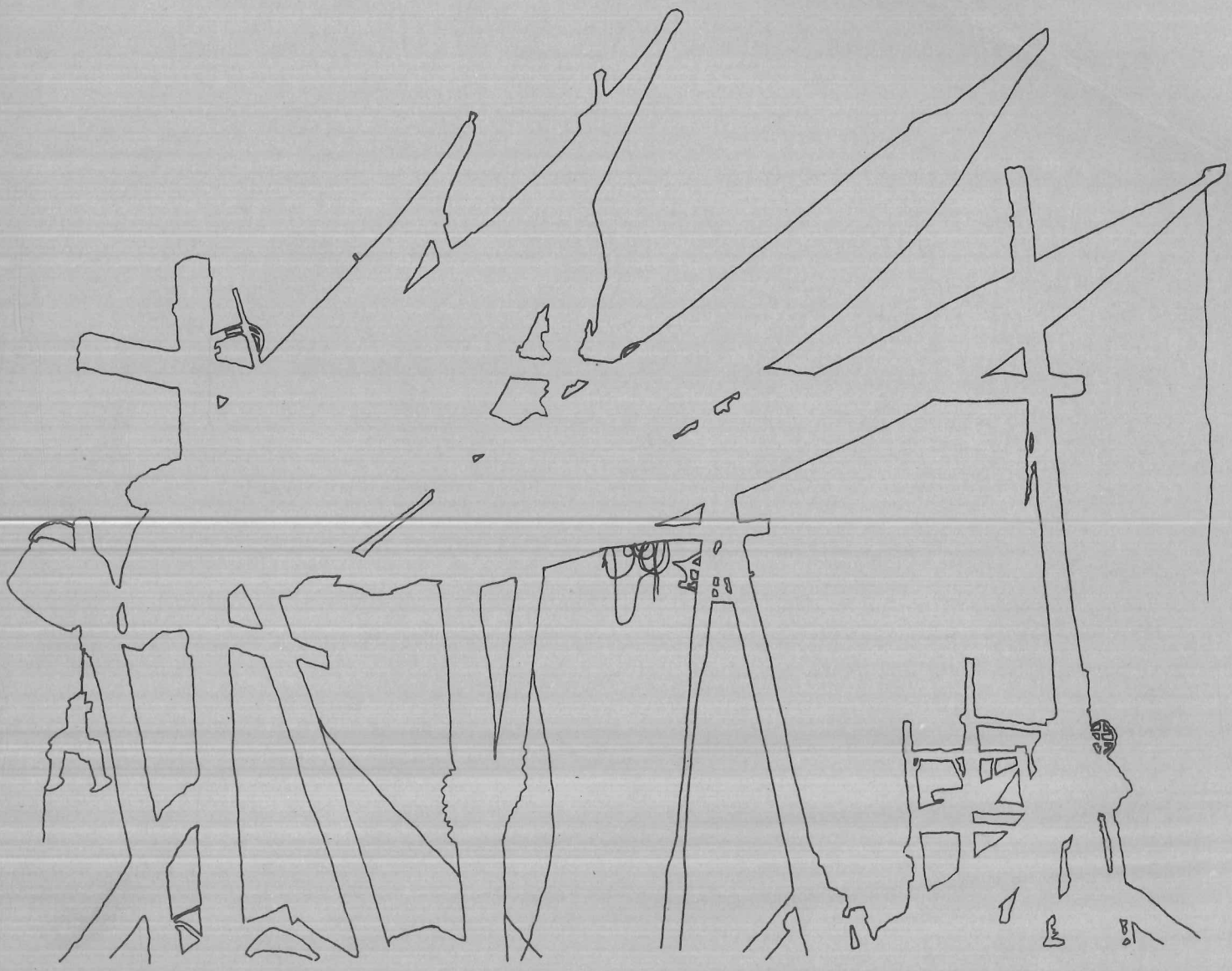
GREENLAND



University of Newcastle
East Greenland Expedition 1967

REPORT

Report of the

University of Newcastle upon Tyne Expedition to East Greenland, 1967

to

Tugtilik and Kungmiut

leaders

Christopher Sugden & Philip Storey

THE EXPLORATION SOCIETY . DAYSH BUILDING . THE UNIVERSITY OF NEWCASTLE UPON TYNE

CONTENTS

ILLUSTRATIONS

INTRODUCTION

The expedition carried out an eight week scientific programme in the Tugtilik region, 150 km. north of Angmagssalik in latitude 66° 22'N, and in the Kungmiut area at the head of Angmagssalik Fjord. It had originally been intended to devote all the time to work in the Tugtilik region but, owing to ice conditions, the expedition was unable to move north until late July. The period 3rd - 21st July was spent at Angmagssalik Fjord and the period 23rd July - 30th August at Tugtilik.

Tugtilik had only been occasionally visited by coastal expeditions before 1931, and then never for longer than a few days. As a result of the British Arctic Air Route Expedition, 1931-2, led by H.G. Watkins, the lake between Tugtilik and Nigertussoq was chosen as the most suitable landing site in East Greenland for sea planes on this air route. Watkins also led the 1932 expedition to the area, and it was on this that he lost his life. The other members of the party, Rymill, Chapman and Riley, wintered in the hut at the head of Tugtilik, completed their several survey tasks and meteorological observations, and returned to Britain at the end of the 1933 season.

Tugtilik Lake was never developed as an air base and no scientific expedition has been based there since. A study of air photographs and of the reports of previous visitors had suggested that the area offered unique opportunities for the geological, geomorphological, palaeomagnetic and biological work planned. In the event the work done around Angmagssalik Fjord was of equal value, and essentially complementary to that in Tugtilik.

THE MEMBERS OF THE EXPEDITION

The expedition comprised ten men. The members from the University of Newcastle were:-

C.J. Sugden, aged 21, final year Geography, joint organiser and geomorphologist.

P. Storey, aged 20, final year Geography/Surveying, joint organiser, geomorphologist and surveyor.

P.C. Ray, aged 21, final year Geography, ornithologist and geomorphologist.

B. Kimpton, aged 25, second year Electrical Engineering, palaeomagnetic work and radio.

R.T.G. Parker, aged 21, final year Geology, geologist.

R.D.L. Beck, aged 20, first year Geology, geologist.

J.R.A. Moorhouse, aged 20, second year Town and Country Planning, palaeomagnetic work and cameraman.

The other members were:-

B.L. Madsen, aged 32, assistant lecturer in Zoology at the University of Copenhagen, limnologist.

J. Elsley, aged 26, second year Botany at the University of Leicester, botanist.

E. Thornton, aged 28, H.M.C. Electrical Engineering, British Antarctic Survey 1960-65, radio operator and surveyor.

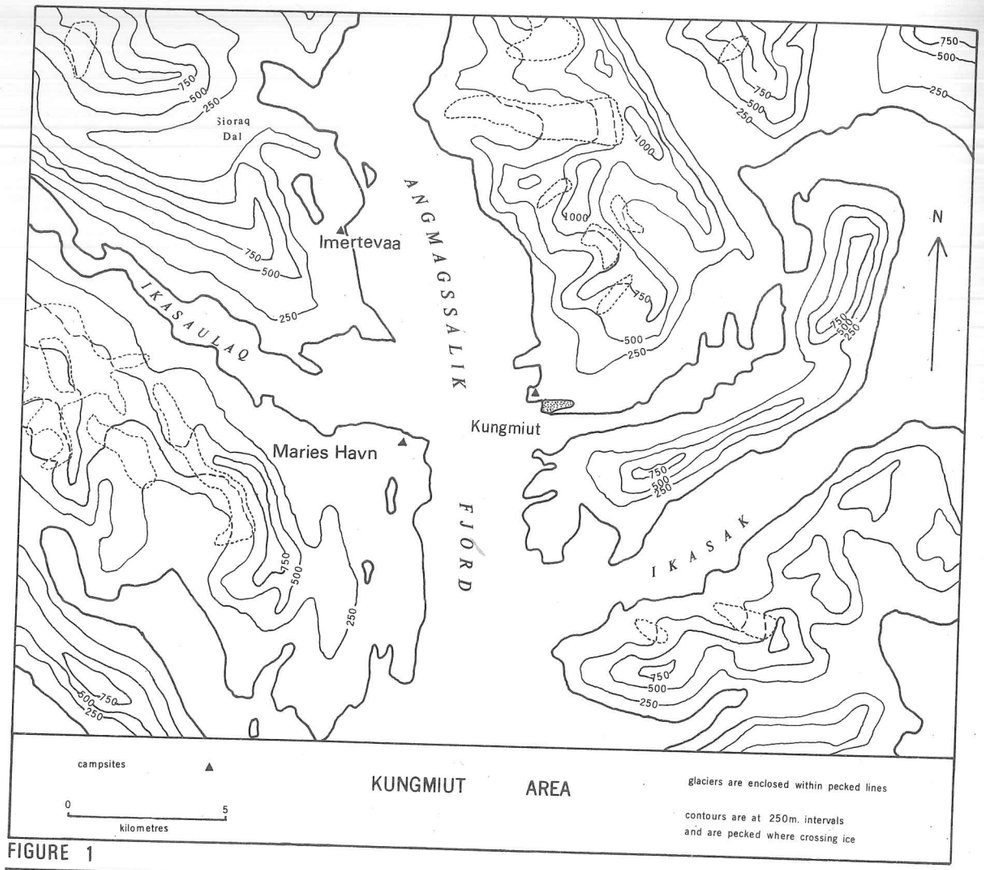


FIGURE 1

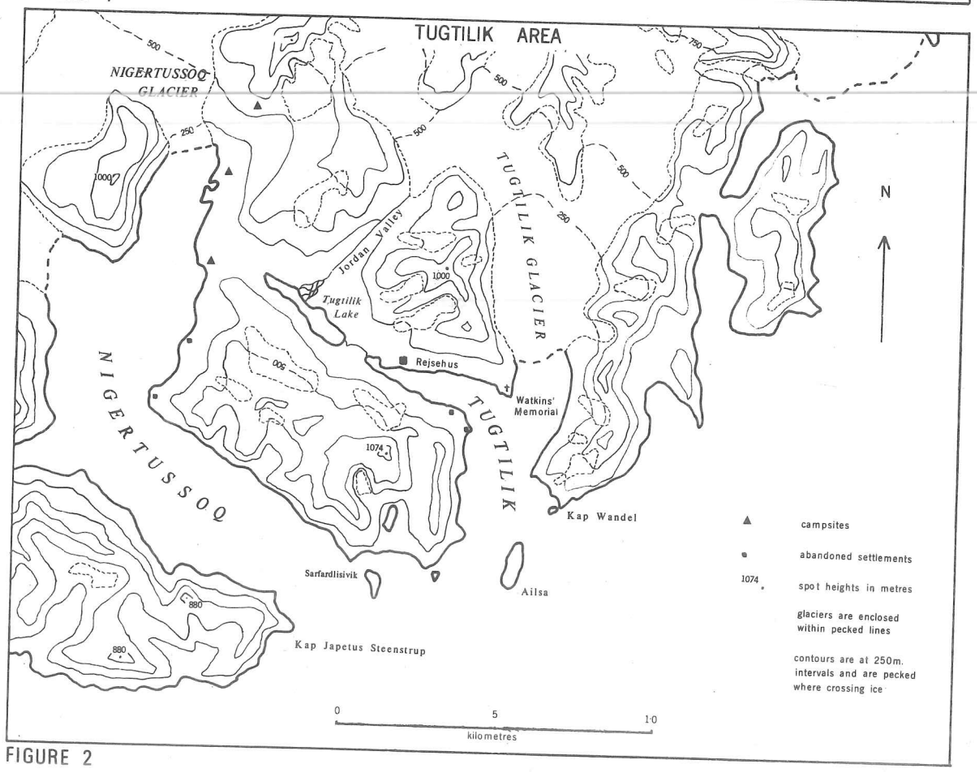
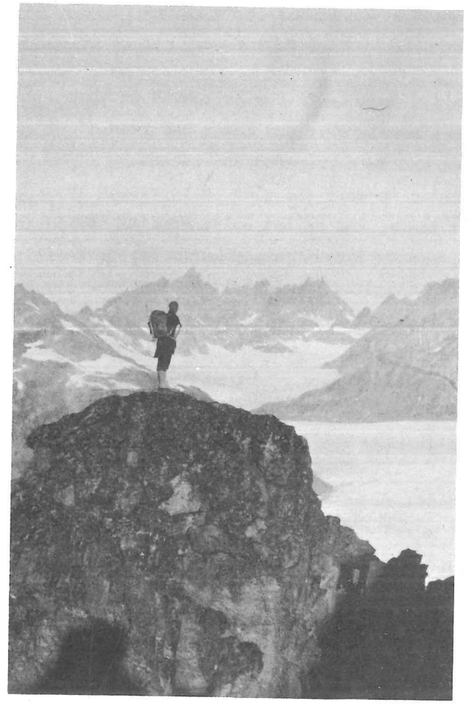
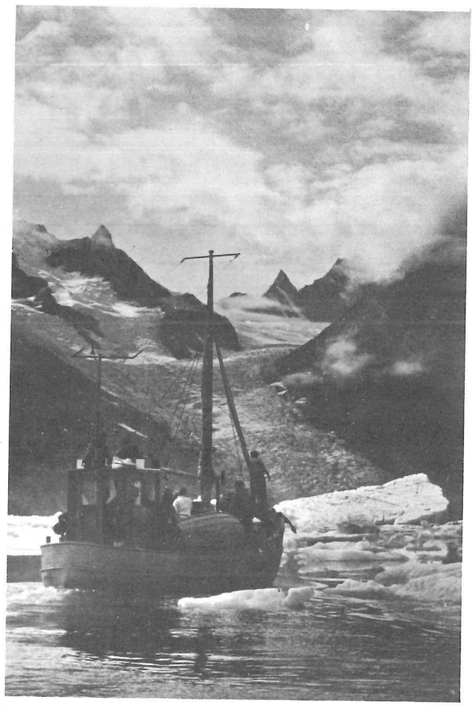


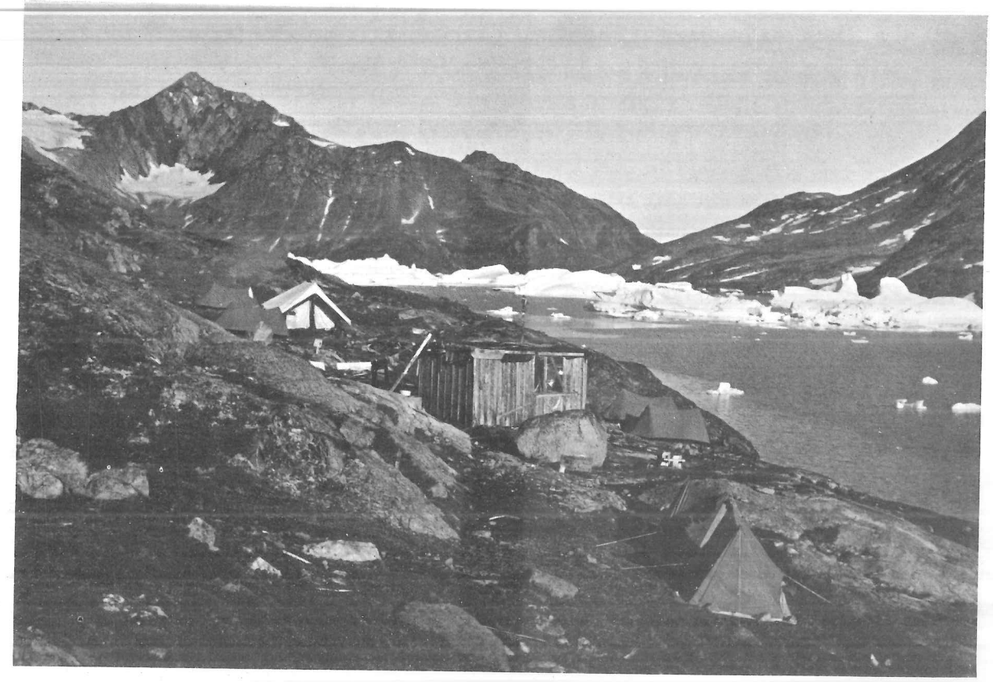
FIGURE 2



Nigertussoq Glacier, and, in the distance Ingolfs Fjaeld (2232 m.)



The 'Ako' in Kangerdlugssuatsiaq



Base camp at Tugtilik with the hut built by Ejnar Mikkelsen in 1932

THE EXPEDITION

Early in the evening on 26th June the expedition sailed from Leith for Reykjavik on the Icelandic vessel, M.S. "Gullfoss". University exams were barely over and there had been a busy ten days as the ton and a half of food and equipment had been prepared and packed. After three uncomfortable nights crossing the North Atlantic we were all glad to be ashore in Reykjavik, Iceland's capital city. Two days were spent there, and on 1st July, sharing the cost of a D.C. 6B charter flight with the Birmingham University Expedition, we left Reykjavik for Greenland. Within an hour the cloud and drizzle of Iceland were well behind, and we were flying at 3,500 m. over the continuous belt of pack-ice that lies off the east Greenland coast. Beyond the pack the coast slowly emerged as an endless chain of unbroken and barren mountains. Nearer, the sharply serrated peaks of the Caledonian Alps could be seen standing above the glaciers which make their way down to the fjords from the inland ice. In these fjords, and immediately along the coast, the pack was broken and the ice drifted in isolated masses.

Several men, heavily muffled, stood by with a fire tender at the bleak airstrip on Kulusuk Island as the plane touched down, raising a trail of gravel and dust. As we disembarked we were impressed by the scenes that would very soon become familiar to us.

It was intended to move to Tugtilik, 160 km. further north on the coast, but the Greenlanders at Kulusuk said that the ice in this area had not yet broken up, and that it would be at least another two weeks before it did. With this in mind, immediate plans were made to move to Kungmiut, a prosperous settlement at the head of Angmagssalik Fjord. A start could then be made on some aspects of the scientific programme, and the progress of the ice break-up watched more closely. Having laid in enough fuel for the duration of the expedition, we left Kulusuk on 3rd July in two small and very heavily laden motor boats.

A few hours zig-zagging between the brilliant ice-floes which lay stranded in the fjords brought us within sight of Kungmiut, a modern village nestling beneath a jagged skyline. The small pier filled with people who looked on curiously as we came ashore. Wooden houses, the newer ones brightly painted, were scattered along the rocky shore and linked by dusty pathways. Teams of scruffy dogs were chained in long lines outside the houses, and well out of their reach on wooden frames, fish and seal skins were left drying. Close to the pier was the store where the shelves were noticeably empty as the supply ship had not yet called after the winter freeze. From the church, high on the rocks in the centre of the village, one looked across an open bay where many small boats lay moored between the ice-floes. On a promontory to the north of the bay was a new fish factory, built in an attempt to diversify the traditional Eskimo economy. Nearby stood many rows of high timber frames on which white cod hung drying. Parched by the sun, the cod creaked and rattled in the wind.

We pitched our tents beyond these fish racks. From the camp there was a magnificent view up Angmagssalik Fjord to the low col at the head of Qingorssuaq. In the clear midday sun the colours were vivid, and brightly coloured flowers and gleaming icebergs contrasted with the deep blue of the sky and sea. As the sun dipped behind the mountains for a few hours at midnight the colours changed through pastel shades of pink and green, each colour reflected in the icebergs.

During the first part of July two areas on the western shore of Angmagssalik Fjord were

visited. Madsen, Kimpton, Elsley and Ray carried out some botanical and limnological work at Maries Havn and Imertevaa (7th - 12th July), and then some further work was done in the big lake, Imertevaa, by the same party, but with Moorhouse replacing Elsley (17th - 19th July). On the other side of the fjord Parker and Beck made a detailed geological study of a small area north of Kungmiut, while Elsley collected herbarium specimens from the rich flora of the area. The rest of the party were engaged variously in making a large scale topographic map of the settlement, and in preparing and testing equipment for use in Tugtilik.

