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Report on the Geology and Coals of the Central City, Madisonville, Calhoun, and Newberg Quadrangles (in Muhlenberg, Hopkins, Ohio, McLean, Webster, Daviess, and Henderson Counties)

F M. Hutchinson

Kentucky Geological Survey

CHARLES J NORWOOD, Director.

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REPORT ON

The Geology and Coals

OF THE

CENTRAL CITY, MADISONVILLE, CALHOUN, AND NEWBERG QUADRANGLES

In Muhlenberg, Hopkins, Ohio, McLean, Webster, Daviess and Henderson Counties.

By F. M. HUTCHINSON.

Completed in 1911.

1912.

LETTER OF TRANSMITTAL.

His Excellency, AUGUSTUS E. WILLSON,

Governor of Kentucky.

Sir: I have the honor to transmit for publication a report on the coals included in the Central City, Madisonville, Calhoun, and Newberg 15-Minute Quadrangles, embracing parts of Muhlenberg, McLean, Ohio, Daviess, Hopkins, and Henderson counties, by F. M. Hutchinson. The field work for this report was done chiefly in 1909, but the report was not put in final form for printing until October 1911.

Very respectfully,

CHARLES J. NORWOOD,

Director, State Geological Survey.

November 1, 1911.

PROF. CHAS. J. NORWOOD,

Director, Kentucky Geological Survey.

Dear Sir:—

I have the honor to submit herewith a detailed report on the coal resources, and a preliminary report on the oil and gas possibilities, of the Central City, Madisonvile, Calhoun and Newberg Quadrangles. These quadrangles are located in the geologic and geographic center of the Western Kentucky Coal Field, and embrac portions of Daviess, Henderson, Webster, McLean, Hopkins, Ohio and Muhlenberg counties, including an area of 882 square miles.

The field work began July 14th, 1909, and ended October 30th of the same year. In addition two weeks were devoted to the gathering of samples of coal for analysis in March, 1910.

The detailed report supersedes the summary report already published.

The Survey is indebted in many ways to the citizens of this region generally for their cheerful co-operation in furthering the work, and especially to Messrs. Hywel Davies, Shelby Gish, P. O. McKinney, James Halstead, R. W. Batsel, W. P. Robertson, E. F. Doudna, F. O. Coffman, and last, but far from least, to Mr. and Mrs. E. E. Clark, of South Carrollton, who afforded the writer and his assistants a delightful home during the hundred-day field season.

Respectfully,

F. M. HUTCHINSON.

October 27, 1911.

Note.

Mr. Hutchinsod's report on the oil and gas possibilities of the quadrangles named above consists largely of a presentation of the theories and principles relating to the

occurrence and underground storage of petroleum and gas as set forth in papers by Orton, White, Griswold, and others; conditions in the quadrangles themselves are dealt with rather sketchily. Later and more definite work by Dr. L. C. Glenn in Webster county, and by Mr. K. D. White and Dr. J. H. Gardner (1911), whose reports are ready for the printer, renders it advisable to omit Mr. Hutchinson's observations from the present publication. They will be presented in connection with the reports of Messrs. White and Gardner.—C. J. Norwood,1912.

COAL RESOURCES OF THE CENTRAL CITY, MADISONVILLE, CALHOUN AND NEWBERG QUADRANGLES.

General Discussion.

Location. The area treated in this report is shaped like an L and is situated in the central portion of the Western Kentucky Coal Field. It comprises the Central City, Madisonville and Calhoun Quadrangles, and that part of the Newberg Quadrangle which lies south of the Ohio River. It includes portions of Henderson, Daviess, Webster, McLean, Ohio, Hopkins and Muhlenberg counties. It has an area of approximately 900 sq. miles, which is about one-sixth of the total area of the Coal Field of which it is a part.

Drainage. Green River, which empties into the Ohio River in the northwestern corner of the area investigated, receives practically all the drainage of this territory. This stream, which traverses the Central City, Calhoun and Newberg Sheets in a tortuously northwestern course, is navigable throughout the year, and is an important factor in the transportation of the region. Its largest tributary from the west is Pond River, which is the principal stream of the Madisonville Quadrangle; from the east is Rough River, which crosses the north-eastern corner of the Central City Sheet. The currents of Green and Rough Rivers flow at relatively rapid rates, but those of the remainder of the streams flow sluggishly through highly tortuous channels.

The elevation above tide of the low water level of Green River at the point of its entrance in the area investigated is 366 ft., at its mouth is 333 ft., which shows a fall of 33 ft., in a distance by water of about 90 miles.

Topography. The topography is typical of the interior portions of the Western Kentucky Coal Field, and is composed of three rather distinct types, viz: (1) Rugged Uplands; (2) Rolling Uplands; and (3) River Flats, or Bottom Lands.

(1). In the rugged uplands the tops of the hills usually extend from 100 to 200 ft., above the general valley levels, and are rather pointed, the ridges are narrow, the slopes are steep, and, as a rule, are badly dissected, while the valleys, when not affected by the filling up process to which the older drainage basins have been subjected, are V-shaped. Erosion has wrought havoc in these areas, and but little cultivable land, apart from the valleys, now remains.

(2). The rolling uplands usually range in elevation well below the 100 ft. line above the general drainage levels. The hills have rounded tops, the ridges are broad, the slopes are gentle, and relatively but little erosion has taken place. The surface is generally well adapted to agricultural purposes.

(3). The river flats, or bottom lands, are usually broad and flat, and filled with fluviatile deposits. By far the greater part of these bottom lands are low, and somewhat marshy, and but little attempt has been made to drain them. A systematic draining of these areas would make available some of the richest farming lands in the country.

Culture. Agriculture and coal mining are the principal industries of the region. More than thirty large mines are at present in operation in the four quadrangles, while a very much larger number of small mines are operating for the benefit of the local market. Most of the coal is shipped by rail to Louisville, and other southern markets, but considerable amounts are shipped by boat down Green River to Evansville and other river ports.

Tobacco, corn, wheat and hay are the principal crops. The rolling uplands are unexcelled for raising dark tobacco, and are excellent for corn and wheat. The bottom lands are very fertile and when properly drained are highly productive, but large areas are sadly in need of compre-

hensive drainage. The highest hill lands, as a rule, are unfit for cultivation on account of the readiness with which the light sandy soil is washed away, and should be reserved for grass.

The region is well provided with means of transportation. Green River, which traverses the Central City, Calhoun and Newberg Sheets, is navigable for fair sized boats the year around, and Rough River is navigable some distance above its mouth for small craft; the L. H. & St. Louis Railroad crosses the Newberg Sheet just south of the Ohio River; the Madisonville, Hartford and Eastern Railroad crosses the Central City and Madisonville Sheets from east to west; the Illinois Central crosses the southeastern corner of the Central City Sheet, while the Owensboro branch of the L. & N. extends from north to south through the center of the Central City Sheet, and the St. Louis line of the same system traverses the western edge of the Calhoun and Madisonville Quadrangles. In addition, the Kentucky Midland R. R., is now in process of construction from Central City to Madisonville.*

There are two small cities, namely, Madisonville and Central City, and several small towns, among which are Livermore, Hanson, Calhoun, Slaughtersville, Island, Spottsville, and Baskett, lying within these quadrangles.

GENERAL GEOLOGY.

Maps. There are nine maps accompanying this report. The base maps used are the topographic maps of the respective quadrangles surveyed by the U. S. Geological Survey and the Kentucky Geological Survey acting in co-operation.

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*This road has been completed to Midland.—C. J. N.

On the Structural Geology Sheets are represented the geologic structure, and the position, elevation, name, and number, which corresponds to number in text of the stratum indicated, of the mines, outcrops, borings, shafts, etc., located in the course of the field work and referred to in the text. The geologic structure is exhibited by means of contour lines, and the mines, etc., by conventional signs.

On the Structure Section Sheet the relations of the topographic features and geologic structure are graphically represented along certain lines by means of cross-sections. Two cross-sections are made of each sheet, one from east to west, and the other from north to south. In addition a cross-section from Ohio River to the southern border of the Madisonville Quadrangle is included.

General Geologic Structure. The general geologic structure of this region has been determined primarily by north and south folding, which has resulted in the formation of roughly parallel great arches and troughs, or anticlines and synclines, extending in a generally east and west direction. Two of these folds cross the area investigated, viz.: the Rough Creek Anticline and the Moorman Syncline.

The Rough Creek Anticline, commonly known as the Rough Creek Uplift on account of the fact that the strata have plainly been uplifted throughout its course, is a well known structural feature, which, though its eastern and western limits have not been defined, is known to extend at least from beyond Leitchfield on the east to and across the Ohio River at Shawneetown, Illinois, on the west. The crest of the anticline, on the area covered by this report, traverses the southern part of the Calhoun Quadrangle, its line of occurrence being indicated on the appropriate map.

The general nature of this Uplift was for a long time in doubt. That portion of it extending across Ohio County,

and eastwardly to the Falls of Rough River, however, was pointed out as early as 1876 by Prof. C. J. Norwood as being an anticlinal fold, and as such, even then, he so regarded the whole disturbance. The work of the present survey has demonstrated that for that additional portion occurring mainly on the Sutherland and Calhoun Quadrangles, but extending westwardly about midway of the Sebree Quadrangle, the uplift is clearly an anticline, which, however, under the strain of excessive folding, has been severely faulted. These facts are illustrated by the detail structure depicted on the structure sheets accompanying this report. By reference to these sheets, it will be seen that the rocks on, or in proximity to the center of the disturbance, which is really the crest of the anticline, have been faulted in many places, but, where undisturbed, dip away in orderly succession, both to the north and to the south. Practically a duplication of these conditions with reference to the Uplift are present, also, on the Sutherland and Sebree Sheets.

The distance from the Falls of Rough River to the middle of the Sebree Quadrangle is about 60 miles, or approximately two-thirds of the total known length of the Uplift. With this proportion of the uplift anticlinal in character, it seems highly probable that such will be found to be its nature throughout its length.

The Moorman Syncline, which lies about midway between the Rough Creek Anticline, and the Twin Tunnels Fault, a parallel Uplift located about 8 miles south of the Central City and Madionville Sheets, and which is probably similar in character to the Rough Creek Uplift, marks the bottom of the trough, or basin, which has resulted from the northwardly dip of the rocks from the one and the southwardly dip of the rocks from the other. It is a broad, deep, canoe shaped basin, of which the eastern and western limits, as far as known, have not yet been determined. Its center, however, from which the rocks rise outwardly in all directions, is located three miles northeast of Madisonville. This point marks what, in all probability, is the lowest point from a geological standpoint in western

Kentucky. In contradistinction to its north and south bounding anticlines, this syncline, so far as the Central City and Madisonville Quadrangles is concerned, has not been subjected to faulting. The line denoting its exact bottom on the area investigated is shown on plates Nos. 5 and 6; and discussions concerning its detailed characteristics are given in the reports for the Central City, and Madisonville Sheets, which it traverses.

Faults. The faults occurring in the area investigated are principally normal faults. Reversed faults may occur but the data suggesting them is of an unsatisfactory nature. The evidence pointing to the occurrence of the normal faults, however, is in many cases well-defined and conclusive.

Of these the Curdsville and Livermore Faults, which are offshoots from the center of the disturbance extending somewhat in the general direction of the strike of the rocks along the sides of the anticline, are normal faults. In addition, what is probably an offshoot of the Livermore Fault apparently leaves the main break about two miles west of Livermore and extends up the Valley of Cypress Creek. It is called for convenience the Cypress Creek Fault.

The Curdsville Fault apparently begins near Eastwood Ferry, thence faithfully follows the general course of Green River northeastward for a distance of nearly twenty miles, before departing from the river and disappearing under Ohio River sediments. The line of fracture, which appears to be confined wholly to Green River Valley, is completely hidden from view; but the fault is clearly a normal fault with a downthrow to the east. The amount of the displacement varies from a few feet, near Eastwood Ferry, to more than 180 feet at Hamilton Ferry, its most northernly defined limit.

Evidence showing the occurrence of the fault is as follows: The dip of the rocks lying east of Green River is in a generally northwestern direction, and such, with but little variance, is the general dip west of the river. Just west of the river, however, the beds are found sud-

denly elevated a maximum distance of more than 180 ft. above their corresponding position on the opposite side of the river; whereas, if the same rate of dip were maintained they would be at least 40 ft. lower. Such a fact cannot be explained by any process of natural folding, and can only be explained by assuming that a fault, accompanied by the required displacement, has occurred.

The Livermore Fault, on the area covered in the present report, follows the general direction pursued by Rough River from its entrance into the Central City Quadrangle to its mouth, thence follows the Valley of Green River westward apparently to within a mile, or so, of the western boundary of the Calhoun Sheet, where it seems to swerve into the Valley of Deer Creek.

The evidence demonstrating its presence is of precisely the same character, at least at Livermore, as that showing the occurrence of the Curdsville Fault. In the case of the Livermore Fault the rise of the rocks on both sides of Green and Rough Rivers is to the north, but the elevation of corresponding beds on opposite sides of the streams shows a difference of 200 ft., with the downthrow to the north, whereas, had the same rate of rise of the rocks in this direction been maintained, the beds on the north side of the streams would have been the higher. The conditions are such that the differences in elevation could not have been caused by natural folding, and therefore, displacement must have occurred.

Westward from Livermore, or, to be more exact, from a point about two miles west of Livermore, the data having a bearing upon the fault was of an unsatisfactory nature, as well as scarce, and this portion of the fault is more or less conjectural. The balance of evidence, however, indicates the prolongation, without material change in its nature, of the fracture in this direction to a point beyond the western border of the Calhoun Quadrangle.

The Cypress Creek Fault is evidenced by the fact that the rocks on the west side of the creek, which, without disturbance, should be on a strike with those on the east side, are really lower by a maximum distance of 300 ft. There has been a downthrow of the beds to the west here,

therefore, this number of feet. Additional evidence showing the fault is visible in the shape of displaced rocks occurring on the nose of a hill located two miles northwest of Island, (No. 413). At this point the Jolly Limestone and associated beds have dropped down a vertical distance of a least 80 ft., and may be seen abutting against the base of the massive sandstone overlying the No. 9 Coal. This fracture, however, is probably only a side break of the main Cypress Creek Fault, which represents a considerably greater displacement.

A fault with a downthrow of about 30 ft., apparently a normal fault, was encountered in the Thomas Mine at West Louisville (No. 70). The fault was struck on the east side of the mine, the coal bed abutting against a sandstone; but the marked difference in elevation of the coal in this mine and in the three mines less than a quarter of a mile further south clearly indicates the extension of the break between these mines. The downthrow is to the west and north.

In the southeastern corner of the Madisonville Quadrangle there is present what appears to be the most northern extension of a large fault extending, from and slightly east of Graham, south 45 degrees west through McNary, thence probably to and connecting with the Twin Tunnels disturbance. The down throw is to the south, the amount of displacement increasing, at least on the Madisonville Quadrangle, from east to west.

This fault has been encountered in several openings of the Skybo Mine of the W. G. Duncan Coal Company at Graham. In driving the 5th south entry of this mine, the vein worked being No. 9 coal, a clay wall 18 inches thick was struck, beyond which was encountered the No. 11 vein of coal. The tops of the two coals, which should have been separated here by an interval of 70 ft., were practically on a dead level. In the 6th south entry, located west of No. 5, the two coals were separated by an interval of about 10 ft., No. 11 being below No. 9. The displacement at this point, therefore, was about 80 ft. Coming east of the 5th south entry No. 11 gradually raises above No. 9, and assumes its normal position near the di-

viding line between the Madisonville and Central City Quadrangles.

South of this fault the rise of the rocks to the south is much intensified, and the upper workable beds, including Nos. 12, 11 and 9, are rapidly carried above the tops of the hills.

Since a brief investigation was sufficient to show that no coal beds having other than local value occur along the top of the anticline on the Calhoun Quadrangle, but little time was devoted to this area, and the structure was not determined with sufficient exactness to admit of contouring, if indeed the arrangement of the rocks is not so complex as to render the matter an impossibility. Much faulting has taken place, the displacements apparently ranging from a few inches up to approximately a thousand feet.

The greatest displacement observed is worthy of note, this being indicated on the farm of Ezra Ashton, located three miles west of Calhoun (No. 107). On this farm a massive limestone, having a visible thickness of 15 ft., and dipping 45 degrees to the south, is exposed. This limestone, which is overlain with a pebbly sandstone, presumably marks the top of the Chester Measures, and if so, the displacement is at least 1,000 ft.

Age of the Faults. The time of occurrence of the Rough River Disturbance is largely a matter of conjecture, but it seems possible to fix it within certain rather wide limits, as follows: The deposition of the Carboniferous beds appears to have been continuous throughout the region affected by the disturbance, which could hardly have been the case had the area previously been broken by faults; the valleys of Green and Rough Rivers faithfully follow the course, including the irregularities of the central disturbance, or its accompanying side-breaks, viz. the Livermore and Curdsville Faults, from the Falls of Rough River westwardly to Berk City, a distance by air-line of eighty miles, and a considerably greater distance by water. The inference plainly is that the fault-lines have influenced the direction of the streams, not that the valleys of the streams have influenced the line of the faults.

From these facts it would seem probable, therefore,

that the disturbance occurred at a time later than the deposition of the Carboniferous Beds, but antedates Green River.

Rocks Exposed. The regularly bedded rocks outcropping over the area investigated are confined to the upper coal measures, and extend from a point about 120 ft. below the No. 9 bed of coal up to a point about 200 ft. above the Madisonville Limestone. The coals included, in descending order, are as follws; 15a, 15, 14a, 14, 13, 12, 11, 10, and 9. In addition, three or four non-persistent, thin veins, of which the correllation is not satisfactory, occur above No. 15a in the region surrounding Slaughtersville on the Calhoun and Madisonville Quadrangles. The highest rocks occur midway between Madisonville and Hanson, while the lowest are exposed in a bluff located one and one-half miles northwest of Island Station. The vertical section is 740 ft. in height.

In addition to the rocks appearing in regular outcrop, some of the strata belonging to the Lower Coal Measures, and at least one outcrop of Chester Limestone is brought to the surface along the crest of the Rough Creek Anticline.

Coals above the Madisonville Limestone. The coals above the Madisonville Limestone, which include the highest veins occurring in the area investigated, are probably seven in number, of which the exact positions of the three lowest veins, only, viz. Nos. 15a, 15 and 14a, have been determined. The highest veins, which from top to bottom have been named respectively Nos. 15e, 15d, 15c, and 15b, are limited in their area of occurence to the region lying north of the M. H. & E. R. R., west of Pond River, and south of Green River, on the Calhoun and Madisonville Quadrangles. As is hereinafter explained, the stratigraphical relations of these beds was not satisfactorily worked out.

No. 15e. No. 15e, the uppermost coal, however, appears to be at an approximate distance of 507 ft. above No. 9. It is an impure coal of local occurrence, with a thickness of from 4″ to 6″ only. It is overlain by sandstone and underlain by fireclay.

No. 15d. This bed occurs 57 ft. below No. 15e, or 450 ft. above the No. 9. It is overlain by blue soapstone and is underlain by siliceous shale. The coal is more or less shaly, and possesses no commercial value.

No. 15c. This vein is a pure, bright coal of a medium degree of hardness, and is the only one of these four higher beds which attains to minable thickness. It varies from 2′ 0″ to 3′ 3″ in thickness and has been entered and mined in a small way in a few places near Hanson. It is overlain with blue, siliceous soapstone, and is underlain with fireclay. It is separated from No. 9 by an interval of approximately 410 feet.

No. 15b. No. 15b coal should really be called a shale, since it is principally a mixture of carbonaceous and siliceous shale. Some thin streaks of pure coal, however, occasionally occur. The bed varies in thickness from 3′ 6″ to 5′ 6″, and is overlain by brown shale, and underlain by shaly sandstone. It lies 25 ft. below No. 15c, or 387 ft. above No. 9.

The interval given above between Nos. 15b and No. 9 coals, is approximately the same as is given for the maximum interval between Nos. 15a and No. 9. This seeming discrepancy in intervals is believed to be due not to a mistaken correllation of the beds, though the correllation is by no means certain, but to difference in the thickness of this portion of the vertical section in the widely separated localities in which the two intervals were determined. The interval for No. 15a was determined on the Central City Sheet near Gishton, while the interval for No. 15b was determined on the Madisonville Sheet near Hanson.

A westward thinning of this interval is, therefore, denoted.

No. 15a. No. 15a has been identified and traced successfully only on the Central City Sheet where it catches in the hills in the vicinity of Gishton. It is of irregular occurrence, but is possibly, represented by some one of the several thin beds occurring above the Madisonville Limestone on the Madisonville and Calhoun Sheets. It has no economic value whatever, being from 6 to 8 inches thick, only, and consisting mainly of black shale. It lies

40 ft. above No. 15 coal, or at a variable distance of from 360 to 390 ft. above No. 9.

No. 15 Coal. The outcrop line of this bed is shown on the areal geology sheets. As a glance at these sheets will show this vein occurs in portions of the Central City, Madisonville, and Calhoun Quadrangles. East of Cypress Creek, which is a stream on the Central City Sheet, the coal is overlain with black, sheety shale, similar in appearance, except that it breaks up in smaller and thinner flakes, to the carbonaceous shale which forms such an excellent roof for the famous No. 9 coal. No. 15, when best developed, is a hard clean coal, without parting, but in places is more or less impure. It is altogether a coal of excellent quality, but, ranging in thickness from 1′ 0″ to 2′ 0″ only, with an average of 1′ 4″, it is entirely too thin to be of importance from a commercial standpoint.

