THE COLLECTIONS

FROM

KERGUELEN ISLAND.

INTRODUCTORY NOTES.

By the Rev. A. E. Eaton, M.A., *Naturalist to the Expedition.*

I. *The Physical Features of Kerguelen Island.*

Kerguelen Island is little else than a succession of hills and mountains formed almost exclusively of volcanic rock. In its greatest diameters it measures about 80 miles from N.W. to S.E., and 70 from N.E. to S.W., but no part of the interior is farther than 10 or 12 miles from the sea, for the coast on all sides is exceedingly intricate and abounds in large inlets and narrow fiords, which run far inland at frequent intervals between ranges of precipitous hills. A district of considerable extent in the midst of the island is occupied by snowfields, whence glaciers descend east and west towards the sea. This district is bounded on the S.E. by a series of snow-clad mountains and lofty hills extending in a curve northwards from Mount Ross almost across the island. The area intermediate between this range, Royal Sound, and the Mount Crozier hills, and likewise the islands in Swains' Bay and Royal Sound, contain series of interrupted ridges, the majority of which are crowned and terraced horizontally with basalt more or less amygdaloidal, and rarely exceed 600 feet in altitude. Their south-eastern and eastern slopes are generally very favourable for vegetation, being sheltered from the prevailing winds; but scarcely any of them attain to heights sufficient to be suitable for the growth of plants restricted to elevated sites in this island. The Mount Crozier hills, and those on the opposite side of the sound, are upwards of 2,000 or 3,000 feet high. Their summits are covered with snow until late in the season. Most of them are massive and rather simple in contour, but near Mount Crozier a few of the peaks are singularly picturesque, bristling with pinnacles, needles, and castellated towers of rock,

some of which are visible from the southward, but not many. A similar departure from the prevailing type of Kerguelen Island scenery is noticeable among the hills near Sprightly Bay, and the aiguilles on the south side of Mount Ross. An active volcano is reported to exist in the neighbourhood of Bonfire Beach, and at one or two places on the same side of the island it is said that there are hot springs, resorted to by the sea elephants for the purpose of recreation at certain seasons of the year. A cold mineral spring oozes forth at the head of a small patch of boggy ground very near the western terminus of Swains' Haulover. It lies within a stone's throw of the sea, in a line with the nearest end of one of the nameless islands in the bay and the apex of the semi-pyramidal extremity of a high precipitous hill, which constitutes a conspicuous landmark on the opposite shore. The water is free from smell, but has a pronounced mineral flavour, seemingly of alum.

On the steep slopes bordering Royal Sound, near Swains' Haulover to the S.E., two or three small patches of yellow clay are visible. The clay appeared to include nothing but small fragments of volcanic rock, similar in composition to the masses *in sitû* around it. A little farther on, along the same shore, opposite the south-eastern point of Seal Island, one of the hills is intersected by a nearly vertical wall of trap conspicuous from the intervening channel.

The coal beds found by Dr. Hooker at Christmas Harbour and Cumberland Bay, and a stratum at the first-named place, containing silicified trunks of trees, are almost the only formations in the island that are not distinctly of igneous origin. Some limestone, however, is stated to occur at Foundry Branch, and after our departure from the country a cast of a fossil conchifer was shown to me by Mr. J. Stone, Assistant Surgeon to H.M.S. "Supply," which was given to him by one of the sealers, who had picked it up "somewhere near Thumb Peak."

The whole island, exclusive of the snowfields already mentioned, abounds in freshwater lakes and pools on the hills and lower ground. Counting large and small together, there were about two dozen of them within a two and a half mile radius of the chief English observatory; two of these were upwards of a mile in length, but the majority of them were much smaller. Beyond this limit, however, some lakes of considerable size existed. They appeared to be uninhabited by fish or by *Neuroptera*, but a small Entomostracon (*Centropages*) was exceedingly plentiful in many of them.

Between the eastern base of the Mount Crozier hills and the coast a broad tract of low-lying land slopes very gently towards the sea. It is saturated with the drainage of the adjacent heights, and with the excessive precipitation upon it of rain and snow, resulting from its situation immediately to leeward of them. Some portions of it are said to be unsafe to persons attempting to walk over it, either through being undermined by subterranean streamlets, or on account of the existence of dangerous bogs. Streams descending from the steep declivities of the hills wear by degrees narrow trenches in the stiff clayey soil of the low ground, whose

sides, in course of time collapsing by their own weight, meet and grow together in an arch above, being kept by roots of plants (especially *Azorella*) from crumbling to pieces. In the tunnel thus formed the work of excavation proceeds; the hidden channel is enlarged until it acquires the dimensions of a chasm, thinly roofed over by a layer of living plants, continuous with the surface of the firm adjacent ground, but easily broken through, into whose dark cavernous entrance the stream in mid career tumbles abruptly to a depth of many feet, sooner or later to reissue at a lower level. Years pass by; the chasm becomes wider, until at length it is disclosed by the subsidence of the yielding vault into the deep cavity beneath. Dr. Kidder states that some of the pits excavated in this manner by streams in the district in question are upwards of 30 feet in depth; the tunnels seen by me were of much smaller dimensions. The sides of such trenches and the entrances to the tunnels frequently offer favourable sites for the more delicate species of *Hepaticæ*.

