ART. XLII.—*The Carboniferous and Permian Age of the Red Beds of Eastern Oklahoma from Stratigraphic Evidence;* by GEORGE I. ADAMS.

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VARIOUS opinions have been expressed from time to time concerning the age of the Red Beds of Oklahoma. By some they have been called Triassic and by others Permian, but because of the general absence of fossils and the lack of stratigraphic work they have remained an uncertain group. Collections of fossils made by C. N. Gould at White Horse Springs, sixteen miles west of Alva, from the Red Bluff formation of Cragin, situated one hundred feet or more above the gypsum ledges, have been determined by Schuchert and Beede as Upper Permian forms.* Vertebrate remains from Orlando in Logan County and from Hardin in Kay County, although not fully studied, are considered by S. W. Williston as equivalent to Cope's Lower Permian fauna from the Wichita beds of Cummins in northern Texas.† The writer has recently done some stratigraphic work which has a direct bearing on the problem of the Red Beds, and it is believed that it supplies a correct interpretation of the beds and furnishes a basis for future detailed study of them.

In tracing the outcrops of the limestone formations of the Carboniferous of Kansas, the writer observed that in going southward there is a gradual transition in the character of the sediments to those which are more arenaceous, and that there is a thickening of the shales and sandstones and a thinning and final disappearance of some of the limestones. Moreover, in describing the shales of the higher portion of the Carboniferous and the lower portion of the Permian, the occurrence of purplish and maroon-colored shales was noted. The significance of these observations was not fully known, since the work of the Kansas survey was limited by the State line. In studying the oil and gas fields of Kansas and Indian Territory,‡ the writer traced to the southwestward the extension of the outcrop of the Fort Scott limestone from the southern border of Kansas into Indian Territory. It extends from west of Chetopa in Kansas to Chelsea, Claremore and Catoosa, and thence to the Arkansas river west of Weer, when it becomes inconspicuous. The horizon as marked by the associated sandstones was followed to a point between Holdenville and

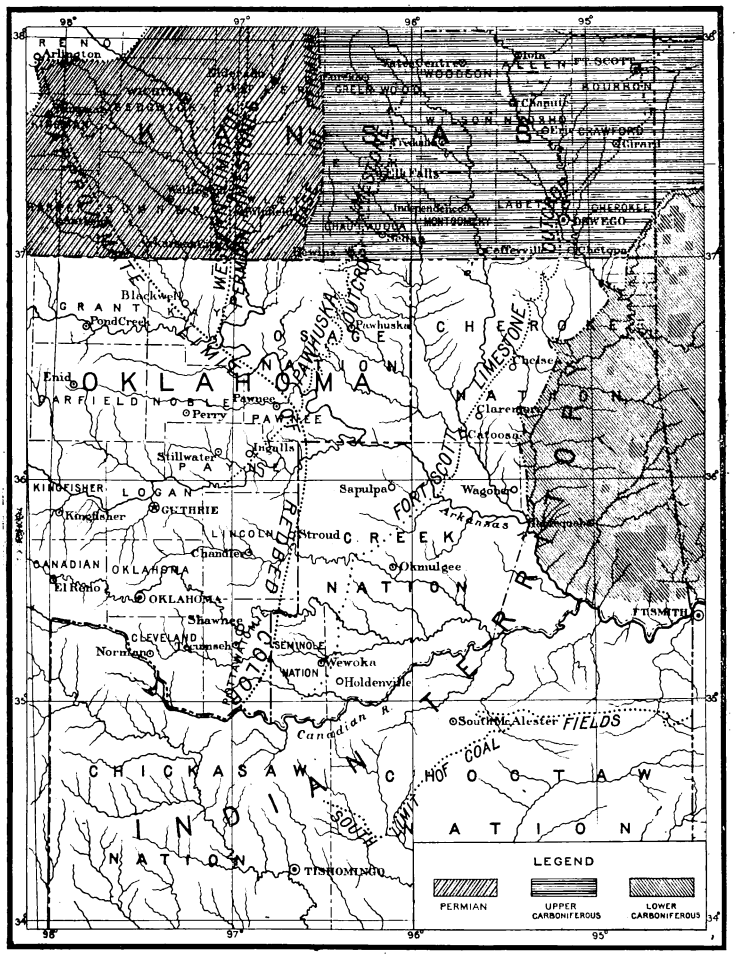
* Amer. Geologist, vol. xx. No. 1, p. 46.
† Article not yet published.
‡ Forthcoming Bulletin U. S. Geol. Survey.

