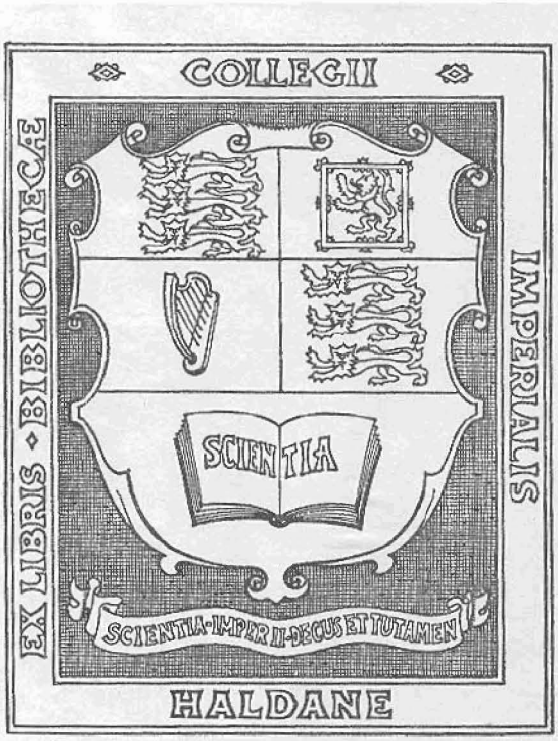
UNIVERSITY OF LONDON
BEERENBERG EXPEDITION
1961

IMPERIAL COLLEGE
EXPLORATION BOARD



THE BEERENBERG AND KJERULFBREEN

Photograph by PETER SMITH

Taken from the deck of SIGNALHORN anchored in KROSSBUKTA

Thursday, 15th June 1961.

PRELIMINARY REPORT

The 1961 University of London

BEERENBERG EXPEDITION

To North Jan Mayen Island, Greenland Sea

by

Frank John Fitch
(Leader)

Birkbeck and Imperial Colleges of the University of London
November, 1961

C O N T E N T S

PREFACE

This report is a dispassionate record of the activities and scientific achievements of the 1961 Beerenberg Expedition. It cannot convey the grief that overshadowed our work on Jan Mayen, resulting from the cruel and tragic loss of five of our members in a sea accident on Sunday the 25th June 1961. The untimely death of these five extremely able and likeable young men, our close friends and companions, with whom we had planned the expedition, and with whom we had been working on the preparations for months past, made it difficult and painful for the rest of us to carry on with our programme.

It was impossible to proceed with the high-level glaciological and geological investigations in the crater of the Beerenberg, which was to have been the next stage of our work, without these experienced mountaineers and sledgers, but whilst I was absent from Jan Mayen for medical treatment, the geological mapping of the flanks of the mountain was continued with great resolution.

The expedition was very fortunate in that it was able to recruit three new members to return to Nord-Jan with me. This enabled the glaciological work on Sorbreen started by Peter Smith's team from Imperial College to be completed, and some further parts of the general glaciological and mountaineering programme to be attempted.

Hard dedicated work by the remaining members of the expedition, helped by sympathetic and understanding co-operation from many other people, including particularly the Norwegian authorities, Birkbeck and Imperial Colleges and the Department of Scientific and Industrial Research, enabled the expedition to achieve finally a large part of its scientific objectives. Particular credit must be given to the four members of the first party who remained on the island after the accident, and to my deputy leader, John Banfield, who took the second geological party out to Jan Mayen, and directed their work with outstanding ability.

Frank J. Fitch.

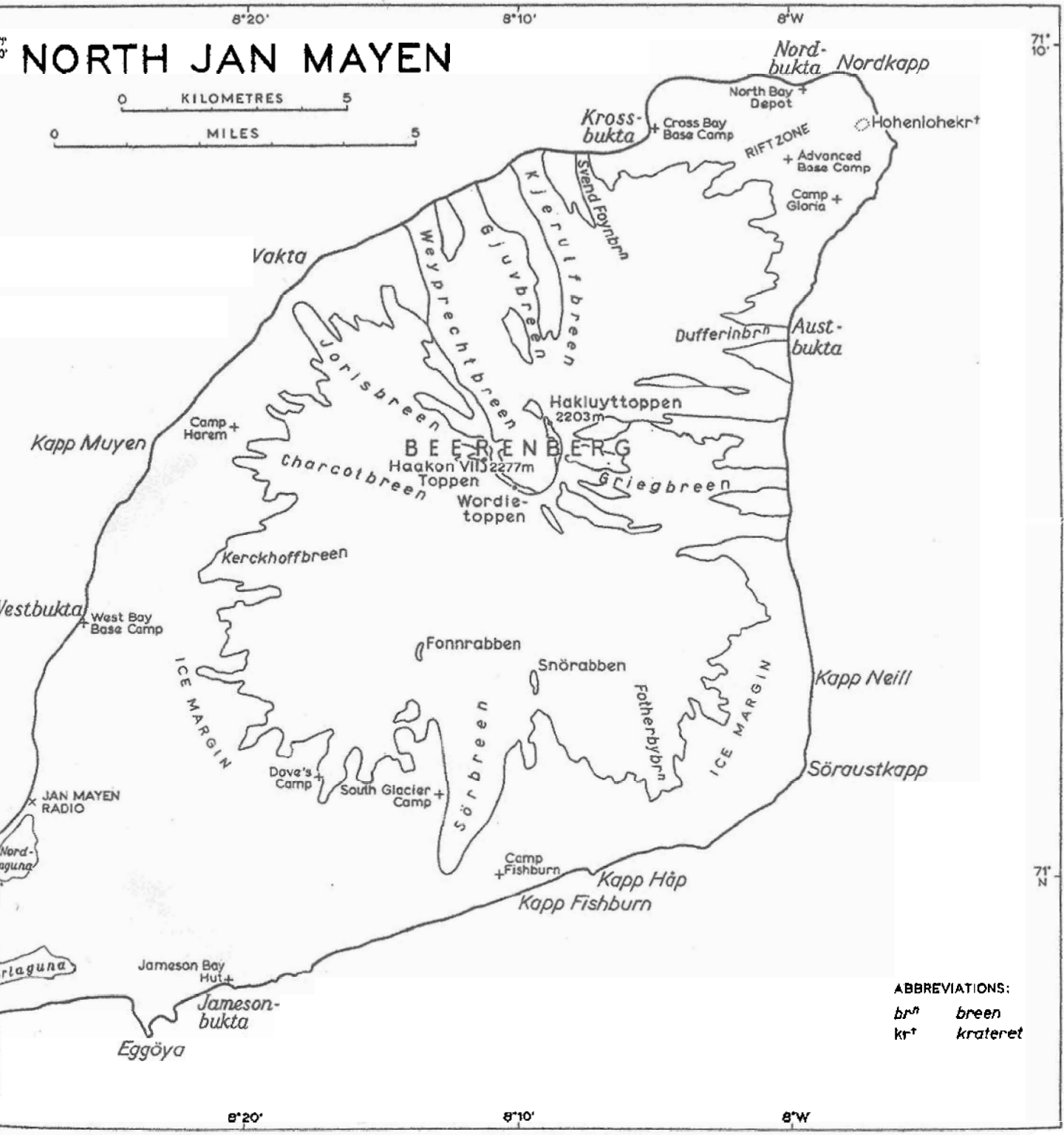
London, November, 1961.

As Deputy Leader of the Expedition there are certain remarks I would like to add to those expressed above. Firstly, I wish to emphasize strongly the great debt we owe to the kindness and generosity of the Norwegians stationed on Jan Mayen. Without their help and encouragement things would have been very different. I also wish to praise the members of the second geological party for their hard work and excellent spirit during the period they were alone on the island.

Finally, I feel that special mention must be made of the courage shown by Frank Fitch in returning to Jan Mayen so soon after his ordeal.

John Banfield.

Durham, November, 1961.


NORTH JAN MAYEN
0 KILOMETRES 5
0 MILES 5
8°20'
8°10'
8°W
71° 10'
71° N
Nord-bukta
Nordkapp
North Bay Depot
Kross-bukta
Cross Bay Base Camp
Hohenlohekr†
RIFT ZONE
Advanced Base Camp
Camp Gloria
Svend Foynbr^n
Kjerulfbreen
Gjuvbreen
Weyprechtbreen
Vakta
Dufferinbr^n
Aust-bukta
Jorisbreen
Hakluyttoppen 2203m
Camp Harem
Kapp Muyen
BERENBERG
Haakon VII's 2277m Toppen
Charcotbreen
Wordie-toppen
Griegbreen
Kerckhoffbreen
Vestbukta
West Bay Base Camp
Fonnrabben
Snörabben
Kapp Neill
ICE MARGIN
Sörbreen
Fotherbybr^n
ICE MARGIN
Söraustkapp
Dove's Camp
South Glacier Camp
JAN MAYEN RADIO
Nord-laguna
Camp Fishburn
Kapp Håp
Kapp Fishburn
Jameson Bay Hut
Jameson-bukta
Eggöya
ABBREVIATIONS:
br^n breen
kr† krateret

IN MEMORIAM

The five men who lost their lives on the expedition were:-

PETER SMITH

A twenty-three year-old research student in the Civil Engineering Department of Imperial College London. Deputy Leader of the Expedition particularly concerned with the glaciological side of the scientific programme. A very sound and promising young man, who was already the veteran of three Arctic expeditions, including a previous visit to Jan Mayen in 1959.

