

STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION
A. M. SHELTON, *Director*
DIVISION OF THE
STATE GEOLOGICAL SURVEY
M. M. LEIGHTON, *Chief*

Cooperative Mining Series
BULLETIN 31

**COAL STRIPPING POSSIBILITIES IN
SOUTHERN AND SOUTH-
WESTERN ILLINOIS**

BY
G. H. CADY

ILLINOIS MINING INVESTIGATIONS

Prepared under a cooperative agreement between the Illinois State Geological Survey
Division, and the Engineering Experiment Station of the
University of Illinois



PRINTED BY AUTHORITY OF THE STATE OF ILLINOIS

URBANA, ILLINOIS

1927

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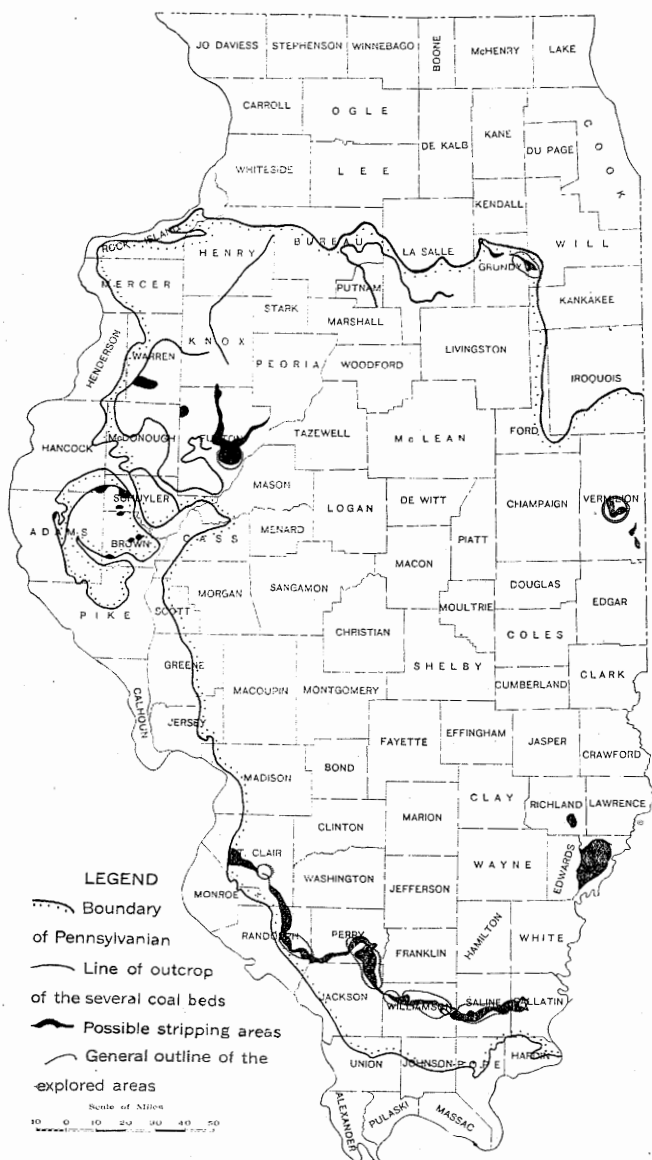


Fig. 1. Map of Illinois showing the locations of possible stripping areas. In most of the areas outlined in red, exploration is restricted to a single bed. The extent of exploration in Fulton County is not known.

COAL STRIPPING POSSIBILITIES IN SOUTHERN AND SOUTHWESTERN ILLINOIS

By G. H. Cady

PART I

INTRODUCTION

GENERAL STATEMENT

In 1925 the Illinois State Geological Survey published a preliminary report on coal stripping possibilities in the State.¹ This report was prepared at a time when the area of coal being stripped and the production of strip coal were undergoing notable expansion. In 1924 the production of strip coal was 1,503,542 tons, whereas in 1925 it was 3,053,723 tons. Since the summer of 1925, no additional large strip pits have been opened but there has been an appreciable increase in production as shown in Table 1.

Although strip-mine production has not greatly changed since 1925, a continued interest in stripping as a possible source of coal is manifest in the large amount of exploratory work that has been carried on in this interval in the areas designated in the preliminary report as suitable for investigation. Some of the exploration was begun before the report was published but most of it is of a later date and has been located in accordance with suggestions contained in the bulletin. As a result of test drilling, large tracts have been explored in northern Illinois, particularly in Grundy County, and in southern Illinois along the outcrop of No. 6 coal from Millstadt, St. Clair County, east into Saline County, and along the outcrop of No. 5 coal in Williamson and Saline counties. The areas which as a result of drilling completed or now in progress can no longer be included in the category of untested regions are indicated in figure 1 which also shows the location of possible stripping areas in the State as described in the preliminary bulletin.

To meet continued calls for information the present bulletin, giving additional data in regard to specific untested areas, as of May, 1927, is issued. Some of the areas selected for description are chosen because new and more detailed information has become available as a result of special areal mapping in the regions concerned, others because they lie adjacent to regions already tested. Such regions remain untested possibly because of great uncertainty in regard to the position of the border of the coal bed. Since there can be no doubt but that the border actually extends across these areas, the Survey wishes to contribute such information and opinions as it has in regard to the position of this border or outcrop on a map of somewhat larger scale than was published in the earlier report. The special areas described in this bulletin are located along the outcrop of No. 5 and No. 6 coals in southern Illinois. (See fig. 2.)

¹Culver, H. E., A preliminary report on coal stripping possibilities in Illinois: Illinois State Geol. Survey, Cooperative Mining Series Bull. 28, 1925.

TABLE 1.—*Strip mines in Illinois and their production, 1924-1926a*

Company	County	Production			
		Fiscal year ending June 30, 1924 <i>Tons</i>	Fiscal year ending June 30, 1925 <i>Tons</i>	July 1 to Dec. 31, 1925 <i>Tons</i>	1926 <i>Tons</i>
1 <i>b</i> Tiger Coal Mining Co.....	Fulton.....	3,525	4,440		
2 <i>b</i> United Electric Coal Co., No. 9.....	Fulton, Cuba (P. O.).....	51,950	489,366	362,229	822,129
3 <i>b</i> Buckheart Coal and Mining Co.....	Fulton, R. F. D. No. 6, Canton	5,276			5,518
4 Saline Creek Coal Co.....	Gallatin.....		24,177	30,434	
5 <i>b</i> Black Servant Coal Co.....	Jackson, Elkville	171,845	470,076	210,352	431,211
6 Forsyth Coal Co.....	Jackson, De Soto.....			33,572	317,518
7 Scott-Smith Coal Co.....	Perry.....	112,100			
7 Perfection Coal Co.....	Perry, Du Quoin.....		90,000	69,790	189,990
8 Pyramid Coal Co., No. 2.....	Perry.....				40,594
9 <i>c</i> Gayle Coal Co.....	Perry, Du Quoin.....		251,079	156,498	327,555
10 Solar Coal Co.....	St. Clair, Freeburg.....			74,508	157,937
11 <i>b</i> Harrisburg Coal Mining Co., No. 2.....	Saline, Harrisburg.....	216,978	224,255	125,402	200,279
12 Yankee Branch Coal Co., No. 1.....	Vermilion, Georgetown.....	38,046			18,320
13 Chicago Collieries Co., No. 4.....	Vermilion.....	163,303	124,611	102,082	
14 I. I. Coal Co.....	Vermilion.....	3,800			
15 United Electric Coal Co., No. 1.....	Vermilion, Danville.....	205,487	467,588	154,098	299,187
16 United Electric Coal Co., No. 4.....	Vermilion.....	130,297	180,097	93,184	30,588
17 United Electric Coal Co., No. 5.....	Vermilion.....	121,896	95,953	58,538	23,027
18 United Electric Coal Co., No. 12.....	Vermilion.....				128,030
19 Yankee Branch Coal Co.....	Vermilion.....		38,800	30,800	
20 <i>b</i> Coal Belt Coal Co.....	Williamson.....	15,366			
20 Van Hoos Coal Co.....	Williamson.....		3,000		
21 Mammoth Coal Co.....	Williamson, Marion.....	29,271	61,370	15,451	31,791
22 Prosperity Coal Co.....	Williamson.....		1,336	484	
23 <i>b</i> Prosperity Coal Co., No. 1.....	Williamson.....	3,698			
24 <i>b</i> Prosperity Coal Co., No. 2.....	Williamson.....	5,704			
25 <i>b</i> Quaker Mining Co., No. 1.....	Williamson.....	105,000			
25 Worth-Huskey Coal Co., No. 1.....	Williamson.....		106,455	47,151	
26 <i>b</i> Quaker Mining Co., Fuel mine.....	Williamson.....	120,000			
26 Worth-Huskey Coal Co., No. 2.....	Williamson.....		144,209	64,984	
27 <i>d</i> Huskey Coal Co.....	Williamson, Cambria.....				252,947
28 Pyramid Coal Corp., No. 1.....	Williamson, Marion.....				313,508
29 <i>c</i> Pyramid Coal Corp.....	Williamson.....		276,911	157,797	



Fig. 2. Map of Illinois showing locations of areas described in this report.

FACTORS BEARING ON THE AVAILABILITY OF A DEPOSIT

In the preliminary bulletin it was stated that "a commonly accepted minimum for the thickness of the coal is 48 inches for a commercial operation", but other factors may considerably reduce this in certain cases. It is noteworthy that in areas recently explored in Grundy County the coal in general has a thickness of not more than 42 inches; in fact the average thickness of No. 2 coal in the Coal City-Wilmington region is generally regarded as not more than 37 inches. Although detailed information in regard to the thickness of the coal discovered by recent drilling has not been conveyed to the Survey, there is no reason to believe that the coal exceeds the average thickness of the general region. Inasmuch as the facts were known in regard to the probable thickness of the coal when the prospecting was undertaken, it is evident that a thickness of 40 inches was regarded as above the minimum for commercial operation, provided other conditions were particularly favorable.

There seems to be a general opinion among operators that the ratio of the thickness of the coal to the thickness of the overburden should not average more than 1 to 8. Since the cost of excavation increases at a greater rate than the increase in depth, at least as the thickness of the overburden makes necessary two operations; possibly a somewhat larger ratio may hold for thin coals than for thick coals. Local conditions enter so largely into the cost of stripping that no general rule can be stated except that the profitable extraction of coal having a heavy overburden is possible only when other conditions, such as the character of the overburden, machinery, relation to markets, etc., are particularly favorable.

The decrease in the importance of hard layers of rock as deterrents to the stripping operation has been mentioned by Dr. Culver.² He states: "more recent work has demonstrated that the shale and 'slate' do not seriously interfere with operations, and in places, even a 5-foot bed of massive limestone has been handled satisfactorily after shooting." It can now be said that operations appear to be successful in which the thickness of the limestone is 5 to 7 feet. Operations have recently been started near Duquoin in a region where preliminary drilling indicates that limestone of even greater thickness than 7 feet must be moved to reach the coal. It is anticipated that the limestone recovered will constitute a by-product of the operation, the sale of which will largely cover the cost of its removal. Inasmuch as a heavy limestone cover characterizes No. 6 coal west of Duquoin, the prospects seem to be good for the development of a large crushed-stone industry in this portion of the State. Since natural sources of ballast and road material are meager, the local market for the crushed

²Culver, H. E., A preliminary report on coal stripping possibilities in Illinois: Illinois State Geol. Survey, Cooperative Mining Series Bull. 28, p. 10, 1925.

stone probably will be good. Unless the limestone can be marketed at a price that will compensate the cost of removal, it is doubtful whether the coal can be recovered in large areas in southern Illinois west of Duquoin even though the cover is not more than 30 feet thick, because much of this cover is limestone.

The size and capacity of mechanical shovels used in large-scale stripping operations are undergoing changes which necessitate continual revision of the estimate of removable overburden. On the basis of the estimates made in Cooperative Mining Series Bulletin 28 of the Illinois State Geological Survey, of the extent of area in Illinois within which coal is available by open-cut methods of mining, manufacturers have been designing machines with an enlarged capacity, particularly with respect to the handling of limestone beds such as are found above the coals in southern Illinois. It remains to be demonstrated whether or not efficient operation is possible with shovels with a capacity larger than about 8 yards. It is reported that a much larger shovel is to be installed in one of the recently opened pits near Duquoin. If the report is correct much interest will attend the performance of this machine particularly as the limestone overburden is unusually heavy.

ECONOMIC FACTORS DETERMINING THE SUCCESS OR FAILURE OF STRIPPING OPERATIONS

In the earlier report on coal stripping possibilities it is possible that too little attention was given to the conditions which determine the success or failure of a stripping operation other than those dependent simply upon the thickness of the coal and overburden. It is the desire of the Survey to encourage the development of the resources of the State but only as conditions warrant such development. A word of caution needs to be spoken for the sake of those who regard stripping operations as unattended by much risk. The following pertinent statement was recently made:³

"Coal stripping is rather a hazardous business. The apparent simplicity of the proposition is an incentive that often governs those who develop such properties. The cost of the plant ready to produce coal is less than that for a shaft mine; on the other hand the life of a stripping plant is much shorter than that of a shaft mine, and for this reason the stripping plant often proves more expensive in the end. The stripping method requires less labor than a shaft mine to produce an equal amount of coal when the conditions are favorable for stripping. Weather, however, is a factor of serious importance, as a rainy spell may cause very serious financial loss."

³Bement, A., The Illinois coal field, Manuscript report for the Illinois Geological Survey, 1927.

The difficulties that enhance the risk of strip mining in Illinois arise largely from the topographic conditions where the stripping must be carried on. In southern Illinois stripping must usually, if not always, be carried on in areas of low relief. The pit in general lies below the drainage level and the spoil in the first excavation must be piled on the surface. After excavation has proceeded for some time the spoil can be piled back into the part of the pit from which the coal has been removed. Where the overburden is heavy the waste cannot be dumped at a safe distance from the shovel in a single operation and an additional shovel or drag line is usually necessary to remove part of it to a greater distance. There is a natural desire to avoid the use of a second shovel if possible. By so doing there is a very great danger that the shovel making the excavation to the coal will find itself between two treacherous banks of earth and, in the event of rain, even buried in slides from one or both sides.

