STATE OF OHIO
FRANK J. LAUSCHE, Governor
DEPARTMENT OF NATURAL RESOURCES
A. W. MARION, Director
DIVISION OF GEOLOGICAL SURVEY
JOHN H. MELVIN, Chief

REPORT OF INVESTIGATIONS NO. 26

The PITTSBURGH No. 8 And REDSTONE No. 8A COAL BEDS In OHIO

By

Richard M. DeLong

COLUMBUS
1955

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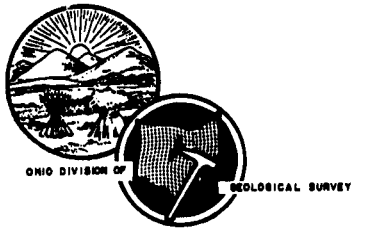
OHIO DIVISION OF
GEOLOGICAL SURVEY

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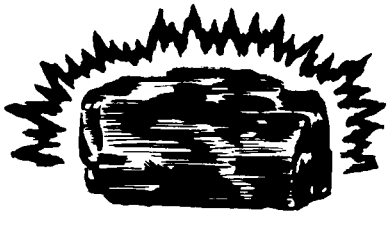

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ABSTRACT

The Pittsburgh coal bed and the Redstone coal bed of Pennsylvanian age are in the lower part of the Monongahela formation. They are separated by an interval of 20 to 40 feet; the rock types in the interval between the two coal beds may be limestone, shale, or sandstone. The gentle regional dip to the southeast toward the axis of the Pittsburgh-Huntington basin is rarely interrupted by local structures.

In Ohio the Pittsburgh coal bed crops out in a southwest trending belt from Jefferson County to Lawrence County. The total area underlain by this coal bed is approximately 2,660 square miles; however, the area under which the coal bed is of minable thickness is only 650 square miles. The Pittsburgh coal bed, described in Chapter 3, contains more than $5\frac{1}{2}$ billion tons of estimated total original reserves. Most of this reserve lies in the Belmont field which comprises Belmont County and adjoining parts of Harrison, Jefferson, Guernsey, and Monroe Counties. Other major Pittsburgh coal fields are the Federal Creek field which occupies parts of Athens and Morgan counties, and the Gallia field which occupies part of Gallia County. Other counties in which the Pittsburgh coal bed is of lesser economic importance are: Meigs, Muskingum, Washington, Noble, and Carroll Counties.

The Redstone coal bed and its reserves are described in Chapter 4. This coal bed underlies an area in Ohio very similar to that of the Pittsburgh coal; however, the area in which the Redstone coal bed is of economic importance is restricted to the southern counties and totals only 225 square miles of workable coal. The total estimated original reserve is slightly less than 1 billion tons. The Pomeroy field, which contains most of the Redstone coal reserves, lies mainly in Meigs County but extends into adjoining parts of Gallia and Athens Counties. A second important area of Redstone coal is the Mercerville-Greasy Ridge field in southern Gallia and northeastern Lawrence Counties.

CHAPTER 1

INTRODUCTION

This is the third of a series of reports on the reserves of the Ohio coal beds. The previous reports include: The Meigs Creek No. 9 Coal Bed in Ohio, 1952, Division Geol. Survey, Rept. Inv. No. 17; and The Lower Kittanning No. 5 Coal Bed in Ohio, 1954, Division Geol. Survey, Rept. Inv. No. 21. Reports on other coal seams in Ohio are in the initial stages of preparation (1955).

The estimate of the reserves of the Pittsburgh No. 8 coal and Redstone (Pomeroy) No. 8A coal in Ohio are based on original reserves only. Account is not made for depletion by mining previous to the date of this publication or losses that can normally be expected in future mining operations. Therefore these figures should not be considered in the light that they represent our present recoverable tonnage. However, this estimate is a first necessary step toward determining our present reserves.

Purpose

The purpose of this report is to present an accurate, detailed estimate of the original coal reserves for the Pittsburgh and Redstone coals in Ohio. The tabulations of reserves list the estimates of tonnage of coal by townships and are totaled for counties and for the state as a whole. The estimates are based on data in open file at the Ohio Division of Geological Survey as well as published reports.

A compilation of this type benefits the citizens of Ohio in several ways. It defines the limits and possible limits of minable coal and thus serves as a guide for future exploration for coal; it serves as a preliminary evaluation of land for owners and coal operators; and it is also a contribution to those people who are interested in the solid fuel reserves not only of Ohio but also within the United States.

Acknowledgements

The writer wishes to acknowledge the contributions of the following people who actively assisted and gave encouragement in many phases of this report: William H. Smith, Head of Coal Section, and Russell A. Brant, Assistant Head of Coal Section, both of the Ohio Division of Geological Survey, both of whom gave many constructive criticisms and valuable assistance in the preparation of this report; to student assistants, especially Lawrence Bronsdon, who gave invaluable service in the preparation of maps and illustrations; to Marian S. Klein, who assisted in the tabulation of reserves; to the many coal operators who contributed information about particular areas, and to others who gave active assistance.

Approach to this Reserve Study

DEFINITIONS AND PREMISES

Methods and definitions used in coal resources studies are well standardized among various states and the U. S. Geological Survey to give a uniformity that was lacking in earlier estimates of coal reserves. Systems of classifications used by some State Geological Surveys and the U. S. Geological Survey are based upon the same premises and differ only in degree and not in principle.

Coal reserves are classified into categories by thickness and by reliability. Both types of categories are arbitrarily selected for convenience of work and presentation of reserve figures in a practical manner.

Estimates of coal reserves within a single thickness category include all coal between two isopachous (equal thickness) lines. The coal within the 14 inch and 28 inch isopachous lines may be referred to as 14"-28" or 21 inch average category, and coal between the 28 inch and 42 inch isopachous lines may be referred to as 28"-42" or 35 inch average category. The part of the coal bed between isopachous lines is assumed to increase or decrease in thickness uniformly and this enables the use of an average thickness to calculate coal reserves by tonnage. Variations in the thickness of the coal bed are abrupt in some localities, and consideration of such variations is generally impractical in a study with as broad a scope as this. Also, many unknown variations undoubtedly exist, particularly in areas where these coal beds are not well known; for these reasons the reserve estimates given for these coal beds should not be considered exact but as provisional.

Reliability categories indicate the relative certainty of the presence of minable coal and are established by radii from a point of known coal thickness. A point of reliable coal thickness is a measurement of the coal bed in a mine, drill core, or of weathered coal on the outcrop. Coal blossom and thicknesses reported by local residents and coal operators are used in a general way to supplement measured coal but are not considered as definite as other classes of information.

Abrupt changes in the thickness of a coal bed affect the accuracy of reserve figures. In areas where a coal bed is known to have good continuity, as the Pittsburgh coal in the Belmont field, the certainty of the thickness of the coal bed at some distance from a point of information is much greater than in areas where "cutouts" or local variations are common. Except for the Belmont field the coal beds in the several fields discussed in this report are subject to considerable variations in thickness, however, from the standpoint of the computation it is believed that these local variations tend to balance each other. Because unknown variations undoubtedly exist, some points of information may be misleading in the interpretation of the extent and the reserve content of a coal bed. Although the Pittsburgh coal is known to be more uniform in the Belmont field than in other fields, for simplicity and uniformity, the same premises are used throughout all areas discussed in this publication.

Two classifications appear in this report, one, used by the Ohio Geological Survey in past and in this report, is adopted from the Illinois Geological Survey (Cady, 1952, pp. 14-20). This classification is used for all of the Pittsburgh coal areas except for Belmont County, and it is used entirely for the Redstone coal area included in this study. Under Cady's classification the value of isopachous lines begins at 14 inches and increases in 14 inch steps to 42 inches, then increases in 12 inch steps. Reliability categories by this classification are termed in descending order "proven," "probable," "strongly inferred," and "weakly inferred."

The other classification is one adopted by the U. S. Geological Survey (Averitt, 1949, p. 224) and used by Mr. Henry Berryhill in the computation of the Pittsburgh #8 coal reserves in Belmont County. The estimate for this coal in Belmont County is taken from U.S. Geological Survey Circular 363. The value of isopachous lines used in the estimation of the Belmont County reserves begins at 14 inches and continues in ascending values of 28 inches, 42 inches, and 60 inches. Three categories of reliability are used, these being in descending order of reliability "measured," "indicated," and "inferred." The "proven" and "probable" categories as used by the Ohio Geological Survey are equivalent to the "measured" and "indicated" categories as used by the U. S. Geological Survey; therefore the only difference in the two classifications is the subdivision of the U.S. Geological Survey's "inferred" category into "strongly inferred" and "weakly inferred" categories by the Ohio Geological Survey. Explanation of these categories are given in the following sub-headings.

Proven Reserves

All reserves that lie within a $\frac{1}{2}$ mile radius of a point of definitely known coal thickness are termed proven reserves by the Ohio Geological Survey and measured reserves by the U.S. Geological Survey. The terms "proven" and "measured" are synonymous in so far as they delineate equal areas of highest coal reserve reliability. The accuracy of this category is considered to be within 20% of the true tonnage.

Probable Reserves

Probable reserves corresponds to the term "indicated" used by the U. S. Geological Survey. This class of reserve lies outside the proven area and extends to two miles from the point of definite information, and thus occupies a band $1\frac{1}{2}$ miles wide extending to and beyond the boundary of the proven coal.

Strongly Inferred Reserves

The reserves in this category includes all coal in the area beyond the outer margin of the probable reserves to a radius of 4 miles beyond the point of known thickness. Thus this category is a belt 2 miles wide beyond the probable reserves category.

Besides the choice of terminology it is at this category that the classifications of the Ohio Geological Survey and the U.S. Geological Survey diverge. The "inferred reserves" used

by the U. S. Geological Survey includes all coal beyond the probable or indicated reserves and thus includes both the strongly and weakly inferred reserves of the Ohio Geological Survey.

Weakly Inferred Reserves

This category includes all coal that lies beyond 4 miles radius of the point of information and is the weakest reliability category in the classification. As indicated above the inferred reserves of the U. S. Geological Survey includes estimates in this category.

OVERBURDEN

Overburden is the material from the surface of the ground down to the coal bed and is usually reported in steps of 1,000 feet as 0-1,000 feet, 1,000-2,000 feet, and 2,000-3,000 feet in regional resources studies. However, the estimated reserves of the Pittsburgh and Redstone coal beds do not lie at a depth greater than 1,000 feet; overburden figures are, therefore, not included in this report.

METHODS USED IN MAKING THIS ESTIMATE

The methods used in making this report are identical with those used for the reserve study of The Lower Kittanning No. 5 coal bed in Ohio (Brant, 1954). The following discussion on method is an excerpt from the above publication, pp. 11-12.

> "The preceding general ideas are embodied in the estimate of the Lower Kittanning coal bed reserves. At the outset a series of work maps of 1^{o} longitude by $\frac{1}{2}^{o}$ latitude were drawn from U.S. topographic maps at a scale of 1:62,500. On these maps were traced all of the political subdivision boundaries: sections, townships, counties, and larger cities.
>
> "The outcrop was traced, and all of the localities and file numbers of the data were accurately plotted. A copy of the map was then made for a work map. Thickness information was placed on the map. All partings exceeding 3/8 inch in thickness were excluded from the measurements of thickness data. After all data were properly plotted at appropriate location, lines (isopachous lines) were drawn to connect points of equal thickness. The line values used were the 14", 28", 42", and 54". The average thickness for the block of coal between two isopachous lines was taken as the average between the two lines. Thus the coal between the 14" and 28" thickness lines averages 21"; that between 28" and 42" averages 35"; and that between the 42" and 54" averages 48".
>
> "After the thickness lines were established, arcs were made around each point of definite data to determine the different categories of reliability. An arc, with a $\frac{1}{2}$ mile radius around the point and on the coal, defines the proven coal; an arc with a 2-mile radius limits the probable coal; and the arc with the 4-mile radius limits the strongly inferred coal. The 14"- thickness line forms the boundary or outer limit of weakly inferred coal except where the outcrop forms a natural limit. Certain data could not be used except to confirm, to a small extent, deductions made from other points. Such data included "reported" thickness of coal (thus not seen and not measured), coal blossom (not definite, actual thickness of bed questionable), and mines not reporting thickness. These could only be used in a general way in conjunction with nearby positive data."

Figure 1 is an actual sample map of the Lower Kittanning coal preparation described to this point. This is, however, only a very small part of the work maps (pattern is added).

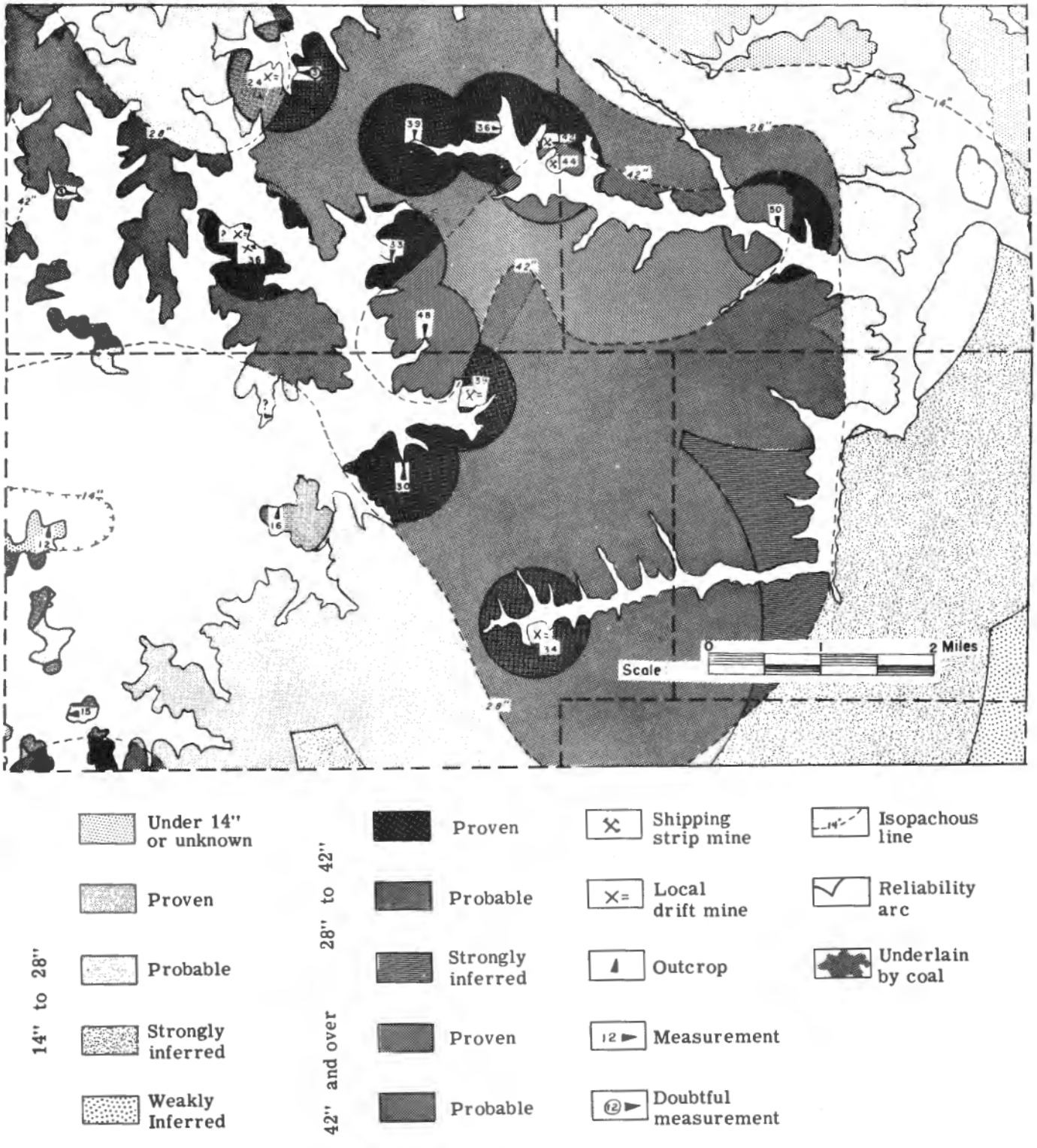


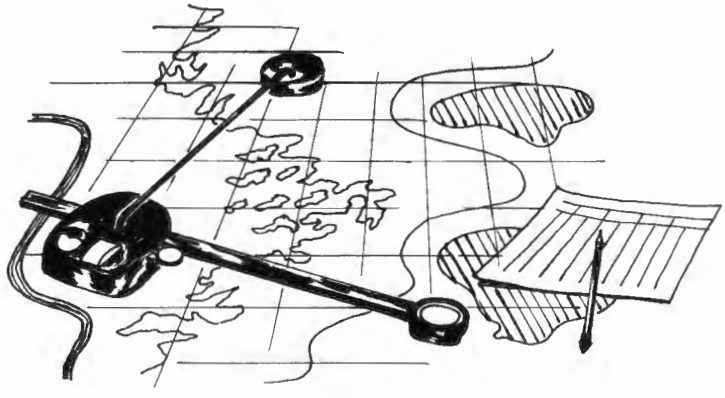
Figure 1. This map is a copy of a portion of one of the work maps and includes a portion of Perry County (Resources Map, Area 16). The shading has been added to show how the various limits of reliability and thickness are made from the definitions that appear in this report and from the data that are available.

METHOD OF CALCULATION

In order to calculate the amount of coal contained in a given bed in a given area it is necessary to find two factors, namely the volume and the density of the coal. The volume is determined by measuring the area and multiplying the result by the average thickness; the density is determined from the specific gravity and is equivalent to 96,000 tons per square mile inch.

The volume in square mile inches is multiplied by the density to determine the tons for a given area. Eighteen hundred (1,800 tons per acre in area one foot thick) is frequently used as a convenient density factor in estimating small areas.

In calculation of the estimate, the areas of the different categories and thicknesses of the coal were measured with a planimeter and the figure placed on a special form for tabulating the data. After completion of the tabulation of the measurements by township, the data were then punched onto business machine cards. These punched cards were then used in electronic business machines to calculate, record, and summarize the results. Summaries of the calculations are found in the Tables 18 and 26 and under the individual county descriptions.



CHAPTER 2

GENERAL GEOLOGY

Physiography

The area underlain by the Pittsburgh and Redstone coal beds is in the unglaciated Allegheny Plateau section of the Appalachian Plateau region (Fenneman, 1938, p. 283). Physiographic changes in this section because of proximity of the glacier to the north are limited to some diversions in direction of original stream flow as well as by deep valley fillings and high terraces along the Ohio, Hocking, and Muskingum Rivers.

The area is drained southeast to the Ohio River by the Hocking and Muskingum Rivers which have their headwaters far to the northwest of the Monongahela outcrop belt, and by numerous minor streams. The streams have broad mature valleys at their mouths and rise to the highlands in a normal concave curve. The highlands have narrow ridges; they are all in slope and are frequently rugged. This marked relief gives a maximum number of exposures for mapping and ideal conditions for drift mining where the coal appears above stream level.

Structure

The area in Ohio underlain by the Pittsburgh and Redstone coal beds lies on the western flank of the Pittsburgh-Huntington Basin with usually a relatively simple geologic structure. The beds are so nearly flat lying that the regional dip to the east and south of approximately 30 feet per mile is not discernible in a single exposure. However, reversals in dip result in synclines and anticlines of local importance superimposed upon the major structure.

