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COAL INVESTIGATIONS MAP C 7 (IN 3 SHEETS) SHEET 3

only (Ashburner, 1883, p. 84).

out the mapped area.

The names of the coal beds used in this report were chosen to conform to the

consensus of usage among operators and to the nomenclature of the previous report of this series. These names do not necessarily agree with those used in the reports of the Second Geological Survey of Pennsylvania, which conformed to local usage

DESCRIPTION OF THE COAL BEDS

THICKNESSES AND OUTCROPS OF COAL

numerous underground measurements made by the operators. They were chosen to indicate the normal thickness of the bed and its included coal in unit areas 1000 feet square. Wherever possible, at least four measurements were averaged for each

unit area. Measurements that were considered to be abnormally affected by struc-tural deformation, such as faulting, pinching, or swelling, were not used; hence,

extreme dimensions of the beds are not included. The following table shows the averages and ranges of these unit-area figures in the mapped area. The ranges in thickness shown in this table, however, may be less than the ranges shown on the

columnar sections on sheet 3 because those in the table represent thicknesses in mined areas, whereas those in the columnar sections represent thicknesses through-

AVERAGE THICKNESSES AND RANGES IN THICKNESS OF COAL BEDS

MINED IN THE SOUTHWESTERN PART OF THE MOUNT CARMEL QUADRANGLE

The coal thicknesses shown in this report were selected chiefly from very

folding and produced overlapping sheets or plates of but slightly folded strata. When the mass could no longer be compressed by faulting, the stabilized fault planes, as well as the overlapping plates, were folded. The hypothesis that deformation occurred in three instead of two principal stages, however, is supported by evidence. According to this hypothesis the first stage resulted in moderate folding such as that in the western part of the Appa-lachian Valley and Ridge province, west of Willis Mountain, Pennsylvania, and in the adjoining Allegheny Plateau province (Pittsburgh Geological Society, 1948). The second stage began when compression was relieved partly by shearing and overthrusting and partly by folding. Shearing probably took place on the lee (northwest) flank of the folds, but there is no evidence in the mapped area that faulting was deferred until the folds were extensively compressed or overturned. After faulting began, deformation proceeded both by additional telescoping, or overthrusting, and by greater compression of the 'folds. These processes probably alternated with each other until the fault planes became so flexed that further movement along them was impossible. Subsequent deformation of the stabilized mass, which took place chiefly by folding, represents the third stage. Deformation in the Enterprise basin is considered to be representative of the second stage of deformation in the three-stage hypothesis. The folds are of low relief and relatively large amplitude; the Enterprise fault generally cuts the beds at low angles or follows bedding planes; the younger beds moved relatively north-ward. (See cross section A-A', sheet 3.) The movement pivoted on the east end of the faulted plate where segments of the Enterprise fault terminate near Locust Gap and half a mile southeast of Maysville No. 1 slope. (See sheet 1.) These two segments can be traced westward into the adjoining area through workings in he Mammoth bed, where they are shown to be the same fault. The third stage of deformation is represented by the New, Mahanoy, and North basins. This three-stage hypothesis is not thoroughly substantiated. More evidence bearing upon it will be obtained during the extension of the current studies to other Subsidiary faults and shear zones. There is no clear line of demarcation between subsidiary (local) faults and principal faults because of intergradation of In many places mining operations are more directly affected by subsidiary faults than by principal faults. Bedding-plane faults cause much local disturbance of the coal. The features that miners call "dirt faults," and probably some that they call "pinches," are bedding-plane faults, in contrast to the term "rock fault," which denotes a fault whose offset is transverse to the bed and greater than its Oblique faults, also subsidiary, are common in the mines. They generally trend at angles of about 45° with the longitudinal axes of the structures, and may cut one or more beds. They may be associated with shear zones (see sheet 2) or with small folds, called rolls, both of which probably represent an early stage in the development of these faults. Some of these faults offset axes of folds, and so were formed later than the folding that established these axes. Shear zones also are subsidiary structures that affect mining adversely. Bands of sheared coal occur in places in most of the beds, and large areas of some beds are sheared, but neither condition may be extensive enough to make the bed unminable. In some areas, however, the coal is so extensively sheared that it

