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DEPARTMENT OF NATURAL RESOURCES  
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**REPORT OF INVESTIGATIONS NO.36**

**COAL RESOURCES  
OF THE  
POTTSVILLE FORMATION**

By  
**JOSEPH A. GRANCHI**

**COLUMBUS**

**1958**

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## PREFACE

The coal beds of the Pottsville formation have added much to the wealth of the State. They outcrop in 20 counties from Scioto and Lawrence on the Ohio River to Geauga in the northeast (fig. 1). The thickness of the individual coal beds varies from a mere streak to several feet. The more important, though not the most persistent of the beds are: The Sharon (No. 1) coal, the Quakertown (No. 2) coal, and the Bedford coal.

The present report is concerned with the occurrence of known areas of minable Pottsville coal. Published estimates have been evaluated and adjusted by the writer, the data discussed herein being a summary of all previously known work such as county geologic reports; oil, gas, and water well records; and the many measured sections on file at the Ohio Division of Geological Survey. Lack of sufficient data, however, makes it impossible to initiate a new estimate of the remaining and recoverable reserves by seam and county for the entire state. In spite of its limitations, the author hopes that it may serve as a guide for coal operators, land owners, prospectors for coal, and other interested parties.

It is suggested that the reader refer to the Bibliography for more complete references on specific areas. Previous reports concerned with estimated original reserves of Ohio's coal are listed below. The current report is the seventh in this series by the Ohio Division of Geological Survey.

- Brant, R. A., 1954, The Lower Kittanning No. 5 coal bed in Ohio: Ohio Geol. Survey Report of Investigations No. 21.
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## ABSTRACT

The Pottsville formation contains geologically the oldest coals in Ohio. These rocks crop out in a north-east-trending belt from Lawrence County to Geauga County, and underlie an area of approximately 11,125 square miles.

Twelve separate beds have been identified within the formation. Six of the twelve coal beds contain minable reserves. The following list summarizes the present estimates for these beds:

Bed	Estimated original reserve (tons)
Tionesta (No. 3b) . . . . .	180,288,000
Bedford . . . . .	308,928,000
Upper Mercer (No. 3a) . . . . .	136,768,000
Lower Mercer (No. 3) . . . . .	297,312,000
Quakertown (No. 2) . . . . .	732,792,000
Sharon (No. 1) . . . . .	<u>1,521,640,000</u>
Total . . . . .	3,177,728,000

The Sharon (No. 1) coal bed represents the largest share of the reserve estimated; second in importance is the Quakertown (No. 2) coal bed. These two beds have been mined somewhat extensively. The minor Pottsville coals, though never mined in large quantities, have contributed greatly to local fuel supplies.

Minable thicknesses of one or more of the Pottsville coal beds occur in twenty of Ohio's coal-bearing counties. The estimated original reserves of the Pottsville coal beds appears, by county distribution, in the following table:

<u>County</u>	<u>Estimated Original Reserve (tons)</u>	<u>County</u>	<u>Estimated Original Reserve (tons)</u>
Coshocton . . . . .	125,568,000	Perry . . . . .	13,824,000
Gauga . . . . .	2,880,000	Portage . . . . .	111,824,000
Hocking . . . . .	51,264,000	Scioto . . . . .	75,416,000
Holmes . . . . .	222,952,000	Stark . . . . .	507,552,000
Jackson . . . . .	530,624,000	Summit . . . . .	<u>228,000,000</u>
Lawrence . . . . .	100,800,000	Trumbull . . . . .	149,760,000
Licking . . . . .	28,000,000	Tuscarawas . . . . .	44,648,000
Mahoning . . . . .	293,184,000	Vinton . . . . .	323,720,000
Medina . . . . .	73,000,000	Wayne . . . . .	<u>239,768,000</u>
Muskingum . . . . .	54,944,000	Total . . . . .	3,177,728,000

## APPROACH TO THIS RESERVE STUDY

Because of the sporadic occurrence of coal in the Pottsville formation and the general inadequacy of qualitative data, coal estimates presented here are the results of deductive evaluation of available information. Clark's (1917) and Ray's (1929) estimates were used as the basis for appraisal of the coal bed resources, and in those instances which recent data tended to confirm a previous estimate, the earlier estimates were accepted. In those areas where more recently acquired data indicated that previous estimates were in error, these previous estimates were adjusted. Some reductions are, out of necessity, drastic but can be justified because: (1) the extent of minable coal is demonstrated or interpreted to be considerably less than original figures; and (2) former correlation is thought to be in error. On the other hand, additions have been made where former estimates show no coal reserves. Verifying these additional tonnages were Survey data indicating the presence of minable coals.

This study is admittedly not detailed. It reflects a more general and arbitrary approach than is commonly desirable in resources reports. The reasons for this are: (1) the coal beds are so erratic in thickness, data showing these variations are not available; and (2) the present economic value of the Pottsville coals does not justify spending excessive research money in their study.

The estimates reported are for original reserves, that is, reserves before mining began. Pottsville coal reserves estimates published by F. R. Clark (1917) and F. A. Ray (1929), plus their evaluation by the present author and new estimates by the author, are presented at the end of county description when practicable. The practicability is governed by the following factors: (1) whether either Clark, Ray, or both, published estimates for the county in question; (2) whether data are available to the author to evaluate Clark's and Ray's work as well as to calculate new reserves.



## GEOLOGY OF THE POTTSVILLE COALS AND ADJACENT ROCKS

Outcrops of the Pottsville rocks in Ohio may be traced more or less continuously from Scioto County on the Ohio River northeastward to eastern Medina County and thence eastward to the Mahoning-Trumbull County area where they pass into Pennsylvania (fig. 1). Outcrops of Pottsville rock are sparse in the northern Ohio area, especially in Portage and Summit Counties, because of the heavy overburden of glacial drift.

### PHYSIOGRAPHY

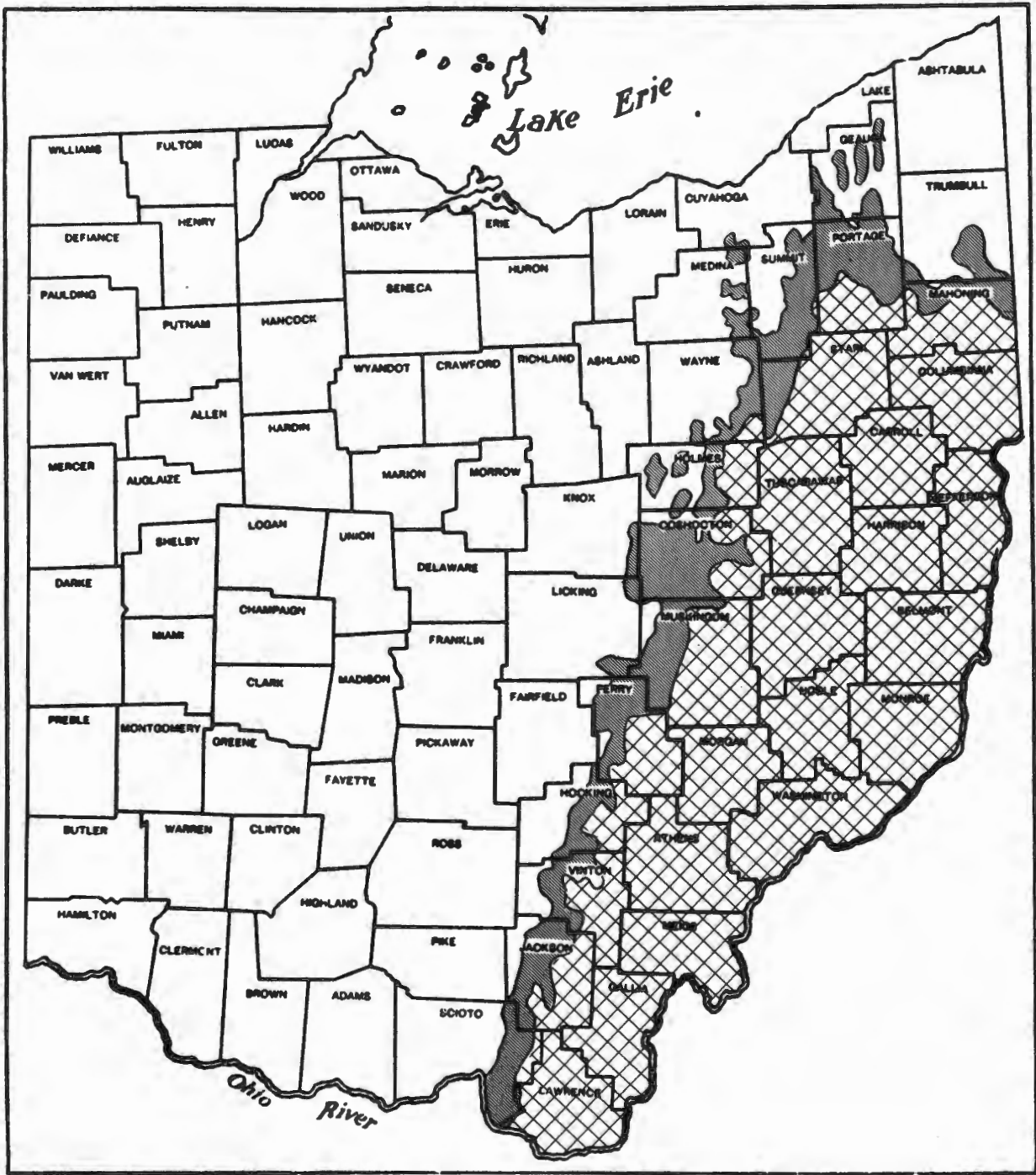
The portion of Ohio underlain by the Pottsville formation is in the Allegheny Plateau section of the Appalachian Plateau province (Fenneman, 1938, p. 283). The northern area is practically all confined to the glaciated part of the Allegheny Plateau section, while the southern half of the Pottsville formation area is in the unglaciated portion of the Allegheny Plateau section. The boundary between the glaciated and non-glaciated portions may be traced eastward through central Holmes County, northeast through southern Stark County, and into Columbiana County (White, 1949, p. 19-22).

The glaciated and non-glaciated areas have essentially the same general surface elevations, but the characteristics of the slopes developed in each are strikingly different. In the glaciated area gentle slopes prevail, while the unglaciated area shows deep, steep-sided ravines and mature valleys with abrupt slopes. Because of a mantle of drift, prospecting for coal in the northern glaciated area is usually done by exploratory drilling. In the unglaciated region much prospecting can be done by surface observation of the outcrops.

The major drainage systems for the entire area of the Pottsville formation in Ohio are the Ohio River to the south and the Cuyahoga River to the north. The main tributaries to the Ohio River are the Mahoning, Muskingum, and Hocking Rivers.

### STRUCTURE

The Pottsville formation of Ohio lies on the western flank of the Pittsburgh-Huntington Basin of the Appalachian coal region. Here the geologic structure is relatively simple. The regional dip is to the south and east, but minor synclines and anticlines resulting from local reversals are superimposed on the regional dip. The most prominent of these local flexures affecting the Pottsville formation of Ohio are the Cambridge anticline and its complementary Parkersburg-Lorain syncline. The Cambridge anticline is a broad and irregular structure, the axis of which extends from St. Mary's, West Virginia, northwest to Cleveland, Ohio. Its crest is most strongly defined in Washington, Monroe, and Noble Counties, but broadens and becomes less pronounced to the northwest.



Area of Pottsville outcrop.



Area of Pottsville that is covered by younger Pennsylvanian rocks.

Figure 1. Extent of Pottsville outcrop in Ohio.

The axis of the Parkersburg-Lorain syncline roughly parallels that of the Cambridge anticline and can be represented by a line extending from Parkersburg, West Virginia, to Lorain, Ohio.

## STRATIGRAPHY

The Pottsville formation is the oldest Pennsylvanian strata in Ohio. It includes all the consolidated rocks lying between the eroded surface of the Mississippian system and the base of the Brookville No. 4 coal (fig. 2).

Present evidence suggests that a disconformity exists at the base of the Pennsylvanian system throughout Ohio. This disconformity, marked by an irregular contact between the Pottsville formation and beds of the Mississippian system, is probably due to extensive erosion of Mississippian rocks prior to the Pottsville deposition. As a result the Pottsville generally rests on the Maxville limestone in the subsurface (eastern part), and on the Logan sandstone in the outcrop region (western portion). Erosion removed the Maxville stratum in many places, leaving remnants of the limestone surrounded by subsequently deposited rocks of Pottsville age. Following this erosional cycle, the region was submerged and the basal members of the Pottsville formation, the Harrison ore and the Sharon conglomerate, were deposited in troughs and basins. These two members, the Harrison and the Sharon, are usually present in the localities where the Maxville limestone has been practically or entirely removed by erosion. In the areas where normal depositional thicknesses of the Maxville limestone are found, any horizon from the Harrison ore to the Quakertown (No. 2) coal may be found resting on the Maxville limestone.

The Pottsville formation ranges in thickness from 100 to 350 feet, and averages about 250 feet. Morningstar (1922, p. 10) has noted a general thickening from the western to the eastern part of the outcrop and suggests that the irregularities in thickness are caused principally by the paleo-relief of the Mississippian rocks.

Areally, the Lower Mercer and Upper Mercer are the most persistent of the Pottsville coal beds. Limestone beds associated with these coal beds are well-defined stratigraphic units and form datum planes for determining the stratigraphic relations of the overlying and underlying formations (fig. 2).



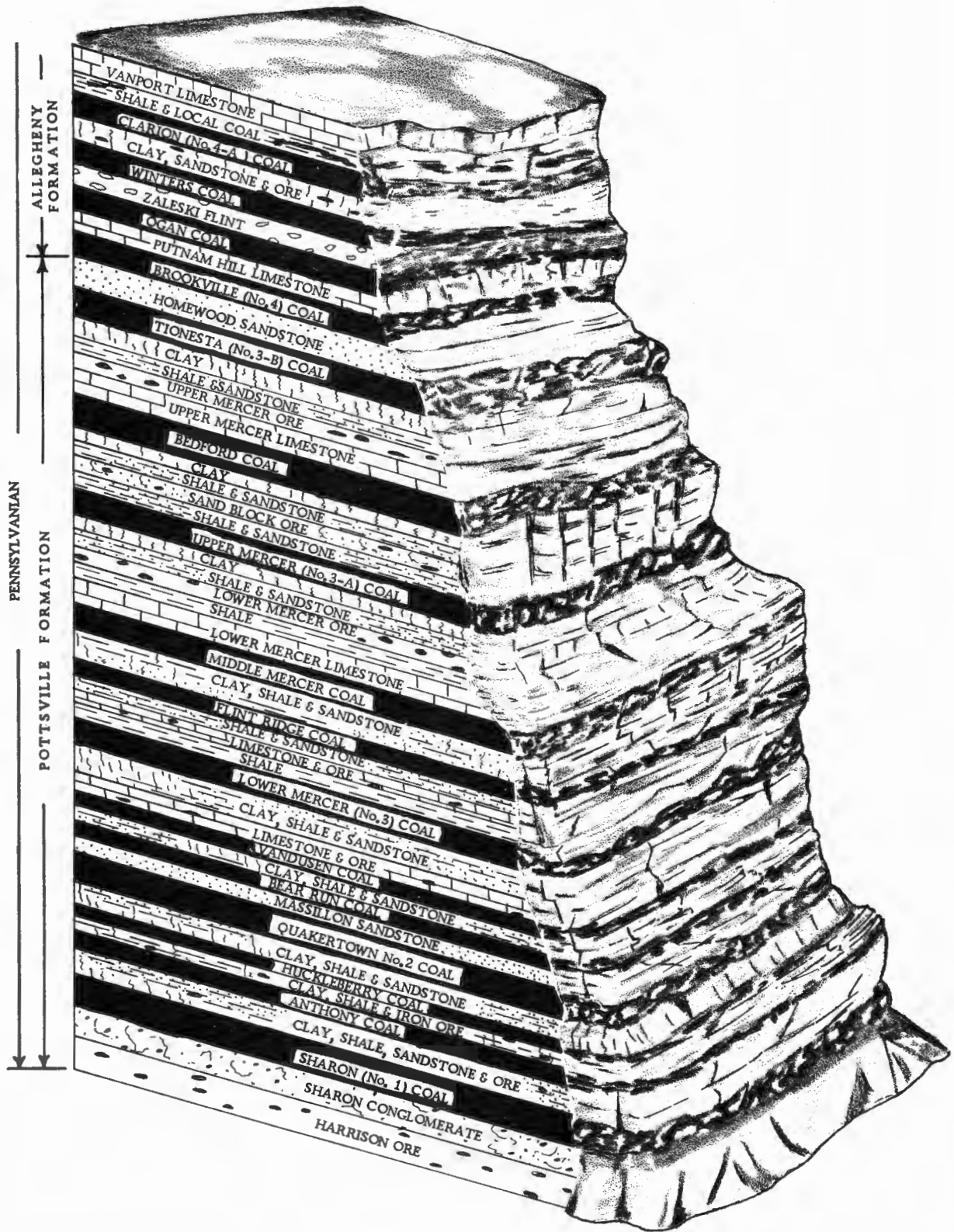


Figure 2. Generalized section of rocks associated with the Pottsville formation.



