

same rate at which its foundations sink, so that these may go down hundreds or thousands of feet perpendicularly, and yet the sea bordering the delta may always be excluded, the whole deposit continuing to be terrestrial or freshwater in character. This appears to have happened in the deltas both of the Po and Ganges, for recent artesian borings, penetrating to the depth of 400 feet, have there shown that fluviatile strata, with shells of recent species, together with ancient surfaces of land supporting turf and forests, are depressed hundreds of feet below the sea level.* Should these countries be once more slowly upraised, the rivers would carve out valleys through the horizontal and unconsolidated strata as they rose, sweeping away the greater portion of them, and leaving mere fragments in the shape of terraces skirting newly-formed alluvial plains, as monuments of the former levels at which the rivers ran. Of this nature are "the bluffs," or river cliffs, now bounding the valley of the Mississippi throughout a large portion of its "course." The upper portions of these bluffs which at Natchez and elsewhere often rise to the height of 200 feet above the alluvial plain, consist of loam containing land and freshwater shells of the genera *Helix*, *Pupa*, *Succinea*, and *Lymnea*, of the same species as those now inhabiting the neighboring forests and swamps. In the same loam also are found the bones of the Mastodon, Elephant, Megalonyx, and other extinct quadrupeds.†

I have endeavored to show that the deposits forming the delta and alluvial plain of the Mississippi consist of sedimentary matter, extending over an area of 30,000 square miles, and known in some parts to be several hundred feet deep. Although we cannot estimate correctly how many years it may have required for the river to bring down from the upper country so large a quantity of earthy matter—the data for such a computation being as yet incomplete—we may still approximate to a minimum of the time which such an operation must have taken, by ascertaining experimentally the annual discharge of water by the Mississippi, and the mean annual amount of solid matter contained in its waters. The lowest estimate of the time required would lead us to assign a high antiquity, amounting to many tens of thousands of years to the existing delta, the origin of which is nevertheless an event of yesterday when contrasted with the terraces formed of the loam above mentioned. The materials of the bluffs were produced during the first part of a great oscillation of level which depressed to a depth of 200 feet a larger area than the modern delta and plain of the Mississippi, and then restored the whole region to its former position.‡

Loess of the Valley of the Rhine.—A similar succession of geographical changes attended by the production of a fluviatile formation, singularly resembling that which bounds the great plain of the Mississippi, seems to have occurred in the hydrographical basin of the Rhine, since

* See Principles, 8th ed. pp. 260-268, 9th ed. 257-280.

† See Principles of Geol. 9th ed., and Lyell's Second Visit to the United States, vol. ii. p. 257.

‡ Lyell's Second Visit to the United States, vol. ii. chap. 34.