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UPPER CARBONIFEROUS OF SOUTHWESTERN IOWA.

BY E. H. LONSDALE.

The district at hand is one somewhat remote from any known field of productive Coal Measures, but being Upper Carboniferous in age is a region to which considerable geological and economical interest has been attached. There has always been an anticipation of finding heavy fuel veins, but as yet these looked-for strata have not been positively located. Reports, often manufactured, and the meeting of thinner veins of coal, have led to the increased expectations now prevalent in the district.

Since the publication of the results of the reconnoissance by Meek and White in 1867 and the more extended report by the latter a few years afterwards all prospecting and hopes have been based upon the conclusions of these authors. Certain of these estimates have proven to be misleading. In the preliminary reports* it was predicted that the Upper and the then-called Middle Coal Measures would be passed through at a level not exceeding 500 feet lower than the water of the Missouri river at Nebraska City, almost the extreme southwestern point in Iowa. Here the elevation above sea level is 907 feet and the drainage level of the greater portion of the southwestern district is from 50 to 200 feet lower. Consequently the depth in the valley to the Lower Coal Measures would in no case be more than 700 feet. This is upon the supposition that the Carboniferous strata in this region lie approximately level. But, considering the dip as southwestward and at the rate of ten feet per mile, as is usually accepted, then at the southwest corner of Adams county, about fifty miles from Nebraska City, the base of the "Middle" Coal Measures would rise to within about 200 feet of the surface.

* U. S. Geol. Surv. of Ter., First Ann. Rep., p. 7. 1878.

There are many other facts which point to the inaccuracy of these early conclusions. Within the last fifteen years especially, deep boring has been prosecuted at various points in the field at hand. Other holes have been drilled and, although there are not many carefully kept records of any of these, each served to indicate the existence of very different conditions from those which had hitherto been believed to prevail. At Council Bluffs, Glenwood, Red Oak, Villisca, Riverton, Shenandoah, Clarinda, Atlantic, and other cities east of the river and at Plattsmouth and Omaha, across the Missouri, holes from 300 to 2,000 feet deep have been bored, in the attempt to find workable coal veins or artesian water. At the first named point on the grounds of the School for the Deaf, a well was put down 1,080 feet, and an examination of the drillings shows that strong clay shales, doubtless Coal Measure, prevailed to the bottom, and no bituminous vein whatever was penetrated.

Call* has reviewed the sequence at the Glenwood deep well and put the base of the Upper Coal Measures at 517 feet from the surface, thus allowing a thickness of only 154 feet to this geological division. A recent careful examination of the drillings reveals the fact that the measures for a great distance below this level are evidently in no manner different from those above, and such beds, mainly argillaceous shales, extend to more than 1,400 feet below the surface. It would certainly be more consistent to consider as belonging to the Upper division all above that point and to concede the remainder of the section to be "Middle" and Lower, or Des Moines series. The last 500 feet, as shown by the samples, is made up of very fine sands, white to yellow in color, with an occasional layer of clay shale.

The Des Moines terrane or Lower Coal Measures has been assigned a thickness of about 400 feet by Keyes†, hence if the division maintains its thickness throughout the southwest, as declared by White‡, and its thickness be added to that of the Upper Coal Measures at Glenwood, then the evidence would tend to show that the Lower Carboniferous beds were nearly reached in the 2,001-foot well. Yet at the same time it would seem more natural for the fine-grained shales to be prevalent in this southwestern area and not the fine sandstones, since the field lies within the central portion of the great Carboniferous

*Proc. Iowa Acad. Sci., vol. I, pt. ii, pp. 60-63. 1892.

†Iowa Geol. Surv., vol. II, pt. iii, p. 118. 1894.

‡Geol. Iowa, vol. 1, p. 243. 1870.

basin. For this reason there is considerable difficulty in explaining this unusual occurrence, unless it can be accounted for by replacements or by conceding the portion just above the sandstones to be barren Lower Coal Measures.