# THE POTTVILLE COAL BEDS, OCCURRENCE AND RESOURCES

## THE SHARON NO. 1 COAL BED

### INTRODUCTION

The lowermost minable coal bed of the Pottsville formation is the Sharon (No. 1) coal. The Sharon coal bed was named for its occurrence near Sharon, Mercer County, Pennsylvania (Rogers, 1858, p. 489-490), and later was introduced into the nomenclature of Ohio's coal beds. Other names for the Sharon coal bed in western Pennsylvania are the "Ormsby" coal bed or the Coal "A," so named by Lesley (Newberry, 1874, p. 130).

### STRATIGRAPHIC RELATIONSHIPS

In Ohio the Sharon (No. 1) coal stratum is normally located from 20 to 50 feet above the Sharon conglomerate, however, in some localities it rests directly upon the conglomerate bed and where the Sharon conglomerate is absent or wanting, the coal lies upon Mississippian strata. Overlying the coal there is usually a black or gray fossiliferous shale.

### CHARACTERISTICS

The Sharon coal bed in Ohio is discontinuous. Newberry (1878b, p. 785) indicates that it was deposited in a series of isolated basins which reflected the irregular Mississippian surface.

The Sharon coal is normally a hard, bright, banded coal, somewhat laminated with very thin shaly partings. Its low sulphur content (less than 1 percent) (Orton, 1884, p. 157), dry-burning, short-flame, and excellent heating qualities made it a popular domestic fuel. The best quality Sharon coal produced contains between 52 and 56 percent fixed carbon and its volatile matter varies between 35 and 39 percent. The ash content is variable, seldom falls below 5 percent. The following is an analysis of a Sharon coal bed sample from the Mahoning field (Newberry, J. S., 1878b, p. 813), however, it should not be construed to be an average analysis.

	<u>Percent</u>		<u>Percent</u>
Carbon	77.88	Phosphorus	Trace
Hydrogen	6.56	Iron	0.14
Nitrogen	1.51	Moisture	3.28
Oxygen	10.57	Oxygen in moisture	2.92
Sulphur	0.64	Oxygen in coal	7.65
Ash	2.84		
	<hr/> 100.00		

The quality of the freshly mined No. 1 coal is excellent, but upon long storage the coal slacks due to weathering along the bedding planes, thereby reducing its marketability.

#### FIELDS OF THE SHARON COAL BED

The Sharon coal bed in Ohio has been mined in three coal fields: the Jackson, Massillon, and Mahoning. The Jackson field includes parts of Jackson, Vinton, Pike, and Scioto Counties (fig. 3). The Massillon and Mahoning fields occupy parts of Tuscarawas, Stark, Wayne, Medina, Summit, Portage, Geauga, Mahoning, Trumbull, and Columbiana Counties respectively (fig. 4). The coal has been known by several local names in these three fields. Scattered minor deposits of Sharon coal have also been found in Ashland, Coshocton, Licking, Hocking, and Muskingum Counties.

#### Jackson Field

The major part of the Jackson field lies in Jackson County (fig. 3). The Sharon coal in Jackson County is known as the "Jackson Shaft" coal. The coal of this coal field is best developed in Jackson and Liberty Townships of Jackson County where the average thickness is 3-1/2 to 4 feet. The extreme southern limit of the Jackson field extends into northeastern Scioto County. The Sharon coal bed lies either directly on the conglomerate or only a few feet above it in the Jackson field (Stout, 1916, p. 44). The bed appears irregularly and conforms to the uneven surface of the underlying conglomerate.

The analysis given below shows the typical composition of the Sharon (No. 1) coal (Stout, 1916, p. 69).

	<u>Percent</u>
Volatile matter	35.12
Fixed carbon	48.80
Ash	8.07
Sulphur	0.41
Phosphorus	0.057
Silica	3.76

The Ohio Annual Coal and Non-Metallic Mineral Report for 1954 listed four operators reporting production from the Sharon coal. The four, the Jackson Iron and Steel Co., Lesta Ramey, Sharon Contractors, Inc., and the Van Fossan Brothers, mined a total of 31,160 tons of Sharon coal. In the 1955 report, these same operators mined only 27,256 tons of Sharon coal, whereas the output for 1956 was increased to 28,278 tons.

Scioto County. - In Scioto County the Sharon coal bed is frequently separated from the Sharon conglomerate by a few feet of argillaceous material, but in some places the coal lies directly on the conglomerate. Only in Madison Township does this coal attain sufficient thickness for drift mining. In this township the coal ranges in thickness from 2 to 3 feet.

Pike County.- The Sharon coal is present in parts of Jackson, Beaver, and Marion Townships of Pike County. It varies in thickness from 20 inches to 3 feet. No reserve estimate of the Sharon coal has been published for Pike County.

Jackson County. - During a ten-year period, from 1946 to 1955 inclusive, 366,116 tons of Sharon coal were mined in Jackson County. Production by seam prior to 1946 is not available, but a considerable tonnage of

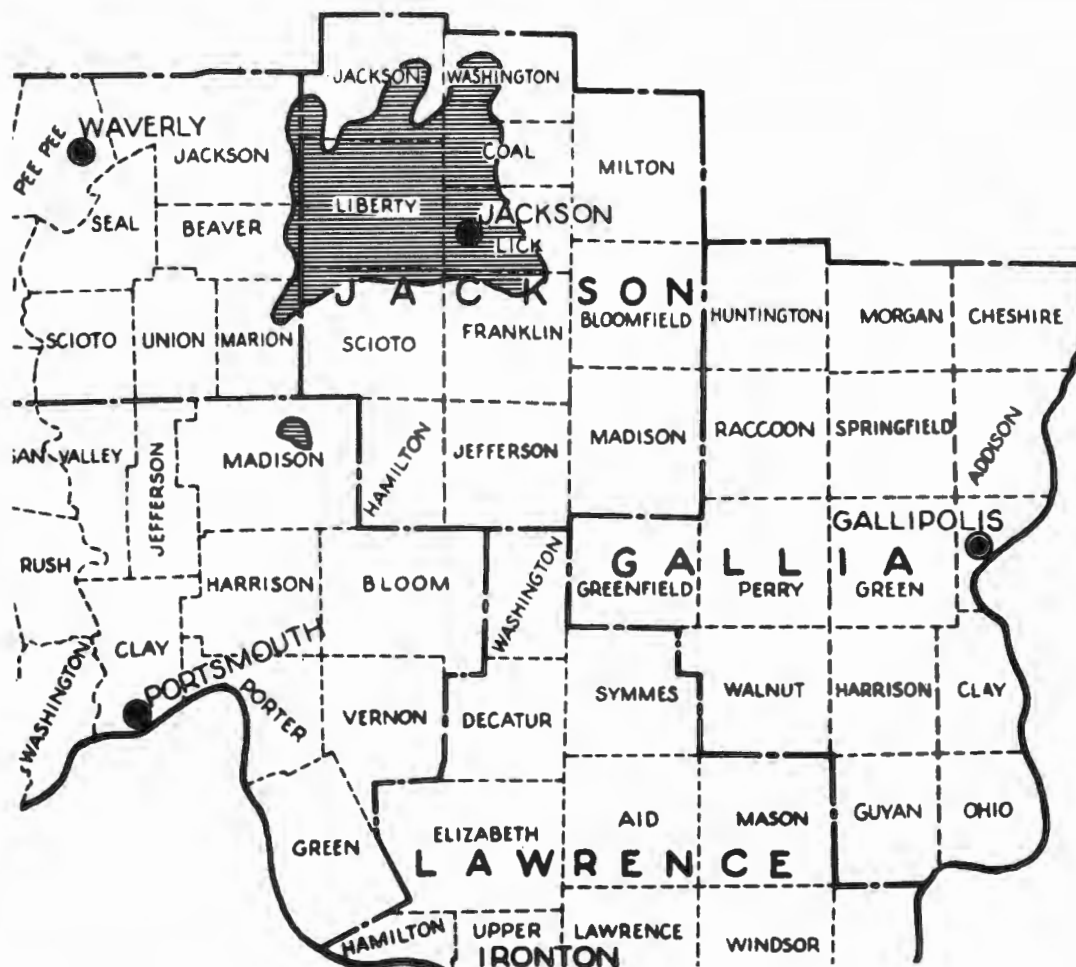


Figure 3. Generalized map of known major occurrences of minable Sharon (No. 1) coal in southern Ohio.

Sharon coal was mined during these preceding years. Taking into consideration the volume of Sharon coal already mined and still being produced, the estimate made by Clark seems reasonable. His (Clark, 1917, p. 92) calculations, based on an average thickness of 2 feet 7 inches and an area of 40 square miles, yielded an estimate of 119,000,000 tons.

Vinton County. - Occurrences of the Sharon coal bed, locally called the "Jackson Shaft" coal, are quite common in Vinton County, but the bed lacks sufficient thickness for extensive mining. A small area underlain by a 2-foot thick bed of this coal was mined in the south central part of section 29, Richland Township. Stout (1927, p. 71) believes minable thicknesses of the Sharon coal are absent elsewhere in Vinton County. F. A. Ray (1927, p. 339) estimated a total of 2,880,000 tons for the Sharon coal in Vinton County.

#### Massillon Field

During the late 19th and early 20th centuries, the most important Sharon coal mines of the State were located in the Massillon field (Orton, 1884c, p. 773). In addition to being the most important field, it was the most extensive of the several areas of minable Sharon coal. The Massillon field includes eastern Wayne, most of Stark, northern Tuscarawas, all of Summit, eastern Medina, northern and western Portage, and southwestern Geauga Counties. The eastern limit of this field is not definite owing to the lack of subsurface information. The Sharon

conglomerate in Summit, Portage, and Geauga Counties is generally continuous and serves as a guide in the exploration for the Sharon coal bed. The thickness of the Sharon coal bed varies from three to six feet in the known coal basins of the Massillon field.

Mode of Deposition. - The Sharon seam in the Massillon field appears to have been deposited in distinct basins or troughs ranging in size from a few to several hundred acres. Although the coal thins toward the margins of the basins, Orton (1884c, p. 775) feels that some of the basins may in reality be connected to each other by a thin sheet of coal.

Even though the mode of deposition and occurrence appears similar to that of the adjacent Mahoning field (see p. 11), the coal of the Massillon field is softer than coal from the same seam in Mahoning and Trumbull Counties (Newberry, 1873, p. 216).

Tuscarawas County. - While there are no records indicating the presence of minable thicknesses of Sharon coal in Tuscarawas County, several abandoned deep shaft mines in the northern part of the county are evidence that the Sharon coal was formerly mined in this county.

J. S. Newberry (1878f, p. 55), in his 1878 report on the county, noted that the Sharon coal horizon does not outcrop and stipulated that no concerted prospecting efforts have been attempted. However, he suggested that diligent prospecting by the drill in Tuscarawas County may discover economic deposits of this coal. Because of his faith that such deposits existed, he noted the following areas which he felt were the most potential sources of Sharon coal: near New Cumberland in the Conotton Creek Valley; and near Trenton and Port Washington, both localities being on Sugar Creek.

Lamborn (1956, p. 26) confirms the findings of Newberry that nowhere in Tuscarawas County does the Sharon coal horizon appear above drainage.

Stark County. - The Sharon coal bed in Stark County was locally designated the "Massillon" or "Briar Hill" by J. S. Newberry and E. Orton (Newberry, 1878, p. 156). The Sharon coal bed in Stark County is of excellent quality and thick enough to mine.

An analysis of the Sharon coal (Newberry, 1878e, p. 165) from Stark County is as follows:

	<u>Percent</u>
Water	7.50
Ash	1.00
Volatile combustible matter	31.00
Fixed carbon	61.00
Sulphur	0.49

The Sharon coal is well developed in Lawrence, Tuscarawas, Sugar Creek, Jackson, and Bethlehem Townships, where the thickness averages between 4 and 5 feet. The greatest reported thickness of the Sharon coal bed was in a boring made on the George Schwalm farm about one mile east of Canton, Stark County, where 6 feet of Sharon coal were penetrated at a 160-foot depth (Newberry, 1878e, p. 159). Newberry (1878, p. 157, 159) further states: "from the peculiar character of this coal seam it is quite impossible to predict with any certainty what will be the result of a systematic search for it where it lies deeply buried.... It appears to be highly probable that a coal area, perhaps of great irregularity, but yet of considerable extent, will be found connected with the basin penetrated by Mr. Schwalm."

During recent years in Stark County, exploratory gas wells have penetrated what is believed to be the Sharon coal. One such location occurs in section 11, Canton Township, Stark County, where six feet of material, logged as coal, was penetrated 246 feet below the surface.

Bownocker (1917, p. 38) and Orton (1884c, p. 797) agree that Lawrence Township, Stark County, of the Massillon field, was in the "heart" of the Sharon coal bed. For some years previous to 1915 the county produced 1,000,000 tons of Sharon coal annually, but in that year production dropped to 500,000 tons annually. Clark's (1917 p. 94) values are accepted for purposes of the present appraisal (see table 1, p. 14).

Wayne County. - The Sharon coal in Wayne County was known as the "Massillon Block" and "Blue Chippewa" coal. This coal is best developed and was mined in Chippewa, Baughman, and Sugar Creek Townships, and to a lesser degree, in Paint Township. The thickness of the coal bed ranges from 3 to 7 feet, and averages about 5 feet (Comrey, 1921, p. 95).

The Sharon coal bed was once extensively mined in Wayne County. Two mines owned by the Silver Creek Mining Company had an aggregate annual output of over 165,000 tons. Read (1878d, p. 536-537) was of the opinion that even though the western limits of the coal fields in Wayne County were partially explored by drilling without disclosing any appreciable number of workable coal beds, it was by no means certain that coal of sufficient thickness for mining purposes did not exist.

Medina County. - The Sharon coal occurs in the southeastern corner of Medina County where it was formerly mined in Wadsworth and Sharon Townships. The coal mined is of good quality, relatively free from sulphur and reaches a maximum thickness of 5 feet (Wheat, 1878, p. 363).

Summit County. - The Sharon coal in Summit County was originally known as the "Briar Hill" coal. Here it is separated from the underlying Sharon conglomerate by an interval of 25 to 50 feet of shale or shaly sandstone. The coal is usually overlain by gray shale, 10 to 40 feet in thickness (Newberry, 1873, p. 217).

The Sharon coal is well developed and was extensively mined in Tallmadge, Norton, Springfield, Franklin, and Coventry Townships, in Summit County. The average thickness of coal in some of the areas mined ranged from 4 to 5 feet. A few mines were operated in Portage Township, now the City of Akron, where the average thickness of the coal is over 4 feet.

Concerning the Sharon coal bed in Summit County, J. S. Newberry (1873, p. 217-219) made the following statement: "We have every reason to believe....that a considerable area in Green Township (Summit County is underlain by the Sharon coal) where it lies far below drainage; and it is almost certain that careful search by boring will reveal the presence of basins in this township such as are not now suspected to exist....Doubtless here, as elsewhere, the basins of coal are connected, and future explorations will result in tracing such connections south and east into other important deposits."

According to Newberry (1873, p. 214-216) all of southern Summit County should be underlain by the Pottsville formation. He is of the opinion that the Sharon coal is rather continuous in the southern part of the county and that it exists over a considerable portion of Springfield, Franklin, Green, and extends into Coventry and North Townships. The combined area of the Sharon coal bed in these townships is 115 square miles. Clark has estimated that 125 square miles of Summit County is underlain by minable quantities of the Sharon coal bed. It is suggested that a more realistic estimate would be 60 square miles with an estimated original reserve of 228,000,000 tons of coal. This revision is based on the fact that though the coal-bearing rocks once extended past the northern limits of the county, erosion has removed much of that strata, including the Sharon coal.

