

THE SECOND ANTARCTIC COMMISSION OF THE R. R. S. "DISCOVERY II"

(Extracts from a paper read at the Evening Meeting
of the Royal Geographical Society of London on 5th March 1934).

by
D. DILWYN JOHN.

With the echo sounding machine it is possible to take numerous soundings without stopping the ship at all; we took over nine thousand on the last commission of the *Discovery II*. An equal number taken by means of a lowered wire would have entailed stopping the ship for a total of more than one year.

On the second Antarctic commission of the Royal Research Ship *Discovery II* we left England on 3rd October 1931 and arrived at our port of registry, Port Stanley in the Falkland Islands, on November 4, early in the southern summer. The months of the summer are the months of the whaling season, and our first piece of work was to make, in them, a complete chemical and biological survey of the waters of the Falkland Sector. It was a repetition and an extension of work of a similar nature made in the same waters during each of the six previous seasons — made, during different seasons, by the *Discovery*, the *William Scoresby*, and the *Discovery II*, or two of them working together. The survey is shown on Map I.

At each of the positions marked on the chart by a black circle the ship was stopped, a sounding was taken, and the series of collections and observations that we know as a "station" was made. This was the procedure. Temperature records and water samples for chemical analysis were obtained from each of the following levels as far as depth permitted: the surface, 10 metres, 20, 30, 40, 50, 60, 80, 100, 150, 200, 300, 400, 600, 800, 1000, 1500, 2000, 2500, 3000, 3500, 4000, and 4500 metres.

Between all stations soundings were taken every half-hour or oftener; a continuous record of the surface temperature was obtained by a distance thermograph; samples of the surface water were taken for analysis every four hours.

We began in the west with a line of stations from the western entrance of the Magellan Straits to the south (see Map I). It ended when we could go no farther, at the edge of the pack-ice. The remainder of the survey consisted of similar lines of stations in a north-to-south or south-to-north direction. The meridional direction is in this area the best suited for our purpose. It is at right angles to the big water movements of the area. Our purpose is to build up a picture of these movements, to define their limits, and to know their flora and fauna. That is to be done most rapidly for a given current by making section after section across it. The southern limit of each line was the edge of the pack-ice. The northern limit was quite as definite a geographical boundary, although it is in the open sea, and not visible to the eye, and not to be defined in a word.

One might well ask, what can this boundary be, far away in the open sea? It might be supposed that sea-water throughout the oceans mixed readily, that there would be something like an even and gradual transition from the water of minus temperature, poor in salts because of melting ice and falling snow, at the Antarctic ice-edge, to the warm water rich in salts in the tropics. It is not so: there are successive zones from north to south separated by sharp boundaries. Antarctic surface water is very cold, and although it is poor in salts it is heavier than the warmer and more saline water of the neighbouring zone to the north, the temperate zone of the southern hemisphere. This temperate zone is called the sub-Antarctic. Now Antarctic surface-water moves for the most part towards the east because of the prevailing westerly winds, but it has a northerly movement too. Where it meets sub-Antarctic water the very different densities of the two do not allow of ready mixing, and the heavier Antarctic water sinks sharply below the lighter sub-Antarctic and continues its flow northwards below it.

This, the line along which the heavy Antarctic surface-water meets the lighter surface-water of the sub-Antarctic and sinks below it, is the boundary in the surface of the open sea that I spoke of. It is called the Antarctic Convergence. It is a physical boundary very easily and precisely detected with a thermometer by the sharp change in

temperature as one passes from one zone to another. It can be detected as easily if not so precisely by a zoologist with a tow-net, because each of the two waters has a distinctive fauna of floating animal life.

We have shown that the Antarctic Convergence is continuous around the Southern Hemisphere. It runs for the most part in the latitude of about 50° S. (Map 2). In the longitude of Cape Horn it lies much farther to the south than elsewhere.