they may be oval, or branching, or have other shapes. They are formed in an incompetent bed by relatively slight differential movement of the adjacent compe-tent rocks, and are composed of the rock fragmented by this movement. If the fragments are coal they occur in thin lenticular masses or flakes bounded by curved slickensided gliding planes, and are called "shelly" coal. Low cohesion between the flakes is indicated by the fact that the sheared coal readily falls apart or "runs" where mined. EFFECT OF DEFORMATION ON THE THICKNESS OF STRATA Deformation has affected the thickness of the strata in the mapped area The effect on coal beds is evident in the troughs of closely folded synclines, which in some places contain masses of coal several times thicker than the normal thickness of the involved coal beds. Some of this thickening is the result of over-lapping beds, and some is due to the movement of shelly coal by gliding along its slickensided surfaces. The movement of individual flakes may be small, but the aggregate movement of countless numbers of flakes may be very large. This

movement is away from areas of maximum pressure, as on the limbs of folds, toward areas of minimum pressure, as along the axes of folds. The presence of stringers of apparently solid coal in fractures in the rock is believed to be the result of similar gliding between coal flakes or particles. The effect of deformation on other strata differs with the competency of the rock. Measurements on single beds, however, do not yield reliable quantitative data on this problem because of lateral variation in facies and thickness. There-fore a sequence of such strata, the Alleghany formation, was studied. Stratigraphic sections, measured at places of approximately equal dip, were prepared and their thicknesses averaged for each principal structure. The dip of the rocks at the places where the sections were measured was also determined, and averaged for each structure. Comparison of these data shows that the Alleghany formation thins as the degree of folding increases. This trend is expressed quantitatively in the following table: RELATIONSHIP BETWEEN THE THICKNESS AND THE DIP OF STRATA IN THE ALLEGHENY FORMATION IN THE SOUTHWESTERN PART OF THE MOUNT CARMEL QUADR ANGLE Average Percentage decrease thickness from thickness of the on Alaska dip where

33° 337 17.0 The relationship between stratigraphic thickness and degree of deformation is also indicated on the accompanying charts showing variations in the thickness of the Allegheny formation. The thickness of this formation varies irregularly along the strike of the folds but exhibits no definite trend in this direction. The degree of irregularity, however, is greater in the southern, more closely folded basins, than in the northern structures. COAL BEDS NOMENCLATURE AND CORRELATION OF THE COAL BEDS Coal beds in the anthracite fields are generally known as veins, following very early custom. The term "vein," in scientific usage, refers to tabular mineral deposits that are foreign to, and younger than, the rocks in which they occur, and deposits are called coal "beds."

The coal beds of a mine are designated by names or numbers, or by both, but this nomenclature has not been completely standardized. Great progress, however, has been made since the early days of mining, when names were given to beds in isolated mines before correlation could be made. Other factors contributing to this lack of uniformity are the complexity of structure and lithology, the scarcity of outcrops, and the difficulty of changing established records. 76° 26' 15" 1500' 1000'

> 1500 Cmc Cpv

40° 45' 00' 1500'