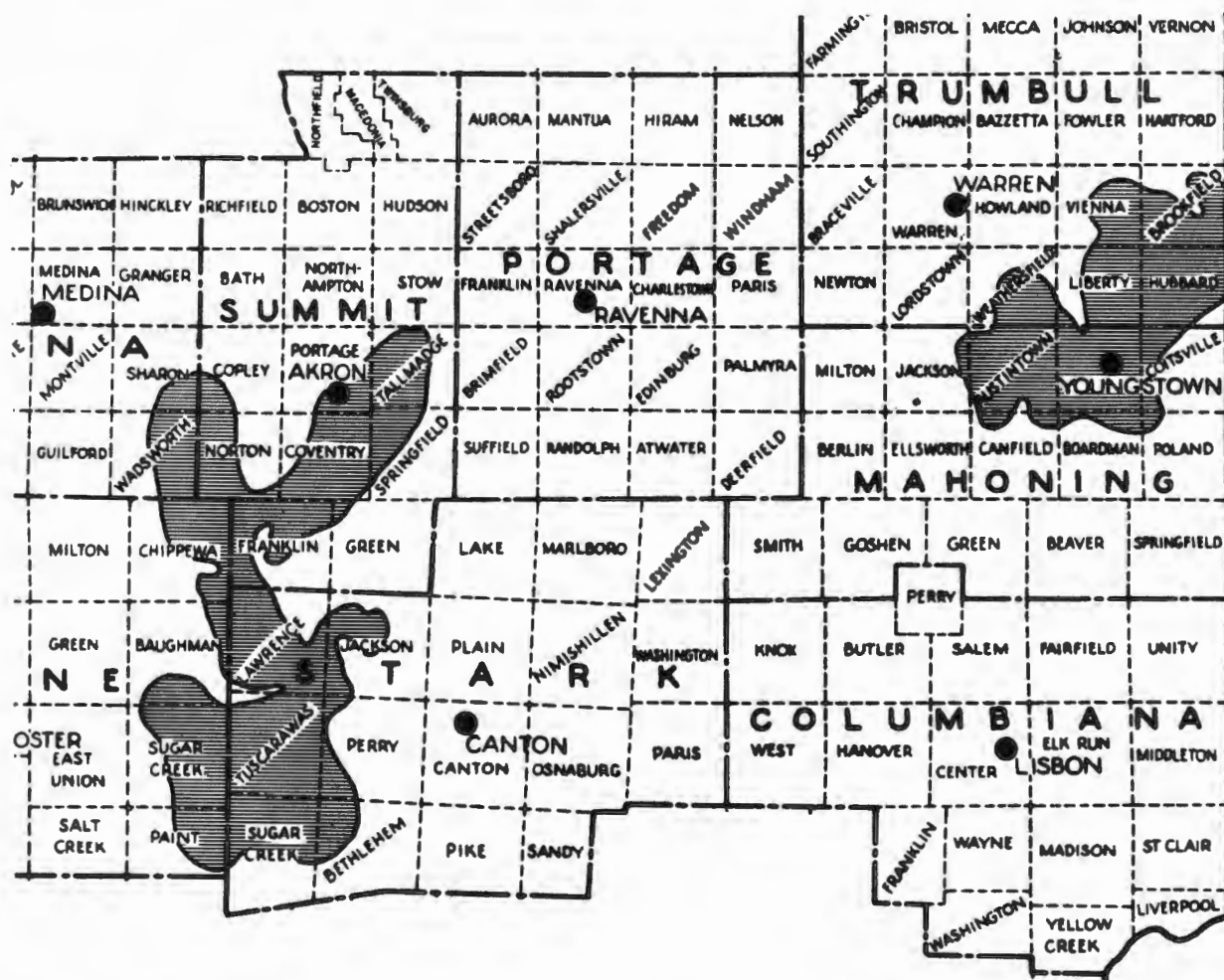


Figure 4. Generalized map of known major occurrences of minable Sharon (No. 1) coal in northern Ohio.

**Portage County.** - The Sharon coal bed exhibits the same thickness and quality as in neighboring Mahoning and Trumbull Counties where this coal is locally referred to as the "Briar Hill" and, therefore, became known in Portage County also as the "Briar Hill" coal. The coal was once mined in Deerfield, Atwater, and Randolph Townships, where its average thickness ranged from 3-1/2 to 4 feet. Newberry (1878c, p. 139) believed that the Sharon coal underlay most of Hiram, the western half of Shalersville and Ravenna, and the southwestern corner of Windham Townships.

Since a considerable portion of Portage County is believed to be underlain by coal-bearing rocks, and the land elevation in the central part of the county is high enough to permit the presence of even higher seams of coal, the author believes the estimate made by Clark is a fair appraisal (see table 1, p. 14).

**Geauga County.** - M. C. Read (1878, p. 521-522) in his geological report of Geauga County, describes a thin, narrow area of coal-bearing rocks along the east bank of the Cuyahoga River, extending from the southern county line to a point where the river curves around to the north of Burton. These strata include the Sharon coal bed and underlie the village of Burton and extend to the northern part of Burton Township.

The northernmost coal mine ever to operate in Ohio was located in Geauga County. This mine was on the Zeil Pfouts farm, 2.7 miles northwest of Burton. The coal mined was the Sharon, which averages 30 to 36 inches in thickness, with a maximum known thickness of four feet.

No estimates were made by either Clark or Ray for the Sharon coal bed mined in Geauga County, but a conservative estimate of the county would be about one square mile of minable Sharon coal, averaging 2-1/2 feet thick, for a total of some 2,880,000 tons.

### Mahoning Valley Field

The Mahoning Valley field of the Sharon coal bed includes the northern half of Mahoning, the southern half of Trumbull, eastern and southern Portage, southeastern Geauga, and parts of Columbiana Counties (fig. 4). The Sharon seam in this field is known as the "Briar Hill" or the "Mahoning" coal. The position of the Sharon coal in the Mahoning Valley field is from 20 to 50 feet above the Sharon conglomerate.

The Sharon coal in this field occupies a series of connected and disconnected basins, separated by intervals of barren territory. Previous to the deposition of the lowest coal seam, the older Mississippian rocks were extensively eroded, making the surface very irregular. It was in the basins and troughs of this surface that the Sharon conglomerate and Sharon coal were deposited.

Figure 5 is a sketch of the abandoned Crawford, Davis and Company coal mine in Hubbard Township, Trumbull County, as mapped by the company mining engineer and presented here to illustrate the irregular outline which characterized many of these swamps. The shaded area represents a mined out area of about 60 acres. The dashed lines indicate the probable extensions of unmined coal as depicted by Read (1873, p. 496). The unshaded portions represent territory lacking coal as shown by barren exploratory borings numbered 1 to 16. This drawing shows that the Pottsville coal basin swamps were very similar to certain surface marshes of the present day, where lakes and stream channels are continually being filled with plant debris. It can, therefore, be expected that the maximum thickness of coal would be towards the center of the old swamp.

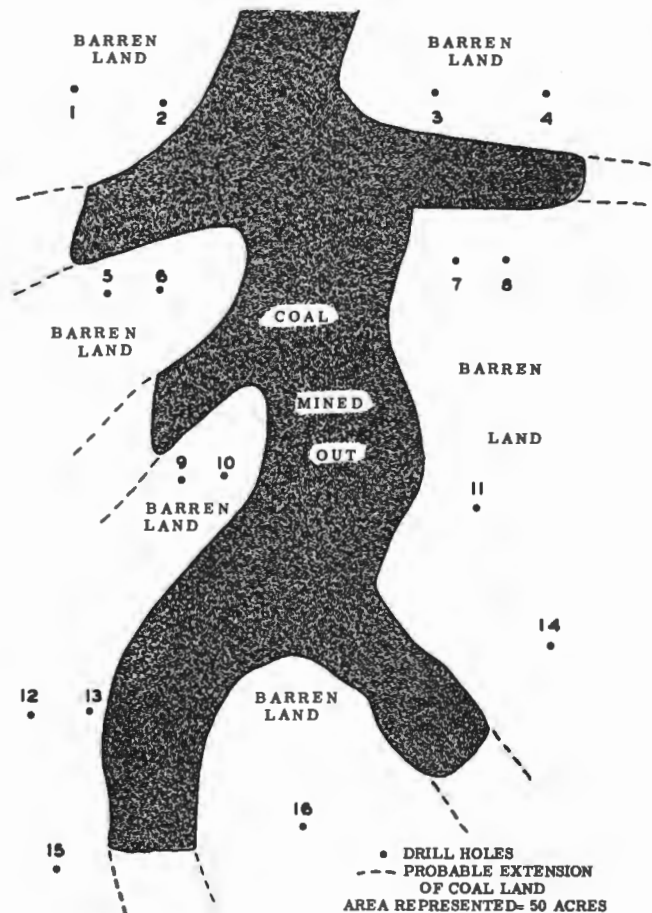


Figure 5. The abandoned Crawford, Davis mine, Hubbard Township, Trumbull County. (After Read, 1873, p. 496.)

Columbiana County. - The Sharon coal has been penetrated by borings and old salt wells in the Bull Creek and Little Beaver Creek Valleys. Some of these wells and borings near Elkton, Elk Run Township, encountered from 4 to 9 feet of Sharon coal approximately 150 feet below the bed of Little Beaver Creek.

Actual mining of the Sharon coal has never been reported for Columbiana County, though it is within the once productive Mahoning field and the occurrence of Sharon coal in the county has been reported in drill holes and salt wells. The depth of the test borings and wells indicate that the coal is under deep cover, but no new quantitative evidence can be found to show the extent of the Sharon coal in Columbiana County.

Clark's estimates for the Sharon coal in Columbiana County are as follows: average thickness, 2 feet; area, 30 square miles; tons per square mile, 2,304,000; total tonnage, 69,000,000.

Mahoning County. - The Sharon coal bed, known locally as the "Briar Hill" or "Mahoning" coal, extends over most of Austintown and Youngstown Townships. It has been extensively mined and reaches its best development in these two townships. It averages approximately 5 feet thick in Youngstown Township and about 4 feet in Austintown Township. The Sharon bed has also been worked in parts of Boardman, Poland, Coitsville, Canfield, and Jackson Townships.

Excavations for the Ohio Turnpike exposed Sharon coal in a roadcut on the west side of the turnpike near the underpass in the north-central part of Jackson Township about 1-1/2 miles east of Jackson Center. Twenty-seven inches of clean, bright, blocky coal were observed at an elevation of 995 feet. In a quarry southwest of Young's School in the southwest corner of Jackson Township, 25 inches of bright, blocky, Sharon coal was observed at an elevation of 952 feet.

Recent drillings for oil and gas in Mahoning County have revealed the presence of Sharon coal in several additional localities. At two locations in section 8, Beaver Township, 3 feet of Sharon coal was noted 195 feet below the surface. In section 18 of the same township, 4 feet of Sharon coal were identified 216 feet below the surface. At two locations in section 23, Green Township, 3 feet of Sharon coal was identified at a depth of 225 feet below the surface. Two feet of Sharon coal were encountered 210 feet below the surface in section 14, Green Township. Two wells in section 11, Goshen Township, passed through 2 feet of Sharon coal 220 feet below the surface. Sharon coal occurs in the northeast corner of Berlin Township, where 5 feet of coal was penetrated 200 feet below the surface.

Clark (1917, p. 93) estimated the Sharon coal in Mahoning County to average 2 feet 5 inches in thickness, to extend over an area of 100 square miles, and to produce approximately 2,784,000 tons per square mile for a total of 278,000,000 tons original reserves. Although Mahoning County was one of the major producers of Sharon coal in the Mahoning field, nearly all mining was limited to Austintown and Youngstown Townships with a combined total land area of 60.2 square miles. It is the author's opinion that Clark's estimates of 100 square miles and 278,000,000 tons may be too great and should be reduced to about 50 square miles and suggests an estimated original reserve tonnage of 139,000,000 tons.

Trumbull County. - The Sharon coal in Trumbull County is the same coal mined near Sharon in western Pennsylvania, hence the name. Known as the "Briar Hill," "Mahoning Block," or "Blackband" coal, it was extensively mined in this county for a number of years.

The Sharon coal bed occurs as two benches over a considerable area of southern Weatherfield Township, Trumbull County, and in the northwestern part of Austintown Township, Mahoning County. These benches are separated by a continuous stratum of good quality blackband ore, capped by a layer of black shale, both of which were worked with the coal for many years. The lower bench is the "typical" bright, blocky, high quality Sharon coal, running from 1 to 2 feet in thickness. The upper bench has more of a pitchy luster and averages from 2-1/2 to 3 feet in thickness (Newberry, 1878b, p. 790). The coal occurs about 80 to 150 feet below the surface and was mined both by shaft and slope methods (Read, 1873a, p. 499).

It is felt that both Ray and Clark underestimated the original reserve of Sharon coal in Trumbull County for strata associated with the Sharon coal bed underlie most of southern and southeastern Trumbull County. In addition, according to production records, more Sharon coal was actually mined than Ray originally estimated; therefore, the original estimates have been revised to 65 square miles and 149,760,000 tons original reserves. Although this estimate is considerably greater than Clark's (see table 1), justification is made on the basis of the rather concentrated early mining that took place in the area. The abandoned mines indicate that an area of some



130 square miles potentially contains the coal, however, because of the patchy nature of the coal, the actual area of minable coal is estimated at half this, or 65 square miles.

#### Miscellaneous Fields

Licking County. - M. C. Read (1878c, p. 357) reported the presence of Sharon coal in sufficient thickness to be mined for local consumption at several localities in Licking County. At a mine located in Madison Township, about two miles southeast of Newark, 30 inches of blocky Sharon coal was reported to be present. In Falls-bury Township (Read, 1878c, p. 349) this same coal bed appears in two benches as a very good, hard, bright, blocky coal varying from 2-1/2 to 3 feet in thickness.

Clark was of the opinion that the Sharon coal in Licking County would average 2 feet in thickness, cover an area of 15 square miles, and yield 2,304,000 tons per square mile for a total of 35,000,000 tons of estimated reserves. Evaluation of the data for the Sharon coal reportedly mined from such limited areas in Licking County suggests Clark's estimates are somewhat optimistic. An estimate of 7 square miles with 15,000,000 tons reserve would be more realistic as suggested by the presently available data.

Hocking County. - The Sharon coal bed, known locally, as the "eight-foot vein," is not of great value in Hocking County. In the Hocking Valley coal field, the Sharon coal generally lies about 100 feet below the Lower Mercer limestone (Orton, 1884b, p. 991).

The Sharon coal is best developed in Washington Township where a few mines once operated. Outcrops of bony to bright Sharon coal, measuring 16 inches or more in thickness, have been measured in Marion Township. Estimates have not been made for the Sharon coal in this county.

Muskingum County. - The Sharon coal bed in Muskingum County is generally a dark carbonaceous shale or a bony coal. It is believed to occur in parts of Newton, Hopewell, Licking, Falls, and Jackson Townships, but has been observed only in Licking and Jackson Townships. The Sharon coal reaches a thickness of nearly 4 feet at various points along Waupatomaka Creek in the northwestern part of Jackson Township.

Clark estimated the average thickness of the Sharon coal in Muskingum County to be 2 feet 3 inches. He estimates that 5 square miles of Muskingum County is underlain with this thickness of coal, containing 2,592,000 tons of coal per square mile for a total of 13,000,000 tons original reserves. These estimates may be accepted as fairly reasonable, though not a true indication of the coal's economic value.

Ashland County. - A narrow extension of coal-bearing strata extend along the southeastern end of Han-over Township into Knox County. This coal was reported by M. C. Read (1878, p. 524) to have been the Sharon coal bed, mined by drifting, and of excellent quality. Estimates of the Sharon coal in Ashland County are not available.

Coshocton County. - The Sharon coal bed was reported by Hodge (1878, p. 568) as being formerly mined in Coshocton County. Southeast of Princeton, Monroe Township, this coal bed measures 3 feet, appears to be partly camel, and is overlain by slaty sandstone.

