

# THE ABRAM CREEK-STONY RIVER COAL FIELD, NORTH-EASTERN WEST VIRGINIA.

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By GEORGE H. ASHLEY.

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## INTRODUCTION.

This paper describes briefly the Abram Creek-Stony River coal field, which lies mainly in Grant, Mineral, and Tucker counties, W. Va. This field is a southward continuation of the Georges Creek and Elk Garden fields of Maryland and West Virginia, in the same basin. The field has a special interest because it contains a large body of low-volatile semibituminous coal at a point nearer tidewater than any other of the Appalachian coals except those of the Georges Creek and Upper Potomac fields. The coal "as received" contains from 13 to 18 per cent of volatile matter, 63 to 73 per cent of fixed carbon, 5 to 16 per cent of ash, and 0.5 to 3.5 per cent of sulphur. It occurs in a number of beds, of which three are widely minable in the area under study. All the beds are more or less broken up with partings of shale, clay, or bone, and the recoverable coal in two of the beds is between 2 and 3 feet and in the third bed between 3 and 6 feet. The third bed commonly occurs in two or more benches separated by partings from a quarter of an inch to several inches or locally several feet thick. Several other beds are minable in a few places. Most of the coal beds are equivalent to the beds occurring under the Pittsburgh bed in Pennsylvania; some remnants of the Pittsburgh bed occupy the hilltops north and east of the lower end of Abram Creek.

The field lies in the southern part of Mineral County, the western part of Grant County, the eastern part of Tucker County, and the northeast corner of Randolph County, W. Va., just south of the west end of Maryland, on the eastern edge of the Appalachian coal field. Its position is shown on the key map of Plate XII. The field is a basin consisting of an eastern prong of the Georges Creek basin, which splits south of Elk Garden, the western prong extending up the North Branch of Potomac River and into the headwater region of Cheat River, and the eastern prong extending more nearly south in the valley of Dry Fork of Cheat River.

The coal of this area is at present entirely undeveloped, and the area is without railroads. It will require, however, only a few miles of branch roads to connect with the Western Maryland Railway or the Baltimore & Ohio Railroad for Baltimore, or with the Western

Maryland for Newport News by way of Elkins and the Chesapeake & Ohio Railway. The general character of the country is shown by the topographic map (Pl. XII). The area lies in the Allegheny Plateau region. The northern part of it consists of flat-topped ridges intercepted by steep-sided valleys. Farther south, in the region of Mount Storm and southward, the flatness of the ridge tops largely disappears, the valley slopes become more gentle, and the whole surface takes on the features of a gently sloping hill country.

This report follows two reconnaissance trips of a week each to this area in April and May, 1918. Interest had been aroused in the area because of the advancing exhaustion of the coals of the Georges Creek and North Branch of the Potomac districts. Examination showed that an earlier report<sup>1</sup> on this area, in which the coals were not mapped in detail, was not altogether accurate in mapping the coals or structure. The present report is prepared in the belief that even though this district was not developed during the war, it is certain to be the subject of inquiry after the war, and the preparation of the data at hand now will meet the need when it arises. In preparing the report all the notes obtained in the Survey for the Piedmont folio have been carefully reviewed, and the coal data have been used to supplement those obtained by the writer.

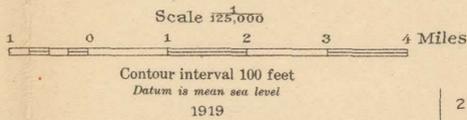
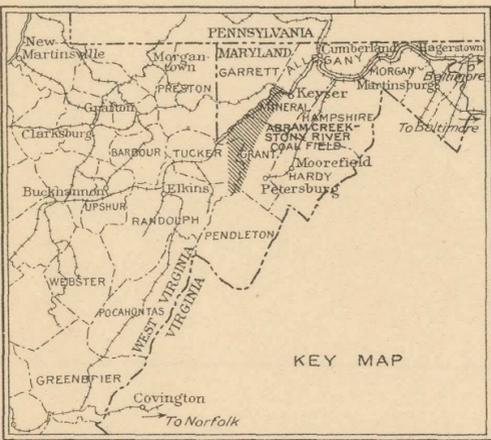
The base map on which the geology is presented has been redrawn from all the data now available, including those obtained by the writer in recent trips. As the map differs materially in some respects from the old Piedmont topographic map and even from the later Oakland topographic map, which covers the northwest quarter of the Piedmont quadrangle, it may be well to indicate the basis for some of the changes. Since the Piedmont map was prepared several primary triangulation stations have been established. The exact longitude and latitude of these stations are of course known. Unfortunately, these points had not been tied by triangulation into the topographic features mapped. However, certain facts have proved useful. For example, Schell triangulation station is in Mineral County 30 yards north of the Grant County line. The county line is known to run from the mouth of Stony River eastward to a stone on the Northwest Turnpike west of Hartmonsville; 50 feet from the point where a road turns southward to Glade Run. The map position of the stone in the Northwest Turnpike was established with some degree of accuracy by means of a recently made property-line map which included the position of the county-line stone and of Key-stone triangulation station. It was thus possible to establish with some approximation to accuracy the position of the mouth of Stony River in a line running from the county-line stone south of Schell triangulation station.

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<sup>1</sup>U. S. Geol. Survey Geol. Atlas, Piedmont folio (No. 28), 1896.