On 15th July word came through from the outlying settlement of Sermiligâq that the ice further north was now well broken up. This was confirmed several days later; the scientific work was rapidly completed and preparations were made to depart on 21st July. During our stay in Kungmiut we were shown considerable kindness by the Greenlanders, particularly the headman, hr. Ulrik Lennert, who gave us much help, and hr. Ulrik Manîkutdlak, who asked us to the dances held in his house. Many a happy night was spent dancing. The young people also, who spent a lot of time around our camp, were only too willing to help where they could.

It was a cold but clear morning when we finally left Kungmiut at 10 a.m., on 21st July, in the two open, six metre motor boats that made their way along the narrow fjords towards the open coast. A short stop was made at Sermiligâq, a small settlement on the side of Sermiligâq Fjord and the mail from Kungmiut delivered. In the late afternoon we reached the open coast where a thick blanket of fog lay over the sea. With visibility sometimes less than a hundred metres we went on compass bearing from headland to headland, taking care to pass to the landward side of the coastal islands. In places, where the mist was thin, the sun broke through and cast across the water a silvery light that seemed to splinter against the ice-floes. Over long periods the only sound was the throb of the boats' engines, but occasionally one of the great icebergs looming up through the fog would heel over and disintegrate with a noise audible for kilometres around. By 10.30 p.m. we had reached Eskimo Ö, a small rocky island on the south side of Kangerdlugssuatsinq. With a total of 15 men and 30 cwt. of equipment in the two small boats, we were all very cramped and cold and glad to go ashore on the island. On a grassy ledge about 10 m. above the sea we were shown the ruins of an old Eskimo winter-house. It was a turf and stone building about 3 m. square with a long tunnel entrance, and on the high rocks nearby there were numerous graves. Although it was quite dark in the fog and the rocks wet and slippery, we all felt much warmer for having been ashore.

In the early hours of 22nd July the mist had lifted to 20 m. and the two boats were travelling along the foot of the precipitous cliffs north of Kangerdlugssuatsinq. Kilometre after kilometre along the coast the cliffs rose vertically from the sea, dark, wet and apparently lifeless. The monotony was broken only by the occasional dirty snow gully that came down from the cloud. The gaps in the cliffs were shrouded in dense masses of fog. Some of the gaps must have been valleys coming down to the sea, for sometimes grey screes or small glacier snouts could be seen protruding from above the cloud level; in other places the fog must have concealed fjord entrances. Somewhere there was Tugtilik Fjord but we did not know where. Shortly after 5 a.m., with the sun beginning to thin the cloud, a seal was sighted and in the usual way the boats went in pursuit through the pack-ice. From a greater distance from the shore a large glacier could be seen coming down to the sea about 5 km. further north. It was soon confirmed that it was Steenstrups Søndre Bræ and that we were well north of Tugtilik. A few shots were fired after the seal, which had long since vanished, and then the boats turned back towards Tugtilik where we landed on the shore of the

muddy branch fjord at 7 a.m.

Close to the landing place were the ruins of the hut which Ejnar Mikkelsen built in 1932 and in which Chapman, Rymill and Riley wintered. We rebuilt it during the next few days and it provided an invaluable base for the expedition's work in the area. The tents were pitched amongst the rocks in a wide area around the hut. For sleeping, four "Arctic Guinea" tents and two "Meades" were used, and a modified "Icelandic" was kept as a store. All the tents proved to be perfectly satisfactory.

During the first few weeks all work was centred on the Tugtilik base and from there most of the area could be reached in a day's walk. For some of the more detailed work in August, however, a number of camps were made near the adjacent fjord of Nigertussoq. Moorhouse, Sugden and Ray worked on the raised marine features on the eastern shore of the fjord (11th - 14th August), while Parker and Beck, with the use of a rubber dinghy, carried out geological investigations on the western side (11th - 18th August) and, from a camp near the Nigertussoq Glacier, Storey and Moorhouse took 24 hour temperature readings in a number of frost features (18th - 21st August).

Although Nigertussoq is named after the cold north-easterly wind that is supposed to blow there, it was almost invariably warmer than Tugtilik at the other end of the Lake where advection fogs were particularly frequent. In the late afternoon it was a common sight to see the white blanket of fog spreading into Tugtilik from the disintegrating pack ice. The fog usually dispersed by mid-morning, but sometimes persisted all day. At base, on such days it was cold and damp, but to climb often only a hundred metres brought one into warm sunshine where the mountains stood above the dense white blanket of fog like nunataks above the ice. When the sun was low in the sky the surface of the mist had a pinkish colour barely different from that of the ice.

On the headland between the two branches of Tugtilik, Rymill, Chapman and Riley erected a memorial to Gino Watkins in November, 1932. When we visited it, thirty-five years later, the cairn remained but the wooden cross had perished. The Greenlanders said the wood had been chewed by a polar bear. There was at this place a remarkable feeling of timelessness, as the water poured to and fro with the swell across the smooth rocks that formed the point between the fjords. Ailsa, the small island standing in the fjord mouth, which was named after the rock in the Firth of Clyde, rose about 300 m. above the water and cast a dark shadow across the pack.

Across the branch fjord, opposite the memorial, we found the ruins of an old Eskimo settlement. It was on a small rocky ledge a few metres above the water, backed by cliffs and screes that rose sheer for over 500 m. The walls of seven winter-houses were visible as ridges about a metre high, and in some cases the tunnel entrances were still intact. In spite of an easterly aspect the ledge bore a luxuriant vegetation, particularly of Sedum rosea and grasses, and the houses were much overgrown.

Old legends of this part of Tugtilik tell of the many salmon (a species of Arctic char) caught, some so large that sealing implements had to be used. The largest salmon that we caught during the summer was only 8 lbs., but the average catch each time the net was put out was over 60 lbs. At first the salmon net was put out at high tide, but the problems of putting out a 3 m. net over a 1 m. boat proved too great, and the net was later laid across the mudflats at low tide. This did not, however, prevent it becoming entangled with the

ice-floes. Throughout the expedition the salmon made a welcome addition to our diet, but they were so plentiful that it was only necessary to put out the net five times. They were most appreciated during the first week, but we rapidly tired of the salmon, mainly because we could catch nothing else. A cod would have been most welcome.

By late August the several survey tasks were nearing completion and preparations were made to leave. The short Greenland summer was virtually over and the geese nesting near the lake had already left on their way southwards. The flowers, which at the time we arrived had streaked the valley floors with colour, had gone to seed and the stunted shrubs had taken on the characteristic autumn hues of red and yellow. Before we left Kungmiut arrangements had been made for the two boats to reach Tugtilik by 23rd August. Work had been rapidly completed and the equipment packed for the return journey when news came through on the radio that the boats had had to turn back because of bad ice conditions. Twice the small boats started out but they barely got beyond Sermiligâq. Every day we had a radio schedule with hr. Lennert at Kungmiut, and all listened anxiously to the latest ice reports. On 25th August a larger experimental fishing boat set out but it too had to turn back. The light was fading on 29th August and for yet another day we had given up hope of the boats arriving when the first sound of engines was heard down the fjord. We had heard it before - the sound of wind blowing across the end of a tubular pack frame, the stream rolling stones along its bed, or just the noise of the generator resounding off the valley walls. This day, however, it was the boats from Kungmiut and we hastily struck camp.

At 3.0 in the morning on 30th August the boats weighed anchor and we made our way out of Tugtilik. It was a damp, overcast day and still dark. There were two boats, the 'Ako', a broad fishing boat with a crew of four and the headman of Kungmiut and a guide from Sermiligâq, and an open motor boat with two other Greenlanders. A climbing party from Imperial College, London, was isolated near the glacier snout at the head of Kangerdlugssuatsiaq and an attempt was to be made to reach them with our larger boat. Once in Kangerdlugssuatsiaq the ice was exceedingly dense and it took most of the day to cover the 20 miles up the fjord. The Imperial College base was on a boulder strewn shore close to the peak of Ingolfs Fjæld, the highest mountain in this part of Greenland.

During the evening we retraced our course down the fjord. The cloud had cleared and Glacier de France and its flanking mountains lay silhouetted against a vivid crimson sky. The ice had a pinkish tinge right into the distance. As it grew darker it grew colder and the fresh ice, which formed in the still water between the ice-floes, crackled as the boats went through. It was almost completely dark when we cut across the fjord to Storø, an island where we planned to rest for the night. A waning moon was rising over Nordfjord and the aurora flickered and wavered continuously across the clear sky. The pilot lights of the 'Ako' were reflected on the floes as we passed, and the searchlights played on the ice ahead.

There is a journeyhouse on Storø but it was grotesque inside, and pieces of ancient seal liver and weird bones hung from the ceiling. Most of us preferred to rest outside or on the boats. When we left the island at 3.30 the next morning it was foggy, but it cleared, and during the morning we made rapid progress down the coast. In areas between the islands the ice was very thick. In one strait the 'Ako', caught between two large ice-floes drifting in the current, was squeezed out of the water. Hastily we all jumped out onto an ice-floe. Much to our relief we watched the skipper slide the boat back into the water.

We reached Kungmiut in the evening and very many familiar figures were gathered on the small pier as the 'Ako' came up the fjord. One day was spent in Kungmiut, living in a Nissen hut in the centre. At 8 a.m. on 2nd September, the first day of school in the village, we left Kungmiut for Kulusuk, and that same day saw us wandering around the busy streets of a Saturday night in Reykjavik. The expedition sailed from Iceland on 9th September and finally reached Newcastle on 12th September.

Note on the radio used in Tugtilik

The radio used for communicating with Kungmiut and Angmagssalik was an Army 19 Set Mk.III Transceiver. The power supply was obtained from 12 volt Nickel-Iron Accumulators, charged by a small petrol generator. In the set-up used at Tugtilik a dipole aerial was erected for operation on 3.25 mc/s. Communications were very unreliable for most of the period, mainly because of insufficient modulation depth and a general lack of power (15 watts output). Whilst Kungmiut and Angmagssalik could usually find our carrier wave and we could usually hear them, they found it difficult to read our signals. There is a simple modification available for this transceiver, which uses the intercom amplifier as a modulation amplifier, and any future expedition using this set would be well advised to effect this improvement.

BOTANY

John E. Elsley

The botanical programme can be divided into two major sections:-

A. The collection and recording of floristic data from localities situated on Angmagssalik Fjord and in the vicinity of our Tugtilik base.

B. Specific ecological investigations at Tugtilik.

FLORISTIC PROGRAMME

Material of vascular plants was collected from three localities on Angmagssalik Fjord, while a further seven were investigated at Tugtilik. Herbarium material was collected for the majority of species recorded, and collections have been deposited in the following Herbaria:-

Botanical Museum, Copenhagen, Denmark.

National Museum of Canada, Ottawa.

Botanical Museum, Oslo.

Komarov Botanical Institute of the Academy of Sciences of the U.S.S.R., Leningrad.

University of Lancaster (Dr. G. Halliday).

University of Leicester.

A complete record, showing the vascular plants and lichens collected and recorded at each locality, is shown in the accompanying tables. Details are listed under the locality numbers.

A. ANGMAGSSALIK FJORD

The following is a description of the localities together with notes on species of particular interest.

(1) Kungmiut Settlement - 65° 51'N 37° 00'W

This locality includes the south facing slopes of Torssukatak Fjord east of the settlement, and corresponds closely to the locality visited by Kruuse in 1899 ('Tunoq'). Sea cliffs and herb slopes around the settlement were also investigated together with the east and south facing mountain slopes on the east side of Angmagssalik Fjord, north of the settlement.

In addition to Kruuse's visit in 1899 the locality was visited during the summer of 1933 by the 6th and 7th Thule Expedition to south-east Greenland. Botanical collections (Locality 34) were made by R. Bøgvad and M. Hammer. The following 11 recorded species are additional to those listed by Kruuse and Bøgvad:-

Asplenium viride

Dryas integrifolia

Equisetum variegatum

Euphrasia frigida

Botrychium boreale

Listera cordata

Platanthera hyperborea

Polygonum aviculare

Ranunculus glacialis

Ranunculus pygmaeus

Rhododendron lapponicum

Of these species the Botrychium boreale and Listera cordata are of outstanding interest. The Botrychium record extends this species northern limit in Greenland - previously its most northerly recorded site on the east coast was an inland locality on latitude 63° 35'N. The previous northern limit of Listera cordata on the east coast was 63° 32'N. In the case of both species only isolated colonies were located.

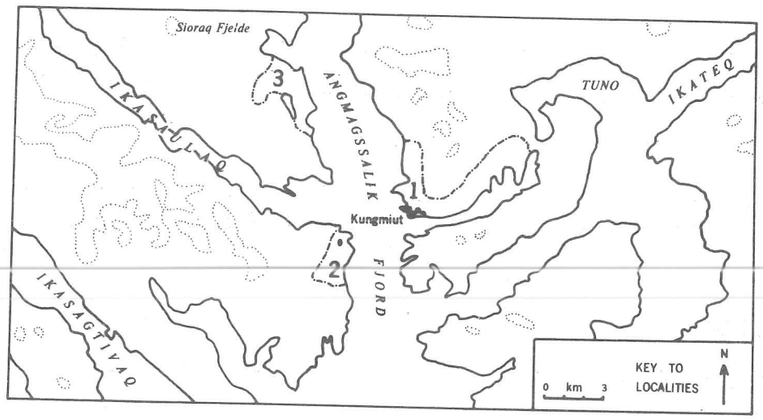


Figure 3 Angmagssalik Fjord Localities

(2) Maries Havn - 65° 50'N 37° 10'W

Situated on the west shore of Angmagssalik Fjord opposite the settlement of Kungmiut. The areas investigated included sea cliffs together with the north/south and east/west valleys leading from Maries Havn. The locality corresponds to locality 32 visited by M. Hammer during the summer of 1933 as a member of the 6th and 7th Thule Expedition.

Nine additional species to those recorded by M. Hammer were noted:-

Cardamine bellidifolia

Carex glareosa

Draba nivalis

Honkenya peploides

Pedicularis flammea

Puccinellis coarctata

Saxifraga tenuis

Sedum annuum

Thelypteris phegopteris

Of these species Cardamine bellidifolia is of particular interest, in that, apart from being especially local in its distribution in the Angmagssalik area, it is considered as occurring mainly in inland alpine habitats. In this instance it was located in a sheltered rock crevice near the coast at an altitude of 50m.

(3) West coast of Angmagssalik Fjord. 8 Km. north of Maries Havn and south of Quingorssuaq - 65° 55'N 37° 10'W

Areas visited included the southern coastline of Sioraq Dal and the river valley leading south and south-east of Sioraq Fjelde. This locality has no previous botanical records, but is situated just south of locality 33 visited by the 6th and 7th Thule Expedition in 1933. Cassiope tetragona and Viola palustris are two of the most interesting species noted, having only infrequent records in the Angmagssalik region.

B. TUGTILIK / NIGERTUSSOQ LOCALITIES - 65° 20'N 35° 00'W

Prior to our own expedition this area had been visited by three botanists, Kruuse in 1899, Böcher in 1932 and Bǿgvad during the summer of 1933. In addition, Chapman has made several references to the Tugtilik flora while Böcher attributes the discovery of Potentilla nivea to the Wager brothers who visited Tugtilik in 1935.

The records of Kruuse (1899) constitute the first botanical information from the locality. He briefly landed at two sites, one on the north side of Nigertussoq west of the entrance to Tugtilik, and secondly on the north-east branch of Tugtilik between the glacier at the head of the fjord and the promontory on the west side where Watkin's Mindesmaerke once stood. His finding of Alchemillia wichurae and Hieracium nigrescens hyparticum are among his most significant finds. Chapman, as a member of the British Arctic Air Route Expedition called at "Lake Fjord" during the summer of 1930, and although his later writings only briefly mention the flora of Tugtilik, Böcher (1938) refers to verbal communications with Chapman. In this context, Chapman made reference to the occurrence at Tugtilik of three significant species, namely Betula nana, Gnaphalium norvegicum and Papaver radicatum.

Böcher himself briefly visited Tugtilik in 1932 as a member of the Scoresby Sound Committee's 2nd East Greenland Expedition (Böcher 1933). During his visit he noted 81 species, several of them having an extremely disjunct distribution in East Greenland. Examples of such species include Carex atrata, Carex microglochin, Carex rufina and Saxifraga aizoides. Most of his data was collected on the north shore of "Lake Fjord", and he cites reasons for the interest of Tugtilik as a locality and suggestions for its especially rich flora (Böcher 1958). Bǿgvad, during his brief visit to Tugtilik as a member of the 6th and 7th Thule Expedition in 1933 added a further ten species to Böcher's list.

Böcher (1938) lists Bögvad's finds under localities 47 and 48.

A total of 21 species, additional to the previous combined lists for Tugtilik and Nigertussoq, were collected in the summer of 1967, bringing the combined total of recorded species for both localities to 122. The seven localities investigated (4a - 4g) cannot be directly related to any sites previously visited.

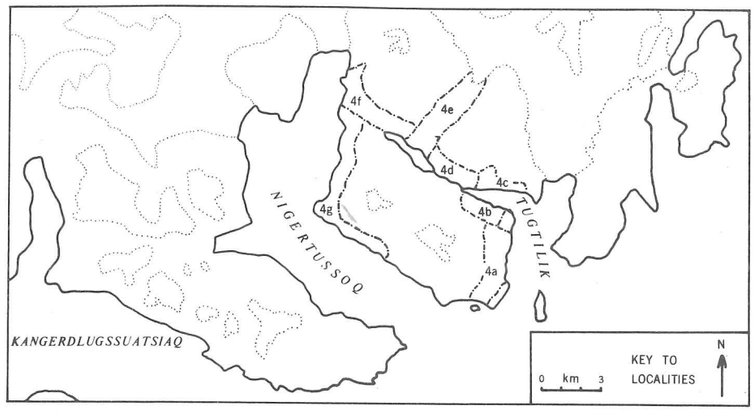


Figure 4 Tugtilik and Nigertussoq Localities

4a. North side of the mouth of Nigertussoq opposite Sarfardlisivik. Collections made around the lake and along the main north/south orientated valley up to the col leading over to "Lake Fjord", and along the ridge separating the main valley from Tugtilik Fjord. This ridge provided a number of northern and continental species, very rare in south-east Greenland and chiefly recorded from inland nunataks. Arnica alpina, Erigeron compositus, Campanula uniflora and Papaver radicatum provide examples of such species.

4b. North facing slopes on south side of "Lake Fjord". Exposed habitat with numerous snow patches plus associated meltwater areas.

4c. South facing slopes on north side of "Lake Fjord" between the Rejsehus to about mid-way between it and Watkin's Mindesmaerke. Rich herb slopes especially below 75 m.

4d. Marshy flats and heath between the Rejsehus and the Jordan Valley river.

4e. Both sides of the Jordan Valley ascending on the west to about 600 m. East facing valley slopes richly vegetated - in marked contrast to the west facing slopes.

4f. West of Jordan Valley river to Nigertussoq and including part of the east coast of Nigertussoq towards the glacier. Mainly rocky heath but isolated patches of more luxuriant vegetation in more sheltered, watered habitats.

4g. Rocky heath on the north-east shore of Nigertussoq and along the coast to within 5 km. of the fjord mouth. Isolated patches of luxuriant vegetation in the more protected habitats towards the fjord mouth.

Five species previously only recorded by Kruuse from Nigertussoq were found growing at Tugtilik, namely Gentiana nivalis, Hieracium groenlandicum, Sedum annuum, Sedum villosum and Woodsia glabella. A sixth species, Alchemilla wichurae, was still restricted to Nigertussoq and confirmed Kruuse's original record previously unsubstantiated by a specimen at Copenhagen (Böcher 1958). This present find probably corresponds to Kruuse's original locality. The discovery of Betula nana, Papaver radicatum and Gnaphalium norvegicum confirm Chapman's verbal records. A fragment of Potentilla nivea was collected in the mountains behind the Tugtilik Rejsehus, confirming the record by the Wager brothers. This later species, together with the finding of Carex supina at locality 4e. are additional examples of northern and continental species rare in south-east Greenland.

