ILLINOIS

COAL MINING INVESTIGATIONS

COOPERATIVE AGREEMENT

State Geological Survey
Engineering Experiment Station, University of Illinois
U. S. Bureau of Mines

BULLETIN 15

Coal Resources

OF

District VI

BY

GILBERT H. CADY

Field work by K. D. White, Fred H. Kay, and others

Printed by authority of the State of Illinois

STATE GEOLOGICAL SURVEY
UNIVERSITY OF ILLINOIS
URBANA
1916

The Forty-seventh General Assembly of the State of Illinois, with a view of conserving the lives of the mine workers and the mineral resources of the State, authorized an investigation of the coal resources and mining practices of Illinois by the Department of Mining Engineering of the University of Illinois and the State Geological Survey in cooperation with the United States Bureau of Mines. A cooperative agreement was approved by the Secretary of the Interior and by representatives of the State of Illinois.

The direction of this investigation is vested in the Director of the United States Bureau of Mines, the Director of the State Geological Survey, and the Head of the Department of Mining Engineering, University of Illinois, who jointly determine the methods to be employed in the conduct of the work and exercise general editorial supervision over the publication of the results, but each party to the agreement directs the work of its agents in carrying on the investigation thus mutually agreed on.

The reports of the investigation are issued in the form of bulletins, either by the State Geological Survey, the Department of Mining Engineering University of Illinois, or the United States Bureau of Mines. For copies of the bulletins issued by the State, and for information about the work, address Coal Mining Investigations, University of Illinois, Urbana, Ill. For bulletins issued by the United States Bureau of Mines, address Director, United States Bureau of Mines, Washington, D. C.

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COAL RESOURCES OF DISTRICT VI

By Gilbert H. Cady

CHAPTER I—INTRODUCTION

Definition and Importance of Area

District VI includes that part of Illinois lying east of the Duquoin anticline and of District VII[1] in which coal No. 6 (Herrin) is commercially the most important of the workable coal beds. East of this area is District V in which coal No. 5 (Harrisburg) is the most productive bed. The district under consideration is essentially coextensive with Williamson, Franklin, and Jefferson counties but does not include the southern tier of townships in Williamson County (fig. 1).

The coal resources of District VI are very great. The original tonnage of coal No. 6 alone is estimated to be 8,732,000,000 tons. Of this only 206,000,000 tons, or 2.35 per cent, have been mined. The amount of coal represented by 8,000,000,000 tons is equivalent to the total production of the United States to the end of 1910. This volume of coal would supply Illinois at the present rate of production and with the present proportion of recovery for about 40 years, and the entire United States between 5 and 10 years. No careful estimate of the amount of coal in the coal beds other than No. 6 has been attempted, but inasmuch as the total tonnage per foot for the entire area is 1⅓ billion it is not improbable that there is nearly as much coal available in the other beds as was originally available in No. 6 seam.

From this area come the much-advertised Franklin and Williamson county coals, known in the trade by various names adapted from towns and rivers within the district. Since July, 1911, Franklin and Williamson counties have led the State in county production; Williamson County during the fiscal years 1912, 1913, and 1914, and Franklin County during 1915. Coal No. 6 has been mined in Williamson County for about 50 years, and about 82,000,000 tons of this coal have been produced from this county since 1881. In Franklin County, however, the exploitation of coal No. 6 has taken place during the last twelve years. The first mine to operate this coal in Franklin County was opened in 1903 at Zeigler; since then 20 commercial mines have

[1]Kay, F. H., Coal resources of District VII: Illinois Coal Mining Investigations Bull. 11, 1915.

FIG. 1.—Map showing area covered in the report.

operated in the county with a total production of 33,119,962 tons.[2] It is indicative of the importance of the Franklin County field that fifteen out of the 18 mines operating in the county in 1915 each produced over 2,000,000 tons during the fiscal year. The coal is very deep in Jefferson County and possibly thinner than it is farther south, so that this part of the district has been but slightly exploited.

The following table shows the production of coal in District VI from 1881 to the end of June, 1915. The figures for annual production were taken from the reports of the State Mining Board; totals for Williamson and Jefferson counties from 1881 to 1907 were obtained from State Geological Survey Bulletin 16.[3]

TABLE 1.—*Production of coal in Franklin, Jefferson, and Williamson counties, 1881 to July, 1915*

Year	Franklin (Coal No. 6)	Jefferson[a]	Williamson		
			All coal	Coal No. 5	Coal No. 6
	Tons	*Tons*	*Tons*	*Tons*	*Tons*
1900	.....	.....	.....	5,685	.....
1901	.....	.....	.....	5,166	.....
1902	.....	.....	.....	4,180	.....
1903	.....	.....	.....	7,031	.....
1904	4,240	.....	.....	7,220	.....
1905	136,788	.....	.....	7,097	.....
1906	387,230	.....	.....	16,191	.....
1907	863,165	379,311[b]	29,881,544[b]	6,352	.....
1908	1,678,195	25,000	5,367,140	6,002	5,361,138
1909	2,442,978	18,600	5,869,757	16,871	5,852,886
1910	2,071,143	8,485	5,908,544	9,312	5,899,232
1911	2,356,439	10,708	5,212,749	5,750	5,206,999
1912	4,026,815	7,958	7,086,554	6,041	7,080,513
1913	5,232,526	35,619	7,709,110	8,546	7,700,564
1914	6,595,799	28,129	7,710,740	10,237	7,700,503
1915	7,324,644	19,646	7,216,188	9,970	7,206,218
Total	33,119,962	533,456	81,994,384	131,651	81,862,733
		Grand total:	115,247,802		

[a]Figures for Jefferson County after 1907 include production from coal No. 6 only.
[b]Total production from 1881 to 1907.

This report for District VI is one of a series of reports on the coal resources and on mining practice prepared by the State Geological Survey in cooperation with the Engineering Experiment Station of

[2]Coal reports of State Mining Board, 1904-1915.
[3]Bement, A., The Illinois coal field; Ill. State Geol. Survey Bull. 16, pp. 193 and 194, 1910.

TABLE 2.—*Shipping mines in Franklin, Jefferson, and Williamson counties, 1915*

Map No. and order of production	Name of present operator and dates of opening since 1902	Mine	Date of change of ownership	Former operator and mine	Location ¼	¼	Sec.	T.	S.	R.	E.	Surface elevation	Depth to coal	Altitude of top of coal	Average thickness	Production 1915
	Franklin County											*Feet*	*Feet*	*Feet*	*Ft.* *in.*	*Tons*
3	...., Bell & Zoller Coal Co.....	Zeigler	1910	Zeigler Coal Co.	SW	SE	13	7	1			411	417	—6	10 ..	653,490
11	1905, Benton Coal Co.....	No. 1 (Benton)		.....	NW	SW	19	6	3			477	625	—142	9 6	361,175
14	1914, Chicago, Wilmington & Franklin Coal Co.....	Orient	1914	Chicago, Wilmington & Vermilion Coal Co.	SE	SW	10	7	2			420	505	—85	.. ..	280,386
4	...., Christopher Coal Mining Co..	No. 1	1915	Zeigler District Colliery Co., North	NW	SW	24	6	1			446	507	—61	10 ..	572,397
9	...., Christopher Coal Mining Co..	No. 2	1915	Christopher Coal Mining Co., No. 1	SW	SW	14	6	1			...	...	...	.. ..	368,188
6	...., Franklin Coal & Coke Co...	No. 2 (South)	1914	Big Muddy Carterville Mining Co., No. 1	NW	SW	33	7	1			391	214	+177	8 11	468,361
18	...., Franklin Coal & Coke Co...	No. 1 (North or Mitchell)	1911	Big Muddy Carterville Mining Co., No. 2	SW	NW	28	7	1			412	307	—105	9 6	45,871
10	1908, Hart-Williams Coal Co.....	Hart-Williams	....	.....	NE	NE	30	6	3			471	621	—150	9 6	367,664
20	...., John A. Logan Coal Co.....	Hanaford	1915	Benton District Coal Co.	SE	SE	35	6	3			490	689	—199	.. ..	Idle
19	1916, Middle Fork Mining Co.....	Middle Fork	....	.....	NW	NW	21	6	3			...	...	...	.. ..	Not open
1	...., Old Ben Mining Corporation.	No. 8	1914	Ohio Valley Mng. Co.	NE	NE	25	7	2			400	440	—40	9 ..	858,365
8	1915, Old Ben Mining Corporation.	No. 9	....	.....	Cen. E. ½	SE	20	7	3			...	...	...	.. ..	377,427
17	...., Producers Coal Co.....	No. 18	1915	Dering Coal Co., No. 18	SE	SE	8	7	3			404	504	—100	8 1	178,565
15	...., Producers Coal Co.....	No. 19	1915	Dering Coal Co., No. 11	SE	SW	18	7	3			388	499	—102	10 ..	258,502
13	1907, William P. Rend Collieries Co.	No. 1	....	.....	SW	NE	4	6	2			421	571	—150	8 9	337,859
5	...., Sesser Coal Co.....	Sesser	1911	Franklin County Colliery Co., No. 1	SW	NE	19	5	2			...	...	—251	8 6	568,254
16	...., Taylor Mining Co.....	Possum Ridge	1915	Southern Ill. Coal & Coke Co., P. R.	SW	SW	33	7	2			400	338	+62	.. ..	175,510
12	1907, United Coal Mining Co.....	No. 1 (East)	....	.....	NW	NW	30	6	2			416	490	—74	9 3	360,629
2	1912, United Coal Mining Co.....	No. 2 (Buckner)	....	.....	SE	SE	20	6	2			...	...	...	.. ..	712,647
7	1911, West Frankfort Coal Co....	West	....	.....	NE	SW	24	7	2			...	...	...	.. ..	379,354
	Jefferson County															
1	...., Mt. Vernon Coal Co.....		1912	Roland Coal Mining Co.	SW	NE	32	2	3			464	860	—396	4 6	19,646

	Williamson County													
10	...., Big Muddy Coal & Iron Co..	No. 7	....	.....	SW	SE	20	8	2	411	139	+272	9 ..	283,895
2	1905, Big Muddy Coal & Iron Co..	No. 8	....	.....	NE	SW	14	8	1	398	160	+238	9 ..	527,324
22	...., Big Muddy Fuel Co.....	New Virginia	1910	Consumers Coal Co.	NE	SE	25	8	2	423	119	+304	9 ..	177.425
27	1903, Carterville & Big Muddy Fuel Co.	John	....	.....	NE	NW	33	8	1	459	71	+388	9 6	15,052
23	1904, Carterville & Herrin Coal Co.	Jeffrey	....	.....	SE	SW	22	8	2	410	134	+276	9 ..	167,304
16	1905, Carterville Coal Co.....	Burr "C"	....	.....	SE	SW	34	8	1	460	90	+370	9 4	203,335
19	...., Chicago & Big Muddy Coal & Coke Co.	No. 1	....	.....	NE	NW	2	9	2	485	103	+382	8 ..	190,051
6	...., Chicago & Carterville Coal Co	"A" (No. 1)	....	.....	SW	NW	19	8	2	405	177	+228	9 ..	405,978
28	1907, Chicago & Carterville Coal Co.	"B"	....	.....	NE	NW	17	8	2	384	247	+137	.. ..	9,413
11	...., Consolidated Coal Co. of St. Louis	Lake Creek	1913	Big Muddy Consolidated Coal Co., Lake Creek	SW	NE	18	8	3	456	314	+142	.. ..	267,609
15	1906, Hafer Washed Coal Co.....	No. 3	....	.....	NW	NE	36	8	1	455	111	+344	8 ..	208,672
1	...., Johnston City Coal Co.....	West (No. 1)	1908	Johnston City & Big Muddy Coal Co., West	NE	NW	24	8	2	408	210	+198	8 6	623,733
8	...., Madison Coal Corporation...	No. 8	1906	St. Louis & Big Muddy Coal Co., Dewmaine (Daws)	NW	NW	35	8	1	412	91	+321	9 ..	339,776
4	...., Madison Coal Corporation...	No. 9	1906	Colp Coal Co.	NW	SE	22	8	1	395	111	+284	8 10	456,939
25	1914, New Enterprise Coal Co....	.....	....	.....	....	...	4	9	2	...	...	...	.. ..	78,248
3	...., Peabody Coal Co.....	No. 3	1905	Southern Ill. Coal Mining & Washing Co., No. 3	SW	NW	1	9	2	503	105	+398	9 ..	492,539
20	1909, Pond Creek Mining (Coal?) Co.	Pond Creek	....	.....	NE	SW	5	8	2	386	237	+149	.. ..	183,893
5	1909, W. P. Rend Coal & Coke Co.	No. 2	....	.....	NE	NW	1	8	1	394	190	+204	9 10	423,996
	~~*Franklin County*~~													
26	1904, St. Louis & Carterville Coal Co.	Dale (Walnut Ridge 1904 to 1909)	....	.....	SE	SW	29	8	2	429	92	+337	8 7	63,552
21	1908, Scranton & Big Muddy Coal Mining Co.	Scranton	....	.....	SE	SW	33	8	3	481	154	+319	7 ..	181,614
7	...., E. C. Searles, receiver.....	McClintock	1912	Standard Collieries Co., No. 2	SW	NE	19	8	3	427	261	+166	9 ..	350,576

TABLE 2.—*Shipping mines in Franklin, Jefferson, and Williamson counties, 1915*—Concluded.

Map No. and order of production	Name of present operator and dates of opening since 1902	Mine	Date of change of ownership	Former operator and mine	Location					Surface elevation	Depth to coal	Altitude of top of coal	Average thickness		Production 1915
					¼	¼	Sec.	T.	S.R.E.						
	Franklin County									*Feet*	*Feet*		*Ft.*	*in.*	*Tons*
9	...., Sunnyside Coal Co.....	Sunnyside	....	.....	N.	½	25	8	1	413	150	+263	9	..	298,738
18	...., Taylor Mining Co.....	Energy No. 1	1915	Carterville Mining Co., No. 1	SE	NW	32	8	2	446	48	+398	9	6	197,875
14	...., Taylor Mining Co.....	Energy No. 2	1915	Carterville Mining Co., No. 2	SW	NE	31	8	2	468	131	+337	9	9	234,730
29	...., Taylor Mining Co.....	Walnut Ridge	1915	Southern Ill. Coal & Coke Co., Hemlock	SE	SW	30	8	2	433	141	+292	9	..	2,429
24	1906, Watson Coal Co.....	No. 2	....	.....	SE	SE	34	8	2	470	61	+409	9	..	84,057
13	1904, Western Coal & Mining Co..	Bush No. 1	....	.....	NE	NE	7	8	1	409	110	+299	8	6	253,452
12	1907, West Virginia Coal Co.....	Ideal No. 1 (W. Virginia)	....	.....	SW	NE	5	9	3	491	108	+383	8	..	258,541
17	...., Williamson County Coal Co..	Black Briar	....	.....	SE	SE	24	8	2	409	163	+246	9	4	201,239

the University of Illinois and with the U. S. Bureau of Mines. The districts examined and the scope of the Investigations are defined in Bulletin 1, *A Preliminary Report on Organization and Method of Investigations.*

Table 2 is a list of mines in District VI giving data regarding the location of mines, the depth and altitude of coal, and the production.

Acknowledgments

The material comprising this report represents a compilation of data from various sources. A large part of the area in Williamson and Franklin counties has been surveyed in detail by members of the State Geological Survey in cooperation with the U. S. Geological Survey in preparation for reports for publication as folios of the geological atlas of the U. S. Geological Survey. Much use has been made of the text and maps in the Murphysboro-Herrin folio by E. W. Shaw and T. E. Savage, and of the manuscript and maps of the unpublished West Frankfort-Galatia folio by E. W. Shaw and G. H. Cady.

The excellent notes of Messrs. K. D. White and F. H. Kay, taken in 1912 in the mines selected for field observation under the cooperative agreement, have been of especial assistance. Use has also been made of the field notes of Messrs. T. E. Savage, F. F. Grout, W. F. Wheeler, F. W. DeWolf, J. M. Webb, M. L. Nebel, C. W. Smith, T. E. McDonald, H. L. Stafford, and others.

As commonly throughout the coal field, there has been kindly cooperation with the work of the Survey on the part of mining men. Much of our information in regard to the district is based upon drilling records made available for study, and mines have been opened freely to the members of the Investigation. One of the companies has furnished excellent underground photographs for which due acknowledgment will be made.

In the preparation of the report the writer is especially indebted to the director, Mr. Frank W. DeWolf, and to Mr. F. H. Kay for helpful suggestions, and to Mr. W. S. Nelson for aid in preparation of diagrams and sketches.

Geography and Topography

District VI occupies nearly all of 36 townships in Williamson, Franklin, and Jefferson counties. The area is approximately rectangular in outline and lies in the south-central part of the State. Because of its importance as a coal field the area is served by numerous

railroads of which the Chicago and Eastern Illinois Railroad, the Illinois Central Railroad, the Louisville and Nashville Railroad, and the Chicago, Burlington, and Quincy Railroad are the most important. Of the towns in the area, Mount Vernon in Jefferson County; Benton and West Frankfort in Franklin County; and Carterville, Herrin, and Johnston City in Williamson County are among the largest. Marion, the county seat of Williamson County, is located about a mile south of the outcrop of coal No. 6, so that its northern environs lie within the district.

Except for the northeastern part of Franklin County and the eastern part of Jefferson County, the area lies within the drainage basin of Big Muddy River; the rest of the district is drained by tributaries of Saline River. Below an elevation of about 520 feet above sea level the streams are bordered by wide plains believed to represent the floor of broad lake-like expanses of water known as Lake Muddy which extended up the valleys in southern Illinois and which were due to the silting up of the Mississippi in one of the later epochs of the glacial period.[4] Above these lake flats at an elevation of about 600 feet above sea level is the till plain formed in the Illinoian stage of the glacial period. The continuity of this plain is interrupted by numerous valleys and by occasional hills, commonly only thinly covered with glacial drift, which rise to an elevation rarely exceeding 700 feet above sea level.

The Illinoian till plain terminates at the southern border of the district at the outcrop of coal No. 6 and the overlying limestone. The coal and limestone commonly mark the crest of a low escarpment which faces a lowland lying to the south. This escarpment can be traced eastward from near Carterville to Harrisburg in Saline County, and its position is indicated approximately by the outcrop of the coal.

Surficial Deposits

Glaciation in District VI

The preglacial topography of District VI has been modified by deposits made directly from the ice, which underlie the till plains, and by deposits made in lakes and streams by which the older valleys were filled to their present height. The Illinoian glacial till which mantles almost the whole of the area except the stream valleys consists of "an intimate mixture of clay and more or less decayed pebbles and bowlders of many kinds of rock. The till has a rather uniform thickness,

[4]Shaw, E. W., and Savage T. E., U. S. Geol. Survey Geol. Atlas, Murphysboro-Herrin folio (No. 185) p. 12, 1912.

which averages about 15 feet."[5] Very locally the till is 100 feet or more in thickness, but so excessive a thickness is apparently very rare. In general, the glacial till has no appreciable bearing on mining operations in this district except that it obscures outcrops of the country rock; the valley fill, however, presents an important problem to be discussed under the following heading.

LAKE MUDDY

The accompanying map (fig. 2), based on the investigations of Mr. E. W. Shaw of the U. S. Geological Survey, shows the area of

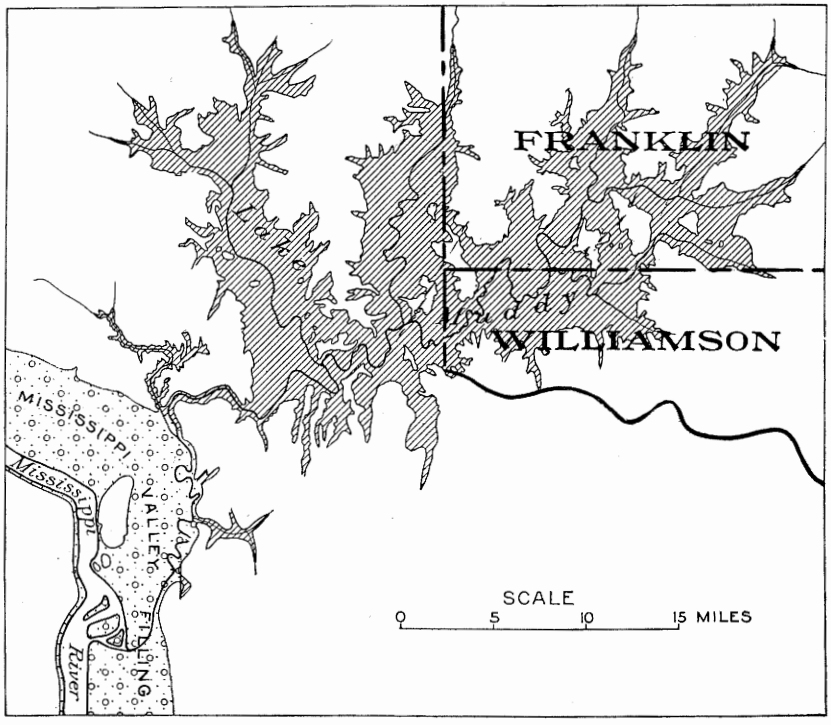

FIG. 2.—Map of Lake Muddy showing boundaries of District VI.

Lake Muddy and those parts of the lake lying within District VI. Deposits in this lake basin reach a depth of 100 feet. "Nearly all the material deposited in the lakes was fine sediment such as would be carried in suspension, and the lakes seem to have been filled with this material up to certain concordant positions, which were probably

[5]Idem, p. 8.

the natural positions of flood plains, or just below the high-water marks of the time."[6] Locally the lake deposits contain beds of gravel and are very porous.

It is not improbable that where the streams flow across the lake beds a large part of the drainage of the area is underground, the gravels and sands being rather abundant aquifers. For this reason shaft sinking on the valley flats is commonly preceded by drilling to bed rock to determine the thickness of the fill and the presence or absence of undesirable water-bearing gravels. The presence of water in mines in this district is due commonly to leakage from overlying gravel either down the shaft or along breaks in the roof. The "Coal Measures" themselves are for the most part dry.

VALLEY FILL

The character and thickness of the valley fill along Big Muddy River and its tributaries is shown in the accompanying sections, all but the first being based upon drilling records.

Section of Pleistocene materials exposed in the SW. 1/4 SW. 1/4 sec. 33, T. 7 S., R. 1 E.[a]

		Thickness *Feet*
5.	Clay, greenish gray, lime concretions (later fill)	20
4.	Clay, light yellowish (loess)	6
3.	Sand and gravel, stratified (earlier fill)	7
2.	Gravel and clay, unassorted, light-yellowish gray (Illinoian till)	5
1.	Gravel and clay, unassorted, dark-bluish gray (Illinoian till?)	9

[a]Idem, p. 9.

The following are sections of the surface deposits at various places in the West Frankfort quadrangle.[7]

Section from the prairie lying east of West Frankfort

		Thickness		Depth	
		Ft.	*in.*	*Ft.*	*in.*
4.	Surface	16	..	16	..
3.	Sand and gravel	17	..	33	..
2.	Limestone (?), blue	..	6	33	6
1.	Mud, blue, and sticks	24	6	58	..

[6]Idem, p. 12.

[7]Cady, G. H., Geology of the West Frankfort quadrangle: Ill. State Geol. Survey Bull. 16, p. 250, 1910.

