Westminster East Greenland Expedition 1974 Report

WESTMINSTER EAST GREENLAND EXPEDITION - 1974

Patrons: The Right Reverend Launcelot Fleming, D. D.,
Dean of Windsor

Major E. R. D. French - Leader of the Westminster East Greenland Expedition 1972

Members:

W. S. L. Woolley - Leader
M. H. Jamison - 2 I/C
A. C. Houston
E. Lodge
H. P. A. MacNair
R. S. Oliver
G. Swainson
M. I. Williams

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This report gives an account of the activities of an expedition to the Tasflaq region of East Greenland. It has been written by members of the expedition in the hope that others planning similar ventures may benefit from our experience. It is dedicated to the many individuals, organisations and firms whose advice and generous support made our journey possible, and to whom we offer our sincere and grateful thanks.

WESTMINSTER EAST GREENLAND EXPEDITION 1974

R E P O R T

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EXPEDITION LEADER'S REPORT

The Westminster East Greenland Expedition 1974 was conceived as a follow-up expedition to the Westminster East Greenland Expedition 1972 which had an enjoyable and successful summer in the area of Kangerdlugssuaq. However it was recognised from the start that the 1972 expedition had been fortunate in reaching Kangerdlugssuaq and that ice conditions, and the difficulties involved in obtaining coastal transport, might thwart an attempted second visit. With this in mind we obtained the approval of the Danish Ministry for Greenland to mount an expedition to Kangerdlugssuaq as first choice and to the area of Tasílaq Fjord as second choice. In the event, owing to a lack of coastal transport, we settled for Tasílaq Fjord.

The area of Tasílaq Fjord had been drawn to my attention by Michael Tuson of the 1971 University of London Graduate Mountaineering Club East Greenland Expedition. This expedition had spent the greater part of its time in the area of Ingolfsfjaeld but for the final period Mike Tuson had taken his boat 'Ice King' north to Tasílaq Fjord. The members of the University of London expedition had found a useful route inland from the coast and had done some climbing in an area up to some eight miles inland. The attraction of Tasílaq Fjord to us was that once beyond the coastal fringe the country lying to the north of the K.I.V. Steenstrups Nordre Brae (Glacier) and to the edge of the inland ice had not previously been visited.

Thus we saw Tasílaq Fjord as an expedition base area which hopefully we could bank on reaching but which being some one hundred and twenty miles north of Angmagssalik was beyond that region, lying between Angmagssalik and Kangertitivatsiaq, which had already received a lot of attention from expeditions.

The expedition sailed from Angmagssalik to Tasílaq Fjord on board the 'Ejnar Mikkelsen' and our thanks go to Captain Underberg for the kind consideration he gave to our needs and also to Mr. Frederiksen, the Angmagssalik manager of the Royal Greenland Trade Department, for the many endeavours he made on our behalf. Captain Underberg left us at Tasílaq Fjord on 19 July and returned to collect us on 26 August.

One of the attractions of Tasílaq Fjord was a small hut built by the government for hunters some ten years previously. We had no up-to-date knowledge of the condition of the hut but found it to be in good shape and virtually unused since its construction. The hut was small but gave us a pleasant communal area and kitchen. While on base we slept in our own tents pitched around the hut.

The expedition programme can be summarized as follows:

1. A botanical programme
2. An inland journey including climbing
3. A geological programme

It was the intention that the botanical and geological programmes would be pursued in the main well inland and that they would therefore fit in well with the inland journey. As things turned out, the fact that the expedition finally went to Tasílaq Fjord, and not to Kangerdlugssuaq, meant that the geological programme had to be pursued in the coastal area where the dyke swarms were numerous.

The botanical programme/inland journey was therefore carried out by a party of six leaving two of our members on the coast to pursue the geology programme. All eight members of the expedition however were initially involved in the build-up of stores and equipment inland which provided the botanical programme/inland journey with a strong departure base.

The build-up of stores inland took about a week. Our first task was to investigate the best route inland and we sent out two parties - one to investigate the small glacier used by the University of London expedition and the other to look at the arm of the K.I.V. Steenstrups Nordre Brae which descends to Vestre Tasfssaq. Both routes proved feasible but the former was preferred as height was gained more rapidly. A small depot left by the University of London party was found on the col above the glacier and those contents still in reasonable condition were put to good use. The arm of the K.I.V. Steenstrups Nordre Brae referred to above was used by the botany/inland journey party on its eventual return to base.

To facilitate travel inland we had brought a small sledge with us and this somewhat unknown quantity was one of the success stories of the expedition. In retrospect we could, making full use of the sledge, have gone further and done more. It certainly gave a party of six the capacity to be quite independent for one month with a substantial safety factor. The sledge was obtained W.D. surplus and was modified to the extent of sheathing the runners with tufnel. Being only seven feet long it could be carried, complete with traces, as a reasonable back pack load for one person and given the area of moraine and dry ice which had to be traversed before the snowline was reached this was an essential feature. Skis were not used by the expedition.

The build-up of stores inland involved a certain amount of leap-frogging but once depots had been established all members retired to base for two days' rest and heavy eating before the start of the expedition's main efforts.

The route taken by the inland party is clearly shown on the accompanying map. In general once above 700 m surfaces were good. Whenever possible we travelled at night to obtain better conditions and a general conclusion was that if surfaces were soft it was probably better to wait until the weather changed and conditions improved, and then to make a major effort, rather than work very hard in soft snow for a small distance gained.

The serious work of the expedition is described in the reports that follow and I can leave these to speak for themselves, only recounting here one or two of the unimportant but more amusing occasions to redress the balance so to speak.

The first was the occasion when the inland journey party reached the further depot laid down in the build-up period and was then sensibly urged by one of the party to take advantage of the good surface, and the time remaining before sunrise, to relay a load some five miles forward - this distance finishing with a climb of some 400 m to a small col. Leaving two of the party to make camp four of us set off with a sizeable load on the sledge.

The ascent of the col proved steeper than we had anticipated but determination made us keep at it until we were reduced to man-~~handling~~ hauling on all fours, using every possible bit of contact with the ground, and with the sledge seemingly hanging beneath us. This would not have been remarkable but for the now very much harder surface, as we gained height, which gave us little purchase and left us measuring upward progress in inches. All were envisaging a moment when no further upward movement would be possible at all and when the whole assembly would slide ignominiously back whence it came. A final straw was nearly provided by a line of open crevasses suddenly appearing across our line of ascent - although I for one was very thankful to use the bottom lip of a crevasse to hang on to! However our load was eventually deposited successfully on the col and all four of us climbed on the sledge to toboggan erratically back down the hill at an alarming rate of knots and in hilarious mood. To cap it all the sun rose to cheer us and to show that all was well with the next day's weather. Such occasions remain in the mind and in their own way rival the acknowledged highlights of the expedition.

A second episode worthy of note was the descent of a major ice-fall towards the top of the K.I.V. Steenstrups Nordre Brae. The ice-fall presented considerable problems particularly as we were travelling by day and the snow covering was soft. Eventually we managed to squeeze through close to the land where the crevasses, although numerous, were in the main fairly narrow. For a stretch of two to three miles people were dropping through frequently and on at least two occasions five members of the party were either falling in or extracting themselves from holes all at the same time! After a long spell of such flounderings I suddenly found consolation and amusement in the facial expressions of the party. These varied from stern resolve to whimsical resignation; from irritated scowls to scientific curiosity. Luckily my own face was hidden from me but doubtless relief was apparent when it became clear that we had found a viable way down the fall!

My thanks go to all the members of the expedition for their various efforts which in total made our expedition a success. In particular I feel I must mention the highly-praised ration scale provided by Mike Williams, the patient explanation of facts botanical by Ned Lodge and the notable work done by Mike Jamison and Graham Swainson in getting as many members of the expedition up as many peaks as possible.

The expedition left a variety of foodstuffs and stores in the expedition area. If any other parties are considering visiting this part of Greenland I would be pleased to give details. An address can be found for this purpose at the back of the report.

GEOLOGY REPORT - by M. I. Williams

The original aim of the expedition was to get to Kangerdlugssuaq and the Skaergaard peninsular. From a geological viewpoint this was an ideal site in which a small amount of work could usefully be done given the short field season and the limited experience. For example from here it would have been possible to travel up the Frederiksborg Glacier and over to the inland nunataks where there are small outcrops of sedimentary rock yielding a few ill-preserved fossils. These have helped in the time correlation of the stratigraphy and the episodes of dyke injection of the whole of this section of the east coast. Time spent searching these outcrops for further fossils would be very worthwhile. Additional work could also have been done in the coastal area in attempting to assess the total crustal extension involved in the coast parallel dyke swarm, by actual physical measurement of the dykes on the ground. As this is one of the very few regions of the earth where dyke injection accompanies, and is demonstrably of the same period as a continental flexure, quantitative measurements would have been very significant in assessing actual extension and hence deducing the amount of flexuring, tying this in with the models thought likely by observations on the dip of the very slightly earlier lava flows.

In the event an attempt was made at these dyke measurements in the Tasîlaq region which became our objective. Here unfortunately the lava flows are not present and so it is not possible to observe on the ground the dip of the country rock increasing to seaward as one can in Kangerdlugssuaq but one must reason that the flexuring is still present by the similar attitude of the dyke swarm itself.

Tasîlaq Fjord is just inland of Kap Gustav Holm, which is capped by a very thin remnant of sediment and plateau basalt, and from the map it looked as though it might be possible to reach this, but actual sight of the glaciers which barred the way from our base camp area soon stilled any hopes of such an expedition. One would have needed to set up a long chain of food supplies as well as tackling two difficult glacial snouts which were in bad condition and with the climbing party inland there was simply not the manpower available to do this. So reluctantly we had to settle for work on the dyke swarm accessible to us from base camp (which was some 4 miles in from the outer coastline) where the swarm was just decreasing in intensity but we could work inland to the swarm's westernmost limits.

The coastal flexure and the related dyke swarm have been well described by Wager in Meddel. om Grønland Vol 134 No. 5, 1947 and the brief description that follows is based on that paper. The coastal flexure can be deduced directly from observing the lie of the basaltic lavas around Mikis Fjord which very obviously increase their dip seaward to about 45° at the coast and decrease landward fairly rapidly so that five miles inland the dip is only 12° and a little further 7°. This attitude of the lavas is typical wherever they outcrop on this section of the coast. The dyke swarm is however the more obvious in the field and it is most interesting to note that where the dip of the lavas is greatest the dyke swarm is at its most intense.

On Kap Edvard Holm for instance the densest part of the dyke swarm cuts the gneisses and inland part of the basalt outlier where the basalts are dipping at 60°. The swarm is less dense further seaward where the basalts dip at 40° and the dykes are rare on Nordre Aputitek and Keglin Island where the dips of the lavas are still less. The dip of the dykes is 80° landward to the west of the basalt outlier in the metamorphic complex and decreases nearer the coast to 60° where the swarm is densest and less still on the islands.

