THE POLAR RECORD

Edited by F. DEBENHAM

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HERR DAUGAARD-JENSEN

THE POLAR RECORD

Number 17 *January* 1939

FOREWORD

At this time of year there is usually news from the Antarctic, but it has come too late for more than a brief reference in our editorial note.

Lincoln Ellsworth, now a veteran of the polar regions, has made yet another flight from his ship, *Wyatt Earp*. He has been operating in what may be loosely termed the Enderby Land Sector, but the flight appears to have been over Princess Elizabeth Land, well to the east of Enderby Land itself. He flew far inland over a plateau which seems to have been about 9000 ft. high, and saw no bare land.

The Norwegian Government has made formal announcement of its claim to the sector of the Antarctic which lies between the Falkland Islands Dependencies and the Australian Dependency. It will be remembered that this stretch of coast, lying to the south of the Atlantic, has been the field for many Norwegian expeditions in recent years, and, except for Coats Land, all the coastline yet known there has been discovered by Norwegians. It was, curiously enough, in this sector that the first undoubted land of the main mass of the continent was seen, though not recognised as land. Captain Bellingshausen on February 5, 1820, only six days after Bransfield had sighted Trinity Land, when he was 50 miles from what is now known as Ragnhild Land, described what he saw in the following terms:

"The edge of the ice to the S.S.W. was perpendicular and formed into little coves, whilst the surface sloped upwards towards the south to a distance so far that its end was out of sight even from the masthead lookout."

It is a pleasure to record that Miss Louise A. Boyd, on her return from her seventh expedition to the Arctic, six of which she has led herself, has been awarded the Cullum Gold Medal by the American Geographical Society.

The naming of the new Admiralty survey ships after Sir John Franklin and Captain Scott deserves a special note. H.M.S. *Scott* was launched and so named by Lady Skelton at Dundee on August 23. The Antarctic Club, at its annual dinner, had the pleasure of presenting to the ship, represented by her captain, a set of silver tankards and a portrait of Captain Scott. Vice-Admiral Skelton also presented a silver cigarette box, which had been given to him by Captain Scott after the National Antarctic expedition of 1901–4.

We regret to have to announce the death of several people of prominence in polar affairs.

The death of Herr Daugaard-Jensen, the wise and kindly Director of the Greenland Administration, is given a full note elsewhere, but the Editor desires to put on record the great services he rendered to the Polar Institute in the past, as well as to many young men who have visited Greenland with his permission and guidance. The portrait for our frontispiece was kindly given to *The Polar Record* by the editor of *Berlinske Tidende*.

The passing of Lady Ellison Macartney, sister of Captain Scott, removes one more of the intimate circle of his relations who have helped the Institute both in spirit and in deed.

Petty Officer Crean, of Captain Scott's two expeditions and Sir Ernest Shackleton's Weddell Sea expedition, is the subject of a separate note in this issue.

The sudden death of a youthful explorer in the field always strikes a more poignant note. The loss by drowning of Reynold Bray in Foxe Channel has been a tragic one; we extend our deepest sympathy to his family, and particularly to his young widow.

OBITUARY

The recent death of the head of the Greenland Administration has brought to an unexpected end a life devoted entirely to Greenland and its inhabitants. In 1894, at the age of twenty-three, Daugaard-Jensen went out to Greenland as an assistant in the Administration, and six years later he became Inspector for North Greenland. In 1905 he first put forward the detailed proposals for the reorganisation of the Administration which became his life's work. He became Director in 1912.

Always in favour of a large measure of home rule for Greenland, he devoted himself to the extremely difficult work of preparing the Greenlanders for closer contact with civilisation, and the large number of administrative positions now held by them is a testimony to his success.

During his time as Director the whole country has been united under government administration, and most important scientific investigations have been made. It was his deep interest and sympathy for the individual problems of the Greenlanders which made him anxious to have under his own control all the details of the administration. What was best for the Greenlanders was always his guiding motive, and it was for their sake that he was so strict in excluding all tourists from Greenland. But he made it easy for scientists, whatever their nationality, to visit this fascinating country, and, in England, we owe him a great debt for the freedom he allowed and the help he gave to our expeditions.

Reynold Bray lost his life at the age of 27, on September 14, 1938, 40 miles south of Igloolik, when he was blown out to sea in a small collapsible boat in Foxe Channel. He was setting out with one companion on an expedition to continue the ornithological work and mapping which he had started the previous year.

This was his third expedition to Arctic Canada. He was a member of the Oxford University expedition to Hudson's Bay in 1931, and from 1936 to 1937 he was ornithologist to the British Canadian Arctic expedition under the leadership of T. H. Manning.

Colonel Valeri Chkaloff, the famous Soviet long-distance flier and test pilot, was killed recently while trying out a new type of plane. By a non-stop flight of 5200 miles over the North Pole from Moscow to California in 1937, Colonel Chkaloff won for the U.S.S.R. the world's long-distance record. For this achievement he and his two companions were awarded the title of "Hero of the Soviet Union".

J. D. Morrison, the Chief Engineer of the *Morning* relief expedition, 1902–4, died on November 13, 1938.

ARCTIC REGIONS

SVALBARD AND JAN MAYEN

Completed Expeditions

Cambridge Spitsbergen Expedition, 1938.

A preliminary account of the Cambridge expedition which was at work during the summer of 1938 in West Spitsbergen, under the leadership of L. H. McCabe, was given in *The Polar Record*, No. 16. The object of the expedition was to carry out geomorphological work in continuation of W. V. Lewis's investigations in cirque development in Iceland in 1937.

Six weeks were spent in the Campbell Range on the east side of Billefjorden, Klaas Billen Bay. One party then visited the Stubendorff Mountains, and another visited Gips Valley, inland from the Campbell Range.

McCabe examined the cirques and their relation to the geological structure, and made a more precise investigation into the mode of their formation. Two well-developed cirques in the Stubendorff Mountains were visited and many significant differences between these and the cirques of the Billefjorden region were noted. To supplement this work, nivation hollows were studied in detail; sections were dug, and soil temperatures recorded.

The geological work, carried out by W. B. Harland, consisted of a detailed examination of the stratigraphy of the Campbell Range, and an exploratory survey of the structure of the area visited in the Stubendorff Mountains. Soil polygons were found to be well developed in the former area and the different types were mapped in relation to the underlying rock type.

W. V. Balchin mapped the raised features along the coast of Billefjorden and Gips Bay on a scale of 4 in. to a mile. Heights were determined by running lines of levels, from the shore to the foot of the mountains, at half-mile intervals along the coast.

A map of the Campbell Range, on the same scale, was completed by N. Pye, who also mapped the head of Gips Valley on a scale of 2 in. to a mile. This will be joined to the former map by a theodolite triangulation which W. B. Adams carried from Bruce City to the head of the valley.

Norwegian Expedition to Svalbard, 1938.

An expedition, organised and sent out by Norges Svalbard-og Ishavs-undersøkelser, and led by Docent Adolf Hoel, was at work in Svalbard during the summer of 1938. As the original plane hired by the expedition was badly damaged on a test flight near Oslo on July 1, the expedition was delayed and did not leave Tromsø till July 16 in the whaler *Haug III*, with a staff consisting of the following:

DOCENT ADOLF HOEL, leader and geologist.
HARALD CHRISTOFFERSEN, ship's wireless operator.
Lt. MARTIN HAMRE, Norwegian Army, air pilot.
Commander ROLF VON KROGH, Norwegian Navy, captain and hydrographer.
Lt. KJELL LASSEN-URDAHL, Norwegian Navy, air pilot.
BERNHARD LUNCKE, leader of the aerial survey, aerial photographer.
Lt. REIDAR LYNGAAS, Norwegian Navy, mate and hydrographer.
Lt. NILS ROMNAES, Norwegian Army, chief air pilot, wireless operator on board the plane, and film photographer.
HANS STRANDRUD, air mechanic.

There was also a ship's crew of seven men, and two assistants, making a total of eighteen men.

An aeroplane was used in the survey of Svalbard for the first time in 1936, when 3300 photographs, covering two-thirds of the area of the islands, were taken (see *The Polar Record*, No. 13). The main task of the 1938 expedition was to photograph from the air the rest of the islands, including North East Land. The plane used was a Stinson highwing monoplane, fitted with floats. With a crew of three men and outfit, wireless, camera, emergency rations, rubber boat, etc., this plane had a flight range of four hours. The survey camera was a Zeiss pattern, type P 21, picture size 18 × 18 cm., mounted to take photographs obliquely, or vertically, through openings in the body of the plane. The expedition had twelve rolls of Agfa aeropan film, sufficient for 3300 exposures.

The expedition reached Longyear City on July 19. The *Haug III* left here on July 23, called at Ny-Ålesund, Kings Bay, where an hotel has now been erected, left this point on June 25 and anchored in Sorgfjorden on the following day. In the afternoon of June 26 the first photographic flight was undertaken. Long spells of good weather for photographic work were very rare. The intervals between flights were occupied in repairing the house in Sorgfjorden, building cairns at five trigonometrical points and building beacons on Fosterneset, Verlegenhuken and Gråhuken. After twelve flying hours, the *Haug III* left for Longyear City on August 13 to take in coal. Docent Hoel then returned to Norway, leaving von Krogh in charge of the expedition. After carrying out three hours' flying at Ice Fjord the vessel went north again on August 15, called at Mossel Bay to take some soundings, and then proceeded to Murchison Bay, which was used as a base for a series of flights above North East Land and Hinlopen Strait, a total of twenty-three hours' flying. The hydrographers made soundings in Murchison Bay, and charted a sunken rock (2 m. of water) at Cape Sparre. On August 27 the ship sailed southwards to Kong Karls Land, but encountered a strong north-easterly gale with rough seas south of Cape Mohn. She had to turn back to Ice Fjord, chiefly on account of the plane, which was placed on a platform aft and would not have been able to withstand worse weather. On September 2 they had four hours' flying, during which some vertical photographs of Longyear City were taken in addition to the oblique ones for survey. On September 3 the expedition received orders from the authorities in Norway to search for three missing hunters at Kong Karls Land, at the Bastian Islands and at Hope Island. After coaling, these areas were closely searched, the plane also being used for this work, but no trace of the missing men could be discovered.

Most of the Spitsbergen glaciers have retreated, at any rate during the last forty to fifty years. Only one glacier, the Negri, on the west side of Storfjord, has been known to advance. This year, however, the expedition was able to record another glacier advance, of unusual dimensions and of considerable interest. The eastern part of North East Land consists of a gently sloping ice-cap terminating in the sea. Recently the glacier area west of Cape Mohn has begun to break up on a front of 20–25 km., from the sea far into the interior. In this area there is now a distinct glacier separated from the ice-cap, and in the course of a short time it has advanced enormously so that it now extends far into the sea. The brash-ice from the glacier covered a belt 15 km. wide, thinning out in the direction of Olga Strait.

During a flight lasting two hours, the whole of Kong Karls Land was photographed. The expedition then left for Hope Island on September 11 and reached Tromsø on September 13.

In spite of the unfavourable weather conditions the programme was more or less completed. During the forty-four hours' flying, 2178 photographs were taken, covering an area of about 25,000 sq. km. For other purposes the plane was in the air for fourteen hours, and 2500 m. of cinema film were exposed.

Norwegian Fisheries Expedition to Svalbard, 1938.

As in previous years, the Norwegian Board of Fisheries sent out an expedition under the leadership of Thor Iversen, with Einar Koefoed as assistant biologist. The expedition used the fishing vessel *Solveig I* (about 50 tons gross) of Ålesund.

The expedition started from Bergen on April 28 and returned on September 22, 1938. The investigations were mainly carried out in the waters along the west coast of Spitsbergen, Ny-Ålesund, Kings Bay, being used as a base.

On the northward trip seven stations were worked about 40 miles west of Bear Island. Practical fishing experiments were carried out off the west coast of Spitsbergen, and extensive biological material was collected. 143 stations were worked at sea, and at seventy-five, hydrographical observations were made.

German Aviation Experiments in Spitsbergen, 1938.

During the summer of 1938 Dr Ernst Hermann experimented with a new type of German aeroplane in Spitsbergen and amongst the pack-ice up to Lat. 80° N. We understand that experimental landings and take-offs resulted in a new technique being evolved.

Imperial College of Science Expedition to Jan Mayen, 1938.

An expedition from the Imperial College of Science, London, consisting of ten members whose names were given in *The Polar Record,* No. 16, carried out scientific work in Jan Mayen during the summer of 1938. The expedition was led by A. King, with R. Scott Russell as deputy leader.

The party left London on June 25 for Tromsø, where they embarked on the *Fortuna* for Jan Mayen. A base camp was established near the Norwegian wireless station, and a wooden hut, erected by the Austrian 1932–33 Polar Year expedition, was converted into a laboratory where chemical and physiological work could be carried out. A sealing hut at North Lagoon was used as a base for work on that side of the island, and a botanical and survey camp near the South Glacier was occupied for a large portion of the time.

Two ascents of the highest peak of Beerenberg were made in connection with cosmic ray work. The first was made soon after arrival and under difficult snow and weather conditions. The second climb, made at the end of August, was in perfect weather, and Scott Russell succeeded in obtaining a complete panoramic photograph of the great crater rim. Plates for recording the paths of cosmic rays were exposed on the summit of Beerenberg between the two ascents, and another series has been left in position in the hope that some day they may be recovered by another climbing party.

Expeditions were made to all parts of the island. Most noteworthy was a journey made by five members of the party to the flat land on the north-east coast. Very little of this country has been visited previously, so that the botanical and ornithological observations should be of considerable interest.

From the north-east end of Jan Mayen, Scott Russell and Jennings made an ascent of the hitherto unclimbed north-east peak of Beerenberg, for which they have proposed the name Hakluyt Peak, thus restoring the original name suggested by Fotherby in 1612; the mountain was named Beerenberg by the Dutch some years later. The return was made by way of the north-west coast, crossing the extremely active Weyprecht Glacier.

The following is a summary of the chief results of the expedition:

Survey. Weather conditions prevented the original survey programme from being carried out, but, in spite of this, many corrections were made to the map. Behind Egg Bluff a pegged base-line, 2516·2 ft. in length, was measured with a 150 ft. steel tape. Using a Zeiss theodolite, this base was extended to 8110 ft. The height of Beerenberg was found to be 7680 ft. and the crater diameter (from North-east Peak to North-west Peak) 5500 ft. The position of the crater is in the centre of the northern part of the island, a position considerably different from that shown on the Austrian map. The northern part of the island was found to be incorrectly mapped and considerable adjustments have been made to the coastline.

A detailed plane-table map was made of the South Glacier snout and its moraines (scale 1 : 5000). This was connected with the main triangulation, and should be of use in connection with future glaciological studies.

In addition to the above, several local maps were made in connection with the ecological work.

Glaciology. A general survey of the glaciers was made, and several glaciers not previously reported have now been described and named. Whereas the Weyprecht Glacier is still in a very active condition, those on the east of Beerenberg and, in particular, the South Glacier, are in rapid retreat. Detailed work was done on the South Glacier.

Geology. A geological map on a scale of 1 : 25,000 was made of the accessible central part of the island from the slopes of Beerenberg on the north to Walrus Gat in the south, and the sequence of volcanic rock types and their structural relationships established.

Botany. Almost every part of Jan Mayen was visited, making possible an ecological survey of the whole island. Collections of flowering plants, mosses, lichens and fungi were made, and have been deposited in the British Museum.

A number of physiological experiments were undertaken to investigate the effects of various aspects of the Arctic environment on plant metabolism.

A soil survey was made, samples being taken from various representative habitats for chemical analysis and for the study of the soil flora and fauna. Analysis for the essential nitrogen constituents was done in the expedition laboratory.

It should be emphasised that the physiological investigations constitute merely a brief introduction to problems which require detailed and prolonged experimental study.

Ornithology. A survey of the birds breeding on the island was made and several species were recorded for the first time. Some experiments were done on the nesting habits of Brunnich's Guillemot (*Uria lomvia*); the problem of non-breeding of gulls was investigated; stomach contents and parasites were brought back for identification.

Marine biology. A study was made of the effect of environmental changes such as those of light intensity, depth, and salinity, on plankton. Shore collections were made, and the fauna and flora of the two fresh-water lagoons and of several fresh-water lakes examined.

In addition to the above, a collection of insects was made, and measurements were taken of the components of the magnetic field.

The chief obstacles in the way of work on Jan Mayen appear to be bad weather and difficult transport. Throughout the summer months there are few days when the visibility is sufficiently good to make survey possible. Although distances on the island are small, transport is both slow and laborious; for example, the journey from the wireless station to the north-eastern extremity, some 12–15 miles, takes about fifteen hours. It is strongly urged that any future expedition to Jan Mayen should take a light and seaworthy boat, easily manipulated in the surf, and equipped with a reliable out-board motor.

The expedition was picked up at the end of August by the *Polarbjørn* on her return journey from East Greenland in the service of Norges Svalbard-og Ishavs-undersøkelser.

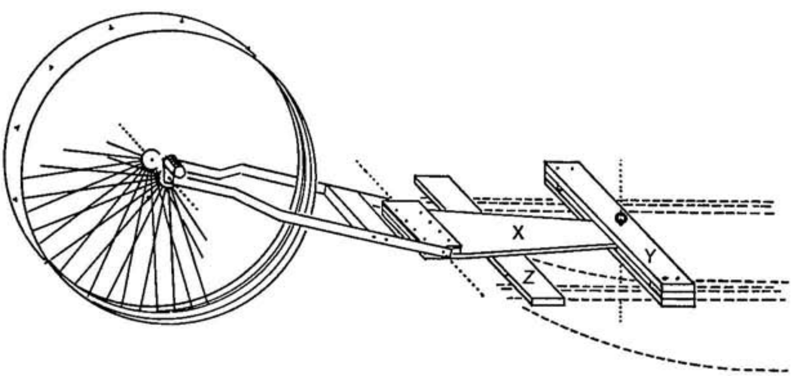
DESIGN FOR A SLEDGE-WHEEL

BY W. B. HARLAND

[In response to a request from the Editor, W. B. Harland has sent the following description of a sledge-wheel used during the Cambridge Spitsbergen Expedition of 1938.]

The wheel was constructed as shown in the accompanying sketch.

It was made from a bicycle wheel and a thin sheet of iron 4 in. wide. The bolts fixing this tread on to the rim projected so as to grip the ice. An ordinary cyclometer was attached to the axle so as to "tick over" by contact with a projection on the spoke. The axle of the wheel was bolted on to a simple iron frame held rigid by a wooden cross piece and



a metal rod parallel to the axle. So much was assembled in England at a cost of 15*s.* 6*d.*

At the base camp a very simple attachment was constructed out of packing-case wood in such a way that no great strength was necessary. A piece of wood *X* was hinged on to the metal rod, giving the wheel vertical movement for surface irregularities, and the horizontal swing was effected by a vertical pin at the other end of *X*. At this point, *X* was held horizontal between two cross-pieces *Y*, which were lashed to the sledge or handle-bar structure. The pin was easily removed, thus detaching the wheel completely as in a motor-car trailer, or else the wheel could be folded upwards and forwards on to the sledge.

Various constructional details commended themselves, such as the use of $\frac{3}{8}$-inch plywood for *X*, to give both strength and resilience; the use of sheet metal to strengthen the rod bearing on *X*, and the fixture of a piece of wire to scrape snow off the wheel. A more fundamental improvement, when handle-bars are to be used constantly, is to trail the wheel from the side of the sledge supported by modified extended cross-pieces *Y* and *Z*. Details, however, depend on the nature of the sledge and handle-bars.

It is, of course, necessary to find the factor for the cyclometer readings, empirically, over a measured distance. The wheel was successful on rough ice and in crossing crevasses even when the sledge reversed into one. The design would seem to survive average treatment in virtue of its simple, light and flexible nature. and, if broken, its simplicity permits rapid reconstruction.

It is hoped that this account may induce others to come forward with descriptions of sledge-wheels they have used.

EUROPEAN ARCTIC

Completed Expedition

Oxford University Women's Biological Expedition to Lapland, 1938.

An expedition of six women biologists from Oxford was at work in Swedish Lapland during July 1938. The party consisted of the following members:

U. Wykes, zoologist, leader.
S. Andrews, zoologist.
J. Annis, botanist.
F. Hobson, zoologist.
M. Mortimer-Woolf, botanist.
R. Murray, ornithologist.

Their base was at Jebrenjokkstuge on the north shore of Lake Torne Träsk (Lat. 68° 12′ N., Long. 18° 20′ E.). This was reached by train from Stockholm to Abisko and thence by boat across the lake. A hut belonging to the Svensk Touristforeningen provided a laboratory and living room, while tents were used for sleeping.

