The Report of the
Queens' College, Cambridge Spitsbergen Expedition
1978

ABSTRACT

The seven-man expedition spent five weeks in Spitsbergen based at Brucebyen on the North-East side of Billefjord (78° 39' N, 11° 21' E). Three main projects were successfully undertaken.

a. Over one hundred cloacal swabs were taken from a breeding Kittiwake colony at Kap Fleur de Lys (S.W. Billefjord). This was part of the global study of the incidence and transmission of the influenza virus being co-ordinated by the World Health Organisation.

b. A survey of the disassortative mating of the Spitsbergen population of Arctic Skuas was undertaken around Billefjord and Tempelfjord. The highest number of dark phase Skuas seen on the island since the War was recorded.

c. A snout position survey was made of the Nordenskiöld glacier to provide retreat data when used in conjunction with previous plots made over the last century. Several ice movement/ablation phenomena were examined.
PATRONS
Sir Vivian Fuchs, D.Sc., Ph.D., F.R.S.

MEMBERS
James F. Cooper
Logistic Leader.
3rd year Engineering undergrad.
Glaciological expeditions to Norway (1976) and Greenland (1977).

J. Graham Thurlow,
B.Sc. (Zoology)
Overall Project Leader.
2nd year Veterinary Medicine.

Nigel D. Bankes
Equipment Officer.
3rd year Law undergrad.
Glaciological expedition to Norway (1976).

Cliff R. Bassett
Boat, Firearm and Medical Officer.
3rd year Chemical Engineering undergrad.

John M.W. Baynham,
B.A. (Engineering)
Surveying Officer.
Member of consulting engineering company.
Glaciological expedition to Norway (1976).

Ian G.M. Mackley
Engine Officer.
1st year Engineering undergrad.

Myles P. Ripley
Food Officer.
3rd year Natural Sciences (Zoology) undergrad.
B.S.E.S. expedition to Iceland (1975) and glaciological expedition to Norway (1976).

REFERENCES
Dr. D.W. Bowett, President, Queens' College.
Prof. K.J. Miller, Department of Mechanical Engineering, Univ. of Sheffield.
Dr. G.C. Schild, Director of the National Institute for Biological Standards and Control.

Copyright: Norsk Polarinstitutt; reproduced by kind permission.
FORWARD

The aim of this report is three-fold. Whilst it is chiefly an account of our journey and the work undertaken in Spitsbergen, it also gives us an opportunity of expressing gratitude and appreciation to everyone who helped us. We hope, moreover, that the reader will sense glimpses of the grandeur of the Archipelago on turning the pages.

J.F.C.

CONTENTS

<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>1</td>
</tr>
<tr>
<td>MEMBERS</td>
<td>3</td>
</tr>
<tr>
<td>FOREWORD</td>
<td>4</td>
</tr>
<tr>
<td>SPITZBERGEN - A HISTORY</td>
<td>4</td>
</tr>
<tr>
<td>WEATHER</td>
<td>5</td>
</tr>
<tr>
<td>FOOD REPORT</td>
<td>9</td>
</tr>
<tr>
<td>EQUIPMENT</td>
<td>10</td>
</tr>
<tr>
<td>MEDICAL REPORT</td>
<td>12</td>
</tr>
<tr>
<td>WEAPON REPORT</td>
<td>15</td>
</tr>
<tr>
<td>BOAT REPORT</td>
<td>16</td>
</tr>
<tr>
<td>ENGINE REPORT</td>
<td>17</td>
</tr>
<tr>
<td>BRUGSEYN HUTS</td>
<td>19</td>
</tr>
<tr>
<td>PROJECT LEADER'S REPORT</td>
<td>20</td>
</tr>
<tr>
<td>RELATED REPORT</td>
<td>20</td>
</tr>
<tr>
<td>INFLUENZA REPORT</td>
<td>23</td>
</tr>
<tr>
<td>SHELL REPORT</td>
<td>26</td>
</tr>
<tr>
<td>GENERAL BIRD OBSERVATIONS</td>
<td>31</td>
</tr>
<tr>
<td>ZOOLOGY REPORT</td>
<td>32</td>
</tr>
<tr>
<td>COLLECTION OF ANTLERS AND SHELLS</td>
<td>33</td>
</tr>
<tr>
<td>GLACIOLOGICAL PROGRAMME</td>
<td>36</td>
</tr>
<tr>
<td>DENTAL CONE REPORT</td>
<td>44</td>
</tr>
<tr>
<td>MOUNTAINING REPORT</td>
<td>49</td>
</tr>
<tr>
<td>EXPEDITION ADMINISTRATION</td>
<td>50</td>
</tr>
<tr>
<td>HISTORY OF EXPEDITION</td>
<td>57</td>
</tr>
<tr>
<td>LOG OF PROMINENT DAILY EVENTS</td>
<td>60</td>
</tr>
<tr>
<td>FINANCIAL STATEMENT</td>
<td>79</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>80</td>
</tr>
</tbody>
</table>

Spitzbergen - A History

The first mention of Spitzbergen seems to have been in the Icelandic sagas, as far back as 1194, but the first well-documented "discovery" took place four hundred years later, in 1596(1). The search was on for a North-East route to the Indies, and on the 18th May 1596, two Dutch ships set sail from Amsterdam with Willem Barendszoon (hence 'Barents' Sea) acting as chief pilot. The expedition sailed Northwards, passing Bear Island on 12th June, and came within sight of land on the 17th. The explorers made landfall in the N.W. of the island, and then sailed Southwards along land which was "for the most part broken .... consisting only of mountains and pointed hills .... for which reason we gave it the name of Spitzbergen". They formally took possession of the land for Holland, before travelling back to Bear Island. From there, Barendszoon sailed East to Novaya Zemlya where he died in June of the following year, having wintered in the Arctic.

Regular visits to Spitzbergen soon began, with voyages made by Hudson, Edge, Marmaduke and others. The main incentive seems to have been the hunting of walrus, and Polar bears, although any of the abundant animal life was taken as game - reindeer, wildfowl and foxes. Whales were not hunted at first, as the only people with the necessary expertise were, apparently, the Basques. However, the trade soon caught on, the Muscovy Company of London being the first commercially successful concern.

Whaling became so profitable that considerable friction developed between the English and the Dutch fleets, who were competing for the catch. Permanent whaling stations were set up, at Cape Comforthless by the English, and at Amsterdam Island by the Dutch, and the two fleets eventually agreed to work in different areas along the West coast. The exploitation of the South and East coasts continued slowly with Spanish and Danish activity increasing.

By 1670, this extensive exploitation had reduced the whale population to such an extent that the ships now had to operate very far from the shore. Consequently, the large whaling stations on Amsterdam Island, and elsewhere, fell into disuse; today only traces of the foundations of the blubber-boiling vats are all that remain. Thus the whaling industry in Spitzbergen lasted for barely sixty years.

The first "scientific expedition" to Spitzbergen took place in 1833. The King of Denmark sent a fleet to "make observations as to the products and characters of lands and seas", while the first botanical samples and classification of wild life was made by Frederick Murtens, in 1671. The European war led to cases of hostile action in Spitzbergen in the mid 1670's; the French, being particularly aggressive, captured many of the off-shore whalers of Dutch and Spanish origin.
The early 1700s saw the first visits to Spitsbergen by Russian vessels, and by 1730 a Russian trapping industry had built up on the west coast — indeed, the Russians overwintered regularly. A remarkable story of survival against the rigours of an Arctic winter is worth recording. Four sailors, whose boat had been trapped and destroyed by ice were forced to land on the S.W. coast of Edge Island, with supplies for a few days only. They were fortunate to find a hut, which they repaired with the help of an axe, and the plentiful supply of driftwood on the shore. With their twelve rounds of ammunition they killed twelve reindeer and afterwards made use of a homemade bow to supply them with food. They made oil-lamps out of clay found on the island and thus managed to keep a fire burning continuously for the six years that they were marooned on the island. Their clothing was of reindeer hide, sewn using needles fashioned from old iron nails, while sinews served for thread. They were rescued in 1749 by a ship that had been blown off-course while on its way to the West coast.

Not all who over-wintered in Spitsbergen were so fortunate, however. Many died of scurvy, leaving only their beached boats as grim reminders of their fate, to be seen by any passing vessel.

The Russian trapping industry continued steadily until the 1820s, at which time a massive increase in the number of trappers took place, many of the newcomers being Norwegian; in fact, this competition apparently destroyed the Russian trade. The Norwegian trade has dwindled since 1820 — there now (1979) being only two professional hunters in Spitsbergen.

Scientific interest in the Northern lands sparked off in the mid-17th century by a request for information made by the Royal Society of London began to grow significantly in the 18th century.

The Hon. Daines Barrington was a great moving spirit in Britain; resulting, in 1773, in the presentation by the Royal Society of a memorial to the King, stressing the desirability of equipping a naval expedition to discover the Northern limit of navigable waters.

The expedition, which included the 14 year-old Horatio Nelson as a midshipman, on board the "Carrack", sailed as far North as 80° 36', but was then stopped by pack-ice. They landed on Spitsbergen, and carried out a geographical survey of Fairhaven, which resulted in a chart which was "a marvel ... for its extraordinary badness". Further studies were carried out, and the ivory Gull was discovered — but the importance of the expedition was that it was the first purely geographical Arctic Expedition.

William Scoresby, a Queen'sマスト whaler of Whitby, was an Arctic explorer who calls for special mention in connection with Spitsbergen. In 1806, aged 16 and Chief Officer on the ship 'Resolution', he sailed to 81° 30' N and 19° E visiting, on route, a great part of the Spitsbergen coast. In 1818, he landed on Collin's Cape and climbed the hills there, recording (in his book 'Account of the Arctic Regions' published in 1820) the difficulty of climbing and descending these much eroded peaks.

Memorial found in Petuniabukta

Plaque reads 'Christopher John Bilsett Kirkton 17.8.1937 - 26.7.1958 Expedition of Queens' College, Cambridge, who lost his life while collecting fossils on the mountain afterwards called Kirktonygen at the foot of which he is buried thirty miles to the North East of this, the base of the Cambridge Spitsbergen Expedition 1958 of which he was a member'.

See Queens' College Record, 1979.
In 1818 another British expedition was sent to Spitsbergen. A second survey of Fairhaven produced a more acceptable chart, the first good map of any part of Spitsbergen, and it is for this that the expedition should be mainly noted. Sketches produced to accompany the map were displayed publicly in London, and attracted much attention.

From 1820 onwards, many expeditions went to Spitsbergen, Adolf Nordenskjöld (hence, Nordenskjöldbreen) carrying out survey work culminating, many years later, in the accurate measurement of a fairly long meridional arc. In 1826 Parry mooted an expedition (supported by the Royal Society), to attempt to reach the North Pole across the pack-ice from Spitsbergen. The expedition was also to carry out much scientific work on Spitsbergen, including measurements of the amplitude of magnetic dip, the magnetic variation, temperature, pressure, extent and type of sea-ice encountered, depth and salinity of the sea, and so on, along the Northern and Eastern coasts of Spitsbergen. The North Pole was not reached, the greatest Northing achieved being 82° 40' N (a record at the time), but the scientific work was carried out very successfully.

Kelling, and later Lovén, carried out extensive geological exploration, resulting in the first exporting of coal from Spitsbergen, by a Norwegian clipper in 1899.

Expedition, and exploration, of Spitsbergen have continued to this day. In the first quarter of the 20th century many small coal-mining companies were set up, including the Scottish Spitsbergen Syndicate, which furnished the exploratory base at Brusselsby. Many of the companies collapsed; the two remaining coal-mining concerns being those of the Norwegians and the Russians. Brusselsby was named after William Speirs Bruce, a very active Polar explorer, and a great naturalist. Bruce took part in the expeditions to Spitsbergen of H.M.S. the Prince of Monaco, in 1898, 1900 and 1906 and carried out surveys of Prince Charles Foreland. He continued to visit Spitsbergen until 1920; one year before he died.

In 1922 Spitsbergen was declared a Norwegian Sovereignty by International Treaty, but mining rights have remained international. As yet, oil exploration has only been sporadic, in the main, to unencouraging bore hole results; if and when activity is increased, however, the effect could well be devastating.

Spitsbergen remains largely unspoiled - the ruins of the old mine workings, the hunters' huts, and the bones of the whaling industry are merely poignant reminders of the existence of man, as one walks through this wide-open country.

References


John Baynham

WEATHER

Of the five weeks the expedition was in the Brabuelsen region, ten days were very fine with clear or nearly cloudless skies; compared with the two or three days we had been told to expect, this was excellent. On about four days, we were prevented from working because of either rain, wind or sea-level fog. The "average" weather was full cloud cover to 1000 ft with occasional drizzle; heavy rain was uncommon.

A maximum-minimum thermometer was installed at Brabuelsen but it seemed rather unreliable. Best estimates gave a maximum of 14 °C and minimum of -1 °C at the Brabuelsen huts although lower temperatures were encountered on Nordenskjöldbreen. Of course, equivalent wind chill temperatures were much lower, especially in the inflatable boat.

In the early part of the expedition, the "day" and "night" temperatures were roughly constant at about 7 °C. Towards the end, "day" and "night" became quite distinct with noticeable temperature drops in the evening.

It is worth noting that whilst surveying was impossible in bad weather, it was also difficult to sight on very sunny days because of a strong heat haze.

Ian Mackley

FOOD REPORT

The food for this expedition was planned with several incompatible objectives in mind - palatability, low weight, ease of preparation and cost. At the time that the food was being planned, cost became by far the most important consideration. Unfortunately by the time we left, money became available and food could have been replenished, barring the fact that it had all been bought and packed. This would be avoided by those expeditions who are able to plan for two years. The possession of our inflatable boat made weight of relatively minor importance. Modern food and the possession of a secure base made ease of preparation a convenience only.

The menu was largely planned in conjunction with whatever food donations or offers occurred. As regards quantities and detailed constitution of the diet, many expedition reports were consulted (especially The Peak District Spitsbergen Expedition 1977) and, of course, our own collective expedition experience. It seems, however, that almost any approximation to a normal diet includes a reasonable balance of the main nutrients. We added a little fresh food in the form of one case of oranges and a sack of potatoes, and supplemented with vitamin pills. Being money conscious, we bought in bulk which again ensured a reduction in variety.

Members of the expedition were forced to join the Steine school of expedition food. Our patrons both expressed the view that one could pander too much on an expedition, with the result that one slightly lost some of the flavour of it. The addition of innumerable Colman's sauces to our soy-based evening meals seemed to make no difference at all to our possibly jaded palates; the only improvement was adding white wine. At no time could there ever be said to be a shortage of food but at times members had a vast appetite for something tasty. When offered bacon and eggs by some Norwegian miners, mouths watered at the very thought! Luckily we weren't faced with the problem of stimulating the appetite of high altitude climbers.
Rations were packed in 8 man-day bags which were further split up so as to facilitate breakdown into smaller units. Thus, at any time, people could be provided with the right amount of food within a very short time without all the chaos that always accompanies repacking. This was facilitated by the fact that we were carrying about 10% extra food as insurance against loss or damage. On top of our 50 × 8 man-day bags, we also carried a number of sundries designed for base camp use such as bread mixes. We generated a certain amount of spare food, most of which was left in the hut according to the 'Bothy' principle. We were pleasantly surprised at the short time that it took us to repack our food into convenient units for our 8 man-day bags. This is certainly a process that we would highly recommend to any expedition, saving much time in the field. The rations were packed in such a fashion as to be, on the whole, strong and waterproof enough to be carried in a rucksack in the worst conditions. This was highly facilitated by a kindly warehouseman who supplied us with large numbers of strong plastic bags.

A brief outline of our typical 8 man day ration packs is given below.

**Menu (8 man days)**

<table>
<thead>
<tr>
<th>Daily Ration</th>
<th>Sundries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee</td>
<td>Salt</td>
</tr>
<tr>
<td>Tea</td>
<td>Syrup</td>
</tr>
<tr>
<td>Sugar</td>
<td>Primula Cheese</td>
</tr>
<tr>
<td>Milk</td>
<td>Lavatory Paper</td>
</tr>
<tr>
<td>Breakfast</td>
<td>Matches</td>
</tr>
<tr>
<td></td>
<td>Scouring Pad</td>
</tr>
<tr>
<td></td>
<td>Ozo-Cubes</td>
</tr>
<tr>
<td></td>
<td>Multivitamins</td>
</tr>
<tr>
<td>Porridge</td>
<td>2 oz</td>
</tr>
<tr>
<td>Alpen</td>
<td>3 oz</td>
</tr>
<tr>
<td>Westabix</td>
<td>1 bottle 'Fivepins'</td>
</tr>
<tr>
<td>Digestive Biscuits</td>
<td>1 tube</td>
</tr>
<tr>
<td>Lunch</td>
<td>2 tubes</td>
</tr>
<tr>
<td>Cheese</td>
<td>1 lb</td>
</tr>
<tr>
<td>Digestive Biscuits</td>
<td>1 tube</td>
</tr>
<tr>
<td>Pudge or Mars Bars</td>
<td>1 tin</td>
</tr>
<tr>
<td>Tim Rice</td>
<td>1 tin</td>
</tr>
<tr>
<td>Dried Fruit</td>
<td>1 lb</td>
</tr>
<tr>
<td>Boiled Sweets</td>
<td>1 oz</td>
</tr>
<tr>
<td>Supper</td>
<td>1 lb</td>
</tr>
<tr>
<td>Soup</td>
<td>1 lb</td>
</tr>
<tr>
<td>Timed Meat or</td>
<td>1 lb</td>
</tr>
<tr>
<td>Hydrated Keep</td>
<td>1 lb</td>
</tr>
<tr>
<td>Spaghetti</td>
<td>1 lb</td>
</tr>
<tr>
<td>Macaroni</td>
<td>1 lb</td>
</tr>
<tr>
<td>Beef Potato</td>
<td>1 lb</td>
</tr>
<tr>
<td>Instant Pasta</td>
<td>1 lb</td>
</tr>
<tr>
<td>Rice</td>
<td>25 oz</td>
</tr>
<tr>
<td>Dried Vegetable</td>
<td>25 oz</td>
</tr>
<tr>
<td>Timed Pudding</td>
<td>25 oz</td>
</tr>
<tr>
<td>Stewing Fruit</td>
<td>alternatives</td>
</tr>
<tr>
<td>Pancakes</td>
<td>alternatives</td>
</tr>
<tr>
<td>Custard Pudding</td>
<td>alternatives</td>
</tr>
</tbody>
</table>

**Equipment Report**

Although by far the largest part of our equipment belonged to individual expedition members, some had to be borrowed, and the rest bought out of expedition funds. As it happened, the Brucesbyan hut provided a perfectly adequate base unsupplemented by tents, but in order to be safe, we clearly had to take sufficient tents to accommodate not only ourselves but also some of our more delicate stores. We took

4 Vango Force Ten Mk.3 L.W.,
1 Vango Force Ten Mk.2 L.W., and
2 Store tents

Only 6 of the tents were in use at any time, and this only on one occasion when the bird group were working at Cap Plemel du Lys and the "glaciologists" were camped on the ice. We could, therefore, have managed with a smaller number and perhaps a future expedition could take less if the huts remain in their present condition. Had the huts been totally unfit for use, we would undoubtedly have been short of canvas. The Vangos stood up well to their use, but it should be pointed out that we never experienced very strong winds. In view of the fact that good camping ground is sometimes difficult to find, snow valances should certainly be sewn on to all flysheets. The extra weight is a small price to pay for the increased stability and ease of erection. Doubts may also be cast on the strength of Vango flysheets in severe weather. A number of spares were taken including pegs, angle pieces and a spare ridge pole.

