of parasitic cones, and the collapse due to the dying out of volcanic energy.[108]

The cone grows by additions made to its surface during successive eruptions, and though liable to great local variation of contour and topography, preserves its general form with singular persistence. Many exaggerated pictures have been drawn of the steepness of slope in volcanic cones, but it is obvious that the angle cannot as a whole exceed the maximum inclination of repose of the detrital matter ejected from the central chimney.[109] A series of profiles of volcanic cones taken from photographs shows how nearly they approach to a common average type.[110] One of the most potent and constant agencies in modifying the outer forms of these cones is undoubtedly to be found in rain and torrents, which sweep down the loose detritus and excavate ravines on the declivities till a cone may be so deeply trenched as to resemble a half-opened umbrella.[111]

The crater doubtless owes its generally circular form to the equal expansion in all directions of the explosive vapors from below. In some of the mud-cones already noticed, the crater is not more than a few inches in diameter and depth. From this minimum, every gradation of size may be met with, up to huge precipitous depressions, a mile or more in diameter, and several thousand feet in depth. In the crater of an active volcano, emitting lava and scoriæ, like Vesuvius, the walls are steep, rugged cliffs of scorched and

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[108] J. Milne, Geol. Mag. 1878, p. 339; 1879, p. 506. Seismolog. Soc. Japan, ix. p. 179. G. F. Becker, Amer. Journ. Sci. xxx. 1885, p. 283.

[109] Cotopaxi is a notable example of such exaggerated representation. Mr. Whymper found that the general angles of the northern and southern slopes of the cone were rather less than 30° ("Travels amongst the Great Andes," p. 123). Humboldt depicted the angle as one of 50°!

[110] See Milne, Seism. Soc. Japan, ix., and Geol. Mag. 1878, plate ix.

[111] On the denudation of volcanic cones, see H. J. Johnston-Lavis, Q. J. Geol. Soc. xl. p. 103.