

in the irregular variations at distant stations, there must be correlation at stations close together, and it is important to determine limits of distance. By the photoelectric method this should be comparatively quick and easy.

#### BIBLIOGRAPHY.

The work here described is discussed somewhat more fully in *Proc. Roy. Soc. A*, vol. 119, p. 11,

1928. The figures are here reproduced by kind permission of the Society.

See also on some points earlier papers—*Proc. Roy. Soc. A*, vol. 106, p. 117 (1924), and *Proc. Roy. Soc. A*, vol. 109, p. 428 (1925).

The results of these earlier papers are, however, in part superseded.

A paper on *Visual Observations of the Aurora Line in the Night Sky* appears in *Gerlands Beiträge zur Geophysik*, May 1928.

## Oceanographic Observations between Greenland and North America.

By DONALD J. MATTHEWS.

THE history of the exploration of the seas between Greenland and America begins in the year 982, when Erik the Red founded on the south-west coast of Greenland the Norwegian colonies which were abandoned about the end of the fourteenth century. To oceanographers, the interest of this episode lies in a suggestion by Otto Pettersson that such voyages could not have been made in the open ships of the Norsemen unless the ice conditions had been much more favourable than they are now, and that the colonies were eventually abandoned because the climate had become more severe. The second stage in the exploration was the series of attempts to find a Northwest Passage, which came to an end with the discovery of Baffin Bay in 1616, and the third brings us down to the present time and includes the whaling voyages, the Danish voyages of discovery along the Greenland coast, and modern Arctic exploration. The reports of the ice masters contained a great store of information as to the general set of the currents and the distribution of icebergs and sea ice, but little else of oceanographical value, and in particular they throw no light on the cause of the great variation from year to year in the amount of ice which drifts southwards to the trans-Atlantic traffic lanes.

The circulation of the water is fairly simple. The East Greenland Current flows south and west to Cape Farewell, round which it turns to the north-west under the directing force of the earth's rotation and the density gradient across the coastal fringe of lighter water. It then becomes the West Greenland Current and flows northwards, probably as far as Melville Bay; according to some oceanographers, however, it does not penetrate beyond Disko Bay, and the northerly coastal current in Melville Bay is of the nature of an eddy. No east coast bergs are found on the west coast north of Julianehaab, about 100 sea miles beyond Cape Farewell; and in the Godthaab region, in about 65° N. lat., the cold current comes in contact with a warmer salter Atlantic current, in which the last of the sea ice melts. There appears to be a tendency for the current to spread westwards on the surface in these latitudes, but it carries no ice with it. Much less is any ice carried south-westwards from Cape Farewell to Newfoundland by a direct extension of the East Greenland Current, in the way shown on some of the older charts,

with complete neglect of the necessary effect of the earth's rotation.

In Baffin Bay there is a northerly set on the east side in Melville Bay with many bergs, and westwards of this two great southerly drifts of heavy ice which are derived from Smith Sound, the western Sounds, and from Melville Bay, which are known as the Middle Ice and the West Ice. Between them, at the head of Baffin Bay, lies one of the most interesting features of these regions, an open space called the North Water, said never to freeze over, and generally attributed to a current of warm salt Atlantic water welling up from below. The Middle Ice and the West Ice unite at the northern entrance to Davis Strait, and as the Labrador Current flow south and east along the continental shelf of the Labrador coast as far as the Tail of the Grand Banks.

Little is known of the oceanography of these waters. The *Scotia* and the *Chance* have shown that the current on the Labrador coast is confined to the shallow water of the continental shelf, and that to the eastward of it lies warmer and salter Atlantic water in which the lines of equal density are horizontal, as if the water were at rest, at least so far as density currents are involved. This is somewhat remarkable, since there must be a continual movement northwards to compensate for the water removed on the outer edge of the Labrador Current, and in any event it is known that this water, or at least a similar water, dives under the fresher and colder surface layer in about the latitude of Cape Farewell and flows over the ridge in Davis Strait as undercurrent at a depth of 125 metres. In Disko Bay it is found at 200 metres, and at 250 metres in Melville Bay. In the north of Baffin Bay it meets the rising bottom at the entrance to Smith Sound, and is forced upwards to form the North Water and feed the Middle and West Ice. The permanent existence of such a warm layer between two colder ones necessitates a permanent northward flow from the open Atlantic.

The currents described account for the general trend of the movements of the ice but do not explain their changes. In 1906, Mecking published a discussion of the material then available from the years 1888 to 1896. According to his results, the bergs are for the most part formed in the Disko region, on the west coast of Greenland

north of Davis Strait, and are set free in the summer. If the barometric gradient is such as to set up strong east winds in this region, the bergs are blown across to the Labrador Current, which carries them southwards so as to reach the waters south of Newfoundland in the following spring and summer, with a maximum in May and nearly as many in June. If, on the other hand, the wind is weak or deviates much from east, the bergs either are held up near their birthplace or else they wander northwards to Melville Bay, where they may drift about for years before they break up or are carried over in to the south-going Middle Ice.

