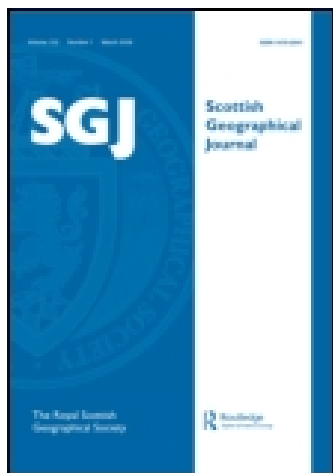


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## THE SCOTTISH NATIONAL ANTARCTIC EXPEDITION.

SECOND ANTARCTIC VOYAGE OF THE "SCOTIA."<sup>1</sup>

By J. H. HARVEY PIRIE, B.Sc., M.B., and

R. N. RUDMOSE BROWN, B.Sc.

*(With Map and Illustrations.)*

It is very satisfactory to be able to report that, although the Scottish National Antarctic Expedition has returned, it has been found possible to continue part of the work begun by that expedition in the Antarctic



FIG. 1.—Omond House, South Orkneys.

regions. The Argentine Government, during the stay of the *Scotia* at Buenos Ayres, agreed with Mr. Bruce to take over and continue the meteorological and magnetical observatory at Omond House, Scotia Bay, South Orkneys, which was built and set in working order during the winter that the Scottish Expedition spent at these islands. The Argentine Government had previously taken a very conspicuous part in the rescue of the recent Swedish Antarctic Expedition, and by now undertaking the responsibility of this Antarctic observatory, is showing itself keenly alive to the interests of science. The arrangement come

<sup>1</sup> Cf. this *Magazine*, vol. xx. pp. 57 and 113. We regret that, owing to ill-health, Mr. W. S. Bruce has been himself unable to complete the account of the *Scotia's* work in the Antarctic, and this task has therefore been delegated to members of his staff.—ED. *S.G.M.*



*Photograph by W. Crooke, Edinburgh.*

*Wm. S. Bruce.*

to was in great measure due to Mr. W. H. Haggard, British Minister to the Argentine Republic, Mr. W. G. Davis, of the Argentine Meteorological Office, and Dr. Francisco Moreno, of the La Plata Museum.

On January 21, 1904, the *Scotia* left Buenos Ayres for the south on her second journey. In addition to her own staff, there were on board three Argentine scientists, Messrs. E. Szmula, L. H. Valette, and H. Acuña, for the meteorological observatory in Scotia Bay. On her way the *Scotia* called at Port Stanley, Falkland Islands, where the remainder of the expedition's stores were taken on board, and finally on February 9 she left for the South Orkneys.

After a quick passage, during which no ice was met with, the South Orkneys were reached on February 14.

The effect of the summer temperatures was very noticeable in the amount of rock and beach now exposed in various parts of the islands.

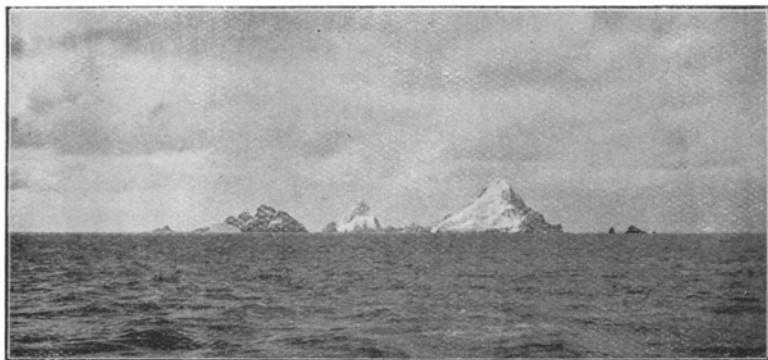


FIG. 2.—Saddle Island, South Orkneys.

