

The destruction of fissured lavas goes on in connection with the action of steam and other volcanic vapors; and in solfataras the rocks become reduced over large areas, to whitish and yellowish earth, passing to red from the presence of iron oxide. Silica is, to some extent, set free; orthoclase is reduced to kaolin; and nearly all the mineral species present are decomposed.

On Hawaii, the effects of spent vapors have their climax in the empty tunnels made by a flowing lava-stream (page 287), in which the liquid lavas, as they vacate the tunnels, leave vapors that have at first the extremely high temperature of the lavas. These tunnel-like caves in the lava-stream of 1880-81, near Hilo, are hung in places with slender lava stalactites 10 to 30 inches long (Figs. 258-260,  $\frac{1}{3}$  natural size), each having its stalagmite (Fig. 261) below it; and they consist of the same material as the lava (labradorite and augite), in the same rock-like condition, and also have crystals of these minerals, and of magnetite and hematite, in their many cavities. The chrysolite is the only mineral omitted in this *remaking of basalt in stalactitic form by the highly heated vapors*. (Similar stalactites occur also in Kilauea.) Figs. 262, 263 represent portions of stalactites enlarged, showing the lines of growth (?) over the exterior, and 264, 265, the same with interior cavities; Fig. 266, a section of a stalactite having the usual delicate tabular crystals of labradorite, characterizing basaltic lava, with augite (the clear spots), and the magnetite in dendritic forms. The figures are from the description of Hawaiian rocks by E. S. Dana in the author's work on volcanoes.

### 5. Distribution of Volcanoes.

Volcanoes, now mostly extinct, occur over the border-regions of the continents,—that is, the regions between the oceans and the summit of the border-range of mountains, as between the Pacific and the eastern limit of the summits of the Rocky Mountains; in the continental islands, or those near seacoasts, as on the western border of the Pacific; in oceanic islands, nearly all of which, excepting the coral islands, are throughout volcanic,—and the coral islands have probably a volcanic basis. Volcanoes are most numerous along the borders of the larger ocean, the Pacific,—the mainland, or the islands near by, abounding in them on the east, north, and west, and, to some extent, on the south in the Antarctic seas. They are numerous also in the seas separating the northern from the southern continents, namely, the West Indies, between North and South America; the Mediterranean, between Europe and Africa; the Red Sea, between Asia and Africa; the East Indies, between Asia and Australia,—the whole together making a transverse volcanic belt around the globe. Few exist on the borders of the Atlantic, and these few in the West Indies and in the Cameroons Mountains on the coast of the Gulf of Guinea. Over the interior of continents, remote from the regions mentioned, they are almost unknown.

1. *Over the Pacific.*—The linear arrangement of the islands of the Pacific, explained on page 39, is the linear arrangement of volcanoes. Active volcanoes occur in the Hawaiian