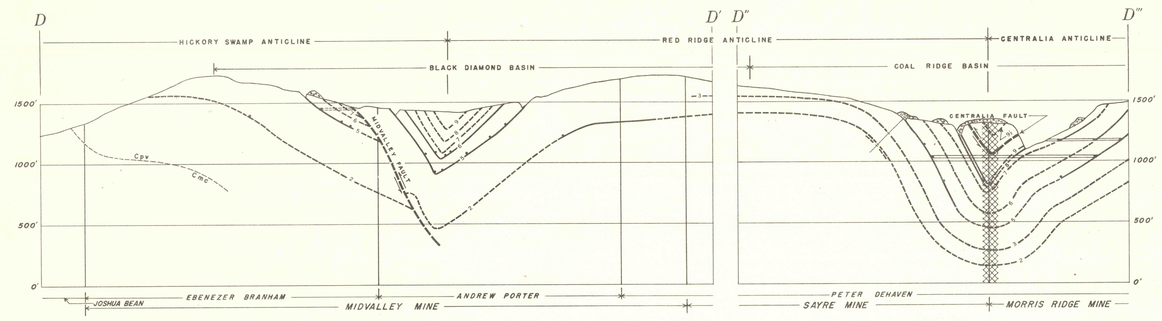
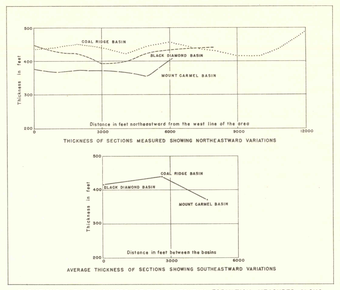
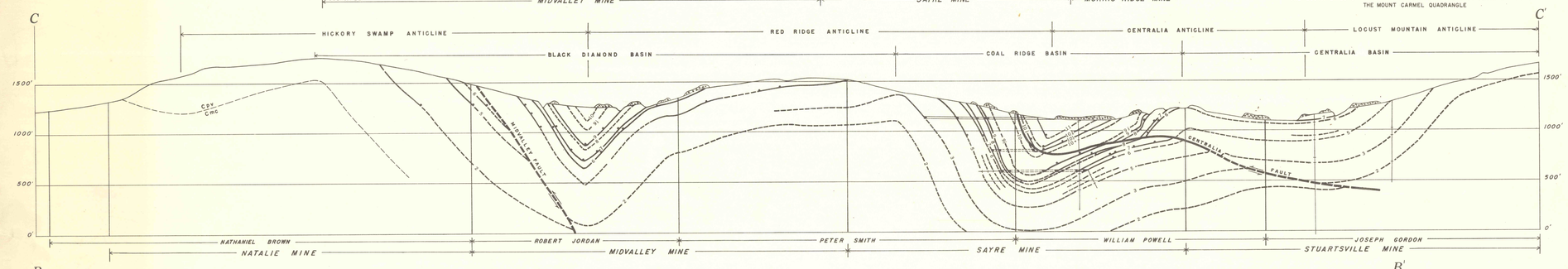
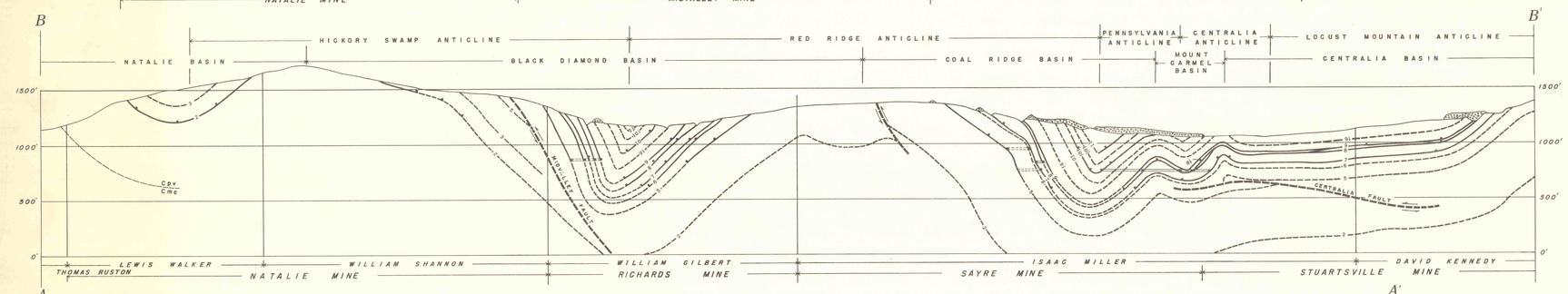
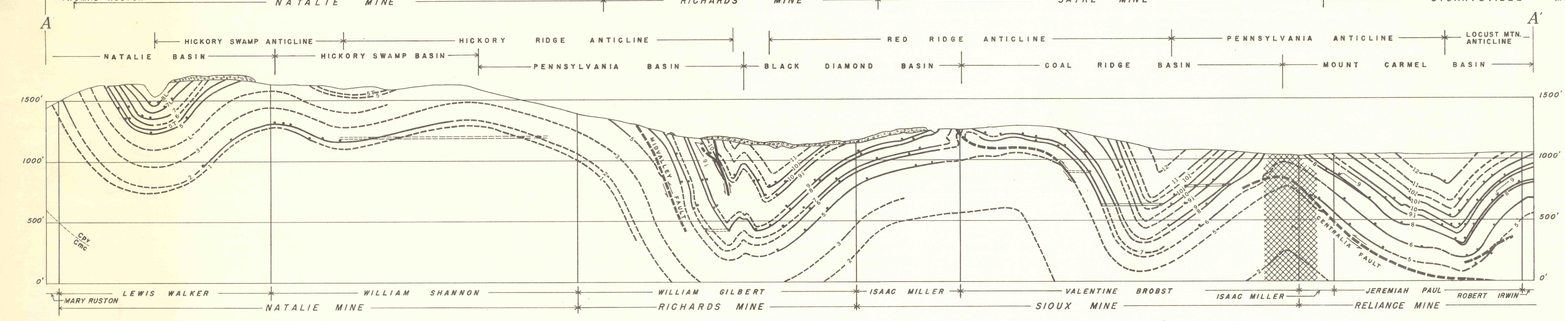