Wise choice of equipment both in kind and amount will very largely determine the outcome of a stripping venture. A study of the statistics of stripping operations indicates that experience is of the same importance in this sort of operation as in other sorts of mining. The largest and most successful pits are those that have been longest in operation or are operated by experienced companies. So far as the writer is aware there are in Illinois no areas where coal can be stripped on a large scale in an operation unattended by much financial risk.

In a report of this kind emphasis is naturally placed upon large-scale operations. In fact it is only as equipment is introduced capable of lifting cheaply a burden 8 to 10 times the weight of the coal, that most of the coal at shallow depth becomes available for recovery by open-cut methods. On the borders of areas where stripping is possible, however, there are usually small bodies of coal under particularly shallow cover available for recovery by the simple methods of team and scraper excavation. Small pits of this kind have been in operation in various parts of the State continuously. They represent a common source of cheap coal during the summer months, at least, for the immediately surrounding rural district. Like local mines they are of relatively small importance in comparison with the production of the State as a whole, but may be of considerable local importance. It is quite probable that within the areas described in this report there are places where under very shallow cover small bodies of coal exist suitable for recovery on a small scale. The 8,000 tons of coal in a 5-foot bed extending beneath an acre of land would be a sufficient supply for a rural community for a number of years.

RESTORATION OF THE WASTE LAND

The chief popular objection to stripping operations is directed against the unsightly and unredeemable piles of spoil that result from open-cut

mining. That the land may have been of little value under cultivation is rarely considered. A 5-foot bed of coal has much more immediate value than the surface at even \$100 an acre. Yet the destruction of a permanent potential resource represented by the soil for the sake of recovering and exhausting another resource, although it may be of greater immediate value, will always be popularly regarded as economically unsound. There is constant danger of the enactment of legislation against this method of mining coal particularly as the scale of the operations becomes increasingly large. It therefore behooves those interested in such operations to take some thought of the possibility of restoring the worked-over lands to cultivation. That the spoil could be distributed in less topographic confusion seems certain. Before any of the land can be rendered fit for cultivation it must first be restored to some resemblance to the original topographic form. It then becomes the problem of agronomists and botanists to determine the most suitable procedure for restoration of the soil and vegetation. The writer is of the opinion that the consideration of the matter of restoration of lands wasted by the large-scale stripping process cannot be indefinitely delayed.

PART II

UNEXPLORED STRIPPING POSSIBILITIES IN SOUTHERN ILLINOIS

INTRODUCTORY STATEMENT

The rise of the coal-bearing rocks toward the margin of the coal field in southern Illinois brings to the surface the important coal beds mined through shafts in St. Clair, Randolph, Perry, Jackson, Williamson, and Saline counties. This is a matter of particular interest to those searching for areas of coal suitable for open-cut mining. Three beds are mined by shafts in the southern part of the State, No. 6, No. 5, and No. 2. Of these, No. 6 is the most widespread. In fact it appears to be continuous entirely across the southern part of the State, and its outcrop is therefore also continuous. No. 5 coal is locally interrupted, if not entirely absent, west of Randolph county, and No. 2 coal cannot be identified along the outcrop of the coal-bearing beds west of Jackson County. The upper or No. 6 coal known as the Belleville or Herrin coal, is the most important coal bed in the State. It is very regular in thickness which varies from six to nine feet along its southern margin, and of good quality, so that particular interest is attached to facts relating to the position and character of its outcrop. The accompanying maps and descriptions are concerned mainly with conditions along the outcrop of No. 6 coal, although some consideration will be given to No. 5 coal in certain areas.

GENERAL MAP OF THE COAL OUTCROPS IN SOUTHERN ILLINOIS
GENERAL STATEMENT

As a background for the discussion a map has been prepared (Pl. I) showing the outcrop of No. 6 coal from the Mississippi River bluff line near Belleville to the vicinity of Harrisburg, Saline County, and showing also the outcrop of No. 5 coal across Williamson and Saline counties. In the preparation of the map the outcrops were first plotted on quadrangle maps on a scale of about one mile to an inch with as great detail as was possible. The lines were then transferred to the smaller scale map of publication. The published map is on the same scale, four miles to the inch, as is the road map of Illinois published by the State Division of Highways, which was used as a base. The entire line of outcrop, or outcrops where two coals are mapped, possesses interest, because along it, if anywhere, will open-cut mining be possible in the southern part of the State.

CHARACTER OF THE OUTCROP

The word outcrop unfortunately suggests that the coal bed mapped actually comes to the surface of the ground and can therefore be traced by

following the coal blossom. This, however, is not true, since it is only here and there that the coal actually comes to the surface or to the grass roots. The most common places of actual exposure are where streams have removed the usual covering. Not only the outcrops of the coal, but also the outcrops of any rocks are rare. Sandstones and limestones appear at the surface more commonly than do other rocks. In general the surface material consists not of rocks but of unconsolidated material deposited by glaciers, streams, and wind, and the rock surface may lie from a few inches to 100 feet or more below the surface of the ground. In general throughout Illinois, the rock surface possesses considerably more relief than the ground surface; particularly is this true in southern Illinois where the valleys are deeply silted. In tracing the outcrop of a coal bed one of course notes its position on the rock surface, hidden beneath a mantle of soil.

COMPARISON WITH EARLIER MAPS

For earlier maps published by the State Geological Survey showing the outcrop of the coals across the southern part of the State only a rough approximation to accuracy was claimed. The lines indicating the margins of the beds for the most part connected scattered points of actual outcrop, and the intervening position of the lines was determined mainly in accordance with existing knowledge of the topographic features, the known depth of the coal at points north of the outcrop and the supposed character of the dip between these points and the outcrop. Where the beds are nearly horizontal and the surface is likewise level or only gently sloping it was then, as it is now, impossible without test holes to delineate their margins with much accuracy. The accurate information in regard to surface configuration furnished by the topographic maps now available entirely across southern Illinois is of great assistance in projecting the probable position of an outcrop. In addition, more detailed information in regard to the general lay and position of the coal approaching the outcrop has become available and knowledge concerning the position of the outcrop has been increased by local exploration by the drill; consequently an outcrop map based upon such improved data has a much stronger claim for accuracy than earlier maps prepared from less abundant data.

RELATIVE ACCURACY OF DIFFERENT PORTIONS OF THE MAP

The information accumulated in the Survey files regarding the outcrop of the coals in southern Illinois relates unequally to the various positions along the margin of the coal beds; an equal degree of accuracy cannot, therefore, be claimed for all portions of the designated lines of outcrop. In general where the lines describe somewhat intricate and

irregular patterns the knowledge concerning the position of the outcrops may be considered good; where the lines consist of open broad curves, generalization may be suspected. In any case it is probable that the line of outcrop is more irregular than is represented since the scale of the map does not permit the delineation of small irregularities such as probably exist. The claim for greatest accuracy is made for those regions where privately conducted exploration by the drill, and detailed field investigation by members of the Survey staff provide the most complete information, and particularly for the position of the outcrop of No. 5 and No. 6 coals across Saline and most of Williamson counties, and of the outcrop of No. 6 coal across the northwest corner of Jackson County, along the east side of Beaucoup Creek in Perry County, and in Randolph County from Sparta to Percy. Along these stretches the outcrop of the coal has been tested by drilling in fairly large blocks and in several places field investigation has revealed the position of all actual outcrops. From Pinckneyville westward nearly to Willisville and westward from the vicinity of Sparta to the vicinity of Belleville there are stretches where the outcrop has been very little tested and its position remains uncertain. The outcrop northwestward from Marissa was mapped at the time the New Athens quadrangle was geologically surveyed in 1911.¹ Knowledge of the position of the outcrop of No. 6 coal in that area has not greatly improved since that time, except for a small area near the open-cut of the Solar Coal Company between Freeburg and New Athens.

SPECIAL AREAS

This report is particularly concerned with those areas along the outcrop that appear suitable for investigation but have not yet been tested by the drill. The position of the more important of these is indicated on Plate I; they are numbered I to VI from west to east across the map. Larger scale maps of these smaller areas (Pls. II-VII) have been printed on thin paper on the same scale as that of the topographic maps issued by the U. S. Geological Survey² and by placing them in their proper positions over these latter maps the relation of the outcrop lines to the topography can be readily ascertained. Other smaller areas suitable for investigation exist here and there along the outcrop of the coals, and although they will be mentioned, the main purpose of the report is to describe the conditions obtaining with respect to occurrence of the coal in the six special areas.

¹Shaw, E. W., U. S. Geol. Survey Geol. Atlas, New Athens-Okawville folio (No. 213), 1921.

²Topographic maps are available at ten cents a copy. The following quadrangles are included within the area covered by this portion of the report:

Baldwin	Galatia	New Athens
Campbell Hill	Harrisburg	Pinckneyville
Carbondale	Herrin	St. Louis
Coulterville	Marion	Waterloo
Duquoin	Murphysboro	West Frankfort

GENERAL CHARACTERISTICS OF THE COALS AND ASSOCIATED ROCKS IN
SOUTHERN ILLINOIS

AVAILABLE COALS

Within all the areas, except possibly I and II located in St. Clair County, two coals outcrop—No. 5 and No. 6. However, only No. 6 coal is mapped except in Area VI in Williamson County, because, although there seems to be no doubt as to the presence of No. 5 coal in Areas IV and V, and although it may be present beneath Area III, the position of the outcrop and depth of the lower coal have not been sufficiently explored to warrant delineation. Its presence beneath No. 6 coal along the outcrop of the latter in St. Clair County is improbable. Between St. Clair and Williamson counties the outcrop of No. 5 coal is indefinite. In the vicinity of Willisville and southwest of Sparta, Randolph County, there has been some drilling along the outcrop of this coal, but for the most part the territory southwest of the outcrop of No. 6 coal has not been much drilled and outcrops of the lower coal are rare. It is probable, however, that the outcrop of the lower coal lies in general within half a mile south of the outcrop of No. 6 coal since the coals west of the Duquoin anticline are commonly separated by only 25 to 30 feet of strata.

In Williamson and Saline counties where No. 5 coal is economically more important there is more detailed information in regard to its outcrop than there is farther west. Even in these counties the mapping is not of uniform accuracy. Eastward from New Denison, that is across Ranges 4, 5, and 6, East, the outcrop has been traced by field parties and determined by authenticated drilling. The outcrop as mapped from the vicinity of New Denison northwestward to the line of the Chicago, Burlington and Quincy Railroad northwest of Marion represents determinations resulting from drilling. The data were supplied to the Survey but they have not been closely checked in the field. From the line of the Chicago, Burlington and Quincy Railroad westward to Carterville the position of the outcrop is only approximately accurate. The occurrence of the coal in this strip is considered in the description of special Area VI (p. 52). From Carterville west to the county line the margin of the coal has been discovered in places by drilling and open-cut mining, but has not been mapped in detail.

It will be noted in examining the maps that the outcrop of No. 5 coal in general closely parallels the outcrop of No. 6 coal, but that the parallelism is somewhat less close in Saline and eastern Williamson County than elsewhere. The closeness of the two lines of outcrop is of course due to the fact that the coal beds are generally separated by only about 25 to 30 feet of strata. In the eastern part of Williamson County, however, the interval between the two beds increases considerably; it is about 75 feet

in the vicinity of Craborchard village, about 100 feet at the Saline-Williamson county line, and 125 feet near Carrier Mills. Eastward from Carrier Mills it decreases somewhat. The increase in the interval between Craborchard and Carrier Mills explains the wider separation of the outcrops of the two coals.

CHARACTER OF STRATA BETWEEN NO. 5 AND NO. 6 COALS

From Randolph County eastward to Williamson County the strata between the two coals consist of from 25 to as much as 60 per cent of limestone. In northeastern Jackson County where the coals are about 35 feet apart, the presence of 10 feet of limestone seems to be usual. Near Carterville the interval between the coals is about 40 feet, and here also about 10 feet of the intervening rock is limestone. Near the outcrop of No. 6 coal north of Marion No. 5 lies about 45 feet below No. 6 with 10 feet of limestone between the two coal beds. In T. 9 S., R. 3 W., the interval between the beds is from 50 to 60 feet, with no more than ten feet of limestone present, and in places as much as 17 feet of sandstone. In Range 4 E., where the interval is from 80 to 100 feet or more, usually less than 5 feet of limestone is present, but sandstones as much as 55 feet thick were encountered in some of the drill holes. It is noteworthy that only in eastern Williamson County where the intervening section contains a notable amount of sandstone is the line of outcrop of No. 5 coal marked by topographic irregularities. The coal outcrops at the foot of an escarpment marking the position of the outcropping sandstone lying between the coals. Elsewhere the outcrop of No. 5 coal is less readily followed because there are no resistant beds above it and the surface usually slopes gently across the outcrop of beds lying for some distance below No. 6 coal. Because of the resistance to erosion offered by the sandstone above No. 5 coal in eastern Williamson County and the resulting steep slope adjacent to the outcrop of the coal the thickness of the overburden increase rapidly and conditions for stripping this coal are not particularly good, but slope mining can be carried on very close to the outcrop. In central Saline County the rocks between the coals are largely shale and here again gentle slopes prevail for some distance north of the outcrop of the coal so that large scale open-cut mining is possible.

In the Sparta region the beds intervening between the two coals were very largely limestone. It is noteworthy that these are not sufficiently resistant to weathering and erosion to affect the topographic expression of the surface. Apparently these rocks did not conspicuously protrude from the preglacial surface. Their presence under cover is, however, very definitely established by the numerous test holes that have penetrated both coals. It is very evident that the most favorable situations for the recovery

of No. 5 coal by open-cut methods are where the rocks intervening between No. 5 and No. 6 coals consist largely of shale, as in central and western Williamson County and in Saline County. Elsewhere stripping operations in No. 5 coal will be forced to handle considerable thicknesses of resistant rock, either limestone or sandstone.