The bed was used to some extent in determining the structure. It is easily identified when overlain with the black shale, but when the shale is absent is apt to be confused with the overlying beds of coal.

Its position in the vertical section is at an average distance of 350 ft. above No. 9, or varies from 320 to 360 ft.

No. 14a Coal. No. 14a is a non-persistent, thin vein which is known to occur in two small localities, only, both being in the Central City Quadrangle. It occurs about 10 ft. above the Madisonville Limestone, or about 310 ft. above the No. 9 Coal. In thickness it ranges from zero to a maximum of 1′ 8″, but is usually about 3 inches thick. It is overlain by brown sandy shale, or sandstone, and is underlain by blue clay. The bed has been opened in a number of places, but in no case was it found of sufficient importance to justify mining.

The Madisonville Limestone. The Madisonville Limestone is one of the most readily recognizable and persistent geologic markers occurring in the area under discussion, and as much of the stratigraphy, and structure were determined by its aid, some general facts concerning it are pertinent.

The position of this bed in the vertical column is almost midway between Nos. 15 and 14 coals, or about 300 ft. above the No. 9 bed. It occurs, therefore, over a greater area than does No. 15 coal, but a somewhat smaller area than that occupied by No. 14. See plates Nos. 1, 2 and 3. As mentioned above, it is a very persistent bed, and is present generally wherever its horizon appears. It usually occurs in only one ledge, but sometimes two are present. It is a hard, brittle limestone, which breaks into conchoidal shapes, weathers a dingy gray, but is a steel-gray on fracture, and carried an abundance of fossil forms. It is usually overlain by clay, or shale, and is underlain by from 6 to 10 ft. of siliceous clay. This underclay is of excellent quality and is used for making tiling near Madisonville. The limestone varies in thickness from 4 to 6 ft.

In the vicinity of Madisonville occurs a ledge of limestone from 6 to 8 ft. thick, which presents the same general appearance as the Madisonville Limestone, and is apt to be confused in outcrop with it. The two beds are distinct, however, and in the Reinecke Shaft near Madisonville are separated by an interval of 38 ft. this second ledge, which is called the Upper Madisonville Limestone being the uppermost bed. It appears to be confined to the vicinity of Madisonville, only, in so far as the area under discussion is concerned. This bed makes good road material, and is used for macadamizing the streets of Madisonville, the stone being obtained from a quarry inside the corporation limits.

No. 14 Coal. The outcrop line and areal distribution of No. 14 are indicated on the areal geology sheets.

As reference to these plates will show the vein occurs in parts of the Central City, Madisonville and Calhoun Quadrangles, only.

No. 14 is a firm, lustrous coal of a medium degree of hardness, comparing favorably in this respect with the better known No. 9. As a rule it is overlain by from 1 to 5 ft. of soft shale, which is followed by from 30 to 40 ft. of hard, massive sandstone. It is underlain with fire-

clay. Usually it occurs in two benches, which are separated by from 1 to 4 inches of shale, this shale occurring about 20 inches above bottom. The upper bench carries less sulphur than the lower bench, and is in demand locally for blacksmithing purposes. Streaks of sulphur, or "sulphur balls", sometimes occur in the lower bench, but the total amount of sulphur carried is not large, the analyses showing an average of not more than 3 per cent. The coal is an excellent steam coal, and when burned leaves but little clinker.

This vein, which ranges from 0′ to 11′ in thickness, when best developed, is the thickest coal occurring over the area investigated. It is, however, of a pockety nature, and, except for certain well-defined areas, is of doubtful commercial importance. The largest area containing this coal in known workable condition, lies east of Cypress Creek in the Central City Quadrangle, and contains about 25 sq. miles.

A number of country banks are operating No. 14 for the home market, and some coal is supplied to the Green River steamboats. No large mines are in operation in the area investigated, but at least one large mine in Western Kentucky, viz. the Nebo Consolidated Coal and Coking Company's mine, at Nebo, is operating this bed.

No. 14 is of little value, except in small localities, as a geologic marker on account of its non-persistent nature. It overlies No. 9 a varying distance of from 200 to 250 ft.

The following analyses were made in June, 1910, by Mr. J. S. McHargue, chemist for the Kentucky Geological Survey, from samples collected by the writer in the preceding March. The analysis in each case represents the coal as obtained in the mine and was made by the uniform method adopted by the American Chemical Society.

	Mois.	V. M.	F. C.	Ash.	Phos.	Sul.	Sp. gr	Coke	Char. Coke.	Lab. No.
1.	9.15	36.64	46.19	8.02	.013	2.49	1.320	54.20	porous	3209
2.	11.47	32.24	46.70	9.59	.026	2.20	1.339	56.29	"	3216
3.	10.70	33.81	46.79	8.70	.010	..	1.345	..	"	3206
4.	8.70	36.33	45.83	9.14	.022	4.06	1.350	55.07	dense	3207
5.	8.08	34.85	48.90	8.17	.026	3.21	1.347	56.07	"	3208
6.	7.30	35.20	48.96	7.54	.031	2.98	1.337	56.50	small cells	3210
Av.	9.23	34.84	47.23	8.53	.021	2.99	1.339	55.63		

Locations of mines from which samples of No. 14 were taken for analysis are as follows:

1. C. G. Kimbly's mine, 4 mi. southwest of Centertown. Central City Quadrangle. Map No., 397.

2 and 3. Foley's mine, ½ mi. southeast of South Carrollton. Central City Quadrangle. Map No., 121.

4. Brown's mine, 1½ mi. northwest of Centertown. Central City Quadrangle. Map No., 334.

5 and 6. C. U. Parker's mine, 7 mi. east of Madisonville. Madisonville Quadrangle. Map No., 92.

No. 13 Coal. The No. 13 Coal is a thin vein of no commercial importance. Its occurence is limited to the Central City, Madisonville, and Calhoun Sheets. It is a vein of irregular occurrence, but is nevertheless found in widely separated areas. It is seldom seen in outcrop, however, on account of the loose mantling material overlying it, which is usually composed of soft, sandy shale, though sometimes the shale merges into reddish-brown sandstone. Blue fireclay forms its floor. In thickness the coal ranges from 1 to 2½ ft., the average being about 18 inches. It is a hard coal of good appearance, but so far as information can be secured, it has never been tested as to its burning qualities. It is of but little value as a geological marker. No. 13 ranges from 137 to 173 ft., above No. 9, the average interval being 151 ft.

No. 12 Coal. No. 12 is a widely persistent vein extending over practically all of the quadrangles investigated. It attains its maximum thickness along the southern portions of the Central City and Madisonville quadrangles, varying there from 3½ to 5½ ft. thick. It gradually wedges out northward, however, and is seldom ever more than 2 ft. thick in the Calhoun and Newberg Quadrangles; consequently its minable area is limited to the Central City and Madisonville Sheets, and may be restricted in the main to the southern halves of these two sheets. It is a hard, pure coal, containing less sulphur than any workable coal in this region, the amount running as low as 0.70 of one per cent., with an average of 1.20 per cent. It is usually overlain with a medium hard, fine-grained sandstone, though in some areas, particularly in the southern

half of the Central City Quadrangle, a seam of Black Band Iron Ore, from 6 to 12 inches thick, intervenes between the coal and the overlying sandstone. It is underlain by fireclay. No large mines are operated in this vein at present, but a number of country banks are being mined to supply the local trade. No. 12 is a good geological marker. It overlies No. 9 from 80 to 100 ft., the average interval being about 100 ft.

The following analyses were obtained from Vol. D, page 77, of the Reports on the Western Kentucky Coal Field. The samples were obtained from mines formerly operated at Paradise, Kentucky.

	1.	2.	3.
Specific Gravity	1.593	1.332	1.278
Moisture	7.06	4.70	3.60
V. C. M	30.84	30.60	31.40
Fixed Carbon	58.70	58.80	58.50
Ash	3.40	5.90	6.50
Total	100.00	100.00	100.00
Sulphur	0.789	1.455	1.438
Coke	62.10	64.70	65.00

No. 11 Coal. No. 11 coal is one of the best known and most widely distributed coals in Western Kentucky, and is generally recognized as being surpassed in value only by No. 9. It underlies practically all of the four quadrangles investigated, but has a workable area limited in the main to the Central City and Madisonville Quadrangles. It attains its greatest thickness, also, in the southern portions of these two sheets, from whence it gradually, though with local interruptions, wedges out northward, ranging from 1 to 3 ft. on the Calhoun and Newberg Sheets. In its minable territory, it varies from 4 ft. to 7 ft. 2 in. in thickness. A fair average over the southern halves of the Madisonville and Central City Quadrangles is 5 ft. 6 in. It is a brilliant black, firm coal with an inch clay parting about 18 inches above its bottom. It is underlain with the usual fireclay, and is overlain with from 0″ to 6″ of gray or black shale, which is invariably followed by from 3 to 5 ft. of hard, gray limestone. In sulphur it

varies from 2 to 4 per cent, which may be reduced to about 1 per cent by washing. The greater part of this sulphur is contained in the bottom section.

This bed yields excellant coke and for years has been coked in large quantities at the St. Bernard Mines near Earlington. It lies at a variable distance of from 70 to 138 ft. above No. 9, the average interval being about 90 ft.

The following analyses from samples collected by myself in March, 1910, were made by Mr. McHargue the following June. The analysis in each case represents the coal as obtained in the mine and was made by the uniform method adopted by the American Chemical Society.

	Mois.	V. M.	F. C.	Ash.	Phos.	Sul.	Sp. gr	Coke.	Char. Coke	Lab. No.
1.	7.96	39.44	47.20	5.50	trace	2.58	1.340	52.68	large cells	3217
2.	7.42	39.10	45.56	7.92	.010	3.90	1.228	53.48	" "	3211
3.	7.36	38.30	48.02	6.32	.047	2.90	1.312	54.33	" "	3212
4.	7.70	40.01	45.69	6.60	.051	3.64	1.307	52.28	" "	3213
5.	6.50	39.41	46.50	7.59	.026	3.88	1.329	54.07	cellular	3215
Av.	7.39	39.25	46.59	6.79	.027	3.38	1.323	53.29		

Location of mines from which samples of No. 11 were taken for analysis:

1. Sam Jarvis mine, 1 mi. north of Luzerne. Central City Quadrangle, No. 269.

2. Henry Kipling, 6 mi. northeast of Cleaton. Hartford Quadrangle.

3. Harrison Curdiff mine, 6 mi. east of Cleaton. Hartford Quadrangle.

4. W. E. Evitt mine, 3 mi. southeast of Earles. Madison Quadrangle, No. 4.

5. A. H. Cotton mine, ½ mi. west of Earles. Madison-

No. 10 Coal. No. 10 Coal is a thin vein of no commercial importance and of irregular occurrence. It occurs, however, in widely scattered areas. It is usually overlain by sandstone, but sometimes by gray shale. Fireclay is the underlying stratum, though in one instance, at least, sandstone was reported as underlying the coal. It has a maximum thickness of 3′ 0″, but usually is only about 1 ft. thick. Its vertical position lies 66 to 97 ft. above No. 9.

No. 9 Coal. No. 9 is pre-eminently the most valuable and most extensively developed coal bed in the Western Kentucky Field. There are at present far more large mines operating this vein than all other veins combined. Its popularity is due not so much to the superior intrinsic value of the coal, for it is really inferior in this respect to some of the other beds, as for example Nos. 14 and 12, but to the following five principal reasons:

(1). Its area of occurrence, over by far the greater part of which it preserves a workable thickness, exceeds that of any other vein in the field.

(2). It is remarkably uniform in thickness. In an area of more than 1,000 sq. miles surveyed in detail by the writer the total variance between the maximum and minimum thicknesses, respectively, was only 2′ 2″.

(3). It is generally free from bone-coal, and almost invariably without parting of consequence.

(4). It invariably has a very superior roof, of the kind that maintains itself for years without props.*

(5). It is, with the possible exception of No. 14, the best shipping coal in the field.

These five facts, which are generally true of none of the other veins, account for the present high state of development of No. 9 as compared to the relatively slight development of the rest of the coals of the Western Kentucky Coal Field.†

The horizon of No. 9 underlies practically 95 per cent. of the total area of the four quadrangles treated in this report. The bed, however, has been completely eroded from that portion of the Newberg Sheet covered by the Ohio-Green River Flats, and partly eroded from the Green River Flood-Plain, and from certain other smaller areas hereinafter discussed in detail, and, in addition, is of doubtful occurrence over the northern third of the Madisonville Quadrangle. This latter area, however, has been very imperfectly tested up to date, and future development will

*In this Mr. Hutchinson errs. As is well known by those engaged in mining No. 9 coal, the roof requires careful propping.—C. J. N.

†A large part of the tonnage produced in the Western Field is supplied by No. 11 coal, which also is a good shipping coal.—C. J, N.

doubtless show that considerable bodies of workable coal exist here, also. As a whole not less than 70 per cent. of the total area investigated is underlain by No. 9 in workable condition.

In thickness this vein ranges from 6′ 0″ to 3′ 10″, with a fair average of 4′ 6″. It attains to its maximum development along the southern edges of the Central City and Madisonville Quadrangles, north of which it gradually "wedges" out until the Rough Creek Anticline is reached; north of this fold the coal becomes thicker for a distance of about six miles, thence continues the general northward thinning until Ohio River is reached. It is a hard, bright coal, free from partings of consequence, and runs about 3 per cent. in sulphur. It is overlain by a hard, sheety, carbonaceous shale, from 1′ 0″ to 4′ 0″ thick, and is underlain by from 3 to 6 ft. of fireclay.

There were 28 large mines and about three times the number of small mines operating this bed in the area investigated in 1909.

No. 9 is the most valuable geologic marker occurring in this region and was used as the key horizon upon which to plot the geologic structure.

The twenty analyses given below are sufficient to show the composition of the bed. Of these Nos. 1 to 14, inclusive, were made by the chemists for the Kentucky Geological Survey, the remainder by the U. S. Fuel Testing Plant, at St. Louis. All the analyses, except Nos. 17 and 20, which were from car samples, were from run of mine samples.

No.	Mois.	V. M.	F. C.	Ash.	Phos.	Sul.	Sp. Gr	Coke.	Char. Coke.	Lab. No.	B.T.U.
1.	11.19	33.98	43.90	10.93	trace	3.30	1.309	54.83	small cells	3218	
2.	9.07	36.88	45.50	8.55	.004	2.62	1.327	54.05	porous	3214	
3.	11.30	34.96	44.21	9.53	trace	3.26	1.335	53.74	small cells	3219	
4.	7.57	34.95	46.06	11.42	0.00	2.54	1.346	51.48		2869	11,980
5.	6.23	34.67	46.93	12.17	trace	2.58	1.34	59.10	dense	3103	11,860
6.	6.05	37.23	46.02	10.70	"	3.24	1.356	56.72	"	3106	11,510
7.	5.72	35.23	42.60	16.45	"	6.34	1.441	59.05	"	3107	10,600
8.	5.83	35.71	48.14	10.32	"	3.11	1.312	58.46	"	3108	11,760
9.	5.75	38.10	46.95	9.20	"	2.73	1.322	56.15	"	3109	12,220
10.	2.87	39.53	49.17	8.43	0.00	3.54	1.283	57.60	light	2901	12,156
11.	2.68	37.35	47.87	12.10	0.00	2.86	1.344	59.97		2902	12,639
12.	2.55	41.18	47.14	9.13	0.00	3.30	1.275	56.27		2903	11,970
13.	2.54	42.01	46.78	8.67	0.00	3.14	1.293	55.45	.....	2904	12,390
14.	5.03	36.52	41.33	17.12	0.00	2.90	1.357	58.45	dense	3075	10,880
15.	10.03	36.06	46.24	7.67	.....	2.56	.....	.....	.....	3722	12,076
16.	9.89	35.70	45.72	8.69	.....	2.45	.....	.....	.....	3723	11,927
17.	8.70	35.00	47.34	8.96	.....	3.14	.....	.....	.....	3865	12,078
18.	8.76	35.02	46.80	9.42	.....	4.07	.....	.....	.....	2453	11,965
19.	8.75	34.00	46.48	10.77	.....	3.69	.....	.....	.....	2454	.....
20.	8.47	35.24	46.81	9.48	.....	3.60	.....	.....	.....	2595	11,986
Av.	6.95	36.47	46.10	10.45	0.00	3.24	1.331	56.52	.....	.....	11,875

Location of mines from which the samples for analysis of No. 9 were obtained.

	Mine	Location	Quad.	
1.	J. M. O'Bryan Mine.....	at West Louisville....	Central City.....	No. 25
2.	Joel T. Wright Mine.....	1½ mi. north of Luzerne.....	Central City.....	No. 268
3.	John Archbold Mine.....	at Bluff City.....	Newberg.....	No. 8
4.	Pittsburg Coal Company's Mine.....	at Baskett.....	Newberg.....	No. 30
5.	Utopia Coal Company'sMine	at Utopia.....	Calhoun.....	No. 92
6.	Zion Coal Company's Mine..	at Zion.....	Newberg.....	No. 14
7.	John Archbold Mine.....	at Bluff City.....	Newberg.....	No. 8
8.	Pittsburg Coal Company's Mine.....	at Baskett.....	Newberg.....	No. 30
9.	Green River Coal Company's Mine.....	at Spottsville.....	Newberg.....	No. 28
10.	Green River Coal & Coke Company's Mine.....	at Island.....	Central City.....	No. 183
11.	Green River Coal & Coke Company's Mine.....	at Island.....	Central City.....	No. 183
12.	Alva Karnes Mine.....	at Island.....	Central City.....	No. 407
13.	Alva Karnes Mine at.....	at Island.....	Central City.....	No. 407
14.	Diamond Block Mines.....	near Drakesboro.....	Greenville.....	No.
15.	McHenry Mine.....	at McHenry.....	Hartford.....	No.
16.	McHenry Mine.....	at McHenry.....	Hartford.....	No.
17.	McHenry Mine.....	at McHenry.....	Hartford.....	No.
18.	Central Coal & Iron Company's Mine.....	at Central City.....	Central City.....	No. 128
19.	Central Coal & Iron Company's Mine.....	at Central City.....	Central City.....	No. 128
20.	Central Coal & Iron Company's Mine.....	at Central City.....	Central City.....	No. 128

Coals Below No. 9. The rocks containing the horizons of the veins occurring below the No. 9 bed of coal are everywhere deeply buried, except along the northern rim of the hills to the northwest of Island, and along the highly elevated crest of the Rough Creek Anticline, in the Calhoun Quadrangle. The data pointing to the occurrence of these lower beds in outcrop, however, was limited wholly to the latter locality. In this region occur several beds of doubtful classification, but so badly faulted as to be of little or no commercial value, except in extremely limited areas.

One or more test wells deep enough to penetrate these lower beds have been made on each of the Quadrangles, except the Calhoun; but the only area tested up to date which would seem to contain a lower bed in workable thickness is the limited region surrounding South Carrollton, on the Central City Sheet. Several borings made in this area report No. 8 coal as having an average thickness of 7 ft., and as being overlain with black slate. The interval separating the bed from No. 9 averaged 103 ft. in thickness. The limits of this area of workable coal have not been defined, but it appears quite possible that a further addition to the number of valuable coals of this particular region, at least, may be represented by No. 8.*

Following is a list of primary bench marks established by the U. S. Geological Survey and the Kentucky Geological Survey, acting in co-operation, on the Central City, Madisonville, Calhoun, and Newberg Quadrangles, Kentucky:

CENTRAL CITY QUADRANGLE.

Calhoun South Along Highways to Sacramento.

	Feet.
Semiway post-office, 4.5 miles south of Calhoun, in south face of southwest corner pier of post-office and store building; aluminum tablet stamped "400–1907"	400.780

*No. 8 nowhere exhibits a thickness of 7 feet, and is nowhere workable. It is usually overlaid by a thick bed of richly bituminous shale, which is responsible for erroneous reports by drillers as to the thickness of No. 8. The latter seldom exceeds 18 inches.—C. J. N.

From Point 1.25 Miles North of Earles East Along Kentucky Midland Railroad to Rockport.

	Feet.
Bethel Church, 5 miles west of Central City, northeast corner of crossroads, in south face of southwest corner of brick church building; aluminum tablet stamped "Prim. Trav. Sta. No. 7; 502–1907"	500.990
Central City, in west face of northwest corner of Gish Bank Building; aluminum tablet stamped "427–1907"	426.219
Nelson, 1 mile west of, 360 feet west of mile post "Louisville 122", Illinois Central railroad concrete bridge No. T 12206, in bridge seat at southeast corner; aluminum tablet stamped "405–1907"	404.026

Livermore South Along Louisville and Nashville Railroad Central City.

Livermore, in wall of Bank of Livermore building (brick) southwest corner, 1.9 feet from ground; aluminum tablet stamped "401 Louisville"	400.757
Island, in west end of stone box-culvert about 1200 feet south of station; aluminum tablet stamped "418–1907"	416.666
Moorman, 0.5 mile north of, 40 feet east of wagon road, in next to top coping stone at northwest corner of small stone culvert; aluminum tablet stamped "410–1907"	408.996
South Carrollton, southwest corner of M. E. Church, in west fact of, in next to corner foundation pier; aluminum tablet stamped "457–1907"	456.291

Central City South Along Louisville and Nashville Railroad to Cleaton thence East Along Highways and Paradise.

