

part of Mount Kea the extraordinary density of 3·7, for which volcanic science has as yet no explanation.

Haleakala ended its work in throwing up over the bottom of the great crater many cinder-cones 500' to 900' high, and Mount Kea gasped out its life in making similar cones, but as summit peaks.

Extinction, besides being due to a downward withdrawal of the conduit lava, may take place in consequence of the cooling of these lavas from the outside, when in contact with the solid rocks. The supply conduit of Kilauea has probably been as large in cross sections as the crater (page 276); and perhaps much larger, this being suggested by an outside range of bluffs on its north and northeast side. It may be as large now; but the confinement of the recent eruptions to the basin, Halemaumau, in its southwestern part, suggests the possibility that cooling has already reduced it to less than a third of its former size. The reduction may, however, be restricted to the upper portion of the conduit; in which case it may regain its former size at another great eruption. At Vesuvius, the modern active cone is partly surrounded by the walls of a former crater, of far wider extent, called Somma; and the relative sizes of the modern and ancient craters probably indicate the amount of contraction that has taken place in the lava-conduit. Teneriffe and some other large volcanic mountains have extensive amphitheaters marking the limits of the ancient crater, and a cone of relatively small size within it representing the later condition of the fires.

7. *Explosive eruptions.* — Besides the ordinary eruptions above described, there may be, in all kinds of volcanoes, true *explosive* eruptions. The projectile action *within the crater* in such an eruption, instead of ceasing at the commencement of a discharge of the lavas, as described above, becomes at once enormously increased, and projectile discharges of terrific violence are produced, with destructive shakings, violent thunder storms, and copious cinder-ejections over a wide reach of country. The stones thrown out are often of great size. At one such eruption in 1883, that of Krakatoa, an island off western Java, the finer ashes ascended 50,000 feet, and are supposed to have been carried around the world, and to have caused the red sunset-glows of the autumn following. The end came as suddenly as the beginning. The eruption began early one morning, made day into night by its gray and black cinder-ejections, and left the sky clear by the close of the next day. No outflow of lavas took place. Another such eruption occurred in the Tarawera region, New Zealand, in 1886. The eruption was of extreme violence, yet it was ended, and the ashen sky cleared, in six hours. But it destroyed villages and their inhabitants, and deluged with mud-eruptions the beautiful geyser terraces of the region.

Kilauea had such an eruption in 1789 (or about that time). The borders of the crater for one to two miles in breadth, especially to the south and southwest, are covered with the blocks of lava (some of 100 cubic feet), scoria, and ashes of the eruption, and a larger region with the finer material.

For such *explosive eruptions* water in large volumes must gain *sudden access to the interior* of a lava-conduit, — that is, to the liquid lavas of the lava-column; for the projectile force of the abruptly generated vapors is enormous, and all is quick work, as in an explosion. The stones ordinarily come up from the throat of the volcano, the region of hot rocks; and this