we cannot suppress our delight at having land in sight; it is like bathing one's eyes to look out over the beautiful bluish-grey tints laid in waves over the heights. Behind us, all is dazzling white, now doubly painful to the eyes by contrast.

There is only one thing to be done; we must get on until we are near enough to make certain of our position. Keenly alert, we hurry down until we can clearly distinguish the land ahead. It does not take us long: looking out through a little fjord below we discover Qeqertarssuaq, and at once recognise Iterdlagssuaq and the country behind Qânâ.

Alas, we have altered our dates the wrong way round after all, and thus, setting our course by observations, fetched round to the north side of Inglefield Gulf instead of the south. Today is therefore, as we subsequently proved on our arrival home, the 4th of September, and not the 6th, as we had thought.

This is hard lines indeed on the dogs, as we have now no more food to give them. Of the 27 with which we started, 20 got through to the west coast, after covering the 850 km. from Navy Cliff to the north side of Inglefield Gulf, in 20 working days, making an average of 43 km. per day's run, in spite of the wretched state of the snow for two thirds of the journey. And now, instead of having, as we had reckoned, a couple of days' journey home, we find ourselves forced to go the whole way round Inglefield Gulf, which cuts deep into the land, before we can shape a course for Thule. Slowly and disappointedly we make our way up over the inland ice again, camping somewhere behind the Qânâ country. The day's run amounted to 28 km.

We might of course have gone in search of people, both at the Qânâ settlement and at Quinisut, a little distance away, both places being but a day's journey off. When we started out in the spring, however, none of the nomad Eskimos had yet decided to take up land here, and if we failed to find people, we should have used up the dogs' last strength in a fruitless journey, first down and then up over the inland ice.

Camp 20. 5 September.

Start off in a haze of snow, trusting to the dark mass of land on the coast, still visible through the mist, as a point by which to steer. Soon, however, this too disappears, and we are forced to halt, after making but two km., the shortest distance we have ever shifted camp. And now, with the goal before our eyes, it is doubly hard to have to lie weatherbound. As regards food for ourselves we can manage well enough, having still oatmeal, suet, dried musk ox meat and some musk ox tongues which we had intended should furnish forth a little dinner on our arrival at Thule. Some of these tongues we have today, making a modest feast to mark our satisfaction at having safely crossed the inland ice twice within six months.

6 September.

Still lying up, on account of fog and snow.

Camp 22. 7 September.

Cover 22 km. in 10 hours, over hilly ground, snow-filled hollows alternating with hills of polished ice. We are now nearly opposite Qaqujârssuaq, the place mentioned before, where there are said to be reindeer. If so, they would be most welcome as food for the dogs.

Camp 23. 8 September.

Deep snow and heavy going; dogs exhausted. Make 20 km. in about 10 hours, snow driving hard all the time.

Camp 24. 9 September.

The surface of the inland ice here near the edge is very variable, but changes, unfortunately only from one extreme to the other. Yesterday we had hollows with deep snow, today it is bare, prickly ice, which cuts the dogs' paws till they bleed. Make 23 km. in 10 hours, landing at last on a moraine at Qaqujârssuaq. We have now only 15 dogs left.

10 September.

Uvdloriaq and Inukitsoq set out in search of reindeer, while I remain behind with Freuchen, who has been suffering the last few days from pains in the leg, doubtless due to over-exertion on the long day's marches.

As a matter of fact, it was not surprising that troubles of this sort happened to one or another of us from time to time, as a six months' trip of this sort necessarily involves a strain on even the toughest constitution. For the first few days in the Zig-Zag Valley, Inukitsoq and I were practically unfit for work owing to pains in the back. The same thing had happened to Uvdloriaq, though in a lesser degree, during the work of getting down our gear on to Nyeboes Glacier. I had been bad at Navy Cliff, on the first part of the homeward journey, and now it was Freuchen's turn. He now suggested that we should leave him behind on the nunatak and fetch him in from Thule later on, so as to give the dogs a better chance of getting back alive. With the slow progress we were making, however, it might be a fortnight before new sledges could reach him, and to leave him under such conditions was out of the question. He would have to go on with us, even if we had to haul him on a sledge.

The two hunters came back during the night with four hares, having seen no reindeer.

We now decided to leave one sledge and all our gear behind, making one team of the 13 remaining dogs, and make the best of our way in, a matter of 200 km.

Camp 25.

Our homeward way lies now in a broad curve round behind the tongues of ice that jut out into the land. Deep fissures abound, and now and then one or two of the dogs fall in, but are hauled up again, as they are held by the traces. By ten in the evening, after a twelve hours' day, we are abreast of the Nunatarssuaq country, about the latitude of Academy Glacier. Made about 40 km. this day.

Freuchen has stubbornly disregarded his bad leg and refuses to sit on a sledge. At the end of the day, he is in a high fever, and loses consciousness.

Snowstorm coming up.

12 September.

Freuchen conscious now, but pains very bad indeed.

Camp 26.

In spite of haze and south westerly gale we try to get on a little farther, but after a few hours are obliged to give up.

Camp 27. 13 September.

Weather fine. Make about 50 km., passing the big reindeer country SW. of Olriks Bay. Journey took only 12 hours, no difficulties occurring. We have lengthened the uprights of the sledge out to the sides, by fastening a ski stave to the cross bar on either side. By this means, two men can push the sledge forward without having to stoop in a cramped position. The dogs have now practically no weight to haul; we are still, however, obliged to send a pacer on ahead to make them move. We must remember, however that they have had nothing to eat now for many days save the flesh of their exhausted comrades, which is barely enough to keep them alive.

Camp 28. 14 September.

Reach Nunatarssuaq at the base of Wolstenholme Sound. Freuchen's leg much better now, and he marches with the rest of us, doing the 40 km. or so in 14 hours.

15 September.

Reach Thule after a 16 hours' march. Eight dogs still alive.

Mounting the crest of a hill close to our settlement just as the dusk is beginning to hide the houses, we fire a salute to announce our arrival, each man of us happy in the knowledge of having done his duty.

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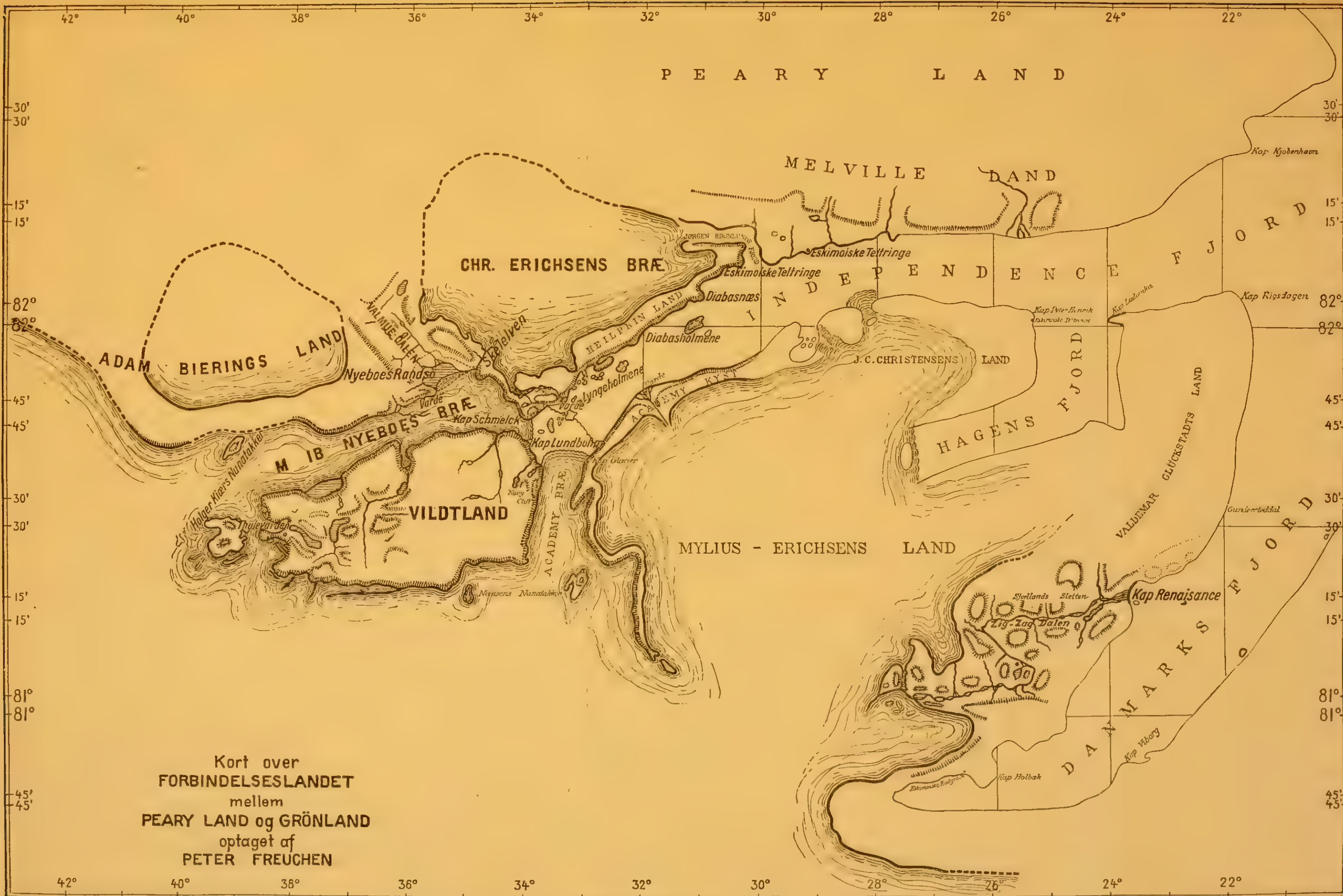
I cannot close this brief report of the First Thule Expedition without a word of thanks to my comrades for all their services to the Expedition from first to last.

Especial thanks are due to the cartographer of the Expedition, Peter Freuchen, for the cheerful spirit which marked his work. Hardy to a degree, able to put up with anything, and possessing a rare adaptability to Eskimo conditions, he is eminently qualified for the work of arctic exploration.

Our journey being based to a great extent upon Eskimo methods, it was natural that Uvdloriaq and Inukitsoq should from the start occupy a position far exceeding in importance that which usually falls to the Eskimo members of an expedition. Their personal qualities, as well as the skill which they possessed in their own sphere of work, frequently helped us to overcome with ease difficulties which might otherwise have been considerable. And in particular I wish to thank them for the unwavering confidence with which they backed me up in all my plans from first to last.



Map of the connecting land between Peary Land and Greenland drawn by Peter Freuchen.

Chart showing altitudes on the inland ice in metres, direction of wind and length of each days journey.

IX.

GENERAL OBSERVATIONS AS TO NATURAL CONDITIONS IN THE COUNTRY TRAVERSED BY THE EXPEDITION

BY

PETER FREUCHEN

On the 10th April, the expedition assembled, with attendant sledges and all gear, at the village of Neqe (Robeson Bay) whence we were to make our start out over the inland ice. It was decided to make the ascent at Clemens Markham's Glacier, some little distance away, a place frequently used by the Eskimos on their way to the settlements north of Cape Alexander and farther on. The Neqe district is a regular meeting place in winter and spring for a great number of Polar Eskimos, as the strong current round the promontories prevents the ice from becoming very thick, and it is consequently liable to be broken up by any gale or spring tide; the place is therefore a favourite winter haunt of walrus, which are caught in great numbers from the young ice. This was also the case now, but unfortunately the ice had just broken up.

On the 11th April, therefore, the ice was too thin to bear the weight of our heavily laden sledges across to the place of ascent.

On the 12th and 13th April a violent snowstorm was raging, and we had to wait until the 14th before striking camp and moving off. After a run of 13 km. or so over level young ice we reached the glacier. The ice here ran about 3 km. out over the land; to the north, however, the open water appeared to reach right in to the coast.

Clemens Markham's Glacier is one of the more easily negotiable of the active glaciers. It runs out into the sea, sloping gently down through a ravine between perpendicular walls of cliff, from 2—4 km. across. At its outflow into the sea, the glacier ends in a steep precipice, the height of which, measured barometrically, is 30 metres. Bergs are not formed to any very great extent, and when this does take place, the loosened portion glides as a rule gently and slowly forward until partly borne up by the water, which is deep right in to the face of the ice. The berg then breaks off and floats away, generally without any loss of equilibrium. On either side lie great masses of stone, the lateral moraines, which run straight out into the sea; these consist almost exclusively of stones, without clay or gravel. The intervals between the banked moraines and the glacier itself are in winter filled up at many places with great snow drifts, and it was over one of these that we made our way up on to the glacier.

In the middle of the glacier, the wind had completely cleared the ice of snow, and we were therefore obliged to drive over the snow which lay at the foot of the cliffs on the southern side. There were no fissures to be seen in the glacier itself; there were, however, two systems of the well-known blue line formations formed by the filling of those narrow fissures which are made by the warmth of the sun in spring, with water from the summer thaws. These were visible everywhere, one system running throughout parallel with the direction of movement, i. e. along the ravine, and following the various curvings of the same, the other forming an angle of 60° with the first. These blue lines continued almost up to the summit of the glacier, where the snow covers the ice.

In front of the cliffs to the south, we found regularly for the first part of the way great stones lying on the ice; they had not fallen down from the cliffs, however, as they did not belong to the rock formations in question. The stones became more and more numerous as we went on, leading finally, at a point some 7 km. from the glacier front, to three parallel rows of gneiss blocks, some 5—6 ft. high, rounded and much worn. The rows were some 200 metres apart, the distance between the blocks themselves being from 1—20 metres. These ranks of stone continued for a distance of 1.5 km. and then ceased. The glacier slopes more sharply here for some little distance, after which the moraine disappears. Where the breadth of the ravine varies, the alteration is compensated in the glacier, not by fissures, as is often the case, but by a change in the angle of the slope, which increases or decreases as the channel narrows in or widens out. The whole length of the glacier therefore moves in an undulating line down towards the sea, the separate waves being from 300 to 1000 metres wide and 50 to 75 metres high. After a good 12 km. run, a final and somewhat steeper ascent brings one to the inner end of the ravine, where the glacier joins the inland ice itself. The cliffs (altitude 485 barom.) here disappear under the ice.

The summits of these cliffs, by the way, are submerged for almost the whole of the way out to the sea by the inland ice, so that their inner sides, facing the glacier, present the appearance of perpendicular walls of rock capped with some 20 metres of ice. This icing, moreover, calves from time to time, throwing off blocks which lie piled in great heaps along the foot of the cliffs.

(It should here be mentioned that the maps of the locality are, as is the case with most maps of Greenland, far from complete as regards the boundaries between the land and the inland ice).

When the inland ice is reached, there are two or three narrow fissures (abt. 1/2 m.) across the line of the ravine; save for these, however, the surface is level and unbroken. The covering layer of snow is quite thin, and in many places, where irregularities in the surface appear, the ice breaks through in smooth polished hummocks. The ascent is gradual; we halt in the evening after about 54 metres run, having then reached an altitude of 1150 metres.

The paucity of snow is due to the continual wind, which often incommodes the Eskimos when travelling here; we ourselves lost a couple of days in this way. Not until the 64th degree of longitude is reached does the snow lie in an unbroken covering over the ice.

On the 18th April we set off again, the snow underfoot varying considerably as to firmness. For the first 5—6 km. we had good firm snow, drifted hard and much worn by the wind (SSE wind), and furrowed by the same in parallel lines, the ridges being so strong as to bear unbroken the weight of our 600 kilo loads. Then suddenly we came upon equally long stretches of soft heavy snow, in which we sank up to the ankles.

On the 19th April, at about 63°, we encountered a couple of narrow fissures in the ice, running SE—NW, and towards the end of the day, a couple running north and south. These are evidently due to the influence of the Humbolt Glacier, which is further marked by a distinct slope of the ice towards the north. During the day we could clearly see high sharp rocky summits to the NW. Our two Eskimos, who are thoroughly familiar with the whole country within their hunting grounds, declared without hesitation that these were the Victoria and Albert Mountains in the interior of Ellesmere Land, which Peary and others have observed from places as far distant as Cape Summer and Polaris Promontory. We were then 1350 metres above sea level.

The going was very good to begin with, but for the latter half of the run, the crust which had formed on the surface of the snow became thinner, and broke under the weight of dogs and sledges. The depth of the snow above the solid ice was very slight, varying from 0.5 metres to a couple of centimetres. It would therefore seem likely that in summer, there would be clear, smooth ice here, which is further supported by the fact that no transition stage between snow and ice was visible, the snow lying in a fine dusty mass immediately on the ice. The surface of the ice undulated considerably, with a difference between crest and hollow of about 100 metres.

On the 20th April we again encountered a few fissures running NE—SW. as also on the following day. All these fissures found far up in the interior of the ice were only 1 dcm. across.

Not until the 60th degree is reached is it possible to assert with any confidence that the snow covers the ice all the year round. This layer is about 20 cm. thick, so that the separate grains of ice coalesce, forming a transition stage between ice and snow, i. e. having the appearance of ice, but yet so soft that it can be cut with a knife. Our latitude is now about 79 N; height above sea level 1350 metres. We have still the same hill and valley formation; a regular system, the valleys all lying SE—NW, some narrow fissures at the bottom also running in this direction.

23rd April. The surface of the snow resembles exactly that of old sea ice after a snow storm, with sharp-edged ridges of snow all around.

On the 25th April we endeavoured to measure the thickness of the snow layer, digging a couple of metres down and then, from the bottom of the hole, thrusting the saw used for building snow huts downward as far as it would go. This tool measures 60 cm. long, but did not suffice to reach the bottom. The lie of the ice has now changed somewhat, presenting alternating stretches of level and rising ground — i. e. sloping upward towards the east — but with no downhill slopes.

27th April. The snow is now so soft that we sink in up to our ankles at every step; for the first time, also, we can find no snow suitable for hut-building. The dogs are therefore somewhat exhausted at the end of the day's march. The soft snow lies in a perfectly level mass, with no contours or shading to catch the eye; this may possibly be due to the fact that there is little or no wind here, though it by no means proved to be the case while we were there.

Shortly before camping, we sighted land far to the north; possibly the country north of Osborne Fjord?

On the 29th April the going improved somewhat, though there was still no real crust to the snow. The upper layer, however, to a depth of about 75 cm., is firm enough to be cut into blocks, which, though unsuitable for hut-building, yet serve to build a sheltering wall round the tent. Beneath this sharply defined layer lies another consisting of grains of ice rather like hailstones, about 3 cm. thick; beneath this again the snow is quite loose, having much the same appearance as castor sugar. The intervening layer of granulated ice is probably not due to melting, but rather to sublimation between one layer of snow and the next.

The snow lifts and drives before the slightest breath of wind; moving like clouds of vapour. Often it is too fine to be visible at all, until after the lapse of a few minutes men, dogs and sledge are seen to be covered with finely powdered snow.

Thus on the 31st April and 1st May, when the wind was extremely violent — 20—25 metres per second — not a single flake of snow was to be seen, but the air seemed filled with a thick fog. The snow forced its way into the tent on all sides, and on going outside for a moment, to look to the sledge for instance, one's clothes would be snowed up in an instant, both inside and out, pockets and ears becoming filled with snow, despite protecting flaps and caps.

On the evening of the 1st May, however, we were able to proceed. The temperature had now fallen again, and the snow was hard

Fig. 1. Ascent of Clemens Markhams Bræ.

Fig. 2. Ascent of the Inland ice.

and firm, the recent gale having levelled all irregularities in the surface. We had here an opportunity of observing very marked effects of refraction; on looking at the sledges, for instance, one might see them piled two or three one above the other, or one would disappear entirely, etc.

On the 3rd May, at about 42° long, we near the highest levels reached (abt. 2200 metres). Here we are once more in hilly country, the valley systems running apparently north and south, the average height of the intervening hills from bottom of valley being about 50 metres.

Throughout the greater part of the day the snow lies in such a manner that the upper crust will bear the sledges on their broad runners; both men and dogs, however, sinking through. This crust, which is a couple of centimetres thick, is smooth on its upper surface, the lower, however, consisting not of granulated ice, but of fine needle-points, perpendicularly set. These cause the dogs a considerable amount of inconvenience, pricking their paws, and in the case of the younger animals, frequently so as to draw blood. The upper crust is very hard, and if a lump of it be kicked, or a large piece thrown down, it breaks with a sound like that of fine porcelain smashing. The ice needles, which as before are probably not caused by melting, rest likewise on a bed of loose, "dry" snow.

Now and again, at places where the crust bears better, great sheets over 20 metres across cave in as we drive across, with a loud crack, or rather a kind of sighing noise. At a first glance, there is nothing to be seen, but on closer examination one may find the outline of the broken sheet.

4th, 5th and 6th May. Mercury frozen. It is excellent going now, the snow firm and hard, and packed so close by the wind as to be unsuitable for hut-building, snow of this consistency giving a cold shelter, besides being difficult to work with. Strong refraction effects all round. After reaching the highest point, 2225 metres, with a steep slope up, the ground falls as steeply again down to 2120 metres, after which we appear to be driving on a level. The severe cold is accompanied by a cloudless sky, and the sunlight causes much inconvenience, as our snow spectacles are useless on account of the rime which collects on them.

All down the eastern slope of the inland ice the snow is smooth and hard, the descent being also practically imperceptible. Only here and there do we encounter the hill and valley formation noticed on the western side. The ridges and furrows in the snow, here formed by WSW and SW winds, seem to indicate a more constant direction of the wind than on the western side.

6th May. Even with so slight a wind as 1—2 metres the snow drives continually, though frequently only to be noticed by the fact that sledge, tent, etc., become covered with snow.

On the 8th May we had a momentary glimpse of land away to the north — possibly however only refraction — which soon disappeared in a bank of mist. All night a perfectly complete (vertical and horizontal) system of mock suns was visible, more magnificent than any we had seen on the way.

9th May. In the morning, after a strong spell of driving snow, the wind fell to about 6—7 metres, and we were able to go on. Ahead of us lie the characteristic cloud banks which always accompany land when seen from the inland ice. Immediately after, however, the snow begins driving again, with renewed force, so that we can see but a little distance ahead of our teams. After covering 40 km., we get a clear spell again, and can now see a great expanse of land ahead and to the left, extending north and south, while to the right, we can see the line of the coast south of Danmarks Fjord, running out to the eastward. South of the fjord lies the glacier, and beyond this again high mountain country, but without distinct summits; doubtless the country behind Mallemuk Fjæld. Before there is time to sketch the lie of the land however, or take an azimuth observation, the snow comes up again and the land disappears.

We are now 1690 metres above sea level. We shift our course due east, towards a point where we have seen lower ground, which might possibly be the base of Danmarks Fjord.

The ice slopes downward fairly steeply now, and the covering snow layer diminishes in thickness, frequently exposing the bare ice. A couple of quite narrow cracks run north and south. At the end of the day, having covered 88 km, we reach some narrow nunataks, the barometer then registering 675 metres above sea level. The nunataks consist of great boulders and heaped gravel, with no sign of vegetation. Solid rock formation is nowhere to be seen, and it is therefore impossible to say with certainty if these are true nunataks or only enormous mounds of moraine deposit. There are three of these nunataks, about 35 metres high, diameter apparently 1—2 kilometres. The ice formation here is hilly and irregular, shutting out the view on either side. There are probably more of these nunataks, placed sentinel-wise along the border of the land; the three we saw, at any rate, stood in a row parallel with the edge of the inland ice. The ice between them was very steep and slippery, making progress difficult, even with our dogs, who are accustomed to driving down steep slopes of ice at home. (They are trained to go behind the sledge, backing as hard as they can).

From the summit of the nunataks a "plain" of ice was visible lying between them and the land; we estimated it to be about 4 km. Owing to irregulatities of the surface it was impossible to use the odometer, as the driver attending to it is unable to guide and support the sledge. This "plain" was reached by the steep road between the nunataks above mentioned. At the foot of these, however, we found ourselves in the bottom of a basin, now empty, resembling that near Ymers Nunatak, described by Captain J. P. Koch, and which I visited in company with him. It is thus, as a matter of fact, fresh water ice, with, however, nothing but calved ice at the bottom and sides, which in this case seemed to me to suggest an annual draining of the basin. Here, however, we found both calved ice and pieces of true fresh water ice, 1.5 metres thick, now consisting of perpendicular sharp needles, left behind when the water below had flowed off. This must thus have taken place while there was still ice on what was then a lake.

We had, however, but little opportunity of making observations at all, partly on account of the driving snow, and partly because our course led us almost at right angles to the direction of the basin, which, as far as I could see, lay north and south. We could not see whence the calved ice had come; wherever we passed, the sides were rounded off by melting. There is however, no doubt of the fact that the place in question was a drained lake with calved off fragments from the inland ice itself; the calved blocks lying on the dry bottom, the high water marks in the basin, and finally the true fresh water ice lying loose on top, furnish proof enough. The basin was shaped like a long narrow trench, the ends of which, as mentioned, we were unable to see. The breadth was about 800 metres, and depth from highest water mark to bottom 20 metres.

We followed the bottom of the basin for a couple of kilometres, until we reached a big watercourse, the bottom of which was filled with snow, leading in to the basin from the east. This offered a comparatively easy road, and we took it accordingly. We were now on the "plain" which we had seen from the summit of the nunatak. Strangely enough, it did not slope down towards the land for the first 500 metres, all the watercourses which here furrowed the surface of the ice indicated that the water flowed down to the basin above mentioned, or, as was frequently the case, disappeared down perpendicular holes, where the watercourse then ended abruptly.

The ice here made difficult going, partly on account of the many watercourses, and partly because of the very slippery surface, where dogs, men and sledges found no foothold. We were forced to keep as far as possible to the furrows and patches between the higher portions of the uneven ground, where there was some snow. Consequently, while still nominally working towards the edge of the ice, we were actually shaping our course so as to take advantage of such opportunities as the nature of the ground afforded, this same ground, moreover growing steadily worse. We reached the edge at last, only to find that we had happened on a most inconvenient spot. The ice terminated here in a steep precipice with overhanging brow, and we were thus obliged to lower ourselves down with all our gear. The margin of the ice here ran east and west, a tongue of land a little to the north running up into the ice. Here, quite close to the edge, we encountered for the first time true glacier fissures, running nearly at right angles to the edge. We lost a couple of dogs down these, having let the animals loose preparatory to lowering them down. Some cases which also fell down stuck before they had fallen very far, and we were ultimately able to fish them up again with a hook fastened to our harpoon shafts and tent poles lashed together. The ice front itself was about 20 metres high, measured with the harpoon lines which we used for lowering down. A fissure running about halfway through however, enabled us to get down with our gear without any great difficulty or danger. At the mouth of this fissure came the actual precipice, formed by the breaking off of the ice, and from here we had to lower ourselves, our sledges and dogs, down on to the land below. The length of the projecting portion above, measured as from the point at the foot of the cliff where we landed, was 235 cm. (height about 20 metres).