	Feet.
Cleaton, 90 feet east of station; in bottom stone at southeast corner of culvert; aluminum tablet stamped "444–1907"	442.793
Mt. Carmel church, 3 miles west of Paradise, in south face of southeast corner of foundation pier of church; aluminum tablet stamped "504–1907".	503.005

Heflin South Along Highways to Centertown.

James' Hill on Knott's Ferry road, 4 miles northwest of Centertown, 3.5 miles south of Heflin, west side of road on top of hill, in top of sandstone bluff; aluminum tablet stamped "507–1907"	506.121

MADISONVILLE QUADRANGLE.

Slaughterville, South Along Louisville and Nashville Railroad, to Earlington.

Slaughterville in limestone doorsill of main south entrance to town hall building, on west side; aluminum tablet stamped "403–ADJ–1903"	402.597
Hanson, north side of road, 150 feet east of railroad, in south face of southwest corner of hotel building; aluminum tablet stamped "433–1907".	432.213
Hanson, 2.5 miles south of, in west face of northwest corner of foundation of Mt. Zion Church; aluminum tablet stamped "493–1907"	492.762
Madisonville, in northwest corner of Court House yard; iron post stamped "Prim. Trav. Sta. No. 2 470–1907"	469.959

Earlington, South Along Louisville and Nashville Railroad, to Morton's Gap; thence Northeast Along Highways to Salem Church.

	Feet.
Barnsley, 100 feet to west of Louisville and Nashville railroad, in front of St. Bernard Mining Company's store; iron post stamped "Prim. Trav. Sta. No. 3–484"	483.317

Salem Church, Northeast Along Highway, to Earls; thence North to Sacramento; thence West to Hanson.

Free Henry Ford, 1 mile west of, 6 miles northeast of Morton's Gap, in north face of northeast corner of foundation of Henry Whitefield dwelling; aluminum tablet stamped "417–1907"	416.748
Pleasant Hill Church, 4 miles west of Earles post-office, in east face of southeast corner foundation pier of church; aluminum tablet stamped "608–1907"	608.117
Earles post-office, at southeast corner of cross-roads, in foundation pier center of west side of house of Mr. Summers; aluminum tablet stamped "512–1907"	511.926
Briar Creek Church, 3 miles north of Earles, in east face of southeast corner foundation pier of church; aluminum tablet stamped "476–1907"	475.923
Sacramento, 3 miles south of, southeast corner of road forks, in west face of southwest corner of J. M. Harned's brick house; aluminum tablet stamped "429–1907"	429.646
Sacramento, 400 feet west of main street, at east corner of village school building; iron post stamped "Prim. Trav. Sta. No. 8–497"	497.340

	Feet.
Sacramento, 4 miles west of, Tower Chapel, in north face of northwest corner of foundation pier; aluminum tablet stamped "422–1907"	422.506
Hanson, 6 miles east of, 2 miles west of Pond River, in south face of southwest corner of foundation pier of C. E. Eastwood's dwelling; aluminum tablet stamped "391–1907"	391.233
Providence Church, 2 miles east of Hanson, in west face of southwest corner of foundation pier; aluminum tablet stamped "459–1907"	458.958

CALHOUN QUADRANGLE.

Sorgho Along Highway South, to Cleopatra; thence Southeast to Calhoun.

Sorgho, 3 miles southwest of, on West Louisville and Sorgho road, at south end of west dide of bridge over Panther Creek, at southwest corner, on top of abutment stone; cut cross	379.83
West Louisville, in front of J. H. Elder's store, 1.5 feet above platform, left of main entrance; aluminum tablet stamped "462 LOUISVILLE"	461.421
Cleopatra, in base of chimney at south end of C. L. Short's house, 1.9 feet above ground; aluminum tablet stamped "498 LOUISVILLE"	497.149
Calhoun, in top of limestone belt course (water table) around Court House, 1.6 feet south of main entrance; aluminum tablet stamped "397 LOUISVILLE"	396.618

Calhoun Along Highway Northwest, to Beechgrove; thence West to Sebree.

Beech Grove, in west wall of McLean County Bank, 3.9 feet from northwest corner, 2 feet from ground; aluminum tablet stamped "408 LOUISVILLE"	407.117

Delaware Northwest Along Highways, to Euterpe.

(Single Spur Line from circuit from Beech Grove to West Louisville.)

	Feet.
Euterpe, in north side of base of chimney at north end of Walter Scott's house, 0.25 mile east of Cash Creek Baptist Church; bronze tablet stamped "468 LOUISVILLE"	467.063

Elmwood East Along Highway Via Onton and Ashbyburg, to Calhoun.

Elmwood, in front of Louisville and Nashville station; top of rail	390.9
Onton, in base of outside chimney of post-office which is Bryant's house; aluminum tablet stamped "478 LOUISVILLE"	479.124
Ashbyburg, in east wall of Brown and Luck's store building, 2.3 feet from southeast corner and 2.3 feet from ground; aluminum tablet stamped "391 LOUISVILLE"	391.024
Calhoun, (Rumsey) river gage at Government locks on Green River, elevation of "17" upper river gage, and "29" lower river gage	372.65

NEWBERG QUADRANGLE.

Stanley West Along Louisville, Henderson and St. Louis Railroad, to Lees Switch.

Worthington, 300 feet west of station, south of track, in northwest corner of sandstone foundation of water tank; aluminum tablet stamped "385 ADJ 1903"	383.872

	Feet.
Reeds, 60 feet south of station, in northeast corner of Chas. Williams' store; aluminum tablet stamped "379 ADJ 1903"	378.215
Spottsville, 600 feet east of, west edge of railroad bridge over Green River, in northwest corner of west sandstone pillar; aluminum tablet stamped "385 ADJ 1903"	383.442
Basketts, 200 feet east of station, north of track, in foundation at southeast corner of tank room of Pittsburg Coal Co.; aluminum tablet stamped "401 ADJ 1903" (Reported destroyed October 1907)	400.316

Lees Switch Along Highway Southeast, to Hebbardsville; thence East to Sorgho.

Zion, in west side of northwest pillar of Zion Baptist Church; aluminum tablet stamped "455 ADJ 1903"	454.761
Hebbardsville, northwest corner of crossroads at, in southeast brick pillar of C. W. Johnson's store on east side; aluminum tablet stamped "426 ADJ 1903"	424.964
Hamiltons Ferry over Green River, 1500 feet east of, in north side of brick chimney of house owned by Ed. Hamilton and occupied by James Estler; aluminum tablet stamped "404 ADJ 1903"	403.300

CENTRAL CITY QUADRANGLE.

Location. The Central City Quadrangle is bounded by parallels 47° 15′ and 37° 30′, by meridians 87° 0′ and 87° 15′, and comprises parts of Ohio, Muhlenberg and McLean Counties. It derives its name from Central City, which is the principal town on the sheet, and has an area of 241 sq. miles.

Drainage. Green River drains the central part of the sheet, crossing it in a tortuously diagonal course from southeast to northwest; Cypress Creek, which is a very sluggish stream, composed largely of a succession of swamps, drains the greater part of the western half; Rough River crosses the northeastern corner, and Pond Creek the southeastern corner, but neither plays a very important part in the removal of the water fall from this sheet.

Relief. Practically all of the upland areas lying east and south of Cypress Creek, comprising about seven-ninths of the total upland area, is of the type designated rugged uplands. In this region erosion has wrought fearful havoc and relatively but little cultivable land, apart from the valleys, now remains.

In the western central portion of the sheet, in the vicinity of Bremen, is located some low and gently sloping hill land, which is well suited to agriculture.

The overflow areas of Green and Rough Rivers and of Cypress and Pond Creeks comprise practically all of the river flats on the sheet. These river flats, or bottom lands, range from one to four miles in breadth. They have a fall of six feet, ranging from 389 ft., in the southeastern corner of the sheet, to 383 ft. in the northwestern corner, a distance by water of about thirty-five miles.

The highest points on the sheet are a few hills in the southwestern corner of the sheet, these being contoured at slightly more than 620 ft.; the lowest elevation is 366 ft., which is the elevation at low water of Green River.

Culture. This quadrangle is well supplied with means of transportation. The Madisonville, Hartford & Eastern Railroad crosses its center from east to west, the Louisville & Nashville Railroad from north to south, also through the center, the main line of the Illinois Central crosses the southeastern corner, and the Kentucky Midland Railroad, now nearing completion, is being built westward from Central City to Madisonville. In addition, as has been previously mentioned, Green River furnishes water transportation throughout the year.

Central City, which is the county seat of Muhlenberg county, is the principal town; other towns of importance are South Carrollton, Livermore, and Island Station. All of these are mining towns, except Livermore.

GEOLOGY.

Structure. The Moorman Syncline enters this sheet from the east at a point one-half mile northeast of Ceralvo, thence, extending westward, crosses Green River at Smallhouse, passes through Moorman, and leaves the sheet at a point about one-half mile north of west of Bremen. The dip of the rocks, which is westerly, to Ceralvo, is about 40 ft. to the mile, but is only 100 ft. from the total remaining distance, or less than 10 ft. to the mile. Southward from the bottom of the Syncline the strata rise rapidly, the average rate being 40 ft. per mile; to the north the average rate is about the same until the upward rise is interrupted by the Livermoore and Cypress Creek Faults, hereinbefore described.

Rocks Exposed. The rocks exposed over the Central City Quadrangle extend from a point 40 ft. above No. 15a Coal, down to a point 100 ft. below the No. 9 bed, or to about the No. 8 coal horizon. The vertical section is 520 ft. high.

Following is a general section of all the rocks appearing at the surface of this sheet.

General Section.

		Av.	Min.	Max.
1.	Sandstone, incoherent, yellowish brown, coarse	30′0″	20′0″	35′0″
2.	Shale, blue	8′0″	6′0″	10′0″
3.	Coal, No. 15a, hard, shaly, sometimes nearly carbonaceous shale	0′5″	0′0″	0′8″
4.	Fireclay, blue	0′9″	0′6″	1′0″
5.	Shale, blue and gray, soft	30′0″	10′0″	40′0″
6.	Sandstone, soft, coarse, shaly in streaks, sometimes entirely displaced by blue shale	20′0″	15′0″	25′0″
7.	Shale, carbonaceous, sheety, resembles shale above No. 9 Coal, but thinner and breaks up in smaller sizes, bluish black	1′8″	1′6″	2′0″
8.	No. 15 Coal, hard, pure, lustrous	1′4″	1′0″	1′8″
9.	Fireclay, blue, sometimes yellowish blue	4′0″	2′0″	6′0″
10.	Shale, blue, sometimes siliceous	20′0″	10′0″	30′0″
11.	Sandstone, hard, coarse, reddish brown	15′0″	4′0″	20′0″
12.	Sandstone, shaly	9′0″	5′0″	10′0″
13.	Shale, blue, soft, sandy	3′6″	2′0″	5′0″
14.	No. 14a Coal, impure	0′8″	0′0″	1′4″
15.	Fireclay and shale	2′6″	2′0″	3′0″
16.	Madisonville Limestone, occurs usually in two ledges, but sometimes in a single ledge, is filled with crinoidal stems and brachiopod shells, gray or dingy yellow in color, dark blue on fracture	6′0″	5′0″	7′6″
17.	Coal, impure	0′2″	0′0″	0′6″
18.	Fireclay, blue, siliceous	8′0″	6′0″	10′0″
19.	Sandstone, reddish brown	7′0″	6′0″	9′0″
20.	Shale, blue, sometimes sandy	18′0″	15′0″	21′0″
21.	Sandstone, coarse, hard, gray, massive	35′0″	30′0″	40′0″
22.	Shale, gray, soft	4′0″	0′5″	6′0″
23.	No. 14 Coal, hard, lustrous, frequently irridescent, usually with parting from 0′ to 4″	7′4″	2′6″	8′8″
24.	Fireclay, blue	1′6″	1′0″	2′0″
25.	Sandstone, usually soft, with very hard streaks, fine-grained, light brown	45′0″	40′0″	53′0″
26.	Shale, sandy	12′0″	10′0″	18′0″
27.	Shale, gray	1′6″	1′0″	2′0″
28.	No. 13 Coal, pure, hard	1′3″	0′6″	2′0″
29.	Fireclay, blue	4′0″	2′0″	7′0″
30.	Sandstone, solid, hard, fine-grained, sometimes shale or entirely displaced by shale	25′0″	20′0″	30′0″
31.	No. 12 Coal, hard, pure, when best developed has one inch clay parting, 2 ft. above bottom	4′6″	3′0″	5′6″
32.	Fireclay, blue	2′4″	2′0″	3′0″
33.	Jolly Limestone, hard, has an abundance of crinoidal stems and brachiopod shells, which are thickest near top, usually in a single ledge, weathers a dingy gray, but grayish blue on fracture	4′0″	3′0″	5′ 0′
34.	Shale, hard and limy, though sometimes carbonaceous, gray or black	0′6″	0′2″	4′0″
35.	No. 11 Coal, hard, pure, with one inch clay parting 18″ above bottom	4′10″	3′6″	6′3″
36.	Fireclay, blue	6′0″	3′0″	8′0″

		Av.	Min.	Max.
37.	Sandstone, hard, light brown, fine-grained, soft	27′0″	20′0″	30′0″
38.	No. 10 Coal	1′6″	0′6″	3′4″
39.	Sandstone, massive, medium grained, gray	50′0″	30′0″	80′0″
40.	Shale, siliceous, soft	8′0″	4′0″	10′0″
41.	Shale, carbonaceous, sheety	1′6″	1′0″	2′6″
42.	No. 9 Coal, pure, hard, without parting	4′8″	3′10″	5′3″
43.	Fireclay, blue	4′0″	3′0″	6′0″
44.	Sandstone, shaley	20′0″	10′0″	30′0″
45.	Sandstones and shales	60′0″	50′0″	75′0″
	Total	508′5″		

DETAILS CONCERNING THE COAL BEDS.

No. 15a Coal. No. 15a Coal is the highest coal of known occurrence in this quadrangle. It is observed in a few places in the vicinity of Gishton, only. Where found it was embedded between blue shales, and was more or less mixed with shale; in places, in fact, it was reduced to a mere carbonaceous shale. It was never found more than a few inches in thickness. It lies 40 ft. above No. 15 Coal, or about 390 ft. above No. 9.

The following sections showing the coal and associated rocks were obtained.

Section 224. Section exposed on the hill side in the road one mile east of Gishton.

1.	Soil	
2.	Sandstone, soft, shaley	15′0″
3.	Shale, blue	8′0″
4.	No. 15a Coal, shaley	0′5″
5.	Shale, blue, sandy	40′5″
6.	No. 15 Coal, hard, pure	0′6″
7.	Clay, blue	1′6″

Section 424. Section obtained on the Solomon Noffsinger farm, located 2½ miles northeast of Gishton.

1.	Soil, containing an abundance of water-worn flint and chert pebbles, of variegated colors probably Tertiary material.	
2.	Clay, blue	1′8″
3.	No. 15a Coal, mainly carbonaceous shale	0′8″
4.	Shale, blue	0′8″

No. 15 Coal. The steep dip of the rocks into the trough of the Moorman Syncline brings this coal down so that it catches in the hills in an area ranging from 5 to 8 miles in width, and lying from east to west entirely across the sheet, except for a narrow strip along its eastern edge. See Plate No. 1. It usually varies in thickness from 1′ 4″ to 2′ 0″, and is without parting. This vein, however, thins out to the west, being only 6″ thick in the vicinity of Gishton.

A number of openings have been made in the region east of Green River.

Section 320. Section showing one mile north of Equality Post Office, on Wm. G. Fulkerson's farm.

1.	Soil.	
2.	Sandstone, solid, hard, coarse grained, brown,	12′0″
3.	Shale, carbonaceous, sheety	1′0″
4.	No. 15 Coal, pure, hard, (reported)	2′0″
5.	Concealed	40′0″
6.	Madisonville Limestone	4′0″

The coal had been opened on this farm, but had been mined in only a limited way and the bank is now fallen shut.

Section 393. Section obtained 1½ miles west of Ceralvo, on the Robert Eudaly farm.

1.	Soil.	
2.	Sandstone, soft, coarse	15′0″
3.	Shale, sheety, black	1′0″
4.	No. 15 Coal	2′6″

The vein had also been opened at this point but the bank had fallen shut and the coal could not be seen.

Section 162. Section obtained in the railroad cut 2 miles north of South Carrollton.

1.	Soil.	
2.	Sandstone, coarse, brown, soft, shaley streaks	15′0″
3.	Shale, black, sheety	2′0″
4.	No. 15 Coal, pure, hard, without parting	1′4″
5.	Clay, blue	8′0″

The above section is typical of this bed and its associated rocks for the region lying east of Cypress Creek.

A few openings have been made in this vein near Moorman, notably on the W. P. Robertson farm, where it was reported as being 1′ 8″ thick; Mr. Robertson reports the coal at his bank, which is now abandoned and fallen shut, as being block coal, possessing excellent burning qualities.

No. 14a Coal. This bed is found in the vicinities of Smallhouse, on Green River, and of Worthington Chapel, which is located about four miles west of Island Station. Near Smallhouse the vein is very thin, ranging from 2″ to 12″ in thickness. It here lies about 10′ above the Madisonville Limestone. It has been opened in two or three places in this neighborhood, but none of the openings were worked to any extent.

Section 301. Section obtained in road one-quarter mile east of Smallhouse.

1.	Soil.	
2.	Sandstone, soft, thin-bedded	6′0″
3.	Shale, sandy, brown	2′0″
4.	No. 14a Coal	0′2″
5.	Clay, blue	1′0″
6.	Shale, blue	9′0″
7.	Madisonville Limestone, badly weathered	0′6″
8.	Clay, blue	1′6″

Section 302. Section exposed one-half mile east of Smallhouse.

1.	Soil.	
2.	Sandstone, soft, slightly mixed with shale	15′0″
3.	Shale, carbonaceous, with streaks of coal	5′0″
4.	Sandstone, shaley	10′0″
5.	No. 14a Coal	0′3″
6.	Fire Clay, blue	3′0″

Section 430. Located three-quarters miles southeast of Worthington Chapel.

1.	Soil.	
2.	Shale, soft, sandy	30′0″
3.	Clay, blue	3′0″
4.	No. 14a Coal, pure, hard	1′8″
5.	Clay, blue	10′0″
6.	Madisonville Limestone	5′0″
7.	Clay, blue	3′0″

Coal had been opened and slightly mined at this place, but the bank is now abandoned. The farmers here reported the coal as being an excellent stove coal.

The section given above was the only one of value obtained showing the bed in this locality.

No. 14 Coal. By referring to Plate No. 1, it will be seen that this vein underlies an area about 8 miles wide, extending, except for a strip about one mile in width, along its eastern outcrop line, from east to west entirely across the center of the sheet. Its southern outcrop area, however, extends in a fringe-like manner some distance beyond this main body of coal. In thickness the coal varies from 2 feet to 8 feet 8 inches, being thinnest along its southern outcrop edge, and thickest in its central area, or in that area overlying the trough of the Moorman Syncline. No large mines have ever been operated in this vein on this sheet, but nine small country banks are now being worked, and about a dozen have been more or less extensively worked in the past, and abandoned. The maximum distance which No. 14 overlies No. 9 on this sheet is 217 feet; the minimum is 204 feet; while the average is 211 feet. The quality of the coal is everywhere good.

The following sections and other detailed data are sufficient to show the characteristics of this coal in the various localities in which information could be obtained.

A number of good banks are in operation between Centertown and Smallhouse. In this region the coal attains its maximum development for this sheet, but here also it contains a shale parting of from 1″ to 4″ which is not usual elsewhere.

Section 337. Section obtained at the A. M. Asheby Bank, located 3 miles northwest of Centertown.

1.	Soil.			
2.	Shale, siliceous, soft, gray			10′0″
3.	Shale, hard with carbonaceous streaks			2′6″
4.	No. 14	Coal	4′0″	..
		Shale	0′½″	..
		Coal	3′6″	..
		Bone Coal	0′5″	..
		Coal	1′0″	8′11½″
5.	Fireclay		..	3′0″

In this bank the coal is shot on the solid, the overlying carbonaceous shale affording a fair roof. A small amount of lump sulphur was noticeable in the bottom bench.

Section 400. Section exposed in railroad cut one-half mile east of Equality Post Office.

1.	Soil.		
2.	Shale, siliceous, gray		15′0″
3.	Shale, soft, pure		5′0″
4.	No. 14 Coal, visible 6′ 6″, but reported as extending 2½ feet below the surface, without parting		9′0″
5.	Fireclay		

Section 397. Section showing at C. G. Kimbly's Bank, located 3 miles northeast of Smallhouse.

1.	Soil.			
2.	Madisonville Limestone			4′0″
3.	Sandstone and partly concealed			40′0″
4.	Shale, soft, gray			12′0″
5.	No. 14 Coal,	Coal	7′1″	
		Shale	3″	
		Coal	1′8″	8′11″
6.	Fireclay.			

In this mine 18″ of coal is left as a roof. The upper portion of the coal is of a beautiful peacock color. The shale parting varies from 1″ to 4″ in thickness. Coal from this bank is extensively used by the local blacksmiths, and when burned leaves but little clinker.

This bed has been mined for many years along the south bank of Green River between Carrollton and Kincheloe Ferry, and the total amount of coal removed is large. A few mines are in operation at Kincheloe at the present time. The coal is mainly furnished to the home market, but some is supplied to the Green River steamboats.