Several of the recorded species reach their known northern distribution limit at Kangerdlugssuatsiaq, namely Hieracium groenlandicum, Chamaenerium angustifolium, Gnaphalium norvegicum and Platanthera hyperborea. The Draba incana record is an extension of its known east coast range northwards from the Angmagssalik area, while that of Carex bicolor is an extension south of its range, south from Kangerdlugsuak. The records of Asplenium viride, Botrychium lanceolatum and Leuchorchis albida fill in major distribution gaps between their previous northern and southern records. Tugtilik is now only the second known locality of Carex norvegica between Kap Dausay (68° 44'N) and the head of Graaks Fjord (63° 40'N).

Further information relating to these and other recent botanical discoveries in south-east Greenland has been included in a paper prepared in conjunction with Dr. G. Halliday.

References:-

1. Böcher, T.W. 1933b Studies on the Vegetation of the East Coast of Greenland. Medd. om Grønl. 104.

2. Böcher, T.W. 1938 Biological Distributional Types in the Flora of Greenland. Medd. om Grønl. 106.

3. - 1958 Area-limits and Isolations of Plants in Relation to the Physiography of the Southern Parts of Greenland. Medd. om Grønl. 124.

LICHENS

During the time the expedition was at Tugtilik a collection of lichens was made and subsequently given to Mr. D.L. Hawksworth (University of Leicester) for determination. The lichens are all now in his herbarium, with the exception of one in the herbarium of Colorado University.

Collections were made at three localities:-

(i) West side of peak north-east of Rejsehus, alt. 100 - 150 m., 5th August 1967. 66° 25' N, 35° 02' W.
3 species

Alectoria minuiscula f. applanata (Lynge) M. Lamb (syn. Parmelia minuiscula ssp.

minutissima Ras.) Known from N.E. Greenland but this is the first record for this form south of Scoresby Sund. It is also known in Antarctica.

Alectoria pubescens (L.) R.H. Howe

Alectoria pubescens var. reticulata (Wulf) Wade

Umbilicaria hyperborea Ach.

(ii) Rejsehus, 1st August 1967; and south facing slope of "Lake Fjord" north west of Rejsehus, alt. 10 - 20 m., 22nd August 1967. 66° 20-22' N, 34° 56-58' W.

30 species

Alectoria minuiscula Nyl. Alectoria nigricans (Ach.) Nyl.

Alectoria pubescens (L.) R.H. Howe

Alectoria pubescens var. reticulata (Wulf) Wade

Cetraria hepatizon (Ach.) Vain.

Cetraria islandica (L.) Ach. A rare species in East Greenland; previous records are from about sea-level as was this collection.

Cetraria nivalis (L.) Ach.

Cladonia bellidiflora (Ach.) Schaer.

Cladonia chlorophsaea (Flk.) Spreng.

Cladonia ecmocyna (Ach.) Nyl.

Cladonia macrophyllodes Nyl.

Cladonia mitis Sandst.

Lecanora alpina Sommerf. Herb. COLO. This specimen is peculiar in having an ochraceous thallus due to uptake of iron from the substrate rock and in having the areolae separate and not in a continuous crust due to erosion by wind and rain.

Lecanora badia (Hoffm.) Ach.

Lecanora polytropa var. alpigena (Ach.) Rabenh.

Lecidea dicksonii Ach.

Lepraria neglecta (Nyl.) Erichs.

Physcia muscigena (Ach.) Nyl.

Psoroma hypnorum (Vahl.) S. Gray

Rhizocarpon geographicum (L.) DC.agg.

Rhizocarpon grande (Florke ex Flot.) Arnold

Rhizocarpon tinei ssp. diabasicum (Ras.) Runemark

Solorina crocea (L.) Ach.

Sphaerophorous fragilis (L.) Pers.

Staurothele clopima (Wahlenb. ex Ach.) Th.Fr.

Stereocaulon alpinum Baur.

Stereocaulon botryosum Ach.

Thamnolia vermicularis var. subuliformis (Ehrh.) Schaer.

Umbilicaria cylindrica (L.) Del.

Umbilicaria hyperborea Ach.

Umbilicaria torrefacta (Lightf.) Schrad.

Xanthoria elegans (Link) Th.Fr.

(iii) On exposed gneiss, south end of north-south ridge on west side of Tugtilik Fjord, alt. 650 m., 28th July 1967. 66° 17' N, 34° 48' W.

2 species

Alectoria nigricans f. subchalybeiformis Räs. New to Greenland. Previously only known from Russian Finland.

Thamnolia vermicularis var. vermicularis (Sw.) Schaer.

A paper concerning these species, with a discussion on A. nigricans f. subchalybeiformis Räs., is published in the Bryologist in 1968 (Hawksworth, D.L., Bryologist 71, pp. 52-54).

ECOLOGICAL PROGRAMME

The following is an outline of the ecological investigations undertaken at Tugtilik. It is intended to publish a more detailed account of the work at a later date on the completion of a more detailed analysis of the data.

(1) Much of the work was concerned with the effect of aspect on specific ecological factors including termperature, floristic composition and edaphic features. The investigations were undertaken at four sites on the banks of "Lake Fjord", three on the north shore having a southern aspect, and a fourth site on the south shore having a northern aspect. Those on the north shore were located along a 60 m. transect, each site having a slightly different micro-aspect. All four sites were situated at approximately the same altitude.

A. Temperatures

Hourly diurnal readings were taken at each site, an attempt having been made to make the readings at each site on days with as similar prevailing weather conditions as possible. Simultaneous readings were made with a thermister at 10 cm., 5 cm., and 1 cm. below ground level, at ground level, and 1 cm. above ground level, together with readings in different vegetation types. A record was also made 1 m. above ground level at each site, while a comparable reading, 1 m. above sea level, could be used for all four sites. Lower soil and vegetation temperatures were recorded at the site with the northern aspect. Differences in the range of 10 - 15° C were common when compared to similar positions at the other sites. Surface and near surface readings on the south shore reached their daily maximum earlier than at the other sites, falling very rapidly after reaching this point. Over a diurnal period the most constant temperatures occurred at the deepest recorded level, while surprisingly large fluctuations were noted around ground level. Differences between the maximum and minimum 1 cm. below ground level reached 25 - 30° C, while on occasions the

ground level readings exceeded this range. No really significant differecnes were recorded in different vegetation types, although species of "denser" habit (e.g. Empetrum hermaphroditum) reached higher temperatures than more "open" species (e.g. Salix glauca).

B. Vegetation

At each site a detailed floristic investigation was undertaken, including the laying of quadrats and the recording of species occurring in the immediate vicinity of the sites. The quadrat data showed that the three sites on the north shore of the Fjord supported a far greater range of species than the south shore site. Also, they showed a greater percentage of the ground surface covered by vegetation, while individual species tended to be of greater height. In more general terms, the vegetation on the south side of the fjord was markedly later in its growth; species in flower on this side tended to be fruiting on the north shore. Snow patches were in evidence down to the fjord's edge on the south shore, while the occurrence of typical "snow patch" species in full flower provided another indication as to the nature of the north facing locality. These "snow patch" species (e.g. Oxyria digyna, Cassiope hypnoides, Ranunculus glacialis) were largely absent on the south facing slopes.

C. Edaphic Features

Soil profiles were cut at each site and samples collected for investigation. The three sites on the north side provided a similar profile with clearly defined horizons. The upper or "A" horizon consisted largely of undecomposed organic matter bound together by the fibrous roots of shallow rooting species (e.g. Empetrum). Below this was a "B" horizon composed of a mineral soil and decomposed organic matter. Large Salix roots permeated this horizon. The underlying "C" horizon consisted of mineral soil and fragments of the underlying parent rock. Roots of deeper rooting species (e.g. Vaccinium) were much in evidence throughout this horizon. It seemed probable that the profile had developed largely in situ, and from early results there is evidence of leaching from the upper horizons. The depth of profile development was approximately 40 cm. On the south side of the fjord much larger areas of the ground surface consisted of bare rock, with a thin soil development in depressions and on ledges. Although not as distinct as in the previous profile, horizons could be located in the profile section. The surace "A" horizon was highly organic, while the "B" horizon below consisted of a mixture of mineral soil and partially decomposed organic matter. The height of profile development was around 25 cm. It is likely that the profile was mainly formed in situ, although some of the material could easily have been derived.

(2) Another project involved an investigation into the temperature regimes within Silene acaulis, a species of extreme caespitose habit. The plant investigated was growing on the glacial outwash delta at the west end of "Lake Fjord", and exhibited a marked degree of flower zonation. Hourly diurnal temperature readings were taken with the thermister simultaneously on the north, south, east and west sides of the plant just below the surface. The east facing side of the plant showed a much later flower development when compared with the more sheltered western side. The northern aspect of the plant showed an even greater delay in flower formation. From the evidence obtained, the east side of the plant warmed up first but then cooled down earliest, while the west side, although slower in heating up, remained warmer over a longer period of the day. Continually low temperatures were recorded on the north side, while much higher readings were obtained on on the south side. Although premature clouding over prevented the recording of any extreme

diurnal readings, the evidence obtained seemed to indicate that temperature played a major role in determining the succession of flowering zones in Silene acaulis.

(3) Finally soil samples were collected from habitats of the following ecologically interesting species:-

Carex rufina

Carex atrata

Carex microglochin

Gnaphalium norvegicum

TABLE OF SPECIES COLLECTED AND RECORDED AT THE 10 LOCALITIES VISITED

x Collected Material

o Recorded Material

	Angmagssalik Fjord			Tugtilik and Nigertussoq						
	1	2	3	4a	4b	4c	4d	4e	4f	4g
Alchemilla alpina	o	o	x	o	o	o	o	o	o	o
A. " filicaulis	x	-	-	-	-	-	-	-	-	-
A. " glomerulans	x	-	o	-	-	o	o	o	o	o
A. " wichurae	-	-	-	x	-	-	-	-	-	-
Antennaria canescens *	o	x	o	o	o	o	o	o	o	o
Arabis alpina	o	x	o	o	o	o	o	o	o	o
Arnica alpina	-	-	-	x	-	-	-	-	-	-
Asplenium viride	x	-	-	-	-	x	o	o	-	o
Bartsia alpina	x	o	o	o	o	o	o	o	o	o
Betula nana	x	-	-	-	-	x	-	-	-	-
Botrychium boreale	x	-	-	-	-	-	-	-	-	-
B. " lanceolatum	-	-	-	x	-	-	-	-	-	-
B. " lunaria	-	-	-	-	-	x	-	-	-	x
Campanula rotundifolia	x	o	o	o	o	o	o	o	o	o
C. " uniflora	-	-	-	x	-	-	-	-	-	-
Cardamine bellidifolia	-	x	o	o	o	-	-	-	-	-
Carex arctogena	-	-	-	o	-	-	o	-	x	o
C. " atrata	-	-	-	-	-	x	-	x	-	o
C. " bicolor	-	-	-	-	-	-	x	-	-	-
C. " bigelowii	o	x	x	o	o	o	o	o	o	o
C. " capillaris	-	-	-	o	x	o	o	o	-	o
C. " glacialis	-	-	-	o	-	o	o	o	x	o
C. " glareosa	o	x	o	o	o	o	o	-	o	o
C. " lachenalii	-	-	-	x	-	o	x	o	o	o
C. " macloviana	-	-	-	-	-	o	o	x	x	o
C. " microglochin	-	-	-	-	-	x	o	-	-	o
C. " nardina	-	-	-	-	x	x	o	x	x	o
C. " norvegica	-	-	-	o	x	o	o	x	-	o
C. " rariflora	x	-	x	o	-	o	x	-	-	o
C. " rufina	-	-	-	-	-	-	x	-	-	o
C. " rupestris	-	-	-	x	-	o	o	o	o	-
C. " saxatilis	x	-	-	-	-	-	-	-	-	-
C. " scirpoidea	o	x	o	o	o	o	o	o	o	o
C. " supina	-	-	-	-	-	-	-	x	-	-
Cassiope hypnoides	x	x	o	o	o	o	o	o	o	o
C. " tetragona	-	x	o	x	o	o	-	o	-	o
Cerastium alpinum *	o	x	o	o	o	o	o	o	o	o
C. " cerastoides	o	x	o	o	o	-	-	-	x	-
Chamaenerium angustifolium	o	o	o	o	-	x	o	o	o	o
C. " latifolium	o	o	x	o	o	o	o	o	o	o
Cochlearia officinalis	o	o	x	-	-	-	-	-	-	-
Coptis groenlandica	x	o	o	-	-	o	o	-	-	o
Cystopteris fragilis	x	-	o	o	o	o	o	-	-	-

ground level readings exceeded this range. No really significant differecnes were recorded in different vegetation types, although species of "denser" habit (e.g. Empetrum hermaphroditum) reached higher temperatures than more "open" species (e.g. Salix glauca).

B. Vegetation

At each site a detailed floristic investigation was undertaken, including the laying of quadrats and the recording of species occurring in the immediate vicinity of the sites. The quadrat data showed that the three sites on the north shore of the Fjord supported a far greater range of species than the south shore site. Also, they showed a greater percentage of the ground surface covered by vegetation, while individual species tended to be of greater height. In more general terms, the vegetation on the south side of the fjord was markedly later in its growth; species in flower on this side tended to be fruiting on the north shore. Snow patches were in evidence down to the fjord's edge on the south shore, while the occurrence of typical "snow patch" species in full flower provided another indication as to the nature of the north facing locality. These "snow patch" species (e.g. Oxyria digyna, Cassiope hypnoides, Ranunculus glacialis) were largely absent on the south facing slopes.

C. Edaphic Features

Soil profiles were cut at each site and samples collected for investigation. The three sites on the north side provided a similar profile with clearly defined horizons. The upper or "A" horizon consisted largely of undecomposed organic matter bound together by the fibrous roots of shallow rooting species (e.g. Empetrum). Below this was a "B" horizon composed of a mineral soil and decomposed organic matter. Large Salix roots permeated this horizon. The underlying "C" horizon consisted of mineral soil and fragments of the underlying parent rock. Roots of deeper rooting species (e.g. Vaccinium) were much in evidence throughout this horizon. It seemed probable that the profile had developed largely in situ, and from early results there is evidence of leaching from the upper horizons. The depth of profile development was approximately 40 cm. On the south side of the fjord much larger areas of the ground surface consisted of bare rock, with a thin soil development in depressions and on ledges. Although not as distinct as in the previous profile, horizons could be located in the profile section. The surace "A" horizon was highly organic, while the "B" horizon below consisted of a mixture of mineral soil and partially decomposed organic matter. The height of profile development was around 25 cm. It is likely that the profile was mainly formed in situ, although some of the material could easily have been derived.

(2) Another project involved an investigation into the temperature regimes within Silene acaulis, a species of extreme caespitose habit. The plant investigated was growing on the glacial outwash delta at the west end of "Lake Fjord", and exhibited a marked degree of flower zonation. Hourly diurnal temperature readings were taken with the thermister simultaneously on the north, south, east and west sides of the plant just below the surface. The east facing side of the plant showed a much later flower development when compared with the more sheltered western side. The northern aspect of the plant showed an even greater delay in flower formation. From the evidence obtained, the east side of the plant warmed up first but then cooled down earliest, while the west side, although slower in heating up, remained warmer over a longer period of the day. Continually low temperatures were recorded on the north side, while much higher readings were obtained on on the south side. Although premature clouding over prevented the recording of any extreme

diurnal readings, the evidence obtained seemed to indicate that temperature played a major role in determining the succession of flowering zones in Silene acaulis.

(3) Finally soil samples were collected from habitats of the following ecologically interesting species:-

Carex rufina

Carex atrata

Carex microglochin

Gnaphalium norvegicum

TABLE OF SPECIES COLLECTED AND RECORDED AT THE 10 LOCALITIES VISITED

x Collected Material

o Recorded Material

	Angmagssalik Fjord			Tugtilik and Nigertussoq						
	1	2	3	4a	4b	4c	4d	4e	4f	4g
Alchemilla alpina	o	o	x	o	o	o	o	o	o	o
A. " filicaulis	x	-	-	-	-	-	-	-	-	-
A. " glomerulans	x	-	o	-	-	o	o	o	o	o
A. " wichurae	-	-	-	x	-	-	-	-	-	-
Antennaria canescens *	o	x	o	o	o	o	o	o	o	o
Arabis alpina	o	x	o	o	o	o	o	o	o	o
Arnica alpina	-	-	-	x	-	-	-	-	-	-
Asplenium viride	x	-	-	-	-	x	o	o	-	o
Bartsia alpina	x	o	o	o	o	o	o	o	o	o
Betula nana	x	-	-	-	-	x	-	-	-	-
Botrychium boreale	x	-	-	-	-	-	-	-	-	-
B. " lanceolatum	-	-	-	x	-	-	-	-	-	-
B. " lunaria	-	-	-	-	-	x	-	-	-	x
Campanula rotundifolia	x	o	o	o	o	o	o	o	o	o
C. " uniflora	-	-	-	x	-	-	-	-	-	-
Cardamine bellidifolia	-	x	o	o	o	-	-	-	-	-
Carex arctogena	-	-	-	o	-	-	o	-	x	o
C. " atrata	-	-	-	-	-	x	-	x	-	o
C. " bicolor	-	-	-	-	-	-	x	-	-	-
C. " bigelowii	o	x	x	o	o	o	o	o	o	o
C. " capillaris	-	-	-	o	x	o	o	o	-	o
C. " glacialis	-	-	-	o	-	o	o	o	x	o
C. " glareosa	o	x	o	o	o	o	o	-	o	o
C. " lachenalii	-	-	-	x	-	o	x	o	o	o
C. " macloviana	-	-	-	-	-	o	o	x	x	o
C. " microglochin	-	-	-	-	-	x	o	-	-	o
C. " nardina	-	-	-	-	x	x	o	x	x	o
C. " norvegica	-	-	-	o	x	o	o	x	-	o
C. " rariflora	x	-	x	o	-	o	x	-	-	o
C. " rufina	-	-	-	-	-	-	x	-	-	o
C. " rupestris	-	-	-	x	-	o	o	o	o	-
C. " saxatilis	x	-	-	-	-	-	-	-	-	-
C. " scirpoidea	o	x	o	o	o	o	o	o	o	o
C. " supina	-	-	-	-	-	-	-	x	-	-
Cassiope hypnoides	x	x	o	o	o	o	o	o	o	o
C. " tetragona	-	x	o	x	o	o	-	o	-	o
Cerastium alpinum *	o	x	o	o	o	o	o	o	o	o
C. " cerastoides	o	x	o	o	o	-	-	-	x	-
Chamaenerium angustifolium	o	o	o	o	-	x	o	o	o	o
C. " latifolium	o	o	x	o	o	o	o	o	o	o
Cochlearia officinalis	o	o	x	-	-	-	-	-	-	-
Coptis groenlandica	x	o	o	-	-	o	o	-	-	o
Cystopteris fragilis	x	-	o	o	o	o	o	-	-	-

