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Ten Years of Antarctic Exploration

Author(s): Hugh Robert Mill

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CALCUTTA.

Year.	Mean sea-level above zero of gauge.	Yearly difference from general mean.	
		feet.	millimetres.
1881-82	10·739	-0·026	-7·9
1882-83	10·686	-0·079	-24·1
1883-84	10·599	-0·166	-50·6
1884-85	10·669	-0·096	-29·3
1885-86	10·950	+0·185	+56·4
1886-87	11·383	+0·618	+188·5
1887-88	11·080	+0·315	+96·1
1888-89	10·842	+0·077	+23·5
1889-90	11·232	+0·467	+142·4
1890-91	11·364	+0·599	+182·7
1891-92	10·618	-0·147	-44·8
1892-93	10·817	+0·052	+15·9
1893	11·292	+0·527	+160·7
1894	11·383	+0·618	+188·5
1895	10·476	-0·289	-88·1
1896	10·123	-0·642	-195·8
1897	10·535	-0·230	-70·2
1898	10·858	+0·093	+28·4
1899	10·660	-0·105	-32·0
1900	10·604	-0·161	-49·1
1901	10·358	-0·407	-124·1
1902	10·398	-0·367	-111·9
1903	10·711	-0·054	-16·5
1904	10·830	+0·065	+19·8
1905	10·593	-0·172	-52·5
1906	10·722	-0·043	-13·1
1907	10·358	-0·407	-124·1
1908	10·397	-0·368	-112·2
1909	10·770	+0·005	+1·5
1910	10·895	+0·130	+39·7
General mean ...	10·765		

be attributed mainly to errors of observation. The probable error of a value of mean sea-level, as deducted from a complete year's tidal observations at a well-chosen coast station, should be about $\pm 0\cdot05$ foot.

TEN YEARS OF ANTARCTIC EXPLORATION.*

By HUGH ROBERT MILL, D.Sc.

AT the moment when the attainment of the South Pole by the splendid journey of Captain Amundsen and his companions is bringing the congratulations of all the world to the fortunate explorer, it is useful to review the recent progress of discovery within the Antarctic Circle and consider whether the attainment of the Pole is likely to increase or diminish exploration.

In 1898 the new era of Antarctic exploration was initiated by the

* Map, p. 420.

drift of the *Belgica* in the pack throughout the first Antarctic winter ever experienced by man, and in 1899 the landing party from the *Southern Cross*, under Mr. Borchgrevink, lived through the first winter on the Antarctic continent. Neither expedition added much to the knowledge of the Antarctic region proper, which had been obtained more than half a century previously by Biscoe and Ross; but both prepared the way for a new method of attacking the old problem, and they effectually exorcised the demon of an unendurable winter climate in the far south. Borchgrevink's expedition also proved that the great Barrier in Ross sea had receded southward by about 30 miles since Ross had mapped it in 1841, and that it was not so uniformly inaccessible as was supposed, for at one point in 164° W. he had been able to land upon it, and found a smooth level surface over which travelling should prove very easy; Mr. Bernacchi, who was one of the party, suggested that a motor-car might be used upon it.

So far as the coasts of Antarctica were known up to this date they are represented in a light line on the accompanying map. The heavy lines on the map show the additions to our knowledge made in the last ten years, and these are sure to require extensive alterations when the result of the expeditions now in the field under Captain Scott, Dr. Mawson, and Lieut. Filchner become known to us. The blue tint shows open water so far as it is known or pack-ice through which some ship is known to have passed. The southern boundary of the blue in the places where it does not meet a coast is the track of the expedition which has got farthest to the south in that region. It is striking to find that the voyages of Cook (140 years ago), Bellingshausen (92 years ago), and Biscoe (80 years ago) are the latest which have attempted to approach the Pole or even the Antarctic Circle throughout great stretches of longitude. In fact, serious attempts to enter Antarctica have only been made in three places south respectively of New Zealand, South America, and Kerguelan.

