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ELK GARDEN AND UPPER POTOMAC
COAL-FIELDS OF WEST VIRGINIA.

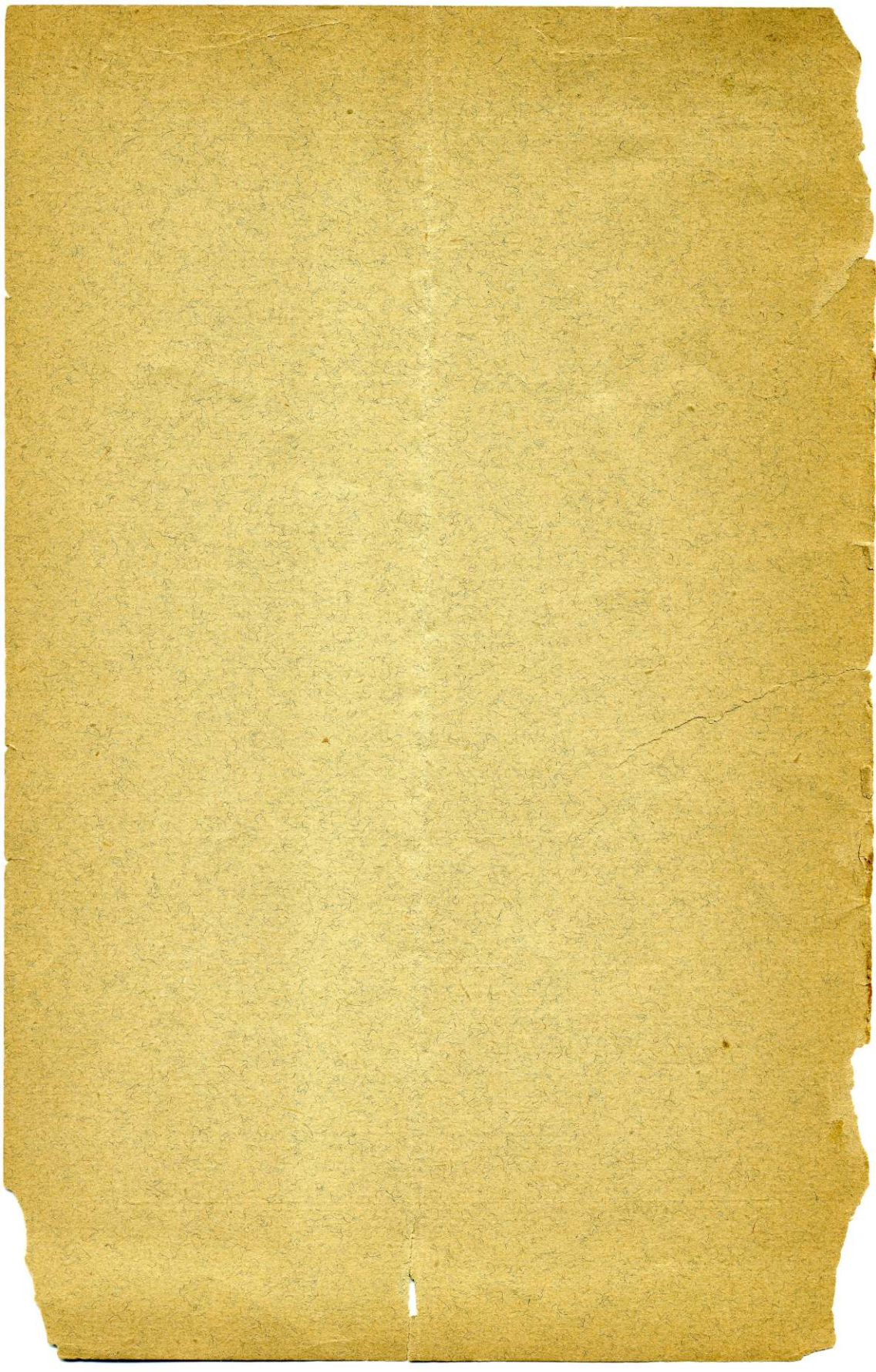
BY

JOSEPH D. WEEKS,

PITTSBURGH, PA.

