XII. THE BENTON CRETACEOUS IN OKLAHOMA

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The object of this paper is to present to the members of the Academy the recent discovery of the presence of a formation heretofore unknown in Oklahoma, namely, the Benton limestone. A paper discussing this and other matters connected with the geology of Cimarron County, Oklahoma, is being prepared by Frank C. Greene and Virgil O. Wood to be published by the Oklahoma Geological Survey, and for that reason only a brief mention of this subject will be presented at thistime.

In response to a letter of inquiry regarding the type locality of the Benton, Dr. T. W. Stanton, Chairman of the Committee of Geologic Names of the United States Geological Survey, wrote me as follows:

Meek and Hayden named the Fort Benton group in 1862 (Acad. Nat. Sci. Philadelphia, vol. 13, pp. 419, 421), when the term group was used in the sense in which we now use the formation. The type locality is Fort Benton, Montana, but the actual description is based chiefly on exposures in eastern Nebraska, where the shale is limited above by the Niobrara limestone and below by the Dakota sandstone, its limits being indefinite in the neighborhood of Fort Benton. The Fort part of the name was dropped as unnecessary many years ago. In a large part of the Great Plains area where the Greenhorn limestone is developed and separates an upper shale, the Carlile, from a lower one, the Graneros, Benton is no longer used, its three divisions just mentioned being recognized as distinct formations.

In typically exposures in Kansas and Nebraska, the Benton usually lies west of and above the Dakota sandstone which is usually considered as being the basal member of the upper Cretaceous of North America. The Benton, as exposed in parts of Kansas, Nebraska, the the Dakotas, and Montana, is essentially a shale formation, usually gray in color, containing one or more limestone members, and contains a characteristic pelecypod fauna, in which the genus *Inoceramus* predominates, the principal species being *I. Labiatus.*

The first published description of the geology of what is now Cimarron County, Oklahoma, was in 1906, when the present writer in Water Supply Paper No. 148 of the U. S. Geological Survey, described the various formations outcroppings in the valley of the Cimarron River.

In the northwestern part of Cimarron County, Cimarron River has cut a channel several hundred feet deep into the otherwise level or gently sloping Tertiary covered plain. The rocks encountered in this downward cutting consist of alternating ledges of heavy resistant sandstones and soft shales. The resultant topography is a series of valleys, buttes, and mesas, with many unusual and bizarre erosion forms. The stratigraphy is not complex, but, as I hope to show, as new data have accumulated from time to time, the interpretation has changed considerably.

Progress Classification of the Rocks Exposed Along the Cimarron River in Northwestern Cimarron County, Okla.

Character of Rock	Thickness In Feet	Gould 1908	Rothrock 1925	DeFord 1927
Lava	60	Lava	Lava	Lava
Tertiary Sand & Clay	45	Tertiary	Tertiary	Tertiary
Limestone	60	Not Recognized	Not Recognized	Benton
Brown Sandstone	40	DAKOTA	Dakota	Dakota
Shale	40		PURGATOIRE	Purgatoire
Sandstone	60			
Sandy Shale	100			Morrison
Sandstone	0-70			Exeter
Varigated Shales	0-50	Not Recognized	Morrison	Unnamed Shale
Red Beds	100	Red Beds	Red Beds	Red Beds

Three classifications of the rocks of this region are presented herewith. The first of these was made, 1908 by Gould, published in Water Supply Paper No. 148 just referred to. The second classification published in Bulletin 33 of the Oklahoma Geological Survey in 1925 was by Rothrock. The third classification by DeFord appeared in Bulletin American Association of Petroleum Geologists, vol. 11, No. 7, July 1927. The classification now being prepared by Greene and Wood will probably differ slightly from either of the others, but will follow DeFord in most regards.

From a glance at these classifications, it will be noted that neither the writer nor Professor Rothrock recognized the presence of the Benton in Cimarron County. I am not so sure who is entitled to the credit for first identifying these rocks. During the past few years since the hundreds of petroleum geologists have been scouring the entire country, a number of men have noted the occurence of these rocks, but Mr. DeFord was the first man, so far as I have been able to learn, who has recorded the Benton in Cimarron County.

I do not have an accurate map of the area of the outcrops of the Benton in this area. It occurs in a more or less circular structural basin, or butter bowl, about four to six miles in diameter, centering near the old post office of Mineral, in the southwest quarter of section 7, T. 4 N., R. 2 E. Cimarron Meridian. The area includes part or all of sections 5-6-7-8-17-18 and 19, T. 4 N., R. 2 E., and parts or all of sections 1-11-12-13-14 and 24, T. 4 N., R. 1 E., and perhaps other sections. The outcrop of the Benton in this butter bowl is rimmed on all sides by the Dakota sandstone which underlies it.

The thickness of the Benton at this place is known to be in excess of 60feet. The rocks consist of gray to drab limestone and shale, and the limestone containing large numbers of the characteristic Benton fossil, *Inoceramus labiatus.*

Other outcrops of Benton are reported a few miles west of the one mentioned, near the Oklahoma-New Mexico line, in Union County, New Mexcio. The formation is exposed over large areas still farther west in New Mexico, so that the Oklahoma exposure may be considered an outlier of Benton lying in a syncline east of the main exposure.