VARIATIONS IN THE THICKNESS OF THE ALLEGHENY FORMATION MEASURED ALONG THE SOUTH LIMBS OF THREE OF THE BASINS IN THE EAST-CENTRAL PART OF THE MOUNT CARMEL QUADRANGLE







EXPLANATION OF CROSS SECTIONS

Cpv / Cmc — Contact between the Mauch Chunk shale (Cmc) and the Pottsville formation (Cpv)

Coal bed with designating number. *Solid where mined, dashed where unmined.*

Fault showing relative movement. *Solid where location is known, dashed where uncertain.*

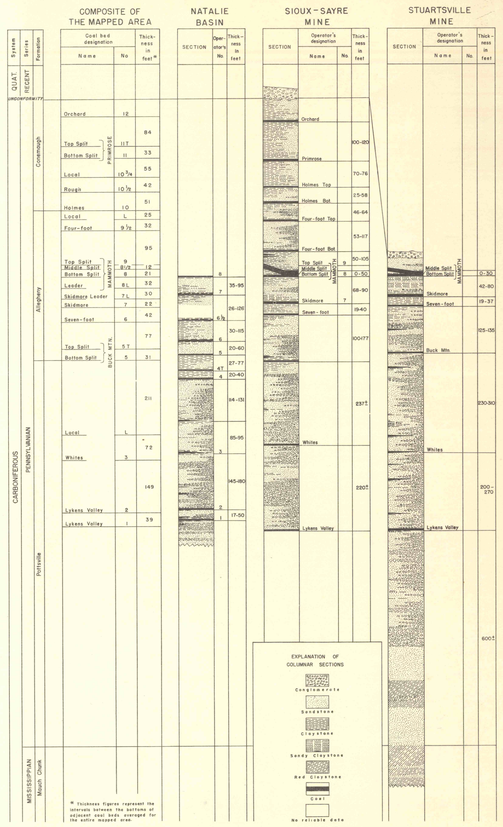
Drill hole showing position of coal beds found in core or cuttings. *Solid where hole is in the plane of the section, dashed where projected to the section.*

Cross section of gangway

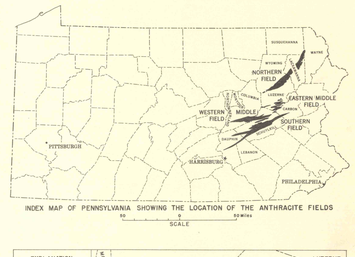
Tunnel showing position of intersecting gangway. *Solid where tunnel is in the plane of the section, dashed where projected to the section.*