All our cooking was done on primus stoves. We took the following plus spares:

- 3 × 1 pint primus
- 1 × 2 pint primus
- 1 × 4 pint primus

Apart from routines cleaning the primuses gave no trouble whatsoever and can, as usual, be highly recommended. Paraffin is obtainable from Longyearbyen. We used about 4 gallon masts and 8 gallons paraffin. Some paraffin was also used for rubber disposal.

A variety of cooking utensils were taken and the following pans proved adequate for our needs:

- 2 sets of nesting billys
- 3 × 4 pint saucepans
- 1 × frying pan

As well as this, each member had, of course, his own personal cutlery and mess tins.

We took a large variety of watercarriers with a total capacity of about 50 gallons. With 7 people at the base and no major logistical problems it was almost a case of the "more the merrier". We also had 2 collapsible watercarriers for use away from the huts.

We had sufficient climbing equipment to enable 2 groups to be well equipped for both ice and the bird cliffs. In the event the ropes were very rarely used since the bird cliffs, being gypseeferric, were far too brittle to climb on. (Indeed ropes were only used twice on the cliffs; once for ascending a gulley and once for a bit of ice climbing to reach some Kittiwake parochs) and the glaciers were mainly snow-free. The following equipment was in
the expedition "pool":-

1 x 45 m Redrid Ever Dry
2 x 35 m x 11 mm Viking kernmantel
1 x 100 ft No. 4 hawser laid
3 x ice screws
9 x pitons - various sizes
Various tapes, nuts, stitched slings and karabiners

In addition, most members of the expedition had a harness and crampons. Each member had an ice-axe but we took no spares since we did not envisage any occasion when everybody would need an axe at the same time.

Since we intended to live in the huts if at all possible, we took a selection of tools with us:- hammer, pliers, gimlet, screwdrivers, 30 inch bow saw, hand axe, bill-hook, pruning saw, assorted nails and screws. We also had a selection of tools for the boat:- allen keys, adjustable spanners, spark-plug spanners and fueler gauges. We used all the tools that we took and could have done with a few more. For example, we should have taken a glass-cutter, some spare glass, window framing wood, wood chisel, putty and roofing-felt.

Various other odd items were also taken including 2 buckets, 2 bowls, toilet fluid for the oil-drum toilet, detergent, 'J' clothes, pegs, pan-scourers and washing powder (3 packets lasted adequately).

In view of the 24 hours light we only took one hurricane lamp and some night lights. As it happened it was only in the last week that we used them but in some respects we were lucky since we were in a well lit hut. Towards the end of our stay it was beginning to get so dim at night as to make reading difficult. A tilley lamp would have been a useful addition.

Nigel Banks

MEDICAL OFFICER'S REPORT

Illness and injury are potentially the most disruptive influences that can affect an expedition. To do his job properly, the expedition Medical Officer must be familiar with first-aid techniques and also with the use of any drugs at his disposal. Most importantly, he must recognise his own limitations and know when to call for professional assistance.

Although most expeditions specifically have a Medical Officer, it is useful for most of the expedition members to have received some medical training. This is particularly important if the expedition is likely to operate at two or more autonomous groups. The expertise of our expedition ranged from a knowledge of first-aid, to James, who had been an expedition Medical Officer, and Graham who had completed two years of the Medical Sciences course at Cambridge.

Once our expedition was approved by the Cambridge University Explorers' and Travellers' Club I was able to take full advantage of the training provided by the Department of Community Medicine at the University School of Clinical Medicine. The department organised seminars on various aspects of expedition medicine which were most informative. The most pertinent fact to come out of these seminars was that we were likely to be much healthier going out to the Arctic than to the disease ridden Tropics! The local branch of the Red Cross also organised a seminar on expedition medicine, with particular reference to the selection and use of drugs.

Much information can be obtained from books, one well worth reading being 'A Travellers Guide to Health' by Lt. Col. James H. Adam, published by Hodder and Stoughton for the Royal Geographical Society.

The old adage of "prevention is better than cure" is particularly applicable to expedition medicine. Some preventative measures can be taken before leaving on the expedition. A visit to the dentist is essential for all members, as dental problems are often impossible to cure in the field. Innoculations are not normally required for polar regions, but a Tetanus booster is worth consideration. While still at home, the Medical Officer should familiarise himself with any medical problems which the other members may have. These may necessitate the carrying of additional drugs, as in the case of Penicillin sensitivity.

Hygiene is, of course, important, and a supply of liquid antiseptic is desirable. To reduce the risk of infection, an antiseptic cream was applied regularly to the hands of those working on the bird colony. Sterilising tablets were used whenever the purity of the drinking water was suspect.

Tablets were taken in an attempt to prevent sea-sickness, but these proved largely ineffective in our case.

Expeditions travelling on snow and ice should be wary of the large amount of ultra-violet radiation reflected by the ground. All exposed areas of skin are vulnerable and so suitable barrier creams should be used. Lips are easily ignored, but these should be protected by the use of a suitable lip salve. Of prime importance, however, are the eyes. Good quality ski-goggles should be used, but for less extreme conditions, polarised sun-glasses proved quite adequate.

On the whole, our expedition was quite healthy. The first problem encountered, however, was sea-sickness. Two types of tablet were used, Maresins and Avenins. Some members preferred not to take any tablets. The correlation between the precautions taken and the severity of the sickness experienced was inconclusive. While everyone suffered to some extent, it was noticeable that some suffered more than others no matter what precautions they took.

It is said that on the first day of sea-sickness you feel as though you are about to die; and that on the second day you know that you are! Fortunately, by the third day you are usually feeling a little better.
After a couple of weeks on Spitsbergen, most members were affected by an infection which caused elevated temperatures and sickness for about 24 hours. Recovery after the sickness was rapid and no treatment was attempted, other than the regular drinking of water to counter dehydration. Salt was added to the water at a concentration of two level teaspoons per gallon. This is below the taste threshold but helps replace the salt lost through vomiting.

No serious injury was encountered, although one member bruised an elbow following a fall while skiing. Although not serious, the bruising limited the use of the affected arm for several weeks.

The medical kit was found to be wanting when some members complained of piles. Fortunately one of those affected had brought his own medication which provided some relief.

The only other problems encountered were minor cuts and bruises, muscular aches and pains, blisters and one case of Athlete's Foot.

The kit used was that supplied by the Department of Community Medicine at the University School of Clinical Medicine, Cambridge. Due to the generosity of several companies, this kit is supplied at nominal cost to those expeditions approved by the Cambridge University Explorers' and Travellers' Club.

The standard kit was as follows:

<table>
<thead>
<tr>
<th>Antimotilary:</th>
<th>Foot: Powder (Phytoderm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin (Penbritin)</td>
<td>Cream (Jade)</td>
</tr>
<tr>
<td>Erythromycin (Erythrod)</td>
<td>Eyewash (Bactine)</td>
</tr>
<tr>
<td>Penicillin (Crystapen V)</td>
<td>Ointment (Brolene)</td>
</tr>
<tr>
<td>Tetracycline (Bactrim)</td>
<td>Wash (Ordinary)</td>
</tr>
<tr>
<td>Antiseptics:</td>
<td>Jelonek</td>
</tr>
<tr>
<td>Hibitane cream</td>
<td>Indigestion:</td>
</tr>
<tr>
<td>Savlon liquid</td>
<td>Algurix</td>
</tr>
<tr>
<td>Bandages:</td>
<td>Insects:</td>
</tr>
<tr>
<td>3 inch</td>
<td>Cream (Flypel)</td>
</tr>
<tr>
<td>BUTTERFLY closures</td>
<td>Powder (Cooper)</td>
</tr>
<tr>
<td>Crepe</td>
<td>Spray</td>
</tr>
<tr>
<td>Elastic adhesive</td>
<td>Sting relief</td>
</tr>
<tr>
<td>Shell</td>
<td>Safety pins</td>
</tr>
<tr>
<td>Strip</td>
<td>Splinter forceps</td>
</tr>
<tr>
<td>Triangular</td>
<td>skin:</td>
</tr>
<tr>
<td>Wound dressings No. 15</td>
<td>Glacial cream</td>
</tr>
<tr>
<td>Zinc Oxide Tape</td>
<td>Urticat cream and lip salve</td>
</tr>
<tr>
<td>Constipation:</td>
<td>Lanolin cream</td>
</tr>
<tr>
<td>Cascara</td>
<td>Analgesic:</td>
</tr>
<tr>
<td>Diarrhoea:</td>
<td>Pain relief:</td>
</tr>
<tr>
<td>Kaolin</td>
<td>Aspirin</td>
</tr>
<tr>
<td>Thalassole</td>
<td>Fortgesic</td>
</tr>
<tr>
<td>Flagyl</td>
<td>Thermometer</td>
</tr>
<tr>
<td>Embrocation:</td>
<td>Travel sickness:</td>
</tr>
<tr>
<td>Salmonella</td>
<td>Marline</td>
</tr>
<tr>
<td>Wool</td>
<td>Water sterilizing tablets:</td>
</tr>
<tr>
<td>Scissors</td>
<td>Scrobabs</td>
</tr>
</tbody>
</table>

In addition to the standard kit two extra items were carried.

i) 118 Tablets. These tablets were issued by the Department of Community Medicine as a pain killer in case of a fracture as a result of a fall from the bird colony.

ii) Lignocaine Gel. This was for use as a local anaesthetic to aid the cleansing of gravel rash, etc.

I would like to record my gratitude to the following for assisting my job as Medical Officer: Dr. T.W. Davies, Medical Adviser to Cambridge Expeditions, Mr. D. Gurner, Department of Community Medicine and Dr. Playfair and the Cambridge Branch of the Red Cross.

Cliff Bassett

WEAPON OFFICER'S REPORT

In the past there have been several attacks on humans by hungry Spitsbergen Polar bears. Some of these attacks have led to fatalities and as a result we were advised to take some means of defence with us.

It was decided that for personal protection, each member should carry a flare. Two types of flare were issued, one launching a projectile, the other being hand held. Opinions differ as to the effectiveness of either type, but the flares served a second useful purpose as a means of attracting attention if in distress.

Because the effectiveness of the flares was in some doubt, it was decided that we should take a rifle with us as a last means of defence. The type of weapon chosen was a Ruger .44 Magnum Auto-loading Carbine, which had the following advantages:

i) It had sufficient firepower to be effective against Polar bears.

ii) It had a short barrel making it lighter to carry and easier to use in a confined space, e.g. inside a tent.

iii) Being auto-loading we were guaranteed of four shots as quickly as we could pull the trigger.

iv) The auto-loading mechanism helped reduce the amount of 'kick' given by the weapon.

As a result of the semi-automatic nature of the weapon, it was impossible to obtain permission to fire it for practice in this country. Once on Spitsbergen, however, we were free to practice and gain confidence in the use of the rifle. The weapon proved very effective against cardboard Polar bears!

Obviously, safety is a major consideration when handling a firearm. Strict procedures were followed when firing the rifle and as a result no accidents occurred. Without in use, the rifle was kept loaded with rounds in the magazines but with no round in the breech.

Cliff Bassett
The inside of the boat was normally fairly dry, the Mapa 402 featuring an unique "dry-ride" design. This is basically a combination of an uplifted bow with a poly-carbonate wind and spray screen. In the event of excess water entering the boat the self-draining ports could be used to great effect.

Although not recommended by the manufacturers, the boat was usually carried with the outboard attached. No adverse effects were noted on the handles. In this state it took four people to carry the boat. In emergencies, the boat could be moved by two people if a see-saw motion was adapted. Future expeditions might consider taking inflatable rollers to facilitate landing and launching.

An extensive repair kit was taken, but only minor repairs were carried out. At no time did the buoyancy chambers become punctured, even when in contact with sharp ice floes.

The Norwegians on Spitsbergen showed great interest in the inflatable as few are in use there at the present. We were all very impressed by the boat's performance. In particular, the boat's sea-keeping qualities gave us a great sense of security in all but gale force conditions.

Despite the "dry-ride" name, passengers often tended to get wet and strong water-proof clothing is recommended. Beaufort Sports-Foam Life Jackets were worn at all times in the boat as an extra safety measure.

Cliff Basset

USE OF OUTBOARD ENGINE

A Chrysler Marine 25 h.p. outboard was taken to power the inflatable. The engine was new but given a small amount of running in before we left this country.

Throughout the expedition, it was convenient to keep it bolted to the transom; care was taken, however, to drain the cooling system of water after use since frozen water in the block could have had serious consequences.

Had the boat been fully loaded more frequently, a larger engine (say 35 or even 50 h.p.) would have been necessary; this would have required the fitting of a remote steering unit instead of the tiller arrangement we were able to use and, naturally, it would have been heavier to carry. In use, fuel consumption varied from one to three gallons/hour depending on conditions. We took separate two-stroke oil to mix with the petrol as required but limited quantities might have been purchased in Longyearbyen.

On the whole, the engine ran well throughout the expedition although we did experience the minor problem of the sparking plugs seizing up. It would seem that hotter plugs were required to compensate for the low temperature cooling water; we were to find, later, that there are available and their use is strongly recommended in similar Arctic conditions.

Whilst some of the expedition had had previous experience of outboards, simple maintenance proved easy although major repairs would have been difficult without the requisite special tooling. A small tool kit was taken together with spares; principally spark plugs and a propeller. The plugs could have been used many times over but the propeller was not needed; the installed version standing up well to accidentally running aground and through ice in the water. The two propellers were of dissimilar pitch for different conditions, but one proved adequate for the whole period of the trip.
HUTS

Brucebyen consists of four double-walled huts arranged in a group between two freshwater ponds. They were built in the early part of this century by the Scottish Spitsbergen Syndicate, but considering their age, they are still in good condition.

On our arrival, the worst hut was completely uninhabitable. Consisting of a single bare room, roughly four metres by nine, it would require full reglazing, considerable roof repairs and patching on the walls and floor. We did, however, use it for storage of some equipment.

The smallest hut was used primarily for storage but with some repairs could prove quite habitable. Having one window, it is about three metres by six. Both the above huts are without a stove.

The smaller of the two habitable huts is divided into two compartments each about five metres square. The roofing is patchy and prone to leaks but the windows have rudimentary "double-glazing". An enormous Russian stove is installed, which, while consuming vast quantities of the plentiful driftwood, produces considerable fire but not excessive heat. Six bunks with mattresses line the walls.

We used the largest of the huts. Four metres by nine, it has an entrance at one end and an excellent "kitchen area" at the other, complete with table and door. On our arrival, all the windows were broken and finding ourselves with some sheet glass but without a glass-cutter, we resorted to cutting with flint and gluing together those sheets where we had an accident. Seven driftwood bunks were built, and an excellent table and bench set made. Holes in the roofing felt were patched with polythene, but even so the hut had numerous leaks, some more serious than others. There was a small stove but without a suitable chimney so some piping and a corrugated tin were adapted; it was, however, necessary to clear out built-up soot every two or three days.

The two best huts certainly proved very comfortable this year and should be basically usable for the next few years at least. Recommendations for repair equipment for future expeditions would include: hammer and screwdriver, a variety of nails and screws, roofing felt and clout nails, saw, chisel, mallet, glass (say 400 x 600 mm sheets) and glass-cutter. A variety of small timber, say 25 x 25 mm, would be useful, but relatively good long planks can be found amongst the plentiful driftwood on all beaches in the area. Crescents could perhaps also be useful for preserving what is currently a delightful haven.

Ian Mackley
PROJECT LEADER'S REPORT

The three major projects undertaken by the expedition members necessitated our splitting up into groups; John Baynham, James Cooper and Ian Macley carried out the glaciological studies while Nigel Banks, Cliff Bassett, Nyles Riple and Graham Thurlow collected samples from seabirds for virological investigation. Though the primary concern of Nyles was work on Arctic Skuas, he gave invaluable assistance to those involved in the influenza project.

On our arrival at Brueghyen, the first two days were spent renovating the hut which was to be our base for the duration of the expedition; this completed, we started work.

The first task of the bird group was to locate an accessible breeding colony of seabirds and as this was accomplished on our first day out, we were able to plan our work immediately.

The area around the hut was investigated for the presence of nesting Arctic Skuas but as none were to be found, searches further afield - both by boat and on foot - proved necessary.

A sortie onto Nordenskiöldbreen Glacier was made at the earliest opportunity and sites for both surveying stations and strain experiments were selected in preparation for future 'work' parties.

All preliminary investigations were completed within a week of our arrival at base and, having agreed on a suitable timetable whereby both bird and glaciological teams had adequate use of the essential inflatable boat, we pressed on with our projects.

