4. *Formation of Carbonates.*—Silicates of lime, potash, and soda, with the ferrous and manganous silicates which exist so abundantly in rocks, are attacked by rain-water containing carbonic acid, with the formation of carbonates of these bases and the liberation of silica. The felspars are thus decomposed. Their crystals lose their lustre and color, becoming dull and earthy on the outside, and the change advances inward until the whole substance is converted into a soft pulverulent clay. In this decomposition the whole of the alkali, together with about two-thirds of the silica, is removed, leaving a hydrous aluminous silicate or kaolin behind. But the rapidity and completeness of the process vary greatly, especially in proportion to the abundance of carbonic acid. Where it advances with sufficient slowness, most of the silica, after the abstraction of the alkali, may be left behind. In the case of magnesian minerals (augite, hornblende, olivine, etc.) the silicates of magnesia and alumina, being less soluble, may remain as a dark brown or yellow clay, colored by the oxidation of the iron, while the lime and alkalies are removed.[84] Evidence of the progress of these changes may be obtained even for some distance from the surface in many massive rocks. Diabase, basalt, diorite, and other crystalline rocks, which may appear to be quite fresh, will often reveal, by the effervescence produced when acid is dropped on their newly broken and seemingly undecomposed surfaces, that their silicates have been attacked by meteoric water and have been partially converted into carbonates.

5. *Hydration.*—Some anhydrous minerals, when exposed to the action of the atmosphere, absorb water (become hy-

[84] Roth, op. cit. i. p. 112.