Mine waste

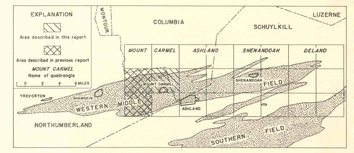
Area reserved for barrier pillar



COLUMNAR SECTIONS



INDEX MAP OF PENNSYLVANIA SHOWING THE LOCATION OF THE ANTHRACITE FIELDS



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

Prepared in 1950 from data supplied by the Hazle Brook Coal Company, Lehigh Valley Coal Company, Natalie Coal Corporation, Philadelphia and Reading Coal and Iron Company, and the Susquehanna Collieries Company, with modifications by the U. S. Geological Survey, Department of the Interior.

CROSS SECTIONS SHOWING THE STRUCTURE OF THE COAL BEDS IN THE EAST-CENTRAL PART OF THE MOUNT CARMEL QUADRANGLE

SCALE 1:6,000

Datum is mean sea level

GEOLOGY OF ANTHRACITE IN THE EAST-CENTRAL PART OF THE MOUNT CARMEL QUADRANGLE, PENNSYLVANIA

INTRODUCTION

The Pennsylvania anthracite fields, the principal source of anthracite in North America, are in the eastern part of the Commonwealth of Pennsylvania. (See index map of Pennsylvania, sheet 3.) The coal occurs in four elongate areas--Northern, Western Middle, Eastern Middle, and Southern--that are separate but resemble one another in outlook arrangement. The fields range in length from 24 to 66 miles and in width from a fraction of a mile to 10 miles, and include about 478 square miles of coal-bearing land (Smith, 1929, p. 50). The area covered by this report is in the Western Middle Field.

The boundaries of the coal-bearing areas that constitute the anthracite fields are considered to be the outcrops of the clients of the Lykens Valley coal beds. Each of the fields has a boundary that is a single continuous line, except the Western Middle field, which consists of several closely spaced but disconnected coal-bearing areas. The approximate boundaries of the fields are generally indicated by outcrops of the conglomerate Pottsville formation, one of the red rocks of the Mauch Chunk shale below the Pottsville.

The mapped area here described is near the middle of the Western Middle field and consists of the east-central part of the Mount Carmel quadrangle, as shown on the accompanying topographic quadrangle. (See index map of the Western Middle field, sheet 3.) This part of the quadrangle is between latitudes 40°47'30" and 40°50'00" N., a distance of 2.82 miles, and longitudes 76°22'30" and 76°26'15" W., a distance of 3.06 miles, in Northumberland and Columbia Counties. The borough of Mount Carmel is in the southwestern part of the area.

This report is the third of a series on the anthracite fields inaugurated by the Federal Geological Survey with the approval of the Bureau of Topographic and Geologic Surveys of the Commonwealth of Pennsylvania. The first report of the series described the west-central part of the Mount Carmel quadrangle (Rothrock et al., 1951), and the second the southeastern part (Rothrock et al., 1951). Information in these reports includes (1) the location of coal outcrops (sheet 1), (2) the depth, pitch, and other structural features of representative coal beds, (3) the natural and artificial barriers and the structural relationships between the various coal basins (sheets 1, 2, and 3), (4) the stratigraphic intervals between the coal beds, (5) a standard nomenclature for these coals, and (6) the approximate tonnages of the recoverable anthracite in the coal beds (sheet 3). The reports will bring up to date and amplify the Grand Atlas of the Anthracite Fields published by the Second Geological Survey of Pennsylvania in 1894-95, and the reports that supplemented the Atlas. It is expected that the reports of the present series will aid operators who are mining either on the surface or underground, or who are formulating plans for control of mine drainage, ventilation, and transportation. It also direct attention to overlooked or neglected reserves of coal.

Acknowledgments. Much of the information comprising this report was compiled from mine maps, cross sections, surface surveys, core drill records, and other data supplied by the Hazle Brook Coal Co., Lehigh Valley Coal Company, Natalie Coal Corp., Philadelphia and Reading Coal and Iron Co., and the Susquehanna Collieries Co. The cooperation of the companies' officials who made available this indispensable information and the aid given by John P. Brogoy, State Mine Inspector, is deeply appreciated.

