FURTHER ANTARCTIC RESULTS.[1]

THE Belgian Antarctic Expedition has issued another seven sections of the ten important volumes which it is contributing to Antarctic knowledge. Four of the new parts are technical contributions to systematic zoology. Prof. Jungersen, of Copenhagen, describes the Pennatulids, which are represented in the collection by eight specimens; all of them are referred to one species, the *Umbellula carpenteri*, first discovered by the *Challenger*. Herr Böhmig, of Graz, describes the Turbellarians, a small but interesting fauna containing a new genus of Acœla and three species of the characteristic sub-Antarctic genus Procerodes. A detailed account is given of the anatomy of these worms, and the author establishes a new genus and subfamily, the Stummerinæ, for a species that had been collected by the French Antarctic Expedition, and referred by Hallez to Procerodes. Herr L. Plate contributes a note on the Scaphopods, which are represented by one determinable and one indeterminable species of Dentalium, both collected south of latitude 70°. The Cirripedes are described by Herr P. P. C. Hoek, and this group is represented by three species, of which one, *Verruca mitra*, is new. They all come from the neighbourhood of the Magellan Straits. But that area does not appear to be rich in these crustacea, and the only known Antarctic species is a Scalpellum collected by the *Challenger* near the Antarctic Circle.

The geographical results include a valuable joint report by M. Arctowski and Dr. H. R. Mill on the serial temperature observations. Ross had attempted to determine the temperature of the deep sea in the same area, but, as is well known, his results were misleading, as his thermometers were not protected against pressure. The *Challenger* thermometers were, of course, guarded against this error, but they recorded only the temperatures of the coldest and warmest of the layers passed through during the sounding. Bruce, in the *Balaena*, was better equipped; but he was only able to determine the temperatures at two localities. The Belgian expedition, however, was able to conduct serial temperature soundings with such precision and in such numbers that the seas which it explored are, as regards temperature distribution, described by Dr. Mill as now one of the best-known parts of the oceans.

The observations show that the distribution of temperature in the seas between South America and Graham Land is typically sub-Antarctic. There is a zone of warm water between a cold surface layer and the mass of cold water below. South of the Antarctic Circle seasonal variations were found to affect the temperature to a depth of only 150 metres. In most localities the coldest water was found at the surface, and the temperatures rose, sometimes regularly, to a maximum in most cases at the depth of about 600 metres. Below that level there is a slow fall in temperature to the sea bottom. The bearing of these observations on submarine topography is shown in Gerlache Strait, where only one serial temperature observation was made; the temperature of the water was almost uniform throughout, and the water was a little colder at the bottom than at the surface. The authors, therefore, conclude that Gerlache Strait is a closed basin, and that a shallow threshold protects it from the inflow of warmer water.

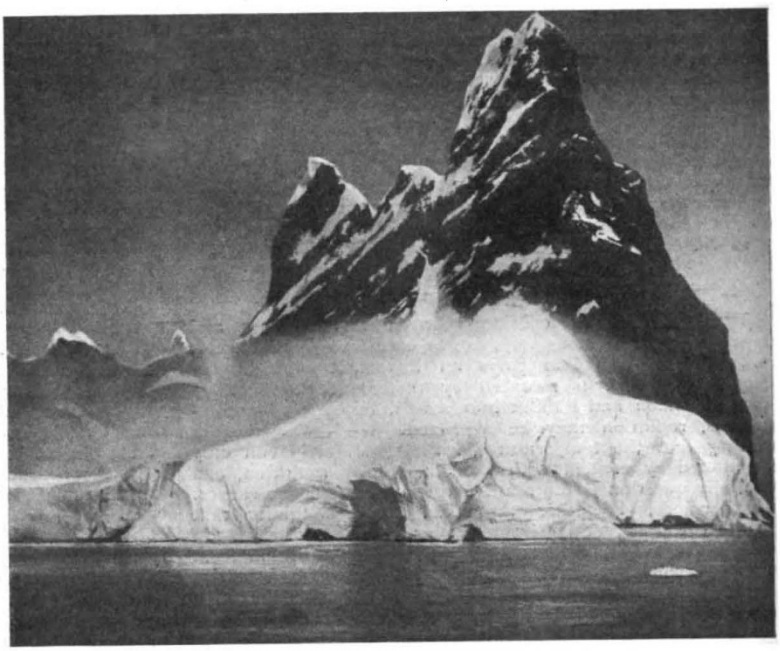

FIG. 1.—Aiguilles of Cape Renard, seen from the North-east.