Thicknesses Bed Bed Coal Percent number Average Range Average Range of refuse 1'6" - 8'7" 9¹4¹¹ 5¹0¹¹ - 16¹2¹¹ 6¹7¹¹ 3¹8¹¹ - 12¹6¹¹ 29.4 5¹10^m 1¹6^m - 11¹10^m 4¹11^m 1¹6^m - 10¹10^m 15.7 $4^{\dagger}7^{\dagger}$ $3^{\dagger}8^{\dagger}$ - $6^{\dagger}4^{\dagger}$ $3^{\dagger}4^{\dagger}$ $1^{\dagger}11^{\dagger}$ - $5^{\dagger}7^{\dagger}$ 27.2 101/2 $4^{\dagger}7^{\dagger}$ $0^{\dagger}6^{\dagger}-12^{\dagger}0^{\dagger}$ $3^{\dagger}11^{\dagger}$ $0^{\dagger}6^{\dagger}-7^{\dagger}6^{\dagger}$ 14.5 $3^{1}6^{11}$ $1^{1}10^{11}$ $- 10^{1}1^{11}$ $2^{1}10^{11}$ $0^{1}6^{11}$ $- 9^{1}11^{11}$ 19.0 $6^{\dagger} 8^{\dagger} 0^{\dagger} 10^{\dagger} - 23^{\dagger} 4^{\dagger} 5^{\dagger} 7^{\dagger} 0^{\dagger} 7^{\dagger} - 16^{\dagger} 4^{\dagger} 16.2$ 6¹8^m 1¹4^m - 16¹7^m 5¹8^m 1¹4^m - 15¹7^m 15.0 81/2 $7^{\dagger}0^{\dagger}0^{\dagger}8^{\dagger}-16^{\dagger}4^{\dagger}6^{\dagger}3^{\dagger}0^{\dagger}2^{\dagger}-13^{\dagger}7^{\dagger}10.7$ 8 3¹4¹¹ 1¹0¹¹ - 11¹5¹¹ 2¹7¹¹ 0¹4¹¹ - 8¹3¹¹ 22.5 $3^{1}10^{11}$ $0^{1}10^{11} - 13^{1}6^{11}$ $2^{1}10^{11}$ $0^{1}5^{11} - 9^{1}4^{11}$ 26.0 6 $4^{1}7^{11}$ $1^{1}4^{11}$ - $10^{1}4^{11}$ $2^{1}11^{11}$ $1^{1}0^{11}$ - $5^{1}8^{11}$ 36.4 5T $5^{\dagger}5^{\dagger}$ $1^{\dagger}0^{\dagger}$ - $13^{\dagger}10^{\dagger}$ $4^{\dagger}2^{\dagger}$ $0^{\dagger}1^{\dagger}$ - $11^{\dagger}7^{\dagger}$ 23.0 5 $4^{\dagger}7^{\dagger}1^{\dagger}0^{\dagger}-10^{\dagger}0^{\dagger}2^{\dagger}11^{\dagger}1^{\dagger}0^{\dagger}-5^{\dagger}5^{\dagger}36.4$ 4 6¹2ⁿ 1¹7ⁿ - 12¹6ⁿ 5¹8ⁿ 0¹5ⁿ - 12¹6ⁿ 8.1 Coal beds less than 1-1/2 feet (18 inches) thick are generally not recorded in this report. Coal beds that have thicknesses of 18 inches or more for only short distances up and down, dip or across it are herein termed "local" beds and are shown on sheet 1 for short distances only. Outcops of the more persistent beds are indicated, in some places, for long distances beyond any known point of occur-rence. They give the authors' estimate of the position of the horizon of the bed in order to serve as a guide for prospecting, but do not signify that the bed is necessarily minable throughout this extent. The outcrops shown on sheet 1 indicate the positions that the coal beds would occupy if they were projected to the surface of the ground. The beds rarely crop out in this manner because they are generally covered by a mantle of soil, and where they appear in the soil as weathered coal or bloom they occur down the slope at various distances from their original positions because of creep of the weathered soil. Exploration for the unweathered outcrop, therefore, should be started at the position of the outcrop shown on the map and extended in the direction of dip of the coal bed. LYKENS VALLEY (NO. 2) COAL BED The Lykens Valley (No. 2) coal bed, which lies about 150 feet stratigraphically above the contact of the Mauch Chunk shale and Pottsville formation, is the most widely mined bed in the Pottsville. It has been mined extensively underground in the Reliance mine, and subsurface mining and surface stripping oper-ations have been carried on sporadically in the Helfenstein, Ben Franklin, and Margie Franklin mining areas in the southern part of the mapped area. The bed has been found in tunnels and by exploratory drilling in other mines of the area, but it has not been worked in them. The bed is usually found at the base of an abrupt slope if the outcrop occurs in the side of a mountain. The Lykens Valley (No. 2) coal bed normally is a single bed of hard, dense medium-bright coal containing little refuse. Its thickness averages 6'2" but varies widely. The bed contains a parting of gray sandstone 7 feet thick in one of the strippings on the south side of Mahanoy Mountain. A notable example of the detrimental effect of faulting occurs near the boundary of the Reliance and Alaska mines, where a bedding-plane fault has made mining unprofitable. Several local coal beds, 18 inches or more thick, occur in the Pottsville ormation. One of these is indicated by the waste beside a single prospect pi in the southwestern part of the mapped area, where it is approximately 140 feet below the No. 2 bed. Three other local beds, found by diamond drilling and surface prospecting, occur above the Lykens Valley (No. 2) bed. The oldest of these beds lies about 20 feet stratigraphically above the No. 2 bed and consist of 1'6" of sheared coal. About 110 feet higher in the stratigraphic column another local bed, prospecting 3^{12} " of each each each each each of the stratigraphic for t containing 3'2" of coal and refuse, was found. The youngest of these beds lies about 480 feet above the No. 2 coal bed and was found to have a bed thickness that ranged from 7'6" to 18", of which 2'7" to 1'8" was coal. The authors believe that these local beds represent the margins of beds that attain minable thicknesses to the west in the Shamokin and Trevorton quad-rangles, and to the southwest in the Southern anthracite field where as many as eight beds within the Pottsville formation have been mined. eight beds within the Pottsville formation have been mined. LITTLE BUCK MOUNTAIN (NO. 4) COAL BED The Little Buck Mountain coal bed, approximately 30 feet below the top of