JACK COLE

The oldest member of the expedition at forty: a man of many talents and skills; acting as the principal photographer for the Expedition, and responsible for the running of the moter-boat and for radio communications. An experimental officer at the Post Office Research Station. He leaves a widow and three children.

JOHN FRASER

A research assistant in the Civil Engineering Department at Imperial College. Twenty-four years old: he accompanied Peter Smith on an expedition to Spitsbergen in 1960; was a keen member of the glaciological group sponsored by Imperial College Exploration Board over the last three years.

JOHN BOOTH

Another young research student in the Civil Engineering Department of Imperial College. At twenty-four he had already won academic distinction, and was regarded as a man of exceptional promise.

MARTIN SMITH

A twenty-five year-old research student in the Chemistry Department of Imperial College. Already an experienced explorer, he had spent two-and-a-half years in the Antarctic with the Falkland Islands Dependancies Survey, and was another of those who had been to Spitsbergen in 1960.

On the day of the accident Fitch and Cole brought the expedition motor-boat "Arctic Fox" from Krossbukta to Stasjonsbukta by Jan Mayen Radio. The motor-boat was a twin motor fibre-glass dinghy specially modified for near shore use in Jan Mayen waters by Cole. At Jan Mayen Radio they were met by Peter Smith, Booth, Fraser and Martin Smith, who had been working on Sörbreen for ten days. The plan was for all to return to the Expedition Base Camp at Krossbukta in preparation for a combined assault on the high-level ice field, summit and crater of the Beerenberg.

The first ten miles of the return coastal journey were accomplished without incident on a calm sea in bright sunshine. Near the point called Vakta, a sudden violent mountain squall capsized the boat, and only Fitch managed to survive the hundred yards swim to the shore, although everyone was wearing life-jackets and protective clothing. It is thought that the other five succumbed to the cold, which might have been as low as 28°F. The boat was capsized at 9.0 p.m. G.M.T. on the 25th June and Fitch alerted the Norwegian Radio Station at 3.20 a.m. the following morning, after traversing ten miles of difficult lava- and ice-covered country virtually in bare feet.

A full search for survivors was made by a team of Norwegians under F. Jensen and T. Raaby, and this was repeated by the Norwegian frigate "Garm", with Fitch on board, twenty four hours later. Martin Smith's body was recovered at sea on the 28th, and taken by "Garm" to Akureyri in Iceland. Here he was landed with full naval honours, and later flown to England for cremation.

The only other body to be recovered was that of Jack Cole, who was found by a member of the crew of "Signalhorn" on its return to Krossbukta with the second party on 14th July. Cole was buried beside the Expedition Base Camp in Krossbukta, and a short Burial Service was held by the members of the expedition present. A wooden memorial plaque to all those who lost their lives was put up, and a cross was erected at the head of Jack Cole's grave.

Fitch, Thomas, Birch and Raaby landed at Krossbukta again on the 8th August and attached an engraved metal memorial plaque to the large ankaramite-basalt boulder behind the grave. The plaque reads as follows:-

TO THE MEMORY
OF
JOHN FREDERICK COLE WHO LIES BURIED HERE
AND OF

JOHN DAVID BOOTH	CYRIL MARTIN SMITH
JOHN ROBERTSON FRASER	PETER SMITH

MEMBERS OF AN EXPEDITION TO NORTH JAN
WHO LOST THEIR LIVES INSHORE ON 25th JUNE 1961

MAY THEY REST IN PEACE

Before leaving the island for good on the 15th August, the expedition ship "Signalhorn" put into Krossbukta for the last time. The engines were stopped, and members of the expedition and the crew of "Signalhorn" observed a two-minute silence in memory of the lost men.

A Memorial Service was held on the 12th October 1961 at Holy Trinity Church, Prince Consort Road, London, for those who lost their lives off Jan Mayen Island, and for three other members of Imperial College who lost their lives whilst climbing in the Alps. An Address was given by the Bishop of Kensington.

'Some set out to explore
earth's limit, and little they recked if
Never their feet came near it
outgrowing the need for glory:'
.....
'Their spirits float serene
above time's roughest reaches,
But their seed is in us and over
our lives they are evergreen.'

C. Day Lewis.

INTRODUCTION

Jan Mayen is an arctic island situated between 70°49,6' and 71°9,6' N.Lat. and between 7°56' and 9°05' Long.W. The island is 36.5 miles long, up to 10 miles broad in the north-eastern part, only 1.5 miles across in the central part and up to 4 miles broad in the southern part. The total area is 150 square miles. The whole island is built of volcanic rocks, with only minor intercalations of terrestrial sediments and glacial deposits. The northern part is dominated by the 7,470' volcanic mountain Beerenberg. A chain of submarine peaks and ridges towards the north-east and south-west shows that volcanic eruptions have taken place along this line. Jan Mayen lies on an important volcanic and seismic line, the Mid-Atlantic Ridge. No volcanic eruptions have occurred on Jan Mayen in recent years, but in some places steam still escapes from small fissures. Some eruptions are reported in older literature, such as those of 1732 and 1818, probably from Eskkrateret.

The dominant rock-types on Jan Mayen are basaltic lavas, but a whole series of intermediate lavas and intrusions leading to trachytes and rare quartz-bearing rocks can be found in small quantity, especially in Sör-Jan. Various agglomerates and tuffs, are widespread, and some tillites and morainic deposits are to be found. The age of the island is not known with certainty, but it is likely that a Recent volcanic edifice has been built on a basement consisting largely of late-Tertiary volcanics. The sands along the coast are very rich in olivine and magnetite. Erosion is rapid: large changes in the coastline have occurred within historical times. Minor earthquakes are frequent on Jan Mayen.

The flora of Jan Mayen is very poor, but the green and orange-yellow patches of mosses and lichens form a striking contrast with the predominantly dark colours of the rocks. Much of the land surface is entirely without soil or plant cover, and in Nord-Jan over half the surface is beneath permanent ice- or snowfield. The arctic fox is the only non-migratory mammal that lives on the island, but during the winter polar bears are occasionally seen. The bird life is very rich, especially in summer, when large quantities of guillemots, little auks, gulls, Fulmar petrels and other birds nest in the steep rock cliffs.

The climate is poor. The annual mean temperature is 0.0°C, the mean for the warmest month being only 6.1°C. Storms are frequent, and may be of great violence. Fog often covers the island for weeks inbetween periods of high wind. The midnight sun shines for 73 days from 16th May until 27th July, and the sun is absent from 18th November until 25th January. Between Jan Mayen and East Greenland runs the cold Greenland current, carrying large masses of polar ice, which often surround the island in winter and spring. There is no harbour on Jan Mayen, all landings must be from small boats. Large quantities of drift-wood, mainly of Siberian origin, are seen on the beaches, along with whitened whale-bones left from the whale factories of the early seventeenth century. Norwegian sealers catch Greenland seal on the ice west of the island in March and April, but very little whaling is now possible.

There are two small permanent stations on Jan Mayen. The meteorological station has been established since 1921, firstly at Jamesonbukta, but since the war, at Jan Mayen Radio overlooking Nordlagunn. In 1959 a Loran station was built at Bätvika in Sör-Jan.

The discoverer of the island is not known with certainty. There are a few ambiguous references to what may be Jan Mayen in the earliest literature. An Irish monk may have known of the island in the 6th Century, it is possibly referred to in the Icelandic Sagas of 1194 and in a book published in Venice in 1558, but it was not until the early 17th Century that it was generally known to mariners. English captains probably discovered the island and named it "Hudson's Tutchos" and later "Trinity Island", but it is named "Jan Mayen" after the first authenticated discoverer, Jan Jacobsz. May, who visited it in July 1614. A period of intensive whaling followed, in which there was bitter rivalry between Dutch and English ships. This lasted until about 1642, and after this few vessels went near to the island.

Scientific observations were made by Robert Fotherby in 1615 and by William Scoresby Junior in 1817. Carl Vogt stayed four days on the island in 1861, and a Norwegian expedition landed in 1877. Apart from these visits, only perfunctory observations were made before the Austrian Polar Year Expedition wintered on Jan Mayen in 1882-83. Amongst other scientific work the Austrians produced a map of the island on the scale of 1:100,000. Many short visits were made between 1883 and 1921, when the first permanent station was established at Jamesonbukta. Sir James Wordie was a member of a scientific party that stayed on Jan Mayen in the summer of 1921: he made a broad geological and glaciological reconnaissance of the island and was a member of the first party to climb the Beerenberg. Since 1921, eight British expeditions have visited Jan Mayen, in 1934, 1938, 1947, 1950, 1959, 1960 and 1961. These have been mostly University parties, from London, Oxford and Reading. Birkbeck and Imperial Colleges of London University have been involved in five of these expeditions, and Dr. A.T.J. Dollar of Birkbeck College has been on Jan Mayen for no less than five summers.

