

velope, loses part of its water, becomes cheese-like in consistency, and finally hardens into stone.³⁵⁸

In the formation of extensive beds of bog iron-ore, the agency of vegetable life is of prime importance. In marshy flats and shallow lakes, where the organic acids are abundantly supplied by decomposing plants, the salts of iron are attacked and dissolved. Exposure to the air leads to the oxidation of these solutions, and the consequent precipitation of the iron in the form of hydrated ferric oxide, which, mixed with similar combinations of manganese, and also with silica, phosphoric acid, lime, alumina, and magnesia, constitutes the bog-ore so abundant on the lowlands of North Germany and other marshy tracts of northern Europe.³⁵⁹ On the eastern seaboard of the United States, large tracts of salt marsh, lying behind sand-dunes and bars, form receptacles for much active chemical solution and deposit. There, as in the European bog-iron districts, ferruginous sands and rocks containing iron are bleached by the solvent action of humus acids, and the iron removed in solution is chiefly oxidized and thrown down on the bottom. In presence of the sulphates of sea-water and of organic matter, the iron of ferruginous minerals is partially changed into sulphide, which on oxidation gives rise to the precipitation of bog-iron.³⁶⁰ The existence of beds of iron-ore among sedimentary formations affords strong presumption of the existence of contemporaneous organic life by which the iron was dissolved and precipitated.

³⁵⁸ W. H. Weed, Ninth Ann. Rep. U. S. Geol. Survey, 1889. *Amer. Journ. Sci.* xxxvii. 1889, p. 351.

³⁵⁹ Forchhammer, *Neues Jahrb.* 1841, p. 17, ante, p. 254.

³⁶⁰ Julien, *Amer. Assoc.* 1879, p. 347, and ante, p. 763.