ILLINOIS

COAL MINING INVESTIGATIONS

COOPERATIVE AGREEMENT

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

BULLETIN 14

Coal Resources

OF

District VIII (Danville)

BY

FRED H. KAY and K. D. WHITE

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
1915

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 now vested in the Director of the United States Bureau of Mines, the Director of the State Geological Survey, and the Director of the Engineering Experiment Station, 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 Engineering Experiment Station, 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 VIII (DANVILLE)

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INTRODUCTION

Importance of the Area

There has been extracted from Vermilion and Edgar counties since 1880 more than 58,000,000[1] tons of coal; but in the Danville District proper, where detailed information is available, more than 1,494,000,000 tons remains in the ground. Both on account of its importance as a producer and its geographic position (fig. 2), the region was selected as a district of the Illinois Coal Mining Investigations. The present report is one of a series being prepared on the coal resources of Illinois.

Although Edgar County has produced only a small amount of coal, some of the Vermilion County beds underlie this county, and it may be regarded as a connecting link between the Indiana fields to the east and the Danville field to the north. Coal No. 6, locally called the Grape Creek coal, is most actively mined in the vicinity of Westville; coal No. 7 or the Danville coal is mined near Danville and Fairmount. These are the only beds commercially utilized at present. Early mining was principally in the Danville bed, but the largest mines now operate in the Grape Creek coal.

Production and Mines

Production in tons, year ended June 30, 1914[2]	2,983,591
Production in tons, year ended June 30, 1913[2]	3,510,661
Average annual production, 1910-1914[2]	3,034 508
Total production, 1881-1913 (calendar year)[3]	57,908,547

During the year ended June 30, 1914, Vermilion County produced 4.9 per cent of the total output for the State. Thirty-five mines were in operation, 13 of which were shipping mines. Of the total production, coal No. 6 (Grape Creek) furnished 2,410,045 tons, whereas coal No. 7 (Danville) contributed only 573,546 tons. Table 1 is a list of shipping mines in Vermilion County in the year ended June 30, 1913.

[1]Statistics from U. S. Geol. Survey Mineral Resources.
[2]Statistics from reports of State Mining Board.
[3]Statistics from Mineral Resources, U. S. Geol. Survey.

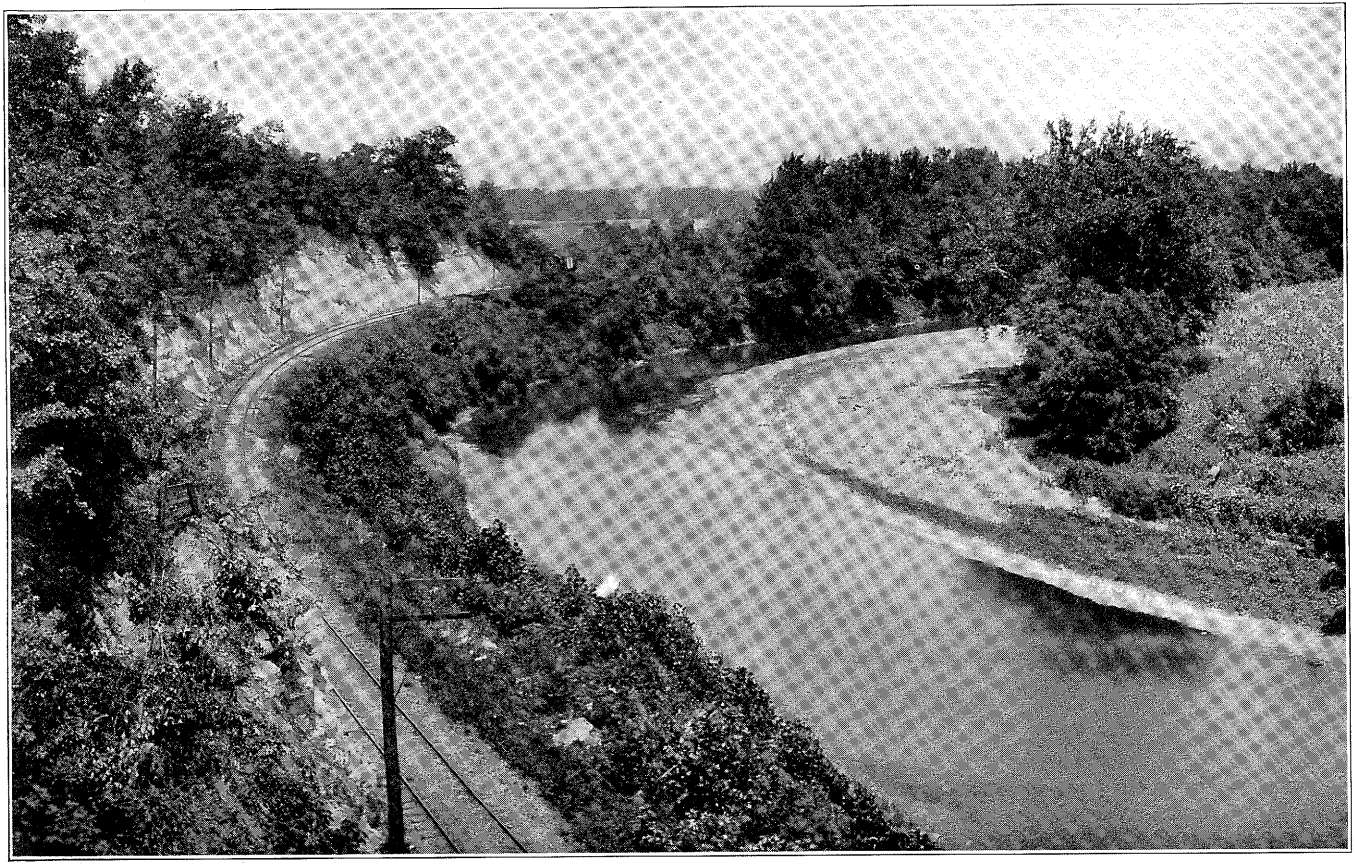

FIG. 1—Looking northeast from bend in Vermilion River, N.W. ¼ sec. 22, T. 19 N., R. 11 W. Coal No. 6 outcrops in bluff and dips west.

Acknowledgments

The authors wish to acknowledge their indebtedness to the men connected with mining industry in Vermilion County for the generous cooperation which has made the report possible. A large number of drill records have been furnished by the Bunsen Coal Co., C. C. C. & St. L. R. R., Two Rivers Coal Co., C. L. English, Western Brick Co., Hegler Bros., and the Danville Belt Coal Co.

The mines have been opened freely and the work has been facilitated by uniform courtesy both in the offices and underground. Special thanks for many favors are due Messrs. DuBois and Jones of Dering Coal Co., and to Mr. Webb of the Danville Belt Coal Co.

The Danville folio by M. R. Campbell[4] has been of great use and has been drawn upon freely.

STRATIGRAPHY

Method of Study

Below the glacial drift the district is underlain by Pennsylvanian strata ("Coal Measures"), some of which outcrop along Vermilion River, North Fork, Little Vermilion, and a few of the smaller creeks. The beds which may be studied on the outcrop are but a small part of the series, and over most of the district, only records of wells, mine shafts, and drill holes furnish knowledge of the stratigraphy.

Since this report is concerned chiefly with the coal resources, the rocks underlying the "Coal Measures" are treated only in a brief manner. The general characteristics of these lower rocks may be seen by reference to the graphic sections in Plates VI and VII which are described in the Appendix.

Coal-bearing Rocks

The coal-bearing rocks of Illinois are divided by geologists into three formations named in ascending order: Pottsville, Carbondale, and McLeansboro.

POTTSVILLE FORMATION

The Pottsville formation is a series of sandstones, shales, and thin coals, comprising the base of the "Coal Measures". The name is applied to the beds above the Mississippian formations and below coal No. 2. The Pottsville beds were deposited upon an old land surface and are consequently variable in thickness and in composition.

Sandstone is the predominating constituent of this formation and ranges from fine-grained material to typical conglomerate. Its composition is so irregular, however, that no definite character can be

[4]Campbell, M. R., U. S. Geol. Survey Geol. Atlas, Danville folio (No. 67), 1900.

TABLE 1.—*List of shipping mines in Vermilion County for year ended June 30, 1913*

Map No.	Company	Mine	Location					Coal Bed	Depth to Coal	Average thickness		Production 1913	Production 1914
			¼	¼	Sec.	T. N.	R. W.						
										Ft.	*In.*	*Short tons*	*Short tons*
16	Bunsen Coal Co.	Little Vermilion	NW	SE	19	18	11	6	175	6	6	792,315	726,413
11	do	4	NE	SW	5	18	11	6	164	6	0	669,307	600,626
10	do	2	SW	SE	31	19	11	6	183	6	0	418,694	342,782
12	do	3	NE SW	NE	7	18	11	6	189	5	6	386,310	372,059
13	Dering Coal Co.	2	W½	NE	13	18	12	6	210	6	0	208,143	185,064
14	do	4	NW	SE	15	18	12	6	208	6	0	164,720	148,074
15	do	3	SE	NE	23	18	12	6	190	6	0	144,428	abandoned
6	Electric Coal Co.	Electric	SW	NW	10	19	12	7	90	6	0	116,426	84,121
9	Danville Coll. Co.	Catlin	SW	NW	35	19	12	7	153	6	0	112,738	88,161
4	Mission Min. Co.	1	W½	NE	17	19	12	7	20	6	0	62,240	106,858
3	Missionfield Coal Co.	3	NW	NE	20	19	12	7	80	5	8	48,244	100,191
2	Tilton Coal Co.	Comet	W½	NW	18	19	12	7	100	6	0	46,448	47,494
..	Black Diamond Coal Co.	1	W½	NE	18	19	12	7	..	6	0	45,283	abandoned
..	Missionfield Coal Co.	2	NW	NE	17	19	12	7	Dr	6	0	34,205	3,766
1	Black Diamond Coal Co.	B. D.	...	SE	9	19	13	7	80	6	0	27,482	abandoned
17	Sharon Coal & Brick Co.	Sharon	NW	NE	7	17	11	6	235	5	6	27,080	28,379
8	Danville Consumers Coal Co.	.....	Center	NW	18	19	11	7	..	7	0	21,848	abandoned
5	Gray Coal Co.	Gray	...	NW	16	19	12	7	18	6	0	18,710	abandoned

assigned to it. The study of a large number of records shows that individual beds of sandstone or shale can be traced but a short distance, that one grades into the other laterally, that in one place the entire formation is represented by sandstone, whereas in another the sandy beds are almost absent. A few thin coals lie within the Pottsville, but they have been explored in only a few places, and their correlation presents great difficulties. Most of the drill records show one or more unimportant coals in this part of the section, the most important of which lies 90 feet below the top of the formation and averages 1 foot in thickness. Drill hole No. 47 of the Dering Coal Co., sec. 18, T. 18 N., R. 11 W.; and No. 51, C. C. C. & St. L. R. R., sec. 6, T. 20 N., R. 12 W. (see page 17) show the Pottsville to be of 281 and 362 feet thick, respectively. In other parts of the district, as at Allerton and in sec. 26, T. 17 N., R. 13 W. in the western part of the area, only a small thickness of coal-bearing rocks underlies the drift, pre-Pennsylvanian formations being only a short distance below the surface materials. Further west in the vicinity of Mahomet, Champaign County, no "Coal Measures" rocks are present below the drift, the first bed rock being of Devonian age.

The thinning of the Pottsville west and north indicates that it was deposited in a basin which the sea probably did not fill, or that it suffered erosion after deposition. The character of the formation is indicated by the following drill record.

Record of drill hole No. 47, Dering Coal Co., NE.¼ NW.¼ sec. 18, T. 18 N., R. 11 W.

(Elevation—689 feet)

See Plate III, No. 8

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Drift—				
Surface soil and clay	8	..	8	..
Sand	41	..	49	..
McLeansboro formation—				
Shale, blue	41	..	90	..
"Slate", blue	11	6	101	6
Coal No. 7	3	6	105	..
Fire clay	5	..	110	..
Shale, sandy	10	..	120	..
Sandstone	44	..	164	..
Shale, blue	25	..	189	..
"Slate", blue	13	9	202	9
Carbondale formation—				
Coal No. 6	7	3	210	..

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Fire clay	4	6	214	6
Limestone	3	..	217	6
Shale, gray	66	..	283	6
Shale, blue	2	6	286	..
Sandstone	58	..	344	..
Limestone	2	..	346	..
Shale, light	4	..	350	..
Sandstone	47	8	397	8
Coal	1	10	399	6
Fire clay	1	6	401	..
Sandstone	11	..	412	..
Shale, light	2	..	414	..
Sandstone	2	6	416	6
"Slate", black	..	9	417	3
Coal	2	6	419	9
Pottsville formation—				
Sandstone	20	3	440	..
Shale, blue	14	..	454	..
Sandstone	11	..	465	..
Shale, blue	1	..	466	..
Limestone	7	..	473	..
"Slate", sandy	6	..	479	..
Sandstone	12	..	491	..
Shale, blue and brown	17	8	508	8
Coal	1	3	509	11
Fire clay	1	7	511	6
Sandstone	2	6	514	..
"Slate", black	4	..	518	..
"Slate", blue	9	..	527	..
Sandstone	173	..	700	..

In the boring described above the upper part of the formation is composed of shales and sandstones, and the lower part consists of a massive sandstone, the thickness of which is 170 feet and 150 feet respectively. It is reported that a small amount of gas was found in drill hole No. 51, C. C. C. & St. L. R. R.

The top and bottom of the Pottsville are not easily determined in the district since the "Mud Vein," which is probably the same as coal No. 2 at the top of the formation, is not everywhere reported. At the base of the Pottsville, the thick Mississippian limestones, so prominent in western Indiana and in parts of Illinois, seem to have been removed by erosion before the deposition of the "Coal Measures". Consequently, the Pottsville rests on a series of shales, sandstones, and thin limestones, not unlike the lower coal-bearing rocks.

CARBONDALE FORMATION

The Carbondale formation extends from the base of coal No. 2 up to the top of coal No. 6. The Grape Creek coal is correlated with coal No. 6 largely because of the similarity between the fossil plants in the roof shales in the Danville field and in the roof of typical coal No. 6 of southern Illinois.[5] Likewise the "Mud Vein", so called because of its division into several benches by layers of shale, is correlated tentatively with coal No. 2 (Murphysboro) mainly because of its position in the "Coal Measures". Its distance below coal No. 6 in District VIII, and consequently the thickness of the Carbondale formation, varies from 165 feet to about 220 feet and averages about 185 feet. In other parts of the State these beds are from 200 feet to 250 feet apart, and in Saline County 300 feet is not an unusual distance, the additional thickness of beds being attributed to the interval between coals No. 5 and No. 6 which is 50 feet greater than in other parts of the State.

In the northern part of Vermilion County and the western part of Vermilion and Edgar counties, the lowermost beds of the Carbondale were either never deposited, or they were eroded after deposition as shown in Plate I.

Such conditions are shown in drill holes at Reilly, and Rankin in the north, and near Allerton at the west. In this same part of the area the top beds of the formation were eroded before glacial times.

The Carbondale as a whole is composed of shale and sandstone interbedded with a few layers of limestone, coal, and carbonaceous shale. A few feet below coal No. 6 lies a thin, but persistent, limestone which serves as a marker in several drill records in which the coal is absent. Clay shales, 80 to 100 feet thick, underlie the limestone. The next lower bed is a black, carbonaceous shale averaging 8 feet in thickness. A number of records show a thin limestone 120 to 140 feet below the top of the formation and a short distance above the black shale mentioned. The following drill records together with the cross-sections (Pls. III and IV) furnish detailed information regarding the character of the Carbondale.