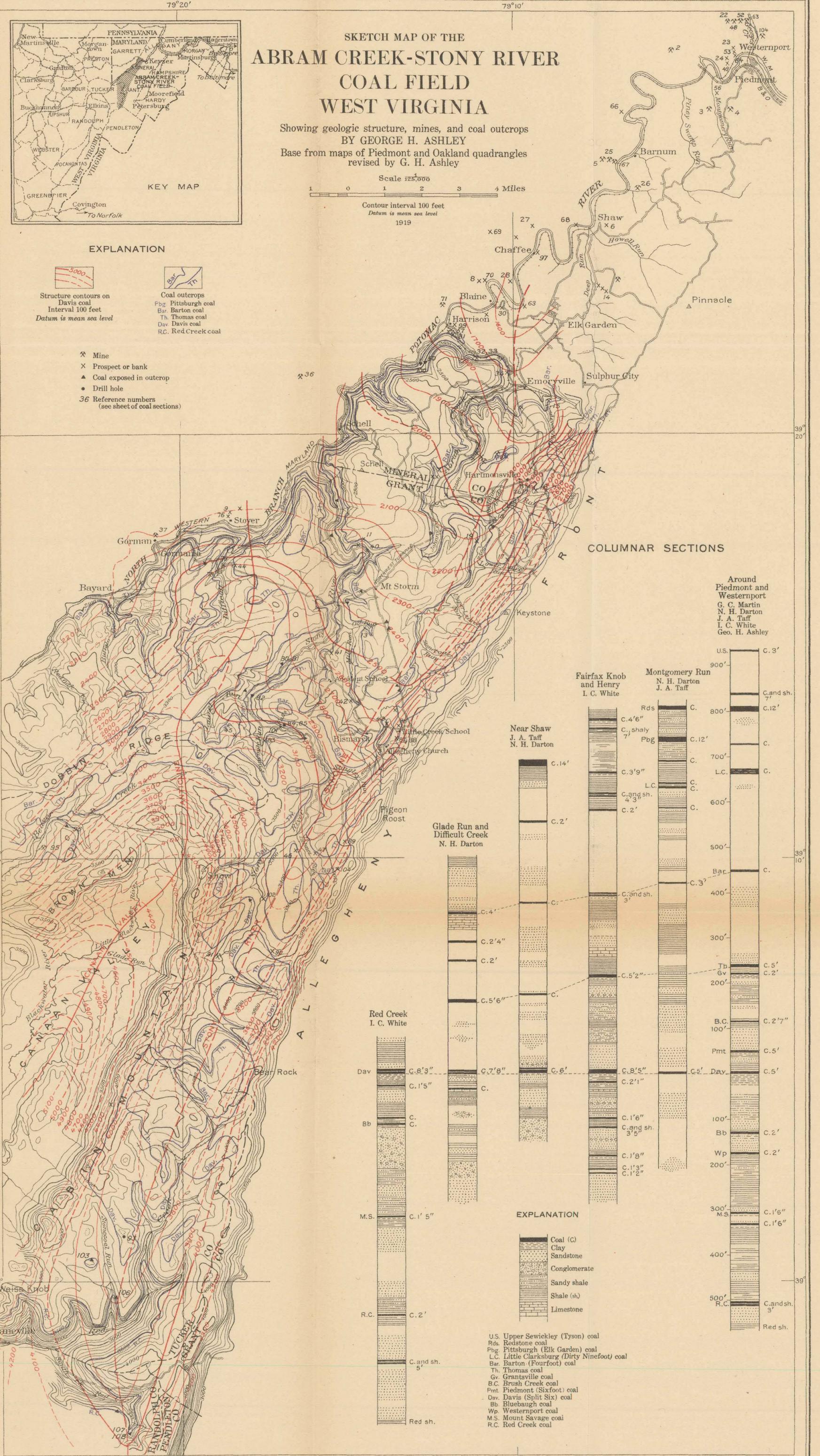
# SKETCH MAP OF THE ABRAM CREEK-STONY RIVER COAL FIELD WEST VIRGINIA

Showing geologic structure, mines, and coal outcrops  
BY GEORGE H. ASHLEY  
Base from maps of Piedmont and Oakland quadrangles  
revised by G. H. Ashley



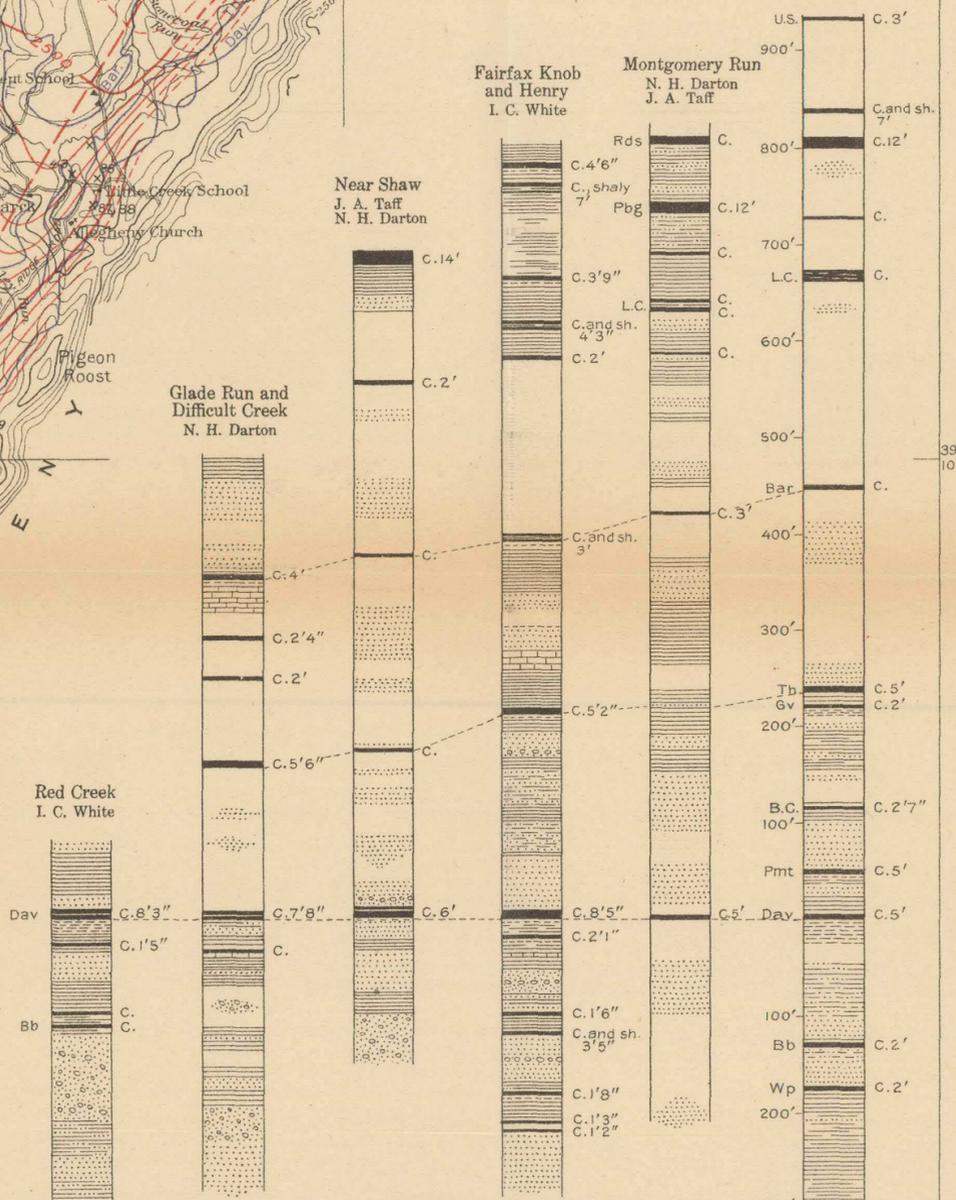
### EXPLANATION

- Structure contours on Davis coal Interval 100 feet Datum is mean sea level
- Coal outcrops: Pbg. Pittsburgh coal, Bar. Barton coal, Th. Thomas coal, Dav. Davis coal, R.C. Red Creek coal
- Mine (marked with X)
- Prospect or bank (marked with X)
- Coal exposed in outcrop (marked with triangle)
- Drill hole (marked with dot)
- 36 Reference numbers (see sheet of coal sections)



### COLUMNAR SECTIONS

Around Piedmont and Westernport  
G. C. Martin  
N. H. Darton  
J. A. Taff  
I. C. White  
Geo. H. Ashley



### EXPLANATION

- Coal (C)
- Clay
- Sandstone
- Conglomerate
- Sandy shale
- Shale (sh)
- Limestone

- U.S. Upper Sewickley (Tyson) coal
- Rds. Redstone coal
- Pbg. Pittsburgh (Elk Garden) coal
- L.C. Little Clarksburg (Dirty Ninefoot) coal
- Bar. Barton (Fourfoot) coal
- Th. Thomas coal
- Gv. Grantsville coal
- B.C. Brush Creek coal
- Pmt. Piedmont (Sixfoot) coal
- Dav. Davis (Split Six) coal
- Bb. Bluebaugh coal
- Wp. Westernport coal
- M.S. Mount Savage coal
- R.C. Red Creek coal

In addition there were available to the writer a railroad survey up Stony River to the mouth of Helmet Run; an instrumental survey of Abram Creek from the Wabash mine to the Ben Hamline place, about east of the mouth of Helmet Run; a map of the property lines including the area from the Wabash mine to the mouth of Helmet Run and from the Allegheny Front nearly to Stony River; and three instrumental profile sections run on lines N. 75° W. from the Allegheny Front to Stony River. Unfortunately accumulated errors of these surveys made it impossible to fit them together and largely negated their value in mapping. For example, the railroad survey of Stony River agrees in orientation with two previous surveys, but if placed on the map far enough west of Schell station to allow that station to lie on the upland rather than in the valley, it shows the upper course of the valley along the crest of Cabin Mountain instead of a mile or more to the east. The errors in these instrumental surveys will be remedied when the area as a whole is remapped with adequate secondary triangulation. The portion of the map showing Tucker County is taken bodily from a resurvey made in 1916 and is therefore assumed to be correct. All the data of the original surveys of both the Piedmont and Oakland quadrangles were reviewed and used in the redrawing of the sketch map, after being checked and supplemented by meander lines and compass readings by the writer, who takes entire responsibility for the base map here presented.