NO. 5 COAL

THICKNESS

In the Sparta and Willisville region in Randolph County No. 5 coal usually has a thickness of about 4 feet, but varies from 40 to more than 60 inches. In general it appears to be more variable in thickness than No. 6 coal. In northeastern Jackson County the few available records of holes penetrating it indicate that its thickness is between 4 and 5 feet. One record reports as much as 5 feet 2 inches. At the pit of the Huskey Coal Company in western Williamson County the coal has a thickness of 4 feet. In Range 2 East it varies from 4 to 5 feet in thickness. Thence eastward it is usually more than 4 feet thick, though not generally more than five feet except between Carrier Mills and Harrisburg, where in places it is locally 7 to 8 feet thick.

CHEMICAL CHARACTERISTICS

The chemical character of No. 5 coal in Randolph, Williamson, and Saline counties is indicated by the analyses of face samples collected in mines in those counties, and given on the following page.

It will be noted that the analyses in Table 2 apparently favor the coals sampled in Williamson County. It is commonly true, however, that analyses made prior to 1912, before standardized methods of analysis were established, show calorific values somewhat higher than those determined for the coal from the same mine in 1912 and since that year. Although the quality of the coal is best indicated by the "unit coal" value it is doubtful whether No. 5 coal in Williamson County is in general superior in quality to the coal from the same seam in Saline County because of the lower ash content of the Saline County coal. Additional analyses of No. 5 coal in Williamson County are needed to establish its character definitely. Comparison of the analyses in Tables 2 (p. 20) and 3 (p. 27) indicate the superiority of the lower seam over No. 6 coal. In Randolph County the lower coal appears to have an advantage over No. 6 coal of about 300 B. t. u. on the unit coal basis and in southern Williamson County of at least 100 B. t. u. but the latter advantage is not well established by the data used. There are no analyses of No. 6 coal that can be used for comparison with determinations for No. 5 coal in Saline County.

The most notable difference in the character of No. 5 coal across the southern part of the State is in the amount of non-coal substance, that is

moisture, ash, and sulphur, present in the coal. The impurities decrease considerably from west to east so that whereas the combustible constituents make up 76 per cent of the coal in Randolph County, they compose 80 per cent in Williamson County, and 85 per cent or more in Saline County.

TABLE 2.—*Analyses of No. 5 coal in Randolph, Williamson, and Saline counties*

(Face samples only)								Calorific Value (B. t. u.)
Analysis No.	Date	Form of Analysis	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulphur	
8835 ^a		As rec'd	13.90	35.33	41.33	9.44	4.84	11015
		Dry		41.03	48.00	10.97	5.63	12793
		Unit coal ^e						14709
8836 ^a		As rec'd	12.21	35.22	41.61	10.96	4.47	11037
		Dry		40.12	47.40	12.48	5.10	12572
		Unit coal ^e						14711
1809 ^b	9/08	As rec'd	6.47	35.96	45.84	11.73	3.39	12022
		Dry		38.45	49.02	12.53	3.62	12840
		Unit coal ^e						14985
896 ^c	8/07	As rec'd	6.29	36.72	46.99	10.00	3.61	12251
		Dry		39.20	50.12	10.68	3.86	13073
		Unit coal ^e						14917
12918 ^d	7/21	As rec'd	5.75	35.01	52.65	6.59	2.05	12800
		Dry		37.15	55.86	6.99	2.18	13581
		Unit coal ^e						14927
12919 ^d	7/21	As rec'd	6.58	32.89	53.29	7.24	2.06	12565
		Dry		35.21	57.14	7.75	2.20	13450
		Unit coal ^e						14754
12917 ^d	7/21	As rec'd	5.62	34.61	52.52	7.25	2.02	12781
		Dry		36.67	55.65	7.68	2.14	13542
		Unit coal ^e						14840

^aNear Blair, Randolph County. Analysis made since 1912.

^bLocal mine near Cartersville, Williamson County.

^cSpillertown Coal and Coke Co., Williamson County. Mine abandoned.

^dNear Carrier Mills, Saline County.

^eAsh, sulphur, and moisture free calorific value.

It is interesting to note that practically the same differences exist in the character of No. 6 coal, at least in Randolph and Williamson counties. It will be observed that the moisture content of No. 5 coal in Randolph County is notably higher than it is in the counties to the east.

PHYSICAL CHARACTERISTICS

The physical characteristics of No. 5 coal can be most satisfactorily described by means of detailed sections and the citation of observations made at the coal face in various places from Randolph County eastward.

*Sections of No. 5 coal in mine No. 9, Willis Coal and Mining Co., Percy,
sec. 11, T. 6 S., R. 5 W., Randolph County^a*

Section 1—Face of the 4th north entry		
Strata	Thickness	
	Inches	Inches
Coal	2	
Charcoal	$\frac{1}{4}$	
Coal	$4\frac{1}{2}$	
Charcoal	$\frac{1}{4}$	
Coal	$1\frac{1}{2}$	
"Sulphur"		$\frac{1}{2}$
Coal	5	
Charcoal	$\frac{1}{4}$	
Coal	$5\frac{1}{2}$	
"Sulphur"		$\frac{1}{4}$
Coal	$4\frac{1}{2}$	
"Sulphur"		$\frac{1}{2}$
Coal	16	
"Sulphur"		$\frac{1}{8}$
Coal	5	
Clay mixture		$\frac{1}{4}$
Coal	$4\frac{1}{2}$	
<hr/>		
Total coal	49 $\frac{1}{4}$	
Total impurities		$1\frac{5}{8}$
Thickness of bed.....	50 $\frac{7}{8}$	inches
Measured thickness	49	inches

Section 2—Face of main east entry		
Strata	Thickness	
	Inches	Inches
Coal	8	
Charcoal	$\frac{1}{4}$	
Coal	5	
Charcoal	$\frac{1}{4}$	
Coal	$1\frac{1}{2}$	
"Sulphur"		$\frac{1}{2}$
Coal	7	
Charcoal	$\frac{1}{8}$	
Coal	3	
"Sulphur"		$\frac{1}{8}$
Coal	1	
"Sulphur"		$\frac{1}{8}$
Coal	11	
"Sulphur"		$\frac{1}{4}$
Coal	13	
Clay		$\frac{1}{8}$
Coal	6	
<hr/>		
Total coal	56 $\frac{1}{8}$	
Total impurities		$1\frac{1}{8}$
Thickness of bed.....	57 $\frac{1}{4}$	inches
Measured thickness	57	inches

Strata	Section 3—Face of the 4th south entry	Thickness	
		Inches	Inches
Coal		4½	
Charcoal		¼	
Coal		6½	
Charcoal		¼	
Coal		9½	
"Sulphur"			½
Coal		4	
Charcoal		¼	
Coal with lenses of "sulphur"		17	
"Sulphur"			½
Coal		6	
Clay and charcoal			¼
Coal		8	
Total coal		56¼	
Total impurities			1¼
Thickness of bed		57½	inches
Measured thickness		57	inches

*a*Observations by Wilson and Netzeband, 1912.

Observations by G. H. Cady in 1918: The coal does not lie in benches, but is uniform throughout. There are no "horsebacks" and no boulders in the roof. The coal contains a few scattered lenses of massive pyrite one inch thick and 4 to 6 inches across and an occasional lens of laminated pyrite, all in one general part of the mine.

Record of observations by H. E. Culver in 1925 in the local mine operated by Jones and Sons near Blair, sec. 26, T. 5 S., R. 6 W., Randolph County

The coal has a thickness varying from 51 to 60 inches and averaging 56 inches. It contains scattered lenses of brown and of bright pyrite but apparently at no persistent positions. The seam is not separated into distinct benches. The coal is described as consisting largely of dull bands. Facings of calcite, pyrite, and possibly gypsum occur as joint fillings in the coal.

Record of observations by H. E. Culver in 1925 in the strip mine operated by the Quaker Coal Co., now Huskey Coal Co., near Carterville, sec. 5, T. 9 S., R. 1 E., Williamson County

The coal has a thickness varying from 36 to 48 inches and averaging 42 inches. The coal lies in one bench, except that a layer of pyrite occurs rather persistently about 12 inches from the bottom of the coal. The coal contains rather numerous partings and lenses of charcoal.

Sections of No. 5 coal in mine No. 2 Wasson Coal Co., Carrier Mills, sec. 33, T. 9 S., R. 5 E., Saline County a

Strata	Section 1—Face of 11th east off the main north entry	Thickness	
		Inches	Inches
Shale			
Coal		12	
Charcoal		¼	
Coal		7¼	
Charcoal		¼	
Coal		31	
Pyrite lens			⅞
Coal		5½	
Total coal		56¼	
Total impurities			⅞
Thickness of bed		56¾	inches
Measured thickness		57	inches

Section 2—Face of 5th east off main north entry

Strata	Thickness	
	Inches	Inches
Shale		
Coal	10 $\frac{1}{4}$	
Charcoal	$\frac{1}{4}$	
Coal	43 $\frac{1}{2}$	
Total coal	54	

Section 3—Room 24 off the 11th north off the main west entry

Strata	Thickness	
	Inches	Inches
Shale		
Coal	7	
Pyrite		$\frac{1}{4}$
Coal	47 $\frac{1}{2}$	
Total coal	54 $\frac{1}{2}$	
Total impurities		$\frac{1}{4}$
Thickness of bed	54 $\frac{3}{4}$	inches
Measured thickness	54 $\frac{1}{2}$	inches

^aMeasured by Netzeband, 1912.

The foregoing sections and other observations although less complete than is desirable, particularly with respect to the coal in Williamson County, indicate two noteworthy characteristics of the coal: (1) No. 5 coal differs from No. 6 coal in that it is a single bench seam. (2) The ash content decreases eastward across the State, but, so far as is known, it nowhere decreases to the extent to which the ash content of No. 6 coal decreases in parts of Williamson County. There is, however, very little reliable information about the character of No. 5 coal in Williamson County, so that generalizations are not of great value.

CHARACTER OF THE STRATA ABOVE NO. 6 COAL

Certain generalizations in regard to the character of the rocks associated with No. 6 coal will doubtless be of interest. Particular interest is attached to the character of the cap rock which is one of the most widespread beds in the Pennsylvanian formations of Illinois. Its presence within a short distance above the top of No. 6 coal is almost universal. It is invariably present west of Williamson County and in eastern Williamson and Saline counties. In central Williamson County its absence in places is one reason for the favorable stripping conditions for No. 6 coal in the region where are located the Pyramid, Mammoth, and Prosperity pits, near the line of the Chicago, Burlington, and Quincy Railroad between Herrin and Marion (Pl. VII). In a small area apparently not more than one mile wide the limestone cap seems to be generally absent. The area seemingly lies at the margin of a region extending northward into central Franklin County and widening to the east and west in which the limestone cap rock is generally absent or 25 feet or more above the coal.

It is approximately coterminous with the area in which No. 6 coal is 8 feet or more thick.

Where the cap rock is present its thickness increases somewhat from east to west. It is not commonly more than 8 feet in Saline and eastern Williamson County. Of 180 records of drill holes in Saline County most of which penetrated No. 6 coal only three report cap rock 10 feet or more in thickness. The greatest thickness reported is 12 feet, and the usual thickness is 6 feet or less. The limestone thickens somewhat through western Williamson County. In the strip pit operated by the Black Servant Coal Company, in northeastern Jackson County, the cap rock is about 7 feet thick. Between Duquoin and Pinckneyville where there has been much exploration, thicknesses in excess of 10 feet are common and in places the limestone is said to be as much as 20 feet thick. In western Perry County in the vicinity of Willisville the cap rock appears to have a very uniform thickness of about 6 feet; in the Sparta region it seems to be slightly thinner. In the Sparta-Willisville region two other persistent beds of limestone are present within 40 feet of the coal, one about 5 to 6 feet thick lying about 25 feet above the coal, and the other about 3 feet thick lying about 40 feet above the coal. These three limestones can be very definitely identified from drill hole to drill hole over a considerable area. Exploration with the drill east of Freeburg in St. Clair County indicates that the limestones present in Randolph County also underlie at least parts of St. Clair County and possess similar characteristics. The data herein presented indicate that the thickness of the cap rock as a single ledge is greatest in the Duquoin-Pinckneyville region.

Where open-cut mining requires the removal of a considerable thickness of limestone, as is the case generally along the outcrop of No. 6 coal, the value of the rock so removed is a matter of interest. The use to which the rock can be put depends very largely upon its chemical character. The Survey has in its files the single analysis of the cap rock given below which represents a sample collected in the Duquoin region.

Analysis of the limestone cap rock of No. 6 Coal near Duquoin, Illinois ^a
Per cent

SiO ₂	34.04
Fe and Al oxides.....	7.88
CaCO ₃	50.86
CaO.....	28.56
MgCO ₃	4.26
MgO.....	2.04
Loss of ignition.....	23.87
Alkalies (by difference) Na ₂ O and K ₂ O.....	3.67

^aLaboratory No. 15354. Analyst, J. M. Lindgren.

This analysis accords with the determinations of the physical character of the rock. In its usual manifestation it is an impure earthy limestone, from buff to dark gray in color. It is very sparingly fossiliferous. Where exposed it weathers to a smooth, light gray to buff surface. It is brittle and relatively soft and when struck sharply with a hammer breaks off in thin, more or less rectangular fragments parallel to the weathered surface and not to the bedding, which is not very definitely marked. The chief impurity is fine siliceous silt, in accordance with the very high per cent of silica determined by analysis. The weathered product produced by the decay of the rock has not the usual plastic character of material derived from pure limestones because of its high siliceous content. Physical and chemical examination of the rock indicates that in general it does not possess the characteristics of a high-grade limestone suitable for the manufacture of the better grades of agricultural limestone, portland cement, etc. Its possibilities of usefulness reside mainly in its qualifications for use as rubble and ballast.

