

to issue through the cracks, and the ground was covered with a yellow and black powder : thus, a subterranean fire was produced by the chemical combination of sulphur, iron, and water. In the cliffs of Charmouth, Whitby and Weymouth, we have precisely the same mineral substances combined, that were used in the experiment of Lemery.

The earth itself is, in all probability, the great laboratory in which, by the aid of subterranean heat, are combined and prepared the mineral substances that compose the hard crystalline crust of the globe. All the minerals which form primary rocks, occur in a perfect state, in modern or ancient lava. The substances ejected through fissures in the earth, or volcanoes, belong to the four grand divisions of the mineral kingdom,—the inflammable, saline, metallic, and earthy.

The *inflammable substances* are sulphur, carbon, and hydrogen. The inflammable quality of sulphur prevents its being found in lava in a solid form ; during volcanic eruptions it is evolved in a gaseous state combined with hydrogen. It is also sublimed from the fissures of extinct or dormant volcanoes, and forms thick incrustations on the sides of the craters. Almost all the sulphur of commerce in Europe is procured from the craters of dormant volcanoes in the south of Italy, Sicily, and the Lipari Islands. When the combustion of sulphur in volcanoes takes place where there is access to atmospheric air, it forms sulphurous acid gas, and sulphuric acid.

Carbon combined with hydrogen, forming bitumen, is found in volcanic rocks, and also in some basaltic or trap rocks. The volcanic tufa in the vicinity of Clermont, in France, contains so much bitumen, that in warm days it oozes out, and forms streams of bitumen resembling pitch, which is the more remarkable, as this tufa must have been erupted some thousand years. Bitumen has been observed oozing out of the lava of *Ætna*. The moya ejected from the volcanoes in the Andes, in aqueous or muddy eruptions, contains so much bitumen or carbon, as to be inflammable. As bitumen exists in many volcanic rocks, the black smoke which issues during an eruption may proceed from its combustion, though it has generally been supposed to consist of minute volcanic sand, called ashes. Carbon also combines with hydrogen in a gaseous state, and forms carburated hydrogen gas.

The hydrogen gas evolved from volcanoes, or from chasms in the earth during earthquakes, is generally combined with sulphur or carbon ; it is probably formed by the decomposition of water, when it finds access to subterranean fire. Whether phosphorus be a product of volcanoes is unknown : its extreme inflammability prevents it from being discovered in a concrete form ; but the dense white clouds, like bales of cotton, which sometimes cover *Vesuvius*, resemble the fumes produced by the combustion of phosphorus. Among the products of volcanoes, only three are combustible at a moderate temperature ;—sulphur, hydrogen, and carbon. It has been conjec-