

ture, so as to give rise, by their mixture, to the condensation of aqueous vapor.

The more closely the strata productive of coal have been studied the greater has become the force of the evidence in favor of their having originated in the manner of modern deltas. They display a vast thickness of stratified mud and fine sand without pebbles, and in them are seen countless stems, leaves, and roots of terrestrial plants, free for the most part from all intermixture of marine remains,—circumstances which imply the persistency in the same region of a vast body of fresh water. This water was also charged, like that of a great river, with an inexhaustible supply of sediment, which seems to have been transported over alluvial plains so far from the higher grounds that all coarser particles and gravel were left behind. Such phenomena imply the drainage and denudation of a continent or large island, having within it one or more ranges of mountains. The partial intercalation of brackish-water beds at certain points is equally consistent with the theory of a delta, the lower parts of which are always exposed to be overflowed by the sea even where no oscillations of level are experienced.

The purity of the coal itself, or the absence in it of earthy particles and sand, throughout areas of vast extent, is a fact which appears very difficult to explain when we attribute each coal-seam to a vegetation growing in swamps. It has been asked how, during river inundations, capable of sweeping away the leaves of ferns and the stems and roots of *Sigillariæ* and other trees, could the waters fail to transport some fine mud into the swamps? One generation after another of tall trees grew with their roots in mud, and their leaves and prostrate trunks formed layers of vegetable matter, which was afterwards covered with mud since turned to shale. Yet the coal itself or altered vegetable matter remained all the while unsoiled by earthy particles. This enigma, however perplexing at first sight, may, I think, be solved, by attending to what is now taking place in deltas. The dense growth of reeds and herbage which encompasses the margins of forest-covered swamps in the valley and delta of the Mississippi is such that the fluvial waters, in passing through them, are filtered and made to clear themselves entirely before they reach the areas in which vegetable matter may accumulate for centuries, forming coal if the climate be favorable. There is no possibility of the least intermixture of earthy matter in such cases. Thus in the large submerged tract called the "Sunk Country," near New Madrid, forming part of the western side of the valley of the Mississippi, erect trees have been standing ever since the year 1811–12, killed by the great earthquake of that date; lacustrine and swamp plants have been growing there in the shallows, and several rivers have annually inundated the whole space, and yet have been unable to carry in any sediment within the outer boundaries of the morass, so dense is the marginal belt of reeds and brushwood. It may be affirmed that generally in the "cypress swamps" of the Mississippi no sediment mingles with the vegetable matter accumulated there from the decay of