The land immediately in front of the ice was covered with moraine deposit, through which the water had cut a channel 10 metres wide along the edge of the glacier, the channel itself being filled with fallen masses of ice. On the 15th May, when we returned to fetch away some things we had left behind, we found that fresh masses of ice had fallen down into the channel.

As already mentioned, a tongue of land ran up into the ice a little to the north. Across this a lake ran north and south, the inland ice reaching down into it at either end, and depositing small icebergs. This lake was 510 metres above sea level; the small bergs, which projected 4—6 metres up over the ice and had moved some little distance from the calving place, showed that the depth must have been fairly considerable. The lake was surrounded by moraine formation, the banks in several places forming cliffs up to 30 metres high, consisting of gravel and clay. At several places, however, on either side of the lake, there was a layer of very fine sand some 8—10 metres thick, and apparently horizontal. Rounded stones were also to be seen in the cliffs. Despite careful search, neither shells nor plant remains could be found; a sample of the sand was taken and brought home.

Although this glacier lake must on the whole be considered as a reservoir for the outflow from the glacier or perhaps as a broad river which does not dry up in winter, there were nevertheless distinct signs along the banks that the water had been fully 1 metre higher when the autumn ice formed than it was now.

Immediately after getting down on to the lake I was attacked by a spell of snow blindness so severe as to necessitate my remaining in the tent while the other three went out hunting. This led to our making a mistake in the date; when the rest of the party returned on the 14th May, I thought it was the 15th. Not until our return home was the error corrected. Throughout the remainder of our journey we now reckoned with the wrong date, which in the first place led to an inexplicable discrepancy between Robert Peary's observations and mine, and in the second, to another error which proved fatal to the dogs, as instead of making land on the homeward journey at the place we had reckoned on reaching, we ran right out into Prudhoe Land.

From the southern end of the lake above mentioned, an outflow runs eastward along the ice in a deep ravine with perpendicular walls on either side; ice to the south, and sandstone cliffs to the north. Down into this ravine the river poured over a sudden break in the cliff, about 100 metres from the lake. This waterfall, frozen now, of course, was a most magnificent sight, measuring from the uppermost pool to that at the bottom 180 metres, and falling in 4 sections, each of which was practically passable by lowering sledge and dogs. The whole of the fall lay between the steep walls of ice and rock, like tall close-built houses on either side of a street. The ravine furnished an excellent profile view of the rock, of which four samples were taken from different strata.

The whole of this great waterfall presented a most wonderful sight: unfortunately, however, it was snowing all the time, so that we were unable to photograph or sketch, however much we might have wished to do so.

The next lake runs out from the inland ice, and lies almost due east and west, bounded on either side by cliffs about 600 metres high, all formerly part of a plateau sloping down towards Danmarks Fjord. Now, however, the whole formation has been broken up into a number of regular sandstone heights, their flat upper surface terminating in perpendicular cliffs, the lower portions of which are buried in masses of fallen rock. The whole landscape presents a remarkably regular, ordered appearance.

The second lake is 2 km. broad by 7 long, ending in a broad river which leads down to Lake No. 3. This last, which is situated 350 metres above sea level, is of the same breadth as the other, and hardly 3 km. long. The watercourse, which has hitherto been running a little north of east, now swerves very slightly northward. The Valley through which it runs, Zig-zag Valley, broadens out, affording space for a quantity of grassy lowland. "Grassy" however, is not here intended to denote any high degree of luxuriance; the vegetation probably suffers considerably from the constantly drifting sand.

From Lake No. 3, the water flows on again down the channel, which latter, however, winds in gentle curves down through the valley. I have in the foregoing advisedly referred to "lakes", these being so far distinctly recognisable as such. From here onwards, however, it becomes difficult to distinguish between lake and river. The lie of the water may perhaps best be described by saying that the river varies in width from 20 to 1000 metres. It is apparantly not very deep anywhere, as there are small islands in many places and rocks jutting up above the water. These are, however, greatly water-worn — the islands themselves are but rocks — and probably submerged for the most part during summer by the water, which then, as is evident both from the ice and from the algæ, rises considerably higher, in places possibly 1 metre above. The various widenings of the channel are marked on the map according to the odometer; for these features, and others generally, reference should be made to the rough map, which has been drawn from sketches made on the spot. A couple of kilometres beyond Lake No. 3, the main river is joined by a tributary from the north, which apparently brings down a great quantity of water. Through the valley down which it flows we could see the inland ice whence it came. Two km. below the mouth of this tributary river we found, in the main channel, a piece of inland ice rising 1 metre above the water — a sufficient indication of the great volume of water brought down by the river in summer.

As already mentioned, and as noted on the map, the rows of hills gradually diverge towards the west, the bottom of the valley at the same time rising above the water of the river, which thus cuts its channel deeper and deeper, the banks at the first break being 20 metres high. The bottom of the valley is here formed terrace-wise, and consists of raised sea bottom.

At one or two places in the final, eastern reach, the river had washed through to the rock, which here showed through the bank. Samples of this were brought home.

After making its way some 38 km. or more to the east, the river turns suddenly northward (barometer here showed 290 metres above sea level), and after about another 8 km. W. by N. after which it continues for some distance towards north-west. This reach slopes more sharply than any other place below the falls; at the mouth of a river which drains the lake lying between the two portions of Zigzag Valley before and after the break, the altitude was 190 metres, and at our camping place in the evening, 170 metres.

It will readily be understood that we were not altogether pleased to find ourselves thus compelled to work towards the north-west, a direction which should probably bring us to Hagens Fjord or thereabouts. Our business being to search for Einar Mikkelsen, the natural objective would have been Cape Kronborg, which place Einar Mikkelsen had indicated as his goal before starting.

On the 22nd May, after covering scarcely 7 km., we found that the river again turned eastward, and a little later on even slightly south of east. This was terribly discouraging, the more so as the snow was now half a metre deep, and loose and heavy into the bargain, in addition to which, we had now no more food for the dogs. After a while, however, we find ourselves heading at last out towards the fjord, this being especially noticeable when we camp in the evening, and find the altitude only 70 metres. Knud Rasmussen set out from here on ski down the valley, until he could see out over the sea ice and the land beyond. The river bed is here cut deeper for the last part of the way, the bare rock showing through in places.

We climbed up one of the hills to a height of about 400 metres, in order to take a sample of a certain rock which stood out apart on the summit; beyond this practically nothing was done in the way of investigating the natural features of the country here, partly on account of eye troubles (snow blindness) and partly because the snow hindered our movements.

The river divides towards its mouth into a great delta; for the last 20 km. of its length it practically forms two separate channels the whole way, with a few anastomoses. Farther out, the difference between the level of the old sea beach and the surface of the river itself amounts to 40 metres, and the river flows in numerous branches, cutting up the bottom of the valley into a regular bastion formation. Somewhat to the south of the river, and parallel with the same, lies a long, narrow lake, with outflow and inflow to and from the river. Below the spot where the lake water comes down, the river narrows suddenly, at the same time clearing a wide, fan-shaped delta free of all obstacles. And here it is that the largest river I have seen in Greenland flows out into Danmarks Fjord.

From this point we shaped our course out through the fjord. Danmarks Fjord was at this time of year of course frozen over; we were all agreed, however, that the ice which lay there was some years old — possibly many — this being distinctly evident from the fact that the surface had commenced to assume the irregular formation which is characteristic of inland ice, exhibiting, moreover very fine cracks in the surface, extending but a little way down. This ice is called by the Eskimos „Sikosaq" (*vide infra*). Farther out towards the mouth of the fjord, this peculiar formation disappears. Here also, however, the ice was at least over a year old, being more than 5.60 metres thick. We were unable to measure beyond this depth, which we only reached by lashing together all the poles we had. The measurement was taken at a breathing hole, where the seal had come up through a crack in the ice. The ice in which this crack appeared was 2.18 metres thick; reckoning this as corresponding to one year, the whole thickness might be taken as representing two or three at least. There are, however, occasional years when the fjord is entirely ice-free, as was proved by the presence of a piece of drift wood, the root of a tree, found by Knud Rasmussen on the shore near the mouth of the Zigzag River.

The spring has now (1st June) set in. We saw the first thawed water while still up on the Glacier Lake; naturally however, only in specially favoured spots, sheltered, or facing south, etc.

On the 30th May we saw the first stream of any considerable dimensions which flowed for the whole of the 24 hours.

The country about the innermost portion of Danmarks Fjord consists, as far as we could see, both on the north and south sides of low, worn hills of rock, partly covered by moraine deposit.

All the time we were in the fjord, the wind kept constantly WSW; the snowdrifts in ice and land show this to be the prevailing direction (Føhn). All signs such as plant growth indicated much wind and little rainfall. At no place did the inland ice appear to reach down into the fjord, nor were any icebergs seen; all along the south-east coast, however, the inland ice comes fairly close to the shore, while in many places snow-filled valleys afford an easy means of ascent. The inland ice itself appears firm and immobile, without fissures.

Out across Kronprins Christians Land the sky presented the appearance which it has above water: the distance and direction would correspond to Mallemuk Fjæld, where there would doubtless be open water at that time.

The south-eastern side of the fjord consists, as regards the inner and central portions, of low hills with hollows and valleys. On talking over the fate of Mylius Erichsen and his comrades, the three Greenland-born members of our party, all born hunters, were agreed that travellers compelled to subsist on game in the fjord would have their best chance of finding musk ox here.

On the 31st May we emerged from the Zig-zag Valley, and proceeded out through the fjord, as already mentioned, keeping to the north-western side. The appearance of the country here clearly indicated an old ice fjord. The hills lay farther back from the coast, about 5 km., with huge heaps of moraine deposit, old lateral moraines, at their foot. Between the heights and the moraine runs a long tract of valley, at the bottom of which clay bogs alternate with small lakes. The great valley of clay is entirely devoid of vegetation; on the hillsides, however, there are a number of rich moist spots, the haunt of hare and musk ox.

The mounds of moraine deposit were about 100 metres high, diminishing, however, as we went on, and some 10 km. farther they disappeared entirely, the hills at the same time growing lower, and as a matter of fact passing over into the plateau formation, covered at the top by a layer of moraine clay, which extends over the whole of the peninsula. When the lateral moraines cease, the rocky heights present a sheer precipitous front towards the coast. We made no measurements here, the cliffs appeared, however, to be about 100 metres high or more, and consisted of the same material as all the other sediment rocks we encountered. Somewhat farther on (8 km.) a narrow foreshore appears;

Fig. 3. Cliff-face of Inland ice at place of descent on eastern side.

Fig. 4. Cliff face of Inland ice, near the big waterfall.

this extends out as far as Cape Kronborg, without growing broader. The land now grows gradually lower, the rock of the hills being soon no longer visible; clay slopes, however, occur frequently. Somewhat farther inland the land rises again; it is somewhat hilly, and everywhere covered with barren clay mixed with gravel, or gravel with a slight admixture of clay.

Immediately to the south of a large river we came upon a point which I remembered from HAGEN's map. The coast turns northward here. At this place we sighted something sticking up on the shore, which proved to be a sledge runner, bent into a right angle, standing apex upwards from the ground, into which both legs were fixed, and further supported by tent stones, which had been piled together in two small heaps, the whole evidently calculated to attract the attention of any who might pass by the spot.

Proceeding to closer examination, we immediately recognised that the place must be MYLIUS ERICHSEN's camp; not, in all probability, the summer camp, but the spot where the party had pitched their tent on landing again after their premature attempt to cross the ice.

A sadder picture of utter want I have never seen. All that we found — all, that is, which could be identified as having belonged to the Danmark Expedition, — might have been packed in one small parcel. A pair of ragged drawers, a metal plate which JØRGEN BRØNLUND had used to repair one of his sledge-runners, some fragments of a leather trace, which I recognised as having been made on board, and finally the lid of a meat extract jar.

The extremity to which they were reduced was evident from the fact that the excrements of the dogs were too poor even to tempt the foxes and ravens, containing mainly fragments of bone and rags, the latter either remnants of tent cloth or portions of clothing, with some grass and bits of rope. A single horn lay near the camp, that of a young musk ox; it had been sawed off from the head. This was the only sign of their having found game at all.

We went up inland, on the south side of the river. Flat plains of clay and mounds of gravel, with but the slightest possible amount of vegetation; beyond comparison the most unfavourable spot for a summer camp of any place we saw on the whole journey.

Here on the actual spot where my old comrades had encountered so much suffering and disaster it becomes more and more evident that they must have been forced to settle down here for the summer for reasons unknown to us, possibly induced thereto by the unfortunate accident of encountering here, by some unusual chance, a large herd of musk ox. Had they but carried their gear up towards the inland ice, they would, after a couple of days, have found a region where game was plentiful enough to furnish food for themselves and the dogs. Some sickness must have overtaken them, which as far as MYLIUS ERICHSEN himself is concerned, appears to have been the case, according to Brønlund's diary. We found no message, however, and it is thus unlikely that the riddle will ever be solved.

Two cairns had been built on a couple of hills south of the river, probably by Hagen, for survey purposes; we set out towards them, but the snow was so deep that we were forced to return to the tent for our ski, and then decided to go on first to the principal cairn at Cape Kronborg, and camping there, proceed to examine the two others later on.

Cape Kronborg is, as a matter of fact, not a cape at all, in the sense of a promontory, being rather a high, conspicuous hill close to the sea. Here a cairn about 1 metre high had been built; owing to lack of material, it was not made solid all through. We found no report there, and the cairn did not appear to have been previously visited. A wolf had been there; the excrements might have been from the previous year. Judging from what is generally accepted as customary, we could not but suppose that Einar Mikkelsen would himself have left some message here if he had visited the spot at all; failing any such, therefore, we presumed that he had never reached it. The question before us now was whether to go on, or turn back and follow Einar Mikkelsen's route in search of him.

It should be borne in mind that our search was throughout a purely personal undertaking, based on newspaper reports which in themselves contained several improbable features, such as one would hardly suppose to have originated from so practised an explorer as Einar Mikkelsen but rather from some misunderstanding on the part of the journalist responsible. We had at any rate, no certain facts on which to act, and were thus naturally somewhat at a loss whither to direct our search.

There was, moreover, reason to suppose that an expedition under the leadership of Capt. I. P. Koch would arrive at Danmarks Havn in the course of the summer, so that it would be superfluous on our part to proceed thither; by so doing, we should also render it impossible to carry out our own independent plans of exploring the Peary Channel. Our work as a search party in quest of Einar Mikkelsen could there fore only be regarded as at an end, with negative result.

The country about Cape Kronborg was similarly waste and uninviting. The vegetation was of the scantiest, and the very few musk ox tracks found were all old. From the summit of the hill, an excellent view is obtained out over Danmarks Fjord and the big islands beyond. The snow lay deep and soft on the ice, and on the slope down towards the sea; the summit itself was almost free from snow. This is due to the fact, which we had occasion to note during our stay, that the wind on the summit was north, about 10 metres per second, while on the ice it was perfectly calm.

On the 3rd June, a thick fog came down which rendered it impossible to see more than ten metres ahead; this lasted so long that we were obliged to relinquish our idea of investigating the two cairns inland, proceeding instead along the coast by way of Cape Rigsdagen. The fact was, that our provisions had come to an end, and we had now no food either for ourselves or the dogs. Our only choice therefore, was either to go back, — which in view of the rapidly approaching spring would have been a very risky thing to do, if we wished to avoid going into summer quarters — or to press on towards better hunting grounds. Here, at any rate we had no means of subsistence.

The route round by Cape Rigsdagen is known from the journeys made by Koch and Berthelsen; I will here only mention that we found the ice ground up and closely packed about 2 km. from land; beyond this, as far as the eye could see, the ice was flat and level, making easy going.

We followed the line of Valdemar Glückstadts Land in to Hagens Fjord. The land slopes down here in a hilly formation towards Independence Fjord; gravel and clay, with but slight vegetation and nothing in the way of game save a very few musk ox tracks, and these very old. A solitary bear's track led out from the land northward over the ice.

At the mouth of Independence Fjord and farther in we saw a considerable number of icebergs, which was not surprising, as we know from Peary's map that there were glaciers reaching down into the fjord and the supposed „Channel". What interested us more was the finding of „sikosaq" i. e. fresh-water ice formed on the sea.

This kind of ice originates from the same causes as the glaciers, viz; excessive rainfall or thaw, and differs only from ordinary glacier ice in the fact that it is formed not on land, but on the sea ice. Fissures appear in this glacier ice formed on the sea. The phenomenon has, by the way, been observed by Capt. Koch in Jøkelbugten, and in possibly all the fjords of East Greenland north of the 79th degree. No better opportunity of investigating these sikosaq could be found than at Thule, where one fjord, near Cape York, is covered, for the greater part, by sikosaq; this form of fresh-water ice is thus well-known to the Eskimos. On our present journey, we encountered it, as already mentioned, in its first stage in Danmarks Fjord, and in great quantities up near the base of Independence Fjord. Sikosaq is also found throughout all the open fjords on the north side of Grants Land, according to the reports of the Eskimos who have accompanied Peary. This would indicate that there must be very little open water, and but slight current.

Several large floes of sikosaq lay outside Hagens Fjord, the largest being about 1 square kilometre in extent. All rose 7 metres up above the level fjord ice, and had perpendicular sides, with the irregular surface characteristic of ordinary inland ice.

From Hagens Fjord, where, as already mentioned, no game was to be found, we crossed over to Peary Land, the pressure of hunger, both among ourselves and the dogs, rendering it imperative to give up all idea of exploring the inner portion of Hagens Fjord.

On the 5th June, we reached the mouth of a big river at about long. 25°30′ W. on the coast of Melville Land, east of Brønlunds Fjord. While still out on the ice we sighted a couple of musk ox on land, and going up on shore we found fertile fields, alternating with gravel hills. All the hollows were well watered and covered with a close carpet of grass. Lemmings, hares and ptarmigan were numerous, and during the two hours or so we spent on shore we saw first two, then one, and later four musk ox, besides numbers of fresh tracks. We were unable to stay longer on account of the river; even when we landed it had already become difficult to get forward, as great masses of river water were spreading out over the ice, turning the snow to slush, and greatly impeding progress, while closer in to shore, the river had melted the ice of the fjord altogether, and was pouring down in a torrent. The river itself, which branched off into a number of minor channels towards the mouth, ran at right angles to the coast for the last part of the way, the channel turning westward, however, a little farther up, and being probably fed from a glacier which we fancied we could distinguish in the distance. It had cut its way down, not only through the moraine deposit, which was here only some 3—4 metres thick, but also deep into the rock beneath, so that we were able to take samples on the spot. The current was furiously strong, and we had considerable difficulty in crossing, laden as we were with big loads of musk ox meat, although the water did not reach above our knees. An hour later, however, the river had risen so rapidly as to fill several of the channels in the delta which had been dry when we arrived, the volume of water increasing to such a degree that we had difficulty in getting out on to the ice again. When I returned to the sledges with a load of meat, after an absence of three hours, I found the ice hardly recognisable, owing to the water which had poured out over it. We were forced to leave behind the greater part of two musk ox which we had shot, and hurry back out on to the ice.

During these days it was difficult going close in to land, as the river water massed on the sea ice until it thawed a passage way to the fissures already made. This once effected, the ice became dry and good once more.

East of Brønlund's Fjord a line of sediment rock commenced, rising gradually to a height of about 800 metres, the precipitous cliffs running in a straight line from west to north and continuing round behind Brønlunds Fjord, broken here and there, however, by ravines and river beds. At the eastern end, the line of cliffs reaches right out to the coast, terminating in a sheer face of rock rising directly from the water; stones fallen from above lie strewn out over the ice. As the coast draws away to the south, however, a belt of land appears, between the rock face and the sea, growing continually wider as the two directions diverge. We found a piece of drift wood on the shore.

As long as the belt of land is narrow and steeply sloping, it is fertile throughout, and well watered by the melting of the ice from the rocks above. As it broadens out, however, the water collects in lakes and some few streams. Here the vegetation is mainly restricted to these more favourable parts; on the whole, however, the entire belt may be said to be very fertile.

8th to 12th June; (Lat. 82°11′ N., long. 29°10′ W.).

We were now in an ideal hunting country. In the immediate vicinity of the tent, three herds of musk ox were grazing, hare and ptarmigan abounded, and seals lay out on the ice basking in the sun, so that we could get as many as we wanted. Down by the fjord, the ground was again divided up into meadows and marshy patches near the lakes and streams, while farther inland, towards the rocky heights, the country rose somewhat, with big hills, these last, however, with a rich growth of Arctic willows, and consequently affording good feeding grounds for musk ox.

The icebergs and sikosak which had drifted ashore — so thickly at times as to form a regular little mountain range along the shore — showed, as did also the lie of the snowdrifts and the appearance of the vegetation, that south-westerly winds prevail. The water had now formed channels in the ice, and the snow was firm, rendering progress much easier. Some birds of passage made their appearance during these days, viz; Arctic Tern (*Sterna macrura*), Glaucous Gull (*Larus glaucus*), Eider duck (*Somateria spectabilis* (?), Barnacle goose (*Anser leucopsis*) etc.

On the 12th June (Lat. 82°9′ N., long. 29°45′ W.) we started out again, halting off Cape Harald Moltke to take observations, and also to provide the dogs with sandals in order to protect their paws from the needle points formed in the ice by the action of the sun. The ground changes now to raised beaches, with a slope some 10 metres high out towards the bottom. Here I found the remains of a whale skeleton, lying loose on the slope. Behind this terrace lies another, about 40 metres above the sea, its horizontal gravel surface losing itself in the general hilly formation about a couple of metres farther inland. In the middle of this belt of land rises an isolated pyramidal rock, apparently about 300 metres high, and very conspicuous on account of its position. From Cape Harald Moltke a good view is obtained out over Brønlunds Fjord. This seems to be drawn somewhat too large on Hagen's map, the part which curves off towards the west behind Cape Knud Rasmussen soon after leading up into a valley. This last was, it is true, covered with snow, and thus difficult to distinguish from the Fjord itself, low and even as it is; it continues, however, far out to the west. Cape Harald Moltke itself is formed by the raised terrace above referred to. A number of small icebergs lay round it, Bronlund's Fjord also being filled with such bergs, which had been driven across by the wind from the other side of the fjord.

13th June (Lat. 92°9′ N., 30°20′ W.).

Crossed straight over the mouth of Brønlunds Fjord to Cape Knud Rasmussen. The seals were now more numerous than ever; it was impossible to count them as we drove. Knud Rasmussen found some Eskimo tent rings here, at the outermost point of the promontory which Mylius Erichsen had named after him.

Went on 12 kilometres past Cape Knud Rasmussen to a little point where it was easy to land. Generally, there lay a broad belt of melting-water between the ice and the land; here and there however, one might come upon a loose floe of ice which could serve as a ferry on which to cross. Great numbers of seals all over the ice.

Cape Knud Rasmussen forms the commencement of that chain of rocky heights which runs from here all along the northern coast of Independence Fjord as far as Cape Schmelck; this first part consists of sediment rock, and lies apart from the heights by Brønlunds Fjord, already referred to, and the valley which forms its continuation. The front of the range facing the fjord consists of great slopes, the height increasing as one nears Cape Schmelck. These slopes of the sediment formation are very fertile, and abounding with game, musk ox and hare being plentiful. Farther to the west, however, where the diabase crops out, the ground becomes perfectly barren. We set out from the camp, where we had been forced to halt by a violent westerly gale, and made our way northwards over the heights, which here reached some 650 metres. The range breaks off sheer towards Brønlunds Fjord, and continues westward as far as Chr. Erichsens Bræ, which fills the valley at the inner end of Brønlunds Fjord. The icebergs in the fjord had not drifted farther in than the point where this sharp break occurs. The inner portion of the fjord is therefore probably shallow.

At this camp, as also at the former one, musk ox came wandering down to the tent.

The ice in Independence Fjord was not more than 5 metres thick; about 30 metres from the shore lay a number of fairly large icebergs, which became more numerous as we came farther in.

15th June (Lat. 81°59′, long. 30°55′ W.).

At about 32°4′ N., 31° W., we came to a jutting point which even from a distance was conspicuous on account of its peculiar shape, the worn and rounded surface presenting a distinct contrast to the rugged sediment rock. This was the diabase which here came to light, just as on the two islands, Great and Little Diabasholm, outside. At Diabasnæs we made a brief investigation in the hope of finding the point of transition, and obtaining samples, but without success, both the ness and the islands being covered with moraine stones. Scored marks were found; only, however, in one direction, that leading out of the fjord.

From Little Diabasholm, the highest point of which lies but 20 metres above the sea, an excellent view is obtained out over the base of Independence Fjord; even from here it appears unlikely that the Peary Channel should exist. Great Diabasholm reaches a height of 120 metres.

At a point in the gently curving bay west of Diabasnæs the diabase crops out again. Here, by the way, in front of the steeply sloping heights, lie rows of high mounds of moraine deposit, similar to those found in Danmarks Fjord.

Camp at 81°54′ N., 32°25′ W.

The group called Lyngeholmene consists of 19 islands, some large some small; some of these were seen by Peary. All are of diabase, and on all we found erratic blocks of sandstone. The vegetation was quite insignificant. The largest island, that on the east of the group, is 60 metres high, the remainder are lower, from 10 to 20 metres. The comparatively large peninsula, which is connected with the mainland by an isthmus only a few metres wide, is 200 metres high. A large number of icebergs lay about between the islands.

From Chr. Erichsens Bræ a tongue of ice runs down towards the coast. The numerous rows of terminal moraines here suggested frequent and sudden changes in the glacier.

18th June (Lat. 81°48′ N., long. 33°25′ W.).

The inner part of the fjord was now becoming more and more closely packed with icebergs or the hybrid „sikosak". We had now reached the point where this lay firm and unbroken. Between the sea ice and the sikosak there was an abrupt change of level, amounting to 7 metres, the same as was noted in the case of the pieces of sikosak found at Hagens Fjord. Off Academy Bræ and Nyeboes Bræ the icebergs lay closely packed.

