thesis just noticed, three others already mentioned, to which we must again refer. First of these, we have that which supposes the material of serpentine to have come from the earth's interior as an igneous fused mass consisting essentially of olivine, which by subsequent hydration has been changed into serpentine. This strictly plutonic hypothesis being, however, by many geologists held to be incompatible with observed facts in the geognosy of serpentine, one which has been called hydroplutonic, and has already been set forth at length in these pages, has found advocates. These, conceding that the geognostical relations of serpentine require us to admit that it was laid down from water, have conjectured that a material so unlike that of ordinary aqueous sediments was ejected from the earth's interior, not in a state of igneous fluidity, but as an aqueous magma or mud, consisting essentially of a hydrous silicate of magnesia, which subsequently consolidated into serpentine, and even into olivine and enstatite. This view, as we have seen, is maintained by a school of Italian geologists, and Daubrée, while holding to the origin of serpentine by the hydration of a plutonic olivine-rock, supposes this to have passed into a hydrous condition before its ejection. *

§ 113. There are, however, no facts in the history of vulcanism to justify this strange hypothesis of an erupted magnesian mud. The materials known to us as volcanic muds and ashes do not differ essentially, as regards their constituent chemical elements, from other detrital matters, and the origin of this conjecture may perhaps be traced to the unfounded assumption that olivine is peculiarly a plutonic mineral, and that rocks in which it and other magnesian silicates predominate are presumably plutonic in their origin. It is at best but a survival of the belief in a subterranean providence, which could send forth at pleasure from its reservoirs alike granite and basalt, olivine-rock and limestone, quartz-rock and magnetite. A rational science, however, seeks for the origin of these various and unlike mineral masses in the operation of natural causes, and endeavors to explain their production in accordance with known chemical and physical laws. Enlightened geologists are now agreed as to the aqueous origin of limestones, of dolomites, of iron-oxyds and of quartz, by processes which are intelligible to every chemist, and the formation in the humid way of the native silicates of magnesia is equally simple and intelligible.

§ 114. It was, as already set forth in these pages, after a careful study of natural mineral-waters and sediments, and of the chemistry of artificial magnesian silicates, that the present writer, in 1860, ventured to assert the aqueous origin of the masses of native magnesian silicates, and their formation by reactions between the soluble silicates of lime and alkalies from decaying rocks and the magnesian salts of natural waters. † This view, although adopted by Delesse, as we have shown in § 11, and also, soon after by Gümbel, by Credner, and by Favre, ‡ has not found general recognition. I have, however, to record the recent adhesion to it of Dieulefait, the eminent chemist and geologist of Marseilles, whose arduous and original studies have already placed him in the front rank of students in terrestrial chemistry; and also of Stapff, the learned and acute geologist of the St. Gothard tunnel.

* Géologie Expérimentale, p. 542.

† Hunt, Chem. and Geol. Essays, pp. 122, 296, 317.

‡ Ibid. pp. 304, 305, 317.