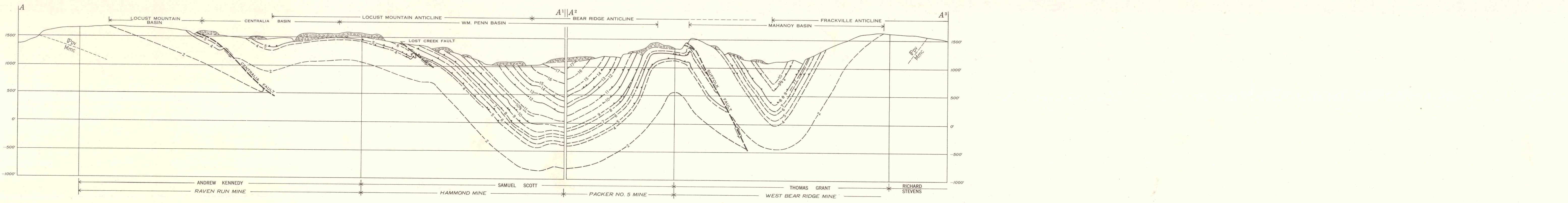
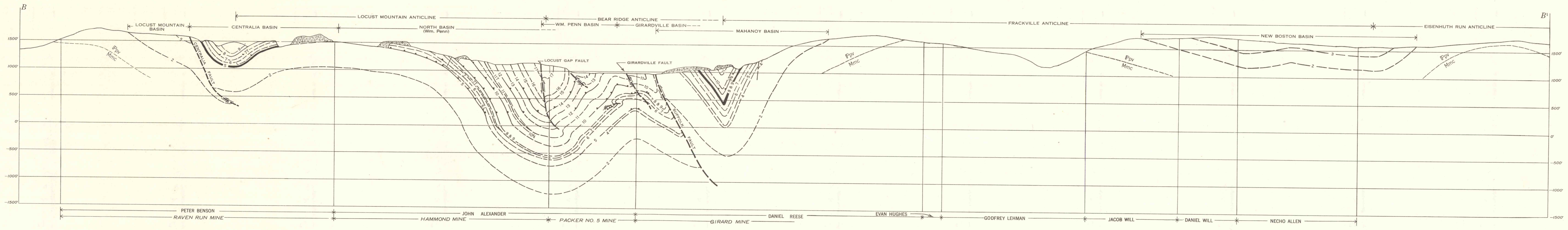
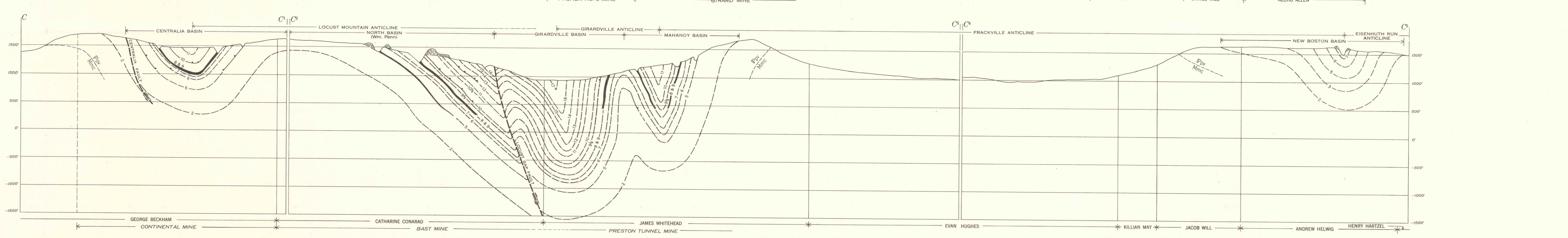