The party investigated the rodent population of the district, and the animals associated with them as predators and parasites. Four rodent species (*Evotomys = Clethryonomys rufocanus*, *E. rutilus*, *Microtus agrestis* and *Lemmus lemmus*) and one insectivore (*Sorex araneus*) were collected by means of breakback traps. The skins are now preserved in the Bureau of Animal Population at Oxford. The predators, chiefly rough-legged buzzards (*Buteo lagopus*), were studied by analysis of their pellets. The parasites have not yet been fully identified.

The botanists paid special attention to the plant zonations occurring round the shores of the lake, but collections were also made from other habitats in the neighbourhood. The specimens are to be incorporated in the Herbarium of the Oxford Department of Botany. In addition, a collection of insects was made (mainly Lepidoptera and Hymenoptera), and these will be deposited at the Hope Department, Oxford.

RUSSIAN ARCTIC EXPEDITIONS

Relief of the Soviet Ice-breakers, and the Drift of the Sedov.

As stated in *The Polar Record*, Nos. 15 and 16, the three Soviet ice-breakers, *Sadko*, *Sedov* and *Malygin*, were ice-bound in the Laptev Sea at the end of October 1937, and were carried by the drifting ice into the Arctic Ocean. Of the 217 people on board these vessels, 184 were removed by planes in April 1938. At the end of August the ice-breaker *Yermak* penetrated beyond Lat. 83° N. and freed the ice-bound ships. The steering-gear of the *Sedov* was broken and the *Yermak* took her in tow. However, this slowed down the escape of the other ships to a dangerous degree, and it was decided therefore that the *Sedov* should be allowed to continue her drift under the command of Captain Badigin, with fifteen men. She had reached Lat. 84° N. and Long. 138° E. at the end of October 1938. The ship had then covered 1500 miles and penetrated 500 miles northward in the course of the year. This is the first time, since Nansen's voluntary voyage of 1893–96 in the *Fram*, that any ship has undertaken such a drift. Weather observations are being kept, and an emergency camp and supply depot has been established on an ice-floe 100 yards from the *Sedov*, with sufficient provisions to sustain the party for four months should it become necessary to abandon the ship.

The Soviet steamer *Kamchadal*, a small hydrographic survey vessel, is reported to have arrived at Vladivostok in October 1938, after a voyage of more than a year. Sailing from Leningrad in July 1937, the *Kamchadal* ran into a large ice-field in the Laptev Sea. She was caught in the ice and began a long drift in a north-westerly direction, reaching Lat. 78° N. With the onset of winter the drift became more difficult. A second vessel, the timber-carrier *Robochi*, which had been drifting alongside the *Kamchadal*, was crushed by the ice. The cargo and crew were transferred to the *Kamchadal*, which was freed in the summer of 1938 by the ice-breaker *Krassin*.

Soviet Work in the Arctic, 1938.

It has again been impossible to get direct news of Soviet expeditions. It appears that the research work of the Arctic Institute and of the Chief Administration of the Northern Sea Route is being reorganised, and it is reported in the Press that the Institute will concentrate on the organising of fuel bases at known coal and oil deposits in the Arctic. It is hoped to make the Arctic coastline, with its extensive shipping, self-supporting as far as fuel is concerned and to develop numerous ore deposits. One such deposit, a nickel field on the Kola Peninsula, was reported to have been put into commercial operation in October 1938, with 40,000 workers in the mine and smelting plant.

A new air base, equipped with special Arctic planes, is also said to be planned for the coming year to assist navigation and to avert the danger to ships of being caught in the ice. Plans for building other new Arctic ports and new ice-breakers are also in progress.

It is reported that the government has authorised the construction of a new building at Leningrad to house the Arctic Institute, and that there have been changes in the personnel.

The Finding of De Long's Diary on Henrietta Island.

The diary left by the American explorer, Lieut. Comdr. George W. De Long, on Henrietta Island in 1881, during the drift of the *Jeannette*, was discovered by M. Leonov, biologist of the Soviet expedition under the leadership of L. F. Mukhanoff, stationed on Henrietta Island. The diary was in the copper cylinder in which Lieut. G. W. Melville, a member of De Long's party, placed it under a rock cairn. The diary has been much damaged by water, but has been taken to the Arctic Institute at Leningrad, where it is hoped that it can be deciphered.

THE USE OF WIRELESS EQUIPMENT BY EXPEDITIONS

BY CAPTAIN I. F. MEIKLEJOHN, R.SIGNALS

Wireless Officer to the British Graham Land Expedition, 1934–37

[Although wireless equipment has been successfully used by many polar expeditions, very little information regarding its use has been published. It is hoped that this article will be of use both to those planning an expedition and also to those radio engineers who may accompany future expeditions.]

I. *General Remarks on Wireless Equipment*

1. Wireless communication can undoubtedly be of great value to an expedition, especially in case of emergency. On the other hand, the necessary apparatus is expensive, and failure of communication, either on account of unsuitable equipment or inexperienced operators, will cause considerable anxiety and inconvenience. If, then, wireless is to be used on an expedition, suitable equipment must be used by trained personnel. Whilst only a little practice is necessary to enable anyone to operate a wireless set, many months of training are essential before an operator can diagnose and rectify faults.

The ease with which individuals learn the Morse code varies considerably, but the average person should be able to learn to copy signals at a speed of twelve to fifteen words a minute by doing two hours' work a day over a period of two months. This speed is sufficient for handling small numbers of short messages, although wireless operators normally work at speeds varying between eighteen and twenty-four words a minute.

It should be remembered that, in the earlier stages of operating, regular practice is necessary. The beginner who has acquired a speed of, say, twelve words a minute will rapidly lose speed without practice. For reliability, an operator must be so trained that the ability to read Morse is an additional sense which, once acquired, is not impaired by lack of practice.

It is also found that experienced operators who can read Morse at a certain speed in a classroom always develop "stage fright" when first told to handle traffic on a circuit. For this reason a period of time spent handling "live" traffic is always included in an operator's training.

Provided, however, that high operating speeds and extreme accuracy are not required, the average individual can certainly be trained to receive messages in time of emergency.

It is inadvisable to instal a transmitter and receiver for use in case of emergency only. The general conditions encountered on an expedition necessitate regular maintenance. One member of the party should, therefore, be a trained radio engineer who can add to the value of the scientific results of the expedition by doing other work such as ionospheric research.

2. *Time-signal receivers.* The use of wireless receivers for the reception of time signals is now common practice. Such receivers can now be made of light weight, extreme compactness and reliability at a cost not exceeding £15 per station. The stations can also be used by sledge parties in the field for the reception of orders, information, etc., transmitted to them from the base station. The receivers can be operated by a novice, but under these conditions it is desirable to have a reserve set at the base, as the conditions of service are abnormally severe. Such sets should on no account be brought into a warm tent in cold weather as moisture resulting from condensation is most injurious. The equipment should be carried in a box having a canvas cover to exclude salt water and drift snow. The size of box can be about 10 in. × 10 in. × 14 in., and the total weight of the station should not exceed 25 lb.

3. *Direction-finding equipment.* At the present state of development, direction-finding apparatus having any degree of accuracy is bulky and expensive. In general, such equipment is not likely to be of use to an expedition in the field. The expedition ship may be so equipped at the discretion of the captain.

4. *Sledge transmitting sets.* The design of transmitters for use by sledging parties presents no great difficulties, provided that ranges in excess of 1000 miles are not required. Small hand- or pedal-operated generators suitable for supplying power are readily obtainable and low-powered transmitters can be designed which are very simple to operate. The generators, however, give very little power, and the aerial must therefore be supported on bamboo sectional masts so as to make it as efficient as possible. Radio telephony can be provided, although this increases the bulk and weight of a transmitter and reduces the range. Communication on the move with such sets is not yet a practical proposi-

tion except over very short ranges. The complete transmitting and receiving station could be carried in two ration boxes weighing approximately 80 lb.[1]

Reports frequently appear in the press of light-weight portable intercommunication sets which would appear to be suitable as sledge equipment. Most of these sets are designed for special short-range communication and use ultra short wave-lengths. The characteristics of waves of this length are such that for reliable communication there must be an optical path between the two stations. Thus, even in flat country, the range is strictly limited owing to the curvature of the earth.

5. *Base transmitter*. Such transmitters, besides affording facilities for communication from any part of the world to the United Kingdom, may also be used for sending messages to units of the expedition equipped with time-signal receivers in the field. The equipment of the base station represents additional expenditure which can, however, be balanced out by the sale to the press of despatches describing the work of the expedition. The transmitter will require a small internal combustion engine to supply the necessary power. Power for electric lighting of the base hut can be obtained from the same source. The claims of amateurs to establish contact with stations at very great distances using power from dry batteries do not justify the use of such low power at the base station. There is a great difference between establishing communication occasionally and the ability to handle traffic daily throughout the year.

A separate room must be allotted for wireless purposes in the base hut. The suggested minimum space is 7 ft. 6 in. by 5 ft. One of the walls should be an outside one to facilitate the running of leads from the sets to the aerial. The petrol engine must be housed separately either in the porch or in an outhouse.

In connection with the supply of despatches to the press, leaders of expeditions should not bind themselves to transmit long press reports to any one particular station without consulting the wireless engineer. The nearest station to the expedition's base is not necessarily the most convenient station, because it is a regrettable fact that many wireless stations situated near the polar regions have the most antiquated equipment.

The proprietors of newspapers securing a world copyright of expedition news frequently suggest the use of a simple code to guard against the

[1] The writer is at present investigating this problem.

interception and publication of press telegrams by rival newspapers. As expedition press reports are only likely to be transmitted at, say, monthly intervals, the danger of interception is not great, and hardly justifies any precautionary measures being taken. Simple codes have been used in which certain key nouns and verbs are coded. It has been found that even the best editorial staffs sometimes fail to decode the article completely and, therefore, publish nonsense. The degree of secrecy thus afforded is negligible.

It is, therefore, not considered necessary or desirable to take any measures to ensure the secrecy of press messages.

6. *Aircraft equipment.* Wireless communication from air to ground presents no great difficulties and either telegraphy or speech can be provided. Very great ranges, especially in the case of a forced landing, should not be expected owing to the inefficiency of the aerial system and the low power available. Ranges up to 1000 miles are quite practicable. The power for the transmitter and receiver is obtained in flight from a dynamo driven by a windmill in the slip-stream. When on the ground an alternative power supply must be provided to allow for communication in event of engine failure. This emergency power supply can take the form of a hand- or pedal-driven generator similar to that suggested for sledge transmitters. If communication is required to an aeroplane, the machine must be electrically "bonded" and the ignition system screened. This is carried out by the manufacturer at a cost of about £50 for a small machine. The total weight of equipment including emergency power supply would be of the order of 75 lb.

7. *Production of equipment.* Any of the equipment mentioned can readily be obtained at short notice from the trade at a price. However, provided the wireless engineer is informed of the communication requirements at an early date, there is no reason why he should not assemble the necessary equipment from components at a very much lower price. The trade are averse to making concessions to expeditions in exchange for publicity since, in the past, the promised publicity has not been forthcoming. In general it can be said that the wireless equipment of the fighting services, which is built for specific purposes, is not generally suitable for use on an expedition.

II. *Technical Considerations*

1. This portion of the article has been kept as general as possible, since it is useless to make detailed suggestions for a scheme of communication which must be extremely flexible and which uses a rapidly developing technique.

2. *Choice of frequencies.* With the possible exception of time-signal reception in the Arctic it is not considered that the use of medium and low frequencies is justified. For communication at short ranges conditions are such that no trouble need be anticipated from skip distance effects provided that frequencies as low as 3·5 Mc./s. are used. Time-signal receivers should work on the same frequency range as the base transmitter so that traffic can be sent "blind" from the base. The aeroplane equipment must also use the same frequency range.

3. *High-latitude propagation.* As the condition of the ionosphere is dependent upon the action of the sun's rays, propagation characteristics in high latitudes are different from those of the lower latitudes. In polar regions conditions in the summer months correspond to intense daylight conditions in normal latitudes and in winter months to night conditions in normal latitudes. Only at the equinoxes are conditions strictly normal. In summer the attenuation and bending of waves of all frequencies is above normal, and in winter below normal. In Lat. 70° S., for instance, skip distance effects are not noticeable on all frequencies below 8 Mc./s., but in winter the skip distance varies between 750 miles at 3 p.m. sun time to 1500 miles at 5 a.m. sun time. Owing to the abnormal conditions great care has to be exercised in the selection of suitable frequencies, particularly in the case of communication from the Antarctic to Great Britain in the Northern Hemisphere summer months.

Static interference is conspicuous by its absence in the local winter months, but becomes quite fierce in the summer. "Fade-outs" appear to occur more frequently and are more intense the nearer the transmission path approaches the magnetic pole.

4. *Time-signal receivers.* There are now many time signals radiated on the higher frequencies which can be received with simple types of receivers using aerials of low effective height. The novice, once familiar with a high-frequency receiver, experiences no difficulty in locating the correct transmitter. In certain areas of the Antarctic the low-frequency time signals cannot be received with simple aerial gear. There does not

appear, therefore, to be any use for a low-frequency receiver for expedition purposes. A simple two- or three-valve receiver used with 60 ft. of wire slung between two skis stuck upright in the snow without a counterpoise is all that is required. Dry-cell low-tension batteries have a reasonable life if used for a short period each day to deliver a current of 0·3 amp. If the expedition is to be in the field for more than one season it is advisable to use Inert cells, which do not deteriorate in storage if kept dry. Small capacity Inert H.T. batteries are marketed by Siemens Bros., and have proved very satisfactory. All batteries require to be warmed near a stove if they have been subjected to low temperatures. Batteries and receivers should, therefore, be separate components so that the receiver is not brought into the tent with the battery. It is perhaps unnecessary to emphasise the necessity for robust construction. Spare valves should be carried and precautions must be taken to prevent valves being shaken out of their sockets or fouling other components when subjected to severe shock.

5. *Aircraft equipment.* There should be no technical difficulties as far as the equipment itself is concerned. If long and short ranges are required, it will be necessary to use two frequencies. The transmitter should be crystal controlled and as simple as possible, as it will have to be operated either by the pilot or passenger. If telephony is employed the microphone must be carefully chosen to avoid troubles from condensation of the operator's breath in the instrument.

6. *Sledge transmitters and receivers.* The chief difficulties with such equipment are the questions of power supply, robustness and weight. The power supply for the transmitter is limited to a hand- or pedal-driven generator, which is not suitable for receiver power supply as it is difficult to eliminate background noise. A time signal or similar type of dry-battery receiver would probably be the best solution. A choice of two frequencies for short and long distance would be desirable with crystal control on both frequencies. Adequate weather proofing must be ensured. Light bamboo sectional masts are made which can be used as aerial supports.

7. *Base power supply.* The system will be called upon to supply power for lighting the base hut in the winter as well as running the transmitter and receiver. It is desirable to simplify arrangements as far as possible and to avoid the necessity for charging odd small accumulators.

A central battery to meet all requirements would be large and heavy, and it would probably be difficult or wasteful to distribute the load equally on all cells. The simplest arrangement is probably to obtain the transmitter power supply from a petrol driven 220 v. alternator, the transmitter having the necessary transformers, rectifiers and smoothing circuits. Provision should also be made for the petrol engine to drive a 120/180 v. 10 amp. dynamo for charging a 120 v. bank of small capacity, say 60–70 A.H. accumulators. Lightweight, 12 v. unit, aircraft accumulators are small in size and stand up well to hard work. This bank would be used for lighting and receiver (D.C. mains type) supplies. The petrol engine should preferably be a big slow-running air-cooled machine. Small, high-efficiency, fast-running machines require too much maintenance. The engine would need suppression of the electrical system and should be housed as far away from the receiver as possible.

Magnetos are likely sources of trouble with petrol engines in cold climates and, therefore, spare ones should be taken. The petrol supply should be well filtered, as petrol stored in cans becomes very dirty. A light engine oil is essential, but even the lightest oils will gum up an engine badly in low temperatures. Take a Pyrene; cold engines spit badly and carburettor fires may get out of control.

No trouble need be anticipated from accumulators, although it is advisable to take some spare cells in case some are found to leak as a result of rough handling in transport. Acid does not freeze unless the cells are practically "flat", in which case some trouble may be experienced in very cold weather. Glacier ice can be melted to provide water for topping up. Sea-ice or snow lying in the vicinity of the sea should, of course, not be used. If the water is unsuitable it will turn cloudy when a small quantity of 10 per cent silver nitrate solution is added.

8. *Base transmitter*. An aerial power of about ½ kW. on continuous waves is desirable, which means the input power would be too great to be taken from any but very large size, heavy accumulators. It is, therefore, suggested that the transmitter should be of the A.C. mains operated type. Provision for radio telephony may be necessary for communication to sledging parties or to the aeroplane. It is often very desirable to be able to adjust the frequency of the transmitter quickly in order to avoid interference and the allotted working frequencies are not likely to be in direct harmonic relation. As low-power master oscillators having a high degree of frequency stability are now a practical proposition, crystal control is not advocated.

9. *Receivers.* To simplify the power-supply question a D.C. mains type of receiver is recommended which can be operated off the D.C. lighting supply. It is a good idea to have two receivers, one a high-grade "communication" type of receiver and the other a simple stand-by receiver. The servicing of communication receivers is not simple, and may take a considerable time so that the stand-by receiver may be invaluable. The finish of the receivers should, of course, be fully tropical. A loudspeaker should be included to enable members of the expedition to listen to broadcast programmes. A separate aerial should be used for reception, and the petrol engine should be well screened and as far from the receiver as possible to allow of "break-in" working which saves much time when there is much traffic to be cleared or conditions are poor.

10. *Base station aerials.* The choice of suitable equipment is complicated by the small power of the transmitter and the high wind velocity which may be experienced in certain polar regions. The problem is to instal an efficient aerial system, using a minimum number of short masts which will be equally efficient over a wide range of frequencies. If long-distance communication to a fixed station is anticipated, a directional array is of great advantage. The rhombic antenna is the ideal directional system for use at the base station. It is a high gain array requiring only four small masts, and it is efficient over a wide band of frequencies. The only disadvantage, which is not likely to be serious, is the large amount of space required. The solution to the problem is probably a rhombic antenna for fixed long-distance communication, with dipoles suspended diagonally inside the rhombic for shorter range omni-directional transmission. A separate short vertical aerial should be included for reception.

If there is insufficient space for a rhombic, vertical or horizontal Vee aerials may be satisfactory. To be aperiodic, the ends of the wires must be earthed. Some trouble may be experienced finding satisfactory earths.

For mast gear 40 ft. scaffold poles are recommended. Sectional steel masts are heavy to transport and will buckle in really strong winds. Scaffold poles which can be lashed in the ship's rigging in transport are comparatively light and will not break in gales. Metal guys may be used, although these tend to become brittle and break in low temperatures. Rope guys, on the other hand, require constant readjustment. Holdfasts for guys can be made from baulks of timber buried under stone cairns.

Bicycle Generator. O.U. Arctic Expedition, 1935–36.

Receiving Time-signal, Greenland Ice-cap, 1934.
[*Photos H. A. C. Croft*]

The bases of the masts may be secured in a similar fashion. The baulks of timber used as holdfasts should have thick steel strops round them sufficiently long to remain 4 ft. above the snow level in winter. Dogs will chew through thin steel guys!

Aerials should be mechanically spring loaded to minimise aerial movement when the masts move in a high wind.

Ice or snow does not constitute an earth. Earth nets in the sea will probably disappear with the ice in the summer. Counterpoises, on the other hand, are electrically efficient and also make excellent clothes' lines if made of strong enough wire. Counterpoises cause much bad language and may be dangerous to members of the expedition in the dark.

11. *Causes of breakdowns.* Most of the troubles encountered will probably be due either to rough handling in field equipment or to damp. The amount of unavoidable rough usage to which field equipment may be subjected should not be underestimated. There is considerable mechanical vibration and jolting on sledges on sea-ice and the sledges not infrequently overturn, sometimes in pools of water.

At the base, the wireless room, which is usually very small, can be kept warm at night by a small paraffin stove. If this is not done, steam from cooking or washing operations will condense on the cold metal work and hoar frost may form on the inside walls of the room. Tropical finish is essential on all components.

Generators sometimes have a disconcerting habit of failing to give any output if housed in an unwarmed porch. This is due to moisture from condensation on the commutators freezing. It is not likely that the armatures will get sufficiently damp to burn out when load is put on, but this is a point to watch.

12. *Miscellaneous points.* Licences for the use of wireless equipment are issued by the country, dominion, colony, etc., claiming the land in which the expedition proposes to work. The government concerned probably attempts to grant a restricted licence so that all traffic has to be handled through the government's radio station. Some additional charge is made for this. As far as private and short expedition telegrams to England are concerned, the Post Office will probably arrange for this traffic to be handled direct through its station at Portishead. The Post Office are usually most obliging in this respect, and this is the cheapest

and quickest method of clearing traffic for Great Britain. Other arrangements must be made for long press reports, etc., and these may conveniently be relayed by the nearest government station. Press traffic should be sent "collect", charges payable by the newspaper concerned.