The Cambridge anticline and the complementary Parkersburg - Lorain syncline are the most prominent of the flexures affecting the strata in Morgan, Washington, Noble, and Guernsey Counties. Structures of lesser extent are the Newell Run uplift and Cow Run uplift in Washington County, the Cadiz anticline in Harrison County, and the Jacobsburg anticline in Belmont County.

The Pittsburgh and Redstone coal beds are usually thin or absent in the area affected by these structures; however in areas where the coal is of minable thickness the structures cause engineering problems rather than affect the commercial quality and thickness of the coal.

Structure has had little or no control on the development of the stream pattern but has affected to a small degree the steepness of slope.

Stratigraphic Relationships

The base of the Pittsburgh coal is the arbitrary lower boundary of the Monongahela series of the Pennsylvanian system of rocks; the Redstone coal is within the Monongahela series, lying approximately 20 to 30 feet above the Pittsburgh coal. The distribution of the Monongahela series in Ohio is illustrated in the generalized map of Figure 2.

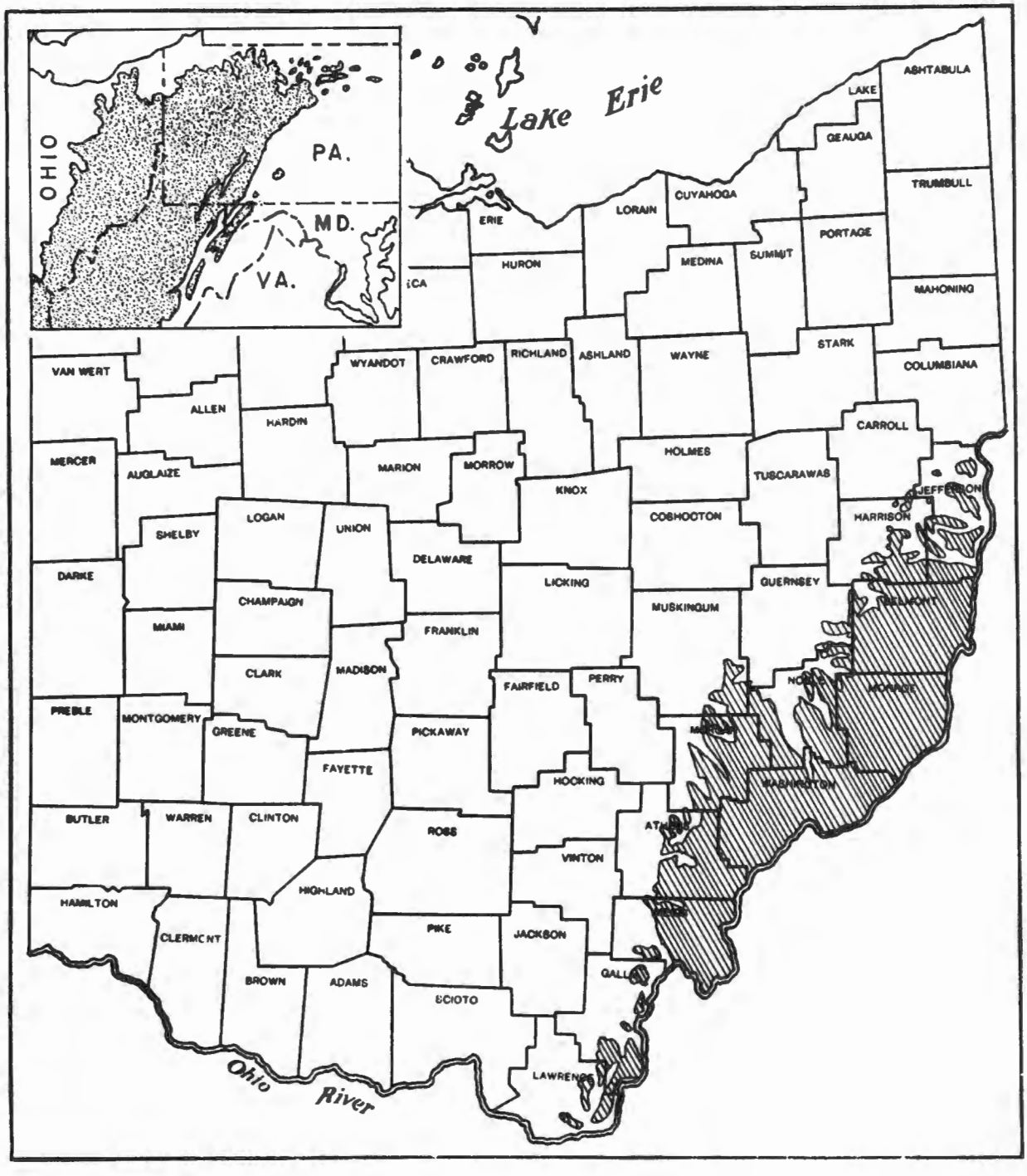
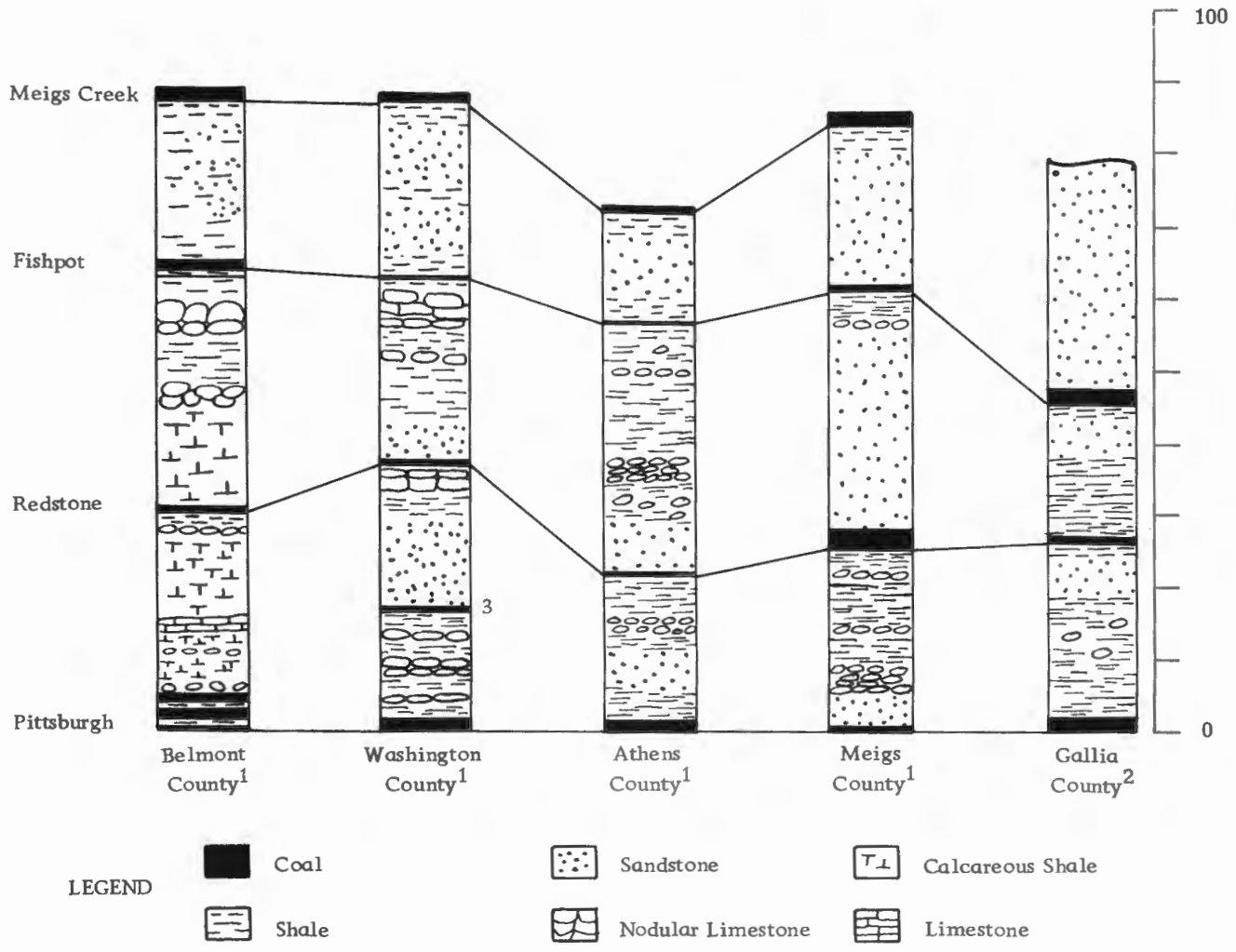


Fig. 2. Generalized map of the Pittsburgh coal bed in Ohio. The Redstone coal occupies approximately the same area as the Pittsburgh coal. The ruled pattern indicates the area underlain by the Pittsburgh and Redstone coals but does not indicate productive regions. Inset shows the location of the northern Appalachian coal basin.

The rocks in the interval between these two coals and the rocks overlying the Redstone coal consist of a variety of rock types including shales, sandstone, and fresh water limestone. The generalized sections shown in Figure 3 graphically illustrate the character of the rocks in the lower part of the Monongahela series in several counties of eastern Ohio. This portion of the geologic column is considered to be largely of continental origin and is characterized by rather abrupt facies changes within the individual units. These are discussed in greater detail in the chapters on the Pittsburgh and Redstone coals.



[1] Adapted from Ohio Division of Geological Survey Open File Report Series #1, W. Stout, 1954.
[2] Adapted from unpublished thesis Ph.D., Oliver D. Blake, The Ohio State University, 1952.
[3] Unnamed thin coal, best developed in Duck Creek add little Muskingum river valleys of Washington County. This coal which has been designated as Pittsburgh in some reports is discussed in the Eastern Washington field in the text of this report.

Figure 3. Generalized sections of strata overlying Pittsburgh and Redstone coal in selected Ohio counties.

CHAPTER 3

THE PITTSBURGH NO.8 COAL BED

The Pittsburgh coal was first described by H. D. Rogers (1839, pp. 96-97) in his early studies in the State of Pennsylvania, and named for exposures in the Pittsburgh, Pennsylvania area. This seam is one of the most valuable and extensive of all coal seams in the coal measures of eastern United States and is recognized and mined in Maryland, Pennsylvania, West Virginia, and Ohio.

In Ohio the Pittsburgh coal can be traced from Jefferson County to Lawrence County. This coal bed thickens and thins along the belt of outcrop resulting in several separate coal fields, the Eastern Ohio or Belmont field being the largest and most important. Other important Pittsburgh coal fields in Ohio are the Federal Creek field, Eastern Washington field, Shade Creek field, and the Gallia field. The areal extent of this coal bed in Ohio is shown by the generalized outcrop map of Figure 2; the location and extent of the coal fields is shown in Figure 4.

Local names were first applied to this seam in the several fields in Ohio. However, this bed was recognized early in Belmont County by Ohio geologists (Andrews, 1874, p. 562) as being the Pittsburgh coal described by H. D. Rogers in Pennsylvania. Still, some confusion prevailed in regard to the correlation of the fields to the southwest. Notably the miscorrelation of

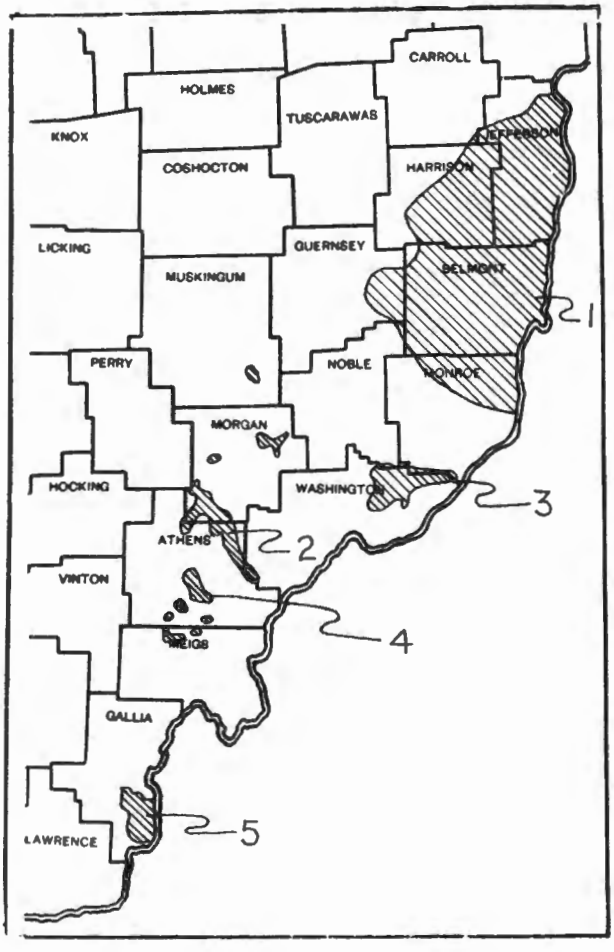


FIGURE 4

Distribution of Pittsburgh coal fields in Ohio

1. Eastern Ohio or Belmont Field
2. Federal Creek Field
3. Eastern Washington Field
4. Shade Creek Field
5. Gallia Field

the Redstone (Pomeroy) # 8a coal in Meigs County with the Pittsburgh coal of the Belmont field was generally accepted until shown otherwise by D. D. Condit in 1907 (Bownocker, 1908, p. 96). The difference in stratigraphic position of these two coal beds as demonstrated by Condit has now been accepted and confirmed by such workers as Bownocker and Stout.

Although correlated with the Pittsburgh coal of the Belmont field, the seam in the Federal Creek field was concurrently correlated with the Redstone coal in the Pomeroy field and was known as the Federal Creek or Pomeroy coal. The miscorrelation of the Pittsburgh coal in the Federal Creek field with the Redstone coal in the Pomeroy field was possibly due to the circumstance of the heavy sandstone overlying the coal in their respective fields for Andrews (1873, p. 284) writes "On Federal Creek . . . the coal is everywhere overlain by a heavy sandrock . . . The Pomeroy coal at Pomeroy has a similar heavy sandrock . . . ." The term Pittsburgh coal has now come into general use for this coal in the Federal Creek field.

Correlation of the Pittsburgh (?) coal of the Eastern Washington field has been controversial, for Stout (1954, Vol. II, p. 31) places the position of the Pittsburgh coal 10 to 22 feet above the minable seam which he called "Lower Salem" coal; and Bownocker (1908, p. 64), Condit (1912, p. 154), and Bell (1950, p. 45) regarded Stout's "Lower Salem" coal to be correlative with the Pittsburgh coal of the Belmont field. This problem is discussed in greater detail farther on in the text.

The Pittsburgh coal of the Gallia field has been locally known as the Swan Creek, Lewis, or Jeffers coal, but it was recognized as being the correlative of the Pittsburgh coal by Bownocker (1908, p. 86). Correlation across Gallia County has been difficult because of poorly developed coal beds and cyclical sequences (Blake, 1950, p. 40). For this reason spore studies in areas of thick coal in Gallia County are extremely useful in identification of coal beds.

Mining History

Because of its excellent thickness above drainage along the Ohio River in Jefferson and northern Belmont Counties this coal was one of the earliest to be utilized for domestic use. Shipment of this fuel by river began about 1835 and became important about 1845, with some of the coal being sent as far south as New Orleans (Bownocker, J. A., 1908, p. 13). Rail shipments began in 1858 but it was not until about 1900 that the great coal mining boom began. A high rate of production from this field has now continued for over a half a century.

The mining industry developed rapidly in the Federal Creek field upon completion of railroad connections in 1885 (Smith, 1952, p. 6) although coal had a long previous use as a local fuel. Production from this field has declined in recent years.

The Gallia field was a source of coal for river traffic in the early 20th century but was discontinued several years before 1930 (Bownocker, 1929, p. 185). The advent of strip mining has made this field increasingly important within the last few years.

Table 1, page 12, shows production by strip and underground methods from 1946 to 1954 for the Pittsburgh coal in Ohio.

Fields of the Pittsburgh Coal

BELMONT OR EASTERN OHIO FIELD

The Pittsburgh coal in the Belmont or Eastern Ohio field is found in some part of every township of Belmont County, in extensive areas of Jefferson and Harrison Counties, and to a lesser extent in Guernsey, Noble, and Monroe Counties (see Figure 4, p. 10). Most of the Pittsburgh coal reserves in Monroe County are below drainage, and because of lack of subsurface information the southern limit of minable (14") coal is not positively known. Toward the

Table 1

Production of Pittsburgh Coal in Ohio by County, 1946 - 1954[1]

(Short tons)

	1946		1947		1948		1949		1950	
County	Total	Strip	Total	Strip	Total	Strip	Total	Strip	Total	Strip
Total	15,281,410	5,532,014	17,686,339	6,378,310	14,554,014	6,655,162	13,319,913	6,183,428	15,101,613	7,005,472
Athens	99,508	52,749	88,426	10,549	222,965	159,689	66,946	38,590	63,233	16,483
Belmont	7,091,894	363,220	8,077,881	546,908	7,713,867	603,613	5,772,990	370,188	6,645,408	312,025
Gallia	1,187	-	7,448	-	45,384	-	38,479	32,138	28,731	-
Guernsey	4,753	-	47,357	33,172	147,677	113,836	125,142	112,618	171,590	155,312
Harrison	3,915,136	3,114,177	4,140,897	3,255,544	3,217,487	2,223,809	3,158,475	2,961,010	3,577,419	3,524,727
Jefferson	4,045,428	1,894,003	5,178,014	2,398,562	2,530,144	2,881,876	3,943,878	2,457,895	4,425,569	2,812,305
Meigs	-	-	-	-	-	-	-	-	-	-
Monroe	-	-	4,183	-	-	-	-	-	-	-
Morgan	35,822	32,948	33,349	29,181	11,367	7,650	2,652	2,652	3,769	-
Muskingum	-	-	40	-	-	-	-	-	542	-
Noble	87,682	74,917	108,058	104,394	480,869	480,435	54,810	51,796	48,819	48,819
Washington	-	-	686	-	184,254	184,254	156,541	156,541	136,533	135,801

	1951		1952		1953		1954	
County	Total	Strip	Total	Strip	Total	Strip	Total	Strip
Total	16,483,473	6,888,316	16,201,222	7,865,381	16,236,339	7,738,662	14,436,184	7,660,059
Athens	37,083	6,623	19,684	453	33,232	14,005	21,604	4,368
Belmont	8,065,798	589,052	7,192,521	794,165	6,668,263	613,542	5,501,248	607,465
Gallia	4,504	-	556	-	5,646	5,646	87,788	86,233
Guernsey	235,247	221,021	346,479	292,594	314,466	314,186	346,181	329,826
Harrison	3,292,835	3,203,722	4,558,624	4,403,800	4,992,962	4,258,236	4,680,242	4,524,159
Jefferson	4,679,667	2,701,512	3,797,636	2,089,768	3,958,528	2,270,675	3,614,316	1,928,240
Meigs	-	-	38,756	38,756	29,048	29,048	30,810	26,609
Monroe	-	-	-	-	-	-	-	-
Morgan	26,610	24,990	1,121	-	870	-	836	-
Muskingum	-	-	-	-	20,682	20,682	-	-
Noble	34,833	34,833	78,048	78,048	74,150	74,150	92,842	92,842
Washington	106,896	106,563	167,797	167,797	138,492	138,492	60,317	60,317

1. Source: Ohio Department of Industrial Relations Annual Coal and Non-Metallic Mineral Reports, 1946-1954. Some changes in seam identification made by the author of this report have served to modify the county totals by seam published in the earlier reports.

northern and western margins of the Belmont field the coal thickness remains steady to the last outlier. However at the southwestern edge of the field in southeastern Guernsey and northeastern Noble Counties the Pittsburgh coal thins from several feet to a few inches within a distance of a mile or two and locally within 100 feet (Stout, 1954, Vol. I, p. 24).

