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THE BEDFORD CANNEL COAL.

BY EDWARD ORTON, JR.

In the hills of southern Jefferson and northern Bedford townships, Coshocton County, Ohio, is found a coal vein, to the structure and possible economic importance of which I wish to call attention. It is most widely known as the Bedford Cannel, the largest tracts of it being found in Bedford Township.

Though there are, in nearly all the coal-bearing counties of the State, small local deposits of cannel coal, yet only six places assume sufficient importance to be called cannel producing districts. Five of these are located respectively at Flint Ridge, Licking County; Millersburg, Holmes County; Sand Run, Hocking County, Milton Township, Jackson County, and in Eastern Columbiana County. The first two deposits are of very small importance; the Darlington Cannel, of Columbiana County, is so inferior to that just over the Pennsylvania line that it assumes no importance as yet, and the developments at Sand Run and Jackson County are of about equal and growing importance. The sixth and last deposit, the Bedford Cannel is the largest, and, probably, the best body of cannel in Ohio; but its remoteness from railroad travel has prevented its reputation or use from extending far. The field was carefully worked over during the summer of 1882 for the Geological Survey now in progress; a sketch map was constructed upon which many valuable details were placed, and which is to appear in Volume V of the Survey, when published.

The area of ground covered by the coal is not large; its outlines fall between Jackson township on the east, Newcastle on the west, the Walhonding River on the north and Tunnel Hill on the south. Not all the square area falling inside these points, and which is just about 16,000 acres in extent, is covered by the formation; aside from that which the drainage of the territory has cut out, the curved line which marks the boundary does not include more than 12,500 or 13,000 acres. Inside this rough and approximate line, which indicates the feather-edges of the formation itself, are other lines which mark the spaces covered by the valuable cannel, or that of minable thickness. The latter

boundary has been laid down with much greater care than the first, and probably includes not more than 3,000 acres. This area has still to be diminished by what has been cut out by drainage which leaves, as nearly as can be estimated, between 1,400 and 1,500 acres of valuable ground. Besides, what falls inside the limits assigned, outliers of this coal are found in one or two localities near by, but of such inferior quality as to scarce need mention; one in Newcastle Township showed three and a half feet of a rich black shale, while nearly seven feet of bone coal was found about two miles north of the Wallhonding River on this level. To the eastward, at Roscoe, the cannel reappears, and, according to some reports, may be found continuous exposures from that point to the cannel district, but there is much doubt as to the truth of this assertion.

The hills of this part of the county are rather low and regular in shape; the valleys are of medium width and on the slopes, about sixty feet above drainage level, is the place of the coal. The hills do not rise more than 200 feet higher than this level.

The geological horizon of this coal has been much disputed. According to Dr. Newberry, it is the Putnam Hill limestone seam or No. 4 coal. Prof. Hodges, who, during the former work of the Survey had Coshocton County in charge, called it No. 3, or the Zoar Limestone Coal. The principal effort of this recent work was directed toward settling this matter. The coal proves to be neither 3 nor 4, but the Upper Mercer limestone coal or No. 3A. There would still be room for doubt as to the certainty of this decision, if the very facts which misled both these authorities on the subject had not been found. The inquiry of both was turned at once to the two most prominent coal banks in the cannel district, and from them, without any comparison of the other banks easily accessible, was the horizon determined.

By a peculiar accident, the Lower Mercer limestone is wanting at these two banks, which are in close proximity, so that the opinion of Prof. Hodges, at least, is not unreasonable. When the coal is found under a blue limestone, and occurring at approximately the right interval below the Gray Limestone level above, it is natural from these facts *alone*, to call it the Zoar Limestone Coal or No. 3, as this horizon is the most constant and faithful of the lower coal measures.

But at every other coal bank in the district the real Zoar or Lower Mercer limestone is found about twenty feet below the cannel, and covering a small coal vein of its own. Hence, no alternative is left but to call the upper limestone the Upper Mercer, and the coal No. 3A. This section was obtained on all sides of the two banks before mentioned. On the farm of James Sharpless, the two Mercer limestones and coals were obtained in the regular order on the east back of Simmon's Run, while scarcely 300 yards distant on the opposite side of the valley, the lower limestone and coal are completely elided and replaced by sandrock, while the upper limestone and coal are met in their finest development.

The conditions under which this cannel grew, occurring as it does in the midst of veins of bituminous coal, and indeed accompanied and sometimes replaced by them, is a source of much speculation to many thoughtful people.