Details of each project are given below; our five weeks in the field proved highly successful and all but the Skua work was satisfactorily completed.

Graham Thurlow

SEALED REPORT FOR THE JOURNEY BETWEEN GEINSBY AND SPTISBERGEN, VIA THE NORTH SEA, BLOOM, THORS AND BEAR ISLAND ON THE M.T. COTFOUS

All the records are from the South-North trip, when most of the watching and recording was done by Nigel Banks with Cliff Bassett assisting. Apart from recording any sightings of particular interest to us, we also proposed, at the suggestion of W.R.P. Bourne of the Seabird Group, to attempt to keep general seabird counts especially in the open areas of the North and Barents Seas. This was done by recording the number of birds seen in successive 10 minute periods. Unfortunately, physical conditions were not ideal for this sort of counting. Due to cramped conditions on the bridge, we were unable to use this as an observation point and therefore most watching was done from the aft deck, which, in adverse or cold weather conditions, was not a place for a prolonged stay. However, while Nigel was standing bridge watch he kept records of birds seen so far as duties at the helm allowed. The bridge was about 3 m above sea level and the aft deck 1 m.

From the aft deck we could see through 270° without difficulty, by moving at frequent intervals from port to starboard. Most of the observation was by naked eye, as one had a wider field of view. Binoculars (8.5 x 44 or 10 x 50) were used mainly to check identification, to give the occasional sweep of the horizon and to assist in the counting of closely packed rafts of Auk.

Different methods of counting were used depending on the species. Fulmars (Fulmarus Glacialis) generally followed the boat or flew around it, and so to avoid the possibility of double counting, we simply counted the largest number of Fulmars in view at any one time during the 10 minutes. This would probably result in under-estimation, since some Fulmars would perhaps settle on the water and drop out of sight within the 10 minutes. We also tried to divide the Fulmar count into phases, light (with a light crown and neck) and dark with a darker crown and neck. No attempt was made to distinguish the phases further. Kittiwakes (Rissa Tridactyla) were generally counted in the same way, although we had to be more flexible here; sometimes they followed the boat but otherwise, especially near Bear Island, some followed while others fed near the boat and others were flying South-North or North-South. These readily discernible as following the boat were counted in the same manner as the Fulmars but the rest were simply counted cumulatively. Similar problems were encountered with greater and Lesser Black Back Gulls (Larus Marinus and Larus Fuscus, respectively).

All Auk's (Alcidae) were counted cumulatively because they showed no tendency to follow the boat although occasionally results may be high due to groups or individuals flying round the boat.

Not as much sea watching was accomplished as we had hoped, owing, in part, to seasickness. We had decided to concentrate our efforts on the North and Barents Seas, which, not surprisingly, turned out to be the roughest and most uncomfortable area. Consequently, many valuable hours were spent in bunks. Finally, it should be noticed that the two watchers were inexperienced in observing Arctic seabirds and difficulty was encountered in distinguishing from the boat, Brumichs (Uria Louvlia) and Common Guillemots (Uria Aalga). Consequently, in the table, Guillermots will cover both types. Distinguishing the Scandinavian form of the Lesser Black Back Gull also proved difficult. Unless a specific note is made, the phases of the Fulmar are not distinguished in the accompanying table.

Other Observations

Although this was the limit of our sea watches, we did record observations at other times, notably at Bear Island and the Lofoten Islands. These will be dealt with in chronological order.

05.00 28 June: An unidentified Shearwater (08.00 position 57° 31' N, 3° 59' E).

29 June: Dark Phase Arctic Skua (Stercorarius Parasiticus).
<table>
<thead>
<tr>
<th>DATE</th>
<th>POSITION</th>
<th>TIME</th>
<th>Pulmar</th>
<th>Little Auks</th>
<th>Great Skua</th>
<th>Lesser Black Back Gull</th>
<th>Arctic Tern</th>
<th>Fulmar</th>
<th>Guillemot</th>
<th>Glacous Gull</th>
<th>Little Auk</th>
</tr>
</thead>
<tbody>
<tr>
<td>26/6</td>
<td>08,00</td>
<td>10,00</td>
<td>57 1/4</td>
<td>10,10</td>
<td>11</td>
<td>10,30</td>
<td>10,40</td>
<td>10,50</td>
<td>10,50</td>
<td>10,50</td>
<td>10,50</td>
</tr>
<tr>
<td></td>
<td>08,00</td>
<td>12,00</td>
<td>57 1/4</td>
<td>12,00</td>
<td>7</td>
<td>12,30</td>
<td>12,40</td>
<td>12,50</td>
<td>12,50</td>
<td>12,50</td>
<td>12,50</td>
</tr>
<tr>
<td></td>
<td>08,00</td>
<td>14,00</td>
<td>57 1/4</td>
<td>14,00</td>
<td>1</td>
<td>14,30</td>
<td>14,40</td>
<td>14,50</td>
<td>14,50</td>
<td>14,50</td>
<td>14,50</td>
</tr>
<tr>
<td></td>
<td>08,00</td>
<td>16,00</td>
<td>57 1/4</td>
<td>16,00</td>
<td>4</td>
<td>16,30</td>
<td>16,40</td>
<td>16,50</td>
<td>16,50</td>
<td>16,50</td>
<td>16,50</td>
</tr>
<tr>
<td></td>
<td>08,00</td>
<td>18,00</td>
<td>57 1/4</td>
<td>18,00</td>
<td>6</td>
<td>18,30</td>
<td>18,40</td>
<td>18,50</td>
<td>18,50</td>
<td>18,50</td>
<td>18,50</td>
</tr>
<tr>
<td></td>
<td>08,00</td>
<td>20,00</td>
<td>57 1/4</td>
<td>20,00</td>
<td>2</td>
<td>20,30</td>
<td>20,40</td>
<td>20,50</td>
<td>20,50</td>
<td>20,50</td>
<td>20,50</td>
</tr>
<tr>
<td>27/6</td>
<td>08,00</td>
<td>10,00</td>
<td>57 1/4</td>
<td>10,10</td>
<td>11</td>
<td>10,30</td>
<td>10,40</td>
<td>10,50</td>
<td>10,50</td>
<td>10,50</td>
<td>10,50</td>
</tr>
<tr>
<td></td>
<td>08,00</td>
<td>12,00</td>
<td>57 1/4</td>
<td>12,00</td>
<td>7</td>
<td>12,30</td>
<td>12,40</td>
<td>12,50</td>
<td>12,50</td>
<td>12,50</td>
<td>12,50</td>
</tr>
<tr>
<td></td>
<td>08,00</td>
<td>14,00</td>
<td>57 1/4</td>
<td>14,00</td>
<td>1</td>
<td>14,30</td>
<td>14,40</td>
<td>14,50</td>
<td>14,50</td>
<td>14,50</td>
<td>14,50</td>
</tr>
<tr>
<td></td>
<td>08,00</td>
<td>16,00</td>
<td>57 1/4</td>
<td>16,00</td>
<td>4</td>
<td>16,30</td>
<td>16,40</td>
<td>16,50</td>
<td>16,50</td>
<td>16,50</td>
<td>16,50</td>
</tr>
<tr>
<td></td>
<td>08,00</td>
<td>18,00</td>
<td>57 1/4</td>
<td>18,00</td>
<td>6</td>
<td>18,30</td>
<td>18,40</td>
<td>18,50</td>
<td>18,50</td>
<td>18,50</td>
<td>18,50</td>
</tr>
</tbody>
</table>

**Light phase**

- weather: fair; high cloud; force 3
- Pulmar including raft of 14
- weather: same although more cloudy
- not following boat; flying SW
- flying NW; didn't follow the boat

**Dark phase**

- first tern on Norwegian side of N. Sea
- Kittiwakes mainly feeding in large groups. Weathers force 2 N.W. cold, good visibility.
- some Guillemots had rattled undersides
- just South of Bear Island
- Bear Island still in sight
- weather: force 1, good visibility
- visibility down to 300 metres +30 unidentified birds
- observations from the bridge
- from the bridge. Little auks flying around the boat

---

**Razorbill (Alca Torda)**

- 2 July: Arctic Circle: Large numbers of Greater and Lesser Black Back Gulls following and flying around the boat, up to 40 at one time.
- 15,00 2 July: We reached the Lofoten Islands. The first indication we had of this was the large numbers of Arctic Terns and groups of Puffins. There were also groups of Guillemots and large numbers of Storm Petrels. At one time a group of 30 Petrels was counted feeding.
- 3 July: Vagsfjorden (South of Tromsd): Large numbers of Eider (Somateria mollissima), Pale Phase Arctic Skua and a Great Skua.
- 09,00 3 July: Berents Sea: Great Skua flew West-East across the bows.
- 10,00: About 20 Pulmar following the boat about 1/3 of which were Dark Phase.
- 19,00: A reported sighting of a Pomarine Skua-Pale Phase (Stercorarius Pomarinus).

**Bear Island:** We landed in the South near Sermman in an area of cliffs densely populated with seabirds. There were particularly large colonies of Pulmar (about half of which were Dark Phase), Kittiwakes and Common Guillemots. No attempt was made to estimate numbers. Pairs of Great Skuas were seen on two separate occasions but it may have been the same pair. We were allowed to approach one pair very closely and noted that one bird was noticeably darker than the other; the lighter one having traces of white in the throat area. There were large numbers of Glacous Gulls (c 100) to be observed, some of which appeared to be suffering from an ailment. One was found dead at the base of the cliffs where we landed, a further dead bird was found, and a third bird was struggling desperately, but was incapable of flight. There was no obvious cause of this incapacity. We saw three unfrighted chicks. About 20 Black Guillemots were seen which allowed a very close approach. There was a surprisingly small number of Puffins about, estimated at less than 10. Greater Black Back Gulls were also present in small numbers and a party on Miseryfell and reported a Snow Bunting (Plectrophenax Nivalis). One of our party recorded an Arctic Tern and pairs of Pale Phase Arctic Skua were seen attacking Kittiwakes on July 7 as we moved north up the East coast of Bear Island.

**Miguel Bankes**

**REPORT ON THE INVESTIGATION INTO THE INCIDENCE OF INFLUENZA VIRUS IN SEABIRDS**

The discovery that the influenza virus is found, not only in Man, but also in wild birds and mammals, has resulted in a worldwide project to investigate the incidence of the virus in animal populations. It is thought that the particularly virulent strains of the 'flu' virus that occasionally occur in Man may be due to hybridization between animal and human strains and the collection of samples from birds provides a method of indicating viral presence and also enables new strains to be detected.
On arrival in Spitsbergen, our preliminary investigations of Billefjord, using the inflatable rubber boat, showed that many of the mountains flanking the coast were unsuitable for nesting seabirds; their lower slopes were predominantly of scree which led to crumbling rocky outcrops at higher levels. Other mountains had sheer and inaccessible faces many hundreds of feet high which provided suitable nesting ledges for large colonies of Fulmars (Fulmarus Glacialis).

Despite this, a thriving colony of breeding Kittiwakes (Rissa Tridactyla) and Brünnich’s Guillemots (Uria Lomvia) was located at Kap Fluer de Lys, several miles south of Brücebyen and on the opposite (Western) side of the Fjord; see map. This meant that the bird team had to set up a separate camp away from base and, once that was established and supplied, work commenced.

The cliffs on which the birds nested consisted of four tiers. A cliff from the beach led to a steep slope covered in vegetation growing in a deep layer of guano. Above this, there was a second cliff holding the main part of the colony. Beyond this, a steeper grass and boulder strew inclined led to another part of the colony and higher still were huge rock outcrops housing nesting Fulmars.

We were fortunate in that the slope below the main nesting area was a convenient ridge, on which we were able to set up our mist nets used to catch the birds. This was reached via a ‘streamers’ route along scree flanking the breeding cliffs; extreme caution was, however, needed while working here due to the steepeens of the slope and the slippery nature of the vegetation. The crumbling rock precluded the use of fixed ropes to increase our security.

Our mist nets were seven feet by eighteen feet, black and with a four inch mesh (2100/12ply). On catching a bird, our intention was to take paired samples consisting of a cloacal swab and blood obtained from the bird’s wing vein; this method of bleeding, using a very fine needle, had proved successful on pigeons kept at the Department of Veterinary Medicine in Cambridge. Obtaining blood from Kittiwakes (which constituted most of our catch), however, proved very difficult, due to the dark colour of the bird’s skin; it was decided, therefore, to collect cloacal swabs only.

Having taken our samples, the birds were released and the swabs were placed in plastic tubes containing virus transport medium. These were put in a vacuum dewar containing ice; this was then stored in a deep cave dug in glacier ice. It would have been preferable for the samples to have been frozen in liquid nitrogen but this proved impossible to obtain in the quantities needed and it was hoped that, at a temperature of a little below 0 °C, any ‘flu virus present would remain viable.

The following samples were obtained:

- Kittiwake 96 samples
- Brünnich’s Guillemots 2
- Glaucous Gull (chicks) 4
The Glaucous Gull chicks were well grown birds found close to the daily route to the colony.

The methods used by the National Institute for Biological Standards and Control for influenza virus isolation involves the inoculation of the material under investigation into ten-day-old chick embryos which are then incubated at 35 °C. The presence of haemagglutinins in the allantoic fluid after incubation indicates viral presence.

Although a majority of samples collected from seabirds in Spitsbergen have shown no presence of influenza virus, a few have produced suspicious results and these are still being processed.

The absence of 'flu virus is not inconsistent with previous investigations of Arctic seabirds; previous work has shown that colonies with a total absence of the virus in one year, have, on subsequent investigation, given positive results.

Although an accurate count of the number of nesting birds at the colony was impossible due to the number of inaccessible rock pinnacles and dark, narrow gullies, it was estimated that there was a minimum of 1500 Kittiwakes and 1500 Brunnich's Guillemots together with much smaller numbers of Puffin (Fratercula Arctica) and Little Auk (Ptytus Alle).

It should be noted that no casualties were sustained by any of the birds handled.

Graham Thurlow.

INVESTIGATION OF THE ARCTIC SKUA

The object of this research was to investigate and record examples of disassortative mating in the Spitsbergen population of the Arctic Skua (Stercorarius Parasticus). This work was prompted by Dr. O'Donald of the Cambridge University Genetics Department. The project was not an unqualified success although we were able to record the highest numbers of Dark Phase Skuas seen on the island since the war. We had hoped to find a colony of the birds, although this was considered unlikely, having consulted recent records. The pairs that we did see were scattered along the coastline at almost all points of the coast that we were able to visit. The only unusual pair in this connection, were the two seen half-way up Gipsadal. Ideally, for a survey of this sort, 6 weeks could have been well spent travelling along the coast solely with the object of finding Skuas.

A total of 14 Arctic Skuas were seen (more were sighted but we were unable to say unequivocally that they were the not the same as previous sightings).

<table>
<thead>
<tr>
<th>Dates</th>
<th>Site</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/7</td>
<td>Near huts</td>
<td>1 pr. pale</td>
</tr>
<tr>
<td>20/7</td>
<td>Kapp Ekhola</td>
<td>1 intermediate pale</td>
</tr>
<tr>
<td>22/7</td>
<td>Kapp Ekhola</td>
<td>1 intermediate pale</td>
</tr>
<tr>
<td></td>
<td>Nuar huts</td>
<td>1 dark</td>
</tr>
<tr>
<td>23/7</td>
<td>Kapp Fleur de Lys</td>
<td>1 intermediate pale</td>
</tr>
<tr>
<td>27/7</td>
<td>Mid Gipsadal</td>
<td>1 100 % pale</td>
</tr>
<tr>
<td>29/7</td>
<td>Base of Gipsadal</td>
<td>1 intermediate pale</td>
</tr>
<tr>
<td>1/8</td>
<td>Kapp Ekhola</td>
<td>previous sighting confirmed</td>
</tr>
</tbody>
</table>
Of these, only one pair were known to be nesting - they had an egg laid by 29th July which was hatched by 13th August (probably several days earlier by the stage of development of the chick). This is considerably later than we were led to expect by the literature (e.g. Southern 3) and is probably a reflection of the late arrival of summer. The pale phase is recorded as breeding later than the dark phase and this may be an adaptation to Arctic conditions. The clinal phase frequencies certainly show a reduction in dark frequency towards the North.

<table>
<thead>
<tr>
<th>Pale phase</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>S. Norway and Baltic</td>
</tr>
<tr>
<td>21</td>
<td>Fair Isle</td>
</tr>
<tr>
<td>50-75</td>
<td>N. Norway</td>
</tr>
<tr>
<td>90</td>
<td>Jan Mayen</td>
</tr>
<tr>
<td>100</td>
<td>S. Greenland</td>
</tr>
<tr>
<td>100</td>
<td>Bear Island (personal observation)</td>
</tr>
</tbody>
</table>

This compares with a calculated figure of 77% pale phase for the birds which we observed in the Bruscebyen area of Spitsbergen.

The advantage in late hatching may be associated with the arrival of peak food abundance, e.g. fish, small insects, worms, berries (Gray and Davis 6). The associated decrease in reproductive effort may well increase the inclusive fitness of the pale phase till it outweighs that of the dark phase in the Arctic (terminology of Dawkins 5, O’Donald 7).

Difficulties using mist nets meant that we were unable to catch any Skuas to evaluate their sex. Thus, for the pair at Kapp Ekholm we were unable to quote the sexes. For the data necessary to Dr. O’Donald, all the other pairs are considered to be pale phases. The standard classification according to Dr. O’Donald 1 and the Collins Field Guide 2 was used. According to this, we observed no intermediates at all. However, we observed a wide range of pale phases from the total white belly to ones with a 4 inch wide brown neck band.

The nearest birds were approximately 4.5 km apart, whereas the furthest were 15 km apart. Whether this reflects food abundance is unclear. The normal kleptoparasitic habits were only rarely observed in the Spitsbergen population. The nesting birds at the base of Gipsedalen and the Kapp Fleur de Lys individual were both observed but the others did not appear to indulge in this, while under observation. More often, they were seen to be chased off by Arctic Terns or a variety of gulls. The pair in the middle of Gipsedalen were seen to be ranging over a piece of cundra and 'apparently' feeding on an old gull’s wing.

