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President "the Work of the Advisory II « W? Assembly" might be mentioned in our next Bulletin, referring also to the Journ? /33 number. J.M. 23.2.33.

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Secretary-General 25.II.33

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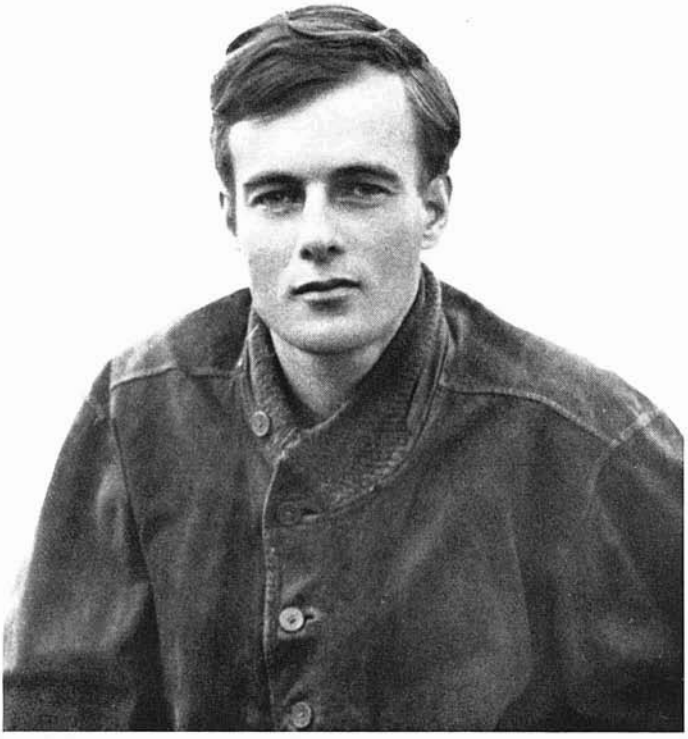
Technical-Assistant

Translator


INTERNATIONAL HYDROGRAPHIC BUREAU
15FEB 1933
MONACO



MR AUGUSTINE COURTAULD

ANNUAL REPORT
OF
THE SCOTT POLAR RESEARCH INSTITUTE

PRESENTED BY
THE COMMITTEE OF MANAGEMENT TO THE
SENATE OF THE UNIVERSITY
29 MAY 1932

The chief event of the year has been the progress of plans for the new building for the Institute. The University has allotted a site at the north-east corner of the grounds of the Lensfield site, and it is hoped that work will be begun in the autumn. Sir Herbert Baker has been selected as architect.

During the year the Institute has been open from 10 to 4 p.m., and besides ordinary visitors, members of projected expeditions have made use of it for reading and for consulting files, in connection with their preparations. One of the research rooms was used during the winter by the chief surveyor of the British Arctic Air Route Expedition for working up results; and another room is now being used for the preparations for an expedition going to Iceland this summer. Slides from the Institute's collection have been borrowed on several occasions for polar lectures.

The Polar Record has now reached its fourth number, and may be said to have established itself. Demands for it have been steadily increasing throughout the year; and it was found necessary to have a reprint made of the second number, the supply of which had been exhausted. The Institute has received a generous gift of £2000 from the Trustees of the British Museum, to be used as a Publications Fund. This sum was the balance remaining from the sum subscribed towards the expenses of publishing the *Scientific Reports of the British Antarctic Expedition*, 1910–13, and was transferred to the Institute in November.

The Museum and Library have received a large number of additions during the year, and great interest has been shown in both of them by the relatives of explorers, as well as by actual members of former polar expeditions. Miss Lefroy, of Crondall, has presented a number of Franklin

relics, including some interesting bas-reliefs of Sir John Franklin, Sir James Clark Ross, and Sir John Richardson. Mrs McCann has generously given a set of sixteen pictures of the Nares Expedition, 1875, which formerly belonged to her father, Sir Albert Markham. Lieutenant-Commander Bernacchi has presented a large case of penguins to the Museum. Other acquisitions include a large collection of articles from West Greenland lent by Miss I. Hutchison, and the snow shoes, harpoon, etc., used by Mr A. Stephenson on the British Arctic Air Route Expedition. These are on permanent loan. Other gifts, too numerous to record in detail, have been received from the following:

Mr George Binney.
Miss G. M. Scott.
Det Danske Meteorologiske Institut.
Prof. Debenham.
Dr Lauge Koch.
Prof. W. H. Hobbs.
Dr Mario Bossolasco.
Mr Bassett Jones.
Dr F. H. H. Guillemard.
Mr I. M. Martin.
Mrs McCann.
Dr W. Donald.
International Hydrographic Bureau.
Miss Louise A. Boyd.
Dr A. Haushofer.
Mr N. E. Odell.
Prof. E. von Drygalski.
Prof. E. de Margerie.
Arctic Institute, Leningrad.
Prof. L. M. Gould.
Royal Society of Edinburgh.
The Explorers Club, New York.
Captain K. N. MacKenzie.
Mr B. B. Roberts.
Mr A. Stephenson.
Captain J. King Davis.
Lieutenant-Commander Bernacchi.
Dr B. Brockamp.
Prof. Jules Schokalsky.
Dr T. G. Longstaff.
Mr V. Stefansson.
Mr J. Richardson Reynolds.

A. C. Seward, *Chairman*.
F. Debenham.
J. M. Wordie.
R. E. Priestley.
H. R. Mill.

ARCTIC REGIONS

SVALBARD, FRANZ JOSEF LAND, AND RUSSIAN ARCTIC REGIONS

Soviet Union Expeditions, 1931.

News has been received of several expeditions which the U.S.S.R. sent out to the Arctic in the summer of 1931, which we are now able to report in some detail. Most of this information has been obtained from the *Bulletin* of the Russian Arctic Institute, 11, 12, of 1931, and 1, 2, and 3, of 1932.

A preliminary reconnaissance of the air route from Archangel, over Novaya Zemlya, was carried out in the summer of 1931. Franz Josef Land was visited in the ice-breaker *Malyguin*, and a site for the proposed naval air station considered. The coast of Novaya Zemlya was explored by means of the motor boat *Aeroarctic* from Krestovaya Bay to the north end of the island. The personnel included the following:

J. K. Ivanov, air pilot; leader, Franz Josef Land party.
N. Ph. Feltchanov, technician.
P. M. Stoliarov, leader, Novaya Zemlya party.
P. P. Doubrovin, hydrographer.
A technician.
A mechanic.

An expedition sent out by the Botanical Museum of the Russian Academy of Sciences carried out a study of the reindeer pastures of the Pechora basin, in the Bolshezemelskaya and the Malozemelskaya tundras in the summer of 1931, with a view to investigating the quality and quantity of fodders, and other problems connected with reindeer in the tundra regions. The expedition was commanded by Th. V. Sambouc, and the following led parties:

V. J. Andreev.
A. A. Dictov.
A. A. Kortchaquin.
A. A. Mekhov.
V. M. Sdobnikov.

At the same time another botanical expedition was at work on the south island of Novaya Zemlya studying the reindeer pastures, and the organisation of the State reindeer farm. This was in continuation of the work of a similar expedition in 1930. In the summer of 1931 a crossing

of Novaya Zemlya was made from the mouth of the Nekhvatova river in the west, to the mouth of the Savina river in the east. Other work included a survey of the Goussinaya Zemlya, with detailed maps of the tundras, and different types of pasture: also explorations were made in the Meshdusharsky peninsula, in Rogatcheva Zemlya, and the area round the Savina river. About 470 reindeer are being reared on the State farm. Summer and autumn grazing conditions are extremely good in Novaya Zemlya, but in winter the snow covering the pastures becomes hardened by wind. It is planned that next winter the reindeer herds shall be moved to the Kara district, where the winter pastures are better.

The Barents Sea being exceptionally free from ice during the summer of 1931, the *Persey*, the research ship of the Oceanographic Institute, was at work in the area between Novaya Zemlya and Franz Josef Land, and has discovered that the waters of the north-east portion of the Barents Sea are of Atlantic origin. This vessel has further located several depressions near Novaya Zemlya, which are filled with cold water and are stagnant zones. The expedition was at work from August 10 to September 15 and was led by A. V. Sokolov.

The second expedition of the Arctic Institute to Novaya Zemlya led by the geologist of the Institute, M. M. Yermolayev, was at work doing geological and geomorphological research along the south shore of Matotchkin Shar, Novaya Zemlya, in the summer of 1931. A journey was made across the island from the Barents to the Kara Sea, during which a topographical survey, covering 650 sq. km. (247 sq. miles) was carried out. At the same time, and also under the auspices of the Arctic Institute, a geological survey was made on a scale of 1 : 25,000 at Murmansk in the district of the river Voronye, being a continuation of work begun in 1930. The expedition was led by Miss N. P. Loupanova.

The *Knipovitch* hydrological research boat was sent out as usual in the summer of 1931, in connection with the Murmansk biological station at *Polarnoye*, the object of the expedition being to make a hydrological section along the meridian of Kolsk Bay. Owing to the total absence of ice in that part of the Arctic, it was found possible to carry this out as far as Victoria Island. Leaving there on August 20, the expedition visited Franz Josef Land, and, after landing at Cape Neale, coasted Mary Harmsworth Island, and steered north, the first ice being sighted in Lat. 81° 57′ N., Long. 42° 00′ E. By moving along the edge of the ice the meridian 35° E. was reached. A landing was made at Brock Island, and

another hydrological section carried out up to Alexandra Land, which was reached on September 5. The expedition returned to Archangel on September 14, having made a return section on the 42nd meridian as far as the *Polarnoye* settlement. The scientific work was in charge of Th. Belov.

News that a party, working under the leadership of V. J. Sokolov, at the mouth of the Lena, during the summer and autumn of 1931, returned to Leningrad last December, was published in the *Bulletin*, No. 1 of the Arctic Institute, from which the following details have been obtained. The plans for this expedition were given in *The Polar Record*, No. 2. The expedition, consisting of two parties, arrived at Bulun on July 27. The first party made a journey, using reindeer transport, by way of the mountains from Bulun to Kumak-Surt, and then in the direction of Neyelov Bay. A topographical survey was made, ornithological and botanical work done, and a collection made of plankton. Meanwhile, the second party, travelling by motor boat, visited Sagastyr, the site of the Russian Polar Year station of 1882–3, to see whether the buildings could be utilised for a meteorological station this year. They proved, however, to be more or less in ruins. The members of the expedition included:

G. A. Voytzekhovsky, zoologist.
V. J. Oushakov, mechanic.

As mentioned in *The Polar Record*, No. 2, an expedition in the *Beluga* visited the Kara Sea during the open season of 1931, leaving Archangel on August 6, and reaching Dickson Island on August 18, where B. G. Tchoukhnovsky joined the party with a Dornier Wal aeroplane in order to investigate ice conditions east of Dickson Island. The next day a wintering camp at Kolossov was visited. Heavy pack ice was met with later near the Scott Hansen Islands, causing the expedition to return to Kolossov. Flights were made north of Taimyr Island and the Gulf of Middendorf, and it was observed that near the land there was open water from 3 to 7 miles broad, but out to sea there was dense pack ice. Two hunters were left to winter at Cape Mikhailov, and the expedition returned to Dickson Island on September 17. The work of the expedition was chiefly concerned with hydrological and meteorological observations, but a topographical survey was also made of Piassinsky Bay, and the Morshov and North-East Islands. The personnel of the expedition included:

Captain Burke of the *Beluga*.
P. K. Hmysnikov.
I. M. Sendik.
S. S. Shiian.

Soviet Union Expeditions, 1932.

News of the forthcoming Soviet Union Expeditions has been obtained principally from the *Bulletin* of the Arctic Institute, Leningrad.

