

These igneous rocks of the Val di Noto, and the more ancient trappear rocks of Scotland and other countries, differ from subaerial volcanic formations in being more compact and heavy, and in forming sometimes extensive sheets of matter intercalated between marine strata, and sometimes stratified conglomerates, of which the rounded pebbles are all trap. They differ also in the absence of regular cones and craters, and in the want of conformity of the lava to the lowest levels of existing valleys.

It is highly probable, however, that insular cones did exist in some parts of the Val di Noto; and that they were removed by the waves, in the same manner as the cone of Graham Island, in the Mediterranean, was swept away in 1831, and that of Nyöe, off Iceland, in 1783.* All that would remain in such cases, after the bed of the sea has been upheaved and laid dry, would be dikes and shapeless masses of igneous rock, cutting through sheets of lava which may have spread over the level bottom of the sea, and strata of tuff, formed of materials first scattered far and wide by the winds and waves, and then deposited. Conglomerates also, with pebbles of trap, to which the action of the waves must give rise during the denudation of such volcanic islands, will emerge from the deep whenever the bottom of the sea becomes land. The proportion of volcanic matter which is originally submarine must always be very great, as those volcanic vents which are not entirely beneath the sea are almost all of them in islands, or, if on continents, near the shore.

As to the absence of porosity in the trappean formations, the appearances are in a great degree deceptive, for all amygdaloids are, as already explained, porous rocks, into the cells of which mineral matter such as silex, carbonate of lime, and other ingredients have been subsequently introduced (see p. 469); sometimes, perhaps, by secretion during the cooling and consolidation of lavas.

In the Little Cumbray, one of the Western Islands, near Arran, the amygdaloid sometimes contains elongated cavities filled with brown spar; and when the nodules have been washed out, the interior of the cavities is glazed with the vitreous varnish so characteristic of the pores of slaggy lavas. Even in some parts of this rock which are excluded from air and water, the cells are empty, and seem to have always remained in this state, and are therefore undistinguishable from some modern lavas.†

Dr. MacCulloch, after examining with great attention these and the other igneous rocks of Scotland, observes, "that it is a mere dispute about terms, to refuse to the ancient eruptions of trap the name of submarine volcanoes; for they are such in every essential point, although they no longer eject fire and smoke."‡ The same author also considers it not improbable that some of the volcanic

* See *Princ. of Geol.* *Index*, "Graham Island," "Nyöe," "Conglomerates, volcanic," &c.

† MacCulloch, *West. Islands*, vol. ii. p. 487.

‡ *Syst. of Geol.* vol. ii. p. 114.