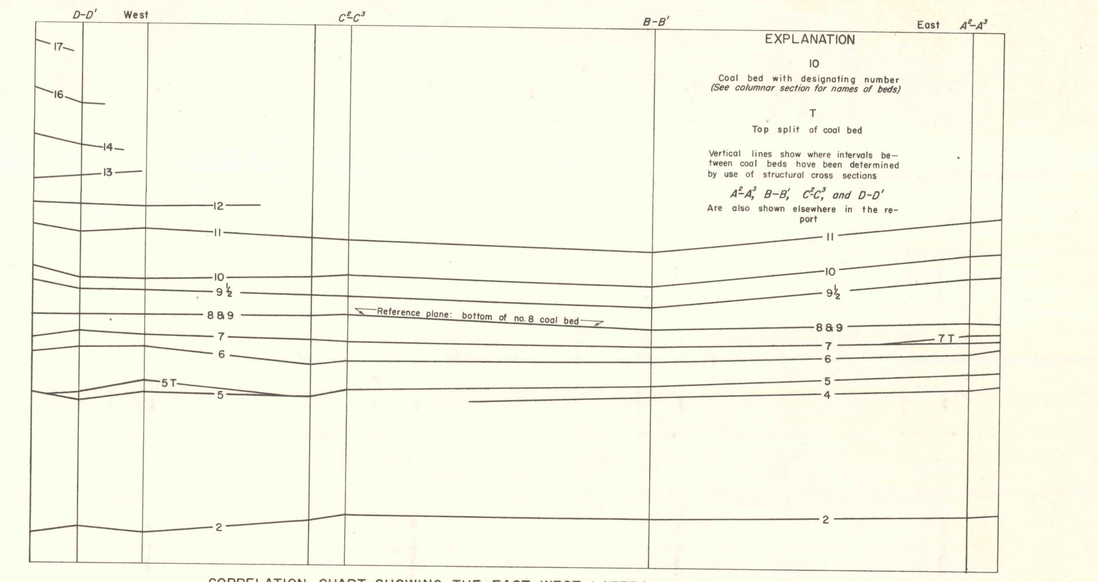
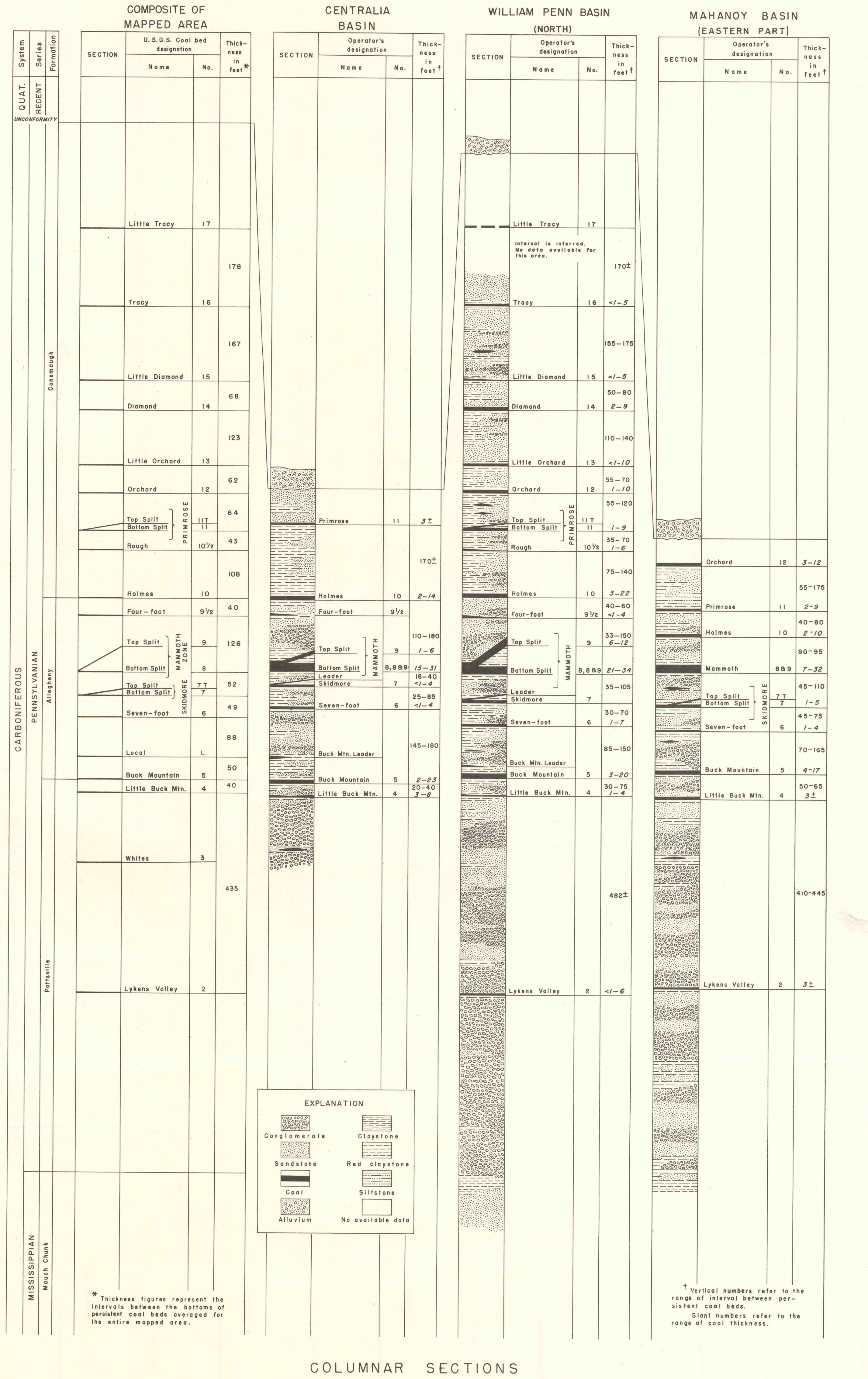