So the dense swarm is confined to the most steeply dipping lavas and this relationship persists over so wide an area that it must be taken to prove that the dyke swarm was injected as the flexuring of the basalts was taking place. During flexuring there would be tension in the upper crust where the flexure is convex upwards and it is in just such a situation that one would expect dyke injection when this tension reached some critical value. The injection of dykes relieves the strain, further bending causes more tension in the upper part of the flexure and more injection and so on. Field evidence suggests that there was time between injection episodes for the dyke magma to cool to a solid rock because successive fractures mostly break new ground though sometimes open up earlier dykes.

The close connection between the basalt flexuring and the dyke swarm can be used to deduce the flexuring structure where the basalts are absent and though to the south basalts have so far only been found in position on the summit of Kap Gustav Holm the dyke swarm continues to Kap Wandel and it is safe to assume that the flexure of the crust continues also, resulting in uplift of the inland region and down-sinking of the sea.

It is also worth noting here that where there is a real change of direction of the crustal flexure of about 30° around the mouth of Kangerdlugssuaq (for some unexplained reason), the dyke swarm being due to the same process has followed the same course. There is a structural difference in level on the two sides of the flexure of at least 8 km and there has been uplift of the land and down-sinking of the sea over a very large area. Thus a major epeirogenic movement can be proved and dated from the illustrations the flexure and dyke swarm provide of the fundamental tectonics of this part of East Greenland. Wager concludes that from the parallelism of the flexure and the trend of the coast it is clear that the distribution of land and sea is the direct result of this major epeirogenic movement and that this ranks among the major tectonic features of the earth's crust.

Wager's observations in the area in which we were working showed that the dyke swarm was densest on Kap Gustav Holm where the dip of the dykes landward was 75°. This would coincide with the maximum seaward dip of the flexure, though this cannot be observed in the main country rock, the gneiss forming the metamorphic complex, but could be observed on the summit of Kap Gustav Holm where there is a remnant from the base of the basaltic lava.

As mentioned above the nearest we could get to Kap Gustav Holm was some five miles distant and here the swarm was less dense, about 30 - 40 per mile dipping 75° - 80° landward.

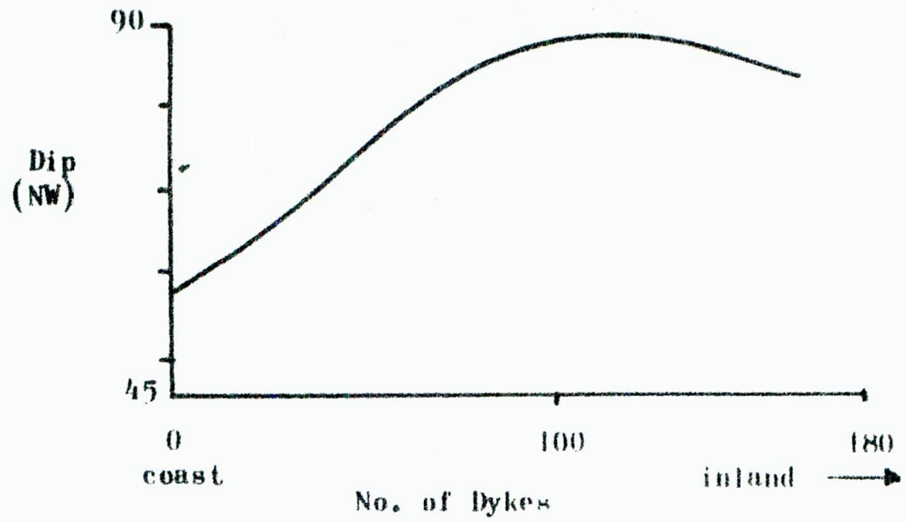
The actual way in which we proposed the measurement of the dykes was simple: carefully plotted traverses on foot were to be made from the most seaward dyke on each line inland until the dykes were so far apart as not to constitute a swarm. Each dyke crossed would be identified for the rock type (to try to distinguish different periods of injection), the dip and strike measured (to show the landward decrease in curvature of the flexure, and also to see if different periods of injection varied at all in dip or trend) and the width across strike would be measured to find the crustal extension and by the aggregate of widths the total crustal extension.

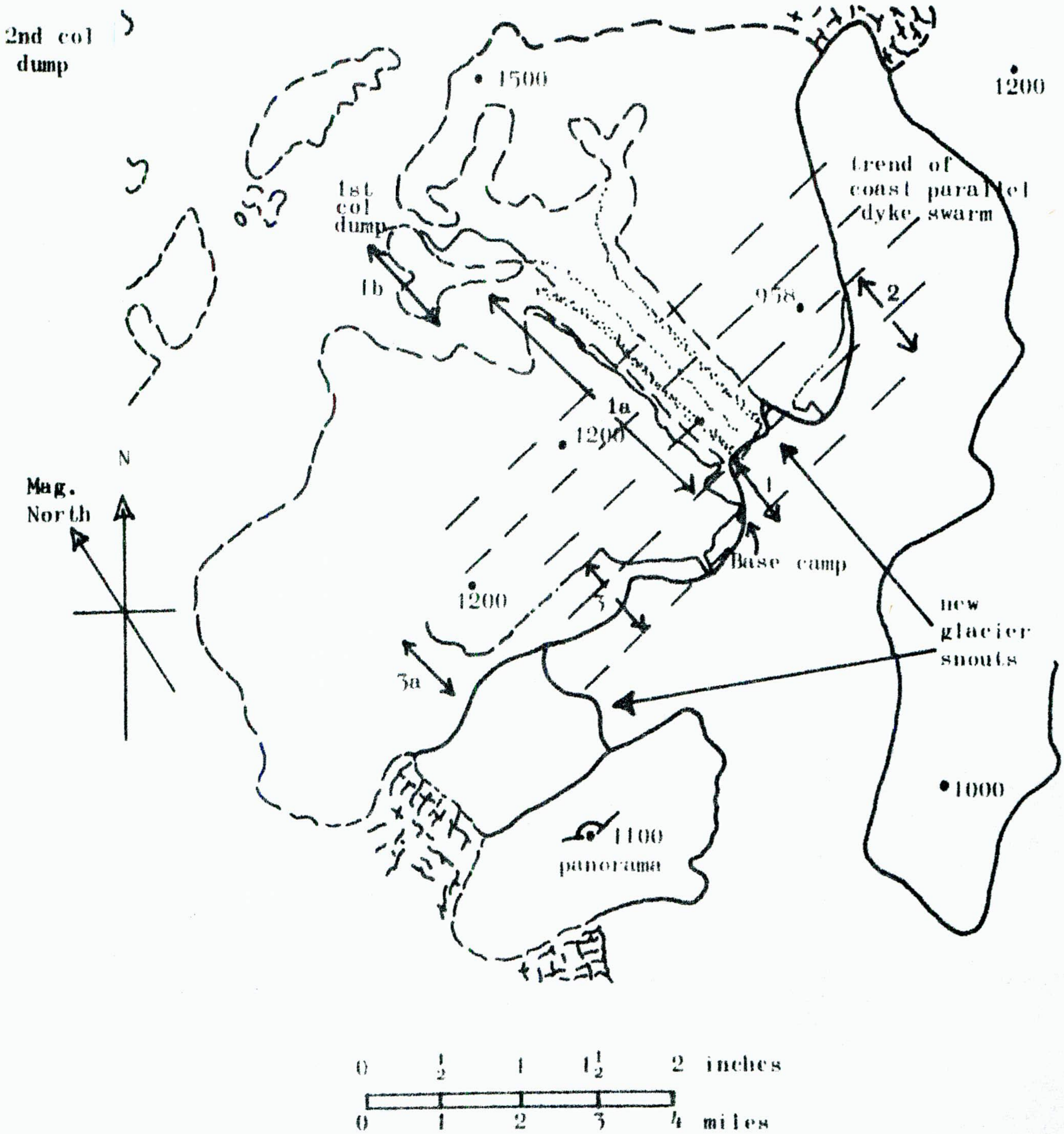
The routes taken for the traverses are shown on the map which also shows the straight line sections across the strike, giving the true length of the traverses. Of these 6 routes numbers 1, 1a, 2 and 3 each were given a very detailed survey, every dyke being measured with a tape across strike and each yielding a dip and strike measurement from a rock plane. On routes 1b and 3a and at the top of traverse 1a a few dykes were impossible to approach and the measurements for dip and strike were made at a distance and the widths estimated. I had hoped that it would have been possible to obtain accurate measurements of these inaccessible dykes working from photographs taken at the time, in exactly the same way as I hoped to measure those dykes seaward of the base camp by taking photographs from the Ejnar Mikkelsen as we sailed across strike leaving the fjord. The photographs would show a mountain peak of known height and the dykes that cut through it. This should provide a scale from which one could measure the width of the dykes. Unfortunately though the photographs have come out very well the technique proves neither easy to apply nor very accurate. The reasons are that the dykes are not always seen precisely down strike no matter how many photographs are taken and because of the fore-shortening effect. One can however find the number of dykes easily and the general strike and dip.

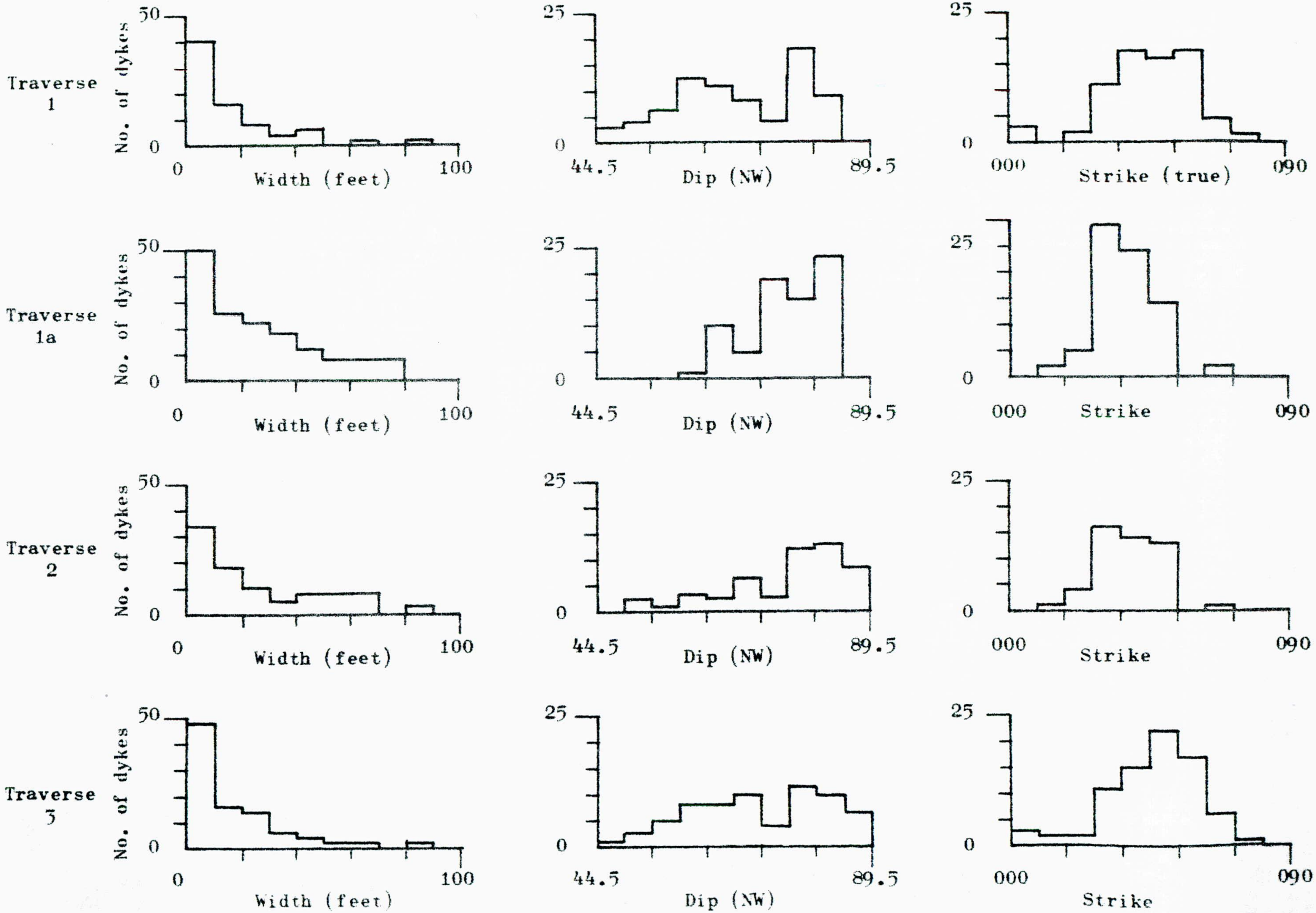
Diagrams of the principal measurements made on the dykes for the main traverses are shown in the accompanying figures. The block diagrams illustrate clearly the main features of the dyke swarm. The majority of the dykes are less than 10 feet thick with progressively fewer dykes in each category of larger widths, those above 90 feet being rare. The landward increase in the dips of the dykes can be shown in the difference between 1 and 1a and on the graph. Dips less than 80° are spread fairly evenly between 55° and 75° and the fact that these occur near the coast shows that this variation occurs near the point of maximum curvature of the crustal rocks. The block diagrams of the strike measurement also clearly illustrate the coast parallel nature of the swarm, mean strike being about 045 which is marked on the map. A very satisfactory outcome from the block diagrams is the great similarity between each on traverses 1, 2 and 3, proving the continuity of the structure and attitude of the swarm along strike.