An expedition, organised by the Arctic Institute in connection with the International Polar Year, will be at work in the central Polar Basin in 1932, starting in July. The expedition will have the use of the ice-breaker *Krassin*, and will carry two aeroplanes.

The *Krassin* will try to reach Lat. 85°, where flights, lasting two or three days, will be made for reconnaissance purposes. It is planned that the expedition shall pass the winter of 1932–33 in the ice, during which observations will be made on the flora and fauna, the migration of the fur-bearing animals, and the possibility of exploiting the region of their migration. Meteorological, aerological and magnetic work will also be done, with a view to the organisation of regular air cruises and in order to help in the solution of the Arctic Air Route problem.

Professor O. U. Schmidt, Director of the Arctic Institute, is also to lead an expedition this year. It is planned to start from Archangel some time in the summer of 1932, and it will endeavour to reach Vladivostock by way of Bering Strait. The ice-breaker *Sibiriakov* will be used, accompanied as far as Severnaya Zemlya by an expedition on the ice-breaker *Rusanov*, led by Professor R. L. Samoilovitch, the object of which is to erect a meteorological station at Cape Chelyuskin. The *Sibiriakov* will call at the station on the Serge Kamenev Islands, in order to relieve the party under G. A. Uschakow, left there by the *Sedov* expedition in 1930. Other work will include exploration at the mouth of the Lena river. The expedition is well equipped with aeroplanes, radio, etc., and provisions for 15 months are carried, in case it may be found necessary to spend the winter in the Arctic.

A party is at work on the exploration of the Yamal peninsula in the area of the Polar Ural between Obdorsk and Ust-Ussa. Its investigations are in connection with the All Union Association of the Civil Air Fleet, and are being made with a view to the development of airways in the Arctic. With the same end in view the Khatahga-Anabar Expedition of the Civil Air Fleet has spent the winter of 1931–32 at the mouth of the Olenek River.

News has been received that work at the Tchukotsk peninsula will be continued in 1932, and a fresh party is being sent to take the place of those who were at work in 1931. The expedition will be supported by the

base-points at the settlements Anadyr and Markovo. It is planned that a topographical survey shall be made from the air, and a Dornier Wal plane is being taken for that purpose. Geomorphological observations will also be made. The party will be headed by Professor S. V. Obrutchev.

It is hoped that it may be possible to relieve and replace the personnel of the station on Wrangel Island in 1932, and an expedition will leave Vladivostock for this purpose during July on the steamer *Soviet*. The schooner *Tchukotka*, which was sent to the relief of the station last year, was crushed in the ice, and thus failed to reach the island. The expedition will carry 100 sledge dogs, a frame house to put together on the spot, and a powerful wireless station. Reindeer will also be taken to the island, as it is planned to start a breeding industry there.

An expedition, planned by the Communist Youth organisation, is to visit Spitsbergen, Franz Josef Land, Greenland, and Novaya Zemlya in a ship built specially for the purpose. Topographical work will be done from the air, and ice investigations made.

An interesting relic has recently been sent to the Arctic Institute at Leningrad in the shape of a note from the Baldwin-Ziegler Expedition, which wintered in Franz Josef Land, 1901–2. The message was one of many sent out attached to balloons when the supply ship failed to reach the expedition. It was picked up in the Obmany Shar in the south of Novaya Zemlya in Lat. 71° N. in November 1931 by a Samoyed; and was worded as follows: "Headquarters of Baldwin-Ziegler Expedition. Ziegler's Camp, Franz Josef Land, June 7th, 1902. To the nearest American Consulate: Imperative, urgent, supply coal. . . . The work of the first year has been successful. A large depot made in April and May on Rudolf Island. Desirable to get hay for five ponies, dried fish for 150 dogs and sleighs. Expect to return beginning of August, probably will not realise our plans, but will not be defeated. Everything is well. Third balloon. Buoy Number 30. Baldwin."

According to Professor W. J. Wiese, ice conditions are expected to be favourable in the Barents and Kara Seas this summer.

Serge Kamenev Islands Research Station, 1930–32.

The party left by the *Sedov* Expedition in 1930 on the Serge Kamenev Islands, to the west of Severnaya Zemlya, continued their observations there during the winter of 1931–32. Short accounts of their work up to that time have already appeared in *The Polar Record*, Nos. 1, 2, and 3.

Concerning the state of the ice during the summer of 1931, they report that open water was met with at the 81st parallel near the east coast of Severnaya Zemlya in the middle of May, and in the latter part of May to the north of the islands, though to the west and south-west they were still closed in by pack-ice. The third week in June, the ice cleared away from the sea on the west, and at the beginning of August, there was open water all round the Kamenev Islands, except for a few floes. Ice remained to the south of the islands, however, till the middle of August. Finally, in September, the sea was entirely free from ice, and the straits between the islands were open as well. The group was thus accessible to ships from the beginning of August to the middle of October. A fringe of sea ice, 7–8 km. (about 4½ miles) wide was formed at the beginning of November. Later reports on ice conditions received by wireless from time to time are equally interesting. The spaces of open water near the islands did not disappear till December 18, when the sea was completely frozen over, although on the same day open water, estimated from the colour of the sky to be of considerable extent, was sighted 15 km. (9 miles) away to the eastward of the station. All sign of this had, however, disappeared by December 28, and on the 29th a vast pressure of ice began, lasting for two days.

The work of the expedition has now included more than 4000 miles covered in exploratory journeys, the mapping of the islands, and valuable geological results. A preliminary report on these has been published, having been received by wireless from the station. Seventy polar bear, 14 fox, 9 walrus, and 21 Arctic hare were killed during the winter of 1931–32.

Severnaya Zemlya is found to be a group of three large islands, surrounded by smaller ones, either singly or in groups. The northern island, Komsomoletz, which has an area of 9500 sq. km. (3610 sq. miles), and of which the most northerly point is in Lat. 81° 16′ N., Long. 82° 43′ E., is separated from October Revolution Island by the Red Army Strait. This strait is narrow, being only 140–150 metres (400 ft.) wide. October Revolution Island covers an area of 14,500 sq. km. (5510 sq. miles), and is thus the largest of the group, the third island, Bolshevik Island, having an area of only 9000 sq. km. (3420 sq. miles). These two islands are divided by the Straits of Schokalsky (formerly believed to be a bay), which are 15 km. (9 miles) wide at the narrowest part. The expedition worked only on the Komsomoletz and October Revolution Islands, making journeys round both of them in the course of their explorations, and crossing

October Revolution Island from Stalin Bay (Lat. 79° 30′ N.) across Matusevitch Fiord to Berg Cape (80° 02′ N.). The eastern coast of October Revolution Island, and the southern part of Komsomoletz Island consist of steep cliffs, in contrast to the west coasts, which are much indented, some of the fiords being quite long, the Matusevitch Fiord, which was discovered by the expedition, stretching for about 30 km. (18 miles). The eastern and western coasts of the northern and middle parts of Komsomoletz Island are low. The interior consists of a well-defined dome, which reaches a height of 800 metres (2624 ft.) towards the east, though not exceeding 250 metres (820 ft.) at the west side. There are two terraces on the west side of the island about 420 metres (1277 ft.) absolute height. No large rivers have been discovered so far, the largest seen being only 20 km. (12 miles) in length. The dome-shaped hills in the centre and north of Komsomoletz Island are none of them more than 250 metres (820 ft.) high.

The interior of both islands consists of a continuous sheet of ice covering 80–90 per cent. of the area; the relief corresponds in softened outlines to the slope of the underlying ground, but nunataks were observed at the edges of the ice shield. The ice appears to be receding as a whole, and in some localities there are stagnant glaciers.

The geological results prove the existence of an immense arch of foldings of post-Permian age on the Taimyr Peninsula, of which Severnaya Zemlya is structurally a part. During the Quaternary epoch Severnaya Zemlya, in common with the Taimyr Peninsula, was covered with continental ice, the movement of the glaciers being westward and north-westward. The present outlines of Severnaya Zemlya are due to faults of Quaternary age, and the general slope of the land to the west is caused by a series of step faults in a meridional direction. A general elevation of the land was observed to be taking place, the process being much faster on the eastern side.

The expedition is still continuing its work, and news that all is well at the station has been received at Leningrad by radio. The station has also established communication with Franz Josef Land. One of messages reports that the wind motor is proving a great success for the wireless generating electric energy, and is being used for radio transmission.

It is hoped that the station may be relieved this summer by the projected *Sibiriakov* expedition, under the leadership of Professor O. U. Schmidt, the Director of the Arctic Institute at Leningrad.

Cambridge Spitsbergen Expedition, 1932.

This expedition, led by R. M. Jackson, will continue the work begun by him and his three companions in 1930. This year the party will consist of the following:

R. M. JACKSON, St John's, leader and surveyor.
A. D. G. BRAITHWAITE, Gonville and Caius.
H. W. BUXTON, Royal School of Mines, surveyor and geologist.
P. E. FAIRBAIRN, Trinity and Royal School of Mines, geologist.
A. R. GLEN, Balliol, Oxford, surveyor.
J. I. MOORE, St John's.
W. G. WELCHMAN, Sidney Sussex.
P. LAMARTINE YATES, St John's.

The expedition has purchased the Scottish herring boat *Dawn*, a cutter of about 30 tons, 45 ft. in length, with auxiliary motor. The party will sail her themselves, and expect to leave King's Lynn on June 29. A call will be made at Tromsö for further fuel and stores, before proceeding to Icefiord in Spitsbergen. A base will be set up at Ebba Valley in Klaus Billen Bay.

The main party of four will ascend to the inland ice by way of the Ebba Glacier, and turn north, pulling their own sledges, to the Stubendorff Mountains, by a route about ten miles to the eastward of the Mittag-Leffler glacier. Part of the route was prospected by the 1930 Expedition, and it is hoped to complete a topographical survey both of the region formerly visited, and more particularly of the Stubendorff Mountains. The survey of the Stubendorff Mountains will also necessitate mapping the east shore of Wijde Bay. In 1930 the south end of the bay was found to be about five miles to the westward of the position given in the available charts. The base party will be responsible for the work at Wijde Bay, and by accurately determining the longitude, should help materially to settle the problem of the Stubendorff Mountains, for hitherto it has been impossible to fit in this important mountain group between the Lomme Bay Glacier and the accepted longitude of parts of Wijde Bay.

Norges Svalbard-og Ishavs-undersøkelser Hydrographic Expedition, 1932.

We are indebted to Dr Adolf Hoel for the following note on the work to be done in the summer of 1932 under the auspices of the Norges Svalbard-og Ishavs-undersøkelser.

A hydrographic expedition, led by Lieutenant Rolf Kjaer, will be at work in the waters round Bear Island. The expedition will use the Fishery Inspection ship *Fridtjof Nansen*, belonging to the Norwegian Navy, which was built in Norway in 1931, and which is fitted with echo sounding

apparatus. The hydrographic work was started on May 28, when Bear Island was found to be surrounded by a belt of drift ice varying in width from 8 to 25 miles. Besides hydrographic work, the distribution of drift ice will be studied, and magnetic and meteorological observations made.

Cambridge Bear Island Expedition, 1932.

A small expedition from Cambridge has gone to Bear Island this summer. The personnel is as follows: G. C. L. Bertram, St John's College, who will study the freshwater fauna, and D. L. Lack, Magdalene College, who will study the terrestrial fauna. Six weeks will be spent on the island, working from Tunheim in the north as a base.