Additional coal and provisions were landed, a complete wooden roof was put on the house, and a large lean-to shed built. On February 22 the Argentine party was left under the leadership of Mr. R. C. Mossman, who had consented to remain for a further period of twelve months. William Smith, the *Scotia's* cook, also agreed to stay.

This season there was an almost complete absence of pack in the vicinity of the islands, and on leaving the Orkneys a south-easterly course was steered with the object of cutting between our two tracks of the previous year. With the exception of bergs, no ice was met with till near the Antarctic Circle, where a slight detour had to be made to round some pack-ice.

In the beginning of March the *Scotia* crossed her old track of the previous year, and a few days after exceeded her previous southern record, and also Ross's furthest south in 1843. Skirting more or less open pack to the westward for about the last 300 miles, we had as yet met no obstacle to our southern progress, whereas the previous year we found impenetrable pack in this region.

In  $72^{\circ} 18' S.$ ,  $17^{\circ} 59' W.$ , we obtained a sounding of 1131 fathoms. This was a sudden shallowing, as up till now the depths had all been over 2600. At the same time land was reported ahead. Steaming towards this we found a lofty ice-barrier stretching in a north-easterly and south-westerly direction, effectually barring further progress to the south. Close heavy pack prevented a nearer approach than two miles. This barrier was traced for a distance of 150 miles to the south-west. In  $73^{\circ} 30' S.$ ,  $21^{\circ} 30' W.$ , a depth of 159 fathoms was got, the barrier being then two and a half miles off.

Early on the morning of the 7th the *Scotia* was caught in a north-easterly blizzard, and despite all efforts to get free, was beset in slush and heavy pack. During the following day pressure from the driving pack became great, the ice at times piling up against the ship's sides, and, as we found afterwards, going right under her, with the result that the ship was lifted bodily out of the water some four feet. It was doubtless in consequence of this that the *Scotia* suffered no injury from the tremendous pressure.

At the end of two days the gale abated. We then found that we had been driven into a bight of the ice barrier. This was in  $74^{\circ} 1' S.$ ,  $22^{\circ} 0' W.$ , and the depth here was 161 fathoms—two miles off the barrier. There was no open water in sight, and the temperatures down to zero which now set in soon froze up the pack. For four days there was no change in the weather, and owing to the lateness of the season, which seemed to preclude the possibility of our being liberated, we began to make preparations for the winter. During these days collections of the marine fauna were made by means of traps, and a number of emperor penguins, which were here extraordinarily abundant, were secured for the double purpose of specimens and food in the event of our having to winter. Giant petrels (*Ossifraga gigantea*), Skuas (*Megalestris antarctica*), and Terns (*Sterna hirundinacea*), Antarctic petrels (*Thalassæca antarctica*), and Snowy petrels (*Pagodroma nivea*), were present in large numbers, and some seals (*Lobodon carcinophagus* and *Leptonychotes weddelli*) were seen.

On March 13 a change took place, the pack began to break up under the influence of a gentle south-west wind, but the *Scotia* remained firmly fixed in a large floe. After futile efforts to break the ice by tonite, gunpowder, and other means, the floe gave way of its own accord, and the ship was once more afloat.

But during the succeeding twenty-four hours the ice remained tightly packed, and little progress was made, and it seemed quite probable that the ship would be again beset. Fortunately, however, the ice soon slackened again in a way which it often does without any apparent reason, and the *Scotia* was skilfully navigated to the edge of the pack, though not without great difficulty. This newly discovered part of the Antarctic Continent has been named "Coats Land," after Mr. James Coats, jun., and Major Andrew Coats, the two chief subscribers to the expedition.