DISPLAYS: The most pronounced displays were shown by the nesting pair who were actually defending their clutch of one egg.

Approx. distance from nest

- 50-70 m Low flying passée-displacement activity (feeding, preening)
- 20-10 m Wing flapping on ground - perhaps ritualised takeoff operations. Much calling.
- 10-0 m Hovering in air in front of observer. Low passes trying to hit us, altogether inaccurate.

As observers got closer in each zone, the frequency of display increased (interpretation based on Hind 6).

The pair at Kapp Ekholm also displayed but with no apparent rationalisation. We were unable to find a nest and can only assume that they were a young pair establishing a territory for the next year. The same displays were used but with much less intensity and frequency. The other pairs observed did not display at all which may imply that they either had finished with their clutch, had the clutch eaten, or were preparing a territory but weren’t defending it. Of these possible reasons, the most likely is that the clutch had been destroyed by some predator, e.g. Arctic Fox, (as happened to the Arctic Terns and Gannets by our hut). One would not have expected them to have finished dealing with their clutch by this date (see ‘base Gipsedalen’ pair). Nor would one expect them to display if on their territory (see Kapp Ekholm pair). One can only interpret displays as a vacant territory (no nest) in terms of parental investment for the next year’s brood. In anthropomorphous terms, either the male or female is imposing a certain investment on its partner to ensure a higher reproductive success - perhaps due to non desertion (Therlows 8 for a fuller discussion of parental investment). The investment appears more logical when one considers that the same territory is maintained all through their active breeding life.

In conclusion, we have gathered some useful data but not sufficient for a statistical test for disassortative mating. We feel that this could be done with a highly mobile group with this project as their priority. They would be able to revisit nests and gather full data which could be gathered in statistical quantities. Their mobility would isolate them from any other group and they would not be able to use any permanent base. One problem has been solved - that the incidence of the dark phase is high enough to repay further investigation. One area that particularly needs filling in is the East coast.

We would particularly like to record our thanks to the following, who helped us with much advice:

- Dr. P. O’Donald
- The late Dr. Brian Roberts
- Professor Hind
In Austfjorden, a pair of Long-Tailed Skuas were seen - 1 pale phase and 1 dark intermediate. The dark form is quoted as being unknown in recent years (Peterson et al 2). Thus this find is of great importance especially as it underlines that the dark phase is of selective advantage in the Arctic.

1. Dr. O'Donald Pers. comm.
8. Trivers (72) In 'Sexual selection and the descent of man', ed. B. Campbell.

Myles Ripley

Pala Arctic Skua (Stercorarius parasiticus) observed in Gipsadalen.

Svalbard Reindeer.

GENERAL BIRD OBSERVATIONS

The high Arctic regions are host to a number of bird species, particularly ground nesters such as waders, ducks and geese. The short breeding season is offset by the twenty-four hours of daylight allowing continuous feeding and consequent rapid growth of the chicks.

On Spitsbergen, disturbance by Man is minimal - many birds being protected by governmental legislation during the breeding season - and the only serious threat to ground nesting birds is that of the Arctic Fox.

As a number of the expedition members were keen bird-watchers, observations were made in the region of our work. A list of sightings is given below:

*Red-throated Diver (Gavia stellata)
*Pintail (Anas acuta)
*Sider (Somateria mollissima)
*Long-tailed Duck (Clangula hyemalis)
*Pulmar (Pulmarus glacialis)
*Brünnich’s Guillemot (Uria lomvia)
*Black Guillemot (Cepphus grylle)
*Little Auk (Patactus alle)
*Puffin (Fratercula arctica)
*Glaucous Gull (Larus hyperboreus)
*Ivory Gull (Pagophila eburnea)
*Kittiwake (Rissa tridactyla)
*Arctic Tern (Sterna paradisaea)
*Arctic Skua (Stercorarius parasiticus)
*Long-tailed Skua (Stercorarius longicaudus)
*Turnstone (Arenaria interpres)
*Ringed Plover (Charadrius hiaticula)
*Gray Phalarope (Phalaropus fulicarius)
*Red-necked Phalarope (Phalaropus lobatus)
*Purple Sandpiper (Calidris maritima)
*Dunlin (Calidris alpina)
*Turnagain (Lagopus mutus)
*Snow Bunting (Plectrophenax nivalis)

(* indicates species seem to have eggs or young)

Both Puffin and Little Auk frequented crevices in the cliffs housing the colony of Kittiwakes and Brünnich’s Guillemots suggesting that these two species also bred there.
Of the birds recorded, we were particularly interested to see a single Dunlin for which there are very few sightings in Spitsbergen. Also a female Pintail with four ducklings frequented a small lake close to our hut and this too caused considerable interest as up to 1964, only a single nest of this species had been recorded.

A number of dark phase Arctic Skuas were observed (separate report) together with a single dark phase Long-tailed Skua - this specimen being seen in the company of a light phase bird of the same species. There would appear to be only two records of dark phase Long-tailed Skuas and it is considered that dark birds seen are, in fact, juveniles.

Although geese have been reported as inhabiting the area of Spitsbergen visited by the expedition, sightings were limited to a distant view of a small flock flying along the Fjord; identification was not possible.

An example of the efficiency of Arctic Fox predation was seen during our stay on Spitsbergen; the small colony of Arctic Terns nesting near our hut was decimated by a fox visiting the area just as the eggs were beginning to hatch. Shortly after this, most of the adult Terns departed, although a pair of Red-throated Divers, which also lost their eggs to this predator, periodically returned to the lake, on which they nested, to bouts the area with their warning call.

While on a visit to Petunia Bukta, Nigel Bankes sighted a small wader which was identified as a Little Stint (Calidris Minuta). Avifauna of Spitsbergen, 1964, states, however, that sightings of this bird on the islands have never been substantiated and as a photograph proved unobtainable, this situation remains.

1. 2, 3 - Avifauna of Spitsbergen, 1964. N.P.I.

Graham Thurlow

ZOOLOGY REPORT

The following report contains the results of casual observations on the fauna of the areas in which we were. This has necessarily strongly skewed the emphasis towards the mammals (the avifauna being the subject of another separate report).

Arctic Fox (Alopex Lagopus) (LINN)

26/7/78. One adult, brown phase, was observed in Brucebyen and proceeded to consume all the local population of Arctic Tern chicks and the chicks of the Red-throated Diver. However, those Arctic Terns nesting further to the North on the raised beaches were left alone. A further observation of this presumed same fox on 8/8, appeared to show no predation.

28/7. Arctic Fox cub observed near Reindalen. Assumed to be cub on account of its size. An indistinct observation led to a possible conclusion that it was a silver phase.

28/7. Arctic Fox adult (brown phase) near Reindalen but some 3 miles from the cub. Also large numbers of winter skins were seen on the hut of a Norwegian hunter caught in the traditional, homemade trap. It is to be deplored that miners from Longyearbyen use gin traps to catch the Foxes. This practice has long been outlawed in Britain and should be there as well.

Reindeer (Rangifer Tarandus) (LINN)

A large number of these were seen almost everywhere we went but rarely in large groups. The largest group seen consisted of 2 females and 1 male young male adult and 2 fawns. A number of shed antlers were collected and brought back for analysis of the degree of chewing to aid dietary deficiencies.

Ringed Seal (Pusa Hispida) (SCHREBER)

A large number of ringed seals were seen in Adolfbukta. On one occasion, 13/8, about 20 were observed basking on a large number of ice floes created by the recent warm weather. The continuance of the warm weather no doubt prompted the basking to occur. On an earlier occasion, 5/8, we were able to approach to within about 2 feet of a seal pup lying on a small floe.

Seals, unidentified, but probably ringed, were also seen at Kapp Fleur de Lys and in Isfjorden near Longyearbyen Airport.

Whales - Beluga (Delphinapterus Leucas)

One young Beluga was seen by the snout off Mordenskjoldbreen. Only the dorsal surface was seen as it swam along by the South coast of Adolfbukta. This was later identified for us by a Norwegian hunter.

Miles Ripley

COLLECTION OF ANTLENS AND SHELLS

Although the three main projects occupied most of the expedition's time, two smaller items of work were also carried out.

Dr. A.J. Sutcliffe at the Department of Palaeontology, British Museum (Natural History) has been studying the chewing of bones and the cast antlers of deer by both carni-vorous and non-carnivorous mammals such as deer and rodents. He is working on the geographical distribution of this phenomena and its relationship to the dietary requirements of the latter group of animals as it is thought that a deficiency in the minerals phosphorus and/or calcium leads to the development of this habit.

The region of Spitsbergen in which the expedition travelled, held a number of reindeer and cast antlers were fairly common. When found, these were investigated for evidence of chewing and a number of these have been collected for detailed study at the British Museum.

The second of these projects concerned the collection of molluscs shells from the shores of the fjords around which we worked and from any raised beaches in the area. Mr. P. Cambridge of the School of Environmental Sciences, University of East Anglia is
particularly interested in the Buccinidae, but, due to the difficulty in obtaining Northern material, he asked for any shells or live specimens found.

The working area proved to be rich in shells although live specimens were impossible to collect without the correct dredging gear.

A number of species of mollusc shells were brought back to Britain from both shore level and raised beaches and have, subsequently, been identified by Mr. Cambridge as:

**Crepidula**
- Pyrula pusilla (Reeve)
- Buccinum Glaciale (Miller)
- Chlamys Islandicus (L)
- *Retracta*
- Chlamys Islandicus (L) juvenile
- *Natica Clauss* (Brod. and Sow.)
- *Hiatella Arctica* (L)

**Crepidula de Lys**
- Astarte Borealis (Clemm.
- *Hiatella Arctica* (L)
- *Serripes Groenlandicus* (Cham)
- *Buccinum Glaciale* (Miller)

**Bruscabryen**
- Chlamys Islandicus (L)
- *Mya Turbo* (L)
- *Natica Calcaria* (Ouel)
- *Hiatella Arctica* (L)
- Astarte Elisae (Benn.)
- *Mactra Niger* (Gray)
- Astarte Borealis (Schum)
- *Serripes Groenlandicus* (Cham)
- *Buccinum Glaciale* (Miller)

**Bucephalen Raised Beaches (> 2 m)**
- Mytilus Edulis (L)
- *Listeria Saxatilis* (Oliv)
- *Natica Clauss* (Brod. and Sow.)
- *Tropon Glacratum* (L)
- *Buccinum Glaciale* (Miller)
- *Buccinum sp*
- *Plecofusus Kyayi* (Miller)
- Fish remains - probably the bony plates of a sturgeon, perhaps *Asipenser Oxyrhynchus*

Graham Thurlow
GLACIOLOGICAL PROGRAMME

Introduction

The expedition set out with four definite glaciological objectives:

1. The setting up of a permanent surveying base grid from which all future Nordskiöldbreen profile surveys could be referenced.

2. Obtaining a 'present' snout profile of the glacier.

3. Obtaining strain measurements around selected crevasse configurations.

and 4. Obtaining data on the effects of fjord tidal variations on the Nordskiöldbreen snout.

In the event, objectives (1) and (2) were successfully carried out; attempts at (3) were thwarted by deficiencies in our equipment and the high ablation rate; objective (4) was partially successful. In addition, however, an ad-hoc experiment examining the growth of dirt cones was carried out and some interesting results obtained.

Permanent Surveying Grid

Four permanent and four semi-permanent surveying stations were established on the West side of the Nordskiöldbreen snout. The permanent ones, placed so as to be clearly visible from virtually all parts of Adolfsfjorden, were clearly marked and should remain readily identifiable for many years without further maintenance. Of the four remaining stations, two were marked with stone cairns and the others with painted wooden posts. Since both cairns and posts were observed to weather well in Arctic environments, it is expected that these stations will, also, survive indefinitely.

For surveying the grid, one inch diameter plastic tubing was painted "Dye-Glo orange" and erected over the stations to act as markers. This arrangement proved admirably suitable for sighting - even over the longer legs of approx. 4 km: this fact was, doubtless, attributable to the clear Spitsbergen air. A Wild 'T2' one second theodolite, kindly loaned by the Cambridge University Engineering Department, was used for all the grid measurements. To simplify calculations, a flat earth approximation was adopted.

Location and Description of Stations

Station 1

Q.C.S.E. Co-ordinates* 3,954.0 2,067.0
U.T.M Co-ordinates* E 541,496 N 8,732,945
Location: On highest point of Rettrettdy
Identification: Nail in natural crack; marked by 1.2 x 1.2 m flat white-painted cross

Beware: TAKE GREAT CARE WHEN LANDING ON ISLAND. ICE FALLS INTO FJORD LEAD TO WAVES WHICH DO FULLY SWAMP THE ISLAND.

Station 2

Q.C.S.E. Co-ordinates* 3,201.8 1,659.8
U.T.M Co-ordinates* E 541,616 N 8,734,252
Location: On rock outcrop on North shore of Adolfsfjorden; set back from the shore line - approx. due North of Rettrettdy and East of small river entering the fjord.
Identification: Nail embedded in rock; marked by low (red-painted) cairn and flat white-painted mosaic cross. Rock outcrop marked by red-painted square, visible from South.

Station 3

Q.C.S.E. Co-ordinates* 4,948.8 1,069.9
U.T.M Co-ordinates* E 540,974 N 8,734,253
Location: On rock outcrop on North shore of Adolfsfjorden - approx 650 m due West of Stn. 2.
Identification: Plastic tube encased in rock; marked by low (red-painted) cairn and flat white-painted mosaic cross. Rock outcrop marked by red-painted squares visible from South-East and Rettrettdy.

Station 4

Q.C.S.E. Co-ordinates* 3,513.5 2,635.3
U.T.M Co-ordinates* E 541,845 N 8,732,315
Location: On rock exposure in Nordskiöldbreen snout.
Identification: Nail embedded in rock; marked by low (red-painted) cairn and a 1.0 x 1.0 m flat white-painted cross.

Station 5

Temporary station.
Q.C.S.E. Co-ordinates* 1,714.9 1,216.4
U.T.M Co-ordinates* E 539,828 N 8,731,226
Location: On furthest extent of terminal moraine on South shore of Adolfsfjorden; situated close to shoreline.
Identification: Low (red-painted) cairn.

Station 6

Temporary station.
Q.C.S.E. Co-ordinates* 1,318.7 1,809.7
U.T.M Co-ordinates* E 540,215 N 8,730,627
Location: On furthest extent of terminal moraine on South shore of Adolfsfjorden; situated approx. 700 m South-East of Stn. 6.
Identification: Low (red-painted) cairn.
Station B1

End point of O.C.S.E. baseline; surveying datum.

**Q.C.S.E. Co-ordinates**

<table>
<thead>
<tr>
<th>Datum</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**U.T.M. Co-ordinates**

<table>
<thead>
<tr>
<th>Datum</th>
<th>E</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>538,031</td>
<td>8,730,133</td>
<td></td>
</tr>
</tbody>
</table>

**Location:**
Brucebyen; South, South-West from the huts; approx. level with Southern tip of lake.

**Identification:**
40 x 40 mm square (yellow-painted) wooden peg.

Station B2

End point of O.C.S.E. baseline.

**Q.C.S.E. Co-ordinates**

<table>
<thead>
<tr>
<th>Datum</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>929.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**U.T.M. Co-ordinates**

<table>
<thead>
<tr>
<th>Datum</th>
<th>E</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>538,400</td>
<td>7,730,987</td>
<td></td>
</tr>
</tbody>
</table>

**Location:**
On shore of Adolfbukta; on the Sentahtukta side of Kapp Napier.

**Identification:**
40 x 40 mm square (yellow-painted) wooden peg.

Cambridge Spitsbergen Expedition, 1949

The 1949 Cambridge Spitsbergen Expedition's survey of Nordenskiöldbreen was based on the datum of the South-East corner of the South-East hut at Brucebyen. For completeness, these co-ordinates are included.

**Q.C.S.E. Co-ordinates**

<table>
<thead>
<tr>
<th>Datum</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>125.7</td>
<td></td>
<td>80.0</td>
</tr>
</tbody>
</table>

**U.T.M. Co-ordinates**

<table>
<thead>
<tr>
<th>Datum</th>
<th>E</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>538,154</td>
<td>8,730,217</td>
<td></td>
</tr>
</tbody>
</table>

* The Queen's College Spitsbergen Expedition (Q.C.S.E.) Co-ordinates are Cartesian relative to Station B1. The 'x' Co-ordinate is +ve along STS; the 'y' Co-ordinate was +ve along the "Aldoricia" perpendicular to STS. Values quoted are accurate to ± 0.15 m.

+ The Universal Transverse Mercator (U.T.M.) Co-ordinates are based on N.P.L. figures for two caims visible on Geddelafjell-

<table>
<thead>
<tr>
<th>Datum</th>
<th>E</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>543,586.13</td>
<td>8,728,154.30</td>
<td>770.15</td>
</tr>
<tr>
<td>542,358.66</td>
<td>8,726,714.76</td>
<td>489.80</td>
</tr>
</tbody>
</table>

* The Q.C.S.E. survey, using a flat-earth approximation, gave a minor discrepancy (1.68 m) over the relative positions of the two caims when compared with the N.P.L. figures. The values quoted should, therefore, be only used as a guide.

† The white crosses are suitable for identification in low level air photographs taken during summer months

Adolfbukta Shore Survey

All surveying required on easily accessible land was done using a ex-military artillery range finder (kindly loaned by the Royal Geographical Society) and a Watts 20 second vernier theodolite (which, like the Wild T2, had been kindly loaned by the Cambridge University Engineering Department). Hand held ranging rods were sighted from small temporary stations; both angle and range values were recorded. The range finder was suitable for use up to 1 km; prior to departure, the device had been calibrated against a Wild DI 10 Distant.
View of Nordskjöldbreen from the Brucebyen base.

Purple Saxifrage (Oppositifolia).

Red-throated Diver (Gavia stellata) nesting on the Brucebyen lake.

The afterglow facing North after Norwegian landfall in mid-August.
Ice Front

The ice cliffs forming the glacier snout proved to be most unstable and the manual placing of surveying markers was impossible. Instead, natural marks along the front were noted and then sighted from two of the grid stations (3 and 4 for Northern sector and 3 and 6 for Southern part). This triangulation technique had two inherent failings:

1. The ice features appeared completely different from the two vantage points.
2. It was not infrequent that ice cliff falls completely altered sections of the snout between the two sets of theodolite readings.