Walking over the island is at certain localities very unsafe, in consequence of the frequent occurrence of mud-holes, the surface of which is precisely similar in appearance (or very nearly so) to many surrounding patches of firm bare soil. Holes of this description are produced by underground springs deep enough down to permit the surface to remain tolerably dry, while they keep the earth below in the consistency of liquid mortar, the water that issues from the source escaping by percolation through the soil. They are sometimes dangerously deep. The Antarctic Expedition, in the course of an overland journey in the northern part of the island, found their average depth on the western coast to be up to a man's waist.

In places where the ground is soft and boggy (as is frequently the case on gentle slopes and in the valleys) it is well to take notice of the kind of plants growing upon it. Patches of incoherent *Hepaticæ* and tremulous sheets of moss are best avoided. Stunted *Azorella* is somewhat uncertain, but is generally firm. Spaces overgrown with *Acæna*, as a rule, may also be traversed with safety. But wherever the surface waves freely, whatever may be growing there, it is advisable to be cautious.

So serious are the obstacles to travelling on foot in Kerguelen Island presented by fiord, lake, bog, and terraced hill, that some parts of it are absolutely inaccessible by land from districts immediately adjoining them, while others can be reached only by following the devious windings of a complicated maze. Measurements of the map afford no very trustworthy bases for estimates of the time needed for a journey of a given length in a certain direction.

The climate of Kerguelen is tempestuous, chilly, and wet. Days perfectly calm are of extremely rare occurrence, gales, or at least strong breezes, being almost constant. The wind is usually westerly, and cold; but now and then, in the south of the island, it comes on to blow from the E. and S.E., and this change is attended with a rise of temperature. In a treeless country, such as "Desolation," the violence of a gale is recognised not by ravages committed by it, but by transient evidences

of its force exhibited at the time of its progress. Waterfalls descending from the cliffs are intercepted in mid air, and driven backwards in continuous clouds of spray to the hills, from whence they leap down, leaving the stream bed empty below; and similar clouds swept up from lakelets on the mountain side roll rapidly away to leeward, like vapour from a cauldron. But perhaps the strangest sights may be observed at such times from the shelter of a cliff, for there the air resounds with the gale, which is not felt, while eddies launched from the summit plunge with tremendous force upon the sea, scour the surface into foam, and hurtle the water to and fro with fitful violence. Sudden squalls and "willy-waughs" from the hills, such as are usually met with off mountainous coasts, prevail in many parts of the island, and cause boat navigation to be attended with considerable risk. But the unconcentrated force of the usual wind is the greatest obstacle to boating. In Observatory Bay, when the wind was off shore, it was often impossible for three or four days together for anyone to land from the "Volage" and "Supply," though their distance from the landing place was only 300 or 400 yards to leeward.

The range of temperature throughout the year does not appear to be excessive, the highest readings of the thermometer in summer being under 70° F., and the lowest in winter seldom being less than 32°. At Christmas Harbour it did not descend below 27° during the stay of the "Erebus." Before the English expedition arrived at the island the Americans, early in September, found the temperature one night to be as low as 18°. In the warmer months the readings are not often much higher than 55° or 56°, or much lower than 42°, on the eastern side of the island. The western coast is, however, much more bleak than the other, as is evidenced by the belt of herbage adjacent to the sea attaining a lower altitude there than it does on the eastern side of the island. On exposed parts of the S.W. shore the hill sides are conspicuously green to a height of hardly more than 150 to 200 feet (as it seemed to the eye); but in Royal Sound, and on the lee side of the island, the upper limit of verdure is between 500 and 700 feet above sea-level.

On the high hills and mountains fog is very prevalent, but districts of only slight elevation are comparatively free from it, and enjoy more frequent sunshine than other portions of the country. While the English were in Royal Sound the glimmer of distant lightning was seen one night in the direction of Mount Ross; but this was a very exceptional occurrence. Such displays of the aurora as were observed were not remarkable for their brilliancy.

II. *Recent Visits of Naturalists to Kerguelen Island.*

Kerguelen Island has been visited within recent times by five scientific expeditions,—the Antarctic under Sir James Ross, the Challenger under Sir George Nares, and three Transit of Venus' expeditions.