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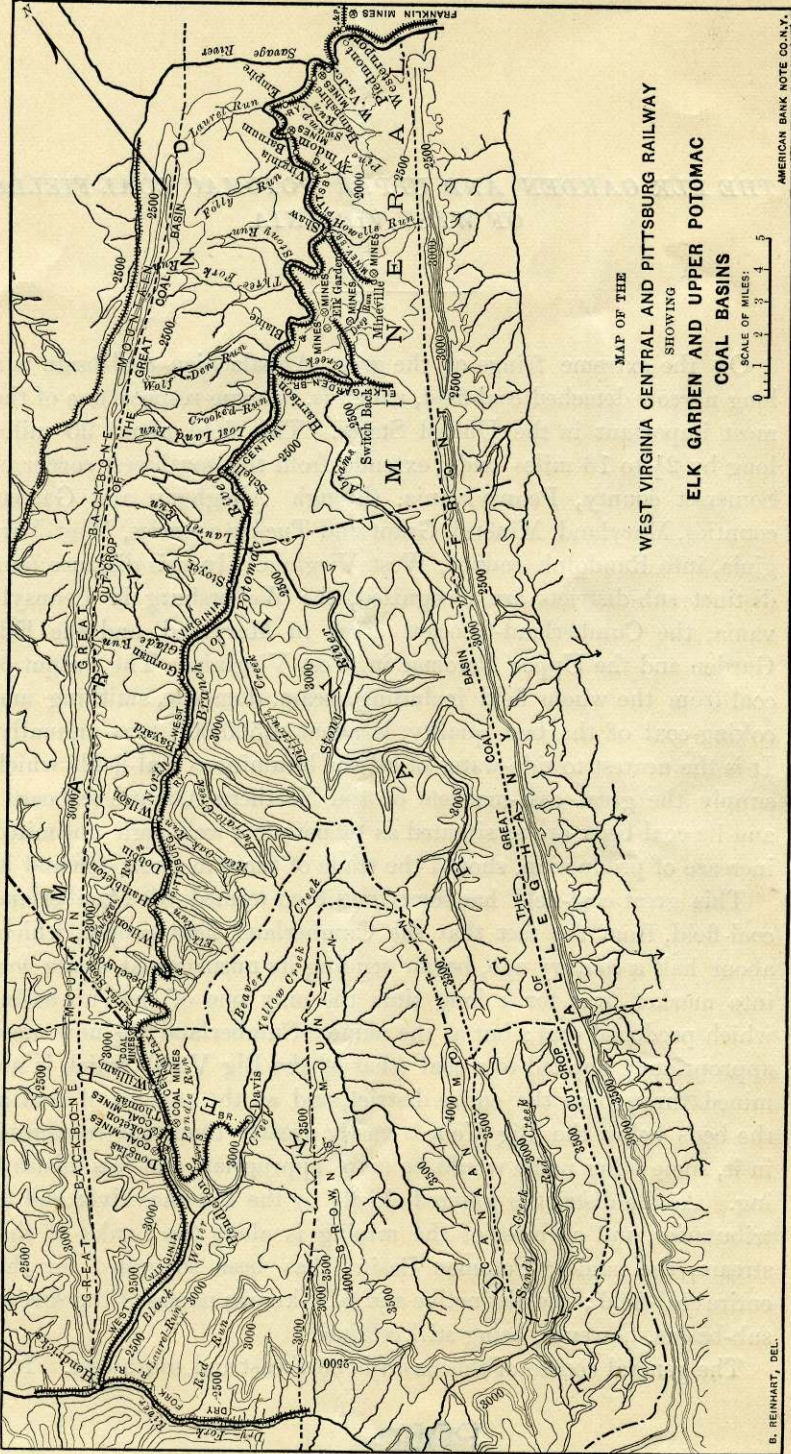
THE ELK GARDEN AND UPPER POTOMAC COAL-FIELDS
OF WEST VIRGINIA.

ON the extreme fringe of the great Appalachian coal-basin is a long narrow detached coal-field, which is, in some respects one of the most important in the United States. This field, about 90 miles long by $2\frac{1}{2}$ to 16 miles wide, extends from the southwest corner of Somerset county, Pennsylvania, through Alleghany and Garrett counties, Maryland, Mineral, Grant and Tucker counties, West Virginia, into Randolph county, West Virginia. In this distance four distinct sub-districts are recognized, the Wellersburg in Pennsylvania, the Cumberland-Georges creek in Maryland, and the Elk Garden and the Upper Potomac in West Virginia. The output of coal from the whole field including steam, domestic, smithing and coking-coal of the best quality, is about 4,500,000 tons annually. It is the nearest to tide-water of all the bituminous coal-fields which supply the great coal-markets of the Northern Atlantic seaboard; and its coal-beds are so situated as to permit a well-nigh unlimited increase of production, should the trade of these markets demand it.