	1	2	3	4a	4b	4c	4d	4e	4f	4g
Deschampsia alpina	-	-	-	-	-	o	x	o	o	o
Diapensia lapponica	x	o	o	o	o	o	o	o	o	o
Draba incana	x	-	-	-	-	-	-	x	-	-
D. " nivalis	o	x	o	x	-	o	-	o	o	-
Dryas integrifolia	x	-	-	o	o	o	o	x	o	o
Empetrum hermaphroditum	o	o	o	o	o	x	o	o	o	o
Epilobium anagallidifolium	o	-	x	-	-	-	-	-	o	-
E. " lactiflorum	x	-	-	-	-	x	o	-	o	o
Equisetum arvense	o	o	o	o	-	o	x	o	o	o
E. " variegatum	x	-	-	o	o	o	o	o	o	o
Erigeron borealis	x	-	-	-	o	-	-	-	-	-
E. " compositus	-	-	-	x	-	-	-	-	-	-
E. " humile	o	-	-	x	o	o	o	o	o	o
E. " uniflorus	x	x	-	-	-	-	-	-	-	-
Eriophorum scheuchzeri	o	o	x	o	o	-	o	o	o	o
Euphrasia frigida	x	-	-	o	-	o	o	-	-	o
Festuca vivpara	x	-	o	-	-	x	o	o	o	o
Gentiana nivalis	x	x	-	o	-	x	o	o	o	o
Gnaphalium norvegicum	x	-	-	-	-	x	-	-	-	-
G. " supinum	x	-	-	-	-	o	o	o	o	o
Hieracium alpinum	x	o	o	-	-	o	o	o	o	o
H. " groenlandicum	-	-	-	-	-	-	-	x	-	x
Hippuris vulgaris	x	-	-	-	-	-	-	-	-	-
Honkenya peploides	x	o	o	-	-	-	-	-	-	o
Juncus biglumis	-	-	-	-	-	x	x	o	o	o
J. " trifidus	o	o	x	o	o	o	o	o	o	o
Juniperus communis	o	o	o	o	o	x	o	-	o	o
Kobresia myosuroides	-	-	-	x	-	-	-	o	o	-
Koenigia islandica	-	-	-	-	-	o	x	o	-	o
Leuchorchis albida	-	-	-	-	-	x	-	-	-	o
Listera cordata	x	-	-	-	-	-	-	-	-	-
Loiseluria procumbens	x	o	o	o	o	o	o	o	o	o
Luzula confusa	o	x	o	o	o	o	o	o	o	o
L. " spicata	x	-	o	o	o	o	o	o	o	o
Lycopodium alpinum	o	x	o	o	o	o	o	o	o	o
L. " annotimun	o	x	o	o	o	o	o	o	o	o
L. " selago	o	x	o	o	o	o	o	o	o	o
Minuartia biflora	o	x	o	o	o	o	-	-	-	-
M. " rubella	-	-	-	o	o	o	-	x	-	-
Oxyria digyna	x	o	o	o	o	o	o	o	o	o
Papaver radicatum	-	-	-	x	o	o	-	-	-	-
Pedicularis flammea	o	x	o	o	o	o	o	o	o	o
P. " hirsuta	-	x	o	o	o	o	o	o	o	-
Phleum commutatum	x	o	o	-	-	o	o	x	o	o
Phyllodoce coerulea	x	o	x	o	o	o	o	o	o	o
Pinguicula vulgaris	o	x	o	o	o	o	o	o	o	o
Platanthera hyperborea	x	-	-	-	-	x	-	-	o	o
Poa alpina	x	o	o	o	o	o	o	o	o	o
P." arctica	x	-	-	-	-	o	o	o	-	o
P." glauca	-	-	-	-	-	x	o	o	o	o
Polygonum aviculare	x	-	-	-	-	-	-	-	-	-
P. " viviparum	x	o	o	o	o	o	o	o	o	o
Polystichum lonchitis	x	-	-	o	-	o	o	o	o	o
Potentilia crantzii	x	x	o	o	o	o	-	o	o	o
P. " egedii	o	-	x	-	-	-	-	-	-	-
P. " palustris	o	-	o	-	-	-	-	-	-	-
Puccinellia coarctata	o	o	o	-	-	-	-	-	-	-
Pyrola minor	o	o	o	o	o	o	x	o	o	o

	1	2	3	4a	4b	4c	4d	4e	4f	4g
Ranunculus ager	x	-	-	-	-	-	-	-	-	-
R. " glacialis	o	x	o	o	o	o	o	o	o	o
R. " pygmaeus	x	-	-	o	x	-	o	-	-	-
Rhododendron lapponicum	x	-	-	o	o	o	-	o	o	o
Salix glauca ssp.callicarpaea	x	o	o	o	o	o	o	x	o	o
S. " herbacea	o	x	o	o	o	o	o	o	o	o
Saxifraga aizoides	-	-	-	-	-	x	o	o	o	o
S. " aizoon	x	o	-	o	o	o	o	x	o	o
S. " cernua	x	-	x	o	o	o	o	o	o	o
S. " caespitosa	o	x	o	o	o	o	o	o	o	o
S. " nivalis	o	x	o	o	o	o	o	o	o	o
S. " oppositifolia	o	x	o	o	o	o	o	o	o	o
S. " rivularis *	o	-	-	o	x	o	o	-	o	o
S. " stellaris	o	-	x	-	-	o	o	o	o	o
S. " tenuis	o	x	-	-	o	o	-	-	-	-
Scirpus caespitosus	x	o	o	o	o	o	o	o	o	o
Sedum annuum	o	x	-	x	-	o	o	o	o	o
S. " rosea	o	x	o	o	o	o	o	o	o	o
S. " villosum	-	-	-	-	-	x	-	-	-	-
Sibbaldia procumbens	o	x	o	o	o	o	o	o	o	o
Silene acaulis	o	x	o	o	o	o	o	o	o	o
Stellaria humifusa	o	-	x	-	-	o	-	o	-	o
Thalictrum alpinum	o	-	x	o	-	o	o	o	o	o
Thymus drucei	x	x	o	o	o	o	o	o	o	o
Taraxacum croceum *	o	o	x	o	-	o	o	o	o	o
Thelypteris phegopteris	-	o	-	o	-	-	-	-	-	-
Tofieldia pusilla	o	x	o	o	o	o	o	x	o	o
Trisetum spicatum *	o	o	x	o	o	o	o	o	o	o
Veronica alpina	x	-	x	o	o	o	o	o	o	o
V. " fruticans	x	-	-	x	-	o	-	o	-	o
Viola palustris	x	-	o	-	-	-	-	-	-	-
Viscaria alpina	x	o	o	o	o	o	o	o	o	o
Vaccirium uliginosum	o	x	o	o	o	o	o	o	o	o
Woodsia glabella	-	-	-	-	-	x	-	-	-	-
W. " ilvensis	o	x	o	x	-	o	o	o	o	o
	101	66	74	87	67	103	90	88	84	96

* = Aggregate Species

ORNITHOLOGY

Philip Ray

Having been advised by Dr. F. Salomonsen of the Zoological Museum, Copenhagen, that the avifauna of this whole stretch of coast was likely to be poor, the absolute paucity, both of numbers and species, still came as something of a surprise and is a recurrent theme throughout these notes. All Latin names of birds are those as used by Salomonsen in his "Birds of Greenland" (1950). Where racial differences are critical the race has been inferred from Salomonsen's accounts of their ranges.

Observations made in the Angmagssalik Fjord area were concentrated on Kungmiut, Maries Havn, and Imertevaa (Localities 1, 2 and 3 respectively in Figure 3)

MARIES HAVN

A narrow north-south valley on the west side of Angmagssalik Fjord, entering Ikasaulak at 65° 51' N, 37° 9' W. This valley, together with the rock basin lakes to its west, was covered for a period of three days from 7th to 9th July, 1967. Bare rock and scree abound, flat land being confined to narrow gravel or marshy strips in valley floors and adjacent to the coast. Vegetation cover approaches completeness only on the valley floors and on isolated hillside patches which were usually below 300 m. and free of scree. Locally dominant were Vaccinium, Empetrum with Cassiope on drier slopes, replaced with Carices and Eriophorum on the valley floors.

1) Red-Throated Diver (Colymbus stellatus). One pair on large shallow rock-basin lakes to east of valley. Nest on a minute rocky islet in middle of the largest lake. Still brooding 9th July.

2) Ptarmigan (Lagopus mutus rupestris). One pair had nest on gravel flat near large lake. Contained 6 eggs. Another pair held similar territory in main valley. The males of these pairs, together with two other apparently unattached males, were still showing very much white, with the brown of the summer plumage beginning to show through on the crown and nape of only one individual.

3) Wheatear (Oenanthe o. leucorrhoa). Only one bird seen.

4) Redpoll (Carduelis flammea rostrata). One pair probably of this species seen by Madsen near lakes.

5) Snow Bunting (Plectrophenax n. nivalis). Commonest bird by far. 20 - 30 pairs seen throughout the area, and thus at best thinly populous. One free-flying juvenile near valley mouth on 7th July, while on 9th July an adult was seen near lakes with a feather in its bill. There is thus a distinct possibility of double brooding having occurred during this season.

IMERTEVAA and SIERAQ

West coast of Angmagssalik Fjord, 8 km. north of Maries Havn (65° 55' N, 37° 10' W). The area covered included the basin containing two lakes and the mouths of the two valleys

which open into Sieraq, an inlet with several thousand square metres of tidal mud flats. Such a large expanse of this type of habitat is something of a rarity in this area, and in Europe might well be rich in bird life. The only birds in evidence here, however, were three Mallard. Altogether four days were spent in the district.

1) Red-Throated Diver. A pair bred on the smaller of the two lakes, in preference to Imertevaa, the larger lake. Madsen suggests that this may well be because the larger lake, being deeper and colder than the smaller lake on which the divers bred, was noticeably poorer in aquatic life. These factors would counter-balance the element of security which the large lake offered to a greater degree. Neither lake contained islands, which offer the usual secure site for this species. The pair had two young on 11th July, in post-first moult down (cf. pair still brooding at Maries Havn two days before).

2) Mallard (Anas platyrhyncha). Two males and one female, feeding in a shallow creek on the mud flats in Sieraq at low-water on 11th July. All in breeding plumage, but presumably non-breeding birds.

3) Ptarmigan. Two males only, one showing very little of the white winter plumage.

4) Raven.(Corvus corax principalis). One flying over area 19th July.

5) Wheatear. Locally fairly plentiful, with an apparent preference for steep slopes with turf covered rocky ledges and occasional boulders and rock outcrops. 10 - 15 pairs altogether.

6) Redpoll. Very local, with preference for open slopes, well vegetated with Vaccinium, Empetrum and Salix bushes. Four birds seen, one pair clearly in possession of territory in an area of dense Salix scrub.

7) Lapland Bunting (Calcarius lapponicus subcalcaratus). Eight seen. Two pairs in Sioraq Dal in possession of territory. One male in the east-west valley south of Sioraq Fjelde in company with three flying juveniles. Singing males' territories very similar to Snow Bunting habitat, being rocky, boulder-strewn slopes with patchy vegetation, but on more level ground nearer valley floor.

8) Snow Bunting. Again by far the most plentiful bird with numbers approximately equalling the sum of the other passerines. One nest with four well-fledged young found 11th July.

KUNGMIUT

Area centred on settlement of Kungmiut.

All the above species present with the exception of Red-Throated Diver. Ptarmigan confined to higher slopes well away from settlement. Only three Lapland Buntings seen, two males and a flying juvenile, in Torssukatak 4 km. east of the settlement. Two Redpolls seen with the buntings. Wheatears, and particularly Snow Buntings, fairly plentiful, with the latter well domesticated in Kungmiut. Other species of note were:-

1) Mallard. Four males and three females by edge of fjord in Torssukatak. Breeding

plumage, but presumably non-breeding. Two male mallards were also hanging up outside one of the houses in the settlement.

2) Ringed Plover (Charadrius h. hiatacula). One bird in Torssukatak.

3)& 4) Glaucous Gull (Larus h. hyperboreus) and Iceland Gull (Larus g. glaucoides). Birds of both these species present all the time in small numbers, rarely in excess of ten birds observable on any given occasion. Both species were shot by the villagers for food. Majority of birds seen were adults.

TUGTILIK and NIGERTUSSOQ

The Tugtilik-Nigertussoq area was the destination of the expedition. A boat journey was undertaken lasting 21 hours on 21st-22nd July, and passing some 80 miles of desolate coast. A constant watch was maintained throughout, though hampered by fog and semi-darkness for some 9 or 10 hours, and was most revealing in its largely negative results. The narrow ice-free margin of land was composed of large stretches of steep boulder and scree-strewn mountain slopes, broken by the mouths of fjords and occasionally accidented by cliffs, usually of less than 100 m. in height. The only concentrations of sea birds were near such cliffs. Birds observed whilst travelling were:-

1) Fulmar (Fulmarus g. glacialis). One bird seen near Kangerajikajik (66° 4' N, 35° 40' W).

2) Eider (Somateria molissima borealis). Eight to ten on sea at east end of Ikasak (65° 50' N). Six off mouth of Iliartalik (65° 55' N). A further six off Depotö (66° 05' N).

3)& 4) Glaucous Gull and Iceland Gull. Relatively frequent in ones and twos. Probably at least fifty Glaucous Gulls at a gullery on very steep cliffs on the south-east of Depotö. This would be quite a large gullery for the species on this coast according to Salomonsen (1950).

5) Black Guillemot (Cephus grylle arcticus). The only plentiful species, yet not really abundant or widespread. Locally up to twenty or thirty birds in loose parties as at Depotö and in Ikasak (65° 55' N). Well over 100 around cliffs just north of Kap Wandel 66° 17' N.

The only previous ornithological records from the Tugtilik-Nigertussoq area appear to be those of Chapman on Watkins' 1932-33 expedition. His records for the expedition are published in his book "Watkins' Last Expedition" (1934), and it is most interesting to note the several changes in the avifauna which have occurred in the thirty-five years which have since elapsed. These will be discussed briefly in the section which follows.

1) Red-Throated Diver. Two pairs bred, one on a very small lake in the old lateral moraine of the Nigertussoq glacier, with one well grown young losing its down by 7th August, and the other on the Tugtilik Lake which lies in the transverse valley between Nigertussoq and Tugtilik. The one chick of the latter pair did not hatch until 14th-15th August, very late in the season when the fjords were beginning to freeze at night. Chapman has two records of this species in summer, but none of breeding.

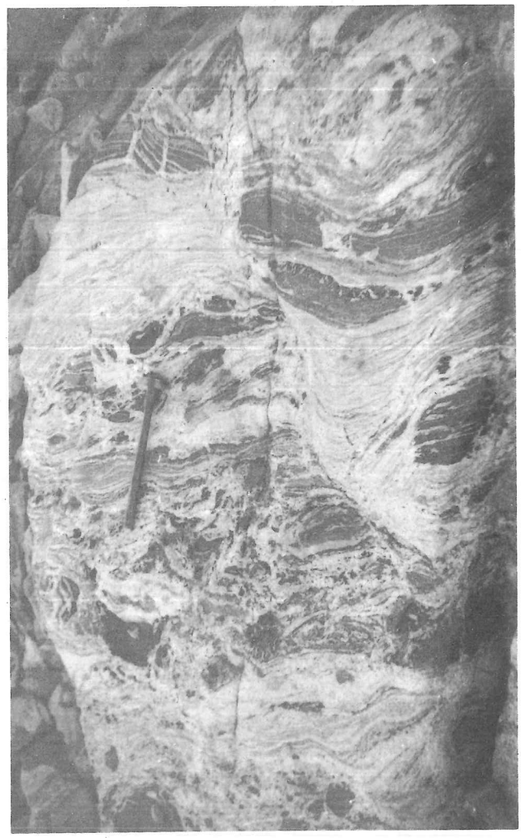


Plate 1 Agratite with blocks of foliated amphibolite and matrix of foliated gneiss.

Plate 2 Typical blocky agmatite with pegmatite matrix.

Plate 3 Looking west across Nigertussoq. Wide, large scale lithologic bands are seen in the lower half of the mountain. A large overfold is visible in the centre of the mountain.

37 36 W 35

K. I. V. STEENSTRUPS N. BRAE

K. I. V. STEENSTRUPS S. BRAE

Kap Gustav Holm

GLACIER DE FRANCE

Asavakit Glacier

NIGERTUSSOQ

Nuuk Inut

KANGERDLUGSSUATSIAQ

Alitta

Kap Japetus Steenstrup

CALEDONIAN ALPS

Storø

Eskimo Ø

Depotfjord

Depot Ø

SERMILIK

Sermilikvand

66 N

Sermiligaq

SERMILIGAQ

Kungmiut

ANGMAGSSALIK I.

ANGMAGSSALIK FJORD

Angmagssálik

Kap Dan

Kulusuk

Kilometres

0 10 20 25 30 40 50

36W

37

35

66 N

UNIVERSITY OF NEWCASTLE UPON TYNE

EXPEDITION TO EAST GREENLAND 1967

Route of the expedition in Greenland — northward —o—o— southward —x—x—

Kungmiut

Settlement

Rejsehus

Ice-free land in Summer

GREENLAND

Arctic Circle

Angmagssalik

ICELAND

Reykjavik

BRITISH ISLES

Newcastle

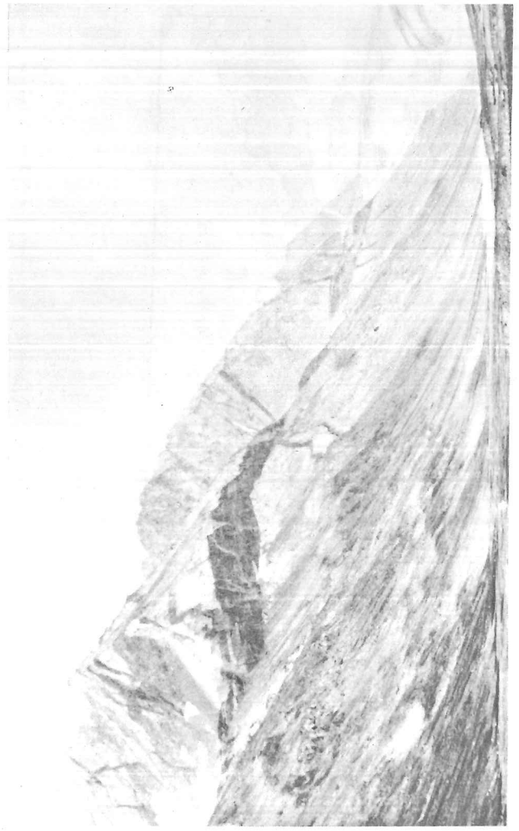


Plate 5 Jordan Valley showing horizontal amphibolite sheet and Tertiary dykes.

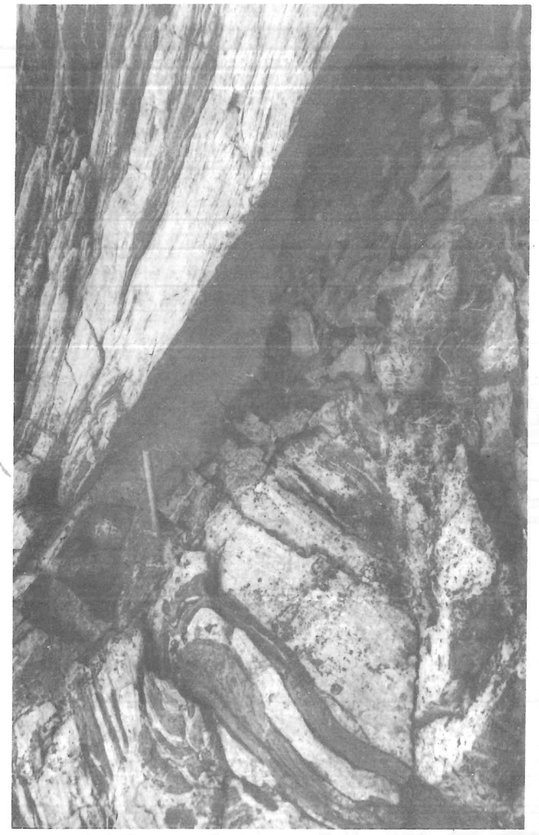


Plate 7 Amphibolite sheet strongly discordant at the base but concordant at the upper contact.

