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CERTAIN BASIN FEATURES OF THE HIGH  
PLATEAU REGION OF SOUTHWESTERN  
UNITED STATES.

BY CHARLES R. KEYES.

[ABSTRACT.]

In the Basin region of Western America there exists a remarkable type of intermontane valleys to which the Spanish name Bolson has been given. The geological sub-structure of these plains has been recently described at some length.\* In the present connection some additional features are discussed.

The bolson plains of New Mexico, for example, are found only in that part of the region which belongs to the geographic subdivision known as the basin region. This includes the southern two-thirds of New Mexico, or the portion lying south of the Rocky mountains, which abruptly terminate 100 miles south of the Colorado line. Southward, from this latitude, the bolson plains occur—long level strips of plains country, separated from one another by high but narrow mountain ranges. Far beyond the New Mexican boundaries the same type of physiography prevails, nearly as far as the city of Mexico.

The peculiar alternation of narrow mountain ranges and broad plains presents many features which are not easily understood until the country both to the eastward and to the westward is taken into account. In both directions from the central highland the "perse" character of the basin plains is soon lost.

The different plains become confluent and more continuous, and the mountain ranges more disconnected and

\* *Am. Jour. Sci.*, (4), Vol. XV, pp. 207-212, 1903.

finally isolated altogether. Still beyond, the plain alone persists without notable mountains. This condition continues on the one hand to the Gulf of California and on the other to the Gulf of Mexico.

At the beginning of Tertiary time the region between the two great gulfs north to the present Colorado line must have been a vast lowland plain, with but faint relief features. A large part of this plain was on the bevelled edges of Cretaceous and older strata as is shown now in its remnants still clearly discernible. The Las Vegas plateau, the Llano Estacado, the bolson plains of central New Mexico and some of the less broken plains of eastern Arizona seem to belong genetically together. To the east and west of the vast area thus outlined a broad submarine platform was formed from the sediments derived from the planing off of the central land area. When the general bowing up of the region took place later in Tertiary times the great plain formed was partly a peneplane of destructional land origin and partly a constructional plain of marine origin.

After the period of the main uprising, after the whole surface of the country had attained somewhat more than its present elevation above sea-level, normal faulting on a vast scale gave rise to numerous monoclinical block mountains, with a trend of north and south. There were numerous halts in general movement and the Mesozoic and youngest Paleozoic beds here are completely stripped off the mountain summits. Several times the staying process has enabled partial peneplanation to take place. But the mountain blocks have become more and more tilted.

Between Tertiary time and the present, enormous erosion has taken place. The vast plain has been deeply dissected by such old mountain-born streams as the Canadian, Pecos, Rio Grande, and Colorado. The valleys of these water courses are very wide and deep. On the east the Canadian flows 4,000 feet below the level of the old plain. The Pecos perhaps 2,500 feet. The Rio Grande about 1,500 feet. While the Colorado canyon is a mile in depth.

In the Llano Estacado the remnant of the great plain contains 50,000 square miles. The bolson plains are already beginning to give way to erosion agencies. In the valley of the Rio Grande nearly all traces of the old plain are already destroyed. The displaced intermontane basins, like the Jornada del Muerto, which adjoin the long Rio Grande valley are beginning to be deeply dissected wherever the great river touches the borders.

In its broader features the surface of New Mexico may be regarded as a ribbed tableland. Both north and south valleys alternate with long narrow more or less continuous mountain ridges. The most important of the long basin plains and valleys are the Pecos, Huerco, Estancia, Jornada, Rio Grande, San Augustine, and Mimbres.

Over such a surface from the southern end of the Rockies three great streams diverge. These are the Canadian river, the Rio Pecos, and the Rio Grande. The first of these after leaving the mountains flows eastward to the Arkansas in Indian Territory and thence its waters find their way to the Mississippi. Rio Pecos trends southeastwardly, entering Texas near the southeast corner of New Mexico. From the San Luis Valley in Colorado the Rio Grande flows slightly west of south to El Paso. Of these the last two streams mentioned flow in broad valleys between lines of block mountains.

Comparison of physiographic features of basin valleys which the great mountain-born streams traverse and of those which are not so occupied, quickly demonstrates that the bolson owes its existence merely to lack of erosion agencies. The Rio Grande no doubt at first passed through a series of bolsos identical with those at present found on either side of its present valley. It has cut down its channel often 2,000 feet below the surface of the ancient bolsos. Within the valley nearly all traces of the bolson characters are now lost. No waters are received by the great stream after it emerges from the Rockies. The work of this river has been confined to cutting its canyon. Little additional work of side streams has imposed upon it.

A still grander example of its kind is found in the Colorado River of the West. Its great valley, so far below the level of the table land, exists merely because the drainage-way has its source in a region of abundant moisture.

Between the Rio Pecos and Rio Grande valleys at the south end of the Rockies there is a small mountain stream, the Rio Galisteo, which crosses the Estancia bolson, and which soon falls into the Rio Grande. This little stream has carved out a remarkable valley. It is an illustration of how wonderfully effective is even a small, often dry, rivulet in corradng the high plains.

The bolson plains may be considered as sections of an upraised peneplaned surface in its earliest infancy, at a stage in which they are as yet untouched by stream action. They could not exist under present hyprometric conditions except in an arid region, which snow-fed perennial rivers do not traverse. The bolsons are only apparently lake-like basins. They have a marked slope in at least one direction of their major axis, as in the case of the Jornada del Muerto, where the slant is twenty feet to the mile and greater than the gradient of the parallel Rio Grande. Had the latter stream entered at Santa Fe the Estancia-Huerco, or Estancia-Jornada line of bolsons instead of the line to the westward, a vast canyon would have occupied these basins.

The bolson plains of central New Mexico hang high above the great channels of the Rio Pecos and Rio Grande on either side. Were the rainfall of the region sufficient to produce perennial streams the plains would soon be as deeply carved out as the great adjoining valleys of the rivers just mentioned.