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VIRGINIA GEOLOGICAL SURVEY

UNIVERSITY OF VIRGINIA

THOMAS LEONARD WATSON, PH. D.
DIRECTOR

LOAN COPY,

Bulletin No. XIX

The Geology and Coal Resources
of the Coal-bearing Portion of
Tazewell County, Virginia

BY

T. K. HARNSBERGER

PREPARED IN CO-OPERATION WITH THE
UNITED STATES GEOLOGICAL SURVEY

CHARLOTTESVILLE
UNIVERSITY OF VIRGINIA
1919

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LETTER OF TRANSMITTAL

VIRGINIA GEOLOGICAL SURVEY,

UNIVERSITY OF VIRGINIA,

CHARLOTTESVILLE, December 15, 1919.

*Governor Westmoreland Davis, Chairman, and Members of the State
Geological Commission:*

GENTLEMEN:—I have the honor to transmit to you herewith, and to recommend for publication as Bulletin No. XIX of the Virginia Geological Survey Series of Reports, a manuscript and illustrations of a report entitled "The Geology and Coal Resources of the Coal-bearing Portion of Tazewell County, Virginia," by Mr. T. K. Harnsberger.

This report, prepared by the Virginia Geological Survey in coöperation with the United States Geological Survey, is the fourth one of a series of detailed reports published by the Virginia Geological Survey on the coal resources of southwest Virginia, under the coöperative agreement of the State and Federal Surveys, and the second one of the county reports. It is accompanied by topographic and geologic maps of the coal-bearing portion of Tazewell County.

Respectfully submitted,

THOMAS L. WATSON,
Director.

THE GEOLOGY AND COAL RESOURCES OF THE COAL-BEARING PORTION OF TAZEWELL COUNTY, VIRGINIA

BY T. K. HARNSBERGER.

INTRODUCTION

Location of area.—Tazewell County is in southwest Virginia and the part herein described consists of a narrow belt bordering Buchanan County, Virginia, and McDowell County, West Virginia, on the northwest and included between Russell County, Virginia, and Mercer County, West Vir-

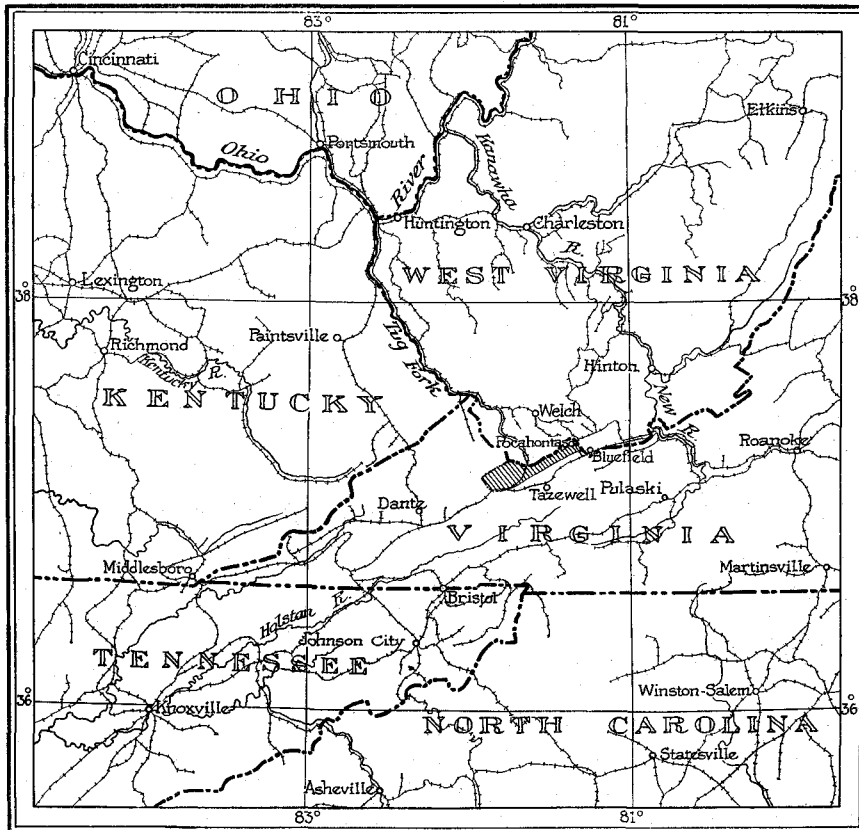


Fig. 1.—Index map, showing location of area.

ginia, on the southwest and northwest, respectively. It lies along the southeast border of the central part of the great Appalachian coal field.

The total area of coal land, according to the writer's survey, which is based on the most recent maps of the State and Federal surveys, is 696.5 square miles. This estimate includes the narrow zone of dipping beds extending from Laurel Fork of Dry Fork to Raven, from which a large proportion of the coal will eventually be recovered.

Most of the people living in the region are connected with or dependent in some way upon the coal industry for a livelihood. Farm products find a ready sale at the mining camps and there is usually a demand for miners. Corn and garden truck, raised in small cleared patches, and a few hogs are about the only farm products in the rough, timbered region comprising the coal field, but in the open and less rugged limestone area to the southeast farming is done on a larger scale and stock-raising is an important industry. (See Pl. III.) Pocahontas, the largest town in the area, is dependent entirely upon the mines in the vicinity, as, to a large extent, are Richlands and Raven.

Method of work.—The survey upon which this report is based was undertaken primarily for the purpose of assembling general and detailed information which would be of value in the development of the coal. Both the geologic and topographic work was done in coöperation by the Virginia Geological Survey and the United States Geological Survey, the expense being shared by both organizations. The topographic survey of the eastern portion of the area was made in 1909 as a part of the Pocahontas Special quadrangle and the remainder in 1915. Practically all the geologic work was done in the summer of 1916.

Many coal openings were located instrumentally and assigned elevations by the topographers in the course of their mapping, but by far the greater number were located by the writer and their elevations determined with a barometer. Temporary stadia stations, not shown on the accompanying map, were established at many places along the main roads and these elevations were available to the geologist. By checking and resetting the barometer at points of known elevation the large errors due to variation in atmospheric pressure were eliminated and fairly accurate results obtained.

Tracing out the coal beds and correlating from one stream to the next was possible only by close detailed work. Steep and irregular dips, a heavy growth of underbrush, especially in the burned-over areas, and the lack of reliable key-rocks were the principal difficulties met. Geologic profiles were made along all roads and trails. All reported coal openings were visited and

detailed sections of the coal bed obtained where possible. The locations of many old prospect pits, at which the coal was not exposed, are shown on the geologic map but not mentioned in the text. In some parts of the region, where little prospecting had been done, it was necessary to determine the dip and carry the correlation by following the outcropping ledges of sandstone. Where this was impossible the outcrops were correlated by comparing stratigraphic sections measured up closely adjacent spurs.

Acknowledgments.—Henry Hinds, of the United States Geological Survey, had general supervision of the work and the writer wishes to thank him for his many valuable suggestions.

Outcrop maps, coal measurements, and other data were cheerfully furnished by Messrs. A. G. Russell, Jr., of the Faraday Coal & Coke Co., H. N. Eavenson of the U. S. Coal & Coke Co., Thomas H. Claggett of the Pocahontas Coal & Coke Co., A. H. Stow of the Pocahontas Consolidated Collieries Co., W. J. Elgin of the Matoaka Coal Corporation, M. Zeigler of the Empire Coal Land Corporation, and the Jewell Ridge Coal Corporation. Special thanks are due Mr. Charles B. Neel of the Raven Red Ash Coal Corporation, who in addition to outcrop maps and coal sections, furnished much oral information and spent several days guiding the writer to coal openings on Coal and Mudlick creeks. The writer is duly thankful for the uniform hospitality and willing assistance offered by the people living in the region.

Information relating to the beginning of the coal industry at Pocahontas was obtained from publications kindly furnished by Mr. Stuart M. Buck of Bramwell, W. Va., and from the early numbers of *The Virginias*.

The entire area has been described in folios¹ by M. R. Campbell, prepared at a time when little prospecting had been done and when little was known of the coals outside the few mining districts. Neighboring parts of West Virginia are adequately covered by reports on McDowell² and Mercer³ counties, and a report by Hinds⁴ describes in great detail the adjacent portion of Buchanan County.

¹ Campbell, M. R., U. S. Geol. Survey. Atlas, Pocahontas folio (No. 26), 1896; and Tazewell folio (No. 44), 1897.

² Hennen, R. V., Wyoming and McDowell counties: West Virginia Geol. Survey, 1915.

³ Krebs, C. E., Raleigh County and the western portions of Mercer and Summers counties: West Virginia Geol. Survey, 1916.

⁴ Hinds, Henry, The Geology and Coal Resources of Buchanan County, Va.: Virginia Geol. Survey Bull. XVIII, 1918.

SURFACE FEATURES.

Relief.

The surface of the country is extremely hilly, or even mountainous, and there is a relatively small proportion of flat land, especially in the part underlain by coal. The average local relief in the western part of the area where the streams flow directly into Clinch River is about 500 feet; it is considerably greater on the Dry Fork drainage in the central part, but is only about 250 feet on Laurel Fork in the Pocahontas region. The maximum difference in elevation for the entire area is about 1,700 feet, the lowest point being on Dry Fork at the State line and the highest on Big Stone Ridge, southeast of Horsepen Post-Office.

The long divides between the streams flowing from Sandy Ridge toward Clinch River are roughly parallel and in the coal field have a fairly definite north-south trend. The ridge tops are winding, but persist in general direction, and in many places are sufficiently flat or rounded to be cleared and farmed. There is practically no flat land in the valleys, most of which are distinctly V-shaped. The west sides of most of the valleys are noticeably steeper, presumably because of the prevailing westward dips. (See Pl. I.)

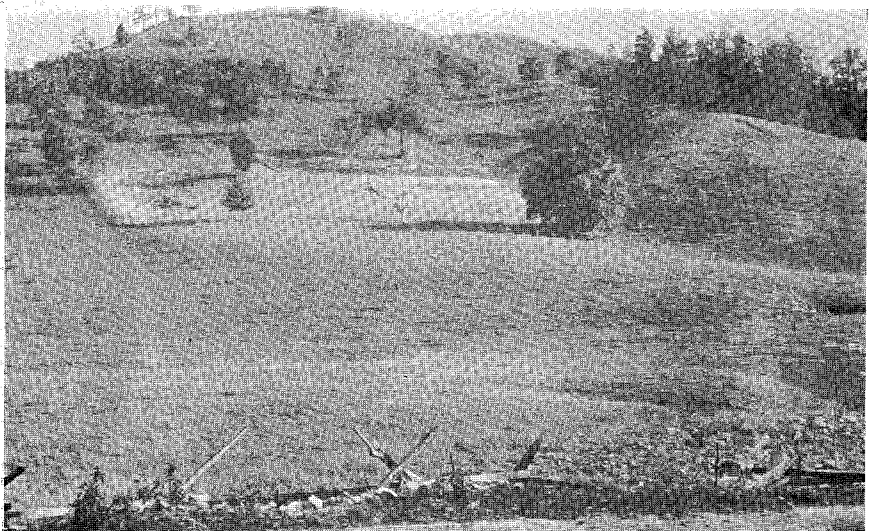
There is no regularity to the larger topographic features in the area drained by Dry Fork, though the ridges on either side of Upper Beech Fork are fairly straight and appear to be influenced by structure, just as are the ridges south of the coal field, farther west. The most conspicuous topographic feature of the entire region is Big Stone Ridge, which rises to an altitude of a little more than 3,350 feet, about 1,550 feet above Jacob Fork at Shraders. Horsepen and Crockett coves are peculiar, pocket-like valleys eroded in the north side of this ridge. Small depressions, having no surface outlet, are common in the areas closely underlain by limestone, especially in Abbs Valley, a gently rolling, trough-like depression with high ridges on either side. There are considerable areas of fairly flat land on the ridges north of Laurel Fork of the Bluestone, and narrow strips of bottom land along some parts of that stream.

Drainage.

The streams of the area are tributary to three great drainage systems. Indian Creek and streams west of it flow directly into Clinch River, which joins the Tennessee, a major tributary of the Ohio. East of Indian Creek the divide between the Clinch and Big Sandy drainage is no longer in the



(A) View east from State line at head of Right Fork of Beech Creek, showing rugged character of country containing coal and forest mantle; underlying rocks, hard sandstone and shale, with coal beds.

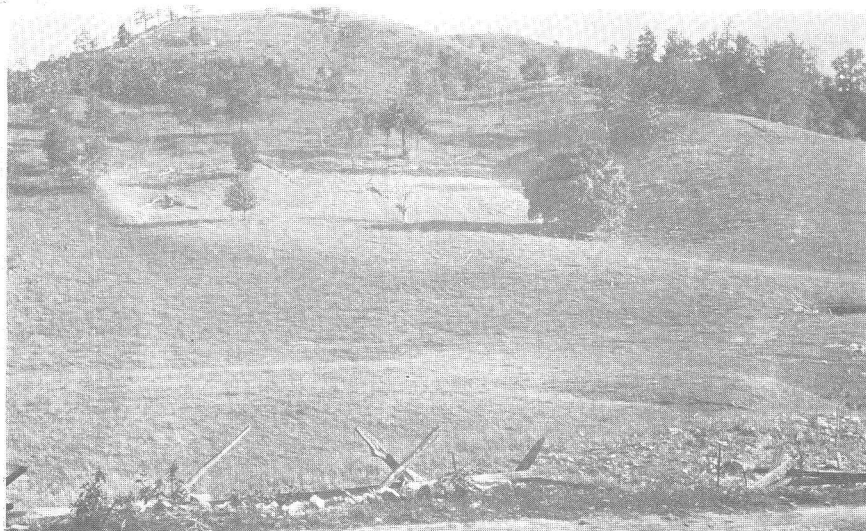


(B) View looking south at head of Abbs Valley, outside coal field; showing gentle topography and land under cultivation. Lower slopes cut in Bluefield shale.

PLATE III.—VIEWS SHOWING CONTRASTING SURFACE AND CULTURE WITHIN AND OUTSIDE COAL FIELDS.

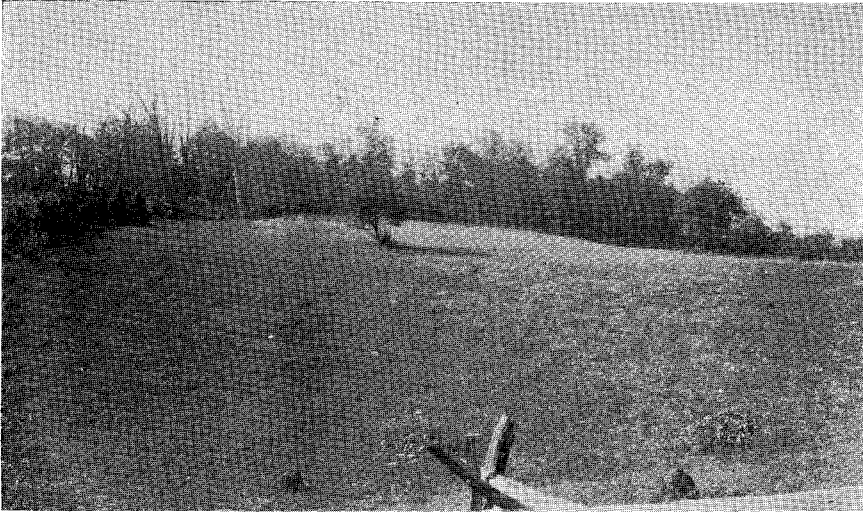


(A) View east from State line at head of Right Fork of Beech Creek, showing rugged character of country containing coal and forest mantle; underlying rocks, hard sandstone and shale, with coal beds.

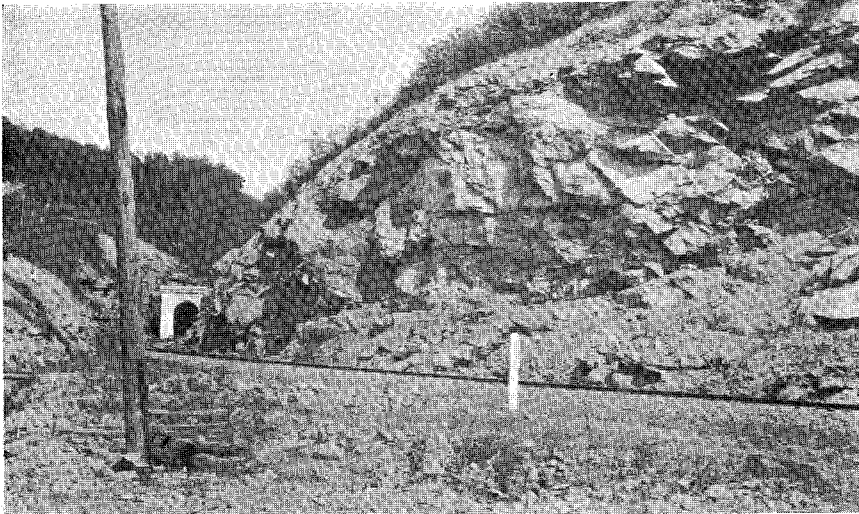


(B) View looking south at head of Abbs Valley, outside coal field; showing gentle topography and land under cultivation. Lower slopes cut in Bluefield shale.

PLATE III.—VIEWS SHOWING CONTRASTING SURFACE AND CULTURE WITHIN AND OUTSIDE COAL FIELDS.



(A) View $2\frac{1}{2}$ miles southeast of Bearwallow, showing broad upland bench resulting from the resistance to weathering of the sandstone below the Greasy Creek coal bed.

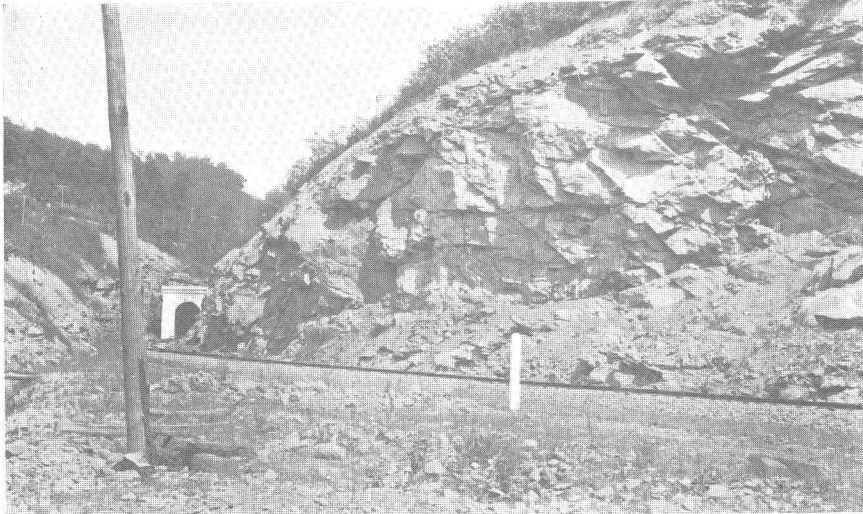


(B) View at west portal of tunnel near Bandy, showing sandstone below Greasy Creek coal bed, responsible for the broad bench shown above.

PLATE IV.—VIEWS SHOWING EFFECT OF HARD SANDSTONES ON CHARACTER OF SURFACE. THE BENCHES FORMED BY THE RESISTANCE OF SOME SANDSTONES TO WEATHER PROVE OF GREAT ASSISTANCE IN TRACING AND LOCATING THE COAL BEDS.



(A) View $2\frac{1}{2}$ miles southeast of Bearwallow, showing broad upland bench resulting from the resistance to weathering of the sandstone below the Greasy Creek coal bed.



(B) View at west portal of tunnel near Bandy, showing sandstone below Greasy Creek coal bed, responsible for the broad bench shown above.

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coal field, the headwaters of Dry Fork extending into the "limestone" country to the southeast. Dry Fork flows into Tug Fork of the Big Sandy and reaches the Ohio by a direct northerly route. The eastern part of the area is drained by Laurel Fork, a tributary of Bluestone River, which flows northeast to New River, a confluent of the Kanawha, and thus reaches the Ohio.

The elevation of the high parts of the area is practically the same but there is a noticeable difference in the level at which the major streams of the three systems are flowing. This indicates in a general way the extent to which the present drainage systems have cut down the former more or less level land surface. In the vicinity of Richlands, Clinch River is between 1,900 and 2,000 feet; Dry Fork is about 200 feet lower, and Laurel Fork of the Bluestone about 500 feet higher. The headwaters of Dry Fork are therefore advancing much more rapidly than the other streams and will eventually divert into that system some of the water that now flows into Clinch and Bluestone rivers.

Most of the streams have running water throughout the year, except in unusually dry summers, but only Clinch River has a very large flow. The rainfall in the section is greater than in most parts of the United States, the average annual precipitation being about 50 inches, but disastrous floods are prevented by the dense growth of trees and brush (see Pl. III) and the high stream gradients. Springs are plentiful and furnish the necessary water supply for most of the people living in the coal field, though it is common practice for those living in the valleys to obtain water from shallow wells near the streams. A small artesian flow has been obtained at Red Ash on Coal Creek.

INDUSTRIAL FEATURES.

Early history of mining at Pocahontas.

Early in the year 1873 Captain I. A. Welch, a well-known pioneer and explorer of that time, was employed by Major Jed Hotchkiss of Staunton, Va., to examine and report upon the timber, surface, and mineral value of a tract of 500,000 acres, including what is now the Pocahontas-Flat Top coal field. The area, known as the Wilson-Cary-Nicholas grant, by the State of Virginia in 1795, lay on Bluestone River, Elkhorn Creek, and on the headwaters of Guyandotte River. The region was known to contain coal, but prior to Captain Welch's examination no authentic report had come to the attention of capitalists.

According to Captain Welch's account¹ the Pocahontas No. 3 coal was first opened on Laurel Fork of the Bluestone and it is said that the original opening was about half a mile below the present town of Pocahontas:

"I entered upon the property on Laurel Creek, then the residence of Jourdan Nelson, one of the pioneer settlers of that section. Mr. Nelson was a blacksmith and had out-cropped a bed of coal for use in his shop, which, when fully driven under cover, showed a thickness of thirteen feet between the roof and floor rock. Interested in such an unexpected discovery, the continuity of the bed was traced down the valley of the Bluestone River, having it out-cropped at the various tributaries of the latter, which take their sources in the Great Flat-Top range and flow in a southeasterly direction."

At that time there were very few inhabitants along Bluestone River, below Laurel Fork, and at the present site of the town of Pocahontas there was an almost impenetrable jungle of hemlock and rhododendron. There were no roads but in spite of lack of means of communication and transportation, coal from the Nelson opening was soon being carried across the mountains on horseback to the prosperous farming districts to the south-east. In regard to the difficulties of prospecting, Captain Welch says:

"There was not a shovel or spade; the prospecting had to be done with a narrow hoe used by the natives for digging the roots of ginseng, then the most important industry in the entire section. For a shovel, a seasoned white-oak board, sharpened, with a handle made from the body of the board, which served the purpose for moving the loose material over-lying the coal. In this way the entire . . . area was examined . . ."

To Major Jed Hotchkiss, more than to any other man, belongs the credit of making known to the world this great deposit of valuable coal. Through the columns of *The Virginias*, a geologic journal of which he was editor, he persistently advocated its merit and urged its development.

In the years following Captain Welch's exploration in 1873, the region was more fully investigated and development planned by several groups of capitalists, one of which, the Grahams of Philadelphia, even got as far as to start building a narrow-gauge railroad to the field from the New River bridge of the Norfolk & Western Railway. No material progress was made, however, until the incorporation of the Southwest Virginia Improvement Co. in 1880. The following year the Norfolk & Western Railway Co. began work on a standard-gauge extension and the track was laid to Pocahontas in March, 1883. In order to have everything in readiness for shipping coal by the time the railroad was completed, mining operations were started in advance. In the fall of 1881 a permanent camp was established on Laurel Fork in what was known as "Powell's Bottom" and by June, 1882, entries

¹ Welch, I. A., The Pocahontas-Flat Top coal fields: *The Daily Telegraph*, Bluefield, W. Va., November 1, 1896.

had been driven into the bed on Coal Run, and the little town of Pocahontas had acquired a population of 400. Store supplies and necessary mining equipment were brought in on horseback and by wagons and men came on foot from Hinton, W. Va., and Wytheville, Va., then the nearest railroad points. In April, 1883, the company had built two hundred coke ovens and hundreds of tons of coal were piled on the ground ready for shipment. Regular shipments began May 1. The first car of coal was consigned to Hon. William Lamb, Mayor of Norfolk, Va., for distribution in that city. The total output of coal for 1883 was 119,053 short tons, of which 25,282 tons were shipped as coke.

The successful development at Pocahontas and the exceptional quality of the coal soon attracted capitalists and mine operators to adjoining areas and within a few years there were mines on many of the tributaries of the Bluestone to the east. To open up a hitherto inaccessible portion of the field it was necessary to extend the railroad through the divide northwest of Bluestone River. Accordingly, a tunnel more than 3,000 feet long, which follows the horizon of the Pocahontas No. 3 coal bed, was driven through the mountain at the head of Mill Creek. In Tazewell County operations extended westward, along the north side of Laurel Fork, and at the present time the underground workings of the East, West, Baby, and Boissevain mines of the Pocahontas Consolidated Collieries Co., and the two smaller mines of the Big Vein Pocahontas Coal Co. cover practically all of the area east of Curran Branch (see fig. 7). The 1918 production from these mines was 1,121,568 tons.

Mining operations at Pocahontas suffered a serious setback as the result of a disastrous¹ explosion on March 13, 1884. At that time there were 9,000 feet of entries, comprising the East mine, and about 200,000 tons of coal had been taken out. So violent and widespread was this explosion that out of the 114 men at work in the mine not one escaped. Some were killed instantly without warning, others were hurled against the coal or struck by flying timbers. The force of the explosion was so great that loaded cars, timbers, and tracks in some of the entries were blown entirely out of the mine.

Accessibility and future development.

The coal field in Tazewell County is especially well located with reference to the various markets. The greatest part of the present production, that

¹For a detailed account of the Pocahontas mine explosion see Trans. Am. Inst. Min. Eng. for May, 1884.

from the Pocahontas region, is carried to the main line of the Norfolk & Western Railway at Bluestone, by the branch line up Laurel Fork, and hence is available for either the seaboard or the western markets. Practically all of the lower beds, on the upper part of Laurel Fork, can be mined from the Tug Fork side of the divide, but it will be necessary to extend the Bluestone-Boissevain branch for taking out the outcropping coals on the upper part of the stream, and it will no doubt prove best to work the Pocahontas No. 3 by shaft, as was once planned.

The Dry Fork division of the Norfolk & Western Railway, between Cedar Bluff and Iaeger, makes the central part of the area easily accessible. A spur will undoubtedly be constructed up Jacob Fork at some time in the future, and its extension up Horsepen Creek will make the coal in that area available. Short feeders from the present "cut-off" will cover the remainder of the Dry Fork drainage, and a spur up Indian Creek from Bandy will draw from a large area. Coal on streams west of Indian Creek may be taken out by spurs from the Clinch Valley division of the Norfolk & Western Railway.

In addition to the several branches of the Norfolk & Western Railway there is a narrow-gauge logging road which extends from Doran up Mudlick Creek and crosses the divide into Buchanan County. It is probable that the adjacent portion of Buchanan County will be developed by a branch road up some of these streams and a tunnel under Sandy Ridge.

Most of the wagon roads in the eastern part of the area follow the valleys and are too rough for travel other than by horseback and wagon. In the area drained by Clinch River the ridges are fairly well defined and furnish a better location for the wagon roads than the narrow, rocky valleys. There are some improved, graded roads, sufficiently good for the use of automobiles, in and around the principal settlements, and along the border of the coal field, and an exceptionally good road has recently been built between Boissevain and Jenkinjones, the Pocahontas Consolidated Collieries Co.'s mining camp on the upper part of Tug Fork.

GEOLOGIC FORMATIONS

GENERAL STATEMENT.

The rocks exposed at the surface, in the part of Tazewell County described in this report, belong wholly to the Carboniferous and Devonian systems. The Pennsylvanian series of the Carboniferous, which contains most of the coal in the Appalachian fields, underlies the greater part of the area. At the surface there is almost everywhere a thin covering of soil and residual material and, except for some resistant ledges of sandstone and limestone, the underlying indurated rocks may be seen only where washed bare along streams and on steep slopes. Most of the larger stream valleys, especially outside the coal field, are filled with alluvium, but these surficial deposits were not considered extensive enough to map.

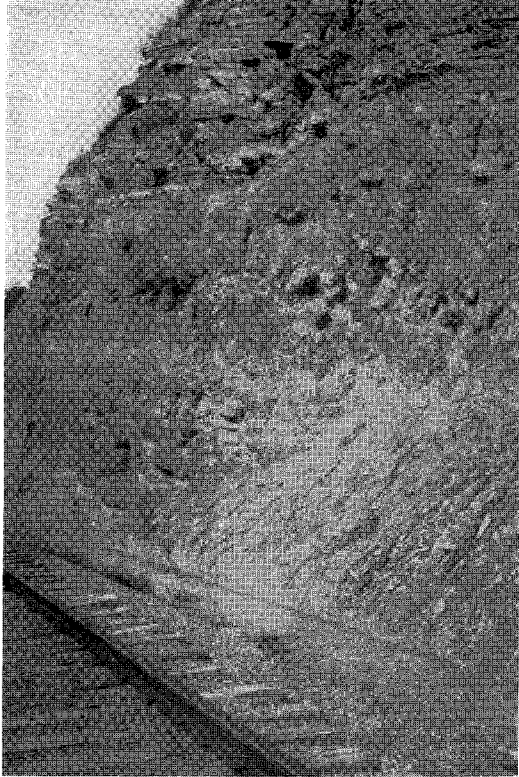
In order to determine the relation of the coal-bearing Pennsylvanian series to the barren formations below, the latter have been mapped in a narrow belt bordering the coal field on the southeast. In Abbs Valley a sharp anticlinal fold, or uplift, has brought these older rocks to the surface, and to the southwest they have been shoved up along faults, to the level of the normally overlying Pennsylvanian series.

DEVONIAN AND CARBONIFEROUS SYSTEMS.

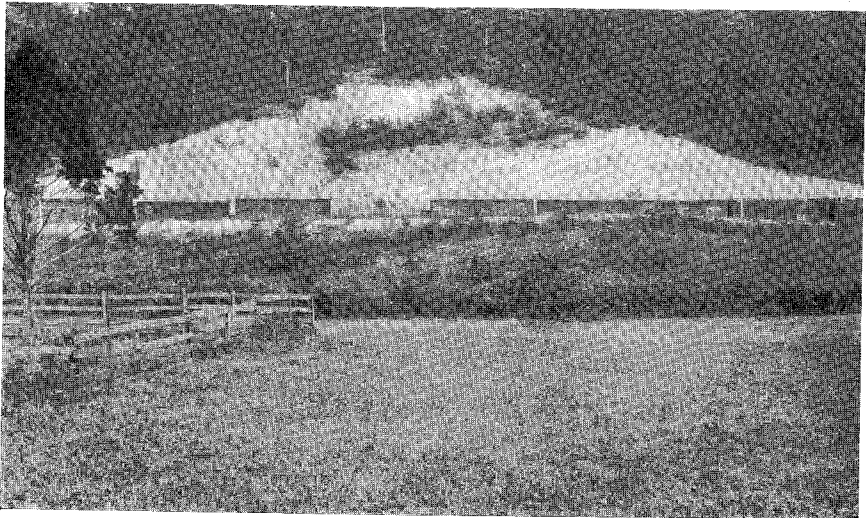
Grainger shale.

The upper part of the Grainger shale belongs to the Mississippian series of the Carboniferous and the lower part to the Devonian system. The term Grainger shale is applied to the formation Campbell mapped as Kimberling in the Tazewell quadrangle north of Clinch Mountain, because recent fossil evidence proves that the upper part is of Mississippian age. The name Kimberling was originally used to designate the topmost formation of the Devonian and was here applied to the shaly beds below the Mississippian limestone because the normally overlying Price sandstone appeared to be lacking. It now seems certain that the upper part of the formation which Campbell called Kimberling in this area is the equivalent of the Price sandstone and is therefore of Mississippian age.

The Grainger shale outcrops in a long narrow zone and in several small areas in the west half of the area. The upper two or three hundred feet are

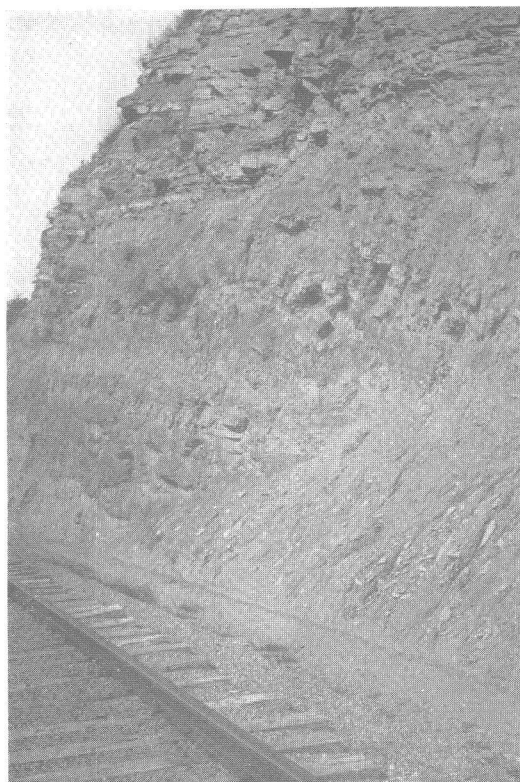


(A) View in railroad cut northwest of Indian, showing contact between Newman limestone below and underlying Granger shale.

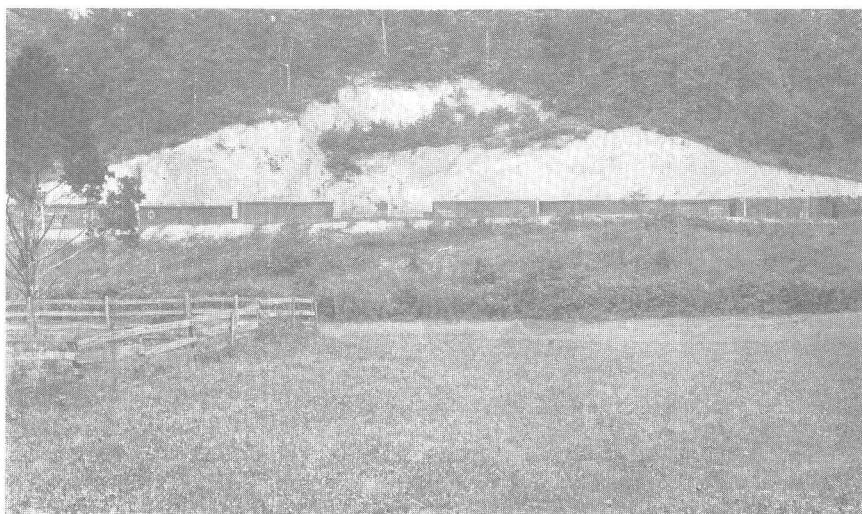


(B) View in railroad cut one-fourth mile northwest of Indian, showing Grainger shale.

PLATE V.—VIEWS SHOWING EXPOSURES OF ROCKS BELOW COAL-BEARING ROCKS.

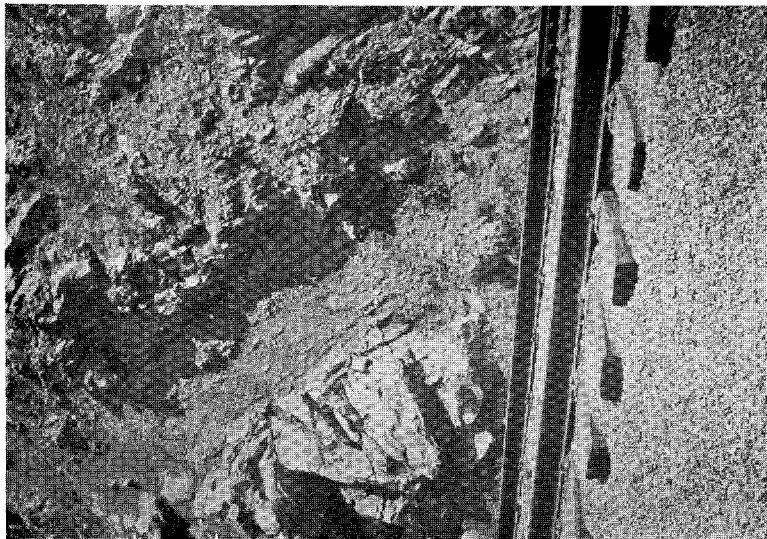


(A) View in railroad cut northwest of Indian, showing contact between Newman limestone below and underlying Grainger shale.

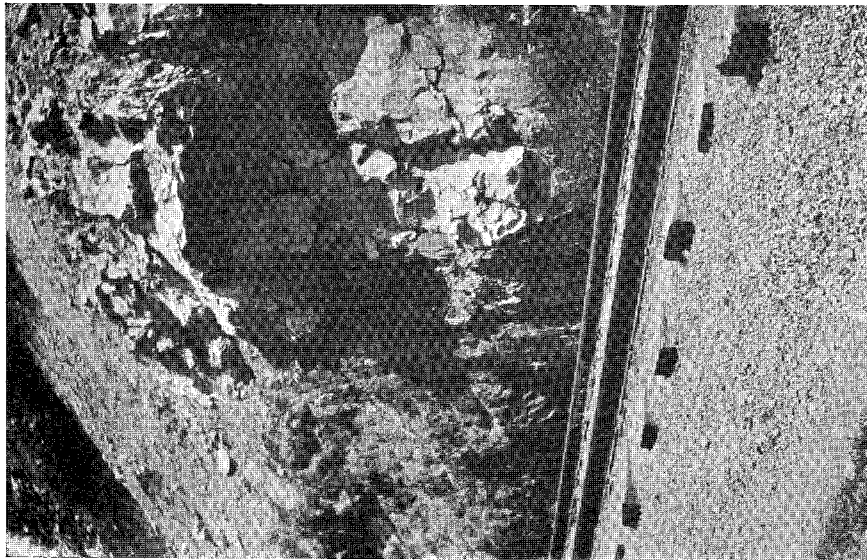


(B) View in railroad cut one-fourth mile northwest of Indian, showing Grainger shale.

PLATE V.—VIEWS SHOWING EXPOSURES OF ROCKS BELOW COAL-BEARING ROCKS.

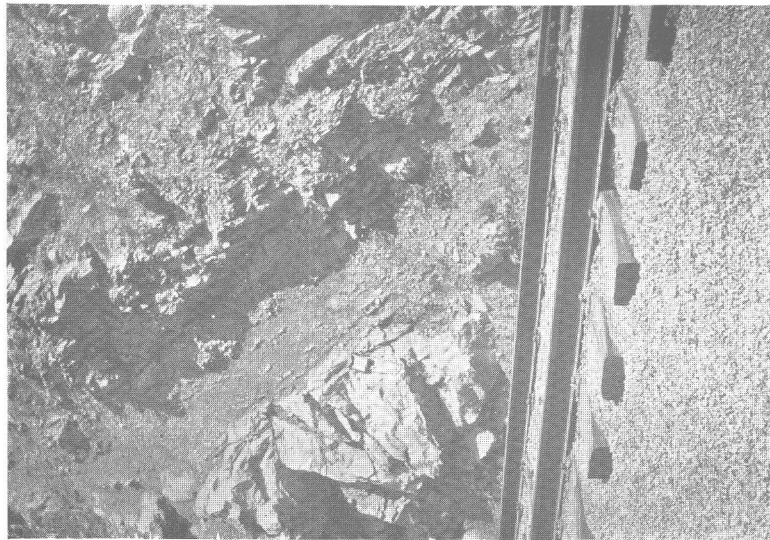


(A) View at Cedar Bluff, showing contact between the Knox dolomite (of Cambrian and Ordovician age) at left and the Russell formation (of Cambrian age).

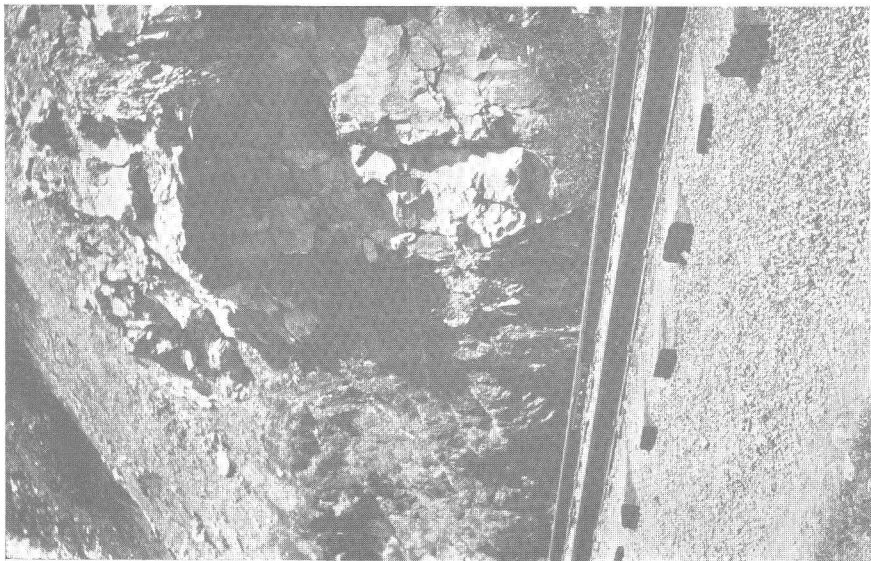


(B) View at Cedar Bluff, showing contact between Knox dolomite (at right) and Grainger shale.

PLATE VI.—VIEWS SHOWING CHARACTER OF FAULT CONTACTS IN AND ADJOINING THE AREA OF THIS REPORT.



(A) View at Cedar Bluff, showing contact between the Knox dolomite (of Cambrian and Ordovician age) at left and the Russell formation (of Cambrian age).



(B) View at Cedar Bluff, showing contact between Knox dolomite (at right) and Grainger shale.

PLATE VI.—VIEWS SHOWING CHARACTER OF FAULT CONTACTS IN AND ADJOINING THE AREA OF THIS REPORT.

Section in railroad cut near the mouth of Laurel Fork of Indian Creek.

	Feet.
Limestone, impure, blue, flaggy.....	20
Shale, red and yellow	3
Limestone, yellow crystalline containing fragments of red clay..	8
Clay, red, green and yellow.....	2
Shale, red	4
Clay-shale, light-drab	1
Limestone, impure, grading into fine-grained shaly sandstone at base	10
Sandstone, fine-grained, thin-bedded, bluish.....	40

The Newman limestone outcrops for a short distance along the crest of an anticline in Abbs Valley and in two narrow zones extending northeast from Richlands. The entire formation is exposed only in Crocketts Cove and for a few miles southwest. The thickness, as determined from several measurements in this locality, is 800 to 900 feet. The formation is composed of beds of thick-bedded, fairly pure limestone alternating with beds of calcareous shale and impure, flaggy limestone. Some of the shaly beds near the base show pink and green tints and a distinctive feature of the formation is the peculiar greenish-yellow color of most of the impure layers. Light-colored chert and black chert nodules are fairly abundant in some beds in the lower half and there are many fossils throughout.

The presence of a large quantity of limestone and shale, adjacent to a practically unlimited supply of fuel, makes this region ideal for the location of cement plants. The following analyses show that the formation also has great agricultural value either as lime or ground limestone.

Analyses of Newman limestone.

(Penniman and Brown, Analysts.)

	I	II	III	IV	V	VI
Insoluble siliceous matter.....	6.68	6.56	4.27	6.13	6.53	7.91
Oxide of iron.....	0.59	0.32	0.32	0.48	0.40	0.24
Alumina	0.36	0.38	0.18	0.20	0.26	0.63
Lime	49.14	50.75	51.94	51.87	51.45	48.51
Magnesia	2.27	0.93	1.18	0.40	0.44	2.13
Pure limestone (calculated).....	87.54	90.62	92.75	92.62	91.88	86.62

- I. Crockett Cove; three thin beds in lower 100 feet of formation.
- II. Crockett Cove; 50-foot bed 200 feet above base of formation.
- III. Crockett Cove; 100-foot bed 150 feet below top of formation.
- IV. Horsepen Cove; 40-foot bed at top of formation.
- V. Horsepen Cove; 50-foot bed 150 feet below top of formation.
- VI. Railroad cut, 1½ miles northeast of Cedar Bluff; 40-foot bed.

Pennington group.

BLUEFIELD SHALE.

Overlying the Newman limestone and grading into it are 1,100 to 1,300 feet of shale and limestone corresponding to the basal portion of the Pennington shale of the southwestern part of the State. To this series of beds Campbell gave the name Bluefield shale in the Pocahontas folio. The formation is chiefly greenish-yellow to yellow shale. Near the base it is calcareous and contains some lenticular beds of dove-colored limestone; the upper half is mostly sandy and thin sandstones are present near the top. Fossils are abundant in the limy portions of the formation.

The Bluefield shale outcrops in a broad belt through Abbs Valley and extends westward through Horsepen and Crockett coves. A small area has been included in the mapping near Adria. In valleys and on gentle slopes the lower part forms good soil and supports a luxuriant growth of blue-grass. The upper part is in most places covered with sand and talus from the overlying formation.

HINTON FORMATION.

The Hinton formation, 1,100 to 1,300 feet thick, occupies the middle part of the Pennington group and overlies the Bluefield shale. At its base, and forming a very distinct lower boundary, is a white, quartzitic sandstone about 75 feet thick, which forms great walls in Crockett and Horsepen coves (see Pl. VII). This same sandstone forms the straight, narrow ridges bordering the lower part of Abbs Valley. Above the basal sandstone the Hinton formation is chiefly red shale, although there are many green and yellow beds. Lenticular sandstones 2 to 20 feet thick are common near the top and bottom and a 20-foot bed of impure fossiliferous limestone was seen in several places.

Some prospecting has been done on thin streaks of coal occurring near the top of the Hinton formation on Big Branch, south of Abbs Valley. The principal opening was filled with water when visited but exposures in smaller pits and pieces of coal on the dump indicate that the bed is both thin and highly impure. It is also apparently of very limited extent, as no trace of coal was seen in this formation elsewhere. The Mississippian rocks of the area mapped probably contain no coal beds of economic importance, although such beds are present and are being utilized in other parts of the State. A fairly thick bed is being mined on New River by the

Pulaski Anthracite Coal Co., but its position is below the Newman limestone, hence it comes several thousand feet below the bed prospected on Big Branch.

PRINCETON SANDSTONE.

The Princeton sandstone is not an important formation in the area described in this report and justifies recognition as a separate formation only because it is a prominent formation of the Pennington group farther east. It outcrops along the lower part of Laurel Fork of Bluestone River and forms the backbone of the narrow ridge between Pocahontas and Boissevain, where it is 30 to 40 feet thick. In a quarry south of the town of Pocahontas the bed contains some white quartz and limestone pebbles imbedded in a calcareous matrix. These characters are typical of the formation farther east, but were not observed west of Laurel Fork. From Whiteoak Ridge eastward the Princeton sandstone closely follows the crest of Big Stone Ridge and is present in small areas on the southeast side. The sandstone is here fine-grained and quartzitic and not easily distinguished from the thinner beds above and below. For convenience the Princeton has been mapped with the overlying formation.

BLUESTONE FORMATION.

The Bluestone is the upper formation of the Mississippian red shales and includes the strata between the Princeton sandstone and the coal-bearing rocks of the Pennsylvanian series. The upper limit is not well defined but it is assumed by Campbell to be the base of a thick sandstone 360 feet below the Pocahontas coal and this boundary has been followed as closely as possible.

The Bluestone formation is principally red shale but there are also green and yellow beds. In the upper part especially there are thin quartzitic sandstones, and beds of impure limestone occur in some places. The formation is 700 to 800 feet thick. It outcrops in a narrow belt on the south side of Laurel Fork of Bluestone River and south of Big Stone Ridge, northeast of Adria.

UNDIFFERENTIATED PENNINGTON.

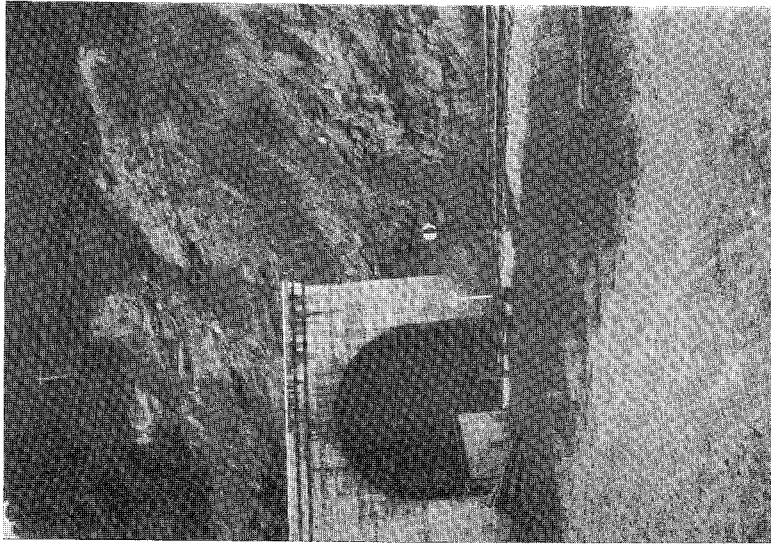
Beginning at the head of Horsepen Creek and extending westward almost to Raven is a long narrow zone of steeply dipping rocks in which it has been impossible to differentiate the formations. Except west of Rich-

lands the dip is uniformly to the southeast at angles of 40 to 60 degrees. Throughout its length the area is bounded by faults and chiefly for this reason an exact determination of the formations cannot be made. It is certain, however, that the rocks belong to the Pennington group, chiefly above the Bluefield shale, and are all or part of the Bluestone formation, the Princeton sandstone, and the Hinton formation. The red and green colors of the Pennington are conspicuous and fairly thick sandstones are present in some localities. The most notable of these sandstones forms the high ridge extending from Middle Creek to Laurel Fork of Indian, about $1\frac{1}{2}$ miles north of the railroad. It is fairly coarse and hard, contains many white quartz pebbles, and is at least 150 feet thick. What is probably the same sandstone may be traced almost continuously from Indian Creek to Dick Creek.

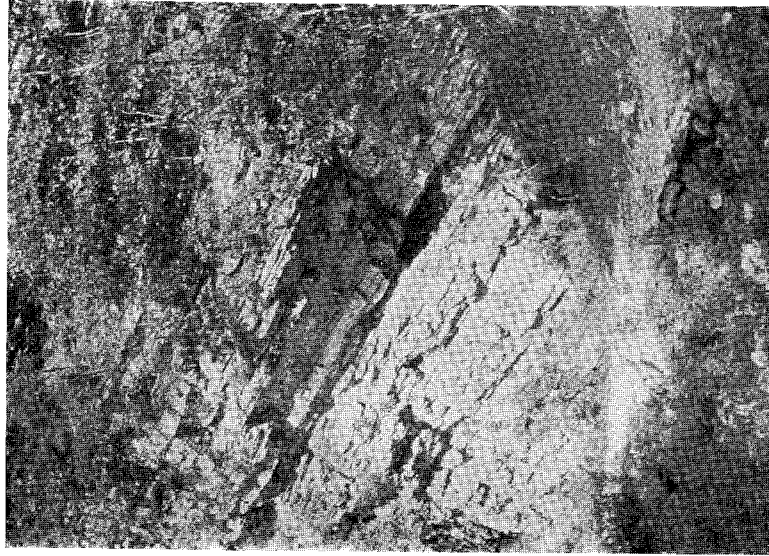
Pennsylvanian series.

GENERAL STATEMENT.

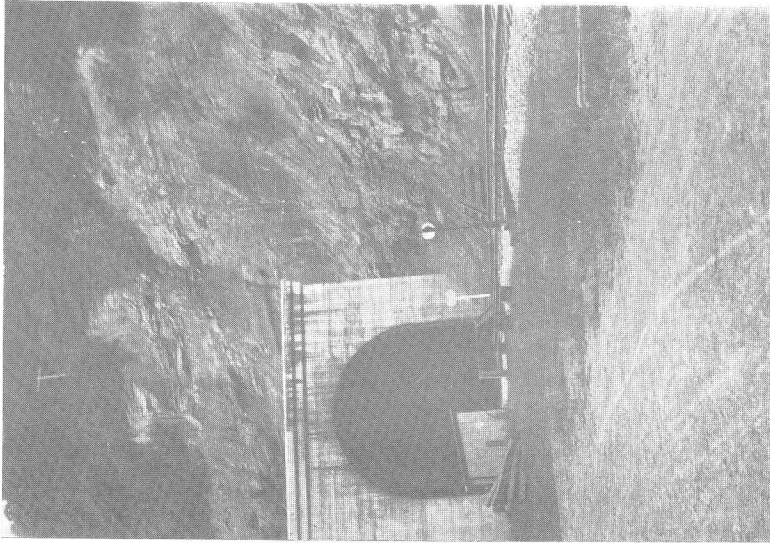
The Pennsylvanian series, in which occur all the commercially valuable coal deposits of this area, consists of sandstone, shale, coal, and thin beds of clay. Calcareous concretions are found at a few horizons, but are not persistent enough to be of value as markers. The rocks are all of Pottsville age and have been divided by Campbell into the Norton and Lee formations in the Estillville folio and in other reports in the extreme southwestern portion of the State. These formations have been traced from their type localities to this area and the names are used in recent reports of a series intended to cover the southwest Virginia coal field. Hence it seems advisable to ignore the local divisions used in the folios covering Tazewell County and to continue the nomenclature in use in the remainder of the coal field. The lithologic characters, on which the division of the Pennsylvanian series was based in the Cumberland Gap region, do not extend to this area. There is practically no difference between the beds comprising the Norton and Lee formations except that the latter contains a larger proportion of sandstone. Each is composed of interbedded layers of sandstone, shale, and coal, with no perceptible order of recurrence, and with no characteristics which are persistent over a large area. However, the division into formations shows the age-relation of the coal deposits of Tazewell County to other parts of the coal field and furnishes a means of grouping the individual beds. To effect a further grouping and to more clearly bring out the structure, the Lee is divided into two parts on the map.



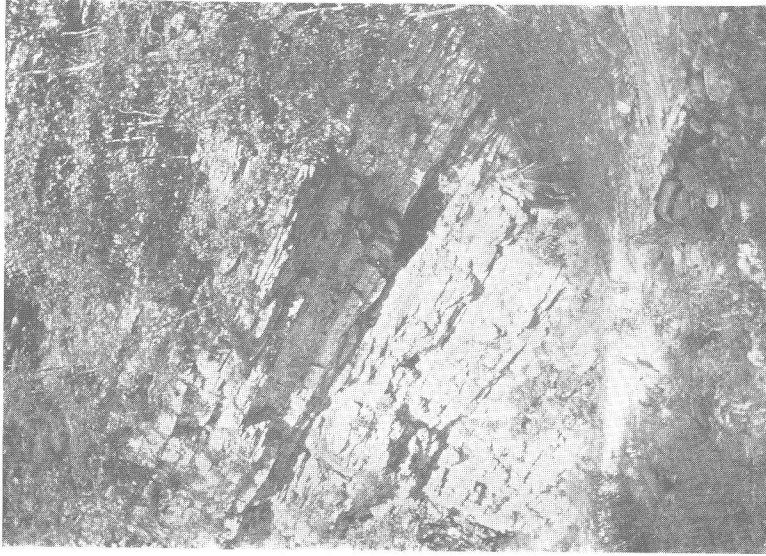
(A) View at west end of tunnel near Bandy, showing rocks above the Upper Horsepen coal bed, characteristic of the more shaly portions of the coal measures.



(B) View in Crockett Cove, showing sandstone at the base of the Hinton formation.



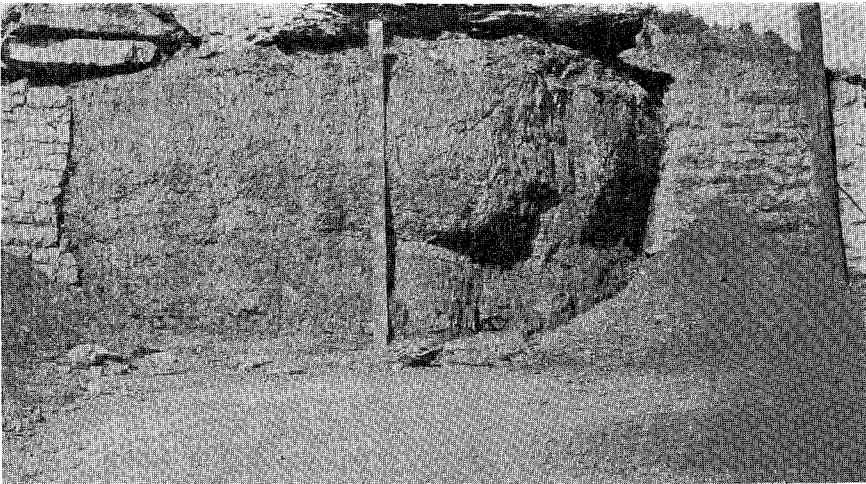
(A) View at west end of tunnel near Bandy, showing rocks above the Upper Horsepen coal bed, characteristic of the more shaly portions of the coal measures.



(B) View in Crockett Cove, showing sandstone at the base of the Hinton formation.



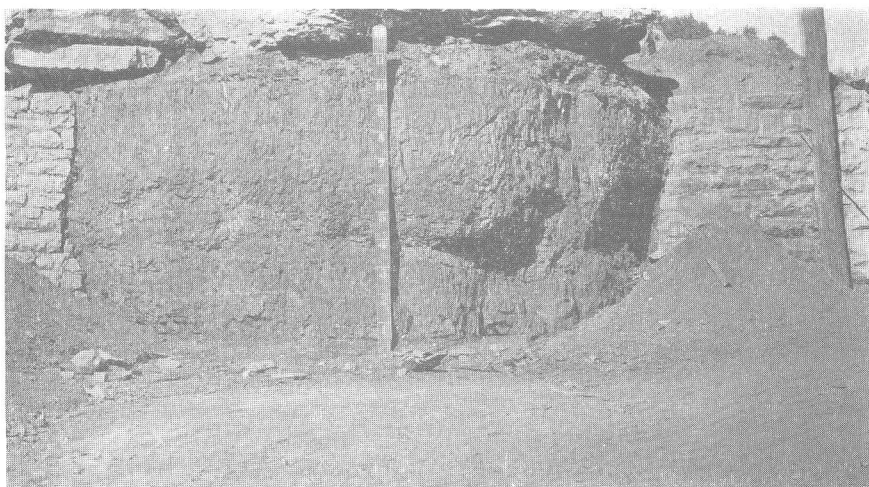
(A) Exposure of top bench of War Creek coal bed on Beech Fork (location 172).



(B) Exposure of Pocahontas No. 3 bed at Pocahontas.



(A) Exposure of top bench of War Creek coal bed on Beech Fork (location 172).



(B) Exposure of Pocahontas No. 3 bed at Pocahontas.

PLATE VIII.—EXPOSURES OF COAL BEDS IN TAZEWELL COUNTY.

Correlation of the coal beds outcropping in different parts of the area has been very difficult. Owing to the heavy mantle of soil and residual material it is impossible to actually follow the outcrop of the coal beds from place to place and irregularities of dip add to the difficulty. By very close detailed work, performed in the manner already described, it has been possible to locate and map the outcrops of the principal coals (see Pl. X).