M. Lecointe, the second in command of the Belgian expedition, contributes a memoir on the pendulum observations. The frontispiece is a photograph of Lieutenant E. Danco, who had charge of this work until his death during the expedition. The memoir gives a detailed account of the instrument employed, Sterneck's half-second pendulum. It was only used during the expedition at one locality, Punta Arenas, in Tierra del Fuego, where the value of g was determined as 9·8108.

The new contribution to the reports of the Belgian expedition of widest general interest is M. Arctowski's valuable report on the glacial observations in the neighbourhood of Magellan's Straits and in the South Shetland Archipelago; and the glaciers and icebergs of those regions are illustrated by eighteen excellent photographic plates. M. Arctowski describes the former greater extension of the glaciers, and regards this as part of a world-wide phenomenon, for which he says the explanation has yet to be found. He adopts ex-

[1] "Résultats du Voyage du S.Y. *Belgica* en 1897-9." G. Lecointe, Physique du Globe, Mesures pendulaires, 1907, 40 pp., 9 figures; P. P. C. Hoek, Zoologie, Cirripedia, 1907, 9 pp., 4 figures; H. F. E. Jungersen, Zoologie, Pennatuliden, 1907, 12 pp., 1 plate; L. Böhmig, Zoologie, Turbellarien, 1908, 32 pp., 2 plates; L. Plate, Zoologie, Scaphopoden, 1908, 4 pp.; H. Arctowski and H. R. Mill, Océanographie, Relations thermiques, Rapport sur les Observations thermométriques faites aux Stations de Sondage, 1908, 36 pp., 4 plates; H. Arctowski, Géologie, Les Glaciers, Glaciers actuels et Vestiges de leur ancienne Extension, 1908, 74 pp., 18 plates. (Anvers: D. E. Buschmann.)

"Deutsche Südpolar Expedition, 1901-3." Edited by E von Drygalski. Vol. ii., Kartographie, Geologie; Part ii., 1908, pp. 91-222, plates ix-xxii., and 3 maps. (1) E. Werth, Aufbau und Gestaltung von Kerguelen, pp. 91-183, plates ix-xiv, 33 figures, 3 maps; (2) E. Philippi, Geologische Beobachtungen auf Kerguelen, pp. 185-207, plates xv-xxii, 2 figures; (3) R. Reinisch, Petrographische Beschreibung der Kerguelen-Gesteine, pp. 209-222, 6 figures. (Berlin: G. Reimer, 1908.)

Vol. i., Geographie, Heft ii. Pp. 99-280. Edited by E. von Drygalski. Vol. ii., Geographie, Geologie, part iii., 1908, pp. 223-298, plate xxiii. (1) E. von Drygalski, Geographie von Heard-Eiland, pp. 223-239, plate xxiii., 3 figures; (2) E. Philippi, Geologie der Heard-Insel, pp. 241-250; (3) R. Reinisch, Gesteine der Heard-Insel, pp. 251-263, 8 figures; (4) E. Vanhöffen, Tiere und Pflanzen der Heard-Insel, pp. 265-271; (5) W. Meinardus, Skizze des Klimas der Heard-Insel, pp. 273-298, 2 figures.

treme views on some glacial questions, and holds that the progressive advance of civilisation to the temperate regions from the tropical and subtropical zones is one manifestation of the spread of a milder climate across the earth. Of the suggested theories of glaciation he regards Croll's as the most seductive, but admits that it has fallen with all the rest; nevertheless, he still argues with Croll's wild estimate that the ice at the South Pole is six miles thick, as if that notion were worth serious consideration. Arrhenius's view that glaciation is due to variations in the atmosphere Arctowski rejects as being far from a satisfactory explanation of the facts. His own idea is that the climatic change was due to a variation in the heat supply from the sun.