STRATIGRAPHY

The rocks that crop out in the mapped area belong to the Carboniferous and Quaternary systems. The Carboniferous rocks include the top of the Mauch Chunk shale (Mississippian), and the Pottsville, Allegheny, and lower part of the Conemaugh Formations (Pennsylvanian). The eroded outcrop of these formations are covered in places with Recent deposits and Quaternary glacial deposits. The following stratigraphic descriptions were obtained from the study of mine cross sections, core drill records, and sections taken along mine tunnels, slopes, and shafts by company engineers, and from field observations.

Mississippian Rocks

Mauch Chunk shale. The Mauch Chunk shale crops out on the north slope of Big Mountain, but no exposure of it was found because of the cover of talus from the overlying Pottsville formation. A core drill hole in the Stuartsville mine penetrated a zone approximately 125 ft. thick of red claystone with interbedded sandstones. The top of this zone is considered to be the top of the Mauch Chunk shale in this report. The color of the rocks at the top of this formation at the horizon below which the rocks are predominantly red and fine grained (Mauch Chunk) and above which they predominantly weather gray or brown and are coarse grained (Pottsville).

Pennsylvanian Rocks

The Pennsylvanian (Carboniferous) rocks are of continental origin and consist of lenticular deposits of arenaceous and argillaceous rocks, interbedded with 15 persistent beds and several local beds of coal. The lower part of the Pennsylvanian rocks is predominantly red and fine grained (Pottsville), and the upper part, with individual beds, however, exhibits such abrupt changes in lithology that the type of rock of which an outcrop is composed is seldom indicative of a definite stratigraphic position. The coals are the most persistent of the rock types, most of the principal beds being found throughout the coal-bearing area.

Pottsville Formation. The Pottsville Formation, the oldest of the Pennsylvanian rocks, overlies the Mauch Chunk shale and underlies the Allegheny formation. The thickness of the Pottsville formation ranges from approximately 910 ft. in the adjoining area on the west to about 1,110 ft. in the Stuartsville mine area. As the Formation consists of resistant conglomerates and sandstones, it forms the core of Big Mountain, Locust Mountain, and the more northerly ridges in the mapped area. The base of the formation is not exposed in the mapped area, but a core drill record in the Stuartsville mine indicates that the lower 175 ft. of the formation consists chiefly of sandstone with a bed of red claystone near the middle. This claystone corresponds to a similar zone of gray and red fine grained clastics in the lower part of the Pottsville in the west-central part of the Mount Carmel quadrangle. The Pottsville Formation above the red claystone zone consists of lenticular conglomerates interbedded with thinner beds of sandstone and, in the upper part, beds of gray and red fine grained clastic sediments. The conglomerates, which are composed of pebbles of milky quartz and quartzite in a quartz sand matrix cemented by silica, form ridges or cliffs in many places but none form much a ridge throughout the area of outcrop. One of the most persistent ridge-forming conglomerates crops near the middle of the formation and is overlain by the No. 2 bed of the Lykens Valley coal zone. In the Stuartsville mine area, the lower part of the conglomerate forms a small ridge or cliff and supports only a scanty vegetation--characteristics that are helpful in identifying the No. 2 coal in some places. In the southwestern and southeastern parts of the Mount Carmel quadrangle, however, the conglomerate above the No. 2 coal usually makes a more prominent ridge than does the coal. The conglomerate at the top of the Pottsville formation is persistent throughout the area of the Mount Carmel quadrangle. In mapped area, a topographic feature that is useful in locating the Buck Mountain (No. 5) coal, which overlies the conglomerate. The Pottsville Formation contains three coal beds that have been mined--the No. 1 and No. 2 beds of the Lykens Valley coal zone, the Whites (No. 3) coal bed, and several beds that are of little importance.

Allegheny Formation. In the mapped area the Allegheny Formation extends from the base of the Buck Mountain (No. 5) coal bed to the base of the Holmes (No. 10) coal bed, which is the basal bed of the Conemaugh Formation. The Formation is 300 ft. to 420 ft. thick. (See charts on sheet 3,showing variations in the thickness of the Allegheny Formation.) The thickness of the Formation measured in the south limbs of the basins of the upper chart shows no consistent trend of thickness in a longitudinal (northeastward) direction. The lower chart indicates that the Formation thins with northeastward southward from the Coal Ridge basin. How much of this thinning is depositional and how much deformational is not apparent. The following table, however, records the known facts.