The Pennsylvanian rocks in this area are composed of about equal parts of shale and sandstone, the latter being slightly more abundant in the lower part. Much of the sandstone is fine-grained and thin-bedded and contains many shaly beds. In general the coarse sandstone is massive and more resistant, forming conspicuous cliffs on the spurs. Practically all the sandstones show marked current bedding and irregularities due to deposition. The weathered sandstone is mostly buff to brown from iron stain, but the fresh material, such as is seen in diamond-drill cores, is light to dark gray, often with a bluish tinge. Grains of quartz, decomposing feldspar, and mica are the commonest constituents. Many of the sandstones contain well-rounded pebbles, either in layers or scattered. This conglomeratic feature frequently aids in identifying the bed over small areas but is not strictly reliable because the same sandstone does not contain pebbles in all localities.

Most of the rock type that has been described as shale is slightly sandy, and most of the shale beds grade into sandstone through the intermediate sandy shale. The common color is drab, but there are some streaks of yellow usually in the more argillaceous portions. Hard, slaty beds exposed along some of the smaller streams are distinctly blue.

The clay beds are generally associated with the coal, which will be discussed later. Thin layers of clay are present as partings in many of the coal beds, but the thick layers are just below the coal. Clay occurring above the coal is generally sandy and shows distinct laminations. No tests were made, but undoubtedly most of the clay is refractory and could be utilized for fire brick if found in sufficient quantities.

The fossils of the Pennsylvanian of this region are almost wholly plants and are found chiefly in the roof-shales of the coal beds. Collections were made from many horizons and their identification by David White has been a great aid in making correlations with other areas. Marine invertebrates are known from the roof-shale of the Pocahontas Nos. 3 and 6 coal beds but none was seen by the writer. The only fossil shells found were of fresh or brackish water types and came from shale above the Pocahontas No. 7.

LEE FORMATION.

The Lee formation covers above three-fourths of the area of Pennsylvanian rocks appearing at the surface in Tazewell County. For the purpose of showing the effects of structure it has been divided into two parts on the map. The Lee is first brought to the surface by the Dry Fork anticline on Mudlick Creek, from which it rises gradually toward the east until only the lower part has escaped erosion on Laurel Fork, in the vicinity of Pocahontas.

The top member of the formation is a massive sandstone about 100 feet thick. Locally it has a thin coal bed at the top and contains a few scattered, small, white pebbles. It is well exposed on the divide between Middle and Big creeks and was seen in a number of other places. The rocks of the Lee differ very little from those of higher Pennsylvanian formations and cannot be distinguished from them on lithologic grounds. In general the sandstones are less arkosic and contain a larger proportion of quartz grains.

The total thickness of the Lee, as compiled from incomplete sections measured on the larger streams, is 1,740 feet. As far as could be observed from outcrops there is very little variation in thickness, but the record of a deep bore hole (S C) on Seng Camp Fork, 8 miles north of Richlands, indicates that the thickness may be greater in the western part of the area. Northwest of the area mapped there is a marked decrease in the thickness which is irregular, due to the uneven surface on which the formation was deposited. Such an uneven contact or unconformity between the Lee and Pennington is recognized in many localities, but it is either lacking or too slight to be noticeable on Laurel Fork.

NORTON FORMATION.

The Norton formation is present only along Sandy Ridge and in the western part of the area. Small outliers cap the ridge tops as far east as Indian Creek, south of the Dry Fork anticline, and because of the higher land surface the outcrops extend around the head of this stream north of the anticline. Except for small patches of Lee on Town Hill and Mudlick creeks, the surface rocks west of West Fork are all Norton. The zone of overturned Pennsylvanian rocks is undoubtedly Lee throughout most of its length but west of Big Creek it may contain some Norton.

The thickness of the Norton in adjoining portions of Buchanan County is about 1,300 feet but only the lower 1,000 feet remain in Tazewell County, the highest portion capping Sandy Ridge near the Gap of Sandy. The

formation is composed of sandstone, shale, and coal, and is very similar to the underlying Lee. It contains a slightly greater proportion of shale beds and in general the sandstone is more arkosic. A detailed description of the coal beds and the rocks associated with them will be given in later pages. The stratigraphic succession, including the position of all coal beds, is given in the generalized sections (fig. 2).

UNDIFFERENTIATED PENNSYLVANIAN.

Bordering the level or slightly dipping rocks of the coal field along the southeast side is a narrow zone occupied by rocks of the same general character but mostly dipping at angles of 40 to 60 degrees. In this elongated area, which extends from Laurel Fork, 1½ miles east of Sayersville to Raven, it has not been possible to identify the coal beds with those outcropping elsewhere in the region. Practically all of the area is comprised of rocks belonging to the Lee formation but west of Big Creek some Norton may be included.

A number of coal beds in this zone have been prospected where they outcrop on Middle Creek, some of them being fairly thick. These beds are below stream level in the adjacent portion of the undisturbed area to the north, the strata having been simply overturned. The position of the outcropping coal bed relative to the faults bordering this zone is a rough index of its depth below the surface in the adjoining undisturbed area; beds successively outcropping toward the north being younger and hence at shallower depths (see Pl. XII).

QUATERNARY SYSTEM.

Recent Series.

ALLUVIUM.

Every stream in the area flows through unconsolidated material carried into the valleys by the action of running water. In the area of Pennsylvanian rocks the heads of the small hollows may be washed bare, the slope being too great for any loose material to remain. When the stream gradient has decreased sufficiently the narrow valleys accumulate boulders, pebbles, and sand, which are gradually assorted and carried downstream, their place being taken by more wash from the hillsides. Except near their mouths, the valleys of major streams originating in the coal field are filled with angular or rounded rocks of all sizes, most of the loose sand having

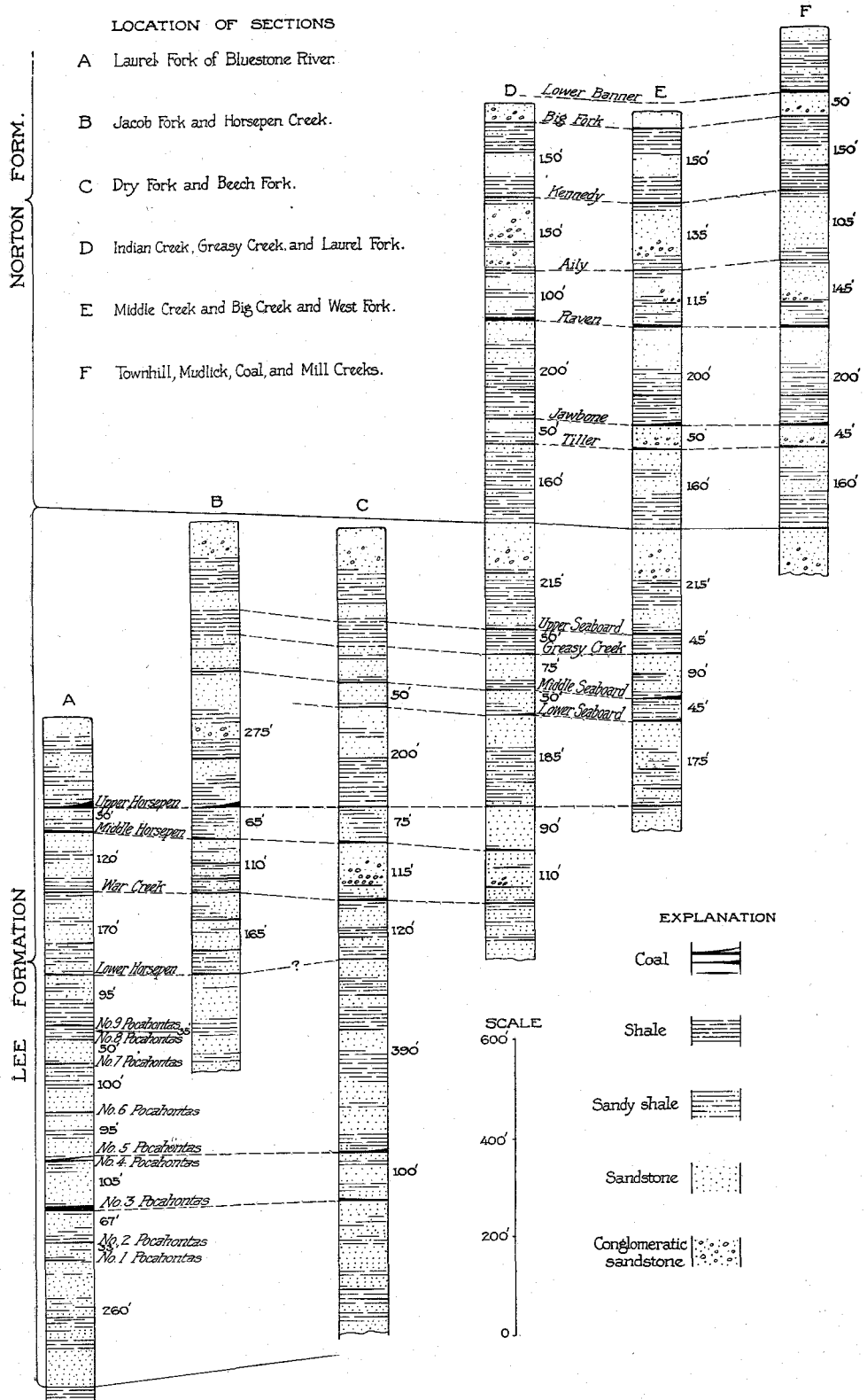


Fig. 2.—Generalized columnar sections of Pennsylvanian rocks in Tazewell County (average intervals in feet).

been washed away. In general the streams flowing through Mississippian rocks, especially the limy portions, have alluvial valleys. A very fertile type of alluvium, which is chiefly sandy loam, has accumulated in large quantities along Clinch River near Richlands.

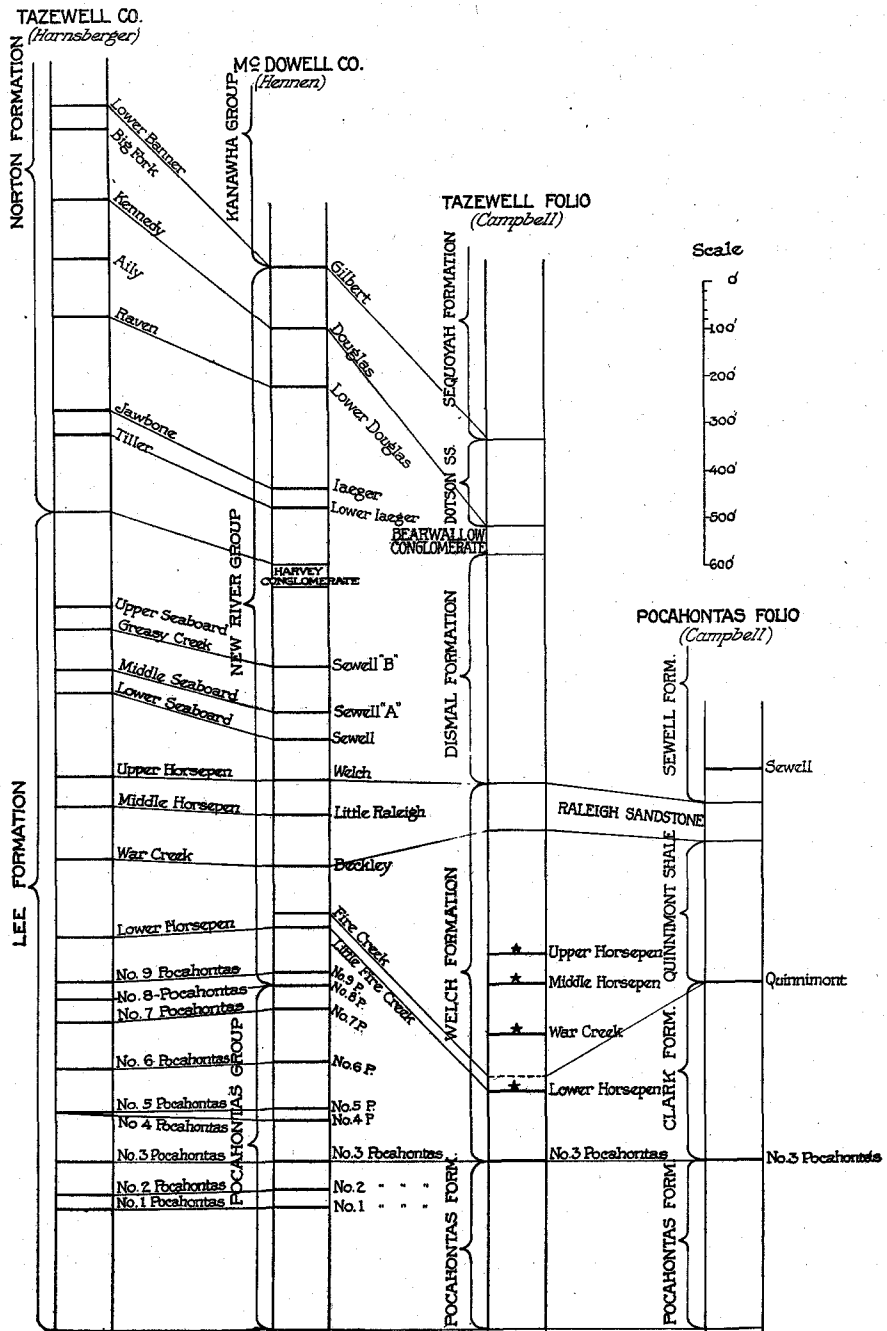
SOIL.

Soils are the result of decay and disintegration of the underlying formations and their character is therefore largely dependent upon the nature of the parent rock. In the area of Pennsylvanian rocks the soils are good only where erosive action is not too strong. Along Sandy Ridge, particularly near Bearwallow (see Pl. IV), and on some of the long even-topped spurs joining it, small areas have been cleared and are in grass or under cultivation. On the hillsides the soil is good in most localities but it is generally mixed with coarse talus, which makes it of little value for farming, and is soon washed away when the land is cleared and cultivated.

The best soils of the area are derived from the Newman limestone and the lower, limy portion of the Bluefield shale. Abbs Valley and Crockett and Horsepen coves owe their fertility to these formations. The Hinton forms narrow sandy ridges in most places and the resulting soil is of little value for agriculture. The poorest soil is furnished by the Grainger shale. The broad bottoms along Clinch River, near Richlands, are underlain by this formation but their soil is derived from the alluvium, not from the Grainger.

Correlations with adjoining areas.

The entire area covered by this report has been previously described by Campbell in the Tazewell and Pocahontas folios, prepared at a time when there were very few coal openings, and when little was known of the continuity of the beds. All of the coal-bearing formations and most of the coal beds were named and defined at distant localities and some errors were made in tracing them to Tazewell County. Steep dips and complicated folds resulting from the Dry Fork anticline and the neighboring fault to the southeast made accurate mapping next to impossible in the short time allotted to geologic investigation in this area, and irregularity in the sedimentation added to the uncertainties. Campbell's mapping of the formations outside the coal field has been followed very closely, both as to formation boundaries and as to structure, practically the only changes incorporated in the present report being those resulting from the use of a larger scale and more accurate base map.



* See page 21 for explanation of discrepancy in position of these coals.

Fig. 3.—Sections showing correlations with adjoining areas.

On Indian Creek, Campbell mapped the sandstone below the Greasy Creek coal as the Raleigh, and considered the Jawbone bottom-rock on Big Creek and streams to the west to be the same bed. Recent work by the West Virginia Geological Survey, however, makes it practically certain that the Raleigh sandstone of the type locality comes just below the Upper Horsepen coal, 580 feet below the top of the Lee. At its type locality on Bearwallow Knob, north of the Post-Office, the Bearwallow conglomerate is the sandstone a few feet below the Lower Banner coal and a sandstone mistaken for the Dotson is just above. The true Dotson, however, is the first sandstone below the Lower Banner coal, at its type locality at Wyoming (formerly Dotson) on Tug Fork, and a lower rock is mapped as the Bearwallow. The Horsepen coals were believed by Campbell to be much closer to Pocahontas No. 3 than they are now known to be, and consequently their identification in parts of the area to which they could not be actually traced is generally incorrect. His stratigraphic position of the Horsepen coal, relative to the Raleigh sandstone, is in error because that stratum, though a valuable key-rock elsewhere, is badly split by shale and not recognized in the vicinity of Horsepen.

Correlation of the Tazewell County coals with those recently described in McDowell County¹ has been difficult because of lack of coal openings in the portion of West Virginia adjacent to Tazewell County. Except for coal beds which have actually been traced and tied to definite horizons in McDowell County, the identifications made in this report are based entirely on stratigraphic data. Some plant collections were made but pressure of other work prevented David White, of the United States Geological Survey, from devoting the necessary time to their study; hence the correlations lack the broader application they might otherwise have had. Field work done in preparing the Buchanan County report has established the equivalency of the Jawbone, of Buchanan and Tazewell counties, and the Iaeger, of West Virginia; beds above the Jawbone beds have similarly been correlated with fair certainty. The Pocahontas coals have been numbered in accordance with the general usage but there may be some doubt about the correct identification of those above Pocahontas No. 6, most of the exposures being road blooms.

The Lower Horsepen coal, which Hennen identifies as Pocahontas No. 9, on Horsepen Creek, is here correlated with the Little Fire Creek, largely because of its position at the top of a strong sandstone, apparently

¹Hennen, R. V., Wyoming and McDowell counties: West Virginia Geol. Survey, 1915.

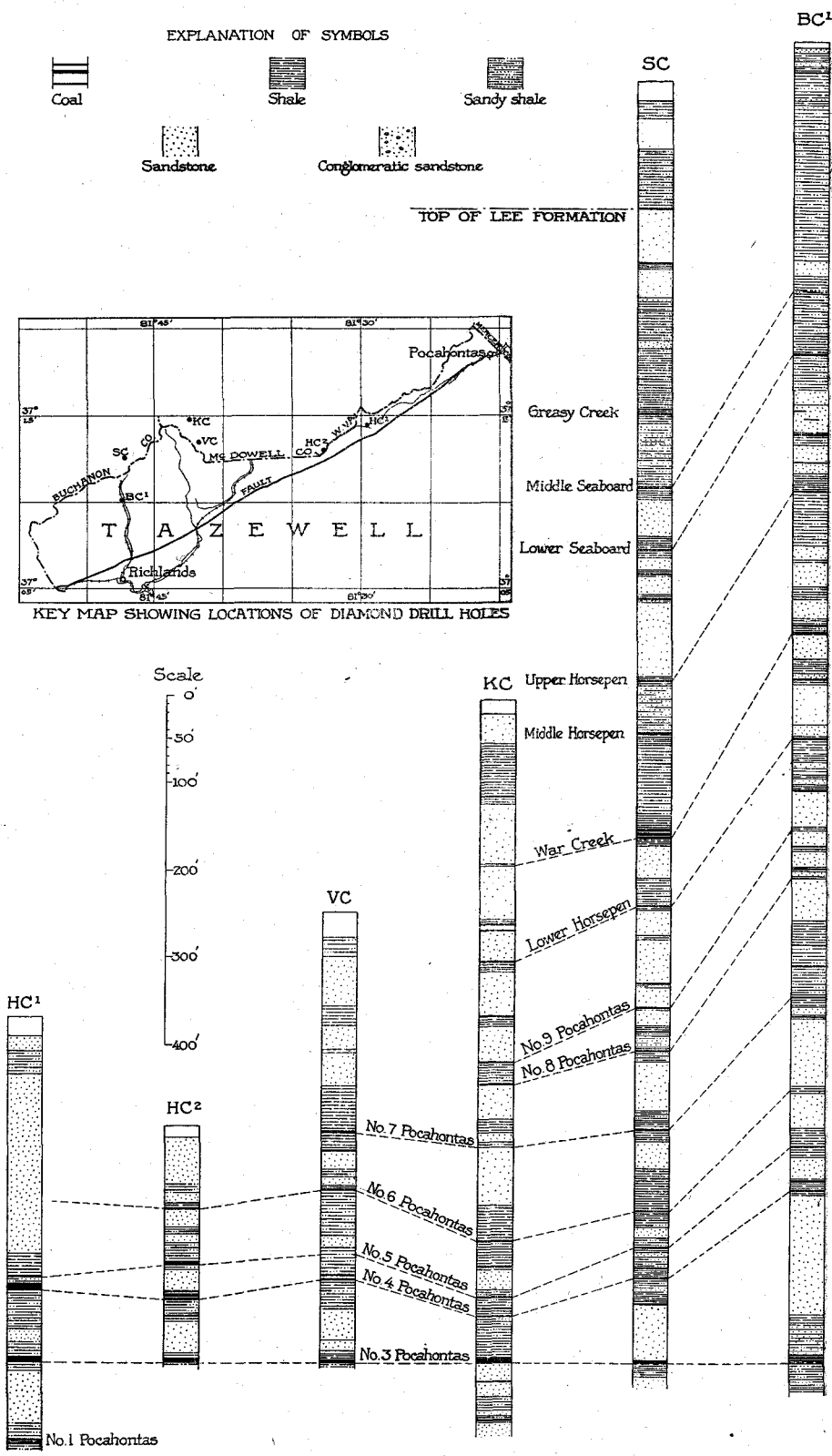


Fig. 4.—Sections of diamond drill prospect holes in or near Tazewell County.

the Pineville sandstone of the West Virginia Geological Survey. On Laurel Fork of the Bluestone there are two beds close above the Lower Horsepen, one of which may correspond to the Fire Creek. A coal opening on the lower part of Horsepen Creek (location 111), which Hennen thinks is in the Fire Creek bed, is believed to be only about 50 feet below the War Creek coal and is the upper of two coal beds between this horizon and the Lower Horsepen. A 5-foot bed, opened at the head of a hollow a mile west of Horsepen Post-Office (location 128), he identifies as the War Creek, but it is here assigned to the Middle Horsepen because of its thickness and stratigraphic relation to the Lower Horsepen.

A sandstone which reaches a thickness of 200 feet and which forms conspicuous cliffs on Beech Fork, is apparently the Raleigh of the West Virginia Geological Survey. The Upper Horsepen coal at its top has therefore been correlated with the Welch, and the War Creek, at its base, with the Beckley. East and west of Beech Fork, this thick sandstone is broken by shale beds and the Middle Horsepen, which appears in the upper half, probably corresponds to the Little Raleigh.

Above the Upper Horsepen there is a considerable expansion of the section in Tazewell County, many of the intervals between coal beds increasing to twice the thickness recognized to the north. This is in accord with the general thinning to the northwest, brought out by detailed work in Buchanan County.¹ At the Breaks of Sandy, 30 miles northwest, the Lee formation, which is here 1,740 feet thick, has thinned to about 800 feet, is almost all sandstone, and contains practically no coal.

Diamond drill prospecting.

Comparatively little drilling has been done in the area and very few of the records were available for publication. The location of all drill holes found has been shown on the map, reference letters accompanying those described in the text. The records of three shallow holes drilled on Coal Creek could not be obtained, nor were the detailed logs available for the holes on West Fork (WF) and on Big Creek at Seaboard (BC 2). A deep boring was completed by the New River and Pocahontas Consolidated Coal Co. at the head of Indian Creek at the time the field work was done and several more holes were planned for that vicinity. The record of this boring would have been invaluable in correlating but it could not be obtained even for confidential use. Logs of borings on Dry Fork and Laurel Fork were also unavailable.

¹ Hinds, Henry, *Geology and Coal Resources of Buchanan County, Virginia*: Va. Geol. Survey Bull. No. XVIII, 1918.

The four records following are quoted from reports of the West Virginia Geological Survey; few changes have been made in the correlations.

Boring on Upper Horsepen Creek, 1.6 miles northeast of Horsepen Post-Office.

(HC 1, elevation 2,178)

	Thickness.		Depth.				
	Ft.	in.	Ft.	in.			
Sand and gravel and boulders.....	21	0	21	0			
Sandstone	18	0	39	0			
Shale, sandy	28	0	67	0			
Shale	6	0	73	0			
Sandstone	200	0	273	0			
Shale	25	4	298	4			
Coal (Pocahontas No. 5)	2	8	301	0			
Shale, sandy	1	0	302	0			
Shale	5	1	307	1			
Coal with shale bands, 0 ft. 11 in. } (Pocahontas	8	4	315	5			
Coal					7	5	No. 4)
Shale, sandy	39	7	355	0			
Shale	6	0	361	0			
Sandstone, shaly	2	0	363	0			
Sandstone	10	0	373	0			
Shale, sandy	18	1	391	1			
Coal (Pocahontas No. 3)	7	1	398	2			
Shale, sandy	7	10	406	0			
Sandstone	60	0	466	0			
Shale, sandy	19	2	485	2			
Coal	7	1	492	3			
Shale					0	4	} (Pocahontas
Shale					5	11		No. 1)
Coal	0	10					
Sandy shale to bottom	1	9	494	0			

Boring on Horsepen Creek, three-fourths mile north of Shraders Post-Office.

(HC 2, elevation 1,811)

	Thickness.		Depth.	
	Ft.	in.	Ft.	in.
Sand	7	0	7	0
Sand and boulders	9	0	16	0
Sandstone	54	0	70	0
Shale, sandy	9	0	79	0
Sandstone	10	0	89	0
Shale	7	5	96	5
Coal (Pocahontas No. 6)	0	11	97	4
Shale	0	8	98	0
Sandstone	20	0	118	0
Shale	3	0	121	0
Sandstone, shaly	5	0	126	0
Sandstone	10	0	136	0
Shale, sandy	18	0	154	0
Shale	2	10	156	10

	Thickness.		Depth.	
	Ft.	in.	Ft.	in.
Coal (Pocahontas No. 5)	5	6	162	4
Shale, sandy	3	8	166	0
Sandstone	25	0	191	0
Shale	0	8	191	8
Coal, slaty	1 ft.	4 in.	} (Pocahontas No. 4)	200
Shale	2 "	1 "		
Coal	3 "	9 "		
Shale	0 "	6 "		
Coal	0 "	10 "		
Shale, sandy	15	11	216	1
Coal	0	6	216	7
Shale, sandy	6	5	223	0
Sandstone, shaly	3	0	226	0
Sandstone	37	0	263	0
Shale	6	3	269	3
Coal	5 ft.	3 in.	} (Pocahontas No. 3)	275
Shale	0 "	3 "		
Coal	0 "	3 "		
Shale, sandy	4	0	279	0

*Boring on Vall Creek, two and three-fourths miles east of Bearwallow
Post-Office.*

(VC, elevation 2,065)

	Thickness.		Depth.	
	Ft.	in.	Ft.	in.
Surface soil	28	0	28	0
Shale, dark, sandy	22	0	50	0
Sandstone	57	0	107	0
Shale, dark	16	0	123	0
Slate, black	4	0	127	0
Fire clay	1	6	128	6
Sandstone	28	0	156	6
Soapstone	2	6	159	0
Sandstone	38	0	197	0
Shale, dark	53	0	250	0
Coal (Pocahontas No. 7)	0	9	250	9
Fire clay	3	3	254	0
Shale, dark	17	0	271	0
Coal	0	8	271	8
Fire clay	1	0	272	8
Sandstone	24	4	297	0
Shale, dark, sandy	7	0	304	0
Sandstone	10	0	314	0
Shale	4	0	318	0
Coal (Pocahontas No. 6)	0	8	318	8
Fire clay	2	4	321	0
Shale, dark, sandy	48	0	369	0
Sandstone	15	0	384	0
Slate, black	6	0	390	0
Shale, dark, sandy	24	0	414	0
Coal	0	1	414	1
Shale, dark	4	0	418	1
Coal, 7 in. bony (Pocahontas No. 4)	1	10	419	11

	Thickness.		Depth.		
	Ft.	in.	Ft.	in.	
Fire clay	12	1	432	0	
Shale, dark, sandy	13	0	445	0	
Soapstone	7	0	452	0	
Sandstone	38	0	490	0	
Soapstone	1	0	491	0	
Sandstone	11	6	502	6	
Soapstone	1	0	503	6	
Sandstone	2	0	505	6	
Shale, dark	2	6	508	0	
Shale, black	0	6	508	6	
Coal	2 ft. 0 in.		} (Pocahontas No. 3)		
Coal, bony	0 " 4½ "			3	1
Coal	0 " 8½ "				
Shale, dark	1	0	512	7	
Shale, hard, sandy to bottom.....	4	5	517	0	

*Boring on Kewee Creek, two and one-half miles northeast of Bearwallow
Post-Office.*

(K C, elevation 1,955)

	Thickness.		Depth.		
	Ft.	in.	Ft.	in.	
Surface soil	16	0	16	0	
Sandstone	33	0	49	0	
Shale, dark	37	0	86	0	
Slate, black	17	0	103	0	
Shale, dark	6	0	109	0	
Coal		5	109	5	
Fire clay	8	0	117	5	
Sandstone	68	7	186	0	
Shale, dark	3	0	189	0	
Sandstone	58	0	247	0	
Shale, dark	7	0	254	0	
Coal	0 ft. 6 in.		}		
Coal, bony	0 " 3 "			9	1
Clay	4 " 0 "				
Shale, dark	2 " 3 "				
Coal and shale	2 " 1 "				
Shale, dark, sandy	4	0	267	1	
Sandstone	29	7	296	8	
Shale, black	0	10	297	6	
Coal	0 ft. 1 in.		} (Lower Horsepen)		
Clay	1 " 5 "			2	0
Coal, bony	0 " 6 "				
Clay	5	0	304	6	
Shale, dark, sandy	5	0	309	6	
Sandstone	50	6	360	0	
Coal, bony	0 ft. 5 in.		}		
Clay	1 " 4 "			1	11
Coal	0 " 2 "				
Clay, shale	10	1	372	0	
Sandstone	42	0	414	0	
Coal (Pocahontas No. 9)	0	4	414	4	
Clay, shaly	3	8	418	0	

DIAMOND DRILL PROSPECTING

	Thickness.		Depth.	
	Ft.	in.	Ft.	in.
Shale, sandy	22	0	440	0
Coal, bony	0	2 in.	440	5
Coal, good	0	3 "		
	} (Pocahontas No. 8)			
Clay	1	0	441	5
Sandstone	40	7	482	0
Shale, dark	14	0	496	0
Sandstone	10	0	506	0
Shale, dark, sandy	6	10	512	10
Sandstone	67	2	580	0
Shale, dark	38	6	618	6
Coal, bony (Pocahontas No. 6)	0	8	619	2
Clay, sandy	5	0	624	2
Shale, dark	21	4	645	6
Coal	0	10	646	4
Clay	4	0	650	4
Sandstone	23	0	673	4
Shale, dark, sandy	7	8	681	0
Coal	1	0 in.	682	8
Binder	0	6 "		
Coal	0	2 "		
	} (Pocahontas No. 5)			
Shale, dark	13	8	696	4
Coal	1	0 in.	705	10
Clay, shale	7	8 "		
Coal, bony	0	10 "		
	} (Pocahontas No. 4)			
Clay, shale	4	0	709	10
Shale, dark, sandy	23	2	733	0
Shale, black	22	11	755	11
Coal, bony	2	10 in.	759	4
Coal	0	7 "		
	} (Pocahontas No. 3)			
Clay, shale	3	9	763	1
Sandstone	22	3	785	4
Coal	0	3	785	7
Sandstone	18	0	803	7
Shale, dark, sandy	16	0	819	7
Sandstone	5	5	825	0
Shale, dark	1	6	826	6
Coal, bony	0	10 in.	828	5
Clay, shale	0	5 "		
Coal, bony	0	8 "		
	}			
Clay, shale	1	7	830	0
Sandstone	18	0	848	0

The following excellent record of a diamond-drill boring near the head of Seng Camp Fork of Dismal Creek, furnished by officers of the Pocahontas Mining Corporation, shows all of the Lee formation, except 300 to 350 feet at the base and the lower part of the Norton:

Boring on Seng Camp Fork, 2 miles north of Jewell.

(S C, elevation about 2,260)

	Thickness. Ft. in.	Depth. Ft. in.
Alluvium:		
Sand and boulders (Tiller coal horizon 3 feet below top)	23	23
Norton formation:		
Shale, sandy	20	43
Sandstone	35	78
Shale, sandy	70	148
Shale, blue	1	149
Coal	10	149 10
Clay	8	150 6
Lee formation:		
Sandstone	61	211 6
Shale, dark	1	211 7
Coal	1	212 8
Shale, dark	6	218 10
Sandstone	33	252 4
Shale, with sandstone partings	28	280 4
Shale, blue, sandy	23	303 4
Sandstone	9	313
Shale, blue, sandy	10	323
Shale, with sandstone partings	13	336
Shale, blue, sandy	28	364
Sandstone, with shale partings	8	372
Shale, blue, sandy	10	382
Shale, dark	2	384 4
Coal	1 ft. 0 in.	
Shale, dark	0 " 9 "	} (Greasy Creek)
Coal	0 " 6 "	
Shale, dark	6	392 7
Shale, light	4	396 7
Sandstone, with shale partings	25	421 7
Shale, with sandstone partings	30	451 7
Shale, blue, sandy	12	464
Shale, dark	1	465 6
Shale, with coal partings	6	466
Coal	0 ft. 2 in.	
Shale, dark	0 " 2 "	} (Middle Seaboard)
Coal	0 " 3 "	
Shale, black	3 " 2 "	
Coal	0 " 11 "	
Shale, dark	6	471 2
Shale, light	11	482 2
Sandstone	42	525
Shale, blue	11	536

	Thickness.		Depth.				
	Ft.	in.	Ft.	in.			
Shale, black		4	536	4			
Coal (Lower Seaboard)	1	10	538	2			
Shale, dark		3	539	5			
Sandstone, with shale partings	11		550	5			
Sandstone	13		563	5			
Shale, dark, with coal partings	4	7	568				
Coal		4	568	4			
Clay		8	569				
Shale, sandy	2	2	571	2			
Sandstone	19		590	2			
Shale, blue	4	7	594	9			
Coal		9	595	6			
Clay	1	6	597				
Shale, blue, sandy	2	6	599	6			
Sandstone	85	4	684	10			
Shale	4	6	689	4			
Coal (Upper Horsepen)	2		691	4			
Clay		8	692				
Shale, dark	8		700				
Sandstone, with shale partings	32		732				
Shale, blue, sandy	14		746				
Shale, dark		8	746	8			
Coal (Middle Horsepen)	2	4	749				
Shale, dark		3	752				
Shale, blue		13	765				
Shale, dark, sandy		80	845				
Shale, dark		12	857				
Coal	2 ft.	6 in.	} (War Creek)	10	6	867	6
Slate	0 "	1 "					
Coal	0 "	6 "					
Bone and slate	0 "	6 "					
Coal	2 "	8 "					
Slate	0 "	4 "					
Bone and coal	2 "	10 "					
Coal	1 "	1 "					
Clay		3	870	6			
Shale, dark		3	874				
Shale, light, sandy		3	877				
Sandstone		38	915				
Shale, light, sandy		30	945				
Shale, black		1	946				
Coal (Lower Horsepen)		3	946	3			
Clay		1	947	9			
Shale, light		3	950	9			
Sandstone, very hard		30	980	9			
Sandstone, with shale partings		5	985	9			
Sandstone		47	3	1,033			
Coal	0 ft.	7 in.	}	1	2	1,034	2
Shale, dark	0 "	3 "					
Coal	0 "	4 "					
Shale, dark		10	1,035				
Shale, light, sandy		3	1,038				
Sandstone		22	1,060				
Shale, dark		1	4	1,061	4		
Coal (Pocahontas No. 9)		8	1,062				
Clay		1	1,063				

	Thickness.		Depth.	
	Ft.	in.	Ft.	in.
Shale, light, sandy	2		1,065	
Sandstone	18		1,083	
Shale, light	4		1,087	
Shale, with coal partings		6	1,087	6
Shale, light	1		1,088	6
Shale, dark		6	1,089	
Bone		1	1,089	1
Shale, dark		11	1,090	
Coal	0	ft. 2 in.		
Shale, dark	0	" 4 "		
Coal	0	" 2 "		
Shale, dark		2	1,090	10
Shale, light, sandy	3		1,094	
Sandstone, with shale partings	14	6	1,108	6
Shale, dark	3	6	1,112	
Coal (Pocahontas No. 8)		8	1,112	8
Clay		6	1,113	2
Shale, light, sandy	11	10	1,125	
Sandstone, gray	56		1,181	
Shale, dark	2		1,183	
Sandstone and shale	3		1,186	
Shale, sandy	6	6	1,192	6
Shale, blue	8		1,200	6
Shale, dark		6	1,201	
Coal (Pocahontas No. 7)	1		1,202	
Clay		6	1,202	6
Shale, blue	12	6	1,215	
Sandstone, gray	30		1,245	
Shale, dark	49		1,294	
Coal (Pocahontas No. 6)	1		1,295	
Shale, dark		2	1,295	2
Clay	4		1,299	2
Shale, light, sandy	1	8	1,300	10
Shale, dark	4		1,304	10
Clay	3		1,307	10
Shale, sandy	4	6	1,312	4
Sandstone, gray	13		1,325	4
Shale, blue, sandy	9		1,334	4
Coal (Pocahontas No. 5)	1	2	1,335	6
Shale, light	1	6	1,337	
Sandstone, gray	6	6	1,343	6
Shale, sandy	6	6	1,350	
Shale, gray, sandy	9		1,359	
Shale, dark	2		1,361	
Bone		2	1,361	2
Coal		10	1,362	
Clay	1		1,363	
Shale, dark	8	6	1,371	6
Coal (Pocahontas No. 4)		4	1,371	10
Shale, dark	1	2	1,373	
Sandstone, with shale partings	5		1,378	
Shale, with sandstone partings	12		1,390	
Shale, blue	8		1,398	
Shale, dark	4		1,402	
Coal		4	1,402	4
Clay	1	8	1,404	

	Thickness.		Depth.	
	Ft.	in.	Ft.	in.
Sandstone	60		1,464	
Coal 1 ft. 0 in. } (Pocahontas	2		1,466	
Shale 0 " 1 " } No. 3)				
Coal 0 " 11 " }				
Bone	3		1,466	3
Clay	2		1,468	3
Shale, sandy	16		1,484	3
Sandstone	15	9	1,500	

The record of a deep boring on the upper part of Big Creek, furnished by Mr. W. B. Crawford, defies satisfactory correlation, but is nevertheless given for what it may be worth. It shows no resemblance to the record of the Seng Camp drilling, $2\frac{1}{2}$ miles north, and is entirely unlike the stratigraphic sections measured where the corresponding strata outcrop to the east. It is possible that the hole has been put down at a place where the beds have been slightly crumpled.

Boring on Big Creek, three-fourths mile south of Jewell.

(BC 1, elevation 2,378)

	Thickness.			
	Ft.	in.		
Sand and gravel	6	0		
Gray sandstone	6	0		
Shale	10	0		
Sandstone	4	6		
Shale	7	6		
Coal	0	2		
Shale, sandy seams	41	0		
Sandy shale	170	0		
Sandstone	21	0		
Shale	17	0		
Sandstone, coal streaks	5	0		
Sandy shale	48	0		
Shale	18	0		
Black shale	1	0		
Coal 0 ft. 4 in. } (Lower Seaboard)	3	2		
Shale 0 " 4 " }				
Coal 2 " 6 " }				
Shale	1	4		
Sandy shale	11	8		
Sandstone	5	0		
Sandy shale	24	0		
Sandstone	18	0		
Sandstone, coal streaks	27	2		
Black shale	1	8		
Coal	1	0		
Black shale	1	3		
Sandy shale	13	11		
Gray sandstone	15	9		
Shale	0	7		
Coal	0	9		

	Thickness.	
	Ft.	in.
Sandstone, coal streaks	16	8
Black shale	9	3
Gray shale	7	0
Bone	0 ft. 2 in.	} (Upper Horsepen)
Coal	0 " 3 "	
Shale	1	5
Shale	26	0
Black shale	3	0
Sandy shale	37	0
Sandstone	15	0
Blue shale	6	0
Gray sandstone	25	0
Sandy shale	5	0
Blue shale	12	0
Gray sandstone	18	0
Sandy shale	7	0
Coal	0	8
Sandy shale	6	2
Coal (War Creek)	1	11
Shale	3	11
Sandstone	27	0
Sandstone, coal streaks	2	0
Sandy shale	15	0
Sandstone	4	9
Black shale	0	3
Coal	0 ft. 1 in.	}
Bone	0 " 3 "	
Blue shale	5	8
Gray sandstone	45	0
Sandstone	10	0
Shale	2	9
Coal	1 ft. 6 in.	} (Lower Horsepen)
Shale	0 " 2 "	
Coal	0 " 1 "	
Shale	17	6
Sandy shale	3	0
Shale	7	0
Sandstone	4	0
Shale	1	0
Sandstone	1	0
Shale	0	6
Sandstone	4	6
Shale	5	0
Sandstone	7	0
Shale	7	9
Shale	0	7
Bone	0 ft. 5 in.	}
Coal	1 " 6 "	
Bone	0 " 2 "	
Coal	0 " 6 "	
White sandstone	42	1
Shale	4	0
Sandstone	18	0
Coal	0	4
Shale	6	11
Sandstone	17	0

	Thickness.	
	Ft.	in.
Shale	1	7
Coal	0	3
Shale	1	6
Sandstone	3	0
Coal (Pocahontas No. 8)	0	2
Shale	1	6
Sandstone	51	0
Shale	33	4
Coal	0	3
Sandy shale	14	4
Coal	0	5
Shale	8	8
Sandy shale	23	0
Black shale	3	9
Coal (Pocahontas No. 7)	0	5
Blue shale	10	0
Sandstone	8	1
Shale	4	5
Coal	0	4
Sandstone	77	3
Shale	10	0
Sandstone	48	0
Shale	23	4
Coal (Pocahontas No. 5)	0	6
Shale	12	2
Sandstone	24	0
Shale	1	3
Coal	2	1
Shale	8	10
Coal (Pocahontas No. 4)	1	1
Shale	5	9
Sandstone	135	0
Shale	16	0
Sandy shale	35	0
Shale	2	9
Sandstone	0	8
Coal	1 ft. 3 in.	
Bone	0 " 1½ "	
Coal	0 " 3½ "	
Shale	1 " 1 "	
Bone	0 " 1½ "	
Shale	0 " 6 "	
Bone	0 " ½ "	
Shale	0 " 8 "	
Coal	0 " 3½ "	
Shale	0 " 1½ "	
Coal	1 " 7 "	
Bony coal	1 " 0 "	
} (Pocahontas No. 3)		
Sandy shale	6	6
Shaly sandstone	17	0
Blue shale	5	0
Limestone?	2	0

Mr. Zeigler is authority for information regarding the drill holes on West Fork and on Big Creek at Seaboard. At the latter locality (BC 2)

the Middle Horsepen, 33 inches thick, was reached at a depth of 275 feet; the War Creek, 91 feet lower, had a total thickness of 55 inches but contained 13 inches of shale, 17 inches from the bottom. The shallow test on West Fork (WF) showed about 3 feet of coal in the Upper Seaboard, 60 feet below the surface.

The following log is that of a diamond-drill hole near the station at Pocahontas, the exact location of which could not be determined; the section was measured from the bore hole northward along the ridge east of Coal Run. Up to coal bed No. 5 the measurements were made with spirit level; above No. 5 with a barometer.

Geologic section and record of bore hole at Pocahontas, by Lathrop.¹

	Thickness.	
	Ft.	in.
Concealed	40	0
Coal bed No. 7 (8)	2	0
Concealed	20	0
Coal bed No. 6 (7)	1	6
Concealed	80	0
Coal bed No. 5 (6) { Coal	2	6
{ Bone and dirt	2	0
Concealed (horizon of No. 5 is 20-30 feet above base)	91	0
Coal bed No. 4	2	0
Concealed	90	0
Sandy fire clay	6	0
Coal bed No. 3 { Coal	10	0
{ Shale	0	3
{ Coal	1	0
Fire clay	6	0
Shales and sandstone	61	0
Coal bed No. 2 { Coal	1	0
{ Shale	2	0
{ Coal	1	0
Concealed to level of Pocahontas station	12	6
Record continued in diamond drill hole.		
Gray sandstone	15	4
Coal bed No. 1	1	0
Shale	2	0
Sandstone	27	6
Shale	3	0
Gray sandstone	35	4
Sandstone, with streaks of coal	8	8
Sandstone and shale	27	2
Gray sandstone	4	0
Gray sandstone and shale	8	5
Fire clay and shale	8	10
Blue slate	7	10
Sandstone and shale	15	1
Gray sandstone	17	0

¹ Published in *The Virginias* for June, 1884, p. 97.

	Thickness.	
	Ft.	in.
Dark shale	27	1
Blue sandstone	26	3
Blue sandstone, very hard	26	4
Shale	1	0
Gray sandstone	23	10
Dark shale, lighter at bottom.....	102	7
Gray sandstone	3	0
Gray shale	2	4
Gray sandstone	1	6
Gray shale	2	0
Red shale	7	6

The nomenclature of this type section was subsequently modified by I. C. White¹ (changes in parentheses), coal beds Nos. 5, 6, and 7 being changed to 6, 7, and 8, when it was found that a fifth bed was present in the concealed interval above No. 4.

GEOLOGIC STRUCTURE.

Method of Representation.

The position in which coal and other beds lie in a region in which dips are low, is best shown by means of structure contours—lines drawn so that some important or easily recognizable reference stratum is at the same elevation along any one of them, and a certain conventional distance, the contour interval, above or below that elevation along the next line. The contour interval used for this report is 50 feet, and the datum of the elevations shown by the structure contours is the same as that of the topographic contours—mean sea-level. In the Tazewell County coal field only the coal beds in the lower part of the Lee extend over the entire area, but they are deeply buried and their elevation cannot be ascertained in the western part. Therefore, a different reference stratum has been used in the two parts of the area; the Raven coal bed in the western and the Pocahontas No. 3 in the eastern, different colors serving to distinguish them on the geologic map.

By reading the structure contours on the geologic map it is possible to determine the direction and magnitude of the dip at any point and to determine the position and elevation of any of the coal beds. It is frequently convenient to employ the contours for the latter use when the outcrop of a coal is deeply buried beneath talus and soil, or when the bed is

¹ White, I. C., Supplementary coal report: West Virginia Geol. Survey, vol. 2 (A), pp. 103-104, 1908.

below drainage. For example, if it is desired to find the position of the Middle Horsepen at some point on Indian Creek, the elevation of the Raven horizon, as shown by the structure contours, is first noted. Then the interval between the Middle Horsepen and the Raven is ascertained for that locality from the detailed description of the Middle Horsepen on that stream or from the generalized sections in figure 2. As the Middle Horsepen is below the Raven, this interval subtracted from the elevation of the latter bed will give the elevation of the Middle Horsepen, from which the position of its outcrop can be readily ascertained by reference to the surface contours. If the bed under consideration is below the surface, the depth to which it is necessary to drill in order to reach it can be determined by subtracting its elevation from that of the surface at that point.

Folds.

Dry Fork anticline.—The most prominent structural feature of the area is the Dry Fork anticline, a long, bowed-up fold which extends from Buchanan County, near Big "A" Mountain, to Mercer County, West Virginia. The axis intersects the Tazewell-Russell county line about $1\frac{1}{2}$ miles south of Sandy Ridge, from which point it extends a little north of east to McDowell County, West Virginia, crossing the State line just 1 mile west of Beech Fork. The anticline continues to trend in a northeast direction through McDowell County, crossing Jacob Fork a quarter of a mile southeast of Squire, and Tug Fork slightly less than half a mile northwest of the mouth of Millseat Branch, according to the West Virginia Geological Survey. From this point it runs almost due east in the direction of Coopers, crossing the northeast corner of Tazewell County 1 mile south of Peeled Chestnut Gap.

The Dry Fork anticline marks the division between dips to the northwest, which continue entirely across Buchanan County, and dips to the southeast, which extend to the faults limiting the coal field or to narrow synclines along the border. Only the lower portion of the southeast flank extends into Tazewell County in the region between Dry Fork and Haynes Branch of Laurel. On the northwest side of the structure the dips range from 100 to 450 feet to the mile and from 150 to 700 feet on the southeast side, the steepest being on Beech Fork and the lowest on Laurel Fork of the Bluestone. The fold also has a decided pitch to the southwest, along its crest, the average rise between Russell and McDowell counties being 100 feet to the mile, the total rise between the two ends of Tazewell County being about 1,950 feet.

Pocahontas syncline.—Beginning near the bend of Laurel Fork of the Bluestone and extending northeastward is a narrow depressed fold designated in this report the Pocahontas syncline. It passes just south of Low Gap and crosses Coal Run at its mouth, where it turns and enters Mercer County in the direction of Coopers, apparently merging with the Dry Fork anticline. The north side is formed by the flank of the latter structure, the south side by the limb of the sharp fold along Abbs Valley. Dips are gentle except along the south side, at less than half a mile from the axis, where the strata are turned up suddenly to almost vertical. Southwest of Low Gap a fault encroaches on the southeast limb and finally cuts it off completely.

The Pocahontas syncline pitches to the southwest at an average rate of 75 feet per mile. It furnishes a natural course for drainage in mining operations and it is so utilized by the Boissevain and Pocahontas mines, a main tunnel diverting water from the entire area of underground operations to the head of Tug Fork, where the axis of the syncline approaches the divide.

Other folds.—A poorly defined syncline, in some ways similar to the Pocahontas syncline, extends from West Fork to the McDowell County line north of Faraday. It closely parallels the breaks along the margin of the coal field as far east as Indian Creek, where the south limb is cut off by the fault; beyond Indian Creek it follows the general direction of Beech Fork to Faraday, whence it turns north and dies out near the State line.

The most important fold outside the coal field is the anticline along Abbs Valley. The position of the axis of this fold is indicated by the long narrow outcrops of Newman limestone along its crest in the lower part of the valley, south of Pocahontas, and near the head of Horsepen Creek. In the latter locality the Newman has been brought to the surface by the fault which developed near the crest when the folded strata were compressed to the breaking point, and to the southwest only the south limb of the anticline remains, as shown in the cross-section at Philips School and at Adria. (See fig. 6.)

Faults.

At some remote geologic time the Tazewell County coal field extended to the southeast of its present limit as shown on the accompanying map. Giant folds and faults lifted the coal-bearing rocks in the region to the southeast far above those of the present coal field and they were subsequently worn down and carried away by the erosive forces which tend to reduce the general land surface to the same level.

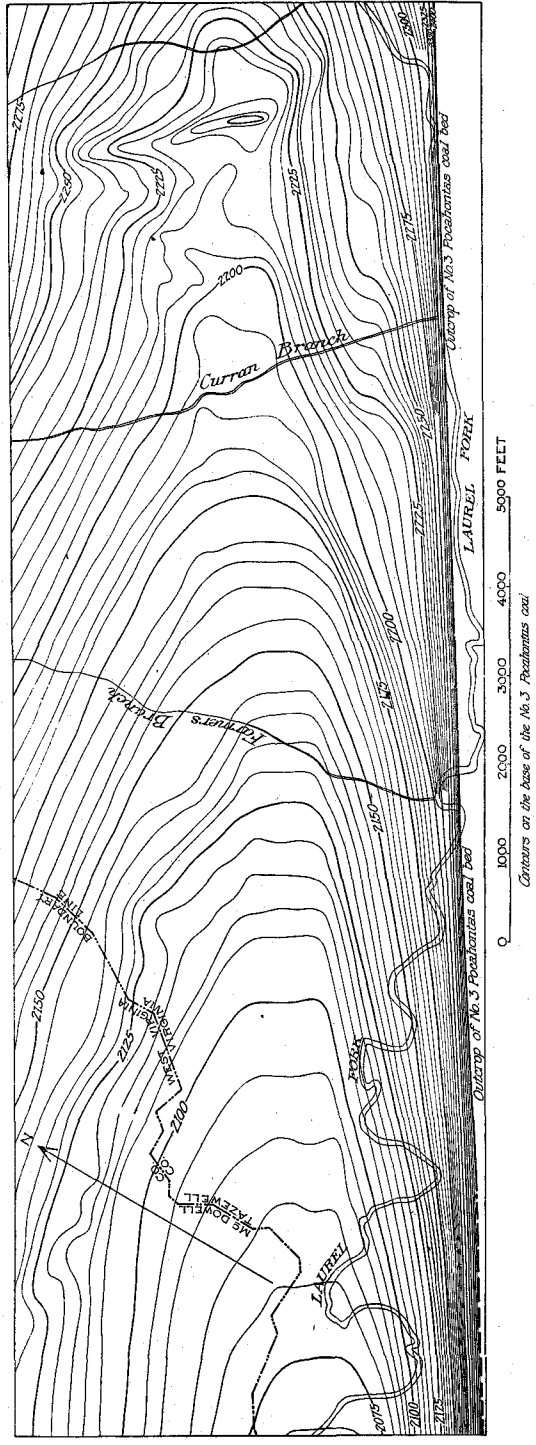


Fig. 5.—Structure of the Pocahontas syncline (modified from a map furnished by A. H. Stow).

*Boissevain fault.*¹—A remnant of one of the great folds already described may be seen in the anticline along Abbs Valley. To the southwest this fold becomes so closely compressed that a break occurs on the north side, about 1½ miles from Boissevain. This break, or fault, continues to the southwest as far as Doran, marking the boundary between the variegated shales and sandstones of the Mississippian and the coal-bearing rocks of the Pennsylvanian. At Doran it joins another fault and continues westward through Raven into Russell County. The beds on the southeast of the fault have been thrust up, relative to those on the northwest side, along a plane which is in most places inclined at about 45°. The amount of the displacement seems to be about the same at different points along the fault as far west as Laurel Fork of Dick Creek, from which place it diminishes and is very small as far as Richlands.

Richlands fault.—After developing a break on the side, as just described, the Abbs Valley anticline was still further compressed and finally broke where the beds were sharply bent at the crest. This fault begins at the head of Laurel Fork, 4 miles northeast of Horsepen Post-Office, and extends to Doran, where it joins the Boissevain fault. It roughly parallels the latter fault, passing near Shraders and Bandy and just north of the town of Richlands, from which it is named. It is also a thrust fault which, as far as the west side of Crocketts Cove, results merely in cutting off the north limb of the Abbs Valley anticline. Farther west the break is no longer along the crest of this fold, which is here overturned, but far down on the side, in a position similar to that of the Boissevain fault at Low Gap. A strip of Newman limestone outcrops next to the fault and a broader zone of Grainger shale along the crest of the overturned fold. Just east of Richlands a narrow tongue of this limestone, which may be bounded by a fault on the north side, extends into the shale area.

Middle Creek "fault."—On Laurel Fork of Dick Creek the sharp and well-defined fault contact between the flat-lying Pennsylvanian and the undifferentiated Pennington disappears and a narrow wedge of steeply dipping beds of the Pennsylvanian comes between these formations. The coal-bearing rocks appear to have been upturned, as along the lower part of Laurel Fork of the Bluestone, and folded back on the flat-lying beds, their present position being up side down. It is probable that this sharp fold resulted in at least a break and at many places there is no doubt some displacement, the dipping coal-bearing rocks being shoved up relative to

¹ Name suggested by Hennen, *Op. cit.*, p. 47.

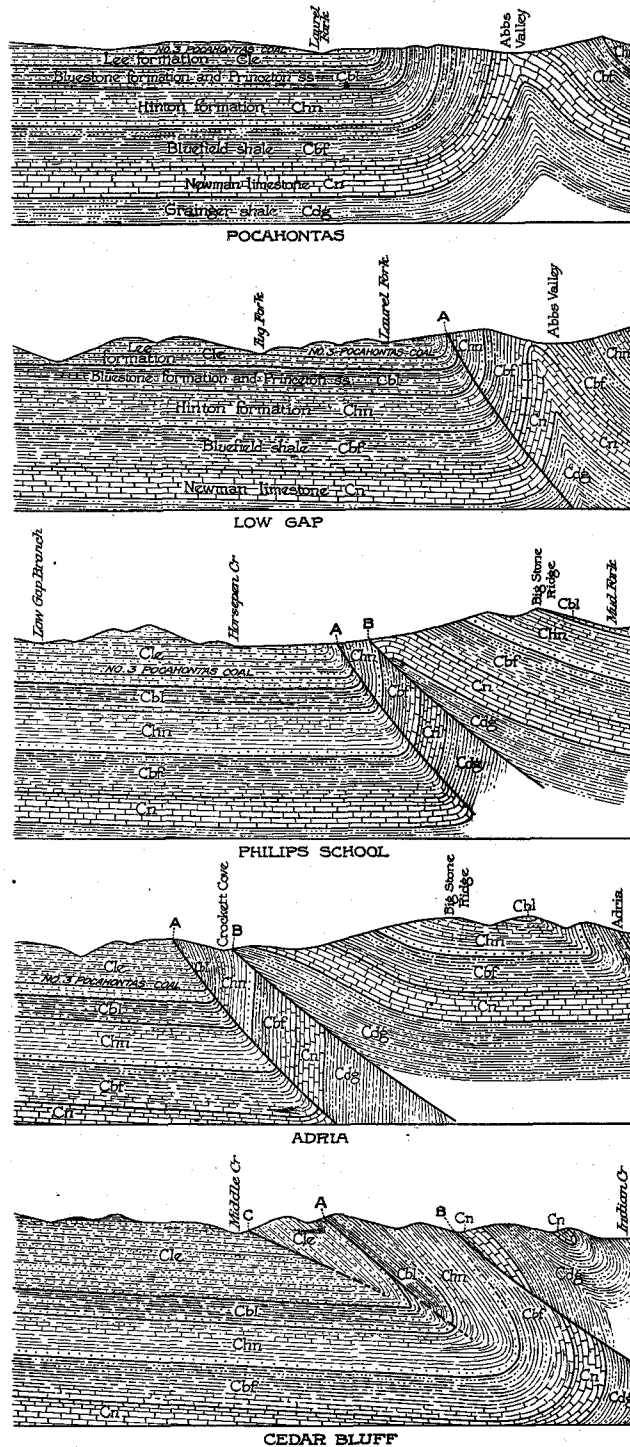


Fig. 6.—Cross sections showing manner in which Tazewell County coal field is terminated along southeast side.

the beds on the north of the fault. The zone of undifferentiated Pennsylvanian and the "fault," which is named from its close relation to a part of Middle Creek, extends almost to Raven. It is well exposed in a cut of the railroad spur up Town Hill Creek and has a noticeable effect on the courses of some of the streams, particularly Little Town Hill Creek, Middle Creek, and Laurel Fork of Indian.

COAL RESOURCES

GENERAL DESCRIPTION OF COAL BEDS.

Introduction.