Three sections southwest of West Frankfort along Pond Creek

		Thickness	Depth	Thickness	Depth	Thickness	Depth
		Feet	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*
3.	Surface	7	7	12	12	33	33
2.	Sand, yellow	14	21	4	16	2	35
1.	Clay, yellow and blue	36	57	41	57	17	52

Section from Williamson County along Lake and Pond creeks

		Thickness	Depth
		Feet	*Feet*
5.	Clay, yellow (hard pan)	15	15
4.	Clay, sandy, yellow	10	25
3.	Clay, blue	6	31
2.	Clay, blue, and sand	10	41
1.	Sand, yellow, and drift logs	41	82

Table 3 shows the thickness of the surficial material encountered in various places in the district mainly within the area of Lake Big Muddy, as shown in figure 2.

TABLE 3.— *Thickness of the surficial deposits in Franklin and Williamson counties*

Location			Thickness	Location			Thickness
Sec.	T. S.	R. E.		Sec.	T. S.	R. E.	
Franklin County			*Feet*				*Feet*
3	6	1	22	8	7	3	60, 70
6	6	1	24	10	7	3	12
10	6	1	16	13	7	3	45
12	6	1	26	17	7	3	41
16	6	1	19	19	7	3	55
22	6	1	20	21	7	3	24, 27
24	6	1	9	23	7	3	15
29	6	1	27	24	7	3	5
35	6	1	39	27	7	3	16
7	6	2	45	28	7	3	79
8	6	2	31	29	7	3	59
9	6	2	16	35	7	3	29
14	6	2	32	*Williamson County*			
17	6	2	31	1	8	1	38
19	6	2	25	3	8	1	88
30	6	2	26	6	8	1	17
33	6	2	65, 75	7	8	1	93
7	7	1	38	8	8	1	74
13	7	1	15	10	8	1	56, 74, 88
14	7	1	20, 55	12	8	1	60, 74
15	7	1	22	13	8	1	70
22	7	1	30	14	8	1	91
24	7	1	32	18	8	1	84
25	7	1	41, 67	19	8	1	37, 69, 73, 74
26	7	1	64, 71	20	8	1	71
27	7	1	66	25	8	1	5 ?
28	7	1	52	28	8	1	9
29	7	1	24	29	8	1	30, 40, 62, 78
30	7	1	40	30	8	1	19, 34, 52, 84
32	7	1	8	2	8	2	82
4	7	2	73, 79, 83	3	8	2	76
5	7	2	68, 67	4	8	2	103 ?
6	7	2	27	5	8	2	68, 85
7	7	2	20	7	8	2	100
8	7	2	19, 43, 73	10	8	2	77
10	7	2	69, 100, 132	13	8	2	16
12	7	2	72	15	8	2	72, 76
13	7	2	56	17	8	2	92
15	7	2	86	19	8	2	27
16	7	2	56, 70	20	8	2	26, 35
20	7	2	68	21	8	2	25
24	7	2	75	23	8	2	51
25	7	2	82	25	8	2	40
27	7	2	80	27	8	2	25, 65
29	7	2	9	28	8	2	36, 57, 60
31	7	2	68	29	8	2	25, 27
33	7	2	71	30	8	2	33, 50
35	7	2	21	33	8	2	20-46
2	7	3	13	35	8	2	23
4	7	3	8	36	8	2	5, 13½

CHAPTER II—GENERAL GEOLOGIC RELATIONS IN DISTRICT VI

General Description

The Pennsylvanian series ("Coal Measures"), which contains all the known coal beds of the State, underlies the entire area. The series rests unconformably upon the Mississippian rocks, and is overlain by unconsolidated alluvium or glacial till as already described. The relationships are similar in all respects to those that obtain in District VII.[1] The rocks which make up the Illinois "Coal Measures" consist of series of sandstones and shales of different thicknesses and minor amounts of coal, clay, and limestone. A total thickness of about 2,000 feet is known in the southeast part of the State, to the north the series is thinner, and in this district between 1,400 and 1,500 feet are known.

Except possibly for a small part of the Pennsylvanian section, the succession of strata in District VI is in general the same as that found west of the Duquoin anticline in District VII. Sandstones and shales found in one district are similar in character and thickness to those found in the other, and the same persistent limestone and coal beds have a widespread distribution in both areas. It seems probable that a thicker series of clastics lies between coal No. 6 (Herrin) and its overlying *Fusulina* limestone in an area adjacent to and east of the Duquoin anticline than is commonly found in District VII, but other parts of the sections are similar.

The Illinois "Coal Measures" are divided into three formations all of which are represented in District VI. In ascending order these are the Pottsville formation, the Carbondale formation, and the McLeansboro formation. The Pottsville includes that part of the Pennsylvanian series which lies below coal No. 2 (Murphysboro or La Salle), the Carbondale is represented by the portion between the base of coal No. 2 and the top of coal No. 6 (Herrin or Belleville), and the McLeansboro formation includes all the "Coal Measures" lying above coal No. 6.

Pottsville Formation

The knowledge of the Pottsville is based almost entirely upon the records of drilling within the Herrin and the West Frankfort quad-

[1]Kay, F. H., Coal resources of District VII: Ill. Coal Mining Investigations Bull. 11, 1915.

rangles (Pl. I). In other areas the Pottsville is known to rest upon an uneven surface of Mississippian strata and hence to be of variable thickness. The same conditions apparently hold in this district and lithologically the formation has the same characteristics as elsewhere.

The Pottsville of southern Illinois is mainly a sandstone formation. The seven sandstone horizons described by Shaw and Savage[2] in the Murphysboro-Herrin folio may possibly be united farther eastward into three heavy beds, but there seems to be much variation even in this succession. The formation is characteristically lacking in limestone, but thin beds which are probably lenticular are found near the top at some places. Not uncommonly in the lower 200 feet is a coal bed 2 to 3 feet in thickness, and another bed is found in some of the drill holes near the top of the formation. Shaw and Savage mention a persistent 10-inch coal within the Pottsville 40 to 70 feet below coal No. 2. So far as known none of the Pottsville strata underlying this area is of economic importance.

The Pottsville formation has been penetrated at fewer than ten places within the district. It is evident, however, from these that the thickness varies considerably from place to place. On the west side of the Herrin quadrangle about 5 miles west of the Williamson County line 670 feet of Pottsville have been noted. At Creal Springs a few miles south of the area the record of an oil prospect shows 630 feet of probable Pottsville. About 400 feet of the rock encountered in the deep city well at Herrin has been interpreted as Pottsville. In the west part of Saline County within the Galatia quadrangle about 450 feet of Pottsville are known, but this possibly does not represent the total thickness. The formation thins toward the north, 300 feet having been encountered at Mount Vernon.

In most drill records the base of the Pottsville can be placed at the first limestone after the drill has passed through all the main coal beds and has been working for some distance in a series composed mostly of sandstones and conglomerates. The top of the formation is difficult to identify where coal No. 2 is absent, and the base is impossible to determine where the upper Mississippian (Chester) limestone has been eroded leaving clastic material at the top of the formation underlying the clastics of the Pottsville.

From collections of fossils made from the shale of the Pottsville formation in the Murphysboro quadrangle and elsewhere, David White is able to say that the rocks between the top of the Chester group of the Mississippian series and coal No. 2 are to be correlated with the Pottsville formation of Pennsylvania.

[2]Shaw, E. W. and Savage, T. E., U. S. Geol. Survey Geol. Atlas, Murphysboro-Herrin folio (No. 185), p. 6, 1912.

CARBONDALE FORMATION

STRATIGRAPHY

Most of the drill holes which penetrate to coal No. 2 within the district are located within the boundaries of the Herrin and of the West Frankfort quadrangles. The investigations within these areas have yielded a general knowledge of the Carbondale formation.

Shaw and Savage state in the Murphysboro-Herrin folio that the formation ranges in thickness from 250 to 300 feet, and that below the persistent coal No. 6, which lies at the top of the formation, it is composed of shale and sandstone with several thin layers of limestone and beds of coal. "The shale, which is poorly laminated and claylike, ranges in color from dark to light gray. The sandstone is generally loosely cemented, and rather micaceous, though one or two of the beds are firmly cemented by calcium carbonate. The limestone is hard, gray or bluish gray, and more or less fossiliferous. Some of it has a peculiar brecciated or conglomeratic appearance.[3] In the section are five persistent beds of coal: (1) coal No. 2 (Murphysboro or La Salle) at the base, (2) a bed 6 to 28 inches thick about 55 feet above coal No. 2, (3) a 2-foot bed 135 feet above coal No. 2, (4) coal No. 5 (Harrisburg or Springfield) 35 to 40 feet below the top of the formation, and (5) coal No. 6 (Herrin or Belleville).

In the West Frankfort quadrangle the Carbondale formation varies in thickness from 275 to 350 feet; east of the district in Saline County the formation is still thicker, varying from 350 to 400 feet; farther east it becomes thinner. The strata in the West Frankfort district are similar to those found in the Herrin quadrangle except that in addition to the five persistent beds of coal found in that area two other lenticular beds are also present. The coal beds known are (1) coal No. 2 at the base, (2) a thin lenticular bed 40 to 60 feet above the coal No. 2, (3) a 1-foot lenticular bed 100 to 110 feet below coal No. 5, (4) a persistent bed 2 to 5 feet in thickness about 70 feet below coal No. 5, (5) coal No. 5, (6) a thin coal or a group of thin coals midway between coal No. 5 and coal No. 6, and (7) coal No. 6. Of these beds only coals No. 5 and No. 6 are known to be of economic importance in District VI. It is not improbable, however, that some time the lower beds will be exploited, especially in the southern part of the area where they approach the surface. The coals of this formation will be described in considerable detail in the chapter on economic geology.

[3] Shaw, E. W. and Savage, T. E., U. S. Geol. Survey Geol. Atlas, Murphysboro-Herrin (No. 185), p. 6, 1912.

The stratigraphic sequence in the Carbondale formation in the southern part of the area is shown by the graphic sections in Plate I. The logs are arranged in order from west to east, and the position of each drill hole is projected upon a line running from the northwest to the southeast across the area as is shown in small sketch map on the plate. The confidential character of some of the logs makes it impossible to give a more definite location of the holes.

The following record of a drill hole in the NE. cor. SE. ¼ sec. 6, T. 9 S., R. 4 E., was compiled from the drill core by members of the Survey. This core was the source of our most accurate information as to the character of the Carbondale formation in the district. The drill penetrated 241 feet of McLeansboro formation and 334 feet of the Carbondale strata, but probably did not reach the bottom of the latter formation.

Log of diamond-drill boring through lower part of McLeansboro formation and upper part of Carbondale formation, NE. cor. SE. ¼ sec. 6, T. 9 S., R. 4 E.

Description of strata	Thickness		Depth	
	Ft.	*in.*	*Ft.*	*in.*
Recent and Pleistocene series	30	..	30	..
Pennsylvanian series—				
McLeansboro formation—				
Shale with sandstone partings	1	..	31	..
Shale with sandstone partings	18	..	49	..
Shale, light gray	4	..	53	..
Shale, dark gray; upper 2 feet inclined to be fissile. Contains fossiliferous limestone nodules	5	..	58	..
Coal	..	2	58	2
Shale, light gray	1	10	60	..
Limestone, nodular, impure	3	..	63	..
Shale with sandstone partings	18	..	81	..
Shale, dark, slightly sandy	4	..	85	..
Shale, dark, with occasional sandstone parting; black toward the bottom	5	8	90	8
Shale, black, to cannel coal	..	4	91	..
Shale, black	2	..	93	..
Coal	1	..	94	..
Clay	2	2	96	2
Shale, gray	2	6	98	8
Limestone	1	..	99	8
Shale, sandy, with sandstone partings	16	4	116	..
Shale, gray, with little sand	5	..	121	..
Shale, gray	9	..	130	..

Description of strata	Thickness		Depth	
	Ft.	*in.*	*Ft.*	*in.*
Shale, dark; in places black with little brown nodules	9	..	139	..
Limestone, light gray, hard, and fine grained; *Productus nebrascensis* Owen (?), *Chonetes verneuilanus* N & P., and *Dielasma bovidens* Morton (?)	2	6	141	6
Shale, greenish	..	6	142	..
Shale, dark	1	..	143	..
Shale, gray	1	..	144	..
Coal	1	2	145	2
Shale, greenish black	4	10	150	..
Shale, gray	3	..	153	..
Shale, dark	5	..	158	..
Sandstone	2	..	160	..
Shale, dark, hard, sandy	4	..	164	..
Sandstone, dark to gray	4	6	168	6
Shale, dark, numerous plant impressions	1	8	170	2
Coal	..	2	170	4
Shale, black, fine grained	1	..	171	4
Sandstone, dark, shaly	2	..	173	4
Sandstone, gray, hard	3	6	176	10
Sandstone, gray, shaly	1	6	178	4
Shale, gray, sandy in upper part	..	8	179	..
Sandstone, gray, hard	7	..	186	..
Shale, dark, sandy	4	..	190	..
Sandstone, dark, fine grained, micaceous	17	6	207	6
Sandstone, gray, coarse grained	3	9	211	3
Sandstone, dark, micaceous	1	9	213	..
Shale, black fine grained; *Ambocoelia planoconvexa* Shumard, and *Chonetes mesolubus* N. and P.	..	8	214	8
Shale, dark, hard, calcareous; *Squamularia perplexa* McC.	2	..	216	8
Shale, black, fine grained; *Lingula umbonata* Cox	..	4	217	..
Coal	..	2	217	2
Shale, black; *Derbya crassa* M. & H. and crinoid stems	..	6	217	8
Shale, dark, fine grained, slightly micaceous	3	..	220	8
Shale, dark, fine grained, micaceous	..	6	221	2

Description of strata	Thickness		Depth	
	Ft.	*in.*	*Ft.*	*in.*
Sandstone, gray, coarse, micaceous	..	6	221	8
Shale, dark, micaceous, somewhat sandy	3	6	225	2
Sandstone, gray, micaceous	1	..	226	2
Shale, dark, fine grained, micaceous	2	..	228	2
Shale, black, fine; *Pleurotomaria ? carbonaria* N. & P. and *Aviculopecten rectalaterarius* Cox	3	3	331	5
Shale, dark, fine grained	..	..	...	..
Carbondale formation—				
Coal (No. 6) thickness confidential	..	..	...	..
Sandstone, gray, coarse	1	..	247	7
Shale, dark, sandy	3	6	251	1
Coal	..	6	251	7
Shale, dark calcareous, *Ambocoelia planoconvexa* Shumard, *Spiriferina kentuckiensis* Shumard, and crinoid segments	1	6	253	1
Sandstone, dark, shaly, micaceous; *Lingula umbonata* Cox, *Aviculopecten rectalaterarius* Cox, and plant remains	6	..	259	1
Coal	..	2	259	3
Shale, black	..	3	259	6
Coal	..	4	259	10
Shale, black	..	6	260	4
Coal	..	6	260	10
Shale, black, calcareous; *Ambocoelia planoconvexa* Shumard and *Spiriferina kentuckiensis* Shumard	1	6	262	4
Sandstone, dark, shaly, fine, micaceous	4	6	266	10
Sandstone, gray to dark, shaly, micaceous	15	..	281	10
Shale, dark, calcareous; *Chonetes verneuilanus* N. & P. and *Squamularia perplexa* McChesney	2	8	284	6
Shale, black, fine	2	6	287	..
Sandstone, hard, fine, shaly, micaceous	31	8	318	8
Shale, dark; clay	..	9	319	5
Coal (No.5), thickness confidential	..	..	...	..
Shale, dark gray; clay	..	..	...	..
Sandstone, gray, fine grained	11	..	336	10

Description of strata	Thickness		Depth	
	Ft.	*in.*	*Ft.*	*in.*
Shale, dark, fine grained, sandy..	6	..	342	10
Sandstone, gray to drab, very fine, shaly	2	6	345	4
Sandstone, dark, fine, sandy.....	2	6	347	10
Sandstone, dark, fine, hard, micaceous	25	..	372	10
Sandstone gray to dark, fine, shaly, micaceous	20	6	393	4
Coal (No. 4 ?).....	2	..	395	4
Shale, black, hard.....	4	6	399	10
Shale, drab, sandy.....	2	..	401	10
Sandstone, gray, fine, micaceous..	1	6	403	4
Sandstone, gray	6	..	409	4
Sandstone, dark, somewhat conglomeratic	2	..	411	4
Sandstone, gray	3	..	414	4
Sandstone, dark, fine, hard, shaly	16	3	430	7
Shale, dark	..	6	431	1
Coal	..	8	431	9
Shale, dark, sandy.....	7	8	439	5
Sandstone, dark, shaly.....	1	6	440	11
Sandstone, dark gray, micaceous..	7	..	447	11
Sandstone, dark, hard, micaceous	2	..	449	11
Coal	..	6	451	5
Shale, black, micaceous, sandy; *Orbiculoidea missouriensis* Shumard, *Marginifera muricata* N. & P., and *Aviculopecten rectalaterarius* Cox.....	1	2	452	7
Sandstone, gray, hard, coarse, micaceous	3	4	455	11
Sandstone, dark, hard, micaceous.	7	8	463	7
Sandstone, dark, slightly micaceous	5	..	468	7
Sandstone, dark, fine, shaly, micaceous	21	6	490	1
Shale, dark; *Lophophyllum profundum* M-E. & H., *Chonetes mesolobus* N. & P., *Aviculopecten rectalaterarius* Cox,and crinoid stems	1	8	491	9
Shale, dark, fine, micaceous.....	2	6	494	3
Sandstone, dark, fine, micaceous, shaly; *Lingula umbonata* Cox and *Aviculopecten rectalaterarius* Cox	10	3	504	6

CORRELATION

From a study of the fossil plants found in the coal seams and associated strata in the State, David White concludes that coal No. 2 is the lowest coal bed in Illinois that falls within the time interval of the Allegheny formation of Pennsylvania. He also concludes that coal No. 6 may be of Freeport age, possibly as high in the stratigraphic column as the Upper Freeport coal, which is the uppermost layer of the Allegheny formation in the Appalachian region. From these correlations it will be seen that the Carbondale formation corresponds in a general way to the Allegheny formation of the Appalachian coal basin.

McLeansboro Formation

GENERAL DESCRIPTION AND CORRELATION

The McLeansboro formation includes all the "Coal Measures" rocks above coal No. 6. It takes its name from McLeansboro, Hamilton County, Illinois, where borings have penetrated it to a depth of one thousand feet. It underlies the entire region north of the outcrop of coal No. 6 and in most places is covered by glacial drift.

The formation consists of several distinctive beds of shale and a minor amount of sandstone, limestone, and coal. Although several of the coals above No. 6 are persistent, none has been found sufficiently thick to be of commercial value. They are significant only as correlation horizons. In its barrenness of productive coals and in general age, the McLeansboro is similar to the Conemaugh formation of Pennsylvania.

The following record, reproduced graphically in Plate II shows the character of the strata of the McLeansboro formation for nearly its maximum known thickness in this district. The thickness of coal No. 6 has been obscured in the record at the request of the operators. A single hole located in Jefferson County, the log of which is also reproduced in Plate II, reached coal No. 6 through a greater thickness of the McLeansboro strata. The third record graphically shown in the same plate is that of a well in Shelby County in which all the formation units typical of both District VI and District VII were found. This record has served as a basis of comparison of the many records available in this district, and is thought to be very typical of the southern Illinois McLeansboro section from the New Haven limestone to the base of the formation.

Drill record of the McLeansboro formation in Stephens No. 1 hole SE. cor. sec. 35, T. 5 S., R. 4 E.
(Plate II, No. 4)

Description of strata	Thickness		Depth	
	Ft.	*in.*	*Ft.*	*in.*
Soil	1	..	1	..
Clay, yellow	9	..	10	..
Sandstone, brown	27	..	37	..
Sandstone, gray	10	..	47	..
Shale, soft, blue	4	..	51	..
Limestone	1	..	52	..
Limestone, sandy	3	..	55	..
Shale, gray, sandy	115	..	180	..
Shale, gray	30	..	210	..
Shale with fossils	1	..	211	..
Coal, good core	1	..	212	..
Shale, gray, soft	8	..	220	..
Shale, gray, sandy, with limestone	3	..	223	..
Sandstone	10	..	233	..
Sandstone with shale partings	12	..	245	..
Shale, dark, gray	4	..	249	..
Limestone, gray	1	..	250	..
Shale, dark blue	1	..	251	..
Limestone, gray	1	..	252	..
Shale, dark blue	4	..	256	..
Coal	..	8	256	8
Shale, sand	53	4	311	..
Shale, dark	4	..	315	..
Sandstone	12	..	327	..
Sandstone with thin coal partings	24	..	351	..
Shale, blue	2	..	353	..
Sandstone	3	..	356	..
Limestone	1	6	357	6
Shale, dark blue, very tough	9	6	367	..
Limestone, gray	3	..	370	..
Shale, dark	10	..	380	..
Limestone	10	..	390	..
Shale, gray, soft	4	..	394	..
Shale, gray, lime fossils	17	..	411	..
Shale, gray	36	..	447	..
Shale, gray, sandy	45	..	492	..
Shale, blue	22	..	514	..
Shale, black	2	..	516	..
Shale, black	2	..	518	..
Limestone	1	..	519	..
Shale, dark blue	1	..	520	..
Shale, gray	3	..	523	..
Shale, gray, with limestone spots	2	..	525	..
Shale, gray, sandy	9	..	534	..
Sandstone	64	..	598	..

Description of strata	Thickness		Depth	
	Ft.	*in.*	*Ft.*	*in.*
Sandstone, shaly	22	..	620	..
Limestone, sandy	3	..	623	..
Sandstone, shaly	3	..	626	..
Shale, blue, tough	24	..	650	..
Sandstone, shaly	59	..	709	..
Sandstone	16	6	725	6
Sandstone with coal partings	..	6	726	..
Sandstone	6	..	732	..
Coal	..	½	732	½
Shale, blue	31	11½	764	..
Shale, dark blue	4	6	768	6
Coal	..	1	768	7
Shale, gray, with hard brown spots	14	5	783	..
Shale, black, with hard bands	12	..	795	..
Shale, carbonized	1	..	796	..
Shale, blue	1	..	797	..
Shale, carbonized	1	..	798	..
Coal (pretty core)	1	..	799	..
Shale, gray	3	..	802	..
Shale, gray, sandy	9	..	811	..
Shale, gray, sandy, with lime spots	6	..	817	..
Shale, blue	4	6	821	6
Shale, blue, with coal partings	..	6	822	..
Shale, blue	2	..	824	..
Limestone	3	..	827	..
Sandstone, shaly	10	10	837	10
Coal	2	2	840	..
Shale, light gray	9	..	849	..
Shale, sandy gray	1	..	850	..
Sandstone	4	..	854	..
Shale, dark gray	2	..	856	..
Coal	..	1	856	1
Shale, gray	3	11	860	..
Limestone, broken	2	..	862	..
Shale, gray, with lime spars	5	..	867	..
Shale, sandy gray	14	..	881	..
Sandstone	3	..	884	..
Shale, sandy	6	..	890	..
Shale, gray, sandy	11	..	901	..
Shale, blue, with brown bands	2	6	903	6
Limestone, blue	..	6	904	..
Shale, black	1	..	905	..
Limestone, blue	..	4	905	4
Shale, gray	3	8	909	..
Shale, blue	5	..	914	..
Shale, dark blue	1	6	915	6
Coal (Herrin or No. 6) thickness confidential	..	..	...	..
Fire clay	..	..	...	..