Wewoka. This made possible the correlation of the Kansas section of the Carboniferous with the Indian Territory section thus far worked out by Mr. Joseph A. Taff and the writer.* It appears that there are in the Choctaw Nation 9,000 feet of shales and sandstones above the lowest productive coal, which are lower than the Fort Scott limestone and its equivalent, while in southeastern Kansas there are but 450 feet of shales and sandstones between the Fort Scott limestone and the Mississippian or Lower Carboniferous. It will be observed that the line of outcrop of the limestone as above traced diagonals the divisions of the Coal Measures as drawn by N. F. Drake† and the horizon extends into the area which he erroneously called Permian.

The results of tracing this horizon strengthened the writer's conviction that similar work in the higher portion of the section would determine the relation of the Red Beds to known formations in Kansas, and in June a trip was made through the Osage Nation into Oklahoma. The previous geological work which had been done in this locality by Drake and by Gould consisted of sections across the rocks and did not permit of accurate correlations.‡ The formation which was selected to be traced is the limestone described in the writer's field notes as the Elk Falls.§ It occurs about 700 feet below the base of the Permian as determined by Prosser. It was chosen because, from its thickness and its relation to the adjacent formations, it was believed that it would be found persistent for a considerable distance southwestward. The line of its outcrop was followed from near Hewins, Kansas, and it was found to pass just west of Pawhuska, where it is the equivalent of the Pawhuska limestone, named by J. P. Smith,‖ and mentioned in the sections by Drake and Gould. In southern Kansas, there are two heavy ledges of limestone separated by shales. In the Osage Nation, although it has not been previously so noted, there are three, all of which are persistent as far as the Arkansas river, although considerably thinner southward. The line of outcrop crosses the Arkansas river at Blackburn and continues to Ingalls, where it is the same as the limestones mentioned by Gould in his section made east of that place. Southwest of Ingalls the limestone becomes thinner. Its strike will carry it across the Cimarron river near Perkins. From Ingalls the route followed by the writer was to Ripley and thence to Chandler. In traveling southward, the shales and

* Coalgate Folio, U. S. Geol. Survey.
† Proc. Amer. Philos. Soc., vol. xxxvi, p. 326.
‡ This Journal, March, 1901, p. 185.
§ Vide vol. iii, Kans. Univ. Geol. Surv.
‖ Jour. Geol., vol. ii, p. 199.

sandstones associated with the limestones were seen to become gradually redder in color. South of the Arkansas river they are typical Red Beds, In going from Ingalls to Chandler and



Stroud, one passes over formations which are much lower geologically, and they are likewise red in color.

It appears, therefore, that rocks in Eastern Oklahoma which have been referred to the Red Beds on lithologic grounds, are in part of Upper Carboniferous or Coal Measure age. The sedimentation from the Carboniferous into the Permian is an

unbroken sequence. From what is known of the Permian limestones of Kansas, they will be found, when followed southward, to diminish in thickness, and this change will be accompanied by a transition to more sandy beds. This is in accordance with the observations made by Mr. Gould. The age of that portion of the Red Beds which is in strike with the Permian of Kansas may confidently be expected to be found to be of Permian age. This is in accordance with the evidence already furnished by the vertebrate fossils. Above the Permian limestones in Kansas occur the Wellington shales, which are bluish and greenish gray in color. They are probably represented southwestward by formations which are red. The succeeding formations are typical Red Beds, and have thus far yielded only Permian fossils. Upon the accompanying map (p. 385) the approximate line of transition in color has been drawn with the purpose of showing that it is diagonal to the strike of the Carboniferous and Permian formations.