**CHARACTER AND QUALITY OF THE COAL.**

The coal of this field is a low-volatile, so-called smokeless coal, similar in general to that from the Georges Creek region, as might be expected from the fact that this area is a prong of the same basin that contains the Georges Creek coal. The coal is tender and soft, breaking down readily, like all of the so-called smokeless coals of Pennsylvania, Maryland, and West Virginia. Its chemical character is indicated by the following analyses of samples obtained by the writer by standard methods:

*Analyses of coal from Abram Creek-Stony River field, W. Va.*

Locality and bed.	Laboratory No.	Condition.	Moisture.	Volatile matter.	Fixed carbon.	Ash.	Sulphur.	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	British thermal units.
<b>BARTON BED.</b>												
2 miles southwest of Hartmons-ville, in Grant County; Kitz-miller mine, head of entry.	69065	1	3.76	15.55	72.71	7.98	1.56	4.45	78.55	1.41	6.05	13,660
		2	.....	16.16	75.55	8.29	1.62	4.19	81.62	1.46	2.82	14,194
		3	.....	17.62	82.38	.....	1.77	4.57	89.00	1.59	3.07	15,478
<b>THOMAS BED.</b>												
½ mile southeast of Emoryville, Mineral County; Cross mine, head of main entry, 500 feet from mouth.	69072	1	2.38	16.11	65.93	15.58	2.54	4.15	70.32	1.58	5.83	12,605
		2	.....	16.50	67.54	15.96	2.60	3.98	72.03	1.62	3.81	12,912
		3	.....	19.63	80.37	.....	3.09	4.74	85.71	1.93	4.53	15,364

\* 1. Sample as received; 2, dried at 105° C.; 3, moisture and ash free.

## Analyses of coal from Abram Creek-Stony River field, W. Va.—Continued.

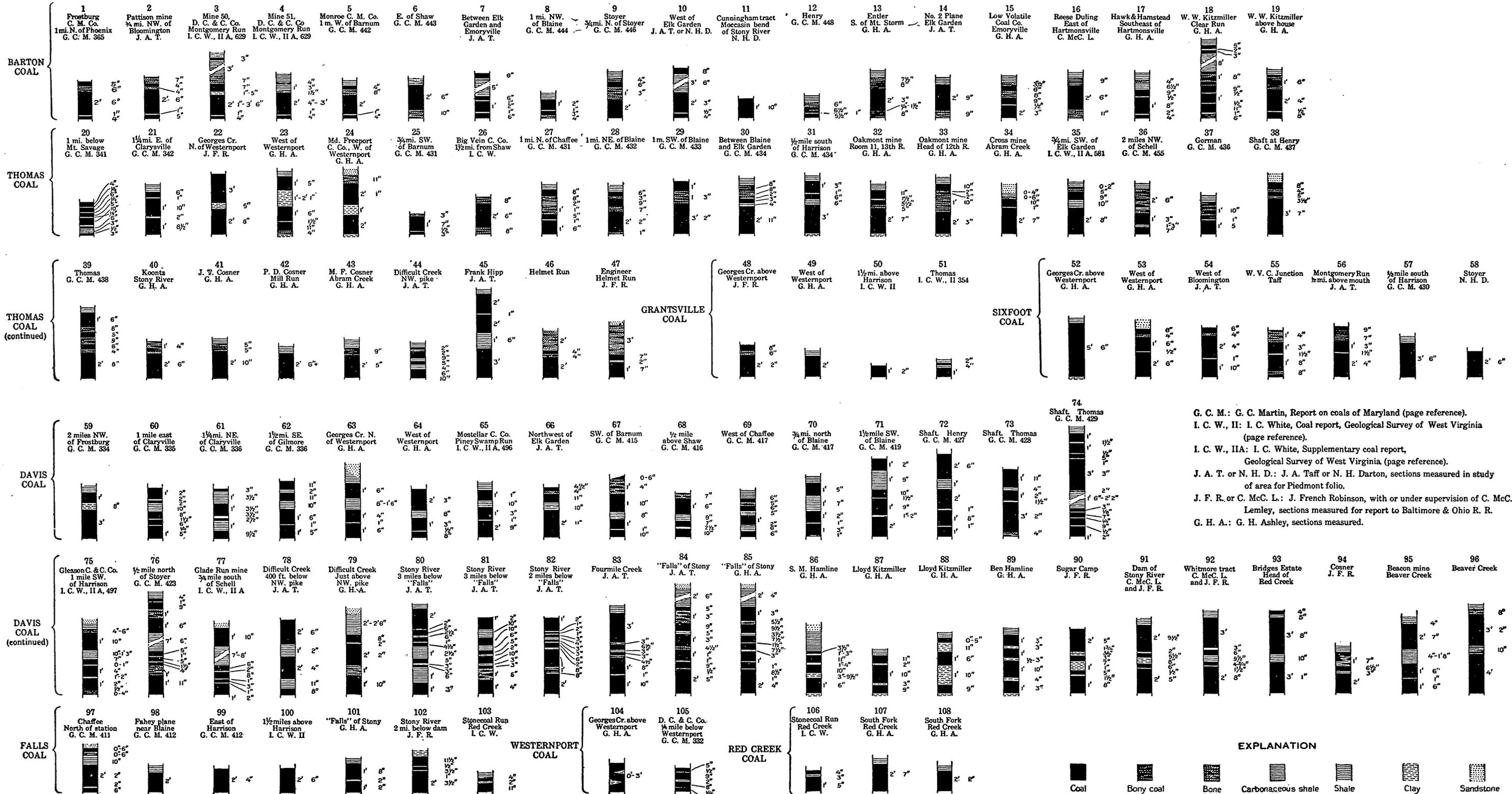
Locality and bed.	Laboratory No.	Condition.	Moisture.	Volatile matter.	Fixed carbon.	Ash.	Sulphur.	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	British thermal units.	
<b>THOMAS BED.—continued.</b>													
1 mile north of Mount Storm, Grant County, on Stony River; Koontz mine, break-through from first right-hand entry; roof coal.	69064	1	4.43	13.25	52.04	30.28	0.42	3.54	57.38	0.83	7.55	9,776	
		2	.....	13.85	54.46	31.68	.....	.44	3.19	60.04	.87	3.78	10,219
		3	.....	20.29	79.71	.....	.....	.64	4.67	87.88	1.27	5.54	14,958
1 mile north of Mount Storm, Grant County; Koontz mine, break-through from first right-hand entry.	69070	1	3.76	15.72	75.41	5.11	.53	4.59	82.00	1.49	6.28	14,171	
		2	.....	16.33	78.36	5.31	.55	4.33	85.20	1.55	3.06	14,725	
		3	.....	17.25	82.75	.....	.....	.58	4.57	89.98	1.64	3.23	15,551
½ mile east of Bismarck, Grant County; Cosner mine, head of entry.	69068	1	3.02	16.69	71.00	9.29	2.73	4.35	77.42	1.23	4.98	13,583	
		2	.....	17.21	73.21	9.58	2.82	4.14	79.83	1.27	2.36	14,006	
		3	.....	19.03	80.97	.....	.....	3.12	4.58	88.29	1.40	2.61	15,490
2 miles up Abram Creek from Harrison, Mineral County; Oakmont mine, room 11, thirteenth right entry, 5,100 feet from mouth.	69071	1	2.36	15.41	71.86	10.37	2.95	4.06	76.78	1.51	4.33	13,419	
		2	.....	15.78	73.60	10.62	3.02	3.89	78.64	1.55	2.28	13,743	
		3	.....	17.66	82.34	.....	.....	3.38	4.35	87.99	1.73	2.55	15,376
<b>DAVIS BED.</b>													
1½ miles east of Bismarck, Grant County; Hamline mine, face of room being driven to west.	69069	1	4.89	18.04	63.55	13.52	2.23	4.44	71.50	1.27	7.04	12,533	
		2	.....	18.97	66.81	14.22	2.34	4.10	75.17	1.34	2.83	13,177	
		3	.....	22.11	77.89	.....	.....	2.73	4.78	87.63	1.56	3.30	15,361
½ mile above falls of Stony River, four-fifths mile west of Bismarck, Grant County; outcrop, sampled from small stock pile dug last winter from bed of river.	69066	1	2.5	18.6	63.9	15.0	1.51	.....	.....	.....	.....	12,650	
		2	.....	19.1	65.5	15.4	1.55	.....	.....	.....	.....	.....	12,970
		3	.....	22.6	77.4	.....	.....	1.83	.....	.....	.....	.....	15,340
<b>FALLS BED.</b>													
Falls of Stony River, four-fifths mile west of Bismarck, Grant County; outcrop, cast out by river at water's edge.	69073	1	5.3	16.1	68.6	10.0	3.31	.....	.....	.....	.....	13,080	
		2	.....	17.0	72.4	10.6	3.50	.....	.....	.....	.....	.....	13,810
		3	.....	19.0	81.0	.....	.....	3.91	.....	.....	.....	.....	15,450
<b>RED CREEK BED.</b>													
Near head of South Fork of Red Creek, above Laneville, Randolph County; bare outcrop faced back 3 or 4 feet; ash and sulphur probably high on account of action of water.	69067	1	6.5	17.2	64.6	11.7	2.76	.....	.....	.....	.....	12,610	
		2	.....	18.4	69.1	12.5	2.95	.....	.....	.....	.....	.....	13,480
		3	.....	21.0	79.0	.....	.....	3.37	.....	.....	.....	.....	15,410