DISTINCTIVE HORIZONS

COMPARISON WITH DISTRICT VII

Following the practice observed in Bulletin 11, Coal Mining Investigations, several well-marked stratigraphic horizons of the McLeansboro can be enumerated. Mr. Kay has listed the following units in District VII:

7. New Haven limestone, 200 to 250 feet above Carlinville limestone.
6. Shoal Creek limestone, about 100 feet above the Carlinville.
5. Carlinville limestone, so called because of typical outcrops near town of this name in Macoupin County. Its position is from 200 feet to a little more than 300 feet above coal No. 6.
4. Coal No. 8 ranging in thickness from 8 inches to 2 feet where present and lying 150 to 180 feet above coal No. 6.
3. A bed of pink, red, or variegated shale, variable in thickness, seldom exceeding 15 feet, averaging from 35 to 50 feet above coal No. 6.
2. Coal No. 7, generally only a few inches thick, 25 to 40 feet above coal No. 6.
1. A hard limestone, averaging 7 feet in thickness overlying or slightly above coal No. 6.

Most of the units listed above can be recognized also in District VI, and in addition several others are widespread and recognizable from place to place. On the other hand, some of the beds present in District VII are not present, or at least are not recognizable, in this district. The strata which in this area are reasonably persistent and which serve as correlation horizons on which considerable dependence can be placed include numbers 1, 4, 5, 6, and 7, in the list above. Number 2 is probably present locally but is not readily recognizable, since the interval above coal No. 6 is variable. Number 3 is apparently not present, since none of the records of drilling within the area show the presence of variegated shale either at this or at any other horizon in the McLeansboro formation, with possibly a single exception. Number 4 (coal No. 8) is less readily traced from place to place than other members of the formation that are listed, although it is very commonly present.

As persistent strata in District VI there should be added to the members noted in the preceding paragraph three thin beds of coal, to which tentatively the numbers 9, 10, and 11 are given for the sake of ease in reference. They are not known to be the same as the coal beds which received similar numbers from the early State Surveys.

The entire list of important stratigraphic units for this district is herewith enumerated:

8. New Haven limestone, 200 to 250 feet above Carlinville limestone.
7. Coal No. 11.
6. Coal No. 10.
5. Shoal Creek limestone about 100 feet above the Carlinville.
4. Coal No. 9.
3. Carlinville limestone, 200 feet to a little more than 300 feet above coal No. 6.
2. Coal No. 8.
1. A hard limestone, averaging 4 to 5 feet in thickness overlying to possibly more than 100 feet above coal No. 6.

1. LIMESTONE ABOVE COAL NO. 6

The roof of coal No. 6 has been described at some length in the following discussion of coal No. 6 (Chapter III). This cap rock which is found within 25 feet of the coal in the east half of the district is commonly widespread in this and adjoining districts. The distribution of the limestone in this area and the character of the underlying rock down to the coal is shown graphically in Plate III. Reference to the diagram will show that on the east side of the district the limestone is commonly within 25 feet of the coal. To the west, however, either the limestone is not present, having either been removed after deposition or never deposited, or else is the same as a limestone commonly found at a considerably greater distance above the coal.

In the Murphysboro-Herrin folio the absence of the limestone over part of this district is explained by presuming an erosional unconformity near the limestone so that the black shale and limestone cap rock were removed by erosion previous to the deposition of the gray shale that overlies coal No. 6 throughout most of the area of the Herrin quadrangle. If it should be shown that the erosion which effected this unconformity in any place extended into the coal and decreased its thickness or even entirely removed it in places the fact of an unconformity at this place would probably be established. So far as is known, however, the assumed erosion never extended into the coal, but on the contrary, the bed is generally thickest where the limestone cap rock is absent or at a greater height above the coal.

A diagram presented in a previous publication[4] and reproduced herewith (fig. 3) shows the relationship of the coal and limestone

[4]Kay, Fred H., Coal resources of District VII: Ill. Coal Mining Invest. Bull. 11, fig. 31, p. 177, 1915.

along a section crossing the axis of the Duquoin anticline. Instead of an unconformity being present the interval between the coal and the limestone is interpreted as increasing eastward toward the boundary of District VI. Some attention to Plate III will probably convince the reader that a similar interpretation is applicable to the conditions

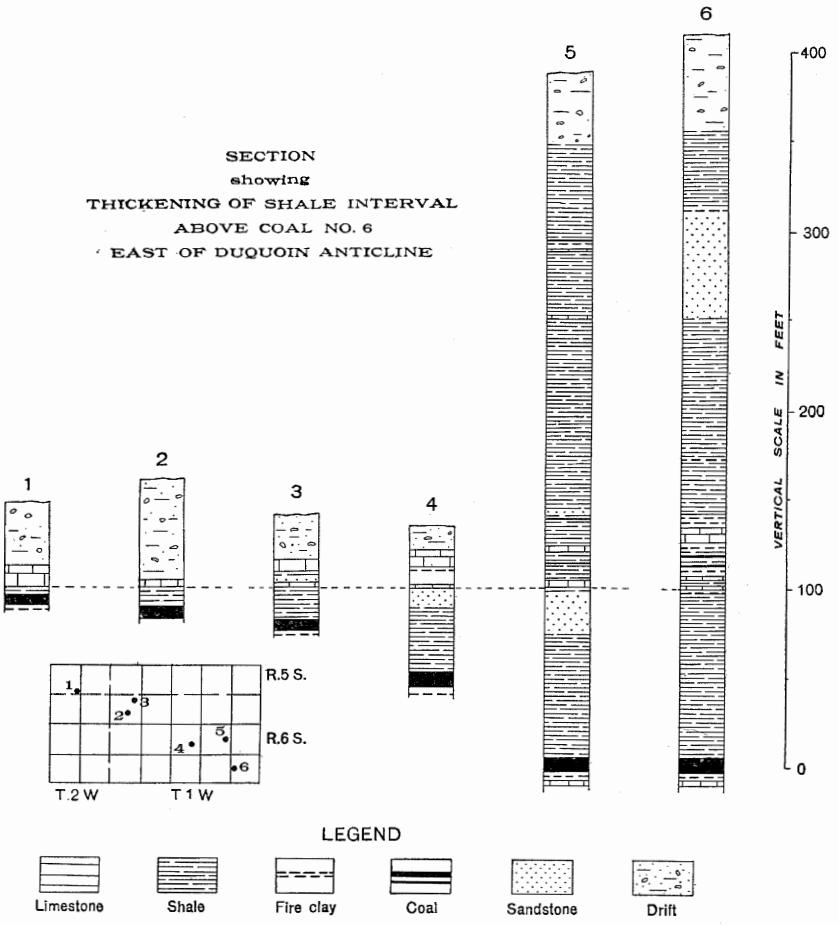

FIG. 3.—Series of graphic sections of borings showing the thickening of the shale interval above coal No. 6 east of the axis of the Duquoin anticline.

in this district. The limestone is shown in the diagram to lie at increasing intervals above the coal in passing from the east side of this district to the west, and in places again to decrease somewhat near the west boundary. In other words according to this interpretation the limestone is widespread over this district as in the adjacent dis-

tricts, but is separated by different thicknesses of shale from coal No. 6.

A study of Plate IV will doubtless make it evident to the reader that the thick coal is found where the interval between the coal and the limestone, according to this last interprctation, is greater than 25 feet, and indeed that the very thick coal is commonly found where a great thickness of shale overlies the coal. This relationship is regarded as a substantiation of the interpretation advanced. It will be shown that coal No. 5 commonly lies nearest coal No. 6 where the upper coal is thickest and, therefore, that it is probable that the upper coal in part accumulated in a broad basin the trough of which ran north and south near the west side of the district. The basin having been ultimately filled by a greater accumulation of peat in the trough than to either side plant growth finally ceased. In the subsequent shrinkage of the peat to form coal it is obvious that the greatest shrinkage would take place where the coal was thickest—that is, along the line of the former trough. This would tend toward the formation of another basin in approximately the position of the earlier one, and in this basin mud rather than limestone would probably be deposited. The effect would be cumulative up to a certain limit, the greater thickness of material deposited in the trough tending toward more rapid shrinkage of the peat below. Ultimately the difference in rate of shrinkage of the thick and thin coal would practically disappear, the trough would become filled, and limestone deposition could be carried entirely across the district.

The limestone cap rock is of variable thickness up to about 11 feet, the average thickness being from 4 to 5 feet. Its usual appearance in outcrop is that of a compact, heavy-bedded, brownish limestone, weathering to a light-brown, chalky, friable rock. It is commonly dark, almost black when fresh. The limestone is fossiliferous, the most common species being *Marginifera splendens* Sowerby, *Squamularia perplexa* McChesney, *Chonetes mesolobus* N. & P., and a small fusulinoid shell identified by Meek as *Fusulina ventricosa* but which may be new. This latter form is regarded as an index fossil for this horizon, not being found in other Pennsylvanian beds unless possibly in the upper part of the McLeansboro formation several hundred feet above the base. The fossil is about the shape and size of a rather thick grain of oats, and minute partitions can be seen traversing the shell if it is broken open.

2. COAL NO. 8

In District VII a thin coal is reported from 150 to 180 feet above coal No. 6 in a majority of the records. The same coal is not of uncommon occurrence in this district. In a few places it is reported to have a thickness of nearly 4 feet, but commonly it is only 5 to 12 inches in thickness. The distance above coal No. 6 is in places possibly not more than 140 feet, and in other places may be as much as 190 feet. In general, however, it lies within the intervals common to District VII.

In the central part of Franklin County, especially, but also elsewhere in the district, a thin coal is not uncommonly encountered 110 to 140 feet above the Herrin coal. Both this coal and coal No. 8 may be present at the same locality. Where a single coal is present about 140 feet above coal No. 6 definite correlations in this region are obviously impossible. A number of the logs also show several thin coal beds below the horizon assigned to coal No. 8. Some of these possibly correspond to coal No. 7 of District VII. It is not unusual to find a thin coal recorded about 80 feet above coal No. 6. This bed is rather widely distributed in the east half of Williamson County in ranges 3 and 4 east. An interval of not over 60 feet separates this coal from coal No. 6 in places, and elsewhere the interval may be nearly 100 feet.

It is impracticable to correlate with definiteness any of these several thin layers of coal found within 125 feet of the base of the McLeansboro formation. Apparently there are a number of horizons where coal may be found. Whether the beds are continuous or not, it is not known; certainly there is nothing sufficiently definite about the beds themselves or the associated strata to give them stratigraphic value as aids in correlation.

3. CARLINVILLE LIMESTONE

The Carlinville limestone is one of the most widely distributed beds in the "Coal Measures" of Illinois. It has been traced from north of Carlinville, Macoupin County, southeast to the Indiana line in Gallatin County.

In the type localities this limestone is, according to Udden, "generally bluish gray, compact, close textured, and very hard, breaking into irregular, splintery pieces. On weathering it assumes a rusty color. It averages about 7 feet in thickness. There are two features that are characteristic of this limestone—one a blotchy appearance, and another its tendency to weather into seams two and one-half to three inches in thickness."[5]

[5]Udden, J. A., Shoal Creek limestone: Ill. State Geol. Survey Bull, 8, p. 119, 1908.

No exposures of this limestone are known within this district, the outcrop being covered by glacial drift. The approximate position of its outcrop can be traced, however, by the aid of coal drillings. The limestone outcrop lies not far south of the line representing the approximate outcrop of coal No. 9 (Pl. IV), since the two members are separated by less than 50 feet of strata.

The interval between the Carlinville limestone and coal No. 6 for District VII is given by Mr. Kay[6] as 275 to 325 feet. In this district the average is about 25 feet lower, that is, from 250 to 300 feet above coal No. 6. The stratum is commonly thin in this area and possibly has escaped mention in some of the records for this reason. It rarely exceeds 18 inches in thickness, though a few records described limestone 7 to 10 feet thick at this horizon. In general this member of the McLeansboro formation is not of great importance in this area as an aid in correlation. It is of some assistance, however, in identifying coal No. 9, the next coal bed above. In Bulletin 11 the correlation of the Carlinville limestone with a limestone 250 to 300 feet above coal No. 11 of Kentucky (Illinois No. 6) was suggested by Mr. Kay.

4. COAL NO. 9

Among the important members of the McLeansboro formation, coal No. 9 is the most widespread and readily identifiable. It lies about 300 feet above the Herrin coal, the distance being somewhat less in the east half of the district and somewhat more in the west part. The interval between coals No. 9 and No. 6 is shown by the convergent contours on Plate IV. The contours show a minimum interval of about 150 feet and a maximum interval of less than 260 feet. A comparison of the data presented in Plate IV on the thickness of coal No. 6 shows a similar distribution of the thick coal No. 6 and the larger interval between coals No. 6 and No. 9. It has already been shown that by one interpretation of the stratigraphy of the district, the limestone above coal No. 6 also lies at the greatest distance from the coal where the coal bed is thickest. It seems not improbable, therefore, that much of the variation in the distance between the two coal beds in the district can be adequately explained by the variations in interval between coal No. 6 and the *Fusulina*-bearing limestone. This seems a further substantiation of the theory advanced to account for the apparent absence of the *Fusulina*-bearing limestone (cap rock of coal No. 6) over considerable areas in the district since the resulting difference in the amount of shrinkage of the thick and thin coal is

[6]Kay, F. H., Coal resources of District VII: Illinois Coal Mining Investigations Bull. 11, p. 23, 1915.

largely accounted for in the deposits of varying thickness lying between the coal and the limestone.

Coal No. 9 is not of commercial importance. Its thickness is rarely over 12 inches and is commonly from 6 to 9 inches. Its identification is made somewhat more easy than that of the other thin beds because within 50 feet below it is the horizon of the Carlinville limestone, and within 25 feet above it the horizon of the Shoal Creek limestone. These two limestones have not a very widespread distribution in this district, but one or the other, and in some cases both, may be recorded in drilling logs. A coal bed about 300 feet above coal No. 6 and associated either above or below with a limestone would not improbably prove to be coal No. 9.

Running northeast-southwest through the east side of Franklin County north of the outcrop of coal No. 9 a narrow area in which the coal is absent is shown in Plate IV. Its place is occupied by sandstone or sandy shale which extends to a considerable depth below the horizon of the coal, in places having a thickness of 150 feet and reaching to, or nearly to, the horizon of coal No. 8. It also probably extends above the horizon of coal No. 9. This sandstone is apparently lenticular in cross-section and probably represents a channel deposit or something of that nature.

5. SHOAL CREEK LIMESTONE

In a few of the drill records a thin limestone is noted above coal No. 9 and at a distance of 300 to 350 feet above coal No. 6. This apparently discontinuous layer is not improbably the Shoal Creek limestone. Like the Carlinville limestone it is commonly thin, but thicknesses from 5 to 9 feet are noted in some places. It is not known from outcrop within this area. This limestone member is of service in identifying coal No. 9 which lies within 50 feet below.

6 AND 7. COALS NO. 10 AND NO. 11

Coals No. 10 and No. 11 are present over considerable areas in Jefferson and Franklin counties and in the northeast part of Williamson County. Most of Williamson County lies south of the outcrop of these coal beds. Except for T. 7 S., Rs. 1 and 2 E., Franklin County is underlain by strata at the horizon of these coal beds. A thick sandstone or sandy shale cuts out one or both of the coals in much of T. 6 S., R. 3 E., and T. 5 S., Rs. 3 and 4 E. This sandstone occupies about the same geographic position as the sandstone which is found at the horizon of coal No. 9, but the width of the bed is somewhat greater.

The coals are found commonly about 40 to 50 feet apart in the interval lying between 400 and 500 feet above coal No. 6. The coal is generally less than 18 inches in each bed. The lower bed is reported to be 30 inches thick in one drill hole and 42 inches in another, but it is commonly much thinner. Both beds may be locally represented by strata reported as black shale or "slate."

8. NEW HAVEN LIMESTONE

Strata at the horizon of the New Haven limestone underlie Jefferson County and T. 5 S., Rs. 4, 3, and part of 2 E., Franklin County. In this area a thick limestone occurs locally between 500 and 550 feet above coal No. 6. One record shows 10 feet of limestone at this horizon and another 13 feet. At other places the stratum is known to be thinner. About 50 per cent of the records of drill holes north of the approximate outcrop of the limestone show arenaceous sediments at the horizon of the New Haven limestone. This sandstone is in places as much as 100 feet thick and is apparently more or less lenticular like the sandstone at the horizons of coals No. 9, No. 10, and No. 11.

The New Haven limestone in District VII appears to be a solid bed which in most of the logs is given a thickness of at least 25 feet. It can be traced east from District VI by outcrop and drill holes to New Haven, Gallatin County, where it shows in typical exposure in the NE. ¼ sec. 20, T. 7 S., R. 10 E.

In a few of the records a thin coal is placed a short distance below this limestone.

STRATA ABOVE NEW HAVEN LIMESTONE

Of the remaining 400 feet more or less of the McLeansboro formation known from drilling in this district, only the lower 300 feet or so has been explored by the drill a sufficient number of times to warrant generalizations in regard to it. The sequence in the upper 300 feet of the formation in two places in the northern part of the district is illustrated by the record immediately above and by the graphic logs 4 and 5 in Plate II.

Most of the material above the New Haven limestone is shale and sandstone with no characteristic beds. There is, however, in a number of the records mention made of a thin bed of coal, commonly less than a foot in thickness about 550 feet above coal No. 6.

CHAPTER III—ECONOMIC GEOLOGY OF THE COALS AND ASSOCIATED STRATA

Coal Beds below Coal No. 6

COAL NO. 2

The coal thought to be the equivalent of coal No. 2 (Murphysboro or La Salle) appears in the various records either as an undivided bed varying in thickness from 3 feet to 5 feet 8 inches, or as a split bed, the lower part being 10 inches and the upper part about 2 feet in thickness. Where the bed is divided the parts are separated by a few inches to 5 feet of shale. As all the wells which penetrate this bed were churn-drill borings, little or nothing is known of the quality of the coal, and even the thicknesses given are liable to error.

COALS BETWEEN COALS NO. 2 AND NO. 5

Shaw and Savage describe a thin bed of coal found about 55 feet above coal No. 2 in the Murphysboro-Herrin quadrangles. The bed varies in thickness from 6 to 28 inches and is somewhat thinner to the north than to the south. It is exposed within two miles of the west side of the district in the east bank of Crab Orchard Creek, near the NW. cor. of sec. 35, T. 8 S., R. 1 W., where it has been mined by drifting. The following section was made by T. E. Savage at this place:

Section exposed in sec. 35, T. 8 S., R. 1 W.

		Thickness	
		Ft.	*in.*
5.	Sandstone, yellowish brown, marked with numerous brown spots	4	6
4.	Limestone, argillaceous, single bed	1	4
3.	Shale, black, fissile	2	8
2.	Coal	2	..
1.	Underclay, gray	1	6

The same bed is exposed along Crab Orchard Creek in secs. 1 and 2, T. 9 S., R. 1 W. It is not known to outcrop within District VI. In the eastern part of the district in the West Frankfort quadrangle a similar thin coal has been encountered in a number of drill holes 35 to 65 feet above the Murphysboro (No. 2) coal and is not improbably the same bed. In mine measurement the coal averages less than a foot in thickness and ranges from 4 inches to 3 feet.

One of the most persistent thinner beds of coal in the Carbondale formation lies about 70 feet below coal No. 5. The bed is 2 to 5 feet

thick and is commonly covered with a black shale roof (Pl. I). It is possible by drilling records to trace this bed with a fair degree of accuracy eastward to Gallatin County where it apparently corresponds to the coal called coal No. 4 by Cox in the early State reports. On the west side of the district the interval between coals No. 2 and No. 4 is about 135 feet, and on the east 180 feet.

From 35 to 40 feet below coal No. 4 and approximately 100 to 110 feet below the Harrisburg (No. 5) coal is a thin bed about 1 foot thick. The common association of this bed and coal No. 4 is an aid in the identification of this part of the section.

COAL NO. 5

ECONOMIC IMPORTANCE

Coal No. 5 (Harrisburg or Springfield) is found in District VI practically wherever borings have penetrated to a sufficient depth. This is the most important coal bed of District V to the east, and it affords a very good quality of bituminous coal. Coal No. 5 or Harrisburg coal of this district is probably the equivalent of the Springfield (No. 5) coal, of the Fulton County and Peoria County (No. 5) coal, and of the "Middle Vein" coal in the La Salle area. It is very regular in thickness over the entire State, varying between 4 and 6 feet.

INTERVAL BETWEEN COALS NO. 5 AND NO. 6

The interval between coal No. 5 and coal No. 6 varies from 35 to 40 feet on the west side of the district to about 100 feet on the east side. The intervals between the two coals are shown in Plate I. It will be noted that in general the larger intervals are found where the upper coal is unusually thick and where it is overlain by a thick series of clastics rather than limestone. The significance of this relationship is discussed in the section devoted to coal No. 6.

THICKNESS

The thickness of coal No. 5 in District VI varies in the different drill holes up to 66 inches. Some idea of the variation in thickness from place to place can be obtained from the following table compiled from the coal borings in the district:

TABLE 4.—*Thicknesses of coal No. 5 in Jefferson, Franklin, and Williamson counties*

Location			Thickness
Sec.	T. N.	R. E.	
	Jefferson County		*Inches*
..	1	1	72? (churn drill)
..	1	3	60? (churn drill)
..	2	1	60? (churn drill)
..	2	2	44
..	4	1	84? (churn drill)
	Franklin County		
..	5	1	45, 47
..	5	2	59
..	6	1	51, 53, 24
..	6	2	54
..	6	3	48
21	6	3	52
35	6	3	48
..	7	1	48 to 60 (13 drill holes)
..	7	2	36 to 55 (5 drill holes)
..	7	3	48, 50
	Williamson County		
..	8	1	24, 28, 42
..	8	2	24, 47, 48, 66?
..	8	3	15?, 49, 52,54
25 and 36	8	4	48 to 68 (37, 38, 78) (11 holes)
..	9	3	36, 48, 50, 51, 54, 66
1 to 4	9	4	38, 46, 49, 50, 60, 65, 66
8 to 12	9	4	50, 51, 54, 56, 60, 61, 65
13	9	4	42, 52, 58
14 and 15	9	4	51 to 58 (7 holes)
16	9	4	54, 55
20 and 21	9	4	34, 48, 52, 56
22 and 23	9	4	42, 48, 51, 52, 55
24 to 28	9	4	26, 48, 49, 54, 60

The 35 diamond drill holes recently put down in the northeast part of Williamson County show an average thickness of 52 inches for this coal. The shortest core taken out had a length of 28 inches, and in only one hole was the coal entirely absent.

PHYSICAL CHARACTERISTICS OF COAL NO. 5

Coal No. 5 locally is reputed to be superior to coal No. 6. It is free from clay bands but contains here and there streaks of sulphur. These streaks where present are usually one-sixteenth to one-half inch

thick and are most commonly found 4 to 10 inches from the top of the bed. Rarely they are found as low as 27 inches from the top or reach a thickness of 1 inch. In some places the upper 2 inches of the coal is bony. The coal is of medium hardness, of good appearance, and stands up well under handling and transportation.

For further details in regard to the physical characteristics of this coal the reader is invited to consult the report on District V in which coal No. 5 will receive especial attention. So far as is known the qualities characteristic of the bed in the Harrisburg region also hold in this area (District VI). In figure 4 are shown two graphic sections of coal No. 5 as measured in mines in the district.

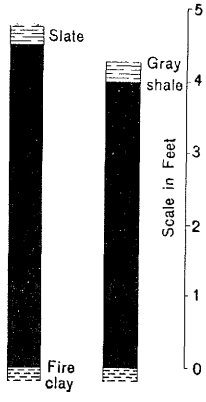

FIG. 4.—Graphic sections of coal No. 5.

ROOF OF COAL NO. 5

The roof of coal No. 5 is most commonly a black fissile shale. Concretions or "niggerheads" are commonly present in considerable numbers in the lower part of the roof shale. In some places a gray or blue shale lies between the coal and the black shale. This latter rock is in most places overlain by limestone. Table 5, based upon drilling records, shows the character of the roof of coal No. 5 in many sections in this district. The strata tabulated lie above the coal in the order read.

