

deepen its channel either proportionately or more rapidly, so that it was never diverted from its former course.

Independently of Medlicott and Powell, Tietze arrived at a similar explanation of the origin of transverse valleys in the Elburz mountains in Persia, and of the Iron Gates of the Danube across the Transylvanian mountains. Tietze refers the beginning of such transverse valleys to a period when the chains across which they pass had no existence as such, but still formed part of a continental plain. The Swiss geologists, Heim and Brückner, support this theory, but it has been opposed by Löwl, who accepts Rüttimeyer's explanation that the backward erosion of valleys may finally cut through watersheds and even entirely through mountain-chains.

Within the last few decades geographers have made great advances in the detailed knowledge regarding the erosion of river-channels, the diversion of river-courses, the serpentine windings, the recession of watersheds, and the causes of special forms of erosion such as river-terraces and pot-holes. These are fully treated in Penck's *Morphologie* (vol. i., pp. 259-385).

The first exact reports on the quality and kinds of material transported by rivers were those made by Mr. Everest (1832), who determined that the average annual amount of detritus covered by the River Ganges amounts to $\frac{1}{510}$ by weight. Under the auspices of the United States Government, a very important series of investigations were carried out on the Mississippi river. The accurate results obtained there by the engineers Humphreys and Abbot showed that the proportion of material held in suspension by the river was $\frac{1}{1100}$ by weight, and that the total weight of earthy matter annually transported to the Gulf of Mexico by the Mississippi river amounted to 812,500,000,000 pounds. (*Report upon the Physics and Hydraulics of the Mississippi*, 1861.)

Nearly all the great rivers have now undergone examination in this respect, and the results obtained have given geologists a much clearer conception of the actual rate of progress of subaerial waste. In an able essay, entitled *On Modern Denudation*, published in 1868, Sir Archibald Geikie made careful calculations of the amount of material annually transported by rivers, and showed how an irregular surface can be entirely levelled to a plain by the subaerial agencies of denudation.