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The chairman has remarked that no zone of irrigation oases is shown on the map in the foothills of the Riff. This part of the map is copied from Fischer, who drew along the Atlas a zone where cultivation is possible only by irrigation. He regards the Riff foothills as within the zone of possible cultivation without irrigation. In drawing the isohyets of the Meseta Fischer had to depend largely upon the vegetation for the interior, but at the coast, *i.e.*, where the dews are most marked, he had rainfall observations for several coastal towns.

With regard to the type of water supply existing in the oases of the Saharan border. Those on the Draa, the Ziz and the Gir are situated where the streams emerge from narrow valleys in the hills and are beginning to lose themselves in the sand. The oases in Algeria on the eastern border of Morocco, such as Figig and Aïn-Sefra, have an artesian supply.

REVIEW OF THE RESULTS OF TWENTY YEARS OF ANTARCTIC WORK ORIGINATED BY THE ROYAL GEOGRAPHICAL SOCIETY.

By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S.

THE time has arrived for explaining briefly the plan and objects of the renewal of the Antarctic exploration which I, as President of the Royal Geographical Society, originated in 1893, in concert with my expert polar advisers. For our chosen leader must have reached the South Pole last January, and is on the eve of completing geographical discoveries in the first direction we selected.

The actual knowledge we possessed in 1893 is best explained by dividing the Antarctic region into four quadrants, each having the Pole as their apex, and the Antarctic circle as their arcs:—

90° E. to 180°—*The Victoria Quadrant.*

180° to 90° W.—*The Ross Quadrant.*

90° W. to 0°—*The Weddell Quadrant.*

0° to 90° E.—*The Enderby Quadrant.*

We knew from Balleny, Dumont d'Urville, and Wilkes that there is more or less land along the arc of the Victoria Quadrant, from Biscoe and Kemp that there is land along the arc of the Enderby Quadrant. Ross had boldly forced his way through that close pack which had stopped every one else, in sailing vessels, had sighted the east coast of Victoria Land with its lofty mountains and active volcano, and had discovered the extraordinary phenomenon known as the "great ice barrier." Weddell, in the quadrant which bears his name, had found that the land was not near the arc of that quadrant, but far to the south, not in sight even in 74° 15'; while Biscoe had discovered a long island or peninsula, which was named Graham Land, extending from the Antarctic towards the Andean region. In the Ross Quadrant Cook and Bellingshausen had discovered that there

also the land was far to the south of its arc, not to be seen in 70° or in $71^\circ 10' S$.

It was clear that there existed a great Antarctic land mass, extending to beyond the Antarctic circle in the Victoria and Enderby Quadrants, but receding far to the south in the Weddell and Ross Quadrants. It was no use to potter about any more round the Antarctic circle either in sailing vessels or steamers, merely to sight land or think it is sighted. Ringgold's Knoll is a warning. There are perhaps more than one Ringgold's Knolls. But it is desirable to revise and extend the old work, provided that it is done by wintering and with travelling parties; and this is what Mr. Mawson has undertaken with regard to the arc of the Victoria Quadrant. Similar work should be done along the arc of the Enderby Quadrant.

Our conclusion was that future Antarctic enterprise must be devoted :—

1. To exploring the Antarctic land mass by landing and by sledge parties, to ascertain its geographical features, the character of its glaciation, its geology, and its physical phenomena.
2. To ascertaining the outline of the Antarctic continental lands, and, above all, whether they consist of one or two or more land masses.

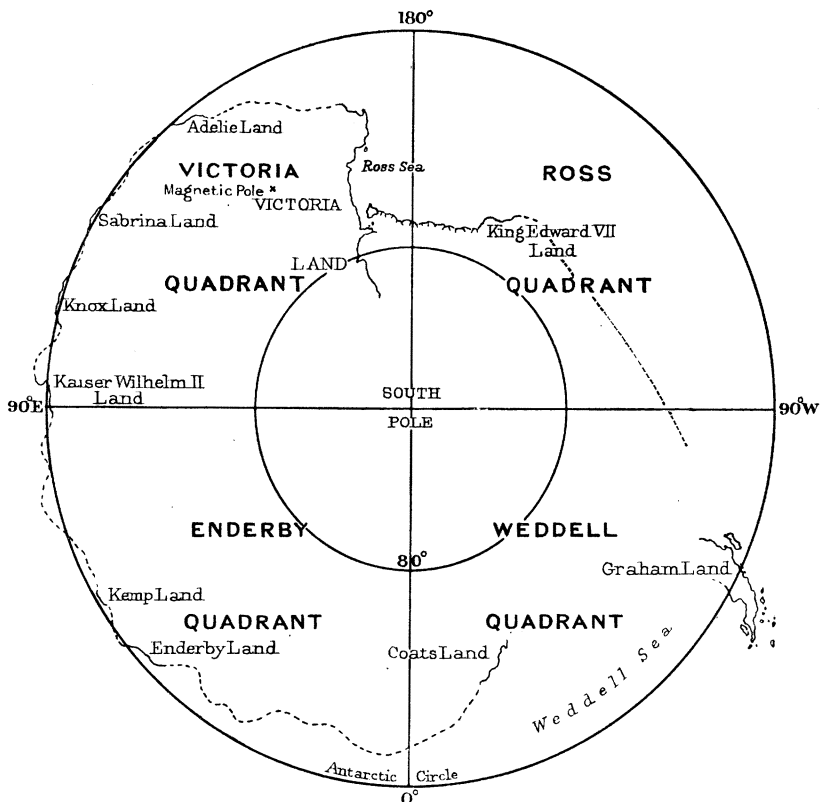
For these objects the course must be south, in the direction of possible openings, so as to land as near the heart of the unknown region as possible. One such opening, the most important one, had been discovered by Sir James Ross in the Victoria Quadrant. A second had been indicated by the *Challenger* east of Kemp Land, where in $66^\circ 35' S$. there could have been no high land within 60 miles, while the absence of icebergs led to the conclusion that a high latitude could be reached on meridians between 70° and 80° . To the east of Graham Land, and where Weddell reached $74^\circ 15'$, another opening may be found. In the Ross Quadrant the land is also far to the south, and it would be a hazardous undertaking to attempt to force an opening near Cook's furthest. These then are the canons of Antarctic exploration which we established for the guidance of organizers :—