69065. This sample was cut at face of main entry in mine of W. W. Kitzmiller (No. 18, Pl. XIII), 2 miles north of Hartmonsville, on April 27, 1918. It includes the three benches of coal 9, 12, and 11 inches thick, and also the two included partings each half an inch thick.

69072. This sample was cut at face of main entry, 500 feet from the mine mouth, in mine of Low Volatile Coal Co. (No. 15, Pl. XIII), three-fourths of a mile southeast of Emoryville, on April 23, 1918. The sample represents the three benches of coal 6, 9, and 27 inches thick.

69064. This sample was cut at break-through from first right entry in Koontz mine (No. 40, Pl. XIII), 1 mile north of Mount Storm, on Stony River, on April 24, 1918. It includes the bench of bone 1 foot 4 inches thick.

69068. This sample was cut at face of main entry of mine of M. F. Cosner (No. 43, XIII), three-fourths of a mile east of Bismarck, on April 27, 1918. It represents the lower bench of coal 2 feet 5 inches thick.



G. C. M.: G. C. Martin, Report on coals of Maryland (page reference).  
 I. C. W., II: I. C. White, Coal report, Geological Survey of West Virginia (page reference).  
 I. C. W., IIA: I. C. White, Supplementary coal report, Geological Survey of West Virginia (page reference).  
 J. A. T. or N. H. D.: J. A. Taff or N. H. Darton, sections measured in study of area for Piedmont folio.  
 J. F. R. or C. McC. L.: J. French Robinson, with or under supervision of C. McC. Lemley, sections measured for report to Baltimore & Ohio R. R.  
 G. H. A.: G. H. Ashley, sections measured.



COAL SECTIONS IN THE ABRAM CREEK-STONY RIVER COAL FIELD, WEST VIRGINIA.

69070. This sample was cut at break-through from first right entry in Koontz mine (No. 40, Pl. XIII), 1 mile north of Mount Storm, on April 24, 1918. It includes coal only from the lower bench 2 feet 6 inches thick.

69071. This sample was cut in room 11, off thirteenth right entry, 5,100 feet from mine mouth, in Oakmont mine (No. 32, Pl. XIII), on Abram Creek 2 miles from Harrison, on April 23, 1918. It represents the three benches of coal 11, 5½, and 31 inches thick.

69069. This sample was cut in room being driven to west in mine of S. M. Hamline (No. 86, Pl. XIII), 1¼ miles east of Bismarck, on April 25, 1918. It represents the four benches of coal 3½, 11, 10, and 18 inches thick.

69066. This sample was taken from a small stock pile of coal dug the preceding winter from the bed of the river. The sample was obtained April 27, 1918, and is probably somewhat weathered. The coal bed at this place has the section shown in No. 85, Plate XIII.

69073. This sample was cut from an outcrop of the Falls coal bed at the falls of Stony River (No. 101, Pl. XIII), four-fifths of a mile west of Bismarck, on April 27, 1918. It represents the two benches of coal 1 foot 8 inches and 1 foot 2 inches thick. Coal probably weathered.

69067. This sample was cut from an outcrop above Lanesville, near the head of the South Fork of Red Creek (No. 108, Pl. XIII), on April 26, 1918. It represents the entire thickness of the bed 2 feet 2 inches. Coal probably weathered.

As will be seen, most of these coals are high in ash and sulphur, the ash ranging from 5 to 16 per cent (exclusive of the roof coal of the Koontz mine), with an average of 11.4 per cent, and the sulphur from 0.5 to 3.5 per cent, with an average of 2.31 per cent. These figures may be compared with those of other smokeless coals as follows: Pocahontas, with an average ash between 4 and 5 per cent and average sulphur between 0.5 and 0.6 per cent; New River, with an average ash below 4 per cent and sulphur between 0.5 and 0.6 per cent; Thomas, Tucker County, with an average ash of about 8 per cent and an average sulphur of about 1 per cent; Elk Garden, with an average ash between 8 and 9 per cent and an average sulphur of a little over 1 per cent; Georges Creek, Maryland, with an average ash of about 8 per cent and an average sulphur of less than 1 per cent. These figures for the Elk Garden and Georges Creek areas apply specifically to the Pittsburgh coal, which in the past has been the main source of supply. The beds below the Pittsburgh bed, which will necessarily be the main source of supply from these areas in the future, have about the same ash and sulphur content as the coal of the Abram Creek basin.

Farther north, in Somerset County, Pa., there is a very small quantity of Pittsburgh coal, and the main coal output is from the lower beds, which are all of better quality than most of the coals of Georges Creek, having less than 10 per cent of ash, with an average of about 8 per cent, and an average sulphur content of about 1 per cent. This is especially true of the coal in the Windber region, where commercial shipments show commonly less than 8 per cent of ash.

In Cambria County, Pa., the quality of the coal differs somewhat in different beds. In the southern and middle parts of the county the Lower Kittanning bed is a low-ash bed, averaging probably less than 7 per cent in mine samples and less than 8 per cent in tippie samples. The ash in the other beds ranges from 9 to 12 per cent in the southern part of the county and from 6 to 10 per cent in the northern part of the county. Except in the southeastern part of the county sulphur runs fairly high, from 1 to nearly 4 per cent, with an average of about 2 per cent in the southern half of the county and of 1.5 per cent in the northern half of the county.

