

from large areas. That water has, in this case, been the denuding agent, we may infer from the fact that the rocks have yielded according to their different degrees of hardness; the hard trap of the Wrekin, for example, and other hills, having resisted more than the softer shale and sandstone, so as now to stand out in bold relief.*

Origin of valleys.—Many of the earlier geologists, and Dr. Hutton among them, taught that “rivers have in general hollowed out their valleys.” This is no doubt true of rivulets and torrents which are the feeders of the larger streams, and which, descending over rapid slopes, are most subject to temporary increase and diminution in the volume of their waters. It must also be admitted that the quantity of mud, sand, and pebbles constituting many a modern delta is so considerable, as to prove that a very large part of the inequalities now existing on the earth’s surface are due to fluvial action; but the principal valleys in almost every great hydrographical basin in the world, are of a shape and magnitude which imply that they have been due to other causes besides the mere excavating power of rivers.

Some geologists have imagined that a deluge, or succession of deluges, may have been the chief denuding agency, and they have speculated on a series of enormous waves raised by the instantaneous upthrow of continents or mountain chains out of the sea. But even were we disposed to grant such sudden upheavals of the floor of the ocean, and to assume that great waves would be the consequence of each convulsion, it is not easy to explain the observed phenomena by the aid of so gratuitous an hypothesis.

On the other hand, a machinery of a totally different kind seems capable of giving rise to effects of the required magnitude. It has now been ascertained that the rising and sinking of extensive portions of the earth’s crust, whether insensibly or by a repetition of sudden shocks, is part of the actual course of nature, and we may easily comprehend how the land may have been exposed during these movements to abrasion by the waves of the sea. In the same manner as a mountain mass may, in the course of ages, be formed by sedimentary deposition, layer after layer, so masses equally voluminous may in time waste away by inches; as, for example, if beds of incoherent materials are raised slowly in an open sea where a strong current prevails. It is well known that some of these oceanic currents have a breadth of 200 miles, and that they sometimes run for a thousand miles or more in one direction, retaining a considerable velocity even at the depth of several hundred feet. Under these circumstances, the flowing waters may have power to clear away each stratum of incoherent materials as it rises and approaches the surface, where the waves exert the greatest force; and in this manner a voluminous deposit may be entirely swept away, so that, in the absence of faults, no evidence may remain of the denuding operation. It may indeed be affirmed that the signs of waste will usually be least obvious where the destruction has been most complete; for the annihilation

* Prestwich, Geol. Trans. second series, vol. v. pp. 452, 473.