ments have shown that many of the common minerals of rocks are attacked by organic acids. There is reason to believe that in the decomposition effected by meteoric waters, and usually attributed mainly to the operation of carbonic acid, the initial stages of attack are due to the powerful solvent capacities of the humus acids. Owing, however, to the facility with which these acids pass into higher states of oxidation, it is chiefly as carbonates that the results of their action are carried down into deeper parts of the crust or brought up to the surface. Although carbonic acid is no doubt the final condition into which these unstable organic acids pass, yet during their existence they attack not merely alkalies and alkaline earths, but even dissolve silica. The relative proportion of silica in river-waters has been referred to the greater or less abundance of humus in their hydrographical basins,[325] the presence of a large percentage of silica being a concomitant of a large proportion of organic matter. Further evidence of the important influence of organic acids upon the solution of silica is supplied by many siliceous deposits (p. 810).

Wherever a layer of humus has spread over the surface of the land, traces of its characteristic decompositions may be found in the soils, subsoils and underlying rocks. Next the surface, the normal color of the subsoils is usually changed by oxidation and hydration into tints of brown and yellow, the lower limit of the weathered zone being often sharply defined. Where the humus acids can freely

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Geological Action of the Humus Acids. Amer. Assoc. 1879, p. 311. Prof. H. C. Bolton has experimented on the action of citric acid on 200 different mineral species, and he finds that this organic acid possesses a power of dissolving minerals only slightly less than that of hydrochloric acid; Brit. Assoc. 1880, Sects. p. 505.

[325] Sterry Hunt's "Chemical and Geological Essays," pp. 126–150.