The renewal of Antarctic research on a large scale in 1901-1904 by the associated expeditions of the *Discovery* under Captain Scott and the *Gauss* under Prof. E. von Drygalski, and the independent expeditions of Dr. Otto Nordenskjöld in the *Antarctic* and Dr. Bruce in the *Scotia*, produced an immense increase in our knowledge. This was followed up by Dr. Jean Charcot in the *Français* in 1904 and in the *Pourquoi Pas?* in 1909 in Bellingshausen sea on the one side of the continent and by Sir Ernest Shackleton in the *Nimrod* on the other side in 1909. It is remarkable that with the exception of the *Discovery* and the *Gauss* all these expeditions, like all those now in the field, were private enterprises organized by the explorers themselves and supported only to a very moderate extent, if at all, by public funds. While several of the expeditions made a prominent feature of the attainment of a high latitude, none of them could be classed as a mere dash to the pole, and all of them were

concerned in studying the physical conditions of the neighbourhoods in which they wintered, or which they were able to visit. It will clear the way for considering the results of the expeditions of 1911-12 if we trace, in a brief and general way, the main results and different methods of the expeditions between 1901 and 1909.

Looking first at the portion of the Antarctic continent which lies to the south of South America, and is approached from Bellingshausen sea on the Pacific side and from Weddell sea on the Atlantic side, we are impressed by the remarkably small addition to our information since the voyage of the *Belgica*. Nordenskjöld's expedition failed to cross the Antarctic Circle; but Bruce, in the *Scotia*, made a fine run to the southward midway between the routes of Weddell and Ross. He found deep water, which made it certain that there is no continental land in the great unknown segment from 62° to 72° S. between the meridians of 15° and 30° W. At the extreme south he found shallow water and sighted a coast (Coats Land) in 74° S., the most southerly land known in the Antarctic regions except the shores of Ross sea, diametrically opposite to it. We are still quite ignorant of the great slice of Weddell sea between 35° and 60° W., in which Dr. Bruce believes that the New South Greenland of Morrell is concealed. If this be so, Morrell must have been at least 3° out in his latitude, for in 1823 he says he coasted it to the north point of New South Greenland, in $62^{\circ} 41'$ S., and no shipmaster could have made so serious a mistake. If we can believe Morrell at all, it is easier to suppose that he made a mistake of 10° in his longitude, a very easy thing in his time, and that the land he coasted was the peninsula terminating in Louis Philippe Land. By this time Lieut. Filchner may have solved the problem.

In Bellingshausen sea Dr. Charcot has greatly extended our knowledge. He has traced the coast of Graham Land to 73° S., giving to the southern parts the names of Loubet and Fallières. He shows that Gerlache's position for Alexander I. Land corresponds roughly with his Loubet Land, while he finds Alexander I. Land to occupy almost exactly the position originally assigned to it by Bellingshausen, and that it is apparently an island, Fallière's Land seeming to extend behind it. Charcot Land and another new land not fully surveyed carry on the line of land to 70° S. and 80° W. Charcot's last definite advance was to sail west south of 70° S., and to emerge from the Antarctic Circle in about 125° W., thus cutting a substantial slice from the hitherto untouched region of the ice-pack.

These investigations on the American side have all been by sea, and they have been subject to all the uncertainties and baffling difficulties of ice navigation and the frequent necessity of fixing positions by dead reckoning in foggy weather. South of the Atlantic and Indian oceans the only advance since the time of Biscoe has been the discovery of Kaiser Wilhelm Land by the *Gauss* just on the Circle, and no notable land

journeys were made in that region. But we know that two landing parties of Dr. Mawson's Australian expedition are there just now. South of the Pacific from Charcot's farthest in 124° W. to the meridian of 150° W. at King Edward Land, no ship has tried to get south of the tracks of Cook and Bellingshausen, and Cook, in 1773, was the last man to reach the Antarctic Circle in those seas.

There remains only the area of Ross sea between the meridians of 150° E. and 150° W., one-sixth of the circumference of the Antarctic Circle, but within that sixth there have been crowded in the last ten years the labours of four separate and successive expeditions, exploring by land in many directions—those of Captain Scott in the *Discovery*, of Sir Edward Shackleton, of Captain Amundsen, and of Captain Scott in the *Terra Nova*, of whose achievements we have not heard up to the time of writing.

