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The Natural Fuels of Nebraska

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40

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ERWIN HINCKLEY BARBOUR, State Geologist

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THE NATURAL FUELS OF NEBRASKA

BY

ERWIN H. BARBOUR



209 B

THE NATURAL FUELS OF NEBRASKA.

BY ERWIN H. BARBOUR.

Inquiries concerning the natural fuels of Nebraska, more especially oil and gas, have greatly increased during the past three or four years, and it is imperative that a circular letter, in the form of this leaflet, be prepared for correspondents.

Any one of the natural fuels, coal, oil, or gas, would be a commercial boon to this commonwealth. Hence it is not surprising that citizens have spent large sums in prospecting. This is not squandering money, nor is the undertaking useless though without results. Even negative results, and negative information, are valuable. Drilling is to be commended and encouraged, for it is from the logs of deep wells that the geologists gather data of value. When divided among many subscribers, the cost of drilling is small, and it is the only means of getting an exact knowledge of the underlying strata. It is a matter of regret that bills brought before our legislature, carrying appropriations for sinking test wells in various parts of the State, could not have passed.

From Territorial days, geologists have feared that the natural fuels were wanting in Nebraska, but there is still hope of reversing this opinion, despite the fact that records from many deep wells confirm early views. Since 1891 the Nebraska Geological Survey has been collecting and filing well records. Without entering into detail, suffice it to say, that many wells, widely distributed over the State, have been drilled to depths varying from several hundred to 2800 feet. None show oil or gas, but those in the eastern corner of the State pierce a few inches of coal.

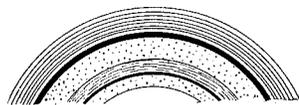


Fig. 1.—Diagram of an anticline. Strata curved upward in this way form a dome which catches and holds oil and gas. The crown or axis of an anticline is the likeliest place on which to drill.

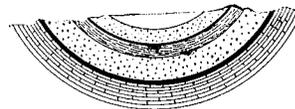


Fig. 2.—Diagram of a syncline. Strata curved downward into a trough allow gas and oil to escape. Synclines are notoriously barren.

TABLE OF NEBRASKA DEEP WELLS.

COUNTY	TOWN	DEPTH	REMARKS
Adams	Hastings	1350	
Banner	Harrisburg	800	
Boone	Albion	1700	Test well for coal. Unsuccessful.
Boyd	Alford	760	Artesian.
	Butte	760	Artesian.
	Lynch	682	Artesian.
	Lynch	680	Artesian.
	Ft. Randall	700	Artesian.
Buffalo	Shelton	1100	Test well for oil and gas.
Cass	Union	500	
	Union		Now approaching 1,000 feet.
Cedar			Many wells in this county ranging from 200 to 600. All artesian.
Chase	Champion	500	
Dawes	Chadron	1800	No flow.
Douglas	Omaha		Many wells from 840 to 1880 feet. A little coal.
Furnas	Arapahoe	700	
Gage	Beatrice	1260	Artesian, salt, few inches coal.
	Beatrice	1260	Abandoned.
	Beatrice	1240	
Grant			Many wells from 300 to 625 feet. Artesian.
			Unsuccessful.
Howard	Howard	1011	
	Dannebrog	1000	
Knox			Several from 500 to 770 feet. All artesian.
	Santee	740	
Lancaster	Lincoln	2463	Test well. Few inches coal.
	Public Square	1050	
	Burnham	1700	
Merrick	Silver Creek	1700	
Nemaha	Brownville	1001	
Otoe	Palmyra	1000	
	Nebraska City	2800	
Richardson	Falls City	1300	Several layers of coal 2 to 11 inches in thickness.
	Rulo	1354	Artesian.
Sarpy	Dearfield	1450	Abandoned.
Seward	Seward	610	Unsuccessful.
Sheridan	Gordon	582	
Thayer	Hubbell	725	
Wheeler	Ericson	905	
York	York	600	

From the center of the State to the Wyoming line deep wells naturally diminish in number. Regardless of location, all wells testify to the absence of natural fuels. This may be reversed by drilling operations now in progress in southeastern Nebraska on anticlines determined by Prof. Schramm for the Nebraska Geological Survey. In our Carboniferous formation "structure" though obscured by deep soil and vegetation is more evident than elsewhere in the State. Anticlines, which are up-folds or crests, are not necessarily oil-bearing, although the chance of striking oil is greatly increased by drilling on them. Synclines, which are down folds or troughs, are notoriously barren. The structure of southeastern Nebraska seems to be in continuity with that of the oil fields of Oklahoma and Kansas. Accordingly many prominent oil companies have been in correspondence with this Survey, have visited the State, and are now mapping its structure in the hope that we are not too far north to be productive. Already considerable land has been leased around Union, Nehawka, and Table Rock. It is not wholly unreasonable to still hope for oil in southeastern Nebraska and possibly along the Wyoming line. Cook has reported structure in Sioux County.¹ Low anticlines extend from Harlan County northwestward across the State.