The entrance to Hagens Fjord, which is bounded on the north by the low flat spit of Cape Ludovica, is bounded on the west by Cape Peter Hendrik, which slopes steeply both towards both Hagens Fjord and Independence Fjord. This country we did not explore at all, as we were forced to subsist on such game as we could find, and therefore naturally kept to the north coast. From Cape Peter Hendrik, which is 50—100 metres high, the coast line towards the west is formed by a continuous range of sediment rock, increasing in height towards the west. The part about Cape Grundloven, which dominates the whole coast, is about 300 metres high. Immediately to the west of Cape Grundloven, three small glaciers crop out through the rock formation, two of them calving considerably out into the fjord, the third, however, being shut off from the fjord by a great terminal moraine. Immediately west of this again lies a small fjord running laterally up, about which the rock formation is somewhat lower. From here to Cape Glacier, however, the height of which I found by measurement to be 600 metres, the regular range of cliffs fronting steeply on to the sea, increases in height. An exception is formed by the ravine which breaks through into the fjord a little before the 22nd degree is reached, affording a channel for a big river coming down from the interior. The remaining ravines and channels are unimportant. The land here consists only of a narrow fringe of coastal hills, continuing out from Cape Glacier along Academy Bræ.

To reach Cape Glacier was practically out of the question for us, unless we chose to go back, cross the ravine already mentioned, ascend the heights there and then proceed on foot to the Cape itself.

Camp at Lat. 84°48′ N., 33°25′ W.

From here, further progress westward through Independence Fjord was impossible. On making a reconnaissance, however, we found that it would be possible, though with considerable difficulty, to carry our gear up to a tongue of ice which jutted out from Chr. Erichsens Bræ down in a south-easterly direction towards Cape Schmelck, about 750 metres above sea level. We could then drive along Chr. Erichsens Bræ to Skelelven, from where we should then have to lower or carry our gear down to Nyeboes Bræ. In the course of this reconnaissance I reached as far as the hill 940 metres high north of Nyeboes Lake. Here for the first time I was able to look out over Valmuedalen, and saw that it was free from ice. From this moment, all idea of a Peary Channel filled with glacier ice had to be relinquished. I had already previously observed that Nyeboes Bræ led up to the inland ice, and could thus not be supposed to mask any such channel.

On the hill 940 metres high above mentioned I found an outcrop of solid diabase at 920 metres, and solid sandstone at 910 metres.

Chr. Erichsens Bræ does not extend beyond the 36th degree. Where the exact northern boundary lies I am unable to say; the summits of some hills were visible on the other side, but my attempts at observation were unsuccessful. The glacier does not in all probability at any point reach farther north than 82°30′. The southern edge of the glacier lies at a height of 600—900 metres, nunataks being here and there visible along this side.

Skelelven (= Boundary River) was very swollen. It touches Nyeboes Bræ at an altitude of 310 metres, turning off again to the westward, and flowing out into Nyeboes Lake.

To the east of the point of contact between the river and the glacier, the rock is of reddish sandstone, sample of which was taken at the surface of the glacier, altitude 365 m. We then proceeded across Nyeboes Bræ to Adam Bierings Land, passing a number of large rivers with broad and deep-cut channels. Save for these, the going was good, the ice being covered with a firm layer of hardened snow. There were

Fig. 5. Glacier Lake, Nyeboes Bræ, with Valmuedalen in background.

Fig. 6. River on Nyeboes Bræ, with sledge as ferry. Rugged ice in background.

no fissures along the route we followed, but out in the glacier itself there was a chaos of enormous breaks in the ice.

29nd—30th June (Lat. 81°51′ N., long. 35°40′ W.).

Nyeboes Lake is remarkable in several respects. The surface of the water was at this time at a level of 270 metres. The lake was full of calved blocks, but still frozen over save for the part nearest the shore and outside the mouth of the river.

From Nyeboes Bræ a tongue of ice runs out into the lake, sloping fairly sharply down from the upper portion towards the lake itself, but terminating in a sheer cliff which rises about 15 m. above the surface of the water. Three distinctly marked water-lines on the ice showed the considerable heights to which the water had formerly reached. The shore near the lake was strewn in all directions with icebergs and large and small blocks of calved ice, left high and dry at the places where they had stood when the water subsided. On the south-western side of the lake was a fairly steep slope, from which stones had fallen down towards the water. The exact level of highest water was here very distinctly marked, the stones being covered with a thin layer of the clay deposited by the water. The calf ice extended right up to this limit, the smaller blocks naturally reaching highest, as they would have been able to float in shallower water. The larger of the stranded icebergs, which we estimated as about 20 metres high, had in many cases cut up the face of the ground, the mass of ice turning over as the water subsided, and tearing a furrow for itself among the loose stones before coming to a final resting place. It was an imposing sight to see the huge rocks which these icebergs had carried down before them or thrust aside out of their path; the effect gave one a good idea of the tremendous weight and power of the ice. Naturally, the icebergs had in many cases toppled over and been smashed to pieces. On the opposite side of the lake and in towards Valmuedalen the banks were more horizontal — in Valmuedalen the water even flows in, when at its highest level, over flat stretches of raised sea bottom — so that the icebergs here lay for the most part in the same position as they had occupied in the water, having simply bored themselves deep down into the loose sand and taken root, so to speak. Here, as at Ymers Nunatak, the pillar-shaped bergs appeared to be by far the most numerous. The vertical height from surface of the water to uppermost water mark on the ice was 45 metres, the actual high water mark on land, however, lying 10 metres higher, reckoning from the clay deposit. It must have been several years since the water had reached such a level, as plants several years old (poppies and potentilla) were found growing right down to the water's edge. It would therefore seem that the lake was now in process of filling, and with regard to its period, the following may be stated:

In view of the fact that there is ice on the lake from the last winter, there must consequently have been water the year before; it is probable, however, that the filling of the basin which is now in progress commenced two, or more likely three years ago, plants of several (at least two) years' growth being now found right down to the water's edge. It is hardly likely that they would have been sown directly the water had subsided. Three large rivers were now flowing out into the lake, the volume of water in each case being so considerable as to render the channels passable only with difficulty, if at all, by wading. The dogs could not touch bottom. In addition to these, there were also a number of smaller streams, besides the water from the melting ice. During our stay in Adam Bierings Land, however, (from 29th June to 11th July, i. e. 13 days) the water of the lake rose only a little over 1 metre (118 cm.). This measurement, which was, it must be confessed, somewhat uncertain, would give a rise for the whole of the summer amounting to 5 metres. As the extent of surface at highest water mark would be about twice the area covered in 1912, the average annual rise after that year may be taken as $\frac{1}{2}(5 + 5/2$ metres. According to this, the lake should be filled by the year 1912 $+ 55 \div \frac{1}{2}(5 + 5/2) = 1912 + 20 = 1932$. The period during which the lake is emptied may thus be reckoned as a quarter of a century. This is naturally but a rough estimate; it serves, however, to give some idea of the magnitude in question.

In Valmuedalen, among the stranded icebergs, many holes and furrows were noticeable in the earth, these being, despite a certain indistinctness occasioned by their having been covered with water, evidently the „footmarks" made by icebergs stranded during an emptying of the lake previous to that which had last taken place. Whether these bergs had since melted away, or had been carried off elsewhere during the subsequent period of high water, the fact suffices to show that the water must now and then reach its highest level or near it before flowing out.

Valmuedalen, to which we then proceeded, is a big, broad valley running out from the lower portion of Nyeboes Bræ into Adam Bierings Land. There is no doubt that this must be the hollow which Peary and Astrup looked out over in 1892 but without being able to see down into it. The country rises again, however, a little farther in: It is very fertile here, plains of clay alternating with level raised beaches of gravel and pebbles. These were found up to a height of 400 metres. At Bierings Varde also, we found similar stones at the foot of the rocks. These pebbles, together with polished fragments of solid rock, were found up to a certain sharply defined level, above which the rock was rugged and pointed. Owing to continual rain, the actual height was not measured.

The great fertility of Valmuedalen, which in many places presents the appearance of great stretches closely carpeted with yellow, is doubtless due to the fact that is is so well watered, there being, besides the many large rivers, numerous smaller streams, with meadow and marshy patches. The valley being very broad and level, and the hills sloping gently down, there is but little shelter to be found, so that there will doubtless be but little snow in winter, save for large drifts at certain spots. For this reason, the place is a favourite haunt of musk ox and hare, which we found here in great numbers, the animals again contributing their share towards the general fertility of the place by the quantities of dung which were everywhere visible. By way of illustrating the resources of the valley, I may mention that we were obliged, during our stay there, to use willow twigs for fuel, there being but little of the cassiope which we generally used. The willow, however, was so abundant, that a quarter of an hour sufficed for the gathering of a whole sackful, sufficient for two fires.

On the 2nd July we had continual rain or fog, which rendered all attempts at surveying the surrounding country fruitless.

The main river in the valley runs first on the right side, crossing then to the left — the altitude here is 525 metres — and continuing down that side to the lake. A big river runs straight down across the valley from the south-west, forming the natural boundary of the raised beach land, the country behind it being apparently old moraine deposit. Animal life was here abundant, and there were numbers of breeding birds on and about the numerous small lakes. We also found antlers, indicating that reindeer had formerly lived here; these animals have, however, now become extinct here, as in other regions on the east coast of Greenland.

On the 8th July, despite the rain and fog which were now exhausting our patience, I went in through the valley, hoping to get some idea of the surrounding country if the weather should clear up. In this, however, I was disappointed. After a 12 hours' tramp in the wet I came to a rocky height, at which point the valley appears to divide into two, one running north and the other west. This hill I have marked on the map from an estimate of the course of the glacier. We saw what appeared to be a continuous range of hills far away to the west; owing to the bad weather, however, we were unable to get an accurate survey for the map.

In order to avoid misunderstanding, I may state that I have thought it correct to draw the boundaries of the localities named by Peary as follows: By Melville Land I understand the country east of Brønlunds Fjord; Heilprins Land being the land between Brønlunds Fjord and Cape Schmelck, while west of this, Adam Bierings Land begins. Academy Land should be the country between Academy Glacier and the glaciers at Cape Grundloven.

As already mentioned, the boundary between Independence Fjord and Nyeboes Bræ, — a limit which it is difficult to determine, and which is doubtless not constant in itself — has been taken as at Cape Schmelck, where the cliffs which rise perpendicularly up from the ice run out in a north-westerly direction as far as Skelelvens Næs. The height of this range is fairly constant. We were unable to get up to the cliff itself and take samples, owing to the nature of the ice; judging from the colour, however, which is pink, it would seem to be the same rock as a sample brought home from the hills east of Skelelven. The southern coast, which forms the boundary between this country and Game Land commencing at Cape Lundbohm, is somewhat more irregularly indented. The heights vary a good deal. At Skelelven, the ice is pressed violently against the steep wall of the cliff, and is in many places forced far up its sides. Possibly, this appearance may to a certain extent be produced by huge snowdrifts which are piled up against the cliffs during the winter gales and subsequently transformed into ice. In some cases, however, there is no doubt of the fact that it is caused by the ice from the glacier itself, which is forced upwards by the strong lateral pressure.

On the 11th July, we left Adam Bierings Land, which was still wrapped in mist and clouds, so that we were forced to relinquish our last hopes of an accurate survey. We followed the boundary of Adam Bierings Land westward along the steep hills, progress over the ice being at present impossible on account of the enormous fissures. The cliffs stand sheer up from the ice, rising some 300 metres above the same. There is no terminal ravine or river along the edge of the land, the ice lies pressed close against the rock, in many places to a height of 20—30 metres.

The centre of the glacier was in very evident movement. Along the side, some 20—30 metres out from the land, was a belt of steadier ice which offered fairly easy going, while close up to the rocky wall itself the ice became once more rugged and unstable. This gave rise to a peculiar phenomenon which, as far as I am aware, has not been previously described. On either side of the more immobile belt above referred to, the breadth of which varied from 10—50 metres, stood a number of curved bridges of ice, each independent of the others, but placed in parallel rows running at right angles to the direction of movement of the glacier, and with their convex side upward. These bridges stood in rows one beside the other, the streams flowing beneath, presenting in many places the appearance of huge cylinders, each cut into a number of sections.

The arches were from half a metre to several metres thick, and varying in height.

We decided to make an attempt to get straight across the stream of ice, and ultimately succeeded in doing so, though not without considerable difficulty and danger. The ice was cut up in all directions by fissures, some old, others more recently formed; by dint of patience and careful search, however, we managed, as one often may, to find a way through.

On the 13th July we were obliged to keep to the tent, on account of a violent gale from the south-west, with snow and rain, the wind very strong. Next day, however, the storm gave place to a quiet snowfall, and we were able to proceed along the border of Game Land, the snow underfoot soon making excellent going. Between 37° and 38° W. the ice sloped in towards the land, forming a lake which extended over to the land itself. The extent of this lake was difficult to judge, as it was partly frozen, and the boundary between lake ice and glacier ice imperceptible. The outline given on the map is therefore somewhat uncertain. Our course now lay westward again along the borders of Game Land, the snow hard and firm underfoot, and the ice still rising in a fairly steep slope. Following the line of the land, which turned sharply off to the south, we came to a small bay, formed by a huge mound of moraine deposit which ran up from the southward and joined the land. At the base of this bay, on the inner side of the moraine, lay a small lake, and here we camped.

14th July (81°32′ N., 38°30′ W.).

The southern and western portions of Game Land are throughout of moraine formation, stony and barren. This last feature is of course largely due to the fact that the country slopes gently upwards towards the north, and is thus exposed without shelter to the continual southwest wind and driving snow from the inland ice.

The whole character of the country however shows that it has in recent times been covered by the ice; stones and heaps of gravel lie strewn about on every side, the solid rock in its original formation being nowhere visible. Outside the border, along the whole of the south coast, lie enormous masses of moraine deposit, clay gravel, and great rounded boulders, deeply scored, indiscriminately mixed together, or at times heaped up in narrow mounds. One of these I measured; the height was 13 metres, thickness at foot being only about 20 metres or a little over (measured at the end of the mound).

These moraine masses have been observed here and described, by Peary and Astrup, and are also mentioned by the latter in his work „Blandt Nordpolens Naboer"; they extend out at intervals all along the south coast of Game Land and are also to be found, in horseshoe form, south of the largest of Nansens Nunataks. The horseshoe formation was perhaps the most common; S-shaped or merely straight mounds were also found in numbers, as indicated on the map. In many cases one end of the mound joined up to the mainland; the direction, however, did not appear to indicate any definite system, varying between a line parallel to the coast and one at right angles to the same. Outside the largest of Holger Kiærs Nunataks also, we found a couple of these huge ridges of moraine deposit.

Peary's map shows, besides the two nunataks noted by us, also two others, lying farther south, i. e. farther up in the inland ice. Peary has charted them as low islands, almost flat, in the surrounding ice.

These were now nowhere to be seen. The ice, however, at the place where they were marked, and which we could easily see, was extraordinarily rugged, ridged and undulating, presenting a picture of utter confusion when viewed through the glass. Time did not permit of our going across to make a closer investigation of the spot; we supposed, however, that in the course of the 20 years which had elapsed since Peary visited this region, the ice must have crept up over these two flat nunataks, and ultimately covered them.

Save for the features stated above, Game Land consists of rocky heights with deep ravines and valleys, where lakes and streams, in conjunction with the shelter afforded by the hills, render the region excellently adapted to vegetation, which again serves to maintain a large stock of game, chiefly musk ox.

The rock samples which we brought home from here have been determined as sandstone in the case of the lower strata; the upper strata consisted, here as at the other places we visited, of diabase, which is seldom if ever found elsewhere in great continuous formations of this character.

The rock formation of the country is thus rendered extremely regular, the hard diabase protecting the softer sandstone beneath; the summits of the hills are the remains of a great plateau, which has gradually been cut up by ravines. These are for the most part quite narrow at the bottom, the masses of disintegrated material from either side meeting in the middle, and here, in the summer, the rivers pour down in torrents between great boulders or heaps of smaller stones, the water being provided by the melting of the snow which remains in the ravines until summer sets in.

In many places, however, the rock formation lies farther back, yielding place to large hollows and narrow, elongated lakes, which form the haunt of the many musk ox which we saw; clean-trodden paths show that they have their regular routes, and the vegetation, which in view of the geographical situation is abundant, doubtless renders the country far more hospitable than many regions lying farther south.

We now drove down a tongue of ice which had become separated from the main glacier by a narrow strip of land, and entered a valley which we afterwards called the „High Road Valley" on account of the constant stream of musk ox passing through it; here we remained from the 16th July to the 7th August, during which time we laid in a store of provision for ourselves and the dogs sufficient to serve us on the homeward journey.

The lakes were at this time not yet thawed, nor did they thaw that summer save in portions near the banks. It is hardly probable that they contained salmon; we kept a good look out for same, but saw no air-bubbles such as are made by the fish when snapping up mosquito larvæ. A pair of red-throated divers (*Colymbus septentrionalis*) had their haunt on the lake.

On the 22nd July, I went out with the Eskimo Inukitsoq to Navy

Cliff, where Peary and Astrup built a cairn in 1892 before starting on their return journey. We found the brass case containing the message they had left, as also a whisky bottle containing a report and some articles from the New York Sun.

We did not, however, find the illustrated magazines which should, according to Peary's report, have been deposited in the cache, nor was there any trace of Peary's stay. A good view was obtainable from the spot out over the fjord, where the ice still lay unbroken; an explorer looking out from there, and not considering it necessary or advisable to proceed farther, might well imagine that the fjord extended farther to the west.

Navy Cliff consists of diabase (sample taken) and falls away sharply to the north and west. The cliff itself does not face immediately on to the fjord or the glacier, being separated from the latter by a fairly broad valley, on the farther side of which again rises a narrow wall of rock which hides the portion of Academy Glacier below. The upper and lower parts of the glacier, however, are distinctly visible.

Astrup's description with accompanying sketch of the steep glacier at the foot of the cliff would thus rather apply to the rock immediately adjacent to the glacier.

The ground at Navy Cliff furnished an excellent illustration of the manner in which everything is preserved in the Arctic, doubtless on account of the slight rainfall; the snow, moreover, never lying where it falls, but being constantly borne forward by the wind. The cairn here was not particularly high, 1 metre or a little over. The summit of Navy Cliff is covered with gravel and small stones, with some few larger boulders here and there. The tracks made by Peary and Astrup were still clearly visible in the gravel about the cairn they had built; it was strange indeed to walk here literally in Peary's footsteps. Despite the 20 years which had elapsed, we both agreed that the uninitiated might reasonably have supposed the tracks to have been 8 to 14 days old.

Our visit to Navy Cliff was made during a violent gale, which rendered it impossible to set up the theodolite at all, in addition to which the sun was hidden all the time, so that we could make no measurements.

An account of our journey was deposited in the cairn, enclosed in a tin case, together with one copy of Peary's report, which was written in duplicate.

During the whole of our stay in Game Land we were much inconvenienced by bad weather. From the 1st August to the evening of the 6th it rained and blew almost incessantly. The autumn then appeared to be rapidly approaching, the snow buntings were assembling for flight, the rivers had almost ceased to flow, and new ice appeared on the lakes. Summer in these regions is but of short duration, but is the more intensely felt while it lasts.

On the 7th August we drove up to the edge of the glacier with the last of our gear. We now built a cairn, Thulevarden, on a high and conspicuous hill, depositing there our final report, enclosed in a sealed gun-barrel. From this hill an excellent view of the surrounding country was obtainable, and here we laid the finishing touches to our survey work. At 10 p. m. on the 9th August we commenced our homeward journey over the inland ice, with 3 sledges and 27 dogs.

9th August. Leaving the land behind us, we now commenced the ascent of the inland ice. In comparison with the difficulties which Peary and Astrup had encountered in the border zone, our work here was easy enough. The season was now so far advanced that the frost had commenced, and the snow lay firm and hard, the water with which it had been soaked having now solidified. The small lakes and pools which are always to be found in hilly parts were frozen over, as were also such of the streams as had not yet dried up; they formed an excellent sledge road. Where the flow of water had ceased however, the dried channels, which were frequently broad and deep, presented a series of obstacles by no means pleasant to negotiate.

A run of 7 hours brought us to the largent of Holger Kiærs Nunataks. The ice found about was full of quite narrow fissures, running for the most part towards the nunataks.

The ice was very hilly, the general trend, however, being naturally upward. We had now no means of taking altitudes, our barometer having been spoiled on the 12th of July by immersion in water.

In conclusion, I should mention that the maps, which had to be completed before my departure from Denmark, would not have been finished in time had it not been for the valuable assistance kindly rendered, in the first place in Greenland, by Frk. Mimi Poulsen of Upernivik, in copying and colouring, and untimately in Denmark, by my former comrade from an earlier expedition, Hr. Bendix Thostrup, who undertook the final work of preparing them for the press. To both I wish to express my very sincere thanks.

Note: In my account of the expedition, written for the most part in diary form, I have purposely refrained from correcting the error in date; in Freuchen's „General observations as to natural conditions" however, the mistake has been rectified from the day on which it is presumed to have occurred. Thus the 15th of May in my report answers to the 14th in Freuchen's, and so on, with a difference of one day thenceforward.

Knud Rasmussen.

X.

PLANTS COLLECTED DURING THE FIRST THULE EXPEDITION TO NORTHERNMOST GREENLAND

DETERMINED BY

C. H. OSTENFELD

During the first Thule-Expedition (1912) Mr. Peter Freuchen collected a fair number of plants at several of the tent-places of the expedition. It is quite remarkable that he succeeded in making botanical collections under the circumstances under which he worked, and in bringing the plants collected home in good condition.

His time for collecting was very restricted, and we may therefore not expect that the list given below comprises the entire flora. It is merely a list of the more conspicuous flowering herbs and shrubs, while such plants as grasses and sedges naturally have been neglected, at least in part. Of course also the cryptogames are very poorly represented in the collection; some few tufts of mosses and single pieces of lichens and algæ are brought home, and in the moss-tufts and among the basal parts of the flowering plants several other mosses have been discovered, when I was working up the collection. Mr. A. Hesselbo has been good enough to prepare a list of the mosses, while I have thought it of no importance to try to get names to the few pieces of algæ and lichens which are only very commonly distributed arctic forms.

In 1909 Dr. H. G. Simmons published "A revised list of the Flowering Plants and Ferns of North Western Greenland" (Rep. Sec. Norweg. Arct. Exped. in the "Fram" 1898—1902, No. 16), in which he has critically compiled all earlier contributions to the flora of N. W. Greenland north of Melville Bay. If we compare his list with that given below, we will find no species enumerated here which has not been found before in N. W. Greenland. On the other hand, our list is very useful with regard to the regional distribution within this big area, extending from ca. 76° Lat. N. to nearly 84° Lat. N., as it brings the records of several species much farther north than hitherto. N. W. Greenland may, from a botanical point of view, be divided into two natural parts, a northern part north of the big Humbolt Glacier, and a sounthern part south of it. The southern part is much richer in plants — is also better explored, botanically, — than the northern one. Simmons (l. c., p. 22) gives only 27 species known from the northern part, while the flora of the whole N. W. Greenland contains 108 species, and all of the 27 species of the northern part (except one: *Dupontia Fisheri*, which occurs farther south in Greenland) are also found in the southern part.

The region explored by the first Thule Expedition belongs most naturally to the northern part of N. W. Greenland in spite of the fact that Independence Bay has its opening towards East, and therefore the collection here treated means a considerable addition to the poor flora hitherto known from this northernmost part of Greenland.

The list of the flowering plants and ferns given below enumerates 45 species, 28 of which were not found before in the northern part of N. W. Greenland, the flora of which consequently now has (28 + 27 =) 55 species. 10 species recorded earlier from N. W. Greenland did not not occur in Freuchen's collection, viz. *Poa cenisia*, *Dupontia Fisheri*, *Juncus biglumis*, *Melandrium apetalum*, *Hesperis Pallasii*, *Braya purpurascens*, *Lesquerella arctica*, *Cochlearia officinalis* and *Ranunculus nivalis* (the last one being represented by the nearly allied *R. sulphureus*).

Several of these (e. g. *Hesperis*, *Braya*, *Lesquerella* and *Cochlearia*) are too conspicuous to have been overlooked by Freuchen's keen eyes, and it is therefore probable that they do not occur in the region visited by him, which may be too far North for them. On the other hand the grass-like plants may have occurred in the region in question where undoubtedly several more grasses and the like could be found, if investigated by a botanist.

As it might be expected, most of the species collected are hardy and common arctic species of a wide geographical distribution. They occur both to the east and to the west of the area investigated. But still some species may deserve a special attention. I may here point out the discovery of the rare arctic grass *Pleuropogon Sabinei*, which was hitherto only found in one place in N. W. Greenland and has been reported from Germania Land and other places on the N. E. Greenland coast. Arctic species not occurring everywhere are further: *Erigeron compositus*, *Taraxacum phymatocarpun* and *Poa abbreviata*, the last being evidently common in the area investigated. As species the occurrence of which at this high latitude was not to be taken for granted, I may name: *Statice armeria*, *Cardamine bellidifolia*, *Trisetum spicatum*, *Sagina intermedia*, *Silene acaulis*, *Woodsia glabella* etc.

The more common and conspicuous species in the area seem to be, besides *Poa abbreviata*, — *Carex nardina*, *Papaver radicatum*, *Saxifraga oppositifolia*, *Cerastium alpinum*, *Dryas* and *Salix arctica*.

The localities where Freuchen had time to collect plants are the following:[1]

A. The region of the Danmarks Fjord.

18. May: The Zigzagdalen, Sjællandssletten, on the western side; moraine, dry, sandy soil.

[1] A preliminary report on the Expedition was given in Geografisk Tidsskrift, Bd. 22, Hefte V, 1914, Köbenhavn, by Knud Rasmussen: Foreløbig Beretning om "Den første Thule-Ekspedition" 1912—1913.

23. May: Sjællandssletten; slope facing south; dry moraine gravel of a river bottom.

3. June: Valdemar Glückstadts Land (Cape Kronborg), snow-covered clayey plain.

B. Melville Land.

5. June: The south coast, opposite J. C. Christensens Land.

C. Head of Independence Bay.

18. June: Heilprin Land, "Sidste Næs".
20. June: Cape Schmelck.
11. July: Valmuedalen (Valley of Poppies).

D. Vildtland, west of Independence Bay.

20. July: Western part.
3. August: Western part.

The localities are situated between 81°15′ and 82°15′ Lat. N. and between 22° and 38° W. Long.

In the list below is given under each species only the date of collecting, from which it is easy to find the locality in question as given above. The names of the plants have been arranged as follows: Within the four main groups of vascular plants the families (orders) are enumerated in alphabetical order; the same is the case as regards the genera within the families and the species within the genera.

I. Pteridophyta.

Fam. Polypodiaceæ.

1. **Cystopteris fragilis** (L.) Bernh.

20/VI: Specimens with young leaves bearing unripe sori and with year-old leaves with emptied sori.

2. **Woodsia glabella** R. Br.

20/VI: Year-old leaves with emptied sori were found among the leaves of the foregoing species.

II. Monocotyledones.

Fam. Cyperaceæ.