The total thickness of coal-bearing formations in Tazewell County is about 2,800 feet, every portion of which outcrops in some part of the area. At least fifteen coal beds are 30 inches or more thick over areas of sufficient size to justify mining. In general the coal is of excellent coking quality and has a high fuel rank, hence thin beds can be worked more profitably than in some other parts of the State. Beds 2 feet and less in thickness are not at present considered as assets but they will become so when the thicker coals are exhausted. Some beds which are thin along the outcrop no doubt increase in thickness below drainage and can be profitably mined by shaft. In going from east to west, successively higher coal beds are encountered coming in at the tops of the hills, the lower beds disappearing below drainage. This results in the exposure of a large number of beds over small areas, but since comparatively little drilling has been done, practically no information is available for any bed except in the region where it outcrops. General considerations based on observed stratigraphic tendencies may furnish a clue to whether a coal bed becomes thicker or thinner after it disappears below drainage. From the somewhat limited data available it appears that the thick deposits of coal in this area are lenticular and elongated in a northeast-southwest direction, making a small angle with the fault lines at the south side of the fields. If such an hypothesis is correct, Nos. 3, 4, and 5 will be found equally as thick or thicker where they are below drainage near the faults, as they are where they first outcrop northeast of the faults. In general succeeding higher coals become thick in a southwest direction from the east end of the area. On the lower part of Laurel Fork the Pocahontas No. 3 is thick, a few miles southwest of Boissevain the Pocahontas No. 4 becomes a thick bed, and at the head of Horsepen Creek the Pocahontas No. 5 begins to thicken. The thickness of the Kennedy increases to the southeast along Sandy Ridge and the Tiller and Jawbone are thick enough to be of value only west of Big Creek. Data relating to stratigraphy, intervals, thickness of coals, etc., will be found in another part of this report.

No bed is sufficiently constant in thickness or has sufficiently well-marked characters to be identified throughout the area of its outcrop, even

though that area be small. The roof may change from clay to coarse sandstone within a few feet, and partings an inch thick on one side of a spur may increase to several feet on the other side, making the bed worthless. The most common roof is sandy shale, or very fine-grained sandstone, separated from the coal by a few inches to a foot or more of "draw slate" which comes down when the coal is taken out. Some beds have coarse sandstone directly on the coal over small areas, but ordinarily a few inches of "slate" intervene. Most of the partings are clay, or shale, but thin lenses of sandstone occur in a few beds, and some fairly thick layers of rash were noticed. The term "rash" is applied to an intimate mixture of coal and shale, in many places contorted and slickensided by movement, so that it breaks up in fine scales. The underclays are generally light-drab in color and slightly sandy, though some in the lower part of the Lee are fairly pure and if found sufficiently thick may be valuable for their heat-resisting qualities. In general they are very hard and are not apt to cause trouble in the mines by "squeezing."

Because of the extreme variability of the coal beds in this region, plans for development should be preceded by careful and thorough prospecting under the direction of an experienced geological engineer. Outcropping coals may be prospected by pits and short drifts, so spaced as to insure detection of any radical changes in the character of the bed. To guard against the possibility of jumping from one bed to another in regions of steep or irregular dips, it is well to open one or two beds above or below the one being investigated, even though they may be too thin for mining. The structure contours will be a valuable guide in such prospecting, but they do not possess the degree of accuracy necessary for laying out the plan of a mine. For this purpose the openings should be located by transit survey on a large scale map and instrumentally determined levels assigned. In a region of such irregular deposits as Tazewell County it is not safe to install equipment for mining unless the thickness and character of the coal bed are known around three sides of the area. Hence beds which go below drainage should be proved by prospecting with the diamond drill. Such prospecting will doubtless demonstrate the existence below the surface of some beds of minable thickness of which outcrops give no indication.

Coal beds in the Lee formation.

POCAHONTAS NO. 3 BED.

The most important coal in the area and in fact one of the most important in the Appalachian coal field is the Pocahontas No. 3. As described

in a preceding part of this report, mining of this bed on Laurel Fork was begun in 1882 and has continued to the present time. In this locality, the only one in which it is being worked in Tazewell County, the Pocahontas

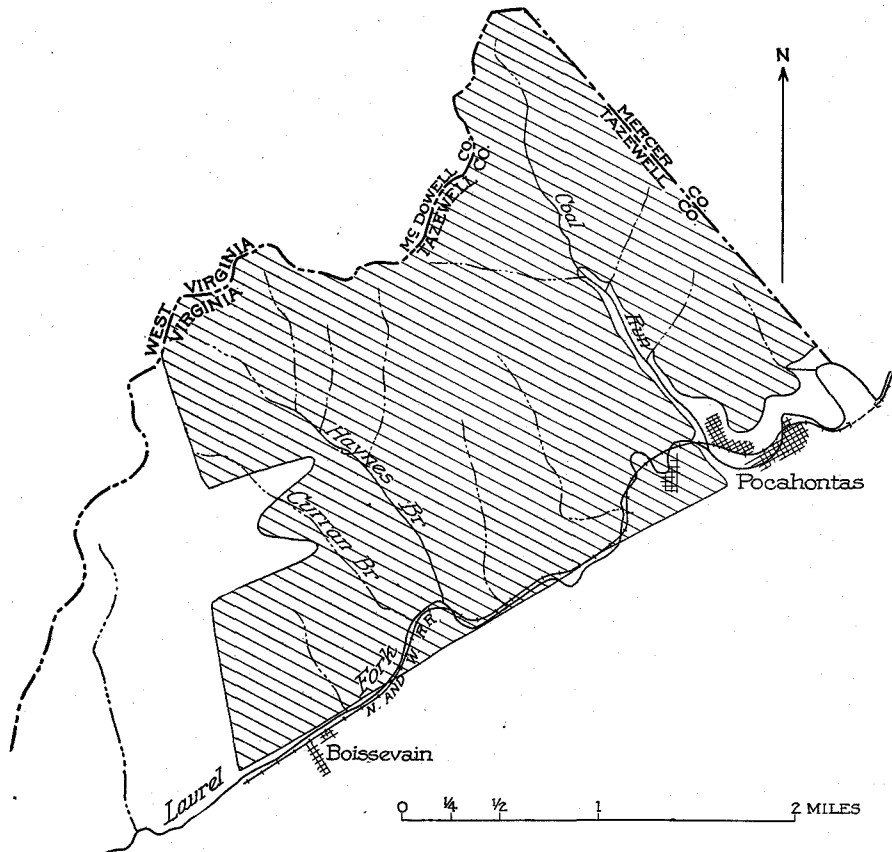


Fig. 7.—Sketch map showing approximate area in which Pocahontas No. 3 coal was being mined on Laurel Fork in 1916.

No. 3 bed has produced roughly 21,600,000 tons from an area of about 6.2 square miles (see fig. 7) and the mines are by no means exhausted.

The Pocahontas No. 3 coal bed was originally known as the "Nelson," from the name of the man who first opened it. It was later assigned the number indicating its position in the series, by W. A. Lathrop, as mentioned on a preceding page. The nomenclature used in this report for the

Pocahontas coals is that adopted by the West Virginia Geological Survey.¹ Pocahontas Nos. 1 and 2 occur in the interval between this bed and the base of the Lee formation. Neither is thick enough to have any value in this area.

On Laurel Fork the Pocahontas No. 3 outcrops in the steeply dipping rocks at the south side of the coal field, and up Coal Run, where it is 10 to 11 feet thick (see Pl. VIII), but it thins to 9 feet at the head of Haynes Branch and northward. There is quite a notable thinning to the west and southwest from Pocahontas; the coal is 7 feet thick at the drill hole on the upper part of Horsepen Creek but only 5½ feet near the mouth of that stream. On Beech Fork the bed contains 4½ feet of coal but only 2½ feet are worth mining at the head of Right Fork. Drill records indicate that the bed becomes still thinner to the northwest. No positive information is available but because of the tendency of the bed to thicken to the southeast it is probable that it contains at least 3 feet of coal in a narrow zone near the fault as far west as Big Creek. It is doubtful whether the Pocahontas No. 3 bed contains as much as 30 inches of workable coal north of the Dry Fork anticline on Indian Creek or west of Big Creek.

The stratigraphic position of the bed, on Laurel Fork especially, is well marked by a thick massive sandstone which lies either a few feet above the coal or directly on it. In some parts of the area there is a strong ledge of sandstone immediately below the coal, but ordinarily only thin shales and sandstones. This bed has been chosen as a datum for the structure contours in the eastern part of the area.

POCAHONTAS NO. 4 BED.

The Pocahontas No. 4 bed is thin in the limited area in which it outcrops. In the neighborhood of Pocahontas the coal is 1 or 2 feet thick, but exposures on the head of Tug Fork in McDowell County indicate that the thickness soon increases to the west (see fig. 9) and it is a valuable bed to within a short distance of Dry Fork. Its horizon is exposed in railroad cuts on Beech Fork but no coal was seen. The coal is about 7 feet thick at openings near the head of the South Fork of Tug and it may be assumed that this thickness extends southward to the fault. On Horsepen Creek the bed begins to thin and is only a little over 4 feet thick at the drill hole

¹ This report follows the earlier usage of the West Virginia Geological Survey of putting the generic term first, as that is undoubtedly correct. Thus: Pocahontas No. 5 bed is used in place of No. 5 Pocahontas bed.

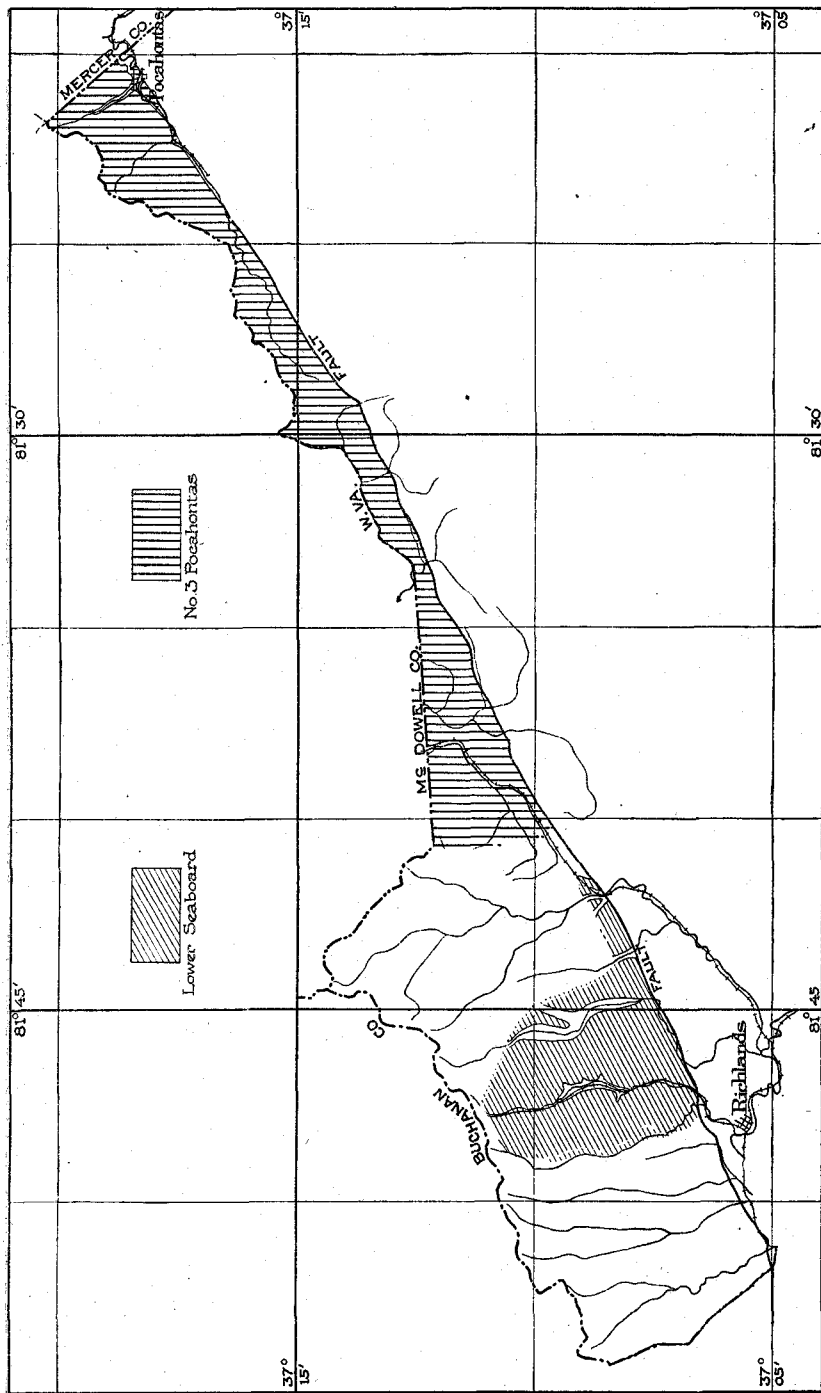


Fig. 8.—Sketch map showing areas in which Pocahontas No. 3 and Lower Seaboard beds are known to contain 30 inches or more of minable coal.

near the mouth of that stream. While its area is comparatively small, this bed contains a large tonnage of high-grade coal,—perhaps equal in quality to the Pocahontas No. 3.

At Pocahontas this coal occurs at the top of the strong sandstone capping the Pocahontas No. 3, but on the South Fork of Tug River it is about 25 feet above this sandstone. A sandstone which forms strong cliffs in the latter locality is found either directly on or a short distance above this coal bed. The distance above the Pocahontas No. 3 is 105 feet at Pocahontas but averages only about 75 feet on Horsepen Creek.

POCAHONTAS NO. 5 BED.

The Pocahontas No. 5 coal is thin where it outcrops on Laurel Fork and appears to be a split off the next lower bed. On the lower part of Horsepen Creek it is separated from the Pocahontas No. 4 by about 30 feet of sandstone, which on Beech Fork apparently consolidates with the cap-rock of the Pocahontas No. 3 and cuts out the former coal entirely. Its distance above the Pocahontas No. 3 does not vary much from 100 feet. The area in which the Pocahontas No. 5 is thick begins near the head of Horsepen Creek, and extends westward to the upper part of Beech Fork (see fig. 10). In the drill hole (HC 1) near the head of the former stream the coal is 32 inches thick, increasing to 5½ feet near the mouth of that stream (HC 2). It probably holds this thickness to the west in the part of the area near the fault but it is only 4 to 4½ feet thick along the outcrop on Dry Fork. On Beech Fork it is thicker but less uniform, ranging from 3 feet, where the outcrop crosses the railroad, to more than 8 feet thick on the south side of Right Fork. North and west of Right Fork the bed is less than 30 inches thick; south of its outcrop along this stream the thickness is a matter of conjecture, but if the lenticular shape of the deposit has been properly interpreted the coal is equally thick in this area, and may be thick along the fault for some distance to the southwest.

The Pocahontas No. 5 is everywhere practically free from partings, and its quality and purity, as indicated by analyses in another part of this report (p. 164), give it a value equal to or better than that of the Pocahontas No. 3. The tonnage available from this bed is enormous, but despite its high fuel rank and proximity to the railroad it has never been mined on a commercial scale in Tazewell County.

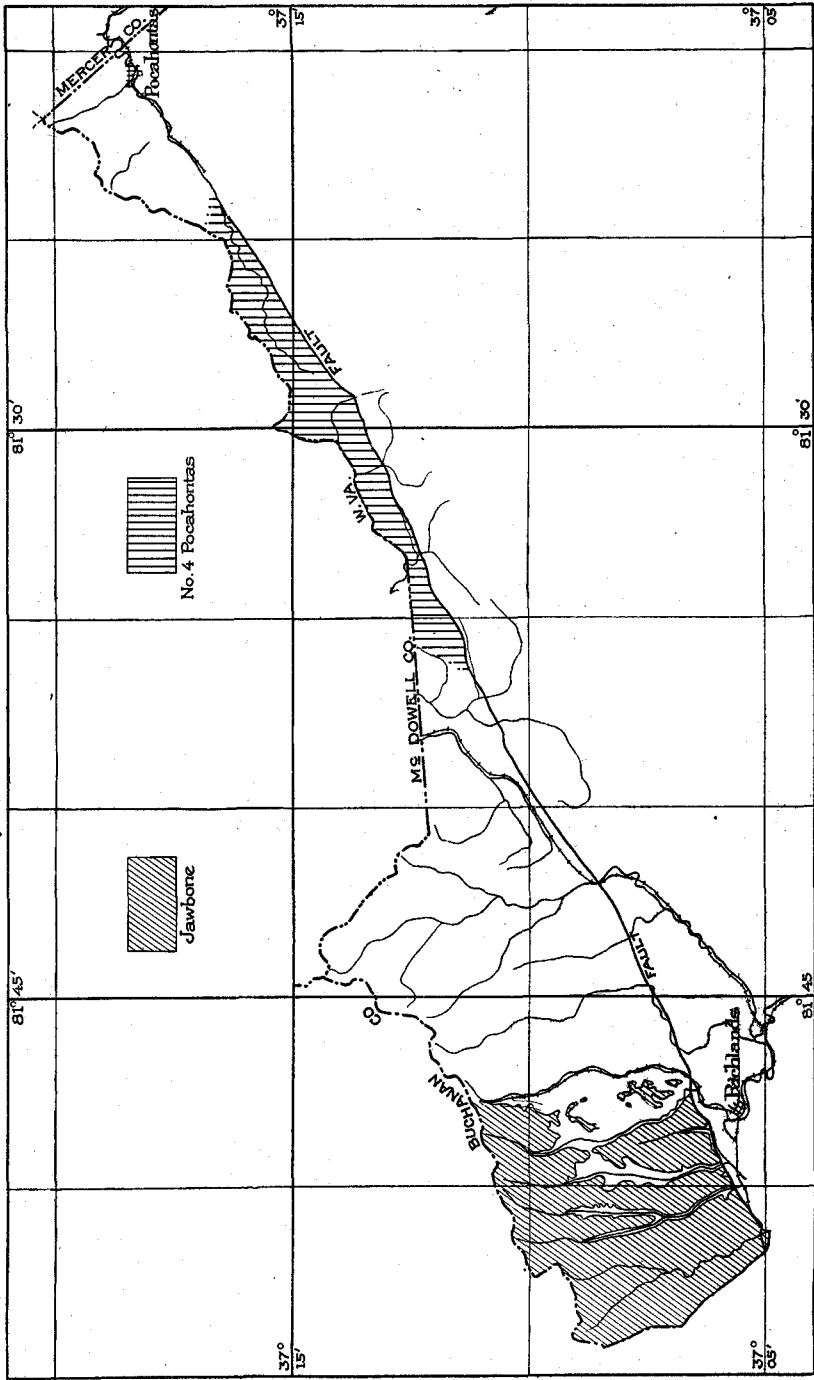


Fig. 9.—Sketch map showing areas in which Pocahontas No. 4 and Jawbone beds contain 30 inches or more of minable coal.

POCAHONTAS NO. 6 BED.

The Pocahontas No. 6 outcrops on the lower part of Laurel Fork and on Dry and Beech forks but no exposures were found in the latter region, where it may be absent. Logs of the drill holes on Horsepen Creek indicate that it is entirely cut out by sandstone, or less than a foot thick, in that locality, but it is 2 feet thick where opened by the Pocahontas Coal and Coke Company on the spur above location 34 at the head of South Fork of Tug.

On Coal Run the bed has been opened for local use in a number of places but it nowhere exceeds 2 feet in thickness. It is clean and of good quality except for about 3 inches of impure cannel coal at the top. The horizon is easily followed in this locality, because of its position at the top of strong bench-forming sandstone, 200 feet above the Pocahontas No. 3.

Pocahontas Nos. 7, 8, and 9 occur in the interval between the bed just described and the Lower Horsepen, No. 7 being 100 feet above it at the base of a 50-foot sandstone, and Nos. 8 and 9, 150 and 185 feet above, respectively. The latter two coals are too thin in this area to ever be mined and the Pocahontas No. 7 is less than 18 inches at all exposures seen. Coal, reported $3\frac{1}{2}$ feet thick at an opening on the spur above location 34, is tentatively correlated with this bed.

LOWER HORSEPEN BED.

The Lower Horsepen bed, 480 feet above the Pocahontas No. 3, is of importance only on the upper part of Horsepen Creek. The coal is 4 or 5 feet thick in several small patches northwest of Boissevain, where it occurs at the top of 30 to 50 feet of sandstone. It has been opened for local use at a number of places on Horsepen Creek, above the Post-Office, where an average section of the bed shows about $2\frac{1}{2}$ feet of coal split into three benches by partings which aggregate 6 inches. There are more than $3\frac{1}{2}$ feet of coal at an opening south of the Post-Office where the bed was first described and named by Campbell. There are no openings on the lower part of Horsepen Creek but the 100-foot sandstone below the coal in this region forms conspicuous cliffs. The coal is thin or absent on Dry Fork and Beech Fork and is probably of no value in the area to the west, where it is below drainage. Hennen correlates this bed with the Pocahontas No. 9 but it is believed to correspond more closely with the Little Fire Creek of McDowell County.

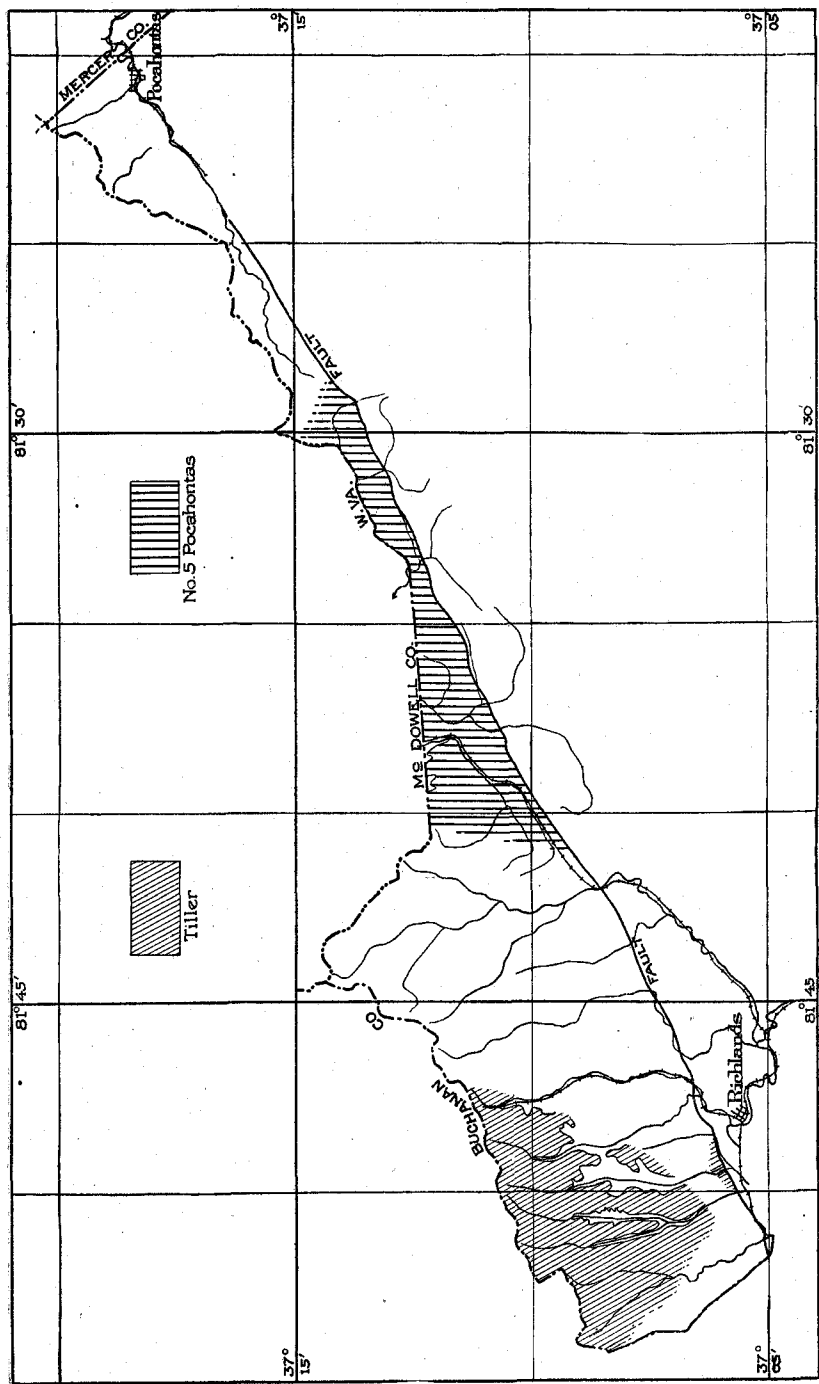


Fig. 10.—Sketch map showing areas in which the Pocahontas No. 5 and Tiller beds contain 30 inches or more of minable coal.

Two thin coals occur in the interval between the Lower Horsepen and the next important bed above. On Laurel Fork only the blooms were seen and neither bed exceeds 2 feet. In the vicinity of Shraders two beds which may not correspond to those on Laurel Fork have been opened at several places; the upper is 2 feet or more thick and the lower at least 3 feet in places.

WAR CREEK BED.

The War Creek bed, 160 to 170 feet above the Lower Horsepen bed, makes its best showing on Beech Fork, where it has been prospected extensively by the Faraday Coal & Coke Co. The bed was first named by Campbell in the Tazewell folio, from its occurrence on War Creek, and there is every reason for thinking that its identification in this area is correct. The coal is about 2 feet thick where it outcrops on the upper part of Laurel Fork, and 2 to 2½ thick on tributaries of Jacob Fork. Near Shraders there is a coal of about equal thickness 60 feet above the War Creek.

On Beech Fork there are 200 feet of locally conglomeratic sandstone above the War Creek, corresponding to the Upper and Lower Raleigh sandstones of the West Virginia Geological Survey. The bed is very variable as to thickness and partings, but contains at least 3 feet of recoverable coal over most of the area. Several openings show a total thickness of almost 5 feet of coal but its value is everywhere impaired by partings of clay and rash. The few exposures on Indian Creek indicate that the War Creek coal thins to the north and west and is badly split up by partings.

MIDDLE HORSEPEN BED.

The Middle Horsepen bed is 110 to 120 feet above the War Creek, and is a valuable bed over most of the area in which it outcrops. It was named by Campbell from its occurrence south of Horsepen Post-Office. On Laurel Fork it has chiefly sandy shale above it and a weak sandstone below; on Beech Fork and Indian Creek its position is near the middle of the thick sandstone above the War Creek. This sandstone is the Raleigh of McDowell County, as mapped by the West Virginia Geological Survey, hence the Middle Horsepen correlates with Hennen's Little Raleigh coal.

Where the Middle Horsepen coal outcrops on Laurel Fork its thickness is almost 4 feet but it appears to be absent at the head of Horsepen Creek. Near the Post-Office on this stream and under Pine Ridge the coal is 4 feet thick and it is at least 3 feet where it outcrops a short distance west of Shraders. No exposures were seen and the bed is probably thin or absent

on Dry Fork and Beech Fork, being cut out by the sandstone above the War Creek. On Indian Creek it comes in again and is locally thick but is in many places badly damaged by partings. The coal is $2\frac{1}{2}$ to $3\frac{1}{2}$ feet thick on the west side of Greasy Creek, and it probably does not outcrop farther west. If the 33-inch coal penetrated by the drill at Seaboard (BC 2) has been properly identified, the Middle Horsepen has attractive possibilities in the area between Greasy Creek and Big Creek.

UPPER HORSEPEN COAL.

The Upper Horsepen coal was named by Campbell at an opening south-east of Horsepen Post-Office. It is locally referred to as the "Smith" coal because one of the first openings was near a store of that name on the upper part of Laurel Fork. It appears to correspond to the Welch coal of McDowell County, as suggested by I. C. White.¹ The stratigraphic position of this coal is 800 to 820 feet above the Pocahontas No. 3.

At Horsepen there is sandstone below the coal and a strong coarse 40-foot ledge 15 feet above, which is lacking elsewhere. On Beech Fork and Indian Creek the bed lies at the top of about 200 feet of sandstone, which over most of the area is broken near the middle by shale, and it has 100 feet or more of shaly material above. The coal is thick and important only on Horsepen Creek and the head of Laurel. In the divide between these streams the thickness is quite variable, ranging from $1\frac{1}{2}$ to more than 11 feet, including some bony streaks. The bed contains about $6\frac{1}{2}$ feet of coal, exclusive of partings, south of Horsepen Post-Office and under Pine Ridge. It has not been prospected between Jacob Fork and Dry Fork and it is only about 2 feet thick at most of the exposures on Beech Fork and Indian Creek, where its horizon is well marked by the top of the strong sandstone mentioned above. Two thin coals, 50 and 100 feet above the Upper Horsepen, were found on the lower part of Indian Creek and its tributary, Laurel Fork.

LOWER SEABOARD BED.

One of the most promising beds in the western part of the area is the Lower Seaboard, so named in this report from its occurrence on Big Creek at Seaboard, where it is the lowest bed mined. On the basis of stratigraphic evidence it is the same as the Sewell coal of McDowell County, as

¹White, I. C., Supplementary coal report: West Virginia Geol. Survey, vol. 2 (A), p. 108, 1908.

described by Hennen. The bed is about 1,000 feet above the Pocahontas No. 3 and 800 feet below the Raven. There is everywhere a strong, coarse sandstone below the coal and either sandstone or sandy shale above.

The Lower Seaboard first comes in at the hilltops west of Horsepen Post-Office and is above drainage as far west as Big Creek, where it is mined along the outcrop from Seaboard to Coaldan. No exposures were seen and the bed is probably lacking or badly split up east of the head of Beech Fork. On Indian Creek and Laurel Fork the Lower Seaboard contains 30 inches or more of coal near the fault but thins to the north. The thickness increases to about 3½ feet, exclusive of two or three or more partings on Middle Creek and there are 4 feet of coal and 4 to 10 inches of clay at exposures on Big Creek. Logs of the drill holes on Big Creek (BC 1) and Seng Camp (SC) indicate that 30 inches of coal may be expected as far north as Sandy Ridge, and there is no sign of thinning to the west. Diamond-drill prospecting will probably prove that this valuable deposit of coal extends for some distance west of Big Creek.

MIDDLE SEABOARD BED.

The Middle Seaboard, separated from the lower bed just described by 40 to 50 feet of sandstone or sandy shale, is also named from the mining camp at Seaboard, where it was formerly exploited on a commercial scale. It is at about the same horizon as the Sewell "A" coal of McDowell County. The outcrop is shown on the geologic map only in two areas west of Dry Fork, but it may be easily located elsewhere from its position about 50 feet above the Lower Seaboard.

At the only complete exposure seen west of Dry Fork the Middle Seaboard contains slightly more than 3 feet of coal and several thin partings. The coal is 3 to 4 feet thick at a number of exposures on Indian Creek south of the Dry Fork anticline but is everywhere badly split up by partings, a characteristic feature of the bed at its type locality on Big Creek. On Middle Creek the bed contains more than 3½ feet of coal near the fault, but thins perceptibly to the north. The Middle Seaboard contained 3½ feet of coal where it was formerly mined on Big Creek, but it splits and is worthless north of Seaboard. It is probably a valuable bed on this stream in a zone bordering the fault, if the partings are not too numerous.

GREASY CREEK BED.

The Greasy Creek bed, so called from its occurrence on the creek of that name, was found only north of the Dry Fork anticline. Its position

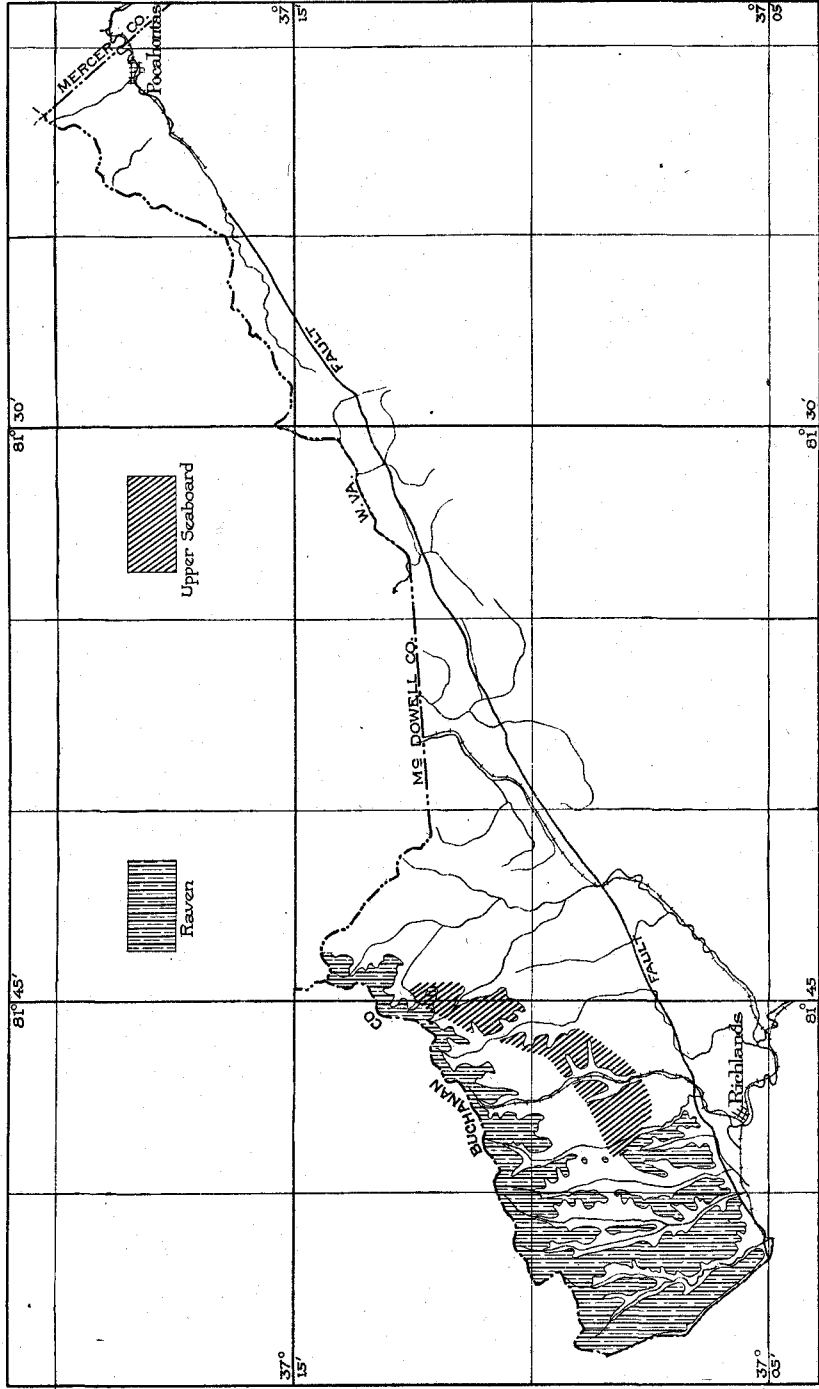


Fig. 11.—Sketch map showing areas in which Upper Seaboard and Raven beds contain 30 inches or more of minable coal.

is at the top of a strong bench-forming sandstone (see Pl. IV), which, in many places, extends down to the Middle Seaboard, 75 to 90 feet below. On the upper part of Indian Creek the bed contains at several openings about 3 feet of coal badly split up by partings, but it is said to be much thinner where penetrated by the drill (IC) near the head of that stream. The coal is probably $2\frac{1}{2}$ feet thick exclusive of partings between Greasy and Indian creeks, but is somewhat less on the west side of the latter. Bloom of the bed was seen on the east side of Middle Creek, but it is apparently absent farther west. The Greasy Creek coal may be the same as the Sewell "B" of the West Virginia Geological Survey.

UPPER SEABOARD BED.

The Upper Seaboard is 200 to 315 feet below the top of the Lee and about 625 feet below the Raven. It is the highest of the three beds mined at Seaboard, from which place it takes its name. It appears to come between the Harvey conglomerate and the Sewell "B" coal of Hennen's section for McDowell County. There is a sandstone of variable thickness close above the coal, and it is separated from the Greasy Creek bed by 40 to 50 feet of shale. Thin, irregular, layers of coal in the clay or shale roof are characteristic of the bed and it may be identified in places by a peculiar mottled coloring in the shale about 25 feet below.

The Upper Seaboard coal is 30 inches or more thick in an elongated area about $1\frac{1}{4}$ miles wide, extending northeast from Seaboard (see fig. 11). The bed is not more than 2 feet thick on Indian Creek and it is thin or absent on Big Creek above Coaldan. South of Alfredton it likewise thins to less than 30 inches. In the mines at Seaboard and between Big Creek and Greasy Creek, the coal is remarkably clean and $2\frac{1}{2}$ to 3 feet thick. If the coal bed in the drill hole on West Fork (WF) has been properly identified, the Upper Seaboard may be over 30 inches thick on a considerable area west of Big Creek.

Coal beds in the Norton formation.

TILLER BED.

The Tiller bed is 160 feet above the top of the Lee and 250 feet below the Raven. In most places there is sandstone below the coal and a strong bench-forming sandstone above, which rests directly on the coal and is locally conglomeratic. The Tiller is at the top of a 375-foot interval which contains no coal except for thin and probably lenticular beds at the top and bottom of the sandstone forming the top of the Lee.

This coal bed is of value only west of Big Creek and it appears to be at its best in the part of this area adjacent to Sandy Ridge (see fig. 10). It is quite variable in thickness owing to the sandstone roof and is in many places impaired by partings. The coal has an average thickness of $3\frac{1}{2}$ feet and is fairly clean where mined near the mouth of Town Hill Creek, but the average for the entire area is probably less than 3 feet.

The name Tiller was applied by Stone to a thick coal bed on the upper part of Indian Creek, which splits elsewhere, and the upper part of which is now known to be equivalent to the Jawbone. The lower bed has been traced to Tazewell County by Henry Hinds and the writer, and the name Tiller is applied to it. The Lower Iaeger of the West Virginia Geological Survey is probably the Tiller.

JAWBONE BED.

The position of the Jawbone bed is at the top of a strong sandstone which forms a distinct and easily followed bench, because of the 100-foot interval of shale and sandy shale above it. In general the 30 to 50 feet of sandstone separating it from the Tiller below are coarse and slightly conglomeratic. The stratigraphic interval between this bed and the overlying Raven is 200 feet.

The Jawbone coal is thin and worthless because of partings at the few exposures seen along Sandy Ridge east of Big Creek, but it may thicken to the north. It is more than 30 inches thick at practically all exposures west of Big Creek (see fig. 9). A characteristic but unfortunate feature of the bed is the presence of streaks of bone and bony coal, which cannot usually be separated from the good coal, and partings of shale. The Jawbone makes its best showing in a narrow zone bordering the fault between Raven and Richlands. It is almost 6 feet thick where mined on the west side of Town Hill Creek and equally thick to the east at openings near the fault. North of the Dry Fork anticline, the bed is considerably thinner but much improved in quality, there being less bony material. A coal bed $1\frac{1}{2}$ to $2\frac{1}{2}$ feet thick, which occurs 60 feet above the Jawbone, is being mined for local use at several places on Coal Creek, and was seen at a number of exposures west of Big Creek.

The Jawbone derived its name from Jawbone Hollow, between Banner and Virginia City. The name has been used by Hinds¹ in a recent report

¹Hinds, Henry, The Geology and Coal Resources of the Clintwood and Bucu Quadrangles, Va.: Virginia Geol. Survey Bull. No. 12, 1916.

on a neighboring area from which it has been traced to Tazewell County. The Jawbone is the same as the Jaeger coal of the West Virginia Geological Survey.

RAVEN BED.

One of the most valuable beds outcropping in the western part of Tazewell County is the Raven, so named from the locality in which it is mined on Coal Creek. It is the same as the Lower Douglas of the West Virginia Geological Survey. The coal is of sufficient thickness to be an attractive mining proposition at the present time. East of West Fork it is present only along Sandy Ridge and spurs to the south, having been eroded elsewhere. It is being mined extensively on Coal Creek, at the head of Big Creek, and on Town Hill Creek. Because of its importance it has been chosen as a datum for the structure contours in the western part of the area. It is near the base of a thin series of sandstones and is approximately 1,800 feet above the horizon of the Pocahontas No. 3. About 50 feet above the Raven, there is in most places a thin coal at the base of a conglomeratic, cliff-forming sandstone (see Pl. X).

The Raven coal has an average thickness of about $4\frac{1}{2}$ feet in the mines at the head of Big Creek and along Sandy Ridge to the east, but it is locally worthless in small areas because of thick and irregular partings. It contains one or more clay partings, which are easily separated from the coal, in most of the area where it is more than the normal thickness of 3 to $3\frac{1}{2}$ feet. The Raven has been opened at a number of places west of Big Creek which show a range in thickness from 26 to 75 inches. The bed is without partings over most of this area and the average content of coal is about 39 inches. In the mines of the Raven Red Ash Coal Corporation the bed normally contains 36 or 37 inches of clean coal, but it is somewhat thicker in the mines to the south and on the upper part of Coal Creek.

AILY BED.

The Aily coal occurs in a thin shaly interval about midway between the Raven and next important bed, 250 feet above. The thick sandstones both above and below are conglomeratic in most places, and no doubt locally cut out the coal. At the few exposures seen the coal is $1\frac{1}{2}$ to $2\frac{1}{2}$ feet thick but little is known of its average thickness and extent. The name Aily was first applied by Hinds to a thin coal at this horizon in Dickenson County.

KENNEDY BED.

The Kennedy bed occurs at the top of the thick series of conglomeratic sandstones 250 feet above the Raven. In most places a shaly interval above results in these sandstones forming a distinct bench (see Pl. X) on which the outcrop of this bed is easily located. The name Kennedy has long been in use in the district where this bed is mined in Russell County; it is the same as the Douglas of the West Virginia Geological Survey.

East of Town Hill Creek, the Kennedy is present only along Sandy Ridge, where it is comparatively thin and present only in small areas. The coal is 1 to 2½ feet thick at the head of Indian Creek, and 2½ to 3 feet thick, including 5 or 6 inches of clay in the lower part, in the vicinity of Jewell. Farther west along Sandy Ridge it may average 3 feet. It is thin or absent on Red Root and Road ridges, where another bed comes in at the base of a sandstone about 50 feet above the Kennedy. Bloom of this higher bed was observed at several places in the road along Sandy Ridge, but it is thick only south of the Dry Fork anticline. The coal is clean and 1½ to 6 feet thick at the exposures seen but will probably average not more than 30 inches.

BIG FORK COAL.

The Big Fork coal occurs at the base of a coarse, massive sandstone, 150 feet above the Kennedy. It has been so named by Hinds, in a report on Buchanan County,¹ from Big Fork Ridge, north of Jewell. No complete exposures were seen but the coal is said to be about 30 inches thick in the few small areas which have escaped erosion in the northwest corner of the county.

LOWER BANNER COAL.

The Lower Banner is on top of the sandstone which overlies the Big Fork coal and is 200 feet above the Kennedy in the few small areas remaining. The name Lower Banner was first applied to this coal in the region to the southwest, where it has been mined for many years. It is the same as the Gilbert coal of the West Virginia Geological Survey. It occurs in Tazewell County only in a few small patches at the head of Coal and Mudlick creeks, where it is clean and 4 to 6 feet thick.

¹Hinds, Henry, The Geology and Coal Resources of Buchanan County, Virginia: Virginia Geol. Survey Bull. No. XVIII, 1918.

DETAILED DESCRIPTION OF COAL BEDS.**Method of treatment.**

In this region the railroads built in connection with the development of the coal resources will have to follow the valleys of the principal streams. It is thought advisable, therefore, to discuss the large drainage basins separately, grouping some of the smaller ones for convenience. Each coal bed in each of these natural divisions is described separately, beginning with the lowest, and its outcrop is traced along one side of the basin to the head then back along the other.

Each measured coal exposure has been given a number which appears on the geologic map. The location of many openings for which no section was obtained is also shown. The numbers are consecutive for each bed in the basin being described and are assigned in the order in which the exposure is mentioned in the text. All measurements were made by the writer unless otherwise stated.

Most of the elevations given were determined with an aneroid barometer by the writer; a few were determined by stadia in the course of the topographic mapping by Fred McLaughlin and his assistants. Some elevations have been taken from the carefully prepared outcrop maps furnished by coal companies.

Many coal measurements described in the text are also shown graphically. The numbers on the right side of the graphic sections indicate the thickness in inches of the layers of coal; those on the left side, the partings that would be discarded in mining.

Two companies are mining Pocahontas No. 3 coal on Laurel Fork; the Pocahontas Consolidated Collieries Co. on Coal Run and at Boissevain; the Big Vein Pocahontas Coal Co. on Laurel Fork, half a mile, and one and a quarter miles west of Pocahontas.

LAUREL FORK BASIN.

General features.—This basin is in the northern corner of the county, and includes all of the land tributary to the drainage of Laurel Creek, to the divide between Laurel and Horsepen creeks. All of the Pocahontas coals from 1 to 9 outcrop in the basin, though all of the lower coals outcrop only in the lower part of the stream drainage. Coals as high as the Upper Horsepen occur in the upper part of the basin and in Big Stone Ridge. This area is a structural basin all lying within the Pocahontas syncline. The position of the axis in a part of the basin is shown in figure 5, page 38.

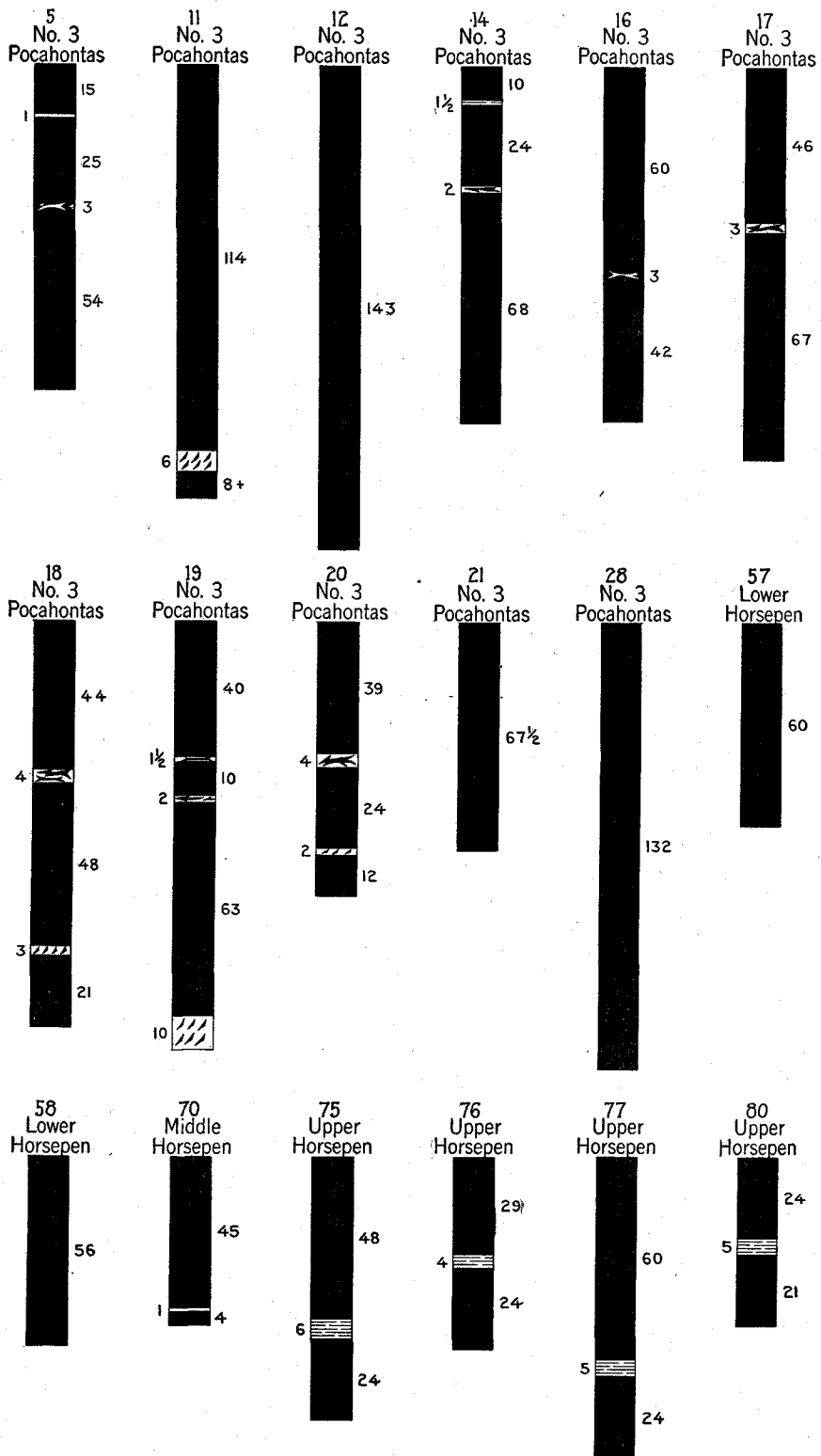


Fig. 12.—Sections of coal beds on Laurel Fork of Bluestone River.

This basin contains the type locality of Pocahontas coal, one of the most valuable coals in the United States. The commercial coal has come entirely from one bed, the Pocahontas No. 3, which has a thickness up to 11 feet at the town of Pocahontas, but which thins to the westward and southwestward. It has a thickness of 9 feet under Big Stone Ridge and of 6 feet on the South Fork of the Tug. The structure results in the coal dipping not only to the axis of the syncline from the northwest and southeast, but also with the syncline to the southwestward, so that the drainage from the mines is carried down to the axis of the basin and then southwestward down the axis until it is tapped by a tunnel under Big Stone Ridge and empties into Tug Fork. Mine workings cover practically all of the No. 3 bed in this basin as far as Boissevain and probably more than one-half of the coal of that bed in that part of the basin has been mined out. The coal in this bed in the upper part of the basin will be reached from the mines at Jenkin-jones at the head of Tug Fork. At distances of 100 feet and 65 feet below the No. 3 occur Pocahontas Nos. 1 and 2 beds, respectively. Both of these beds are thin, the No. 1 commonly less than 1 foot, and the No. 2 less than 18 inches. They outcrop only in the lower end of the basin and in the Bluestone River valley.

About 100 feet above the No. 3 bed is Pocahontas No. 4, overlying the massive cap rock of the No. 3. It is of little value in the lower part of Laurel Fork but reaches a thickness of 7 to 9 feet near the head of the fork. Just above No. 4 in the lower part of Laurel Fork valley and possibly a split from it, is the No. 5, which has a thickness of from 1 inch to 27 inches. One hundred feet higher is the Pocahontas No. 6 bed which, although not over 2 feet thick, has been utilized in a small way in many places.

Pocahontas Nos. 7, 8, and 9 beds are thin in this area, measuring commonly less than 18 inches in thickness. They lie at 300 feet, 350 feet, and less than 400 feet above No. 3. The Lower Horsepen coal is an irregular bed from 15 inches to 5 feet thick, lying 480 feet above the No. 3. Blooms of two coals, from 18 inches to 2 feet thick, occur 30 feet and 65 feet above the Lower Horsepen. The War Creek coal, 650 feet above the No. 3, is found only in the upper part of the Laurel Fork valley and is about 2 feet thick. The Middle Horsepen coal, at 770 feet above No. 3, is from 2 to 4 feet thick. The Upper Horsepen coal at 820 feet above the No. 3 is a very irregular bed, having a thickness of from 2 feet to 9 feet.

Pocahontas No. 1 bed.—The lowest coal bed recognized on Laurel Fork is the Pocahontas No. 1, which comes about 100 feet below the Pocahontas No. 3 coal. A drill hole on Horsepen Creek (HC 1), opposite the head of

Laurel Fork, struck a coal bed which probably represents this horizon 94 feet below Pocahontas No. 3. Sandstone predominates between this coal and the one next higher.

The Pocahontas No. 1 coal bed is of no commercial value but it serves as a guide to the important bed close above. The bed is reported by Krebs¹ to be 4 inches thick and impure in the road near the forks of Mill Creek, about three-quarters of a mile east of the State line. An exposure in the road half a mile northeast of Pocahontas (location 1, elevation 2,335) shows about a foot of bloom and the bed is one foot thick in the drill hole near the station. Where penetrated by the drill near the head of Horsepen Creek the coal is 14 inches thick but is separated into two benches by 71 inches of shale.

Pocahontas No. 2 bed.—At the type locality the Pocahontas No. 2 coal is 67 feet below the No. 3 bed, from which it is separated by sandstone and a little interbedded shale. The bed outcrops on Laurel Fork from just west of the station at Pocahontas eastward to the State line and in the upturned rocks south of the stream. The coal appears to be thick enough for possible future use only on the lower part of Laurel Fork, where the average thickness is probably not more than 18 inches. Absence of coal at this horizon in the drill hole near the head of Horsepen Creek leads to the conclusion that the bed is thin or absent on the upper part of Laurel Fork.

Krebs reports 21 inches of coal in this bed where it is exposed in the road at the forks of Mill Creek (locality 2, elevation 2,395) and a few inches of coal were seen at this horizon in the road northeast of Pocahontas (east of locality 1). In the end of the spur just north of the station at Pocahontas, 6 inches of coal, apparently representing this bed, were seen 60 feet below the Pocahontas No. 3 coal. Immediately above this exposure and 40 feet below the Pocahontas No. 3 are 4 inches of coal which may represent Hennen's² Pocahontas No. 2 "A" bed. In the section by Lathrop (p. 34) the Pocahontas No. 2 bed consists of 2 feet of coal split into equal parts by 2 feet of shale.

According to Krebs the following section represents the bed in an old opening on the east side of Bluestone River at Coopers:

¹ Krebs, C. E., Report on Raleigh County and the western portions of Mercer and Summers counties: West Virginia Geol. Survey, 1916.

² Hennen, R. V., Report on Wyoming and McDowell counties: West Virginia Geol. Survey, p. 230, 1915.

Pocahontas No. 2 bed at Coopers.

(Location 3, elevation 2,410)

	Ft.	in.
Sandstone		
Shale	1	1
Coal		10
Shale		5½
Coal	1	4
Shale		2½
Coal		2
Shale	2	0
Coal		2
Coal	2	6
Partings	2	8

Pocahontas No. 3 bed.—The Pocahontas No. 3 is by far the most valuable coal bed on Laurel Fork. Its importance so far overshadows that of the thinner beds outcropping on the lower part of this stream that little attention has been paid to them in mining, and they have not been thoroughly prospected. When the Pocahontas No. 3 bed is completely mined out the disturbances in the overlying strata due to settling may prove so great as to seriously interfere with, if they do not make unprofitable, the recovery of the thinner coal beds above.

The Pocahontas No. 3 bed is 360 feet above the base of the Lee formation at Pocahontas. On Road Fork the coal rests almost directly on a strong 50-foot ledge of sandstone but at Pocahontas thin sandstones and shales are found below it. A valuable marker in following this coal bed is the thick, massive sandstone which lies either directly on the coal or is separated from it by a few feet of shale.

The outcrop of this coal bed is shown on the geologic map. On Laurel Fork it goes below drainage a few hundred feet west of Coal Run, and ascending the latter stream it keeps just above water for slightly over a mile. Followed southward from the mouth of Coal Run the bed rises gently for about 1,100 feet, then turns up sharply, reaching the surface in an almost vertical position. The outcrop of the steeply dipping bed may be traced from Pocahontas, southwestward for about 4½ miles, to a short distance south of Low Gap beyond which it is engulfed in the Boissevain fault and does not appear at the surface.

The Pocahontas No. 3 bed thins to the west and southwest from the town of Pocahontas. On the lower part of Laurel Fork the average thickness is about 10½ feet. It is somewhat less in the Jenkinjones mines and still further west, where the bed outcrops on the headwaters of the South Fork of Tug, the average thickness is close to 6 feet.

The area of Pocahontas No. 3 coal in Tazewell County east of Curran Branch (see fig. 7) is almost entirely covered by mine workings and considerably more than half the total amount of coal that may be obtained from the bed in this region has already been removed. The Pocahontas No. 3 coal is not being mined in Tazewell County west of the shaft mine at Boissevain but some of the Jenkinjones entries are rapidly approaching the State line.

The section for Pocahontas No. 3 bed at an opening near the head of the left fork of Mill Creek, east of the State line, is reported by Krebs as follows:

Pocahontas No. 3 bed on Mill Creek.

(Location 4, elevation 2,445)

	Ft.	in.
Shale		
Coal	10	
"Sulphur" band		1
Coal	2	7
Bone		3
Coal	5	0
"Sulphur" band		1
Coal	1	0
Coal	9	5
Partings		5

According to Mr. Claggett the bed in the Virginia portion of the Coal-dale mine of the Mill Creek Coal & Coke Co., about 1½ miles north of Pocahontas, consists of 8 feet of clean coal separated from a 14-inch bench at the top by one-half inch of "sulphur." In some places the top bench is left up as a roof in advance work. The following mine section, also furnished by Mr. Claggett, is typical of the bed a few hundred feet south of Peeled Chestnut Gap:

Pocahontas No. 3 bed near Peeled Chestnut Gap.

	Ft.	in.
Coal and "sulphur" (left as roof in places)	1	0
Coal	1	3
Sulphur and bone		2
Coal	7	1
Coal	9	4
Partings		2

In a prospect near the head of Little Creek of Tug Fork, one-half a mile west of Peeled Chestnut Gap (location 5, elevation 2,425), the bed, according to Hennen, is 8 feet thick, including a 1-inch sulphur band

15 inches from the top and 3 inches of bony coal $4\frac{1}{2}$ feet from the bottom. Near the State line on the north side of Laurel Fork (location 6, elevation 2,415) the bed, where exposed in the road, appears to be about 10 feet thick including 10 inches of clay 10 inches from the bottom.

Half a mile northwest of the mouth of Coal Run (location 7, elevation 2,410) is the East mine. This was the first shipping mine in the Pocahontas-Flat Top coal field. It is not producing at present and only a few pillars are left in it. A weathered exposure on the east side of Coal Run (location 8, elevation 2,435), a short distance north of the abandoned fan entries to the East and West mines, shows coal 10 feet 8 inches thick, apparently without partings. The coal rests on three feet of white clay and is overlain by 12 feet of shale under a thick ledge of sandstone. About 400 feet south of location 8, there is a prospect on the west bank of the stream which shows 6 feet of clean coal belonging to the upper part of the bed. The entrance to the West mine is several hundred feet south of the East mine and on the opposite side of Coal Run (location 9, elevation 2,410). The coal is hauled across the stream and down the east side to the old tippie near the mouth. Coal from the Baby mine (location 10) is loaded from a steel tippie at the mine entrance. The bed which here outcrops near water level is reached by a gentle incline from the tippie. The average daily production of these two mines is about 3,500 tons. A new steel tippie with a capacity of 6,000 tons per day is planned for handling the joint output.

The following sections were taken in these mines in connection with their sampling in 1909. The analyses obtained from these samples have been discarded, as it was later found that due to unsteady gas pressure in the laboratory the heat used in determining volatile matter was as a rule too low and the resulting percentage of volatile matter so obtained was too low. New samples were taken in these mines in 1917 and the analyses given are from these samples. To aid identification, the original laboratory numbers of the samples will be retained. The mines are taken in order from east to west.

Sections for samples 8392-8395 were measured in the West Mill Creek mine, $1\frac{1}{2}$ miles north of Pocahontas, Va., and 1 mile northwest of Coopers, Mercer County, West Virginia. Section 8392 was obtained from the face of the tunnel entry, or the heading for entry 7; section 8393, from the pillar in room 9 on the Jackson entry, in what is known as the West Fork-Mill Creek drift; section 8394, from a pillar in room 16 on the Gammons entry; and section 8395, from a pillar in room 17 on the Keystone entry.

Pocahontas No. 3 bed at points measured in West Mill Creek mine.

	8392		8393		8394		8395	
	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.
Coal	1	2	0	10	1	0	1	2
Bone and "sulphur"	0	½	0	¾	0	¾	0	½
Coal	2	2	2	7½	2	10	2	9
Coal, gray, graphitic	1	4	1	3	1	2	0	9
Coal	3	0	3	7¾	3	10	2	8
Bone and "sulphur"	0	½	0	½	0	½	0	½
Coal	1	5	0	7	1	4	1	4

Sections 8396 and 8397 were measured in the East Mill Creek mine, 1½ miles north of Pocahontas, Va., 1 mile northeast of Coopers, Mercer County, West Virginia. Section 8396 was obtained from the face of Taber entry, 800 feet north of the Brickley Taylor entry; section 8397, from a pillar of room 4, on cross-entry 2.