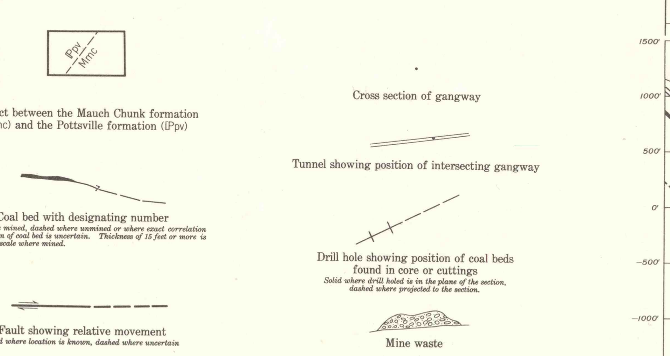


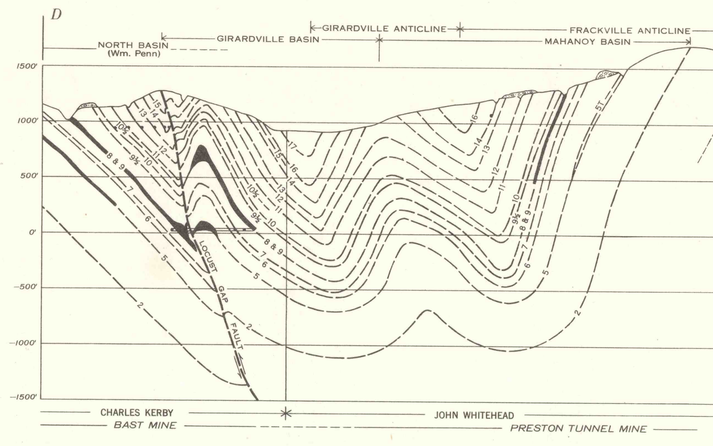


CORRELATION CHART SHOWING THE EAST-WEST LATERAL VARIATION IN THE INTERVALS BETWEEN COAL BEDS IN THE SOUTH LIMB OF THE MAHANOY BASIN