The graph of dip against the number of the dyke inland merely shows in the crudest way the landward increase in the dips and cannot hope to be anything more than diagrammatic. A more complicated plot, taking into account the actual distance of the dyke inland, would show a much less steep curve and would be scientifically valid.

Traverses 1 and 1a







Traverse 1
Traverse 1a
Traverse 2
Traverse 3
No. of dykes
50
0
0
100
Width (feet)
25
44.5
89.5
Dip (NW)
000
090
Strike (true)
Strike

The physical relations of the dykes themselves have now been illustrated and one can now proceed to the physical extent of the swarm and the resulting crustal extension.

Traverse	1	1a	1b	2	3	3a
No. of dykes	77	90	11	57	89	23
Total width (ft)	1,454	1,938	423	1,060	1,379	267
Traverse length (mls)	0.90	2.3	1.47	0.91	1.125	0.73
Crustal extension (%)	30.6	15.9	5.5	22.1	20.5	7.0

These figures illustrate very clearly not only the drop in the number of the dykes/mile going inland but the very sharp drop in the extension going inland: the intense swarm is limited to the coastal strip.

From the photographic traverse taken leaving the fjord the approximate number of dykes/mile is 85 and the distance of this traverse 3.5 miles. Assuming the same crustal extension as in traverse 1 which is reasonable since the number of dykes/mile is almost the same we can deduce a further crustal extension of some 30% which amounts to 4,500'. Thus the total extension between the first col and the outer coast is 8,315' approximately 2,750 metres which represents a very large volume of basaltic lava. As the distance from first col to the open coast is 21.25 kilometres the overall extension is 13%.

If we suppose that the centre of the dyke swarm passes through Kap Gustav Holm, as is fairly probable from Wager's observations, then the total crustal extension filled by the dykes would be some 16,500', approximately 5,500 metres, the remaining half of the swarm being below the sea at this point. Thus if 5,500 metres of extension has taken place in 42 kilometres the original pre-swarm land surface was 36.5 kilometres long.

The basalt rock types of the dykes have as yet only been examined in hand specimens and it is possible to see differences in the rock between different dykes. For the most part all are a standard very fine grain basalt, but a few dykes very near the coast which can be shown to be the latest injected are richer in olivine. It is significant that these are late stage dykes in the centre of the swarm where flexuring was most intense because they originate possibly from deeper in the crust.

The most recent interpretation of the tectonics in this part of East Greenland highlights the importance of the crustal flexure emphasised by Wager and explains its part in the opening of the North Atlantic. This interpretation is by C. Kent Brooks (Nature Phys. Sci. 244 No. 132) who is actively engaged in research work in Kangerdlugssuaq. He interprets evidence from Greenland as proving the early stages of activity of a rising mantle plume centred under Iceland, assuming as has been suggested that such plumes drive the lithospheric plates.

The earliest expression of the hot spot under Iceland was the outpouring in East Greenland of vast volumes of tholeiitic lavas ranking amongst the world's most voluminous occurrences of plateau basalts. These differ slightly from typical ocean ridge basalts in that they are richer in iron, titanium and potassium as are recent basalts from the active zone in central Iceland. These differences may be common to plume basalts.

Immediately subsequent to this volcanism large-scale vertical movements took place. Working from Wager's (1947) idea of the original attitude and thickness of the plateau basalts he deduces that the original top to the doming around Kangerdlugssuaq was some 6 km above present sea level, there being 3,500 m of basalts overlying 2,500 metres of basement gneiss - the pre-basaltic land surface. The rifting and volcanism caused by such doming often has a Y-shaped configuration and later lithospheric movement will be restricted to two arms of the Y with the third arm being an inactive rift having some characteristic volcanism. In this case it is supposed that the proto-Icelandic plume caused crustal separation along the arms marked by the present coastline, with Kangerdlugssuaq as the inactive rift. (This fjord has many characteristics in rock type of continental rift valleys but no marginal faults have yet been identified.).

As crustal separation took place and new ocean floor was formed the seaward flanks of the dome were modified by the crustal flexure resulting in the differential vertical movement of some 7 km noted by Wager.

That no further subsidence of the landward region took place, composed as it is of the Arctic's higher mountains, suggests that the doming is not merely a thermal effect over the mantle plumes but must also be accompanied by the addition of relatively light material to the base of the lithosphere.

C. Kent Brooks sees the associated coastal dyke swarm either as a consequence of the flexuring as Wager suggested or as dyking associated with the formation of new lithosphere, and is studying the petrology to try to differentiate between these two possibilities, but it is still not clear at the moment which is the case.

Our work gives a value to the physical extent of the swarm which could be tied in with the vertical doming movements and if this can in any small way help in the explanation then it will be very amply justified. A very thorough exercise of a similar nature undertaken further north at Kap Edvard Holm or Cap Hammer, where the densest part of the swarm is accessible, would be very worthwhile undertaking.

GLACIOLOGY REPORT - by M. I. Williams

A brief glaciology programme was carried out towards the end of the expedition. This consisted of a photographic survey of the main glacial snouts easily accessible from base camp.

It had been noted in the very first days of exploration out of camp that the Danish Geodetic survey map was inaccurate in plotting the snouts of these glaciers and the extent of the valley glaciers feeding them. The dry glacier up which we made our route to the food dump and the nunatak base appeared to have receeded 200 - 300 metres whilst the branch of Steenstrups Nordre Brae calving into Vestre Tasfssaq had advanced some 2 miles. Had the maps been drawn from aerial photographs taken in the spring, when there would still have been considerable quantities of sea ice in the fjords and snow cover on the mountains, then it is possible that the glacier snouts had been incorrectly positioned. If in fact the maps were accurate when drawn then we can see a real and significant movement in the positions of the glacial tongues for which there is abundant evidence.

All along the glacial tongue calving into Vestre Tasfssaq the ice-rock border is very clean with no loose boulders on the roches moutonnées and a convex surface to the ice. The moraines along the side of the fjord are old and well compacted in complete contrast to the moraines around the dry glacier which are very active, loose piles of boulders. The ice is concave or flat where it meets the rock and the edges are very dirty with rubble and rock flour; nowhere is there solid rock against the ice. The snout of the Tasîssaq glacier is heavily crevassed for two miles back from the sea but that of the dry glacier can be safely crossed 100 yards from the snout and at low tide a series of outwash fans and lateral moraines appear and it is obvious that the bay is being silted up with rock flour.

The dry glacier with a limited catchment area is subject very much to coastal climatic conditions and most of its ice would come from the snowfields in the cwms around its head. Steenstrups Nordre Brae is in contrast one of the largest glaciers flowing out onto the east coast and connects directly with the inland ice. Its supply of ice is thus almost unlimited so the fluctuation in length of the branch into Vestre Tasfssaq could easily occur independently of the coastal weather. It is very interesting however to note the increase in size of the valley glacier now flowing into Vestre Tasfssaq from the north as this has an even more limited catchment area than the dry glacier. The next valley to the west, now dammed up by the large glacial tongue extending from Steenstrups Nordre Brae, contains a small lake of meltwater derived from the hanging glacier in the cwm behind. These features can be easily seen and compared with the map in the panorama of photographs taken from the summit of Akilerut.

Three cairns were built as reference points from which detailed photographs were taken of each glacial snout. The positions of the cairns were plotted and photographed so that in a few years' time further observations can be made of the glacial snouts and any movement compared directly with this visual record. A similar photographic record was taken from the cairn at the snout of the dry glacier of the outwash plain and the lateral moraines, and a further survey in a few years' time will be most informative as the glacier may well have ceased to reach the sea if it is indeed retreating and the bay could be completely silted up with a meltwater river flowing across it.

BOTANICAL REPORT - E. Lodge

When the idea of a second Expedition to Kangerdlugssuaq was first conceived, Mr. M.C. Burns once again agreed to be responsible for its botanical programme. With help from Dr. G. Halliday of Lancaster University Burns devised a schedule of work which extended some of the projects carried out on the 1972 Expedition and also fitted in with the climbing and exploring aims of the other members of the party. Unfortunately, shortly before the group was due to leave for Greenland, Burns found himself unable to take part in the Expedition; at this stage I was invited to replace him and carry out his suggested programme as far as possible. In the event it proved impossible to reach Kangerdlugssuaq and all plans had to be modified to suit conditions in the area actually visited which was the region to the north-west of Tasilaq. The Expedition was, however, able to achieve one of its original botanical aims, namely the investigation of the nunatak flora of an area lying inland from the coast.

Tasilaq fjord is situated north-east of K.I.V. Steenstrups Nordre Brae, a large glacier flowing into the Denmark Straits from the Greenland Ice-cap. It lies just to the north of the mountains around the Sermilik, Sermiligaq and Kangerdlugssuatsiaq fjords, an area which is comparatively well known botanically, having been visited by several expeditions since 1963. The Tasilaq region itself has not, however, been extensively worked, though in 1971 collections of plants were made at two sites in the vicinity of the fjord by members of the University of London Graduate Mountaineering Club.