A similar boundary, or convergence, exists between the sub-Antarctic zone and the zone of warmer surface-water to the north of it, the sub-Tropical zone. It is called the sub-Tropical Convergence. Lying in lower latitudes, its course is not continuous like that of the Antarctic Convergence, it is broken by certain of the southern land-masses. There are differences in the waters and the faunas on either side of this convergence similar to those on either side of the Antarctic Convergence.

I have made this long digression to explain what was the northerly limit of our work during the survey of the waters of the Falkland Sector. It was the Antarctic Convergence.

The bases of the first and second and of the third and fourth lines were joined up by frequent stations along the ice-edge which we were following.

We made a number of radiating lines of stations around South Georgia as in other seasons. Christmas was spent at Grytviken, the harbour with the oldest whaling station, and the seat of the administration of the island by servants of the Government of the Falkland Islands.

To complete the survey we meant to make a line of stations as far south into the Weddell Sea as the ice would allow, and we hoped that would be far. It was for this reason: the South Orkney and South Sandwich Islands and the eastern side of South Georgia are bathed by water which flows in a north-easterly direction out of the Weddell Sea.

The origin of the current which flows out is an inflow along the coasts of Antarctica from the east. I have described Antarctic surface water as flowing to the east and north. That is true for the greater part of it falling under the influence of westerly winds. But far south in the Antarctic, south of 66° S., easterly winds prevail and the surface water moves to the west. That is the water which flows into the Weddell Sea, circulates around it, and emerges into the region of westerly winds.

Our line of stations, begun on 10th January 1932, was to the east of the South Sandwich Islands.

In 70° S., on January 19, we were brought up by a clear-cut wall of impenetrable pack which lay unbroken to the south. No ship could have entered it.

During the first three days of our return passage, on the second of which we recrossed the Antarctic Circle, we had no difficulty.

Early on the fourth day our passage became difficult and it remained so off and on for the five days which followed, until we were clear of the ice. This was for a distance of about 250 miles. The pack was closer than before, with few and narrow leads and a scattering through it of old heavy floes which gave it greater weight; and all was bound together by the new ice, now anything from 6 inches to 2 feet thick.

We continued to make our routine stations during our passage through the ice out of the Weddell Sea. Sometimes the space available between the floes was big enough for our vertical observations but not big enough for us to tow nets behind the ship.

We went from the Weddell Sea to South Georgia and thence we made a line of stations to the Falkland Islands, returned to South Georgia, and sailed for the Cape. At Simonstown the ship was docked and repaired in the month of March 1932.

And now came what was, in many ways, the most interesting feature of the commission, the winter work: a series of cruises to and from the ice-edge east-about from South Africa to South America (Map 2). We had not been in these waters before, nor had we, nor any other ship, made such long cruises to the highest latitudes possible in winter. On each of the cruises a full chemical and biological station of the kind I have already described was made each night. Echo soundings were taken at half-hourly intervals, i.e. one for every 4 or 5 miles steamed.

The first of the cruises began from Simonstown on April 8 and was south-east to the ice-edge off Enderby Land and from there to Western Australia. The edge of the ice lay in 65° S., 70 miles from Enderby Land, and that was the nearest that we got to the mainland on any of these cruises. This cruise lasted thirty-one days.

We spent a week at Fremantle. On the next cruise we met the ice-edge in 63° S. some 100 miles from the coast of Banzare Land. We turned and steamed north-east to Melbourne where we stayed one week before again going south to meet the ice. We

found it in 61° S., farther north than on either of the two previous occasions, on June 22, midwinter's day, 1932. After spending two days in work along the ice we turned north-east for Auckland, New Zealand, where we arrived on July 4. Each of these two cruises had taken about three weeks.

We remained in New Zealand refitting until the end of August. On September 1 we left Wellington to attempt a cruise longer than any yet. On each of the three V-shaped cruises I have just described we crossed and recrossed both the sub-Tropical and the Antarctic Convergences and so fixed their positions, which were unknown before, in six different longitudes.

We wanted to do more in the vast southern ocean south of the Pacific than to cross and recross those convergences once, as on a V-shaped cruise; we wanted the positions of the convergences, and we wanted observations and collections, midway between New Zealand and South America, where a V-shaped cruise would not have taken us. So we set out to make a W-shaped cruise, the two bases of the W to be on the ice-edge, the middle apex a point on the sub-Tropical Convergence south of the mid-Pacific.