The low ash content of the coal in northern Cambria County continues into Clearfield County, where the ash averages about 8 per cent, being lowest in the Lower Freeport or Moshannon bed, which in the past has been the main source of supply. Sulphur in the coal of Clearfield County ranges from 0.6 to nearly 3.5 per cent, with an average of less than 2 per cent.

In practical operation the disadvantage of the high ash content in these coals will be still more marked, because the beds are so much split up that mining must be confined to a single bench, which is commonly thin, or else it will be necessary to separate the partings of clay, shale, and bone from the coal by mechanical separators, washing, or careful hand picking.

The "smokeless" quality of this coal may be judged by comparing its fuel ratio with that of other well-known coals. The fuel ratio of the coal of this area ranges from 3.4 to 4.8 and averages about 4.1. This is about the average for the Pocahontas field as a whole, including McDowell, Mercer, Wyoming, and Raleigh counties, W. Va.; the range is from about 3.4 in the Pocahontas area of Virginia to around 5 near Welch. The fuel ratio of the New River coal ranges from about 3.5 in the up-river part of the field to 2.3 at Hawks Nest. In general, the coal from the part of the New River field above Thurmond has a fuel ratio of 3 or more and that from the part below Thurmond of less than 3. The Abram Creek-Stony River coal also has a higher fuel ratio than the coal at Thomas or along the North Branch of Potomac River, which commonly runs between 3 and 4. The fuel ratio of the coal of the Georges Creek basin ranges from 3 to 4.5 and averages about 4, or practically the same as for this field.

The coals of Somerset County, Pa., average a little higher in fuel ratio than those along Abram Creek. Most of the coals run over 4, and many of them come between 4.5 and 4.9. For the southern part of Cambria County the figures are still higher, many of the coals there having a fuel ratio of over 5. In central Cambria County the average is below 4, and in the northern part of the county the average is below 3. In Clearfield County, east of the Laurel Ridge anti-

cline, the fuel ratio ranges between 3 and 3.5, with an average of about 3.2. This drops to about 2.8 between the Laurel Ridge anticline and the Chestnut Ridge anticline.

The heating value of this coal may be judged by comparison with the other smokeless coals already referred to. As shown in the table of analyses (the roof coal of the Koontz mine being omitted), the values lie between 12,500 and 14,200 British thermal units for the coal as mined, with an average of 13,100 British thermal units. This is lower by 300 to 1,300 British thermal units than the average of the competing fields, even when comparison is made with analyses of commercial samples. The several thousand analyses of Pocahontas coal nearly all run over 14,000 British thermal units, with an average between 14,400 and 14,500. Mine samples of Pocahontas coal, taken in the same way as the samples in this field, average between 14,600 and 14,800 British thermal units. New River coal has about the same heating value as Pocahontas. The average heating value of commercial coal from the Thomas and Coketon districts is about 13,500 British thermal units, or 400 British thermal units above that of the coal of this district. The average commercial coal of the Georges Creek district, Pittsburgh bed, shows a heating value around 13,900 British thermal units, or about 800 British thermal units higher than the average of the Abram Creek field. The lower beds of the Georges Creek district are fairly comparable with the coal of this field, though the analyses at hand indicate that they are a few hundred British thermal units better. In Somerset County, Pa., the coals are of better quality, most of the analyses yielding more than 14,000 British thermal units for the coal "as received" and the average being probably 800 British thermal units higher than in the Abram Creek-Stony River field. The same is true of the coals in Cambria and Clearfield counties.

It therefore appears that the coal of the Abram Creek-Stony River field is of lower grade than any of the competing coals now being put on the market, but as most of the samples were taken from small mines, in which the coal is under slight cover, it seems probable that the coal obtained when large mines are opened in this field may be of a slightly higher grade than that shown by these samples. In fact, a comparison of the ash and sulphur of these coals with those of the so-called smokeless coal of other districts suggests that this coal if properly cleaned will average 500 British thermal units higher than is shown in the analyses. On the other hand, taking into account the number and character of the partings in the beds, the writer believes that very little of this coal will be mined that will run 14,000 British thermal units on commercial samples, and that most of it will run well under 13,000 British thermal units.

## THE COAL BEDS.

### GENERAL FEATURES.

The coal of this region occurs in a score of beds ranging in thickness from  $1\frac{1}{2}$  to 20 feet. These beds are scattered through a series of sandstones and shales, having a total thickness between 1,500 and 1,600 feet. At or near the top of a section is the Pittsburgh bed, which has an average thickness of about 12 feet but locally thickens to 20 feet. The series of rocks underlying the Pittsburgh bed, about 800 feet thick, is commonly known as the "Lower Barren Coal Measures," or the Conemaugh formation. Ten coal beds occur in this formation; two of them, Barton and Thomas, are commonly of workable thickness; and four others, the Lower Clarksburg or Dirty Ninefoot, the Sixfoot, and two others between the Sixfoot and Barton, are workable locally. Below the Conemaugh rocks is the Allegheny formation or, as formerly known, the "Lower Productive Measures," containing in Pennsylvania the Freeport, Kittanning, and Clarion coals. In the major part of the Abram Creek-Stony River field only one of the beds in the Allegheny formation—the Davis coal, or Split Six bed of the Westernport area—is of value. Below the Allegheny is the Pottsville formation, which includes the rest of the coal measures and contains one or more coal beds.

The position of these coals in various parts of the field is indicated in the columnar sections on Plate XII. The Pittsburgh bed need not be considered in detail here, as it occupies only small areas at the north edge of this field and is now nearly exhausted. Of the other beds, one, the Davis, has a thickness of 5 to 9 feet, including everywhere from one to seven partings of shale or clay or benches of bone or bony coal. The total thickness of coal in this bed ranges from  $2\frac{1}{2}$  to  $7\frac{1}{2}$  feet. Two other beds, the Barton and Thomas, contain nearly everywhere in this field at least one bench of clean coal averaging about 30 inches or a trifle more in thickness. In most places each of these two beds contains also from 1 to 2 feet of coal or bone, commonly overlying the main bench of coal, which may prove of considerable value as a source of power, either for use locally or to be transmitted to a distance. The thickness of the other beds is more variable, and although several of them contain in places from 2 to 6 feet of coal they appear to average much less than that and to be absent in parts of the field.

### DIVISION OF THE LOCAL COAL MEASURES.

In the Piedmont folio the coal measures of this area were subdivided into five formations—the Elk Garden formation, comprising the rocks from the base of the Pittsburgh or Elk Garden coal, as it was then called, to the top of the section; the Fairfax formation,

which included the 300 feet of strata above the massive sandstone that overlies the Barton coal; the Bayard formation, which comprises the strata below the Fairfax formation to the top of the Davis coal, including the Thomas coal near the middle; the Savage formation, including the beds from the top of the Davis coal downward for 130 to 160 feet to the top of a massive sandstone or conglomerate, which forms most of the crest of the Allegheny Front; and the Blackwater formation, which included the massive sandstone at the base of the coal measures.