Jan Mayen has been Norwegian territory since 1929. The publication of a new map on the scale of 1:50,000 by the Norsk Polarinstitutt in 1959, and its making available the 1:20,000 sheets from which this was prepared, has greatly facilitated other scientific work on the island.

The Beerenberg (71°05' N.-8°10' W.), is the large volcanic mountain that occupies the whole north-eastern part of Jan Mayen. The uppermost part is an ice-filled crater bordered by a circular ridge with several peaks, the highest of which is Haak à VII Topp, 7,470'. Other prominent peaks are Wordietoppen, Mercantontoppen and Hakluyttoppen. Fotherby named the mountain Mount Hakluyt in 1615, but the name passed into oblivion, and was superseded by the name Beerenberg (= Bear Mountain) in 1633. The southern part of the Beerenberg is covered by a large glacial area called Kronprins Olavs Bre,

and the north-eastern part by a somewhat smaller area named Kronprinsesse Marthas Bre. On the east and northern sides large glaciers flow down to the sea. In all some twenty glaciers radiate from the central cone. The Weyprechtbreen has its origin in the crater of the Beerenberg, and flows very steeply down to the sea in just over three miles. The first persons known to have ascended the Beerenberg are Wordie, Mercanton and Lethridge in 1921. The mountain was climbed again in 1927, 1933, 1938, 1944, 1950, 1959 and 1961, all except Odell in 1933 using a southerly route. A complete traverse of the crater rim has not been made, nor has the actual crater itself been entered. The glaciers and high sea-cliffs make it very difficult to travel around the flanks of the mountain.

AIMS

The Beerenberg Expedition was an entirely scientific expedition concerned mainly with geological and glaciological investigations in the northern half of Jan Mayen Island. Its principal objectives were the production of a large-scale geological map of Nord-Jan, and a further detailed study of the large glacier, Sörbreen. Minor objectives included the collection of oriented samples for palaeomagnetic studies, general observations on the fauna and flora, the gathering of a lichen collection for the British Museum (Natural History), extensive record photography and the making of a colour cine film. Mountaineering was necessary to the scientific programme, and it was expected that stores would be transported by sledge across the northern icefield and a camp set-up within the crater of the Beerenberg.

The volcanic accumulation of the Beerenberg is interesting because of its large size and its Oceanic situation on the Mid-Atlantic Ridge. It has been suggested that the Mid-Atlantic Ridge is the site of a "world crack", and in this connection it is significant that the Beerenberg, (like the Hawaiian volcanoes), sits on a large volcanic rift, and that evidence of fissure eruption is widespread on Jan Mayen. The mechanics of volcanic eruption can be readily studied on Jan Mayen as a result of the unweathered and vegetation-free nature of much of the rock outcrop.

A considerable amount of geological reconnaissance work in Nord-Jan was done on pervious British expeditions. Wordie, Ashby, Nichols, Carstens and Dollar must be mentioned especially in this connection. Fitch and Banfield made a further reconnaissance of the Nordkapp area in 1959. The principal geological objectives of the 1961 programme were all related to the 1:10,000 geological field map of Nord-Jan that it was intended should be made. A tentative stratigraphy was suggested by Fitch and Banfield in 1959; this was to be tested during the mapping, and extended or corrected as necessary. The final result of this work was to be the production of a detailed account of the geological and volcanic history of Nord-Jan and the Beerenberg, revealing the relationships between the various volcanic centres and fissure systems. As well as this study of the relative age relationships of the rocks, it was hoped that some evidence of the actual ages might be found, either from specimens suitable for radioactive age determinations, or indirectly, from a correlation of the denudation chronology and glaciological evidence with known climatic and eustatic changes in the North Atlantic basin. Extensive rock collections were to be made, for laboratory investigations of the petrography and petrochemistry of the rock suites of Nord-Jan, and detailed studies of selected areas were to be made in the field, to assist in the unravelling of the petrogenesis of the rocks and to help towards the understanding of the mechanics of magmatic intrusion and extrusion in such a basaltic province. The volcano-tectonic structure of Jan Mayen presents a fascinating problem, and it was hoped that the detailed mapping would lead to further advances in this field.

From a glaciological point of view, the crater ice-field and the exceptionally fast moving glaciers that radiate from the cone of the Beerenberg present a uniquely interesting field of study. The forward surge of Sörbreen, observed by a party led by Peter Smith in 1959, coming as it did after a long period of glacier retreat, would, if confirmed, have important climatological implications. Interesting and unusual rime-formations, dead-ice masses and permafrost structures to be found on Jan Mayen all demand detailed investigation.

Glaciologists from Imperial College have been active on the Beerenberg since 1938, when a map of Sörbreen snout was made by Ward and Jennings. Peter Smith, Kinsman, Wright and Chadwick from Imperial College made a further detailed survey of Sörbreen during the 1959 Jan Mayen Expedition led by Dr. Dollar. The glaciological programme for 1961 included, firstly, a repetition and enlargement of the detailed surveying and investigation of Sörbreen, to enable long-term comparisons to be made with the known observations on this glacier going back to 1817, and secondly, a general glaciological survey of the whole ice-field and glacier system of the Beerenberg. This general survey was intended for comparison with the aerial photographic cover taken in 1949 and 1950, and with the observations of the 1959 expedition. In 1959 it was suggested that the advance of Sörbreen was not an isolated occurrence, and that the whole ice-field of the Beerenberg was becoming active. It was hoped to obtain confirmation of this suggestion, and to make a record of the 1961 state of the Beerenberg ice for the use of future investigators. The extensive photography that was planned was mainly intended for this purpose.

In order to carry out the geological and glaciological programme it was intended that some difficult mountaineering should be accomplished, including traverses of the crater rim, descent into the crater and climbs on several of the rock walls bounding glaciers and overlooking the sea. The other objectives of the expedition, the geophysical and biological observations, were to be regarded as incidental to the main geological and glaciological tasks.

PERSONNEL

FIRST PARTY: Sailed from Inverness on 10th June 1961.

FRANK JOHN FITCH, B.Sc., F.R.G.S., F.G.S. (36)
Leader and Scientific Director
Lecturer in Geology, Birkbeck College London.

PETER SMITH, B.Sc.(Eng.), A.C.G.I., D.I.C. (23)
Deputy Leader (Glaciology)
Research student, Imperial College London.

DAVID THOMAS, B.Sc. (36)
Climbing advisor and Emergency Leader
Experimental Officer, H.M. Geological Survey.

TERENCE RONALD WILFRED HAWKINS, B.Sc. (28)
Geological team-leader (Northern Sector)
Experimental Officer, H.M. Geological Survey.

BRINLEY ROBERTS, B.Sc. (28)
Geologist
Assistant lecturer in Geology, Birkbeck College.

JOHN FREDERICK COLE, (40)
Photographer and boat operator
Experimental Officer, G.P.O. Research Station.

JOHN DAVID BOOTH, B.Sc. (24)
Glaciologist
Research student, Imperial College London.

JOHN ROBERTSON FRASER, B.Sc. (24)
Glaciologist
Research student, Imperial College London.

CYRIL MARTIN SMITH, B.Sc., A.R.C.S. (25)
Glaciologist
Research student, Imperial College London.

PETER JAMES DESMOND GUILE, (27)
General Assistant
Technician, Imperial College London.

(Peter Smith, Booth, Cole, Fraser and Martin Smith lost their lives on the 25th June 1961. Fitch was away from Jan Mayen from 28th June until he returned with the third party).

SECOND PARTY: Sailed from Aalesund on 10th July, 1961.

JOHN BANFIELD, B.Sc. (31)
Deputy Leader
Lecturer in Teachers Training College, Durham.

BRENDA BLANCHE FOX, B.Sc. (28)
Geological team-leader (Southwest Sector)
Mineralogist, Overseas Geological Surveys.

ARTHUR WADE WELLS, B.Sc. (32)
Geological team-leader (Southeast Sector)
Schoolmaster, Chingford County High School.

JOHN DAVID SLADE, (34)
Geologist
Schoolmaster, Bethnal Green.

ROSEMARY JEAN CONRAN, B.Sc. (29)
Geologist and Naturalist
Civil Servant, British Museum (Natural History).

CHRISTOPHER TALBOT, (20)
Geologist
Student, Imperial College London.

(On the arrival of the second party, Thomas, Hawkins, Roberts and Guile returned to England. Thomas came back to Jan Mayen with the third party).

THIRD PARTY: Sailed from Aalesund on 4th August, 1961.

FRANK JOHN FITCH and DAVID THOMAS returned to Jan Mayen,
accompanied by:-

DAVID JOHN JAMES KINSMAN, B.Sc. (23)
Geologist and Glaciologist
Research student, Imperial College London.

JOHN WILSON SHEARD, B.Sc. (21)
Glaciologist and Botanist
Demonstrator, Imperial College London

DESMOND CONNELL BIRCH, (32)
Climber
Schoolmaster, Ilkley, Yorkshire.

