

phyre and the transformation of compact limestone into a crystalline mass differing in its chemical character, we are, to a certain degree, justified in believing, where the second phenomenon is manifested unattended by the appearance of the first, that this apparent contradiction is owing to the absence, in certain cases, of some of the conditions attendant upon the exciting causes. Who would call in question the volcanic nature and igneous fluidity of basalt merely because there are some rare instances in which basaltic veins, traversing beds of coal or strata of sandstone and chalk, have not materially deprived the coal of its carbon, nor broken and slacked the sandstone, nor converted the chalk into granular marble? Wherever we have obtained even a faint light to guide us in the obscure domain of mineral formation, we ought not ungratefully to disregard it, because there may be much that is still unexplained in the history of the relations of the transitions, or in the isolated interposition of beds of unaltered strata.

After having spoken of the alteration of compact carbonate of lime into granular limestone and dolomite, it still remains for us to mention a third mode of transformation of the same mineral, which is ascribed to the emission, in the ancient periods of the world, of the vapors of sulphuric acid. This transformation of limestone into gypsum is analogous to the penetration of rock salt and sulphur, the latter being deposited from sulphureted aqueous vapor. In the lofty Cordilleras of Quindiu, far from all volcanoes, I have observed deposits of sulphur in fissures in gneiss, while in Sicily (at Cattolica, near Girgenti), sulphur, gypsum, and rock salt belong to the most recent secondary strata, the chalk formations.* I have also seen, on the edge of the crater of Vesuvius, fissures filled with rock salt, which occurred in such considerable masses as occasionally to lead to its being disposed of by contraband trade. On both declivities of the Pyrenees, the connection of diorite and pyroxene, and dolomite, gypsum, and rock salt, can not be questioned;† and here, as in the other phenomena which we have been considering, every thing bears evidence of the action of subterranean forces on the sedimentary strata of the ancient sea.

There is much difficulty in explaining the origin of the beds of pure quartz, which occur in such large quantities in South America, and impart so peculiar a character to the chain of

* Hoffman, *Geogn. Reise*, edited by Von Dechen, s. 113-119, and 380-386; Poggend., *Annalen der Physik*, bd. xxvi., s. 41.

† Dufrenoy, in the *Mémoires Géologiques*, t. ii., p. 145 and 179.