The object of the expedition is to make, as far as possible, a comprehensive survey of the fauna of the island. Whereas the knowledge of the fauna of Spitsbergen and of northern Norway is now extensive, the fauna of Bear Island, lying midway between them, has been much neglected. Previous zoological expeditions were those of Nathorst in 1898, and of Oxford University in 1921. Both of these paid quite short visits, while on their way to Spitsbergen, and the latter worked only in the southern part of the island. Finally in 1924, Sig Thor collected some of the invertebrate groups in the northern area. The western portion of the island is zoologically unknown, and is probably the most favourable to animal life.

Polar Year Stations in the Svalbard Sector of the Arctic, 1932–33.

There will be several stations established in the Svalbard sector of the Arctic in the summer of 1932 in addition to those already mentioned, for observations in connection with the International Polar Year, 1932–33. News has been received of the following:

An expedition from Sweden, headed by F. Lindholm, will be at work in Spitsbergen, with headquarters at the Svea coal mine, and two auxiliary stations. There will be close communication between the three stations by radio.

The Polish participation in the Polar Year activities will consist of a station on Bear Island for aerological, magnetic, and atmospheric electrical observations.

There will also be magnetic stations at Bodö, Bossekop, and Hammerfest as the contribution of Norway to the scheme.

GREENLAND

Summary of the Work of the German Greenland Expedition, 1930–31. *By Professor Dr Kurt Wegener.*

The German Greenland Expedition of Alfred Wegener really began when in 1929 he with three companions went to the west coast of Greenland to find a suitable place from which to reach the inland ice. It was necessary that such a place should be far enough south for a landing to be made sufficiently early in the year to allow of arrangements being made, and the equipment being transported up to the ice-cap, and yet sufficiently far north for the temperatures on the glaciers to be low enough for the expedition to investigate certain fundamental problems in glaciology. Kamarujuk Bay, which is on the west coast in the Umanak district, in Lat. 71° N., was chosen as the landing place.

The main expedition left Germany in the spring of 1930, and bases were established on both the east and the west coasts of Greenland.

The work of the East Coast Station was begun in July 1930, from the Danish Radio Station in Scoresby Sound, as the fiord was still blocked with ice. Later, when the ice melted, the party was able to go up the fiord by motor boat, but was forced to return to the Danish Radio Station in May of 1931.

The main party of the expedition landed on May 4, 1930, near Umanak, on the west coast and went to Uvkusigsat. The projected landing at Kamarujuk was not possible, as, the fiord being open, sledges could not be used to transport the equipment, as had been planned. On June 16 the upper camp was set up at Kamarujuk, and the work of transporting the baggage up on to the ice-cap was begun. It took 120 days with the aid of 25 ponies, to transport the equipment, totalling 120,000 kg. (125 tons) up to the edge of the inland ice, at a height of about 1000 m. (3280 ft.). Then a way was found across the Kamarujuk Glacier, though, because of the rapid melting of this glacier (up to 4 m., or 13 ft. a year), making it difficult to keep in the same glacier path, the best route was found to be on the lateral moraine. The expedition had two air-propeller sledges, which had to be hauled over the rocks with hand winches. The 25 Iceland ponies carried 40 kg. (88 lb.) on each side each journey, but they could only travel every second day. Much of the equipment was therefore transported by the Greenlanders themselves.

The winter quarters were erected in October on the Kangerdluarsuk Glacier. The scientific work of the expedition had already begun, both

during the transport of the stores, and whilst waiting at Uvkusigsat. The winter passed without incident at the upper West Station and also at the East Station.

In July 1930, a third station in the interior of Greenland, about 400 km. (248 miles) from the West Station, was set up, and named Eismitte. Three long journeys with 10 sledges were necessary to establish this station, altogether 3500 kg. (7000 lb.) of gear being taken, for the use of the personnel of the station. When the last of these parties returned to the West Station, it brought a letter from the two observers left at Eismitte, Georgi and Sorge, announcing that they would have to abandon the station on October 20, unless further supplies of petroleum and instruments could be sent there. This difficulty had already been foreseen by the leader of the expedition, and he had sent off a party with the propeller sledges, to carry out the transport. The propeller sledge party could not get further than half-way, or 200 km. (124 miles), from the base on account of deep fresh snow; their loads were therefore deposited at that point, and the party returned. The leader had organised a party by dog sledge in support of the propeller sledges, but this party too met with difficulty from low temperatures and deep snow. On receipt of the message from Eismitte, Wegener decided to send the main party back, and go forward himself with Loewe and one Greenlander, Rasmus Willemsen, to Eismitte, planning to winter there, Georgi and Sorge returning to the base with the dog teams. On arrival at Eismitte, after experiencing very low temperatures, a change of plan was found to be necessary, for Loewe had had his toes frozen on the journey, while Georgi and Sorge volunteered to spend the winter at Eismitte. The food supply would have been insufficient for five men for the winter, so, on November 1, Wegener left Eismitte for the West Station with Rasmus Willemsen. As ordered, a supporting party waited at the depot indicated from November 21 to December 7; Wegener did not return, and it was concluded that he and his companions had probably decided to remain with the others at the central station for the winter. On the arrival of the spring relief party at Eismitte in May, Georgi, Sorge and Loewe were found alive and well, but it was learnt with dismay that Wegener and Rasmus had left for the west coast on November 1. A party was sent out from the West Station in May, with seven dog sledges and both propeller sledges to try to discover the fate of the leader of the expedition; his body was found at a point 189 km. (117 miles) from the station. It had been carefully buried by the Greenlander Rasmus. The clothing was tolerably free from snow, so that

apparently death had followed as the result of exhaustion. The fate of Rasmus remains unknown, and it seems probable that he perished on the ice-cap. It was discovered that some of the flags, put up to mark the route, had been buried in the deep fresh snow, and he did not know how to steer a course.

In June 1931, Sorge undertook a journey in search of Rasmus, and at the same time Weiken began his work on trigonometrical height measurements. A seismic party went to the 62 km. mark in order to measure the thickness of the ice-cap in a north-south direction. In July the two Norwegians, Høygaard and Mehren, passed through Kamarujuk before they made their crossing of Greenland.

At the end of July Sorge brought the seismic instruments up to Eismitte with the aid of the propeller sledges, and, at the same time, a sledge party set out for the 300 km. mark with a gravity pendulum. From there the accompanying Greenlanders returned with the pendulum to the 120 km. mark, where they set it up for another measurement. A further sledge party under the leadership of Lissey went to Eismitte with supplies, and to carry on the trigonometrical height measurements from the 300 km. mark. The first seismic party, consisting of Wölcken, Brockamp and Herdemerten, went to the 120 km. mark, and carried out a series of measurements of the thickness of the ice there.

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

A. *Triangulation.*

Kamarujuk to the West Station and neighbourhood, by Weiken and Jülg.

B. *Trigonometrical height measurements.*

From the West Station to the 33 km. mark by Lissey and Gudmundur.

From 38 km. mark to 300 km. mark, by Weiken and Jülg.

From 300 to 400 km. marks, by Lissey and Gudmundur.

C. *Gravity measurements*, by Weiken and Jülg, at

(1) Uvkusigsat (Control), (2) Scheideck, (3) 82 km., (4) 120 km., (5) 300 km., and finally at (6) Uvkusigsat (Control).

D. *Ice thickness.*

(1) From the neighbourhood of the West Station to the 38 km. mark, some 12 measurements, including the profile of Kangerdluarsuk, by Wölcken, Brockamp and Herdemerten, and on occasions, Georgi, Sorge and Loewe.

(2) The north-south profile at the 62 km. mark, from 62 km. north to 1½ km. south, 4 measurements, by Wölcken, Brockamp and Herdemerten.

(3) At the 82 km. mark, 6 measurements, by Wölcken, Brockamp and Herdemerten.

(4) At the 120 km. mark, 12 measurements over about 2 sq. km. (0·772 mile), by Wölcken, Brockamp and Herdemerten.

(5) 400 km., 1 measurement, by Sorge, Schif and Kraus.

E. *Meteorology.*

Besides the East Station, Eismitte, and the West Station, a meteorological station was built at Umanak, which was in charge of Katechet Kruse. Temperature and humidity were also registered at Kamarujuk, in the taking off station, and at some 200 km. (124 miles), where a self-recording meteorograph with a three-month period was employed, which was wound up periodically by the sledge parties passing it. Apart from the general climatic observations, 142 kite ascents were made and 141 pilot balloons were sent up from the East Station. At Eismitte there were 17 kite ascents, and 37 pilot balloons sent up, and at the West Station 15 kite ascents and 30 pilot balloons.

F. On the route to Eismitte snow levels were taken at every 20 km. (12 miles) by the sledge parties journeying through.

G. *Glaciology.*

At the West Station a shaft 20 metres (65 ft.) deep was sunk into the ice, in which continuous observations of ice temperature were made. At Eismitte Sorge also dug a shaft of 16½ metres (52 ft.), a hole down to 7 metres (22 ft.) and a boring for the remaining 10 metres. Thickness measurements of the névé, and researches on its annual stratification were made in many places by different observers.

H. *Gravity and seismic apparatus.*

This equipment as a whole weighed 500 kg. (1100 lb.) with the radio instrument. The seismic outfit, as used for ice thickness measurements at Eismitte, weighed 1000 kg. (2200 lb.) together with 200 kg. (440 lb.) of explosives, and the requisite amount of cable. The weights of the other seismic party, which worked at two observation posts, so that at every explosion two tracings at different distances were recorded, amounted to 1500 kg. (3300 lb.). This latter party worked with dog sledges, and was limited in its activities to the edge of the inland ice.

I. *Sledges.*

The air-propeller sledges were more useful than the dog sledges, as without them thickness measurements of the ice would not have been possible. The chief advantage of the propeller sledges was that, not only were they faster under normal conditions, but they did not consume fuel except when running. With the dog sledges, on the other hand, it was only possible to send out work parties and leave them at the scene of their observations, the dogs having to return owing to the large amount of food they consume, and then a second dog sledge had to be sent out to fetch back the work party itself.

A popular narrative of the expedition, written by F. A. Brockhaus, has appeared under the title of *Alfred Wegener's Last Greenland Journey*: edited by Frau Elsie Wegener, his widow, with the collaboration of many section leaders. The full scientific results will be published by F. A. Brockhaus, Leipzig, after the completion of the various memoirs. The first part will appear in August, 1932, and the whole work will probably be completed in 1934.

Commander von Gronau's Flight over Greenland, 1931.

The successful crossing of the Greenland ice-cap by air, by Commander von Gronau, was briefly mentioned in *The Polar Record*, No. 3. We are now able to print a fuller account, through the courtesy of Commander von Gronau.

The 1931 flight was the sequel to a somewhat similar one in 1930, when Commander von Gronau crossed Greenland near its southern extremity. In 1931 he flew over the centre of the ice-cap, from Scoresby Sound to Sukkertoppen, a distance of 850 miles. The flight took eight to nine hours, and was made at a height of about 9000 ft. The plane was a Dornier Wal (a later type of the Amundsen Wal used the previous year), equipped with two BMW engines, each of 700 h.p., made at the Bavarian Motor Works, Munich. The machine was so constructed that it was possible to discharge fuel quickly during a flight in case of emergency. Suitable equipment and provisions were carried, as a forced landing on the ice-cap might have necessitated a march of several weeks to safety. The flight was planned with the support of the German Ministry of Transport, and of the Danish Government.

The route chosen by Commander von Gronau for his second flight was by way of the Faroes and Iceland. He left Reykjavik for Greenland on August 13, 1931, and about a quarter of an hour after leaving the coast of Iceland he saw below him the pack-ice, loose at first, but be-

coming thicker further west towards Greenland. Over the pack-ice the weather was somewhat foggy, until, by climbing above the clouds, an impressive view of the mountains of Greenland was seen in brilliant sunshine. The weather improved steadily as the flight was continued north, and Scoresby Sound was reached after five hours' flying, and a landing safely effected on a small ice-free space on the fiord.