This great coal-field has sometimes been termed the Cumberland coal-field, from the fact that the Cumberland field proper, which, about half a century ago, began sending its unsurpassed steam-coal into market, was for a long time the only one of the sub-basins which produced coal; but as the name "Cumberland" is now more appropriately applied to a coal (that of the Big Vein) which is not mined throughout the entire district, and as the amount of coal in the beds below the Big Vein is vastly greater than that remaining in it, some other name would be more appropriate and less misleading. As the district is watered chiefly by the Potomac river and its tributaries, and as most of the mining is along the banks of that stream, the name "Potomac Basin" has been suggested for this entire coal-field; the distinctive and well-known names of the several sub-basins, however, being still retained.

The general course of this basin is northeast and southwest. It is

FIG. 1.



MAP OF THE
 WEST VIRGINIA CENTRAL AND PITTSBURG RAILWAY
 SHOWING
 ELK GARDEN AND UPPER POTOMAC
 COAL BASINS

SCALE OF MILES:
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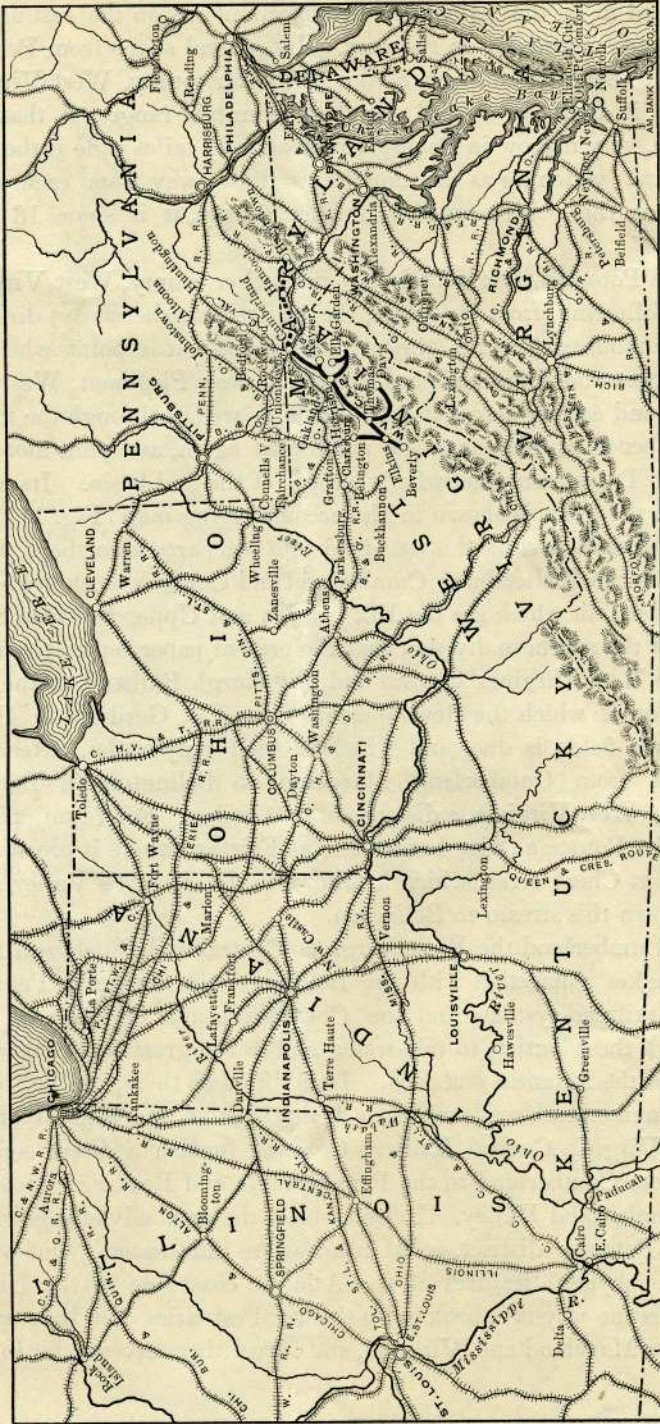
hemmed in by the Allegheny Front mountains on the east and the Backbone mountains on the west. Its general shape from Pennsylvania to near the southern border of Tucker county, West Virginia, where it abuts on several parallel mountain-ranges, is that of a wedge, very narrow in Pennsylvania, only $2\frac{1}{2}$ miles wide at the State line, and widening as the mountains draw away from each other, until, at the point named in Tucker county, it is some 16 miles wide.

