STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION

DIVISION OF THE
STATE GEOLOGICAL SURVEY
FRANK W. DE WOLF, Chief

Cooperative Mining Series
BULLETIN 19

COAL RESOURCES OF DISTRICT V
(Saline and Gallatin Counties)

BY

GILBERT H. CADY

ILLINOIS MINING INVESTIGATIONS
Prepared under a cooperative agreement between the Illinois State Geological Survey Division, the Engineering Experiment Station of the University of Illinois, and the U. S. Bureau of Mines

PRINTED BY AUTHORITY OF THE STATE OF ILLINOIS

URBANA, ILLINOIS
1919

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

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

The reports of the investigation are issued in the form of bulletins, either by the State Geological Survey Division, the Engineering Experiment Station, University of Illinois, or the United States Bureau of Mines. For copies of the bulletins issued by the State Geological Survey Division, address State Geological Survey Division, Urbana, Illinois; for those issued by the Engineering Station, address Engineering Station, University of Illinois, Urbana, Illinois; and for those issued by the U. S. Bureau of Mines, address Director, U. S. Bureau of Mines, Washington, D. C. (See list at end of book.)

STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION

DIVISION OF THE
STATE GEOLOGICAL SURVEY
FRANK W. DE WOLF, Chief

Cooperative Mining Series
BULLETIN 19

COAL RESOURCES OF DISTRICT V
(Saline and Gallatin Counties)

BY

GILBERT H. CADY

ILLINOIS MINING INVESTIGATIONS
Prepared under a cooperative agreement between the Illinois State Geological Survey Division, the Engineering Experiment Station of the University of Illinois, and the U. S. Bureau of Mines

PRINTED BY AUTHORITY OF THE STATE OF ILLINOIS

URBANA, ILLINOIS
1919

STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION

DIVISION OF THE
STATE GEOLOGICAL SURVEY
FRANK W. DeWOLF, *Chief*

Committee of the Board of Natural Resources and Conservation

FRANCIS W. SHEPARDSON, *Chairman*
Director of Registration and Education

KENDRIC C. BABCOCK
Representing the President of the University of Illinois

ROLLIN D. SALISBURY
Geologist

SCHNEPP & BARNES, PRINTERS
SPRINGFIELD, ILL.
1919
19962—5M

CONTENTS

ILLUSTRATIONS

TABLES

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

COAL RESOURCES OF DISTRICT V
(Saline and Gallatin Counties)

By Gilbert H. Cady

CHAPTER I—INTRODUCTION

Definition and Importance of Area

It is to the thickness and good quality of the No. 5 or Harrisburg coal that District V owes its position as the chief competitor of District VI in which No. 6 or Herrin coal is produced. District V includes the parts of Saline and Gallatin counties north of the outcrop of No. 5 coal (see fig. 1); District VI of the Cooperative Investigations lies directly to the west in Williamson, Franklin, and Jefferson counties.

The known coal resources of the district are great. At least two workable coal beds underlie most of the area and there are probably others that will be exploited eventually. The original tonnage of these two workable beds is estimated to have been 2,712 million tons in Saline County alone. Of this, up to July, 1915, only about 55 million tons or 2.63 per cent of the original quantity had been mined or rendered unminable, and this output has been practically all from one coal bed. The same two coal beds in that part of Gallatin County included in District V represent a total original resource of about 1,971 million tons, of which only about 2½ million tons, or about one-tenth of 1 per cent of the original quantity, have been mined or rendered unminable. The remaining available coal in these two beds in Saline and Gallatin counties, on a basis of a recovery of 60 per cent, is about 2,770 million tons, or about 40 times the total production for Illinois in 1916. No estimate of the amount of coal in coal beds other than No. 5 and No. 6 has been attempted but it is probable that some of the lower beds constitute large reserves.

The operations in this district are largely tributary to one railroad, the Cleveland, Cincinnati, Chicago & St. Louis Railway, the greatest amount of development being located along this road between Eldorado and Carriers Mills southwest of Harrisburg. The Illinois

Central Railroad and the Louisville & Nashville Railroad also receive shipments directly from a few of the mines.

Although two or three commercial mines were operating before 1900 the district has been largely proved and developed since that date. At present there are only twelve companies operating in Saline County and two in Gallatin County, with twenty-three mines in the former county and two in the latter. Furthermore, the present companies control much of the already proved coal lands, so that future development will probably wait on the conservative expansion of the operations of these companies and the testing of areas in the north part of the district and in adjacent parts of White and Hamilton counties.

The following table shows the production of coal in District V from 1881 to the end of June, 1917. The figures for the annual production were taken from the reports of the State Mining Board; totals for Gallatin and Saline counties from 1881 to 1907 were obtained from State Geological Survey Bulletin 16.[1]

TABLE 1.—*Production of coal in Saline and Gallatin counties, 1881 to July, 1917*

Year	Saline *Tons*	Gallatin *Tons*
1881–1907	5,531,780	972,718
1908	2,482,677	75,322
1909	2,798,527	58,218
1910	3,062,098	76,692
1911	3,232,736	63,105
1912	4,088,575	73,620
1913	4,519,936	78,099
1914	3,875,511	67,509
1915	3,863,030	73,863
1916	4,502,801	68,094
1917	4,530,903	125,366
County Totals:	42,488,574	1,732,606

District total: 44,221,180

Table 2 is a list of mines in District V giving data regarding the location of mines, the depth and altitude of coal, and the production for the fiscal years, 1915–1916, and 1916–1917.

The district is of peculiar interest because it is the only one in which the coal is known to be affected by igneous intrusions. A dike as much as 180 feet in width in one place, and other dikes of lesser width in other places cut vertically through the coal beds altering the coal for some distance on either side into natural coke, or hardening it by an apparent silicification. Furthermore, certain parts of the district are affected by faults, the coal in one mine having been displaced vertically as much as 160 feet.

[1] Bement, A., The Illinois coal field: Ill. State Geol. Survey Bull. 16, pp. 193 and 194, 1910.

Acknowledgments

This report for District V is one of a series on the coal resources and on mining practice prepared by the State Geological Survey in cooperation with the Engineering Experiment Station of the University of Illinois and with the U. S. Bureau of Mines. The districts examined and the scope of the Investigations are defined in Bulletin 1, *A Preliminary Report on Organization and Method of Investigations.*

The material comprising the report represents a compilation of data from various sources. A large part of the area was surveyed in detail by members of the State Geological Survey in cooperation with the U. S. Geological Survey in preparation for publication as folios of the geological atlas or as bulletins of the U. S. Geological Survey. This field work was done previous to 1912 by Messrs. F. W. DeWolf, A. J. Ellis, and G. H. Gady, and during 1918 by Mr. Charles Butts. Liberal use has been made of the results of these investigations.

The notes of Messrs. K. D. White and F. H. Kay, taken in 1912 in the mines selected for field observation under the cooperative agreement, have been of special assistance.

As is commonly true throughout the coal field, there has been kindly cooperation with the work of the Survey on the part of mining men. Much of the information in regard to the district is based upon drilling records made available for study by the operators, and mines have been opened freely to members of the Investigations.

Previous Investigations

The published results of earlier geologic investigation in the region are listed below:

Worthen, A. H., Coal Measures and Lower Carboniferous limestones: Geol. Survey of Illinois, Vol. III, Chap. 1, pp. 1–19, 1868.

———, Coal Measures: Geol. Survey of Illinois, Vol. VI, Chap. 1, pp. 1–8, 1875.

Cox, E. T., Gallatin County: Geol. Survey of Illinois, Vol. VI, Chap. XVII, pp. 197–219, 1875.

———, Saline County: Geol. Survey of Illinois, Vol. VI, Chap. XVIII, pp. 220–234, 1875.

Nickles, J. M., Geological section—St. Louis to Shawneetown: Rept. of the Illinois Board of World's Fair Commissioners, pp. 155–176, 1895.

DeWolf, F. W., Coal investigations in the Saline-Gallatin field, Illinois, and the adjoining area: U. S. Geol. Survey Bull. 316, pp. 116–136, 1906. Reprinted: Ill. State Geol. Survey Bull. 8, pp. 211–229, 1907.

———————, Coal investigations in Saline and Williamson counties, Illinois: Ill. State Geol. Survey Bull. 8, pp. 230–245, 1907.

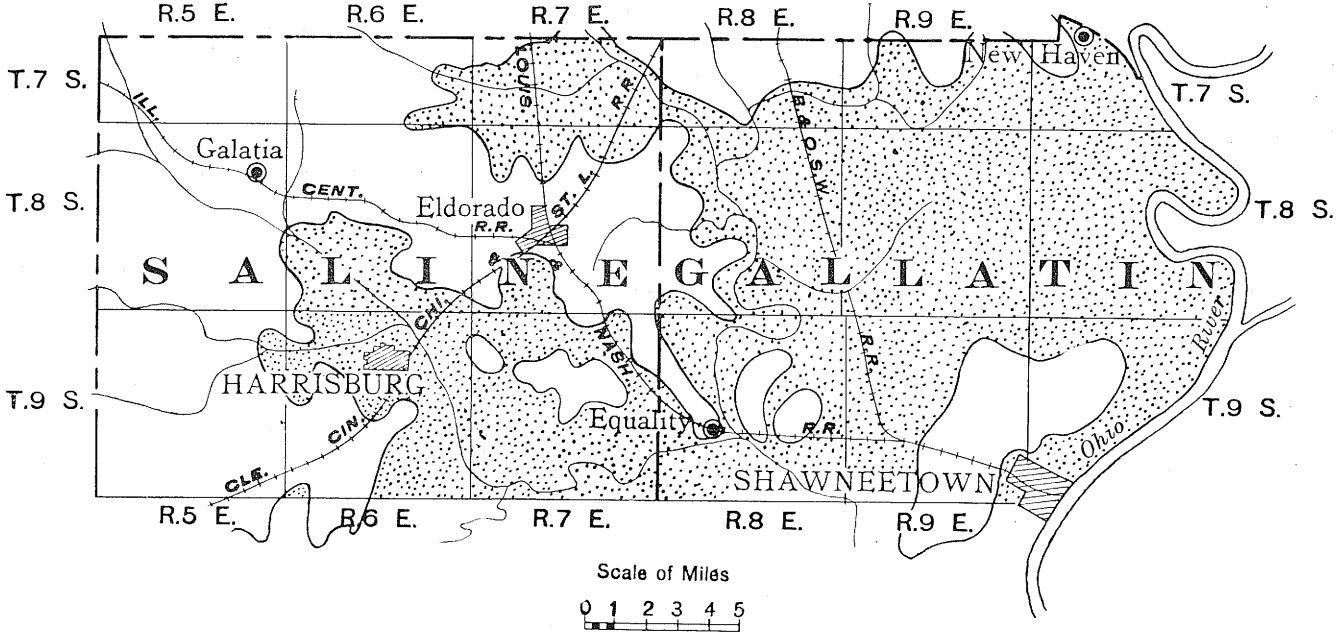

FIG. 2.—Sketch map showing area of alluvial plains in District V.

GEOGRAPHY

District V includes primarily the mining districts centering around Galatia, Eldorado, Harrisburg and Carriers Mills in Saline County and around Equality in Gallatin County. For convenience in description and mapping the arbitrary limits of the district on the north, east, and west are taken as the county boundaries. To the south the district is defined by the outcrop of No. 5 coal. Practically nothing is known concerning the coal resources of the low land bordering the Wabash and Ohio rivers in R. 10 E. (New Haven and Shawnee townships) so that in reality so far as our knowledge goes the district is limited on the east by the west boundary of these townships.

Although by definition the outcrop of No. 5 coal is the southern boundary of the district the coals below No. 5 and the structure characteristic of the district probably continue uninterruptedly a few miles farther south to the line of faulting marked by the hilly country known locally as the "mountains". This line of faulting forms the structural southern boundary of this area and of the Illinois coal basin as a whole.

The district lies entirely within the drainage basin of Saline River but is not coextensive with it. In no direction does the district reach the watershed. Bordering the river and its tributaries are broad alluvial plains (fig. 2) similar to those along Big Muddy River and its tributaries in District VI and thought by some investigators to be lake deposits.[1] These level plains lie at elevations between 360 and 400 feet above sea level and comprise about one-half of the surface of the area. Upstream the valley flats become narrow and finger into uplands having summit altitudes rarely over 600 feet above sea level. The upland areas are characterized by gentle slopes, rock cliffs of any height being very unusual, so that there is no part of the district that is not easily accessible to railroads. Isolated hills, such as Equality and Hickory Hills, here and there rise above the plains which entirely surround them.

The Shawneetown hills, near the southeast corner of the district and lying north of Shawneetown, partake somewhat of the character of the hilly country to the south of the district. This range of hills is composed of rock at least toward the east end, and the north and east slopes are relatively steep. The greater part of the hills, however, is covered by a thick mantle of loess or yellow clay, entirely hiding the rock. The steepness of the east end of the range is prob-

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

ably due to undercutting at some time by Ohio River. Similarly the north bluff may be steep because of undercutting by some river, or it may in part be due to faulting, just as the bluffs along the southern edge of the district are fault bluffs. Drilling has not been distributed in such a way as to show satisfactorily the relative position of strata in the hills and in the lowland immediately to the north.

The surface configuration of most of the district bears no close relation to the lithology or structure of the underlying rocks. It is possible, however, that the greater altitude of some of the rolling country along the west side of Saline County is due to the outcrop of one of the massive widespread sandstones commonly found in the Pennsylvanian section, 200 to 300 feet above No. 6 (Herrin) coal. In western Saline County the limestone overlying No. 6 coal and the coal itself are sufficiently resistant to erosion to produce an escarpment along the north side of the valley of South Fork of Saline River. This slope can be traced with some gaps from Harrisburg nearly to Marion in Williamson County, and it continuously marks the outcrop of No. 6 coal.[1]

The development of the region and of the coal resources seems to have little relation to the topography. Since an early date local drift mines and shallow shafts have worked No. 6 coal at numerous places along the escarpment facing South Fork valley. In places No. 5 coal has also been worked at the outcrop farther south in the same valley. The chief factor, however, in the disposition of the shipping mines has not been topographic features, but the locations of the railroads, and of these especially the Big Four Railway. Fifteen out of seventeen of the commercial mines of Saline County which produced coal in the fiscal year 1915–1916 were located along this railroad. Three of these mines are in the vicinity of Eldorado and the others are distributed as far south as Carriers Mills. Of the two other mines, one is located at Galatia on the Illinois Central Railroad and the other 2½ miles southeast of Eldorado on the Louisville & Nashville Railroad.

Surface Deposits

Although surface configuration reflects but slightly the structure and lithology of the indurated strata, it is an immediate indication of the character of the deposits overlying the hard rocks. That is, upon the hills above an elevation of about 400 feet the surface soil, glacial drift, or other uncemented material is commonly thin, rarely being over 30 feet in thickness and usually less. This sort of material

[1] Cady, G. H., Coal resources of District VI: Ill. Coal Mining Investigations Bull. 15, 1915.

does not hinder the development of the coal resources, except as it conceals the bed rock and obscures the outcrops.

Beneath the river plains, on the other hand, the depth of the material above the rock is variable, in places exceeding 100 feet. Moreover the material underlying the river flats is not uncommonly sandy and water soaked, and therefore of such a character as to give trouble in shaft sinking. Accordingly special attention is directed to the variation in thickness of the deposits underlying the river or alluvial plains, due to the irregularities in the rock floor of the valleys. Because of these irregularities it is difficult to predict the thickness of the roof for some distance north of an outcrop of a coal bed beneath a heavy deposit of silt and sand in the larger valleys. Many irregularities in coal beds, commonly known by miners as "faults", are buried erosion channels. It is possible for the engineer to avoid them or at least to become cognizant of their existence by preliminary drilling, especially if he has an appreciation of the character of the bed-rock topography and the nature of the material lying in the valleys.

Special attention is directed to the large area of low land bordering Wabash River in eastern Gallatin County north of Shawneetown, lying largely in New Haven Township. The liability of floods in this area as well as the character of the filling, its probable water-soaked condition, and its uncertain thickness will probably postpone the exploitation of coal in this part of the district for many years, or until drainage conditions are improved.

The character of the valley deposits as well as their thickness is illustrated by the following sections based upon well records. The general character of these beds is similar to the deposits in the Big Muddy basin. It is not improbable that where streams flow across the deeply filled alluvial flats, or lake beds as they have been called, a large part of the drainage is underground, the gravel and sands being rather abundant aquifers. For this reason shaft sinking on the valley flats is commonly preceded by drilling to bed rock to determine the thickness of the fill and the presence or absence of quicksand and water-bearing gravels.

Sections of the surface deposits in the Saline-Gallatin coal district

	Thickness	Depth
	Feet	*Feet*
SW. ¼ NW. ¼ sec. 18, T. 7 S., R. 10 E. Well of M. E. Dagley.		
3. Clay, yellow	18	18
2. Mud, blue, and small stones	16	34
1. Quicksand	26	60

SW. ¼ NE. ¼ sec. 16, T. 7 S., R. 9 E.

Well dug mostly in blue mud; logs at a depth of 35 feet.

Total depth about 60 feet	..	..

NW. ¼ SW. ¼ sec. 20, T. 8 S., R. 9 E.

4. Clay red	10	10
3. Quicksand	2	12
2. Mud, blue	6	18
1. Quicksand; red at top and with small gravel	20	38

NW. ¼ NW. ¼ sec. 36, T. 8 S., R. 10 E.
Well of W. Maloney.

5. Sand	6	6
4. Clay, yellow; some gravel	5	11
3. Quicksand	14	25
2. Mud, blue, old stick, etc	85	110
1. Gravel	10	120

SE. ¼ NW. ¼ sec. 1, T. 9 S., R. 8 E.
Coal test on L. Drone farm.

3. Clay, yellow	17	17
2. Quicksand	18	35
1. Mud, blue	32	67

NW. ¼ NE. ¼ sec. 10, T. 9 S., R. 8 E.
Well on Moore farm.

3. Soil and yellow clay	5	5
2. Quicksand	2	7
1. Mud, blue	23	30

SW. ¼ NW. ¼ sec. 9, T. 8 S., R. 9 E.
Well on the farm of George Belt.

5. Soil	5	5
4. Quicksand	4	9
3. Mud, blue, sticky	20	29
2. Gravel	½	29½
1. Quicksand	+	29½+

SE. ¼ NE. ¼ sec. 7, T. 8 S., R. 7 E.
Well.

4. Soil and clay	14	14
3. Sand, white	7	21
2. Clay, joint, cream to yellow	6	27
1. Clay, blue, tough	18+	45+

CHAPTER II—GENERAL GEOLOGY

STRATIGRAPHY

GENERAL GEOLOGIC RELATIONS

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

In its larger divisions the succession of strata of the Pennsylvanian section in District V is the same as that found to the west in District VI and still farther west in District VII. Studies of many drilling records have demonstrated a remarkable persistence of certain beds which make possible rather detailed correlation entirely across southern Illinois and farther south and east into Kentucky and Indiana.

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

SECTIONS OF THE PENNSYLVANIAN STRATA

The accompanying illustration (Pl. II) shows graphically a number of sections based upon drilling records and exposures located in southern Illinois and western Kentucky. The diagram compares

[1] Cady, G. H., Coal resources of District VI: Ill. Coal Mining Investigations Bull. 15, 1916.

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

graphically the succession of strata in southeastern Illinois and the Kentucky part of the Shawneetown quadrangle. The sections are lined up on the base of No. 6 coal, to enable ready comparison between different parts of the sections. Any other coal would serve as well in all probability. The section assigned to western Kentucky is graphically reproduced from a recent report by Wallace Lee [1] for the Kentucky Geological Survey.

POTTSVILLE FORMATION

The Pottsville of southern Illinois is mostly sandstone and sandy shale and has a total thickness of about 800 to 1000 feet. In the description of this formation contained in the report on District VI [2] it was stated that the seven sandstone horizons described by Shaw and Savage [3] might possibly be united farther eastward into three heavy beds. Studies of the succession in this district (District V) substantiate this supposition for it is possible to identify three heavy sandstone beds separated variously by sandy shale, gray shale, and thin beds of coal. Limestone seems to be developed rarely in the Pottsville formation, but it is not unknown, occurring associated with the shaly beds lying between the sandstones.

The best section of the Pottsville in this area is obtained from the core of a drilling put down at New Haven some years ago. This core was examined by Professor T. E. Savage of the University of Illinois and State Geological Survey, and the result of his examination is a very accurate description of the stratigraphic succession of the Carbondale and Pottsville formations at that place. The very sandy character of the formation can best be appreciated by examination of Plate II, No. 8, where the record is shown graphically.

The graphic reproduction of the New Haven record shows at the base of the Pottsville formation a succession of "Coal Measures" shales containing a thin bed of coal. The exact position of the base of the Pennsylvania rocks cannot be determined, but it is thought to be between the coal and the top of the first underlying limestone. Above the basal shaly beds is a massive sandstone 90 to 100 feet thick which is followed by a series of shales about 30 feet thick containing a bed of black "slate". There next follows a series of beds about 60 feet

---

[1] Lee, Wallace, Geology of the Kentucky part of the Shawneetown quadrangle, Kentucky Geological Survey, 1916.

[2] Cady, G. H., Coal resources of District VI: Ill. Coal Mining Investigations Bull. 15, p. 20, 1915.

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

thick consisting largely of sandstone but with a few shale partings. This is overlain by 15 to 20 feet of shale containing a coal bed. Above the coal is a massive sandstone about 200 feet thick, and this is overlain by shale beds containing thin layers of coal to a thickness of about 70 feet. A third massive sandstone about 80 feet in thickness is next in the section. This is followed by alternating beds of sandstone, sandy shale, clay shale, and coal for about 300 feet. No. 2 coal and the top of the Pottsville formation is found about 110 feet above the 80-foot sandstone.

On Plate II there is some attempt made to correlate the strata below No. 2 coal as reported in several wells drilled in southeastern Illinois with the section outcropping in Union County, Kentucky, as described by Wallace Lee.[1] These correlations are not conclusive and doubtless will need to be revised when the results of investigations made by Mr. Charles Butts of the U. S. Geological Survey in the Illinois part of the Shawneetown Quadrangle become available. Investigations in the Eagle valley region south of the Shawneetown fault lead to the belief that there are certain coals in the Pottsville formation in that area which may be correctly correlated with Pottsville coals found in Union County, Kentucky. Following the correct interpretation of this Eagle Valley section it may be possible to identify some of the Pottsville coals found in the drill holes within the area of District V; at present, however, such correlation is not practicable.

It is important for the prospector to have in mind the lenticular character of these Pottsville beds, and the possibility of local development of such coal beds to commercial thickness which justifies continuing a hole to the base of the coal-bearing rocks in an area not previously tested. Furthermore, the character of the Pottsville sandstones is such that under proper conditions of structure they may be reservoirs of oil and gas.

Correlation.—From collections of fossil plants made from the shale of the Pottsville formation in the Murphysboro quadrangle (Jackson County) and elsewhere, David White is able to say that the rocks between the top of the Chester group of the Mississippian series and the base of No. 2 coal are to be correlated with the Pottsville formation of Pennsylvania. Both middle and upper Pottsville beds are present.

CARBONDALE FORMATION

Definition and general description.—The Carbondale formation of District V is similar to the Carbondale formation of District VI as

[1] Lee, Wallace, Geology of the Kentucky part of the Shawneetown Quadrangle: Kentucky Geological Survey, pp. 16–29, 1916.

described in Bulletin 15,[1] the two districts being a part of the same basin of deposition.

In Bulletin 15 the following coal beds of the Carbondale formation were listed: (1) No. 2 coal at the base; (2) a thin lenticular bed (No. 3 coal?) 40 to 60 feet above No. 2 coal; (3) a 1-foot lenticular bed 100 to 110 feet below No. 5 coal; (4) a persistent bed (No. 4 coal?) 2 to 5 feet in thickness about 70 feet below No. 5 coal; (5) No. 5 coal; (6) No. 5A coal, a thin coal or a group of thin coals midway between No. 5 coal and No. 6 coal; and (7) No. 6 coal. This same series of coals persists into Saline and Gallatin counties, with about the same intervals and thicknesses.

Sections of the Carbondale formation.—The Survey possesses two exceptionally good sections of the Carbondale formation, one of which is in the log of the New Haven drill core shown graphically as No. 8, Plate II, and the other in the log of the diamond-drill core of a boring located in Brushy Township (T. 8 S., R. 5 E.) shown as No. 4, Plate III. Part of each of these two records and several others are shown in Plate III, which is a series of graphic sections showing the character of the Carbondale formation from west to east across the district. This plate is a continuation to the east of Plate I, Cooperative Bulletin 15, and comparison of the two illustrations shows that the stratigraphy of the two areas is about the same for this part of the Pennsylvanian system.

Thickness and kinds of strata.—The Carbondale section in District V has a thickness of about 350 to 400 feet, which is about 50 feet more than in the district to the west. There is some reason for believing that most of this difference in thickness can be accounted for in the interval between No. 5 and No. 6 coals, which is about 50 feet greater in this district than in District VI.

Of the coals of the Carbondale formation listed in a preceding paragraph, only No. 5 and No. 6 are known to be of economic importance in this area. It is not improbable, however, that some time the lower beds will be exploited, especially in the southern part of the area where they approach the surface.

The records reproduced in Plate III are nearly the extent of information concerning the character and succession of strata in the Carbondale formation below No. 5 coal. Concerning the upper part of the formation, however, there is much more information, based upon the records of between 250 and 300 drill holes, most of which penetrate both No. 5 and No. 6 coals. Of the strata intervening between the coal beds the larger part, possibly 95 per cent, is sandstone or

[1] Cady, G. H., Coal resources of District VI. Ill. Coal Mining Investigations Bull. 15, p. 21, 1916.

sandy shale. Limestone is not common, and such beds as are encountered by the drill are only 2 or 3 feet thick.

The data available from drilling records in regard to the character of the roof of No. 5 coal are presented in Table 8. Inspection of the table shows that the roof of the coal is commonly a dark shale overlain by gray shale, which is in turn overlain by sandstone and sandy shale. The sandy shale or sandstone commonly continues up to the intermediate No. 5A coal, or when this is absent up to the beds lying a few feet below No. 6 coal. These latter beds consist of limestone and the floor clay of the coal bed. The limestone is 5 feet or less in thickness, and is commonly found only in the west side of the district, especially in Galatia, Raleigh and Brushy townships (T. 8 S., Rs. 5 and 6 E., and T. 9 S., R. 5 E.)

In its effect upon coal mining one of the most important strata in the Carbondale section is a sandstone which occupies what seems to have been a channel running southward through the central part of the district in the west side of Raleigh and Harrisburg townships (Ts. 8 and 9 S., R. 6 E.). This channel was apparently formed and filled before the deposition of No. 6 coal and probably during or after the deposition of No. 5 coal. The position of the channel so far as it can be determined by the available drill records is shown by stippling on the structure map (Pl. I). The sandstone mass which fills the channel is lenticular in cross section and lies across the horizon of No. 5 coal, so that where it occurs the coal is absent. It has a maximum known thickness of about 100 feet and the base of the lens extends possibly to a depth of 50 feet below the horizon of No. 5 coal.

The northward extension of this channel sandstone has not been determined. There are apparently two branches in that direction or else the width of the deposit greatly increases. Certain irregular conditions recently encountered in No. 5 coal in the mine at Galatia suggest that possibly the sandstone "fault" as it is called may be present to the east of this mine.

Drillers operating in the east half of Galatia and Brushy townships (T. 8 S., R. 5 E.), and in the west half of Raleigh Township (T. 8 S., R. 6 E.) should be aware of the possibility that No. 5 coal may be cut out by a massive sandstone or sandy shale in these localities. Where such omission occurs the interval between No. 6 coal and the coal next underlying No. 5A coal amounts to about 60 feet more than the usual interval between No. 5 and No. 6 coals. The coal thus encountered should be correlated not with No. 5 but with No. 4 coal, the 2- to 5-foot bed commonly found 60 to 75 feet below No. 5,

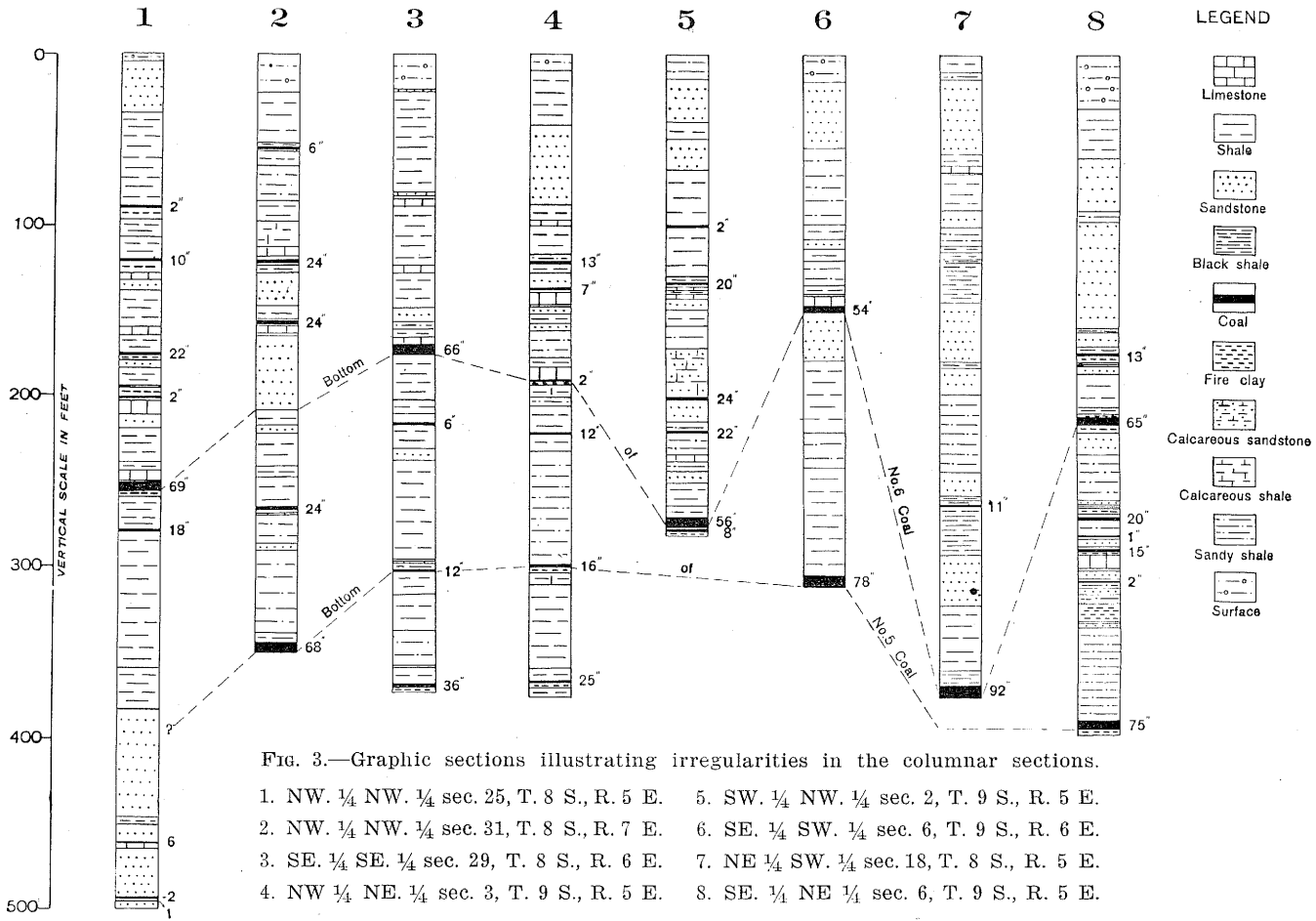

FIG. 3.—Graphic sections illustrating irregularities in the columnar sections.

1. NW. ¼ NW. ¼ sec. 25, T. 8 S., R. 5 E.
2. NW. ¼ NW. ¼ sec. 31, T. 8 S., R. 7 E.
3. SE. ¼ SE. ¼ sec. 29, T. 8 S., R. 6 E.
4. NW ¼ NE. ¼ sec. 3, T. 9 S., R. 5 E.
5. SW. ¼ NW. ¼ sec. 2, T. 9 S., R. 5 E.
6. SE. ¼ SW. ¼ sec. 6, T. 9 S., R. 6 E.
7. NE ¼ SW. ¼ sec. 18, T. 8 S., R. 5 E.
8. SE. ¼ NE ¼ sec. 6, T. 9 S., R. 5 E.

as is shown in the graphic sections presented in figure 3. To illustrate the case at hand, the reader is referred to a graphic reproduction of a drilling record shown in figure 3 (No. 1). This hole penetrates the channel sandstone and the record shows the general relation of No. 6 and No. 5A coals and also shows the next coal below, which, following the terminology of Worthen, may be called No. 4 coal. The approximate horizon of No. 5 coal is indicated.