Throughout the Belmont field this coal seam is remarkably steady in thickness and is the highest quality Pittsburgh coal in Ohio. The partings within the seam and development of the coal divide this seam into characteristic benches throughout the Belmont field and also over an extensive area in western Pennsylvania (Cross, 1954, p. 46), facilitating correlation from eastern Ohio into the type area near Pittsburgh.

Limestone and calcareous shales are the most important rock types of the Monongahela series in this field. Stout (1954, Vol. 1, p. 51) writes that these rocks are remarkably persistent and similar. Sandstone strata outcrop at only a few horizons and sandy shale is only locally developed. Clays are thin and nowhere of economic value. The floor of the Pittsburgh coal is either calcareous shale or fresh water limestone throughout the field.

South and southwest of the Belmont field across most of Noble, Morgan, and Washington Counties to the Federal Creek field and Eastern Washington field the Pittsburgh coal is thin or represented by a carbonaceous shale or carbonaceous limestone and is easily confused with thin coals above and below the Pittsburgh horizon.

EASTERN WASHINGTON FIELD

The extent of the Eastern Washington field includes Salem, Fearing, Liberty, Lawrence, and Ludlow Townships and an extension based on a core record into Grandview Township, Washington County. A small portion of the northern edge of the field lies in southern Monroe County (See Fig. 4, p. 10). This field includes the Lower Salem field of Aurelius, Salem, and northwestern Fearing Townships as described by Stout (1954, Vol. II, p. 31). The coal of the Lower Salem field was named the Lower Salem coal by Stout who places its position from 10 to 22 feet below the Pittsburgh coal. However, the correlation of the "Lower Salem" coal of Washington County with the Pittsburgh coal in Belmont County has caused considerable controversy which is still not settled. Andrews (1874, p. 482), Bownocker (1908, p. 64), and Condit (1912, p. 154) correlated the "Lower Salem" with the Pittsburgh. Bell (1950, p. 45) tentatively correlated the "Lower Salem" with the Pittsburgh but left the correlation still open to question. To date tentative results of spore studies by Cross (personal communication, 1954) has not been sufficiently diagnostic to determine the correct stratigraphic relationship between the "Lower Salem" coal and the Pittsburgh coal in Belmont County.

For convenience in this report the "Lower Salem" coal is assumed to be correlative with the Pittsburgh coal and the reserves are included as such.

Because of the Parkersburg-Lorain syncline the Pittsburgh coal dips below drainage on the Muskingum River but it is brought above drainage on the Little Muskingum River by a local structure, the Cow Run uplift. This coal bed has been interpreted to be of uniform thickness between the two rivers and also from the outcrop on the Little Muskingum River eastward to drill-hole data in Grandview Township. Thus the Eastern Washington field includes not only the area of the Lower Salem field as defined by Stout but also a considerable area beyond.

Although the Eastern Washington field is of considerable areal extent the coal is so thin that this field is of minor importance. The thickness of the coal bed in this field is generally 14 to 28 inches and only rarely exceeds 30 inches.

Because of its association with the overlying and underlying limestone beds the Pittsburgh coal in this field has been referred to in the past as the "limestone" coal. Limestone and shale are the predominant rocks above the Pittsburgh ("Lower Salem") coal although some thin but persistent sandstone beds are present.

FEDERAL CREEK FIELD

Over a large area to the southwest of the Belmont field, including most of Noble, Monroe, Morgan, and western Washington Counties, the Pittsburgh coal is thin and only occasionally occurs 14 inches in thickness or greater. These local areas of thickening of Pittsburgh coal are in Union and Meigsville Townships, Morgan County, and Rich Hill and Union Townships, Muskingum County.

The southwestern trend of generally thin coal is interrupted by the Federal Creek field in Morgan and Athens Counties. The Federal Creek field is second only to the Belmont field in extent and amount of reserves of Pittsburgh coal; the coal occurs with good thicknesses but lacks the continuity of the seam in the Belmont field. The Federal Creek field is elongated in a northwest-southeast direction and includes parts of the following townships: Rome, Bern, and Ames Townships of Athens County and Homer and Marion Townships of Morgan County (See Fig. 4, p. 10). The southeastern end of the field is below drainage and because of a lack of reliable subsurface information the margin of minable coal at this end of the field is not well known. Study

of the part of the field that is above drainage shows that the seam at the margins of the field thins rapidly and may grade laterally to a thin carbonaceous shale.

As stated above, the coal within the Federal Creek field attains a good thickness, 98 inches of minable coal is the maximum known. It occurs in its best development as a double-benched seam; the two benches are separated by a clay shale that is about one foot thick. The coal within the Federal Creek field is subject to rapid changes within short horizontal distances because of the thinning of the upper bench (Smith, 1952, p. 6). This thinning, according to Smith, is due either to lack of deposition or to channeling and filling by sand.

The Pittsburgh coal in the Federal Creek field is overlain by a series of shales, sandstone, and limestone, with either shale or sandstone resting on the coal. The thicker coal is overlain by shale up to 20 feet thickness (Smith, 1952, p. 6) but the shale is frequently replaced by the Upper Pittsburgh sandstone. This sandstone may cut out or replace not only the shale but also the upper bench of the coal, which results in a thinner coal bed. Fresh-water limestone and calcareous shales occur higher above the Pittsburgh coal in this field than in the Belmont field. A comparison of the rock sequence above the Pittsburgh coal in the two fields shows the Federal Creek field to contain more sandstone and sandy shale than the Belmont field where limestone is predominant.

The Pittsburgh coal is underlain by a clay of no economic value.

FIELDS IN SOUTHERN ATHENS AND NORTHERN MEIGS COUNTIES

In southern Athens and northern Meigs Counties the development of the Pittsburgh coal is very erratic, thickening and thinning rapidly to form several small fields, the largest of which is the Shade Creek field in Canaan and Lodi Townships, Athens County. Along Kingsbury Run and West Fork Shade Creek, Meigs County, the Pittsburgh coal occasionally swells to minable thickness but the seam has poor continuity along either stream. (See Fig. 4, p. 10).

The coal in the Shade Creek field occurs as a double benched seam separated by a clay parting about one foot in thickness, resulting in a structure that has characteristics similar to that in the Federal Creek field (Bownocker, 1930, p. 183). Variations in thicknesses of this seam in this field are due to thinning or thickening of the upper bench.

Overlap of areas of minable thickness of Pittsburgh #8 coal and Redstone coal in some localities of northern Meigs County has permitted the mining of both coals in a single stripping operation. The interval of 22 to 30 feet between the Pittsburgh and Redstone coals in northern Meigs County is occupied by shale, calcareous shale, and thin limestone beds; in the Shade Creek field, sandstone is more predominant. The massive Pomeroy sandstone overlies the Redstone coal but is separated from the coal bed by about 15 feet of shale in northern Meigs County. The underclay of the Pittsburgh coal in northern Meigs County is thin and of no economic importance. Through southern Meigs and northern Gallia counties this clay is thin but steady and marks the position for the Pittsburgh coal where the coal has thinned to an insignificant thickness.

GALLIA FIELD

The southernmost field of Pittsburgh coal in Ohio occurs in southern Gallia County. This field, called the Gallia field, includes almost all of Ohio and Clay Townships and eastern Harrison and Guyan Townships (See Fig. 4, p. 10). The coal occurs with a good thickness but the bed does not have good continuity and the coal is of poorer quality than Pittsburgh coal of either the Belmont or Federal Creek field.

In the Gallia field the coal is known in places to thicken and thin too abruptly to be shown by isopachous lines on the map at the scale of an inch to a mile. The thickest deposit reported (Blake, 1950, p. 104) is nearly 12 feet, but horizontally it thins to only a few feet within a few yards.

Near the Ohio River the interval between the Pittsburgh and Redstone coals is occupied by blocky clays and sandy shales but to the west of the river sandstone beds become more predominant. Near the base of this sequence there are occasionally thin beds of calcareous ironstone nodules (Blake, 1950, p. 43).

Classification and Characteristics

Coal with heat value of 13,000 to 14,000 B. t. u. (rank index 130 to 140) on moist mineral-matter-free basis is classified as high-volatile B bituminous coal; coal with a heat value of over 14,000 B. t. u. (rank index 140) and fixed carbon of less than 69% is classified as high-volatile A bituminous coal (ASTM, 1948, p. 80). Analyses of the Pittsburgh coal in Ohio on a moist mineral-matter-free basis show a rank index ranging from 131 to 145, giving two classifications, high-volatile A bituminous coal and high-volatile B bituminous coal. The Gallia County field, the most southerly of the Pittsburgh fields, produces the lowest (131) rank coal; the rank of the coal increases steadily to the northeast along the belt of outcrop and attains its greatest (145) rank in Belmont County.

Selected analyses of the Pittsburgh coal in each of the fields of its development are given in Table I. These and other analyses have been previously published by the Ohio Geological Survey or by the U. S. Bureau of Mines. In the Belmont and Federal Creek fields the quantity and quality of analytical data are sufficient to select analyses that represent median values. However, the paucity of data from other fields causes the selection of analyses to be very narrow or mandatory.

The primary uses of the Pittsburgh coal are steam generating, general industrial use, and for domestic purposes. Attempts at coking have been made, notably at Utley, Athens County, but these have all failed. Regarding coking qualities of this seam Stout (1919, p. 2386) states: "The coal cokes freely; but the sulfur and ash are too high to yield a suitable coke for metallurgical use."

BELMONT OR EASTERN OHIO FIELD

The bed structure of the Pittsburgh coal is not consistent from field to field in Ohio. The Belmont field is the only area where the seam exhibits a structure similar to that which is characteristic of the Pittsburgh coal in Pennsylvania (Cross, 1954, Diagram p. 35). This similarity enabled early workers to correctly correlate the bed in the Belmont field with that of the type area. The dominant structure of the Pittsburgh coal in the Belmont field as given by Stout (1954, Vol. 1, p. 25) is as follows:

Roof coal, variable in thickness and poor in quality.
Clay-shale parting, "draw slate," usually about 1 foot in thickness.
Breast coal, a regular and valuable bench.
Shale parting, regular, but usually quite thin.
Bearing-in-coal, ordinarily less than 6 inches in thickness, used for bearing-ins by the pick miners.
Shale parting, regular, but generally thin.
Brick coal, mining yields brick shaped blocks, good quality.
Shale parting, regular, known as "copperband," high in pyrite.
Bottom coal, usually of inferior quality due to irregular partings.

The Pittsburgh coal in the Belmont field has been one of the most desirable of Ohio's coals because of its uniformity of thickness and consistently high quality. Figure 5 illustrates several sections of the coal in this field; analyses are given in Table I.

Table 2

Analyses of Pittsburgh Coal in Ohio

County and Township	File number[1]	Source[2]	Year	Condition[3]	Proximate analysis				Ultimate analysis					Heat value	
					Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulphur	Calories	B.t.u.
Athens Bern	277-1	OGS	1907	1	6.60	35.05	48.15	10.20	5.13	66.61	.93	13.72	3.41	6,607	11,893
				2	-	37.53	51.55	10.92	4.71	71.32	1.00	8.40	3.65	7,074	12,733
				3	-	42.13	57.87	-	5.29	80.06	1.12	9.43	4.10	7,941	14,293
				4	-	40.83	59.17	-	-	-	-	-	-	8,088	14,559
	277-2	OGS	1907	1	4.51	38.24	45.76	11.49	5.10	65.92	.99	11.62	4.88	6,636	11,945
				2	-	40.05	47.92	12.03	4.82	69.03	1.04	7.97	5.11	6,949	12,508
				3	-	45.53	54.47	-	5.48	78.47	1.18	9.06	5.81	7,899	14,218
				4	-	44.00	56.00	-	-	-	-	-	-	8,084	14,552
Athens Canaan	275	OGS	1928	1	7.37	39.02	42.53	11.08	-	-	-	-	4.20	6,407	11,533
				2	-	42.12	45.92	11.96	-	-	-	-	4.54	6,917	12,451
				3	-	47.84	52.16	-	-	-	-	-	5.16	7,857	14,142
				4	-	46.52	53.48	-	-	-	-	-	-	8,028	14,451
Athens Lodi	274-1	OGS	1928	1	8.52	39.15	42.44	9.89	5.41	64.19	1.60	15.85	3.06	6,442	11,595
				2	-	42.79	46.40	10.81	4.87	70.17	1.75	9.06	3.34	7,042	12,675
				3	-	47.98	52.02	-	5.46	78.68	1.96	10.16	3.74	7,896	14,211
				4	-	46.93	53.07	-	-	-	-	-	-	8,034	14,462
Belmont Colerain	273	OGS	1907	1	3.79	36.37	50.84	9.00	5.14	70.41	1.09	10.20	4.16	7,145	12,861
				2	-	37.80	52.84	9.36	4.91	73.18	1.13	7.10	4.32	7,426	13,367
				3	-	41.70	58.30	-	5.42	80.73	1.25	7.83	4.77	8,193	14,747
				4	-	40.36	59.64	-	-	-	-	-	-	8,348	15,027
Belmont Mead	270-A	OGS	1907	1	2.91	37.94	51.15	8.00	5.11	72.95	1.04	8.59	4.31	7,340	13,212
				2	-	39.08	52.68	8.24	4.93	75.13	1.07	6.19	4.44	7,560	13,608
				3	-	42.59	57.41	-	5.37	81.87	1.17	6.75	4.84	8,239	14,830
				4	-	41.33	58.67	-	-	-	-	-	-	8,388	15,098
Belmont Union	262	OGS	1907	1	4.46	36.00	48.78	10.76	4.85	68.24	1.10	10.60	4.45	6,903	12,425
				2	-	37.68	51.06	11.26	4.56	71.42	1.15	6.95	4.66	7,225	13,005
				3	-	42.46	57.54	-	5.14	80.48	1.30	7.83	5.25	8,142	14,655
				4	-	40.94	59.06	-	-	-	-	-	-	8,321	14,977
Gallia Harrison	255	OGS	1907	1	6.98	36.14	47.85	9.03	5.24	64.91	1.01	14.60	5.21	6,583	11,849
				2	-	38.85	51.44	9.71	4.81	69.77	1.08	9.03	5.60	7,076	12,737
				3	-	43.03	56.97	-	5.33	77.27	1.20	10.00	6.20	7,837	14,107
				4	-	41.46	58.54	-	-	-	-	-	-	8,007	14,412
Guernsey Millwood	173-A	USBM[4]	1927	1	4.50	40.60	46.60	8.30	5.40	70.30	1.10	10.30	4.60	7,111	12,800
				2	-	42.50	48.80	8.70	5.20	73.60	1.20	6.40	4.90	7,444	13,400
				3	-	46.50	53.50	-	5.70	80.70	1.30	7.00	5.30	8,156	14,680
				4	-	45.40	54.60	-	-	-	-	-	-	8,311	14,960
Harrison Cadiz	251	OGS	1907	1	3.83	36.70	48.59	10.88	5.09	67.70	1.27	10.68	4.38	6,864	12,355
				2	-	38.16	50.53	11.31	4.85	70.40	1.32	7.57	4.55	7,137	12,847
				3	-	43.03	56.97	-	5.47	79.37	1.49	8.54	5.13	8,047	14,485
				4	-	41.55	58.45	-	-	-	-	-	-	8,221	14,797
Jefferson Knox	186	USBM[5]	1916	1	3.18	38.11	49.35	9.36	-	-	-	-	4.02	7,187	12,937
				2	-	39.36	50.97	9.67	-	-	-	-	4.15	7,423	13,361
				3	-	43.57	56.43	-	-	-	-	-	4.59	8,218	14,791
				4	-	42.31	57.69	-	-	-	-	-	-	8,373	15,072
Jefferson Smithfield	192	USBM[6]	1913	1	4.87	36.63	51.25	7.25	5.36	71.91	1.38	11.50	2.60	7,218	12,992
				2	-	38.51	53.87	7.62	5.07	75.59	1.45	7.54	2.73	7,588	13,658
				3	-	41.69	58.31	-	5.49	81.82	1.57	8.16	2.96	8,214	14,785
				4	-	40.78	59.22	-	-	-	-	-	-	8,322	14,979
Morgan Homer	240	OGS	1907	1	6.87	40.55	44.39	8.19	5.32	67.39	.90	13.98	4.22	6,722	12,100
				2	-	43.54	47.67	8.79	4.90	72.36	.96	8.46	4.53	7,218	12,992
				3	-	47.74	52.26	-	5.37	79.33	1.05	9.28	4.97	7,914	14,244
				4	-	46.61	53.39	-	-	-	-	-	-	8,058	14,504
Washington Salem	494	OGS	1929	1	2.19	41.06	46.00	10.75	4.91	68.37	.70	10.08	5.19	6,972	12,550
				2	-	41.98	47.03	10.99	4.77	69.91	.71	8.32	5.30	7,128	12,831
				3	-	47.16	52.84	-	5.36	78.54	.80	9.35	5.95	8,008	14,415
				4	-	45.74	54.26	-	-	-	-	-	-	8,192	14,746

1. Graphic profile of coal bed and map location reference are shown in Figure 5.
2. OGS - Ohio Geological Survey; USBM - United States Bureau of Mines
3. 1, As received; 2, moisture-free; 3, moisture- and ash-free; 4, dry mineral-matter-free (unit coal).
4. USBM Bull. 499, p.36, 1952
5. USBM Bull. 193, p.51, 1922
6. USBM Bull. 85, p.62, 1914.