Absolute accuracy for these measurements was, however, not essential owing to the dynamic nature of the ice front.

Depth Survey

A line of depth soundings was made in Adolfbukta parallel to the front of the glacier. The inflatable was used to traverse the fjord along a pre-determined line defined by a set of shore-based 'leading' markers. A theodolite cross-fix was taken for each sounding position from Station 4. Depths were measured with a weighted calibrated line.

Figure 51 shows the present (July 1978) position of the Nordenskiöld glacier along with previous lines observed over the last seventy years; the depth survey is also marked. Figures 52 and 53 show two views of the snout; 52 taken from Cadellsfjellet (1978) and 53, an air photograph taken in 1960 for R.F.I.

The glacier has clearly retreated since 1960 as witnessed by the appearance of the large rock exposure housing Station 4. Visual inspection of the rest of the snout showed that it was grounded in several other places along its length. Observation suggested that only small areas of the glacier South of Station 4 rested in significant depths of water, although a thorough examination was deemed unsafe on account of the frequent large ice falls.

Strain Measurements around Crevasses

Two methods of measuring ice strain were tried in the large, heavily crevassed area in the centre of the Nordenskiöld Glacier.

In areas where large ice displacement was expected, the simple expedient of sinking 2" diameter plastic tubes into 1 metre of solid ice was adopted. First holes were drilled with a converted wood drill and then the P.V.C. pipes hammered into place. It is suggested that future expeditions, using converted wood drills, cut off the small diameter 'lead in' as this tended to reduce boring efficiency. Measurements were taken, with a standard pocket rule, from the lips of the tubes. A triangular layout was used to enable principal strain directions to be evaluated from results obtained.

In low strain areas, a more accurate measurement system was needed and a small meter was kindly lent to the expedition by Dr. Goodman, (Cavendish Laboratory).
The existing sound profiles are mainly reproduced from the report of the 1949 Cambridge University expedition. Their relative positions are only approximate owing to a lack of data, although more surveys will be able to benefit from the permanent grid stations. The 1941 charts are reproduced from M.I.A. map 06 (1:100,000) and air photographs.

Land profiles west of Ymerovola and Hoppitera were not checked in 1970 and are based on available records.

- circle: main base camp
- cross: G.S. camp
- grid: survey
- rock: outcrop

ADOLFBUKTA

Kap Hopper
St Paul
Saulukbukta

N

Kilometers

0 1 2 3 4 5 6 7 8
The plastic tubes were sunk, as before, but measurements were made with the 'invar' bar and clock gauge arrangement shown in Fig. 42. This device could theoretically resolve to 1/10 000" but three systematic failings (flexing of the plastic tubes when loaded by the clock gauge spring, inherent slack within the jointed 'invar' bar structure, and the bowing of the bar itself) made it impossible to obtain reasonable results even in ideal conditions.

In the twenty days the two experiments were in place, severe ablation occurred and all the poles rose from their tops being flush with the ice to being ½ metre proud of it. The results, although recorded, proved spurious and, as such, are not reproduced in this report.

**Tidal Variation**

1. **Strain Meter**

   An electronic strain meter was located on the ice cliffs over part of the snout suspected to be floating in a significant depth of water. It was hoped that any Cantilever swaying of the ice with tide would be clearly represented by changes of strain.

   The device, designed by Dr. Goodman (Cavendish Laboratory) is illustrated in Fig. 55. 8.78 metres of 'invar' wire was stretched between two plastic poles embedded securely in 1 metre of ice. Constant tension was maintained by 22 cm of low stiffness spring. At one end, the 'invar' wire was made to pass round a grooved flange which was attached via a spindle to a 360° potentiometer. Theoretically, any change in friction would cause the potentialmeter to rotate and the resultant voltage change marked on a low power chart recorder driven by a crystal quartz time base.

   Unfortunately, stress melting (the phenomenon of ice melting under load) plus the general high ablation rate resulted in the collection of spurious data. Within four days, the plastic tubes were free and the experiment was terminated.

2. **Theodolite Observations**

   A twenty-four hour survey was held on Sunday 6th and Monday 7th September 1978 in an attempt to collect data manually after the failure of the electronic test. A theodolite was set up on Station 4 and an ice pinnacle on the snout was sighted every 15 minutes except when low cloud and mist obscured the view. An ablation reference test was also conducted in parallel.

   The results are shown in Figure 56. The high degree of scatter was inevitable with several different people taking the sighting readings.

   James Cooper

---

**Fig. 56** Despite a significant (1.5%) tidal variation, the plot shows no indication of sympathetic ice motion. The horizontal readings show a gradual forward advance of the snout (approx. 0.15m per day); the vertical ones follow the average ablation line. The scatter in readings around the 03.0C high tide is probably attributable to the prevailing poor visibility and not to the tide itself. The results are in agreement with the observation, noted earlier, that the glacier is almost totally grounded.
DIRT CONES - A CRITERION FOR THEIR FORMATION

General

It is generally recognized that dirt cone formation is the result of the 'insulation' of local patches of glacier ice from the full effects of the sun and warming winds by a covering layer of material such as sand or silt. In this report, we suggest that although there are many possible mechanisms by which 'dirt' is deposited, there is a single condition governing the growth of a 'cone'.

Types of Covering Material

C. Swithinbank (1949) suggested that dirt is deposited by wind or water in existing holes in the ice; such windborne dust would be very fine in nature. O. Liestøl (1950) reported sand 'pillars' which, he suggested, were due to sand being water-deposited in melt holes. On Nordenskiöldbreen (1976) dirt cones comprised a silty material were noted together with a 'dirt cone' composed of stones (ranging from 20 to 400± m in size) formed from the medial moraine running East from Tjøllirfjellet. The latter 'cone' was, in fact, a platform nearly 20 metres wide and extended from the snow line (where it was zero height) to the snout where a maximum height of approximately 4 metres was found - a total distance of 3 km. The sides of the platform were inclined at approximately 45° to the horizontal and the resulting loss of covering material reduced its width near the snout. It is not known whether the platform had survived the previous winter; certainly there was marked growth between 19th July and 8th August.

It was thus evident that cone formation can occur with covering material ranging from fine wind-blow dust to rocks of 400± m dimension. In fact, the rocks weighing up to several tonnes frequently found resting on ice pedestals can also be considered as a type of cone.

The Opposing Effects of A Covering Layer

The effect of the ablation rate of ice underneath a covering layer can be twofold:

1. If the covering layer is relatively thin, the relative ablation rate is increased and a depression will be formed.

2. If the covering layer is thick, however, the relative ablation rate is reduced and a cone will start to form.

Thus for any particular covering material, it appears that there is a critical thickness below which ablation is increased and above which the reverse is true. An explanation of the opposing effects is given below.

Increased or Decreased Ablation?

In order to explain the contrasting effects of a layer of material covering an area of ice, it is necessary to consider the rate of heat flow into the ice from the environment. Assumptions and approximations made in the argument are given below.

a. The rate of radiation/adsorption of energy from/to a real surface can be assumed proportional to that of a 'black body'. Hence for a surface 't'

Stefan's Law gives the specific rate of energy radiation

\[ \dot{q}_t = \sigma_b (T_t^4) \]

where \( \sigma_b \) = Stefan-Boltzmann constant for the surface 't'

and \( T_t \) = temperature of the surface 't' in absolute units.

It is assumed here that the Stefan-Boltzmann constant for the covering material is greater than that of the ice, i.e.

\[ \sigma_{\text{dirt}} > \sigma_{\text{ice}} \]

It is also assumed that the rate of absorption of radiation energy by the ice and the dirt surface can be approximated to:

\[ \dot{q}_{\text{ice}} = \sigma_s (T_s^4) \]

\[ \dot{q}_{\text{dirt}} = \sigma_s (T_s^4) \]

This assumption simplifies the argument and leads to an increased understanding of the mechanisms involved in cone formation.

b. Conduction of heat from the atmosphere to the dirt layer and from the atmosphere to the ice is assumed to occur at the same rate per degree difference in temperature, i.e.

\[ \dot{q}_{\text{Atmosphere - Dirt}} = \frac{K(T_s - T_l)}{\text{per m}^2} \]

\[ \dot{q}_{\text{Atmosphere - Ice}} = \frac{K(T_a - T_s)}{\text{per m}^2} \]

where

\( K \) = a constant

\( T_a \) = the ambient temperature

\( T_s \) = the temperature of the dirt surface

and

\( T_l \) = the temperature of the ice surface

It is assumed that \( T_s > T_l > T_a \).

c. Conduction of heat within the dirt layer is governed by the equation

\[ \dot{q}_d = k_d \frac{dT}{dx} \text{ per m}^2 \]

where

\( k_d \) = the thermal conductivity of the layer

and

\( \frac{dT}{dx} \) = the temperature gradient.

Consider, first, the rate of absorption of energy by the surface of a patch of bare ice.

Specific heat flow in per second = \( \sigma_b (T_s^4) + K(T_s - T_l) \)

Specific heat flow out per second = \( \sigma_p (T_l^4) \)

\( \therefore \) heat absorbed per second = \( \dot{q}_p ((T_s^4) - (T_l^4)) + K(T_s - T_l) \)

(1)
Now consider the case of a patch of ice covered by a thickness $L$ of dirt:

Specific heat flow in per second $= \sigma_g(T_A)^k + K(T_A - T_I)$
Specific heat flow out per second $= \sigma_g(T_B)^k$

$. . . . heat absorbed per second $= H_2 = \sigma_g(T_A)^k - (T_B)^k + K(T_A - T_B)$

hence

$$T_A = (T_I + \frac{H_2}{\sigma_g/k_d})$$

Substituting in eqn. (2) for $T_A$ gives:

$$H_2 = \sigma_g(T_B)^k + K(T_B - T_I) = \sigma_g(T_B)^k - \frac{d}{k_d}(H_2 + T_I)^k + \ldots \ldots$$

The term $(\frac{H_2}{\sigma_g/k_d})$ can be assumed to be $<< 1$ since the temperature difference $(T_A - T_I)$ is likely to be much smaller in magnitude than the absolute temperature $T_I$ (see eqn. (3)).

Using the binomial theorem, eqn. (4) can be re-written:

$$H_2 = \sigma_g(T_B)^k + K(T_B - T_I) = H_2 \left(1 + \frac{H_2}{\sigma_g/k_d} \right) - \sigma_g(T_B)^k(1 + \frac{H_2}{\sigma_g/k_d}) + \ldots \ldots$$

Now considering the case where the ice is bare and where there is a covering by a layer of dirt. The temperatures $T_A$ and $T_I$ will not be affected by the presence of the dirt layer and hence the right hand of eqn. (6) is a positive constant. When $\frac{d}{k_d}$ is 'small', $H_2 > H_1$ and the ablation rate of the ice will be increased by the presence of the dirt layer. When $\frac{d}{k_d}$ is 'large', however, $H_2 < H_1$ and the ablation rate of the ice will be decreased.
### Experimental Confirmation

An impromptu and qualitative experiment to investigate the ablation rates of ice under different thicknesses of covering material was carried out on Nordenskiöldbreen. A silty material was 'borrowed' from a medium sized nearby dirt cone and deposited in various thicknesses on equal areas of clear ice. The silt was measured out by volume; layers were made up of different numbers of billie cms of mud. The site was re-visited to monitor progress; after ten and twenty days, the patches were measured. The results (tabulated below) indicate that the critical layer thickness for the mud was between 7.5 and 15 mm.

<table>
<thead>
<tr>
<th>No. of billies on patch</th>
<th>Depth of layer mm</th>
<th>Amount of differential ablation*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.5</td>
<td>-20 20</td>
</tr>
<tr>
<td>2</td>
<td>15.0</td>
<td>55 45</td>
</tr>
<tr>
<td>3</td>
<td>22.5</td>
<td>75 45</td>
</tr>
<tr>
<td>4</td>
<td>30.0</td>
<td>85 45</td>
</tr>
<tr>
<td>5</td>
<td>37.5</td>
<td>45 45</td>
</tr>
<tr>
<td>6</td>
<td>45.0</td>
<td>30 45</td>
</tr>
</tbody>
</table>

*Note: means reduced ablation under layer (i.e. mound)

**The low figures were probably due to the layers disintegrating, in time, into discreet lumps thus allowing unhindered ablation. This breakup was caused by the initial layer material - compacted, saturated mud - drying in the sun. Future experiments should use a dry, sifted material similar to that found on genuine cones.

It is possible to propose a mechanism for dirt cone formation based on the experience on Nordenskiöldbreen; there is, however, no evidence to suggest that any one mechanism is uniquely responsible for the phenomenon.

Dirt is spread over the entire glacier by gravitation, wind and water. In summer, random dirt concentrations form into cryocomites (depressions, floored with fine silt) by the preferential ablation mechanism discussed above. These cryocomites are frequently found joined together by small melt rivulets and this would be the method by which the initially thin deposits would approach and finally exceed the “critical” thickness. The relative ablation rate would, thus, change and a cone start to form. During this stage, it is conceivable that high winds, a water surge or heavy rain could wash away the dirt; this would account for the fewer number of cones than cryocomites.

John Baynham
James Cooper

---

### MOUNTAINEERING

Although the expedition had no specific mountaineering objectives, it is felt that a few words about our mountaineering impressions and achievements may be of some use to others visiting the area.

Nigel and Ian were keen to do some rock climbing but all the cliffs which looked likely to give good routes proved to be very loose and potentially dangerous.

Although snow/ice routes existed in the Brucabyen area, none were attempted. At the bird colony at Kapp Fleur de Lys, an ice gully was climbed by Nigel, Ian and Myles in order to catch seagulls, but this would be best described as a mixed ice/guano climb, consisting of a short seventy degree ice pitch followed by combinations of step-cutting and wading through a two foot layer of bird droppings.

We settled for some ascents of local mountains. John, James and Ian attempted to ascend Terrierfjellet (4003 ft) on Nordenskiöldbreen, crossing the glacier by cutting across from the moraine at the foot of Ferrierfjellet, and camping by the side of Terrierfjellet. The next day almost whiteout conditions brought the attempt to a premature end.

John nearly reached the summit plateau of Teltfjellet by ascending the sree directly behind the Brucabyen huts, but eventually it became too steep. We all ascended Cadellfjellet (2527 ft) from Nordenskiöldbreen, taking a sree gully to the lower calm and from there up steeper and looser srees to the summit. We descended into Matthewbreen.

Ian and James ascended Kroeningfjellet (3110 feet) on the South side of Sassenfjord from Vinandalen on a cloudless day. This started as a hill walk, developing into a snow plod at about 1500 feet, ending in steep climbing and scrambling at the summit. We were rewarded by terrific views over Isfjord, Tempelfjord and over towards Olav V land.

There were undoubtedly many more mountains in the region that were easily ascended but we unfortunately did not have time to take advantage of the good weather. Snow in the characteristic gullies would give the best routes, otherwise most sree slopes are climbable with effort. The sree is so fine that quick descents are possible.

No problem was encountered with crevasses on Nordenskiöldbreen. By our arrival, all were snow-free and could be easily avoided. However, two sets of snow-covered crevasses at right-angles between Terrier and Ferrierfjellet gave some temporary difficulties. The crevasse/snow situation will, of course, alter each summer.

James and Ian ascended Aldertind (2466 feet) in Norway on our return trip to the U.K.

Ian Mackley
EXpedition ADMINISTRATION

Permission to stay in Spitsbergen

Under the Spitsbergen Treaty, British expeditions do not require visas or any other documents to visit the Archipelago. The Governor (Stysselmann PÅ Svalbard) does, however, take an active interest in visitors and does reserve the right of deportation against those individuals or groups threatening themselves with insufficient gear for the prevailing conditions. He should be contacted early in the expedition's planning; his only requirement apart from self-sufficiency is that a registration form, containing the next of kin of members, should be deposited at his Longyearbyen Office before the expedition sets out into the field.

In his capacity as Police Chief, he sends a small booklet (in English) outlining the Svalbard Environmental Regulations and points out those relevant to the expedition's area. Should the expedition's intended work programs infringe any of these regulations (e.g., collection of botanical, biological or geological samples), the Governor must be informed so that he can apply for a dispensation from the Norwegian Environment Ministry.

The facilities in Spitsbergen are extremely limited and, thus, expeditions and tourists (over forty groups were there last year) tend to be regarded an an unfortunate nuisance by the residents. It is, therefore, incumbent on expeditions to make themselves as independent as possible, thus ensuring a reception in the characteristic Norwegian manner.

Maps

Several maps of Spitsbergen are readily available.

1. 1: 125,000 Southern Ny Friesland
   This covers approx. 78° 28'-79° 25' N and 15° 40'-18° 50' E; it is available (1978 cost £1) from the Royal Geographical Society.

2. 1: 1,000,000 (N.P.I.) Svalbard Nkr 18, -

3. 1: 500,000 (N.P.I.) Svalbard 4 sheets Nkr 18, - each

4. 1: 100,000 (N.P.I.) Several areas of Svalbard; minimum cost Nkr 10,80 per sheet

5. 1: 200,000 (N.P.I.) Still in preparation (Nov. 1978)

Maps 2 and 3 are readily found in U.K. shops; agents in the U.K. include Edward Stanford Ltd., in London and T.H.A. Services Ltd.

Den Norske Turistforbund in Oslo are most helpful with any map enquiry and send an invoice with maps ordered.

Air Photographs

Spitsbergen is well covered by aerial photographs and these are available from the Norsk Polarinstitutt in Oslo (cost, 1978, Nkr 30,- + 35 I VAT). Landsat satellite photographs are kept by N.P.I. and any enquiries about these should be directed there.

Payment of Foreign Bills

The most convenient method of paying bills abroad is by Banker's Orders which can be arranged by branch banks with minimal notice. These tend to be expensive (£1.35 fee) unless the issuing branch is prepared to waive their handling charges for the sake of scientific advancement. The advantage of the order lies in the fact that it is issued in the correct currency.

