

advance of erosion he made a calculation of the age of the Niagara Falls; his result was afterwards modified by Woodward and Gilbert. In the second half of this century, the rate of river erosion has been examined in minute detail. Physicists, geographers, and engineers have combined their efforts to obtain an accurate determination of the rate of movement in the different parts of a river-course, and the corresponding capacity of the stream to transport solid material. Geologists especially investigated the abrasive work effected by the transported pebbles and sand in deepening and widening a river-channel. In American literature, the writings that had the most marked influence upon contemporary science were Dana's publications in the *Reports of Wilkes' Exploring Expedition* and his *Manual of Geology* (1863), and Newberry's "Description of the Grand Cañon" in his *Report upon Colorado* (1861).

Oldham elucidated in 1859 the erosion of the valleys in the Khasi Hills of India, Rubidge investigated the work of water in eroding the South African valleys, and in 1870, Blanford gave an account of the Abyssinian valleys. Greenwood, Jukes, Whitaker, and Topley dealt exhaustively with the erosion of English river-valleys. In 1869, Rüttimeyer published at Bâle his famous work on Valley and Lake Formation, which has exerted a permanent influence upon geological thought. Rüttimeyer endeavoured to prove that the majority of the mountain-valleys in Switzerland, including the largest river-valleys, had originated only in virtue of stream erosion, but that long geological periods had been occupied in the excavation of the channels. The commencement of the valley erosion had been coeval with the uprise of the Alps, but erosion had not always progressed with the same intensity. Erosion had worked from the foot of the mountains backward and upward to higher levels, consequently the different portions of a river-course might present distinct types of erosion (waterfalls, lakes, rivers, etc.). A sketch-map illustrating the history of the lakes and rivers of Switzerland accompanied Rüttimeyer's work, and was of special value as the first bold attempt to classify the Swiss valleys according to their geological age.

The American geologist Gilbert, in 1877, in his *Geology of the Henry Mountains*, established the fundamental laws of river action in the erosion of valleys. The researches of Powell and