The Little Buck Mountain coal bed, approximately 30 feet below the top of the Pottsville formation, is the uppermost coal in the Pottsville. It was mined only in the Enterprise mine, where it was reached by short rock holes from the Buck Mountain bed. The Little Buck Mountain bed does not crop out in the mapped area because it is cut off by faulting. Immediately west of the mapped area, however, it crops out along the north flank of the Locust Mountain anticline. Drillhole records show the presence of coal at the horizon of the No. 4 bed in the Locust Gap, Locust Spring, Alaska, and Reliance mines. BUCK MOUNTAIN (NO. 5 AND 5T) COAL BED The Buck Mountain coal bed marks the base of the Allegheny formation. It lies 330 feet stratigraphically above the Lykens Valley (No. 2) coal in the northern part of the mapped area and 685 feet above it in the southern part. Generally the Buck Mountain is a single bed, but in the western part of the area it consists of two units, or splits, called No. 5 and No. 5T coals in this report. In the Excelsior-Corbin mine, where both splits were worked, they are separated by 10 to 30 feet of shale and sandstone. The No. 5 bed crops out along both the north and the south sides of Locust Mountain and along the north side of Mahanoy Mountain. The Enterprise fault, a strike fault along the north limb of the Locust Mountain anticline, has cut the Buck Mountain coal for a distance of about 2-1/2 Mountain anticline, has cut the Buck Mountain coal for a distance of about $2-\frac{1}{2}$ miles, repeating the bed in places and eliminating much of the outcrop in the western part of the area. (See sheets 1 and 2.) western part of the area. (See sheets 1 and 2.) The Buck Mountain bed has been mined extensively in the Scott, Alaska, Excelsior-Corbin, Enterprise, and Locust Gap mines and locally in the Reliance, Pennsylvania, Maysville, and Locust Spring mines as shown on Sheet 2 by the rel-ative abundance of solid as compared with dashed contour lines. The thickness of the coal decreases southeastward from about 7 feet in the northern part of the mapped area to 3 feet in the southern and eastern parts of the mapped area. Mining of the Buck Mountain bed in the Locust Spring mine has been very local, possibly owing to the irregularity in thickness of the coal. The average thicknesses of the bed and its included coal in the mined areas were 5¹5" and 4¹2", respectively. The coal in the Buck Mountain bed is typically bright in luster and often breaks to small cubical or rectangular fragments whose faces usually exhibit conchoidal fracture or contain whitish deposits that the miners call "bird-eye." At several places it has been noted that the bed has a high fusain ("mother-of-

At several places it has been noted that the bed has a high fusain ("mother-of-A local coal bed, which lies approximately 50 feet stratigraphically above the Buck Mountain bed in the Locust Gap mine area, was exposed in two prospect trenches where it is from $3^{\circ}0^{\circ}$ to $2^{\circ}4^{\circ}$ thick but contains a large percentage of SEVEN-FOOT (NO. 6) COAL BED The Seven-foot coal bed, which lies about 90 feet stratigraphically above the No. 5 bed, has been found in tunnels and by exploratory drilling throughout the mapped area. Extensive mining in the bed, however, was done only in the Alaska basin portion of the Enterprise and Alaska mines and in the north basin of the Locust Gap mine. Correlation of the bed with its equivalent in the west-central part of the Mount Carmel quadrangle is not positive because the workings in the wo areas are not connected. In most of the mapped area the Seven-foot bed contains such a high percentage interbedded carbonaceous claystone that mining is unprofitable. The coal content of the No. 6 bed averages only 2 feet where mined in the central and southern parts of the mapped area, but increases to 5 feet at the eastern border. In the mined areas the average thickness of the bed was 3'10", and the average coal content 2'10", the waste being 26 percent. On the north dip of the Alaska basin, in the area between the Alaska and Enterprise mines, mining suggests there for Sate and the consistence of the complice with one work of the cost of rock that the Seven-foot bed consists of two splits with as much as 40 feet of rock