Transport

Arriving at Brusebyen by boat relieved the expedition of the problem of freighting people, supplies and equipment to and from Spitsbergen. Future expeditions may not be as fortunate and so a few notes are given below on the subject.

Freight

Freight can be shipped to Longyearbyen or Ny Ålesund by "Hurtigruten", the Coastal express boat which sails weekly to Spitsbergen during the summer months. Only two U.K. agents, P.H. Matchiessen and Co. Ltd., and John Sutcliffe and Son (Grimsby) Ltd. will arrange this freighting and costs are relatively high (approx. £125 per 1 000 kgs or 3 cubic metres).

It is often advisable for a member of the expedition to accompany the luggage to ensure that it makes the correct connections; stories are rife about equipment that took the wrong boat ! The equipment should be met at Longyearbyen or Ny Ålesund else it might easily go astray in the general confusion that normally accompanies the boat's arrival.

Air freight from Tromsø is cheap as it is subsidised by the Norwegian Government.

We were quoted for Håø to Longyearbyen:

<table>
<thead>
<tr>
<th>Weight</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 45 kg total</td>
<td>Nkr 2.6/kg</td>
</tr>
<tr>
<td>More than 45 kg total</td>
<td>Nkr 1.95/kg</td>
</tr>
</tbody>
</table>

The London Office of S.A.S. were very helpful and should be contacted if air freighting is contemplated.
PEOPLE

By Boat

Berths can be booked on "Hurtigruten" although these are very popular and preliminary bookings should be made before Christmas. It is also an expensive method of travel – the 1978 passages Bergen - Longyearbyen ranged between NKr 1 740,- and NKr 2 460,- depending on class of travel. An advantage of travelling by boat, however, is that one can be "dropped off" and "collected" at Bear Island or Magdalenefjord (dependent on local weather conditions); this is the only commercial route into these areas.

Enquiries should be directed, initially, to the Norway Services Section of Fred Olsen Lines in London. If a non-standard 'drop' is required, direct contact with the appropriate shipping company is needed. The different boats are owned by various companies and Fred Olsen Lines will give further details on request.

It is important to note that the Norwegian Carriers will not co-operate without some kind of proof that the proposed expedition is approved by the Sysselmann.

By Air

The cheapest way into Spitsbergen is by the bi-weekly flight into the new International Airport at Longyearbyen. Student concessionary fares are available for part of the journey; costs in 1978 were:

<table>
<thead>
<tr>
<th>Route</th>
<th>Class</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>London - Longyearbyen</td>
<td>Full</td>
<td>£182</td>
</tr>
<tr>
<td>Longyearbyen - London</td>
<td>Full</td>
<td>£222</td>
</tr>
<tr>
<td>Longyearbyen Return</td>
<td>Full</td>
<td>£194</td>
</tr>
<tr>
<td>Longyearbyen - London</td>
<td>Student</td>
<td>£195</td>
</tr>
</tbody>
</table>

The flights, like "Hurtigruten" are popular and so should be booked early (March at the latest). The London Office of S.A.S. will book the flights at the other end of the 'phone and their direct access to the booking computer can prove very useful. Although seats are booked early, payment is not required until a few days before the flight. This facility is useful for most hard-up expeditions!

Travel within Spitsbergen

Walking is cheap but slow; all other Spitsbergen-based transport is expensive. A helicopter may be chartered at Longyearbyen but this is, obviously, expensive. Certain employees of the Norwegian Coal Company own boats and are happy to take on small charters; this should be arranged in advance.

A small camp-site exists by the Longyearbyen Airport but this is intended as a "transit camp" for people just arrived or awaiting a flight.

Expedition activity in/around Longyearbyen is not really appreciated.

An inflatable boat is probably the best form of expedition personal transport on account of it being relatively small and light for transporting. Against this, however, is the initial outlay of some £1,000 and the high depreciation.

Fuel

Both Paraffin and Petrol can be purchased at Longyearbyen by prior arrangement with the Norwegian Mining Company, Store Norske Spitsbergen Kulkompani.

It should be noted, however, that prices quoted by the Berger Headquarters are subject to alteration without notice and are also subject to a 40 % (sometimes 50 %) handling surcharge. The surcharge is often not mentioned until one's arrival in Longyearbyen.

The Russian settlement at Barentsburg will, apparently, not assist "Westerners" with their purchasing of fuel.

Those approaching Spitsbergen by boat may be interested that tax-free petrol may be purchased at Tromsø at the Norol Depot. This must be specifically requested.

Costs:

<table>
<thead>
<tr>
<th>Item</th>
<th>NKr/litre</th>
<th>pence/gal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paraffin (Longyearbyen inc. surcharge)</td>
<td>1.176</td>
<td>54</td>
</tr>
<tr>
<td>Petrol</td>
<td>1.512</td>
<td>69</td>
</tr>
<tr>
<td>Paraffin (Tromsø)</td>
<td>1.075</td>
<td>49</td>
</tr>
<tr>
<td>Petrol &quot;</td>
<td>NKr 223,2/200 litre drum</td>
<td>50</td>
</tr>
</tbody>
</table>

Communications

Svalbard radio, based at Longyearbyen, is a very useful service if expeditions can equip themselves with a suitable transceiver.

To broadcast, an expedition requires a licence (issued free) which must be obtained in advance from the Norwegian Telecommunication Administration in Oslo.

Issue of the licence may take up to three months and in the application, one must specify:

1. Duration of stay
2. Need for the radio link
3. What equipment the expedition has available

The licence specifies a call sign (ours was LRM0 (Lima Romef Seven Oscar)) and insists that all use of the set will take place in accordance with the 1976 edition of the I.T.U. Radio Regulations.
The following frequencies are used:

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2182 KHz</td>
<td>Distress</td>
</tr>
<tr>
<td>2036</td>
<td>&quot; you + = you</td>
</tr>
<tr>
<td>2049</td>
<td>&quot;</td>
</tr>
<tr>
<td>2456</td>
<td>&quot; you + Coastal Stns.</td>
</tr>
<tr>
<td>2541</td>
<td>&quot;</td>
</tr>
<tr>
<td>1694</td>
<td>&quot; Coastal Stns. + you</td>
</tr>
<tr>
<td>1736</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Apart from 2182 KHz (Distress) which is operated on a conventional half duplex system, all communication is fully duplex, using two frequencies. All calling is done off 2182 KHz although a silence is maintained around the hour and half hour for genuine emergencies.

1978 telecommunication charges are as follows:

**TELEPHONE CALLS**

<table>
<thead>
<tr>
<th>Service</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base via radio to Longyearbyen and thence to U.K.</td>
<td>Nkr 24.3 /3 mins.</td>
</tr>
<tr>
<td></td>
<td>+ Nkr 8.1 /1 min. extra</td>
</tr>
<tr>
<td>Longyearbyen to U.K.</td>
<td>Nkr 3.6 /min. (3 mins. minimum)</td>
</tr>
<tr>
<td>Telegram</td>
<td>Nkr 25.95 /7 words</td>
</tr>
<tr>
<td></td>
<td>+ Nkr 0.85/extra word</td>
</tr>
</tbody>
</table>

Telegram and telephone calls made over the radio are charged to the call sign account. Although Svalbard Radio has Telex and will accept incoming messages (on Longyearbyen O2), best used between 0900 and 1300 G.M.T. due to radio propagation, they will not 'hire' an outgoing telex line to expeditions; the telegraph service must be used.

**Mail**

Incoming mail is held at Longyearbyen at either the Post Office or Governor's Office. It is sometimes delivered if the Syysselmann's helicopter is to be in the neighbourhood.

**Firearms**

Firearms are strongly recommended for expeditions visiting Spitsbergen since people have been killed by Polar bears in the last two summer seasons. No permit is required in Spitsbergen although the Governor likes to know what kind of weapon you have and the U.K. Firearm Certificate No.. Obtaining a Firearm Certificate for holding a weapon in the U.K. usually presents no problems although different Counties impose differing restrictions. A clear criminal and mental record is useful for the person applying for the certificate. Apply to the local Police Station for the appropriate application form and submit this plus fee (£16 in 1978) about three months before departure as the formalities can take some time.

Some types of flare launchers also require a Firearm Certificate; if use of these are contemplated, contact either the manufacturer or local Firearms Department to check the relevant regulations. Certificates for distress flares are often free-of-charge.

**Insurance**

This is an expensive item; our premiums were £290 and included cover for personal accident (up to £2000 each), medical and emergency travel expenses (up to £2500 each), rescue costs (up to £2000 each), cancellation costs (up to £500 each), firearm liability (up to £100 000) and equipment (personal gear £400 each, Expd. gear £6850).

Our agents were Stanhouse Reed Shaw (London) Ltd. who advised the British Mountaineering Scheme. This is probably the best all-round cover, although several agents offer competitive rates for cover against airborne rescues.

Our only claim against the underwriters (Lloyds) was for £70.02 for some damaged equipment. The settlement, £50.02, was paid on 3.3.79; since the claim date was 13.9.78 the service cannot be described as speedy, but it is, however, generally considered to be secure.

**Useful Addresses**

**General**

Syysselmannsplassen, Svalbard, Longyearbyen, Svalbard, Norway.

Norsk Polarstasjonsutst, Postboks 158, 1330 Oslo Lufthavn, Norway.

W.B. Harland, Director, Cambridge Spitsbergen Expeditions, Department of Geology, University of Cambridge, Sedgwick Museum, Downing Street, Cambridge CB2 3EQ.

**Maps**

The Royal Geographical Society, Kensington Gore, London SW7 2AR.


Den Norske Turistforening, Skollingsgt. 28, Oslo 1, NORWAY.
Freight

P.H. Matthesen & Co. Ltd.,
54 Pilgrim Street,
Newcastle-upon-Tyne, NE1 6JZ.

John Sutcliffe & Son (Grimby) Ltd.,
Royal Dock,
Grimby,
South Humberside.

Transport

Scandinavian Airlines System,
Conduit Street,
London.
Reservations: 01-734-4020.

Fred. Olsen Lines,
129 Regent Street,
London W1R 8AP.

Owners of M/S "Nordmorge":
Ofotens Dampskibsselskab,
N-8500 Harvik,
Norway.

Owners of the "Jarl" fleet:
Det Nordensfjeldske Dampskibsselskab,
N-7000,
Trondheim,
Norway.
Telex: 55180 NPDS N.

Fuel

Store Norske Spitzbergen Kulkompani A/S,
Strandgaten 209,
5011 Bergen,
Norway.

OE
9170 Longyearbyen,
Svalbard,
Norway.

Telecommunications

The Norwegian Telecommunication Administration,
Postboks 6701,
St. Olavs P1.,
N-Oelo 1,
Norway.
Telex: 11203A GENTL N.

Insurance

Stanhouse Reed Shaw London Ltd.,
230 High Street,
Potters Bar,
EN6 3RZ.

Valencourt Scarr & Co.,
Crown House,
151 High Road,
Leighton,
Essex IG10 4LG.

Liquid Nitrogen

Although never used, the possibilities of using liquid nitrogen were examined. Cost to fill 25 litre dewar Nkr 192,- + 20% VAT

Norgas A/S,
Oloa.
Telex: 16209A GAS N

Norgas A/S,
Harstad.

History of the Expedition

The Queen's Laundrette is hardly noted amongst Cambridge architecture but remains, nevertheless, quite a centre of reluctant College activity. It also boasts the privilege of being at the birth of the present expedition, one wet and dark evening in October 1977. Three members of the 1976 Queen's Expedition to Svalbard, James, Hylas and Nigel happened to meet there and whilst the washing machines ran, serious thought was given to a return trip to the Northern latitudes. Over mugs of coffee, a short list was drawn up - Alaska, Greenland and Spitzbergen. Within days, Spitzbergen became a clear favourite - mainly on account of ease of transport. Plans, made a year earlier by James and Nigel, for such a trip, were dug out and restated with vigour.

The personnel was increased; John, another Svalbard veteran, joined the team along with Cliff, Graham and Ian. We regretted that Dr. Rod Smith, leader of the 1976 Svalbard Expedition was unable to accept field leadership of the venture owing to pressure of work at the University Engineering Laboratory.

A skeleton scientific programme was thought out and overtures made to patrons and referees. By mid November, preliminary plans were well advanced and our first prospectus printed in readiness for circulation to potential sponsors in early December and a general air of confidence prevailed.

It was at this stage that the first relatively major set back occurred. It was expedient that approval of our plans be obtained from the Cambridge Expeditions Committee; a body of experienced expeditioners, who vetted expeditions on behalf of the Cambridge University Explorers' and Travellers' Club (CUETC). We were somewhat surprised and exceedingly distressed to learn that our application to the Committee had been unilaterally dismissed by the CUETC hierarchy. One criticism was, apparently, that the forms were hand-written; displeased, we re-submitted a typed set of forms direct to the Committee Secretary but we had missed the circulation deadline for the November meeting.
The next and final meeting was in January; a two-month delay. It was necessary to go ahead with our first request for funds without approval - expedition financing is extremely competitive and last time easily results in insufficient funding. We were confident, however, that the case presented in the prospectus was of a quality to stand up for itself.

The immediate response from our first appeal was most encouraging. By the time the committee met in January, we had been promised, or already given, over £1000 towards our projected budget of approx. £6000. Our optimism was heightened by the committee's approval which left us clear to seek support from such bodies as the Royal Geographical Society and Royal Society; this we did with little delay.

By February, it was becoming obvious that forthcoming final examinations and expedition organisation were not totally compatible and so James, up to then General Leader, gave over responsibility for the project work to Graham whilst retaining control over general logistics.

In March, the Rubicon was crossed despite a poor financial position and the inflatable boat was ordered (the one we were originally to hire had changed hands and subsequently went to East Greenland) and the ship sub-charter costs paid.

Despite the considerable morale boost following the April announcement of our being supported by the Royal Geographical Society, the forthcoming exams - finals in the case of four members - led to the thought of revision.

Three other British expeditions were to be in the field in 1978; the Cambridge Spitsbergen Expedition, the perennial Cambridge Geology Department group, led by Mr. W.R. Harland, based at Ny Ålesund, an Oxford University Ornithological Expedition and the Royal Holloway Meteorological Expedition who were also to use Brucebyen as their base. Contact had been established with all these parties well in advance and arrangements had been made to share transport for mutual benefit.

In June, with academic work shelved for three months, the serious task of last-minute expedition organisation reached its climax. The boat and outboard had arrived and had been tested on the North Sea at Alesund; food had been collected together and all air flights had been confirmed. Small problems still beset us - the photographic film had been delayed, the distress flares had gone astray in transit; one of the theodolites we were to use was found to be faulty and required factory attention. By 24th June, however, all was prepared; the expedition was about to start.
LOG OF PROMINENT DAILY EVENTS

Sunday, 25th June

Cliff, James, Myles and Nigel left Queens’ with approximately one ton of food and equipment for the journey to the Royal Dock, Grimsby. There, the H.Y. Copious, a 70 ft converted Scottish fishing vessel, was to transport the expedition direct to the Brueghelyn base. At 7.30 p.m., on the high tide, she arrived and loading began despite the persistent drizzle. In the meantime, John had arrived after a journey from Mid Wales. At 11.30 p.m. a halt was called.

Monday, 26th June

Vital last minute stores were bought (2 c.w.c. ice for the Copious fridge) whilst loading continued. By 1.00 p.m. all was on board and half an hour later we passed through Grimsby Locks. The Humber Estuary was calm and we lunched well. After Spurn Head; however, force five seas were met and all passengers became seasick to various degrees. Dinner was poorly attended despite the excellent Shepherds’ Pla. On board were: Captain - Mike Tuson; Mate - Andrew Lee; Cook - Liz Hall; Bos’n - Chris Webb; our six members of O.S.E and three members of the Cambridge Spitsbergen Expedition (CSE), John Barne, Tim Druiett and Dave Waldron.

Tuesday, 27th June

The sea was “quite calm” (Captain’s words (!) - force 4). In the morning we passed the Argyll oil field and at 7.00 p.m. passed the Echo Fjøske platform. The site of the installations was surprisingly large; in the darkness, the green rig lights gave the impression of a huge, floating, multi-vertied sea-structure.

Wednesday, 28th June

The sea was only force 3 and all passengers felt well. The ship’s sextant was found and several attempts were made to check the Decca Navigator. The latter was performing excellently! In the evening, Norway was well in view on the starboard side. As it was Tim’s birthday, we had an excellent meal of roast beef plus trimmings. At about midnight, a fishing net became caught up around the propeller.

Thursday, 29th June

At first light, Mike Tuson donned diving gear to cut away the unwanted nets. The sea was calm and a very restful day ensued. Copious boasts many comforts including a fair library, a real-c-o-real tape recorder and two cassette players. Part of the charter agreement was that we would assist the crew by sharing watches and helping in the galley. This proved an excellent introduction to seamanship and was good training in rough weather when bunks could, too easily, become a preferred travelling position.

Friday, 30th June

At 6.14 a.m. we docked at Ålesund on the Norwegian mainland. We obtained Customs clearance at 10.00 and were then able to visit the town and sample the excellent Norwegian coffee. At the main key, the ‘Nordmøre’, one of the 287 ft, 16.5 knot Coastal boats, was preparing to leave on the regular run to Kirkenes on the Northern Norwegian-Russian border.

We washed clothes, filled the boat’s water tanks and left in the late afternoon just as heavy rain set in. Sheltered by the Norwegian Coast, we dined well on Coq-au-Vin.

Saturday, 1st July

Despite leaving Tredheim Fjord in the early morning, the sea was mirror-calm and the sun shone brilliantly. The boat’s spin-drisc and one of the sea-water lavatories was needed and the galley primus overhauled. Sunbathing on deck was very popular. The last sunset for several weeks was observed at 22.06 G.M.T.

Sunday, 2nd July

At approx. 8.15 a.m. we crossed the Arctic Circle. The sea was, again, mirror-calm, and the sun was very fierce. At 1.00 p.m. the Lofoten Islands came into view. The area was teeming with bird-life; thousands of jelly-fish surrounded the boat.