The memoir begins with a description of the glacial phenomena of the neighbourhood of the Magellan Straits, supplementing the valuable observations in this area by Dr. Otto Nordenskjöld. The second part of the memoir is a valuable contribution to the tectonic and glacial geology of Gerlache Strait. He describes that strait as a tectonic valley, but he is doubtful (p. 34) whether it was formed as a syncline or a rift valley. In dealing with the Antarctic lands, he notes the various forms of the name Antarctica, and suggests that the western section should be called "Westantar," as "Antar" includes all that is common in the various forms of the name Antarctica.

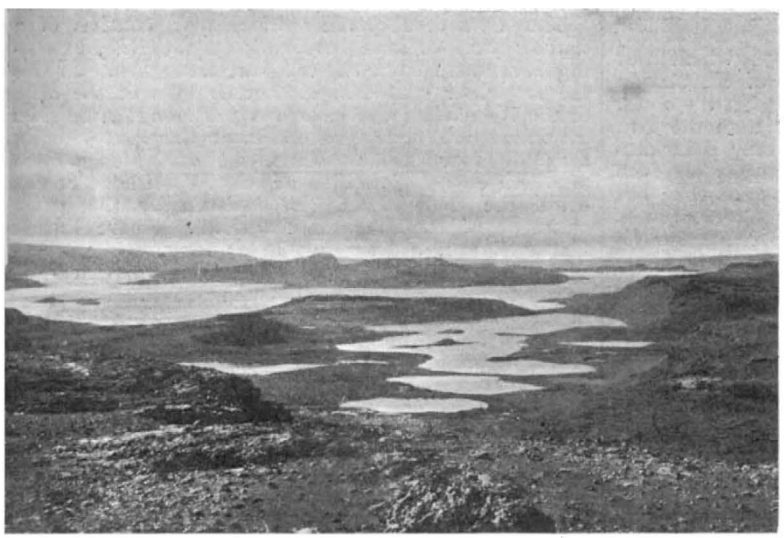

FIG. 2.—View of Royal Sound, Kerguelen.

In his account of the tabular icebergs, M. Arctowski is emphatic as to their identity with the floebergs of the Arctic, and he quotes with approval Greeley's excellent statement of the formation of floebergs. He discusses the question of glacial erosion, and says that his observations show that erosion by glaciers is a mere "minime"; but he remarks that ice has powers of deeper erosion than rivers, as it can erode below sea-level, whereas a river cannot excavate deeper than the level of its mouth. His report concludes with an interesting discussion on the extent of the refrigeration of climate indicated, according to the theory he accepts, by the former extension of glaciers.

A further instalment of the reports of the German Antarctic Expedition includes three instructive memoirs on Kerguelen. Dr. Werth records his additions to the geography of the island during a year's residence, in 1901 and 1902, at a station erected on the Gauss Peninsula in south-eastern Kerguelen to obtain observations for comparison with those simultaneously made by the *Gauss*. Emil Philippi, the geologist of the expedition, records the results of his excursions ashore during the stay of the *Gauss* at Kerguelen, and Dr. Reinisch describes in detail the rock specimens collected there.