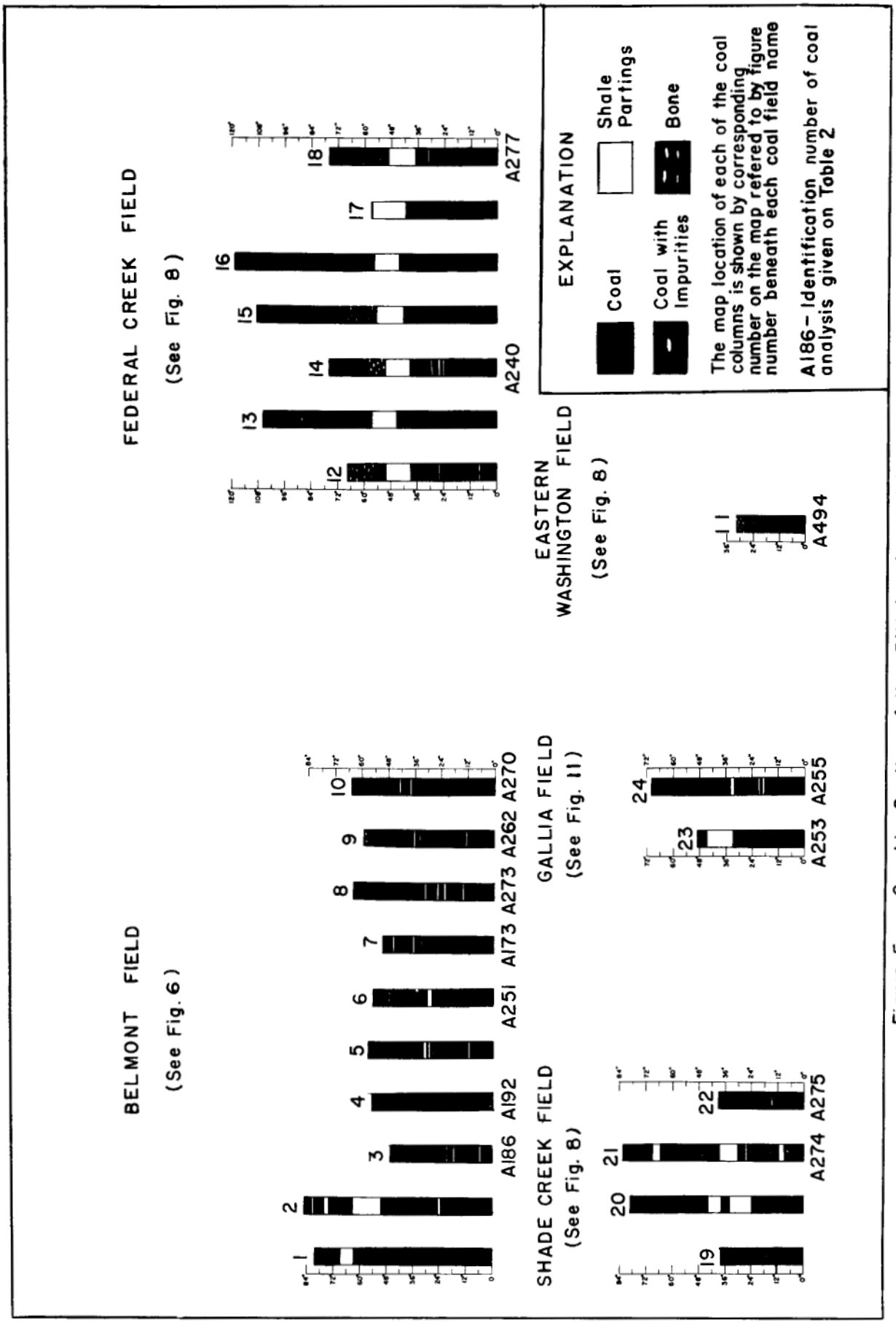


Figure 5. Graphic Sections of the Pittsburgh Coal in Ohio

EASTERN WASHINGTON FIELD

The Pittsburgh ("Lower Salem") coal of the Eastern Washington field is much thinner than in the Belmont field; it usually is between 14 and 28 inches thick and rarely exceeds 30 inches. The seam within the Eastern Washington field is interbedded with thin shale partings, none of which is distinctive or persistent. Replacement of the coal bed by channel filling is rare, only one being reported (Bell, 1950, p. 44).

The B. t. u. of the Pittsburgh coal within the Eastern Washington field is 12, 550 on the "as received" sample (see Table 1) but the coal has not been mined extensively because it is thin. Depletion of more desirable beds and changes in the economic conditions of the coal industry will be necessary before this field is an important part of our reserves.

FEDERAL CREEK FIELD

The Pittsburgh coal within the Federal Creek field displays a distinctive structure that is typical within the boundaries of the field but different from that of the Belmont field. The Pittsburgh coal of the Federal Creek field occurs in two benches that are separated by a foot of clay shale; whereas in the Belmont field this bed is divided into several benches.

Within the Federal Creek field the Pittsburgh coal lacks uniformity of thickness. The thickest coal is overlain by about 20 feet of shale; where sandstone occurs above the coal the upper bench thins. Thin shale partings and pyrite stringers or inclusions are common but not persistent in both benches of the coal. The B. t. u. of the coal on the "as received" basis is approximately 12, 000, and ash and sulfur content is high. (See Table I)

FIELDS IN SOUTHERN ATHENS AND NORTHERN MEIGS COUNTIES

Although the Pittsburgh coal in the Shade Creek field occurs in two benches as does the coal in the Federal Creek field, it is not definitely established that these two benches are equivalent in the two fields. Further field work and laboratory studies will be necessary to establish that true relationship of the two fields.

The extent of the Shade Creek field is relatively small with only a small percentage of the field containing coal more than 42 inches in thickness. Nevertheless it has been mined for both local use and for shipment.

Strong variations of the Pittsburgh coal thickness within the Shade Creek field are attributed to irregularities of the upper bench. Pyrite and thin shale partings are also common but not continuous. The B. t. u. of the coal on the "as received" basis averages close to 11, 500 and the coal is high in ash and sulfur. (See Table I, p. 12).

In the small fields of the Pittsburgh coal along Kingsbury Run and the West Fork of Shade Creek the bed occurs as a thin single bench of low quality coal. These fields are mainly a source for local fuel and do not constitute an important part of the reserves of this coal bed.

GALLIA FIELD

None of the partings in the Pittsburgh coal of the Gallia field is sufficiently thick or persistent to produce a distinctive structure (Blake, 1950, p. 39). The partings are as much as 6 inches thick and are irregular and discontinuous. The coal thickness is frequently too variable to be shown in detail on maps scaled one inch to the mile.

Analyses on the "as received" basis show the B. t. u. of this coal to average around 11,800. Details of analyses from this field are shown on Table I.

Reserves of the Pittsburgh No.8 Coal

RELIABILITY OF ESTIMATE

The Pittsburgh coal has been studied by many Ohio geologists in the past and as a result a large amount of information on this seam is in the files of the Ohio Division of Geological Survey. The best and most reliable information is where mining activity has been greatest, frequently leaving in doubt only the precise outer margins of minable coal of some localities.

Control for drawing of isopachous lines in the Belmont field is excellent except in northern Monroe County, where the position of the boundary of minable coal is questionable.

The limits of the Federal Creek field are well delineated except at the southeastern end of the field where the coal is below the surface. Lack of subsurface information leaves the limits of this part of the field to interpretation.

Although there is little information to justify the interpretation, the Pittsburgh ("Lower Salem") coal of the Lower Salem field is believed to have good continuity even though it is thin. There is at present no reason to believe that this seam increases anywhere in this region to the excellent thickness of the Pittsburgh coal in the Belmont and Federal Creek fields.

In southern Athens and northern Meigs Counties sufficient points of information are available to make it possible to isolate the small patches of Pittsburgh coal.

The isopachous lines of the Gallia field are probably the most doubtful in accuracy of all of the fields discussed in this report. Even so the reserve estimate for this field is considered to be of reasonable accuracy.

COMPARISON WITH PREVIOUS ESTIMATES

Table 3 compares by county and state total the results of this estimate with that of Clark (1917, pp. 88-96).

The estimate of Ohio coal reserves made by Ray (1919, pp. 329-41), includes both Pittsburgh and Redstone coals within one figure. Table IV compares a combined estimate of the Pittsburgh and Redstone coal reserves of this report with that made by Ray, although in his reserve study he considered a coal bed thickness of 32 inches as the minimum minable thickness.

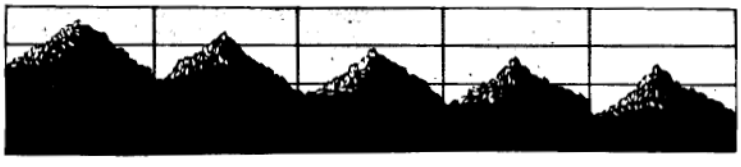


Table 3

Comparison by Counties of Estimated Original Pittsburgh Coal Reserves
(In thousands of short tons)

County	Author	
	Clark[1]	DeLong
Athens	552,000	217,697
Belmont	2,690,000	2,752,476[2]
Carroll	-	46
Gallia	158,000	180,557
Guernsey	84,000	64,786
Harrison	623,000	490,728
Jefferson	623,000	718,581
Meigs	173,000	45,144
Monroe	1,475,000	783,858
Morgan	100,000	82,463
Muskingum	29,000	12,675
Noble	22,000	27,277
Washington	334,000	183,644
Totals	6,863,000	5,559,932

[1] Clark, 1917, pp. 88-96

[2] From U.S.G.S. Circ. 363

Table 4

Comparison by Counties of the Combined Estimated Original Pittsburgh and Redstone Coal Reserves
(In thousands of short tons)

County	Author	
	Ray[1]	DeLong
Athens	95,040	223,502
Belmont	2,191,200	2,752,476[2]
Carroll	-	46
Gallia	42,240	331,105
Guernsey	52,800	64,786
Harrison	580,800	490,728
Jefferson	580,800	718,581
Lawrence	-	22,658
Meigs	451,584	662,390
Monroe	174,240	783,858
Morgan	-	82,463
Muskingum	-	12,675
Noble	-	27,277
Washington	-	183,644
Totals	4,168,704	6,356,189

[1] Ray, 1929, pp. 627-652

[2] From U.S.G.S. Circ. 363

DISCUSSION OF RESERVES BY COUNTY

Jefferson County

Jefferson County, which contains an estimated total original reserves of 718,581,000 tons of Pittsburgh coal, constitutes an important part of the Belmont field. This coal bed is widespread in its occurrence in Jefferson County where it is found in every township except Brush Creek in the northwestern corner of the county (see Fig. 6, p. 22). In the southeastern corner of Jefferson County the Pittsburgh coal outcrops closely above drainage level and rises gradually to the west and north. In the northern part of the county the coal bed is confined to the high hills and knobs. Because of the ideal conditions for strip mining, production by this method exceeds production by underground mining. Production from the Pittsburgh coal bed for Jefferson County in recent years is given in Table 2, p. 16.

The Pittsburgh coal in Jefferson County is remarkably persistent in thickness and nowhere has it measured less than 28 inches. The estimated total original reserves for Jefferson County given in Table 5 shows the excellent thickness and reliability of the Pittsburgh coal in this county.

Table 5

Estimated Original Reserves of the Pittsburgh Coal Bed in Jefferson County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78" +	Total
Proven	-	2,150	77,922	182,189	1,590	-	263,851
Probable	-	4,838	145,153	298,888	138	-	449,017
Strongly Inferred	-	-	5,713	-	-	-	5,713
Weakly Inferred	-	-	-	-	-	-	-
Total	-	6,988	228,788	481,077	1,728	-	718,581

Harrison County

The Pittsburgh coal in Harrison County constitutes a part of the Belmont field. This coal bed occurs in the eastern and southern townships but it is most extensive in Short Creek, Athens, Cadiz, and Green townships. The Pittsburgh coal lies well above drainage throughout the county and in the extreme western and northern parts of the county lies high on the ridges and knobs (see Fig. 6, p. 22). More than half of the production shown in Table 2, p. 16, is by stripping methods.

The preponderance of thick (28"+) coal is shown in Figure 6; coal less than 28 inches thickness occupies an inconsequential areal extent on a few of the high knobs in the southwestern part of the county. Table 6 shows the high degree of reliability (99% proven and probable) category of the estimated 490,728,000 tons of original reserves of Pittsburgh coal.

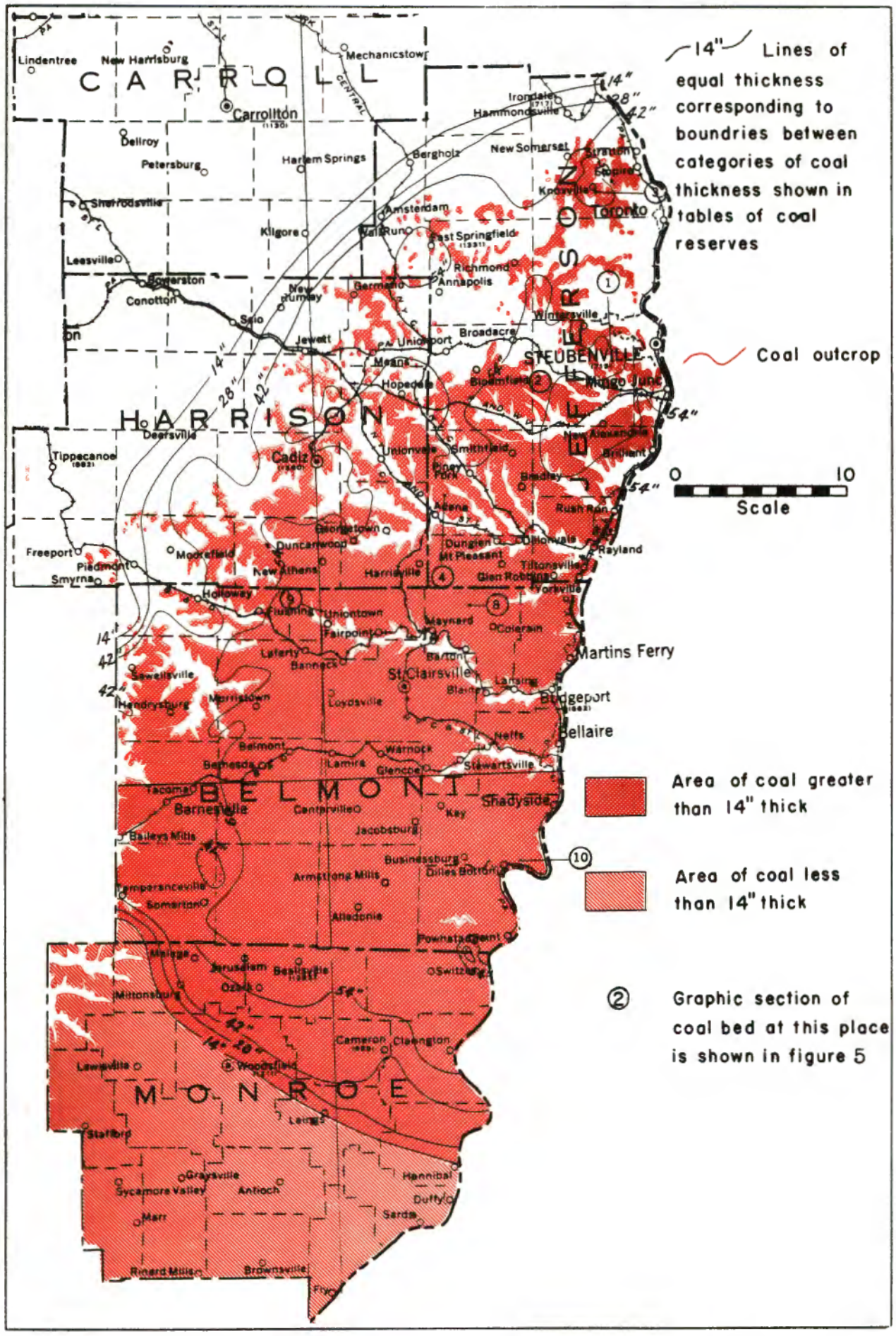


Figure 6. The Pittsburgh Coal in Carroll, Jefferson, Harrison, Belmont and Monroe Counties

Table 6

Estimated Original Reserves of the Pittsburgh Coal Bed in Harrison County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78"	Total
Proven	-	3,293	61,977	111,916	-	-	177,186
Probable	343	4,570	104,601	200,045	-	-	309,559
Strongly Inferred	20	-	3,963	-	-	-	3,983
Weakly Inferred	-	-	-	-	-	-	-
Total	363	7,863	170,541	311,961	-	-	490,728

Belmont County

The estimate of the Pittsburgh coal reserves in Belmont County was made by Mr. Henry Berryhill of the U. S. Geological Survey in its cooperative program with the Ohio Division of Geological Survey for the mapping of this county. The figures presented in Table 7 for the total estimated original reserves of Belmont County are Mr. Berryhill's and are based on the classification adopted by the U. S. Geological Survey and published by that organization in Circular 363. As stated previously in Chapter 1, there are no essential differences between the "measured" and "indicated" categories of reliability as used by the U. S. Geological Survey and the "proven" and "probable" categories of reliability as used by the Ohio Division of Geological Survey. Although there are differences in the inferred categories in the classifications used by these two organizations they are of no consequence in the reserves of Belmont County as all Pittsburgh coal reserves are within the "measured" and "indicated" categories of reliability.

A difference of thickness categories used in the Belmont County study from those used for the other counties of this report should be noted. The values of lines of equal thickness used in Belmont County are 14 inches, 28 inches, 42 inches, and 60 inches; values for these lines in all other counties are 14 inches, 28 inches, 42 inches, 54 inches, 66 inches, and continue increasing in 12-inch steps.

The well known Belmont field richly deserves the derivation of its name from Belmont County since this county is the center of this valuable block of coal. Despite the fact that Belmont County contains but a fraction of the areal extent of this coal bed, nearly half of the total estimated original reserves lies within its boundary. Figure 6, p. 22, shows that a very small proportion of the coal bed in Belmont County has been removed by stream and valley cutting, which results in very broad expanses of continuous coal. The high quality, excellent continuity, and extent of the coal have caused this seam to be highly desired by coal operators and has resulted in Belmont County being the leading coal producer in Ohio in recent years. Of the original estimated 2,752,476,000 tons of reserves in Belmont County 826,751,100 tons has been mined and lost in mining. Because the Pittsburgh coal appears above drainage along only a few of the streams, underground mining has continued to be the most important method of taking the coal.

Table 7 below demonstrates the excellent thickness and high reliability of the Pittsburgh coal throughout Belmont County. It is only in the extreme southwestern corner of the county that the coal bed thins and becomes of no commercial value.

Table 7

Estimated Original Reserves of the Pittsburgh Coal Bed in Belmont County[1]
(In thousands of short tons)

Reliability category	Thickness				
	14" - 28"	28" - 42"	42" - 60"	60" +	Total
Measured	-	15,211	354,392	965,136	1,334,739
Indicated	419	34,031	655,347	727,940	1,417,737
Inferred	-	-	-	-	-
Total	419	49,242	1,009,739	1,693,076	2,752,476

[1] Estimate by H. Berryhill, U.S.G.S. Circ. 363, 1955.

Monroe County

In the northwestern corner of Monroe County the Pittsburgh coal dips below drainage and remains under cover throughout the rest of this county (see Fig. 6, p. 22). Consequently the extent of thick coal of the Belmont field that occurs in Monroe County is known only by core-drill methods and by mining that has taken place only in the northeastern part of Switzerland Township. Core drill information at the southern edge of the Belmont field is not sufficiently adequate to precisely delineate the margin of minable coal, nor to give a desirably accurate picture of the reserves estimate. Although the estimated total original reserves is an impressive 783,858,000 tons of Pittsburgh coal, a figure second only to Belmont County, the tenuous character of this estimate may be appreciated when it is pointed out that of this total figure 44% is of the strongly and weakly inferred categories of reliability, and only 9% is in the proven category. Therefore, until more information regarding this seam is available, Monroe County should not be given the stature of Jefferson or Harrison Counties with regards to quantity and value of the reserves of Pittsburgh coal.

Table 8 illustrates the estimated reserves by thickness and reliability categories.