Recent detailed studies by C. K. Swartz and Harvey Bassler in the Georges Creek and North Potomac basins for the Maryland Geological Survey and in Pennsylvania for the United States Geological Survey have demonstrated that the Elk Garden formation is equivalent to the Monongahela formation of Pennsylvania, as has long been recognized; that the Fairfax and Bayard formations are the equivalent of the Conemaugh formation of Pennsylvania; that the Savage formation is the equivalent of the upper part of the Allegheny of Pennsylvania; and that the Blackwater is the equivalent of the lower part of the Allegheny and the portion of the Pottsville occurring in this region. As the present report is purely economic and as Swartz and Bassler have in preparation a detailed report on the results of their studies, to be published by the Maryland Geological Survey, attention will be confined here to the coal beds, and the stratigraphy or correlation of the beds will not be discussed beyond noting that, in accordance with the work of Swartz and Bassler, the Davis bed may be regarded as the equivalent of the Upper Freeport of Pennsylvania, the Thomas bed as the equivalent of the Bakerstown, the bed 115 feet above the Davis as the equivalent of the Brush Creek, the Six-foot bed of the Westernport area as the possible equivalent of the Mahoning coal of Pennsylvania, and the Split Six bed of the Westernport area as the equivalent of the Davis. The Barton is possibly the equivalent of a bed designated the Elk Lick on Allegheny River, and a coal the bloom of which was seen at a number of points south and southeast of Mount Storm may be the Wellersburg coal. The sandstone above the coal next over the Barton is probably the Morgantown sandstone. The coal that crops out at water level at the falls of Stony River is here called the Falls coal and may be equivalent to either the Lower Freeport or the Upper Kittanning. The coal above railroad level at Westernport, from a knife-edge to 4 feet thick, which is underlain by a light-colored clay that is mined in the northern part of that town, may be the equivalent of the Middle Kittanning, and the bed about 50 feet lower may be the equivalent of the Lower Kittanning. The two coals next below these, which crop out east of Piedmont, are thought to be the equivalent of the two beds at Mount Savage and in turn to be at the horizon of the Craigs-

ville and Brookville, or Upper and Lower Mercer coals of Pennsylvania.<sup>1</sup>

The Red Creek coal, near the base of the section, is in the Pottsville formation and possibly is as low as the Sharon coal, though its nearness to the supposed base of the Allegheny suggests that it belongs in the Connoquenessing part of the Pottsville of western Pennsylvania. Certainly it is not as low as the Sewell coal of the New River Region, with which it has commonly been correlated. The exact correlation of all the beds in this field must await detailed tracing of the strata and studies of the associated fossils.

In general the distance from the Pittsburgh bed to the Davis bed decreases toward the south from about 775 feet at Piedmont to 625 or 650 feet in the Fairfax knob area. The equivalents of the coal beds of the lower part of the section have not been worked out, so it is not possible to say whether the Savage formation or the rocks equivalent to the Allegheny formation of Pennsylvania are thinner at the south than at the north, but that is suspected to be the case. The Pottsville formation is known to thicken toward the south, especially by the addition of beds at the bottom which were deposited at the southeast only. The sections at Piedmont and on Red Creek indicate that some of the Pottsville beds thicken toward the south in this region.

None of the Pottsville coals are thick in this field, though locally one of the beds reaches 2 feet or more, and in the southern part of the field the Red Creek coal, as here designated, shows a thickness of 2 feet or more at a few openings. Where seen by the writer on the South Fork of Red Creek in a surface outcrop the coal reaches a thickness of 31 inches, but a few feet away it pinches out. What is assumed to be this coal was opened many years ago by Mr. Leatherwood on the west flank of Cabin Mountain, a little southwest of the corner of Grant County. It is here nearly 300 feet below the crest of the mountain, on the trail from the head of Red Creek to Cortland. What is probably this coal was seen in the face of the Allegheny Front on the road from Hopeville to Laneville some distance below the summit. This coal crops out around Red Creek and has been mined on Little Stonecoal run for use in smithing, a fact which indicates its freedom from sulphur. It is reported to be about 2 feet thick and is commonly solid but locally has a 3 to 4 inch shale parting 4 inches below the top. Coals are reported to

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<sup>1</sup> Recent studies by the writer have led him to think it probable that the Craigsville and Brookville coals of the Allegheny Valley are the equivalent of the Upper and Lower Mercer of the Beaver River valley, the Homewood sandstone of the Beaver River valley having been called the Clarion sandstone in the Allegheny Valley, and that the Brookville coal of the Mercer County area is the equivalent of the Clarion coal of the Allegheny Valley. This is only a working hypothesis pending additional field studies at the type localities.

occur on the east flank of the Allegheny Front at a number of points north of this, some of which are doubtless at the same horizon as the Red Creek coal. The next coals above this, which if the Allegheny formation has not thinned between Piedmont and Red Creek may be the equivalent of the two coals at Mount Savage, are too thin to be of present commercial interest. The thickness, so far as noted, generally runs less than 20 inches. One of these beds appears to have been mined on Stonecoal Run for locomotive use while the lumber of the Red Creek basin was being cut.

Two coals which lie from 90 to 175 feet below the Davis are commonly thin or dirty. One or the other of these beds is exposed at many places in the cuts along the Western Maryland Railway on the North Branch of the Potomac. This bed is locally known as the Railroad bed. Although in places it is as much as 2 feet thick, it appears to be very irregular in thickness and to contain some bony coal. The upper of these two beds is being mined in the northern outskirts of Westernport, where its thickness ranges within a short distance from a knife-edge to 3 feet. Where thickest the body of good coal is much cut down by irregular partings of clay. It is underlain by a valuable bed of clay and may prove workable in connection with the clay.

#### FALLS COAL.

The Falls coal (secs. 97-103, Pl. XIII) is of workable thickness in parts of this area, but so far as examined does not appear to be of high quality or to be regular in thickness. At the falls of Stony River this bed contains nearly 3 feet of coal but is high in sulphur, as shown by the analyses. It is in two benches. The sulphur in the upper bench occurs principally as nodules, and that in the lower bench is in the joint planes. As shown by the other sections given, this bed has been found at a number of points in this and adjacent areas to have a thickness of 2 to 2½ feet. All the analyses obtained indicate a coal below the average in quality.

#### DAVIS COAL.

The Davis coal (secs. 59-96, Pl. XIII) is the most valuable bed in the field. It is sometimes known in this region as the Split Six, the name referring to its thickness, locally 6 feet or more, and to the fact that it is commonly split into two main benches by a parting which may range from 1 inch to 7 or 8 feet but is generally less than a foot in thickness. In addition to the main parting each of the two main benches is generally broken up by one to six partings of shale and bone. The bed as a whole has a thickness between 5 and 6 feet in the northern part of the area and of 7 to 9 feet in the southern part. Subtracting the bone, clay, and shale partings leaves 3½ to 5 feet of

coal at the north and 5 to 8 feet of coal at the south. In most sections there is at least one bench of clean coal from 2 to 3½ feet thick. In many of the sections by including one or two thin partings of shale or clay the bed is found to contain a principal bench 3½ to 4 feet thick. As shown by the sections, the partings are extremely irregular. This is brought out especially by sections taken at the same mine or near the same point—for example, the two sections at the Lloyd Kitzmiller wagon bank (87 and 88), the two at the falls of Stony River (84 and 85), the two 3 miles below the falls (80 and 81), or the two on Difficult Creek within 400 feet of each other (78 and 79). This same irregularity was noted at practically every mine entered and must be taken into account in any plans for mining this bed. Obviously if this bed is to be mined with any regard to the conservation of the coal it must be mined as a whole and washed, and only the washed portion should be shipped; the bony coal and poorer layers and waste coal should be used on the ground for the production of power to be transmitted by electricity for manufacturing plants along Potomac River or elsewhere. For this use advantage should be taken of modern types of grates designed especially for burning high-ash coals and bone.

This coal is generally overlain by a thick sandstone which is separated from the coal by a body of shale from a few inches to several feet thick. Between this coal and the next underlying coal there is locally a limestone or a body of flint clay. This flint clay is unusually thick at the falls of Stony River, where the following section was measured:

*Section at falls of Stony River.*

	Ft.	in.
Sandstone, brown, heavy bedded.....	25	
Shale, black.....	2	4
Coal, Davis.....	9	
Flint clay, mainly of low grade.....	32	
Shale or clay, dark brown, crumbly.....	15	
Shale, black to drab, with iron nodules.....	13	
Shale and thin sandstone.....	3	
Shale, black.....	4	
Coal, Falls.....	3	
Clay to water in river.		