3. **Carex nardina** Fr.

18/V, 23/V: Old tufts in winter-stage, numerous fruiting stalks from the year before. 18/VI: The leaves begin to grow by basal growth, the basal parts being green, the distal ones faded and pale; some fruiting stalks from the year before.

4. **Eriophorum polystachyum** L.

3/VIII: Low (ca. 5 cm) specimens with unripe fruits (the bristles half way grown).

5. **Eriophorum Scheuchzeri** Hoppe.

11/vii: Low (8—11 cm) specimens with unripe fruits (the bristles more than half way grown).

Fam. Gramineæ.

6. **Alopecurus alpinus** Sm.

18/v: Year-old culm only. 3/viii: Medium sized (15 cm) specimens in full flower.

7. **Hierochloe alpina** (Liljebl.) R. & S.

3/viii: Large and strong specimens with ripe fruits.

8. **Pleuropogon Sabinei** R. Br.

11/vii: 10—12 cm high specimens in full flowering.

9. **Poa abbreviata** R. Br.

18/v, 3/vi: In winter stage, with year-old culms.

3/viii: Flowering over, the fruits have dropped, year-old culms present.

10. **Poa glauca** M. Vahl.

18/vi, 20/vi: Year-old culms and just beginning growth of the roset leaves. 3/viii: Panicle well developed, year-old culms present.

11. **Trisetum spicatum** (L.) Richter.

20/vi: Year-old panicles only.

Fam. Juncaceæ.

12. **Luzula arcuata** (Whbg.) Sw., subsp. **confusa** Lindeb.

18/vi: Year-old culms with clusters. 20/vi: New clusters begin to develop.

13. **L. nivalis** (Læst.) Beurlin. (**L. arctica** Blytt).

3/viii: The seeds in the capsules nearly ripe.

III. Choripetalæ.

Fam. Caryophyllaceæ.

14. **Cerastium alpinum** L.

17/v: A condensed form with year-old fruiting stalks; winter stage. 18/vi: Long shoots with new buds in the axils of the year-old, withered leaves; old fruiting stalks. 20/vi: A condensed specimen with nearly fullgrown flowering buds. 11/vii: Condensed specimen in full flower and with year-old fruiting stalks. 3/viii: Strong and rich-flowered specimen in full flower and with year-old fruiting stalks. — All these specimens are hairy. There was also found a single small specimen of the small-leaved, glabrous, condensed f. *pulvinata* Simmons (18/vi, no trace of flowering organs).

15. **Melandrium affine** J. Vahl.

20/VI: Low specimens, just beginning to flower.

16. **M. triflorum** (R. Br.) J. Vahl.

11/VII: Small specimens in bud and with fruits developing. 3/VIII: Specimens with nearly ripe fruits.

17. **Minuartia verna** (L.) Hiern, var. **rubella** Wahlenb.

17/V and 18/VI: Winter stage. 20/VI: Strong rosette with buds and year-old fruiting stalks. 11/VII and 3/VIII: Strong rosettes with flowers and year-old fruiting stalks.

18. **Sagina intermedia** Fenzl.

18/VI: One very small specimen with year-old stalks bearing withered flowers (no developed fruit).

19. **Silene acaulis** L.

23/V: Winter stage with year-old fruits and withered flowers. 18/VI: With young leaves and young flower buds. 11/VII: In full flowering. 3/VIII: Only a small fragment present.

20. **Stellaria longipes** Goldie.

2/VI: A big tuft with year-old broad leaves and young leaf-buds in the axils. 18/VI: Fragments of elongated stolons with young leaf-buds in the axils of the old leaves. 3/VIII: Condensed broad-leaved shoots without flowers; they have been covered in moss tufts.

Fam. **Cruciferæ.**

21. **Cardamine bellidifolia** L.

20/VI: A single specimen in full flower.

22. **Draba alpina** L., var. **glacialis** (Adams) Dickie.

18/V: Winter-stage; old rosettes. 20/VI: In full flower. 11/VII: In flower.

23. **Draba fladnizensis** Wulf.

23/V: Winter-stage; old rosettes. 20/VI and 11/VII: In flower and with year-old fruit-scapes.

24. **Draba hirta** L., var. **arctica** (J. Vahl) S. Wats.

3/VIII: A low coarse specimen with unripe new fruits and year-old fruit-scapes.

Fam. **Oenotheraceæ.**

25. **Epilobium latifolium** L.

23/V: Year-old dead shoots. 20/VI: Nearly fully developed new shoots with flower buds.

Fam. **Papaveraceæ.**

26. **Papaver radicatum** Rottb.

Common everywhere. 18/V and 3/VI: Year-old withered leaves and scapes. 18/VI: Young new leaves and old scapes. 20/VI: Flowering just beginning. 11/vii and 20/vii: In full flower and with year-old scapes. 3/viii: The petals have dropped; empty year-old capsules.

Fam. **Polygonaceæ.**

27. **Oxyria digyna** (L.) Hill.

11/vii: Medium sized (12 cm) specimens with unripe new fruits and year-old fruiting scapes. 3/viii: Low specimens (4 cm) with unripe fruits.

28. **Polygonum viviparum** L.

11/vii: Medium sized specimen; most of the bulbils dropped. The underside of the leaves rather hairy.

Fam. **Ranunculaceæ.**

29. **Ranunculus sulphureus** Soland.

11/vii: Small specimens (ca. 5 cm) in full flower. 3/viii: Flowering over and fruits developing.

Fam. **Rosaceæ.**

30. **Dryas integrifolia** M. Vahl.

18/v: Winter stage.

The specimens from Zigzagdalen are quite typical *D. integrifolia* with regard to the dentation of the leaves etc.

The two nearly related species, *D. octopetala* and *D. integrifolia*, which mostly exclude each other as regards their areas of occurrence, are both present in the northernmost parts of Greenland, and intermediate specimens occur here. Hence we have the diverging records, some authors giving *D. octopetala*, others *D. integrifolia* from the same or closely neighbouring regions. Thus H. G. Simmons (1909, l. c.) has referred all records of *Dryas* from Northwestern Greenland to *D. integrifolia*, taking var. *intermedia* Nath. as a form of this species. In North-eastern Greenland on the other hand *D. octopetala* is the commoner species and *D. integrifolia* the rarer one. Kruuse (Medd. om Grønland, XXX, 1905, p. 148) reports *D. octopetala* (in several forms) from his whole area and *D. integrifolia* (which he regards as a subspecies) only from a few places — all situated in the inner parts of the fjords. Ostenfeld and Lundager (Danmarks Ekspeditionen, Medd. om Grønland, XLIII, 1910, p. 28) also give *D. octopetala* as the common species in Germania Land and the other localities investigated which all are near or comparatively near to the coast; only the specimens from Hyde Fjord belong to var. *intermedia* Nath., and on closer examination now I should prefer to put them under *D. integrifolia.*

Thus it seems that the true *D. integrifolia* in the northernmost part of Greenland is rather rare and restricted mostly to the heads of the fjords.

31. **Dryas octopetala** L., f. **minor** Hook.

23/v: Winter stage. 20/vi: in full flower. 3/viii: in beginning fruit-setting.

The specimens from 23/v are good *D. octopetala* f. *minor*; those from 20/vi are a mixture: 1) some are good *D. octopetala* with regard to dentation of the leaves, but hairy on the upper side of the leaves (f. *hirsuta* N. Hartz) or lanate on the upper side (f. *argentea* A. Blytt), 2) others are intermediate between *D. octopetala* and *D. integrifolia* and must be referred to var. *intermedia* Nath. The specimens from 3/viii agree with the last mentioned and must also be named var. *intermedia*. It is remarkable that in the area where *D. octopetala* and *D. integrifolia* both occur, the variability of the species is much greater than elsewhere and that this variability concerns not only the distinctive marks between the two species, but also other characters, e. g. hairiness.

32. **Potentilla emarginata** Pursh.

18/vi: Winter-stage with old leaves and flower stalks; new leaves only as small buds (locality correct?). 20/vi and 11/vii: Low specimens in flower and with year-old flower stalks.

33. **Potentilla nivea** L.

18/v: Winter-stage; condensed specimens with old leaves and flower stalks; also as "pillars". 20/vi: Flowering just begun, old flower stalks present; also as "pillars". 3/viii: Fruiting specimens.

The specimens from 18/v and 20/vi belong to var. *pinnatifida* Lehm., while those from 3/viii are more like the typical *P. nivea*. In the first two collecting places wind-affected specimens forming compact "pillars" (with a few living leaves in the top of the erect standing axis covered densely with dead leaves) were found, like those mentioned and figured by Ostenfeld and Lundager (l. c. p. 27 and plate V). The "pillars" collected during the Danmark Ekspedition were referred to *P. pulchella* R. Br., but on repeated examination I have found that some of them belong to *P. nivea*, as also those here mentioned.

34. **Potentilla pulchella** R. Br.

18/vi: A medium sized specimen with large year-old leaves and new leaves in buds. 3/viii: A low specimen (f. *humilis* Lge.) with rip-fruits.

Fam. Salicaceæ.

35. **Salix arctica** Pall.

18/v and 23/v: Branches in winter-stage and with empty year-old capsules. 3/vi: Branches, dropping the scales covering the catkins. 20/vi: Female specimens with flowering catkins and half developed leaves. 3/viii: Leaves fully developed, broadly ovate in some specimens, ovate-lanceolate (f. *groenlandica* Lundstr.) in others.

Fam. **Saxifragaceæ.**

36. **Saxifraga cernua** L.

18/vi: Year-old flower scapes and new leaves. 11/vii: In full flower; not only the terminal flower developed, but also the terminal flowers of the branches; numerous small bulbils in the axils.

37. **Saxifraga flagellaris** Willd.

20/vi: Small, low (1—2 cm) specimens in flower. 11/vii and 3/viii: Medium sized and coarse (7 cm high) specimens towards the end of the flowering period.

38. **Saxifraga groenlandica** L., var. **uniflora** (R. Br.) Simmons.

20/vi: Flowering beginning. 11/vii: In full flower; scapes slender, flowers rather small.

39. **Saxifraga nivalis** L.

3/viii: A rather slender specimen; flowering nearly over.

40. **Saxifraga oppositifolia** L.

Common everywhere. 18/v and 3/vi: Winter-stage; year-old empty capsules. 5/vi: Flowering just beginning. 18/vi and 20/vi: In full flowering and with year-old empty capsules. 11/vii: Flowering over. 3/viii: Fruits half-ripe; year-old empty capsules still present.

IV. Gamopetalæ.

Fam. **Compositæ.**

41. **Erigeron compositus** Pursh.

20/vi: New young leaves and flowering buds present, but the scapes of the flower heads are not stretched; old scapes (1 and 2 years old) present, with empty heads.

42. **Taraxacum phymatocarpum** J. Vahl.

23/v: Very small specimen with young leaves and small flowering buds (locality correct?). 11/vii: Specimens with unripe fruits and still also heads in bud. 3/viii: Specimen with half and wholly ripe fruits (achenes).

Fam. **Ericaceæ.**

43. **Cassiope tetragona** (L.) D. Don.

23/v: Winter-stage. 18/vi: No flower buds to be seen. 20/vi: Flower buds present. 11/vii: In flower and some flowers already gone, year-old empty capsules. 3/viii: Flowering over, young fruits.

Fam. **Plumbaginaceæ.**

44. **Statice armeria** L., var. **sibirica** (Turcz.) Rosenv.

11/vii: Low specimens in beginning of flowering and with scapes with year-old fruits. Involucral bracts and flowers purple.

Fam. **Scrophulariaceæ.**

45. **Pedicularis hirsuta** L.

11/VII: A low (5 cm) specimen in full flower.

Bryophyta,

determined by A. Hesselbo.

3/VI. *Ditrichum flexicaule* (Schw.) Hampe, and *Encalypta commutata* Br. Germ.

18/VI. *Pohlia cruda* (L.) Lindb., *Bryum oenum* Blytt, *Bryum crispulum* Hagen (♀), *Timmia austriaca* Hedw., *Bartramia ityphylla* Brid., and *Lophozia bicrenata* (Schmidel) Dum.

3/VIII: *Racomitrium canescens* (Hedw.) Brid. (very common), *Polytrichum alpinum* L., *Polytrichum pilosum* Neck., *Tortula ruralis* (L.) Schwgr., *Pohlia cruda* (L.) Lindb., *Bryum ventricosum* Dicks., *Encalypta commutata* Br. Germ., *Grimmia apocarpa* (L.) Hedw., *Myurella julacea* (Willd.) Br. eur., and *Hypnum revolutum* (Mitten) Jaeger.

The Botanical Museum, Copenhagen.
11th June 1914.

XI.

EXAMINATION OF SOME ROCKS FROM NORTH-GREENLAND

COLLECTED BY KNUD RASMUSSEN AND P. FREUCHEN IN THE YEAR 1913

BY

O. B. BØGGILD

THE rocks are from the following localities.

1) Academy Land, boundary hills fronting towards the inland ice. Lat. 81°5′8″ N., altitude abt. 500 m. Of the samples collected, several consist of a light greyish-red sandstone, one is a very fine-grained, reddish-grey glauconitic sandstone and one a very fine-grained, highly metamorphosed diabase.

2) Zig-Zag Valley, near Danmarks Fjord, Lat. 81°15′ N., altitude 285 m. A piece of fine-grained diabase.

3) Zig-Zag Valley; Lat. 81°10′ N., altitude 300 m. A piece of fine-grained diabase, which according to sketch on label forms horizontal strata with steep face at the top of the hills.

4) Peary Land. A piece of fine-grained grey sandstone, which on microscopic examination reveals a highly impure consistency, containing, besides quartz, some glauconite and a quantity of calcite, frequently forming distinct rhombohedra.

5) Solid rock behind Gneisnæs, altitude 312 m. Three pieces of light-red sandstone.

6) Gneisnæs, Heilprin Land, sea level. A piece of diabase.

7) Little Gneisholm in the Peary Channel, altitude 28 m. Two pieces of diabase.

8) Høje Island in the Peary Channel, summit of the island. A piece of coarse-grained diabase.

9) Navy Cliff, altitude 690 m. Some pieces of diabase.

10) Thulevarden, Game Land. Some pieces of diabase.

11) Western end of Watershed River, (glacier stream, Top of Cape Schmelck), altitude 365 m. A piece of metamorphosed diabase, colour red. Under the microscope it reveals a structure like that of fine-grained, porphyritic diabase, but is transformed throughout, both the phenocrysts and the ground-mass, to quartz.

12) North side of Bierings Land; two pieces of red sandstone (altitude 920 m.) and a piece of diabase (altitude 940 m.)

13) Bierings Land, opposite Bieringsvarde, altitude 630 m., (not at the summit). Some pieces of diabase.

It will be seen from the foregoing that the rocks throughout this extended tract of country are of fairly uniform character, there being only two different sorts, viz. sandstone and diabase, each of which appears to be distributed throughout the whole region. The fact that no sandstone was brought home from the two places in Game Land where diabase was found may possibly be accidental. The comparatively small variations between the individual occurrences of diabase and sandstone, as shown in the list, are of no importance as regards the general view to be obtained of the geological character of the country. Where both rocks occur at the same locality, it would seem that the diabase forms strata above the sandstone.

In the absence of fossil finds, we can only endeavour to conclude, from examination of the rocks themselves, to which formations they belong. The large amount of red sandstone found suggests the Devonian, which in these regions is generally seen to have developed in this manner. The nearest occurrences known are Kaiser Franz Joseph's and King Oscar's Fjords on the one hand, and King Oscar's Land west of Ellesmere Land on the other. In both these places the formation consists chiefly of red sandstone, and mention is also made of diabase in veins, not however, in layers. The Devonian formation in these places lies for the most part in undisturbed position.

Another formation to which the rocks here in question might reasonably be ascribed is the Cambrian. This is found on the Bache Peninsula, western side of Smith's Sound, in the form of slightly sloping layers of sandstone, alternating with diabase, having a total thickness of abt. 250 m. As regards the colour of the sandstone, nothing is stated. To this should also possibly be added the strata found on the Greenland side between Cape York and Smith's Sound; various rocks have been described from here, but Kane, however, mentions red sandstone, surmounted by a deposit of trap rock as the principal formation in these regions. Unfortunately, no fossils have been found here, so that the age of these strata cannot be accurately determined, and they have also been ascribed, by scientists who have had occasion to observe them, to different formations, from the archaic to the tertiary.

It will doubtless be impossible, from the data here given, to state anything definite as to the age of the formations found in the regions visited by the expedition. Various features would seem to suggest that they should be assigned either to the Cambrian or to the Devonian; it is by no means impossible, however, that they may be found to belong to some other period.

XII.

REPORT OF THE FIRST THULE EXPEDITION

BY

P. FREUCHEN

SCIENTIFIC WORK

Introduction.

The Leader of the expedition has already pointed out, in his introductory report, that it was no part of our plan to explore the inland ice, this being, in our case, merely a route to be followed, not a goal in itself. I take this opportunity of emphasising the fact, in order that our scientific observations may be judged accordingly. I am fully aware that such observations with regard to meteorological and glaciological conditions etc. as we have been able to make must therefore necessarily fall short of what might be desired. Possibly, however, they may yet be of some slight value as a contribution towards the study of natural features in the greatest desert of ice at present known, in which case, the object with which they are published will have been attained.

Zoology.

On a sledge trip of so considerable length, it is obviously necessary to reduce the loads to an indispensable minimum. In our case, where the double journey to and from our field of operations covered 1000 kilometres over the inland ice, the transport of heavy preparations was out of the question, and the zoological collections were in consequence practically restricted to insects. Under such circumstances, the observations of an expert zoologist would naturally have been more valuable, as well as more numerous; my notes were of necessity confined to such birds and mammals as I was able to determine with certainty. Insects, larvæ etc. were merely collected and labelled as well as possible. In several cases I have been assisted by Knud Rasmussen and the other members of the party, who were well versed in the ornithology of their native country.

Of mammals, 7 species were observed, and tracks of 3 others found.

Observed:		Tracks or other good sign seen of:
Musk ox	Fox	Bear
Hare	Wolf	Reindeer
Lemming	Ringed seal	Greenland Whale
Stoat.		

Of birds, 13 species were observed, and tracks of 3 others seen.

Observed:		Tracks or other good sign seen of:
Snow Bunting	Barnacle Goose	Greenland Gyrfalcon
Redpoll	Eider Duck	Mallemuk (Fulmar)
Ptarmigan	Ringed Plover	Snowy Owl
Turnstone	Red-throated Diver	Longtailed Skua
Sanderling	Lapland Bunting	
Tern	Arctic Tern	
Glaucous Gull.		

1. **Musk ox.** *Ovibos moschatus.*

The expedition was from first to last equipped as for the sledge trips we were accustomed to make in our own country about Thule, i. e. in Eskimo fashion, the food of both dogs and men consisting of game procured on the way. We had here counted on musk ox, and were by no means disappointed, killing 84 in all, which number we could have increased considerably had it been necessary. The fear expressed by certain writers, including so eminent a scientist as Herluf Winge, that the musk ox should be in danger of extermination, would seem to be somewhat exaggerated; at any rate, there is doubtless reason to believe that the danger is by no means imminent. Pearyland is for the most part free from ice, and numerous expeditions have already had occasion to note that the musk ox are found there in astonishing profusion, their numbers being far beyond what might be expected in view of the sparseness of vegetation. A country so distant and inaccessible as this forms in itself a natural preserve, a "National Park", where the percentage killed by an occasional expedition may doubtless be regarded as insignificant. In the Eskimo kitchen middens at Independence Bay we found bones of musk ox, a fact which shows that they must have been hunted in former times, without having become exterminated as yet, although the Eskimos would certainly never have considered the question of protective measures.

I should here observe, however, that the musk ox have not everywhere been able to survive the systematic hunting to which they are subjected by the Eskimos. That they should have been exterminated in the Arctic Eskimos' own district is not remarkable, when we consider the small extent of that country; of late however, since the reindeer have become to all intents and purposes extinct there, on account of a succession of winters with "skarresne"[1], the natives have begun to make excursions into Ellesmere Land, where the musk ox are already very scarce, in order to obtain sleeping furs. In 1912, having discovered

[1] "Skarresne" — a thin and brittle crust, which forms upon the snow under certain atmospheric conditions.

a good sledge route, they even made their way across to Axel Heibergs Land, and killed 55 head, and it is hardly likely that this journey will be their last. Moreover, some half-dozen families have taken up their winter quarters at different places in Ellesmere Land, — possibly even in North Devon (Cape Sparbo).

As far as Peary Land is concerned, the musk ox there are safe enough for long years to come. From the wolf, which is generally regarded as their most dangerous enemy, they have probably little to fear; at any rate, as soon as they have passed their first year. The well-known square formation which they adopt when attacked is a practically impregnable defence; we have at least seen cases where our own dogs, accustomed as they were to dealing with bears, found themselves powerless against musk ox, even when outnumbering them by 20 to 3. And while the wolves may doubtless be supposed to be better equipped for the contest than our dogs, they do not in all probability operate in large packs.

Even when alone, however, the musk ox evinced no fear of the dogs, as long as they could reach a rock or cliff to guard them against any attack from the rear. We have also known a solitary musk ox, when tackled on an open plain, take up its position in the middle of a rushing river, where the depth and swiftness of the water rendered it difficult for the dogs to move — so much so, indeed, that the attempt cost one of our beasts its life. A musk ox can gore a dog, ripping its body from end to end, or toss it to such a height as to disable it in the fall.

The musk ox are swift runners, a fact which has been disputed by various writers. The dogs cannot overtake them, at any rate at the start, when they dash off to seek a suitable position where they can form square — the top of a hill, for instance — or other natural protection. And when they make a sortie, the dogs are frequently unable to escape: one of our dogs was gored from behind in this way, and received a wound which rendered it helpless for days. The musk ox do not, however, always exhibit the same amount of energy in resisting attack: this depends, perhaps, to some extent upon their estimate of the danger.

I am unable to say whether they feel any severe pain on being hit: I have never seen them give up the struggle until physically compelled. I have twice had the misfortune to break one of their forelegs with a bullet: in both cases the beast appeared to forget the injury between each step and the next, as it continued to tread with the wounded leg until it fell. The slight growl or snort which they give from time to time is not, as far as I can see, induced by wounds or pain.

Frequent records have been made as to the finding of dead musk ox "killed by wolves", the correctness of which it is perhaps not easy to dispute. I may nevertheless observe that it will doubtless be a matter of considerable difficulty to determine whether the wolves had commenced operations before or after death of their prey. One thing is certain; musk ox are frequently killed in rutting time by rivals of their own species. A skeleton was found in Adam Bierings Land, with the skull split along the sagittal furrow between the horns, the damage having evidently been occasioned by the force with which a couple of fighting bulls dash against each other (*vide infra*). The battle is here to the strong, and the weaker falls. This moreover, explains the fact that the leader of a herd may be able to maintain authority as such even after losing the greater portion of its horns. Some degree of skill in fence, besides sheer swiftness and force of weight and bulk is also exhibited, however; we have on several occasions found musk ox with great deep wounds in breast and shoulder, evidently caused by the long, sharply pointed horns, which they use to so good effect against the dogs. It might well be that the wolves would prefer to wait for the death, or at least disablement, of such a foe before coming to close quarters. The Eskimos assert that the wolves bring down reindeer by biting at the anus until the beast bleeds to death: I should be loth to believe that this could be done in the case of a musk ox, where the long shaggy hair forms a protection which would be difficult to work through with the teeth unless the victim were already incapable of resistance.

With regard to the time at which the musk ox first made their appearance in East Greenland, this has long been an open question, and will perhaps never be altogether solved: our expedition has, however, furnished one or two facts of interest in this connection.

As to how long the Eskimos and the musk ox have lived as neighbours in Independence Bay I may mention that among the tent rings which we discovered at either side of the entrance to Jørgen Brønlunds Fjord — places where there is now, at any rate no lack of either musk ox or fjord seal — we found bones of both these animals, and in such quantities as to prove distinctly that both species must have played an important part in the domestic economy of the former inhabitants. I may here refer the reader to KNUD RASMUSSEN's description of the Eskimo remains: it should be noted, however, that these were evidently of far more recent date than all such similar remains as I had previously seen on the Danmark Expedition. The wood, for instance, was found when sawn through to be almost like new a few millimetres from the outer surface. On the other hand, the preserving influence of the climate, with its slight rainfall, should be borne in mind: PEARY's and ASTRUP's tracks on Navy Cliff, for instance, stood there as fresh as though but a few days old.

In contrast to these fresh bones found among the Eskimo remains, we found at several places in Adam Biering's Land, and also in the Navy Cliff country, skulls of musk ox in a state of advanced disintegration; the horns had disappeared, only the bony core remaining. The teeth, and all the thinner and finer bones had gone, leaving only the thicker and heavier parts. In some cases these skulls were found overgrown with a thick layer of moss, tufts of grass, or *Saxifraga oppositifolia* — and were thus of very antiquated origin.

On the 10th May we reached the land behind (to the north of) Danmarks Fjord. Here the ice fell away in a sheer cliff with projecting brow, so that we were forced to lower our gear and ourselves down with rope and tackle. As soon as we got down, we came upon musk ox dung on the moraine: it was winter dung, but not from that year.

On the 12th May we shot a solitary bull in the Zigzag Valley, and on the same day a herd of eight, consisting of 3 bulls, (one old and two younger), two young cows and 3 yearling calves. The country was entirely free from snow. In the upper part of Zigzag Valley musk ox tracks were plentiful everywhere. The beasts were all, with one exception, in very poor condition. Vegetation very scanty.

On our way down through the Zigzag Valley we saw no musk ox, nor any tracks of same, the country now being covered with deep snow.

24th May. Shot a solitary bull close to the mouth of the Zigzag River in Danmarks Fjord (Sjællandssletten). It was very old, with teeth and hoofs much worn; in spite of this, however, it was not very big, and in but poor condition, the meat very tough.

26th May. On this day I found tracks of 3 musk ox not far away; the animals had evidently come down from the hills by way of a ravine, and moved outwards towards the coast along the lower slopes. They had moved for the most part in single file, but with frequent halts in order to graze. The snow had packed fairly hard, covering everything, and they had cast it aside with their feet; there were frequent traces of their having used their horns, though this may have been merely in play. After a time I lost the tracks, owing to the driving snow, and returned to the tent. Knud Rasmussen then drove out and found them again, some distance farther off. They had then in several places trampled the snow down in great patches, probably in play, and had been racing aimlessly round some gravel mounds near the shore. When he approached, they dashed up to the top of one of these mounds and took up a position there. The 20 dogs which formed the sledge team then surrounded them, and it was some time before it was possible to fire. One of the dogs was ripped up, and several others were wounded. A principal part in the defence was taken by one very old ox, whose horns had both been knocked off, so that only the bony core remained. All three stood with their heads turned outwards, thus guarding against any attack from behind. From this position they sallied out, one at a time, to attack the dogs, dashing forward some 12—20 metres and then retiring on their old position, always however, stepping backwards so as to face the attack all the time.