The Potomac river, which rises in Tucker county, West Virginia, after following, from its source, the general (northeasterly) direction of the mountains, turns abruptly to the east at a point where the Baltimore and Ohio Railroad crosses it, near Piedmont, West Virginia, and cutting across the coal-fields, as well as through the mountains, bends at Keyser to the northward again, and runs along the base of Dan's mountain, wholly outside of the coal-basin. Its course within the basin is shown in the accompanying map (Fig. 1). The Potomac thus divides this coal-field into two parts, a northern, which includes the Wellersburg, Cumberland and George's creek fields, and a southern, in which are the Elk Garden and Upper Potomac fields. It is of the southern division that the present paper especially treats.

The West Virginia Central and Pittsburgh Railway, to the construction of which the development of the Elk Garden and Upper Potomac fields is due, and which is their only outlet, extends at present from Cumberland, Maryland, to Belington in Barbour county, West Virginia, a distance of 131 miles. For 74 miles it follows the Potomac to its headwaters at Fairfax, where it crosses the divide at Cheat river, which it follows to the Tygart's Valley river and down this stream to Belington.

At Cumberland the West Virginia Central and Pittsburgh Railway makes connection with the Baltimore and Ohio and Pennsylvania railroad-systems and the Chesapeake and Ohio Canal, and through these outlets to tide-water and to the great coal-consuming cities of the Atlantic seaboard. In addition to these, the Baltimore and Cumberland road, which is being built in the interest of the West Virginia Central Railway Co., will furnish a direct connection from Cumberland to the Pennsylvania and Reading systems in the Cumberland Valley. Indeed, one of the great advantages of the entire Potomac district, is its nearness to tide-water. One of the notable physical features of the Atlantic coast-line of the United States is the way it is broken by the tidal estuaries and bays which separate Maryland and Virginia, and thrust themselves so far inland

FIG. 2.



Map Showing Railroad Connections to the Seaboard and the West of the West Virginia Central and Pittsburgh Railway.

bringing tidal water and the head of navigation very far towards the mountains. Another effect of the existence of these immense bodies of water on the border-line between the north and the south has been to determine the route of the leading highways of trade between these sections, deflecting them from the coast.

As a result of these physical features, the Potomac coal-field lies nearest to tide-water of all the important fields that supply the great coal-markets of the Atlantic border. The distance from the Elk Garden region to tide-water at Baltimore is 218 miles, while the competing field nearest to tide-water is the Clearfield, which is 253 miles from Philadelphia, its nearest tide-water port. By reason of the fact that the Chesapeake has deflected the lines of railroad inland, this region can reach the great eastern coal-markets by rail over remarkably short lines, 312 miles to Philadelphia *via* the Baltimore and Ohio, and 392 miles to New York *via* the Pennsylvania railroad. When the extension, by the Baltimore and Cumberland railway which has already been begun, shall have been completed to Hagerstown, these distances will be materially shortened. The railroad map (Fig. 2) shows the commercial relations of the region.

Most of the bituminous coals which are sent to the North Atlantic seaboard-markets are mined from four great coal-beds: the Pittsburgh of the Upper Measures, the Freeport and the Lower Kittanning of the Lower Measures, and the New River and Flat Top beds of the Pottsville Conglomerate, or Seral.

