my teaching, as above, that "*the plutonic rocks are formed from the metamorphic rocks, and represent the maximum of intensity or the extreme term of general metamorphism.*" * The history of the abandonment by Delesse of his former view of the plutonic for that of the neptunian origin of serpentines, and his acceptance at the same time of the hypothesis of an aqueous origin of plutonic rocks, is significant as a recognition of the new ideas for which I had contended, and which constitute a new departure in theoretical geogeny.

§ 13. In further explanation of this source of magnesian silicates, it was shown by the writer in a series of experiments, the results of which were published in 1865, that whenever the comparatively soluble silicates of alkalies or of lime (which are set free by the decay of crystalline silicates, and are found in many natural waters), are brought in contact with solutions like sea-water, holding magnesian sulphate or chlorid, double decomposition takes place with the separation of a very insoluble gelatinous silicate of magnesia; and further, that precipitated silicate of lime is decomposed by digestion with such magnesian solutions, its lime becoming partially or wholly replaced by magnesia.

This process, it was pointed out, is the reverse of that which happens when carbonates of alkalies or of magnesia come in contact with sea-water, in which case the comparative insolubility of carbonate of lime causes the decomposition of the soluble calcium-salts present. "In the one case, the lime is separated as carbonate, the magnesia remaining in solution; while in the other, by the action of silicate of soda (or of lime) the magnesia is removed, and the lime remains. Hence carbonate of lime and silicates of magnesia are found abundantly in nature, while carbonate of magnesia and silicates of lime are produced only under local and exceptional conditions. It is evident that the production from the waters of the early seas of beds of sepiolite, talc, serpentine, and other rocks, in which a magnesian silicate abounds, must, in closed basins, have given rise to waters in which chlorid of calcium would predominate." † The generation of magnesian silicates in aqueous sediments was thus shown to be the result of a natural process as simple as that giving rise to carbonate of lime.

§ 14. There are many questions connected with this theory of the source of serpentine and related rocks, such as the probable variations in the composition of the original silicates; their admixture with other silicates and carbonates; the changes wrought in these by subsequent chemical reactions, resulting in the genesis of talc, serpentine, enstatite and olivine, and, in certain cases, the subsequent changes of these anhydrous species; the presence in these magnesian minerals of ferrous silicate, which is so abundant in many serpentines, and its relations to the as yet obscure problem of the origin of glauconite, itself sometimes a more or less magnesian silicate; finally, the notable fact of the presence in most of these magnesian rocks of small portions of rarer metals, such as nickel and chromium, which is to be considered in connection with the similar metallic impregnation of certain mineral waters that may well have intervened in the production of these magnesian silicates. All of these are important points, which must be reserved for future discussion.

§ 15. One great object in geology is to discover by what natural processes the different

* Delesse, Etudes sur le Metamorphisme, 1861, p. 87.

† Amer. Jour. Sci. (2) xl., 49; also Chem. and Geol. Essays, p. 123.