Pocahontas No. 3 bed at points measured in East Mill Creek mine.

	8396		8397	
	Ft.	in.	Ft.	in.
Coal	1	2	1	2
"Sulphur" and bone	0	½	0	¾
Coal	2	4½	2	4
"Sulphur" and bone	0	1½	..	..
Coal, gray	0	10½	1	5
Bone	0	1¼	..	..
Coal	0	9	..	..
"Sulphur" and bone	0	½	..	..
Coal	3	4	4	0

Sections 8387-8391 were measured in the Coaldale mine at Coaldale, Mercer County, West Virginia, 3 miles north of Pocahontas, Va. Section 8397 was obtained from a pillar in room 8, on entry 5; section 8388, from a pillar in room 16, on left entry 9; section 8389, from a pillar in room 10, on left entry 12; section 8390, from a pillar in room 17, on right entry 5½; and section 8391, from a pillar in room 1, on right entry 13.

Pocahontas No. 3 bed at points measured in Coaldale mine.

	8387		8388		8389		8390		8391	
	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.
Coal	1	6	1	0	1	2	1	5	..	..
Bone and "sulphur"	0	½	0	½	0	½	0	½	..	..
Coal	2	6	2	6	2	3	2	1	1	10
Coal, gray	1	6	1	7	1	5	1	9	1	0
Coal	2	4	2	7	3	0	2	8½	3	6
Bone	0	1½	0	½	0	½	0	2	0	½
Coal	2	0	0	10	1	5	2	1	1	10½
"Sulphur" and bone	0	½	0	½	..	..	0	½	..	..
Coal	0	10	0	4½	..	..	0	5½	..	..

Section 8635 was measured in the East Pocahontas mine of the Pocahontas Consolidated Collieries Co., three-quarters of a mile northwest of Pocahontas, Tazewell County, Virginia, August 2 or 3, 1909. The section was taken from a chain pillar on the main entry, 2,500 feet from the drift mouth. This pillar had been exposed to the mine air for 25 years.

Pocahontas No. 3 bed at point measured in the East Pocahontas mine.

	8635	
	Ft.	in.
Coal	0	3¼
"Sulphur"	0	¾
Coal, with mother coal streaks.....	1	¼
Coal, bony	0	5
Coal, with mother coal streaks.....	2	½
Coal, bony	0	6½
Coal	0	1½
Coal, bony	0	3½
Coal	0	2
Coal, bony	0	6½
Coal, with mother coal streaks.....	2	10

Sections 5268, 5269, 7172, 7173, 8640-8642 were measured in the Baby Pocahontas mine of the Pocahontas Consolidated Collieries Co., at Pocahontas, Tazewell County, Virginia. (Pl. XIII.) Section 5268 was obtained in room 37, off cross-entry 9, off main entry, 6,000 feet southwest of the drift mouth; section 5269, in cross-entry 4, off the diagonal entry, 6,700 feet southwest of the drift mouth:

Pocahontas No. 3 bed at points measured in the Baby Pocahontas mine.

	5268		5269	
	Ft.	in.	Ft.	in.
Coal, left as roof.....	..	..	..	..
Coal	3	5	3	0
Coal, bony	0	4	0	4½
Coal	4	6	3	8
"Sulphur"	0	¾	..	..
Coal, bony .....	..	..	0	3
Coal	1	0	1	9½
"Sulphur" .....	..	..	0	¼
Coal .....	..	..	0	11

Section 7172 was obtained at the face of the diagonal entry, 7,300 feet west by 2,700 feet south of mine entrance; section 7173, in cross-entry 1, off diagonal entry, on break through from airway to entry, opposite room 27, about 7,100 feet west of mine entrance.

Pocahontas No. 3 bed at points measured in the Baby Pocahontas mine.

	7172		7173	
	Ft.	in.	Ft.	in.
Coal	1	2	1	3 $\frac{3}{4}$
Coal, gray	0	8 $\frac{1}{4}$	2	1
Bone .....	..	..	0	2
Coal, bright	1	1 $\frac{1}{4}$	..	..
Mother coal	0	$\frac{1}{4}$	..	..
Coal .....	..	..	0	1 $\frac{1}{2}$
Bone .....	..	..	0	6
Coal	0	7	..	..
Coal, gray	0	3 $\frac{3}{4}$	0	5 $\frac{1}{2}$
Coal	0	4	0	3 $\frac{1}{2}$
Bone	0	1 $\frac{1}{2}$	0	3 $\frac{1}{2}$
Coal	0	4	2	5 $\frac{1}{2}$
Bone	0	2	0	2 $\frac{1}{2}$
Coal	0	1	2	$\frac{1}{2}$
Bone	0	2	..	..
Coal	0	5 $\frac{3}{4}$	..	..
Mother coal	0	$\frac{1}{4}$	..	..
Coal and bone	0	5 $\frac{1}{2}$	..	..
Bone	0	5	..	..
Coal, bright	0	2 $\frac{1}{2}$	..	..
Bone	0	1 $\frac{1}{2}$	..	..
"Sulphur," black	0	$\frac{3}{8}$	..	..
Coal	2	2	..	..

Section 8640 was obtained from the chain pillar of cross-entry 8, about 5,600 feet from the drift mouth; section 8641, from the face of the diagonal main air course, 8,400 feet from the drift mouth; and section 8642, from the face of cross-heading 1, about 8,400 feet from the drift mouth.

Pocahontas No. 3 bed at points measured in the Baby Pocahontas mine.

	8640		8641		8642	
	Ft.	in.	Ft.	in.	Ft.	in.
Coal	1	4 $\frac{1}{2}$	2	$\frac{1}{2}$	..	..
Bone	0	3	0	2	..	..
Coal, hard and bright .....	..	..	..	..	2	3 $\frac{1}{4}$
Coal, bony .....	..	..	..	..	0	7 $\frac{1}{2}$
Coal	1	8	0	3 $\frac{1}{2}$	0	4 $\frac{1}{4}$
Coal, bony	0	2	0	3	0	1 $\frac{1}{4}$
Coal	0	3	0	4	0	2 $\frac{1}{2}$
Coal, bony	0	4	0	6 $\frac{1}{2}$	0	7 $\frac{1}{2}$
Coal, with mother coal streaks	0	3 $\frac{1}{2}$	0	5 $\frac{1}{4}$	3	2
Coal, bony .....	..	..	0	3	0	3 $\frac{1}{2}$
Coal, with mother coal streaks	2	10	0	2 $\frac{1}{2}$	2	2
Coal, bony	0	3	0	3 $\frac{1}{2}$	..	..
Coal	1	3 $\frac{1}{2}$	2	2 $\frac{1}{2}$	..	..
Coal, bony .....	..	..	0	3 $\frac{1}{2}$	..	..
Coal, with mother coal streaks .....	..	..	2	$\frac{1}{2}$	..	..

Sections 8613-8615 and 8636-8639 were measured in the West Pocahontas mine of the Pocahontas Consolidated Collieries Co., three-fourths of a mile northwest of Pocahontas, Tazewell County, Virginia.

Section 8613 was obtained from the face of right air course 6, off Newport News entry, 2 miles from drift mouth; section 8614, from the face of entry 3, off Newport News entry, 2 miles from drift mouth; section 8615, from a pillar in the haulway, off Salem entry near room 2 on the Bluefield entry; section 8636, from the face of right entry 8, off Norton air course, 2½ miles southwest of the drift mouth; section 8637, from a pillar in room 14, Kingston entry, 10,500 feet from the drift mouth; section 8638, from a pillar in Jed entry, 11,000 feet from the drift mouth; and section 8639, from a pillar in the second left St. Paul entry, 900 feet from the drift mouth.

Pocahontas No. 3 bed at points measured in the West Pocahontas mine.

	8613		8614		8615		8636		8637	
	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.
Coal	1	8	1	3	3	4	1	4½	0	5
"Sulphur" .....	..	..	..	..	..	..	..	..	0	¼
Coal, hard .....	..	..	..	..	..	..	0	3	0	4
Coal, bony	0	5½	..	..	..	..	..	..	0	4..
Coal	0	11½	0	11	0	10½	0	8	1	9
Coal, bony .....	..	..	0	2½	..	..	0	4	..	..
Coal	5	1½	5	8½	1	9	5	6¼	5	11¾

Pocahontas No. 3 bed at points measured in the West Pocahontas mine.

	8638		8634	
	Ft.	in.	Ft.	in.
"Sulphur"	0	¼	..	..
Coal, with mother coal partings	1	2	0	10½
"Sulphur"	0	¼	0	½
Coal	1	8½	2	2
Coal, bony	0	5	0	3½
Coal	0	4½	1	7½
Coal, bony	0	6	0	3
Coal	0	3	0	3½
Coal, bony	0	2	0	6½
Coal, with mother coal streaks	2	7½	0	8
Coal, bony	0	3	0	2
Coal, with mother coal streaks	2	3	1	4½
Coal, bony .....	..	..	0	1½
Coal, with mother coal streaks .....	..	..	1	5½

What may be regarded as a typical development of the Pocahontas No. 3 bed in this neighborhood (Pl. VIII) is seen in the walled-up exposure on the point between Coal Run and Laurel Fork.

Pocahontas No. 3 bed at the mouth of Coal Run.

(Location 11, elevation 2,345)

	Ft.	in.
Sandstone	40+	0
Shale	1	0
Coal	9	6
Impure coal and rash.....		6
Coal		8+
Coal	10	2+
Partings		6

Through the courtesy of Mr. S. B. Maxey, two sections were obtained in the No. 2 slope mine of the Big Vein Pocahontas Coal Co., one mile west of Pocahontas (location 12). (Pl. XIV.) The first section, measured at fourth left, 2,400 feet S. 75° W. of the slope, showed 10 feet 10 inches of clean coal. The second, measured at the motor pit in the main entry, 1,100 feet west of slope, was as follows:

Pocahontas No. 3 bed at motor pit in No. 2 slope mine.

	Ft.	in.
Shale		
Coal	1	8
Coal, slightly bony		5
Coal	3	4
Coal, slightly bony		2
Coal	5	10
Clay, hard.....		
Coal	11	5

The average thickness of the bed in this mine is said to be 10 feet 6 inches, no part of which is discarded in mining. The average daily production is 650 tons.

The Pocahontas No. 3 is about 9 feet thick under Big Stone Ridge at the head of Haynes Branch. The first of the two sections following was reported by Hennen; the second was measured by the writer in the Tug River mine of the Mill Creek Coal and Coke Co. which extends into Virginia:

Pocahontas No. 3 bed under head of Haynes Branch.

(Location 13, elevation 2,480)			(Location 14, elevation 2,445)		
	Ft. in.			Ft. in.	
Shale			Coal	10	
Coal	4	0	Shale and "sulphur"	1½	
Bone		3	Coal	2	
Coal	4	10	Bone	2	
	<hr/>		Coal	5	
Coal	8	10		<hr/>	
Partings		3	Coal	8	6
			Partings	3½	

In the Tug River mine the top bench is left up in advance work. The bone parting is said to range in thickness from 2 to 4 inches and the bed from 7 to 11 feet.

The shaft mine at Boissevain (location 15) is sunk just north of the outcrop of the upturned Pocahontas No. 3 bed.

Sections 8633, 8634, 8732, 8736, and 8737 were measured in the Boissevain shaft mine at Boissevain, Tazewell County, Virginia, August 4, 1909. Section 8633 was measured on the main entry 3,000 feet from the shaft; section 8634, on east entry 1, about 2,000 feet from the shaft; section 8732, on the face of west entry 1, about 1,200 feet from the shaft; section 8736, on the face of east entry 3, about 1,600 feet from the shaft; and section 8737, in room 8, west entry 3, about 1,500 feet from the shaft.

Pocahontas No. 3 bed at points sampled in the Boissevain mine.

	8633		8634		8732		8736		8737	
	Ft. in.		Ft. in.		Ft. in.		Ft. in.		Ft. in.	
Coal, soft, bright	0	7½	2	2	2	½	2	8	1	4
"Sulphur" band .....	..	..	..	..	..	..	..	..	0	½
Coal, bony	0	3½	..	..	0	1½	0	4½	..	..
Coal	2	11½	1	½	0	4	0	6	1	4
Coal, bony	0	1½	0	2½	0	2	..	..	0	9
Coal	2	8¾	1	6	1	10	2	4	2	10
Coal, bony .....	..	..	0	1	..	..	..	..	..	..
Coal, mother coal streaks ..	..	..	1	8¾	..	..	..	..	..	..
Coal, bony .....	..	..	0	1½	..	..	..	..	..	..
Coal .....	..	..	2	6¾	2	7¾	2	5	2	9
Coal, bony .....	..	..	..	..	0	3	..	..	..	..
Coal .....	..	..	..	..	2	6¾	..	..	..	..
Included in sample	6	3¾	8	11½	9	5	7	11	8	3½
Excluded from sample	0	5	0	5	0	6½	0	4½	0	9

The average daily output of the mine is about 1,500 tons. According to Mr. Stow arrangements have been completed for the construction here of a new steel tipple of 3,000 tons daily capacity.

The five sections following were obtained by Hennen on the headwaters of Tug Fork. The first two were measured in prospects; the remaining three in the Jenkinjones mines.

Pocahontas No. 3 bed on Millseat Branch.

(Location 16, elevation 2,445)

	Ft.	in.
Shale		
Coal	5	0
Coal, bony		3
Coal	3	6
<hr/>		
Coal	8	6
Parting		3

Pocahontas No. 3 bed on Sams Branch.

(Location 17, elevation 2,330)

	Ft.	in.
Shale		
Coal	3	10
Bone		3
Coal	5	7
<hr/>		
Coal	9	5
Parting		3

Pocahontas No. 3 bed in drift 4, mine 6.

(Location 18, elevation 2,162)

	Ft.	in.
Shale	5+	
Coal	3	8
Bone		4
Coal	4	
Black rash		3
Coal	1	9
<hr/>		
Coal	9	5
Partings		7

Pocahontas No. 3 bed in drift 1, mine 7.

(Location 19, elevation 2,137)

	Ft.	in.
Shale		
Coal	3	4
Bone		1½
Coal		10
Bone		2
Coal	5	3
Black rash		10
<hr/>		
Coal	9	5
Partings	1	1½

Pocahontas No. 3 bed in drift 1, mine 8.

(Location 20, elevation 2,206)

	Ft.	in.
Shale	5+	
Coal	3	3
Bone		4
Coal	2	0
Black rash		2
Coal	1	0
<hr/>		
Coal	6	3
Partings		6

According to Hennen's information, the coal bed in mine 6 is regular and averages about 10 feet in thickness; in mine 7 it is from 2 feet to 14 feet thick with an average of about 7 feet; and in mine 8, it is from 2½ feet

to 12 feet thick with an average of about 6½ feet. Other sections of the coal bed in the mines at Jenkinjones, measured in connection with their sampling for analysis, are given as follows:

Sections 20507, 20508, 20509, 20510, and 20511 measured in No. 7 mine of the Pocahontas Consolidated Collieries Co., at Jenkinjones, McDowell County, West Virginia, 2½ miles west of Boissevain, Va., December 12, 1914. Section 20507 was measured at the face of 2nd right, off main 7-5 entry, 3,300 feet from entrance; section 20508, face of 3rd right, off main 7-5 entry, 3,400 feet from entrance; section 20509, face of 7th right, off main 7-1 entry, 3,400 feet from entrance; section 20510, face of 4th parallel air course, 3,500 feet from entrance; and section 20511, face of main 7-1 entry, 4,100 feet from entrance. (For analyses of samples cut at these places, see p. 163.)

Pocahontas No. 3 bed at points sampled in No. 7 mine.

	20507	20508	20509	20510	20511
	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.
Coal	3 10	3 10	3 2	3 8	4 3
Coal, bony	*0 3	*0 2	*0 2	*0 4	*0 4
Coal	3 9	4 4	3 10	3 6	6 5
Included in sample.....	7 7	8 2	7 0	7 2	10 8
Excluded from sample.....	0 3	0 2	0 2	0 4	0 4

Sections 20518, 20519, 20520, 20521, 20522, and 20523 measured in No. 6 mine of the Pocahontas Consolidated Collieries Co., at Jenkinjones, McDowell County, West Virginia, 2 miles west of Boissevain, Va., December 11, 1914. Section 20518 was measured at the face of F-6 entry, off F entry; section 20519, face of F-5 entry, off F entry, 3,700 feet from entrance; section 20520, face of main 6-1 entry, 3,100 feet from entrance; section 20521, face of main 6-8 entry, 2,225 feet from entrance; section 20522, face of M-11 entry, off main entry; and section 20523, face of P entry, off P-11, off main 6-8 entry, 2,400 feet from entrance. (For analyses of samples cut at these points, see p. 163.)

* Not included in sample.

Pocahontas No. 3 bed at points sampled in No. 6 mine.

	20518	20519	20520	20521	20522	20523
	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.
Coal	4 0	3 9	3 10	3 11	3 10	4 3
Coal, bony.....	*0 4	*0 3	*0 3	*0 2	*0 2	*0 2
Coal	6 2	6 3	3 6	5 7	5 8	5 6
Included in sample	10 2	10 0	7 4	9 6	9 6	9 9
Excluded from sample	0 4	0 3	0 3	0 2	0 2	0 2

Sections 20531, 20532, 20533, 20534, and 20535 measured in No. 8 mine of Pocahontas Consolidated Collieries Co., at Jenkinjones, McDowell County, West Virginia, 3½ miles west of Boissevain, Va., December 12, 1914. Section 20531 was measured at face of F entry, off main 8-1, 1,530 feet northeast of entrance; section 20532, face of H-2 entry, off I entry, 1,000 feet from entrance; section 20533, face of B entry, off A entry, off main 8-D entry, 1,800 feet from entrance; section 20534, face of B air course, off A entry, 1,800 feet from entrance; and section 20535, face of F-2 entry, off F entry, off main entry, 1,600 feet from entrance. (For analyses of samples cut at these points, see p. 164.)

Pocahontas No. 3 bed at points sampled in No. 8 mine.

	20531	20532	20533	20534	20535
	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.
Coal	4 0	3 11	4 2	3 10	3 10
Coal, bony	*0 2	*0 ½	*0 2	*0 2	*0 2
Coal	4 4	2 9½	1 10	2 3	3 0
Included in sample	8 4	6 8½	6 0	6 1	6 10
Excluded from sample.....	0 2	0 ½	0 2	0 2	0 2

The westward thinning of the Pocahontas No. 3 becomes very noticeable in mine 8 on Ballard Harmon Branch, west of which it never regains its original thickness. In a small mine on Road Fork (location 21, elevation 2,160) the bed shows 5 feet 7½ inches of coal without partings. Measurements furnished by Mr. H. N. Eavenson show an average thickness of about 6 feet, including an inch or two of shale, for the bed on the headwaters of South Fork, north of Laurel Fork. The bed is 7 feet 3 inches thick including 2 inches of shale, at an opening in the next hollow west of Road Fork (location 22, elevation 2,176), and 5 feet 7 inches thick, including

* Not included in sample.

1 inch of shale, in a prospect three-fourths of a mile southwest (location 23, elevation 2,125). There are about 5 feet of coal and 1 inch of shale in a pit still further southwest (location 24, elevation 2,142).

A number of drill holes have been put down on Laurel Fork to determine the position and thickness of the Pocahontas No. 3 bed, but the records could not be obtained. The coal is known to thin rapidly to the north and west and it is probable that the thickness is greater on the upper part of Laurel Fork than is indicated by the measurements made on the headwaters of South Fork. Where penetrated by the drill near the head of Horsepen Creek just west of Laurel Fork (HC 1) the bed is 7 feet 1 inch thick.

A short distance south of Low Gap (location 25), the steeply dipping bed has been prospected by an incline which was full of water when visited. No information was obtained regarding the thickness of the bed which here seems to be involved in the fault and which probably does not reach the surface west of this location.

An exposure three-fourths of a mile east of Low Gap (location 26) showed 10½ feet of clean coal at the top of the bed, separated by 6 inches of clay from a 46-inch bench at the bottom. The coal is here standing on end but shows no evidence of abnormal thickening due to crushing, even the finest laminations remaining perfectly distinct. Several old strippings nearby are reported to have shown a uniform thickness of 10 feet of clean coal. The bed probably ranges from 7 to 10 feet in average thickness on Laurel Fork west of Low Gap. One mile northeast of Boissevain (location 27), 13 feet of badly weathered but apparently clean coal are exposed in an old stripping. The dip is about 85° northwestward. The coal shows the original bedding and does not appear to have suffered any contortion but the massive sandstone which comes above it has been badly shattered.

In the No. 1 shaft mine of the Big Vein Pocahontas Coal Co., one-half a mile west of Pocahontas (location 28), the coal bed averages about 11 feet thick, with a thin streak of bone near the middle in places. This is one of the oldest mines on Laurel Fork and there are only pillars left in it. The average daily production is 100 tons.

Pocahontas No. 4 bed.—The Pocahontas No. 4 coal bed on Laurel Fork rests on the conspicuous cap-rock of the Pocahontas No. 3 bed, or is separated from it by a few feet of shale. The interval between the coal beds is about 105 feet at Pocahontas and according to Hennen only 80 feet at Coaldale, 3 miles north. A similar thinning takes place to the west. At the drill hole near the head of Horsepen Creek the beds are 82 feet apart

and where thoroughly prospected by the U. S. Coal and Coke Co. on the headwaters of South Fork north of Laurel Fork, they are 65 to 90 feet apart with an average of 75 feet. The sandstone above the Pocahontas No. 3 bed is not so thick on the South Fork of Tug as at Pocahontas and the Pocahontas No. 4 is separated from it by at least 25 feet of shale. A sandstone which forms heavy cliffs on South Fork is found either directly on or a short distance above this coal bed.

On Coal Run and adjacent portions of Laurel Fork where the Pocahontas No. 4 bed outcrops, the few exposures found indicate that it is of little value. On the upper part of Laurel Fork the bed is 7 or 8 feet thick. No information as to the thickness could be obtained in the area between Coal Run and Low Gap but it is probably less than 30 inches.

Where exposed at a sharp bend in the road, near the State line (location 29, elevation 2,515) the bloom of the Pocahontas No. 4 bed is about 10 inches thick, but the lower 6 inches is apparently very dirty. A foot of coal exposed near the top of the quarry opposite the station at Pocahontas (location 30, elevation 2,490) may represent this bed. About $1\frac{1}{2}$ miles up Coal Run are several old drifts close together but at slightly different levels. Possibly two beds have been opened here. The coal which probably represents Pocahontas No. 4 is reported to be about 2 feet thick in the old opening on the west side of the stream near location 36.

The following outcrop measurements furnished by Mr. H. N. Eavenson show that this bed thickens rapidly to the west from the head of Tug Fork. At an opening on the west bank of the stream, near location 19, the coal is 2 feet, 4 inches thick and contains 4 inches of shale. The bed is $3\frac{1}{2}$ feet thick including 4 inches of shale at a prospect pit near the head of Ballard Harmon Branch, on the west hillside above location 20. Where opened on Road Fork, 1 mile southwest (location 31, elevation 2,224), the coal is $6\frac{1}{2}$ feet thick and contains 4 inches of shale. The coal is 6 feet 4 inches thick in the next hollow to the west (location 32, elevation 2,246), $8\frac{1}{2}$ feet thick at another pit one-half mile south (location 33, elevation 2,158), and $7\frac{1}{2}$ feet thick where opened above the Pocahontas No. 3 coal, one-half mile southwest (location 34, elevation 2,188). The bed carries $2\frac{1}{2}$ to 3 inches of shale at each of these openings. The Pocahontas No. 4 coal in this region is about 7 feet thick exclusive of the persistent 2- to 4-inch shale parting, and it may be safely assumed that this thickness continues southward to the fault. No exposures of the bed were found in the steeply dipping rocks south of Laurel Fork.

Pocahontas No. 5 bed.—The Pocahontas No. 5 coal appears to be a split off the Pocahontas No. 4, and where exposed on the lower part of Laurel Fork the two beds are nowhere more than 10 feet apart. Only one bed is present in many localities where either the two are together or the upper has been cut out by the sandstone which comes above it. Where both beds are found there is shale or sandy shale between them. No information was obtained regarding the thickness of the bed on the upper part of Laurel Fork, and it is of doubtful value where it outcrops on the lower part.

According to Krebs there are 21 inches of impure coal in this bed where it is exposed in the road west of Ruth (location 35, elevation 2,510). About 1½ miles up Coal Run the following section which probably represents this bed is exposed in an abandoned drift on the east side of the stream:

Pocahontas No. 5 bed on Coal Run one and one-half miles from mouth.

(Location 36, elevation 2,525)

	Ft.	in.
Shale	10	
Coal		4
Clay		3
Coal	1	6
Clay		9
Coal		5

Coal	2	3
Partings	1	0

In the road on the opposite side of the stream, what is thought to be the same bed consists of 6 inches of coal at the top separated by 1½ feet of shale from 18 inches of coal and bone below. Both Pocahontas No. 4 and No. 5 are exposed in the road up Reeds Branch, about 300 yards northeast of location 44. The lower bed is represented by a streak of bloom and the upper by a 1-inch layer of coal. The beds are separated by 10 feet of shale and there is sandstone above and below. In a railroad cut 1 mile northeast of Boissevain (location 37, elevation 2,410) the Pocahontas No. 5 bed consists of one foot of dirty coal and is overlain by 50 feet of sandstone. The bed is 32 inches thick in the drill hole on upper Horsepen Creek and still thicker further west, but it is probably not more than 2 feet thick on the upper part of Laurel Fork.

Pocahontas No. 6 bed.—The Pocahontas No. 6 coal bed outcrops on the lower part of Laurel Fork, where it is about 100 feet above the next lower bed and 200 feet above Pocahontas No. 3. Coarse sandstone, with shale or

sandy shale near the middle, separates this bed from the Pocahontas No. 5 below, and above it there is sandstone which rests directly on the coal in most places. The sandstone ledge below the coal is very massive and forms strong benches.

The Pocahontas No. 6 coal bed was nowhere found to be more than 2 feet thick on Laurel Fork, but the bed is being utilized at a number of small openings. Its horizon is easily followed because of the bench-forming sandstone below it. The outcrop of the bed on Laurel Fork is shown on the geologic map.

One foot of bloom was seen at the horizon of the Pocahontas No. 6 coal bed in the county road near the State line (location 38, elevation 2,615) and there is probably more. At an opening on the east side of Coal Run (location 39, elevation 2,635) the bed is 22½ inches thick, including 3½ inches of impure cannel coal at the top, and has a sandstone roof. A similar section was measured in an extensive stripping at the head of the stream (location 40, elevation 2,610) and the coal was reported 18 inches thick at an opening beside the road a short distance south (location 41, elevation 2,630). At an opening in a little hollow in the west side of the stream (location 42, elevation 2,625) the coal is also 18 inches thick and there are 3½ inches of impure cannel coal above it. The bed is said to be about 2 feet thick in an old drift one mile northwest of Pocahontas (location 43, elevation 2,600). About 2 feet of coal were seen at this horizon in a spring beside the road, 200 yards northwest of the mouth of Reed Branch (location 44, elevation 2,510), and at an opening on Haynes Branch (location 45, elevation 2,570) the coal is 16 inches thick under coarse sandstone. The Pocahontas No. 6 coal is 18 inches thick where exposed in the Boissevain-Jenkinjones road (location 46, elevation 2,430). The bed is probably cut out by sandstone on the upper part of Laurel Fork.

A coal bed about 50 feet above the Pocahontas No. 6 was found exposed in several localities. It shows as 14 inches of bloom in the road near location 43. The bed is thin at two places on the east side of Haynes Branch (location 47, elevation 2,525 and location 48, elevation 2,575). There is said to have been a stripping in 3 feet of coal at about this horizon in the bed of Curran Branch near its mouth (location 49, elevation 2,460).

Pocahontas No. 7 bed.—The Pocahontas No. 7 coal bed is about 300 feet above the No. 3 bed and 100 feet above the No. 6 bed. It lies just under a 50-foot sandstone and over 50 feet of shale, in part sandy.

Exposures indicate that this bed is thin on Laurel Fork. Krebs reports it only 6 inches thick in the county road just south of location 35 and about

that thickness was seen in the private road on the west side of Coal Run, a short distance north of location 43. The bed shows 17 inches of clean coal on the next stream west of Haynes Branch (location 50, elevation 2,530) and 14 inches at a stripping in the bed of Farmers Branch (location 51, elevation 2,450). The bed is 15 inches thick in the road near the mouth of this branch (location 52, elevation 2,450), where the rocks begin to turn up sharply on the south side of the syncline.

Pocahontas No. 8 bed.—Resting on the sandstone cap-rock of the bed just described and 50 feet above it is the Pocahontas No. 8. Few exposures of the bed were found on Laurel Fork and it is probably too thin to ever be mined. The coal is 15 inches thick in the road on Big Stone Ridge at the head of Coal Run (location 53, elevation 2,755) and 9 inches thick where it is being stripped from the bed of Farmers Branch (location 54, elevation 2,495). It is probably cut out by sandstone at the head of Laurel Fork.

Pocahontas No. 9 bed.—The thin coal bed which represents the Pocahontas No. 9 in this region may be seen in the road north of Peeled Chestnut Gap (location 55, elevation 2,800). The bed is here separated from the Pocahontas No. 8 coal by 35 feet of shale. Two blooms, each one foot thick, were seen at about this horizon on the Boissevain-Jenkinjones road (location 56, elevation of lower 2,645). Inconspicuous blooms of this coal were seen in several other places but nowhere were they thick enough to indicate a bed of any value.

Lower Horsepen bed.—A coal bed which is believed to represent the Lower Horsepen was found at several openings near the head of Curran Branch. There are 30 to 50 feet of sandstone below the coal and a thin ledge of sandstone close above it. The distance above Pocahontas No. 3 is about 480 feet. The outcrop of the bed is shown on the geologic map.

On the ridge east of Curran Branch (location 57, elevation 2,830) there is an old opening not now worked, at which this bed consists of 5 feet of clean coal. Road blooms indicate that the coal is very much thinner along this ridge to the south. The coal is 4 feet 8 inches thick in a small mine in West Virginia at the head of Sams Branch (location 58, elevation 2,815) and apparently not more than 18 inches thick at the head of Farmers Branch. There are 3 feet 2 inches of coal further south in a small drift in the ridge west of Curran Branch (location 59, elevation 2,705) and 15 inches at an opening half a mile south (location 60, elevation 2,640).

A bloom exposed in the road on Road Fork (location 61, elevation 2,540) indicates that the Lower Horsepen is at least one foot thick in that region.

Several feet of steeply dipping coal in a spring one mile southwest of Low Gap (location 62) may belong to this bed. It is probably $1\frac{1}{2}$ to 2 feet thick on the upper part of Laurel Fork.

At distances of 30 feet and 65 feet above the Lower Horsepen are thin coal beds, the blooms of which were found in a few places. The lower bed rests on the sandstone over the Lower Horsepen coal and is separated from the upper chiefly by sandstone. Both of the beds are exposed in the road west of Curran Branch, where the lower of the two (location 63, elevation 2,825) seems to be at least 2 feet thick. This bed is said to be 18 inches thick in an old opening one mile southwest of Low Gap (location 64, elevation 2,580). It has also been opened in the hollow 1,000 feet southwest and near the wagon road across head of Laurel Fork (location 65, elevation 2,585). At least 2 feet of bloom exposed in the Boissevain-Jenkinjones road at the gap (location 66, elevation 2,710), belong to this bed or to the one 35 feet above it.

War Creek bed.—The War Creek coal in this region is 170 feet above the Lower Horsepen and 650 feet above Pocahontas No. 3. For 100 feet below the bed the rocks are mostly sandstone, and above are about 25 feet of shale overlain by the coarse, massive sandstone that forms the flat tops along Big Stone Ridge between Low Gap and the gap at the head of Road Fork. This coal bed has escaped erosion only on the upper part of Laurel Fork, where it is about 2 feet thick.

The only complete measurement of this bed obtained on Laurel Fork was made in a small mine about $1\frac{1}{2}$ miles west of Low Gap (location 67, elevation 2,690) where there are 27 inches of coal split by $\frac{1}{2}$ to 3 inches of rash a foot from the bottom. Nearly a mile west (location 68, elevation 2,665) at least 2 feet of bloom were exposed near the wagon road gap and about a foot of bloom was seen 10 feet below. The bed is about 2 feet thick where exposed in the wagon road almost half a mile south (location 69, elevation 2,590).

Middle Horsepen bed.—The Middle Horsepen coal is about 770 feet above Pocahontas No. 3 on Laurel Fork and 120 feet above the War Creek bed. It lies at the top of a thick sandstone which is locally split by shale, and in this region there is sandy shale and sandstone above it. At the exposures found the coal was almost 4 feet thick but the bed thins slightly to the west and 40 inches is probably the average for Laurel Fork. The position of this bed in any locality may be determined by reference to the outcrop of the upper Horsepen which is shown on the geologic map.

Where measured in a small mine on Big Stone Ridge (location 70, elevation 2,765) the bed was 45 to 52 inches thick including an inch of clay 4 inches from the bottom, and at an opening about 400 feet west (location 71, elevation 2,770) the section is practically the same. The bed is 46 inches thick, including 2 inches of clay 3 inches from the base, in a local drift 1,000 feet southwest (location 72, elevation 2,720) and shows the same section in another opening 200 feet west. The bed is said to be 3 to 4 feet thick where it is brought to the surface at an old stripping in the upturned rocks south of Laurel Fork (location 73).

Upper Horsepen bed.—On Laurel Fork the Upper Horsepen coal bed is about 820 feet above Pocahontas No. 3, and 50 feet or less above the Middle Horsepen. There are a few feet of shale above the coal in most places, followed by sandstone and sandy shale, and there is a thin sandstone close below. The bed is extremely irregular in thickness and ranges from 2 feet to about 9, with an average of perhaps 5 feet for the Laurel Fork region.

Coal at a small drift in Big Stone Ridge (location 74, elevation 2,715) measured 4 feet at the face and had 8 inches of bone above it; at the entrance there appeared to be another bench above a layer of shale. According to the section furnished by Mr. Claggett for this opening, or one very close to it, the Upper Horsepen bed is here 8½ feet thick including 6 inches of shale 2 feet from the bottom. The following outcrop measurements made by the same company show that the bed thins to the west, along Big Stone Ridge. On the north side of the ridge (location 75, elevation 2,770) one-fourth of a mile northwest of the location just given, the 6-foot bench at the top of the bed has thinned to 4 feet, and less than half a mile west (location 76, elevation 2,767) it is 29 inches thick and only 4 inches of shale separate it from the 2-foot layer of coal at the bottom of the bed. At the next opening (location 77, elevation 2,808) the top bench, 5 feet thick, is separated from a 2-foot bench below by 5 inches of shale. At an opening slightly over half a mile southwest (location 78, elevation 2,794) the bed is 29 inches thick, including 5 inches of shale 4 inches from the top, and at a prospect further west (location 78 A, elevation 2,791) a bottom bench of 24 inches represents the entire bed. The bed has thickened to 5 feet including 4 inches of shale at the last opening in this direction (location 79, elevation 2,804).

On the waters of Horsepen Creek directly opposite the head of Laurel Fork the coal is only about 28 inches thick, but it is much thicker on the south side of Laurel Fork. Near the forks of this stream (location 80, elevation 2,646) the bed is said to be 50 inches thick including 5 inches

of shale 2 feet from the top, and about 8 feet thick at a prospect 450 feet southeast. The coal is reported about 9 feet thick at an opening a short distance east (location 81, elevation 2,627) and 7 and 14 feet, respectively, in the next openings to the south where the coal is on end (location 82, elevation 2,573 and location 83, elevation 2,567). Where it has been uncovered in the next hollow to the west (location 84) the coal appears to be between 6 and 7 feet thick, and is dipping 60° southeastward.

JACOBS FORK AND HORSEPEN BASIN.

General features.—The coal field in this basin is very narrow, covering only the extreme headwaters of Jacobs Fork and lying between Horsepen Creek and the Boissevain fault. The Pocahontas coals are all below drainage in this immediate area though the upper Pocahontas coals outcrop only a short distance down Jacobs Fork in West Virginia. The outcropping strata include those from below the Lower Horsepen coal to above the Middle Seaboard coal. In general the structure is that of a monocline dipping from the north toward the south or toward the fault.

Below drainage occur the several Pocahontas coals of which the No. 3 is estimated to have a thickness of from 7 feet at the east end of the basin to 6 feet at the west. The Pocahontas No. 4 has an estimated thickness of 5 to 7 feet under all of the basin. The No. 5 is estimated to range from about $2\frac{1}{2}$ feet at the east to 2 feet at the west. The Pocahontas No. 6 is thin, ranging from 18 inches thick at the east to a foot or a little over at the west. The Pocahontas Nos. 7, 8, and 9 together are estimated to have a thickness of less than 4 feet at the east and a little more than a foot at the west. The Lower Horsepen is the lowest of the workable beds exposed, though about 200 feet of rocks under it outcrop at the county line. On upper Horsepen Creek this bed shows about $2\frac{1}{2}$ feet of coal in three benches and $2\frac{1}{2}$ to 3 feet at Low Gap. Around Horsepen Post-Office it reaches a thickness of $3\frac{1}{2}$ to 4 feet or more but including rather thick partings. Little is known of this bed on the lower part of Horsepen Creek. Between the Lower Horsepen and War Creek are at least two beds; the first, 50 to 65 feet above the Lower Horsepen, and the other, 100 feet above. Neither averages over 2 feet and the upper bed is split. The War Creek bed, 165 feet above the Lower Horsepen, is from 2 to $2\frac{1}{2}$ feet thick on the average. It is not opened on the upper part of Horsepen. Between the War Creek and the Middle Horsepen are two coals at 30 and 60 feet above the underlying bed. The lower is of no value but the upper is from 2 to $2\frac{1}{2}$ feet thick near Shraders, and averages 38 inches, including

5 inches of shale, on the headwaters of Horsepen Creek. The Middle Horsepen coal, 125 feet above the War Creek, is an important bed. It is 4 feet thick under Pine Ridge and around Horsepen, and 3 feet thick west of Shraders. The Upper Horsepen coal, 50 to 65 feet above the last, and 800 to 820 feet above the Pocahontas No. 3, is variable though locally very thick, reaching in places nearly 12 feet. It will probably average in this district over 6 feet in thickness. Of the beds above the Upper Horsepen only the Middle Seaboard is at all known. It is believed to be the coal which underlies some of the high knobs on which openings have been made and the coal found to be from 3 to 4 feet thick.

Lower Horsepen bed.—The lowest coal bed of importance outcropping on Jacob Fork and its tributaries in Tazewell County is the Lower Horsepen. Two hundred feet of strata are exposed below this bed but they appear to be practically barren. A 3-inch coal at the base of 30 feet of shale and about 125 feet below the Lower Horsepen bed was seen at the road forks about half a mile east of Horsepen and in the bed of Horsepen Creek less than half a mile northeast of the drill hole (HC 2) near the mouth.

The Lower Horsepen coal has been mined for local use at a number of places on the upper part of Horsepen Creek and its horizon may be easily followed along the lower part of this stream because of its position at the top of a 100-foot ledge of sandstone, which forms conspicuous cliffs. (Pl. IX.) In some localities as much as 50 feet of shale and sandy shale are found above the bed but ordinarily there are only 10 or 15 feet of shale. Sandstone rests directly on the coal in a few places. On the upper part of Horsepen Creek an average section of the bed shows about 2½ feet of coal split into three benches by partings which aggregate 6 inches.

The Lower Horsepen coal rises rapidly to the north on Low Gap Branch and outcrops only a few feet above the gap at the head of this stream. The bed appeared to be about 3 feet thick at an old pit 150 feet west of the gap (location 85a, elevation 2,550). Hennen, who identifies this bed as the Pocahontas No. 9, reports the first of the following sections for an opening beside the trail on the west side of the branch and the second was measured by the writer half a mile southwest of the first.

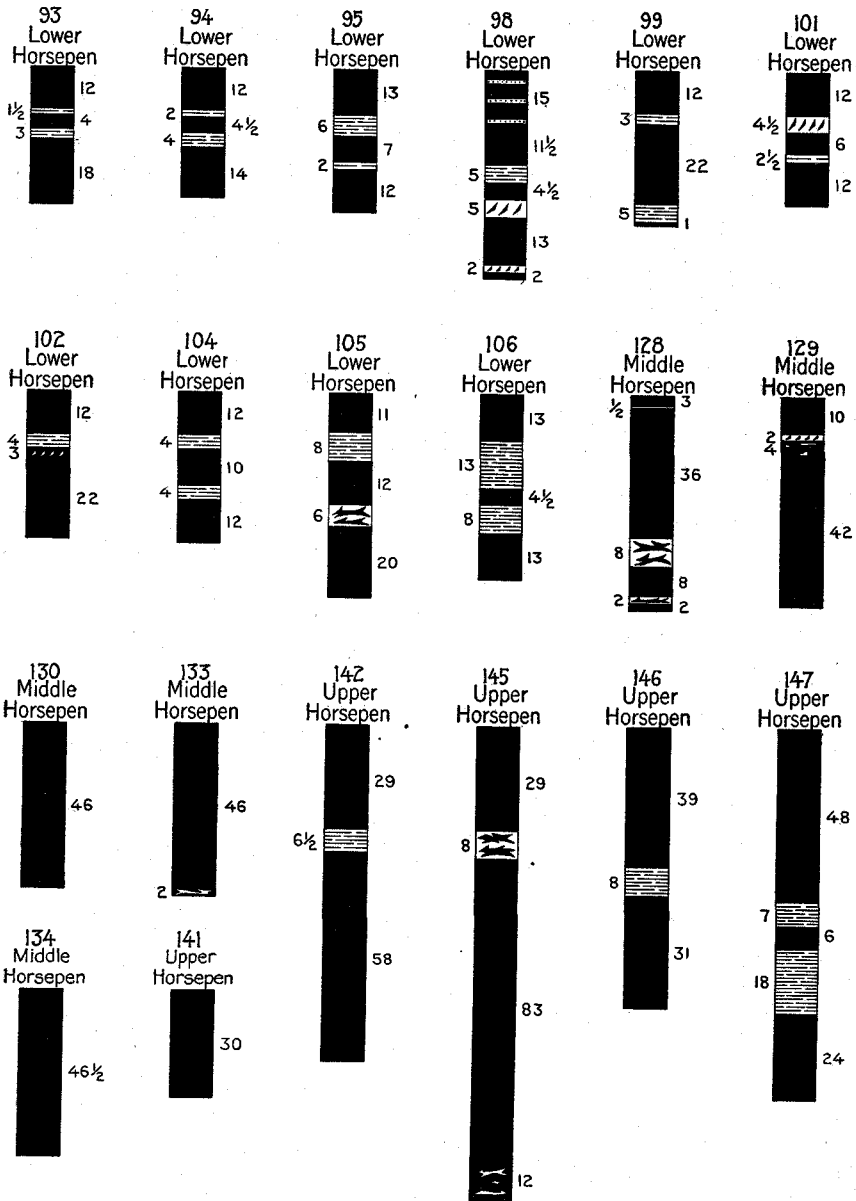


Fig. 13.—Sections of coal beds on Jacob Fork and tributaries, including Horsepen Creek.

Lower Horsepen bed near the head of Low Gap Branch.

(Location 86, elevation 2,495)		(Location 87, elevation 2,440)	
	Ft. in.		Ft. in.
Shale		Shale	
Coal	10	Coal	10½
Shale	1½	Clay	½
Coal	3½	Coal	4
Shale, with coal streaks	4	Rash	1½
Coal	1 3	Coal	1 4
		Coal	2 6½
Coal	2 4½	Partings	2
Partings	5½		

Measurements of the bed on the east side of Low Gap Branch were furnished by H. N. Eavenson. In a hollow near the head of the branch (location 88, elevation 2,460) the bed is said to contain 2½ feet of coal and 8 inches of shale. On the next spur to the south (location 89, elevation 2,395) a 31-inch section shows only 25 inches of coal, but the bed thickens near the head of the adjacent hollow (location 90, elevation 2,385) where there are 40 inches of coal and 9 inches of shale. The bed is 3½ feet thick at a prospect pit a short distance southwest (location 91, elevation 2,325) including 8 inches of shale and it contains 3½ feet of coal with only 5 inches of shale at a neighboring opening (location 92, elevation 2,300).

The three sections following were obtained on the west side of the Low Gap Branch, the first about half a mile from the mouth and the others to the south.

Lower Horsepen bed on the west side of Low Gap Branch.

	(Location 93, elevation 2,290)	(Location 94, elevation 2,225)	(Location 95, elevation 2,215)
	Ft. in.	Ft. in.	Ft. in.
Shale			
Coal	1 0	1 0	1 1
Clay	1½	2	6
Coal	4	4½	7
Clay and rash	3	4	2
Coal	1 6	1 2	1 0
Coal	2 10	2 6½	2 8
Partings	4½	6	8

According to Mr. Eavenson the bed is 2 feet thick including 3 inches of shale at an opening on Horsepen Creek near Low Gap Branch (location 96, elevation 2,225) and contains 20 inches of coal with an inch of shale

at a prospect pit half a mile northeast (location 97, elevation 2,260). The following sections were measured at small local mines in a tributary from the south:

Lower Horsepen bed near head of Horsepen Creek.

(Location 98, elevation 2,265)		(Location 99, elevation 2,255)	
	Ft. in.		Ft. in.
Sandstone		Shale	
Coal and tongues of sandstone from roof	1 3	Coal	1 0
Coal	11½	Clay	3
Clay, very hard	5	Coal	1 10
Coal	4½	Clay and rash	5
Rash	5	Coal	1
Coal	1 1	Coal	2 11
Rash	2	Partings	8
Coal	2		
Coal	3 10		
Partings	1 0		

Four measurements were obtained in a tributary from the south, half a mile east of Horsepen.

Lower Horsepen bed near Horsepen Post-Office.

(Location 100, elevation 2,135)		(Location 101, elevation 2,150)	
	Ft. in.		Ft. in.
Shale	8+	Shale	
Coal	1 0	Coal	1 0
Clay and rash	2½	Rash	4½
Coal	1	Coal	6
Rash	1	Clay	2½
Coal	5	Coal	1 0
Clay and rash	3	Coal	2 6
Coal	11	Partings	7
Coal	2 5		
Partings	6½		
(Location 102, elevation 2,165)		(Location 103, elevation 2,150)	
	Ft. in.		Ft. in.
Shale	8+	Shale	5+
Coal	1 0	Coal	9½
Clay	4	Rash	1
Rash and coal	3	Coal	6½
Coal	1 10	Clay	3
Coal	2 10	Coal	1 0
Partings	7	Coal	2 3½
		Partings	4

The Lower Horsepen bed is 3½ feet thick, including a 4-inch clay parting a foot from the top and another a foot from the bottom, at a local mine near the Post-Office on the north side of the creek (location 104, elevation 2,185). The section obtained by Campbell in a small mine at the schoolhouse south of Horsepen is as follows:

Lower Horsepen bed at schoolhouse south of Horsepen Post-Office.

(Location 105, elevation 2,030)

	Ft.	in.
Shale		
Coal	11	
Clay and bone	8	
Coal	1	0
Bone	6	
Coal	1	8
<hr/>		
Coal	3	7
Partings	1	2

That the coal is here considerably thicker than the average for this region is indicated by a measurement made at an opening in the end of the spur 100 yards southwest and by the section at a small mine on the west side of the stream where the partings are exceptionally thick.

Lower Horsepen bed in tributary south of Horsepen

(Location 106, elevation 2,030)

(Location 107, elevation 2,020)

	Ft.	in.		Ft.	in.
Coal	1	1	Sandstone, coarse..		
Clay and rash.....	1	1	Coal	1	0½
Coal	4½		Clay	11	
Clay and rash.....	8		Rash	5	
Coal	1	1	Coal	5	
<hr/>			Clay	1	2½
Coal	2	6½	Coal	10+	
Partings	1	9	<hr/>		
			Coal	2	3½+
			Partings	2	6½

There is a 30-foot ledge of coarse sandstone below the first of these two drifts and a 10-inch bed of coal, which appears to be lenticular, is exposed in the road at the base of it.

According to Hennen the bed shows the following section at a local mine on the west side of Rockhouse Branch:

Lower Horsepen bed on Rockhouse Branch.

(Location 108, elevation 2,205)

	Ft.	in.
Shale	5	0
Coal	0	11
Shale, with coal streaks.....		7
Coal		2
Shale		7
Coal		9
	<hr/>	
Coal	1	10
Partings	1	2

The Lower Horsepen coal has not been prospected on the lower part of Horsepen Creek, though its horizon is fairly well defined by the top of a 100-foot sandstone which outcrops conspicuously. A bed that is probably the Lower Horsepen shows the following section at a stripping in a branch (Banjo Branch) north of Shraders:

Lower Horsepen bed north of Shraders.

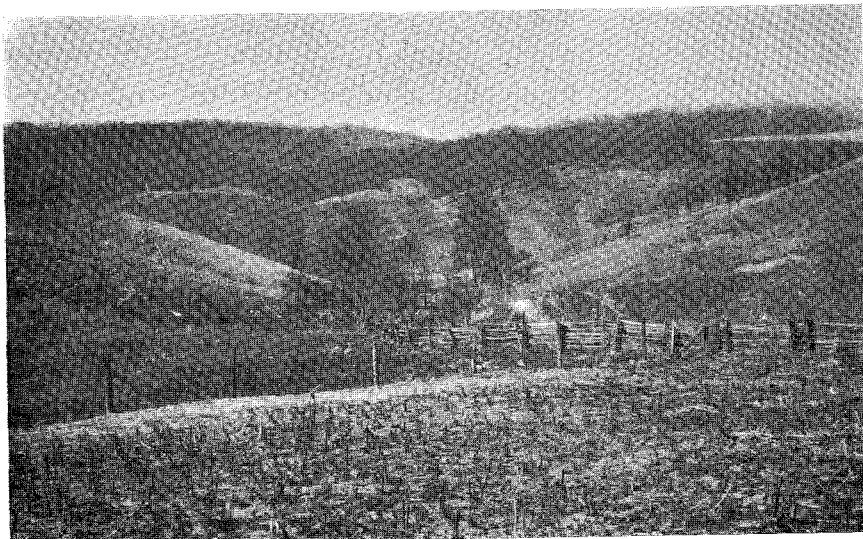
(Location 109, elevation 1,850)

	Ft.	in.
Sandstone	10+	
Coal	1	3
Clay		1
Coal		4
Clay		4
Coal		4
	<hr/>	
Coal	1	11
Partings		5

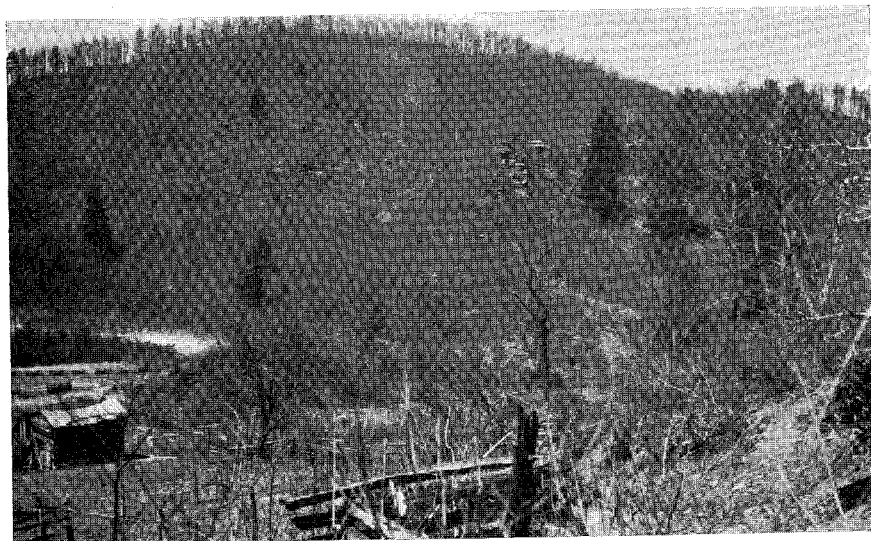
The upper 20 inches of this section is represented by 1 foot of clean coal in some parts of the exposure.

Coal beds between the Lower Horsepen and War Creek beds.—At least two coals are present in the 165-foot interval between the Lower Horsepen and War Creek beds. The lower bed is 50 to 65 feet above the Lower Horsepen coal and the upper which appears to be split in places is about the same distance below the War Creek. Further prospecting is necessary to determine the extent and thickness of these beds but probably neither of them will average more than 24 inches of coal in this region.

Both beds were opened at the head of South Fork where each showed 18 inches of coal. The upper bed is said to be 2 feet thick at an opening a short distance east. Two prospects 20 feet apart on the upper part of Horsepen Creek (location 110, elevation of lower 2,355) may represent the

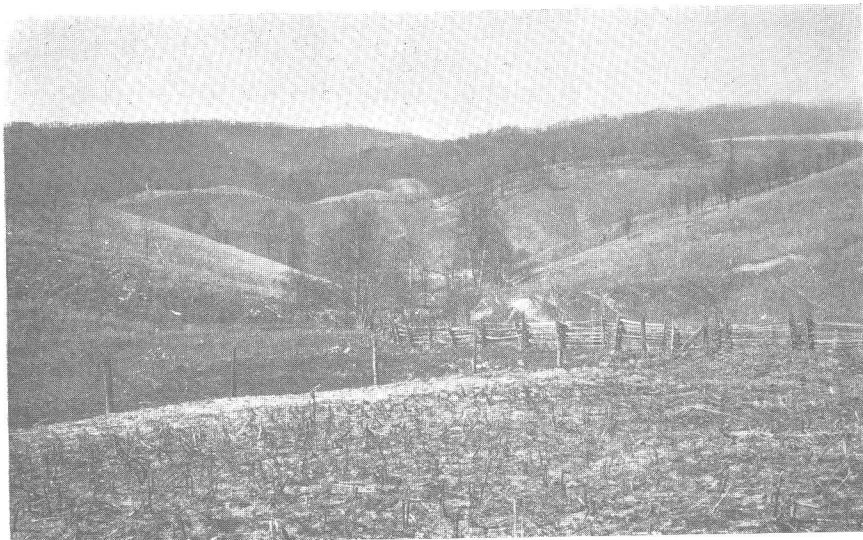


(A) View in the Horsepen Creek drainage basin, showing character of surface and cultivation.



(B) View at mouth of Horsepen Creek, showing character of sandstone exposures. Note "balanced rock" supporting pine tree in middle distance.

PLATE IX.—VIEWS SHOWING CHARACTER OF LAND SURFACE AND ROCK EXPOSURES IN HORSEPEN CREEK BASIN.

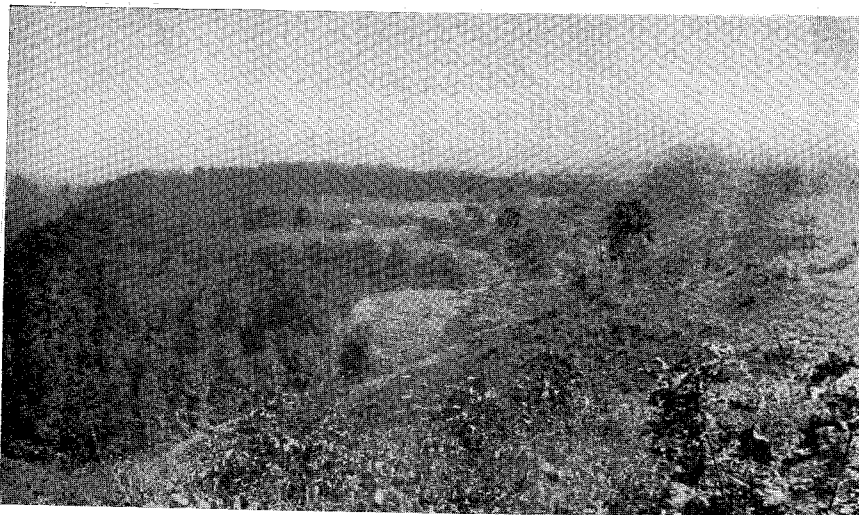


(A) View in the Horsepen Creek drainage basin, showing character of surface and cultivation.

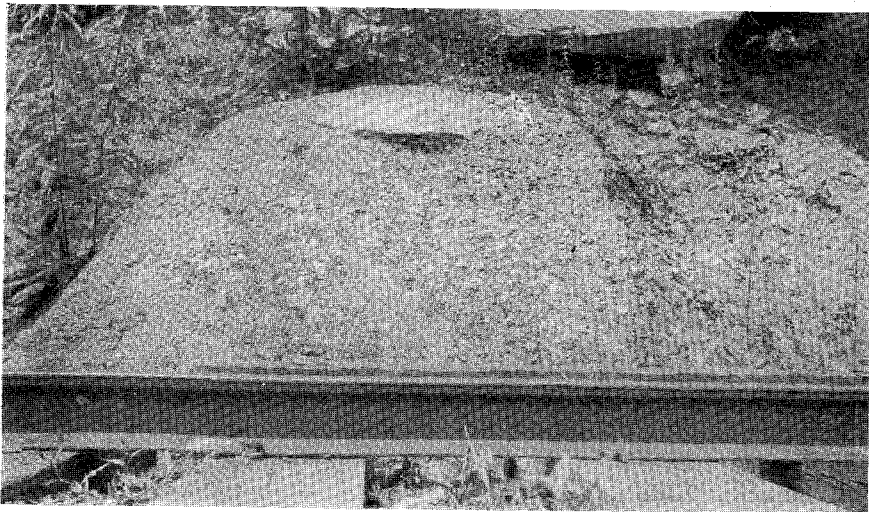


(B) View at mouth of Horsepen Creek, showing character of sandstone exposures. Note "balanced rock" supporting pine tree in middle distance.

PLATE IX.—VIEWS SHOWING CHARACTER OF LAND SURFACE AND ROCK EXPOSURES IN HORSEPEN CREEK BASIN.



(A) View at head of Indian Creek, showing flat-topped spurs underlain by sandstone under Kennedy coal bed.

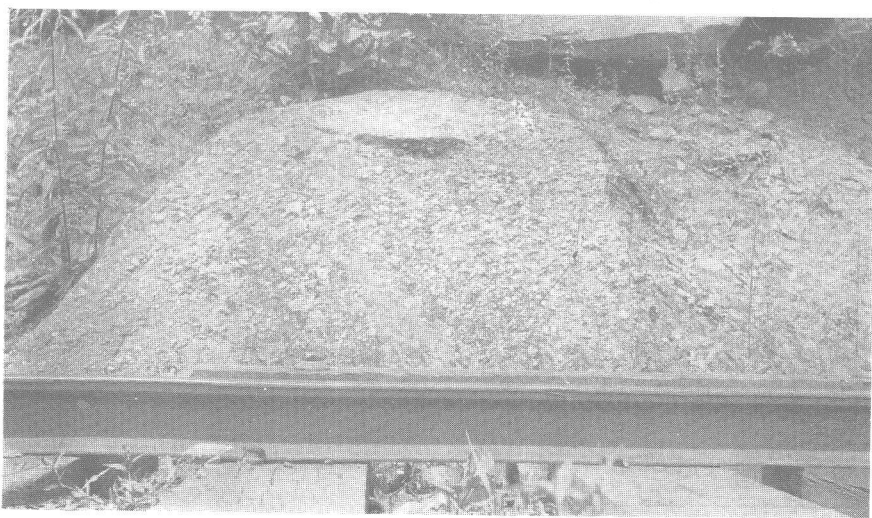


(B) Loose block showing character of conglomerate that lies about 50 feet above the Raven coal bed.