In this connection we quote the words of Mr. Bruce:—"I have been asked by several if I am sure that this great ice-barrier was really part

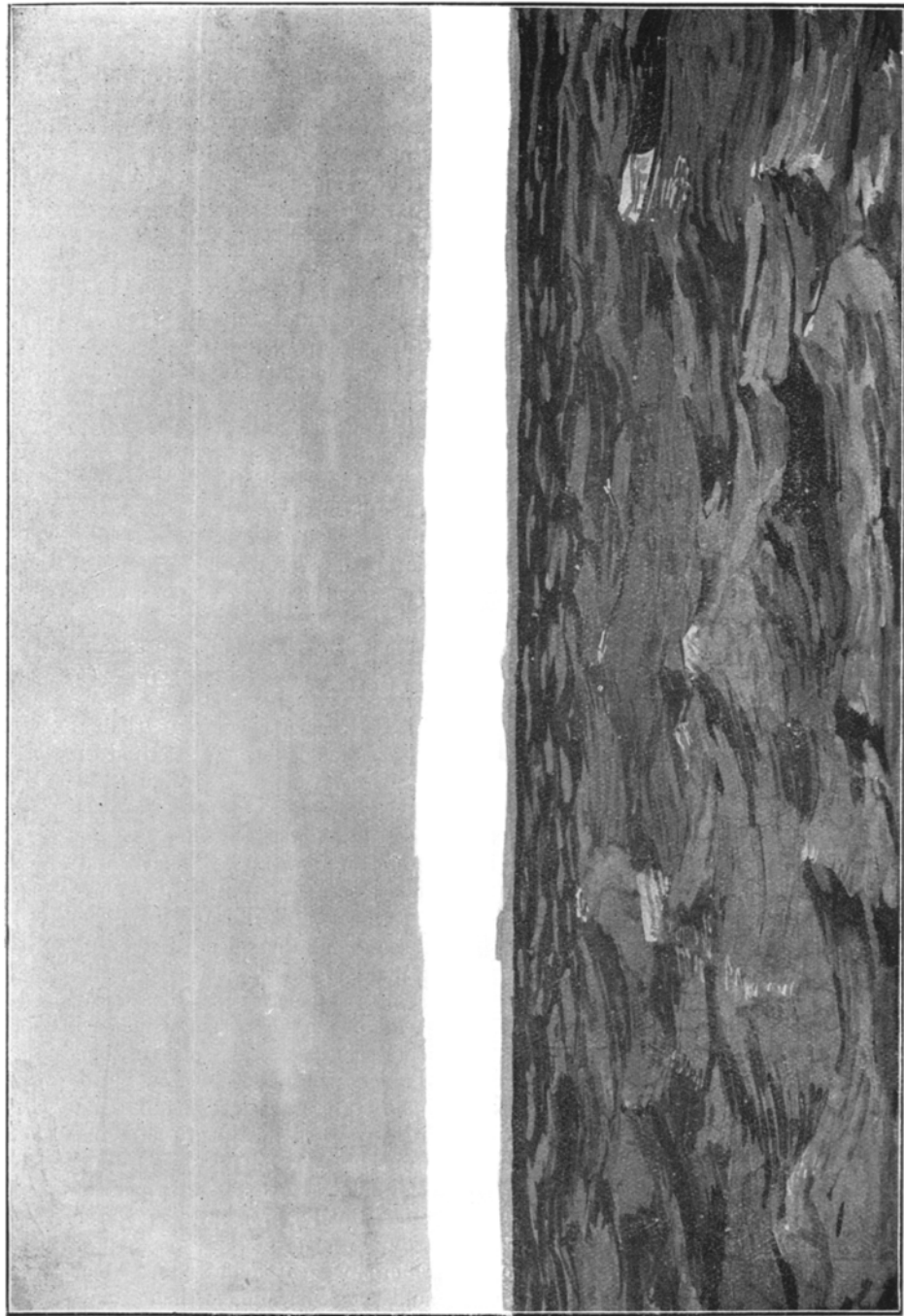


FIG. 3.—Coats Land.

