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Report on the

ROYAL NAVAL

EAST GREENLAND EXPEDITION

1966

by

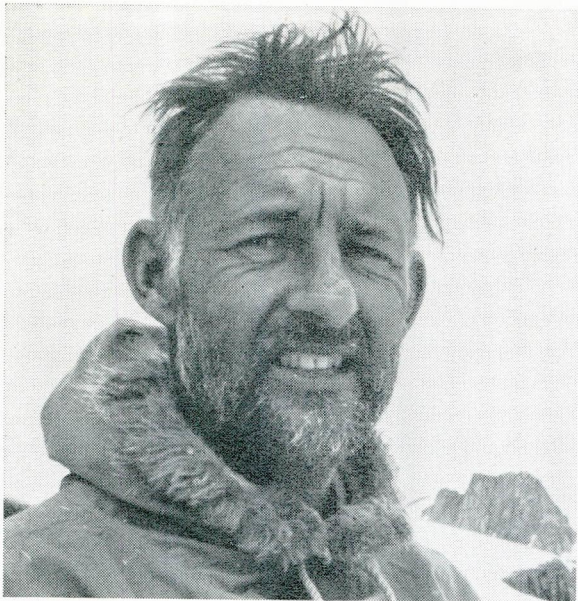
*Lieutenant Commander M. B. Thomas, Royal Navy*

*Doctor R. H. Wallis*

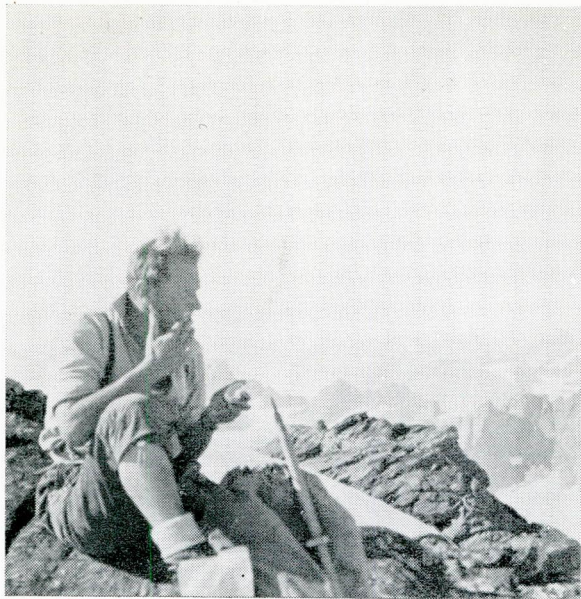
*and Members of the Expedition*







*Lieutenant Commander Stocken, D.S.C. Royal Navy*



*Chief Petty Officer P. J. Garden*

*They shall grow not old  
As we that are left grow old,  
Age shall not weary them, nor the years condemn,  
At the going down of the sun and in the morning  
We will remember them.*



*Photo of Cairn  
(Stocken)*



*Photo of Cairn  
(Garden)*



**REPORT**  
on the  
**ROYAL NAVY EAST GREENLAND EXPEDITION 1966**  
by  
**Lieutenant Commander M. B. Thomas, Dr. R. H. Wallis**  
and  
**Members of the Expedition**

**PATRONS**

Sir Vivian Fuchs, M.A., Ph.D.  
Admiral Sir Varyll Begg, G.C.B., D.S.O., D.S.C.  
Commander C. J. W. Simpson, C.B.E., D.S.C. Royal Navy (Retired)

**SPONSOR**

The Royal Navy Ski and Mountaineering Club

**EXPEDITION MEMBERS**

**Spring**

Lieutenant Commander M. B. Thomas, Royal Navy  
Major M. E. B. Banks, Royal Marines

**Summer**

Lieutenant Commander C. M. Stocken, D.S.C. Royal Navy—Leader  
Dr. R. H. Wallis, Ph.D., F.G.S.—Deputy Leader  
Dr. N. Dilly, M.B., B.Sc.  
Lieutenant G. D. B. Keelan, Royal Marines  
Flying Officer R. Dearman, Royal Air Force  
2nd Lieutenant C. H. Agnew, Royal Highland Fusiliers  
Chief Petty Officer P. J. Garden  
Petty Officer M. E. Collins  
Petty Officer T. W. Kirkpatrick  
Leading Radio Operator J. R. Corner  
Leading Electrical Mechanic K. Rowe  
Marine R. E. Twigg



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## SECTION 1

### INTRODUCTION

Background

Aims

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Figure 1:

Location of Schweizerland  
East Greenland showing areas  
visited by post war expeditions

### SECTION 1 — INTRODUCTION

#### BACKGROUND

1. The Expedition arose through the association of Lieutenant-Commander Thomas with Lieutenant-Commander (now Commander) Erskine in the preparation of a plan for the traverse of the unknown portion of the Greenland ice-cap that lies between Kangerdlugsuak in the west and Scoresby Sound in the east and formerly known as Knud Rasmussen Land. For various reasons, this did not eventuate and early in 1964 Erskine was appointed in command of a sea-going ship. At about the same time Thomas took up an appointment on the staff of the Britannia Royal Naval College at Dartmouth and was able to pursue the more modest aim, originally suggested by Erskine, of a mountaineering expedition to Schweizerland (66. 30N, 37W).

2. Schweizerland was attractive for several reasons. Although previous expeditions had visited the general area none had penetrated west of Femstjernen, the confluence of five major glaciers about 45 miles directly inland from the settlement of Kungmiut, where there remained an area of some 400 square miles of glacier and mountains totally unexplored. Also, the time and cost scales involved were appropriate to a Service expedition relying on non-public funds.

3. The detailed history of this area is now fairly well known and documented. It can be summarised as follows:

- 1912 Schweizerland peaks sighted by the Swiss explorer de Quervain in the course of his west-east crossing of the ice-cap
- 1930-1 Members of the British Arctic Air Route Expedition attempted to climb Mt. Forel, 3,360 metres, from the north
- 1934 & 1936 Area again signed by the trans-Greenland sledge parties of Lindsay and Victor
- 1937 Paul-Emil Victor's attempt on Mt. Forel from the south which was the first penetration of the area
- 1938 Andre Roch's Swiss expedition ascended Mt. Forel and several other peaks
- 1959 An Austrian expedition climbed several peaks adjacent to Kangerdlugsuatsiak
- 1963 Swiss and Scottish expeditions climbed numerous peaks south of the lines of the Midgaard and France Glaciers
- 1965 Japanese attempt on Mt. Forel

4. Thus, in 1966, there remained great scope for exploratory mountaineering provided a party could be established in the Femstjernen area. This fact did not go unnoticed elsewhere and ultimately there were three other expeditions in the field at the same time as R.N.E.G.E., namely Imperial College London, Swiss and Japanese.

#### AIMS

5. The aims of the Expedition were stated as follows:

- (a) To explore and climb in the relatively untrodden portions of the Schweizerland area of East Greenland, particularly east and west of Femstjernen, a large area of open glacier in the centre of the region, and to make first ascents of Pointe de Harpon, 2,900 metres, and other un-climbed peaks. This aim was modified when it became known that other expeditions would be in the area, indeed the Mount Everest Foundation's grant was conditional upon avoiding any duplication of effort in mountaineering or scientific fields, and it was decided by mutual agreement with the Leaders of the Swiss and Imperial College Expeditions that R.N.E.G.E. would concentrate on Schweizerland proper, west of Femstjernen. It was not known at that time that the Japanese expedition would be present but this presented no difficulties.



- (b) To carry out a programme of geological work (see App. IV).
  - (c) To give advanced field experience to potential leaders of Service adventure training schemes.
  - (d) To give beneficial publicity to the Royal Navy by the production of a 16mm. film and other means.
  - (e) To give Officers and Ratings experience of Polar conditions of future benefit to the Service.
  - (f) To give members of the Royal Navy Ski and Mountaineering Club opportunity to progress to exploratory mountaineering within the organisation of the Club.
  - (g) To encourage Club membership and to raise its status in comparison with the Army and R.A.F. Mountaineering Associations, both of which have sponsored Himalayan expeditions in recent years.
6. In addition to the foregoing, Lieutenant-Commander Stocken undertook botanical work (see App. V).

## PLAN

7. The construction of an airstrip at Kulusuk having eliminated the traditional difficulty of approach to the coast, the problem remaining was that of establishing the Expedition and approximately a ton of stores 45 miles inland.

8. It was thought from previous reports that thaw conditions would make it impossible to transport the required weight overland in July. In particular, the 1963 Scottish expedition had reported prohibitively bad man-hauling conditions and had had little help from their hired dog-teams and drivers. Thus the alternatives appeared to be:

- (a) Ski-wheeled aircraft to land above the thaw-line in July
- (b) Depot-laying by dog-sledges in the Spring
- (c) Air-drop

Of these, a ski-wheeled aircraft was not available and would not have been able to land at Femstjernen in any case although there are possibilities higher up. Spring sledging, although almost certainly more expensive than air-dropping was considered to be more sure and was the method chosen.

9. As all four expeditions chose different methods of dealing with the access problem it is worth summarising those of the other three, viz.

- (a) Imperial College—elected to have an air-drop on the Paris Glacier. This was carried out on schedule in good weather but, for reasons which will appear, without the planned ground party. This resulted in the drop taking place in a heavily crevassed area and being so scattered by wind in the parachutes after landing that it took five days to collect into one place.
- (b) Swiss—hired and drove their own dog-teams, sending two men to the area a month in advance to arrange this and to learn the technique. This proved highly successful.
- (c) Japanese—penetrated considerably further inland than any other expedition, man-hauling. A feat probably beyond Occidental metabolism.

10. In more detail, it was originally intended to place the main depot on the north-east flank of Pt. 1800 at the south end of Femstjernen, with intermediate depots at Conniats Bjoerg and on 16th September Glacier, the latter to include a sledge and man-harnesses. This was later revised to omit the Conniats Bjoerg depot as it was felt that travelling conditions on the Haabets Glacier and beyond would be reasonably good. Obviously, there was more than one reason why it might prove impossible to place the depots as planned. However, even in the relatively well-known coastal mountains there was much worth attempting and to have had to abandon the main aim would have been far from a disaster.



11. In the event, the best that could be done was to place the main depot at Conniats Bjoerg. Nevertheless, at the time this was felt to be quite adequate, lying, as it did, only fifteen miles from Schweizerland by the shortest route. This fallacy was exposed in July when that route proved totally impracticable and the alternative, via the Glacier de France, both twenty miles longer and quite unsuitable for man-hauling. As will be seen, the accident to the Imperial College party which prevented them from actually receiving their air-drop led also to a mutually advantageous exchange of food and fuel between the two expeditions, giving R.N.E.G.E. a 90 man/day depot on Femstjernen without which activities in Schweizerland would have been severely limited in time or numbers or both.

12. This plan, sponsored by the Royal Navy Ski and Mountaineering Club (now divided into its component parts), was approved by the Ministry of Defence in April 1965 and an Expedition Committee was formed under the Chairmanship of the Chief Staff Officer (Administration) to Commander-in-Chief, Plymouth. The Committee were shortly honoured to learn that Sir Vivian Fuchs, Admiral Sir Varyll Begg (President of the R.N.S.M.C.) and Commander C. J. W. Simpson (Leader of the British North Greenland Expedition 1952-4) had accepted invitations to act as Patrons.

### PERSONNEL

13. The criteria applied to the selection of members were that the total number should be a multiple of four and that not less than half should have had Alpine or equivalent experience. It was also decided to return past compliments of the Army and R.A.F. Mountaineering Associations and invite a member of each to take part. The plan required a qualified geologist, not often found amongst Naval personnel; and a doctor was deemed essential. Subject to the above criteria it also proved highly desirable for financial reasons that the party should number not less than twelve.

14. Selection of personnel for Service expeditions is naturally bedevilled by the exigencies of the Service. Of the 35 R.N.S.M.C. members who volunteered, half could not be spared from their duties. Of the remainder, some were retired from the Navy and their selection would not have furthered aims (5c) and (5e), and others were too inexperienced. The list finally arrived at, meeting the criteria referred to, was as follows:

Lieut. Cdr. M. B. Thomas—Leader  
Lieut. Cdr. C. M. Stocken—Deputy Leader  
Dr. R. H. Wallis, Ph.D., F.G.S.—Geologist  
Surgeon-Lieut. I. D. Hay, R.N.R.  
Lieut. G. D. B. Keelan, R.M.  
Flying Officer R. Dearman, R.A.F.  
2nd Lieut. C. H. Agnew, R.H.F.  
Chief Petty Officer P. J. Garden  
Petty Officer M. E. Collins  
Petty Officer T. W. Kirkpatrick  
L.R.O. J. R. Corner  
Marine R. E. Twigg

### Spring Journey

Lieut. Cdr. M. B. Thomas  
Major M. E. B. Banks, R.M.

Unfortunately, shortly before the main party left Thomas broke a foot climbing at Sennen and Hay found himself unexpectedly unable to get away. Stocken took over the leadership with Wallis, who was the only member with previous Polar experience, as deputy. Hay found an admirable and versatile substitute in Dr. N. Dilly of University College Hospital and the vacant place was taken by L.E.M. K. Rowe.

15. These last-minute changes exacerbated the other main difficulty facing Service expeditions. With members scattered throughout the country and beyond, it is seldom possible to form a cohesive team in advance of departure. In this case the majority of the party met in the Cairngorms in January, and in Wales at Whitsun. Some had met one another before but many had not, and this was a short acquaintance. Three members, Agnew, Dilly and Rowe, arrived at the airport unknown to one another and to the rest.



## SECTION 2

### SPRING EXPEDITION

by

Lieutenant Commander M. B. Thomas

### SECTION 2 — SPRING EXPEDITION

1. The Expedition stores and I travelled to Iceland in the Icelandic Steamship Company's M.V. Gullfoss arriving on 23rd March. The ensuing days of official negotiation were made easy for me by the help and interest of Mr. Brian Holt, H.M.B. Consul, to whom I am most grateful. Thereafter I led a leisurely existence as the guest of the United States Navy at Keflavik, of whose hospitality I, and later other members of the Expedition, cannot speak too highly.

2. Mike Banks arrived by air on 31st March and 2nd April saw us booted, if not spurred, for departure. However, the weather decreed otherwise and it was not until the afternoon of 3rd that our chartered DC3 crossed the pack-ice in brilliant weather and made that startling abrupt landing at Kulusuk. Off season travel has its advantages and we were provided with luxurious accommodation in the main building and soon realised what a friend we had in Paul Carlsen, the airport manager. His assistance and experience were invaluable and his hospitality to two ever-demanding guests unflagging.

3. As the doctor's boat, the Signe Vest, was expected the next day, we had a hectic evening sorting stores, preparing tents and, already, discarding inessentials. Next morning, using six sledges, we relayed for a cold two hours to the ice-edge beyond Akinaq. Everything was tossed aboard and we crunched up to Kungmiut through two inches of sea-ice in glorious weather.

4. At Kungmiut we were met, accommodated, fed, entertained and organised by the two schoolmasters, Johann Plesner and Erik Meyer and their charming wives. That evening a round-table conference developed with Daniel Danielssen, wise, capable dog-driver and intemperate drinker, representing the local men and Jeremias Kalia applying the rules on behalf of the Royal Greenland Trade Department. Prices were agreed and routes discussed but left *sub judice* until the full meeting of delegates the following day.

5. On 5th, after prolonged and largely incomprehensible negotiation with the drivers and, it seemed, most of their relations, it was agreed broadly that we would travel via the Knud Rasmussen Glacier. There were to be ten sledges but in the event we left with twelve, one of which appeared to be a sub-contract and another just passing through. We finished up with nine three days later. It was not easy to keep track and on return I nearly paid off one cheerful soul who hadn't come at all. We monopolised the old schoolhouse for another day's sorting and jettisoning and provided ceaseless entertainment for the children.

6. We got away at 1030 on 6th in muggy, overcast weather and made 48 Kms. to Sermiligaq via Ilivinga and Qianarteq. There was quite a lot of snow on the ice in Sermiligaq Fjord which caused me needless worry about conditions inland. The weather cleared in the evening giving fine views of Rytterknoegten and the soi-disant Caledonian Alps. We spent the night in the house of one of our drivers which was a memorable experience, not least for the exclusively hill-billy music emitted by a battery-operated record-player; and somewhat exhausting.

7. Local opinion being against a direct approach to the Rasmussen Glacier, we followed the fjord-side to Ilivtiartik and then crossed over into Kangertivartikajik which at first seemed a total cul-de-sac until a snow-slope disclosed itself on the eastern side. The afternoon was a prolonged struggle but evening saw us established on the glacier beneath the shapely summit of Pt. 1067.



8. On 8th we left at 0730 in bright sunshine and, after a cursory glance at the col between Pts. 1316 and 1067, turned uphill on the eastern side of the latter. By the time that we had reached that col the weather had clouded a lot but still gave a fine view up the broad avenue of the Rasmussen Glacier. After an exciting descent and crossing two moraines we kept up the east side for some distance, moving nearer the centre as we approached Pt. 1490. After the first mini-crevasse passed beneath my feet as I sat with Pavia Nathanielssen on 600 lbs. or so of loaded sledge I began consciously to concentrate on other things. Later in the afternoon we got too far west and wove through a large crevasse system before winning clear and camping fairly close under the eastern buttress of Pt. 1760 at the Rasmussen/16th September confluence. That evening, unaware of the 1963 Swiss site over the road, we placed the Intermediate Depot beneath a small crag on the north ridge of the buttress; a choice that was to prove anathema to the summer party.

9. The 9th was one of the most brilliant days I have ever known in the mountains. We made steady progress round the corner and up the Haabets Glacier with ample leisure to admire the spectacular spires and walls of Pt. 1860 and Henry Leon's Bjoerg. That night we camped at the foot of the final slopes leading up to the Conniats Bjoerg col at 1410 metres. We also took a decision that would have proved a very serious, if not disastrous, error had we been able to implement it. Knowing from aerial photographs that the descent north from the col was steep and heavily crevassed and having seen something of the limitations of heavy sledges on such ground, we decided to head south-west from the col, a route that the photographs indicated as straightforward, and then to swing right past Larrondes Bjoerg, cross the Midgaard Glacier and place the depot below Pt. 1800 at the eastern end of Charcots Fjoeld. Had we succeeded in this the summer party would have been hard pressed to reach the depot at all.

10. The following day dawned with thick cloud through which adjacent rocks loomed dimly. As time went on it got thicker and snow began to fall. We slowly climbed the col and hustled down the other side until, as we approached the corner, the leading driver came to a halt. He had reason, for it was obvious that we were almost on top of a large crevasse system. For several hours we probed around in a maze of really big ones, gaining perhaps half-a-mile in the desired direction and crossing at least one highly dubious bridge. Clearly this was not for heavy-laden sledges without more thorough study. In the meanwhile, the weather worsened and the morale of the drivers sagged perceptibly. For most of them this was their first sight of serious crevasses and they were frightened. We didn't blame them. We camped where we were with the uneasy suspicion that it would be unwise to tread the snow too heavily.

11. On 11th, in the same conditions, we re-ascended the col and placed the depot at the south-east corner of Conniats Bjoerg in brisk snowfall. This intensified and a penetrating north-easterly wind sprang up as we groped down the Haabets Glacier in whiteout conditions, trying, and failing, to hit off our outward line through the converging crevasse systems at its lower end. The taciturn Albert Mikike led throughout the afternoon, ignoring my occasional advice and generally doing an excellent job.

12. The following day approached blizzard conditions and we stayed put, but on 13th the wind had dropped and it was possible from time to time to form an erroneous opinion about our position. We pressed on sluggishly through 12 inches of new snow. There was one alarming incident when we suddenly sensed that all sledges were steadily descending into a pronounced hollow, but nothing happened and we camped at the top of the Rasmussen Glacier.

13. The rest was plain sailing, 14th and 15th being brilliantly fine. The only experiences of note were an abortive attempt to follow the Rasmussen to its snout, the very fast descent to Kangertivartikajik and the exhilarating final run on the now almost bare sea-ice.

14. Back in Kungmiut, we had some argument with the drivers about prices but this was really only the try-on of a splinter group, and officialdom was on our side. Between arguments we shaved, bathed, drank whisky and listened to Erik Meyer's recording of Nielsen's 5th Symphony. Once again Erik and Johann shouldered our problems in the most generous fashion and we shall be everlastingly grateful to them for this and their warm hospitality. We left reluctantly on 18th and found clear water to within five miles of Kulusuk.

15. Our return to U.K. was protracted for various reasons and it was not until a week (and the ascent of the local hill) later that an aircraft appeared to take us to Sondre Stromfjord. Visibility over the ice-cap was poor but we had a clear view of the DEW-line station, DYE 3, and of the tortured ice on the western side. Once again, American hospitality kept us happy for a further three days until we finally got airborne for Europe.



## SECTION 3

### SUMMER EXPEDITION

by

Dr. R. H. Wallis

Narrative

Diary

### SECTION 3 — SUMMER EXPEDITION

#### NARRATIVE

1. The culmination of months of planning was reached when all twelve members of the expedition foregathered at the Royal Air Force Station Lyneham, on the evening of 12th July. After a pleasant night in the transit hotel, the expedition embarked in a Britannia aircraft at 0900, and was soon heading for Iceland. The sight of the forlorn figure of our original leader, Mike Thomas, watching our departure was a sad one. The flight was uneventful and comfortable, but enlivened by a fine view of Surtsey volcano south of Iceland. At Keflavik the Americans were most generous, and we were soon ensconced in palatial quarters, with the many facilities of the airbase placed at our disposal. Next day the party moved down to Reykjavik, and departed at 2015 in a DC3 plane of Icelandair for Greenland.