All four of these coals are found in the district here described; and at no other point in the Appalachian field do the first three exhibit greater size, or ease and cheapness of mining. The Pittsburgh bed is the Big Vein of this region, reaching at times a thickness of 16 feet, averaging 12 feet to 14 feet, and carrying 67 to 72 per cent. of carbon, 19.33 to 26.5 per cent. of volatile matter and but 5 to 6.75 per cent. of ash. The Upper Freeport (Thomas) measures 8 feet and gives from 4 to 6 feet of good workable coal, while the Lower Kittanning (Davis) bed measures 11 feet and works 6½ feet of valuable steam- and coking-coals, remarkably low in sulphur and phosphorus. Though the New River group has been found in this district, it has at present but little commercial importance.

The "Big Vein" or Pittsburgh seam, though it enjoys the widest reputation, is by no means the most important or valuable coal of this basin. Without wishing to detract from the well-established and widely-known reputation of this coal, I would simply indicate that in this district it is not as important or valuable as other coals.

The "Big Vein" goes into the air just north of Stony river, and shows in but one place to the south of the Elk Garden district namely, on the top of Fairfax Knob, at a height of some 3200 feet above the sea, where a few acres are still left.

As has been suggested, the Upper Freeport (Thomas) and the Lower Kittanning (Davis) are the important coals of this district. One or the other, sometimes both, are found throughout the entire length of both the Elk Garden and Upper Potomac districts, except here and there in a narrow valley, where they have been cut out. While, therefore, the beds are not as thick as the "Big Vein," yet, by reason of the great area underlain by these beds, the amount of coal remaining in them in the hills is vastly greater than that belonging to the "Big Vein." It is estimated at 90,000,000 tons in the Elk Garden, and 2,000,000,000 tons or more in the Upper Potomac district. The range of use of these coals is wide. The Freeport (Thomas) lump is shipped as a domestic fuel, and the "run of mine" as steam-coal, while the slack is coked, though the coke does not equal in physical structure or purity that made from the other bed. The Upper Kittanning (Davis) coal, which in this basin is remarkably free from sulphur, is, in the form of "run of mine," shipped as steam-coal; and the coarse slack has a large market in the west as a smithing-coal, while the fine slack makes a strong, bright, porous coke.

THE ELK GARDEN DISTRICT.

The Potomac river divides the Elk Garden district from the Cumberland-George's Creek field. This district extends from near Piedmont, in West Virginia, to Stony river, just south of Schell, West Virginia, a distance of 20 miles. The coal-measures, which are both the Upper and Lower Productive, lie on both sides of the Potomac, though nearly, if not quite, all that is left of the Pittsburgh seam is on the West Virginia side.

The Pittsburgh seam is mined to a considerable extent, and yields a coal with all the well-known characteristics of the "Big Vein" coal of this basin, being an excellent steam- and smithing-coal. The vein averages 14 feet, and it is estimated that some 10,000,000 tons of coal are still available in the bed within this district.

While the chief production of coal in the Elk Garden district is from the "Big Vein," some of the beds of the Lower Measures are also worked, viz., the Upper Freeport (4-foot vein) and Lower Kittanning (6-foot vein). At one place a 7-foot vein above the Pitts-

burgh is mined. In these smaller veins, which underlie a much larger area than the Big Vein, it is estimated that some 90,000,000 tons are still available, making, with the "Big Vein" coal still remaining, about 100,000,000 tons of available coal in the Elk Garden district.

An analysis of the coal from the Big Vein of this district, made by the United States Geological Survey in 1888, is as follows :

Analysis of Elk Garden Coal from Pittsburgh Vein.

	Per cent.
Moisture,	0.76
Volatile carbon,	19.39
Fixed carbon,	72.99
Ash,	6.86
	100.00
Sulphur,	0.880

TABLE I.—*Total Shipments of Coal from All the Mines in the Elk Garden Region on the Line of the West Virginia Central and Pittsburgh Railway, from October 20, 1881, When the First Shipment was Made to, January 1, 1893.*