DIARY OF EVENTS

Fitch and Peter Smith began making the first tentative arrangements for the Beerenberg Expedition in October 1960. Applications for financial support and for permission to work on Jan Mayen were mostly made before the end of the year. Several meetings were held in the early months of 1961 to decide upon personnel, scientific programme and to discuss logistics. The first item of expenditure was maps and aerial photographs bought from the Norsk Polarinstitutt in March. By the end of April the expedition was certain of financial support, and gathering of the necessary stores and equipment was well under way.

The bulk of the stores and equipment was collected in 27, Torrington Square, W.C.1., a house generously made available to the expedition by Birkbeck College. A great deal of time and effort was put into packing these stores in appropriate loads for dumping at different depots on Jan Mayen, as required by the scientific programme. All members of the expedition worked on this job. At the same time Cole was working on the modification of the motor-boat loaned by Birkbeck College, to make it suitable for near-shore use in Jan Mayen waters. Various members concerned with aspects of the logistics and programme put in a lot of hard work to ensure the success of our efforts.

The final packing of the expedition stores and equipment was completed on the morning of Wednesday, 7th June 1961, and these were loaded into a removal lorry owned and driven by Mr. Reed of Sawbridgeworth in the afternoon. The lorry was to convey them to Inverness, and to meet the members of the First Party there.

The expedition ship, the M/V SIGNALHORN, a chartered 133-ton Norwegian arctic sealer, owned by Martin Karlsen of Brandal, near Aalesund, sailed from Aalesund at 02.00 hours on the 8th June. It had a crew of eight; Captain Bjarte Brandal. Peter Smith caught the night train from London that evening and was joined by David Thomas from Leeds.

Peter Smith and Thomas spent the 9th June in Inverness making final arrangements for the expedition departure. Fitch, Cole, Guile, Booth, Hawkins and Roberts caught the night sleeper, and were met in Inverness on the morning of the 10th by Peter Smith, Thomas, Martin Smith and Fraser. SIGNALHORN docked at 9 a.m., and after an initial disturbance over the non-arrival of film stock, members were able to unload the lorry and re-pack the stores and equipment in the hold of the ship. Customs and other formalities were completed at 8 p.m., and the ship sailed at 10.30 p.m. on the 10th June. Peter Smith and Fraser travelled in the pilot boat until the pilot was dropped. A school of porpoises followed the ship out.

On Sunday, 11th June, SIGNALHORN sailed east of the Pentlands, Orkneys and Shetlands on a dead calm sea and in blazing sun. Only one member of the party was sea-sick.

The next two days continued an unusual dead calm whilst the ship sailed north across the Arctic Circle. Members of the expedition took their turn at the wheel, and explored the crow's nest and other parts of the ship.

The Beerenberg was first sighted at 4 p.m. on the 14th June, and gradually the whole of Jan Mayen rose out of the sea. SIGNALHORN sailed around the southern extremity of the island in magnificent weather, and anchored off Jan Mayen Radio for the night (this was, of course, during the period of midnight sun, so there was no darkness). The members of the expedition went ashore to pay their respects to the Commander of the Norwegian station, Finn Jensen, and to meet the other Norwegians on the island. As SIGNALHORN was the first ship to call this year, a toast or two in the expedition whiskey was much appreciated.

The real work of the expedition started on the 15th June. Stores depots were laid down at Vestbukta, Krossbukta and Nordbukta. The Expedition Base Camp was established at Krossbukta by Fitch, Hawkins, Thomas, Roberts, Guile and Cole. The period of calm sea was broken late that evening, as SIGNALHORN left Nordbukta with Peter Smith, Martin Smith, Booth and Fraser aboard. A proposed stores depot at the snout of Sörbreen could not be laid down, and during an attempted landing in Jamesonbukta one of the ship's lifeboats was swamped in the surf, and had to be abandoned after lashing it to some nearby rocks. Captain Brandal and the glaciological party were picked up by the ship's other lifeboat, and SIGNALHORN returned to Krossbukta to report this accident to the Leader.

On the arrival of SIGNALHORN at Krossbukta on the morning of the 16th, Fitch, Cole and Guile went aboard from "Arctic Fox". Fitch spoke to Jensen on the radio telephone, and through his good offices was very kindly offered assistance from the Norwegians under Torstein Raaby at the Loran station. It was arranged that SIGNALHORN should unload the remainder of the stores at Kvalrossbukta, and that they would be transported to Jamesonbukta overland by tractor and lorry. This was done, and the glaciological party was established at Jameson Bay Hut by that evening. The tractor was used to recover SIGNALHORN's lifeboat. In the meantime the main party worked on strengthening the avalanche walls around the Cross Bay Base Camp, and tried unsuccessfully to establish radio contact with Jan Mayen Radio. This was never accomplished, presumably due to the screening effect of the great mass of the Beerenberg.

No work was possible at Krossbukta on the 17th June, owing to heavy rain, but the glaciological party on the south side of the Beerenberg were able to commence their work on Sörbreen. Peter Smith's diaries were lost in the accident on the 25th, but it is known that the glaciologists had a very successful eight days' work between the 17th and 24th June. They established South Glacier Camp, re-surveyed the snout of Sörbreen, inserted and surveyed four lines of stakes across the glacier, at 100-, 300-, 600- and 900- metres above sea-level, placed painted boulders

in known positions downstream from the stakes, and drilled several holes in the ice for the insertion of a series of thermistors. The weather during this period was fine on Sörbreen, and the skiing conditions at high-level were excellent. SIGMALHORN sailed for Aalesund on the 19th June.

On the 18th the main party began moving stores from North Bay Depot to establish an advanced base camp in the North Cape Rift Zone, at about 2,000ft, or as high as possible, from which the proposed crater camp could be approached, and from which the high-level geological mapping of the northern sector could be attempted. Opportunity was taken on this and other stores lifting journeys to start geological collecting, also the more general observations and filming. Between the 18th and the 24th June an Advanced Base Camp, consisting of two mountain tents, food and fuel stores, skiing and mountaineering equipment was set-up at 1,800ft. just below the ice-field. A further three-man camp was set-up at the southern end of Marmadukeflya for the use of the geologists, and named Camp Gloria. During this period the weather was variable, with rain and heavy snow-storms alternating with sunny days. "Arctic Fox" made many trips from Krossbukta to Nordbukta and back in rough seas. Each day, after carrying a load out on a pack frame, the geologists spent the afternoon mapping and making rock collections.

By the 25th June, when Fitch and Cole set out to bring the glaciologists north to join the main party, the first phase of the expedition programme had been very successfully completed. All was then ready for the high-level work to commence. Thomas, Hawkins, Roberts and Guile crossed Svend Foynbreen on the 25th and made rock collections between this glacier and the Kjerulfbreen. The tragic accident occured after Fitch and the men who lost their lives had spent a pleasant afternoon with the Norwegians at Jan Mayen Radio discussing their progress and plans. The four men at Krossbukta knew nothing of the accident until Fitch returned there in GARM on the 28th. In the meantime, the geologists, Hawkins and Roberts, had spent two days mapping from Camp Gloria. Two slight earthquake shocks were noticed at both Base Camp and Camp Gloria at near 10.00 p.m. B.S.T. on the 26th June.

On the departure of GARM from Krossbukta, Guile set out to recall the geologists from Camp Gloria. The four remaining members of the First Party set out from Cross Bay Base Camp for Jan Mayen Radio at 3.0 p.m. on the 28th June, led by Thomas, who now took over as Emergency Leader of the expedition. They searched all beaches again on this march, and looked for any other signs of survivors, but found nothing beyond Fitch's footprints and the tracks of the earlier Norwegian search parties. It took them six hours to cross the four large glaciers, and thirteen to reach Vestbukta. Here they had a meal and a few hours sleep before proceeding to Jan Mayen Radio to await instructions on the expedition's future from London. Three days were spent enjoying the warm hospitality of the Norwegian staff of the station. On the 2nd July a

cable was received from London saying that a decision would not be made for a week, so the party moved to Jameson Bay Hut. During the three days they were at Jamesonbukta the weather was bad, but Roberts and Guile collected the most valuable equipment left by the glaciologists at South Glacier Camp, and the geologists spent one day mapping in the Ekerolddalen. The party moved back to Jan Mayen Radio in a gale on the 5th July.

There was still no news from London, but the party decided that they must move back to Krossbukta and make an attempt to continue with the expedition programme for the northern sector whilst it was still possible. Fortunately a message was received confirming the continuation of the expedition before they left Jan Mayen Radio on the 6th June. Cross Bay Base Camp was reached after a tiring fifteen hours march, which included crossing the glaciers, in the early hours of the 7th July.

The geologists were able to get in a further two days mapping from Camp Gloria on the 8th and 9th July. After this the weather was bad for several days, and although rock-collecting forays were made from Cross Bay Base Camp, it was not possible to cross any of the East Coast glaciers. The days before the arrival of SIGNALHORN on the 14th July were spent mapping southwestwards towards Weyprechtbreen, and in completing detailed rock-collections.

