

thus reducing Sven Hedin's caravan to four camels, one horse, two dogs, and four men. Three horses had perished. After surveys had been made, the best caravans were taken along, and the caravan proceeded southward. During the next day, nine more dwellings were discovered. The woodwork was carved in the same way as the above mentioned, and the best pieces were taken along. Soon afterward the caravan reached a salt water lake; no vegetation was to be found around it, and Sven Hedin thinks that it was a newly formed lake. Proceeding further south, the caravan arrived at the shores of the Karakoshun, where, on splendid pasture ground, abounding in fresh water springs, a halt of two days was made. From that point the return to the headquarters was made in canoes. The headquarters were reached after about a month's travel, on May 8. After a rest of a few days, Sven Hedin started with the whole caravan from Jañgi-Köll by way of the river to Abdal. He concludes his letter by stating that he will leave the main caravan at Abdal, and will go with a small escort to the mountains. He then intends to make journeys from Abdal with light caravans through Northern and Central Tibet. In the autumn he will go to the Mongols in Northern Tjadjam, and return once more to the above mentioned ruins in the desert south of Altimisch-bulak. He intends to leave his main caravan during the winter (1900) in the small town of Tjarkhlik, whose Chinese amban is an old acquaintance of the explorer. His next report, he says, will be sent in November to Kashgar.

THE SCOTTISH NATIONAL ANTARCTIC EXPEDITION.*

By WILLIAM S. BRUCE, F.R.S.G.S.

MORE than half a century has gone by since any great interest was taken in the Antarctic regions. Indeed, people seem to have forgotten that there is an area round about the South Pole, greater than that of Africa, about which we practically know nothing. During the early forties there were no less than three expeditions with six ships representing America, France, and Britain, exploring in the Antarctic at one and the same time, and until recently no further exploration work has been done. The "Challenger" crossed the circle in 1874, and the Scottish whalers carrying scientists and an artist with them in 1892-93 worked for three months in the pack in the vicinity of Erebus and Terror Gulf. Last year a Belgian expedition, under the leadership of Lieut. de Gerlache, returned to Europe after being the first human beings to spend an entire year within the Antarctic Circle, and bringing back a rich series of scientific observations.

This year Sir George Newnes' expedition, under the leadership of Mr. Borchgrevink, has returned, having supplemented the work of the Belgians by bringing back records of a second winter in the Antarctic. Next year, if all is well, at least three expeditions will set sail. The first of these is from Germany, the other two are from the United Kingdom. Scotland is making a special effort, in that she not only partakes in the honor of contributing her share to the British ship, under the command of Lieut. Scott, R.N., but in that she is sending out a second vessel on her own account. Several eminent geographers have advocated such a course, among others, Prof. Erich von Drygalski, leader of the German expedition, who says that "an expedition from a third side would find a wide and important field of activity to the south of South America." The Scottish expedition will co-operate with the others, but while magnetism forms the most important feature of the German and British expeditions, it will devote itself more particularly to physical and biological oceanographical researches, and to geology and meteorology.

Germany will concentrate her attention to the south of the Indian Ocean. "The point which the German expedition has in view for commencing the penetration of the Antarctic region is the still hypothetical Termination Island." An effort will be made to establish a station on land to the southward of this. The main work of the British expedition will lie in M'Murdo Bay at the foot of Mount Erebus, their winter headquarters, and the adjacent coasts or ice barriers for a considerable distance on each side. The Scottish expedition will work to the south of South America, setting up its wintering station on the east coast of Graham's Land, as far south as is desirable.

The Scottish vessel will be one of the ordinary Norwegian or Scottish type of whalers, about 500 tons, with auxiliary engines. The proposed staff includes 6 scientists, 5 ship's officers, and a crew of 26. The ship will proceed from Scotland on August 1, 1901, to Port Stanley, in the Falkland Islands, which will form the base for operations in the Antarctic regions. Thence she will head southward by Weddell's track in 30° west. This route has never yet been tried seriously with a steamer. Weddell, in 1823, penetrated far south with two sailing ships, one of 120 tons and one of 65 tons. Bellinghousen also was successful a little further eastward. Ross, with sailing ships, failed; but Larsen, with a steamer, reached 68° south in about 60° west. The Dundee whalers, in 1892 and 1893, being on commerce bound, were chiefly occupied killing seals, and since these abounded in the vicinity of the Circle, they had no need to go further south. There is little doubt that the ice can be penetrated by such a vessel as that above mentioned. The ice I saw in 1892 and 1893, and worked among in 50° to 60° west in neighborhood of the Antarctic Circle, is very similar, and is certainly not so heavy as East Greenland ice, in which ships like this one navigate every year.

The writer will take command of the expedition with a whaling captain under him and four other officers. A naturalist will be permanently attached to the ship, and will take charge of and carry on the scientific work there during the leader's absence with the wintering party. The land party will land in a high latitude on the east coast of Graham's Land, and the ship will return northward for the winter.