The Sharon coal was mined southeast of central Perry Township where it is from 2-1/2 to 3 feet thick. According to Hodge (1878, p. 580) the coal on the whole is of excellent quality, quite free from sulphur, and

TABLE 1

## ESTIMATES OF THE ORIGINAL SHARON NO. 1 COAL RESERVES IN OHIO

County	Average Thickness <sup>1</sup>		Area (square miles)	Tonnage	
	Feet	Inches		Per square mile	Total (rounded)
By F. R. Clark (1917)					
Columbiana	2	-	30	2,304,000	69,000,000
Coshocton	2	-	10	2,304,000	23,000,000
Holmes	2	-	50	2,304,000	115,000,000
Jackson	2	7	40	2,976,000	119,000,000
Licking	2	-	15	2,304,000	35,000,000
Mahoning	2	5	100	2,784,000	278,000,000
Medina	3	2	20	3,648,000	73,000,000
Muskingum	2	3	5	2,592,000	13,000,000
Portage	2	2	30	2,496,000	75,000,000
Stark	3	2	135	3,648,000	492,000,000
Summit	3	2	125	3,648,000	456,000,000
Trumbull	2	-	10	2,304,000	23,000,000
Wayne	4	8	40	5,376,000	215,000,000
Total	-	-	610	-	1,986,000,000
By F. A. Ray (1927) <sup>2</sup>					
Medina	3	-	5	2,880,000	14,400,000
Portage	3	-	5	2,880,000	14,400,000
Stark	3	-	11	2,880,000	31,680,000
Summit	3	-	3	2,880,000	8,640,000
Trumbull	3	-	2	2,880,000	5,760,000
Vinton	3	-	1	2,880,000	2,880,000
Wayne	3	-	5	2,880,000	14,400,000
Total	-	-	32	-	92,160,000
By J. A. Granchi (1957)					
Geauga	2	6	1	2,880,000	2,880,000
Jackson	2	7	40	2,976,000	119,000,000
Licking	2	-	7	2,142,000	15,000,000
Mahoning	2	5	50	2,780,000	139,000,000
Medina	3	2	20	3,648,000	73,000,000
Muskingum	2	3	5	2,592,000	13,000,000
Portage	2	2	30	2,496,000	75,000,000
Stark	3	2	135	3,648,000	492,000,000
Summit	3	2	60	3,800,000	228,000,000
Trumbull	2	-	65	2,300,000	149,760,000
Wayne	4	8	40	5,376,000	215,000,000
Total	-	-	453	-	1,521,640,000

<sup>1</sup> Pertains only to area of minable thickness.<sup>2</sup> Average thickness given by Ray for entire Sharon area rather than for each county.

has open burning characteristics, though part of it appears to be of a slaty cannel structure intermixed with mineral charcoal.

Hodge (1878, p. 570) also reports Sharon coal in an outcrop about two miles southwest of Bloomfield near a small branch of Killbuck Creek. An 18-inch thick outcrop of what is believed to be the Sharon coal was observed in the steep hill extending from Newcastle to the Walhonding River in Newcastle Township. Hodge (1878, p. 576) believed that the Sharon coal might be present in the northern half of Jefferson Township. Other likely places where minable thicknesses of the Sharon coal might be found are: ".....at the base of the great massive sandstone bed, and between that and the Waverly shales, for about 200 feet above the Mohican River (in Tiverton Township).....in the deep runs below Tiverton Center, and on the slope of the steep hill down to the Mohican River" (Hodge, 1878, p. 568, 569). The coal has been recognized by Lamborn (1954, p. 39) lying immediately above the Harrison member along the south bank of the Walhonding River, 1-1/2 miles west of Warsaw Junction, Jefferson Township.

F. R. Clark (1917, p. 91) assumes an average thickness of 2 feet underlying an area of 10 square miles for the Sharon coal in Coshocton County and estimates the original coal reserves to be 23,000,000 tons. Data from drilling records and more recent geologic work suggests that Clark's estimates are too high.

The Ohio Department of Industrial Relations, in its Annual Coal and Non-Metallic Mineral Report (1953, p. 25), reported that 82 tons of Sharon coal were mined in Coshocton County during 1953. Because records regarding thickness of the coal bed are incomplete, and in part in doubt, reserves of Sharon coal in Coshocton County are not estimated at this time.

## SUMMARY OF THE SHARON COAL RESOURCES

The estimate of original reserves of Sharon coal bed in Ohio, according to Clark, totals 610 square miles and 1,986,000,000 tons. Ray, on the other hand, maintained that there are only about 32 square miles of proven Sharon coal with an estimated total of 92,160,000 tons of run-of-mine recoverable Sharon coal. A review of the former estimates suggests that a reserve estimate somewhat less than Clark's and substantially more than Ray's would be more reasonable. It is, therefore, proposed that an area of 453 square miles and 1,521,640,000 tons of Sharon (No. 1) coal be accepted as an original reserve value (see table 1). Records show that 450,334 tons of Sharon coal has been mined in Ohio during the past ten years.

## THE QUAKERTOWN NO. 2 COAL BED

### INTRODUCTION

The Quakertown (No. 2) coal bed was named in 1879 by I. C. White for exposures of this coal along Quakertown Run, Mahoning Township, Lawrence County, Pennsylvania. This coal is present in Ohio from Scioto County on the south to Mahoning County on the north (fig. 6).

The first Ohio discovery of Quakertown coal was in 1872 when a shaft was sunk for the Sharon coal at the site of the present village of Wellston. The Quakertown coal became known locally as the "Wellston," "Jackson Hill," and the "Elk Fork" coal.

## STRATIGRAPHIC RELATIONSHIPS

The Quakertown coal lies near the middle of the Pottsville formation, 60 to 80 feet above the Sharon coal, or 25 to 40 feet above the Sciotoville clay and from 90 to 110 feet below the Lower Mercer limestone. The coal bed is overlain, and in many places entirely replaced, by the Massillon sandstone (Stout, 1927, p. 82).

## CHARACTERISTICS

The Quakertown coal bed is practically free from shale or clay partings and from pyrite nodules and bands. The mined coal is clean and bright and does not show much discoloration upon exposure to the air. It is a free-burning coal, ignites readily, has a long-lasting flame, and desirable heating qualities. The coal produces little smoke, little ash, and practically no soot. Stout ranked the Quakertown coal as one of the best domestic coals in the State and placed it on a par with the best coals of West Virginia and Pennsylvania. It is reputed to be one of the best in the country for burning ceramic ware, even surpassing the famous West Virginia coals (Stout, 1916, p. 111, 112).

Other favorable features of the Quakertown coal facilitate its mining. The roof material is usually a thick, tough shale, but in a few localities a sandstone forms the roof. This shale forms a satisfactory roof, allowing a high percentage of the coal to be mined. Draw slate and horsebacks occur rarely, though local rolls and dips are occasionally encountered. The floor material is a rather hard siliceous clay, which does not tend to produce a plastic mud along the haulways and also provides a firm footing for posts and pillars. The high quality of the coal, freedom from partings, and character of the roof and floor enable the Quakertown coal bed to be mined at a low cost, even where the stratum is thin.

## GEOGRAPHIC EXTENT

The Quakertown coal bed crops out and has been mined in Scioto, Jackson, Vinton, Perry, Muskingum, Coshocton, Holmes, Wayne, Stark, Summit, and Mahoning Counties. This coal is beneath drainage farther east in the other coal-bearing counties.

## DESCRIPTION BY COUNTY

Lawrence County. - The Quakertown coal has been noted in a few drill records for Lawrence County. These records suggest that the coal bed is thin, but a mine formerly active in Hamilton Township operated in a three-foot seam of this coal.

Scioto County. - The southernmost extension of the Quakertown coal is in Scioto County. It lies about 35 feet above the Sciotoville clay and about 35 feet below the Bear Run coal bed. The stratum is generally thin in this county. The Quakertown coal attains its thickest development in Bloom Township where a maximum thickness of 22 inches occurs. In western Harrison Township the Quakertown coal horizon is marked by a thin bed of bright coal. It is reported to be about 6 inches thick in parts of Vernon and Porter Townships.



Figure 6. Generalized map of known major occurrences of minable Quakertown (No. 2) coal in Ohio.

**Jackson County.** - The Quakertown coal, sometimes known as the "Welston" or Jackson Hill" coal, attains its maximum development for the State in Jackson County. It lies from 80 to 100 feet above the Sharon coal bed, with an average interval of 90 feet separating the two coal beds. The Quakertown coal underlies Liberty, Coal, Jackson, Lick, Milton, Washington, Franklin, Hamilton, and Scioto Townships, and ranges in thickness from a six-inch blossom to over four feet.

This coal is still mined in Jackson County. The 1954 Ohio Annual Coal and Non-Metallic Mineral Report listed six mining operators producing a total of 2,045 tons of Quakertown coal. During the past ten years, 48,698 tons of the coal were reported mined in Jackson County (Ohio Annual Coal and Non-Metallic Mineral Reports, 1946-1955). Clark's (1917, p. 92) estimate of 369,000,000 tons original reserves is considered reasonable.

**Vinton County.** - In Vinton County, the Quakertown coal is above drainage in eastern Eagle, Jackson, western Swan, eastern Harrison, western and central Richland, and central Elk Townships. For many years the coal has been mined by shafting and drifting in all of these townships. It is best developed in Harrison, Elk, Richland, and Jackson Townships where it ranges from sixteen inches to four feet in thickness.

Nearly 20,000 tons of Quakertown coal has been mined in Vinton County during the past ten years (Ohio Annual Coal and Non-Metallic Mineral Reports, 1946-1955). Clark's estimate of 269,000,000 tons original reserves is considered reasonable.

Hocking County. - The Quakertown coal bed occurs in two benches about 2 feet in thickness some 45 feet below the Lower Mercer limestone. This two-bed coal was formerly mined in section 30, Falls Gore Township. The Quakertown coal also crops out in other parts of Falls and Marion Townships where it measures 3 to 12 inches in thickness, but the average for the county is about 7 inches.

Perry County. - The Quakertown coal in Perry County ranges from bright, lustrous coal to a mixture of bright and bony coal or fissile carbonaceous shale. This coal occurs from two to fifty feet above the Maxville limestone. It ranges from a few inches to over three feet in thickness. Its thickest development is in Madison Township where this coal bed measures over three feet thick. A total of 2,880,000 tons original reserves is estimated for the Quakertown coal bed in Perry County.

Muskingum County. - The Quakertown coal in Muskingum County is very thin and is frequently replaced by the overlying Massillon sandstone. The Quakertown coal is above drainage in Newton, Hopewell, Falls, Licking, Jackson, and Cass Townships. In these townships it ranges in thickness from a few inches to almost three feet. Its best development is in Jackson Township. Clark's 12,000,000 tons original reserve estimates are deemed reasonable.

Coshocton County. - The Quakertown coal crops out in the western part of Coshocton County in parts of Tiverton, Newcastle, Perry, Pike, Monroe, Jefferson, Bedford, Washington, Clark, and Bethlehem Townships. The coal is represented by a few inches of black shale or thin coal overlying a thin bed of tough, dark, siliceous clay. It is overlain, and in some areas entirely replaced, by the Massillon sandstone.

The Quakertown coal has been reported mined for local use. Lamborn (1954, p. 43), in his report on Coshocton County, makes the following statement: "Outcrops of the Quakertown member in Coshocton County do not indicate a coal bed of any economic importance for fuel. If minable coal occurs on this horizon, its location and extent must be determined by test drilling." However, the author believes there are local commercial deposits and estimates 6,912,000 tons original reserve.

Holmes County. - The Quakertown coal, known locally as the "Welcome" coal, lies near the base of the Pottsville formation in this county. In most places it is only five to ten feet above the Pottsville-Logan contact and 70 to 80 feet below the Lower Mercer limestone. It is commonly overlain and locally replaced by the Massillon sandstone.

In Holmes County the Quakertown coal bed ranges in thickness from a mere streak to over 2-1/2 feet. It may be expected above drainage in every township except Paint, Walnut Creek, and Clark (White, G.W., 1949, p. 69). Thin outcrops of the Quakertown coal have been observed in western Salt Creek, southeastern Washington, central Knox, central Mechanic, and central Killbuck Townships. It is thicker in Monroe, north central Prairie, northern Killbuck, southeastern Hardy, and northwestern Richland Townships. The bed is deeply buried in Berlin, Walnut Creek, and Clark Townships.

Since the Quakertown coal is patchy and often replaced by sandstone in Holmes County, Clark's (1917) estimate of 127,000,000 tons original reserves is thought to be excessive. The author considers 58,600,000 tons a more conservative reserve tonnage.

Wayne County. - The Quakertown coal in Wayne County is locally known as the "rider" seam of the Sharon coal because the Quakertown member is usually penetrated in drilling for the Sharon coal. In this county 55 to 65 feet of gray sandstone and shale separate the Quakertown coal from the Sharon coal below. Its thickness ranges from a few inches to about 2-1/2 feet (Comrey, G.W., 1921, p. 98). The thickest occurrence of Quakertown coal in Wayne County (averaging 2-1/2 feet thick) is found in Baughman, Chippewa, Sugar Creek, Clinton, and Franklin Townships.

Comrey (1921, p. 100), in his Wayne County report, states: "The recognition of the Quakertown coal when away from its association with the Sharon bed is difficult. In the southern part of the county there are at a number of places thin coal beds near the base of the Pennsylvanian that probably are the equivalent of this bed, but with no guide rocks the identification cannot be satisfactorily made." The Quakertown coal, although more persistent in lateral extent than the underlying Sharon and Anthony coal beds, locally grades into shale. This was noted in Sugar Creek Township, where the underclay interval is represented by a clay-bonded, fine-grained sandstone (Multer, 1955, p. 32).

Estimates have not previously been made for the Quakertown coal bed in Wayne County, but the author suggests an estimate of 5,184,000 tons original reserves.

Stark County. - The Quakertown coal in Stark County lies immediately below the Massillon sandstone. It usually exists as a thin seam, 12 to 18 inches thick, and is known to oil well drillers as the "Fifteen-inch seam" (Newberry, 1878e, p. 167). No mines have been reported operating in the seam within the county.

Clark's (1917, p. 94) estimate of 46,000,000 tons original reserves for the Quakertown coal in Stark County appears unaccountably high, for nowhere in the county are there sufficient thicknesses of this coal known to warrant even a very conservative estimate.

Summit County. - The Quakertown coal bed, which is generally thin, only 12 to 18 inches thick, and locally absent, is found thirty to fifty feet above the Sharon coal bed in Summit County.

This coal is often referred to as the "Fifteen-inch seam" (Newberry, 1874, p. 136). Though persistent over most of the county, the Quakertown coal has little economic value.

Mining activities in this coal have never been reported. Clark estimated an average thickness of 2-1/2 feet. From more recently available data, the author believes that Clark's 86,000,000 tons estimated reserve is too great and that no estimate is justified for Quakertown coal reserves in Summit County.

Mahoning County. - The Quakertown coal in Mahoning County, found fifty to eighty feet above the Sharon coal, is local in extent and very thin. Outcrops are present in Coitsville Township along Dry Run. The coal here is only 4 to 10 inches thick. At Mill Creek Park, west of Hiawatha Flats in Youngstown, an outcrop has been observed that measured 17 inches in thickness.

Reasonable estimates are impossible because of the thin and discontinuous nature of the coal.

Trumbull County. - The Quakertown coal in Trumbull County is found about 45 feet above the Sharon coal. Although persistent over most of the county, nowhere does the bed attain sufficient thickness for mining, the coal is never over 18 inches and generally less than one foot in thickness (Read, 1873, p. 499-500). Estimates of reserves are not warranted for the Quakertown coal bed in this county.

## SUMMARY OF THE QUAKERTOWN COAL RESOURCES

Clark's original estimates for the Quakertown coal is for a total of 315 square miles and 909,000,000 tons original reserves. Ray's estimates covers three counties with a total of 32 square miles and 82,944,000 tons original reserves. Evaluation of information collected since Clark's and Ray's estimates were published has been compiled for ten counties totaling 247 square miles and 732,792,000 tons original reserves. The following table presents a county breakdown for the various estimates.

TABLE 2

## ESTIMATES OF THE ORIGINAL QUAKERTOWN (NO. 2) COAL RESERVES IN OHIO

County	Average Thickness <sup>1</sup>		Area (square miles)	Tonnage	
	Feet	Inches		Per square mile	Total (rounded)
By F. R. Clark (1917)					
Holmes	2	-	55	2,304,000	127,000,000
Jackson	2	8	120	3,072,000	369,000,000
Muskingum	2	-	5	2,304,000	12,000,000
Stark	2	-	20	2,304,000	46,000,000
Summit	2	6	30	2,880,000	86,000,000
Vinton	2	9	85	3,168,000	269,000,000
Total	-	-	315	-	909,000,000
By F. A. Ray (1927)					
Hocking	2	7	3	-	7,776,000
Jackson	2	7	25	-	64,800,000
Vinton	2	7	4	-	10,368,000
Total	-	-	32	-	82,944,000
By J. A. Granchi (1957)					
Coshocton	2	-	3	2,304,000	6,912,000
Hocking	1	6	3	1,728,000	5,184,000
Holmes	2	-	25	2,304,000	58,600,000
Jackson	2	8	120	3,072,000	369,000,000
Lawrence	2	-	1	2,304,000	2,304,000
Muskingum	2	-	5	2,304,000	12,000,000
Perry	2	6	1	2,880,000	2,880,000
Scioto	1	6	1	1,728,000	1,728,000
Vinton	2	9	85	3,168,000	269,000,000
Wayne	1	6	3	1,728,000	5,184,000
Total	-	-	247	-	732,792,000

<sup>1</sup>Pertains only to area of minable thickness.