Coal No. 6 (Grape Creek) at the top of the formation is variable in thickness. It is the best known in Vermilion County where it is actively mined. In this region it has an average thickness of 6 feet; whereas to the north, west, and southwest of Danville its thickness decreases materially. It has not been positively identified south of the Vermilion-Edgar county line. The scarcity of drill holes south

[5]White, David, Paleobotanical studies: Ill. Geol. Survey Bull. 14, pp. 293-295, 1909.

of Ridge Farm is probably responsible for the lack of identification, and later it will no doubt be possible to correlate with coal No. 6 one of the thin coals in the southern part of T. 16 N., Rs. 10 and 11 W. and to trace this bed across the boundary into Indiana.

Record of Electric mine shaft, Electric Coal Co., SW. cor. SE.¼ NW.¼ sec. 10, T. 19 N., R 12 W.

(Elevation—654 feet)

See Plate III, No. 13

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Drift—				
Surface	8	..	8	..
Hardpan	30	..	38	..
McLeansboro formation—				
Sand, slate, and limestone	59	6	89	6
Coal No. 7	5	7	95	1
Clay	4	11	100	..
Shale, sandy	7	..	107	..
Hard rock	4	..	111	..
"Slate", black	2	..	113	..
Shale, sandy	4	..	117	..
Rock	2	..	119	..
Shale, blue	47	..	166	..
"Slate", brown	11	4	176	4
Carbondale formation—				
Coal No. 6	..	8	177	..
Shale, sandy	13	..	190	..
Shale, blue	30	..	220	..
"Slate", black	10	..	230	..
Clay	2	..	232	..
Shale, blue	10	..	242	..
"Slate", brown	2	..	244	..
"Slate" and smut	3	..	247	..
Clay	2	..	249	..
Shale, light	1	..	250	..
Limestone	2	..	252	..
Shale, sandy	9	..	261	..
"Slate", black	3	..	264	..
Shale, blue	10	..	274	..
"Slate", black	2	..	276	..
Coal	1	3	277	3
Clay	3	9	281	..
Shale, light	6	..	287	..
Shale, blue	3	6	290	6
"Slate", brown	5	..	295	6
Coal	3	..	298	6
Clay, brown	1	..	299	6
"Slate", black	2	..	301	6

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Coal	2	4	303	10
Shale, clayey	14	2	318	..
Sandstone	4	..	322	..
Shale, blue	14	..	336	..
Shale, light	13	..	349	..
"Slate", dark brown	11	..	360	..
Shale, light	7	..	367	..
Pottsville formation—				
Coal and "slate"	1	6	368	6
Shale, blue	6	6	375	..
Sandstone	6	..	381	..
"Slate", sandy	10	..	391	..
Coal and "slate"	2	..	393	..
Shale, brown	2	4	395	4
Coal	..	6	395	10
Clay	4	..	399	10
Shale, blue	8	..	407	..
Sandstone	15	6	422	6

Record of drill hole No. 51, C. C. C. and St. L. R. R., NW.¼ NW.¼ sec. 6, T. 20 N., R. 12 W.

(Elevation—584 feet)

See Plate III, No. 23

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Sand and gravel	8	..	8	..
Clay, blue	10	..	18	..
Clay, yellow	22	..	40	..
Sand	2	..	42	..
Clay, sandy	12	..	54	..
Clay, blue	4	..	58	..
Sand	4	..	62	..
Clay, blue	57	..	118	..
Coal No. 7	4	8	122	8
Shale, gray	15	..	137	8
Sandstone	4	..	141	8
Shale, black	1	4	143	..
Carbondale formation—				
Coal No. 6	2	..	145	..
Shale, gray	8	..	153	..
Limestone	6	..	159	..
Shale, blue	2	..	161	..
Sandstone	10	..	171	..
Shale, blue	50	..	221	..
Shale, black, carbonaceous	3	6	224	6
Shale, light gray	51	6	276	..

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Shale, black	1	..	277	..
Shale, blue	2	..	279	..
Shale, black	1	..	280	..
Shale, brown	6	..	286	..
Limestone	6	..	292	..
Shale, dark blue	16	..	308	..
Shale, black	..	6	308	6
Shale, blue	8	6	317	..
Shale, black	..	4	317	4
Coal	..	6	317	10
Shale, gray	6	..	323	10
Coal	..	6	324	4
Shale, blue	12	..	336	4
Shale, black	3	..	339	4
Coal	2	8	342	..
Pottsville formation (?)—				
Shale, blue	2	6	344	6
Limestone	1	..	345	6
Shale, gray	2	..	347	6
Coal	2	1	349	7
Shale, blue, sandy	20	5	370	..
Sandstone	4	..	374	..
Shale, dark blue, sandy	21	..	395	..
Shale, dark blue	17	..	412	..
Coal	..	4	412	4
Shale, white	5	..	417	4
Shale, black and white alternately	11	..	428	4
Shale, white	8	..	436	4
Limestone, blue	6	..	442	4
Sandstone, white	4	..	466	4
Shale, black	..	8	447	..
Coal	1	..	448	..
Shale, green	..	4	448	4
Sandstone, white, green streaks	19	..	467	4
Limestone, hard, cherty	20	..	487	4
Chert	..	9	488	1
Limestone	8	..	496	1
Shale, dark blue, sandy	24	..	520	1
Shale, dark blue, sandy, streaks of stone	21	..	541	1
Shale, blue and green	10	11(?)	552	..
Limestone, blue	4	..	556	..
Sandstone	48	..	604	..
Sandstone, calcareous, dark blue, (oil and gas)	46	..	650	..
Sandstone	54	..	704	..
Mississippian group—				
Shale, blue, sandy	64	..	768	..

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Limestone	16	..	784	..
Shale, blue	2	..	786	..
Limestone	6	..	792	..
Black streak	..	2	792	3
Shale, blue, calcareous mottled	95	..	887	..
Limestone, white, cherty	4	..	891	..
Shale, blue and white mottled, sandy	84	..	975	..
Shale, blue	25	..	1000	3

MCLEANSBORO FORMATION

The McLeansboro formation includes all of the "Coal Measures" rocks above coal No. 6. It takes its name from McLeansboro, Hamilton County, where borings have penetrated it to a depth of 1000 feet. In the area under consideration, its maximum known thickness is about 240 feet, and in places the entire formation was removed by erosion before glacial times.

East of North Fork near Danville all of the McLeansboro and most of the Carbondale is absent, and its place is occupied by glacial drift. West along the line represented by the cross-section EF (Pl. IV) not more than 80 feet of McLeansboro beds remains. In the southern part of the Danville district proper, along the line represented by cross-section CD, as much as 180 feet of the formation underlies the drift.

The McLeansboro formation is composed of shales which are sandy in places, a few beds of sandstone, and one commercial bed of coal, No. 7, which is mined in the vicinity of Danville and Fairmount. North of an east-west line through the southern part of T. 19 N., Rs. 11 and 12 W. coal No. 7 has an average thickness of more than 5 feet, whereas south of the same line the thickness decreases at a somewhat regular rate to an average of 2 feet 8 inches. The interval between coals No. 6 and No. 7 is occupied largely by sandy shale, although lenticular beds of limestone are present in places. Northwest of Danville the two coals are 20 to 30 feet apart, whereas toward the south and west the interval increases at a rather uniform rate, and in the vicinity of Vermilion Grove 80 to 90 feet is not uncommon.

Plate I has been prepared to show graphically the history of the Danville region since the deposition of coal No. 6. It explains not only the thickening interval between the coals toward the south and southwest, but also the fact that where coal No. 6 is thick, coal No. 7 is thin, and the interval between the two is greatest.

The general character of the McLeansboro formation is shown in Plates III and IV and in the following detailed logs.

Record of drill hole No. 120, Dering Coal Co., SW. cor. SE.¼ SW.¼ sec. 12, T. 17 N., R. 13 W.

(Elevation—672 feet)

See Plate IV, section CD, No. 1

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Drift—				
Soil	4	..	4	..
Clay	21	..	25	..
Clay, blue	5	..	30	..
Gravel	3	..	33	..
Shale, sandy	35	..	68	..
Gravel	10	..	78	..
Clay, dark	85	..	163	..
McLeansboro formation—				
Rock	2	..	165	..
Shale, blue	15	..	180	..
Shale, calcareous	60	..	240	..
Gravel	2	..	242	..
Shale, blue	5	..	247	..
Rock, broken	13	..	260	..
Shale, dark	25	..	285	..
Shale, black	1	..	286	..
Shale, dark	4	..	290	..
Shale, black	7	..	297	..
Coal No. 7	4	6	301	6
Shale, dark	..	6	302	..

Record of drill hole No. 12, Dering Coal Co., SW.¼ SW.¼ sec. 4, T. 17 N., R. 12 W.

(Elevation—672 feet)

See Plate IV, section CD, No. 3

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Drift—				
Soil	2	..	2	..
Clay, yellow	10	..	12	..
Clay, blue	2	..	14	..
Sand (water)	8	..	22	..
Gravel	20	..	42	..
Clay, dark	19	..	61	..
McLeansboro formation—				
Sandstone	27	..	88	..
Shale	9	..	97	..

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Sandstone, trace of shale	48	..	145	..
Shale, dark	42	..	187	..
Shale, black, soft	6	..	193	..
Coal No. 7	3	7	196	7
Clay, light, soft	10	3(?)	207	..
Shale, sandy	32	..	245	..
Shale, light, soft	2	..	247	..
Carbondale formation—				
Coal No. 6	5	4	253	4
Clay, light	3	8(?)	257	..
Shale, light, hard	1	..	258	..

Record of drill hole No. 45, C. C. C. & St. L. R. R., NE.¼ SW.¼ sec. 7, T. 20 N., R. 12 W.

(Elevation—632 feet)

See Plate III, No. 22

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Drift—				
Soil	1	..	1	..
Sand and gravel	56	..	57	..
Clay	7	..	64	..
McLeansboro formation—				
Shale, blue	63	8	127	8
Coal No. 7	5	7	133	3
Shale, gray	1	3	134	6
Shale, black	..	1	134	7
Shale, gray	15	..	149	7
Coal	..	1	149	8
Shale, gray	9	..	158	8
Coal	..	4	159	..
Shale, gray	2	..	161	..
"Slate", black	5	..	166	..
Carbondale formation—				
Coal No. 6	9	3	175	3
Shale, gray, sandy	19	9	195	..

Glacial Features

DRIFT

Overlying the bed rock throughout the district is a mass of unconsolidated clays, sands, and gravels which varies in thickness from a few feet to about 250 feet. This glacial drift, as it is called, contains many bowlders of Canadian origin, as well as fragments of limestone from northern Illinois, a characteristic showing that it was

transported to this region and deposited as an unassorted mass upon a surface consisting of hills and valleys which showed greater relief than those of today in the district under consideration.

The results of two different ice invasions have been recognized in District VIII. The oldest drift, the Illinoian, extends 100 miles south of this area and is overlain by a rather uniform thickness of a later drift sheet, the Wisconsin, which conceals the older drift except in the deeper valleys. The pre-glacial valleys are filled largely with the earlier deposits which tended to make a smooth topography upon which the Wisconsin drift was later laid down.

PRE-GLACIAL CHANNELS

The following description of drainage features is taken from geologic folio No. 67 of the U. S. Geological Survey by M. R. Campbell and Frank Leverett:

The narrowness and the rocky character of the Vermilion River clearly indicate that the present course of the stream is of recent date and that it does not necessarily correspond with any drainage line which existed in pre-Pleistocene time. It is not known positively that any drilled wells have yet reached the bottom of the valley in which flowed the old Vermilion River, but its position is indicated by the great depth of drift found in the well at Danville Junction. The altitude of the rock floor at this point is 435 feet above the level of the sea. The well recently drilled at the Soldiers' Home reached solid rock at an altitude of 480 feet, and a well drilled a number of years ago near the depot at Grape Creek reached the rock floor at about 470 feet above sea level. These wells show a much lower rock surface than that which is found south of the river, and they are also found slightly below the level of the rock floor northeast of Danville. Three wells in Newell Township reached the rock at an altitude of about 430 feet, one at 528 feet, one at 520 feet, one at 515 feet, and one at 480 feet. From these figures it will be seen that there is a rather deep valley in the vicinity of Danville Junction, and presumably this valley extends southeastward along the course of Stony Creek and Vermilion River to the mouth of Grape Creek. The sharp, rocky gorge which the river enters on leaving the great alluvial amphitheater at this point shows that the course of the old stream must have been different from that which the river occupies at present. The drill hole at Grape Creek station is located on the extreme edge of the valley and consequently it is doubtful whether it represents the full depth of the old channel in this vicinity. Unfortunately there has been no drilling in the center of this wide flat, and one can only surmise the depth to which the rocky strata have been eroded. The old valley turned at this point and presumably pursued an easterly direction beyond the margin of this quadrangle.

There is no evidence of reversal or any such decided change in the drainage of this region. It is simply a case of readjustment to new conditions along practically the same lines that the streams occupied before the advent of the ice. During the time of maximum glaciation the streams were probably entirely arrested by the ice, but upon its retreat they formed along lines of least resistance, which in this case appear to have been nearly in their former courses. The ice front occupied a nearly east-west position, hence the southern parts of

the valleys would be open first, and here the streams generally formed. When the ice had retreated to about the position of Danville the water from its melting front found a channel along the present course of the Vermilion, more than half way up the rocky side of its old valley. Toward the south the high rock floor interposed a barrier to the pathway of the stream, but it pursued its course parallel to that highland and just at its foot. Doubtless the streams were at first located upon glacial drift only; as time advanced they eroded their channels and encountered the solid rock, but their pathway was selected, and they persisted in it despite the solid rock through which they had to cut, even though only a short distance to the northeast there was a channel already cut through the solid rock to a greater depth than the one which they now occupy. The pre-Pleistocene river flowed east and probably joined the Wabash, and the modern stream has followed in nearly the same course.

North and west of Danville the old topography is not so easy to study, for the creeks have not yet cut down to solid rock except in the immediate vicinity of Danville, and only a few wells have reached the original rock floor. There seems to be a general depression in this rocky floor along a line running directly northwest from Danville, for in sec. 16, T. 20 N., R. 12 W., solid rock was struck at an altitude of 470 feet, whereas in sec. 32, T. 21 N., R. 12 W., a well reached rock at an altitude of 525 feet. It seems probable, therefore, that the western fork of the old river entered this territory near where the present Middle Fork enters, flowed southeast, and north of Danville joined another fork which occupied a slight depression along approximately the present line of North Fork.

This rather extensive drainage system in the northern part of the quadrangle is responsible for the lowness of the rocky floor in that region, and hence is indirectly responsible for the deep filling of drift that occurs there and for the absence of the coal beds which are so important in the territory south of the river. In the extreme northeastern part of the quadrangle the height of the rock floor is not known since all the deep wells in that region have failed to reach solid rock. It shows, however, along Wabash River in the vicinity of Covington at an altitude of about 500 feet, hence it seems probable that it is about the same in the vicinity of State Line.

The sudden termination toward the east of the productive coal, as shown on the economic map, is due to the erosion of the rocks and the coal beds to a plane below the level of the latter. The outlines are only approximately correct, and hence do not represent the actual rugosities of the pre-Pleistocene topography. In Danville the coal beds are similarly cut away by early erosion, so that the beds which are prominent along the river bluff on the southwestern side of the city are not present in the northeastern part. In this locality the change is very abrupt and striking, and its existence has been verified again and again by the many wells that have been sunk below the level of the coal beds without encountering solid rock.