The formation of cannel coal is now quite generally acknowledged to be due to the decay of vegetation under water, instead of in the spongy state of moisture which characterizes the peat-bogs of the present, and which must have existed in the bituminous coal swamps of the Carboniferous Age. In almost every coal vein small streaks of cannel, which cover limited areas and again disappear, are found, and by this theory correspond to periods of overflow, during which the vegetation of the swamp was decomposed under water and made cannel coal; when the bituminous matter filled up to the surface level again, the conditions of a peat-bog were again assumed and the growth of bituminous coal proceeded. Thus it may be seen at once that the geological equivalence of veins of coal cannot be in any degree connected, because both are cannel. The identity of the Millersburg, the Bedford and the Flint Ridge Cannels has been claimed on no better grounds. The Millersburgh coal and the Bedford are probably the same vein; the Flint Ridge is not.

The patches of ground covered by valuable cannel are three in number. The two smaller ones are located in Jefferson township, on either side of Mohawk Creek, and to the east of Mohawk town. On these areas are the workings of James and John Moore and James Givens. The latter is a new bank and has had but little attention so far. The Moore banks are both old and

have been worked in former years on a large scale, but have now fallen to the level of farmers' or neighborhood banks. In these workings the cannel is six feet thick, with about a foot of poor bituminous coal above it, which serves to make an easy "bearing-in," or "cut."

Eastward from the Moore's banks the cannel thins down to a foot or so included between 18" of bituminous coal above and below. The vein is here unworthy of mining. After passing Flint Run, the coal increases in thickness till on the hills of the Simmons Run Valley, it attains one of its best showings. Here are the workings of Messrs. Sharpless, Lyman, Mowrie and Creighton. The coal is five feet thick and with three feet of good bituminous coal as a roof. On the opposite side of the run the cannel appears at full thickness, but on the other side of the hill has dwindled down to ten inches 10" of cannel and about a foot of bituminous coal. To the eastward, even *this* scanty showing disappeared.

To the south of the Sharpless bank, which is on the southern edge of Jefferson Township, the largest body of fine cannel lies. It has been tested by small pits all through the country-side. It extends in an elongated point as far south as Tunnel Hill in the center of Bedford Township. The whole district is dotted with coal banks. Nearly every farmer has *some* coal vein opened on his lands, and many exposures of the cannel coal are found. In most of the area, it figures as a thin stratum from six to twelve inches thick, overlaid and underlaid by common coal. When, in the spots of valuable ground, the cannel part of the coal thickens up, the undercoal disappears, leaving the cannel resting on a stiff fire-clay floor. The number of banks open, or which need only a few days work to be in mining order are only eight; five of these are now in good condition.

They are all much the same in appearance. The cannel runs from two to six feet, averaging perhaps four feet. Over it, returning, from one to three feet thick, lies a soft, sulphurous, bituminous coal, easy to mine and affording every chance to get at the hard, solid cannel beneath. In the bank of James Moore, which has in former days been worked on the largest scale of any in the district, the mining was conducted on a loose attempt at the single entry plan. The butts and face of the coal are more marked than in bituminous mines, and it would be next to impossible to drive

an entry at an angle through the coal. The face of the coal is most beautiful and smooth. At intervals of about sixteen 16", occur joints parallel to the face and also butt slips as well. When one block is moved from its place, the use of hammer and sledge alone suffice to bring down the entire wall, like the regular blocks of masonry. When powder is employed the "bearing-in" is made above and the shot placed in the bottom of the cannel. The result of a blast is a large amount of square blocks with almost no dust or fragments. So little slack or broken coal is made in ordinary working, that it is necessary to break a large block by a sledge, into pieces of the requisite size in order to get a sample for the cabinet or for analysis.

When once under the hill, the roof is perfect; the top coal is mostly left up and the firm limestone arch stands solid over that. Immunity from danger tends to lead a miner into negligence and carelessness. In these banks which have every advantage and encouragement to be the most orderly and regular possible, great cavities, supported by inadequate ribs and all the forms and results of poor mining may be seen. The previous workings have been made on such a large scale that bank room for a good many men could be rapidly provided.

The palmiest days which this neighborhood has ever seen were those before the war. In those times the supply of the oils such as naphtha and gasoline, was quite limited. The distillation of this cannel coal for gas, accidentally revealed what stores of these oils was laid away in the dull black mineral.

Large developments were immediately set going. The bank mouths were surrounded by lines of smoking retorts and the product of oils was fairly coining money to the fortunate owners. At this time the war commenced, and soon after the discovery of large wells of petroleum stopped this young industry and left it as a bursted bubble. The rusty retorts, half buried vats, and piles of charred refuse are still to be seen. How would the prophesy have been received in those days that the oils which they slowly distilled from the coals should flow from the earth in such enormous amounts as 1,000 barrels an hour?