The charges incurred on private telegrams should be made payable by an expedition secretary at home who can arrange for deposits to be made by members of the expedition.

GREENLAND

Changes in the Greenland Administration

The new director of the Greenland Administration is Herr Knud Oldendow. He was Governor of South Greenland from 1925 to 1932, and since then business manager of the Administration in Copenhagen. Herr Rosendahl, the Governor of North Greenland, will succeed to this position in Copenhagen, and his place will be taken by Herr Eske Bruun, at present working in the Copenhagen office.

Completed Expeditions

Miss Louise A. Boyd's Arctic Expedition, 1938.

Miss Boyd and her party, whose plans were outlined in *The Polar Record*, No. 16, left Norway on June 1 on the Norwegian sealer *Veslekari*. The work was begun at Jan Mayen, where magnetic and tidal observations were made and soundings taken. Current observations were also made between there and Bear Island, over a bank discovered during the 1937 expedition. The soundings were continued to Spitsbergen and north of Seven Islands, off the north coast, to Lat. 81° 30′ N. There was no ice as far east as Cape Platen in early July.

The ship then went westward along the pack-ice to Greenland, where open water enabled a landing to be made at the northern point of Ile de France in Lat. 77° 50′ N. To the best of Miss Boyd's knowledge, this is the second farthest north landing ever made from a ship on this coast, and the *Veslekari* was the only ship to go as far north this year.

The whole of August was spent in the vicinity of Germania Land. Dove Bay was open for the first time for several years, and was penetrated for some distance. Survey and geological work was done in the numerous fjords of this region. The short-wave radio observations made during the summer showed many fade-outs, but the short wave worked out of the fjords despite the high cliffs. The expedition was in daily communication with Norway, sending meteorological data.

The *Veslekari* returned to Norway at the beginning of September. The results of the 1937 and 1938 expeditions are being worked up at the American Geographical Society.

Norwegian Expeditions to East Greenland, 1938.

During the summer of 1938 four Norwegian expeditions visited East Greenland:

(1) The *Veiding* of Hammerfest (Skipper Olav Bogstrand) was sent out by Norges Svalbard-og Ishavs-undersøkelser to relieve the Norwegian meteorological station of Torgilsbu (Lat. 60° 32′ N.) and to take out supplies for a fresh wintering party. The *Veiding* left Oslo on July 19, 1938, and reached Torgilsbu on the 31st. The ice conditions were exceptionally difficult. During a stay of three weeks a new and bigger station building was set up and equipped with radio for short and long waves. The new radio operator, with his wife and her brother, remained to spend the winter of 1938–39. The ship left on August 20 and reached Ålesund on the 31st.

(2) The *Rundehorn* of Ålesund went on a fishing expedition to the Skjoldungen district (Lat. 63°–63° 40′ N.). The leader was Hallvard Devold. The ship met a broad and tight belt of drift-ice, which later in the summer blocked the fjords. Having no radio the ship was assumed lost when nothing was heard of her until the first days of October. A relief expedition was sent out by the Norwegian Government in the *Polaris* of Brandal, but it had to return a few days later, the *Rundehorn* having managed to get through the ice and call at a harbour in Iceland.

(3) The *Polarbjørn* of Ålesund (Captain K. Marø) this year carried out the relief of the Norwegian meteorological station of Myggbukta, Mackenzie Bay, and of the Norwegian hunting stations in North-east Greenland. The expedition was sent out by the N.S.I.U. and was led by John Giaever, Secretary of the N.S.I.U. Some Swedish and Norwegian tourists were also on board.

The *Polarbjørn* left Ålesund on July 21, 1938, and reached Cape Herschel at Gael Hamkes Bay after a record crossing of only five days. The ice and weather conditions were favourable this summer, and the ship called at all the Norwegian stations between Davy Sound and Dove Bay. Only Shannon Strait did not break up this year. The English ornithologist, C. G. Bird, was taken on board in Peter Bay. He had spent two years at the Norwegian stations carrying out scientific work. On the homeward voyage the ship called at Jan Mayen and embarked the Imperial College of Science expedition, led by Alexander King, and reached Ålesund on August 31.

C. G. Bird's Biological Investigations in East Greenland, **1936–38.**

An account of the first year's work by C. G. and E. G. Bird, who had their base at Myggbukta, the Norwegian station in North-east Greenland, was given in *The Polar Record,* No. 15. E. G. Bird returned to England in August 1937, but his brother remained for another winter.

Owing to the bad ice conditions in the summer of 1937 it was not possible for the *Polarbjørn* to land any food further north than Cape Herschel. Bird had decided to work farther north than Myggbukta, so he sledged north during February 1938, by way of Loch Fyne, the inside of Clavering Island, over Wollaston Foreland, and outside Kühn Island to Peter Bay, Hochstetters Foreland. Here an old trapper's hut was found to be habitable for the spring and summer. After returning to Myggbukta for the remainder of his gear, Bird worked from the middle of April to August 18 in Peter Bay and on Hochstetters Foreland. During this period large collections of vascular plants, birds, butterflies, moths and spiders were made. All his sledge journeys were carried out alone, and he was also alone for four and a half months in Peter Bay.

Ice conditions were very good in the summer of 1938, the coast being virtually ice-free up to Cape Marie Valdemar, Lat. 77° 15′ N. It was a record season for fox trapping, one trapper being known to get 410 foxes. Musk oxen were seen in great numbers throughout the autumn and winter.

Dr Lauge Koch's Expedition to East Greenland, 1936–38.

Previous accounts of this expedition have appeared in *The Polar Record,* Nos. 13, 14, 15, 16. During the winter of 1937–38 geological work was carried out from four stations in East Greenland. The personnel of the wintering parties is given below, with a note on the work of each:

Eskimonaes

W. Mayne, stratigrapher.
A. Vischer, tectonic geologist.
One radio operator.
One Danish and two Eskimo assistants.

Geological mapping of the area Hold-with-Hope, Loch Fyne, Giesecké Mountains.

Ella Øya

Malte Andersson, stratigrapher.
W. Bierther, stratigrapher.
Th. Heinrichson, palaeontologist.
One radio operator.
One Danish and three Eskimo assistants.

Geological mapping of the northern part of Scoresby Land.

Gurreholm (in the interior of Scoresby Sound)

H. HÜBSCHER, stratigrapher.
H. STAUBER, stratigrapher.
One radio operator.
One Danish, one Icelandic and one Eskimo assistant.

Geological mapping of the northern and central parts of Jameson Land.

Rosenvinge Bay (Scoresby Sound)

K. KLEIBER, stratigrapher.
EIGIL NIELSEN, palaeontologist.
One Danish and several Eskimo assistants.

Geological mapping of Canning Land and parts of Liverpool Land and Jameson Land.

The geological mapping of the whole fjord area between Lat. 71° and 75° N. has now been completed on the basis of the new 1 : 250,000 maps issued by the Danish Geodetic Institute.

In the summer of 1938 the geological parties all returned to Copenhagen in the *Godthaab*, which had taken to Greenland a Heinkel hydroplane to help with the mapping. Summer work was also carried out by the zoologist, Dr H. A. Kreis, of Basel, and by Dr H. Butler, who, with three assistants and using six Icelandic ponies, made a geological map of Hudson Land between Musk-ox Fjord and Wordie Glacier. Dr A. Mittelholzer, with one assistant, is remaining during the winter, 1938–39, to continue his geological work near Eskimonaes.

Ice conditions off the coast were very variable. In July the ship was ice-bound off Scoresby Sound and drifted southwards for ten days. Then she was released in time to enable the expedition to begin work in Musk-ox Fjord at the end of July. During the rest of the summer, several large, densely packed ice masses were passed, but the position of these was noted from the air and the ship was able to avoid them.

Expedition of the Akademischer Alpenclub Zürich to East Greenland, 1938. *Ascent of Mount Forel.*

An expedition of the Akademischer Alpenclub Zürich was at work in East Greenland from July to September 1938, under the leadership of André Roch and organised by Michel Perez of the French Ethnographical expedition 1934–35, and the French Trans-Greenland expedition 1936. A preliminary account and list of personnel was given in *The Polar Record*, No. 16.

The expedition sailed from Iceland at the beginning of July 1938, on board the *Gertrud Rask* which had put into Reykjavik for repairs, and arrived at Angmagssalik on July 15, having met practically no ice.

The seven members of the expedition, with eight Eskimos and fifty-five hired dogs, left by motor-boat to establish a base camp in Sioralik Fjord, north of Kumiut. Equipment was then carried along an alluvial valley with torrents and steep slopes to the edge of the Sioralik Glacier, about 5 km. north of the base.

On July 22 the expedition started from the edge of Sioralik Glacier with eight sledges. Six of these were of the ordinary wooden Greenland type, but two strips of duralumin were screwed on to each runner to make them slide more easily on soft snow without sinking in. This system appeared to work very well on both hard ice and soft snow. The other two sledges were of the Nansen type, but built completely of duralumin. These broke up on the last day as a result of the very rough surface of the glacier, but it is the opinion of the organiser that this experiment in the use of duralumin sledges should be repeated before any fair judgment can be made.

The glacier was followed in the direction of Mount Forel. The surface was extremely variable, in places the loads having to be carried over moraines. On the third day the sledges had to be pulled up an ice slope of 200 m. by means of pulleys and ropes.

After four days the Eskimos returned to the coast with six sledges, and the expedition went on with one Eskimo boy, Larsi, and the two duralumin sledges, each loaded with about 350 kg. On August 1 the south foot of Mount Forel was reached at a height of about 2000 m. Next day Roch, Pidermann and Baumann succeeded in climbing Mount Forel (3500 m.) by the south ridge, while another party, consisting of Dr Wyss-Dunant, Coninx and Landolt made an unsuccessful attempt on the north side.

For the next few days the weather was bad. The party then split up. Perez and Dr Wyss-Dunant went on to the ice-cap, staying ten days and reaching a height of 3380 m., 60 km. north of Mount Forel, while the other five returned with one sledge by the way they had come. Seventeen summits were climbed on the return journey. Half way back the two groups met and continued a programme of glaciology, climbing and filming.

On August 25 the expedition returned to the base at Sioralik Fjord, having crossed for the first time the longest axis of the mountains of the Angmagssalik district, and having covered a distance of about 400 km.

From August 25 to September 22 the expedition had to wait for the *Gertrud Rask* which was not able to reach the coast on account of heavy ice. Copenhagen was reached on October 7.

Dr C. E. Wegmann's Geological Expedition to South Greenland, 1938.

During the summer of 1938 Dr C. E. Wegmann of Schaffhouse, Switzerland, continued his geological investigations begun in 1936 and 1937 in Southern Greenland. This time the areas chosen were those around Nanortalik and Arsuk. He was assisted by Rodolphe Herzog from Zürich and two Greenlanders.

Danish Geological Research in South-west Greenland, 1938.

From July 1 to September 9 Richard Bøgvad was carrying out geological research at the cryolite mine for the company at Ivigtut and in the district round Arsuk Fjord in South-west Greenland.

Danish Ornithological Investigations in West Greenland, 1938.

From June 10 until September 19, 1938, Arthur Christiansen of Copenhagen made ornithological observations in West Greenland between Lats. 64° and 67° N. His object was to study local bird distribution and breeding biology, to collect specimens, and to mark young birds with numbered rings. Exceptionally bad weather conditions hindered this work considerably, but it appears that most of his programme was successfully accomplished with the help of native assistants.

The Work of Professor W. Thalbitzer and Professor L. L. Hammerich in West Greenland, 1938.

From June to September 1938, Professor W. Thalbitzer and Professor L. L. Hammerich were studying the language, literature and music of the Greenlanders from Holsteinsborg to Julianehaab. Smaller places, particularly Sarfánguaq, Kangeq, Qôrnoq, Narssalik, Neria, Arsuk and Igaliko were also visited. Professor Thalbitzer continued his work of previous years, especially renewing and strengthening his acquaintance with the Greenland men of literature, and working on plans for promoting this literature. He also supplemented his collection of native music, as well as his collection of place-names and names of the winds. Professor Hammerich, who was making his first visit to Greenland, after acquiring some practical knowledge of the language, assisted Thalbitzer, and in particular made a collection of recent popular ballads.

German Expedition to West Greenland, 1938.

An expedition under the auspices of the Hermann-Göring Foundation "Reichsjägerhof" was at work in West Greenland during the summer of 1938, under the leadership of J. Herdemerten, a member of Alfred Wegener's expedition of 1930–31. Other members of the expedition were Dr K. Magerstaedt and E. Knoespel. The object of the expedition was to study the habits and environment of the Greenland falcon (*Falco rusticolus*), and to attempt to correlate past distributions with oscillations in climate. Six falcons were brought back to Germany. These have been taken to the Riesengebirge at about 1400 m. (4200 ft.), where the climate is more or less similar to that of the Greenland habitat, and the study of the birds can be continued.

While the other members of the expedition were at work in West Greenland, Dr Magerstaedt travelled to Thule and back with the Danish trading ship. He was interested in the incidence of tuberculosis among the Eskimos and took some blood samples.

Oxford University Greenland Expedition, 1938.

The plans and members of the Oxford University Exploration Club 1938 expedition to West Greenland were given in *The Polar Record*, No. 16. The expedition left Southampton on June 29. After terminating the agreement with the captain of the steam yacht *Valhal*, which had been chartered for the expedition, the party was able to reach the Faroes by cargo boat and to continue on a fishery depot ship to Faeringehavn. Thence they went by the Greenland Administration motor-boat via Sukkertoppen to Evigheds Fjord.

Owing to difficult country the equipment had to be landed very near to the foot of one of the main glaciers of the Sukkertoppen ice-cap, at a place quite unsuitable for a camp. A base camp was chosen on the glacier itself, some 800 ft. up, whence it seemed possible to begin sledging. The first three days were spent establishing this sledging base. On the fourth day the first load was sledged up the glacier as far as possible, but after about five miles an ice-fall of about 500 ft. blocked the way. With the time available, it would have been impossible to have packed all the heavy equipment beyond this point. It was decided, therefore, to make the main meteorological and wireless station just below the ice-fall, on the glacier, at a height of about 1000 ft. Mott found a suitable site for the survey camp on the valley side above the ice-fall, while Sugden and Etienne reached a site for an ice-cap station some 5000 ft.

up and 12½ miles inland. It was possible to equip this station with the necessary instruments for the meteorological and glaciological work. Within eight days all three stations were established and the work was in progress.

Since a party was to stay out until November, the stations continued to be improved and they were gradually fully equipped with all the necessary provisions and equipment. At the ice-cap station two large caves were dug 12 ft. below the surface, large enough to contain three-man tents, and joined by a communicating tunnel. Here the temperature remained consistently at 32° F., although the temperature outside varied from 40° to 6° F. The entrance to the cave was small enough to be covered by a small tent which kept out drifting snow and acted as an air vent.

Meteorological and glaciological work was carried out, and a survey made by Mott with a Wild photo theodolite. Details of the work done have not yet been received. The short-range wireless sets were proved and communication was established between the various camps.

Mott, Etienne and Kershaw remained in the field until the beginning of November, while the rest of the party returned in a Faroes fishing smack, arriving in England on September 29.

Cambridge West Greenland Expedition, 1938.

The plans and personnel of the Cambridge West Greenland expedition, 1938, were given in *The Polar Record*, No. 16. The object of the expedition, led by H. I. Drever, was to carry out a varied programme of scientific work in Umanak Fjord, West Greenland, for two months during the summer. A house built by Rockwell Kent, American artist and author, in Igdlorssuit, the settlement on Ubekendt Island, was used as a permanent base, from which excursions were made in kayak, yawl and motor-boat. The motor-boat was chartered from Sarqaq, Nugssuaq Peninsula, for three weeks and proved efficient and reliable.

Ubekendt Island was mapped geologically, and a representative collection of rocks—Tertiary lavas, dykes and plutonic intrusions—was brought back. This collection includes a great variety of types which are now under examination. The island proved to be an especially rich field from the petrological standpoint. P. Game also investigated a small area of Tertiary rocks on the south-west corner of Upernivik Island.

D. M. Carmichael carried out experimental psychological work with the natives of Igdlorssuit, connected with ethnological observations.

A great variety of data was collected; mechanical and other intelligence tests were successfully completed, while at the same time some study of the material culture, past and present, was pursued. Carmichael stayed on at Umanak for an extended period to continue his work on a wider basis.

R. W. Feachem excavated abandoned dwelling sites, which were located at the few habitable places round the generally precipitous coast. The majority of these sites were found to date from the late sixteenth to the early nineteenth centuries. A steady increase of European influence was present, weapons found ranging from bone prongs to flint locks. A collection of plants from Ubekendt Island and some other districts in Umanak Fjord was made for the British Museum.

Ten pilot balloons were sent up to altitudes of between 14 and 18 miles; they were followed and their direction and rate of ascent were measured by means of one or two balloon theodolites.

Upernivik Island, which is mainly composed of Archaean gneiss, has a valley pass, filled with glaciers, which runs from the north coast to the west coast for about 18 miles. This was crossed for the first time. Also, an unsuccessful attempt was made to climb one of the peaks of the island.

The members of the expedition were able to carry out their programmes as originally planned. The party travelled up to Greenland on the second voyage of the *Disko* in June, three returning by the third voyage of that ship in September, while Carmichael returned by the *Gertrud Rask* in December.

The *Gertrud Rask* returned to Copenhagen on Christmas Eve. Such a late return of a Greenland ship has not occurred for many years. The ship had a hard time all through the summer, losing her screw in the ice off the east coast of Greenland, and later being caught in the pack for several days outside Angmagssalik. Finally, on her last voyage back from Greenland, she was considerably delayed by south-easterly gales and finally made her landfall at Ålesund in Norway.

Danish Geological Expedition to Northern West Greenland, **1938.**

An expedition consisting of Dr A. Rosenkrantz, leader; Frk. Sole Munck, petrologist; J. Troelsen, palaeontologist; Th. Sorgenfrei, geologist, and assisted by a number of Greenlanders, was at work on the Nûgssuak Peninsula (Umanak and Ritenbenk districts) from July 4 to September 13, 1938. The object of the expedition was a detailed investigation of the sedimentary and igneous rocks. The expedition spent the time from July 4 to August 10 investigating the north coast from Niaqornat to Kûk from the shore to the margin of the ice-cap, and from August 14 to August 25 crossing the peninsula from Niaqornat through the valley Itivdleq to Nûluk on the south coast. From August 27 to September 13 they made a trip through the interior, walking from Sarqaq on the south coast to Lake Taserssuaq, and then through Auvfarsuaq valley to the old ruins of Nûssaq at the Vaigat. From here the investigations were continued along the south shore to Pautût, where the work was finished for this year.

The preliminary results of the expedition may be summarised as follows:

Cretaceous fossil plants were collected, some from new localities.

Cretaceous marine fossils were collected, many from horizons (possibly up to Danian in age) hitherto unknown in this region. Two mud volcanoes and a "burning cliff" caused by a landslip were found within the area of the marine deposits. The deposits consist principally of bituminous shales.

Petrological studies were made, special attention being paid to the sills and dykes (ranging from ultrabasic to acid) and to a basalt breccia which forms the basal part of the basalt formation.

Faults both older and younger than the basalt eruptions were recognised, one being traced right across the peninsula from north to south.

The geological map of the region was modified in accordance with the expedition's results. The topographical maps of the Danish Geodetic Institute were used by the expedition and proved of great value.

In addition to the geological work, the expedition made collections of living plants especially in a number of localities in the interior, never before visited by scientists. Moreover, at the western end of Lake Taserssuaq, an old reindeer hunter's dwelling was found with stone houses, numerous meat caches and a "nāngissat".[1] Other "nāngissats" have been discovered along the outer coast.

The expedition was financed by the Carlsberg Foundation.

American Meteorological Expedition, 1937–38.

Fairly full accounts of this expedition have been given in the last three numbers of *The Polar Record*. These accounts were taken from press articles which contained some errors. We have now received a report from a more reliable source.

[1] According to Dr Schultz-Lorentzen (Dictionary of the West Greenland Eskimo language, *Medd. om Grønland*, Bd. LXIX, 1927) this word means "a row of stones on which one hops on one leg from one to the other".

The members of the expedition were:

C. J. MacGregor, leader and meteorologist.
R. Fitzsimmons, magnetician.
P. B. Furlong, engineer.
J. Johnson, cook and engineer.
— Lawrence, assistant.
R. Ingles, boy scout and assistant surveyor.
G. Sayre, radio operator.
Lieut. Commdr. I. Schlossbach, late U.S. Navy, navigator, pilot and mechanic.
M. Wiener, photographer.

The account in *The Polar Record*, No. 16, gave accurate details of the work accomplished up to the beginning of May 1938. Shortly afterwards there was an unfortunate accident in which Johnson had his arm broken by the propeller while starting the aeroplane. He was sledged down by Eskimos to Robertson Bay, where fortunately Dr Scheibel was paying his spring visit to the settlement of Sioropaluk. Johnson was then taken down to Thule hospital where his arm was successfully set.