2. This was a memorable flight, particularly when the staggering array of the peaks of the Greenland east coast range gradually rose over the horizon. There were good views also of the pack ice and of enormous icebergs. Nearing Kulusuk low cloud was encountered, and the descent was a little hair-raising. At Kulusuk airport a Nissen-type hut was kindly given us by Herr Carlssen and we were able to sort ourselves out in comfort. Enquiries made by Herr Carlssen revealed that all local craft were engaged for several days, but that the Norwegian motor vessel **M.V. Aarvak**, currently unloading sand at Kap Dan, could embark the party at 0800 on the 15th and take it into Tasissarsik fjord.

3. The passage through the leads was most exciting, and the skilful manner in which the skipper manoeuvred his vessel through the ice from his vantage point at the masthead was most impressive. Soon some of the peaks we had heard so much of came into view, and we were not disappointed. After a brief stop at Kungmiut village to collect gear left for us by the Spring party the **Aarvak** headed up into Tasissarsik fjord. Here we were landed in the ship's boat some two miles from the head of the fjord.

4. An excellent camp site was found, tents put up, and gear sorted out. It was resolved at once to lift loads up to the top of the Tasissarsik 'A' glacier icefall, from which our ingress route by glacier commenced. This was successfully completed, and all were back by late evening. It rained heavily that night thus preventing our departure until 1630 the next day. The start of our march in was again delayed by more rain on the forenoon of the 17th, but by 1200 all were away. It proved a most exhausting day, and only six miles were gained. Even making some allowance for lack of fitness loads were clearly too heavy (70 lbs.) and some painful re-appraisals had to be made. All non-essential gear and most of the luxury food was dumped, and this enabled better progress to be made the next day. The exhausted party camped for the night below a steep icefall, the "Bealach Kelpie" of S.E.G.E. 1963, with its seracs looming imposingly above us in the mist and rain. However, the 19th dawned a lovely day, and a passage was found through the icefall to a col, from which there was a sharp descent that proved a severe trial to our less skilled skiers. The day, however, went well and by nightfall camp was pitched not far above the 16th September glacier. Ahead of us stretched interminably the rutted tracks left by the Swiss and Japanese expeditions, some three or four days ahead. Even for those with alpine experience the very size of this country was staggering; the enormous endless glaciers and innumerable splendid peaks in all directions being almost overpowering.



5. On July 20th the intermediate food depot was reached, after being sighted from about  $1\frac{1}{2}$  miles away. Both the sledge and the food were found to be intact. It was of interest that the snow level had dropped by at least ten feet since the depot was laid in the spring, and that the approach to the depot was now exceedingly crevassed. A fine camp site was found amongst the rocks above the glacier, but our jubilation was slightly dampened by more rain during the night. The following day (21st) the sledge was loaded up, and a start made across to our highway, the Haabets glacier. This proved to be exceedingly hard work, for it took some five hours to pass through a crevassed area of about three miles. The countless crevasses, the poor manoeuvrability of a loaded sledge, and our inexperience all contributed to such poor going, and bore ominous forebodings for the future. Fortunately on the Haabets glacier the going much improved as height was gained; and by the day that the main depot was reached (23rd July) a steady 2 m.p.h. was being achieved, the human dog team having become fully co-ordinated into a rhythm and into the "character building" skills of sledge hauling! The main depot was reached at 1600.

6. Thus, thanks to previous good planning and forethought, the expedition covered the 50 miles to its main base in good order, high spirits and on schedule. This is not to say that there were no troubles; but these were expected, and although the first few days of heavy load carrying were not enjoyable, and nor were the first two days of sledging lightly forgotten, all these adversities helped to weld the members into a team and, most important, made them fit.

7. At Conniats Bjoerg a rude shock awaited us in the shape of the Leader of the Imperial College Expedition with a broken leg, accompanied by two members of his party. As a result of this misfortune these three, the advance party of their expedition, had been unable to complete their journey to their airdrop position, and being short of food had very understandably decided to return to the R.N.E.G.E. depot until our arrival. In practical terms this meant that some of our expedition rations had had to be consumed.

8. It was now decided to remain at Conniats Bjoerg for two days to do some climbing; to examine the next part of our route; and to await the arrival of the remaining members of the Imperial College Expedition with whom the ration situation would obviously have to be carefully discussed. The weather was superb, and in fact nineteen consecutive fine days were experienced before there was a break on the 10th of August. Nights were cold between 2000 and 0300, but of course remained light throughout. However, during the daytime it became extremely hot, and in spite of precautions most members suffered from sunburn in one place or another. Base camp was a good site with full sun from 0300-1600, and there was often running water available. Considerable competition developed among the party in constructing elaborate cooking shelters out of the snow, and in other domestic requirements.

9. On the 24th July after a welcome late rise, Wallis and Stocken with Twigg and Kirkpatrick climbed one of the Conniats Bjoerg peaks above the Conniats Bjoerg icefall, from which a valuable view of all the surrounding country was obtained. The icefall appeared considerably steeper and more complicated than expected, but was obviously negotiable as evidenced by the tracks of the Imperial College, Swiss and Japanese parties.

10. One look at the Midgaard glacier, across which it had been hoped to force a route into Schweizerland was sufficient to put this out of mind, even the approach glacier being hopelessly crevassed. This opinion was more than confirmed a few days later by Dilly's (B) party, which walked down another of the Midgaard tributary glaciers for a closer look. They found the glacier—some four miles wide at this point—an unbelievable jumble of hundred foot ice towers and bottomless chasms, on which even an H-bomb would have made little impression.

11. It may well be asked why this route was ever even considered feasible, the fact is that much of the expedition plans had to be based on photographs of the route taken some 25 years ago, and quite unknown to us there had been an astonishing drop in glacier level during this period, in many cases of at least one hundred feet. This has had a quite remarkable effect on nearly all the glaciers below 1300 metres; all have become exceedingly crevassed in areas that were hitherto unbroken, and most of the later difficulties experienced by the expedition were due to this cause.



12. Later that day the remainder of the Imperial College Expedition arrived from the coast, having taken four days with light loads, and were a little perturbed to find their leader in such a sad state. Now that it was abundantly clear that Schweizerland could only be reached by way of the Femstjernen (which in fact was Thomas's original plan before the Spring journey) it was obvious that neither expedition could fully achieve its aim without a measure of inter-dependence on the other. Thus it was agreed that some 90 man days of rations would be made available to the Imperial College members at Conniats Bjoerg, and that at the first opportunity Imperial College would sledge an equal amount of rations to a depot in the Femstjernen. That same evening six Imperial College members set off to collect their air-drop on the Paris glacier 25 miles further north. This arrangement seemed most satisfactory from the R.N.E.G.E. point of view, since it largely obviated sledging a large weight of rations northwards, a task that experience had already shown to be most discouraging.

13. On the next day (25th) everyone left to climb a small peak of 1750m., some four miles to the south-east, and a most enjoyable day was experienced, ending with a fast ski-run back to base. That evening, consequent upon the changed circumstances, it was resolved to dispose the party afresh as follows:

- (a) **Party A.** Stocken, Keelan, Twigg and Corner to make up the Schweizerland Party, climbing for  $3\frac{1}{2}$  weeks on the Imperial College rations.
- (b) **Party B.** Dilly, Agnew, Collins and Kirkpatrick to form a support party assisting the Schweizerland party into Schweizerland, climbing there until the limit of sledged rations and then returning to Conniats Bjoerg Base.
- (c) **Party C.** Wallis, Garden, Dearman and Rowe to form the Conniats Bjoerg Base party, assisting with getting the sledge down the icefall, and then tackling the numerous unclimbed peaks in the vicinity.

14. On the 26th July the whole party left with the loaded sledge, and after considerable difficulty reached the bottom of the icefall in  $3\frac{1}{2}$  hours, the going thereafter being much easier until the next ascent up a steep col between two glacier systems. This was successfully negotiated by a direct pull, a splendid effort by all, and camp pitched at midnight. After a short rest Party C started on their long trek back to base.

#### "C" team, July 27th—August 5th

15. At midnight, on the col below Devauxbjoerg, with the A/B teams going forward to the "promised land" of Schweizerland, the four rather disheartened members of the C team, were left to plod back to Conniats Bjoerg; a dismal prospect. Little did the C team realise that the consensus of opinion of the "Schweizerland heroes" was—"Lucky people! Trust them to know when they are on a good thing"—someone else's grass is always greener!

16. However, next day to raise morale, and accompanied by Geoff Taylor of Imperial College, an ascent (the 3rd) was made of Solverbjoerg. This is the highest peak in the Conniats Bjoerg area and the climb facilitated a reconnaissance of the surrounding country prior to a C team attempt—to clean up the area! The return from the climb was enlivened by the formation of the "Conniats Bjoerg down-hill-only ski club" for the hair raising ski return from the access col. Only Pete Garden made a no-fall return! The weather remained fabulous with endless sunny days and clear nights, and together with Geoff Taylor, C team made first ascents of Badeuils Bjoerg, the nearest of the Conniats peaks, and the "Big Thumb", a fine peak in the Solverbjerg cum. An attempt on the fine snow peak west of Rodbjoerg got no further than the maze of enormous crevasses below the bergschrund; and an attempt on the big rock peak, Point 2000m, was abandoned in our sleeping bags as the only misty night prevented the snow freezing. This was discouraging with an estimated 5 to 6 hours on skis being involved. Instead we left at 0900 to climb the fine rock peak south of Conniats Bjoerg.

17. An approach was made on skis to a high col below the north face, and then the bergschrund was crossed and a snow gully followed up to the rock face above. C team divided into two ropes of Dearman and Rowe, and Garden and Wallis. Approximately 200 feet up the face Dearman sustained a 40 foot fall whilst leading, but was well held and suffered no more than severe shock. Garden, as Leader of the Arbroath Mountain Rescue team, quickly and very efficiently organised Dearman's safe descent down the face and back to the skis on the col. From here he escorted Dearman down the glacier whilst Wallis and Rowe sorted out the climbing gear. Approximately 1 mile from Conniats Bjoerg base camp Garden moved ahead of Dearman to probe a slight steeping of slope and fell vertically for over 80 feet to the base of a crevasse. Garden suffered multiple head injuries and died instantaneously. With the help of Rowe and Dearman, assisted by Geoff Taylor, of Imperial College, Garden's body was examined by Wallis and his rucksack recovered. Then



Dearman was accompanied to Base camp. A full account of the accident is given in Appendix I. Next day (August 5th) Wallis and Rowe collected together the equipment left around the crevasse and then awaited the return of Dilly's "B" team before organizing a journey to Kungmiut to inform Thomas in the U.K. However, much to their surprise the evening of August 5th brought both "A" and "B" teams back to Conniats Bjoerg and the whole expedition was reunited.

#### **"A" and "B" teams, July 27th—August 5th**

18. The day after "C" team returned to Conniats Bjoerg (July 27th), A/B teams continued sledging northwards; but they very soon ran into difficulties, and progress through endless crevasses became so slow that a halt was called at 1530, and it was decided to rest for a few hours and try a night march. Another start was made at 2230, but very little advantage appeared to be gained by night travel, and the rate of advance was reduced to barely 300 yards an hour. Thus, after a few hours of night travel, and with no prospect of the terrain getting any easier, Stocken made the decision to give up the idea of sledging to Schweizerland, for not only were the members rapidly being driven into raving nunataks, but worse the sledge was beginning to get damaged by the repeated jolting on the hard tops of the crevasses.

19. Therefore, Party B was told to remain in the Devauxbjoerg area, and to climb until their rations (7 days) were consumed, and then to return to Conniats Bjoerg base. Meanwhile, Party A would proceed to the Femstjernen food depot. With pack carrying assistance of three of the "B" team the moraine at the corner of the Glacier de France was reached at 0800 that morning and camp set up. Even without the sledge this further portion of the glacier—that connecting the Glacier de France with the Midgaard Glacier—turned out to be a nightmare, taking some  $3\frac{1}{2}$  hours to cover five miles. The "B" team members then returned to their camp below Devauxbjoerg.

20. The Schweizerland party then spent a pleasant day, some asleep, some sunbathing, and some making good use of a water supply to catch up on the washing. That night, starting at 2310, slow progress was made up the dry Glacier de France towards Femstjernen; few crevasses were encountered, which was as well, as loads were in the region of 70 lbs. apiece. Nearing the Femstjernen a heavily crevassed area was encountered, and nothing that had been seen before or since could be compared with it. Perhaps as the meeting place of five major glaciers this is scarcely surprising; however there were no previous indications that this would be so, and indeed thirty years ago it may well have been much more accessible.

21. The route to the agreed food depot lay right through this maze, but eventually the area of the depot was reached at 0800 after many hazardous moments. To their chagrin there was no sign of anything and a further search during the day in the immediate vicinity was equally fruitless. Finally, quite exhausted, the tents were put up on a convenient nearby moraine and all slept till the following morning. All this emphasises the dangers of selecting a point for a rendezvous in an unknown area; but in the circumstance there was little option. The situation was now somewhat serious since only two days ration remained, and this was scarcely sufficient to meet unforeseen contingencies. Next day (30th July) Twigg and Corner were sent to climb Pt. 1800, above camp, so that at least one peak in Schweizerland would be ascended, while Stocken and Keelan set off towards the Paris glacier in search of either the Imperial College party or a message—since it was plain that the depot had not been laid.

22. Stocken and Keelan's journey proved exceedingly arduous and the relatively clear area above the icefall at the bottom of the Paris glacier was not reached until 1900, a good camp site being found on the central moraine. Sunday, 31st July was yet another lovely day and by 0630 Stocken and Keelan's search was extended another five miles up the Paris glacier. Although they carried good binoculars nothing could be seen either of signs of the air drop (parachute) or of the orange tents of the Imperial College base camp. Thus, most reluctantly, steps had to be turned towards the far distant Conniats Bjoerg base camp. The Femstjernen, is of course an enormous area in which an army could easily be concealed. In fact Imperial College were nearby and would almost certainly have been discovered the next day when they hung their parachutes out to dry.

23. Twigg and Corner (with the consolation of a successful ascent), were met on the Femstjernen central moraine at 1900, and after three hours rest the long trek back was begun. This tested all four to the limit, and the "B" team camp was not reached until 1030 the next day. Thus ended a somewhat epic sortie; a failure certainly, but the fine effort by Stocken and Keelan, who covered some fifty miles of dreadful country in little over 24 hours was surely noteworthy.



24. When "B" team returned from their climbing that evening, they were naturally somewhat surprised to find four exhausted visitors in their tents. During the previous three days the "B" team had taken a close view of the Midgaard glacier (once was enough); just failed to reach a fine 1800m summit after about a thousand feet of ice climbing; and climbed another peak of 1500m: all fine achievements.

25. On August 2nd both "A" and "B" teams moved up to the col below Devaux-bjoerg where there was a much more convenient camp site with rocks nearby. Party "A" took the day easily, to recover from their exertions of the previous four days. In the evening the "B" team most gallantly hauled up the sledge, covering the three miles in six hours. The following day Stocken and Keelan climbed a big rock peak (1750m) behind the camp site. The climb ended somewhat ignominiously with a forced abseil over an over-hanging bergschrund onto the glacier. On the other side of the valley Agnew and Kirkpatrick climbed Point 1400m. Next day (August 4th) whilst two ropes comprising Dilly and Twigg, Corner and Kirkpatrick were climbing the remaining accessible virgin peak, the remainder of the party took the sledge down to the lower glacier in preparation for the return to Conniats Bjoerg.

26. On the following day this operation was accomplished in fine style, first by a long steady pull on skis to the start of the Conniats Bjoerg icefall, where a well-earned rest was taken. Then the sledge was lightened and the loads carried up on ski to the relatively easier ground above the icefall. Finally the sledge was hauled up on a single long rope in less than two hours, in a fashion which would have done credit to those heroes of olden days, who thought little of slinging thirty-two pounders up cliffs. The icefall had changed very considerably for the worse during the previous week, and several extremely tricky snow bridges had to be negotiated. Several of the party fell into crevasses, but being well secured thought nothing of it. By this time such happenings had become commonplace; however, it is worth recording that Agnew proved to be far and away the most successful in this gambit! At 2030 the sledge and its eight willing mules reached the snow crest near the base camp in high spirits, but one look at Roger Wallis's face who had come out to meet the A/B teams quickly sobered up everyone. Briefly, Peter Garden's tragic accident was recounted, and with all their own troubles forgotten "A" and "B" teams hurriedly put up the tents and retired sadly to bed.

27. Next morning, and yet another lovely one; the Leader spoke briefly to the expedition members, his theme being that they must now pull themselves out of their despondency by continuing with the climbing programme as soon as possible, but, first that final respects in the shape of a small service must be held in Peter Garden's memory. Fortunately the problem of a fatality occurring had been discussed at some length in Iceland, and it had been unanimously agreed that the expedition should go on even if such a dreadful event took place.

28. That afternoon all members skied down to a rocky bluff some two hundred yards from Garden's last resting place, and erected a cairn and plaque to his memory. A short service was held, an impressive and moving requiem, for we all realised that not only had we lost a comrade, but that we bore witness to the passing of a very fine man.

29. Immediately afterwards, Wallis, Dilly and Stocken walked up to the fatal spot, and carried out a close examination of the area. Having listened to Wallis's account of his descent into the crevasse Stocken wisely decided to let the body remain there.

30. Sunday, 7th August was given up to our cinematic expert, Agnew, who spent the day filming various climbers disporting themselves on two small nearby peaks—"Stac Polly" and "Filmbjoerg". This was a pleasant change from the obsequies of the previous day, and enabled the party to relax a little.

31. A major problem now faced the leader, in that the base rations were now insufficient to feed the party until the proposed departure date of the 27th August. All would be well, however, if the Imperial College party now due back at Conniats Bjoerg could confirm that the food depot had been laid, and pin-point its location. On this score, therefore, all that could be done was to await their arrival. Of equal importance was the need to send home news as soon as possible of Garden's death; but as it was most desirable that Dearman should be a member of this party it was decided to delay its departure a few days until he was fit for travel.



32. The magnificent weather continued and on both the 8th and 9th August the most was made of it, some fine climbs being made. The highest peak in the Conniats Bjoerg group (1950m) fell to Dilly and Keelan, closely followed by Agnew and Kirkpatrick. Twigg and Corner attempted the prominent rock tower (the "Little Thumb") facing the camp, and on consecutive days Wallis with Rowe and Stocken with Taylor (Imperial College) climbed Henry Leons Bjoerg west (1870m) and made the 2nd ascent of Point 2000m, a fine triangular rock peak some six miles to the north-east. All but one of these were virgin peaks, and on each of the latter two ascents some five hours skinning was all part of the climb.

33. The long awaited Imperial College relief party returned to Conniats Bjoerg on the 9th August, and brought interesting news with them, not only of their ascents, including the Pointe de Harpon (2900m), but also of our promised supplies. It seemed that, due to the time that had elapsed between the air drop and its recovery, some of the parachutes with their precious burdens drifted a considerable distance into a crevassed area. It therefore took much longer than expected to find them, and to establish a base camp, by which time the Schweizerland Naval advance party had arrived and, to Imperial College's dismay, retreated again. In fact the Imperial College team sledged stores to the depot on August 2nd (only 2 days after "A" team had left) and, finding the area so heavily crevassed, left them as near to the promised position as possible, approximately  $\frac{1}{2}$  mile away.

34. Thus the time had now come for yet another regrouping of the party, with at last a real chance of getting into Schweizerland. Some difficult personnel decisions had to be made by Stocken, some of which would unfortunately cause disappointment; nevertheless the members selected for each task were, it is considered, those best suited for them. At least one problem was made easier by Agnew's unselfish act of volunteering to undertake the unenviable job of leading the coastal party.

The Expedition members were now grouped as follows:

- (d) **Schweizerland Party**—consisting of Stocken, Wallis, Dilly, Keelan, Kirkpatrick and Rowe, to leave on 10th August and returning to Conniats Bjoerg Base on 26th/27th August.
- (e) **Coastal Party**—made up of Agnew, Dearman and Collins to proceed to the coast to convey news of Garden's death, to confirm arrangements for a boat at Kungmuit to pick up the Expedition, and then to remain climbing in the Tasissarsik fjord region until the return of remainder of expedition on about 3rd September.
- (f) **Conniats Bjoerg Base Party**—comprising Twigg and Corner to undertake climbs in the vicinity of Base.

**Coast Party ("E" team) Journey, August 12th—September 3rd by Lt. C. H. Agnew**

35. Leaving Twigg and Corner at Conniats Bjoerg on August 12th, we made the 16th September glacier in 10 hours via the "Col d' Eskimo", a reasonable day without any major set-backs. Next day after skiing through cold mist, we eventually made the slog up and across to "Winlattar" and then pushed on to the top of the "Col des Pouliés", to make our first camp on rock for over three weeks. After a tiring descent from the Col we pushed on to the "luxury" dump—the "dash for the Sardines". Fortified with this morale booster we easily made Tasissarsik fjordside the next day, four days from Conniats Bjoerg.

36. It rained hard that night and continued to do so next day, as Collins and I made the 10 hour traverse of melt-water streams and the fjordside to Kungmuit to send telegrams to Mike Thomas in England. Herr Meyer, the assistant school master put us up for the night, and next day, having stocked up with food and having received an acknowledgement from Mike Thomas, we hired a Greenlander boat for the return trip to our campsite in Tasissarsik.

37. Then followed days of ptarmigan shooting, salmon culling and sitting in endless rain; food was packed up the Tasissarsik "A" icefall, reconnaissances made of the coastal mountains, and the returning Swiss Expedition entertained. Finally we made the journey back to "Montenvers" on the 30th August to await the arrival of the rest of the expedition from Conniats Bjoerg.