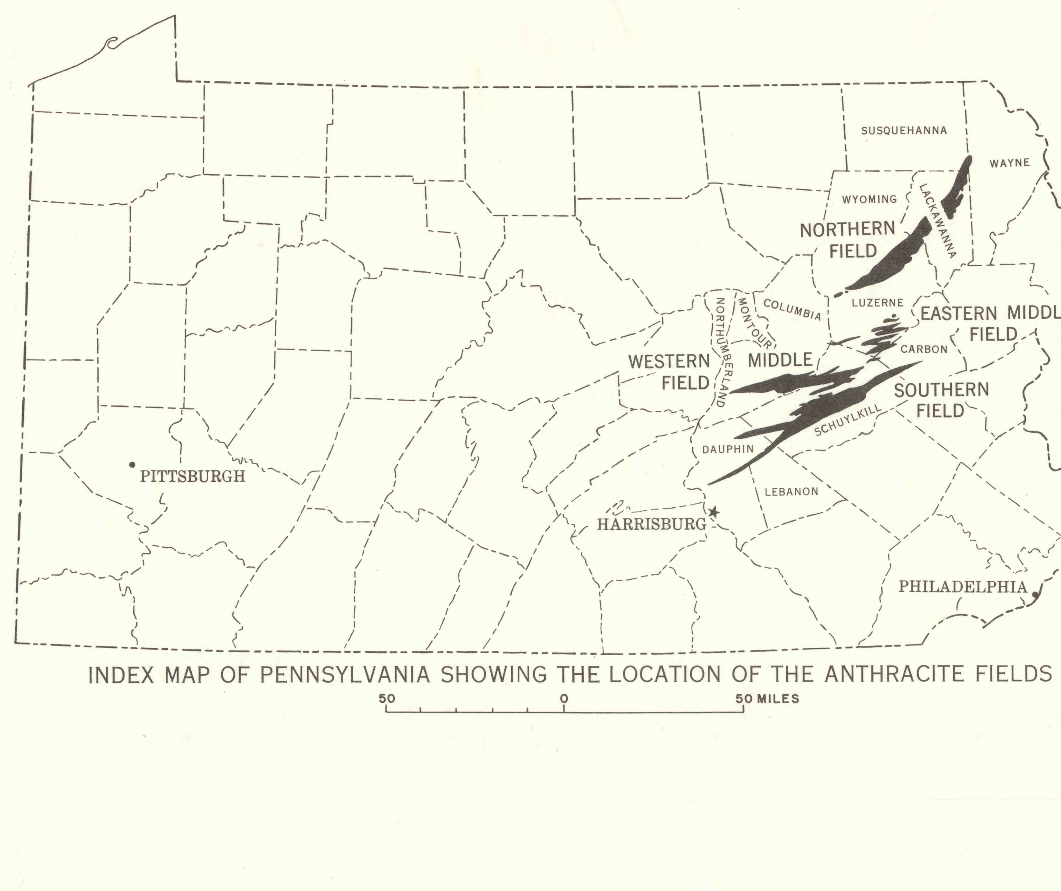


COLUMNAR SECTIONS

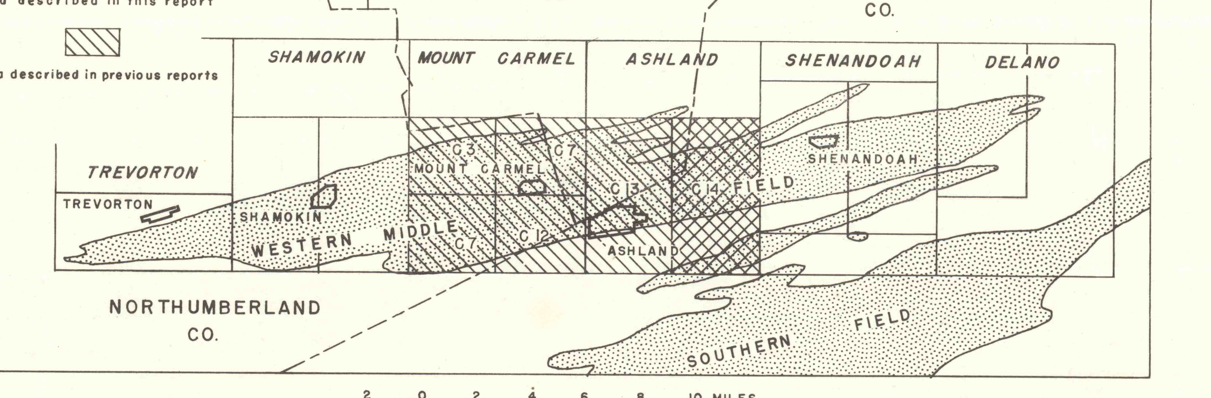




STRUCTURAL CROSS SECTIONS



INDEX MAP OF PENNSYLVANIA SHOWING THE LOCATION OF THE ANTHRACITE FIELDS



INDEX MAP OF THE WESTERN MIDDLE ANTHRACITE FIELD SHOWING THE LOCATION OF MAPPED AREAS

GEOLOGY OF ANTHRACITE IN THE EASTERN PART OF THE ASHLAND QUADRANGLE, PENNSYLVANIA

INTRODUCTION

The Western Middle anthracite field is one of four structural basins containing anthracite in eastern Pennsylvania. This report describes the geology of the part of the Western Middle field that lies in the eastern half of the Ashland quadrangle (index map, sheet 2). The mapped area covers about 19 square miles in Schuylkill and Columbia Counties, and the borough of Girardville is in the central part of the area. The New Boston basin, a coal-bearing syncline near the south edge of the Ashland quadrangle, is generally considered to be a part of the Western Middle field, although it is separated from the rest of this field by an area along the Frackville anticline that contains no coal. The Eisenhuth Run anticline, which crosses the southeast corner of the mapped area, is the dividing line between the Western Middle and the Southern anthracite fields (sheet 1).

This is the sixth of a series of reports describing different parts of the Western Middle field. Previous reports are listed below under "References;" areas covered by these reports are shown on the index map of the Western Middle field (sheet 2).

