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Ohio Mining Journal

**Title:** Uses of Ohio Coals

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**Issue Date:** 15-Nov-1883

**Citation:** Ohio Mining Journal, vol. 2, no. 1 (November 15, 1883), 18-23.

**URI:** <http://hdl.handle.net/1811/32419>

**Appears in Collections:** [Ohio Mining Journal: Volume 2, no. 1 \(November 15, 1883\)](#)



*USES OF OHIO COALS.*

BY PROF. EDWARD ORTON.

A few general statements as to the chief uses of Ohio coals will be given here, in order that the detailed statements that follow may be seen in their proper light.

The following list shows their more important applications:

1. Household use.—Grates, stoves, furnaces.
2. Steam production. { In locomotives.  
In stationary engines.
3. Iron smelting coal.
4. Coke manufacture.
5. Rolling mill fuel.
6. Gas-making.

1. For household use there is no fixed and common standard. Widely separated varieties are used with apparently equal acceptance in different sections of the State. The rich, cementing coals of the Pittsburgh district have long been the chief supply of the Ohio Valley, and here they hold their ground against all competitors.

The open-burning coals of the Mahoning and Upper Tuscarawas Valleys are the standard fuels of Northern Ohio. Through Central Ohio several distinct varieties have each the decided preference in as many distinct fields. The most accessible coal will generally be used by each section, and acquaintance with the character of this particular fuel will often lead to its being retained, even when competing coals of intrinsically higher, though different quality, reach the market.

There are, however, some general considerations by which the degree of adaptability of our several coals to domestic use can be determined. For this, as indeed for all other uses, low percentages of ash and sulphur (pyrites) are desirable, as it is to these elements that the production of "clinker" is due. It is must also be free from slate and bone." Furthermore, the coal must ignite easily, and still must hold the fire at least moderately well. A fairly high percentage of carbon is of course necessary. The less smoke and soot it makes in burning the better. In addition to these points, its physical properties must also recommend it. It should be clean and bright, and it should also have strength enough to bear all necessary handling without excessive breakage.

According to such a standard, the coal of the Sharon seam, and especially in the Massillon district, would be entitled to the first place, but it would be followed close by several other coals. There are many large coal fields, and some entire seams that make no attempt to enter this market.

2. High quality in a coal will tell upon its efficiency in the production of steam as promptly and certainly as in any other use, but poorer quality is less objectionable and offensive here than elsewhere. Chemical and physical properties that would wholly exclude a coal from certain of the higher uses may not interfere with the wide and acceptable use of the same coal in the production of steam. A coal that mines small, or that is too tender to bear handling, is ruled out of the market for domestic use, but such points count little or nothing against it as a steam coal at the present time. Both locomotive and stationary engines have been lately adjusted so as to successfully use the smaller grades of coal, nut, pea, and even slack. The yard engines of many railroads, and the freight engines of some, do all their work on pea coal and slack. This great saving of fuel, often derived from the best part of the seam and entirely lost hitherto, is a matter of great importance to the coal fields, and the State as well.

The "strength" of the coal, or its absolute heating power, seems a matter of more consequence in a steam coal than the nicer points of composition.

All the coals of the State, from the purest and best, to the seams of lowest quality, do duty as steam coals, but there are some seams that are practically limited to this service. The Upper Freeport coal is an example of this class. It is one of the most important seams of the Coal Measures, but every year fixes its character more definitely and exclusively as a steam coal. Its high percentage of fixed carbon ensures its efficiency, and its tenderness under handling works less against it here than in most other applications.

Open-burning and cementing coals are used promiscuously by the same railroad often, but probably not without some disadvantage. Each coal has its own behaviour on the grate-bars, and each gives better results when treated in one way than in other ways. The neglect to study and recognize these "personal equations" of the different seams, vitiates or even nullifies many of the practical tests to which the coals are subjected. Unless each coal

has been so treated as to ensure its best results, the so-called test is unfair and deceptive. One locomotive engineer will complain of a coal that it "smuts the flues." Another will use coal from the same mine without experiencing the slightest tendency to this trouble.

Ash, sulphur and slate that tend to run on the grate and form "clinker," or that accumulate so as to deaden the fire, are the elements that are most obnoxious in our steam coals.

3. For blast furnace use, only the best and purest of our open-burning coals are available in the raw state. There are four fields from which such coals are taken, viz., the Mahoning Valley, the Massillon district, the Hocking Valley, and the Jackson County district. The first of these regions has furnished the type and standard of this class of fuels hitherto, but its day of service in this field has gone by, and it is now almost entirely displaced on its own ground by the great iron making fuel of the Ohio Valley, Connellsville coke. The Massillon coal has not as happy an adaptation to this use as the coal already named, and has never been applied to iron making in the large way. But very little of it is used in furnaces at the present time.

The Hocking Valley coal in its best phases is well adapted to iron manufacture, and a great and growing industry is already established upon it in this connection.

The two seams of Jackson Court House and vicinity, viz., the Shaft coal and the Hill coal, are both largely and successfully used in the furnaces of the district to which they belong.

4. There is but one field of the State in which coal is mined expressly for coking. The small coal and slack of several districts go to the coke ovens, but in Leetonia alone is the whole product of the mines brought to the ovens.\* This is the only coke now made in Ohio that is used in iron smelting. The Shaft coal of Steubenville has been largely used in this way in the past, but it, too, has succumbed to the superior quality and lower price of Connellsville coke.