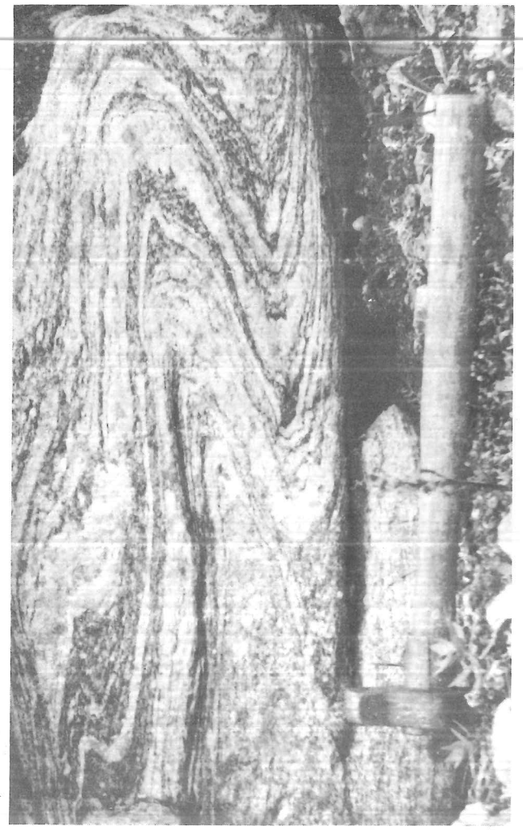


Plate 4 Rare small-scale fold in foliated gneiss.

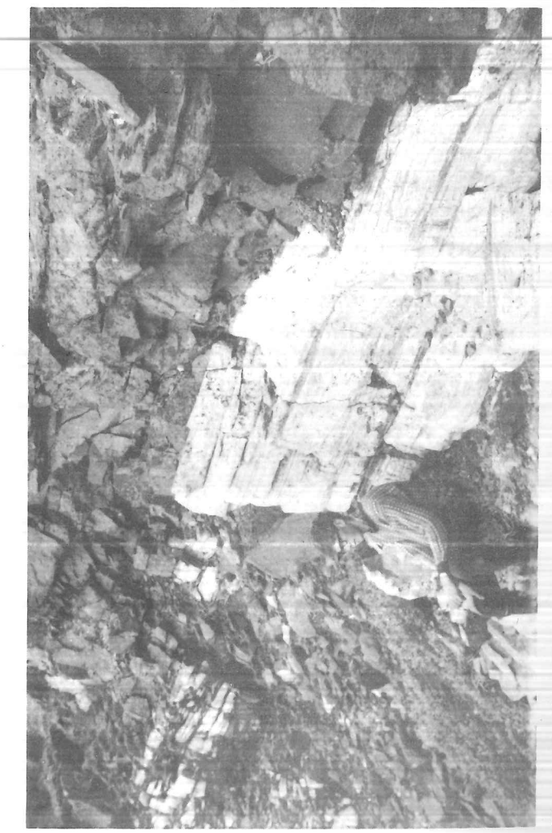


Plate 6 Comfortable lower contact of Jordan Valley amphibolite.

2) Long-Tailed Duck (Clangula hyemalis). Eight male and six female adults in summer plumage, but presumably non-breeding, on a small tidal lagoon in Nigertussoq on 4th and 7th August. May well have stayed longer. Chapman has no records of this species in summer.

3) Eider. Mixed parties of up to eleven adults on Tugtilik close to the base camp. Commonly between thirty and fifty on Nigertussoq, all in eclipse by 7th August. No signs of their having bred.

4) Pink-Footed Goose (Anser fabialis brachyrhynchos). Undoubtedly the most interesting species recorded in the area. Salomonsen (1950) records its known breeding range in Greenland as extending from the Hochstetter Foreland south to Mikis Fjord (68° 08' N), the Mikis Fjord birds being severed off from the main population to the north by the barren Blosseville Coast. On 24th July four members of the expedition surprised two family parties of Pinkfeet which had been feeding near small pools in the gravels between the Lake and Nigertussoq: two pairs of adults, one with five goslings and one with two. The goslings were well grown, approximately 25-35 cm. in length, still in down, and were very active runners. The parents, however, gave way to flight when pursued persistently. The nesting sites of these geese were not found but the transverse valley between the fjords abounds with open grassy areas of the kind which Salomonsen states to be possible sites for such isolated pairs. This breeding ground lies 200 km. south of the previous known southerly limit of the species' range.

Besides the breeding pairs there was a large flock of non-breeding free-flying Pinkfeet (possibly first year birds), first noted 31st July on the Lake. Numbers seen varied considerably from day to day, but the maximum count was twenty-one. The grassy area around the Lake was liberally scattered with the evidence of moult and with goose droppings. The birds were observed through until late August. They appeared to feed on, amongst other things, Cerastium, Salix and Carices, and luxuriant growths of Carex bigelowii were often found well cropped. The peninsular area between the two fjords would be expected perhaps to provide a good refuge for geese, and the only signs of contemporaneous occupation of the area by foxes were a set of tracks on a beach in Nigertussoq, together with some old tracks and droppings by the Lake; in total very little.

5) Barnacle Goose (Branta leucopsis). Also a high arctic breeding species in Greenland, not breeding south of Scoresby Sund (Salomonsen 1950). Four non-breeding free-flying birds (possibly first year birds) summered on Tugtilik Lake, and it was noticeable that they rarely consorted with the Pinkfeet. Chapman mentions finding goose feathers and droppings by the Lake in mid-August but has no sight records of geese in summer except one of a single Barnacle Goose in June. The geese in 1967 were very secretive and inconspicuous, and the non-breeding birds were overlooked for the first two weeks, although all the signs of a recent moult were in abundance, so it is perhaps possible that some did summer in 1932.

6) Gyrfalcon (Falco rusticolus candicans). No sightings but plucked remains of gulls were found on two occasions and, together with large pellets containing the bones and feathers of what appeared to be a Snow Bunting, these were taken as being evidence of the recent presence of a raptor, probably of this species. Chapman recorded a pair breeding above a gullery off Kap Japetus Steenstrup, but the lack of local sea-bird colonies would presumably account for the non-residence of this species in the immediate Tugtilik district.

7) Ptarmigan. Fairly common; groups of up to nine juveniles recorded and several family parties with free-flying juveniles after 4th August. One young pullus, however, only c. 6-8 cm. and still in down, was caught and examined on 12th August, while the adult birds were nearby.

8) Ringed Plover. Two pairs held territories on alluvial fans, one in Nigertussoq, the other near the Tugtilik rejsehus.

9) Turnstone (Arenaris i. interpres). Eight adults in summer plumage seen on rocky shore in Nigertussoq on 4th August. One in winter plumage on gravels near river mouth in Tugtilik the next day. Up to four on tidal shingle by rejsehus throughout last ten days of August.

10) Knot (Calidris canutus). Poor views of three on Jordan Delta on 2nd August; one of which was certainly in winter plumage. One red bird at the same place ten days later. Up to six on mud in Tugtilik at end of August.

11) Sanderling (Crocethia alba). One in winter plumage with Turnstones in Nigertussoq, 12th August. Up to eight on mud in Tugtilik at end of August.

12) Glaucuos Gull. Frequent over fjords and the Lake. On return journey to Kungmiut, 30th August, a large colony of very approximately one hundred pairs was discovered on the steep cliffs just south of Kap Japetus Steenstrup. Many first year birds were present, but no other species were observed on the cliffs.

13) Iceland Gull. Very few positively identified and no evidence of breeding found in the area. This is in direct contrast to Chapman's records of "plentiful" numbers of the species in "Lake Fjord" around 22nd - 29th August 1932. It may be that his birds were moving south through the area, for it is around this date also that he noted the coastal auk migration. He also makes reference to a gullery off Kap Japetus Steenstrup, with Iceland Gulls breeding, but in 1967 no trace of this species breeding was seen.

14) Sabine's Gull (Xema Sabinii). Five small gulls, with the striking wing pattern of this species, were observed at long range as they inspected the salmon net at the mouth of the river in Tugtilik on 28th August, after several days of onshore winds.

15) Black Guillemot. A few pairs bred in small cliffs on the north shore of Tugtilik, with many more on the steep sides of Sarfardlisivik and at Kap Wandel.

16) Raven. Only three sightings of up to three birds.

17) Wheatear. Rather scarce, but locally more frequent, as in the Sieraq area. Few in lower Nigertussoq, and none seen in the barren valley which opens south towards Sarfardlisivik. Several family parties seen by mid-August. It is difficult to assess how this compares with Chapman's record of "several family parties" seen during a single walk past the lake in 1932.

18) Meadow Pipit (Anthus pratensis). A species with a very recent history of colonisation in the Angmagssalik district (Salomonsen 1950); it was recorded by Chapman on 17th August 1932, near the Rejsehus at Tugtilik, and also in large numbers further south near Angmagssalik. In 1967 the writer observed no bird of this species. It would be

interesting to know more of the present status of this species in East Greenland; as its foothold has been so recently gained, its population may be more subject to fluctuations than longer established species appear to be.

19) Redpoll. A very scarce species, only three pairs recorded, and no proof of breeding, although two pairs appeared to be occupying territories. On 17th - 18th August, 1932, Chapman recorded parties of up to twelve birds flying over the Rejsehus.

20) Lapland Bunting. Also very scarce. One fledged and free but as yet flightless juvenile caught and examined by the lake on 24th July, and a pair of adults were seen in the same area the next day. Two adults with two juveniles in Nigertussoq on 13th August complete the total. Chapman's record of "a few Lapland Buntings" for 11th August on a walk from the Rejsehus past the lake perhaps suggests a greater abundance than this.

21) Snow Bunting. By far the commonest land bird, yet still rather thinly spread. No more than three pairs were in evidence in the valley opposite Sarfardlisivik. Together with a pair of Redpolls and a pair of Ravens they made up the total avifauna of this valley. Many family parties seen after 4th August when on a 7 km. walk from the Rejsehus and past the lake one might encounter thirty or forty birds altogether. Contrast this with Chapman's records of parties of fifty or sixty birds seen near the base around the same time in August (18th - 22nd).

Preferred habitats were as in the Angmagssalik Fjord area. The species was very rarely encountered on the bare slopes above 500 m.

Unfortunately, lack of quantitative data, both for the 1932-33 and the 1967 expeditions, precludes the drawing of any firm conclusions. However, the records would suggest one of three alternatives:

(1) A considerably denser resident population of passerines in the Tugtilik-Nigertussoq area during 1932-33 than in 1967.

(2) A greater down-coast passage of passerines during 1932-33 than 1967, swelling the local population. Most of Chapman's large parties were seen after mid-August and were in flight, but he did record parties of twenty or thirty snow buntings as early as 11th August, which were all juveniles, the adults having 'disappeared'. In 1967 no such obvious inflation of the passerine population was recorded, there being merely a population with many juveniles, most of which were in family groups. This is such as might be expected as the fruition of a season's breeding. Furthermore, the areas to the north are severely restricted in terms of passerine habitats which could supply a passage population. Chapman makes no comment on whether or not the parties he observed appeared to be migrants.

(3) A coastal passage may have either been delayed or taken place to seaward of the recording area. This does, however, seem unlikely in view of the numerous frosts after 13th August and the persistent onshore winds during the month. The small, but noticeable, influx of waders and gulls in the area suggests that the normal passage was in progress, having begun around mid-August.

I would like to thank Dr. F. Salomonsen, and Mr. R. Spencer of the British Trust for Ornithology, for their kind assistance and advice on the ornithological programme.

LIMNOLOGY

Bent Lauge Madsen

This is only a short report on my work on the expedition. The full account of the results will appear in Meddelelser om Grønland.

While the localities at Kungmiut were very fine and interesting from a limnological point of view, the localities at Tugtilik were rather disappointing.

1. Ecological work on water beetles

At Kungmiut as well as at Tugtilik I found many larvae of Colymbetes dolabratus. Soon it was evident that it occurred only in low ponds, never in lakes or in ponds at higher altitudes.

This was in contrast with my previous results in West Greenland, where its main occurrence was in lakes, and where in summer larvae as well as adults were found. This led me to the idea that the species had a different mode of wintering in West and East Greenland. In West Greenland it winters in the water under the ice as an adult. As Dr. Røen has shown, its northern limit distribution is limited by the duration of the ice cover (personal communication). Probably the duration of the ice cover is too long in the Kungmiut/Tugtilik area for the adults of C. dolabratus to winter. I postulate that here it winters in the egg stage. The eggs hatch in spring and the larvae grow up in the short summer. Therefore they are restricted to ponds, which melt early and soon reach a high temperature. No larvae were found in ponds with low temperatures, i.e. those at higher altitudes.

In Fig. 6 I have shown the life history in West Greenland and the suggested life history in East Greenland. The mean temperatures give an indication of the difference in the duration of ice cover.

Unfortunately the expedition ended before I could expect to find adults, although I found larvae beginning pupation. The best way to check the postulate is to search for eggs in the adults in the fall or for adults in the spring.

At Tugtilik I found larvae, pupae and adults of another water beetle, Hydroporus melanocephalus. The last day at Tugtilik a lot of newly pupating larvae were found in the gravel bordering a pond. The larvae were seen crawling on the stones, a behaviour quite different from that of C. dolabratus, which is a swimming larvae.

2. Plankton in the lakes and ponds

In all the lakes and ponds visited plankton samples were taken with a no. 20 net. In Imertivaa, near Kungmiut, series of vertical hauls were taken in order to estimate the standing crop.

The material is under preparation by Dr. Røen, University of Copenhagen. He has been working with fresh-water plankton from Greenland for more than ten years and has placed a preliminary list at my disposal. I will here only mention that the most numerous species was Cyclops scutifer and that Diaptomus minutus and Alonella nana have never before been recorded in East Greenland.

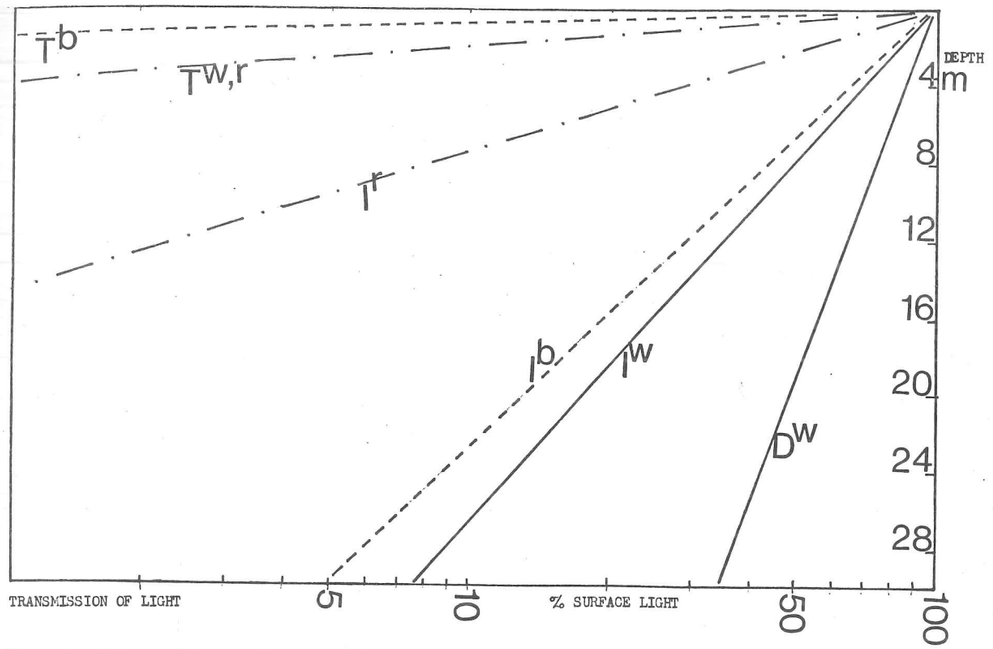


Figure 5. Light conditions in Imertevaa (I) and Tugtilik (T)

W = white light. b = blue light. r = red light. D = distilled water
I = Imertevaa. T = Tugtilik lake.

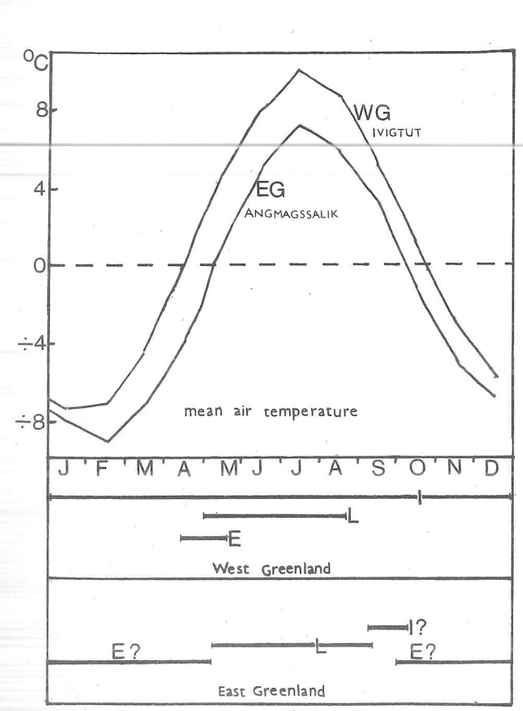


Figure 6. Life histories of the populations of Colymbetes dolabratus in West and East Greenland

I = adult. L = larvae. E = egg

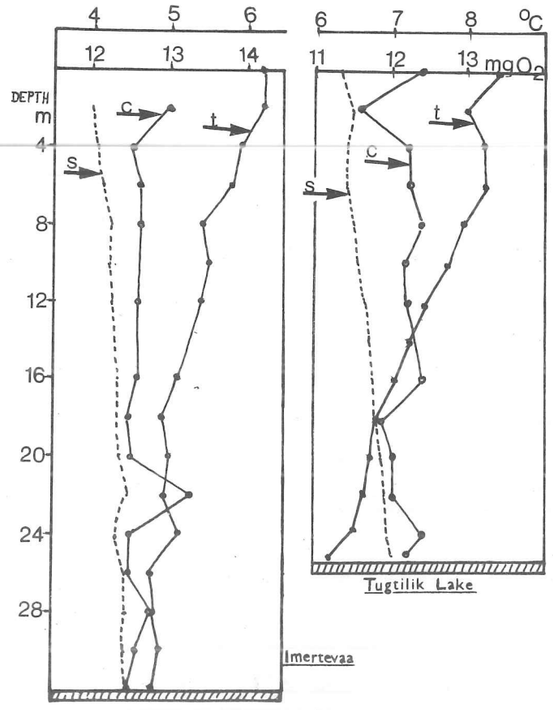


Figure 7. Oxygen and temperature conditions at various depths in Imertevaa and Tugtilik lake

S = saturation. C = actual oxygen content. T = temperature.

3. Chemical investigations in lakes and ponds

The oxygen conditions in Imertevaa and in the big turbid lake at Tugtilik are shown in Fig. 7 . There is an excess of oxygen, probably due to photosynthesis and a very low decomposition. The degree of supersaturation is shown by the area between the graph of actual oxygen content and that of the saturation values calculated from the temperatures.

Chemical analysis is given below.

Locality	pH	Alkalinity meq/l	Conductivity umho/cm	Cl^- mg/l
Tugtilik	4.8		38	1.3
Tugtilik, Pond 1	6.4	0.3	39	1.3
Tugtilik, Pond 2	4.9		14.3	0.6
Imertevaa, Kungmiut	6.3	0.07	33.5	1.5

Locality	Ca^{++}mg/l	Mg^{++}mg/l	K^+mg/l	Na^+mg/l
Tugtilik	3.4	0.5	0.6	0.9
Tugtilik, Pond 1	5.1	0.6	0.7	1.6
Tugtilik, Pond 2	0.9		0.4	0.7
Imertevaa, Kungmiut	3.5	0.4	0.8	1.3

4. Physical investigations in the lakes

Temperature measurements in Imertevaa and in the lake at Tugtilik show no pronounced thermocline (Fig. 7 .).