Two other sandstone lentils in the upper part of the Carbondale formation are recognizable in places. In the central and eastern parts of the area there is a widespread sandstone, which increases in thickness eastward, lying between No. 5A and No. 6 coals. This sandstone forms the crest of the range of hills west of Equality in secs. 23 and 24, Cottage Township (T. 9 S., R. 7 E.). In the western part of the district in Galatia, Brushy, and Carriers Mills townships (Ts. 8 and 9 S., R. 5 E.), a lenticular sandstone lies approximately at the horizon of No. 5A coal. Neither of these sandstones has any special economic significance.

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

MCLEANSBORO FORMATION

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

The formation consists largely of shale with minor amounts of sandstone, limestone, and coal. Drilling in the northern part of the district is not sufficiently well distributed to allow safe generalization concerning that part of the section more than about 400 feet above No. 6 coal, but such records as are available show a general similarity with the section as revealed by drilling in Williamson and Franklin

counties. In the lower part of the formation sandstones occupy a somewhat more prominent place than they do in the district to the west.

Correlation.—Although several of the coals above No. 6 are persistent, none has been found sufficiently thick to be of commercial value. They are significant only as correlation horizons. In its barrenness of productive coals and in general age, the McLeansboro is similar to the Conemaugh formation of Pennsylvania.

Sections of the McLeansboro formation.—Knowledge of the McLeansboro formation is obtained from a large number of drill records which are rather unevenly distributed throughout the district. Within Saline County alone there are available between 250 and 300 records which show part of the McLeansboro formation, and these, as shown by the structure map, Plate I, are for most part in Ts. 8 and 9 S., Rs. 5, 6, and 7 E. These townships are probably more thoroughly explored by the drill than any other area of similar size in the mining districts of the State. In Gallatin County there are only about 20 records in all. Seven of these are oil prospects and were drilled by a churn drill, and hence are practically worthless in this study. Of the Gallatin County records, then, less than 10 furnish reliable information in regard to the McLeansboro formation. The record of the New Haven drilling in White County a short distance north of the Gallatin County line gives the best data concerning the McLeansboro formation in Gallatin County. This record has been previously referred to and is reproduced graphically as No. 8 in Plate II. The record of a drilling in Brushy Township (T. 8 S., R. 5 E.), also reproduced graphically as No. 4 in Plate II, gives an excellent section of the lower part of the McLeansboro formation which is very typical for a large part of the district. One other record selected more or less at random from among the records of drilling in Brushy Township (T. 8 S., R. 5 E.), is reproduced graphically as No. 5, Plate II, to illustrate the similarity of the section in different places, and the character of the succession.

Distinctive horizons.—Within the McLeansboro formation there are several strata that are widespread and recognizable throughout much of the district. These include sandstones, limestones, and coal beds, which are of no known economic importance and which, with the exception of those lying within a short distance above No. 6 coal, have no immediate bearing upon the mining industry. For the sake of satisfying a possible interest in the general character of the McLeansboro succession the following list of identifiable stratigraphic units is presented, which corresponds in general with the lists of units presented in Bulletins 11 and 15 of the Cooperative Series for Districts VII[1]

and VI[2] respectively. The roof of No. 6 coal is described in detail in the chapter on economic geology.

Distinctive horizons of the McLeansboro formation

13. Shoal Creek limestone; about 400 feet above No. 6 coal; generally absent.
12. No. 9 (?) coal; commonly less than 1 foot thick, 250 to 300 feet above No. 6 coal.
11. Carlinville limestone; 1 foot 2 inches to possibly 6 feet thick, about 50 feet below No. 9 coal, or 200 to 250 feet above No. 6 coal.
10. Sandstone; commonly 50 to 60 feet thick, between No. 9 and No. 8 coals.
9. No.8 (?) coal; in two beds each less than 1 foot in thickness and 35 to 50 feet apart, about 135 to 180 feet above No. 6 coal.
8. Sandstone; 10 to 45 feet thick and between 100 and 150 feet above No. 6 coal.
7. Limestone; 2 to 4 feet thick, the cap rock of the underlying coal bed.
6. Coal; 2 to 3 feet thick, widely distributed, 70 to 90 feet above No. 6 coal.
5. Coal; commonly less than 1 foot in thickness and in places in two benches separated by 10 feet or less of shale; 40 to 70 feet above No. 6 coal.
4. Limestone; lenticular, commonly less than 5 feet thick, and within 25 feet of the coal bed overlying the Anvil Rock sandstone.
3. Anvil Rock (?) sandstone; a widely distributed sandstone, 2 to 5 feet thick, corresponding in position to the Anvil Rock sandstone of Kentucky.
2. No. 7 (?) coal; a lenticular thin coal lying closely above the top of the cap rock of the No. 6 coal.
1. Limestone; cap rock of No. 6 coal, from 5 to 8 feet in thickness, either lying directly upon the coal or separated from it by rarely more than 15 feet of shale.

Regional Structure

In the chapter on economic geology, details of the structure of the coal beds as observed or as reported to exist in coal mines are considered. This part of the report attempts to indicate only the general structural characteristics of the "Coal Measures" of District V.

STRUCTURE MAP

The significance of structure and the method of preparation of a structure-contour map have been described in preceding bulletins of the series. By *structure* is meant the "lay" of the rock strata; that is, whether they are flat-lying, inclined, folded, or broken by faults. The structure-contour map is constructed as an engineer's contour map,

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

[2] Cady, G. H., Coal resources of District VI. Ill. Coal Mining Investigations Bull. 15, p. 29, 1916.

from observations made at accurately located points such as drill holes, mines, or outcrops where the elevation of the coal bed or whatever stratum is to be mapped, is determined. In these investigations the elevations of the surfaces of No. 5 and No. 6 coals are used as the bases of the structure maps (Pls. I, IV, and V). Upon the large map (Pl. I) the location of those holes, the surface elevations and locations of which have been determined by members of the State Geological Survey or by other responsible persons, are indicated by dots. Other holes, the elevations of which are estimated from elevations shown on the topographic maps, are indicated by circles. Churn drill holes are indicated by dots or circles with vertical bars, and prospects for oil by dots or circles with both horizontal and vertical bars. Records of oil prospects have been of little service in the preparation of this report as the details of the "Coal Measures" succession are not reliable or are wanting.

PARALLELISM OF "COAL MEASURES" STRATA

The large features of structure of No. 5 and No. 6 coals are essentially parallel and are thought to be those of the Pennsylvanian rocks as a whole. The beds above and below the coals parallel the coal beds in a general way, so that the structure of the coal beds is approximately the same as the srtucture of the overlying and underlying strata. This is especially true of the coal and limestone members of the "Coal Measures" series because these beds are thought to represent horizontal depositions, and the general parallelism of successive beds is to be expected. Sandstones and shale beds apparently occur in places as the filling of channels; hence their lower surfaces at least may depart from horizontality.

Although general parallelism of "Coal Measures" strata is believed to exist, the variations in interval between successive coal beds indicate that there are departures from parallelism. The unequal shrinkage of coal beds because of lack of uniformity in the thickness of the original body of peat is believed to be an important cause of local variation in the interval between coal beds. This unequal shrinkage possibly causes certain coal beds to depart from parallelism to the extent of 50 to 75 feet in District VI to the west and in this district to the amount of 25 to 50 feet. Inasmuch as the actual variation in the altitude of the coal amounts to several hundred feet the effect of these slight departures from parallelism is negligible in the delineation of the regional structure. However these departures from parallelism make it somewhat difficult to determine with exactness the true detailed structural conditions of the "Coal Measures", and produce

differences in the structure-contour maps of successive beds such as are apparent in the structure-contour maps of No. 5 and No. 6 coals (Pls. I. IV, and V). These maps represent the lay of the coal beds within certain limits of error due to inaccuracy of data. They do not, however, represent the structure of the "Coal Measures" as a whole with the same precision, since part of the irregularities shown arise not from the general movements that have affected the entire thickness of the Pennsylvanian but are due to those causes which produce variations in interval between successive beds of coal. It is believed that in general a structure-contour map based upon a coal low in the section is a more accurate delineation of "Coal Measures" structure as a whole than a structure map based upon a higher coal, provided both coals are persistent, and readily identifiable.

It has been found in the study of the regional structure of the Illinois coal beds that not only are the coals nearly parallel, but also that many structures of the "Coal Measures" strata are apparently shared by the deeper foundations. It is therefore possible to make predictions of the presence of anticlines, domes, and terraces in the strata below the "Coal Measures" where such structures are indicated on the structure map of an overlying coal bed. This agreement in the "lay" of the Pennsylvanian and pre-Pennsylvanian rocks has made possible the location of several of the important oil- and gas-producing areas of the State from a study of the coal structure, and similar studies are the basis of all advice given by the Survey relative to prospecting in new territory within the coal basin.

STRUCTURE OF DISTRICT V

RELATION TO GENERAL ILLINOIS STRUCTURE

The "Coal Measures" of Illinois occupy a spoon-shaped basin, the deepest part of which is in Hamilton, Wayne, and White counties. The long axis of the "spoon" which is pointed to the south passes near Olney in Richland County and Lovington in Moultrie County. The district under consideration lies at the south end of the "spoon", approximately on its longer axis. The general dip is to the north, although it is not regular but varies in direction and degree, and is interrupted by faults.

RELATION TO STRUCTURE OF DISTRICT VI

The structural features of District V are very similar to those of District VI and some of the irregularities of that area continue eastward into District V.

District VI lies on the west side of the axis of the Illinois coal

basin so that the general dip varies from northeast on the west side of the district to nearly north on the east side, where it joins with District V. The dip is gentle and the rate declines fairly uniformly from about 100 feet per mile in Williamson County to 25 feet or less per mile in Jefferson County. There is, however, a belt of irregular structure about 2 miles wide which crosses the district from near the Franklin-Williamson county line on the west and crosses the east boundary about 6 to 8 miles south of the County line, whence it continues apparently into Saline County. The strata are known to be faulted in certain mines in the west part of the district lying within this belt; it is believed probable that faults will eventually be discovered in the east part of the district especially in the south half of T. 8 S., R. 3 E., the south half of T. 8 S., R. 4 E., and north half of T. 9 S., R. 4 E. There is abundant evidence to indicate that this belt of irregular structure persists into District V crossing Saline and part of Gallatin County.

STRUCTURAL FEATURES OF DISTRICT V

In the following description of the structure of District V emphasis will be placed upon the irregularities. It is not the intention thereby to warn the investor or prospector from the region. The fact that in most of the district the coal is approximately level and is readily accessible to mining and that there are apparently many square miles of coal uninterrupted by important structural irregularities is of much more significance than the irregularities that affect small portions of the area. Such irregularities as do exist will probably not render the coal unminable except very locally, but unusual means will possibly need to be employed to recover the coal. It is hoped that the present report will be of service to the engineer and mining man in locating and determining more accurately the nature and position of the irregular structures to be pointed out.

The general northward dip of the rocks of this region is similar to that of the strata in District VI. Within the first six miles north of the outcrop of No. 5 coal it declines from 350 to 400 feet above sea level to between sea level and about 100 feet above. Thence northward the rate of decline is much less, amounting to 100 to 150 feet in 6 miles. The general northward inclination of the strata is interrupted by two conspicuous irregularities or belts of irregularities. One of these is the eastward continuation of the irregular belt of folding and faulting noted in the paragraph describing the structure of District VI. This belt enters the district on the west side of secs. 6 and 7, Brushy Township (T. 8 S., R. 5 E.), and continues a few degrees south of east through Brushy (T. 8 S., R. 5 E.), Harrisburg (T. 8 S., R. 6 E.),

Cottage Grove (T. 8 S., R. 7 E.), and Equality (T. 8 S., R. 8 E.) townships, possibly passing into the Shawneetown fault near the pass of the Saline River through the hills to the south. Evidence will be advanced to show that probably for that part of the belt in eastern Harrisburg and in Cottage Grove and Equality townships the irregularities are due to faulting. The other conspicuous irregularity of the area consists in a line or zone of faulting or folding running a little west of north from the pass of Saline River through the hills passing near Ridgway and Omaha. It is not possible to prove that faulting has actually taken place along this belt but this seems to be the case. The strata to the east of this structural feature lie at a considerably lower altitude than those to the west.

The following interpretation of the structure of the district can be best appreciated by reference to the structure map (Plate I) upon which the discussion is based. With the structure map at hand it will be noted that the contour lines lying between the outcrop of No. 5 coal and the 175-foot line are approximately parallel, indicating a fairly even slope of the coal down to that depth. From the position of the 175-foot contour line northward for a distance of about three miles or approximately to the line separating T. 8 S. from T. 9 S., is the belt of irregular structure noted in the preceding paragraph, in which the contour lines either show no consistent trend or are interrupted by fault lines. North of this belt the contour lines are again fairly evenly spaced and roughly parallel.

The interpretation of the structure in Brushy (T. 8 S., R. 5 E.) and western Harrisburg (T. 8 S., R. 6 E.) townships where no faults are shown is based upon the altitude of the coal as determined by drilling. Although the drill discovered significant differences in the altitude of the coal the holes are not sufficiently closely spaced to actually establish the existence of a fault between any two of them, and as yet there has been no mining in this part of the belt. Accordingly on the structure map (Plate I) the differences in altitude are assumed to be due to folding rather than to faulting.

In order that the possibility of faulting may be given proper weight a structure map of parts of Brushy, Carriers Mills, Raleigh and Harrisburg townships is presented showing the possible position of faults not actually known to exist (Plate V). In deciding upon the position of the faults the relative elevation of the coal at closely adjacent holes was the chief criterion, but the general dip in each of the faulted portions was preserved so that as a rule the coal is shown dipping northward from the fault lines. The map is submitted to illustrate how the differences in elevation may be accounted for, assuming faults

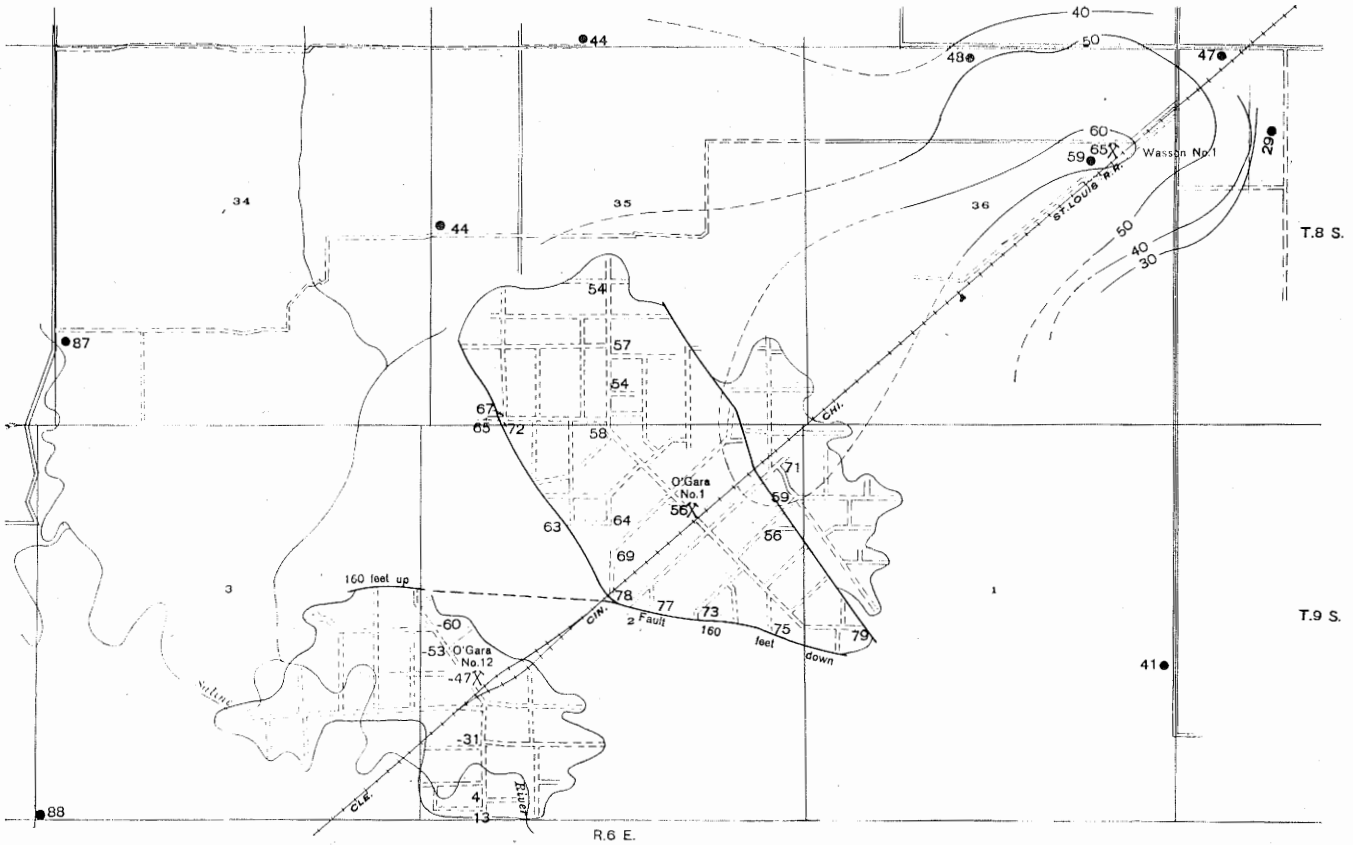

FIG. 4.—Map showing faults and structure in mine No. 12, Harrisburg Big Muddy Coal Company, mine No. 1, O'Gara Coal Company, and mine No. 1, Wasson Coal Company.

to be present; but it is largely a matter of chance if later development work discovers faults where they are indicated on the map. It is the belief of the writer that the development of the coal resources of the region should proceed in accordance with the possibility that there are faults in certain parts of the area.

The following paragraphs discuss the evidence of faulting as shown on the map in the eastern part of the district.

Harrisburg fault.—The existence of a fault north of Harrisburg having a throw of 100 to 150 feet is determined by phenomena encountered in mine No. 1 of the O'Gara Coal Co. and mine No. 12 of the Harrisburg Big Muddy Coal Co. (see figure 4). Mine No. 12 is located in secs. 2 and 3, Harrisburg Township (T. 9 S., R. 6 E), south of the fault, and mine No. 1 in sec. 2, Harrisburg Township, and sec. 35, Raleigh Township (T. 8 S., R. 6 E.), north of the fault. The workings of mine No. 1 extend along the fault for more than one-half mile, the coal near the fault line in one place having an altitude of about 75 feet above sea level. The workings of mine No. 12 extend along the fault line on the south side in the NE. ¼, NE. ¼, sec. 3, Harrisburg Township (T. 9 S., R. 6 E.), where the coal is 72 feet below sea level. The coal dips north in mine No. 12 toward the fault at the rate of about 85 feet in about one-half mile. A bore hole is said to have found coal north of the fault in the NE. ¼, NE. ¼, sec. 3 about 100 feet above its altitude in the mine to the south; the record of this drill hole is, however, not available.

From the evidence at these two mines the fault can be projected about 1¼ miles, from the NW. ¼, SW. ¼, sec. 1 to the NE. ¼, NE. ¼, sec. 3, Harrisburg Township (T. 9 S., R. 6 E.). It is believed, however, that the fault continues in a direction slightly south of east from its observed position in the mines through Cottage Grove (T. 9 S., R. 7 E.) and possibly also through Equality (T. 9 S., R. 8 E.) townships. The evidence that this is the case consists in the differences noted in the altitude of the coal in drill holes and outcrops on either side of the proposed position of the fault. The data are presented in the following paragraph.

Continuing eastward from mine No. 1, No. 5 coal is encountered in sec. 12 Harrisburg township at an altitude of 12 feet (See Plate I); about 1 mile northeast in sec. 6 the coal has an altitude of 46 feet. Again, in sec. 7 of Cottage Township the coal lies at an altitude of 117 feet. The fault probably extends eastward between the hole in sec. 12 and those in secs. 1 and 7. In the south half of sec. 8, Cottage Township the coal is found at an altitude of 77 feet, whereas about ½-mile northeast in sec. 9 it has an altitude of 193 feet. The fault is

believed to pass between these two holes. It should be stated, however, that the hole in sec. 8 passes through a coal which lies at an altitude of 192 feet, and did not test strata below the coal. The correlation of this coal becomes a matter of considerable importance in determining the position of the fault line. However, the facts that the coal is thicker than No. 5 as commonly found in the immediate region and that it has a limestone cap-rock within 5 feet of the coal together with the character and position of certain limestone and coal strata within 100 feet above the coal, point to its correct correlation with No. 6 coal rather than with No. 5. But whether the coal is No. 5 or No. 6 it is believed that the fault line passes near this drill hole, south of it if the coal is No. 5 and north of it if the coal is No. 6. The evidence of faulting is not so good, however, if the coal is correlated with No. 5. A hole in sec. 15 passes through No. 5 coal at an altitude of 143 feet. No. 6 coal outcrops at Cottage Grove directly north at an altitude of 420 feet, No. 5 coal accordingly being at an altitude of about 300 feet. There is little doubt that a fault passes south of Cottage Grove and north of the drill hole and it is thought to be continuous with the Harrisburg fault. Examination of the hill known as "Quarry Hill" in secs. 15 and 16, which is believed to lie south of the fault, failed to locate No. 6 coal in outcrop. It is believed that the coal is present below the general level of the swamp land as would be expected were it on the down-throw side of the fault.

No. 5 coal outcrops around the range of hills in secs. 23 and 24, Cottage Township, reaching an altitude of about 450 feet on the south side of the hill in the NW. ¼ sec. 24. The old Cassells and Temple mine drifted into the base of the hill in the NE. ¼, sec. 24, presumably at an altitude of about 375 feet. About 1 mile east at the West Side mine at Equality the coal is about 100 feet lower. These differences in altitude seem to be due to faulting especially as the observed dip of the coal does not appear to agree with the differences in altitude of the coal at the localities noted. It is thought that the difference in the altitude of the coal at the West Side mine and the Cassells and Temple mine is probably due to off-set along the continuation of the Harrisburg fault.

It will be noted that the displacement along the fault line changes from a down-throw on the south side near Harrisburg to an up-throw on the same side near Equality. That the fault continues to and coalesces with the Shawneetown fault at the base of the "mountains" southeast of Equality is suspected but has not been definitely determined.

The possible Ridgway-Omaha fault.—The existence of a fault

passing nearly north and south near Ridgway and Omaha is strongly suggested by differences in the altitude of the coal on the two sides of the suggested line or zone of displacement. Thus the coal is 112 feet below sea level at Omaha and 364 feet below sea level 2½ miles east. In sec. 28, North Fork Township (T. 8 S., R. 8 E.), No. 5 coal was found at an altitude of 14 feet above sea level whereas two miles east what is thought to be No. 5 was found in an oil prospect 480 feet below sea level. Whether or not this record is reliable the great depth of the coal in the east part of the county is indicated by the fact that it was found in a diamond drill hole in sec. 20, Ridgway Township (T. 8 S., R. 9 E.), 2½ miles east of the oil prospect noted above, 378 feet below sea level.

The southward continuation of the fault or sharp fold into Equality Township (T. 9 S., R. 8 E.) is indicated by borings in secs. 1 and 2 and others in the vicinity of Junction. In sec. 2 No. 6 coal was penetrated in a boring at an altitude of 249 feet; in sec. 1 there are two drill holes in the north half of the section, in the northern one of which No. 6 coal was penetrated at an altitude of 208 feet and in the other at 188 feet. This difference along the normal direction of strike is possibly indicative of faulting.

Three drill holes in the vicinity of Junction in sec. 24, Equality Township, penetrated a coal reported to lie at an altitude of 115 to 165 feet above sea level which is thought to be No. 5. The No. 6 coal was penetrated about 120 feet higher in the section. Assuming the higher altitude of 165 feet to be the correct one there exists a difference of about 200 feet in the altitude of the coal in sec. 24 and at the mine at Hickory Hill in sec. 23. The fact that this difference is along the normal direction of strike is fairly indicative of the existence of a fault or sharp fold between the two points.

It is also probably significant that the "3-foot" coal or upper bench of No. 2 coal was penetrated in drilling in the SE. ¼ sec. 25 at an altitude of 325 feet. It seems probable that this drill hole is located on the up-throw side of the fault.

Minor structural irregularities.—There are certain other relationships with respect to the altitude of the coal in Cottage and Equality townships that suggest faulting. Thus the difference in the altitude of the coal of about 100 feet in the north half of sec. 1, Cottage Township (T. 9 S., R. 7 E.) may be the result of faulting. There is also possibly a difference in the altitude of the coal in the S. ½ sec. 10, Equality Township (T. 9 S., R. 8 E.) of which faulting may be the cause. An abandoned mine opened by Dr. L. W. Gordon found No. 6 coal at an altitude of 315 feet in the N.W. ¼ sec. 10. No. 5 coal was

found by drilling, at an altitude of 195 feet. A drill hole located in the N. ½ sec. 15 is reported to pass through the two benches of No. 2 coal, the upper bench lying at an altitude of 185 feet. No. 5 if present would have an altitude of at least 390 feet. A difference of 200 feet in the altitude of the coal within a distance of less than one mile is unusual and if it actually exists may be partly effected by faulting.

Small faults most of which are not continuous more than a few hundred feet are rather common in the coal mines of the area. These local faults will be described in greater detail in the chapter that follows on economic geology. One fault, however, near Eldorado seems to be present in several of the mines and is probably of more than local significance. This fault or faulted zone parallels the L. & N. Railroad and is found in mine No. 3 of the Dering Mines Co., in mine No. 8 of the O'Gara Coal Co., and possibly in mine No. 6 of the Saline County Coal Co. It is understood that the workings on the west side of the Dering mine terminate at the fault. In mine No. 8 an up-throw to the east of 8 feet is reported. In this mine the main fault is apparently accompanied by others that are less persistent. In mine No. 6 at Grayson a fault is reported which is apparently the extension of the one found in mine No. 8 but particulars are not known.

REGIONAL STRUCTURE AND MINING

The regional structure so far as it involves merely the relatively gentle northward dip of the strata typical of most of the district has no harmful effect upon mining. A general dip of this character is probably of benefit rather than otherwise as it provides a natural slope for drainage where that is necessary and may be of service in furnishing advantageous haulage gradients. Local structural irregularities, however, as will be shown in the section on economic geology, may more than offset this regional dip. In the relatively small part of the area where faults are possibly present or are known to be present numerous irregularities may exist, the character and extent of which depend upon the amount and frequency of faulting.

IGNEOUS ACTIVITY

DIKES

As shown on the structure-contour may (Plate I), various mines have encountered igneous dikes cutting No. 5 coal. This rock is not known to outcrop in the area and has not been identified in drill cores, but specimens collected in the mines show a resemblance to the dark-colored igneous rock of rather common occurrence in Pope and Hardin counties and in adjacent parts of western Kentucky. Most of the dikes extend beyond the workings of the mines in which they are found.

Mine No. 3 of the O'Gara Coal Co., and mine No. 3 of the Saline County Coal Co., are both crossed by the same dike which accordingly has a horizontal extension of at least 1½ miles.

One dike at least is known to be located along a fault line, the fault extending beyond the end of the dike. In mine No. 2 of the J. K. Dering Coal Co., movement has taken place along the side of the dike. These relationships make it difficult to establish the time relation between the faulting and intrusion. It is not improbable that intrusion was accompanied by faulting and that there has been also later movement.

The general trend of the dikes is northward, and the width of the intrusions is commonly less than 50 feet although there are certain dikes that exceed that width. Although it is suspected that the dikes traverse the region rather generally, so far as is known none has been encountered in drilling except in the immediate vicinity of the mines. The character of the rock is such that it rapidly disintegrates under the effect of the weathering agencies, which probably explains the failure to find it in outcrop.

More detailed description of the dikes and the effect of their intrusion upon the coal beds will form part of the ensuing chapter on economic geology of the coals.

CHAPTER III—ECONOMIC GEOLOGY OF THE COALS

General Statement

The minimum thickness of coal beds mined in the United States is about 15 inches, but varies according to the rank of the coal, being approximately 2 feet in sub-bituminous coal and 3 feet in lignite. The maximum percentage of ash permissible in a coal is more difficult to determine on account of the variability of the factors involved in the cleaning of such coal for the market. Thirty per cent has been regarded[1] as the limit, with a question as to whether or not it had better be placed at 25 per cent. The deepest coal mines in the world (in Belgium) go to a depth of approximately 4,000 feet, but the U. S. Geological Survey has set a depth of 3,000 feet as the limit for easily minable coal, in estimating coal resources.

In view of the preceding statements, it is obvious that any two-foot bed of coal in the coal-bearing rocks of this region may be minable at some time, since the extreme thickness of the Pennsylvanian series is only about 2,000 feet. Indeed, it is possible that even thinner beds at shallow depths may be exploited, especially where associated with the bituminous shale from which oil and gas can be distilled.

The total average thickness of all coal beds including and underlying No. 9 coal in this district probably amounts to about 30 feet in many places. The number of beds amounts to possibly 25, the majority of which are less than one foot in thickness.

The present chapter will attempt to summarize the economic possibilities of the various coal beds underlying the district, especially as concerns the thickness of the beds, the physical character of the coal, roof and floor, and the structural conditions attending the various seams as far as information is available.

Pottsville Coals

The Pottsville coals apparently occur within a series of shales that lie below, between, and above the three heavy Pottsville sandstones. Such a succession is met with in southern Williamson and Saline counties south of the fault, as reported by Dr. A. D. Brokaw.[2] The Pottsville coals seem to be of lenticular character and of local development. The succession of coals from above downward is as follows:

[1] Campbell, M. R., Future of coal: Mining Congress Journal, vol. II, p. 351, 1916.

[2] Brokaw, A. D., Oil investigations in parts of Saline, Williamson, Pope, and Johnson counties: Ill. State Geol. Survey Bull. 35, pp. 24–37, 1917.

1. Coals between No. 2 coal and the Curlew sandstone.
2. Coals between the Curlew and the middle (Finnie?) sandstone.
   Curlew coal.
   Ice House coal.
3. Coals between the middle (Finnie?) sandstone and lowest sandstone (Caseyville conglomerate).
   Position of the Bell, Battery Rock, Cook and Caseyville coals, and possibly other local beds.
4. Coals below the Caseyville conglomerate coal in the New Haven record.

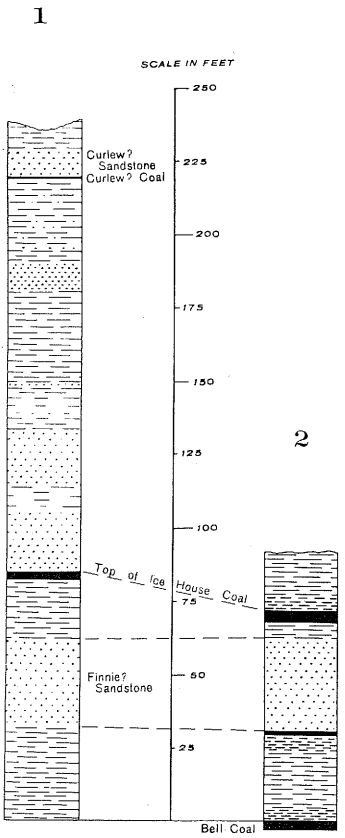

FIG. 5.—Graphic sections including the Ice House and Bell coals.

Between No. 2 coal and the sandstone thought to be the Curlew sandstone of Kentucky there appear to be commonly several thin beds a foot or less in thickness. The record of the well at New Haven

shows three such coals, a well near the central part of the district encountered three, and a well in the eastern part of the area found but one. It is doubtful whether coals at this horizon will ever prove to be of commercial value in this region.

If any coals below the Curlew sandstone are of workable thickness in this region it is not improbable that they will be found toward the southern part of the area. In the Eagle Valley region there is at least local development to a workable thickness of beds thought to be the equivalent of the Bell and Ice House coals in western Kentucky. In the central part of District V there is one hole which encountered a coal 3 feet 10 inches in thickness at the proper distance below No. 2 coal to be the Curlew. Thus there seems to be evidence that some of the Pottsville coals may be of commercial thickness in this region.

The accompanying graphic sections (fig. 5) include the Ice House and Bell coals, as measured by Mr. F. H. Kay in the SW. ¼ SW. ¼ sec 23, T. 10 S., R. 7 E., a few miles south of District V. Both coals are provided with a black slate roof. The thickness of the Bell coal is shown as 3 feet 9 inches and the Ice House coal as 3 feet 6 inches. The Bell coal in the region is described as being a very hard coal, black and bright, and apparently of a good quality. The generalization for Illinois coals that the older the coal the better is its quality, seems to be applicable to the Bell coal.