The herd consisted, as already mentioned, of three bulls, one very old, the two others young: one of these latter was in fairly good condition, the other two were poor. The stomachs were quite full, as is always the case in every musk ox I have seen. On account of the season, the contents of the stomach was dry, of a consistency somewhat resembling that of dry horsedung, the dung itself forming pellets; in summer, on the other hand, when grass and leaves are fresh, the contents of the stomach forms a thick, semi-fluid mass, with a fresh, acid taste, and the dung is then found in caked form, very much like that of ordinary cowdung at home. The contents of the stomach consisted mainly of *Dryas* and *Salix arctica.*

Even when very thin, the musk ox are almost always found to have a considerable deposit of suet at certain places, viz: on the inner side of the *sternum*, interwoven in the *pleura parietalis*, in the *epicardium*, in the *omentum*, and in part of the *pelvis minor.* Here there will invariably be found a layer of suet at least one centimetre thick, on the inner side of the the *membrana obturatoria* and adjacent parts. Both *vesica* and *rectum* have also a fairly thick layer of suet interwoven in the *tunica muscularis* and covering the same. When the animal grows fatter, the suet collects in lumps the size of coffee berries all along the outside of the intestine. Round the kidneys also, and behind the vessels and nerves about the eyes, suet is always found. The suet in these places differs from the back suet etc. in fat beasts by its almost entire freedom from membrane, and melts down without leaving any connective tissue.

On the 28th May I found the year-old carcase of a bull, lying on the shore of a little peninsula in the Danmarks Fjord; it had not, however, been touched either by foxes or wolves. The dogs devoured it eagerly.

On the 31st May, moving out of Danmarks Fjord (along the north coast) two musk ox were sighted, both bulls, on the slopes of the hills towards the coast. When shot, they were found to be in far better condition than those hitherto seen. Vegetation at the place where they were found was very scanty.

Farther out from Danmarks Fjord the hills disappear, giving place to plains of clay and gravel — not good country for musk ox, — with nothing in the way of shelter.

On the 2nd June, as we moved over the ice, we saw a musk ox track in the snow on the shore: it ran northwards, however, going up inland, and we did not follow it.

On the 3rd June we reached the ill-fated summer camp of MYLIUS ERICHSEN. Went up some way inland, but found the country almost void of game. Flat clay land, with gravel hills. Compared with other places on the way we here found but few tracks of musk ox, all those seen being old. It is evidently the most unfavourable place on the whole journey at which the unfortunate men were forced to take up their summer quarters. Close by the camping place we found the horn of a heifer.

The country round Cape Rigsdagen and as far as Hagens Fjord in Independence Bay was of the same character.

From Hagens Fjord inwards, the southern coast of Independence Fjord is extremely narrow, consisting only of a series of steep hills, crowned by the inland ice, and thus leaving no room for such growth as is necessary for the existence of land mammals.

On the 5th June we went across Independence Fjord to that part of Peary Land noted on the map as Melville Land. The country here was low-lying, but comparatively fertile, richly watered spots occurring frequently between the gravel mounds and flat clay hills: at these places there was abundance of grass, making almost a meadow land. While still on the ice we sighted two musk ox some distance up inland: on the way after them we passed a solitary bull. The two had lain down in one of the small hollows already mentioned, where the ground was very moist: their fur was muddied all over with the clay, and their feet sank in up over the hoofs. They lay about 30 metres apart, but closed in together at once when we loosed a couple of dogs which we had brought with us. They appeared to be drowsy, and disinclined to fight. Both were bulls, and in fairly good condition. While we were flaying them, 4 other bulls passed some little distance away.

On the 7th June, on the way to Jørgen Brønlunds Fjord, we walked inland for over thirty hours without finding more than a few single tracks, and these very old. The country is barren, moraine gravel with very little vegetation.

8th June. Some few kilometres east of Brønlunds Fjord the country looks much more promising, sloping down from the heights inland, richly watered by rivers, and with plenty of vegetation. Close to the coast, near a little lake, we found a herd of musk ox, numbering twelve head, and shot them all. There were four cows with sucking calves, three of them yearlings, the fourth born in the spring of this year, two heifers and two bull calves. The finding of yearling heifers still unweaned — we found such repeatedly later on — suggests that the cows bear at most but once every other year, which would also appear likely in view of the small number of calves always found in a herd. All the four cows had abundance of rich good milk in their udders: the milk was pleasant to the taste. The fur has already begun to grow thin, the winter wool being gradually shed. On the following day the flesh of all the animals was green and smelling, as they had not been flayed — except so much as was necessary to procure food for the dogs — being merely slit across the belly. The flesh was perfectly grass-green in places. The little calf, which could not have been more than about a month old, had a few *Salix* leaves in its stomach.

A little distance away three bulls were grazing, but soon moved off.

On the 11th of June, at the same place, a herd came moving down towards us from the hills inland, they neared us slowly, grazing as they came. The herd consisted of 6 in all, two cows, a young heifer, two young bull calves, and a yearling bull calf. As we approached them, we were first discovered by the five of them, the sixth grazing on a little distance away. Not until we had begun to fire, and the dogs to give tongue, did it take any notice of us, and then, despite the fact that we stood between it and the rest, it dashed up to take part in the defence, apparently never thinking of flight. The calf was pushed in to the centre of the herd, and the old cows took the lead. Both these had milk in their udders: on commencing to suck one of these, I noticed a peculiar taste, and on examination, found that the milk was clear, like water, though plentiful in quantity. The milk of the other was rich and good.

Their stomachs were all well filled: as far as we could see they had eaten only *Salix arctica*, disregarding all else.

On the 13th June we found a dead musk ox floating in the narrow channel between the ice and the land. The animal had probably been drowned in the autumn, in trying to get out on to the young ice. The carcase was only slightly decomposed, and had not been gnawed by wolves or foxes. Next morning, while at the same place (west of Brønlunds Fjord) 8 musk ox came down towards the tent. We shot three of them; one bull, one cow, and a yearling heifer, all in fairly good condition. We did not loose the dogs at them, and the rest of the herd went on calmly grazing after we had brought down their three companions.

On the 16th June, farther up in Independence Fjord, we sighted from where we were on the ice three musk ox and later one more, possibly belonging to the same (large) herd, moving eastward.

At the base of Independence Fjord the diabase breaks out through the sediment; the coast becomes steep, and vegetation extremely scarce. Only a few tracks of musk ox were here seen; the animals doubtless only pass here on their way to other grounds.

In Adam Bierings Land we found everywhere many tracks of musk ox.

On the 25th June we shot three old bulls in Valmuedalen, they were fairly fat, and had already shed a good deal of fur.

On the 29th June, not far from the same place, we shot a solitary bull. It was a huge beast, and very wild, turning furiously on the dogs, and taking up a position in a rapid river, where the water came up to its belly.

On the 2nd July, some 15 kilometres farther north along Valmuedalen, we shot 13. They were grazing in three parties, first two bulls alone, then two more a little way off, and farther again a larger group, of 5 cows, 2 young bulls and 2 calves. Before loosing the dogs, Knud Rasmussen went straight up to the two bulls, to see what they would do. The one which sighted him first started up in fright, and made as though to run, but as it turned, it happened to knock against its companion. The latter became enraged at this, and struck out in turn, with the result that a regular battle took place between the two. Both moved back, stamping and snorting, in opposite directions, until they were some 20 or 30 metres apart, whereupon they dashed at each other in full gallop, head down at the charge. Then they met, with a mighty shock and a furious crash. Retiring again, they repeated the charge several times, until one acknowledged defeat by moving aside so as to avoid the other. The victor then desisted from further attacks, but seemed, by various movements and gestures, to be exhibiting scorn of its conquered foe. Throughout the whole of this passage of arms they had entirely forgotten the presence of an unknown being, to wit, Knud Rasmussen, close by. At last, when their own differences had been settled, and he walked up to them, they turned in a fright and trotted off to the cows. Once here, however, they forgot their common enemy once more, and instead of giving the alarm and taking to flight, they calmly commenced grazing anew. At this point we loosed the dogs at them, and soon after we had brought down the whole herd.

Some little distance from this spot we came upon a skeleton, the skull of which had been split in battle. The force with which two such bulls dash against each other is enormous, and it takes all the thickness of the skull, and the helmet-like protection of the horns, to stand the shock.

Game Land, the country at the base of Independence Fjord, twice visited by Peary, is so called solely from the abundance of musk ox. The land is entirely surrounded by the inland ice, which runs out into the fjord, locking it in. It consists partly of large moraine-covered areas to the south and west, and partly of high hills, furrowed at every turn by deep ravines and valleys, with rushing torrents of water. Down in the valleys vegetation thrives, as the ground is moist and sheltered. All the remaining country, however, consists of gravel and stones with no plant life at all. The musk ox therefore often prefer to keep to the lower ground; along the backs of lakes and rivers one finds everywhere trodden paths, levelled and trampled hard, with the grass worn away. On either side of these paths, the grass grows luxuriantly, being manured by the passing beasts. We found numerous skeletons and fragments of same in the neighbourhood of these paths, for the most part in small open spaces such as would afford a good duelling ground. We found their dung also, wherever we went.

Peary's successful hunting in this country is well known. In "Musk Ox Valley" on the way up to his cairn, we found skeletons of cows and calves which he had killed. The skulls, by the way, had still some bleached remains of hair round and between the horns.

On the 14th July, we reached the land and camped out near the moraine. We then divided into two parties and set out in search of game. Our party soon sighted a solitary bull in a valley; while moving up towards it, however, we came upon two others, likewise bulls, a kilometre or so away. One of these distinguished itself by disregarding the dogs completely, and charging down upon us instead, forcing us to take shelter behind a rock. Both had almost shed their coats, the loose grey winter hair hanging in long tufts behind them. Both had a layer of suet 1 cm thick along the back. The one which we had sighted first, and which we subsequently shot, was in poorer condition, and had shed less of its coat. Contents of stomach a thick fluid, as the grass is now fresh.

On the same day the other party shot 8 head in all, 5 cows and 3 calves, at a place some 5 km distant. They had also seen another herd of seven, and later a single ox.

On the 16th July, on our way to the camp, we passed close by the two bulls we had first killed, and saw two others calmly grazing a little way off. Close to the camp we came upon a herd of seven; 3 old cows, 3 yearling heifers, and one calf born the same year. Having only sufficient cartridges for five of the beasts, we were obliged to kill the calf and one of the heifers with our knives, as they would not be driven off. The calf attacked me angrily when I tried to drink its mother's milk. This calf had just commenced to shed its foetal hair. The mother had not shed nearly so much as the others, which trailed long streamers of winter hair about them, these giving a most fantastic appearance, especially in a wind.

While we were flaying these, a solitary bull came down towards us, but was soon driven off.

All these animals had been seen and shot in the same valley, to which we now brought down our tent and sledge, availing ourselves of a jutting arm of ice which ran out into it. The lower end of the ice was covered with dung, so that one could not move a step without treading on it. A path ran through the valley, as good as any through the woods at home; on reaching the lake, a narrow piece of water about 20 km. long, it branched off into two, one path following either side. This valley, by the way, we called "The High Road" on account of the constant traffic. Other paths ran out from adjoining valleys and ravines, making connection with the main thoroughfare. These paths will last for years, when once stamped hard; I have seen several trodden by reindeer at the base of Olriks Bay, still clear and good, though the reindeer have not been numerous there for ten or fifteen years.

We pitched our camp in an adjoining valley.

On the 17th July we shot three bulls, each moving by itself, about 1 km from the tent. One of them had an old fracture of the *sternum*, the *proc. ensiformis*, which is cartilaginous, being almost separated from it. The fracture had evidently been made by a thrust of some obtuse body (a horn). All three had about 1½ cm of suet on the back.

On the 18th July two full grown cows and a calf passed through the valley.

On the 19th July a bull came down towards us and lay down to sleep in the shadow of a big rock in the middle of the valley. After having slept for five hours it advanced towards the tent; we fired, and it took to flight, dashing off through the dogs, and faster than they could follow. At last it halted at the entrance to a narrow gulley, where it faced about, barring the way. Making a sudden sortie, it overtook one of the dogs and gored it severely. We killed it at last, and while we were flaying it, six musk ox came grazing down towards us.

On the 20th July, 11 musk ox came down towards the camp, one old and very big bull a kilometre or more ahead of the rest. We fired and wounded it, whereupon it turned and made off towards the rest of the herd, taking no notice of the dogs. Before it could reach the others, however, we brought it down. The remainder, 7 big cows and 2 calves, appeared in no way disturbed by our flaying of the first victim, but grazed calmly on, and lay down to sleep close by. The last of the herd, a bull, was likewise about 1 km behind the rest.

From the 21—24 July I was out on foot, visiting Peary's and Astrup's cairn on Navy Cliff. On the way I saw altogether 13 musk ox; 1 bull, 4 cows and 1 calf, 5 full grown beasts, 2 bulls. The last-named were sheltering under the lee of some big boulders, as a violent storm was raging down the valley. I came up within 6—8 metres of them but they did not heed me.

During our absence, the others in camp had shot an old bull, in very poor condition for the time of year, and with fresh wounds, evidently inflicted by the horns of another, on neck and shoulder. Four bulls lay nearly all day sheltering in a crevice of the cliff just opposite the tent, out of the wind.

26th July three bulls passed through the valley, one by one.

27th July. One bull passed by the tent.

On the 28th July we shot 2 bulls, one very old and thin, the other younger and very fat.

29th July. One bull passed close by the tent. Two others, likewise bulls, came down towards us, but on reaching a spot where we had recently flayed some others, one carcase still remaining, they checked, and dashed off down a side valley.

On the 30th July two bulls came past, and later on we shot a young bull by itself. In the evening a bull came down and grazed a couple of hundred metres from the dogs, the latter being then tied together. On the same day we sledged up with some dog-feed to the upper ice; on the moraine here we saw two bulls.

On the 1st August we scared a wolf close by the tent; it ran up towards the crevice in the rock before mentioned, coming suddenly upon a musk ox, a bull, which was lying asleep behind a boulder. The beast started up from behind the sheltering rock and set off down a ravine in chase of the wolf, both being then lost to sight.

On the 2nd August two cows, each with a calf from the same year, came down towards us. We went up to them, leaving the dogs behind, and shot first one cow, on which the other turned to protect both calves, and ran off with them some little distance. Then it stood at bay, still covering both the calves. We shot the calf belonging to the cow already killed, and still the second cow did not move. At last, when we commenced flaying, it dashed off with its calf. The calf we had shot had an even layer of suet all over the body, not confined to certain particular places as in the case of the grown animals. The foetal hair had not yet fallen off, but was now faded, reddish, and quite loose. Beneath this was a close covering of fine hair. The cow had completely shed its coat, and its hair was thin; milk rich and plentiful. A solitary bull approached, but moved off again on scenting blood.

All the musk ox here mentioned as seen in the "High Road" came up from the valley to the south. This latter runs almost due north and south, and lies higher than the "High Road", and closer to the inland ice. I should hardly imagine, however, that this regularity of direction points to any following of a certain route, on account of the slight extent of the country.

On the 6th August, when we were striking camp, a couple of musk ox were grazing close by.

On the 7th August, when camping near the edge of the ice (Thulevarden) we sighted 5 musk ox from the tent, 1-1-3.

On the 8th August we shot a young bull, near Thulevarden. It was fatter than any we had hitherto seen, the layer of suet being almost 3 cm thick all over the back. Two others were grazing with it.

2. **Polar Hare.** *Lepus variabilis glacialis sive timudus.*

We started out from the west coast of Greenland just about the time when the hunting season for polar hare is at its height, the skins then being thick and warm for the winter. They are used for stockings, and are doubtless the warmest material which can be found for the purpose. At Neqe, where most hares are found, they are extremely abundant. In the spring about 25 per day are shot or snared, without any appreciable effect on the stock; in addition to which foxes abound, and these probably also take their share.

Some six or seven of the sledge parties which escorted us part of the way out over the ice went out hunting hares in the country south of Peabody Bay, where they are said to be numerous.

On the 10th May we reached the east coast, i. e. the land behind Danmarks Fjord. Quite close to the edge of the inland ice we saw 15 hares, playing about in two groups. They were fairly tame, in contrast to those on the west coast, where much hunting is done. Shot five.

We saw no hares in the upper part of the Zigzag Valley, and the ground on either side of the watercourse we followed was flat and but ill-suited to hares, which prefer the hilly slopes.

22nd May. Saw a couple of hares on a little hill.

24th May. Two more hares as before. *Salix arctica* is more abundant here than in the moraine country (Sjællandssletten).

26th May. Shot two hares at the mouth of the Zigzag valley, where it runs down into Danmarks Fjord.

On the 27th May we were lying up in a snow hut out on Danmarks Fjord. A hare came running out over the ice, evidently intending to cross the fjord. The dogs sighted it, and set off in chase, whereupon it swerved out so as to pass clear of the camp, and then resumed its original direction. In the outer part of Danmarks Fjord and the whole of Mylius Erichsens Land we saw no hares, nor any traces of same. The flat clay country is probably not to their liking.

5th June. Reached Peary land. Shot one hare and saw several others. They are now beginning to shed their coats.

6th June. Made a long excursion up into Peary Land (see notes on musk ox). Saw a single hare, very shy.

7th June. Saw several more hares, which took to flight at long range. Farther up in Independence Fjord they are more common. Saw several every day, for the most part singly, or in small numbers at a time.

14th June. Shot two hares together at Cape Knud Rasmussen: the *uterus* of the one contained seven fully-developed young.

Shot a number of hares at Cape Schmelck, all singly.

20th June. Made a reconnaissance to Bierings Land and shot three hares which were feeding together. All three females, with milk, the latter fairly plentiful and pleasant to the taste. The young we could not see.

Some hares appear to be much tamer than others; at Cape Schmelck for instance, one came quite close up to me (about 3 metres away) while others found at the same place took to flight at long range.

27th June. Shot a couple of hares, at Vardebakken, both males.

In Adam Bierings Land hares are everywhere abundant. On the southern slopes of the hills, in the middle of the day, they are always to be seen round about.

On the 28th of June, as we were lying beside our camp fire at Nyeboes Bræ, a hare passed close by, with 4 young, (I am not quite sure of the number, as they dodge about so among the rocks; there may have been 5, or possible only 3) I tried to catch one of the young ones which crouched down until I almost touched it. Then followed a chase of ten minutes, during which it repeatedly checked and crouched, so that I dashed past it before I could stop. At the end of that time it became exhausted, and jumped down among some rocks, where I finally caught it. It was of the same colour as a Danish hare, but hardly half the size of a full-grown specimen. The stomach contained curdled milk and some few stalks of grass.

On the 29th June, in Valmuedalen, we saw a flock of 10 hares at night; they were feeding on the slopes which then faced towards the sun. Saw hares everywhere throughout the valley, and shot several. They are now fast shedding their fur. On the 10th July, the last day of our stay, I counted 24 at the foot of a hill, in two flocks.

In Game Land also the hares are everywhere abundant. Eskimos who have made excursions into Ellesmere Land — where the hares are so numerous that "the ground is lousy with them" as they say — are there obliged to hide their meat from the hares, as the latter will jump up on to the roofs of the huts and devour any meat which may be there. This phenomenon I have never seen referred to by any other writer: Knud Rasmussen has, however, on his journeys in Ellesmere Land, frequently noticed the same thing. We had also an opportunity of witnessing it ourselves here. It happened continually, when we had shot a musk ox, and left some of the meat to dry on the spot, or to be brought away later, that hares were found nibbling at it. I had also cut out the stomach of a hare, containing remains of meat, and intended to bring it home; unfortunately, however, the dogs got hold of it and devoured it.

On reaching the west coast on our way back, we saw a number of hares at Qaqujârssuaq, behind Inglefield Gulf, and shot four.

3. **Lemming.** *Myodes torquatus.*

All along the east coast, wherever we went, we found traces of lemmings. Immediately after our descent from the inland ice, as also on our way down through Zigzag Valley, we found their tracks in the snow; their frequency, as also that of the fox tracks far up in the country, and also of stoat tracks, would seem to indicate that the animals themselves must be extremely numerous. Both in Danmarks Fjord and in Independence Fjord we saw tracks leading out over the ice, away from land. At Cape Rigsdagen, we saw about a score of tracks running out over the sea ice in a north-easterly direction. The ice for the first two kilometres out from land was ground and piled up into heavy rugged masses; beyond this lay the level ice over which we drove. And it was here, on the level ice beyond the barrier, that we found the tracks of the lemmings, so that the animals must have managed to make their way over the piled up masses without getting out of their course, which led, as already mentioned, straight away from land, out towards the open sea.

On the 5th July, we reached Peary Land. Here, on a slope by the shore, which, facing south, had been thawed clear, we came upon one of their winter nests; there were several others close by. All over Peary Land we were continually coming upon their winter quarters, and tracks leading out over the ice. As usual, there were small heaps of excrements near each nest; we found also remains of lemmings everywhere, in the excrements of foxes, or in owl-pellets. A remarkable feature was the frequency with which we found whole skulls of lemmings, perfectly unharmed, the remainder of the skeletons, however, being nowhere to be seen.

The lemmings appear to be more numerous in Adam Bierings Land than at any other place we visited; Valmuedalen in particular was a favourite haunt of theirs, and we found many winter nests there. A number of small longtailed Skuas (*Lestris longicauda*) were also brooding there.

On the 28th of July, as I lay by the fire cooking, I caught sight of a lemming a few paces away; it slipped off among some stones, and reappeared again on a little hillock, where it sat upright on its hind-quarters watching me. Before I could manage to secure it, it had disappeared among the stones.

At Nyeboes Bræ, between Adam Bierings Land and Game Land, we saw many traces of lemmings.

In Game Land also the lemmings abounded. We found their winter nests, while foxes, Skuas and stoat also told of their presence. We did not actually see any, however. A couple of tracks were found leading away from Game Land over the inland ice.

4. **Stoat.** *Mustela erminea.*

At several places in the Zigzag Valley we came upon the characteristic tracks of the stoat, with the long jumps which it makes in loose snow. Here and there I found holes in the snow, with tracks leading to and from the same, which showed that they were the work of stoats. I have seen similar holes when with the Danmark Expedition.

On the 10th July, near Valmuedalen in Adam Bierings Land, we saw one of these animals, in its summer coat, in chase of a ptarmigan hen, which was leading it away from her chickens. I went towards it, but it disappeared among the rocks.

On the 15th of July we shot a male stoat, in brown summer dress, in the "High Road"Valley, Game Land. The body was unfortunately lost, however; we left it between some stones, to be called for later, but when we returned a couple of days later it had been taken by foxes. We had first sighted the creature at a couple of metres distance, as it sat in the crevice of a rock, with the upper part of its body projecting: when shot, it jumped up to a considerable height and fell back dead — exactly as does a fox when shot through the head.

5. **Arctic fox.** *Canis lagopus.*

Wherever we went, we found numerous traces of foxes, the animals themselves being sighted several times. On the west coast of Greenland, the foxes are mostly encountered near the shore, especially in the vicinity of bird cliffs; here, however, they appeared to be fairly evenly distributed throughout the country. The excrements, and the holes dug in the snow, indicate that the lemmings form their staple food. We often heard them barking in the distance. It is a remarkable fact that we found two dead musk ox entirely untouched, which would seem to suggest that they prefer lemmings to other food, and are moreover, able to obtain a sufficient supply.

On the 22nd July, on a barren stony hilltop near Navy Cliff, I saw a fox, brownish grey in colour, like the hares at home. It looked poor and thin in its summer coat, its tail hardly thicker than that of a rat. It followed me some little distance and then disappeared among the rocks.

6. **Wolf.** *Canis lupus.*

At two places in the Zigzag Valley, Knud Rasmussen found excrements of wolves, full of musk ox hair. Near the cairn at Cape Kronborg, also, which was built by Mylius Erichsen, we found excrements of wolves, of a later date than the cairn itself.

On the 5th July, when we were camping in Valmuedalen in Adam Bierings Land, a wolf came up to the tent in the night. We heard it worrying about among our gear outside, and went out to see what was the matter. At first we thought it was a white dog belonging to one of the teams, which had got loose, and began to call it by name. The beast took to flight on hearing us, and we then discovered the mistake, but by the time we had got our guns it was out of range. It was a small specimen, and wretchedly poor and thin.

Next day we saw it again, trotting coolly past the tent some 300 metres away, apparently not in the least concerned at sight of the camp. We had shot first one, then 3 and finally 13 musk ox at places close by: these, however, the wolf did not appear to have discovered as long as we were there.

On the 1st of August. while we were in the "High Road Valley", Game Land, I went out to fetch some meat from a musk ox we had shot near the tent. On the way I lay down beside the river to drink, and as I rose, there stood a wolf on the opposite bank, watching me. Again I mistook it for our own white dog, and spoke to it sharply. It was standing by the remains of a musk ox shot some days before; at the sound of my voice it ran off a little way and halted again. I was unfortunately unarmed, but the others up at the tent had also sighted the animal, and came running down towards it. At this it made off in earnest, and turned into a crevice in the cliff, where it disturbed a musk ox that was lying alseep there. The latter started up at once to attack the intruder, and the wolf fled down a gully close at hand. It was a big beast, but in poor condition and with a remarkable reddish-yellow coat. (At the same time a fine snow-white wolf-skin — male — was brought in to Thule from Ellesmere Land — Baysfjord).

7. **Ringed Seal.** *Phoca foetida*).

On the 6th April near Herbert Island we saw the two first seals of the year, at a spot where the ice was thin on account of the current. We also took a young one alive in a birth cave beside an iceberg close by.

On the 1st June we shot a seal on the ice in Danmarks Fjord. It was an old and evil-smelling male, with teeth much worn, and scars of many bites on body and limbs. The breathing hole through which it had emerged was bored up through two old ice floes. The "thin" ice over the crack was 2.18 m thick, the old ice more than 5.60 m (we had nothing longer with which to measure it). This was the only seal we saw in Danmarks Fjord.

Length down back 1.63 metres; from point of flipper to do. (across back) 1.11 metres. The stomach contained two fish bones and a quantity of intestinal worms.

In Independence Fjord we found seals in great numbers, for the most part at the base of the fjord, near the glaciers.

On the 5th June we saw two seals near the same breathing hole in the ice.

On the 8th June we saw first two and later three ringed seals, each group with but one breathing hole in common. By the tent rings on either side of the mouth of Brønlunds Fjord we found a number of bones of ringed seal; these animals had thus evidently formed the staple food of the now extinct Eskimos.