Year.	W. Va. Central. Tons.	Big Vein. Tons.	Davis & Elkins. Tons.	Atlantic. Tons.	Vir- ginia. Tons.	Hamp- shire. Tons.	Switch- back. Tons.	Mer- rill's. Tons.	Total Tons.
1881	11,372	.....	.....	.....	.....	.....	.....	.....	11,372
1882	228,294	28,774	.....	.....	.....	.....	.....	.....	257,068
1883	261,075	68,942	.....	.....	.....	.....	.....	.....	330,017
1884	375,590	83,170	.....	.....	.....	.....	.....	.....	458,760
1885	268,780	65,792	.....	57,213	.....	.....	.....	.....	391,785
1886	211,852	50,686	.....	63,715	.....	.....	.....	.....	326,253
1887	259,354	59,801	.....	107,605	.....	.....	.....	.....	426,760
1888	356,259	30,407	.....	97,285	.....	.....	.....	.....	483,951
1889	353,216	.....	18,671	62,934	1737	.....	.....	.....	436,558
1890	414,547	.....	73,384	63,121	5926	.....	.....	.....	556,978
1891	420,503	538	88,576	92,192	193	502	5718	1872	610,094
1892	358,915	3,876	71,033	42,365	.....	17,326	39,421	174	533,110
1893	.....	.....	.....	.....	.....	.....	.....	.....	450,394
	3,519,757	391,986	251,664	586,430	7856	17,828	45,139	2046	5,273,100

Mining began in the district in 1881, and the first shipment of coal was made October 20th of that year. The total amount mined and sent to market up to December 31, 1893, has been 4,822,706 tons. The total shipment for each year since mining began and for each mine is given in the table on page 7:

THE UPPER POTOMAC FIELD.

The Upper Potomac field of the Potomac basin is at present regarded as extending from Stony river in Mineral county, West Virginia, where the Elk Garden district ends, through Grant and Tucker counties to the end of the basin in Randolph county. The important coal-workings, however, are just beyond Fairfax, at Thomas, Davis, Coketon, and Douglass, on the watershed between the Potomac and Cheat rivers.

The chief coal-beds worked in this district are the Upper Freeport and the Lower Kittanning in the Lower Measures. These are known locally as the Thomas and Davis veins, so named from the brothers, Henry G. and Thomas B. Davis, who were the pioneers in the development of this region. The Thomas vein is the Upper Freeport; the Davis vein the lower Kittanning. The Thomas vein of this region has a thickness of nearly 8 feet; but a bony coal or slate near the center of the bed leaves only about 6 feet of merchantable coal. The coal is valuable for both steam- and coking-purposes. The Davis vein has a thickness of nearly 11 feet. With respect to its tenor of sulphur, this is one of the purest coals mined. It is not only used largely for steam, but is especially valuable for blacksmithing purposes, having an extensive market in the west, where it is put in bags and sold to interior points off the lines of transportation. For coking, it is an excellent material.

The following (Table II., page 9) are analyses of these coals, made by the United States Geological Survey from full sections.

This field is of great extent; how great, has not been determined. In 1882, when the explorations were exceedingly limited, Prof. Pumpelly, who prepared the report on coal for the Tenth Census, estimated that there were 250 square miles of coal-land in the Upper Potomac and Stony River basins, after allowing for the erosion of the valleys, and gave 2,000,000,000 tons as the minimum amount of coal in beds of workable thickness, half of which was above drainage and accessible from the valleys. As the 8-foot vein was the largest known at that time, it is evident that the amount of coal in the basin was much under-estimated.

TABLE II.—*Analysis of Thomas and Davis Coals, Upper Potomac Field West Virginia.*

	Davis (Lower Kittanning).		Thomas (Upper Freeport).		
	No. 1.	No. 2.	Upper.	Middle.	Bottom.
Moisture.....	0.80	0.70	0.64	0.68	0.96
Vol. Matter.....	26.84	22.03	22.87	23.88	22.90
Fixed Carbon.....	67.18	70.53	65.60	65.99	72.76
Ash.....	5.18	6.74	10.89	9.45	3.38
Total.....	100.00	100.00	100.00	100.00	100.00
Sulphur.....	1.68	0.924	0.64	1.39	0.59
Phosphorus.....	.....	.....	0.06	0.02	0.01

At Coketon, only the Lower Kittanning, or Davis seam, is mined. A section of this coal, known here as the 11-foot seam, is as follows :

Section of Davis Vein at Coketon, West Virginia.

	Inches.	
Coal, upper bench,	12	} Portion worked.
Slate,	2	
Coal, middle bench,	18	
Slate,	2	
Coal, lower bench,	44	
	78	
Slate,	18	} Floor, not mined.
Coal,	32	
	128	

Of the 106 inches of coal in the seam, the 32 inches below the 18-inch slate is left in the floor. All of the vein above this 18-inch slate is mined, giving in actual working 72 to 78 inches of coal. For this reason the seam is sometimes called the 6-foot or 6½-foot coal.