At Red Oak only shales and limestones are recorded in a 650 foot well section—all certainly Upper Coal Measures; while thirty miles northeast, at Atlantic, a well was bored 1,300 feet deep and down to the last 250 feet the strata passed through consisted for the greater part of similar materials, and from 1,100 to the bottom the same sandstones which were met at Glenwood were discovered. Allowing for the dip and respective elevations of the two points the discrepancy in the depths to sandstone would just about be explained, the total dip being from about 300 feet between the two points.

At Clarinda, about fifty miles south of Atlantic, a prospect hole 1,020 feet deep was put down, and from the record it would seem conclusive that the Upper Coal Measures were not fully penetrated. The same may be said of the holes at Shenandoah and Riverton to the westward. The records of shallower borings in southwestern Iowa might be gone over, and likewise the drillings at Plattsmouth, Omaha and Council Bluffs, but these data simply corroborate the statements already made and nothing at variance is found.

Considering, therefore, the data at hand as at least in a manner reliable, the following conclusions pertaining to the Upper Paleozoic rocks of southwestern Iowa might be given: 1. The combined thickness of the divisions of the Upper Carboniferous approximates 2,000 feet. 2. The Upper Coal Measures, or Missouri series of Keyes, has a thickness of from 1,400 to 1,500 feet.

In support of this it may be stated that Broadhead* found the Upper Coal Measures in Atchison, the most northwestern county in Missouri, to be more than 1,100 feet thick, and the Upper Carboniferous as 1,900 feet. Later information has led this author to place the thickness of the latter in Missouri as 1,979, and the old Middle and Lower as 664 feet. These figures relating to the superior division have been more recently vouched for by Winslow†.

After a brief reconnoissance of the Iowa-Missouri coal field, and a review of the work of Meek, White and Broadhead,

* Iron Ores and Coal Fields, Geol. Surv. Mo., pt. ii, pp. 6 and 98. 1873.

† Mo. Geol. Surv., Prelim. Rep. on Coal. p. 23. 1891.

Aughey* argues that the Lower Coal Measure beds might be reached at any locality between Omaha and Plattsmouth at from 800 to 900 feet from the surface. This is exceeded somewhat by the figures here given; and is at the same time considerably more than the theoretical estimates of the earlier writers.

As to the general lithological character of the Upper Carboniferous beds in the area under discussion it may be said that there is a difference in the several sections so far as the association is concerned, but similar beds may be traced over the entire region.

It is a noticeable feature that while the upper or exposed strata are prevailinglly limestones, in the case of under layers as shown by borings, the reverse is true, they being made up of argillaceous shales interlaid sparingly with ledges of limestone, bituminous shales, coals and sandstones. The total depth, however, of the exposed strata is by no means comparable with that of the concealed beds. These upper limestones may have occupied at the close of the Carboniferous epoch the highest position of that formation, or may have been overlain by softer strata such as clay shales or even arenaceous deposits, which being comparatively friable easily gave way to the later erosive agencies. The limestones as well as many of the shales are highly fossiliferous. The bituminous veins, whether coal or shale, are rather uncommon in occurrence and the individual layers rarely exceed two feet. The coal seam mined in Adams, Taylor, Page, Montgomery and Adair has an average thickness of perhaps twenty-one inches with an extreme of thirty inches. As yet the existence of heavier veins has not been definitely proven; the certain detection of coal beds of the Lower Coal Measures has not been possible and no satisfactory evidence indicating the presence of such seams as are mined in central and southeastern Iowa and in Missouri has been produced.

The Nodaway coal underlies a large territory, perhaps a greater one than that of any other vein in the state; it has been safely traced from the southern edge of Cass county as far south as the state boundary and northward from this line for some miles. It is even possible that the Adair county coal as well as the vein found in western Mills county and running across into Missouri may be connected with the Nodaway seam.

* Phys. Geog. and Geol. of Neb., p. 66. 1880.