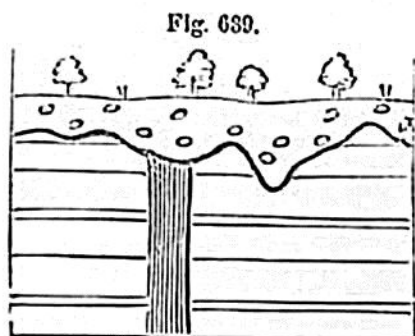


like comparing the roots of a tree with its leaves and branches, which, although they belong to the same plant, differ in form, texture, color, mode of growth, and position. The external cone, with its loose ashes and porous lava, may be likened to the light foliage and branches, and the rocks concealed far below, to the roots. But it is not enough to say of the volcano,

“quantum vertice in auras
Ætherias, tantum radice in Tartara tendit,”

for its roots do literally reach downwards to Tartarus, or to the regions of subterranean fire; and what is concealed far below is probably always more important in volume and extent than what is visible above ground.

We have already stated how frequently dense masses of strata have been removed by denudation from wide areas (see chap. vi.); and this fact prepares us to expect a similar destruction of whatever may once have formed the uppermost part of ancient submarine or sub-aerial volcanoes, more especially as those superficial parts are always of the lightest and most perishable materials. The abrupt manner in which dikes of trap usually terminate at the surface (see fig. 639), and the water-worn pebbles of trap in the alluvium which covers the dike, prove incontestably that whatever was uppermost in these formations has been swept away. It is easy, therefore, to conceive that what is gone in regions of trap may have corresponded to what is now visible in active volcanoes.



Strata intercepted by a trap dike, and covered with alluvium.

It will be seen in the following chapters, that in the earth's crust there are volcanic tuffs of all ages, containing marine shells, which bear witness to eruptions at many successive geological periods. These tuffs, and the associated trappean rocks, must not be compared to lava and scorie which had cooled in the open air. Their counterparts must be sought in the products of modern submarine volcanic eruptions. If it be objected that we have no opportunity of studying these last, it may be answered, that subterranean movements have caused, almost everywhere in regions of active volcanoes, great changes in the relative level of land and sea, in times comparatively modern, so as to expose to view the effects of volcanic operations at the bottom of the sea.

Thus, for example, the examination of the igneous rocks of Sicily, especially those of the Val di Noto, has proved that all the more ordinary varieties of European trap have been there produced under the waters of the sea, at a modern period; that is to say, since the Mediterranean has been inhabited by a great proportion of the existing species of testacea.