The terms black shale and black "slate" are used more or less indiscriminately so that there is little value attached to the separation of the two shales except in so far as it has facilitated tabulation. Shales which in some of the records appear as dark shales are in some cases regarded as blue shale and in others as black shales. Light shale and clay shale are tabulated as gray shale.

TABLE 5.—*Character of the roof of coal No. 5 as shown by drilling records in Franklin and Williamson counties*

(Strata are tabulated in order of occurrence above coal)

Location			Shale			Sand-stone	Lime-stone	Black "slate"	Sandy shale
Sec.	T. S.	R. E.	Blue	Gray	Black				
			Ft. in.	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*
27	5	2	4 2	.. ..	.. ..	.. ..	.. ..	4 ..	.. ..
12	5	2	1 7	.. ..	2 6	.. ..	.. ..	.. ..	.. ..
12	5	2	.. ..	.. ..	2 4	.. ..	1 ..	.. ..	.. ..
6	6	1	.. ..	.. ..	4 7	.. ..	1 ..	.. ..	.. ..
22	6	1	.. ..	.. ..	2 6	.. ..	1 6	.. ..	.. ..
4	6	2	.. ..	.. ..	3 4	.. ..	1 ..	.. ..	.. ..
3	6	3	8 2	.. ..	3 ..	.. ..	.. 9	.. ..	.. ..
21	6	3	1 4	.. ..	4 6	.. ..	1 ..	.. ..	.. ..
35	6	3	13 7	.. ..	6 6	.. ..	1 6	.. ..	.. ..
13	7	3	66 4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
21	7	3	.. ..	12 ..	4 ..	.. ..	.. ..	.. ..	.. ..
7	7	2	.. ..	6 ..	.. ..	.. ..	.. ..	6 6	.. ..
8	7	2	3 ..	.. ..	1 8	.. ..	.. ..	2 ..	.. ..
10	7	2	8 9	.. ..	4 ..	.. ..	.. ..	.. ..	.. ..
20	7	2	12 ..	.. ..	.. ..	1 ..	.. ..	8 ..	.. ..
25	7	2	.. ..	3 6	.. ..	.. ..	.. ..	5 ..	.. ..
13	7	1	..	.. ..	15 ..	.. ..	4 ..	.. ..	.. ..
14	7	1	4 8	.. ..	4 ..	.. ..	.. ..	.. ..	.. ..
..	..	..	11 ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
22	7	1	.. ..	.. ..	3 4	.. ..	.. ..	.. ..	.. ..
..	..	..	.. ..	.. ..	9 4	.. ..	.. ..	.. ..	.. ..
24	7	1	.. ..	.. ..	.. ..	.. ..	.. ..	4 6	.. ..
..	..	..	.. ..	.. ..	18 ..	3 ..	12 ..	.. ..	.. ..
25	7	1	.. ..	15 3	4 9	.. ..	2 ..	.. ..	.. ..
26	7	1	.. ..	.. ..	5 ..	.. ..	2 6	..	.. ..
27	7	1	5 10	.. ..	3 ..	.. ..	.. ..	.. ..	.. ..
28	7	1	.. ..	.. ..	2 ..	.. ..	.. ..	.. ..	.. ..
29	7	1	.. ..	4 ..	4 ..	.. ..	2 ..	.. ..	.. ..
30	7	1	.. ..	6 6	4 ..	.. ..	1 ..	.. ..	.. ..
32	7	1	.. ..	.. ..	.. ..	.. ..	.. ..	6 ..	.. ..
..	..	..	16 ..	.. ..	.. ..	15 ..	5 ..	.. ..	.. ..
12	8	1	.. ..	.. ..	.. ..	32 ..	.. ..	.. ..	.. ..
..	..	..	.. ..	.. ..	24 ..	.. ..	8 ..	.. ..	.. ..
14	8	1	10 ..	.. ..	4 10	.. ..	10 ..	.. ..	.. ..
19	8	1	.. ..	2 3	7 2	.. ..	1 9	.. ..	.. ..
19	8	1	1 9	.. ..	4 10	.. ..	1 6	.. ..	.. ..
19	8	1	4 9	.. ..	5 3	.. ..	2 1	.. ..	.. ..
23	8	1	1 6	.. ..	5 4	.. ..	.. ..	.. ..	.. ..
..	..	..	.. ..	17 6	.. ..	.. ..	.. ..	.. ..	.. ..
29	8	1	.. ..	2 11	6 7	.. ..	1 8	.. ..	.. ..
29	8	1	.. ..	5 8	7 6	.. ..	1 5	.. ..	.. ..
29	8	1	.. ..	5 11	5 11	.. ..	3 4	.. ..	.. ..
29	8	1	.. ..	8 3	5 2	.. ..	1 2	.. ..	.. ..
30	8	1	.. ..	.. ..	3 8	.. ..	2 ..	.. ..	.. ..

TABLE 5.—*Character of the roof of coal No. 5 as shown by drilling records in Franklin and Williamson counties*—Continued

Location			Shale			Sand-stone	Lime-stone	Black "slate"	Sandy shale
Sec.	T. S.	R. E.	Blue	Gray	Black				
			Ft. in.	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*
16	8	2	8 9	.. ..	3 ..	.. ..	.. ..	3 4	.. ..
27	8	2	8 ..	.. ..	3 1	.. ..	.. ..	.. ..	20 6
28	8	2	9 9	.. ..	3 3	6 9	.. ..	.. ..	.. ..
30	8	2	6 ..	.. ..	5 ..	.. ..	.. ..	.. ..	.. ..
..	..	..	.. ..	10 ..	.. ..	.. ..	15 ..	.. ..	.. ..
33	8	2	.. ..	.. ..	6 ..	.. ..	2 ..	.. ..	.. ..
33	8	2	.. ..	.. ..	5 6	.. ..	2 6	.. ..	.. ..
25	8	3	.. ..	.. ..	.. 9	.. ..	1 6	.. ..	.. ..
26	8	3	.. ..	.. ..	11 ..	.. ..	.. ..	.. ..	.. ..
26	8	3	.. ..	3 ..	.. ..	.. ..	.. ..	4 10	.. ..
..	..	..	.. ..	.. ..	.. ..	.. ..	1 10	.. ..	.. ..
9	8	4	19 2	.. ..	.. ..	.. ..	.. ..	.. ..	49 ..
25	8	4	30 6	.. ..	.. ..	.. ..	.. ..	.. ..	160 ..
25	8	4	31 8	.. ..	.. ..	.. ..	.. ..	.. ..	44 ..
25	8	4	39 8	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
29	8	4	.. ..	.. ..	23 ..	.. ..	.. ..	.. ..	.. ..
30	8	4	63 3	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
31	8	4	.. ..	.. ..	58 8	.. ..	.. ..	.. ..	.. ..
34	8	4	2 ..	.. ..	.. ..	.. ..	.. ..	.. ..	65 ..
34	8	4	38 8	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
34	8	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	69 ..
35	8	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	80 ..
35	8	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	71 ..
2	9	3	.. ..	.. ..	9 ..	.. ..	.. ..	3 ..	.. ..
6	9	3	9 5	.. ..	3 8	.. ..	.. ..	.. ..	.. ..
6	9	3	.. ..	.. ..	.. ..	.. ..	.. ..	1 7	.. ..
24	9	3	11 ..	.. ..	4 ..	.. ..	3 ..	.. ..	.. ..
35	9	3	12 ..	.. ..	7 ..	.. ..	.. ..	.. ..	.. ..
1	9	4	.. ..	5 6	4 4	.. ..	6 7	.. ..	.. ..
1	9	4	.. ..	8 5	3 10	.. ..	6 6	.. ..	.. ..
1	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	70 ..
2	9	4	.. ..	.. ..	4 10	.. ..	4 ..	.. ..	.. ..
2	9	4	.. ..	.. ..	4 8	.. ..	8 2	.. ..	.. ..
2	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	30 2
..	..	..	12 ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
4	9	4	13 6	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
6	9	4	.. ..	.. ..	9 ..	.. ..	.. ..	.. ..	.. ..
..	..	..	.. ..	23 ..	.. ..	.. ..	.. ..	.. ..	.. ..
6	9	4	.. ..	.. ..	.. 9	31 8	.. ..	.. ..	.. ..
8	9	4	13 ..	.. ..	4 ..	.. ..	.. ..	.. ..	.. ..
9	9	4	43 ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
9	9	4	20 2	.. ..	2 7	.. ..	.. ..	.. ..	.. ..
10	9	4	28 6	.. ..	.. ..	.. ..	3 ..	.. ..	.. ..
11	9	4	48 2	.. ..	.. ..	.. ..	.. ..	2 4	.. ..
12	9	4	.. ..	9 3	5 ..	.. ..	2 6	.. ..	.. ..

TABLE 5.—*Character of the roof of coal No. 5 as shown by drilling records in Franklin and Williamson counties*—Concluded

Location			Shale			Sand-stone	Lime-stone	Black "slate"	Sandy shale
Sec.	T. S.	R. E.	Blue	Gray	Black				
			Ft. in.	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*
12	9	4	.. ..	.. ..	5 ..	.. ..	5 ..	1 6	.. ..
12	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	13 6
..	..	..	.. ..	.. ..	4 ..	.. ..	1 ..	.. ..	.. ..
13	9	4	.. ..	9 9	.. ..	.. ..	.. ..	.. ..	47 ..
13	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	51 5
13	9	4	18 6	.. ..	.. ..	.. ..	.. ..	.. ..	9 ..
13	9	4	20 7	.. ..	.. ..	32 6	.. ..	.. ..	.. ..
14	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	6 ..	.. ..
..	..	..	.. ..	36 2	.. ..	4 ..	.. ..	.. ..	.. ..
14	9	4	80 ..	.. ..	.. ..	.. ..	.. ..	.. ..	26 6
12	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	28 10
		..	.. ..	.. ..	3 ..	.. ..	.. ..	.. ..	.. ..
15	9	4	.. .	.. ..	21 ..	.. ..	2 ..	.. ..	.. ..
15	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	26 7
..	..	..	.. ..	.. ..	3 ..	.. ..	4 ..	.. ..	.. ..
15	9	4	.. ..	.. ..	26 ..	.. ..	.. ..	.. ..	.. ..
15	9	4	.. ..	.. ..	26 3	.. ..	.. ..	.. ..	.. ..
15	9	4	.. ..	.. ..	20 7	.. ..	4 ..	.. ..	.. ..
12	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	14 ..
..	..	..	.. ..	.. ..	4 ..	.. ..	.. ..	.. ..	15 ..
16	9	4	.. .	.. ..	16 8	26 ..	.. ..	.. ..	.. ..
16	9	4	.. .	.. ..	19 ..	15 ..	.. ..	.. ..	.. ..
16	9	4	.. ..	.. ..	15 6	.. ..	.. ..	.. ..	.. ..
20	9	4	.. ..	15 ..	6 3	.. ..	.. ..	.. ..	.. ..
20	9	4	.. ..	.. ..	21 ..	.. ..	.. ..	.. ..	.. ..
21	9	4	.. ..	.. ..	16 ..	.. ..	.. ..	.. ..	.. ..
..	..	..	.. ..	.. ..	.. ..	.. ..	.. ..	4 ..	.. ..
21	9	4	.. ..	14 ..	6 ..	.. ..	.. ..	.. ..	.. ..
22	9	4	.. ..	.. ..	19 6	.. ..	2 6	.. ..	.. ..
..	..	..	.. ..	.. ..	.. ..	16 6	.. ..	.. ..	.. ..
22	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	15 10
..	..	..	.. ..	.. ..	.. ..	.. ..	2 ..	.. ..	25 ..
22	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	45 ..
23	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	62 1
23	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	28 9
..	..	..	.. ..	.. ..	.. ..	55 ..	.. ..	.. ..	.. ..
23	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	27 ..
..	..	..	.. ..	.. ..	.. ..	52 ..	.. ..	.. ..	.. ..
24	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 6
..	..	..	.. ..	.. ..	.. ..	15 ..	.. ..	.. ..	.. ..
24	9	4	.. ..	.. ..	9 ..	66 ..	.. ..	.. ..	31 6
25	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	58 ..
26	9	4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. 59

FLOOR OF COAL NO. 5

Coal No. 5 rests upon a blue or gray shale known as "fire clay." The shale is commonly about 3 feet in thickness and below it in many places is a limestone less than 5 feet in thickness. The underclay is hard and does not creep readily.

EXPLOITATION

At only a few places in the district has a coal bed lying below coal No. 6 been utilized. At Spillertown in the early part of these investigations a bed 75 feet below coal No. 6 was worked intermittently. This bed is believed to be coal No. 5. The same bed has been mined at the Ingram country bank 1½ miles southwest of Marion in the SE. cor. NE. ¼ SE. ¼ sec. 23, T. 9 S., R. 2 E. South of Crab Orchard in secs. 29 and 32, T. 9 S., R. 4 E. coal No. 5 has been worked at several country banks. A shaft has been sunk to the lower bed in sec. 33, T. 8 S., R. 2 E., but for some reason there has been no further development. In the mine of the Chicago Big Muddy Coal and Coke Company, sec. 2, T. 9 S., R. 2 E., coal No. 5 was passed through in crossing a block faulted up about 50 feet on the east side of the shaft.

In the region including, and adjacent to, T. 9 S., R. 2 E., coal No. 5 is commonly known as the "Black Diamond Vein." About 40 feet below it another bed is reported also approximately 4 feet thick which is believed by the writer to be coal No. 4 previously described. This lower bed is not known to have been worked.

MINE NOTES

The following notes based upon observations in the mines describe the conditions found:

Spillertown Coal and Coke Co.

Sec. 1, T. 9 S., R. 2 E.

The bed is 4½ feet thick, and is clean, hard, and brittle. A well-marked face is left after shooting. Only occasional sulphur balls or streaks are found, and these are easily removed. The roof is "slate" and very good. It contains no "niggerheads" but small pebbly concretions protrude from the roof, similar to those observed in a mine in coal No. 5 at Eldorado, Illinois. Only one "horseback" or clay slip has been encountered in this mine, this being about two feet thick and trending in a northwest-southeast direction. The floor is fire clay.

Ingram Coal Co.

NE. ¼ SE. ¼ sec. 23, T. 9 S., R. 2 E.

The coal is 3 feet 10 inches to 4 feet thick and is quite uniform in appearance throughout. The lower 6 inches is somewhat more compact and lustrous

than the upper part of the bed. In a few places in the mine there is a clay seam a fraction of an inch thick about 1 foot from the floor. What sulphur there is occurs in narrow streaks and is not of great importance. The roof of this coal bed is gray shale, and the floor fire clay. The correlation of the coal with the Harrisburg (No. 5) coal is open to some question.

COAL BETWEEN COALS NO. 5 AND NO. 6

In a few of the drill holes located in the west part of Williamson County where the interval between coals No. 5 and No. 6 is 75 to 100 feet a thin bed of coal lies 25 to 30 feet below coal No. 6. Eastward in Saline County this thin bed has a widespread distribution but tends to be 15 to 30 feet lower in the section. The bed is overlain by more or less arenaceous shale, but apparently never by black shale, as commonly found above coal No. 5; for this and other reasons it seems improbable that the coal lying 40 to 50 feet below coal No. 6 in the west side of the district and correlated as coal No. 5 is, rather, the thickened representative of this intermediate bed, as has been suggested.[1] This bed of coal has at present no economic value.

COAL NO. 6

ECONOMIC IMPORTANCE

The entire output of coal from Franklin and Jefferson counties and nearly all that of Williamson County is obtained from coal No. 6 (Herrin or Belleville). Within the district this most important Illinois coal bed attains the remarkable thickness for Illinois coal of 13 to 14 feet. Because conditions are suitable for the recovery of the coal on a large scale, many of the largest mines of the State are located in this area.

DEPTH, DISTRIBUTION, AND THICKNESS

North from its line of outcrop coal No. 6 is known to lie at depths below the surface varying to a maximum of 930 feet in Jefferson County. The depth increases northward because the coal dips in that direction (see structure map, Plate V), but other variations in depth arise from surface irregularities. The altitude of the coal varies from about 500 feet above sea level to more than 350 feet below sea level. As the surface is known to reach an altitude of at least 700 feet in places, and is especially high on the west side of Franklin and Jefferson counties, the depth of the coal probably locally exceeds 1,000 feet. The deepest mine in the district, that at Mount Vernon, Jefferson County, extends 850 feet below the surface.

[1]Cady, G. H., Geology of the West Frankfort quadrangle: Ill. State Geol. Survey Bull. 16, p. 262, 1910.

There is no reason for doubting that coal No. 6 is widespread north of its outcrop. Exploration has barely reached the east half of Jefferson County, but such drilling as has been done in that part of the district has encountered the coal.

The average thickness of coal No. 6 in the Herrin quadrangle as estimated by Shaw and Savage is 9 feet 5 inches in 130 drill holes. In the West Frankfort quadrangle the average of 150 measurements of the coal is about 9 feet. Within these areas the coal varies in thickness from rarely less than 4 feet to 14 feet. The average for the entire district, by planimeter measurement is 6.521 feet.

The distribution of thickness over the entire district is shown in Plate IV. A line is drawn separating the coal commonly more than 8 feet thick from that commonly less than 8 feet thick. Other lines separate coal more than 10 feet from that less than 10, and that more than 5 feet from that less than 5 feet. The lines are not drawn with precision and do not absolutely separate the occurrences of thin or thick coal, but they are approximately correct. In addition to the lines showing the thickness of the coal, wherever there have been measurements made of the coal that are not of a confidential nature, these measurements are also shown. Several measurements in a single mine may be indicated.

From a study of Plate IV described above several facts in regard to the distribution of thicknesses are evident. The thickest coal is located in detached areas lying parallel to and near the west border of the district. As the Duquoin anticline extends north and south along the east side of District VII in Perry County the areas of thick coal, therefore, lie near the anticline in more or less elongated regions extending in a direction parallel with the fold. The coal becomes thinner toward the east and near the southeast corner of the district is an area in which the thickness rarely exceeds 5 feet.

INTERVAL BETWEEN COALS NO. 5 AND NO. 6

Upon Plate IV also are shown in red figures the interval between coals No. 5 and No. 6. By reference to the plate the reader will see that the interval between the two beds is commonly least where the upper coal is thickest, and where the coal becomes thinner in the southeast part of the district the interval between the two coals becomes greater. It is suggested that possibly the distribution of thickness is casually related to variations in interval between the two coals.

If, as was probable, the surface of the lower coal was originally approximately flat lying, the necessity of assuming the existence of an uneven floor upon which the upper coal accumulated seems un-

avoidable in view of the differences in interval between the two coal beds. Whether this difference in interval is due to erosion of the strata overlying coal No. 5 prior to the deposition of coal No. 6, or whether it is due to non-deposition is not known. The floor of such a basin as is believed to exist was 50 to 75 feet lower along the west side of the district than the surface upon which the coal accumulated in the east part of the area; yet in view of the great amount of shrinkage to which peat is subject upon consolidation into bituminous coal, it is not improbable that the irregularities became entirely obscured before the end of the period of peat formation, and that a flat-lying surface underlain by peat extended over this entire area. The thickest coal should, therefore, be found where originally had been the deepest parts of the basin, and this in general seems to be the case. In the series of diagrams on Plate VI is shown graphically the conditions of accumulation of coal No. 6 as outlined in the preceding paragraph.

The differential shrinkage of the thick and thin coal deposited within and without the basin respectively have much to do apparently with the position of the "blue band" within the coal bed itself, and with the stratigraphy of the lower part, at least, of the McLeansboro formation.

PHYSICAL CHARACTERISTICS OF COAL NO. 6

GENERAL DESCRIPTION

The following description of the coal from the Murphysboro-Herrin folio is generally applicable to the district:

> The coal is shining black, commonly banded, and on close inspection appears laminated with alternating bright and dull lines. A "blue band," or dirt band, found almost everywhere 18 to 30 inches above the floor, generally consists of bone or shaly coal or of gray shale. Its thickness varies from one-half to 2½ inches with an average of about 1⅔ inches.
>
> A clean persistent parting of mother coal lies 14 to 24 inches below the top of the bed and a second parting generally appears 5 to 8 inches down. Above the upper parting the coal is in layers 3 to 6 inches thick, with partings of mother coal between them. Local lenses of mother coal, 6 inches to 5 feet in length and 1 to 4 inches thick, are common in the upper third of the bed. Small pyrite lenses and streaks of bone, a few inches to a foot or more in length and one-fourth to 1 inch in thickness are found here and there in the middle portion of the bed a short distance above the "blue band." In the middle and lower parts of the bed the lamination is less distinct but the bedding is still evident.

Figures 5 and 6 are underground flash lights of coal No. 6 showing the bed where it attains an unusual thickness of 13 and 14 feet. The "blue band" is plainly shown in the photographs about 3 feet

from the floor. This is somewhat higher than is common. The roof in the mine is the top coal.