The physical characteristics of the higher limestones present in the Randolph County area are such as to indicate that these beds are more highly calcareous than the cap rock of No. 6 coal. The writer is not aware that any analyses of these limestones have been made, but from a knowledge of their physical character as displayed in outcrop he is confident that the possibilities of their usefulness are much greater than those of the cap rock.

The strata other than limestone lying within 50 feet of No. 6 coal consist almost entirely of shale except in parts of Saline County. In western Kentucky a wide-spread sandstone known as the Anvil Rock sandstone overlies the cap rock of Herrin (No. 6) (Kentucky No. 11) coal. This sandstone has been identified in the Eagle Valley region in southern Gallatin County, Illinois.³ In places in Saline County sandstone occupies a position similar to that of the Anvil Rock sandstone in Gallatin County, Illinois, and in western Kentucky. The presence of such a sandstone in the section above No. 6 coal may largely explain the southward facing escarpment extending from Ledford to Harrisburg, though it is probable that sandstone in this locality overlies a limestone known as the Bankston Creek limestone, the position of which is between 30 and 40 feet above No. 6 coal. There are numerous drill holes in Saline County, however, the records of which show the presence of thick sandstone beds within a few feet of the coal. Such sandstones do not seem to be present commonly west of the Williamson-Saline county line.

³Butts, Charles, Geology and mineral resources of the Equality-Shawneetown area: Illinois State Geol. Survey Bull. 57, Pl. I, 1925.

NO. 6 COAL

CHEMICAL CHARACTERISTICS

Numerous chemical analyses of face samples show that the quality of the coal substance as expressed by the unit coal B. t. u. value (moisture, ash, and sulphur free) improves progressively eastward and southward across the southern part of the State, at least as far as eastern Williamson County. Whether this improvement in quality persists across Saline County there is at present no means of knowing as analyses are not available. This change in the character of the coal is demonstrated by the analyses in Table 3 which are so arranged that they refer to the quality of the coal at points successively farther and farther east. The unit coal B. t. u. value represents the heating value of the coal substance free from all non-coal substance; that is, moisture, ash, and sulphur. The "as received" B. t. u. value may be regarded as the unit coal B. t. u. value decreased in proportion to the amount of moisture, ash and sulphur in the coal as mined. It will be noted from an inspection of the data in Table 3 that of the three non-coal components, moisture shows the most definite change in quantity between the west and east sides of the State. The decrease in moisture together with an increase in the heating quality of the pure coal necessarily means that the coal as mined improves toward the southeast even though the ash and sulphur remain the same. It will be noted that the ash content in eastern Williamson County is not greatly different from that in St. Clair and Randolph counties. The sulphur content is only a little if any less. There is, however, an area in central Williamson County characterized by relatively low ash and sulphur content. The amount of moisture is intermediate. This low ash and sulphur content together with a relatively low moisture content provides as low a total non-combustible content as is found in the eastern part of the county where the moisture possesses its minimum value, but the ash and sulphur are slightly higher in amount. Therefore we find that the "as received" values of the coal in the central and eastern parts of Williamson County differ very little. Although the total non-coal substance in the coal in the two parts of the county is approximately the same, it is important to understand that a larger portion of the non-combustible material is ash in the coal mined in the eastern part of the county than is the case with respect to the coal in the central part of the county.

The chemical character of No. 6 coal in mines adjacent to its outcrop across the southern part of the State is shown by the analyses in Table 3.

TABLE 3.—*Analyses of No. 6 coal in mines adjacent to the outcrop of the coal in southern Illinois*

			(Face samples only)					
Analysis No.	Date	Form of Analysis	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulphur	Calorific Value (B. t. u.)
St. Clair County								
12559 ^a	5/21	As rec'd	11.5	37.2	41.7	9.6	2.8	11155
		Dry		42.0	47.1	10.9	3.2	12607
		Unit coal						14394
1600 ^b	6/08	As rec'd	11.4	37.8	37.4	13.4	5.0	10547
		Dry		42.6	42.2	15.1	5.7	11908
		Unit coal						14435
2628 ^c	7/09	As rec'd	10.0	37.6	41.0	11.3	4.4	11219
		Dry		41.8	45.6	12.6	4.8	12471
		Unit coal						14600
5524-6 ^d	8/12	As rec'd	10.0	39.3	39.1	11.5	3.9	11045
Average		Dry		43.7	43.4	12.8	4.3	12278
		Unit coal						14398
12558 ^d	5/21	As rec'd	9.4	37.2	40.9	12.6	4.0	10959
		Dry		41.0	45.1	13.9	4.4	12091
		Unit coal						14378
^a Near Millstadt.			^c Near Lenzburg.					
^b Near Freeburg.			^d Near Marissa.					
Randolph County								
12564 ^a	5/21	As rec'd	9.7	37.3	41.7	11.3	4.1	11135
		Dry		41.3	46.2	12.5	4.6	12330
		Unit coal						14412
5045-7 ^b	8/12	As rec'd	11.1	37.3	40.1	11.4	4.2	10855
Average		Dry		43.7	43.4	12.8	4.3	12278
		Unit coal						14351
^a Northern part of county.								
^b Central part of county.								
Perry County								
5034, 37, 38, 40, 42, 43 ^a	6/12	As rec'd	10.95	37.0	41.8	10.2	3.6	11060
Average		Dry		41.5	47.0	11.5	4.0	12420
		Unit coal						14314
5514								
19, 20 ^b	8/12	As rec'd	12.45	36.1	42.8	8.6	2.8	11207
Average		Dry		41.3	48.8	9.9	3.2	12801
		Unit coal						14431
31033-6 ^c	10/18	As rec'd	12.04	33.9	44.8	9.2	1.5	11227
Composite		Dry		38.5	51.0	10.5	1.7	12764
		Unit coal						14449
^a Near Pinckneyville.			^b West of Duquoin.					
^c South of Duquoin; Security No. 1 mine; U. S. Bur. Mines Bull. 193, p. 33, 1922.								
Williamson County								
12875 ^a	7/21	As rec'd	8.1	31.2	53.0	7.7	1.1	12156
		Dry		34.0	57.7	8.3	1.2	13164
		Unit coal						14508
4996, 5000, 5006 ^b	6/12	As rec'd	8.2	33.9	48.9	9.0	2.2	11913
Average		Dry		37.0	53.2	9.8	2.3	13030
		Unit coal						14652
12883 ^c	7/21	As rec'd	5.7	35.4	45.0	13.9	4.2	11514
		Dry		37.5	47.7	14.8	4.4	12215
		Unit coal						14695
12882 ^c	7/21	As rec'd	4.9	37.0	46.7	11.4	3.4	12106
		Dry		38.9	49.1	11.9	3.6	12557
		Unit coal						14750

PHYSICAL CHARACTERISTICS

In the selection of a coal bed for open-cut mining its physical characteristics need to be taken into consideration as fully as the chemical characteristics, particularly when the analyses represent face samples of coal. Face sampling permits the discard of impurities greater than $\frac{1}{4}$ -inch in thickness; hence it is quite possible that in some regions the importance of certain persistent banded impurities, which can scarcely be discarded in open-cut mining, is not fully realized.

The physical features of No. 6 coal differ considerably from point to point in the southern part of the State. The most conspicuous difference is between the coal east and that west of the Duquoin anticline, or approximately that position. There is no definite line of demarcation and it is probable that the Williamson County type of coal persists somewhat to the west of the line of the anticline into Jackson and Perry counties.

One of the very prominent and characteristic features of No. 6 coal is its "bench" arrangement. All through southern Illinois a division into a top, middle, and lower bench is possible. The lower bench is separated from the middle bench by a bed of shale, or fire clay, known as the "blue band" which is without question the most characteristic physical feature of the bed. The upper and middle benches are commonly separated by a "mother coal" or mineral charcoal parting which is probably significant of a time during which there was wide-spread oxidation of the surface of the peat deposit now represented by the coal. The coal above the parting; that is, the top coal, and the bottom coal below the blue band generally make solid benches of good coal, although the upper bench is probably superior in quality to the rest of the coal in the seam. It is in the physical character of the middle bench that there resides the great difference between the coal underlying the eastern and that underlying the western part of the southern end of the State. In some places in Williamson County and the Duquoin region the middle bench is solid like the top and bottom benches. Where it is split up, the thinner benches are not persistent and the partings are generally thin layers of mother coal. The lack of persistence of the subdivisions is noteworthy.

There follows a series of measured sections of No. 6 coal collected during the past twenty years by members of the Survey staff from mines adjacent to the outcrop through St. Clair, Randolph, Perry, and Williamson counties.

ST. CLAIR COUNTY

*Section of No. 6 coal in mine of Pittsburg Mining Co., Belleville,
sec. 16, T. 1 N., R. 8 W.^a*

About 1200 feet southeast of shaft

Strata	Thickness	
	Inches	Inches
Coal, top	11½	
Coal	15½	
Slate, blue		¾
Coal "drift"	11½	
Slate, blue		¾
Coal "block"	11½	
"Sulphur"		½
Coal	3	
Slate, blue		1
Coal	1¾	
Slate, blue (blue band?)		¾
Coal, bottom	18	
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Total coal	72¾	
Total impurities		3¾
Thickness of bed	76½	inches

^aMeasured by W. F. Wheeler, 1907.

*Section of No. 6 coal in strip pit operated by Chas. Deffenbaugh,
Millstadt, sec. 24, T. 1 S., R. 9 W.^a*

Strata	Thickness	
	Inches	Inches
Shale, carbonaceous, weathered		
Coal	8¾	
Shale		¼
Coal	12	
Pyrite		¼-½
Coal	14½	
Shale, pyritic		½-1
Coal	1¾	
Pyrite		¾
Coal	21	
<hr/>		
Total coal	57½	
Total impurities		2½
Thickness of bed	60	inches
Measured thickness	59½	inches

^aMeasured by Wilson, 1921.

*Section of No. 6 coal in mine of Mulberry Hill Coal Co., Freeburg,
sec. 18, T. 1 S., R. 7 W.^a*

Strata	Thickness	
	Inches	Inches
"Slate," black		
Coal, hard, sulphur stringers, calcite facings.....	11¼	
Charcoal	¾	
Coal, mostly dull, with bony and "sulphur" lenses.....	10½	
"Sulphur" parting		¼
Coal, as above	5¾	
Shale		¼
Coal	15	
Shale, black		¾
Coal	12	
"Sulphur" lens		¾
Coal	4	

"Sulphur" lens	1
Coal	4
Shale	$\frac{1}{2}$
Coal	$23\frac{1}{2}$
<hr/>	
Total coal	$86\frac{1}{4}$
Total impurities	$3\frac{1}{8}$
Thickness of bed	$89\frac{3}{8}$ inches
Measured thickness	89 inches

*a*Measured by P. T. Post, 1925. Position in mine not stated.

*Sections of No. 6 coal in mine of the Star Coal Co., Freeburg,
sec. 30 T. 1 S., R. 7 W.^a*

Section 1—Sixth room off the 8th south on west side

Strata	Thickness	
	Inches	Inches
"Slate"		
Coal, with "sulphur" lens (1 by 6 inches)	$17\frac{3}{4}$	
Clay streak		
Coal	16	
Clay, "sulphur" in places		$\frac{1}{2}$
Coal	12	
Clay and "sulphur"		$\frac{1}{4}$
Coal	4	
Blue band and pyrite		1
Coal	$28\frac{1}{2}$	
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Total coal	$28\frac{1}{4}$	
Total impurities		$1\frac{3}{4}$
Thickness of bed		80 inches
Measured thickness		79 inches

Section 2—Measured near shaft on east side

Strata	Thickness	
	Inches	Inches
"Slate," black		
Coal	$25\frac{1}{2}$	
Clay, sulphur, mother coal parting		
Coal	$13\frac{1}{2}$	
Clay		$\frac{1}{2}$
Coal	9	
Clay, mother coal, "sulphur"		$\frac{1}{2}$
Coal	7	
Blue band		$\frac{1}{2}$
Coal	$24\frac{1}{2}$	
<hr/>		
Total coal	$79\frac{1}{2}$	
Total impurities		$1\frac{1}{2}$
Thickness of bed		81 inches
Measured thickness		81 inches

Note: The partings Nos. 2, 4, 6, and 8, are very persistent throughout the mine. In many places one or more of them will be pyrite. The blue band is not uncommonly all pyrite.

Section 3—Fifth and sixth south entries on east side

Strata	Thickness	
	Inches	Inches
"Slate," black		
Coal	31	
Clay streak		
Coal	19	
Clay and pyrite		$\frac{1}{2}$
Coal	14	

Clay streak		
Coal	4	
Blue band		1
Coal	30½	
Mother coal	½	
Coal	21	
<hr/>		
Total coal	120	
Total impurities		1½
Thickness of bed	121½	inches
Measured thickness	121½	inches

Note: Coal in this mine varies in thickness from 78 to 124 inches. The average thickness is 84 inches.

^aMeasured by G. H. Cady, 1918.

*Section of No. 6 coal in Fairbanks (No. 3) mine, Kolb Coal Co., New Athens,
sec. 2, T. 3 S., R. 7 W.^a*

Strata	Room 3 off third east entry		Thickness	
Clod			Inches	Inches
Shale (2 inches)				
Coal		121½		
"Sulphur"				1/8
Coal		107½		
"Sulphur"				1/4
Coal		5		1/8
"Sulphur"				1/8
Coal		9½		
Coal, bony				1/2
Coal		11½		
"Sulphur"				1/2
Coal		41/8		
Blue band				5/8
Coal		22		
<hr/>				
Clay	Total coal	75½		
	Total impurities			2½
	Thickness of bed	77¼		inches
	Measured thickness	77½		inches

^aMeasured by E. W. Shaw, 1911.