The land party will consist of five scientific men and two skilled workmen. The leader is included in this number. Systematic observations will be taken and collections made. The ice, both on land and sea, will be studied—its physical state, the movements of gla-

ciers, salinity, etc. In the spring sledge journeys with dogs will be undertaken for topographical and other purposes. I have seen fast land floe ice in the Antarctic that could be traveled over with dogs, sledges, and ski; and I have no doubt that useful journeys could be made on the inland ice. In 1902 the ship will return south to relieve the wintering party and to resupply it with fresh food. If there is occasion and opportunity, further exploration will be made with the ship in the summer months in that region, before she returns northward for the second winter. A second winter will be spent at the station, and a final return made during the third year, unless funds allowed the expedition to stay another winter.

Modern expeditions, whatever unknown part of the world they intend to explore, must not be content merely to cover great stretches of land or sea; they must concentrate all the powers and resources of civilization and science in bringing back a complete and detailed record of the parts they visit. To go to the South Pole and back again is of no value beyond being an athletic feat, but to carefully survey the land, sea, and atmosphere in a definite area in the south polar regions, and to bring back complete records of every description, is of the greatest possible value, and is what is required of every south polar expedition.

So vast is the unknown area of the Antarctic that there is room enough for many more expeditions than those that are setting out next year from Europe. This is emphasized when we recall that as many as five expeditions have been wintering in the much explored Arctic regions during the past winter, and that there was still room for others. It is to be hoped, therefore, that other countries, America and Norway, for instance, will join in this great international piece of work.

Many important problems will be presented to the Scottish expedition along the route it intends to follow. The voyage to the Falkland Islands will be made as quickly as possible. The first stop will be to coal at the Cape de Verde Islands, after which a course will be steered for a point almost half way between Trinidad and Ascension Islands, nearly a thousand miles east of Bahia, on the Brazilian coast, where Ross did not reach the bottom with 4,600 fathoms of line. This sounding has been overlooked by cartographers, only appearing, as far as I am aware, in one chart of the South Atlantic. A sounding will be made in this place to prove or disprove the accuracy of Ross's sounding, which up till quite recently was the greatest depth recorded in the oceans. Should the weather remain favorable, other soundings will be made in this little known "deep." Besides adding important facts to our knowledge of the bathymetrical survey of the Atlantic Ocean, this will enable us to test the capabilities of our deep-sea gear to its fullest extent, thus bettering our researches in the south. As fast a passage as is possible will then be made to the Falkland Islands, where a few days will be spent taking a final supply of coal on board, as well as fresh mutton, beef, and other provisions. Throughout this part of the voyage as many observations and collections as possible will be made, without stopping the ship, in meteorology, in physical observations of the surface of the ocean, and in planktonic and neektonic collections.

After leaving the Falkland Islands a course will be steered until longitude 30° west is reached in the vicinity of the Sandwich group; this point should be reached on or about November 1, 1901. It is possible that a line of soundings running southward will be taken at this time along the meridian of 30° west, which will be of extreme interest in relation to Ross's sounding of 4,000 fathoms, no bottom, in latitude 68° 34 minutes south and longitude 12° 49 minutes west, and to the deep soundings taken by the German Deep-Sea Expedition in the ship "Valdivia," between Borwet and Enderby Land. During this season, however, the primary piece of work will be to push southward in this longitude to a high latitude and establish a wintering station. Possibly a latitude of 80° south may be attained, or if the coast line of Antarctica be not met with in that latitude, the ship will push southward as far as the ice allows, till land is reached. No sacrifice of the ship, or of scientific work and records, will be made in attempting to reach the South Pole, but failing to find land south, a course will be steered westward to strike the southern continuation of the east coast of Graham's Land, where the station will be set up.

After the house has been built and provisions for three years landed, as well as scientific equipment and the seven winterers, the ship will hastily retire before winter sets in to gain the open sea and the Falkland Islands. Here officers and crew will rest and recruit for a week or so, in order to continue with vigor the work that will have to be done during the winter months, before returning to relieve the high latitude station in the spring—namely, November, 1902. The ship will not winter if it is possible to avoid it, for by so doing she becomes a hulk to all intents and purposes, whereas if she is free she can be carrying on oceanographical researches in the open sea in unknown and moderately high southern latitudes, and be visiting islands which lie in her track. At the end of the winter the ship will call at Buenos Ayres or Port Stanley, and, after being overhauled, another two years' provisions and coal will be taken on board for the high latitude station in addition to the three years' provisions landed the previous season. Thus the winterers will be perfectly secure for four more years should the ship find it impossible to reach them again during the next or following three years—a circumstance which, though possible, is scarcely probable, yet must be provided for. There will, no doubt, also be a plentiful supply of food near the station, seals, penguins, and other birds forming excellent and nutritive food as well as fuel.