## THE MERCER COAL BEDS

### INTRODUCTION

There has been much misinterpretation in the literature concerning the naming and stratigraphic position of the limestones associated with the Mercer coal beds. Thus, a review of figure 2 (p. 4) may be appropriate in orientating oneself with the stratigraphic positions of the various members of the Mercer coal beds. Professor Andrews, in his study of the Mercer limestones and coal, pronounced the Lower Mercer limestone to be a guide to the stratigraphic position of the rocks below it everywhere in Ohio.

### THE LOWER MERCER (NO. 3) COAL BED

#### Stratigraphy and Extent

The Lower Mercer coal was named by I. C. White (1879, p. 62) for exposures of a thin bed of impure coal occurring from 0 to 18 feet below the Lower Mercer limestone in Lawrence County, Pennsylvania. In Ohio this coal is 15 to 55 feet below the Lower Mercer limestone. The Lower Mercer (No. 3) coal bed is present with a moderate degree of persistence across Ohio from Scioto County to Mahoning County. Though it appears to be best developed in Lawrence, Scioto, Jackson, Vinton, and Mahoning Counties, this coal also occurs in Hocking, Perry, Licking, Muskingum, Guernsey, Coshocton, Holmes, Wayne, Tuscarawas, Jefferson, Columbiana, Stark, Summit, and Portage Counties.

#### Characteristics

The Lower Mercer coal seam in Ohio is variable and changes from a carbonaceous shale less than a foot thick to a medium-quality, minable coal bed over four feet in thickness. Marked changes, both in quality and thickness occur within small areas. Locally it assumes a cannel nature, and near the eastern border of Ohio it is usually a coking bituminous coal from 2 to 4 feet thick, moderately pure, but containing considerable sulphur (Newberry, 1874, p. 137).

#### Description by County

Scioto County. - In Scioto County the Lower Mercer coal is reported to lie about 45 feet above the Vandusen coal. The coal has been mined for local use in Green, Porter, Vernon, and Bloom Townships where the average thickness of the coal is between one and two feet.

Lawrence County. - The Lower Mercer coal bed in Lawrence County is commonly called the "Kelleys Mills" coal. It lies about 45 feet below the Lower Mercer limestone. The coal bed, 1-1/2 feet thick, has been mined in Hamilton and Elizabeth Townships (Stout, 1916, p. 291). The Lower Mercer coal passes below drainage near Hanging Rock, Hamilton Township.

Jackson County. - The Lower Mercer coal in Jackson County is present as a series of carbonaceous shales and thin coal bands, but it is sufficiently thick for mining in a few localities. It ranges in thickness from 2 to 4 feet. The Lower Mercer coal, in the southern part of the county, lies from 35 to 55 feet below the Lower Mercer limestone, and about 25 feet below the Lower Mercer limestone in the northern part of the county. The coal bed

has been either locally mined or reported to be present in Hamilton, Scioto, Franklin, Lick, Coal, and Washington Townships.

Vinton County. - In Vinton County, the position of the Lower Mercer coal is from 15 to 40 feet below the Lower Mercer limestone. The Lower Mercer (No. 3) coal is reported to be present locally above drainage in western Brown, Swan, Jackson, Elk, Richland, and western Clinton Townships, but is of minable thickness only in Swan and Richland Townships. Generally the coal is thin but ranges in thickness from an inch to four feet. The lack of data prevents the calculation of estimates.

Hocking County. - The Lower Mercer coal bed in Hocking County may occur from 0 to 20 feet below the Lower Mercer limestone. This coal is locally referred to as the "Price" coal. It is reported to be present in parts of Benton, Falls, Falls Gore, Marion, Starr, and Washington Townships.

The Lower Mercer coal varies in thickness and quality from a one-inch bony coal to a "good" blocky 42-inch coal. Due to the meager knowledge of the Lower Mercer coal in Hocking County, Clark's (1917, p. 92) estimate of 104,000,000 tons original reserve is too high. The author suggests that a realistic estimate is about one-third that of Clark's and, therefore, has revised the figure to 34,560,000 tons original reserve.

Perry County. - The Lower Mercer coal in Perry County varies from a carbonaceous shale to a bright, lustrous coal. It ranges in thickness from a paper-thin streak to 3-1/2 feet, but averages about one foot. In this county the coal is generally overlain by the Middle Mercer shale and sandstone. Flint (1951, p. 99) indicates that this coal bed has been mined locally. Data is very sparse but calculated reserves have been made (see table 3).

Muskingum County. - The Lower Mercer coal in Muskingum County lies about 24 feet below the Lower Mercer limestone. It is present above drainage in Newton, Hopewell, Springfield, Falls, Licking, Muskingum, Jackson, Cass, Jefferson, Washington, and Madison Townships. The coal seam is persistent throughout the county but rarely exceeds one foot in thickness.

Wilber Stout (1918, p. 69) in his evaluation of the Lower Mercer coal reports: "The Lower Mercer coal in Muskingum County is unimportant as a fuel supply. The only area that gives promise even of yielding coal for local consumption is a small field in northern Jackson Township of not more than 2 square miles, as the bed lies near the summits of the main ridges. The coal appears to be of good quality. Elsewhere the stratum is so impure that it is worthless for fuel, or so thin that it may only be mined cheaply along stream beds where the fuel is solid and the covering thin. In Muskingum County the average thickness of the bed will not exceed 8 inches, even when the impure layers are also considered." If the coal only averages 8 inches in thickness, then a revision of Clark's (1917) estimate is in order. Because data indicate that minable Lower Mercer coal in this county is very limited, Clark's 35,000,000 tons estimate is reduced to 4,600,000 tons estimated original reserves.

Licking County. - At Flint Ridge, Hopewell Township, the Lower Mercer bed is a cannel-type coal and is known as the "Flint Ridge Cannel." Orton (1878, p. 913) reported this as the best quality cannel coal in the State and that it had been mined for some time near Logan for the distillation of coal oil. Clark's estimates of 13,000,000 tons original reserve appear to be reasonable.

Coshocton County. - The Lower Mercer coal outcrops are extensive in Coshocton County. The coal is about 31 feet below the Lower Mercer limestone and 26 feet above the Vandusen coal. The coal bed appears above drainage in parts of every township west of the Muskingum River and north of the Tuscarawas River, but it

is best represented in Pike, Perry, Bedford, and Washington Townships (Lamborn, 1954, p. 53). This coal stratum lacks both persistence and quality, and nowhere is it known to be of sufficient thickness for mining. Where present, the seam consists of a thin coal, a carbonaceous shale, or a mixture of both, ranging in thickness from one inch to one foot.

Tuscarawas County. - The Lower Mercer coal bed in Tuscarawas County occurs about 150 feet above the Sharon coal. The coal is less than 18 inches thick and is not known to have been mined anywhere within the county. Information is insufficient to permit accurate reserve estimates.

Holmes County. - The Lower Mercer coal bed in Holmes County usually lies less than 25 feet below the Lower Mercer limestone; the average interval is about 23-1/2 feet (White, G.W., 1949, p. 90).

The thickest deposits of Lower Mercer coal in Holmes County have been found in southeastern Mechanic, east central Ripley, and central Monroe Townships, where thicknesses vary from one to three feet. Clark's (1917) estimate of 276,000,000 tons would seem unwarranted for the Lower Mercer coal bed in Holmes County. The author estimates 6,912,000 tons original reserves for the bed.

Wayne County. - M. C. Read (1878d, p. 535) reported that the Lower Mercer coal bed in Wayne County varies greatly in thickness and character. Outcrops of the coal have been observed in only a few localities. H. G. Multer (1955, p. 41) stated that the Lower Mercer cyclothem is present in every township of Wayne County containing Pennsylvanian rocks with the exception of Chippewa, Baughman, Milton, Wooster, and Wayne Townships. The coal is not sufficiently persistent to justify Clark's estimate of 86,000,000 tons original reserves being accepted. A more logical appraisal is 2,304,000 tons estimated reserve.

Stark County. - The Lower Mercer coal in Stark County rarely exceeds two feet in thickness and generally lies under deep cover some 150 to 200 feet above the Sharon coal. The Lower Mercer in Sugar Creek Township occurs as a bright, clean, partially open-burning coal ranging in thickness from 3 to 3-1/2 feet. This coal ranges in thickness from 4 to 42 inches in Tuscarawas, Lake, and Bethlehem Townships.

A revised estimate of 5,184,000 tons original reserve represents a considerable reduction from Clark's 125,000,000 tons estimate. This revision was necessary to bring the tonnage into line with the extremely sparse occurrences of minable thicknesses of this coal.

Summit County. - The Lower Mercer coal in Summit County lies from 130 to 160 feet above the Sharon coal. The coal is usually a very thin seam associated with a thick stratum of fire clay. The coal in Summit County is significant only as a stratigraphic guide in exploration for the lower coals. Lack of data prevents a definite estimate.

Portage County. - The Lower Mercer coal in Portage County lies from 150 to 200 feet above the Sharon, and from 30 to 50 feet below the Bedford coal. The bed in this county is somewhat irregular in thickness. It has been observed along a stream near the north-south road northwest of the Village of Atwater, but here it is only a few inches in thickness.

Clark's estimate of 23,000,000 tons original reserves is considered reasonable.

Mahoning County. - The Lower Mercer coal is often erroneously called the No. 2 coal in Mahoning County. This seam varies in thickness and quality and is found from 100 to 150 feet above the Sharon coal bed.

In the Mahoning River gorge near Lowellville, the Lower Mercer coal is well exposed and consists of half cannel and half bituminous coal, both of good quality. The coal ranges in thickness from one to three feet. The Lower Mercer coal attains its maximum known thickness of three feet in Green, Goshen, and Poland Townships.

The Lower Mercer coal bed is actively mined in Mahoning County. The 1954 Ohio Annual Coal and Non-Metallic Mineral Report listed the Davis Coal Company as producing 38,684 tons of this coal. The ten-year production total of Lower Mercer coal reported mined in Mahoning County is 160,621 tons. From the evidence at hand, Clark's (1917) estimate of 149,000,000 tons original reserves is correct.

Summary of the Lower Mercer Coal Resources

Original estimates of Lower Mercer coal in Ohio by Clark are: 680 square miles and 1,967,000,000 tons; revised estimates are: 119 square miles and 297,312,000 tons (see table 3).

The tonnage of Lower Mercer coal reported mined in Ohio during the past ten years was 507,715 tons, but this figure is believed to be inaccurate for some mine operators have mistaken other coal beds for that of the Lower Mercer.

TABLE 3

ESTIMATES OF THE ORIGINAL LOWER MERCER (NO. 3) COAL RESERVES IN OHIO

County	Average thickness <sup>1</sup>		Area (square miles)	Tonnage	
	Feet	Inches		Per square mile	Total (rounded)
By F. R. Clark (1917)					
Columbiana	2	4	175	2,688,000	470,000,000
Guemsey	2	2	40	2,496,000	100,000,000
Hocking	2	0	45	2,304,000	104,000,000
Holmes	3	0	80	3,456,000	276,000,000
Jefferson	2	7	50	2,976,000	149,000,000
Licking	2	4	5	2,688,000	13,000,000
Mahoning	2	7	50	2,976,000	149,000,000
Muskingum	2	0	15	2,304,000	35,000,000
Portage	2	0	10	2,304,000	23,000,000
Stark	2	2	50	2,496,000	125,000,000
Vinton	2	11	130	3,360,000	437,000,000
Wayne	2	4	30	2,880,000	86,000,000
Total	-	-	680	-	1,967,000,000
By J. A. Granchi (1957)					
Hocking	1	6	20	1,728,000	34,560,000
Holmes	2	0	3	2,304,000	6,912,000
Jackson	2	0	6	2,304,000	13,824,000
Lawrence	1	6	2	1,728,000	3,456,000

Table 3

Estimates of the original Lower Mercer (No. 3) coal reserves in Ohio (continued)

County	Average thickness <sup>1</sup>		Area (square miles)	Tonnage	
	Feet	Inches		Per square mile	Total (rounded)
Licking	2	4	5	2,688,000	13,000,000
Mahoning	2	7	50	2,976,000	149,000,000
Muskingum	2	0	2	2,304,000	4,600,000
Perry	2	0	1	2,304,000	2,304,000
Portage	2	0	10	2,304,000	23,000,000
Scioto	1	6	6	1,728,000	10,368,000
Stark	1	6	3	1,728,000	5,184,000
Vinton	2	6	10	2,880,000	28,800,000
Wayne	2	0	1	2,304,000	2,304,000
Total	-	-	119	-	297,312,000

<sup>1</sup> Pertains only to area of minable thickness.

### THE UPPER MERCER (NO. 3a) COAL BED

#### Stratigraphy and Extent

The Upper Mercer coal bed occurs midway in the interval between the Lower Mercer limestone and the Upper Mercer limestone. This coal bed crops out from Scioto County to Mahoning County (fig. 7), being a discontinuous, erratic member and lacking prominence in the northern and east central parts of the State. The Upper Mercer coal bed is thickest in southern Jackson, northeastern Scioto, and northern Lawrence Counties.

#### Characteristics

The Upper Mercer coal bed is generally thin, seldom reaching one foot in thickness, but is of fairly good quality. It is high in volatile matter, low in sulphur and ash content, and burns freely with a long flame. The coal bed is relatively free from shale and pyrite partings, quite broken by joint planes, and usually occurs as one bench. Generally, the roof is a bluish shale, sufficiently tough and solid for safe, efficient mining of the coal.

#### Description by County

Lawrence County. - The Lawrence County Upper Mercer, locally named the "Webster Block," coal bed occurs about midway in the interval between the Lower and Upper Mercer limestones. The coal bed is persistent, but in only a few areas does it attain sufficient thickness for mining. It is well developed and mined for local use in Hamilton, Elizabeth, Decatur, and Washington Townships. In these townships the thickness ranges from 1 to 3-1/2 feet. Because coal of minable thickness has been reported for only a few places in the county, Clark's (1917) estimate of 253,000,000 tons has been revised to an original reserve of 43,200,000 tons.



Figure 7. Generalized map of known major occurrences of minable Upper Mercer (No. 3a) coal in Ohio.

Scioto County. - As in neighboring Lawrence County, the Upper Mercer, or "Webster Block," coal bed of Scioto County is found in the interval between the Lower and Upper Mercer limestones (see fig. 2). The coal is of minable thickness in Bloom, Vernon, and Green Townships and ranges from less than 1 foot to 3-1/2 feet thick.

The following analysis is for a sample collected in the northeast quarter of section 22, Bloom Township, Scioto County, and is typical of the Upper Mercer coal bed for Scioto County (Bownocker and Dean, 1929, p. 24).

	Ultimate Analysis		Proximate Analysis	
	As Received Percent	Moisture Free Percent	As Received Percent	Moisture Free Percent
Carbon . . . . .	69.28	77.16	Moisture . . . . .	10.22
Hydrogen . . . . .	5.39	4.73	Volatile matter . .	40.82
Oxygen . . . . .	19.62	11.76	Fixed carbon . . .	45.69
Nitrogen . . . . .	1.53	1.70	Ash . . . . .	3.27
Sulphur . . . . .	0.91	1.01		
Ash . . . . .	3.27	3.64		
	<u>100.00</u>	<u>100.00</u>		
			100.00	100.00

		<u>As Received</u>	<u>Moisture Free</u>	
Heating Value	{	Calories . . . . .	6,894	7,679
		B. t. u. . . . .	12,409	13,822
Fusion of Ash	{	Incipient . . . . .	2,444° F.	
		Complete . . . . .	2,500° F.	

The present estimate of 23,000,000 tons original reserves represents a reduction of 7,000,000 tons from the estimate of Clark (1917, p. 94).

Jackson County. - The Upper Mercer coal bed is locally known in Jackson County as the "Webster Block" coal (Stout, 1918, p. 91). The Upper Mercer coal bed has been found in parts of Hamilton, Jefferson, Scioto, Franklin, Bloomfield, Lick, Coal, Milton, and Washington Townships. The coal ranges from 2 to 30 inches in thickness but is thickest in local areas of Jefferson, Scioto, Lick, and Bloomfield Townships. Sufficient data is available to increase Clark's (1917) estimate of 15,000,000 tons to 17,280,000 tons original reserves.

