There are also lagoons at the mouths of many rivers, as the Nile and Mississippi, which are divided off by bars of sand from the sea, and which are filled with salt and fresh water by turns. They often communicate exclusively with the river for months, years, or even centuries; and then a breach being made in the bar of sand, they are for long periods filled with salt water.

The Lym-Fiord in Jutland offers an excellent illustration of analogous changes; for, in the course of the last thousand years, the western extremity of this long frith, which is 120 miles in length, including its windings, has been four times fresh and four times salt, a bar of sand between it and the ocean having been as often formed and removed. The last irruption of salt water happened in 1824, when the North Sea entered, killing all the freshwater shells, fish, and plants; and from that time to the present, the sea-weed *Fucus vesiculosus*, together with oysters and other marine mollusca, have succeeded the *Cyclas*, *Lymnea*, *Paludina*, and *Charæ*.*

But changes like these in the Lym-Fiord, and those before mentioned as occurring at the mouths of great rivers, will only account for some cases of marine deposits of partial extent resting on freshwater strata. When we find, as in the southeast of England, a great series of freshwater beds, 1000 feet in thickness, resting upon marine formations and again covered by other rocks, such as the cretaceous, more than 1000 feet thick, and of deep-sea origin, we shall find it necessary to seek for a different explanation of the phenomena.†

CHAPTER IV.

CONSOLIDATION OF STRATA AND PETRIFACTION OF FOSSILS.

Chemical and mechanical deposits—Cementing together of particles—Hardening by exposure to air—Concretionary nodules—Consolidating effects of pressure—Mineralization of organic remains—Impressions and casts how formed—Fossil wood—Göppert's experiments—Precipitation of stony matter most rapid where putrefaction is going on—Source of lime in solution—Silex derived from decomposition of felspar—Proofs of the lapidification of some fossils soon after burial, of others when much decayed.

HAVING spoken in the preceding chapters of the characters of sedimentary formations, both as dependent on the deposition of inorganic matter and the distribution of fossils, I may next treat of the consolidation of stratified rocks, and the petrifaction of imbedded organic remains.

Chemical and mechanical deposits.—A distinction has been made by

* See Principles, Index, "Lym-Fiord."

† See below, Chap. XVIII., on the Wealden.