Schlossbach made two more flights, during one of which he observed land in the Greenland ice-cap. Preparations were made for him and J. W. Wright (of the British Arctic expedition) to fly in and check this discovery, but the plane got out of control while being warmed up and was damaged. Schlossbach and Wright then sledged in to the supposed site of the nunatak, but found no land. It was established fairly definitely that what Schlossbach had seen was the land at the head of Inglefield Gulf. Its western end had been covered by cloud so that he could not see that it continued to the sea, and, being alone in the aeroplane, he had been unable to take any proper observations for drift or land speed.

The expedition ship, *General Greely*, was freed from the ice on July 8 and reached Thule five days later. Wright was dropped and Johnson taken on board, and they set sail for home. After being beset in the ice for three weeks, they experienced a hurricane, in which pumps had to be worked continuously, and the ship was nearly abandoned. New York was not reached until early in October, three months after leaving Etah.

The magnetic observatory which this expedition established at Etah was operated from mid-September 1937 to July 5, 1938. Practically complete records of the magnetic elements were obtained during this period, since the variometers were operated at a sensitivity of approximately 22 γ to the mm. Of outstanding interest to magneticians is the fact that a complete record was obtained during the very severe storm of January 22, 1938, when the range in horizontal intensity was greater than 3500 γ.

In addition to the usual meteorological observations, an exceptionally fine series of upper-air observations was obtained. Few aurorae were seen and consequently less than fifty auroral photographs could be taken.

Expeditions in the Field

Norwegian-French Expedition to North-east Greenland, 1938–40.

The plans of the Norwegian-French Arctic expedition, led by Willie Knutsen and Count Gaston Micard, were given in *The Polar Record*, No. 16: but these have had to be altered owing to pack-ice on the north-east coast of Greenland. The expedition ship, *En Avant*, was unable to reach its destination, Ingolfs Fjord, in about Lat. 80° N., but was stopped by the ice at Germania Land. A meteorological station has been set up in about Lat. 77° N., while the ship and the crew are wintering in a harbour at Koldewey Island.

French Expedition to West Greenland, 1938–39.

A French expedition led by Dr Hubert Garrigue, Director of the Observatory of the Pic du Midi, left Copenhagen at the beginning of September 1938 for West Greenland. The expedition intends to continue the work of the late Dr Jean Charcot, and a commemorative ceremony was held on September 16, on the outward voyage, at the spot off the coast of Iceland where the *Pourquoi-Pas?* was lost in 1936.

The expedition is reported to have established a base on Disko Island, West Greenland. The plans include studies of nocturnal sources of light by spectrographic methods, and investigations in radioactivity.

CONFERENCE ON GREENLAND GEOLOGY

We are asked by Dr C. E. Wegmann to print the following notice:

"A number of geologists who have travelled in Greenland in the last six years, and specialists who have studied the material collected, propose to arrange a meeting in March 1939, in Schaffhouse, Switzerland, to discuss the new problems of the geology of Greenland. The programme will be sent to all persons interested on application to C. E. Wegmann, Geol., Bocksriet, Schaffhouse, Switzerland."

THE SURVEY WORK OF THE DANISH GEODETIC INSTITUTE IN GREENLAND AND ICELAND

BY PROFESSOR N. E. NØRLUND

[The Director of the Danish Geodetic Institute has kindly sent us these accounts of the work being done by the Institute in Greenland and Iceland, which must constitute one of the most ambitious survey programmes ever planned in the Arctic.]

Greenland

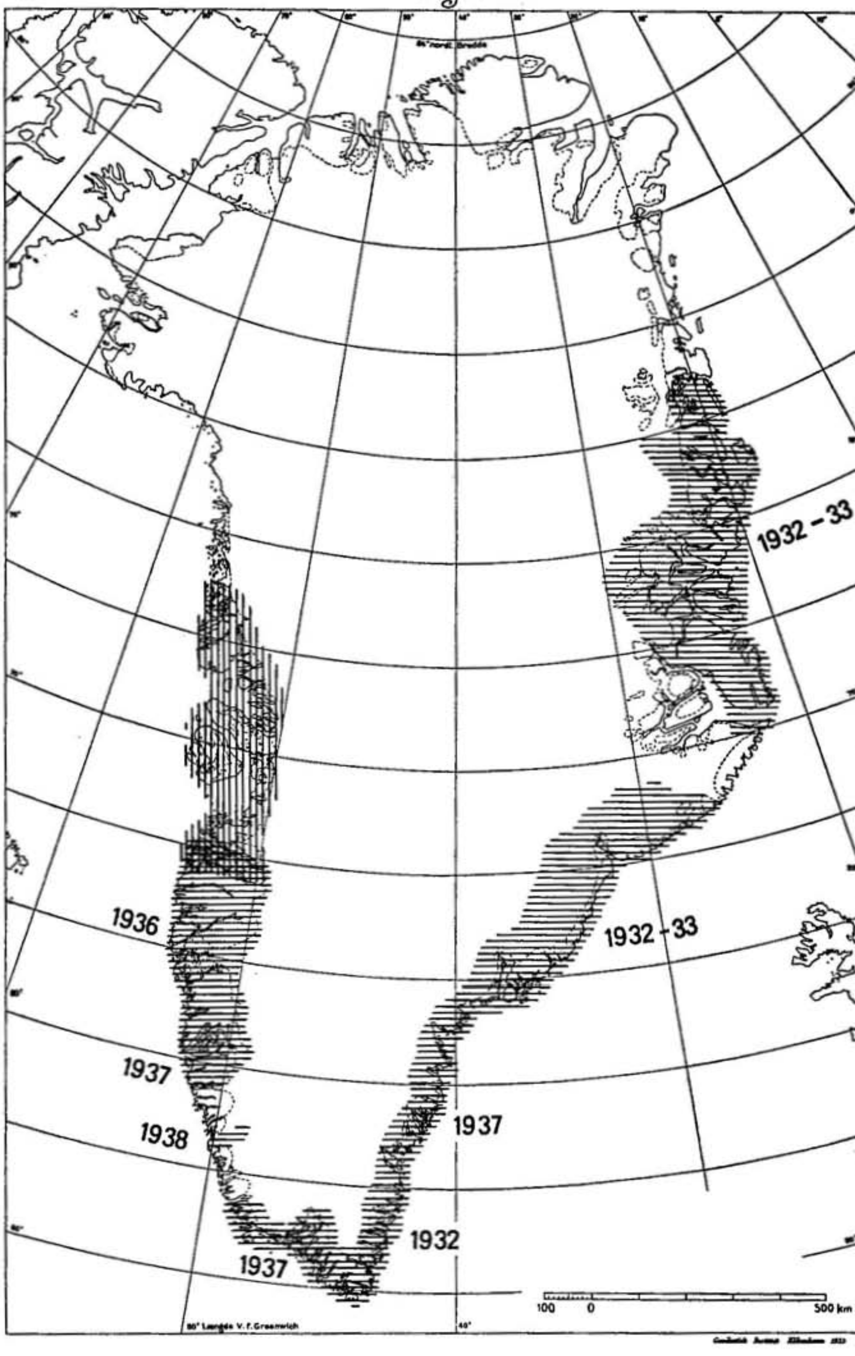
This work was commenced in 1927 and has been continued ever since without interruption. Every spring the Institute has sent an expedition to Greenland with the ordinary line steamers. In Greenland, transport to the working places proceeds by means of four fast motor-boats specially built for this work. They are very suitable for use in the numerous rocky fjords and sufficiently large to traverse the long distances from one end of the field of operations to the other. The frequent transfer of the surveyors from one station to another is not the least of the difficulties which the organisation of the survey work in Greenland presents. The distance run by a survey boat during a summer has often exceeded 3500 nautical miles and even reached 5600 miles. There are wireless transmitters and receivers on each boat in order to maintain communication between the different survey parties. Besides the four larger boats, the survey has the use of ten smaller boats for sailing in sheltered waters.

A first-order triangulation has been carried out along the west coast from Lat. 60° to 75° N. Within this range seventy-six first-order stations and 482 second-order stations have been established. At the trigonometrical stations we have during the last few years very successfully made use of a particularly light electrical beacon lamp specially constructed for the work in Greenland.

In the years 1931–37 the area between Lat. 67° 30′ and 73° N. on the west coast has been mapped by plane-table equipment on a scale of 1 : 250,000. This area is shown in Fig. 1 by vertical hatching. The regions shown by horizontal hatching have been surveyed from the air in the years indicated opposite the respective areas.

The photographs are taken from Heinkel hydroplanes lent to us by the Danish navy. The photographs are taken perpendicular to the flying

Fig. 1



Surveyed from the ground. Surveyed from the air.

direction between the pontoon and the bearing plane. The base of the stereogrammes thus obtained is 2 km. in length, and the interval between the stereogrammes is 6 km. The tilt of the camera axis is not so great that the horizon fails to appear on the stereogrammes. The flying height is 4000 m. The routes are kept parallel to the coastline. Where the ice-free land is of great width, other routes are flown parallel to the coast route, at a distance of 35 km. apart. The following table gives a summary of the aerial photographs taken in Greenland during the last three years.

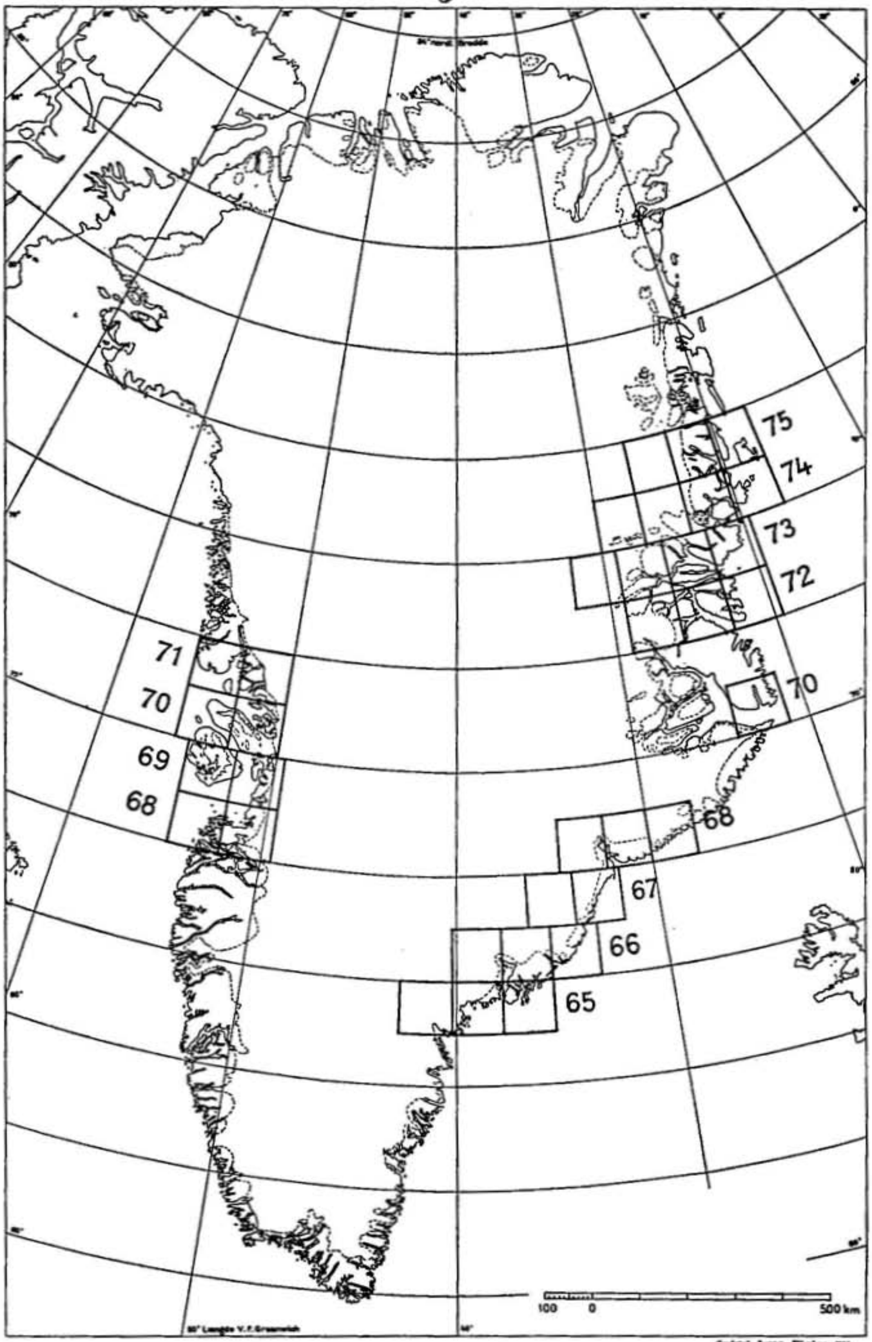
Year	Region	Area, which can be plotted, approximately sq. km.	Flying hr.	Photo km.	Number of pictures
1936	West coast between 68° and 64°	55,000	117	7000	2500
1937	West coast between 64° 30′ and 63° 30′	49,000	128	5700	2350
	East coast between 64° and 62°	—	—	—	—
	West coast south of 61° 20′	—	—	—	—
	East coast south of 60° 40′	—	—	—	—
1938	Environs of the settlement Julianehaab and of the Iceblink of Frederikshaab	5000	18	690	273

In West Greenland the determination of the necessary points of minor control for plotting is based on the triangulation of first order. As an example it may be mentioned that in the summer of 1937 an expedition, comprising one land surveyor, the leader, seven topographers, two motor-boats with mates and twenty Greenlanders determined the necessary points of minor control between Lat. 64° and 68° N., a mountainous region covering about 55,000 sq. km. The surveyors had with them air photographs taken in 1936.

During operations on the east coast, surveyors from the Geodetic Institute took part in the seventh Thule expedition under the leadership of Dr Knud Rasmussen, in the Three-Year expedition to Christian X's Land under the leadership of Dr Lauge Koch, and in the Scoresby Sound Committee's second East Greenland expedition under Captain Ejnar Mikkelsen.

No connected triangulation of the east coast was carried out, but a great number of astronomical determinations were made together with local triangulations. Points were to a large extent determined by inter-

Fig. 2



section from a short horizontal base, the length of which was found by means of an angle measurement from one end of the base to a horizontal 2 m. bar placed at the other end. An elaborate description of the method applied appeared in the *Geographical Journal*, vol. 86, pp. 317–29.

By means of its aerocartograph (Zeiss-Aerotopograph) the Geodetic Institute has now plotted 200,000 sq. km. of Greenland on the scale of 1 : 200,000, and photographs of another 140,000 sq. km. are in hand for later plotting. The plotted areas comprise the east coast between Lat. 76° and 72°, between Lat. 71° and 70° and between Lat. 69° 20′ and 63° 30′ N.

The maps are published on the scale of 1 : 250,000. Each sheet (about 12,000 sq. km.) covers from north to south one degree of latitude. The sheet is numbered by using the most southerly degree of the sheet followed by a V or an Ø (respectively West or East Greenland) and a number. Thirty-four sheets have now appeared. Their location is shown on Fig. 2.

Iceland

In Iceland the importance of possessing a good map of the country was realised at an early date. One evidence of this is Bishop Guðbrandur Thorláksson's map, which appeared in 1585. That same year the bishop made the first determination of latitude in Iceland. His descendant, Bishop Thórðar Thorláksson, also worked out maps of Iceland in the years 1668–70, but these were not published. Among other cartographers of former times the names of T. H. H. Knopf (1734) and Admiral P. de Löwenörn especially deserve to be mentioned.

In the years 1801–18 a triangulation of the coast was carried out by officers of the Danish-Norwegian army, among whom the lieutenants Frisach and Scheel were particularly active. This triangulation forms the basis of Björn Gunnlaugsson's famous map of Iceland, which was published in 1844 by the Icelandic Literary Society on a scale of 1 : 480,000.

The aim of the present survey work is to provide a precise and complete map of all Iceland on a scale of 1 : 100,000. The work was commenced in 1900, but was interrupted in 1914 by the Great War. Since 1930 the Danish Geodetic Institute has sent an expedition every year to Iceland, where the mapping is being done in co-operation with the Government of Iceland. A new triangulation has been carried out, first of the coast, and from there gradually extended so that it now covers the whole country. In the first years the angle measurements were carried out with a 14 cm. universal theodolite by Hildebrandt, in the later years by means of Wild's theodolites. Astronomical determinations of longitude, latitude and azimuth were made at Reykjavik and Akureyri, and determinations of latitude and azimuth at Hornafjörður.

Four base-line measurements have been completed in all. In the neighbourhood of Reykjavik three lines were measured, of a little over 1 km. each, and by means of a very careful triangulation these lines were joined to a computed baseline of 6·6 km. In the neighbourhood of Akureyri a baseline of 1·6 km. was measured with a mean error of ±0·8 mm. At Hornafjörður there is a 5·0 km. baseline, the mean error of which is ±4·2 mm. The last of the Icelandic baselines was measured near Gilsfjord; its mean error is ±0·7 mm. and its length 1·9 km.

The mapping was commenced in 1902 by plane-table surveys on the scale of 1 : 50,000, but after the first four years the scale was changed to 1 : 100,000, and the work was continued until 1936, when the whole coastal tract had been mapped on this scale. Since 1930 parts of the desolate and uninhabited ranges in the centre of the country have been mapped on a scale of 1 : 200,000. The following table indicates the extent of the areas mapped in the individual years.

Year	Number of surveying parties	Surveyed on scale 1 : 50,000 sq. km.	Surveyed on scale 1 : 100,000 sq. km.	Surveyed on scale 1 : 200,000 sq. km.
1902	2	109	—	—
1903	6	1316	—	—
1904	10	5294	—	—
1906	6	1640	—	—
1907	6	—	2616	—
1908	11	—	5492	—
1910	7	—	4306	—
1911	7	—	2720	—
1912	8	—	5067	—
1913	7	—	4356	—
1914	7	—	3114	—
1920	7	—	3532	—
1930	6	—	2850	310
1931	8	—	3771	2844
1932	5	—	1727	8420
1933	5	—	2509	5800
1934	5	—	2690	3216
1935	7	—	3738	2892
1936	3	—	1600	1300
1938	6	—	—	8431

The area which has been mapped by plane-table measurements on 1 : 100,000 (or larger scales) comprises 58,447 sq. km. and covers all the inhabited coastal region.

In 1930 a photogrammetric survey from the ground was carried out in the neighbourhood of Akureyri and Siglufjord over an area of 714 sq. km. In the following years the Danish Geodetic Institute made extensive aerial surveys in Greenland. As these proved successful and gave very detailed and precise maps, it was decided to complete the mapping of Iceland on a scale of 1 : 100,000 by means of an aerial survey of all the central and mostly inaccessible part of the country.

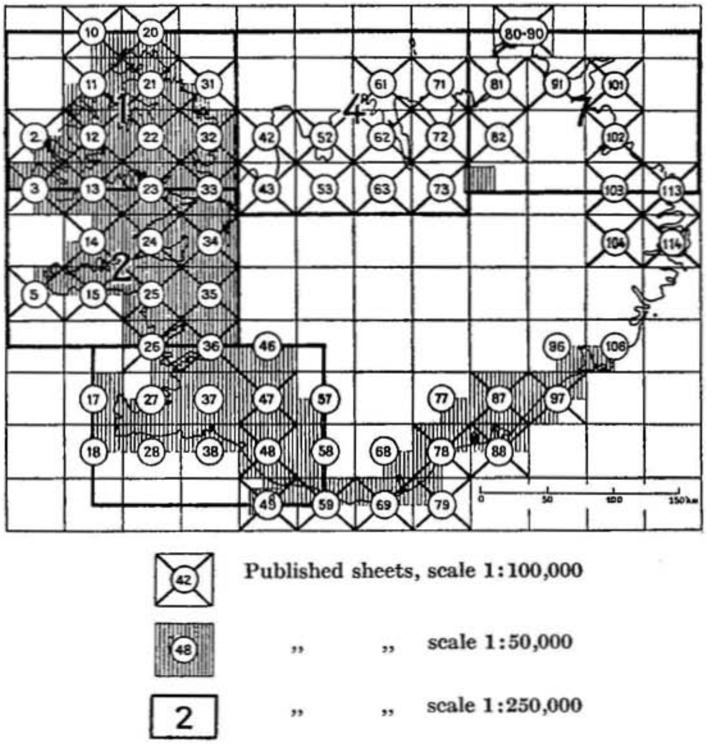


Fig. 3

This work has been carried out in 1937 and 1938. The Danish Navy placed a Heinkel II hydroplane at the disposal of the survey. H.M.S. *Hvidbjörnen* acted as mother-ship to the aeroplane. The photographs were taken at a height of 4000 m. with an Eagle III camera, the focal length being 6 in. It took 124 flying hours to secure the photographs, and they comprise 3800 photo-km. The number of pictures is 1884, and the area which can be plotted from the air is approximately 52,000 sq. km. This area is nearly identical with that part of the map (Fig. 3) which is shown as not yet published, except for the east coast, of which two sheets measured from the ground have not yet been published. The necessary points of minor control for the plotting were obtained either by direct measurement in regions which have never been measured before, or by utilising previous measurements on the scale of 1 : 200,000. From the air photographs about 4500 sq. km. have now been plotted, comprising the terrain along the northern border of Vatnajökull. Photographs of other 47,500 sq. km. are in hand for later plotting.

