

likewise occur by themselves apart from any lava-producing volcano, though usually they afford indications that columns of lava have risen in their funnels, and even now and then that this lava has reached the surface.

The cones of the Eifel district have long been celebrated for their wonderful perfection. Though small in size, they exhibit with singular clearness many of the leading features of volcanic structure. Those of Auvergne are likewise exceedingly instructive.¹¹⁵ The high plateaus of Utah are dotted with hundreds of small volcanic cinder-cones, the singular positions of which, close to the edge of profound river-gorges and on the upthrow side of faults, have already (p. 348) been noticed. Among the Carboniferous volcanic rocks of central Scotland the stumps of ancient tuff-cones, frequently with a central core of basalt, or with dikes and veins of that rock, are of common occurrence.¹¹⁶

The materials of a tuff-cone are arranged in more or less regularly stratified beds. On the outer side, they dip down the slopes of the cone at the average angle of repose, which

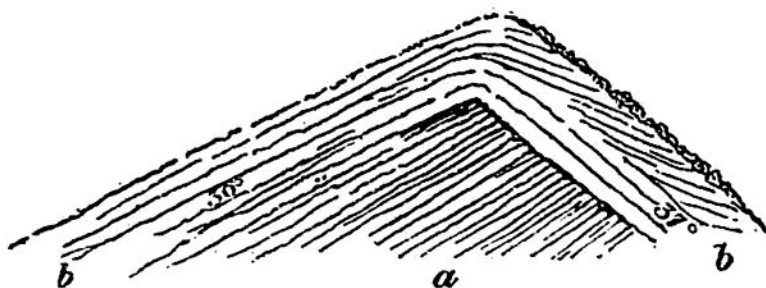


Fig. 57.—Section of the crater-rim of the Island of Volcano.
a, Older tuff; b b, younger ashes; the crater lies to the right.

may range between 30° and 40°. From the summit of the crater-lip they likewise dip inward toward the crater-bottom at similar angles of inclination (Fig. 57).

3. **Mud-Cones** resemble tuff-cones in form, but are usually smaller in size and less steep. They are produced by the hardening of successive outpourings of mud from the orifices already described (p. 407). In the region of the Lower Indus, where they are abundantly distributed over an area

¹¹⁵ For Auvergne, see works cited on p. 374. For the Eifel, consult Hibbert, "History of the Extinct Volcanoes of the Basin of Neuwied on the Lower Rhine," Edin. 1832. Von Dechen, "Geognostischer Führer zu dem Laacher See," Bonn, 1864. "Geognostischer Führer in das Siebengebirge am Rhein," Bonn, 1861.

¹¹⁶ Trans. Roy. Soc. Edin. xxix. p. 455. See postea, Book IV. Part VII.