On August 15, the weather reports seemed favourable, and a start was made from Scoresby Sound. Ten hours' petrol was carried. This amount was necessary, for besides having a flight of an hour and a half along the fiords before turning inland, the plane would also have to reach a height of at least 8500 ft.

The flight began by way of Cape Hope, where the plane was saluted by the Louise A. Boyd Expedition, which was also visiting Scoresby Sound; and Jameson's Land was then passed over. This peninsula is ice-free, and is ranged over by musk oxen, a herd of which was seen from the plane. As the plane proceeded further into Scoresby Sound some anxiety was felt, for the mountains ahead were 8000 ft. high, with the prospect of ranges still higher farther on. The plane received considerable buffeting from a sudden squall, and a strong down wind was encountered, so that, even with the engines going at full speed, it was impossible to attain to the necessary height to cross the mountains. A way had to be found, therefore, by flying up the lower glacier valleys, and so round the mountains which were too high to be flown over. It took an hour to clear the mountains, which were not indicated on the map; and even when these obstacles had been passed, and the inland ice reached, the latter rose so rapidly that the plane had to continue flying under full throttle, leaving no reserve of power in hand.

The plane rose steadily, and finally reached a height of 10,000 ft. As regards the risks of flying over this part of the Arctic Air Route, Commander von Gronau considers that, while an emergency landing could probably be effected quite easily on this part of the ice-cap, it might, nevertheless, be extremely difficult to sledge either to Angmagssalik or Scoresby Sound, the only inhabited places on the east coast. It had been hoped that if one of the engines gave out, it would still be possible to continue the flight for two or three hours with the second engine; but actually it was found that only by running both engines at full speed could the necessary altitude be maintained.

Later, near the middle of the ice-cap, further obstacles were encountered in the shape of low clouds, mist and snow. The visibility became

practically nil, it was impossible to estimate the height, and there was danger of ice-coating on the plane. At one point the wireless antenna was found to be dragging through the snow. These conditions lasted for an hour and a half, till the plane again emerged into sunshine. At this point the ice-cap is described as being a flat white surface as far as the eye could see, the horizon appearing to be higher than the position of the seaplane in the air. The leader compares his feelings at this point to those of a fly in a vast white bath tub. Soon afterwards, on descending towards the west, the atmosphere became apparently warmer. The ice below showed signs of thaw, having a dirty appearance, with large visible cracks. Little streams, with occasional lakes, were noticed, and then the coastal mountains were sighted, and it became possible to pick up radio messages from Godthaab. For some unknown reason all radio contact had been completely cut off for more than five hours whilst crossing the ice-cap. Navigation had been by sun compass, as well as by magnetic bearings, the latter being untrustworthy, however, on account of the rapid changes in variation, through being near the Magnetic Pole.

It had been hoped that on approaching the west coast open water might be found, either by flying along a fiord, or over a glacier; but it was found instead that the Holsteinborg district is separated from the ice-cap by a mountain area 150 miles in width. At this point the available maps were useless, and it was impossible to fix the position of the plane until some authentic landmark could be recognised. A radio message, however, indicated that the sky was clear above Godthaab, and a course was set towards some blue sky, which was in the right direction. It then became evident that the petrol supply would not last as far as Godthaab, the steep climb up on to the ice-cap having used up much more than had been anticipated. It was decided, therefore, to make for Sukkertoppen, and Godthaab was informed by radio of the change of plan. Finally, a glacier was reached, which sloped down to the mouth of the Evighedsfjord, and a landing effected at Sukkertoppen, just as it was getting dark. Next day a fresh supply of petrol was taken on board, and the remainder of the journey made to Godthaab.

A reconnaissance flight had been planned for the following day, but bad weather caused a day's delay till August 18, when, in spite of a strong head wind, a visit was made to Ivigtut. On this flight engine trouble developed, and necessitated lengthy repairs which took a week's hard work. By August 28, the plane was fully repaired, and, the weather reports being favourable, the flight was continued. At the start the

weather was fine, with good visibility, but a strong wind from the north-west was met with soon after, and it became evident that the petrol could not hold out. Fortunately communication had been established with the radio station on Resolution Island, and inquiries could be made as to the existence of petrol dumps on the Labrador coast. It would have been possible to obtain petrol on Resolution Island, but no suitable landing place could be found for the seaplane.

After passing over Akpatok Island, the Labrador coast was reached, and later the mouth of the Payne river recognised. Navigation at this point was difficult, owing to untrustworthy maps and the absence of any distinctive landmarks. Finally the leader decided to fly by compass only to the west coast. In the evening an Eskimo settlement was reached, a landing effected on the water, and the night passed in sleeping bags. The next day, August 29, the problem of finding a petrol dump was becoming serious, and was complicated by the fact that the rain made the visibility very bad. At last, however, after a long search and many disappointments, a dump of petrol was found. This was very lucky, as the supply of petrol in the plane was very nearly finished, and the nearest place where more could have been obtained, Port Harrison, was 100 miles away, with uninhabited and impassable land in between. After this the flight was continued, but progress was slow, owing to bad visibility, and the fact that the only available maps were practically useless. There was also a strong head wind. These obstacles caused an enormous consumption of petrol, and there was again some anxiety for fear this should not hold out. In fact when the weather cleared suddenly, and Port Harrison was reached, it was found that there was only five minutes' petrol left.

The flight was continued on August 31 in bad weather, but with prospects of finer weather ahead. The following night was spent at Long Lake, where fresh supplies of petrol were picked up, and the following day, September 1, the plane reached Chicago.

Danish Expeditions to East Greenland, 1931–34.

These expeditions are in continuation of the Danish work carried on during the last two years in connection with their three-year programme of scientific investigations in East Greenland: the following details, both of the wintering party, and of the plans for this summer, have been obtained through the kindness of the general leader of the expeditions, Dr Lauge Koch.

The party wintering on Clavering Island in 1931–32, brief mention of which was made in *The Polar Record*, No. 3, consisted of eleven scientists, two radio operators, and three Greenlanders. Several journeys for scientific purposes were made in the spring and autumn. In March 1932 a depot was made on the Wordie Glacier at about 3280 ft., and on April 6 a party of four started on a sledge journey across the inland ice to Dronning Louise Land, from which, up to the time of writing, they had not yet returned.

The expedition has the use of the S.S. *Gustav Holm* and S.S. *Godhaab*; the S.S. *Gertrud Rask* is to call at Scoresby Sound, and there may be a fourth steamer as well. The expedition will also have at its disposal twelve motor boats, two three-seater seaplanes of the Heinkel type, equipped with 460 h.p. Jaguar engines. Four wireless stations, besides those on the ships and the aeroplanes, will be functioning in connection with the expedition, i.e. at Scoresby Sound, Ella Island, Eskimonaes (Clavering Island), and Hochstetter Foreland, some of which were established in 1931. The personnel of the expedition is as follows:

Leader of the Expedition
Dr Lauge Koch.

Surgeon
Dr E. Tulinius.

Geologists
Prof. H. G. Backlund.
D. Malmqvist.
G. Säve-Söderbergh.
Dr Wegmann.
Dr C. Teichert.
A. Noe-Nygaard.
Eigil Nielsen.
T. Säve-Söderbergh.
Lindgren.
S. Kamman.
Alexander Jensen.
Two Assistants.

Topographers
T. Johansen.
S. Stenør.
O. Simonsen.
Captain L. Bruhn.
A. B. C. Madsen.
Devantier.
P. C. A. Halfdaner.
S. Koefoed.
Arnholtz, Larsen, Poulsen, B. Purschel } Assistants.

Zoologists
Dr R. Spärck.
J. Braendegaard.
G. Thorson.
Alwin Pedersen.
Holger Madsen.
Helge Knudsen.

Botanists
G. Seiderfaden.
Th. Sørensen.
P. Gelting.
Mogens Koie.

Archaeologists
Helge Larsen.
P. V. Glob.

Aviators
N. V. Petersen.
H. Harms.
Overbye.
Münter.
H. Herschend.
H. H. Nielsen.
Bonde.
Thovdahl.
Four mechanics.
Two photographers.

There will be two main bases for seaplane flights; one on Ella Island with a subsidiary base at Scoresby Sound, and with S.S. *Godhaab* as a floating base, and another at Eskimonaes, with Hochstetter Foreland as a subsidiary base, and S.S. *Gustav Holm* as a floating base. The staff of each plane, both of which are equipped with a half automatic Eagle camera, will comprise two navigators, two mechanics, two air photographers, and a photographic assistant, who will do any developing work necessary whilst still in the air. In the southern area two parties of surveyors, each consisting of two topographers and one assistant, will be at work, and will fix points in connection with the survey from the air, using motor boat transport. Two similar parties will be at work in the northern area.

In the southern area, King Oscar and Franz Josef Fiords, five parties will be at work, as follows:

(1) A party of two geologists and one assistant, led by Dr Wegmann.

(2) A party of two geologists and one assistant, led by Dr Säve-Söderbergh.

(3) A party consisting of Dr Teichert, and one assistant, doing geological work.

(4) A biological party, consisting of two biologists and one assistant, led by Dr Th. Sørensen.

(5) S.S. *Godhaab*, which is equipped with echo sounding apparatus, and various zoological and hydrographical instruments, is to make a hydrographical investigation of Franz Josef Fiord, under the leadership of Dr R. Spärck, assisted by two zoologists and one hydrographer.

Work in the northern area, Clavering Island-Hochstetter Foreland, will be carried out by the following parties:

(1) A party of two geologists and two assistants, led by Professor Backlund.

(2) A party of one geologist and two assistants, led by Eigil Nielsen.

(3) An archaeological party, consisting of two archaeologists and two assistants led by Dr Helge Larsen.

(4) A party consisting of one zoologist and one botanist, led by Alwin Pedersen.

At least one new scientific station will be established within the northern area in the summer of 1932, and in the following winter it is planned that about sixteen members of the expedition shall winter at the various stations.

Dr Ejnar Mikkelsen's Expedition to East Greenland, 1932.

This expedition is being sent to Greenland in the summer of 1932 under the auspices of the Scoresbysund Committee, Copenhagen, under the leadership of its President, Dr Ejnar Mikkelsen, through whose kindness the following account has been obtained.

The Expedition will leave Copenhagen about the middle of June, having chartered M/V *Søkongen* with a crew of eight men. The ship is fitted with wireless, electric sounding apparatus, and dredging instruments, and two motor boats will be carried. The scientific staff of nine will include the following:

Mr L. R. WAGER, geologist.
Mr WAGER, Jun.
Mr MICHAEL SPENDER, topographer.
Mr M. DEGERBØL, zoologist.
Mr F. BØCKER, botanist.

It is planned that the expedition shall follow up the explorations of the British Arctic Air Route Expedition on the South East Coast of Greenland, principally between Cape Dalton and Kangerdlugsuak, and as far south towards Angmagssalik as time and weather permit. The chief object of the Expedition will be to prepare a better map than now exists of the area between Cape Dalton and Kangerdlugsuak, to make a geological map of the parts of the coast and the interior visited, and to do zoological, botanical, archaeological and hydrological work.

The expedition is expected to return to Copenhagen at the beginning of October.

H. G. Watkins' Expedition to Greenland, 1932.

Mr H. G. Watkins, whose plans for an Antarctic Expedition were abandoned for reasons given later in this issue, has sent us a brief note on the small expedition to the Angmagssalik district of East Greenland, which he proposes to lead.