The *Discovery* expedition was confronted by the serious problem of organizing land exploration on the Antarctic continent for the first time, and this was complicated by the still unbroken traditions of Arctic sledge travel—always follow a coast-line, never establish a base camp on floating ice, and the rest. The expedition was designed for scientific research into magnetism, geology, biology, meteorology, and other subjects; but Captain Scott carried out two long journeys of epoch-making importance in conditions of great difficulty due to improper food, for which he was in no way responsible, and the consequent weakening of the dogs. In his southward journey he kept along the Barrier ice from MacMurdo sound under the great range of coast mountains, which he followed to $82^{\circ} 17'$, 380 miles from his base, much embarrassed as he approached the mountains by crevasses and disturbed ice. Far to the south great summits could be seen, indicating a continuation of the range. In a second great journey in the following year a way was found through the mountain range and over the high plateau behind, above 9000 feet in altitude, due west to $146^{\circ} 33'$ E., a distance of 300 miles from the ship. The results of this expedition were enormous. The expedition had spent two winters 500 miles nearer the south pole than people had ever wintered before, the method of laying out dépôts for food in advance on the sledge routes had been worked out, and an immense advance in geographical knowledge secured. It was shown that Ross's Great Barrier was not the end of the ice-cap, but the edge of a vast expanse of level ice probably afloat, fixed on the seaward side between Ross island and King Edward Land, with a front of 490 miles, and extending southward more than 380 miles. On its western edge this level ice was shown to be ridged and crevassed where it met the base of a great mountain range running from Cape Adare in 71° S. to at least 83° S., a distance of about 850 miles; and this range buttressed a vast plateau rising to more than 9000 feet above sea-level, and as uniform and level on the summit as the surface of the barrier at the base.

Sir Ernest Shackleton started in 1907 with the design of establishing himself at King Edward Land and making a journey southward towards the Pole over the surface of the Barrier, though his expedition was also equipped for very extensive scientific work. Compelled to relinquish his original design, he wintered in MacMurdo sound, and advanced geography in three different directions. One party made the first ascent of Mount Erebus; another under Prof. David reached the South Magnetic Pole, and proved that the high plateau extended along nearly the whole length of the great coast range towards the north. The third party, trusting to Siberian ponies instead of dogs for transport, travelled south over the Barrier surface, keeping about 50 miles farther from the mountains than Scott had done, and so finding smoother and less broken ice. In 84° S. the Beardmore glacier was found, offering a practicable though difficult path to the plateau behind the mountains, and over the smooth surface of that plateau, at an elevation approaching 10,000 feet, Shackleton and his companions struggled on to $88^{\circ} 23' \text{ S.}$, where starvation, due to the loss of all the transport animals, compelled them to return. But for the loss of the last pony the Pole would have been reached. The farthest point reached was 420 miles beyond Scott's farthest, but still 113 miles from the Pole. The great mountain range was traced to 86° on the plateau side, and it was trending strongly to the south-east, suggesting that it might turn and run towards Edward VII. Land. The length of the mountain chain from Cape Adare was extended to 1060 miles, and the height of the loftiest summits seemed to be increasing towards the south-east.

The southern summer 1911-12 saw even more expeditions in the southern ice than on the great revival in Antarctic exploration ten years earlier. Lieut. Filchner was entering the Weddell sea. Captain Scott has been working from MacMurdo sound, and a part of his expedition from Cape Adare; Captain Amundsen from a point on the Barrier near King Edward Land, where a Japanese expedition arrived as he left; and Dr. Mawson had landed two parties on the part of the continent known as Wilkes Land; where, according to a Reuter's telegram from Hobart, he had shown that D'Urville's Côte Clarie does not exist as land. We may expect to find great changes on the map in this quarter, but what they will be remains to be learned when news comes of last season's work from Captain Scott and of next season's work from Dr. Mawson.