Table 8

Estimated Original Reserves of the Pittsburgh Coal Bed in Monroe County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78" +	Total
Proven	-	840	11,290	57,599	-	-	69,729
Probable	13,910	17,271	98,933	235,296	-	-	365,410
Strongly Inferred	19,678	64,748	90,410	38,937	-	-	213,773
Weakly Inferred	19,092	28,325	74,051	13,478	-	-	134,946
Total	52,680	111,184	274,684	345,310	-	-	783,858

Carroll County

In Carroll County the Pittsburgh coal occurs only in Loudon Township as a small, isolated patch of approximately 6.4 acres. Because of its limited areal extent, the Pittsburgh coal reserves for Carroll County is the smallest of any county in which this coal seam appears, the estimated original reserves totals being 46,000 tons. Table 9 given below shows the reliability of the reserves.

Table 9

Estimated Original Reserves of the Pittsburgh Coal Bed in Carroll County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78"	Total
Proven	-	-	-	-	-	-	-
Probable	-	-	46	-	-	-	46
Strongly Inferred	-	-	-	-	-	-	-
Weakly Inferred	-	-	-	-	-	-	-
Total	-	-	46	-	-	-	46

Guernsey County

The Belmont or Eastern Ohio field extends west into Guernsey County where the field is terminated in the eastern tier of townships. This portion of the Belmont field is confined to the knobs and high ridges, subsequently limiting the areal extent of this valuable block of coal, for nearly everywhere in this county that this coal bed is found it is of sufficient thickness to be of value. Essentially all reserves of the Pittsburgh coal in Guernsey County occurs in this eastern tier of townships.

Owing to the influence of the Cambridge anticline the Pittsburgh coal has been eroded and removed over a considerable area in the southern part of Guernsey County, but it is present in the high ridges and knobs in the southwestern corner of the county as a thin bed that is unimportant to the reserves estimate (see Fig. 7, p. 26).

The estimated total reserves for Guernsey County is 64,786,000 tons of Pittsburgh coal, of which approximately 80% is 28 inches or more in thickness. The thickness and reliability categories of the reserve estimates are given below in Table 10.

Table 10

Estimated Original Reserves of the Pittsburgh Coal Bed in Guernsey County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78"	Total
Proven	544	6,586	15,898	-	-	-	23,028
Probable	1,170	6,015	33,453	-	-	-	40,638
Strongly Inferred	202	437	461	-	-	-	1,100
Weakly Inferred	20	-	-	-	-	-	20
Total	1,936	13,038	49,812	-	-	-	64,786

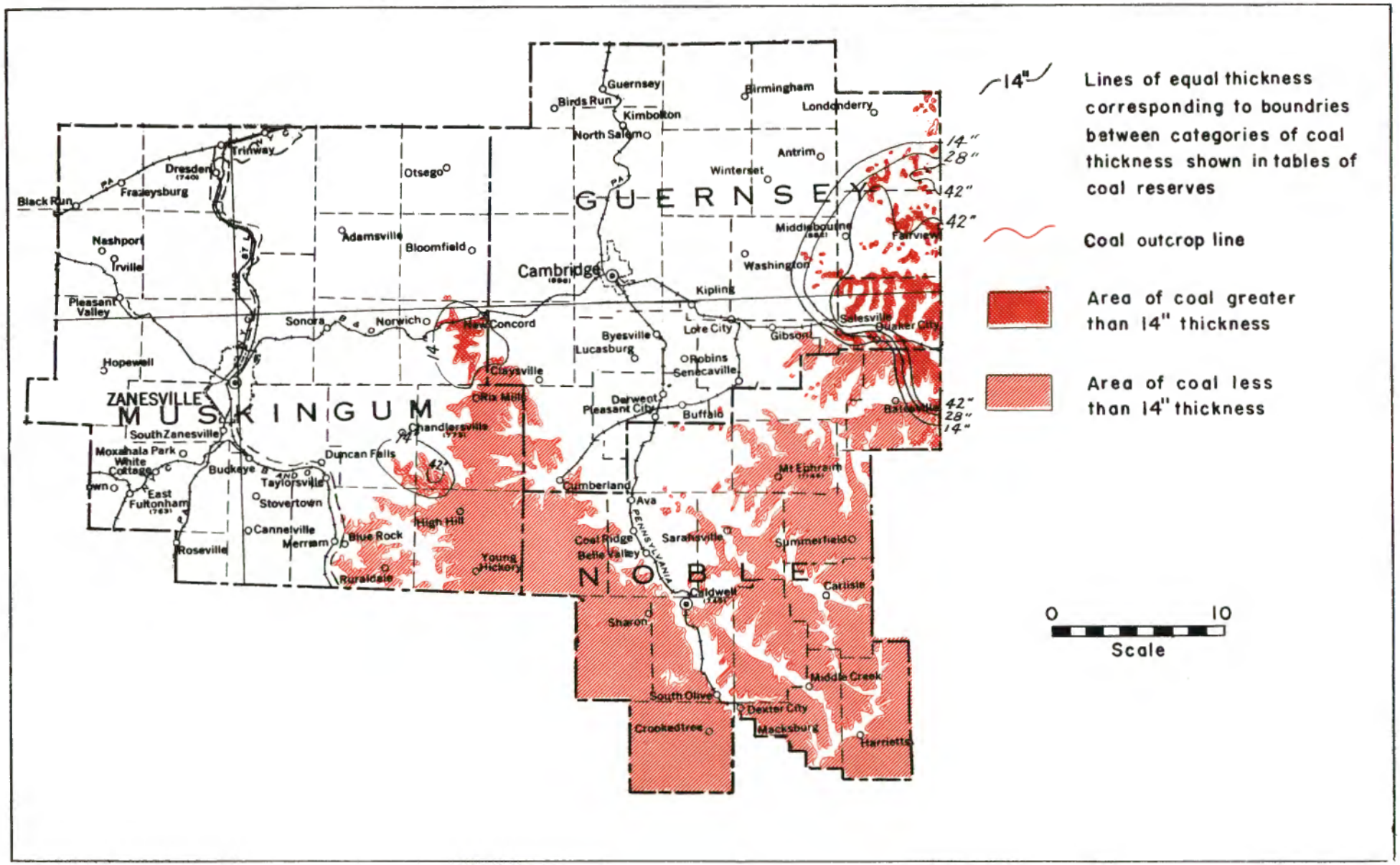


Figure 7. The Pittsburgh Coal in Guernsey, Noble and Muskingum Counties

Noble County

The Pittsburgh coal outcrops in some part of every township of Noble County (see Fig. 7, p. 26) but nevertheless Noble County has the lowest reserve estimate of any county in which there is an extensive occurrence of this coal bed. The thick Pittsburgh coal of the Eastern Ohio or Belmont field is found in the northeastern part of Beaver Township but the coal bed thins rapidly to the southwest and does not thicken to economic importance anywhere across Noble County.

As shown in Table 11 the estimated total original tonnage of Pittsburgh coal for Noble County is 27,277,000 tons, of which 62% is in the 42-54 inch thickness category.

Table 11

Estimated Original Reserves of the Pittsburgh Coal Bed in Noble County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78"	Total
Proven	483	134	9,032	-	-	-	9,649
Probable	3,850	3,091	7,603	-	-	-	14,544
Strongly Inferred	3,084	-	-	-	-	-	3,084
Weakly Inferred	-	-	-	-	-	-	-
Total	7,417	3,225	16,635	-	-	-	27,277

Muskingum County

In Muskingum County the area underlain by the Pittsburgh coal is small, the coal occurring in the ridges and knobs in the southeastern part of the county (see Fig. 7, p. 26). It has been mined for local use, but because this coal bed is thin and the area limited it does not constitute an important part of the reserves of the Pittsburgh coal.

As shown in Table 12 below the estimated total original reserves of the Pittsburgh coal in Muskingum County is extremely low, totaling only 12,675,000 tons.

Table 12

Estimated Original Reserves of the Pittsburgh Coal Bed in Muskingum County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78"	Total
Proven	1,472	773	-	-	-	-	2,245
Probable	9,939	370	-	-	-	-	10,309
Strongly Inferred	121	-	-	-	-	-	121
Weakly Inferred	-	-	-	-	-	-	-
Total	11,532	1,143	-	-	-	-	12,675

Washington County

There are two areas of minable Pittsburgh coal in Washington County, one, the Eastern Washington field in Aurelius and surrounding townships, the other in Decatur Township where the Federal Creek field terminates (see Fig. 8, p. 29).

The Pittsburgh coal at the terminal end of Federal Creek field in Decatur Township is entirely under cover and known only in a small number of mines and core-drill holes. The precise boundary of the field is unknown to date and its position has been inferred by knowledge of the regional aspects of this field. All reserves above 42 inches shown in Table 13 occurs in this field.

The Pittsburgh coal in the Eastern Washington field is thin, widespread, and much of it is of a low reliability classification. The low reliability is a result of most of the reserves in this field lying under cover.

Table 13 which shows the total original reserves for Washington County includes the reserves of both areas. Although the total estimated original reserves for Washington County is an impressive 174,250,000 tons of coal, 144,507,000 or over 80% is thin (14-28") coal; of the total amount of thin coal nearly 40% is in the strong to weakly inferred categories of reliability.

Table 13

Estimated Original Reserves of the Pittsburgh Coal Bed in Washington County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78"	Total
Proven	20,584	9,912	-	-	-	-	30,496
Probable	80,296	2,587	599	1,613	1,244	-	86,339
Strongly Inferred	52,315	1,008	2,120	4,435	4,493	-	64,371
Weakly Inferred	706	672	1,060	-	-	-	2,438
Total	153,901	14,179	3,779	6,048	5,737	-	183,644

Morgan County

The Pittsburgh coal is found in nearly every township of Morgan County, but it is generally too thin to be considered as a minable reserve. The extension of the Federal Creek field into Homer and Marion Townships accounts for most of Morgan County's reserves, and it is only in these townships that the coal exceeds 28 inches in thickness. Pockets of thin (14"-28") coal occur in Union and Meigsville Townships. Figure 8 illustrates the outcrop and minable coal distribution for this county.

Of the estimated original reserves of 82,463,000 tons of coal in Morgan County, approximately 60% is within the Federal Creek field in Homer and Marion Townships, and all coal over 28" is confined to these same townships. Table 14 shows the estimate for original reserves for the county; for the reserve breakdown by townships the reader is referred to Table 18, p. 32.

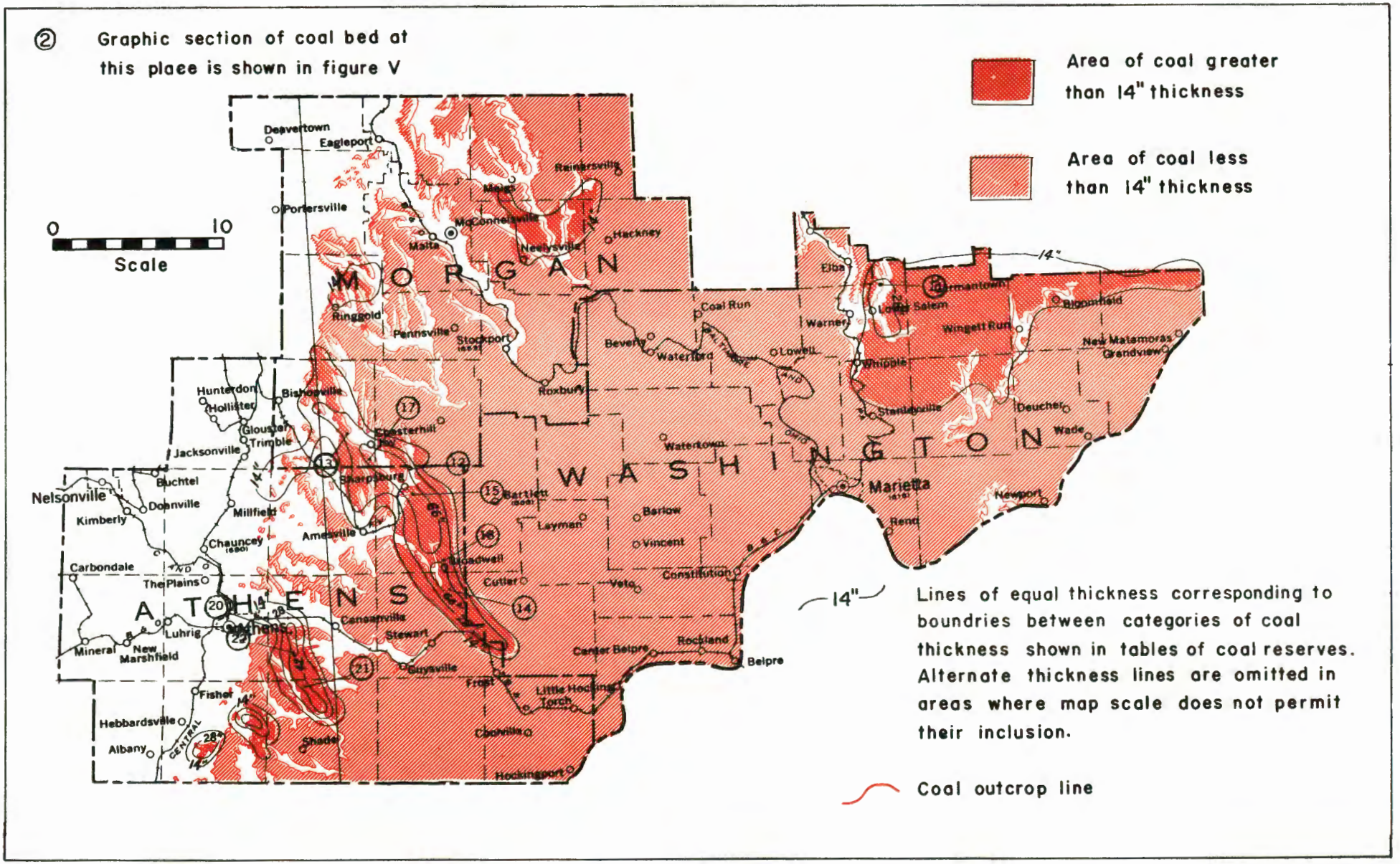


Figure 8. The Pittsburgh Coal in Washington, Morgan and Athens Counties

Table 14

Estimated Original Reserves of the Pittsburgh Coal Bed in Morgan County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78" +	Total
Proven	13,971	4,503	3,825	3,801	3,664	5,628	35,392
Probable	25,908	10,483	2,672	2,188	2,903	2,413	46,567
Strongly Inferred	504	-	-	-	-	-	504
Weakly Inferred	-	-	-	-	-	-	-
Total	40,383	14,986	6,497	5,989	6,567	8,041	82,463

Athens County

The Pittsburgh coal has wide distribution in Athens County and becomes of economic importance in two main areas, one, the Federal Creek field in northeastern Athens County, and the Shade Creek field in the south-central part of the county. Of the two fields, the Federal Creek field contains the greatest reserves. The outcrop and distribution of the Pittsburgh coal in Athens County are illustrated in Figure 8.

Except for the Belmont field area, Athens County has the richest Pittsburgh coal deposits in Ohio, the estimated original reserves totaling 217,697,000 tons. Of this tonnage only 11% is estimated as thin (14-28") coal and approximately 95% of the total tonnage falls within the proven and probable categories of reliability. Table 15 shows the tabulations by thickness and reliability categories of the estimated original tonnage. No distinction by fields has been made in this table but reserves by township are shown in Table 18, p. 32.

Table 15

Estimated Original Reserves of the Pittsburgh Coal Bed in Athens County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78" +	Total
Proven	8,629	10,214	19,630	17,223	16,382	25,232	97,310
Probable	13,204	16,330	17,648	13,018	28,546	19,329	108,075
Strongly Inferred	988	1,310	2,258	3,053	1,797	-	9,406
Weakly Inferred	786	1,613	507	-	-	-	2,906
Total	23,607	29,467	40,043	33,294	46,725	44,561	217,697

Meigs County

Although the Pittsburgh coal outcrops in a north-south belt across Meigs County it is only in restricted parts of Scipio and Bedford Townships that it is of economic importance (see Fig. 9, p. 36). The estimated original reserves for the county is a modest 45,144,000 tons, of which approximately 33% is thin (14-28") coal (see Table 16 below).

Table 16

Estimated Original Reserves of the Pittsburgh Coal Bed in Meigs County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78" +	Total
Proven	4,697	11,323	7,972	1,325	-	-	25,317
Probable	10,665	7,526	1,521	115	-	-	19,827
Strongly Inferred	-	-	-	-	-	-	-
Weakly Inferred	-	-	-	-	-	-	-
Total	15,362	18,849	9,493	1,440	-	-	45,144

Gallia County

All minable Pittsburgh coal in Gallia County occurs in the Gallia field which is restricted to parts of Ohio, Clay, Guyan, and Harrison Townships (see Fig. 9, p. 36). Along the Ohio River this coal bed outcrops slightly above drainage level but it gradually rises to the west and it is found in the ridges in the eastern parts of Guyan and Harrison Townships.

The Gallia field is the third ranking field of Pittsburgh coal in Ohio. Of the estimated original reserves of 180,557,000 tons, 7% is thin (14-28") coal and practically all of it is in the proven or probable categories of reliability (see Table 17 below).

Although this field is of moderate extent the coal has not been as highly sought after as the Pittsburgh coal from other fields. During the 1920's and 30's there was only a minor amount of coal mined in Gallia County but in more recent years production has been up as a result of the increase in strip mining methods.

Table 17

Estimated Original Reserves of the Pittsburgh Coal Bed in Gallia County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78" +	Total
Proven	1,552	6,417	6,220	14,573	10,852	6,355	45,969
Probable	10,341	12,970	19,031	63,245	28,961	-	134,548
Strongly Inferred	40	-	-	-	-	-	40
Weakly Inferred	-	-	-	-	-	-	-
Total	11,933	19,387	25,251	77,818	39,813	6,355	180,557

Table 18

Estimated Original Reserves of the Pittsburgh Coal Bed in Ohio

(In thousands of short tons. To obtain total tonnage add three zeros to end of each figure.)