The Second Party flew from London Airport to Oslo on the 9th July. They travelled by overnight sleeper from Oslo to Aalesund, and joined SIGNALHORN on the 10th July. The Second Party was led by Banfield, and included Miss Fox, Miss Conran, Wells, Slade and Talbot. Dr. Dollar's "1961 Birkbeck College Jan Mayen Expedition", consisting of himself and two companions, J. Guest and J. Hayward, were transported to Bätvika in Sör-Jan by SIGNALHORN on this occasion. As the senior British scientist present, Dr. Dollar kindly took over responsibility for liaison with the Norwegian authorities during the absence of the Leader. SIGNALHORN sailed from Aalesund on the 10th July and arrived at Bätvika on the 13th. The arrival of two Englishwomen made a definite impression on the staff of the Loran station. After taking Baaby on board SIGNALHORN proceeded to Krossbukta, where it arrived on the morning of the 14th July. The expedition Base Camp was broken for removal to Vestbukta, and most of the stores were recovered from North Bay Depot. A food and fuel dump, that might be of some use to shipwrecked sailors, was, however, left at Nordbukta. It was during the loading of stores from Krossbukta that the Deck Boy of SIGNALHORN, Kjell Yri, discovered the body of Cole amongst the rocks on Koksneset. Cole was buried on an improvised stretcher made from a pair of skis.

The six members of the second party were landed and their stores unloaded at Vestbukta between 10.00 a.m. and 12 Noon on the 15th July. SIGNALHORN sailed to Jan Mayen Radio with Thomas, Hawkins, Roberts and Guile, and after farewells there, rounded the southern part of Jan Mayen

in an attempt to put Dollar, Guest, Hayward and Raaby down at Bätvika. This was impossible because of heavy seas, and the ship had to return to Kvalrossbukta before they could disembark. SIGNALHORN reached Aalesund on the 19th July and Thomas and Co. spent one night in Aalesund before catching the coastal steamer for Bergen on the 20th. They crossed the North Sea in LEDA over the night of 21st/22nd July and arrived back in London and Leeds respectively in the late-afternoon of the 22nd.

Banfield and the members of the Second Party established the second expedition Base Camp at Vestbukta on the 15th July in good weather; the tents being set-up beside the old trapper's hut known as Polheimen to the Norwegians. As with all beach camps on Jan Mayen, the guy-lines of the tents were fastened to large drift-wood logs buried in trenches in the sand; and as had been found necessary at the northern camps, walls of drift-wood, boulders and sand were built to protect the largest tent from the full force of the wind. The stores depot laid down a month before was found to be in good condition, although the tarpaulin covering it was already affected by the damp climate. The old trapper's hut, of heavy wooden construction, was in a very poor and wet condition, but it was re-roofed with a new tarpaulin and dried out by the two large paraffin stoves belonging to the expedition. At the end of about 24 hours it became a habitable kitchen and mess, although only 7ft. x 10ft. in size, with a very low roof.

Good water was readily available from a waterfall 100 yards away from this West Bay Base Camp, and the same glacial stream provided adequate, if chilly, washing facilities where it crossed the beach. The other camps on the island were not so fortunate. In the north, water was only obtained from snow patches, or from trickles appearing from the ice, after a long tramp carrying buckets, water containers and ice axes. At Jameson Bay Hut all the water came from melted snow, but this was obtained quite close to the hut.

Establishment of the West Bay Base was completed on the 16th, and the six members carried loads across to Jamesonbukta on the 17th July. The old hut there was also re-roofed with a tarpaulin and dried out by the use of paraffin stoves. The Jameson Bay Hut is much larger than Polheimen, and at one time housed as many as eight members of the expedition. On the 19th July the six members of the Second Party started geological mapping from Jamesonbukta together, in order to establish a uniformity in their nomenclature and methods. Fox and Slade returned to Vestbukta on the following day to begin the mapping of the Southwest Sector. Banfield and Conran accompanied them to collect a further load of stores from West Bay Base Camp. Between the 21st and 28th July, Banfield, Wells, Conran and Talbot were mapping in the area from Sörbreen to Paulsen Hallet from an advance camp in

Fishburndalen; whilst Fox and Slade covered the area from Vestbukta to Kapp Muyen, working from West Bay Base Camp. On the 28th July Banfield and Conran left Wells and Talbot at Jamesonbukta and moved to Vestbukta. From then until the expedition departed from Jan Mayen, Wells and Talbot continued geological mapping of the Southeast Sector from Jameson Bay Hut. Between the 31st July and 10th August, Fox and Conran mapped the area north of Charcotbreen as far as Weyprechtbreen, from an advance camp (referred to as "The Harem"), at the southern end of Nordahl Grieglia. Without the mountaineering assistance it was originally intended that they should have during this period, they were unable to reach the higher and more dangerous ground above Jorisbreen. Meanwhile, Banfield and Slade continued mapping from West Bay Base Camp in the area of Krosspynthallet and from Jan Mayen Radio to Palffykrateret.

The geological mapping and general observational work achieved by the Second Party was greatly assisted by a period of, what was, for Jan Mayen, good weather. During the latter part of July and early August there were few rainstorms. The principal weather obstacle was the patches of low cloud and sea-mist which form very rapidly on the flanks of the Beerenberg, especially around mid-day. At first, during the period of twenty-four hours daylight, this could be avoided by working at night and sleeping by day, but as the sun began to go below the horizon for longer periods each day, it became necessary to revert to normal working hours. Slade narrowly missed serious injury on one occasion in a rock-fall from the cliffs near Nordvestkapp. Regular contact with Jan Mayen Radio was made by the Vestbukta party, but attempts at radio contact between Vestbukta and Jamesonbukta were not successful.

A Third Party left London on the 3rd August, flying to Aalesund via Oslo, and joined SIGNALHORN on the 4th. The Third Party consisted on Fitch, Thomas, Birch, Kinsman and Sheard. The expedition was very fortunate to obtain the help of Kinsman, who had been a member of the team that worked on Sörbreen in 1959; and, indeed, fortunate to receive the encouragement and assistance from many sources that made it possible for the Third Party to go out to Jan Mayen. The principal objective of the Third Party was to complete the work on Sörbreen started by the glaciologists lost in the accident, and to generally assist in the completion of those other parts of the programme which it appeared might give the most valuable scientific results. SIGNALHORN arrived off Jamesonbukta on the 7th August, and Kinsman and Sheard were put ashore with the glaciological surveying equipment. After a brief courtesy call at Bøtvika, during which the Commander of the Loran station, Raaby, joined the ship, SIGNALHORN proceeded around Sör-Jan to Jan Mayen Radio. Banfield and Slade were waiting here to welcome Fitch on his return, and to have a general discussion on progress and plans for the last fortnight of the expedition. On the 8th August, Fitch, Thomas,

Birch and Raaby sailed in SIGNALHORN to Krossbukta, where they landed and erected a memorial plaque to the lost men at the head of Jack Cole's grave. On the return trip to Jan Mayen Radio advantage was taken of the relatively calm sea to take the first load of stores off from West Bay Base Camp. Fitch, Thomas and Birch were transported from Jan Mayen Radio to Jameson Bay Hut that evening in a Norwegian land rover. Kinsman and Sheard had already begun work on Sörbreen, and this work was continued on the following days with the help of Thomas and Birch. Fitch, Wells and Talbot spent the 9th August doing geological work in the Ekerolddalen and the 10th in Sörhalet. Banfield, Slade, Jensen (The Radio Station Commander) and another Norwegian went north from Vestbukta and helped Fox and Conran break camp and return to West Bay Base Camp from Camp Harem on the 10th. Wells and Talbot moved to Jan Mayen Radio on the 11th and completed their mapping south of the station on that and the following days. Fitch joined the party at Vestbukta, and inspected their geological results on the 11th and 12th August.

West Bay Base Camp was struck on the 12th, and the geologists moved to Jan Mayen Radio in SIGNALHORN that evening. During the last few days the geologists completed certain difficult areas, and checked the mapping in the vicinity of the boundary between the Southwest and Southeast Sectors. Thomas went sick on the 11th August with a very painful tooth abscess, which was treated at Bätvika on radio instructions from Norway. Banfield and Fitch carried out a coastal reconnaissance from Stasjonsbukta round Nordkapp to Jamesonbukta in SIGNALHORN on the 13th, and this was repeated in reverse by Banfield and Conran on the 14th, as photographic conditions had been poor on the east coat on the previous day. The last geological and glaciological work was completed on the 14th and the Beerenberg was climbed successfully by Birch and Kinsman. Fitch and Talbot acted as support party to the climbers.

All members of the expedition were at Jamesonbukta on the morning of the 15th August, when Jameson Bay Hut was cleared, and the stores and equipment loaded onto a lorry loaned by the Loran Station for transport to Kvalrossbukta. Here they were transferred to SIGNALHORN and packed in the hold for the voyage to Scotland. After farewells at Jan Mayen Radio, SIGNALHORN sailed (via Vakta, Krossbukta and Nordkapp), in the late afternoon of the 15th August.