Section 297. Section exposed at the George Doss coal mine at Kincheloe Ferry.

1.	Soil.		
2.	Sandstone, massive, soft, coarse grained, light gray		15′0″
3.	Shale, soft, siliceous at top, grayish blue		10′0″
4.	No. 14 Coal, hard, upper part "peacock" coal, from 4′6″ to 5′9″		5′1″
5.	Fireclay		3′0″

The average thickness given above is thinner than the average for this locality as is shown by the following measurements obtained in neighboring mines.

Section 115. Located one-quarter mile east of Kincheloe Ferry on the George Doss farm.

1.	Soil.	
2.	Shale	10′0″
3.	No. 14 Coal, hard, without parting	6′4″
4.	Fireclay.	

Section 121. Section showing at T. Foley's Bank, located one-quarter mile west of Kincheloe Ferry.

1.	Soil.	
2.	Sandstone	10′0″
3.	Shale	8′0″
4.	No. 14 Coal	7′1″
5.	Fireclay.	

About two miles north of South Carrollton a shaft was sunk by W. P. Robertson and others in which this coal was found to be 7′ 10″ thick, and without parting. The overlying strata was shale. See Section 79, page 00.

Section 169. Record of test well drilled at Moorman for W. P. Robertson; authority W. P. Robertson.

		Thickness.	from	to.
1.	Soil	8′0″	0′0″	8′0″
2.	Gravel	3′0″	8′0″	11′0″
3.	Sand	9′0″	11′0″	20′0″
4.	Sand rock	6′0″	20′0″	26′0″
5.	Fireclay	14′0″	26′0″	40′0″
6.	Flint rock, hard, (Madisonville Limestone)	7′6″	40′0″	47′6″
7.	Soapstone	1′0″	47′6″	48′6″
8.	Coal, thin	1′6″	48′6″	50′0″
9.	Soapstone	2′0″	50′0″	52′0″
10.	Sandstone	6′0″	52′0″	58′0″
11.	Limestone	2′0″	58′0″	60′0″
12.	Clay	3′0″	60′0″	63′0″
13.	Sandstone	39′0″	63′0″	93′0″
14.	Coal (No. 14)	8′6″	93′0″	101′6″
15.	Clay	1′0″	101′6″	102′6″
16.	Soapstone	2′0″	102′6″	104′ ″
17.	Sandstone	21′6″	104′6″	126′0″

The names given above were supplied by the writer. As will be seen by reference to the record, the coal here attains almost to its maximum development for this quadrangle.

In the test sunk near Bremen no traces of No. 14 was found (240, page 00). Whether this fact indicates a mere local "pinching out" or its more general absence can only be determined by further testing, but the finding of the coal with a thickness of 4′ 6″ at Sacramento, which is located 4 miles to the northwest, would lead to the former view. (See Madisonville No. 112.)

These two tests, are the only ones sunk over this area to this bed, and the information furnished by them, which is all that is available, is entirely too incomplete to afford a basis for an opinion. A knowledge of the splendid development of No. 14 under the Moorman hills, however, would lead to the belief that the vein should be found under like conditions west of Cypress Creek, also, and further testing will probably show that under portions at least of this region the coal is in good workable condition.

Along the edge of its southern outcrop area No. 14 is thinned down to such a degree as to be of little economic value. The following sections are typical here.

Section 234. Section exposed on R. D. Amos farm, located 4 miles west of Central City.

1.	Soil.	
2.	No. 14 Coal	3′0″
3.	Clay	0′6″

Section 207. Section showing on W. T. Peasley's farm, located 3 miles west of Central City.

1.	Soil.	
2.	Sandstone	10′0″
3.	No. 14 Coal (reported)	2′0″
4.	Clay	

At this point the coal has been opened but has long since been abandoned. The thickness of the coal was obtained from W. T. Peasley, who opened the bank.

Section 199. Section exposed in road 2 miles northwest of Central City.

1.	Soil.	
2.	Sandstone, soft, shaley	20′0″
3.	No. 14 Coal	0′6″
4.	Fireclay, blue	2′0″

Section 379. Section exposed in road 3 miles northeast of Central City.

1.	Soil.	
2.	Sandstone	20′0″
3.	No. 14 Coal	0′10″
4.	Clay	1′2″
5.	Sandstone	10′0″

No. 13 Coal. This vein is of no economical importance in this quadrangle. It underlies No. 14 Coal at an average distance of 66 ft. The extreme range of interval between this vein and No. 9 is from 137 to 173 ft., but usually the vein follows closely parallel to No. 9, overlying it an average distance of 151 ft.

The following sections showing No. 13 and its associated stata were obtained:

Section 10. Section in road 1½ miles southwest of Central City.

1.	Soil.	
2.	Sandstone, soft, reddish brown	10′0″
3.	Shale, light gray	0′6″
4.	No. 13 Coal	0′6″
5.	Fireclay, light blue, weathers white	2′0″
6.	Shale, sandy	6′0″

Section 82. Section exposed in road 1½ miles east of Central City.

1.	Soil.	
2.	Sandstone, hard, coarse, brown	20′0″
3.	Clay, blue	3′0″
4.	No. 13 Coal	0′6″
5.	Clay, blue	2′0″

Section 378. Section showing in road 3 miles northeast of Central City.

1.	Soil.	
2.	Sandstone, hard, coarse grained, brown	20′0″
3.	No. 13 Coal	0′10″
4.	Sandstone, hard, reddish brown	30′0″
5.	Shale, siliceous	20′0″
6.	Sandstone, soft, shaley	16′0″
7.	Clay	3′0″
8.	No. 13 Coal	0′6″
9.	Clay	1′0″

In the Moody Shaft at South Carrollton, No. 13 was found to be 1′ 8″ thick, and overlain with gray shale. In the Robertson Shaft near Moorman, this vein was found to be 2′ thick, overlain with 1′ of grayish slate and underlain with 1′ of fireclay. Mr. Robertson reported this coal to be hard and without parting, and apparently of good quality.

In the J. H. Grundy well near Bremen this vein was reported to be 6′ thick. This is a very extraordinary thickness for No. 13, and probably represents only a local thickening.

The Kentucky Midland Coal Company's test No. 5 located on Cypress Creek 4 miles west of Central City, found the coal to be 2′ thick. Other tests by the same company in this region found the bed to possess varying thicknesses of from 8″ to 2′.

No. 12 Coal. The area which No. 12 occupies may be said for all practicable purposes to be co-existent with that of No. 11 (see Plate No. 1). It overlies No. 11 an average distance of only 13 feet. Its extreme range of thickness is from 2′ to 5′ 9″; the average of all the measurements taken is 4½′, which is about the usual thickness. The overlying strata is sandstone, except in the southwestern corner and again in the southeastern corner of the sheet, where a vein of Black Band Iron Ore from 6″ to 14″ thick intervenes between the coal and the sandstone. The underlying strata is clay. About 30 small mines, but no large mines have been operated in this vein on this sheet. No. 12 overlies No. 9 an average distance of 118′, the maximum and minimum distances being 147 and 109 feet respectively.

No. 11 Coal. As reference to the map will show, No. 11 underlies practically all the uplands of this sheet, except a small area surrounding the town of Island, where the steep rise in the rocks to the north carries the coal above the tops of the hills. In thickness it ranges from 3′ to 6′ 3″, the average being 4′ 10″. As a rule it is of workable thickness over its entire area of occurence. No large mines are at present being operated in No. 11, but

several have been operated in the past, notably the Black Diamond Mine, located one mile east of the southeastern corner of the sheet, near Paradise. The Kentucky Midland Coal Company first started its operations in this vein, but the management finally decided that it would be wiser to take out the more minable No. 9 first, and thereupon abandoned the No. 11 workings. About 60 small country banks are at present in operation. The interval between this vein and No. 9 varies 75 to 138 feet, the average being 103 feet.

The following sections are given to assist in displaying the stratigraphy.

Section 46. Section exposed at the Tom English Bank located one mile west of Cleaton.

1.	Soil.			
2.	Sandstone, hard, fine-grained			30′ 0″
3.	No. 12 Coal..	Coal	3′ 5″	
		Clay	0′ 2″	
		Coal	1′ 10″	5′ 5″
4.	Clay, blue			2′ 0″
5.	Jolly Limestone			3′ 0″
6.	Clay and Shale			1′ 0″
7.	No. 11 Coal, (top only visible)			0′ 6″

The thickness of No. 12 given above is the greatest of this vein measured by the writer on the four quadrangles mapped, though some measurements obtained from logs of shafts, etc., were greater. In the northern portion of the sheet, at No. 354, the combined thickness of coal and shale was greater, but the amount of coal was less than in the section given above.

Section 52. Section exposed in road 4 miles west of Central City.

1.	Soil.	
2.	Sandstone, soft, brown with reddish streaks..	16′ 0″
3.	Iron ore, hematite	3′ 0″
4.	Shale, siliceous, white	11′ 0″
5.	No. 12, Coal	4′ 0″
6.	Clay, blue	5′ 0″
7.	Jolly Limestone	4′ 0″
8.	Clay, blue	1′ 0″
9.	No. 11 Coal	4′ 0″
10.	Fireclay.	

In a mine operated by William Eads, 100 yards west of Section 52, No. 11 had a thickness of 5′ 10″, so the thick-

ness shown in the section above is too small for this coal by 1′ 10″.

Section 373. Section exposed at the abandoned Woodcock Mine, located 3 miles east of Nelson.

1.	Soil.		
2.	Sandstone, massive, hard		30′0″
3.	No. 12 Coal		3′2″
4.	Fireclay.		

No. 12 is reported by miners as being 6 inches thicker within the mine than exposed at opening.

Section 131. Section at the Natural Bridge, located on J. H. Corley's farm, 2½ miles north of Mt. Carmel Church.

1.	Soil.		
2.	Sandstone, solid, hard, gray, medium grained		35′10″
3.	No. 12 Coal, without parting		4′3″
4.	Clay		1′1″

The sandstone which closely overlies the coal here apparently would form a good roof.

Section 42. Section located one-half mile east of Hillside.

1.	Soil.			
2.	Sandstone			10′0″
3.	No. 12 Coal			2′0″
4.	Shale, gray			5′0″
5.	Jolly Limestone			5′8″
6.	Carbonaceous shale			0′8″
7.	No. 11 Coal,	Coal	4′2″	
		Shale	0′1″	
		Coal	1′8″	5″9′

A new opening is being made at this point and an excellent exposure afforded.

Section 84. Section exposed at Greenberry Rose Mine, located one mile north of Cleaton.

1.	Soil.	
2.	Jolly Limestone	3′0″
3.	No. 11 Coal, 1″ Clay parting	4′8″
4.	Clay.	

Limestone here furnishes an excellent roof, and relatively few props were required.

Section 212. Section showing at mine on farm of John Henry, located one mile northwest of Hillside.

1.	Soil.			
2.	Jolly Limestone			2′6″
3.	Clay, blue			0′6″
4.	No. 11 Coa...	Coal	1′5″	..
		Clay	0′¼″	..
		Coal	2′6″	..
		Clay	0′½″	..
		Coal	1′5″	5′5¼″
5.	Clay, blue		..	3′0″

Section 267. Section located one mile northeast of Cypress Creek Church.

1.	Soil.			
2.	No. 12 Coal			1′0″
3.	Shale, soft blue			8′0″
4.	No. 11 Coal..	Coal	1′6″	
		Clay	0′2″	
		Coal	2′9″	
		Clay	0′2″	
		Coal	0′6″	6′1″
5.	Clay.			

This exposure of the Jolly Limestone was replaced in outcrop by shale. The bank was just being opened, however, and the limestone, in all probability, will be found, as usual, further in.

Section 56. Section exposed at mine on William Edwards' Hairs' farm, located 1½ miles southeast of Midland Station.

1.	Soil.			
2.	No. 11 Coal..	Coal	3′10″	
		Clay	0′1½″	
		Coal	1′4½″	5′4″

The mine could not be entered at the time of my visit on account of water; but the coal was reported as being from 2 to 4 inches thicker further back in the mine.

Section 79. Record of shaft sunk by W. P. Robertson Coal Company on land owned by W. P. Robertson, located 2 miles north of South Carrollton, authority W. P. Robertson.

	Robertson Shaft.	Thick-ness.	From.	To.
	No. 15 Coal (outcrop at mouth of shaft)	2′		
1.	Clay, yellow	8′0″	0′0″	8′0″
2.	Potters Clay	8′0″	8′0″	16′0″
3.	Shale	32′0″	16′0″	48′0″
4.	Limestone, (Madisonville)	7′0″	48′0″	55′0″
5.	Fireclay and coal	2′0″	55′0″	57′0″
6.	Sandstone, red	7′0″	57′0″	64′0″
7.	Shale	21′0″	64′0″	85′0″
8.	Sandstone, coarse	37′0″	85′0″	122′0″
9.	Slate, Gray	3′0″	122′0″	125′0″
10.	Coal (No. 14)	7′10″	125′0″	132′10″
11.	Fireclay	2′0″	132′10″	134′10″
12.	Sandstone, blue, fine-grained	6′0″	134′10″	140′10″
13.	Sandstone, white, coarse	32′0″	140′10″	172′10″
14.	Sandstone, fine-grained, hard "Building stone"	15′0″	172′10″	187′10″
15.	Slate, sandy	18′0″	187′10″	205′10″
16.	Slate, gray	1′0″	205′10″	206′10″
17.	Coal (No. 13)	2′0″	206′10″	208′10″
18.	Fireclay	1′0″	208′10″	209′10″
19.	Fireclay and boulders	6′0″	209′10″	215′10″
20.	Slate, gray	10′0″	215′10″	225′10″
21.	Coal (No. 12)	5′6″	225′10″	231′4″
22.	Fireclay	1′0″	231′4″	232′4″
23.	Limestone (Jolly)	2′0″	232′4″	234′4″
24.	Slate, black	4′0″	234′4″	238′4″
25.	No. 11 Coal	4′4″	238′4″	242′8″
26.	Fireclay	8′0″	242′8″	250′8″

This record was a great aid in clearing up the geology of this region. The shaft is sunk in an effort to reach the No. 9 vein of coal, which was erroneously supposed to be much nearer the surface than it really was. In reality, it would have been necessary to sink the shaft approximately 93′ deeper to have reached this vein.

Section 278. Section located in bed of stream three-fourth mile west of Cleaton.

1.	Soil.	
2.	Sandstone, soft, yellow	30′0″
3.	No. 12 Coal	3′0″
4.	Fireclay, blue	0′10″
5.	Jolly Limestone	2′6″
6.	Shale, greenish color	0′3″
7.	No. 11 Coal	4′0″
8.	Fireclay.	

Section 35. Section at mine on farm of George Root, located 1½ mile south of Central City.

1.	Soil.	
2.	Sandstone	15′0″
3.	No. 12 Coal	5′6″
4.	Clay	1′0″
5.	Shale	3′0″
6.	Jolly Limestone	4′0″
7.	No. 11 Coal	6′0″
8.	Clay	1′0″

The following table shows different thicknesses of Nos. 11 and 12 Coals, obtained from the records of certain shafts and borings sunk over the sheet, together with the corresponding map number, location, and the page of text on which the full record may be found.

No. and Location.	Remarks.	Thickness No. 12	Thickness No. 11.	Page.
55. 2 miles S. E. of Midland Station	Boring. No. 12 has probably been partly eroded	2′6″	4′8″	00
74. At South Carrollton	Shaft. Moody Coal Co	5′6″	4′6″	00
116. ½ mile S. E. of Kincheloe Ferry	Deep well sunk for oil by Shelby Gish	4′0″	5′0″	00
126. 1 mile N. W. of Central City	Deep well sunk for oil by Shelby Gish	3′0″	5′6″	00
128. At Central City	Shaft of Central City Coal & Iron Co	5′0″	3′0″	00
240. ¾ mile N. W. of Bremen	Churn Drill coal test sunk for I. Bailey. This is thinnest recorded measurement of No. 12	0′6″	5′6″	00
243. 1 mile S. E. of Gishton	Boring by Kentucky Midland Coal Co	4′6″	5′0″	00
247. 1 mile S. W. of Gishton	Boring by Kentucky Midland Coal Co	5′0″	5′2″	00
251. At Midland Sta	Boring by Kentucky Midland Coal Co	5′9″	5′1″	00
253. 1½ miles S. W. of Gishton.	Boring by Kentucky Midland Coal Co	4′0″	5′1″	00
254. 1½ miles south of Gishton	Boring by Kentucky Midland Coal Co	5′6″	5′1″	00
255. 2½ miles south of Gishton	Boring by Kentucky Midland Coal Co. No. 12 has only locally thinned out	2′0″	4′10″	00
256. 2 miles east of Midland Station	Boring by Kentucky Midland Coal Co	4′7″	4′10″	00
257. 1½ miles S. E. of Gishton	Boring by Kentucky Midland Coal Co	4′7″	3′8″	00
258. ½ mile South of Midland Station	Boring by Kentucky Midland Coal Co	5′0″	3′3″	00
259. ¾ mile S. W. of Midland Station	Boring by Kentucky Midland Coal Co	5′0″	4′11″	00
	Average	4′2″	4′9″	

Section 413. Section exposed 2 miles west of Island Station.

1.	Soil			
2.	Jolly Limestone			3′0″
3.	Clay			6′0″
4.	No. 11 Coal			Showl
5.	Clay.			

The coal here was only partially exposed. As previously mentioned, a sheer fault of about 80 feet occurs at this point.

Section 354. Section located one mile north of Kirtley.

1.	Soil.			
2.	Sandstone			28′0″
3.	No. 12 Coal..	Carbonaceous shale.	0′6″	
		Coal with clay partings	3′6″	
		Shale with streaks of coal	2′0″	
		Coal	1′8″	7′8″
4.	Fireclay			5′0″
5.	Jolly Limestone			5′0″
6.	Clay			5′0″
7.	Sandstone, solid, hard, coarse, gray			51′0″
8.	Green River water level			

No. 12 which has been mined to a considerable extent in two places here, has greatly changed in character and appearance as compared with a typical section of the southern half of the sheet, where it was usually only a single vein of solid coal. The large proportion of shale here existing renders the coal of little value from a commercial standpoint. This bed was not observed elsewhere in this immediate locality, so it is not known whether this shaly condition is the prevailing one or not. The typical sandstone so prevalent further south was here replaced with shale.

No. 11 was not exposed in this section.

The massive sandstone given above as extending below the water level of Green River is the one lying above No. 9 Coal. This coal, it was reported, occurs in the bed of Green River at this point.

Section 349. Section 2 miles northeast of Matanzas School, at coal bank on farm of Al. Coffman.

1.	Soil.			
2.	Sandstone			10′0″
3.	Shale, soft, gray			0′10″
4.	No. 12 Coal			4′0″
5.	Clay.			

The bank was fallen shut and could not be entered. The thickness of the coal was obtained from Mr. Coffman.

Section 433. Section 10 yards east of the railroad bridge in the North bank of Green River at Livermore.

1.	Alluvium.			
2.	No. 12 Coal..	Coal	3′0″	
		Clay	0′5″	
		Coal	1′0″	4′5″
3.	Fireclay			5′0″
4.	Jolly Limestone			3′0″

No. 12 was reported as having been struck in the wells near by with a much thinner thickness, but nothing definite could be learned.

In the test made by P. O. McKinney on the A. L. Ashby farm, located 1 mile southeast of Centertown, No. 12 coal was absent, while No. 11 was found to be only 3′ 3″ thick. In another test made by P. O. McKinney on the Barnes farm, located 2 miles southeast of Centertown, No. 12 was 2 feet thick, while No. 11 was 1′ 6″ thick. No. 12 was here overlain with surface dirt and clay, and may possibly have been eroded to some extent, but that, of course, could not have been the case with the underlying No. 11.

No. 10 Coal. No. 10 coal was found in a few shafts and borings over various portions of the sheet. It is, however, of very irrgular occurrence. It was not observed in outcrop at all, being covered by the loose shale above, though it was found outcropping in a few places just off the southeast corner of the sheet near Paradise. It was there exposed as a mere smut in the road, without any distinguishing features.

It was found at its maximum thickness in the shaft of the Nelson Creek Coal Company's Mine at Nelson, there being 3′ 4″ thick, and overlain with gray slate.

Of the ten tests drilled through the horizon of this vein by the Kentucky Midland Coal Company in the southwestern portion of the sheet, this vein was found in only one; in this single test the coal was 1′ 4″ thick and was overlain with shale.

Coming eastward it was absent at Central City, but was found in the Moody shaft at South Carrollton, being there 2′ 6″ thick, and overlain with sandstone.

In the Shelby Gish test at Kincheloe Ferry coal was only 1′ thick.

Still further to the east this bed was found in two of the P. O. McKinney tests near Centertown, varying from 6″ to 2′ in thickness. The overlying strata was shale in both instances.

The interval between Nos. 9 and 10 coal varies between 53 feet and 19 feet, the average being 33 feet. This interval converges from west to east, the maximum interval of 53 feet being obtained at Bremen, (see Sec. 240), while the minimum interval of 19 feet was obtained near Centertown, (see Sec. 330.) As a rule this bed follows appreciably more closely parallel to No. 11 Coal than to No. 9.