This coal shows the columnar structure typical of all good coking-coals. It is so soft as to be easily broken by the hand, and breaks flaky and in slivers, even the finest slack showing

under the microscope minute columnar flakes. The "run of mine" is used for steam, and the coarse slack is in high repute and good demand in the west for blacksmithing, while the slack of the lower bench is coked.

The conditions at Douglas, where the same vein is mined, are similar.

At Thomas, but a mile north of Coketon, the Davis vein has gone below the surface, and the Thomas vein appears in the hillside above the railroad. The distance here between the two veins is 200 feet, though the shaft sunk to the Lower Kittanning is but 184 feet deep.

A section of the Thomas (Upper Freeport) vein, at Thomas, which is an average of thirty sections made by Mr. F. S. Landstreet, the General Manager of the Davis Coal and Coke Company, the chief operator throughout this entire region, is as follows :

*Section of Thomas Vein (Upper Freeport) at Thomas Mine,
West Virginia.*

	Inches.
Coal,	18
Bone coal,	5
Coal,	6
Slate and bone,	4
Coal,	4
Bone coal,	3
Coal,	6
Slate,	3
Coal,	37
	—
Total,	86
Coal,	71
Slate and bone,	15

Of the 86 inches shown in the section, some 78 inches is mined, the upper bench (18 inches) being removed first. The coal is harder than that of the Davis seam, breaks with a cubical fracture, and will stand transportation better. The lump is shipped for domestic purposes and the run of mine for steam purposes, while the slack is coked.

Shipments were begun from this field in 1885, since which time, up to December 31, 1892, the output has been 881,914 tons of 2240 pounds, as will be seen from the following table :

TABLE III.—*Total Shipments of Coal from All the Mines in the Upper Potomac Region on the Line of the West Virginia Central and Pittsburgh Railway from 1885 to December 31, 1893.*

	Davis.	Thomas.	Douglas.	Spring Garden	Fairfax	Bayard	Junior.	Total.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1885	8,434	1,131	.....	.....	.....	.....	.....	9,565
1886	17,904	2,772	.....	.....	.....	.....	.....	20,676
1887	18,287	3,774	.....	.....	.....	.....	.....	22,061
1888	69,297	10,350	.....	.....	.....	.....	.....	79,647
1889	99,771	23,320	.....	696	.....	.....	.....	123,787
1890	111,477	30,495	.....	1290	.....	.....	.....	143,262
1891	141,142	55,888	15,146	1247	357	.....	.....	213,780
1892	107,877	95,160	62,860	.....	990	416	1833	269,136
1893	.....	.....	.....	.....	.....	.....	.....	423,610
	574,189	222,890	78,006	3233	1347	416	1833	1,305,524

The total production of the Elk Garden and Upper Potomac fields, from the beginning of shipments in 1881, have been as follows in tons of 2240 pounds. (See Table IV., page 13.)

COKE-MAKING IN THE UPPER POTOMAC REGION.

Though all three seams of coal mined in the Elk Garden and Upper Potomac regions are coking-coals, only two are coked, the Thomas (Upper Freeport) and Davis (Lower Kittanning), and chiefly the latter. In addition to its being more valuable as a steam- than as a coking-coal, the Big Vein coal is lower in volatile matter than either the Thomas or Davis veins, and does not coke as readily.

There are three coke-plants, with 393 ovens, in this field, all in the Upper Potomac district, no coal being coked at present in the Elk Garden district. Two of these, the plant at Coketon, with 327 ovens, and the one at Douglas, just south of Coketon, with 44 ovens, coke the Davis seam. The plant at Thomas, just north of Coketon, with 22 ovens, uses the Thomas coal.

TABLE IV.—*Total Coal-Production of Elk Garden and Upper Potomac Fields.*

Year.	Elk Garden.	Upper Potomac.	Total.
1881.....	11,372	.....	11,372
1882.....	257,068	.....	257,068
1883.....	330,017	.....	330,017
1884.....	458,760	.....	458,760
1885.....	391,785	9,565	401,350
1886.....	326,253	20,676	346,929
1887.....	426,760	22,061	448,821
1888.....	483,951	79,647	563,598
1889.....	436,558	123,787	560,345
1890.....	556,978	143,262	700,240
1891.....	610,094	213,780	823,874
1892.....	533,110	269,136	802,246
1893.....	450,394	423,610	874,004
	5,273,100	1,305,524	6,578,624

The ovens used are all bee-hives of the standard Connellsville type, 12 feet in diameter by 7 feet high, the batter of the ovens beginning 18 inches above the floor.