There follows a number of measured sections of coal No. 6 made by members of the Survey and of the Cooperative Mining Investiga-

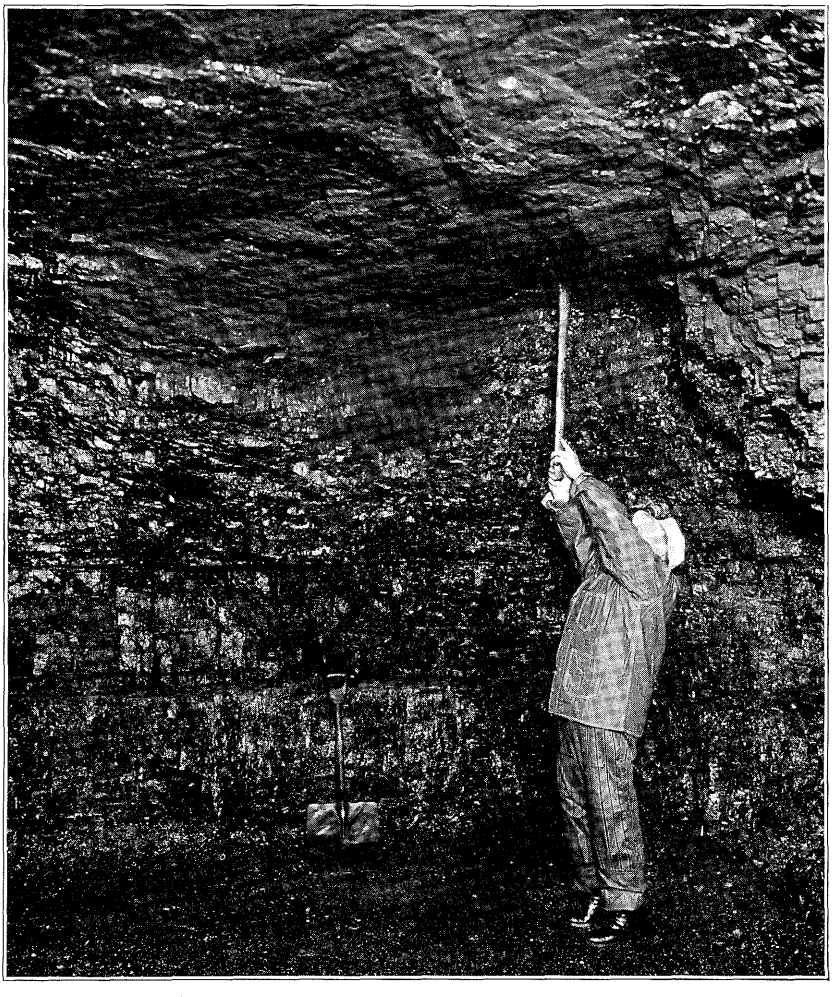

FIG. 5.—Coal No. 6 in its unusual thickness of about 13 feet near Christopher (courtesy of Purity Coal Co.)

tions which show the character of the coal from mine to mine in considerable detail. Some of the sections are shown graphically in figures 7 and 8, and will be given in detail below. Some sections given in detail below are not shown in the figures; these are either from

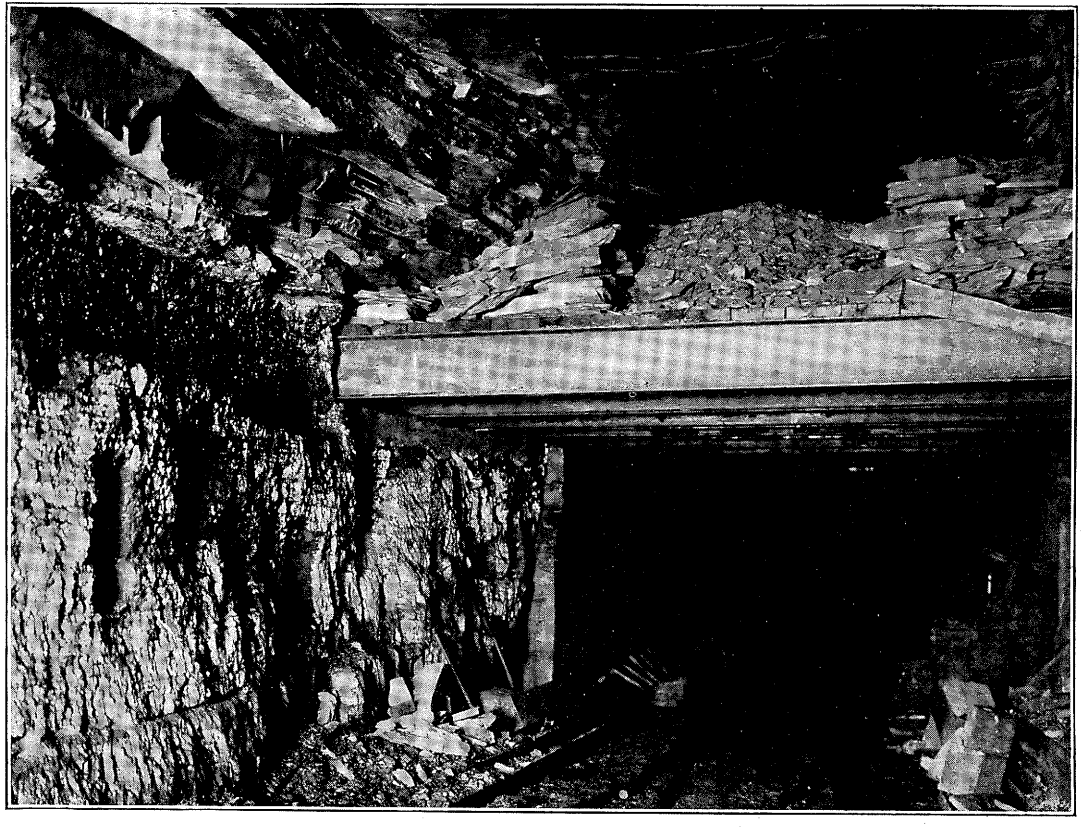

FIG. 6.—Roof of coal No. 6 and its "blue band" in Dewmaine mine (courtesy of Madison Coal Corporation).

the Murphysboro-Herrin folio or are drawn from measured sections presented in U. S. Bureau of Mines Bulletin 22, part 2.

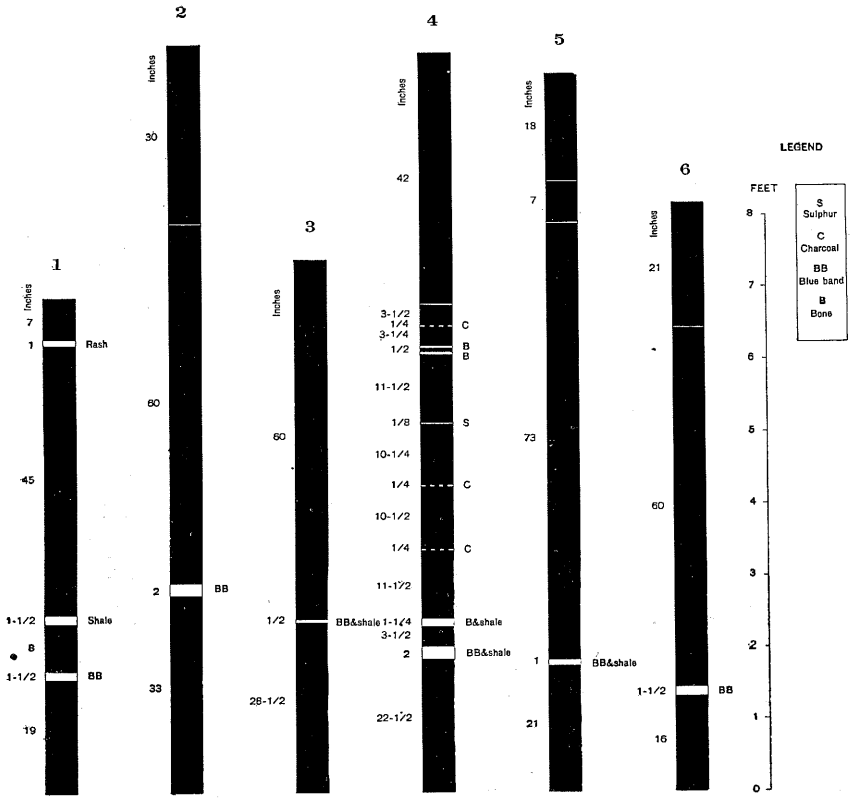

FIG. 7.—Graphic sections of coal No. 6 in Franklin County.

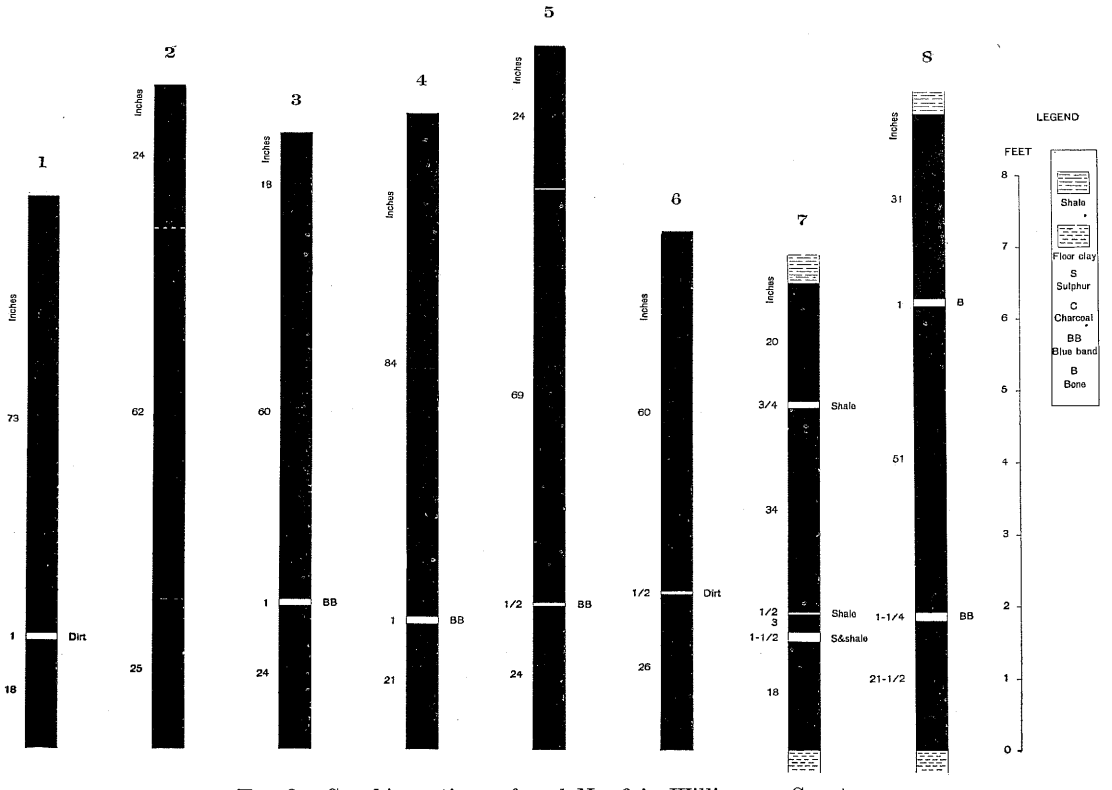

FIG. 8.—Graphic sections of coal No. 6 in Williamson County.

TABLE 6.—*Mines in Franklin and Williamson counties at which measured sections of coal No. 6 were made*

Company	Mine	Number of sections
Franklin County—		
Christopher Coal Mining Co.	1 (Old North)	2
Brazil Block Coal Co.	11	1
Sesser Coal Co.	Sesser	2
Bell & Zoller Coal Co.	1 (Leiter)	5
United Coal Mining Co.	1 (East)	3
Franklin Coal & Coke Co.	1 (Mitchell or North)	4
W. P. Rend Collieries Co.	1	3
Hart-Williams Coal Co.	Hart-Williams	3
Williamson County—		
Chicago & Herrin Coal Co.	N.R.	1
Scranton & Big Muddy Coal Mining Co.	1	1
Pittsburg & Big Muddy Coal Co.	2	1
Consolidated Coal Co.	Lake Creek	1
Sunnyside Coal Co.	1	1
Brinkley Miles Co. (stripping at Spillertown)		1
Brinkley Miles Co. (stripping at Marion)		1
Hafer Washed Coal Co.	3	4
Big Muddy Coal & Iron Co.	8	5
Chicago & Carterville Coal Co.	"A"	2
Carterville & Herrin Coal Co.	Jeffrey	2
Johnston City Coal Co.	1 (West)	4
Peabody Coal Co.	3	4

CHRISTOPHER COAL MINING CO., MINE NO. 1 (OLD NORTH), CHRISTOPHER

Section 1

	Thickness	
	Ft.	*in.*
Top coal	2	6
Middle coal	5	3
"Blue band"	..	3
Bottom coal	2	1
	10	1

Section 2—1st south right off 5th west south

Top coal (reported)	4	..
Middle coal—		
Coal	4	8
Shale	..	½
Coal	..	7
"Blue band," shale	..	¾
Bottom coal	2	..
	11	4¼

BRAZIL BLOCK COAL CO., MINE NO. 11, WEST FRANKFORT

3d off 1st north entry off east

	Thickness	
	Ft.	*in.*
Top coal, soft, contains sulphur balls	1	10
Middle coal, contains sulphur balls	5	8
"Blue band"	..	½
Bottom coal, contains sulphur balls	2	2
	9	8½

SESSER COAL CO., SESSER

Section 1—1st east, north, east entry

(See figure 7, No. 1)

	Thickness	
	Ft.	*in.*
Top coal (concealed)	..	..
Middle coal, hard, bright	5	6
"Blue band," grayish-brown shale	..	1½
Bottom coal, similar to middle bed, harder and dirtier	2	5
	8	½

Section 2—Entry near room 22, 3d east, north, east entry

Top coal	1	7

The middle bed of section 1 shows a few dirt streaks and a number of mother-coal bands, some one-half inch thick. Bands of glance coal up to 2 inches thick are scattered through the bench. Mother coal is found in irregular lenses. There is some sulphur in bands and in vertical streaks. The coal in section 2 is about 50 per cent glance coal and contains considerable mother coal. The bench is interlaced by a mixture of sulphur and calcite. The coal is very hard and brittle, ringing under the hammer.

BELL & ZOLLER COAL CO., MINE NO. 1 (LEITER), ZEIGLER

Section 1—Room 4 off 3d left off 6th west entry

	Thickness	
	Ft.	*in.*
Top coal, clean and bright	2	..
Middle coal, clean and bright	6	..
"Blue band," dirt, bony	..	2½
Bottom coal, clean and bright	2	10½
	11	1

Section 2—Face, 1st left off 8th west entry south

Top coal, clean and bright	1	10
Middle coal, clean and bright	5	7
"Blue band," dirt, bony	..	1½
Bottom coal, bright	2	1
	9	7½

Section 3—Room 12 C south, 8th west, 1st left entry

Top coal (reported)	5	..
Middle coal; similar to other sections; contains sulphur balls of irregular occurrence	7	..
"Blue band," almost clay, bluish gray to brown	..	1½
Bottom coal, contains sulphur balls	3	10
	15	11½

Section 4—Room 1 off 1st right off 1st east north

Top coal (reported)	4	..
Middle coal	5	7
"Blue band," blackish shale	..	1
Bottom coal	4	..
	13	8

Section 5—Face, 2d right entry off 4th east
(See figure 7, No. 2)

	Thickness	
	Ft.	*in.*
Top coal (reported)	2	6
Middle coal	5	..
"Blue band," very carbonaceous shale, nearly a bony coal; stringers of glance are scattered through the band	..	2
Bottom coal, clean and bright; mother-coal bands are scattered through bed	2	9
	10	5

The middle bench of coal No. 6 in section 4 is a hard, bright coal. Large lenses of glance coal up to 2 inches thick are scattered through a matrix of dull coal. Lenses and bands are generally one-fourth inch thick; the amount of glance coal is about 30 per cent. The coal is blocky and very brittle. Bands of mother coal are scattered through the bed. Some of the lenses are one-half inch thick, but most are one-fourth to a knife edge in thickness. Some calcite is scattered through the bench.

The middle bench in section 5 is generally similar to that of the previous section, except that it contains more mother coal in lenses usually 1 inch thick. Glance coal is in smaller amount and in smaller masses; bands vary up to one-half inch in thickness. Lenses of bone coal are also found.

UNITED COAL MINING CO., MINE NO. 1 (EAST), NEAR CHRISTOPHER

Section 1—Face, 6th southeast entry

	Thickness	
Middle coal—	*Ft.*	*in.*
Coal, clean, bright	5	7
Clay band	..	1
Coal	..	3
"Blue band," "slate"	..	4
Bottom coal	1	9
	8	0

Section 2—Face, 6th northwest entry

Middle coal, clean, bright	5	2
"Blue band," dirt, bony	..	2½
Bottom coal, clean, bright	1	11
	7	3½

Section 3—Room 10, off 4th right

(See figure 7, No. 3)

Middle coal, laminated with many dirt bands and some sulphur; coal bright with glance streaks	5	..
"Blue band," gray shale	..	½
Bottom coal, harder, cleaner, brittle	2	4½
	7	5

FRANKLIN COAL & COKE CO., MINE NO. 1 (MITCHELL OR NORTH), ROYALTON

Section 1—Face, room 8 on 1st south off 2d west, south entry

(See figure 7, No. 4)

	Thickness	
	Ft.	*in.*
Top coal	3	6
Middle coal—		
Coal, clean, bright	..	3½
Mother coal	..	¼
Coal, clean, bright	..	3¼
Bone	..	¼
Coal, dirty	..	½
Bone	..	¼
Coal, fairly clean	..	11½
Pyrite	..	⅛
Coal, dirt streaked	..	10¼
Mother coal	..	¼
Coal, clean, bright	..	10½
Mother coal	..	¼
Coal, fairly clean and bright	..	11½
Bone and gray shale	..	1¼
Coal, clean, bright	..	3½
"Blue band," gray shale	..	2
Bottom coal, hard, bony	1	10½
	10	3⅝

Section 2—Face, room on 2d south off main east entry

Top coal (not measured)	..	..
Middle coal—		
Coal, clean, bright	..	4¼
Bone	..	¼
Coal, clean, bright	..	3¾

Bone	..	¼
Coal, fairly clean	3	3½
Mother coal	..	¼
Coal, fairly clean, banded, dull	..	10¾
"Blue band," gray shale	..	1½
Bottom coal—		
Coal, dull	..	¾
Coal, very clean, bright	1	8½
Total thickness exclusive of top coal	6	9¾

Section 3—Room 9 off back air shaft

Top coal (not measured)	..	..
Middle coal—		
Coal, fairly clean	..	6
Bone	..	½
Coal, fairly clean	1	4½
Mother coal	..	¼
Coal, clean, bright	1	10
Coal, bony, dull, hard	..	8
Bone and shale	..	1
Coal, clean, soft	..	4½
"Blue band," bone and shale	..	2
Bottom coal, clean, bright	1	10¼
	6	11

Section 4—Room 4 in main air entry

Top coal (reported)	2	6
Middle coal, bright, hard	5	4
"Blue band," brownish-gray shale	..	2
Bottom coal, contains number of black jack and sulphur bands	1	11
	9	11

The middle bench of section 4 contains glance coal in bands up to one-half inch in thickness and amounting to 25 per cent of the bed. The impurities in the bed are a little black clay and a few sulphur bands. Calcite is found along the glance coal in small amounts.

W. P. REND COLLIERIES CO., MINE NO. 1, NEAR REND

Section 1—Face, 1st northwest entry

	Thickness	
	Ft.	*in.*
Top coal (not measured)	..	..
Middle coal—		
Coal	3	9
Clay band, blue	..	¾
Coal	..	3
Clay band, blue	..	1

Coal	..	3
Sulphur band	..	1
Coal	..	4
"Blue band," clay	..	1
Bottom coal—		
Coal	..	3
Dirt, blue	..	½
Coal	1	4
Total, exclusive of top coal	6	6¼

Section 2—Face, 5th southwest entry

Top coal (not measured)	..	..
Middle coal	6	..
"Blue band," blue dirt	..	1
Bottom coal	1	6½
Total, exclusive of top coal	7	7½

Section 3—Face, main east air course, one-half mile from shaft

(See figure 7, No. 5)

	Thickness	
	Ft.	*in.*
Top coal	1	6
Middle coal—		
Coal, very hard, bright; large amount of glance coal and calcite ("6-inch bench")	..	7
Coal	6	1
"Blue band," grayish-brown shale, little carbon scattered through it	..	1
Bottom coal, very hard, dirtier than other benches	1	9
	10	0

The lower part of the middle coal in section 3 is dirtier and harder than the "6-inch bench" and contains a considerable number of dirt, sulphur, and mother-coal bands distributed through the bed both vertically and horizontally. The coal is bright, but slightly duller than the bed above. Bands of glance as thick as one-quarter of an inch are scattered through the bench. The coal becomes dirtier toward the "blue band." "Cat faces" also occur. The dirt in the bottom coal is in brownish bands and has a number of sulphur streaks scattered through it.

HART-WILLIAMS COAL CO., NEW MINE, NEAR BENTON

Section 1—Room 6th off southwest entry

	Thickness	
	Ft.	*in.*
Top coal	1	2
Middle coal—		
Coal, some small sulphur streaks	4	10

Dirt band, blue	..	½
Coal, clean, bright	..	9½
"Blue band," sulphur	..	½
Bottom coal, clean bright	1	8½
	8	7

Section 2—Face, main east entry

Top coal	1	2
Middle coal, clean, bright	5	2
"Blue band," sulphur	..	1
Bottom coal	1	4
	7	9

Section 3—Room 1 off 4th northeast entry

(See figure 7, No. 6)

Top coal, hard and bright, calcite along cleavage, cleat strongly developed	1	9
Middle coal, hard, bright, few tarry bands, pyrite balls, sulphur streaks, "cat faces," few dirt bands	5	..
"Blue band"	..	1½
Bottom coal, bright, hard, brittle	1	4
	8	2½

CHICAGO & HERRIN COAL CO., NEAR HERRIN

Room 9 off southeast entry main south entry, 1,500 feet south and 900 feet east of shaft

	Thickness	
	Ft.	*in.*
Top coal	1	7
Middle coal, clean	5	1
"Blue band"	..	⅝
Bottom coal	1	6
	8	2⅝

SCRANTON & BIG MUDDY COAL CO., MINE NO. 1, NEAR MARION

Cross cut, 200 feet west of shaft between 1st and 2d entries

(See figure 8, No. 1)

	Thickness	
	Ft.	*in.*
Top and middle coal, clean	6	1
"Blue band," hard, slate, sulphur	..	1
Bottom coal	1	6
	7	8

PITTSBURG & BIG MUDDY COAL CO., MINE NO. 2, PITTSBURG

Wall of entry, 125 feet west and 140 feet south of shaft

	Thickness	
	Ft.	*in.*
Top and middle coal, bands of sulphurous clay	5	11½
"Blue band"	..	1
Bottom coal, bands of sulphurous clay	..	9½
	6	10

CONSOLIDATED COAL CO., LAKE CREEK MINE, NEAR JOHNSTON CITY

Main entry, 55 feet from shaft

	Thickness	
	Ft.	*in.*
Top and middle coal—		
Coal, bony, ½ to 1 inch thick	..	1
Coal	5	10
"Blue band," ¼ to 1 inch thick	..	1
Bottom coal	2	1
	8	1

SUNNYSIDE COAL CO., MINE NO. 1, NEAR HERRIN

Room 6 off 9th south entry off main west entry, west side of mine

	Thickness	
	Ft.	*in.*
Top coal	1	8
Middle coal, streak of bone 3 to 4 inches thick occurs throughout the mine a few inches above "blue band"	4	10
"Blue band"	..	½
Bottom coal	2	6
	9	½

BRINKLEY MILES CO., STRIPPING NEAR SPILLERTOWN

SE. 1/4 SW. 1/4 sec. 6, T. 9 S., R. 3 E.

	Thickness	
	Ft.	*in.*
Top coal, soft	1	6
Middle coal	4	11
"Blue band," ½ to 1 inch thick	..	1
Bottom coal	2	..
	8	6

BRINKLEY MILES CO., STRIPPING NEAR MARION

Sec. 12, T. 9 S., R. 2 E.