No. 9 Coal. No. 9 underlies practically the entire sheet, except where erosion has removed it along the northern edge from an irregular area comprising the following: The Valley of Cypress Creek extending south almost to the tram road leading westward from Stroud, the Valley of Green River south to a point ½ mile north of Kirtley, and all of the valley of Rough River; and, in the southeastern part of the sheet, all of the valley of Pond Creek. There are, in addition, certain other small areas as, for example, the greater portion of the valley of Cypress Creek lying south of Central City, and the valley of Green River lying east from a point 1 mile east of Ceralvo, in which erosion has doubtless progressed to such an extent as either wholly to remove the coal or to subject it to such a degree of weathering as to render it largely unfit for mining.

With the above mentioned areas excluded, No. 9

Coal may be expected to underlie the entire sheet in workable condition.

This bed is thickest along the southern border of the sheet, where it usually runs from 4′ 8″ to 5′ 6″ in thickness, with an average of 5′ 1″; in the central portion of the sheet it averages 3″ to 4″ less, while in the northern third of the sheet its average is about 4′ 2″. Its thinest recorded measurement is one taken in the Davis Mine, located one mile west of Island Station; the vein here having an average height of only 3′ 10″ (see Sec. 440.) The characteristic black, sheety shale is everywhere present, ranging from 1′ 6″ to 4′ in thickness and affording a most excellent roof.

All of the 18 large mines at present operating in this quadrangle are mining this coal, besides which there are 35 country banks now operating. Most of these mines, both large and small, are operating the coal in or near its outcrop area, though the following mines are exceptions, viz.: The Central Coal & Iron Company's mine in Central City; the Kentucky Midland Coal Company's mine at Midland Station; the Nelson Creek Coal Company's mine at Nelson, and the Moody Coal Company's mine at South Carrollton. In these mines the coal ranges from 172 to 284 feet below the surface. The remainder of the shaft mines, except the Dovey mine, which has a shaft 105 feet deep, all have shafts less than 100 feet deep.

In addition to the large mines named above as being in active operation, ten have been operated and more or less worked out in the past and are now abandoned.

Sections showing this coal and associated rocks were obtained as follows:

Section 268. Section at J. T. Wright's coal bank, located one mile east of Cypress School in the southwestern corner of the sheet.

1.	Soil.	
2.	Sandstone and concealed	20′0″
3.	Shale and concealed	10′0″
4.	Shale, black, sheets	2′0″
5.	No. 9 Coal	4′6″
6.	Fireclay.	

There are no regular partings in the coal here, but occasionally a small parting appears for a few feet.

About three-fourths mile southeast of this mine is located the Jarvis opening of the W. G. Duncan Coal Company's Luzerne Mine; this mine is one of the largest and best known mines in western Kentucky. The coal in this mine has an average thickness of 5′ 2″.

Section 217. Section showing at John McDonald's coal bank located 2 miles west of Hillside.

1.	Soil.	
2.	Shale, black	2′6″
3.	No. 9 Coal	2′10″
4.	Fireclay.	

Section 55. Record of Kentucky Midland Coal Company's test No. 1, located 2 miles east of Midland Satation.

		Thickness.	From.	To.
1.	Soil	15′0″	0′0″	15′0″
2.	No. 12 Coal	2′6″	15′0″	17′6″
3.	Fireclay	2′0″	17′6″	19′6″
4.	Limerock	7′0″	19′6″	26′6″
5.	Slate, light	1′6″	26′6″	28′0″
6.	No. 11 Coal	4′8″	28′0″	32′8″
7.	Fireclay	2′0″	32′8″	34′8″
8.	Sandrock	2′0″	34′8″	36′8″
9.	Sandrock, gray	47′0″	36′8″	83′8″
10.	Slate, Gray	3′0″	83′8″	86′8″
11.	Sandrock, gray	5′0″	86′8″	91′8″
12.	Shale, hard	1′0″	91′8″	92′8″
13.	Shale, sandy	20′5″	92′8″	113′1″
14.	Slate, gray	13′0″	113′1″	126′1″
15.	Slate, Black	1′0″	126′1″	127′1″
16.	No. 9 Coal	5′2″	127′1″	132′3″
17.	Fireclay	12′1″	132′3″	144′4″

Bottom 3 feet of fireclay is given as being sandy.

Section 256. Record of Kentucky Midland Coal Company's test No. 2, located on the Joe Gish farm, 2 miles east of Midland Station.

		Thickness.	From.	To.
1.	Soil	54′0″	0′0″	54′0″
2.	No. 13 Coal	1′0″	54′0″	55′0″
3.	Fireclay	6′0″	55′0″	61′0″
4.	Slate, soft, sandy	21′0″	61′0″	82′0″
5.	No. 12 Coal	4′7″	82′0″	86′7″
6.	Fireclay	2′0″	86′7″	88′7″
7.	Limestone	6′3″	88′7″	94′10″
8.	Slate	0′8″	94′10″	95′6″
9.	No. 11 Coal	4′10″	95′6″	100′4″
10.	Fireclay	2′8″	100′4″	103′0″
11.	Shale, sandy	12′8″	103′0″	115′8″
12.	Sandrock, white	58′4″	115′8″	174′0″
13.	Shalr, gray, sandy	8′0″	174′0″	182′0″
14.	Slate, gray, sandy	29′0″	182′0″	211′0″
15.	Slate, black	2′0″	211′0″	213′0″
16.	No. 9 Coal	4′8.	213′0″	217′8″

Section 243. Record of Kentucky Midland Coal Company's test No. 3, located on farm of Samuel Drake, 1 mile southeast of Gishton.

		Thickness.	From.	To.
1.	Soil	4′0″	0′0″	4′0″
2.	Sandrock, brown	35′0″	4′0″	39′0″
3.	Sandrock, gray	31′0″	39′0″	110′0″
4.	No. 13 Coal	2′0″	110′0″	112′0″
5.	Fireclay	8′0″	112′0″	120′0″
6.	Sandrock	2′0″	120′0″	122′0″
7.	Slate, gray,	15′0″	122′0″	137′0″
8.	No. 12 Coal	4′6″	137′0″	141′6″
9.	Fireclay	1′0″	141′6″	142′6″
10.	Limerock	5′0″	142′6″	148′4″
11.	No. 11 Coal	5′1″	148′4″	153′4″
12.	Fireclay	10′0″	153′4″	163′4″
13.	Shale	7′0″	163′4″	170′4″
14.	Sandrock, gray	61′0″	170′4″	231′4″
15.	Slate, gray	32′0″	231′4″	263′4″
16.	Slate, black	2′0″	263′4″	265′4″
17.	No. 9 Coal	4′9″	265′4″	270′1″

Sec. 257. Record of Kentucky Midland Coal Company's test No. 0, on farm of Wood Gossett, located 1½ miles southeast of Gishton.

		av.	min.	max.
1.	Soil	32.'0″	0′0″	32′0″
2.	Sandrock	10′0″	32′0″	42′0″
3.	Coal	0′6″	42″0″	42′6″
4.	Sandrock	23′0″	42′6″	65′6″
5.	Coal	2′0′″	65′6″	67′6″
6.	Sandrock	5′0″	67′6″	72′6″
7.	Coal	1′6″	72′6″	75′0″
8.	Fireclay	7′0″	74′0″	81′0″
9.	Sandrock	3′0″	81′0″	84′0″
10.	Slate, gray	20′0″	84′0″	104′0″
11.	No. 12	4′7″	104′0″	108′7″
12.	Limerock	3′8″	108′7″	112′3″
13.	No. 11	3′8″	112′3″	115′11″
14.	Fireclay	10′0″	115′11″	125′11″
15.	Shale	23′0″	125′11″	148′11″
16.	No. 10	1′4″	148′11″	150′3″
17.	Fireclay	2′0″	150′3″	152′3″
18.	Shale, sandy	6′0″	152′3″	158′3″
19.	Sandrock, gray	52′0″	158′3″	210′3″
20.	Slate, gray	33′6″	210′3″	243′9″
21.	Slate, black	2′0″	243′9″	245′9″
22.	No. 9	4′7″	245′9″	250′4″

Sec. 255. Kentucky Midland Coal Company's test No. 5, located on farm of Watkins' Bros., 2 miles east of Midland Station.

		av.	min.	max.
1.	Soil	6′0″	00′0″	6′0″
2.	Sandrock, soft	33′0″	6′0″	39′0″
3.	No. 13	2′0″	39′0″	41′0″
4.	Fireclay	4′0″	41′0″	45′0″
5.	Slate, soft	21′0″	45′0″	66′0″
6.	No. 12 (and slate)	2′0″	66′0″	68′0″
7.	Limerock	6′2″	68′0″	74′2″
8.	Slate, black	1′4″	74′2″	75′6″
9.	No. 11	4′10″	75′6″	80′4″
10.	Fireclay	4′0″	80′4″	84′4″
11.	Sandrock, white	59′0″	84′4″	143′4″
12.	Shale, dark, sandy	23′1″	143′4″	165′5″
13.	Slate, gray	6′1″	165′5″	172′1″
14.	Slate, black	3′0″	172′1″	175′1″
15.	No. 9	5′6″	175′1″	180′7″

Sec. 254. Kentucky Midland Coal Company's test No. 6 located on Clark's farm 1¼ miles south of Gishton.

		av.	min.	max.
1.	Soil	33′0″	0′0″	33′0″
2.	Sandrock	17′0″	33″0′	50′0″
3.	Coal mixture	5′6″	50′0″	55′6″
4.	Fireclay	4′0″	55′0″	59′6″
5.	Shale, limy	23′0″	59′6″	82′6″
6.	Slate, gray	12′0″	82′6″	94′6″
7.	No. 12	5′6″	94′6″	100′0″
8.	Fireclay	1′6″	100′0″	101′6″
9.	Shale	1′0″	101′6″	102′6″
10.	Limerock	6′0″	102′6″	108′6″
11.	No. 11	5′1″	108′6″	113′7″
12.	Fireclay	4′5″	113′7″	118′0″
13.	Sandrock	48′0″	118′0″	166′0″
14.	Slate	3′6″	166′0″	169′6″
15.	Sandrock	6′0″	169′6″	175′6″
16.	Slate, gray	27′0″	175′6″	202′6″
17.	Slate, black	0′10″	202′6″	203′4″
18.	No. 9	4′6″	203′4″	207′10″

Sec. 251. Kentucky Midland Coal Company's test No. 7, located at Midland Station.

		av.	min.	max.
1.	Soil	19′0″	0′0″	19′0″
2.	Sandrock	6′6″	19′0″	25′6″
3.	Sandrock	4′0″	25′6″	29′6″
4.	Shale, limy	10′6″	29′6″	40′0″
5.	Slate	19′8″	40′0″	59′8″
6.	No. 12	5′9″	59′8″	65′5″
7.	Fireclay	2′0″	65′5″	67′5″
8.	Limerock	5′6″	67′5″	72′11″
9.	Slate	0′8″	72′11″	73′7″
10.	No. 11	5′1″	73′7″	78′8″
11.	Fireclay	5′0″	78′8″	83′8″
12.	Shale, sandy	1′0″	83′8″	84′8″
13.	Limerock	1′0″	84′8″	85′8″
14.	Shale, sandy	7′4″	85′8″	93′0″
15.	Sandrock	23′0″	93′0″	116′0″
16.	Shale, sandy	24′0″	116′0″	140′0″
17.	Slate, gray	22′0″	140′0″	162′0″
18.	Slate, black	1′0″	162′0″	163′0″
19.	No. 9 coal	4′10″	163′0″	167′10″
20.	Clay	7′2″	167′10″	175′0″

Sec. 247. Kentucky Midland Coal Company's test No. 8, located on farm of Chas. Gish, 1 mile southwest of Gishton.

		av.	min.	max.
1.	Soil	13′0″	0′0″	13′0″
2.	Sandrock	9′6″	13′0″	22′6″
3.	Clay	2′0″	22′6″	24′6″
4.	Sandrock, broken	6′6″	24′6″	31′0″
5.	Sandrock	39′0″	31′0″	70′0″
6.	Fireclay	2′6″	70′0″	72′6″
7.	Sandrock	29′0″	72′6″	101′6″
8.	No. 13	1′6″	101′6″	103′0″
9.	Fireclay	6′0″	103′0″	109′0″
10.	Shale, white	16′0″	109′0″	125′0″
11.	Slate	12′0″	125′0″	137′0″
12.	No. 12	5′4″	137′0″	142′4″
13.	Fireclay	2′0″	142′4″	144′4″
14.	Limerock	7′0″	144′4″	151′4″
15.	Slate	0′6″	151′4″	151′10″
16.	No. 11	5′2″	151′10″	157′0″
17.	Fireclay	3′0″	157′0″	160′0″
18.	Sandrock	10′0″	160′0″	170′0″
19.	Slate	4′0″	170′0″	174′0″
20.	Limeshale	3′6″	174′0″	177′6″
21.	Sandrock	33′6″	177′6″	211′0″
22.	Shale, hard, sandy	25′6″	211′0″	236′6″
23.	Slate, gray	13′6″	236′6″	250′0″
24.	Slate, black	1′11″	250′0″	251′11″
25.	No. 9 coal	4′10″	251′11″	256′9″

Sec. 253. Kentucky Midland Coal Company's test No. 9, located on farm of P. S. Naffsinger one-half mile north of Midland Station.

		av.	min.	max.
1.	Soil	2′0″	0′0″	2′0″
2.	Sandrock	87′0″	2′0″	89′0″
3.	No. 13	0′8″	89′0″	89′8″
4.	Fireclay	3′0″	89′8″	92′8″
5.	Shale, limy	16′9″	92′8″	109′5″
6.	Slate, gray	17′0″	109′5″	126′5″
7.	No. 12	4′0″	126′5″	150′5″
8.	Fireclay	1′7″	130′5″	132′6″
9.	Limerock	7′6″	132′0″	139′6″
10.	Slate, dark	0′7″	139′6″	140′1″
11.	No. 11 coal	5′1″	140′1″	145′2″
12.	Fireclay	2′0″	145′2″	147′2″
13.	Sandrock	56′0′	147′2″	203′2″
14.	Shale, sandy	16′0″	203′2″	219′2″
15.	Slate, gray	16′9″	219′2″	235′11″
16.	Slate, black	1′0″	235′11″	236′11″
17.	No. 9 coal	5′3″	236′11″	242′2″

Sec. 258. Kentucky Midland Coal Company's test No. 10, located on farm of Luke Vincent ½ mile south of Midland Station.

		av.	min.	max.
1.	Soild	18′0″	0′0″	18′0″
2.	Fireclay	4′0″	18′0″	22′0″
3.	Sandrock	11′0″	22′0″	33′0″
4.	Shale, limy	14′0″	33′0″	47′0″
5.	Slate	16′1″	47′0″	63′1″
6.	No. 12	5′0″	63′1″	68′1″
7.	Fireclay	2′8″	68′11″	70′9″
8.	Limerock	4′4″	70′9″	75′1″
9.	Slate and coal	2′0″	75′1″	77′1″
10.	No. 11 coal	3′3″	77′1″	80′4″
11.	Fireclay	2′0″	80′4″	82′4″
12.	Sandrock	60′0″	82′4″	142′4″
13.	Sandstone, shaly	20′0″	142′4″	162′4″
14.	Slate, gray	12′0″	162′4″	174′4″
15.	Slate, black	2′0″	174′4″	176′4″
16.	No. 9	4′11″	176′4″	181′3″

No. 11 coal being unusually thin in this test, a second test was made ¼ mile west to determine if the test, given below, which was sunk only through No. 11, found that vein to possess its usual thickness.

Sec. 259. Kentucky Midland Coal Company's test No. 11 located ¾ mile southwest of Midland Station.

		av.	min.	max.
1.	Soil	2′0″	0′0″	0′0″
2.	Sandrock	12′0″	2′0″	14′0″
3.	No. 13 coal (and and)	2′0″	14′0″	16′0″
4.	Fireclay	4′0″	16′0″	20′0″
5.	Sandrock	2′0″	20′0″	22′0″
6.	Shale, limy	10′0″	22′0″	32′0″
7.	Slate	25′10″	32′0″	57′10″
8.	No. 12	5′0″	57′10″	62′10″
9.	Fireclay	3′3″	62′10″	66′1″
10.	Slate	0′8″	70′7″	71′3″
12.	No. 11 coal	4′11″	71′3″	76′2″

This well was drilled as a test for No. 11 only, there being no reason to doubt that No. 9 possessed its usual thickness.

Sec. 240. Record of test made by I. Bailey, of Madisonville, Kentucky, located on farm of J. H. Grundy ¾ mile northwest of Bremen.

		av.	min.	max.
1.	Clay, red	15′0″	0′0″	15′0″
2.	Soapstone	10′0″	15′0″	25′0″
3.	Slate, gray	10′0″	25′0″	35′0″
4.	No. 15 coal	2′0″	35′0″	37′0″
5.	Fireclay and soapstone	8′0″	37′0″	45′0″
6.	Sandstone, gray	3′0″	45′0″	48′0″
7.	Fireclay	6′0″	48′0″	54′0″
8.	Sandstone, white	17′0″	54′0″	71′0″
9.	Sandstone, blue	5′0″	71′0″	76′0″
10.	(No. 14a), Coal	0′6″	76′0″	76′6″
11.	(Madisonville) Limestone	1′6″	76′6″	98′0″
12.	Soapstone, (probably clay)	5′0″	78′0″	83′0″
13.	Slate, gray	12′0″	83′0″	95′0″
14.	Sandstone, white	71′0″	95′0″	166′0″
15.	Slate, black	67′0″	166′0″	233′0″
16.	No. 13 Coal	6′0″	233′0″	239′0″
17.	Fireclay	1′0″	239′0″	240′0″
18.	Sandstone, white	3′0″	240′0″	243′0″
19.	Slate, hard, gray	9′0″	243′0″	252′0″
20.	No. 12 Coal	0′6″	252′0″	252′6″
21.	Jolly Limestone	6′6″	252′6″	259′0″
22.	No. 11 Coal	5′6″	259′0″	264′6″
23.	Fireclay	2′6″	264′6″	267′0″
24.	Sandstone, blue	11′6″	267′0″	278′6″
25.	Sandstone, white	28′0″	278′6″	306′6″
26.	Slate, gray	5′0″	306′6″	311′6″
27.	No. 10 Coal	3′0″	311′6″	314′6″
28.	Fireclay	3′0″	314′6″	317′6″
29.	Slate, gray	3′0″	317′6″	320′6″
30.	Limestone. ?	1′0″	320′6″	321′6″
31.	Sandstone, blue	18′6″	321′6″	340′0″
32.	Slate, gray	33′0″	340′0″	373′0″
33.	Kidney bed	12′6″	373′0″	385′6″
34.	Slate, hard, black	7′6″	385′6″	393′0″
35.	No. 9 Coal	5′3″	393′3″	398′3″

This is a very important record since it constitutes the only available data showing the condition of the deeper coals in an extensive region surrounding Bremen. No. 12 is here very thin while No. 14 appears to be entirely absent; Nos. 11 and 9, however, occur in their usual thickness and condition. The names of the various important horizons given in the record were supplied by the writer.

Sec. 12. Record of shaft at Dovey Mine located on the I. C. R. R. 3 miles southwest of Central City. Record obtained from Hywel Davis.

1.	Clay	16′0″
2.	Sandrock	38′0″
3.	Slate, siliceous, containing boulders and kidney beds	50′0″
4.	Draw slate	1′2″
5.	No. 9 Coal	5′2″
6.	Fireclay.	

Sec. 13. Section of shaft at R. Morgan Coal Company's No. 1 Mine, located ½ mile southwest of Mercer.

1.	Soil, clay, shale and sandstone	81′0″
2.	Slate, black, sheety	2′0″
3.	No. 9 Coal	4′10″

Sec. 277. Record of shaft at Holt Company's Mine No. 1 located ½ mile north of Cleaton.

1.	No. 11 Coal	4′0″
2.	Soil, sandy	20′0″
3.	Sand rock	20′0″
4.	No. 10 Coal	3′2″
5.	Sand rock soft, hardening toward the bottom	50′0″
6.	Slate, gray	20′0″
7.	Slate, black	3′0″
8.	No. 9 Coal	5′8″
9.	Fireclay.	

Sec. 4. Record of shaft of Crescent Coal Company located on L. and N. R. R., ½ mile southeast of Cleaton.

1.	Soil, sandstone and shale	33′0″
2.	Slate, black	2′0″
3.	No. 9	5′3″

Of eighty measurements made by the Coal Company in the mine, the average, was 5′ 3″, the maximum was 6 ft., and the minimum was 4′ 11″.

