# IV. NOTICES OF NEW BOOKS.

I. Geological Observations *on the* Volcanic Islands *visited during the voyage of H. M. S.* Beagle, *together with some brief notices on the geology of* Australia *and the* Cape of Good Hope; *being the second part of the Geology of the Voyage of the Beagle, under the command of Capt. Fitzroy, R. N., during the years* 1832 *to* 1836. By Charles Darwin, M. A., F. R. S., V. P. G. S., Naturalist to the Expedition. London, pp. 176. with a map of the Island of Ascension.

Almost the whole of this Second Volume of Mr. Darwin's narrative is occupied by descriptions of volcanic rocks of various geological ages met with in the island of St. Iago (one of the Cape de Verdes), in Ascension Island, in St. Helena, and in some of the islands in the Galapagos Archipelago. Besides these descriptions, however, the work contains notices of rocks occurring in a few other islands, and some general considerations on trachyte and basalt, and on the distribution of volcanic islands, in addition to notices on Australia and the Cape of Good Hope, alluded to in the title.

As Mr. Darwin's observations chiefly relate to matters of fact, and are by no means diffusely expressed, it would not be possible in a short notice even to touch upon all the matters discussed and described in this work. It will be more to the purpose to consider the general views of the author with respect to volcanic products and to communicate his views concerning the cause of the upheaval of volcanic craters and islands, and the distribution of these islands on the earth.

Mr. Darwin observed with regard to the islands of St. Helena, St. Iago, and Mauritius that all three are bounded (at least in the parts he examined) by a ring of basaltic mountains, now much broken, but evidently once continuous (p. 93). The average inclination of these mountains is, however, greater than that which could have been acquired by lava flowing down a sloping surface, and all three islands have been raised in mass. The following ingenious conjecture is offered to explain these circumstances:—"That during the slow elevation of a volcanic district or island in the centre of which one or more orifices continue open, and thus relieve the subterranean forces, the borders are elevated more than the central area, and that the portions thus upraised do not slope gently into the central less elevated area, but are separated from it by curved

faults. By this hypothesis, the elevation of the districts in mass and the flowing of deluges of lava from the central platforms are likewise connected together, and the marginal basaltic mountains of the three islands alluded to might thus still be considered as forming 'craters of elevation,' the kind of elevation implied having been slow, and the central hollow or platform having been formed, not by the arching of the surface, but simply by that part having been upraised to a less height." (p. 96.)

The formation and position of crystals, whether of albite or other volcanic minerals, in basalt, is a subject of considerable interest, and is connected with that of the order of eruption when trachyte and basalt are both present. Observations on this subject, and relating to the spontaneous separation of certain minerals and the formation of dykes in partially cooled rocks, are of the greatest interest to the geologist, since almost every region in which igneous rocks are extensively distributed abounds also in trap dykes, and it is no easy matter to determine whence the greenstone and basalt forming these dykes was derived.

"Are we to suppose, like some of the elder geologists, that a zone of trap is uniformly spread out beneath the granitic series, which composes, as far as we know, the foundations of the earth's crust? Is it not more probable that these dykes have been formed by fissures penetrating into partially-cooled rocks of the granitic and metamorphic series, and by their more fluid parts, consisting chiefly of hornblende, oozing out and being sucked into such fissures? At Bahia, in Brazil, in a district composed of gneiss and primitive greenstone, I saw many dykes of a dark augitic or hornblendic rock, which, as several appearances clearly proved, either had been formed before the surrounding mass had become solid, or had, together with it, been afterwards thoroughly softened. On both sides of one of these dykes the gneiss was penetrated to the distance of several yards by numerous curvilinear streaks or threads of dark matter, and some few of these threads could be traced to their junction with the dyke. When examining them I doubted whether such hair-like and curvilinear veins could have been injected; and I now suspect that, instead of having been injected from the dyke, they were its feeders. If the foregoing view of the origin of trap-dykes in widely-extended granitic regions, far from rocks of any other formation, be admitted as probable, we may further admit, in the case of a great body of plutonic rock being impelled by repeated movements into the axis of a mountain chain, that its more liquid constituent parts might drain into deep and unseen abysses, afterwards perhaps to be brought to the surface under the form either of injected masses of greenstone and augitic porphyry, or of basaltic eruptions. Much of the difficulty which geologists have experienced when they have compared the composition of volcanic with plutonic formations, will, I think, be removed, if we believe that most plutonic masses have been, to a certain extent, drained of those comparatively weighty and easily liquified elements which compose the trappean and basaltic series of rocks." (p. 124.)

The distribution of volcanic islands scattered through the great oceans which cover so large a proportion of the earth, becomes a matter of interest when we consider it with reference to the rest of the islands in those seas and the other volcanic districts of the globe. With the exception of some islands of large size, as New Zealand (which, however, contains volcanoes), the Falkland Islands, near the coast of South America, New Caledonia (a large island), the Seychelles, situated in a line prolonged from Madagascar, and

one or two others, the vast and almost innumerable multitude of islands scattered throughout the Pacific, the Indian, and the Atlantic Oceans are all composed either of volcanic or of modern coral rocks (p. 125). This fact, singular as it is, is a manifest extension of that law and the effect of the same causes, whether chemical or mechanical, from which it results that a vast majority of the volcanoes now in action either stand as islands in the sea or are near its shores.

"This fact of the Ocean islands being so generally volcanic is also interesting in relation to the nature of the mountain chains on our continents, which are comparatively seldom volcanic, and yet we are led to suppose that where our continents now stand, an ocean once extended. Do volcanic eruptions, we may ask, reach the surface more readily through fissures formed during the first stages of the conversion of the bed of the ocean into a tract of land?" (p. 126.)

In the volcanic archipelagos the islands are generally arranged either in single, double, or treble rows in lines which are frequently curved in a slight degree. This arrangement in lines seems to exist in a perfect series from a few volcanic islands placed in a row, to a train of linear archipelagos following each other in a straight line, and so on to a great wall, like the Cordilleras of America. Along the shores of great continents also there exist islands forming small volcanic groups, indicating, it would seem, a relation, not only by proximity but in the direction of the fissures of eruption, to the neighbouring continents, and in some cases affected by the same volcanic disturbances. The lines of intersection at the Galapagos, at the Cape de Verde archipelagos, and the best marked line of the Canary Islands, are examples of this relation, and in some of these cases eruptions have taken place within the historical period on more than one of these parallel lines of fissure. "Believing," says Mr. Darwin, "that a mountain axis differs essentially from a volcano, only in plutonic rocks having been injected instead of volcanic matter having been ejected, this appears to me an interesting circumstance; for we may infer from it as probable, that in the elevation of a mountain chain, two or more of the parallel lines forming it may be upraised and injected within the same geological period." (p. 129.)

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