The present Expedition made collections and records of vascular plants and bryophytes from 13 inland sites as well as from low-lying ground around the Expedition Base Camp. The approximate situation of these sites is shown on the map at the end of this Report and a brief description of the inland localities is given in Table I. In the following brief discussion of results the inland collections are dealt with first.

The inland sites

The species encountered on the nunataks are listed in Table II. Nomenclature used for the vascular plants is that adopted by Böcher, Holmen and Jakobsen (1957). The specimens collected are at present held in the Botany Department of Royal Holloway College.

From the Table it is apparent that the total number of species recorded from the different sites varied considerably, the largest number of species occurring at sites 2, 5, 12 and 13: the shortest lists were obtained from sites 1, 4, 6 and 8. Whilst the length of the lists to some extent reflects the amount of time available for searching the area, it is unlikely that this is the only reason for the observed differences. The aspect, the stability of the site and the amount of ground suitable for colonisation undoubtedly affected the richness of the flora, sites with the largest numbers of species having an approximately southerly aspect as well as affording many patches of substrate stable enough for plant growth. In contrast, sites with few recorded species were either north, east or west facing as well as being for the most part extremely unstable.

TABLE I

The sites examined

Site ref. number	Site description	Map co-ordinates	Altitudinal range (m)	Approx. aspect	Dates visited (1974)
1	Loose cliff	66°42'N 34°40'W	900-950	N	24 July
2	Consolidated scree slopes	66°41'N 34°42'W	1050-1100	S-SW	25 July 26 July 27 July 18 Aug.
3	Exposed but consolidated block scree slope	66°44'N 35° 4' W	1250	E	1 Aug.
4	Unstable scree slope near summit of small nunatak	66°48'N 35° 9' W	1400-1450	W	2 Aug.
5	Rocky ridge with broad ledges (see figs. 1, 2, 3)	66°53'N 35°12'W	1500-1600	S	2 Aug. 13 Aug. 14 Aug.
6	Exposed, shattered ridge surrounded by ice	66°59'N 35°28'W	1900-1950	E	3 Aug.
7	Consolidated scree slope	67° 1' N 35°50'W	2100-2150	W	7 Aug.
8	Exposed, very unstable scree slope	66°56'N 35°38'W	1750-1850	W	9 Aug.
9	Sheltered gullies in steep cliffs	66°54'N 35°34'W	1550-1580	SW	10 Aug.
10	Stabilized scree slope	66°54'N 35°27'W	1490-1500	S	11 Aug.
11	Stabilized scree slope	66°53'N 35°24'W	1450-1600	SE	11 Aug.
12	Sheltered gullies in steep cliffs	66°51'N 35° 6' W	1500-1520	S-SW	15 Aug.
13	Stabilized scree slopes	66°45'N 35° 2' W	1200-1400	SE	17 Aug.

TABLE II

The species encountered

Species	Site Number 1	2	3	4	5	6	7	8	9	10	11	12	13
(a) Flowering plants & ferns													
Antennaria canescens		+			+				+	+	+	+	+
Arabis alpina									+			+	
Campanula gieseckiana		+	+		+						+	+	+
C. uniflora		+								+	+	+	+
Cardamine bellidifolia		+			+		+		+	+			+
Carex nardina		+	+		+		+		+	+	+	+	+
Cerastium arcticum		+	+		+				+	+	+	+	+
Chamaenerion latifolium			+		+						+		+
Diapensia lapponica subsp. lapponica		+											
Draba arctica subsp. groenlandica							+			+	+		
D. nivalis	+	+	+		+						+		+
Empetrum hermaphroditum		+											
Erigeron eriocephalus					+							+	+
E. humilis		+			+							+	
Euphrasia frigida												+	
Festuca hyperborea							+		+	+	+	+	+
F. vivipara		+									+		
Gnapthalium supinum		+											
Harrimanella hypnoides		+											
Juncus trifidus		+											
Luzula confusa		+	+		+		+		+	+	+	+	+
L. spicata					+				+			+	+
Melandrium apetalum					+								
Minuartia biflora							+			+	+		
M. rubella			+		+								
Oxyria digyna		+	+						+			+	+
Papaver radicatum		+	+	+	+		+	+	+	+	+	+	+
Phleum commutatum												+	
Poa arctica			+		+		+		+	+	+	+	+
P. glauca		+	+							+	+	+	+
Potentilla hookeriana subsp. chamissonis		+							+	+	+	+	+
Polygonum viviparum		+											
Ranunculus pygmaeus												+	
Rumex acetosella		+											
Saxifraga caespitosa subsp. caespitosa		+	+		+		+		+	+	+	+	+
S. cernua				+	+		+		+	+		+	
S. hyperborea									+				
S. nivalis	+	+	+		+		+			+	+	+	+
S. oppositifolia		+	+				+		+	+	+	+	+
Salix herbacea		+											
Sedum rosea		+											
Sibbaldia procumbens		+											
Silene acaulis		+	+		+		+			+	+	+	+
Trisetum spicatum		+	+		+				+	+	+	+	+
Viscaria alpina		+											
Woodsia glabella		+	+		+						+	+	+

Species	1	2	3	4	5	6	7	8	9	10	11	12	13
	Site Number												
(b) <u>Bryophytes</u>													
Anthelia julacea		+	+		+							+	+
Bartramia ithyphylla		+			+		+					+	+
Blindia acuta		+			+							+	
Dicranoweissia crispula		+			+							+	+
Dicranum fuscescens					+		+			+		+	+
Grimmia apocarpa	+	+		+	+	+	+			+			
Meesia tristicha		+	+		+		+			+			
Pohlia cruda							+			+	+		
Pogonatum capillare			+									+	
Polytrichum alpinum		+			+		+	+		+		+	+
P. piliferum	+	+	+		+		+			+		+	+
Rhacomitrium canescens	+	+	+		+		+	+	+	+	+	+	+
Total number of species (flowering plants, ferns and bryophytes)	5	40	22	3	31	1	21	3	18	26	24	35	30

As one would expect, the nunatak species are mostly wide-ranging arctic and montane plants, many of which grow on mountains in the British Isles. Virtually all of them are extremely tolerant of exposure and all have been reported before from a similar range of altitudes in south-east Greenland. The highest nunatak site investigated, occurred at an altitude of 2100 metres and supported some 21 species of flowering plants and bryophytes. This altitude must be somewhere near the upper limit for flowering plants in this area however, for no species were seen during the ascent of Peak 3000 metres, even though several apparently suitable south facing sites were noted.

One feature of the nunatak flora of the area is the abundance of the arctic poppy (Papaver radicatum), a species much less common on the low-lying cliffs around the Expedition Base Camp. According to Halliday (1971) this is a species which requires an arctic continental climate with dry summers. Woodsia glabella, a fern with similar preferences, was also fairly common on the nunataks, and at some sites (e.g. site 13) occurred in abundance. Surprisingly, Melandrium affine, a species in the same category, appears to be absent from the area even though it is known from sites further south. Melandrium triflorum and Minuartia rossii were not seen either in spite of careful searching. These two species have an essentially northern distribution in East Greenland though they occur further south in inland areas at high altitudes.

Site 2 was almost certainly the nunatak from which collections were made by the University of London Graduate Mountaineering Club Expedition in 1971. Almost all the species noted by this group were seen and 10 additional records of flowering plants were also collected, including Diapensia lapponica which here must be growing virtually at its altitudinal limit.

The coastal vegetation

Although only a short time was available in which to examine the vegetation around Base Camp, the following plants were noted on the low ground between the approach glacier and the Hut and along the north-west shore of Vestre Tasissaq. In spite of the superficially barren appearance of the area (see fig. 4), the list includes 59 species of flowering plants, ferns and fern allies and 14 species of bryophytes. These plants of course were not distributed about the area at random but formed communities composed of species with approximately similar habitat demands. The communities encountered were for the most part very fragmentary but nevertheless snow patch and flush communities, dwarf shrub heath and communities of fell-field, solifluction soils and beaches could all be recognised.

Antennaria canescens	Cerastium arcticum
Arabis alpina	Chaemaenerion latifolium
Betula nana	Cystopteris fragilis
Campanula gieseckiana	Diapensia lapponica
C. uniflora	Diphasium alpinum
Cardamine bellidifolia	Draba nivalis
Carex bigelowii	Empetrum hermaphroditum
C. nardina	Erigeron eriocephalus
C. scirpoidea	E. humile

Euphrasia frigida

Festuca vivipara

Gnapthalium supinum

Harrimanella hypnoides

Hyperzia selago

Juncus trifidus

Juniperus communis subsp. *alpina*

Loiseleuria procumbens

Luzula confusa

L. spicata

Melandrium apetalum

Minuartia rubella

Oxyria digyna

Papaver radicatum

Pedicularis flammea

Phleum commutatum

Poa arctica

P. glauca

Polygonum viviparum

Potentilla hookeriana subsp. *chamissonis*

Ranunculus glacialis

R. hyperborea

Rumex acetosella

Salix glauca

S. herbacea

Saxifraga caespitosa subsp. *caespitosa*

S. cernua

S. hyperborea

S. oppositifolia

S. paniculata

S. rivularis

S. stellaris

Sedum villosum

Sibbaldia procumbens

Silene acaulis

Thalyctrum alpinum

Thymus praecox subsp. *arcticus*

Tofieldia pusilla

Trisetum spicatum

Veronica alpina

Viscaria alpina

Anthelia julacea

Aulocomnium turgidum

Bartramia ithyphylla

Blindia acuta

Dicranum fuscescens

Dicranoweissia crispula

Drepanocladus uncinatus

Grimmia apocarpa

Hylocomium splendens

Meesia tristicha

Pohlia cruda

Polytrichum alpinum

P. piliferum

Rhacomitrium canescens

The list of higher plants from around the fjord is considerably longer than given from the same locality in the Report of the London University Mountaineering Club Expedition and probably represents a fairly complete record of the plants of the area. Thus a comparable list from Tugtilik which is noted for its especially rich flora includes 122 species of flowering plants and ferns whilst the ground at the head of Kangerdlugssuatsiaq, also well vegetated, is reported as supporting some 66 species of higher plants including several which here reach their northern limit in Greenland.

References

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CLIMBING REPORT - by Dr. M. H. Jamison

Introduction

East Greenland offers many exciting possibilities for climbers. The highest peaks in the main mountain areas have now been climbed and the more easily accessible areas have been visited by a steadily increasing procession of expeditions. The area just north of Angmagssalik which includes Mount Forel (3360 m) and Ingolfsfjaeld (2230 m) has been explored by a variety of groups from all over Europe. Similarly the Stauning Alps near Scoresbysund have been popular for some years. Both these areas have been relatively easily reached by air and sea. Kangerdlugssuaq lies midway between these two centres and its inaccessibility has frustrated many expeditions. North of Kangerdlugssuaq lie the famous Watkins Mountains (3700 m), the highest range in Greenland, climbed by Augustine Courtauld's party in 1935. Also in this area lies the Lemon's Bjerg range of which Mitivagkat (2250 m) was climbed during the 1972 Westminster East Greenland Expedition.

