

## GEOLOGY.

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The following is a list of the collection of minerals from Kerguelen Island, determined by Dr. F. M. Endlich, geologist to the Smithsonian Institution :

Smithsonian No.

9376. *Basalt*; containing decomposed *olivine* and small white crystals of *chabazite*.
9377. *Basaltic rock*.
9378. *Basaltic rock* decomposed. The red color is due to the presence of ferric sesquioxide.
9379. *Basaltic rock* decomposed. Stained by ferric sesquioxide.
9380. *Basaltic rock* decomposed. Stained by ferric sesquioxide.
9381. *Basaltic rock*, very compact.
9382. *Basalt*; containing small white crystals of *chabazite* in vesicles.
9383. *Basalt*, vesicular, with small crystals of *chabazite* and dark brown *olivine*. The red color of the portions exposed to atmospheric influences is due to decomposing *magnetite*. It contains also some *augite* in small particles.
9384. *Basalt*, slightly vesicular, containing *augite*, yellow *olivine*, and *chabazite*.
9385. *Basalt* with *olivine*.
9386. *Basalt* with large geodes of *olivine*—typical *olivine* color.
9387. Vesicular *basalt*, the vesicles being drawn out during the flow before rigidity of the material had occurred.
9388. *Chabazite* in *basalt*.
9389. *Basalt* coated with carbonate of lime, the result of the decomposition of its constituent minerals.
9390. *Basalt* with amygdules of *calcite* and crystals of *chabazite* and *augite*.



9391. *Basalt* with amygdules of *calcite* and crystals of *chabazite* and *augite*.
9392. *Calcite*, radio-columnar.
9393. *Dolerite*. A volcanic rock related to *basalt*, containing *olivine* and *labradorite*.
9394. *Aragonite*. Large radio-columnar colorless crystals found in deep pockets in *basalt*.

SUMMARY.—“The volcanic rocks of the region examined contain a limited number of zeolitic species, and some carbonates, as epigene products. The main rocks are *basalt* and *dolerite*, of uniform physical character and constancy of inclosed minerals.”

The foregoing list represents fairly the constitution of the surface-rock in the southern part of Kerguelen Island. The streams had cut their way deeply in places, exposing extensive surfaces of rock; but diligent search along these water-courses failed to disclose any stratified or fossiliferous beds. At the northern end of the island, however, in the neighborhood of Christmas Harbor, stratified rocks are abundant, with extensive deposits of coal (of poor quality), and contain many trunks of petrified trees. For a specimen of these last I am indebted to Mr. R. P. Maynard, bearer of dispatches on board the United States steamer *Monongahela*; my own observations having been confined to the neighborhood of the head of Royal Sound, at the southern end of the island.

Sealers and whalers say that there is a great glacier in the middle of the island, extending in a general easterly and westerly direction, and reaching quite to the sea on the western coast. It is related by them that a party of fourteen French sailors, from a wrecked sealing-schooner, tried several years ago to reach the southern part of the island on foot, and that all but six perished in crossing this glacier from exposure and starvation.

The island is hilly everywhere and in parts mountainous—Mount Ross reaching an altitude of over 5,000 feet, and Mount Crozier, near the American station, about 3,000. The higher peaks are remarkably sharp and irregular in outline, quite bare of vegetation, and mostly covered with snow. Table-topped hills are frequent, as also are level plateaux or terraces of basalt, projecting from the sloping sides of the less sharply defined hills. These terraces no doubt indicate former flows of the volcanic material, but our limited field of observation did not permit sufficiently extensive investigation to determine the points of outflow.



Should the islands of that region become at any time thoroughly well known, and a similar or identical feature be observed at different points, much could be learned regarding the distribution of land in that part of the world during the later Tertiary period.

Many of the hills slope smoothly up to abruptly projecting rocky crowns of basalt. Some are quite smooth in outline, without these characteristic rocky crowns. Others, running in general southwest and northeast, are long and barrow-like, and seem to have been thrown up only or chiefly by the action of the winds, which are in this part of the world remarkable for their violence. The lee (north and east) sides of the larger hills are covered by broken rocks of all sizes, irregularly heaped together; while the weather, or south and west, sides are less rocky and covered by fine gravel.