The voyage to Inverness was uneventful apart from a day of heavy seas just north of the Shetlands. SIGNALHORN docked at Inverness on the morning tide of Sunday, 20th August. Mr. Reed was waiting on the quay with his lorry, to return the expedition stores to London. Members said goodbye to their good friends of the SIGNALHORN crew and caught trains to London and Leeds that evening.

ACHIEVEMENTS

The scientific work of the Beerenberg Expedition will be discussed in four reports, dealing with geology, glaciology, natural history and mountaineering respectively. The tragic accident which deprived the expedition of five of its members naturally resulted in some parts of the original programme being severely curtailed. The general glaciological observations and the high-level and inter-glacier work were most affected. A vigorous effort was made, however, to complete those parts of the programme which promised to give the most valuable scientific results.

GEOLOGICAL REPORT

Geological mapping was based on the provisional stratigraphy proposed in 1959 by Fitch and Banfield. In an area of Recent volcanics such as Jan Mayen, stratigraphical division is most obviously made between successive eruption cycles. Where there is a petrographic difference between the rocks of successive cycles, geological mapping of these divisions can proceed in the usual way, but where, as in Nord-Jan, the petrographic differences between the rocks of successive cycles are often not obvious in the field, alternative mapping criteria must be used. Fitch and Banfield found that geomorphological evidence, based on a study of the denudation chronology, could be employed successfully to supplement the more usual geological criteria. Their methods and stratigraphy were given stringent examination and criticism in the field as mapping progressed, but were vindicated finally by results. Enlargement and modification of the stratigraphy was made as new evidence accumulated: the revised version is given below. Evidence has also appeared which strongly suggests that much of the Kapp Muyen Group is Recent rather than Late-Pleistocene in age.

For the geological survey, Nord-Jan was divided into three sectors radial from the Beerenberg Crater, each the responsibility of a team-leader, who was expected to record and correlate the geological work done in his/her sector. The Northern Sector extended from Weyprechtbreen on the northwest to Willebreen on the east. The dividing line between the Southwest and Southeast Sectors ran southwestwards from the Beerenberg summit past Vogtfjellet, then west to Nordlaguna.

The team-leader for the Northern Sector was Hawkins. He and Roberts worked together as a mapping team; assisted at various times by Fitch, Thomas and Guile. Detailed 1:10,000 geological mapping of an area extending around the coast from Weyprechtbreen to Austbukta, and inland as high as the 1,000 metre contour was accomplished. The high ice-field

and the area between the glaciers on the east coast were not mapped owing to the loss of most of the climbing team and the subsequent delay before mapping could recommence. The rock collecting and photographic parts of the geological programme for the Northern Sector were largely completed, however.

The team-leader for the Southwest Sector was Miss Fox, and for the Southeast Sector, Wells. Benfield ensured close correlation between the work being done in these two sectors by mapping at times in each. Three mapping teams of two were continuously working in the Southeast and Southwest Sectors from the time of arrival of the Second Party. All the lower part of the Southwest Sector was mapped on the scale of 1:10,000. The high 45° cone of the Beerenberg was examined by the climbing party. In the Southeast Sector 1:10,000 mapping was completed except for a small area in the vicinity of Kapp Neill. The failure to make the detailed geological maps absolutely complete was again due to the tragic loss of the main climbing party. Every effort was made, however, to ensure that photographic and observational reconnaissance of the unmapped areas was as full as possible, so that attempts can be made to interpret them from the aerial photographs with reasonable certainty. In the Southwest and Southeast Sectors large rock collections were made, and a palaeomagnetic collection was gathered by Talbot in the Southeast Sector.

ROCK-STRATIGRAPHIC UNITS: NORD-JAN

VERY RECENT AND PRESENT DAY DEPOSITS		
JAN MAYEN VOLCANIC SERIES	NORDKAPP VOLCANIC GROUP	KOKSSLETTA FORMATION
		TROMSORYGGEN FORMATION
		SENTRALKRATERET FORMATION
	KAPP MUYEN VOLCANIC GROUP	NORDVESTKAPP FORMATION
		HAVHESTBERGET FORMATION
		STORFJELLET FORMATION
		KAPP FISHBURN TILLITE
		KROSSBUKTA FORMATION
	SUBMERGED FOUNDATION VOLCANIC GROUP	

The principal task facing the geologists is the production of a 1:50,000 geological map of Nord-Jan, promised to the Norsk Polarinstitutt. It is hoped that sufficient information has been gathered to make this possible, and to provide the basis of a general geological account to supplement this map. The rock collections will provide material for petrographic and petrochemical research on Jan Mayen basalts, to be undertaken in the Geology Department at Birkbeck College. It is hoped that the general geological observations will provide material for a number of research papers.

The palaeomagnetic specimens are being studied in co-operation with Dr. Nairn of the Physics Department, University of Durham, Newcastle-upon-Tyne, and at Imperial College London.

There is still much further geological work that could be done in Nord-Jan. It is proposed in the Final Report of this expedition to make definite suggestions as to the form that this work might take.

GLACIOLOGICAL REPORT

The glaciological work was that part of the programme most affected by the accident, as the entire glaciological team was lost. Without the understanding help of many people, the work done by this team would have been wasted, but as a result of this help, a Third Party was able to go out to Jan Mayen and complete the most essential parts of the glaciological programme. The first glaciological party had concentrated their offerts on Sorbreen, and the principal work of Kinsman, Sheard and their helpers was to finish this study. All members of the expedition co-operated in making the general glaciological and photographic observations of the other glaciers that had been called for in the original programme.

A detailed study of Sörbreen (South Glacier) was made by a team under the direction of Peter Smith in 1959, and an extended programme of surface flow (strain), ablation and temperature measurements was undertaken this year in order to continue this study. The line of stakes inserted by the First Party at 600 metres could not be found, nor could many of their painted boulders or thermister holes, but it was found possible to reconstruct their surveying grid. As all of their log books and all but one of their field notebooks were lost, this was very much to the Third Party's credit.

Redetermination of the glacier snout by various methods showed an advance of a further 124 metres since 1959. Strain measurements were made at the 100-, 300- and 900 metre stake lines. These, measured after a lapse of between six and seven weeks, showed strain values ranging from 4 - 40cms/day, the highest values being recorded from the 900 metre line and the lowest from the snout region. Ablation measurements ranged from 1 - 5cms/day. The highest ablation figure recorded was 257 cms (about 8'6"), in 51 days at the 100 metre line of stakes. The stakes at greater altitudes showed a progressive fall in the ablation rate, as would be expected. Surface temperatures of the ice showed little variation from $0^{\circ}C$ at altitudes up to 900 metres.

Field observations and the comparison of photographs show that the snout of Sörbreen has undergone considerable thickening since 1959. Large seracs, indicative of increasing ice-activity, have developed just behind the snout region of the glacier. An increase in broadth behind the snout has resulted in the partial re-incorperation in the glacier of the ice-cored lateral moraines, observed in 1959 to be separated from the glacier margin by an expanse of morainic debris.

The advance of Sörbreen is not an isolated feature. Many of the glaciers of Nord-Jan show definite signs of advance. The ice margin is

everywhere in a state of activity, in places cutting through or 'bull-dozing' piles of old morainic debris. Two glaciers of the northwest coast, Svendfoynbreen and Gjuvbreen have re-entered the sea since 1949: the latter since 1959, when it was reported to be inactive. Jorisbreen has made a spectacular advance since 1959, and is now hanging over the 600 ft. cliff south of Vakta. All the glaciers of the east coast now terminate in the sea.

This advance of the ice on Jan Mayen correlates well with the general trend of sea-temperature, sea-ice limits, air-temperature and precipitation figures for the North Atlantic. The climax of the warming period which preceeded the present advance is thought to have occurred in the early 1940's. The actual advance appears to have started in Jan Mayen in the early or middle 1950's.

The ice-cored inner laterals seen in the snout regions of many of the glaciers are thought to represent a small oscillation in the general retreat which preceeded the present readvance. At present the readvance, which is taking the form of a series of surges, is comparable in scale to this oscillation. The main lateral moraines represent the maxima of the last advance, when Sörbreen as well as many of the other glaciers terminated in the sea. Such was the situation when it was observed by William Scoresby (Jun.) in 1817. Earlier lateral moraines, well-exposed by Sörbreen and Smithbreen are evidence of an older period of ice-advance.

The glacier which deposited the prominent lateral moraines seen between Austkapphallet and Trinityberget is not named on the Norwegian 1:50,000 map, so for convenience of description, and as a mark of our respect for the glaciological enthusiasm of Peter Smith, we have named it Smithbreen. We hope that the Norsk Polarinstitutt will be able to accept this name for future use.

The detailed record of the glaciological studies made on this year's expedition and on the 1959 expedition has already been sent to various institutions and individuals that might be interested, in the form of an Interim Glaciological Report. On the basis of criticism of this document, and as the result of extensive research now being undertaken, it is hoped to publish some glaciological research papers discussing the implications of the Jan Mayen ice advance.