Since the foregoing was written, the C. C. C. & St. L. R. R. has drilled a large number of holes southwest of Danville in T. 20 N., R. 12 W. The rock surface in many of these holes is not more than 500 feet above sea level, whereas in T. 19 N., R. 12 W. it averages more than 600 feet. The former low area is no doubt a continuation of the one northeast and southeast of Danville.

For a knowledge of the Ordovician, Silurian, Devonian, and Mississippian formations which underlie the coal-bearing rocks the reader is referred to the Appendix (page 56).

STRUCTURE

Definition

The term *geologic structure* is used to denote the attitude or "lay" of rock beds. It is common belief that in Illinois all of the formations are horizontal. This belief is due to the gentleness of dips over most of the State, and also to the surficial drift cover, which obscures the underlying formations. It is only upon studying large areas in detail that the real structure may be determined.

Method of Determining Structures

The two-color map (Pl. II) was prepared for the purpose of showing the position of the beds underlying Vermilion County. In favorable regions a map would be prepared from data collected at the outcrops of the different formations, but as has been mentioned, over most of the region all the beds are covered by unconsolidated sands, clays, and gravels, known as glacial drift. In such an area it is necessary to collect and study all available data from drill records. On Plate II drill holes the logs of which are filed in the office of the State Geological Survey are indicated by appropriate symbols. These records have been obtained from many sources. For the most part they represent test holes for coal and petroleum. Almost without exception the operators have furnished their logs for purposes of study. The Survey is requested to hold a large number of records confidential, and for this reason the thickness of the coal is not shown on the map.

Unfortunately the available records for Edgar County are too few to be of much value for correlation or for the study of coal resources. The Survey has knowledge of 67 holes that have been drilled in the county, excluding the large number of shallow farm wells, but after careful inquiry among the drillers it is found that most of the records have been lost, misplaced, or destroyed, and the valuable information obtained at considerable expense is unavailable, and only 13 good records have been secured. It should be remembered that records of any kind have worth even if they show the absence of coal, since if the record is lost, useless drilling may be done in the future.

Structure Contour Map

STRUCTURE CONTOURS

Prominent, curved, red lines bearing conspicuous numbers ranging from 200 to 600 extend in a general northwest-southeast direction

across the map. These contour lines show the position of coal No. 6 above sea level. Since the "Coal Measures" rocks above and below coal No. 6 are essentially parallel to it, the geologic structure is indicated by the lines representing the top of this coal bed. Coal No. 6 was selected for contouring because of its ease of identification over most of the area. In Edgar County, data are too scarce to permit satisfactory correlations and contouring, hence the available information for this county is only tabulated.

In studying the contour map, the reader is requested to imagine all the rocks removed to the top of coal No. 6; in other words, suppose this coal bed to be the surface of the ground. Again, imagine Vermilion County to be flooded by an arm of the ocean, the water standing 575 feet above present sea level. The shore line would be represented by the contour marked 575 on the map. If the level of the water were lowered by 25-foot intervals, the successive shore lines would be indicated by the corresponding contours. The upward folds or anticlines such as the one in the northern part of T. 19 N., R. 12 W., would extend long arms of land into the sea; whereas the downward folds or synclines such as the one immediately south of the anticline mentioned above, would be covered by bays and lagoons. The area inside of the closed contour west of Georgetown, would rise above sea as a low island when the water stood at 475.

In Plate II the contour interval is 25 feet. The elevation of the coal above sea level was determined in each place by subtracting from the surface elevation the figure representing the depth to the top of coal No. 6 as given in the drill or shaft record.

ACCURACY OF STRUCTURE CONTOURS

The accuracy of structure contours depends directly on (1) the number and distribution of the datum points where information is available, (2) the correctness of correlations between beds, and (3) degree of precision in determination of surface elevations.

(1) Data are sufficient to contour only eight townships in the southeastern part of Vermilion County. Where the drill holes are numerous and evenly distributed the position of the contours is closely determined. It is also possible to use a small contour interval and thereby introduce great detail. Although it would have been possible in some parts of the map to have used a 10-foot contour interval, the data for the entire district would not permit the use of an interval less than 25 feet. In areas where information is meagre, doubt is expressed by the use of broken contours.

(2) Throughout the contoured area, coals No. 6 and No. 7 are the most important beds and their persistent characteristics render

them easily identified; it is thought that correlations are correctly made.

(3) Surface elevations have been determined by various methods. Instrumental levels were run to the C. C. C. & St. L. R. R. drill holes northwest of Danville. The Danville quadrangle topographic map was used in order to estimate the elevation of many holes south and southwest of the city. Wherever possible, accurate levels furnished by the Bunsen Coal Co., Dering Coal Co., Two Rivers Coal Co., and others were used and all the elevations were adjusted to sea level datum. In southern Vermilion County elevations were estimated from the Rolfe topographic map of 1892-3 which was constructed largely by barometric control and is, therefore, subject to considerable error.

PRACTICAL USE OF MAP

The base map has been compiled from the best available data. Each smallest square represents a section of approximately 640 acres. On this base is shown the location of all drill holes and mine shafts of which records are on file in the Survey. So far as it is known, the map shows the areal distribution of coal No. 6, its approximate depth at any given point, and its position with reference to sea level. For points located between contour lines, intermediate elevations may be assigned to the top of coal No. 6; for example, the elevation of the coal at a point half-way between the 500-foot and the 525-foot contours is 512½ feet. Figures obtained in this way are approximately correct and are sufficient for all practical purposes.

Certain black figures on the map show surface elevations. In order to determine the depth to coal No. 6 it is necessary only to subtract from the surface elevation the figure representing the elevation of the coal (obtained from the nearest contour line). For example, at Georgetown, the surface elevation is 676 feet and the altitude of coal No. 6 as shown by the red contour is 475. The difference, 201 feet, is the depth to coal No. 6. Coal No. 7 at this place is about 70 feet above the Grape Creek bed.

The absence of contours in southwestern Vermilion County does not signify the absence of coal, but merely the lack of sufficient information regarding it.

STRUCTURE OF DISTRICT VIII

RELATION TO GENERAL STRUCTURE OF ILLINOIS

The coal field of which District VIII is only a part covers 36,800 square miles in Illinois and a smaller area in Indiana and Kentucky.

The two counties under consideration lie near the northeast corner of the field as shown in figure 2.

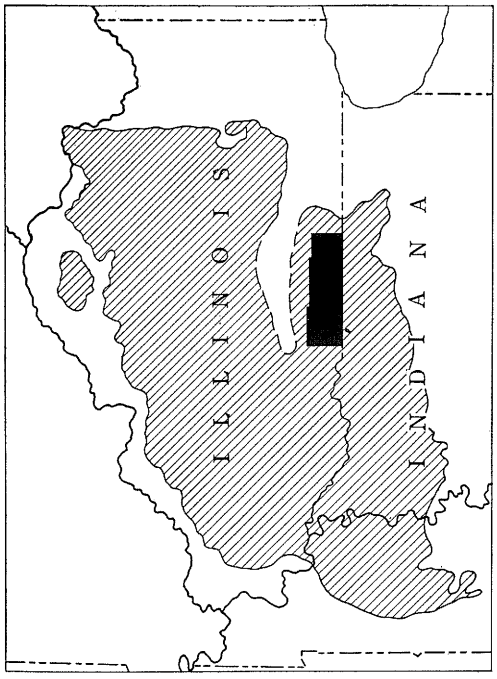

FIG. 2.—Sketch map showing relation of District VIII to Eastern Interior coal field.

The coal-bearing rocks lie in a wide basin-shaped area formed by the older formations. In Illinois, the basin is spoon-shaped, 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. Latest information indicates that the La Salle anticline materially alters the shape of the eastern side of the Illinois basin. This upward fold extends northwest from the northwest corner of Clark County, and it has been recognized in drillings at least as far as Mahomet, Champaign County. An anticline of similar character is well exposed in the vicinity of La Salle and has been traced 15 to 20 miles southeast of that city. In southern La Salle County its axis appears to extend almost north-south, and it is uncertain that it connects with the anticline mentioned farther southeast. At any rate, the effect of the latter is almost to separate the Danville field from the main Illinois basin. In other words, an area of older rocks underlies the drift along the anticline west of Vermilion and

Edgar counties, with coal-bearing rocks on each side. At the south the Danville area is connected with the main body of "Coal Measures" as shown in figure 3.

STRUCTURAL FEATURES

The structure of the area is very simple. The general strike of the beds is a little west of north. The beds dip regularly southwestward from 30 to 50 feet per mile for about 3 miles where they flatten into a terrace 3 miles wide, in the southeastern part of T. 18 N., R. 12 W. Here the dip is about 8 feet per mile. On this flat are two portions of higher structure and one depression. The larger elevated area is 25 feet above the surrounding flat and covers secs. 36, 35, and 25, T. 18 N., R. 12 W. and parts of secs. 15, 21, 22, 23, T. 18 N., R. 11 W. The smaller area is irregular in shape and extends over parts of secs. 15, 21, 22, and 23, T. 18 N., R. 12 W. The depression affects parts of secs. 14 and 15, T. 18 N., R. 12 W.

DESCRIPTIONS OF STRUCTURAL SECTIONS

The following descriptions refer to cross-sections AB, CD, and EF which show the position of the beds in different parts of the district.

SECTION AB

Section AB (Pl. III) lies in a general northwest-southeast line from sec. 23, T. 17 N., R. 11 W. to sec. 6, T. 20 N., R. 12 W., cutting slightly across the strike of the beds. It is constructed with sea level as a datum plane.

The section shows slight irregularities in dip and the eastward rise of the coal beds No. 6 and No. 7 above the plane of glacial erosion. The coal beds likewise ride above this plane along the northwest projection of the section toward Reilly, but no data are available at present to show the exact former location of the beds. All recognizable horizons are correlated, and the section shows also variations in the character of the strata and in the thickness of the beds between correlated horizons, such as the thinning of the beds between coals No. 6 and No. 7 from 85 feet in the southeast to an average of 35 feet in the northwest.

SECTION CD

Cross-section CD (Pl. IV) lies along the dip across the southern part of the county. It shows the glacial trough in the southeast corner of Vermilion County, and the dip of the coal beds westward from this area below the line of glacial erosion. The dip is at the rate of 40 feet to the mile from the outcrop of coal No. 6 to sec. 30, T. 18 N., R. 12 W. From this locality westward the strata flatten into a terrace 2½ miles across, beyond which the western dip of

about 30 feet per mile continues to a line where it is influenced by the La Salle anticline. The interval between coals No. 6 and No. 7 decreases regularly westward from 110 to 60 feet.

SECTION EF

Cross-section EF (Pl. IV) shows the structure near the northern outcrops of coals No. 6 and No. 7. The interval between these coals gradually decreases westward, but not so conspicuously as in cross-section CD. The coals themselves are eroded east of sec. 36, T. 20 N., R. 12 W.

Besides the larger features mentioned above, many minor irregularities exist that can not be shown on the contour map. They consist of small irregularities in the coal floor, such as hills and basins covering a few acres and causing considerable grades for haulage. Generally the relief shown by such features is not more than 20 to 30 feet, and they are not discovered except when the coal is exposed in mining.

COAL BEDS OF DISTRICT VIII

General Relationships

Three or more beds of coal underlie parts of Vermilion and Edgar counties, but it is probable that only two of them are of sufficient thickness to be mined profitably. These beds, known as the Grape Creek or No. 6, and the Danville or No. 7, lie 20 to 30 feet apart northwest of Danville, whereas toward the south and west the interval between the two coals is commonly 80 to 90 feet. The areas of best development of coals No. 6 and No. 7 do not coincide. Where one is thick the other is almost invariably thin and unimportant. The general relations are shown in figures 3 and 4. Another coal, known locally as the "Mud Vein" lies 165 to 220 feet below coal No. 6. It consists generally of three or four benches separated by partings of shale, which render it so impure that it has never been mined in the district.

Near the northern boundary of Vermilion County, the beds existed formerly, but they were eroded prior to glacial times, and the present rock surface under the drift consists of strata older than the "Coal Measures."

In southwest Vermilion County and western Edgar County the coals are not present. The older rocks are brought nearer the surface by the La Salle anticline, and it is not certain whether the coals were ever deposited or whether they were uplifted and eroded after deposition.

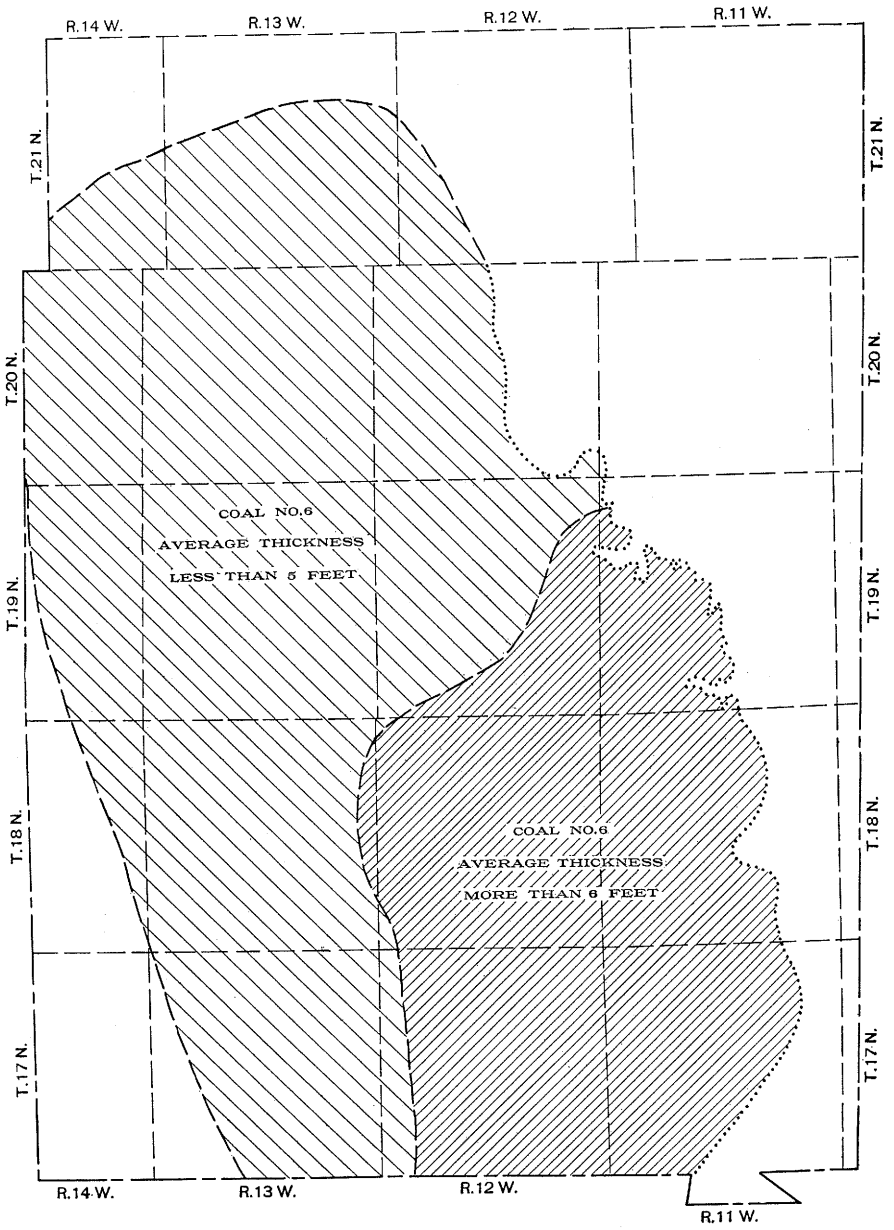

FIG. 3.—Map showing areas of thick and thin coal No. 6 in Vermilion County.