**Schweizerland Party ("D" team), August 10th—26th**

38. The wonderful spell of fine weather finally broke on the 10th August, which was cool and overcast, but as the day was set aside for preparing to depart north that evening this did not matter unduly. At 1600 with high hopes and expectations the party set off cheerfully down the Conniats Bjoerg icefall on the first stage of their long journey. The skis were left on the edge of the moraine after three hours, and further progress made on foot. The descent of, and passage across, the two glaciers leading to the Glacier de France turned out to be just as irritating and long as had been



anticipated, but the old moraine camp site on the corner of the Glacier de France was finally reached at 0400 and weary heads laid to rest. To make matters worse the weather was so overcast, even with patches of fog, that there was barely enough light to locate the route through the crevasses. During the day the howling of dogs was heard and through the binoculars the Swiss Party was spied camped on the moraine of the Pourquoi Pas Glacier some three miles away. For our return journey, or possible emergency, some fuel and food was left in a small cairn on the moraine.

39. The venture was continued at 2200 and such good speed made up the Glacier de France that the Femstjernen central moraine was reached at 0300. By this time the weather had cleared completely, and there was a superb dawn during which the ring of summits slowly passed through delicate lines of pink to gold. At the same time it suddenly grew extremely cold; feet froze, breath steamed and frosted beards positively sparkled in the sun's first feeble rays. After a brief and vain attempt to sight the food depot with the binoculars it was decided first to traverse the icefall by the same line used by the earlier advance party, "A" team. A very good route was found through the inevitably involved crevasse system, and by 0730 "D" team was in a position to start searching for the food depot.

40. Stocken and Keelan now reconnoitred the icefall, and just when hope was dwindling, Keelan's sharp eyes sighted the flagged depot in almost the exact position that Imperial College had described. However, reaching this position was quite another matter since it involved going at right angles to the crevasses, or rather chasms, some of which were of a quite staggering size, certainly fifty yards long by thirty yards across and over a hundred feet deep. However, by 1130 the whole party had reached the depot, and a memorable moment it was. The return passage to clear ground with very heavy loads was an extremely hazardous one. Many of the snow bridges between the crevasses were not only narrow but unstable and icy, and a single false step would have had serious consequences. On arrival back at our packs and rucksacks, all the team was exhausted, but a two hour rest in the hot sun did much to help restore energies.

41. The burning question was now 'Whither next', but this was fortunately settled by the discovery of a most promising looking camp site on the edge of the Jura glacier some three miles away. All ideas of a weary crossing of the much crevassed Jura glacier to climb on the north, Guldnaalene, side were immediately put out of mind on reaching this camp site position at 1600. For here situated at 1340m on a rocky col on the southern edge of one of the main tributary glaciers draining north Schweizerland was a site that was quite ideal for a base camp. Besides being easily accessible from both sides there was firm ground for tents, a small half frozen lake and, so important, sun from early morning almost to sunset. The tents were put up, and after a further brief rest the party returned to the dump to collect the rest of the food. After such a long day this necessary task was almost the last straw, but 23 hours of continuous pack carrying was at last completed at 2100.

42. A gloriously fine, warm day, August 13th, was given up to rest, binocular inspections and gastronomic pleasures, and what delight too! Steak and Kidney puddings, sweet biscuits, dried vegetables, special drinks, and not only luxuries in variety but also in abundance. Despite such temptation and a modicum of official approval for licence, only one member of the party suffered any ill effects, and these were disguised under a long latin medical term, for which most of us had another name! Lest these remarks should in any way be construed as dissatisfaction with the expedition's excellent rations let it be said that there was a world of difference between the two. In our case everything had to be sacrificed to weight, and as long as the calories were there nothing else mattered whereas in the case of an airdrop there was really no difficulty in ensuring that a good selection direct from the shelves of Fortnum and Mason and Harrods could descend gently down to the waiting mouths on the Paris glacier!

43. The next day dawning fair, Stocken and Kirkpatrick left to assault 'Prospect' and see what views of the interior they could spy, and Wallis and Rowe left for the imposing cirque of peaks behind the camp, points 2150m, 2130m "the Old Man and the Old Lady". Eventually an ascent of what was apparently the north face of 2150m led to 2130m being climbed! The ascent gave exciting views of the interior of Schweizerland, big snow peaks, rock aiguilles and the highest peaks not far away. Also a possible high interior camp-platz was sighted.

44. The next two days were overcast and miserable and were utilized in getting six days food and fuel and all the gear to the high camp. This at 1810m, over 6,000 feet above sea level and 10 miles into Schweizerland was our ultima thule; a rocky spur facing into the sun from 0300 till 1600; a fine site immediately below "Fishwick Peak" the best rock aiguille in the area.



45. The weather returned to its best and the Stocken/Kirkpatrick peak bagging team got away with three 1st ascents in the day; and the Dilly/Keelan 'hard man' pair took a direct line up "Fishwick Peak"—i.e. the nearest from camp, a superb climb up a striking peak. All six members gathered on the top of point 2520m on August 18th, the highest peak in Schweizerland, after a fabulous 5½ hour ridge traverse. This success was celebrated with Imperial College's whisky—with which they had very thoughtfully provided us. The weather remained perfect for four further days, summits falling in all directions, and eventually the last food was eeked out to provide for an expedition to climb Schweizerland's 2nd highest peak, point 2500m, for which Stocken thoughtfully had cut steps up and over the "col de Finger" on the previous day. The 8 mile approach march was begun at 0400 on August 21st, the mountain provided a fine climb up and across its south face, ending with a memorable traverse over its snow summit. The day ended back at camp 15 hours after the start, right on schedule. This fine peak, the most northerly summit reached by the expedition gave in fact our last successful climb. On 22nd August all six members of "D" team returned down "Garden's glacier", Wallis and Rowe stopping to camp half-way down so as to be in a position to tackle again point 2150m, and the rest carrying on down to Base camp to tackle point 2220m the next day. During the evening of the 22nd August the barometer began to drop and little grey and black zeppelin shaped clouds crossed the sky. The barometer continued to drop over the next three days, during which time we watched our various camps rise hundreds of metres, and eventually the Deputy Leader placed an embargo on the broadcasting of barometer readings!

46. The next day, the 23rd August, was overcast, and with poor visibility and snow showers in 30 knot winds, Wallis and Rowe abandoned their climb on Point 2150m at 1900m, and packed their camp and returned to the main Schweizerland base camp. Stocken and Kirkpatrick were out with Dilly and Keelan on Point 2220, also in the same very unpleasant conditions. As a team they also decided that discretion was the better part of valour and decided to abandon the mountain and climb down. Unfortunately during the descent a rock fall crushed Chris Stocken's crash helmet, and he suffered serious head injuries and lost consciousness. The other three, in now appalling conditions, lowered him 700 feet down to the glacier where 4 hours later he died.

47. Chris Stocken had been an inspiring leader of the Expedition; without his enthusiasm, drive, sense of humour and sense of purpose we would not have reached Schweizerland nor would we have made the best use of our opportunities there and on the way.

48. Next day after a simple ceremony Stocken was buried in a crevasse, and a large cairn surmounted by his ice-axe, labelled "C.S. 23rd August, 1966", was built at the lower camp site.

49. Equipment was sorted out and a cache left of some food, fuel and climbing gear; and early on August 25th the return was begun to the Conniats Bjoerg main base. The weather was very ominous, but in spite of, or because of, this fast progress was made across the wastes of the Femstjernen and down the Glacier de France, with the little ones steadily jog-trotting along in Keelan's great strides! We had left a depot of 12 man days food on the moraine of the side glacier leading down to the Midgaard gletscher, but on arrival we found that all but one pack had been destroyed and eaten by ?dogs-Swiss, ?foxes, ?polar-bear; gloom accompanied this finding, so we pressed on through the crevasse maze at the head of the side glacier. At 1700 in torrential rain, we stopped for the day after 11 hours pack carrying. Next day was more unpleasant with rain and thick wet snow, and so in soaking clothing we trudged round and round crevasses, up and down and over the "Col" below Devauxbjoerg to our skis. Ski-ing made a change, and through the evening, as first we entered the cloud level and then ski'd up the Conniats Bjoerg ice-fall, in heavily falling snow, we followed the Japanese, Imperial College and Swiss litter trail to the Clapham Junction of the north—Conniats Bjoerg.

50. Here we rejoined Twigg and Corner who, since we left, had succeeded in climbing the "Little Thumb" in the Solverbjoerg cwm and also had taken a five day sledge trip down the Haabets glacier and climbed 2 new peaks there. They reported bad weather at Conniats Bjoerg since the 22nd August, and snow falling almost continuously with but one three hour break. Snow continued to fall throughout the 26th and the 27th August.

51. The 28th dawned fine, and we set about drying ourselves out, locating and digging out our gear from 2-3 feet of snow, re-packing it, and then loading the sledge. This was all done by 1400 and as the new snow began to pack down well we hoped for a fine, hard freezing night and good travelling on the 29th. However, all night and all the 29th it continued to snow; all together another one foot fell. Imperial



College sharing the same camp site decided to move off on the 45 mile journey to the coast. But with food to spare, 3 men to help at the top of fjord and 7 days to our rendezvous with the boat in Tasissarsik fjord we decided we could sit out another 24 hours in the hope of an improvement in conditions which would let us travel really fast back to the coast.

52. On the morrow our hopes were partially fulfilled, for the sun began to break through and we could see our way forward to the "Col 'd Eskimo", a route which would save 15 miles on our inward journey. So on the 30th we decided to begin the return to Tasissarsik. We followed the tracks left by the Japanese, Swiss and Imperial College parties for we were the last on the homeward trail. The tracks, and marker flags kindly left by the other expeditions, were very encouraging along an unknown route in rapidly changing and worsening weather conditions—new snow, wind, cold dark mist and often poor visibility. The "Col d' Eskimo" descent was found to be straight-forward. After 600 feet of hand-lowering the loaded sledge, the tow rope was released and the loaded sledge ran free down the lower slopes and out across the flat—an exciting few moments. A long evening drag brought us to the crevassed complex at the corner of the 16th September glacier where after 12 hours sledging and 13 miles gained we pitched camp in low mist and sleet. Next day in 50 yards visibility and thick snowballing snow we plodded along on a slow unpleasant journey to the col north of the "Col des Poulies". Eventually the sun broke through and we could see where we were after 8 hours of travelling. An immediate boost in morale was apparent in an increased tempo of movement and we made the base of the col that night. Again it snowed through the night and the ascent of the col proved to be very exhausting with arm pulling, double tracking, and back-packing operations producing eventually a gain of  $\frac{1}{2}$  mile in 5 hours. 1 hour later we reached "Winlatta", half-way to the "Col des Poulies". The sun broke through, and soon wet clothing, wet sleeping bags, and wet tents covered the rocks. After unpacking and carrying the unladen sledge we reached the last stage to the top of the "Col des Poulies". The "Winlatta" camp site was superb and we were loathe to leave it, so we decided to camp there, but to ski on with light loads and leave them at the top of the "Col des Poulies" and then return to "Winlatta" for the night. A beautiful afternoon's ski-ing across wind frozen new snow and with wonderful views, was our delight.

53. Next morning we took advantage of a hard night's frost and left camp before 0600 to arrive at the top of the "Col des Poulies" at 0900, in the most perfect day for the last two weeks. With the sweeping and immaculate form of Rytterknaegten in front of us, the sledge was lowered, with members of the team standing in broken crevasses holding the sledge as it passed over them! Three figures appeared below—the coast party: a great moment, reunion, and help and news, the statement—"England's won the World Cup" was met with incredulity! Thus in brilliant sunshine the sledge with 1,000 lbs. of gear and equipment was safely brought down the steep slopes of the "Col des Poulies" to that hallowed rubbish heap of passing expeditions—"Montenvers"! Again an opportunity was taken to dry out and camp on rock, and again light loads were back-packed forward for  $1\frac{1}{2}$  hours to speed the following day. After a brilliant sunset, the aurora of the night and another crisp dawn, came a beautiful day. This proved to be our best ever day of movement, travelling from "Montenvers" to the head of the Tasissarsik "A" icefall. 14 miles crossed in 7 hours; 2 miles per hour achieved for a whole day; and then everyone carried down 60 lbs. odd to the bottom of the glacier: a fine day, and the whole Expedition back on Mike Thomas's mythical U.K. schedule! The contingency food we had sledged so far could now be consumed and so double rations rounded off everyone's empty stomach's and full hearts.

54. Next day, again in perfect weather, we leap-frogged Imperial College and established our fjordside camp again 51 days after leaving. Jumper Collins provided everyone with grilled salmon fillets, culled by Agnew from the Tasissarsik streams.

55. Following a day of sorting and packing, the sounds of the approaching armada of Kungmuit Greenlanders broke through our slumbers on the dawn of September 6th. It was the top of the tide and there was no time to lose. A frantic rush ensued until Imperial College and R.N.E.G.E. embarked on four small open boats for the passage down Tasissarsik fjord to Kungmiut. Here we had coffee with the Swiss and took the opportunity to thank Herren Leannerts, Meyer and Plesner, and then away again down the open waters of Angmagssalik fjord to the airstrip and base buildings of Kulusuk. Here we were greeted by the gifts of civilization—running hot water, showers, and tables and chairs in centrally heated bunk-houses.



56. Noel Dilly cracked the local medicine-man supply crisis by serving two 20 hour stints operating in Angmagssalik hospital. Thanks to Benny Svensen and Herr Carlsen, extensive use was made of civilian and military radio telephone networks to contact Iceland, U.K. and Angmagssalik, to inform those concerned of our return plans and to complete the formal documentation with regard to Garden and Stocken.

57. After three quiet days we gathered on the evening of the 9th September for a Fokker Friendship, chartered from Icelandair to arrive. Dead on time it did so; and even more important, complete with Air Hostess! A few last goodbyes to our friends at Kulusuk, directions from Herr Carlsen and then swiftly up and away, with clear views below of Rytterknaegten, Laupersbjerg and Mont Forel, the great curve of the Haabets gletscher, and range after range of peaks, of trodden and untrodden glaciers, and far away lines of more distant peaks and distant snows. Then we passed on high over the dark waters of the silent fjords and the light grey haze of the pack-ice and then up above the clouds—goodbye to all that.

58. The U.S. Navy met us at Reykjavik, and as the Imperial College and Swiss parties left to camp in the "Hangar Hotel" we were moved by swift American efficiency and hospitality to Kelflavik Navy Base, back to "eggs any style" and to canned beer, and we settled back into normality, to money, to a choice of meals, to 4 wheels and the petrol engine and to writing reports!

59. Monday evening—12th September brought the instigator of our summer—Mike Thomas in an R.A.F. Hastings which next day brought all of us home to R.A.F. Colerne; to green grass and trees; wheatfields and flowers; to newspapermen and T.V. interviewers; and to the realization of other values, other judgements, different points of view. Home to inevitable questions, to be sucked out of our closed little environment into the world of choice; to selection of comment; to memory, of why do you do it? and was it worth it? We all dispersed: the Expedition was over.



# DIARY OF SUMMER EXPEDITION

|        |    |               |                                                                                                                                                                          |
|--------|----|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| July   | 11 |               | Party assembled at R.A.F. Lyneham.                                                                                                                                       |
| "      | 12 |               | R.A.F. Transport Command Britannia flew party to U.S.N. Base at Keflavik, Iceland.                                                                                       |
| "      | 13 |               | Icelandair D.C.3 flew party from Reykjavik to Kulusuk, East Greenland.                                                                                                   |
| "      | 14 |               | Kulusuk.                                                                                                                                                                 |
| "      | 15 |               | M.V. Aarvak sailed party up Angmagssalik Fjord to Kungmiut, and then to head of Tasissarsik Fjord. First loads carried to the top of Tasissarsik "A" icefall to "Sodom". |
| "      | 16 |               | The party with the rest of the equipment ascend the icefall and establish camp at "Sodom".                                                                               |
| "      | 17 |               | Camped at the northern end of "Strathspey".                                                                                                                              |
| "      | 18 |               | Crossed the "Sahara", and the upper reaches of the Karales glacier to below the "Bealach Kelpie".                                                                        |
| "      | 19 |               | Crossed the "Bealach Kelpie", and then traversed the upper part of the "Ober Sermiligaq glacier", and crossed the col beyond "Winlatta" to the 16th September glacier.   |
| "      | 20 |               | To the Intermediate depot at the corner of Knud Rasmussens glacier.                                                                                                      |
| "      | 21 |               | Sledged up the Lower Haabets glacier.                                                                                                                                    |
| "      | 22 |               | Sledged up the Upper Haabets glacier.                                                                                                                                    |
| "      | 23 |               | Sledged to the Main depot below Conniats Bjoerg.                                                                                                                         |
| "      | 24 |               | 2nd ascent of Conniats Bjoerg IV.                                                                                                                                        |
| "      | 25 |               | 1st ascent of "the Wedge".                                                                                                                                               |
| "      | 26 |               | Sledged down the Conniats Bjoerg icefall to the col below Devaux Bjoerg.                                                                                                 |
| "      | 27 | A/B           | Parties made two attempts to sledge down the glacier below Devaux Bjoerg.<br>Party C returned to the Conniats Bjoerg base camp.                                          |
| "      | 28 | A/B<br>B<br>C | Pack-carrying to the corner of the Glacier de France.<br>Return to below Devaux Bjoerg.<br>3rd ascent of Solverbjoerg.                                                   |
| "      | 29 | A<br>B<br>C   | To Femstjernen.<br>Attempted peak north of Devaux Bjoerg glacier.<br>1st ascent of the "Big Thumb".                                                                      |
| "      | 30 | A<br>B        | Stocken/Keelan searching up Paris glacier; Twigg/Corner make the 1st ascent of point 1800m.<br>2nd attempt on the peak of July 29th.                                     |
| "      | 31 | A<br>B<br>C   | Stocken/Keelan continue search up Paris glacier. and then begin the return to B team.<br>Walk to Midgaard glacier.<br>1st ascent Badeuils Bjoerg.                        |
| August | 1  | A<br>B<br>C   | Rejoined B team.<br>1st ascent of N. Devaux Bjoerg.<br>1st ascent Conniats Bjoerg I.                                                                                     |
| "      | 2  | A<br>B<br>C   | Camped on col below Devaux Bjoerg.<br>Sledged back to col below Devaux Bjoerg.<br>Attempted peak west of Rodbjoerg.                                                      |
| "      | 3  | A/B           | 1st ascent of point 1750m by Stocken/Keelan, and Devaux Bjoerg south (point 1400m) by Kirkpatrick/Agnew.                                                                 |
| "      | 4  | A/B<br>C      | 1st ascent of central Devaux Bjoerg; sledge taken to base of col.<br>Attempted peak point 1850m south of Conniats Bjoerg. P. J. Garden died.                             |
| "      | 5  | A/B           | Sledged back to Conniats Bjoerg base camp.                                                                                                                               |
| "      | 6  |               | Burial service for P. J. Garden.                                                                                                                                         |
| "      | 7  |               | 1st ascents "Stac Polly" and "Film Bjerg" on Film Day                                                                                                                    |



|           |    |       |                                                                                          |
|-----------|----|-------|------------------------------------------------------------------------------------------|
| „         | 8  |       | 1st ascents Conniats Bjoerg No. III (main peak) and Henri Leons Bjoerg west.             |
| „         | 9  |       | 2nd ascent of point 2000m.                                                               |
| „         | 10 | D     | Left for Schweizerland.                                                                  |
| „         | 11 | D     | Reached corner of Glacier de France, camped and left for Femstjernen.                    |
| „         | 12 | D     | Reached Femstjernen, found food depot and then established main Schweizerland base camp. |
|           |    | E     | Left Conniats Bjoerg and reached 16 September glacier                                    |
|           |    | F     | Left Conniats Bjoerg and sledged down Haabets glacier.                                   |
| „         | 13 | D     | Binocular reconnaissance of east Schweizerland.                                          |
|           |    | E     | To top of "Col des Poulies".                                                             |
|           |    | F     | 1st ascents of points 1600m and 1300m, above lower Haabets glacier.                      |
| „         | 14 | D     | 1st ascents of the "Old Lady" and "Prospect".                                            |
|           |    | E     | To corner of "Strathspey".                                                               |
|           |    | F     | Reconnoitred point 1860m.                                                                |
| „         | 15 | D     | Began to establish upper Schweizerland camp.                                             |
|           |    | E     | Reached Tasissarssik fjordside.                                                          |
| „         | 16 | D     | Established upper Schweizerland camp.                                                    |
|           |    | E     | Reached Kungmuit.                                                                        |
|           |    | F     | Sledged back to Conniats Bjoerg main base.                                               |
| „         | 17 | D     | 1st ascents of points 2330m, 2300m, 2280m, 2300m ("Fishwick Bjoerg"), 2250m.             |
|           |    | E     | Returned to Tasissarssik fjord.                                                          |
| „         | 18 | D     | 1st ascent of point 2520m.                                                               |
| „         | 19 | D     | 1st ascents of point 2300m ("The Maiden"), and points 2200m and 2160m.                   |
|           |    | F     | Attempted 2nd ascent of Conniats Bjoerg No. III.                                         |
| „         | 20 | D     | 1st ascents of points 2350m, 2050m, 2080m.                                               |
| „         | 21 | D     | 1st ascent of point 2500m.                                                               |
|           |    | F     | 2nd attempt on the "Little Thumb".                                                       |
| „         | 22 | D     | Returned to Schweizerland Base Camp.                                                     |
|           |    | E     | Food/Fuel depot established above Tasissarssik "A" icefall.                              |
|           |    | F     | 1st ascent of the "Little Thumb".                                                        |
| „         | 23 | D     | Attempts on points 2200m and 2150m.                                                      |
|           |    |       | C. M. Stocken died.                                                                      |
| „         | 24 | D     | Burial service for C. M. Stocken.                                                        |
| „         | 25 | D     | Left Schweizerland, and returned to beyond the Glacier de France.                        |
| „         | 26 | D     | Reached Conniats Bjoerg main base, rejoined F team.                                      |
| „         | 27 | D/F   | Conniats Bjoerg main base.                                                               |
| „         | 28 | E     | Camped at top of Tasissarssik "A" icefall.                                               |
| „         | 29 | D/F   | Conniats Bjoerg main base.                                                               |
| „         | 30 | D/F   | Left Conniats Bjoerg main base and sledged to 16th September glacier.                    |
|           |    | E     | Camped at "Montenvers" and ascended "Col des Poulies".                                   |
| „         | 31 | D/F   | Reached base of col north-east of "Winlatta".                                            |
| September | 1  | D/F   | Camped at "Winlatta", loads to top of "Col des Poulies".                                 |
| „         | 2  | D/F/E | Rejoined on the "Col des Poulies", all camped at "Montenvers".                           |
| „         | 3  |       | Camped at the top of the Tasissarssik "A" icefall.                                       |
| „         | 4  |       | Camped on Tasissarssik fjordside.                                                        |
| „         | 5  |       | Tasissarssik fjordside.                                                                  |
| „         | 6  |       | Greenlander boats took the Expedition to Kungmuit, and then to Kulusuk.                  |
| „         | 7  |       | Kulusuk.                                                                                 |



|   |    |                                                                                                            |
|---|----|------------------------------------------------------------------------------------------------------------|
| „ | 8  | Kulusuk.                                                                                                   |
| „ | 9  | By Icelandair Fokker Friendship to Reykjavik, Iceland,<br>and then U.S.N. bus to Keflavik U.S. Naval Base. |
| „ | 10 | Keflavik.                                                                                                  |
| „ | 11 | Keflavik, M. B. Thomas arrived by R.A.F. Transport<br>Command.                                             |
| „ | 12 | R.A.F. Transport Command Hastings to R.A.F. Colerne.                                                       |

Travel U.K. to Conniats Bjoerg main base—12 days.