Since the discovery of the archipelago by Kerguelen in 1772, and the establishment of its insular nature by Cook in 1775, it has been visited by many expeditions, including the *Erebus* and *Terror*, the *Challenger*, the *Gazelle* and the *Valdivia*, and by private naturalists, such as Hall, the Australian ornithologist. It has also been the resort of seal and whale fishers. Nevertheless, and in spite of the important contributions of the expedition under Drygalski, Kerguelen is still imperfectly known. Dr. Werth made numerous excursions from the station, but the main interior and its glaciers and mountains, were inaccessible to him, and the southern and western coasts he describes as still practically unknown. Dr. Werth's range of work was restricted by the difficulties of transport. His party had at first to carry all their equipment on their backs, and were therefore limited to excursions of about five days' duration. Later on he used dogs, and as each dog carried a pack of twenty pounds, it could take its own rations for ten days, and some supplies for the explorers. In the later part of the stay on the island exploration was unfortunately prevented by illness.

The chief island of the Kerguelen Archipelago is only 130 square geographical miles, and it is divided into three divisions. The western coast lands are still little known, and may contain some centres of recent volcanic activity. The central highlands, running from north-west to south-east across the island, include two high ice-covered plateaus, and culminate at their southern end in Mount Ross, a volcano with a well-preserved crater and 1990 metres high. The third section includes the country on the eastern parts of the island; it is deeply indented by the sea, and is mainly lowland, but it includes one independent mountain complex and some wide plateaus.

The solid geology of Kerguelen is disappointing. It consists of nothing but a vast dissected sheet of basalts, with their associated tuffs, and various glacial and alluvial deposits. There are older trachytic and phonolitic lavas, of which the German expedition obtained traces in beds of sanidine sand. There are no known pre-volcanic sedimentary rocks, and whether Kerguelen is a continental or an oceanic island is left undecided. The physical geography of the island is, therefore, its chief interest. For a land in the latitude of only 48°–50°, it has the remarkably low snow-line of 1850 feet, and its central highlands are covered by an ice sheet which Dr. Werth has named after Richthofen. There is abundant evidence that the glaciers were more extensive, at a date that Dr. Werth calls "diluvial," which may be more recent than the chief glacier extension in north temperate regions. The glaciers certainly formerly reached the present sea-level, and appear to have continued some distance over what is now the sea floor. It is, therefore, disappointing that there is no certain evidence as to the post-Glacial

uplift of the land. Both Werth and Philippi describe the occurrence of recent shingle and shells at heights up to about one hundred metres; but they recognise the possibility of these having been carried inland by sea-gulls or sea elephants. There is abundant evidence of recent subsidence; the eastern district, according to the chart and many beautiful photographs, presents the typical features of a sunken land.

Dr. Werth discusses at length the origin of the valleys and the relations of the two types of drowned valleys known as "fjords" and "fjärds." The distinction between them was established by Penck in 1882; fiords are complex and usually branched valleys in mountainous districts, and fjärds are valleys that are usually parallel to one another, and occur in low-lands. The value of this distinction has been doubted, but Werth thinks it is useful; and he proposes that valleys of the fjärd type should be called "föhrde," after the name given them in southern Denmark, as it has the same root as the Norwegian fjörd, the Swedish fjärd, the Icelandic fjördur, and the Scottish firth.

Denudation in Kerguelen, according to Dr. Werth, is due chiefly to glacial action, for the rivers are insignificant; but Philippi points out that the valleys were pre-Glacial. Consideration of their age necessarily involves that of the lava flows through which they have been cut. In the neighbourhood of the station the eruptions were obviously pre-Glacial; but the crater of Mount Ross must be much younger than the lava flows of the eastern lowlands. The only palæontological evidence of the age of the eruptions is given by some fragments of the stem of Cupressoxylon; but as this conifer ranges from the Upper Cretaceous to the Pliocene, its evidence is not very precise, though the Kerguelen species is regarded as pre-Pleistocene. Wind erosion is exceptionally well exhibited, owing to the violence of the storms and the abundance of loose volcanic débris for the sand blast; the effect of the wind is illustrated by photographs of a carved block of basalt and of some potholes bored by sand erosion on the face of a vertical rock.

The important contributions of the German expeditions to the natural history of Kerguelen show how great are the gaps in our knowledge of that interesting and accessible archipelago, and will, it may be hoped, lead to its fuller investigation.

