

XXXIII PHYSIOGRAPHIC HISTORY OF THE ARBUCKLE MOUNTAINS

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The Arbuckle Mountains consist of a low dissected plateau pitching gently to the southeast, from 1300 feet in the west to 750 feet in the southeast. The plateau is somewhat triangular in shape and has an extent of some 600 to 800 square miles. Only the western section of this plateau, namely its highest part west of the Washita River, mainly in southern Murray County, is usually referred to as the Arbuckle Mountains by the residents of the region. Geologists, however, include the much larger plateau area extending some 30 miles east of the Washita River as the Arbuckle Mountains because this larger plateau area is a unit in mountain

structure; in geologic age, and in physiographic history. The rocks of the Arbuckle plateau range in age, beginning with the oldest, from pre-Cambrian granite and porphyries to the Mississippi limestone, and include some 10,000 feet of sediments of Paleozoic formations distributed among the Cambrian, Ordovician, Silurian, Devonian and Mississippian systems, the thickest of these formations being the Arbuckle limestone, of 5000 to 6000 feet.

Surrounding the older rocks of the Arbuckle plateau are younger formations of Pennsylvanian age mainly, with some Permian at the western border, which usually lie at a level of 100 to 200 feet lower than the older rocks of the plateau area immediately adjacent. The geologic history of the Arbuckle plateau region involves the processes of sedimentation which resulted in the formation of the stratified rocks of the plateau area, the uplift and folding of these formations into mountains, and the erosion of these mountains to a low plateau. There was essentially continuous deposition of sediments in the Arbuckle plateau area from the Cambrian to the close of the Mississippian as indicated by the general conformation of all the strata of these systems.

At the close of the Mississippian, however, this long period of essentially conformable deposition ceased, and the rocks of the Arbuckle plateau were uplifted and folded into mountains, and these mountains were subjected to erosion. The material eroded from the mountains was deposited in the low lands and seas surrounding the uplifted area and forms the Pennsylvanian and Permian sediments that now make up the usually lower lands that surround the plateau.

There is essential agreement among geologists who have worked in the Arbuckle region, concerning the geologic history of the area, so far as it concerns the deposition of the pre-Mississippian rocks of the plateau and their uplift into mountains in post-Mississippian time. There is, however, good reason for a difference of opinion concerning the physiographic history of the region after the mountains were formed, especially in regard to the age of the development of the Arbuckle plateau, and it is to this feature of the geology that attention is called.

Taff(1), who was the first, in 1904, to present a geologic account of the Arbuckle region, ascribed the development of the Arbuckle plateau to a Cretaceous period of degradation. He further supposed that the Cretaceous sea not only covered the entire plateau area but also extended farther to the north and that Cretaceous

(1) Prof. Paper 31, U. S. Geol. Sur.

sediments were spread over the entire region.

Subsequently, during a post-Cretaceous uplift these Cretaceous sediments were removed and the streams started in the Cretaceous beds overlaying the plateau were imposed, after erosion of the Cretaceous, upon the underlying folded plateau formations, and thus the valleys now entrenched in the plateau were described by Taff as typical superimposed valleys.

The writer's interpretation of the physiographic history of the Arbuckles differs from Taff's in ascribing a much earlier date to the degradation of the mountain area to the low relief of a plateau. It is the writer's interpretation that the Arbuckle Mountains were reduced to the low features of a plateau during the Carboniferous period of degradation which closed with the deposition of the Permian redbed sediments rather than at the much later Cretaceous period of degradation. The writer's interpretation is based upon a more extended study of the character and distribution of the Carboniferous conglomerates than Taff was able to make.

While it is difficult to understand fully the reasons for Taff's views, it seems that Taff thought that the erosion of the 10,000 feet of folded Paleozoic sediments of the Arbuckle area at the close of the Carboniferous period of degradation had reached down only to the Arbuckle limestone. This view may have been based upon his belief, as indicated by his description of the Franks Conglomerate of Carboniferous age, as containing pebbles and boulders not older than the Arbuckle limestone formation; or at least he does not mention the occurrence of pre-Cambrian pebbles and boulders in the Carboniferous conglomerates of the Arbuckle region.

With reference to the relief of the area Taff speaks of the Arbuckle Mountains as having been worn down to mountains of moderate relief at the close of the Carboniferous, and a moderate mountain relief, (say an elevation of 3000 to 4000 feet) would seem a reasonable assumption concerning the conditions of degradation when the Paleozoic covering the pre-Cambrian had been eroded only some distance into the Arbuckle limestone formation.

It has been found, however, by a more intensive study of the conglomerate that the later Permo-Carboniferous conglomerates contain abundant pre-Cambrian pebbles and boulders. Thus the constituents of the late Carboniferous sediments clearly indicate that the erosion of the rocks of the Arbuckle Mountains had not only reached entirely through the Arbuckle limestone formation but the erosion had also extended some distance down into the underlying pre-Cambrian as early as the beginning of the deposition of

the Permian redbeds series.

Furthermore, the latest of these beds of Permo-Carboniferous conglomerate containing the pre-Cambrian pebbles and boulders lie in the valleys within the plateau area and have such gentle slopes extending up to the low summit of the plateau as to indicate that degradation of the mountains to a low plateau had already been acquired when these valleys were formed.

It is the interpretation of the writer, therefore, that not only had the low plateau features of the Arbuckle Mountains been acquired, but that the plateau itself was deeply entrenched by valleys, much as it appears today, by the close of the Permo-Carboniferous period of degradation.

Although Cretaceous sediments overlie the lowest slopes of the southeastern part of the Arbuckle Mountain area there are no outlying remnants of the Cretaceous far beyond the border and it is the belief of the writer that the Cretaceous never extended more than a few miles beyond the present exposed boundary of the formation as shown on maps.

The Arbuckle area and the surrounding region, where the Permian occurs seems to have been a land of low altitude most of the time since the close of the Permian as indicated by the relatively low reliefs, of only a few hundred feet which have been sculptured out of the Permian sediments, adjacent to the Arbuckle Mountain area.

The Arbuckle uplift with other similar uplifts in the surrounding region were the source of abundant sediments that were laid down in basins surrounding the uplifted areas in Permo-Carboniferous times. Many of the uplifted areas were later buried by Permian sediments in the general degradation of the region and are now found as buried hills by the drilling of wells. It is quite probable that the large Arbuckle Mountain area and likewise the large Wichita Mountain area were never completely covered either by Permian or by Cretaceous sediments.