We met the ice ten days after leaving Wellington in 62° S. and we turned north-east for the sub-Tropical Convergence. We were very near to it in 41° S., 126° W. The cruise we were attempting was a long one, just within the range of the ship given moderately good conditions; there was little fuel to spare. To have gone farther north to find precisely where the sub-Tropical Convergence lay would have been to prejudice our chance of reaching the ice a second time, and this we were very anxious to avoid. But we did fail to reach it nevertheless. Soon after we had turned south-east a gale came which blew for five days. Observations were impossible and we made poor distance. When the gale was over we resumed our stations and carried them to 63°57' S., 101°16' W., where there was no sign of ice to the southward. There we had to turn; the fuel remaining was not sufficient to go on. We arrived at Magallanes on October 5 and at Port Stanley on the 9th. The cruise from New Zealand had lasted thirty-nine days; it was 7,000 miles long.

One cruise remained to complete our circumnavigation of the Antarctic; one in the Atlantic Sector between South America and South Africa. It could not be done until March 1933. It was done then and the turning-point was south of the Antarctic Circle, in 69°22' S., 9°37' E. We were there on a gloriously sunny day; the depth was only 1,513 fathoms so that we were not very far from land, but there was nothing to suggest that it was very near. We have since learned that our position lies 60 miles within the eastern extremity of Crown Princess Martha Land, charted by Captain HALVORSEN, as shown in a map published by the *Geographical Review* (Vol. 22, No. 1, 1932, Plate 1). This is the fifth occasion on which the Antarctic has been circumnavigated, the first on which the greater part of it was done in winter.

Captain Cook completed the first circumnavigation of the world in high latitudes in 1775, and finally disproved the existence of a large continent in the temperate zone of the south. He made the first discovery of a typical Antarctic land, South Georgia, and shortly afterwards discovered the southernmost of the South Sandwich Islands. The Russian voyage around the Antarctic under BELLINGSHAUSEN in 1819-21 has been described by Dr. MILL as "a masterly continuation of that of Cook, supplementing it in every particular, competing with it in none". It was for the most part in a considerably higher latitude than Cook's voyage, showing that there was continuous sea south of the 60th parallel. The first land south of the Antarctic Circle, Peter I Island, in what is now called the Bellingshausen Sea, was discovered.

The two other circumnavigations, though the first was British and the second Norwegian, and although they were separated in time by one hundred years, have this in common: that each was conceived and paid for by a merchant with more than a commercial interest in the Antarctic.

In 1830 John BISCOE left London on a sealing voyage to the Antarctic with a brig and a cutter and instructions from his owners, Messrs. ENDERBY, to make discoveries in a high latitude. He circumnavigated the Antarctic east-about from the Falkland Islands, following the ice-edge for a great part of the way, and discovered what is now known as Enderby Land. It was not seen again for a hundred years, and then by Sir Douglas MAWSON, in the *Discovery*. The story of BISCOE's voyage is one of wonderful endurance and perseverance in the face of handicap. This Society listened recently to an account of the circumnavigation of the Antarctic by the *Norvegia*, in 1930-31, sent out by Consul Lars CHRISTENSEN, of Sandefjord, Norway.

We come now to the second summer season of the commission, that of 1932-33. The first months of it were spent in making a survey of the waters of the Falkland Sector similar to that of the previous season.

We had arrived at Port Stanley from New Zealand on October 9, we left again on the 15th; and had completed the survey before Christmas, a month earlier than in 1931-32.

There were big differences in the ice conditions of the two years. The Bransfield Strait had been closed with ice in late November 1931; it was completely ice-free in the first week of November 1932. We entered Deception Harbour and made stations across the Strait. There was heavy pack immediately to the north of the South Orkney Islands in early December 1931; the islands were ice-free in late November 1932. The pack lay 70 miles to the south of them and ran in a north-easterly direction besetting the southernmost of the South Sandwich Islands.

