

portion of a single side of the crater remains. The dip of the layers, and their composition, are proofs that the islands were formerly craters. Nuutele is the largest and highest of the four. The others are from a half to two-thirds of a mile long, and are not over three hundred feet in height. Namu'a and Tapu-tapu are connected with the shores of Upolu by the coral reef. Nuutele and Nuulua stand isolated, with deep water around them. The tufa is mostly composed of fine basaltic or volcanic earth, with rarely an imbedded pebble. It has a compact earthy appearance and colour, and is often friable. Coarse varieties, or conglomerates, are uncommon, but isolated masses of basalt are sometimes imbedded in the tufa.

Besides the volcanic materials, the tufa also contains an occasional fragment of *coral*, or *coral limestone*. I collected some specimens of imbedded limestone pebbles from the tufa near the top of Namu'a, two hundred feet above the sea. The pebbles were as white as the coral rock of the reefs, and some of them were as large as walnuts. Tested with an acid, they afforded a brisk effervescence. They were undoubtedly enclosed within the tufa as a part of it, and not subsequently carried up to their present place.

The facts here adduced show that these islands are not the result of lava eruptions. The ejections of lava, if there were such, were submarine. The islands have been formed by ejected volcanic earth or mud falling over the rising walls of the crater, which they consequently overlap, inclining both inwards toward the central vent, and outward down the slopes of the cone. The opening of these submarine vents probably followed some movement in the neighbouring volcanoes, and there may have been an ejection of lava beneath the sea from the fissures thus formed. But subsequently the eruptions consisted of loose cinders and comminuted lava. The present position of the craters in a sea which covers, to a considerable height, their tufa sides, (for the tufa extends with its even dip some distance below the surface,) and so low that the bottom of the crater, as in Nuutele, is not above the level of the sea, is some evidence that these are the results, in part, if not wholly, of eruptions from vents beneath the water. The fragments of coral rock imbedded in the tufa, lead us to the same conclusion; or at least, they show that the vent was liable to incursions of the sea, through some opening below, which carried in the coral pebbles. The coral pebbles were not subjected to a high heat, for they retain their original freshness outside as well as within.