

er. The action of rivers in extensive and level valleys, tends rather to fill them with *débris*, brought from the more elevated countries in which the rivers had their origin, than to excavate them deeper.

The formation of the greater number of valleys cannot be explained by the action of water alone. There are valleys of elevation formed by the raising of the strata on each side—valleys of subsidence, formed by the sinking of the ground, leaving the adjacent rocks unmoved—valleys formed on the line of faults, in which the rocks on one side have been thrown up or depressed—valleys of disruption, where a range of mountains, or an extent of country has been rent by earthquakes or by subsidence. Most of the valleys formed originally by these causes, have been subsequently enlarged or modified by the action of water. There are, indeed, instances of valleys and ravines formed entirely by the continued erosion of water; such is the valley of Niagara, between Queenstown and the Falls. (See the frontispiece to the present volume.) Other instances might be cited, in which the action of water is equally evident. In many cases, however, where water appears to have been the sole agent in excavating rocks, I am inclined to believe, that an original break or fissure has greatly accelerated the process. In many broader valleys, the excavation must often have been effected by more powerful agents than any which we perceive in present operation; and when a broad outlet is once made, the subsequent drainage of a country may work its way to the sea in a very sinuous course; but this sinuous course, does not prove that the valley had been originally formed by the river that flows through it.

Besides the action of mountain torrents, the bursting of lakes, and the regular flowing of rivers, many geologists believe that the excavation of valleys, and the transportation of loose rocks, have been effected by the more powerful agency of the ocean, thrown over the surface of the land by the great convulsions that have upheaved mountain ranges and continents. For the benefit of the geological student, I shall endeavour to give a brief outline of the principal theories that have been maintained respecting the formation of valleys; but the first of these theories is now admitted to be untenable.

The formation of valleys has been ascribed to the following causes:—

- 1st, To the original unequal deposition of the earth's surface.
- 2d, To excavation, by the rivers that flow through them.
- 3d, To the elevation or subsidence of part of the earth's surface.
- 4th, To excavations, caused by the sudden retreat of the sea from our present continents.
- 5th, To excavations by inundations or deluges, that have suddenly swept over the surface of different parts of the globe.

I shall notice the leading facts that favour or oppose each of these theories. The disappearance of large portions of strata from districts