*Section of No. 6 coal in mine No. 2, Borders Coal Co., Marissa,
sec. 21, T. 3 S., R. 6 W.^a*

Strata	Thickness	
	Inches	Inches
Limestone more than 2 feet thick		
Coal, "blacksmith"	18	
Parting		1/8
Coal	24	
"Sulphur" and shale		1/4
Coal	13½	
"Sulphur"		1/8
Coal	4½	
Blue band and "sulphur"		1½
Coal	18	
<hr/>		
Clay	Total coal	78
	Total impurities	2
	Thickness of bed	90 inches

^aMeasured by Jon Udden, 1908. Location of section in mine not stated.

*Sections of No. 6 coal in mine No. 1, Borders Coal Co., Marissa,
sec. 27, T. 3 S., R. 6 W.^a*

Section 1—East room off south entry

Strata	Thickness	
	Inches	Inche
Limestone		
Coal, clean, bright	16½	
Pyrite		¼
Coal, dirty	15½	
Pyrite		⅜
Coal, very dirty	20½	
Pyrite		⅜
Coal, bony		+
Blue band, bone, shale, pyrite.....		1½
Coal, fairly clean, hard.....	19	
Clay		
Total coal	71½	
Total impurities		6½
Thickness of bed.....		78 inches
Measured thickness		78 inches

Section 2—Room 8 north off 6th east off north

Strata	Thickness	
	Inches	Inche.
Shale, black		
Pyrite and bone		2
Coal, clean, bright	15¼	
Pyrite		¼
Coal, fairly clean	10	
Pyrite		¼
Coal, fairly clean and bright.....	16	
Bone and pyrite.....		¼
Coal, fairly clean	16	
Blue band; bone and shale.....		1½
Coal, dirty	23	
Clay		
Total coal	80¼	
Total impurities		4¼
Thickness of bed.....		84½ inches
Measured thickness		85 inches

Section 3—Room 5 from face of 2nd east off north

Strata	Thickness	
	Inches	Inches
Limestone		
Coal, top bench, clean, bright.....	9½	
Coal, clean, bright.....	15¼	
Bone		¼
Coal, dirty	16	
Pyrite and bone.....		¾
Coal, dirty	17	
Blue band; bone and shale.....		¾
Coal, dirty	18½	
Clay		
Total coal	76¼	
Total impurities		1¾
Thickness of bed		78 inches
Measured thickness		78 inches

^aMeasured by Nebel and Smith, 1912.

*Sections of No. 6 coal in Meek mine of the Egyptian Coal and Mining Co.,
Marissa, sec. 36, T. 3 S., R. 6 W.^a*

Section 1—Fourth west entry south

Strata	Thickness	
	Inches	Inches
"Slate"		
Coal	8	
Charcoal	$\frac{1}{4}$	
Coal	5	
Pyrite		$\frac{1}{2}$
Coal	5	
Charcoal and pyrite		1
Coal	$6\frac{3}{4}$	
Charcoal	$\frac{1}{4}$	
Coal	15	
Charcoal	$\frac{1}{4}$	
Coal	5	
Pyrite and charcoal		1
Coal	13	
Pyrite		$\frac{1}{2}$
Coal	$4\frac{1}{2}$	
Slate; blue band		$\frac{3}{4}$ -1
Coal	16	
Clay		
Total coal	79	
Total impurities		$3\frac{3}{4}$
Thickness of bed		$82\frac{3}{4}$ inches
Measured thickness		82 inches

Strata	Thickness	
	Inches	Inches
"Slate"		
Coal	12	
Pyrite		$\frac{1}{2}$ - $\frac{3}{4}$
Coal	14	
Clay mixture		$\frac{1}{2}$
Coal	9	
Pyrite		$\frac{1}{8}$
Coal	$6\frac{1}{2}$	
Shale and pyrite		$\frac{1}{2}$
Coal	$16\frac{1}{4}$	
Shale, blue band		$\frac{3}{4}$
Coal	16	
Clay		
Total coal	$73\frac{3}{4}$	
Total impurities		$2\frac{5}{8}$
Thickness of bed		$76\frac{3}{8}$ inches
Measured thickness		76 inches

^aMeasured by J. M. Wilson, 1921.

RANDOLPH COUNTY

*Section of No. 6 coal in the mine of the Boyd Coal Co., Sparta,
sec. 1, T. 5 S., R. 6 W.^a*

Strata	Thickness	
	Inches	Inches
Draw "slate"		
Coal, top	14	
"Sulphur"		$\frac{1}{4}$
Coal ("nine-inch bench")	12	
Parting		
Coal ("drift bench")	11	
Dirt		$\frac{1}{16}$
Coal ("block bench")	16	
"Sulphur"		$\frac{1}{4}$

Coal	4	
Blue band		1½
Coal	11	
<hr/>		
Total coal	68	
Total impurities		2 1/16
Thickness of bed	70	1/16 inches

*a*Measured by G. H. Cady. Location in mine not stated. Observations in 1918 (?)

*Sections of No. 6 coal in the mine of Moffat Coal Co., Sparta,
sec. 8, T. 5 S., R. 5 W.^a*

Strata		Thickness	
Section 1—Location in mine not stated		Inches	Inches
Clod, shaly			
Coal	11¾		
Shale			⅛
Coal, clean	4¾		
Coal with pyrite	5¾		
Shale			⅝
Coal with thin pyrite partings	11½		
Shale band			⅜
Coal	15⅞		
Shale			½
Coal	8		
Blue band, shale			1
Coal	5¾		
Clay		<hr/>	
Total coal	62⅞		
Total impurities			2⅝
Thickness of bed	65½		inches

Section 2—North rib on 10th west (in 120 feet east of face) off 13th south.
Called main 10th west

Strata		Thickness	
		Inches	Inches
Shale, black fissile			
Coal	7⅛		
Pyrite parting			2/8
Coal	5		
Pyrite parting			⅛
Coal	9 6/8		
Shale			2/8
Coal	5⅜		
Charcoal parting	⅛		
Coal	7		
Charcoal parting	2/8		
Coal	3⅞		
Shale			4/8
Coal	13⅝		
Shale and pyrite band			4/8
Coal	4⅛		
Blue band, shale			1 6/8
Coal	6 6/8		
Clay		<hr/>	
Total coal	62¼		
Total impurities			3⅜
Thickness of bed	65⅝		inches
Measured thickness	65 6/8		inches

Note: Culver reports that the shale partings are persistent; about as much so as the so-called blue band, which here is very low in most parts of the mine. In the abundance of relatively persistent partings this bed appears to be more like No. 6 coal in the Belleville region than like the coal in the vicinity of Duquoin.

*a*Measured by H. E. Culver, 1925(?).

*Section of No. 6 coal in mine No. 4, Illinois Fuel Co., Sparta,
sec. 16, T. 5 S., R. 5 W.^a*

Face of 13th east off main north entry

Strata	Thickness	
	Inches	Inches
Shale, fissile		
Coal, top (estimated).....	8	
Parting		
Coal	24 6/8	
Shale		4/8
Coal	13	
Charcoal and pyrite lens.....		3/8
Coal	3	
Pyrite		2/8
Coal	14	
Pyrite band		3/8
Coal	1 6/8	
Pyrite parting		1/8
Coal	1 1/8	
Shale; blue band.....		1 4/8
Coal with thin pyrite lenses.....	12 6/8	
Clay		
<hr/>		
Total coal	78 3/8	
Total impurities		3 1/8
Thickness of bed.....		81 1/2 inches
Measured thickness 72 inches plus estimated 8 inches		80 inches
^a Measured by H. E. Culver, 1925 (?)		

*Sections of No. 6 coal in mine No. 6, Willis Coal and Mining Co., Percy,
sec. 14, T. 6 S., R. 5 W.^a*

Section 1—Twenty-first south entry

Strata	Thickness	
	Inches	Inches
"Slate"		
Coal	9	
"Sulphur"		1/4
Coal	7	
"Sulphur"		1/4
Coal	28 1/2	
Clay		1/4
Coal	10	
Shale		1/4
Coal	13 1/2	
Shale		1
Coal	2 1/2	
Blue band		2
Coal	15	
Clay		
<hr/>		
Total coal	85 1/2	
Total impurities		4
Thickness of bed		89 1/2 inches
Measured thickness		87 1/2 inches

Section 2—Face of main east

Strata	Thickness	
	Inches	Inch
"Slate"		
Coal	14½	
"Sulphur"		¾
Coal	10	
"Sulphur"		¼
Coal	7	
Clay		1
Coal	10½	
"Sulphur"		½
Coal	6½	
"Sulphur"		½
Coal	9	
Blue band, shale and "sulphur"		1½
Coal	7	
"Sulphur"		½
Coal	5	
Clay		
<hr/>		
Total coal	69½	
Total impurities		4¾
Thickness of bed	74¼	inch
Measured thickness	75	inches

Section 3—Face of the 12th north entry

Strata	Thickness	
	Inches	Inch
"Slate"		
Coal	5½	
"Sulphur"		¼
Coal	10	
"Sulphur"		¼
Coal	9	
Charcoal	⅛	
Coal	2	
Shale		¼
Coal	8	
Clay		¼
Coal	6	
Charcoal	¼	
Coal	3	
Shale		¼
Coal	1½	
"Sulphur"		¼
Coal	13½	
"Sulphur"		¼-½
Coal	3	
Blue band; shale		1½
Coal	16	
<hr/>		
Total coal	77⅞	
Total impurities		3¾
Thickness of bed	81¼	inch

aMeasured by Wilson and Netzeband, 1921.

PERRY COUNTY

*Sections of No. 6 coal in mine No. 8, Willis Coal and Mining Co., Willisville,
sec. 30, T. 6 S., R. 4 W.^a*

(Depth to coal, 67 feet; average thickness, 72 inches)

Section 1—12th south off 1st east

Strata	Thickness	
	Inches	Inches
"Slate"		
Coal, hard	3	
Coal, softer, pyrite and calcite strings	27	
Clay and charcoal		4½
Coal	8½	
Clay		¼
Coal	16	
Clay		½
Coal	4	
Clay, blue band		¾
Coal, hard	11	
Underclay		
Total coal	69½	
Total clay and impurities		6
Thickness of bed		75½ inches
Measured thickness		74 inches

Section 2—12th north off 1st east at entry

Strata	Thickness	
	Inches	Inches
"Slate"		
Coal	6	
Coal, softer, pyrite, and calcite strings	27	
Clay and charcoal		3½
Coal	9½	
Clay		¼
Coal	14	
Shale and pyrite, blue band		½
Coal	4	
Shale and clay		½
Coal	13	
Total coal	73½	
Total clay and impurities		4¾
Thickness of bed		78¼ inches
Measured thickness		75 inches

Section 3—3rd south off main east

Strata	Thickness	
	Inches	Inches
"Slate"		
Coal, hard top	5½	
Coal	21	
Shale		¾
Coal	12	
Coal and charcoal	3	
Coal	23	
Shale, blue band		1½
Coal	11	
Total coal	75½	
Total clay and impurities		1⅞
Thickness of bed		77¾ inches
Measured thickness		75½ inches

Strata	Section 4—4th west off 3rd south	
	Inches	Thickness Inches
"Slate"		
Coal, top	6½	
Coal	4	
Shale and pyrite.....		¼-¾
Coal	10	
Shale		¼
Coal	33	
Shale, blue band.....		1½
Coal	9½	
<hr/>		
Total coal	63	
Total clay and impurities.....		2¾
Thickness of bed.....		65⅞ inches
Measured thickness		65 inches

^aNotes by Wilson.

Sections of No. 6 coal in mine No. 1, Willis Coal and Mining Co., Willisville, sec. 30, T. 6 S., R. 4 W.

(Depth to bottom of coal 86 feet; average thickness 74 inches)

Strata	Section 1—Face of the 5th main south entry ^a	
	Inches	Thickness Inches
Black "slate" roof		
Coal, brittle, very hard, bright.....	14	
Coal, hard, bright, less brittle.....	10	
Coal, laminated, filled with "mother coal" in thick layers, bands and glance coal between.....	12	
Coal, about same, little more solid.....	12	
Coal, more solid, but with "mother coal".....	12	
"Blue band"		?
Coal, dirty, considerable sulphur and "mother coal".....	15	
<hr/>		
Total thickness.....		75 inches

Section 2—1st Room off 7th south off main east 4000 feet southeast of shaft^b

Strata	Thickness	
	Inches	Inches
Draw "slate"		
Coal	13	
Mother coal	½	
Coal	11	
"Sulphur"		⅜-¼
Coal	6	
Mother coal	½	
Coal	29	
Blue band		1
Coal	13	
Underclay		
<hr/>		
Total coal	73	
Total clay and impurities.....		1¼
Thickness of bed.....		74¼ inches

^aNotes by K. D. White, 1912.

^bNotes by Jon Udden before 1910.

*Section of No. 6 coal in the mine of the Illinois Sixth Vein Coal Co., Pinckneyville,
sec. 13, T. 5 S., R. 3 W.^a*

Strata	Thickness	
	Inches	Inches
"Slate"		
Coal	8	
Charcoal	$\frac{1}{4}$	
Coal with stringers of "sulphur"	27	
Charcoal	$\frac{1}{2}$	
Coal	7	
"Sulphur"		$\frac{1}{4}$
Coal with bedded "sulphur"	17	
"Sulphur"		$\frac{1}{4}$
Coal	$2\frac{1}{2}$	
Blue band; shale and "sulphur"		1
Coal	$3\frac{1}{2}$	
Shale		$\frac{1}{4}$
Coal	7	
Total coal	72 $\frac{3}{4}$	
Total impurities		1 $\frac{3}{4}$
Thickness of bed		74 $\frac{1}{2}$ inches
Measured thickness		73 inches

^aMeasured by Wilson and Netzeband, 1921, at face of first west entry.