SKIDMORE (NO. 7) COAL BED The Skidmore bed was mined in the Locust Spring and Locust Gap mines only. Elsewhere its presence in the mapped area was verified by crosscut tunnels and diamond drilling. The Skidmore bed crops out along the north side of Mahanoy Mountain and on both the north and south sides of Locust Mountain. It has been strip-mined in the extreme southwestern part of the mapped area, where the Mahanoy basin "spoons out." In mined areas the average thicknesses of the bed and its included coal were 3 '4" and 2 '7", respectively, but wide ranges above and below these averages were reported. MAMMOTH COAL ZONE

The Mammoth coal zone generally consists of three principal coal beds, called splits, except in the North basin where there are two. The splits join or divide abruptly as shown on the correlation diagram on sheet 3. These principal beds of the Mammoth coal zone are called the bottom, middle, and top splits and are designated in this report as No. 8, No. 8¹/₂, and No. 9, respectively. In addition to these beds, a split off the top split, designated as the 9B, occurs locally below the top split in the southeastern portion of the mapped area. The bottom split (No. 8) generally is a distinct bed separated from the other splits by 30 to 50 feet of rock, but this parting or divider thins to only a few inches splits by 50 to 50 feet of fock, but this parting of divider times to only a few inches in places. The parting between the middle and top splits consists of hard, gray, medium to coarse-grained sandstone that is interbedded with I to 10 feet of silt-stone. The sandstone is conglomeratic in places. It ranges from 10 to 40 feet in thickness but over considerable areas is so thin that the middle and top splits can be mined together. Bottom split (No. 8) of the Mammoth coal zone. The No. 8 bed, or bottom split of the Mammoth coal, is a very persistent bed and is generally easily recog-nized. It crops out in many places in the mapped area and has been mined exten-sively both underground and on the surface. Because of its persistence, the ease sively both underground and on the surface. Because of its persistence, the ease with which it is recognized, and the widespread mine workings in it, this bed is often used as a reference datum or key bed in determining the stratigraphic positions of other beds or in depicting the structure of the area. A thin, black, carbonaceous claystone, underlain by brown siltstone that characteristically contains large ironstone concretions, underlies the No. 8 bed in most of the mapped area. The coal content of the No. 8 bed averaged 6'3" in mined areas and was found to have its greatest average thickness of nearly 9 feet in the eastern part of the Alaska mine area. The bed thickness in all mined areas averaged 7'0". In the mapped area the coal of the bottom split consists of approximately equal amounts of bright and dull coal in variable layers from 1 to 2 feet thick. It is a very hard bed and cannot, except with much difficulty, be mined with a pick but must usually be blasted. pick but must usually be blasted. Middle split (No. 8%) of the Mammoth coal zone. The middle split of the Mammoth coal zone is present throughout the mapped area except in the Locust Gap mine. The absence of the No. $8\frac{1}{2}$ bed in that mine may be due to lensing out of the coal or to merging into either the top or the bottom splits. Coal thicknesses do not appear to verify the latter hypothesis, hence it is assumed that the bed has lensed out. The average thickness of the bed in the mined areas was $6\frac{1}{8}$, of which $5\frac{1}{8}$ was coal. Local (No. 9B) coal bed. A fourth coal bed in the Mammoth zone occurs locally in the Locust Spring mine, where it splits from the bottom of the No. 9 bed and is as much as 25 feet below it. This relationship is the basis for the authors' designation of the bed as No. 9B, although operators have called it a