Table showing the thickness of the Allegheny formation and the dip of the measured sides

Basin	Measured thickness	Average dip of south limb
Black Diamond	417 ft.	35°
Coal Ridge	440 ft.	30°
Mount Carmel	371 ft.	36°

The Allegheny formation consists of interbedded conglomerate, sandstone, siltstone, claystone, and coal. In the lower part of the formation arenaceous rocks predominate. In the upper part claystones and siltstones occur more frequently and conglomerate becomes a lesser constituent. The bottom rock of the Bottom Split (No. 8) of the Mammoth coal is a conglomerate. Conglomerate beds ranging from 5 feet to 50 feet in thickness occur in the upper part of the Allegheny, and the unusual pressure of similar conglomerates elsewhere in the section, the conversions are less useful in the correlation of the Bottom Split in this area than they are in the southeastern part of the Mount Carmel quadrangle. The Allegheny formation in the source of most of the coal that is mined in the Pottsville. Seven coal beds have been mined in the past. Of late, the Four-foot (No. 9), Seven-foot (No. 6), and the Seven-foot (No. 6), Skidmore (No. 7), and the Mammoth coals in the intervening zone.

Conemaugh Formation. Only the lower 450 ft. of the Conemaugh formation is exposed in the area. It includes the Holmes (No. 10) coal, which is the lowest bed of the Conemaugh, the Skidmore (No. 12) coals, and then about 290 ft. of claystone and siltstone overlying the Orchard coal. The rocks are interbedded sandstones, siltstones, and claystones, with lenses of conglomerate in the lower part of the Formation.

Recent deposits

Recent deposits consist of boulders, gravel, sandy silt, and water-borne mine waste. These deposits, covered in many places by alluvial mine waste, are generally found in the valleys. In a previously mapped area to the southwest, deposits indicative of glacial origin were found (Rothrock et al., 1951, sheet 3). Although glacial deposits were not noted in the area studied, it is possible that they are present but covered with subsequent alluvium.

STRUCTURE

Each of the Pennsylvania anthracite fields is a composite synoline, consisting of a group of roughly parallel overlapping folds, some of which have been faulted. The general trend of these folds is northeastward. The synclinal parts of these folds are called basins by miners, a practice that is followed in this report. The term generally designates a complete synoline, consisting of a single fold, but it also is used for a fault block bounded by the truncated edge of a faulted synoline, in which the names "back" basin, "North" basin, and "Underlap" are locally applied.

The mapped area includes the north edge of the composite synoline that is the Western Middle field, which trends northeast a little more than halfway across it. The synclines within this area are comparatively broad and have gentle pitches, but the anticlines pitch southwestward. As a result, the coal beds are deeper in the southwestern part of the area in the Mount Carmel basin, where the Lykens Valley (No. 2) coal is about 600 ft. below sea level. The maximum measurable structural relief in the area is about 2,500 ft., as measured from the Mount Carmel basin to the highest outcrop of the same bed, which occurs at an altitude of about 1,700 ft. on Big Mountain.

Folds

The folds in the mapped area are concentric (parallel) and most of them are slightly asymmetric, with axial planes dipping northward or southward at angles ranging from 65° to 90° and averaging 80°. The flattened medial parts of the limbs of major folds subtend angles that range from 90° to 135°, and so include both moderately acute and obtuse types of folds.

The principal synclines are the Black Diamond, Coal Ridge, and Centralia basins. Hickory Swamp, Pennsylvania, and Mount Carmel basins, which are large synclines in the west-central and southwestern parts of the Mount Carmel quadrangle, terminate or "spoon out" in the western part of the mapped area. (See sheet 2.) In most localities the troughs of the synclines are more closely compressed than are those of the Black Diamond and the several complex synclines to the east. Nevertheless, the trough of the Hickory Swamp basin, which is folded to about the same degree as the adjoining anticlines. The continuation of this synoline in the west-central part of the Mount Carmel quadrangle, however, conforms to the general condition or norm. Another exception is the trough of the Natalie basin, which, like the adjoining anticlines, is only moderately folded throughout most of its extent, a condition that is probably related to the geographic position of the basin in the northwestern part of the area, where it is relatively near the Mahanoy Fault, a fault that is due possibly to relief of compression resulting from the Centralia fault. (See sheet 2.)