The Ice House coal at the Craig and Willis mine is described by Mr. Kay as being very slabby, but of good quality. It is somewhat more in the nature of a cannel coal than are most of the Illinois coals.

TABLE 3.—*Analyses of the Ice House and Bell coals of southern Saline and Gallatin counties*

(Figures are for coal as received)

Mine	Coal	Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	B. t. u.
Willis	Ice House	7.15	34.34	53.32	5.19	.84	13,035
Willis	Ice House	4.73	33.91	49.65	11.71	4.78	12,492
Colbert	Bell	3.40	33.33	55.18	8.09	4.25	13,401

These analyses indicate that the coal has a relatively high B. t. u. value as compared with other Illinois coals. This seems to be due in part at least to the relatively low moisture content and the relatively high percentage of fixed carbon. The relation of these coals to other Illinois coals can be determined by a comparison of the figures given above with those shown on Plate IX.

Two analyses of the Bell coal in Kentucky are given below for comparison.[1] It will be noted that this coal is very similar in character in the two states.

TABLE 4.—*Analyses of the Bell coal of Kentucky*

(Figures are for coal as received)

Mine	Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	B. t. u.
Barnaby.....	4.42	36.77	51.12	7.69	3.43	13,286
Newcome.....	4.38	35.88	52.94	6.80	3.43	13,439

The coal below the Caseyville conglomerate appears only in the log of the well at New Haven in White County, where it is recorded as shaly coal and coaly shale. It is of very doubtful value and of unknown extent.

The relative position of the Pottsville coals and their relation to the upper coal beds have been described in detail in the chapter on stratigraphy and are shown graphically in the columnar sections (Pl. II.)

CARBONDALE COALS

NO. 2 COAL

Records are available of ten diamond-drill borings in or very near this district which are thought to reach No. 2 coal. This seam is the one worked in the vicinity of Murphysboro, in Jackson County, and from this town has received its place name, the Murphysboro coal. The bed in the Jackson County district is in two benches separated by shale varying in thickness from a knife edge to 35 feet or more.[2] As a rule the lower bench is the thicker, four feet being a common thickness. whereas the upper bench is three feet or less in thickness. There is considerable variation in the thickness of the benches and of the intermediate shale. This intermediate shale is commonly black and fissile, and is the miners' "black slate." Murphysboro or No. 2 coal can be traced through Williamson County, although nowhere else is it known to be as valuable as at Murphysboro.

In Plate VI are shown various sections of this coal at different

[1] Lee, Wallace. Geology of the Kentucky part of the Shawneetown quadrangle, Kentucky Geol. Survey, Table No. 4, 1916.

[2] Cady, G. H., Coal resources of District II: Ill. Coal Mining Investigations Bull. 16, 1917.

places in the southern part of the State. Numbers 1 and 2 are sections observed in mines in Jackson County; numbers 3, 4, and 5 are sections based upon drilling records in Williamson County. The remaining sections are from records of holes in this district, two from Saline County and five from Gallatin County.

In southern Gallatin County this coal can be observed in outcrop. Here, as in places in Jackson County, the seam is in two benches, separated by 15 to 40 feet of strata, and is apparently less commonly regarded as a single coal. In the Eagle Valley region and in western Kentucky the lower bench is known as the "Four foot," and the upper bench as the "Three foot." As suggested by their local names, the lower bed is commonly about 4 feet in thickness (3 feet 6 inches to 4 feet) and the upper coal about 3 feet in thickness (2 feet 9 inches to 3 feet 6 inches).

Most records (see Plate VI) report a dark to black shale above the lower coal as in the Jackson County region. This black shale is in places at least very carbonaceous and may be of some commercial value as an oil shale, though such is not known to be the case. Inasmuch as recent drilling at widely separated points in the district has shown that this coal is practically always present, the drilling of any block of leases within the district should include testing for the presence of these lower coals. The interval between No. 2 and No. 6 coals is only about 350 feet, and before many years the exploitation of a three- or four-foot bed at a depth of 350 feet or less may be entirely practicable for this area. South of the outcrop of No. 6 coal, the No. 2 seam is in general at a depth of less than 350 feet. The approximate outcrop of the coal is indicated on Plate III.

In heating quality the Murphysboro (No. 2) coal in Jackson County is among the best in the State, better coal being known only in the Eagle Valley region. Its comparative position among the Illinois coals is shown by the diagram, Plate IX, and in the table of comparative heating values of the various Illinois coals (Table 14). No analyses of No. 2 coal from Saline and Gallatin counties are available, but three analyses of the Davis, "Four foot," or No. 6 coal of Kentucky, which is the same as the lower bench of No. 2 coal in District V in Illinois, are presented to show approximately the character of this coal in Illinois.

Comparison of these analyses (with those given in Table 3 and Plate IX) indicates that the "Four foot" or lower bench of No. 2 coal is of slightly better quality in Kentucky than the Murphysboro coal, but that it is somewhat lower in B. t. u. value than the Bell and Ice House coals.

COALS BETWEEN NO. 2 AND NO. 5 COALS

Three thin beds of coal, two of which are possibly in places of economic value, lie between the Murphysboro (No. 2) and Harrisburg (No. 5) coal beds. Coals, probably the same, are recorded in various records of drilling in District VI to the west. The lowest of these lies 40 to 60 feet above No. 2 coal, or 180 to 210 feet below No. 5, the middle one 100 to 110 feet below No. 5 coal, and the upper one about 70 feet below No. 5 coal. The interval between the lowest and middle of these coal beds averages about 70 feet. The lowest bed is commonly thin and of no value, but in a record of a boring in Omaha Township (T. 7 S., R. 8 E.), it is reported as being 2 feet 5 inches in thickness. The intermediate bed is apparently always one foot or less

TABLE 5.—*Analyses of Davis or No. 6 coal from Union County, Kentucky* [a]

(Figures are for coal as received)

Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	B. t. u.
4.36	37.94	50.97	6.73	2.17	13,338
4.43	37.13	49.60	8.84	2.66	13,003
4.47	36.87	49.82	8.84	2.95	12,962
Average 4.42	37.31	50.13	8.13	2.59	13,101

[a] Kentucky Geological Survey, 4th Series, Vol. II, Pt. I, 378–380, 1914.

in thickness. The upper bed has a thickness of about 2 feet 6 inches and will possibly be of commercial value in places eventually. This coal is believed to be the same as the original No. 4 of the Gallatin County section of the "Coal Measures," proposed by E. T. Cox.[1]

NO. 5 COAL

Nearly the entire output of coal from Saline and Gallatin counties is obtained from the No. 5 (Harrisburg) coal. Within this district this coal attains a thickness of 9 feet in at least one place. Because of the high quality of the coal and favorable conditions of recovery, coal mining is especially profitable in this field.

DEPTH AND DISTRIBUTION

No. 5 coal is known to lie at an altitude of 363 feet below sea level at New Haven near the northeast corner of Gallatin County. This is at a depth of about 770 feet below the surface. At West End, near the northwest corner of Saline County, the coal lies at an altitude

[1] Cox, E. T., Gallatin County: Geol. Survey of Illinois; vol. VI, p. 202, 1875.

of 330 feet below sea level or 780 feet below the surface. It is probable that in the hilly country north of Galatia the coal lies at a depth of 825 to 850 feet. None of these depths are prohibitive in the development of a bed of the usual thickness and quality of No. 5 coal. The

TABLE 6.—*Thicknesses of No. 5 coal in Saline and Gallatin counties as determined by drilling*

Location			Number of drill holes	Thickness
Sec.	T. S.	R. E.		
Saline County—				*Inches*
19 and 20	8	5	7	51 to 62
25 to 27	8	5	8	55 to 84
28 and 29	8	5	6	51 to 62
30, 31, 33, 34 and 35	8	5	7	27 to 80
15, 22 to 25	8	6	9	38 to 67
26 to 29	8	6	8	6 to 62
33 to 36	8	6	9	56 to 66
10, 14, 15, 17 and 19	8	7	6	50 to 75
22, 23, 27, 28, 31, 32 and 34	8	7	8	49 to 75
1 to 4	9	5	10	16 to 76
5 to 9	9	5	9	52 to 78
10 to 13	9	5	7	(17?) 56 to 91
14 to 18	9	5	9	52 to 104
19 to 22	9	5	..	(6?) 48 to 86
23 to 26	9	5	13	33 to 76
34 and 36	9	5	16	29 to 68
1, 2, 4 and 5	9	6	8	54 to 71
6 to 10	9	6	8	48 to 78
11 to 16	9	6	10	52 to 81
17 to 19	9	6	10	(27?) 36 to 87
23 to 25	9	6	7	24 to 66
27, 28 and 30	9	6	7	16 to 63
31	9	6	9	55 to 92 (110?)
32, 33 and 36	9	6	10	47 to 90
2 to 5	9	7	7	36 to 63
6 to 10	9	7	6	54 to 61
11, 15, 16, 17, 18 and 19	9	7	7	50 to 62
20, 21, 22 and 27	9	7	5	30 to 57
Gallatin County—				
...	7	8, 9	7	52 to 59
...	8	8, 9		24 to 69
...	9	8, 9		53 to 56

deepest mine in No. 5 coal in the area, located at Galatia, reaches the coal at a depth of 485 feet.

No. 5 coal is found in District V north of its outcrop practically wherever borings have penetrated to a sufficient depth. There is, however, a strip barren of No. 5 coal lying near the west side of Raleigh and Harrisburg townships (Ts. 8 and 9 S., R. 6 E.) (see Plate I). The sandstone lens which cuts out the coal in this strip has been described on a previous page and the possibility of its being a channel deposit mentioned. This interruption in the continuity of the bed is the most serious one known in the district, and prospecting and development work in western Raleigh and eastern Galatia townships (T. 8 S., Rs. 5 and 6 E.) and even in Tate and Long Branch townships (T. 7 S., Rs. 5 and 6 E.) should be guided by the possibility of the northward extension of this irregularity or "fault," as it is called.

No. 5 (Harrisburg) coal is probably the equivalent of the Springfield, Fulton County, and Peoria County No. 5 coal, and of the "Middle Vein" coal in the La Salle region. Except for local variations it is very regular in thickness over the entire State, varying from 4 to 6 feet.

INTERVAL BETWEEN NO. 5 AND NO. 6 COALS

The interval between No. 5 and No. 6 coals varies from less than 100 feet in the west to more than 150 feet in the central part of the district. In the eastern part of the district the interval gradually decreases to about 110 feet. In general the interval between the two coals increases or decreases with the thickness of the lower coal.

THICKNESS

Table 6 gives detailed information in regard to the thickness of the bed as determined by drilling. The depth to the coal at the various mines and drill holes is presented in tabulated form in the appendix. In this table the thickness of the coal is also given if such information is not confidential. Inspection of the data will show that the thickness of the coal varies from less than 1 foot to possibly about 9 feet.

Sections of No. 5 coal measured in various mines of the district are shown graphically in Plate VII. These and other sections measured by the members of the Survey and Cooperative Mining Investigations are printed in detail in the following pages.

MEASURED SECTIONS OF NO. 5 COAL

DERING MINES CO. MINE NO. 3, NEAR ELDORADO[1]

Section 1—Room 13, off 6th west entry off south

(See Plate VII, No. 1)

	Thickness	
	Ft.	*in.*
Bone coal	..	1½
Coal, dull and glance	..	10½
Coal, as above with knife edges of "mother coal"	1	..
Coal, dull and glance	1	6
Coal with bands of "mother coal"	..	3
Coal	..	11
	4	8

Section 2—Room 1 of 1st east entry off south

Coal, dull and glance with one small sulphur lens	1	6
Coal, with a few streaks of charcoal	2	8
Sulphur streak	..	..
Coal	..	10
	5	

HARRISBURG BIG MUDDY COAL CO., MINE NO. 14, NEAR HARRISBURG

Room 3 off 2d east entry off main north entry 1,300 feet northeast of shaft

(See Plate VII, No. 2)

	Thickness	
	Ft.	*in.*
Coal	5	11

[1] Formerly Eldorado Coal and Mining Co., mine No. 1.

O'GARA COAL CO., MINE NO. 4, NEAR HARRISBURG

Section 1—Entry 8 south off main east[1]

(See Plate VI, No. 4)

	Thickness	
	Ft.	*in.*
Coal	..	8½
Sulphur	..	3/16
Coal	1	9¼
Sulphur	..	⅜
Coal	..	5⅛
Sulphur	..	5/16
Coal	..	5½
Sulphur	..	¼
"Mother coal" streak	..	..
Coal	..	5¾
Sulphur	..	¾
Coal	..	4
Sulphur	..	1/16
Coal	..	8
Sulphur	..	⅜
Coal	..	5 5/16
Sulphur	..	5/16
Coal	..	8
	6	2 1/16

O'GARA COAL CO., MINE NO. 4, NEAR HARRISBURG

Section 2

Coal with small sulphur streak	..	8
Dirt	..	¾
Coal	1	1¼
"Mother coal"	..	½
Coal	..	6½
Sulhpur and dirt streak	..	..
Coal with thin streaks of dirt and sulphur	..	6
Shale, gray	..	3
Coal, clean	..	6
"Mother coal"	..	¼
Coal, banded	..	7¾
Coal with thin streaks of "mother coal"	..	6
Coal with plates of sulphur on faces	1	5
	6	3

Section 3

Coal, very good, clean	7	6

[1] U. S. Bureau of Mines Bull. 22, Pt. II, p. 508, 1913.

O'GARA COAL CO., MINE NO. 8, NEAR ELDORADO

Room 1 off 1st north entry 700 feet east of shaft

(See Plate VII, No. 6)

	Thickness	
	Ft.	*in.*
Coal	4	9½

O'GARA COAL CO., MINE NO. 9, NEAR HARRISBURG

Section 1—Fourth south entry off 4th east south

	Thickness	
	Ft.	*in.*
Top bench	1	1
Lower bench; coal laminated and filled with slips; considerable calcite	6	..
	7	1

Section 2—Face 10th east entry off main south

Top coal	1	1
Lower bench	4	..
	5	1

Section 3—Room off the 3d southeast entry

(See Plate VII, No. 7)

Bone coal	..	3
Coal, variable thickness	..	10
Parting	..	..
Coal	5	8
	6	9

HARRISBURG BIG MUDDY COAL CO., MINE NO. 12, NEAR HARRISBURG

Room 1 off 2 east entry off north entry

(See Plate VII, No. 8)

	Thickness	
	Ft.	*in.*
Coal	2	3
Sulphur	..	1
Coal	2	8
	5	

SALINE COUNTY COAL CO., MINE NO. 2, NEAR CARRIERS MILLS

Room 4 off 1st west entry off main south, 350 feet northwest of shaft

(See Plate VII, No. 9)

	Thickness	
	Ft.	*in.*
Coal	..	10
Sulphur	..	1/6
Coal	6	6
	7	4 1/6

SALINE COUNTY COAL CO., MINE NO. 3, NEAR HARRISBURG

Section 1—Face of main east entry

	Thickness Ft.	in.
Coal, very bright, hard glance and dull coal, contains sulphur bands and "mother coal" layers; harder at bottom.....	6	6

Section 2—Room 1 off the 2d southeast entry

(See Plate VII, No. 3)

Top coal; glance and dull coal mixed; very few bands of glance coal and a little sulphur. Harder than bottom coal	..	11
Parting—		
Coal, soft; a mixture of coal and partings of bone.....	..	7½
Coal, same as in section 1.....	4	7
	6	1½

Section 3—Face of the main west air course

(See Plate VII, No. 10)

Top coal, hard	..	6
Coal, laminated, with considerable bone and some clay bands and lenses	1	4
Bottom bench	4	10
	6	8

SALINE COUNTY COAL CO., NO. 6 MINE NEAR ELDORADO

Entry face off the 5th north entry off the main west, 2,000 feet from shaft

(See Plate VII, No. 11)

	Thickness Ft.	in.
Coal, bright	2	9
Sulphur band	..	1
Coal, bright	..	6
"Mother coal"	..	1
Coal, bright	1	7
	5	

WASSON COAL CO., MINE NO. 1, NEAR HARRISBURG

Room face, 1st and 2d north off main west entry, 1,500 feet from shaft

(See Plate VII, No. 12)

	Thickness Ft.	in.
Coal, bright	..	8
Sulphur streak	..	1½
Coal, bright	4	5
	5	2½

GALLATIN COAL AND COKE CO., MINE NO. 1, NEAR EQUALITY

Room 16 off 2d north main entry, 5,000 feet northeast of shaft
(See Plate VII, No. 13)

	Thickness	
	Ft.	*in.*
Coal, clean	..	10
Sulphur	..	1/16
Coal, clean	3	3/8
Sulphur	..	1/16
Coal, clean	..	10
	4	8½

DISCUSSION OF COAL SECTIONS

Coal sections such as have been presented in graphic and written form furnish a concrete picture of the thickness of the bed and also show the persistence, position, and thickness of bedded impurities, or of the various benches in the seam. Inspection of the various graphic sections will fail to reveal any persistent bedded impurity by which the coal is divided into benches, although some of the sections show a division near the top of the seam, a foot or less from the roof, which is a common plane of parting within the seam, separating an upper thin bench from a thicker bench below. Some sections show a sulphur or clay parting at this place, but in other places the parting does not seem to be accompanied by impurities.

GENERAL APPEARANCE OF NO. 5 COAL

By the Cooperative observers, the Harrisburg (No. 5) coal is commonly described as bright, and hard; very thin bands of bright or glance coal alternate with somewhat thicker bands of dull coal. Layers of mother coal a quarter of an inch or so in thickness occur here and there in the bed, and sulphur is to be seen in small balls or in thin lenses and partings. Calcite flakes along the cleavage planes are always present. In general the bed has a brighter look than the No. 6 coal and is somewhat harder. It is doubtful, however, whether there are any criteria of practical application that serve as distinguishing characteristics.

In some of the mines in the district, No. 5 coal is characterized by a rather well developed cleavage or cleat in two directions. For instance, in mine No. 9 of the O'Gara Coal Company the following cleat was observed.

Room 1, 3d north entry off 3d east south—
Cleat: N. 60° E.
N. 35° W.

5th north entry off 3d east south—
Cleat: N. 55° E.
N. 32° W.

Room 3 off 9th east, off the main south entry—
Cleat: N. 52° E.
N. 32° W.

1st north entry, off the 2d west north—
Cleat: N. 55° E.

Such cleavage is not known to be general for the district.

IRREGULARITIES OF NO. 5 COAL

The irregularities in coal beds are of three sorts: (1) bedded impurities, (2) structural irregularities, and (3) igneous intrusions.

Bedded impurities.—Bedded impurities include any material of a sedimentary character that takes the place of some of the coal. Such

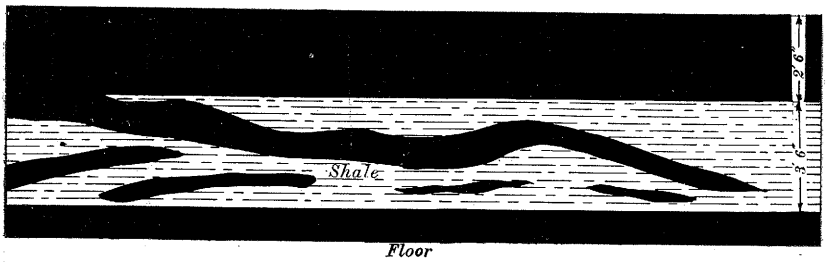

FIG. 6.—Diagrammatic illustration of bedded impurities in mine No. 7, O'Gara Coal Company, face, 2d south off 7th west. Mine not now operated.

impurities vary from thin laminae of clay, iron pyrites (sulphur), or bone, to masses of sandstone that take the place of the entire coal bed along narrow channels. Bedded impurities in No. 5 coal are of the usual character. Not uncommonly, especially in the middle of the bed, thin streaks of clay with iron pyrite are associated with rather numerous laminae of mineral charcoal or mother coal, so that the coal looks dirtier in this part of the seam (see Plate VII, No. 4) than at the top or bottom. A streak or layer of clay and sulphur a fraction of an inch in thickness is not uncommon between the upper and lower bench.

In some places bedded impurities become of serious importance. For example in the abandoned mine No. 7 of the O'Gara Coal Company at Carriers Mills, No. 5 coal in places is 7 feet 6 inches thick but about 2½ feet from the top is a bed of mixed shale and coal 3½ feet thick, separating the coal into two beds and rendering it unminable

in the parts of the mine where this occurs (see fig. 6). Similarly in mine No. 15 of the Harrisburg Saline Collieries Company and in mine No. 2 of the Saline County Coal Company a mass of clay divides the coal into two benches (see fig. 7). On the east side of mine No. 15 the clay bed attains a thickness of at least 3½ feet. The upper bench of coal is not mined when the shale becomes thicker than 3 feet, so that measurements are not available, but its thickness seems to be 11 inches very persistently. The lower bench is possibly 4 to 8 inches thinner where the clay parting is thick, but there is no very con-

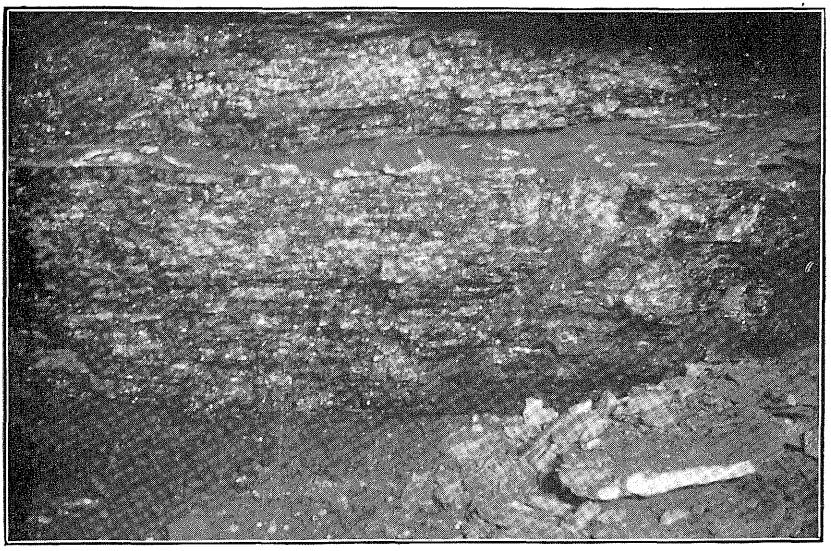

FIG. 7.—Photograph of a parting in the coal bed in mine No. 2, Saline County Coal Company.

spicuous difference in different places. On the west side of the mine a similar clay seam lies near the middle of the coal separating it into two thin beds each of which finally becomes unminable. The distribution and character of this "faulty condition" of the coal near mine No. 15 is illustrated by the graphic sections and map shown in Plate VIII. The conditions in mine No. 2 are in a limited area like those on the west and northwest side of mine No. 15. Such an interruption of the coal would possibly receive the name "fault" from the miners, but it is to be distinguished from the fault of the geologist and engineer by whom the word is used to designate a break and movement along a fracture plane.

Irregular conditions in the coal in the mine at Galatia are due to depositional impurities. Conditions here are very unusual for No. 5

coal. The lower 6 inches to nearly 3 feet of the coal contains layers of carbonaceous shale or "bone" that render that part of the bed unmarketable. The middle of the bed is generally fairly clean for a thickness of 3 to 5 feet. The upper part of the bed is again interbedded with shale the partings increasing in number and thickness to the top of the bed, which in this mine is about 6 feet thick. The actual position of the top of the bed is rather difficult to ascertain because stringers of coal apparently leading out from the coal bed can be traced to as much as 5 or 6 feet above the coal, and in places possibly as much as 10 feet. This shale contains a large amount of organic material, and impressions of leaves and stems are exceedingly numerous in the roof of the entries. In places the interbedding of coal and roof shale begins as much as 3 or 4 feet below the top of the coal and conditions similar to those characteristic of a "roll", as described later, are encountered. The shale roof in this mine is unusually treacherous and "slippy", planes of weakness apparently having been produced as a result of the differential movement between different parts of the mass during shrinkage.

Conditions in this mine are further complicated by the existence of a probable plane of erosion which crosses the horizon of the coal bed. Erosion of the roof shale and of the coal seems to have taken place on the east side of the mine along what may prove to be the extension of the sandstone "fault" discovered by drilling in the eastern part of Harrisburg Township. In the erosion channel thus formed sandstone was deposited, which in places passes through and cuts out the coal bed.

In one or two of the mines southwest of Harrisburg a bedded impurity known as "bone" appears in the upper part of the coal. In mine No. 9 of the O'Gara Coal Company this material renders the upper foot to three feet of the coal worthless. The impurity is variable in character. In places it seems to be calcareous balls or lenses up to 4 inches in diameter, containing a considerable quantity of iron sulphide. Elsewhere the upper part of the seam is a succession of thin laminae of black slate and coal. The "bone" coal is commonly crossed by many smoothed surfaces, especially where calcareous nodules are present, showing that there has been considerable adjustment between different parts of the bed.

Rolls have not the same frequency of occurrence in this bed as they have in No. 6 coal in District VI. Rolls are commonly the result of the deposition of shale similar to that composing the roof in relatively small depressions in the surface of the peat before it had consolidated into coal. The movements between the parts of the roof

overlying the coal where a roll is situated, because of the unequal thickness of the coal below the roll and the coal on all sides, tended to weaken the roof at this place and as a result "smooths" penetrate the rolls forming treacherous places to undermine. (See fig. 8.)

Removal of part of the bed possibly by erosion not long after the peat was deposited seems to explain the absence of the coal bed along the line of the channel deposits indicated on the structure-contour maps near the line separating Rs. 5 and 6 E.

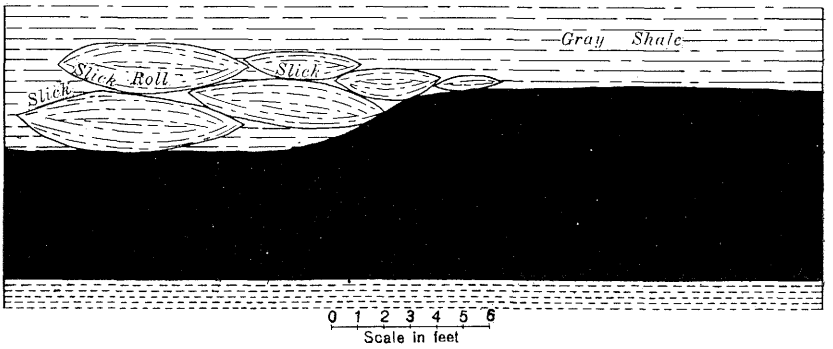

FIG. 8.—Diagrammatic illustration of rolls showing tendency of roof shale to occur in lenses with slickensided surfaces. North side of mine, 1st north, 2d west, north, mine No. 9, O'Gara Coal Company.

Structural irregularities.—Structural irregularities in the Harrisburg (No. 5) coal are of three kinds: slips, faults, and folds. The faults are apparently associated with another type of irregularity—the igneous intrusion. Slips are commonly filled with clay and are then called *clay veins.*

Slips, like rolls, are more or less common to all coal beds. They seem to be more common in coals not having a limestone roof or cap rock, of which the Harrisburg coal is an example, than in coals having a solid roof such as is typical of No. 6 coal. They are believed in places at least to be due to adjustments in the bed and associated strata accompanying the shrinkage of the coal bed. It is not improbable that this process of shrinkage produces an actual downward movement of the beds over the coal through a distance of at least five times the thickness of the coal bed below.[1] Where the coal is of uniform thickness this downward movement will be uniform over large areas, but where differences in thickness are common, differential movement will take place and one part of the roof will move against other parts. Release from pressure may in places be effected downward or

[1] Savage, T. E., Geology and mineral resources of the Springfield quadrangle, Illinois: Ill. State Geol. Survey Bull. 20, p. 118, 1915.

upward, and clay be thrust either upward or downward into cracks that have been produced in the coal bed itself. Such cracks may proceed entirely through the bed or only part way.

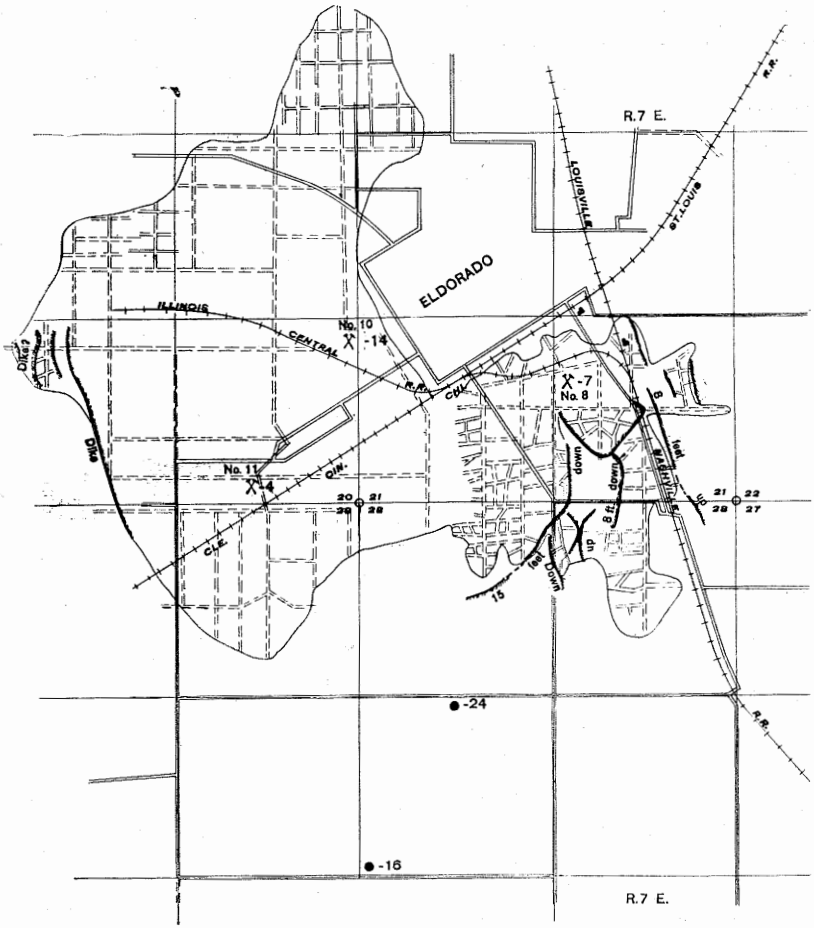

FIG. 9.—Map showing distribution of dikes and faults in and near mines No. 8, No. 10, and No. 11, O'Gara Coal Company.

The abundance of clay-filled slips in No. 5 coal is one of the common criteria of identification of the bed, although in this area such slips are not especially characteristic. The material filling one of these slips consisted of fragments of hard shale and pieces of coal in a structureless matrix of gray clay, the whole being very hard. The coal fragments contained in the slip seemed to indicate that the fracturing of the seam must have taken place after the coal had attained nearly its present hardness.

Faults are more common in this than in any other of the eight coal districts. Scarcely a mine but has one or more displacement, and between mine No. 1 of the O'Gara Coal Company and mine No. 12 of the Harrisburg Big Muddy Coal Company the coal has been offset over 100 feet. The position of the various faults is indicated on the structure map, Plate I, and figures 4 and 9 show some of these in greater detail.

Figure 10 is the reproduction of a sketch of a fault in the Dering Mines Company's mine No. 3 in the 5th west entry off the main south.

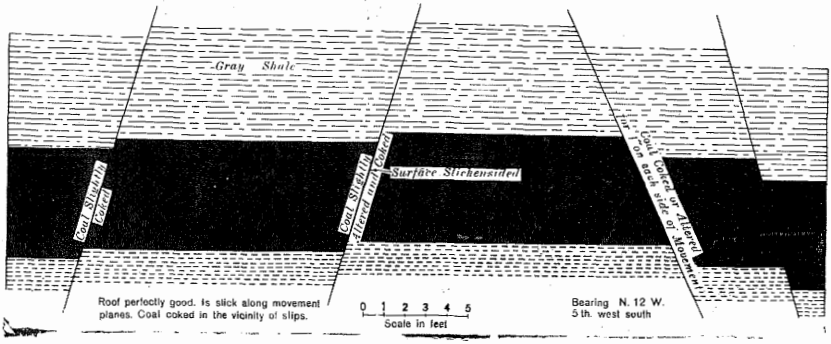

FIG. 10.—Diagrammatic illustration of faults in a coal bed in mine No. 3, Dering Mines Company. 5th west entry off the main south.

It is significant not so much in the amount of displacement as in the fact that the coal along the lines of fracture is reported to be coked, as though hot gases at some time after the faulting had traversed the fault planes.