*Sections of No. 6 coal in mine of the Ritchey Coal Co., Pinckneyville,
sec. 23, T. 5 S., R. 3 W.*

Section 1—At face of room 4 on 2nd west, north side^a

Strata	Thickness	
	Inches	Inches
Shale, carbonaceous		
Coal (top coal), irregular parting below; brittle and hard; calcite and "sulphur" plates scattered through coal	8	
Coal with mother coal in thick bands; less calcite and "sulphur"	28	
Coal, with bands of bone and sulphur for 3 inches above blue band	30	
Blue band		1 $\frac{1}{2}$
Coal, with shale bands and considerable bone and dirt	18	
Total coal	84	
Total impurities		1 $\frac{1}{2}$
Thickness of bed		85 $\frac{1}{2}$ inches

Section 2—At face of entry of 4th east off main north, 1000 feet from shaft^b

Strata	Thickness	
	Inches	Inches
Coal, bright	40	
Mother coal	1	
Coal bright	1	
"Sulphur" streak		1
Coal, bright	2	
Mother coal	1	
Coal, bright	22	
Blue band		$\frac{3}{4}$
Coal, bright	3	
Blue band		1
Coal, bright	2	
Mother coal	1	
Coal, bright	17	
Total coal	90	
Total impurities		2 $\frac{3}{4}$
Thickness of bed		92 $\frac{3}{4}$ inches
Measured thickness		92 $\frac{3}{4}$ inches

^aMeasured by K. D. White, 1912.

^bMeasured by McDonald and Stafford, 1912.

*Section of No. 6 coal in strip pit operated by the Scott Smith Coal Co., Duquoin,
secs. 16 and 17, T. 6 S., R. 1 W.^a*

Strata	Thickness	
	Inches	Inches
Coal, few inches gone, rather hard, dull, with "sulphur" facings	3	
Charcoal	$\frac{1}{4}$	
Coal, more bright	8	
Charcoal	$\frac{1}{8}$	
Coal, more dull bands	$7\frac{1}{4}$	
Clay "sulphur" parting		$\frac{1}{4}$
Coal, alternating 2-inch bands of dull and bright coal	$31\frac{1}{4}$	
Shale, dark gray, blue band		$1\frac{1}{4}$
Coal, exposed	3	
Coal, unexposed	?	

^aMeasured by P. T. Post in SW. $\frac{1}{4}$ SW. $\frac{1}{4}$ sec. 16, 1925.

*Sections of No. 6 coal in mine of Security Coal and Mining Co., Duquoin,
sec. 29, T. 6 S., R. 1 W.^a*

Section 1—In room 2 off the 17th north off 4th west north, 1000 feet north,
5000 feet west of shaft

Strata	Thickness	
	Inches	Inches
Roof: shale, gray, clay		
Coal, top, left for roof	12	
Coal, interbedded bright and dull layers, "sulphur" spangles and vertical seams of pyrite	60	
Mother coal	$\frac{1}{2}$	
Coal, hard, brilliant	$13\frac{1}{4}$	
Blue band		2
Coal	12	
Floor: gray underclay		

Total coal	86 $\frac{1}{4}$	
Total impurities		2
Thickness of bed	88 $\frac{1}{4}$ inches	
Measured thickness	88 $\frac{1}{4}$ inches	

Section 2—In room 8, south off 6th east south 2500 feet south and 2000 feet
east of the shaft

Strata	Thickness	
	Inches	Inches
Roof: shale, gray, clay		
Coal, top, not mined	24	
Coal with bright luster	12	
Mother coal and clay		$\frac{1}{4}$
Coal, banded dull and bright	7	
Mother coal	$\frac{1}{4}$	
Coal, bright with dull bands	$32\frac{1}{2}$	
Blue band		$1\frac{1}{4}$
Coal	$14\frac{1}{2}$	

Total coal	90 $\frac{1}{4}$	
Total impurities		2
Thickness of bed	92 $\frac{1}{4}$ inches	
Measured thickness	92 inches	

^aMeasured by Schroyer, 1918.

WILLIAMSON COUNTY

*Sections of No. 6 coal in John mine, Carterville and Big Muddy Coal Co.,
Carterville, sec. 33, T. 8 S., R. 1 E.^a*

Section 1—Room 10 in the main north 60 feet from face

Strata	Thickness	
	Inches	Inches
Shale		
Coal, roof	20	(approx.)
Coal with stringers of pyrite and calcite.....	15	
Mineral charcoal	$\frac{1}{4}$	
Coal	38	
Pyrite		$\frac{1}{8}$
Coal	10	
Blue band, shale.....		$1\frac{1}{2}$
Coal	12	
Pyrite		$\frac{1}{4}$
Coal	10	
Total coal	105 $\frac{1}{4}$	
Total impurities		$\frac{1}{8}$
Thickness of bed.....	107 $\frac{1}{8}$	inches
Measured thickness (exclusive of top coal).....	85 $\frac{1}{2}$	inches

Section 2—Cross cut 25 feet from face of 10th north off 14th west

Strata	Thickness	
	Inches	Inches
Shale		
Coal, roof, estimated.....	24	
Coal, stringers and lenses of pyrite.....	30	
Charcoal	$\frac{1}{8}$	
Coal	40	
Blue band, shale, and coal.....		2
Coal	21	
Total coal	115 $\frac{1}{8}$	
Total impurities		2
Thickness of bed.....	117 $\frac{1}{8}$	inches
Measured thickness (exclusive of top coal).....	94	inches

^aMeasured by J. M. Wilson, 1921.

*Sections of No. 6 coal in mine No. 8, Madison Coal Co., Dewmaine,
sec. 35, T. 8 S., R. 1 E.^a*

Section 1—Face of 7th south off main west

Strata	Thickness	
	Inches	Inches
Shale		
Coal left as roof.....	18	(approx.)
Charcoal parting		
Coal	18	
Charcoal	$\frac{1}{4}$	
Coal	12 $\frac{3}{4}$	
Charcoal	1	
Coal	13 $\frac{1}{2}$	
Charcoal	$\frac{1}{2}$	
Coal	16 $\frac{1}{4}$	
Blue band, shale.....		$\frac{3}{4}$
Coal	24	
Total coal	104 $\frac{1}{4}$	
Total impurities		$\frac{3}{4}$
Thickness of bed.....	105	inches
Measured thickness (exclusive of top coal).....	89 $\frac{1}{2}$	inches

Section 2—Face of 3rd south off 3rd west

Strata	Thickness	
	Inches	Inches
Shale		
Coal left as roof.....	18 (approx.)	
Charcoal parting		
Coal	24½	
Charcoal	⅞	
Coal with pyrite stringers.....	14	
Coal with charcoal partings.....	4	
Coal	8½	
Blue band; shale with coal stringers.....		2
Coal	10	
Charcoal	⅝	
Coal	11½	
Charcoal (blackjack) lens.....		1¾
Coal	1½	
Total coal	92¾	
Total impurities		3¾
Thickness of bed.....		96½ inches
Measured thickness (exclusive of top coal).....		79 inches

^aMeasured by Netzeband, 1921.

*Sections of No. 6 coal in mine No. 1, Taylor Coal Co., Herrin,
sec. 32, T. 8 S., R. 2 E.^a*

Section 1—Third northwest room 56

Strata	Thickness	
	Inches	Inches
Shale		
Coal left as roof.....	14 (approx.)	
Coal with pyrite lenses and stringers.....	42½	
Charcoal	½	
Coal	16½	
Blue band		1
Coal	5	
Shale		¾
Coal	8	
Clay mixture		1
Coal	13	
Total coal	99½	
Total impurities		2¾
Thickness of bed.....		102¼ inches
Measured thickness (exclusive of top coal).....		87 inches

Section 2—Third southwest room 50

Strata	Thickness	
	Inches	Inches
Shale, white		
Coal left as roof.....	14 (approx.)	
Coal	22½	
Charcoal	1¼	
Coal	3	
Charcoal	2	
Coal	10½	
Shale		¼
Coal	3	
Shale and pyrite.....		½

Coal with pyrite stringers.....	14½	
Blue band; shale and pyrite.....		1¼
Coal	12½	
Pyrite		1¼
Coal	7½	

Total coal	90¾	
Total impurities		3¼
Thickness of bed.....		94 inches
Measured thickness (exclusive of top coal).....		81 inches

^aMeasured by Netzeband, 1921.

*Sections of No. 6 coal in mine No. 2, Sincerity Coal Co., Marion,
sec. 34, T. 8 S., R. 2 E.^a*

Section 1—Face of the 5th east off the back north

Strata	Thickness	
	Inches	Inches
Coal left as roof.....	18 (approx.)	
Coal, stringers of pyrite.....	9	
Charcoal	¾	
Coal	14 6/8	
Charcoal	⅛	
Coal	20 4/8	
Shale		4/8
Coal	15 4/8	
Blue band; shale mixed with coal.....		1
Coal	22	
Clay		

Total coal	100¼	
Total impurities		1½
Thickness of bed.....		101¾ inches
Measured thickness (exclusive of top coal).....		83½ inches

Section 2—Face of the main north entry

Strata	Thickness	
	Inches	Inches
Coal left as roof.....	18 (approx.)	
Coal; joints filled with pyrite.....	12	
Charcoal	1	
Coal	14	
Charcoal	⅛	
Coal	35 4/8	
Blue band; shale and coal.....		2
Coal	20	
Clay		

Total coal	100⅝	
Total impurities		2
Thickness of bed.....		102⅝ inches
Measured thickness (exclusive of top coal).....		84¼ inches

^aMeasured by Netzeband, 1921.

*Sections of No. 6 coal in the mine of Orchard Coal Co., Pittsburg,
sec. 2, T. 9 S., R. 3 E.^a*

Section 1—Room 19 off the 2nd north entry

Strata	Thickness	
	Inches	Inches
"Slate" black		
Coal with pyrite stringers.....	4½	
Pyrite lens		⅛
Coal	32½	
Pyrite lens		⅛
Coal	20	
Blue band; shale.....		1
Coal	11½	
<hr/>		
Total coal	68½	
Total impurities		1¼
Thickness of bed.....		69¾ inches
Measured thickness		69 inches

Section 2—Face of 2nd south of main east

Strata	Thickness	
	Inches	Inches
"Slate" black		
Coal	1½	
Pyrite		⅛
Coal	21	
Charcoal	¼	
Coal	25	
Pyrite		¼
Coal	13	
Blue band; shale.....		½
Coal	6	
Pyrite		⅛
Coal	23	
<hr/>		
Total coal	89¾	
Total impurities		1
Thickness of bed.....		90¾ inches

^aMeasured by J. M. Wilson.

PART III

SPECIAL AREAS IN SOUTHERN ILLINOIS IN WHICH EXPLORATION FOR COAL SUITABLE FOR OPEN- CUT MINING IS RECOMMENDED

INTRODUCTION

Six special areas crossed by the outcrop of No. 6 coal are recommended for investigation with the view of determining the availability within them of bodies of coal suitable for recovery by open-cut mining. The areas selected for consideration are not those in which the most information is available concerning the position of the margin of the coal bed or beds. In some areas along the outcrop of No. 6 coal and also of No. 5 coal exploration in anticipation of development has been thorough and the position of the coal bed explored can be indicated with considerable accuracy. General interest, however, is not directed toward these explored or developed areas but toward the remaining unexplored areas. Although the amount of available information about some of these areas is unfortunately small certainly its compilation, together with the presentation of general facts in regard to the coals and associated strata, will be of assistance in directing the course of further investigations and explorations.

The available information in regard to the areas selected for description is assembled on Plates II-VII. On each map is indicated the outcrop of No. 6 coal as closely as this can be determined from the data at hand. Since all outcrops, drill holes, mines, etc., are indicated by symbols, the absence of such symbols implies that the line of outcrop is simply the closest approximation to accuracy that general information permits. The nature of this general information consists mainly of determinations in regard to the altitude of the coal at mines and drill holes adjacent to the margin of the bed. From a comparison of such data can be determined the general slope of the coal-bearing rocks in the vicinity of the outcrop of the coals. The topographic maps available furnish information in regard to the surface altitude. With the depth of the coal at any point near the outcrop, the slope of the beds, and the altitude of the surface all known, obviously a close approximation to the position of the outcrop can be made, provided the thickness of the unconsolidated covering is not highly variable. The variation in the thickness of the glacial and alluvial material in fact provides the greatest element of uncertainty in maps of this kind, and is one of the reasons why drilling along the outcrop must be closely spaced in order to "prove" the coal thoroughly and convincingly. In view of the consideration expressed it is hoped that the reader will not regard the maps as delineating facts established by detailed exploration but rather as

simply indicating probabilities and, to that extent, of possible service in directing exploration.

The areas will be considered serially from west to east.

AREA I

Special Area I (Pl. II) embraces a region in northern St. Clair County lying along the outcrop of No. 6 coal between Freeburg and the vicinity of Belleville and extending southward about six miles from the environs of Belleville. Most of the area lies in T. 1 S., R. 8 W. I includes part of each of two quadrangles, New Athens on the east, and Waterloo on the west. The larger part of the area lies in New Athens quadrangle.

The outcrop of No. 6 coal in the part of the area included in the New Athens quadrangle is approximately as mapped by Shaw.¹ The outcrop in the remaining portion of the area is extended from the end of the outcrop line in the New Athens quadrangle southward in a position determined with reference to a few outcrops, a small strip mine, scattered drilling, and the altitude of the surface. So far as is known there are no outcrops of the coal at the surface along the entire designated position of outcrop. The line is to be regarded therefore simply as an approximation to the actual conditions. The coal lies buried beneath an overburden consisting largely of alluvium to a depth of 20 feet or more.

The position of the margin of the coal bed is very largely determined by the altitude of the coal as it approaches the outcrop line. The altitude of the coal, where it is 400 feet or more above sea level, is shown by structure contours having an interval of 50 feet. The position of the 400-foot contour is determined by the altitude of the coal in numerous shafts along the Illinois Central Railroad and roughly parallels the line of the railroad. Drill holes and mines located northeast of the railroad indicate a general dip of the coal in that direction so that it is probable that the bed rises at about the same rate toward the southwest, and that its outcrop will have approximately the position indicated. Since the surface northeast of the position of the 400-foot structure contour line has everywhere an altitude exceeding 460 feet, it is apparent that the coal lies too deep for open-cut mining in that direction. So far as the writer is aware, there has been no drilling to explore the margin of the bed between Freeburg and Belleville. It is probable that examination of mine maps and elevations of those mines located close to the designated position of the outcrop would furnish definite information about the actual position of the outcrop and the depth of the coal in part of the area, and so far as possible such examination should be made if exploration of any part of the area is contemplated.