Jan Mayen is glaciologically unique, and the findings of the present expedition are only valuable as part of a long-term study of its ice-field and glacier system. Sketchy information going back to 1817 is available, and Sorbreen has been studied in detail by parties from Imperial College London in 1938, 1959 and 1961. Peter Smith realized the importance of full glaciological records for the use of future expeditions, and his programme included detailed observational and photographic recording of all glacier and ice-fronts on the island. For this purpose he co-operated with Guile in designing a special light-weight photographic panorama head that could

be used on an ice-axe or under difficult conditions. The surviving members of the expedition are very sorry that Peter Smith's ambitious programme was not fully completed, and are hopeful that Imperial College will be able to send a glaciological team out to Jan Mayen to continue his work at some time in the not too distant future. Detailed recommendations as to the work such an expedition could do will be part of the Final Report of this expedition.

NATURAL HISTORY REPORT

Effort was concentrated on producing a collection of lichens for the Cryptogamic Herbarium of the British Museum (Natural History). Between the 25th July and the 14th August, 250 specimens were taken by Miss Conran and Sheard, from a variety of localities, habitats and altitudes, some of which had not been studied before. The majority came from areas between Eggoya and Kapp Hap, and from between Vestbukta and Jorisbreen; the localities ranged from sea-level to 2,300 ft. Of the 55 species so far identified at the British Museum, 15 have proved to be new records for Jan Mayen. Collections of particular lichen species were also made, for use in current research problems being investigated in the Lichen Section of the Cryptogamic Herbarium.

A number of insects, and seeds for chromosomal studies were also collected for the British Museum (Natural History). A few mites were collected for a post-graduate research student at Birkbeck College. Close-up colour photographs were taken of the characteristic species of flowering plants.

Arctic foxes were seen in all coastal regions of Jan Mayen, particularly between Eggoya and Kapp Hap, and between Krossbukta and Nordkapp. They were filmed collecting and catching food from camp sites, playing with balls of paper and seizing young birds who had fallen on the beach instead of into the sea. At least five series of occupied barrows were found - two above the 100 metre cliffs near Kapp Muyen, one immediately south of Svarttjørna, one west of Hohenlohekrateret and others at the base of the cliffs near Kapp Hap. Seals, porpoises, a 15ft. Pilot Whale and a Bottle-nosed Whale were seen close to the shore. Narwhals were observed during the voyage to the island.

The following bird species were recorded on the island or close inshore:- Fulmar, Eider, Arctic Skua, Great Skua, Little Skua, Pomarine Skua, Glaucous Gull, Icelandic Gull, Kittiwake, Arctic Tern, Little Auk, Brünnich's Guillemot, Black Guillemot, Puffin, Sandpiper, Wheatear and Snow Bunting. A Tawny Owl was found dead on the beach at Stasjonsbukta. Cine and still colour photographs were taken of bird cliffs, particularly at Kapp Muyen and at Krossbukta, showing the vertical distribution, nests and young of Kittiwakes, Brünnich's Guillemots, Fulmars and Glaucous Gulls. Arctic Tern, nesting amongst driftwood on the beach at Nordlaguna, were filmed in flight and with their young. A number of sea birds were filmed in slow motion.

Although the occasional snowstorm was still causing drifts down to sea-level, the bird cliffs were already densely populated when the expedition arrived at Jan Mayen on the 14th June. At Krossbukta the bird noise was continuous and deafening. On fine days the air above the Cross Bay Base Camp was filled by the endless passage of birds to-and-from the sea. Some nest sites were vacated by 14th July, but feeding of nestlings

was then at a peak, whilst further eggs were being incubated and gulls were still engaged in courtship and nesting activities. By 14th August, however, the cliffs were almost deserted. Occasional Kittiwakes, Fulmars and Glaucous Gulls were feeding nestlings, but following a series of storms between the 3rd and 8th August, no Arctic Terns, and relatively few Puffins or Guillemots were to be seen. These storms heralded the break-up of an exceptionally warm dry summer in Nord-Jan.

The lichen collections made by the expedition have been accepted by the British Museum, and it is hoped that descriptions of those species that are new records for Jan Mayen will be published in the "Lichenologist". Sheard expects to do research work on the lichens collected by the expedition.

Published papers show that most botanical and zoological collecting and faunal studies on Jan Mayen have been restricted to a relatively small number of selected areas, usually in the central and more readily accessible parts of the island. The Nordkapp area is seldom visited, yet, in spite of its exposed position and northern aspect, it bears a considerable vegetation of mosses, lichens, fungi and flowering plants. Arctic foxes are numerous and easy to approach, whilst the 500 metre cliffs behind Krossbukta support the largest sea bird colony on Jan Mayen. The area between Vestbukta and Weyprechtbreen seems rich in lichens. Species new to the island were recorded from glacial moraines and lava tunnels, and further search of these widespread habitats should prove rewarding. The old whale skeletons of Kvalrossbukta may yield calcareous forms. It is of interest to note that lava rock-types could often be recognised by their associated lichen species.

Each expedition to Jan Mayen records new invertebrate and plant species. Small though it is, it seems certain that the island's native life is far from being entirely known. Study of the less accessible parts, that so far have been but rarely visited, should be completed before the further spread of introduced species from the vicinity of the Norwegian stations. A historical study of introduction of new species might be possible, and might resolve some of the doubts concerning the early history of man's knowledge of Jan Mayen. Jan Mayen should certainly be a profitable site for Lichenometric studies (dating of rock surfaces by their lichen population).

MOUNTAINEERING REPORT

As part of the geological programme, and in the course of moving overland to Jan Mayen Radio, the four members of the First Party who remained on the island after the accident crossed the glaciers of the north coast on several occasions. No particular difficulty was encountered. During June conditions on the ice-field were ideal for skiing, but steadily deteriorated as the summer progressed. But for the loss of some of its experienced members, the expedition would have had little difficulty in achieving its mountaineering programme in June or early July.

One climb of the Beerenberg (7,470ft.) was made, on the 14th August. The climbing party was D.C. Birch and D.J.J. Kinsman. Kinsman (who was a member of the party who climbed the Beerenberg in 1959) replaced D. Thomas at the last minute, when Thomas was unfortunately laid-up with a tooth abscess. Birch and Kinsman left Jameson Bay Hut at 0100 hrs. on the 14th August and went up the Ekkerolddalen to a well-stocked mountain tent (Dave's Camp), previously erected near Hetta at about 1,500 ft. Here they slept and fed before starting on the climb at 1150 hrs. Cloudy weather is typical of Jan Mayen in August, and the characteristic cloud blanket surrounding the Beerenberg was entered immediately. The climbers donned crampons as soon as they got onto the ice-field from the morainic ridges above Ryggvarden, and took a direct compass route for Nunataken, a small rock outcrop below the final steep slope of the Beerenberg cone.

At about 4,000 ft. the cloud was left behind, and the Beerenberg towered above them, brilliantly lit by the August sun. Nunataken was straight ahead, and to the right lay the vivid red and yellow cliffs of Sörnuten. From Nunataken the S.W. ridge was laboriously gained through soft snow laying on ice. The ridge steepened, and for about 300 ft. great care was required as the angle of the snow and its condition were critical for avalanches. The temperature was well above freezing, and waterfalls poured from the rocks. With relief the climbers reached the gentle slope to the col between Wordietoppen and Haakon VII Topp, only to be confronted by a further obstacle.

Great rime slopes guarded the approach to the crater rim. The rime had an open fibrous structure, and where deep, was impossible to climb. In strength and appearance it was rather like a meringue. A detour had to be made, and the ridge joined later for the final arete to the summit, which was reached at 2045 hrs. The summit itself is a large rime-dome about forty feet in diameter with the south side eroded or melted away. From photographs taken in 1938 and 1959 it can be seen that the size of the dome varies enormously; being smaller in 1938 and about five times larger in diameter in 1959.

A steep ice couloir runs down from the summit to the crater floor, which is filled by a level snowfield. The crater snowfield is unbroken except for three enormous crevasses which span it at its northern end, and herald the approach to the ice-fall of Weyprechtbreen. Around the crater floor, above a wide bergschrund, rock buttresses and steep ice-slopes rise between 500 and 1,000 ft. to the several peaks of the horseshoe-shaped crater wall. At the northwestern end of the horseshoe lies Hakluyttoppen (7,217 ft.) the second highest point, and then in a clockwise direction Mercantontoppen and Wordietoppen, and so back to the summit, Kong Haakon VII Topp, at the western extremity of the crater rim.

Hakluyttoppen is a straight mile distant from Haakon VII Topp, but two miles distant around the ridge. The crater ridge itself has a coating of rime in some places over 50 ft. thick, which has been blown and eroded into fantastic shapes. Razor edge, thin flakes and cornices abound, particularly round Wordietoppen.

From the summit photographs were taken and a route for a descent into the crater visually reconnoitered. The easiest route seemed to be from the col between Hakluyttoppen and Mercantontoppen. During the descent from the summit Birch and Kinsman collected rock samples from exposures on the southern flank of the upper cone not previously sampled, then followed their outward track down through the cloud, reaching Dave's Camp at 0020 hrs. on the 15th. Fitch and Talbot met them here with a hot meal, and carried the heavy gear down to Jameson Bay Hut. The climbers had a short sleep before breaking camp and continuing the descent.

