

greater than that of running water: cliffs broken and smashed into ruins are unquestioned witnesses of the work of destruction effected by the sea on coasts. Running waters deposit at their mouths the matters which they carry in suspension, thus forming the deltas of rivers. In their turn the mineral particles in suspension in marine waters are deposited at the bottom of the sea, often at considerable distances from the coasts. Among the factors which play a part in marine sedimentation, tides and currents are enumerated. Seneca points out, besides, that all waters, and especially those of the ocean, possess the power of cleansing themselves from all impurities; they may be said to wash the coasts and lay down near them all matters in suspension. During a series of centuries the lines of coasts undergo sensible modifications.¹

A few notions regarding the geological action of water, the sediments carried into the sea and then solidified, are met with in the works of Kazwini,² and other Arab writers.

We find in Maçoudi³ examples of the carriage of fluviatile sediments, whose accumulation causes the sea to retire. He had been profoundly impressed by the sanding up produced by the Tigris and Euphrates; he cites the case of the city of Hiza, formerly a sea-port, which, after the lapse of 300 years, was situated far in the interior.⁴

Albirouni⁵ embraced the idea, previously expressed by Megasthenes, according to which Bengal has been formed by the accumulation of sediment deposited by the Ganges. The writings of this author also show that he had observed the distribution of materials transported by water; he points out that the larger fragments are deposited at the upper parts of rivers, that gravel is found lower down in their course, and finally, that sand and the finest particles are carried into the ocean.

In Italy, in the fifteenth century, Leonardo da Vinci wrote that the sea changes the equilibrium of the earth, that the shells accumulated in various layers have necessarily lived on the spot which the sea occupied. The great rivers, he says, carry into the ocean the waste of the land, and the deposits thus formed have been successively covered by others of various thicknesses, and finally the bottom of the sea has become the top of mountains.⁶

The Dane, Steno⁷, endeavours to show that the carapaces of Crustacea are formed of matter secreted by the animal's body; he establishes the connection existing between fossils and the sedimentary layers which contain them, and the true origin of both. He was the first to distinguish the layers formed in the sea from those deposited in fresh water, and to notice the character of the shells in both instances. He concludes, from

¹ See A. Nehring, *Die geologischen Anschauungen des Philosophen Seneca*, Wolfenbüttel, 1873 and 1876.

² Flourished about 1263 A.D.

³ Flourished about 915 A.D.

⁴ Maçoudi, *Les Prairies d'Or*, texte et traduct. par MM. Meynard et Courteille, Paris 1861; see in particular the anecdote of Kaled and Abd-el-Meçih, tom. i. c. ix. pp. 216, 222.

⁵ Flourished about 1000 A.D.

⁶ See Venturi, *Essai sur les ouvrages physico-mathématiques de Léonard da Vinci*, Paris, 1797.

⁷ *De solido intra solidum naturaliter contento dissertationis prodromus*, Florence, 1669.