Small boats from Angmagssalik can reach areas up to 40 miles up the coast with relative ease during a good ice year and Kangertitivatsiaq has been a popular starting point for expeditions to Ingolfsfjaeld and the glacier systems radiating from the Glacier de France. Small boats are reluctant to venture further north than this because the two K.I.V. Steenstrups glaciers are a fertile source of large icebergs, making navigation dangerous. The area north of these glaciers is therefore rarely frequented.

Our destination, Tasflaq Fjord, has been visited by London University Graduate Mountaineering Club in 1971. They ventured inland some 8 miles and climbed Pt. 1500 m and several other peaks near the coast. Beyond this was virgin territory containing an interesting progression of spot heights marked on the map stretching up to the ice cap.

Our climbing strength was certainly not enormous. We could probably recall about 10 Alpine seasons between us and rock climbing ability ranged from enviable elegance at one extreme to partial ataxia at the other, with all grades of oarsman's brute strength in between. However there was no lack of enthusiasm. We were lucky to have the services of Graham Swainson whose mountaineering skills and previous experience of Greenland were greatly appreciated. We were neither expecting nor intending to involve ourselves in any very difficult technical climbing in such a remote area but we ended up climbing suitably taxing and strenuous routes.

The rock varied in quality. Loose, crumbly gneiss was found invariably near the coast but further inland it was often a much more solid gneiss weathered to produce lovely, nobbly protuberances that only occasionally came off in one's hand. Snow conditions were often difficult to judge as sometimes the crust was insufficiently hard to support one's weight. Patches of ice were visible on the faces and gullies but these usually proved bypassable. Good cramponing conditions often made steep ascents feasible but a number of detours had to be made on descent because of soft snow in the afternoon sun. We were fortunate in having good, reliable weather and this, combined with the virtual absence of darkness, made climbing for a party with relatively inexperienced members less dangerous than it might have been.

Our objectives changed daily. After initial delays progress inland was rapid. Imposing peaks rose impressively from the glacier and we had to curb our impatience to climb them and divert our energies to pack-hauling and dragging the sledge inland. However climbing routes were noted for the return journey. At last, finding ourselves camped near a 3000 m peak, we could wait no longer and embarked on an attempt to plant all six members of the inland journey and a Union Jack on the summit.

Peaks Climbed

Ascent of Peak 3000 by south ridge - 5 ~~July~~ August 1974

After a very cold night and a slow breakfast (the primus stove was frozen), we left our camp on the glacier at 3.30 a.m. Half an hour later we put on crampons and picked our way through the ice-falls and crevasses of a small south-facing glacier climbing as two ropes of three. After three and a half hours of scrambling along the gently rising ridge of alternating rock and snow we rested in sight of the summit. The route from here traversed a steepening snow slope keeping to the right of the ridge which looked chaotic at this point. Cramponing straight to the summit looked feasible from here but the slope was concave and we had to bear left up an awkward gully to the ridge again. From here scrambling took us to a rock platform below the summit from which individual ascents to the accompaniment of clicking of cameras were made. (6½ hours from camp). A slow descent down the rocky ridge was necessary as the snow was now out of condition. Halfway down we branched left and pursued a meandering course through a maze of crevasses cutting out the tedious ascent ridge. We arrived back at camp at 4 p.m. enormously thirsty. Round trip 11½ hours. Grade PD.

This was an excellent start to our climbing. From the summit we had made a detailed inspection of the adjacent peaks, noting possible routes (and retreats). The weather still looked settled. The only drawback was that this impressive, vast expanse of snow, ice and rock, though a dream for the mountaineer, was too inhospitable for the hardy little plants sought after by our botanist. We had to come to a suitable compromise between the botanical and mountaineering aims of the expedition.

Ascent of Peak 2800 by N.E. ridge - 6 ~~July~~ August 1974

The following morning saw three of us setting off at 3.00 a.m. towards this impressive peak, a deceptive 1½ hours brisk walk away across the glacier. A bitter wind funnelling down from the ice cap numbed our limbs and faces. Even when we came out of the shade we continued to freeze until, rising out of the glacier gutter, we started to sweat profusely in the still, morning air.

We had walked round the east flank of the mountain and now approached it from the north. One and a half hours of ascent from the main glacier up a subsidiary branch flanked on each side by steep ice-falls took us to the N.E. ridge visible from the camp site five miles away. An easy snow arête led up to a complex series of gendarmes. We decided to bypass the first of these using a narrow snow platform lying at the base of the gendarme. This platform began to peter out and become friable in the morning sun and we were relieved to eventually set foot on good rock after an awkward traverse on steep snow in poor condition. After some scrambling and a pitch of Grade III the ridge was blocked by a 50 ft rock step (Grade V). In spite of the dearth of holds the leader appeared to climb this pitch with great ease but we bypassed it with difficulty on the left after tentatively scratching at the smooth surface with our fingernails. We reached the summit at 10.00 a.m. (5½ hours of climbing; 7 hours from camp).

The route of descent was debated on the summit and eventually we headed back down the same ridge intending to keep to the rock and not venture again onto the S.E. face. Some scrambling and two short abseils brought us to the large gendarme we had bypassed on the ascent. If this proved insurmountable we knew we had problems. There seemed no obvious line but Graham, after disappearing for a look round to the left, appeared in a gymnastic position grunting something like "beautiful rock, nuggets everywhere". Stan looked worried as the finishing overhang was surmounted but then he proceeded to climb the pitch with great vigour using the beautifully wind-carved ornate handholds. (Grade IV).

Several pitches of Grade III climbing and a 150 ft abseil remained before we had defeated this gendarme ($4\frac{1}{2}$ hours from summit). An hour later we were back on the glacier and confronted with a two-hour plod across nasty, crumbling sastrugi. After such an exciting climb it was possible to repress the discomfort of blisters, sores from chafing clothes and the burning eyes which were to be my pre-occupation for the next two days. Round trip $15\frac{1}{2}$ hours. (ascent 7 hours; descent $7\frac{1}{2}$ hours). Grade AD.

The following four days were spent in and around camp because of bad weather so I did not need to feel guilty about holding up operations because of my snow-blindness. We then made slow progress back to Botany Point Camp, leaving a smug collection of unclimbed virgins relieved at our departure. This camp was only four miles from Peak 2400, a snow-capped dome that had become a focal point of interest during our hours of pulling the sledge up the glacier.

<u>Account of Ascent</u> of 2400 - 14 July 1974

We were impatient to do some more climbing after the spell of bad weather and so after an afternoon of clear skies we assumed it would freeze hard during the night. We therefore set off at 10.30 p.m. just as the crust was forming, hoping for a snappy, clear ascent. Our hopes were soon dashed for, in spite of the clear sky, it never really froze hard and we were continually breaking through the crust that was just tough enough to hold our weight initially before collapsing a moment later when muscles were relaxed. We laboured on in the stillness, ascending almost due west to the col that was our gateway to the peak itself.

Distances were more than usually deceptive but on nearing the col our dome gradually showed its silvery, shapely head and shoulders. It was tempting to try a directissima ascent up the steep N.W. face in front of us but it looked rather icy and retreat would have proved difficult. We therefore contoured round to the S.W. corner of the mountain ($2\frac{1}{2}$ hours). This smooth, rounded shoulder looked most enticing and after putting on crampons we attacked it with enthusiasm. Unfortunately each step broke through the crust into the powdery snow beneath and progress was slow. This continued for 400 ft before we approached some nice-looking gneiss. Appearances were deceptive - anything you touched or stood on disintegrated and slid gracefully down the snowslope. Back on the snow higher up where the gradient of the dome eased we progressed gently by leaning into the slope and making as much body contact with the snow as possible such that our crampons could grip the surface crust without breaking through. The summit was reached at 4.00 a.m. (3 hours of climbing) and we were surprised to find our dome was in fact a snow ridge running N.E.-S.W.

Reluctant to descend the same way we continued along the ridge amongst rocky outcrops garnished on their windward surfaces with sparkling rime ice which must have formed in the freezing mist of the previous morning and survived the spell of afternoon sunshine. We moved slowly along this airy ridge testing each frozen-up rock with care and delicately balancing our way across some knife sharp sections made of crumbling snow. There seemed no easy way of descent so we continued along the ridge until we were forced to slowly front point backwards down the face on our right and jump an impressive bergschrund. From here we were fortunate to find a route through a chaotic ice-fall and then had a long plod back to camp. Descent 6½ hours. Grade AD.

Ascent of Peak 2100 - 16 ~~July~~ August 1974

This ascent was made from near the foot of the mountain itself thus cutting down glacier plodding to a strict minimum. 1.15 a.m. start. Rising traverse of N. face on good frozen now. Snow-covered rock (Grade II) to reach N.W. ridge. Scrambling to foot of 50' wall with 2 slim cracks (Grade V) bypassed on right by loose, dangerous pitch (Grade IV) or ascended by prussicking. 300 ft scrambling to summit. Descent by similar route involving two abseils. Ascent 4½ hours. Descent 3½ hours. Grade PD sup.

Ascent of Peak 1800 and 'Horseshoe Ridge' - 18 ~~July~~ August 1974

What looks like a ridge on a map made from aerial photographs may turn out to be a series of fairly well demarcated peaks. For this reason our 'horseshoe ridge' provided us with a long day of 18 hours, most of which was hard work.

We left the sledging party at 2.00 a.m. and ascended a small glacier to the west of the mountain. After climbing delicately up a fragile bridge over the bergschrund we continued up the N.W. face on good snow to reach the ridge itself. (1½ hours). Another two hours of scrambling over very scrappy territory brought us to one of the many summits. The ridge continued with alternating coniced snow arêtes and rocky outcrops. A final impressive rocky summit was reached after interesting swimming manoeuvres through soft mushy snow covering uncomfortably large holes. After spending 4 hours asleep on the summit we cramponed down a steep gully negotiating the bergschrund at the bottom with care. This is presumably the same gully that ULGMC used on their attempt to climb the 'Church' in 1971. Ascent from camp 5½ hours. Traverse 6½ hours. Sleep on summit 4 hours. Descent to nunatak 2 hours. Grade PD sup.

Ascent of the Church 1800 - 22 ~~July~~ August 1974

After a brief recovery at base camp down by the sea two of us set off up the pack-hauling glacier, camped below the final ice-fall and prepared for an energetic morrow. We made a 1 a.m. start when it was just light enough to see. Two hours later we were six miles from the tent at the foot of the gully used on the descent of the Horseshoe Ridge. Conditions so far had been perfect with a beautifully frozen crust making walking a pleasure. The bergschrund was climbed by making an ascending traverse of a bulge at its centre cutting steps in the hard ice. Soon we were on frozen snow which held crampons beautifully and after a certain amount of gasping and coughing reached the top of the gully. From here we progressed up a series of snow arêtes seeing more and more of the coastal mountains and the sea as we neared the summit which was reached at 5 a.m. (2 hours of climbing). The ice cap and the inland mountains were enshrouded in mist and blue sky above was rapidly being replaced by cloud so we didn't linger on the summit. A slight slip at the bottom of the gully caused an ice axe to disappear down the bergschrund. It could not be located in spite of some interesting searching manoeuvres in the depths. It may well appear sticking out of an iceberg in the N. Atlantic in the distant future!