The coke now made in the State is chiefly manufactured from the small coal and slack that accumulate in mining. The impurities of the seam are often gathered here in large amount, and the coke that results shows their presence by excessive ash and sul-

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\*The Hammondsville Strip Vein is mined for coking also, but the output is insignificant.

phur. These cokes are used to but small extent in foundries, and find their main applications in heating purposes where quality is not essential. The use of these waste products in this way is an important step in the line of fuel economy, a topic which our coal producers are just beginning to consider.

The seams used for cooking are especially the Freeport coals and the Pittsburgh. No successful manufacture now exists in any other seam, in fact, except in the two cases already noted of the Lower and Middle Kittanning coals, at Leetonia and Hammondsville, respectively.

5. The requisites for a good milling coal are quick combustion, with plenty of flame, together with as much purity as can be secured. The Brush Creek coal, the Freeport coals, and the Kittanning coals furnish the chief supply. Each of these several seams does good service at some point or other in its development.

The Salineville Strip seam (Brush Creek coal), the Steubenville Shaft seam (Lower Freeport), and the Leetonia coal (Lower Kittanning) all enjoy excellent reputation as milling coals. The Pittsburgh and the Upper Freeport seams are also considerably used. The Block coal of the Mahoning Valley is highly esteemed for this use wherever the price at which it can be afforded allows it to be used.

6. For gas making, our native supply is not drawn upon to any great extent outside of the State boundaries. Within these limits several seams are used with a fair degree of acceptance. The Hocking Valley coal furnishes by far the largest supply for this purpose. The inferior quality of the coke produced puts them all at a disadvantage when compared with the Pittsburgh coal.

Almost all Ohio coal is sorted and cleaned by a process called screening, before it is brought into market. All that is used for domestic purposes is treated in this way, also all that is used in iron making. Until quite recently, all railroad fuel has also been screened. A large proportion of it is still prepared in this way, but there is a growing tendency on the part of railroad companies to either use the coal as it comes from the miner's pick, which is technically known as the "run of mine," or else to throw together two or more of the several grades of coal that have been sold separately hitherto.

There are are two grades of coal supplied by almost all mines, and three grades from many. These are respectively designated lump or round coal, nut coal, and slack. The first commands the highest price, the last is often valueless, but within the last few years, the slack of certain seams has come into demand for various purposes, and a large quantity is now finding its way to market. From the slack is also derived the grade of coal called pea coal, which a few mines are furnishing.

The process of screening consists in passing the coal as it comes from the bank cars over one or more inclined screens on its way to the cars, boats, or wagons by which it is to be transported to market. There is no general system in force in the process of screening. The length and width of the screens, the angle or pitch at which they are placed, the space between the bars, the width and shape of the bars, all these vary between wide limits in the different portions of the field, and even different mines in the same district. The miner is paid in most of the districts on that portion of the coal only that passes over the screen, or in other words, on lump or round coal, which is also called clean coal. The varying characters of the seams, the differences between different mines in the same seam, and different portions of the same mine, all these elements combine with the facts already noted as to the varying dimensions of the screens to make the question of wages for mining a complicated and troublesome one. The screens are a fruitful source of discord between the mine operator and the miner.

There is a rapidly growing appreciation of the second grade of the coal product, *i. e.*, the nut coal. This grade results quite largely from the operation of "bearing in" upon the coal seam, or undermining it. In a large number of instances, the best portion of the seam occurs in the "bearing in" bench, and thus the nut coal often contains the choicest fuel that is produced from the seam. The lump coal must generally be reduced to smaller size before it can be used, but still the popular demand has hitherto been for large coal, and great quantities of the smaller sizes have been utterly wasted. The arrest of this waste, and the bringing into use of all the products of the mine are steps of great interest to the State at large.

The nut coal is run with the slack in some fields, enriching this latter element so as to make it a fully marketable product, which still goes under the name of slack.

Within a few years, two new departures have been made in the disposition of the slack in several districts. In some the slack is sifted or washed in revolving screens, by which the dust is removed, and the resulting fuel is known as pea coal. This finds market for use in stationary engines, and for other like purposes. The second of these new methods consists in coking the slack.

The proportion of the coal gained in mining is increasing in most districts of the State, owing to better methods of mining, and better demand for the smaller coal. The empirical rule that gives 1,000 tons of coal to every acre for each foot in thickness of the seam, doubtless expresses the actual result in a large number of instances, but better figures are now obtained in many sections, as will be hereafter shown, and far better results are certainly attainable in almost all our districts.

The specific gravity of our coals ranges for the most part between 1.24 and 1.34. Assuming the mean, or 1.29 as the average, and this figure is very near the truth, every acre of such coal will contain for each foot in thickness 1,752 tons of 2,000 pounds. The miner's estimate, as embodied in the rule above referred to, shows that he is content with securing four-sevenths, or a little more than half, of the coal that the seam contains. The best foreign practice is far in advance of such results. In the Bristol coal field of England, it is calculated that 1,500 tons to the foot are won for each acre, the entire loss in mining being reduced to one-tenth of the seam. The best practice that is fairly well verified in Ohio gains two-thirds of the coal, and the cases in which this is done are very rare. More than this is claimed in many mines, but is probable that, if examined, such claims would be found to be untenable.

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