PLATE X.—VIEWS RELATING TO THE SANDSTONES ASSOCIATED WITH THE UPPER COAL BEDS.



(A) View at head of Indian Creek, showing flat-topped spurs underlain by sandstone under Kennedy coal bed.



(B) Loose block showing character of conglomerate that lies about 50 feet above the Raven coal bed.

PLATE X.—VIEWS RELATING TO THE SANDSTONES ASSOCIATED WITH THE UPPER COAL BEDS.

upper coal. Each of the beds is said to be 18 inches thick here and the lower is 100 feet above the Lower Horsepen coal.

On the north side of Horsepen Creek near the mouth there is a small mine in what is probably the upper bed at an elevation of about 110 feet above the Lower Horsepen coal. The bed at this opening is correlated with the Fire Creek coal by Hennen,¹ who gives the following section:

Coal bed about 50 feet below the War Creek bed on Lower Horsepen Creek.

(Location 111, elevation 2,125)

	Ft.	in.
Sandstone	4	0
Coal	1	6
Shale		½
Coal	4	
Shale		½
Coal	5	

Coal	2	3
Partings		1

The top 12 inches of a thin coal 75 feet below the War Creek were seen at a small pit half a mile southwest of the mouth of Horsepen Creek (location 112, elevation 1,880).

A prospect about 55 feet above the horizon of the Lower Horsepen coal was found on a tributary of Jacob Fork 1¼ miles west of Shraders (location 113, elevation 2,030) and a pit 40 feet above it may represent the upper bed. Further south in the same tributary (Dalton Branch) the lower bed has been opened at several places near water level on the east side of the stream (location 114, elevation 1,885) and at the forks. Above the road a few hundred feet west is an old prospect on the upper bed which is said to be about 7 feet thick including many partings. The same bed has been opened a short distance north (location 115, elevation 1,940) where it is only about 3 feet thick and has two or three streaks of rash in the upper half. What is probably the same coal is said to be 26 inches thick in a prospect on the other fork of this stream (location 116, elevation 2,005).

War Creek bed.—The coal bed which is thought to be the War Creek in this region is about 165 feet above the Lower Horsepen coal and 105 to 125 feet below the Middle Horsepen. The difficulty in recognizing this

¹Hennen, R. V., Report on Wyoming and McDowell counties: West Virginia Geol. Survey, p. 626, 1915.

bed on Jacob Fork is due to the splitting up of the sandstone above it, which on Mile Branch is 100 feet thick and unbroken. The average thickness of the War Creek coal is between 2 and 2½ feet.

A bed which is probably the War Creek is said to be 2 feet thick and 4 feet thick at two prospect openings near the head of South Fork. No openings which could be definitely assigned to this bed were found on the upper part of Horsepen Creek. A strong bloom belonging to the War Creek or to the next bed below it is exposed in the upturned roots of a tree on the sharp spur about a mile northeast of the mouth (location 117, elevation 2,150) of the stream. The War Creek coal is 25 inches thick in a small pit three-fourths of a mile northeast of Shraders (location 118, elevation 1,985) and the bed shows the following section where it has been opened in a small hollow one-half mile west of Shraders:

War Creek bed on a tributary of Jacob Fork.

(Location 119, elevation 1,955)

	Ft. in.
Sandstone	5+
Coal	4
Rash	½
Coal	9
Bone	1
Coal	9
<hr/>	
Coal	1 10
Partings	1½

The coal has been exposed at three prospect pits on a tributary of Jacob Fork (Dalton Branch) 1½ miles west of Shraders where, according to measurements furnished by A. G. Russell, it is from 2 to 3 feet thick. On the north side of the stream (location 120, elevation 2,045) the bed is 35 inches thick, including some partings, and there are 2 feet of coal at an opening about 800 feet southwest (location 121, elevation 2,020). At a pit on the south side of the stream (location 122, elevation 2,020) the bed is 33 inches thick but contains three partings.

Coal beds between the War Creek and Middle Horsepen beds.—Two coals, which are not present on Mile Branch, were found between the War Creek and the Middle Horsepen. The lower bed, which is about 30 feet above the War Creek, is probably absent in many places and is nowhere thick enough to ever be of value. The upper bed, about 60 feet above the War Creek, is 2 to 2½ feet thick in a small area near Shraders but appears

to be worthless to the west. Where opened on the long spur at the head of South Fork the lower coal is 12 inches thick and the upper 16 inches.

A bed which may be the upper of these two has been thoroughly prospected on the headwaters of Horsepen Creek. Measurements of the bed at many prospects, all of which are now closed, were furnished by H. N. Eavenson and are given below. The interval between this bed and the upper Horsepen seems to be quite variable but 100 feet is close to the average. The average thickness of the bed is about 38 inches including 5 inches of shale.

The bed is 43 inches thick, including 6 inches of shale, at a prospect pit on Low Gap Branch about a mile from the mouth (location 123, elevation 2,545) and the thickness is about the same at several openings in the adjacent hollow on the north. On a spur between the forks of the next hollow to the south (location 124, elevation 2,520) the bed contains 4 feet of coal and only 2 inches of shale, but the coal has thinned to 28 inches at the next opening (location 125, elevation 2,460). A 38-inch section contains 8 inches of shale at a prospect pit on the spur a mile east of Low Gap Branch (location 126, elevation 2,465), and there are 3 feet of coal without partings where the bed has been opened about 100 feet below a neighboring pit on the Upper Horsepen (below location 143). The coal is clean and only 17 inches thick at a pit a short distance east (below location 144, elevation 2,555).

At a small drift on a tributary (Banjo Branch) which empties into Jacob Fork from the east (above location 118, elevation 2,045) a bed which is probably the upper of these two is said to be about 2 feet thick. The same bed has been opened west of Shraders (above location 119, elevation 2,030) where the coal is about 2½ feet thick including half an inch of clay. Both beds have been exposed on the next branch to the west (Dalton Branch), where the lower, at a prospect on the north side of the stream (above location 120, elevation 2,085), is said to consist of 14 inches of coal at the top separated by an equal thickness of clay from 3 inches of coal and rash at the bottom. On the south side of the branch (above location 122, elevation 2,045) the same bed is reported to contain 6 inches of coal and shale separated by 12 inches of shale from a 9-inch bench of coal below. The upper bed where opened on the hillside 40 feet above is apparently only 5 inches thick.

Middle Horsepen bed.—One of the most important beds in this area is the Middle Horsepen which occurs 50 to 65 feet below the Upper Horse-

pen coal and a little more than 100 feet above the War Creek. A thick sandstone is everywhere found below the bed and on Horsepen Creek, there is above the bed a 40-foot ledge of coarse sandstone which appears to be replaced to the west by a shaly interval similar to that over the Upper Horsepen on Pine Ridge. This suggests that what has been called the Middle Horsepen in the region west of Shraders is really the Upper Horsepen; but a thin coarse sandstone seen above the coal at several openings leads to the belief that the sandstone which normally comes between these two coals has merely thinned and that the identification here given is correct. On the upper part of Horsepen Creek, a region thoroughly prospected by the U. S. Coal & Coke Co., no coal appears to have been opened at this horizon though the bed has its normal thickness on Big Stone Ridge near the head of Laurel Fork. The coal will probably average 4 feet thick under Pine Ridge and around Horsepen and at least 3 feet in the small area to the west of Shraders.

The Middle Horsepen coal has been opened near the head of the hollow at the schoolhouse south of Horsepen (location 127, elevation 2,305) and around the hill to the east at several places, one of which is 65 feet below an old drift on the Upper Horsepen. According to Campbell the coal is clean and 4 feet thick in this locality. The thickness is about the same but includes some impurities at a drift in West Virginia, $1\frac{1}{2}$ miles northwest, where the bed is identified as the War Creek by Hennen.¹

Middle Horsepen bed 1 mile northwest of Horsepen.

(Location 128, elevation 2,500)

	Ft.	in.
Shale	3+	
Coal		3
Clay		$\frac{1}{2}$
Coal	3	0
Bone		8
Coal		8
Bone		2
Coal		2
	<hr/>	
Coal	4	1
Partings		$10\frac{1}{2}$

The Middle Horsepen bed has been opened at several places on the south side of Pine Ridge. Where measured at the face of a drift three-fourths of a mile northeast of Shraders the bed showed the following section, but it is thinner in some parts of the mine:

¹ Op. cit., p. 613.

Middle Horsepen bed on south side of Pine Ridge.

(Location 129, elevation 2,150)

	Ft.	in.
Sandstone, coarse, granular	35	0
Shale	5	
Coal		10
Rash		2
Coal, dirty		4
Coal	3	6
	<hr/>	
Coal	4	4
Partings		6

Where measured further east by Mr. Russell the bed contains 46 inches of clean coal at one opening (location 130, elevation 2,095) and more than 9 feet at another (location 131, elevation 2,155). The coal at the last opening is said to show the effects of the adjacent fault which is no doubt responsible for the abnormal thickness.

There are several openings in the Middle Horsepen coal on a tributary of Jacob Fork west of Shraders (Dalton Branch). According to Mr. Russell the coal is only 23 inches thick at a prospect pit on the north side of the right fork (location 132, elevation 2,155), but the bed is 4 feet thick and clean, except for 2 inches of bony coal at the bottom, where measured by the writer in a small drift further west (location 133, elevation 2,115). Three feet of coarse sandstone rest directly on the coal here and there are 60 feet of shale above. The coal is said to be 46½ inches thick at a prospect pit on the south side of the branch (location 134, elevation 2,140) and 38 inches thick at a new opening on the left fork of this stream (location 134a, elevation 2,100).

Upper Horsepen bed.—The Upper Horsepen coal is 800 to 820 feet above the Pocahontas No. 3 and 50 to 65 feet above the bed last described. There is sandstone not far below the coal at all exposures seen and at Horsepen there are 15 feet of shale above, overlain by a prominent 40-foot ledge of coarse sandstone. The coal, which is very thick in many places, is shown to be quite variable on the upper part of Horsepen Creek where it has been thoroughly prospected by the U. S. Coal & Coke Co. Unless otherwise stated, measurements given for this bed on the upper part of Horsepen Creek are taken from an outcrop map furnished by Mr. Eavenson.

The Upper Horsepen bed is 41 inches thick and contains 4 inches of shale at a prospect on Big Stone Ridge near the head of Low Gap Branch (location 135, elevation 2,780) and the coal is 5 inches thicker in the next opening to the south (location 136, elevation 2,755). The coal is only

22 inches thick in the end of a spur three-fourths of a mile north of Horsepen Creek (above location 123, elevation 2,675) and 28 inches where opened 1,000 feet south (location 137, elevation 2,650). At a prospect near the top of the spur between Low Gap Branch and Horsepen Creek (location 138, elevation 2,625) there are 65 inches of coal and 1 inch of shale. A 41-inch section includes 2 inches of shale at a pit on the north side of a tributary of Horsepen Creek (location 139, elevation 2,620). The coal is 25 to 41 inches thick at other openings on the north side of this branch and is 26 inches thick at the head (location 140, elevation 2,660). There are 2½ feet of coal at a prospect a short distance southwest (location 141, elevation 2,710) and about the same at other openings on the south side of this branch. Near the end of the spur the thickness of the bed increases suddenly as shown by the measurement obtained by the writer in a small local mine (location 142, elevation 2,605). The bed is here 93½ inches thick including 6½ inches of carbonaceous clay 29 inches from the top. According to information furnished by Mr. Eavenson the coal is only 1½ feet thick and contains a 5-inch parting at a prospect about one-third of a mile east (location 143, elevation 2,625) but it is 11 feet 8 inches thick about 800 feet distant (location 144, elevation 2,615) exclusive of an 8-inch parting. The bed is 11 feet thick including 8 inches of bone 29 inches from the top where measured by the writer in an old mine near the fault (location 145, elevation 2,610). The coal in the lower 12 inches of the bed appeared to be bony and to contain some rash.

The Upper Horsepen coal has been opened half a mile southeast of Horsepen (location 146, elevation 2,385) where 78 inches of clean coal occurs in two equal benches separated by 8 inches of shale. The bed shows the following section at a small mine on the south side of Pine Ridge:

Upper Horsepen bed on Pine Ridge.

(Location 147, elevation 2,195)

	Ft.	in.
Shale	5	+
Coal	4	0
Shale, black, carbonaceous		7
Coal		6
Shale, carbonaceous	1	6
Coal	2	0
	<hr/>	
Coal	6	6
Partings	2	1

Coal 46 inches thick which probably represents only the top bench of this bed was measured at the face of a small drift half a mile east (location 148, elevation 2,275).

No exposures of the bed were found west of Horsepen Creek where it is probably thin or absent.

Middle Seaboard bed.—Little is known of the coals above the Upper Horsepen in this region but there should be several beds underlying small areas if the Seaboard coals are persistent. There is an opening near the top of the hill about three-fourths of a mile west of Shraders (location 149, elevation 2,245) at which the coal is said to be 4 feet thick but this could not be verified. This coal is probably about 100 feet above the Upper Horsepen. The section at a small mine near the head of Mile Branch indicates that the Middle Seaboard may contain as much as 3 feet of coal in this area. No complete exposures were found but a strong bloom which is believed to belong to this bed was seen near the top of Pine Ridge (location 150, elevation 2,575).

DRY FORK AND BEECH FORK BASINS.

General features.—This basin includes the area drained by Dry Fork and Beech Fork, lying north of the Middle Creek fault and between the Dry Fork-Jacobs Fork divide on the east and the Beech Fork-Indian Creek divide on the west. The Norfolk & Western Railroad crosses this basin from north to southwest. The horizons of practically all of the coals up to the Middle Seaboard are exposed in this basin, though the Pocahontas No. 3 coal outcrops over only a very small area on Beech Fork near the State line. The Pennington shales which underlie the coal measures are exposed just north of the State line on Beech Fork. Three hundred feet or more higher is found Pocahontas No. 3, which is 44 to 50 inches thick on Dry Fork just north of the State line, and 4½ feet on Beech Fork. The thickness and quality decrease rapidly to the westward as indicated by openings on the Right Fork of Beech Fork north of the State line. The Pocahontas No. 5 bed, lying 100 feet above the No. 3, is the most important coal in this section. It outcrops for a short distance south of the State line on both Dry Fork and Beech Fork. It is 4½ feet thick on Dry Fork and 2½ to 6½ feet thick on Beech Fork. Locally it is canneloid, mining without slack and having the peculiar physical appearance, but not the chemical character, of cannel coal. On the Right Fork of Beech Fork, just north of the State line, this bed is 7 to 8 feet thick, but it thins out to the northward.

In the large interval between the No. 5 and War Creek beds only thin coals were found, but very little prospecting has yet been done, and more detailed search may later prove some of the intervening beds to be thick enough to mine.

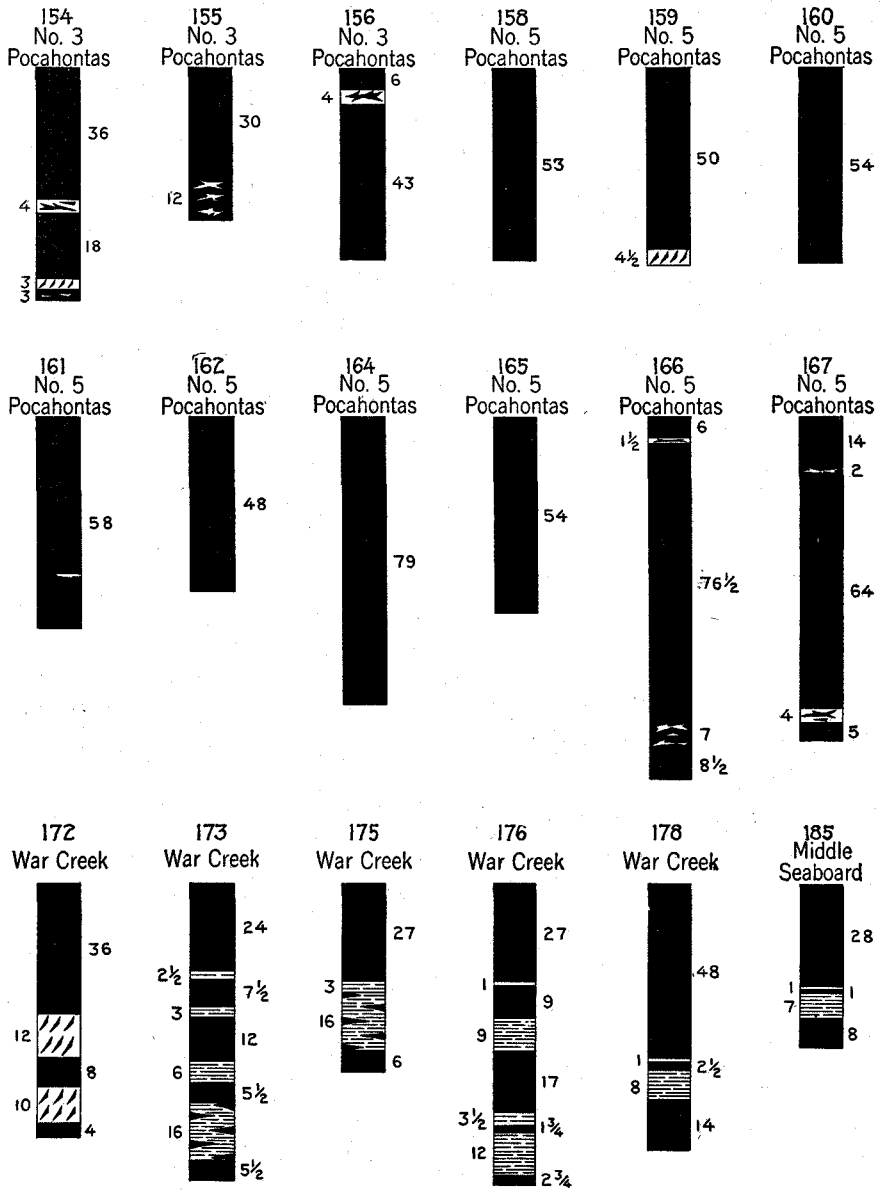


Fig. 14.—Sections of coal beds on Dry and Beech forks.

The War Creek bed occurs 500 to 525 feet above the No. 5. It is variable and broken up with partings, yielding 3 to 4 feet or more of recoverable coal, but it thins to the northwest and eastward on Dry Fork.

The Middle Horsepen bed, about 100 feet above the War Creek, is thin or absent in most of the area but thickens toward the east. The Upper Horsepen bed, 190 feet above the War Creek, reaches 2 feet locally, but in general is thin or absent.

About 100 feet above the Upper Horsepen is a bed that locally reaches 2 feet in thickness. The Lower Seaboard lies about 200 feet above the Upper Horsepen. It has been eroded from the center of this district and occurs only in the divides on either side. It is a split bed at the head of Beech Fork. The Middle Seaboard, 50 feet higher, is little known but appears to contain 3 feet or less of coal. The Upper Seaboard should be present at the head of Beech Fork, but has not as yet been noted.

Pocahontas No. 3 bed.—Strata below the Pocahontas No. 3 are well exposed in railroad cuts on the lower part of Beech Fork. The only coal in this part of the section appears to be represented by two 6-inch beds seen in a cut at the State line about 200 feet below the Pocahontas No. 3. A few hundred feet north of the State line the rocks of the Pennington group are brought to the surface and are well exposed with their characteristic red and green colors in the railroad cuts north of Right Fork.

On Dry Fork the Pocahontas No. 3 outcrops only north of the State line. According to Mr. Russell the bed contains 50 inches of coal and 2 inches of bone at a prospect on the east side of the stream (location 151), 47 inches of coal and 3 inches of bone 400 yards southeast (location 152), and 44 inches of coal and 3 inches of shale at an opening near the State line (location 153). The bed is somewhat variable but shows the following average section at a local drift mine on Beech Fork:

Pocahontas No. 3 bed on Beech Fork, one-half mile north of Faraday.

(Location 154, elevation 1,765)

	Ft. in.
Sandstone	10+
Coal	3 0
Bone	4
Coal	1 6
Rash	3
Coal, dirty	3

Coal	4 6
Partings	10

That this coal bed thins toward the west is indicated by a measurement obtained at an old drift near water level on Right Fork (location 155, elevation 1,855). The bed here is $3\frac{1}{2}$ feet thick but the lower 12 inches is a worthless mixture of coal and bone. According to A. G. Russell the coal has a thickness of 53 inches including 4 inches of bone, 6 inches from the bottom at a prospect half a mile east (location 156) and about the same at an opening near the mouth of Right Fork (location 157) where there is a $5\frac{1}{2}$ -inch shale parting.

Pocahontas No. 5 bed.—The most important coal in this region is the Pocahontas No. 5, which is 100 feet above the Pocahontas No. 3 and separated from it principally by sandstone. The bed outcrops for short distances on both Dry Fork and Beech Fork but is soon carried under to the southward by the strong dip. There is no coal at the horizon of the Pocahontas No. 4 in the railroad cuts along Beech Fork but the bed may be present further south in a zone bordering the fault.

The Pocahontas No. 5 bed is a little less than $4\frac{1}{2}$ feet thick at an old prospect on the east side of Dry Fork north of Mile Branch (location 158, elevation 1,690) but could not be examined for partings. At an opening 400 feet southwest (location 159, elevation 1,685) there are 50 inches of clean coal underlain by $4\frac{1}{2}$ inches of rash. Mr. Russell reports the bed about $4\frac{1}{2}$ feet thick in a prospect pit at the State line (location 160, elevation 1,785) and almost 5 feet thick at a pit half a mile northwest (location 161).

At the openings found on Beech Fork the Pocahontas No. 5 is generally thicker but less uniform. The coal appeared to be clean and about 4 feet thick at a prospect in a little hollow on the east side of the stream (location 162, elevation 1,840) but it is only 33 inches thick in a railroad cut 200 yards south (location 163, elevation 1,790) where the upper 6 inches has a peculiar dull luster and is hard and brittle. On the opposite side of the stream the coal is 79 inches thick in the Altizer mine, a local drift mine (location 164, elevation 1,745), and the entire bed shows these unusual characters together with a fairly well developed vertical columnar cleavage. The coal is broken up in small pieces, averaging 2 or 3 inches in diameter but there is practically no slack, and in mining it needs only to be raked down with a pick. The general appearance of this coal and its irregular occurrence in the bed indicate that it is a cannel coal of high purity which has lost much of its volatile matter, and been altered to its present state, through the agencies of heat and pressure incident to the movements which caused the fault to the south. An analysis of coal from this mine may be found in a subsequent chapter (p. 164).

The Pocahontas No. 5 bed is 50 to 55 inches thick and exhibits the same peculiarities of structure at a prospect pit a mile northwest (location 165, elevation 2,085). The coal, which is very clean, rests on a hard clay floor and has 10 feet of drab shale above. The bed is thicker at two openings nearer the head of Right Fork, but contains some bone partings and the coal is soft and bright.

Pocahontas No. 5 bed on south side of Right Fork.

(Location 166, elevation 2,035)		(Location 167, elevation 1,960)	
	Ft. in.		Ft. in.
Sandstone	10	Sandstone	8+
Coal	6	Coal	1 2
Bone	1½	Coal, bony	2
Coal	6 4½	Coal	5 4
Coal, bony	7	Bone	4
Coal	8½	Coal	5
Coal	8 2	Coal	7 1
Parting	1½	Parting	4

The area in which the Pocahontas No. 5 is thick, appears to extend no further north than Right Fork. The coal is said to be thin or absent at prospects on the north side of this stream, and it is only a few inches to about a foot thick in drill holes on Vall and Kewee creeks.

Coal beds between the Pocahontas No. 5 and War Creek beds.— Practically no prospecting has been done on the coals occurring between the bed last described and the War Creek, 500 to 525 feet above. The only part of this interval which is not clearly exposed in the railroad cuts along Beech Fork is that which includes the horizons of Pocahontas Nos. 6 and 7. These beds are thin or absent in the Horsepen Creek region to the east and they are probably of no consequence in this area.

A bed which is thought to be 50-75 feet below the horizon of the Lower Horsepen has been opened in the hollow back of the schoolhouse at Sayersville (location 168, elevation 1,735) and the same bed contains 20 inches of coal and a 11-inch shale parting where exposed in the road a short distance west (location 169, elevation 1,715). The bed shows the following section in the railroad cut at Faraday and is said to contain 4 feet of coal where it was exposed just below track level at the next cut to the west:

Coal 50-75 feet below the Lower Horsepen at Faraday.

(Location 170, elevation 1,835)

	Ft.	in.
Shale	2	0
Coal		4
Shale	3	0
Coal	1	6
Rash	1	0
Coal	1	10
Partings	3	0

A number of coals are exposed along the railroad between Faraday and the bridge near the mouth of William Branch but they are very irregular and thin and no attempt has been made to correlate them.

War Creek bed.—The War Creek bed in this region is 600 to 625 feet above the Pocahontas No. 3. The rocks below the coal are mostly shale for a hundred feet or more but above there is a prominent sandstone which on Beech Fork reaches a maximum thickness of 200 feet. The lower part of the sandstone is conglomeratic, especially on Beech Fork, and the pebbles, which occur either scattered or in layers, are chiefly of white quartz averaging about half an inch in diameter. A coal occurring locally at the base of the conglomerate about 30 feet above the War Creek has been opened in a few places but is said to be thin.

The outcrop of the War Creek coal on Beech Fork has been surveyed by the Faraday Coal and Coke Co., and is indicated on the geologic map for the purpose of showing the effects of the structure. Prospecting by this company proves the bed to be very variable in thickness and badly broken up by partings on most of Beech Fork and it is no better on Dry Fork.

The few measurements obtained indicate that the bed thins to the northwest and it is probably not more than 2 feet thick in most of the region north of the Dry Fork anticline, nor east of Dry Fork. The bed may contain between 3 and 4 feet of recoverable coal over a large part of the remaining area.

The War Creek bed, with characteristic irregularities, is exposed at several old drifts in a hollow on the north side of Mile Branch at one of which the following section was obtained:

War Creek bed on Mile Branch.

(Location 171, elevation 2,110)

	Ft.	in.
Sandstone	10+	
Coal and shale		5
Coal		8
Rash		5
Coal		4
Clay	1	5
Coal		11

Coal	1	11
Partings	1	10

A complete section of the bed (see Pl. VIII) was obtained in the railroad cut near the big bridge south of William Branch.

War Creek bed in railroad cut on Beech Fork.

(Location 172)

	Ft.	in.
Sandstone	25+	
Shale, blue	5	0
Coal (elevation, 1,965)	3	0
Rash	1	0
Coal		8
Rash		10
Coal		4
Clay-shale, blue	4	0
Coal		7
Shale, blue	6	0
Coal		6
Clay-shale		7
Coal		4
Sandstone, fine-grained	2	0
Shale, sandy	8	

The thin layers of coal 5 to 10 feet below the principal bench appear to be fairly persistent in this region and were also seen below the opening on Mile Branch.

A. G. Russell reports the following section for the bed at an old drift which was full of water when visited by the writer. The sandstone above the coal is about 200 feet thick in this locality and the conglomerate in the lower part is well exposed in a railroad cut opposite the mine.

War Creek bed on Beech Fork.

(Location 173, elevation 1,970)

	Ft.	in.
Coal	2	0
Shale		2½
Coal		7½
Shale		3
Coal	1	0
Shale		6
Coal		5½
Coal and shale	1	4
Coal		5½
Coal	4	6½
Partings	2	3½

The upper part of the bed is cleaner at a prospect pit on the hillside opposite the mouth of Johnnie Branch (location 174, elevation 2,010). According to Mr. Russell, the top bench is here 49 inches thick including one inch of shale and there are 29 inches of worthless coal and shale below. The War Creek coal has been prospected near the head of the next large tributary west of Johnnie Branch where the following section was obtained by the Faraday Coal & Coke Co.:

War Creek bed on Beech Fork 2 miles northeast of Harman.

(Location 175, elevation 2,475)

	Ft.	in.
Shale		
Coal	2	3
Shale		3
Coal and shale	1	4
Coal		6
Coal	2	9
Partings	1	7

Two old strippings were found near the mouth of this branch but the bed was not completely exposed at either. There are said to be 4 feet of clean coal in the upper part of the bed at the exposure farthest north and the following section is reported for the other stripping:

War Creek bed three-fourths of a mile southwest of Johnnie Branch.

(Location 176, elevation 2,155)

	Ft.	in.
Coal	2	3
Shale		1
Coal		9
Shale		9
Coal		4
Coal, slightly impure	1	1
Shale		3½
Coal		1¾
Shale	1	0
Coal		2¾
<hr/>		
Coal	4	9½
Partings	2	1½

Coal from these strippings was used many years ago at a logging camp near the mouth of this tributary and it was probably at this locality that Campbell obtained the section given in the Tazewell folio. The bed at that time was generally believed to be the Pocahontas No. 3 and is reported 67 inches thick including 6 inches of shale 1½ feet from the bottom.

The top bench of the War Creek bed is reported to be 4 feet thick including one inch of shale at a prospect on the north bank of the stream, half a mile southwest of the mouth of Johnnie Branch (location 177, elevation 2,045), but the opening appears to have been made in a slide and consequently the section may not be reliable. The following section which is said to be the best showing of the bed was reported by Mr. Russell for a pit about a mile north:

War Creek bed on east side of Johnnie Branch.

(Location 178, elevation 2,485)

	Ft.	in.
Shale		
Coal, containing knife-edge partings	4	0
Shale		1
Coal		2½
Shale		8
Coal	1	2
<hr/>		
Coal	5	4½
Partings		9

On the west side of William Branch at an opening which was not found the bed is said to contain 4 feet of coal split into two nearly equal parts by 11 inches of shale. Coal 28 inches thick which may represent only a part of this bed was seen at an opening on the south side of Right Fork opposite the head of Long Branch (location 179, elevation 2,555).

Middle and Upper Horsepen beds.—The Middle Horsepen coal, which is a little more than 100 feet above the War Creek, appears to be thin or absent over most of the area. Only 3 inches of bloom were seen at this horizon on the spur north of location 171 on Mile Branch, but the bed thickens to the east and contains 4 feet of clean coal where it outcrops on the Jacob Fork side of the divide. No exposures of the coal were found on Beech Fork, where it is probably cut out by the massive sandstone above the War Creek, but it is a valuable bed on adjacent portions of Indian Creek.

The Upper Horsepen coal is thin and may be absent in many places. It was found only on the upper part of Beech Fork where it comes at the top of a massive sandstone about 190 feet above the War Creek. The coal is 12 to 20 inches thick at a small pit on the south side of Beech Fork near the fault (location 180, elevation 2,160) and is reported to be only 12 inches thick near the tunnel at the head of that stream (location 181, elevation 2,210). A caved pit a mile northeast (location 182, elevation 2,140) is said to have been in coal about 2 feet thick.

Lower and Middle Seaboard beds.—Between the Lower Seaboard and Upper Horsepen beds, and about 100 feet above the latter, there is a thin coal which is probably the same as that occurring west of Shraders at location 149. The bed was opened in several places near the head of Beech Fork to supply the fuel used in driving the tunnel. The coal which here has a 30-foot sandstone cliff above it was seen at only one drift (location 183, elevation 2,250) where it was about 2 feet in average thickness but irregular because of an uneven sandstone roof. There appeared to be only 6 to 18 inches of coal at this horizon in the cut above the tunnel a short distance southwest.

At the head of Beech Fork the lower half of the 200-foot interval between the Upper Horsepen and the Lower Seaboard is shale and the upper part is almost all sandstone. The Lower Seaboard coal has escaped erosion only in the area east of Dry Fork, where it has not been prospected, and along the divide between Beech Fork and Indian Creek. Bloom of the bed was seen at several places in the latter region, and at an old opening at the head of Beech Fork (location 184, elevation 2,300) it is said to contain about 3 feet of coal split near the middle by about 4 feet of shale.

The Middle Seaboard is 50 feet above the bed last described and is separated from it chiefly by sandstone. Near the head of Mile Branch of Dry Fork the following section was obtained at a small local mine:

Middle Seaboard bed on Mile Branch.

		Ft.	in.
(Location 185, elevation 2,425)			
Shale		5	
Rash			2
Coal	2		4
Rash			1
Coal			1
Clay			7
Coal			8

Coal	3		1
Partings			8

No other exposures of this bed were found but the sections obtained at several openings about half a mile north of Bandy indicate that there are about 3 feet of coal in the bed at the head of Beech Fork.

Coal higher than the Middle Seaboard was not found in this region but the Upper Seaboard should be present in the small area between Harman and the head of Beech Fork.

INDIAN CREEK BASIN.

General features.—The coal-bearing area in Tazewell County broadens out in a north and south direction in the Indian Creek basin, due to a change in the direction of the State line. Mining has never been started in this area on a commercial scale, and in general its coal resources are less attractive than those of adjoining areas, particularly the part north of the axis of the Dry Fork anticline. The entire basin of Indian Creek can be reached by a spur from the Norfolk and Western Railway at Bandy, with gathering lines up the tributaries.

The Dry Fork anticline crosses the basin, a short distance south of the center, in an east-west direction; beds on the south therefore dip toward the Middle Creek fault, while those on the north dip toward the head of the stream. All important beds below the War Creek are below drainage in this area, due to the westward pitch of this great arch. The ridge at the head of Indian Creek contains the higher coals, up to and including the Big Fork.

Practically nothing is known of the coals below the surface on Indian Creek, but it is possible to draw some conclusions from data in adjoining regions and observed tendencies. A diamond drill hole, the record of which could not be obtained, was put down near the head of Indian Creek to a depth sufficient to test the Pocahontas No. 3. Reports from several sources indicate that only thin coal was found at the horizon of the Pocahontas No. 3, and above. Deep drillings in the adjacent part of McDowell County

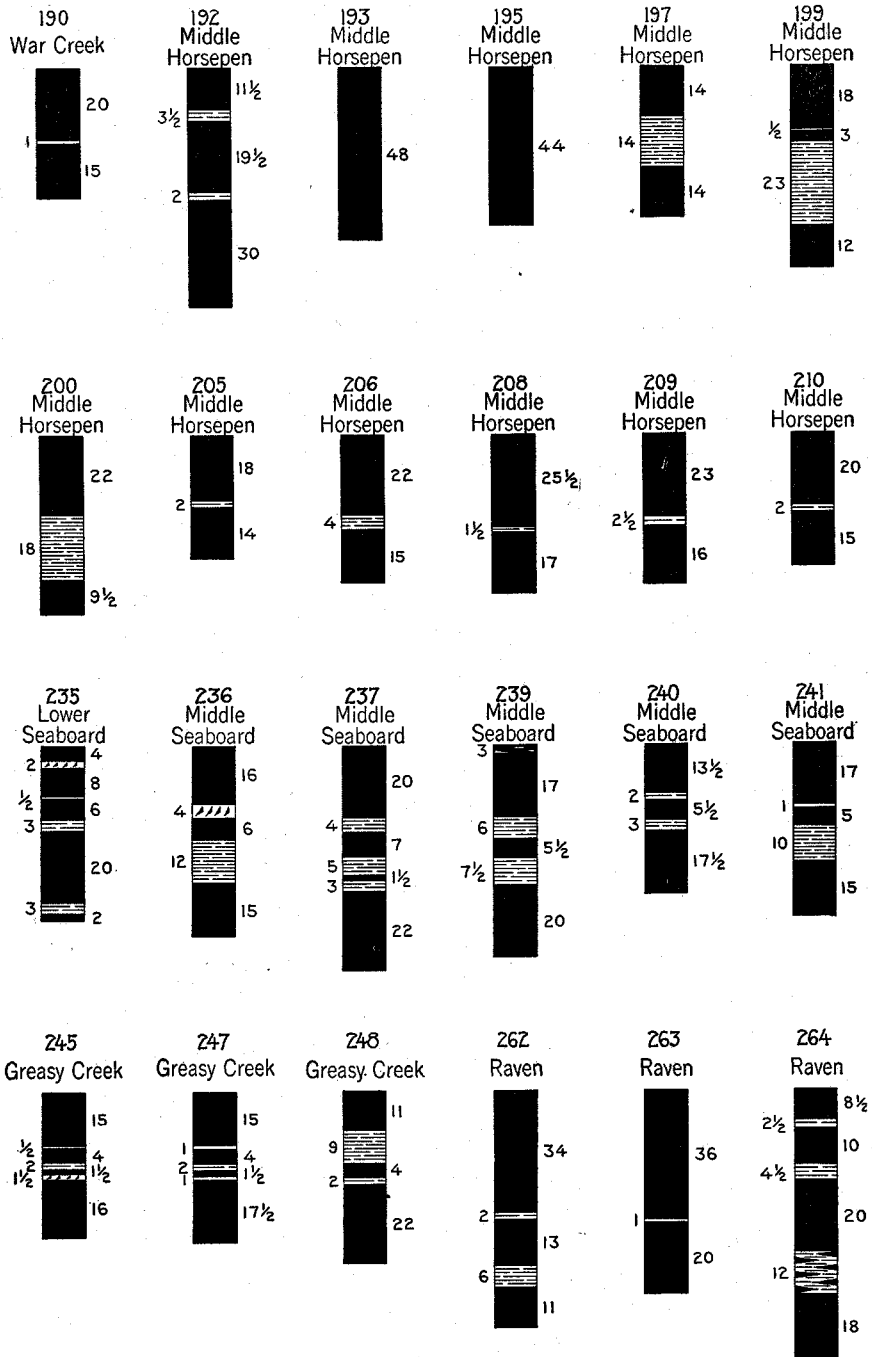


Fig. 15.—Sections of coal beds on Indian Creek.

also indicate that the coals below the surface on the upper part of Indian Creek are thin. No drilling has been done on Indian Creek south of the Dry Fork anticline, but coals outcropping in the undifferentiated, steeply-dipping zone farther west are doubtless also present in the southern portion of this basin. The Pocahontas No. 3 may be as much as 3 feet thick on the lower part of Indian Creek and the thick deposit of Pocahontas No. 5, outcropping on Beech Fork, probably extends across the area drained by it south of the Dry Fork anticline. Other coals of the Pocahontas series are probably thin or absent.

Comparatively little prospecting has been done on Indian Creek. The War Creek bed is generally thin, and is recognized with difficulty in the basin. A typical exposure was seen about half a mile northeast of Harmon, where the bed could not be measured but is said to contain about 3 feet of fairly clean coal. Elsewhere, the coal at this horizon appears to be badly split by partings and of little value. Two thin beds occurring between the War Creek and Middle Horsepen may contain workable coal in a few small areas.

The Middle Horsepen, 110 feet above the War Creek, is perhaps the most valuable bed on Indian Creek. It is $3\frac{1}{2}$ to 5 feet thick and fairly clean, over a small area in the east central part of the basin, but is split by thick partings to the west. On Greasy Creek, the coal is not so thick but the partings are thin and the bed is commercial over a considerable area. The Upper Horsepen is clean but generally less than 2 feet thick in this basin. Two beds occur between it and the Lower Seaboard, but both are thin or else damaged by partings.

The Lower Seaboard, about 200 feet above the Upper Horsepen, is generally not over 2 feet thick, but locally reaches 4 feet including partings. The Middle Seaboard, which seems to be present only in the southern part of the area, is generally 4 to 5 feet thick but is everywhere damaged by partings which in places make it worthless at the present time. The Greasy Creek and Upper Seaboard coals appear to be present only north of the Dry Fork anticline. The Greasy Creek coal is generally 2 to 3 feet thick but almost everywhere contains partings, especially where it is thickest. The Upper Seaboard is generally clean but not more than 2 feet thick.

No coal more than $1\frac{1}{2}$ feet thick was found in this area, in the 625-foot interval between the Upper Seaboard and Raven, though the Tiller and Jawbone may be thicker than this under Sandy Ridge. The Raven bed is $4\frac{1}{2}$ to 5 feet thick but locally contains thick partings. It is present only along Sandy Ridge.

The Aily, Kennedy, and Big Fork coals are present only under Sandy Ridge. These beds have not been systematically prospected, but at the few openings found, the coal is generally not more than 2 feet thick.

Coal beds below the War Creek.—The need for information regarding the coal beds below the surface on Indian Creek and tributaries may, to some extent, be supplied by general considerations and the records of drill holes in McDowell and Buchanan counties. On the upper part of the stream the Pocahontas beds all appear to be thin, and it is doubtful whether any coal below the War Creek is thick enough to justify shaft-mining north of the Dry Fork anticline. The Pocahontas No. 3 may be 3 feet thick on the lower part of this stream and the thick deposit of Pocahontas No. 5 outcropping to the east, probably extends across the area drained by it south of the Dry Fork anticline.

Perhaps the lowest bed which reaches the surface on Indian Creek is exposed in the railroad cut north of Bandy (location 186), where there are about 3 feet of coal exclusive of a 15-inch clay parting; the coal and the inclosing sandstones are dipping 55° southeast. A coal bed which has the following section was found on the main right fork of Indian Creek:

Coal 50 to 75 feet below the War Creek, 2 miles north of Harman.

		(Location 187, elevation 2,300)		Ft.	in.
Sandstone	.....			
Coal	.....	0	4		
Clay	.....	0	1		
Coal	.....	1	0		
Clay	.....	1	0		
Coal	.....	0	5		
		<hr/>			
Coal	.....	1	9		
Partings	.....	1	1		

Thick bloom of what may be the same bed was seen in the wagon road a short distance west (location 188, elevation 2,290). A coal bed badly split by partings has been mined from a pit at Harman, where the following section was obtained:

Coal bed 50 feet or less below War Creek, at Harman.

		(Location 189, elevation 2,165)		Ft.	in.
Coal	.....	0	7½		
Clay	.....	0	1		
Coal	.....	0	2		
Clay	.....	0	3		
Coal	.....	0	3		
Clay	.....	0	7		
Coal	.....	0	8		
		<hr/>			
Coal	.....	1	10½		
Partings	.....	0	11		

War Creek bed.—The War Creek bed is thin and identified with difficulty where it outcrops on Indian Creek. The most typical exposure was seen at an opening below the road slightly more than half a mile northeast of Harman (location 190, elevation 2,330). The bed is said to be 3 feet thick here including an inch of shale near the middle. Eight feet of blue shale overlain by sandstone rest on the coal here, and there is a streak of bloom under a layer of conglomerate 30 feet above. In the road one mile north (above location 188), there are six thin blooms within a stratigraphic interval of 50 feet, of which one or more probably represent the War Creek. Bloom at about this horizon was seen at several other places and the bed has been prospected in the end of the ridge between Indian and Greasy creeks and about a mile up the latter stream on the west side.

Middle Horsepen bed.—The position of the Middle Horsepen, the next coal of importance on Indian Creek, is 110 feet above the War Creek. The interval between these beds is occupied almost entirely by sandstone and in places is divided into approximately equal parts by two thin coals.

The lowest of these two coals was measured in only one locality, about 2½ miles north of Harman (location 191, elevation 2,385), where the bed contains 15 to 20 inches of coal at the top and about 30 inches of coal and shale in alternate layers below. Ten feet of coarse sandstone containing streaks of coal and plant remains are exposed above the opening which is 65 feet below a pit on the Middle Horsepen. A thin coal 35 feet below the Middle Horsepen was found on Greasy Creek. According to measurements furnished by A. G. Russell the bed is 4 feet thick, including 2 feet of shale 8 inches from the bottom, in the hollow below location 207, and is 2 feet thick in the hollow below location 211.

The Middle Horsepen is an excellent bed on the upper part of a large tributary on the east side of Indian but it is badly damaged by partings in many places elsewhere and is probably thin or absent southeast of Harman. According to A. G. Russell the bed shows the following section in a hollow on the south side of the tributary mentioned:

Middle Horsepen bed two and one-half miles northeast of Harman.

		(Location 192, elevation 2,490)	
		Ft.	in.
Sandstone	.....	
Coal	.....		11½
Clay, sandy	.....		3½
Coal	.....	1	7½
Shale	.....		2
Coal	.....	2	6
<hr/>			
Coal	.....	5	1
Partings	.....		5½

The bed contains about 4 feet of clean coal at a small mine in the next hollow to the north (location 193, elevation 2,465) and is reported to be the same thickness at a prospect a short distance further up the main stream (location 194, elevation 2,420). The following measurements furnished by the Faraday Coal & Coke Co. show that the bed is impaired by partings to the southwest. The coal is clean and 44 inches thick at each of two prospects on the upper part of the stream (location 195, elevation 2,450 and location 196, elevation 2,440). At the next prospect which is between two sandstone cliffs (location 197, elevation 2,435) the coal is said to be split into two 14-inch benches by an equal amount of shale. The first of the two sections following was obtained half a mile north of the forks of the creek and the second above the road in a small hollow which empties into Indian:

Middle Horsepen bed about one and three-fourths miles north of Harman.

(Location 198, elevation 2,465)		(Location 199, elevation 2,470)	
	Ft. in.		Ft. in.
Sandstone		Sandstone	15+
Coal	1 ½	Coal	1 6
Rash	4 ½	Shale	½
Shale	1 6	Coal	3
Coal	11	Shale	1 11
		Coal	1 0
Coal	1 11 ½		
Partings	1 10 ½	Coal	2 9
		Partings	1 11 ½

The bed contains 22 inches of coal in the top bench at an opening on the west side of the main fork of Indian 2½ miles north of Harman (location 200, elevation 2,330), and there are said to be 9½ inches more below an 18-inch layer of coal and shale. According to A. G. Russell the bed is 51 inches thick but contains a 22-inch shale parting at a prospect pit less than half a mile south (location 201, elevation 2,395).

Coal 21 inches thick, which may be only the top part of the bed, was found at a stripping near the forks of Greasy Creek (location 202, elevation 2,515).

The bed is said to be 4 feet thick, including partings, at a pit three-fourths of a mile up the right fork (location 203, elevation 2,390).

At most of the exposures on Greasy Creek the parting in the Middle Horsepen bed is not so thick as at the openings just described and the coal is cleaner. On the east side of the stream, below Greasy Creek School (location 204, elevation 2,425), there are 2½ feet of coal split into equal parts by 4 inches of clay, and at another local mine in the next hollow to the

north (location 205, elevation 2,370), the bed is 34 inches thick including 2 inches of clay 18 inches from the top. There are 15 feet of coarse sandstone exposed above the coal at each of these openings. At a pit in the bank of the stream a few hundred feet west (location 206, elevation 2,335) coal 22 inches thick at the top of the bed is separated from a 15-inch bench below by $\frac{1}{2}$ to 4 inches of clay.

Coal 18 inches thick which may be only a part of the bed is said to have been exposed at a prospect pit on the west side of Greasy Creek near the forks (location 207, elevation 2,440). The bed is 44 inches thick and contains $1\frac{1}{2}$ inches of clay 17 inches from the base at a small drift less than half a mile southeast (location 208, elevation 2,480). In the next hollow (location 209, elevation 2,475) the top bench is only 23 inches thick and the parting has increased to $2\frac{1}{2}$ inches. The bed is said to be 37 inches thick including 2 inches of clay at a prospect pit half a mile west of Harman (location 210, elevation 2,405) and 30 inches thick in the next hollow to the south (location 211, elevation 2,360), where a 2-foot bench at the top of the bed is separated by an inch of clay from 5 inches of bony coal below. The Middle Horsepen bed is probably thin or absent south of this locality.

Upper Horsepen bed.—The position of the Upper Horsepen, where it outcrops on the lower two-thirds of Indian Creek, is at the top of a thick sandstone, 85 to 100 feet above the Middle Horsepen. The coal is not thick at the exposures seen and it is probably very thin or absent on the upper part of the creek.

The only measurement obtained on the east side of Indian Creek was at a small pit about $1\frac{1}{4}$ miles from Harman (location 212, elevation 2,615) where the coal was 15 to 18 inches thick and slightly crumpled by movement. The sandstone below the coal is well exposed here, and there is a shaly interval above. According to measurements of the Faraday Coal & Coke Co., the coal is 18 inches thick at a prospect $2\frac{1}{2}$ miles north of Harman (location 213, elevation 2,420) and 20 inches thick less than half a mile south (location 214, elevation 2,490).

The Upper Horsepen coal is 18 inches at a stripping near the forks of Greasy Creek (location 215, elevation 2,645) and 18 to 30 inches at a stripping near Greasy Creek School (location 216, elevation 2,375). The bed is said to contain 25 inches of coal in the hollow near location 207 and 24 inches were seen at an opening half a mile west of Harman (location 217, elevation 2,455). At a small pit on Laurel Fork 2 miles west of Bandy (location 218, elevation 2,315) the bed is 26 inches thick and there are 3 inches of rash below but the lower 8 inches appeared to be impure.

The coal is clean and 26 inches thick at an opening on the west side of the stream half a mile north (location 219, elevation 2,415).

Coals between the Upper Horsepen and the Lower Seaboard.—Two thin coals 50 and 100 feet above the bed last described were found on the lower part of Indian Creek. The rocks associated with them are generally shale or shaly and the upper coal is only a short distance below the Lower Seaboard bottom-rock.

The lower bed is said to have shown a thickness of 27 inches where opened on the west side of Indian Creek in the hollow above location 214. What may be the same bed is reported by Mr. Russell to show the following section where opened on the north side of the hollow near the mouth of Greasy Creek a few hundred feet northwest of location 211:

Bed 50 feet above the Upper Horsepen half a mile west of Harman.

	(Near location 211, elevation 2,520)	Ft.	in.
Shale			
Coal		2	
Clay			½
Coal			8
Shale			2½
Coal and shale			2½
Coal	1		6
<hr/>			
Coal	2		4
Partings			5½

The coal was reported only one foot thick at a pit on the east side of Laurel Fork 1¼ miles north of the fault (location 220, elevation 2,310) and 3 feet thick including a foot of shale near the middle at an old opening about a mile north (location 221, elevation 2,485).

The upper bed is about 2 feet thick near the head of the hollow above location 199 and is said to be slightly thicker at an old pit half a mile north (location 222, elevation 2,520). Coal which belongs either to this bed, or to the one 50 feet lower, has been opened on the east side of a tributary of Laurel Fork where the following section was obtained by Mr. Russell:

Coal 100 (?) feet above the Upper Horsepen on Laurel Fork.

	(Location 223, elevation 2,410)	Ft.	in.
Coal			5
Shale			2
Coal			5
Shale			11
Coal			1
Shale			8½
Coal	1		6
<hr/>			
Coal	2		5
Partings	1		9½

The same bed is said to be 63 inches thick including a 17-inch shale parting 30 inches from the bottom where opened on the west side of the branch about 400 yards north.

Lower Seaboard bed.—The Lower Seaboard is a little less than 200 feet above the Upper Horsepen and is about 800 feet below the Raven. There is thick, massive sandstone below the bed and the roof may be either shale or sandstone. The coal thins slightly to the north and east but is badly split up by partings in the southeastern part of the area, where it is thickest.

The bed is present on the east side of lower Indian in the ridge north of the tunnel. At the only prospect found (location 224, elevation 2,280) the coal is reported by the man who opened it to be 30 inches thick but split by a 10-inch parting. The parting apparently thickens to the east (see location 184) making the bed practically worthless within half a mile. Bloom of the bed may be seen in the road at several isolated patches along the divide between Indian Creek and Beech Fork. The coal was 1½ to 2 feet at the thickest exposure seen (location 225, elevation 2,780). There is a small pit in West Virginia near the State line, 1¼ miles north, (location 226, elevation 2,580) where the bed contains 26 inches of coal.

At a partially closed stripping on the east side of Indian Creek 3 miles north of Harman (location 227, elevation 2,610) the coal is said to be slightly less than 2 feet thick and about 15 inches were seen. The bed has a sandstone roof and is 21 inches thick at a stripping on the west side of the stream (location 228, elevation 2,560) and is 20 inches thick including a 2-inch layer of clay near the bottom where exposed in the trail along the ridge further south (location 229, elevation 2,730).

The Lower Seaboard coal is 27 inches thick and is separated from the overlying sandstone by 6 inches of shale at a stripping on the right fork of Greasy Creek (location 230, elevation 2,550). The bed is said to be 30 inches thick including a shale parting near the middle at an old opening three-fourths of a mile southeast of Pleasant Hill (location 231, elevation 2,625). According to Mr. Russell a bed which is probably the Lower Seaboard has been opened near the forks of Greasy Creek (location 232, elevation 2,705), where there are 30 inches of coal split near the middle by a foot of shale.

The following section was measured along the road at the head of a tributary which empties into Indian Creek near Bandy:

Lower and Middle Seaboard beds one mile west of Harman.

(Location 233)

	Ft.	in.
Shale	30+	
Middle Seaboard {	Coal	10
	Clay	1½
	Coal	6
	Clay	5½
Coal (elevation 2,705)	1	4
Shale	15	0
Sandstone, medium-grained	25	
Shale	7	
Lower Seaboard {	Coal	8
	Clay	3
	Coal	5
	Clay	1	0
Coal (elevation 2,655)		10
Sandstone	10	0
Shale	3	0
Sandstone	30+	

The bed rests on sandstone at a local drift on the west side of Laurel Fork, one mile north of the fault.

Lower Seaboard bed on west side of Laurel Fork.

(Location 234, elevation 2,450)

	Ft.	in.
Shale	5+	
Coal		2½
Clay, hard		2½
Coal		2½
Rash		2½
Coal	1	7
Clay and rash		1
<hr/>		
Coal	2	0
Partings	0	5

The coal is thicker further south at a small mine which supplies the local demand for fuel.

Lower Seaboard bed on Laurel Fork near the fault.

(Location 235, elevation 2,200)

	Ft.	in.
Coal		4
Rash		2
Coal		8
Rash		½
Coal		6
Clay		3
Coal	1	8
Clay		3
Coal		2
<hr/>		
Coal	3	4
Partings		8½

At the working face of this mine the coal is cleaner but not quite so thick. Measurements of the bed are as follows:

Section 25912 was measured on the Lower Seaboard bed in the Patrick local drift mine on Laurel Fork of Indian Creek, 1½ miles southwest of Bandy, Tazewell County, Virginia (location 235 on map), August 28, 1916. The section was measured on the working face about 100 feet from the entrance. (For analysis of sample cut at this place see p. 165.)

Lower Seaboard bed at point sampled in the Patrick mine.

(Location 235)

	Ft.	in.
Rash	*0	8
Coal	1	0
Mother coal	0	¼
Coal	0	1½
Clay, hard	*0	2
Coal	1	5
Mother coal	0	¼
Coal	0	1
Clay, hard	*0	3
Rash	*0	1½
Included in sample	2	8
Excluded from sample	1	2½

Middle Seaboard bed.—The Middle Seaboard bed is about 50 feet above the coal last described. The coal, which is everywhere impaired by partings, seems to be limited on Indian Creek drainage to south of the Dry Fork anticline.

The first of the following sections was obtained at an old mine which supplied fuel for the construction of the tunnel near Bandy; the second is reported by A. G. Russell from a prospect near the mouth of Greasy Creek:

Middle Seaboard on Indian and Greasy creeks.

(Location 236, elevation 2,390)

(Location 237, elevation 2,660)

	Ft.	in.		Ft.	in.
Shale			Coal	1	8
Coal	1	4	Clay		4
Rash		4	Coal		7
Coal		6	Clay		5
Clay, including one-inch layer of coal.....	1	0	Coal		1½
Coal	1	3	Clay		3
			Coal	1	10
Coal	3	1			
Partings	1	4	Coal	4	2½
			Partings	1	0

* Not included in sample.

On the west side of the ridge near the last location measurements were obtained at openings about 250 yards apart:

Middle Seaboard bed one and one-half miles northwest of Bandy.

(Location 238, elevation 2,605)			(Location 239, elevation 2,645)		
	Ft.	in.		Ft.	in.
Shale			Shale		
Coal, impure, cannel- like	5		Coal, dirty	3	
Coal	4½		Coal	1	5
Rash	1½		Clay		6
Coal	1	0	Coal		5½
Clay	1	1	Clay		7½
Coal		6	Coal	1	8
Coal and clay		6			
Coal	1	8	Coal	3	6½
			Partings	1	1½
Coal	3	6½			
Partings	1	8½			

The bed showed the first of the following sections at the head of the tributary in which the last measurements were obtained and the second at a local drift near the mouth of the same stream:

Middle Seaboard bed on a tributary of lower Indian Creek.

(Location 240, elevation 2,690)			(Location 241, elevation 2,240)		
	Ft.	in.		Ft.	in.
Shale	10+		Sandstone		
Coal	1	1½	Coal	1	5
Clay		2	Bone		1
Coal		5½	Coal		5
Clay		3	Clay and streaks of coal		10
Coal	1	5½	Coal	1	3
Coal	3	½	Coal	3	1
Partings		5	Partings		11

A large amount of coal is said to have been taken from an abandoned opening in the head of the hollow 35 feet above location 240.

At the Christian mine on Laurel Fork near the fault (location 242, elevation 2,260), the Middle Seaboard has a thickness of 3 feet 11½ inches, including 10 inches of rash 14 inches from the bottom and 1 inch of clay 9 inches higher. An analysis of coal from this mine is given on page 166.

Greasy Creek bed.—The Greasy Creek coal which was found only north of the Dry Fork anticline, may be easily followed in this region because of its position at the top of a prominent bench-forming sandstone. (See

Pl. IV.) The horizon of this coal is about 50 feet below the Upper Seaboard and 75 feet above the bed last described. The bed is not thick but seems fairly persistent on the upper parts of Indian and Greasy creeks.

The Greasy Creek coal is 25 inches thick in a pit at stream level near the head of one of the main tributaries of Indian Creek 2 miles southeast of Bearwallow (location 243, elevation 2,530) but is only 15 inches thick, including an inch of bone near the middle, at a stripping in the stream bed 1 mile south (location 244, elevation 2,565).

The following sections were obtained at openings near the head of Indian Creek:

Greasy Creek bed near the head of Indian Creek.

	(Location 245, elevation 2,355)		(Location 246, elevation 2,360)		(Location 247, elevation 2,405)	
	Ft.	in.	Ft.	in.	Ft.	in.
Shale						
Coal	1	3	1	3½	1	3
Clay and rash		½		1		1
Coal		4		4		4
Clay		2		2		2
Coal		1½		2		1½
Rash		1½		1		1
Coal	1	4	1	1½	1	5½
<hr/>						
Coal	3	½	2	11	3	2
Partings ..		4		4		4

The bed is said to be thin where penetrated by the drill 0.6 mile north of location 245.

On the west side of Indian Creek and on Greasy Creek, the bed has been opened at a number of places most of which had fallen shut when visited. The following section is reported by the owner for a drift 1½ miles northeast of Pleasant Hill:

Greasy Creek bed on west side of Indian Creek.

(Location 248, elevation 2,695)

	Ft.	in.
Shale	10+	
Coal		11
Shale		9
Coal		4
Shale		2
Coal	1	10
<hr/>		
Coal	3	1
Partings ..		11

What is presumably only the upper part of the bed was measured in a hollow near Greasy Creek School (location 249, elevation 2,610) where there are 15 inches of coal at the top, under sandstone, followed by 6 inches of clay and 2 inches of coal. At an opening northwest of Pleasant Hill (location 250, elevation 2,485) a bed 30 inches thick including 2 inches of clay 2 inches from the top is thought to represent the Greasy Creek. The following section was measured 400 yards south:

Greasy Creek bed near Pleasant Hill.