Light measurements are shown in Fig. 5 . Imertevaa is extremely clear. As a reference I have shown the transmission in distilled water on the same figure. The lake at Tugtilik, in contrast, has an extremely low transmission. It is very turbid due to the melting water from the Jordan glacier. An interesting thing is that the red light penetrates to a greater depth than the blue light. This is very seldom, if ever, seen before. It may be explained by the fact that the absorption, which is greatest at high wavelengths, is smaller than dispersion, which acts most on the smaller wavelengths.

5. Others

Some interesting groups of animals found are under preparation by various specialists. It can be mentioned that I found some, probably new water mites. They are with U. Lettevall at the University of Lund, Sweden. The Chironomids are under preparation by Dr. Saether, University of Oslo.

GEOLOGY

Richard Parker and Richard Beck

THE KUNGMIUT AREA

In this area a general survey of structure and lithological types was made (Figure 8). The rocks were all found to be gneissic and the foliation dipped strongly north-west. The strike was about 050° in the West of the district but decreases eastwards and is only slightly east of north in the eastern part of the area.

Almost all the rocks had a marked foliation due to the concentration of melanocratic constituents along certain planes. Some small isoclinal fold closures were observed, the limbs running parallel to the foliation. In some of the more basic gneisses small augen of felspar were observed and these tended to be drawn out in the plane of foliation to form a conspicuous lineation.

The gneisses of the area could be divided into three main lithological types, each with a characteristic mineral assemblage.

(1) The grey gneisses in the south-east of the area contain the assemblage quartz-plagioclase-hornblende-biotite-garnet.

(2) The acid gneiss occupies a wide band north-west of the grey gneiss. The mineral assemblage is quartz-plagioclase-biotite. The foliation is not as prominent as in the grey gneiss because the melanocratic constituents are less abundant. Wide folia (i.e. up to 2.5 cm.) are separated by narrow laminae of biotite. The very acid nature of the gneiss would suggest its derivation from a psammitic sediment.

(3) Alumina rich gneiss. This occurs in the northern part of the area and forms a conspicuous rusty weathering ridge. The abundance of kyanite would suggest that the rock is derived from an alumina rich pelite - i.e. it is a metasediment.

The mineral assemblage present is quartz-plagioclase-biotite-garnet-kyanite with wide (up to 2.5 cm.) folia of quartz and felspar separated by narrow (up to 0.7 cm.) folia of biotite, kyanite and garnet. A narrow lens containing the assemblage quartz-garnet also occurs and is shown in Figure 9 . Small flakes of molybdenite were found in one band.

Plagioclase amphibolite. These occur as rafts and lenses within all three types of gneiss. The general assemblage is usually hornblende-plagioclase but biotite and garnet may also be present. In some cases the garnets are surrounded by kelyphitic rims, and in others the garnets are completely altered to circular pseudomorphs.

The amphibolites have probably been derived from basic dykes, as strings of amphibolite boudins can sometimes be traced over distances of a few hundred metres along the foliation. The amphibolites seem to be more mechanically competent than the surrounding gneiss as the gneiss has flowed under stress whereas the amphibolite has fractured and produced boudins. In some places the movement of the gneiss has led to incorporation of the amphibolite. The amphibolite band marked in Figure 9 has undergone a type of brecciation rather than boudinage, large blocks of amphibolite being separated by wide branching veins of pegmatite and quartz. The strict concordance of this band with the lithologic units mapped in the pelitic

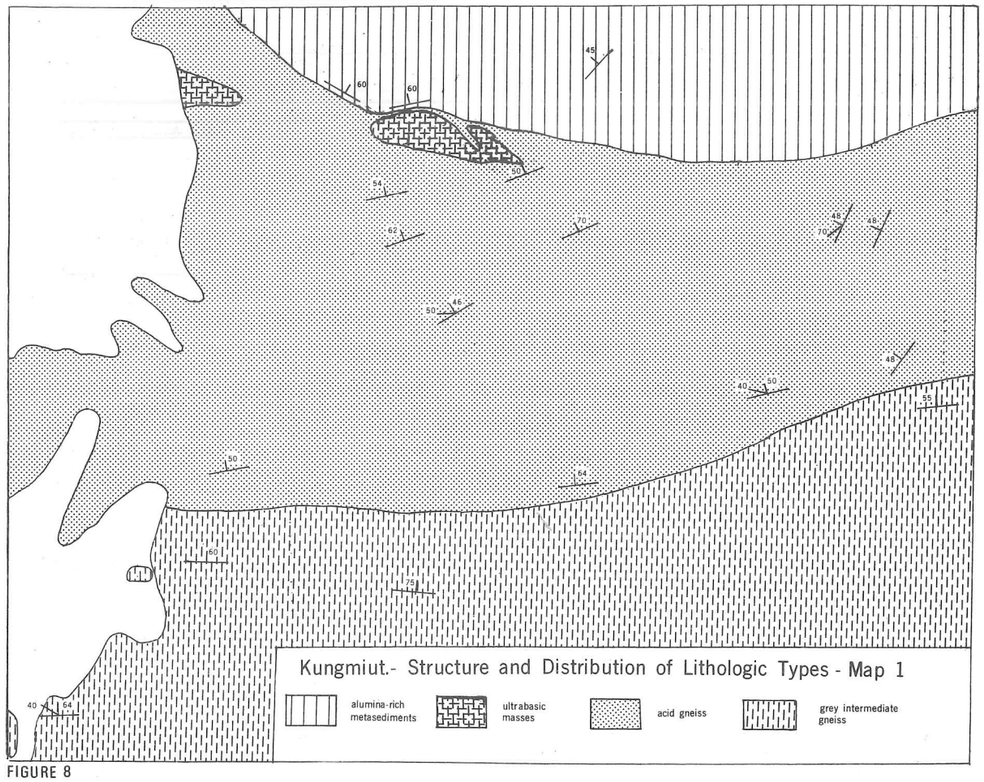


FIGURE 8

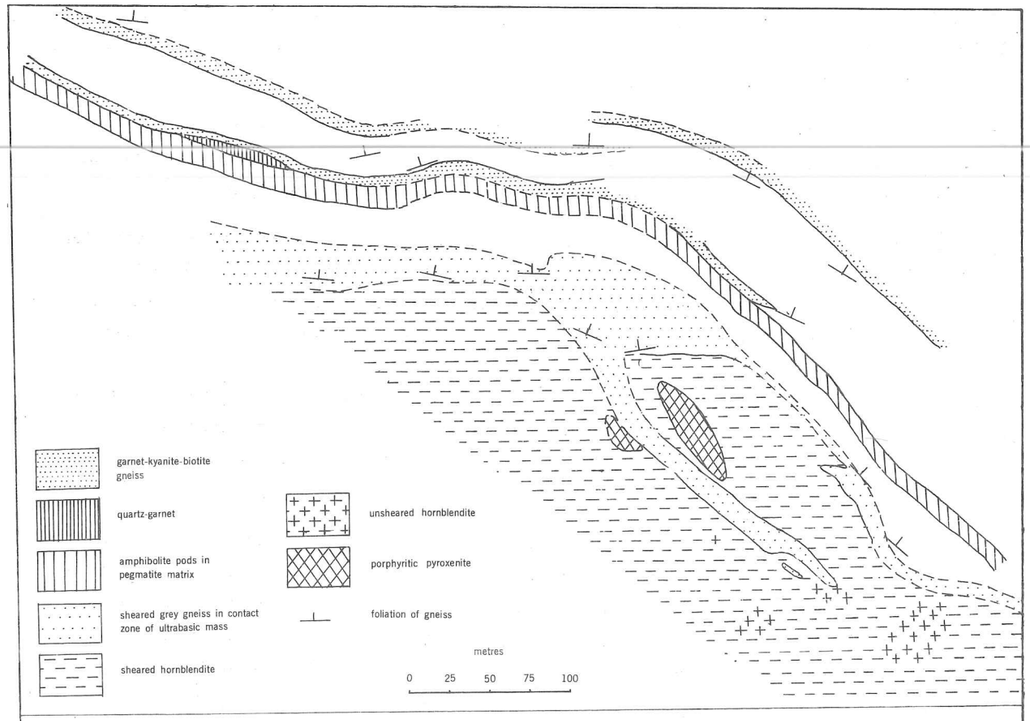


FIGURE 9

metasediment would suggest the mass was originally sill-like.

Ultrabasic Masses. Several of these masses occurred in the gneiss. Most were rather small (20 or 30 m. long) and consisted entirely of hornblende. However in the north of the area mapped there is a particularly large ultrabasic mass about 400 m. long. It is surrounded by metasediments which have several bands of distinctive lithology. These bands were mapped out in order to determine the relationships of the ultrabasic mass with the surrounding gneiss (Figure 9).

On the map it can be seen that the northern contact of the gneiss is concordant but the eastern and western contacts are slightly discordant with respect to the lithologic bands. It would appear that the mass has displaced the country rock partly sideways and partly upwards. The deflection of the foliation round the mass would suggest that the foliation was in existence prior to emplacement of the mass.

The mass is surrounded by a zone of highly sheared granular rock. This rock contains lenses and schlieren of ultrabasic material in various stages of disintegration, and drawn out parallel to the margin of the mass. This type of rock is unique to the margins of the ultrabsic mass and appears to have been produced by earth movements subsequent to emplacement of the mass. The fractured nature of this marginal rock would suggest that it was formed during a minor earth movement, later than that which formed the gneiss.

The unaltered rock is only found near the centre of the mass and has the homogeneous texture of an igneous rock. This rock contains large phenocrysts (up to 2.5 cm.) of pyroxene. A similar porphyritic pyroxenite is described by L.R. Wager (1934). The central core of unaltered pyroxenite is surrounded by a wide zone in which the rock has been altered to black hornblende. The black hornblende is further altered to green hornblende along narrow shear planes.

The unaltered core of the mass has only escaped alteration because of the large size of the mass; smaller ultrabasic masses tend to be totally altered to amphibole.

Metamorphic grade. The presence of kyanite indicates that the rocks are of high metamorphic grade and probably belong to the almandine-amphibolite facies. The abundant hornblende and less abundant biotite are probably the results of retrogressive metamorphism. This could also account for the alteration of the ultrabasic masses.

Pegmatites. Two undeformed pegmatites each about 30 cm. wide trended in the directions 020° and 345°, i.e. across the foliation. They were therefore later than the gneiss.

THE TUGTILIK REGION

The rocks here were all gneissic with the exception of the Tertiary dyke swarm. The gneisses fall into two distinct types, different in both structure and lithology.

(1) The granite gneiss. In this type the foliation is usually indistinct and where present it shows strong small-scale folding. When traced laterally the foliation tends to die out. In composition the gneiss was more acidic than the grey gneiss at Kungmiut, and could be described as a granite gneiss, the mineral constituents being quartz-plagioclase-biotite-

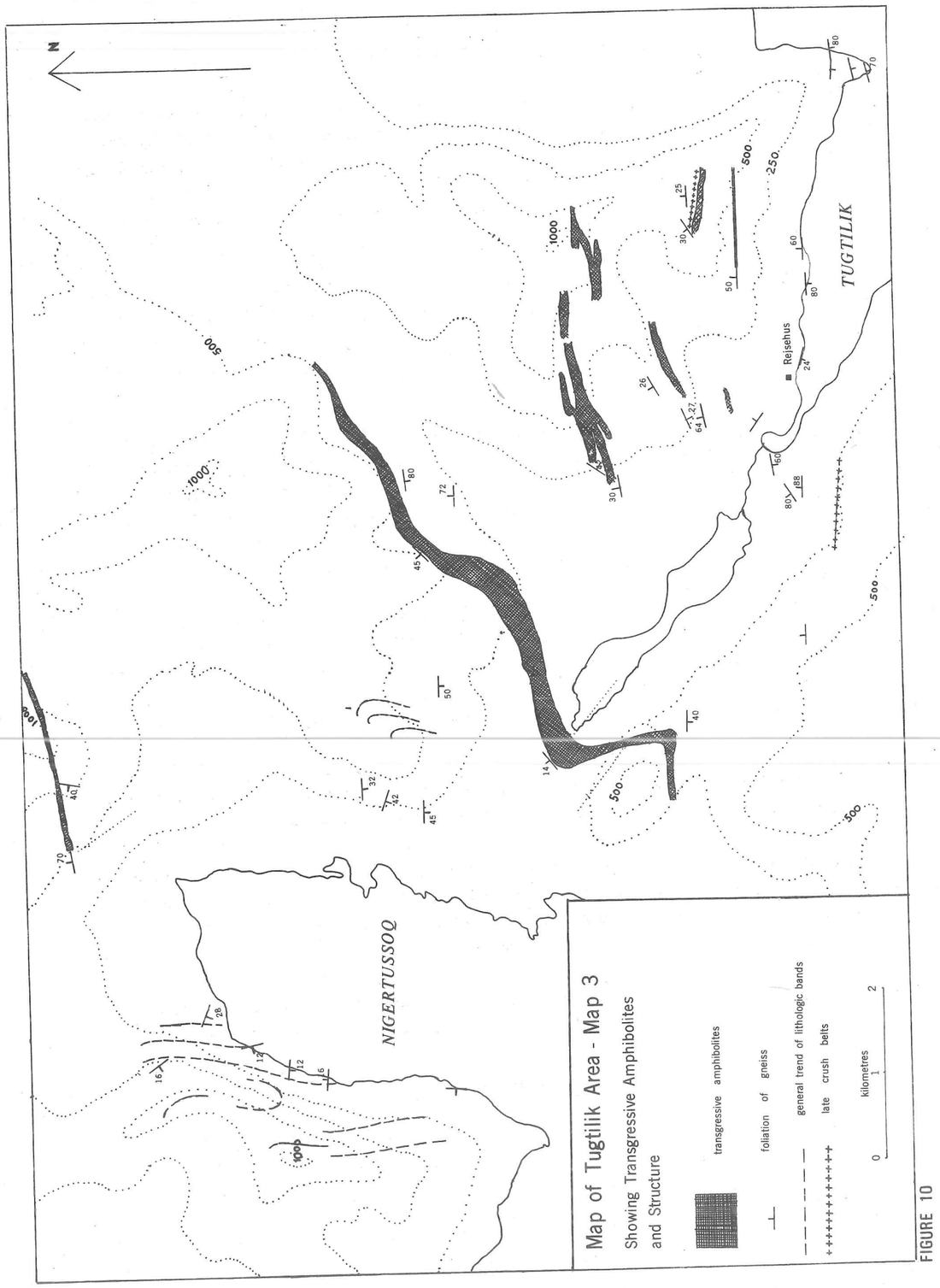


FIGURE 10

hornblende. The rocks appear to have undergone a post-deformation granitisation and this would account for the poor foliation. The more massive rocks contain a pinkish or purplish felspar which seems to be associated with the granitisation. The rock shows little variability except where it contains agmatites. These occur as irregular bodies in the gneiss and consist of angular blocks of amphibolite embedded in a leucocratic matrix. Two distinct types of agmalite were found:

(1) contains unfoliated amphibolite blocks in a pegmatite matrix (Plate 2)

(2) Foliated amphibolite blocks in a gneissic matrix (Plate 1).

No boudinaged amphibolites as found at Kungmiut occurred.

(2) Well Foliated Gneiss. This tends to be more basic than the granite gneiss and is generally mesocratic. These rocks lie mostly to the west of Nigertussoq, whereas the granite gneiss outcrops in the eastern part of map in Figure 10 . The foliation is very well developed and large-scale lithologic bands were observed parallel to the foliation (Plate 3). These well foliated gneisses do not show the same small-scale folding as found in the granite gneiss. The foliation generally has a gentle and consistent dip to the south or south-west. Looking westwards from the mountain tops near Tugtilik it can be seen that similar large-scale lithologic banding occurs on mountain faces westwards from Nigertussoq as far as Ingolfs Fjaeld.

There seems to be no definite boundary between the granite gneiss and the well foliated gneiss to the west; the foliated gneiss and the granite gneiss appear to be interbanded in the vicinity of Nigertussoq. A sharp contact between granite gneiss and foliated gneiss can be seen at the head of Nigertussoq at the western end of the glacier snout although well foliated gneiss occurs in bands for several kilometres to the east. Blocks and rafts of the granite gneiss a few metres across showing the characteristic strong small-scale folding were found surrounded by the well foliated gneiss on the western shore of Nigertussoq.

Plagioclase Amphibolite. These rocks have a similar mineralogy to the amphibolite blocks found in the agmatite, i.e. plagioclase and hornblende, and occasionally garnet. The field relationships, however, prove that they are younger than the agmatites.

Wager (1934) described a horizontal sheet of amphibolite cutting transgressively across the gneiss at Kap Japetas Steenstrup and deduced that the amphibolite was younger than any period of flow of the gneiss. Similar sheets were found in the Tugtilik region. There is a particularly conspicuous example in the Jordan Valley (Plate 5).

The amphibolites of the region show various degrees of structural conformity with the country rock. Plate 6 shows the lower contact of the Jordan Valley amphibolite and here the contact is parallel to the foliation of the underlying gneiss and of the amphibolite itself. However, about 30 metres vertically below the contact the strong foliation dies out and normal granite gneiss occurs. The gently dipping attitude and the unfolded structure of these amphibolites suggests an association with the well foliated gneisses to the west of Nigertussoq. It was thought that the amphibolites might be emplaced by a shearing mechanism rather than by simple intrusion, but the occasional presence of angular xenoliths

near the lower contacts of some amphibolites suggests that shearing was only of minor importance.

Plate 7 shows a higher degree of structural discordance; the upper contact is concordant with the foliation of the gneiss but the lower contact is markedly discordant.

The amphibolite marked on the map about 1.5 km. north-east of the head of Nigertussoq is a dyke-like body showing a greater degree of disconformity with the structure of the surrounding gneiss. At the western end of the outcrop the shear zone at the contact is only about 2 cm. wide and the amphibolite has a massive unfoliated appearance. This body dips strongly northwards and has a strike of about 080°. It can be seen to continue eastwards on a straight course for at least 4 km. Similar bodies can be seen in the mountains to the west, cutting across the gently dipping lithologic banding. These amphibolites are truly transgressive and are obviously later than any movements of the gneiss.

About 2 km. east-north-east of the Tugtilik rejsehus a similar dyke-like body of amphibolite was found; it is about 0.75 m. wide and trended east-west. There is no sign of shearing at the margins of the dyke and it contains randomly oriented felspar crystals which appear to be original igneous phenocrysts.

Ultrabasic Mass. A similar ultrabasic mass to those at Kungmiut was found about 3 km. south-west of the rejsehus. This was the only such mass found in the area. It is about 20 m. across and 50 m. long, elongated along the foliation. The larger part of the mass is a black hornblende rock but there is a small core of porphyritic pyroxenite very similar to that at Kungmiut.

Late stage crush belts. Two such belts were observed, one about 1.5 km. on a bearing 255° from the rejsehus and the other about 2.5 km. north-east of the camp. These belts are 2 - 10 m. wide and are characterised by crushed and brecciated gneiss. The interstices between the breccia blocks are often voids and are sometimes lined with quartz or calcite. The existence of voids means that movement must have taken place at shallow depth and is later than the main movement of the gneiss. The belts are stained by haematite and can therefore be easily traced.

Tertiary dykes. These formed a swarm with most dykes trending about 030°.

Two types were very distinct in the field:

(1) Weathers chocolate brown

(2) Weathers pale green-grey and has large felspar phenocrysts.

The former type is cut by and therefore older than the latter.

Reference:-

Wager, L.R. 1934 Geological Investigations in East Greenland, Part 1. General geology from Angmagssalik to Kap Dalton. Meddelelser om Grønland. Bd 105, No. 2, p. 1-46.

