1897-98]. HIGH PLATEAU AND SUBMARINE ANTILLEAN VALLEYS.

these flood-plains are bounded by high bluffs of soft or incoherent rocks of Cretaceous and early Tertiary ages, and later superficial deposits, in contrast to the hard Paleozoic formations of the upper section of the valley. The difference of width of the upper and lower portions of the valley is mostly due to the rainfall acting upon the more readily yielding strata during a long period of base level of erosion. The lower part of the buried valley reaches to the great depth of about 1,000 feet below the Gulf of Mexico.* If the region should further subside⁺ by 300 feet, the river would become an estuary like that of the St. Lawrence.

The Colorado River of the West forms another type of valleys. It flows from elevated plateaus, some of which have altitudes of 8,000 or 10,000 feet above the sea. From Echo Cliff, the Marble canyon extends sixty-six miles to the mouth of the Little Colorado River, below which the gorge of the Grand canyon reaches 195 miles to Grand Wash, but the canyon is twenty-five miles longer. The gradient of the river is commonly between seven and eight feet per mile, although reduced in parts to five feet, or increased to twelve feet in others, and locally it is nowhere more than twenty-five feet. The mean slope is accordingly 8.5 feet per mile. (These slopes are illustrated in figure 2, page 364). The inner canyon may have a breadth equal to the depth, or from 3,500 to 4,000 feet, but the outer canyon has a width of from five to over twelve miles, with bounding escarpments 2,000 feet above the higher floor. The outer valley suggests that the region was at a lower base level, when the altitude could not have been at more than a slight elevation above the sea, like that of the modern Mississippi valley.

The gorge of the Niagara River is seven miles long, and although the volume of water is very large, the mean declivity is about sixteen feet per mile; but locally there are great rapids and eddies.

Equally important, with the study of the slopes of the great valleys and rivers, is that of the gradients of their short tributaries. These are often hardly more than stupendous washouts, forming great amphitheatres. The gradients of these short valleys may be from 400 to 600 feet per mile for a few miles, but this is greater near its head, and less along its lower portions. The declivity is never less than 200 feet per mile (Dutton[‡]).

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^{*} The depth has long been known to exceed 600 feet, but lately Mr. E. L. Corthell has found by borings that it reaches to about 1,000 feet.

[†] Mr. Corthell has also found that the region about New Orleans is sinking at the rate of five feet a century. "Geographical Development of the Lower Mississippi." Communicated to the British Association, Toronto, 1897.

[‡] The measurements were taken from the "Tertiary History of the Grand Canyon District" (of the Colorado of the West), by C. E. Dutton (1882).