Travel from Conniats Bjoerg main base back to the U.K.—14 days.

At Conniats Bjoerg main base and inland from there—37 days—of which 13 days  
were spent in Schweizerland.



## SECTION 4

### CONCLUSIONS

by

Lieutenant Commander M. B. Thomas, Royal Navy

and

Dr. R. H. Wallis

### SECTION 4 — CONCLUSIONS

1. The failure to place the main depot north of Conniats Bjoerg and the hard going beyond it would have placed Stocken in a hard dilemma had it not been for the I.C.E.G.E. air-drop and the food/fuel exchange. This could have been realised before the main party left the U.K. had more been known about the Japanese expedition of 1965. As the first party to travel north of Conniats Bjoerg since Roch in 1938 their experience represented the only valid information on that area and should not have been ignored.

2. Without I.C.E.G.E. assistance, Stocken would have had either to abandon the main aim (which as the substitute leader of another man's plan he was reluctant to do) or to have partially achieved it at the expense of an inordinate amount of back-packing which could have involved some members of the Expedition full-time.

3. Even with I.C.E.G.E. assistance, it is a tribute to Stocken's leadership that so much was achieved after the tragedy of Garden's death.

4. The policy of using hired dog-sledges as opposed to an air-drop was in part vindicated by the accident to the I.C.E.G.E. advance party which could have cost them all their stores. Nevertheless, the unknowns attendant upon Spring sledging are numerous, not least among them the reaction of Greenlanders to crevassed glaciers; and it is very expensive. The cost of getting about 1650 Kgms. of stores to Conniats Bjoerg was about £30/day for the eleven day journey and although this may not be a great total it could have been a great deal more had there been much bad weather; and it is a costly way of lying in a tent doing nothing. More to the point is the additional cost of transport to and from Greenland which is shown in Appendix XI. On balance, sledging is still preferred to air-dropping because it is most unlikely that it could result in the loss of any significant quantity of stores. However, it is essential that the aims of the expedition are sufficiently flexible to allow for partial failure. The Swiss decision to drive their own dogs was based on their 1963 experiences and came as a surprise after reading the 1963 Scottish report. It proved highly successful and is clearly a better solution than either of the above alternatives.

5. Despite the inevitable lack of complete confidence in one another at the outset, the team settled down well, as evidenced by their achievements, and there were no more or deeper schisms than might be expected in any expedition of this type. Notwithstanding the way in which they carried out their aims there were undoubted weaknesses, for the most part inevitable but worth the cognizance of future expeditions, viz.

- (a) Lack of cross-country ski-ing experience.
- (b) The besetting sins of British climbers, i.e. slow movement, particularly on loose ground, and poor powers of reconnaissance of unknown routes.
- (c) Shortage of really strong rock-climbers, e.g. there were only two members capable of leading at Very Severe standard with certainty.
- (d) Too great a disparity in skill and experience.

6. The timing of the Expedition was based primarily on the experiences of the 1963 Scottish party who found sufficient fjord-ice in mid-July to discourage planning for an earlier start. In 1966 R.N.E.G.E. could with advantage have arrived in Greenland two weeks earlier. The onset of the first winter snowfall appears to be more predictable and it is probably wise to plan to reach the coast not later than 25th August. It may be possible to hire helicopters from Angmagssalik in the foreseeable future. This would be the obvious method for any party wishing to exploit the remaining unexplored area, viz. southern Schweizerland and the Kristians Glacier region. For more modest ambitions, the coastal mountains east of Kungmiut and particularly east and south-east of the Knud Rasmussen Glacier would be very rewarding.





*Spring Journey—Back on the Fjord ice*



*Summer party approaching Conniats Bjoerg*

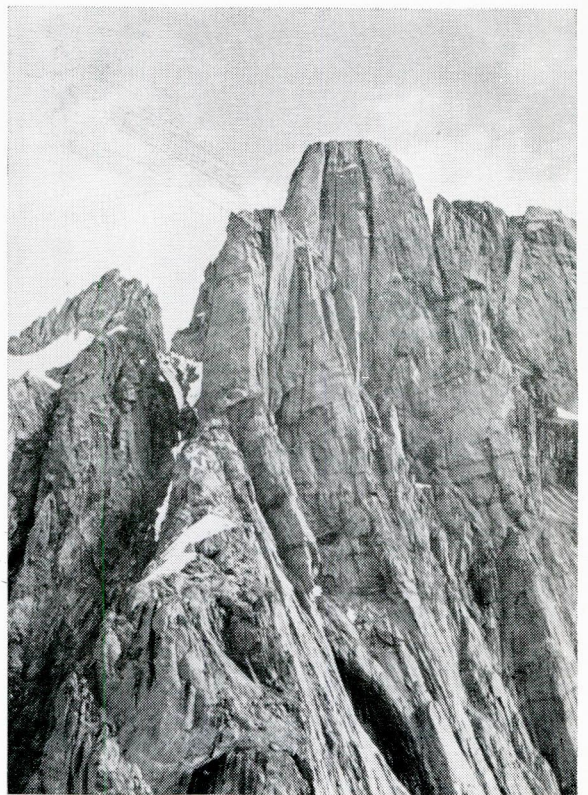




*The Solverbjoerg cwm from Conniats No. 1. Left to right: "Little Thumb", "The Wedge", "Big Thumb" and Solverbjoerg.*



*Typical back packing*



*South face of Conniats No. 2 from point 1850 m.*



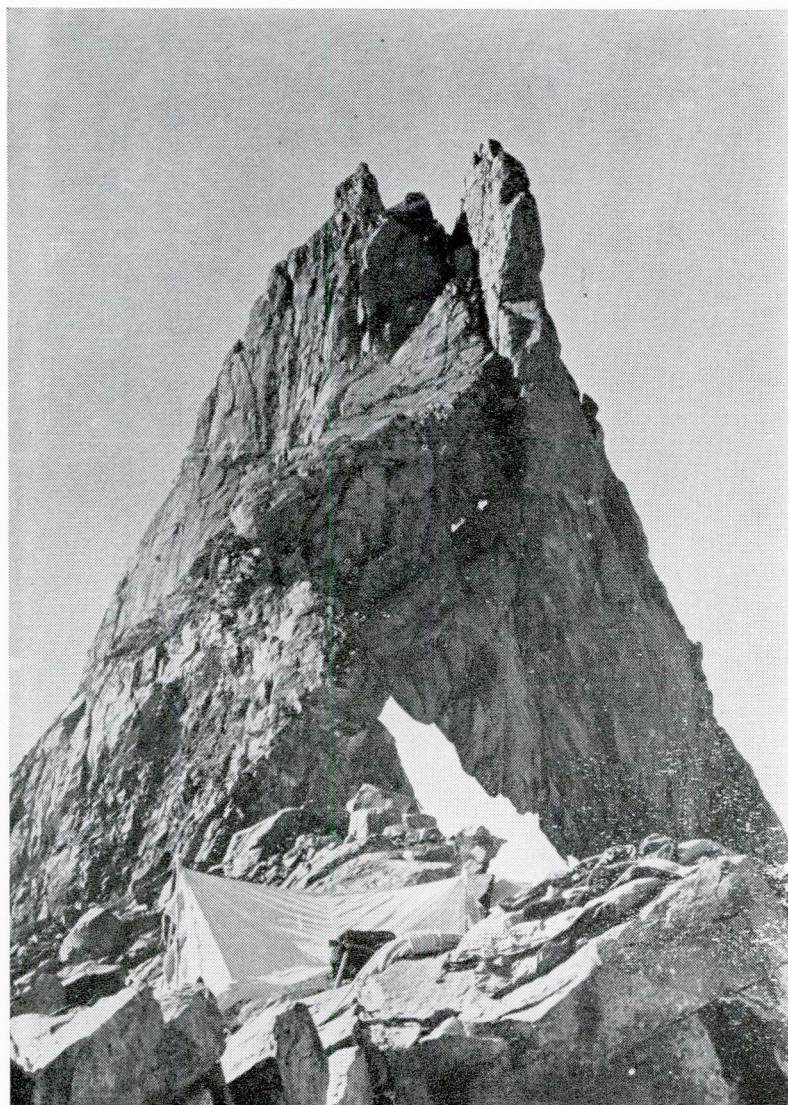


*Schweizerland from the Lower Camp. Far left: "Fishwickbjoerg" and right: Point 2520 m.*



*View South East from Point 2500 m. across Eastern Schweizerland.*





*"Fishwickbjoerg" from the upper Schweizerland Camp.*



*Point 2500 m. West Summit from East Summit.*



## APPENDIX I

### ACCOUNT OF THE DEATH

of

CHIEF PETTY OFFICER P. J. GARDEN

## APPENDIX I

### Account of the death of Chief Petty Officer P. J. Garden

1. At 0900 on 4th August the Conniats Bjoerg party of Wallis, Dearman, Garden and Rowe left camp to attempt the ascent of an unnamed peak one mile south-east of Conniats Bjoerg. This is about 1,850 metres in height and marked † on the map (see Appendix XII, Fig. 3). Climbing on skis they reached the col between this peak and Conniats Bjoerg at 1000. Leaving their skis at the col, they climbed on crampons up the snow-ridge to the base of the final rock face. At 1030 they started rock-climbing, roped in two pairs Dearman/Rowe and Wallis/Garden. At about 1200 Dearman fell whilst leading. He was 40 feet above the other three and 20 feet above a running belay. His fall was observed as it occurred and he was held on the rope without difficulty.

2. Dearman had not apparently sustained any serious injury but it was decided to descend. The party started down at 1300 and reached the col without further incident at 1600. Whilst Wallis and Rowe sorted out equipment, Dearman started to walk straight down the glacier on foot using ski-sticks to support himself and escorted by Garden who was carrying his skis over his shoulder. At about 1630 they approached a small depression with open crevasses some fifty yards away to right and left. Garden told Dearman to wait while he tested the snow. He had almost reached the centre of the depression when first one and then the other foot sank and he slowly disappeared. Dearman at once called for help to Wallis and Rowe who were respectively 150 and 400 yards behind.

3. Wallis then roped up and, belayed by the other two, approached the hole which he noted was only 2 feet in diameter. With some difficulty he was able to discern Garden's body lying face downwards at the bottom of the crevasse about 80 feet below. There was no response to his calls. He then found a safe place to cross the crevasse and sent Rowe back to camp on skis for assistance, clothing and first-aid equipment. During the hour that this took, Wallis and Dearman found a suitable place from which to descend into the crevasse about 100-150 feet from Garden.

4. On Rowe's return with Taylor (I.C.E.G.E. and the only other climber at Conniats Bjoerg except for the injured Pert), Wallis abseiled into the crevasse, unroped and made his way along the bottom to Garden's body. This was cold, there was no response to stimuli and in addition to other injuries the skull was smashed with escape of brain matter. Wallis presumed Garden dead, removed his rucksack which was hoisted to the surface and was then himself hauled out with considerable difficulty.

5. A form of Death Certificate was made out by Dr. Dilly on Wallis's evidence and from his own observation from the surface two days later. A short memorial service was held and a cairn built on rock at the right-hand (north) side of the entrance to the cwm. It was decided that it would be dangerous to attempt to recover the body. It was also noted that the bridge through which Garden had fallen thinned suddenly and dramatically at the centre from several feet in thickness to a few inches and for a horizontal distance of about two feet.



**APPENDIX II**  
**ACCOUNT OF THE DEATH**  
of

**LIEUTENANT COMMANDER C. M. STOCKEN, D.S.C. ROYAL NAVY**

**APPENDIX II**

**Account of the death of Lieutenant-Commander C. M. Stocken**

1. At 0700 on August 24th four members of the Schweizerland party, Stocken, Dilly, Keelan and Kirkpatrick, left camp to attempt the ascent of Point 2220 on the western edge of Femstjernen. This was to be the last climb before setting off for the coast. The route had been reconnoitred the day before by Keelan and Dilly, and lay up an oblique crack in the western flank of the north ridge.

2. The party crossed the bergschrund roped in pairs, Keelan /Dilly and Stocken / Kirkpatrick, as light snow began to fall. The route proved technically fairly straightforward but was more a gully than a crack and held much loose rock. By about 1130 when the leading pair had climbed about 800-900 feet the weather had seriously deteriorated with increasing wind and snowfall. Keelan and Dilly decided to turn back and informed Kirkpatrick who was leading the second rope and about 100-150 feet below them. Stocken, who was lower and out of sight of the leading pair, agreed with this decision and told Kirkpatrick to start down.

3. Because of the loose rock and knowing that there were no serious difficulties, Keelan and Dilly un-roped before starting to descend, by which time Kirkpatrick has passed Stocken and was descending below him. Shortly after Dilly and Keelan started to descend a rock on which Dilly was standing collapsed starting an avalanche of boulders about a foot square. Almost at once there was a second fall from the same place and immediately afterwards Kirkpatrick called that Stocken had been hurt.

4. Stocken was found to be unconscious and bleeding profusely from the back of his head. His rock-helmet had been heavily dented and split. While Keelan descended to select anchor points, Dilly and Kirkpatrick secured Stocken to a rope-stretcher. They then lowered this, pitch by pitch, with Keelan escorting and protecting Stocken. They reached the glacier about 1515 and started to carry Stocken back to camp but when pausing for a rest at 1545 it was found that Stocken had died.

5. Leaving Stocken's body beside a crevasse, they returned to camp where they met Wallis and Rowe who had earlier abandoned their climb. The following day Stocken was buried in the crevasse, a memorial service held and a large cairn built in a conspicuous position as approached from Femstjernen.



## APPENDIX III

### CLIMBING REPORT

by

Dr. R. H. Wallis

## APPENDIX III

### Climbing Report

by

Dr. R. H. Wallis

1. All climbs are first ascents except where stated otherwise.
2. Names shown in inverted commas are those used by the Expedition and have no official standing. It is intended to submit Nos. 9 and 16 to the Danish authorities for formal recognition.

#### (A) Climbs in Schweizerland

##### (1) Point 1800 m

66° 37' N 36° 45' W  
30th July 1966  
Corner, Twigg.

The ascent followed the east face and, in the upper part, the east ridge which gave one pitch of severe. Ascent: 3½ hours. Total time: 6 hours.

##### (2) Point 2000 m ("Prospect")

66° 39' N 36° 52' W  
14th August 1966  
Kirkpatrick, Stocken.

Climbed via the east ridge, which gave 1000 feet of slab climbing above the initial overhanging start; the slabs led out onto the upper and easier ridge which was followed to the summit. Ascent: 4 hours. Total time: 13 hours.

##### (3) Point 2130 m ("The Old Lady")

66° 37' N 36° 53' W  
14th August 1966  
Rowe, Wallis.

The north face was climbed at its eastern end, a mixture of rock and snow ridges with 100' pitch of severe. At the top of the face the north and then east ridges were followed to the summit. Descent by the north face hanging glacier. Ascent: 7 hours. Total time: 11 hours.

##### (4) Point 2330 m

66° 34' N 37° 04' W  
17th August 1966  
Kirkpatrick, Stocken.

Climbed from the S.W. col, snow and ice slopes to the final rock ridge. Ascent: 4 hours.

##### (5) Point 2300 m

66° 33' N 37° 06' W  
17th August 1966  
Kirkpatrick, Stocken.

Descended Point 2330 m to its west col, and then followed the east snow ridge to summit. Ascent: 1½ hours.

##### (6) Point 2280 m

66° 33' N 37° 05' W  
17th August 1966  
Kirkpatrick, Stocken.

Point 2300 m descended towards the south, and then the north ridge of 2280 m was followed to the east ridge; very steep snow was climbed to the ridge which was followed to the summit. Ascent: 1½ hours. Total time: 9 hours.

##### (7) Point 2300 m ("Fishwick Bjoerg")

66° 36' N 37° 05' W  
17th August 1966  
Dilly, Keelan.

The imposing peak behind the upper Schweizerland camp. The very steep S.E. ridge was followed direct to the summit, giving one pitch of V.S. to turn the highest gendarme. Ascent: 4½ hours.



(8) Point 2250 m

66° 36' N 37° 07' W  
17th August 1966  
Rowe, Wallis.

A route was taken into the S. cwm, and the ice slope above traversed to the S.W. ridge. This gave delightful climbing to the summit. Descent via the S.W. ridge. Ascent: 2 hours. Total time: 4 hours.

(9) Point 2520 m ("Stockenbjoerg")

66° 36' N 37° 10' W  
18th August 1966  
Dilly, Keelan, Kirkpatrick, Rowe,  
Stocken, Wallis.

The S.E. ridge was gained from the north, and followed for over a mile over various small gendarmes and one major gendarme to the major ridge intersection at point 2480 m. The ridge was then followed for a further mile over a delightful mixture of rock gendarmes and snow ridges to the intersection with the N. ridge which was followed to the summit. Descent by the south ridge. Ascent: 5½ hours. Total time: 10 hours.

(10) Point 2300 m ("The Maiden")

66° 36' N 36° 58' W  
19th August 1966  
Rowe, Wallis.

The N.W. snow ridge was followed to a steep ice gully leading out onto the upper part of the ridge. This continued as a pleasant mixture of snow ridges and good rock. Descent was made down the south face. Ascent: 3½ hours. Total time: 8½ hours.

(11) and (12) Points 2200 m and 2160 m

66° 37' N 37° 02' W  
19th August 1966  
Dilly, Keelan.

Two minor snow peaks which gave a pleasant traverse. 6 hours.

(13) Point 2350 m

66° 35' N 37° 07' W  
20th August 1966  
Dilly, Keelan.

From the northern col, the N.E. face was climbed diagonally left (east) up steep hard snow with one pitch of water ice, a good snow climb. Ascent: 4 hours.

(14) Point 2050 m

66° 35' N 37° 02' W  
20th August 1966  
Kirkpatrick, Stocken.

Climbed by the northern snow ridge, with an interesting snow gendarme to the final rock ridge; descent on snow and ice on S.E. face to S.W. col. Ascent: 2 hours.

(15) Point 2080 m

66° 34' N 37° 03' W  
20th August 1966  
Kirkpatrick, Stocken.

Climbed the N.E. ridge, with interesting snow and ice leading up on to a very good gendarmed rock ridge to the summit. Ascent: 1½ hours. Total time: 6 hours.

(16) Point 2500 m ("Gardenbjoerg")

66° 40' N 37° 10' W  
21st August 1966  
Kirkpatrick, Rowe, Stocken, Wallis.

The eastern edge of the south face was gained from the upper southern snow cwm. A devious, but extremely enjoyable line was taken up and across the face and led to the lower (eastern) rock summit. A fine snow ridge led to the western (higher) summit. Descent via western end of the southern face. Ascent to west summit: 5½ hours. Total time: 14½ hours.



**(B) Climbs in the area of Conniats Bjoerg Main Base**

**(17) Point 1750 m (Conniats Bjoerg East or No. 4)**

66° 24' N 36° 27' W

24th July 1966 (2nd Ascent, first by Imperial College 1966)

Kirkpatrick, Stocken, Twigg, Wallis.

The base of the south face was gained on skis and then the central S.E. snow/ice couloir was followed to the col between Conniats Bjoerg South (or No. 5) and No. 4, and the west ridge was then taken to the summit; pleasant scrambling on good rock. Ascent: 3 hours. Total time: 7 hours.

**(18) Point 1750 m ("The Wedge")**

66° 22' N 36° 21' W

25th July 1966

Collins, Corner, Dearman, Garden, Kirkpatrick, Rowe, Stocken, Twigg, Wallis.