(See figure 8, No. 2)

	Thickness	
	Ft.	*in.*
Top coal	2	..
Mother coal parting	..	..
Middle coal	5	2
Bottom coal	2	1
	9	3

HAFER WASHED COAL CO., MINE NO. 3, NEAR CARTERVILLE

Section 1—Shaft bottom

	Thickness	
	Ft.	*in.*
Top coal, bright, not very hard, little calcite, cleat well developed	1	9½
Middle coal	5	2
"Blue band"	..	⅛
Bottom coal	..	..
	6	11⅝

Section 2—Face, 3d east entry on south side

Top coal	..	..
Middle coal, bright, fairly clean, calcite along cleavage planes, sulphur balls, "cat faces," numerous black jack streaks	5	2
"Blue band"	..	1½
Bottom coal, harder than middle coal, bright, numerous dirt bands	1	10½
	7	1½

Section 3—4th west entry on south side

Top coal	..	..
Middle coal, bright, hard, clean, some calcite	5	4
"Blue band"	..	..
Bottom coal	2	..
	7	4

Section 4—Room 33 off 2d east entry on south side

Top coal	1	6

Section 5—Room 33 off 2d east entry on south side

Top coal	..	..
Middle coal	4	7½
"Blue band"	1	1½
Bottom coal	2	..
	6	9

BIG MUDDY COAL & IRON CO., MINE NO. 8, NEAR CLIFFORD

Section 1—South side of mine

(See figure 8, No. 3)

	Thickness	
	Ft.	*in.*
Top coal, very bright, much glance but little dull coal	1	6
Middle coal, bright, fairly hard, considerable glance coal, some dirt and sulphur bands, little calcite	5	..
"Blue band"	..	1
Bottom coal, slightly dirtier and harder	2	..
	8	7

Section 2—Room 72 off 4th northwest entry on north side

Top coal	1	3
Middle coal, bright (similar to section 1)	5	6
"Blue band"	..	¾
Bottom coal	1	10
	8	7¾

Section 3—Room 13 off 4th southeast entry

Top coal	2	..
Middle coal	6	5
"Blue band"	..	1½
Bottom coal	1	11
	10	5½

Section 4—Cross cut opposite room 1 off 2d north on west side

Top coal, soft	1	..
Middle coal	5	10
"Blue band," gray shale	..	1
Bottom coal	1	10
	8	8½

CHICAGO & CARTERVILLE COAL CO., MINE "A," NEAR HERRIN

Section 1—Room off 3d south entry off 5th east on north side

(See figure 8, No. 4)

	Thickness	
	Ft.	*in.*
Top and middle coals, blocky, bright, very little dirt, small amount calcite	7	..
"Blue band," gray shale	..	1
Bottom coal, clean, brittle	1	9
	8	10

Section 2—Room 3 off 2d north off 4th east entry on north side

Top coal, soft	2	1
Middle coal	4	9
"Blue band," 1 to 2 inches	..	1
Bottom coal	1	11
	8	10

CARTERVILLE & HERRIN COAL CO., JEFFREY MINE, NEAR HERRIN

Section 1—Room 3 off 4th east

	Thickness	
	Ft.	*in.*
Coal	1	..
Clay band, blue	..	½
Coal	..	5
Clay band, white	..	1
Coal	4	2
Clay band, blue	..	1
Coal	..	10
Clay band, blue	..	½
Coal	..	7
Clay band, white	..	1
Coal	2	..
	9	4

Section 2—Room 5 off 1st west

(See figure 8, No. 5)

Top coal, soft	2	..
Middle coal	5	9
"Blue band"	..	½
Bottom coal	2	..
	9	9½

JOHNSTON CITY COAL CO., MINE NO. 1 (WEST), NEAR JOHNSTON CITY

Section 1—Room 2 off 10th south entry off southeast entry

	Thickness	
	Ft.	*in.*
Top coal (not measured)	..	..
Middle coal	3	4½
"Blue band"	..	½
Bottom coal	3	..
	6	5

Section 2—Face, 3d northwest entry

Top coal (not measured)	..	..
Middle coal—		
Coal	4	½
Clay	..	1
Coal	..	8
"Blue band," clay	..	1
Bottom coal	1	7
	6	5½

Section 3—Face, 10th south entry off main west entry

(See figure 5, No. 6)

Middle coal	5	..
"Blue band," clay	..	½
Bottom coal	2	2
	7	2½

Section 4

Top coal	1	2
Middle coal, clean, brighter than usual	5	8
"Blue band"	..	1
Bottom coal, hard, clean	1	8
	8	7

PEABODY COAL CO., MINE NO. 3, NEAR MARION

Section 1—Room 12, 5th south off 1st west entry on north side

	Thickness	
	Ft.	*in.*
Top coal	1	7
Middle coal	5	2
"Blue band"	..	¾
Bottom coal	2	..
	8	9¾

Section 2—Face, southwest entry

Top coal (not measured)	..	..
Middle coal—		
Coal, clean, bright	3	9
Clay band	..	½
Coal	1	4
"Blue band," clay	..	1
Bottom coal	2	1
Total, exclusive of top coal	7	3½

Section 3—3d southwest entry

Middle coal—		
Coal	..	4
Shale	..	1
Coal	4	5
"Blue band," shale	..	1
Bottom coal	2	5
	7	4

Section 4—1st north entry on east side of mine

Middle coal	5	..
Sulphur	..	2
"Blue band," shale	..	1½
Bottom coal	1	10
	7	1½

"BLUE BAND" IN COAL NO. 6

The general characteristics and the position of the "blue band" (fig. 9) have been indicated. This bedded impurity in coal No. 6 is

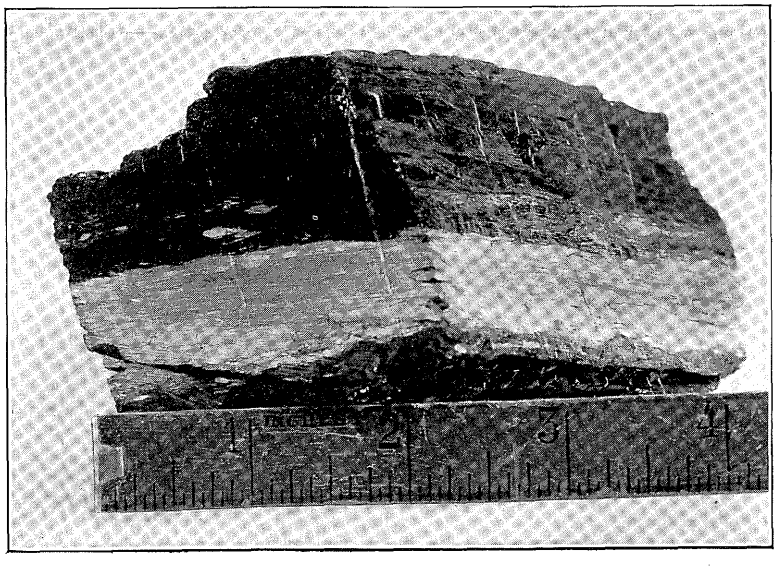

FIG.9.—Photo of "blue band", a characteristic feature in the lower part of coal No. 6.

the most common criterion of identification of the coal from point to point within the Illinois coal basin. It is conspicuously uniform in

its position in the lower part of the bed, and it possesses widespread similarity in thickness and lithologic character.

At the risk of repeating some of the data included in the sections of the coal given on preceding pages, table 7 is introduced to show the various positions and thicknesses of the "blue band" in many of the mines and in some of the drill holes of the area. Where it is available, data in regard to the thickness of the upper bench of coal is shown in the tabulation.

TABLE 7.—*Thicknesses of the lower, middle, and upper benches, and of the "blue band" of coal No. 6, as measured in mines and on diamond-drill cores*

Mine or location of drill hole	Lower bench	"Blue band"	Middle bench	Middle and upper bench	Upper bench	Total
	Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
Sesser Coal Co.	23	1½	82	....	....	106½+
Do	29	1½	66	....	....	96½
Do	22	2	36½	....	22½	83
Christopher Coal Mining Co., No. 1.	25	3	63	....	30	121
Do	24	¾	63½	....	48	136¼
Benton Coal Co.	21	1½	94	....	24	140½
Brazil Block Coal Co., No. 11	26	½	68	....	22	116½
Hart-Williams C. Co.	19½	1½	63	....	....	83+
Do	20½	½	68	....	14	103
Do	16	1½	60	....	21	98½
Do	16	1	62	....	14	93
Bell & Zoller C. Co.	34½	2	72	....	....	108½
Do	34½	2½	72	....	24	133
Do	25	1½	67	....	22	115½
Do	48	1	67	....	....	116+
Do	52¾	½	33	....	....	86¼
Do	33	2	60	....	....	95
Do	46	1½	84	....	....	131½
W. P. Rend Coll. Co., No. 1	19½	1	57¾	....	....	78¼
Do	18½	1	72	....	....	91½
Do	21	1	80	....	18	120
Do	22	1½	48½	....	....	72
Franklin C. & C. Co., No. 1	22½	2	57⅛	....	42	123⅝
Do	21¼	1½	59	....	....	81¾
Do	22¼	2	58¾	....	....	83
Do	23	2	64	....	30	119
United Coal Mining Co., No. 1	21	2½	58	....	18	99½
Do	21	4	71	....	....	96+
Do	23	2½	62	....	....	87½
Do	28½	½	60	....	....	89
Chicago & Herrin C. Co.	18	⅝	61	....	19	98⅝
Scranton & Big Muddy C. M. Co.	18	1	....	73	....	92

TABLE 7.—*Thicknesses of the lower, middle, and upper benches, and of the "blue band" of coal No. 6, as measured in mines and on diamond-drill cores*—Continued

Mine or location of drill hole	Lower bench	"Blue band"	Middle bench	Middle and upper bench	Upper bench	Total
	Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
Pittsburg & Big Muddy C. Co.	9½	1	....	71½	....	82
Consolidated C. Co., Lake Creek	25	1	....	71	....	97
Sunnyside Coal Co.	30	½	58	....	20	108½
Brinkley Miles	24	1	59	....	18	102
Do	25	..	62	....	24	111
Carterville & Herrin C. Co., Jeffrey	24	½	69	....	24	117½
Johnston City C. Co.	36	½	40½	....	....	77
Do	19	1	57½	....	....	77½
Do	26	½	60	....	?	86½
Do	20	1	68	....	26	115
Peabody Coal Co. No. 3	25	1	61½	....	....	87½
Do	29	1	58	....	....	88
Do	29½	½	58½	....	....	88½
Do	22	1½	62	....	....	85½
Do	24	¾	58½	....	....	83¼
Do	24	¾	62	....	19	103¾
Chicago & Carterville C. Co., "A"	24	1	58	....	....	83
Do	23	1	57	....	25	106
Do	20	1	....	75	....	96
Do	21	1	....	84	....	106
Big Muddy Coal & Iron Co., No. 8	24	1	60	....	18	103
Do	26	1	63½	....	....	90½
Do	22	¾	66	....	15	103¾
Do	23	1½	77	....	24	125½
Do	23	1½	67	....	....	91½
Do	22	½	70	....	12	104½
Chicago & Big Muddy Coal & Coke Co., No. 1	20	½	66	....	....	86½
Do	....	....	....	....	14	....
Do	21½	½	62½	....	....	84½
Hafer Washed Coal Co., No. 3	24	½	62½	....	....	84½
Do	15	1¼	63½	....	....	79¾
Do	....	....	....	....	18	....
Do	....	⅛	62	....	21½	83⅝
Do	22½	1½	62	....	....	86
Do	24	¾	64	....	....	88¾
Do	24	1½	55½	....	....	81
T. 5 S., R. 3 E.						
Sec. 6 (NW. ¼ NE. ¼)	10	....	....	66	....	77
Sec. 12 (SE. ¼ SE. ¼)	8¾	1¼	....	64	....	73
Sec. 18 (SE. ¼ SE. ¼)	3	1½	....	61	....	..

TABLE 7.—*Thicknesses of the lower, middle, and upper benches, and of the "blue band" of coal No. 6, as measured in mines and on diamond-drill cores*—Concluded

Mine or location of drill hole	Lower bench	"Blue band"	Middle bench	Middle and upper bench	Upper bench	Total
	Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
T. 5 S., R. 2 E.						
Sec. 2 (SE. cor)	6	2	....	74	....	82
Sec. 12	10	¼	....	83	....	93¼
Sec. 15 (SE. ¼ SE. ¼)	6½	1½	....	77	....	85
Sec. 23 (SE. ¼ SE. ¼)	5	1	....	77	....	83
Sec. 27 (NW. ¼ NW. ¼)	27	?	....	75	....	102+
T. 5 S., R. 1 E.						
Sec. 24 (NE. ¼ SW. ¼)	22½	½	....	81	....	104
T. 6 S., R. 2 E.						
Sec. 19 (NE. ¼ SE. ¼)	18	1	....	84	....	103
Sec. 30 (SE. ¼ SW. ¼)	19	18	....	63	....	100
Sec. 33 (SW. ¼ NW. ¼)	17½	7½	....	92	....	87+
T. 6 S., R. 3 E.						
Sec. 21 (NE. ¼ NE. ¼)	11	2	....	73	....	86
T. 7 S. R. 3 E.						
Sec. 13 (SW. ¼ SE. ¼)	8½	4	....	(a)	....	(a)
T. 7 S., R. 2 E.						
Sec. 4 (SW. ¼ NW. ¼)	34	4	....	(a)	....	(a)
Sec. 4 (NE. ¼ NW. ¼)	18	8	....	(a)	....	(a)
Sec. 4 (SE. ¼ NW. ¼)	24	4	....	(a)	....	(a)
Sec. 5 (NE. ¼ NE. ¼)	22	22 shale	....	(a)	....	(a)
		10 coal	....	(a)	....	(a)
		22 shale	....	(a)	....	(a)
Sec. 5 (NW. ¼ SE. ¼)	22	16 shale	....	(a)	....	(a)
		16 coal	....	(a)	....	(a)
		10 shale	....	(a)	....	(a)
Sec. 8 (NW. cor.)	40	2	....	(a)	....	(a)
Sec. 8 (SW. cor.)	27	2	....	(a)	....	(a)
Sec. 10 (SE. ¼ SW. ¼)	25	1	....	(a)	....	(a)
T. 7 S., R. 3 E.						
Sec. 8	35	?	....	80	....	115

[a] Confidential.

THICKNESS OF LOWER BENCH OF COAL NO. 6

The commonly greater thickness of the lower bench of coal No. 6 in the area of thicker coal on the west side of the district, if it is of general occurrence, is due probably to the more rapid accumulation of coal in the basin already described as compared with areas outside of the basin. Observations are too restricted and the results of drilling, especially if a core is not available, are too uncertain in regard to

this minor detail to justify reliable generalizations for the entire district.

IRREGULARITIES IN CONTINUITY OF COAL NO. 6

Introductory statement.—The irregularities in the continuity of the bed due to deposition, erosion, or movement are not uncommon, but are not sufficiently large in many of the mines to hinder mining to a great extent. The most common irregularities are "rolls" found both in the roof and floor. "Slips" are possibly nearly as common

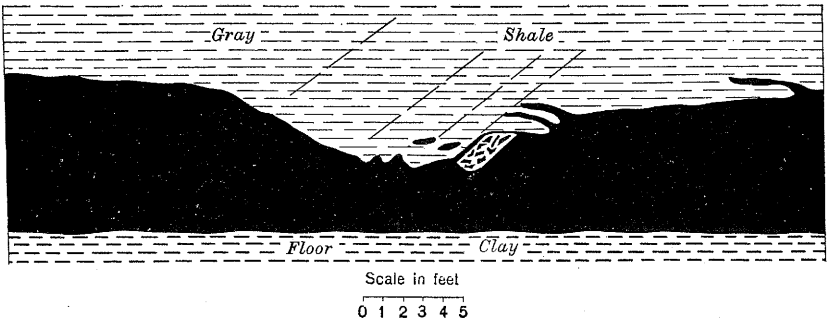

FIG. 10.—Diagrammatic illustration of a roll bearing N. 55° E., room 3, third east off north entry, mine No. 3, Hafer Washed Coal Co.

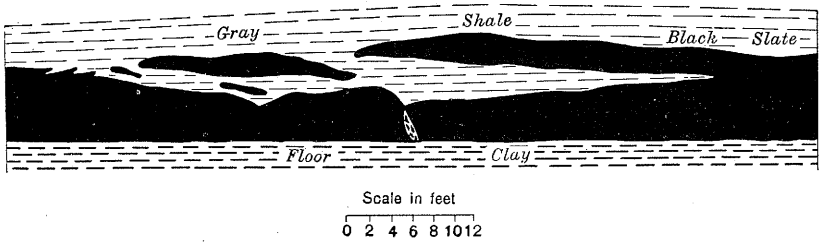

FIG. 11.—Diagrammatic illustration of a roll bearing N. 50° E., second east off sixth north, 1,500 feet east of shaft, mine No. 1, W. P. Rend Collieries Co.

as the rolls. In many of the mines are small folds or flexures; in some mines the bed has been displaced by faulting, a subject to be discussed under "Regional structure."

Rolls.—The rolls found in the roof of coal No. 6 are the result of the deposition of shale similar to that composing the roof in relatively small depressions in the surface of the coal. In places the depressions extend through the top bench so that the shale in the roll rests upon the middle bench. Such a deep roll is illustrated by the accompany-

ing sketch (fig. 10) made in mine No. 3, by Hafer Washed Coal Co., by figure 11 drawn in mine No. 1, W. P. Rend Collieries Co., by figures 12, *a* and *b*, drawn in the Jeffrey mine, Carterville & Herrin Coal Co.

Rolls may lie within the coal bed. In such cases the deposition of shale apparently began in depressions in the surface of the peat

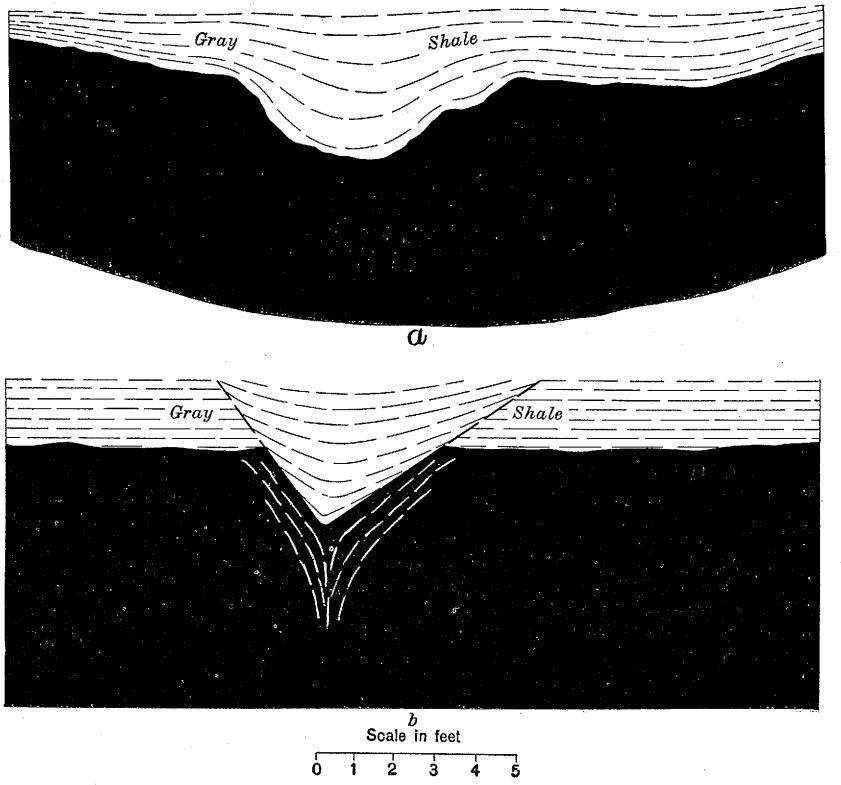

FIG. 12.—Diagrammatic illustrations of rolls in Jeffrey mine, Carterville & Herrin Coal Co.

a. Roll resulting from pressure exerted from above.

b. Roll due original deposition.

before peat accumulation had generally ceased and later the shale became covered with peat either washed in from the sides or deposited from vegetable growth in place. A sketch (fig. 13) was made in the mine of the Johnston City Coal Co., and illustrates the conditions just described. A gray shale lens up to 2 feet in thickness lies about three-quarters of the way to the top of the bed. The lens has a length of

about 200 feet. Other bodies of shale may be very compact and relatively thick as shown in figure 14 sketched in the Jeffrey mine. Such a body of shale, inclosed in the coal and apparently entirely detached from the roof shale above the coal, has little cohesion to the overlying material and is very likely to fall. Figure 11 is illustrative of conditions common to the rolls, the clay extending as a lens into the coal bed but not entirely detached from the roof. It is believed that all rolls observed in District VI are the result of original irregularities

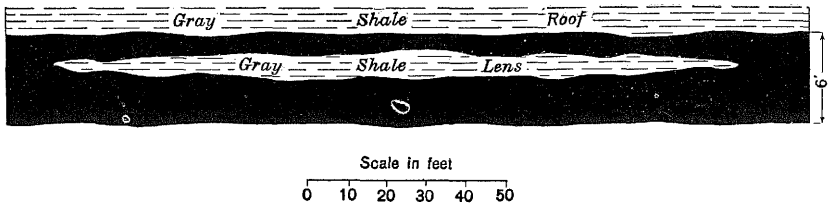

FIG. 13.—Diagrammatic illustration of a clay lens 300 feet east of the shaft of mine No. 1 (West), Johnston City Coal Co.

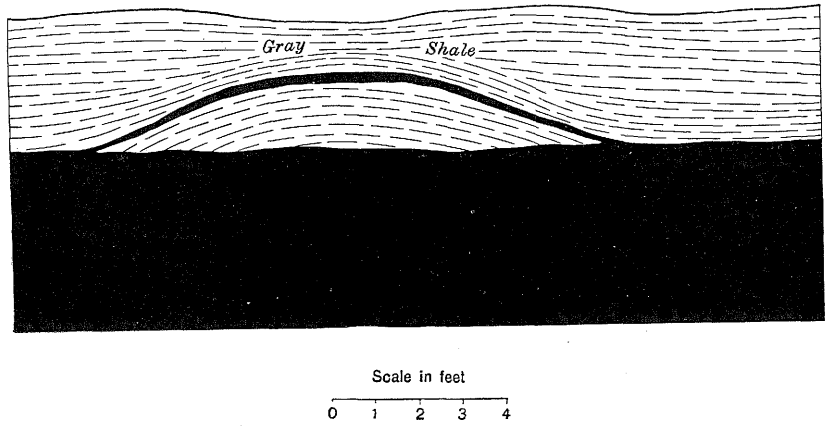

FIG. 14.—Diagrammatic illustration of a clay lens in the roof of coal No. 6, Jeffrey mine, Carterville & Herrin Coal Co.

in deposition and not to subsequent forcing of the shale or clay into the coal.

Irregularities in the floor, commonly also called "rolls," are thought to represent original unevennesses of the surface upon which the coal was laid down. Figure 15, an interpretative sketch of a floor roll in the Sesser mine, is thought to be indicative of the condition commonly existing where such rolls are found. However, the protruding rock is not always found to be limestone; other rock is similarly effective.

Slips.—"Slips" are commonly associated with rolls. Several of the figures already discussed and also figures 16 and 17, sketched from observations in the Hart-Williams and the Sesser mines respectively, show slips and rolls. Even where the coal bed is not broken, the clay of the roll is very commonly broken and crossed by many slickensided

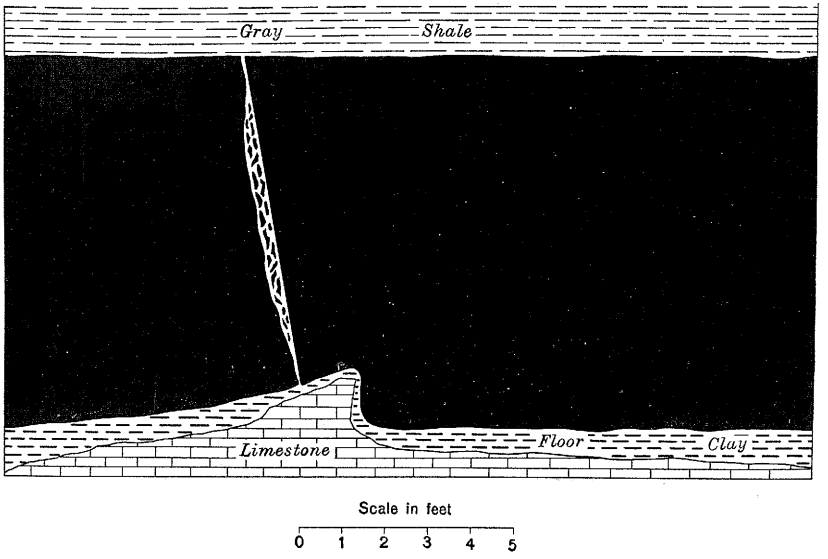

FIG. 15.—Diagrammatic illustration of a roll in the floor of coal No. 6 in the Sesser mine.