This report has been prepared to aid in the planning of exploratory, developmental, and water-control operations by showing: (a) The location of all known coal outcrops (sheet 1), (b) the depth and structure of representative coal beds (sheet 1), (c) the natural and artificial barriers between mines, and the structural relationships between the basins (sheets 1 and 2), (d) the kinds of rocks and the intervals between coal beds (sheet 2), and (e) a standard nomenclature of the coal beds.

The information presented in this report was obtained, in part, from the actual and theoretical data shown on mine maps, cross sections, drill logs, and other records made available by the Philadelphia and Reading Coal & Iron Co., the Hazle Brook Coal Co., and the Girard Estate. The cooperation of the officials of these companies is deeply appreciated.

Donald A. Myers, Richard E. Bergenback, John L. Snider, and John A. Maxwell, of the U. S. Geological Survey, aided in the field mapping of this area.

STRATIGRAPHY

Rocks of the Carboniferous and Quaternary systems crop out in the mapped area. The Carboniferous rocks belong to the upper part of the Mauch Chunk Formation of Mississippian age, and to the Pottsville, Allegheny, and lower part of the Conemaugh formations of Pennsylvanian age. Unconsolidated alluvial clay, silt, sand, and gravel of Quaternary age have been deposited along the stream valleys. Stream-transported mine waste, some of which contains valuable deposits of detrital coal, also has been deposited along many streams. Although the Quaternary alluvium has not been mapped, the economically important deposits of mine waste are shown on the outcrop map (sheet 1).

ROCKS OF MISSISSIPPIAN AGE

The Mauch Chunk formation crops out in the northern part of the area on the Red Ridge and Centralia anticlines and in the southern part of the area on the Frackville anticline between Ashland Mountain and Broad Mountain. Only the upper 1,500 feet of the formation is exposed in the mapped area.

The rocks that comprise the Mauch Chunk formation are mainly red claystone, shale, siltstone, and fine-grained sandstone; but green siltstone and fine-grained sandstone, red or green medium- to coarse-grained sandstone, and scattered lenses of gray or green conglomerate are also present. Most of the strata are quite lenticular. The Mauch Chunk appears to grade upward into the overlying Pottsville formation.

ROCKS OF PENNSYLVANIAN AGE

Rocks of Pennsylvanian age consist of lenticular beds of conglomerate, sandstone, siltstone, claystone, and shale, interbedded with 12 persistent coal beds and several local coal beds. The lower part of the Pennsylvanian in the mapped area is predominantly conglomeratic, and the upper part is chiefly fine-grained. The coal beds, some of which extend throughout the Western Middle field, are the most persistent of the lithologic units, whereas the other strata exhibit so many variations that they are of minor value for use as reference or key beds.

Pottsville formation.—The Pottsville formation, which includes the oldest rocks of Pennsylvanian age in the area, overlies the Mauch Chunk formation and underlies the Allegheny formation. The Pottsville consists chiefly of resistant clastic strata that form all the mountains and most of the major ridges in the mapped area. The formation is approximately 1,000 feet thick in the southern part of the area but thins to approximately 880 feet in the northern part. The lower part of the Pottsville formation extends southward across the Eisenhuth Run anticline and into the Southern anthracite field.

The rocks of the Pottsville formation are mainly conglomerate and sandstone, but they also include small amounts of siltstone, claystone, and coal. Most of the strata are gray, but brown, red, and green beds are present near the bottom of the formation. The conglomerate is poorly bedded and contains well-rounded and well-sorted pebbles of quartz and scattered pebbles of chert embedded in a siliceous matrix. In diameter the quartz pebbles are as much as 4 inches and the chert pebbles are generally less than 2 inches. The sandstone in the formation is medium- to coarse-grained and commonly grades laterally into conglomeratic sandstone and conglomerate.

A persistent coal bed known as the Lykens Valley (No. 2) coal bed is near the middle of the Pottsville formation in all the basins in the area. Two nonpersistent coal beds—Whites (No. 3) and Little Buck Mountain (No. 4)—are present in the upper part of the formation.

Allegheny formation.—The Allegheny formation, the base of which was designated by White (1900, p. 824) as the Buck Mountain (No. 5) coal bed, overlies the Pottsville formation and underlies the Conemaugh formation. The Allegheny formation ranges from 300 feet to 450 feet in thickness and averages about 400 feet. This formation is composed of conglomerate, sandstone, siltstone, claystone, and coal. The coal beds are the only laterally persistent lithologic units. In the lower part of the formation, sandstone and conglomerate are abundant; in the upper part, claystone and siltstone are more common, and the conglomerate is a minor constituent.