Vinton County. - The Upper Mercer coal in Vinton County is found 24 feet above the base of the Lower Mercer limestone, 15 feet below the Upper Mercer ore, and 4 feet below the Sand Block ore, depending upon which unit is locally identifiable (Stout, 1927, p. 137). The coal bed is thin and is not known to exceed a foot and a half in thickness. It is found in western Brown, Swan, eastern Jackson, eastern Richland and Clinton Townships.

The author's estimated original reserve of 25,920,000 tons represents only ten percent of Clark's (1917, p. 95) 259,200,000 tons estimate.

Hocking County. - The Upper Mercer horizon appears as a smut streak or as a few inches of shaly coal in parts of Benton and Falls Gore Townships. The bed is found about 30 feet above the Lower Mercer limestone. This coal is not known to have been mined anywhere in the county. The estimated original reserve figure for this report is 3,456,000 tons for Hocking County, which is nearly 27,500,000 tons reduction from that of Clark (1917, p. 92).

Muskingum County. - Locally the Upper and Lower Mercer coal beds in Muskingum County lie stratigraphically close together. In such instances they are separated by only a foot or two of clay or shale. In other localities they are separated by many feet of strata.

The Upper Mercer coal bed lies above drainage in Newton, Hopewell, Springfield, Falls, Licking, Muskingum, Washington, Jackson, Cass, Jefferson, Madison, and Adams Townships. It is usually thin, exceeding one foot in thickness only in a few places. Present information indicates that the coal bed in Muskingum County is of no consequence as a reserve.

Coshocton County. - In Coshocton County the Upper Mercer coal bed occurs about 18 feet above the base of the Lower Mercer limestone and about 9 feet below the base of the Upper Mercer limestone. Exposures of the coal have been observed in Jefferson, Bethlehem, Mill Creek, and Crawford Townships. This coal member is generally thin, ranging from a few inches to 1-1/2 feet in thickness, and is often present as shaly coal interstratified with carbonaceous shale.

Lamborn (1954, p. 77) sums up the Upper Mercer coal bed in this fashion: "Owing to its limited occurrence, thin development, and generally shaly character the Upper Mercer coal has little conceivable economic importance in Coshocton County." In view of the fact that a few measurements show minable thicknesses of coal, an original reserve of 3,456,000 tons is estimated for Coshocton County.

Tuscarawas County. - The Upper Mercer coal in Tuscarawas County lies above the Lower Mercer limestone. This coal is three feet thick in railroad cuts near Zoar Station. It is soft, of poor quality, and contains a great quantity of sulphur (Newberry, 1878f, p. 60).

During the past ten years 277,401 tons of Upper Mercer coal have been reported mined in Tuscarawas County. Available data indicate that Clark's (1917, p. 95) estimate of 17,000,000 tons original reserves is quite accurate.

Holmes County. - The Upper Mercer coal bed lies about 16 feet above the Lower Mercer limestone and is mappable only in the northeastern part of Holmes County. Elsewhere in the county the horizon of the Upper Mercer coal is occasionally represented by discontinuous lenses of coal or carbonaceous shale (White, 1949, p.122). Except for the extreme western part of Clark Township, the Upper Mercer coal bed horizon is below drainage.

Recent work (White, 1949, p. 121-125) in Holmes County fails to substantiate Clark's (1917) estimate of 146,000,000 tons original reserves. Because of the general shaly nature and thinness of this seam, no estimate for minable coal from the Upper Mercer bed is made in this report.

Wayne County. - M. C. Read (1878d, p. 535) reported the Upper Mercer coal bed in Wayne County to be a dry, semi-cannel coal of fair quality, developed to a thickness of nearly five feet near the east line of Salt Creek Township. It is apparently thin and wanting over the greater part of the county. However, data justifies the inclusion of 3,456,000 tons of estimated original reserves.

Stark County. - Exposures of the Upper Mercer coal in Stark County are sparse. The coal has been reported to occur in Sugar Creek, Pike, and Osnauburg Townships. Its thickness ranges from 10 to 12 inches, but it is not known to have been mined.

Mahoning County. - The Upper Mercer coal bed, locally called the "Bruce" and "Kirkpatrick" coal, lies 40 to 50 feet above the Lower Mercer coal bed. It crops out in only a few places but in some localities it has been reached by shafting. In the southern tier of townships the coal is generally below drainage. Throughout most of the county it is of minable thickness, sometimes as thick as four feet. In a gorge near Lowellville, on the north side of the Mahoning River, the Upper Mercer seam measures four feet thick (Newberry, 1878b, p. 795; Orton, 1884, p. 30-31).

Evaluating the data available it would seem that Clark's estimate for the coal bed in Mahoning County is rather optimistic (see table 4). With the present status of our knowledge it would probably be more reasonable to omit any estimate of reserves for the Upper Mercer coal bed at this time.

#### Summary of the Upper Mercer Coal Resources

Clark's total original reserve estimates of Upper Mercer coal in Ohio amounts to 482 square miles and 1,265,000,000 tons. The author's revised estimates are 70 square miles and 136,768,000 tons (table 4). The total of reported mined Upper Mercer coal during the past ten years is 315,411 tons.



TABLE 4

## ESTIMATES OF THE ORIGINAL UPPER MERCER (NO. 3a) COAL RESERVES IN OHIO

County	Average thickness <sup>1</sup>		Area (square miles)	Tonnage	
	Feet	Inches		Per square mile	Total (rounded)
By F. R. Clark (1917)					
Coshocton	6	8	2	7,780,000	15,000,000
Hocking	1	4	20	1,536,000	31,000,000
Holmes	3	2	40	3,648,000	146,000,000
Jackson	1	4	10	1,536,000	15,000,000
Lawrence	1	10	120	2,112,000	253,000,000
Mahoning	2	4	175	2,688,000	470,000,000
Perry	1	7	20	1,824,000	36,000,000
Scioto	1	9	15	2,016,000	30,000,000
Tuscarawas	3	0	5	3,456,000	17,000,000
Vinton	2	11	75	3,360,000	252,000,000
Total	-	-	482	-	1,265,000,000

By J. A. Granchi (1957)

Coshocton	1	6	2	1,728,000	3,456,000
Hocking	1	6	2	1,728,000	3,456,000
Jackson	1	6	10	1,728,000	17,280,000
Lawrence	1	6	25	1,728,000	43,200,000
Scioto	2	0	10	2,304,000	23,000,000
Tuscarawas	3	0	5	3,456,000	17,000,000
Vinton	1	6	15	1,728,000	25,920,000
Wayne	3	0	1	3,456,000	3,456,000
Total	-	-	70	-	136,768,000

<sup>1</sup> Pertains only to area of minable thickness.

## THE BEDFORD COAL BED

The Bedford coal was named by Orton (1884a, p. 845). Its type locality occurs in Bedford Township, Coshocton County where it consists of both bituminous and cannel varieties of coal, with one or more partings, and a thickness that ranges from a few inches to 9 feet.

Although correlated by Orton (1884) and Hodge (1878) with the Upper Mercer coal bed, Wilber Stout (1918, p. 91-93) has shown that the Bedford coal bed actually occurs a few feet above the Upper Mercer coal bed. The Bedford coal has fair continuity and is found in parts of Lawrence, Scioto, Jackson, Vinton, Muskingum, Coshocton, Tuscarawas, Holmes, Wayne, Stark, Portage, and Mahoning Counties (see fig. 8).

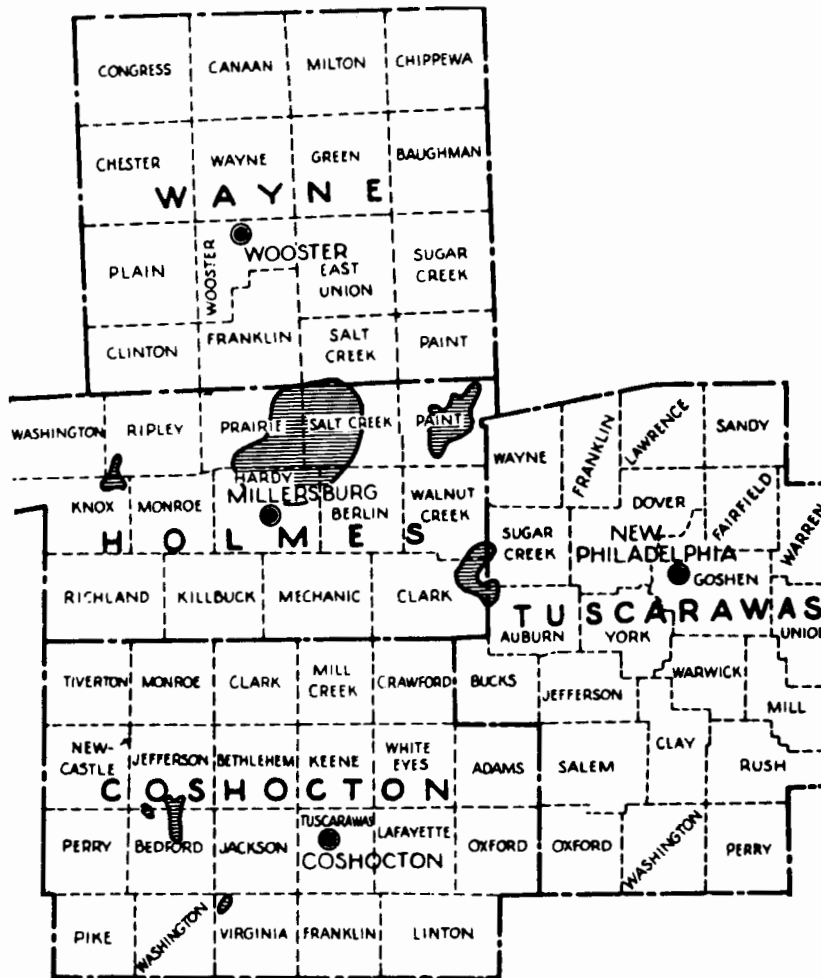


Figure 8. Generalized map of known major occurrences of minable Bedford coal in Ohio.

The Bedford coal bed ordinarily occurs in two to four benches, separated by shale or clay partings. It varies in composition from a highly volatile bituminous coal to a true cannel coal, or fissile carbonaceous shale. These three types may sometimes be found together. The coal is moderately hard and bright, often containing thin bands of cannel coal. It contains a high percentage of volatile matter, ignites readily, burns freely, and has a heating value of moderate quality. The percentage and character of the ash varies according to regional variations of the coal itself and beneficiation by the producer.

DESCRIPTION BY COUNTY

Vinton County. - The Bedford coal bed in Vinton County has no economic value and is of little stratigraphic interest. The known thickness of the coal ranges from less than one inch to a maximum of 6 inches. This horizon crops out in parts of Clinton, Elk, and Richland Townships (Stout, 1927, p. 141-142).

Hocking County. - The Bedford coal ranges in thickness from a one-inch soot streak to eleven inches of

bony coal and appears on the outcrop in parts of Benton, Falls, Falls Gore, Marion, Starr, Washington, and Ward Townships. It lies, on the average, 23 feet above the Lower Mercer limestone and about 16 feet below the Putnam Hill limestone.

Muskingum County. - The Bedford coal, according to Stout (1918, p. 93), is the most valuable Pottsville formation fuel in Muskingum County. The outcrop of this coal extends across the western half of the county, being above drainage in Newton, Hopewell, Springfield, Falls, Washington, Licking, Muskingum, Jackson, Cass, Jefferson, Madison, and Adams Townships.

The coal bed ranges in thickness from 13 inches to a maximum of 3-1/2 feet. The coal stratum is often composed of two, three, or even four layers of coal, separated by shale or clay partings. The composition of the coal is quite variable. It may be a highly volatile bituminous coal, a true cannel coal, or a fissile carbonaceous shale, and frequently all three types may be found in the same section.

Coshocton County. - The position of the Bedford coal bed in Coshocton County is approximately 26 feet above the base of the Lower Mercer limestone and about 48 feet below the Putnam Hill limestone. The horizon of the Bedford coal bed is above drainage level in parts of every township in Coshocton County. Ordinarily, the member in this county is more persistent than the Upper Mercer coal.

The Bedford coal bed is quite variable in character. It may consist of carbonaceous shale and shaly coal interstratified with bituminous coal or cannel coal, or with bituminous and cannel coal split by one or more of the clay or shale partings. It ranges from a few inches to a maximum thickness of nine feet, but is generally less than two feet thick. It is known to be particularly thick in southern Jefferson and northern Bedford Townships. Here, this coal bed consists of both cannel and bituminous coal and locally attains a maximum thickness of 9 feet.

The following is a typical analysis of the Bedford coal bed (Bownocker and Dean, 1930, p. 26) :

Analysis of Bedford Coal by D. J. Demorest

Sample taken from type locality, Bedford Township, Coshocton County, Ohio.

	Ft.	In.
Shale, roof . . . . .	-	-
Coal, not used . . . . .	-	4
Shale, dark, much pyrite . . . . .	-	2-1/2
Coal, bituminous, canneloid . . . . .	2	0
Clay, carbon . . . . .	-	0-1/2
Coal, cannel laminated, (not sampled) . . . . .	1	0
Coal, cannel, sampled . . . . .	2	6
Clay, floor . . . . .	-	-

Only the 2-foot 6-inch bed of cannel coal was sampled.

	<u>Ultimate Analysis</u>		<u>Proximate Analysis</u>	
	<u>As Received</u> <u>Percent</u>	<u>Moisture Free</u> <u>Percent</u>	<u>As Received</u> <u>Percent</u>	<u>Moisture Free</u> <u>Percent</u>
Carbon . . . . .	64.63	65.61	Moisture. . . . .	1.54
Hydrogen. . . . .	4.95	4.86	Volatile matter	46.57
Nitrogen . . . . .	1.67	1.70	Fixed carbon . . . . .	35.42
Oxygen. . . . .	8.54	7.29	Ash . . . . .	16.47
Sulphur. . . . .	3.74	3.80		100.00
Ash. . . . .	16.47	16.74		100.00
	100.00	100.00		

Air drying loss 0.23 percent.

	<u>As Received</u>	<u>Moisture Free</u>
Heating Value	Calories . . . . .	6,591
	B. t. u. . . . .	11,864
Fusion of Ash	Incipient . . . . .	2,240° F.
	Complete . . . . .	2,354° F.

Holmes County. - The Bedford coal bed in Holmes County lies about 55 feet below the Putnam Hill limestone and 24 feet above the base of the Lower Mercer limestone. G. W. White (1949, p. 125) deems this coal the most valuable Pottsville formation fuel in Holmes County.

The bed is quite persistent, being present in all the townships of the county, but the coal lacks purity and minable thickness in most townships. It ranges in thickness from less than a foot to over 11 feet, and usually is separated into two benches by a thick shale parting near the middle of the bed. At some localities the higher quality coal is found in the upper bench; in other places it is found in the lower bench. Locally both benches are somewhat shaly, frequently it is a carbonaceous shale rather than a true coal.

Wayne County. - The Bedford coal bed in Wayne County usually lies directly below the bluish-to-black, flinty Upper Mercer limestone. This is especially true in Sugar Creek and Salt Creek Townships where the coal bed has been described as ranging from a 6-inch blossom in Salt Creek Township to a thickness of 24 inches in section 9, Sugar Creek Township. The Bedford coal, with several thin shale partings, has been reported to attain a maximum thickness of 4 feet in Wayne County (Multer, 1955, p. 109), but generally it is much thinner and uncertain in occurrence.

Stark County. - The Bedford coal in Stark County lies immediately below the Upper Mercer limestone. It is exposed in parts of Canton, Pike, Lake, and Plain Townships and ranges in thickness from 2 to 18 inches.

Portage County. - The Bedford coal bed is mined by strip mining methods two miles east of Atwater Center, Atwater Township. The coal at this location is hard, somewhat bony in nature, and has shale and pyrite partings. The average thickness of the bed, including the partings, in this strip pit is four feet. At the abandoned Keller strip mine, 1-1/4 miles east of Atwater Center and north of Route 224, the Bedford coal measures 51 inches, including the partings, and is overlain by 30 feet of sandstone and shale.