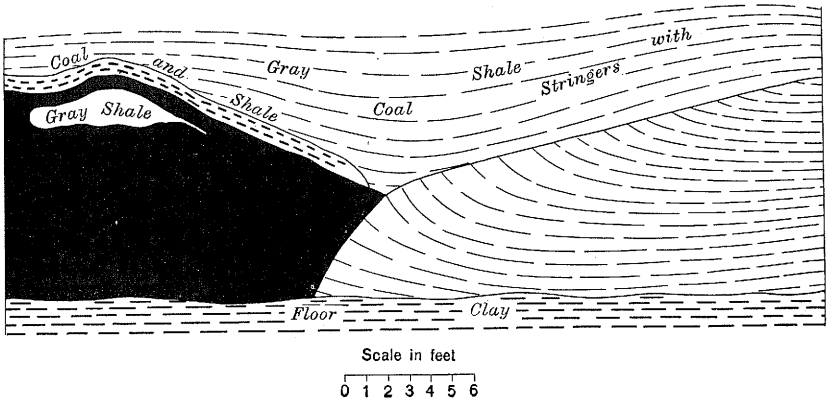

FIG. 16.—Diagrammatic illustration of a roll and slip, third northeast cross entry, half way between second and third left, Hart-Williams mine. The general bearing of the roll is N. 35° W., that of the slip N. 70° W.

surfaces, so that it is very likely to fall; hence much timbering is required, if it is supported. Where the slips occur, the coal has commonly been slightly displaced along the fault plane. The amount of displacement is in many places, however, so slight as to be inappre-

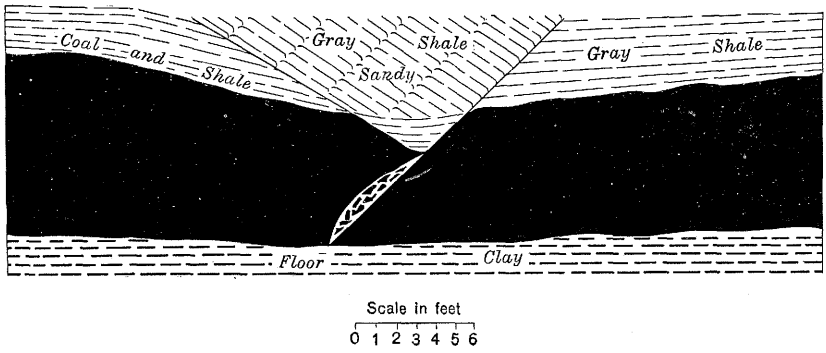

FIG. 17.—Diagrammatic illustration of a roll and slip bearing N. 40° E., first east entry 1,000 feet northeast of shaft, Sesser mine.

ciable, and in other places no displacement seems to have taken place, at least vertically. The plane of fracture may or may not extend up into the roof and may even affect only part of the coal bed.

The small faults or slips associated with the rolls, and not uncommonly found at other places in the mines, are thought to be due to differential strains that arise from the unequal shrinkage of the coal and shale.

If it is true, as is thought, that peat shrinks to one-fifth or one-sixth of its original volume in becoming bituminous coal, strains are inevitable between those parts of the bed composed entirely of peat and those parts in which are interbedded several feet of relatively non-shrinking shale. This appears even more true where the clay lens is relatively narrow and thick and hence differences in shrinkage great within a short distance. To illustrate: If a bed of peat 50 feet in thickness contains a mass of clay in a narrow depression 5 feet in depth and 15 feet in width, it is apparent that the upper 5 feet of peat adjacent to the lens of clay will shrink to about 1 foot of coal, while the clay will continue to be 5 feet in thickness. Finally the peat where pure will be represented by 10 feet of coal, but where interbedded with shale by 14 feet of coal and clay. Thus the effect will be that of increasing the thickness of the bed 4 feet very locally. If the mass of clay were essentially rectangular in vertical section, one would expect slips or faults around the borders. The rolls, however,

most commonly lenticular vary from paper thinness near the edges to maximum thickness usually at a distance from the edge, but not necessarily in a central position. There arises, therefore, an exceedingly complex and constantly changing series of strains increasing as the thickness of the shale increases and possibly culminating where the shale in the roll is thickest. The position of no strain being below the center of the thickest part of shale, and the position of maximum strain either side of the center, since the greatest differences in the amount of shrinkage of the coal and shale is found at these places, the position of fracture should most commonly be found at the lowest part of the roll. Several of the figures showing rolls indicate a slip located centrally below the roll. The character of the slips and their positions relative to the rolls is apparently a matter controlled by the shape of the roll. Since the strains do not involve the position of the coal bed as a whole the fractures are rarely accompanied by offset.

Folds and faults.—In several of the mines in the southern part of the district are found local variations in the altitude of the coal which have been interpreted as low folds. In some of the mines such variations in the level of the coal are possibly original. In other places the folds are probably part of structural features of the district that have been developed by the movements accompanying the general depression of the Illinois coal basin to the north (see "Regional structure").

Faults are likewise not uncommon, especially in Williamson County. This structure represents actual displacements of the coal bed, not the miners' "fault" or the local slips associated with rolls. Faults are more commonly regional areas or belts. Folds may run into faults or be associated with faults, especially where they are part of regional movements.

In this district folds have been observed in the following mines:

No. 1 (Leiter), Bell & Zoller Coal Co.,
Jeffrey mine, Carterville & Herrin Coal Co.,
No. 1 (West), Johnstone City Coal Co.,
Oak Ridge, Southern Illinois Coal & Coke Co.

In the Jeffrey mine and West mine the folds are associated with faults. Other mines in which faults are known are:

No. 2 (South), Franklin Coal & Coke Co.,
No. 1, Chicago & Big Muddy Coal & Coke Co.,
"B," Chicago & Carterville Coal Co.,
Oak Ridge, Southern Illinois Coal Co.,
No. 2, W. P. Rend Coal & Coke Co.,
Mine No. 3, Hafer Washed Coal Co.

The details of some of the folds and faults as observed by members of the Coal Mining Investigations and of the State Geological Survey are presented in figures 18 and 19. In mine No. 3 of the Hafer Washed Coal Co. (fig. 18) is a drop of about 3 feet along a north-south fault line where considerable water enters the mine along this break.

The fault in mine No. 1 (West), Johnston City Coal Co., has a downthrow of about 28 feet to the west (fig. 19). It crosses the main west entry about 2,200 feet from the shaft and bears in a direction N.30°W. The coal bed rises from the east as the fault is approached

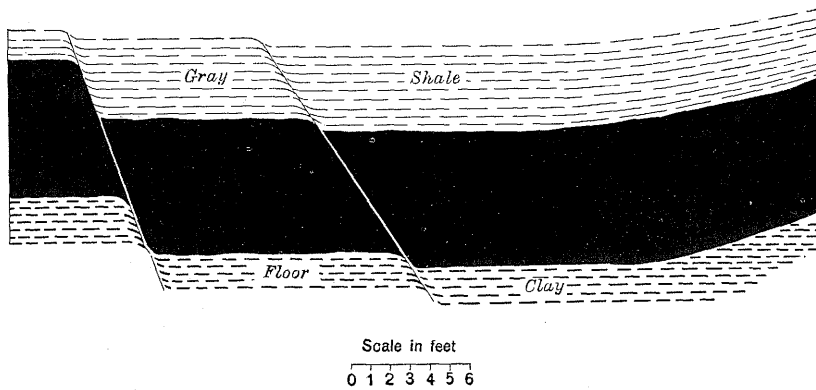

FIG. 18.—Diagrammatic illustration of a fault bearing N–S, room 30, third east entry off south, north rib, mine No. 3, Hafer Washed Coal Co.

until it is 77 feet higher than the floor at the bottom of the shaft. In the faulted zone, which has a width of about 40 feet, the coal shows the effect of drag and is much folded. Three or four faults cut the coal, but only at the most westerly one is the bed entirely moved away from the face. The faults in general seem to dip slightly toward the east. The relationships suggest more or less thrusting in a northeast-southwest direction, though the phenomena may be due to more or less horizontal movement parallel to the strike of the fault.

In the Jeffrey mine of the Carterville and Herrin Coal Co. (SW.¼ sec. 22, T. 8 S., R. 2 E.), the dip is so great in places and so irregular that coal cannot be hauled out of the rooms. Entries are driven along the strike and the rooms made up the dip. The coal is then hauled around the hills. In the northeast and southeast parts of the mine are numerous local sags and elevations. In some of the sags the top coal is cut out by a roll (fig. 12). On the elevations (fig. 20) the limestone ordinarily underlying the fire clay lies directly under the coal cutting out the fire clay. The local dips in the mine are as much

as 15° to 18°, so that the bed has a hummocky surface (see profile, figure 21).

A sharp fold in the strata is found nearly surrounding the shaft in the Oak Ridge mine located in the SW. ¼ SW. ¼ sec. 23, T. 8 S., R. 2 E. The accompanying map and profile from Illinois State Geol-

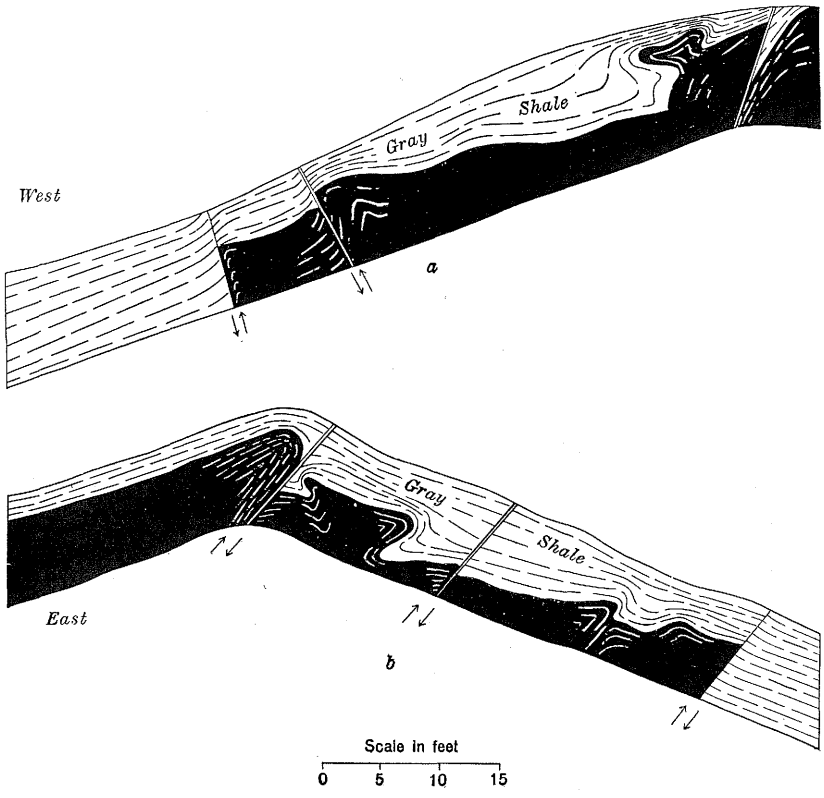

FIG. 19.—Diagrammatic illustrations of the fault 2,200 feet west of the shaft, mine No. 1 (West), Johnston City Coal Co. The bearing is N. 30° W.; and the total displacement, 28 feet.

a. North side of entry.

b. South side of entry.

ogical Survey Bulletin No. 16 shows the nature and bearing of the fold. So far as could be observed the coal seemed to be folded rather than faulted, though the change in altitude of the bed is very rapid along the east and west main entries.

Three faults (fig. 22) are found in mine No. 1 of the Chicago & Big Muddy Coal and Coke Co. (NE. ¼ NW. ¼ sec. 2, T. 9 S., R. 2 E.).

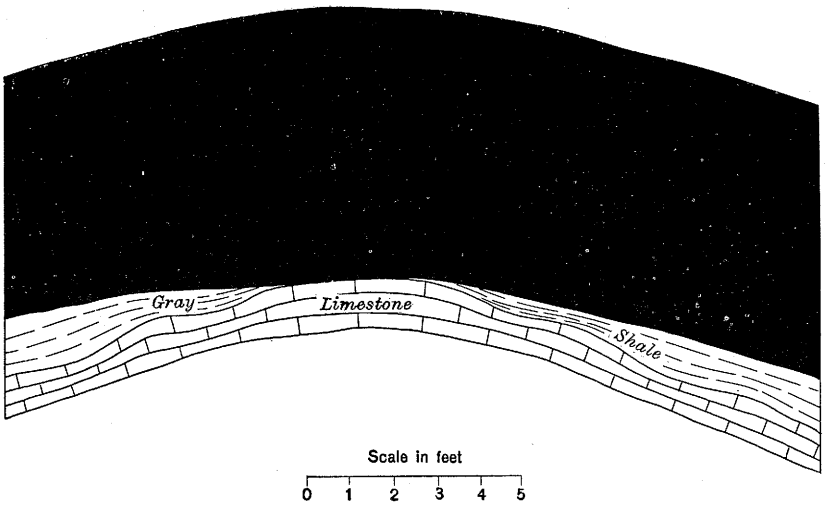

FIG. 20.—Diagrammatic illustration showing the relation of the limestone and clay underlying coal No. 6 in Jeffrey mine, Carterville & Herrin Coal Co.

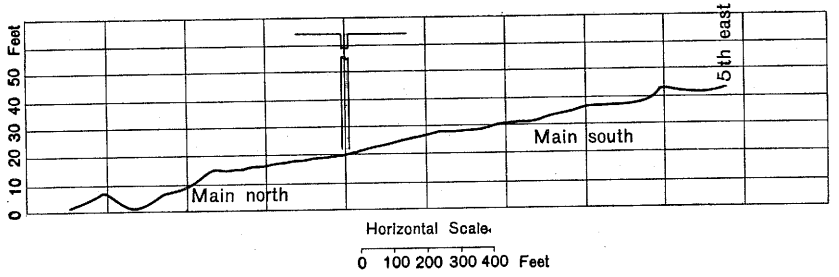

FIG. 21.—Profile of some of the entries in Jeffrey mine, Carterville & Herrin Coal Co.

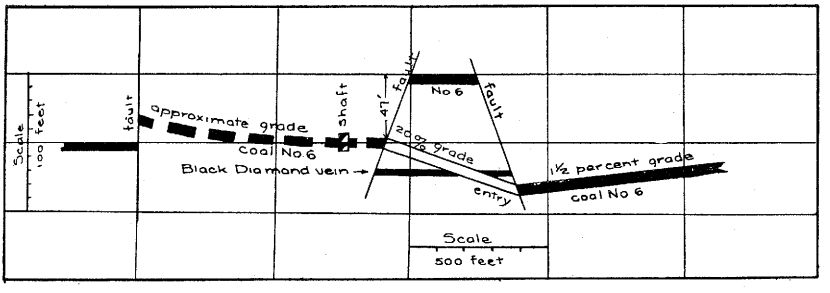

FIG. 22.—Diagrammatic illustration of faults in mine No. 1, Chicago & Big Muddy Coal & Coke Co.

The coal is displaced along lines bearing slightly east of north. One fault passes about 700 feet west of the hoisting shaft, along which the coal is dropped a maximum of 22 feet to the west. The throw decreases toward the north, and the indications at the time observations were made pointed to the disappearance of the fault in that direction. On the east side of the shaft are two faults lying on opposite sides of a block which has been faulted up. There is a difference of 47 feet in the elevation of the bed along the fault plane near the shaft, and about 75 feet difference along the easternmost fault plane. East from the fault block the coal rises at a 1½-per cent grade. These faults continue across the mine, but to what extent beyond is not known. They trend toward the Oak Ridge mine, and the folds in that mine may be the continuation of the faults in the Chicago & Big Muddy mine. There are, however, no intermediate data to corroborate this supposition.

Shaw and Savage in the Murphysboro-Herrin folio have sketched a small fault found in mine "B" of the Chicago and Carterville Coal Co. Their illustration is reproduced in figure 23.

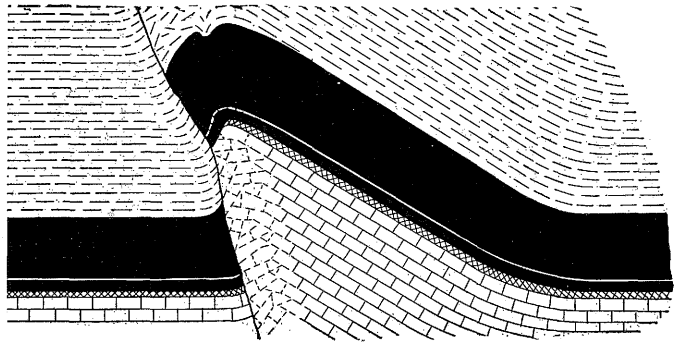

FIG. 23.—Diagrammatic illustration of a fault in mine "B," Chicago & Carterville Coal Co.

The mines having the most conspicuous faults are located near the Williamson-Franklin county line in Ranges 1 and 2 E. (see structure map, Plate V). In the Possum Ridge mine, NW. ¼ NW.¼ sec. 33, T. 7 S., R. 2 E., two faults have been observed (fig. 24) and there is possibly another. On the northeast side of the mine the bed is faulted up 18 feet along a line which is possibly continuous with the fault in the West mine, Johnston City Coal Co. On the south side of the mine the coal is faulted down 37 feet along a line which bears slightly north of west and is possibly continuous with faults found in

the north side of the W. P. Rend mine No. 2, sec. 1, T. 8 S., R. 1 E.; the north side of the Pond Creek Coal Co. mine, NW. ¼ sec. 5, T. 8 S., R. 2 E.; and again in the mine at Pierce, SW. ¼ sec. 33, T. 7 S., R. 1 E. It is probable that two faults cross sec. 5, T. 8 S., R. 2 E., since south of the first one already described drilling has shown the coal to be 94 feet higher than the downthrow south of the first fault.

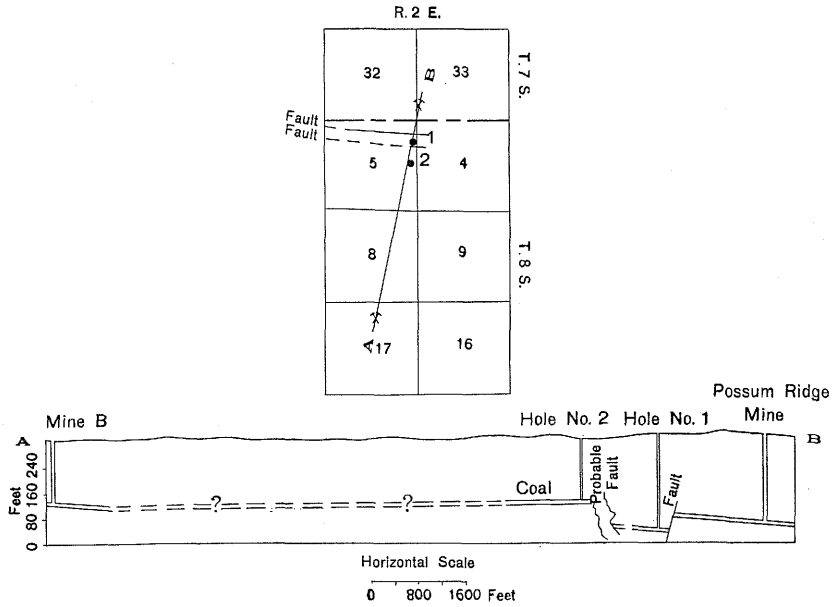

FIG. 24.—Diagrammatic illustration of a fault in Possum Ridge mine, Taylor Mining Co.

In the W. P. Rend mine No. 2, sec. 1, T. 8 S., R. 1 E., the coal is faulted down to the north about 55 feet. Whether another fault is present farther north which elevates the coal again, as in sec. 5, T. 8 S., R. 2 E., is not known, but its presence may be suspected. These two fault lines are apparently about 1,000 feet apart. The coal bed in the Pond Creek Coal Co. mine (sec. 5) and in the W. P. Rend mine No. 2 (sec. 1) slopes from the shafts northward toward the suspected or known fault lines. A photograph of a fault in the Orient mine is shown in figure 25.

The regional significance of these faulted areas will be considered under the following heading.

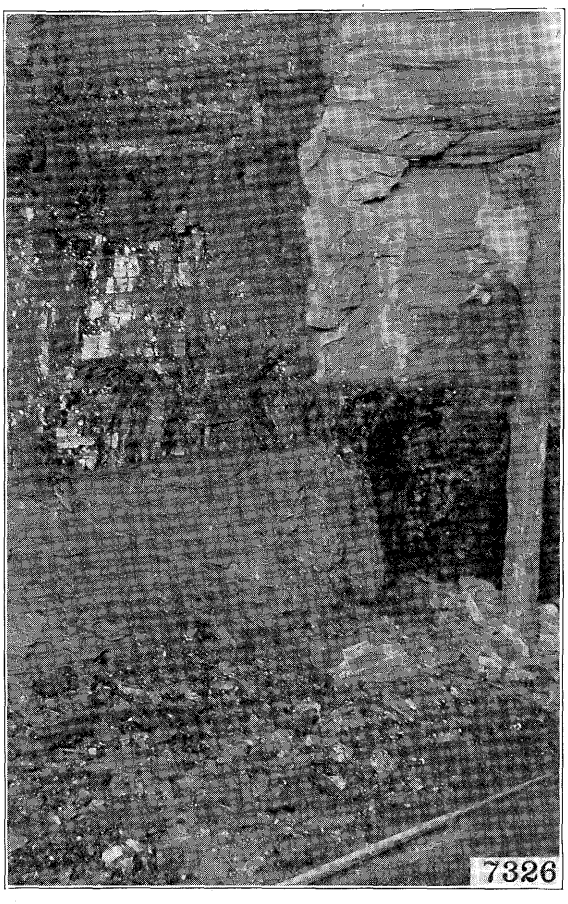

FIG. 25.—Fault in Orient mine, Chicago Wilmington & Franklin Coal Co. (photo by J. R. Fleming).

REGIONAL STRUCTURE OF COAL NO. 6

SIGNIFICANCE

The significance of structure and the method of preparation of a structure contour map have been described in preceding bulletins[2] of the series to which the reader is invited to turn if necessary. It is sufficient to state here that by *structure* is meant the "lay" of the rock layers; that is, whether they are flat lying, inclined, folded, or broken by faults. The structure contour map is constructed as an engineer's contour map from observations made at accurately located points such as drill holes, mines, or outcrops where the elevation of the

[2]Illinois Coal Mining Investigations Bull. 10, pp. 41 and 47, and Bull. 11, pp. 29-32.

coal bed, or whatever stratum is to be mapped, is more or less carefully determined. In these investigations the elevation of the surface of coal No. 6 is the basis of the structure map (Plate V). Upon the map those holes whose surface elevations and locations have been determined by members of the State Geological Survey or other responsible persons are indicated by a dot. Other holes of which only estimates of the elevation are made are indicated by a circle. Experience has shown that estimates may be in error as much as 50 feet.

The large features of structure of coal No. 6 are thought to be those of the Pennsylvanian rocks as a whole. The beds above and below the coal are essentially parallel so that the lay of the coal bed is approximately the same as the lay of the overlying and underlying strata. This is probably especially true of the coal and limestone beds found in "Coal Measures" as they commonly represent horizontal deposition so that general parallelism of successive beds is to be expected. Sandstones and shale apparently in many places occur as the filling of channels, hence are apt to depart from horizontality, and the upper surface is more likely to be a plane than the lower.

It has been frequently found in the study of the regional structure of the Illinois coal beds, that not only are the coals about parallel, but also that the structures of the "Coal Measures" strata are continuous into the underlying formations. It is therefore possible to predict the presence of anticlines, domes, and terraces in the strata below the "Coal Measures," if their occurrence is evident in the structure map of the coal above. This relationship has made possible the location of several of the important oil fields of the State and has been of great service in directing drilling.

RELATION TO GENERAL ILLINOIS STRUCTURE

The "Coal Measures" of Illinois occupy a spoon-shaped basin, its deepest part being in Hamilton, Wayne, and White counties. The long axis of the "spoon" passes near Olney in Richland County and Lovington in Moultrie County. The district under consideration lies on the southern border of the "spoon" but west of its axis, and the general dip is north and northeast toward the main axis of the basin. The dip is not regular but varies in direction and degree.