Coal No. 6 (Grape Creek)

DISTRIBUTION AND THICKNESS

The data available at present are not sufficient to map the entire outcrop line of coal No. 6, or to estimate with accuracy the area underlain by it. Exposures in Vermilion County are confined entirely to Vermilion River and its larger tributaries.

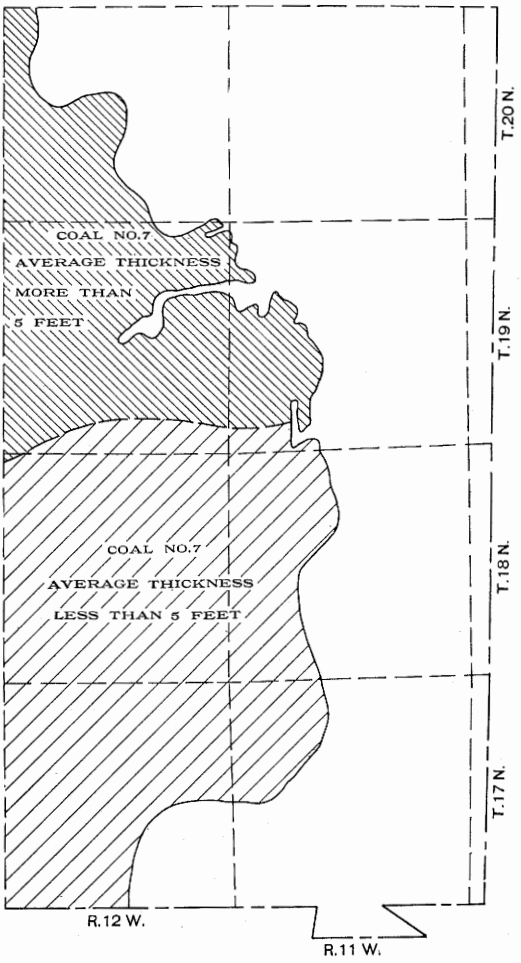

FIG. 4.—Map showing areas of thick and thin coal No. 7 in Vermilion County.

The line of outcrop indicated on the contour map represents the location to the best of present knowledge and is approximately correct. Where it enters the county about the center of T. 17 N., R. 11 W. the outcrop is concealed by the drift. It follows a general

course due north to Grape Creek, where it is exposed in the banks of the stream and can be traced to where the river swings westward at Danville. Here the area of coal No. 6 extends for a short distance beyond Vermilion River. The stream has eroded its channel below the coal horizon, so that the area on the east bank forms an outlier from the main body. The outcrop of the main area follows the south side of Vermilion River as far as Schafer's mine, in sec. 7, T. 19 N., R. 12 W. beyond which it is concealed by the drift, but a number of drillings locate the outcrop to the line between Tps. 20 and 21 N. This is as far as it can be positively traced. The drilling in sec. 6, T. 20 N., R. 12 W. shows drift to the top of coal No. 7. Several hundred feet of Pennsylvanian beds including coal No. 6 are absent in the well drilled for oil at Reilly, and it is probable that the line of outcrop passes westward towards Champaign County through T. 21 N.

The western boundary of coal No. 6 is unknown except approximately in one locality. Samples examined from the well at Allerton in T. 17 N., R. 14 W. show that the top of the hole is below the horizon of coal No. 6, whereas at Sidell both coal No. 6 and coal No. 7 are present. This places the line of outcrop between Allerton and Sidell.

The area included within the outcrop just described embraces either part or all of Tps. 17, 18, 19, and 20 N., Rs. 11, 12, and 13 W., or approximately 325 square miles.

Figure 3 shows the area underlain by coal No. 6 where it has an average thickness of 6 feet in Tps. 17, 18, and 19 N., Rs. 11 and 12 W., and the remaining area in which the average is less than 6 feet. North of the boundary line the coal has irregular thickness, and available data indicate a range from a few inches to 4 feet, the average being 2 feet 9 inches. The boundary line between thin and thick coal is subject to revision.

Lack of drilling in T. 16 N., Rs. 11 and 12 W., and in the vicinity of Ridge Farm renders correlation between Vermilion and Edgar counties impossible at the present time, and it is thought best to present the knowledge regarding Edgar County coals in tabular form (see Table 2). Plate V is a map showing the location of drill holes in Edgar County. Diligent efforts have been made to secure records for all of the holes drilled in this county, but unfortunately many records were not kept. The map shows only a small number of holes for which complete logs are available.

TABLE 2.—*Drill records of coals in Edgar County*
(No confidential records published)

Location					Depth		Thickness		Remarks
¼	¼	sec.	T. N.	R. W.					
					Ft.	*In.*	*Ft.*	*In.*	
SW	NW	6	15	10	400	..	7	..	
SW	NW	29	16	10	136	6	1	6	
					151	..	3	3	
SE	NE	30	16	10	153	6	2	6	
SW	SW	26	13	11	104	4	0	8	
					184	5	0	11	
					250	7	5	1	Coal, jack, and sulphur.
					371	7	4	4	
					421	..	1	..	Dirty coal.
					531	6	0	6	
					553	6	5	11	
SW	SW	26	13	11	99	..	1	..	
					181	10	0	6	
					252	8	0	6	
					366	2	4	2	
					415	10	0	6	
					526	4	1	..	
					551	..	6	2	
NE	NW	26	13	11	581	..	8	..	Shale and coal.
SE	SE	27	13	11	154	3	0	10	
					233	7	1	..	
					303	2	1	1	
					402	4	2	3	
					425	..	0	9	
					475	7	1	..	
					530	10	1	..	
					585	2	1	..	
					604	..	6	..	
NE	SE	14	14	11	98	10	1	5	
					219	3	0	3	
NW	NW	25	16	11	34	6	3	8	
					139	..	3	10	
					161	6	2	4	
					234	6	1	0	
					313	6	2	0	
SW	NW	25	16	11	94	..	0	8	
					95	..	0	6	
Cen.	..	35	16	12	500	..	7	0	
NW	SW	29	15	13	130	..	3	..	
					275	..	2	..	
SE	SW	4	16	13	380	..	2	..	
					490	..	7	..	
					540	..	3	..	

Table 3 shows the depths, altitudes, and thicknesses of coals No. 7, No. 6, and No. 2 (?) in Vermilion County holes the logs of which are not confidential.

TABLE 3.—*Thicknesses and depths of coals throughout Vermilion County*
(No confidential data published)

Location					Kind of drill	Surface elevation	Coal No. 7				Coal No. 6				Coal No. 2 (?)				Remarks
							Depth		Thickness		Depth		Thickness		Depth		Thickness		
¼	¼	sec.	T.N.	R.W.															
						Feet	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	
NW	NE	7	17	11	Mine shaft	674	139	1	3	9	247	0	5+	..	..	..	..	..	
NE	SE	20	17	11	C.	663	0	0	0	0	94	0	1	..	390	..	4	..	
SW	NE	5	18	11	D.	616	15	6	4	7	78	0	9	0	279	..	Badly broken		
Cen.	NE	8	18	11	D.	675	68	6	3	2	151	..	6	6	..	..	..	..	
SE	SW	9	18	11	D.	680	77	6	3	6	155	6	6	6	..	..	..	..	
NW	SW	13	18	11	D.	500	..	..	Eroded		..	..	Eroded		252	..	7	2	10 in. parting
SE	SW	16	18	11	D.	665	..	..	Eroded		130	4	6	10	..	..	..	..	
SW	NE	27	18	11	D.	670	..	..	do		108	..	4	5	..	..	..	..	
SW	NE	28	18	11	D.	665	62	1	3	8	159	10	7	4	..	..	..	..	
SE	SW	4	19	11	C.	610	..	..	Eroded		..	..	Eroded		253	..	6	..	
SW	SW	21	19	11	D.	645	76	..	6	..	112	..	7	3	..	..	..	..	
SE	NW	21	19	11	D.	620	..	..	Eroded		78	..	6	6	..	..	..	..	
NW	NW	21	19	11	D.	630	..	..	Eroded		81	2	6	3	..	..	..	..	
SW	SW	30	19	11	D.	650	100	8	6	2	137	..	5	6	..	..	..	..	
SW	SW	30	19	11	C.	650	96	..	6	..	136	..	5	..	..	..	..	..	
SE	SW	30	19	11	D.	650	97	10	3	1	..	..	..	..	..	..	..	..	Not drilled to No. 6
NW	SW	30	19	11	D.	650	99	..	6	6	146	..	6	..	..	..	..	..	
NE	SW	30	19	11	D.	650	99	..	5	10	152	..	6	..	..	..	..	..	
SW	SW	14	20	11	D.	640	..	..	Eroded		..	..	Eroded		180	6	Broken		
NW	NW	31	20	11	D.	573	..	..	do		..	..	do		178	..	do		
NE	NW	34	20	11	D.	671	..	..	do		..	..	do		136	4	1	10	
NE	SE	1	17	12	D.	633	109	6	2	4	208	9	5	6	..	..	..	..	
NW	NW	4	17	12	D.	...	170	8	3	8	231	8	5	9	..	..	..	..	Bottom 3 ft.
..	..	3	18	12	D.	...	140	..	5	4	171	2	2	7	..	..	..	..	No. 6 dirty

TABLE 3.—*Continued*

Location					Kind of drill	Surface elevation	Coal No. 7				Coal No. 6				Coal No. 2 (?)				Remarks
¼	¼	sec.	T.N.	R.W.			Depth		Thickness		Depth		Thickness		Depth		Thickness		
						Feet	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	..	..	
NW	NW	3	18	12	D.	665	167	..	4	10	202	..	5	0	..	..	..	..	
SW	SE	3	18	12	D.	685	149	..	5	1	186	5	4	7	..	..	..	..	
SW	SE	10	18	12	D.	685	185	7	6	8	244	10	6	4	..	..	..	..	
NW	NE	10	18	12	D.	675	176	10	4	5	217	3	6	6	..	..	..	..	Struck roll at No. 6
NW	NE	10	18	12	D.	675	170	6	4	4	213	2	3	..	..	..	..	..	
NE	SE	10	18	12	D.	683	188	2	4	8	237	8	6	8	..	..	..	..	
SE	SE	14	18	12	D.	682	175	4	4	..	235	..	8	3	..	..	..	..	
SE	SW	15	18	12	D.	682	148	2	4	4	202	4	5	4	..	..	..	..	
NE	SW	15	18	12	D.	682	177	3	5	2	219	9	6	5	..	..	..	..	
NE	SW	15	18	12	D.	682	163	..	4	6	217	9	6	6	..	..	..	..	
NE	NE	15	18	12	D.	685	143	9	3	9	228	10	6	6	..	..	..	..	
..	NE	16	18	12	C.	...	149	2	2	6	223	4	6	2	..	..	..	..	
NW	SE	20	18	12	D.	...	213	8	3	10	281	7	6	9	..	..	..	..	
NW	SE	20	18	12	D.	682	179	..	3	9	221	6	5	10	..	..	..	..	
SE	SE	20	18	12	D.	682	194	2	3	10	241	8	6	3	..	..	..	..	
SE	SE	21	18	12	D.	677	165	11	5	3	199	1	5	8	..	..	..	..	
NE	NE	22	18	12	D.	685	145	..	3	11	208	6	5	9	..	..	..	..	
SW	NE	22	18	12	D.	685	145	..	3	7	208	9	5	4	..	..	..	..	
SW	NW	35	18	12	D.	...	65	8	3	0	159	5	6	7	..	..	..	..	
SW	NE	4	19	12	D.	588	42	..	5	7	68	4	2	3	..	..	..	..	
NE	NE	4	19	12	D.	620	72	..	5	5	95	..	1	5	..	..	..	..	
NE	NE	5	19	12	D.	573	27	11	5	2	68	9	0	1½	..	..	Many partings		
SE	NW	10	19	12	..	654	89	6	5	7	111	..	0	0	276	..	..	..	
NW	SE	12	19	12	D.	...	16	..	5	9	46	3	6	..	..	..	..	..	No. 6 coal and slate.

TABLE 3.—*Continued*

Location					Kind of drill	Surface elevation	Coal No. 7				Coal No. 6				Coal No. 2 (?)				Remarks
							Depth		Thickness		Depth		Thickness		Depth		Thickness		
¼	¼	sec.	T.N.	R.W.		*Feet*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	
SE	SW	12	19	12	D.	...	24	..	6	8	57	2	4	..	..	..	..	..	
NE	SW	12	19	12	D	...	37	6	6	6	63	2	1	6	..	..	..	..	
NW	SW	12	19	12	D.	...	54	..	6	..	92	8	2	9	..	..	..	..	
Cen.	..	12	19	12	D.	...	86	6	6	3	122	4	7	8	..	..	..	..	
NE	SE	14	19	12	Stripping	575	20	..	6	..	..	..	..	..	..	..	..	..	
SW	NW	18	19	12	Mine, strip	646	113	..	5	..	..	..	..	..	..	..	..	..	
SW	SE	18	19	12	do	566	36	9	5	8	..	..	..	..	..	..	..	..	
SE	SE	18	19	12	do	560	28	6	5	7	..	..	..	..	..	..	..	..	
NE	NE	19	19	12	do	560	19	7	5	8	..	..	..	..	..	..	..	..	
NE	NW	19	19	12	do	561	19	9	5	9	..	..	..	..	..	..	..	..	
SE	SE	25	19	12	D.	650	96	..	5	11	138	..	6	1	..	..	..	..	
NW	NW	6	20	12	D.	584*	118	..	5	8	144	..	2	..	..	..	..	..	
NW	NE	6	20	12	C.	580*	102	..	6	2	132	8	1	10	..	..	..	..	
SE	SE	7	20	12	C.	612*	..	..	Eroded		111	..	3	8	..	..	..	..	No. 6 badly broken
SE	SW	7	20	12	C.	619*	105	..	5	7	137	..	4	4	..	..	..	..	
NE	SW	8	20	12	C.	595*	..	..	Eroded		99	..	3	6	..	..	..	..	
NW	SW	12	20	12	C.	637*	..	..	Eroded		..	..	Eroded		218	..	4	7	In 2 benches with 2′ 5″ parting
SW	SW	16	20	12	D.	584*	61	..	5	7	86	3	4	5	267	..	Split	seam	
NW	SE	16	20	12	C.	636*	..	..	..	..	107	6	2	0	297	6	3	7	
SW	NW	16	20	12	D.	606*	..	..	Eroded		114	..	0	6	..	..	..	..	
NW	NW	17	20	12	C.	632*	..	..	do		136	..	0	0	..	..	..	..	Clay with pieces of No. 6
SE	NW	17	20	12	C.	605*	..	..	do		98	..	4	0	..	..	..	..	
SW	SE	17	20	12	C.	598*	..	..	do		117	..	4	1	..	..	..	..	

Elevations marked * were determined instrumentally from bench marks; other elevations are estimates from U. S. G. S. topographic map or from Rolfe topographic maps.