Mahoning County. - The Bedford coal bed in Mahoning County lies either directly below or close to the Upper Mercer limestone and crops out at elevations from 994 to 1,075 feet in Berlin, Ellsworth, and Poland

Townships. This coal bed is best developed in Poland Township, where exposures averaging 15 inches in thickness are reported.

### SUMMARY OF THE BEDFORD COAL RESOURCES

Reserve estimates of the Bedford coal in Ohio were not made by Clark or Ray. Conservative estimates made by the writer total 80 square miles in area, containing 308,928,000 tons of coal (see table 5).

TABLE 5

#### ESTIMATES OF THE ORIGINAL BEDFORD COAL RESERVES IN OHIO

(By J. A. Granchi, 1957)

County	Average thickness <sup>1</sup>		Area (square miles)	Tonnage	
	Feet	Inches		Per square mile	Total (rounded)
Coshocton	5	0	20	5,760,000	115,200,000
Hocking	2	0	2	2,304,000	4,608,000
Holmes	3	2	40	3,648,000	145,920,000
Mahoning	1	6	3	1,728,000	5,184,000
Muskingum	2	0	6	2,304,000	13,824,000
Portage	3	0	4	3,456,000	13,824,000
Stark	1	6	2	1,728,000	3,456,000
Wayne	2	0	3	2,304,000	6,912,000
Total	-	-	80	-	308,928,000

<sup>1</sup> Pertains only to area of minable thickness.

### THE TIONESTA COAL BED

The Tionesta coal bed, named by H. D. Rogers (1858, p. 489), presumably for exposures along Tionesta Creek in northwestern Pennsylvania, is the uppermost coal member of the Pottsville formation. It is commonly overlain by the massive Tionesta (Homewood) sandstone.

The Tionesta coal bed is quite persistent, being replaced only locally by Homewood sandstone. Outcrops occur over a broad belt in Ohio, extending from Lawrence and Scioto Counties on the south to Mahoning County on the north. It is locally thick in Muskingum, Tuscarawas, Stark, Wayne, and Holmes Counties and has been mined for local use.

This coal is similar to the Upper and Lower Mercer coals in that it usually occurs as benches. Because of

## THE POTTSVILLE FORMATION IN OHIO

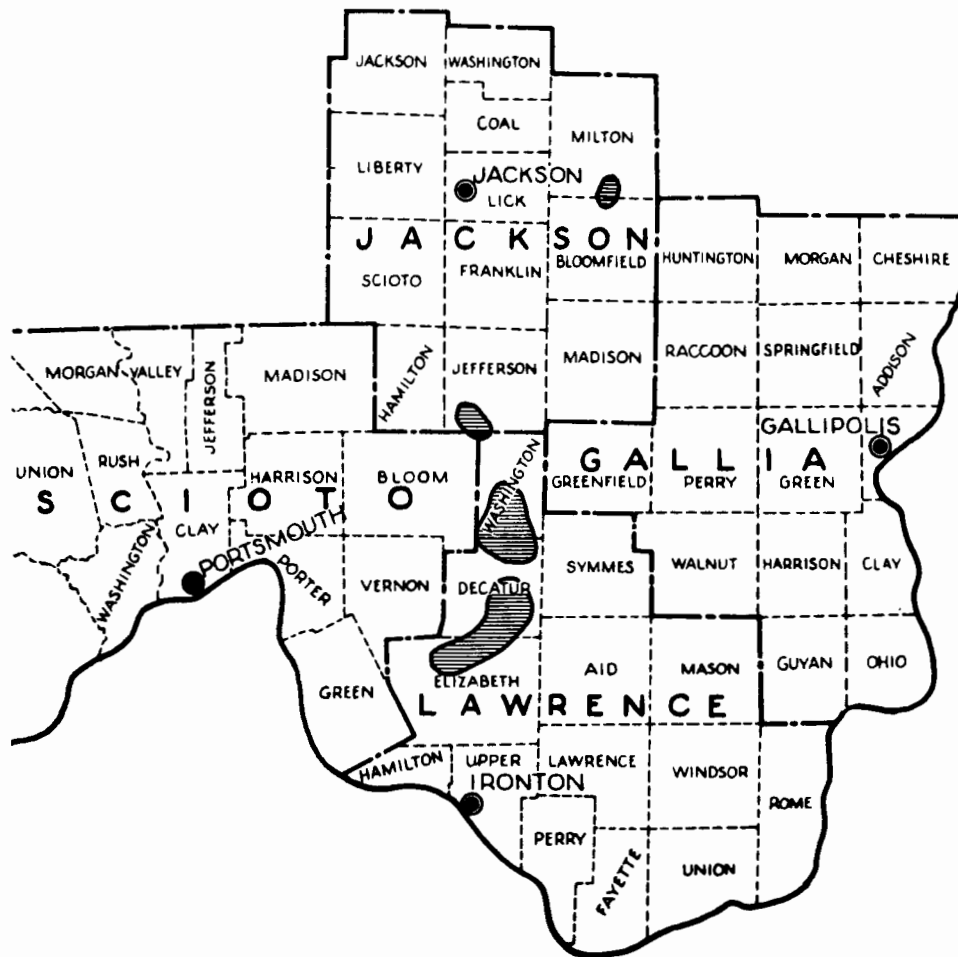


Figure 9. Generalized map of known major occurrences of minable Tionesta (No. 3b) coal in Ohio.

its blocky structure, it is possible to extract it in large lumps, with almost no fine material. The thickness of the Tionesta coal bed ranges from a few inches to 3-1/2 feet, but averages only 4-1/2 inches. It is a free-burning coal, moderately low in ash; it does, however, contain a relatively high amount of pyrite which is distributed irregularly along the bedding planes.

## DESCRIPTION BY COUNTY

Lawrence County. - The Tionesta coal bed in Lawrence County lies about 32 feet above the Upper Mercer ore and about 63 feet below the Vanport limestone. Because it occurs approximately 60 feet below the Vanport limestone, this coal became known as the "60-foot coal." The Tionesta coal is quite persistent in the northern part of Lawrence County. This coal bed is thickest in Washington Township, where the thickness range is from 2 to 3 feet.

Former reserve estimates are considered to be too high. Clark reported 115,000,000 tons of estimated original reserves whereas present analysis of the available data indicate the estimate should be no greater than 51,840,000 tons.

Scioto County. - The interval incorporating the Tionesta coal bed in Scioto County is extremely variable. The strata between the coal and the overlying Vanport limestone vary from 50 to 90 feet in thickness, while the interval from this coal to the underlying Upper Mercer ore ranges from 20 to 55 feet.

The coal bed is quite persistent throughout the county, although in places it is thin and bony. It occurs well above drainage in the eastern parts of Bloom, Vernon, and Green Townships, where it ranges from 1-1/2 to 3 feet in thickness and averages about 20 inches.

Because data indicate that this coal is fairly persistent in Scioto County, Clark's estimate of 40,000,000 tons original reserves is considered accurate.

Jackson County. - The Tionesta coal in Jackson County lies at an average of 55 feet below the Vanport limestone, 22 feet below the Zaleski limestone, and 29 feet above the Upper Mercer ore. The Tionesta coal bed is persistent in areal relationship but variable in thickness in Jackson County as well as extremely variable in structure. It may be composed of one bench at one locality and at others the stratum may consist of several thin benches with intervening clay or shale partings. The deposit varies from a cannel to a bituminous coal. It attains its greatest thickness in Jefferson Township.

The persistency of the coal, coupled with the former mining activities, substantiate Clark's (1917) estimate of 12,000,000 tons original reserves.

Vinton County. - The Tionesta coal bed in Vinton County lies about 7 feet below the Brookville coal. It has been observed in a few isolated places throughout the county as a soot streak or as a few inches of carbonaceous shale.

Hocking County. - The Tionesta coal bed in Hocking County lies approximately 12 feet above the Upper Mercer limestone. The coal is bony, shaly, and of poor quality. It crops out in parts of Falls, Falls Gore, Marion, Washington, and Starr Townships. This coal bed ranges in thickness from a half-inch smut streak to 20 inches, the average being 7 inches.

The low quality and general lack of minable thickness accounts for the drastic revision of estimates reported in table 6.

Perry County. - The Tionesta coal bed in Perry County lies on the average about 12 feet above the Upper Mercer limestone. The coal bed is a bright, bony, or shaly coal; at some places, however, it is only a thin layer of carbonaceous shale on top of the Tionesta clay. The coal ranges in thickness from less than an inch to 2 feet. Previous estimates of reserves (see table 6) are revised to 8,640,000 tons because areally the coal is extremely thin.

Muskingum County. - The Tionesta coal bed in Muskingum County lies approximately 20 feet above the Upper Mercer limestone. This coal bed has been found above drainage in all or parts of every township, except Harrison, west of the Muskingum River, and parts of Wayne, Washington, Madison, and Adams Townships east of the river.

The bed, known locally as the "White Ash" coal, is thickest in Wayne and Springfield Townships. The thickness of this coal ranges from 20 to 36 inches. Wilber Stout (1918, p. 119), referring to Wayne and Springfield Townships in his report on Muskingum County, comments that in a few places in Newton, Hopewell, and Cass Townships small quantities of fuel may be obtained by stripping along stream beds.

Coshocton County. - In eastern Coshocton County, the position of the Tionesta coal averages about 23 feet above the base of the Upper Mercer limestone and crops out in parts of every township. Well exposed outcrops have been noted in Adams, Crawford, Keene, and Virginia Townships. In these townships the coal horizon is represented by black shale or shaly coal, varying in thickness from 2 inches to about one foot. The Tionesta coal in Coshocton County is generally too thin and impure to mine.

Tuscarawas County. - The Tionesta coal bed in Tuscarawas County occurs in Oxford, Fairfield, Lawrence, Sugarcreek, and Wayne Townships. Locally it is known as the Bolivar coal. It lies above the Upper Mercer limestone, the thickness interval varying from 3 feet in Sugarcreek Township to 24 feet in Wayne Township. The interval between the coal and the overlying Putnam Hill limestone likewise varies greatly, from 16 feet in Fairfield Township to 42 feet in Sugarcreek Township.

The coal stratum ranges in thickness from a half-inch layer near Zoar in Fairfield Township to 51 inches, including a 3-inch black shale parting, in Sugarcreek Township. In composition the coal varies from a smut streak to a coal of moderate quality, but generally is shaly and of low quality.

The areal shaly nature of the coal warrants a revision of Clark's (1917, p. 95) estimate of 65,000,000 tons to 27,648,000 tons original reserves.

Holmes County. - In Holmes County, the Tionesta coal bed is approximately 27 feet below the Putnam Hill limestone and 29 feet above the Bedford coal. In a few localities the interval is so thin that the Tionesta and Brookville clays make up a single bed, being separated only by an inch or two of Tionesta coal (White, G.W., 1949, p. 155).

The Tionesta coal is remarkably persistent and crops out in every township of the county. It has been mined in Prairie and Killbuck Townships. The coal ranges from a mere soot streak to a maximum known thickness of 3-1/2 feet, but the average thickness is only about 4-1/2 inches.

The acreage estimated by Clark (1917, p. 92) is undoubtedly reasonable, but the thickness used in the estimate is probably excessive.

Wayne County. - The Tionesta coal bed in Wayne County usually lies from 15 to 25 feet above the Upper Mercer limestone. The thickness of the coal bed varies from 1 to 3 feet. Sandstone usually overlies the coal and, hence, the seam became known locally as the "Sandstone vein." Outcrops of the Tionesta coal have been observed in Franklin, Paint, and Salt Creek Townships. In these townships the coal is from 2 to 36 inches thick.

Stark County. - The Tionesta coal bed in Stark County occurs approximately 29 feet above the Upper Mercer limestone. In this county the Tionesta coal bed is somewhat shaly. The coal varies from a one-inch smut streak to a thickness of three feet, the average for the county being about 10 inches. Outcrops of the Tionesta coal bed has been observed, at elevations from 969 to 1,031 feet, in parts of Canton, Lake, Pike, and Bethlehem Townships.



An estimate of 6,912,000 tons original reserves has been made for this county.

Columbiana County. - The Tionesta coal bed in Columbiana County lies about 16 feet above the Upper Mercer limestone. The coal is seldom well exposed; where observed it is poorly developed and of no economic importance.

Mahoning County. - The only known exposures of Tionesta coal in Mahoning County are confined to Poland Township. One inch of shaly Tionesta coal, overlain by 8 feet of gray siliceous shale, was observed 13 feet above the Upper Mercer limestone along Burgess Run, 1-1/2 miles south of Poland. Nine inches of good quality Tionesta coal, with a one-inch clay parting, was noted in a ravine on the north side of the Mahoning River, one-half mile east of Struthers. The coal at this outcrop lies about 8 feet above the Upper Mercer limestone and is overlain by 3-1/2 feet of black, tough, fissile shale.

#### SUMMARY OF THE TIONESTA COAL RESOURCES

Original reserve estimates of Tionesta coal bed in Ohio, by F. R. Clark (1917, p. 92-95), total 210 square miles with an estimated 516,000,000 tons. Revised estimates have reduced the area to 90 square miles and tonnage to 180,288,000 for estimated original reserves.

TABLE 6

#### ESTIMATES OF THE ORIGINAL TIONESTA (NO. 3b) COAL RESERVES IN OHIO

County	Average thickness <sup>1</sup>		Area (square miles)	Tonnage	
	Feet	Inches		Per square mile	Total (rounded)
By F. R. Clark (1917)					
Hocking	2	9	50	3,168,000	158,000,000
Holmes	2	6	5	2,880,000	14,000,000
Jackson	2	0	5	2,304,000	12,000,000
Lawrence	1	8	60	1,920,000	115,000,000
Perry	2	0	30	2,304,000	69,000,000
Scioto	1	9	20	2,016,000	40,000,000
Tuscarawas	2	3	25	2,592,000	65,000,000
Vinton	2	6	15	2,880,000	43,000,000
Total	-	-	210	-	516,000,000

By J. A. Granchi (1957)

Hocking	1	6	2	1,728,000	3,456,000
Holmes	2	0	5	2,304,000	11,520,000
Jackson	2	0	5	2,304,000	11,520,000
Lawrence	1	6	30	1,728,000	51,840,000
Muskingum	2	0	5	2,304,000	11,520,000
Perry	1	6	5	1,728,000	8,640,000

Table 6  
Estimates of the original Tionesta (No. 3b) coal reserves in Ohio (continued)

County	Average thickness <sup>1</sup>		Area (square miles)	Tonnage	
	Feet	Inches		Per square mile	Total (rounded)
Scioto	1	9	20	2,016,000	40,320,000
Stark	2	0	3	2,304,000	6,912,000
Tuscarawas	2	0	12	2,304,000	27,648,000
Wayne	2	0	3	2,304,000	6,912,000
Total	-	-	90	-	180,288,000

<sup>1</sup> Pertains only to area of minable thickness.

## MINOR POTTSVILLE COAL BEDS

### INTRODUCTION

Besides the six major coal beds of the Pottsville system, there are six minor ones which are either (1) separate, (2) independent, or (3) splits from the major coal beds. These six coal bed members, though not persistent or of as much commercial importance, have contributed much to the wealth of the State.

The minor Pottsville coal beds, in their ascending stratigraphic order, are: Anthony, Huckleberry, Bear Run, Vandusen, Flint Ridge, and Middle Mercer. Like the Major Pottsville coal beds all of these minor coal beds are known by a great number of local names, usually derived from the name of the property on which they are mined.

### ANTHONY COAL BED

The Anthony coal was named in 1870 by E. B. Andrews and Edward Orton from the occurrence of a coal bed 3-1/2 feet thick on the land of Samuel Anthony, section 7, Coal Township, Jackson County (Stout, 1916, p. 74; 1927, p. 75). The quality of the coal is variable. It may be rather pure coal, a bony, carbonaceous shale, a bituminous or a dense cannel coal. The bed ranges from a soot streak to three feet in thickness.

The Anthony coal bed is a series of isolated coal pockets that have been deposited upon the Sciotoville clay member of the Pottsville formation.

It has been traced from the Ohio River through eastern Scioto; eastern Pike; western Jackson, portions of Vinton, Hocking, and Perry; eastern Licking, southwestern Muskingum; and western Coshocton Counties (Morningstar, 1922, p. 21).

Table 9 is a county summary of the quality, geology, and economic appraisal of the Anthony coal bed in Ohio.

