

silicate of protoxide of iron and potash, which sometimes includes a considerable proportion of alumina in its composition, has been observed by Ehrenberg, Mantell, and Bailey, associated with organic forms in a manner which seems identical with that in which pyroxene, serpentine, and loganite occur with the *Ezoön* in the Laurentian limestones. According to the first of these observers, the grains of greensand, or glauconite, from the Tertiary limestone of Alabama are casts of the interior of Polythalamia, the glauconite having filled them by "a species of natural injection, which is often so perfect that not only the large and coarse cells, but also the very finest canals of the cell-walls and all their connecting tubes are thus petrified and separately exhibited." Bailey confirmed these observations, and extended them. He found in various Cretaceous and Tertiary limestones of the United States, casts in glauconite, not only of *Foraminifera*, but of spines of *Echinus* and of the cavities of Corals. Besides, there were numerous red, green, and white casts of minute anastomosing tubuli, which, according to Bailey, resemble casts of the holes made by burrowing Sponges (*Cliona*) and Worms. These forms are seen after dissolving the carbonate of lime by a dilute acid. He found, moreover, similar casts of *Foraminifera*, of minute Mollusks, and of branching tubuli, in mud obtained from soundings in the Gulf-stream, and concluded that the deposition of glauconite is still going on in the depths of the sea*. Pourtales has followed up these investigations on the recent formation of glauconite in the Gulf-stream waters. He has observed its deposition also in the cavities of *Milnepores*, and in the canals in the shells of *Balanus*. According to him the glauconite-grains formed in *Foraminifera* lose after a time their calcareous envelopes, and finally become "conglomerated into small black pebbles," sections of which still show under a microscope the characteristic spiral arrangement of the cells†.

It appears probable from these observations that glauconite is formed by chemical reactions in the ooze at the bottom of the sea, where dissolved silica comes in contact with iron-oxide rendered soluble by organic matter; the resulting silicate deposits itself in the cavities of shells and other vacant spaces. A process analogous to this, in its results, has filled the chambers and canals of the Laurentian *Foraminifera* with other silicates; from the comparative rarity of mechanical impurities in the silicates, however, it would appear that they were deposited in clear water. Alumina and oxide of iron enter into the composition of loganite as well as of glauconite; but in the other replacing minerals, pyroxene and serpentine, we have only silicates of lime and magnesia, which were probably formed by the direct action of alkaline silicates, either dissolved in surface-waters or in those of submarine springs, upon the calcareous and magnesian salts of the sea-water. Experiments undertaken with the view of determining the precise conditions under which these and similar silicates may thus be formed are now in progress.

* Amer. Journ. Science, 2nd ser. vol. xxii. p. 280.

† Rep. Amer. Coast-Survey, 1858, p. 248.