TABLE 3.—*Continued*

Location					Kind of drill	Surface elevation	Coal No. 7				Coal No. 6				Coal No. 2 (?)				Remarks
¼	¼	sec.	T.N.	R.W.			Depth		Thickness		Depth		Thickness		Depth		Thickness		
						Feet	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	
SW	NW	18	20	12	C.	695*	185	..	4	11	224	11	4	2	..	..	..	..	
SE	NE	19	20	12	C.	725*	240	..	5	8	268	8	4	4	..	..	..	..	
SE	SE	19	20	12	C.	649*	154	..	6	2	181	2	3	10	..	..	..	..	
NE	NW	19	20	12	C.	714*	227	..	4	4	256	..	3	4	..	..	..	..	
SW	SW	19	20	12	C.	684*	208	..	5	10	237	10	2	2	..	..	..	..	
SE	NW	20	20	12	C.	605*	113	..	6	6	143	10	3	9	..	..	..	..	
NE	NW	21	20	12	C.	588*	78	6	4	9	110	..	4	2	..	..	..	..	3 benches with wide shale partings
NE	SE	26	20	12	C.	678*	..	..	Eroded		..	..	Eroded		..	..	..	..	
NW	NE	27	20	12	C.	674*	..	..	do		..	..	do		290	..	5	7	
NW	NE	28	20	12	C.	619*	72	..	5	2½	104	..	1	4	..	..	..	..	
NE	NE	28	20	12	C.	623*	72	..	3	8	95	8	0	5	283	..	..	..	No. 2 badly split
NW	NW	28	20	12	C.	575*	60	..	5	11	92	..	4	11	..	..	..	..	
NW	SE	28	20	12	C.	700*	..	..	Eroded		168	7	4	9½	..	..	..	..	
SW	SE	28	20	12	C.	659*	112	..	5	8	141	..	1	3	..	..	..	..	
SW	SW	28	20	12	D.	612*	83	7	5	2	107	6	1	1	..	..	..	..	
SE	SE	28	20	12	C.	691*	..	..	Eroded		168	..	2	9	..	..	..	..	
NW	NW	29	20	12	C.	629*	115	..	3	..	136	..	2	6	..	..	..	..	
SW	SE	29	20	12	C.	566*	..	..	Eroded		72	..	1	10	..	..	..	..	
NW	SW	29	20	12	C.	600*	..	..	do		116	..	3	3	..	..	..	..	
NE	SW	29	20	12	C.	567*	..	..	Eroded		78	..	2	1	..	..	..	..	
NW	NW	30	20	12	C.	684*	207	..	4	9	238	..	2	1	..	..	..	..	
NW	NW	31	20	12	C.	664*	173	..	5	4	199	..	2	8	..	..	..	..	
SW	NE	31	20	12	C.	661*	176	..	5	8	203	..	1	0	..	..	..	..	

Elevations marked * were determined instrumentally from bench marks; other elevations are estimates from U. S. G. S. topographic map or from Rolfe topographic maps.

TABLE 3.—*Continued*

Location					Kind of drill	Surface elevation	Coal No. 7				Coal No. 6				Coal No. 2 (?)				Remarks
							Depth		Thickness		Depth		Thickness		Depth		Thickness		
¼	¼	sec.	T.N.	R.W.			*Feet*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	*Ft.*	*In.*	
NW	SE	31	20	12	C.	629*	147	..	3	5	179	..	0	3	..	..	..	..	
NW	NW	32	20	12	C.	689*	190	..	5	1	216	4	2	5	..	..	..	..	
NE	SE	32	20	12	D.	558*	24	1	5	8	49	2	0	10	..	..	..	..	
SW	NW	32	20	12	C.	655*	170	..	4	8	195	..	1	6	..	..	..	..	
SE	SE	33	20	12	C.	637*	98	..	5	5	127	..	3	3	..	..	..	..	
NW	SE	34	20	12	D.	643*	88	6	5	8	122	..	6	10	286	..	1	8	
SE	SE	35	20	12	C.	633*	..	..	Eroded		..	..	Eroded		226	10	2	3	
NW	SE	36	20	12	D.	661*	..	..	do		..	..	Eroded		244	..	..	..	Badly broken
NW	SW	26	17	13	C.	650	390	..	2	0	455	..	7	0	..	..	..	..	
SW	SW	9	19	13	Shaft	635	191	..	5	6	..	..	..	..	..	..	..	..	
..	..	22	17	14	C.	698	0	..	0	0	0	0	0	0	0	0	..	..	
NE	SE	11	23	14	C.	718	0	..	0	0	0	0	0	0	0	0	..	..	

Elevations marked * were determined instrumentally from bench marks; other elevations are estimates from U. S. G. S. topographic map or from Rolfe topographic maps.

PHYSICAL CHARACTERISTICS

Coal No. 6 averages 6 feet in thickness in the important mining area south of Danville. It consists generally of two benches which are separated from each other by the "blue band", the top of which lies 1 foot 9 inches to 3 feet 6 inches above the floor. The two benches which are similar in character, consist of bright and dull layers of coal with which are interlaminated mother coal, dirt, and pyrite. As a rule the "blue band" is the only impure layer that can be traced throughout a mine, the others being disconnected lenses.

Here and there the bed varies greatly in physical appearance and its character is best indicated by sections measured at the face in different mines of the district.

DERING COAL CO., MINE NO. 4, NW.¼ SE.¼ SEC. 15, T. 18 N., R. 12 W.

Maximum thickness, 10 feet; minimum, 4 feet 6 inches; average, 5 feet 9 inches. Coal bright and brittle, of irregular fracture, and banded structure, and divided into two benches which are similar in character. Calcite is present along the fracture planes, and the sulphur occurs in bands and stringers; between the benches is the "blue band" which consists of two 1-inch layers of gray clay separated by 6 inches of coal.

Section, face main south entry

Description of strata		Thickness *Inches*	Depth *Inches*
Coal		7	7
Sulphur		1	8
Coal		15	23
Sulphur		1	24
Coal		23	47
"Blue band"	"Blue band"	1	48
Coal		6	54
"Blue band"		1½	55½
Coal		14	69½

SHARON COAL AND BRICK CO., SEC. 7, T. 17 N., R. 11 W.

Maximum thickness, 5 feet 8 inches; minimum, 4 feet; average, 5 feet. Two benches, both about same character; mostly bright, with subconchoidal fracture. "Blue band" persistent, about two-thirds distance from top; small dirt bands and sulphur mostly in lower bench.

Section, face 2nd NE.

Description of strata	Thickness *Inches*	Depth *Inches*
Coal, hard, bright	10	10
Bone	1½	11½

Description of strata	Thickness *Inches*	Depth *Inches*
Coal, hard, bright	22	33½
Bone	2	35½
Coal, hard, dull ("Blue band")	5	40½
Bone	2	42½
Coal, soft	5	47½
Sulphur	½	48
Coal	5	53
Sulphur	2	55
Coal	7	62

BUNSEN COAL CO., LITTLE VERMILION MINE, SEC. 19, T. 18 N., R. 11 W.

Maximum thickness, 12 feet; minimum, 0; average, 6 feet; upper bench, about 3 feet 7 inches; lower bench, about 2 feet. "Blue band" as much as 7½ inches thick. Dirt in irregular bands.

Section, face S. 7 W.

Description of strata	Thickness *Inches*	Depth *Inches*
Coal, laminated, bright to dull, several small bands of dirt.	50	50
Dirt	2½	52½
Coal, dull, dirty	4	56½
Dirt, "blue band"	3	59½
Coal, bright, clean, except small amount of sulphur	31½	91

Section, 7 E. off main N.

Description of strata	Thickness *Inches*	Depth *Inches*
Coal, laminated, dull, fine bands of dirt, sulphur, and calcite	43	43
"Blue band," bone and shale	7	50
Coal, cleaner and brighter than upper bench	22½	72½

SCHAFER MINE, NW.¼ SW.¼ SEC. 7, T. 19 N., R. 11 W.

Maximum thickness, 9 feet; minimum, 18 inches; average, 6 feet. Coal is hardest near top and bottom. "Blue band" is present throughout mine; several dirt and sulphur bands of irregular vertical and horizontal extent. Sulphur sticks to coal and is difficult to separate.

Section of coal No. 6 at Schafer Mine

Description of strata	Thickness *Inches*	Depth *Inches*
Coal, laminated, fairly hard, contains sulphur and dirt bands and some gypsum	28	28
Coal, softer and blocky, less sulphur	12	40
"Blue band" containing sulphur balls	1½	41½
Coal, contains clay and sulphur bands and pyrite balls, bottom 10 inches harder	41	82½

KELLEY COAL CO., HIMROD MINE (ABANDONED), NE.¼ SE.¼ SEC. 9 T. 18 N., R. 11 W.

Section face 5th N. off NE. Entry

Description of strata	Thickness *Inches*	Depth *Inches*
Coal	46½	46½
"Blue band"	1	47½
Bone	2	49½
Coal	25½	75

ROOF OF COAL NO. 6

The very persistent limestone overlying coal No. 6 in southwestern Illinois, is absent over most of this field. It is well developed in the immediate vicinity of Danville, and it is possible that the bed once covered the entire area but was removed by erosion and replaced by the present shales.

The regular roof in the Danville district is a gray, sandy shale containing plant impressions and their carbonized remains and possessing so little cohesion that it falls easily in more or less tabular masses. It contains many "slips" and rolls which are described under the topic "Roof Irregularities in the Danville District."

The following notes and sections were made in various mines of the district.

SHARON MINE, SEC. 7, T. 17 N., R. 11 W.

Above the coal is a 3- to 4-inch carbonaceous shale which is in places underlain by a thin layer of bone. In parts of the mine a 5-inch draw slate occurs. The gray, sandy, shale cap rock is at least 15 feet thick; the lowest 2 feet shows a large number of laminations and contains flattened marcasite concretions in layers from 4 to 6 inches apart.

Roof is good until lowest carbonaceous shale is removed, when moisture swells the shale and causes it to break and fall piece by piece to the cap rock.

DERING NO. 4, NW.¼ SE.¼ SEC. 15, T. 18 N., R. 12 W.

Roof which falls in tabular slabs is light, sandy, gray shale up to 20 feet thick, overlain by 80 feet of gray shale. Roof contains plant impressions and some sulphur balls. It is most sandy in vicinity of rolls. An area extending approximately north-south in the vicinity of the shaft contains numerous rolls. A smaller area exists to the west. Rolls have a general northeast-southwest bearing.

BUNSEN COAL CO., LITTLE VERMILION MINE, NW.¼ SE.¼ SEC. 19, T. 18 N., R. 11 W.

Roof is gray, sandy shale irregularly bedded; contains rolls and stringers of coal which cause weakness; falls in conchoidal masses. Coal No. 7 lies 43 feet above No. 6. A harder, smoother shale called soapstone overlies the immediate roof and in places is in contact with the coal.

SCHAFER MINE, NW.¼ SW.¼ SEC. 7, T. 19 N., R. 11 W.

Roof of this mine is typical of small area in which limestone is present.

Section of roof

	Description of strata	Thickness Ft.	In.	Ft.	In.
4.	Limestone, dark gray, argillaceous, nodular..	3½	to	4	
3.	Shale, calcareous, light gray.....		6	to	8
2.	Shale, black, very bituminous.....	3	to	4	
1.	Shale, black, hard (lenticular).....		18		

No 3 contains clay seams bearing N. 60° W. and N. 30° E. It forms roof of part of mine. It is reported that cannel coal replaces No. 1 here and there, and when neither black shale nor coal are present the roof falls to limestone cap rock.

Section from coal No. 6 to coal No. 7 at Schafer's mine

Description of strata	Thickness Feet	Depth Feet
Coal No. 7 (Danville)	6	6
Shale, carbonaceous	4	10
Coal, impure	1	11
Shale, brown, unconsolidated	10	21
Limestone, clayey, weathers rapidly	3	24
Slate, black to water's edge	2	26
Coal No. 6 (Grape Creek) visible at lower water.....	..	..

IRREGULARITIES IN ROOF AND FLOOR

GENERAL DESCRIPTION

Throughout the Danville district the contact of the roof with the coal is extremely irregular. Lenticular masses of shale usually covered by a thin layer of coal extend downward into the coal bed, and in many places they practically replace the bed. This kind of roof is known as "rolly" by the miner and the individual masses are termed "rolls."

The typical roll of this district is a lens-shaped body of shale similar in all respects to the roof material, its long axis parallel with the bedding of the coal lying in the upper part of the bed. In most rolls examined thus far, the roof proper is separated from the lenticular shale by a layer of coal ranging in thickness from a mere streak up to about 1 foot. Moreover, this stringer of coal if considered alone, forms a dome-shaped covering for the underlying roll, the dome extending up into the roof to a distance depending on the size of the roll. A vertical thickness of 10 or 15 feet is not uncommon at the central part of the shale lens. Figure 5 shows the side view at the edge of a roll and the coal stringer extending up into the roof. The smaller rolls extend along the entries about ten feet, whereas others may affect the roof for hundreds of feet, there being no uniformity in size.

The matrix of the lenses is composed of sandy shales, similar in all respects to the regular roof shales of the district. In places small

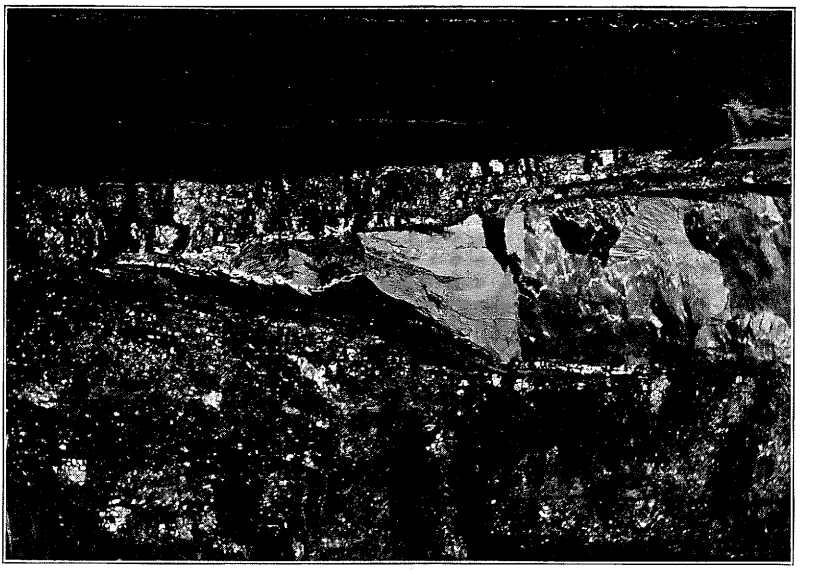

FIG. 5.—A typical roll of the Danville District (entry cuts through the roll, of which only one side is shown).

amounts of sand are interlaminated with the shale of the roll just as they occur higher up in the regular roof (see figure 6).

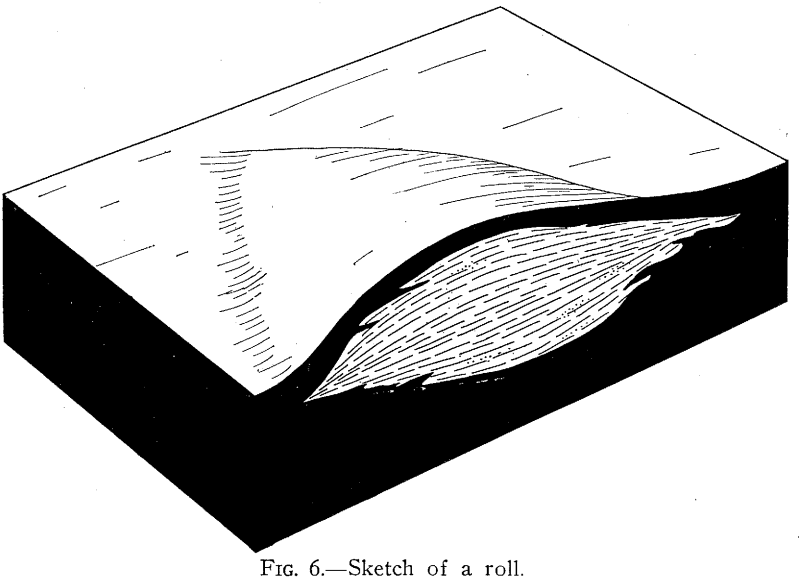

FIG. 6.—Sketch of a roll.