The head of second cwm east of Solverbjoerg was gained on skis. The steep snow ridge on the north face was taken to gain the summit ridge which was traversed and a descent made down the west ridge. Ascent: 3 hours. Total time: 7½ hours.

**(19) Solverbjoerg (2050 m)**

66° 22' N 36° 23' W

28th July 1966 (3rd Ascent, 1st Ascent Swiss 1938, 2nd Ascent Austrians 1959).

Dearman, Garden, Rowe, Taylor (I.C.), Wallis.

The head of the cwm east of Solverbjoerg was gained on skis and then the south ridge was followed to the summit, mixed snow and rock climbing. Ascent: 5 hours. Total time: 8 hours.

**(20) Point 1750 m ("The Big Thumb")**

66° 22' N 36° 22' W

29th July 1966

Dearman, Garden, Rowe, Taylor (I.C.), Wallis.

The west face was reached on skis. Dearman and Taylor followed the northernmost break on the face, a rock and snow gully (one pitch of severe) to the summit ridge which was followed to the north (main) summit. Garden, Rowe and Wallis ascended an ice gully to the southern summit, and then traversed the summit ridge to gain Dearman's and Taylor's line. Ascent: 7½ hours. Total time: 12 hours.

**(21) Badeuils Bjoerg (1800 m)**

66° 26' N 36° 19' W

31st July 1966

Dearman, Garden, Rowe, Taylor (I.C.), Wallis

The party ski'd to the foot of the south ridge which was followed to the summit, a cairn was passed at 1700 m, the ridge gave some pleasant scrambling. Ascent: 4 hours. Total time: 11 hours.

**(22) Point 1750 m (Conniats Bjoerg S.E. or No. 1)**

66° 23' N 36° 26' W

1st August 1966

Dearman, Garden, Rowe, Taylor (I.C.), Wallis.

The east ridge was followed to the snowfield on the south face, and then the south ridge was followed to the summit (pitches of V. Diff and 150 foot pitch of Hard Severe). Descent by east face, down delightful cracks in excellent rock to the snowfield. Ascent: 3 hours. Total time: 8 hours.

**(23) Devaux Bjoerg (north—1500 m)**

66° 28' N 36° 25' W

1st August 1966

Agnew, Dilly, Kirkpatrick.

Climbed by the N.E. face, and by traversing the N. ridge, most gendarmes were taken direct and gave several pitches of V. Diff. Ascent: 7½ hours.



(24) Devaux Bjoerg (south—1400 m)

66° 27' N 36° 23' W  
3rd August 1966  
Agnew, Kirkpatrick.

Snow and ice of the east face was ascended to the Devaux Bjoerg south—central col and then the N.N.W. rock ridge followed to the summit. Ascent: 4 hours. Total time: 7 hours.

(25) Point 1650 m (S.E. end of the ridge opposite Devaux Bjoerg to the north)

66° 29' N 36° 19' W  
3rd August 1966  
Keelan, Stocken.

Ascent was made by the south west face. The face was gained by a 600' diagonal gully leading from the southern glacier and then the face was followed directly to the summit with one pitch of 140' Mild V.S. Ascent: 5 hours

(26) Devaux Bjoerg (central, 1600 m)

66° 27' N 36° 24' W  
4th August 1966  
Corner, Dilly, Kirkpatrick, Twigg

Climbed by the S E ridge, the upper 600' giving sustained V Diff rock climbing of chimneys and slabs. Ascent: 4½ hours.

(27) Point 1550 m ("Stac Polly")

66° 24' N 36° 23' W  
7th August 1966  
Stocken, Wallis.

Ski'd to the col west of the hill, and then followed the west ridge with 80' abseil over the gendarme, to a snow col from which poor rock led to the summit. The same route was followed in descent, the abseil pitch providing a pleasant V. Diff wall. Ascent: 2 hours. Total time: 4½ hours.

(28) Point 1500 m ("Film Bjoerg")

66° 24' N 36° 24' W  
7th August 1966  
Dilly, Kirkpatrick.

The hill to the west of "Stac Polly", featured as an I.T.N. epic on "Dateline", climbed by the E. ridge.

(29) Point 1950 m Conniats Bjoerg (Conniats Bjoerg No. 3)

66° 23' N 36° 27' W  
8th August 1966  
Agnew, Dilly, Keelan, Kirkpatrick.

A very fine rock climb with some mixed climbing in the lower part. The snow couloir at the foot of the N.E. face was taken to the east ridge, the lower snow-field was avoided by a traverse to the north ridge, and then the east ridge was regained and followed to the summit. Continuous climbing of V. Diff to Severe standard. Ascent: 3 hours (the Reconnaissance on 24th July having taken 17 hours!)

(30) Point 1800 m (west Henry Leons Bjoerg)

66° 24' N 36° 11' W  
8th August 1966  
Rowe, Taylor (I.C.), Stocken, Wallis.

Ski'd to the eastern cwm from where the delightful S.W. snow and rock ridge led to the western summit ridge which was followed to the summit. Descent via the west face. Ascent: 2½ hours. Total time: 11 hours.

(31) Point 2000 m ("The Pyramid")

66° 25' N 36° 15' W  
9th August 1966  
Rowe, Taylor (I.C.), Stocken, Wallis.  
(2nd Ascent, 1st by Austrians 1959).

Ski'd to base of S.E. ridge; over 400 m of pleasant scrambling up slabs and cracks led to the base of the 'big tower'. This provided two steep severe pitches leading to the summit ridge. Ascent: 4½ hours. Total time: 11 hours.

(32) Point 1600 m

66° 22' N 35° 57' W  
13th August 1966  
Corner, Twigg.

Ski'd from Lower Haabets glacier camp site to foot of the N.W. rock ridge, which was followed to summit. Total time: 5½ hours.



(33) **Point 1300 m**

66° 21' N 35° 58' W  
13th August 1966  
Corner, Twigg.

Climbed via the south snow ridge and final slabby rock face. Total time: 3 hours.

(34) **Point 1750 m ("The Little Thumb")**

66° 23' N 36° 19' W  
22nd August 1966  
Corner, Twigg.

Gained the base of the N.W. ridge on skis. The ridge provided eight pitches of severe with the final summit pitch being Hard Severe. Ascent: 4 hours. Total time: 10 hours. (3rd Attempt by their 3rd choice route by Corner and Twigg).



**APPENDIX IV**  
**GEOLOGICAL REPORT**

by

Dr. R. H. Wallis

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**Introduction**

1. Early geological work in the general Angmagssalik region has been reviewed by WAGER (1934). In the years 1930-1932 WAGER revised and added substantially to this work, but his investigations were largely restricted to coastal areas and to observations on a inland sledge trip to Mont Forel. Thus, prior to collections by the SCOTTISH EAST GREENLAND EXPEDITION 1963 (WALLIS 1965a, 1965b), little was known of the inland area between Sermilik and Kangerdlugsuatsiaq fjords. The S.E.G.E. party collected specimens between Tasissarsik fjord and the 16th September glacier, and from these WALLIS (1965a, 1965b) tentatively suggested a stratigraphy for this area, and compared this succession with that suggested by WAGER (1934) for the Angmagssalik region as a whole.

2. Participation on R.N.E.G.E. 1966 has allowed both the S.E.G.E. 1963 area to be restudied and a substantially larger area northwards towards Mont Forel to be visited. The necessity of reaching the main base at Conniats Bjoerg in the shortest time restricted geological work on the journey in, and bad weather had a similar effect on the way out. However, 14 days were spent between Tasissarsik fjord and Conniats Bjoerg. Approximately 18 days elapsed in the general region of the Conniats Bjoerg main base, and 6 days were spent in travelling between Conniats Bjoerg and Schweizerland, but these journeys were done in poor weather and when pack-carrying heavy loads, thus little detailed work was accomplished. During a stay of approximately 12 days in N.E. Schweizerland geological reconnaissance was based on "Garden's glacier".

3. The late Lt. Cdr. C. M. Stocken provided moraine specimens from the Jura and Paris glaciers, and from subsidiary glaciers joining the Paris glacier from the north; and also the photographs of the northern side of Guldnaalene.

4. A very extensive coverage of colour and black/White photographs were taken and 33 specimens have been thin-sectioned. It is hoped that an integrated account from the photographs, field work, thin-sections and earlier work will be completed in 1967.

**Preliminary Account of the 1966 Field Work**

5. Approximately 3000 sq. kms. of country were reconnoitred during the course of the summer's field work: this is best described in three sub-areas.

**(a) Tasissarsik fjord—16th September Glacier area**

(1) The country between inner Tasissarsik fjord and the 16th September glacier has, apparently, a unified geological history, and the superbly exposed, glacially eroded, slabs at "Sodom", "Montenvers", "Col des Poulies", "Bealach Kelpie", "Winlatta" and at the junction of the 16th September Glacier and the Knud Rasmussen glacier, facilitate study and comparison, and compare very well with WAGER'S photographs (WAGER 1934, Plates 2-4) for the Angmagssalik region as a whole. WAGER'S (1934) work includes the southern edge of this area, and the region is described by WALLIS (1965a, 1965b).

(2) The dominant lithology is a medium to coarse grained, banded grey gneiss. The degree of lineation and foliation is variable, as is the amount of minor folding, and the degree and kind of migmatization. The rock type appears to represent a quartz rich psammatic metasediment; variability in lithological type is restricted to pelitic rusty weathering zones, seen particularly well on either side of Angmagssalik fjord near Kungmiut. Similar zones are occasionally seen north of the Karales glaciers. Otherwise variation in lithology is restricted to concordant amphibolitic material, possibly representing basic igneous pyroclastics or sills, occasionally these concordant amphibolites are seen (e.g. just north of "Winlatta") to be associated with transgressive amphibolites (D1a) which might represent feeder dykes.



(3) The distribution of penecontemporaneous basic igneous material varies considerably, for it is extremely common on a generally E-W strike across the northern part of the Karales glacier, but to south along Tasissarsik fjord it is quite rare.

(4) Much of the area possesses marked compositional banding, this usually consists of layers with contrasting amounts of biotite + hornblende to quartz + feldspar. However, this foliation is seen to be related to a widely distributed series of small scale, tight, similar folds which are formed by a penetrative shear deformation ( $F_1$ ). The parallelism and occasional loss of one fold limb produces much of the compositional foliation, which is thus, not strictly parallel to original bedding surfaces.

(5) Whether there are any large scale structures which are of similar style and age to these small structures is unknown. Where rust zones exist, e.g. in the fjord area, large scale structures are clearly visible but these folds ( $F_2$ ) e.g. the Kungmiut synform, are open folds, concentric in style, and appear to contain the foliation and small scale folds of  $F_1$ .

(6) This foliation sequence of sediments and contemporaneous basic igneous material has been regionally metamorphosed, and it has been suggested (WALLIS 1965a and b) that this regional metamorphism was possibly of Granulite facies. No new evidence has been found in this area to establish the grade of the early metamorphism ( $M_1$ ).

(7) The folded metasediments and amphibolites are regionally migmatized, see WALLIS 1965. However, though the compositional banding is disrupted and displaced, the scale of the early agmatization (fragmentation) stage is very small. The migmatization consists mainly of selective recrystallization, occasionally accompanied by a certain amount of passive flow deformation, and in limited area, e.g. "Bealach Kelpie", recrystallization produces coarse grained nebulitic gneisses.

(8) The migmatization phase is followed by the emplacement of parallel sided, transgressive metadolerites. This emplacement is in two stages for one group of metadolerites ( $D_2$ ), which are clearly transgressive to the  $F_1$  folded metasediments and amphibolites, are themselves folded, whilst the other group are apparently unfolded ( $D_3$ ).

(9) The  $D_2$  and  $D_3$  metadolerites are both fairly common and the best exposures are about "Winlatta". Here the  $D_2$  metadolerites are seen to be folded on a mesoscopic scale, in open, concentric but often overturned and inverted folds. Whether this post- $D_2$ , pre- $D_3$  folding episode is equivalent to  $F_2$  affecting the meta-sediments is unknown.  $D_2$  metadolerites are often boudined and cut by transgressive as well as segregation pegmatites. The transgressive pegmatites are fairly rare and have been described by WALLIS (1965b).

(10) The  $D_3$  metadolerites tend to be narrower and slightly less common than  $D_2$  metadolerites and have been described in WAGER (1934) and in WALLIS (1965a and b). The emplacement of  $D_2$  and  $D_3$  metadolerites and the intervening period of folding appears to be followed by a period of static metamorphism of Almandine-amphibolite facies, for the metadolerites are not foliated or lineated, but they consist of a granular interlocking mosaic of plagioclase and hornblende.

(11) The last phase of development is seen in the formation of small retrogressive shear belts, zones of cataclasis and epidote covered joint sets. These rocks are cut by the coast parallel 060° trending Tertiary dykes, ( $D_4$ ), these are occasionally seen along Angmagssalik fjord, but have not been observed inland.

(12) Table I compares this sequence of events with that of WALLIS (1965 a and b) and with WAGER (1934).

#### (b) Conniats Bjoerg area

(1) North of the 16th September glacier there is a striking change in the appearance of the mountains. The generally pale, light to dark striped, coarse grained, foliated gneissose hills, with their numerous sheets of metamorphosed basic igneous material, give way northwards, apparently by transition, to an area of medium grained, granular, almost nonfoliated, pink to red, homogeneous, granulite facies rocks. These are more or less devoid of metadolerites. The junction zone is quite apparent to the eye on a large scale, but it is not so easy to define in detail on any one particular mountain-side.

(2) Along the margins of the homogeneous red weathering area the grey gneisses of the south become more varied in colour and composition and thus the overall structure, e.g. on Tupilaq, becomes much more apparent than in the areas immediately to the south of the 16th September glacier. A similar transition, to a banded group of metasediments, occurs to the north of the Haabets glacier, and from Badeuils Bjoerg southwards to Point 1860 m, the compositional variation is sufficient to illustrate the structurally complex folding of the area. But, generally between the



TABLE 1

| 1966 WORK                                                                  | WALLIS 1965 (a) and 1965 (b)                          | WAGER (1934)                                                     |
|----------------------------------------------------------------------------|-------------------------------------------------------|------------------------------------------------------------------|
| Coast parallel dykes (D <sub>4</sub> )                                     | —————                                                 | Tertiary coast dyke swarm                                        |
| Late jointing, cataclasis<br>retrogressive shear zones                     | Epidote jointing<br>Late Calacclasis and Scapolite    | Epidote jointing<br>Kangerdlugsuatsiak shear zone<br>(scapolite) |
| Regional static almandine<br>amphibolite metamorphism                      | Almandine-amphibolite static<br>regional metamorphism | —————                                                            |
| Metadolerites (D <sub>3</sub> )                                            | Metadolerites                                         | Transgressive sheets of Plagioclase<br>Amphibolite               |
| Folding (?F <sub>2</sub> ), boudinage,<br>transgressive pegmatites         | Transgressive pegmatities                             | Pegmatities                                                      |
| Metadolerites (D <sub>2</sub> )                                            | Metadolerites                                         | —————                                                            |
| —————                                                                      | —————                                                 | Charnockites                                                     |
| Regional Migmatization                                                     | Regional Migmatization                                | Grey Gneiss                                                      |
| Granulite facies<br>regional metamorphism and<br>folding (F <sub>1</sub> ) | Granulite facies regional<br>metamorphism             | —————                                                            |
| —————                                                                      | Early Amphibolites                                    | Plagioclase Amphibolites                                         |
| —————                                                                      | —————                                                 | Ultra basics                                                     |
| Metasediments, basics sills,<br>pyroclastics, dykes (D <sub>1</sub> )      | Metasediments                                         | Sediments                                                        |



16th September and the Haabets glaciers the rocks are very uniform, weathering pale red to brown, being fine to medium grain with granular assemblages of quartz, feldspar and pyroxene (?), and only rarely showing any well developed compositional or structural foliation. The rocks have very uniform mechanical properties, and jointing and shear zones are well developed and these are more important erosional guide planes than any compositional foliation present.

(3) Variation in composition is rare, on "The Wedge" some layers of finer grain size and higher mica content are found, and occasionally lenses of biotite-hornblende schist are encountered, the latter possibly represent an early basic igneous component. As described above both to the north and south the strata becomes compositional banded together with variations in grain size and colour. Mostly the banding consists of changes in the ratio of feldspar to quartz, and also of the percentage of mica's, hornblende and pyroxene. On Badeuils Bjoerg other lithologies present are quartzite, quartz-garnet horizons, rare marble horizons and layers of biotite schist. Amphibolitic compositions are extremely rare, but on the peak west of Conniats Bjoerg two boudined and folded basic dykes were clearly emplaced prior to the later migmatization phase, and folded concordant igneous horizons occur on Henri Leons Bjoerg west. The stratified metasediments are seen to be strongly folded west of Conniats Bjoerg and also on Badeuils Bjoerg and Point 2000m. The folds are large scale, open folds of concentric type, sometimes overturned and faulted, with the dominant axial trend N.W.-S.E. However, definite cross foliation striking N.E.-S.W., which is presumably associated with cross folding, is found on Henri Leons Bjoerg and Tupilaq.

(4) Localised areas of agmatization occur rather spasmodically, and migmatization is generally present as an anastomosing network of pegmatites and aplites. The migmatization occurs after the development of the rather structural foliation and also appears to post-date the formation of the large open folds.

The sequence of folded and migmatized metasediments is cut by a 50m amphibolite running N.E.-S.W. from Nigserseq fjord via the north wall of the Midgaard glacier across the Glacier de France to the north wall of the Pourquoi Pas glacier. A similar N.E.-S.W. group of amphibolites cross the Glacier de France just below Laupersbjoerg.

(5) Along the south wall of the Glacier de France opposite the Pourquoi Pas glacier these N.E.-S.W. amphibolites can be seen to be cut by a swarm of N.W.-S.E. dykes. These dykes extend northwards to the Guldnaalene across the Femstjernen, and south-eastwards to the north wall of the Haabets glacier. Isolated examples occur in the Solverbjoerg eastern cwm, where they are seen to be parallel sided, rectilinear, abruptly transgressive, unfolded and unfoliated. However, they lack characteristic igneous ophitic pyroxene-plagioclase relationship and consist of corona textured garnet-pyroxene-hornblende rocks. Presumably a period of static high grade metamorphism has elapsed after the emplacement of these dykes.

(6) The following sequence can thus be proposed for the Conniats Bjoerg area:

- (1) Metasediments, feldspathic, together with rare quartzites and marbles.
- (2) Rare penecontemporaneous basic igneous rocks.
- (3) Folding, metamorphism (to Granulite facies?)
- (4) Dykes emplaced.
- (5) Deformation, migmatization, shear zones.
- (6) N.E.-S.W. amphibolite.
- (7) N.W.-S.E. metadolerites
- (8) Static regional metamorphism
- (9) Jointing

(c) **N.E. Schweizerland area**

(1) The general uniformity characteristic of the Conniats Bjoerg area persists to the north, and overall the rocks of south, east and north-east Schweizerland tend to be very similar, i.e. a uniform massive, pink to brown weathering, medium grained, granular, occasionally foliated, group of quartzofeldspathic (and ? pyroxene bearing) rocks of indeterminate origin. Occasionally, as about the lower Schweizerland Base camp and in N.W. Schweizerland (in a low lying area N.E. of the Fenrisglacier) metasediments appear as white and yellow (quartzite) and dark horizons (mica schists or amphibolites) together with rusty horizons (biotite schists). To a lesser extent some lithological variations exist in the Guldnaalene on a megascopic scale, and compositional foliation extends across the Paris glacier to Mont Forel, though these more easterly areas consist mainly of the red weathering, uniform, pyroxene bearing strata. Elsewhere the granular quartzofeldspathic rocks varied from well foliated



to poorly foliated, but in most exposures close jointing and mylonitic foliation were more prominent than compositional banding and thus major structures were not obvious. However, sufficient lithological and colour banding (due to grain size variation and mica content) existed to illustrate the form of the megascopic folds, e.g. on the north wall of "Garden's Glacier" and on the south face of Point 2500m, as large, open, sometimes overturned folds of varying but with dominantly a N.W.-S.E. axial strike.

(2) Amphibolites are extremely rare in this area, but boudined biotite schist layers may represent basic material of similar age to that of the metasediments, such biotite schists were found on Point 2520m, Point 2500m, Point 2300m ("The Maiden") and about the upper part of "Garden glacier" and about the lower Schweizerland camp.

(3) The folded metasediments are occasionally seen to be cut by sharply defined parallel-sided, but folded, metamorphosed basic dykes. This is especially well demonstrated approximately half-way up "Garden Glacier" on the north wall, and similar occurrences are found in the cwm at the head of "Garden Glacier" and also to the south of the glaciers. The dykes are fine to medium grained, well foliated and lineated and consist of garnet, hornblende and plagioclase with occasionally some remenant pyroxene.

Almost as rare as the amphibolites are a set of dykes striking 330°, i.e. parallel to the Guldnaalene swarm. These dykes are up to 55m wide, steeply dipping or vertical, with sharply transgressive rectilinear walls which are occasionally off-set when guided by pre-existing joints. The dykes are often coarse grained, with a fairly obvious ophitic igneous texture, but occasionally this texture is broken down and the dykes are foliated and lineated, and consist of pyroxene, hornblende and plagioclase with rare garnet.

(4) Across Point 2500m, and from there west to N.W. Schweizerland, and east to the Guldnaalene are one or more low angled or horizontal basic intrusions of sill like form, approximately 50m thick, these sills make a very prominent feature in this area. On Point 2500m the sill is seen to cut the N.W.-S.E. dykes. The sills possess chilled margins, break up into cuboidal blocks and consists of a granular assemblage of pyroxene and feldspar. Thin sections show, however, that in fact the sills have been metamorphosed.