County and Township	Proven coal						Probable coal					
	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total
ATHENS												
Alexander	2,863	2,520	2,212	--	--	7,595	1,673	1,378	922	--	--	3,973
Ames	605	1,848	5,161	518	725	8,857	726	1,209	2,903	--	--	4,838
Athens	60	101	--	--	--	161	383	--	--	--	--	383
Bern	605	739	1,935	11,117	32,980	47,376	2,863	4,805	6,589	7,546	30,655	52,458
Canaan	1,210	1,982	4,101	2,938	2,350	12,581	2,701	4,234	2,258	1,613	829	11,635
Carthage	40	--	--	--	--	40	20	--	--	--	--	20
Dover	101	--	--	--	--	101	60	--	--	--	--	60
Lodi	3,145	3,024	5,760	1,786	--	13,715	3,649	2,822	2,442	--	--	8,913
Rome	--	--	461	864	5,559	6,884	1,109	1,882	2,534	3,859	16,391	25,775
Trimble	--	--	--	--	--	--	20	--	--	--	--	20
Total	8,629	10,214	19,630	17,223	41,614	97,310	13,204	16,330	17,648	13,018	47,875	108,075
BELMONT*												
Colerain	--	--	--	137,200	--	137,200	--	--	--	--	--	--
Flushing	--	13,786	32,258	--	--	46,044	--	3,704	33,716	--	--	37,420
Goshen	--	427	5,476	1,454	--	7,357	--	4,729	67,469	120,717	--	192,915
Kirkwood	--	571	19,271	--	--	19,842	--	4,504	69,516	--	--	74,020
Mead	--	--	--	160,936	--	160,936	--	--	--	30,166	--	30,166
Pease	--	--	--	145,519	--	145,519	--	--	--	--	--	--
Pultney	--	--	--	143,806	--	143,806	--	--	--	--	--	--
Richland	--	--	14,153	219,541	--	233,694	--	--	5,796	100,163	--	105,959
Smith	--	--	30,987	--	--	30,987	--	--	43,722	138,757	--	182,479
Somerset	--	--	6,615	--	--	6,615	419	6,239	124,063	--	--	130,721
Union	--	--	78,959	2,020	--	80,979	--	--	109,429	--	--	109,429
Warren	--	--	28,937	--	--	28,937	--	--	124,495	--	--	124,495
Washington	--	--	--	26,984	--	26,984	--	--	--	194,351	--	194,351
Wayne	--	427	--	745	--	1,172	--	14,855	63,290	112,657	--	190,802
Wheeling	--	--	137,736	--	--	137,736	--	--	13,851	--	--	13,851
York	--	--	--	126,931	--	126,931	--	--	--	31,129	--	31,129
Total	--	15,211	354,392	965,136	--	1,334,739	419	34,031	655,347	727,940	--	1,417,737
CARROLL												
Loudon	--	--	--	--	--	--	--	--	46	--	--	46
Total	--	--	--	--	--	--	--	--	46	--	--	46
GALLIA												
Addison	806	--	--	--	--	806	--	--	--	--	--	--
Clay	40	941	138	6,739	6,991	14,849	--	168	1,935	19,066	28,477	49,646
Green	444	336	--	--	--	780	181	--	--	--	--	181
Guyan	--	134	184	2,650	7,866	10,834	2,802	3,797	2,028	4,205	484	13,316
Harrison	101	3,528	1,428	1,267	1,382	7,706	3,024	3,024	3,087	4,262	--	13,397
Ohio	161	1,478	4,470	3,917	968	10,994	4,334	5,981	11,981	35,712	--	58,008
Total	1,552	6,417	6,220	14,573	17,207	45,969	10,341	12,970	19,031	63,245	28,961	134,548
GUERNSEY												
Londonderry	242	874	415	--	--	1,531	323	3,091	230	--	--	3,644
Millwood	282	3,864	10,460	--	--	14,606	403	504	25,298	--	--	26,205
Oxford	--	1,378	4,977	--	--	6,355	--	1,546	7,649	--	--	9,195
Westland	20	--	--	--	--	20	444	34	--	--	--	478
Wills	--	470	46	--	--	516	--	840	276	--	--	1,116
Total	544	6,586	15,898	--	--	23,028	1,170	6,015	33,453	--	--	40,638
HARRISON												
Archer	--	168	10,137	12,441	--	22,746	--	--	7,096	10,311	--	17,407
Athens	--	--	7,004	14,227	--	21,231	--	--	29,076	62,842	--	91,918
Cadiz	--	840	19,353	17,222	--	37,415	--	269	33,132	8,928	--	42,329
German	--	--	3,917	--	--	3,917	--	--	14,838	461	--	15,299
Green	--	--	5,023	38,938	--	43,961	--	--	2,627	37,094	--	39,721
Moorefield	--	1,882	6,774	5,875	--	14,531	202	4,032	8,663	2,995	--	15,892
Nottingham	--	67	1,152	864	--	2,083	141	269	2,903	806	--	4,119
Rumley	--	--	599	--	--	599	--	--	2,027	--	--	2,027
Short Creek	--	--	8,018	22,349	--	30,367	--	--	4,239	76,608	--	80,847
Stock	--	336	--	--	--	336	--	--	--	--	--	--
Total	--	3,293	61,977	111,916	--	177,186	343	4,570	104,601	200,045	--	309,559
JEFFERSON												
Cross Creek	--	--	10,967	15,494	--	26,461	--	--	26,450	20,102	--	46,552
Island Creek	--	--	5,668	3,341	--	9,009	--	--	19,261	6,682	--	25,943
Knox	--	1,512	11,059	8,928	--	21,499	--	2,856	8,756	12,212	--	23,824
Mount Pleasant	--	--	--	18,029	--	18,029	--	--	--	81,907	--	81,907
Ross	--	--	2,995	--	--	2,995	--	571	2,028	--	--	2,599

* Belmont County reserve estimates were made by the U.S.G.S. and utilize thickness categories of 14-28 inches, 28-42 inches 42-60 inches and 60 and over inches. See U.S. Geological Survey Circular No. 363 by H. Berryhill, 1955.

Table 18 (Continued)

Estimated Original Reserves of the Pittsburgh Coal Bed in Ohio

Strongly inferred coal						Weakly inferred coal						Total					
14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total
--	--	--	--	--	--	--	--	--	--	--	--	4,536	3,898	3,134	--	--	11,568
--	--	--	--	--	--	--	--	--	--	--	--	1,331	3,057	8,064	518	725	13,695
--	--	--	--	--	--	--	--	--	--	--	--	443	101	--	--	--	544
161	--	--	--	--	161	--	--	--	--	--	--	3,629	5,544	8,524	18,663	63,635	99,995
--	--	--	--	--	--	--	--	--	--	--	--	3,911	6,216	6,359	4,551	3,179	24,216
--	--	--	--	--	--	--	--	--	--	--	--	60	--	--	--	--	60
--	--	--	--	--	--	--	--	--	--	--	--	161	--	--	--	--	161
--	--	--	--	--	--	--	--	--	--	--	--	6,794	5,846	8,202	1,786	--	22,628
827	1,310	2,258	3,053	1,797	9,245	786	1,613	507	--	--	2,906	2,722	4,805	5,760	7,776	23,747	44,810
--	--	--	--	--	--	--	--	--	--	--	--	20	--	--	--	--	20
988	1,310	2,258	3,053	1,797	9,406	786	1,613	507	--	--	2,906	23,607	29,467	40,043	33,294	91,286	217,697
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	137,200	--	137,200
--	--	--	--	--	--	--	--	--	--	--	--	--	17,490	65,974	--	--	83,464
--	--	--	--	--	--	--	--	--	--	--	--	--	5,156	72,945	122,171	--	200,272
--	--	--	--	--	--	--	--	--	--	--	--	--	5,075	88,787	--	--	93,862
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	191,102	--	191,102
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	145,519	--	145,519
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	143,806	--	143,806
--	--	--	--	--	--	--	--	--	--	--	--	--	--	19,949	319,704	--	339,653
--	--	--	--	--	--	--	--	--	--	--	--	--	--	74,709	138,757	--	213,466
--	--	--	--	--	--	--	--	--	--	--	--	419	6,239	130,678	--	--	137,336
--	--	--	--	--	--	--	--	--	--	--	--	--	--	188,388	2,020	--	190,408
--	--	--	--	--	--	--	--	--	--	--	--	--	--	153,432	--	--	153,432
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	221,335	--	221,335
--	--	--	--	--	--	--	--	--	--	--	--	--	15,282	63,290	113,402	--	191,974
--	--	--	--	--	--	--	--	--	--	--	--	--	--	151,587	--	--	151,587
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	158,060	--	158,060
--	--	--	--	--	--	--	--	--	--	--	--	419	49,242	1,009,739	1,693,076	--	2,752,476
--	--	--	--	--	--	--	--	--	--	--	--	--	--	46	--	--	46
--	--	--	--	--	--	--	--	--	--	--	--	--	--	46	--	--	46
--	--	--	--	--	--	--	--	--	--	--	--	806	--	--	--	--	806
--	--	--	--	--	--	--	--	--	--	--	--	40	1,109	2,073	25,805	35,468	64,495
--	--	--	--	--	--	--	--	--	--	--	--	625	336	--	--	--	961
40	--	--	--	--	40	--	--	--	--	--	--	2,842	3,931	2,212	6,855	8,350	24,190
--	--	--	--	--	--	--	--	--	--	--	--	3,125	6,552	4,515	5,529	1,382	21,103
--	--	--	--	--	--	--	--	--	--	--	--	4,495	7,459	16,451	39,629	968	69,002
40	--	--	--	--	40	--	--	--	--	--	--	11,933	19,387	25,251	77,818	46,168	180,557
--	--	--	--	--	--	--	--	--	--	--	--	565	3,965	645	--	--	5,175
--	--	461	--	--	461	--	--	--	--	--	--	685	4,368	36,219	--	--	41,272
--	--	--	--	--	--	--	--	--	--	--	--	--	2,924	12,626	--	--	15,550
--	--	--	--	--	--	--	--	--	--	--	--	464	34	--	--	--	498
202	437	--	--	--	639	20	--	--	--	--	20	222	1,747	322	--	--	2,291
202	437	461	--	--	1,100	20	--	--	--	--	20	1,936	13,038	49,812	--	--	64,786
--	--	138	--	--	138	--	--	--	--	--	--	--	168	17,371	22,752	--	40,291
--	--	--	--	--	--	--	--	--	--	--	--	--	--	36,080	77,069	--	113,149
--	--	--	--	--	--	--	--	--	--	--	--	--	1,109	52,485	26,150	--	79,744
--	--	2,673	--	--	2,673	--	--	--	--	--	--	--	--	21,428	461	--	21,889
--	--	--	--	--	--	--	--	--	--	--	--	--	--	7,650	76,032	--	83,682
20	--	--	--	--	20	--	--	--	--	--	--	222	5,914	15,437	8,870	--	30,443
--	--	--	--	--	--	--	--	--	--	--	--	141	336	4,055	1,670	--	6,202
--	--	1,152	--	--	1,152	--	--	--	--	--	--	--	--	3,778	--	--	3,778
--	--	--	--	--	--	--	--	--	--	--	--	--	--	12,257	98,957	--	111,214
--	--	--	--	--	--	--	--	--	--	--	--	--	336	--	--	--	336
20	--	3,963	--	--	3,983	--	--	--	--	--	--	363	7,863	170,541	311,961	--	490,728
--	--	--	--	--	--	--	--	--	--	--	--	--	--	37,417	35,596	--	73,013
--	--	3,087	--	--	3,087	--	--	--	--	--	--	--	--	28,016	10,023	--	38,039
--	--	--	--	--	--	--	--	--	--	--	--	--	4,368	19,815	21,140	--	45,323
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	99,936	--	99,936
--	--	--	--	--	--	--	--	--	--	--	--	--	571	5,023	--	--	5,594

Table 18 (Continued)

Estimated Original Reserves of the Pittsburgh Coal Bed in Ohio

County and Township	Proven coal						Probable coal					
	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total
Salem	--	--	2,765	3,514	--	6,279	--	--	10,230	1,958	--	12,188
Saline	--	638	--	--	--	638	--	1,411	1,152	--	--	2,563
Smithfield	--	--	26,865	52,416	--	79,281	--	--	14,008	56,966	--	70,974
Springfield	--	--	2,074	1,382	--	3,456	--	--	2,120	2,074	--	4,194
Steubenville	--	--	3,272	2,362	--	5,634	--	--	6,359	173	--	6,532
Warren	--	--	3,686	26,496	1,590	31,772	--	--	3,041	41,530	138	44,709
Wayne	--	--	2,857	25,920	--	28,777	--	--	19,169	42,106	--	61,275
Wells	--	--	5,714	24,307	--	30,021	--	--	32,579	33,178	--	65,757
Total	--	2,150	77,922	182,189	1,590	263,851	--	4,838	145,153	298,888	138	449,017
MEIGS												
Bedford	2,681	6,048	7,235	1,325	--	17,289	5,383	4,502	1,475	115	--	11,475
Scipio	2,016	5,275	737	--	--	8,028	5,282	3,024	46	--	--	8,352
Total	4,697	11,323	7,972	1,325	--	25,317	10,665	7,526	1,521	115	--	19,827
MONROE												
Adams	--	--	5,484	--	--	5,484	--	1,814	49,075	--	--	50,889
Benton	--	--	--	--	--	--	1,270	--	--	--	--	1,270
Bethel	--	--	--	--	--	--	3,508	--	--	--	--	3,508
Center	--	--	--	--	--	--	--	--	--	--	--	--
Green	--	--	--	--	--	--	--	4,402	--	--	--	4,402
Malaga	--	--	--	--	--	--	--	--	--	--	--	--
Ohio	--	--	--	--	--	--	4,697	3,461	--	--	--	8,158
Salem	--	840	2,903	10,598	--	14,341	--	7,594	25,528	44,698	--	77,820
Sunsbury	--	--	2,258	18,662	--	20,920	--	--	20,367	68,832	--	89,199
Switzerland	--	--	645	28,339	--	28,984	--	--	3,963	121,766	--	125,729
Washington	--	--	--	--	--	--	4,435	--	--	--	--	4,435
Total	--	840	11,290	57,599	--	69,729	13,910	17,271	98,933	235,296	--	365,410
MORGAN												
Bloom	--	--	--	--	--	--	1,210	--	--	--	--	1,210
Bristol	1,714	--	--	--	--	1,714	2,500	--	--	--	--	2,500
Center	323	--	--	--	--	323	1,835	--	--	--	--	1,835
Homer	685	3,293	1,705	1,555	7,126	14,364	2,460	8,602	2,442	806	4,141	18,450
Manchester	766	--	--	--	--	766	726	--	--	--	--	726
Marion	907	1,210	2,120	2,246	2,166	8,649	504	168	230	1,382	1,175	3,459
Meigsville	8,891	--	--	--	--	8,891	11,451	--	--	--	--	11,451
Morgan	--	--	--	--	--	--	585	--	--	--	--	585
Union	685	--	--	--	--	685	4,637	1,714	--	--	--	6,351
Total	13,971	4,503	3,825	3,801	9,292	35,392	25,908	10,484	2,672	2,188	5,316	46,567
MUSKINGUM												
Blue Rock	625	--	--	--	--	625	--	--	--	--	--	--
Meigs	--	--	--	--	--	--	1,452	--	--	--	--	1,452
Rich Hill	202	773	--	--	--	975	3,306	202	--	--	--	3,508
Salt Creek	--	--	--	--	--	--	645	--	--	--	--	645
Union	645	--	--	--	--	645	4,536	168	--	--	--	4,704
Total	1,472	773	--	--	--	2,245	9,939	370	--	--	--	10,309
NOBLE												
Beaver	60	134	9,032	--	--	9,226	1,794	3,091	7,603	--	--	12,488
Elk	282	--	--	--	--	282	1,915	--	--	--	--	1,915
Jefferson	141	--	--	--	--	141	141	--	--	--	--	141
Total	483	134	9,032	--	--	9,649	3,850	3,091	7,603	--	--	14,544
WASHINGTON												
Aurelius	323	504	--	--	--	827	645	--	--	--	--	645
Decatur	--	--	--	--	--	--	423	470	599	1,613	1,244	4,349
Fearing	1,230	1,512	--	--	--	2,742	13,930	773	--	--	--	14,703
Grandview	1,653	--	--	--	--	1,653	4,697	--	--	--	--	4,697
Independence	--	--	--	--	--	--	101	--	--	--	--	101
Lawrence	3,467	--	--	--	--	3,467	8,044	--	--	--	--	8,044
Liberty	746	--	--	--	--	746	26,712	--	--	--	--	26,712
Ludlow	6,512	1,915	--	--	--	8,427	11,592	538	--	--	--	12,130
Salem	6,653	5,981	--	--	--	12,634	14,152	806	--	--	--	14,958
Total	20,584	9,912	--	--	--	30,496	80,296	2,587	599	1,613	1,244	86,339
State Total	51,932	71,356	568,158	1,353,762	69,703	2,114,911	170,045	120,082	1,086,607	1,542,348	83,534	3,002,616

Table 18 (Continued)

Estimated Original Reserves of the Pittsburgh Coal Bed in Ohio

Strongly inferred coal						Weakly inferred coal						Total					
14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total
--	--	2,442	--	--	2,442	--	--	--	--	--	--	--	--	15,437	5,472	--	20,909
--	--	--	--	--	--	--	--	--	--	--	--	--	2,049	1,152	--	--	3,201
--	--	--	--	--	--	--	--	--	--	--	--	--	--	40,873	109,382	--	150,255
--	--	46	--	--	46	--	--	--	--	--	--	--	--	4,240	3,456	--	7,696
--	--	--	--	--	--	--	--	--	--	--	--	--	--	9,631	2,535	--	12,166
--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,727	68,026	1,728	76,481
--	--	138	--	--	138	--	--	--	--	--	--	--	--	22,164	68,026	--	90,190
--	--	--	--	--	--	--	--	--	--	--	--	--	--	38,293	57,485	--	95,778
--	--	5,713	--	--	5,713	--	--	--	--	--	--	--	6,988	228,788	481,077	1,728	718,581
--	--	--	--	--	--	--	--	--	--	--	--	8,064	10,550	8,710	1,440	--	28,764
--	--	--	--	--	--	--	--	--	--	--	--	7,298	8,299	783	--	--	16,380
--	--	--	--	--	--	--	--	--	--	--	--	15,362	18,849	9,493	1,440	--	45,144
--	3,192	31,427	--	--	34,619	--	1,042	4,285	--	--	5,327	--	6,048	90,271	--	--	96,319
81	--	--	--	--	81	--	--	--	--	--	--	1,351	--	--	--	--	1,351
3,992	--	--	--	--	3,992	--	--	--	--	--	--	7,500	--	--	--	--	7,500
--	--	1,981	--	--	1,981	10,423	17,035	25,160	--	--	52,618	10,423	17,035	27,141	--	--	54,599
10,766	18,447	--	--	--	29,213	3,246	437	--	--	--	3,683	14,012	23,286	--	--	--	37,298
--	--	3,917	15,034	--	18,951	5,342	8,669	34,560	13,478	--	62,049	5,342	8,669	38,477	28,512	--	81,000
3,387	30,744	3,779	--	--	37,910	81	1,142	5,391	--	--	6,614	8,165	35,347	9,170	--	--	52,682
--	12,365	25,252	4,262	--	41,879	--	--	3,779	--	--	3,779	--	20,799	57,462	59,558	--	137,819
--	--	24,054	17,510	--	41,564	--	--	876	--	--	876	--	--	47,555	105,004	--	152,559
--	--	--	2,131	--	2,131	--	--	--	--	--	--	--	--	4,608	152,236	--	156,844
1,452	--	--	--	--	1,452	--	--	--	--	--	--	5,887	--	--	--	--	5,887
19,678	64,748	90,410	38,937	--	213,773	19,092	28,325	74,051	13,478	--	134,946	52,680	111,184	274,684	345,310	--	783,858
504	--	--	--	--	504	--	--	--	--	--	--	1,714	--	--	--	--	1,714
--	--	--	--	--	--	--	--	--	--	--	--	4,214	--	--	--	--	4,214
--	--	--	--	--	--	--	--	--	--	--	--	2,158	--	--	--	--	2,158
--	--	--	--	--	--	--	--	--	--	--	--	3,145	11,894	4,147	2,361	11,267	32,814
--	--	--	--	--	--	--	--	--	--	--	--	1,492	--	--	--	--	1,492
--	--	--	--	--	--	--	--	--	--	--	--	1,411	1,378	2,350	3,628	3,341	12,108
--	--	--	--	--	--	--	--	--	--	--	--	20,342	--	--	--	--	20,342
--	--	--	--	--	--	--	--	--	--	--	--	585	--	--	--	--	585
--	--	--	--	--	--	--	--	--	--	--	--	5,322	1,714	--	--	--	7,036
504	--	--	--	--	504	--	--	--	--	--	--	40,383	14,986	6,497	5,989	14,608	82,463
--	--	--	--	--	--	--	--	--	--	--	--	625	--	--	--	--	625
--	--	--	--	--	--	--	--	--	--	--	--	1,452	--	--	--	--	1,452
--	--	--	--	--	--	--	--	--	--	--	--	3,508	975	--	--	--	4,483
101	--	--	--	--	101	--	--	--	--	--	--	746	--	--	--	--	746
20	--	--	--	--	20	--	--	--	--	--	--	5,201	168	--	--	--	5,369
121	--	--	--	--	121	--	--	--	--	--	--	11,532	1,143	--	--	--	12,675
--	--	--	--	--	--	--	--	--	--	--	--	1,854	3,225	16,635	--	--	21,714
3,084	--	--	--	--	3,084	--	--	--	--	--	--	5,281	--	--	--	--	5,281
--	--	--	--	--	--	--	--	--	--	--	--	282	--	--	--	--	282
3,084	--	--	--	--	3,084	--	--	--	--	--	--	7,417	3,225	16,635	--	--	27,277
--	--	--	--	--	--	--	--	--	--	--	--	968	504	--	--	--	1,472
1,048	1,008	2,120	4,435	4,493	13,104	706	672	1,060	--	--	2,438	2,177	2,150	3,779	6,048	5,737	19,891
2,923	--	--	--	--	2,923	--	--	--	--	--	--	18,083	2,285	--	--	--	20,368
4,939	--	--	--	--	4,939	--	--	--	--	--	--	11,289	--	--	--	--	11,289
--	--	--	--	--	--	--	--	--	--	--	--	101	--	--	--	--	101
10,161	--	--	--	--	10,161	--	--	--	--	--	--	21,672	--	--	--	--	21,672
30,341	--	--	--	--	30,341	--	--	--	--	--	--	57,799	--	--	--	--	57,799
2,903	--	--	--	--	2,903	--	--	--	--	--	--	21,007	2,453	--	--	--	23,460
--	--	--	--	--	--	--	--	--	--	--	--	20,805	6,787	--	--	--	27,592
52,315	1,008	2,120	4,435	4,493	64,371	706	672	1,060	--	--	2,438	153,901	14,179	3,779	6,048	5,737	183,644
76,952	67,503	104,925	46,425	6,290	302,095	20,604	30,610	75,618	13,478	--	140,310	319,533	289,551	1,835,308	2,956,013	159,527	5,559,932