Christmas Harbour was selected for head-quarters by the Antarctic Expedition, which remained there from the 15th of May until the 20th of July 1840. It is a

deep inlet on the east coast at the north end of the mainland, bounded on each side by steep terraced hills more than 1,000 feet high, and terminated by a sandy beach at the foot of a gentle slope of moderate altitude. At the entrance it measures a mile across, but half way up it is abruptly narrowed to a quarter of its former breadth. Lying lengthwise in the direction of the prevailing winds it is open to every gale that sweeps over the neck of low land at its head; and consequently it would seem to be not the best site in the island that could be chosen for the prosecution of researches in natural history. In fact a collector stationed here would have good cause to utter Caliban's remonstrance:—

. . . . . " here you sty me
" In this hard rock, whiles you do keep from me
" The rest of the island." . .

For it apparently is quite cut off by precipices from the country immediately to the south of it,— an obvious disadvantage. Notwithstanding these drawbacks, however, many interesting specimens can be obtained here. A small tarn, not far from the sandy beach, contains a peculiar species of *Ranunculus* (discovered by Mr. Moseley). At the foot of a huge mass of dark volcanic rock that is conspicuous on the south side of the harbour, between the summit of the hill and the mouth of the bay, is fossil wood in abundance. In a small bay on the same side, close to the Arch Rock at the entrance to the harbour, and 30 feet above the sea, and again in a little cave in shale near the centre of the small bay formed by C. François on the opposite shore, coal beds crop out. Besides these, the cliffs and hill sides in the vicinage of the harbour are resorted to by two or three species of birds that are not found in more sheltered localities.

The collections made by Dr. Hooker and his colleagues in this neighbourhood appear to have been very complete for the season during which they were formed, and the area investigated by them. They included the following numbers of species: —15 birds, 18 fishes, 4 insects, 4 Crustacea (exclusive of some *Entomostraca*), an earthworm, and about 6 marine Annelida, 7 or 8 Mollusca, 2 or more Polyzoa, a Holothurian and 2 or 3 star-fish, a few Actinozoa, 2 or 3 sponges; 16 Phanerogams, 3 ferns, 1 or 2 Characeæ, 25 Musci, 10 Hepaticæ, 1 Fungus, 19, with 2 doubtful, species, and 2 named forms of Lichens, and 57, with 1 doubtful, species of Algæ (viz., 38, and 1 doubtful, marine with 6 Diatoms, and 13 freshwater Algæ). These amount in all to about 66 animals and 135 plants.*

The Challenger Expedition stayed at Kerguelen Island from the 7th to the 31st January 1874. Three days seem to have been spent at Christmas Harbour, one at Fuller's Harbour, eight at Betsy Cove, and three at Three Island Harbour; and at various times and places along the lee side of the island dredging was successfully carried on. Lists of the plants (which were all collected by Mr. Moseley, one of the

* Dr. Hooker's manuscript journal, which is full of very interesting and valuable matter, has been most kindly placed at my disposal.

Naturalists of the expedition) have been published in the Journal of the Linnæan Society for October 1874 and March 1876; and some information concerning the zoology has been given by Sir C. Wyville Thomson in "Good Words," 1874, November, pp. 743–751; and December, pp. 814–821.* From these accounts it may be gathered that *inter alia* the following numbers of species were procured by this expedition:—3 seals, 18 birds, 12 insects; 23 Phanerogams, 3 ferns and Lycopodia, 28 Musci, 12 Hepaticæ, 4 Fungi, 13 and 1 named form of Lichens, 13 marine and 1 freshwater species of Algæ, besides 23 Diatoms. The exact localities of the plants do not appear to have been recorded.

The German Transit of Venus and Surveying Expedition arrived at the island in H.I.M.S. "Gazelle," and established an astronomical observatory in the midst of the small graveyard at Betsy Cove, which is described by Sir C. Wyville Thomson, *op. cit.* p. 815. No complete account of the natural history specimens collected by this expedition has been published as yet. The cove is favourably situated for a naturalist's station. To the south and west are the Mount Crozier hills, affording much variety of altitude and exposure. On the east and south-east a broad tract of low marshy land is extended. Probably the situation is not well adapted for marine species that require very sheltered water; but others which haunt the open coast are found there in plenty. Dredging was conducted from the "Gazelle" in the neighbouring sea; and it may be anticipated that the results obtained by this means will prove to be the most important part of the collection. Considerable attention was bestowed upon the vertebrata, careful etchings being prepared of many species. Large series of specimens of birds in different stages of development, and the skins and skeletons of three species of seals, are other specialities of this collection. It is almost to be regretted that this district should have been worked over twice at the same season in consecutive years, when so much of the island is *terra incognita*.

