ART. XXXV.—*Remarks on the possibility of a workable bed of Coal in Nebraska*;† by F. V. HAYDEN.

SUPPLEMENTARY to my article on the lignites of the West, in the March No. of this Journal, I wish to make a few remarks in regard to the existence of workable beds of coal in Nebraska. During the geological survey last season, the greatest interest was felt in this question, by the people, from the fact that nearly all the State is a treeless prairie. Even a bed of coal, of moderate thickness, at a reasonable depth, would be of inestimable value, and the solution of this

* I do not wish to be understood as saying that the Jurassic rocks do not occur, south of the Arkansas, as well as the Permian and Triassic, for there is ample room for their fullest development, but no evidence has ever yet been obtained of its (Jurassic) existence, although the country has been so long traversed by explorers. The evidence, so far as it goes, would seem to be against its occurrence at all.

† In the final report of the U. S. Geological Survey of Nebraska, Mr. Meek has discussed the relations of the Carboniferous rocks of Nebraska, with those of the neighboring States, with great minuteness and care. He has, also, made a most extensive comparison of the fossils, from the large amount of material in his possession. He gives in his report numerous tables of fossils, in which he shows clearly what rocks may be regarded as upper Coal-measures, Permo-carboniferous and Permian, with the vertical as well as geographical range of the fossils. He finds no traces of the Dyas or Mountain limestone.

problem seemed to be the most important one of the survey. It is now known that all the Carboniferous rocks of Nebraska belong to the upper Coal-measures, and that these rocks occupy but a small area in the southeastern portion.

In ascending the Missouri, they pass beneath the water level of the river near DeSoto, about 30 miles above Omaha. The area occupied by them widens southward; but it forms only a narrow strip, hardly two counties wide, even at the south boundary of the State. Overlying the upper Coal-measure rocks, are a series of beds which were called, by Mr. Meek and the writer, Permo-carboniferous, as they occurred in Kansas, a portion of the coal-measure fossils passing up through them, and Permian types passing down. Still holding a higher position, especially in valleys of the Big and Little Blue rivers, are some beds of yellow, soft magnesian limestone which seem to be only a northern extension of what we have regarded as Permian in Kansas. Overlying these are the Cretaceous rocks—especially No. 1 or the Dakota group. There, is, however, no break in the order of sequence of the beds from the Coal-measures to the summit of the Permian.

It is now pretty well proven that in the upper Coal-measures of the West, there are no workable beds of coal, and that, while thin seams occur in many places, they never attain a thickness of more than 2 or 2½ feet. Near Nebraska City, on the Missouri, an outcropping, about 8 inches thick, has attracted some attention. This seam has been wrought by drifting in a distance of 300 yards or more, and several thousand bushels of pretty good coal have been taken from it. At Brownsville, there is a seam of coal probably holding a lower position than the one at Nebraska City, which is accompanied by several species of coal-plants peculiar to the upper Coal-measures, among which Prof. Lesquereux has detected *Neuropteris Loschi*, *N. hirsuta* and *Calamites*.

The seam of coal is from 4 to 6 inches in thickness; but the whole bed of black shale and coal is about 12 inches thick. At Aspinwall, in Nemaha county, two seams of coal were met with. One of them high up in the hills, is probably the same as that just mentioned as occurring at Brownsville, while near the water's edge another seam is disclosed about 22 inches in thickness. Coal commands a ready sale here at 40 to 80 cents per bushel. Some English miners have commenced sinking a shaft, and already cut through the 6 inch seam, expecting in due time to strike the more profitable 22 inch seam.

At Rulo, some 15 or 20 miles below Aspinwall, near the south line of the State, a seam of coal has been wrought for some years. It was about 5 inches thick at the outcrop, but

after a drift had been carried into the bank 100 feet or more, it increased to 11 inches, and then nearly disappeared again. About 200 bushels of rather inferior coal have been taken out of this mine; but it does not promise well. On the Iowa Indian reservation, this same bed has been worked, and several hundred bushels of coal taken out, but the mine was soon abandoned.

The seam on the reservation and the one at Rulo is probably identical with the 22 inch seam, revealed 16 feet above the water level of the Missouri river, at Aspinwall. Underneath the coal seam, at Rulo and on the Iowa reserve, is a bed of light gray fire clay, filled with fragments of plants as fern leaves, stems of rushes, *Calamites*; and among the ferns are *Neuropteris Loschi* Brongt. and *N. hirsuta* Lesq., both common in the upper Coal-measures of Ohio and Kentucky, and the former occurring in the Permian of Europe. Again in Pawnee Co., about 35 miles west of the Missouri, on some of the small branches of the Nemaha river a coal seam crops out which has created some excitement among the settlers.

Again at Tecumseh the county seat of Johnson Co., a thin seam of coal has been opened by a drift and worked with some success. The coal is mostly used by blacksmiths in the vicinity, for there is not sufficient to supply the country with fuel. It is probably the same bed observed south in Pawnee Co., though here the coal seems to be more impure, being made up largely of masses of sulphuret of iron.