of the Antarctic Continent. I have no hesitation in saying 'yes,' and my reasons are these: All our soundings between  $60^{\circ}$  to  $70^{\circ}$  S. were 2500 to 2700 fathoms. In  $72^{\circ}$  S. they shoaled to about 2300, fifty miles from the barrier. Thirty-five miles from the barrier they shoaled to 1400 and 1200 fathoms, and two miles from the barrier to 160 fathoms. This alone should answer the question in the way which I have done. Secondly, from the vertical cliff of ice 100 to 150 feet in height which bordered the ocean, the ice rose high inland in undulating slopes and faded away in height and distance into the sky. It was impossible to estimate the height of this field of ice—the true inland ice of Antarctica—but probably it was many thousands of feet. Thirdly, seals and birds, which up till now had become few in numbers, were seen in myriads—penguins, especially emperors, many petrels, and terns swarming in every direction—the inhabitants of the beaches and rocky cliffs of some actual land not very far distant."

It was now the end of the Antarctic summer, and our somewhat unexpected escape from the ice was sufficient warning that it would be unwise at that season to force the *Scotia* again into the pack. We therefore turned north-eastward towards the "Ross Deep," an examination of which was part of the programme of the expedition. The water began to rapidly deepen to 2000 fathoms and over until after a few days, when, as the sea seemed open in that direction, we set a somewhat more easterly course, which soon brought us into rapidly shoaling water, until in  $71^{\circ} 32' S.$ ,  $17^{\circ} 15' W.$ , it was 1221 fathoms, which showed we were getting to the continental shelf. At this point, however, pack again began to be met with, and the *Scotia* was therefore turned back on her former course to the north-east. It is worthy of note that a trawling we took in 1410 fathoms in  $71^{\circ} 22' S.$ ,  $16^{\circ} 34' W.$ , resulted in one of the richest hauls we had in Antarctic waters, no less than some sixty species of animals being obtained.

On March 23 a sounding of 2660 fathoms was obtained within one mile of Ross's reported sounding of 4000 *fathoms no bottom*, and so after sixty years this sounding, and with it the hypothetical contours of the South Atlantic based on it, have been obliterated from the map. This, however, implies no disparagement of the splendid work of Ross in his exploration of the Antarctic. Doubtless his error was due to the inadequate sounding apparatus which was then at the disposal of oceanographers, and to the existence of a strong undercurrent which we discovered in this region. This undercurrent was a source of great trouble, and on two occasions prevented the trawl from reaching the bottom, while on a third occasion we had to pay out about 1000 extra fathoms of cable before this was effected. After this the *Scotia* turned northward with the intention of sailing along the meridian of  $10^{\circ} W.$ , and taking a line of soundings and other observations up to Gough Island. In this part of the South Atlantic Ocean there were no previous records, but deep water of 3000 fathoms was hypothetically charted.

Up to about the latitude of  $54^{\circ} S.$  icebergs were frequently met with, but on the whole the weather was fine and the seas calm, so that sounding and trawling were carried on with little difficulty and sets of serial

