

which they have once evidently covered, is also a phenomena of frequent occurrence; and its explanation must be sought from some of the same causes, that have excavated valleys. This appearance of the strata is called a denudation.

The first of the above theories is that of Werner: he supposed that all the matter of which primary, transition, and secondary rocks are formed, was originally held in solution by water, and that the water, so saturated with mineral matter, covered the whole globe. The primary rocks of granite were formed by chemical precipitation, and their peaked summits and declivities were the result of their original deposition. On the steep sides of these primary mountains were subsequently deposited the different schistose rocks, and all the secondary strata. During the time that these rocks were depositing, the water, though nearly saturated with mineral matter, was capable of supporting animal life, and the shells and remains of zoophytes and fish, were enveloped in the strata, at the period of their deposition. According to this theory, when the water retired from the present continents, the mountains and valleys were already formed.

The theory of Werner requires for its support the admission of conditions, which appear in the present state of our experience impossible, and it is at variance with existing phenomena. The vertical position of beds of puddingstone, sandstone, and the tertiary strata in the Alps, could not have been their original one; nor can the bendings and contortions of the strata, so common in Alpine countries, be explained by original deposition. A further account of part of Werner's theory is given, Chap. IX. p. 148. Werner's theory of valleys is altogether distinct from that theory which ascribes the formation of valleys to inequalities of the surface, subsequently enlarged by the erosion of water.

The second theory, that all valleys have been excavated by the rivers that flow through them, was maintained by Dr. Hutton and Professor Playfair: it formed a part of their general theory of the earth; the leading propositions of which are, that the surface of the present continents is wearing down by the action of the atmosphere and by torrents, and that the materials are carried by rivers into the sea, and there deposited. At a future period, these materials will be melted or consolidated by subterranean heat under pressure of the ocean, and subsequently, by the expansive force of central fire, the bed of the ocean will be elevated, and form new continents. According to this theory, our present continents have been also formed from the ruins of a preceding world, and elevated by a similar cause. It is only with that part of the Huttonian system, which relates to the excavation of valleys, that we have at present any concern.

It is remarkable, that a theory which maintains that the continents were raised from the ocean by subterranean fire, should limit the formation of valleys to the action of the rivers that run through them; for if the land were raised by an expansive power acting from be-