Some ranges, especially those fronting the southeast, present abrupt cliffs, intersected by broad rock-strewn plateaux. On the tops of these cliff-walls, particularly in the small gorges that notch their crests, are frequent pillar-shaped rocks, standing alone and near together, and curiously carved, as if by the action of the wind and sand. On the higher slopes it was a common thing to find boulders of great size resting upon flat rocks, in such a position that it seemed quite impossible for them to have rolled thither. I never succeeded in finding surface-scratches indicative of former glacial action, nor would the abruptness of the physical outline of the country agree with such a supposition. It would seem that the present hills were at first lofty and irregular projections of basalt, from which fragments have continually been broken off by the violence of the winds and the action of ice. These fragments have gradually become piled up against the bases of the hills on their lee sides until the long southeasterly slopes now existing have been built up, from which the remainder of the original rock projects as a more or less rounded crown. On the weather or southwesterly sides the approach is generally more abrupt, less marked by large boulders, and covered by small, flat gravel, through which the bed-rock frequently crops out. Possibly accumulations of snow, filling the shallower hollows in winter and sliding down the hill-sides in summer, may have their effect in moving the boulders above referred to. Such a body of snow still existed on Mount Crozier so late as December, which had been frozen by night and thawed by day until it had become nearly solid ice, quite capable of carrying rocks of considerable size with it should it ever slide down the hill-side.



In some instances the projecting rocks have become so undermined by the action of the elements as to present very remarkable outlines. An immense mass of basalt, for example, facing northwest, some four miles from our station, seemed to be held by the strength of its material alone, so far did it overhang its center of gravity; its base being deeply grooved and carved, as if by the action of the wind.

The streams are numerous, and furnish an excellent supply of pure, very cold water; sufficiently pure, indeed, to be used by the photographers. Strange to say, these streams seemed to be absolutely without animal life, perhaps owing to the extreme coldness of the water (averaging  $42^{\circ}$  Fahrenheit). Ponds are frequent on both high and low land, and often of considerable size. In many places are extensive quaking bogs, and here and there are to be seen deep pits where the surface has fallen in, sometimes to the depth of 30 or 40 feet. Quicksands, or rather mud-holes, are said by the whalers to abound, and in most unexpected places. They tell many stories of shipmates who have undertaken to explore the island and have never returned, supposed to have been swallowed up in sink-holes. Persons connected with the transit parties often got upon insecure ground, but no serious accident followed in any case.

The general aspect of the island is desolate in the extreme. Snow covers all of the higher hills, against which the abrupt outlines of their dark basaltic ridges are most clearly defined. Only along the sea-shore is a narrow belt of herbage, of which the singular Kerguelen cabbage is at once the largest and most conspicuous component. The weather is also extremely inclement, there being scarcely a day without snow or rain. Violent gales of wind prevail to an extent unknown in the same northern latitude. It was often impossible to go on foot any considerable distance from the home-station on account of the severity of the wind. Sir J. Clarke Ross tells of one of his men being actually blown into the sea, and of saving himself from a like accident only by lying flat on the ground. Little squalls called "woolleys" (willy-waws?) are particularly dreaded by the sealers. A small white sphere of cloud is seen high up on the mountain-side, and immediately comes down with immense speed and violence, often burying vessels bows under. These squalls are dangerous not only by their violence but by their nearly vertical direction. In such a squall, on the 11th September, the entire transit expedition, with many officers of the *Swatara*, narrowly escaped with their lives and the loss of two boats, being overtaken while on their way from shore to the ship, anchored not more than a mile away.



Following is the monthly summary of the meteorological observations:\*

United States observing station, Kerguelen Island; latitude,  $49^{\circ} 21' S.$ ; longitude,  $70^{\circ} 15' E.$ ; altitude of barometer above sea-level, 130 feet.

Month.	Barometer, mean.			Thermometer, mean.			Saturation, mean percentage.			Wind, mean force.	Rain, total. <i>Inches.</i>
	8 a. m.	2 p. m.	8 p. m.	8 a. m.	2 p. m.	8 p. m.	8 a.m.	2 p.m.	8 p.m.		
September *	29.60	29.52	29.60	42.9	46.00	38.14	.....	.....	.....	8.1	.....
October †.....	29.36	29.32	29.32	41.97	41.6	34.00	.....	.....	.....	5.6	.....
November ‡..	29.73	29.74	29.74	44.9	50.	41.6	.855	.792	.823	5.3	2
December § ..	29.53	29.39	29.54	49.02	52.05	43.2	.83	.77	.84	6.45	6.3

\* Snow or rain, excepting two clear days.

