

of running water. In a strongly flexed region, for instance, the drainage is largely controlled by the attitude of the rocks. A country of horizontal strata of moderate resistance, such as those of the Ozark plateau, is particularly favorable to the development of a swinging course. Where soft and hard beds, like shales or limestones and cherts, alternate, we can readily conceive how a stream of comparatively rapid fall may move or expand its meanders considerably while cutting only a slight depth through underlying resistant beds. Did time and space permit it would be interesting to elaborate further and to trace the effects of other modifying conditions. Without being prepared at present to express final conclusions, it seems to me probable, however, that the presence of such streams as the Osage over the Missouri-Arkansas plateau can be assigned to local conditions of declivity and stratigraphy.

Whichever hypothesis be advanced it is, of course, necessary for its acceptance that other facts of the geological history of the region be reconcilable with it. As I view the question at present, such reconciliation seems more readily effected on the hypothesis I have advanced, than on Professor Davis's. The exceptions I took to his, that the country had been base-levelled in Tertiary times, are not objections against mine. But, whether Mr. Davis be right or not as to the volume of erosion (leaving out of consideration the resultant forms) and as to the earth movements that have taken place since Paleozoic time, the explanation which I offer stands equally good.

I do not mean by this, however, to beg the questions of the extent of Mesozoic denudation and of the oscil-

lations which have taken place since the Paleozoic period. There have undoubtedly been changes of levels; such were necessary to bring the Cretaceous and Tertiary rocks of the Mississippi embayment to their present altitudes; but I do not think the differential movements within the limits of Missouri have been very great. While the seas existed in which the post-Paleozoic deposits of Kansas and Colorado were laid down, the drainage of a part of Missouri probably flowed in that direction. With the uplift of the western area, certain readjustments of drainage must have taken place over Missouri. When I stated in my last letter that the sculpturing of the topography must have been uninterrupted in progress from the end of the Paleozoic to the present time, I meant that Missouri had been essentially a land surface since that time. Probably the larger features of its drainage system were blocked out at the beginning of this period of emergence. This statement is not at all opposed to the idea that changes of level or readjustments of drainage took place during that period. Just what was the exact sequence of events, or the nature of the changes, I do not feel prepared to say. More critical field studies, better knowledge and more careful consideration of the geological history of surrounding areas is necessary before anything like the full story can be told. With such knowledge as we have, however, I am not inclined to accept the hypothesis of a wide base-levelling such as is required, if all of the sinuous streams of this region are assigned to that cause; and this especially when another hypothesis seems adequate to explain the phenomena in question.

ARTHUR WINSLOW.

Office State Geological Survey, Jefferson City, Mo., March 5, 1894.

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