CHAPTER XXIII.

ON THE FORMATION OF VALLEYS, AND THE GEOLOGICAL THEORIES RELATING TO VALLEYS AND DENUDATIONS.

On the Causes that have broken the Surface of the Globe.—Erosive Action of running Water, illustrated by the Process called *Hushing*.—Bursting of Lakes.—Some valleys originally formed by Elevation or Subsidence, and subsequently enlarged by the Action of Water.—Different Theories respecting the Formation of Valleys.—Theory of Werner—of Hutton.—Of Elevation.—Of the retiring Waters of the Ocean.—Theory of Excavation and Denudation by Deluges. Modification of this Theory by Sir James Hall; its Application to Explain Denudations, and Transportation of Blocks of Granite from the Alps.—Particular Phenomena, presented by the scattered Blocks in the Vicinity of Geneva.—Denudation of Stratified Rocks, effected by the same Causes which have broken the Primary Rocks, and scattered their Fragments into distant Districts.

From what has been stated in the preceding chapter, respecting the elevation and submersion of the earth's surface, the geological student might infer, that such elevations and submergences offer a satisfactory explanation of the formation of valleys, but the inference would be erroneous. There are two distinct causes which have modified the surface of the globe; the one internal, dependent on the atmosphere which surrounds it; beside these, there is the ceaseless flux and reflux of the ocean, dependent on the attractive forces of the sun and moon, and on the earth's diurnal revolution on its axis. The two former causes have been principally concerned in the formation of valleys; and there are few valleys in which the combined effects of both these causes may not be traced. The inequalities of surface produced by the upheaving of mountain ranges, or the emergence of continents from the ocean, must have originally determined the course of the retiring water, or of atmospheric water precipitated in rain. Of the power of atmospheric water, to act upon the surface of the globe, we can form but a very feeble idea, from what we observe in our own country. In warm climates, as much rain will sometimes fall in one hour, as falls at different times, during three months, in northern latitudes: added to this, when the rain descends in mountainous regions, the water is suddenly collected into powerful rivers, rushing with incredible violence to the lower valleys. At remote epochs, it is highly probable that many elevated depressions, which are now mountain valleys in alpine regions, upheld the waters and formed lakes, that have subsequently burst their barriers, and have ploughed a passage for the succeeding rivers, when the drainage of the country became more regular.

To enable the reader to form some notion of the force of falling water, carrying with it loose stones that occur in its passage, it may be useful to describe a process called *hushing*, in Westmoreland.