On the 9th June we saw a number of seals on the ice about here. Shot two, one male and one female, both with empty stomachs. The female very fat, had born no young this year (*mammæ* hirsute) length down back 1.60 metres. Male; length down back 1.68 m., from point of flipper to do. 1.09 metres. Both very light in colour. From this time onwards seals are to be seen everywhere on the ice.

12th June. Shot a ringed seal. Length down back 1.31 metres, from point of fore flipper to do. 0.87 metres. Nothing in stomach.

On the 13th June we passed several hundred seals on the ice; at one fissure there were 29, each close beside the other. Shot four, all males, nothing in stomachs. Measurements as follows:

I.	Length	down	back	1.47	point of	flipper	to do.	0.91 m
II.	—	—	—	1.60	—	—	—	0.98 m
III.	—	—	—	1.15	—	—	—	0.785 m
IV.	—	—	—	1.35	—	—	—	0.92 m

On the 14th June a ringed seal came up in the narrow channel which had thawed out between the ice and the shore. Very shallow here, the sandy bottom sloping gently down.

On the 15th June we shot three seals. One not measured; nothing in stomach.

Male,	length	down	back	1.35	flippers	0.89 m
Male	—	—	—	1.17	—	0.77 m

Shot one in the water same day; this one sank and was lost.

8. **Polar Bear.** *Ursus maritimus.*

Saw tracks of a bear a little to the west of Cape Rigsdagen, leading due north. The animal had come from the landward side.

9. **Reindeer.** *Rangifer tarandus.*

Both at Cape Schmelck and in Adam Bierings Land, as also in Game Land, we found numerous antlers of reindeer. All were more or less disintegrated, and overgrown with algæ. The animal itself is probably extinct here; our expedition being dependent upon game for food, we naturally explored the country pretty thoroughly in search of same, and could thus hardly have failed to notice tracks or excrements, if not the animals themselves, had any such still existed.

10. **Greenland Whale?** *Balæna mysticetus?*

On the 12th June, on the coast of Independence Fjord near Cape Harald Moltke, we found a number of bones, the remains of a whale, species uncertain. The coast land here is formed in flat levels, arranged terrace wise, consisting of raised beaches. The bones lay some 20 metres from the shore, at a height of about 10 metres. A number of them lay scattered about, some partly buried in the gravel. One was recognisable as a portion of a vertebra. This piece weighed about 20 kg. The whole find strongly resembles that made by the Danmark Expedition at Sælsøen.

Birds.

1. **Snow bunting.** *Emberiza nivalis.*

On the 9th April we saw the first snow bunting at Neqe, while halting there preparatory to making the ascent.

On the 9th May we reached land on the east coast, behind Danmarks Fjord; even while still up on the ice we could hear the snow buntings twittering on the land below. We found them everywhere we went, and they seemed more numerous here than at Smith Sound.

On the 20th May we saw a large flock of snow buntings in Zigzag Valley. Numerous everywhere.

On the 4th June we saw five of them flying across Independence Fjord.

15th June, Peary Land, base of Independence Fjord. Snow bunting more numerous here than anywhere hitherto seen.

On the 3rd July, in Adam Bierings Land, we saw for the first time birds of the young brood. These were then still in the downy stage, but on the 6th we saw one close by which was already able to fly.

On the 14th July, in Game Land, we saw several flocks of young birds flying; they were tired out, however, after a flight of about 20 metres, so that the dogs are able to run them down. Snow bunting common everywhere in Game Land.

6th August. They are now beginning to collect in larger flocks, doubtless getting ready for migration.

On the 9th and 10th August, the last days of our stay, we saw them flying away in fairly large flocks.

On the 21st August, at night, while at work by the tent, about 79° 40′ N., 51° 30′ W., in the middle of the inland ice, a snow bunting came flying up, circled once or twice round the camp, and then flew off in a north-westerly direction. (Land south of Osborne Fjord a good 300 km away?).

On the 29th August another snow bunting visited the camp then at 78° 24′ N. 61′ W. It seemed cheerful enough; perched on the upright of a sledge and twittered a little, then flew away towards the east. This appeared to be a young bird.

On the 1st September, at about 78° 10′ N., abt. 64° W., as I was running on ski ahead of the sledges, a snow bunting came flying up and settled on the snow in front of me, twittered a little, and flew off to the westward.

2. **Redpoll.** *Cannabina linnaria*, var. *canescens.*

On the 18th May, near the frozen waterfall between the Glacier Lake and the Zigzag river, I saw a redpoll of the lighter type, apparently engaged in picking seeds from the cock's foot grass. In noting this as belonging to the lighter variety (*canescens*) I am merely judging from what I could see at a glance, the reddish tint on neck and breast being apparently lighter than I remember to have seen in other redpolls; I make the statement, however, with all reserve.

3. **Lapland bunting.** *Emberiza lapponica.*

On the 23rd July, in the "High Road" Valley, Game Land, one of these birds was seen carrying what was possibly a larva in its beak.

4. **Ptarmigan.** *Lagopus mutus rupestris.*

These birds were common wherever we went on land, being doubtless as numerous as in the inhabited parts of Greenland.

On the 20th May, a solitary specimen was shot in the Zigzag Valley.

On the 22nd May we shot two pair, after which date we saw them every day, shooting as many as we needed for food. Both male and female were still quite white; the mating season could not, however, be far off. They are now found almost exclusively in pairs, otherwise singly. They appear to be somewhat more numerous than on the coast farther up near the inland ice. On our way out through Danmarks Fjord we continually heard ptarmigan calling from the land.

31st May. Shot a hen, with some few brown feathers.

2nd June. Shot a hen, in full breeding dress (speckled).

On the 5th June, (Peary Land) we saw a number of ptarmigan, partly in pairs, also some solitary males.

7th June. Shot a hen, with fully developed egg in the oviduct.

8th June. Shot a hen, eggs not yet fully developed.

On the 28th June, in Adam Bierings Land, we saw a great number of ptarmigan. A single male bird sat persistently on a stone for whole days as a time, quite close to our cooking place, returning again as often as we drove it away. We tried hard to find its mate, but without success. As we left, however, we saw both birds running rapidly about; whether this was due to the fact that our dogs were now loose, and the birds therefore wished to divert attention from their eggs or whether it simply meant that the hen had got up to feed, I do not know.

On the 4th July, Knud Rasmussen came upon a flock of young ptarmigan in Valmuedalen; they were not yet fully fledged. He took them to be about 14 days old.

On the 6th July, we again saw a flock of young birds, hardly more than a couple of days old. I had sat down to rest on one side of a small valley, the birds being on the other, and discovered them when the mother bird got up and commenced to flutter away. When I stood still for a few minutes, the young birds raised their heads and began to call for their mother; the latter kept to the ground some little distance off, finding it impossible to entice me away. It made a great deal of noise all the time, screaming and flapping its wings. As soon as I moved towards the young birds, they ducked down again, and the mother came hurrying up right in front of me, trying to divert my attention to herself.

On the 10th July, we saw a ptarmigan protecting her young in exactly the same manner against a stoat. In Game Land also the ptarmigan were to be found wherever we went.

On the 14th July we came across some young birds now able to fly. These took to flight, instead of crouching down. At Peary's Cairn on Navy Cliff we found a quantity of excrements showing that the ptarmigan often sat here; these would perhaps be males keeping watch while their mates were on the nest.

On the 12th September we reached land on the west coast of Greenland, and found flocks of ptarmigan, now in their white winter dress.

5. **Turnstone.** *Strepsilas interpres.*

On the 1st June, when out on the ice in Danmarks Fjord, we heard a turnstone calling from the land, and a little afterwards saw a small bird flying along the shore, probably the same.

On the 3rd June, at Cape Kronborg, we saw two of these birds flying up from the south. On the next day again two were seen. After that date they were seen and heard regularly as long as we were in Independence Fjord. None were observed after we had passed inland.

6. **Sanderling.** *Calidris arenaria.*

These birds were first observed after reaching Adam Bierings Land, which may be due to the fact that suitable conditions were not present in the country previously traversed.

On the 6th July in Valmuedalen, we saw a sanderling with four young ones, still downy, which it was leading about in a moist patch of meadow ground near a stream. It was not so successful in diverting attention from its young as are ptarmigan or ringed plover, the young ones also being too impatient to lie still. As soon as the danger was some 5—6 paces distant, they bobbed up and ran about calling, on which the mother would came back and make them lie down again.

On the 9th July, having gone out some little way to the north of Valmuedalen, we came upon 5—6 broods of young sanderlings.

On the 14th July, in Game Land, we saw several sanderlings in different valleys. In the "High Road" Valley, on the banks of the lake, which was only free from ice close to the land, there was quite a little colony of these; 25—30 birds at least, with their young.

On the 25th July the young birds were able to fly; as late as the 4th August, however, they still kept together in broods, following their mothers.

7. **Ringed Plover.** *Ægialitis hiaticula.*

On the 5th June we saw the first of these birds, in Independence Fjord; it came from the southwards, across the bay. Later on we saw one now and then; not until the 15th however, could they be said to be common.

On the 10th July in Valmuedalen, we saw a ringed plover fluttering about in order to distract attention from nest or young, neither of which was found.

On the 24th July, in Game Land, where the species is of common occurrence, we found the young of these birds able to fly.

8. **Arctic Tern.** *Sterna macrura.*

On the 12th June, in Independence Fjord, we saw two terns flying in over the fjord, and on the day following 5 were seen.

9. **Glaucous Gull.** *Larus glaucus.*

On the 8th June, in Independence Fjord, a glaucous gull came flying up along the shore (Peary Land) inwards through the fjord, one also seen on the following day.

On the 14th June, five were seen, also flying towards the west.

10. **Longtailed Skua.** *Lestris longicauda.*

These birds have here doubtless relinquished sea life altogether, and become land birds, living mainly on lemmings.

On the 2nd June, in Danmarks Fjord, the first of these birds was seen, coming up from the south and flying northward across the fjord.

On the 4th June, a flock of 7 flew across Independence Fjord to Peary Land; on the following day also many were seen; after this, they appear to have made their arrival in the country for this year. Very common everywhere.

On the 6th July we found several pair brooding in Valmuedalen, or possibly already with young.

On the 14th July, in Game Land, we shot two of these skuas flying together; one of them was carrying two butterfly grubs, which lay perfectly unharmed on its tongue, and were doubtless intended as food for its young.

On the 28th August, on the inland ice at Lat. 78°35′ N., Long. abt. 58° W. we were surprised to see five skuas come flying up from the east. They flew over our heads, watching us, and then went off to the westward. They were flying very fast, giving the impression that they were bound on some definite errand across the inland ice.

I may here observe that the lateness of the season when we made our homeward journey might furnish a good deal of information as to whether (and if so which) birds take their autumn flight across Greenland.

11. **Red-throated Diver.** *Colymbus septentrionalis.*

On the first of August we saw two of these birds in the lake in "High Road" Valley; this was, however, the only occasion on which any were seen.

12. **Barnacle Goose.** *Anser leucopsis.*

On the 8th of June, when we were camping a little east of the mouth of Brønlunds Fjord, three flocks of these geese came flying in along the shore, first two, then six, and then six again. On the next day we saw several more flocks, the largest counting 9 birds. A flock settled down on the narrow strip of water between ice and land, but would not let us get near them. Later on we saw two others by a small lake, these also very shy. All were moving westward along the fjord, or perhaps into Brønlunds Fjord.

13. **Eider Duck.** *Somateria mollissima.*

On the 12th of June, in Independence Fjord, we saw two eider duck, male and female, flying over us towards the west; on the following day we saw a solitary male, of which we only obtained a glimpse, but which doubtless also belonged to this species.

14. **Fulmar or Mallemuk.** *Fulmarus glacialis.*

On the 31st of May, looking out from the heights in Danmarks Fjord, we could see from the look of the sky that there was open water at Mallemukfjæld.

On the 13th July, at Nyboes Bræ, we found the dried head of a mallemuk.

15. **Greenland Gyrfalcon.** *Falco gyrfalco.*

Close to the head of the mallemuk above mentioned lay a hawk's feather, which showed how the bird had come by its end. This was, strangely enough, the only trace of hawks we saw in these regions, where Peary and Astrup found them during their short stay. The raven also we never saw once during the whole journey.

16. **Snowy Owl.** *Nyctea nivea.*

Both in the Zigzag Valley and in Adam Bierings Land we found the ejected pellets of owls in several places. All contained bones of lemming.

XIII.

METEOROLOGICAL OBSERVATIONS

BY

P. FREUCHEN

Remarks on the Observations.

Technical Features.

The instrument used for observations throughout the expedition was the „Kleinster Reise-Theodolit" made by Hildebrand of Freiburg in Saxony. In addition to the usual features of make and finish, the solidity and precision of which have been appreciated by so many explorers, the instrument was furnished with ebonite tops to all screws, so that in working with bare hands at low temperatures, the fingers were not constantly brought into contact with the naked metal. The instrument case was, moreover, so constructed as to furnish a stand for the theodolite itself. By this simple device, the instrument is no longer rendered useless by loss or breakage of the tripod stand, which last accident actually happened to me, one of the legs breaking just above the point.

The tripod stand in its present form is, as a matter of fact, the weak point of the theodolite. In our case, we were, as it happened, able to repair the damage on the journey; I have seen the same accident happen before, however, with the instruments which Mylius Erichsen carried on the Danmark Expedition. In pressing the legs of the tripod down into the ground, a breakage may easily occur just above the point, the wood not being strong enough to stand the hard usage to which it is frequently subjected. A tripod of stouter build, on the other hand, would obviously involve increased weight. Might it not be better to employ a telescopic tripod made of metal tubes, even though this could perhaps, when exposed to the rays of the sun, occasion some disturbance of the libella now and then? While on the inland ice I frequently felt the want of a few loose plates on which to place the tripod. The pointed ferules of the feet often rendered it difficult or impossible to fix the legs firmly, even when pressed far down into the loose snow, which moreover involved the inconvenience of stooping low over the instrument when making observations. In camp, I managed better by placing each foot of the tripod upon a piece of dogs' meat — great pieces of walrus hide or musk ox — which gave a firm support. On the march however, this could only be done by unpacking at least one of the sledges entirely. Moreover, if one takes the precaution to tread out a firm patch in the snow before setting up the tripod, one may frequently, in walking about the spot during observation, cause a large part of the surface to cave in, thus bringing the instrument out of position. Most explorers who have had to take observations when on loose snow will doubtless have experienced this particular difficulty.

The theodolite itself worked, as already mentioned, admirably, which is the more to be appreciated since it was subjected, on this trip as on previous occasions, to rough usage, the sledge on which it was stowed upsetting or rolling over, or falling down hollows or channels in the ice etc. One such accident, however, did involve some slight damage to the instrument. On the 17th of June, when we were in Independence Fjord, I had started out over a small island in order to take observations. When close up to the island I fell down a fissure which was hidden by the snow above, and filled below with a slushy mess of snow and water. I had some difficulty in getting out again, and while endeavouring to extricate myself I dropped the theodolite and had to go down after it again. It took me some little time to find it; so that the instrument was left lying at the bottom for the space of twenty minutes or thereabout. After this, it was found that the excentricity for the vertical circle had altered a little, while some black smudges had appeared on the scale of the horizontal, rendering it difficult to read in places.

I should also mention that all the observations after reaching Zigzag Valley were carried out while suffering more or less from snow blindness, which troubled me a great deal, and which must doubtless have considerably affected the accuracy of the observations.

Our determinations of longitude are unfortunately far from being sufficiently accurate. The station was originally supplied with two observation chronometers made by Carl Ranch, Copenhagen, marked *A* and *B*. Observations were made throughout a long period during the winter of 1910—11 and also later, as to the correctness of their movement; as ill-luck would have it, however, a servant unacquainted with such instruments, to whom the task of winding them had been entrusted in my absence, forgot this duty, and on finding that the clocks had stopped, opened them and endeavoured to repair the omission by coercing the interior with a penholder. After this, the one marked *B*, which was the better of the two, refused to go at all.

Chronometer *A*, the movement of which had been fairly accurately determined by a series of observations at the station, we took with us on the expedition, and on the way from Thule to the last settlement I carefully noted the inevitable alteration occasioned by the journey. Unfortunately this instrument exhibited one fatal weakness: the slightest alteration of temperature stopped it at once. The cessation of movement might sometimes be of but a moment's duration; it occurred, however, almost invariably whenever the instrument was taken out for purposes of observation, a thing which can hardly be avoided. We then tried making the observations with an ordinary watch, but the mere comparison of the chronometer with this, though made in the tent in the evening, generally sufficed to stop the movement again, and this despite the protection of a celluloid cover. When cooled again, it would resume its movement; it was the transition from one temperature to another which affected it. Ultimately, when we had ceased to use it for purposes of observation, Knud Rasmussen carried it as a pocket watch; he had, however, continually occasion to note the same failing.

After this, we used the better of the two pocket watches which we had with us; on the outward journey however, I had the misfortune to break the glass of this. I then carried it in a breast pocket, enclosed in a celluloid case, the front of which, however, would now and again be pressed in on to the hands when I turned over in my sleeping bag, thus stopping the watch for the time being.

The movement of the other pocket watch was too irregular to permit of its being used for observation purposes.

Our determinations of longitude on the inland ice are therefore based for the most part on the distances covered, these being determined by means of an odometer, marking tenths of a kilometre. I have both on this and previous trips had occasion to note that the error involved — when travelling with sledges drawn by dogs, and according to compass, — by taking 2 kilometres' run as = one mile (= 1 minute) in a straight line, is practically imperceptible. The sure and steady driving, due to Knud Rasmussen's and Uvdloriaq's unequalled skill in managing their teams, together with the fact that we were able to check our calculations on arrival at Danmarks Fjord, enabled us, despite the inadequacy of our instruments, to avoid serious error in this respect.

For survey work, we used both the odometer and also angles taken to and from Hagen's Cairn at Cape Kronborg, Cape Glacier, and the Cairn at Navy Cliff; the two last-named have both been determined by Peary.

The altitudes taken on the inland ice were reckoned exclusively with the aneroid barometer. The expedition had originally been furnished with two compensating holosteric barometers, having different scale intervals for altitudes up to 2500 metres. One of these had, however, previously proved so untrustworthy that we decided to leave it behind. Such measurements are naturally always somewhat uncertain; they suffice however, to give some idea of the rise and fall of the country, while the absolute altitudes will as a rule be sufficiently accurate to permit of reliable results being ultimately obtained by comparing with the barometric pressure for the dates in question at nearest meteorological station (Upernivik, North Star Bay). These calculations, however, I am naturally unable to make at present owing to lack of the requisite material. In cases where any alteration in barometric pressure occurred during our stay at any one place, the altitude has been reckoned from the mean.

These meteorological observations, albeit incomplete, and not made at the times of day agreed upon at the International Meteorological

Congress, will, I believe, when compared with the observations made by previous expeditions on the inland ice, furnish some idea of the climate.

We carried two normal thermometers with mercury, and one spirit thermometer. The last, however, proved useless, so that I have on some days been unable to make any record beyond the fact that the temperature was less than ÷ 37°. (At temperatures below this figure the mercury cannot be relied on).

Velocity of the wind has been noted as estimated, in metres per second.

Clouds noted as estimated, the figure 10 indicating sky entirely overcast.

Meteorological observations on the First Thule Expedition.

✱ falling snow	⊥⊥ rime	⌒ rainbow
⇉ driving snow	≡ fog	aurora
● rain	⊕ mock sun	

Strength of weather phenomena and volume of clouds indicated by the exponents 0—1—2.

Wind: W = West, N = North, E = East, S = South, c = calm, SSW = South-south-west etc.

Clouds: ci = cirrus, str = stratus, cu = cumulus, ni = nimbus, f = Føhn-clouds, fr-str = fractostratus, str-cu = strato-cumulus, a-cu = alto-cumulus etc.

Meteorological observations on the First Thule Expedition.

Date		Hour	N. Lat.	Long. W. of Gr.	Altitude m. above sea level	Atmosph. temp.	Volume of clouds	Nature of do.	Direction of wind	Velocity of do. m. pr. sec.	Weather	Remarks
April	14	10 a	77°54′	71°52′	0 m	÷ 11.0	1^{0}	ci	c	....	....	Neqe (Cape Robertson) Inland ice
—	—	10 p	78°14′	68°20′	I 1150	÷ 15.0	10^{1}	ni	ssw	9—10	$*^{0}\rightrightarrows^{1}$	
—	16	7 a	—	—	1150	÷ 22.3	10^{1-0}	ni	n	4—5	$*^{0}$	—
—	—	4 p	—	—	1090	÷ 26.0	10^{0}	ni	c	....	$*^{0}$	—
—	—	9 p	78°22′	65°52′	II 1248	÷ 28.0	3^{1}	str	ene	4—5	$\rightrightarrows^{0}$	—
—	17	noon	—	—	1248	÷ 27.3	2^{1}	str	c	....	....	—
—	—	5 p	—	—	1255	÷ 31.0	....	—	—	—	....	—
—	18	7 a	—	—	—	÷ 29.0	4^{1}	f	se	5—6	....	—
—	—	7 p 30	78°28′	63°32′	III 1470	÷ 35.1	2^{1}	fr-str(f)	e	2	....	—
—	19	noon	—	—	—	÷ 30.0	1^{0}	ci	c	—	....	—
—	—	10 p	—	—	1440	÷ 33.8	0	—	se	6—7	$\rightrightarrows^{0-1}$	—
—	20	noon	78°45′	61°46′	IV —	÷ 25.5	3^{0}	ci	se	2—3	....	—
—	—	6 p	—	—	1430	÷ 26.1	10^{0}	str	se	2	....	—
—	—	10 p 30	78°54′	60°53′	V 1450	÷ 28.0	3^{0-1}	str, ci-cu	n	4	$\rightrightarrows\oplus^{1}$	—
—	21	6 p	—	—	1390	÷ 26.5	0	....	sw	4	$\rightrightarrows^{0}$	—
—	—	midn.	79°06′	59°38′	VI 1280	÷ 30.5	0	....	se	5—6	$\rightrightarrows^{0}$	—
—	22	6 a	—	—	1340	÷ 26.0	0	....	se	6—7	$\rightrightarrows^{0-1}$	—
—	—	noon	—	—	—	÷ 23.4	0	....	se	2	....	—
—	—	11 p 30	—	—	—	÷ 26.5	0	....	sw	3—4	$\rightrightarrows^{0}$	—
—	23	6 a 30	79°20′	58°26′	VII 1530	÷ 18.7	3^{0}	ci, ci-cu	se	3	$\rightrightarrows^{0}$	—
—	—	noon	—	—	—	÷ 12.0	10^{0}	ci-str	sse	3	$\rightrightarrows^{0}$	—
—	24	2 a 30	—	—	1480	÷ 17.6	8^{1}	str (ni?)	se	7—8	$\rightrightarrows^{0-1-2}$	Bar. falling strongly
—	—	6 a 30	—	—	—	÷ 19.8	10^{1}	str (ni?)	se	5—6	$\rightrightarrows^{0-1}$	
—	—	noon	79°26′	56°51′	VIII 1540	÷ 15.0	10^{1}	ni	se	10—12	$\rightrightarrows^{1} *^{0}$	
—	25	6 a	—	—	—	÷ 15.0	10^{1}	ni	se	1—2	$*^{0}$	
—	—	noon	—	—	1605	÷ 11.5	9^{0-1}	cu	s	3	$\rightrightarrows^{0}$	
—	—	8 p	79°33′	53°40′	IX 1685	÷ 10.7	7^{0-1}	cu, ci	s	4	$\rightrightarrows^{0}$	Bar. rising
—	26	noon	—	—	—	÷ 11.7	7^{0}	ci, ci-cu	s	3	$\rightrightarrows^{0}$	
—	—	9 p 45	—	—	1740	÷ 12.0	8^{0-1}	ci, str	s	7—8	$\rightrightarrows^{0-1}$	

Meteorological observations (continued).