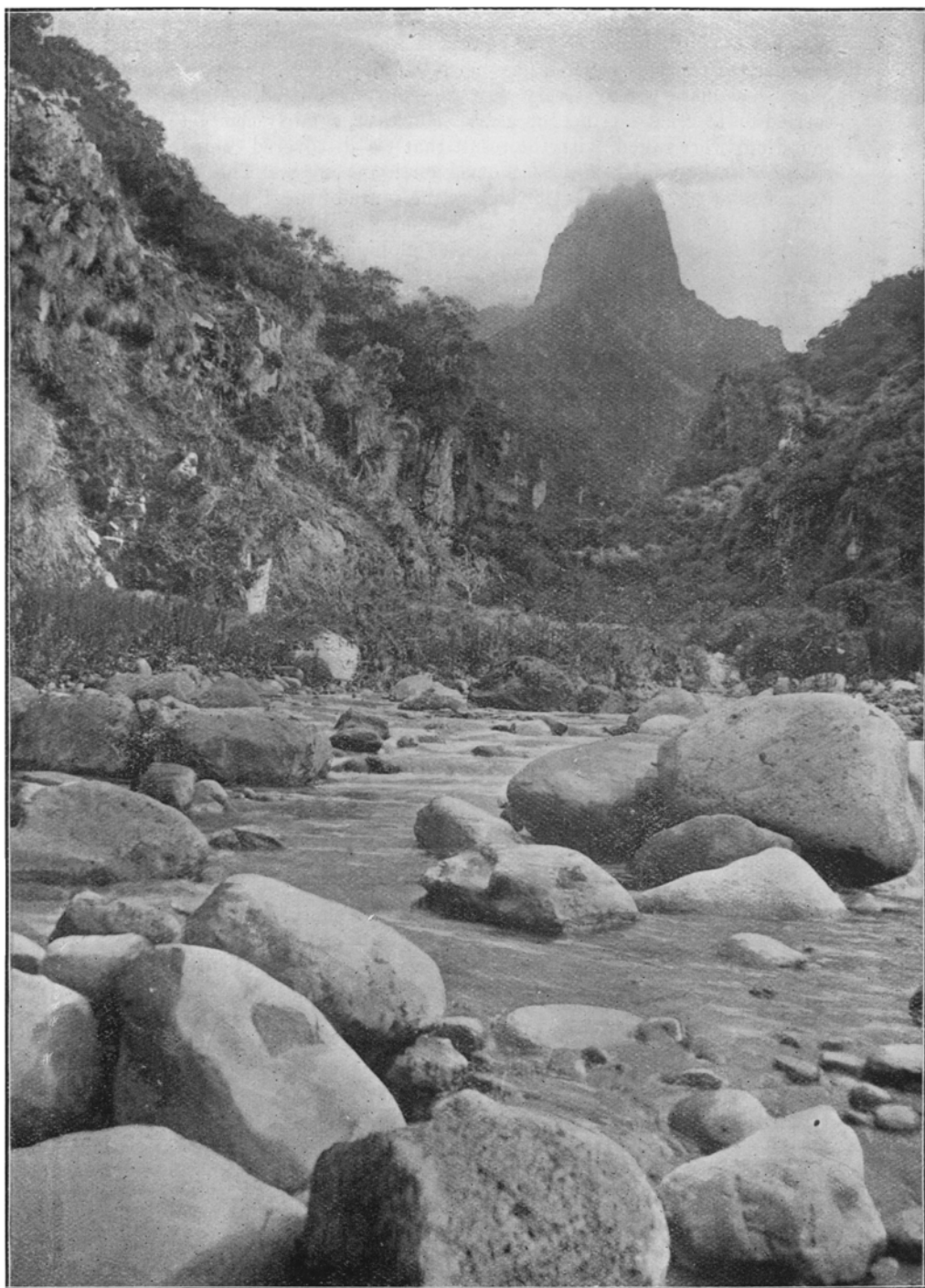


FIG. 4.—Glen on Gough Island.



temperatures obtained. North of this latitude we got into very stormy weather. Constant gales from the NW. and NNW. accompanied by heavy seas made progress very slow, and only permitted sounding to be carried on at great sacrifice of gear. However, a fairly complete set of soundings were taken, with the result that we discovered comparatively shallow water, under 2000 fathoms, north of  $52^{\circ}$  S. This shows an extension of the Mid-Atlantic ridge to the south of the Tristan d'Acunha group. From  $58^{\circ}$  S. to  $48^{\circ}$  the bottom was diatom ooze and hard ground; in  $46^{\circ}$  and  $41^{\circ}$  S. samples of globigerina ooze were brought up.