(Location 251, elevation 2,520)

	Ft.	in.
Shale, drab	20+	
Clay, with streaks of coal	3	0
Coal, with streak of clay in middle		4
Clay		2
Coal	1	6

Coal	1	6
Parting	0	0

The lower bench of the coal appears to be about 2 feet thick, including a streak of clay, where exposed in the road half a mile south of Greasy Creek School (location 252, elevation 2,755), and there are two thin layers a few feet above. The following section was obtained in the road half a mile southeast and is only approximate because of the weathered condition of the bed:

Greasy Creek bed in road 1 mile southeast of Pleasant Hill.

(Location 253, elevation 2,810)

	Ft.	in.
Shale		
Coal		1
Clay		1
Coal		1
Clay		1
Coal		2
Clay		5
Coal	1	3
Clay		3
Coal	1	0

Coal	2	7
Partings		10

Upper Seaboard bed.—The Upper Seaboard bed is about 50 feet above the Greasy Creek and is separated from it by shale a part of which has a peculiar mottled appearance in some parts of the area, and is easily recog-

nized. In most places there are about 25 feet of sandstone close above the bed. The coal is fairly thick to the west but thins northeast of Greasy Creek and appears to be absent south of the Dry Fork anticline.

At a stripping about 3 miles southeast of Bearwallow (location 254, elevation 2,580) the bed is said to be 2 feet thick including an inch of rash near the middle but the lower part of the bed was not exposed. The bed contains less than a foot of coal and is probably split where exposed in the east bank of the stream, 1½ miles south of Bearwallow (location 255, elevation 2,400), and it is said to be equally thin in the ridges to the south and east. The following section was obtained at a local drift on Greasy Creek, where the bed is thicker:

Upper Seaboard bed on Greasy Creek, north of Pleasant Hill.

(Location 256, elevation 2,530)

	Ft.	in.
Sandstone, coarse	3+	
Shale	3	0
Coal		9
Coal, sandstone and shale.....		5
Coal		9
Clay	6	2
Coal, dirty		3
Clay		1
Coal	2	8
	<hr/>	
Coal	4	2
Partings	6	10

West of the Greasy Creek School, the coal is 28 inches thick at an opening in the end of a spur (location 257, elevation 2,660) and 30½ inches thick at a drift in the hollow to the south (location 258, elevation 2,700). A characteristic feature by which the bed may be recognized in many places is the presence of thin layers of coal in the clay-shale roof. The peculiar mottled shale below a thick bloom of the Upper Seaboard is well exposed in the road half a mile south of Greasy Creek School (location 259, elevation 2,805). The sandstone above the coal is here 25 feet thick and is separated from it by 5 feet of white clay.

Coal beds between the Upper Seaboard and the Raven.—The 625-foot interval between the bed just described and the Raven appears to contain no coal bed more than 1½ feet thick on Indian Creek. Bloom of a bed about 18 inches thick was seen on the 100-foot sandstone at the top of the Lee formation three-fourths of a mile southwest of Greasy Creek School (location 260, elevation 3,005) and there are two thin streaks of coal at the base of the sandstone.

The Tiller and Jawbone beds are thin where they outcrop on Indian Creek and tributaries but exposures on the upper part of Dismal Creek indicate that they may contain some workable coal under Sandy Ridge. Bloom of the Tiller appeared to be only about a foot thick in the ridge between the forks of Greasy Creek and the Jawbone is 15 inches thick at a prospect by the road, three-fourths of a mile east of Bearwallow (location 261, elevation 2,580).

Raven bed.—The Raven is present on Indian Creek only under Sandy Ridge and adjacent spurs. The bed is about 1,800 feet above the Pocahontas No. 3 and about 410 feet above the top of the Lee. The coal rests on about 40 feet of coarse sandstone and there is sandstone not far above but the layer of conglomerate, closely associated with the bed to the west, is thin or lacking. The coal is between 4½ and 5 feet thick but in places contains irregular clay partings which will make mining expensive. Exposures on Dismal Creek indicate that the bed thins very slightly to the north, under Sandy Ridge.

No openings were found in the small area underlain by the Raven bed east of Indian Creek but blooms indicate that the coal is in two benches about 15 feet apart, both of which are thin. The bed has the following section at the Christian mine (local) on the east side of Indian Creek and is said to be essentially the same at two openings within half a mile south, where only the top part of the bed was exposed:

Raven bed 0.3 mile east of Bearwallow.

(Location 262, elevation 2,615)

	Ft.	in.
Shale		
Coal	2	10
Clay		2
Coal	1	1
Clay		6
Coal		11
Coal	4	10
Partings		8

The bed has a shale roof and is 57 inches thick including only an inch of clay 3 feet from the top at an old drift near the head of Greasy Creek (location 263, elevation 3,015), but where measured a short distance northwest there are several partings of variable thickness and both roof and floor are uneven.

Raven bed near head of Greasy Creek.

(Location 264, elevation 2,915)

	Inches.
Sandstone, coarse	
Coal	8½
Shale	1-4
Coal	10
Shale	1-8
Coal	20
Coal and shale	10-14
Coal	16-20
<hr/>	
Average coal	56½
Average partings	19

At a partially closed drift on the west side of Greasy Creek (location 265, elevation 2,935) the exposed part of the bed is 46 inches thick, including an inch of clay near the bottom and there is more coal below.

Aily, Kennedy, and Big Fork beds.—The Aily bed is 100 feet or more above the Raven and is separated from it principally by sandstone. Little is known of the bed because of the few exposures but it appears to be persistent. At a pit in West Virginia, 1½ miles northeast of Bearwallow (location 266, elevation 2,825), the coal is 28 inches thick including 3 inches of rash near the middle. The bed is 27 inches thick in Buchanan County on Bearwallow Branch of Jones Fork but contains many films of shale. The Aily coal is 31 inches thick at a stripping 1¼ miles southwest of Bearwallow (location 267, elevation 2,800).

The Kennedy coal is about 250 feet above the Raven and a short distance above the top of a massive, conglomeratic sandstone which forms the top of a series of beds called by Campbell the Dismal conglomerate lentil. The bed is easily followed along the outcrop because of its position on the prominent bench formed by these sandstones (see Pl. X).

There are only 8 inches of bloom at the outcrop of the Kennedy in the road ¾ of a mile east of Bearwallow but the bed is thicker to the west and contains 31 inches of clean coal at a drift a mile southwest of the Post-Office (location 268, elevation 2,880). The coal is 1½ to 2 feet thick at neighboring pits in Buchanan County.

The Big Fork coal, 150 feet above the Kennedy, has escaped erosion under only a few acres at the head of Indian. No measurements of the bed were obtained but it is known to be thin. At the top of a 35-foot sandstone about 90 feet above the Kennedy there is a thin coal which is not more than a foot thick in this region.

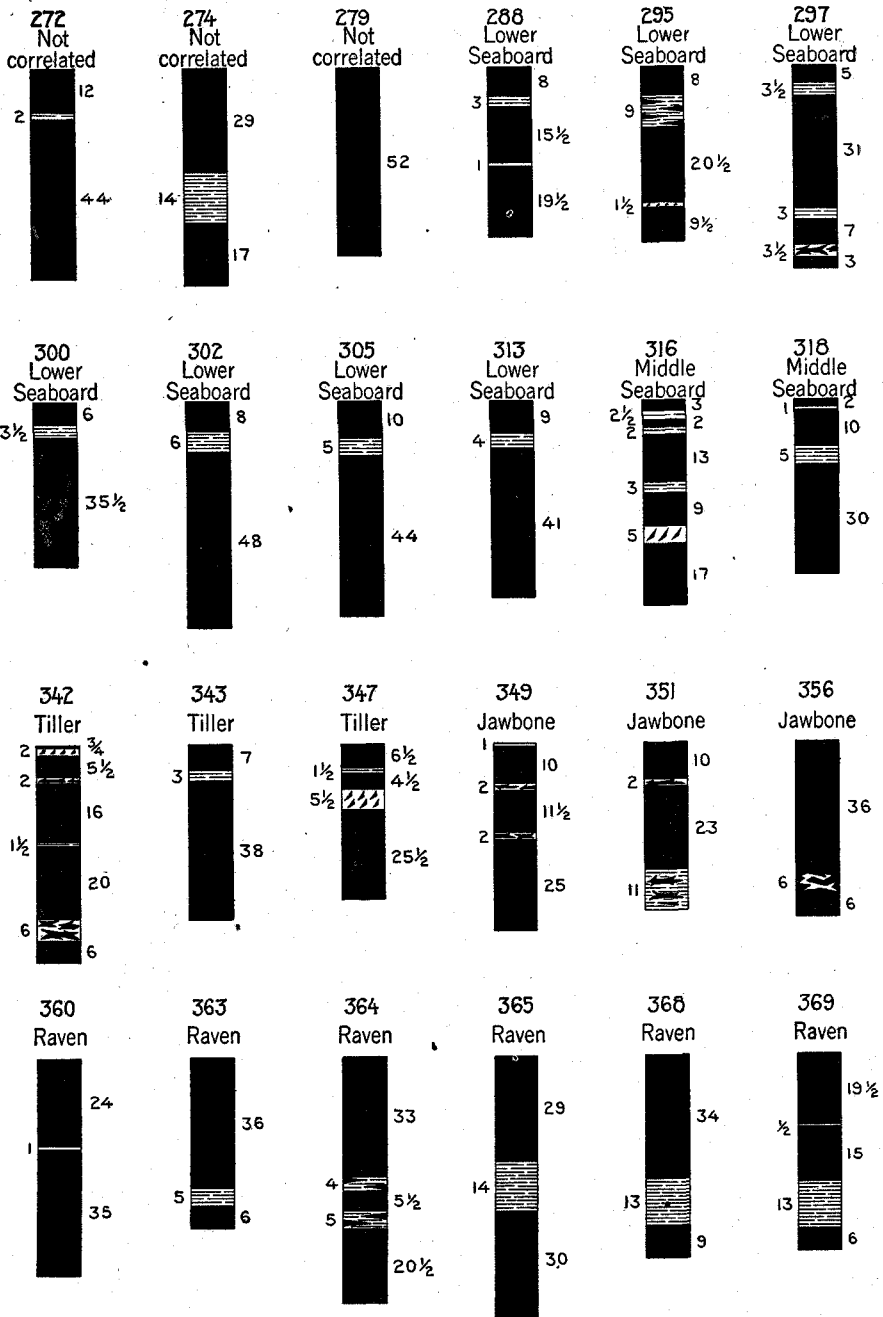


Fig. 16.—Sections of coal beds on Middle and Big creeks.

BIG CREEK AND MIDDLE CREEK BASINS.

General features.—This district includes the area drained by the waters of Big Creek and Middle Creek as well as West Fork of Big Creek. The exposed section includes the beds from the Upper Horsepen coal to the Big Fork coal. Structurally the basin is divided by the Dry Fork anticline, the strata south of the axis dipping in the main southward while north of the axis the dip is northward. Of the coals below drainage little is known except what may be judged from the few drill records in or near this region, but that combined with measurements of the steeply-dipping coals found north of the Middle Creek fault, indicates that some of these lower beds will be workable in this district. It is probable that at least in the southern part of the district the Pocahontas No. 3, and the Pocahontas No. 5, reach a workable thickness. These coals are thought to thin toward the northwest, so that the thicknesses found in the drillings near Jewell and on Seng Camp Fork may not serve as a fair average for all of this area. Between the Middle Creek and Boissevain faults are a series of overturned beds dipping southeastward at angles of about 45° , that contain several coal beds ranging in thickness from $1\frac{1}{2}$ to 5 feet. As a result of the relief of pressure due to faulting the coal in these beds is probably higher in volatile matter than the coals north of the Middle Creek fault. Likewise it may be anticipated that the thickness of the beds will be irregular as a result of the movements to which they have been subjected.

The Upper Horsepen coal, the lowest bed exposed in the district, is found only close to creek level and has a thickness of from 1 to $2\frac{1}{2}$ feet on Middle Creek. It is below drainage on Big Creek. The Lower Seaboard coal bed, lying 1,000 feet above Pocahontas No. 3 and 800 feet below the Raven, is exposed for a short distance on Big Creek and for a considerable distance on Middle Creek. The coal is, in most places, from $2\frac{1}{2}$ to 4 feet thick not including from 6 inches to 2 feet of partings. The Middle Seaboard coal bed, 40 to 50 feet above, is from 2 to 4 feet thick, including, however, many partings. The Upper Seaboard bed, 625 feet below the Raven, is clean and about 3 feet thick in a zone extending northeast from Seaboard, but thins north and south of this area. It has been extensively mined near Seaboard where it ranges from 30 to 36 inches thick. The Tiller coal averages over 3 feet thick on the upper part of Big Creek and West Fork, exclusive of partings. It is thin or absent on the lower part of Big Creek. The Jawbone bed, 40 to 60 feet above the Tiller is slightly thinner and is also impaired by partings. The Raven bed, 200 feet above

the Jawbone, is confined to Sandy Ridge and the high divides. It is generally 4 to 5 feet thick under Sandy Ridge but the value of the bed is reduced by the irregularity of the roof and floor. The Kennedy coal, two hundred and fifty feet above the Raven, underlies a small area on Sandy Ridge, where it is 2½ to 3 feet thick. The Big Fork bed is probably about 2 feet thick in the few small patches that remain.

Coal beds not correlated.—On the lower part of Middle and Big creeks a number of coals, dipping about 45° southeast, outcrop in rocks which have been mapped as “undifferentiated.” A sharp bend in the strata accompanied by a slight break has brought to the surface coal beds which are deeply buried to the north. (See fig. 6, p. 40.) It is not possible to correlate these steeply dipping coals but their position with reference to the faults bounding the undifferentiated zone is a rough index to their depth below the surface north of this area; those outcropping nearest the fault on the south side of this zone are most deeply buried and succeeding coals to the north are relatively nearer the surface in the adjoining area of gently dipping strata. The number and thickness of the dipping coal beds on Middle and Big creeks justify thorough prospecting on the lower parts of these streams north of the fault with the diamond drill. The dipping beds can be mined at present in competition with the flat-lying beds only where fairly thick and uniform. Operators should bear in mind that irregularities in thickness are very common in beds of this type and expensive equipment should be installed only after thorough prospecting.

The following section was obtained at a drift in a small tributary of Middle Creek, where the coal is dipping about 40° southeastward:

Coal bed dipping about 40°, on the east side of Middle Creek.

(Location 269, elevation 2,250)

	Ft.	in.
Coal		6
Rash		1
Coal	2	8
Clay	1	3
Bone		2
Coal		4
	<hr/>	
Coal	3	6
Partings	1	6

Coal probably belonging to the same bed is said to be 4 to 8 feet thick, and to contain 6 or 7 inches of shale in the lower part, at an old local

mine near the head of the same hollow (location 270, elevation 2,600). At an old drift near the road on Middle Creek (location 271), the coal is reported to average 35 inches but only 15 inches were seen at the entrance. Coal 33 inches thick is said to have been exposed at a prospect about 50 feet north, and another bed has been opened about 75 feet north. A bed 58 inches thick including 2 inches of clay a foot from the top was exposed at a neighboring pit (location 272). Coal 2 feet thick has been mined from an opening 30 feet above the road, about 700 feet northwest (location 273), and a bed 5 feet thick, including a 14-inch parting in the lower part, is exposed on the east side of the creek about 100 feet from the fault (location 274). On the west side of the creek, not more than 150 feet from the fault (location 275), a coal 18 inches thick has been exposed and there are about 20 inches at an opening 100 feet south. A prospect midway between these two openings had completely fallen shut. The coal bed exposed at location 272 has been opened in several places on the west side of the stream, where it is said to show a maximum thickness of 7 feet, but there were only 22 inches, with a 3-inch clay parting in the middle, at the only pit that had not fallen in (location 276). Coarse sandstone forms the hanging wall of this bed and separates it from another coal about 30 feet lower, stratigraphically, which was said to be 5 feet thick but will probably average less. A short distance southeast (location 277) coal 18 inches thick has been opened and there are 2½ feet, including 1½ inches of rash near the top, at a small drift at water level, 125 feet distant (location 278). What is probably the same bed as that exposed at location 269 is being mined further south to supply the local trade. There are several drifts on each side of the creek but the only one in operation was on the west side (location 279) where the coal is clean and 52 inches thick.

On the east side of Big Creek, just north of Richlands (location 280) clean coal, said to be 2½ to 3 feet thick, is being utilized at a small local mine and what is apparently the same bed has been exposed on the opposite side of the stream. The position of these openings relative to the faults suggests that the bed is the same as that mined at location 279.

Coal is being mined on a commercial scale by the Weyson Coal Co. at a mine 1½ miles northeast of Richlands (location 281), where the beds are dipping about 45 degrees. The coal, which is clean and 2½ to 3 feet thick, is fairly uniform, as far as the entries have been driven, but irregularities due to squeezing may be expected. According to an analysis furnished by Mr. H. A. Lee, the coal as it comes from the mine contains less than 3 per cent of ash and has a heating value of more than 15,000 British

thermal units. The bed is probably the same as that exposed at location 274 on Middle Creek. At a small drift on the west side of Big Creek near Richlands (location 282) clean coal $2\frac{1}{2}$ to 3 feet thick is being mined for local use and the same bed has been opened across the creek.

Upper Horsepen bed.—The Upper Horsepen outcrops for several miles on Middle Creek but is nowhere more than 50 feet above stream level. The coal is thin at the few exposures found and little is to be expected from it on Big Creek and westward, where it does not appear at the surface.

The coal appears to be only about a foot thick at an old stripping on an eastern tributary of Middle Creek (location 283, elevation 2,485). It is said to be clean and 29 inches thick, one-fourth of a mile southwest (location 284, elevation 2,485), and there are $26\frac{1}{2}$ inches at a neighboring pit on the same side of the stream (location 285, elevation 2,435). The coal is $21\frac{1}{2}$ inches thick in a spring on the east side of main Middle Creek (location 286, elevation 2,400) and Mr. Russell reports 28 inches of clean coal belonging to this bed at a prospect on the west side (location 287, elevation 2,385).

Bloom of a thin coal 75 feet above the Upper Horsepen was seen in one locality and a bed only 35 feet above has been exposed in several places. The latter bed is 15 inches thick, including 5 inches of bone near the middle, at a natural exposure in the hollow above location 284, and it is said to contain 26 inches of coal at a pit up the hollow west of location 287, where there is a 11-inch shale parting in the lower half.

Lower Seaboard bed.—The Lower Seaboard bed is 800 feet below the Raven and about 1,000 feet above the horizon of the Pocahontas No. 3. The bed is high in the hills on the east side of Middle Creek at the Dry Fork anticline but is above drainage for only a short distance on Big Creek, west of which it does not reach the surface. The coal is being mined at Seaboard, and several mines at Coaldan which were idle in 1916, have subsequently been put in operation. On Middle Creek the bed contains an average of about $3\frac{1}{2}$ feet of coal and two or more partings which in places seriously impair its value. An average section on Big Creek shows about 4 feet of coal and 4 to 10 inches of clay near the top of the bed.

The Lower Seaboard has the following section at a pit on the east side of Middle Creek, three-fourths of a mile north of the fault:

Lower Seaboard bed on Middle Creek three-fourths of a mile north of fault.

(Location 288, elevation 2,305)

	Ft.	in.
Shale		
Coal		8
Clay		3
Coal	1	3½
Clay		1
Coal	1	7½
Clay, soft	2	0
Coal	3	7
Partings		4

According to A. G. Russell, the coal is only 20 inches thick and includes 2 inches of shale at a prospect a mile further north (location 289, elevation 2,495). There are 27 inches of coal, including a 2-inch layer of clay 8 inches from the bottom, at a small local drift on an eastern tributary of Middle Creek (location 290, elevation 2,650) and there may be more coal below. What appears to be only the upper part of the bed is exposed at a pit a mile southwest (location 291, elevation 2,575) where there are 33 inches of coal with 8 inches of clay 11½ inches from the top. The two sections following were measured at pits on the east side of the stream:

Lower Seaboard bed on east side of Middle Creek.

(Location 292, elevation 2,590)

(Location 293, elevation 2,570)

	Ft.	in.		Ft.	in.
Coal		6	Shale		
Bone		1	Coal	1	5½
Coal	2	0	Clay		2
Clay		7½	Coal		6
Coal		8	Clay and rash		11
Shale (reported) ..		3	Coal		8
Coal (reported) ..		5			
			Coal	2	7½
Coal	3	7	Partings	1	1
Partings		11½			

Mr. Russell reports the bed 32½ inches thick, including 11½ inches of rash near the middle and 7 inches of impure coal at the bottom, at a prospect near stream level half a mile south of Fed Hollow (location 294, elevation 2,480).

The following measurements were obtained on the west side of the stream:

Lower Seaboard bed on west side of Middle Creek.

(Location 295, elevation 2,510)			(Location 296, elevation 2,530)		
	Ft.	in.		Ft.	in.
Shale			Shale		
Coal	8		Coal	1½	
Clay and rash.....	9		Shale and rash.....	6	
Coal	1	8½	Coal	6½	
Rash		1½	Rash	1½	
Coal		9½	Coal	1	7½
			Rash		1½
			Coal		6
Coal	3	2			
Partings		10½	Coal	2	9½
			Partings		9

The coal is slightly thicker in the next big hollow to the south, and Mr. Russell reports the second of the following sections for a prospect one mile east of Baldwin Hollow:

Lower Seaboard bed on Middle Creek, east of Coaldan.

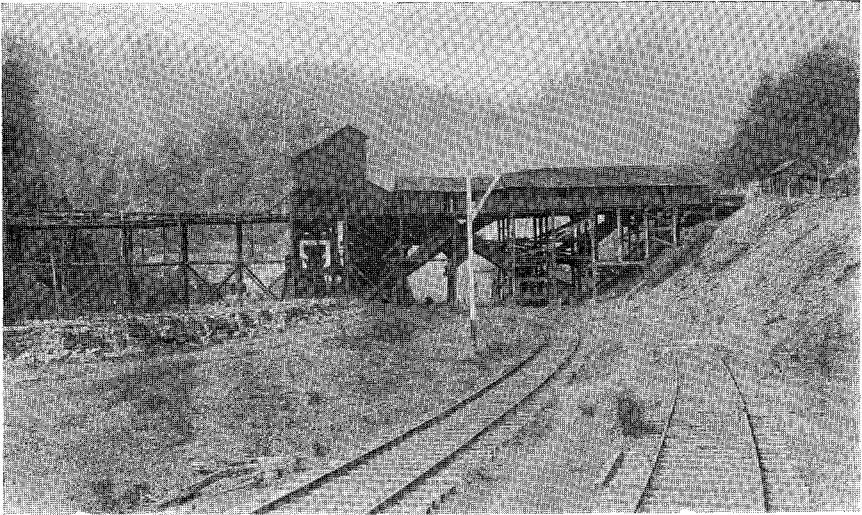
(Location 297, elevation 2,535)			(Location 298, elevation 2,475)		
	Ft.	in.		Ft.	in.
Sandstone, shaly ...	1	6	Shale		
Coal		5	Coal	1	7½
Clay, light		3½	Rash and shale.....		7
Coal	2	7	Shale		6
Clay, dark		3	Coal	1	3
Coal		7	Shale		4
Bone		3½	Coal		3
Coal		3			
Clay			Coal	3	1½
			Partings	1	6
Coal	3	10			
Partings		10			

According to the same authority the bed is very irregular and badly damaged by partings at the next prospect to the south.

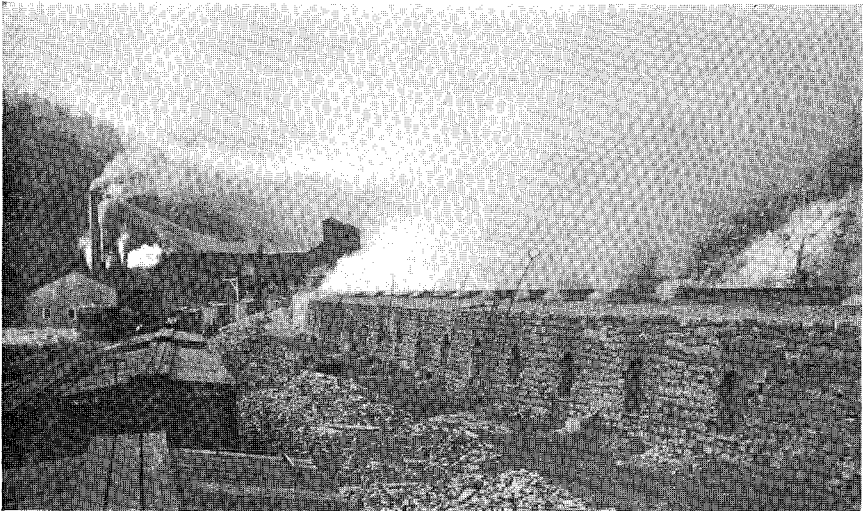
Lower Seaboard bed on the west side of lower Middle Creek.

(Location 299, elevation 2,430)

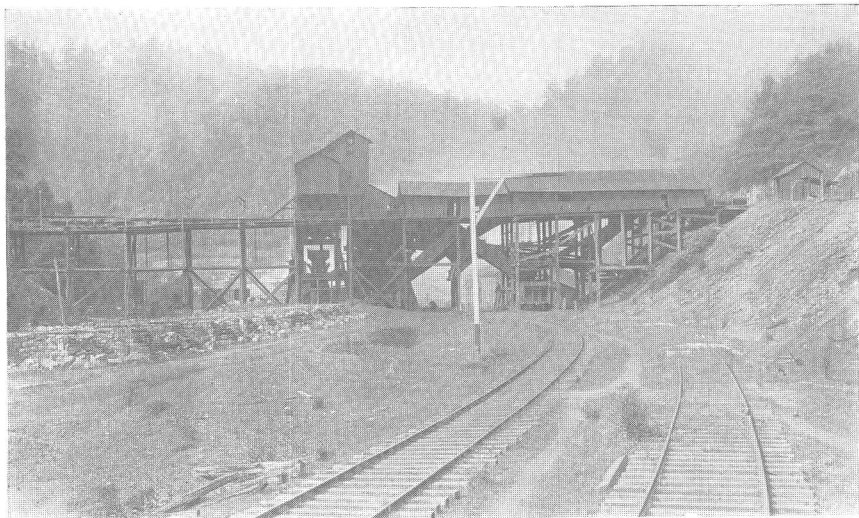
	Ft.	in.
Shale		
Coal		3
Clay		2
Coal		2½
Clay		6
Coal		5
Shale and rash.....		5
Coal		4
Clay		1
Coal		6
Shale		1
Coal		1½
Coal and shale		10½
Coal	1	5
Coal	3	3
Partings	2	1½



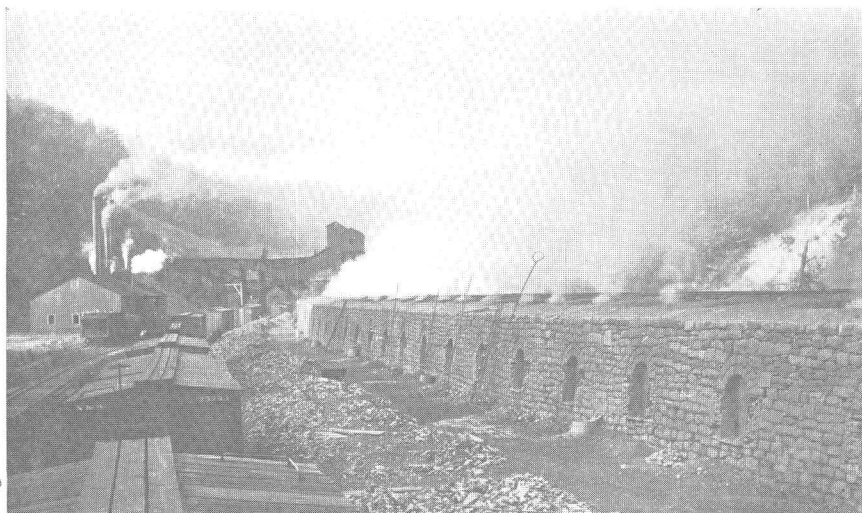
(A) View of tipple at Seaboard.



(B) View of coke ovens and tipple at Seaboard.



(A) View of tipple at Seaboard.



(B) View of coke ovens and tipple at Seaboard.

At a local mine three-fourths of a mile from the fault (location 300, elevation 2,280), the bed is 45 inches thick and contains only a 3½-inch parting, 6 inches from the top. A short distance down stream the southward dip carries the coal below the drainage but a few hundred feet from the fault it reappears dipping toward the north. The bed is less than 30 feet below the stream at the deepest part of this downward fold. The following measurement was obtained in a small mine about a hundred yards from the fault, where the coal is dipping 21 degrees north 30 west. The dip becomes more gentle in the up stream direction but it increases rapidly and become almost vertical as the fault is approached.

Lower Seaboard bed on Middle Creek near the fault.

(Location 301, elevation 2,200)

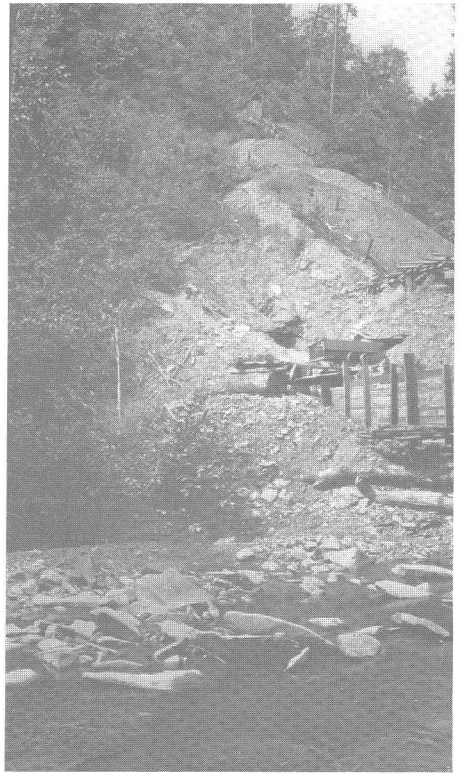
	Ft.	in.
Coal		4
Clay		5
Coal	1	0
Clay		½
Coal	1	10
Clay		1½
Coal		2
	3	4
Coal		4
Partings		7

A. G. Russell reports the bed 62 inches thick, including a 6-inch parting 8 inches from the top, at an old mine one-fourth mile west (location 302, elevation 2,185), and the coal is said to be equally thick at a neighboring pit in the edge of the road (location 303, elevation 2,170).

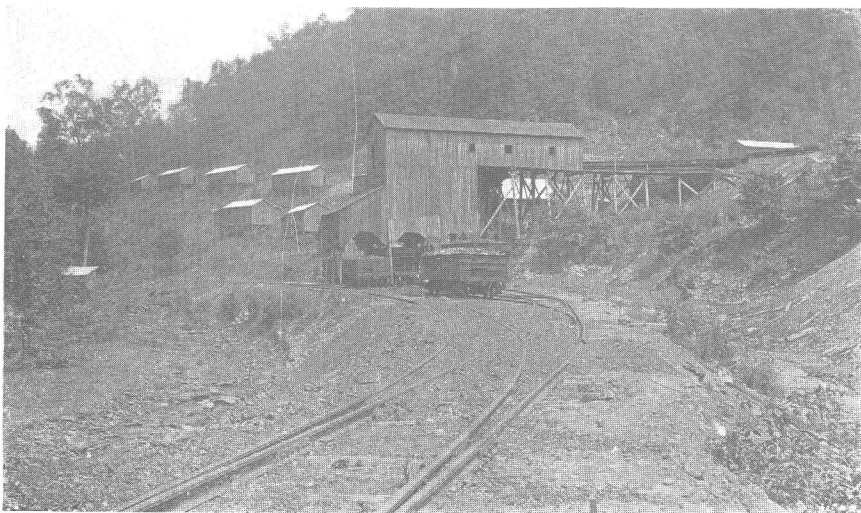
The Lower Seaboard coal is brought to the surface by the Dry Fork anticline at the commissary at Seaboard, where it has been opened, but the first mine (mine 2) on the east side of Big Creek is opposite the tippie (location 304, elevation 2,265). (Pl. XI.) No measurements were obtained in this mine by the writer but there are said to be 70 inches of coal with a 2-inch layer of shale near the top, in room 8, off the third left entry. The bed is 59 inches thick including 5 inches of hard clay 10 inches from the top at the entrance to mine 5 near the mouth of Baldwin Hollow (location 305, elevation 2,335), and the following section was measured in a local drift in a hollow south of Coaldan:



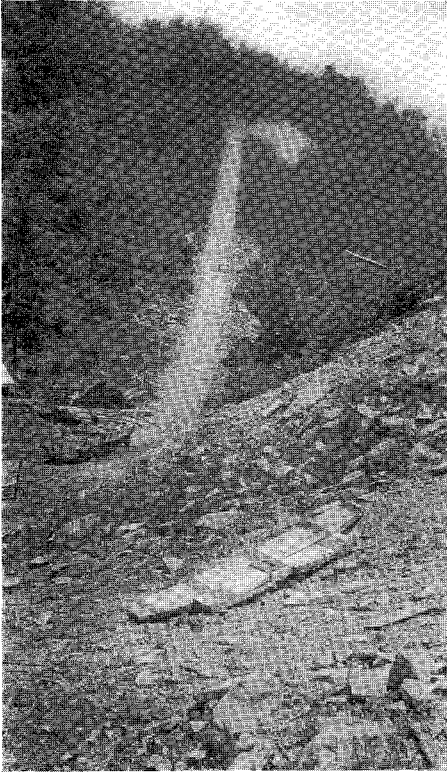
(A) Incline at Matoaka No. 2 mine.



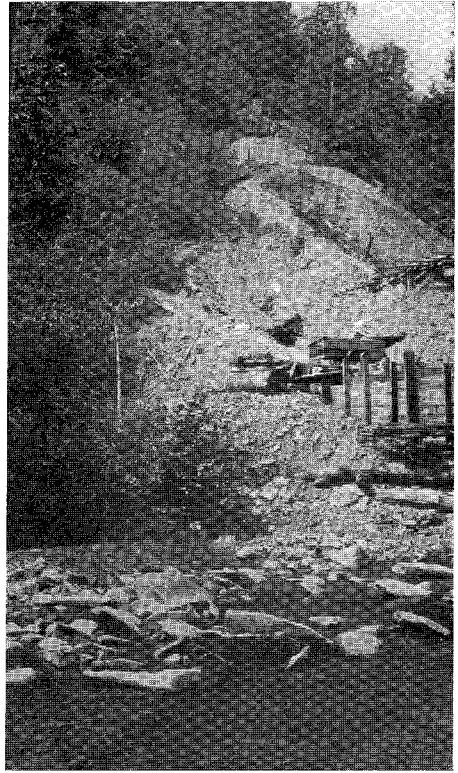
(B) Mines at different levels on coal bed dipping 45° . Middle Creek.



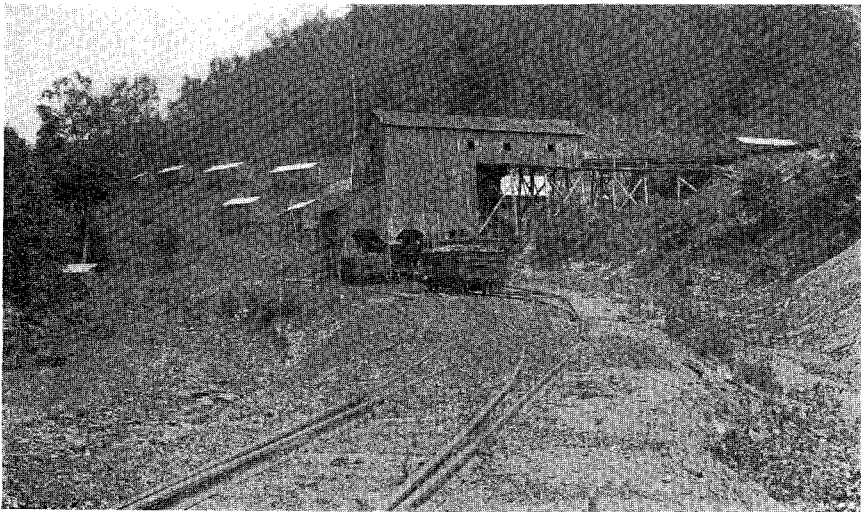
(C) Tipple of Matoaka Coal Corporation mines and part of town.



(A) Incline at Matoaka No. 2 mine.



(B) Mines at different levels on coal bed dipping 45°. Middle Creek.



(C) Tipple of Matoaka Coal Corporation mines and part of town.

Lower Seaboard bed one-fourth mile south of Coaldan.

(Location 306, elevation 2,350)

	Ft.	in.
Shale, sandy		
Coal	5	
Clay	8	
Coal	2	9
Rash		1
Coal		8
	3	10
Coal		
Partings		9

Near the entrance to mine 1 at Coaldan (location 307, elevation 2,340), the bed contains 42 inches of coal and 7½ inches of clay 10 inches from the top. An analysis of coal from this mine may be found on page 166. Measurements of the bed made at the time of sample are as follows:

Sections 4304 and 4305 were measured at No. 1 mine at Coaldan, 4½ miles north of Richlands, Tazewell County, Virginia (location 307 on map), December 8, 1906. Section 4304 was measured on the main straight entry, 2,000 feet S. 30° E. of drift mouth; section 4305, in room 12, off left entry 3, about 1,600 feet east of drift mouth.

Lower Seaboard bed at points sampled in No. 1 mine.

(Location 307, elevation 2,340)

	4304		4305	
	Ft.	in.	Ft.	in.
Coal	0	9½	0	7¾
Shale	*0	5½	*0	7
Coal	1	1	0	3½
"Sulphur"			0	⅛
Mother coal	0	⅛		
Coal	0	6	0	11
Mother coal and "sulphur"	0	¼		
Mother coal			0	⅛
Coal	0	2	0	10½
Mother coal and "sulphur"	*0	½	0	¼
Coal	*0	1	1	3¾
Mother coal and "sulphur"	*0	¾		
Coal	1	1		
Rash	0	2½		
Coal	0	10½		
Included in sample	4	8⅞	4	1
Excluded from sample	0	7¾	0	7

Mines 2 and 3 at Coaldan are located about one-fourth mile northeast (location 308, elevation 2,355 and location 309, elevation 2,350) of the tipple. The following section was measured near the entrance to the latter:

* Not included in sample.

Lower Seaboard bed in mine 3 at Coaldan.

(Location 309, elevation 2,350)

	Ft.	in.
Coal		9
Clay		7
Coal	2	4
Rash		2
Coal		9
		<hr/>
Coal	3	10
Partings		9

No measurements were obtained in the old or new Victoria mines (location 310 and 311, elevation 2,325) but the bed was reported to be about 58 inches thick, including a 10-inch clay parting near the top. The coal goes below drainage a few hundred feet north and it is not definitely known what the thickness is on the upper part of Big Creek. The record of the drill hole (B C1) one mile northwest of Coaldan shows no coal at this horizon but what is probably the Lower Seaboard coal is 22 inches thick in a drill hole (S C) on Seng Camp Fork in Buchanan County. The coal has been opened above the road southwest of Coaldan (location 312, elevation 2,335) but no measurement was obtained.

Near the entrance to mine 1½ (Seaboard), opposite the mouth of Baldwin Hollow (location 313, elevation 2,345), the Lower Seaboard coal is 4½ feet thick, including 4 inches of clay 9 inches from the top, but the thickness is said to be a little less in the first left heading, where there are only 35 inches in the lower bench. No measurement was obtained in the abandoned mine 1 (Seaboard) at the tipple (location 314, elevation 2,265) but the bed showed the following section at mine 4 (Seaboard) half a mile west:

Lower Seaboard bed at mine 4, northwest of Seaboard.

(Location 315, elevation 2,280)

	Ft.	in.
Shale		
Rash		4
Coal		8
Clay		5
Coal	2	11
		<hr/>
Coal	3	7
Parting		5

Middle Seaboard coal.—The Middle Seaboard is 40 feet above the bed last described at the type locality on Big Creek but the interval has increased to about 50 feet on Middle Creek. A characteristic feature of the

bed is the presence of shale partings which are in many places so thick or so numerous as to make the bed practically worthless. Few exposures of the coal were found on Middle Creek and it is probably thin north of the Dry Fork anticline. On Big Creek the bed contains about $3\frac{1}{2}$ feet of coal where it outcrops south of Seaboard and it is probably equally thick further south.

The bed has the following section at a pit near the fault on the lower part of Middle Creek:

Middle Seaboard bed on east side of Middle Creek near fault.

(Location 316, elevation 2,220)

	Ft.	in.
Sandstone	5+	
Coal		3
Clay		$2\frac{1}{2}$
Coal		2
Clay		2
Coal	1	1
Clay		3
Coal		9
Rash		5
Coal	1	5
<hr/>		
Coal	3	8
Partings	1	$\frac{1}{2}$

This coal bed was not identified with certainty anywhere on Middle Creek north of the location just given but an exposure seen at the mouth of Fed Hollow is believed to represent it.

Middle Seaboard bed on upper part of Middle Creek.

(Location 317, elevation 2,450)

	Ft.	in.
Sandstone	10+	
Shale	20	0
Rash		4
Coal		2
Clay		1
Coal		$1\frac{1}{2}$
Clay		$4\frac{1}{2}$
Coal	1	8
Sandstone	5+	
<hr/>		
Coal	1	$11\frac{1}{2}$
Partings		$5\frac{1}{2}$

The bed has been opened at several places on the lower part of Middle Creek, in the neighborhood of location 303, but no measurements could be obtained.

On Big Creek, the Middle Seaboard is brought to the surface by the Dry Fork anticline about 2,000 feet below Seaboard and is carried under again less than three-fourths of a mile above Coaldan. Mr. Zeigler reports the following section for the bed in room 2, off the first left entry, at an abandoned mine south of Seaboard:

Middle Seaboard bed in mine 12 at Seaboard.

(Location 318, elevation 2,210)

	Ft.	in.
Coal	2	
Shale		1
Coal		10
Shale		5
Coal	2	6
<hr style="width: 100%;"/>		
Coal	3	6
Partings		6

According to the same authority the principal shale parting, which is only 3 inches thick in the southern part of this mine; increases to 9 feet further north. The bed appeared to be 49 inches thick, including 9 inches of shale and rash 15 inches from the top, at an old mine about 800 feet north-west (location 319, elevation 2,230), but there may be a few inches more coal at the bottom.

Upper Seaboard bed.—The Upper Seaboard is 200 to 215 feet below the top of the Lee and about 625 feet below the Raven. The Greasy Creek bed, 40 to 50 feet below, rests on sandstone which in some places extends almost down to the Middle Seaboard. The presence of thin irregular layers of coal in the clay or shale roof of the Upper Seaboard frequently serves to identify the bed and a peculiar mottled coloring in the shale about 25 feet below is also of value in locating the horizon.

The Greasy Creek coal, which is probably absent over most of this region, was seen only along the divide east of Middle Creek, where it is thin. The Upper Seaboard is being mined extensively on Big Creek. The coal is clean and a little less than 3 feet thick in a zone extending northeast from Seaboard, but is thin north and south of this area.

Thick bloom was seen at the horizon of the Upper Seaboard in the road, three-fourths of a mile south of Pleasant Hill (location 259), and there are 34½ inches of clean coal in the bed at a local drift on Middle Creek south of Fed Hollow (location 320, elevation 2,675). Three feet of shale containing characteristic thin layers of coal separate the bed from the overlying sandstone. A similar shale roof was seen over 34 inches of coal

at an opening at stream level in Fed Hollow (location 321, elevation 2,600) and at a small drift less than a mile east of Coaldan (location 322, elevation 2,690), where the coal is $33\frac{1}{2}$ inches thick. Coal, which is tentatively correlated with the Upper Seaboard, has been exposed and is said to be 18 inches thick, including a streak of shale near the middle, at a pit on the lower part of Middle Creek about half a mile southeast of White School (location 323, elevation 2,230).

A coal bed, which is probably the Upper Seaboard, is said to be 18 to 20 inches thick at a small abandoned mine on Big Creek near the fault (location 324, elevation 2,100), and several old openings in the hollow to the east may be on the same bed. The coal is 20 inches thick, including 6 inches of bone at the base, at a small pit half a mile from the fault (location 325, elevation 2,170) and it appears to be no thicker at a prospect near White School (location 326, elevation 2,210). The Upper Seaboard is said to average 34 inches of clean coal at mine $6\frac{1}{2}$, southeast of Seaboard (location 327, elevation 2,355), and there are 20 to 30 inches of shale above containing knife-edge partings of coal. Two sections measured at the time of sampling are given on page 172. Coal 35 inches thick was measured at the entrance to mine 6, southeast of the tipple at Seaboard (location 328, elevation 2,420), and 30 inches at the mouth of a local drift near the head of Baldwin Hollow (location 329, elevation 2,560). There are 33 inches of clean coal in this bed at a local drift near the head of Beaver Hollow (location 330, elevation 2,625) and 35 inches of coal at an opening 400 yards southwest (location 331, elevation 2,585). Coal belonging to a bed which was not found elsewhere is said to be 4 feet thick, including 5 inches of shale near the middle, at a pit just south of the last location and 80 feet lower. The Upper Seaboard is only $29\frac{1}{2}$ inches thick at a local mine 1,500 feet east of Coaldan (location 332, elevation 2,575) and 27 inches thick at the head of a tributary which enters Big Creek from the east (location 333, elevation 2,615). There are only 9 inches of coal at this horizon in the wagon road north of Coaldan and the bed is said to be equally thin at a prospect pit below the road (location 334, elevation 2,485). There is no record of coal at this horizon in the drill holes on Big Creek (B C 1) and Seng Camp Fork (S C). (See fig. 4, p. 22.)

One of the first mines on Big Creek was in the Upper Seaboard bed on the spur above mine 1 at Seaboard (location 335). According to Campbell, the coal was $21\frac{1}{2}$ feet thick 1,200 feet from the outcrop. He correlates this coal with the Middle Horsepen and the Lower Seaboard with the Lower Horsepen. The Upper Seaboard bed is reported by the miners to average

32 inches of clean coal at mine 9, half a mile northwest of Seaboard (location 336, elevation 2,445), and there are 36 inches in the hollow west of the commissary (location 337, elevation 2,355) at the entrance to mine 7. Thorough prospecting under the direction of Mr. Zeigler failed to find the bed on any part of West Fork, and he believes that it does not outcrop west of Big Creek. Coal 11 inches thick at a stripping one mile west of Seaboard (location 338, elevation 2,300) resembles the Upper Seaboard but may be a higher bed. According to Mr. Zeigler, the coal is about 3 feet thick where struck by the drill 60 feet below the surface (elevation of surface 2,310) at a prospect hole (W F) half a mile northwest.

Tiller and Jawbone beds.—No coal of importance occurs on these creeks between the Upper Seaboard and the Tiller. Thin coals were found at the bottom and top of the thick sandstone which forms the top of the Lee, and the latter may be as much as 2 feet thick in places (see location 260), but the average thickness is probably not much over a foot. The Jawbone coal is 40 to 60 feet above the Tiller and 200 to 215 feet above the top of the Lee formation. The bed is easily identified because of its position at the bottom of a large shaly interval and at the top of a thick series of sandstones. Coarse sandstone, locally conglomeratic, forms the roof of the Tiller bed almost everywhere and furnishes a means of distinguishing it from the Jawbone.

The Tiller is split up by partings everywhere but contains an average of a little more than 3 feet of coal on the upper part of Big Creek and West Fork. The bed appears to thin to the south and may be absent on the lower part of the latter stream. The Jawbone contains 2 to 4 feet of coal and is likewise impaired by partings. It is probably thickest in the small area south of the Dry Fork anticline. Exposures in the adjacent part of Buchanan County indicate that the Tiller thins slightly under Sandy Ridge but the Jawbone retains its average thickness of about 3 feet. Thin blooms of the Tiller and Jawbone beds were seen in the road along the divide east of Middle Creek but no complete measurements were obtained except on Big Creek and West Fork.

The Tiller is said to be about 2½ feet thick, including partings which make the bed almost worthless, at each of two caved openings near the road east of upper Big Creek (location 339, elevation 2,800 and location 340, elevation 2,745). The Jawbone is said to be less than 2 feet thick in this locality.

Sections of the Tiller bed were obtained on opposite sides of Big Creek a short distance below Jewell.

Tiller bed near head of Big Creek.

(Location 341, elevation 2,485)		(Location 342, elevation 2,465)	
	Ft. in.		Ft. in.
Sandstone		Sandstone, coarse...	
Shale	5	Coal, "frozen" to	
Coal	7½	roof	¾
Bone	2½	Rash, "frozen" to	
Coal	1 1½	coal above	2
Clay	¼	Coal	5½
Coal	9	Bone	2
Rash	4	Coal	1 4
Coal	5	Clay	1½
Clay, hard		Coal	1 8
		Bone	6 6
		Coal	6 6
Coal	2 11		
Partings	6¾	Coal	4 ¼
		Partings	11½

According to Mr. Zeigler, the bed is 4 feet thick including 3 inches of shale 7 inches from the top at a prospect near the head of a large tributary which empties into Big Creek at Seaboard (location 343, elevation 2,735) and 34 inches thick, including only half an inch of shale, at a pit on West Fork about half a mile west (location 344). The following sections were obtained at openings on the upper part of West Fork; the first in a small mine which formerly supplied fuel for an engine used at a lumber camp and the other two at prospects:

Tiller bed on upper West Fork.

(Location 345, elevation 2,415)		(Location 346, elevation 2,440)		(Location 347, elevation 2,500)	
	Ft. in.		Ft. in.		Ft. in.
Sandstone	10+	Sandstone	25+	Shale, sandy	4+
Coal	6	Coal	4	Coal	6½
Clay, hard	2½	Clay, hard	2	Clay, hard	1½
Coal	5	Coal	4	Coal	4½
Rash	2	Rash	2	Rash	5½
Coal	1 7	Coal	2 0	Coal	2 1½
Rash	½				
Coal	5				
		Coal	2 11		
		Partings	5		

No exposures of the Tiller bed were found on West Fork south of the last location and it is probably absent on the lower part of that stream.

The Jawbone bed is said to be only 23½ inches thick, including one-half inch of shale in the middle, at a prospect on the upper part of Big Creek (location 348, elevation 2,525). The first of the following sections was obtained in a hollow half a mile south, 40 feet above a caved pit on the Tiller, and the second was reported for a prospect at the head of a tributary which joins Big Creek at Seaboard:

Jawbone bed on the upper part of Big Creek.

(Location 349, elevation 2,590)		(Location 350, elevation 2,780)	
	Ft. in.		Ft. in.
Rash	1	Shale	8
Coal	10	Coal	9
Bone	2	Shale	7
Coal	11½	Coal	5
Bone	2	Bone	5
Coal	2 1	Coal	1 0
Coal	3 10½	Coal	2 2
Partings	4	Partings	1 0

The Jawbone coal has been eroded from the ridge between West Fork and Big Creek where the Dry Fork anticline crosses but is present in a small area southwest of Seaboard. The section given below was obtained in an old local mine on West Fork slightly more than half a mile from the fault.

Jawbone bed on West Fork about half a mile north of fault.

(Location 351, elevation 2,475)

	Ft.	in.
Sandstone, fine-grained	12	0
Shale	10	0
Coal		10
Bone		2
Coal	1	11
Clay, bone and rash		11
Coal	2	9
Parting		2

The bed is said to be 5 feet thick, including partings, at an old opening near a house about half a mile north (location 352, elevation 2,650). The first of the following sections was reported by Mr. Zeigler for a prospect 1¼ miles northwest of Coaldan, and the second for an old mine on the upper part of West Fork.

Jawbone bed on West Fork.

(Location 353)			(Location 354, elevation 2,440)		
	Ft.	in.		Ft.	in.
Coal		9	Coal	1	2
Coal, bony		2	Coal, bony		1
Coal	1	5	Coal	1	1
Coal, bony		6	Coal, bony		4
Coal		6	Coal		9
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Coal	2	8	Coal	3	0
Partings		8	Partings		5

According to the same authority the bed is 3 feet thick, including 6 inches of shale 5 inches from the bottom, at a prospect on the west side of the stream (location 355, elevation 2,495), and 4 feet thick, including 6 inches of bony coal, at a pit further south (location 356, elevation 2,545). The bed is said to be thick at an old mine near the fault (location 357, elevation 2,365) but no section could be obtained.

Thick bloom of the persistent coal about 60 feet above the Jawbone was seen in the road west of Middle Creek (location 358, elevation 2,955) and almost 2 feet of coal at the same horizon were seen in the bed of the creek near the head of West Fork (location 359, elevation 2,485).

Raven bed.—The Raven coal is 200 feet above the Jawbone and about 410 feet above the Lee formation. There are about 100 feet of sandstone below the bed and the same amount above, the latter locally split by two shaly intervals in the lower part, each of which carries a thin coal bed. The upper of these two coals, 50 feet above the Raven, has conglomeratic sandstone above it in most places and is fairly persistent. The Raven is fairly thick and of excellent quality but it has escaped erosion in this region only along Sandy Ridge and in the divide between Town Hill Creek and West Fork. The bed is being mined extensively by the Jewell Ridge Coal Corporation at Jewell, where it averages about 4½ feet thick, including about 6 inches of worthless material in the lower part. The coal is 4 to 5 feet thick under Sandy Ridge east of the mine and thick partings are absent nearly everywhere. West of the Jewell Ridge mine, the parting in the lower portion of the bed, thickens to about 3 feet on the north side of Sandy Ridge but it is only 1 to 5 inches thick at the head of West Fork.

The Raven bed is 5 feet thick including 1 inch of shale 2 feet from the top and in excellent condition for mining at a small local drift on the east side of Middle Creek near the ridge road (location 360, elevation 2,915). On the west side of Middle Creek near the head, the coal is said to be about 4 feet thick at a caved opening at water level (location 361,

elevation 2,640). A coal bed 33 inches thick, which is thought to be about 50 feet above the Raven, is exposed at an old drift a few hundred feet southeast (location 362, elevation 2,745). The Raven is 47 inches thick, including 5 inches of shale 3 feet from the top, at a partially caved pit near the road west of Middle Creek (location 363, elevation 2,865), where an 18-inch bench is said to be below the part of the bed exposed. The following section was obtained on the Big Creek side of the ridge about 1,000 feet northwest:

Raven bed three-fourths of a mile east of Jewell.

(Location 364, elevation 2,805)

	Ft.	in.
Sandstone		
Coal	2	9
Clay and rash		4
Coal		5½
Clay and rash		5
Coal	1	8½
Sandstone		
Coal	4	11
Partings		9

The bed is 73 inches thick, including a 14-inch shale parting 2½ feet from the base, at an opening near the head of a hollow less than half a mile east of Jewell (location 365), according to data taken from the mine map furnished by Mr. Grady. At a prospect almost due east of Jewell the bed is said to be only about 5 feet thick and to contain 17 inches of shale.

The No. 3 main entry, 400 feet south and 33 feet above No. 1, is driven about east (location 366, elevation 2,618). The No. 1 main entry of the Jewell Ridge Coal Corporation mine is driven about northeast and is located at stream level near the head of Big Creek (location 367, elevation 2,585). The entrance to No. 2 main entry has been abandoned and the coal is brought out through No. 1 entry. The coal in this region is in two distinct benches, the upper fairly regular and 30 to 36 inches thick, the lower about 12 inches in average thickness but 2 feet or more in parts of No. 3 entry. The parting in the bed is ordinarily about 5 inches of rash and clay, or there may be a thin layer of coal included, in which case the thickness is greater. The following detailed sections of the bed were measured in No. 1 main entry.

Sections 25651 and 25652 were measured at No. 1 mine of the Jewell Ridge Coal Corporation, at Jewell, Tazewell County, Virginia (location

368), July 22, 1916. Section 25651 was measured on second right, off main entry, 1,900 feet N. 60° E. of mine entrance; section 25652, from No. 6 main entry, 3,700 feet northeast of mine entrance.

*Raven bed at points sampled in the No. 1 mine of the
Jewell Ridge Corporation.*

(Location 367, elevation 2,585)

	25651		25652	
	Ft.	in.	Ft.	in.
Coal	2	8	2	6
Rash	*0	1	*0	1
Coal	*0	2	0	4
Rash	*0	1	*0	1
Clay, hard	*0	2	*0	2
Rash .....	..	..	*0	2
Coal	0	10	1	¼
Included in sample	3	6	3	10¼
Excluded from sample	0	6	0	6

(For analyses of samples cut at these places see p. 168.)

In spite of the thickness of the Raven bed in this locality it has been difficult to mine on account of certain irregularities. In some places the coal is cut out by a raise in the floor, the roof remaining perfectly even, and in other places only the roof is irregular. It is not unusual to find the bed abnormally thick or thin due to the combined effect of uneven roof and floor. In some of these distorted zones, which the miners refer to as "trouble," or "rolls," portions of the coal bed wedge out into the roof or floor and tongues of sandstone or shale extend into the coal. The irregularities appear to be due to unstable conditions, resulting in an uneven floor, at the time of deposition of the coal and to movements soon after deposition, before the coal and the inclosing rocks had become hard. The laminations in the coal at the "rolls" may be at an angle to the general plane of the bed, and in many places are curved and twisted. No evidence of movement subsequent to the consolidation of the bed, such as shattered coal and rock, were seen.

At a pit in the head of a little hollow on the west side of Big Creek, southwest of the mine (location 368), the bed is 56 inches thick, including 13 inches of clay 34 inches from the top, according to Mr. Zeigler. It has the following section in the next hollow to the south:

* Not included in sample.

Raven bed at prospect one-fourth mile west of Jewell.

(Location 369, elevation 2,635)

	Ft.	in.
Coal	1	7½
Clay		½
Coal	1	3
Clay	1	1
Coal		6
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Coal	3	4½
Partings	1	1½

The same authority reports the bed 45 inches thick, including 6 inches of shale 26 inches from the top, less than half a mile southwest of Jewell (location 370, elevation 2,730).

The Raven coal has the following section at a prospect in a little hollow near the head of West Fork:

Raven bed near head of West Fork.

(Location 371, elevation 2,650)

	Ft.	in.
Sandstone	5+	
Shale	1	6
Coal	3	4
Shale		2½
Coal (reported)		5
Clay (reported)		8
Coal (reported)		2
<hr/>		
Coal	3	11
Partings		10½

On the opposite side of the spur about 400 feet north (location 372, elevation 2,640) the bed is 40½ inches thick and has 2½ inches of clay 4 inches from the bottom.

Sections furnished by Mr. Zeigler show that the bed is about 40 inches thick and contains 3 to 6 inches of clay near the base, at two prospects near the head of this fork, northeast of the last location. The coal is 35 inches thick, the lower 2 inches being bony, at a prospect on the east side of the creek at the head of the other prong of West Fork (location 373, elevation 2,500), and 34 inches thick, including an inch of clay near the bottom, at a pit 100 yards southwest (location 374, elevation 2,500). In the hollow above the last location, 2 feet of coal are exposed 25 feet above the Raven and an equal thickness 60 feet above (location 375, elevation 2,560). The Raven coal is 34 inches thick and there are 3 inches of bone

below, in a hollow one-fourth mile south (location 376, elevation 2,535), and the bed is said to be 3 feet thick, including a 3½-inch clay parting 4 inches from the base, at a prospect west of the forks (location 377).