1. Valuable results can only be obtained by landing, and by sledge travelling.
2. A main object must be to ascertain the conformation of the Antarctic land.
3. Openings must be forced through the ice pack, and far southern coasts must be reached for landing.

We relied upon the great advantage that steamers have over those old sailing vessels, by which all former Antarctic discoveries had been made. I had myself served in the first polar expedition in which steam power had been efficiently used, and I had served in an Arctic sailing vessel. I had seen both steamers and sailing vessels in ice navigation. The difference is very great. A steamer can more quickly take advantage of a lead or opening, can force her way more easily through ice which is not too closely packed. But there are limitations. When once beset, or against solid

floes, a steamer can do no more than a sailing vessel. However, we placed great reliance on steam power for forcing a way through ice pack floating northwards.

Of the four possible openings we selected the one discovered by Sir James Ross, for the first expedition of the two great Societies, as the only one that had been forced, and as the most certain to lead to valuable results. Never was an anticipation more fully confirmed. A talented and highly recommended naval officer was carefully selected to command



the expedition, in the person of Captain Robert F. Scott, R.N. He made himself master of all that had gone before, both in the Arctic and Antarctic regions, especially as regards sledge travelling. He forced the good ship *Discovery* through the pack in the footsteps of Sir James Ross, and established winter quarters in the far south. Captain Scott is the creator and founder of Antarctic sledge travelling which differs in several respects, owing to different ice and other conditions, from Arctic sledge travelling. He organized an admirable system down to the minutest detail. He carefully examined and surveyed the great ice barrier including soundings. He discovered the very important land mass, which was named "King

Edward VII. Land." He made a memorable sledge journey to the south, and another more remarkable one up the Ferrar glacier and over the ice cap to a great distance, by his observations fixing the position of the magnetic pole. He brought to our knowledge the existence of a lofty range of mountains extending for certainly 500 miles, cut by ravines occupied by glaciers, and consisting of limestone with overflows of basalt, the limestone presenting horizontal structure without any lateral pressure. He discovered the island formed by Mounts Erebus and Terror. He discovered the interesting phenomena connected with the receding of Antarctic land ice. His zealous and loyal officers and men took continuous observations in all branches of physics. Twelve volumes of valuable scientific work form the imperishable monument of the results of this great and admirably conducted expedition. It more than justified the canons we had laid down for Antarctic discovery.

But the work, even though it was resolutely prolonged through two winters, could not be completed by one expedition. The Victoria Quadrant, which Captain Scott had made peculiarly his own, had to be explored to its very apex, which happens also to be the south pole; and further geological research was needed, without which the position and age of the limestone formation remained unknown.

It was always Captain Scott's desire to complete the work so admirably commenced, as soon as the exigencies of his profession would admit of his sparing the time. Accordingly he and his colleague, Lieut. Evans, raised the funds and organized a second expedition to complete their exploration of the Victoria Quadrant. The *Terra Nova* sailed in June, 1910, with the best equipment for scientific work that ever entered the polar regions. We have just received an account of the first season's work. Captain Scott, in his southern journey, had reached $87^{\circ} 32' S.$ and will have been at the south pole on about January 14. His journey, without the aid of dogs or ponies, from the foot of the glacier to the pole, is by far the finest in the annals of polar discovery, equalling those of McClintock and Meham as regards distance, and exceeding them as regards difficulties overcome. Two ably conducted geological parties had found fossils, which was one of the greatest Antarctic desiderata. The winter journey of Dr. Wilson to Cape Crozier was magnificent. But our gallant countrymen are still in the midst of their work.