¹Shaw, E. W., U. S. Geol. Survey Geol. Atlas, New Athens-Okawville folio (No. 213), fig. 5, p. 7, 1921.

From the data available, tracts in Area I which appear to be particularly suitable for investigation are as follows: sec. 11 and the N. $\frac{1}{2}$ sec. 14, T. 1 S., R. 8 W.; sec. 5 and the E. $\frac{1}{2}$ sec. 6 of the same township. The line of designated outcrop west of Freeburg in secs. 24 and 25 indicates the coal as outcropping at an altitude between 400 and 450 feet. This signifies that the depth of surface covering here is possibly as much as 75 feet. It is altogether probable that it is actually much thinner than this and that therefore the margin of the coal may lie as much as a mile farther west than as indicated. A line of test holes 50 to 75 feet in depth, or sufficiently deep to penetrate the coal at approximately $\frac{1}{4}$ -mile intervals from the center of sec. 19 to the center of sec. 23 would determine the margin of the coal. It is thought probable, likewise, that the boundary is mapped too far north in the S. $\frac{1}{2}$. Sec. 33, T. 1 N., R. 8 W., since the surface cover here is likewise indicated as about 75 feet thick. The southward extent of the workings of the Perry Coal Company in the SW. $\frac{1}{4}$ sec. 34 would afford important information in regard to the bed in that direction. Sec. 4, T. 1 S., R. 8 W., therefore, offers possibilities of being underlain by bodies of shallow coal.

AREA II

Area II (Pl. III) lies along the outcrop of No. 6 coal from the St. Clair-Randolph county line northwest to the vicinity of New Athens. Within it is included part of each of four quadrangles. Most of the area, like Area I, lies in the New Athens quadrangle. It crosses a corner of Okawville quadrangle northeast of Marissa. South of New Athens and Okawville quadrangles are respectively the Baldwin and Coulterville quadrangles; the boundary passes through the north part of Marissa. The boundary between the Baldwin and Coulterville quadrangles lies east of the larger part of the town of Marissa.

Geological field investigations have been made in the area included in this map. A map of the geology of the New Athens-Okawville quadrangles has already been published² and the outcrop of No. 6 coal as shown by Shaw for the New Athens quadrangle corresponds closely with the outcrop as indicated on the map of Area II (Pl. III). The outcrop within the area of the Baldwin quadrangle west and southwest of Marissa is very much generalized and is based on the relationship existing between the altitude of the coal at Marissa, the dip of the rock strata, and the surface configuration. The position of the outcrop as indicated in the New Athens quadrangle seems to rest upon no better basis, since there are no exposures or drill holes to determine its position.

The map shows the position of the top of No. 6 coal by 25-foot contours from an altitude of 350 feet upwards. Since except immediately

²Shaw, E. W., op. cit.

adjacent to the valley of Kaskaskia River the surface has an altitude of 420 feet or more where the coal is 350 feet or below no stripping operations can be conducted north of the position of the 350-foot contour. The position of the 350- and of the 375-foot contour lines is determined very largely by reference to the altitude of the coal in the rather closely spaced mines along the Illinois Central Railroad. Persons having access to the mine maps and level data in the mines can verify the map or rectify any errors to the extent that mine workings extend south of the railroad toward the designated outcrop.

The areas that seem most favorably situated topographically for investigation lie between the areas of alluvium along Doza Creek and along Kaskaskia River at New Athens. The Dutch Hill region 2 miles west of Lenzburg, in secs. 2, 3, 10 and 11, sec. 13 directly south of Lenzburg, and sec. 33 south of Marissa, all in T. 3 S., R. 7 W., are thought to merit particular mention. The fact that No. 6 coal lies at a depth of only 55 feet in the abandoned mine in sec. 21, T. 3 S., R. 7 W., gives some importance to the area in secs. 20, 21 and 28 adjacent to this mine. This area does not, however, appear to be topographically well situated. It may be generally assumed that where the cover is less than 20 feet the coal will probably be unsuitable for recovery.

Coal No. 5 is not believed to be present in this area, but there is need for drilling to determine whether or not a coal is present within 50 feet of No. 6 coal. In the Sparta region the coal called No. 5 lies about 30 feet below No. 6.

AREA III

Area III is in T. 4 S., R. 6 W., and lies adjacent to and northwest of Sparta (Pl. IV). It forms part of the region included in the map of the Sparta area showing the structure of No. 6 coal published by the Survey in 1926.³ Plate IV shows the structure of No. 6 coal approximately the same as that given by Moulton. It will be noted, however, that data in regard to the position of the coal are indefinite in the north half of the area.

The outcrop of No. 6 coal can be traced fairly accurately from the south boundary of the area to Plum Creek. The limestone reported outcropping or near the surface along Plum Creek in the NE. $\frac{1}{4}$ NE. $\frac{1}{4}$ sec. 27, T. 4 S., R. 6 W., is arbitrarily correlated with the cap rock of No. 6 coal. It may, however, be the limestone between No. 5 and No. 6 coals, and if so, the outcrop of No. 6 coal is drawn too far west in sec. 27. From Plum Creek northward to the county line no great amount of accuracy can be claimed for the outcrop line. If the altitude of the coal

³Moulton, Gail F., Oil and gas possibilities near Sparta: Illinois State Geol. Survey Press Bulletin Series, Illinois Petroleum No. 1, Pl. I, pp. 4-5, April 17, 1926.

is approximately accurately mapped the line of outcrop as indicated cannot be greatly in error. It is probable that the line lies too far to the west rather than too far to the east. The particular value of the map north of Plum Creek lies in the fact that it indicates the approximate area in which prospecting for coal lying at shallow depth might well be conducted. This area is bounded on the east by the 400-foot structure contour. It can hardly be expected that strippable coal will be found east of this line except possibly in a small area on the north side of Plum Creek in the S. $\frac{1}{2}$ secs. 22 and 23. The line showing the outcrop of the coal bounds the area on the west. The fact that in this district there are extensive nearly level surfaces possibly underlain by coal also lying nearly horizontal is particularly noteworthy. To the writer it appears that in view of the absence of rock outcrops in the region and of drill holes and deep farm wells exploration should be conducted by a series of test holes running west approximately from the position of the 400-foot structure contour line.

In drilling along the margin of the coal bed as indicated care will need to be exercised in the identification of the coals encountered. The actual existence of lower coals north of Sparta is uncertain because the diamond drill test holes stop at No. 6 coal. The identity of the coal encountered at 90 feet in the shaft located near the center of sec. 34 is uncertain. The coal there mined is reported to be 6 feet thick and until more definite information in regard to it becomes available it is tentatively correlated as No. 5. A bed of poor coal is reported to have been encountered at a depth of 293 feet in a well at the creamery at Houston. The coal is said to have been 4 feet thick with a clay band in the middle. If such a coal is present at that depth at Houston, it has the approximate stratigraphic position of No. 2 coal. From the foregoing statements it will be seen that the information in regard to coal-bearing strata below No. 6 coal in this region is very indefinite.

Areas recommended for exploration in Area III are as follows: sec. 26, west of the 400-foot structure contour; from the road running through the center of sec. 14 westward to the center of sec. 16; W. $\frac{1}{2}$ sec. 10 and north and east halves sec. 9; sec. 4 and SE. $\frac{1}{4}$ sec. 5.

AREA IV

Area IV lies in the south-central part of Perry County, largely in T. 6 S., R. 3 W. (Pl. V). Four quadrangles corner in the northwest part of the area: Coulterville on the northwest, Pinckneyville on the north, Murphysboro on the south and Campbell Hill on the southwest.

It will be noted by inspection of the map that No. 6 coal underlies a considerable portion of the north half of the area. Except on the west the position of the outcrop is largely in Pinckneyville quadrangle. This

area has not yet been geologically mapped, but a geological map has been published of the Murphysboro quadrangle⁴. Detailed field investigations have been made in both the Coulterville and the Campbell Hill quadrangles but the results of these investigations have not yet been published.

There are no outcrops of coal so far as known at any point along the designated margin of the bed. The drift conceals this margin so that its position can be indicated with only approximate correctness in accordance with data regarding the position and depth of the coal or the cap rock farther north, the dip of the coal-bearing beds, and the topographic configuration of the surface. Three drill holes are situated south of the outcrop of No. 6 coal. Along Galum and Little Galum creeks are a number of outcrops of limestone reported by Worthen⁵ and he also reports that limestone was encountered at shallow depth in numerous farm wells located between Galum Creek and Pyatts. This limestone is thought to be the cap rock of No. 6 coal. There is a shallow slope mine in sec. 16, T. 6 S., R. 3 W. The coal has also been mined in the SE. $\frac{1}{4}$ sec. 22, T. 6 S., R. 4 W., and the sink holes mapped on the Campbell Hill sheet along the north line NW. $\frac{1}{4}$ sec. 26 indicate the presence of an underlying limestone, probably the cap rock of the coal. The limestone outcrops along Galum Creek in the E. $\frac{1}{2}$ sec. 18, T. 6 S., R. 3 W., and along Little Galum Creek in sec. 9 of the same township. A slope or shaft located in the NE. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 35, T. 6 S., R. 4 W., is thought to have reached No. 5 coal in view of the probable altitude of No. 6 coal at this place if it were present.

The surface in the S. $\frac{1}{2}$ secs. 26 and 27, T. 6 S., R. 4 W., is rather deeply underlain by glacial drift so that the outcrop line is only a rough approximation to accuracy. Even greater indefiniteness characterizes the available information in regard to the margin of the coal bed in the area near Denmark between Pipestone and Galum creeks. Eastward from Galum Creek the line is somewhat more definitely established because of the occurrence of limestone in the wells along the road west from Pyatts through secs. 13, 14, 15, and 16. Even here the coal may extend farther south than is indicated along the ridges between the streams. The strata are nearly horizontal and in many places may locally dip south, as they are known to do in a similar position on the east side of Beaucoup Creek where a large area has been prospected by the United Electric Coal Company.

It is thought that this area contains large blocks of No. 6 coal suitable for recovery by open-cut methods. It is believed that the most favorable region for investigation lies north of the indicated position of the outcrop and east of Little Galum Creek. The area between Pipestone and Galum

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

⁵Worthen, A. H., Geological Survey of Illinois, vol. III, p. 91, 1868.

creeks including secs. 13 and 14 and the N. $\frac{1}{2}$ secs. 23 and 24, T. 6 S., R. 4 W., is also favorably situated. A smaller area recommended for investigation lies in the N. $\frac{1}{2}$ sec. 17 and S. $\frac{1}{2}$ sec. 8, T. 6 S., R. 3 W., between Galum and Little Galum creeks.

The greatest difficulty in open-cut mining in this area will be the removal of the cap rock. In Perry and Randolph counties this stratum appears to be thicker than it commonly is elsewhere, and it is probable that the average thickness is at least 8 feet.

Drilling along the margin of No. 6 coal should be continued at least here and there to a depth no less than 50 feet below No. 6 coal or until No. 5 coal is encountered. The character of the surface south of the designated margin of No. 6 coal, particularly in secs. 22, 23, 26, and 27, T. 6 S., R. 3 W., is exceedingly well disposed to favor the recovery of a lower coal if it is present.

AREA V

The fifth area recommended for special investigation extends six miles east and three miles south of Pinckneyville, in Perry County (Pl. VI). It lies entirely within the area of the Pinckneyville quadrangle, which has not yet been surveyed geologically. The information which is presented herein does not, therefore, represent the results of special investigation, but is a compilation of data available in the literature and in the Survey files. Although it is small in amount it indicates the existence of coal at shallow depth at a number of places so that the recommendation of the area for exploration seems warranted.

In earlier maps published by the Survey and other maps the outcrop of No. 6 coal in this area has been indicated at various positions. In general it has been indicated as extending northward through the west side of sec. 35, T. 5 S., R. 2 W., to the SW. cor. sec. 26, and thence northwest to the SW. $\frac{1}{4}$ sec. 22, where it crossed Panther Creek. From there it was mapped as swinging southwest passing just north of the drill hole in the SW. $\frac{1}{4}$ sec. 29 and crossing the main branch of Beaucoup Creek in the north half of sec. 30, from which point it was continued southwest close to the township line at the east side sec. 36, T. 5 S., R. 3 W. Information now available seems to indicate that erosion along Beaucoup Creek and its branches was by no means so extensive as was formerly thought and that the outcrop of the coal lies much nearer the creek than was suspected, and accordingly does not finger up the valleys so far.

The Panther mine, according to information furnished by the State Mine Inspector, mines No. 6 coal at a depth of 54 feet in the vicinity of Denny, sec. 33, T. 5 S., R. 2 W. It is probable therefore, that the margin of the coal is crossed by the creek some distance below the line of the Illinois

Central Railroad and that in general the outcrop lies south of the railroad rather than north of it, at least across sec. 33. The outcrop apparently swings north across the railroad in the N. $\frac{1}{2}$ sec. 32 and southward across the railroad again in the SE. $\frac{1}{4}$ sec. 30. Worthen⁶ in his report on Perry County states that No. 6 coal has been worked in a ravine in sec. 30. He further states: "A half mile northeast of town (Pinckneyville) the coal crops out on the Beaucoup; and several shafts have been sunk to the coal at this point. . . . There seems to be an undulation in the strata here which brings the main coal above the creek level, just at the town, while it dips below that level above and below." It will be noted that the coal lies at a depth of 29 feet at the Shakerag mine in the SE. $\frac{1}{4}$ SW. $\frac{1}{4}$ sec. 26, T. 5 S., R. 2 W., so that it is possibly as much as 30 to 35 feet higher in altitude than it is at the Panther mine. Since there is apparently a southward dip from near Pinckneyville, at the west side of the area, and apparently also a dip in the same direction at the east end of the area it is thought the coal throughout the area dips southward from an axis parallel to the Illinois Central Railroad lying a mile or more northeast of the railroad. Since a large portion of this area lies between 400 and 460 feet above sea level and the slopes are very gentle, conditions seem to be particularly favorable for open-cut mining provided the coal is present at the shallow depth suggested. The fact that the cap rock in this region is relatively heavy is probably an advantage since it served as a protection against preglacial and glacial erosion of the coal bed itself.

