

mere films. The veins in the limestone are minute threads of ore crossing it irregularly for a short distance and then disappearing, and are associated with numerous round to elliptical areas of the same.

Vermont ores of manganese occurring in Rutland and Winsor counties are similarly associated, although the country rock is Lower Cambrian and their geological position is at the base of the Stockbridge limestone as irregular lenses and small areas of porous earthy ore, carrying a large percentage of iron, in yellow or white clay. The limestone lying conformably on a flinty quartzite affords an excellent water way, and its alteration to clay has liberated the ore so that it can now be removed simply with pick and shovel. Here as at Quaco the rock at the base of the ore-carrying stratum is one of the least porous varieties. A section across the ore-bearing horizon in which the Crimora ores are found in Virginia presents the same association as found in Vermont. There again the manganese, occurring mainly as "kidney ore" is found in lenses and scattered masses in yellow clay, the product of a decomposed limestone such as makes the surface of the country in that region, which lies on a micaceous quartzite or quartz schist,—the layer of ore-bearing clay being next the quartzite. In the geology of the Virginias these rocks are classed as Silurian-Cambrian.¹ One stalactite weighing several pounds was given me by a miner at Crimora who assured me he had found it pendent from the roof of a small limestone cavern. In Vermont lenses and geodes of limonite occur with stalactites of psilomelane traversing the interior like bars. These bars in section show concentric bending.

As regards the source of manganese nodules one cannot fail to notice the similarity of the more porous, earthy variety of ore occurring at Quaco to the manganese nodules found by dredging in the deep sea during the voyages of the Challenger and Blake. The two nodules not only resemble each other physically but chemically the resemblance is still more marked. Phosphorus exists in much larger amounts in the deep sea nodules and their specific gravity is less owing to their porosity. Analyses of the ores uniformly show the presence of phosphorus and iron in varying amount. The following are partial analyses of the com-

¹ Rogers, Report reprinted in 1884.