A CASE OF SNOW-BLINDNESS - by Dr. M. H. Jamison

When showing the contents of the medical box to the expedition members at base I distinctly remember explaining that both frost-bite and snow-blindness were preventable diseases. Amongst the medical kit were two spare pairs of goggles and everyone had sunglasses. I myself was the proud owner of a new pair of goggles with colourful red plastic rims.

The ascent of Peak 2800M took place the day after an 11½-hour struggle up Peak 3000M in bright sunshine. I remember wearing goggles only intermittently during the 3000M ascent, being infuriated by their misting up whenever I exerted myself (which was frequently). However I had no trouble with my eyes after this ascent: it is probable that because of this I was a little careless the following day.

During the ascent of Peak 2800M about 4 hours were spent on snow in the glare of the morning sun before we reached rock. I was sweating profusely (especially on a difficult, steep,snow traverse) so most of this time my goggles were hanging uselessly around my neck. On the rock I was lulled into a false sense of security as the glare from the surrounding snow must have been intense. At 5 p.m. (the sun had been shining for 13 hours), whilst descending an awkward rock pitch at the foot of the summit ridge, I noticed that the air seemed a little smokey and I was having trouble accurately locating small holds on the rock. I felt no pain but as no-one else noticed the smokiness I suspected that snow-blindness was brewing. I discarded the useless new goggles hanging pathetically round my neck and put on the 'reserve' collapsible pair I had in my rucksack. One and a half hours later, whilst laboriously plodding across the glacier back to camp I felt an irresistible urge to rub my eyes. This progressed to an unpleasant sensation of 'grittiness' followed by frank pain. Over a period of a quarter of an hour the pain had turned to agony and I realised how accurately this type of pain has been compared with the feeling of sand being rubbed on the surface of the eyeball. This comparison however suggests a superficial pain whereas what I was experiencing was the combination of a sharp superficial pain combined with a deep boring pain penetrating behind the eyes. I rummaged quickly through the medical bag and found the amethocaine (local anaesthetic). A drop of this in each eye and the application of eye pads produced dramatic relief.

I had now become a burden on the expedition and was relieved to find that the weather was deteriorating and that halting of activities would not be due to my incapacity. Camping whilst blind is not easy. You cannot change position without fear of knocking over the primus or putting a foot in the precious food. After amethocaine drops have been applied you are not strictly blind but things looked distinctly hazy after removing the eye pads for a quick squint. You peer through a deluge of tears coming from irritated lachrymal glands working overtime. As amethocaine makes the conjunctival membrane insensitive the blinking reflex is lost and the eye's protection is severely impaired making further damage to the eye a very real danger.

I had to keep up the application of amethocaine throughout the night. One drop in each eye every 50 minutes was necessary as those grains of sand started scratching promptly at 45 minutes. I became quite adept at applying the drops in the crowded tent taking enormous care not to waste any. The following day was really quite enjoyable. I continued to apply the magic drops every 45 minutes and spent most of the time sleeping and talking. I was most grateful to my tent companions for providing a regular supply of food and brews. Twenty-four hours after the onset of the pain I was running short of amethocaine but the interval necessary between applications was widening. I put in the last remaining drop at 9 p.m. and slept to be awoken at 2 a.m. with painful, gritty eyes again. I tried some chloromycetin eye ointment with no relief. I attempted to close my eyes and keep them completely still but this proved surprisingly difficult and afforded only very slight relief. Aspirin and distalgesic (a moderately powerful pain killer) were totally inadequate so with streaming, bleary eyes I loaded a syringe with 10 mg of morphine and had a jab at what seemed an anatomically unimportant area of my thigh. Expecting glorious waves of ecstasy to seethe through my body I was a little disappointed to find that I only floated a little and the pain seemed totally unimportant. I was soon asleep until a late breakfast.

Forty hours after the onset of pain my eyes were at last comfortable with no need for medication. The following morning we were back in sledging harnesses. Sharp skylines remained a little blurred for several days.