(5) The following succession can therefore be tentatively proposed for the N.E. Schweizerland area:

- (1) Metasediments, quartofeldspathic with quartzite and mica schists.
- (2) Boudined biotite schists representing ex basic igneous material? ( $D_1$ ).
- (3) Folding, boudinage, metamorphism.
- (4) Rare, folded basic igneous dykes ( $D_2$ ).
- (5) Folding, metamorphism and migmatization and pegmatites.
- (6) N.E.-S.W. basic dykes ( $D_{3b}$ ).
- (7) Basic sills ( $D_{3c}$ ).
- (8) Static regional metamorphism.

## 6. Conclusions.

- (a) All the rocks seen were crystalline.
- (b) No major structural discontinuity was seen anywhere. The line north of the 16th September glacier divides dissimilar lithologies and more importantly different metamorphic grades with granulite facies lying to the north and amphibolite facies to the south.
- (c) Overall the rocks appear to belong to one coherent geological entity and to have passed through a similar geological evolution, see Table 2. Lithological variation is provided by the distribution of original compositions, and more importantly the amount of later igneous intrusion and the degree of migmatization.
- (d) The N.W.-S.E. axial fold direction appears to be of regional significance, as are the  $D_2$  folded dykes, and the  $D_3$  unfolded, but statically metamorphosed dykes and sills.
- (e) WAGER suggested two origins for the Charnockites (Granulites facies rocks) of Angmagssalik area, either they represent metamorphic rocks (WAGER 1932) or igneous intrusions (WAGER 1934). The author would revive WAGER'S earlier (1932) suggestion to explain their random outcrop as representing relicts surviving the later lower grade migmatization.
- (f) Erratics suggest that there is an igneous (granitic-syenitic pluton) in the Laupersbjoerg massif.



**Table II — Geological Sequence**

- (1) Sediments (of unknown thickness and stratigraphy). Predominantly psammatic south of 16th September glacier more arkosic to the north, rare intercalations of quartzite, marble and pelite (rust zones).
- (2) Penecontemporaneous basic igneous material ( $D_{1a}$ ) as sills and pyroclastics with some feeder dykes ( $D_{1b}$ ), ( $D_1$ ) much common more south of 16th September glacier.
- (3) Penetrative foliation, development of small scale folds ( $F_1$ ) and ? large scale structures.
- (4) High grade metamorphism reaching Granulite facies in many parts of the area.
- (5) Regional development of migmatization, of retrogressive metamorphic character, most strongly to the south of 16th September glacier, variable in character and development to the north. Accompanied by plastic deformation and/or agmatization. An event with various stages.
- (6) Emplacement of cross cutting dolerite dykes ( $D_2$ ), especially common between Karales and 16th September glaciers but found spasmodically throughout the area.
- (7) Folding of the  $D_2$  dykes, and ? the  $F_2$ , open folding of the metasediments.
- (8) Generations of transgressive pegmatites and aplits.
- (9) The emplacement of cross-cutting basic igneous sheets,  $D_{3a}$  the N.E.-S.W. amphibolite of Midgaard-Pourquoi Pas glaciers,  $D_{3b}$  the Guldnaalene dyke swarm and dykes south of 16th September glacier,  $D_{3c}$  the Jura glacier sill complex.
- (10) Static regional metamorphism of amphibolite facies.
- (11) Late shearing, jointing etc.
- (12) The Tertiary, coast-parallel, basic dykes, ( $D_4$ ).

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- |                        |                                                                                                                                                                                            |
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## APPENDIX V

### BOTANY REPORT

by

Dr. G. Halliday

University of Leicester

Graph of the Percentage frequency of groups  
1 and 6 with altitude

Map of Gribbon's and Stocken's Collecting sites

#### Introduction

1. During the course of the 1963 Scottish East Greenland Expedition, a number of comprehensive plant collections were made by the leader, Dr. P. W. Gribbon of St. Andrew's University, from Kulusuk and Angmagssalik on the coast, from the head of Tasissarsik fjord, and from 15 montane sites in the Caledonian Alps. Many of the latter are nunataks ranging in height from 820-1570m. A preliminary account of Gribbon's results is given in the Report of the Expedition, but a more detailed treatment is to be published in a paper entitled "Altitudinal Zonation in East Greenland". Although this deals with the zonation of the various species of vascular plants occurring in the Caledonian Alps, Gribbon is particularly concerned with the varying importance at different altitudes of the various phytogeographic-climatic groups recognised by Bocher, Holmen and Jakobsen (1959). Gribbon also draws attention to the occurrence within this area of a number of species which were previously either unknown from the Angmagssalik region, or else had been found only at a few places in the inner fjords.

2. When I learnt that the present Expedition was to visit Schweizerland, I wrote to Lt. Cdr. Stocken and asked whether, in view of the rich and interesting flora that Gribbon had found in the Caledonian Alps, he would be prepared to make a collection of plants, particularly from the inland nunataks. Since he had already arranged to make a collection for the Royal Botanic Garden, Edinburgh, Stocken readily agreed to this. At the end of the Expedition, the whole collection was sent to me for working up. This has now been completed and it will shortly be divided between the Edinburgh Herbarium and the Arctic Herbarium at Leicester. Duplicates of the rarer species will also be sent to the Copenhagen Herbarium.

#### The Collection

3. Stocken collected 80 species of vascular plants from 14 different localities. He also collected a number of lichens and bryophytes. These have not yet been identified and are therefore omitted from this account. 16 species were collected near Keflavik airfield in Iceland. Of these, *Saxi-fragra hypnoides*, *Galium sternerii* and *Cardaminopsis petraea* are absent from Greenland, and *Dryas octopetala* is restricted to the northern half of the east coast, its place in the Angmagssalik area being taken by the closely related *Dryas integrifolia* of the western arctic. Of the 22 species collected at Kulusuk, the following were not recorded by Gribbon, neither are they listed by Bocher (1938 pp. 34-39) as occurring nearby at Kap Dan: *Ranunculus pygmaeus*, *Thymus drucei*, *Veronica alpina*, *Campanula gieseckiana* and *Taraxacum croceum*.

4. Gribbon's major collecting area was at the head of the Tasissarsik fjord where he found a rich and interesting flora of 67 species. This was not surprising in view of Krusse's (1911) investigations around the head of Qingorssuaq fjord about 12km to the north-west. Kruuse found here 142 of the 162 species of vascular plants which he recorded for the whole of the Angmagssalik area. It was in fact by far the richest locality that he visited. Stocken's Tasissarsik collection was from virtually the same area as Gribbon's. His visit there was brief and hurried. Only two of the 32 species, *Dryas integrifolia* and *Saxifraga caespitosa*, were not recorded by Gribbon.

5. Stocken's nunatak sites lie, with one exception, to the north of 16th September Gletscher, and they extend to the north and north-east parts of Schweizerland, midway between the head of Sermilik fjord and Mont Forel. They extend inland to 125km from the head of Sermilik and to 92km from Kangerdlugssuaq, further inland than any other expedition has collected in south-east Greenland. All his sites lie to the north of Gribbon's and considerably further inland; they also cover a greater altitudinal range (700-2480m).



6. The collecting sites of both Gribbon and Stocken are shown on the map. Stocken's nunatak sites are listed below and the species occurring at these sites are presented in Table 1. The following species listed in this Table were not recorded by Gribbon:

|                             |                           |
|-----------------------------|---------------------------|
| <i>Pedicularis flammea</i>  | <i>Gnaphalium supinum</i> |
| <i>Campanula uniflora</i>   | <i>Arnica alpina</i>      |
| <i>Antennaria porsildii</i> | <i>Phippsia algida</i>    |

Locality

- 4. 16th September Gletscher, 66.14 N, 36.17 W, rocky cliffs at 700-800m by side of glacier. July 20th.
- 5. Conniats Bjoerg, 66.23 N, 36.27 W, east to south-east facing, 1600-1800m. July 23rd.
- 6. Mountain 5km south-east of Conniats Bjoerg, 66.22 N, 36.19 W, south-facing cliffs, 1750m. July 25th.
- 7. Femstjernen, 66.38 N, 36.43 W, south-facing cliffs, 1100m. July 29th.
- 8. Mountain north of Devaux Bjoerg, 66.28 N, 36.19 W, south-facing cliff ledges, 900-1700m. August 3rd.
- 9. Point 2000m, 66.25 N, 36.13 W, rock ledges, 1700-2000m. August 9th.
- 10. Glacier de France, 66.32 N, 36.25 W, steep south-east-facing cliffs, 800m. August 11th.
- 11. Femstjernen, 66.39 N, 36.47 W, rocky col, 1300m. August 13th.
- 12. Schweizerland: Mountain east of Point 2520m, 66.36 N, 37.05 W, south-facing slopes, 1800-2480m. August 16-18th.
- 13. Schweizerland: Point 2500m, 66.40 N, 37.10 W, south face above glacier, 2200-2400m. August 21st.
- 14. Point 2200m, 66.38 N, 36.48 W, rock ledges on north face, 1900m. August 23rd.

(Localities 1-3 are Keflavik, Kulusuk and Tasissarssik respectively).

TABLE 1  
Species occurring at nunatak sites

| Locality No.                                      | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Group |
|---------------------------------------------------|---|---|---|---|---|---|----|----|----|----|----|-------|
| <i>Lycopodium selago</i> .. .. .                  | * |   |   |   |   |   |    |    |    |    |    | 8     |
| <i>Lycopodium annotinum</i> .. .. .               | * |   |   |   |   |   |    |    |    |    |    | NC    |
| <i>Woodsia alpina</i> .. .. .                     |   |   |   |   |   |   |    |    | *  |    |    | 5     |
| <i>Woodsia ilvensis</i> .. .. .                   | * |   |   |   |   |   |    |    |    |    |    | 5     |
| <i>Cystopteris fragilis</i> .. .. .               |   |   |   | * | * |   |    | *  |    |    |    | NC    |
| <i>Ranunculus pygmaeus</i> .. .. .                |   |   | * |   |   |   |    |    |    |    |    | 5     |
| <i>Dryas integrifolia</i> .. .. .                 | * |   |   |   |   |   | *  |    |    |    |    | 1     |
| <i>Potentilla nivea</i> .. .. .                   |   | * |   | * | * |   |    | *  |    |    |    | NC    |
| <i>Potentilla crantzii</i> .. .. .                | * |   |   |   |   | * |    |    |    |    |    | 6     |
| <i>Sibbaldia procumbens</i> .. .. .               |   |   |   |   | * |   |    |    |    |    |    | 6     |
| <i>Sedum rosea</i> .. .. .                        | * |   | * | * | * |   | *  |    |    |    | *  | 6     |
| <i>Saxifraga nivalis</i> .. .. .                  |   | * |   | * | * |   |    | *  | *  |    |    | 1     |
| <i>Saxifraga tenuis</i> .. .. .                   | * |   |   | * | * |   |    |    |    |    |    | NC    |
| <i>Saxifraga cernua</i> .. .. .                   |   | * |   | * | * |   |    | *  | *  | *  |    | 1     |
| <i>Saxifraga caespitosa</i> .. .. .               | * | * |   | * | * |   |    | *  | *  | *  |    | 1     |
| <i>Saxifraga aizoon</i> .. .. .                   | * |   |   | * | * |   |    |    |    |    |    | 6     |
| <i>Saxifraga oppositifolia</i> .. .. .            | * | * |   |   | * | * |    | *  | *  | *  | *  | 1     |
| <i>Chamaenerion latifolium</i> .. .. .            | * |   | * |   | * | * |    | *  |    |    |    | 1     |
| <i>Papaver radicatum</i> .. .. .                  |   | * |   | * | * | * |    | *  | *  | *  |    | 1     |
| <i>Draba nivalis</i> .. .. .                      |   | * |   |   |   | * |    | *  | *  | *  |    | 1     |
| <i>Draba norvegica</i> .. .. .                    |   |   |   |   |   |   |    | *  |    |    |    | 6     |
| <i>Salix herbacea</i> .. .. .                     | * | * |   |   | * |   |    |    |    |    |    | 6     |
| <i>S. glauca</i> ssp. <i>callicarpaea</i> .. .. . | * |   |   | * | * |   |    |    |    |    |    | 5     |
| <i>Ocyrria digyna</i> .. .. .                     | * |   |   |   | * |   | *  | *  | *  | *  |    | 1     |
| <i>Polygonum viviparum</i> .. .. .                | * |   |   |   | * |   |    |    |    |    |    | 1     |
| <i>Cerastium cerastoides</i> .. .. .              |   |   |   |   | * |   |    |    |    |    |    | 6     |
| <i>Cerastium arcticum</i> .. .. .                 | * | * | * |   | * | * |    | *  |    | *  | *  | 1     |
| <i>Minuartia rubella</i> .. .. .                  |   |   |   |   | * | * |    |    | *  | *  |    | 1     |
| <i>Minuartia biflora</i> .. .. .                  | * |   |   |   |   |   |    |    |    |    |    | 5     |
| <i>Lychnis alpina</i> .. .. .                     | * |   |   | * | * |   |    |    |    |    |    | 6     |
| <i>Silene acaulis</i> .. .. .                     |   |   |   |   | * |   |    |    |    | *  | *  | 1     |







TABLE 2

| Group           | 1       | 3      | 4      | 5      | 6       | 8     | Not<br>Not<br>classified |
|-----------------|---------|--------|--------|--------|---------|-------|--------------------------|
| Group           | 1       | 3      | 4      | 5      | 6       | 8     |                          |
| Locality 3 * .. | (20)    | (4)    | (2)    | (20)   | (42)    | (8)   | 11                       |
| 4 ..            | 9 (28)  | 1 (3)  | 1 (3)  | 9 (28) | 11 (34) | 1 (3) | 2                        |
| 5 ..            | 9 (64)  | —      | 2 (14) | —      | 3 (21)  | —     | 1                        |
| 6 ..            | 2 (40)  | —      | —      | 1 (20) | 2 (40)  | —     |                          |
| 7 ..            | 4 (33)  | 1 (8)  | 1 (8)  | 2 (16) | 4 (33)  | —     | 2                        |
| 8 ..            | 12 (36) | 2 (6)  | 2 (6)  | 4 (12) | 13 (39) | —     | 4                        |
| 9 ..            | 8 (73)  | 1 (9)  | —      | —      | 2 (18)  | —     |                          |
| 10 ..           | 1 (20)  | 2 (40) | —      | 1 (20) | 1 (20)  | —     |                          |
| 11 ..           | 11 (73) | 1 (7)  | —      | —      | 3 (20)  | —     | 3                        |
| 12 ..           | 11 (69) | 1 (6)  | —      | 1 (6)  | 3 (19)  | —     | 1                        |
| 13 ..           | 9 (82)  | —      | —      | —      | 2 (18)  | —     |                          |
| 14 ..           | 3 (50)  | —      | —      | —      | 3 (50)  | —     |                          |

\* Also represented at this locality are Group 7 (2%) and Group 9 (4%).

Figures in brackets are percentage frequencies.

9. Despite the fact that Stocken's collections are considerably smaller, his data do support Gribbon's finding that away from the influence of the coast and fjords groups 1 and 6 predominate, and that with increasing altitude group 1 increases in frequency at the expense of group 6. This is best seen in the graph where the percentage frequency of these two groups is plotted against altitude. The data for localities 6, 10 and 14 are excluded as the collections are too fragmentary.

10. Group 5 plays a relatively minor role by comparison with Gribbon's coastal and fjord sites, and indeed many of his localities in the Caledonian Alps. This is presumably a reflection of the increasing continentality of the climate as one goes further inland. It is often entirely absent and exceeds 20% only at Locality 4. It here reaches 28%, a level comparable to Gribbon's montane sites overlooking the Tasissarsvik valley. Locality 4 is however well inland near the head of Knud Rasmussens Gletscher and 18km from the head of Sermiligaq fjord. It is interesting that Stocken remarks in his notebook on the occurrence here of a fjord type of flora. It is his only nunatak site for such species as *Phyllodoce*, *Diapensia* and *Bartsia*.

11. Gribbon's highest locality (no. 8) was at 1570m. Seven of Stocken's sites exceed this, the highest (12) reaching 2480m. The following species were found above 2000m (localities 12, 13):

|                                |                      |                             |                      |
|--------------------------------|----------------------|-----------------------------|----------------------|
| <i>Saxifraga nivalis</i>       | 2200 (12)            | <i>Minuartia rubella</i>    | 2480 (12), 2300 (13) |
| <i>Saxifraga oppositifolia</i> | 2400 (12), 2350 (13) | <i>Silene acaulis</i>       | 2200 (13)            |
| <i>Saxifraga cernua</i>        | 2450 (12), 2400 (13) | <i>Erigeron uniflorus</i>   | 2200 (12, 13)        |
| <i>Saxifraga caespitosa</i>    | 2400 (12), 2300 (13) | <i>Antennaria canescens</i> | 2300 (12, 13)        |
| <i>Papaver radiculatum</i>     | 2450 (12), 2400 (13) | <i>Luzula spicata</i>       | 2200 (12)            |
| <i>Draba nivalis</i>           | 2300 (12, 13)        | <i>Carex nardina</i>        | 2300 (12)            |
| <i>Oxyria digyna</i>           | 2280 (12), 2200 (13) | <i>Poa glauca</i>           | 2300 (12)            |
| <i>Cerastium arcticum</i>      | 2300 (13)            | <i>Phippsia algida</i>      | 2300 (12)            |

The only species in this list which was not found below 2000m is *Phippsia algida*.

### Phytogeography

12. Attention has already been drawn to the fact that the oceanic climate of the outer coast, exemplified by Kulusuk and Angmagssalik, changes as one enters the fjords, becoming increasingly continental. These changes are reflected in the flora which is augmented by a number of species which prefer the warmer, drier climate of the inner fjords and are rare or lacking on the coast, for example *Equisetum variegatum*, *Papaver radiculatum*, *Draba aurea* and *Carex rupestris*. Extensive deglaciated areas with fjords and nunataks far inland are of limited occurrence in south-east Greenland and it is not therefore surprising that a number of species, particularly those belonging to the Arctic Continental group 3 and the Medium-Arctic Montane group 4, should have disjunct southern outposts in the interior of the Angmagssalik area. Species of both groups tend to become increasingly inland and alpine towards their southern limits. 13. The Arctic Continental group includes *Arnica alpina*, found by Stocken at localities 8 and 10 but otherwise known in the Angmagssalik area only from Kruuse's record near the head of Qingorssuaq, where it reaches its southern limit on the east coast. *Cassiope tetragona* likewise reaches its southern limit in the Angmagssalik area, where it is restricted to the interior. Bocher (1938 p. 154) has mapped its five localities in this area. These must now be supplemented by that of Gribbon and two of Stocken's. *Erigeron compositus* behaves similarly:



it is commonest in the central parts of both west and east Greenland, but in the east its only known locality along the entire coast between Kap Farvel and Scoresby Sund was, until recently, that on the west side of Skjoldungen island (63.30 N). However, Bocher (1938 p. 189) suggested that it might well grow in the mountains inland from Angmagssalik, and it was subsequently found by Gribbon (locality 4) and by Stocken at three sites (7, 8, 11). It does in fact seem probable that it is fairly generally distributed throughout the nunatak area. All these sites lie between 1000-1500m.

14. It is curious that the Low-Arctic Oceanic species *Gnaphalium spinum*, a characteristic snow-patch plant, and also *Cerastium cerastoides*, both common along the outer coast, should occur on the same nunatak (locality 8) as the Arctic Continental *Erigeron compositus*.

15. Three species in the Medium-Arctic Montane group, if we include *Potentilla nivea*, reach their southern limit on the east coast in the Angmagssalik area. Until recently, two, the *Potentilla* and *Juncus castaneus*, were only known from Qingorssuaq, while the third, *Campanula uniflora*, occurs near the head of Sermilik fjord and also near Angmagssalik. *Juncus castaneus* was collected by Gribbon from the head of Tasissarsik fjord, where it was also found by Stocken. Presumably it is not uncommon there. Its occurrence there and at Qingorssuaq is extremely disjunct, there being no other localities between here and Scoresby Sund. *Campanula uniflora* behaves similarly, though it is recorded also from Kangerdlugsuaq, midway between Angmagssalik and Scoresby Sund. This species, which was not recorded by Gribbon, was found by Stocken at two localities (5, 7). *Potentilla nivea*, which is known from a number of localities between Angmagssalik and Scoresby Sund, was found by Gribbon at five new sites (3, 4, 6, 14, 17) and by Stocken at four (5, 7, 8, 11).

16. A species with a distribution in south-east Greenland similar to that of *Juncus castaneus* is *Antennaria porsildii*. Previously known south of Scoresby Sund only from Qingorssuaq, it was found by Stocken at 1500m at locality 8. Mention must also be made of *Papaver radicum*. Bocher (1938 p. 98) gives only two localities in the Angmagssalik area, Tugtilik and Qingorssuaq, but both Gribbon and Stocken recorded it from seven of their montane sites, all above 1000m. It is clearly generally distributed and ascends at least to 2450m.

17. Of the species recorded by Gribbon from the Caledonian Alps but not found by Stocken, the following are conspicuous and can reasonably be assumed to be uncommon or even absent on Stocken's more northerly nunataks: *Juniperus communis*, *Ranunculus glacialis*, *Rhododendron lapponicum* and *Hieracium alpinum*.