Exploration in this region should be directed toward discovering the altitude of the coal along lines running north or northeast from the railroad, particularly in the interstream areas. Since the coal lies at shallow depth, its outcrop will doubtless be very irregular, and yet it is found in other places that irregularities in the outcrop of the coal generally conform to the present topography after allowance is made for about 20 feet of fill. For this reason, inasmuch as the coal lies close to the level of drainage, drilling should be restricted to the divides until the position of the coal is established.

It is not improbable that the area in which the coal lies at an altitude of 400 feet or more extends eastward beyond the boundary of the special area for several miles, at least through sec. 24, T. 5 S., R. 2 W., and sec. 19, T. 5 S., R. 1 W. There appears to be a large area suitable for exploration.

AREA VI

The final special area to be described lies adjacent to the heart of the Williamson County coal field, occupying an area lying between Herrin, Carterville, and Marion (Pl. VII). The particular portion of the area

⁶Worthen, A. H., Geological Survey of Illinois, vol. III, p. 90, 1868.

where exploration is recommended lies west of the Chicago, Burlington, and Quincy Railroad, that is between the pit operated by the Pyramid Coal Corporation in sec. 33, T. 8 S., R. 2 E., and Carterville.

This area includes a part of each of four quadrangles, namely, the Herrin quadrangle on the northwest, the Carbondale quadrangle on the southwest, the West Frankfort quadrangle on the northeast and the Marion quadrangle on the southeast. The geology of each of these areas, except the Marion quadrangle, has been mapped in detail and geological maps of the Herrin and Carbondale quadrangles have been published.⁷

Information in regard to the lay of No. 6 coal is fairly accurate in the portion of the area lying in T. 8 S. Near the outcrop, however, less definite information is available. The outcrop of both No. 5 and No. 6 coals is shown with as much accuracy as possible. The outcrop of No. 6 coal is probably more accurately indicated than that of No. 5 coal, but since the two coal beds are only 25 to 30 feet apart the lines of outcrop will probably not generally be separated more than half a mile. Particular attention is called to the small anticlinal fold exposed along the creek in the SW. $\frac{1}{4}$ sec. 6, T. 8 S., R. 2 E. The outcrop of No. 5 coal is swung north through the south half of secs. 5 and 6 in accordance with the probabilities with respect to this minor structure.

Areas recommended for exploration are particularly the E. $\frac{1}{2}$ sec. 5 with respect to No. 6 coal, and the S. $\frac{1}{2}$ sec. 1, T. 9 S., R. 1 E., and the W. $\frac{1}{2}$ sec. 9 and the E. $\frac{1}{2}$ sec. 8, T. 9 S., R. 2 E., with respect to No. 5 coal. The outcrop of both coals has been explored from the line of the Chicago, Burlington, and Quincy Railroad east nearly to Harrisburg, and most of the coal is under option or actual ownership of those interested in open-cut mining, so that recommendations for explorations do not apply for this portion of the area. The writer wishes to call attention, however, to the outcrop of No. 5 coal as delineated in the eastern part of the area, since it has not previously been mapped in this region. The line is established by recent drilling for coal suitable for open-cut mining in a large area adjacent to Marion. The boundary of No. 5 coal has not been checked in the field and there is a possibility that the southward extension of the coal into sec. 23 may be due to the confusion of No. 5 coal with a lenticular bed that lies a short distance below No. 5 in some places in the vicinity of Marion. The map is of particular interest because it shows the southward displacement of the outcrop along the fault zone in sec. 10.

Attention may well be directed to the occurrence of a body of coal adjacent on the east to that owned by the Pyramid Coal Corporation and the Carbon Fuel Company, lying in the NW. $\frac{1}{4}$ sec. 34, T. 8 S., R. 2

⁷Shaw, E. W., and Savage, T. E., U. S. Geol. Survey Geol. Atlas, Murphysboro-Herrin folio (No. 185), 1912.

Lamar, J. E., Geology and mineral resources of the Carbondale quadrangle: Illinois State Geol. Survey Bull. 48, 1925.

E. It will be noted that the altitude of the coal varies from 425 feet along the south line of sec. 34 to about 375 along the north line. The surface slopes in the same direction but more gently than the coal. In this region the cap rock is generally thin or absent, or 25 feet or more above the coal and the rock cover therefore would offer less difficulty in its removal than is commonly the case.

OTHER AREAS

There remain for consideration two areas of relatively small size located along the outcrop of No. 5 and No. 6 coals in southern Illinois beneath which are bodies of coal under shallow cover. These will be considered in the order of their geographic position from east to west.

The first area lies on the west side of the Illinois Central "cut-off" near the Williamson-Saline county line in secs. 35 and 36, T. 9 S., R. 4 E., and in sec. 2, T. 10 S., R. 4 E. The underlying coal is No. 5, and its margin has been traced partly across Saline County to the Williamson County line by Harrisburg interests. The outcrop of the coal probably passes west through the south quarter of sec. 36, swings south and then west again through the SE. $\frac{1}{4}$ sec. 35 and the north half of sec. 2. In the west half of sec. 2 the cover is heavy close to the outcrop. There is probably between 100 and 150 acres of coal available in this tract and it lies very close to transportation.

A much larger tract than that just described is to be found along the outcrop of No. 6 coal west of Hallidayboro in Jackson County. This tract occupies a position lying between the tracts developed on the north by the Black Servant Coal Company, and on the south by the Forsyth Coal Company. In an area largely confined to the W. $\frac{1}{2}$ sec. 36 and the SW. $\frac{1}{4}$ sec. 25, T. 7 S., R. 2 W., and the NW. $\frac{1}{4}$ sec. 1, T. 8 S., R. 2 W., the coal lies at an altitude of 375 feet or above, and the surface has an altitude of between 400 and 420 feet. It is possible that coal may extend southwest into the E. $\frac{1}{2}$ sec. 2, T. 8 S., R. 2 W. Drilling along the margin of No. 6 coal should seek to discover the position of No. 5 coal since it seems probable that it is recoverable by stripping in secs. 26 and 35, T. 7 S., R. 2 W., and 2, T. 8 S., R. 2 W. That No. 5 coal may be present also at shallow depth in sec. 7, T. 8 S., R. 1 W., south of the area occupied by the Forsyth Coal Company, seems probable.

SUPPLEMENTARY DATA ON THE COAL AREA IN WILLIAMSON COUNTY

Since the writing of this report, additional information has been obtained on an area of coal under light cover in sec. 36, T. 9 S., R. 4 E., and in sec. 2, T. 10 S., R. 4 E., Williamson County. This area lies along the Williamson and Saline county line near the southeast corner of Crab

Orchard and the northeast corner of Stonefort townships. The right of way of the Edgewood-Metropolis division of the Illinois Central Railroad lies along the east side of the area. The nearest town, Carrier Mills, is $3\frac{1}{2}$ miles east on the Big Four Railway.

The area is included in the Harrisburg topographic quadrangle, and the mapping of the geology was incident to the preparation of a geological map of that quadrangle. The writer is especially indebted to his assistant, Mr. Lloyd G. Henbest, for the field data and the compilation of the map (Pl. VIII).

About 246 acres of coal is thought to be present in the area under a cover whose thickness has a ratio of 8 to 1 with respect to the thickness of the coal, and an additional 325 acres under a cover with a ratio of 10 to 1. The total tonnage available at an average thickness of $4\frac{1}{2}$ feet of coal is about $4\frac{1}{2}$ million tons.

The outcropping coal is No. 5, the same bed which is extensively mined at Harrisburg, Eldorado, and elsewhere in Saline County. It is an excellent quality of Illinois coal. The cover of the coal is mainly shale, and glacial drift or alluvium. Where the cover is less than 8 to 1, it consists of about one-half unconsolidated material and one-half shale; where the cover is heavier, the drift rarely exceeds 20 feet. In some places, a thin bed of limestone one to two feet thick is found in the shale at various distances above No. 5 coal.

The northern boundary of the strippable area is placed at the outcrop of a thin coal, called " $5\frac{1}{2}$ " or "5A" (possibly the equivalent of the Briar Hill coal of Kentucky^s), which lies 50 to 60 feet above No. 5 coal and about the same distance below No. 6 coal.

No. 5 coal in this area is at least $4\frac{1}{2}$ feet thick, and at several places is reported as 4 feet 8 inches thick. Its attitude is nearly horizontal. Probably small local flexures will be found to be of more importance than the general regional northward dip in affecting the depth of overburden.

Plate VIII indicates the area recommended for testing and also shows the locations of coal outcrops and other field data listed in Table 4. It will be noted that the district recommended has three divisions: (1) an area where the cover has a ratio of 8 to 1 with respect to the thickness of the coal; (2) an area where the ratio is between 8 to 1 and 10 to 1; and (3) an area south of the designated outcrop of No. 5 coal within which there may be patches of the coal. The line marking the outcrop of No. 5 coal can be indicated only in a general way. Possibly in places it lies slightly north and in other places south of the designated position. In the tonnage estimates that have been made, possible bodies of coal south of the indicated position of the outcrop of No. 5 coal were not included. The

^sLee, Wallace, *Geology of the Kentucky part of the Shawneetown quadrangle*: Kentucky Geol. Survey, p. 33, 1916.

most desirable body of coal, shown by the shaded portion on Plate VIII, probable underlies the eastern part of the area where the ratio of the overburden to the coal is less than 8 to 1.

About 40 acres of strippable coal was reported to be under option in this tract at the time the data were collected in June, 1927.

TABLE 4.—*Surface data collected in secs. 35, 36, T. 9 S., R. 4 E.; sec. 31, T. 9 S., R. 5 E.; sec. 6, T. 10 S., R. 5 E.; secs. 1, 2, 3, T. 10 S., R. 4 E.*

Numbers correspond to the numbers on the map (Pl. VIII).

Sec. 35, T. 9 S., R. 4 E. (Williamson County)

Map No.

1. Outcrops of No. 5A coal and of shale.
2. No. 5A coal, 10 to 15 feet below surface in shallow well.
3. No. 5 coal at Will Hill drift mine. Surface altitude at mouth about 450 feet. Altitude of top of coal 445 feet. Slight southward dip. Coal 4 feet 8 inches thick.
4. Two shallow wells.

Sec. 36, T. 9 S., R. 4 E. (Williamson County)

1. Outcrop of No. 5A coal.
2. No coal in shallow well.
3. Outcrop of No. 5A coal.
4. Outcrop of black slate near limestone horizon.
5. Water well—exact location uncertain. Surface altitude 440 feet. 27 feet to top of No. 5 coal. Drilled through 6 feet of coal without penetrating bed. (Part of the 6 feet may be black slate.)
6. No information.
7. Drill hole: No. 5 coal at 33 feet; over 4 feet thick.
8. Drill hole: No. 5 coal at 17 feet; 3 feet 7 inches thick.
9. Probably no coal.
10. Drill hole: probably no coal.

Sec. 31, T. 9 S., R. 5 E. (Saline County)

1. Outcrop of No. 5A coal in cut.
2. Drill hole: No. 5 coal at 65 feet.
3. Drill hole: No coal to 51 feet.
4. Probably no coal; shallow well, about 15 feet.

Sec. 6, T. 10 S., R. 5 E. (Saline County)

1. No coal in well; 10 to 20 feet deep.

Sec. 1, T. 10 S., R. 4 E. (Williamson County)

1. Shaly sandstone struck in water well. No coal at 12 feet.
2. Drilled water well; 5 feet of coal reported struck at 165 feet. This is probably No. 2 coal.
3. Well at approximately this location; 21 feet deep with 20 inches of coal at bottom. Probably thin coal between No. 2 and No. 5 coals.
4. Well; no coal.
5. Drilled water well 50 feet deep; no coal.

Sec. 2, T. 10 S., R. 4 E. (Williamson County)

1. Outcrop of shale. Coal in wash, probably from No. 6 coal outcropping on the hill to the north.
2. Struck No. 5A coal in bottom of 16-foot well in barn lot.

3. Outcrop of sandstone in road.
4. Outcrop of shale in road.
5. Old stripping; No. 5A coal.
6. Well 20 feet deep in roof shale of No. 5 (?) coal.
7. Old prospect shaft for lead. Coal penetrated at about 20 feet.
8. Outcrop of limestone over blue shale.
9. Outcrop of shale.
10. Drill hole; coal reported at 33 to 36 feet.
11. Outcrop of shale.
12. Exposure of glacial till.
13. Outcrop of soft sandstone.
14. Exposure of glacial till.
15. Outcrop of soft shaly sandstone.
16. Shallow well; no coal.
17. Shallow well; no coal.
18. Well 40 feet deep; no coal.
19. Well in barn lot 15 to 20 feet below the house. About 35 feet deep; said to have encountered coal.
20. Well 20 feet deep; no information.
21. Well dug mostly in clay; 15 to 20 feet deep.

Sec. 3, T. 10 S., R. 4 E. (Williamson County)

1. Exposure of glacial till.
- 2, 3. Wells; no coal.
4. Farm well in shale; no coal.
5. Shallow wells; not certain whether coal was encountered.
6. Outcrop of shale and limestone.
7. Well; no coal.
8. Drill hole about 30 feet deep; no coal.
9. Well 12 feet deep in till.
10. Exposures of glacial till.

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