TABLE 7  
COUNTY SUMMARY OF THE ANTHONY COAL BED IN OHIO

County	Quality				Thickness (Inches)		Stratigraphic Position	Township Minable In	Local Name	Remarks		
	Fuel	Impure	Shale-Shaly-Bony	Not Persistent	Not Economic	From					To	Average
Scioto	X					14	18			In close proximate above Sharon conglomerate.	Madison; Porter	
Pike					X							
Jackson			X	X	X			36				Generally a carbonaceous shale.
Vinton			X		X			4				
Hocking			X		X	1		13		32 feet below Massillon sandstone		Generally a soot streak or carbonaceous shale
Perry	X		X				14					
Muskingum			X				14					
Coshocton			X				3			Immediately above Sciotoville clay		
Wayne						3	21				Franklin	

## THE HUCKLEBERRY COAL BED

The name "Huckleberry" has been applied in the Sciotoville coal field of Ohio to a clay bed and an overlying thin coal bed found in the interval between the Anthony and Quakertown coals. The Huckleberry coal bed is very patchy and usually occurs as lenses of little or no value (Stout, 1927, p. 76). In Hocking County the coal usually lies only a few feet below the Huckleberry sandstone.

Few exposures of this coal have been noted. In section 4, Hamilton Township, Jackson County, and in the southwest quarter of section 29, Richland Township, Vinton County, 14 and 16-inch veins of this coal are present, respectively. A bony coal, one to six inches thick, representing this coal horizon is recognized in Falls, Falls Gore, Green, Marion, and Washington Townships, Hocking County.

## THE BEAR RUN COAL BED

The Bear Run was named by Wilber Stout (1916, p. 552; Lamborn, 1954, p. 46) for its prominent exposures along Bear Run in northern Bloom Township, Scioto County. In this township the coal attains a maximum thickness of 4 feet. Its horizon has been recognized and traced over scattered areas of Scioto, Jackson, Vinton, Hocking, southwestern Perry, Muskingum, Coshocton, Holmes, and Wayne Counties. The Bear Run coal lies, on the average, about 70 feet above the Sciotoville clay, 15 to 35 feet above the Quakertown coal, and 120 feet below the Lower Mercer coal (Stout, 1916, p. 552; White, 1949, p. 86).

A marked feature of this coal bed is the variability of its composition. It may be represented by cannel or bituminous coal, black band ore, bone shale, or a combination of any of these. Although usually thin and frequently represented as carbonaceous shales, the Bear Run coal is locally of good quality and of sufficient thickness for mining. The strata above the coal is ordinarily a tough blue-gray shale, providing an excellent roof for mining purposes. The upper part of the coal bed is variable in quality. Generally the minable coal is an oily, free-burning coal, producing a medium ash, and having a low sulphur content. The following is a proximate analysis of Bear Run coal (Stout, 1916, p. 557):

	<u>Percent</u>
Moisture	7.67
Volatile matter	38.58
Fixed carbon	46.85
Ash	6.90
Sulphur	0.68

The economic and geologic appraisal of the Bear Run coal bed in Ohio has been set forth in table 8.

## THE VANDUSEN COAL BED

The Vandusen coal bed was named for a thin-bedded, but good quality, coal which had been strip-mined on the Marion Vandusen property in section 1, Hamilton Township, Jackson County. Stratigraphically, the Vandusen coal bed lies between the Bear Run and the Lower Mercer coal. It is found about 20 feet above the Bear Run coal, 28 feet below the Lower Mercer coal, and 48 feet below the Lower Mercer limestone.

TABLE 8  
COUNTY SUMMARY OF THE BEAR RUN COAL BED IN OHIO

County	Quality					Thickness (Inches)			Stratigraphic Position	Townships Minable In	Local Name	Remarks
	Fuel	Impure	Shale-Shaly-Bony	Not Persistent	Not Economic	From	To	Average				
Scioto	X					9	48	15	65-85 feet above the Sciotoville clay.	Bloom		
Jackson						0	24		45-80 feet above the Sciotoville clay.	Gilleland, Mayhew, and Martin		Locally replaced by sandstone.
Vinton							18		85 feet below Lower Mercer limestone.			
Hocking	X		X					4	70 feet below Lower Mercer limestone.			
Perry	X		X		X			12				
Muskingum			X		X	0	12		75 feet below Lower Mercer limestone.			Generally a carbonaceous shale.
Coshocton					X				70 feet below Lower Mercer limestone.			
Holmes	X		X			0	?		8-15 feet above Quakertown coal.			Locally replaced by Massillon sandstone.
Wayne	X		X			1	3					

Outcrops occur in parts of Scioto, Jackson, Vinton, Hocking, Perry, Muskingum, Coshocton, Holmes, Wayne, and Stark Counties. In many localities the Massillon sandstone replaces both the Bear Run and Vandusen coals (Lamborn, 1954, p. 48). This coal is too thin to be important as a fuel. It consists of bright, dense, bituminous coal, free from shale and pyrite bands, and it is rather oily, tending somewhat towards the cannel types.

The county summary of the Vandusen coal bed is depicted in table 9.

#### THE FLINT RIDGE COAL BED

The Flint Ridge coal was named for a cannel coal which occurs in Flint Ridge, western Hopewell Township, Licking County (Orton, 1884, p. 908). Stout (1918, p. 75; Lamborn, 1954, p. 56) describes it as a thick cannel coal, lying about twelve feet below the Lower Mercer limestone and about midway in the interval between the Lower Mercer and Middle Mercer coal beds.

The Flint Ridge coal bed, though not persistent, is present from Scioto County to Mahoning County. It varies from a pure bituminous to bony, cannel coal. With the exception of its type locality, this coal is too thin to mine (Stout, 1927, p. 112; Lamborn, 1954, p. 56). The coal bed ranges from one inch to 3-1/2 feet in thickness, but the average is about six inches. This maximum thickness was noted in Hopewell Township, Licking County.

Pertinent facts of the Flint Ridge coal bed has been summarized by counties in table 10.

#### THE MIDDLE MERCER COAL BED

The Middle Mercer coal bed occurs directly below the Lower Mercer limestone or separated from the limestone by approximately a foot of shale. This coal bed persists with reasonable continuity and crops out from Scioto County to Mahoning County on the Ohio-Pennsylvania line (White, 1949, p. 103). The coal is quite variable in character. It may be a bright bituminous coal, bone coal, cannel coal, or a carbonaceous shale. It is usually thin, averages about six inches in thickness, but locally it is as much as three feet thick. As a fuel this coal has little value but is of considerable value as a stratigraphic guide to correlating other coal beds. No attempt has been made to estimate the original reserves of this coal bed because of meagerness of stratigraphic information and thickness data which indicates it is of insignificant economic importance.

The following is an analysis of a sample of Middle Mercer coal taken from the Betty Coal Company No. 1 mine, SW 1/4, section 8, Tuscarawas Township, Stark County (Bownocker and Dean, 1929, p. 22):

<u>Ultimate Analysis</u>			<u>Proximate Analysis</u>		
	As Received	Moisture Free		As Received	Moisture Free
	Percent	Percent		Percent	Percent
Carbon . . . . .	63.82	66.17	Moisture . . . . .	3.54	0.00
Hydrogen . . . . .	5.17	4.94	Volatile matter	40.38	41.86
Nitrogen . . . . .	0.87	0.90	Fixed carbon . . .	42.35	43.91
Oxygen . . . . .	13.96	11.22	Ash . . . . .	13.73	14.23
Sulphur . . . . .	2.45	2.54		100.00	100.00
Ash . . . . .	<u>13.73</u>	<u>14.23</u>			
	100.00	100.00			

TABLE 9  
COUNTY SUMMARY OF THE VANDUSEN COAL BED IN OHIO

County	Quality					Thickness (Inches)			Stratigraphic Position	Townships Mappable In	Local Name	Remarks
	Fuel	Impure	Shale-Shaly-Bony	Not Persistent	Not Economic	From	To	Average				
Scioto						18	24	19	90 feet below Lower Mercer ore.			
Jackson			X			0	12		60-100 feet below Lower Mercer ore.			
Vinton			X					3				Locally a carbonaceous shale.
Hocking	X		X			1	9		28 feet below Lower Mercer limestone.			
Perry	X		X					12				
Muskingum								14	58 feet below Lower Mercer limestone.	Hopewell		
Coshocton			X			0	4		57 feet below Lower Mercer limestone.			Locally replaced by sandstone and shale.
Holmes									46 feet above Harrison ore.			Locally a carbonaceous shale.
Wayne			X			2	6					
Stark			X					2				

THE POTTSVILLE FORMATION IN OHIO

Air Drying Loss 0.68 percent

		As Received	Moisture Free	
Heating Value	{	Calories . . . . .	6,401	6,636
		B. t. u. . . . .	11,521	11,944
Fusion of Ash	{	Incipient . . . . .	2,554° F.	
		Complete. . . . .	2,683° F.	

A county summary of the Middle Mercer coal bed is contained in table 11.

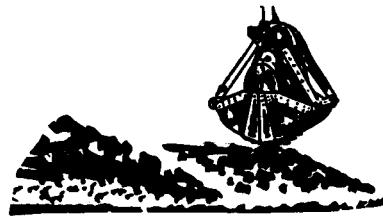




TABLE 10  
COUNTY SUMMARY OF THE FLINT RIDGE COAL BED IN OHIO


County	Quality				Thickness (Inches)			Stratigraphic Position	Townships Minable In	Local Name	Remarks	
	Fuel	Impure	Shale-Shaly-Bony	Not Persistent	Not Economic	From	To					Average
Vinton			X			1	14	6	3-18 feet below Lower Mercer limestone.			
Hocking			X		X	1	10		13 feet below Lower Mercer limestone.			
Perry	X		X					1				
Licking							40			Hopewell		
Muskingum					X			5				
Coshocton			X			0	36	18				
Holmes			X		X			7	8 feet below Lower Mercer limestone.		Sometimes replaced by sandstone.	
Wayne			X		X	0	2					
Stark							13		13 feet below Lower Mercer limestone.		Coal with 3-inch shale partings.	

TABLE 11  
 COUNTY SUMMARY OF THE MIDDLE MERCER COAL BED IN OHIO

County	Quality					Thickness (Inches)			Stratigraphic Position	Townships Mappable In	Local Name	Remarks
	Fuel	Impure	Shale-Shaly-Bony	Not Persistent	Not Economic	From	To	Average				
Vinton		X	X			2	10		Very close below Lower Mercer limestone.			
Perry	X		X			0	42		Very close below Lower Mercer limestone.			
Hocking								5	Very close below Lower Mercer limestone.			
Muskingum	X		X			0	11		Very close below Lower Mercer limestone.			
Coshocton			X			0	28					
Holmes			X		X	2	48	6	Very close below Lower Mercer limestone.			
Wayne					X	2	36		Very close below Lower Mercer limestone.			
Stark			X			6	41					
Mahoning						2	24		Very close below Lower Mercer limestone			



APPENDIX



SUMMARY OF POTTSVILLE COAL RESOURCES




TABLE 12

SUMMARY OF ESTIMATED ORIGINAL POTTSVILLE COAL RESERVES IN OHIO  
BY SEAM AND COUNTY

(In thousands of tons)

Seam and County	Estimated Reserves (short tons)	Seam and County	Estimated Reserves (short tons)
Tionesta No. 3b		Lower Mercer No. 3 (Cont'd)	
Hocking	3,456	Muskingum	4,600
Holmes	11,520	Perry	2,304
Jackson	11,520	Portage	23,000
Lawrence	51,840	Scioto	10,368
Muskingum	11,520	Stark	5,184
Perry	8,640	Vinton	28,800
Scioto	40,320	Wayne	2,304
Stark	6,912	Total . . . . .	297,312
Tuscarawas	27,648	Vandusen . . . . .	-
Wayne	6,912	Bear Run . . . . .	-
Total . . . . .	180,288	Quakertown No. 2	
Bedford		Coshocton	6,912
Coshocton	115,200	Hocking	5,184
Hocking	4,608	Holmes	58,600
Holmes	145,920	Jackson	369,000
Mahoning	5,184	Lawrence	2,304
Muskingum	13,824	Muskingum	12,000
Portage	13,824	Perry	2,880
Stark	3,456	Scioto	1,728
Wayne	6,912	Vinton	269,000
Total . . . . .	308,928	Wayne	5,184
Upper Mercer No. 3a		Total . . . . .	732,792
Coshocton	3,456	Huckleberry . . . . .	-
Hocking	3,456	Anthony . . . . .	-
Jackson	17,280	Sharon No. 1	
Lawrence	43,200	Geauga	2,880
Scioto	23,000	Jackson	119,000
Tuscarawas	17,000	Licking	15,000
Vinton	25,920	Mahoning	139,000
Wayne	3,456	Medina	73,000
Total . . . . .	136,768	Muskingum	13,000
Middle Mercer . . . . .	-	Portage	75,000
Flint Ridge . . . . .	-	Stark	492,000
Lower Mercer No. 3		Summit	228,000
Hocking	34,560	Trumbull	149,760
Holmes	6,912	Wayne	215,000
Jackson	13,824	Total . . . . .	1,521,640
Lawrence	3,456	State Total . . . . .	3,177,728
Licking	13,000		
Mahoning	149,000		

TABLE 13  
SUMMARY OF ESTIMATED ORIGINAL POTTSVILLE COAL RESERVES IN OHIO  
BY COUNTY AND SEAM  
(In thousands of tons)

County and Seam	Estimated Reserves (short tons)	County and Seam	Estimated Reserves (short tons)
<b>Coshocton</b>		<b>Mahoning</b>	
Bedford	115,200	Bedford	5,184
Upper Mercer No. 3a	3,456	Lower Mercer No. 3	149,000
Quakertown No. 2	6,912	Sharon No. 1	139,000
Total . . . . .	125,568	Total . . . . .	293,184
<b>Geauga</b>		<b>Medina</b>	
Sharon No. 1	2,880	Sharon No. 1	73,000
<b>Hocking</b>		<b>Muskingum</b>	
Tionesta No. 3b	3,456	Tionesta No. 3b	11,520
Bedford	4,608	Bedford	13,824
Upper Mercer No. 3a	3,456	Lower Mercer No. 3	4,600
Lower Mercer No. 3	34,560	Quakertown No. 2	12,000
Quakertown No. 2	5,184	Sharon No. 1	13,000
Total . . . . .	51,264	Total . . . . .	54,944
<b>Holmes</b>		<b>Perry</b>	
Tionesta No. 3b	11,520	Tionesta No. 3b	8,640
Bedford	145,920	Lower Mercer No. 3	2,304
Lower Mercer No. 3	6,912	Quakertown No. 2	2,880
Quakertown No. 2	58,600	Total . . . . .	13,824
Total . . . . .	222,952	<b>Portage</b>	
<b>Jackson</b>		Bedford	13,824
Tionesta No. 3b	11,520	Lower Mercer No. 3	23,000
Upper Mercer No. 3a	17,280	Sharon No. 1	75,000
Lower Mercer No. 3	13,824	Total . . . . .	111,824
Quakertown No. 2	369,000	<b>Scioto</b>	
Sharon No. 1	119,000	Tionesta No. 3b	40,320
Total . . . . .	530,624	Upper Mercer No. 3a	23,000
<b>Lawrence</b>		Lower Mercer No. 3	10,368
Tionesta No. 3b	51,840	Quakertown No. 2	1,728
Upper Mercer No. 3a	43,200	Total . . . . .	75,416
Lower Mercer No. 3	3,456	<b>Stark</b>	
Quakertown No. 2	2,304	Tionesta No. 3b	6,912
Total . . . . .	100,800	Bedford	3,456
<b>Licking</b>		Lower Mercer No. 3	5,184
Lower Mercer No. 3	13,000	Sharon No. 1	492,000
Sharon No. 1	15,000	Total . . . . .	507,552
Total . . . . .	28,000		

## THE POTTSVILLE FORMATION IN OHIO

Table 13

## Summary of Estimated Original Pottsville Coal Reserves in Ohio

## By County and Seam (Continued)

(In thousands of tons)

County and Seam	Estimated Reserves (short tons)	County and Seam	Estimated Reserves (short tons)
Summit		Wayne	
Sharon No. 1	228,000	Tionesta No. 3b	6,912
Trumbull		Bedford	6,912
Sharon No. 1	149,760	Upper Mercer No. 3a	3,456
Tuscarawas		Lower Mercer No. 3	2,304
Tionesta No. 3b	27,648	Quakertown No. 2	5,184
Upper Mercer No. 3a	17,000	Sharon No. 1	215,000
Total . . . . .	44,648	Total . . .	239,768
Vinton		State Total . . . . .	3,177,728
Upper Mercer No. 3a	25,920		
Lower Mercer No. 3	28,800		
Quakertown No. 2	269,000		
Total . . . . .	323,720		

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