18. The occurrence of such a widespread, phytogeographically interesting nunatak flora is strong evidence for the persistence in this area of nunatak or lowland refugia throughout at least the last major glaciation. Bocher (1956) is of the opinion that for physiographic reasons the inner Qingorssuaq valley was such a lowland refugium. Gribbon has taken up this suggestion in the light of his own findings and applied it to the Tasissarsik valley. While agreeing with them, I think it significant that most of the rare species referred to above are not in fact restricted to these two valleys. These valleys could well have provided refugia for such lowland species as *Juncus castaneus* and *J. arcticus* but it seems likely that many of the nunatak plants such as *Potentilla nivea*, *Papaver radicum*, *Arbica alpina*, *Erigeron compositus* and *Antennaria porsildii* could have survived on nunataks in similar habitats to those which they occupy at the present time.

19. In conclusion I should like to express my admiration of the careful and conscientious way in which Lt. Cdr. Stocken carried out his botanical programme.

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## APPENDIX VI

### EQUIPMENT REPORT

by

Lieutenant Commander M. B. Thomas, Royal Navy

Lieutenant G. D. B. Keelan, Royal Marines

Flight Lieutenant R. Dearman, Royal Air Force

1. The Expedition was fortunate in being able to borrow much equipment from the Infantry Training Centre, Royal Marines with consequent financial saving. Other items were purchased from various firms at generous discounts. (See Acknowledgements). Individuals provided almost all their own clothing.

#### 2. COMMENTS

##### (a) Climbing Equipment

(1) **Ropes.** 6 x 300 ft. No. 4 nylon (half dyed red) were used as the main climbing ropes, and various other weights provided for making slings etc. Tape etriers were also taken. No. 4 was too heavy and 300 ft. lengths of No. 3 would have been more suitable.

(2) **Karabiners and Pitons.** These were ex-R.M. and predominantly steel. This contributed significantly to the weight problem in the Spring. In the event, no really long, hard rock routes were encountered. Had they been, the advantages of alloy would have been even more apparent.

(3) **Ice Screws.** Were used repeatedly and are essential in the area.

(4) **Crampons.** Members supplied their own and all well-known makes were represented and satisfactory. Spares were provided in the form of one pair of Avcin adjustable and several pairs of instep type. The former are not strong enough and the latter were not used.

(5) **Zdarsky Sacks.** These were never unpacked in anger but made satisfactory fly-sheets (see Tents).

(6) **Rock Helmets** were used at all times and are absolutely essential. Stocken's death was caused by a boulder at least a foot in diameter falling a considerable distance and was not attributable to any weakness in his helmet.

##### (b) Ski Equipment. All equipment was ex-R.M. except wax.

(1) **Skis.** Norwegian metal-edged cross-country type. These stood up quite well to very hard wear and to six novices. The merits of alloy skis were admirably demonstrated by the Swiss Expedition.

(2) **Bindings.** The majority were Kandahar Type C and quite inadequate. Heel wires broke on many occasions and side plates bent. The stronger Grasshopper type used by one member was entirely satisfactory. Soft bindings (see under Boots) might have been the best solution of all.

(3) **Sticks.** These were predominantly bamboo with two small baskets, and there were many casualties. Alloy shafts are essential.

(4) **Skins and Waxes.** Lacking experience, the organiser consulted numerous experts and received almost equally numerous and conflicting opinions. Skins were used for man-hauling uphill and downhill ski-ing with loads and, as to be expected, sustained heavy wear on hard surfaces. On balance, wax appears to be preferable but was not provided in adequate quantity or quality. The majority of British vendors of ski equipment seem scarcely aware of the existence of a wax to slow one down, rather than to speed one up.

##### (c) Camping Equipment

(1) **Tents.** For the Spring journey, Edgington's pyramid tents were used, heavy canvas and nylon lining. These were excellent although the R.M. description '4 man Arctic' does less than justice to R.M. physique. For sledging, the pole sections were taped together permanently and each morning the tents were collapsed umbrella-fashion and lashed, when they fitted neatly on a Greenlander's sledge. In the summer, R.M. 2-man snow warfare tents were used. These are Black's Mountains in double terylene. Designed for cold conditions, they are very warm and robust but have no flysheets and are not waterproof. For obvious, military reasons they are white in colour, which is a drawback.



(2) **Sleeping Bags and Mattresses.** Various combinations of bags and air and foam mattresses were used, all apparently with success. Bags approximated to Icelandic Special quality and better. On the Spring journey, foam, Icelandic Special and duvet jacket were sufficient. One member of the Spring party successfully sealed his foam mattress against moisture with Fablon.

(3) **Stoves and Fuel.** Optimus 111B 1-pint were used and were very satisfactory, the slight weight penalty over other designs of the same capacity being well worthwhile. The internal pricker demands care and several had to be replaced, some almost certainly as a result of abuse by the Greenlanders in the spring and the others probably from the slovenly habit of priming with paraffin. Paraffin was provided on the basis of  $\frac{1}{2}$  pint/man-day. This was over-generous, actual consumption approximating to  $\frac{1}{3}$  pint/man-day, but allowance had to be made for damage to plastic fuel cans on the spring journey.

(d) **Clothing**

(1) **General.** The only items of Service clothing generally used were Combat trousers, woollen wristlets and windproof outer gloves. All were good although ordinary climbing breeches were also quite adequate in summer. Cagoules and waterproof over-trousers were invaluable on occasions. Summer clothing plus long underpants and duvets sufficed for the Spring.

(2) **Boots.** (a) Of the Spring party, one wore H.A. and the other lace-up rubber U.S. surplus 'Mickey Mouse' boots. The former became thoroughly soaked leaving the sea-ice and remained soaked throughout despite prodigious paraffin expenditure. Polythene bags were resorted to between boots and socks and proved fairly effective. The rubber boots were excellent and perspiration was no serious problem under those conditions. It was of course necessary to manufacture soft ski-bindings from leather belting and lamp-wick. These were not satisfactory on the H.A. boots because of the absence of any flat portion on the toe, thus adding to their wearer's discomfort. (b) The summer party provided their own boots and again various patterns were represented. No final solution emerged to the conflicting requirements of cross-country ski-ing and rock-climbing. The conventional ski-mountaineering boot is too stiff for the former although good, with the toe-welts trimmed, for the latter. The Expedition's spare boots were R.M. 'Greenlanders' which are ideal for cross-country ski-ing but far too flexible for any but the most moderate rock. Ordinary mountaineering boots with grooves cut in the heels were fairly satisfactory for ski-ing, using toe-straps.



## APPENDIX VII FOOD REPORT

by

Petty Officer M. E. Collins

Marine R. E. Twigg

1. The ration was based on the M.R.C. Summer Sledging Ration, after consideration of those used by the Scottish East Greenland Expedition 1963 and the Combined Services South Georgia Expedition 1965, using standard Service items wherever possible. It was intended that it should be supplemented by luxury packs. Contents and calorific value lists are enclosed. The higher C.V. 'B' ration was intended for use on the journeys to and from the coast. There were four varieties of meat bar and three of jam and chocolate within both ration scales.

2. The 'A' ration C.V. was probably just sufficient, no member of the Expedition lost weight, but other Expeditions in the area had basic rations nearer to 5000 cal. The 'B' ration C.V. was not sufficient for man-hauling in difficult country except in the best conditions but the deficiency was not great enough to be serious over the relatively short distances involved.

3. Unfortunately, the number of sledges available in the Spring necessitated omitting the luxury boxes, portions of which were carried in July. Not surprisingly, therefore, the main complaint was of monotony and the change to Imperial College's air-dropped diet constituted a highlight of the Expedition for those lucky enough to get it.

4. The main criticisms of the ration as such were as follows:

- (a) Both breakfast and the main meal could have been greatly improved in palatability and bulk by the inclusion of e.g. egg powder and A.F.D. vegetables which would have added little to weight. In particular, un-embellished Beef-and-Pork bar soon lost its charm and its appearance gave rise to consternation if not panic.
- (b) The quantities of sugar and milk powder did not equate to the quantities of porridge and coffee, and the Service milk powder was not easily re-constituted under these conditions.
- (c) Tea, supplied in the luxury boxes only, was sorely missed.

5. The packing, which was of particularly high standard and resisted all but the most determined assault, was designed with the April-July storage period too much in mind. It can now be seen that the outer wrappings were unnecessary and that lighter boxes would have been adequate.

### RATION SCALES

All rations were packed in two-man/day units as follows:

#### SCALE A

| Item                  | Weight             | Cals per man/day           |
|-----------------------|--------------------|----------------------------|
| Milk Powder           | 2 oz.              | 150                        |
| Chocolate             | 8 oz. (4 x 2 oz.)  | 628                        |
| Spangles              | 3 oz. (2 x 1½ oz.) | 174                        |
| Oatmeal               | 4 oz.              | 232                        |
| Salt                  | 1 oz.              | —                          |
| Sugar                 | 7 oz.              | 392                        |
| Meat Bar              | 6 oz.              | 575 (ave.)                 |
| Cheese                | 3 oz. (2 x 1½ oz.) | 217                        |
| Nescafe               | 2 oz.              | 198                        |
| Lemon Powder          | 2 oz.              | 112                        |
| Sultanas              | 2 oz.              | 72                         |
| Margarine             | 5 oz.              | 562                        |
| Biscuits              | 12 oz.             | 834                        |
| Onion Flakes          | 0.2 oz.            | —                          |
| Jam                   | 2 oz.              | 80                         |
| Nett Wt. /2-man /days | 59.2 oz.           | Total Cals. /man /day 4226 |

#### SCALE B—as A but add:

|         |          |      |
|---------|----------|------|
| Sugar   | 3 oz.    | 168  |
| Oatmeal | 1 oz.    | 58   |
|         | 63.2 oz. | 4452 |

#### Luxury Packs

Containing:

Sardines, Horlicks Powder, Drinking Chocolate, Rum Fudge, Mint Cake, Tea.



## APPENDIX VIII

### MEDICAL REPORT

by

Dr. N. Dilly, M.B., B.Sc.

1. The medical supplies that were placed at Conniats Bjoerg by the Spring party were adequate and comprehensive except for the omission of amethocaine eye-drops and some form of tubonic analgesic. The latter were carried in in July. The amethocaine drops were used on several occasions for the treatment of snow-blindness, to which one member was particularly susceptible.

2. An easy and simply injectable analgesic was required because the Expedition split into groups on several occasions and not everyone was skilled in the technique of giving injections. Twelve ampoules of tubonic omnopon were taken and divided between the three group leaders.

3. At the outset of the Expedition everyone was healthy and had had dental surveys and treatment before leaving the U.K.

4. The major problem of the march in was that of blisters. These were treated successfully in all cases by the application of **non**-waterproof elastoplast with dry dressing pads attached. In camp they were left exposed.

5. Due to prophylaxis with anti-sunburn oils, no painful cases of sunburn occurred although there were numerous cases of cracked and sore lips despite the use of lip-salve.

6. Despite drinking melt water there were no cases of diarrhoea until later on and none of those required active treatment. There was one case of diarrhoea and vomiting that may have been due to toxic enteritis but more likely gluttony. No ill effects resulted from the large meals consumed at the U.S.N. Base at Keflavik on the return.

7. One member lost a filling from an upper molar. Otherwise there were no dental problems.

8. Two members died, both as the result of head injuries with cerebral contusions. One was caused by a fall into a crevasse and the other by a rock-fall.

9. The leader of the Imperial College Expedition was treated for a first degree Potts fracture sustained whilst ski-ing in. It was decided not to evacuate him but to allow the leg to heal in plaster and to remove the latter for the journey out. This technique proved successful although he had only seven weeks in plaster.

10. While waiting for the charter flight to take the Expedition back to Reykjavik from Kulusuk, the Doctor visited the hospital at Angmagssalik at the kind invitation of Dr. Ole Maunessen. On arrival, the base doctor was found to be ill and in bed. For the next two days the Expedition Doctor stood in for her, performing two surgical procedures and a post mortem and retiring to bed considerably later than he had anticipated on what were nominally rest-days.



## APPENDIX IX

### PHOTOGRAPHIC REPORT

by

2nd Lieutenant C. H. Agnew, Royal Highland Fusiliers

#### Cine Photography

1. The Expedition borrowed a Bell and Howell 16mm. camera, a Weston V exposure meter and a neck-strap/monopod from Service sources.
2. The camera was not ideal being heavy and bulky and for this reason it was not possible to cover all aspects of the Expedition, in particular no filming was done in Schweizerland. Most of it was concentrated into about two days in the Conniat Bjoerg area and proved to be of sufficient quality to appear on I.T.N. A 50 ft. magazine camera is probably the best solution to the weight/bulk problem, but such are not available from the Services and funds did not permit of purchase.
3. The camera was fitted with a 1 in. lens only and 2x yellow filter (no colour film was shot). In the field there were occasions when the absence of either a long-focus or zoom lens was regretted but this had been considered beforehand and the weight and delicacy of these lenses coupled with the fact that the Expedition had no experienced cameraman were the deciding factors.
4. Film was F.P.3 (ASA 125) which was too fast for a camera that only stopped down to f.22, in the absence of neutral density filters which should have been remembered but were not.

#### Still Photography

5. All still photography was carried out with members' own 35mm. cameras. All aspects of the Expedition were covered in colour and most were duplicated in black and white. The colour film used was Ektachrome II (ASA 64) which was rather too fast for some of the cameras used. This was also true of the F.P.3 B. and W. film as many members did not have filters.
6. The total quantity of film provided was 44 x 20 colour and 30 x 36 B. and W. Since the geologist, who was necessarily one of the more active photographers, was using a half-frame camera well over 2000 shots were taken. This should have been sufficient, but needless to say, was not.



## APPENDIX X

### WEATHER REPORT

by

Lieutenant Commander M. B. Thomas, Royal Navy

Dr. R. H. Wallis

#### Spring Journey

1. For the first three days (6th-8th April) the weather was calm, predominantly overcast and without precipitation; the fourth day was brilliant. On the fifth day there was continuous light snowfall with a slight north-easterly breeze; this intensified on the sixth day and precluded movement, mainly on account of lack of visibility. By the seventh day about twelve inches of new snow had fallen, the wind had dropped, visibility remained poor but progress was possible. This storm appears to have been more severe at Kulusuk where it cleared almost all of Angmagssalik Fjord of 2 in. of ice. It was followed by two brilliant days and then the resumption of calm, overcast conditions.

2. The party did not carry a thermometer but it is thought that temperatures did not fall below minus 20 degrees Centigrade.

#### Main Expedition

3. The first seven days among the coastal mountains were made unpleasant by frequent rain although there was sufficient sunshine to enable the party to dry out. At Conniats Bjoerg during this period, July 14-20, there was rain and sleet.

4. From July 20 to August 10 only one foggy morning interrupted the succession of freezing nights and burning days.

5. August 10 marked a change in the weather pattern with an increasing number of days with wind, poor visibility and precipitation, thus: August 10/11 poor, 12-14 good, 15/16 very poor, 17-21 good, 22-31 poor to very poor. This final period was characterised by strong winds, nil visibility and heavy precipitation.  $4\frac{1}{2}$  feet of new snow fell at Conniats Bjoerg in three days and the snow-line had descended to 800 ft. above sea level by September 9. There were a few clear periods of about six hours each.

6. Periods of bad weather were heralded 3-12 hours in advance by white/black lenticular clouds and rising wind. During fine weather there was absolutely no wind which was surprising in a mountainous area with 6000 feet of relief and a diurnal temperature variation of 40 degrees C.

7. It is worth noting that Expeditions with previous experience in the area left Conniats Bjoerg by 20th August.



# APPENDIX XI

## BALANCE SHEET

| INCOME                                                                  |     | £     | £    |
|-------------------------------------------------------------------------|-----|-------|------|
| from Members' contributions .....                                       |     |       | 1589 |
| from Mount Everest Foundation .....                                     |     |       | 700  |
| from Nuffield Trust for the Forces of the Crown .....                   |     |       | 500  |
| from R.N. and R.M. Sports Control Board .....                           |     |       | 100  |
| from Scott Polar Research Institute (Gino Watkins Memorial Trust) ..... |     |       | 50   |
| from Royal Geographical Society .....                                   |     |       | 50   |
| from Service Non-Public Funds                                           |     |       |      |
| Commander-in-Chief, Plymouth .....                                      | 75  |       |      |
| Commander-in-Chief, Home Fleet .....                                    | 50  |       |      |
| Commander-in-Chief, Portsmouth .....                                    | 50  |       |      |
| Portsmouth Command Sports Fund .....                                    | 10  |       |      |
| Flag Officer Naval Air Command Amenities Fund .....                     | 25  |       |      |
| Major General Royal Marines, Plymouth .....                             | 10  |       |      |
| Flag Officer Sea Training .....                                         | 25  |       |      |
| HMS Lion .....                                                          | 10  |       |      |
| HMS Collingwood .....                                                   | 25  |       |      |
|                                                                         |     |       | 280  |
| from Polar Postal History Society .....                                 |     |       | 25   |
| from Press and Publishers .....                                         |     |       | 474  |
|                                                                         |     |       |      |
|                                                                         |     | TOTAL | 3768 |
| EXPENDITURE                                                             |     |       |      |
| Equipment .....                                                         |     |       | 332  |
| Victuals .....                                                          |     |       | 177  |
| Insurance of Equipment .....                                            |     |       | 167  |
| Training .....                                                          |     |       | 38   |
| Freight to Iceland .....                                                |     |       | 88   |
| Spring Expedition                                                       |     |       |      |
| Passenger fares .....                                                   | 182 |       |      |
| Air Charter from Reykjavik to Kulusuk .....                             | 500 |       |      |
| Hire of Dog Teams .....                                                 | 360 |       |      |
| Insurance of Greenlanders .....                                         | 19  |       |      |
| Miscellaneous .....                                                     | 89  |       |      |
|                                                                         |     |       | 1150 |
| Summer Expedition                                                       |     |       |      |
| Air Charter from Reykjavik to Kulusuk .....                             | 500 |       |      |
| Air Charter from Kulusuk to Reykjavik .....                             | 342 |       |      |
| Miscellaneous .....                                                     | 175 |       |      |
|                                                                         |     |       | 1017 |
| Printing .....                                                          |     |       | 120  |
| Miscellaneous .....                                                     |     |       | 21   |
| Refund of contributions of deceased members .....                       |     |       | 414  |
| Remainder to be given to widows .....                                   |     |       | 244  |
|                                                                         |     |       |      |
|                                                                         |     | TOTAL | 3768 |



## APPENDIX XII

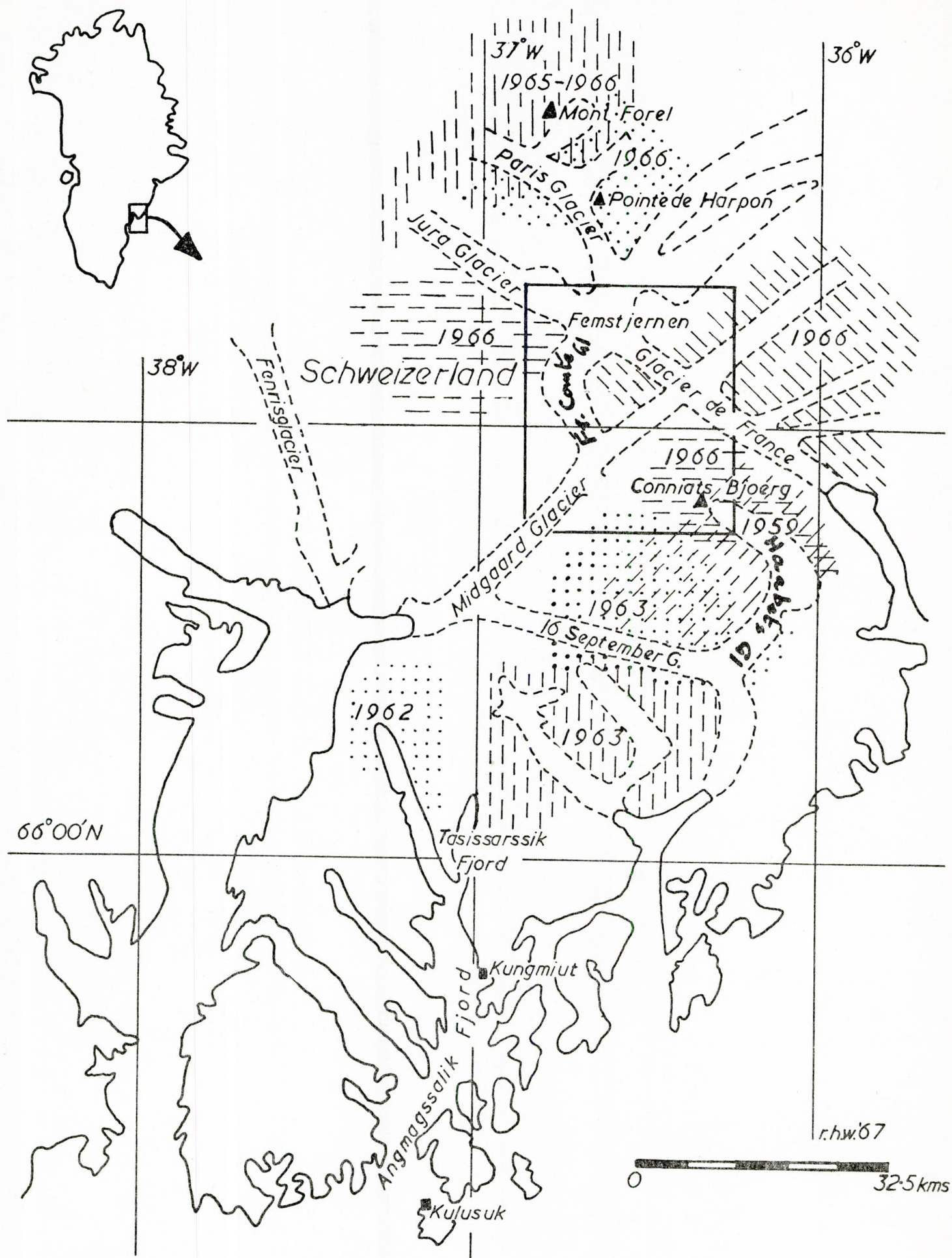
### MAPS

- |          |                                                  |
|----------|--------------------------------------------------|
| Figure 2 | Part of East Greenland showing Expedition routes |
| Figure 3 | Conniats Bjoerg                                  |
| Figure 4 | North East Schweizerland                         |