Christmas was again spent in Grytviken, South Georgia.

Our main work, it will be clear from what I have said, is oceanographical. But we take any opportunities which may occur to survey the little known coasts of the Falkland Dependencies. The South Sandwich Islands were surveyed in 1930 on the first commission of the *Discovery II*, when Dr. KEMP was directing the work in person.

On our second commission the month of January 1933 was set aside for survey work provided that the oceanographical programme was completed before. We hoped to do the South Orkney Islands; if that had been impossible we should have gone on to the South Shetlands where some work had been done but where very much remains. The oceanographical work was completed at South Georgia before Christmas; in the course of it we had seen that the South Orkneys were ice-free so early as late November. They are surrounded by ice every winter, open for a longer or shorter period every summer. We left South Georgia on 20th December 1932 and arrived at the South Orkneys on 2nd January 1933 in fine weather and a survey of the islands was begun at once. It was directed by Commander CAREY, and was carried out by Lieut. A.L. NELSON, R.N.R., then Chief Officer and Navigator, now Master of the *Discovery II*.

The group is composed of two big islands, Coronation and Laurie, the former of which is about 30 miles long by 10 miles broad; two smaller islands, Powell and Signy; and a larger number of very small islands and rocks.

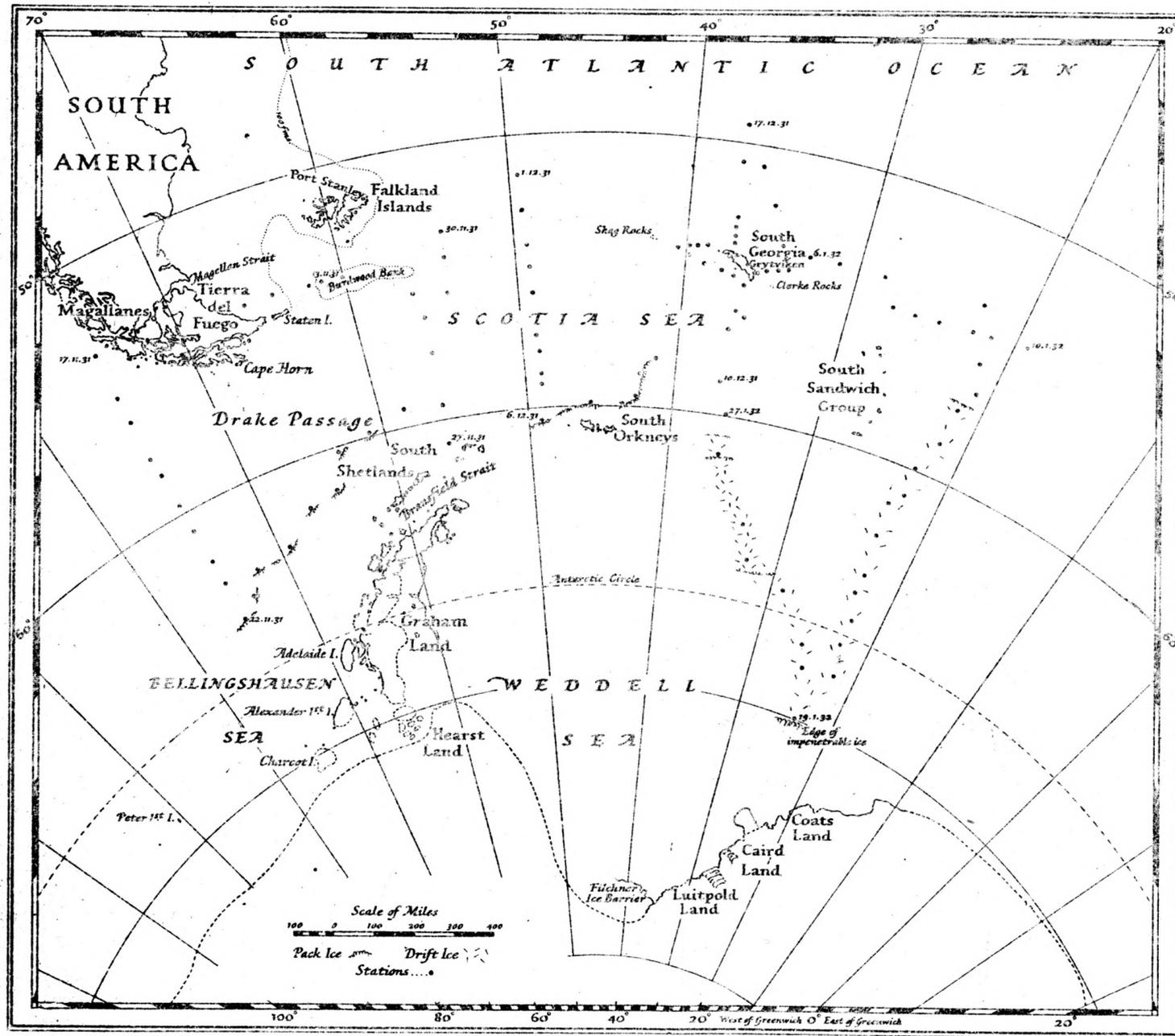
The islands were discovered in early December 1821 by the Englishman Captain George POWELL, in the sloop *Dove*. He landed, took possession, and made a survey. He was accompanied by the American Captain N.B. PALMER, in the *James Monroe*, with whom he had sailed east from the South Shetlands in search of seal. Nine weeks later they were visited by James WEDDELL, who came again the following season, still unaware of POWELL'S discovery and work, and examined them thoroughly for seal, finding few; he made a survey of the group and left to make his remarkable journey, to a higher latitude than any ever attained before, in the sea that is now named after him.