Small stringers of coal varying in thickness from a fraction of an inch up to 3 or 4 inches extend out into the lens from the main coal bed or from the stringer covering the lens. Only a few of these stringers are disconnected from the main coal, but it is significant that they all lie approximately horizontal or along laminations in the matrix of the lenses. Figure 7 shows a roll as sketched in mine No. 4 of the Dering Coal Company.

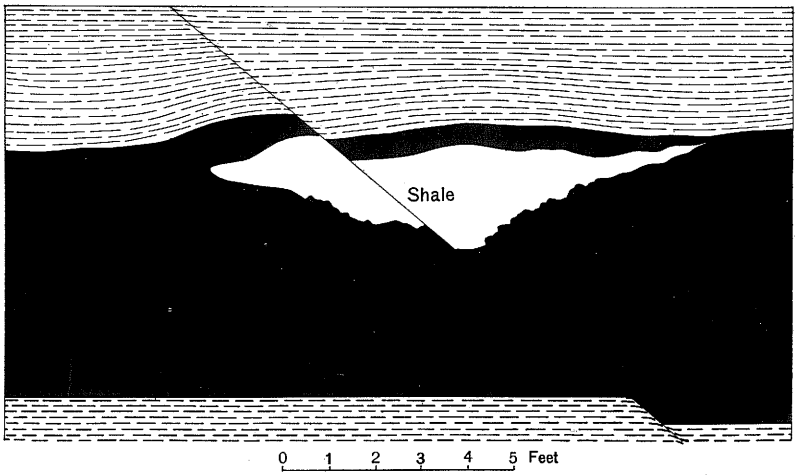

FIG. 7.—Sketch of roll in Dering mine No. 4.

Underground study and examination of mine maps kindly furnished by the Dering and Bunsen Coal companies seem to indicate that the long axes of the individual lenses extend in a general northeast-southwest direction, and that the rolls tend to occur along lines parallel to the long axes.

Figure 8 illustrates the effect of the rolls as shown in one of the mines of the district. It is necessary to turn rooms along the rolls, therefore the mine map gives a clear idea of their abundance and direction.

In practically all of the rolls, slickensides are developed along the contact of the coal and shale. Many of the rolls, especially the larger ones or those occupying a major part of the coal bed, were faulted to some extent after they had reached a stage of solidification approximating their present condition. The amount of displacement varies, but in general it does not equal the thickness of the roll. Figure 9 is a sketch showing such a faulted lens.

Under all of the large rolls studied, the floor is depressed. This characteristic is so noticeable that to the miner a sudden local dip usually signifies the presence of a roll.

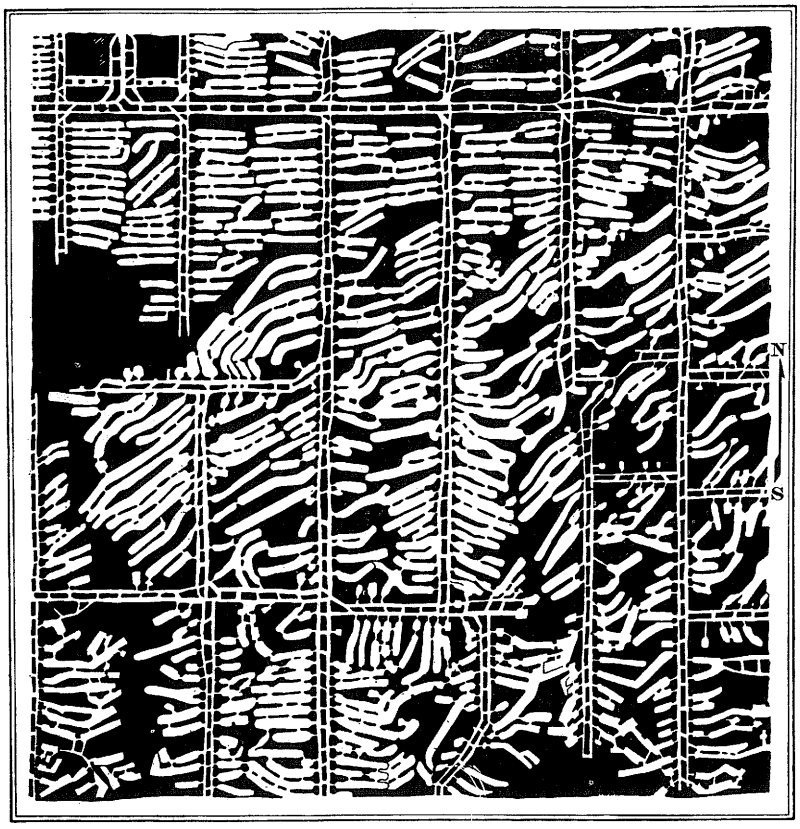

FIG. 8.—Sketch of a portion of Dering mine No. 4 showing effect of rolls on position of rooms.

ORIGIN OF ROLLS

The laminations and bedding planes so clearly shown in the material composing the lenses, the small stringers of coal fingering out from the main bed into the lens, the absence of fragmentary material such as broken coal, leave small room for doubt that the lenses are of sedimentary origin. They are believed to have come to their present position through the processes outlined below.

After most of the vegetal matter had collected it seems likely that the surface of the coal swamp was uneven, consisting of slight elevations and depressions, the latter probably containing water, but

not forming regular drainage channels. If at any time the general level of water in the swamp was slightly raised, there was of course an overflow from one depression to another depending on the height of the barrier or the higher ground between them.

A short time before the submergence that put an end to the deposition of coaly matter, the general level of the swamp was lowered in the vicinity of the present Danville field and the result was an incursion of water loaded with very fine sediment. The higher parts of the swamp were probably not submerged, but the depressions were flooded, and many of them were slowly filled with fine muds and

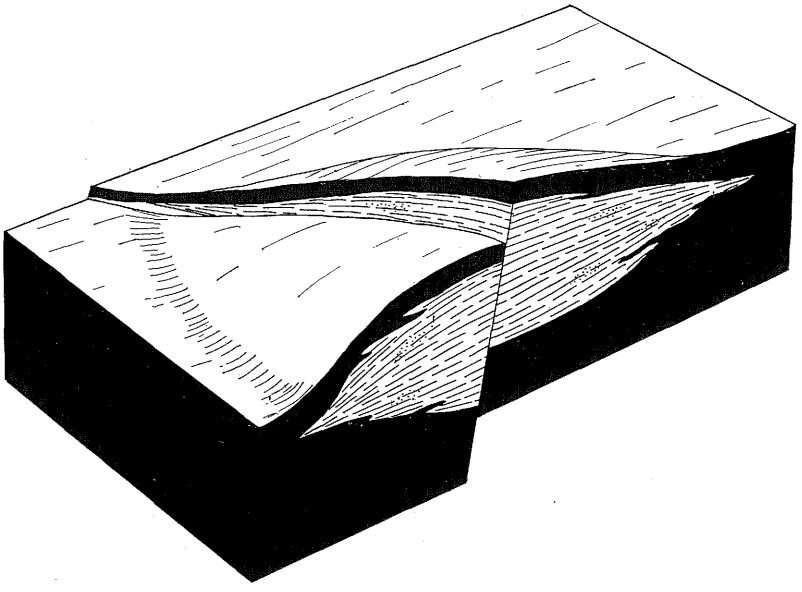

FIG. 9.—Sketch of faulted roll.

sands interlaminated. During the deposition of this material in the small depressions, vegetable matter, leaves, and trees fell or were washed into the hollows and were interbedded with the sediments. The overflow from one depression flooded an adjacent low area and the small divide between the two received only a thin layer of sediment. It is believed that if all of the overlying material were removed, there would be seen dirt bands of various sizes connecting the shale lenses along bedding places in the coal. Such connection was not actually traced in any of the mines, but it must be remembered that examination is limited to the comparatively small area exposed along mine workings.

Before the final submergence began, conditions were probably stable for a considerable time and vegetal deposits accumulated in various amounts over many of the filled depressions. The whole region then began to sink and permitted the deposition of the roof materials, and at once pressure on the coaly material began to be effective.

It must be remembered that a bed of coal 6 feet thick probably represents almost 200 feet of original vegetal matter. According to Ashley and others 1 foot of surface peat forms about 1⅛ inches of compact peat; and for 1 foot of bituminous coal, like that of the Pittsburg coal, 3 feet of compact peat are required. According to these figures, about 32 feet of surface vegetal matter slightly compressed would be required for each foot of coal like that of the Grape Creek bed. At the time of deposition of the lenses there was probably 16 feet of peat already in existence covered by 25 or 30 feet of looser vegetal matter. In other words, the lenticular masses rested 40 or 50 feet above their present position when pressure began to be exerted by the accumulating roof muds and sands. The figures quoted are probably somewhat too high for Illinois coals, but a considerable reduction in the amount of original vegetal matter would still leave a decided excess in the thickness of this material over that of the clay lens.

While the coaly matter was compressed from 40 or 50 feet to 6 feet, the lens held practically its same size, owing to its almost incompressible nature when compared to vegetal matter. The final result was that the thickest part of the lens settled least of all and arched the stringer of coal as shown in figure 10.

As stated above, most of the large lenses have not only an arched top, but also have depressed the floor slightly. Slickensides are present in all of the rolls as would be expected when it is recalled that the solid clay has settled perhaps 50 feet surrounded by an extremely compressible medium. Irregular settling has caused movement of the clay in different directions in order to accommodate unequal pressures and the result is in many places not a smooth lenticular mass but an irregularly shaped lens with an uneven contact, as shown in figure 10.

Many of the large rolls show faulting that occurred after both coal and shale had become solidified to almost, if not quite, their present condition. The connections of the fractures to the lenses that occupy the major part of the bed is in accord with the theory that the greatest differential strains were produced where the largest lenses of incompressible shale settled into the accommodating coaly

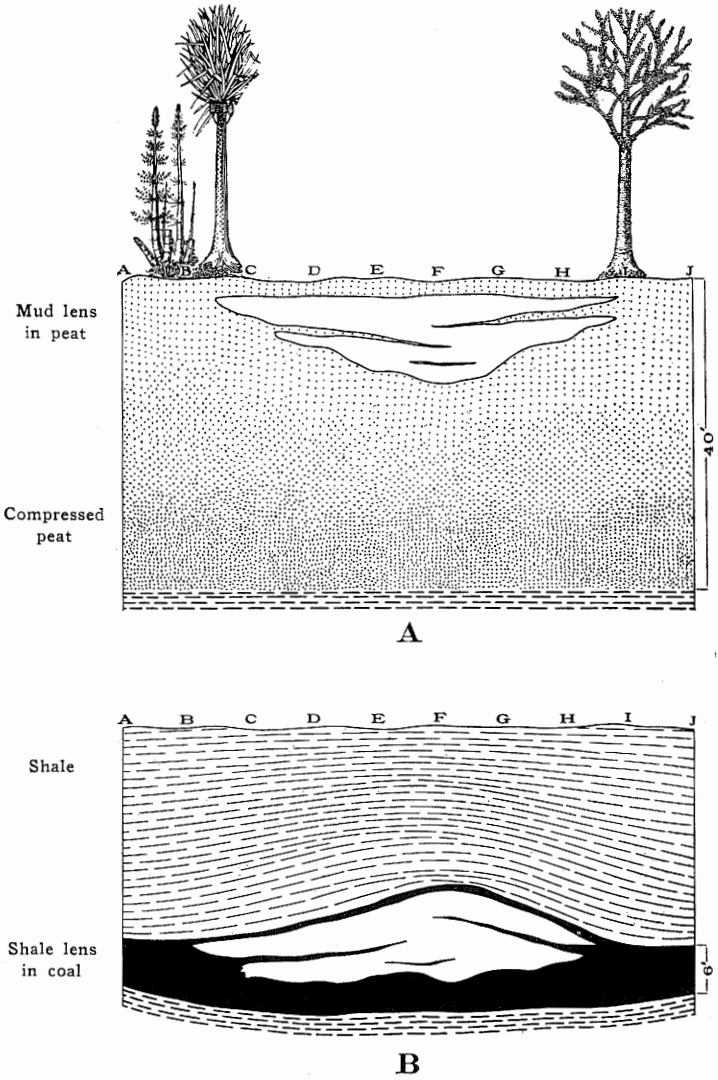

FIG. 10.—Sketch showing compression of coaly matter and shale lens.

A—Sketch showing slightly compressed peat with lenticular deposit of clay and interbedded vegetal matter near surface of swamp. A small amount of vegetal matter overlies the clay.

B—Sketch showing effect of compression by the accumulating muds which now form the roof shales of the coal. The vegetal matter is compressed, whereas the lens of clay retains its volume, and the arching of the top of the lens is the result. At A, B, I, and J of figure A the entire mass is composed of highly compressible material, whereas at C, D, E, F, G, and H there is a variable amount of almost incompressible clay. The section at F contains the most of the clay and will be compressed least of all as shown in B.

substance. In all rolls thus far examined the evidences of movement and fracturing, or in other words, the pressure, is directly proportional in a general way to the size (mass) of the lens.

From the nature of the rolls, it is not possible to predict their position or size since they are probably dependent upon the nature of the original swamp surface, only the general characteristics of which are now known. If the theory outlined represents the facts, the lenses are simply variations of the dirt bands so common in the coals and are not more regular in their occurrence than are the latter.

The rough alignment of the lenses in a northeast-southwest direction is probably the result of the slow settling of the swamp surface toward the southwest, and the development of parallel incipient drainage channels prior to the deposition of the sediment that formed the lenses.

It must be remembered that the variable conditions under which the mass of clay settled into the coaly material, and especially the compressible nature of the latter as compared with the clay, enabled the mass of clay to assume under pressure a great variety of shapes. It is, therefore, not always possible to recognize the similarity to a lens. In some places no accumulation of vegetal matter occurred above the clay now forming the lens, therefore no stringer of coal caps the lens. However, the same general results have been brought about by settling, and slips occur between the regular shale roof and the material composing the lens. The roof is thereby weakened and the lenticular material falls about in the same manner as if the coal stringer were present.

The lenticular masses of clay in the upper part of the Danville coals then are probably not essentially different in their mode of origin from the clay bands throughout the bed, or from the lenses 1 to 2 feet thick which in places are called partings. Their present shape is the result of (1) the form of the deposition basin and (2) to the readjustments incident to the settling of a somewhat plastic incompressible clay into a highly compressible vegetal mass.

FLOOR

The floor of coal No. 6 is a grayish clay containing plant remains and varying in thickness from a few inches up to several feet. In most of the mines, the clay heaves when wet, the amount of heave being different in different mines. At Little Vermilion mine of the Bunsen Coal Company, the swelling of the clay is used to raise the tracks in small depressions. At the Sharon mine near Georgetown the clay is about 5 feet thick and contains ferruginous concretions,

whereas in the Schafer mine near Danville the immediate floor is only 4 to 6 inches thick and heaves readily as soon as wet, but below is a solid gray shale. Here the clay locally contains coal lenses. Below the clay floor, is a thin limestone that is reported in most of the drillings.

Coal No. 7 (Danville)

DISTRIBUTION AND THICKNESS

Although coal No. 7 probably exists in Edgar County, it has not been positively identified. Its eastern limit in the southern part of Vermilion County is known to be about 2½ miles west of Ridge Farm. It extends east and north approximately parallel to the outcrop of coal No. 6. Drill holes north of Georgetown are sufficiently close together to locate its eastern boundary with considerable accuracy (see Plate V).

Its eastern limit was determined by pre-glacial erosion as is indicated by Plate III. The glacial drift now fills the ancient valleys, and the present topography bears little resemblance to that of pre-glacial times. There is no surface indication of the eastern boundary of coal No. 7, and its extent has been determined only by drilling.