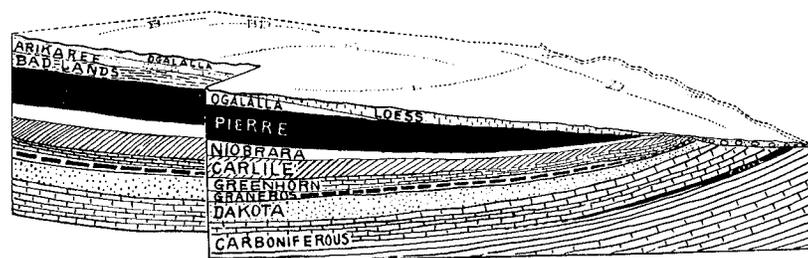


Fig. 3.—Sketch map showing the main physiographic divisions and underground geology of Nebraska. D, general position of the Glacial drift; L, Loess; S, Sandhills; B D, Bad Lands; B, Butte region.

The Carboniferous beds are about 1,200 feet; Dakota, mostly sand, 300 to 400 feet; Graneros, shale, 0 to 300 or 400 feet; Greenhorn, limestone, 20 to 50 feet; Carlile, shale, 400 to 600 feet, or more; Niobrara, chalk, 0 to 100 feet, or more; Pierre, shale, 0 to 2,000 or 3,000 feet, eroded away on the dome of the Harlan County anticline; Bad Land, clays, 200 to 600 feet; Arikaree, sand, 300 to 500 feet; Ogalalla, 50 to 150 feet; Pliocene beds, 50 to 150 feet; Pleistocene 0 to 50 feet.

It should be noted that most of the strata thicken to the westward.

¹Notes on the Geology of Sioux County, Nebraska, and Vicinity by Harold J. Cook, Neb. Geol. Survey, Vol. 7, Part 11, Bull. 55.

Even though certain favorable structures are known, it does not necessarily follow that oil and gas will be found, for the thick, oil-bearing sands of Oklahoma and Kansas thin out rapidly towards Nebraska and are mostly replaced by impermeable shales.

The difficulties of drilling in eastern Nebraska are not great, but in western Nebraska where Cretaceous shales thicken enormously, they seem insurmountable. Briefly stated, the geology of Nebraska comprises Carboniferous beds in the southeastern corner of the State, and west of this, Cretaceous overlaid more or less by Tertiary beds of varying thicknesses. The aggregate thickness of the Cretaceous shales and limes reaches several thousand feet. A single member, the Pierre, must be 2000 to 3000 feet thick and increases to 7000 in the Denver Basin. This member has never been pierced in western Nebraska, but wherever entered is barren. The Pierre formation "shells in" badly, according to drillers, and as an expedient thin cement is poured into the hole and when set is pierced and another block cast, and so on. At the best, this is a slow and costly operation. The overlying Tertiaries aggregate several hundred to a thousand feet in thickness.

A well, now 1140 ft. deep, at Ardmore, S. D., one mile north of the Sioux County line, is destined on completion to furnish an important well-log for northwestern Nebraska.

COAL¹

There are about twenty acres of coal, nearly 3 feet in thickness, at Peru, in the Honey Creek Mine on the Missouri River bluffs, in Otoe County. This is negligible in amount and does not materially affect the view of geologists that workable coal is not to be expected in Nebraska.

At several other points Carboniferous coal seams, varying from 10 to 15 inches, are known, and have been worked, but these rapidly thin out to the westward and are but 5 or 6 inches thick on the meridian of Lincoln. In northeastern Nebraska, lignitic coal of Cretaceous age, varying from a few inches to 15 or 20, occurs in a number of exposures. This lignite runs high in ash and water, but low in fixed carbon. Attempts to mine it profitably seem to have failed and the mines are abandoned.

¹Report on the Honey Creek Coal Mine by Erwin H. Barbour, Neb. Geol. Survey, Vol. 2, Part 7, Bull. 8.

Coal in Nebraska by Roy V. Pepperberg, Neb. Geol. Survey, Vol. 3, Part 10, Bull. 19.