Sec. 128. Record of shaft of the Central City Coal and Iron Company's Mine at Central City. Record obtained from Hywel Davis, General Manager.

		av.	min.	max.
1.	Soil	8′0″	0′0″	8′0″
2.	Soapstone	9′0″	8′0″	17′0″
3.	No. 12 Coal	5′0″	17′0″	22′0″
4.	Slate	1′0″	22′0″	23′0″
5.	Limestone	3′0″	23′0″	26′0″
6.	No. 11 Coal	3′0″	26′0″	29′0″
7.	Fireclay	4′0″	29′0″	33′0″
8.	Sandstone	4′0″	33′0″	37′0″
9.	Shale	3′0″	37′0″	40′0″
10.	Sandstone, white	13′0″	40′0″	53′0″
11.	Bastard rock	11′0″	53′0″	64′0″
12.	Sandstone, gray	5′0″	64′0″	69′0″
13.	Slate, shelly	1′0″	69′0″	70′0″
14.	Sandstone, white	4′0″	70′0″	74′0″
15.	Sandstone, shelly	5′0″	74′0″	79′0″
16.	Bastard rock	2′0″	79′0″	81′0″
17.	Sandstone, white	14′0″	81′0″	95′0″
18.	Sandstone, shaly	28′0″	95′0″	123′0″
19.	Sandstone, dark blue	12′0″	123′0″	135′0″
20.	Sand and slate	29′0″	135′0″	164′0″
21.	No. 9 Coal	5′0″	164′0″	169′0″

Sec. 126. Partial record of deep well No. 3 sunk by Shelby Gish as a test for oil 1¼ mile northeast of Central City.

		av.	min.	max.
1.	Soil	22′0″	0′0″	22′0″
2.	Soapstone	27′0″	22′0″	49′0″
3.	No. 13 Coal	3′0″	49′0″	52′0″
4.	Soapstone and slate	21′0″	52′0″	73′0″
5.	No. 12 Coal	3′0″	73′0″	76′6″
6.	Limestone, Jolly	10′0″	76′6″	86′6″
7.	No. 11 Coal	5′6″	86′6″	92′0″
8.	Shale, light	15′0″	92′0″	107′0″
9.	No. 10 Coal	1′0″	107′0″	108′0″
10.	Sandstone	62′0″	108′0″	170′0″
11.	Shale, gray	22′0″	170′0″	192′0″
12.	Slate, black	2′0″	192′0″	194′0″
13.	No. 9 Coal	6′0″	194′0″	200′0″
14.	Not recorded	100′0″	200′0″	300′0″
15.	Shale, gray	7′0″	300′0″	307′0″
16.	Slate, black	1′0″	307′0″	308′0″
17.	No. 8 Coal	7′0″	308′0″	315′0″

Sec. 116. Partial record of deep well No. 4 sunk by Shelby Gish as a test for oil 2 miles northeast of Central City.

		av.	min.	max.
1.	Soil	22′0″	0′0″	22′0″
2.	Soapstone	27′0″	22′0″	49′0″
3.	No. 13 Coal	3′0″	49′0″	52′0″
4.	Soapstone	21′0″	52′0″	73′0″
5.	No. 12 Coal	4′0″	73′0″	77′0″
6.	Fireclay	1′0″	77′0″	78′0″
7.	Limestone	10′0″	78′0″	88′0″
8.	No. 11 Coal	5′0″	88′0″	93′0″
9.	Sandrock, white	6′0″	93′0″	99′0″
10.	Slate, gray	8′0″	99′0″	107′0″
11.	No. 10 Coal	1′0″	107′0″	108′0″
12.	Shale	10′0″	108′0″	118′0″
13.	Sandrock, hard, white	30′0″	118′0″	148′0″
14.	Soapstone	5′0″	148′0″	153′0″
15.	Sandrock, white	17′0″	153′0″	170′0″
16.	Shale, dark, brown	22′0″	170′0″	192′0″
17.	Slate, black	3′0″	192′0″	195′0″
18.	No. 9 Coal	6′0″	195′0″	201′0″
19.	Fireclay	6′0″	201′0″	207′0″
20.	Limestone	5′0″	207′0″	212′0″
21.	Sandrock, hard	19′0″	212′0″	231′0″
22.	Shale, dark	44′0″	231′0″	275′0″
23.	Slate, black	13′0″	275′0″	288′0″
24.	Soapstone	12′0″	288′0″	300′0″
25.	Slate, gray	7′0″	300′0″	307′0″
26.	Slate, black, hard	1′0″	307′0″	308′0″
27.	No. 8 Coal	7′0″	308′0″	315′0″
28.	Sandrock	1′0″	315′0″	316′0″
29.	Slate, gray	5′0″	316′0″	321′0″

Sec. 74. Record of Moody Coal Company's Shaft at mine, located ½ mile south of South Carrollton.

		av.	min.	max.
1.	Soil	13′0″	0′0″	13′0″
2.	Sandstone, yellow	39′0″	13′0″	52′0″
3.	Shale, hard, gray	67′11″	52′0″	119′11″
9.	No. 13 Coal	1′8″	119′11″	121′7″
5.	Iron Compound	23′8″	121′7″	145′3″
6.	No. 12 Coal	5′6″	145′3″	150′9″
7.	Jolly Limestone	4′3″	150′9″	155′0″
8.	No. 11 Coal	4′6″	155′0″	159′6″
9.	Fireclay	5′10″	159′6″	165′4″
10.	Sandstone, hard, white	15′0″	165′4″	180′4″
11.	Sandstone, black, hard	13′1″	180′4″	193′5″
12.	No. 10 Coal	2′6″	193′5″	195′11″
13.	Sandrock, gray	65′0″	195′11″	260′11″
14.	Shale, "kidney bed"	18′0″	260′11″	278′11″
15.	Slate, black	2′8″	278′11″	281′7″
16.	No. 9 Coal	5′0″	281′7″	286′7″
17.	Fireclay	3′0″	286′7″	289′7″

Sec. 139. Record of well drilled by E. F. Doudna on the Ferguson land, located 1 mile north of South Carrollton.

		Thickness.	Total Thickness.
1.	Soil or clay	30′	30′
2.	Sandrock	11′	41′
3.	Gray and blue shale	41′	82′
4.	Coal, No. 14	5′	87′
5.	Fireclay	3′	90′
6.	Soapstone and shale hardening to solid sand rock on top of No. 12	92′	182′
7.	Coal, No. 12	5′	187′
8.	Fireclay	1′6″	188′6″
9.	Black lime, hard as slate	5′6″	194′6″
10.	Coal, No. 11	4′	198′
11.	Fireclay	3′	201′
12.	Sandrock	9′	210′
13.	Fireclay or soapstone	8′	218′
14.	Black slate	3′	221′
15.	Coal, No. 10	2′	223′
16.	Black sandrock	6′	229′
17.	Gray slate	5′	234′
18.	Sandrock	11′	245′
19.	Fireclay or soapstone	3′	248′
20.	White sandrock	16′	264′
21.	Gray slate and soapstone	24′	288′
22.	Bastard lime	1′	289′
23.	Hard gray slate mixed with brown kidney rock	7′	296′
24.	Black slate	2′	298′
25.	Coal, No. 9	5′2″	303′2″
26.	Fireclay	2′4″	305′6″
27.	Limerock	6″	306′
28.	Lime rock continued	5′	311′
29.	Sandrock	15′	326′
30.	White slate	54′	390′
31.	Black slate	10′	390′
32.	Coal, No. 8	7′	397′
33.	Fireclay	2′	399′
34.	Slate	30′	429′
35.	Coal and sand, No. 7	3′	432′
36.	Black slate	28′	460′

Sec. 157. Section in south bank of Pond Creek located 3 miles northeast of Mt. Carmel Church.

1.	Soil	
2.	Sandstone	20′0″
3.	Concealed	20′0″
4.	Shale, carbonaceous, sheety	3′0″
5.	No. 9 Coal	4′8″
6.	Fireclay	3′0″

A small mine had been opened a few feet from this exposure, but being almost on a level with the water in Pond Creek, had never been extensively worked on account of frequent flooding. The coal was finely exposed here. No partings were seen.

Sec. 365. Partial section of shaft of the Nelson Creek Coal Company at Nelson. Authority, J. M. Master, Superintendent.

No. 10 Coal	3′4″
No. 11 Coal, without parting, about	5′0″
No. 9 Coal	4′10″ to 5′0″

Except for lumps of sulphur, and an occasional strip of bone coal at the top, No. 9 is practically pure, and without parting. Depth to No. 9 in shaft is 180′.

Island Hills District.

Sec. 181. Record of test No. 2, by Pierce and Bridges, of Drakesboro, Kentucky, on farm of J. S. Kirtley, located ⅛ mile west of Kirtley. Coal owned by James Halstead, and others, of Island, Kentucky.

		av.	min.	max.
1.	Clay	22′0″	0′0″	22′0″
2.	Sand, loose	8′0″	22′0″	30′0″
3.	Soapstone	10′0″	30′0″	40′0″
4.	Sandrock	50′0″	40′0″	90′0″
5.	Soapstone	4′0″	90′0″	94′0″
6.	Slate, gray	28′0″	94′0″	122′0″
7.	Slate, black	3′0″	122′0″	125′0″
8.	No. 9 Coal	4′8″	125′0″	129′8″
9.	Fireclay	5′0″	129′8″	134′8″
10.	Soapstone	37′0″	134′8″	171′8″
11.	Fireclay and slate	24′0″	171′8″	195′8″
12.	Slate, black	5′6″	195′8″	201′2″
13.	No. 8 Coal	1′10″	201′2″	203′0″

This test was made near Green River and on its flood-plain, and the upper 40′ of the section, including

the horizon of No. 11 Coal, is composed of alluvial soil. (As will be observed, No. 8 Coal is here too thin to be of value.)

Sec. 182. Record of test by Pierce and Bridges, of Drakesboro, Kentucky, drilled for James Halstead, and others, of Island, Kentucky, on farm of W. T. Medker, located 2 miles east of Island.

	Thick.	From	To
1. Clay	17′0″	0′0″	17′0″
2. Sand, loose	7′0″	17′0″	24′0″
3. Sandrock	15′0″	24′0″	39′0″
4. Soapstone, black	8′0″	39′0″	47′0″
5. No. 10 Coal	0′6″	47′0″	47′6″
6. Soapstone	23′0″	47′6″	70′6″
7. Slate, gray	40′0″	70′6″	110′6″
8. Slate, black	4′0″	110′6″	114′6″
9. No. 9 Coal	4′4″	114′6″	118′6″

There are at present four large mines and eleven small mines operating No. 9 coal in the isolated, islandlike hill land on which is located the town of Island. In addition several mines, most of them falling in the "country bank" class, have been more or less extensively worked in the past and abandoned. All of the small mines, and one of the large ones, now operating, are working the coal in its outcrop area, but two of the large mines are shaft mines, and one is a slope mine. The coal under this area rises very rapidly to the north at rates ranging from 80 to 160 ft. per mile.

In the Green River Coal and Coke Company's mine, located just south of the town, No. 183, the depth to the coal is 75 ft. No. 9 here varies from 48″ to 52″ and has the usual black shale roof.

In the Big Four Coal Company's mine, located just north of Island, the coal, which is reached by a shaft 46 ft. deep, averages 4′ 6″ thick. One-half mile further north at the Memphis Coal Company's Mine, No. 185, this being the "slope" mine, the coal is 27 ft. below the surface, and averages 4′ 5″ in thickness.

The Davis Mine, located ¾ mile west of Island, No. 407, is the only large mine now operating No. 9 on its outcrop. The coal in this mine averages only 3′ 10″ in thickness, which is the lowest average for any mine on the sheet. The coal here is without parting, and its roof is excellent.

Sec. 194. Section exposed at J. T. Daniels' Mine, located 1¼ mile north of Island.

1.	Sandstone, solid, hard, (forms a bluff here)	30′ 0″
2.	Concealed	9′ 0″
3.	Shale, sheety, black	2′ 0″
4.	No. 9 Coal	4′ 3″
5.	Fireclay	3′ 0″
6.	Sandstone and concealed	109′ 0″

Sec. 409. Section at B. J. Drake's Mine, located 1½ mile west of Island.

1.	Shale and concealed	20′ 0″
2.	Shale, sheety, carbonaceous	5′ 0″
3.	No. 9 Coal, 3′ 6″ to 4′ 0″ av.	3′ 10″

Region East of Green River.

The following four sections are records of four tests drilled for the Gallatin Coal and Coke Company. Authority "Al." Coffman.

Sec. 352. Test No. 1, located on the Nat. Linley farm, located ½ mile east of Pt. Pleasant.

		Thick.	From	To
1.	Clay, sandy	18′ 0″	0′ 0″	18′ 0″
2.	Quicksand	10′ 0″	18′ 0″	28′ 0″
3.	Sandstone	5′ 0″	28′ 0″	33′ 0″
4.	Slate, gray	37′ 6″	33′ 0″	70′ 6″
5.	Slate, black	0′ 10″	70′ 6″	71′ 2″
6.	No. 9 Coal	6′ 2″	71′ 2″	77′ 4″

Sec. 323. Test No. 2, located on the North Bell farm 2 miles southeast of Pt. Pleasant.

		av.	min.	max.
1.	Clay, yellow	30′0″	0′0″	30′0″
2.	Clay, and gravel	6′0″	30′0″	36′0″
3.	Limestone	1′0″	36′0″	37′0″
4.	Soapstone	2′0″	37′0″	39′0″
5.	Limestone, Jolly	4′6″	39′0″	43′6″
6.	Gumbo, blue	9′0″	43′6″	52′6″
7.	Limestone, impure	14′6″	52′6″	67′0″
8.	Sandstone, gray	45′0″	67′0″	112′0″
9.	Shale, dark gray	24′6″	112′0″	136′6″
10.	No. 9 Coal	4′9″	136′6″	141′3″

Sec. 347. Test No. 3, located on Watt Taylor's farm one mile east of Matanzas.

		av.	min.	max.
1.	Clay, sandy	5′0″	0′0″	5′0″
2.	Sandstone	21′0″	5′0″	26′0″
3.	Jolly Limestone	5′0″	26′0″	31′0″
4.	Gumbo, blue	11′0″	31′0″	42′0″
5.	Limestone, impure	17′0″	42′0″	59′0″
6.	Sandstone, gray	61′0″	59′0″	120′0″
7.	Shale, gray	31′0″	120′0″	151′0″
8.	No. 9 Coal	4′6″	151′0″	155′6″

Sec. 348. Test No. 4, located on the F. O. Coffman farm one mile northwest of Matanzas.

		av.	min.	max.
1.	Shale, gray	40′0″	0′0″	40′0″
2.	Shale, sandy	12′0″	40′0″	52′0″
3.	Slate, dark	5′6″	52′0″	57′6″
4.	No. 9 Coal	4′0″	57′6″	61′6″

The following five sections are records of tests made for P. O. McKinney, Rockport, Kentucky. Authority, P. O. McKinney.

Sec. 328. Test No. 1, located on the T. M. Hatcher farm ½ mile southeast of Centertown.

		Thick.	From	To
1.	Dirt and clay	15′0″	0′0″	15′0″
2.	No. 11 Coal	1′1″	15′0″	16′1″
3.	Sandrock, gray	10′11″	16′1″	27′0″
4.	Sandrock, hard	3′0″	27′0″	30′0″
5.	Soapstone	4′0″	30′0″	34′0″
6.	Sandrock, hard	7′0″	34′0″	41′0″
7.	Sandrock, gray	11′0″	41′0″	52′0″
8.	Sandrock, brown	16′0″	52′0″	68′0″
9.	Shale	21′0″	68′0″	89′0″
10.	Slate, gray	24′0″	89′0″	113′0″
11.	Slate, black	1′4″	113′0″	114′4″
12.	No. 9 Coal	4′3″	114′4″	187′7″
13.	Fireclay	0′9″	118′7″	119′4″

Sec. 330 Test No. 2, located on the A. L. Ashby farm 1½ mile southeast of Centertown.

		Thick.	From	To
1.	Dirt	8′0″	0′0″	8′0″
2.	Sandrock, red and gray	24′0″	8′0″	32′0″
3.	Sandrock, red	12′0″	32′0″	44′0″
4.	Shale, sandy	15′9″	44′0″	59′9″
5.	No. 11 Coal	3′3″	59′9″	63′0″
6.	Fireclay	2′0″	63′0″	65′0″
7.	Sand and shale	5′0″	65′0″	70′0″
8.	Sandrock, hard	2′0″	70′0″	72′0″
9.	Shale, sandy	6′6″	72′0″	78′6″
10.	Slate, black	0′6″	78′6″	79′0″
11.	No. 10 Coal	2′0″	79′0″	81′0″
12.	Fireclay	1′0″	81′0″	82′0″
13.	Sandrock, hard, brown	3′0″	82′0″	85′0″
14.	Sandrock, gray	6′0″	85′0″	91′0″
15.	Soapstone	2′0″	91′0″	93′0″
16.	Sandrock, hard	4′0″	93′0″	97′0″
17.	Sandrock, white	14′0″	97′0″	111′0″
18.	Shale	48′6″	111′0″	159′6″
19.	Slate, gray	9′7″	159′6″	169′11″
20.	Slate, black	1′3″	169′1″	170′4″
21.	No. 9 Coal	4′0″	170′4″	174′4″
22.	Fireclay	0′6″	174′4″	174′10″

Sec. 332. Test No. 3, located on the D. Miller farm one mile east of Centertown.

		Thick.	From	To
1.	Dirt and gravel	14′0″	0′0″	14′0″
2.	Rock, hard, gray	0′6″	14′0″	20′6″
3.	Soapstone, gray, and coal	0′6″	20′6″	21′0″
4.	Rock, white	8′0″	21′0″	29′0″
5.	Rock, gray, hard	8′0″	29′0″	37′0″
6.	Sandrock	13′0″	37′0″	50′0″
7.	Shale, sandy	31′0″	50′0″	81′0″
8.	Slate, gray	16′0″	81′0″	97′0″
9.	Slate, black	1′4″	97′0″	98′4″
10.	No. 9 Coal	3′10″	98′4″	102′2″
11.	Fireclay	0′10″	102′2″	103′0″

Sec. 329. Test No. 4, located on the Wm. Iglehart farm ½ mile east of Centertown.

		Thick.	From	To
1.	Dirt and clay	15′0″	0′0″	15′0′
2.	Sandrock, gray	6′0″	15′0″	21′0″
3.	Shale, sandy	16′0″	21′0″	37′0″
4.	Slate, gray	11′0″	37′0″	48′0″
5.	Slate, black	1′5″	48′0″	49′5″
6.	No. 9 Coal	4′1″	49′5″	53′6″
7.	Fireclay	1′6″	53′6″	55′0″

Sec. 331. Test No. 5, located on the Barnes' farm 2 miles southeast of Centertown.

		Thick.	From	To
1.	Dirt and clay	13′0″	0′0″	13′0″
2.	No. 12 Coal	2′0″	13′0″	15′0″
3.	Fireclay	2′0″	15′0″	17′0″
4.	Slate, gray	5′6″	17′0″	22′6″
5.	No. 11 Coal	1′6″	22′6″	24′0″
6.	Fireclay	4′7″	24′0″	28′7″
7.	Sandrock, soft	4′11″	28′7″	33′6″
8.	Limestone	3′0″	33′6″	36′6″
9.	Sandrock, white	9′6″	36′6″	46′0″
10.	Slate, gray	1′0″	46′0″	47′0″
11.	No. 10 Coal	0′6″	47′0″	47′6″
12.	Fireclay	1′6″	47′6″	49′0″
13.	Sandrock, white	41′0″	49′0″	90′0″
14.	Shale, sandy	20′0″	90′0″	110′0″
15.	Slate, gray	12′3″	110′0″	123′3″
16.	Slate, black	1′3″	122′3″	123′6″
17.	No. 9 Coal	4′1″	123′6″	127′7″
18.	Fireclay	0′6″	127′7″	128′1″

These five test wells, though located in the Hartford Quadrangle, serve also as tests for the adjoining region on the Central City Sheet, and are, therefore, included in this report. From them it is apparent that No. 9 exists here in its usual workable condition, its average thickness being 4′ 1″. The usual black shale forms its roof.

The following four sections represent logs of wells drilled by the Rockport Coal Company to test its holdings near Rockport. Authority, P. O. McKinney, Secretary and Treasurer.

Section: Test No. 1, located ¼ mile northwest of Rockport on farm of J. T. Carter.

		Thick.	From	To
1.	Clay, boulders	14′0″	0′0″	14′0″
2.	Rock shale	2′0″	14′0″	16′0″
3.	Fireclay	6′0″	16′0″	22′0″
4.	Rock	17′0″	22′0″	39′0″
5.	Clay	0′6″	39′0″	39′6″
6.	Rock	12′6″	39′6″	52′0″
7.	Soapstone, tough	5′0″	52′0″	57′0″
8.	Slate rock	13′0″	57′0″	70′0″
9.	Soapstone	15′0″	70′0″	85′0″
10.	Slate	5′0″	85′0″	90′0″
11.	Rock, hard	11′0″	90′0″	101′0″
12.	Slate	11′6″	101′0″	112′6″
13.	No. 9 Coal	4′5″	112′6″	116′11″

Sec. 369. Test No. 3, located ¼ mile east of Rockport on the Canfield farm.

		Thick.	From	To
1.	Clay and gravel	32′0″	0′0″	32′0″
2.	Slate	1′3″	32′0″	33′3″
3.	No. 9 Coal	4′6″	33′3″	37′9″

Section: Test No. 2, located ¾ mile northeast of Rockport on farm of J. T. Carter.

		Thick.	From	To
1.	Clay	16′0″	0′0″	16′0″
2.	Quicksand and clay	66′0″	16′0″	82′0″
3.	No. 9 Coal	2′0″	82′0″	84′0″

Stopped drilling in coal.

Section: Test No. 4, located ¼ mile north of Rockport on the J. T. Carter farm.

	Av.	Min.	Max.
1. Clay	30′0″	0′0″	30′0″
2. Rock	20′0″	30′0″	50′0″
3. Slate rock	10′0″	50′0″	60′0″
4. Slate, gray	29′0″	60′0″	89′0″
5. Slate, black	7′0″	89′0″	96′0″
6. No. 9 Coal	4′4″	96′0″	100′4″

Coals below No. 9. The horizons of the veins possibly occurring below the No. 9 Coal on the Central City Quadrangle all lie deeply buried below the surface, except along the rim of the hills to the northwest of Island, where the lower rocks are sufficiently exposed to admit of the outcrop of No. 8. No exposures of this bed, however, were observed, or reported.