The above map shows the sheets hitherto published. The maps are printed in six colours, the heights being indicated by 20 m. contours and some points of altitude. The characteristics of the soil are illustrated very carefully by means of conventional signs.

The 1 : 100,000 scale maps comprise 1760 sq. km. each. The size of the sheets is 40 × 44 cm. Fifty-two sheets have been published on this scale; thirty-five other sheets will appear in the course of the next five years, as the work of plotting by stereoplanigraph is accomplished.

The 1 : 50,000 maps cover 440 sq. km., so that four of these sheets cover the same terrain as one of the 1 : 100,000 maps mentioned above. One hundred and eighteen sheets have been issued on this scale. The publication of these sheets will not be continued except for revised editions of the sheets already issued.

A general map of Iceland, on a scale of 1 : 250,000, has also been commenced. This map will cover the whole country and appear in nine sheets. Each sheet comprises 21,120 sq. km., the size being 48 × 70·7 cm. Five of these sheets, covering the western and northern part of the country, have already appeared.

ICELAND

Completed Expedition

Swedish-Icelandic Vatnajökull Investigations in 1937 *and* 1938.

[The following notes have been sent by Professor H. W. Ahlmann.]

The glaciological investigations in the eastern part of Vatnajökull made by the Swedish-Icelandic Vatnajökull expedition in the summer of 1936[1] were continued and supplemented by Sigurdur Thorarinsson in the summers of 1937[1] and 1938. One year's observations of accumulation and ablation had proved insufficient to provide a satisfactory knowledge of the glacier's regime.

The work in the summer of 1937 had four main objects: inspection and continuation of the ablation measurements of Hoffellsjökull and Heinabergsjökull; the digging of pits on both of these glaciers to determine the total accumulation in 1936–37; mapping of the Hoffellsjökull accumulation area, and determination of the rate of movement of Hoffellsjökull.

On June 20 Thorarinsson arrived at Hornafjörður where he engaged as his assistant Sigfinnur Pálsson, of Hoffell. On June 23 a meteorological station was installed at Hoffell for comparison with observations at the regular station at Hólar. The following week equipment was carried up the badly crevassed Hoffellsjökull to a height of 750 m., and on June 30 the actual glacier journey began. The weather was continuously bad, with snow and rain, but all the ice-cap work was nevertheless carried out according to plan. The remaining work was done between July 12 and 31 when Thorarinsson left Hornafjörður.

As in the previous winter, the ablation on the two glaciers was observed in the winter of 1937–38 by the two farmers Guðmundur Jónsson of Hoffell and Skarphéðinn Gíslason of Vagnstaðir.

Except for the mapping, the programme was broadly the same in the summer of 1938 as it was in 1937, and, thanks to the better weather conditions, it was carried through much more quickly than in the previous summer. Thorarinsson left Reykjavik by land on June 14 and travelled along the southern margin of Vatnajökull to Hornafjörður.

[1] See *Geografiska Annaler*, No. 39, 1937, Parts I–IV. The remaining parts will be published in succeeding volumes. See also *Geographical Review*, vol. XXVIII, No. 3, July 1938.

He stopped for a few days on Skeiðarársandur to study the effects on the glacier and the *sandur* of the last glacier burst or *jökulhlaup* (May 23 to about May 30, 1938). At Kálfafellsstaður he was met by Sigfinnur Pálsson, who was his assistant this summer also.

The total accumulation on the uppermost part of Heinabergsjökull in the winter of 1937–38 was determined on June 21 and 22. Corresponding observations on the upper parts of Hoffellsjökull were made from June 28 to July 6. The following weeks were devoted to a determination of the rate of movement of Hoffellsjökull, and to various supplementary glaciological investigations. Vatnsdalur, the ice-dammed lake on the east margin of Heinabergsjökull, recently emptied by the *jökulhlaup*, was visited at the beginning of July. Thorarinsson left Hornafjörður on July 17. The ablation measurements on the two glaciers will be continued at least up to the end of 1938 by the same farmers as before.

ARCTIC CANADA AND LABRADOR

Completed Expeditions

British Arctic Expedition, 1937–38.

[Previous notes on this expedition, which was under the leadership of D. Haig-Thomas, have appeared in *The Polar Record*, Nos. 14, 15 and 16. The following is an account of the work of the expedition during the whole of its stay in North-west Greenland and Ellesmere Island.]

The expedition, consisting of D. Haig-Thomas, leader and ornithologist; R. A. Hamilton, physicist, and J. W. Wright, surveyor, left England in the summer of 1937, and established a base at Thule, North-west Greenland. In the autumn of 1937 work was considerably hampered by the failure of the motor-boat, but Haig-Thomas made a collection of flowers from West Greenland. The expedition was able to buy an 18 ft. boat of a type designed to replace the Eskimo umiaks. With the help of an outboard motor Haig-Thomas and Wright took a ton of dog- and man-food up the coast and made a depot north of Etah. They also succeeded in getting several walrus in Smith Sound, and arrived back at Thule on September 3. In the meantime Hamilton had moved into a house lent by the Greenland Administration. He had carried out a number of observations on the ozone with a Dobson spectrograph, completed a month's tidal observations and started the meteorological log, which was continued until the end of February.

The rest of the autumn was spent in hunting walrus and seal for dog-food, and in starting a large-scale map of Wolstenholme Fjord. Three dog teams had been bought in Jakobshavn and Upernivik, but they compared unfavourably with the local dogs, and the worst team was exchanged for one belonging to a Thule Eskimo. During the winter the members of the expedition practised dog driving, and a number of journeys were made with Eskimos to the outlying settlements, a hundred miles to north and south. Wright and Hamilton carried out a series of star observations to fix the position of Thule, and Haig-Thomas collected a number of animal skulls and ethnological specimens from the Eskimos.

The sun returned in the middle of February 1938 and the expedition left Thule at the end of the month and travelled up the coast to Etah. At Etah they enjoyed the hospitality of the American Meteorological expedition, which lent them several items of equipment, including an

Alaskan sledge. Their own Nansen sledge proved almost useless on the sea-ice and ice-foot, which were the normal travelling routes.

The southern part of Smith Sound is rarely frozen over, and it is seldom possible to cross over to Ellesmere Island as far south as the latitude of Etah. In 1938 the edge of the fast-ice lay in a curve from a point about 20 miles north of Etah, running up to the 79th degree and so down to Pim Island on the west side. There was a narrow stretch of good new ice along this edge, which made the crossing comparatively easy. In the middle of Smith Sound the party divided into two.

With one Eskimo, Nukagpianguak, a veteran of Macmillan's, Lauge Koch's and Edward Shackleton's expeditions, Haig-Thomas continued on to Bache Peninsula. From here they made a fast journey westwards to Amund Ringnes Island, past the southern end of Axel Heiberg Island, and returned by approximately the same route. They used an Eskimo hard-runner sledge with detachable Nansen runners, which was entirely successful. They made several corrections to the map, discovering a new island about 20 miles long between Amund Ringnes and Axel Heiberg Islands, and a large bay in the south coast of the latter. Unfortunately no observations for position were made, so that these discoveries cannot be plotted accurately on a map. Temperatures down to $-52°$ F. were experienced. Haig-Thomas returned to Thule at the end of May.

Meanwhile Hamilton and Wright had crossed over to the police hut at Fram Harbour. After returning to Etah to fetch over a second load and to dry their clothes, they started south from Fram Harbour on April 2 with fourteen dogs, and two sledges carrying about 500 lb. each.

During the next two months they travelled slowly down the east coast of Ellesmere Island as far as the mouth of Makinson Inlet. Little difficulty was experienced as the coast was unusually free of pack-ice. Camps were made at the foot of prominent mountains, from the summits of which rounds of angles were taken with a Wild theodolite, and photographs with a calibrated camera attached to it. The camps were fixed by sun observations, G.M.T. being given by a short-wave time-signal set. They were connected to the mountain summits by a short base triangulation.

Two short journeys were made into the interior, one from Talbot Inlet and the other west of Baird Fjord. The Prince of Wales Mountains were found to stretch over the whole area covered, with highland ice between the peaks, rising to a level ice-cap plain about 40 miles inland.

It is hoped that a map will be produced on a scale of about 1 : 300,000 of some 6000 sq. miles of country. The whole coast should be accurate, but the interior will have several areas of dead ground in which only the principal peaks are fixed: several of these are over 6000 ft. in height. A satisfactory connection has been established with Bentham's work in the south (see p. 52). The weather was almost perfect throughout.

This party returned to Etah at the end of May, and Hamilton travelled down to Thule in order to carry on ozone work. Wright stayed at Etah and, with Schlossbach, a member of the American Meteorological expedition, made a fortnight's journey eastwards, penetrating 150 miles into the interior. One aneroid was taken and heights were regularly measured, the traverse being made by aerial compass and sledge wheel, checked by sun observations. This part of the Greenland ice-cap was found to be considerably higher than was previously supposed. Wright later travelled down to Thule with the American ship.

During the summer Haig-Thomas made a collection of butterflies and plants, and carried out a series of observations on a pair of Greater Snow Geese (*Chen hyperboreus nivalis*). He managed to bring them, and one young bird, back to England alive. Very little is known about the breeding of this species.

After the middle of July the weather deteriorated and scarcely any more work was possible. However, a few additions were made to the map of Wolstenholme Fjord, and the year's movement of the Moltke and Knud Rasmussen Glaciers was measured. Wright also collected a considerable amount of information about the retreat of the ice-cap in this area.

The Danish ship *Sværdfisken* arrived on August 10 and the party travelled by slow stages back to England.

Spring Patrols of the Royal Canadian Mounted Police.

As usual, a number of patrols were made in Arctic Canada by members of the R.C.M.P. during the spring of 1938. The main objects of these patrols are to keep a check on the numbers of game, to collect vital statistics of the population in the outlying settlements, and occasionally to deal with cases of crime and curable sickness among the Eskimos. The official reports of these patrols are extremely interesting, but naturally enough they are primarily concerned with details of administration, most of which must remain outside the scope of *The Polar Record*. We note, however, that one patrol to Frobisher Bay from Pangnirtung had among its objects the exploration of a river flowing into Cumberland

Sound from the height of land north-east of Frobisher Bay, in order to find a shorter route for future patrols. Not much could be done owing to bad weather, but the leader of the patrol, Lance-Corporal E. E. Muffitt, saw enough to make him consider that the river system would form a better route across to Frobisher Bay, and he urged its thorough exploration by a party which should travel up from the outlet.

The journey of R. Bentham and Lance-Corporal R. N. Yates, of which an account supplied by Bentham is given below, is also the subject of a detailed report by Lance-Corporal Yates. This has been filed in the Institute with the other reports received from the R.C.M.P.

The Eastern Arctic Patrol, 1938.

The *Nascopie* sailed from Montreal on July 9, 1938, on her seventeenth cruise through the Arctic Archipelago. Major D. L. McKeand, Superintendent of the Eastern Arctic, and leader of seven consecutive patrols, was again Officer-in-charge and Government Representative in the Canadian Arctic Archipelago. Dr Keith F. Rogers acted as medical officer and made an examination of the Eskimos at all points of call. Other scientists accompanying the expedition included D. A. Nichols of the Geological Survey, Ottawa, as physiographer, and J. J. Bildfell, who made a study of the nesting grounds of the Eider-duck. During the patrol, T. M. Shortt, ornithologist of the Royal Ontario Museum of Zoology, Toronto, collected 172 bird specimens, representing about forty-five species, and a considerable number of external and internal bird-parasites. Mr Frederick Horsman Varley, A.R.C.A., went with the patrol to paint pictures, for the National Gallery of Canada, of Eskimos, government posts and other subjects relative to the Arctic. Mrs Marion Grange was historian of the expedition.

The Officer-in-charge of the Royal Canadian Mounted Police detachment was Superintendent T. B. Caulkin. The following embarked at Montreal for two years' service in the Arctic: Lance-Corporal R. W. Hamilton for Craig Harbour, Constable H. H. MacLeod for Pangnirtung, Constable W. Taylor for Eskimo Point; Lance-Corporal L. Weston was transferred from Port Harrison to Chesterfield, N.W.T.

Ports of call included Hebron, Port Burwell, Lake Harbour, Wakeham Bay, Sugluk, Dorset, Wolstenholme, Southampton, Cape Smith, Port Harrison, Churchill, Chesterfield Inlet, Thule (Greenland), Craig Harbour, Arctic Bay, Fort Ross and Pangnirtung.

The scope and influence of the Eastern Arctic Patrol has been extended each year, despite the fact that some of the ports of call are accessible only for a period of ten days or two weeks each year. Whereas the first patrol in 1922 covered about 7000 miles, the 1938 cruise is estimated at more than 11,000 miles.

An interesting feature of the voyage was the meeting, at Fort Ross, with the schooner *Aklavik* which had come through from the western Arctic, thus virtually making the North West Passage for the second year in succession.

Robert Bentham's Investigations in Southern Ellesmere Island, 1936–38.

Previous accounts of Robert Bentham's work have appeared in *The Polar Record*, Nos. 12, 13, 14 and 15. The following is an account of the work accomplished in the 1938 season.

The first journey of the 1938 season was a short trip to Coburg Island, made in early February for the purpose of collecting geological specimens. Camp was established at the south-eastern end of the island, about 40 miles from Craig Harbour, but little work was accomplished owing to a blizzard arising soon after arrival and breaking up the ice. It was not until nearly three weeks had elapsed that the weather became sufficiently calm to allow the formation of new ice, and by that time provisions were finished and it was necessary to return home.

At the beginning of March, Bentham, accompanied by Corporal Yates and Eskimo Mulla, left Craig Harbour on an exploratory journey inland from the head of Starnes Fjord for the purposes of investigating the possibility of a short cut to either Baumann Fjord or Makinson Inlet. Travelling conditions on the land were troublesome, since at first the valley was filled with deep and soft snow, while higher up bare rock predominated. Although the valley maintained a gentle gradient and continued to head in a northerly direction, the possibility of using it as a route to Baumann Fjord or Makinson Inlet had to be abandoned, as travelling conditions were too poor to allow the passage of heavily loaded sledges.

It was proposed, to make a journey in the spring round the southern part of Ellesmere Island, but before this could be attempted it was necessary to make a cache in Makinson Inlet. This was accomplished during the latter half of March without incident, though trouble with rough and also thin ice was experienced in the vicinity of Clarence Head.

In the first week of April, Bentham, Yates and Mulla left on the main trip of the season. Five days' travel brought them to the head of the south-west arm of Makinson Inlet, where some time was spent on geology and in making a survey. During this period a wind rose so suddenly that Bentham's theodolite, which had been set up for an afternoon longitude observation, was hurled to the ground and badly damaged. The next part of the journey was the traverse overland from Makinson Inlet to Vendom Fjord. Travelling conditions on land were good, the route being up a broad valley of gentle gradient, cut by a stream having its source in numerous tributaries flowing off the evenly rounded hill country typical of this part of Ellesmere Island. The watershed was reached at approximately 1600 ft. above sea-level, at which height traces of a gravel plateau were seen.

The Tertiary coal measures out-cropping on the south side of Stenkohl Fjord were examined, as were also the steeply dipping Palaeozoic strata on the north side. Later the highly disturbed strata at the head of Vendom Fjord were investigated, but fossils were few and poorly preserved. While encamped in Vendom Fjord the new tracks of a pack of ten wolves were seen, but there was no sign of the animals themselves. Other game, with the exception of caribou, was also abundant, particularly musk-oxen and foxes, the latter on a number of occasions coming quite close to camp. Numerous bear tracks were seen at the mouth of Vendom Fjord, but no bears were secured until Eidsfjord on the west coast was reached. In Eidsfjord, Mulla secured the first seal of the journey and this, together with the bear, was a welcome addition to the rapidly diminishing supplies, and enabled them to spend a short time working in this area. After this the party returned to Craig Harbour via Nordstrand, Goose Fjord and Jones Sound.

Throughout the journey the weather had been excellent, but immediately after the return it rapidly deteriorated and there was over a week of almost continuous blizzard and snow. This caused a projected trip on to the ice-cap to be abandoned, since there were still two journeys to be made before the end of May when cracks in the ice became troublesome. These journeys were to Stewart and Coburg Island to complete the survey, and to Cape Sparbo and Bjorne Head on North Devon Island to examine the sedimentary rocks outcropping in this area. Both these trips were successfully completed, and in early June the work in Starnes Fjord, begun the previous year, was continued. This completed the geological programme and the rest of the sledging season, until July 5, was spent in excavating ancient igloos at Fairman Point, in Fram Fjord and on Smith Island.

The Hudson's Bay Company steamer *Nascopie* arrived on August 25 and proceeded to Halifax, calling at Arctic Bay, Fort Ross, Pond Inlet, Pangnirtung and Hebron on the way.

Captain Bartlett's Arctic Cruise, 1938.

Captain Robert A. Bartlett made his fourteenth voyage to the Arctic from June to September 1938, in his schooner *Effie M. Morrissey*. Nine college students were taken in addition to the regular crew. Ice conditions were good, and the expedition reached a point 25 miles south of Cape Sabine in Ellesmere Island. Collections were made in Murchison Sound, North-west Greenland, and Smith Sound for the Smithsonian Institution, the Cleveland Museum and the Zoological Gardens, Washington.

Commander Donald B. MacMillan's Arctic Cruise, 1938.

Commander Donald B. MacMillan made his seventeenth voyage to the Arctic during the summer of 1938. As usual the expedition was made up of young college students and scientists. A large area of pack-ice was encountered en route from Baffin Island to the Labrador coast, and the ship was caught in the ice for eight days. The most northerly point reached was Etah, in North Greenland.

Expeditions in the Field

British Canadian Arctic Expedition, 1936–40.

[See also *The Polar Record*, Nos. 12–15 inclusive.]

Very little has been heard from T. H. Manning since the publication of the last number of *The Polar Record*. He crossed during the summer of 1938 to Cape Dorset, Baffin Island, and there he was married by the Bishop of the Arctic to Miss E. Wallace Jackson of Halifax, Nova Scotia, who arrived on board the *Nascopie*. He apparently intends to carry out his original plans, accompanied by his wife and an Eskimo family. They propose to travel up the west coast of Baffin Island making a survey of the coast.

British Expedition to Northern Baffin Island, 1938–39.

P. D. Baird, geologist and surveyor, and R. J. O. Bray, ornithologist and surveyor, left England in the summer of 1938 to continue their work in Baffin Island. Their plans were given in *The Polar Record*, No. 16.

They left Churchill, Manitoba, with their stores on August 12, 1938, on board the Roman Catholic Mission schooner *Thérèse*, bound for Igloolik. The ship got within one day of Igloolik when she ran into very heavy ice, and was forced to retreat south. On August 28 they were lying off Winter Island. On the advice of Father Schulté, who had examined Foxe Basin from the air, the captain of the *Thérèse* decided to abandon the attempt to reach Igloolik, in spite of the intention of the Hudson's Bay Company to establish a post there.

Baird and Bray were therefore landed with their stores and 30 ft. whaleboat, at Winter Island, some 300 miles from Igloolik. They hoped that during September they would be able to get up to Igloolik in the whaleboat, collect an Eskimo family, and go over to Piling on the west coast of Baffin Island according to plan. But on September 14 Bray lost his life when he was blown out to sea in their small Planet Foldflat boat at a point 40 miles south of Igloolik. Baird attempted to rescue him in the whaleboat, but the attempt was useless.

Baird then went north to Igloolik with some Eskimos, and later sledged south to Repulse Bay. He proposed to cross to Baffin Island and carry on the work of the expedition, and to return in the Hudson's Bay Company's steamer *Nascopie* in September 1939, joining the ship either at Pond's Inlet or at Clyde River.

G. W. Rowley's Archaeological Work in Baffin Island, 1938–39.

G. W. Rowley, archaeologist of the British Canadian Arctic expedition, 1936–37, returned to the Canadian Arctic in August 1938. His plans were to sail at the end of August to Repulse Bay in the Hudson's Bay Company schooner *Fort Severn*; to spend the autumn in this neighbourhood doing archaeology, and as soon as practicable to sledge to Igloolik. In the summer of 1939 he hopes to excavate an important Eskimo site near Igloolik before returning to England in the autumn. Some ethnology is included in the programme.

Swiss Ethnological Expedition, 1938–39.