From time to time a market has been opened for the coal, but the distance from rail is now between ten and twelve miles and this makes it very expensive of course. It has been tested in New York and has been praised as a most excellent article, in every

respect the equal of the English imported cannel, except a trifling increase in the per cent. of ash. There are three grades of the coal. The middle part of the seam is the best, the bottom next. The top is the most valuable part for making oils, though it is so high in ash as to be often slaty or bony. The amount of sulphur is medium, and it is usually dissiminated in fine shot-like pellets instead of the more usual forms.

The chemical composition of cannel coal ranges from that of pitch coal or albertite on one side to a bituminous coal, or to an oil shale on the other, according as the pure pitch disseminated is in an impure shale or in a purer coal. Such a thing as a standard analysis of cannel has not yet been agreed upon. But in lists of analyses of so-called coals, those representing either the pitch coals, oil shales, or semi-bituminous types can often be selected. The following analyses were made in the laboratory of the Survey by Prof. Lord:

	Moisture.	Hydrocarbons.	Fixed Carbon.	Ash.	Sulphur.
1	2.35	47.05	37.00	13.60	2.33
2	2.32	44.52	41.13	12.03	.84
3	2.42	49.29	38.00	10.29	.84
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1. Bedford Cannel.
2. Coal Run, Jackson County.
3. Trumbull County Cannel.
4. Sand Run, Hocking County.

The careful method of sampling so as to secure averaged results, and the efficiency of the methods employed, will make these analyses of much more value than those which were made in the previous work of the Survey.

A few of these, as copied from Prof. T. G. Wormley's Report in Geological Survey of Ohio, 1870, are:

	Moisture.	Gases.	Fixed Carbon.	Ash.	Sulphur.
1	36.80	43.25	19.95	1.31
2	2.60	40.20	44.00	13.20	1.34
3	1.65	37.35	44.65	16.55	1.70
4	4.30	37.70	51.75	6.25	1.25
5	1.35	36.35	42.60	19.70	1.89

1. Flint Ridge Cannel.
2. Flint Ridge Cannel, 2d sample.
3. Holmes County Cannel.
4. Jackson Cannel.
5. Coshocton County Cannel, (probably Bedford.)

The wide differences of these analyses from the other Ohio cannel is probably due to the methods of analysis.

The owners of this cannel are mainly farmers. A railroad company, which years before was to run a road through this deposit, bought 700 acres of the finest of the coal. When it failed, the property passed into the hands of speculators, where it now remains. Of course this deposit, valuable as it would be, is doomed to be inactive until railroad communication opens it up to civilization. Cannel coal in New York commands high prices, just as split wood for parlor fires does; \$15 or \$16 a ton is not unfrequently paid for English cannel and our American cannel are just as good. Ohio cannel would probably be worth \$4.00 or \$5.00 a ton now, if it were wisely introduced into the proper markets.

As might be expected, the farmers, to whom this cannel is easily accessible, hold it in low esteem for the very points which make it courted by those who cannot reach it. They prefer bituminous coal whose heating power is somewhat higher, and the cheerful fire and cleanliness of the cannel go for nought.

It would seem that the day is now approaching when this peaceful country district must give way to the boisterous life of a coal mining community. The Mt. Vernon, Coshocton & Wheeling Railroad is being pushed rapidly forward, and, probably, by the end of the approaching summer, trains will be daily passing within two miles of the best of the cannel. Under such circumstances it is nearly certain to be opened up.

DISCUSSION.

Mr. CHAMBERLAIN.—I would like to inquire of Prof. Orton whether the cannel coal of Mahoning County is the same as No. 3A.

Prof. ORTON.—No. The Mahoning cannel belongs to the ferri-ferous limestone level, and is two levels higher in the scale.

Mr. CHAMBERLAIN.—I was much interested in the paper of Mr. Orton, because I was interested in making oil out of coal similar to that he describes. We got usually ten gallons of oil per ton at a density of twenty or twenty-three degrees. In refining, we got only three gallons fit to burn; the rest was drawn out of the stills and allowed to run down the creek, except the last, and the residue retained in the tanks and ponds. It was nothing unusual to see, on a cold morning, in a tank twenty feet square, three-fourths to one inch of the most beautiful paraffine. Tons of that paraffine were thrown out in the refuse and ran down the creek, thousands and thousands going into the Ohio River. I think the time will come when persons will distil this coal and make the best of lubricating oil out of it.

Mr. HOWELL.—I would ask Prof. Orton if this is the same coal as that of Brush Creek, in Muskingum County.

Prof. ORTON.—I don't at this moment recall that coal.

Mr. HOWELL.—We have five or six feet of coal.

Prof. ORTON.—Where?

Mr. HOWELL.—On the Wilmington Railroad and across Turkey Run. It is just below the limestone.

President ROY.—I would judge from the horizon that this is the same cannel as that of Jackson County.

Prof. ORTON.—No; that belongs to the No. 3B Level, and is not a limestone coal.