‡ Twelve days without snow or rain.

† Four days without snow or rain.

§ Nine days without snow or rain.

The barometer touched its highest point, 30.30 inches, on September 16 and November 17; the wind being light on both occasions, from the southward and westward, with rain on the latter date. On October 18, the day after a severe gale, the barometer fell to 28.74, the forenoon being clear with snow in the afternoon, and the wind from the southwest. Again, on October 25, the wind being light, from the northwest, with snow all day, the barometer fell to 28.72. This also was the day *after* a severe gale. As a rule, we were disposed to place more reliance upon the *steadiness* of the barometer as an indicator of good weather than upon its actual height; fierce gales, snow, and rain occurring with almost every position of the mercury, but generally preceded by either a rapid rise or a rapid fall. From the 4th of December, for example, to the 9th (the day of the transit), the barometer had fallen steadily but very slowly from 29.92 to 29.12; yet the morning of the 9th dawned perfectly clear, and one of the stillest that occurred during all of our stay. The barometer began to rise about 8 o'clock, coincidentally with the appearance of heavy clouds, followed by rain in the evening.

The highest thermometers recorded were  $64^{\circ}$  at 8 a. m., September 18, and  $65^{\circ}$  at 2 p. m., December 5; the wind being northwest on both occasions. The lowest recorded was  $23^{\circ}$  at 8 p. m., September 26, with a westerly wind. On one occasion, during a night early in September, the thermometer was observed to be as low as  $18^{\circ}$ , this being the lowest temperature noted. In September the extremes of temperature were  $64^{\circ}$  and  $23^{\circ}$ ; in October,  $54^{\circ}$  and  $27^{\circ}$ ; in November,  $60\frac{1}{2}^{\circ}$  and  $33\frac{1}{2}^{\circ}$ ; and in December,  $65^{\circ}$  and  $35^{\circ}$ .

\* For detailed meteorological register, see report to Surgeon-General of the Navy, dated June 12, 1875; published by Bureau of Medicine and Surgery, 1876.



The force of the wind is figured on the scale usually employed on sea-going vessels, according to which the maximum is 12, representing the strongest possible wind, such as is experienced in a typhoon or hurricane. According to this scale the force of the wind was three times estimated to equal 11, and fourteen times 10, in violence. Such estimates are of course liable to a certain personal error on the part of the observer; but it is not probable that in this case the error lies on the side of excess. The average daily rain-fall for November was 0.205, and for December 0.252 inch, no rain-gauge having been set up previous to November. Both the rain and tide gauges were extemporaneous contrivances, constructed by Commander Ryan as soon as opportunity and leisure offered. By the latter the rise and fall of the tide were measured with considerable accuracy, and were found to vary from 3 feet to 7 feet, according to the season of the month, and partly to the direction and force of the wind. The average rise of the tide was about 5 feet.

## MAMMALS.

The only land-mammal found on the island is the common mouse (*Mus musculus*), which abounds everywhere; doubtless imported by one of the earlier sealers. It builds its nest in holes in sand-banks (in one instance in the brain-cavity of the skull of a sea-elephant), lining it with dried grass-stems or bits of oakum. From the husks of grass-seeds scattered about the entrances to its burrows, I suppose these to be its principal food.

Upon Cat Island, one of those bounding Three Island Harbor, the wintering-place of the sealers, the domestic cat has, for many years, existed in a wild state. It lives in holes in the ground, preying upon sea-birds and their young, and is said to have developed extraordinary ferocity. Recent attempts to retame individuals, even when taken quite young, have always, as I am informed, failed. I was not able to visit Cat Island during the stay of the transit expedition, and therefore am unable to say whether any obvious structural signs of reversion were presented by these animals.

Rabbits, swine, and goats have been introduced upon the Crozet and some of the Kerguelen Islands from time to time, and have always thriven well. Hog Island, the westernmost of the Crozet group, is overrun with rabbits, which have also been introduced into Kerguelen by the English transit party.