The American Transit of Venus Expedition occupied a position on a slope near Molloy Point in Royal Sound, close to the commencement of the rocky beach which extends from thence to the Prince of Wales' Foreland. Speaking roughly, the country adjoining this position is similar to the district in the neighbourhood of Betsy Cove, differing chiefly in its distance from the open sea and its situation on the opposite side of the Mount Crozier hills. The expedition remained at Molloy Point from the beginning of September until the commencement of the second week in January. Dr. Kidder, the surgeon at the astronomical station, studied the zoology and botany of the locality, and obtained many interesting observations of the habits of birds, together with a large collection of skins and eggs. The results obtained by him are recorded in Nos. 2 and 3 of the Bulletin of the United States

* This publication contains a detailed account of the past history of the island, and of its leading physical features, together with a summary of the proceedings of the expedition while there, and notices of interesting Natural History incidents.

National Museum, Washington, 1876. They include the following species:—2 mammals (one a seal); 20 birds; 3 or 4 fishes; upwards of 12 insects, besides 3 Arachnida; 7 Crustacea; 3 or more Annelida; 14 Mollusca; several Tunicata and Polyzoa, and 4 Echinodermata; 17 Phanerogams; 6 ferns and Lycopodia; 28 Musci; 18 Lichens, and 22 marine Algæ, total 69 or more species of animals, and 91 of plants.

The English Transit of Venus Expedition sailed from Simon's Bay on the 18th of September in H.M.S.S. "Volage" and "Supply." After a stormy passage the vessels joined company at the rendezvous at Three Island Harbour in Royal Sound on the 11th of October. Leaving this in the afternoon of the following day, they came to anchor in Observatory Bay in the morning of the 13th, whence they took their final departure on the 27th of February 1875. Collections were made at the following places while the expedition was at the island:—Cat Island, in the afternoon of October 11th; Observatory Bay and the adjoining district, to a distance of five miles inland, during most of October, November, December, and February; isthmus at the head of Carpenter's Cove, January 4th–9th; Thumb Peak, December 7th noon till 10th morning; vicinage of second astronomical station and hills near Swain's Haulover, October 27th, afternoon December 22nd–24th; shores and islands of Swain's Bay, January 15–30th.

The character of the localities just mentioned has been sufficiently described above in the general account of the island. The "isthmus at the head of Carpenter's Cove" is a high pass which divides the Mount Crozier hills from those to the westward of them. The summit and upper portion of this pass is referred to as a locality, in some of the botanical reports, as a "hill N.W. of Mount Crozier." A large bog at the foot of the northern declivity of the pass is described as a "bog near Vulcan Cove," and a waterfall descending the hills a little to the east of it is similarly specified as a "waterfall near Vulcan Cove"; but their real position is doubtful, and may be nearer the promontory enclosing an inlet adjacent to the entrance of Foundry Branch than to the cove in question.

The collections represent the fauna and flora of the inland and sheltered portions of the island from altitudes of 500 or 600 feet above the sea down to the depth of about 10 fathoms along the coast, and are as a rule rather deficient in duplicate specimens. The groups which are most poorly represented are those which at the time of collecting were known to have been the special subjects of investigation by other naturalists in the island, *e.g.* mammals, birds, and the Phanerogamic plants. In such groups, with the exception of certain particular species, it was considered that the interests of science would be best consulted by restricting the series of examples to minimum proportions, in order that more time might be devoted to the acquisition and preservation of specimens in less popular branches of natural history. The number of species that came under observation were as follows:—3 (besides 1 undetermined) native mammals and 2 or 3 introduced; 22 (with 1 or 2

doubtful) birds and eggs of 16 species; 4 (with 1 doubtful) species of fishes; 21 (and 5 undetermined) native insects, besides 1 introduced; 5 (and 2 undetermined) terrestrial Arachnida; upwards of 12 Crustacea; 8 Annelida; 25 Mollusca; 3 Tunicata, and 26 Polyzoa; 13 Echinodermata; 2 Actinozoa; 7 Hydroida; 8 sponges; 20 native (besides 1 introduced) species of flowering plants; 6 ferns and Lycopodia; 1 Characeæ; 43 Musci; 15 Hepaticæ; 5 Fungi; 51 or 52 species, besides 9 named forms of Lichens; 54 marine and 81 freshwater Algæ, in all about 170 species of animals, and 277 of plants.

Preliminary notices and descriptions of new species in the collections were published in the Annals and Magazine of Natural History for 1875 and 1876, the Entomologists Monthly Magazine for August 1875 and August 1876, the Journal of Botany for February 1876, and the Journal of the Linnean Society (Botany) for July 1876.

In such a country as Kerguelen Island no one without assistance could execute a fairly complete survey of the botany and zoology of an area lying within the radius of a day's walk from his head quarters in less than a month or six weeks; and then it would hold good only for that period of the year at which it was made. Much, therefore, has to be allowed for before the absence of a species from a collection can be attributed without question to its non-existence in the district in which that collection was formed; while on the other hand, should the physical conditions presented by the district be unfavourable to its occurrence, its absence does not indicate deficiency in point of completeness in the collection.