The following data concerning No. 8 were obtained.

Sec. 181. In a test well drilled on the J. S. Kirtley farm, near Kirtley, (see Sec. 181, page 0, for full record), No. 8 was found to be only 1′ 10″ thick. It was here overlain by black shale. This coal would seem, therefore, to possess no commercial value in this region.

Near South Carrollton, however, a number of tests penetrating No. 8 have been made, which indicate a thickness of 7 ft.* The data are as follows:

Sections 116 and 126. In two churn drill wells sunk by Shelby Gish, 1¼ miles northeast of Central City, No. 8 was found at a distance of 114 ft. below No. 9, or at a depth of 308 ft. (see Sections 116 and 126, page 00. The coal was overlain by black slate and had an average thickness of 7 ft.

*Having seen exposures of No. 8 at many places over a large area, I think it quite safe to assume that the driller made an error in reporting such thickness of coal; he must have included part of a thick, black, bituminous shale that overlies the coal.—C. J. N.

A number of other wells have been drilled by Mr. Gish in this immediate vicinity, and the above given thickness of the bed was reported as having been obtained in each of the wells.

Mr. Gish furnished the following analysis, which was made from this coal obtained from one of the wells.

Moisture	1.60
Volatile matter	41.72
Fixed carbon	49.64
Ash	7.04

It is hardly necessary to say that an analysis made from a sample obtained from a churn drill test could hardly show the correct composition of the entire bed.

Sec. 139. In a test well drilled for R. M. Browder on the Ferguson land, located one mile north of South Carrollton, No. 8 was found to be 7 ft. thick, and overlain with black slate. (For complete record see Sec. 139.)

For the immediate vicinity of South Carrollton, therefore, it seems very probable that No. 8 possesses a workable thickness, and is a valuable vein.*

With the exception of the Browder record mentioned above (No. 139), in which what is probably No. 7 coal is recorded as having a thickness of 3 ft., no data is available concerning the remainder of the beds possibly occurring below No. 9 on this sheet.

*See foot-note concerning No. 8 coal on a preceding page. There is small probability of finding No. 8 in workable thickness anywhere in the Western Coalfiield.—C. J. N.

THE MADISONVILLE QUADRANGLE.

Location. The Madisonville Quadrangle, which adjoins the Central City Quadrangle on the west, is bounded by parallels 37° 15′ and 37° 30′, and by meridians 87° 15′ and 87° 30′, and it covers parts of Muhlenberg, McLean, Hopkins and Webster counties. It takes its name from the city of Madisonville, through which its western boundary line passes, and, like the Central City Sheet, has an area of 241 sq. miles.

Drainage. Pond River, which traverses the center of the sheet from south to north, in an irregular course, is the principal stream. Its length on this sheet is about 37 miles, and in that distance it has a fall of about 20 ft. Other streams of consequence are Elk Creek, which drains the western central portion of the sheet; Otter Creek, in the northwestern corner; and Cypress Creek, which crosses the northeastern corner. All of these streams are sluggish and otherwise typical of the streams of this region.

Relief. The rugged uplands are located along the southern and western borders of the sheet. But little tillable land remains in these areas.

The rolling uplands, roughly speaking, are located in the central, eastern-central and northeastern portions of the sheet. These regions present some fine farming land, and are generally in a high state of cultivation.

The overflow basins of Pond River and its tributaries, with the exception of Cypress Creek, comprise practically one great lowland area, varying from ½ to 5 miles in width. These valleys are generally imperfectly drained and therefore unfit for cultivation, except along the borders.

The highest recorded elevation is 646 ft., this being the elevation of the top of a hill located five miles east of

Barnsley; the lowest is 350 ft., which is the elevation of Pond River at low water at Bells Ferry.

Culture. Madisonville, the county seat of Hopkins county, is by far the most important town. Other towns of importance are Hanson, Slaughtersville and Sacramento.

The railroad facilities are excellent. The western margin of the sheet is traversed from north to south by the St. Louis & Nashville line of the L. & N. R. R., and the center of the sheet in an east and west direction, is crossed by the Madisonville, Hartford & Eastern R. R. In addition the Kentucky Midland R. R., a new road now in process of construction from Central City to Madville is completed westward to a point near Earles.

Some excellent farming land is found around Anton and Sacramento, but the major portion of the upland lands fall within the "rugged" type, in which erosion has done rather disastrous work The bottom lands of Pond River are very fertile, and when even poorly drained give abundant yields in favorable seasons. The good results that would follow the proper drainage of these bottom areas can hardly be overestimated, and would justify any reasonable expense.

GEOLOGY.

Structure. The Moorman Syncline enters the Madisonville Quadrangle at Lynn City, thence extends westward in an almost due western course, passing one and one-half miles west of Anton, and leaving the sheet at a point midway between Madisonville and Hanson, or one-fourth mile south of the County Poor Farm. The rocks along the bottom of the Syncline continue the slight westward dip observed on the Central City Sheet until a point three miles southeast of Hanson is reached, where a reversal of the dip occurs, forming a broad, shallow basin, out of which the rocks rise in all directions. The north side of the Syncline overspreads the entire north half of the sheet, presenting a surface which raises gently to the north at a rather uniform rate of about 20 ft. per mile.

The southern side of the Syncline covers all of the southern half of the sheet, except the southeastern corner, the rise of the rocks being about 50 ft. per mile.

On the southeastern corner of the sheet, the upward rise of the rocks culminates in a small anticline, which extends from east to west just north of Graham. To this anticline has been given the name of Harps Hill Anticline from the hills of that name which top its crest.

The Graham Fault extends across the extreme southeastern corner of the sheet, passing through Graham. The downthrow, which is to the north, varies from 20 to 70 ft. on this sheet, the increase being to the west.

Rocks Exposed. The rocks exposed over the surface of the Madisonville Sheet range from a point about 75 ft. below No. 9 Coal, up to a point about 200 ft. above the Madisonville Limestone. The vertical section is 500 ft. in height.

General Section.

		Av.	Min.	Max.
	Sandstone, hard, reddish-brown	10′0″	6′0″	30′0″
15e	Coal, impure, usually displaced by shale	0′4″	0′0″	0′6″
	Fireclay	1′6″	1′0″	2′5″
	Sandstone, soft, medium-grained, shaly in places, brown	53′0″	36′0″	75′0″
	Soapstone, siliceous, blue	3′0″	4′0″	6′0″
15d	Coal, impure, shaly	2′0″	0′6″	3′0″
	Shale, gray, siliceous	35′0″	30′0″	45′0″
	Soapstone, soft, siliceous, blue	3′0″	2′6″	5′0″
15c	Coal, (Epply), pure, without parting, of a medium degree of hardness	2′0″	1′6″	3′3″
	Fireclay, blue	1′0″	0′6″	2′0″
	Shale, siliceous, gray, or light brown	20′0″	10′0″	25′0″
15b	Coal, very impure, mainly carbonaceous shale imbedded in siliceous shale	3′6″	0′0″	5′6″
	Sandstone, shaly	20′0″	10′0″	30′0″
	Shale, black	0′6″	0′0″	1′0″
15a	Coal	1′0″	0′0″	6′0″(?)
	Shale, soft, sandy	20′0″	7′6″	30′0″
	Shale, black, frequently sandy	0′6″	0′0″	0′6″

		Av.	Min.	Max.
No. 15	Coal, usually displaced by sandy shale	1′6″	0′6″	6′0″(?)
	Clay, blue	0′6″	0′0″	1′6″
	Upper Madisonville Limestone, in three, sometimes in four, ledges, grayish-blue, hard, fossiliferous	4′6″	0′0″	7′6″
	Clay	2′5″	2′4″	2′6″
	Limestone	0′8″	0′0″	0′0″
	Fireclay, blue	6′6″	5′0″	8′0″
	Sandstone, soft, red, sometimes displaced by shale	10′0″	5′0″	15′0″
No. 14a	Coal, impure, generally absent	1′0″	0′0″	4′0″
	Clay	13′0″	10′0″	15′0″
	Madisonville Limestone, hard, steel-gray, fossiliferous	4′0″	3′0″	5′0″
	Coal, impure, of local occurrence only	0′6″	0′0″	1′0″
	Clay, siliceous, dark blue	10′0″	8′0″	18′0″
	Sandstone, coarse, brown, sometimes displaced by shale	45′0″	20′0″	63′0″
No. 14	Coal, hard, with parting of shale from 0 to 4 thick	5′0″	0′0″	11′0″
	Fireclay, blue	2′0″	0′0″	3′0″
	Sandstone	50′0″	30′0″	68′0″
	Shale, soft, gray, siliceous	20′0″	15′0″	40′0″
No. 13	Coal	1′6″	0′0″	2′4″
	Fireclay	2′0″	0′6″	3′0″
	Sandstone, reddish-brown	4′0″	2′0″	6′0″
	Sandstone, soft, sometimes shaly, light brown	24′0″	15′0″	26′0″
	Limestone, (usually absent)	1′7″	0′0″	2′0″
No. 12	Coal, hard, pure, without parting	4′6″	2′0″	5′6″
	Fireclay, and shale, blue	2′0″	0′10″	4′0″
	Jolly Limestone	3′6″	3′0″	6′0″
	Shale, gray, limy	0′5″	0′0″	0′8″
No. 11	Coal, hard, pure, with 1″ clay parting, sometimes overlain by from zero to 1′6″ of black, shaly shale	6′0″	4′0″	7′0″
	Fireclay, blue, sometimes underlain with 1 ft. of limestone	1′6″	0′11″	2′0″
	Sandrock, sometimes shaly, soft	40′0″	23′0″	60′0″
No. 10	Coal	1′6″	0′0″	2′0″
	Fireclay	1′0″	0′0″	3′0″
	Sandstone, reddish-brown	20′0″	10′0″	25′0″
	Shale, gray, sometimes grayish-black	20′0″	15′0″	33′0″
	Shale, black, shaly	2′0″	1′0″	3′0″
No. 9	Coal, hard, pure	4′6″	3′6″	5′4″
	Fireclay, blue	2′0″	1′6″	3′6″
	Shale, brown, siliceous	15′0″	10′0″	25′0″
	Limestone, soft, non-fossiliferous, dingy yellow, blue fracture	1′0″	0′6″	2′0″
	Clay, blue	1′0″	0′4″	1′6″
	Sandstone, brown	6′0″	5′0″	10′0″
	Total	517′11″		

DETAILS CONCERNING THE COAL BEDS.

Coals above the Madisonville Limestone. The coal beds occurring above the Madisonville Limestone are confined, on the Madisonville Sheet, almost entirely to the region lying west of Pond River and north of the M. H. & E. R. R. The area thus defined, beyond which, for lack of time, the work of investigation did not extend, did not yield sufficient data satisfactorily to determine the stratigraphic relations of these beds, and additional work in the region underlain by these horizons further westward will be necessary for this purpose. No pretense is made, therefore, that that portion of the general section lying above the Madisonville Limestone is not capable of modification.

Within the province above mentioned, however, are six or seven veins of coal, all of which are of minor importance, and appear to be of local, or irregular occurrence. Two of these veins are of workable thickness over small localities, viz.: Nos. 15 and 15c, but the rest have no economic value whatever. The intervening strata consist of soft sandstones, shales, and clays.

The following sections, and other data, were obtained:

Sec. 138. Section exposed in road 1 mile north of Madisonville.

1.	Sandstone, shaly	10′0″
2.	No. 15b Coal, mainly carbonaceous and siliceous, shale	4′0″
3.	Shale, sandy	6′0″

Sec. 139. Section exposed in road, 1½ miles north of Madisonville.

1.	Sandstone, shaly	20′0″
2.	No. 15b Coal	1′8″
3.	Fireclay	0′6″

This vein had been opened in the bed of the stream 200 yards west, but the bank, (140), was never worked on account of the poor quality of the coal.

Sec. 130. Section showing in road 1½ miles northeast of Madisonville.

1.	Shale, soft, sandy	20′0″
1.	No. 15c Coal, mainly carbonaceous shale	0′10″
3.	Shale and clay	20′0″

Sec. 131. Section exposed in road 2 miles northeast of Madisonville.

1.	Shale, sandy	30′0″
2.	No. 15c	0′6″
3.	Clay	2′0″
4.	Shale	15′0″

141. A vein of coal about 2 ft. thick, and overlain with slate was reported by W. C. Spicer as having been found in his weell at a depth of 16 ft. This bed probably represents No. 15c.

142. The same bed, reported as being 6 ft. thick, has been opened and slightly worked on A. D. Rain's farm, but was abandoned about 35 years ago. Mr. Rain reported that about 3,000 bushels of coal had been mined here, and that it was of good quality. The bank was completely closed at the time of my visit. The vein was overlain by a stratum of sandstone about 30 ft. thick. It was also found in digging neighboring wells.

Sec. 133. Section exposed in road above, and including, a coal bank on Jack Epply's farm located 3 miles southeast of Hanson.

1.	Shale, sandy	4′0″
2.	No. 15e Coal	0′5″
3.	Fireclay	2′5″
4.	Shale, siliceous, with hard streaks of sand	10′0″
5.	Sandstone, hard, coarse, brown	12′0″
6.	Sandstone, shaly	31′0″
7.	Soapstone, blue, sandy	4′0″
8.	No. 15d Coal, impure, shaly	3′0″
9.	Shale, sandy	38′0″
10.	No. 15e Coal, pure, without parting	3′0″
11.	Fireclay	1′0″

The coal bank above mentioned was the only one found operating any vein which occurs geologically higher than the Madisonville Limestone on this sheet. The coal obtained is of good quality and without parting.

1.	Shale, soft, sandy	20′0″
1.	No. 15c Coal, mainly carbonaceous shale	0′10″
3.	Shale and clay	20′0″

Sec. 131. Section exposed in road 2 miles northeast of Madisonville.

1.	Shale, sandy	30′0″
2.	No. 15c	0′6″
3.	Clay	2′0″
4.	Shale	15′0″

141. A vein of coal about 2 ft. thick, and overlain with slate was reported by W. C. Spicer as having been found in his weell at a depth of 16 ft. This bed probably represents No. 15c.

142. The same bed, reported as being 6 ft. thick, has been opened and slightly worked on A. D. Rain's farm, but was abandoned about 35 years ago. Mr. Rain reported that about 3,000 bushels of coal had been mined here, and that it was of good quality. The bank was completely closed at the time of my visit. The vein was overlain by a stratum of sandstone about 30 ft. thick. It was also found in digging neighboring wells.

Sec. 133. Section exposed in road above, and including, a coal bank on Jack Epply's farm located 3 miles southeast of Hanson.

1.	Shale, sandy	4′0″
2.	No. 15e Coal	0′5″
3.	Fireclay	2′5″
4.	Shale, siliceous, with hard streaks of sand	10′0″
5.	Sandstone, hard, coarse, brown	12′0″
6.	Sandstone, shaly	31′0″
7.	Soapstone, blue, sandy	4′0″
8.	No. 15d Coal, impure, shaly	3′0″
9.	Shale, sandy	38′0″
10.	No. 15e Coal, pure, without parting	3′0″
11.	Fireclay	1′0″

The coal bank above mentioned was the only one found operating any vein which occurs geologically higher than the Madisonville Limestone on this sheet. The coal obtained is of good quality and without parting.

136. No. 15c Coal has been mined to a considerable extent on the Webb Brown Farm. The coal was reported to average 3 ft. in thickness, and as being overlain with sandy shale. Bank now fallen shut.

Sec. 134. Section exposed in road 2 miles southeast of Hanson.

1.	Shale, sandy	5′0″
2.	No. 15d coal, dirty	2′6″
3.	Shale, blue	1′6″
4.	Shale, carbonaceous	2′0″
5.	Clay, blue	2′0″
6.	Shale	14′0″
7.	No. 15c Coal	0′6″
8.	Clay, blue	8′0″

Sec. 148. Section exposed in road 2½ miles southeast of Hanson.

1.	Sandstone, shaly	20′0″
2.	No. 15b Coal, composed mainly of alternating carbonaceous and siliceous shale layers	3′6″
3.	Clay.	

An old shaft mine, (No. 155), of which but little was learned, is located at Hanson. This mine was reported to have been operated during the "seventies", but when a vein of water, of such volume as "to drown a mule used in the mine before the animal could be rescued," was struck, the mine was abandoned, and operations were never resumed. The coal had a reported thickness of 6 ft. The bed would appear to be the same as was struck in the T. M. Jones boring at 60 ft., (see Sec. 149), and probably represents the No. 15 vein.

Two coal tests and one shaft have been sunk on the T. M. Jones farm, located one-half mile north of Hanson. The shaft was sunk to what is probably No. 15 coal, penetrating that vein at 60 ft. This mine was never operated extensively, and was abandoned shortly after being sunk. The coal was reported as being 6 ft. thick, and of good quality.

A record of one of the borings is given on another page. (See No. 149). A total of three veins of coal were struck

above the Madisonville Limestone. The lower vein, which was found 9 ft. above the limestone, had a thickness of 4 ft., and probably represents No. 14a Coal. The uppermost vein appears to be No. 15, and as in the T. M. Jones Shaft, had a thickness of 6 ft. Nothing was learned as to the quality of these two veins. The intermediate coal, occurring 10 ft. below No. 15, was only six inches thick. This is the only information obtained in any of the quadrangles investigated concerning the occurrence of a coal between Nos. 14a and 15 coals.

The second test, which was drilled by Weir and Orton, of Hanson, was located only a few feet distant from the first. It was drilled to a depth of 500 ft. according to Mr. Weir. This gentleman had not kept a record of the well, and Mr. Orton, who did have a record, refused to give out any information concerning the same. Mr. Weir supplied the following data from memory.

Coal at 60 ft.
Coal at 90 ft.
Coal at about 300 ft.

The results obtained may have been unsatisfactory.

Sec. 151. Section exposed in railroad cut located 3 miles north of Hanson.

1.	Sandstone, solid, gray	40′0″
2.	Sandstone, shaly	10′0″
3.	Coal, (15 b?), (bottom not seen,)	1′0″

An abandoned shaft mine is located on the Ed. Ogden farm, located 3 miles northeast of Hanson. Judging from the size of the dump, considerable coal had been taken out here. The coal was reported to be 33 ft. deep in the shaft, and to have a thickness of 3 ft. Farmers living near reported that the coal was of good quality, making an excellent stove coal.

No. 14 Coal. Knowledge of the occurrence of No. 14 is limited to two small and rather widely separated dis-

tricts, one of which consists of the isolated peninsula-like area on which is located Browder Church, and the other of the region closely surrounding Sacramento and Faith. In thickness the coal has an extreme range, in these two provinces of from 2′ 2″ to 11′ 0″, being thinnest to the south of Sacramento, and thickest under the Browder Hill. A 2″ shale parting occurs in the latter locality, however, which was not observed, or reported, in the former. The roof-forming material is everywhere sandstone; the underlying stratum is fireclay. The quality of the coal is generally good, comparing favorably with that in its type locality near South Carrollton. The only direct interval obtained between No. 14 and No. 9 was 252 ft. The average interval was computed to be 240 ft.

The following sections, etc., were obtained.

Sec. 120. Section exposed at Sanders Ellis coal bank located ½ mile southwest of Faith.

1.	Soil.	
2.	Sandstone	15′0″
3.	No. 14 Coal, without parting	4′2″

This is a small mine now in operation. The quality of the coal appears to be good.

(2) **Sec. 116.** Section at abandoned bank on farm of W. S. Mackey.

1.	Soil.	
2.	Sandstone	10′0″
3.	Soapstone, reported	10′0″
4.	No. 14 Coal, reported from 6 ft. to 7 ft. thick, av.	6′6″

The above bank had been abandoned on account of a lack of drainage facilities, and was fallen shut. Mr. Mackey reported the coal as burning well, but leaving considerable ash. No partings of consequence were reported.

(3) **Sec. 112.** Record of shaft sunk by Dr. H. H. Whitson at Sacramento. Authority, Dr. H. H. Whitson.

		Thick.	From	To
1.	Coal, (No. 15)	1′10″	0′0″	1′10″
2.	Shale, black	4′0″	50′0″	54′0″
3.	Limestone, bastard, (Madisonville)	4′0″	64′0″	64′0″
4.	Coal, small showing	0′1″	64′0″	64′1″
5.	Fireclay	3′11″	64′1″	68′0″
6.	Sandstone, white	53′0″	68′0″	141′0″
7.	Coal, (No. 14), 2″ clay parting	4′6″	141′0″	145′6″

The names in parentheses above were supplied by the writer. The No. 14 vein was worked a short while, and abandoned. The shaft has now completely fallen in. As previously mentioned, it was sunk in an endeavor to reach the No. 9 vein, which was supposed to be much nearer the surface than it really is. In reality it would have been necessary to sink the shaft fully 200 ft. deeper in order to reach the latter vein.

In the test sunk on the Floyd Bates Farm, located one-half mile southeast of Sacramento, No. 14 was found to be only 2′ 2″ thick, and at a depth of 118 ft. It was here overlain by gray slate. See Sec. 118.

Sec. 92. Section showing at the C. M. Parker mine, located 2½ miles southeast of Anton.