Correspondents repeatedly raise the question, "If thick beds of coal are found to the north in South Dakota, to the east in Iowa, to the south in Kansas, and to the west in Colorado and Wyoming, why doesn't it of necessity extend across the whole State of Nebraska, and why may not workable coal be found everywhere by drilling?" The logic of this is plausible at first, though unsound in fact. The coals of Iowa and Kansas belong to the Carboniferous or coal age, while those of Colorado, Wyoming, and South Dakota belong to a much later age, the Cretaceous. So there is no relation between them. It so happens that all coal seams thin out toward Nebraska, hence our beds are practically worthless. It is probable, as claimed, that the Iowa coal beds extend westward well across the State. But a seam of coal 3 or 4 inches thick is merely of interest, not of economic importance. There is another factor in the problem—the Carboniferous beds dip or sag to the westward, and are deeply covered by Cretaceous shales whose thickness aggregates many hundred feet in central and western Nebraska, accordingly, if workable coal did occur it would be too deeply buried to be available. Nebraska lies between, rather than upon, productive coal areas. Indiscriminate drilling for coal in Nebraska is futile.

PEAT.

Peat is incipient coal. It is the first stage in the coal series. It is vegetable matter which has collected in ponds and swamps, and because submerged, has undergone but partial decomposition. Good peat is an excellent fuel, and in some states important beds are known and worked with profit. It is cut in chunks of convenient size, is ricked up like wood, and when dry is ready for the stove. In certain states considerable amounts are compressed into bricks or cakes which are hard and resemble coal. It burns with a clean flame and is altogether a very satisfactory fuel. The color of peat in the bog varies from brown to black. The fact that fire reduces it to ash may aid in distinguishing it from other dark substances. Ordinarily peat occurs in cool, humid countries. Still, many good peat beds have been reported in Nebraska, and excellent samples have been brought to the State Museum, but in no instance has the locality been divulged. As yet not a peat field of commercial interest is recorded by the Nebraska Geological Survey. It is feared that our peat samples, though good, are from beds too local to be of consequence.

NATURAL GAS.

Natural gas, that important illuminant and fuel, has not been found in the State. There are several authentic reports of wells in which gas could be ignited and burned continuously for two or three days, but they were shallow wells. The occurrence of this gas is interesting but not of the slightest commercial or industrial significance.

In fact, natural gas is quite universal and therefore to be expected in soils and ponds containing much organic matter. Inflammable gas has been collected from many of our ponds, thus inducing many speculations. These ponds, when frozen over, catch the marsh gas which may be ignited along cracks or artificial holes in the ice. Marsh gas is often mistaken for the escape of natural gas from deep-seated beds.

There is not an authentic record of natural gas in any of our deep wells. Naturally, then, geologists fear it may never be found. Still it seems wiser to hold judgment in abeyance, awaiting the results of work now progressing at Union, Stromsburg, and Cambridge.

OIL.

It is safe to say that there has been greater disquietude respecting oil than any other natural resource. Judging from inquiries, there is an "oil show" on every pool. In a certain sense this is true, for iron rust imparts an iridescent film precisely like oil. Out of all the samples examined and all the places visited, no trace of oil has been found. In almost every case the "oil show" proves to be iron rust floating on the surface like a film of oil. Occasionally samples prove to be diatomaceous; that is, the microscopic plant called the Diatom often gives stagnant water an oily appearance.

Carbonic acid gas is universal, and the water carrying it in solution is sure to leach out a little iron from soils and rocks through which it percolates. In this form it is colorless and invisible to the eye, and insensible to the taste. But when such water comes to the surface in seeps, pools, springs, etc., the oxygen of the air acting upon it develops iron rust, which is visible to the eye as the beautiful iridescent film so imitative of oil.

If the "oil show" is copious it should be possible to get a grease spot on white paper. Another test is to make a zig-zag line with a stick through the "oil show" where it seems most distinct and note the effect. If the path traced by the stick is discernible, the film is not oil but iron rust. Another very simple test is to skim off some of the

supposed oil film, pour into a bottle, and shake vigorously. A brown flocculation should appear and settle to the bottom. This precipitate is iron, and the experiment proves that the "oil show" was illusory. Drop a bit of gum camphor, the size of a pinhead, on the water to be tested. If it contains oil the camphor will remain inactive. If the water is free from oil it will be active. The test is a delicate one inasmuch as the merest trace of oil, that from the hands, for instance, is sufficient to spoil the experiment. Therefore the camphor should be handled with a needle point or clean knife blade.

As each well is drilled the hope is entertained that it may prove to be successful. But all things considered, the outlook for natural fuels in Nebraska is not the brightest, and indiscriminate drilling can not be encouraged. Though reluctant to offer adverse reports, it is the assumption that in asking sincere questions, direct and sincere answers will not be unacceptable to correspondents.

Those bent on drilling, for oil or gas, are advised to consult impartial engineers and geologists to learn whether the rock structure is favorable or unfavorable, and how deep they must drill. A company should then be formally organized and a responsible well-driller engaged. It is common practice to secure oil leases on considerable adjoining property before drilling, the ordinary royalty being one-eighth of the crude oil. Those wishing to do so are always at liberty to consult the office of the Nebraska Geological Survey.

The University of Nebraska,
Lincoln, November, 1914.

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