It will consist only of four men, all members of his last expedition, as follows:

J. R. RYMILL, surveyor.
Q. RILEY, meteorologist.
F. CHAPMAN, ornithologist and photographer.
and the leader.

From Angmagssalik they will go to Lake Fiord in their own motor boat, and establish a base, with the general purpose of confirming their suggestions of last year as to the suitability of this region for stations on a future Arctic Air Route. Weather and ice observations will be kept

throughout the year at Lake Fiord, and arrangements will be made to have similar records from a station in Sermilik Fiord. Some of the party will make journeys inland, particularly to the Mount Forel district, for survey work. Life at their base will be modelled on the Eskimo practice, since the expedition is unable to take wood for a house, and will have to depend on hunting for a great part of their food. In the spring of 1933 a journey may be made across the ice-cap to Godthaab.

Norges Svalbard-og Ishavs-undersøkelser Expedition to East Greenland, 1932.

An expedition to East Greenland, planned under the auspices of the Norges Svalbard-og Ishavs-undersøkelser, will leave Norway at the beginning of July in the M/S *Polarbjørn* of Aalesund. The scientific staff will include geologists, topographers, zoologists, a hydrographer and an oceanographer.

French Polar Year Expedition to East Greenland, 1932–33.

Dr J.-B. Charcot kindly sent us the following news of the French Polar Year Expedition to East Greenland this summer.

As a preliminary to this expedition, the leader Dr J.-B. Charcot went to the Scoresby Sound district of East Greenland in August 1931, to choose a site for the French Polar Year Station, and arrange for the building of an observatory and hut. These were erected during the winter by a Danish carpenter.

The French Polar Year activities, of which this is the most important, are being financed by the Government, monetary grants being received from the Department of Instruction, and the Navy giving practical assistance. The scientific staff, which has been commissioned since December, 1931, and has been in training at various observatories, consists of the following:

Lieut. J. HABERT, leader of the party.
Lieut. DOUGUET, physicist, and hydrological work.
M. AUZANNEAU, physicist, and hydrological work.
Dr LE MEHAUTÉ, doctor and zoologist.
M. DAUVILLIER, physicist.
M. ROTHÉ, physicist and geologist.
M. TCHERNIAKOFSKY, zoologist.
1 warrant officer.
7 seamen, including wireless operators.

The Expedition will be transported to Scoresby Sound in the *Pourquoi Pas?*, accompanied by the ice-breaker *Pollux*, lent by the French Navy,

which will convey the equipment, provisions, etc. Dr J.-B. Charcot and Professor Ch. Maurain will superintend the setting up of the base, but will not winter there. The equipment of the station will include a motor boat, sledges, and instruments for hydrographical and topographical work. The party will remain at Scoresby Sound until August 1933, when Dr Charcot will return with the *Pourquoi Pas?* to take it back to France.

University of Michigan Expedition, 1932.

The University of Michigan is sending its fifth expedition to Greenland this year, details of which have reached us through the courtesy of Professor W. H. Hobbs.

The expedition will sail from New York on June 14, in the *Morrissey*, in charge of Dr Ralph L. Belknap, who was Second-in-Command on the second and third expeditions, and the personnel will include, besides the Director: Evans S. Schmeling, Assistant Director, aerologist and geologist, Max Demorest, assistant geologist, both of whom were members of the Fourth Michigan Expedition, and Herbert Gardiner, photographer and botanist. Professor W. H. Hobbs is Honorary Director.

Dr Belknap plans to establish an aerological station on the neck of the Upper Nugssuak Glacier, North-west Greenland, in Latitude 74° N., similar to those of the earlier Michigan Expeditions; to carry out geological and glaciological studies, and to make a journey by dog-sledge to the centre of the ice-cap.

Cambridge Iceland Expedition, 1932.

This expedition has as its chief object the measurement of the thickness of the chief ice-cap in Iceland, Vatnajökull, by seismic methods. The party will consist of six members, as follows:

B. B. Roberts, Emmanuel, leader and ornithologist.
F. W. Anderson, University College, Southampton, geologist and zoologist.
J. A. Beckett, Sidney Sussex, surveyor.
P. Falk, King's, botanist.
W. L. S. Fleming, Westcott House, geologist.
W. V. Lewis, Gonville and Caius, seismologist and surveyor.

The expedition will sail from Hull, having been able to obtain free passages in a trawler through the kindness of the Hull Steam Trawlers Mutual Insurance and Protection Co. They expect to land at Hornafjördr at the end of June. From there the party will ascend on to Vatnajökull, probably by way of the Heinabergs Glacier. Pony transport

will be used as far as the ice-cap, the ponies will then be sent back, and the party will proceed as two units, each of three men with a sledge.

The ice-cap will be crossed to the west end of Bruarjökull, seismic soundings being taken at selected points on the way. The soundings will be made by means of a geophysical seismograph made by the Cambridge Instrument Co., and obtained by the aid of grants from the Royal Society and the Royal Geographical Society. A similar method of sounding was used by the German Greenland Expedition, 1930–31, but this is the first time it has been employed by a British expedition. Briefly, the procedure is to fire a charge of explosive in the ice, at some distance from the instrument, which records accurately the instants of arrival, both of the direct wave travelling through the surface of the ice, and of the wave reflected from the underlying rock floor. The distance between the explosion and the recording instrument being known, the thickness of the ice can be calculated from the time interval between the reception of the two waves. Members of the party will later carry out a plane table survey of the northern border of Bruarjökull, which will be connected up on the west with the map of Kverknùka rani, and Kverkfjöll compiled by Max Trautz in 1912. Observations will also be made on the glacial economy of Vatnajökull. The area provides features of special interest owing to the ice-cap being superimposed on a highly active volcanic region.

On reaching Kverkfjöll the second unit will separate from the survey party, and the geologists will make a survey and collect specimens. It is hoped to investigate the navigability of the river Jökulsa á Fjöllum with a view to a future expedition going down to the north coast in a folding boat. The object of this journey will be to study the disintegration of lava by an examination of the silts through the whole length of the river.

Other work will include a search for the breeding grounds of the White-fronted (*Anser albifrons*) and Pink-footed (*Anser brachyrhynchus*) Geese, species which are supposed to be nesting at the sources of the rivers running northwards from the ice-cap. The botanical work will consist of a general ecological survey in relation to the birds, and seed dispersal between the oases of the Odadahraun. It will also include physiological experiments on the effect of a greatly reduced time of darkness. The results of these experiments will be worked out under Dr James at Oxford, and will be the first adequate investigations of their kind.

After about three weeks the two parties will meet again at Kverkfjöll, and the ice-cap will be re-crossed, this time southwards to Oraefajökull, seismic soundings again being made on the way. The expedition will descend from the ice-cap somewhere between Oraefajökull and Skeidarajökull, and will return along the coast eastwards to Hornafjördr, using pony transport. During the journey observations will be made on beach formation, and it is hoped that some ecological work will also be possible.

The expedition will re-embark at Hornafjördr after about seven weeks work ashore.

Other Expeditions, 1932

It is announced that a party will visit Cape York, North-west Greenland, this summer, to erect a monument in the shape of a column 60 ft. high to Admiral Peary. The expedition, which will be accompanied by Mrs Edward Stafford, Admiral Peary's daughter, will sail from New York, on June 14, in the *Morrissey*.

In addition to the expeditions already mentioned, there will be several smaller parties at work in 1932 in connection with the International Polar Year. News has been received of two small expeditions starting from Denmark in June to set up meteorological stations, one in Thule, the other in South Greenland. The staff of the Danish magnetic station at Godhavn, in West Greenland, will also be increased in view of the extensive research contemplated. Besides this a Dutch station will be established at Angmagssalik, in East Greenland, for magnetic and meteorological observations.

In Iceland a party from Holland will make aerological observations, with the help of aeroplanes, near Reykjavik, and a station will be established at Snaefellsjökull.

Projected Flight to Canada via Greenland, 1932.

A flight, in connection with the proposed Arctic Air Route to Canada via Greenland, has been planned for the end of June by Mr J. D. M. Gray, Managing Director of the Aviation Shop, Toronto, with the object of helping to prove the practicability of the route for a mail service from England to Canada.

He will use a Comper "Swift" high-wing monoplane, with a 75 h.p. Pobjoy "R" engine, having chosen this type of machine on account of

its high speed, 118–120 m.p.h.; low petrol consumption, 4·4 gallons per hour, and low landing speed, 35–40 m.p.h. The latter reduces the probability of accidents considerably. The route planned is by way of the Faroe Islands, Reykjavik, Tassiusak, (Greenland), Godhavn, across Davis Strait to Pangnirtung (Baffin Island), Lake Harbour (Baffin Island), Lake Timagisac, Northern Quebec, Ottawa, Toronto, New York.

ARCTIC CANADA AND LABRADOR

British Polar Year Expedition to Fort Rae, 1932–33.

This expedition, a full account of the plans of which appeared in *The Polar Record*, No. 3, has now left for Fort Rae, on the Great Slave Lake, Canada, in Lat. 62° 50′ N., the advance party sailing from England on May 14. The personnel consists of the following:

J. M. STAGG, leader.
J. L. KENNEDY, cook mechanic.
W. A. GRINSTEAD, observer.
W. R. MORGANS, observer.
P. A. SHEPHERD, observer.
A. STEPHENSON, observer.

The party will remain at Fort Rae until August, 1933.

The National Committee for the Polar Year, which organised the Fort Rae Expedition, has also given assistance to an expedition, led by Professor Appleton, for observations of the ionisation of the upper atmosphere at Tromsö in Norway.

Williams-Maris Expedition to Fort Conger, 1932–34.

As announced in *The Polar Record*, No. 3, an expedition in connection with the International Polar Year is going to Fort Conger, Ellesmere Island, this summer, under the leadership of Captain Flavel Williams, with Dr H. B. Maris in charge of the scientific staff. No further official news has been received, however, of the plans for this expedition, but it is hoped that particulars of them will be available for the next issue.

Expedition to Prince Patrick Island, 1932.

We have received news in outline of an expedition, to be led by H. J. Barnes, to Prince Patrick Island, from Fort Churchill, Hudson Bay, to be made in the summer of 1932. The party will consist of four.

Canadian Department of the Interior, North-West Territories, and Yukon Branch Expedition, 1932.

The annual Eastern Arctic patrol organised by the Department of the Interior will take place as usual this summer, and will sail from Montreal on the S.S. *Ungava* about July 9. The officer in charge will be Major D. L. McKeand, M.C., Secretary of the North-West Territories Council.

Calls will be made at the six centres of administration in this region of the Arctic: Lake Harbour, Pangnirtung and Pond Inlet (on Baffin Island), Dundas (on Devon Island), Craig Harbour and Bache on Ellesmere Island, in addition to other places.

During the winter of 1931–32 the Royal Canadian Mounted Police have been conducting a search for Dr H. K. E. Kreuger and Mr R. A. Bjare, who left Bache Peninsula on a scientific expedition in March 1930, and who are still missing. A full report of this work will be brought back by the *Ungava* in September, when the expedition returns.

Other Polar Year Stations in the Canadian Sector.

Special meteorological and magnetic stations, in connection with the Polar Year, will be established at Coppermine and at Chesterfield Inlet, on the west coast of Hudson Bay, but as yet no further details of these have been forthcoming. The work of these stations will be supplemented by weather reports every 6 hours from meteorological outposts at: Resolution Island, Cape Hopes Advance, and Nottingham Island, on Hudson Straits; Fort Churchill, on the west coast of Hudson Bay; Fort Smith, on the southern edge of the North-West Territories; Fort Simpson, Fort Norman, and Aklavik in the Mackenzie River district; and Mavor Bridge and Dawson, in the Yukon.

There will also be a station at Meanook, Alberta, and one installed by the United States in Alaska.