Jean Gabus plans to be at work in Labrador, Baffin Island and Greenland, during the year 1938–39. He is at present working alone, but will be joined by another Swiss worker in the spring of 1939. Gabus arrived in Churchill, Hudson's Bay, at the beginning of June 1938. He is collecting ethnological specimens for several museums in Switzerland.

ARCHAEOLOGICAL REGULATIONS IN CANADA

The Canadian Government has, in 1938, promulgated a decree to the effect that no archaeological excavation can be undertaken in Canada without Government permission. Further, the National Museum at Ottawa has the right to take over any material excavated should such be desirable in the interests of the national collections. Permission to remove collections to other countries for purposes of study will only be given after the Museum authorities have satisfied themselves as to what should remain in, or be returned to, Canada.

This decree is only a natural outcome of the desire to prevent national archaeological treasures leaving the country, and follows the example of the Danish laws relating to excavations in Greenland, and the better known arrangements in Egypt, Iraq and India.

Application for permission should be made to the High Commissioner for Canada, Canada House, London.

REINDEER IN CANADA

The experiment of the Canadian Government in 1935 of bringing reindeer from Alaska to a grazing ground near the mouth of the Mackenzie River is proving a success. The original number of reindeer delivered, according to a recent article in the *Times*, was 2370. The latest round-up showed a total of 4181 deer, comprising 631 adult and yearling bulls, 1963 adult and yearling females, 1206 fawns and 381 steers. This total figure means that, in spite of an annual slaughter of surplus stock to provide food and clothing for local needs, and losses due to natural causes, the herd has almost doubled in three years. The herding is done by a group of Laplanders, with the assistance of Eskimo apprentices who have been selected for training as part of the Government's plan for developing a reindeer industry.

According to information received from the Department of Mines and Resources, Ottawa, a smaller herd of about 800 reindeer is now moving eastward to the Anderson River area. This 150 mile overland drive away from the Government herd near the Mackenzie delta is being carried out under the direction of the chief herder at the Government reindeer station, and marks another forward step in Canada's plan to establish reindeer ranching among the native population. Upon arrival at their new range, the management of the native herd will be entrusted mainly to two Eskimos, Charlie Rufus and Rufus Kalealuk, who, under departmental supervision, will be given an opportunity to demonstrate their ability to herd reindeer. The younger of these natives, Charlie Rufus, has had about three years' training as an apprentice with the main Government herd. This small herd consists of good average stock, the animals varying from young fawns of 1938 to animals several years old. This herd is being loaned to the natives until such time as it has increased substantially in size, when it will then be decided whether a herd of 800 will be taken away to start a fresh enterprise in another suitable locality. Experience has shown that it is not feasible to manage a herd of less than 800 animals.

In addition to lending the reindeer, the Government is providing herd dogs and other equipment, as well as a quantity of rations, to assist in maintaining the herders during the first year.

RADIUM PRODUCTION AT GREAT BEAR LAKE, NORTH-WEST TERRITORIES

According to a report received from the Department of Mines and Resources, Ottawa, there has been an appreciable increase in radium production during the last year, by Eldorado Gold Mines Ltd. at Great Bear Lake. The all-round expansion programme announced at the beginning of the year has been virtually completed, and consequent on increased output at the mine the company is enlarging the capacity of its refinery at Port Hope, Ontario. Including the radium laboratory proper, five new buildings have been erected, and the new facilities at the refinery will make possible a capacity triple that of the previous plant, and also make provision for new products not yet included in Eldorado's growing radium-uranium-silver-lead-copper production list. The uranium products are widely used in ceramic and other industries and a record demand is being experienced for them.

Development work at the mine included an 8000 ft. underground advance, and construction of several buildings. The mine has been electrified by the installation of new Diesel and boiler equipment, the oil for fuel being obtained from the wells at Norman. Installation of this, along with such equipment as jig, filter and additional flotation cells, was all completed in December 1937. The new construction at Eldorado itself includes two 70,000 gallon tanks for fuel oil, a chemical laboratory, a new assay office, and a new two-story kitchen and dining hall. For the No. 2 or gulch shaft, the construction work included an electric transmission line from the central workings as well as a road. The two-compartment shaft has been completed to 125 ft., shaft-house erected and electrically equipped. At Bonanza, on Dowdall Point, road construction has also been completed as well as the power house, blacksmith's shop, headframe and other necessary buildings.

The discovery of pitchblende and silver ores by Gilbert Labine at a point to the north-west of Echo Bay, Great Bear Lake, in May 1930, was one of the most outstanding events in the history of mineral exploration. Considering the remoteness of the region, about 40 miles south of the Arctic circle, the establishment of a modern mining plant capable of handling 100 tons of ore a day and permanently employing more than 100 men is a remarkable achievement.

CANADA'S FUR TRADE TO-DAY

BY MICHAEL LUBBOCK
of the Hudson's Bay Company

The public's knowledge of the fur trade in Canada is necessarily slight. The fur trade is conducted in remote districts; there is nothing sensational about it, and it is not much given to talking about itself. Consequently there are many misconceptions about its present state. Some probably imagine that it is still a matter of trapping at will in any district and always finding an abundance of fur. Others believe that the advance of civilisation and excessive trapping have almost entirely destroyed the animal population, and that furs are becoming dangerously scarce. The truth, as so often happens, lies midway between the two extremes, and this article will attempt briefly to explain the salient points of the situation to-day.

Unless one has travelled very extensively in Canada (and there are few who have, northwards as well as east and west), it is almost impossible to visualise the immensity of the country and to realise that, in spite of the rapid advance and development of mining and other activities, there are still vast territories almost untouched by man. The North-West Territories may be said to hold their animal population fairly intact, except in small areas where mining or excessive trapping have driven the fur-bearers into more inaccessible regions. The northern parts of Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia still produce considerable quantities of fur, but all feel, in greater or less degree, the northward march of civilisation and industrial development, particularly mining.

The least affected of all the fur-bearers is the white fox. This, of course, is because it is only found in the Arctic regions. Not only are even the most southerly parts difficult to reach and supply, but there are still enormous areas untrapped and almost unknown. As late as 1937 the Hudson's Bay Company established a new trading post on Bellot Strait, opposite Boothia Peninsula, at which will be traded white foxes trapped in new districts which have so far been hardly touched. There is consequently more than enough land for sanctuary and for breeding, so that the supply of white fox in the more accessible areas may be constantly renewed. At the same time, it must be remembered that with the white fox, as with other fur-bearers, there is a more or less regular cycle of abundance and scarcity. Much research has been done by scientists into this phenomenon, the causes of which are not yet fully understood. Its importance may be judged by the fact that the collection of white fox in the low year of the cycle may be as little as 5 per cent of the collection in the peak year.

In the case of red and cross fox, mink, marten, fisher, otter and wolf, it is difficult to estimate to what extent the supply has been affected by the advance of civilisation. Undoubtedly, some of these animals have been overtrapped and driven away in areas near the railway lines and around mining and lumber settlements. On the other hand, new territories are being exploited, and trappers are going further inland, some with air transport, to an ever increasing extent. While the supply of such as fisher, marten, lynx and otter appears substantially reduced from former days, other fur-bearers like cross and red foxes, and prairie wolves, are apparently maintaining their numbers fairly well. The whole question, however, is greatly complicated by cycles of abundance and scarcity, by variations in the number of trappers from year to year, by alterations in the game laws and trapping regulations, price fluctuations and other factors.

The two important fur-animals most affected by modern developments and overtrapping are the musk-rat and the beaver. The former has been heavily trapped in easily accessible regions. Further, industrial development and natural causes, chiefly drought, have reduced the water supply in many places and drained many of the former musk-rat breeding grounds. The beaver has been even more seriously affected. Here it is almost entirely a matter of wasteful, excessive trapping, as the beaver is easily taken. It should be said at once that the Indian is, by nature, and if unmolested by white trappers, a wise trapper; that is to say, he realises that he has a permanent interest in the maintenance of the fur supply and that it is to his advantage to avoid overtrapping and to leave enough breeding stock to maintain the population. The same applies to the better type of white trapper who is permanently resident in the country. It is the itinerant trapper who is mostly responsible for the disappearance of the beaver. He comes to a district for one or two seasons only, has no real or permanent interest in it, and is only concerned to make as big a catch in as short a time as possible. Consequently, he traps excessively, often cruelly, and with no regard to the maintenance of the stock. In competition with this trapper the Indian realises he must get what he can while he can and throws his natural caution to the winds. The result is depletion.

One of the most important developments of to-day is the measures being taken for the restoration of the musk-rat and the beaver. For some time there have been restrictions on the trapping of these animals in most provinces, but these of themselves would hardly bring back the former numbers except over a very long period. More positive steps have been taken during the past few years by the Hudson's Bay Company, and others, to encourage the breeding of these two animals in the following way.

In Manitoba and Saskatchewan, the Provincial Governments have granted several leases of marsh areas for the breeding of musk-rats. The lessees undertake to protect the musk-rats, to increase and maintain the water levels by means of dams, dykes, etc., and also to promote the growth of aquatic and marsh plants especially valuable in the musk-rats' diet. In Manitoba the Provincial Government is undertaking considerable development work on public marsh lands near the Pas, restoring drained swamp areas and protecting what musk-rats are left. Already there are indications that musk-rats are increasing rapidly in the areas affected. In a small experimental marsh operated by the Hudson's Bay Company, a heavy growth of the proper vegetation has been promoted and musk-rats are now plentiful where they were nearly exterminated a few years ago. Of course, when populations are restored, the annual take must be closely controlled.

Somewhat similar measures have been taken with regard to beaver. Formerly, the country to the east of James Bay (the south-eastern corner of Hudson Bay) was rich in beaver, which provided the many local Indians with the bulk of their living. Eventually, the beaver were depleted almost to the point of extinction. In 1932 the Hudson's Bay Company obtained from the Quebec Government a lease of 7000 square miles, extending eastwards from Rupert's House and Eastmain, to be set aside as a beaver preserve. The Company undertook to allow no beaver trapping for ten years, and to maintain a staff of twenty Indian beaver guardians for the purpose of protecting the remnant of the former mighty beaver population. To date the experiment has been eminently successful. The beaver census indicated fifty-eight animals in 1932 (less than one to each 100 square miles), but under protection the number has increased to nearly 2000 in 1937 and by 1942 it is estimated the population should approach 50,000, and afford an annual catch sufficient to maintain the local Indian population for all time. The local Indians, poverty-stricken and formerly apathetic and hopeless, have realised the value to themselves of the measures taken and have co-operated loyally and enthusiastically. Thus, in the near future, the former beaver population will be restored, the Indians provided once more with their natural livelihood and a great natural resource maintained.

So successful has been this experiment that preserves have also been more recently established on Charlton Island and Agamiski Island, both in James Bay, and both excellent beaver country, while it is hoped shortly to commence similar projects in depleted beaver areas in Ontario and other provinces.

So much for the wild-fur situation and the steps being taken to maintain and restore the animal population. The other, and increasingly important, section of the Canadian fur trade is that of fur farming.

Silver foxes were first raised domestically in Prince Edward Island about 1894. The island province has been the "home" of the industry ever since, which soon spread out across Canada. In 1912 and 1913 the Dominion Commission of Conservation conducted an exhaustive enquiry into the possibilities of fur farming, and the report of this body gave a great impetus to the industry.

In the pioneer days, as high as $2600 was realised for a single pelt. From 1912 there was a large demand for breeding stock. Fabulous prices were asked and paid for proved breeders, as much as $35,000 being given for a single pair. The number of farms grew rapidly, until to-day there are well over 7000 in the Dominion. From Canada the industry spread to the U.S.A., Norway, Sweden, England and several other countries, the parent stock in nearly all cases coming from Prince Edward Island.

World production in 1937 is estimated at a high record—800,000 silver fox pelts, of which Canada contributes some 200,000. Naturally, prices have dropped far below those of the early days and to-day the average price of raw silver fox pelts is a little under £5, with plenty of breeders available at about £50 per pair in Canada.

The essential conditions for silver-fox farming are a well-drained soil, good water, and proximity to cheap and abundant food supplies. It might also be thought that a dry and very cold climate was necessary, yet Prince Edward Island with its damp sea air still produces as fine pelts as any other district, while good skins even come from parts of England and Scotland, particularly Dartmoor. There are many variations in the methods adopted for housing and feeding the animals. Generally, the vixens live in wooden kennels leading into a run enclosed by wire. Here

Canadian fur-producing areas. Black dots represent Hudson's Bay Company Posts.

they mate and produce their litters. When the pups are weaned, they are separated from their mothers and placed, sometimes in open runs, that is to say, in an enclosure of perhaps 5–10 acres of trees and brush, and sometimes in small sheds. The point of the latter is that the pups should remain entirely in the shade and so develop a clearer and more brilliant top-coat of silver hairs.

Twenty-five years is little time in the life of a livestock industry and though, during this period, extensive and valuable research has been undertaken, silver-fox farming has still many unsolved problems. At the present time, the question of colour is exercising many minds—a rusty tinge being a very common fault in pelts to-day—and, perhaps due to too rapid expansion, the average quality of the present production leaves much to be desired.

Mink farming, too, is spreading fast. There is perhaps still more doubt and controversy over the ideal housing and feeding of mink, as compared with that of foxes. This section has been developed in Canada by some extremely capable men who have bred from excellent stock and shown great patience in developing the regular, dark pelt, so popular with buyers. As in the case of silver fox, Canadian breeders have supplied breeding stock to the U.S.A., Norway and other countries who are quickly developing rival industries. The rapid increase can be realised from the fact that in the winter season of 1926–27 the production of farmed mink in Canada was 4500 pelts, while in 1936–37 it was estimated at over 40,000 with considerably more from the United States. Such progress is certain to continue, since mink remains a particularly popular coat fur; the retail fur trade can consume far more of the even, dark mink pelts than can be obtained from the wild; and it would appear that mink farming can be successfully conducted under more varying conditions of country and climate than fox farming.

Following the commercial breeding of silver fox and mink, it was certain that fur farmers would turn their attention to other skins, particularly such costly ones as fisher and marten. For some years experiments have been conducted in the breeding of these animals, but so far with limited success. The breeding habits of the fisher are fairly well known, but those of the marten remain something of a mystery. In both cases it has so far proved impossible (with a few notable exceptions) to persuade the animals to mate in captivity. Wild females in pup have been captured and have produced litters on the farm, but in only two or three cases have fishers actually mated and bred in captivity, while with marten there have been only scattered successes. Whether it is a matter of the excessively nervous temperaments of these two animals, or of unsuitable diet, is at the moment unknown, but one may feel confident that in due course the scientists will solve the problem and fisher and marten breeding take its place with that of mink and silver fox.

To end this article it may be of some interest to sketch the human side of the Canadian fur trade. The largest unit in the trade is, of course, the Hudson's Bay Company, which to-day operates some 230 trading posts, in every province from east to west and far into the Arctic. Not only are there the posts themselves, but also merchandise depots, river and ocean transport, accounting departments and various administrative offices. The second largest concern is the Northern Traders Ltd., who operate a number of posts on and near the Mackenzie River. Besides these two companies, there are a considerable number of independent traders to be found at nearly every settlement and post, who keep small general stores and trade furs for merchandise; and, finally, many itinerant traders who make periodical expeditions from large centres into the interior.

Possibly the greater proportion of the annual collection of fur is still trapped by natives, Indian and Eskimo. White trappers, however, are to be found in most districts, the number of trapping licences issued in 1935–36 in the respective provinces being as follows:

Quebec	1607
Ontario	5800
Manitoba	3766
Saskatchewan	6022
Alberta	3259
British Columbia	2758
North-West Territories	469

Increasing restrictions are being placed on white trappers by the provincial authorities. It is generally recognised that the fur resources can support only a limited number of trappers. The Indian and Eskimos who know no other means of making a livelihood become charges on the public funds when they cannot live by the chase. Consequently, hunting and trapping privileges in unsettled areas are being gradually restricted to them in the northern parts of Quebec, Ontario, Saskatchewan and North-West Territories. These restrictions on the activities of white trappers are in addition to ordinary provincial game laws which restrict to certain periods, or prohibit entirely, the trapping of certain fur-bearers.

Here, then, is a brief and necessarily incomplete picture of the Canadian fur trade to-day. It has seen many changes since its start in the seventeenth century; but let no one think that it is a spent force or in danger of disappearing. The pioneering and adventurous spirit is far from dead, and it will have to be some more than ordinary difficulty or disaster that cannot be surmounted. Indeed it can confidently be asserted that, so long as furs are in demand, Canada will freely supply them.

ALASKA

Completed Expeditions

The Harvard University-National Geographic Society Alaskan Expedition, **1938.**

An expedition, sponsored jointly by Harvard University and the National Geographic Society, and led by Bradford Washburn, was working in Alaska during the summer of 1938.

The three-fold plan, given in *The Polar Record*, No. 16, was successfully carried out.

1. *The exploration of Mount St Agnes in the Chugach Mountains, north of Prince William Sound, Alaska.* A small expedition of four men—Bradford Washburn, Norman Bright of San Francisco, Peter Gabriel of Sils Maria, Switzerland, and Norman Dyhrenfurth of Zurich, Switzerland—was sent out from the Institute of Geographical Exploration, Harvard University, late in April 1938, to attempt the first ascent of Mount St Agnes (13,250 ft.), the highest peak in the Chugach Range. The Chugach Mountains form a broad arc around the head of Prince William Sound, and although their seaward slopes have been roughly mapped, the north side of the range had never been examined before this summer.

The range was particularly difficult to approach on foot. The southern face of the mountains overlooking the sea was virtually impossible from a climbing standpoint, and after a reconnaissance flight along the whole north side of the range it was decided to place a base camp at the head of the Great Matanuska Glacier. From this base it was decided to attempt the ascent of Mount St Agnes from the north side, and the party hoped to be able to obtain a ground control to assist in mapping the area after a detailed aerial survey had been made later in the summer.

Terrific storms during the entire month of May made it impossible for them to fly the base camp to the glacier from Valdez before the snow was all gone from the winter airport there. Accordingly they moved both camp and personnel to the glacier base during the last two days of May and on June 1 and 3, taking off from the Valdez mud flats with the ski-equipped plane. The skis were specially surfaced with stainless steel and were the same ones used by Washburn on Mount

Lucania in 1937. After the glacier was reached a long succession of storms rendered the ascent of the mountain particularly difficult. With reasonably good weather the climb and survey would not have been difficult. During the entire twenty-eight days that the party was on the glacier there was only one clear day. The summit was reached in a blizzard on June 19. Only a small quantity of food was left and it was impossible to obtain the survey from the summit that had been planned.

The party flew back to Valdez on June 23 after summoning the plane by radio. While at the base camp they were in constant communication with Valdez by two-way radio telephone which worked perfectly. It was a Harvey UHX-10 transmitter and a National DCSW-3 receiver. This was a 10 watt outfit operating on a frequency of 5625·2 kc. They had perfect communication at least twice a day with Valdez anchorage, Chitina and Fairbanks, and twice talked to a station in Nome well over 500 miles away. The weight of the set was prohibitive from a standpoint of moving it up on to the mountain, the receiver and transmitter together weighing about 40 lb., and the storage battery and generator for charging, plus B batteries, amounting to nearly three times that weight.

2. *The ascent of Mount Sanford.* This part of the expedition was organised to climb Mount Sanford (16,200 ft.) the highest unclimbed peak in North America, and the highest mountain in the Wrangell Range. Mount Sanford is a great extinct volcano rising about 30 miles south of the great bend in the Copper River. It is the northern remnant of the Wrangell Range. The purpose of the expedition was to make a brief visit to this part of the Wrangell Mountains and to attempt the ascent of Mount Sanford in the hope that it might be possible to secure data on this, as well as on Mount St Agnes, which would be of value to map construction after the projected aerial photographic work had been completed.

The party consisted of Bradford Washburn, Terris Moore and Mrs Moore, accompanied by Jack Kennedy, a horse packer from Nabesna, and Adam Sanford a local Indian, who was to act as Kennedy's assistant. They had at their disposal Kennedy's ten pack horses, as well as a small dog sledge and five dogs borrowed in Chistochina. Following the motor road from Valdez through Copper Center and Gulkana, they reached the roadhouse at Slana on the morning of July 4. The approach to Mount Sanford first necessitated crossing the Copper River, which they did early in the morning, managing to cross the ford without having to swim the horses. From the other side of the river a long gentle slope rose to the base of the main mountain mass, climbing to an elevation of about 3000 ft. over a distance of about 25 miles. On account of very boggy country and innumerable swamps, five days were spent in covering this first part of the route. At an altitude of about 3000 ft. the party entered a creek, known to the local Indians as Sheep Creek. This was followed to the end of the main glacier falling from this side of Mount Sanford, and camp was established at the bottom of the mountain, about 2 miles up the lateral moraine, at an altitude of 6000 ft. Here the horses left and the dogs took over. Up to that time they had been driven through the swamps, dragging the empty sledge, as the undergrowth was too thick to pack it on the horses.

