

Indies, where there are 200 or more volcanoes, of which there are nearly 50 in Java alone (according to Dr. Junghuhn), and 28 out of the 50 now active, nearly as many in Sumatra, 109 in the small islands near Borneo, and a number in the Philippines, etc.

6. *On the borders of the South Atlantic.* — Only in the Bight of Benin, on the African coast, where a volcano in the Cameroons Mountains is said to be 14,000' high; and on the neighboring islands, from Fernando Po to Annabon.

7. *On the borders of the North Atlantic.* — None on the western north of the West Indies. On the eastern, there are extinct volcanoes in the Auvergne in central France, the Eifel in Prussia, and of past geological ages in Great Britain.

8. *In the Atlantic Ocean.* — St. Helena, Ascension, Tristan d'Acunha, the Cape Verd, Canaries, Madeira, Azores, Iceland, and Jan Mayen are volcanic. All the islands of the deep part of the ocean (that is, not on the European or American borders) are volcanic.

The number of active volcanic vents in the world is about 300. Of these, five sixths, or about 250, are within or on the border of the Pacific basin, there being about 148 on the continental islands between New Zealand and Alaska, 45 on the borders of North America (Central America included), 37 in the Andes, and 20 on Pacific oceanic islands. Those within or on the borders of the Atlantic basin are 39 in number: 13 of them in Iceland or near the Arctic circle, 3 in the Canary Islands, 7 in the Mediterranean, 6 in the Lesser Antilles, and 10 in the Atlantic oceanic islands. The Indian Ocean contains but 3, and the Antarctic Ocean only 2, so far as now known.

The proportion of active volcanoes to the total number in volcanic regions varies indefinitely. In the Hawaiian group it is about 1 : 5; in the Japan Islands, where the total number is about 98, the ratio is 1 : 3½; in the Kurile Islands, out of a total of 49 there are 17 active; in the Marquesas, Tahitian, Samoan, and Fijian groups of the Pacific all are extinct.

NON-VOLCANIC IGNEOUS ERUPTIONS.

1. *General description.* — The ejection of melted rock through fissures, making dikes and outflows, is essentially the same in result whether the ejections are due to distinctively volcanic action or to non-volcanic. The chief difference in method is that the volcano has a localized center, and is pericentric in its work; that is, it has a crater in which projectile work is carried forward at intervals between eruptions, whereas a non-volcanic ejection, when completed, is the end of the outside work until a new and independent fissure is opened. Some reference to a center in the general fracturing may, however, be a fact where there is none for escaping vapors. Commonly, fissures are in long lines, or series of lines, and often, also, in approximately parallel series.

For the origin of large *deposits of volcanic ashes or cinders*, it is most probable that there has been a center of activity; for such ejections depend on escaping gases, rising and exploding in ebullition style, and for this kind of projectile work and its continuance long enough for thick beds, one or more centers of activity appear to be necessary. The action may be brief, as in an explosive eruption. Stones rounded by wear seldom appear