FIGURES

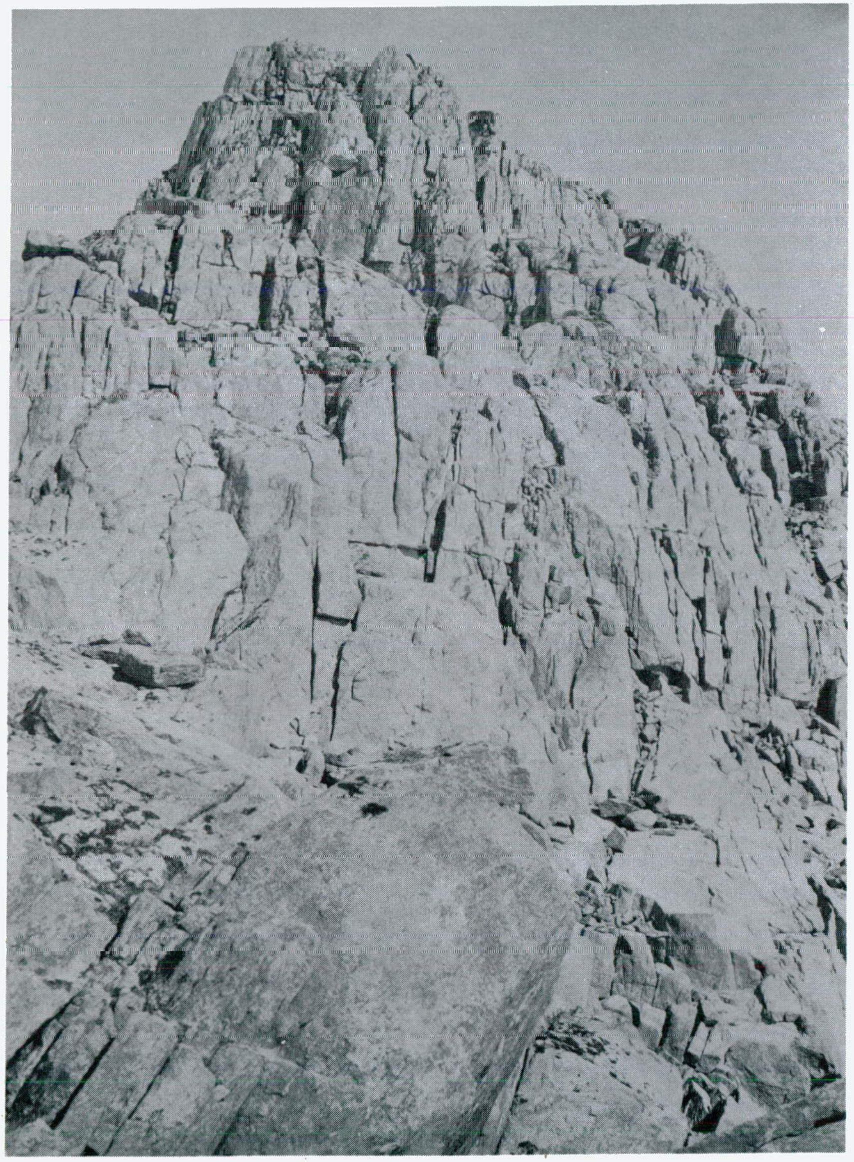


Fig 1

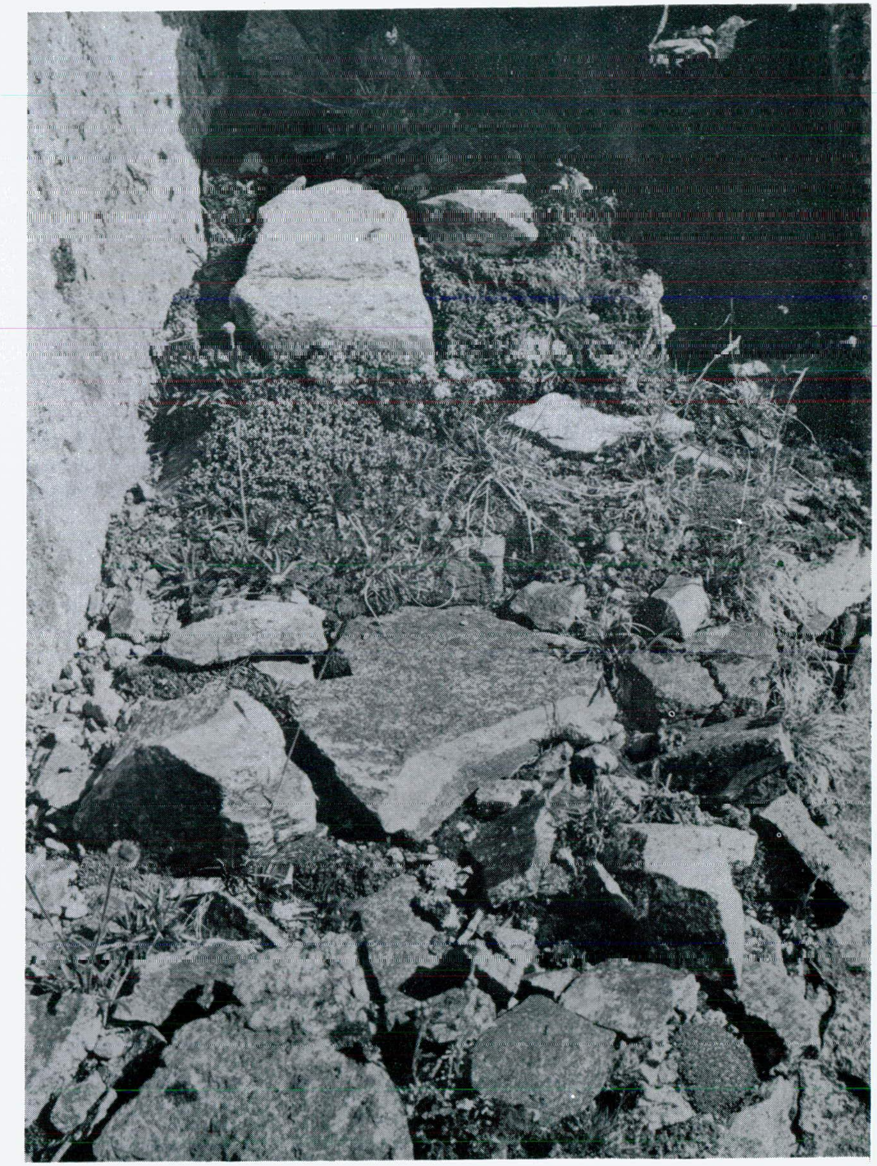


Fig 2

Fig 3

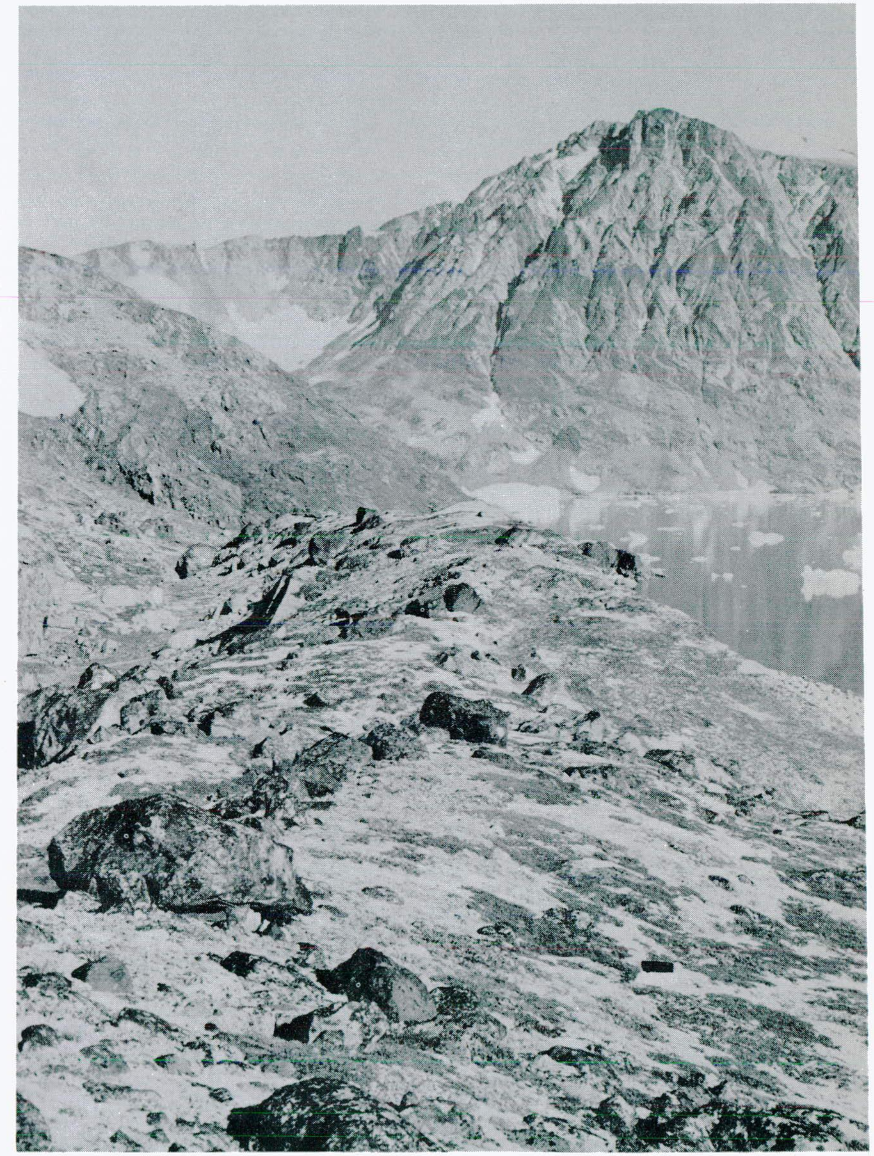


Fig 4

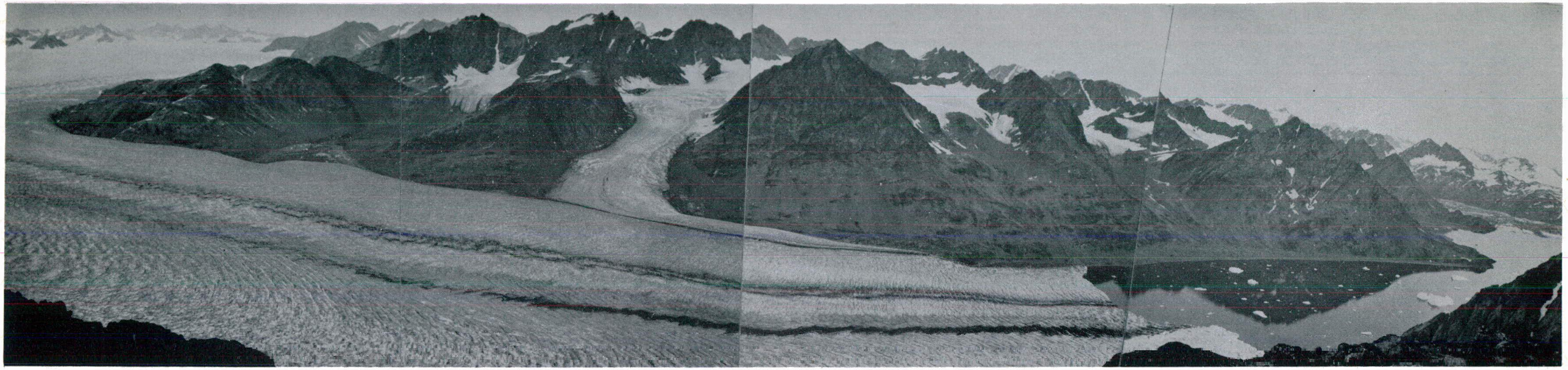


Fig 5

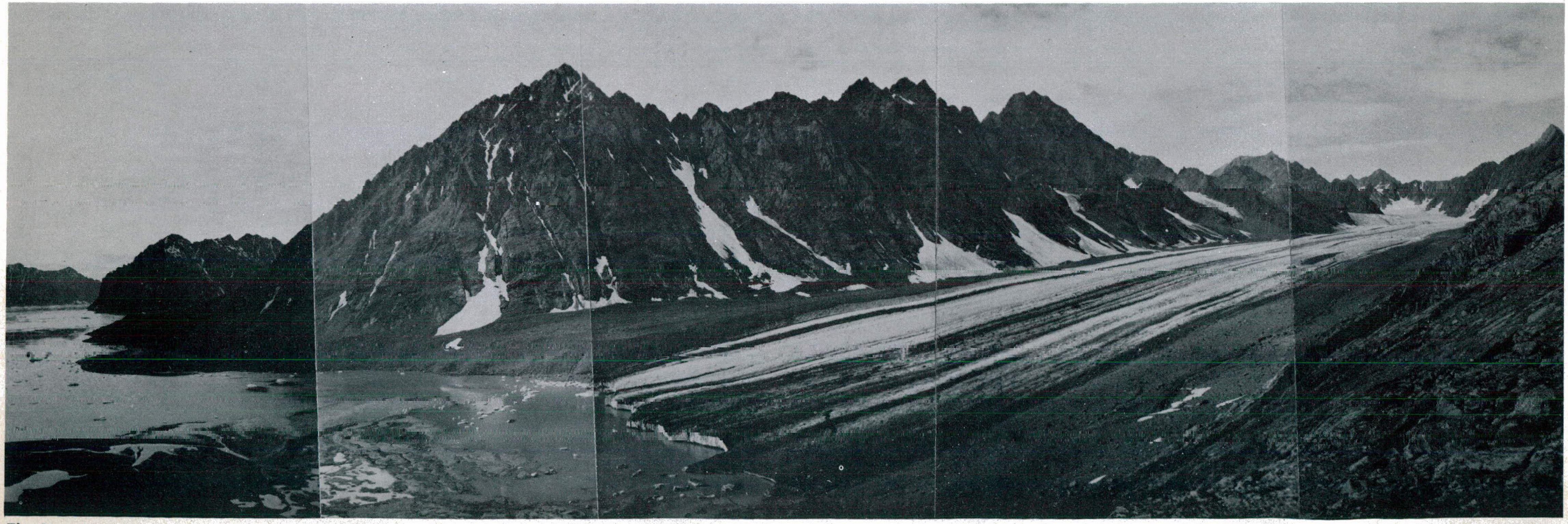
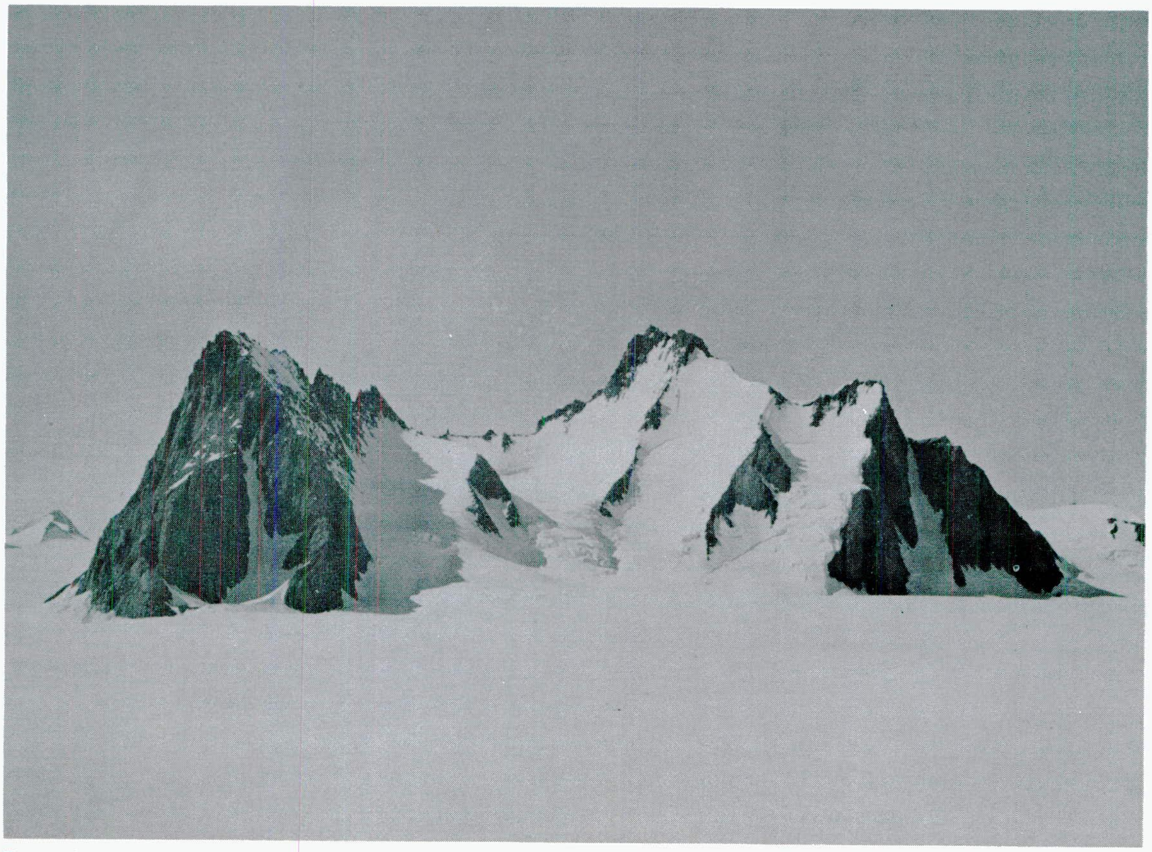
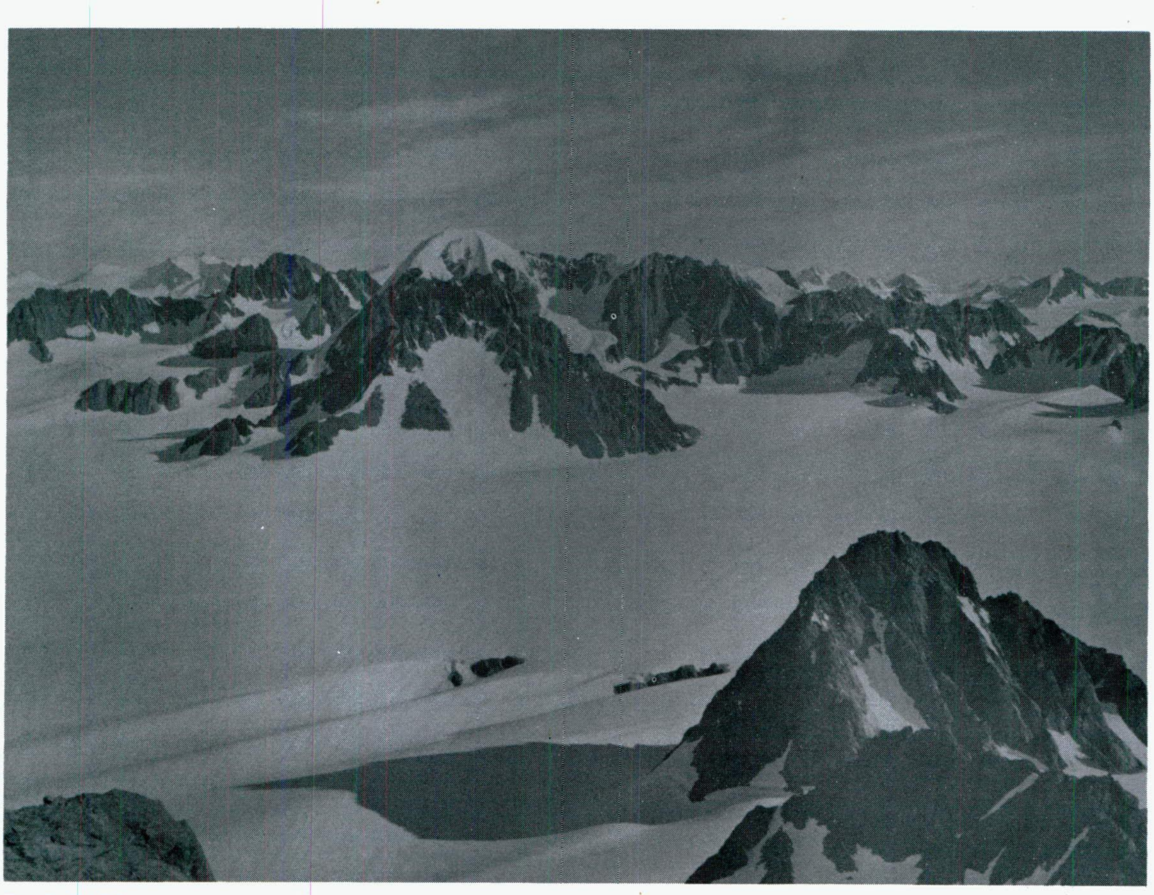