**SIXFOOT COAL.**

The Sixfoot bed reaches a good thickness in the southern part of the Georges Creek valley and around Westernport, where it is 5 feet thick (sections 52-58, Pl. XIII). It is, however, said to run out a few miles southwest of Westernport. Some of the drilling in this field has reported a coal at this horizon, and such a coal shows in a few sections, as at Harrison (section 57, Pl. XIII).

There has been a tendency in many districts to consider the Davis bed as made up of the Split Six bed and this bed. The presence of a massive sandstone over this bed at the north and over the Davis bed at the south and the greater thickness of the Davis coal at the south favor the correctness of this view, but until the writer has opportunity to make a detailed study along the north bank of the Potomac he prefers to leave the question open.

#### THOMAS COAL.

The Thomas coal (sections 20-47, Pl. XIII) occurs from 150 to 225 feet above the Davis bed, averaging about 180 feet. Around Westernport it has a thickness of 5 to 6 feet, including, however, a clay parting of 5 to 15 inches and locally bony coal at the top. Around Elk Garden and the lower part of Abram Creek, where this bed is being mined at the Oakmont and other mines (sections 31-35), it is only 30 inches to 4 feet thick. South of Stony River, near the falls, on the Frank Hipp place, this bed shows, according to J. A. Taff, 7 feet of coal in a bed  $8\frac{1}{2}$  feet thick.

A study of sections 20 to 47 shows that this bed has nearly everywhere one bench of solid coal from 18 to 43 inches thick overlain by a foot or more of coal, bone, and clay or shale. Only a few of the sections show clay or shale, most of them showing the upper part of the bed to be composed of alternate layers of coal and bone. A sample of this top coal was taken at the Koontz mine (section 40) and gave an ash content of 30 per cent. Where seen at the Oakmont mine this coal is variable, as indicated by sections 32 and 33, which were taken on adjoining entries. The roof of this coal, as seen at the Oakmont mine, is very good, including from half to three-quarters of an inch of "draw slate." The whole bed should be mined and the upper part utilized at the mine for producing power. To judge by the sections the lower bench of coal is very regular and probably maintains its thickness under a considerable part of the area. Drilling, however, shows that in places the entire bed is lacking and that the bench of solid coal at the bottom will probably average thinner than is indicated by the measured sections given.

#### BARTON COAL.

The Barton coal bed (secs. 1-19, Pl. XIII) lies about 200 feet above the Thomas coal and 350 to 380 feet below the Pittsburgh coal. It is persistent and of minable thickness in this area, though in general less than 4 feet thick, and resembles the Thomas coal in having a main bench of good coal below and an upper bench of bony coal. The Barton coal, however, differs from the Thomas in having at least

one parting in the lower bench. In fact, many or most of the sections show bony or poor coal below the parting just mentioned. Another feature worthy of note is the occurrence over this coal of a thin rider bed. Like the Thomas coal, the bottom bench will yield from 18 to 33 inches of good coal, which may be mined cheaply, and one or two benches of poor or bony coal which may pay to mine for local use in generating power.

#### COAL ABOVE THE BARTON.

In the region south and southeast of Mount Storm there are a number of road outcrops of a bed of coal not far above the Barton. No sections of this coal were seen, but the bed appeared to have a thickness at one point of at least 30 inches. This coal may be at the horizon of the Wellersburg coal. About 100 feet below the Pittsburgh is a coal bed, possibly the equivalent of the Little Clarksburg, that is locally known as the Dirty Ninefoot. It underlies all of the area covered by the Pittsburgh coal, including the hills on which the Wabash mine and Hartmonsville are situated. At Sulphur City it has a thickness of  $4\frac{1}{2}$  feet, including a 6-inch shale parting 18 inches from the bottom.

#### PITTSBURGH COAL.

The Pittsburgh coal occupies small areas north and east of the lower end of Abram Creek. The main body of coal has been mined out here, but there still remains the outcrop coal and pillar coal. As the coal is about 12 feet thick the outcrop coal should be well worth mining with a steam shovel, and possibly some of the pillar coal may be of sufficient value to mine in the same way.

#### STRUCTURE OF THE FIELD.

The structure or lay of the beds in this field is shown by the contour lines on Plate XII. The field as a whole consists of an elongated basin extending from southern Pennsylvania across Maryland and into West Virginia as far as Randolph County. This basin lies between the Allegheny Front on the east and Backbone Mountain on the west. At the south end of Mineral County it is nearly flat across the center but is turned up sharply on the east side. In northern Grant County the basin is broad and flat in the center and turned up abruptly on the eastern edge and less abruptly toward the west. The center of the basin approximately follows Abram Creek. Near Stoyer the basin begins to divide, being interrupted by the Canaan Valley anticline. The east prong of the basin, with which alone this paper deals, follows up Stony River, keeping on the east side of the river with a narrow center and steep dips on either side. As it crosses into Tucker County the syncline broadens out, and as there has been

a steady rise of the center of the basin southward all the coal measures reach the hilltops a short distance south of Red Creek. The structure contours shown on Plate XII are based on the position of the Davis coal. At Emoryville this coal is found at 1,700 feet above sea level. At the Grant County line it is at 1,900 feet in the center of the basin. At Bismarck post office the Davis coal has risen to 2,700 feet, at Stingley Run to 2,900 feet, at the mouth of Helmet Run to 3,100 feet, at the head of Stony River to 3,600 feet, and at the south line of Tucker County to 3,900 feet, a rise of 2,000 feet in 15 miles, or an average of 133 feet to the mile. The structure shown south of Helmet Run is largely hypothetical, being based on the elevations of a few coal openings or drill holes in the basin and on the assumed position of the Pottsville sandstones on the flanks of the basin. In the vicinity of Red Creek the axis of the basin appears to lie west of the creek, but on the South Fork of Red Creek the axis appears to swing eastward so as to lie close to the Allegheny Front, and from that line the rocks rise with moderate but increasing dip to the east and with very gentle dips to the west.

## DISTRIBUTION OF COALS.

### MINERAL COUNTY.

At Harrison the workable beds are all above drainage level, the Falls coal (section 99) lying about 15 feet above the creek or about level with the railroad track and the other coals cropping out in the hills above. Upstream toward Emoryville the coals lie about flat, but as the elevation of the creek rises from 1,686 feet above sea level at Harrison to 1,967 feet at Emoryville, all the coals up to the Thomas pass below drainage level before Emoryville is reached. From Emoryville to the iron bridge west of Hartmonsville the dip of the rocks and the gradient of the stream are about even, so that at the iron bridge, where the elevation is 2,297 feet, the Upper Freeport coal is found at 70 feet below the bridge level and the Barton coal at about 120 feet above the bridge.

From Emoryville eastward the rise in the rocks about keeps pace with the grade of the stream, so that the Barton coal, which is mined commercially just east of Emoryville by the Low Volatile Coal Co., crops out and has been mined on a small scale at a number of points ascending Vandever Run. This rise brings the lower coals to daylight just west of the crest of the Allegheny Front. The Davis coal has been opened at several localities along the road running north from the point where the Northwest Turnpike crosses the crest of the mountain.