Slack or fine coal only is used, experience having shown that the run of mine or lump does not yield as good a coke. The charge is $5\frac{1}{2}$ tons for 48-hour and $6\frac{1}{2}$ tons for 72-hour coke. The actual yield of coke by weight at the Coketon plant, using the Davis seam, is over 67 per cent.

The coke is bright, silvery, porous, and hard, and has an excellent reputation for foundry uses because of its physical characteristics and low sulphur. It is shipped largely for this purpose to Mexican and South American ports. It is also an excellent blast-furnace fuel, and, when selected and crushed, has a large sale for domestic purposes.

An average of ten analyses of coke, made from the Davis seam at Coketon, West Virginia, is as follows:

Average of Ten Analyses of Coketon Coke.

	48-hour. Per cent.	72-hour. Per cent.
Water,	0.218	0.39
Volatile matter,	1.296	1.348
Fixed carbon,	89.352	91.291
Ash,	9.134	6.971
	<hr style="width: 50%; margin: 0 auto;"/> 100.00	<hr style="width: 50%; margin: 0 auto;"/> 100.00
Sulphur,	0.5946	0.566
Phosphorus,	0.0366	0.024

The first shipment of coke was made from this region in July, 1887. The total production to December 31, 1893, was 242,205 tons. The shipments by years have been as follows :

TABLE V.—*Statement Showing Total Shipments of Coke from All Ovens on the Line of the West Virginia Central and Pittsburgh Railway from July, 1887, when the First Coke was Made to December, 31, 1893.*

Year.	Thomas Ovens.	Coketon Ovens.	Douglas Ovens.	Custer Ovens.	Total Tons.
1887.....	2,211	.....	.....	.....	2,211
1888.....	5,432	.....	.....	.....	5,432
1889.....	12,657	.....	.....	.....	12,657
1890.....	7,409	48,208	.....	.....	55,617
1891.....	8,901	68,273	3,315	.....	80,489
1892.....	8,992	57,745	18,429	633	85,799
1893.....	.....	.....	.....	.....	84,186
	<hr style="width: 50%; margin: 0 auto;"/> 45,602	<hr style="width: 50%; margin: 0 auto;"/> 174,226	<hr style="width: 50%; margin: 0 auto;"/> 21,744	<hr style="width: 50%; margin: 0 auto;"/> 633	<hr style="width: 50%; margin: 0 auto;"/> 326,691

It is evident not only from the character of the coke and from its special adaptation to foundry and domestic uses, but from its nearness to tide-water and to markets, that the coke-industry in this region will have a prosperous future. The advantageous position of the mines to the trade, and the excellent quality of the coal, will enable both the coal and coke of this section to compete at all times with those produced in other districts.

Average of the Analysis of Colton Coals.

1882	1883	1884	1885	1886	1887
100.00	100.00	100.00	100.00	100.00	100.00
8.21	8.12	8.03	8.11	8.20	8.18
1.20	1.25	1.30	1.28	1.22	1.24
0.38	0.35	0.32	0.36	0.34	0.33

The first shipment of coals was made from this region in July 1887. The first production in December 31, 1882, was 2,217 tons. The shipments by years have been as follows:

Table V.—Statement Showing Total Shipments of Coals from the Mines on the Fire Clay and Water Works Coal-field, Colton, Kentucky, from July 1887 until the First of January 1893.

Year	Shipments in Tons	Shipments in Cords	Total Shipments
1887	2,217	.....	2,217
1888	2,121	.....	2,121
1889	2,257	.....	2,257
1890	7,102	.....	7,102
1891	8,301	.....	8,301
1892	8,922	.....	8,922
1893	.....	.....	.....
Total	42,920	.....	42,920

It is evident not only from the statement of the coals and from a general inspection of the field, but also from the fact that the region will have a permanent value. The advantages of the region in the matter of the rate and the excellent quality of the coal will enable both the coal and coke of this section to compete with those produced in other districts.