From a mountaineering point of view the interest of the climb rests in the views of the most unusual summit ridge and the spectacular crater. These sights are witheld for hours of snow trudging and mediocre ice climbing, but they are ample recompense when the summit is achieved. The only real mountaineering problem on Jan Mayen is entry into the crater itself. The crater rim is most easily reached from the south, but can also be readily climbed from the north. There are some excellent glaciers which provide good ice climbing, but generally the rock exposures are rotten, and many of the high rock walls of the glacier valley and sea cliffs are extremely dangerous and prone to large avalanches and rock-falls.

GENERAL REPORT

As a result of the tragic accident no member of the Seerenberg Expedition can regard the expedition as having been a success, although in its scientific work the expedition did produce valuable results. The photographic programme was followed as far as possible, but with the loss of the two principal photographers, Cole and Martin Smith, the results were naturally not as good as had been expected. The cine film of the expedition was continued by Thomas and Banfield after the accident, but it could not, of course, follow the exciting mountaineering script originally prepared by Cole.

In retrospect, it can be seen that if the tragedy had not occurred, the logistics of the expedition would have closely followed the estimated pattern, and that the overall planning would have been successful. Much thought has been given to the position of the motor-boat in the original plan. The dangers inherent in its use in Jan Mayen waters were fully appreciated. It was of a type designed for, and used by the Falklands Islands Dependencies Survey in Antarctic waters. It was bought by Dr. Dollar on the basis of his boating experience around Jan Mayen, and used successfully at Jan Mayen in 1959. Since then it had undergone extensive trials in the Thames estuary, and had been modified and considerably improved by the addition of a second motor as a safety precaution, and by the fitting of extra spray canopies. The dangers of its use were thought to have been reduced to a reasonable minimum by the provision of adequate clothing and life-jackets for every member, and by the proviso that it would only be used in fine weather very close to the shore. There are no harbours on Jan Mayen, all landings must be from a small boat. A small motor boat that can be hauled up on the beach is essential for access to many of the places demanded by scientific work, and on the present expedition was also intended to be the means of moving a sick or injured man to Jan Mayen Radio from the Nordkapp area after SIGNALHORN had departed.

A further, if expensive, safety factor could be provided on future expeditions by having a larger ship stand off-shore with its life-boat lowered during any time when a small boat was being used for landings. It is urged that any future expedition which intends to work in the Nordkapp area, and much scientific work remains to be done in that area, should have its supply ship remain with it as long as it is based north of the glaciers, to provide this additional safety factor during landings and to be its link with the Norwegian bases in event of emergency. This is important as radio contact between Krossbukta and the rest of Jan Mayen is difficult. The use of survival suits during boat operations is also recommended strongly.

All food supplies and items of camping, mountaineering and scientific equipment taken out by the expedition proved satisfactory in the field. Detailed reports will be made as necessary.

ACKNOWLEDGEMENTS

The Beerenberg Expedition received generous financial support from many sources, including N.A.T.O., D.S.I.R., The Royal Society, The Royal Geographical Society, The Mount Everest Foundation, The University of London Central Research Fund and from Birkbeck and Imperial Colleges of the University.

Assistance and encouragement of various kinds was received from many official bodies and organizations, from a great number of private individuals and from numerous commercial firms. The Expedition is particularly grateful to those that helped at the time of the accident. Special mention must be made of Finn Jensen, Torstein Raaby, their companions of the Norwegian Bases on Jan Mayen, Orlogskaptein K.A. Hejdenberg and the crew of GARM, B. Juniusson of Akureyri, the staff of the British Embassy at Reykjavik and the administrative staffs of Birkbeck and Imperial Colleges. The assistance of A.J. Caraffi and Dr. A.T.J. Dollar at Birkbeck College and A. Stevenson at Imperial College has been invaluable.

Acknowledgements are due to the following:-

The Norwegian Government, especially the Defence Ministry, the Naval authorities, the Meteorological Service, the Foreign Office and the Embassy in London.
The British Foreign Office, particularly the Embassy in Reykjavik, Iceland.
The Norsk Polarinstitutt, Oslo.
Jan Mayen Radio Station
N.A.T.O. Base, Båtvika, Jan Mayen.
N.A.T.O. H.Q., Paris
D.S.I.R.
Birkbeck College London
Imperial College London
Imperial College Exploration Board
British Museum (Natural History)
The Ministry of Health
G.P.O. Research Station
The Royal Society
The Royal Geographical Society
The Mount Everest Foundation
The University of London Central Research Fund
F.W.G. Annas, Accountant, Imperial College
Captain B. Brandal and the crew of SIGNALHORN
Professor W.S. Bullough, Birkbeck College
A.J. Caraffi, Birkbeck College
B. Coleby, N.A.T.O. H.Q., Paris
A. Comfort, British Embassy, Reykjavik
Dr. A.T.J. Dollar, Birkbeck College
Miss J. Emery, Birkbeck College

Dr. T. Gjelsvik, Director, Norsk Polarinstitutt
Orlogskaptein K.A. Hejdenberg and the crew of GARM
Dr. H.C.K. Henderson, Birkbeck College
F. Jensen, Commander, Jan Mayen Radio
B. Juniusson, Akureyri
Dr. L.P. Kirwan, Royal Geographical Society
H.H. Lamb, Director, Meteorological Office
E.H. Lelliott, Birkbeck College
Sir P. Linstead, Rector of Imperial
Dr. J.F. Lockwood, Master of Birkbeck
Captain J. MacLean, Harbour Master, Inverness
Miss M.O. Morris, D.S.I.R. H.Q.
Dr. A.N. Nairn, Newcastle
T. Raaby, Commander, N.A.T.O. Base, Bätvika, Jan Mayen
Emeritus Professor H.H. Read, Imperial College
W.E. Reed, Sawbridgeworth
Dr. G. de Q. Robin, Director, Scott Polar Research Institute
P.B. Rowley, Birkbeck College
Professor P.A. Sheppard, Imperial College
Mrs. U. Shukla, Birkbeck College
J. and P. Sinclair, British Embassy, Reykjavik
Dr. H. Simpson, Glasgow
J.W. Spershott, Bursar, Birkbeck College
A. Stevenson, Imperial College
Dr. C.T. Stubblefield, Director, H.M. Geological Survey
Professor J. Sutton, Imperial College
P. Taylor, Imperial College
Miss A. Thomason, Birkbeck College
Professor L.R. Wager, Oxford
D.H. Weir, Deputy Academic Registrar, University of London
Professor W.F. Whittard, Bristol
Sir James Wordie, Cambridge

The Expedition is indebted to the following commercial firms:-

Alladin Ltd., London
Arthur Beale Ltd., London
Thomas Black & Sons, Port Glasgow
Boots Pure Drug Co., Nottingham
Bovril Ltd., London
The Croydon Garage, Essex
Thomas Briggs (London) Ltd.
British Ropes Ltd.
Bull & Bull
Cadbury-Fry Ltd., Birmingham
Cross & Blackwell Ltd., London
Bank Precision Industries, London
Establissment Grain, Lyons, France
Gallenkamp, London
Gibson Provision Merchants, South Woodford
Glaxo Laboratories, Greenford
Horlicks Ltd., Slough
Hunterski Ltd., Lowestoft
Smiths Clocks & Watches Ltd., London
Ilford Ltd., Greenford
Martin Karlsen A/S, Aalesund, Norway
Kodak Ltd., London
Robert Lawrie Ltd., London
Libby, McNeill & Libby Ltd., London
Lillywhites Ltd., London
Mapletons Nut Food Co. Ltd., Liverpool
Maxima Lubricants Ltd., London
Marmite Ltd., London
McGruther & Marshall Ltd., Inverness
McVitie & Price Ltd., London
North British Rubber Co., London
Mitchells (Bags) Ltd., London
Mullard Ltd., Surrey
Nestlé Co. Ltd., Middlesex
Northern Mail Order Co., Edinburgh
Oxo Ltd., London
James Pascall Ltd., Surrey
Perkins Outboard Motors Ltd., Peterborough
Phillips, Scott & Turner Ltd., Surrey
John Player & Sons Ltd., Nottingham
Samuel Putney Ltd., London
Quaker Oats Ltd., Middlesex

Reeds Removals, Sawbridgeworth
William Ridgeway & Sons Ltd., Sheffield
H. Rollet & Co. Ltd., Ware
George Romney Ltd., Kendal
James Sawyer Ltd., London
Shell-Mex & B.P. Ltd., Inverness
Tate & Lyle Ltd., London
Thames Rice Milling Co. Ltd., London
Unicream Ltd., Manchester
Van der Burghs & Jergens Ltd., London
John Walker & Sons Ltd., London
A. Wander Ltd., London
Wayfarers Travel Agency, Torrington Place, London
Timothy Whites Ltd., London
Cutrock Engineering Co. Ltd., London
Zimmermans & Sons Ltd., London