

tance. With regard to the organic matter, it is the experience of practical agriculturists in Britain that oats and rye will grow upon a soil with $1\frac{1}{2}$ per cent of organic matter, but that wheat requires from 4 to 8 per cent.⁶⁸ To a geologist, this organic matter has much interest, as the source of most of the carbonic acid with which so wide a series of changes is worked by subterranean water. The inorganic portion of soil, or still undissolved residue of the original surface-rock, varies from a loose open substance with 90 per cent or more of sand, to a stiff, cold, retentive material with more than 90 per cent of clay. When this sand and clay are more equally mixed they form a "loam."⁶⁹

Reference has just been made to the thick accumulation of rock decomposed *in situ* observable in certain regions which, having been above the sea for a lengthened period, have been long exposed to the action of weathering. Where this action has been supplemented by that of rain, widespread formations of loam and earth have been gathered together. These are well illustrated by the "brick-earth," "head," and "rain-wash" of the south of England—earthy deposits, with angular stones, derived from the subaerial waste of the rocks of the neighborhood.⁷⁰

2. Mechanical Action.—Besides chemically corroding

⁶⁸ Johnston's "Elements of Agricultural Chemistry," p. 80.

⁶⁹ For measurements of the permeability of soils, see Hondaille and Semichow, *Compt. Rend.* cxv. (1892), p. 1015.

⁷⁰ Godwin-Austen, *Q. J. Geol. Soc.* vi. p. 94, vii. p. 121; Foster and Topley, *op. cit.* xxi. p. 446. The vast extent of some superficial formations, like the "loess" above referred to (p. 566), has often suggested submergence below the sea. But when, instead of marine organisms, only terrestrial, fluvial, or lacustrine remains occur in them, as in the brick earths and loess, the idea of marine submergence cannot be entertained. The remarkable "tundras" or steppes of Siberia, and the "black earth" of Russia, are examples of such extensive formations, which are certainly not of marine origin, but point to long-continued emergence above the sea. See Murchison, Keyserling and De Verneuil's "Geology of Russia." *Belt, Q. J. Geol. Soc.* xxx. p. 490.