Monday, 3rd July

At about 5.00 a.m., the F & O. Liner “Canberra”, exhibiting more than our humble 7½ knots, overtook us en route to Narvik. The spectacular fjord views with snow-covered mountains rising from the dark blue water prompted an early morning fishing stop. Myles caught an 18” Cod for lunch. After washing both clothes and boat, we docked at Tromsø at 9.09 p.m. Clive Pickton, Co-coordinator of CSE, flew to Tromsø to make the last leg of the journey on Copious. Before bed, however, a fishing expedition was made around the harbour.

Tuesday, 4th July

A trip to the Tromsø Nat. Office yielded the following forecast for the Barents Sea: N.E. winds force 4–5 with a S.W. airstream to follow. Fog expected around Bear Island in 3 days. Whilst Copious was refuelling, several sorties were made for last-minute shopping. At one key, James and Nigel were offered 15,000 for a two month charter contract by a very friendly (drunk!) Captain! At 3.45 p.m. we set sail North – away from Coastland Norway, amid roughening seas.

Wednesday, 5th July

The sea was grey and choppy and the day overcast, but to the North it was bright. Swimming alongside the boat were some kind of mammal; opinion differed as to what they were – probably some kind of Dolphin.

Thursday, 6th July

The sea was calmer as we approached Bjørnøya (Bear Island). Since the CSE group wanted to obtain samples on Missyjellet, Bear Island’s highest mountain with 3 pyramidal peaks - Urd (536 m), Verdande (462 m) and Skul (454 m), Copious dropped anchor in Sørhamn, the setting of Alistair Maclean’s book “Bear Island”. CSE went on shore to photograph the abundant bird-life and examine the remains of the ill-fated former settlers.
Friday, 7th July

The night was spent at Søhavn amid the sunshine and birds. After breakfast, we sailed to the North of the island where a visit was paid to the Norwegian Meteorological base. We were entertained most hospitably and were able to telephone and telegraph the U.K. On returning to Copious, we set sail for the last time.

Saturday, 8th July

Progress was delayed in the morning on account of having to negotiate pack ice. Around this, the water was calm, but as we sailed away, the sea became rougher. A group of Soviet trawlers was encountered; two of these paid considerable interest to Copious. Spitsbergen was off to starboard but the bad visibility allowed only the occasional sighting. Dinner, a pleasant broth, was not well attended on account of the boat’s motion.

Sunday, 9th July

At 3.00 a.m., we turned into Isfjord and the sudden transformation from rough seas to the almost calm fjord was much appreciated. The views of Isfjord were excellent and the rigours of the journey were soon forgotten. At 7.00 a.m. preparations were made for the imminent disembarkation. The inflatable boat was erected and fuel prepared. At 11 a.m., after a good breakfast, we anchored at Bruebyen and commenced to unload our gear plus some extra equipment for the Royal Mawson Expedition (RME). The RME group had already arrived by air and were unloading the rest of their supplies before venturing onto the ice cap. A start was made to clear up one of the huts for habitation. Meanwhile, the local Arctic Tern population made us feel quite at home by perpetual dive-bombing! At 1.00 a.m., the day was celebrated with a game of frisbee.

Monday, 10th July

General home improvements took much of the day with construction of windows, shelves, bunka, etc., from the liberal quantities of drift-wood to be found at the fjord-side. The excellent weather - sunshine and no wind, prompted the not-so-popular arrival of Mosquitoes. At 7.30 p.m. James and Niles set off for Longyearbyen to pick up Graham who was arriving by air. After several stops, Longyearbyen was reached at midnight and a camp was established and the 2.30 a.m. flight awaited.

Tuesday, 11th July

Graham’s flight arrived at 2.45 and after exchanging news, sleeping bags were enthusiasti- cally donned at 4.00 a.m. At Bruebyen work continued on restoration of the huts. At Longyearbyen, a visit was made to the Svalbard’s Office to see to registration matters. 60 litres of fuel were bought from Store Norske before the journey back to base. Despite roughish fjords, a tail-wind helped the inflatable towards Bruebyen and the journey was completed in 24 hours. In the evening (00.45) Nigeal and John went fishing but caught nothing.
Wednesday, 12th July

After a slow start, the expedition divided into 3 groups. Myles and Nigel went off to find a route into Gipsedalen via Nathedebreen; Cliff and Graham took the inflatable to scour Billafjord for a Kittiwake colony and Ian, James and John set out onto Nordenskiöldbreen to look for surveying points and strain measurement positions. At 9.00 p.m., all were back and were able to report: (1) The route into Gipsedalen was difficult but 2 Skuas had been sighted. (2) A large Kittiwake colony had been located at Kapp Fleur de lys and (3) several potential surveying and strain measurement positions had been found. Since it was Ian's birthday, we broke open one of our fruit cakes.

Thursday, 13th July

The day was overcast with intermittent rain and was spent in preparing equipment. The mist nets were fitted onto poles, strain measurement gear assembled and tested, surveying markers painted "Day-Glo" orange and subsequently fitted with stays and marker tapes. In the evening we entertained the RNC group and a pleasant time was had by all. The group consisted of: leader - Andrew Wilson (RNC, Maths), Graham Bunn (Imperial College, Physics), Rod Clark (Oxford, Zoologist), Bob Heaton (RNC, Chemistry), Bruce Herrod (Oxford, Maths), and Paul Strickland (Bristol, Medec.). At 3.00 a.m. Brucebyen settled down for a quiet night.

Friday, 14th July

At 9.00 a.m., work started again. Two groups were formed. Cliff, Graham and Myles prepared equipment for transporting to a sub-base at Kapp Fleur de lys. The rest set off by boat to the island Retrtrådý, the North shore of Adelshukta and the rock exposures in the centre of the Nordenskiöld snout to place surveying markers. The strength of waves resulting from ice carving was learnt when the boat and some equipment were nearly washed away from a seemingly safe mooring. John's camera was written off in the incident. Four Czech women out on a walk from Pyramiden (they were 9 hours from there) were met. Apparently Pyramid works to Moscow time. 7 Ivory Gulls were observed. The Sysselmann's helicopter dropped in to deliver mail - all for RNC!

Saturday, 15th July

The electronic strain measurement equipment was hosed to the Snout rock exposure and Ian, James, John and Nigel spent most of the day setting this up at the top of one of the Snout's cliffs. In the meantime, the rest of QSER examined the Tundra East of the huts looking for wild-life and observed a reindeer, a Pintail and a Beluga Whale. On the return journey, a fault developed in the outboard, reducing it to half-power. At midnight engine repairs under way and the offending spark-plug identified and replaced. James, John and Myles returned to the strain meter to check performance amid bright sunshine. The RNC expedition left for 3 weeks work on the ice cap.
Thursday, 30th July

The weather had not changed by the morning; the still air and warm sunshine encouraged the mosquitoes to new heights of irritation! (it is rumoured that the mosquitoes, which are not indigenous to Spitsbergen, arrived when a consignment of contaminated water was shipped to Pyramiden!). Graham, Ian and John left for Kapp Fleur de Lys to permit a cinematographic record to be made. Cliff and James established two surveying stations on the terminal moraines, South of Adolfbukta and carried out a theodolite sweep from one of them. At 10 p.m., all personnel from the colony returned for dinner. The Cloacal swabs had to be kept cool so at about 2.00 a.m. Graham, James, John and Nigel set off by boat to Nordenskiöldbreen to put the samples in an ice hole for preservation. Despite 14 hours delay due to the boat minder falling asleep in it and drifting far into the fjord (no names!) the group returned in time for breakfast and then bed.

Friday, 31st July

At 1.00 p.m. we were visited by the two Germans returning from the Glacier. They seemed to be somewhat surprised that 3/7th of our expedition were in bed! Myles had succumbed to "Brucebyen Tummy" during the night. On account of the late start, the day became a "rest" one with the usual attendant washing of persons and clothes. We invited the Germans to a meal and had a good time although they didn't seem too impressed with tinned steam puddings!

Saturday, 2nd July

Myles was much improved but stayed at base to prepare for the forthcoming Gipsadalen trip. Nigel walked down towards Kapp Ekholm to look for xmas whilst the rest set out for the rock Snout exposure. The Cloacal swabs were checked in their ice hole and the electronic strain meter retrieved. Moving to the North shore of Adolfbukta, Ian, James and John surveyed, whilst Cliff and Graham looked for birds. In the afternoon, the bird-watchers turned their attention to the South shore whilst surveying continued.

Sunday, 3rd July

The Bird Group set out early by boat en route for Gipsadalen via Mathiasondalen. The Survey Group cleaned out the hut whilst awaiting the return of the boat. The two Germans left at about noon. At about 3.00 p.m. the entire Bird Group and I broken-down outboard returned! Proving, however, that it is an ill wind which blows no-one any good, Graham succumbed to the "Brucebyen Tummy" and felt grateful that he was not halfway into Gipsadalen! Cliff and Ian worked on the engine; the strong sunshine precluded any further surveying and John went after fossils, Nigel walked toward Nordenskiöldbreen, Myles walked down to Kapp Ekholm and James photographed some of the neighbouring flowers. After a good meal, somewhat spoiled by a confusion over the contents of a clear paraffin bottle, everyone bar Graham attended a rifle practice on the beach. A large outbreak of Mosquitoes resulted in a tactical retreat to the hut and bed.
Monday, 24th July

Graham was much better but Nigel and Ian became new victims of the bug. The Gipsadalen trip was, again, postponed and it was decided that Cliff and John should visit Longyearbyen to obtain more fuel. They set out at 11.30 a.m. and Graham, James and Nyles set off towards the glacier to start part of the shore survey. In the evening, Nigel and Ian were getting better and could face a very indifferent meal made out of a "disgusting" make of tuyo (not kasp). A man and woman arrived shortly after with some mail; he was the Store Norske employee who had shipped RNC from Longyearbyen to Brucebyen.

At Longyearbyen, Cliff and John had hit inclement weather and confused the contents of they petrol and paraffin jerry cans; this delayed their departure until the early hours of Tuesday.

Tuesday, 25th July

The travellers arrived back at 6.30 a.m. and proceeded to go to bed. At 8.30 a.m. the alarm woke the rest of the expedition. Nyles remained at base to pack, yet again, for the Gipsadalen trip, whilst Graham, Ian, and James set off for the central rock exposure for further grid surveying. The weather demonstrated its transient nature; in ten hours it changed from 8/8th cloud cover at 1000 ft., to intense sunshine and blue skies and then to low cloud and dense mist! The outboard was suffering from carbon build-up on the sparking plugs; without doubt due to the low water temperature. After an early meal (8 p.m.), Cliff, Graham, Nyles and Nigel set off for Kapp Fleur de Lys.

Wednesday, 26th July

At base, the morning was disturbed by an Artic Fox which proceeded to destroy the neighbour's bird colony and the nest of a pair of Red Throated Divers. Baseline and shore surveying continued for most of the day. In the evening, two Danes arrived to spend the night. At Kapp Fleur de Lys, a further gully was exploited for Kittiwake samples. Nigel nearly had an unfortunate accident when a dislodged boulder crashed to the ground. Having completed all possible sampling, the "Bird Group" crossed Billefjord and headed into Gipsadalen.

A camp was set up on the West of Gipsadalen having passed the base camp of a joint Norwegian, German and Finnish mining group.

Thursday, 27th July

The surveying Group spent the day positioning the South side of Nordenskioldbreen's Snout using the grid Narsfjord stations East of the huts. During the day, the Sylsvall's helicopter stopped off at Brucebyen to deliver mail for R.N.C. The base was, by now, largely devoid of bird-life; even the Terns had given up their ferocious bombardment since the destruction of their nests. In Gipsadalen a fierce was made up the valley in search of further suitable bird colonies; a pair of pale phase Skuas were sighted and a Fulmar colony located.

Friday, 28th July

A two-day attempt to climb Cadellifjellet (772 m) to investigate its two Cairns and Terriørjøfallet (1082 m) had to be abandoned due to the rapid deterioration of the weather at about noon. Ian, James and John, therefore, spent the afternoon on the edge of Nathorstøen looking for fossils before returning to Brucebyen amid worsening visibility.

Crossing Sassenfjord, Nyles and Nigel explored Sassenedalen whilst Cliff and Graham investigated De Geerdalen. Although no bird colonies were found, several birds of the small, shy Svalbard Reindeer were encountered. The bad weather made the return journey into Templefjord quite arduous. After visiting the hunter's hut (see Sunday, 16th July), where they were entertained with coffee and shown his Husky litter and store of White Fox pelts, the group returned to their Gipsadalen base.

Saturday, 29th July

The weather had substantially improved and it was decided that the Brucebyen residents should attempt an ascent of Terriørjøfallet. Terriørjøfallet was reached with little trouble but an orthogonal deep crevasse network between Terriørjøfallet and Terriørjøfallet delayed progress. Having reached the base of the peak, it began to rain; the ascent was put off to the next day and a camp pitched in a sheltered snow gully. In West Gipsadalen, an Arctic Skua nest was found containing a single egg. The close range parental flying provided an excellent opportunity for photography. In the evening, Cliff and Graham dropped Nyles and Nigel on the East side of Gipsadalselva before returning to Brucebyen.

Sunday, 30th July

The weather had deteriorated overnight; there was low cloud and intermittent rain. At Brucebyen, Cliff and Graham cleaned up after their trip. In Gipsadalen, Nyles and Nigel walked up the valley to the mining concern's camp. Here, exploratory bore holes were being sunk in the search for coal. Having been well entertained by the (English speaking) geologists, they were put up in their executive hut! Below Terriørjøfallet, it was decided that it would be expedient to abandon the climb and return to base. This was accomplished without problem despite the poor visibility. In the evening, the wind increased and heavy continuous rain followed; defects in the roof repairs at Brucebyen were soon evident.

Monday, 31st July

The poor weather continued all day; a boat trip to check the biological samples on the glacier had to be postponed on account of the waves on the fjord. Some of the scientific equipment was re-packed for return journey to U.K. The hut was cleaned and some of the surveying results cross-checked. Nyles and Nigel, meantime, left the mining camp and headed South on the West side of Gipsadalselva. A camp was set up in the mountain range just North of Gipsahoken (725 m).
Tuesday, 1st August

The wind had dropped and the fjord was nearly calm. A trip was made from Brucybeyn to the rock exposure to allow not only the formation of a new ice cave for the Cloacal monks but also a survey of the extent of the rock outcrop. On returning to the huts, a few drops of rain fell but by 4.00 p.m. the sun was shining again. Wood supplies were replenished from the abundant driftwood and another rifle practice was undertaken. Myles and Nigel, who had struck camp and crossed onto the Billefjord shore, arrived back at base in time for meal ('Dinner' to those residing South of the Watford Gap and 'Tea' to the rest) and then bed.

Wednesday, 2nd August

Surveying of the North sector of the Snout needed doing and so while Myles and Nigel recuperated after their trip, the rest moved onto the North shore of Adolfbukta (named after Adolf Nordenskiöld). The glacier was carving severely and Rætettdyva was being continually swamped by the resulting waves; a landing on it was, thus, deemed unsafe. The weather became quite poor with high winds and so an early return was made to the huts. The Syllelmann's helicopter 'dropped' in with some mail for both EBC and ourselves. In the early evening, a start was made to clear the 'rubbish tip side' the huts which had evidently been there for many years. Tins were burnt and then dumped into deep pits along with broken glass; large chunks of metal were dumped in 600 ft of fjord water. EBC were still on the ice-cap; the dense mist which often set on the top of the glacier was evidently slowing progress.

Thursday, 3rd August

The rough 'ssea' prevented a boat trip to Rætettdyva so while Nigel looked after the base, the rest walked down to Kapp Ekholm to find and photograph the pair of Skuas seen there earlier. The pair were quickly located - a pale and a dark phase - who, although defending an area, did not have a nest. After a quick foray into Mathiesonbreen by James, John and Myles, a nest was made to Brucybeyn. Whilst walking South, a crude but effective fox-trap was found and dismantled. After an early meal, Graham, Ian, James and John took advantage of the then calm fjord to land on Rætettdyva to finish the Snout survey. Precarations were taken for a high speed retreat should threatening waves be seen approaching, but these were not required. From midnight onwards, the weather started to deteriorate severely.

Friday, 4th August

The day was overcast and misty and so a day around base was indicated. James painted a wood post for measuring tide levels whilst a final onslaught started on the rubbish dump. It was evident that recent expeditions had not followed the Skeplard Environmental Regulations in the spirit in which they were written. After lunch, painting continued whilst firewood was chopped and routine maintenance carried out on the outboard. The stove chimney was swept since the drought had become quite poor. Cliff, Myles and Nigel refurbished the "Brucybeyn Railway" in an attempt to make a race track.

Since the weather improved during the day, it was decided to finish the layout part of the survey at night and at 11.15 p.m. the entire expedition moved to the North shore of Adolfbukta. A French group under a professional expedition guide was encountered as they prepared to move onto the ice-cap on route for Newtoncoppin (1712 m). While Cliff, Graham and John finished the North shore survey, Ian, James, Myles and Nigel carried out the depth survey across the fjord roughly parallel with the Snout. At about 5.00 a.m. work stopped and the huts reached in time for breakfast and an 8.00 a.m. bedtime.

Saturday, 5th August

It was a late start! At 4.00 p.m., there was breakfast, lunch and afternoon tea rolled into one. A preliminary check of the Snout survey results was made and since all looked O.K., these were packed for analysis in the U.K. Graham, Ian, James, Myles and Nigel had a frisbee practice on the front tundra in preparation for the proposed EBC - QXRE Football and Frisbee Competitions. At 1.00 a.m., the expedition turned in for an early night.

Sunday, 6th August

The last part of the survey was to be the 24 hour ice-position/tide observation. For this, two groups were formed; the second group, Cliff, Graham and John, spent the day looking for fossils near Nathewbreem whilst the rest prepared equipment. Observations were to start at approx. 7.00 p.m. at low tide. At 4.45 p.m. they left for the rock exposure, picking Graham up en route. Having landed all gear and personnel, Graham returned the boat to Brucybeyn. On the rock, the painted tide meter was positioned and a tent and theodolite set up. For the rest of the night (until 7.30 a.m.) height observations were made; a three hour on/1 hour off shift system was adopted.