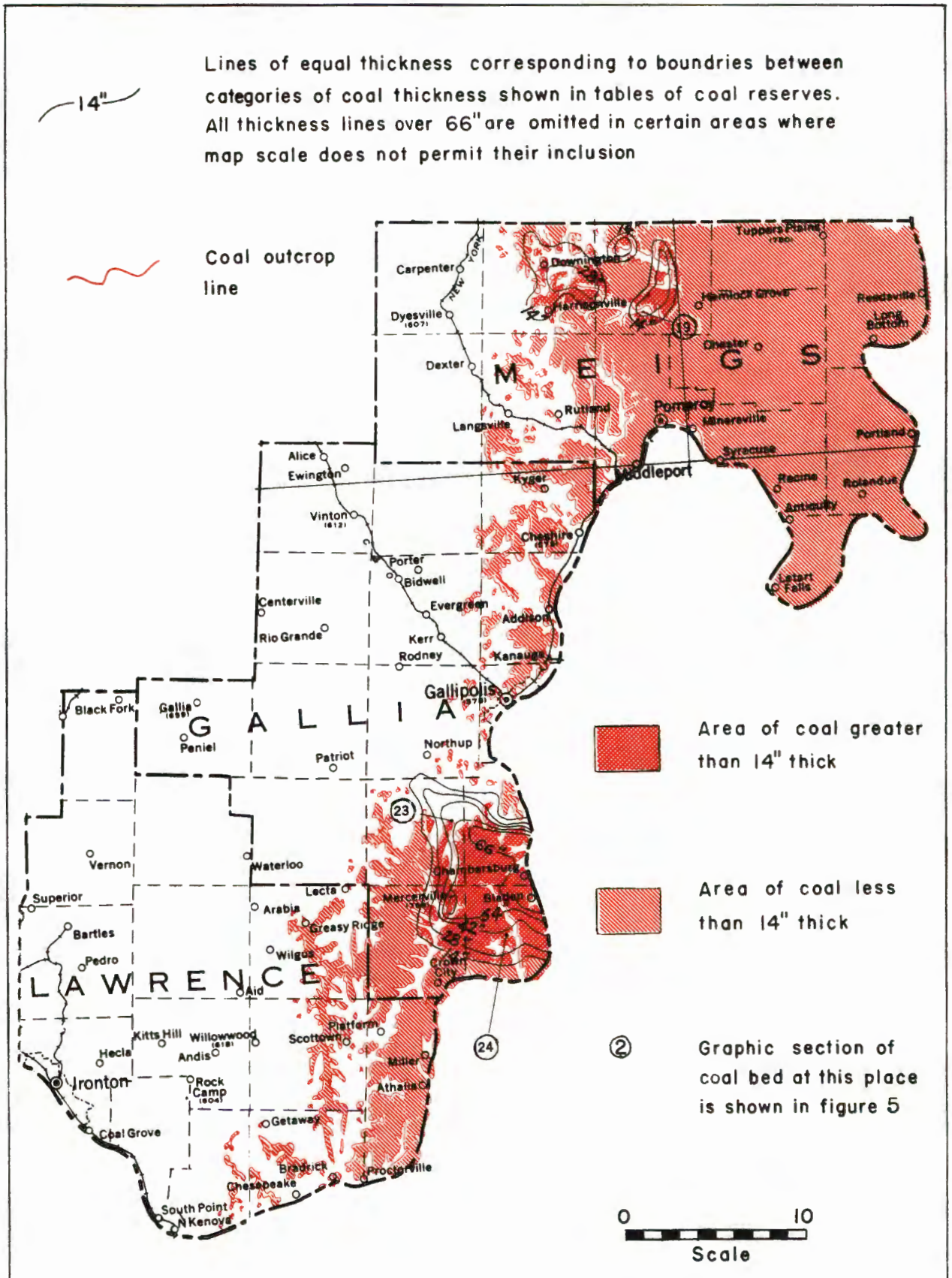


Figure 9. The Pittsburgh Coal in Meigs and Gallia County

CHAPTER 4

THE REDSTONE NO.8A COAL BED

The name Redstone coal was first used by H. D. Rogers (1858, p. 505) to designate a coal which occurs 40 feet above the Pittsburgh coal along Redstone Creek in the Salisbury Basin, Fayette County, Pennsylvania. The geologists of Pennsylvania, West Virginia, and Maryland have since followed Rogers' terminology of Redstone for the coal at this position in the section.

In early Ohio geologic literature the Redstone (Pomeroy) coal of Meigs and Gallia Counties was correlated with the Pittsburgh seam in the Eastern Ohio field but the coal in the field centered around Pomeroy was referred to as the "Pomeroy" coal (Andrews, E. B., 1873, p. 265 and Lovejoy, E., 1888, p. 627). However J. A. Bownocker (1908, p. 96) states that "study of this coal in 1907 shows that the seam is not Pittsburgh but a higher one. It is the equivalent of the Redstone coal of Pennsylvania and West Virginia...". Although this stratum was then recognized to be in the position of the Redstone of Pennsylvania, Bownocker, Condit, and Stout in their earlier works continued the use of the term Pomeroy coal. However, the more recent writers as Lamborn (1930, p. 226), Stout (Monongahela Series, Vol. I and II), and Blake (1950), adopted the name Redstone coal for this stratum.

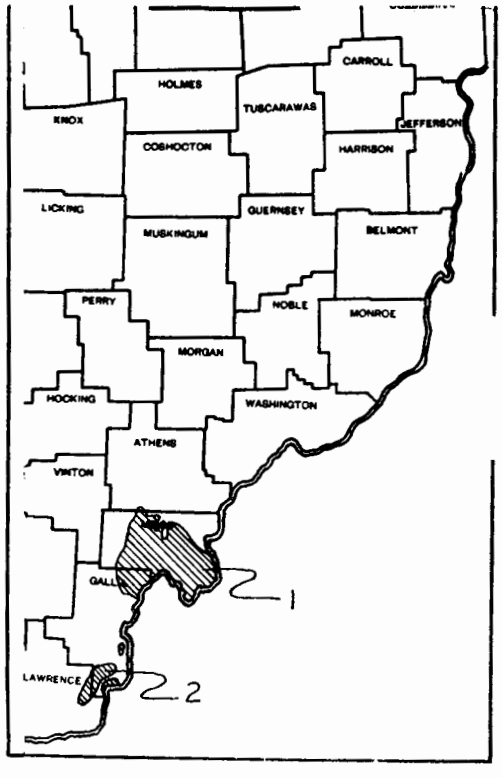


Figure 10

Distribution of Redstone coal fields in Ohio

1. Pomeroy Field
2. Greasy Ridge-Mercerville Field

Mining History

The Redstone coal of the Pomeroy field has been one of Ohio's most desired coals. Because of its proximity to the Ohio River and cheap barge transportation the Redstone coal was mined for shipment as early as 1833. The salt industry that was centered around Pomeroy gave great impetus to the use of the Redstone coal in about 1847. Shipment by rail began upon completion of railroad connections to Pomeroy in 1892.

Production from the Greasy Ridge-Mercerville field began later and has never reached the proportion of the Pomeroy field. However, strip methods of mining have re-vitalized the coal industry in both of these fields within recent years.

Production from this seam within recent years is shown in Table 20.

Fields of Redstone Coal

POMEROY FIELD

In Ohio the Redstone coal is most extensive and best developed in the Pomeroy field of Meigs and northern Gallia Counties where it occurs above drainage in Cheshire Township, Gallia County, and Salisbury, Rutland, Scipio, and Bedford Townships of Meigs County, (see Fig. 10, p. 37). In Sutton, Letart, and Lebanon Townships of Meigs County this seam is known only in the subsurface but it constitutes an important part of our reserves.

The coal bed thins toward the margins of the field and this thinning is known to be gradual where the coal is above drainage. Its occurrence and characteristics below drainage are not as well known; nor is the limit of minable (14") coal. In mines of Letart and Sutton Townships, the coal has numerous rolls or cut-outs (Cross, personal communication). The coal above drainage is irregular but is relatively thick.

The coal has numerous thin shale partings, some pyrite and bone, but none of the partings is persistent enough to split the coal into benches or give the seam a distinctive appearance.

The Redstone coal in the Pomeroy field is usually overlain by a carbonaceous shale which occasionally develops locally into a roof coal. The roof shale and coal are overlain by a shale which has a maximum known thickness of 15 feet and is succeeded by the massive Pomeroy sandstone which is forty to ninety feet thick. The Pomeroy sandstone has an unconformable base and at some localities it replaces part or all of the shale and carbonaceous roof shale, and may rest directly on the coal.

In this field the Redstone coal is underlain by an underclay of no commercial value and a series of soft shales, calcareous shale, and thin limestone beds. The interval to the underlying Pittsburgh coal is 22 to 30 feet.

To the north and northeast of the Pomeroy field the Redstone coal is thin and unsteady and is of little economic importance.

GREASY RIDGE - MERCERVILLE FIELD

From the Pomeroy field to southern Gallia County the Redstone coal is poorly developed, difficult to follow, and of stratigraphic importance only. In Guyan Township, Gallia County, and in Mason and Windsor Townships, Lawrence County, the Redstone coal expands to minable thickness and becomes of economic importance, (see Fig. 10, p. 37). The coal has a fair thickness, usually interbedded with thin shale partings, but it may occur as a solid bed (Bownocker, 1908, p. 117). The roof is similar to that in the Pomeroy field; the coal is overlain by a shale or thinly cross-laminated sandstone (Blake, 1950, p. 43). The coal bed is underlain by a clay of no commercial importance. The interval from the Pittsburgh coal to the Redstone varies little from 40 feet (Blake, 1950, p. 43) and is occupied by shale and sandstone. The Greasy Ridge - Mercerville field does not overlap the minable Pittsburgh coal for where the Redstone coal is best developed the Pittsburgh coal is wanting or very thin (Blake, 1950, p. 43).

Classification and Characteristics

Coal with heat value of 13,000 to 14,000 B. t. u. (rank index 130 to 140) with moist mineral-matter-free basis is classified as high-volatile B bituminous coal (ASTM, 1948, p. 80). Analyses of the Redstone coal on the above basis indicate a rank index of 132 to 136. This coal is therefore classified as high volatile B bituminous coal. Analyses of the coal are given on Table 19.

The Redstone coal in both fields generally has two or more partings in most localities but these are not persistent, and the coal therefore has no definite structure with regard to impurities. Impurities include bone coal, carbonaceous shale, soft clay, and pyrite as bands or nodules. Coal as a solid block has been reported but it is not the usual occurrence. Graphic sections of the coal are shown on Figure 11.

Reserves of the Redstone No.8A Coal

RELIABILITY OF ESTIMATE

The Redstone (Pomeroy) coal has been extensively studied in the past by Ohio geologists, particularly in the Pomeroy field. Because of numerous openings made in this coal in the Pomeroy field, control for drawing isopachous lines was excellent. However control in the portion of the Pomeroy field that is under cover is not as good as the in the portion above drainage but is satisfactory except in the area where the coal thins to the minimum minable thickness.

Although the Greasy Ridge - Mercerville field is entirely above drainage the Redstone coal has not been mined nor studied as thoroughly here as in the Pomeroy field, and therefore the accuracy of the reserve estimate within the Greasy Ridge - Mercerville field is more questionable than for the Pomeroy field. Additional field work to obtain more control points and confirm the correlation of this coal bed will corroborate or disprove the present reserve figures for this area.

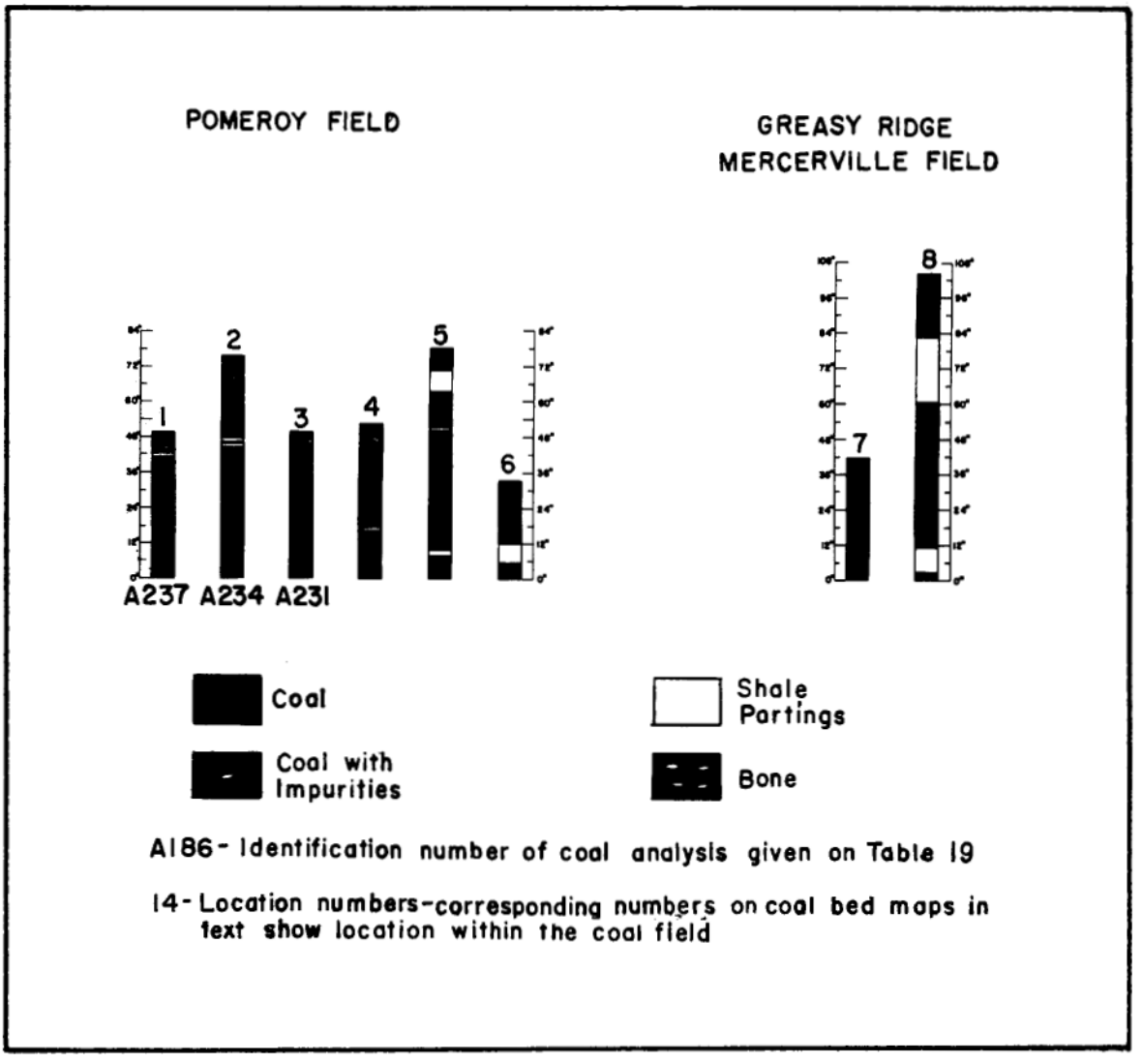


Figure 11. Graphic Sections of the Redstone Coal in Ohio

Table 19

Analyses of Redstone Coal in Ohio

Location		File number[1]	Source[2]	Year	Condition[3]	Proximate analysis			Ultimate analysis						Heat value	
County	Township					Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulphur	Calories	B.t.u.
Gallia	Cheshire	237	OGS	1907	1	8.21	34.23	46.10	11.46	5.48	62.95	1.02	16.91	2.18	6,387	11,497
					2	-	37.29	50.22	12.49	4.98	68.58	1.11	10.47	2.37	6,958	12,524
					3	-	42.61	57.39	-	5.69	78.37	1.27	11.96	2.71	7,951	14,312
					4	-	41.48	58.52	-	-	-	-	-	-	8,088	14,559
Meigs	Rutland	234	OGS	1907	1	7.63	33.33	48.11	10.93	5.20	65.29	1.03	15.72	1.83	6,512	11,722
					2	-	36.08	52.09	11.83	4.71	70.68	1.12	9.68	1.98	7,050	12,690
					3	-	40.92	59.08	-	5.34	80.16	1.27	10.98	2.25	7,996	14,393
					4	-	39.87	60.13	-	-	-	-	-	-	8,121	14,618
Meigs	Salisbury	231	OGS	1907	1	7.33	34.59	49.39	8.69	5.53	66.71	1.06	15.96	2.05	6,725	12,105
					2	-	37.32	53.30	9.38	5.09	71.99	1.14	10.19	2.21	7,257	13,062
					3	-	41.18	58.82	-	5.62	79.44	1.26	11.24	2.44	8,008	14,414
					4	-	40.25	59.75	-	-	-	-	-	-	8,116	14,609

1. Graphic profile of coal bed and map location reference are shown in Figure 5.
2. OGS - Ohio Geological Survey.
3. 1, As received; 2, moisture-free; 3, moisture- and ash-free; 4, dry mineral-matter-free (unit coal).