FIG.1

Location of Schweizerland, East Greenland



////// Austrian 1959

..... Danish 1962

||||| S.E.G.E. 1963

..... Swiss-German 1963

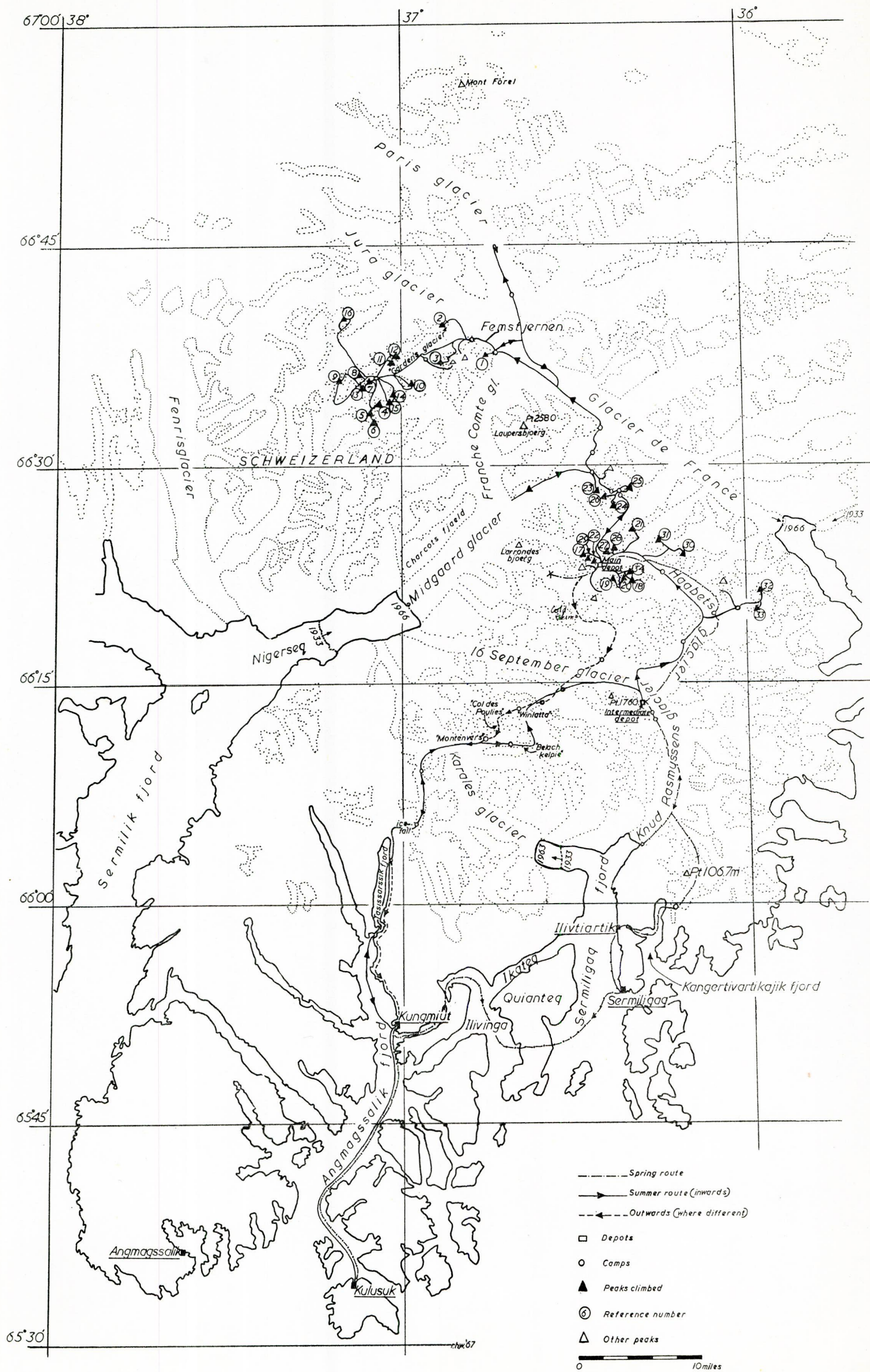
||||| Japanese 1965-66

..... Imperial College 1966

////// Swiss 1966

----- R.N.E.G.E. 1966







**FIG. 3**

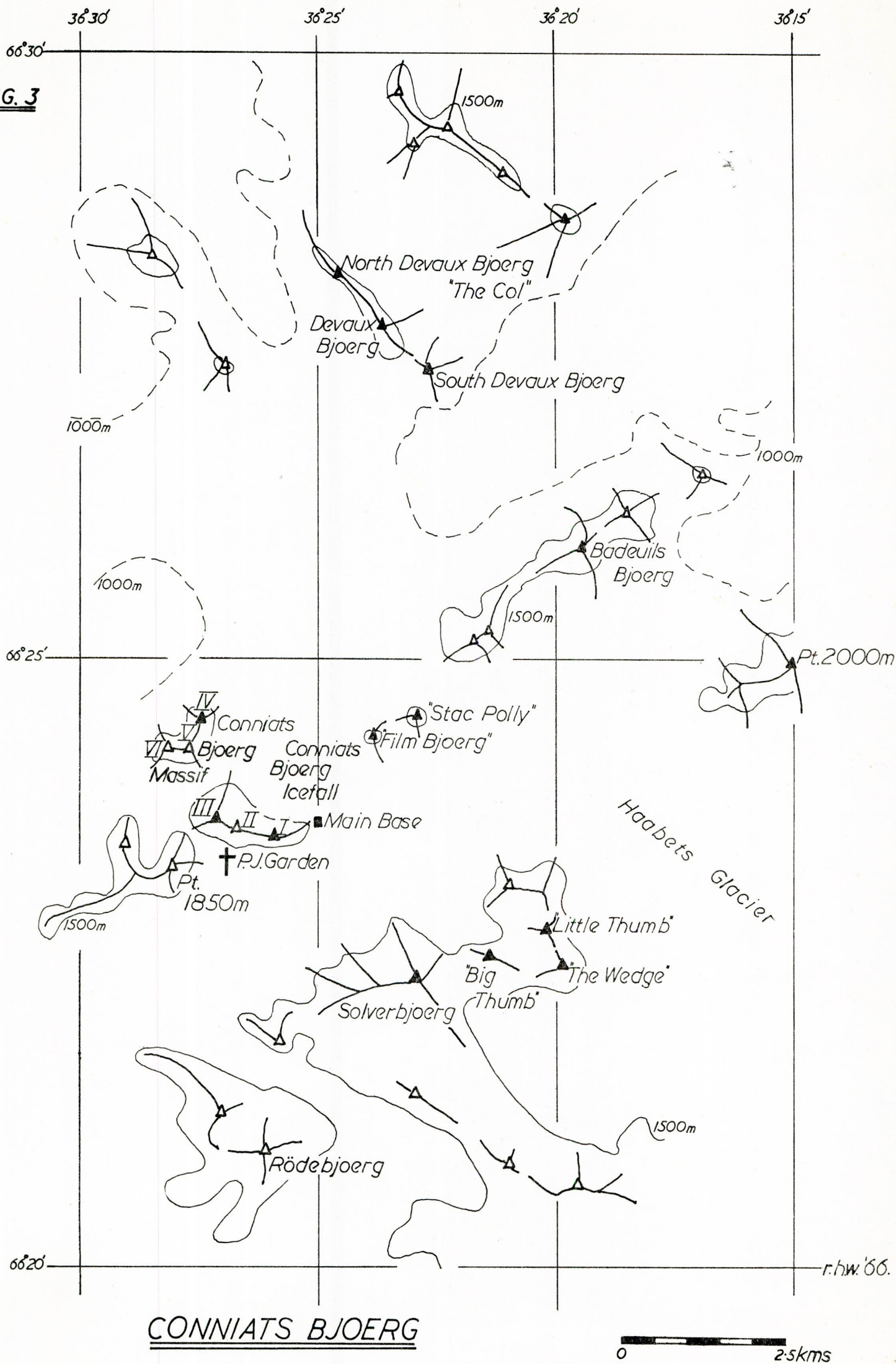
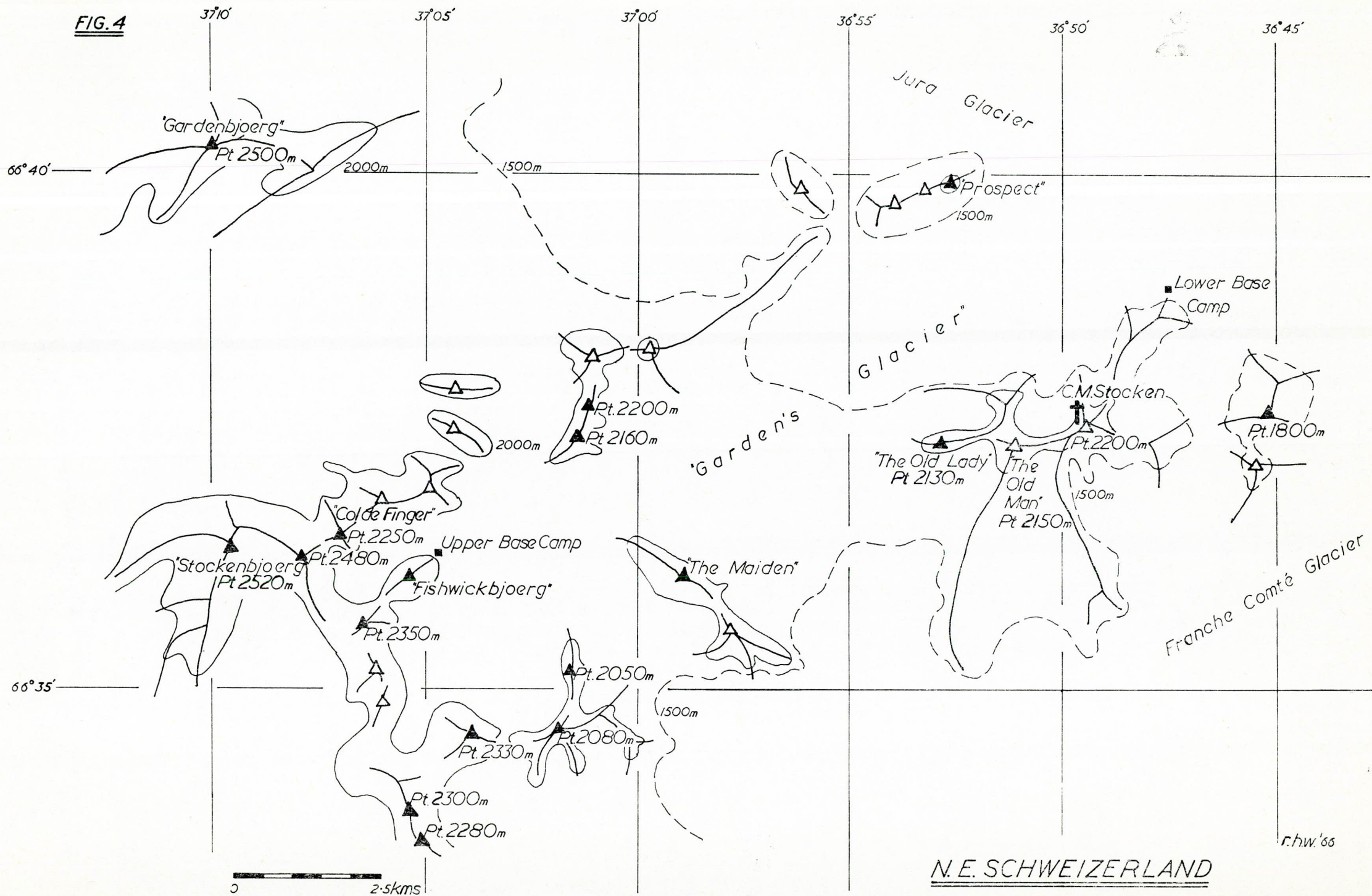
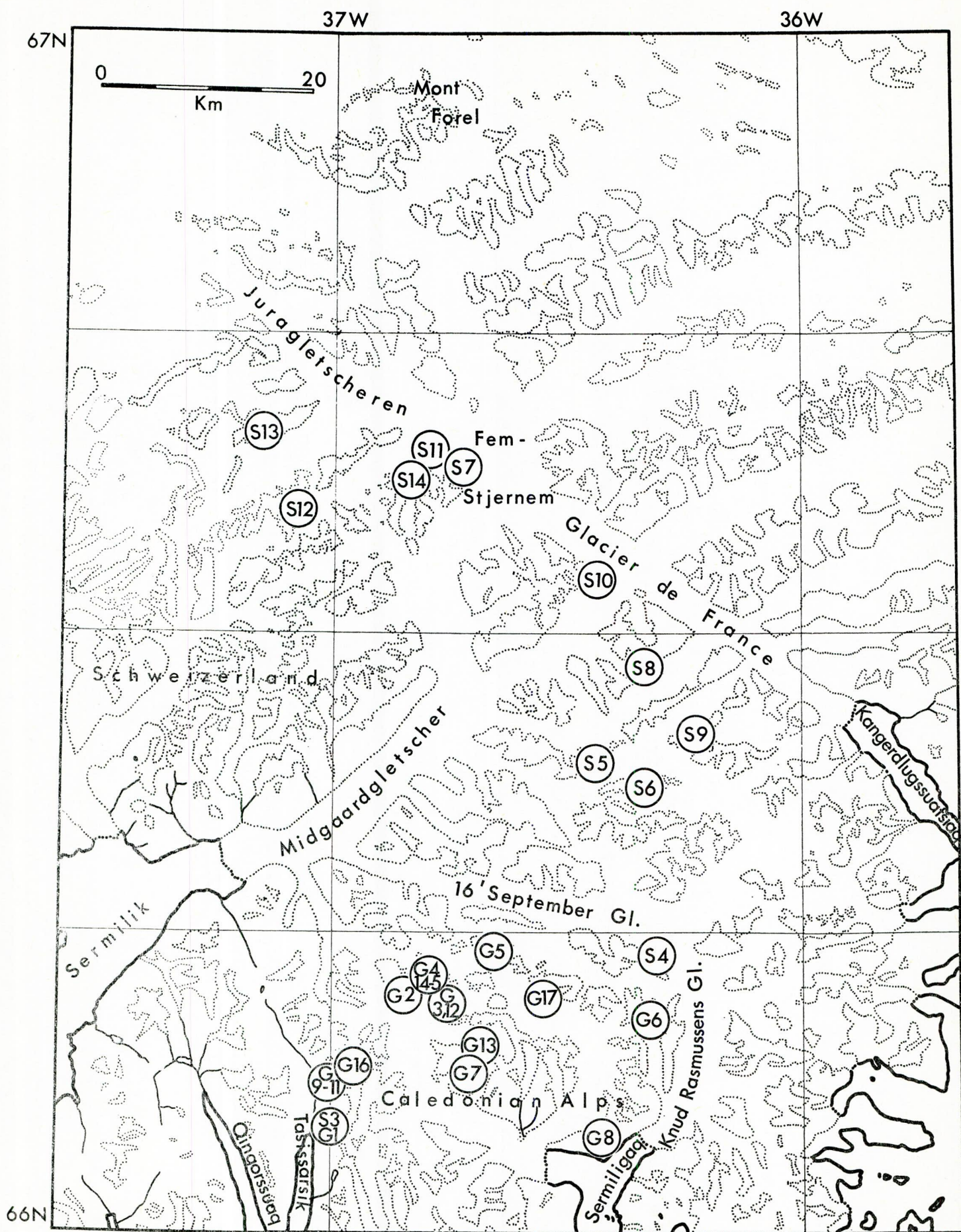




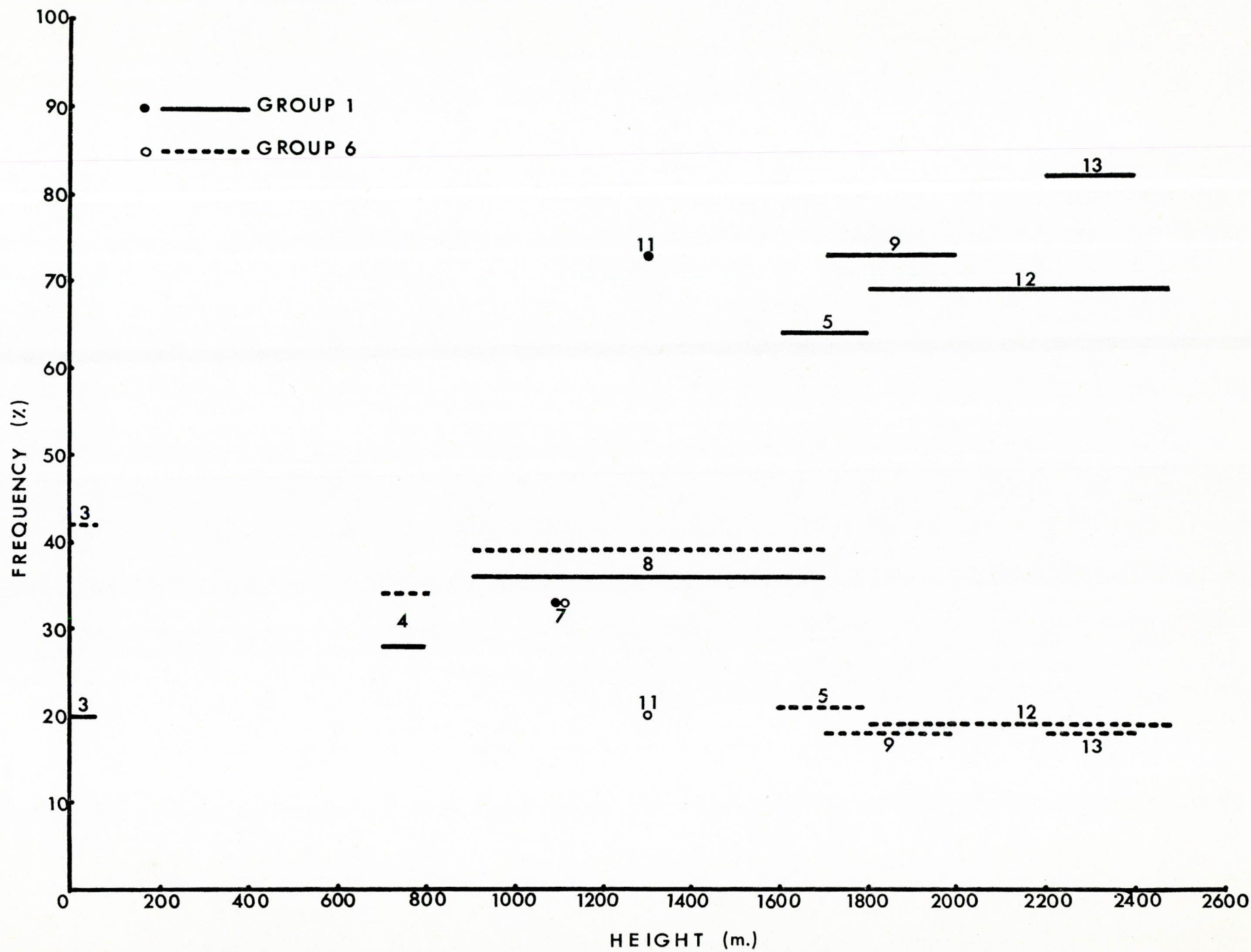
FIG. 4













## APPENDIX XIII

### ACKNOWLEDGEMENTS

The Expedition wishes to acknowledge with gratitude the assistance of the following organisations and individuals without whose help this adventure would not have taken place

#### Patrons

Sir Vivian Fuchs, M.A., Ph.D.  
Admiral Sir Varyll Begg, G.C.B., D.S.O., D.S.C.  
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Mount Everest Foundation  
Nuffield Trust for the Forces of the Crown  
R.N. and R.M. Sports Control Board  
Royal Geographical Society  
Scott Polar Research Institute  
Commander-in-Chief, Plymouth  
Commander-in-Chief, Portsmouth  
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Geodetic Institute

**Greenland**

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Hr. B. Svensen  
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Hr. E. Meyer  
Hr. Laennarts  
Hr. J. Kalia  
Hr. E. B. Sorensen  
Hr. C. Berg-Sorensen  
Hr. Chemnitz  
Hr. Borchersen  
Hr. Schaeffer  
Commanding Officer, U.S. Air Base, Sondre Stromfjord  
Captain and crews of M.Vs Signe Vest and Aarvak

**Dog-drivers**

Daniel Danielsen  
Thomas Ignatiussen  
Pavia Nathanielsen  
Albert Mikike  
Carl Mikike  
John Kalia  
Stephanus Kalia  
Tobias Uitsatikitsek  
Hjalmar Bajaie

**Individuals**

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Surgeon Commander L. G. H. Le Clerq  
Lieut. Cdr. F. R. Brooke  
Lieut. Cdr. M. K. Burley, M.B.E.  
Dr. G. J. Pert and members of the Imperial College East Greenland Expedition  
Hr. Sigi Angerer  
Dr. P. W. F. Gribbon and members of the Scottish East Greenland Expedition 1963  
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*Printed in the Printing Office of the  
Commander in-Chief, Plymouth*

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