The manner in which the faulting breaks the coal near the planes of fracture is shown in figures 11 and 12, the former from Mine No. 3 of the Saline County Coal Company, and the latter from mine No. 4 of the O'Gara Coal Company.

The faults figured above are all of the normal variety, the fault plane sloping toward the side upon which the coal is lowest. Thrust faults are apparently less common in this field than are normal faults, but at least one example has been observed in mine No. 7 of the O'Gara Coal Company near Carriers Mills.

The general trend of the fault lines in the district seems to be slightly north of west and about northeast. The same mine may be cut by several faults, one system running to the west and the other system at a more or less acute angle to it. (See figures 4 and 9.) The fault lines running east and west seem to be the more persistent and correspond to the direction of regional faulting which effects a belt across the entire southern part of the State east from Jackson County.

The relative elevations of the coal as determined by drilling in the western part of the district, is suggestive of the possibility of a north and south zone of faulting near the Williamson-Saline county line. This, however, in entirely hypothetical.

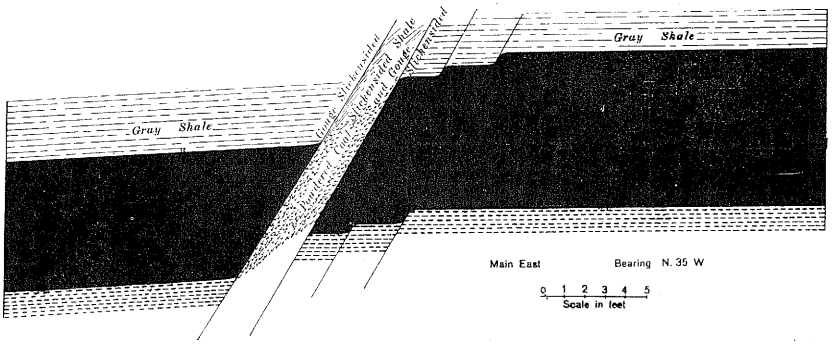

FIG. 11.—Diagrammatic illustration showing breaking of coal along faults in mine No. 3, Saline County Coal Company.

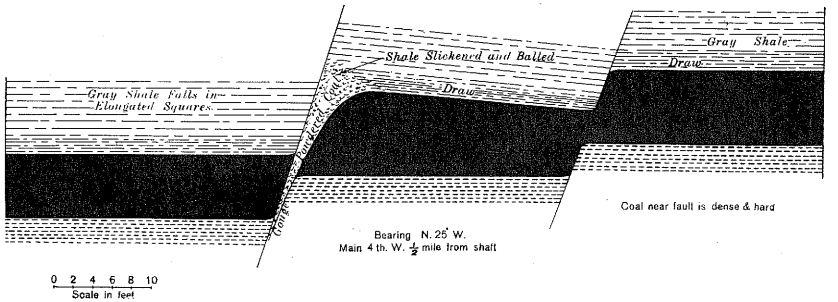

FIG. 12.—Diagrammatic illustration showing breaking of coal along faults in mine No. 4, O'Gara Coal Company.

The effect of the faults is in places merely to offset the coal bed a few inches, the coal not disappearing from the face of the entry or room. In other places, especially along the 100-foot fault, the bed is lost to the mine, and must be worked from another shaft or at least from another level in the same shaft. When a mine encounters such a fault it is commonly necessary to search for the lost bed with the drill.

In some of the mines irregularities in the level of the coal bed occur which are apparently due to flexure. For instance, in mine No. 9 of the O'Gara Coal Company, the coal bed is affected by a series of flexures, the coal thinning down a foot or so on the rises. Some of the high points apparently slope in all directions toward the "swags." Such phenomena may be due to irregularities in original deposition,

however, rather than to subsequent folding. In mine No. 12 of the Harrisburg Big Muddy Coal Company the coal slopes northward toward the large fault on the north side of the mine. The elevations of the coal at the fault and about one-half a mile south show a difference of 85 feet.

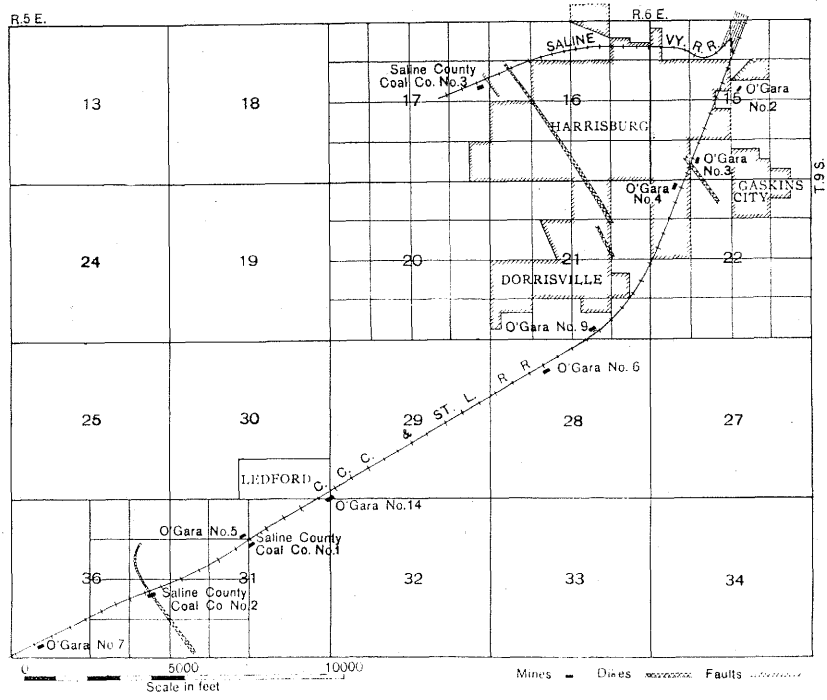

FIG. 13.—Map showing distribution of dikes and faults in the vicinity of Harrisburg.

The lay of the coal in the Wasson No. 1 mine is indicated by contours shown in figure 4. Such irregularities are probably more or less common in all the mines, the general regional northward dip not being uniform from place to place. However they offer no great obstacle to mining in the district.

Dikes.—Igneous intrusions are found in a number of the mines in the Harrisburg region from Eldorado south to Carriers Mills. Observations and sketches of the dikes have been made in six mines. The structure map (Pl. I) shows the position of these as well as of other known dikes, while the accompanying outline map of the vicinity of Harrisburg (fig. 13) shows in greater detail the general distribution of the dikes in that vicinity.

The following notes taken by observers indicate the character of the dikes in five mines.

In mine No. 3 of the Dering Mines Company (see figure 14) the line of contact between the dike and the coal is very irregular, whereas the line of contact between the roof shale and the dike is sharp. The roof adjacent to

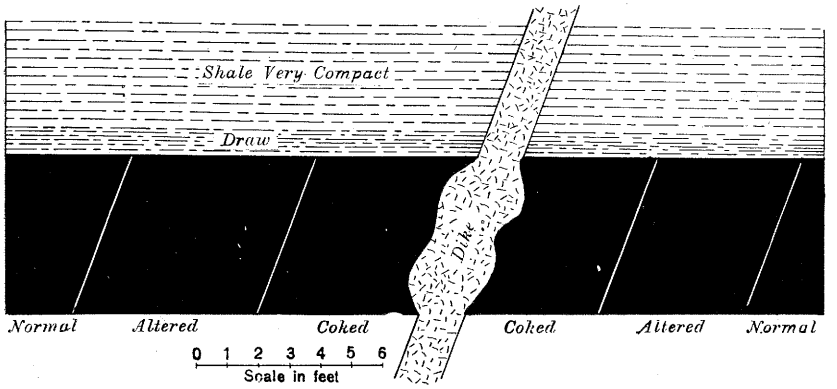

FIG. 14.—Diagrammatic illustration of a dike in mine No. 3, Dering Mines Company.

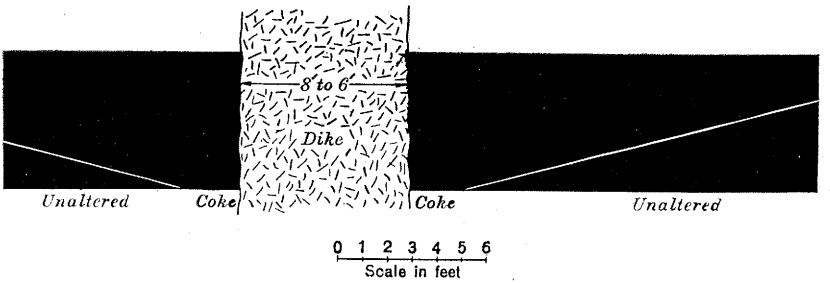

FIG. 15.—Diagrammatic illustration of a dike bearing northwest and southeast on the east side of mine No. 8, O'Gara Coal Company.

the dike is good. The coked coal on either side of the dike is cut by veins of calcite. Similar veins also traverse the dike commonly lying parallel to the dip of the dike. The intrusion is approximately parallel to a step fault that runs in a general northerly direction through the mine.

In mine No. 8 of the O'Gara Coal Company (see figure 15) a dike which is 6 to 8 feet wide occurs on the east side, bearing northwest. It is a hard, fine-grained, gray igneous rock, similar to that found in other mines. For nearly 20 feet the coal has been coked on both sides of the dike. In the coke adjacent to the intrusion are many streaks of calcite, and the contact between the dike and coal is in many places accompanied by calcite crystals.

In mine No. 2 of the Saline County Coal Company (see figure 16) a dike which has been traced for about half a mile is a very troublesome feature. At the point where it was examined it was nearly 300 feet in width. The rock is highly crystalline with micas and ferromagnesian minerals

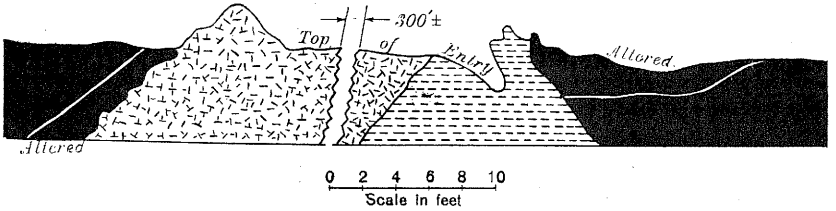

FIG. 16.—Diagrammatic illustration of a large dike in mine No. 2, Saline County Coal Company. North side entry; 3d east main south, 3d east 1st south, 4th south, 3d east.

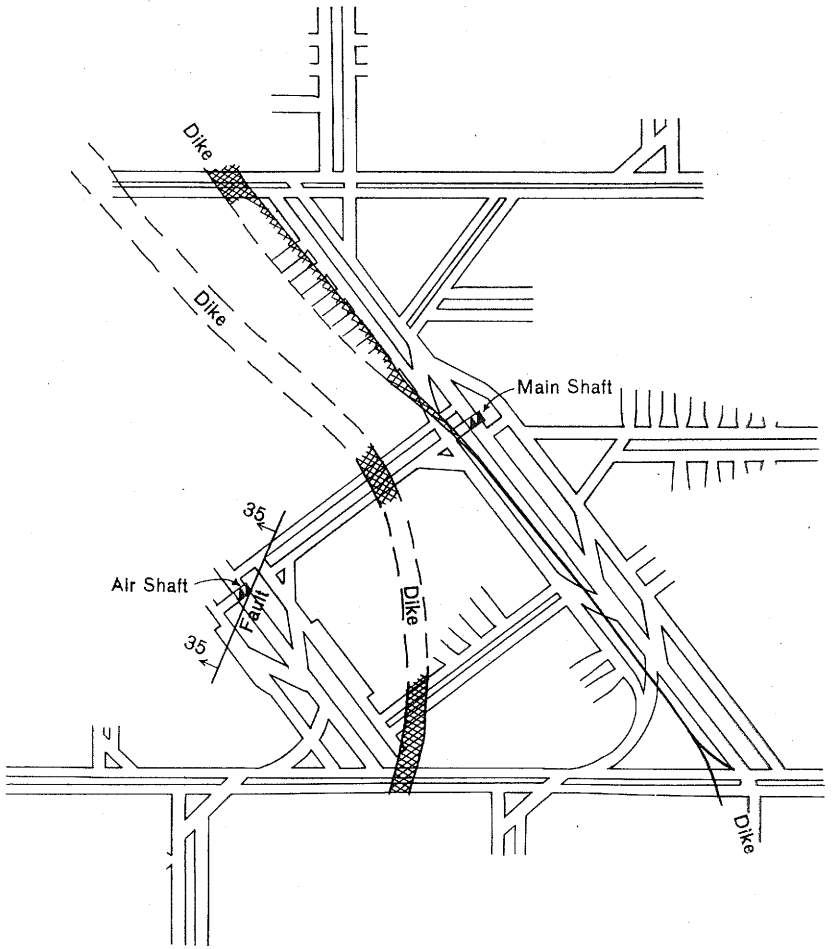

FIG. 17.—Plan of mine No. 2, J. K. Dering Coal Co, showing location of dikes and fault.

predominating. The coal has been greatly metamorphosed at and near the contact. At the contact and for about 3 feet from it a large amount of silicification has taken place. Small stringers of the dike are numerous and although the material may be recognized as coal, the mass is very hard and presents a somewhat resinous appearance. The small masses of coal enclosed by the dike all display the same characteristics as the wall rock. Outside of the zone of silicification the coal has been coked. The coke is lighter in

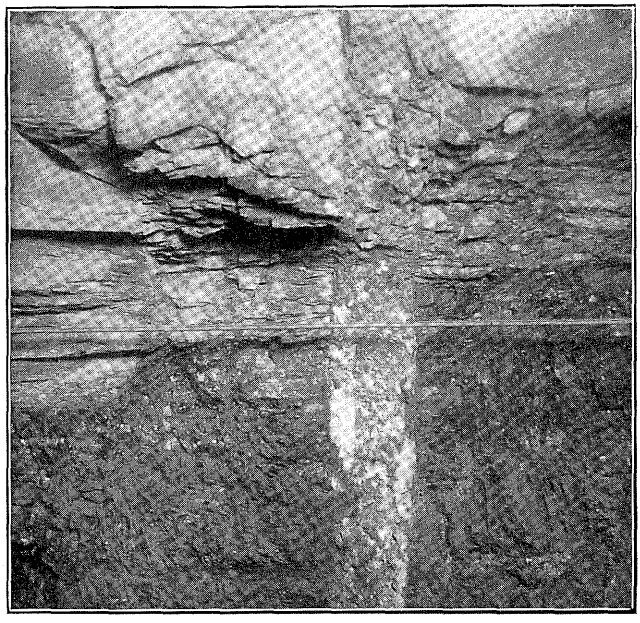

FIG. 18.—Dike in mine No. 2, Saline County Coal Company. Photo by C. M. Young.

weight than the coal but it does not show the porosity of coke made by a mine fire. This coking was apparently done under the original conditions of rock pressure. Between the coke and the normal coal is a variable zone, usually not exceeding 2 feet in width, of what the miners term "dead coal." This material is soft and smutty, having lost its original brittle character.

At the east side the igneous rock forms a sill, resting above the coal. Midway in the bed below very little change has taken place.

In No. 2 mine of the J. K. Dering Coal Company what appear to be two dikes cross the workings between the main shaft and air shaft and have been encountered at intervals for a distance of 1,200 to 1,400 feet, practically across the present extension of the workings. The plan of the mine with the probable position of the dike is shown in figure 17. The larger of the two dikes has a thickness of about 60 feet and the smaller is about 30 feet thick and less. They trend in a general northwest-southeast direction, the larger one diverging to the south. To the north both of the dikes are split or contain blocks of coke. The smaller dike has coked the coal for a distance of about 7 feet and the larger for a distance of about 10 feet.

TABLE 7.—*Structural irregularities in mines in District V*
(Dikes and faults)

Operator	Mine	Faults	Dikes
Dering Mines Co.....	No. 3	Faults with edges coked	1 to 3 feet wide. Coked 4 to 6 feet. Altered 6 to 8 feet more
J. K. Dering Coal Co....	No. 2	Fault at air shaft; 35 feet down to the northwest. Has been traced about 200 feet (See fig. 17)	One 60 feet and the other 30 feet wide (See fig. 17)
O'Gara Coal Co.....	No. 1	Large fault on south 100 feet. 6-inch fault on east. 15-foot fault on west	None known
O'Gara Coal Co.....	No. 3	None known	5 feet wide in roof; 15 feet wide in coal. Coal coked more in upper part of bed than below
O'Gara Coal Co.....	No. 4	Fault at north end (dike); 6 feet displacement	Reported 50 feet wide in places. One 25 feet wide; one 9 to 15 feet wide
O'Gara Coal Co.....	No. 7[a]	Thrust fault; about 2 feet displacement	None known
O'Gara Coal Co.....	No. 8	Small faults, 8- and 15-foot displacements (See fig. 9)	6 to 8 feet wide; coal altered 15 to 20 feet more at top than at bottom, see figure 15
Saline County Coal Co..	No. 2	Fault 3 to 5 feet, and another 40 feet	300 feet wide, coal silicified 20 feet and coked beyond; smaller dike, see figure 16
Saline County Coal Co..	No. 3	Small step faults and slips in coal. Fault 5 to 7 feet	2 to 3 feet wide, stops at roof. Two reported. (See figure 10)
Saline County Coal Co..	No. 6	None known	18 to 30 feet in width; coal silicified on either side (See figure 19)
Wasson Coal Co.....	No. 1	Small vertical faults (large faults in vicinity)	None known

[a] Not operating.

Figure 18 is a photograph of a small dike in the same mine.

The sketch of a dike reproduced in figure 19 was drawn in mine No. 6 of the Saline County Coal Company. The location in the mine is about 450 feet east of shaft on the north side of the main east entry.

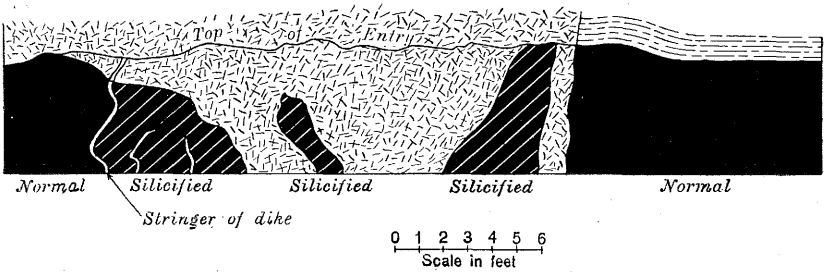

FIG. 19.—Diagrammatic illustration of a dike in mine No. 6, Saline County Coal Company. This dike has been traced 1,750 feet. Side view, north main east, 450 feet east of shaft. Direction N. 10° W .

A sample of the dike taken from one of the mines at Eldorado is reported by Dr. Albert Johannsen of the University of Chicago to be olivine kersantite. "Microscopically the rock is greenish-black with occasional prominent glassy black phenocrysts from 1 to 2 mm. in diameter and contains many glistening white, metallic-looking mica flakes, in a greenish aphanitic groundmass."

Table 7 shows the general distribution of structural irregularities in the mines in this district. The list is based upon information about three years old, so that some of the recently found dikes or faults may not be included in the table.

ROOF OF NO. 5 COAL

The immediate roof of No. 5 coal in the mines of District V is commonly a draw slate which varies in thickness from a knife edge to about 6 inches. In one mine at least this draw slate occurs in two beds, one of which falls some time before the other. Above the draw slate there occurs a gray, dark gray, or black shale or "slate," which forms the permanent roof of the mines. In the east part of the area a limestone cap rock 2 to 20 feet above No. 5 coal seems to be rather general.

The character of the strata above the coal, as determined by drilling in the district, is shown in Table 8. It is not generally practicable to separate draw slate from overlying dark shale in a drill core, so this rarely if ever is described in the record. The table as read from left to right gives the strata in the order of their occurrence above the coal. It shows a general consistency in the succession above the coal over large areas.

TABLE 8.—*Character of the roof of No. 5 coal as shown by drilling records in Saline and Gallatin counties*
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray or blue		Black							
¼	¼	Sec.	T. S.	R. E												
		Saline County			*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
NE	SE	19	8	5	..	..	..	..	..	..	..	..	..	..	74	1[a]
SE	NE	19	8	5	..	..	..	..	25	10	..	..	..	..	40[b]	..
SE	NW	19	8	5	..	..	..	..	22	6	..	..	..	..	49	5[b]
SE	SW	19	8	5	..	..	..	..	35	..	..	..	..	..	36	5[b]
SE	NW	20	8	5	..	..	..	..	20	..	..	..	..	..	16[b]	..
cent	SW	20	8	5	..	..	.	..	..	..	..	..	..	..	80	6[a]
cent.	NE	20	8	5	..	..	..	..	7	..	..	..	..	..	..	..
					..	..	68	..	..	..	..	..	..	..	..	..
NW	NW	20	8	5	..	..	..	..	..	..	..	..	..	..	65	11[a]
SW	NE	25	8	5	..	..	..	..	..	..	..	..	..	..	82	7[b]
SE	SW	26	8	5	..	..	..	..	13	..	..	..	..	..	74	2[b]
NW	NE	26	8	5	..	..	..	..	..	..	..	..	..	..	95	5[a]
NE	SW	26	8	5	..	..	..	..	..	..	..	..	..	..	89[a]	..
NW	NW	27	8	5	..	..	..	..	..	..	..	..	..	..	91	1[a]
SE	SE	27	8	5	..	..	..	..	..	..	..	½	..	..	10	3½[b]
					..	1	..	..	..	..	..	..	..	..	70[b]	..
NW	SW	27	8	5	..	..	..	..	..	..	12	6	..	..	..	..
					..	..	..	..	61	..	..	..	..	..	..	..
SE	NE	27	8	5	..	..	..	..	1	10	..	..	..	..	92	2[b]
SW	NE	27	8	5	..	..	..	..	6	..	10	3	..	..	22	..
NE	SW	28	8	[illegible]	..	..	..	..	..	..	..	..	..	..	88	9[a]

SE	SW	28	8	5	..	..	..	..	..	..	12	2	..	..	..	..	
					..	..	..	..	15	..	..	..	..	..	30	..	
SW	NW	28	8	5	..	..	..	..	..	..	..	..	..	..	92[a]	..	
NW	NW	29	8	5	..	..	23	..	..	..	..	..	..	..	67	..	
NW	NE	29	8	5	..	..	4	..	..	..	..	..	..	..	92[a]	..	
NW	NE	29	8	5	..	..	..	..	..	..	..	..	..	..	80	10[a]	
NE	SE	30	8	5	..	..	..	..	..	..	..	..	..	..	23	8[a]	
					..	..	18	8[c]	..	..	..	..	..	..	44	10	
NE	NW	31	8	5	..	..	..	..	..	..	..	..	..	..	73	1[a]	
NW	SE	33	8	5	..	..	..	..	..	..	33	8	..	..	50[a]	..	
NW	NW	34	8	5	..	..	..	..	..	..	..	..	..	..	78	9[a]	
NE	SE	34	8	5	..	..	..	..	15	6	..	..	..	..	60	10[b]	
SW	SW	35	8	5	..	..	..	..	..	..	..	..	..	..	69	5[b]	
NE	SW	35	8	5	..	..	..	..	..	..	..	..	..	..	93	6[b]	
NE	SE	35	8	5	..	..	17	2[d]	..	..	..	..	..	..	1	..	
					..	..	8	6[d]	..	..	..	..	..	..	..	..	
					..	..	6	..	..	..	..	..	..	..	25	5[a]	
NW	SE	15	8	6	..	..	..	..	..	..	..	3	..	..	..	..	
					..	..	17	..	..	..	..	..	..	..	45	..	
NE	SE	15	8	6	..	..	19	..	..	..	..	..	..	..	56[a]	..	
SE	SE	22	8	6	..	..	37	4	..	..	..	..	..	..	23[a]	..	
NW	NW	22	8	6	..	..	50	..	..	..	..	..	..	..	12	..	
NE	SW	23	8	6	..	..	43	2	..	..	..	..	..	..	21[b]	..	
SE	NW	24	8	6	..	..	..	..	..	..	12	..	..	..	30[b]	..	
NE	SW	24	8	6	..	..	..	..	..	..	..	..	..	..	68[b]	..	
NW	NW	25	8	6	..	..	25	..	..	..	..	..	..	..	30	..	
NE	NW	25	8	6	..	..	8	..	..	..	..	..	..	..	18[b]	..	
					..	..	50	..	..	..	..	..	..	..	..	..	
SE	SW	26	8	6	..	..	31	..	..	..	..	..	..	..	8[b]	..	

TABLE 8.—*Character of the roof of No. 5 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray or blue		Black							
¼	¼	Sec.	T. S.	R. E												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
NE	NE	26	8	6	..	..	23	..	..	..	..	..	..	..	35[b]	..
NW	SE	27	8	6	..	..	27	..	..	..	..	..	..	..	36[a]	..
NW	SW	27	8	6	..	..	34	6	19	..	..	..	..	..	21	..
SE	SE	28	8	6	..	..	50	8	..	..	..	..	..	..	10	..
					..	..	..	..	..	..	2	6	..	..	..	..
NE	NW	29	8	6	..	..	55	..	..	..	..	..	..	..	..	..
					..	..	..	..	..	..	..	6	..	..	15[b]	..
SE	SE	29	8	6	..	..	77	6	..	..	..	..	..	..	..	..
					..	..	5	..	..	..	..	..	..	6	..	..
NE	NW	26	8	6	..	..	..	..	..	..	1	6	..	..	..	..
					..	..	68	..	..	..	..	..	..	..	..	..
SE	SE	33	8	6	..	..	..	..	..	..	..	..	..	..	63[b]	..
SW	SW	34	8	6	..	..	..	..	..	..	..	..	..	..	48	6[a]
SW	SW	35	8	6	..	..	70	5	..	..	..	..	..	..	..	..
SW	SW	35	8	6	..	..	72	3	..	..	..	..	..	..	..	..
SW	SW	35	8	6	..	..	20	5	..	..	..	..	..	..	55[b]	..
SW	SW	35	8	6	..	..	79	..	..	..	..	..	..	..	..	..
NW	SW	35	8	6	..	..	31	..	..	..	..	..	..	..	4	..
					..	..	..	..	..	..	1	..	1	..	..	..
N. central		36	8	6	..	..	54	..	..	..	5[c]	..	..	..	..	..
		36	8	6	..	..	19	..	..	..	..	..	..	..	29[b]	..
NE	NW	10	8	7	..	..	..	..	..	..	7	8	1	..	..	..

					..	..	2	..	..	..	..	..	..	..	36[a]	..
NE	SW	14	8	7	..	..	..	..	..	..	9	..	2	..	..	..
					..	..	8	..	..	..	..	..	..	..	46	..
NW	SE	15	8	7	..	..	..	..	..	..	..	2	2	..	..	..
					..	..	..	..	..	..	1	6	2	6	..	..
					..	..	2	..	..	..	..	..	..	..	44[a]	..
NW	SE	15	8	7	..	..	1	6	..	..	..	..	4	..	38[b]	..
SE	NE	17	8	7	..	..	17	..	..	..	..	..	..	..	51[b]	..
NW	SW	19	8	7	..	..	2	..	..	..	..	..	..	..	45[b]	..
SW	NE	22	8	7	..	..	..	..	..	..	2	6	2	..	47[a]	..
NE	SW	23	8	7	..	..	2	..	..	..	..	..	..	..	..	..
					4	6[f]	..	..	..	..	..	..	..	..	..	..
					..	..	2	..	..	..	..	..	..	..	61[a]	..
SW	NE	26	8	7	..	..	..	..	..	..	3	10	..	..	..	..
					..	..	7	..	..	..	..	..	..	..	41[b]	..
NE	SE	27	8	7	..	..	5	..	..	..	6	..	2	..	..	..
					..	..	27	..	..	..	..	..	..	..	..	..
SW	SW	28	8	7	..	..	52	..	..	..	..	..	..	..	..	..
NW	NW	31	8	7	..	..	16	9	..	..	..	..	..	..	38[b]	..
NW	NW	31	8	7	..	..	5	..	..	..	..	..	..	..	46[b]	..
NW	SE	32	8	7	..	..	47	..	..	..	6	6	1	6	..	..
SW	NE	33	8	7	..	..	..	..	15	3	..	..	..	..	48[a]	..
NE	NW	34	8	7	..	..	..	..	..	..	..	6	..	..	..	..
					3[f]	..	..	..	..	..	..	..	..	..	..	..
					..	..	27	..	..	..	..	..	2	..	20[a]	..
SW	SE	24	9	5	..	..	..	..	..	..	..	..	..	..	44	8[a]
SW	NW	26	9	5	..	..	30[c]	..	..	..	..	..	..	..	..	..
					..	..	40	..	..	..	..	..	..	..	..	..
SW	SW	26	9	5	..	..	14	5[c]	..	..	..	..	..	..	..	..

TABLE 8.—*Character of the roof of No. 5 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray or blue		Black							
¼	¼	Sec.	T. S.	R. E												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
					..	..	25	..	..	..	..	..	..	..	20	..
SE	SW	26	9	5	..	..	38[c]	..	..	..	..	..	..	..	23[b]	..
SE	SW	26	9	5	..	..	..	..	..	..	19	..	..	..	21	..
SW	SW	26	9	5	..	..	..	..	..	..	13[e]	..	..	..	..	..
					..		18	..	..	..	..	..	..	..	8+	..
SW	SW	26	9	5	..	..	17	3[c]	..	..	..	..	..	..	5+	..
NE	NW	26	9	5	..	..	..	..	..	..	15[e]	..	..	..	25[b]	..
NE	NE	26	9	5	..	..	..	..	..	..	9	10[e]	..	..	31[a]	..
SE	SE	26	9	5	..	..	30	..	..	..	..	..	..	..	46[a]	..
NE	SW	26	9	5	..	..	30[c]	..	..	..	..	..	..	..	24[b]	..
SW	SW	27	9	5	..	..	..	..	..	..	5[e]	..	..	..	..	..
					..	..	41	..	..	..	..	..	..	..	3	..
SW	SE	27	9	5	..	..	27	10[c]	..	..	..	..	..	..	..	..
					..	..	30+	..	..	..	..	..	..	..	Surface	
NE	SE	27	9	5	..	..	42	6[c]	..	..	..	..	..	..	..	..
					..	..	25+	..	..	..	..	..	..	..	Surface	
SE	SE	27	9	5	..	..	24	7+	..	..	..	..	..	..	Surface	
SW	NW	27	9	5	..	..	..	..	55	..	..	..	..	..	..	..
NE	NW	28	9	5	..	..	..	..	45	..	..	..	..	..	..	..
NW	SE	28	9	5	..	..	34	..	..	..	..	..	..	..	32	..
NE	NE	28	9	5	..	..	..	..	52	..	..	..	..	..	10[b]	..
NE	NE	30	9	5	..	..	..	..	26	6	..	..	..	..	..	..