DUQUOIN ANTICLINE

The main modification of the structure of the coal basin in southwestern Illinois is the Duquoin anticline named from the town in Perry County near which the fold is well developed. Properly speaking this structure is a monocline. It lies along the east side of Perry

County in District VII, probably crosses the west end of Jefferson County in District VI, and finally plays out north of Sandoval, Marion County, again in District VII. The axis of the fold extends N. 10° E. District VI, except possibly for a small area in Jefferson County, lies east of the Duquoin anticline.

MINOR FOLDS

The general northeastward dip of the rock of the district is interrupted here and there by terraces, basins and anticlines of relatively small dimensions. Inspection of the contour map (Plate V) will reveal localities where the direction and amount of the dip departs from the normal. A crowding of the contour lines indicates a steeper dip at that place, and an unusually wide spacing is indicative of a gentler dip. Where the contour lines bend rather definitely to the northeast forming a protrusion down the dip anticlinal structure prevails, and where the contour lines bend in the opposite direction forming an indentation up the dip the structure is synclinal. Similarly where an area is surrounded by a contour line (see vicinity of Sesser) synclinal or anticlinal structure may exist according to the following law. If the other surrounding contour line is the same as the adjacent continuous contour line down the dip (northeast) the area is synclinal; of the outer surrounding contour line is of the same elevation as the adjacent continuous contour line up the dip (southwest) the area is anticlinal.

Irregularities such as those mentioned above are not uncommon in the district. Crowding of the contours such as was referred to above is apparent in the north part of Williamson County in T. 8 S., R. 2 E., as well as elsewhere. Projections down the dip and indentations up the dip are conspicuous along the –250-foot contour line, but are not wanting along other contour lines. Isolated areas surrounded by contour lines are to be noted in Franklin County in the area between the –100 and –250-foot contour lines.

So far as is known minor structural features of the nature described are not of much importance in their effect upon mining. Areas where the contour lines are most closely crowded have not been explored by mining operations, and it may be found finally that the difference in elevation of the coal noted from drill hole to drill hole is due to faulting rather than to folding. The other irregularities, synclines and anticlines, are commonly characterized by such gentle dips that their presence is of no concern to the operator. Whether mining conditions at the Sesser mine are affected by its location apparently in the basin indicated on the structure map has not been shown. The

differences in the elevation of the coal in the vicinity of Sesser may also be found to be due to faulting.

FAULTS

Many of the faults that have been observed in the mines of the area have been described. It remains in this section of the report to indicate the principal zones of probable faulting as determined from a study of the faults in the mines and the structure-contour map.

East-west zone of faulting.—The more detailed mapping that was possible in the structure maps presented in the folios shows certain structural features with greater emphasis than is possible with a contour interval of 50 feet used in the maps accompanying this report. In the maps to be presented in the West Frankfort-Galatia folio especially, a zone in which conspicuous differences in elevation occur within short distances can be traced across the area from the north part of T. 8 S., R. 2 E., to the north part of T. 9 S., R. 4 E. This zone if continued in the same direction into Jackson County would there include the faulted area described and mapped by Shaw and Savage in the Murphysboro-Herrin folio. Within District VI the important faulted area along the Franklin and Williamson County line is included within the zone and accounts for some of the differences in elevation that have been discovered. That faults cutting the "Coal Measures" will also be found in the east half of Williamson County seems not improbable, especially in the south half of T. 8 S., R. 3 E., the south half of T. 8 S., R. 4 E., and the north half of T. 9 S., R. 4 E. Studies in Saline County show that this zone of pronounced differences in the elevation of the coal extends east toward Harrisburg.[3] Numerous structural features that appear on a structure map similar to the Attila dome are found east of the Williamson County line. It is not improbable that some of the differences in elevation are due to faults.

North-south zone of faults.—Extending about N. 15° W. from the south boundary of the district north of Marion to the Duquoin anticline in Jefferson County is another zone possibly 4 or 5 miles in width in which large differences in the elevation of the coal exist within short distances. In this zone are the Sesser basin, the Plumfield terrace with its strong limiting monocline to the east, Pond Creek flat, and the syncline and fault near the mine of the Chicago & Big Muddy Coal & Coke Co., in the NE. ¼ NW. ¼ sec. 2, T. 9 S., R. 2 E. It is possible that the belt is somewhat wider in places, or as a whole,

[3]DeWolf, F. W., Coal investigations in the Saline-Gallatin fields, Illinois, and the adjoining area; also Coal investigations in Saline and Williamson counties, Illinois: Ill. State Geol. Survey Bull. 8, pp. 211 and 230, 1908.

than has been suggested and includes the Clifford and Zeigler anticlines. The structure as mapped in the structure contour map seems to indicate monoclinal folding of different degrees of intensity along this zone, the downfolding being to the east. The general dip of the beds to the northeast somewhat obscures this feature in the structure map; yet in spite of this, the structure is not difficult to follow in Franklin County at least.

The known faults of the district not found in the zone extending east and west are found in the zone extending nearly north and south. That some of the areas in this belt, where large differences in the elevation of the coal occur in short distances, are faulted, does not seem improbable. Certainly high angles of dip may be expected in the coal beds in these areas.

ROOF OF COAL NO. 6

The roof of coal No. 6 in the mines of District VI is commonly the upper bench of coal, with variable thickness from 1½ and 2 feet to 5 feet. Above the coal is 15 to 110 feet of gray impure shale, the lower part of which commonly contains a great number of plant impressions. This shale does not stand up well when the coal is removed and for this reason the upper bench of coal is commonly left for roof. In a few of the mines is a draw slate becoming locally as much as 6 inches in thickness. This commonly is found where the roof is limestone. Over a large part of the area within 25 feet of the coal is a limestone cap rock which in places rests upon the coal, except for the draw slate that lies between. Where the limestone cap rock is not present within 25 feet of the coal it may be entirely absent, or lie at a considerably greater distance above the coal, amounting in some places possibly to as much as 100 feet.

Plate III shows graphically the character of the roof of coal No. 6 in many of the drill holes in District VI. It will be observed that the thicker coal is generally found where the distance to the cap rock is greater than 25 feet. The significance of this relationship was discussed in the description of the McLeansboro formation of which the roof of the Herrin coal is a part.

The character of the roof in the mines visited by members of the Cooperative Investigations is shown in Table 8. Although this list includes but a small number of the mines within the district it is believed that it presents the main variations found in the roof rock.

Certain local variations noted by the field men in these same mines are described in order in the following paragraphs.

TABLE 8.—*Character of the roof in several mines in Franklin and Williamson counties*

Mine	Limestone cap rock		Immediate roof		Draw slate
	Thickness	Height above coal	Character	Thickness	Thickness
	Feet	*Feet*		*Inches*	*Inches*
Franklin County—					
Hart-Williams	7	0 to 18	coal	about 18	none
Leiter No. 1		(gray shale)	coal	48	none
Mitchell or North	5	22	coal	24 to 30	none
Rend No. 1	9	0+		18	24+ below 1s. only
Sesser		(gray shale)	coal	19 to 24	none
East		(gray shale)	coal	aver. 20	none
Williamson County—					
"A"		(gray shale)	coal	aver. 18	none
No. 8 (Clifford)	(?)	14+	coal	18 to 20	none
Jeffrey		(gray shale)	coal	20	0 to 6
No. 3 (Hafer)		(gray shale)	coal	0 to 24	none
West	(?)	variable	gray and black shale and limestone		0 to 60

Hart-Williams Coal Co.

The limestone cap rock in places forms the roof with only a knife edge of shale between the limestone and the coal. The limestone is dense, hard, and slabby, containing a few drusy cavities and some fossils. Above the gray shale which overlies the coal throughout most of the mine is a dense, black, fissile shale about 5 to 6 feet thick. In places this sheety shale replaces the gray shale. The lower part of the black shale contains limestone and pyrite nodules, the surfaces of which are slickened as though movement had taken place adjacent to them.

Franklin Coal & Coke Co., mine No. 1 (North of Mitchell)

Above the coal is a gray shale reported to be harder than is common throughout the district. It is dense, sandy, and contains plant impressions. A few slips are found in it; but these cause no trouble. The shale falls in irregular masses and breaks into small spalls upon weathering.

W. P. Rend Collieries Co., mine No. 1

The rock above the coal is gray shale with considerable areas of black shale and some limestone. The limestone is in all places separated from the coal by a draw slate. The coal is reported to be dirtier and more impure under the black shale than under the gray shale and still more impure beneath the limestone.

Sesser Coal Co.

No limestone or black shale is found above the coal. The roof is a sandy shale, gray, and is cut by a large number of slickensided surfaces. The shale falls in large tabular masses, and coal is found in plates scattered through the shale near the coal bed.

Big Muddy Coal & Iron Co., mine No. 8

In the mine at Clifford gray shale overlies the coal as usual. Here, however, it is irregularly bedded and very difficult to support. Small areas of black shale overlie the coal here and there in the mine, and where it is found the mine is somewhat wetter than other places in the mine.

Carterville & Herrin Coal Co., Jeffrey mine

The roof is gray shale separated from the coal by 2 to 4 inches of light-colored draw slate, which falls without warning and is either wedged down or propped up in mining. No black shale or limestone overlies the coal. The gray shale shows little bedding. Rolls are not uncommon as has been described in a preceding section.

Hafer Washed Coal Co., mine No. 3

The gray shale roof weathers with a white efflorescence. The shale is slightly sandy, has an irregular fracture, and falls in tabular slabs. This shale is 3 feet thick. Above it is what is called "hard pan," a gray shale slightly harder than that below, and containing a few sulphur nodules of irregular size. This stratum forms the cap rock. The lower gray shale falls badly and is kept up with difficulty near the rolls.

Johnston City Coal & Coke Co., West mine

Three kinds of roof, gray shale, black fissile shale, and limestone, are found in this mine. The black shale and limestone are found for the most part on the east side of the mine. In a few rooms limestone rests directly upon the coal, but commonly it overlies black draw slate which varies in thickness from a thin parting to 5 feet. The coal is reported to be thinnest below the black shale roof, and the quality there is much inferior. Water usually accompanies the limestone roof. One stream on the east side comes through the limestone and black shale top at the rate of about 2 gallons a minute, but no fracture is apparent. The black shale contains many "niggerheads" some as large as 1½ feet in diameter. The exterior of these is remarkably smooth, evidently the result of movement. On fracturing no definite core was found, but the cracks were filled with calcite (calcium carbonate). Around the outer part about one-eighth of an inch below the surface occurs a more or less continuous band of iron sulphide. The black shale is not calcareous as are the concretions, most of which are flattened parallel with the bedding of the shale.

FLOOR OF COAL NO. 6

Underlying coal No. 6 is commonly a hard, gray shale, generally referred to as "fire clay." The underclay varies in thickness from a few inches to 18 feet or more, and has an average thickness of 2 to 4 feet. Measurements of the fire clay are not common, as most of the drill holes which reach coal No. 6 are not known to have penetrated the entire thickness of the clay. Definite measurements are obtained from the records of wells extending to deeper coals, and from excavations in mines where sumps have been dug. Recorded thicknesses of

the underclay greater than 10 feet are very unusual, and even thicknesses of 5 feet and over are not common.

Below the underclay of coal No. 6 is commonly a limestone. This stratum is of variable thickness but rarely is greater than 10 feet. So far as known, the coal never lies directly upon the limestone, but in places the intervening clay is less than a foot in thickness. In the southeast part of Williamson County many of the logs show sandstone or sandy shale below the underclay. In some places the limestone may be absent, and in others may lie below the sandy beds. In still other holes in this part of the district, black shale is found below the gray shale, and this in turn may or may not be underlain by limestone.

The character of the floor was observed with care in those mines visited under the cooperative agreement. A brief description of the conditions noted in each mine will be sufficient to show the variations in the nature of the floor rock from place to place in the district.

Hart-Williams Coal Co.

The floor is fire clay which is soft and a little sandy and varies from 18 to 36 inches in thickness. Limestone underlies the clay. The bottom heaves badly.

Bell & Zoller Mining Co., mine No. 1 (Leiter shaft)

The floor is fire clay 2 to 4 feet thick, which does not heave and below which is about 6 feet of dove-colored, mottled limestone. The contact between the limestone and fire clay is not sharp, there being numerous limestone nodules scattered through the clay for 6 inches above the limestone. The clay does not heave.

Franklin Coal & Coke Co., mine No. 1 (Mitchell or North)

Floor similar to that found in other mines in the district and does not heave. The upper part of the clay contains plant impressions and slickened surfaces. The clay is at least 4½ feet deep, but a sump sunk to this depth did not reach the bottom.

W. P. Rend Collieries Co., mine No. 1

The floor is a light-gray clay the first few inches of which contains carbon. The clay is very hard and the upper foot has slickened surfaces. The floor heaves badly. Limestone lies about 30 inches below the coal.

Sesser Coal Co.

A very hard fire clay more than 10 feet in thickness underlies the coal.

United Coal & Mining Co., mine No. 1 (East)

The floor is clay of variable thickness, from 18 inches to 4 feet. When wet the clay heaves; over most of the mine, however, the floor is dry.

Chicago & Carterville Coal Co., mine "A"

The usual gray clay underlies the coal in this mine. It has a thickness of 2 to 5 feet.

Big Muddy Coal & Iron Co., mine No. 8

The average thickness of the underclay in this mine is 6 feet. It varies in thickness from 2½ to 8 feet. The clay is dark gray, containing much carbonaceous matter. It breaks into rounded fragments with slickened faces. The floor heaves badly. Limestone underlies the clay.

Carterville & Herrin Coal Co., Jeffrey mine

The limestone in parts of the mine is separated from the coal by only a paper edge of shale. In general the clay is thicker reaching 4 feet in places. The floor does not heave.

Hafer Washed Coal Co., mine No. 3

The underclay varies from 4 inches to 3 feet in thickness. It is underlain by sandy limestone. The clay becomes soft and muddy when wet but does not heave.

Chemical Character of Coals

Table 9 shows the chemical character of coal No. 6 in Franklin and Williamson counties as determined from samples collected for the Illinois Coal Mining Investigations during 1912. The tables are reproduced from Bulletin 29 of the State Geological Survey.[4]

If a comparison with analyses of other coals in the State is desired the reader is requested to refer to Table 10 and to Plate VII. It is apparent from the tables that coal No. 6 in District VI is characterized by relatively low moisture and sulphur. In the former respect it is second only to coal No. 5 in Saline County, and its sulphur content is but slightly higher than that of coal No. 2 of Jackson County. Thus it ranks among the best coals of the State.

[4]Parr, S. W., Purchase and sale of Illinois coal on specification: Ill. State Geol. Survey Bull. 29, p. 63, 1914.

TABLE 9—*Average analytical and heat values of coal No. 6 for separate mines in Franklin and Williamson counties*

Co-op No.	Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	CO_2	B. t. u.	"Unit Coal"
Franklin County								
50	9.34	34.84	48.03	7.79	1.04	.38	12004	14633
	Dry	38.42	52.99	8.59	1.15	.42	13241	
51	10.28	33.42	49.05	7.25	1.18	.10	11890	14562
	Dry	37.26	54.66	8.08	1.32	.11	13252	
52	6.77	38.35	44.62	10.26	3.13	.91	11875	14554
	Dry	41.14	47.85	11.00	3.36	.98	12737	
53	10.18	32.78	48.88	8.16	.64	.61	11661	14419
	Dry	36.50	54.41	9.09	.71	.68	12983	
56	8.10	36.30	45.34	10.26	2.51	.74	11826	14601
	Dry	39.50	49.34	11.16	2.73	.80	12758	
57	9.67	35.69	49.55	8.54	.95	.32	11756	14529
	Dry	32.24	54.86	9.45	1.05	.35	13015	
58	8.93	34.51	48.80	7.76	.74	.36	11937	14463
	Dry	37.89	53.59	8.52	.81	.40	13108	
Average	9.04	34.62	47.78	8.56	1.45	.44	11837	14538
	Dry	38.06	52.53	9.41	1.59	.48	13013	
Williamson County								
59	10.47	32.99	47.27	9.27	1.52	.38	11630	14684
	Dry	36.85	52.80	10.35	1.70	.43	12990	
60	8.22	34.00	48.79	8.99	2.16	.33	11959	14660
	Dry	37.04	53.16	9.80	2.35	.36	13030	
61	9.27	33.83	49.70	7.20	1.37	.13	12127	14671
	Dry	37.28	54.78	7.94	1.51	.14	13366	
62	9.13	33.09	49.94	7.84	1.17	.22	12028	14637
	Dry	36.42	54.95	8.63	1.29	.24	13236	
63	9.47	33.45	48.13	8.95	1.94	.36	11852	14730
	Dry	36.96	53.16	9.88	2.14	.40	13092	
64	9.34	32.77	49.48	8.41	.92	.52	11872	14577
	Dry	36.15	54.58	9.27	1.01	.57	13095	
65	9.31	33.52	48.98	8.19	1.70	.13	11919	14627
	Dry	36.96	54.01	9.03	1.88	.14	13143	
Average	9.31	33.38	48.90	8.41	1.54	.36	11913	14655
	Dry	36.81	53.92	9.27	1.70	.40	13136	

In order to compare the heating quality of this coal with that of the other coals of the State, Table 10 showing the average and extreme

TABLE 10.—*Comparative heating values of the various Illinois coals*

(Data after Parr)

District	Coal bed	Condition	British thermal units		
			Minimum	Maximum	Average
1	La Salle, No. 2.....	As rec'd	10,391	11,435	10,981
		Dry	12,587	13,468	13,101
2	Murphysboro, No. 2.....	As rec'd	12,260	12,651	12,488
		Dry	13,565	14,044	13,765
3	Rock Island, No. 1.....	As rec'd	10,366	10,880	11,036
		Dry	12,548	12,737	12,753
4	Springfield-Peoria, No. 5....	As rec'd	10,230	10,951	10,514
		Dry	11,995	12,700	12,384
5	Harrisburg, No. 5.....	As rec'd	12,053	12,550	12,276
		Dry	12,784	13,490	13,165
6	Franklin, Williamson, and Perry, No. 6.....	As rec'd	11,335	12,127	11,825
		Dry	12,583	13,366	13,025
7	Belleville, No. 6.....	As rec'd	10,438	11,207	10,847
		Dry	12,150	12,801	12,406
8	Danville, No. 6.....	As rec'd	10,508	11,228	10,920
		Dry	12,449	12,925	12,764
8	Danville, No. 7.....	As rec'd	.....	.....	11,151
		Dry	.....	.....	12,807

values for the coals of the 9 different districts is inserted. (See also Plate VII.)

TABLE 11.—*Average of 24 proximate analyses of coal No. 5 from Saline County*

Condition	Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	CO_2	B. t. u.
As received	6.92	35.44	49.06	8.58	3.76	.39	12,314
Dry coal	....	38.08	52.70	9.22	4.04	.42	13,229

[5]Parr, S. W., Purchase and sale of Illinois coal on specification: Ill. State Geol. Survey Bull. 29, p. 62, 1914.

The chemical characteristics of coal No. 5 in this general region will be discussed in greater detail in the report on District V. Table 11 is an average analysis[5] of 24 samples collected from 6 mines in Saline County showing the chemical character of coal No. 5 in the adjacent district.

An analysis of coal No. 5 in District VI has been made by Prof. S. W. Parr from a sample collected from the mine at Spillertown in 1908. It is the only mine within the district that has operated in this bed since the investigations in this part of the State were started.

TABLE 12.—*Analysis of coal No. 5 from mine of Spillertown Coal Co.*

Condition	Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	B. t. u.
As received	6.29	46.99	36.72	10.00	3.61	12,251
Dry coal	....	50.12	39.20	10.68	3.86	13,073

COAL RESOURCES

The resources of coal No. 6 in District VI have been estimated with considerable care (Table 13). Contours were drawn showing the distribution of the various thicknesses of the bed, the contour interval being 6 inches. These areas were measured by the aid of the planimeter for each township and checked with the total area of each township. Areas of the same thickness were then assembled (column 2) and the total of these areas checked with the total area of the county or of the area in the county underlain by the coal (column 1); these figures are shown in column 3. The proportion of each of these areas to the area of the county or the area of the county underlain by coal No. 6 (Williamson County) is shown in column 4. In estimating the tonnage the coal was assumed to have an average specific gravity of 1.3, which is equivalent to an average of 1,770 tons per acre foot or 1,132,800 tons per mile foot. The tonnage per foot for each area as shown in column 3 is then readily computed and appears in column 5. In estimating the total tonnage for each area the figures of per-foot tonnage (column 5) were multiplied by a figure representing generally 3 inches less than the average thickness shown in column 2; that is, if the average is 72 to 78 inches 6 feet is taken as the factor. Where a single average figure is given in column 2 that amount reduced to feet is used as a factor 4 for 48 inches, 6 for 72 to 78 inches, and 6½ for 78 to 84 inches. The amount of the original tonnage per areas as well as for counties and for the district is shown in column 7. The

total production is taken from figures shown in Table 1 and is indicated in column 8 of Table 13. From the Williamson County total 400,000 tons are subtracted. This quantity is a rough estimate of the amount of No. 5 coal mined in the county since 1881, based on a production of 131,000 tons since 1900 (Table 1), and the remainder represents the total production of No. 6 coal from the same date. The percentage of recovery (column 9) is based upon figures presented in a previous report.[6] Where an average recovery of 57 per cent is indicated for mines operating under the panel system and 56 per cent under the room-and-pillar system. As but few mines operate under the former system the lower percentage of recovery is probably nearer the general average. On the basis of a recovery of 56 per cent of the seam the total product and the total amount rendered unminable is determined and is shown in column 10. The percentage of this amount relative to the original total is indicated in column 11. The total amount remaining as shown in column 12 can be readily determined. The last column represents the total amount of coal that may eventually be gained on the basis of a 56 per cent recovery of the original total tonnage.

To make more than a rough estimate the longevity of coal No. 6 in District VI is very impracticable for obvious reasons. At the present rate of production the available coal (4,890 million tons) should last about 300 years. This figure is, however, of very little value because of at least two variables—the rate of increase (or decrease) of production, and the possible variation in the percentage of coal recovered. Concerning the rate of increase of production it is significant that present developments are in areas where the coal is thick, and consequently the thickest and most cheaply mined coal will be gained first. When the average thickness of the coal mined is no greater than the average thickness of the coal in other parts of Illinois cheapness of production will no longer be an especial incentive for the development of new property in District VI. The fact that companies now operating in the district have control of nearly all the best coal land is an indication that the rate of increase so far as it depends upon new mines is possibly near its greatest height. The percentage of coal recovered may increase or decrease. It seems to be true that the thicker the coal the thicker the upper bench which is commonly left for roof, and that where the coal is thickest there is greater necessity for leaving the roof coal. It is possible, therefore, that the thinner coal in the east and north parts of the district will require less amount of the

[6]Andros, S. O., Coal mining in Illinois: Ill. Coal Mining Investigations Bull. 13, pp. 76 and 88, 1915.

upper bench to be left and thus permit a larger percentage of recovery. On the other hand the higher marketable qualities of the coal when only that part of the bed above the "blue band" is recovered will possibly be an inducement for leaving the lower bench, a practice which would decrease materially the percentage of recovery.

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Bulletin 1. Preliminary Report on Organization and Method of Investigations, 1913.

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Bulletin 3. A Chemical Study of Illinois Coals, by Prof. S. W. Parr, 1914.

Bulletin 4. Coal Mining Practice in District VII (mines in bed 6 in Bond, Clinton, Christian, Macoupin, Madison, Marion, Montgomery, Moultrie, Perry, Randolph, St. Clair, Sangamon, Shelby, and Washington counties), by S. O. Andros, 1914.

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