The report of Captain Amundsen's expedition, as given in the *Daily Chronicle* of March 9 and later issues, is singularly full, clear, and satisfactory. It enables one to plot the route and grasp the salient features of the expedition with a fair degree of certainty. Amundsen and his fellow-countrymen are, of course, expert ski-runners, and some of them are extremely skilled dog-drivers. They had a great fund of personal experience both in the Antarctic and the Arctic regions to draw on, and they had the records of the two previous expeditions on the Barrier ice

to serve as guides and warnings. As a result of this they relied mainly on frozen seal-meat, of which they collected a great amount along the Barrier front and laid out very large depôts in the autumn after their arrival, so that when they started in the following spring there was no need to economize food. The Barrier surface afforded very easy going, and the party travelling southward over it covered an average distance of 20 miles per day. They followed the 164th meridian of west longitude, and struck the mountain range of Victoria Land in about 85° S., about 200 miles south-east of the Beardmore glacier. Here a path to the plateau was found by following the Devil's glacier, which led between summits of from 12,000 to 15,000 feet high, and at its upper end it led out on to a plateau, the highest point of which was 10,750 feet near the 88th parallel, sloping down to 10,500 feet at the Pole, which was reached easily on December 16, 1911, and a series of hourly altitudes of the sun taken by several observers simultaneously for twenty-four hours. The accuracy of the determination is thus placed beyond all doubt. The return journey to the ship presented no difficulties, and all the men, with eleven dogs, returned in perfect health on January 25, 1912. The important results of this expedition, apart from the sentimental value attached to reaching the Pole, are, first, the rapid travelling and total absence of illness or accident on a double journey of 1700 miles. Second, the discovery that the Great Barrier terminates in a bight apparently encircled by the mountain chain in about 80° S. and 160° W. There seems to be no doubt that the coast range is continuous from Cape Adare to this point, 1300 miles, with the level white surface of the plateau above all the way, and the level white surface of the Barrier ice at its feet for the last 600 miles. The range, it would appear, then divides (but on this point we cannot yet be sure), one branch continuing towards the south-east pointing towards Graham Land, the other turning north-east towards King Edward Land. The latter probably curves widely to the eastward, as there is no mention made of land having been seen in that direction from the route across the Barrier ice, although to the west the mountains of Victoria Land had been visible for more than 100 miles. The description of Amundsen's discoveries fits in in the most satisfactory way with those of Scott on the *Discovery* expedition, and of Shackleton. While Amundsen was in the south, a party of three made a journey to King Edward Land, confirming the accuracy of the coast-line as shown in Captain Scott's map; but the details concerning this part of the work are not full enough to enable us to judge how much new information was obtained.

It now becomes a question whether the exploration of these regions should be continued from the same centre, or renewed in the less-known portions of the circumference of the Antarctic Circle. There is evidently a very tempting opening for a fine expedition along the east side of the Barrier ice to trace the land connection between King Edward

Land and the southern range, if such a connection exists, or to trace the Barrier ice through to the sea behind King Edward Land, if that land is insular. And, apart from this, there is the following of the south-eastern range to its termination to be undertaken; and after that, the crossing of the great plateau beyond the Pole to whatever end it may lead. We have no doubt that great inland journeys have been carried out by Captain Scott's parties, and that such will be carried out by Dr. Mawson's; but even when the results of these are known, we cannot let Antarctic exploration lapse until the continent is bounded by a firm coast-line, or, as now seems much less likely than it did, is split into an archipelago of great islands. The fact that the South Pole has been reached has a certain value, and perhaps the best result of the attainment both of the South Pole and the North is that there is no farther occasion for sensational "dashes" and acrimonious discussions between rival claimants. The fact that both poles have been reached with less difficulty than has accompanied earlier explorations will no doubt dispel much of the terror of the possibilities of polar climate, and by attracting explorers of a more scientific, though perhaps of a less adventurous, disposition will enable a sufficient knowledge of polar geography to be obtained in a few years for all the important purposes to which such knowledge can be put.

CAPTAIN ROALD AMUNDSEN.

AT the meeting of the Society on March 11, Major Leonard Darwin, Vice-President, who was in the chair, made the following remarks: Since our last meeting we have all heard that that courageous Norwegian explorer, Amundsen, who is known to many of us here present, having lectured before this Society, and who has done such excellent work in the Arctic regions, has succeeded in his endeavour to reach the South Pole. On this occasion I do not think I need do more than read the telegram which, at the request of the Council of your Society, your President, Lord Curzon, has to-day sent to him in Tasmania. The telegram runs as follows: "On behalf of Council Royal Geographical Society I congratulate you upon your magnificent journey and successful attainment of the South Pole. (Signed) Curzon, President." I can tell by the applause that all here present endorse the action of the Council in sending this telegram.