					..	..	40	..	..	..	..	..	..	..	..	..
SW	SW	32	9	5	..	..	10	6	27	..	..	..	..	..	6	..
SE	SE	33	9	5	..	..	13	4	..	..	..	..	..	..	25[b]	..
NE	NW	34	9	5	..	..	..	..	18	..	..	..	..	..	..	..
					..	..	22	..	..	..	..	..	..	..	8	..
SW	NE	34	9	5	..	..	15	6	..	..	..	..	..	..	25[b]	..
NE	NE	34	9	5	..	..	8	..	..	..	..	..	..	..	24[b]	..
NW	NE	34	9	5	..	..	40[c]	..	..	..	..	..	..	..	..	..
					..	..	21	..	..	..	..	..	..	..	8	..
NW	NW	34	9	5	..	..	21	4	..	..	..	..	..	..	9	..
NE	NE	34	9	5	..	..	21[c]	..	..	..	..	..	..	..	12+	..
SW	NW	34	9	5	..	..	24	5[c]	..	..	..	..	..	..	..	..
					..	..	18	..	..	..	..	..	..	..	14+	..
SW	NW	34	9	5	..	..	28	3[c]	..	..	..	..	..	..	..	..
					..	..	16	..	..	..	..	..	..	..	12+	..
NW	NW	34	9	5	..	..	15	4[c]	..	..	..	..	..	..	..	..
					..	..	12	..	..	..	..	..	..	..	6+	..
NW	NW	34	9	5	..	..	13[c]	..	..	..	..	..	..	..	..	..
					..	..	11	..	..	..	..	..	..	..	Surface	
NE	NE	34	9	5	..	..	20	6	..	..	..	..	..	..	11+	..
NW	NE	35	9	5	..	..	37	5	..	..	..	..	..	..	14[b]	..
NE	NW	35	9	5	..	..	..	..	..	..	..	4[c]	..	..	..	..
					..	..	11	..	..	..	..	..	..	..	12+	..
SE	NW	35	9	5	..	..	3[c]	..	..	..	..	..	..	..	..	..
					..	..	21	..	..	..	..	..	..	..	23	..
SE	NE	35	9	5	..	..	1	6	..	..	..	..	..	..	57[a]	..
NE	NW	36	9	5	..	..	3[c]	..	..	..	..	..	..	..	..	..
					..	..	23	..	..	..	..	..	..	..	16	..
NE	NE	1	9	5	..	..	31	1½	..	..	..	..	..	..	23	7

TABLE 8.—*Character of the roof of No. 5 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray or blue		Black							
¼	¼	Sec.	T. S.	R. E												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
SW	NE	1	9	5	..	..	12[e]	..	..	..	..	..	..	..	..	..
					..	..	61	..	..	..	..	..	..	..	..	..
NE	SE	2	9	5	..	..	..	..	..	..	..	..	..	..	84[b]	..
SW	NW	2	9	5	..	..	5	6	..	..	2	6	1(?)	..	..	..
					..	..	12	..	..	..	..	..	..	..	12[a]	..
NE	SW	2	9	5	..	..	24	1½	..	..	..	..	..	..	..	..
					1	8	18	..	..	..	..	..	..	..	..	..
NW	NE	2	9	5	..	..	..	..	..	..	..	..	..	..	73[b]	..
SE	SE	3	9	5	..	..	21	8	..	..	..	..	..	..	48[a]	..
NW	SW	3	9	5	..	..	..	..	16	8	..	..	..	..	64[a]	..
NW	NW	4	9	5	..	..	..	..	..	..	..	..	..	..	45[a]	..
NE	SW	4	9	5	..	..	..	..	..	..	..	..	..	..	78[a]	..
NE	NE	4	9	5	..	..	..	..	..	..	..	..	..	..	109[a]	..
NW	SE	5	9	5	..	..	91[g]	..	..	..	..	..	..	..	..	..
NW	SE	6	9	5	..	..	28	6	..	..	..	..	..	..	9	..
					..	..	25	..	..	..	..	..	..	..	33	..
SE	NE	7	9	5	..	..	28	..	..	..	..	..	..	..	73	..
NE	NE	8	9	5	..	..	34	10½	..	..	..	..	..	..	36[a]	..
SW	SW	8	9	5	..	..	..	..	..	..	..	9	7	1	..	..
					..	..	..	..	..	..	2	3½	..	3	..	..
					..	2[f]	..	..	..	..	..	..	..	8	..	..
					..	..	16	9½	..	..	..	..	..	..	..	..

SE	SE	8	9	5	..	..	6[c]	..	..	..	..	..	..	..	..	70[b]	..
N. line		9	9	5	..	..	40	..	..	..	..	..	..	..	..	50	..
SE	NW	9	9	5	..	..	36	..	..	..	..	..	..	..	..	32	..
SW	NE	10	9	5	..	..	15	..	..	..	..	..	..	..	..	50	..
NW	SE	11	9	5	..	..	..	..	..	..	4	..	..	..	..	47[b]	..
SW	SW	11	9	5	..	..	44	2	..	..	..	..	..	..	..	20[a]	..
SE	NW	11	9	5	..	..	..	..	..	..	1[c]	..	..	..	..	..	..
					..	..	27	..	..	..	..	..	..	..	..	47[b]	..
NE	NE	11	9	5	..	..	..	..	5	6	..	..	..	..	..	..	..
					..	..	15	3	..	..	..	..	..	..	..	22[b]	..
NW	SE	12	9	5	..	..	2	6[c]	..	..	..	..	..	..	..	98[b]	..
SE	SE	13	9	5	..	..	..	..	..	..	..	..	..	..	..	61[b]	..
SE	NE	14	9	5	..	..	17	2[c]	..	..	..	..	..	..	..	77[a]	..
NE	SW	14	9	5	..	..	46	2	..	..	..	..	..	..	..	46[b]	..
SW	NE	15	9	5	..	..	..	..	..	..	..	..	..	..	..	95[b]	..
Cent.	NW	15	9	5	..	..	57	9	..	..	..	..	..	..	..	..	..
NE	NE	16	9	5	..	..	35[c]	..	..	..	..	..	..	..	..	8	..
SW	NE	16	9	5	..	..	..	..	..	..	..	..	..	..	..	64[b]	..
SW	NE	17	9	5	..	..	10	6[c]	..	..	..	..	..	..	..	79[b]	..
NW	SE	18	9	5	..	..	..	..	..	..	..	..	..	..	..	4	6[b]
					..	..	37	..	..	..	..	..	..	..	..	37	..
SE	SE	18	9	5	..	..	6[c]	..	..	..	..	..	..	..	..	60[b]	..
SW	SW	19	9	5	..	..	..	..	19	5	..	..	..	..	..	..	..
					..	3	5[c]	..	..	..	..	..	..	..	..	48	..
NW	NW	19	9	5	..	..	29	6	..	..	..	..	..	..	..	21[b]	..
					..	..	..	..	..	..	..	..	1	6	..	..	..
					..	..	21	6	..	..	..	..	..	..	..	..	..
SW	NE	19	9	5	..	..	24	..	..	..	..	..	..	..	..	45[b]	..
NW	SE	21	9	5	..	..	..	..	77	8	..	..	..	..	..	..	..

TABLE 8.—*Character of the roof of No. 5 coal as shown by drilling records in Saline and Gallatin counties*—Continued

(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray or blue		Black							
¼	¼	Sec	T. S.	R. E.												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
SW	NW	21	9	5	..	..	10	..	..	..	..	..	..	..	23	..
SE	NW	21	9	5	..	..	68	..	..	..	..	..	..	..	..	..
NW	NE	21	9	5	..	..	..	..	37	..	..	..	..	..	38[b]	..
NE	NW	22	9	5	..	..	..	..	..	..	..	..	..	..	75[b]	..
SW	SE	22	9	5	..	..	..	..	49	11	..	..	..	..	28[b]	..
NE	NE	22	9	5	..	..	50	..	..	..	..	..	..	..	..	..
NW	SE	22	9	5	..	..	..	..	..	..	..	..	..	..	30	2[b]
					..	..	10[c]	..	..	..	..	..	..	..	..	5[b]
SW	NE	23	9	5	..	..	..	..	..	..	..	9[c]	..	..	..	..
					..	..	88	..	..	..	..	..	..	..	..	..
SW	SE	23	9	5	..	..	38	..	..	..	..	..	..	..	..	..
					..	..	6	..	..	..	..	..	..	..	9[b]	..
NE	NW	24	9	5	..	..	..	..	..	..	20	..	..	..	5[b]	..
NE	SE	1	9	6	..	..	..	..	..	..	..	..	..	..	34[b]	..
NE	SE	2	9	6	..	..	..	..	..	..	2	..	..	..	61[a]	..
NE	SE	2	9	6	..	..	70	5	..	..	..	..	..	..	..	..
SE	SE	4	9	6	..	..	37	4	..	..	..	..	..	..	30[b]	..
SW	SE	4	9	6	..	..	27	..	..	..	..	..	..	..	48[a]	..
SW	SE	4	9	6	..	..	16	7	..	..	..	..	..	..	40[a]	..
NE	NE	5	9	6	..	..	39	6	..	..	..	..	..	..	22	..
NW	NW	5	9	6	..	..	34	..	..	..	..	..	..	..	39[a]	..
SE	SW	6	9	6	..	..	61	..	..	..	..	..	..	..	..	..

NE	SE	7	9	6	..	..	32	7	..	..	..	..	..	..	68	..
SW	NW	8	9	6	..	..	28	..	..	..	..	..	..	..	27	..
NW	SW	8	9	6	..	..	33	6	..	..	..	..	..	..	15	..
NE	NW	8	9	6	..	.	19	6	..	..	..	.	..	..	37	..
NW	SE	9	9	6	..	..	..	..	..	..	3	6	..	..	22[b, h]	..
SW	NE	10	9	6	..	..	31	11	..	..	..	..	..	..	5[b]	..
					..	..	13	..	..	..	..	..	..	..	..	..
SW	SW	10	9	6	..	..	..	..	..	..	..	..	..	..	79	9½[a]
NE	SE	11	9	6	..	.	28	..	..	..	..	..	..	..	18[a]	..
SE	SW	11	9	6	..	..	3	..	..	..	..	..	..	..	20[b]	..
SE	NW	12	9	6	..	..	..	..	..	..	..	10	..	..	31[b]	..
					..	..	3	..	..	..	..	..	..	..	21	..
SE	SE	12	9	6	..	..	13	2	..	..	3	..	..	..	..	..
					..	..	2	..	..	..	1	..	..	..	..	..
					..	..	3	..	..	..	..	..	..	..	26[a]	..
SW	SE	13	9	6	..	..	14	..	..	..	6	..	..	..	..	..
					..	..	13	..	..	..	..	..	..	..	23	..
NW	SW	13	9	6	..	..	19	..	..	..	5	..	..	..	..	..
					..	..	21	..	..	..	..	..	..	..	11	..
SW	SW	16	9	6	..	..	..	..	2	6	..	..	..	..	55[b]	..
SW	SW	16	9	6	..	..	..	..	43	6	..	..	..	..	13[b]	..
SE	NW	16	9	6	..	..	..	..	..	..	..	..	..	..	85[b]	..
NW	SW	16	9	6	..	..	54	..	..	..	..	..	..	..	..	..
NE	NE	17	9	6	..	..	..	..	..	..	5	9	..	..	38[b]	..
SE	SE	17	9	6	..	..	46	6[c]	..	..	..	..	2	..	..	..
SW	SW	17	9	6	..	..	..	..	14	..	..	..	..	..	55[b]	..
SE	NW	18	9	6	..	..	10	10[c]	..	..	..	..	..	..	15[b]	..
SE	NE	18	9	6	..	..	..	..	..	..	..	..	..	..	46[a]	..
NW	SE	18	9	6	..	..	102	..	..	..	..	..	..	..	..	..
NE	NE	18	9	6	..	..	..	..	..	..	..	..	5	..	..	..

TABLE 8.—*Character of the roof of No. 5 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray or blue		Black							
¼	¼	Sec.	T. S.	R. E.	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
					..	..	3	..	..	..	..	..	..	..	31[a]	..
NE	NE	18	9	6	..	..	..	..	..	..	14	..	..	..	..	..
					..	..	16	..	..	..	..	..	..	..	..	..
SE	SW	19	9	6	..	..	..	..	..	..	..	..	..	..	93[a]	..
SE	SW	19	9	6	..	..	67	..	..	..	..	..	..	..	..	..
NE	NE	23	9	6	..	..	15	..	..	..	4	..	..	..	..	..
					..	..	9	..	..	..	..	..	..	..	27[b]	..
SW	NE	23	9	6	..	..	..	..	..	..	..	..	..	..	16[b]	..
					..	..	..	..	..	..	4	..	..	..	28[b]	..
SE	SE	23	9	6	..	..	13	6	..	..	2	..	..	..	2+	..
SE	NW	24	9	6	..	..	..	..	..	..	2	4	..	..	12[b]	..
					..	..	1	..	..	..	3	..	..	..	27[a]	..
SW	NE	24	9	6	..	..	13	..	..	..	3	..	..	..	..	..
					..	..	1	..	..	..	1	..	..	..	20+[b]	..
NW	NE	25	9	6	..	..	..	..	..	..	5	7	..	..	..	..
					..	..	25	..	..	..	..	..	..	..	33	..
NW	NE	25	9	6	..	..	13	..	..	..	..	..	..	..	..	..
					1	5[i]	..	..	..	..	..	..	..	..	Surface	
NE	NE	27	9	6	..	..	12	..	..	..	3	..	..	..	37[b]	..
SE	SW	27	9	6	..	..	10	..	..	..	..	..	..	..	40[a]	..
NW	SW	27	9	6	..	..	10	..	..	..	..	..	..	..	37[a]	..
SE	NW	27	9	6	..	..	11	..	..	..	4	..	2	..	..	..

					..	..	9	..	..	..	..	..	..	..	12[a]	..
NE	SW	27	9	6	..	..	13	..	..	..	5	..	..	..	28+	..
NE	SE	28	9	6	..	..	16	..	..	..	4	..	..	..	9+	..
SW	SW	30	9	6	..	..	4	..	..	..	..	..	..	..	12[b]	..
NE	SE	31	9	6	..	..	23	10	..	..	6	..	1	6	..	..
					..	..	24	..	..	..	..	..	..	..	12	..
SE	NW	31	9	6	..	..	1	..	..	..	3	..	2	..	..	..
					..	..	19	..	..	..	..	..	..	..	6	..
NE	SW	31	9	6	..	..	9	..	..	..	4	..	3	..	17[b]	..
SW	NE	31	9	6	..	..	..	..	..	..	..	..	..	..	11	9[b]
					..	..	..	..	..	..	2	3	2	..	27[b]	..
SE	NW	31	9	6	..	..	24	..	..	..	5	..	2	..	28[b]	..
NE	NW	31	9	6	..	..	16	..	..	..	4	..	2	..	..	..
					..	..	27	..	..	..	..	..	..	..	2	..
SE	NW	31	9	6	..	..	6	..	..	..	5	..	..	..	..	..
					..	..	2	..	..	..	..	..	2	..	26[b]	..
SE	NE	31	9	6	..	..	..	..	..	..	..	6	..	..	..	..
					..	..	14	7	..	..	8	..	2	..	..	..
					..	..	15	..	..	..	..	..	..	..	16	..
SW	SW	32	9	6	..	..	23	..	..	..	..	..	..	..	..	..
					..	..	16+[j]	..	..	..	..	..	..	..	..	..
SW	NW	32	9	6	..	..	..	..	..	..	2	2	..	..	..	..
					..	..	16	..	..	..	5	..	..	..	..	..
					..	..	25	..	..	..	..	..	..	..	5	..
NE	SW	32	9	6	..	..	..	..	..	..	2	..	..	..	..	..
					..	..	35	..	..	..	..	..	..	..	..	..
NW	SW	32	9	6	..	..	15	..	..	..	9	..	..	..	..	..
					..	..	19	..	..	..	..	..	..	..	13[b]	..
SE	NW	32	9	6	..	..	..	..	..	..	1	..	..	..	..	..
					..	..	53	..	..	..	..	..	..	..	..	..

TABLE 8.—*Character of the roof of No. 5 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray or blue		Black							
¼	¼	Sec.	T. S.	R. E.												
					..	..	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
NW	SW	2	9	7	..	..	1	10	..	..	3	..	..	..	..	..
					..	..	16	2	..	..	..	..	..	..	..	..
NE	NW	3	9	7	..	..	..	..	..	..	5	..	2	..	..	..
					..	..	35	..	..	..	..	..	..	..	10	..
SW	SW	4	9	7	*Ft.*	*in.*	17	..	..	..	..	..	..	..	25[a]	..
NE	NW	4	9	7	..	..	13	..	..	..	3	..	..	..	..	..
					..	..	3	..	..	..	16	..	..	..	..	..
SW	SE	5	9	7	..	..	17	..	..	..	3	..	..	..	..	..
					..	..	8	..	..	..	3	..	..	..	..	..
NE	NE	5	9	7	..	..	20	6	..	..	..	..	..	..	..	..
					..	..	3	..	16	..	..	..	..	..	22[b]	..
W½	NW	5	9	7	..	..	8	..	..	..	..	..	..	..	57[b]	..
SE	NE	6	9	7	..	..	..	..	..	..	18[k]	..	..	..	..	..
					..	..	20	..	..	..	..	..	..	..	2[a]	..
SE	NW	7	9	7	..	..	39	6	..	..	3	..	..	..	..	..
NE	SW	8	9	7	..	..	3	..	..	..	..	..	4	..	..	..
					..	..	..	..	..	..	1	..	..	..	28[a]	..
SW	NW	9	9	7	..	..	6	5	..	..	2	6	..	..	..	..
					..	..	12	6	..	..	..	..	..	..	6[a]	..
NW	SW	10	9	7	..	..	6	..	..	..	1	6	..	..	..	..
					..	..	22	6	..	..	..	..	..	..	14	..
NW	NE	10	9	7	..	..	..	..	..	..	2	5	1	..	..	..

					..	..	..	..	..	..	3	..	2	..	..	..					
					..	..	17	..	..	..	..	..	..	..	..	..					
NW	SW	11	9	7	..	..	2	..	..	..	4	..	..	..	..	..					
					..	..	38	6	..	..	..	..	..	..	..	..					
NE	SE	15	9	7	..	..	5	6	..	..	3	7	..	..	46[a]	..					
SW	NE	15	9	7	..	..	11	..	..	..	4	..	..	..	..	..					
					..	..	29	..	..	..	..	..	..	..	4	6[b]					
SE	SE	16	9	7	..	..	5	..	..	..	2	6	..	..	..	..					
					..	..	12	6	..	..	..	..	..	..	24[a]	..					
SE	SW	17	9	7	..	..	8	..	..	..	4	..	..	..	..	..					
					3[h]	..	1	..	..	..	3	..	..	..	..	..					
					..	..	17	..	..	..	..	..	..	..	..	..					
SW	SE	18	9	7	..	..	15	..	..	..	4	..	..	6	..	..					
					..	..	..	..	..	..	1	..	..	..	31[a]	..					
NW	SE	19	9	7	..	..	10	..	..	..	3	..	..	..	..	..					
					..	..	1	..	..	..	1	..	..	..	..	..					
					..	..	10	..	..	..	..	..	..	..	..	..					
NW	SE	20	9	7	..	..	8	..	..	..	6	..	..	..	34[a]	..					
SW	SW	20	9	7	..	..	9	..	..	..	6	..	..	..	..	..					
					..	..	16	..	..	..	..	..	..	..	17	..					
NE	NW	21	9	7	..	..	2	..	..	..	7+	..	..	..	..	..					
SE	NE	22	9	7	..	..	4	9	..	..	..	..	..	..	45	6[b]					
		Gallatin County																			
SE	NW	23	7	8	..	..	..	..	..	..	..	..	4	..	..	..					
					..	..	12	..	..	..	..	..	..	..	15	..					
NE	SE	27	7	8	..	..	..	..	..	..	17	..	..	..	45	..					
NW	NE	31	7	9	..	..	..	..	3	6	.	..	..	..	27[b]	..					
SW	SW	17	8	8	..	..	..	..	4	7	..	..	1	..	..	..					
					..	..	..	..	1	..	..	..	..	..	..	..					
					..	..	14	..	..	..	..	..	..	..	17	..					

TABLE 8.—*Character of the roof of No. 5 coal as shown by drilling records in Saline and Gallatin counties*—Concluded
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Sandstone		Sandstone	
							Gray or blue		Black							
¼	¼	Sec.	T. S.	R. E.												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
SW	SW	33	8	8	..	..	..	..	11	..	..	..	..	..	..	..
					..	..	7	..	..	..	..	..	..	..	29[b]	..
SW	NE	19	8	9	..	..	..	..	2	6	..	..	..	6	..	..
					..	..	..	..	9	..	..	..	..	..	44[a]	..
NE	SW	23	8	9	..	..	..	..	..	..	3[c]	..	..	..	..	..
					..	..	27[d]	..	..	..	..	..	..	..	..	..
NW	NW	28	8	9	..	..	62	..	..	..	..	..	..	..	..	..
SE	NE	5	9	8	..	..	..	..	3	1	..	..	..	..	..	..
					..	..	2	..	..	..	..	..	..	..	2[b]	..
					..	..	..	..	5	..	..	..	..	..	28[b]	..
NE	NE	28	9	8	..	..	..	..	8	..	..	..	..	..	..	..
					..	..	8	7	3	2	..	..	..	..	41	..
NW	NW	36	9	9	..	..	..	..	4	..	..	..	..	..	..	..
					..	..	7	..	4	..	..	..	..	..	13[b]	..

[a] Sandstone and sandy shale.
[b] Sandy shale, no sandstone.
[c] Slate.
[d] Brown.
[e] Black?
[f] Bone coal.
[g] Shale and slate.
[h] Blue.
[i] Coal and slate.
[j] Red.

The characteristics of the roof of No. 5 coal are presented in greater detail in the following selections from observations made in the mines by members of the Investigations.

O'Gara Coal Co., mine No. 9

The roof is of gray shale which is darker than the shale above No. 6 coal. It holds up well in parts of the mine. On the west side of the mine, bony coal and carbonaceous shale with partings and some horizontal slip planes form a poor roof. Four to five inches of draw slate occur in some places beneath the bone.

In places on the north side of the mine the roof is full of slips and very hard to hold (see fig. 8). Where slips are common the slate is generally blacker, and is filled with plant impressions. Bone coal replaces the top bench in a part of the mine. Over some of the area it falls in blocks and is gobbed, but where it will stay up the bone is left for roof and makes a fairly good top. The parting below the bone is very distinct.

Where the top is normal it falls in thin tabular pieces. The shale has a pitted appearance due to small pyrite balls included in it. A number of slips occur in the roof shale in parts of the mine, producing an unsafe condition of the roof.

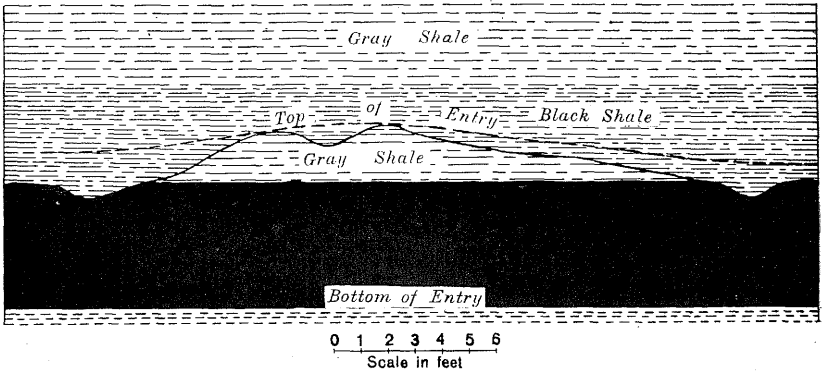

FIG. 20.—Diagrammatic illustration showing character of roof in mine No. 6, Saline County Coal Company.

Harrisburg Big Muddy Coal Co., mine No. 12

The draw slate is thicker than common. In places part of it stays up for a long time, 2 inches falling and about 4 inches remaining in the roof until the face has advanced 40 to 50 feet.

Saline County Coal Co., mine No. 3

The roof is a dark gray shale containing a very little sand and holding sulphur balls in parts of the mine only. It falls in small lenticular fragments.

Saline County Coal Co., mine No. 6

The black slate is the normal roof. It contains great numbers of "niggerheads" that range from a fraction of an inch to 4 feet in diameter

The contact with the coal is irregular, since the concretions extend down into the top of the coal, in places cutting out as much as a foot or two of the bed. In places a light-colored shale known as "white top" lies between the coal and black slate. (See fig. 20.) This shale may occur in a depression in the surface of the coal, but the coal below such places is commonly thicker than elsewhere.

FLOOR OF NO. 5 COAL

The floor of No. 5 coal is most commonly clay, called "fire clay". Locally a very sandy shale, almost a sandstone, is found below the coal, and in other places the floor clay is known to be very carbonaceous. The accompanying table (Table 9) gives the character of the floor in several of the mines in the district as noted in the observations by members of the Survey and Investigations.

TABLE 9.—*Character of the floor of No. 5 coal in several mines in Saline and Gallatin counties*

Mine	Floor	
	Character	Thickness
		Feet
Dering Mines Co., No. 3	Hard dark "fire clay"	5
Gallatin Coal & Coke Co., No. 1.	"Fire clay"	3+
Harrisburg Big Muddy Coal Co., No. 12	"Fire clay"	?
Harrisburg Big Muddy Coal Co., No. 14	"Fire clay" or shale	?
O'Gara Coal Co., No. 3	Sandy "fire clay"	2
	Limestone below clay	½
O'Gara Coal Co., No. 8	Hard "fire clay"	?
O'Gara Coal Co., No. 9	Carbonaceous shale	?
Saline County Coal Co., No. 6	Hard "fire clay"	10
Wasson Coal Co., No. 1	Hard gray sandy shale	5±

The floor is commonly hard and not likely to heave or swell, although rarely there is some trouble when the floor becomes wet.

The combination of hard roof and floor characterizing the coal of this district makes possible a product containing a minimum of foreign material in the way of roof and floor fragments. The conditions in some of the mines in the district are possibly better than in others, but in general the reasonable ease of producing a clean coal is a trade factor in favor of coal from this bed in the Harrisburg region.

NO. 5A COAL

The general distribution of No. 5A coal—the thin coal that lies about midway between No. 5 and No. 6 coals—has been discussed

earlier in the report. This coal possibly becomes of workable thickness in the eastern part of the area, especially in T. 9 S., R. 7 E., and possibly in adjoining parts of Gallatin County. It is not known to have been worked at any time in this district but has been mined in the Eagle Valley field. It is thought to be the same coal as the Briar Hill coal of Union County, Kentucky.

In the eastern part of Saline County this bed commonly reaches a thickness of 2 feet but to the west it decreases in thickness and finally plays out near the Williamson County line.

The chemical character and heating value of the coal at the Peter Hine mine in Eagle Valley is as follows:

		As received			
Moisture	*Volatile matter*	*Fixed carbon*	*Ash*	*Sulphur*	*B. t. u.*
3.94	38.13	45.95	11.98	3.53	12,449

This analysis indicates that the coal is as good as the No. 5 coal in District V, for the high percentage of ash is counterbalanced by the low percentage of moisture.

NO. 6 COAL

GENERAL STATEMENT

North of its outcrop No. 6 (Herrin) coal is as widespread in this district as No. 5 coal. Indeed, the No. 6 bed is more persistent than the lower one, as it does not seem to have suffered local erosion and removal along certain belts to as great an extent as No. 5. This is the most important coal bed in District VI on the west and is destined to be extensively worked in District V. The No. 6 coal of this region (frequently referred to locally as No. 7) is probably the same as the No. 6 coal of the Herrin, Belleville, Peoria, and Danville regions. It is the thickest coal in the State over large areas and attains a thickness of 14 feet in Franklin County. Up to 1916 this bed was worked in the district only by the Galatia Colliery Company and by a few wagon mines in Gallatin County. Since 1916 the Galatia mine has been deepened to No. 5 coal, in which bed it is now operating.

THICKNESS

The average thickness of No. 6 coal in District V is about 5 feet. It is known to vary from about 2 inches to about 8 feet, but it is commonly of average thickness. Some idea of the variation in thickness of this bed can be obtained from a study of the following table and the table in the appendix, compiled from the coal borings in the district. As in the case of No. 5 coal the actual thickness at many of the drill holes must be obscured because of the confidential character of the information.

TABLE 10.—*Thicknesses of No. 6 coal in Saline and Gallatin counties as determined by drilling*

Location Sec.	T. S.	R. E.	Number of drill holes	Thickness
Saline County				*Inches*
18 to 20	8	5	9	62 to 82
25 to 27	8	5	11	61 to 78
28 to 31	8	5	9	65 to 76
32 to 36	8	5	10	62 to 77
15, 21 to 25	8	6	11	48 to 76
26 to 29	8	6	7	12 to 66
33 to 36	8	6	6	48 to 66
10, 14, 15, 17 and 19	8	7	6	42 to 66
22, 23, 26, 27, and 28	8	7	5	24 to 60
31 to 34	8	7	4	48 to 72
1 to 3	9	5	12	2 to 65
4 to 6	9	5	8	36 to 73
7 to 9	9	5	8	63 to 72
10 to 13	9	5	10	55 to 79
14 to 18	9	5	8	54 to 60
19 to 21	9	5	6	24 to 72
22 to 26	9	5	10	36 to 72
1 to 4	9	6	7	48 to 61
5 to 8	9	6	10	3 to 48
9 to 12	9	6	6	33 to 63
13 to 17	9	6	9	52 to 74
18 to 20	9	6	10	42 to 68
20, 23, 27, and 28	9	6	5	24 to 95
2 to 5	9	7	7	24 to 78
6, 7, 9, 10, and 11	9	7	6	45 to 60
15 to 22	9	7	6	29 to 63
Gallatin County				
	7 and 8	9	8	36 to 60
	8 and 9	8		47 to 68

PHYSICAL CHARACTERISTICS

The most conspicuous feature of No. 6 coal is the "blue band" (see figure 21), a dirt or clay band found almost everywhere 18 to 30 inches above the floor, generally consisting of bone, shale, or shaly coal. Its thickness varies from one-half to 2½ inches with an average of about 1⅔ inches. This bedded impurity in No. 6 coal is the most com-

mon criterion of identification throughout the eastern interior coal basin of Illinois, Indiana, and Kentucky. It is conspicuously uniform in its position in the lower part of the bed, and in its thickness and lithologic character.

Commonly the coal is divided into three benches. The top bench is from about one-fourth to one-sixth the thickness of the entire seam. The lower bench which lies below the "blue band" is commonly between one and two feet in thickness, and the middle bench makes

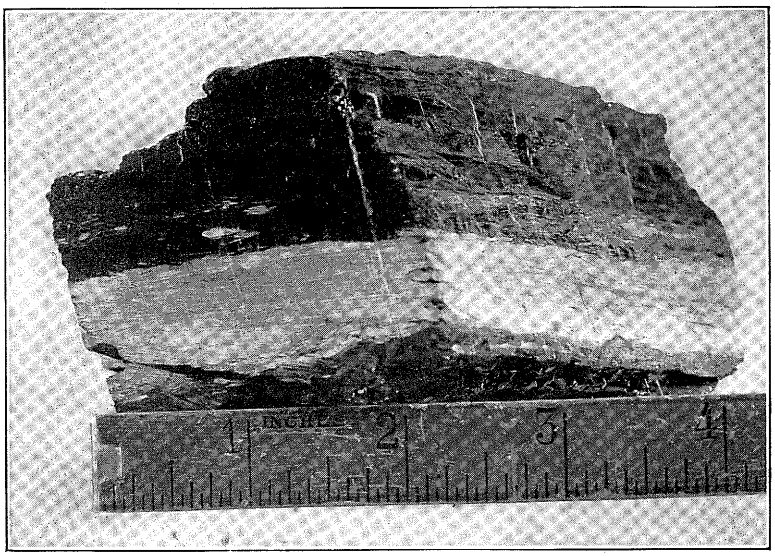

FIG. 21.—Photograph of the "blue band" in No. 6 coal. From Bulletin 11 of the Coal Mining Investigations.

up the remainder of the seam. In the mine at Galatia the upper bench is reported 8 to 10 inches thick; the "blue band" varies in position from as low as 13 inches to as high as 28 inches above the floor. Because of its distinct division into benches, No. 6 coal is locally known as the "Bench" coal as well as the "Blue band" coal.

Two measured sections of No. 6 coal, as observed in the mine at Galatia by members of the Survey, are given below and are shown graphically in figure 22.

The general characteristics of this coal have been described in detail in the report on District VI [1] and as the bed is much the same in both districts, the earlier bulletin may be consulted if further information relative to the physical characteristics of this bed is desired.

[1] Cady, G. H., Coal resources of District VI: Ill. Coal Mining Investigations Bull. 15, 1916.

GALATIA COLLIERY CO., NO. 5 (GALATIA) MINE

Section 1—Main south entry

(See figure 22)

	Thickness	
	Ft.	*in.*
Top coal	..	8
Sulphur, 0 to ½ inch	..	½
Middle coal	3	3
Blue band 1 to 1½ inch	..	1½
Bottom coal	2	4
	6	5

Section 2—500 feet northeast of shaft

(See figure 22)

Top coal	..	10
Bone and sulphur	..	½
Middle coal—		
Coal	..	4
Charcoal	..	¼
Coal	..	4¼
Charcoal	..	½
Coal	..	6
Charcoal	..	¾
Coal	..	6
Sulphur	..	¼
Coal	1	10
Blue band and sulphur	..	½
Bottom bench—		
Coal	..	3
Charcoal	..	½
Coal	..	4
Bone coal	..	½
Coal	..	5½
	5	8½

ROOF OF NO. 6 COAL

In this area No. 6 coal has practically everywhere a limestone cap rock. In the mine at Galatia a draw slate only 3 to 8 inches thick separates the coal from the cap rock. In other parts of the area the limestone is much higher above the coal.

Table 11, based upon drilling records, shows the character of the roof of No. 6 coal in many places in the district. The strata tabulated lie above the coal in the order read, that is, in the first case listed the

coal is overlain by 6 inches of black shale, which in turn is overlain by 2 feet 6 inches of black "slate" and that by 2 feet 6 inches of limestone. The sandstone appearing in the last column is generally above the limestone and is possibly the Anvil Rock sandstone of the Kentucky section.