Monday, 7th August

At 7.30 (30 mins. late!) the two groups swapped and Group 1 went off to bed whilst the others continued the hourly sightings in considerably better weather. After a good meal there was peaceful sleep until 6.00 p.m. despite the minor interruption of the alarm clock at 3.00 p.m! James went to collect Group 2 at 7.00 p.m. and by 9.00 p.m. the whole expedition plus equipment was back at base enjoying yet another meal. The rest of the evening was spent quietly.

Tuesday, 8th August

After the last days of virtually zero physical exertion, an active day was spent finishing off all the scheduled project work. Nigel spent the day around Brucybeyn taking bird photographs from various hides. The rest walked onto Nordenskiöldbreen. The disc core experiment was photographed and results recorded. The strain measurement poles were found and measured. At this point EBC were seen descending the glacier after their spell on the ice. Despite mist, Cadell-fjellet was climbed to examine the two calms - one 1.0 m high at 489.8 m and one 1.1 m high at 770.15 m. The climb to the higher one was hazardous on account of the loose scree slopes. A descent was made onto Nathewbreem and from there to base.
All the project work promised on the prospectus, had now been completed which was pleasing; several people had expressed doubts about our capabilities; we were, however, now truly vindicated.

Wednesday, 9th August

The Brucebyen surveying baseline was made permanent whilst Nyles and Nigel packed rucksacks for a short visit to Petuniabukta and beyond. After lunch, Graham, Ian, Nyles and Nigel set off to Petuniabukta whilst the rest started to tidy the camp in preparation for the exodus in a few days time. At the 'Skotthytta' in Petuniabukta, a friendship was struck up with an American (female) and two Norwegian (male) geologists from Bergen University. The memorial to the Queen's men, Christopher Kirton, was photographed in its resting place, just North of the hut. On the radio that evening, we learnt that Copious would be calling for us at 3.00 p.m. on Monday 14th instead of p.m. on 15th as previously arranged. After dinner, the remains of QCSE were invited for drinks with RNC.

Thursday, 10th August

Nyles, and Nigel had farewell to their American and Norwegian hosts and proceeded North to the shores of Halundavatnet just South of the large Mitter-Laffier glacier. Here the onset of bad weather caused them to halt and pitch camp despite the early hour - 3.00 p.m. At Brucebyen, preparations were made for Graham's imminent departure. At 10.30 a.m., Cliff, Graham and Bruce, Graham and Rod of RNC went to the glacier rock outcrop to retrieve the Cloacal swabs. After lunch, Graham, Ian and James set off for Longyearbyen Airport. Although leaving in cloudy conditions and zero wind, an hour later they were battling through four-foot waves in minimal visibility. After a minor navigational error, they eventually arrived, although soaked by rain and wave spray.

Friday, 11th August

Having pitched a tent at the Longyearbyen camp site, changed and eaten, a dash was made to the terminal building to await the flight. At about 4.00 a.m. the D.C.9 took off taking Graham plus Cloacal swabs to London, via Tromsø and Oslo. Ian and James returned to the tent for bed.

Cliff and John left Brucebyen for the Ice-cap beyond Nordenskiöldbreen to try out cross-country ski-ing using skis kindly loaned by RNC. Nyles and Nigel struck Camp and proceeded down to the Overgangshytta on the Southern shore of Austfjorden before repitching their camp. A near tragedy warned of the potential consequences of pitching at low tide! A pair of dark phase Longtailed Skuas were observed. Ian and James walked into Longyearbyen to visit the Post-Office, shop and Sysselmann's Office and to arrange the purchase of extra Petrol. After dinner, they set off through calm seas en route to De Geerdalen. At Deltaneset, storm conditions were considerably delaying progress and landfall was made at Dinasøren. The inflatable was swamped with waves breaking over the transom; no irreparable damage was, however, sustained.

Saturday, 12th August

The weather had changed completely and the day was sunny and clear. Visibility was superb. Nyles and Nigel set off South climbing onto Mitter-Laffierbreen and descending to Skotthytta, Petuniabukta down Ragnarbreen. The views were excellent - mountains could be seen which were about 100 miles distant. Ian and James spread out the wet gear from the previous day and set out along Vinmadalen and up Knorringsfjellet (948 m) before descending via De Geerdalen.
Sassenfjord, 24 hours earlier, a white waved mass, was then at peace. Cliff, having knocked his elbow in a ski-ing fall, returned with John to Brucebyen and started the long task of clearing up the base.

Sunday, 17th August

Myles and Nigel, tired after their recent trip, walked along the North coast of Adolfbukta amid perfect weather. There were many ringed seals basking on ice floes. Ian and James packed the boat and crossed the mirror-calm Sassenfjord to Gipsadalen; the journey was somewhat delayed owing to outboard problems. The outboard really required a hotter set of spark plugs (we were later to find that these are available) for use in such cold water. Having lunched and photographed the Skaa chick (first seen as an egg on 29th July), a return was made to Brucebyen. In the evening, James and Graham, Paul and Rod of the RBC went to Petuniabukta to pick up Myles and Nigel. After a meal, the long-awaited QCEE-RBC football and frisbee matches took place. Regrettably QCEE lost both - 3-1 and 4-1 respectively! After this, there was a party in RBC's hut which lasted well into the morning.

Monday, 18th August

The morning restarted early, as preparations began for the arrival of Copious. The excellent weather of the past two days had given way to low cloud and increasing winds. By 4.00 p.m. all was packed and stacked on the beach and final clearing of the hut began. Spare food was left for future users. In the early afternoon, the geologists from Petuniabukta came across to us, in our vacated hut, for a day or so. At 6.15 p.m. Copious arrived and loading began in choppy water - she started to drag anchor and station had to be maintained using engines. An hour later, we left Brucebyen for the last time and set sail to Longyearbyen. At midnight Myles and Nigel were dropped off at Longyearbyen Airport as they were to fly to the U.K. on the Tuesday morning flight; like Graham, they both had prior commitments back home.

The rest re-united with John, Dave and Tim of GSE and the Copious Crew and joined by Jim Carter, also of GSE, set sail Southwards away from the Arctic Archipelago.

Tuesday, 19th August

Copious sailed relentlessly toward Bear Island as the expedition tried to regain their sea legs. In the afternoon, the Inflatable was dismantled and stowed on the aft deck. The sea was fairly rough and most passengers kept a low profile.

Wednesday, 20th August

The wind had dropped to force 2 and the sea was much calmer. At about 11.30, Bear Island came into sight; being keen to hit Tromsø before the week-end, the boat didn't stop but passed down the East coast. The sun shone for the first time as we passed the impressive, towering South Stack. As we headed down the 20° meridian, we passed M.S. Lofoten on route for Longyearbyen. The first sunset since the 1st of July was observed.

Thursday, 21st August

The sea was choppy as we slowly neared the Mainland and all was quiet on board. At about 10 p.m., we made landfall and hence calmer seas. Although the sun sets for several hours at that latitude, night is only dusk; we were treated to a wide, clear, orange-pink expanse to the North as we sailed into Grotzund in almost perfect conditions. The spinning log was hauled in as Decca Navigator took over. The lighthouses, switched off in the perpetual light on the outward journey, were all twinkling silently as we passed.

Friday, 22nd August

At 8.00 a.m. we docked at Tromsø and ate a hearty breakfast before obtaining Customs Clearance. At the re-fuelling depot, the Inflatable was taken on shore and hosed down - somewhat to the surprise of the Norol representatives who were, nevertheless, most helpful. Whilst some fished in the harbour, others took advantage of the shops. There was intermittent rain as we set sail from Tromsø; we travelled South for about two hours before anchoring in a quiet bay for the night. Outside it was dark!

Saturday, 23rd August

The journey down Vestfjord was started at 6.30 a.m. The weather was a contrast to our earlier visit - low mist and intermittent rain, but nothing could humble the majesty of the scenery. The evening meal was whale meat; this was a novel experience for most people and reactions varied. Chris (Ros'm) summed up his feelings with 'ughhhhh' whilst Cliff accidently mistook it for prime beef. The 'meat' had a texture like genuine meat but had a characteristic fish aftertaste.

Sunday, 24th August

At 10.30 a.m. the Svalbriis Ice Cap could be seen on the Mainland. This was of particular interest to James and John, who, along with Myles and Nigel, had been participants on the 1976 Queens' College Svalbriis Expedition. At about 2.00 p.m. we passed the Arctic Circle before anchoring for the night in Aldersund beside the Island of Alderen. Surrounded by mountains, and in perfect weather, it was decided to stay there until the following day. Ian and James and John (GSE) climbed Alderfjell (2117 or 2466 ft. depending on which chart one believes) whilst the others swam in the fjord before visiting the Mainland. There was a celebration meal to mark the end of our Arctic stay - Shepherds' Pie and carrots and Christmas Pudding with white sauce and run butter. The 1500 m Radio 2 (now Radio 4) shipping forecasts could be clearly received; the North Sea was, apparently, not calm!

Monday, 25th August

At first light, we set sail towards Hovik. A lot of work was put into mending the automatic pilot which was a shame since it had only blown a fuse! The day was uneventful barring a couple of hours ashore on a scenic arm of the Norwegian Mainland. At 9.30, we docked at Hovik in darkness and not without a few technical problems. As it was Cliff's birthday, there was a celebration meal - smoked salmon joint cooked in honey. Later a nocturnal walk around town was undertaken by all before settling down to a quiet sleep without the chugging of the 152 h.p. Gardner engine.
Tuesday, 22nd August

After breakfast, a two hour shopping break was permitted before Copious sailed to the Esha Jetty to refill water tanks. The weather news was not good and even as we watched, the smell could be seen to get worse and the barometer started to plummet. The boat was made ready for bad weather as we set off South, hugging the coast. It was of comfort to most that supper coincided with a calm stretch of water.

Wednesday, 23rd August

The wind was force 5 and the waves large as morning broke, but seas-legs had been achieved by most people. The London weather forecast for the North Sea was bad and so the proposed trip to Shetland had to be abandoned. We were to continue South in the shelter of the Norwegian Coast to Haugesund before venturing across to Grimsby. The cause of the high winds was, apparently, a low in the Denmark Strait. In the evening, Ålesund was being approached and within the sheltered channels, all was calm. At 8.30 p.m. we docked before eating and walking round the town. Night was, by now, long and black.

Thursday, 24th August

The engine roared to life at 5.15 a.m. and soon Copious was rocking on the roughest seas experienced on the trip. At noon, there was relative calm (force 4/5 conditions) and this continued until some islands gave those on board some respite. Navigation into a fjord system became hazardous as rain squalls rendered the radar useless. It was decided to anchor but within half an hour the boat started to drag onto nearby rocks. Fortunately, the mist cleared for long enough to enable us to spot a jetty at Askovoll and dock alongside. The 03.33 forecast informed us that there was a gale warning out for Viking and Forties.

Friday, 25th August

At 6.45 a.m. the pretty village of Askovoll was left behind as we headed South into Sognefjorden. At about 4.00 p.m. we passed Bergen and James was able to telephone Graham via the Bergen V.H.F. radio link to arrange the hire of a van in Grimsby. The ‘line’ was clearer than the average U.K. local line! In the evening, anchor was dropped in a sheltered bay called Forjeidvåg so as to permit a good night’s rest.

Saturday, 26th August

At 10.00 a.m., we docked in Haugesund. With E.T.D. noon, there was a chance to do some last-minute shopping. Haugesund is a prosperous ship-building town and it has an air of affluence not often seen in towns up the Norwegian coast. It boasts an excellent telephone system; the call box directories contain U.K. exchange numbers and dialing the U.K. is both easy and quick - approx. 10 seconds connection time! At noon, we set sail for the last leg of the journey; across the North Sea to Grimsby. Although the seas were quite rough, most people on board found the boat’s motion quite acceptable.
Sunday, 27th August

The North Sea was in fury but most people were happy to be up and about and there were several takers at each meal. Expedition bills accrued during the voyage were settled and preparations were made for the landfall on the next day.

Monday, 28th August

The sea was quite calm and 'George', the automatic pilot was in full control of the boat. The Spurn Point Lighthouse was the first landmark seen but soon the tall disused hydroelectric tower at Royal Dock came into view. At 5.15 p.m. we docked in the lock and were back in bank-holiday Britain. Despite this, two Customs officials came on board and quickly cleared our gear. We quickly came alongside the local Grease chinese Restaurant before settling down for bed. There was a minor disturbance during the night when Copious had to move to make way for a large ship arriving at the next high tide.

Tuesday, 29th August

Graham arrived early and took James into Grimsby to pick up the hired transit van for taking equipment down to Cambridge. By noon, all unloading was complete; Ian and Graham were to drive to Beverley and Gool, their respective homes, John was met by his parents and they were able to drive to Mid Wales; Cliff and James were to drive South dropping off gear on route. The expedition had come to its close.

Epilogue, 1979

Cliff is currently employed as a Chemical Engineer with Courtaulds Ltd in Coventry.

Graham is still at Queens' continuing his veterinary Medicine course.

Ian is also, still at Queens' continuing his General Engineering course with a view to specialising in Chemical Engineering.

James is currently employed as a Mechanical Engineer with Rolls-Royce Ltd., Aero Division, Derby.

John is studying for a Ph.D. in Finite Element Analysis at the University of Wales, Swansea.

Nyles is studying for a Ph.D. in Freshwater Zoology at the New University of Ulster.

Nigel is studying for a Law Masters Degree at the University of British Columbia, Vancouver, Canada.

Queens' College will forward any post to the current addresses of any of the expedition members.

J.F. Cooper
Acknowledgements

It would be impossible to mention all those people who have aided this expedition; we would, however, like to extend our sincere thanks to the following for their invaluable assistance:

Our Patron:  the Rt. Revd. Laurence Fleming
Sir Yvian Pugh

Our Referees: Dr. D.W. Bowett
Prof. K.J. Miller
Dr. G.C. Schild

Dr. W.R.P. Bourne
(Sea Bird Group, Aberdeen University)

Mr. P. Cambridge
(University of East Anglia)

Mrs. M. Fuller
(Cambridge Veterinary School)

Dr. D. Goodman
(Cavendish Laboratory, Cambridge)

Mr. J. Grandhal
(Svalbardmenn Fj Svalbard)

Mr. D.S. Green
(G.U. Engineering Department)

Mr. W.B. Hardie
(Director, Cambridge Spitzbergens Expeditions)

Mr. R. Hart
(Queens' College, Cambridge)

Mr. S.G. Heide
(Norsk Polarinstitutt)

Mr. O. Leirul
(Norsk Polarinstitutt)

Mr. K.Z. Lenqvist
(Deputy Director, Norsk Polarinstitutt)

Dr. O'Donald
(C.U. Genetics Department)

Mr. C.A.C. Pickton
(C.U. Geology Department)

The late Dr. B. Roberts
(Scott Polar Research Institute)

Dr. R.A. Smith
(Queens' College)

Dr. A.J. Tatcliffe
(Department of Palaeontology, British Museum)

Mr. N. Tun
copy	Copious Enterprises Ltd.)

The expedition also recognises its great debt to the following organisations who helped with encouragement, advice, finance and products, and without whose help the expedition would not have been possible:

The Albert Ballaert Charitable Trust
Ambrosia Ltd.
The Arup Charitable Trust
Biorex Laboratories
Bovril Ltd.
The Cambridge Expeditions Fund
The Chow Fund
The Cambridge Scandinavian Studies Fund
The 1975 Cambridge Spitzbergens Expedition
The Cambridge University Engineers Association Endowment Fund
The Cambridge University Engineering Department
The Cambridge University Health Service
Cape Contracts Ltd.
Christian Salvesen Ltd.

Coggewell and Harrison Ltd.
Compagnie Des Services Dowell Schlumberger
Consolidated Gold Fields Ltd.
Creda Ingredients Ltd.
Crown Decorative Products Ltd.
Chrysler Marine (U.K.) Ltd.
Currys Ltd. Charitable Trust
Darnart Ltd.
Dane and Co. Ltd.
John Dewar and Sons Ltd.
The Douglas Heath Eves Charitable Trust
The Drapers Company
The Ernest Kielworth Charitable Trust
Field and Trek Equipment Ltd.
Firemaster Ltd.
The U.K. Fridtjof Nansen Association
The Giclrist Educational Trust
The Glimmerings Memorial Fund
Goodfellow Metals Ltd.
Halifax (U.K.) Ltd.
Hafner and Sons Ltd.
I.D.G. Ltd.
Kisbon Insulations Ltd.
Kodak Ltd.
Lanene Ltd.
Liptons Ltd.
Lloyds Bank Ltd. (University Cambridge Branch)
Lyle and Scott Ltd.
The Medical Research Council
The Ministry of Overseas Development
Nevell Machine Tool Co. Ltd.
The Norsk Polarinstitutt
Nusvift Ltd.
Park Bakers Ltd.
Pitt and Scott Ltd.
Polyvax Ltd.
Queens' College
The Queens' College Junior Combination Room
Record Past Foods Ltd.
Ripley and Co. Ltd.
James Robertson and Sons Ltd.
R niche Products Ltd.
Ramsay Foods Ltd.
The Royal Geographical Society
The Royal Hallowes Svalbard Expedition
The Royal Society
The Society of St. George
The Scandinavian Bank Ltd.
The Scientific Exploration Society Ltd.
Simpsons Ready Foods Ltd.
The Smiths Food Group Ltd.
South Western Marine Factors Ltd.
Store Norske Spitsbergen Kulkompani A/S
Swiss Cutlery London Ltd.
Taylor Instrument Analytics Ltd.
J.W. Thornton Ltd.
Thielasoff Corrugated Cases Ltd.
Unigate Foods Ltd.
United Biscuits Ltd.
Vesform Plastics Ltd.
The Vincent Wild Life Trust
Vista Thermal Products Ltd.
Weetabix Ltd.
Whitbread Ltd.
T.W. Wingent Ltd.
and The Wors Travelling Scholars' Fund.

The expedition is also indebted to Trish Shepherd for producing the proofs of
this report.

View of Sassenfjord and Billefjord from Knorringsjellet: the clarity of the air
permitted the photography of mountains up to about 100 miles distant.