The Barton coal keeps above drainage level along Abram Creek from Emoryville to the iron bridge and has been opened at a number

of places. Northwest of Hartmonsville the hill is high enough to hold a small body of Pittsburgh coal, which has been mined from the Wabash mine. The sandstone a short distance below that bed underlies and supports the broad upland valley between the Wabash mine and Hartmonsville, at the head of Hogland Glade Run, and rises with the slope to the church at Hartmonsville, leaving no doubt that the Pittsburgh bed has been cut out at Hartmonsville, unless, as does not seem likely, a trace of it is left in the top of the hill south of that place. Under this sandstone is the Little Clarksburg coal, blooms of which were seen in all the roads around Hartmonsville. The Davis and other lower beds underlie the whole of this basin between their outcrops on the west flank of the Allegheny Front and their outcrops along the North Branch of the Potomac between Harrison and the mouth of Stony River.

#### GRANT COUNTY.

The broad divide between Abram Creek and Stony River is underlain by all three of the workable coals in this area, the Barton, Thomas, and Davis. At the mouth of Stony River all the coals are above drainage level, but the grade of the river is sufficient to carry the Davis and Thomas coals to or below drainage level at the toe of the moccasin bend north of Mount Storm. These coals underlie all of the land east of Stony River from its mouth to the mouth of Mill Run, until they rise on the western flank of the Allegheny Front. The Barton coal is above drainage level along both Stony River and Abram Creek but underlies all of the upland between the two streams nearly to Bismarck and also an area extending some distance east of Abram Creek.

West of Stony River the rise of the beds over the Canaan Valley anticline carries the coals up so high that the Barton coal underlies only a small area between Stony River and Difficult Run, and the Thomas coal underlies only the higher parts of the divide, some of which is capped by the massive sandstone over that coal.

South of the Northwest Turnpike the rise of the beds exposes the Barton coal along Mill Run and the Thomas coal in the valley of that creek. The sandstone overlying the Thomas coal makes 30-foot cliffs in the toe of the moccasin bend of Stony River north of Mount Storm and smaller cliffs at the iron bridge southwest of Mount Storm, and from the bridge it rises until it underlies the broad flat in the area around Accident schoolhouse. The Thomas coal crops out under this sandstone and has been opened in the Koontz mine (No. 40, Pl. XII), at the J. T. Cosner place (No. 41), at the P. D. Cosner place on Mill Run (No. 42), and elsewhere. East of Bismarck the Thomas coal has been opened on the M. F. Cosner place, just above Abram Creek, and at the junction of Abram and Little creeks. The sand-

stone over the coal is here very massive and makes a miniature rock city east of Abram Creek. Northeast of Bismarck, where the dip is about  $5^{\circ}$  NW., the rise is sufficient to bring up the Davis coal near the Little Creek schoolhouse, in the S. M. Hamline place (No. 86), and on the Lloyd Kitzmiller place, a short distance farther south.

The rise along Stony River above Mill Run is sufficient to bring the Davis coal above water level at station 78 and to keep it above as far as a point half a mile above the falls. At the falls the Davis coal is about 70 feet above water level and the Falls coal crops out just at water level. Stony River above the falls appears to follow the strike of the beds approximately, but as the river rises from about 2,940 feet above sea level at the falls to 3,130 feet at the mouth of Stingley Run the Thomas coal is brought down to water level. According to the writer's interpretation the Barton coal should underlie a small area on the top of the hill north of the falls, and the same bed should underlie the broad flat north of Stingley Run. South of Stingley Run the rise is rapid, as shown by the outcrop of the sandstone which underlies the Thomas coal. Opposite the mouth of Stingley Run this sandstone makes a prominent cliff which may be traced readily, rising with the hill to the northeast corner of Tucker County. It is therefore estimated that a considerable body of the Thomas coal underlies the top of the ridge at the northeast corner of Tucker County, and a much larger area of the Davis coal. The outcrop of the Davis coal swings around the head of Beaver Creek and passes under that creek not far above the Beacon mine (No. 95).

Above Stingley Run the rise of the rocks a little more than keeps pace with the rise of the river, so that the Davis coal comes to daylight a short distance above the mouth of Helmet Run. The Thomas coal crops out on either side of Helmet Run (sections 45 and 46, Pl. XIII). About 2 miles above the mouth of Helmet Run the Falls coal crops out (section 102), and it keeps above drainage level for at least 2 miles upstream. The Davis coal crops out on both sides of the valley at the dam and has been opened on the west side about a mile above the dam (section 91), at the sugar camp (section 90), and in the Davis Coal Co.'s mine No. 9 southeast of opening 91. The topography and position of the coal beds in the upper Stony River valley as shown on the map are largely hypothetical, being based simply on a few barometric readings in the valley and topographic traverses along the crests of the adjacent mountains. All the lower coals pass under the divide between Stony River and Red Creek, and possibly a little of the Barton coal is caught in the crest of the divide in the center of the syncline. Both the Thomas and Davis coals occupy considerable areas under the upland on both sides of Red Creek. The deep valley of the creek itself is cut out of the Pottsville and

Mauch Chunk rocks. The massive sandstone at the top of the Pottsville forms the shoulders of these narrow ravines and holds up the broad upland. The workable coals are confined to the hills that lie above this upland level, with the exception of the Red Creek coal, which may prove to be of workable thickness.

#### TONNAGE OF COAL.

The computation of tonnage has been confined to the area between the axis of the Canaan Valley anticline and the North Branch of Potomac River on the west and the Allegheny Front on the east and between the course of Abram Creek below Emoryville and thence east from Emoryville to the Allegheny Front on the north and the outcrops of the beds on Red Creek, in Tucker County, on the south. By tracing the outcrops of the several coals on engraved cross-section paper a fairly accurate computation was made of the area underlain by each bed, then from the plate of bed sections a careful estimate was made of the thickness of recoverable coal under present mining conditions. A recovery of 1,200 tons to the acre-foot was assumed. The tonnages thus derived follow:

*Estimated tonnage of coal in Abram Creek-Stony River field.*

Coal bed.	Area available.	Estimated recoverable thickness.	Estimated tonnage.
	<i>Acres.</i>	<i>Ft. in.</i>	
Barton.....	19,200	2 6	57,600,000
Thomas.....	45,880	2 6	134,640,000
Davis.....	63,200	3	227,520,000
		8	422,760,000

If all the good coal of the Davis bed were recovered it would probably yield 5 feet of coal, or 379,200,000 tons for that bed in this area, increasing the total for the three beds to 524,520,000 tons. It is probable that a considerable amount of coal will be obtained from the Falls and other beds, but as drilling is reported to show that these beds have an average thickness less than the figures used for the three beds considered, it is felt that the tonnage to be obtained from the Falls and other beds will not more than make up for the excess in the estimates for the three beds in areas where the coal is thin or lacking.

#### DISTANCE TO MARKET.

The nearness of this field to tidewater is of importance, in view of the probable use of the coal as bunker coal and for export. This field is now in the area served by the Western Maryland Railway, on which the distance from Harrison, at the mouth of Abram Creek,

by way of Cumberland to Baltimore is 214 miles. The distance between Piedmont and Baltimore by the Baltimore & Ohio freight line is 187 miles, to which must be added the distance from Piedmont to points on Abram Creek or Stony River. A comparison of these figures with the distances of other fields from tidewater is of interest. For example, Osceola Mills, in Clearfield County, Pa., is 328 miles from New York; Windber, at the south line of Cambria County, Pa., is 368 miles from New York; Thurmond, on New River, W. Va., is 391 miles from Norfolk by the Chesapeake & Ohio Railway; North Fork, in the middle of the Pocahontas field, W. Va., is 386 miles from Norfolk by the Norfolk & Western Railway; Matoaka, W. Va., is 356 miles from Norfolk by the Virginian Railway; and Echols, W. Va., is 299 miles from Norfolk. Points in the Georges Creek field and along the North Branch of the Potomac below Abram Creek are of course nearer tidewater at Baltimore than points in this field. In general, however, it may be figured that coal from this field will have from 220 to 240 miles to go to reach tidewater.

