

lavas; the relation, however, of its origin to the composition of lava is not yet well understood. Von Buch says that it never occurs where only Labrador-felspar is present.

*Volcanic tuff, Trap tuff.*—Small angular fragments of the scoriæ and pumice, above mentioned, and the dust of the same, produced by volcanic explosions, form the tuffs which abound in all regions of active volcanoes, where showers of these materials, together with small pieces of other rocks ejected from the crater, fall down upon the land or into the sea. Here they often become mingled with shells, and are stratified. Such tuffs are sometimes bound together by a calcareous cement, and form a stone susceptible of a beautiful polish. But even when little or no lime is present, there is a great tendency in the materials of ordinary tuffs to cohere together. Besides the peculiarity of their composition, some tuffs, or *volcanic grits*, as they have been termed, differ from ordinary sandstones by the angularity of their grains, and they often pass into *volcanic breccias*.

According to Mr. Scrope, the Italian geologists confine the term *tuff*, or *tufa*, to felspathose mixtures, and those composed principally of pumice, using the term *peperino* for the basaltic tuffs.\* The peperinos thus distinguished are usually brown, and the tuffs gray or white.

We meet occasionally with extremely compact beds of volcanic materials, interstratified with fossiliferous rocks. These may sometimes be tuffs, although their density or compactness is such as to cause them to resemble many of those kinds of trap which are found in ordinary dikes. The chocolate-colored mud, which was poured for weeks out of the crater of Graham's Island in the Mediterranean, in 1831, must, when unmixed with other materials, have constituted a stone heavier than granite. Each cubic inch of the impalpable powder which has fallen for days through the atmosphere, during some modern eruptions, has been found to weigh, without being compressed, as much as ordinary trap-rocks, and to be often identical with these in mineral composition.

*Palagonite-tuff.*—The nature of volcanic tuffs must vary according to the mineral composition of the ashes and cinders thrown out of each vent, or from the same vent, at different times. In descriptions of Iceland, we read of Palagonite-tuffs as very common. The name Palagonite was first given by Professor Bunsen to a mineral occurring in the volcanic formations of Palagonia, in Sicily. It is rather a mineral substance than a mineral, as it is always amorphous, and has never been found crystallized. Its composition is variable, but it may be defined as a hydrosilicate of alumina, containing oxide of iron, lime, magnesia, and some alkali. It is of a brown or blackish-brown color, and its specific density, 2.43. It enters largely into the composition of volcanic tuffs and breccias, and is considered by Bunsen as an altered rock, resulting from the action of steam on volcanic tuffs.

\* Geol. Trans. 2d series, vol. ii. p. 211.