Date	Hour	N. Lat.	Long. W. of Gr.	Altitude m. above sea level	Atmosph. temp.	Volume of clouds	Nature of do.	Direction of wind	Velocity of do. m. pr. sec.	Weather	Remarks
April 27	2 a	79°44′	51°40′	X 1810m	÷ 12.0	10^{1}	ni	sse	6—7	⇉$^{0-1}$ ✻^{0}	
— —	noon	—	—	—	÷ 10.9	6$^{0-1}$	cu, ci-cu	s	6	⇉$^{0-1}$	
— 28	11 p	-	—	—	÷ 24.9	10^{1}	ni	s	15—20	⇉$^{1-2}$ ✻^{1}	
— 29	6 a 35	—	—	—	÷ 23.7	5$^{0-1}$	str, str-cu	s	8	⇉$^{0-1}$	
—	noon	—	—	1860	÷ 18.8	8^{0}	ci, str-cu	sw	2—3	⇉^{0}	
— —	5 p	—	—	1960	÷ 18.7	7$^{0-1}$	ci, ci-cu	c			
- —	8 p	—	—	2020	÷ 16.4	10^{1}	ni	sw	6—7	⇉$^{0-1}$ ✻^{0}	
— 30	noon	79°48′	48°40′	XI —	÷ 17.2	10$^{0-1}$	ni	sw	10—12	⇉$^{0-1}$ ✻^{0}	
.	8 p	—	—	—	÷ 18.7	10^{1}	ni	sw	20—25	⇉$^{1-2, 2}$	
May 1	noon	—	—	2030	÷ 22.0	10^{0}	ci-str	sw	3	⊕^{1}	Inland ice
—	6 p	—	—	—	÷ 19.9	5^{0}	str	s	3	⇉^{0}	—
—	10 p	—	—	—	÷ 25.0	6$^{0-1}$	str	sw	3	⇉^{0} ≡$^{0-1}$	—
— 2	7 a	—	—	2070	÷ 26.8	5^{0}	ci	ssw	3	⇉^{0}	—
— —	noon	—	—	2090	÷ 21.3	8^{0}	ci	sw	4	⇉^{0} ⊕^{2}	—
— —	5 p 45	80°01′	45°05′	XII 2150	÷ 21.8	8$^{0-1}$	str	c	....	⊕ ≡^{0}	—
— 3	7 p 45	—	—	—	÷ 27.0	7$^{0-1}$	str	sw	3	⇉^{0} ≡^{0}	Bar. rising
— —	noon	—	—	—	÷ 26.1	5^{0}	ci	sw	2		
— 4	1 a	80°07′	42°01′	XIII 2215	÷ 34.9	0	....	sw	1		
— —	noon	—	—	—	÷ 30.8	0	....	c			
— —	9 p 30	—	—	2200	t<÷ 39.0	0	....	c	....	....	Mercury frozen
5	5 a 30	80°26′	39°30′	XIV 2120	t< —	0	....	c	....	....	
— -	noon	—	—	—	÷ 32.3	0	....	c	....	....	—
— 6	2 a	—	—	2140	t<÷ 39	0	....	sw	2	Sun haze	--
— —	noon	—	—	2050	÷ 31.3	3^{0}	str	wsw	3	⇉^{0}	
— —	8 p	80°27′	36°37′	XV 2020	÷ 32.5	0	....	wsw	1		
- 7	6 a	—	—	—	÷ 32.0	0	....	c			
—	noon	—	—	—	÷ 28.0	4^{0}	ci	wsw	2		
— 8	5 a 30	—	—	1750	÷ 29.3	2$^{0-1}$	str	wsw	2—3	⇉^{0}	
— —	noon	80°45′	33°08′	XVI 1780	÷ 24.6	6$^{0-1}$	ci, str	wsw	4	⇉^{0}	
— 9	9 a 30		—	1690	÷ 22.0	4^{1}	str, f	wsw	6—7	⇉$^{0-1}$	Reach land; snow-
15	noon	81°06′	27°35′	510	÷ 15.0	10$^{0-1}$	ci	c	....	....	blind for several
— 17	8 p	—	—	480	÷ 7.5	10^{1}	ni	c	....	✻^{0}	days Zigzag valley
— 18	5 a	81°03′	26°45′	300	÷ 7.6	10^{1}	ni	en	1	✻^{0}	
— 19	5 a 30		—	370	÷ 11.5	1^{0}	ci	c	....	≡^{1}	—
—	noon	—	—	380	÷ 14.1	0	....	c	....	....	
May 20	2 a	81°05′	25°25′	290	÷ 16.2	1^{0}	ci	c	....	....	Zigzag valley
— —	noon	—	—	—	÷ 10.5	0	....	c	....	Sun haze	—
— —	7 p 45	—	-	250	÷ 12.0	0	....	c	....	....	—
— 21	6 a 30	—	--	170	÷ 12.2	0	....	c	2	....	—
— —	noon	—		—	÷ 2.6	3$^{0-1}$	ci, cu ci	c	....	....	—
— —	11 p 30	81°14′	26°10′	150	÷ 9.5	0	....	c	....	....	—
— 22	noon	—	—	70	÷ 5.7	0	....	c	....	....	—
— 23	noon	—	—	100	÷ 2.7	0	....	c	....	....	—
— 24	midn.	—	—	70	÷ 9.6	1^{1}	str	c	....	....	—
— 25	noon	—	—	40	÷ 6.9	0	....	se	1	....	—
— 27	1 a	81°25′	23°42′	0	÷ 10.1	3^{0}	ci-str	s	4—12 (gusty)	b—755	Danmarksfjord
— 28	10 a	—	—	0	+ 1.5	4$^{0-1}$	f, cu	ssw	10—12	b—756	—
- —	5 p	—	—	0	+ 0.5	9^{1}	str, str-cu	ssw	4	b—753	—
— 29	1 p	—	—	0	+ 0.1	10^{1}	str	n	2	b—746	—
— 30	12 a 30	81°32′	24°00′	0	+ 3.0	8$^{0-1}$	str	wsw	3	b—746	—
. —	11 p	—	—	0	÷ 1.5	10^{1}	str	wsw	5	b—748	—
. 31	3 p	—	-	0	+ 0.5	5$^{0-1}$	f	wsw	6	b—751	—
June 1	5 a	—	—	0	÷ 0.5	10$^{0-1}$	str	wsw	5	b—754	Danmarksfjord
— —	noon	—	—	0	+ 1.2	5^{0}	ci	ssw	3—4	b—754	—
— 2	5 a 30	—	—	0	+ 0.7	3^{0}	ci	s	5—6	b—749	—
— —	6 p	—	—	0	+ 0.7	5^{0}	ci	c	....	b—749	—
— 3	6 a	—	—	0	÷ 1.5	4^{0}	ci	c	....	b—747≡$^{0-1}$	Cape Kronborg
— —	midn.	—	—	0	÷ 1.8	1^{0}	str	nnw	5	b—748 ≡^{0}	
4	8 a		23°41′	0	÷ 0.3	1^{0}	ci	ne	1	b—749	Independence Fjord
—	10 p		—	0	+ 1.0	1^{0}	ci	c	....	b—744	Hagens Fjord
. 5	4 p	82°13′	26°10′	0	÷ 2.5	8^{0}	ci	nr	3	b—743	Melville Land
— 6	2 a		—	0	+ 2.0	10$^{0-1}$	str, ci	c	....	b—742	—
— —	8 a	—	—	0	+ 2.0	10^{1}	str	sw	10	b—741	—
— 7	8 a	-	—	0	+ 1.5	9$^{0-1}$	str	c	....	b—747	—
— .	8 p		—	0	÷ 1.1	2^{0}	ci-cu	c	3—4	b—747	Independence Bay
— 8	9 a	82°11′	29°10′	0	+ 1.6	5^{0}	ci-cu	w	1	b—748 ≡^{1}	—
. 9	5 p	—	—	0	÷ 1.8	10^{1}	str (ni)	ne	8—10	b—748	—
— 10	1 a	.		0	÷ 1.8	10^{1}	str (30 m)	ni ne	6—10	b—746 ✻^{0}	—
— —	11 a	—	—	0	+ 0.8	10$^{0-1}$	str-cu	sw	1	b—755	
—	noon	—	—	0	+ 2.0	9^{0}	str-cu	c	....	b—753	
— —	6 p	—	—	0	÷ 1.0	8^{0}	str-cu	ne	2	b—756	
11	2 p		—	0	+ 3.4	10^{1}	ci-str	c	....	b—749	
— —	6 p	—	—	0	+ 2.9	4$^{0-1}$	ci-cu	c	....	b—750	

Meteorological observations (continued).

Date	Hour	N. Lat.	Long. W. of Gr.	Altitude m. above sea level	Atmosph. temp.	Volume of clouds	Nature of do.	Direction of wind	Velocity of do. m. pr. sec.	Weather	Remarks
June 12	2 a	82°09′	29°45′	0 m	+ 1.3	8 $^{0-1}$	cu, str-cu	wnw	4—5	b—755	Cape Harald Moltke
— —	2 p	—	—	0	+ 0.3	1 ^{0}	ci	c	....	b—753	
— —	11 p 30	—	—	0	+ 0.3	2 ^{0}	ci	ene	1	b—753	
— 13	6 a	82°09′	30°20′	80	+ 2.8	6 ^{0}	ci-str	wsw	7	....	Cape Knud Rasmussen
— —	7 a	—	—	0	+ 2.5	9 ^{0}	ci-str	sw	3	b—749	
— 14	1 p 30	82°07′	30°40′	0	+ 10.0	10 ^{1}	str, f	w	5—6	b—747	
— —	11 p	—	—	0	+ 6.7	10 ^{1}	str, f	w	gusty 5—10	b—743	
— 15	2 p	81°59′	30°55′	0	+ 3.6	10 ^{1}	str	c	....	b—744	Lille Diabasholm
— 16	6 a	—	—	0	+ 2.3	9 $^{0-1}$	str	n	2	b—743	
— —	9 p	81°54′	32°25′	0	+ 2.3	8 $^{0-1}$	str-cu	c	....	b—741	Easternmost island of Lyngeholmene
— 17	noon	81°53′	33°05′	0	+ 5.5	1 ^{0}	ci	c	....	b—739	
— —	6 p	—	—	0	+ 2.9	2 ^{0}	ci-cu	e	1	b—740	
— —	10 p	—	—	0	+ 2.8	0	....	c	....	b—739	
— 18	7 a	81°48′	33°25′	0	+ 6.3	2 ^{0}	ci	c	....	b—741	
— 19	8 a	—	—	0	+ 7.8	0	....	c	....	b—743 haze	
— —	noon	81°49′	33°50′	490	+ 14.0	0	....	c	....	....	Cape Schmelck
— —	5 p	—	—	895	+ 6.0	0	....	c	....	....	—
— 20	noon	81°51′	34°25′	910	+ 6.0	10 ^{0}	ci	c	....	thick haze	
— —	6 p	81°48′	33°25′	0	+ 5.1	10 ^{0}	ci	c	....	b—749	
— 21	2 p	—	—	0	+ 2.9	10 ^{0}	ci	c	....	b—754	
— 22	2 a	—	—	0	+ 1.4	10 ^{0}	....	c	....	b—753	
— —	6 p	—	—	0	+ 3.7	0	....	c	....	b—753	
— 23	9 a	81°49′	33°35′	325	+ 11.1	10 ^{0}	a-str	c	2		
— —	9 p	—	—	—	+ 6.3	10 ^{0}	ci	c	....		
— 24	5 a 30	—	—	—	+ 6.1	0	....	c	....	haze	
— —	8 p	81°50′	33°40′	530	+ 6.6	0	....	e	1	....	
— 25	6 p	—	—	—	+ 6.4	0	....	w	1	≡ $^{0-1}$	Bar. rising
— 26	7 a 30	81°52′	33°45′	720	+ 6.2	0	....	c			
— —	11 p	—	—	—	+ 5.1	2 ^{0}	ci-cu	nw	4		
— 28	noon	81°51′	35°40′	410	+ 9.2	0	cu	c			
— 30	9 a	—	—	400	+ 9.5	5 ^{0}	cu	n	6		
July 1	8 a	—	—	520	+ 8.0	3 ^{0}	cu	sw	3		
— —	2 p	—	—	—	+ 8.2	5 ^{0}	ci-cu	s	3		
— 2	6 a	81°58′	36°00′ ?	440	+ 6.1	10 ^{1}	str	n	8—10		
— —	10 p	—	—	—	+ 3.2	10 ^{1}	ni	n	8—10	● $^{1-2}$	*Bar. falling*
— 3	3 a 30	—	—	—	+ 5.0	10 ^{1}	ni	n	5	● ^{0}	— strongly
— —	11 a	—	—	—	+ 2.0	10 ^{1}	ni	n	4	Hail ● $^{1-2}$	— —
— —	10 p	—	—	—	+ 5.8	10 ^{1}	ni	n	4	● ^{0}	— —
— 4	8 a	—	—	—	+ 5.1	4 $^{0-1}$	str-cu	n	3		
— 5	9 p	—	—	525	+ 5.0	10 ^{1}	str	nw	1		
— 6	8 a	—	—	540	+ 4.1	10 ^{1}	str	sw	5		
— —	9 p	—	—	—	+ 5.8	10 ^{1}	str	c	....	....	Bar. rising
— 7	8 a	—	—	440	+ 4.3	10 ^{1}	str	c			
— —	6 p	—	—	—	+ 4.1	10 ^{1}	ni	c	....	● $^{0-1}$	
— 8	8 a	—	—	—	+ 4.5	10 ^{1}	ni	c	....	● $^{0-1}$ ≡ $^{0-1}$	
— 9	6 a	—	—	540	+ 2.1	10 ^{1}	....	ssw	....	≡ $^{1-2}$	
— 10	noon	—	—	410	+ 6.3	0	....	c			
— 11	2 p	81°51′	35°40′	440	+ 7.1	4 ^{0}	cu	c			
— 12	2 p	81°47′	36°12′	640	+ 1.4	10 ^{1}	str	nne	6		
— —	11 p 30	81°40′	37°00′	760	+ 0.7	10 ^{1}	ni	sw	5	✱ ^{1}	
— 13	5 p	81°40′	37°00′	740	+ 2.5	10 ^{1}	ni	sw	8—10	✱ ^{1}	
— 14	1 a	81°32′	38°30′	815	÷ 3.4	6 $^{0-1}$	str, f	w	8	⇉	
— 17	8 p	—	—	600	+ 4.1	10 ^{1}	ni	w	10—12	✱ ^{0}	
— 18	2 p	—	—	—	÷ 3.2	10 ^{1}	str	nw	8		
— —	6 p	—	—	—	+ 2.1	10 ^{1}	str	w	10		
— 19	noon	—	—	—	+ 6.5	6 ^{0}	ci	w	4—5		
— 20	8 a	—	—	510	+ 5.1	0	....	c			
— 21	4 a	—	—	—	+ 4.8	7 ^{0}	ci	w	3		
— 22	11 a	81°37′	34°00′	—	+ 1.1	10 ^{1}	ni	sw	10	✱ ^{0}	Navy Cliff
— 25	noon	—	—	600	+ 3.5	10 ^{1}	str	sw	6		
— 26	noon	—	—	—	+ 3.5	10 ^{1}	str	sw	5		
— —	6 p	—	—	—	+ 6.0	6 $^{0-1}$	str	sw	8		
— 27	2 p	—	—	—	+ 4.2	6 $^{0-1}$	str	sw	6		
— 28	2 p	—	—	—	+ 6.0	3 ^{0}	ci	sw	4—5		
— 29	8 a 30	—	—	—	+ 5.0	5 ^{0}	ci-cu	sw	3		
— 30	5 p	—	—	—	+ 7.5	10 ^{1}	ni	sw	3	● $^{0-1}$	
— 31	2 p	—	—	—	+ 5.4	10 ^{1}	ni	c	....	● $^{0-1}$	
August 1	2 p	—	—	(600)	+ 7.8	5 ^{0}	cu	c			
— 2	2 p	—	—	(—)	+ 9.0	5 ^{0}	ci	c			
— 3	2 p	—	—	—	+ 6.0	10 ^{1}	ni	c	....	● ^{1}	
— 4	2 p	—	—	—	+ 4.5	10 ^{1}	ni	c	....	● ^{1} ≡ $^{0-1}$	
— 5	11 a	—	—	—	+ 2.0	10 ^{1}	ni	sw	2	● $^{1-2}$	
— 6	2 p	—	—	—	+ 1.5	10 ^{1}	ni				

Meteorological observations (continued).

Date	Hour	N. Lat.	Long. W. of Gr.	Altitude m. above sea level	Atmosph. temp.	Volume of clouds	Nature of do.	Direction of wind	Velocity of do. m. pr. sec.	Weather	Remarks
August 6	11 p	.	—	—m	÷ 3.0	10^{0-1}	str-cu	sw	2		
— 7	8 a	—	—	—	÷ 2.0	0	....	c			
— 8	noon	81°29′	38°13′	—	+ 3.5	10^{0-1}	ci-cu	sw	1	....	Thulevarden
— —	9 p	—	—	—	÷ 3.5	10^{1}	....	c	....	$\equiv {}^{1}m^{2}$	
. 9	6 a	—	—	—	+ 1.2	0	....	c			
— .	6 p	—	—	—	÷ 2.0	6^{0}	ci-str	c	1	haze $^{0-1}$	
10	8 a 45	81°07′	40°00′	camp 1	÷ 3.0	7^{0}	ci-str	sw	3	....	Inland ice
— —	noon	—	—	—	÷ 1.8	10^{0-1}	ci-str	c			
— 11	8 p	—	—	—	÷ 6.2	4^{0-1}	str-cu	sw	4		
12	5 a 30	80°52′	40°35′	— 2	÷ 5.8	5^{0-1}	str-cu	w	6	⇉ $^{0-1}$	
— —	noon	—	—	—	÷ 6.2	0	....	wsw	3		
— .	10 p	—	—	—	÷ 8.2	0	....	wsw	3		
— 13	11 a	80°38′	42°28′	— 3	÷ 5.0	10^{1}	ni	c	....	* $^{0}m^{1}$	
— 14	noon			—	÷ 9.5	10^{1}	ni	nw	12—20	⇉ $^{0}m^{1}$ * ^{0}	
— 15	3 a	—	—	—	÷ 8.0	10^{1}	ni	sw	5–6	⇉ $^{0}m^{1}$ * ^{0}	
-	8 a	80°26′	43°20′	— 4	÷ 2.0	10^{1}	str	sw	10	⇉ ^{1}	
— 16	noon	80°19′	44°50′	— 5	÷ 6.7	6^{0}	ci-cu	sw	5	⇉ ^{0}	
— 17	6 a		—	—	÷ 11.3	3^{0}	ci	sw	5	⇉ ^{0}	
— —	noon	—	—	—	÷ 6.0	0	....	sw	3		
— —	7 p 30	80°01′	46°55′	— 6	÷ 11.1	1	ci	ssw	3		
— 18	8 a	—	—	—	÷ 10.8	0	....	ssw	4	haze ⇉ ^{0}	
— —	noon	—	—	—	÷ 7.0	0	....	ssw	3	⇉ ^{0}	
— 19	noon	79°50′	49°20′	— 7	÷ 0.0	10^{1}	str	sw	8–10	⇉ $^{0-1}$	
- 20	noon	—	—	—	÷ 2.0	10^{0-1}	str-cu	sw	7	⇉ $^{0-1}$	
— 21	3 a	79°38′	51°20′	— 8	÷ 7.9	9^{1}	str-cu	sw	3		
— —	noon		-	—	÷ 5.2	0	....	sw	5		
— 22	noon	79°31′	51°53′	— 9	÷ 6.8	0	....	ssw	2		
— 23	11 a 52	79°19′	53°45′	— 10	÷ 8.1						
— —	1 a	—	—	—	÷ 14.8	....	ni	c	...	* ^{1}	
— 24	3 a 30	.	—	—	÷ 5.5	10^{1}	ni	c	....	* ^{1}	
25	noon	79°16′	54°04′	— 11	+ 1.1	10^{1}	str	s	2		
— 26	4 a	78°58′	55°28′	— 12	÷ 23.0	3^{0-1}	str	s	3—4	⇉ ^{0}	
—	noon	—	—	—	÷ 14.0	2^{0}	str	c			
— 27	6 a	78°42′	57°03′	— 13	÷ 18.8	10^{1}	....	se	5	⇉ ^{0}	
28	noon	78°30′	58°10′	— 14	÷ 15.8	0	....	se	4	⇉ ^{0}	
29	2 a	—	—	—	÷ 26.1	0	....	se	1		
— —	noon	—	—	—	÷ 20.0	0	str	se	3		
30	noon	78°20′	60°42′	— 15	÷ 11.0	10^{0-1}	....	se	3		
— 31	noon	78°11′	62°46′	— 16	÷ 15.0	0	....	se	3		
Septbr. 1	2 p	78°06′	66°10′	17	÷ 12.1	0	str	sse	6	⇉ $^{0-1}$	
— 2	midn.	—	—	—	÷ 18.5	3^{0-1}	str	sse	6—8	⇉ ^{0}	
—	noon	78°03′	68°15′	18	÷ 17.2	1^{0}	str	sse	3	⇉ ^{0}	
— 3	3 a	77°58′	68°50′	19	÷ 9.1	10^{1}	str	c			
— 4	3 a	77°57′	68°10′	20	÷ 10.0	10^{1}	str	c			
— 5	2 p	—	—	—	÷ 6.8	10^{1}	ni	c	....	* ^{1}	
— 6	mf	—	—	—	÷ 20	10^{1}	....	c	....	$\equiv^{1}$	
— 7	9 p	77°56′	67°30′	21	÷ 3.5	10^{1}	str	c			
— 8	4 p	77°54′	66°28′	22	÷ 12.2	0	....	n	5	⇉ ^{0}	
— 9	2 p	77°42′	66°05′	23	÷ 15.4	0	....	n	6	⇉ $^{0}m^{1}$	

TRANSLATED BY ALEXANDER WORSTER

XIV.

LEIFIT, ET NYT MINERAL FRA NARSARSUK

AF

O. B. BØGGILD

I de Mineralstykker, som fra Tid til anden er indsamlede af Grønlænderne ved Narsarsuk og indsendt til Mineralogisk Museum, er der fundet nogle faa, som indeholder Krystaller af et hidtil ubekendt Mineral. Ved den videre Undersøgelse har det vist sig at indtage en meget selvstændig Stilling uden at være nærmere beslægtet med noget andet Mineral. Navnet er givet efter Leif den Lykkelige, Erik den Rødes Søn, Amerikas Opdager. Lokaliteten Narsarsuk ligger i meget ringe Afstand fra dennes Bolig, Brattahlid.

Krystalform og fysiske Egenskaber. Krystallerne er heksagonale; men til Trods for, at Mineralet altid findes i krystalliseret Form, er de dog altid ret ufuldkomment udviklede. Den eneste Form, der er udviklet, er et heksagonalt Prisme; Enderne af Krystallerne er altid afbrækkede eller paa anden Maade uudviklede, og trods megen Eftersøgning er det ikke lykkedes mig at finde noget Spor af Pyramideflader og heller ikke af andre Prismeflader. Iøvrigt er det forhaandenværende Prismes Flader ret forskelligartet udviklede; undertiden er de ret plane og blanke og giver Reflekser, der kun afviger nogle faa Minutter fra den teoretiske Beliggenhed; men herfra er der alle mulige Overgange til det langt almindeligere Tilfælde, nemlig at Fladerne er saa stærkt lodret stribede, at Krystallerne næsten faar et cylindrisk Tværsnit, ligesom de i Goniometeret giver en næsten sammenhængende Række Reflekser. Ogsaa paa mange andre Maader kan der være Uregelmæssigheder i Fladernes Udvikling, og meget ofte er de stærkt facetterede.

En Ejendommelighed ved Krystallerne er, at de ofte er ligesom sammensatte af en Masse mere eller mindre løst forbundne, mindre Krystaller, saa at de større Krystaller ofte faar et ret knippelignende Udseende; de enkelte Subindivider kan være mere eller mindre parallelle indbyrdes; i sidste Tilfælde kan der være en Antydning af neglignende Masser, omtrent som hos Desmin.

Størrelsen af Krystallerne er meget varierende; Længden varierer fra faa Millimeter til ca. 2 Centimeter; Tykkelsen er i det højeste ca. 5 Millimeter; men der er fra saadanne Krystaller alle mulige Overgange til andre, ganske tynde naale- eller endogsaa haarformede. I øvrigt bevirker den ovenfor omtalte sammensatte Bygning af Krystallerne, at Grænserne mellem de enkelte Individer kan være svær at bestemme.

Krystallerne er fuldstændig farveløse eller højst i Besiddelse af et meget svagt, violet Skær, i nogle Tilfælde klare og gennemsigtige, i andre mere hvidlige, hvad der delvis kan bero paa den omtalte, løse Opbygning, delvis ogsaa paa Tilstedeværelsen af Interpositioner. I Tyndsnit er Substansen vel oftest ret fri for saadanne; men undertiden findes de ogsaa i rigeligere Mængde. I nogle Tilfælde er de langstrakte efter Hovedaksen, i andre ganske uregelmæssig formede; de er altid meget smaa, og deres virkelige Natur er i de fleste Tilfælde umulig at bestemme; men der synes baade at være Luftblærer, Vædskeinterpositioner og faste Legemer.

Haardheden er 6; Vægtfylden er for det reneste Materiale bestemt ved Thoulets Vædske til 2,565—2,578. Der er en udpræget Spaltelighed efter det samme Prisme, som begrænser Krystallerne udvendig; Tværbruddet er derimod muslet.

Glansen er Glasglans; Lysbrydningen er omtrent den samme som hos Ortoklas, Dobbeltbrydningen derimod væsentlig svagere. Mineralet er optisk positivt; ved Hjælp af et kunstig slebet Prisme er bestemt Lysbrydningskoefficienterne: $\varepsilon = 1{,}5224$ og $\omega = 1{,}5177$. Dobbeltbrydningen er direkte bestemt ved Kompensator til 0,0044.

Kemiske Egenskaber. Mineralet er analyseret af cand. polyt. Chr. Christensen med følgende Resultat:

SiO_2	67,55	pCt.	1,126
Al_2O_3	12,69	—	0,124
MnO	0,41	—	0,006
Na_2O......	15,47	—	0,250
F..........	4,93	—	0,258
H_2O	0,77	—	0,042
	101,92	pCt.	
$-O\,(=F)$..	2,08	—	
	99,74	pCt.	

Ved Udregningen af ovenstaaende Værdier kan man helt se bort fra Manganet, hvis Mængde er saa ringe, at det ikke kan faa nogen Betydning for Formelen; Vandet repræsenterer vel en betydelig større Ækvivalensmængde; men denne er dog kun omtrent en Trediedel af Lerjordens, saa hvis Vandet skulde medregnes i Formelen, maatte denne tredobles, hvorved den vilde blive meget kompliceret. Det rimeligste er vel at antage, at Vandet er til Stede i fast Opløsning. De øvrige Bestanddele passer meget nøje til Formelen:

$$Na_2Al_2Si_9O_{22},\ 2\ NaF,$$

hvortil svarer den teoretiske Sammensætning: 68,5 SiO_2, 12,9 Al_2O_3, 15,7 Na_2O og 4,9 F, i alt 102 ($\div O = F$, 2 = 100).

Det mest paafaldende ved ovenstaaende Sammensætning er Forbindelsens overordentlig store Surhedsgrad; ser vi kun paa Hoveddelen af Molekylet, viser dette en vis Lighed med Albit, ved at Natrium og Aluminium optræder i samme Mængde; men mens Forholdet mellem Iltatomer, der er knyttede til Silicium, og dem, der er knyttede til Metallerne, hos Albit er som 3 : 1, er det samme Forhold hos Leifiten som 4,5 : 1. Mineralet maa følgelig i enhver Systematik, hvor Silikaterne er ordnede efter Aciditeten, stilles alleryderst, endogsaa udenfor Petalit og Milarit, hvis Iltforhold er som 4 : 1; og Leifiten overgaas i denne Henseende kun af de grønlandske Mineraler Neptunit, Narsarsukit og Lorenzenit, i hvilke dog altid en væsentlig Del af Kiselsyren er erstattet af Titan- og Zirkonsyre.

I ovenstaaende Formel knyttedes Fluoret til Natrium; det er naturligvis ikke givet, at dette virkelig er Tilfældet, og Formelen kunde maaske ligesaa godt skrives:

$$Na_4\ (AlF)_2 Si_9 O_{22},$$

hvorved naturligvis Forbindelsens Aciditet ikke forandres.

Ved Ophedning i lukket Rør afgiver Mineralet Vanddamp; ved Ophedning i Bunsenbrænder smelter det overordentlig let under stærk Opblæring og størkner til et farveløst Glas. Det sønderdeles ikke af Saltsyre.