Working almost entirely with the dog teams, Washburn and Moore relayed a camp to 8000 ft., and then a final advance camp was established at 10,000 ft. This was reached on the afternoon of July 18. A vigorous effort was made to reach the top during a short clear spell on the following day, but unfortunately they were turned back by a very heavy storm after having reached an altitude of about 15,000 ft. The storm continued throughout the next day, and finally, on July 21, Washburn and Moore succeeded in reaching the summit at 9 o'clock at night. The climb above 10,000 ft. was accomplished entirely on skis, without which they would have been helpless on account of deep fresh powder snow. As in the case of Mount St Agnes, the ascent of Mount Sanford was made without a single clear day during the entire time the party was in the field, and survey operations were reduced to an absolute minimum, which consisted of local observations taken along the route of travel.

Both this climb and that of Mount St Agnes were accomplished entirely as the result of careful plans made after a detailed study of aerial photographs of the approaches to these peaks, taken in the summer of 1937.

3. *Aerial photography*. During August and September, from bases at Valdez, Cordova and Fairbanks, Washburn made an extended series of photographic flights, financed by the National Geographic Society. During these flights oblique photographs were taken which completely covered the great unmapped areas in the St Elias, Wrangell and Chugach Ranges.

The flights were made with pilots Bob Reeve of Valdez, M. D. Kirkpatrick of Cordova and Merle K. Smith of McCarthy. In all 58 hours and 40 minutes' flying time was spent in covering over 10,000 square miles of unmapped territory with a detailed system of photographs. A large number of vertical photographs were taken as well as obliques. These were taken in stereoscopic pairs, and should prove of great interest in a study of the various glacial phenomena over which the pictures were made. During these flights a vast new ice field was discovered, varying in width from 4 or 5 to nearly 15 miles, and extending westwards from the Columbus Glacier (between Mounts Logan and St Elias) to Mount Hawkins, slightly east of the Copper River. This discovery proves that the entire glacial system of the St Elias range has a single immense gathering ground, from which flow the many glaciers, only the snouts of most of which are at present mapped.

All of the photographs taken on these flights were developed at the field laboratories in Valdez and Cordova. In this way it was possible to check on pictures within a very few hours of the actual time of exposure, and thus succeed in bringing back a complete record which would otherwise have been virtually impossible to obtain. Several slight faults of camera operation were rapidly discovered by this field developing, repaired on the spot, and the pictures taken over again.

Complete reports on the work of these flights are being prepared for the Royal Geographical Society and the National Geographic Society.

Dr Alěs Hrdlička's Work on the Early Races of the Far North of America.

Dr Alěs Hrdlička, of the Smithsonian Institution, Washington, having completed his tenth summer season of archaeological and ethnological investigation in high latitudes, has brought his exploration of the far north of the American continent to a close. He is now engaged in the examination of the skeletal remains of the Aleutian and pre-Aleutian peoples, and of the specimens of the material culture of the latter, collected in the last three years. The following notes are taken from *Nature*, November 26, 1938, where there is a summary of his annual Smithsonian lecture delivered on November 8.

Dr Hrdlička pointed out that when he entered upon this investigation ten years ago, it was supposed that only two peoples lived in this part of the globe, the Eskimo with the Aleut, and the Indians. Now six races are recognised. There are two distinct types of Indians and two types of Eskimo, while it is established that the Aleut are distinct from the Eskimo. The most interesting discovery made by Dr Hrdlička is, however, the sixth race, the pre-Aleut people, whom he regards as close to the Shoshonean and the Californian Indian. Some of them, though not all, practised mummification, and it may be that the Aleut followed them in this practice, as in a few places mummies of the two races have been found together. The remains of the pre-Aleuts show close affinities with the peoples who were discovered in the lowest levels of the old village site on Kodiak Island; but whereas those peoples appear to have been exterminated in a great slaughter, the pre-Aleuts appear to have escaped this fate, although as a distinct people they have disappeared. The evidence which has been gathered points to the pre-Aleuts having reached these islands from Alaska, whither their ancestors had migrated at a very much earlier date from Asia. Dr Hrdlička dates their coming to the Aleutians at approximately two thousand years ago.

British Ornithological Expedition to Alaska, 1938.

W. W. Brigden and M. J. Dunbar spent the summer of 1938 in South-eastern Alaska, studying the birds of Glacier Bay. The impossibility of obtaining a motor-boat at the height of the fishing season restricted the field of work, but they were equipped with a small skiff and had a camp on Drake Island, in the middle of the bay.

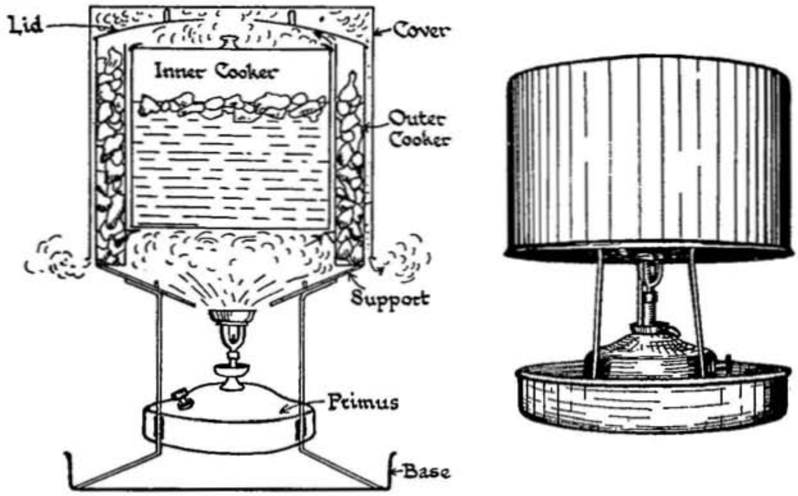
THE USE OF FUEL IN POLAR SLEDGE TRAVEL

BY COLIN BERTRAM

"Either spirits of wine, or some fatty substance, such as stearine of coco-nut oil, tallow or blubber" is the fuel described by McClintock as used on his sledge journeys of the last century. Since those days both the type of fuel and its precise method of use have gradually changed with increasing knowledge and experience. In the present instance it is intended to discuss the use of fuel only in so far as it concerns the unsupported sledge party which must attempt to remain as long in the field as is possible on the supplies that it can carry from the beginning. In such circumstances it has always been obvious that the aim must be to reduce the ration of food and fuel to the absolute minimum of weight. The most efficient fuel is clearly that which provides on combustion the greatest amount of heat per unit weight, though some compromise must be made between the greatest "efficiency" in this sense and questions of safety and convenience. For many years this compromise has resulted in the general use of pressure stoves (such as the Primus) burning liquid paraffin. There is still, however, controversy as to the precise method of use by the sledge party of the small amount of fuel that is carried.

The primary need for fuel on a sledge journey is to melt ice for drinking and to prepare the pemmican and porridge. This expenditure of fuel being unavoidable and the supply being strictly limited, it was a logical step that some device should be invented whereby the maximum of heat provided by the stove should be reserved for this primary need. It was Dr Nansen at the beginning of the century who invented a type of cooking utensil, in which, it is claimed, but 4 per cent of the theoretical calorific content of the fuel is wasted. The Nansen cooker is essentially a large but light double saucepan which is placed over and around the Primus flame. The construction is such that the warm gases which have already given up most of their heat to the inner container, are prevented from escaping until their residual heat has been used to melt the snow in the outer vessel. Little heat being wasted, little fuel need be carried, and so it came about that the Nansen cooker was always used by the earlier British expeditions. Members of the Scott, Shackleton and Mawson expeditions pulled the sledges themselves and the whittling down of sledge loads became a fine art. The fuel taken, about 1 gallon for four men for ten days, was used solely to provide drink, and to warm the food, only 4 per cent of the heat was wasted, and the sledge load was at its minimum.

At first sight the system was perfect, yet post-war travellers have for the most part acted upon another plan. The younger school of travellers has ceased to use the Nansen cooker, and uses fuel to dry clothes, as well as to warm the food and drink. In consequence, on an average, they carry rather more than twice the weight of fuel per man-week used by



Nansen Cooker.

members of the old school. The modern transport system is by dogs rather than man-hauling, and the total sledge loads are for the most part considerably greater than in the past. The desirability of drying clothes in polar travel is obvious. A man doing physical work, even in a very cold atmosphere, always sweats to some extent, and this moisture from his body condenses as hoar frost within the outer garments, windproofs, mitts and socks. A similar production of hoar frost takes place in the sleeping bag. This ice, unless dried off, accumulates from day to day and the colder the weather the greater the accumulation.

There are descriptions in plenty of how sledgers of the old school in the colder months of the year were like knights in armour, their windproofs heavy with ice and crackling as they moved their limbs, while their sleeping bags were so crusted that they could no longer be rolled up. Doubtless some of the accumulated ice evaporated off on days that were clear, and the wise traveller takes every opportunity to make use of the sun. However, the sledge loads, at least in the colder months of the year, were considerably increased in weight (50 lb. or even more, so it is stated) by this gradual accumulation of ice. By carrying the extra load of fuel at the start of the journey, the modern school of sledgers avoids this increment of ice, and is able to live in considerable bodily comfort, knowing few of the pains that beset members of the earlier expeditions.

So arises the question, which system is the more efficient? The question is not yet truly answered, for the two systems have never been tried out alongside one another by experienced men, having the same objective and under the same conditions. Until this is done each may back his fancy; at present we can but point out certain of the relevant facts. From the theoretical point of view (and many would claim by practice also) dog transport is basically more efficient than man-hauling. Dogs need no tents, fuel or other paraphernalia, nothing beyond their food and harness. Potential ration-calories per unit weight of the sledge load as a whole must be the basic measure of theoretical efficiency, and by this standard, calculation quickly shows dog transport to be somewhat in advance of haulage by men (even when the modern greater load of fuel is included). That is to say a small party depending on dogs for transport should be able to stay longer in the field (and practice suggests that they will be able to travel further in the time) than a party of man haulers. At the same time the modern dog sledger with his greater initial load of fuel lives in far greater bodily comfort. He can make and break camp more quickly and so gain hours of travel; he can expect each night to get properly restful sleep; and he is less frequently frost bitten because his drier clothes more completely retain their insulating properties. Less of his body's heat being wasted on useless melting of ice in the clothes and sleeping bag, the modern dog sledger should be able to subsist on a smaller ration than his predecessor, yet maintain his strength and his mental vigour at a higher level to the end. To a large extent the increased weight of fuel is cancelled by the decreased weight of essential food per day.

But in practice even this greater bodily comfort and fitness, dependent on the increased consumption of fuel, has a disadvantage in that it tends to foster a new and inferior attitude to the work in hand. A man in relative comfort tends quite unconsciously to take things easily. A man in discomfort is often spurred to greater efforts, by the feeling that his discomfort cannot be much worse, and that it is worth making great exertions to feel that at least the suffering has been valuable. At the same time, the faculties of receptiveness and judgment are impaired by physical discomfort, and these faculties are those that really matter if a sledge journey is to be of lasting worth. Miles sledged are rarely in themselves of value; the worth of a journey depends upon the scientific appreciation of phenomena, whether by the surveyor or by a specialist in another branch of knowledge.

One further point about modern methods may be urged. In the past the traveller returned completely exhausted from his journey. Nowadays when expeditions, from financial reasons, are obliged to be of minimal size, it is essential that the sledger should return in a condition such that he is fit to set out again after a rest of a few days only. On the older system of transport and fuel use, that is impossible.

The author would express his view that much progress in sledging technique is still to be made. The newer school has made, he believes, a real advance both in the use of dogs and in the abandonment of the Nansen cooker in favour of the naked Primus using more fuel. At the same time much of the benefit of that advance, so far, has been squandered by an unconscious slackening, both in the essential whittling down of sledge loads, and in personal effort in the field. A combination of old effort and new methods is required. As a spur to the modern school, to which he himself belongs, to make full use of newer methods, the author would point out that with the exception of the fine journey made in summer across the Greenland ice-cap in 1934 by Lindsay's party (a well-managed adventure rather than a journey with scientific aims), no British polar land journey by an unsupported party has equalled in length even half the major pre-war journeys in Antarctica.

The above interesting account of the modern method of using fuel seems to call for comment by one of the "old school" referred to in the article.

The Editor, himself one of that school, may perhaps be allowed to make the first reply. He would begin by saying that the discomfort of the old system is considerably exaggerated as also is the weight of ice accumulation, except in one or two special journeys, such as the winter journey by Dr Wilson's party. In that case fuel was used for warming and drying and ice accumulation arose in spite of it, since it was mostly in the sleeping bags.

We are of the opinion that much of Bertram's claim for the efficiency gained by taking an extra supply of fuel is justifiable, nevertheless it must cut down to some extent the length of time spent in the field. For an exploratory journey, as distinct from a scientific one, the maximum efficiency is to achieve the greatest distance with the supplies which can be hauled. A little calculation shows how the two systems compare in weight to be transported. On the Scott ration of fuel 1 gallon had to last four men for ten days, the modern ration appears to be equivalent to nearly 3 gallons for a similar period and party. On a journey to last twelve weeks, a normal length for the Scott-Shackleton type of journey, this would require an extra 16 gallons, say 160 lb. of fuel. This weight would have to replace a similar weight of provisions, which is equivalent to ten days' rations for four men.

In other words the system would cut down such a journey by one-eighth, nearly, a serious fraction when distance is the main object.

The ruling principle, established by Nansen, Scott, Shackleton and Mawson, was that a sledge party should always arrive home on its last biscuit and pretty well exhausted, which is precisely the same principle as one applies in athletics. Comfort must be considered if the lack of it hinders travelling power, but otherwise it must be firmly ruled out.

The Editor would prefer to regard the Nansen cooker, with its saving of fuel, not as "obsolete" but merely in suspense, for he suspects that when the modern school undertakes journeys comparable in length of time with those of Shackleton and Scott, increased as to distance by the use of dogs, they will find the same logic holds true and will have to reinstate the Nansen cooker, and save fuel.

Speaking for the Antarctic alone, one would say that there is no real hardship in the lack of fuel for warming and drying during the three months of November, December and January, while the discomfort of October and February can be endured without serious interference with efficiency. For September and March, as well as for the winter months, the story would be very different and extra fuel would be practically essential.

With regard to the superior efficiency of dog transport compared to that by man hauling there can be no question, provided that the number of dogs is gradually reduced during the journey. All that the old timer can claim for his method of travel is that it was very simple and gave him a sense of independence in the field and of moral satisfaction on his return.

F.D.

ANTARCTIC REGIONS

Expeditions in the Field

The Work of R.R.S. Discovery II.

The fifth commission of the *Discovery II* will end with the ship's return to England about next May. The first season's work, from November 1937 until May 1938, was occupied in a circumpolar cruise. This was described briefly in the last issue of *The Polar Record.* The second season's work, which is now in progress, is being devoted to a series of repeated cruises over a route to the south-west of South Africa.

The *Discovery II* sailed from the Cape on July 1, 1938, after the completion of her refit at Simonstown, and, having reached the Greenwich meridian in 40° S., proceeded on a southerly course until she reached the pack-ice. After turning north-east and south-east she found the ice again in 20° E. and then steamed northwards to return to the Cape after about a month at sea. This is the prescribed route which will be covered seven times before the ship returns to England. The purpose of these repeated observations is to study the seasonal changes in the growth and distribution of the marine life, and in the physical and chemical condition of the water, and for this reason a very full series of oceanographical observations is made, as far as possible, in exactly the same way throughout each cruise.

The earlier cruises have been successfully completed, though, as was expected, the work was often hampered by extremely bad weather. During the later cruises the ice will have retreated to the south, the ship will reach higher latitudes, and it is hoped that she will be able to approach the coast of the Antarctic continent. It is possible that a visit will be made to Bouvet Island in February 1939.

N. A. MACKINTOSH.

Ellsworth Antarctic Expedition, 1938–39.

Lincoln Ellsworth sailed from Cape Town in the *Wyatt Earp* on October 29, 1938, on his fourth expedition to the Antarctic. The expedition is reported to consist of nineteen men, including Sir Hubert Wilkins, in charge of arrangements on the ship; J. H. Lymburner, pilot; T. R.

Trerice, flight engineer and emergency pilot, and Londer Johansen, captain of the *Wyatt Earp*. The plans appear to include a visit to the Enderby sector, where a number of flights will be made inland from the coast. Two planes have been taken. One of these is an all-metal Northrop Delta monoplane with a 750 H.P. Wright cyclone motor, having a cruising range of 2000 miles, thus making possible a proposed flight across the Antarctic continent to Little America. The other is a small Aeronca two-seater scouting plane, to be used for communication between the base and the larger plane.

TOM CREAN: AN APPRECIATION

With the passing of Tom Crean, who died in August 1938, there goes another of a fast dwindling band of stalwarts, the naval Petty Officers of the Scott expeditions to the Antarctic.

When Captain Scott was selected to take command of the *Discovery* on the National Antarctic Expedition of 1901–4, he followed the example of the 1875 expedition under Nares and took with him an almost entirely naval personnel. Amongst these was a tall Irish A.B., Thomas Crean, who even then was celebrated amongst his fellows for a merry tongue and a facility for getting into tight places. He accompanied Lieut. Barne on his journey over the Barrier and fell into more crevasses than any other member of the party. He also went through some rotten ice just before the relief of the *Discovery*, and would certainly have been drowned had he not kept his head and stayed calmly in the mess of brash-ice until help and a rope were brought.

Returning to the Service he became a Petty Officer and was one of Scott's early selections for his 1910–13 expedition which differed from the first expedition in having a nucleus only of naval petty officers. With Evans and Lashly, Crean formed a trio of expert sledgers and handy men. He soon reverted to his propensity for trouble, being one of the party to go adrift with five ponies on the sea-ice. It was on this occasion that Crean distinguished himself by drinking a cup of cocoa made with curry powder by mistake, without noticing anything unusual. In the desperate hours that followed the break up of the ice the leader, Bowers, said of him, what was true on many occasions: "Crean, like most bluejackets, behaved as if he had done this sort of thing before." "This sort of thing" was jumping ponies from one heaving floe to another, dragging the gear across and then waiting until two floes touched again for another scramble, while killer whales heaved up their ugly heads and snorted at their prospective victims. Crean was sent for help and his journey involved climbing a vertical cliff some 15 ft. high, and getting a bad attack of snow blindness. As always he made light of his feats in extricating himself from trouble, and all I ever got out of him about that trip was, "Oh, I just kept going pretty lively, sorr, them Killers wasn't too healthy company."

At headquarters for the winter his quips and his brogue kept the

TOM CREAN

"mess deck" part of the hut merry and he was second only to P.O. Evans both as raconteur and sledge rigger.

He was a member of the main Pole Party and the tale of how he and Lashly saved the life of Lieut. E. R. G. R. Evans on their return journey is too well known for repetition. Many of the entries in Lashly's diary recall Crean vividly to mind. "Old Tom is giving us a song as he shovels snow on the tent."..."As soon as we sighted the Barrier Crean let go one huge yell enough to frighten the ponies out of their graves."

His amazing walk of 35 miles to get help at the end, on the top of a journey of some four months, is one of the unforgettable classics among polar feats. He did it on three biscuits and two sticks of chocolate. Yet when talking to him the chief thing he would mention was his disgust at himself for being sick when the doctor gave him some brandy and then some porridge, "that's the first time in my life that ever it happened, sorr, and it was the brandy that did it".

In the winter it was once more Crean who was the mainstay for cheerfulness in the now depleted mess deck part of the hut, and he took part in the search party which set out next spring.

His last little journey on that expedition was as adventurous as ever, for he again fell through rotten ice, but this time he was in harness and we pulled him out without any difficulty.

Crean had by no means finished with the Antarctic, for little more than a year later he went off with Shackleton in the *Endurance*.

Here again he was always cheerful and true to his character.

Perhaps the finest picture of him is that painted by his leader, who on their perilous journey for 800 miles in an open boat from Elephant Island to South Georgia, refers to Tom Crean as the singing seaman at the tiller, who was always humming some incredible and unrecognisable tune, always making the best out of the worst.

Tom Crean was in his way, unique; he was like something out of Kipling or Masefield, typical of his country and a credit to all his three expeditions. One has only to close one's eyes for a moment to summon up his clean-cut features and his grin as he greeted one in the morning with: "Well fare ye, sorr."

The world is the poorer for losing "the singing seaman".

F. DEBENHAM.

WHALE OIL AND OTHER PRODUCTS OF THE WHALING INDUSTRY

BY BRIAN ROBERTS

[The present article continues our series on the economic resources of the polar regions. Much of the history of Arctic and Antarctic exploration is bound up with that of the whaling industry, which has resulted in more commercial advantage than any other product of these regions. The modern uses to which the results of the industry are directed are so numerous that it is impossible to give more than a brief survey of the subject. Detailed information is difficult to obtain. It is hoped, however, that these notes, which have been obtained from many sources, will provide an indication of the many ways in which this industry affects everyday life in other parts of the world.]

