hemical elements have been segregated and combined during successive ages in the forms in which we now find them in the earth's crust: in other words how, from a once homogeneous mass have been separated quartz, corundum, bauxite, carbonates of calcium and magnesium, as well as carbonates, oxyds and sulphids of manganese, iron, zinc, copper and other metals. Not less important is the problem of the genesis of the corresponding protoxyd-silicates, and especially of those of calcium, magnesium and iron, which form, often with little or no admixture, considerable masses in the earth's crust. Of these, it is unnecessary to say the magnesian rocks under consideration constitute an important part, and all analogies lead to the conclusion that their constituent elements have been brought together by aqueous processes, such as we have already indicated.

II.—Serpentines in North America.

§ 16. It is evident that if we once come to regard serpentine as a rock formed from aqueous sediments of chemical origin, there is no reason, *à priori*, why it may not be found, like limestone, dolomite or gypsum, intercalated in stratified deposits at different geological horizons, and with different lithological associations. Several such horizons of serpentine have been observed in North America, which will be noticed in ascending order.

Included in the ancient gneissic series to which the name of Laurentian has been given, serpentine is frequently met with associated alike with beds of crystalline limestone and with dolomite. In these beds, the serpentine is often disseminated in grains or small irregular masses, giving rise to varieties of so-called ophicalcite. These imbedded masses of serpentine are sometimes concretionary in aspect, and may have a nucleus of white granular pyroxene. They often recall in their arrangement, imbedded chert or flint, and, like this substance, sometimes attain large dimensions. These serpentines occasionally include the calcareous skeletons of *Eozoon Canadense*, the silicate replacing the soft parts of the organism, as described by Dawson and Carpenter. Occasionally, the serpentines of this horizon form beds of considerable size, either pure or mingled only with small portions of calcite or dolomite. Of these, many instances are seen with the limestones of the Laurentian in Canada, and a remarkable example occurs at New Rochelle, on Long Island Sound, near New York city, where massive bedded serpentine, highly inclined and interstratified with crystalline limestone, often itself mingled with serpentine, occupies a breadth of about 400 feet across the strike, the whole being conformably interstratified with massive gneisses and black hornblendic rocks with red garnet. * The general characters of the serpentines found with the Laurentian limestones have been elsewhere described by the present writer. Their lower specific gravity, and generally paler colors, together with a larger proportion of combined water † serve, in some cases at least, to distinguish the serpentines of this horizon from those to be mentioned as occurring in the Huronian series. To this may be added, a smaller amount of combined iron-oxyd, and, in most cases, the absence of compounds of nickel and chrome, which are almost invari-

* For an account of this locality see Mather, Geol. First District of New York (1842), p. 462; also J. D. Dana, Amer. Jour. Sci., 3d ser., xx., 30-32.

† For descriptions and analyses, by the author, of Laurentian serpentines, see Geol. Canada 1863, pp. 471, 594; also Contributions to the History of Ophiolites (1858), Amer. Jour. Sci. (2) xxvi., pp. 234-236, 239.