

Rocks which are merely broken through by the volcanic action are often inclosed in the igneous products. Thus I have found angular fragments of feldspathic syenite imbedded in the black augitic lava of the volcano of Jorullo, in Mexico ; but the masses of dolomite and granular limestone, which contain magnificent clusters of crystalline fossils (vesuvian and garnets, covered with mejonite, nepheline, and sodalite), are not the ejected products of Vesuvius, these belonging rather to very generally distributed formations, viz., strata of tufa, which are more ancient than the elevation of the Somma and of Vesuvius, and are probably the products of a deep-seated and concealed submarine volcanic action.* We find five metals among the products of existing volcanoes, iron, copper, lead, arsenic, and selenium, discovered by Stromeyer in the crater of Volcano.† The vapors that rise from the *fumarolles* cause the sublimation of the chlorids of iron, copper, lead, and ammonium ; iron glance‡ and chlorid of sodium (the latter often in large quantities) fill the cavities of recent lava streams and the fissures of the margin of the crater.

The mineral composition of lava differs according to the nature of the crystalline rock of which the volcano is formed, the height of the point where the eruption occurs, whether at the foot of the mountain or in the neighborhood of the crater, and the condition of temperature of the interior. Vitreous volcanic formations, obsidian, pearl-stone, and pumice, are entirely wanting in some volcanoes, while in the case of others they only proceed from the crater, or, at any rate, from very considerable heights. These important and involved relations can only be explained by very accurate crystallographic and chemical investigations. My fellow-traveler in Siberia, Gustav Rose, and subsequently Hermann Abich, have already been able, by their fortunate and ingenious researches, to throw much light on the structural relations of the various kinds of volcanic rocks.

* Leop. von Buch, in Poggend., *Annalen*, bd. xxxvii., s. 179.

† [The little island of Volcano is separated from Lipari by a narrow channel. It appears to have exhibited strong signs of volcanic activity long before the Christian era, and still emits gaseous exhalations. Stromeyer detected the presence of selenium in a mixture of sal ammoniac and sulphur. Another product, supposed to be peculiar to this volcano, is boracic acid, which lines the sides of the cavities in beautiful white silky crystals. Daubeney, *op. cit.*, p. 257.]—*Tr.*

‡ Regarding the chemical origin of iron glance in volcanic masses, see Mitscherlich, in Poggend., *Annalen*, bd. xv., s. 630 ; and on the liberation of hydrochloric acid in the crater, see Gay-Lussac, in the *Annales de Chimie et de Physique*, t. xxii., p. 423.