Forekomstmaade. Som i Indledningen nævnt, er alt Materialet samlet af Grønlænderne, og man ved ikke andet om Forekomsten, end hvad man kan slutte af selve Stykkerne. Materialet er tilmed ikke særlig stort, idet det kun bestaar af fire smaa Stykker af Vægt mellem 20 og 40 gr. Efter alt, hvad man kan slutte, kan der dog næppe være nogen Tvivl om, at de stammer fra den bekendte Lokalitet Narsarsuk, der ligger i Nærheden af Fjorden Tunugdliarfik i Julianehaab Distrikt, og hvorfra man allerede tidligere kender en Mængde sjældne Mineraler. Dels fandtes Stykkerne i Sendinger, der i øvrigt indeholdt de karakteristiske, sjældne Narsarsuk-Mineraler; dels er de ogsaa selv af en karakteristisk Narsarsuk-Type, selv om de ikke indeholder noget af de for denne Lokalitet specifike Mineraler.

Narsarsukforekomsten[1] maa vel nok betegnes som en Pegmatitdannelse i Augitsyenit; men Bjærgarten er dog ret forskellig i Konsistens fra andre Pegmatiter derved, at den er saa gennemtrængt af Hulrum, at de enkelte Mineraler i den bliver meget løst forbundne indbyrdes, hvorfor Pegmatiten ogsaa i Overfladen er smuldret hen til

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[1] Beskrevet af Flink i Medd. om Grønl. 24, S. 9 ff. og af Ussing i Medd. om Grønl. 38, S. 245 ff.

en grusagtig Masse, der næsten fuldstændig dækker Underlaget. Pegmatiten synes i det væsentlige at bestaa af en Blanding af Feldspat og Ægirin, og i Hulrummene mellem disse er saa de øvrige Mineraler senere udskilte; dog var de to først nævnte Mineraler ikke helt færdigdannede, da de andre begyndte at dannes, hvorfor de som Regel ogsaa kun er i Besiddelse af veludviklede Krystalflader paa de Steder, hvor der ikke har udskilt sig andre Mineraler.

De Stykker, der indeholder Leifiten, er udviklede paa den nylig beskrevne Maade. Hovedmassen af Stykkerne udgøres af Feldspat og Ægirin, og foruden disse og Leifiten findes ikke andre Mineraler end Zinnwaldit og smaa Kalkspatkrystaller, der øjensynlig tilhører en senere Generation. Leifiten og Zinnwalditen er sikkert yngre end de to Hovedmineraler; derimod er de indbyrdes blandede mellem hinanden paa en saadan Maade, at det som Regel er umuligt at sige, hvilken af dem der er den først dannede. I Tyndsnit viser Grænserne mellem de enkelte Mineraler sig overalt at være uregelmæssige, saa de er i alle Tilfælde delvis dannede samtidig.

Den Feldspat, der ledsager Leifiten, ligner makroskopisk fuldstændig den, man ellers kender fra Narsarsuk; af Farve er den hvidlig eller gullig graa. I Tyndsnit viser det sig, at den udelukkende bestaar af Mikroklin uden indblandet Albit; kun i et enkelt Tilfælde er der fundet et større Albitindivid i den ene Side af Mikroklinen; men om nogen regelmæssig Gennemvoksning af de to Bestanddele til en Pertit er der ikke Tale. Selve Mikroklinstrukturen er omtrent som den af Ussing[1] beskrevne, der er saa karakteristisk for de fleste Mikrokliner i denne Egn; Ussing nævner ogsaa en ren Mikroklin fra denne Lokalitet, mens i øvrigt de fleste Feldspater herfra er Mikroklin-Mikropertit eller Kryptopertit.

Grænsen mellem Mikroklin og Leifit er altid ganske uregelmæssig; undertiden findes der et nogenlunde sammenhængende Lag af Zinnwalditindivider paa Grænsen mellem dem; men oftest grænser de umiddelbart op til hinanden. I enkelte Tilfælde er de to Mineraler voksede igennem hinanden paa en saadan Maade, at der dannes en skriftgranitagtig Struktur. De to Mineraler er i alle Tilfælde meget karakteristisk forskellige ved, at Feldspaten indeholder en meget stor Mængde Ægirinnaale indesluttede, hvad man aldrig finder i Leifiten og heller ikke i Zinnwalditen.

Ægirinen er i alt væsentlig udviklet som den sædvanlige fra Narsarsuk; i Tyndsnit viser den oftest grønne Absorbtionsfarver, men undertiden er den ogsaa brunlig (den saakaldte Akmitsubstans). Paa Grænsen mod Leifiten kan Ægirinen undertiden være i Besiddelse af Krystalflader; men oftest er Grænsen ogsaa her ganske uregelmæssig.

Hvad de øvrige, Leifiten ledsagende, Mineraler angaar, frembyder

[1] Medd. om Grønl. 14, Fig. 1, Side 7 ff.

de ikke noget særligt af Interesse. Zinnwalditen optræder i Form af meget daarlig udviklede og utydelige, sekskantede Tavler, og Kalkspaten som ganske smaa, spidse Skalenoedre, hvis Flader er saa daarlig udviklede, at de ikke kan bestemmes nærmere; Flink har fra Narsarsuk beskrevet Kalkspatkrystaller, der udelukkende er begrænsede af det spidse Skalenoeder (4371), og det er muligt, at vi her kan have det samme.

XV.

DAHLLIT FRA KANGERDLUARSUK

AF

O. B. BØGGILD

BLANDT det i ældre Tid indsamlede grønlandske Materiale fandtes en Del Stykker med et ejendommeligt skorpeformet Overtræk, som ved nærmere Undersøgelse viste sig at bestaa af et usædvanlig stærkt kulsyreholdigt Calciumfosfat, der dog i Sammensætning nærmest svarer til den norske Dahllit; saavel den ejendommelige Maade, hvorpaa det grønlandske Mineral forekommer, som den Omstændighed, at det i Modsætning til det norske ogsaa optræder i krystalliseret Form, gør, at det fortjener en nærmere Undersøgelse.

Den grønlandske Dahllit.

Forekomstmaade. Det forhaandenværende Materiale stammer dels fra K. J. V. STEENSTRUP's Rejse i 1888 og hidhører fra Lokaliteterne Kangerdluarsuk og Naujakasik og dels fra G. FLINK's Rejse i 1897, hvilket Materiale hidrører fra Lokaliteten Nunarsuatsiak; da de to sidstnævnte Lokaliteter ligger henholdsvis paa Sydsiden og Nordsiden af Fjorden Tunugdliarfik, synes det altsaa, at Dahlliten er udbredt over største Delen af Naujaitens Omraade[1]. De skorpeformede Masser af Dahllit sidder umiddelbart paa Naujaiten, sandsynligvis beklædende Spalter i denne; Naujaiten er delvis ret frisk umiddelbart ved Grænsen mod Dahllit; dog er Sodaliten oftest fuldstændig omdannet til finkornet Natrolit (Spreusten)[2]. Det ejendommeligste ved denne Dahllitforekomst er i det hele taget den nære Forbindelse, i hvilken den forekommer sammen med Natrolit. Det almindelige Forhold er, at dette Mineral er det først dannede og beklæder Væggen af Spalten i Form af en tynd Skorpe af Krystaller, ovenpaa hvilken Dahlliten dernæst er aflejret. Dette Forhold ses tydelig paa Tvl. XIII. Fig. 1, hvor Natrolitkrystallerne træder meget tydelig frem i Forhold til Dahlliten paa Grund af deres langt svagere Lysbrydning.

I enkelte Tilfælde er Forholdene langt mere komplicerede, og som Eksempel herpaa kan henvises til det Stykke, der er afbildet i Tvl. XIII.

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[1] Angaaende Beskrivelsen og Udbredelsen af denne Bjærgart samt Beliggenheden af de nævnte Lokaliteter henvises til N. V. USSING's Afhandling i Medd. om Grønl. 38, 1912.

[2] Sml. N. V. USSING: Medd. om Grønl. 14, 1898, S. 137 ff.

Fig. 2. Her ses nederst et ganske sort Parti; det er et Arfvedsonitindivid, der udgør en Bestanddel af den underliggende Naujait. Ovenpaa dette ses en tynd hvid Stribe, bestaaende af smaa Natrolitkrystaller; den derpaa følgende mørke Stribe udgøres af Dahllit, der er saa gennemtrængt af Interpositioner, at den næsten er uigennemsigtig; i polariseret Lys viser denne Dahllit sig næsten fuldstændig enkeltbrydende, det synes altsaa, at der her foreligger en amorf Form af Mineralet. Ovenover det mørke Lag findes et lyst Lag af mindre end 1 mm's Tykkelse (paa Figuren), der udgøres af Natrolitkrystaller; og ovenpaa dette findes en Skorpe af indtil 5 mm's Tykkelse, bestaaende af Dahllitkrystaller. Derpaa følger en meget uregelmæssig formet, for største Delen sort Masse, i hvilken ses en Del langstrakte, hvide Krystaller; disse sidste bestaar af Natrolit, som i enkelte Tilfælde viser sig at være afsat umiddelbart paa de nævnte Dahllitkrystaller; Mellemrummene mellem Natrolitkrystallerne er saa senere udfyldt med den sorte Masse, der viser sig at bestaa af uren, amorf Dahllit. Ovenpaa denne følger saa Dahllitens Hovedmasse, der som sædvanlig er af agatlignende Struktur, og i det alleryderste Lag af Skorpen, udenfor det paa Figuren afbildede Parti, findes igen et tyndt Lag Dahllitkrystaller. Den samlede Rækkefølge er altsaa:

1. Natrolit.
2. Amorf Dahllit.
3. Natrolit.
4. Krystalliseret Dahllit.
5. Natrolit i lange Krystaller.
6. Amorf Dahllit.
7. Agatlignende Dahllit.
8. Krystalliseret Dahllit.

Denne Vekselleјring af de to Mineraler er højst ejendommelig i Betragtning af, at de, med Undtagelse af Ilten, saa at sige ikke har en eneste Bestanddel fælles.

Fysiske Egenskaber. Som i foregaaende Afsnit omtalt, forekommer Dahlliten under tre væsentlig forskellige Former, nemlig som Krystaller, som agatagtige og som amorfe Lag.

Krystallerne er altid meget smaa, højest 1/2 mm i Tværmaal; de er heksagonale tavleformede, udelukkende begrænsede af $\{0001\}$ og $\{10\bar{1}0\}$; Fladerne kan være ret blanke, men er altid ufuldkomment plane, mere eller mindre facetterede, saa at de kun giver meget daarlige Reflekser i Goniometeret. Farven er hvidlig eller graalig; i enkelte Tilfælde er Krystallerne graa i det Indre og overtrukne med en hvid Skorpe. Paa Grund af Krystallernes Lidenhed er Vægtfylden ikke bestemt. Lysbrydningen er bestemt ved Immersionsmetoden ved Hjælp af Thoulet's Vædske; den er i forskellige Tilfælde fundet at være 1,619, 1,623, 1,626 og 1,627, altsaa udpræget mindre end hos Apatit. Dobbeltbrydningen er derimod væsentlig større end hos dette Mineral; et Snit af en Krystal er undersøgt i Kompensator, hvorved blev fundet: $\omega - \varepsilon = 0{,}011$.

Den agatagtige Dahllit udgør langt Hovedmassen af hele Forekomsten. Den danner som oftest et jævnt, skorpeformet Lag af 1—7 Millimeters Tykkelse. Overfladen er ret forskelligartet; ofte er den temmelig glat, undertiden med smuk Perlemorglans; i andre Tilfælde er den beklædt med et tyndt Lag Krystaller, og undertiden er den ujævn, forsynet med vorte- eller drypstensformede Fremragninger. I Brudfladerne viser Dahlliten sig i Besiddelse af en fint traadet Struktur; men langt mere fremtrædende er dog en ofte meget fin og regelmæssig Lagdeling, der bevirker, at Substansen ofte faar meget stor Lighed med Agat; dog er Brudfladen ikke saa glat, men oftest mere splintet. Farven er graalig eller brunlig i forskellige Nuancer, ofte stærkt varierende i de enkelte Lag fra rent hvid til ganske mørk.

I Tyndsnit viser Substansen sig ofte at være ret homogen uden tydelig Stribning; i andre Tilfælde er der en meget udpræget og regelmæssig saadan til Stede, saaledes som det vil ses paa Fig. 1 og navnlig Fig. 3. Der er alle mulige Overgange mellem saadanne Tilfælde, hvor Stribningen er ganske svagt fremtrædende, væsentlig kun visende sig ved, at nogle Lag er i Besiddelse af en noget svagere Lysbrydning end Hovedmassen, til saadanne, hvor Striberne fremtræder som udpræget mørke Linier. I disse Tilfælde viser det sig ogsaa, at de udgøres af en Substans med væsentlig svagere Lysbrydning end Hovedmassen; men om denne Substans er en helt anden end Dahlliten eller kun en Varietet af den, er det ikke muligt at konstatere; den har i hvert Fald samme optiske Fortegn som den øvrige Dahllit. Med Undtagelse af de nævnte Striber er Dahlliten ret ren, uden iøjnefaldende fremmede Indeslutninger af nogen Art. I polariseret Lys viser Dahlliten en Struktur som den, der ses i Fig. 4 og 5. Den er opbygget af langstrakte, optisk negative Individer, der i Hovedsagen er orienterede vinkelret paa Stribningen, men dog i Enkelthederne viser mange Uregelmæssigheder, ligesom ogsaa Udslukningsretningerne er ret varierende.

Værdierne for Lys- og Dobbeltbrydning er ogsaa stærkt varierende; ved Hjælp af Thoulet's Vædske er maalt følgende Værdier: $\omega = 1{,}626$, $\varepsilon = 1{,}607$; $\omega = 1{,}610$, $\varepsilon = 1{,}591$; $\omega = 1{,}604$, $\varepsilon = 1{,}592$; i Almindehed er Lysbrydningen altsaa noget ringere end hos Krystallerne, mens Dobbeltbrydningen er kendelig større. Der er en meget paafaldende Variation i Dobbeltbrydningens Størrelse i de forskellige Lag, i hvilke Dahlliten er afsat; den herved frembragte Stribning falder i Reglen sammen med den ovenfor omtalte, der ses i almindeligt Lys; men undertiden optræder den dog ogsaa paa andre Steder. For at faa et Billede af Variationen i Dobbeltbrydning er denne ved Hjælp af Kompensator maalt i to paa hinanden følgende Lag, der viste i høj Grad forskellige Interferensfarver; der blev fundet $\omega - \varepsilon = 0{,}017$ og $0{,}012$.

Vægtfylden af den agatlignende Dahllit er ogsaa stærkt varierende; i to umiddelbart op til hinanden grænsende Lag, der hvert for sig tilsyneladende var fuldstændig frit for fremmede Indblandinger, fandtes følgende Vægtfylder: 3,000—3,012 og 3,090—3,094.

Den amorfe Dahllit, der fandtes i det ovenfor (Side 438) beskrevne Stykke, der er afbildet i Tavle XIII, Fig. 2, er altid overordentlig uren, gennemtrængt af en tæt Masse af fintgrynede Indeslutninger. Da begge de paa det nævnte Sted omtalte Lag er meget tynde, har det ikke været muligt at foretage nogen kemisk Analyse eller Vægtfyldebestemmelse af denne Substans; Lysbrydningen er ved Hjælp af Thoulets Vædske bestemt til 1,619 og 1,605, hhv. for det 1ste og 2det af de omtalte Lag.

Kemisk Sammensætning. Den agatlignende Dahllit, som er den eneste af Varieteterne, der findes i tilstrækkelig Mængde til kemisk Undersøgelse, er analyseret af Cand. polyt. Chr. Christensen med følgende Resultat:

	I	II
P_2O_5	32,40	38,44
CaO	54,10	53,00
Al_2O_3	3,15[1]	—
Na_2O	0,77	0,89
CO_2	8,26	6,29
H_2O	1,32	1,37
	100,00	100,89[2]

Til Sammenligning er (under II) anført Sammensætningen af den norske Dahllit[3]; det vil ses, at Fosforsyremængden i den grønlandske Dahllit er betydelig mindre end i den norske, mens Kulsyremængden til Gengæld er større. For den norske Dahllit er beregnet Sammensætningen $2Ca_3P_2O_8, CaCO_3, {}^1/_2 H_2O$, der kræver 39,0 Fosforsyre, 6,0 Kulsyre, 57,7 Kalk og 1,3 Vand; det grønlandske Mineral passer ikke godt til denne Formel; men paa den anden Side er det ikke muligt at finde nogen simpel Formel, der passer til ovenstaaende Sammensætning. Nærmest kommer vistnok Formelen: $Ca_3P_2O_8, CaCO_3$, der kræver 34,6 Fosforsyre, 54,6 Kalk og 10,8 Kulsyre; i Stedet for den manglende Kulsyre kan man tænke sig, at noget af Vandet er bundet til Kalken. Den tiloversblevne Vandmængde bliver i saa Fald saa ubetydelig, at den ikke kan indgaa som noget selvstændigt Led i Formelen.

Skønt det saaledes efter ovenstaaende kan være ret tvivlsomt, om man virkelig har Lov til at regne det grønlandske Mineral med til Dahllit, mener jeg dog, at det er det rigtigste, i Betragtning af, at

[1] Bestemt som Rest.
[2] Heri indbefattet FO: 0,79 og K_2O: 0,11.
[3] Brögger og Bäckström, Öfv. Ak. Stockholm 45, 1888, 483.

den kemiske Sammensætning ikke kan angives med større Sikkerhed, ikke at skabe større Forvirring i denne Mineralgruppe ved at indføre et nyt Navn.

De i Fosforiten indgaaende Mineraler er grundig undersøgte af Lacroix[1], som adskiller tre Typer: 1, den holokrystallinske, traadede bestaaende af enten Dahllit eller Frankolit; 2, den amorfe, bestaaende af et Mineral, Kollofan, og 3, en Blanding af Dahllit, Frankolit og et ukendt, optisk positivt Mineral, der angives at være i Besiddelse af betydelig stærkere Dobbeltbrydning end de to andre krystallinske Mineraler; disse er derimod negative og i Besiddelse af Dobbeltbrydningen 0,004—0,005. Dette sidste Tal er næppe helt rigtigt; i det mindste har jeg i adskillige af mig undersøgte Fosforiter fundet væsentlig større Dobbeltbrydning, helt op til 0,09, og overalt i negativt Materiale. Hvad den kemiske Sammensætninger angaar, adskiller Frankoliten sig fra Dahllit og Kollofan ved at indeholde Fluor som væsentlig Bestanddel, mens de alle tre indeholder Kulsyre. Om Kollofanen er identisk med den ovenfor beskrevne amorfe Form af Dahllit, lader sig ikke nærmere konstatere, men er vel nok sandsynligt; dens Lysbrydningskoefficient angives til 1,596—1,612.

Da den grønlandske Dahllit indtager en Særstilling blandt alle de forskellige Former af de kulsyreholdige Apatitmineraler ved at indeholde mere Kulsyre end alle de andre og saaledes afviger mest af alle fra Apatiten i Sammensætning, kunde man ogsaa vente, at den i fysiske Egenskaber vilde staa Apatiten fjærnere end de andre, og at man derfor ved Hjælp af dette Mineral vilde kunne danne sig en klarere Forestilling om det Forhold, hvori Apatiten staar til de andre Mineraler. En Sammenligning mellem de mere fremtrædende Egenskaber vil vise følgende:

Krystallerne er hos alle de kulsyreholdige Led af Apatitgruppen meget smaa og daarlig udviklede; de er aldrig i Besiddelse af andre Flader end Prisme og Basis. Da det samme som bekendt ogsaa meget ofte er Tilfældet med Apatitkrystallerne, tyder dette Forhold kun paa, at der er et vist Slægtskab mellem Mineralerne, men siger ikke noget om Graden af dette Slægtskab.

Baade Apatiten og de andre her behandlede Mineraler er optisk negative med Undtagelse af det ovenfor nævnte, af Lacroix beskrevne, positive Mineral, der kun forekommer i Blandinger sammen med de andre, og hvis Egenskaber iøvrigt kun er meget ufuldkomment kendte.

Lysbrydningen er hos Apatit[2], for $\omega = 1,638$ (varierende fra 1,633 til 1,648), for $\varepsilon = 1,635$ (1,631—1,643); hos Frankolit og Dahllit angives den gennemsnitlige Lysbrydning af Lacroix til 1,625. Jeg har

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[1] Compt. rend. 150, 1910, 1213 og Minéralogie de la France, 4, II, 1910, 555. cfr. ogsaa Schaller i Un. St. geol. Surv. Bull. 509, 1912, 89.

[2] De for Apatit angivne Værdier er udregnede efter den ret fuldstændige Sammenstilling af Seebach i Doelters Hdb. d. Mineralchemie, III, 340.

for en Del optisk negative Fosforiter fra mange forskellige Forekomster, der vistnok alle gaar ind under, hvad Lacroix kalder for Frankolit, fundet en meget stærk Lysbrydning, nemlig lige fra 1,614 til 1,629; den gennemsnitlige Værdi er 1,621. Hvad Dahlliten angaar, har jeg for den norske fundet $\omega = 1{,}634$, $\varepsilon = 1{,}627$, altsaa Gennemsnittet 1,6305; for den grønlandske Dahllit er Værdierne, som ovenfor angivet, overordentlig varierende, nemlig fra 1,598 til 1,627; Gennemsnittet er 1,616. De for hvert enkelt Mineral stærkt varierende Værdier umuliggør næsten enhver Sammenligning, og nogen bestemt Forbindelse mellem den kemiske Sammensætning og Lysbrydningen kan ikke paapeges. De, der i kemisk Henseende staar som Yderled, nemlig den grønlandske Dahllit og Apatiten, udviser vel nok de største Modsætninger i Henseende til Lysbrydning; men det er jo i høj Grad paafaldende, at den norske Dahllit, hvis Sammensætning ikke afviger ret meget fra den grønlandske, har en Lysbrydning, der staar ret nær ved Apatitens.

Dobbeltbrydningen er hos Apatit 0,0032, varierende fra 0,001 til 0,005; hos Frankolit og Dahllit angives den af Lacroix til 0,0045; men, som jeg ovenfor har nævnt, mener jeg, at dette Tal er for lille. Frankoliten fra Tavistock har vel nok en meget ringe Dobbeltbrydning, som jeg ved Kompensator har bestemt til 0,004; men for andre Fosforitvarieteter har jeg fundet betydelig større Værdier, saaledes den fra Amberg 0,0077, for den fra La Chapelle, Gard 0,0093 og for den krystalliserende Staffelit fra Staffel 0,0064. Gennemsnittet kan saaledes vistnok snarere sættes til 0,007. For den norske Dahllit har jeg bestemt Dobbeltbrydningen til 0,0067, mens den grønlandske, som ovenfor nævnt, giver ret varierende Værdier, nemlig fra 0,012 til 0,019; Gennemsnittet er 0,016. En Sammenligning mellem disse Værdier vil give et Resultat, der er analogt med det, vi kom til for Lysbrydningens Vedkommende, nemlig at, mens Yderleddene viser en overordentlig stor indbyrdes Forskel, lader Mellemleddene sig heller ikke her indordne i nogen egentlig Række, idet den norske Dahllit atter her staar langt nærmere ved Apatiten, end man skulde vente efter den kemiske Sammensætning.

Apatitens Vægtfylde angives af Seebach at variere fra 3,09 til 3,39, men i de aller fleste Tilfælde at ligge imellem 3,14 og 3,22. Lacroix angiver Vægtfylden af Frankolit til 3,09—3,13 og af Dahllit til 2,97—3,05; den norske Dahllit har Vægtfylden 3,053, mens den grønlandske, som ovenfor angivet, har 3,000—3,094. Som almindelig Regel viser det sig, at Vægtfylden aftager fra Apatit til Dahllit; men paa Grund af de indbyrdes stærkt varierende Værdier for hvert enkelt Minerals Vedkommende lader Sammenligningen sig heller ikke her gennemføre i det enkelte.

Af ovenstaaende Betragtninger kan drages den almindelige Slutning, at det for Tiden næppe er muligt at indordne de her behandlede

Mineraler i noget eksakt System. Det er givet, at de i kemisk Henseende ikke uden videre kan betragtes som Apatit, i hvilken en ækvivalent Mængde Fluor er erstattet af Kulsyre og Vand; thi det indbyrdes Forhold mellem Fosforsyre og Kalk varierer ret betydeligt i de forskellige Led, nemlig fra 1:3 hos Apatit til 1:4 hos den grønlandske Dahllit. De kemiske Analyser giver for de kulsyreholdige Apatiters Vedkommende ret komplicerede Formler, der i de fleste Tilfælde paa ingen Maade kan betragtes som sikre. Af praktiske Grunde er det vistnok det bedste at beholde Lacroix's Inddeling for Hovedmineralernes Vedkommende i den fluorholdige Frankolit og den fluorfrie Dahllit; men den meget fuldstændige Overensstemmelse i fysiske Egenskaber mellem disse gør det rigtignok ganske umuligt i hvert enkelt Tilfælde at kende dem fra hinanden uden en nærmere kemisk Undersøgelse. Den grønlandske Dahllit synes baade i Henseende til kemisk Sammensætning og fysiske Egenskaber at indtage en vis Særstilling, eller maaske snarere Yderstilling, i Forhold til de andre Led i Rækken, ligesom dens Forekomstmaade jo ogsaa er meget ejendommelig; men da de fysiske Egenskaber hos dette Mineral, ligesom ogsaa hos de andre, i sig selv er meget stærkt varierende, har jeg, som ovenfor nævnt, ikke fundet det rigtigt at indføre et nyt Navn i Literaturen, tilmed da Mineralet ikke er mere forskelligt fra de andre, end at det i hvert enkelt Tilfælde vil være forbundet med ret store Vanskeligheder at bestemme det.

TAVLE XIII.

TAVLE XIII.

Fig. 1. Dahllit, siddende paa Natrolitkrystaller.

Fig. 2. Afvekslende Lag af Natrolit og forskellige Former af Dahllit; se nærmere Teksten.

Fig. 3. Dahllit med særlig tydelig Stribning.

Fig. 4. Samme Snit som foregaaende i polariseret Lys.

Fig. 5. Dahllit i polariseret Lys.

Alle Figurerne er forstørrede ca. 10 Gange.

Fig. 1.

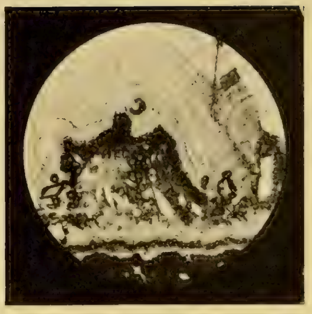

Fig. 2.

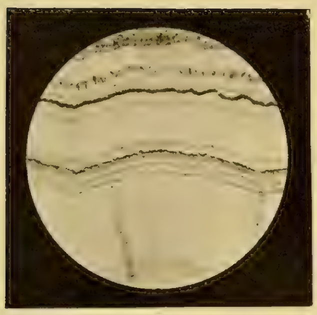

Fig. 3.

Fig. 4.

Fig. 5.