Heard Island, where the German Expedition spent seven profitable hours ashore, is 330 miles south-east of Kerguelen, and is even less known. Both islands rise from the same submarine plateau, and the reports by Philippi and Reinisch show that they are composed of similar volcanic rocks, for Heard island consists of trachytes, felspar basalts and limburgites. The rocks look less weathered than those of Kerguelen, but Philippi suggests, from the greater abundance of trachyte, that the lavas belong to the earlier period of the Kerguelen eruptions. Prof. Drygalski describes the geography of Heard Island and the seven glaciers on the northern coast, Meinardus contributes a sketch of its climate based on all existing records, with the gaps filled by interpolation from the observations on the *Gauss* and at the station at Kerguelen. In view of the many interesting problems connected with Heard Island, Prof. Drygalski recommends it as a suitable locality for a year's expedition; and as at the visit of the *Challenger* there were forty men on the island who were staying there from October to December, an expedition should be easily practicable and profitable.

J. W. GREGORY.

IRRIGATION IN EGYPT.

The Esneh Dam.

THE construction of the dam on the Nile near Esneh, which has recently been completed, the last stone being laid by the Khedive, marks another step in the progress of that country since it has been under British control. Less than thirty years ago Egypt was on the verge of financial ruin, the annual expenses exceeding the income, and there not being sufficient revenue to pay the interest on the national debt. The peasantry were in a miserable and poverty-stricken condition, and constantly harassed by the continuous calls under the labour conscription, or *corvée*, for the repairs of the banks or the cleansing of the irrigation canals. This system has now been entirely done away with; the small farmers are no longer at the mercy of the money-lender, and are in a prosperous and contented condition. The revenue shows a surplus, and the yield of the crops has been enormously increased.

The leading factor in this change has been the better and more effective management, and the extension of the irrigation works, on which the agriculture of Egypt depends for its existence.

The cultivated portion of Egypt consists of a narrow strip of land bordering on the Nile, extending southward from the Mediterranean Sea. Of this the lower, or southern, district consists of the delta of the Nile below Cairo, forming a triangle, the sides of which are about 100 miles in length, with an area of four million acres, the cultivated portion of which covers $2\frac{3}{4}$ million acres. At the head of this delta the Nile water is held up by the great barrages of Rosetta and Damietta. Above this is Upper Egypt, a tract 500 miles long, lying principally on the west side of the river, and extending nearly to the first cataract above Assouan. The width of the land that is cultivated varies from eight to fourteen miles, the sand of the desert in many places at the upper end reaching close up to the river. The area of the land under cultivation is about $2\frac{1}{2}$ million acres, which is dependent entirely on irrigation. Rainfall in Egypt may be said to be conspicuous by its absence, the average fall at the northern end being $1\frac{1}{2}$ inches, and above this the country is practically rainless.

The Nile is one of the longest rivers in the world, its length from the source to the Mediterranean being more than 3000 miles. Owing to its physical conditions, the fact that it has no tributaries for the last 1500 miles of its course, and the great amount of evaporation under the tropical heat of the sun, it presents the peculiar phenomenon that the quantity of water flowing down the river decreases as the lower length of its course is reached. In floods it carries in suspension detritus derived principally from the volcanic plateau in Abyssinia and the swampy regions of the White Nile. The quantity of material thus transported from the middle of Africa and Abyssinia has been estimated at 62 millions of tons a year, raising the level of the cultivated land in Egypt at the rate of $3\frac{1}{2}$ inches in a century, and to a depth which in some places extends to 30 feet.

The Nile being fed from lands having wet and dry seasons, it has a regular rise and fall, the water through Egypt being at its lowest in June and reaching its maximum in October. The reading of the Nilometer at Rodah is watched with the greatest interest, as the prosperity of the country depends on the height of the flood water. The difference between high and low floods varies about $10\frac{1}{2}$ feet, the mean rise varying from 23 feet at Cairo to 26 feet at Assouan at the upper end. The discharge of this