Five persistent coal beds—the Buck Mountain (No. 5), Seven-foot (No. 6), Skidmore (No. 7), and two beds in the Mammoth coal zone (No. 8 and No. 9)—are present in the Allegheny formation. A nonpersistent coal bed, the Four-foot (No. 9½) bed, also is present near the top of the formation.

Conemaugh formation.—The Conemaugh formation overlies the Allegheny formation. The base of the Conemaugh is the Holmes (No. 10) coal bed according to Lohman (1937, p. 46), and, although the lower 1,000 feet of strata is present in the central part of the area, the top of the Conemaugh has been removed by erosion. These rocks consist of sandstone, siltstone, claystone, and scattered lenses of conglomerate, interbedded with six persistent coal beds and several local beds (columnar sections, sheet 2). The Holmes (No. 10), Primrose (No. 11), Orchard (No. 12), Little Orchard (No. 13), Diamond (No. 14), and Tracy (No. 16) are the persistent coal beds in the Conemaugh.

STRUCTURE

The anthracite fields of Pennsylvania occur in four structural basins. Each basin is a synclinorium or composite syncline consisting of several overlapping characteristically asymmetric folds; some of the folds have been faulted. The area covered by this report is in the eastern part of the synclinorium that constitutes the Western Middle anthracite field. The principal component synclines and some of the truncated limbs of synclines in this field are called basins by miners, a practice that is followed by the authors of this report. The miners' term "undersheet"—a truncated limb of a syncline that dips below an adjacent overlying structure—is also used in this report. The undersheet in the Centralia basin is considered to be a part of that basin and not a separate basin as in the case of the North basin (sheets 1 and 2).

FOLDS

In the northern part of the mapped area the Western Middle field consists of a large synclinorium and in the southern part a small syncline. The synclinorium consists of several complete basins, faulted segments of basins, and the intervening anticlines. The principal basins are the Locust Mountain, Centralia, North, William Penn, Girardville, Mahanoy, and New Boston basins. The maximum structural relief of these features is about 3,100 feet as measured on the Lykens Valley (No. 2) coal bed (cross sections, sheet 2).

The Locust Mountain basin is the truncated north limb of a syncline that is probably related to the synclinal Centralia basin, which adjoins it on the south. Truncation was caused by the southward-dipping Centralia fault, which separates the two basins (cross sections BB', CC', and DD', sheet 2). The Centralia basin, a complete obtuse syncline, terminates or "spoons out" in the northeastern part of the area. The next basin to the south is called the William Penn basin in the eastern part of the area where it is a complete, slightly asymmetric syncline. In the central and western part of the area the syncline is bisected by the Locust Gap fault, and the undersheet of this fault becomes the North basin. This structural situation is reversed in the Girardville basin, the next basin to the south, which is an acute, asymmetric syncline in the western part of the area but is cut by the Suffolk fault, which begins near the middle of the area and increases in displacement eastward. The Mahanoy basin is the most southerly basin in the composite syncline. It is also the most acutely compressed of the major structures, its limbs subtending angles as small as 45°. Its depth and width in the mapped area are much less than in the areas to the west. The New Boston basin extends into the area from the east and is the southernmost basin in the Western Middle field.

The folds in the area are of the parallel type and are slightly asymmetrical, the northward-dipping limbs having the greater dips. The axial planes range in dip from 80° N. to 75° S. The limbs of the folds subtend angles ranging from 45° to 140° and so include both acute and obtuse types of folding. The Bear Ridge anticline and the Girardville basin are overturned in the area east of Girardville (sheet 1). The overturning may be attributed to the transfer of movement from the Locust Gap fault to the Suffolk fault.

FAULTS

Most faults in the mapped area are thrust faults that dip southward and are the result of compression. They may be classified as longitudinal faults or as oblique faults. The longitudinal faults have the largest amount of displacement and are generally parallel to the strike of the major folds. The most important longitudinal faults are the Centralia, Locust Gap, and Suffolk faults. The Centralia fault is along the north limb of the Centralia basin and extends across the mapped area and into the adjoining areas. The Locust Gap fault extends into the area from the west and dies out along the north limb of the William Penn basin near Connerton. The displacement on the Locust Gap fault decreases eastward and is taken up by small movements on several small longitudinal faults, such as the Girardville and Lost Creek faults, by bedding slips, and by closer folding of the beds. Movement on the Locust Gap fault may have been partly transferred to the Suffolk fault in the eastern part of the mapped area.