The islands were visited again in 1838 by the Frenchman Dumont D'URVILLE, who did some survey work along the northern coasts. Charts based on the early work of POWELL and WEDDELL, modified by that of D'URVILLE, remained the only ones of the islands until early in this century. Then, when the Scottish National Antarctic Expedition in the *Scotia* wintered in the group in 1903, Dr. BRUCE made an accurate and detailed survey of Laurie Island which replaced D'URVILLE'S on the charts. The meteorological station established on Laurie Island by Dr. BRUCE was taken over by the Argentine Government and is maintained to the present day. In 1912 the Norwegian whaler Captain P. SÖRLE, made extremely useful surveys of the coasts and harbours of the western islands, Coronation, Signy, and Powell. They could not however be accepted as complete or final.

A complete survey of the islands, other than Laurie Island, was made between January 2 and January 30. Numerous inshore soundings were taken with the echosounding machines. Whenever we were steaming around the islands — and for the purposes of survey we steamed slowly — we sounded every two or three minutes. We entered all the bays and sounded them. The harbours were sounded in all directions by boats so that detailed plans of them will be possible. The new charts have not yet been published by the Admiralty.

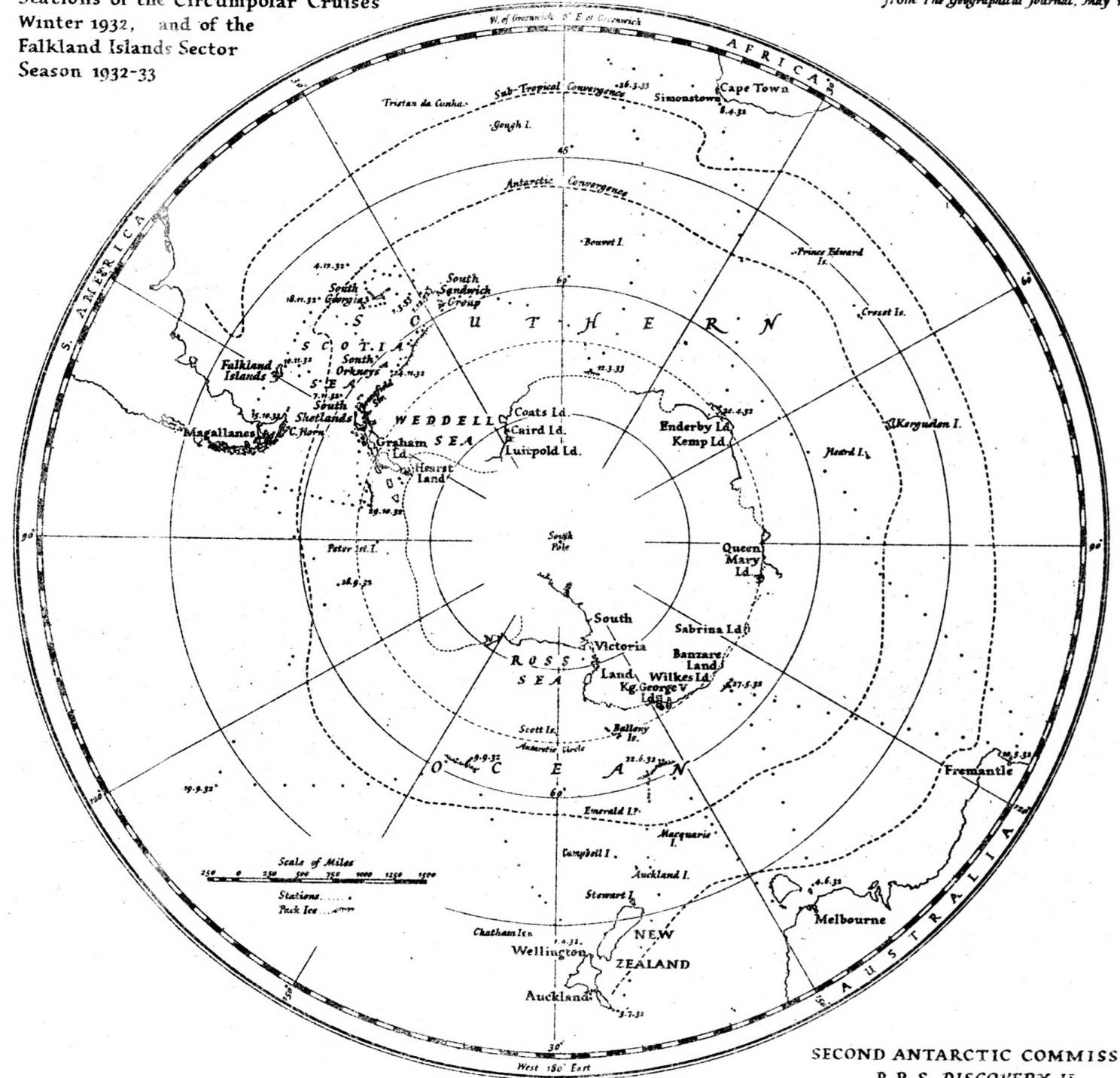