Table 20

Production of Redstone Coal in Ohio by County, 1946 - 1954

(Short tons)

	1946		1947		1948		1949		1950		1951		1952		1953		1954	
County	Total	Strip	Total	Strip	Total	Strip	Total	Strip	Total	Strip	Total	Strip	Total	Strip	Total	Strip	Total	Strip
Total	313,620	22,307	499,973	74,997	708,164	216,159	651,747	278,569	989,329	569,805	1,011,420	560,479	964,297	631,608	1,476,214	1,201,570	1,652,132	881,630
Athens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gallia	13,977	-	134,645	-	285,597	5,714	394,294	164,208	498,214	206,374	525,628	202,781	601,084	379,573	743,829	580,665	765,657	569,047
Lawrence	-	-	23,182	23,026	352	-	35,057	34,727	96,640	96,285	78,231	78,231	17,912	17,912	116,564	116,147	81,310	80,680
Meigs	299,643	22,307	342,146	51,971	422,215	210,445	222,396	79,634	394,475	267,146	407,561	279,467	345,301	234,123	615,821	504,758	805,165	231,903

1. Source: Ohio Department of Industrial Relations Annual Coal and Non-Metallic Mineral Reports, 1946-1954. Some changes in seam identification made by the author of this report have served to modify the county totals by seam published in the earlier reports.

COMPARISON WITH PREVIOUS ESTIMATES

Table 21 given below compares by county and state the reserve estimate of this report with that made by Clark (1917, pp. 88-96).

Table 21

Comparison by Counties of Estimated Original Redstone No. 8A Reserves
(In thousands of short tons)

County	Author	
	Clark [1]	DeLong
Athens	70,000	5,805
Gallia	251,000	150,548
Lawrence	111,000	22,658
Meigs	278,000	617,246
Totals	710,000	796,257

[1] Clark, 1917, pp. 88-96.

DISCUSSION OF RESERVES BY COUNTY

Athens County

The Redstone coal is of limited extent and of minor economic importance in Athens County. This coal bed in southern Athens County forms the thin northern margin of the Pomeroy field and occurs as small separate pockets of minable (14"-28") coal in Lodi and Alexander Townships (see Fig. 12, p. 43). The estimated total original reserves for Athens County is a moderate 5,805,000 tons, the smallest reserves for all counties for which the Redstone coal were estimated. Table 22 below shows the reserve estimate of this coal bed for Athens County.

Table 22

Estimated Original Reserves of the Redstone Coal Bed in Athens County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78"	Total
Proven	1,431	-	-	-	-	-	1,431
Probable	4,193	-	-	-	-	-	4,193
Strongly Inferred	181	-	-	-	-	-	181
Total	5,805	-	-	-	-	-	5,805

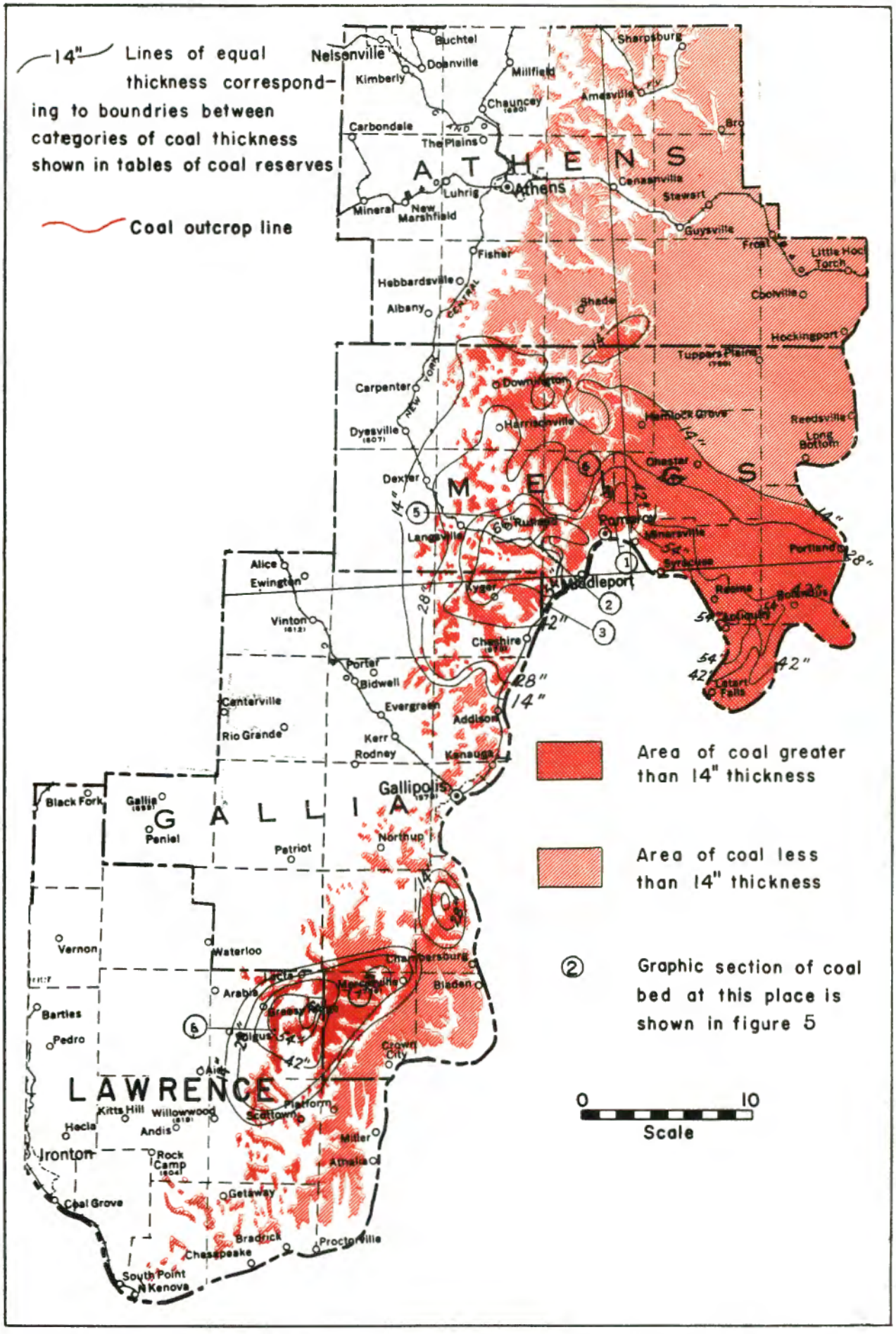


Figure 12. The Redstone Coal in Athens, Meigs Gallia and Lawrence Counties

Meigs County

The Redstone coal of Meigs County constitutes the most important part of the rich Pomeroy field. The extent of this field over Meigs County is wide; this coal bed occurs high on the ridges and knobs of western Scipio and Rutland Townships and owing to the southeastward dip of the rocks the coal seam disappears under cover in southeastern Bedford Township and below the Ohio River in Sutton Township (see Fig. 12, p. 43). Of the portion of the Pomeroy field that is under cover, Letart Township and generous portions of Sutton and Lebanon Townships are known to have thick (28" +) coal that has been mined to some extent; however, the northern edge of minable (14") coal is vague because of the paucity of subsurface information in Chester Township and northern Lebanon Township.

Extensive mining of this coal bed, particularly along the Ohio River front, has taken place where the coal seam is above drainage. Strip and to a small degree auger mining methods as well as underground mining are being utilized to take the coal.

Table 23, below shows the estimated total reserves for Meigs County. Of the 642,538,000 tons of estimated original reserves of Redstone coal in this county, over 45% is 42 inches in thickness or greater, and 88% of the total tonnage is in the proven or probable category of reliability.

Table 23

Estimated Original Reserves of the Redstone Coal Bed in Meigs County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78" +	Total
Proven	35,865	51,743	95,570	54,317	14,653	2,252	254,400
Probable	49,834	106,714	69,303	55,641	8,226	161	289,879
Strongly Inferred	35,481	23,017	14,469	-	-	-	72,967
Weakly Inferred	-	-	-	-	-	-	-
Total	121,180	181,474	179,342	109,958	22,879	2,413	617,246

Gallia County

Minable Redstone coal occurs in Gallia County in two widely separated fields. The northern area, which includes Cheshire Township and small parts of Addison and Morgan Townships, is a part of the Pomeroy field; the southern area, which includes part of Ohio, Clay, Guyan, and Harrison Townships, is a part of the Greasy Ridge - Mercerville field. In the area between the two fields this coal seam is thin and does not contain any of the Gallia County reserves (see Fig. 12, p. 43).

Total production of coal from Gallia County during the late 1920's and 1930's was extremely low but with the advent of strip methods of mining, the coal mining industry was rejuvenated resulting in a considerable increase in production for Gallia County (see Table 20, p. 41.

The estimated original reserves of Redstone coal is 150,548,000 tons, 98% of which is in the proven and probable categories of reliability. The reserve figures shown below in Table 24 include both productive areas of this coal bed; for tonnage figures by township the reader is referred to Table 26, p. 46.

Table 24

Estimated Original Reserves of the Redstone Coal Bed in Gallia County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78"	Total
Proven	3,206	20,462	12,488	9,158	-	-	45,314
Probable	19,676	37,497	24,515	21,369	-	-	103,057
Strongly Inferred	2,177	-	-	-	-	-	2,177
Weakly Inferred	-	-	-	-	-	-	-
Total	25,059	57,959	37,003	30,527	-	-	150,548

Lawrence County

Minable Redstone coal in Lawrence County is confined to the portion of the Greasy Ridge-Mercerville field that extends into Mason and Windsor Townships (see Fig. 12, p. 43). Throughout the Lawrence County portion of this field the coal bed occurs high on the ridges which results in a limited area underlain by the coal bed and a small tonnage of reserves. The total estimated original reserves for Lawrence County is 22,658,000 tons, 90% of which is in the proven or probable categories of reliability (see Table 25 below).

As in Gallia County, strip methods of mining have become the most common means of taking the coal.

Table 25

Estimated Original Reserves of the Redstone Coal Bed in Lawrence County
(In thousands of short tons)

Reliability category	Thickness						
	14"-28"	28"-42"	42"-54"	54"-66"	66"-78"	78"	Total
Proven	181	1,949	3,133	1,843	-	-	7,106
Probable	2,217	6,082	5,990	-	-	-	14,289
Strongly Inferred	1,129	134	-	-	-	-	1,263
Weakly Inferred	-	-	-	-	-	-	-
Total	3,527	8,165	9,123	1,843	-	-	22,658

Table 26

Estimated Original Reserves of the Redstone Coal Bed in Ohio

(In thousands of short tons. To obtain total tonnage add three zeros to end of each figure.)

County and Township	Proven coal						Probable coal						Strongly inferred coal						Weakly inferred coal						Total					
	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total	14"-28"	28"-42"	42"-54"	54"-66"	66" and over	Total
ATHENS																														
Alexander	262	--	--	--	--	262	141	--	--	--	--	141	--	--	--	--	--	--	--	--	--	--	--	--	403	--	--	--	--	403
Ladi	1,169	--	--	--	--	1,169	4,052	--	--	--	--	4,052	181	--	--	--	--	181	--	--	--	--	--	--	5,402	--	--	--	--	5,402
Total	1,431	--	--	--	--	1,431	4,193	--	--	--	--	4,193	181	--	--	--	--	181	--	--	--	--	--	--	5,805	--	--	--	--	5,805
GALLIA																														
Addison	484	1,714	--	--	--	2,198	1,230	3,192	--	--	--	4,422	--	--	--	--	--	--	--	--	--	--	--	--	1,714	4,906	--	--	--	6,620
Cheshire	--	5,006	7,972	6,509	--	19,487	--	6,585	10,368	15,897	--	32,850	242	--	--	--	--	242	--	--	--	--	--	--	242	11,591	18,340	22,406	--	52,579
Clay	1,835	605	323	115	--	2,878	4,899	2,050	--	--	--	6,949	--	--	--	--	--	--	--	--	--	--	--	--	6,734	2,655	323	115	--	9,827
Green	202	370	--	--	--	572	282	--	--	--	--	282	--	--	--	--	--	--	--	--	--	--	--	--	484	370	--	--	--	854
Guyan	121	8,870	4,193	2,534	--	15,718	5,645	17,640	14,147	5,472	--	42,904	1,935	--	--	--	--	1,935	--	--	--	--	--	--	7,701	26,510	18,340	8,006	--	60,557
Harrison	524	1,579	--	--	--	2,103	4,415	3,864	--	--	--	8,279	--	--	--	--	--	--	--	--	--	--	--	--	4,939	5,443	--	--	--	10,382
Ohio	40	2,318	--	--	--	2,358	3,064	4,166	--	--	--	7,230	--	--	--	--	--	--	--	--	--	--	--	--	3,104	6,484	--	--	--	9,588
Walnut	--	--	--	--	--	--	141	--	--	--	--	141	--	--	--	--	--	--	--	--	--	--	--	--	141	--	--	--	--	141
Total	3,206	20,462	12,488	9,158	--	45,314	19,676	37,497	24,515	21,369	--	103,057	2,177	--	--	--	--	2,177	--	--	--	--	--	--	25,059	57,959	37,003	30,527	--	150,548
LAWRENCE																														
Mason	--	1,445	3,133	1,843	--	6,421	1,552	2,890	5,990	--	--	10,432	--	--	--	--	--	--	--	--	--	--	--	--	1,552	4,335	9,123	1,843	--	16,853
Rome	--	--	--	--	--	--	--	--	--	--	--	--	706	--	--	--	--	706	--	--	--	--	--	--	706	--	--	--	--	706
Windsor	181	504	--	--	--	685	665	3,192	--	--	--	3,857	423	134	--	--	--	557	--	--	--	--	--	--	1,269	3,830	--	--	--	5,099
Total	181	1,949	3,133	1,843	--	7,106	2,217	6,082	5,990	--	--	14,289	1,129	134	--	--	--	1,263	--	--	--	--	--	--	3,527	8,165	9,123	1,843	--	22,658
MEIGS																														
Bedford	15,846	1,781	--	--	--	17,627	14,999	168	--	--	--	15,167	121	--	--	--	--	121	--	--	--	--	--	--	30,966	1,949	--	--	--	32,915
Chester	--	2,554	2,534	58	--	5,246	7,499	25,267	9,400	4,435	--	46,601	22,337	11,726	--	--	--	34,063	--	--	--	--	--	--	29,836	39,647	11,934	4,493	--	85,910
Lebanon	40	4,973	10,553	2,880	--	18,446	7,439	32,088	23,916	6,797	968	71,208	11,491	2,319	14,469	--	--	28,279	--	--	--	--	--	--	18,970	39,380	48,938	9,677	968	117,933
Letart	--	3,461	7,050	12,787	3,732	27,030	--	19,152	8,110	7,430	2,074	36,766	--	8,770	--	--	--	8,770	--	--	--	--	--	--	--	31,383	15,160	20,217	5,806	72,566
Orange	--	--	--	--	--	--	302	--	--	--	--	302	--	--	--	--	--	--	--	--	--	--	--	--	302	--	--	--	--	302
Rutland	1,653	5,678	3,041	4,838	6,013	21,223	1,572	12,365	4,838	10,944	3,732	33,451	--	--	--	--	--	--	--	--	--	--	--	--	3,225	18,043	7,879	15,782	9,745	54,674
Salem	20	--	--	--	--	20	1,270	--	--	--	--	1,270	1,290	--	--	--	--	1,290	--	--	--	--	--	--	2,580	--	--	--	--	2,580
Salisbury	9,516	7,627	18,478	26,381	5,708	67,710	4,516	7,325	8,137	13,018	1,613	31,909	--	--	--	--	--	--	--	--	--	--	--	--	14,032	14,952	23,915	39,399	7,321	99,619
Scipio	8,669	1,949	--	--	--	10,618	9,314	1,848	--	--	--	11,162	202	202	--	--	--	404	--	--	--	--	--	--	18,185	3,999	--	--	--	22,184
Sutton	121	23,620	53,914	7,373	1,452	86,480	2,923	8,501	17,602	13,017	--	42,043	40	--	--	--	--	40	--	--	--	--	--	--	3,084	32,121	71,516	20,390	1,452	128,563
Total	35,865	51,743	95,570	54,317	16,905	254,400	49,834	106,714	69,303	55,641	8,387	289,879	35,481	23,017	14,469	--	--	72,967	--	--	--	--	--	--	121,180	181,474	179,342	109,958	25,292	617,246
State Total	40,683	74,154	111,191	65,318	16,905	308,251	75,920	150,293	99,808	77,010	8,387	411,418	38,968	23,151	14,469	--	--	76,588	--	--	--	--	--	--	155,571	247,598	225,468	142,328	25,292	796,257

TABLE 27

LIST OF U.S.G.S. TOPOGRAPHIC QUADRANGLE MAPS FOR AREAS IN WHICH COAL RESOURCES HAVE BEEN ESTIMATED[1]

REDSTONE NO. 8A COAL

County:

Meigs
- Pomeroy
- Point Pleasant
- Ravenswood
- Keno

Athens
- Pomeroy

Lawrence
- Athalia
- Guyandot

Gallia
- Point Pleasant
- Glenwood
- Athalia
- Pomeroy

PITTSBURGH NO. 8 COAL

County:

Athens
- Athens
- Pomeroy
- Chesterhill

Belmont
- Woodsfield
- Clarington
- Flushing
- St. Clairsville
- Wheeling

Carroll
- Cadiz

Gallia
- Point Pleasant
- Glenwood
- Athalia
- Pomeroy

Guernsey
- Cumberland
- Summerfield
- Flushing
- Antrim

Harrison
- Flushing
- Scio
- Antrim
- St. Clairsville
- Cadiz

Jefferson
- St. Clairsville
- Wheeling
- Steubenville
- Wellsville
- Cadiz

Lawrence
- Athalia

Meigs
- Pomeroy
- Point Pleasant
- Ravenswood

Monroe
- Summerfield
- Macksburg
- New Martinsville
- Clarington

Morgan
- Athens
- Chesterhill
- Philo
- McConnelsville

Muskingum
- Philo
- Cumberland

Noble
- Caldwell
- Cumberland
- Summerfield
- Macksburg
- Woodsfield

Washington
- Chesterhill
- Marietta
- Caldwell
- Macksburg
- New Matamoras

[1] Coal outcrop maps, in photostat form, are available on topographic quadrangle base from the Division of Geological Survey.

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