LIVING ALONE UNDER POLAR CONDITIONS

By A. Courtauld

[When news reached England that Mr Courtauld was left alone at the Ice-cap Station, there was considerable criticism, the greater part of which was quite ill-informed. The following article by Mr Courtauld himself will show that, while such an arrangement must obviously be avoided where possible, there is no reason why other men should not come through such an experience just as happily as the author of these notes, given the conditions which he suggests in his last sentence.]

More than a year has passed since the incidents occurred which are the subject of this article. During that time much of the detail has faded from my memory, the impressions have become blurred, and the ideas which then formed themselves in my mind are now forgotten. Yet it may be that a few notes on that time spent on the Greenland ice-cap will be of some use to travellers who, in the future, may be faced with a similar problem. If, by these notes, I can do something to dispel the strange ideas of danger and risk in leaving a man in such a situation, I shall feel justified. There are many men, trappers and the like, who live by themselves for most of the year. An accident is very rare among these men, nor are their minds usually deranged.

The following is a bare outline, from memory, and from an irregular diary, of my five months alone at the Ice-cap Station.

I was one of a party belonging to the British Arctic Air Route Expedition, which set out, in October, 1930, from their base on the east coast of Greenland to relieve two men who were occupying the Inland Ice Station. This station had been set up in August, 1930, for the purpose of taking a continuous meteorological record on the summit of the inland ice. The point chosen was on the route which aircraft will take in crossing Greenland between England and Canada, and was situated in Latitude 67° 03′ N., and Longitude 41° 49′ W., about 120 miles from the coastal base. The house consisted originally of a double-walled canvas tent, shaped like a bee-hive, with an entrance through the floor by a tunnel, but additions had been made by successive occupants. When we arrived they had built a snow house completely over the dome tent, and also two smaller snow houses for stores. These smaller houses could be reached by

branch tunnels, from the main entrance tunnel. They also built an 8 ft. wall of snow completely round the station.

Owing to unexpectedly bad travelling conditions we took 39 days to reach the station, which, to our great relief, we found on December 3. By this time our dog food was exhausted, and instead of being able to leave fourteen 50 lb. ration boxes at the station, only four could be spared, leaving a bare minimum for the returning party. The total provisions at the station at this time were, including the supplies brought by our party:

6 ration boxes (food).
26 gallons paraffin (light and heat).
2 bottles concentrated lemon juice (anti-scorbutic).
1 bottle cod liver oil (vitamin B).

Each ration box was designed to last one man a fortnight, but in fact we found that it would last comfortably for 24 days. The consumption of fuel at the station had previously been at the rate of two gallons a week. This then was sufficient food for one man for 5 months, but if two men were to remain, they would have to be relieved by the middle of February.

Although we hoped that the blizzards would cease, and give place to settled Arctic weather conditions, we realised that unless this happened, relief would be very difficult, if not impossible, before the spring, and it would be folly to leave two men at the station. We therefore decided to carry out the emergency programme which we had discussed before leaving England, and leave one man only at the station. There was no anxiety for the success of the plan on either side when the party left for the Base on December 6. The only doubt in our minds was whether the dogs and the sledges would hold out till they got back to the Base. As it turned out, although provisions ran out completely and daylight was very limited, they got back safely in 18 days, with only one member of the party seriously incapacitated by frostbite.

My first week or two at the station were fully occupied. Clothes and sleeping bag had to be dried, the space inside the wall had to be dug free of snow, and the stores moved into the house. Six times a day I dressed up in full kit, and sallied forth to read the instruments and inspect the weather. This was an absorbing interest in itself. The sudden changes from days of still twilight and nights of dead silence, with their waving curtain of aurora, to those in which day and night were obliterated in one sweeping roar of blizzard, showed me Nature in her most sublime and her most terrible moods.

For the first few weeks I was also kept busy in digging myself out

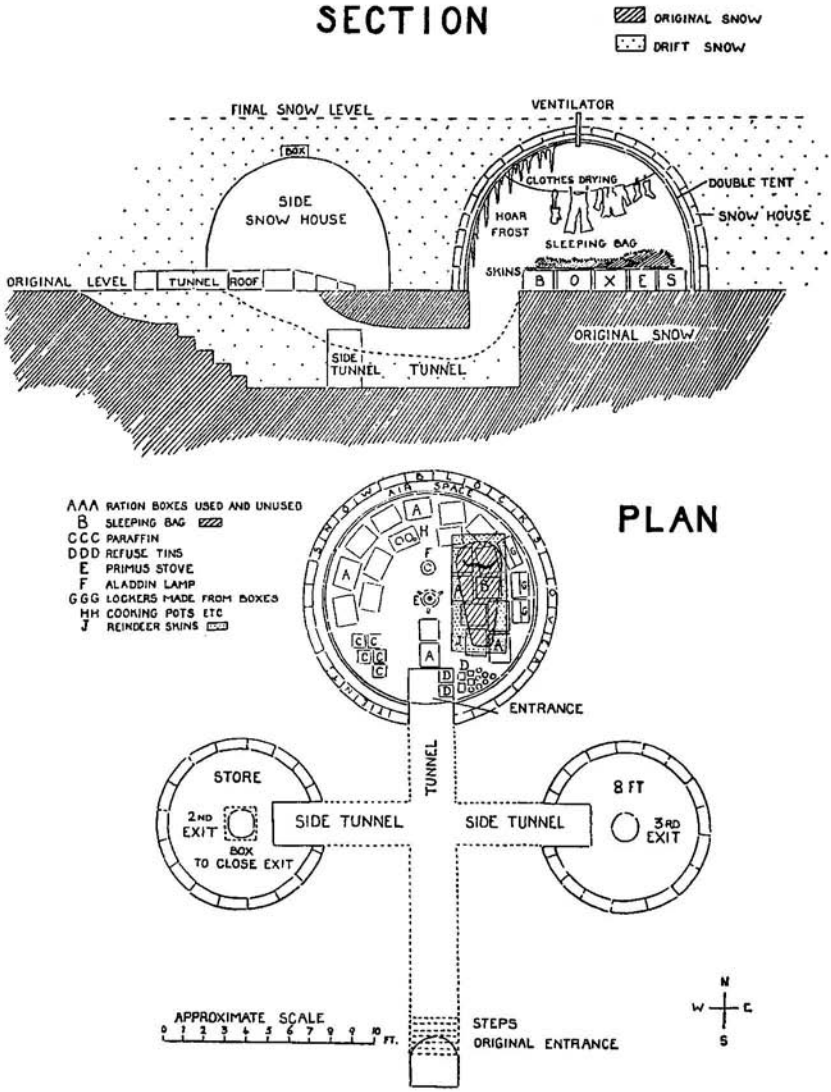
through the tunnel to get to the instruments. This tunnel would get completely filled after half an hour's blizzard. Gradually the drift gained on the digging, and soon I saw that I could not hope to keep it open if the gales continued in frequency and ferocity. The difficulty was that digging from the inside only piled up the débris further back in the tunnel, so that very soon the whole passage way became filled, and only a small crawling space between the débris and the roof could be kept clear.

About Christmas I discovered that some four gallons of paraffin had leaked away, so I had to do without the Primus stove, except for cooking. This was no great hardship so long as there was enough for the Aladdin lamp, which provided a very good heat, though, of course, it was very pleasant to have the Primus as well.

On January 4, a very severe gale finally closed the entrance, and the tunnel was too full to dig any more from the inside. A hole was therefore made in the roof of one of the small snow houses. This was above the level of any obstruction, so it did not get drifted up, since the drift blew past it. For a door I made use of a ration box, packed round with snow. This was a much more satisfactory entrance. During January, the main house got drifted up, and frequently ominous cracks and groans made themselves heard, but, although the walls bulged inwards a lot, nothing collapsed.

By the end of January, as no aeroplane had turned up, I assumed the Moths could not get up to the station, and became resigned to waiting for the spring. I had considerable difficulty in getting the spare paraffin and food into the house. There had been no room for these until the first supply had become exhausted, and when I wanted them I could not find them. After protracted exploratory diggings lasting several weeks they were at length found 6 ft. under the snow, and brought in. The small snow houses gradually caved inwards from the weight of the snow on the top of them, but they never actually collapsed, which was a good thing, as they were my only means of getting out. The partial collapse of one of them buried one of the ration boxes. It took a long time to extricate it, since all the snow had to be cut or chipped with a knife, and emptied outside with a biscuit tin.

On the night of March 19, a gale got up from an unexpected direction. A small hole was blown in the packing round the box which closed my bolt-hole, and very soon there was a jet of fine drift blowing in as if from a high-pressure hose. By the morning the small snow house was completely filled, and exit through it impossible. Accordingly I cut a hole in the roof of the other snow house, and after excavating a shaft about 5 ft.



THE ICE-CAP STATION

in length, the open air was reached. The difficulty was then to close this exit against the next gale. The shaft was too long to reach up from inside, and pack snow round a box covering the hole, as had been done with the previous exit, so the shaft was shortened by digging a hollow from outside. As I feared, a gale immediately started blowing, and drifted up the hollow, thus putting a weight on the closing box, more than it was possible to move. This occurred on March 22, and put an end to further sallies outside, and therefore to the meteorological observations.

There were several aspects of this situation which occurred to me when I realised that I should no longer be able to get out. I will not deny that at first I was anxious about the safety factor. There were three things I was afraid of:

(1) that the air would become vitiated by reason of there being no possible entry for fresh air, and only an exit in the shape of a 2-in. ventilator in the roof of the tent house;

(2) that the accumulating drift of snow on this roof would crush the tent, now that I could no longer clear it away;

(3) that since I could no longer keep a look out, the relief party might miss the station.

The first anxiety was soon dispelled by the air continuing perfectly fresh. This may have been due to a down current through the ventilator, as well as an up current, or more probably from air coming in through the snow walls of the tunnel and side houses. The second anxiety was already partly dispelled by the fact that the snow level had almost reached the top of the tent, and it had stood the strain: though not without many uncanny noises and bulgings inwards. It was, therefore, unlikely that much more would accumulate, since, once it was a level surface, the drift would blow past. For the third I trusted to the Union Jack on its pole, and the navigation of the relief party. I did not think that the route flags, which, at half mile intervals, marked the trial to the base, would be snowed under completely, as in fact they were, although it was always a great anxiety, when one heard the wind roaring overhead, that a party might have got into difficulties through starting too early. There was, therefore, nothing to worry about as far as personal safety was concerned. It was clearly futile to get anxious, when by no possible endeavour on my part could I make any difference to the course of events.

A more unsatisfactory matter was the cessation of the weather record. A man dislikes changing his habits, and this business of the weather had

become a very absorbing habit. So long as one could keep up the observations, one felt that, however vague and academic, some useful purpose was being served. But now that I was prevented from doing my job I naturally felt that I was wasting time, and throwing away an opportunity not likely to occur again. These records were the only results the station would have to show, and, if they were not kept, all the enormous effort of getting the supplies and men up there would be wasted. However, all I could do was to keep a record of wind force estimated from the noise outside, and of pressure readings from the barograph.

The food situation was also becoming interesting about this time. When I first took over the station I had, of course, to decide on the scale of rations of food and fuel I was going to keep to, and for this purpose it was necessary to estimate a date of relief. One way would be to choose the latest possible date, which would allow a very small ration indeed, with the probability of a large amount of the supplies being left over. This would have been the safest course, but for various reasons I did not take it. In the first place I do not like rationing. I prefer, in fact, to eat my cake rather than have it. "Carpe diem" was a tag which served as an excuse whenever I felt hungry. Another reason was that I needed a large amount of fuel to begin with, for drying clothes and for reading. I therefore assumed March 15 as the date of relief, and scaled my rations to last till then, leaving a small amount of the less palatable necessities, and a bare allowance of fuel for cooking after that.