Several faults in the mapped area cut obliquely across the folds, making angles ranging from 25° to 60° with the fold axes. These faults have relatively small displacements that range from a few feet to a few tens of feet. In many places they are associated with shear zones, which have no apparent displacement, and are thought to represent an arrested early stage in the development of an oblique fault. Some of these zones are linear and trend obliquely to the axes of the folds, but others are irregular and have no apparent orientation (sheet 1).

Mining is adversely affected by (1) faults with displacements greater than the thickness of the respective coal bed—called rock faults by the miners, (2) areas in which the coal has been squeezed from between the roof and floor rock—called pinches, (3) small folds that have sheared, thinned, or thickened the coal—called rolls, and (4) shear zones—areas in which the coal is so macerated or fractured by differential movement and extreme pressure that it cannot be profitably mined.

COAL BEDS

NOMENCLATURE

In the Western Middle anthracite field the coal beds of the different mines are designated by a number, a name, or both. This nomenclature has not been standardized between the different mines because (1) coal beds in isolated mines were named before they could be correlated, (2) gaps exist between adjoining workings, (3) the structure and lithology are complex, (4) outcrops are scarce, and (5) it is difficult to change established mining records.

The names of the coal beds used in this report conform with the nomenclature used by the authors in previous reports. These names do not agree in all cases with those used in the Second Geological Survey of Pennsylvania (Ashburner, 1883, p. 84), and they do not agree in all cases with the nomenclature used by the mining companies in the mapped area.

In this report a coal bed is described as persistent, nonpersistent, or local, or as a leader. A persistent coal bed can be traced throughout a basin and can be correlated with a bed in the same stratigraphic position in adjoining basins in the Western Middle field. A nonpersistent coal bed is recognized and correlated in several of the basins, but it is not a continuous coal bed. A local coal bed cannot be correlated across a basin or between adjoining basins, and generally cannot be traced for more than 3 or 4 miles. A leader coal bed is present in only a small area, and when first named was so near a well-known or economically important coal bed that it served as a guide or marker for that bed. It may or may not merge into the persistent coal bed and may be separated in some places from the persistent bed by a stratigraphic interval of as much as 40 feet.

OUTCROPS OF COAL

Coal beds are rarely exposed in natural outcrops owing to the cover of soil. The outcrops shown on sheet 1 are in the position that they would occupy if the coal were projected through the soil to the surface of the ground. These positions may not agree with the blooms of weathered coal, which, because of soil creep, are generally found lower on the slope than the original outcrop.

It was necessary to project some coal beds beyond their last known point of occurrence. This has been done to show the authors' estimate of the extent of that particular coal horizon and does not mean that the coal is of minable thickness throughout its indicated extent. Local or leader coal beds less than 18 inches thick were not mapped.

THICKNESS OF COAL BEDS

Listed below are the average thickness and range in thickness of coal beds in the area covered by this report. Figures on the right half of the table show total thickness of all coal in each bed; figures on the left half of the table show total thickness of all coal and all shale partings in each bed.

Most of the coal and bed thicknesses were obtained from mine company data and were chosen to show an average of many underground observations. Measurements of beds that may have been abnormally affected by deformation were not recorded. The maximum and minimum thicknesses shown in this table and in the columnar sections (sheet 2) are from all observed measurements along tunnels, mined coal measurements, drill cores, or sections measured by the Geological Survey personnel. Thickness figures have been omitted from the table where few reliable data are available.

Average thickness and range in thickness of coal beds in the eastern part of the Ashland quadrangle

Bed number	Thickness						Percentage of refuse
	Bed			Coal			
	Average	Range		Average	Range		
	Ft in.	Ft in.	Ft in.	Ft in.	Ft in.	Ft in.	
17							
16		0 9	5 0				
15		0 11	5 4				
14	8 0	3 6	11 10	6 4	2 0	9 4	20.8
13	6 6	4 4	12 2	4 7	1 10	10 10	29.5
12	8 4	3 6	13 1	6 6	1 2	9 8	22.0
L		1 8	3 6				
11T							
11	7 8	2 7	14 8	5 11	1 1	12 4	22.8
10½		1 2	6 1				
10	9 6	2 2	28 0	8 0	1 7	28 0	15.8
9½	7 4	2 8	11 11	6 5	1 8	10 10	12.5
9	9 2	2 0	14 7	7 1	1 5	12 8	22.7
8	18 10	12 2	24 4	16 10	9 10	22 2	10.6
8 & 9	26 10	13 0	44 0	20 7	9 0	34 8	23.3
7T	2 0	0 7	2 4	1 6	0 7	2 1	16.6
7	3 6	1 0	13 11	2 6	0 10	12 10	28.6
L		1 2	2 7				
6	3 10	1 7	11 0	2 7	0 10	6 7	32.6
L		0 9	3 1				
5	11 11	1 7	23 0	9 8	1 6	23 0	18.9
4	3 8	2 7	8 0	3 5	1 0	8 0	6.8
3							
2		0 7	6 2				