GEOMORPHOLOGY

Philip Storey, Christopher Sugden and Philip Ray

It was thought that the Tugtilik-Nigertussoq area might be a useful area in which to study raised beaches. Little work of the kind planned had been done in this part of East Greenland and a detailed study of air photographs, which unfortunately showed an extensive snow cover, had suggested that there were many interesting landforms. In the event relatively few features in the landscape gave any indication of past marine action. There are depositional terraces around parts of both fjords and close to Tugtilik lake, but nowhere could be found any evidence of wave-cut rock platforms above sea-level. The resistant nature of the country-rock, the limited fetches and the pack-ice all contribute to limit wave action. All the terraces found were closely examined for shells which might have shed some light on their origin or the environment in which they were formed, but none were found; indeed, shells of any kind were only found in limited numbers at two localities on present-day beaches in Nigertussoq. The heights of all features which seemed likely to be of marine origin were determined by levelling, but there was only a limited correlation of altitude between different areas. The altitudes are recorded in metres above mean sea-level in Figure 11. Of the shorelines which were identified, a number may have been formed in ice-dammed lakes, but at the same time no evidence could be found to confirm this.

With the exception of two terrace fragments at 6 m. and 8 m. above mean sea-level, the terraces in Tugtilik fall into three main groups at 10 m., 15 m., and 20 m. In the inner part of the fjord Kruuse (1912) recorded a beach at 10 m. above the high water mark (determined by aneroid barometer), but none could be found at this level (Figure 11), and it is probable that he was referring to one of the beaches at 10m. or 15 m.

The two most extensive terraces at 10 m. and 15 m. are found close to the lake in relatively thin deposits of silts and fine gravels (Figure 13). The fine nature of the material and the disposition of the bedding suggest that the terraces probably represent deltas built into the sea, rather than sub-aerial river fans. The deposits differ markedly from the present-day boulder-strewn fan of the river draining Tugtilik lake. Two kilometres west of the mindesmaerk, on the north side of Tugtilik, a dry alluvial fan comes to an abrupt end 20 m. above sea-level, and on the south side there are several small terraces cut in unstratified deposits at 10 m., 15 m. and 20 m. The position of the terrace features makes it likely that they are shoreline relics, but it could not be demonstrated whether they are of marine origin or formed in a lake impounded by an advance of the Tugtilik glacier. Any lakes at these low levels, however, must have overflowed across the ice very close to the glacier snout, and it is difficult to envisage such an outlet maintaining a constant height for any length of time.

A profile up an isolated beach in Nigertussoq, however, also showed distinct breaks of slope at 10 m., 15 m. and 20 m. (Figure 14), suggesting that these levels could represent marine still-stands. The beach, in a small bay in which there is an Eskimo winter house, is formed of well rounded stones underlain by till.

The most extensive shoreline features were found along the north-east shore of the lake where a series of fans, deltaic deposits and terraces approximate to 32 m. above sea-

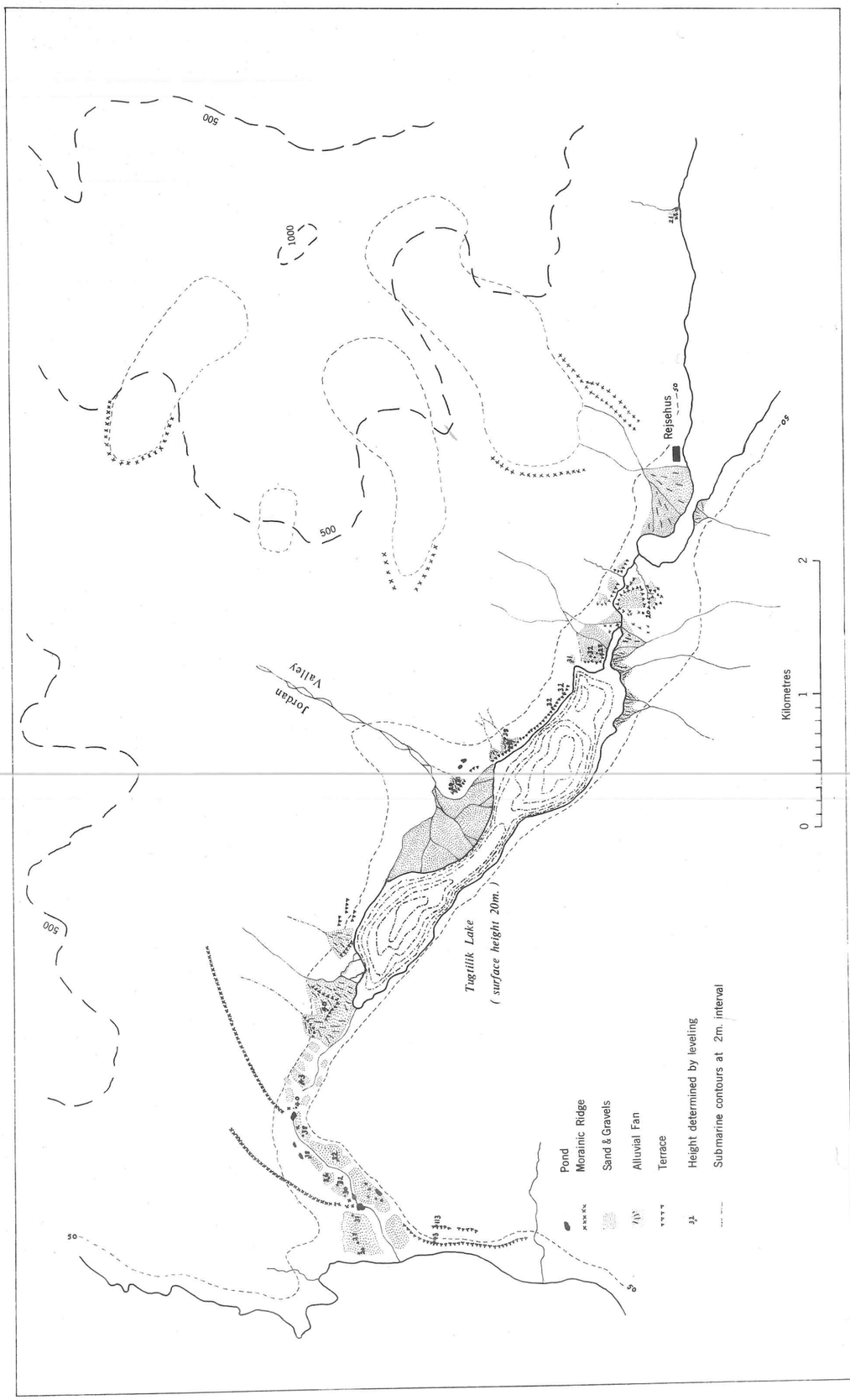


FIGURE 11 MORPHOLOGICAL FEATURES OF TUGTILIK AREA

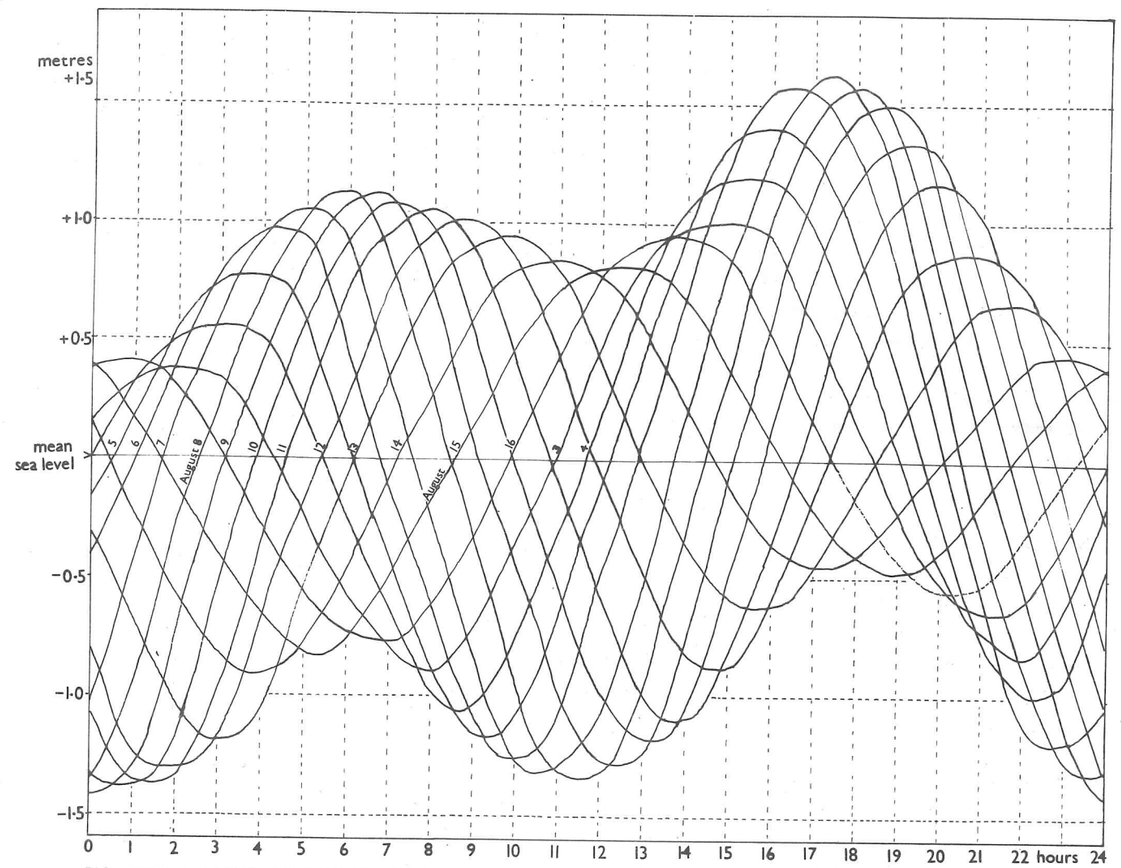


FIGURE 12 SEA LEVEL MEASUREMENTS IN TUGTILIK 3rd - 16th AUGUST, 1967.

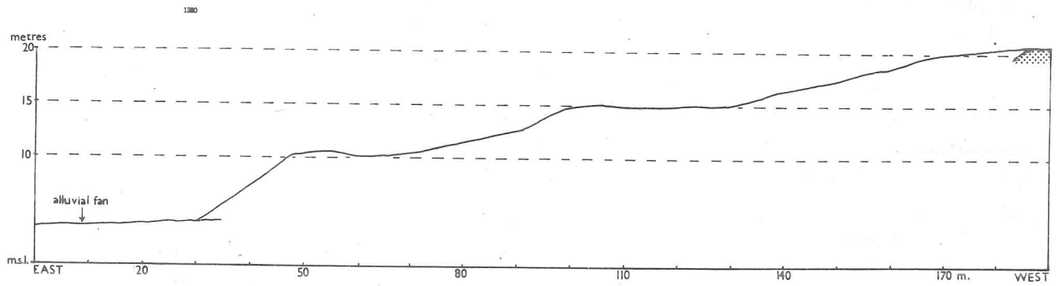


FIGURE 13 PROFILE OF GRAVEL DEPOSITS CLOSE TO TUGTILIK LAKE OUTLET

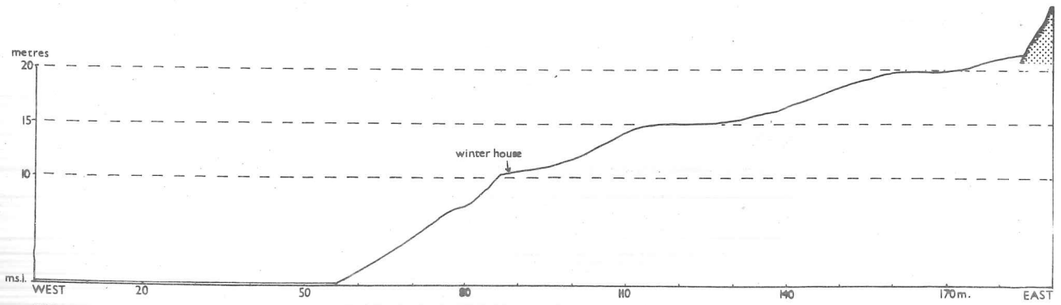


FIGURE 14 PROFILE OF ISOLATED RAISED BEACH IN NIGERTUSSOQ

level. It is also possible, however, that this shoreline is not of marine origin, but again no likely overflow or other evidence of a lake was found.

Another extensive shoreline feature was found on the eastern shore of Nigertussoq at 43 - 44 m. above sea-level. The terrace varies from 30 m. to less than 5 m. in width, but exceeds 1,000 m. in length, although a few portions are detached. The terrace is formed of partially sorted moraine, and in places rises by up to 1 m. towards the lip. It would appear to be similar to shorelines described by Hoppe (1959) in northern Sweden. Directly above the 43 m. terrace is a very poorly defined terrace composed of large boulders with the finer material apparently washed out. For 350 m. it maintains a height relatively close to 113 m. above sea-level, and this may also be a remnant of a past shoreline.

The paucity of raised shoreline features, the absence of any shells, and the possibility of some of the features being of lacustrine origin, rather than marine, makes it difficult to consider either the relative or absolute ages of successive levels.

It does, however, seem likely that the Jordan glacier was about 4 km. further down the valley at the time when the 32 m. shoreline was being formed. Close to the present river, at a level accordant with the shoreline, are a number of alluvial fans from which dry channels can be traced back. One of the channels originates in a breach in an old end moraine of the Jordan glacier, now well above the present river. Further east, 500 m. along the shoreline, another series of channels originate on the valley sides at a position where it is difficult to envisage their being supplied with water were ice not to have been in the immediate vicinity.

Between Nigertussoq and the lake is a low col (Figure 11) with an altitude of 40 m., and west of this is an extensive spread of sparsely vegetated gravels. It is composed of sand and small stones, but with some larger stones up to 20 cm. and a few morainic boulders. Stone sizes generally increased in the direction of the col. There is evidence of sorting, but bedding is not clear near the surface. A glacier from the east has left two end moraines: one on the col and the other 800 m. to the south-west, coming down to an altitude of 30 m.

Only a small stream flows across the gravels today, although their extent suggests they were formed by a much larger river. A larger river would either have originated from a glacier snout at the col, or from Tugtilik lake if it were, by some means, prevented from flowing through its present outlet at the east end. An area of 'kame and kettle' relief in the gravels on the col suggests that this part of the spreads was relatively close to the glacier snout when deposited.

There are no marked breaks of slope on the gravel spreads and it could not be ascertained whether or not they were deposited in water. They must, however, pre-date the 30 m. shoreline around the lake, as when the gravels were deposited this area is likely to have been under the ice which would have destroyed the shoreline.

References:-

Bøgvad, R.	1940	Quaternary Geological observations in south-east and south Greenland. Meddelelser om Grønland. Bd 107, No. 3.
Hoppe, G.	1959	Glacial morphology and inland ice recession in northern Sweden. Geografiska Annaler, No. 41, p. 193.
Kruuse, C.	1912	Meddelelser om Grønland, Bd. 49.

PALAEOMAGNETISM

Bryan Kimpton & Andrew Moorhouse

The numerous Tertiary dykes in the Tugtilik area were sampled for palaeomagnetic purposes. Five or six rock cores were collected from each of eleven sites along the north shore of the Tugtilik branch fjord, and orientated with a sun compass and spirit levels. An adapted two-stroke chainsaw unit fitted with a 25 mm. diameter diamond-impregnated coring drill was used to obtain cylindrical samples of about 10 cm. length. A pressurised water supply was incorporated to cool and lubricate the cutting edge.

The dykes sampled have been investigated in the Department of Geophysics and Planetary Physics at the University of Newcastle upon Tyne. Both normal and reversed polarities, with respect to the present Earth's magnetic field, were found; the normal polarities being the first normal polarities observed in the Tertiary sequences of East Greenland. The mean directions, irrespective of polarity, are similar to those observed previously by other expeditions and these will be published together as part of an analysis of the Tertiary palaeomagnetic field in the North Atlantic.

MEAN SEA LEVEL AT TUGTILIK

Edwin Thornton

For both geomorphological and survey work it was thought useful to know mean sea level. A gauge was constructed and continuous measurements taken for 18 days, 14 consecutive ones being plotted on a graph and averaged to give M.S.L. A bench mark was cut in the rock below the Tugtilik rejsehus at 1.98 m. above M.S.L., the accuracy being estimated at $\pm$ 1.5 cm. (Fig 12)

BATHYMETRIC SURVEY OF TUGTILIK LAKE

Edwin Thornton

The lake floor was mapped to assist the limnology and geomorphology programmes. The maximum depth found was 28 m. and a complete silt deposit was noted. The depth rather disagrees with Rymill's estimate of over 40 fathoms in 1933 (Chapman 1934). (Fig 11)

FILM

Andrew Moorhouse

The expedition is very much indebted to Mrs. V. Parslaw, who kindly donated to the University 1,700 ft. of 16mm. black and white cine film. Thanks is also due to Mr. R. W. Ridley of the Department of Photography in the University Medical School who supervised the editing of the film, and also to Professor W. F. Cassie of the Department of Civil Engineering for the loan of a Bell and Howell 70DR camera. The film is now in the care of the University Exploration Society.

KUNGMIUT SURVEY

Philip Storey and Christopher Sugden

The settlement of Kungmiut was mapped at 1 : 2,500 scale. As no large scale map was available in the village this was considered an interesting and useful project to be carried out in the few free days expected before ice conditions improved further north.

In view of the short period of time expected to be available before the move to Tugtilik, a plane table survey was started. It soon became obvious, however, that more time would be available and so it was decided to switch to a tacheometric survey, using a Kern DKM 1 theodolite, and provisionally based on the control established by plane table. Unfortunately, a higher order of control was never established; indeed, a small area of the detail had to be left over until the return visit in September. The observation of several common points from neighbouring control points allowed some check on the accuracy of control and, in general, this proved adequate. The plotting was done as the survey progressed thus allowing field checking which showed that no buildings were omitted, or other gross errors perpetrated. The coastline and several buildings which also appeared on an unpublished 1956 map were used to superimpose the 1967 planimetry upon the topography. The 1956 map is Copyright (A.31/68) of the Geodetic Institute of Denmark.

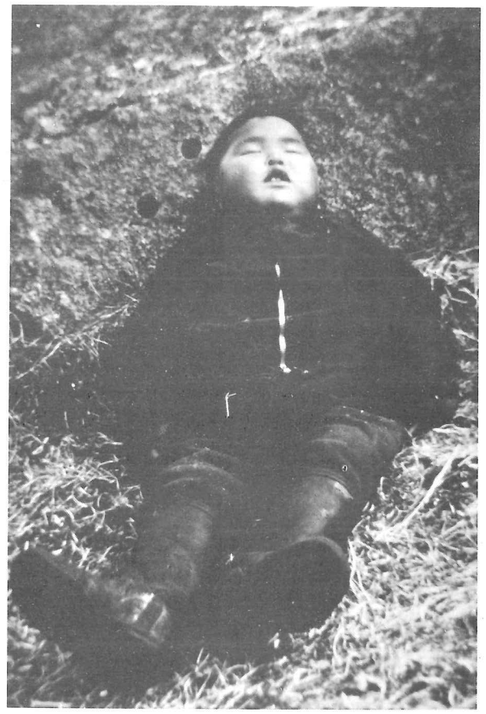
The settlement was founded in 1923, by a catechist, Karale Andreasson, and ten years later Chapman (1934) described "Kuamiut" as a flourishing settlement of twenty or so houses. The houses were built of turf and stone, with timber fronts on the better ones, clustered around some flat land on the north of the stream, 8 - 15 m. above the fjord. Several houses were built side by side to economize on walls. By 1956, although the original nucleus remained, many new buildings had been constructed, particularly on the south side of the stream, and these included the present clinic and store.