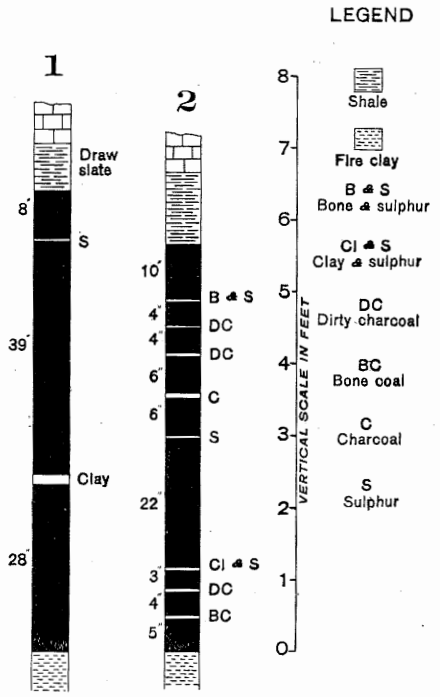

FIG. 22.—Graphic sections of No. 6 coal in the Galatia (No. 5) mine, Galatia Colliery Company.

The terms black shale and black "slate" are used more or less indiscriminately so that there is little value attached to the separation of the two shales in the table. Light shale and clay are tabulated under the heading "gray shale."

FLOOR NO. 6 COAL

No. 6 coal commonly rests upon hard gray shale, generally referred to as "fire clay." The underclay varies in thickness from a few inches to several feet; in the district west it reaches 18 feet or more, but has an average thickness of 2 to 4 feet. The underclay in this region probably does not differ greatly from that in District VI.

TABLE 11.—*Character of the roof of No. 6 coal as shown by drilling records in Saline and Gallatin counties*
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale: Gray and blue		Shale: Black		Black "slate"		Limestone		Sandstone	
¼	¼	Sec.	T. S.	R. E.												
Saline County					*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
SW	NW	30	7	5	..	..	..	6	..	..	2	6	2	6	..	..
S½	NW	18		5	..	..	..	..	..	..	7	6	..	..	..	..
					..	..	38	..	..	..	..	..	..	..	..	..
NE	SE	19	8	5	..	..	..	..	..	..	14	3	..	..	..	..
					..	½	..	..	..	..	..	..	..	..	34	4
SE	NE	19	8	5	..	..	..	..	13	..	..	..	2	6	..	..
					..	..	..	..	1	..	..	..	..	..	53	..
SE	NW	19	8	5	..	..	..	..	9	..	..	..	5	..	54	6
SE	SW	19	8	5	..	..	..	..	11	..	..	..	3	8	54	..
SE	NW	20	8	5	..	..	..	..	..	..	1	..	8	..	..	..
					..	..	..	..	..	..	4	..	..	..	48	..
Cent.	SW	20	8	5	..	..	..	..	..	..	13	4	1	2	..	..
					..	1	..	..	..	..	..	..	..	..	28	3
Cent.	NE	20	8	5	..	..	..	..	..	..	1	..	4	4	..	..
					..	..	..	..	..	..	2	..	..	..	55	..
NW	NW	20	8	5	..	..	..	..	..	..	12	11	..	10	40	6
SW	NE	25	8	5	..	..	..	..	..	..	3	..	6	..	24[a]	..
NW	NW	25	8	5	..	..	..	..	..	..	..	6	5	..	..	..
					..	..	..	..	..	..	5	..	..	..	..	..
SE	NE	26	8	5	..	..	..	..	..	..	1	..	5	..	..	..
					..	..	..	..	..	..	..	3	..	..	..	..
SE	SW	26	8	5	..	..	..	..	3	6	..	..	..	..	..	..

					..	..	2	8	..	..	..	..	..	..	..	..			
					..	3	..	..	..	..	..	..	..	..	26[a]	..			
NW	NE	26	8	5	..	..	..	..	..	..	..	8	6	8	..	11			
					..	..	..	..	..	..	..	6	..	..	24	7			
NE	SW	26	8	5	..	..	..	..	..	..	1	..	..	..	..	..			
					..	..	..	6	..	..	..	..	6	6	..	..			
NW	NW	27	8	5	..	..	..	..	..	.	2	3	1	5	..	..			
					..	..	..	..	..	..	3	4	..	..	38	3			
SE	SE	27	8	5	..	..	..	..	..	..	1	3	6	1	..	..			
					..	..	..	..	..	..	2	3	..	..	..	..			
					..	1	..	..	..	..	..	6	..	..	29[b]	..			
NW	SW	27	8	5	..	..	..	..	..	..	.	..	4	..	..	..			
					..	..	..	..	..	..	4	2	..	..	68	..			
SE	NE	27	8	5	..	..	..	..	1	7	..	..	7	4	..	..			
					..	1	..	..	23	5	..	..	..	..	..	..			
SW	NE	27	8	5	..	..	..	..	..	..	2	..	10	..	..	..			
					..	..	34	..	..	..	..	..	..	..	..	..			
NE	SW	28	8	5	..	..	..	..	..	..	..	9	4	10	..	..			
					..	..	..	..	..	..	5	6	..	..	..	..			
					..	3	..	..	..	..	..	..	..	..	43	6[b]			
SE	SW	28	8	5	..	..	..	..	..	..	2	6	5	6	..	..			
					..	..	..	..	..	..	2	..	..	..	..	..			
					..	..	29	6	..	..	..	..	..	..	..	..			
SW	NW	28	8	5	..	..	..	..	..	..	3	11	3	6	..	..			
					..	..	..	..	..	..	..	2	..	..	..	..			
					..	3	..	..	..	..	..	..	..	..	39	3[b]			
NE	NE	29	8	5	..	..	..	..	..	..	2	10	3	5	..	..			
					..	..	..	..	..	..	2	2	..	..	..	..			
					..	4	..	..	..	..	..	..	..	..	33	6[b]			
SW	SW	29	8	5	..	..	..	..	..	..	2	..	6	..	..	..			

TABLE 11.—*Character of the roof of No. 6 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale: Gray and blue		Shale: Black		Black "slate"		Limestone		Sandstone	
¼	¼	Sec.	T. S.	R. E.												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
					..	..	38	..	..	..	..	..	..	..	..	..
NW	NW	29	8	5	..	..	..	..	..	..	11	..	1	6	..	..
					..	2	..	..	..	..	..	..	..	4	..	..
					..	..	..	..	..	..	2	..	..	..	..	..
					..	..	28	6	..	..	..	..	..	..	..	..
NW	SE	29	8	5	..	..	1	6	..	..	4	..	3	6	..	..
					..	2	.	..	..	..	..	..	..	4	38	6[a]
NW	NE	29	8	5	..	..	..	..	..	..	5	2	3	10	..	..
					..	3	..	..	..	..	..	..	..	..	39	11
NE	SE	30	8	5	..	..	..	..	..	..	10	6	3	2	..	..
					..	2	..	4[c]	..	..	..	..	..	..	17	3
NE	NW	31	8	5	..	..	..	..	..	..	2	11½	4	6	..	..
					..	..	..	..	..	..	4	6½	..	3½	..	..
					..	1½	..	..	..	..	..	..	..	8	35	9[b]
SW	SW	32	8	5	..	..	..	..	..	..	6	5	6	6	..	..
					..	..	28	..	..	..	..	..	..	..	..	..
NE	NE	32	8	5	..	..	..	..	..	..	2	3	7	6	..	..
					..	..	..	..	..	..	..	2	..	..	..	..
					..	3	..	..	..	..	..	..	..	..	39	10
NW	SE	33	8	5	..	..	..	..	..	..	1	3	7	..	..	..
					..	..	..	..	..	..	2	6	..	..	..	..
					..	2	..	..	..	..	..	..	..	..	13	6

NW	NW	34	8	5	..	..	..	..	..	..	..	10	6	2	..	..
					..	..	..	..	..	..	2	9	..	..	..	..
					..	2	..	..	..	..	..	..	..	3	37	2
NE	SE	34	8	5	..	..	..	..	..	..	..	5	4	7	..	..
					..	..	1	8[d]	..	..	16	4	..	..	21	10[b]
SW	SW	35	8	5	..	..	..	..	6	3	..	..	..	..	9	4[a]
					..	..	..	..	8	..	..	..	..	..	14	6[a]
					..	..	..	..	..	..	..	..	8	..	..	..
NE	SW	35	8	5	..	..	..	..	..	..	..	..	6	2	..	..
					..	..	..	..	..	..	3	7[d]	..	..	..	..
					..	..	..	4	17	..	..	..	..	..	..	..
NE	SE	34	8	5	..	..	1	8	..	..	..	5	4	7	..	..
					..	4	..	..	..	..	16	4	..	..	21	10[b]
SW	SW	35	8	5	..	..	..	..	6	3	..	..	..	..	9	4[a]
					..	..	..	..	8	..	..	..	..	..	14	6
					..	..	..	..	..	..	..	..	8	..	..	..
NE	SW	35	8	5	..	..	..	..	..	..	..	..	6	2	..	..
					..	..	..	..	..	..	3	7	..	..	..	..
					..	1	..	4	17	..	..	..	..	..	..	..
NE	SE	35	8	5	..	..	..	..	..	..	2	4	5	..	17	4[b]
NW	NW	36	8	5	..	..	12	3	..	6	..	..	..	..	..	..
					..	..	3	8	..	..	..	..	..	..	19	10[b]
West center		15	8	6	..	..	..	..	..	..	..	..	8	..	..	..
					..	..	39	..	..	..	..	..	..	..	3	..
NW	SE	15	8	6	..	..	1	..	..	..	..	..	8	..	..	..
					..	..	4	..	..	..	..	..	..	..	25	..
NE	SE	15	8	6	..	..	..	..	..	..	2	..	8	..	..	..
					..	..	2	..	..	..	..	..	..	..	39	..
SW	SW	21	8	6	..	..	..	..	1	..	..	..	..	..	38[b]	..
SE	SE	22	8	6	..	..	..	..	..	..	3	..	6	..	..	..

TABLE 11.—*Character of the roof of No. 6 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale: Gray and blue		Shale: Black		Black "slate"		Limestone		Sandstone	
¼	¼	Sec.	T. S.	R. E.												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
					..	..	..	..	..	..	1	..	..	..	34	..
NW	NW	22	8	6	..	..	..	..	..	..	..	..	8	..	36	..
NE	SW	23	8	6	..	..	..	..	..	..	2	..	6	..	..	..
					..	..	19	..	..	..	..	..	..	..	..	..
					1	..	..	..	..	..	..	..	12	..	16	..
SE	NW	24	8	6	..	..	..	..	..	..	..	..	5	..	60[a]	..
NE	SW	24	8	6	..	..	..	..	..	..	3	..	5	..	..	..
					..	..	5	..	..	..	..	..	..	..	35	..
NW	NW	25	8	6	..	..	..	..	..	..	1	6	7	..	..	..
					..	..	11	..	..	..	..	..	..	..	49	6[b]
NE	NW	25	8	6	..	..	..	..	..	..	2	..	7	..	..	..
					..	..	21	..	..	..	..	..	..	..	..	..
NE	NE	26	8	6	..	..	..	..	..	..	1	..	8	..	..	..
					..	..	..	..	..	..	3	..	..	..	..	..
					..	..	10	..	..	..	..	..	..	..	12	..
NE	NW	26	8	6	..	..	..	..	..	..	..	..	7	6	..	..
					..	..	20	..	..	..	..	..	..	..	11	..
NW	SE	27	8	6	..	..	..	..	..	..	4	..	8	..	..	..
					..	..	5	..	..	..	..	..	..	..	15	..
NW	SW	27	8	6	..	..	..	..	..	..	..	..	8	..	..	..
					..	..	6	..	..	..	..	..	..	..	61	..
NW	NE	28	8	6	..	..	..	..	..	..	..	..	4	..	80	..

SE	SE	28	8	6	..	..	..	..	..	..	..	..	..	..	..	..			
					..	..	..	..	2	..	..	..	8	..	36	..			
NE	NW	29	8	6	..	..	4	..	..	..	3	6	..	..	37	6[a]			
SE	SE	29	8	6	..	..	..	..	..	..	..	..	..	..	..	..			
					..	..	..	..	4	..	..	..	5	..	13[b]	..			
SE	SE	33	8	6	..	..	..	..	24	5	..	..	..	..	6	7			
SW	SW	34	8	6	..	..	..	..	..	..	..	4	..	..	..	..			
					..	..	..	..	..	..	2	8	6	..	..	..			
					..	3	3	5	..	..	..	..	..	..	43	9			
SW	SW	35	8	6	..	..	..	..	..	..	1	..	..	..	..	..			
					..	..	20	..	..	..	..	..	5	..	11	..			
SW	SW	35	8	6	..	..	..	..	..	..	1	..	..	..	..	..			
					..	..	..	..	..	..	1	..	7	..	..	..			
					..	..	12	..	..	..	..	..	..	..	12	..			
SW	SW	35	8	6	..	..	..	..	..	..	4	..	..	..	..	..			
					..	..	..	..	..	..	1	..	4	..	32[b]	..			
NW	SW	35	8	6	..	..	..	..	..	..	1	..	..	..	28[b]	..			
Cent. N. ½		36	8	6	..	..	..	..	..	..	1	6	6	..	..	..			
					..	..	28	..	..	..	..	..	7	..	..	..			
		36	8	6	..	..	..	..	8	..	1	..	..	..	19[b]	..			
NE	NW	10	8	7	..	..	..	..	..	..	7	..	..	..	29	6			
NE	SW	14	8	7	..	..	..	..	..	..	1	..	..	..	..	..			
					..	..	5	..	..	..	..	..	9	..	16[b]	..			
NW	SE	15	8	7	..	..	..	..	..	..	2	..	..	..	25[b]	..			
NW	SE	15	8	7	..	..	..	..	..	..	..	..	6	6	..	..			
					..	..	27	..	..	..	..	..	9	..	..	..			
SE	NE	17	8	7	..	..	..	..	..	..	..	6	..	..	..	..			
					..	..	..	..	..	..	1	..	7	6	..	..			
					..	..	2	..	..	..	..	..	..	..	24[a]	..			
NW	SW	19	8	7	..	..	..	..	..	..	5	6	5	..	..	..			

TABLE 11.—*Character of the roof of No. 6 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale: Gray and blue		Shale: Black		Black "slate"		Limestone		Sandstone	
¼	¼	Sec.	T. S.	R. E.												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
					..	..	18	..	..	..	..	..	..	..	12[a]	..
SW	NE	22	8	7	..	..	..	..	..	..	1	6	4	..	21[b]	..
NE	SW	23	8	7	..	..	..	..	..	..	..	..	6	6	15[b]	..
SW	NE	26	8	7	..	..	..	..	..	..	2	6	4	10	..	..
					..	..	5	6	..	..	..	..	..	..	11	..
NE	SE	27	8	7	..	..	..	..	..	..	3	..	3	..	27[b]	..
SW	SW	28	8	7	..	..	..	..	..	..	1	6	5	..	..	..
					..	..	..	..	..	..	4	..	..	..	..	..
					..	..	15	..	..	..	..	..	..	..	6	..
NW	NW	31	8	7	..	..	1	..	..	..	4	..	3	..	..	..
					..	..	27	..	..	..	..	..	..	..	..	..
NW	SE	32	8	7	..	..	1	..	..	..	..	..	4	..	..	..
					..	..	..	..	..	..	6	..	..	..	..	..
SW	NE	33	8	7	..	..	..	..	..	..	..	..	..	..	23	..
NE	NW	34	8	7	..	..	2	..	..	..	..	..	3	..	28[b]	..
NE	NE	1	9	5	..	..	..	..	..	..	..	..	..	5	..	..
					..	..	..	..	..	..	2	5	..	..	..	..
					..	..	6[e]	..	..	..	15	..	..	..	6	6[b]
SW	NE	1	9	5	..	..	39[e]	..	..	..	..	..	..	..	..	..
SE	SW	1	9	5	..	..	..	..	..	..	..	1½	8	2	..	..
					..	..	3	2	..	..	..	1	..	..	..	..

NW	NW	1	9	5	..	..	..	..	..	..	1	8	9	..	..	..
					..	4	..	..	..	..	..	..	..	..	23[a]	..
NE	SE	2	9	5	..	..	..	..	..	..	1	3	7	..	23[a]	..
SW	NW	2	9	5	..	..	..	..	..	..	..	..	..	..	42[a, i]	..
NE	SW	2	9	5	..	..	4	8	..	..	1	8½	..	4	..	..
					..	..	6	4	..	..	..	..	..	..	13	6[b]
NW	NE	2	9	5	..	..	..	..	..	..	1	..	..	..	..	..
					..	..	4	2	10	3	..	..	..	..	20[b]	..
SE	SE	3	9	5	..	..	1	1	..	..	..	..	7	6	..	..
					..	..	..	..	..	..	1	5½	..	6	..	..
					..	..	..	..	..	..	1	..	..	5	..	..
NW	SW	3	9	5	..	..	..	..	..	..	2	6	5	..	..	..
					..	..	..	..	..	..	1	6	..	..	..	..
					..	..	14	6	..	..	..	..	..	..	39	..
NW	NW	4	9	5	..	..	..	..	..	..	..	..	9	..	21	6
NE	SW	4	9	5	..	..	1	3[e]	..	..	..	..	6	2	..	..
					..	..	..	..	2	6	..	..	..	..	..	..
					..	3	5	7[f]	..	..	..	..	..	..	32	..
NE	NE	4	9	5	..	..	..	..	3	4	..	..	..	..	..	..
					..	8	..	..	..	..	..	..	2	10	..	..
					..	..	..	..	..	8	..	..	..	..	..	..
					..	6	..	..	..	..	..	..	..	..	52[b]	..
NW	SE	5	9	5	..	..	..	..	..	..	..	..	..	8	..	..
					..	..	..	..	..	..	2	4	..	..	..	..
					..	..	11[e]	..	..	..	..	..	..	..	26[a]	..
NW	SE	6	9	5	..	..	..	..	..	..	2	..	..	..	..	..
					..	..	6	6	..	..	5	..	4	6	..	..
					..	..	22	..	..	..	..	..	..	..	..	..
NE	NW	6	9	5	..	..	..	..	..	..	..	..	3	..	..	..
					..	..	11	..	..	..	..	..	..	..	28[b]	..

TABLE 11.—*Character of the roof of No. 6 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray and blue		Black							
¼	¼	Sec.	T. S.	R. E.												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
SE	NE	6	9	5	..	..	..	8	..	..	4	..	..	..	..	..
					..	..	19	6[g]	..	..	..	..	..	..	5	5
SE	SE	6	9	5	..	..	..	..	..	..	..	..	1	4	..	..
					..	1	..	..	..	..	..	..	..	..	5[a]	..
					..	..	10	..	..	..	..	..	..	..	6	7
SE	NE	7	9	5	..	..	..	..	..	..	2	6	6	6	..	..
					..	..	41[c]	..	..	..	..	..	..	..	50[a]	..
SE	SW	8	9	5	..	..	..	..	..	..	..	..	6	2	..	..
					..	..	3	6½	..	..	..	7	..	..	..	..
					..	..	2	..	..	..	..	..	..	..	34[b]	..
NE	NE	8	9	5	..	..	..	..	..	..	..	..	..	2	..	..
					..	..	..	..	..	..	1	9	4	10	..	..
					..	..	..	2½[e]	..	..	1	9	..	..	..	..
					..	3[h]	..	..	..	..	1	5	..	6	..	..
					..	..	23	8	..	..	..	..	..	..	6	..
NE	SW	8	9	5	..	..	..	..	..	..	..	..	5	3	..	..
					..	..	..	..	..	..	..	..	..	..	..	..
					..	..	6	7[e]	..	..	..	..	..	..	..	..
SE	SE	8	9	5	..	..	4	2[e]	..	..	..	..	2	2	..	..
					..	..	6[e]	..	..	..	..	..	..	..	52[b]	..
N. line		9	9	5	..	..	..	6[e]	..	..	..	..	5	6	..	..
					..	..	23	..	..	..	..	..	..	..	3	..

SE	NW	9	9	5	..	..	..	..	..	..	2	..	..	..	33	..
SW	NE	10	9	5	..	..	1	6[e]	..	..	..	..	7	..	..	..
					..	..	22	6	..	..	..	..	..	..	5	..
NW	SE	11	9	5	..	..	..	..	..	..	..	..	..	..	54[a]	..
SW	SW	11	9	5	..	..	..	..	..	..	..	3	6	..	..	..
					..	..	2	7[e]	..	..	..	..	..	..	..	..
					..	4[h]	..	..	..	..	..	..	..	6	..	..
					..	..	12	½	..	..	..	..	..	..	11	..
SE	NW	11	9	5	..	..	..	..	..	..	..	..	5	6	..	..
					..	..	..	..	..	..	2	6	..	..	..	..
					..	2	..	..	..	..	..	..	..	4	34	..
NE		11	9	5	..	..	..	..	..	..	5	6	..	..	..	..
					..	..	15	3[e]	..	..	..	..	..	..	21[a]	..
S½	NE	12	9	5	..	..	4	6[g]	..	..	..	..	..	..	..	..
					..	..	..	8	..	..	..	..	..	..	..	..
					..	4	..	..	8	6	..	..	..	..	16+[b]	..
NW	SE	12	9	5	..	..	..	..	..	..	..	4	..	..	..	..
					..	..	2	1[e]	..	..	..	..	4	8	..	..
					..	..	14[g]	..	..	..	..	..	..	..	7	..
SE	SE	13	9	5	..	..	2	2[e]	..	..	..	..	..	..	19+	..
SE	NE	14	9	5	..	..	..	..	..	..	8	10	..	..	29[b]	..
NE	SW	14	9	5	..	..	..	..	..	..	..	..	4	3	15[b]	..
SW	NE	15	9	5	..	..	..	..	..	..	..	..	8	..	35[a]	..
Cent.	NW	15	9	5	..	..	..	6[e]	..	..	..	..	7	..	..	..
					..	..	6	..	..	..	..	..	..	..	17	..
		16	9	5	..	..	4	..	..	..	..	..	..	..	7	..
					..	..	10	..	..	..	..	..	..	..	8	..
SW	NE	16	9	5	..	..	..	..	..	..	2	8	..	..	..	..
					..	2	..	..	..	..	..	..	5	11	..	..
					..	..	..	..	..	..	1	..	..	..	7[a]	..

TABLE 11.—*Character of the roof of No. 6 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale: Gray and blue		Shale: Black		Black "slate"		Limestone		Sandstone	
¼	¼	Sec.	T. S.	R. E.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.
SW	NE	17	9	5	..	..	..	..	..	..	1	3	7	..	..	..
					..	..	..	6	..	..	..	..	..	..	..	..
					..	6	1[c]	..	..	..	..	..	..	..	6	..
NW	SE	18	9	5	..	..	..	6[c]	..	..	..	..	11	..	..	..
					..	..	6	..	..	..	..	..	..	..	32	..
SE	SE	18	9	5	..	..	1[c]	..	..	..	..	..	8	..	..	..
					..	..	8[c]	..	..	..	..	..	..	..	Surface	
SW	SW	19	9	5	..	..	..	..	..	..	..	..	2	..	..	..
					..	..	..	..	..	..	8	..	..	..	18	..
NW	NW	19	9	5	..	..	..	..	..	..	..	1½	7+	..	..	..
SW	NE	19	9	5	..	..	..	..	..	..	..	1½	6	..	..	..
					..	..	17	..	..	..	..	..	..	..	10	..
NW	SE	21	9	5	..	..	..	..	..	..	1	..	4	4	..	..
					..	2	..	..	2	..	..	..	..	..	33[a]	..
SE	NW	21	9	5	..	..	..	..	..	..	2	..	5	6	..	..
					..	..	26	..	..	..	..	..	..	..	1	6+
NW	NE	21	9	5	..	..	..	..	..	..	1	6	9	..	5	..
					..	..	..	..	21	..	..	..	..	..	11	6
NE	NW	22	9	5	..	..	..	..	..	..	1	2	5	1	Surface	
SW	SE	22	9	5	..	..	..	..	1	..	..	..	4	..	..	..
					..	..	..	..	2	8	..	..	..	..	28+[b]	..
NE	NE	22	9	5	..	..	..	..	..	..	..	..	3	..	.	..

NW	SE	22	9	5	..	..	42+	..	..	..	..	..	..	..	..	..	..	..	..
					..	..	..	½[e]	..	..	..	..	..	..	..	..	1	6	
					..	..	..	..	..	..	..	..	4	..	..	..			
SW	NE	23	9	5	..	..	..	..	..	..	1	..	1	..	21	..			
					..	..	..	..	..	..	2	4	4	..	..	..			
NE	NW	24	9	5	..	..	23	6	..	..	..	..	..	..	11	..			
					..	..	1[e]	..	..	..	..	..	6	..	..	..			
SW	SE	24	9	5	..	..	16	..	..	..	..	..	..	..	6+	..			
					..	..	..	..	..	..	1	..	8	..	2	..			
NE	NW	26	9	5	..	..	4	..	..	..	..	..	..	..	8	..			
					..	..	..	..	..	..	..	..	1	..	..	..			
NE	NW	28	9	5	..	..	..	..	..	..	6	..	..	..	12+	..			
					..	..	..	..	..	..	1	4	6	..	..	..			
NW	SE	28	9	5	..	..	..	..	..	..	2	..	..	..	30+[b]	..			
NE	NE	28	9	5	..	..	..	..	..	..	..	6	..	..	5+	..			
					..	..	..	..	..	..	2	..	6	..	..	..			
NE	NW	34	9	5	..	..	..	..	..	..	..	½	..	..	39	..			
					..	..	..	..	..	..	17	..	..	..	..	..			
NE	SE	1	9	6	..	..	9	..	..	..	..	..	..	..	5+	..			
					..	..	..	..	..	..	2	5	4	6	..	..			
NE	SE	2	9	6	..	..	..	..	..	..	3	6	..	..	20[b]	..			
NE	SE	2	9	6	..	..	..	..	..	..	2	4	2	5	35[b]	..			
					..	..	..	..	..	..	..	..	2	..	..	..			
					2	..	..	..	..	..	1	..	..	..	..	..			
					..	..	25	..	..	..	..	..	6	..	..	..			
					..	..	..	..	..	..	..	..	..	..	10	..			
SE	SE	4	9	6	..	..	..	..	..	..	1	..	6	..	..	..			
					..	..	..	..	..	..	8	..	..	..	21[b]	..			
SW	SE	4	9	6	..	..	..	..	..	..	1	3	6	6	..	..			
					..	..	..	..	..	..	11	6	..	..	17[b]	..			

TABLE 11.—*Character of the roof of No. 6 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray and blue		Black							
¼	¼	Sec.	T. S.	R. E.												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
SW	NE	4	9	6	..	..	..	..	..	..	..	..	7	..	..	..
					..	..	..	..	18	..	..	..	..	..	8	..
NE	NE	5	9	6	..	..	..	..	..	..	1	6	6	6	..	..
					..	..	7	..	..	..	..	..	..	..	15	..
NW	NW	5	9	6	..	..	..	..	..	..	2	..	7	..	..	..
					..	..	21	..	..	..	..	..	..	..	5	..
NE	NW	6	9	6	..	..	..	..	..	..	2	..	6	..	..	..
					1	..	11	..	..	..	..	..	..	..	2	..
					..	..	3	6	..	..	..	..	..	..	..	..
					..	6	..	..	..	..	..	..	8	..	..	..
SE	SW	6	9	6	..	..	..	..	..	..	..	..	5	..	..	..
					..	..	..	..	..	..	1	..	..	..	..	..
					..	..	6	..	..	..	..	..	..	..	15[a]	..
SW	SE	7	9	6	..	..	..	..	..	..	2	6	4	6	..	..
					..	..	..	..	..	..	..	6	..	..	..	..
					..	..	13	6	..	..	..	..	..	..	15[a]	..
SE	SW	8	9	6	..	..	5	..	..	..	..	..	..	..	..	..
					1	..	6	6	..	..	..	..	..	..	1	6
					..	..	10	..	..	..	..	..	..	..	..	..
SW	NW	8	9	6	..	..	..	..	..	..	..	..	4	..	5+	..
NW	SW	8	9	6	..	..	..	..	..	..	5	6	1	6	..	..
					..	..	23	..	..	..	..	..	..	..	2	...

NE	NW	8	9	6	..	..	..	..	..	..	3	..	5	..	..	..
					..	..	15	..	..	..	..	..	..	..	5	..
NW	SE	9	9	6	..	..	..	..	..	..	..	6	5	6	28[b]	..
SW	NE	10	9	6	..	..	..	..	..	..	..	1	..	1½	..	..
					..	..	..	..	..	..	2	8	3	3½	..	..
					..	..	..	..	..	..	2	½	..	..	..	..
					..	..	10	6½	..	..	..	..	..	..	12	6[b]
SW	SW	10	9	6	..	..	..	..	..	..	1	..	5	5	..	..
					..	..	..	..	..	..	..	8	..	..	28	6[b]
NE	SE	11	9	6	..	..	..	..	..	..	..	..	5	..	..	..
					..	..	..	..	..	..	4	..	..	..	..	..
					..	..	18[a]	..	..	..	..	..	..	..	7	..
SE	SW	11	9	6	..	..	..	..	..	..	1	..	5	..	..	..
					..	..	..	..	1	..	..	..	..	..	..	..
					..	..	16	6	..	..	..	..	..	..	10[a]	..
SE	NW	12	9	6	..	..	..	..	..	..	..	..	6	..	..	..
					..	..	..	..	..	..	3	4	..	..	26	..
SE	SE	12	9	6	..	..	..	..	..	..	2	3	7	..	..	..
					..	..	..	..	..	..	2	..	1	..	..	..
					..	..	15	..	..	..	..	..	..	..	6	..
NW	SW	13	9	6	..	..	..	..	..	..	1	8	5	..	..	..
					..	..	..	..	..	..	3	..	..	..	..	..
					..	..	2	..	..	..	..	..	..	..	..	..
					1	6	..	..	..	..	..	..	..	..	Surface	
SW	SW	16	9	6	..	..	..	..	..	..	2	..	4	6	..	..
					..	..	..	..	22	8	..	..	..	..	6	..
SW	SW	16	9	6	..	..	..	..	..	..	1	6	4	6	..	..
					..	..	..	..	16	6	..	..	..	..	16+	..
SE	NW	16	9	6	..	..	..	..	..	..	..	..	5	6	29[b]	..
NW	SW	16	9	6	..	..	..	..	..	..	1	4	5	6	..	..

TABLE 11.—*Character of the roof of No. 6 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray and blue		Black							
¼	¼	Sec.	T. S.	R. E.	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
					..	..	18	..	..	..	..	..	..	..	6+[b]	..
NE	NE	17	9	6	..	..	..	..	..	..	..	10	6	..	..	..
					..	..	..	..	..	..	1	..	..	..	..	..
					..	..	..	..	6	..	..	..	..	..	3[a]	..
					..	..	9	..	..	..	..	..	..	..	6	..
SE	SE	17	9	6	..	..	..	..	..	..	1	10	5	6	..	..
					..	..	11	6	..	..	..	..	..	..	13[b]	..
SW	SW	17	9	6	..	..	..	..	..	..	1	11	5	..	..	..
					..	..	..	..	10	..	..	..	..	..	21	..
SW	SW	17	9	6	..	..	..	..	..	..	2	..	2	..	30[b]	..
NW	SW	18	9	6	..	..	..	..	..	..	3	..	3	4	5	..
SE	NW	18	9	6	..	..	..	..	..	..	1	3	4	3	2	8[a]
					..	2	..	..	..	..	..	..	..	..	25	5[b]
SE	NE	18	9	6	..	..	..	..	..	..	..	..	7	3	..	..
					..	..	8	9	..	..	..	..	..	..	11	8
NW	SE	18	9	6	..	..	..	..	..	..	1	6	5	6	..	..
					..	..	..	..	..	..	2	..	..	..	..	..
					..	..	..	..	15	..	..	..	..	..	18	..
NE	NE	18	9	6	..	..	..	..	..	..	..	..	5	..	..	..
					..	..	15	6	..	..	..	..	..	..	18[a]	..
NE	NE	18	9	6	..	..	..	..	..	..	..	..	4	..	..	..
					..	..	15	..	..	..	..	..	..	..	17	..