After I had originated the idea of a renewal of Antarctic discovery several private expeditions were started, Belgian, German, Swedish, Scottish, French, but none of them were of any use as regards Antarctic discovery. I fully appreciate the value of their work as regards deep sea soundings, meteorology, magnetism and biology in the South Temperate Zone, and the researches of Nordenskiöld and Gunnar Anderssen are of the highest value, indirectly throwing some light on the Antarctic problem. But the mere sighting of land at a distance without exploring, the mere rushing to the pole with that as a sole object, are of no use from my point of view.

We have seen that Captain Scott is now completing his work in the Victoria Quadrant. The opening of next importance is that by the Weddell sea and the east side of Graham Land. Some good work had already been done in that direction by Captain Larsen as long ago as 1892, who had landed, made valuable observations on the character of the glaciation, and collected some fossils. His services to Antarctic discovery have never been appreciated as they deserve, though he received one of our minor awards. The Weddell opening has now been undertaken by Captain Filchner with a German expedition, on correct principles. His object is to explore by landing in accordance with the canons we laid down for Antarctic discovery. Captain Scott gave him all possible assistance in his preparations, and as he has undertaken to do the right thing in the right way, he is fairly certain to achieve a measure of success.

The *Challenger* opening in the Enderby Quadrant should be examined though its existence is doubtful.

But the chief work that remains for future explorers is the exploration of the Ross Quadrant, and the detailed examination of the region from King Edward VII. Land to Graham Land. There will be great difficulties, and the work will need another well-equipped expedition, if not two. But the results will be of extreme interest. Nordenskiöld has proved the continuity of Graham Land with the Andes, probably in Jurassic times or later. Both Patagonia and Graham Land are much disturbed and contorted geologically. If King Edward Land is found to be the same, the conclusion is obvious, for the Victoria mountains present horizontal structure without any lateral pressure. I had some conversation with Mr. Mawson on this point, who quite concurred in the great importance of researches in this direction. They may connect King Edward Land with Filchner's possible discoveries. The questions of the Ice Barrier remain to be solved, and Captain Scott may safely be relied upon to solve them. Assertions about mountain ranges seen at long distances are of little or no value.

The attention of all who are interested in Antarctic discovery ought not to be diverted from our gallant countrymen, who have already achieved such great success, and are preparing for still greater efforts in the coming season. They are not the men to scamper to the pole and scamper back for the reward. Their watch-word is "thorough." Captain Scott tells us, "I am remaining in the Antarctic regions for another winter, in order to continue and complete my work." He, with his old comrades Dr. Wilson, Lashley, Evans, and Crean are entering upon their fourth, Williamson on his third, the rest on their second Antarctic winters. Let the warm and cordial sympathy of all geographers be with them, and continue with them until their return. True explorers, true representatives of the great British discoverers of times gone by, they are working with single-minded zeal and no thought of reward, for the honour of their country.

ANTARCTIC WORK REMAINING TO BE DONE.

Victoria Quadrant.—Completion of an examination of the east side of the Victoria Land and the great ice barrier by Captain Scott's expedition next season.

Re-survey of the land reported by Balleny, Dumont d'Urville, Wilkes, and Drygalski, undertaken by Mr. Mawson's expedition.

Ross Quadrant.—Exploration of the west side of King Edward Land.

Discovery of the Edwardian coast from King Edward Land to Graham Land.

Enderby Quadrant.—Investigation of the opening reported to be probably to the east of Kemp Land.

Survey and examination of Enderby Land and its continuation to the westward.

Weddell Quadrant.—Completion of the discovery of the coast of Graham Land on the east side.

Penetration through the pack to the south of Weddell's furthest and discovery of the land far to the south. This has been undertaken by Captain Filchner.

THE BRITISH ANTARCTIC EXPEDITION.

THE following letter from Dr. Edward A. Wilson, Chief of the Scientific Staff of Captain Scott's Expedition, has been received by Sir Archibald Geikie, President of the Royal Society. It is dated "British Antarctic Expedition, McMurdo Sound, October 31, 1911."

"This is the last opportunity I shall have for sending any letter home by the Terra Nova when she comes to us in January. She will leave again early in March, almost certainly before we can return from the long sledge journey South on which we start to-morrow. We shall almost certainly be away for more than four months, and it follows that we have prepared to remain here for another year. If when we arrive back from our journey over the Barrier we find that the ship has gone home, we shall, of course, receive our mails, but we shall be unable to send any replies or news as to the result of our summer's work, unless, as we hope, it may be possible to send it rapidly forward by dog-team in time to catch the ship. I know you will be interested to hear something about the work which has been done here during the winter. You will already have heard what was done up to January, when the ship returned to New Zealand with all our news.

"The following is an epitome which Captain Scott asked me to make out, in as short a form as possible. It may appear in the Press