The *Scotia* behaved splendidly throughout all these weeks of bad weather, and beyond the loss of a quarter boat swept away during a

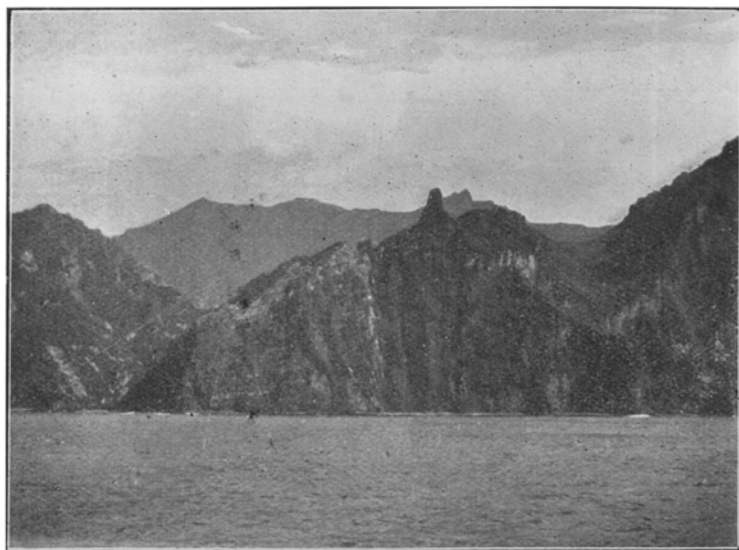


FIG. 5.—Cliffs of Gough Island, showing hanging valley.

severe gale, sustained no damage. She proved herself as satisfactory a sea boat as she had proved herself an ice boat in the Far South.

On April 21 Gough Island was sighted during the first watch. Next morning we steamed along the lee of the island, but so heavy a sea was running that landing was out of the question. The following day the sea had moderated, and we succeeded in landing at what is apparently the only spot on the island whence access to the interior can be obtained. In all other places the island meets the sea in more or less perpendicular precipices with only a small strip of beach at low tide.

At the place where we landed a mountain torrent comes down a picturesque glen from the interior. Vegetation was very plentiful; the whole island indeed is clothed in green. Tussock grass (*Spartina arundinacea*) and a small stunted tree (*Phyllica nitida*) both grow in abundance even on the more exposed places. Ferns and mosses are

luxuriant beside the numerous waterfalls and along the banks of the stream. A number of birds were seen, including finches and a water-hen; a few insects were also found. In its general aspects both the fauna and flora resemble those of Tristan d'Acunha, but without doubt include several new species: two species of birds new to science are now being described. After four hours ashore we returned to the ship with collections which were of exceptional interest as being the first scientific collections ever obtained there. Ruins of huts were found near our landing place. These, we afterwards found at Cape Town, had been inhabited by sealers who had spent some months in the island.

The next day we spent in dredging and collecting birds off the land, and left at nightfall for Cape Town. Fine weather and fair winds were



FIG. 6.—Narrow Peninsula on north coast of Laurie Island.

experienced, so that we got several soundings taken on our course between the parallels of  $39^{\circ}$  S. and  $40^{\circ}$  S., finally reaching Table Bay on the evening of May 5, 1904.

Two weeks later the Scottish Expedition left for home, calling *en route* at Saldanha Bay, St. Helena, Ascension, and Fayal (Azores), at each of which places a stay of two or three days was made. At Cape Town and all other ports of call the expedition was warmly welcomed, and much interest shown in our work. At Ascension we had the good fortune to meet with H.M.S. *Beagle*, whose captain and officers had treated us with so much kindness at the Falkland Islands on our return from the Antarctic in December 1903. On our arrival at the Azores we met S.M.S. *Gazelle*, of the Imperial German Navy, on the point of departure for Europe, and her captain very considerately offered to take home a mail for us. We were glad to take advantage of this opportunity, as otherwise letters could not have reached home before us.

After touching at Kingstown on the way, the *Scotia* reached the Clyde on July 31, and was accorded a magnificent reception at Millport.