SE	SW	19	9	6	..	..	..	..	..	..	2	7	2	11	..	..
					..	..	..	..	..	..	..	6	..	..	28	8[b]
SE	SW	19	9	6	..	..	..	..	..	..	2	..	6	..	..	..
					..	..	20	..	..	..	..	..	..	..	17[b]	..
NE	NW	20	9	6	..	..	..	..	..	..	7	..	..	..	..	..
					..	..	11	..	..	..	..	..	..	..	18[a]	..
					..	..	..	..	..	..	..	..	6	..	..	..
SE	NW	20	9	6	..	..	..	..	..	..	..	11	7	6	27[b]	..
NE	NE	20	9	6	..	..	..	..	..	..	1	..	..	..	..	..
					..	..	4[i]	..	..	..	..	..	..	..	..	..
					..	..	17	..	..	..	..	..	..	..	16[a]	..
SW	NE	23	9	6	..	..	..	..	..	..	..	..	8	..	Surface	
SE	SW	27	9	6	..	..	10	..	..	..	..	..	..	..	Surface	
NW	SW	27	9	6	..	..	10	..	..	..	4	..	..	..	Surface	
SE	NW	27	9	6	..	..	..	..	..	..	..	..	..	..	83[b]	..
NW	SW	2	9	7	..	..	..	..	..	..	1	6	5	..	..	..
					..	..	..	..	..	..	6	..	..	..	..	..
NE	NW	3	9	7	..	..	..	..	..	..	2	4	..	..	..	..
					..	..	26	..	..	..	..	..	6	..	..	..
SW	SW	4	9	7	..	..	..	..	..	..	1	..	5	..	..	..
					..	..	..	..	..	..	5	..	..	..	10	..
NE	NW	4	9	7	..	..	..	..	..	..	6	6	..	..	..	..
					..	..	..	6	..	..	..	..	5	..	..	..
					..	..	..	..	..	..	2	..	..	..	..	..
					..	..	16	..	..	..	..	..	..	..	..	..
SW	SE	5	9	7	..	..	..	..	..	..	..	6	6	..	..	..
					..	..	..	..	..	..	6	..	..	..	17	..
NE	NE	5	9	7	..	..	..	..	..	..	4	..	5	..	..	..
					..	..	..	..	..	..	5	..	..	..	..	..
					..	..	..	..	10	..	..	..	..	..	5	..

TABLE 11.—*Character of the roof of No. 6 coal as shown by drilling records in Saline and Gallatin counties*—Continued
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale: Gray and blue		Shale: Black		Black "slate"		Limestone		Sandstone	
¼	¼	Sec.	T. S.	R. E.												
					Ft.	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
W½	NW	5	9	7	..	..	..	..	..	..	..	..	4	..	24	..
SE	NE	6	9	7	..	..	..	..	..	..	2	..	7	..	..	..
					..	..	..	..	2	5	..	..	..	..	..	..
					..	..	14	..	..	..	..	..	..	..	5	..
SE	NW	7	9	7	..	..	..	..	..	..	2	9	7	..	..	..
					..	..	..	..	2	..	..	..	..	..	..	..
					..	..	16	..	..	..	..	..	..	..	7	..
SW	NW	9	9	7	..	..	2	..	..	..	2	..	2	..	..	..
					..	..	10	..	..	..	..	..	..	..	6[a]	..
NW	SW	10	9	7	..	..	..	..	..	..	2	6	3	6	11	..
NW	NE	10	9	7	..	..	..	..	..	..	3	..	5	..	..	..
					..	..	..	..	..	..	7	..	..	..	12	..
NW	SW	11	9	7	..	..	..	..	..	..	1	6	3	2	..	..
					..	..	..	..	..	..	2	..	..	..	13	..
NE	SE	15	9	7	..	..	7	..	..	..	2	6	..	..	..	..
					..	..	31	4	..	..	..	..	3	5	..	..
					..	..	4	10	..	..	..	..	..	..	3+	..
SW	NE	15	9	7	..	..	..	..	..	..	18	..	..	..	12	..
SE	SE	16	9	7	..	..	..	..	..	..	1	..	5	..	..	..
					..	..	..	..	..	..	..	..	..	..	22[a, j]	..
SE	SW	17	9	7	..	..	..	..	..	..	19	..	..	..	..	..
					..	..	12	..	..	..	..	..	..	..	23	..

SW	SE	18	9	7	..	..	..	..	..	..	8	..	..	..	25	..
SE	NE	22	9	7	..	..	4	..	..	..	2	6	..	..	22	..
					..	..	..	..	..	..	..	..	..	..	9[a, j]	..
		Gallatin County														
SE	NW	23	7	8	..	..	30	..	..	..	..	..	15	..	..	..
					..	..	..	..	5	..	..	..	..	..	10	..
NE	SE	27	7	8	..	..	..	..	..	..	..	..	4	..	..	..
					..	..	..	..	..	..	21	..	..	..	15	..
NW	NE	31	7	9	..	..	..	..	1	9	..	..	2	6	..	..
					..	..	..	..	..	..	2	..	..	..	23[b]	..
SW	SW	17	8	8	..	..	..	..	1	8	..	..	5	..	..	..
					..	..	4	..	..	..	..	..	..	..	11[b]	..
NW	NW	28	8	8	..	..	..	..	1	4	..	..	3	..	..	..
					..	..	10	..	..	..	..	..	..	..	17[a]	..
SW	NE	19	8	9	..	..	..	..	..	..	1	2	..	..	..	..
					..	..	..	..	1	..	..	..	3	..	..	..
					..	..	5	..	..	..	..	..	..	..	17[a]	..
SW	NW	20	8	9	..	..	..	..	..	..	..	..	2	..	..	..
					..	..	14[g]	..	..	..	..	..	..	..	24	..
NE	SW	23	8	9	..	..	14	..	..	..	..	..	6	..	..	..
					..	..	45[g]	..	..	..	..	..	..	..	..	..
NW	NW	28	8	9	..	..	..	..	..	..	..	..	8	..	..	..
					..	..	14[g]	..	..	..	..	..	..	..	10	..
NE	NE	29	8	9	..	..	..	..	..	..	..	..	7	..	..	..
					..	..	3	..	..	..	..	..	..	..	19[g]	..
SE	SW	1	9	8	..	..	1	1	..	..	..	..	2	8	..	..
					..	..	..	..	8	9	..	..	..	..	12	..
Cent. N. ½		1	9	8	..	..	..	..	..	..	..	..	4	2	..	..
					..	..	..	..	3	7	..	..	..	..	..	..

TABLE 11.—*Character of the roof of No. 6 coal as shown by drilling records in Saline and Gallatin counties*—Concluded
(Strata are tabulated in order of occurrence above coal)

Location					Coal		Shale				Black "slate"		Limestone		Sandstone	
							Gray and blue		Black							
¼	¼	Sec.	T. S.	R. E.	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*	*Ft.*	*in.*
SE	NE	5	9	8	..	..	..	..	2	7	..	..	..	..	..	..
					..	..	16	..	..	..	..	..	..	..	3[a]	..
					..	..	10	..	..	..	..	..	4	10	..	..

[a] Sandy shale, no sandstone.
[b] Sandstone and sandy shale.
[c] Fossils.
[d] Thin coal.
[e] Slate.
[f] Variegated.
[g] Brown.
[h] Bone coal.
[i] Lime shale.
[j] Red.
[k] Black?

STRUCTURE

The structure of No. 6 coal is shown in Plate IV. This map is on the same scale as the structure map of Jefferson, Franklin and Williamson counties (District VI) and of maps of Districts II and VII presented in earlier reports.[1]

The four maps together show the structure of No. 6 coal so far as it is well known in the southern part of the State.

Comparison of Plate IV and the structure map of No. 5 coal (Plate I) will show that the two coals are nearly parallel, there being little difference in the structural forms indicated on the two maps.

EXPLOITATION

The development of the No. 6 bed in this region has been held back because it is thinner than the same bed in Williamson and Franklin counties, and is inferior in quality to No. 5 coal mined at Harrisburg. It represents, however, a great and practically untouched coal resource.

McLeansboro Coals

Ten coal beds in the McLeansboro formation are believed to underlie at least part of this district. All but one of these are thin, and it is doubtful whether they will be of economic value for many years, if ever. The coal found from 60 to 90 feet above the top of No. 6 coal (the base of the McLeansboro formation) is in a large number of places known to be at least 2 feet in thickness. In one record it is reported to be 42 inches thick. The other McLeansboro coals are generally thinner.

Chemical Character of No. 5 and No. 6 Coals

Table 12 shows the chemical character of No. 5 coal in Saline and Gallatin counties as determined from the samples collected for the Illinois Coal Mining Investigations during 1912. The table is reproduced from Bulletin 29 of the State Geological Survey.[2]

Comparison with analyses of other coals in the State is made in Table 13 and Plate IX. It is apparent from the tables that No. 5 coal

---

[1] Kay, Fred H., Coal Resources of District VII, Ill. Mining Investigations Bull. 11, Plate I, 1915. Cady, Gilbert H., Coal Resources of District VI, Ill. Mining Investigations Bull. 15, Plate V, 1916. Cady, Gilbert H., Coal Resources of District II, Ill. Mining Investigations Bull. 16, Plate I, 1917.

[2] Parr, S. W., Purchase and sale of Illinois coal on specification: Ill. State Geol. Survey Bull. 29, pp. 62–63, 1914.

TABLE 12.—*Average analytical and heat values of No. 5 coal for separate mines in Saline and Gallatin counties*

Gallatin County

Co-op No.	Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	CO_2	B. t. u.	"Unit" coal
47	5.72	35.77	46.71	11.80	3.47	1.01	12053	14919
	Dry	37.94	49.54	12.52	3.68	1.07	12784	
Extra [a]	4.13	34.21	52.80	8.86	3.23	.02	12987	15175
	Dry	35.68	55.07	9.25	3.37	.03	13546	
Extra [a]	3.68	37.82	48.18	10.32	4.55	.04	12818	15078
	Dry	39.26	50.02	10.72	4.73	.05	13307	
Extra [a]	3.94	38.13	45.95	11.98	3.53	.03	12449	15117
	Dry	39.70	47.82	12.48	3.67	.04	12958	
Extra [a]	4.03	33.71	51.84	10.42	4.19	.02	12783	15256
	Dry	35.13	54.01	10.86	4.37	.02	13319	
Average	4.30	35.93	49.08	10.69	3.79	.24	12616	15109
	Dry	37.54	51.29	11.17	3.96	.25	13183	

Saline County

43	6.97	35.98	49.69	7.36	2.05	.32	12550	14829
	Dry	38.68	53.41	7.92	2.20	.34	13490	
44	6.70	35.31	49.55	8.44	2.56	.02	12401	14824
	Dry	37.85	53.11	9.04	2.74	.02	13291	
45	7.03	34.78	50.27	7.92	2.48	.26	12420	14806
	Dry	37.41	54.07	8.52	2.67	.28	13359	
46	7.96	34.68	48.54	8.82	2.79	.46	12077	14741
	Dry	37.68	52.74	9.58	3.03	.50	13122	
48	7.67	33.90	50.26	8.17	2.56	.70	12234	14739
	Dry	36.72	54.43	8.85	2.77	.76	13250	
49	5.20	38.06	45.90	10.84	4.60	.59	12193	14824
	Dry	40.15	48.42	11.43	4.85	.62	12862	
Average	6.92	35.44	49.06	8.58	3.76	.39	12314	14794
	Dry	38.08	52.70	9.22	4.04	.42	13229	

[a] From mines not included in the original group of 100 selected for examination by the Coal Mining Investigations.

TABLE 13.—*Average analyses of Illinois coals by districts*
(Figures are for coal as received)
Analyses by J. M. Lindgren under general supervision by Prof. S. W. Parr

District	Coal bed	Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	B. t. u.	Number of samples averaged
LaSalle	2	16.18	38.83	37.89	7.08	2.89	10981	33 from 11 mines
Murphysboro	2	9.28	33.98	51.02	5.72	1.29	12488	15 from 5 mines
Rock Island and Mercer counties	1	13.46	38.16	39.75	8.63	3.59	11036	14 from 4 mines
Springfield-Peoria	5	15.10	36.79	37.59	10.53	3.52	10514	54 from 17 mines
Saline County	5	6.75	35.49	48.72	9.04	2.92	12276	27 from 7 mines
Franklin and Williamson counties	6	9.21	34.00	48.08	8.71	1.53	11825	58 from 16 mines
S. W. Illinois west of Duquoin anticline	6	12.56	38.05	39.06	10.33	4.01	10847	76 from 25 mines
Danville: Grape Creek coal	6	14.45	38.29	38.75	9.98	2.93	11143	18 from 2 mines
Danville: Danville coal	7	12.99	38.29	38.75	9.98	2.93	11143	18 from 2 mines

is characterized by the lowest moisture content of any coal in the State aside from that in Eagle Valley, and that the ash of the coals, in Saline County at least, is less than that of all others except No. 6 coal of Williamson and Franklin counties, and No. 2 (La Salle and Murphysboro) coal for the State. In British thermal units the average of No. 5 coal in Gallatin County is higher than that of any other coal sampled during the Investigations, and the coal of Saline County was exceeded in heating quality only by the No. 2 (Murphysboro) coal. Thus No. 5 coal of District V ranks at least second among the coals in the State.

Table 14, showing average and extreme value for the coals of the eight different districts, furnishes a comparison of the heating quality of this coal with that of other coals in the State. (See also Plate IX.)

TABLE 14.—*Comparative heating values of the various Illinois coals*
(Data after Parr)

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

There are no analyses of No. 6 coal in this district available. It is probable that the coal will be slightly higher in sulphur and ash than the No. 6 coal in Williamson County but otherwise it will probably not be greatly different. The chemical characteristics of this coal in the general region are discussed in some detail in the report on District VI. The average quality of the Herrin (No. 6 coal) can be determined by inspection of Plate IX.

Coal Resources

The coal resources of District V can be estimated with but slight pretense to accuracy. Only three townships within Saline County have been closely drilled, and therefore large areas in both Saline and Gallatin counties require further drilling before an accurate estimate of the available coal resources of even No. 6 and No. 5 coals can be made, to say nothing of the lower beds which probably hold a large reserve.

Considerable care has been taken in estimating the resources of Ts. 8 and 9 S., Rs. 5, 6, and 7 E., in Saline County, by the methods employed in the investigations of the resources of District VI. Contours were drawn showing the distribution of the various thicknesses of No. 5 and No. 6 coals, the contour interval being 10 inches rather than 6 inches as used in the estimation of the resources of District VI. These areas were measured by a planimeter, and then areas of the same thickness assembled. (See third column, Table 15.) In estimating the tonnage, the coal was assumed to have an average specific gravity of 1.3, which is equivalent to an average weight of 1,770 tons per acre foot, or 1,132,800 tons per square mile foot. The tonnage per foot for each area shown in column 3 is then readily computed and appears in column 4. In estimating the total tonnage these figures for foot tonnage per square mile are multiplied by the average thickness in feet of the coal in each area, as shown in column 5, the result being the original tonnage as shown in column 6. As the present system of mining allows a recovery of only about 60 per cent, the total original available tonnage has been computed on that basis and is shown in column 7.

For about 53 square miles in the north part of T. 8 S., Rs. 5, 6, and 7 E., the No. 5 coal supply is estimated on a basis of a thickness of 4.5 feet, the same figure being used as the factor of thickness for the south half of T. 7 S., Rs. 5, 6, and 7 E. No. 6 coal in the latter of these areas is estimated to have an average thickness of 5 feet. The reserve tonnage estimated thereby for No. 6 coal in this part of the county amounts to about one-fourth of the total tonnage for No. 6 coal for the whole county.

An accurate estimate of the amount of coal underlying the part of Gallatin County within District V is not possible for reasons already stated. This part of the county comprises roughly about 225 square miles. No. 5 coal probably underlies all this area and No. 6 coal as much as 210 square miles. On the basis of 1,132,800 tons per square mile foot and an average thickness of 4 feet, the total original tonnage of No. 5 coal is estimated to be 1,019,520,000 tons; on the basis of the same average thickness the total original tonnage of No. 6 coal is estimated as 951,552,000 tons, a total of 1,971,072,000 tons for both beds, for the area of Gallatin County within District V.

On the basis of a 60 per cent recovery the total available resource of the two beds shrinks from 4,750,340,499 to 2,850,204,539 tons, the difference in the two figures representing the accumulating waste that is attendant on coal mining in this district. In addition to this 40 per cent of loss, about 4 per cent of the output will be used in the operation of the mines and a certain amount in the transportation of the coal from the mine to the consumer, all of which represents depreciation of the original supply so far as the ultimate consumer is concerned. Within Gallatin and Saline counties there have been mined, or rendered unminable, to date, according to the records, 58,323,360 tons. A small proportion of this, which it is impossible to separate from the total, has been mined south of the district, but it is too small probably to vitiate the figures presented. The total production represents approximately 2 per cent of the total available tonnage.

Of the 98 per cent still remaining of No. 5 and No. 6 coals, large areas underlie regions such as the Wabash flooded lands which will probably be unminable as long as flooding is a liability. However, their ultimate recovery seems probable.

APPENDIX

Table of Surface Data

Location Township and section	Company		Map No. Pl. I	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]		Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6	No. 5	
SALINE COUNTY												
Tate												
T. 7 S., R. 5 E.												
¼ ¼ SEC.												
SW NW 30	..	..	..	425	E.	693	*N.D.E.*	−268	*N.D.E.*	6 9	*N.D.E.*	
Galatia												
T. 8 S., R. 5 E.												
NE SE 7	..	..	1	425	L.	527	*N.D.E.*	−102	*N.D.E.*	6 1	*N.D.E.*	No record
NE SW 11	..	..	1	410	E.	367	485	+43	−75	4 7	.. ..	Galatia Colliery Co., new mine
NE SW 18	..	5	1	436	L.	368	*N.D.E.*	68	*N.D.E.*	7 8	*N.D.E.*	
Brushy												
SE NE 19	G.	151	1	408	L.	322	416	86	−8	5 8	4 6	
SE NW 19	G.	169	2	422	B.	304	396	118	26	5 8	4 6	
NE SE 19	G.	140	3	404	B.	303	397	101	7	5 2	4 3	
SE SW 19	G.	171	4	435	L.	291	389	144	46	5 5	4 5	
NW NW 20	G.	126	1	405	L.	338	437	67	−32	5 11	4 1	
Cen. NE 20	G.	121	2	400	B.	325	429	75	−29	6 ..	5 2	
SE NW 20	G.	113	3	399	L.	311	417	88	−17	6 10	4 10	
Cen. SW 20	G.	117	4	409	B.	304	409	105	..	5 11	4 4	
NW NW 25	G.	104	1	412	B.	250	*out*	162	*out*	5 9	*out*	
NE SE 25	G.	78	2	380	L.	274	392	106	−12	5 8	6 2	

NW	NE	26	G.	95	1	431	L.	291	415	140	16	5	4	7	1	
SE	NE	26	G.	82	2	428	B.	264	*out*	164	*out*	5	4	*out*		Churn drill
NE	SW	26	G.	97	3	438	B.	302	422	136	16	5	1	6	4	Churn drill
NE	SW	26	H.	B–1	4	433	L.	286	406	147	27	..	..	..	..	
SE	SW	26	G.	85	5	445	L.	303	424	142	21	6	6	7	..	
NW	NW	27	G.	73	1	435	L.	286	396	149	39	5	4	4	7	
SW	NE	27	G.	96	2	440	B.	303	406	137	34	6	..	5	6	
SE	NE	27	G.	83	3	427	B.	295	422	132	5	5	5	6	8	
NW	SE	27	H.	HC–1	4	415	L.	297	414	118	1	..	..	..	..	
Cen.	SW	27	G.	81	5	434	L.	289	411	145	23	5	10	6	..	
SE	SE	27	G.	77	6	430	L.	265	384	165	46	5	1	6	..	Churn drill
SE	SW	27	H.	HC–5	7	404	L.	271	399	133	5	..	..	..	..	
SE	SW	27	H.	..	8	421	E.	..	416	..	5	..	..	6	..	Harrisburg Colliery Co., Harco mine
SW	SW	27	H.	HC–4	9	405	L.	260	370	145	35	..	..	..	..	
SW	NW	28	G.	86	1	435	L.	293	402	142	33	5	4	4	3	
NE	SW	28	G.	80	2	420	L.	312	425	108	–5	5	2½	4	3	
SE	SW	28	G.	87	3	442	L.	287	403	155	39	5	9	5	2	
NW	SE	28	H.	HC–2	4	409	L.	283	394	126	15	..	..	..	..	
NE	NE	29	G.	65	1	418	L.	276	*N.D.E.*	142	*N.D.E.*	5	5	*N.D.E.*		
NW	NE	29	G.	102	2	432	L.	295	402	137	30	6	2	4	3	
NW	NW	29	G.	74	3	433	B.	293	402	140	31	6	4	4	4	

[a] G.=Guarantee Trust Co. H.=Harrisburg Saline Collieries Co. Ha.=Harrisburg Colliery Co.
O.=O'Gara Coal Co. P.=Peabody Coal Co. S.=Saline County Coal Co. W.=Wasson Coal Co.

[b] L.=Hand level. B.=Barometer. E.=Estimated from topographic map. Co.=Company elevation.

[c] *E.*=Eroded. *N. D. E.*=Not deep enough to reach coal.

[d] C.=Churn drill; Oil=Oil prospect (churn drill); other drilling by diamond drill.

TABLE OF SURFACE DATA—*Continued.*

Location Township and section	Company		Map No.	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]				Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6		No. 5		
NW SE 29	G.	79	4	455	B.	296	402	158	53	5	7	4	5	
SW SW 29	G.	66	5	455	B.	258	*N.D.E.*	197	*N.D.E.*	5	6	*N.D.E.*		
NE SE 30	G.	84	1	462	L.	286	390	176	72	5	6	4	7	
NW SW 30	G.	72	2	482	B.	..	..	..	..	..	..	..	..	No record
NE NW 31	G.	92	1	448	B.	241	335	207	112	5	5	4	7	
NE Cor. 32	G.	63	1	456	L.	288	*N.D.E.*	168	*N.D.E.*	6	..	*N.D.E.*		
NW SE 32	G.	59	2	448	B.	227	*N.D.E.*	221	*N.D.E.*	5	8	*N.D.E.*		
SW SW 32	G.	47	3	437	L.	163	*N.D.E.*	274	*N.D.E.*	6	..	*N.D.E.*		
NW SE 33	G.	64	1	402	L.	193	303	209	99	6	5	5	..	
SW SW 33	G.	12	2	404	L.	90	193	314	211	5	6	5	..	
SW NW 33	H.	HC–3	3	411	L.	203	315	208	96	..	..	..	..	
NW NW 34	G.	75	1	420	L.	280	383	140	37	5	4	5	..	
NE NE 34	H.	B–2	2	400	L.	250	386	150	14	..	..	..	..	
NE SE 34	G.	91	3	390	B.	208	322	182	68	6	2	2	3	
SE SW 34	G.	89	4	422	L.	..	..	..	..	..	..	..	..	No record
SW NE 34	H.	B–3	5	390	L.	238	370	152	20	..	..	..	..	
NE NW 34	H.	B–4	6	395	L.	240	365	155	30	..	..	..	..	
SE NW 34	H.	B–5	7	410	L.	243	370	167	40	..	..	..	..	
NE SE 35	G.	114	1	420	L.	251	353	169	67	5	4	5	9	Churn drill
NE SW 35	G.	99	2	423	L.	259	391	164	32	5	2	6	5	
SW SW 35	G.	119	3	420	B.	186	312	234	108	6	1	6	8	Hole not found
Cent. NW 36	G.	76	1	438	L.	262	*N.D.E.*	176	*N.D.E.*	6	5	*N.D.E.*		

Brushy																
T. 9 S., R. 5 E.																
NW	Cor.	1	G.	35	1	377	L.	159	*N.D.E.*	218	*N.D.E.*	5	..	*N.D.E.*		
NE	NE	1	G.	5	2	397	?	143	241	254	156	6	..	3	3	
SW	NE	1	G.	46	3	375	L.	83	192	292	182	3	..	3	..	
SE	SW	1	G.	6	4	374	L.	81	*out*	293	*out*	5	..	..	..	
NW	NE	2	G.	106	1	380	L.	170	285	210	95	5	5	5	3	
SW	NW	2	G.	44	2	400	L.	273	..	127	..	5	6	..	..	Identity of coal questionable
NW	SE	2	G.	117	3	380	L.	117	183	263	197	5	4	5	6	
NE	SE	2	G.	110	4	374	B.	106	237	268	137	5	7	5	..	Churn drill
NW	SW	2	G.	32	5	379	B.	111	230	268	149	5	2½	5	4½	
NW	NE	2	G.	111	1	395	L.	193	299	202	96	..	2	1	4	
NE	SW	3	G.	53	2	415	E.	128	244	287	171	5	1	4	9	
NW	NW	3	H.	B–6	3	395	L.	120	252	275	143	..	..	..	..	
SE	SW	3	H.	B–7	4	395	B.	89	211	306	184	..	..	..	..	
SW	SW	4	H.	B–8	1	440	B.	117	242	323	198	..	..	..	..	
NE	Cor.	4	G.	13	2	395	L.	140	266	255	129	5	2	6	4	
SE	NW	4	G.	49	3	420	B.	117	222	303	198	4	4	5	6	
NW	SE	5	G.	52	1	471	L.	127	237	344	234	5	6	4	6	
SW	NE	5	H.	B–11	2	435	B.	102	209	333	226	..	..	..	..	
NE	NW	6	G.	58	1	490	B.	214	*N.D.E.*	276	*N.D.E.*	6	1	*N.D.E.*		
Cen.	NE	6	G.	93	2	440	B.	210	388	230	52	5	5	6	3	Identity No. 5 questionable; churn drill
SW	SE	6	G.	56	3	497	L.	197	297	300	200	3	..	5	8	Churn drill
SE	Cor.	6	G.	55	4	465	L.	..	..	..	..	..	..	..	..	Identity coals questionable

TABLE OF SURFACE DATA—*Continued.*

Location Township and section	Company		Map No.	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]				Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6		No. 5		
SW NE 6	H.	B–12	5	490	B.	205	320	285	170	..	..	..	..	
SE NE 7	G.	11	1	475	B.	219	344	256	131	6	5	4	11	
NW NW 7	H.	B–13	2	445	B.	240	355	205	90	..	..	..	..	
SW SE 7	H.	B–14	3	435	B.	189	325	246	110	..	..	..	..	
NE NE 8	G.	51	1	477	L.	126	231	351	246	6	..	4	4	
SE NW 8	G.	62	2	430	L.	71	183	359	247	5	4	..	6	Location approximate
NW SW 8	G.	57	3	405	B.	172	*N.D.E.*	233	*N.D.E.*	5	6	*N.D.E*		
SE SE 8	G.	27	4	418	L.	149	274	269	144	5	3	4	2	
SE SW 8	G.	67	5	420	B.	175	*N.D.E.*	245	*N.D.E.*	5	5½	*N.D.E.*		
NE NW 8	H.	B–10	6	438	B.	71	194	367	244	..	..	..	..	
SE NE 8	H.	B–9	7	430	B.	71	185	359	245	..	..	..	..	
SW SW 8	H.	B–15	8	400	B.	161	298	239	102	..	..	..	..	
SE SE 8	H.	B–16	9	420	B.	165	305	255	115	..	..	..	..	
Cen. N. line 9	G.	20	1	475	L.	138	277	337	198	6	2	6	6	Churn drill
SE NW 9	G.	50	2	462	L.	113	237	349	225	7	..	6	5	Churn drill
NW NW 10	G.	19	1	442	L.	108	234	334	208	6	..	4	8	
SW NE 10	G.	21	2	440	L.	132	261	308	179	6	..	7	3	Churn drill
NE NE 11	G.	112	1	375	L.	*E.*	187	..	188	..	..	5	..	
SE NW 11	G.	34	2	396	L.	72	195	324	201	5	6	7	..	
NW SE 11	G.	8	3	371	L.	142	261	229	110	9	1	1	5	
SW SW 11	G.	42	4	400	B.	97	218	303	183	5	4	5	7	
S. ½ NE 12	G.	135	1	360	B.	42	*out*	318	*out*	5	1	..	..	Churn drill Approximate location

NE	SW	12	G.	18	2	365	E.	112	263	253	102	5	8	6	1	
SE	NW	13	P.	2	1	366	L.	78	240	288	126	5	6	8	..	Approximate location
SE	SE	13	G.	1	2	373	L.	55	196	318	177	4	7	7	7	
SE	NE	14	G.	30	1	395	L.	98	235	297	160	5	2	8	8	
NE	SW	14	G.	4	2	376	L.	72	218	304	158	5	6	7	6	
NE	NW	15	G.	26	1	428	L.	163	287	265	141	6	..	5	3	Churn drill
SW	NE	15	G.	101	2	383	L.	113	259	270	124	5	6	7	2	
SW	NE	16	G.	100	1	410	B.	171	311	239	99	5	..	6	2	Churn drill
NE	NE	16	..	6	2	395	E.	114	226	281	169	5	6	5	..	Churn drill
SW	NE	17	G.	10	1	408	L.	136	271	272	137	5	2	4	4	
SE	NW	17	H.	B–17	2	415	B.	142	267	273	148	..	..	..	..	
NW	SE	18	G.	22	1	419	L.	92	220	327	199	4	6	5	6	Churn drill
SE	SE	18	G.	9	2	404	L.	63	177	341	227	5	6	5	1	
Douglas																
SE	SE	18	O.	A–5	1	410	L.	41	160	369	250	..	..	..	..	
SW	NE	19	O.	4	2	428	L.	53	174	375	254	3	..	..	6	
SW	SW	19	O.	8	3	458	L.	40	165	418	293	..	..	..	..	
NW	NE	21	G.	48	1	390	L.	123	250	267	140	6	..	4	7	
SW	NW	21	G.	28	2	395	L.	*out*	185	*out*	210	*out*		6	3	Churn drill
SE	NW	21	G.	16	3	389	L.	75	198	314	191	5	6	4	10½	
SE	SE	21	G.	3	4	388	L.	48	183	340	205	5	1	5	4	No written record
SW	SE	21	G.	38	5	395	L.	55	196	340	199	5	..	6	5	
NE	NE	22	G.	24	1	383	L.	75	217	308	166	3	..	7	..	Churn drill
SW	NW	22	G.	14	2	385	L.	71	207	314	178	5	1	5	3	
NW	SE	22	O.	2	3	425	L.	68	215	357	210	5	6	7	4	
SW	SE	22	G.	29	4	407	L.	49	203	358	204	5	6	6	8	
SW	NE	23	O.	35	1	410	L.	67	210	343	200	4	5	6	..	
SW	SE	23	G.	17	2	408	L.	26	150	382	258	5	6	5	..	

TABLE OF SURFACE DATA—*Continued.*

Location Township and section	Company		Map No.	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]		Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6	No. 5	
NE NW 24	G.	41	1	398	L.	52	178	346	220	4 ..	6 5	
SE NE 24	G.	36	2	404	L.	63	197	341	207	5 4	5 3	
SW SE 24	G.	39	3	465	L.	94	219	371	246	5 ..	6 4	Churn drill
SE SW 25	..	..	1	447	E.	*E.*	*out*	*E.*	*out*	*E.*	*out*	
NE NE 26	..	11	1	395	L.	*E.*	116	*E.*	279	.. ..	.. ..	
NE NW 26	..	12	2	431	L.	29	156	402	275	.. ..	.. ..	
SE NW 26	..	9	3	434	L.	*E.*	110	*E.*	324	.. ..	.. ..	
SE SE 26	..	10	4	452	L.	*E.*	130	*E.*	322	*E.*	.. ..	
SW Cor. 26	O.	9	..	..	..	..	..	..	..	.. ..	.. ..	
SW SW 26	C.	10	..	..	..	..	..	..	.	.. ..	.. ..	
SE SW 26	C.	11	..	..	..	..	..	..	..	.. ..	.. ..	Omitted from
SE SW 26	O.	12	..	..	..	..	..	..	..	.. ..	.. ..	structure
NW SW 26	O.	15	..	..	..	..	..	..	..	.. ..	.. ..	map; holes
SE SE 26	C.	13	..	..	..	..	..	..	..	.. ..	.. ..	in or adjac-
SE SE 26	O.	14	..	..	..	..	..	..	..	.. ..	.. ..	ent to area
NE SE 27	O.	16	..	..	..	..	..	..	..	.. ..	.. ..	being mined.
SW SE 27	G.	17	..	..	..	..	..	..	..	.. ..	.. ..	See fig. 9
SE SE 27	O.	19	..	.	..	..	..	..	..	.. ..	.. ..	
SE NW 27	..	1	1	395	L.	*E.*	150	*E.*	245	*E.*	3 ..	
NE NW 28	G.	15	1	433	L.	57	191	376	242	5 6	4 9	
NE NE 28	O.	3	2	444	L.	69	212	375	232	.. ..	.. ..	
N½ SE 28	..	23	3	418	L.	26	176	392	242	4 6	7 ..	Churn drill
NE NE 29	..	..	1	..	..	..	..	..	..	.. ..	.. ..	No record

NE	NE	30	..	..	..	430	L.	10	134	420	296	4	6	5	6	
NW	NW	32	..	28	1	444	L.	*E.*	132	*E.*	312	*E.*		4	3	No written record
SW	SW	32	..	6	2	438	L.	*E.*	59	*E.*	379	*E.*		4	1	Churn drill
NE	SE	33	..	4	1	412	L.	*E.*	62	*E.*	350	*E.*		4	10	Churn drill
SW	SE	33	..	..	2	..	..	..	40	..	..	..	..	..	..	
NE	NW	34	..	..	1	431	L.	*E.*	121	*E.*	310	*E.*		4	10	Wasson C'l Co., mine No. 2
NE	NE	34	..	1	..	..	..	..	..	..	..	..	..	..	..	Omitted from structure map; holes in or adjacent to area being mined. See fig. 9
NE	NE	34	..	2	..	..	..	..	..	..	..	..	..	..	..	
NE	NE	34	..	3	..	..	..	..	..	..	..	..	..	..	..	
NE	NE	34	..	4	..	..	..	..	..	..	..	..	..	..	..	
SE	NE	34	..	5	..	..	..	..	..	..	..	..	..	..	..	
SE	NE	34	..	6	..	..	..	..	..	..	..	..	..	..	..	
NE	NE	34	..	7	..	..	..	..	..	..	..	..	..	..	..	
NW	NW	34	..	8	..	..	..	..	..	..	..	..	..	..	..	
NW	NE	34	..	18	..	..	..	..	..	..	..	..	..	..	..	
NE	NE	34	..	20	..	..	..	..	..	..	..	..	..	..	..	
SW	NE	34	..	21	..	..	..	..	..	..	..	..	..	..	..	
NW	NW	35	O.	15	1	410	L.	..	137	..	273	..	..	5	6	O'GaraCoalCo., mine No.15
SW	NE	35	O.	8	2	442	L.	*E.*	90	*E.*	352	*E.*		5	6	
NE	SW	35	..	9	3	426	L.	*E.*	77	*E.*	349	*E.*		5	8	
NW	NE	35	..	1	..	..	..	..	..	..	..	..	..	..	..	Omitted from structure map; holes in or adjacent to area being mined. See fig. 9
NW	NE	35	..	2	..	..	..	..	..	..	..	..	..	..	..	
NW	NE	35	..	3	..	..	..	..	..	..	..	..	..	..	..	
NW	NE	35	..	4	..	..	..	..	..	..	..	..	..	..	..	
NW	NE	35	..	6	..	..	..	..	..	..	..	..	..	..	..	
NW	NE	35	..	7	..	..	..	..	..	..	..	..	..	..	..	
NE	NW	35	..	8	..	..	..	..	..	..	..	..	..	..	..	