Kennedy and Big Fork beds.—The Aily coal is thin or absent in this region and the next higher coal is the Kennedy, about 250 feet above the Raven. The bed has drab shale above it almost everywhere, and it is a short distance above the top of a thick series of sandstones which are locally conglomeratic. The coal is 2½ to 3 feet thick, including 5 or 6 inches of clay in the lower part, and is present only in a small area along Sandy Ridge. The thickness is about the same at exposures on the north side of Sandy Ridge in Buchanan County. No sections of the Big Fork coal, 150 feet above the Kennedy, were obtained but measurements in adjacent areas indicate that it may be 2 feet thick in the few isolated patches that remain.

The following section of the Kennedy coal was measured in a pit half a mile northwest of Jewell:

Kennedy bed near head of Big Creek.

(Location 378, elevation 2,800)

	Ft.	in.
Shale		
Coal	2	0
Clay		5
Coal		1
Clay		2
Coal		5
		<hr/>
Coal	2	6
Partings		7

The bed is 3 feet thick, including 9 inches of clay and rash 6 inches from the bottom, at an opening a short distance south (location 379, elevation 2,835) and 2½ feet thick, with a 7-inch parting in the same position, in a drift near the head of West Fork (location 380, elevation 2,790). Coal 26 inches thick, which may be only the top bench, was seen at a neighboring pit near Sandy Ridge (location 381, elevation 2,755), and at an opening one-fourth mile south (location 382, elevation 2,775) there is an additional 5-inch layer at the bottom, below 4 inches of shale. The Kennedy bed contains 2½ feet of coal, exclusive of 3 inches of clay in the lower part, at a local drift in a hollow on the west side of West Fork (location 383, elevation 2,750).

BASINS OF MILL, COAL, MUDLICK, AND TOWN HILL CREEKS.

General features.—This district covers the drainage area of the four creeks named and lies at the west end of the coal-bearing area of Tazewell County. The westward dip of the rocks has been so great that only the upper beds, including from the Tiller to the Lower Banner, are above drainage here. In this district the dip south of the anticline is southwest and north of the anticline is northwest, resulting from the fairly strong westward dip along the Dry Fork anticlinal axis. In the absence of diamond drill tests, no information is available concerning the coals below the surface, but it is probable that several valuable beds exist, particularly south of the Dry Fork anticline.

The Tiller coal is the lowest one of any importance outcropping in this district. It lies 27 to 50 feet below the Jawbone and is from 2 to 4 feet thick, averaging at least 2½ feet and probably has a thickness of from 3 to 3½ feet under Sandy Ridge southwest of Wolfpen Knob. The Jawbone coal is from 2 to 6 feet thick, averaging about 3½ feet of recoverable coal. About 60 feet above the Jawbone is a bed that in places is from 1½ to 2 feet thick. Two hundred feet above the Jawbone is the Raven bed from 2 to 6 feet thick. This bed is clean and fairly uniform in thickness and is the principal bed of this district. From 30 to 60 feet above the Raven is a bed that is from 1½ to 2 feet thick. The Kennedy bed, 250 to 300 feet above the Raven, is from 3 to 3½ feet where seen. About 50 feet above the Kennedy, is a coal bed, locally known as the "Caldwell," which attains a fair thickness in the southwestern part of the area. The Big Fork coal, 150 feet above the Kennedy, is 30 inches thick at the only point where seen. The Lower Banner coal, 200 feet above the Kennedy, underlies a small area on Sandy Ridge, where it has a thickness of from 4 to 6 feet.

Coal beds below Tiller.—At the base of the Norton formation, 210 to 220 feet above the upper Seaboard bed, there is a thin coal which is above drainage for a short distance on Town Hill and Mudlick creeks. It has been exposed on Town Hill Creek (location 384, elevation 2,390) where it is reported thin.

Tiller bed.—The lowest coal bed of importance outcropping in this region is the Tiller, which is 160 to 175 feet above the base of the Norton, and 27 to 50 feet below the Jawbone coal. In most places it may be distinguished from the Jawbone by the sandstone above it, which rests directly on the coal at almost all exposures seen and commonly contains a few scattered, small, white pebbles. Both beds have sandstone below them but

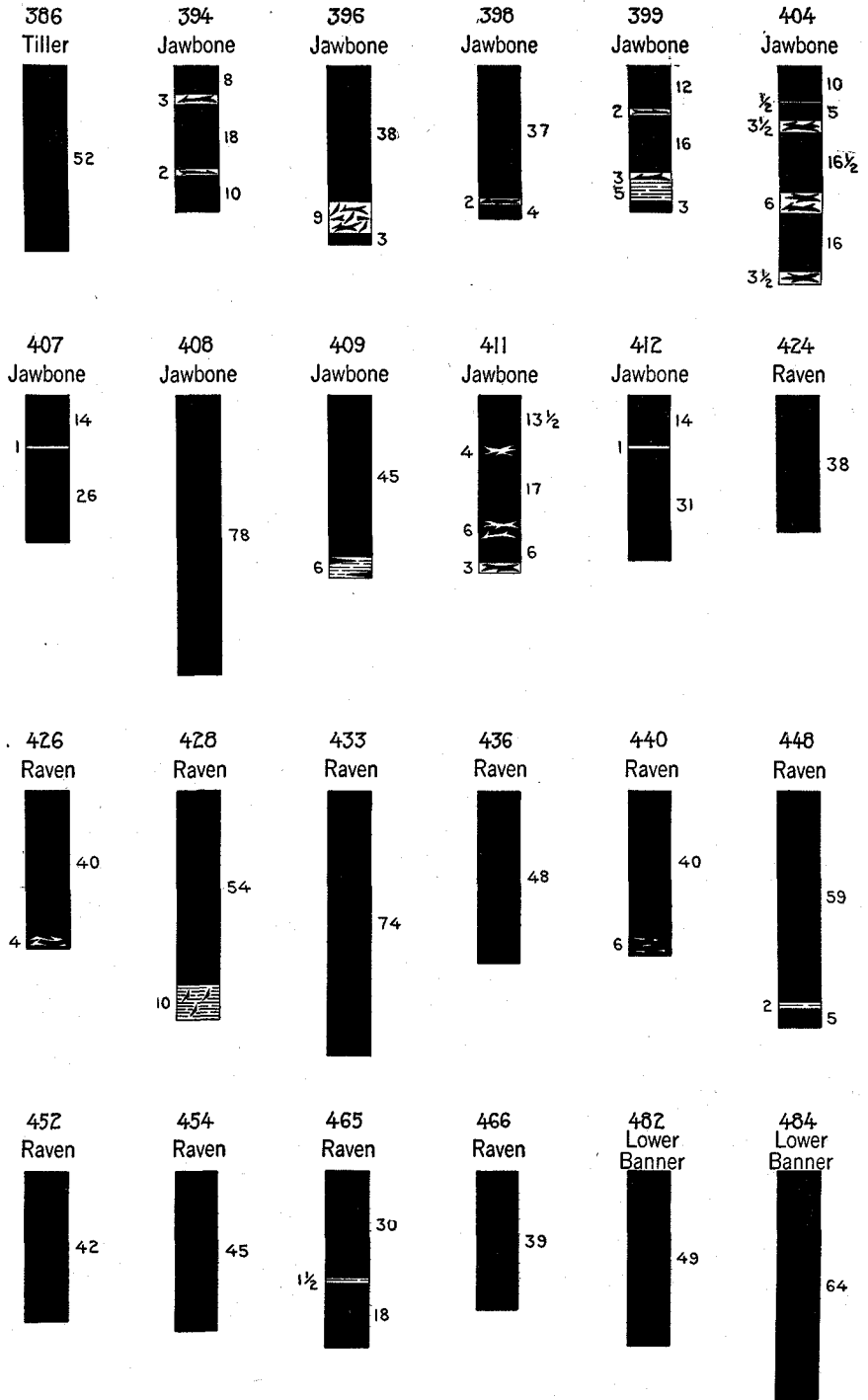


Fig. 17.—Sections of coal beds on Mill, Coal, Mudlick, and Town Hill creeks.

with few exceptions the Jawbone has shale or sandy shale immediately above it. The Tiller coal outcrops on Little Town Hill, Town Hill, and Mudlick creeks but it goes below drainage on the latter stream before it reaches the fault. The location of the bed may be determined by referring to the outcrop of the Jawbone coal which is shown on the geologic map. The beds are about 30 feet apart near the fault but this distance increases to 40 feet within a mile northward and is probably 50 feet on the upper part of the streams. The Tiller coal is 2 to 4 feet thick where it outcrops on these streams and will probably average at least $2\frac{1}{2}$ feet for the entire area. Exposures of the bed at openings on Grassy Creek in Buchanan County indicate that it may contain 3 to $3\frac{1}{2}$ feet of coal under Sandy Ridge southwest of Wolfpen Knob.

On the east side of Town Hill Creek (location 385, elevation 1,980) the Tiller bed is 33 to 45 inches thick, including 2 inches of rash 10 inches from the bottom, at the entrance to a small drift mine of the Big Town Hill Creek Coal Corporation. In the principal mine of this company on the east side of the creek a short distance north (location 386, elevation 1,975) the coal was 52 inches thick where measured in room 1, off the main heading, 450 feet northeast of the entrance, and 4 feet thick, including $1\frac{1}{2}$ inches of bone a foot from the top, at the face of the main heading. The bed here has an excellent sandstone roof and in some places a sandstone floor. According to the mine foreman the coal is rarely less than 30 inches thick and averages $3\frac{1}{2}$ feet. Analyses of coal from this mine are given in another part of the report (p. 166). The average daily output of the mine is 40 tons.

The Tiller coal, showing a local dip of 15° southeast, is only 20 inches thick and rather dirty at the entrance to an abandoned drift further up Town Hill Creek (location 387, elevation 1,975) and is about the same in an opening 150 feet south. The coal is 25 inches thick and has 20 feet of conglomeratic sandstone above it at the next exposure (location 388, elevation 2,025), and the bed is about 3 feet thick in an old opening on the same side of the creek further north (location 389, elevation 2,175) but it could not be examined as to partings. A bed that is probably the Tiller but may be Jawbone shows the following section at an opening in the east side of the stream, about $\frac{3}{4}$ miles north of the fault:

Tiller (?) bed on Town Hill Creek.

(Location 390, elevation 2,585)

	Ft.	in.
Sandstone, coarse, conglomeratic	10+	
Coal		7½
Bone		3
Coal		11
Rash		1½
Coal	1	2½
Coal	2	9
Partings		4½

The Tiller was seen on the west side of Town Hill Creek only at the abandoned local mine about 200 feet north of the fault (location 391, elevation 1,975), where there are about 3 feet of coal with 4 inches of shale in the upper part.

On Mudlick Creek the following section is exposed 1½ miles above Doran, in an opening 45 feet below a nearby prospect on the Jawbone:

Tiller bed on Mudlick Creek, one and one-half miles from Doran.

(Location 392, elevation 2,105)

	Ft.	in.
Sandstone	5+	
Conglomerate		1
Sandstone (absent in places)		3
Coal		7
Sandstone		3
Coal, bony		2
Coal	1	8
Coal	2	5
Partings		3

A section showing similar irregularities in the upper part of the bed was measured in a small drift on the west side of the creek about 3 miles north of Doran:

Tiller bed on Mudlick Creek, 3 miles from Doran.

(Location 393, elevation 2,300)

	Ft.	in.
Sandstone	5+	
Coal		4
Sandstone, shale, and bone		10
Coal	1	8
Clay		½
Coal		4
Coal	2	4
Partings		10½

There is a caved pit on the Jawbone bed, 40 feet above this opening.

Jawbone bed.—The Jawbone coal is usually found on a distinct bench formed by the sandstone over the Tiller. Above the bed there are normally a few feet of shale which may be followed by as much as 40 feet of sandstone, but shale or sandy shale is the rule. The Jawbone contains 2 to 6 feet of coal and is thickest near the fault. The bed is generally impaired by bone and shale partings but will average 3½ feet of minable coal in this region. Exposures of the bed where it outcrops on the north side of Sandy Ridge show about the same amount of coal and similar partings.

At an opening on the east side of Little Town Hill Creek the Jawbone bed showed the following section:

Jawbone bed on Little Town Hill Creek.

(Location 394, elevation 2,205)

	Ft.	in.
Shale		
Sandstone	2	0
Shale	2	0
Coal		8
Bone		3
Coal	1	6
Bone		2
Coal		10

Coal	3	0
Partings		5

The bed is 75 inches thick, apparently without serious partings in an old local mine on the west side of this stream (location 395, elevation 2,175) but it could not be closely examined.

The Jawbone bed is 50 inches thick, including 9 inches of rash and bone 3 inches from the bottom in the abandoned No. 1 drift of the Matoaka Coal Corporation on the east side of Town Hill Creek (location 396, elevation 2,150): A short distance north (location 397, elevation 2,185) in the No. 3 drift (undeveloped) of the same company, the bed is 3 feet thick including 2 inches of bony material 3 inches from the base, and at an opening 50 feet south of this drift the bone parting is only one-half inch thick. The bed is 43 inches thick in the No. 4 drift (undeveloped) of the Matoaka Coal Corporation (location 398, elevation 2,300), including 2 inches of bone 4 inches from the base, and it is 3 inches thinner at another opening 50 feet north where there is a 2-inch streak of bone a foot from the top.

In a pit on the east bank, near where the Jawbone goes below drainage on Town Hill Creek (location 399, elevation 2,460), the bed appeared to be 42 inches thick but it was not examined in detail. Mr. C. B. Neel reports the first of the following sections for this location, and the others for openings less than a mile south on the west side of the stream.

Jawbone bed on the upper part of Town Hill Creek.

(Location 399, elevation 2,460)

	Ft.	in.
Shale		
Sandstone	2	0
Shale	3	0
Coal	1	0
Bone		2
Coal	1	4
Bone		3
Shale		5
Coal		3
Coal	2	7
Partings		10

(Location 400)

	Ft.	in.
Shale		
Coal	1	0
Bone		2
Coal		10
Rash		2
Coal		4
Coal	2	2
Partings		4

(Locations 401 and 402)

	Ft.	in.
Shale		
Coal	1	0
Bone		2
Coal	1	6
Rash		2½
Coal		3
Coal	2	9
Partings		4½

The bed appeared to be 3 feet thick including two 1-inch rash partings where exposed in an old prospect on the south side of the same hollow in which the last two measurements were made (location 403, elevation 2,595). According to Mr. Neel, the bed is about 3½ feet thick and contains two 3-inch partings in openings on the west side of the creek less than a mile southeast.

The Jawbone bed is said to average a little less than 6 feet thick in the Big Town Hill Creek Coal Corporation's mine on the west side of the creek. The two sections following were obtained in this mine; the first 1,700 feet northwest of the entrance, and the second in the first left heading, 1,400 feet west of the entrance:

Jawbone bed in Big Town Hill Creek Coal Corporation mine.

(Location 404, elevation 2,015)

		Ft.	in.			Ft.	in.
Shale	.....			Shale	.....	
Rash	.....	1		Rash	.....	1	
Coal	.....	10		Coal	.....	11	
Rash	.....		1/2	Bone	.....		1 1/2
Coal	.....	5		Coal	.....	1	9
Bone	.....		3 1/2	Bone	.....		1
Coal	.....	1	4 1/2	Coal	.....		4
Bone	.....		6	Bone	.....		3
Coal	.....	1	4	Coal	.....		8
Bone	.....		3 1/2				
		<hr/>					
Coal	.....	3	11 1/2	Coal	.....	3	8
Partings	.....	1	1 1/2	Partings	.....		5 1/2

The shale roof is here badly broken and gives considerable trouble. In driving southward the entries encountered a minor fault of slight displacement which has prevented further development in that direction. The coal in the mine dips southward as this disturbance is approached but it will probably be found at a slightly higher level south of the fault. Analyses of coal from this mine may be found in another part of the report (p. 167). The average daily output is 80 tons, which is shipped as lump over 4-inch base screen and as 4-inch run-of-mine.

The Jawbone bed is reported to have shown a uniform thickness of about 6 feet in an old drift west of Town Hill Creek just north of the main fault (location 405, elevation 2,090). In a caved pit on Mudlick Creek about 1 1/2 miles northwest (location 406, elevation 2,160), the bed is said to be thick and to contain several partings, and there is an abnormal thickness of sandstone above it.

On the spur between the main forks of Mudlick Creek (location 407, elevation 2,305) coal 41 inches thick is overlain by 8 feet of drab shale and there is a 1-inch parting of rock 14 inches from the top of the bed. In a prospect drift further north (location 408, elevation 2,410) the bed consists of 6 1/2 feet of coal without definite partings but there are bony layers and hard, dull streaks which probably represent impure coal. Laminations in the coal at angles to the roof indicate that the thickness here is greater than normal, due to movement, and thinner coal may be expected nearby. The uniform sandstone roof which rests directly on the coal suggests that this is the Tiller bed, but it is believed to be the Jawbone. The Jawbone bed has shale above it where exposed in a prospect pit half a mile north (location 409, elevation 2,335) and consists of 45 inches of clean coal on 6 inches of mixed coal and shale.

Three exposures of the bed were found on the west side of Mudlick Creek. The first pit (location 410, elevation 2,345) showed 3 feet of badly weathered coal apparently without partings; a more detailed measurement was obtained at the second:

Jawbone bed on Mudlick Creek.

(Location 411, elevation 2,330)

	Ft.	in.
Shale	5+	
Coal	1	1½
Coal, bony		4
Coal	1	5
Coal, bony		6
Coal		6
Bone		3
Clay, hard	1	1+
Coal	3	10½

The bed is 46 inches thick, including one inch of dirty coal 14 inches from the top, in a third prospect pit about 200 yards south (location 412, elevation 2,330) and has above it 6 feet of drab shale overlain by fine-grained sandstone.

The Jawbone coal does not appear at the surface in this region west of Mudlick but it is reported on good authority to be 6½ feet thick on the lower part of Coal Creek (location 413) where it was struck in a prospect shaft 30 feet below the surface.

Coal bed 60 feet above the Jawbone.—In the shaly interval above the Jawbone bed there is in this region a thin but persistent coal which has been utilized at several local mines on Coal Creek. The coal is from 1½ to 2 feet thick at the exposures seen.

The bed is 20 inches thick including 2 inches of rash at the top in a prospect pit 55 feet above the level of the Jawbone coal on Town Hill Creek ¾ miles north of Doran (location 414, elevation 2,650). Where prospected above the road near location 404 the bed is said to be 2½ feet thick but this could not be verified.

The bed is reported to be 30 inches thick at an old opening on the east side of Coal Creek near Raven (location 415, elevation 1,920), and at a nearby drift (location 416, elevation 1,950) the coal is 26 inches thick with 2 inches of rash at the top and 6 inches at the bottom in places. According to the operator the coal is 30 inches thick in a small mine (location 417, elevation 1,965) which supplies fuel for a saw-mill, but near the entrance there are only 26 inches.

Near the forks of Coal Creek the bed shows the following sections; the first on the east side of the creek and the second on the west:

Coal bed 60 feet above the Jawbone near the forks of Coal Creek.

(Location 418, elevation 2,215)			(Location 419, elevation 2,205)		
	Ft.	in.		Ft.	in.
Shale	10		Shale	30	
Coal		1	Coal		2
Rash	1	0	Rash		6½
Coal	1	6	Coal	1	10
<hr/>			<hr/>		
Coal	1	7	Coal	2	0
Parting	1	0	Parting		6½

The bed is opened near Raven on the west side of Coal Creek (location 420, elevation 1,920) where it appears to be less than 2 feet thick. Coal which belongs either to this bed or to the Raven is said to be 3 feet thick west of Raven in an old drift (location 421, elevation 1,930) where the bed is cut off by the fault a short distance from the entrance.

Raven and associated coal beds.—The next higher coal and perhaps the most important one in this region is the Raven. It is about 200 feet above the Jawbone and slightly over 400 feet above the base of the Norton formation. There are 50 to 80 feet of sandstone below the coal and in most places 100 to 150 feet above. On the lower part of Coal Creek the sandstone above the bed is very irregular and thinner and is separated from the coal by at least 25 feet of shale. The coal is clean and of fairly uniform thickness in most of this district, but the bed is erratic in some sections, especially toward the south, where at least a part of the irregularity is due to movement. The bed is 26 to 75 inches thick at the exposures seen and averages about 39 inches of coal for this area.

In the adjoining region north of Sandy Ridge, the Raven is represented in places by two coal beds fairly close together. The upper is clean and 2 to 4 feet thick but the lower contains too much interbedded shale to be of much value. The bed apparently splits to the north and will probably be found with a thick parting, or in two distinct benches, under some parts of Sandy Ridge.

On the lower part of Coal Ridge there is a thin coal bed associated with shale 35 feet above the Raven and another 90 to 100 feet above. In most of the area the lower coal is under a persistent layer of conglomerate about 50 feet above the Raven.

The Raven bed is being mined on Town Hill Creek (location 422, elevation 2,405) at the No. 2 drift mine of the Matoaka Coal Corporation,

where the coal is 3 feet thick at the entrance, and has 20 inches of clay below it. Coarse sandstone rests directly on the bed in most parts of the mine, but is separated from it locally by 12 to 18 inches of "draw slate." The coal is everywhere clean and is said to be from 30 to 40 inches thick, averaging 3 feet. Fifty feet above an old opening 200 feet west of the mine entrance, 8 feet of coarse conglomerate may be seen at the base of a 30-foot sandstone cliff. The coal is reported to be 3 feet thick at an old opening about 400 yards north of the mine (location 423, elevation 2,490) and 38 inches thick at a prospect pit still further north (location 424, elevation 2,610).

The Raven bed was reported about 30 inches thick at a pit on the upper part of Town Hill Creek (location 425, elevation 2,770) but only the top 12 inches could be seen. At a stripping where the bed goes below drainage on this stream (location 426, elevation 2,550) the coal is from 26 to 54 inches thick, and has either sandstone or "draw slate" above it. Where the bed is thick there are about 4 inches of bony material at the base.

According to C. B. Neel, the coal is 28 to 36 inches thick at openings on the west side of Town Hill Creek, 400 to 500 yards south of location 399. The same authority reports the coal 37 inches thick at an old pit near the ridge road (location 427, elevation 2,810), and 4½ feet thick with 10 inches of shale and rash below, at an exposure 1,000 feet southwest (location 428, elevation 2,810) where only 4 feet at the top could be seen on account of the slumped condition of the opening.

The bed is reported 3 feet thick at a caved pit 2 miles north of Doran (location 429, elevation 2,510) and only 25 inches thick about 600 yards southeast (location 430, elevation 2,365). Mr. Neel reports 40 inches of coal and 4 inches of sandstone 2 inches from the top of the bed, in a prospect pit 1¼ miles northeast of Doran (location 431).

The Raven coal is 3 feet thick, the lower 3 inches being rather bony, in a local mine at the head of a hollow which empties into Mudlick Creek from the east (location 432, elevation 2,500) and it is said to be 38 inches in a prospect pit in the same hollow about 200 yards northwest.

On the east side of Mudlick, about 3½ miles north of Doran (location 433, elevation 2,770), the coal is clean and 72 to 75 inches thick in a small mine. A caved pit 500 feet northeast (location 434, elevation 2,795) may be the one for which Mr. Neel reports 4½ feet of coal. The bed showed the following section at a nearby drift:

Raven bed on the east side of Mudlick Creek.

(Location 435, elevation 2,765)

	Ft.	in.
Sandstone, coarse	10+	
Clay, shale	1	6
Clay, soft		1
Rash		1
Coal	2	8
	<hr/>	
Coal	2	8

In an opening on the upper part of Mudlick (location 436, elevation 2,570) the Raven is 4 feet thick and there is more coal below a ledge of conglomerate 30 feet above. About 400 yards southeast the coal is said to be only 37 inches thick, at a prospect pit near the head of a little hollow.

The coal is 33 inches thick, under coarse sandstone, where opened near the top of a spur on the east side of Left Fork (location 437, elevation 2,565), and is 39 inches thick near the head of this fork (location 438, elevation 2,390) at the entrance to the small mine which supplies fuel for the C. L. Ritter Lumber Co. railroad. The bed is said to have a maximum thickness of 4 feet in some of the abandoned openings a short distance north but in all the drifts it thins to 30 inches or less between 300 and 400 feet from the outcrop. This mine supplies about 100 tons of coal per month.

The Raven bed is said to contain 38 inches of coal in a partially caved opening on the west side of the creek (location 439, elevation 2,500) and almost that much was seen. The coal is 46 inches thick, including 6 inches of dirty coal at the bottom in a drift slightly over a mile south (location 440, elevation 2,500) and the following section was seen at the working face of a short drift still further south, where the bed has a maximum thickness of 3½ feet near the entrance:

Raven bed on the west side of Mudlick Creek.

(Location 441, elevation 2,400)

	Ft.	in.
Sandstone	10+	
Clay, soft		1
Coal	2	3
Clay, hard		1
Coal		2
	<hr/>	
Coal	2	5
Parting		1

Some of the "slate" from the Raven Red Ash mine is dumped on Mudlick Creek through an opening about a mile northeast of Red Ash (location 442, elevation 2,305).

At a small mine east of Millstone Creek (location 443, elevation 2,080) the Raven coal is so badly crushed and contorted that no reliable conclusion could be formed as to its thickness. A drift near the schoolhouse at Raven (location 444, elevation 2,085) was locked up and could not be investigated but the bloom outside indicated about 4 feet of coal.

The Raven coal is said to be 3 feet thick in a caved pit on the east side of Coal Creek half a mile from the fault (location 445, elevation 2,130) and considerably thicker in the abandoned No. 1 drift of the Virginia and Tennessee Coal Company (location 446, elevation 2,025). At the entrance to the No. 2 drift (idle) a short distance north (location 447, elevation 2,110) the coal is 26 inches thick, but it increases away from the outcrop and probably averages close to 3 feet. The bed shows the following section 50 feet from the entrance to No. 3 drift, the company's present producing mine:

Raven bed in No. 3 drift of Virginia & Tennessee Coal Co.

(Location 448, elevation 2,135)

	Ft.	in.
Sandstone		
Coal	4	11
Shale		2
Coal		5
		<hr/>
Coal	5	4
Parting		2

The coal, which reaches a maximum of 8 feet, is said to thin to a uniform thickness of 3 feet about 500 feet from the outcrop. The average daily output of this mine is 65 tons.

In the No. 1 drift and main entry of the Raven Red Ash Coal Corporation at Red Ash (location 449, elevation 2,190) the coal measured 37 inches and was separated from the overlying sandstone by a foot of hard clay at the face of the air-course to No. 3 heading, 2,600 feet north of the entrance. The bed is $34\frac{1}{4}$ inches thick, including one-half inch of mother coal a foot from the bottom, 3,000 feet northeast of entrance to No. 1 drift. In one or two places the coal is cut out by domelike rises in the floor but there are almost always adjacent patches of coal thicker than normal. Where uniform the bed contains about 38 inches of clean coal, has 3 or 4 inches of "draw slate" above and $1\frac{1}{2}$ to 2 feet of clay, which is said to have good

heat resisting qualities, below. The mine is equipped with electric mining machinery, has electric haulage, and is developed in a systematic and up-to-date manner. Analyses of coal from this mine are given in another part of the report (p. 167). The average daily production is 300 tons. At 250 and 850 feet west are, respectively, drifts Nos. 2 and 3, neither of which is being used at present.

Near the forks of Coal Creek (location 450, elevation 2,345) the Raven bed is said to be 3½ feet thick and in a small drift 1,000 feet northeast (location 451, elevation 2,365) there are 37 inches of clean coal, with 15 feet of shale above. The coal is 3½ feet thick and has a hard streak about a foot from the top in a prospect half a mile from the forks of Coal Creek (location 452, elevation 2,410). In a pit on the east bank of this stream, where the coal goes below drainage (location 453, elevation 2,380), the bed contains 3 feet of clean coal.

The Raven coal is clean and 45 inches thick at an opening in the east bank of the Left Fork near the head (location 454, elevation 2,355), and shows the following section at a pit less than half a mile south:

Raven bed on Left Fork of Coal Creek.

(Location 455, elevation 2,360)

	Ft.	in.
Sandstone	5+	
Shale, sandy	5	0
Sandstone		4
Shale		1½
Coal		2
Clay, hard		4
Coal	2	1½
Clay, hard		
Coal	2	3½
Parting		4

The bed is probably 5½ feet thick where it is exposed half a mile from the forks of Coal Creek (location 456, elevation 2,370) but only the upper 4 feet could be examined closely on account of the condition of the opening. There are about 4 feet of coal at a pit in the next hollow to the south (location 457, elevation 2,345).

The Raven bed is being mined on the west side of Coal Creek, opposite Red Ash, by the Raven Collieries Co. Coal is being taken out half a mile northwest of Red Ash at No. 3 drift (location 458, elevation 2,240), which is the chief producer, and at No. 2 drift (location 459, elevation 2,230). In these openings the coal is said to be a little more than 3 feet thick.

In the abandoned No. 1 drift, south of Red Ash (location 460, elevation 2,145) the coal is reported to have averaged 5 feet thick for about 1,000 feet from the outcrop where it thinned to 34 inches or less. This company mines about 100 tons of coal per day.

The Domestic Coal Company is mining the Raven bed on the west side of Coal Creek about a mile from Raven. At the entrance to their northernmost drift (location 461, elevation 2,120) the roof, coal, and floor are badly shattered by movement and the coal is 8 feet thick but contains considerable rash and dirty coal. Fifty feet from the entrance the bed is squeezed down to 15 inches. The miners report 3 to 3½ feet for the normal thickness of the coal in this mine. There is an abandoned drift back of the tipple, about 400 yards south (location 462, elevation 2,075), and some coal is taken out at another drift 200 feet from the tipple (location 463, elevation 2,070), where the coal was 32 inches thick 100 feet from the outcrop and is said to average less than 3 feet.

In an old mine near Raven (location 464, elevation 2,050) the bed is said to have averaged about 30 inches and to have shown a maximum thickness of 5 feet. At a local drift in a little hollow 1,000 feet southwest (location 465, elevation 2,050) the section of the bed is variable and ranges from 40 inches of clean coal to 4 feet of coal with 1 to 2 inches of shale in the lower half.

The Raven bed contains 39 inches of clean coal in a small mine on the east side of Mill Creek (location 466, elevation 2,030) and perhaps a few inches less in a pit on the opposite side of the stream, 1,000 feet northwest. The coal is 32 inches thick at an opening one mile further upstream (location 467, elevation 2,165) and 3 inches thicker where opened on the opposite side of the creek half a mile northwest.

Near the forks of Mill Creek, a slight error in the topography makes the coal openings appear too high when placed in their proper position on the map.

Coal which belongs to the Raven bed is only 25 inches thick in a small hollow southwest of the forks and is 24 to 37 inches thick where exposed near water level on Little Fork. The bed consists of clean coal 33 inches thick at a small mine near the forks on the east side of the stream (location 468, elevation 2,265) and there is a caved pit 12 feet lower on a bed which is said to be thin. In an opening on the west side of the stream, 1,000 feet north of the forks, the bed appeared to be between 3 and 4 feet thick but a complete measurement could not be obtained. Three feet of massive sandstone are exposed above the bed at the last opening up this stream on the west side where the coal is 31 inches thick.

Coal beds between the Raven and the Kennedy were partially exposed at several localities but information as to their extent and thickness is generally lacking. Probably the most valuable bed is the one 30 to 60 feet above the Raven which may contain as much as $2\frac{1}{2}$ feet of coal in a few small areas. In a hollow on the west side of Town Hill Creek (above location 430, elevation 2,425) the bed appeared to be at least 18 inches thick, where partially exposed in a prospect. There are old drifts near the tipple of the Domestic Coal Company (above location 462, elevation 2,110) on beds 35 and 95 feet above the Raven but the coal could not be measured in either.

Kennedy and associated coal bed.—The horizon of the Kennedy coal in this region is 250 to 300 feet above the Raven. The 300-foot interval prevails in a zone about 2 miles wide bordering the fault, where the coal is thin or absent. Along Sandy Ridge the bed is 3 feet thick and is a short distance above a strong ledge of sandstone that forms the top of a series of coarse conglomeratic sandstones called by Campbell the Dismal conglomerate lentil.

The Kennedy bed has been opened at several places near the head of Mudlick Creek but only one measurement was obtained. The coal measured 3 feet at the entrance to a drift on the west side of this stream (location 469, elevation 2,650) and was said to be $3\frac{1}{2}$ feet thick at the face. The coal is only a few inches less than 3 feet at openings on Laurel Fork and West Fork just east of this area.

Fifty feet or less above the horizon of the Kennedy there is a coal bed, locally called the "Caldwell," which seems to be confined to the part of this region south of the Dry Fork anticline, though it may be the same as the thin bloom seen in the road along Sandy Ridge 25 feet above the Kennedy. The coal has above it in most places about 40 feet of coarse sandstone and it is separated from the Kennedy bottom rock below by shale. Valuable deposits of coal in this bed were found only on Red Root Ridge and Road Ridge.

The coal is said to be $5\frac{1}{2}$ feet thick at a pit half a mile east of Red Ash (location 470, elevation 2,500), 4 feet thick at an opening to the northeast on the same tributary of Coal Creek (location 471, elevation 2,535) and 18 to 24 inches thick at a prospect pit near the ridge road (location 472, elevation 2,555). The bed is reported on good authority to contain 26 inches of coal in a well three-fourths of a mile northeast of Red Ash (location 473, elevation 2,550) and 30 inches at an opening 400 yards distant (location 474, elevation 2,600).

Evidence of thinning of this bed toward the north was found at a group of openings near the ridge road west of the forks of Coal Creek, where the bed is reported to consist of 20 inches of coal. The coal at the entrance to a small drift west of Red Ash (location 475, elevation 2,520) measured 4 feet and was badly shattered by movement. There are here 12 inches of shale above the bed followed by 40 feet or more of coarse sandstone. At an opening a short distance south (location 476, elevation 2,540) the bed is said to be 3 feet thick and 27 inches of coal were measured at an opening 100 yards southeast (location 477, elevation 2,540) where the roof is 12 inches of shale overlain by sandstone.

Where the outcrop of this bed crosses the ridge road (location 478, elevation 2,355) it contains at least 6 feet of coal and it is reported to range from 1½ to 7 feet at an opening a quarter of a mile northwest (location 479, elevation 2,390) where there is sandstone directly on the coal.

Big Fork bed.—In some localities a thin coal rests on sandstone above the bed just described, but it is of no value in this area. The next bed of importance is the Big Fork which comes at the base of the Lower Banner bottom rock and is 150 feet above the Kennedy coal.

No complete measurements of the bed were obtained but it has been opened beside the road at the extreme head of Town Hill Creek (location 480, elevation 2,850) and the coal is reported 30 inches thick at a pit south of the Gap of Sandy (location 481, elevation 2,720) where almost that much was seen.

Lower Banner bed.—The Lower Banner bed rests on the massive sandstone over the coal last described and is about 200 feet above the Kennedy. The coal is about 4 to 6 feet thick in the small areas that have survived erosion along Sandy Ridge. It is stratigraphically the highest coal bed that was found in Tazewell County.

The Lower Banner coal is 49 inches thick in a pit three-fourths of a mile east of the Gap of Sandy (location 482, elevation 2,770) and is somewhat thicker at a small drift by a house, a short distance west (location 483, elevation 2,770), where the upper part of the bed is left as a roof. The bed contains 64 inches of clean coal in an opening at the extreme head of the Left Fork of Coal Creek (location 484, elevation 2,735) where there is massive sandstone exposed below and shale above. At a caved drift a thousand feet south of the Gap of Sandy (location 485, elevation 2,770) the coal is reported to be between 5 and 6 feet thick, and is separated from the Big Fork bed below by 45 feet of coarse, massive sandstone. The average thickness of the bed at openings in adjacent portions of Buchanan County is about 5½ feet.

QUALITY OF THE COALS.**Analyses.**

The quality of the coals in any field is most clearly shown by analyses. In order that these analyses be of value for purposes of comparison with those of coals in competing fields it is essential that they be carefully made according to standard methods from samples carefully collected at fresh exposures. In the following table and discussion, therefore, only analyses made by the United States Geological Survey and the United States Bureau of Mines are considered. The table includes only a few analyses of samples from Tazewell County itself, as the lack of mining activity there rendered it impossible to obtain perfectly fresh coal.¹ The samples from adjoining counties, however, are all from mines only a few miles from Tazewell County that are actively working in coal similar to that of Tazewell County in all essential particulars.

In taking a sample of coal for analysis every effort was made to procure fresh, unweathered coal that would represent as nearly as possible the product of the mine. The bed was faced up and carefully cleaned for a distance of three feet or more on each side of the point selected for sampling, special care being taken to remove all loose fragments of "slate" from the roof and deposited powder smoke from the coal. A uniform cut, of sufficient size to yield about 6 pounds of coal for each foot of thickness of the bed, was then made from roof to floor. All partings or binders more than three-eighths of an inch thick and all concretions of "sulphur-balls" having a maximum diameter greater than 2 inches and a thickness of more than half an inch were excluded from the sample. The material thus obtained was crushed until it would pass through a half-inch mesh and was then thoroughly mixed and reduced by quartering until about 4 pounds remained. The product was placed in a galvanized-iron can, sealed in the mine with adhesive tape, and mailed as soon as possible to the laboratory.

As soon as received at the laboratory the coal was taken from the can, weighed, and allowed to dry at a temperature slightly above normal until its weight became practically constant. It was then reweighed, the differ-

¹ Complete detailed descriptions of part of the samples whose analyses are given in this table, including date of sampling, name of collector, and bed-section of coal at points sampled, are contained in the following publications: Laboratory Nos. 4304-4305 in U. S. Bureau of Mines Bull. 22, Nos. 14405-14472 in U. S. Bureau of Mines Bull. 85, Nos. 19924-22345F in U. S. Bureau of Mines Bull. 123, Nos. 25630-26159 and 67886-67971 not yet published.

ence in weight being the air-drying loss. Because the coal is more stable and more easily handled in the air-dried form, it was analyzed in this condition and the results given under form B. Forms A, C, and D were calculated from form B. Form A represents the coal as it is collected. Form C represents the theoretical condition of the coal if all the moisture were removed, and form D if both moisture and ash were removed.

As shown by the analyses, the coals of this region range from low volatile coals at the northeast to moderately high volatile coals at the southwest. At the northeast is the type locality of Pocahontas coal, which is perhaps the standard in the United States of the low volatile high fixed-carbon coals. The coal of the Pocahontas area is a little higher in volatile matter than the average of the coal that goes onto the market as Pocahontas coal. At Pocahontas, Boissevain, and Jenkinjones, the coal has 20 per cent or more volatile matter as received. Westward and northward in McDowell, Mercer, and Randolph counties, West Virginia, the percentage of volatile matter decreases to about 15 at Welch, beyond which to the westward the percentage increases again. The fuel ratio (fixed carbon divided by volatile matter) of Pocahontas coal is about 3.4. The fuel ratio at Welch is about 5. For the field as a whole probably the fuel ratio will be near 4. In addition to its low volatile matter the coal at Pocahontas is characterized by very low ash and sulphur and high B. t. u. value. Most of this coal has a B. t. u. value above 14,500 and reaching 14,900 or more. The ash of Pocahontas coal will average probably less than 6 per cent in commercial deliveries and nearly all will run under 7 per cent as delivered on Government contracts. Sulphur will average below .70 and in nearly all of this coal it will come under 1 per cent as delivered on Government contracts. The coal, on the moisture and ash free basis, has a heat value averaging over 15,700 B. t. u. The Pocahontas No. 5 coal appears to have the same quality as the No. 3 bed, which supplies most of the coal that goes to market as Pocahontas coal.

Going westward higher coals are encountered and the Pocahontas coals are carried below drainage by the southwestward dip. The coals of Indian Creek and westward are distinctly higher in volatile matter and lower in fixed carbon than those around Pocahontas. The coals of Indian Creek, Middle Creek, and Big Creek have from 25 to 30 per cent volatile matter, while those from Town Hill Creek and farther west have, as a rule, over 30 per cent volatile matter. The ash varies somewhat in different beds, the Jawbone bed being notable as a high ash bed. Sulphur is low in all of the beds. The Lower Seaboard bed near Bandy is higher than the average in sulphur but lower than the average in ash.

Analyses of coal samples from mines in and near Tazewell County—Contd.

Coal bed.	Name and location of mine.	Collector.	Laboratory No.	Air-drying loss.	Form of analysis.	Proximate.				Ultimate				Heating value.		
						Moisture.	Volatile matter.	Fixed carbon.	Ash.	Sulphur.	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	Calories.	British thermal units.
No. 3 Pocahontas	Big Vein No. 2, 2 miles south of Boissevain, Va.	J. J. Bourquin.....	67964	.....	A	2.4	21.3	71.9	4.4	.59	.....	.....	.....	.....	.....	14,700
Do.....	.....do.....	.....do.....	29909	.....	A	2.8	21.25	71.43	4.47	.59	4.76	88.52	1.15	5.53	8,122	14,620
Do.....	.....do.....	.....do.....	69902	.....	C	.....	21.87	73.53	4.6	.61	4.57	85.97	1.16	3.09	8,360	15,048
Do.....	.....do.....	.....do.....	69903	.....	D	.....	22.92	77.08	.....	.64	4.79	90.11	1.22	3.24	8,763	15,773
Upper	Wysor, 1½ miles north-east of Richards, Va.	C. A. Herbert.....	69902	.....	A	3.85	26.59	66.34	3.22	.86	.....	.....	.....	.....	.....	14,432
Do.....	.....do.....	.....do.....	69903	.....	C	.....	27.65	69.00	3.35	.90	.....	.....	.....	.....	.....	15,010
Lower	.....do.....	.....do.....	69904	.....	A	3.05	28.60	62.63	5.79	.73	.....	.....	.....	.....	.....	14,150
Do.....	.....do.....	.....do.....	69905	.....	C	.....	29.50	64.60	5.90	.75	.....	.....	.....	.....	.....	14,595
No. 3 Pocahontas	No. 7 mine at Jenkins, W. Va., 2½ miles west of Boissevain, Va.	H. D. Mason.....	20507	3.1	A	3.4	23.2	68.3	6.1	.54	.....	.....	.....	.....	7,885	14,190
Do.....	.....do.....	.....do.....	20508	3.0	A	3.3	21.9	66.3	8.5	.91	.....	.....	.....	.....	7,670	13,800
Do.....	.....do.....	.....do.....	20509	3.2	A	3.6	22.3	69.7	4.4	.49	.....	.....	.....	.....	8,030	14,450
Do.....	.....do.....	.....do.....	20510	2.8	A	3.2	22.2	67.8	6.8	.49	.....	.....	.....	.....	7,820	14,080
Do.....	.....do.....	.....do.....	20511	2.8	A	3.2	21.8	68.2	6.8	.48	.....	.....	.....	.....	7,835	14,110
Do.....	.....do.....	.....do.....	20512	3.0	A	3.4	22.1	67.9	6.60	.58	4.80	81.31	1.06	5.65	7,855	14,140
Do.....	.....do.....	.....do.....	.....	.....	B	4	22.8	70.0	6.80	.60	4.61	83.80	1.09	3.10	8,095	14,580
Do.....	.....do.....	.....do.....	.....	.....	C	.....	22.3	70.3	6.83	.60	4.58	84.18	1.10	2.71	8,135	14,640
Do.....	.....do.....	.....do.....	.....	.....	D	.....	24.0	73.4	.....	.64	4.92	90.35	1.18	2.91	8,730	15,710
Do.....	No. 6 mine at Jenkins, W. Va., 2 miles west of Boissevain, Va.	.....do.....	20513	2.7	A	3.1	21.5	69.6	5.8	.48	.....	.....	.....	.....	7,955	14,320
Do.....	.....do.....	.....do.....	20519	2.8	A	3.2	22.1	69.5	5.2	.48	.....	.....	.....	.....	7,995	14,400
Do.....	.....do.....	.....do.....	20520	3.2	A	3.6	22.1	69.0	5.3	.46	.....	.....	.....	.....	7,935	14,280

Analyses of coal samples from mines in and near Tazewell County—Contd.

Coal bed.	Name and location of mine.	Collector.	Laboratory No.	Air-drying loss.	Form of analysis.	Proximate.				Ultimate				Heating value.			
						Moisture.	Volatile matter.	Fixed carbon.	Ash.	Sulphur.	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	Calories.	British thermal units.	
No. 3 Pocahontas	No. 6 mine at Jenkins, W. Va., 2 miles west of Boiessevain, Va.	H. D. Mason	20321	4.0	A	4.4	21.3	68.9	5.4	.55	.....	.....	.....	.....	.....	7,880	14,180
Do.	do.	do.	20322	2.7	A	2.9	21.4	69.9	5.8	.48	.....	.....	.....	.....	.....	7,950	14,310
Do.	do.	do.	20323	3.0	A	3.2	20.8	71.3	4.7	.51	.....	.....	.....	.....	.....	8,080	14,460
Do.	do.	do.	20324	3.1	A	3.6	21.8	69.7	5.41	.51	4.84	82.42	1.18	5.64	.....	7,960	14,320
				.....	B	.5	22.1	71.9	5.88	.53	4.64	85.02	1.22	3.01	.....	8,210	14,780
				.....	C	.....	22.1	72.3	5.61	.53	4.61	85.44	1.22	2.69	.....	8,250	14,850
				.....	D	.....	23.4	70.6	.....	.56	4.98	90.52	1.29	2.75	.....	8,740	15,780
Do.	No. 8 mine at Jenkins, W. Va., 3½ miles west of Boiessevain, Va.	do.	20331	2.0	A	2.4	22.1	69.2	6.3	.70	.....	.....	.....	.....	.....	7,985	14,370
Do.	do.	do.	20332	3.0	A	3.4	22.2	69.7	4.7	.50	.....	.....	.....	.....	.....	8,080	14,450
Do.	do.	do.	20333	4.0	A	4.4	21.9	69.1	4.6	.60	.....	.....	.....	.....	.....	7,950	14,310
Do.	do.	do.	20334	4.0	A	4.4	22.0	69.3	4.3	.60	.....	.....	.....	.....	.....	7,965	14,380
Do.	do.	do.	20335	2.3	A	2.6	22.7	68.0	6.7	.55	.....	.....	.....	.....	.....	7,905	14,230
Do.	do.	do.	20336	3.1	A	3.6	21.9	69.2	5.26	.59	4.88	82.54	1.13	5.60	.....	7,955	14,320
				.....	B	.5	22.7	71.4	5.43	.61	4.63	83.15	1.17	2.96	.....	8,205	14,770
				.....	C	.....	22.8	71.8	5.45	.61	4.65	83.57	1.17	2.55	.....	8,245	14,840
				.....	D	.....	24.1	70.9	.....	.63	4.92	90.90	1.24	2.69	.....	8,720	15,700
No. 5 Pocahontas	Crockett Pressley local mine on Jacobs Fork, 1 mile northwest of Shraders, Va.	T. K. Harnsberger	26159	2.9	A	3.3	22.0	71.7	3.0	.53	.....	.....	.....	.....	.....	8,290	14,920
				.....	B	.4	22.7	73.8	3.1	.55	.....	.....	.....	.....	.....	8,565	15,360
				.....	C	.....	23.8	74.1	3.1	.55	.....	.....	.....	.....	.....	8,570	15,400
				.....	D	.....	23.5	76.5	.....	.57	.....	.....	.....	.....	.....	8,840	15,920
Do.	Altizer local mine on Beech Fork, ½ of a mile north of Faraday Va.	do.	26101	3.9	A	4.5	18.5	72.1	4.9	.78	.....	.....	.....	.....	.....	7,980	14,270
				.....	B	.7	19.2	75.0	5.1	.82	.....	.....	.....	.....	.....	8,255	14,860
				.....	C	.....	19.3	75.5	5.2	.82	.....	.....	.....	.....	.....	8,305	14,950
				.....	D	.....	20.4	79.6	.....	.86	.....	.....	.....	.....	.....	8,760	15,770

Analyses of coal samples from mines in and near Tazewell County—Contd.

Coal bed.	Name and location of mine.	Collector.	Laboratory No.	Air-drying loss.	Form of analysis.	Proximate.				Ultimate				Heating value.		
						Moisture.	Volatile matter.	Fixed carbon.	Ash.	Subsur.	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	Calories.	British thermal units.
No. 5 Pocahontas	War Creek mine at War, W. Va., 7 miles N20°W of Faraday, Va.	H. I. Smith and E. B. Sutton...	14405	1.9	A	2.7	16.3	73.1	7.9	.69	.....	.....	.....	.....	.....	.....
Do.	do.	do.	14406	1.1	A	1.9	17.0	72.0	9.1	.76	.....	.....	.....	.....	.....	.....
Do.	do.	do.	14407	1.2	A	2.0	17.0	72.7	8.3	.67	.....	.....	.....	.....	.....	.....
Do.	do.	do.	14408	1.4	A	2.2	16.4	73.0	8.44	.69	4.20	80.70	1.44	4.53	7,750	14,010
				.....	B	.8	16.6	74.1	8.56	.70	4.10	81.25	1.46	3.23	7,900	14,200
				.....	C	.....	16.7	74.7	8.63	.71	4.05	82.50	1.47	2.64	7,955	14,220
				.....	D	.....	18.3	81.7	.....	.78	4.43	80.30	1.61	2.88	8,705	15,070
Do.	John's Branch mine, 1 mile south of War, W. Va., and 6 miles N20°W of Faraday, Va.	do.	14468	1.6	A	2.4	17.0	70.9	9.7	.65	.....	.....	.....	.....	.....	.....
Do.	do.	do.	14469	1.2	A	2.0	17.2	71.4	9.4	.57	.....	.....	.....	.....	.....	.....
Do.	do.	do.	14470	1.6	A	2.4	16.9	73.2	7.5	.58	.....	.....	.....	.....	.....	.....
Do.	do.	do.	14471	1.5	A	2.3	17.1	72.0	8.6	.66	.....	.....	.....	.....	.....	.....
Do.	do.	do.	14472	1.5	A	2.2	17.3	71.6	8.88	.64	4.34	80.36	1.29	4.49	7,750	13,950
				.....	B	.8	17.5	72.7	9.02	.65	4.23	81.58	1.31	3.21	7,870	14,160
				.....	C	.....	17.7	73.2	9.08	.65	4.18	82.20	1.33	2.57	7,930	14,270
				.....	D	.....	19.5	80.5	.....	.71	4.60	90.41	1.45	2.83	8,720	16,700
Lower Seaboard..	Patrick mine on Laurel Fork of Indian Creek, 1½ miles southwest of Bandy, Va.	T. K. Harnsberger	25912	2.2	A	3.4	28.1	64.9	3.6	1.10	.....	.....	.....	.....	8,040	14,560
				.....	B	1.2	28.8	66.4	3.6	1.12	.....	.....	.....	.....	8,275	14,900
				.....	C	.....	29.1	67.2	3.7	1.14	.....	.....	.....	.....	8,375	15,070
				.....	D	.....	30.2	69.8	.....	1.18	.....	.....	.....	.....	8,635	15,650

Analyses of coal samples from mines in and near Tazewell County—Contd.

Coal bed.	Name and location of mine.	Collector.	Laboratory No.	Air-drying loss.	Form of analysis.	Proximate.				Ultimate.				Heating value.		
						Moisture.	Volatile matter.	Fixed carbon.	Ash.	Sulphur.	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	Calories.	British thermal units.
Lower Seaboard..	No. 1 mine at Coal-dan, 4½ miles north of Richlands, Va.	T. K. Harnsberger	4304	2.4	A	3.0	25.8	66.5	4.6	1.70	14,640
Do.....do.....do.....	4305	1.9	A	2.6	24.5	68.4	4.5	1.35	8,130
Middle Seaboard..	Christian mine on Laurel Fork of Indian Creek, 1½ miles west of Bandy, Va.	T. K. Harnsberger	25913	2.5	A	3.5	29.2	63.3	4.0	.99	8,015
Do.....do.....do.....	25913	B	1.1	29.9	64.9	4.1	1.01	8,215
Do.....do.....do.....	25913	C	30.3	65.6	4.1	1.03	8,310
Do.....do.....do.....	25913	D	31.6	68.4	1.07	8,670
Upper Seaboard...	No. 6½ mine at Seaboard, Va.do.....	25760	2.0	A	3.0	28.7	62.7	5.59	.65	4.88	81.48	1.37	6.03	7.01	7,960
Do.....	.....do.....	.....do.....	25760	.....	B	1.0	29.3	64.0	5.70	.66	4.75	83.12	1.40	4.37	8,120
Do.....	.....do.....	.....do.....	25760	.....	C	.....	29.6	64.6	5.76	.67	4.69	83.96	1.41	3.51	8,205
Do.....	.....do.....	.....do.....	25760	.....	D	.....	31.4	68.6	.....	.71	4.98	89.09	1.50	3.72	8,705
Do.....	.....do.....	.....do.....	25761	2.1	A	3.1	29.4	60.8	6.71	.50	5.29	79.19	1.33	7.01	7,825
Do.....	.....do.....	.....do.....	25761	.....	B	1.1	30.0	62.1	6.85	.51	5.14	80.86	1.36	5.23	7,990
Do.....	.....do.....	.....do.....	25761	.....	C	.....	30.3	62.8	6.93	.52	5.07	81.76	1.37	4.35	8,080
Do.....	.....do.....	.....do.....	25761	.....	D	.....	32.6	67.4	.....	.56	5.45	87.35	1.47	4.67	8,630
Upper Seaboard...	No. 6½ mine at Seaboard, Va.	.....do.....	25762F	2.0	A	3.1	29.0	61.8	6.10	.58	5.03	80.04	1.38	6.87	7,895
Do.....	.....do.....	.....do.....	25762F	.....	B	1.1	29.6	63.0	6.23	.53	4.91	81.69	1.41	5.17	8,055
Do.....	.....do.....	.....do.....	25762F	.....	C	.....	29.9	63.8	6.30	.60	4.83	82.63	1.42	4.22	8,150
Do.....	.....do.....	.....do.....	25762F	.....	D	.....	31.9	68.1	.....	.64	5.15	88.18	1.52	4.51	8,700
Tiller	"East" mine of the Big Town Hill Creek Coal Corp., 1½ miles west of Richlands, Va.	.....do.....	25763	2.1	A	3.0	30.5	59.0	7.49	.62	5.00	77.96	1.36	7.57	7,670
Do.....	.....do.....	.....do.....	25763	.....	B	.9	31.2	60.3	7.65	.63	4.87	79.62	1.39	5.84	7,835
Do.....	.....do.....	.....do.....	25763	.....	C	.....	31.4	60.3	7.72	.64	4.81	80.34	1.40	5.09	8,060
Do.....	.....do.....	.....do.....	25763	.....	D	.....	34.1	65.9	.....	.69	5.21	87.06	1.52	5.52	8,375
Do.....	.....do.....	.....do.....	25764	1.5	A	2.4	31.3	57.5	8.86	.47	4.93	77.23	1.32	7.16	7,500
Do.....	.....do.....	.....do.....	25764	.....	B	.9	31.8	58.3	9.00	.48	4.86	78.43	1.34	5.89	7,620
Do.....	.....do.....	.....do.....	25764	.....	C	.....	32.1	58.8	9.08	.48	4.81	79.11	1.35	5.17	7,685
Do.....	.....do.....	.....do.....	25764	.....	D	.....	35.3	64.7	.....	.53	5.29	87.01	1.48	5.69	8,450

Analyses of coal samples from mines in and near Tazewell County—Contd.

Coal bed.	Name and location of mine.	Collector.	Laboratory No.	Air-drying loss.	Form of analysis.	Proximate.				Ultimate				Heating value.		
						Moisture.	Volatle matter.	Fixed carbon.	Ash.	Sulphur.	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	Calories.	British thermal units.
Tiller	"Past" mine of the Big Town Hill Creek Coal Corp., 1½ miles west of Richlands, Va.	T. K. Harnsberger	25765F	1.8	A	2.7	30.9	53.1	8.30	.59	4.90	77.39	1.35	7.33	7,580	13,640
					B	.9	31.5	59.2	8.45	.60	4.88	73.82	1.37	5.88	7,720	13,890
					C	.....	31.8	59.7	8.53	.61	4.82	79.51	1.39	5.14	7,785	14,020
					D	.....	34.7	65.3	.....	.67	5.27	86.93	1.52	5.61	8,510	15,320
Jawbone	"West" mine of the Big Town Hill Creek Coal Corp., 1½ miles west of Richlands, Va.	.....do.....	25757	1.2	A	1.9	31.1	53.8	13.13	.48	4.68	73.57	1.34	6.80	7,210	12,980
					B	.8	31.5	54.4	13.28	.49	4.60	74.43	1.36	5.84	7,300	13,140
					C	.....	31.7	54.9	13.39	.49	4.56	75.02	1.37	5.17	7,355	13,240
					D	.....	36.7	63.3	.....	.57	5.26	86.62	1.53	5.97	8,490	15,280
Do.....	.....do.....	.....do.....	25758	1.3	A	2.2	30.7	57.0	10.05	.47	5.04	76.95	1.43	6.06	7,525	13,550
					B	.9	31.2	57.7	10.18	.48	4.95	77.97	1.45	4.97	7,625	13,730
					C	.....	31.4	58.3	10.28	.48	4.90	78.69	1.46	4.19	7,695	13,850
					D	.....	35.0	65.0	.....	.54	5.46	87.71	1.63	4.66	8,375	15,440
Do.....	.....do.....	.....do.....	25759F	1.2	A	2.1	31.1	55.3	11.55	.48	4.91	75.18	1.39	6.49	7,370	13,260
					B	.8	31.5	56.0	11.70	.49	4.83	76.12	1.41	5.45	7,460	13,430
					C	.....	31.8	56.4	11.79	.49	4.78	76.78	1.42	4.76	7,525	13,540
					D	.....	36.0	64.0	.....	.56	5.42	87.02	1.61	5.39	8,530	15,350
Do.....	Whitewood mine of the C. L. Ritter Lumber Co. at Whitewood, 10 miles north of Raven, Va.	C. A. Davidson	19924	1.7	A	2.4	19.5	64.7	13.4	.71	.....	.....	.....	.....	7,310	13,160
					B	.6	19.9	65.8	13.7	.72	.....	.....	.....	.....	7,440	13,300
					C	.....	20.1	66.2	13.7	.....	.....	.....	.....	.....	7,490	13,480
					D	.....	23.2	70.8	.....	.85	.....	.....	.....	.....	8,680	15,680
Raven	Red Ash mine of the Raven Red Ash Coal Co. at Red Ash, Va.	T. K. Harnsberger	25630	2.0	A	3.2	32.1	58.3	6.4	.57	.....	.....	.....	7,840	14,110	
Do.....	.....do.....	.....do.....	25631	1.9	A	2.9	31.8	60.3	5.0	.67	.....	.....	.....	.....	8,000	14,400
					B
Do.....	.....do.....	.....do.....	25632	2.0	A	2.9	32.0	59.4	5.73	.63	5.60	80.18	1.25	6.61	7,905	14,280
					B	.9	32.7	60.6	5.85	.64	5.49	81.80	1.28	4.94	8,065	14,620
					C	.....	33.0	61.1	5.90	.66	5.44	82.64	1.29	4.18	8,135	14,650
					D	.....	35.1	64.9	.....	.69	5.78	87.72	1.37	4.44	8,650	15,660

Analyses of coal samples from mines in and near Tazewell County—Contd.