To sum up: the chief scientific results of the *Scotia's* voyage are:—

(1) In the Weddell Sea a large number of soundings and the finding of a southern limit at Coats Land, show this sea to be considerably less extensive both in area and depth than was previously supposed. Numerous observations on the temperature and salinity of the water have been taken at all depths, samples of the bottom deposits got, and a zoological collection gathered which embraces a large number of birds in addition to seals, fish, and representatives of almost every class

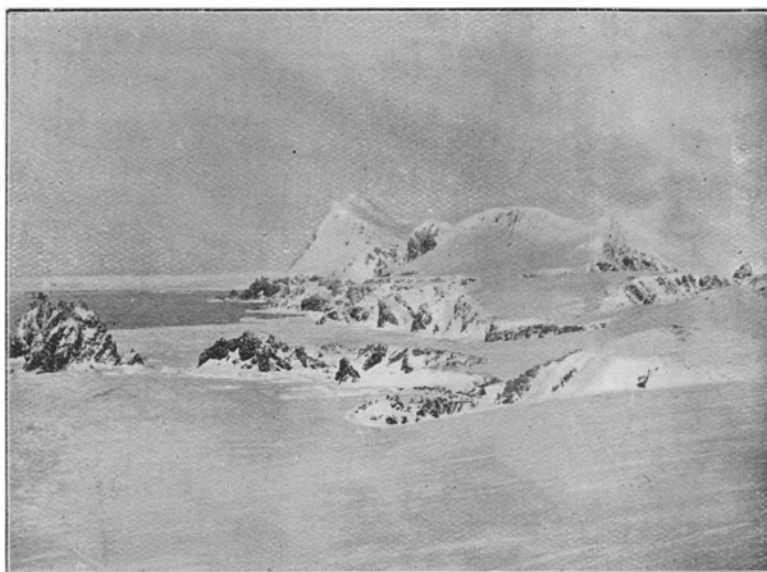


FIG. 7.—Cape Dundas, eastern extremity of Laurie Island.

of the invertebrates, from the surface waters, from intermediate depths, and, above all, from the bottom of the ocean. Systematic plankton collections were also made.

(2) At the South Orkneys materials were collected for a detailed map of Laurie Island (see Figs. 6, 7, and 8), which we hope to have ready for publication very soon; a continuous hourly meteorological record was kept for eleven months, a record which is still being kept, and which is supplemented by similar observations taken by the *Scotia* all the time she was at sea; magnetic observations were made, which this year will see still further extended under Argentine auspices; the botany and geology was investigated, and an extremely rich shallow-water fauna collected, in addition to numerous specimens of the seals and of the birds of the locality, with their eggs.

(3) In the South Atlantic a somewhat deeper channel has been demonstrated between the Falkland Islands and the South Orkneys than was previously supposed to exist.

Further to the east, the ocean's contours have been materially changed by the discovery of a large southern extension of the Mid-Atlantic ridge to the south of Gough Island. Physical and biological work has been carried out in a hitherto entirely uninvestigated ocean; and on Gough Island a small but representative collection of the fauna, flora, and geology has been made for the first time.

But the South Atlantic is large, and there still remains much to do. Between the Tristan d'Acunha group and the South Georgia the ocean is, from a scientific point of view, absolutely unknown. To the south



FIG. 8.—Glacier at head of bay, north coast of Laurie Island.

and east of South Georgia much information is wanted with regard to the ocean depths, and of South Georgia itself, despite the recent work of the Swedish Expedition, comparatively little is yet known. The South Sandwich group remains entirely unexplored. The survey of the South Orkneys begun by this expedition requires to be continued, especially in the western half of the group. Exploration of Antarctic lands in this region offers what is perhaps the finest piece of pioneer work in geography remaining to be done. From Coats Land eastwards to Enderby Land, through  $60^{\circ}$  of longitude, the position of the coast-line is entirely unknown; while to the westward the map shows another great blank area intervening ere the fringe of the Antarctic is again reached in Graham Land. It is to be hoped that our knowledge of this region will not long remain in this partial condition, but that the work commenced by Mr. Bruce will be continued in the near future.

MAP SHOWING THE TRACK OF THE "SCOTIA," 1903-1904.