It was, therefore, all according to plan when stores began to run out. The paraffin supply, especially, got short, owing to leakage. This was very tiresome, since I had to spend more and more time in the dark, and the house got considerably colder without the lamp to give heat. The food problem solved itself, since one's appetite becomes very small if one takes no exercise, and an allowance of half a pound a day proved ample towards the latter part of my stay.

One very pleasant feature of this forced inactivity was when I could hear a blizzard tearing overhead, and knew that I would not have to dress up, and go out into it, with the sequel of undressing again and thawing myself out. Occasionally I used to crawl through the tunnel into the sealed snow house, and do some excavation in the roof. This was a very slow job, as it had to be done with a pocket knife on snow which had turned to ice and taken on the consistency of concrete. I did this as a precaution in case no relief arrived before the food ran out, so that I should be able to get out and, after a week or two of gradually increasing

exercise, to walk back to the Base on a compass course. Actually, it would have taken several weeks to cut my way out, since I could only work for an hour or two at a time. This tunnel crawling was not an easy matter, since the snow used to collect on the floor of the tunnel, and get compressed by the pressure of crawling through it, making it smaller and smaller. Many times I got stuck for some considerable time in this tunnel, but always managed to wriggle one way or another eventually.

By the middle of April there was no more light, luxuries had run out, and the comfort of the house was much reduced. Tobacco was completely exhausted, so tea was used as a substitute. Food consisted of a little oatmeal, just warmed up for breakfast, and, thereafter, uncooked pemmican, biscuit and margarine. The most unpleasant part was the frozen condensed moisture which covered the whole inside of the tent, which, hanging down in long icicles from the roof, used to drop off in one's face. It also condensed inside my sleeping bag, and so froze up any part of it that I was not in contact with. I tried various substitutes for light: paper, string, ski wax, etc. None of them were satisfactory, though a lamp made of string in a tin of ski wax was the best, and would last a few minutes if carefully tended.

The only external incident of interest which happened during the time I was there was the occurrence of a curious and very terrifying phenomenon, of which I have been unable to find an explanation. It was a sound beginning as a distant rushing noise, which rose quickly in a crescendo to end in a crash, rather as if an avalanche had buried the house. It happened twice, in February and in April.

The shortage of fuel made drinking a difficulty, but it was found that, though laborious, sucked snow was perfectly satisfactory.

I am often asked what I did in my spare time, but there is really not very much to say about it. I had no gramophone and, I am glad to say, since we had abandoned it on the way up, no wireless. For the first month or so I was very averse to the least noise. The complete silence all round seemed to urge one to keep in tune with it by being silent oneself. After a time I got over this, and used to get great satisfaction out of a sort of singing. All the time I was not sleeping, and while the light lasted, I used to read, or draw plans of boats, dinners, meteorological instruments and other things. My own library consisted of only one book, as I had not expected to be staying when I set out from the Base; but fortunately my predecessors had left a very good assortment. The ones I remember enjoying most were: *Vanity Fair*, *Guy Mannering*, *Jane Eyre*,

The Forsyte Saga, *The Master of Ballantrae*, and *Whitaker's Almanack*. There were times when the Bible made very good reading.

One fact which I have not yet mentioned, but without which this article would not be complete, was the curious growing feeling of security that came to me as time passed. Many doubts presented themselves to me at the start, and for a while they grew in number and in weight. But, as each month passed without relief, I felt more and more certain of its arrival. By the time I was snowed in, I had no doubts on the matter, which was a great comfort to my mind. I will not attempt any explanation of this, but leave it as a fact, which was very clear to me during that time, that while powerless to help myself, some outer Force was in action on my side, and that I was not fated to leave my bones on the Greenland ice-cap.

On May 5 the Primus gave its last gasp. A few minutes later an extraordinary scraping and scratching sound was heard overhead, which turned out to be the relief party. On being extricated I found that I was perfectly all right, except for a slight feeling of weakness due to the lack of exercise. However, I was able to walk slowly, and in the following days quickly recovered my full strength.

If there are any useful conclusions which I can draw from this experience, they are these:

(*a*) It seems to me that there is no objection to leaving a man alone, provided that:

(1) he volunteers for the post himself;

(2) he is certain of the strength of his house, of his food supply, and of his ultimate relief;

(3) he has plenty to occupy his mind.

(*b*) I consider that a man for this purpose should have an active, imaginative mind, but not be of a nervous disposition.

(*c*) It should be remembered that the remotest risks become, by brooding on them, grave dangers; so that every element of doubt should be eliminated by providing alternative plans for any emergency. If this is done there is no reason why any normal person should not live in perfect peace of mind for an indefinite period.

(*d*) A further important point to be considered is that, if the outside world is to hear of the plan of leaving a man alone, as now, with wireless, is unavoidable, it must also be provided with information as to arrangements for his safety.

The following suggestions as to the fitting out of a station might be useful. The house should be of the "igloo" type, built of snow blocks, with a canvas tent, similar to the one described, inside. The entrance should be through the roof of a smaller snow house connected by tunnel, and it should have a good trap-door with no cracks in it, to be secured from the inside. The rations should be as varied as possible, and contain every need that the body requires, with, of course, an antiscorbutic, such as lemon juice. There should be a plentiful supply of books. For heat and light an Aladdin paraffin lamp is excellent, and a Primus stove for cooking. A good tall landmark should be erected for finding the station. No instruments should be more than a few feet from the house unless a life-line is rigged, as there is danger of getting lost if the weather is bad.

ANTARCTIC REGIONS

The season 1931–32 in the Antarctic has been a barren one as far as exploration is concerned. We can print below merely the reports of the work carried out by the ships of the *Discovery* Committee, and a brief statement of the whaling activities.

During the first six months of 1932, however, plans have appeared in the press of at least three projected expeditions to the Antarctic continent proper, though, at the time of writing, it seems that only one is likely to go during the present year.

Rear-Admiral Byrd expects to leave the United States in September 1932, bound for the Ross Sea. He had bought the *Bear*, famous as one of the relief ships of the Greely party 60 years ago, but his plans, as published, will require the use of at least one other ship. Full particulars of this expedition have not yet appeared, but apparently another flight to the South Pole is contemplated, as well as the establishment of an advanced base in the Queen Maud Mountains, mapped by Professor Gould on the last Byrd Expedition.

Another American, Mr Lincoln Ellsworth, proposes to attempt a flight from the Bay of Whales across to the Weddell Sea and back again, with Bernt Balchen as pilot. The expedition would not winter, and could have no other purpose beyond the flight. It seems likely that this expedition will not go until 1933.

A third expedition, whose detailed plans were published, was that of Mr H. G. Watkins, but this, to the great regret of his supporters, has had to be abandoned, on account of lack of financial support. The plan was, briefly, to cross the Antarctic continent by dog sledge from the Weddell Sea to the Bay of Whales. Expert opinion considered the journey possible, though difficult; in fact, it would have been unique in many respects, for other journeys to the South of approximately the same distance have always been made with the help of depots established on the way out, and picked up on the return. By dint of careful planning, Mr Watkins had reduced the estimated total cost of this expedition to about £10,000, but he found it impossible to raise this sum, and has abandoned the whole plan for the time being.

The Work of the Discovery II, 1931–32

As announced in *The Polar Record*, No. 3, the R.R.S. *Discovery II* has been at work in the region round the South Shetlands and off the coast of Graham Land, during the season of 1931–32. The ship, with a crew of fifty-one, was commanded by Captain Carey, R.N. (Ret.).

On leaving England on October 3, 1931, the ship touched at St Vincent, and then spent a short time round the Falkland Islands, continuing her voyage later to the Strait of Magellan. Here various investigations were made before proceeding into the Weddell Sea, south of 70°, where, in January 1932, she met with fairly open water. On turning north once more closer pack ice was met with, and the ship sustained considerable damage. Her rudder stock of steel, over 12 in. thick, was badly twisted, and a hole made in a plate in part of the ship's bottom where the fuel-oil hold was. Luckily, although the oil in this hold was lost as a result, there was enough left to enable the ship to reach Simon's Town where the necessary repairs were carried out, being completed by the beginning of April, when the *Discovery II* resumed her voyage. The Antarctic winter of 1932 will be spent in circumnavigating the South Polar continent. The expedition will touch at Tasmania, Western Australia, and New Zealand on the way to the Falklands, and will return to England in 1933.

THE WORK OF THE *WILLIAM SCORESBY*, 1930–32

By E. R. GUNTHER, M.A., F.L.S.

[It will be remembered that the *William Scoresby* is one of the three research ships under the *Discovery* Committee regularly at work upon the life history of whales in the Antarctic. The following article by the chief of the scientific staff of the *William Scoresby* shows how the researchers are led far from Antarctic waters in securing the data required for a complete study.]

The Royal Research Ship *William Scoresby* left England in November 1930 and returned to Falmouth on June 1, 1932. On this, her third commission, she carried out successfully three items of work on the *Discovery* Committee's programme: surveys of the southern whaling grounds, of the Humboldt Current, and of the Falkland Islands fishery grounds. Her total complement of twenty-one included two scientific and five other officers and on recent cruises she has worked 351 stations. Mr E. R. Gunther was in charge of the scientific work, with Commander T. A. Jolliffe, R.N. (Ret.), in executive command.

Her work during the Antarctic summer of 1930–31 in co-operation with the *Discovery II* lay in the whaling grounds; off South Georgia, the South Sandwich Islands and in the neighbourhood of the pack as far south as 68° 51′ S., at a point some 200 miles off the Caird coast. Pack ice during this season, as already mentioned in the last number of *The Polar Record*, was unusually far north, and, although it forbade approach to the South Sandwich Islands before January, it enclosed a vast area of open water where whales were few and plankton thin as compared with the richer conditions obtaining along the ice edges. As might have been expected from these ice conditions, the South Georgian whaling season had had a most prosperous beginning. Diatoms were found in exceptional quantity, and *Euphausia superba* (Kril), the staple whale food, was observed at the surface in dense swarms, which imparted a reddish or ochre discoloration to the sea. These swarms are a very striking feature of the plankton, and full advantage was taken of the exceptional opportunities for studying them in close detail. The Kril in these swarms is so densely packed in serried ranks that other macroplankton is excluded from their midst, which helps to explain how it is that whales manage to feed ex-

clusively upon this one species. The work in these grounds was designed to supplement the biological and hydrological observations carried out by the *Discovery II*, and, as far as weather permitted, attempts at whale-marking were also undertaken.

From May to September the ship turned towards the west coast of South America to investigate the nature, and particularly the breadth, of the Humboldt Current throughout its length*.

Navigators have frequently experienced a northerly current off this coast, and especially off Peru, and, in 1803, Alexander von Humboldt noted the presence of cold water close inshore off Valparaiso. From this it was assumed that the Humboldt Current was a northward branch of the circumpolar Antarctic drift, and, although this has long been shown not to be the case, evidence of the fact has been drawn almost entirely from surface observations. A study of the hydrology of the deeper water layers is essential to a proper understanding of the Humboldt phenomenon, and no ship with suitable up-to-date instruments had made these observations prior to the visit of the *William Scoresby*.

It was found that the main importance of the Humboldt phenomenon lay in its effect upon the climate of Peru and Northern Chile and upon the marine life, whose extreme richness colours the waters of the Humboldt variously green, chalky green, olive, brown, red, orange and yellow and gives rise to two industries of economic importance—the whale fishery of Chile and the guano industry of Peru.