Mammoth leader. It was mined both underground and by surface 'stripping on the northern side of Mahanoy Mountain, where it consists of 3'6" of coal. Top split (No. 9) of the Mammoth coal zone. The top split (No. 9) of the Mammoth coal zone is worked in all the mines of the area except in the Alaska and Reliance mines. It was cut in workings of the Alaska mine but was not recogd in the Reliance mine. The thickness of the No. 9 bed ranges from 23'4" to 0'10", the greatest variation in thickness of any of the beds in the area. Its average bed and coal thicknesses were 6'8" and 5'7", respectively The average thickness of the included coal was greater however, along a northeast trending zone through the Enterprise, Excelsior-Corbin, and Scott mines, when the coal averaged 7 feet, and in the Locust Spring mine, where it averaged nearly FOUR-FOOT (NO. 91/2) COAL BED The Four-foot coal bed, one of the poorer coal beds in this area, is mined locally in the Alaska, Locust Gap, and Locust Spring mines. It occupies a stratig-raphic position between the top split of the Mammoth coal zone and the Holmes coal bed and ranges almost completely across the 100- to 150-foot interval between those two beds, approaching within 20 feet of either bed. The average thicknesses of the bed and the coal in mined areas were 3'6" and 2'10", respectively. HOLMES (NO. 10) COAL BED The Holmes coal bed, at the base of the Conemaugh formation, occurs in many places in the mapped area, and has been mined in all the mines. It is over-lain, at vertical distances ranging from 2 to 20 feet, by a persistent stratum of

to thick-bedded brown-weathering micaceous sandstone that ranges from The Holmes bed is not only one of the most persistent coal beds in the area but it is also characterized by low percentage of waste (14½%). The average thickness of the bed in mined areas was 4'7", of which 3'11" was coal. LOCAL (NO. 101/4) COAL BED The designation No. 10¼ was assigned to a coal bed in the Hickory Ridge mine in the west-central part of the Mount Carmel quadrangle. This bed also occurs in the Maysville mine area (see sheet 1), where it lies about midway between the Holmes bed and the Rough bed. Workings in this area showed that the thickness t the bed ranged from 1'5" to 9'5", and its coal content ranged from 1'5" to Two coals of less than minable thickness were found between the No. 10 and No. 10½ beds in the eastern part of the area. One of them may correlate with the No. 10¼ bed, but the relationship between these three beds is not completely ROUGH (NO. 101/2) COAL BED The Rough (No. 101/2) coal bed was found by development work in all mines Inter Rough (No. 1079) coal bed was found by development when minutes in the area but was mined underground in small areas in the Pennsylvania and Reliance mines only, and was locally strip-mined in the Locust Gap mine. The high percentage of waste in the bed (27%) made only the thicker portions of the bed minable. In mined areas the bed averaged 4'7" in thickness, of which only 3'4" was coal. Two coals of less than minable thickness were noted between the No. 10½ and No. 11 beds in the North basin. One of them may correlate with the No. 10¾ LOCAL (NO. 103/4) COAL BED

The No. 1034 bed, which is locally present in the northeastern part of the area, does not crop out but is found in workings of the Pennsylvania mine about 30 feet above the Rough-coal. The average thickness of the bed in mine workings in the adjoining area to the north was 3 feet, of which approximately 24 percent was waste. Minimum and maximum thicknesses of 1'4" and 10'2" have been PRIMROSE (NO. 11) COAL BED The Primrose coal bed is found approximately 220 feet stratigraphically above the base of the Conemaugh formation. It has been designated by various names and has been mined either by surface stripping or by underground operations in all the mines of the area. Both the roof and the floor rocks of the No. 11 bed In the Locust Gap area are black carbonaceous claystone from 5 to 8 feet thick The thickness of the Primrose bed in the workings averaged 5 '10 ", of which 4 '11 ORCHARD (NO. 12) COAL BED The Orchard (No. 12) coal bed normally lies about 100 feet stratigraphicall above the Primrose (No. 11) coal, but the interval increases to as much as 150 feet. This bed crops out in the deeper parts of the Shamokin, Mount Carmel, Mahanoy, and New basins. It has been mined in the Scott, Maysville, Pennsylvania, and Locust Spring mines. The bed averaged 9'4" in thickness, but it contained a high percentage (29%) of waste. DIAMOND (NO. 14) COAL BED The Diamond coal bed, the youngest minable coal in the mapped area, was mined locally in the Shamokin basin area of the Maysville mine and in the Locust

anthracite in the west-central part of the Mount Carmel quadrangle, Pennsylvania: U. S. Geol. Survey, Coal Investigation Series, Map C3. Drafted by John T. Howells

Available measurements indicate that the Diamond coal ranges from

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Ashbuiler, Charles A., July 1000, western mucht e menter reads reads from a comparison of the second seco

Appalachian basin, structure section 1. Rothrock, Howard E., Wagner, Holly C., and Haley, Boyd R., 1950, Geology of

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1'6" to 8'7" in thickness.