A favourable summer gradient in the Disko region is thus necessary for a rich berg season in the following spring, but it is not sufficient by itself. The bergs are off Labrador during the winter months, when the mean wind is parallel to the coast in a south and east direction. If there is an on-shore component in the wind the bergs may

the summer gradient in the Disko region. They consider that the sea ice on the Labrador coast acts as a fender which keeps the bergs from grounding and gives rise to a rich ice year; bergs and sea ice therefore vary in the same way, but not for the reasons given by Mecking. Methods of forecasting the amount of berg ice depending upon the use of an equation into which the gradient enters, and also upon reports of field ice, have been devised and are being tested.

Lieut.-Commander E. H. Smith, of the U.S. Coast Guard, has been oceanographer of the International Ice Patrol for many years, and has worked out recently, on the lines laid down by V. Bjerknæs, Helland-Hansen, and Sandström, a remarkable system of forecasting the drift of the bergs on the Tail of the Banks. The salinity of the water samples collected at a number of positions and depths down to 750 metres is determined on board by an electrical method, and from these and the temperatures are calculated the density and the height of the surface of the water above the layer, assumed to be at rest, at which the pressure of 750 decibars occurs and which is at a depth of nearly 750 metres. These heights are plotted on a chart, and the resulting contour lines are drawn for intervals measured in millimetres; they correspond to the isobars of a weather chart, and for all practical purposes are the stream lines which the bergs follow. This method is still under test.

The work of the Ice Patrol is confined to the water south of Newfoundland, but now that the ice season on the traffic lanes is over for the present year, Lieut.-Commander Smith is at sea in command of the *Marion* (Fig. 1), making oceanographical observations and soundings in the region

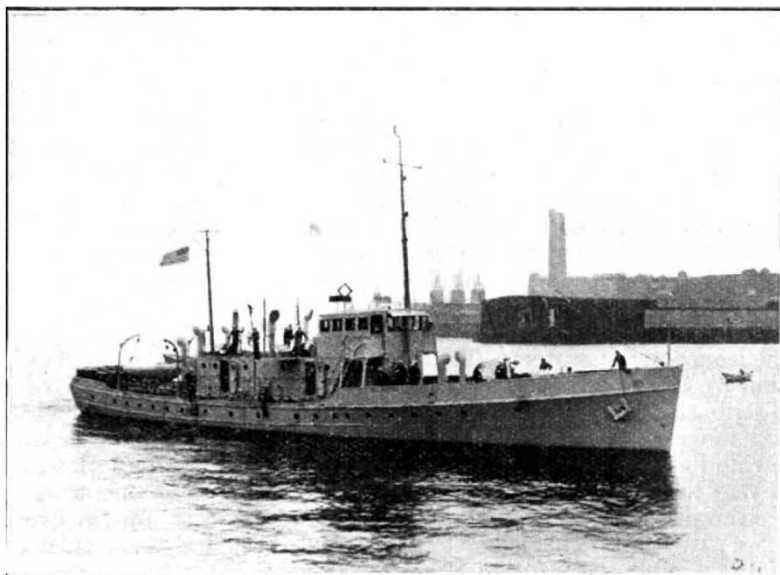


FIG. 1.—The U.S. Coastguard Patrol Ship *Marion*.

strand or be held up in the pack along the coast, so that they reach the traffic lanes late or very probably not at all. An off-shore component, on the other hand, keeps them in the strength of the current, and a rich ice season follows. The wind affects the field ice on the Labrador coast in the same way, but earlier than the bergs, and Mecking pointed out that it should be possible to make forecasts concerning the bergs from the amount and movements of the pack earlier in the year.

The officers of the U.S. Coast Guard engaged on the International Ice Patrol which was instituted after the loss of the *Titanic* in 1912, have recently repeated Mecking's work with the assistance of the Meteorological Office and the U.S. Weather Bureau, making use of a much larger number of observations. A preliminary report shows that they attach more importance to the winter barometric gradient on the coast of Labrador than to

between Greenland and America south of Davis Strait, and working in close co-operation with a Danish expedition in the *Godthaab*. His ship, a coast-guard patrol vessel, is 125 feet in length, has twin screws with Diesel engines, and a radius of action of 3000 miles at 10 knots. She is well equipped for oceanographical work, and carries an echosounding machine, the fathometer, which allows soundings to be made at short intervals without stopping the ship, and also with wire sounding gear for controls and for collecting samples of the bottom. She will be at sea for two months, during which it is hoped to cover 4000 miles on zigzag courses. Lieut.-Commander Smith has a nearly clear field for his work and should be able to make large contributions to oceanography. In particular, he should be able to obtain dynamical sections across the whole area, from which it should be possible to deduce the currents, and especially the strength of the undercurrent in Davis Strait.