Looked at from the point of view of dynamic drift, the Humboldt Current was at the time of the survey weak and exceedingly variable. This is apparently due to the fact that the Humboldt does not obey the laws of a current in the accepted sense. It does not flow continuously along its course, as do ordinary currents like the Gulf Stream, the Guinea Current or the Equatorial Currents. The Humboldt may be likened to a long chain of springs, which well up from the deeper water along the South American coast. The cause of upwelling is traced to the south-east trade winds, which blow the surface water away from the shore in a north-westerly direction, and the drift so formed, influenced by the earth's rotation, spreads farther westwards.

Its genesis occurs, therefore, whenever and wherever along the coast

* It has been erroneously recorded in our issue dated January 1931 (No. 1, p. 26) that the *William Scoresby* left London on October 28, 1930, and that the ship was to winter off Africa. It may be convenient here to mention the correction. The ship left London on November 4, 1930, and spent the following winter off South America as described.

the south-east trade causes upwelling of the deeper layers. Deep waters are cool, and the Humboldt is consequently a thin ribbon of cold water which, having been drawn to the surface close inshore, is blown by the trade winds northward and westward. The current is most pronounced where the coast has a north-westerly trend, as off the Peruvian coast at Mollendo and off the Sechura district. The stronger the wind the better the drift, the more vigorous the upwelling, and the cooler the inshore water. On spreading westward it cools the water of the open ocean with which it mingles. It has no well-defined edge and its breadth was therefore difficult to determine. Its cooling influence on adjacent oceanic water was spread well over 150 and 200 miles from the coast. When the wind drops the current and the cold water vanish, as they had done off many parts of the coast at the time of the *William Scoresby's* visit.

The consequent cooling of the air in these regions has a peculiar effect upon the climates of Northern Chile and Peru. The cold south-easterly trade winds blowing across the Andes, instead of meeting the moisture-laden air arising from the warm Pacific, and thus producing rain, meet instead air cooled by the Humboldt Current, and, in consequence, the climate is dry and the land arid and sandy. The nitrate beds of Antofagasta and Iquique are dependent for their preservation upon centuries of drought and complete absence of rain from this area for scores of years on end. Advantage of this is taken in the use of adobe (mud) for the construction of houses and buildings.

The abundance of plankton off this coast, as well as small fish, sharks, bonito, giant squids, birds, porpoises and whales, is correlated with the high percentage of nutrient inorganic salts in the deeper layers, which through upwelling are brought to the surface within range of light. Of these the phosphates, which appeared most likely to yield promising results, were examined by Mr A. H. Laurie, who throughout the whole course of the survey carried out analyses while at sea, and within a few hours of collecting the samples. Moreover, in addition to the rich supply of nutrient salts that are thus made available to the phytoplankton, two other conditions unusual in the tropics combine to make an ideal environment for diatom growth: the cool temperature, and the continually overcast sky which allows only a diffused illumination.

At two points off the coast diatoms vied with the Antarctic species in their numbers and clogged the nets: *Corethron* sp. and *Chaetoceros* sp. off Cape Carranza, and *Chaetoceros sociale* off Punta Aguja. The collections made at some 150 stations off this coast indicate the existence of a suc-

cession of predominant species from latitude to latitude and from littora to oceanic waters and suggest also that the species show annual changes or irregularity in their abundance.

The dependence of phytoplankton upon upwelling and consequently upon strong winds was illustrated off Callao and at other points where stagnant hydrological conditions were attended by a paucity of diatoms. Off Callao a second series of observations carried out 7 weeks later, after a period of strong winds, showed that marked upwelling had taken place, had cooled the surface waters, and had been attended by an increase in the phytoplankton. The causal relation between wind and the Humboldt phenomenon appeared here to be beautifully illustrated.

Upon the rich substratum of phytoplankton subsists an equally rich animal community and it was interesting to find that off Chile, where whales have been successfully hunted, the genus *Euphausia* is not only more abundant, but took a more important place in the plankton than off Peru. On the other hand, as regards the bulk of the average plankton catch, conditions were reversed: the plankton off Peru was by far the richer, and supports dense shoals of anchovy upon which subsists the densest bird population in the world. Gannets, pelicans, and especially shags appear to occur in hundreds of thousands, and, swimming shoulder to shoulder on the water, their flocks look like black rafts; when disturbed from their rookeries they darken the sky. Through the guano deposits they have been acclaimed as the most valuable bird in the world.

It sometimes happens in the summer months (December to February) that off Northern Peru a north wind supplants the south-east trade and drives hot equatorial water (28° C.) southward over the Humboldt. The hot moisture-laden air condenses in deluges along the Peruvian coast, and washes away buildings and the soil which is parched and dry and unprotected by vegetation. Effects in the sea are as catastrophic. The hot southerly current, which has come to be named "El Niño" after the nativity festival, is driven southwards and raises the temperature of the Humboldt water, which it overruns from the Gulf of Guayaquil to as far as Callao or even Pisco. The Humboldt plankton, unable to withstand the sudden rise in temperature, dies wholesale. The fish die too. The shags wander south in search of food, and desert their rookeries, and their young are left to die in thousands from starvation. Further, the stench of sulphuretted hydrogen evolved from their decomposing bodies becomes an unspeakable nuisance to the neighbourhood, and even blackens the paintwork of anchored ships.

A survey of the Falkland Islands fishery resources has occupied the last six months of the commission. Preliminary surveys carried out in two other seasons, in autumn 1927 and winter 1928, had established the fact that hake and other marketable fish occur upon the extensive plateau of less than a hundred fathoms of water which lies between these islands and South America.

During the present survey, carried out in spring and summer months, a commercial trawl has been fished at some 80 stations placed between the ten degrees of latitude from 43° S. to 53° S. Supplementary collections with a small beam trawl, the Russell net for catching demersal plankton, other plankton nets for fish eggs, larvae and associated organisms and the usual observations upon stomach contents of the fish, their sex ratio, length measurements and weight were part of the routine, and have produced a mass of information yet to be worked up. Work of this nature has been unremitting, and it has been impossible to reach an early conclusion on the interpretation of results. For although the weather around the Falkland Islands lacks the severity of the cold of the sub-Antarctic zone, the Falkland Islands are situated in a district where a heavy swell and winds are frequent, and a trawl catch involves a great deal of hard work before the personnel are ready for the next station and the net can be shot again. Mr G. Rayner, who shared in the tasks of this survey, has made faunistic notes upon the more interesting organisms, including a study of the two Galatheid species, *Munida gregaria* and *M. subrugosa*. Considerable confusion has existed in the past over the identity of these closely allied species. Both were found in quantity and contribute largely to the food of the fish, but whereas *M. subrugosa* appears to undergo the complete life cycle near the sea bottom, the juvenile stages of *M. gregaria* swarm near the surface, imparting a red discoloration not dissimilar to Euphausian patches. Moreover recent evidence has shown that in this locality it constitutes whale food.

Mr Rayner added the observation of cetacea to his duties, and secured a photograph of an albino *Globicephalus melas*. He also harpooned two dolphins: one of them probably the common *Phocaena posidonia*, while the other is an unfamiliar species whose distribution is restricted to Magellan Strait.

ANTARCTIC WHALING SEASON, 1931–32

We are indebted to Captain H. K. Salvesen for news of the whaling activities down south during the season of 1931–32.

Owing to the depressed state of the market for whale oil, whaling operations in the Antarctic were very limited during the season of 1931–32. Ships employed, and results, are tabulated below:

South Georgia	No. of whale-catchers	Barrels whale oil	Whales					Standard blue*	Barrels per standard blue†
			Blue	Fin	Hump-back	Sperm	Sei		
Land stations:									
(1) Grytviken	6	48,700	208	635	0	2	5	527	92
(2) Leith Harbour	6	73,500	230	1100	6	8	11	787	93½
Floating factories:									
(1) *Saragossa* (2) *Sourabaya* (3) *Salvestria*	17	326,000	2516	706	19	3	0	2876	113½
(4) *Southern Empress* (5) *Southern Princess*	16	About 360,000							
(6) Southern Whaling & Sealing Co.		356,940	3561	461	161			3845	92⅔

* 1 Standard blue = 1 Blue = 2 Fin = 3 Humpback = 3 Sperm = 5 Sei.

† The potential production per standard blue whale at South Georgia is much smaller (probably 20 % to 25 %) than that of the floating factories in the ice, where whales are more mature, and fatter, and are brought fresher to the factory.

The five floating factories operated in the area between 55° W., and 65° to 80° E. The main feature of the season was the very early disappearance of the pack ice. In the area between 20° W. and 20° E. pack ice may be expected lying about 60° S. till about the middle of January, after which date it usually disappears rapidly from the whole area, except close to the mainland. This season the ice disappeared entirely about December 20, and after that date no pack ice was seen (except close to the mainland) between 49° E., where there was no pack ice, and 30° W., where pack ice was found. Further, the pack ice entirely disappeared in the north-west corner of the Weddell Sea. In the middle of February the edge of the ice stretched approximately from 32° W., 58° S., to 40° W., 65° S. There was no ice at all between this line, and the northern end of Graham Land. At a position about 54° W., and 64½° S., on February 21, the *Saragossa* reported no ice in sight, and heavy swell

from the south*. In her Master's opinion there would have been free access to the south-west corner of the Weddell Sea. New ice was forming along the coast, and it was in this that he was operating. Normally, at that time of the year there is heavy ice at about 64° S., which works north and west till it closes the Bransfield Strait.

All Antarctic whaling companies, with the exception of The Southern Whaling and Sealing Co. and A/S *Laboremus*, entered into an agreement for the season 1932–33, by which each company has accepted a quota in terms of standard blue whales, of which a maximum of 17,560 are to be killed during the season. To this will have to be added the catch by factories not accepting the quota, namely, the *Southern Empress* and *Southern Princess*, and the *Roald Amundsen* if she operates.

The original intention was to determine the quota of each company in terms of barrels, but as, unfortunately, production costs per barrel over a season are lower with a relatively low average production of oil per standard blue whale (80–90 barrels) than with a high average, this would have resulted in the direct encouragement of waste, and therefore of a less restricted slaughter of whales. The insistence of a British company, however, resulted in the determination of a quota in terms of standard blue whales. The total production of each company will depend, therefore, upon its output from each whale, and every effort will be made by managers at home, and by the personnel of the factories and whale-catchers (the amount of whose bonus depends upon the total number of barrels produced), to secure every drop of oil from every whale.

* This position is about 80 miles due east of Snowhill Island, and was ice free when visited by Captain Larsen in the *Antarctic* in February 1902.—ED.

RECENT POLAR BOOKS

The following books recently published have come to our notice:

CHAPLIN, Lt.-Cdr. J. M., R.N. *Narrative of Hydrographic Survey Operations in South Georgia and the South Shetland Islands*, 1926–30. Cambridge: At the University Press, 1932. *Discovery Reports*, Vol. III. Pp. 297–344, Plates XL–XLIV, Charts 1–4. $9\frac{1}{2} \times 12$. Price 10*s*.

ELLSWORTH, LINCOLN. *Search*. Foreword by GILBERT H. GROSVENOR. New York: Brewer, Warren and Putnam, 1932.

FERGUSON, HENRY. *Harpoon*. London: Jonathan Cape, 1932. $8\frac{1}{2} \times 5\frac{1}{2}$. Pp. 272. 7*s*. 6*d*.

HOUBEN, Professor H. H. *The Call of the North*. Translated from the German by H. J. STENNING. London: Elkin, Mathews and Marrot, 1932. Illustrations. 15*s*.

VILLIERS, A. J. *Sea-dogs of Today*. London: Harrap and Co., 1932. (Contains a biography of Captain C. A. Larsen.)

WELSL, JAN. *Thirty Years in the Golden North*. London: Macmillan, 1932.