This coal appears in the river bluff a short distance below the Wabash Railroad bridge and from this point it may be traced up Salt Fork to Butler Branch, where it dips slightly beneath river level. It is seen again in the bottom of the river in sec. 17, T. 19 N., R. 12 W. Where it lies a short distance below the surface in the river flood plains southwest of Hillery, several large stripping mines have been developed. It is entirely below water level on Middle Fork, but holes drilled by the C. C. C. & St. L. Railroad show that coal No. 7 underlies roughly the southwest half of T. 20 N., R. 12 W. North of sec. 6, T. 20 N., R. 12 W. the extent of coal No. 7 is not known, but in that section the glacial drift rests on the coal, and it is probable that the bed does not extend more than a mile or two north of this place. Its northern limit is probably not far from the C. & E. I. bridge across Middle Fork in the SE. ¼ sec. 26, T. 21 N., R. 13 W. No drilling has been done in T. 20 N., R. 13 W. to locate the western boundary of coal No. 7, but it probably underlies at least the east half of the township. It was mined formerly at Muncie where it is 200 feet below the surface. It probably extends only a short distance west of Muncie since the La Salle anticline brings all of the beds closer to the surface and erosion has removed them. The western limit of coal No. 7 extends south in an irregular line a short distance west of Fairmount and probably 2 miles west of Sidell. Further

south in Edgar County this coal has not been identified, although later drilling will no doubt prove its existence.

Coal No. 7 is exposed all along the river front in the southwest quarter of Danville, but it disappears towards the northeast having been eroded in the formation of the pre-glacial valley of Vermilion River. The coal was formerly stripped near the water works and also at the mouth of Hungry Hollow, but it is not known to extend farther north along this stream.

A line drawn a short distance north of the line between townships 18 and 19 marks the boundary between the area to the north underlain by coal No. 7 with an average thickness of more than 5 feet and the southern area of the same bed with an average thickness of less than 5 feet. South of this line, the coal decreases in thickness at a rather uniform rate from 4 feet 7 inches to 2 feet 8 inches, the separation between the thicker and thinner areas being very much more pronounced than in coal No. 6. It is noticeable that where one coal is thick, the other is generally thin. For details regarding the thickness, the reader is referred to Table 3.

PHYSICAL CHARACTERISTICS

Coal No. 7 is variable in thickness, the maximum being about 6 feet and the average about 5 feet in the area where it is being mined. In some places a parting not unlike the "blue band" of coal No. 6, divides the bed into two benches, but as a rule, the partings are not so persistent at any given horizon. Coal No. 7 generally contains a larger amount of impurities than coal No. 6. Sulphur occurs as lenses, bands, stringers, and plates along bedding planes and cleavage faces. Because of its large amount, it forms a valuable by-product and at one mine a large equipment has been installed to separate it from the coal and to prepare it for the market.

The following notes and sections were made in various mines where coal No. 7 is or has been operated.

ELECTRIC MINE, SW. ¼ NW. ¼ SEC. 10, T. 19 N., R. 12 W. (ABANDONED)

Maximum thickness, 6 feet 6 inches; minimum, 4 feet; average, 5 feet 6 inches. Bed is separated into two benches by a 1-inch clay band 6 to 10 inches from the floor. Upper bench is very hard, bright, and brittle; the lower bench is slightly darker and softer. One sulphur band ½ inch to 1½ inch in thickness was traced for more than 300 feet.

Section in room 16 main south entry

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Coal, bright and blocky having fairly well-developed cleavage planes filled with calcite and pyrite. Alternating charcoal and bright layers from ⅛ inch to ½ inch thick. Large number of disseminated pyrite balls and lenses	5	0	5	0
Clay parting containing variable amounts of pyrite	..	1	5	1
Lower bench generally similar to upper, but contains more dirt	..	10	5	11

Section in room 15 on 15th N. entry

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Coal, hard, bright	1	9	1	9
Sulphur	..	1	1	10
Coal, hard	..	8½	2	6½
Sulphur	..	½	2	7
Coal, hard, bright	2	4½	4	11½
Clay band	..	½	5	..
Coal, hard, bright	..	9	5	9

FAIRMOUNT COAL CO., BENNET STATION MINE, SE.¼ NE.¼ SEC. 34, T. 19 N., R. 13 W.

Maximum thickness, 6 feet; minimum, 2 feet 6 inches; average, 5 feet. Several bands of bone pyrite or clay or a mixture of the three are interbedded with the coal; a parting of carbonaceous clay containing sulphur is present 3 to 8 inches above the bottom, and a 2-inch band of bone coal and pyrite 20 to 26 inches above the floor is likewise persistent. The cleat is marked in places, but it does not determine the turning of rooms nor the driving of entries.

Section of face, 4th NW. entry

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Coal, bright, with vertical calcite veins; fairly soft, having a banded texture and containing a parting 1 foot from the top	1	7	1	7
Sulphur	..	1	1	8
Coal, duller than above, fewer calcite veins	1	1	2	9
Bone and pyrite	..	2	2	11
Coal, dirty and dull, some calcite	1	6	4	5
Sulphur	..	1	4	6
Coal, dull lustre	..	3	4	9

Section, 2nd south entry

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Coal, dirty, with brown streak.....	3	8	3	8
Sulphur and black jack	0	3	3	11
Coal	..	8	4	7
Sulphur	..	3	4	10
Coal	..	5	5	3

OAKLAND COAL CO., S.½ SW.¼ SEC. 18, T. 19 N., R. 12 W.

Section, main entry, 50 yards north of shaft

Description of strata	Thickness		Depth	
	Ft.	*In.*	*Ft.*	*In.*
Coal, with sulphur lenses up to 2 in. x 10 in.	3	4½	3	4½
Clay, hard	..	½	3	5
Coal, same as above	1	7½	5	½
Hard band	..	1	5	1½
Coal, same as above.....	..	11	6	11½

ROOF

The regular roof of coal No. 7 is a black shale of variable thickness, overlain by a gray shale cap rock whose thickness depends on the amount of erosion it has undergone. At Electric mine the black shale ranges from a few inches to two feet, the latter thickness furnishing a fairly efficient roof. Where only a small amount of shale is present, it falls readily and is treated as a draw slate. The black shale carries considerable pyrite which oxidizes to ferrous sulphate and covers the surface with a white powder. In a few places, the black shale is absent, and the gray shale cap rock rests on the coal.

In parts of the Electric mine the coal is very close to the rock surface, the roof strata having a thickness of less than ten feet. Where rooms are driven in such areas, the roof breaks and allows sand and water from the drift above to flood that part of the mine. In most cases the flow of water decreases rapidly, and the damage is only temporary. At the shaft of the Electric mine the gray shale cap rock is 51 feet thick, and the same material is noted in practically all of the logs of the district. The bed is utilized in different parts of the region for the manufacture of brick and tile, the largest plant being that of the Western Brick Company near Danville. The shale contains numerous ironstone concretions which must be removed before grinding. The roof of coal No. 7 "rolls" as does that of coal No. 6, but the rolls are not so extensive in the former.

FLOOR

Coal No. 7 lies directly upon a 6- to 8-inch bed of clay which heaves badly. Subjacent to this layer are 5 feet of hard clay and a lenticular bed of coal about 1 foot thick. At Bennet Station the floor heaves only slightly. A streak of coal ranging in thickness from ½ to 3 inches lies 6 to 8 inches below the base of coal No. 7, and below this is 15 feet of clay containing ironstone concretions.

Coal No. 2

The outcrop of coal No. 2 has not been determined within Vermilion County. Its horizon is traceable south from the line between Tps. 20 and 21 N. and east from the range line between Rs. 12 and 13 W. North of the township line it is known to be absent by the records from wells at Rossville, Reilly, and Rankin, all of which started below its horizon. West of the range line it is not reported in either the Sidell or the Allerton wells, though they commenced above its horizon.

According to Campbell's U. S. Geological Survey Folio 67, this coal is mined on Coal Branch for local consumption, but is so split by shale bands as to be of inferior value. The structure of the beds is essentially the same as that of coal No. 6, and the depth to its horizon may be obtained by adding the distance between it and coal No. 6, averaging about 182 feet, to the distance of coal No. 6 below the surface in that locality.

Since the coal does not outcrop in Illinois, drill records furnish the only available information as to its thickness and character. The logs show 2 to 4 layers of coal separated by bands of shale or limestone; the coal beds vary from a few inches to 3 feet in thickness with partings variable in thickness up to 20 feet.

CHEMICAL CHARACTERISTICS OF THE COALS NO. 6 AND NO. 7

The following table shows the chemical quality of coals No. 6 and No. 7 in District VIII. The figures for coal No. 6 are based on 31 samples, and 18 samples furnish the averages for coal No. 7.

The samples were made at the face in the following manner: A fresh face which represented average conditions, as nearly as possible, was cleaned by taking off a layer of 2 or 3 inches, after which all loose pieces were removed from the immediate roof. A large piece of oilcloth was then spread on the floor, and a strip of coal amounting to at least five pounds to the foot was cut down from top to bottom. Any bone, "blue band", sulphur, or other impurity exceeding three-eighths inch in thickness was discarded. Instead of next being

quartered, as in some earlier collections, the entire sample was quickly ground to one-eighth inch size or smaller in a special grinder (fig. 3). The coal was then reduced repeatedly by means of a mechanical riffle (fig. 4) to a sample weighing 5 pounds, which was placed in an air-tight can. This method yielded results which were more free from accidental or personal error than any of our previous efforts.

As a further improvement, samples were taken from three to six places in each mine, and duplicates were frequently sent to the laboratory of the U. S. Bureau of Mines, so results could be compared with those obtained at Urbana. The laboratory work was done in the laboratory of the University of Illinois, under direction of Prof. S. W. Parr, by J. M. Lindgren and assistants.

Average analysis of coals No. 6 and No. 7 from District VIII

Face samples

Values are for coal as received

Bed	Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	B. t. u.	Number of samples averaged
6	14.45	35.88	40.33	9.34	2.55	10919	31 from 4 mines
7	12.99	38.29	38.75	9.98	2.93	11143	18 from 2 mines

The two coals are not widely different in chemical quality. The higher percentage of sulphur in coal No. 7 renders it the less suitable for domestic use. It also contains more volatile matter which escapes burning in the ordinary stove, and its heat value is largely lost. With perfect combustion coal No. 7 furnishes more actual heat units per pound than coal No. 6. The latter coal has a slight advantage in its lower per cent of ash.

Coal No. 6 in this district contains less sulphur than that in any of the districts except Franklin and Williamson counties. Coal No. 2 mined at Murphysboro is the only other bed in which the sulphur content is lower. A considerable amount of the pyrite in the Grape Creek bed exists in horizontal and vertical bands instead of being disseminated throughout the bed, and it is possible to produce a 1 per cent sulphur coal by careful hand picking or by washing. The washed coal from this bed makes coke of as good quality as that from any Illinois coal thus far tested.

The high moisture content of the Danville coal beds allies them with the other beds of northern Illinois, including the Springfield district. From this part of the State, the per cent of moisture decreases southward, the Harrisburg coal containing only half as much as those at Danville.

SUMMARY OF COAL RESOURCES

In estimating the coal tonnage for the Danville district attention has been limited to beds No. 6 and No. 7 in Tps. 17, 18, 19, and 20 N., Rs. 11 and 12 W., since in this area sufficient drilling has been done to show the areal distribution and the thickness of the beds.

Table 4 shows the original tonnage for beds No. 6 and No. 7 in the area mentioned above.

TABLE 4—*Estimate of original tonnage of coals No. 6 and No. 7 in Tps. 17, 18, 19, and 20 N., Rs. 11 and 12 W., Vermilion County, Ill.*

Bed	Area	Average thickness		Original tonnage
	Sq. mi.	*Ft.*	*In.*	*Short tons*
6	126	6	0	856,396,800
6	44.5	2	9	138,626,400
6	16.5	4	0	74,764,800
				Total No. 6.....1,069,788,000
7	50	5	0	283,200,000
7	88	2	3	224,294,400
				Total No. 7.....507,494,400
				Grand total.....1,577,282,400

According to statistics published by the U. S. Geological Survey, there have been mined in Vermilion County from 1881 to 1913 inclusive, 57,908,547 tons of coal. It has been found[5] that the average recovery in the district is 70 per cent of the total coal, or, in other words, the process of mining has rendered 24,817,949 tons unrecoverable. For purposes of estimation, therefore, 82,726,496 tons of coal have been mined or made unavailable in the district. There remains in the ground 1,494,555,904 tons, of which approximately 1,046,189,133 tons are recoverable under present methods.

APPENDIX

STRATIGRAPHIC SECTIONS

INTRODUCTORY STATEMENT

Knowledge of the rocks older than the Pennsylvanian is obtained from a study of the logs of eight drill holes within the county and one in Indiana. For ease of comparison these logs have been arranged graphically into two groups, so that along a northwest-southeast line from Danville to Danville Junction, five logs serve to show the stratigraphic relations of the beds between the two places (see Plate VI).

[5]Andros, S. O., Coal Mining Practice in District VIII (Danville): Ill. Coal Mining Investigations Bull. 2, 1914.

The position of the cross-section is indicated on the large map accompanying the report by line MN.

The remaining four holes lie along a line in a direction slightly north of east, passing through Allerton, Sidell, and Vermilion Grove, thence northeast to sec. 30, T. 18 N., R. 10 W. in Indiana. It will be referred to as cross-section HI.

DESCRIPTION OF SECTION MN

TRENTON FORMATION

The drill hole at Reilly stopped 345 feet in the Trenton formation. Two other wells in the county penetrate the same horizon. Quoting again from Weller: "The Trenton is in general a more or less crystalline, heavy-bedded, buff-colored dolomite, some portions of which carry chert. At the base there are a few feet of thin-bedded limestones, and at the summit of the formation the dolomite is thin bedded through a thickness of 30 feet."[1]

CINCINNATIAN FORMATION

The Cincinnatian is represented by an alternating series of limestones and shales, varying in thickness from 200 to 295 feet. "The beds of this age vary greatly in lithologic character in the different parts of the State where they are exposed and seem to be limited to the uppermost or Richmond division of the formation, as it is more completely developed in the region lying east of the Cincinnatian arch. In the northwestern part of the State the formation is represented by the Maquoketa which is, in the main, a bed of blue or green clay shale with occasional bands of dolomite and limestone.

"In the northeastern portion of the State the Cincinnatian beds are * * * more calcareous than along the Mississippi, and contain an abundant fauna of the Richmond type."[2]

NIAGARAN FORMATION

The Niagaran formation is a series of massive limestones having in Vermilion County a recorded thickness of 530 to 575 feet. Describing this formation Stuart Weller says: "In northeastern Illinois the Niagaran limestone occupies a great area extending from central Iroquois County to the Wisconsin state line; in this region the beds attain a thickness of from 300 to 388 feet, and consist, for the most part, of more or less massive dolomites of a bluish or buff color * * *. In the lower portion of the series, however, there are also some shaly

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[1]Weller, Stuart, the geological map of Illinois: Ill. State Geol. Survey, Bull. No. 6, p. 16, 1907.

[2]Idem, p. 17.

beds."[3] It will be seen from this that the formation apparently thickens southward.

DEVONIAN FORMATION

The Devonian shales are the most easily recognized beds below coal No. 2 (?), and the top of this formation forms an excellent key horizon for correlation. Its thickness is recorded at Rankin as 130 feet; at Reilly as 135; and the C. C. C. & St. L. R. R. drilling, No. 51, stopped 25 feet in this shale. Danville and Danville Junction records show 70 and 90 feet respectively. The shales vary in color from white and brown to blue and black.