Other interesting problems relate to the warm water which meets the cold current near Godthaab, the reason why the west coast is so favoured climatically in comparison with the Labrador side, and the drift of the bergs in the Disko region. Finally, there is the whole subject of

the depth and geological history of the basin. The results will be awaited with keen interest. The *Marion* is equipped with a short-wave wireless outfit, and it is hoped to keep up communication with headquarters through the help of amateurs.

### News and Views.

THE report of the Council of the British Association for 1927-28 refers to the meeting to be held in South Africa next year. Mr. O. J. R. Howarth, secretary of the Association, has recently visited South Africa and conferred with the authorities there, with the result that the following provisional arrangements have been made:—CAPE TOWN, July 22–July 28–29. Inaugural meeting, July 22, at which it is proposed that the president of the South African Association should address the meeting first, and that the new president of the British Association, Sir Thomas Holland, should then be installed, and reply. Sectional meetings, mornings only, July 23–26. Evening discourse, public lectures, excursions, etc. Call at Kimberley, July 29–30. JOHANNESBURG, July 30–31–Aug. 4. Presidential Address, July 31. Sectional meetings, mornings only, July 31–August 3, and other arrangements as above. PRETORIA—Sectional transactions, etc., as appropriate in connexion with the co-operating congresses; continuing to Aug. 7. After the meetings, extended tours through the Union, to Victoria Falls, Rhodesia, Lourenço Marques, etc., as to which members will be afforded opportunity to indicate their preference.

It is proposed that in consideration of a grant by the South African Association to the British Association of a sum not exceeding £500 and reckoned at £1 per head of the number of persons involved, the British Association should admit to membership members of the South African Association in good standing down to June 1929, entitling them to attend the meeting and receive the report if desired. From 300 to 400 members are expected under this category, and the arrangement resembles that made in 1905. An offer has been received from the Rhodes trustees, and has been gratefully accepted by the Council, to make a grant of £200 towards any further authoritative investigation at the ruins at Great Zimbabwe undertaken in connexion with the South African meeting. A generous invitation has been received from L'Association française pour l'Avancement des Sciences, and from the City of Le Havre, for members unable to take part in the South African meeting to attend that of the French Association in Le Havre, as was done in 1914.

THE British Association, like the great majority of scientific societies, has been unable to recover income tax previously remitted upon income from invested funds. The cases regarded by the Inland Revenue authorities as test cases upon the liability of societies to taxation (Geologists' Association; Midland Counties Institution of Engineers) have been decided against the societies by the Special Commissioners and in the High Court of Justice. The Council is

informed that appeals against these decisions have been lodged. An article upon this subject appeared in the issue of NATURE of Aug. 25. The treasurer of the Association points out in his report that by those decisions the Association is deprived of one-fifth of the income derived from invested funds.

BENMORE and Puck's Glen, a charming region of mountain and stream at the head of Loch Fyne in Argyll, has been given by Mr. Harry George Younger of Benmore to the Forestry Commission acting on behalf of the nation, as recorded in our issue of July 21 (p. 105). It is a handsome and appropriate gift, for the former bare valley had been transformed into a forester's paradise where native and foreign trees grow in great variety and luxuriance, by a former owner, James Duncan of Benmore. Mr. Younger built upon his predecessor's foundation, with the result that Benmore seems destined to be the chief training, experimental, and démonstration area for State forestry in Scotland. Its importance is enhanced because it borders on properties already in the hands of the Forestry Commission. The Commission has decided to hold a formal ceremony at Benmore on a most appropriate occasion. On Saturday, Sept. 8, the Botanical Section of the British Association will make a special excursion to the property, and in the presence of representative botanists of this and other lands, the Right Hon. Sir Herbert Maxwell will dedicate a memorial to the late Sir Isaac Bayley Balfour, in recognition of his lifelong service to arboriculture. Puck's Glen, a mountain gorge full of beauty in itself, affords magnificent glimpses of the wonderful scenery of the district, and the finest view point is now capped by the Bayley Balfour Memorial Rest Hut, a charmingly fantastic structure designed by Sir Robert Lorimer. The hut is built of wood, every variety of timber grown on Benmore being represented in the panelling, the roof-shingles, weather-boards, and the like. Two dedicatory panels are placed within, one to Bayley Balfour and the other to commemorate James Duncan's participation in the afforestation of the area. A small brochure, containing photographs of the memorial hut and of characteristic views in the Glen, has been prepared by the committee in charge of the arrangements.

THE results of the excavations which Prof. Gordon Childe has been carrying out this summer in the Orkneys have now been made known to the public by his letter in the *Times* of Sept. 3. The site on which he has been at work on the southern shore of the Bay of Skail, parish of Sandwick, Orkney, is in many ways remarkable. It is a village consisting of a congeries of chambers or huts of dry masonry, all roughly square, with each course of the masonry projecting slightly