Fig 6

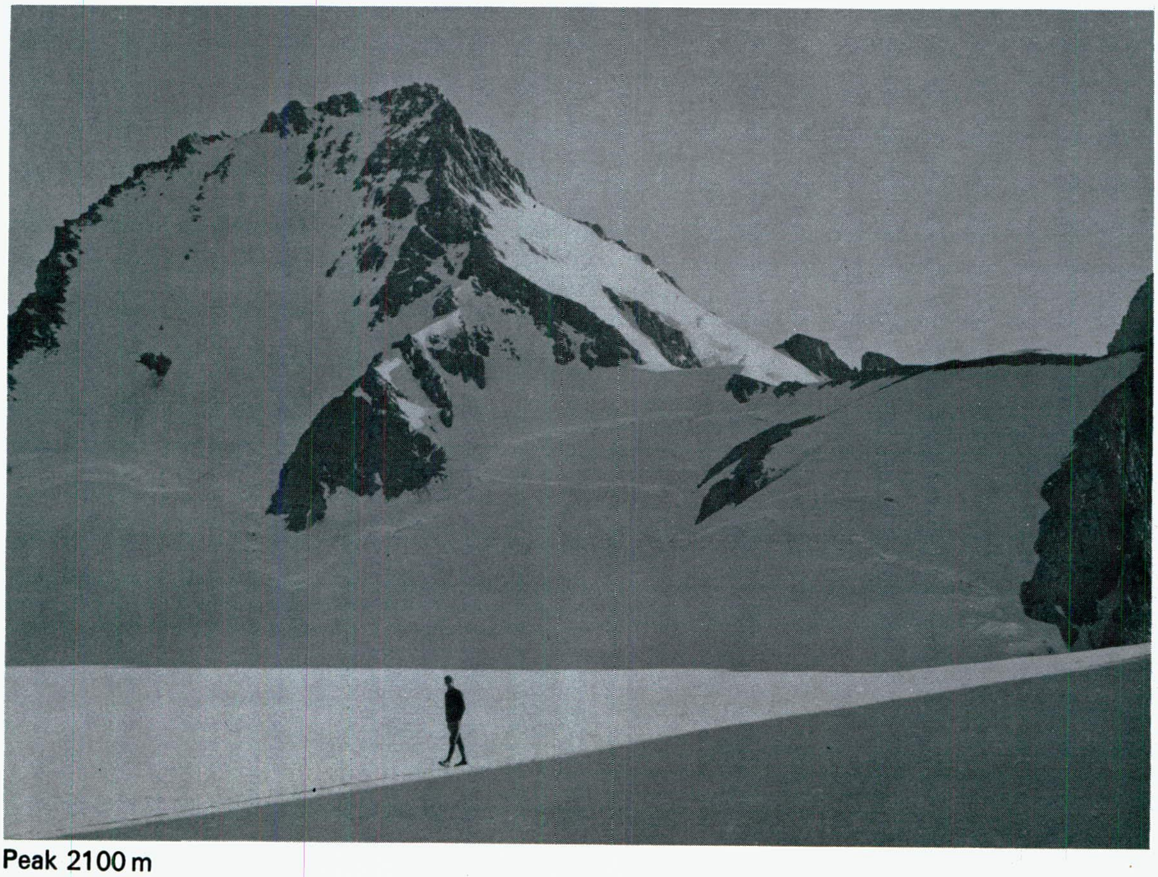
Peak 3000 m



Peak 2800 m



Peak 2400 m



Peak 2100 m

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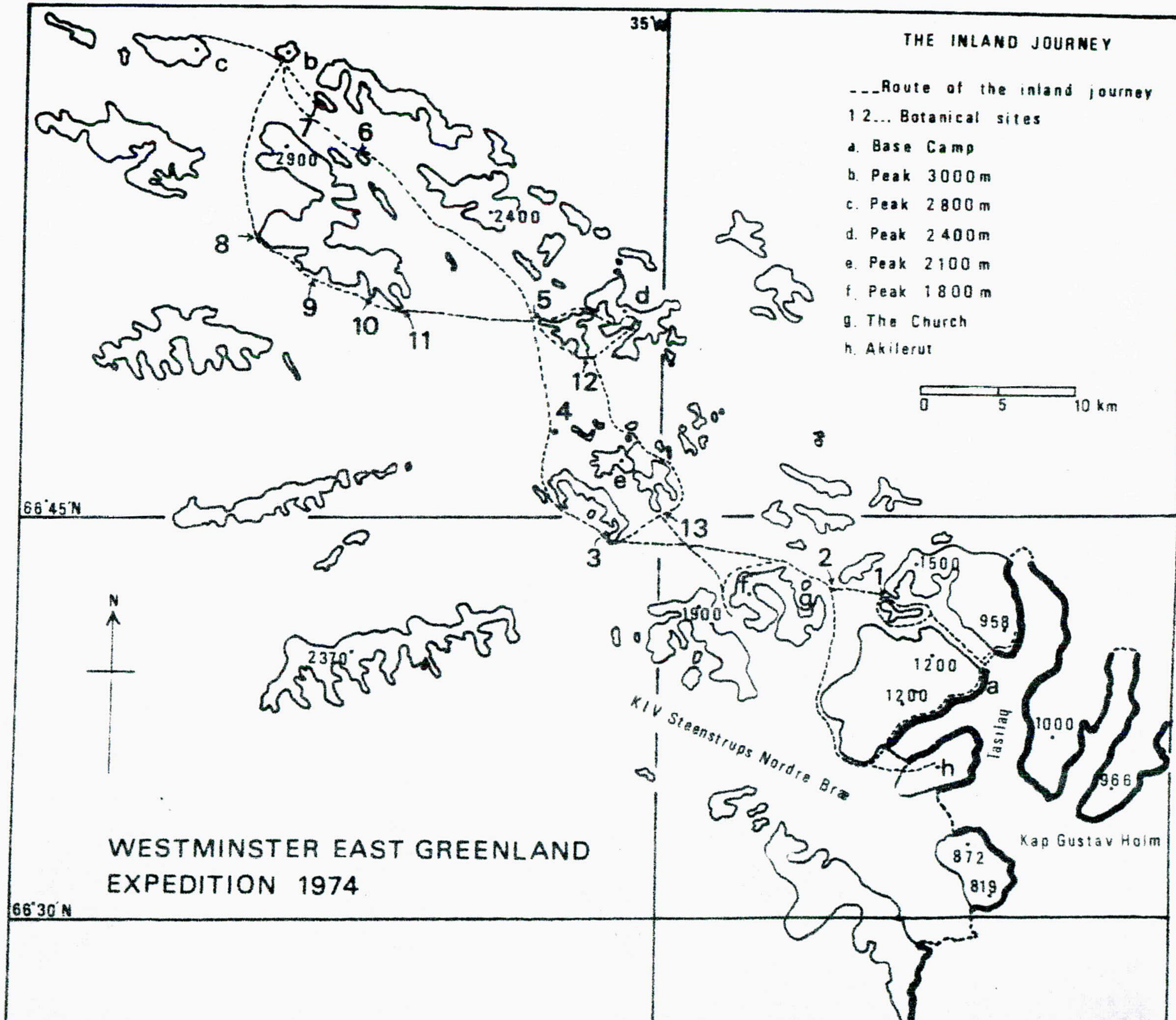
E. M. J. Colocotronis Esq.	50. 00
The Drapers' Company	60. 00
The Forrest and Grinsell Foundation	500. 00
The Mount Everest Foundation	200. 00
The Gino Watkins Trust	50. 00
The Dean and Chapter of Westminster Abbey	50. 00
Members' subscriptions at £290	2320. 00
	£3230. 00

Payments

Air travel	1451. 50
Insurance	265. 37
Food	485. 16
Freight	442. 30
Boat travel	417. 00
General stores	78. 67
Report	90. 00
	£3230. 00


THE INLAND JOURNEY
---Route of the inland journey
1 2... Botanical sites
a. Base Camp
b. Peak 3000m
c. Peak 2800m
d. Peak 2400m
e. Peak 2100 m
f. Peak 1800 m
g. The Church
h. Akilerut
0 5 10 km
35°W
66°45'N
66°30'N
2900
2400
2370
1900
1500
958
1200
1200
1000
966
872
819
KIV Steenstrups Nordre Bræ
Tasiilaq
Kap Gustav Holm
WESTMINSTER EAST GREENLAND
EXPEDITION 1974