As long as the season will allow, the ship will explore in the vicinity of the station during the second summer. Sounding, dredging, tow-netting and all kinds of marine physical observations will be carried on. Again, the ship will not be allowed to winter, if it is possible to avoid it, but will return northward to continue similar work to that she was engaged in during the previous winter. The winterers will once more set to work with serial station observations in meteorology, magnetism, and terrestrial physics and local topographical, geological, biological and other

work during the second winter and spring. In the third summer the ship will again push southward, and the whole expedition will return home unless the welcome news comes that funds sufficient for a third wintering have been secured. On the homeward voyage the expedition will complete, as far as possible, the accurate survey of the east coast of Graham's Land, and the bathymetrical survey between that coast and about 30° west longitude.

The difficulties of transport will necessitate the house being small; it will be of Russian construction, built of logs. There will be double windows and doors, all properly secured against cold, which, as far as we can gather, will not be more intense than that experienced in certain inland parts of Russia. There will be one main compartment and two or three smaller ones. Besides this there will be magnetical and meteorological observatories and store-houses for provisions and gear and properly sheltered accommodation for forty dogs. The station will be lighted by electricity.

The great value of such an expedition at the present time is that it will not only secure a number of highly interesting and important observations in the Antarctic, but that these observations will enhance and be enhanced by the observations being carried on at the same time by the German and British expeditions on the Indian and Pacific sides of the Antarctic. The Scottish station completes a triangle of stations round the South Pole, a condition very favorable, and, indeed, almost indispensable for researches in meteorological science.

I have been assured by the leading members of the councils of most of the learned societies of Scotland that they will constitute a committee of advice, to which all questions concerning the details of the organization and scientific work will be submitted. The cost of the expedition on the lines indicated will be £35,000, of which about £10,000 has already been secured. Many have expressed their pleasure in hearing of a Scottish Antarctic expedition, and among them Prof. Erich von Drygalski, who says: "Wishing the best result to the endeavors made in this direction, I shall be very happy to allow the German expedition to co-operate with the planned Scottish one."

The plans have been long considered, and I have consulted with many of the leading authorities in Europe while maturing them; notably I may mention His Serene Highness the Prince of Monaco and Sir John Murray. They are based on the experience I have gained during one summer I spent in the Antarctic regions and during four summers and one winter in the Arctic regions and during cruises with the Prince of Monaco and Mr. Andrew Coats, doing deep-sea sounding and dredging, as well as on my experience during more than a year on the wintry summit of Ben Nevis, where I was in charge of the observatory.

HEAT UNDER ALPINE SNOW.

WHAT makes the Simplon tunnel chiefly interesting both to engineers and the uninitiated is not the fact that it will be the longest of its kind in the world, but the employment of radically new methods in its construction, says The New York Tribune. These were adopted, moreover, for a reason that few would ever think of. Cutting a hole through granite is not now so serious a difficulty as dealing with the heat that is encountered in a mountain tunnel when it has attained a certain length.

It is well known that the air grows cooler with ascent, similarly, the air gets warmer as one descends; and if, instead of going down from a level surface, as in the copper mines of Lake Superior, one simply pushes ahead horizontally into a mountain a mile or so below its crest, the temperature will be observed to rise in the same manner.

During the construction of the Mont Cenis tunnel a maximum of 85° Fah. was experienced, and in the St. Gothard, 87°. It is estimated that for something like six miles of the Simplon tunnel the rock, when first laid bare, will show a temperature of 104°. While the St. Gothard tunnel was being cut no less than six hundred lives were lost among the workmen, most of them indirectly, in consequence of this heat. After engaging for hours in vigorous physical toil inside the tunnel, the men would go out into the Alpine coolness, take cold, and die. But if such results followed the construction of the St. Gothard tunnel, what might be expected of temperatures 15° or 20° higher for a much longer distance? It was this consideration which gave rise to what is the most important innovation in the Simplon tunnel. Improvements there will be, of course, in methods of drilling, blasting and removing the fractured rock, but the chief novelty has been planned for the sole purpose of abating the intense heat that would naturally be encountered.

The other great mountain tunnels of the world, even when designed to accommodate two railway tracks, are single. The Simplon tunnel will really be a pair of parallel passageways, whose centers are 55 feet 9 inches apart. Each will afford room for only one track. At intervals of 200 meters (656 feet), as the workmen advance, they will cut small cross tunnels to connect the main ones. These openings will be closed with doors, all except that which at any particular time happens to be the one furthest in. It will then be possible, by forcing air in through one tunnel and allowing it to return through the other, to establish a fine circulation. For that portion of the heading which is beyond the last door a supply of air will be furnished through a 10-inch pipe by hydraulic blowers. The air will be artificially cooled by a water spray before being pumped into the tunnel. Already this system is in operation at the southern or Italian end, but for the present a different plan has been employed at the northern end.

When a tunnel of this kind has been finished, it slowly cools off inside. The temperature at the middle of the Mont Cenis tunnel is now about 66° or 68° Fah., and in the St. Gothard tunnel between 72° and 74°, and it remains substantially stationary the year round. A like improvement may be expected to occur in the Simplon tunnel, but more speedily than in the other instances, on account of the plan just described.

Still, even after the heat has been disposed of, other evils have been experienced in the past. It has been deemed too costly to cut vertical shafts from the tunnel to the upper air for ventilating purposes. Accord-

* The Independent.