TABLE OF SURFACE DATA—*Continued.*

Location Township and section	Company		Map No.	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]		Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6	No. 5	
NW NE 35	..	9	..	..	..	..	..	..	..	.. ..		
NE NW 36	..	152	1	444	L.	*E.*	123	*E.*	321	*E.*	2 4	
NE SE 36	S.	2	2	417	L.	..	96	..	321	.. ..	5 6	Saline County Coal Co., mine No. 2
SE SW 36	O.	7	3	405	L.	..	70	..	335	.. ..	6 10	O'Gara Coal Co., mine No. 7
T. 10 S., R. 5 E.												
SE NW 1	..	7	1	387	L.	*E.*	*E.*	*E.*	*E.*	*E.*	*E.*	
SE NW 1	..	6	2	..	..	*E.*	*E.*	*E.*	*E.*	*E.*	*E.*	
NW SW 4	..	5	1	417	..	*E.*	*E.*	*E.*	*E.*	*E.*	*E.*	
Longbranch												
T. 7 S., R. 6 E.												
SE NW 34	..	..	..	410		..	..	..	..	.. ..	.. ..	No record
Raleigh												
T. 8 S., R. 6 E.												
NE NE 1	..	..	1	382	..	..	..	..	..	.. ..	.. ..	No record
NE SW 13	..	..	1	..	..	..	..	..	..	.. ..	.. ..	No record
SW NW 15	Ha.	..	1	405	L.	..	..	..	—67	.. ..	.. ..	No record
N. ½ SW 15	Ha.	2	2	399	L.	345	*N.D.E.*	54	*N.D.E.*	6 4	*N.D.E.*	
NE SE 15	O.	106	3	418	B.	384	499	34	—81	.. ..	.. ..	
SW SE 15	Ha.	5?	4	388	L.	317	429	71	—41	5 4	4 8	

SW	SW	21	O.	B–5	1	378	L.	234	*out*	144	*out*	4	..	..	..	
NW	NW	22	O.	..	1	400	L.	307	408	93	—8	..	..	..	..	
SW	SE	22	..	..	2	372	L.	239	348	133	24	4	..	5	4	Churn drill
NE	SW	23	O.	111	1	400	L.	282	411	118	—11	..	..	..	..	
SE	SW	23	..	..	2	..	..	..	..	..	..	..	..	..	..	Oil. No coal recorded
SE	NW	24	..	..	1	404	E.	315	438	89	—34	4	3	4	4	
NE	SW	24	..	..	2	405	E.	281	400	124	5	4	..	4	6	
SE	NE	24	..	..	3	427	Co.	..	456	..	—29	..	..	5	11	J. K. Dering Coal Co., mine No. 2
NW	Cor.	25	..	..	1	402	L.	266	380	136	22	4	6	4	10	
NE	NW	25	..	..	2	400	L.	273	398	127	2	..	..	..	..	
NE	NE	26	Ha.	..	1	402	L.	269	382	133	20	..	..	..	..	
NE	NW	26	O.	..	2	400	L.	260	384	140	16	5	4	5	3½	
SE	SW	26	O.	..	3	372	L.	*out*	327	*out*	45	*out*		..	..	
Cen.	NE	27	..	..	..	370	L.	..	..	..	..	..	..	..	..	Oil
NW	SE	27	O.	..	1	365	L.	200	327	165	38	1	..	4	10	
NW	SW	27	O.	..	2	369	L.	192	311	177	58	2	..	3	..	
NW	NE	28	O.	B–6	1	376	L.	244	*out*	132	*out*	3	..	*out*		
SE	SE	28	O.	B–7	2	371	L.	186	303	185	68	2	6	2	..	
NE	NW	29	O.	B–4	1	370	L.	240	378	130	—8	1	.	..	6	
SE	SE	29	O.	..	2	365	L.	171	303	194	62	..	..	..	..	
SE	SE	33	G.	105	1	360	L.	160	277	200	83	4	10	5	..	
SW	SW	34	O.	89	1	360	L.	182	267	178	93	5	7	6	2	
SW	NW	35	O.	..	1	375	L.	207	327	168	48	..	..	..	..	
SW	Cor.	35	..	..	..	360	E.	165	290	195	70	5	..	4	8	Indefinite location; not shown on map

TABLE OF SURFACE DATA—*Continued.*

Location Township and section	Company		Map No.	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]				Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6		No. 5		
SW SW 35	..	..	..	360	E.	150	287	210	73	5	..	5	1	Indefinite location; not shown on map
SE NW 36	Ha.	..	1	383	L.	207	334	176	49	4	8	5	6	
SW NE 36	..	..	2	376	E.	185	314	191	62	5	..	5	2	
NW NE 36	..	..	3	384	L.	..	313	..	71	..	..	6	6	Wasson Coal Co., mine No. 1
Harrisburg T. 9 S., R. 6 E.														
NE SE 1	..	3	1	370	E.	203	324	167	46	5	1	4	8	
SW SW 2	O.	12	1	373	L.	..	415	..	—42	..	..	5	2	Harrisburg Big Muddy Coal Co., mine No. 12
NW NE ?	O.	1	2	367	L.	..	311	..	+56	..	..	5	2	O'Gara Coal Co., mine No. 1
SW Cor. 3	G.	185	1	360	E.	130	268	230	92	4	2	5	11	
SW NE 4	O.	5	1	365	L.	184	308	181	57	5	..	4	10	
SW SE 4	G.	184	2	356	L.	141	271	215	85	4	6	5	2	
NE NE 5	O.	A–12	1	365	E.	140	265	225	100	4	6	4	6	

NE	NW	5	O.	A–11	2	368	E.	150	289	218	79	4 6	5 10	
NE	NW	6	O.	A–10	1	374	L.	170	*out*	204	*out*	4 ..	*out*	
SE	SW	6	O.	B–2	2	413	L.	147	304	266	109	4 6	6 6	
NE	SE	7	O.	A–7	1	360	E.	*E.*	183	*E.*	177	.. ..	.. ..	
SE	SW	7	G.	37	2	362	L.	76?	*out*	286?	*out*	.. 3?	.. ..	Correlation doubtful
SW	SE	7	O.	A–1	3	381	L.	66	*out*	315	*out*	3 6	.. ..	
NE	NW	8	O.	A–9	1	363	L.	87	202	276	161	3 ..	5 6	
SW	NW	8	O.	A–6	2	358	E.	39	163	319	195	2 6	4 ..	
Cen.	SW	8	O.	B–8	3	402	L.	71	208	331	194	1 ..	6 6	
SE	SW	8	G.	25	4	400	L.	91	*out*	309	*out*	4 10	.. ..	Churn drill
NW	SE	9	G.	61	1	392	L.	130	260	262	132	4 11	5 8	
SW	SW	9	G.	183	2	393	L.	124	250	269	143	4 2	5 4	
NE	SW	10	G.	71	1	362	L.	150	270	212	92	6 1½	5 2	Location approximate
SE	SW	10	G.	69	2	365	L.	114	250	251	115	4 9	5 7	Location approximate
NE	SE	11	..	21	1	353	L.	183	306	170	47	5 6	5 ..	
S. ½	SW	11	G.	70	2	353	L.	163	291	190	62	4 8	4 4	
SE	NW	12	..	4	1	360	L.	227	348	133	12	6 6	4 7	
SE	SE	12	..	19	2	360	E.	157	273	203	87	2 9	4 9	
NW	SW	13	..	10	1	350	L.	87	209	263	141	5 ..	5 8	
SW	SE	13	..	5	2	357	L.	*E.*	196	*E.*	161	*E.*	4 10	
SW	NE	15	O.	2	1	364	L.	..	245	..	119	.. ..	5 ..	O'Gara Coal Co., mine No. 2, Abd.
SE	SW	15	O.	3	2	368	L.	..	233	..	135	.. ..	6 ..	O'Gara Coal Co., mine No. 3

TABLE OF SURFACE DATA—*Continued.*

Location Township and section	Company		Map No.	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]				Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6		No. 5		
SE NW 16	G.	54	1	356	L.	103	261	253	95	5	5	6	4	Location approximate
NE SW 16	G.	180	2	367	L.	91	242	276	125	4	4	5	6	
NE SW 16	G.	181	3	366	L.	87	234	279	132	4	3½	6	11½	
SE SW 16	G.	179	4	371	L.	74	218	297	153	4	6	6	6	
NE Cor. 17	..	1	1	375	L.	115	268	260	107	..	..	..	..	Location approximate
SW NE 17	C.	31	2	395	L.	110	282	285	113	6	..	7	10	Churn drill
SE NE 17	..	..	3	373	L.	..	261	..	112	..	..	7	3	Saline County Coal Co., mine No. 3
SW SW 17	G.	149	4	383	L.	96	244	287	139	4	9	5	9	
SE SE 17	G.	182	5	395	B.	123	255	272	140	5	..	4	..	
SW SW 17	G.	139	6	387	L.	66	*out*	321	*out*	4	8	..	..	
NE Cor. 18	P.	2A	1	362	L.	64	*out*	298	*out*	..	..	..	..	
NE NE 18	C.	3	2	363	L.	77	201	286	162	5	8	6	1	
SE NE 18	P.	5	3	366	L.	57	*out*	309	*out*	5	3	..	..	
SE NW 18	P.	43	4	377	L.	73	209	304	168	5	..	6	..	
NW SE 18	C.	1	5	380	L.	70	*out*	310	*out*	4	6	..	..	
NW SE 18	P.	4	6	373	L.	56	203	317	170	5	6	9	..	Coal broken
SE SW 19	G.	2	1	436	L.	91	265	345	171	4	7	7	1	
SE SW 19	P.	..	2	443	L.	91	219	352	224	5	..	7	..	Coal broken

NW	NW	20	G.	148	1	404	L.	70	*N.D.E.*	334	..	4	2	..	..	
NE	NW	20	G.	150	2	396	L.	59	*out*	337	*out*	4	2	..	..	
SW	NW	20	G.	40	3	419	L.	59	*out*	360	*out*	4	6	..	..	
SW	SE	21	C.	9	1	379	L.	..	145	..	234	..	..	6	11	O'Gara Coal Co., mine No. 9
NW	NW	22	C.	4	1	369	L.	..	213	..	156	..	..	6	10	O'Gara Coal Co., mine No. 4
NE	Cor.	23	C.	9	1	351	L.	*E.*	161	*E.*	190	*E.*		5	6	Coal broken
SW	NE	23	..	8	2	362	L.	26	147	336	215	5	..	5	..	
SW	NW	24	..	7	1	360	L.	*E.*	135	*E.*	225	*E.*		2	2	
SW	NE	24	..	10	2	358	L.	*E.*	134	*E.*	224	*E.*		4	11	
NW	NE	25	..	11	1	355	L.	*E.*	*E.*	*E.*	*E.*	*E.*		*E.*		
NW	NE	26	..	12	1	365	L.	*E.*	81	*E.*	284	*E.*		5	4	
NE	NE	27	..	13	1	376	L.	*E.*	99	*E.*	277	..	..	..	..	
NE	NW	27	..	..	2	392	..	..	..	..	392	..	..	5+		Slope mine, abandoned
NE	SW	27	..	16	3	373	L.	*E.*	59	*E.*	314	..	..	..	..	
NW	SW	27	..	15	4	371	L.	*E.*	38	*E.*	333	..	..	..	..	
SE	SW	27	..	14	5	369	..	*E.*	30	*E.*	339	..	..	..	..	
SW	NW	28	O.	6	1	380	..	..	..	..	261	..	..	..	..	Mine, abandoned
NE	SE	28	..	17	2	366	L.	*E.*	49	*E.*	317	*E.*		..	..	
NE	NE	29	..	..	1	..	..	..	..	..	..	..	..	..	..	Harrisburg Fuel Co., Harrisburg Fuel mine

TABLE OF SURFACE DATA—*Continued.*

Location Township and section	Company		Map No.	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]		Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6	No. 5	
SE Cor. 30	O.	14	1	410	L.	..	137	..	273	.. ..	5 5	Harrisburg Big Muddy Coal Co., mine No. 14
NE SE 30	..	..	2	..	..	..	..	..	..	.. ..	.. ..	Heato Coal Co., Ledford mine
NE NW 31	O.	5	1	432	..	..	..	..	..	.. ..	.. ..	O'Gara Coal Co., mine No. 5 (abd.)
SW NE 31	S.	1	2	434	..	..	..	..	296	.. ..	.. ..	Saline County Coal Co., mine No. 1 (abd.)
SE NE 31	..	51	3	446	L.	*E.*	135	*E.*	311	*E.*	.. ..	
SE NW 31	..	84	4	455	L.	*E.*	136	*E.*	319	*E.*	.. ..	
NE SW 31	..	86	5	462	L.	*E.*	126	*E.*	336	*E.*	.. ..	
NE SW 31	..	96	6	454	L.	*E.*	128	*E.*	326	*E.*	.. ..	
S. of Cen. 31	..	94	7	456	L.	*E.*	129	*E.*	327	*E.*	.. ..	Coal split
NE SE 31	..	41	8	400	L.	*E.*	85	*E.*	315	*E.*	.. ..	Coal split
SW SW 31	..	15	9	405	..	..	107	..	298	.. ..	9 2	
SW SW 31	..	14	10	458	..	..	150	..	308	.. ..	6 4	
SW SW 31	..	13	11	461	..	..	153	..	308	.. ..	6 6	

SE	SW	31	..	16	12	451	..	..	150	..	301	..	..	..	3	
SW	NW	32	..	15	1	441	..	*E.*	128	*E.*	313		*E.*	..	..	3 feet bone
SE	NW	32	..	31	2	414	L.	*E.*	93	*E.*	321		*E.*	..	..	
NE	SW	32	..	37	3	415	..	*E.*	74	*E.*	341		*E.*	..	..	4 ft. 7 in. bone
NW	SW	32	..	16	4	456	..	*E.*	131	*E.*	325		*E.*	..	..	
SW	SW	32	..	12	5	410	..	*E.*	54	*E.*	356		*E.*	..	..	
SE	SW	32	..	..	6	390	Co.	..	40	..	350	..	..	9	6	Saline Gas Coal Co., mine No. 1
SW	NE	36	..	176	1	365	E.	*E.*	97	*E.*	268		*E.*	6	10	Possibly No. 6 coal
SW	NE	36	..	175	2	365	E.	*E.*	84	*E.*	281		*E.*	6	7	Possibly No. 6 coal
Plainview																
T. 7 S., R. 7 E.																
SE	SW	19	..	..	1	370	..	..	..	..	..	..	..	..	..	No record
NW	NW	28	..	..	1	370	..	..	..	..	..	..	..	..	..	No record
Eldorado																
T. 8 S., R. 7 E.																
NE	SW	1	..	..	..	370	E.	..	..	..	..	..	..	..	..	No record (oil)
S½	SE	2	..	..	..	375	E.	..	..	..	..	..	..	..	..	No record
SW	SE	3	..	..	..	382	E.	..	..	..	..	..	..	..	..	No record
NE	SE	5	..	..	..	375	E.	..	..	..	..	..	..	..	..	No record
NE	NW	10	O.	110	1	395	L.	370	479	25	—84	..	..	..	..	
SE	SW	11	..	..	..	398	E.	..	..	..	..	..	..	..	..	No record (oil)
SE	NW	14	O.	101	1	390	L.	306	426	84	—36	..	..	..	..	

TABLE OF SURFACE DATA—*Continued.*

Location Township and section	Company		Map No.	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]				Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6		No. 5		
NW SW 15	..	1	1	425	L.	356	465	..	—40	6	1	4	6	Dering Mines Co., mine No. 3
SW NE 15	O.	108	2	408	L.	335	446	73	—38	..	..	..	..	
SE NE 17	O.	115	1	410	B.	362	483	48	—73	..	..	..	..	
NW SE 1	..	..	..	398	E.	..	..	..	..	..	..	..	..	
NW SW 19	..	..	1	415	B.	304	447	111	—32	3	6	6	3	
SW SE 20	O.	11	2	385	L.	..	392	..	7	..	..	4	8	O'Gara Coal Co. mine No. 11
NE SE 20	O.	10	1	392	L.	..	406	..	—14	..	..	4	8	O'Gara Coal Co. mine No. 10
NW SE 21	O.	8	1	387	L.	..	393	7	—6	..	..	4	7	O'Gara Coal Co. mine No. 8
SW NE 22	O.	113	1	410	B.	294	405	116	5	..	..	..	..	
SE NW 23	O.	100	1	405	L.	282	405	123	0	..	..	..	..	
SW NE 26	O.	101	1	425	E.	245	358	180	67	4	8	4	7	
NE SE 27	O.	93	1	417	L.	276	400	141	17	..	..	..	..	
SW Cor. 28	O.	81	1	370	L.	249	396	121	—26	..	..	..	..	
NE SW 28	..	..	2	378	L.	..	402	..	—24	..	..	..	..	Oil

NW	NW	31	..	..	..	..	..	..	..	..	..	..	..	..	..	Oil (not shown on map; no coal recorded)
NW	NW	31	..	..	1	378	E.	*out*	343	*out*	35		*out*	5	8	
NW	Cor.	31	..	..	2	390	E.	204	338	186	52	4	..	5	6	
NW	SE	32	..	C–3	1	370	L.	207	349	163	21	5	..	6	..	
NW	NE	33	..	..	1	371	L.	167	331	204	40	4	2	5	8	
NW	NW	34	..	C–5	1	385	L.	183	303	202	82	6	..	5	..	
SE	NE	34	..	..	2	408	L.	..	334	..	74	..	..	5	6	Saline County Coal Co., mine No. 6
SW	SW	36	..	..	1	380	L.	156	278	224	102	..	..	..	..	Depth to coal only
Cottage T. 9 S., R. 7 E.																
SE	NW	1	..	..	1	377	L.	53	*N.D.E.*	324	*N.D.E.*	4	2	*N.D.E.*		Leper mine; local
SW	NW	1	..	..	2	386	L.	30	*N.D.E.*	356	*N.D.E.*	4	4	*N.D.E.*		Swinney mine; local
NW	NW	2	..	..	1	..	..	..	..	215	101	..	..	..	..	Altitude of coal only
NW	SW	2	..	..	2	360	E.	51	166	309	194	..	..	..	..	
NE	NW	3	..	26	1	370	L.	128	247	242	123	..	..	..	..	
SW	SE	4	..	25	1	365	B.	98	215	267	150	5	..	4	6	
NE	NW	4	..	52	2	365	E.	132	251	233	114	5	..	3	9	
NW	NE	5	..	C–2	1	370	L.	161	283	209	87	2	..	5	..	
SW	SE	5	..	24	2	370	E.	101	224	269	146	4	6	5	3	
NW	SW	5	..	1	3	370	E.	138	266	232	104	6	4	4	10	
SE	NE	6	..	23	1	370	E.	144	268	226	102	4	7	4	10	

TABLE OF SURFACE DATA—*Continued.*

Location Township and section	Company		Map No.	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]		Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6	No. 5	
SE NW 7	..	10	1	368	E.	128	251	240	117	3 9	4 7	
NE SW 8	..	25	1	368	L.	176	*N.D.E.*	192	*N.D.E.*	.. ..	*N.D.E.*	
SW NW 9	..	5	1	370	E.	53	177	317	193	.. ..	.. ..	
NW SW 10	..	154	1	390	L.	36	151	354	239	4 ..	4 6	Churn drill
SW SE 10	..	1	..	..	..	..	..	420	*N.D.E.*	.. ..	*N.D.E.*	Local mine
NE NW 10	..	28	2	380	E.	75	202	305	178	.. ..	.. ..	
NE SE 10	..	1	3	400	E.	..	160	..	240	.. ..	5 ..	Oil
NW SW 11	..	2	1	398	E.	33	150	365	248	.. ..	.. ..	
SW SW 12	..	..	1	360	E.	*E.*	74	*E.*	284	*E.*	.. ..	Water well; no record
SW NE 15	..	177	1	379	L.	121	236	258	143	4 8	4 2½	
NE SE 15	..	1	2	375	E.	91	205	284	170	.. ..	.. ..	
SE SE 16	..	4	1	365	B.	41	153	324	212	.. ..	.. ..	
SE SW 17	..	11	1	395	B.	51	168	344	227	5 3	4 9	
SW SE 18	..	6	1	372	L.	69	194	303	178	2 5	5 2	
SW SW 19	..	18	1	356	L.	*E.*	*E.*	*E.*	*E.*	*E.*	*E.*	
NW SE 19	..	19	2	376	L.	*E.*	110	*E.*	266	*E.*	4 8	
NW SE 20	..	20	1	376	L.	*E.*	83	*E.*	293	*E.*	4 9	
SW SW 20	..	22	2	380	L.	*E.*	85	*E.*	295	*E.*	.. ..	
NE NW 21	..	24	1	372	L.	*E.*	119	*E.*	253	*E.*	.. ..	
Cen. SW 21	..	23	2	376	L.	*E.*	90	*E.*	286	*E.*	.. ..	
SE NE 22	..	3	1	380	E.	*E.*	63	*E.*	317	*E.*	6	
Near Cen. 22	..	..	2	375	L.	*E.*	108	*E.*	268	*E.*	1 ..	
SW NW 27	..	..	1	360	E.	*E.*	116	*E.*	244	*E.*	4 ..	

NW NW 27	..	..	2	..	..	*E.*	*E.*	*E.*	*E.*	*E.*	*E.*		
SE SW 29	..	168	1	357	L.	*E.*	*E.*	*E.*	*E.*	*E.*	*E.*		
GALLATIN COUNTY													
Omaha													
T. 7 S., R. 8 E.													
SE NW 23	..	1	1	402	L.	480	571	—78	—169	7 ..	5 6	Oil	
NE SE 27	..	..	1	370	E.	370	482	0	—112	6 6	3 ..	Oil	
SW SW 32	..	100	1	350	E.	144	259	206	91	.. ..	.. ..		
North Fork													
T. 8 S., R. 8 E.													
SW SW 17	..	..	1	360	E.	222	342	138	18	4 7½	5 10		
Cen. SW 23	..	..	1	375	E.	?	268?	?	107?	.. ..	1 ..?		
NW NW 28	..	..	1	373	L.	239	*N.D.E.*	134	*N.D.E.*	.. ..	*N.D.E.*		
SW SW 33	..	..	1	387	L.	*out*	241	*out*	146	*out*	.. ..	Identification of coal uncertain	
NW NW 36	..	..	..	..	..	..	..	..	..	.. ..	.. ..		
Equality													
T. 9 S., R. 8 E.													
SE NW 1	..	2	1	377	L.	90	*N.D.E.*	187	*N.D.E.*	.. ..	*N.D.E.*		
NE NW 1	..	1	2	348	L.	140	255	208	93	.. ..	.. ..		
SE NW 2	..	3	1	348	L.	99	*N.D.E.*	249	*N.D.E.*	.. ..	*N.D.E.*		
SW SW 4	..	..	1	405	E.	190	*N.D.E.*	315	*N.D.E.*	.. ..	*N.D.E.*	Water well	
SE SE 5	..	..	2	395	E.	85+	*N.D.E.*	310+	*N.D.E.*	.. ..	*N.D.E.*	Water well	
NE NE 5	..	3	1	355	L.	66	187	289	168	.. ..	.. ..		
SW NW 10	..	..	1	360	L.	41	161	319	199	4 2	? ?	Local mine. Abd.	
NE NW 15	..	..	1	385	L.	*E.*	*E.*	*E.*	*E.*	*E.*	*E.*		

TABLE OF SURFACE DATA—*Concluded.*

Location Township and section	Company		Map No.	Surface altitude	Elevation method[b]	Depth to coal[c]		Altitude of coal[c]		Thickness of coal[c]		Remarks[d]
	Name[a]	No.				No. 6	No. 5	No. 6	No. 5	No. 6	No. 5	
SW SW 16	..	..	1	362	L.	..	32	..	330	.. ..	4 7	Evans Coal Co., East Side Mine
SE SE 18	..	..	1	377	..	..	94	..	283	.. ..	.. ..	Gallatin Coal & Coke Co., West Side
NW NW 23	..	..	1	362	..	..	75	..	287	.. ..	4 10	Gallatin Coal & Coke Co., mine No. 1
NE NW 23	..	..	1	..	..	..	..	..	375	.. ..	.. ..	Hickory Hill Coal Co., Hickory Hill mine
NE SE 24	..	..	3	360	E.	..	..	..	..	.. ..	.. ..	Record unreliable
NE NE 24	..	..	1	360	E.	..	..	..	..	.. ..	.. ..	Do
SE NE 24	..	..	2	360	E.	..	..	..	..	.. ..	.. ..	Do
NE NE 24	..	1	1	355	..	68	188	287	167	.. ..	.. ..	
SE NE 24	..	2	2	355	..	128	230	227	125	.. ..	.. ..	
NE SW 24	..	3	3	355	..	117	236	238	119	.. ..	.. ..	
SE SE 25	..	17	1	355	..	*E.*	*E.*	*E.*	*E.*	*E.*	*E.*	
NW NE 28	..	..	1	373	L.	*E.*	*E.*	*E.*	*E.*	*E.*	*E.*	

Oakgrove													
T. 7 S., R. 9 E.													
NW NE 31	..	102	1	381	E.	634	745	—253	—364	.. ..	.. ..		
Ridgway													
T. 8 S., R. 9 E.													
SW NE 19	..	105	1	373	E.	644	760	—271	—387	.. ..	.. ..		
SW NW 20	..	..	1	375	E.	?	780	?	—405	?	10 ..		Churn drill
NW NW 28	..	..	1	370	E.	477	632	—107	—262	4 ..	.. ..		
NE NE 29	..	..	1	375	E.	484	668	—109	—293	4 ..	.. ..		
Gold Hill													
T. 9 S., R. 9 E.													
NW SE 19	..	..	1	355	E.	*E.*	*E.*	*E.*	*E.*	*E.*	*E.*		
NW NW 36	..	..	1	370	E.	..	206	..	164	.. ..	.. ..		
WHITE COUNTY													
T. 7 S., R. 10 E.													
NE NW 18	..	..	..	355	E.	..	..	—262	—263	.. ..	.. ..		

[a] G.=Guarantee Trust Co. H.=Harrisburg Saline Collieries Co. Ha.=Harrisburg Colliery Co.
O.=O'Gara Coal Co. P.=Peabody Coal Co. S.=Saline County Coal Co. W.=Wasson Coal Co.

[b] L.=Hand level. B.=Barometer. E.=Estimated from topographic map. Co.=Company elevation.

[c] *E.*=Eroded. *N. D. E.*=Not deep enough to reach coal.

[d] C.=Churn drill; Oil=Oil prospect (churn drill); other drilling by diamond drill.

INDEX

PUBLICATIONS OF ILLINOIS MINING INVESTIGATIONS.

ILLINOIS STATE GEOLOGICAL SURVEY DIVISION
URBANA, ILLINOIS

Bulletin 1. Preliminary report on organization and method of investigations, 1913.
Bulletin 3. Chemical study of Illinois coals, by S. W. Parr, 1916.
Bulletin 10. Coal resources of District I (Longwall), by G. H. Cady, 1915.
Bulletin 11. Coal resources of District VII, by Fred H. Kay, 1915.
Bulletin 14. Coal resources of District VIII (Danville), by Fred H. Kay and K. D. White, 1915.
Bulletin 15. Coal resources of District VI, by G. H. Cady, 1916.
Bulletin 16. Coal resources of District II (Jackson Co.), by G. H. Cady, 1917.
Bulletin 17. Surface subsidence in Illinois resulting from coal mining, by Lewis E. Young, 1916.
Bulletin 18. Tests on clay materials available in Illinois coal mines, by R. T. Stull and R. K. Hursh, 1917.
Bulletin 19. Coal resources of District V (Saline and Gallatin counties), by G. H. Cady, 1919.
Bulletin 20. Carbonization of Illinois coals in inclined gas retorts, by F. K. Ovitz, 1918.
Bulletin 21. The manufacture of retort coal-gas in the central states, using low-sulphur coal from Illinois, Indiana, and western Kentucky, by W. A. Dunkley, and W. W. Odell, 1918.
Bulletin 22. Water-gas manufacture with central district bituminous coals as generator fuel, by W. W. Odell and W. A. Dunkley, 1918.
Bulletin 23. Mines producing low-sulphur coal in the central district, by G. H. Cady, 1919.
Bulletin 24. Water-gas operating methods with central district bituminous coals as generator fuel. A summary of experiments on a commercial scale, by W. A. Dunkley and W. W. Odell, 1919.

ENGINEERING EXPERIMENT STATION
URBANA, ILLINOIS

Bulletin 2. Coal mining practice in District VIII (Danville), by S. O. Andros, 1913.
Bulletin 4. Coal mining practice in District VII, by S. O. Andros, 1914.
Bulletin 5. Coal mining practice in District I (Longwall), by S. O. Andros, 1914.
Bulletin 6. Coal mining practice in District V, by S. O. Andros, 1914.
Bulletin 7. Coal mining practice in District II, by S. O. Andros, 1914.
Bulletin 8. Coal mining practice in District VI, by S. O. Andros, 1914.
Bulletin 9. Coal mining practice in District III, by S. O. Andros, 1915.
Bulletin 12. Coal mining practice in District IV, by S. O. Andros, 1915.
Bulletin 13. Coal mining in Illinois, by S. O. Andros, 1915. (Complete resumé of all the district reports.)
Bulletin 91. Subsidence resulting from mining, by L. E. Young and H. H. Stoek, 1916.
Bulletin 100. Percentage of extraction of bituminous coal with special reference to Illinois conditions, by C. M. Young, 1917.

U. S. BUREAU OF MINES
WASHINGTON, D. C.

Bulletin 72. Occurrence of explosive gases in coal mines, by N. H. Darton, 1915.
Bulletin 83. The humidity of mine air, by R. Y. Williams, 1914.
Bulletin 99. Mine ventilation stoppings, by R. Y. Williams, 1915.
Bulletin 102. The inflammability of Illinois coal dusts, by J. K. Clement and L. A. Scholl, Jr., 1916.
Bulletin 137. Use of permissible explosives in the coal mines of Illinois, by J. R. Fleming and J. W. Koster, 1917.
Bulletin 138. Coking of Illinois coals, by F. K. Ovitz, 1917.
Technical Paper 190. Methane accumulations from interrupted ventilation, with special reference to coal mines in Illinois and Indiana, by H. I. Smith and Robert J. Hamen, 1918.