

are thus formed beneath our eyes by volcanic forces, where the contiguous rock has already attained a certain degree of solidification, show us how, in a similar manner, mineral and metallic veins may have been every where formed in the more ancient periods of the world, where the solid but thinner crust of our planet, shaken by earthquakes, and rent and fissured by the change of volume to which it was subjected in cooling, may have presented many communications with the interior, and many passages for the escape of vapors impregnated with earthy and metallic substances. The arrangement of the particles in layers parallel with the margins of the veins, the regular recurrence of analogous layers on the opposite sides of the veins (on their different walls), and, finally, the elongated cellular cavities in the middle, frequently afford direct evidence of the Plutonic process of sublimation in metalliferous veins. As the traversing rocks must be of more recent origin than the traversed, we learn from the relations of stratification existing between the porphyry and the argentiferous ores in the Saxon mines (the richest and most important in Germany), that these formations are at any rate more recent than the vegetable remains found in carboniferous strata and in the red sandstone.*

All the facts connected with our geological hypotheses on the formation of the earth's crust and the metamorphism of rocks have been unexpectedly elucidated by the ingenious idea which led to a comparison of the slags or scorïæ of our smelting furnaces with natural minerals, and to the attempt of reproducing the latter from their elements.† In all these operations, the same affinities manifest themselves which determine chemical combinations both in our laboratories and in the interior of the earth. The most considerable part of

Lussac, in the *Annales de Chimie*, t. xxii., p. 415, and Mitscherlich, in Poggend., *Annalen*, bd. xv., s. 630. Moreover, crystals of olivine have been formed (probably by sublimation) in the cavities of the obsidian of Cerro del Jacal, which I brought from Mexico (Gustav Rose, in Poggend., *Annalen*, bd. x., s. 323). Hence olivine occurs in basalt, lava, obsidian, artificial scorïæ, in meteoric stones, in the syenite of Elfdale, and (as hyalosiderite) in the wacke of the Kaiserstuhl.

* Constantin von Beust, *Ueber die Porphyrgebilde*, 1835, s. 89-96; also his *Beleuchtung der Werner'schen Gangtheorie*, 1840, s. 6; and C. von Wissenbach, *Abbildungen merkwürdiger Gangverhältnisse*, 1836, fig. 12. The ribbon-like structure of the veins is, however, no more to be regarded of general occurrence than the periodical order of the different members of these masses.

† Mitscherlich, *Ueber die künstliche Darstellung der Mineralien*, in the *Abhandl. der Akademie der Wiss. zu Berlin*, 1822-3, s. 25-41