The larger islands are heavily glaciated and deeply covered with snow. Coronation Island rises to over 3,000 feet.

Stations of the Falkland Islands Sector
Season 1931-32



Map 1

Stations of the Circumpolar Cruises
Winter 1932, and of the
Falkland Islands Sector
Season 1932-33



Map 2

from The Geographical Journal, May 1934

SECOND ANTARCTIC COMMISSION
R.R.S. DISCOVERY II
John

Powell Island, high and steep, is heavily and almost completely ice clad. It has comparatively few bare patches of rock and none of earth. Signy Island is lower and only a part of it is glaciated. There are big patches of bare rock, of scree and earth. The steeper of the smaller islands are free of snow in summer except perhaps for small patches near their highest points.

When this month of survey, a very pleasant interlude, was over we turned again to oceanographical work. We made a line of stations to the Bransfield Strait; repeated in the Strait the survey we had made there in November; made a line of stations from the South Shetlands to the Falkland Islands; and another from the Falkland Islands to South Georgia and repeated earlier observations around that island. This is the skeleton of a second survey of the area in one season. And then in March 1933, we made the V-shaped cruise from South Georgia to the ice-edge south of the Circle in 9° E., to the Cape, which I have already mentioned. Observations were continued up the deep basins of the East Atlantic to the equator.