Coal bed.	Name and location of mine.	Collector.	Laboratory No.	Air-drying loss.	Form of analysis.	Proximate.				Ultimate					Heating value.		
						Moisture.	Volatile matter.	Fixed carbon.	Ash.	Substr.	Hydrogen.	Carbon.	Nitrogen.	Oxygen.	Calories.	British thermal units.	
Raven	No. 1 mine of the Jewell Ridge Coal Corp., at Jewell, Va.	T. K. Harnsberger	25651	3.1	A	3.7	25.9	64.9	5.5	.70						7,960	14,330
Do.	do.	do.	25652	2.5	A	3.1	25.9	65.0	6.0	.79						7,985	14,380
Do.	do.	do.	25653	2.8	A	3.4	25.3	65.6	5.69	.73	5.16	80.98	1.29	6.15		7,980	14,360
					B	.6	23.8	67.5	5.35	.75	4.92	83.30	1.33	3.78		8,205	14,770
					C		20.2	67.9	5.80	.76	4.96	83.80	1.33	3.26		8,255	14,860
					D		27.3	72.2		.81	5.27	89.05	1.41	3.46		8,775	15,790
Kennedy	Sandy Ridge mine of the Sandy Ridge Coal and Coke Co. on Lewis Creek, 7 miles west of Raven, Va.	C. M. Bauer	19328	1.8	A	3.2	33.1	57.7	6.0	.96							
Do.	do.	T. K. Harnsberger	22345F	3.5	A	4.7	30.8	59.4	5.14	.94	5.43	78.33	1.40	6.74		7,760	13,900
					B	1.2	31.9	61.6	5.33	1.00	5.22	81.18	1.45	5.82		8,040	14,470
					C		32.3	62.3	5.39	1.01	5.15	82.17	1.47	4.81		8,140	14,650
					D		34.1	65.9		1.07	5.44	86.85	1.55	5.09		8,600	15,480
Meadow	No. 2 mine of the Richards Coal Co. at Richards, Va.	T. R. Williams	31414	1.4	A	2.28	27.25	53.01	18.46	.60						6,744	12,139
Do.	do.	do.	31415	1.4	A	2.25	31.25	59.70	6.80	.63						7,859	14,146
Do.	do.	do.	31416	1.4	A	2.23	29.36	55.69	12.72	.61	4.73	74.23	1.11	6.60		7,297	13,135
					B	.89	29.78	56.50	12.90	5.41	4.64	75.30	1.13	5.41		7,402	13,324
					C		30.03	56.96	13.01	.62	4.58	75.92	1.14	4.73		7,463	13,433
					D		34.52	65.48		.71	5.27	87.28	1.31	5.43		8,579	15,442
Do.	No. 4 mine of the Richards Coal Co. at Richards, Va.	do.	31417	2.3	A	2.95	27.95	56.28	12.82	.68						7,197	12,955
Do.	do.	do.	31418	2.9	A	3.47	23.04	58.98	9.51	.59						7,479	13,462
Do.	do.	do.	31419	2.6	A	3.30	27.82	57.80	11.08	.63	4.79	75.29	1.07	7.14		7,340	13,212
					B	.72	28.56	59.34	11.33	.65	4.62	77.30	1.10	4.95		7,536	13,565
					C		28.77	59.77	11.46	.65	4.57	77.86	1.11	4.35		7,590	13,662
					D		32.49	67.51		.73	5.16	87.94	1.25	4.92		8,572	15,430

67921, 67924, 67926, and 29906.—Samples collected from the Baby mine of Pocahontas Consolidated Collieries Co., Inc., at Pocahontas, Tazewell County, Virginia, December 19, 1917. Sample 67921 was obtained from No. 19 room, sixteenth cross entry; sample 67924, 75 feet from face of No. 7 room, No. 4 sump entry; and 67926, from No. 36 room, West Gurdan entry. Sample 29906 was a composite made by mixing 67921, 67924, and 67926.

67910, 67953, 67954, 67958, and 29912.—Samples collected in the "West" mine of the Pocahontas Consolidated Collieries Co., Inc., at Pocahontas, Tazewell County, Virginia, December 19, 1917. Sample 67910 was obtained from No. 30 room, St. Paul entry off of tenth entry; sample 67953, from No. 18 room, 34 heading, Newport News district; sample 67954, from No. 30 room, St. Paul entry off of tenth entry; and sample 67958, from No. 7 room, eleventh right entry, Norton district. Sample 29912 was a composite made by mixing 67910, 67953, 67954, and 67958.

67887, 67888, 67892, 67899, 67900, 67901, 67903, 67904, 67922, 67923, 67925, 67957, 67960, 67971, and 29907.—Samples collected from the Boissevain shaft mine at Boissevain, Tazewell County, Virginia, December 17, 1917. Sample 67887 was obtained from No. 9 room, A 1 panel off of fifth entry; sample 67888, from rib of No. 12 room, C 2 panel off of fifth east entry; sample 67892, from face of H 22 entry; sample 67899, from No. 10 room, H 23 panel off of C 4 entry; sample 67900, from face of H 22 entry; sample 67901, from rib of No. 12 room, C 2 panel off of fifth east entry; sample 67903, from No. 9 room, A 1 panel off of fifth east entry; sample 67904, from No. 10 room, H 23 panel, C 4 entry; sample 67922, from 14 Triple entry No. 1, 50 feet from face; sample 67923, from No. 1 room, I-17 entry, 15 feet from face; sample 67925, from No. 1 room, I-17 entry, 15 feet from face; sample 67957 (location not noted); sample 67960, from 14 Triple entry No. 1, 50 feet from face; and sample 67971 (location not noted). Sample 29907 was a composite made by mixing 67887, 67888, 67892, 67899, 67900, 67901, 67903, 67904, 67922, 67923, 67925, 67957, 67960, and 67971.

67886, 67889, 67902, 67934, 67951, and 29908.—Samples collected from Big Vein No. 1 mine of the Big Vein Pocahontas Coal Co., half a mile south of Pocahontas, Tazewell County, Virginia, December 18, 1917. Sample 67886 was obtained from No. 4 room, Cartersville entry; sample 67889, from No. 1 room, Balls Hole entry; sample 67902 (location not noted); sample 67934, from No. 4 room, Cartersville entry; and sample

67951, from split in pillar 60 feet from face, dip heading. Sample 29908 was a composite made by mixing 67886, 67889, 67902, 67934, and 67951.

67927, 67964, and 29909.—Samples collected from Big Vein No. 2 mine of the Big Vein Pocahontas Coal Co., 2 miles south of Boissevain, Tazewell County, Virginia, December 18, 1917. Sample 67927 was obtained from the main entry, face second right; and sample 67964, from No. 1 room, fifth right of entry, 75 feet from face. Sample 29909 was a composite made by mixing 67927 and 67964.

69802-69805.—Samples collected from Wysor mine of the Wysor Coal Co., $1\frac{1}{2}$ miles northeast of Richlands, Tazewell County, Virginia, July 26, 1918. These samples were obtained from an average of mine samples.

20507, 20508, 20509, 20510, 20511, and 20512.—Samples collected in No. 7 mine of the Pocahontas Consolidated Collieries Co., at Jenkinjones, McDowell County, West Virginia, $2\frac{1}{2}$ miles west of Boissevain, Va., December 12, 1914. Sample 20507 was obtained from the face of 2nd right, off main 7-5 entry, 3,300 feet from entrance; sample 20508, face of 3rd right off main 7-5 entry, 3,400 feet from entrance; sample 20509, face of 7th right, off main 7-1 entry, 3,400 feet from entrance; sample 20510, face of 4th parallel air course, 3,500 feet from entrance; and 20511, face of main 7-1 entry, 4,100 feet from entrance. Sample 20512 was a composite made by mixing the five face samples.¹

20518 20519, 20520, 20521, 20522, 20523, and 20524.—Samples collected in No. 6 mine of the Pocahontas Consolidated Collieries Co., at Jenkinjones, McDowell County, West Virginia, 2 miles west of Boissevain, Va., December 11, 1914. Sample 20518 was obtained from the face of F-6 entry off F entry; sample 20519, face of F-5 entry, off F entry, 3,700 feet from entrance; sample 20520, face of main 6-1 entry, 3,100 feet from entrance; sample 20521, face of main 6-8 entry, 2,225 feet from entrance; sample 20522, face of M-11 entry off main entry; and sample 20523, face of P entry, off P-11 off main 6-8 entry, 2,400 feet from entrance. Sample 20524 was a composite made by mixing the six face samples.²

20531, 20532, 20533, 20534, 20535, and 20536.—Samples collected in No. 8 mine of Pocahontas Consolidated Collieries Co., at Jenkinjones, McDowell County, West Virginia, $3\frac{1}{2}$ miles west of Boissevain, Va., December 12, 1914. Sample 20531 was obtained from face of F entry, off main 8-1, 1,530 feet northeast of entrance; sample 20532, face of H-2

¹ For sections see p. 121.

² For sections see p. 122.

entry, off I entry, 1,000 feet from entrance; sample 20533, face of B entry, off A entry, off main 8-D entry, 1,800 feet from entrance; sample 20534, face of B air-course, off A entry, 1,800 feet from entrance; and sample 20535, face of F-2 entry, off F entry, off main entry, 1,600 feet from entrance. Sample 20536 was a composite made by mixing the five face samples.¹

26159.—Sample collected from the Pocahontas No. 5 bed in the Crockett Pressley local mine near the mouth of Dalton Branch of Jacobs Fork, McDowell County, West Virginia, 1 mile northwest of Shraders, Va., September 20, 1916. The sample was obtained in third room to right of main entry, about 300 feet west of entrance, and represents 45½ inches of clean coal, 3½ inches of rash at the bottom of the bed being excluded.

26101.—Sample collected from Pocahontas No. 5 bed in Altizer local mine on Beech Fork, one-third of a mile north of Faraday, Tazewell County, Virginia (location 164 on map), September 16, 1916. The sample was obtained at the working face, 110 feet north of entrance and represents 6 feet 7 inches of clean coal, the entire thickness of the bed.

14405, 14406, 14407, and 14408.—Samples collected in the War Creek mine at War, McDowell County, West Virginia, and 7 miles N. 20° W. of Faraday (flag station), Va., June 30, 1912. Sample 14405 was obtained from face of fourth left cross-entry, off the main entry; sample 14406, from the face of main entry, 1,200 feet from mine mouth; and sample 14407, from face of room 4, off the main air-course, about 1,000 feet from the mine mouth. Sample 14408 was a composite made by mixing 14405, 14406, and 14407.²

14468, 14469, 14470, 14471, and 14472.—Samples collected in the John's Branch mine, 1 mile northeast of War, McDowell County, West Virginia, June 29, 1912. Sample 14468 was obtain at the face of the main entry, 800 feet from the entrance; sample 14469, at the face of heading 3, off the right entry; sample 14470, at the face of room 4, off the first left air-course; and sample 14471, at the face of the first right butt-entry, off left entry 2. Sample 14472 was a composite made by mixing 14468 to 14471, inclusive.³

25912.—Sample collected from the Lower Seaboard bed in the Patrick local drift mine on Laurel Fork of Indian Creek, 1½ miles southwest of

¹ For sections see p. 122.

² For sections see U. S. Bureau of Mines Bull. 85, p. 362.

³ For sections see U. S. Bureau of Mines Bull. 85, p. 362.

Bandy, Tazewell County, Virginia (location 235 on map), August 28, 1916. The sample was obtained at the working face about 100 feet from the entrance.¹

4304 and 4305.—Samples collected in No. 1 mine at Coaldan, 4½ miles north of Richlands, Tazewell County, Virginia (location 307 on map), December 8, 1906. Sample 4304 was obtained in the main straight entry, 2,000 feet S. 30° E. of drift mouth; sample 4305, in room 12, off left entry 3, about 1,600 feet east of drift mouth.²

25913.—Sample collected in the Christian mine on Laurel Fork of Indian Creek, 1½ miles west of Bandy, Tazewell County, Virginia (location 242 on map), August 28, 1916. The sample was obtained from the working face, 250 feet S. 45° W. of entrance.

25760, 25761, and 25762F.—Samples collected from the Upper Seaboard bed in No. 6½ mine at Seaboard, 3 miles north of Richlands, Tazewell County, Virginia (location 327 on map), August 5, 1916. Sample 25760 was obtained from the face of third right entry, 800 feet south of mine entrance and represents 29½ inches of clean coal, 2½ inches of bone at the bottom of the bed being excluded. Sample 25761 was cut from face of second left entry, 700 feet southeast of mine mouth, and represents 36 inches of clean coal, one-half inch of rash at the bottom of the bed being excluded. Sample 25762F was a composite made by mixing 25760 and 25761.

25763, 25764, and 25765F.—Samples collected from the Tiller bed in the "East" mine of the Big Town Hill Creek Coal Corporation, 1½ miles west of Richlands, Tazewell County, Virginia (location 386 on map), August 4, 1916. Sample 25763 was obtained in room 1, off main heading, 450 feet northeast of entrance, and represents 52 inches of coal, the entire thickness of the bed. Sample 25764 was cut from face of main heading 400 feet N. 30° E. of entrance and represents 45½ inches of coal, 1½ inches of bone, 12 inches from the top being excluded. Sample 25765F was a composite made by mixing 25763 and 25764.

25757, 25758, and 25759F.—Samples collected in the "West" mine of the Big Town Hill Creek Coal Corporation, 1½ miles west of Richlands, Tazewell County, Virginia (location 404 on map), August 4, 1916. Sample 25757 was obtained from face of ninth heading, off fourth right, 1,700

¹ For section see p. 200.

² For sections see p. 227.

feet northwest of entrance; sample 25758, from face of first left heading, 1,400 feet west of entrance. Sample 25759F was a composite made by mixing 25757 and 25758.¹

19924.—Sample collected from the Jawbone bed in the Whitewood mine of the C. L. Ritter Lumber Co., at Whitewood, Buchanan County, Virginia, about 10 miles north of Raven, Va., October 9, 1914; the sample was cut 600 feet southwest of the mine entrance and represents 4 feet of coal, a 4-inch shale parting, 8 inches from the bottom of the bed being excluded.

25630, 25631, and 25632.—Samples collected from the Raven bed in the Red Ash mine of the Raven Red Ash Coal Co., at Red Ash, Tazewell County, Virginia (location 449 on map), July 17, 1916. Sample 25630 was obtained from face of air-course to tenth cross-heading, 3,000 feet northeast of No. 1 drift mouth and represents 34 inches of coal the entire thickness of the bed. Sample 25631 was cut from face of air-course to No. 3 main heading, 2,600 feet north of entrance to No. 3 drift, and represents 37 inches of clean coal, the entire thickness of the bed. Sample 25632 was a composite made by mixing 25630 and 25631.

25651, 25652, and 25653.—Samples collected in No. 1 mine of the Jewell Ridge Coal Corporation, at Jewell, Tazewell County, Virginia (location 368 on map), July 22, 1916. Sample 25651 was collected from second right, off main entry, 1,900 feet N. 60° E. of mine entrance; sample 25652, from No. 6 main entry, 3,700 feet northeast of mine entrance. Sample 25653 was a composite made by mixing 25651 and 25652.²

19528 and 22345F.—Samples collected from the Kennedy bed in the Sandy Ridge mine of the Sandy Ridge Coal and Coke Co., on Lewis Creek, Russell County, Virginia, 7 miles west of Raven, June 15, 1914, and May 25, 1915. Sample 19528 was obtained from the south drift, in room off main entry, 150 feet north of entrance, and represents 2 feet 10 inches of coal, the entire thickness of the bed. Sample 22345F was cut in the north drift, 170 feet S. 70° W. of entrance, and represents 2 feet 9 inches of coal, the entire thickness of the bed.

31414, 31415, and 31416.—Samples collected in No. 2 mine of the Richlands Coal Company, at Richlands, Tazewell County, Virginia, February 3, 1919. Sample 31414 was collected 150 feet from face, 560 feet from drift opening; sample 31415, at face 600 feet from opening. Sample 31416 was a composite made by mixing 31414 and 31415.

¹ For section see p. 257.

² For sections see p. 244.

31417, 31418, and 31419.—Samples collected in No. 4 mine of the Richlands Coal Company, at Richlands, Tazewell County, Virginia, February 3, 1919. Sample 31417 was collected from coal pile outside of the mine; sample 31418, 27 feet from face of main entry, 573 feet from drift opening. Sample 31419 was a composite made by mixing 31417 and 31418.

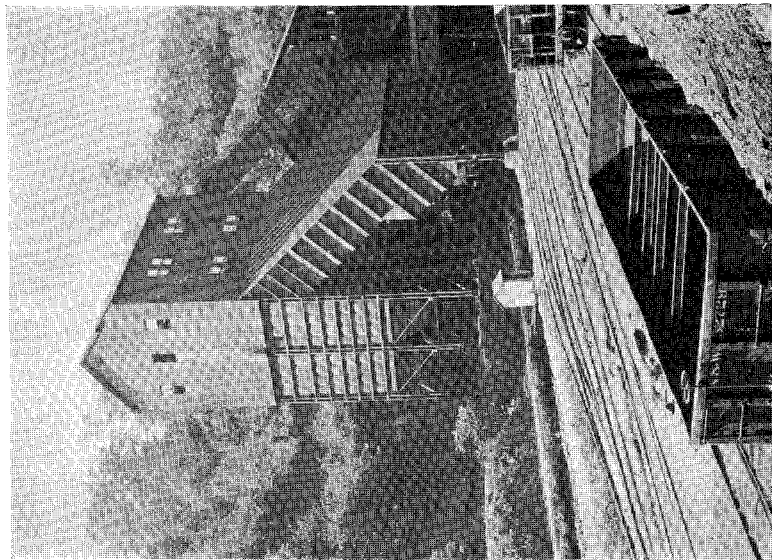
Tests.

GENERAL STATEMENT.

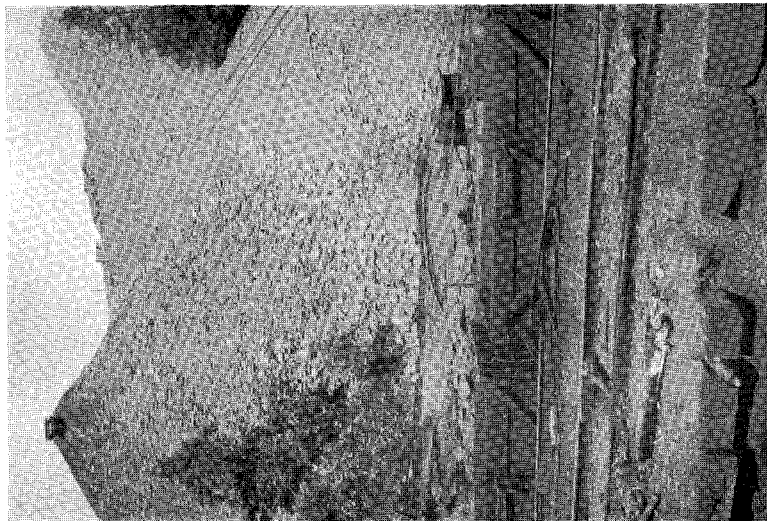
Samples of coal from two localities within the county were subjected to tests in the fuel-testing plants of the U. S. Geological Survey to determine their value for commercial purposes. A run-of-mine sample of the Lower Seaboard bed in the No. 1 mine at Coaldan was used in making washing, coking, producer-gas, and steaming tests in the plant at St. Louis, Mo. The chemical composition of mine samples of this coal is shown in the table of analyses on a previous page. A sample of coal from the Pocahontas No. 3 bed at Pocahontas was tested in the briquetting plant at Norfolk, Va. No other government tests were made on the Pocahontas No. 3 coal from Tazewell County but some analyses of coke by the West Virginia Geological Survey have been given. Results of a steaming test on the Pocahontas No. 3 coal from Crumpler, W. Va., have also been shown, but they are of doubtful value when applied to this bed in Tazewell County.

On the succeeding pages the essential results of these tests are summarized in a manner intended to show briefly the adaptability of the coal to the uses for which it was tested. Further information regarding types of testing apparatus used, conditions under which tests were made, etc., may be had by referring to the publications cited in the footnotes.

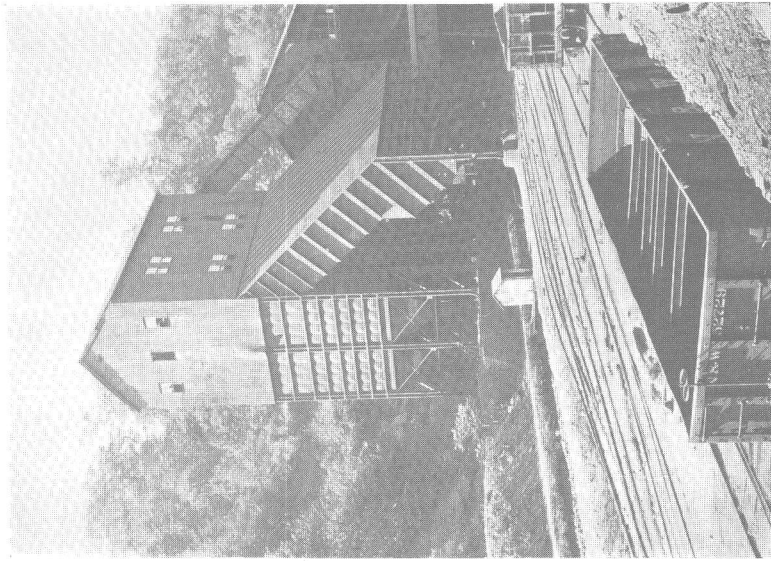
The tests emphasize the excellent qualities of the coals tested. The generally low ash and wide range in fuel ratio (fixed carbon divided by volatile matter) makes available, in Tazewell County, coals suited to almost any commercial use. Good coke is made at Seaboard from both the Upper and Lower Seaboard beds, and the Pocahontas No. 3 coal is being coked at Pocahontas and at many places outside the county. The superior quality of the coke is well known. Because of the exceptionally low ash in this coal it has in some instances been found advisable to mix it with a less pure coal in order to obtain coke of greater strength. The Pishel agate mortar test for coking coal was applied to coal from many other localities with favorable results and it seems probable that any coal in the county will coke.



(A) Steel tippie at Baby Pocahontas mine near Pocahontas.



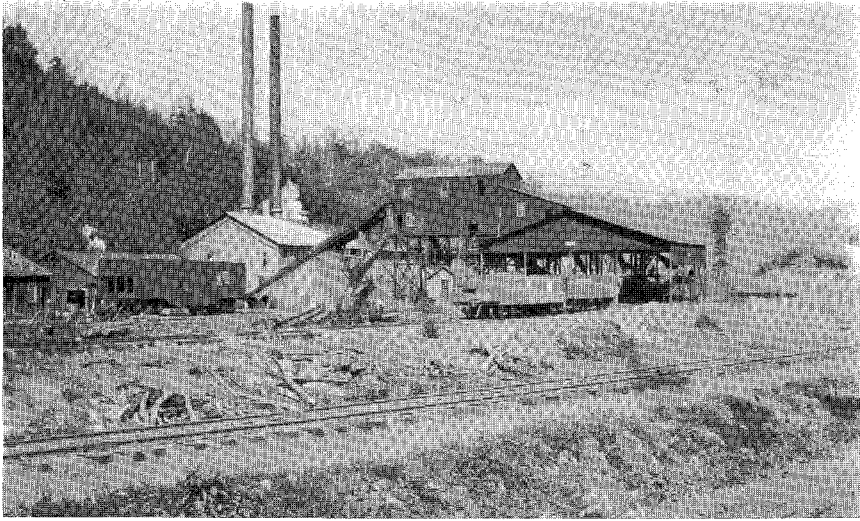
(B) "Slate" dump of the East and West Pocahontas mines.



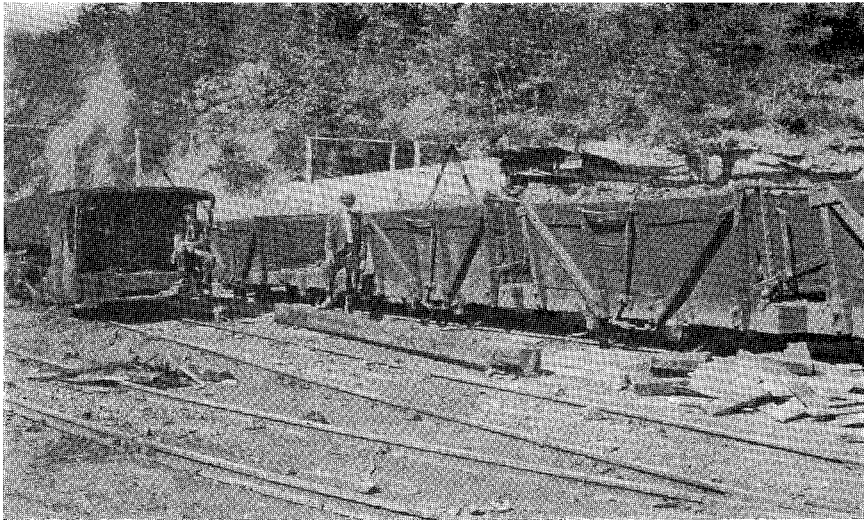
(A) Steel tippie at Baby Pocahontas mine near Pocahontas.



(B) "Slate" dump of the East and West Pocahontas mines.



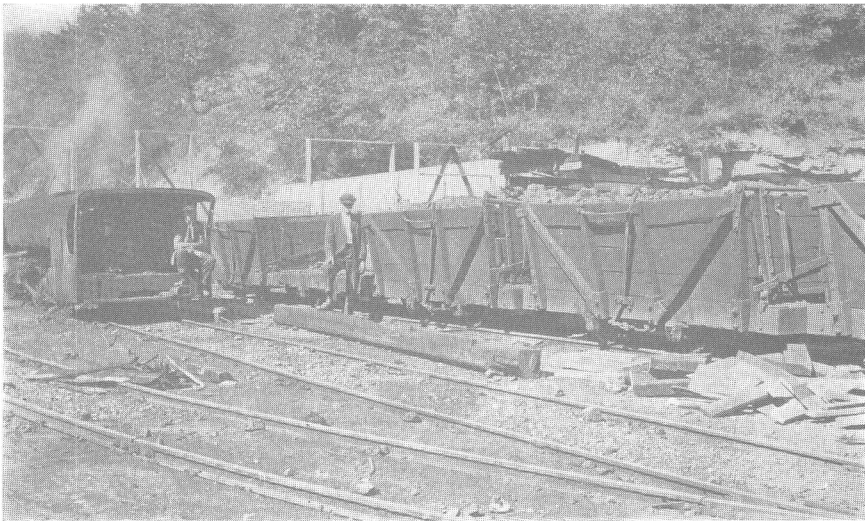
(A) Slope and tippie of Big Vein Pocahontas No. 2 mine near Pocahontas.



(B) Mine locomotive (steam) and type of mine cars used at Pocahontas.



(A) Slope and tipples of Big Vein Pocahontas No. 2 mine near Pocahontas.



(B) Mine locomotive (steam) and type of mine cars used at Pocahontas.

BRIQUETTING TESTS.¹

Four briquetting tests were made of a sample of Pocahontas No. 3 coal from Pocahontas, Va., with excellent results. An English machine was used in test 251, and an American make in the other three. The warm briquets from all four tests had smooth firm surfaces and those from tests 251 and 252 fractured with difficulty. Those from tests 254 and 255 were more brittle but not easily broken. Tests 251, 252, and 254 gave a smooth surface of fracture, while that of 255 crumbled easily. The cold briquets of tests 251, 252, and 254 had smooth surfaces, broke without crumbling, and were excellent in all respects. The cold briquets of tests 255 were rather brittle and the surface of fracture crumbled easily. Water gas pitch was the binder used. When exposed to weathering for from 5 to 6 months the briquets showed no appreciable change, except those of test 255, which were slightly worn and rounded but otherwise practically the same as the original.

¹Wright, C. L., Briquetting tests at the United States fuel-testing plant at Norfolk, Va., 1907-8: U. S. Geol. Survey Bull. 385, pp. 16-17, 1909.

Briquet tests.

	Test Number.			
	251	252	254	255
Size of coal as used:				
Over $\frac{1}{4}$ inch..... per cent....	1.3	0.1	0.0	0.0
$\frac{1}{10}$ to $\frac{1}{4}$ inch..... do	3.4	6.3	9.4	7.4
$\frac{1}{20}$ to $\frac{1}{10}$ inch..... do	13.7	22.6	24.2	23.5
$\frac{1}{40}$ to $\frac{1}{20}$ inch..... do	27.2	32.3	28.0	28.3
Through $\frac{1}{40}$ inch..... do	54.4	38.7	38.4	40.8
Details of manufacture:				
Briquetting temperature.....°F	192	200	204	205
Amount of binder (water-gas pitch) per cent.....	6	6	8	8
Weight of—				
Fuel briquetted..... pounds.....	138,101	181,600	2,000	2,000
Briquets, average..... do	3.27	0.633	0.581	0.595
Heat value per pound—				
Coal as received..... B. t. u.....	14,632	14,632	14,632	14,632
Briquets..... do	14,549	14,726	14,794	14,796
Binder..... do	16,893	16,893	16,718	16,718
Moisture in briquet mixture... per cent....	7.62	3.99	.....	.....
Drop test (1-inch screen):				
Held..... do	74.0	66.5	65.0	46.0
Passed..... do	26.0	33.5	35.0	54.0
Tumbler test (1-inch screen):				
Held..... do	79.0	69.0	71.0	60.5
Passed..... do	21.0	31.0	29.0	39.5
Fines through 10-mesh sieve... do	93.4	95.5	95.2	95.5
Water absorption:				
Time immersed..... days.....	30	21	21	21
Water absorbed..... per cent....	15.38	14.02	15.46	16.62
Average for first four days..... do	2.04	2.74	2.78	3.29
Specific gravity (apparent).....	1.097	1.108	1.101	1.086

Chemical analyses of briquets.

	Test Number			
	251	252	254	255
Proximate:				
Moisture per cent.	2.45	1.64	1.60	1.40
Volatile matter do	18.52	19.73	19.70	19.88
Fixed carbon do	72.79	72.65	73.08	73.22
Ash do	6.24	5.98	5.62	5.50
Sulphur do . . . . .	.63	.61	.50	.58
Ultimate:				
Hydrogen do	4.53	4.62	4.76	4.32
Carbon do	80.63	83.47	84.56	83.62
Nitrogen do . . . . .	.84	.87	.97	.89
Oxygen do	4.19	4.45	3.59	5.09

WASHING TEST.¹

A run-of-mine sample of Lower Seaboard coal from the No. 1 mine at Coaldan was crushed to pass through a 1-inch mesh screen and subjected to a washing test. As shown by the following table, the result is a considerable lowering of the ash and sulphur with a comparatively small loss of coal. Finer crushing would give even better results.

Results of washing test.

Weight of raw fuel (tons)	8.31
Washed fuel:	
Weight (tons)	6.75
Per cent	81.00
Refuse:	
Weight (tons)	1.56
Per cent	19.00
Analysis of raw fuel (per cent):	
Moisture	5.62
Ash	9.79
Sulphur	1.21
Analysis of washed fuel (per cent):	
Moisture	6.36
Ash	4.38
Sulphur	1.30
Actually removed by washing (per cent):	
Ash	64.00
Sulphur	13.00

¹Molendefke, Richard, Belden, A. W., Delamater, G. R., Washing and coking tests of coal and cupola tests of coke: U. S. Geol. Survey Bull. 336, 1908.

COKING TESTS.¹

Two tests (181 and 184) were made of a run-of-mine sample from Coaldan to determine the coking qualities of the Lower Seaboard. The coal was finely crushed and that used in test 184 was also washed. Results of a test (191) on coal from the Pittsburgh bed at Connellsville, Pa., are included in the following table to serve as a standard for comparison:

Summary of coking tests.

	Test 191	Test 181	Test 184
Duration of test..... hours.....	47	50	48
Specific gravity, real.....	1.97	2.00	2.01
Specific gravity, apparent.....	.98	.88	.82
Weight per cubic foot, dry..... pounds.....	60.92	54.71	51.02
Weight per cubic foot, as received (wet).... do.....	92.13	89.65	87.82
Percentage coke.....	50.00	44.00	41.00
Percentage cells.....	50.00	56.00	59.00
Six-foot drop test, percentage over 2-inch mesh:			
1.....	93.50	94.00	96.50
2.....	85.50	87.50	92.50
3.....	79.50	82.00	89.50
4.....	75.00	76.00	87.00
Weight of coal, dry..... pounds.....	11,429	10,359	10,567
Weight of coke, dry..... do.....	7,927	6,673	6,135
Weight of breeze, dry..... do.....	367	266	191
Percentage coke.....	69.45	64.42	58.06
Percentage breeze.....	3.21	2.57	1.81
Total percentage yield.....	72.66	66.99	59.87

Analyses of coal as charged and resulting coke.

	Test 191		Test 181		Test 184	
	Coal	Coke	Coal	Coke	Coal	Coke
Moisture.....	4.29	0.33	5.05	0.38	5.48	0.24
Volatile matter.....	29.92	.15	22.95	1.35	24.77	.32
Fixed carbon.....	58.22	88.54	62.11	86.05	64.96	93.73
Ash.....	7.58	10.98	9.89	12.22	4.79	5.71
Sulphur.....	.91	.87	1.49	1.44	1.45	1.24
Phosphorus.....		.0104		.0076		.0083

¹Op. cit.

Test 191, remarks.—Coke light gray and silvery color; cell structure small but coke not dense; metallic ring; breakage good; uniform size; good heavy coke.

Test 181, remarks.—Coke light gray color; cell structure small; dense; breakage very irregular and pieces of various sizes.

Test 184, remarks.—Coke light gray and silvery color; much deposited carbon; cell structure small but coke not dense; breakage irregular and pieces of various sizes; washing reduces ash and sulphur and improves quality of the coke.

The following analyses made by the West Virginia Geological Survey¹ show the composition of coke (48-hour) from the Pocahontas No. 3 coal at and near Pocahontas, Va.:

- A. Coke from ovens of Pocahontas Consolidated Collieries Co., at Pocahontas, Va. (Baby mine.)
- B. Coke from ovens of Mill Creek Coal & Coke Co., Ruth, Mercer County, W. Va.
- C. Coke from ovens of Booth-Bowen Coal & Coke Co., Simmons Creek, Mercer County, W. Va.
- D. Coke from ovens of Coaldale Coal & Coke Co., Coaldale, Mercer County, W. Va.
- E. Average of 32 analyses of coke from different parts of the Pocahontas field.

Analyses of coke from Pocahontas No. 3 coal.

	A	B	C	D	E
Moisture	0.09	0.05	0.10	0.12	0.09
Volatile matter	1.10	0.69	1.21	1.29	0.98
Fixed carbon	93.67	92.66	91.92	92.38	90.99
Ash	5.14	6.60	6.77	6.21	7.94
Sulphur	0.62	0.68	0.58	0.60	0.58
Phosphorus	0.0035	0.004	0.005	0.0065	0.0061

¹ Hennen, R. V., aided by Gawthrop, R. M.: West Virginia Geol. Survey Rept. on Wyoming and McDowell counties, 1915.

PRODUCER-GAS TESTS.¹

A test was made of the Lower Seaboard coal from Coaldan to ascertain its adaptability for use in producer-gas engines. When delivered on the producer platform the coal was mostly slack. Duration of test 50 hours; average B. t. u. per cubic foot of gas, 138.

Analysis of coal as fired.

Moisture	4.51
Volatile matter	22.77
Fixed carbon	62.64
Ash	10.08
Sulphur	1.59

Analysis of gas (per cent by volume).

Carbon dioxide (CO ₂)	10.5
Carbon monoxide (CO)	17.4
Hydrogen (H ₂)	14.3
Methane (CH ₄)	2.0
Nitrogen (N ₂)	55.5
Ethylene (C ₂ H ₄) .....	.3

Summary of producer-gas tests.

(Coal consumed in pounds per horse-power per hour.)

	Coal as fired	Dry coal	Combust- ible
In producer engine.			
Per electrical horsepower:			
Available for outside purposes	1.18	1.12	1.00
Developed at switchboard	1.14	1.09	.97
Per brake horsepower:			
Available for outside purposes	1.00	.95	.85
Developed at engine .....	.97	.92	.83
In producer plant (including fuel equivalent of auxiliary power).			
Per electrical horsepower:			
Available for outside purposes	1.29	1.23	1.10
Developed at switchboard	1.25	1.19	1.07
Per brake horsepower:			
Available for outside purposes	1.09	1.05	.93
Developed at engine	1.06	1.01	.91

¹Fernald, R. H., and Smith, C. D., Résumé of producer-gas investigations: Bur. Mines Bull. 13, 1911.

Holmes, J. A., Report on the fuel-testing plant at St. Louis, Mo., Jan. 1, 1906, to June 30, 1907: U. S. Geol. Survey Bull. 332, pp. 270-271, 1908.

STEAMING TESTS.¹

Run-of-mine samples of coal from two localities, the Lower Seaboard bed at Coaldan (test 507) and the Pocahontas No. 3 bed at Crumpler, W. Va. (test 56) were subjected to steaming tests. The latter coal came from the Zenith mines, 8½ miles north of Pocahontas, Va., and is considerably higher in ash than the average from this bed.

Proximate analyses of coal as used.

	Test 507	Test 56
Moisture	3.78	4.85
Volatile matter	23.08	16.31
Fixed carbon	63.85	68.36
Ash	9.29	10.48
Sulphur	1.16	.47

Ultimate analyses figured on dry basis.

	Test 507	Test 56
Carbon	78.41	80.34
Hydrogen	4.45	4.00
Oxygen	4.93	3.11
Nitrogen	1.35	1.05
Sulphur	1.21	.49
Ash	9.65	11.01

¹ Breckenridge, L. P., Kresinger, Henry, and Ray, W. T., Steaming tests of coals: Bur. Mines Bull. 23, 1912.
Holmes, J. A., op. cit., p. 270.

Summary of steaming tests.

	Test 507	Test 56
Heating value B. t. u. per lb., dry coal.....	14,177	14,180
Force of draft:		
Under stack damper.....inches water....	0.87	0.52
Above fire .....do.....	0.05	0.22
Average temperature of steam.....°F.....	320.2	325.2
Dry coal used per square foot of grate surface		
per hour .....pounds....	20.59	18.13
Equivalent water evaporated per square foot of water heating		
surface per hour .....pounds....	3.63	3.63
Water apparently evaporated per pound of		
coal as fired.....pounds....	7.01	7.96
Water evaporated from and at 212° F.:		
Per pound of coal as fired.....do.....	8.48	9.54
Per pound of dry coal.....do.....	8.83	10.03
Per pound of combustible.....do.....	11.05	11.75
Efficiency of boiler, including grate.....per cent....	60.15	68.31
Boiler horsepower:		
Builder's rating	210	210
Developed on test	213.7	213.7
Analysis of ash:		
Carbon	36.87	26.13
Earthy matter	63.13	73.87

Test 507, Lower Seaboard coal.—Coal coked in fire; fuel bed required much attention. Steam used in the ash pit. Automatic air admission not operated. Forced draft used. The clinker was easily removed. Size of coal as used; over 1 inch, 13.5 per cent; $\frac{1}{2}$ to 1 inch, 9 per cent; $\frac{1}{4}$ to $\frac{1}{2}$ inch, 16.3 per cent; under $\frac{1}{4}$ inch 61.2 per cent.

Test 56, Pocahontas No. 3 coal.—Plain grate, natural draft. Run-of-mine coal used.

PRODUCTION AND MINING.**Production of coal from Tazewell County.**

In the following table is given the amount of coal mined out under Tazewell County during the years 1883-1918 and the value of that coal as given in Mineral Resources for those years. For some of the earlier dates values are not given and have been assumed at \$1.00 per ton. According to the figures given, $34\frac{3}{4}$ million tons have up to 1918 been taken from this field and between one-fourth and one-half as much more coal rendered

unminable because left as pillars. In general it might be said that from the total amount of coal originally in the ground at least 40 million tons have been removed or lost.

Amount and value of coal produced in Tazewell County, Virginia.

	Amount	Value
1883	92,350	\$ 92,350 ^b
1884	256,435	256,435 ^b
1885	511,575	511,575 ^b
1886	639,751	639,751 ^b
1887	781,155	726,474
1888	948,300	948,300 ^b
1889	807,046	705,121
1890	759,038	554,342 ^a
1891	696,966	560,961
1892	614,333	502,753
1893	653,374	520,565
1894	827,706	580,328
1895	962,269	588,730
1896	785,345	484,178
1897	708,338	415,778
1898	782,015	453,000
1899	844,027	461,288
1900	970,866	869,066
1901	776,568	762,448
1902	723,753	684,663
1903	840,195	883,289
1904	871,720	833,485
1905	961,380	902,335
1906	910,638	931,517
1907	1,116,534	1,240,747
1908	980,014	971,927
1909	975,665	917,229
1910	1,187,146	1,169,981
1911	1,281,224	1,209,138
1912	1,302,043	1,312,762
1913	1,447,351	1,610,548
1914	1,323,530	1,520,085
1915	1,647,081	1,844,383
1916	1,588,044	2,155,040
1917	1,631,849	4,224,746
1918	1,624,736	4,134,006
Total	34,730,360	\$37,179,324

^a Includes one mine in Pulaski County.

^b Lacking additional figures of value; the value is estimated at \$1.00 per ton.

Amount of ultimately available coal.

In the following table are given estimates of the amount of coal originally in each of the principal beds within quadrangles made by the 5 minute meridians and parallels. In preparing this table acknowledgment has been taken of the fact that actual mining operations in Europe have shown that coal of lower grade than this can be profitably mined from beds 14 inches thick or less and at depths greater than any to which it would be necessary to shaft for any bed in Tazewell County. The tonnages in the table therefore include all beds or parts of beds in which there is 14 inches or more of minable coal but do not include thinner beds or parts of beds that could not be mined profitably because of the position and thickness of partings or because of other factors. The calculations are based on an estimate of 1,800 tons per acre for each layer of coal 1 foot thick. Although carefully prepared, these estimates are necessarily only approximations. The estimates for the lower beds in the southwestern part of the field are necessarily liable to error, as little data concerning those beds are available. The calculated totals, though large, are thought to be conservative. If it be assumed that 70 per cent of the coal may ultimately be recovered, taking all beds, there would be left a possible production of 1,600,000,000 tons. The production for 1916 and several years preceding has been around $1\frac{1}{2}$ million tons a year. At that rate the coal in this county should last a little over 1,000 years. The production from the county, however, has doubled during the last 20 years and if that rate of increase were maintained the coal in this county might be estimated to last about 100 years. It must be remembered, however, that much of this coal is in beds that are too thin to be profitably mined and sold in competition with the coals from the more cheaply mined beds now being exploited in this field. Beds, however, that cannot be used to-day are certain to be of value at some time in the future.

Coals	West of 81° 50'		Between 81° 50' and 81° 45'		Between 81° 45' and 81° 40'	
	Acreage	Tonnage	Acreage	Tonnage	Acreage	Tonnage
	Lower Banner	90	540,000			
Big Fork	1,000	4,500,000				
Coals between Big Creek and Kennedy	2,000	6,000,000				
Kennedy	2,500	7,500,000				
Aily	5,000	36,000,000	2,000	14,400,000	500	450,000
Raven	8,300	49,800,000	3,750	26,250,000	870	7,160,000
Coal 60 feet above Jawbone	9,500	34,200,000	5,000	18,000,000	1,200	3,240,000
Jawbone	10,300	63,100,000	6,660	41,900,000	1,540	3,234,000
Tiller	10,300	46,300,000	7,000	31,500,000	1,600	3,360,000
Coal between Tiller and Upper Seaboard	10,300	21,600,000	10,000	21,000,000	4,000	8,400,000
Upper Seaboard	10,000	22,500,000	14,700	35,700,000	5,240	3,182,000
Greasy Creek						
Middle Seaboard	10,300	46,300,000	15,770	91,700,000	2,000	12,000,000
Lower Seaboard						
Coal between Lower Seaboard and Upper Horsepen	10,300	20,600,000	16,000	33,600,000	8,700	26,000,000
Upper Horsepen	10,300	27,000,000	17,000	51,000,000	11,000	33,000,000
Middle Horsepen	10,300	27,000,000	17,300	79,200,000	13,000	33,240,000
Coal between Upper Horsepen and War Creek						
War Creek	10,300	61,800,000	17,300	105,600,000	13,000	52,400,000
Coal between War Creek and Lower Horsepen	10,300	27,000,000	17,300	47,500,000	15,000	60,000,000
Lower Horsepen					5,000	10,000,000
Pocahontas Nos. 7, 8 and 9					16,600	48,000,000
Pocahontas No. 6						
Pocahontas No. 5			12,000	43,200,000	5,000	22,500,000
Pocahontas No. 4			12,000	24,000,000	5,000	18,000,000
Pocahontas No. 3	10,300	20,600,000	17,300	70,400,000	16,600	83,000,000
Other beds						
Totals	10,897	495,340,000	17,332	734,950,000	16,631	482,966,000

Coals	Between 81° 40' and 81° 35'		East of 81° 35' and south of 73° 15'		North of 73° 15'	
	Acres	Tonnage	Acres	Tonnage	Acres	Tonnage
Lower Banner						
Big Fork						
Coals between Big Creek and Kennedy						
Kennedy						
Aily						
Raven						
Coal 60 feet above Jawbone						
Jawbone						
Tiller						
Coal between Tiller and Upper Seaboard						
Upper Seaboard						
Greasy Creek						
Middle Seaboard						
Lower Seaboard	500	2,250,000	100	450,000		
Coal between Lower Seaboard and Upper Horsepen	1,000	4,500,000	500	1,800,000		
Upper Horsepen	1,470	4,200,000	1,400	15,400,000		
Middle Horsepen			2,000	8,000,000	1,800	12,600,000
Coal between Upper Horsepen and War Creek			2,200	6,600,000	570	9,000,000
War Creek	2,680	13,500,000	2,400	9,020,000	1,000	3,000,000
Coal between War Creek and Lower Horsepen	3,000	8,100,000	3,000	13,500,000	1,500	6,750,000
Lower Horsepen	3,500	10,500,000	3,300	11,880,000	2,170	13,020,000
Pocahontas Nos. 7, 8 and 9			3,650	12,390,000	4,000	12,000,000
Pocahontas No. 6			3,650	8,200,000	5,920	17,760,000
Pocahontas No. 5	5,000	40,000,000	3,650	16,400,000	1,830	4,950,000
Pocahontas No. 4	5,100	24,950,000	3,650	45,800,000	6,800	38,400,000
Pocahontas No. 3	5,150	41,200,000	3,650	40,200,000	7,420	137,000,000
Other beds						
Totals	5,315	149,200,000	3,670	189,640,000	7,950	254,480,000

Mining operations.

A history of the beginning of mining operations, particularly in the Pocahontas field, has already been given. In the following table is given a list of companies operating in 1918 as nearly as could be worked out from the Mine Inspector's reports and the coal-mining index published by the Keystone Consolidated Publishing Company of Pittsburgh. The table shows the location, number on the map where that is known, the name of the company, the name of the mine, the nearest town, the name of the bed, the thickness of the coal, and the kind of opening. Several of these mines have been opened since the field work was done in this area and their exact location and some other data are wanting.

Coal mining companies operating in Tazewell County in 1918.

No.	Mining company	Name of mine	Location	Bed	Thickness	Kind of opening
	Ammon Pocahontas C. Co.			Upper Horsepen "Smith"	10' 6"-12' 3"	Drift
28	Big Vein Poca. C. Co.	No. 1 mine	W. of Poca.	Poca. No. 3	10' -12'	Shaft
	Big Vein Poca. C. Co.	No. 2 mine	Olivette	Poca. No. 3	10' -12'	Slope
328	Bluestone Poca. C. Co.	Poca. No. 3	Pocahontas	Poca. No. 3	9'	Drift
327	Carter C. Co. (Empire C. L. Co.)	No. 6 mine	Seaboard	Upper Seaboard	3'	Drift
336	Carter C. Co.	No. 6½ mine	Seaboard	Upper Seaboard	2' 6"- 3'	Drift
461	Carter Red Ash. Coll. Co., Inc. (Domestic C. Co.)	No. 9 mine	Seaboard	Upper Seaboard	2' 8"	Drift
	Carter Red Ash	Carter Red Ash	Raven	Raven	3' 6"	Drift
	Crockett Red Ash C. Co.	Crockett	Raven	Raven	4' 10"	Drift
	Daisy Red Ash C. Co.		Richlands			
	Ellswick & Weatherly		Raven			
	Gillispie-Hearn C. Co., Lim.		Raven			
386	Hill Creek C. Co.	East mine	W. of Richlands	Tiller	2' 6"- 7'	Drift
404	Hill Creek C. Co. (Big Town Hill Cr. C. Corp.)	"West mine"	W. of Richlands	Jawbone	4' - 7'	Drift
	Interstate C. Co.		Alfredton			
368	Jewell Ridge C. Corp.	No. 1 mine	Jewell	Raven	4' - 6'	Drift
366	Jewell Ridge C. Corp.	No. 3 mine	Jewell	Raven	4' - 6'	Drift
	Lampport, N. J. & J. C.					
	Little Mill Creek C. Co.					
422	Matoka C. Corp.	No. 2 mine	On Town Hill Cr.	Raven	2' 6"- 3' 4"	Drift
7	Poca. Consolidated Collieries Co.	East mine	N. of Poca.	Poca. No. 3	8' -12'	Drift
9	Poca. Consolidated Collieries Co.	West mine	N. of Poca.	Poca. No. 3	8' -12'	Drift
11	Poca. Consolidated Collieries Co.	Baby mine	N. of Poca.	Poca. No. 3	8' -12'	Drift
15	Poca. Consolidated Collieries Co.	Boissevain	Boissevain	Poca. No. 3	8' -12'	Drift
	Poca. Fuel Co.		Poca.			
459	Raven Collieries Co.	No. 2 mine	Red Ash	Raven	3'	Shaft
458	Raven Collieries Co.	No. 3 mine	Red Ash	Raven	3'	Drift
449	Raven Red Ash C. Co.	No. 1 mine	Red Ash	Raven	3'	Drift
280	Richlands C. Corp.	Nos. 1, 2, 3	Richlands		4' - 6'	Slope
446	Virginia-Tennessee C. Co.	No. 2	Raven	Raven	3'	Drift
448	Virginia-Tennessee C. Co.	No. 3	Red Ash	Raven	3' - 8'	Drift
	White, Roy T.		Richlands			
281	Wysor C. Co.		Richlands		2' 6"- 3'	Slope

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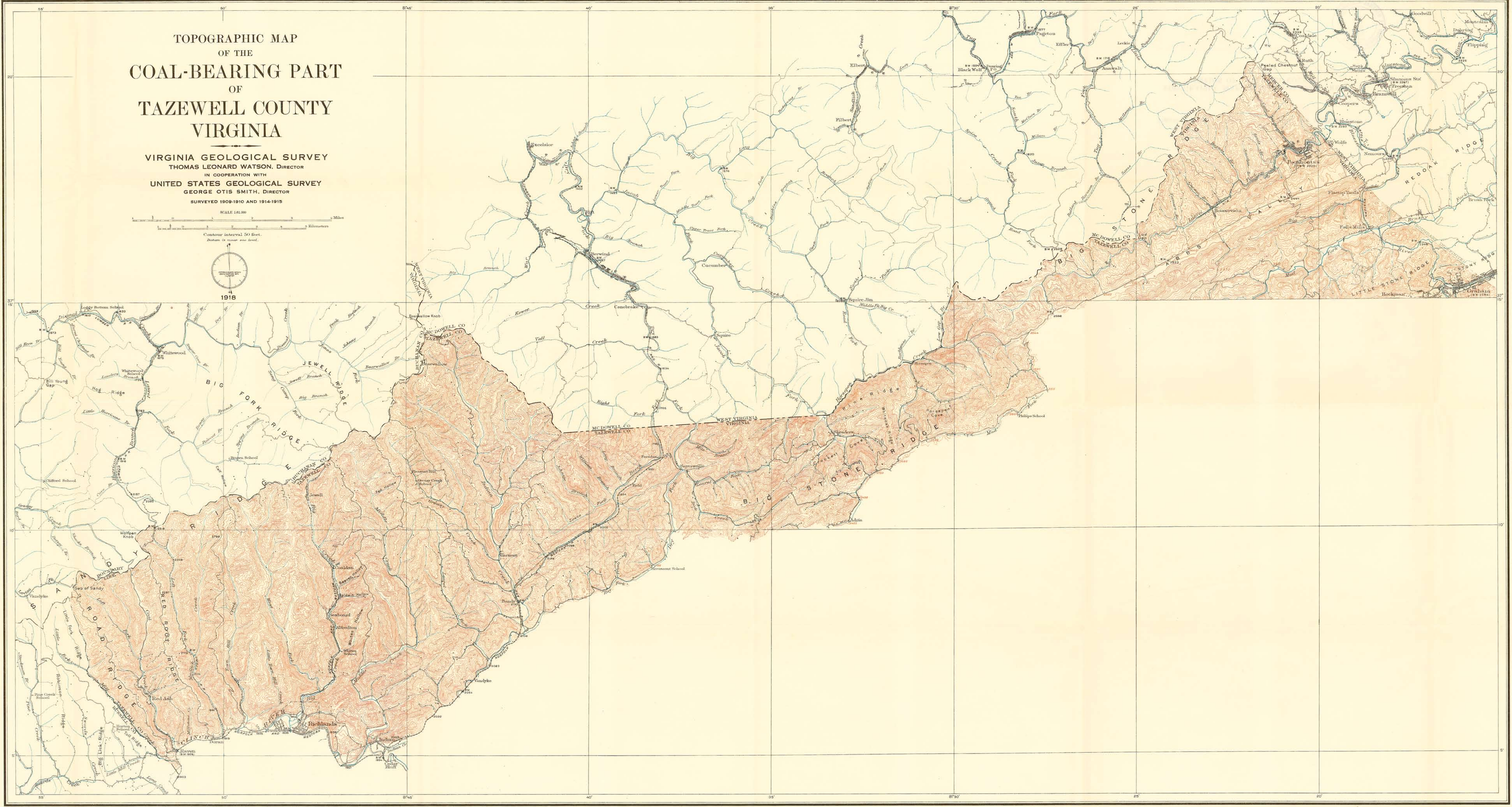
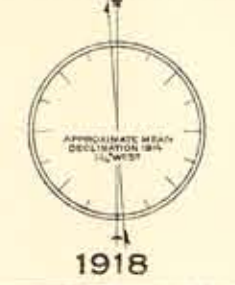
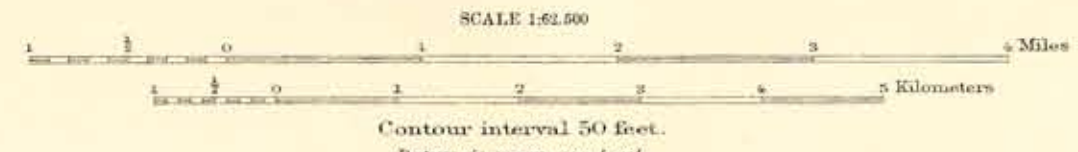
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TOPOGRAPHIC MAP
OF THE
COAL-BEARING PART
OF
TAZEWELL COUNTY
VIRGINIA

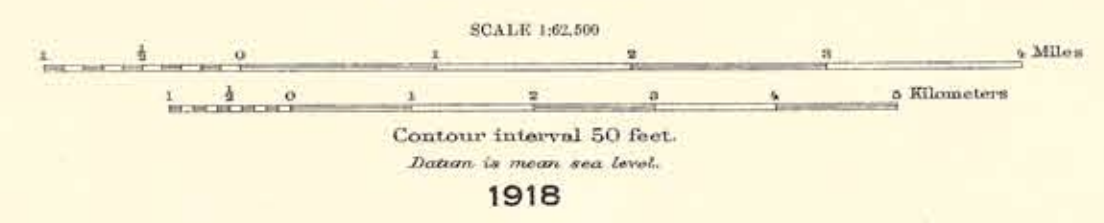
VIRGINIA GEOLOGICAL SURVEY
THOMAS LEONARD WATSON, DIRECTOR
IN COOPERATION WITH
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR
SURVEYED 1909-1910 AND 1914-1915





A GEOLOGIC AND ECONOMIC
 MAP OF THE
 COAL-BEARING PART
 OF
 TAZEWELL COUNTY
 VIRGINIA

PREPARED BY
 VIRGINIA GEOLOGICAL SURVEY
 THOMAS LEONARD WATSON, DIRECTOR
 IN COOPERATION WITH
 UNITED STATES GEOLOGICAL SURVEY
 GEORGE OTIS SMITH, DIRECTOR
 SURVEYED IN 1913-1915
 GEOLOGY BY
 T. K. HARNESBERGER.



LEGEND

- | | | |
|---|---|---|
| <p>Pennington</p> <ul style="list-style-type: none"> Norton formation
(sandstone and shale containing Lower Banner, Big Fork, Kennedy, Alley, Raven, Jewell, Flax, and other coal beds.) Lee formation above Upper Horsepen coal
(sandstone and shale containing Upper Horsepen, Grassy Creek, Middle and Lower Horsepen, and other coal beds.) Lee formation below Upper Horsepen coal
(sandstone and shale containing Middle Horsepen, War Creek, Lower Horsepen, Pocahontas, and other coal beds.) Bluestown formation and Princeton sandstone
(red, green and yellow shale, in part silty, and thin beds of sandstone, some massive, Princeton sandstone, locally conglomeratic at base.) Hinton formation
(red, green, and yellow shale and sandstone, and thin beds of shaly limestone; locally thin layers of coal in upper part.) Bluefield shale
(shaly green and yellow sandy shale of top, and thin beds of calcareous shale and thin beds of impure limestone at base.) Newman limestone
(gray, massive limestone, topped by shaly limestone, and thin beds of calcareous shale.) Granger shale
(fuzzy, fine grained sandstone, lenses of conglomeratic sandstone, and shaly shale, in the upper part, grading into petriolite shale below.) | <p>Carboniferous</p> <ul style="list-style-type: none"> Undifferentiated Pennington
(shaly or shaly Bluestown formation, Princeton sandstone, and Hinton formation in narrow crushed zone between faults.) | <p>Devonian</p> <ul style="list-style-type: none"> Coal outcrop lb—Lower Banner, Norton formation kd—Kennedy, Norton formation rv—Raven, Norton formation jb—Jawbone, Norton formation us—Upper Seaboard, Lee formation gc—Grassy Creek, Lee formation ms—Middle Seaboard, Lee formation ls—Lower Seaboard, Lee formation uh—Upper Horsepen, Lee formation mh—Middle Horsepen, Lee formation wc—War Creek, Lee formation lh—Lower Horsepen, Lee formation p6—No. 6 Pocahontas, Lee formation p5—No. 5 Pocahontas, Lee formation p3—No. 3 Pocahontas, Lee formation |
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| <p>Structure contours
 showing elevation of No. 3 Pocahontas coal
 (contour interval is 50 feet. Datum is mean sea level.)</p> <p>Structure contours
 showing elevation of Raven coal 1800 feet above the Pocahontas coal
 (contour interval is 50 feet. Datum is mean sea level.)</p> <p>Shipping coal mine
 (numbers refer to text reference.)</p> <p>Small local coal mine or prospect pit
 (numbers refer to text reference.)</p> <p>Diamond drill prospect hole
 (letters refer to text reference.)</p> | <p>Fault</p> |
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