Faults

Most of the faults in the area are thrust shears and are the result of compression. The largest faults are parallel with the strike of the folds and are called longitudinal faults. Two such faults traverse the entire area and extend east and west into the adjoining areas. They are the Midvalley fault on the north limb of the Black Diamond and Pennsylvania basins and the Centralia fault in the Coal Ridge basin. The Midvalley fault dips southward (sheet 1, C and D.) The Midvalley fault dips southeastward and repeats the outcrop of the Buck Mountain (No. 5), the Seven-foot (No. 6), and the Skidmore (No. 7) coal beds. The Centralia fault, a warped thrust that cuts the beds at low angles, crops out in the eastern part of the area, but can be traced underground into the west-central part of the Mount Carmel quadrangle.

A smaller longitudinal fault near the western end of the Red Ridge anticline illustrates a type of faulting that occurs commonly on a small scale at the crests of some of the anticlines. In this place the faulting appears to be related to a late phase of folding when compression in the synclines was relieved by faulting of the overthrusting along the crests of adjoining anticlines to the north. Other faults of this type have been found in the adjoining area to the out as hedging-plane faults on the south limb of the anticline.

Another pattern of faulting is provided by oblique faults that usually strike at an angle of about 45° with the strike of the folds. Some of them terminate in the longitudinal faults, but appears to cut these faults, and some are isolated from them. The Stuartsville mine is located in a block of the Pottsville formation, areas in which the coal has been so extensively fractured by differential movement of the roof- and floor-rock that it cannot be mined profitably. Faults are indicated on the map in these measures some a lesser constituent. The bottom rock of the Bottom Split (No. 8) of the Mammoth coal is a conglomerate. Conglomerate beds ranging from 5 feet to 50 feet in thickness occur in the upper part of the Allegheny, and the unusual pressure of similar conversions elsewhere in the section, the conversions are less useful in the correlation of the Bottom Split in this area than they are in the southwestern part of the Mount Carmel quadrangle. The Allegheny formation in the source of most of the coal that is mined in the Pottsville. Seven coal beds have been mined in the past. Of late, the Four-foot (No. 9), Seven-foot (No. 6), and the Seven-foot (No. 6), Skidmore (No. 7), and the Mammoth coals in the intervening zone.

Conemaugh Formation. Only the lower 450 ft. of the Conemaugh formation is exposed in the area. It includes the Holmes (No. 10) coal, which is the lowest bed of the Conemaugh, the Skidmore (No. 12) coals, and then about 290 ft. of claystone and siltstone overlying the Orchard coal. The rocks are interbedded sandstones, siltstones, and claystones, with lenses of conglomerate in the lower part of the Formation.

Recent deposits

Recent deposits consist of boulders, gravel, sandy silt, and water-borne mine waste. These deposits, covered in many places by alluvial mine waste, are generally found in the valleys. In a previously mapped area to the southwest, deposits indicative of glacial origin were found (Rothrock et al., 1951, sheet 3). Although glacial deposits were not noted in the area studied, it is possible that they are present but covered with subsequent alluvium.

STRUCTURE

Each of the Pennsylvania anthracite fields is a composite synoline, consisting of a group of roughly parallel overlapping folds, some of which have been faulted. The general trend of these folds is northeastward. The synclinal parts of these folds are called basins by miners, a practice that is followed in this report. The term generally designates a complete synoline, consisting of a single fold, but it also is used for a fault block bounded by the truncated edge of a faulted synoline, in which the names "back" basin, "North" basin, and "Underlap" are locally applied.

The mapped area includes the north edge of the composite synoline that is the Western Middle field, which trends northeast a little more than halfway across it. The synclines within this area are comparatively broad and have gentle pitches, but the anticlines pitch southwestward. As a result, the coal beds are deeper in the southwestern part of the area in the Mount Carmel basin, where the Lykens Valley (No. 2) coal is about 600 ft. below sea level. The maximum measurable structural relief in the area is about 2,500 ft., as measured from the Mount Carmel basin to the highest outcrop of the same bed, which occurs at an altitude of about 1,700 ft. on Big Mountain.

Folds

The folds in the mapped area are concentric (parallel) and most of them are slightly asymmetric, with axial planes dipping northward

GEOLOGY OF ANTHRACITE IN THE EAST-CENTRAL PART OF THE MOUNT CARMEL QUADRANGLE, PENNSYLVANIA

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

1951

Drafted by John T. Howells and Robert W. Banks

GEOLOGY OF ANTHRACITE IN THE EAST-CENTRAL PART OF THE MOUNT CARMEL QUADRANGLE, PENNSYLVANIA

For sale by U. S. Geological Survey, price $1.50 per set