COAL BEDS MINED IN THE AREA

Eleven coal beds have been mined in the mapped area. Of these, the Buck Mountain (No. 5), Seven-foot (No. 6), Skidmore (No. 7), two splits of the Mammoth coal zone (No. 8 and No. 9), Holmes (No. 10), Orchard (No. 12), and the Diamond (No. 14) coal beds are economically the most important.

The Buck Mountain (No. 5) coal bed, basal unit of the Allegheny formation, overlies the more resistant rocks of the Pottsville formation and underlies the remaining beds of the Allegheny, which are less resistant. As the result of differential resistance to erosion a topographic bench forms in some areas, making it possible to map the outcrop of the Buck Mountain coal bed rather accurately. In the western part of the Ashland quadrangle, to the west (see index map, sheet 2), the Buck Mountain consists of two or three splits, Nos. 5, 5M, and 5T, which are mined as separate coal beds. From the outcrop the splits merge eastward into the area of this report, and the combined No. 5 coal bed contains only discontinuous partings that are generally less than a foot thick. The Buck Mountain, which is extensively mined, has an average thickness of nearly 12 feet in the mapped area.

The Seven-foot (No. 6) and Skidmore (No. 7) coal beds are approximately 140 and 190 feet, respectively, above the Buck Mountain (No. 5) coal bed in this area. The intervening rocks are chiefly sandstone, siltstone, claystone, and occasional lenses of conglomerate. Nos. 6 and 7 coal beds crop out in all of the basins in the mapped area. A split of the Skidmore coal bed, the Skidmore Top Split (No. 7T), crops out in the central part of the area in the North (William Penn) basin and in the southeastern part of the area in the Mahanoy basin. The Seven-foot coal bed has been mined at scattered localities throughout the area, and the Skidmore coal bed has been most extensively mined in the western part of the area in the Bast mine.

The Mammoth coal zone, consisting of the Mammoth Bottom Split (No. 8) and the Mammoth Top Split (No. 9) coal beds has been mined as a single unit over most of the eastern half of the Ashland quadrangle. The Nos. 8 and 9 coal beds are separated by carbonaceous claystone and siltstone that may attain a thickness of 60 feet in some places. In parts of the Raven Run and Hammond mines, Nos. 8 and 9 were mined separately. Where the Mammoth coal zone has been mined as a single unit, the average bed thickness is 26 feet, 10 inches. The persistence, quality, and thickness of the coal beds in the Mammoth coal zone make them the most economically important in the area.

The Holmes (No. 10) coal bed is important because of its greater than average thickness, 9 feet, 6 inches, and its smaller than average percentage of refuse, 16 percent. Extensive mining and a rather uniform interval from the Mammoth coal zone are factors that make the Holmes coal bed useful as a stratigraphic marker.

The Orchard (No. 12) and Diamond (No. 14) coal beds, which are the youngest beds mined in this area, crop out in the more deeply folded North and Mahanoy basins. Both No. 12 and No. 14 coal beds have an average thickness of 8 feet. Partings of carbonaceous claystone or bony coal generally constitute more than 20 percent of the bed thickness. These beds attain their maximum thickness in the west-central part of the area, where they have been mined extensively in the Hammond and Bast mines.

A number of coal beds listed in the preceding coal-thickness table are not described in this report. These coals are generally of poor quality or of such local occurrence that they were of little economic importance at the time this report was written. This, however, does not presuppose that they may not be of great economic importance as mining practices improve or as the market for coal increases.

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COAL INVESTIGATIONS
MAP C14 (SHEET 2 OF 2)

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GEOLOGY OF ANTHRACITE IN THE EASTERN PART OF THE ASHLAND QUADRANGLE, PENNSYLVANIA

By
Boyd R. Haley, Harold H. Arndt, Howard E. Rothrock, and Holly C. Wagner

1954