CARBONIFEROUS FORMATIONS

In the hole at Rankin only 50 feet of Pennsylvanian shales underlies the drift. The Mississippian strata, the top bed of which is represented by the limestone below the shales just mentioned, have a thickness of only 120 feet in this hole, whereas southeast of Reilly they attain a thickness of 175 feet. Further southeast the C. C. C. & St. L. Railroad prospect, No. 51, drilled in sec. 6, T. 20 N., R. 12 W. shows a thickness of 270 feet, whereas the wells at Danville waterworks, and Danville Junction report 470 and 445 feet respectively for the Mississippian. The series is composed of limestones, shales, and sandstones, the last two predominating.

Record of Ruddy Farm Well, Strohecker, Sammis, and Cooper, NE¼ SE.¼ sec. 11, T. 23 N., R. 14 W.

(Elevation—718 feet)

See Plate VI, No. 1

Description of strata	Thickness *Feet*	Depth *Feet*
Drift—		
Soil and clay	80	80
Gravel, thin, fine	97	177
Clay	33	210
Gravel and water	150	360
Pennsylvanian—		
"Slate" rock, thin	50	410
Mississippian—		
Limestone, thin	20	430
"Slate" and rock	40	470
Limestone	60	530
Devonian—		
"Slate" and rock	130	660
Silurian—		
Limestone	30	690
Sandstone, brown	40	730

[3]Idem, p. 18.

Description of strata	Thickness *Feet*	Depth *Feet*
Limestone	160	890
"Slate"	10	900
Limestone	290	1190
Ordovician—		
"Slate", blue	60	1250
Limestone	110	1360
"Slate", brown	115	1475

Record of Martha Ruddick farm well, Strohecker, Sammis, and Cooper, SW.¼ SW.¼ sec. 32, T. 23, N., 13 W.

(Estimated elevation—770 feet)

See Plate VI, No. 2

Description of strata	Thickness *Feet*	Depth *Feet*
Drift—		
Sand and gravel	356	356
Pennsylvanian—		
Shale and slate	34	390
Coal	3	393
"Slate"	60	453
Mississippian—		
Limestone	20	473
"Slate"	47	520
Sandstone, brown	10	530
"Slate"	55	585
Limestone	45	630
Devonian—		
"Slate", white	45	675
Shale, brown	90	765
Silurian—		
Sandstone, brown (water)	20	785
Limestone	560	1345
Ordovician—		
"Slate"	55	1400
Limestone	61	1461
"Slate" and shale	82	1543
Limestone	345	1888

For log of No. 3 (cross-section MN) see page 17.

Record of Danville artesian well

See Plate VI, No. 4

Description of strata	Thickness *Feet*	Depth *Feet*
Drift—		
Soil	10	10
Pennsylvanian—		
Soapstone	285	295
Sandstone, coarse	10	305
Soapstone	10	315

Description of strata	Thickness *Feet*	Depth *Feet*
Sandstone	100	415
Soapstone	15	430
Sandstone, gray	10	440
Shale, blue, sandy	80	520
Quartz or pebble rock	10	530
Mississippian—		
Shale, sandy	145	675
Limestone, gray, hard	30	705
Sandstone	30	735
Shale, blue, clayey	30	765
Pebble, or flint rock	30	795
Shale, blue, hard	90	885
Sandstone, gray	40	925
Shale, blue, hard	45	970
Shale, light green	30	1000
Devonian—		
"Slate", black	75	1075
Silurian—		
Limestone	74	1149

Record of Chicago and Eastern Ill. R. R. Co. well, NW. cor. SE.¼ SW.¼ sec. 4, T. 19 N., R. 11 W.

(Elevation—615 feet)

See Plate VI, No. 5

Description of strata	Thickness *Feet*	Depth *Feet*
Drift—		
Soil, yellow, clay and gravel	20	20
Clay, blue	15	35
Hard pan	30	65
Clay, blue, and gravel	15	80
Loam, fine, sandy	10	90
Sand, clay, and coarse gravel	50	140
Unidentified	8	148
Clay, blue, tough	5	153
Clay, blue, tough	20	173
Sand and gravel	2	175
Pennsylvanian—		
Slate, hard, black, some coal	6	181
Soapstone, drab	20	201
Soapstone, drab blue	32	233
Soapstone, drab blue	10	243
Sandstone, coarse, white	10	253
Coal	6	259
Clay, blue, or soapstone	20	279
Clay, blue, or soapstone	55	334
Rock, hard, flinty	2	336
"Slate", dark blue	35	371
Soapstone, brown	20	391

Description of strata	Thickness *Feet*	Depth *Feet*
Clay, red	11	402
Sandstone, white, soft	68	470
Clay, red, tough	20	490
Sandstone, brown, coarse	27	517
Sandstone, brown, fine	40	557
Sandstone, white, fine	30	587
Mississippian—		
Clay, dark blue	73	660
Rock, hard, pebble	10	670
Clay, white, fine	36	706
Rock, hard, pebble	6	712
Shale, dark blue	96	808
Shale, light blue, soft	65	873
Shale, dark blue, soft	18	891
Shale, red	62	953
Shale, light green	57	1010
Limestone, gray, hard	25	1035
Devonian—		
Slate, black	90	1125
Silurian—		
Limestone, gray, hard	51	1176
Limestone, coarse, soft (sulphur water)	10	1186
Limestone, white and dark blue	160	1346
Limestone, white, soft (sulphur water)	12	1358
Limestone, light and dark	342	1700
Ordovician—		
Sandstone, white (strong salt water)	35	1735
Shale, clayey	110	1845
Limestone, hard, gray	26	1871
Limestone, dark blue	65	1936
Shale, blue, hard	57	1993
Limestone, reddish	15	2008

DESCRIPTION OF SECTION HI

GENERAL STRUCTURE

Section HI presents both the stratigraphy and structure of the beds in the southern part of the county. From the Indiana well the formations dip to the west toward the center of the coal basin. West of Sidell, however, the dip is interrupted by the La Salle anticline, and the rocks rise toward its crest.

CINCINNATIAN AND TRENTON FORMATIONS

The Cincinnatian in the Richard well, which is the only hole penetrating the formation, is represented by 320 feet of sand and shale. Drilling stopped in the Trenton after passing through 47 feet of limestone.

NIAGARAN FORMATION

At present the Allerton drilling records 160 feet of cherty limestone and dolomite of the Niagaran. Dr. Holten's well at Sidell records this limestone series as shaly toward the top and gives the total thickness of the formation as 310 feet. Richard's well shows a continuous limestone section of 370 feet.

DEVONIAN FORMATION

The well at Allerton is the only one in which the Devonian is positively identified. Samples from this well disclose the presence of fossils which T. E. Savage of this Survey identifies as *Sporangites huronense,* a characteristic fossil of the upper Devonian. At Sidell 80 feet of slate at a depth of 845 feet is tentatively called the Devonian. F. E. Richard's well in sec 20, T. 17 N., R. 11 W. records at 755 a 45-foot shale, apparently Devonian. The 85-foot shale at 883 feet in the Indiana well is thought to be Devonian, and the underlying material, reported to be sandstone by the driller, is probably a dolomite, the top of the Niagaran. This error is common as particles of dolomite brought up by the bailer have the appearance of sand grains and do not react with acid.

CARBONIFEROUS FORMATIONS

The thickness of the Pennsylvanian series, as shown by these records, remains fairly constant. The Mississippian beds thin westward from 125 feet in sec. 30, T. 18 N., R. 12 W. to 12 feet at Sidell, but increase to 50 feet at Allerton. The record of the Allerton well is unfortunately of so general a character above the Devonian, that it is impossible to differentiate the Pennsylvanian from the Mississippian.

Record of Allerton farm well, Vermilion Oil Co., sec. 22, T. 17 N., R. 14 W.

(Estimated elevation—698 feet)

Interpreted by T. E. Savage

See Plate VII, No. 6

Description of strata	Thickness *Feet*	Depth *Feet*
Drift—		
Soil	10	10
Till, gray, sandy, with small pebbles	50	60
Till, gray, pink, pebbles, small	20	80
Till, yellow and brown, small pebbles	25	105
Till, gray; fine sand and small pebbles	100	205
Pennsylvanian—		
Shale, black, pyritic, containing impure coal	8	213
Shale, light gray, sandy	47	260

Description of strata	Thickness *Feet*	Depth *Feet*
Mississippian—		
Sandstone, gray, calcareous	20	280
Sandstone, more calcareous	65	345
Sandstone, gray, fine and medium grained	10	355
Sandstone, gray, fine grained, micaceous and calcareous	200	555
Sandstone, gray, very fine grained	15	570
Sandstone, calcareous, very fine grained	20	590
Sandstone, very calcareous, fine grained; much pyrite.	35	625
Shale, gray; some very fine pyritiferous sand	5	630
Shale, gray	30	660
Sandstone, shaly, dark gray	20	680
Upper Devonian—		
Shale, dark, containing *Sporangites huronense*	20	700
Shale, gray and dark, with pyrite	30	730
Middle Devonian—		
Sandstone, gray, calcareous	30	760
Limestone, gray to light brown, crystalline, containing glassy quartz grains and light chert fragments	40	800
Limestone, light gray, crystalline, containing chert fragments	15	815
Silurian (Niagaran)—		
Dolomite, gray, fine grained, crystalline	25	840
Dolomite, light gray, fine grained, crystalline	80	920

Record of Holten prospect, NW. cor. SW.¼ sec. 26, T. 17 N., R. 13 W.

(Estimated elevation—650 feet)

See Plate VII, No. 7

Description of strata	Thickness *Feet*	Depth *Feet*
Drift—		
Black dirt	3	3
Clay, yellow	10	13
Sand and gravel	42	55
Clay, light	110	165
Pennsylvanian—		
Shale, red	30	195
Shale, light	135	330
Limestone and shale	10	340
Shale, brown	50	390
Coal	2	392
Shale	63	455
Coal	7	462
Shale, brown	123	585
Limerock, very hard	45	630
Sand	82	712
Sand (salt water)	13	725
"Slate"	5	730
Limestone, hard	20	750
Sand (salt water at 780)	70	820

Description of strata	Thickness *Feet*	Depth *Feet*
Mississippian—		
Lime and slate (mixed)	25	845
Devonian—		
"Slate"	80	925
Silurian—		
"Slate" and lime (mixed)	115	1040
Limestone	195	1235
Sand (salt water)	68	1303

Record of F. E. Richard farm well, NW. cor. NE.¼ SE.¼ sec. 20, T. 17 N., R. 11 W.

(Estimated elevation—663 feet)

See Plate VII, No. 8

Description of strata	Thickness *Feet*	Depth *Feet*
Drift—		
Clay	40	40
Gravel, dry	4	44
Clay	50	94
Pennsylvanian—		
Coal	1	95
Limestone	20	115
"Slate", soft	165	280
Limestone	2	282
"Slate", black	4	286
"Slate", light	104	390
Coal	4	394
Sand (salt)	6	400
"Slate"	13	413
"Slate", black	32	445
"Slate", light	10	455
"Slate", black	55	510
Sand	75	585
"Slate"	50	635
Sand	5	640
Mississippian—		
Limestone	30	670
"Slate"	20	690
Limestone	65	755
Devonian—		
"Slate"	45	800
Silurian—		
Limestone	250	1050
Limestone, blue	25	1075
Limestone	75	1150
Limestone	20	1170
"Slate"	5	1175

Description of strata	Thickness *Feet*	Depth *Feet*
Ordovician—		
Sand	20	1195
"Slate"	10	1205
Sand	46	1251
"Slate"	5	1256
Sand	68	1324
"Slate"	56	1380
Shale	25	1405
"Slate"	85	1490
Trenton rock	47	1537

Record of Hall well, No. 1 SW. cor NW.¼ NE.¼ sec. 30, T. 18 N., R. 10 W.
(Elevation—611 feet)

See Plate VII, No. 9

Description of strata	Thickness *Feet*	Depth *Feet*
Drift—		
Soil, yellow clay, blue clay	70	70
Sand and clay	3	73
Clay, yellow	5	78
Pennsylvanian—		
Shale, brown	78	106
Limestone, gray, hard	5	111
Sandstone, gray, dark, soft, with smut on water	13	124
Shale, brown, sandy	2	126
Shale, brown	5	131
Fire clay	5	136
Sandstone, white, soft, fine, waxy	5	141
Sandstone, a little coarser (slight trace of oil)	15	156
Sandstone, white, fine, mica specks	8	164
Shale, brown	7	171
"Slate", black	10	181
Shale, brown, and soapstone	9	190
Coal	2	192
Fire clay	4	196
Shale, brown	4	200
Coal	5	205
Hard shell	3	208
Clay, white, fine	8	216
Clay or "slate", white, smooth	19	233
Sandstone, white, fine, waxy	9	244
Shale, brown	21	265
Sandstone, white, coarse	15	280
Shale, brown and black	36	316
Fire clay	5	321
Shale, dark	5	326
"Slate" and sand shells	5	331
Sand, white, fine, soft	5	336
Sand, with lime shell	5	341

Description of strata	Thickness *Feet*	Depth *Feet*
Sand	5	346
Sandstone, white, fine (salt)	39	385
Sandstone and hard shell	5	390
Sandstone, white, fine	5	395
Sandstone, brown, coarser	25	420
Sandstone, grayish, fine	21	441
Sandstone, light gray, soft	6	447
Sandstone, white, soft	12	459
Sandstone, very fine	11	470
Sandstone, white, soft, fine	10	480
Sandstone, gray, soft	10	490
Sandstone containing pyrite with black smut (small show of oil) and coarser	8	498
"Slate", black, pyrite	3	501
Shale or "slate", blue	19	520
Shale	6	526
Sandstone, gray, fine, soft	29	555
Sandstone, very fine	10	565
Sandstone (salt water)	21	586
Sandstone, small particles of red and white sand	18	604
Sandstone, white and muddy, soft	30	634
Mississippian—		
Shale, gray, sandy	54	688
Shale and slaty shells	72	760
Sandstone, gray, soft, dirty	30	790
Soapstone	12	802
Shale, gray, sandy	6	808
Shale, blue, smooth	6	814
Shale, gray, sandy	33	847
Sand, dark gray, fine, soft	6	853
Sand (salt water)	12	865
Sand, a little coarser	6	871
Devonian—		
Shale, gray, sandy	12	883
Soapstone	12	895
"Slate", blue	73	968
Sandstone, gray, fine, soft	10	978
Sandstone, coarser	10	988
Niagaran (?)—		
Sandstone, light gray, fine, soft, (salt water)	48	1036

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PUBLICATIONS OF THE ILLINOIS COAL MINING INVESTIGATIONS

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

Bulletin 2. Coal Mining Practice in District VIII (Danville), by S. O. Andros, 1914.

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.

Bulletin 5. Coal Mining Practice in District I (Longwall), by S. O. Andros, 1914.

Bulletin 6. Coal Mining Practice in District V (Mines in bed 5 in Saline and Gallatin counties), by S. O. Andros, 1914.

Bulletin 7. Coal Mining Practice in District II (Mines in bed 2 in Jackson county), by S. O. Andros, 1914.

Bulletin 8. Coal Mining Practice in District VI (Mines in bed 6 in Franklin, Jackson, Perry, and Williamson counties), by S. O. Andros, 1914.

Bulletin 9. Coal Mining Practice in District III (Mines in beds 1 and 2 in Brown, Calhoun, Cass, Fulton, Greene, Hancock, Henry, Jersey, Knox, McDonough, Mercer, Morgan, Rock Island, Schuyler, Scott, and Warren counties), by S. O. Andros, 1915.

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*Copies of this bulletin may be obtained by addressing the Director, U. S. Bureau of Mines, Washington, D. C.