The extraction of oil from whales is a very ancient process, but no regular oil production existed until the Basques started the whaling industry in the twelfth and thirteenth centuries. With their primitive equipment, they only made use of the blubber, the part of the whale richest in oil. The blubber was cut up into small pieces which were cooked in open iron cauldrons. This method was in use until the beginning of the present century, when less wasteful methods were introduced in order to utilise as much as possible of the carcass. Flesh, entrails and bones are now cooked in closed boilers under increased pressure and temperature, and since about 1925 a combined steam and mechanical treatment of the material, known as "apparatus cooking", has resulted in still more efficient extraction.

In the early days almost all the whale oil produced was used for burning. The commonest form of street lighting, for instance, was by lamps burning whale oil, but the introduction of paraffin largely displaced it from this use. It was, however, still used for underground lighting as it was relatively safer than paraffin owing to its higher flash point. Until 1914 there was a diminishing but still considerable trade in refined whale oil which was shipped mainly through Trieste and used for burning in certain Central European countries. The trade ceased at the outbreak of the Great War and could not be revived. Meanwhile the continued increase in the use of electricity for lighting gradually reduced still further the use of refined whale oil, and now the refiners do only a very small percentage of the trade of pre-war days.

The whaling industry, however, has by no means suffered, and its products have been put to other uses which are ever widening in scope.

Fig. 1, which is copied from a statement issued by David Geddes & Son, shows the world production of whale oil since 1908. From this the reader will gain some impression of the enormous turn-over of the industry. Crude whale oil is sold under the description "good merchantable quality". Grading of the oil is based on the free fatty acid content, colour and smell. There are four grades, and, as is implicit in the term

Antarctic	1907/8	and other areas,		1908	...	150,000	Barrels
,,	1908/9	,,	,,	1909	...	240,000	,,
,,	1909/10	,,	,,	1910	...	300,000	,,
,,	1910/11	,,	,,	1911	...	615,000	,,
,,	1911/12	,,	,,	1912	...	755,000	,,
,,	1912/13	,,	,,	1913	...	775,000	,,
,,	1913/14	,,	,,	1914	...	735,000	,,
,,	1914/15	,,	,,	1915	...	630,000	,,
,,	1915/16	,,	,,	1916	...	630,000	,,
,,	1916/17	,,	,,	1917	...	375,000	,,
,,	1917/18	,,	,,	1918	...	340,000	,,
,,	1918/19	,,	,,	1919	...	360,000	,,
,,	1919/20	,,	,,	1920	...	430,000	,,
,,	1920/21	,,	,,	1921	...	500,000	,,
,,	1921/22	,,	,,	1922	...	640,000	,,
,,	1922/23	,,	,,	1923	...	847,000	,,
,,	1923/24	,,	,,	1924	...	731,000	,,
,,	1924/25	,,	,,	1925	...	1,043,000	,,
,,	1925/26	,,	,,	1926	...	1,161,000	,,
,,	1926/27	,,	,,	1927	...	1,190,000	,,
,,	1927/28	,,	,,	1928	...	1,340,000	,,
,,	1928/29	,,	,,	1929	...	1,863,000	,,
,,	1929/30	,,	,,	1930	...	2,787,000	,,
,,	1930/31	,,	,,	1931	...	3,670,000	,,
,,	1931/32	,,	,,	1932	...	903,000	,,
,,	1932/33	,,	,,	1933	...	2,559,000	,,
,,	1933/34	,,	,,	1934	...	2,500,000	,,
,,	1934/35	,,	,,	1935	...	2,598,000	,,
,,	1935/36	,,	,,	1936	...	2,712,000	,,
,,	1936/37	,,	,,	1937	...	2,984,000	,,
,,	1937/38	,,	,,	1938 (say)		3,700,000	,,

Fig. 1. Estimated world production. (6 barrels = 1 ton.)

"crude", certain variations are permissible within each grade. The free fatty acid limits are: under 2 per cent, No. 1; 2 to 6 per cent, No. 2; 6 to 15 per cent, No. 3; and 15 to 30 per cent, No. 4. The lower grades now form a negligible proportion of the production compared with pre-war times. This is mainly due to the great improvements in equipment, and to the increase in the number of floating factories, as opposed to land stations. The floating factory can follow the catcher and its prey, whereas a catcher from a land station may have to tow the dead whales a considerable distance back to the station, by which time they may be somewhat decomposed.

There are two distinct kinds of oil produced from whales. The first comes from the Baleen whales (*Balaenoptera* and *Megaptera*) and is known to the trade simply as "Whale oil". The second comes from the Sperm whale (*Physeter catodon*) and is known as "Sperm Whale oil" or "Sperm oil". Right whales (*Eubalaena*) are now protected by International Agreement, as they are in danger of dying out, and so their oil does not concern us. The oil from the Bottlenose whale (*Hyperoodon rostratus*) may be regarded as being, for all practical purposes, identical with sperm oil. Whale oil is a fatty oil with a high percentage of glycerides and a high saponification value (187·9–194·2). The specific gravity of No. 1 should be 0·920. Sperm oil is really a liquid wax, largely unsaponifiable (40–45 per cent), and its specific gravity should be 0·880.

It is beyond the scope of these notes to include any discussion of the relation between the oils derived from whales and those from other sources. The proportion of whale oil used in the various industries depends both on the available stock and on world prices. If the stocks are high the prices are correspondingly low. Production is then lowered in order to raise prices again.[1] Fats and oils from all parts of the world find their way into myriad uses and into hundreds of products. Changes in the supply and in the demand for these various fats and oils causes them to be used in varying amounts and for different purposes from year to year.

	Tons	% of total
Rapeseed oil	21,728	0·3
Sesame oil	38,385	0·5
Castor oil	62,361	0·8
Wood oil	93,000	1·1
Sunflower oil	204,650	2·5
Palm Kernel oil	265,754	3·1
Soya Bean oil	290,391	3·6
Whale oil	455,473	5·4
Palm oil	473,925	5·8
Linseed oil	618,528	7·6
Peanut oil	715,704	8·8
Pig products	734,115	9·0
Coconut oil	814,274	10·0
Cottonseed oil	896,283	11·0
Olive oil	918,000	11·3
Cattle products	1,562,370	19·2
Total	8,135,475	

Fig. 2. World production of fats and oils, 1937

[1] The price per ton has undergone very considerable fluctuation from year to year. In 1920 the highest price of No. 1 oil was £90 per ton, while in 1934 it fell as low as £8. 10*s*. 0*d*.

In most statistics whale oil is not separated from other animal or marine animal oils. An approximate idea of the proportion of oil obtained from this source compared with that of other origin may be gained from Fig. 2, which is adapted from information obtained at the Whaling Exhibit of the Oslo Exhibition, 1938. It will be seen that the proportion of whale oil is comparatively small.

Uses of Refined Whale Oil

About twenty-five years ago the application of hydrogenation to whale oil completely revolutionised the trade. It opened up new markets for the oil and caused a great expansion in whaling to meet these new requirements. Briefly, hydrogenation converts the crude oil into a pure, solid fat, white in colour and free from taste, which is extensively used for edible purposes and for soap-making. The germ of the discovery lay in the observations of two French chemists, Sabatier and Senderens, at the end of the nineteenth century, that the catalytic addition of hydrogen to unsaturated liquid oils would harden the oils into a solid neutral fat. Their discovery encouraged intensive research, which brought to perfection the process of fat hardening as it is known to-day.

Hardened whale oil is prepared in two ways in order to suit the needs of the two main branches of consumers: the margarine and lard-compound trade, and the soap trade. For the use of the first-named trades, the oil is hardened and deodorised, the deodorising process rendering it fit for human consumption. For the soap trade, the oil is hardened but not deodorised. The two products are known respectively as "Edible" and "Technical" hardened whale oil.

In the manufacture of margarine and lard compounds hardened whale oil is mixed with liquid oils with the object of producing a fat which will be solid at all ordinary temperatures in the same way as animal lard is solid. It is not essential to the trade that hardened whale oil only be employed; other oils, such as groundnut and soya, can be hardened and serve the purpose equally well. Hardened whale oil has been employed in greater quantities than other hardened oils simply because, in recent years, it has been considerably cheaper.

A very recent development has been the introduction of "Plasticised" hardened whale oil. This article is pure hardened whale oil with no extra soft oils, but the hardened oil is treated in such a manner as to render it plastic in the same way as that in which the lard compound is plastic.

This "plasticised" hardened whale oil resembles white lard compound, and is indeed sold to bakers to be used as such.

The main bulk of whale oil is now hardened for use in edible products, and for making soap. The following figures for the consumption of whale oil in the United Kingdom, published by the Imperial Economic Committee, give the average for the five years 1932–36:

	Whale oil	Vegetable oils and fats	Animal fats and oils
	%	%	%
Margarine	37	57	6
Lard compound	21	77½	1½
Soap	13	55	25 (and about 7 % resin)

The actual consumption figures for whale oil in 1936 were 64,000 tons in margarine, 38,000 tons in soap, and 24,000 tons in lard compound.

These three items are by far the most important, but edible hardened whale oil is also used by the confectionery trade in the manufacture of cheap sweets and toffees, and as a constituent of some of the artificial creams used for filling cakes.

The soap industry is one of the largest consumers of oils and fats in the world. Almost any fat can now be utilised in the manufacture of soap, the choice being determined by the price of the oil or fat and the quality and type of soap required. There has recently been an increased use of whale oil for this purpose. Fig. 3 (adapted from *Norsk Hvalfangst-Tidende*, 1938, Nr. 5) illustrates the fluctuations in the use of the principal soap oils and fats since 1931.

Until the introduction of hydrogenation, the liquid oils were comparatively useless for soap-making because they yielded soaps which were too liquid and soft and strong-smelling. Technical hardened whale oil has proved to be a first-rate soap-making material, in some ways superior to the tallow which it replaces. The lower grades of whale oil, which are unsuitable for hydrogenation, are used mainly in the production of soft soaps.

Practically the whole of commercial glycerine is still derived from the fatty oils, and most of this comes into the hands of the glycerine refiners as a by-product of the soap industry. Glycerine is extremely important in the manufacture of explosives, and for use in shock absorbers for artillery.

As already stated, most of the technical hardened whale oil is absorbed by the soap industry; but it is also used as a constituent for lubricating greases, and in the manufacture of candles. Apart from hydrogenation there is a certain amount of whale oil filtered and sold as a burning oil, for batching jute and other vegetable fibres, for tempering steel, for leather dressing, and as an ingredient of lubricants for screw-cutting machines, etc.

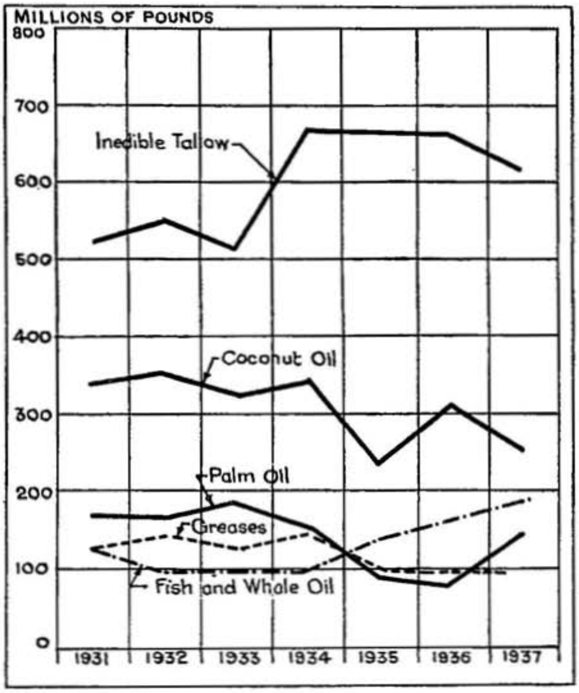


Fig. 3. Utilisation of principal fats and oils in soap-making.

Sperm Oil

Until recently, sperm oil has been mainly filtered and used to some extent for the same purposes as other filtered whale oil. It is a good lubricant for spindles and other light machinery, being valued chiefly on account of its freedom from gumming tendencies; also because it is stainless, and because its viscosity decreases less with increase of temperature than is the case with mineral oils. It is used in making candles, in the dressing of fabrics, in medicine and surgery, and in cosmetic preparations. During the last few years, however, a new use has been found and applied, especially in Germany, where it is converted into cetyl alcohol.

The oil from the head cavity of the Sperm whale contains spermaceti wax which is freed from the oil by filtration and sold for various purposes, including cosmetics.

While the main product of the whaling industry is oil, a few brief notes on subsidiary products are given below:

Whale meat meal is used chiefly for feeding cattle, pigs, poultry and silver foxes.

Whale guano and bone meal are excellent fertilisers containing ammonia and phosphate of lime.

Whalebone ("Finners", "baleen") was formerly cut into narrow strips and used in the umbrella and corset trades. The introduction of steel for most of the purposes to which whalebone was once applied has led to an increasingly restricted market, but it is still used for brushes, the grooves of sliding doors, collar studs and stiffeners, and occasionally for such articles as cigarette cases and the backs of hair brushes.

Canned whale meat is used for food in Japan. Cut into blocks of about 40 lb., it is transported in special refrigerators and sold at about half the price of beef. Only the best meat is used, but in a 50 ft. whale this may reach 2½ tons.

There is (or was until recently) a small trade in canned whale meat with West Africa for consumption by the natives. The tougher it was, the better they liked it.

Ambergris, though never abundant, is found as a pathological product in a small percentage of Sperm whales, and is used as a fixative for perfumes.

In conclusion, it must be emphasised that, with the possible exception of meat meal and guano, the whaling industry is primarily concerned with the production of oil for the purpose of hydrogenation. The other products are relatively unimportant.

THE INTERNATIONAL WHALING AGREEMENT, 1938

BY DR N. A. MACKINTOSH

In the last number of *The Polar Record* an account was given of the International Whaling Conference held in London in June 1938. The general procedure was described, and it was explained that the governments of several nations interested in whaling had signed a Protocol embodying certain amendments to the Agreement of 1937.

The principal measures agreed to in 1937 included a minimum size limit for the various species, the restriction of the Antarctic whaling season to the period from December 8 to March 7, and the prohibition of pelagic whaling in temperate and tropical waters. These regulations limited the scope of Antarctic whaling, and offered some protection to immature and breeding whales, but did not succeed in checking the total number of whales killed.

At the Conference in 1938 the whole position was reviewed, and a number of possible measures for the preservation of the stock of whales were discussed. It was decided that restrictions on the numbers of catchers, or on the amount of oil produced, were impracticable at the present stage. Agreement was reached, however, on two new measures of some importance, namely, the prohibition of Humpback fishing for one year in Antarctic waters, and the institution of a sanctuary for all baleen whales in the Pacific. Although Humpbacks are not taken in such large numbers as Blue and Fin whales there is reason to believe that the stock of this species is smaller and more vulnerable, and in recent years it has been taken in considerably increased quantities, not only by factories working off the west coast of Australia and the south coast of Madagascar but also by the ships working in the Antarctic. The possibility of a world-wide prohibition of Humpback fishing for a year was considered at the Conference, but since it was argued that this would have a disproportionate effect on certain land stations in temperate or tropical waters the prohibition was confined to waters south of 40° S. This is expected to save large numbers of Humpbacks in Antarctic waters.

The sanctuary in the Pacific is defined as the area south of 40° S. and between 70° W. and 160° W. Here pelagic whaling is prohibited for a period of two years in the first instance. Although pelagic whaling has not so far spread to these waters, it is known that the number of whales there is sufficient to be worth protecting. It would be very difficult at the present stage to impose a sanctuary in part of the established whaling grounds, but the new measure should check future expansion, and introduces the principle of sanctuaries.

Other articles of the protocol include a clearer definition of a land station, and minor amendments to some articles in the principal agreement. The definition of a land station affects the status of factory ships anchored in territorial waters, and is a difficult question which gave rise to much discussion.

Although the regulations which have come into force as a result of these conferences do not prevent the killing of what is probably an unduly large number of whales, it must be remembered that with the conflicting interests involved there is always great difficulty in reaching general agreement. Any restrictive measures must react fairly on the different nations concerned and on the individual whaling companies. In the circumstances progress must be slow, but it may be said that the discussions have taken place in a candid and friendly atmosphere which is highly encouraging for the future.

THE SUPPOSED WESTWARD DRIFT OF GREENLAND

It has been brought to our notice that in a recent paper (Astronomical Longitude and Azimuth Observations, *Monthly Notices of the Royal Astronomical Society*, vol. 97, No. 7, 1937, p. 489) Professor Nørlund, the Director of the Danish Geodetic Survey, made the following remarks about the supposed westward drift of Greenland:

"We know that Wegener considered that his hypothesis of the displacement of the continents had been supported by longitude determinations in Greenland, and from them he calculated that Greenland is moving westwards about 20 metres a year. But the old observations used by Wegener were carried out with primitive instruments and he overrated their exactitude. In 1927 and 1936 the Danish Geodetic Survey carried out longitude determinations at Qôrnoq on the west coast of Greenland with a first class transit instrument, both times on the same pillar. Practically speaking the two measurements gave the same result. It is most likely that the deviations of the old measurements from the new ones are the result of observational errors."

The original longitude observations of Börgen in 1870 and J. P. Koch in 1907 used by Wegener were all made before wireless time-signals were available, and cannot therefore be properly compared with those made with modern methods.

J.W.W.

BIBLIOGRAPHY OF NORWEGIAN ARCTIC AND ANTARCTIC EXPLORATION

A bibliography of Norwegian polar exploration from the earliest to the present times is being prepared by Dr Hroar Vartdal, through the initiative of Docent Adolf Hoel, some of the material having been collected previously by Norges Svalbard-og Ishavs-undersøkelser. The bibliography will cover Norwegian periodicals dealing with polar matters, books, papers, articles and maps. In addition to papers by Norwegian authors published in Norway and abroad, it will also include biographies of Norwegian polar explorers by foreign authors, and papers by foreign authors which are the results of the working up of material collected on Norwegian polar expeditions.

One section will contain a chronological list of every Norwegian polar expedition about which anything has appeared in print. For each expedition there will be references to the other sections in the bibliography where the scientific results are recorded.

It is planned to have the work finished in 1940, before the opening of the proposed International Polar Exhibition.

NOTICE

The Institute now has an assortment of polar gear, clothing and food, remainders from various expeditions, which is available for disposal. Particulars can be had by writing to the Director, but selection should preferably be made in person.

GREAT SOVIET ATLAS OF THE WORLD. MOSCOW, 1937[1]

[Published by order of the Central Executive Committee and the Soviet Council of People's Commissars of the U.S.S.R. on December 17, 1933, by the Scientific-Publishing Institute of the Great Soviet Atlas of the World of the Central Executive Committee, under the general editorship of A. F. Gorkin, O. Y. Schmidt, V. E. Motylev, M. V. Nikitin, and B. M. Shaposhnikov. (In Russian.) 20½ × 14½ in.]

This Atlas is of interest to polar travellers since Soviet territory covers such a large section of the Arctic regions. We accordingly find that nearly every map of the territory goes well into the Arctic Circle. The two special pages of circumpolar maps are well printed and follow the usual convention for showing routes of expeditions. Insets on the Arctic sheet give a valuable map of Severnaya Zemlya with relief and soundings; there are also insets of parts of Novaya Zemlya, while weather charts and ice-drift charts complete the page.

The large amount of work by Russian scientists on the hydrography of the Arctic is reflected in the large-scale map of the Arctic Ocean from Spitsbergen to the Lena Delta. This has bathymetric contours, drift directions and land relief in surprising detail.

The Antarctic sheet is on a much smaller scale, and does not call for any particular comment. It includes the route of Ellsworth's flight, but omits the discoveries of the Graham Land expedition, so that the Peninsula appears as an Archipelago. These are towards the beginning of the Atlas and there follow a long series of world maps.

Part II deals mainly with Soviet territory under a number of aspects; the Arctic Coast is included in particular on all of the maps. The data for parts of this coast must be slender, but, with this warning, the material should be of considerable value to students of polar matters.

The projection used for most of the maps is a conical one which suits the area very well, and for almost the first time we have a clear view of how that hitherto rarely visited coast is becoming a more definite factor in economics as well as in pure science.

F.D.

[1] The Institute is indebted to Dr E. J. Lindgren for translating the titles and conventional signs in this Atlas.

RECENT POLAR LITERATURE

The list of recently published polar books which has been printed at the end of each number of *The Polar Record* is to be enlarged to include notices of all the important polar literature which comes under our notice. It is naturally impossible to be exhaustive, but it is hoped that half-yearly bibliographies of published results will supplement the notes on the plans and work of the various expeditions.

Readers will greatly assist the Editor by sending copies of their publications and by notifying us of such references.

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