It is since 1956, however, that there has been the most rapid development. Approaching 100 houses and many new community buildings, including a "Fish factory", school and church, have been built. Today the settlement is characterized by many small, brightly-painted timber houses laid out across the steeply-sloping rock surfaces, together with a nucleus of older turf and stone houses. Between the rocks are patches of earth and grass, a few rancid pools and scattered piles of refuse which give the whole area a not-unpleasant fetid smell.

A more complete description of Kungmiut and the changing economy of the village is published in the Geographical Magazine (Sugden, C.J. & Storey, P., The Geographical Magazine, October 1968).

Reference:-

Spencer Chapman 1934 Watkins' Last Expedition. Chatto and Windus, London.



— Young people at Kûngmiut —

A radio schedule with Kûngmiut from the base at Tugtilik

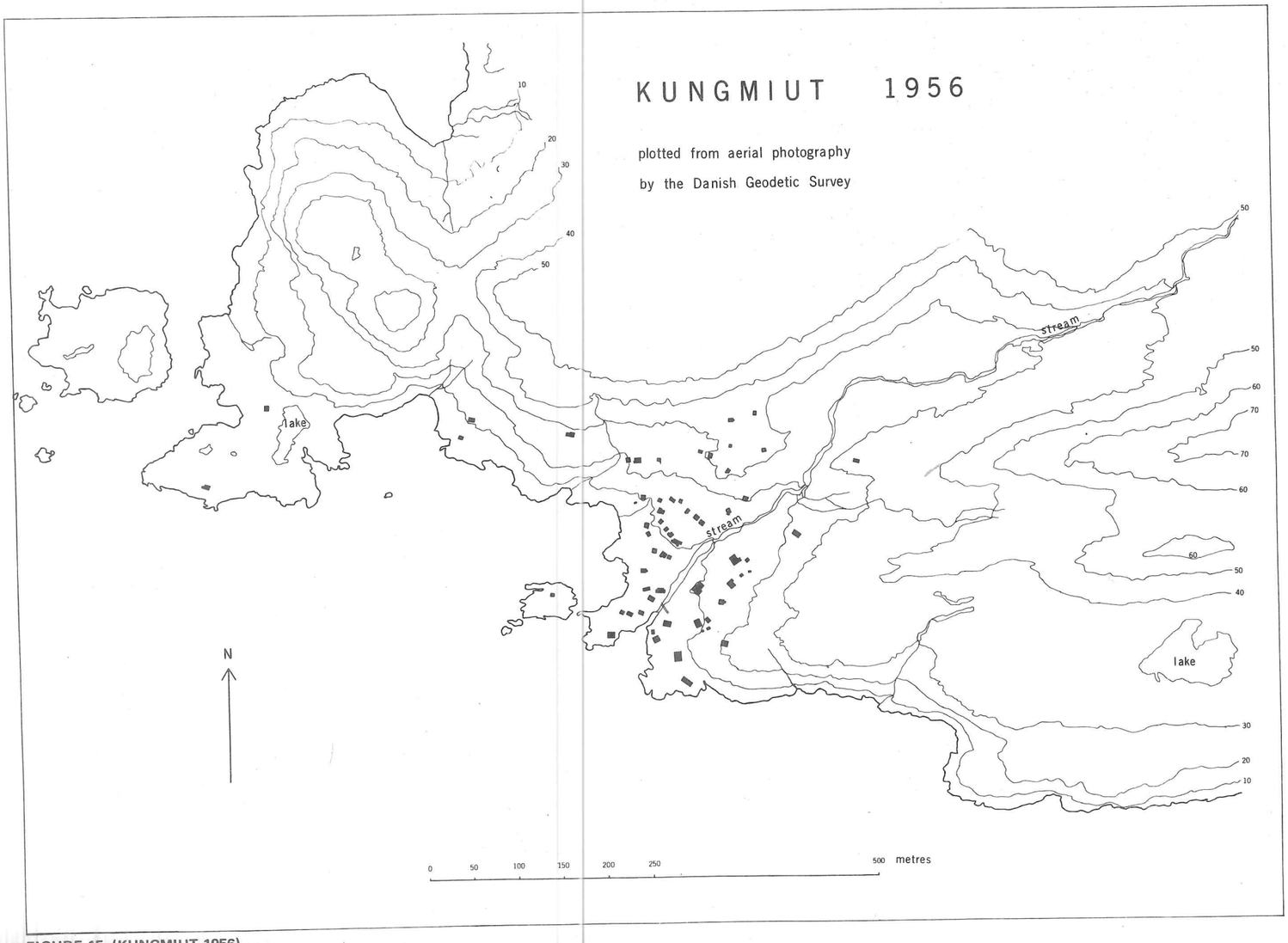


FIGURE 15 (KUNGMIUT 1956)

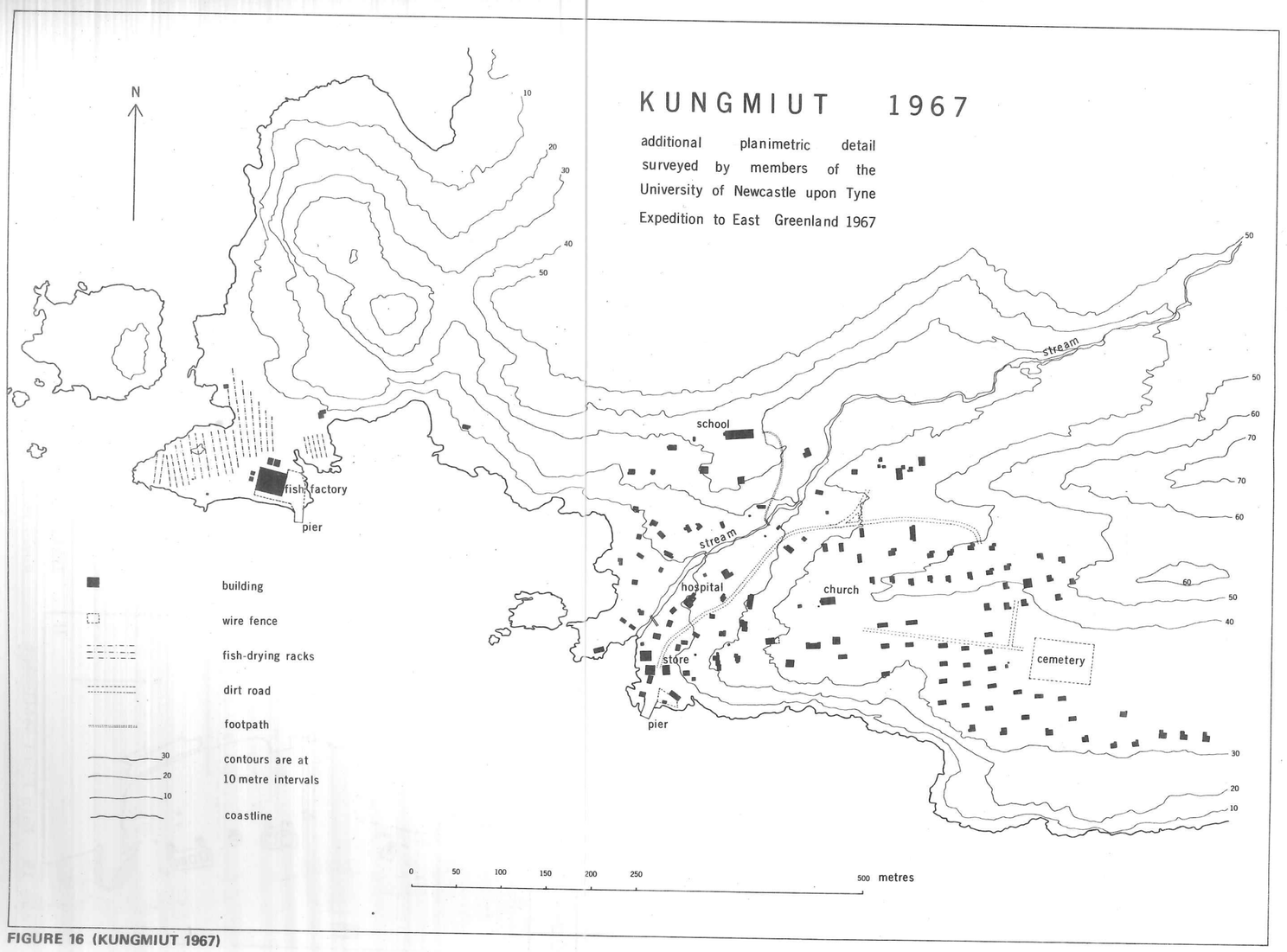


FIGURE 16 (KUNGMIUT 1967)

ESKIMO SETTLEMENT IN TUGTILIK

Christopher Sugden

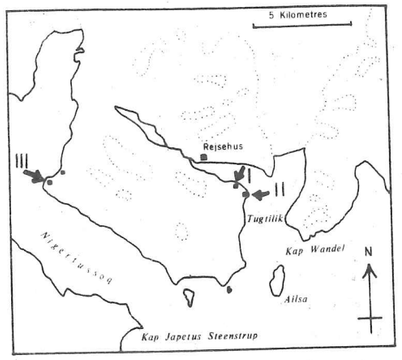


Figure 17 Location of Settlements

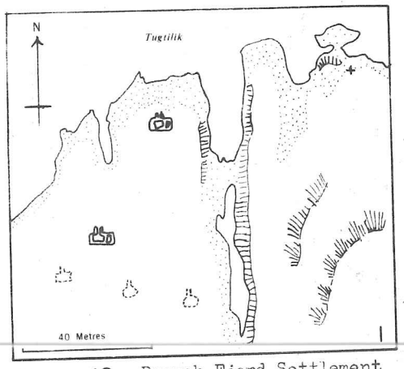


Figure 18 Branch Fjord Settlement

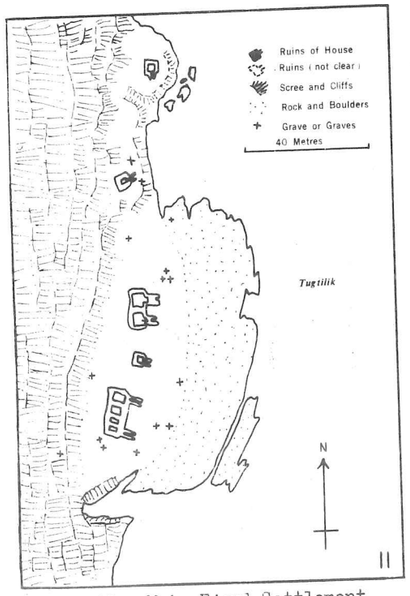


Figure 19 Main Fjord Settlement

The ruins of nine Eskimo winter houses were found in two groups: on the east side of the main fjord (11) and on the south side of the branch fjord (1). When compared with other former Eskimo dwelling-places in the area this would appear to be a relatively large concentration. Reindeer were said to have been plentiful here once (Tugtok is Greenlandic for reindeer) and stories tell of salmon the size of seals. It is also said that a bear trap was erected here by Kagsagisk, the legendary hero of Angmagssalik (related in Chapman, 1934).

The easterly settlement is on a small rocky ledge a few metres above the water, backed by screes and cliffs which rise steeply for 500 m., making access by land difficult. The turf and stone walls of at least seven winter houses are visible as ridges about 1 m. high and 2 m. wide, but they are heavily overgrown with vegetation. The buildings are 15 - 20 sq.m. inside and have narrow tunnel entrances up to 7 m. long, some of which are still intact. Numerous graves are scattered about the settlement, including one in the entrance of a winter house.

At the settlement in the branch fjord there were the ruins of two winter houses and what may be the ruins of three much older ones. An interesting feature of both Tugtilik settlements is the complete absence of any land-water in the immediate vicinity, suggesting a dependence on snow or ice in the fjord throughout the year.

There is one solitary winter house on an isolated raised beach in Nigertussoq (111). It is similar in size to those in Tugtilik, but built entirely of stones. The walls are made with stones from the beach, but faced with more angular stones from the cliffs.

The former Eskimo dwelling-place opposite Sarfardlisivik, which is marked on Geodetic Institute maps and was referred to by Kruuse (1912) could not be identified.

UNIVERSITY OF NEWCASTLE UPON TYNE EXPEDITION TO EAST GREENLAND, 1967

ACCOUNTS

INCOME

Members' Contributions	£807	6	0
Newcastle University Students' Representative Council	100	0	0
Evening Chronicle	4	4	0
The Mount Everest Foundation	700	0	0
The Gino Watkins Memorial Trust	75	0	0
The University of Newcastle upon Tyne	400	0	0
The Ford (Dagenham) Trust	75	0	0
William Leech Limited	20	0	0
The Gilchrist Educational Trust	50	0	0
The Drapers' Company Limited	75	0	0
The British Broadcasting Corporation	5	5	0
	£2,311	15	0

EXPENDITURE

Administration	£ 24	17	0
Food	148	5	3
Equipment	443	15	4
Travel (including freight charges)	1,442	5	3
Photography	62	7	8
Youth Hostel Expenses	20	17	6
Maps and publications	20	8	9
Insurance	104	6	8
Fuel	22	6	10
Balance (to go towards production of this report)	22	4	9
	£2,311	15	0

Equipment purchased has been returned to the University Exploration Society.

ACKNOWLEDGMENTS

The expedition was fortunate to receive financial support from the following:-

Mount Everest Foundation	£700
University of Newcastle upon Tyne	£500
University of Newcastle Students' Representative Council	£100
Gino Watkins Memorial Fund	£ 75
Drapers Company	£ 75
Ford (Dagenham) Trust	£ 75
Gilchrist Educational Trust	£ 70
William Leech (Holdings) Limited	£ 20

We would like to thank them and the Royal Geographical Society for their support.

The expedition is particularly indebted to the Right Reverend Launcelot Fleming, Lord Bishop of Norwich, who very kindly acted as patron and referee. We are also most grateful for the help and advice given to us by many other people during the months of preparation, in particular: the members of the University Exploration Council; Prof. J. Böcher; Mr. E. Fripp; Dr. B.S. John; Geodetic Institute, Copenhagen; Dr. P.W.F. Gribbon; Grønlands Geologisk Undersøgelse; Dr. G. Halliday; Scott Polar Research Institute; Mr. J.I. Sharp; Dr. D.E. Sugden; Dr. D. Tarling; Dr. A. Weidick; Mr. S.B.A. Winchester; and Mr. S.E. Worm.

We are especially grateful for the help and kindness shown to us in Greenland by Mr. Ulrik Lennert, Handelsforvalter, Kungmiut, who not only helped us during our stay in the settlement but devoted considerable time and effort to getting us out of Tugtilik at the end of the expedition. We also received much help from Mr. E. Mejer, Mr. J. Plesner, Mr. P. Carlsen, and Den Kongelige Grønlandske Handel, Angmagssalik. In the long days travelling up the coast we appreciated the kindness of the boatmen, Albert Sanimiaq, Gaba Magdikalat, Thomas Adakat, Asser Pivat, and Jorgen Abelsen and the crew of the 'Ako'.

We wish to thank the following for the invaluable help: Lloyds Bank, Haymarket, Newcastle, for help with finances and foreign currency; Icelandair for assistance in Reykjavik and with the air charter; Miss H.E. Thorne, Miss J. Collingwood, Miss A. Kirkham, Mr. R. Douglass and Mr. J. Oliver, for practical help in Newcastle; the Department of Surveying, for loaning scientific equipment; Mr. A. McGuckin of Mawson & Proctor Pharmaceuticals Ltd., for help with medical supplies; Mr. H. May of Laws Stores, Morpeth; Signode Ltd. for the loan of a steel banding machine; H.N. Storey Ltd. for help with the radio; Royal Naval Reserves (H.M.S. Calliope) for lending distress flares; and the following firms for their gifts of food and equipment:-

ABC Polythene Ltd. - polythene bags
Aerated Foods Ltd. - soups
Ashton Brothers & Co. Ltd. - towels

Thomas Bell & Sons Ltd. - flour
Van den Berghs Ltd. - margarine
Alfred Bird & Sons Ltd. - coffee
Blacks of Greenock Ltd. - camping equipment
Boris Net Company - salmon net
Bowater-Scott Corporation Ltd. - toilet and face tissue
British Egg Marketing Board - dried egg
British Ropes Ltd. - climbing rope
British Steel Wool Co. Ltd. - steel wool
Bryant & May Ltd. - matches

Carrs of Carlisle Ltd. - lifeboat biscuits
Cerebos Foods Ltd. - salt
Chambers Packaging Ltd. - plastic coated boxes
Condima (England) Ltd. - dried vegetables
Copydex Ltd. - 'Copydex' and tape

The Distillers Co. (Yeast) Ltd. - dried yeast

Eksport-Svineslagteriernes Salgsforening - 'Danelard'
Eustace Miles Food Company Ltd. - soups
Evode Ltd. - 'Evostick'

Glaxo Laboratories Ltd. - 'Ostermilk' and 'Complan'

G. & T. Harris (Calne) Ltd. - tinned meat
H.J. Heinz & Co. Ltd. - tinned beans and spaghetti
J.A. Hunter & Co. Ltd. - meat foods

Jeyes Sanitary Products Ltd. - toilet paper and disinfectant

Kavli Ltd. - tinned cheese
Kodak Ltd. - film
Kraft Foods Ltd. - processed cheese
Kurek & Co. Ltd. - camping equipment

I.H. Lavery & Co. Ltd. (DCA Industries) - 'Lamix' and 'Lamilc'

Mapletons Ltd. - fruitarian bars
Mars Ltd. - chocolate
Mawson & Proctor Pharmaceuticals Ltd. - medical supplies
Meltonian Wren Ltd. - boot polish
The Metal Box Co. Ltd. - polythene bags and containers, and paraffin drums
Metal Containers Ltd. - 5-gallon petrol drums
Morris & Jones Ltd. - provisions
S.J. Moreland & Sons Ltd. - matches

H.R. Napp Ltd. - matches
The Nestle Co. Ltd. - coffee

Oxo Ltd. - 'Oxo' and corned beef

George Payne & Co. Ltd. - confectionery
Pearce Duff & Co. Ltd. - dried onions
The Phillips, Scott & Turner Co. - 'Sparkling Spring'
Procter & Gamble Ltd. - 'Daz' and 'Fairy' Soap
L.E. Pritchitt & Co. Ltd. - Milac

Quaker Oats Ltd. - oats

Rank Organisation - cine camera book
Ringtons Ltd. - tea
G. Romney Ltd. - Kendal Mint Cake
Rotunda Ltd. - adhesive tapes
The Ryvita Company Ltd. - 'Ryvita'

Schermuly Ltd. - pyrotechnics
Schweppes (Home) Ltd. - canned drinks
Scott-Brand Foods Ltd. - Scott's Porage Oats
Scottish & Newcastle Breweries Ltd. - 'Brown Ale'
Shaws Biscuits Ltd. - biscuits
C. Shippam Ltd. - meat goods
A.L. Simpkin & Co. Ltd. - glucose tablets and sweets
Sutherlands Foods Ltd. - meat spreads
Swains Packaging Ltd. - polythene food bags

Tate & Lyle Refineries Ltd. - sugar and syrup
Thames Board Mills Ltd. - fibreboard boxes
Thorne's Students' Bookshop Ltd. - stationery
Tyne Brand Products Ltd. - meat foods

Unilever Export Ltd. - 'Vesta Meals', 'Surprise' vegetables, Gibbs 'SR' toothpaste, 'Lifebuoy' soap

Venus Pen & Pencil Co. Ltd. - pens and pencils
Valor Engineering Ltd. - 2-gallon petrol drums

A. Wander Ltd. - 'Ovaltine' biscuits, tablets and drink
Welch & Sons Ltd. - confectionery
H.S. Whiteside Ltd. - peanut butter
W.D. & H.O. Wills - cigarettes and tobacco

Zimclean Ltd. - cleaning pads