I will here quote a paragraph from my preliminary field report of the progress of the Geological Survey of Nebraska, addressed to the Hon. J. S. Wilson, Commissioner General Land Office and printed in his annual report for 1867-8.*

“At Tecumseh a thin seam of coal has been opened, and is now worked with some success by Mr. Beaty. The drift is very similar to that before described in my report of Pawnee Co., and extends into the bank about 100 yards. Mr. Beaty has taken out about 1,000 bushels of coal, which he sells readily at the mine for 25 cents per bushel. It is undoubtedly the same bed that is opened on Turner’s branch and at Friez’s Mill, in Pawnee county; but is not quite as thick or as good; it contains large masses of the sulphuret of iron and other impurities. The coal seam here varies in thickness from ten to fifteen inches. The cap rock is a bed of limestone not more than two or three feet in thickness. A well was sunk in the village of Tecumseh, sixty feet. A drill was driven down through rock and hard clay a few feet further, and passed

* See report of Hon. J. S. Wilson, Commissioner of the General Land Office, 1867, pages 124-177.

through what the workmen thought to be three feet of good coal. This discovery created much excitement at the time and increased the demand for the public lands in Johnson county. It afterward turned out to be the same seam of coal worked by Mr. Beaty on the Nemaha and was only 11 inches in thickness. The prospects, therefore, for workable beds of coal in Johnson county are no better than in the neighboring counties, already examined. The evidence against any important bed of coal being found within the *limits* of Nebraska diminishes in force continually. I have already presented a portion of the evidence in former reports. The fact that all efforts in searching for coal in neighboring districts have resulted in failures, renders the prospect very doubtful."

All the rocks at St. Joseph, Missouri, Leavenworth and Atchison, Kansas, hold a lower position geologically, yet borings have been made about 300 to 500 feet at Atchison and St. Joseph, and a shaft has been sunk about the same depth at Leavenworth, resulting in the discovery of a bed of very impure coal three feet thick, quite unfit for use. The evidence is quite strong that, as I have before suggested, Nebraska is unfortunately located on the western rim of the western coal basin, and that no workable bed will ever be found in the state at a reasonable depth.

I have thus mentioned the different outcroppings of coal in various portions of the state, because their existence seemed to the people to promise better things. The consequence has been that much more money has been spent in the useless search for coal in Nebraska, than the cost of a geological survey for years.

Many excavations and numerous borings have been undertaken without success.

In aid of the solution of the problem whether there are within the limits of the state of Nebraska any workable beds of coal within accessible distance of the surface, the following conclusions are the result of the examination of these rocks during the past season. It has been accurately determined that rocks of the Carboniferous period occupy only a small portion of South Eastern Nebraska, and that these rocks are of the age of the upper Coal-measures, Permo-Carboniferous and Permian.* At Omaha, a boring of nearly 400 feet in depth was made by the U. P. R. R. without passing any important seam of coal. At Nebraska City a boring was made nearly the same distance with the same result.

*The true Permian may not occur in Nebraska. If it does, it is found only in isolated areas.

At Atchison and Leavenworth, Kansas, and at St. Joseph, Mo., where the upper Coal-measures are several hundred feet lower than at Nebraska City or Omaha, borings were made about 400 feet with no better success.

Mr. Brodhead, a geologist attached to the Missouri State Geological Survey, studied with a great deal of care a series of beds of the upper Coal-measures in northern Missouri which he regarded as 2000 feet in thickness without finding a seam of coal more than 2 or 2½ feet in thickness.

In the valley of the Des Moines river, Iowa, 75 to 100 miles east of the Missouri river, coal beds have been found by Dr. White, State Geologist, varying from 1 to 7 feet in thickness ; but the rocks including these beds are regarded by him as the age of the lower Coal-measures. Indeed the upper Coal-measures of the west are regarded as the barren coal-measures, while all the workable beds of coal are confined to the lower Coal-measures. It is plain that all the Carboniferous rocks of Nebraska pass beneath the more recent formations westward to be disclosed again by the uplifting of the Rocky Mountain ranges. We find the Carboniferous limestone all along the margins of the Rocky mountains on either side the axis of elevation. On studying these fossils we find that so many of them are identical with species found in what we know to be the upper Coal-measures along the Missouri, that we do not hesitate to pronounce them as of the same age. Indeed they are simply the western extension of them, thinning out and gradually losing all the thin seams of coal and shale and nearly all the beds of clay and loose sands, leaving for the most part massive beds of limestone.

It is impossible in an article of this kind to present all the details upon which our conclusions are based ; but it seems more than probable that coal in paying quantities will never be found within the limits of the state of Nebraska. If this statement is true, it is a very important negative truth not only to Nebraska, but also to very large portions of Iowa, Missouri and Kansas. We already know that the Carboniferous rocks do not exist in Dakota territory at all, so that along the Missouri river there is a very large district of wonderful fertility, almost treeless and destitute of mineral fuel. This fact at once directs our attention to the lignite formations in the region of the Rocky mountains. It is to be hoped that the general government will see the importance of making appropriations for their careful examination at an early day.