1.	Soil.			
2.	Sandstone			20′0″
3.	Limestone, Madisonville, massive, full of fossils			4′0″
4.	Clay			8′0″
5.	Sandstone, massive, gray, bluff-forming			35′0″
6.	Shale, sandy			6′0″
7.	No. 14 Coal..	coal, left as roof, reported..	1′6″	
		coal, good	3′0″	
		clay	0′1″	
		coal	3′3″	
		slate, hard	0′2″	
		coal, good	2′0″	
				10′0″
8.	Clay.			

Two small mines were in operation here, being located not more than 20 yards apart. The coal mined was much in demand as a stove coal, some farmers claiming that it was better for this purpose than the No. 11, which was being mined only a few miles further south. The extraordinary thickness of coal found here was the greatest for any vein found in the four quadrangles investigated. Only

7′ 6″ of coal was actually measured by the writer, but a thickness of coal, reported as 1 ft. 6 in., was left in mining as a roof, and 2 ft., being the part occurring below the 2″ shale parting, was not taken out on account of a lack of drainage facilities. The information at hand would seem to indicate that this bed occurs here in the form of an isolated basin, possibly limited now to the area actually underlying Browder Hill.

For the remainder of the sheet the information obtained concerning No. 14 is as follows:

No sign of the coal was found in the Reinecke Shaft at Madisonville, nor in the three tests sunk near Anton, all of which penetrated the horizon of this bed. See sections 111, 161, 162 and 164

Neither was any trace found of the vein in its outcrop area lying between Browder Hill and Madisonville.

A bed composed of 4 ft. of slate and 6 inches of coal, and overlain with sandstone, was found at a depth of 171 ft. in the T. M. Jones coal test at Hanson, and this stratum may represent No. 14. The correlation is not positive, however, and about all that appears certain, is that this bed, whether No. 14, or not, like all the remainder of the coals occurring between the Madisonville Limestone, and No. 11 coal in this section, has no commercial value. Sec. 149, page 00.

The data given above, though scant, and showing a large untested area in the northwestern quarter of the sheet, is nevertheless very discouraging to a belief that No. 14 may exist in workable condition, except possibly in small localities, as under Browder Hill, in any portion of the sheet, except for the Browder Hill and Sacramento regions previously discussed.

No. 13 Coal. No. 13 is not known to have been found at any point on this sheet. The vein was penetrated, however, in the shaft of the Reinecke Coal Company, at Madisonville, just off the western edge of the sheet. It was there 2′ 4″ thick, and was overlain with black slate. The underlying stratum was fireclay. It was separated

from No. 9 coal by an interval of 157 ft. See Sec. 111. Some one of the many small coals struck in the T. M. Jones Test at Hanson may represent No. 13, but the correlation is imperfect. See Sec. 149. The remainder of the information obtained concerning this bed indicates its general absence over the sheet.

No. 12 Coal. No. 12 outcrops along the entire southern border of the sheet in an area from 3 to 4 miles in width, north of which it sinks deeply beneath cover, not to appear in outcrop again on this sheet. The south to north thinning of this vein is well illustrated here. Its thickness, which in its outcrop area varies from 3 ft. to 5 ft. 4 in., with an average of 4 ft., gradually diminshes northward until the coal, apparently, pinches out entirely near an east and west line across the center of the sheet. As a result of this northward "wedging "out, the area over which the bed maintains a workable thickness is probably limited to the southern third of the sheet. The information pointing to the non-occurrence of the coal over the northern half of the sheet, while not sufficient to establish this supposition as a fact, is nevertheless, ample to discourage any hopes as to the existence of the coal in minable condition in this province.

The quality of the coal is everywhere good, and no partings of consequence occur. The overlying strata is sandstone which forms a fair roof. The floor is clay.

No large mines have ever been opened in No. 12 on this sheet, but about 25 country banks have been operated, all on a small scale.

No. 12 overlies No. 9 a distance which varies from 83 ft. to 131 ft., the average being 111 ft.

No. 11 Coal. The information concerning No. 11, though scant in places, indicates its occurrence in workable condition over practically the entire sheet. The area in which the coal occurs in the hills is shown on the appropriate map. North of this area it lies buried to depths which vary from zero, at the line of outcrop, to 340 ft. in the bottom of the Moorman Syncline just north of Madisonville.

In thickness, the vein ranges from 2′ 6″ to 7′ 0″, with an average of 5′ 6″. The overlying Jolly Limestone is omni-present, though a hard, gray shale about 5″ thick usually intervenes between the coal and the limestone. In a few instances 1 ft. of black shale occurred above the coal. The lower parting is invariably present and about 1″ thick, but the upper is frequently absent. The quality of the coal is everywhere good.

Several large mines are operating this vein in or contiguous to the southwestern corner of the sheet. Of these the principal ones are the Reinecke Mine, at Madisonville, and the St. Bernard Mines, located between Madisonville and Barnsley. Large quantities of coal from the No. 11 vein are coked by the St. Bernard Company at its ovens near Earlington, Kentucky.

About 20 country banks are in operation, most of which do a thriving business.

No. 11 is separated from No. 9 by a variable interval of from 75 ft. to 111 ft., the average being 93 ft.

Detailed information concerning Nos. 12 and 11 was obtained as follows:

Sec. 72. Section exposed at the Sis Mine of the St. Bernard Coal Company, located ¾ mile north of Barnsley.

1.	Soil.			
2.	No. 12 Coal, outcrop			4′0″
3.	Clay and shale			5′5″
4.	Jolly Limestone in two ledges	Limestone	1′0″	
		"	2′6″	3′6″
5.	Shale, black			2′0″
6.	No. 11, at mine opening			6′6″

The Sisk Mine is one of the several large mines operated by the St. Bernard Coal Company in No. 11 coal.

Sec. 78. Section exposed at small mine located 2½ miles north of Barnsley.

1.	Soil.			
2.	Jolly Limestone			2′0″
3.	Shale, or "gob", black			0′6″
4.	No. 11 Coal..	coal	4′2″	
		clay	0′1″	
		coal	2′0″	6′3″

Sec. 82. Section showing at a small mine owned by Brooks and McGregor, located 3 miles northeast of Barnsley.

1.	Soil.			
2.	Jolly Limestone			3′0″
3.	Shale, black			0′6″
4.	No. 11 Coal..	coal	4′10½″	
		clay	0′ 1½″	
		coal	1′ 6″	6′6″
5.	Fireclay.			

Sec. 84. Section exposed at small mine located 3½ miles northeast of Barnsley.

1.	Soil.			
2.	No. 12 Coal, (outcrop)			2′6″
3.	Fireclay			1′8″
4.	Jolly Limestone, solid			3′6″
5.	Shale, carbonaceous			0′4″
6.	No. 11 Coal..	coal	4′4″	
		shale	0′1½″	
		coal	1′11″	6′4½″
7.	Fireclay.			

Sec. 85.

1.	Soil.			
2.	No. 12 Coal			1′0″
3.	Clay			1′0″
4.	Jolly Limestone, solid, hard			3′6″
5.	Slate, black			1′2″
6.	No. 11 Coal..	coal	1′5″	
		clay	0′1″	
		coal	2′9″	
		clay	0′1½″	
		coal	1′11″	6′3½″
7.	Fireclay.			

In the Sunset Mine, located at Madisonville, No. 12 was only 2 ft. thick, while No. 11 was 7 ft. thick. See Sec. No. 105.

In the Reinecke Coal Company's mine, at Madisonville, No. 12 was 4′ 6″ thick, while No. 11, which is the vein operated, averages 6′ 6″ thick. The usual clay parting, or "blue band" as it is called by the miners, possesses its usual thickness, while the overlying limestone, which here forms an excellent roof, is 6 ft. thick. No. 11 in this mine is 261′ 9″ deep, being deeper than in any other mine

in western Kentucky, in which it is the vein operated. See Sec. 111, page 00.

Sec. 58. Section exposed in hollow located 1½ mile north of Kington Mines.

1.	Soil.			
2.	Jolly Limestone			3′0″
3.	Shale, carbonaceous			4′0″
4.	No. 11 Coal..	coal, solid	4′6″	
		clay	0′1″	
		coal	2′2″	6′9″

Sec. 60. Section showing at old mine in No. 11, located 2½ miles northeast of Kington Mines.

1.	Soil.		
2.	No. 12 Coal, in outcrop		1′6″
3.	Clay		1′6″
4.	Shale, carbonaceous		2′6″
5.	No. 11 Coal, (reported)		6′6″

This bank was abandoned and fallen shut.

Sec. 96. Section exposed at mine operated by Mac Brown, located 2 miles south of Browder Church.

1.	Soil.			
2.	No. 12 Coal, (outcrop)			2′0″
3.	Jolly Limestone			3′0″
4.	Shale, gray, hard			0′6″
5.	No. 11 Coal.	coal	1′4″	
		clay	0′½″	
		coal	2′10″	
		clay	0′1¾″	
		coal	2′3″	6′7¼″
6.	Fireclay.			

The hard shale overlying No. 11 requires props to prevent falling, though it does not fall readily.

Sec. 53. Section exposed at Rolla Moore's Coal Bank, located 2½ miles southwest of Earles.

1.	Soil, and concealed			10′0″
2.	Jolly Limestone			3′0″
3.	No. 11 Coal..	coal	3′10″	
		clay	0′½″	
		coal	2′0″	
		clay	..	5′10½″

Sec. 87. Section exposed in road, located 1½ miles west of Earles.

1.	Soil.			
2.	Sandstone, soft, light brown			15′0″
3.	Shale, sandy, with hard streaks of sandstone			10′0″
4.	No. 12 Coal, (outcrop)			4′0″
5.	Shale			4′0″
6.	No. 11 Coal, (outcrop)			3′0″
7.	Soil.			

Sec. 42. Section exposed near old mines in Nos. 12 and 11, located 3 miles south of Earles.

1.	Soil.			
2.	Sandstone, coarse, brown			8′0″
3.	No. 12 Coal, (outcrop)			3′4″
4.	Fireclay, blue			3′0″
5.	Jolly Limestone			3′0″
6.	No. 11 Coal, in outcrop	coal	1′1″	
		clay	0′1½″	
		coal	2′0″	
7.	Soil.			

Sec. 35. Section exposed at mine of John Johnson, located ½ mile west of Earles.

1.	Soil.			
2.	Jolly Limestone			4′0″
3.	No. 11 Coal, measured 5′4″, but bottom not seen, reported			6′0″

Sec. 39. Section at R. P. Stovall's mine, located 1 mile south of Earles.

1.	Soil.			
2.	Jolly Limestone			4′0″
3.	Shale, carbonaceous			0′8″
4.	No. 11 Coal	coal	0′10″	
		clay	0′½″	
		coal	2′9″	
		clay	0′2″	
		coal	1′2″	4′11½″

Sec. 37. Section exposed at J. A. Lewis' mine, located ½ mile north of Earles.

1.	Soil.			
2.	Jolly Limestone			2′6″
3.	Shale, black			0′7″
5.	No. 11 Coal	coal	1′6″	
		clay	0′1″	
		coal	2′0″	
		clay	0′2″	
		coal	1′7″	5′4″

Sec. 20. Section exposed on J. H. Jones farm, located ¼ mile east of Highley School.

1.	Soil.		
2.	No. 12 Coal, reported		4′6″
3.	Clay and shale		2′0″
4.	Jolly Limestone		3′0″
5.	No. 11 Coal, outcrop		2′0″

No. 12 has been opened here, but bank is now abandoned and fallen shut.

Sec. 17. Section exposed at small mine on Robt. Highley's farm, located 3 miles southeast of Earles.

1.	Soil.			
2.	Sandstone			18′0″
3.	Shale, carbonaceous			1′0″
4.	No. 12 Coal, from 3′ .0″ to 4′6″ thick, av			3′6″
5.	Fireclay.			

Sec. 2. Section exposed at small mine in No. 11 operated by Eugene Stovall, located 1 mile east of Earles.

1.	Soil.			
2.	No. 12 Coal			4′6″
3.	Fireclay			3′0″
4.	Limestone			1′0″
5.	Shale, carbonaceous			4′0″
6.	No. 11 Coal..	coal	1′6″	
		clay	0′½″	
		coal	2′6″	
		clay	0′2″	
		coal	1′7″	5′9″
7.	Fireclay.			

The shale overlying No. 11 here pinches out 20′ back from mouth of mine, letting the limestone down on top of the coal.

Sec. 28. Section made at Findly Hendrick's Bank in No. 11, located 1½ miles northeast of Graham.

1.	Soil.			
2.	Jolly Limestone			2′0″
3.	Shale, carbonaceous			2′6″
4.	Shale, carbonaceous, sheety			0′5″
5.	No. 11 Coal..	coal	1′8″	
		clay	0′1″	
		coal	2′7″	
		clay	0′3″	
		coal	1′2″	5′9″

Only nine wells deep enough to penetrate these veins have been drilled in the deeply buried region lying north of the M. H. & E. R. R. Of these three have been sunk in the vicinity of Anton.

Sec. 164. Record of test drilled on the E. P. Nall farm, located 3 miles northeast of Anton.

		Thick.	From	To
1.	Clay	15′0″	0′0″	15′0″
2.	Sand	4′0″	15′0″	19′0″
3.	Blue slate	6′0″	19′0″	25′0″
4.	Limestone	20′0″	25′0″	45′0″
5.	Shale	54′0″	45′0″	99′0″
6.	Limestone	23′0″	99′0″	122′0″
7.	Soapstone	12′0″	122′0″	134′0″
8.	Light Shale	58′0″	134′0″	192′0″
9.	Sandy Shale	8′0″	192′0″	200′0″
10.	Soapstone	47′0″	200′0″	247′0″
11.	Blue Soapstone	63′0″	247′0″	310′0″
12.	Limestone	25′4″	310′0″	335′4″
13.	Gray Slate	1′0″	335′4″	336′4″
14.	No. 11 Coal	5′8″	336′4″	342′0″

This test was sunk only to the No. 11 vein. No. 12 appears from the record to have been entirely absent here.

In the test made on the William Cardwell farm, located one mile east of Anton, No. 12 was 2′ 6″ thick and overlain with soap stone; No. 11 was 6′ 5″ thick and overlain with limestone. See Section 161.

Neither of these two veins appears in the record of the test made on the John Jackson Farm, located one mile north of Anton. See section 162.

Sec. 149. Record of test well drilled by E. F. Doudna on farm of T. M. Jones, located ½ mile north of Hanson. T. M. Jones, authority.

		Thick.	From	To
1.	Dirt	12′0″	0′0″	12′0″
2.	Sandrock	4′0″	12′0″	16′0″
3.	Soapstone	13′6″	16′0″	29′6″
4.	Sand and Slate	20′0″	29′6″	49′6″
5.	Shale, black	0′6″	49′6″	50′0″
6.	Coal, (15a)	6′0″	50′0″	56′0″
7.	Soapstone and limerock	7′6″	56′0″	63′6″
8.	Black slate	2′6″	63′6″	66′0″
9.	Coal, (15?)	0′6″	66′0″	66′6″
10.	Limerock	0′6″	66′6″	67′0″
11.	Shale	20′0″	67′0″	87′0″
12.	Coal, (14a?)	4′0″	87′0″	91′0″
13.	Fireclay	9′0″	91′0″	100′0″
14.	Limerock, (Madisonville?)	4′0″	100′0″	104′0″
15.	Sandrock	13′0″	104′0″	117′0″
16.	Coal	0′3″	117′0″	117′3″
17.	Sandrock	3′9′	117′3″	121′0″
18.	Coal	0′3″	121′0″	121′3″
19.	Sandrock	0′7″	121′3″	128′0″
20.	Coal	2′6″	128′0″	130′6″
21.	Sandrock	10′0″	130′6″	140′6″
22.	Coal	0′6″	140′6″	141′0″
23.	Sandrock	2′6″	141′0″	143′6″
24.	Slate	6′0″	143′6″	149′6″
25.	Black slate and coal	0′6″	149′6″	150′0″
26.	Soapstone	17′0″	150′0″	167′0″
27.	Coal	0′6″	167′0″	167′6″
28.	Sandstone	4′0″	167′6″	171′6″
29.	Black slate and coal, No. 14 (?)	4′0″	171′6″	175′6″
30.	Coal	0′6″	175′6″	176′0″
31.	Sandrock	44′6″	176′0″	220′6″
32.	Gob	8′0″	220′6″	228′6″
33.	Shale	6′6″	228′6″	235′0″
34.	Coal, (No. 13?)	0′6″	235′0″	235′6″
35.	Soapstone	3′0″	235′6″	238′6″
36.	Limerock	1′6″	238′6″	240′0″
37.	Sandstone	8′6″	240′0″	248′6″
38.	Limestone	1′0″	248′6″	249′6″
39.	Sandrock	13′0″	249′6″	262′6″
40.	Shale	24′0″	262′6″	286′6″
41.	Limerock, Jolly, (?)	3′0″	286′6″	289′6″
42.	Sandrock	10′0″	289′6″	299′6″
43.	Coal (No. 11?)	3′6″	299′6″	303′0″
44.	Slate	1′6″	303′6″	304′6″

The names of the various horizons in this record were supplied by the writer. Judging from some of the intervals, particularly the interval between the limestone marked Madisonville, and the coal designated No. 11, which is

here 192 ft., or about the usual thickness, the correlations have been correctly made, but if so the section has changed materially in a number of places from the usual section for this space. For example, No. 11, instead of being closely overlain with the Jolly Limestone, as elsewhere is invariably the case, is separated from it by ten feet of sandstone. No horizon at all appears which can be assigned to No. 12, but a small vein, which might be No. 13, is found at about the proper interval above No. 11. In the space between the coal marked No. 14 and the limestone correlated as Madisonville, is where the greatest difference occurs. This interval is usually occupied mainly by a single massive sandstone from 40 to 50 ft. thick, at the top and bottom of which is, respectively, clay and shale, whereas, in the present record, there are shown no less than a half-dozen small coals, ranging from 3′ to 2′ 6″ in thickness. The intervening strata are sandrock and shale, which might be expected.

As a whole, therefore, this record is not conclusive and other, and deeper, tests will be necessary before the stratigraphy of this region is made clear. One other test, reported to have been such, 500 ft. deep, was drilled near the Jones test for Weir and Orton, of Hanson, but these gentlemen declined to give out any information concerning the same.

Two deep tests have been sunk at Slaughtersville, both of which were drilled for B. M. Brooks, of that place. No records were kept of these tests, however, but Mr. Brooks furnished the following data from memory.

Sec. 127. Partial record of a well drilled for B. M. Brooks, on J. Monroe Whitsell's farm, located ⅛ mile east of Slaughtersville.

	Av.	Min.	Max.
1. Coal 2. Clay (No. 13?) 3. Coal	2′6″ 2′0″ 2′0″	220′ 222′6″ 224′6″	222′6″ 224′6″ 226′6″
4. Coal, (No. 11?)	4′6″	300′0″	304′6″

Since none of the associated rocks are given, and no other conclusive data bearing on the question are available,

it is impossible correctly to correlate the coals in this section. At first glance it would appear that the upper vein with the 2 ft. clay parting is No. 11, and the lower vein, therefore, No. 9, but the evidence as a whole, though not very satisfactory, rather tends to show that the lower vein is No. 11. The upper vein would seem, therefore, to be No. 13. The total depth of the well was 305 ft.

In the second test which was drilled ¾ mile further south on the W. C. Broos farm, (127), no coal at all was found. This well was drilled a depth of 338 ft. and did not reach the lower vein by about 20 ft. The upper or split, vein, however, appears to have been wholly absent. Salt water was struck in this well between 300 ft. and 338 ft.

The two wells were drilled by S. H. Hopgood and G. W. Harris, both of whom are reported as having been, at the time, inexperienced drillers.

The record of the deep well sunk by the Pure Oil Company, 1½ miles northwest of Faith, shows coal at 45 ft., and again at 230 ft. The latter vein, including the black shale, is reported as being 10 ft. thick. and would seem to be the No. 9 vein. If this supposition is correct, Nos. 12 and 11 coal are absent here. However, Mr. Bell, the land owner upon whose farm the well was drilled, reports that a bed of coal 4′ 6″ thick, (not given in the company's record), was struck at a depth of 210 ft., and in that case this vein, and the vein struck at 230 ft., would appear to be Nos. 12 and 11, respectively. Too much importance should not be attached to measurements of coals in oil well records, however, for since coal beds are frequently of little or no value to the driller, his measurements with respect to them are made with a corresponding lack of care and are not always reliable. It is hardly necessary to add, therefore, that further testing will be necessary to clear up the stratigraphy in this region.

In a test well drilled by E. F. Doudna on the Floyd Bates farm located ½ mile southeast of Sacramento, the total thickness of No. 11, including a parting of "coal slate" (probably carbonaceous shale) was only 3′ 6″ thick, while No. 12 was entirely missing. See Sec. 48.

As is shown by this record, the vein is not here of commercial value, which was hardly to have been expected, as it was found to be 5′ 6″ thick in the J. H. Grundy well located 3½ miles southeast of Sacramento. See Sec. 240, of the report on the Central City Quadrangle.

Another test well was drilled by Mr. Doudna in this area, being located on the farm of R. W. Batsel, located 2 miles south of Sacramento. (119.) The record of this well, however, appears to have been lost.

No. 9 Coal. The outcrop area of No. 9 coal on the Madisonville Sheet appears, when platted, as a mere fringe from two to three miles in width bordering the entire southern edge of the sheet. North of this area the bed rapidly sinks beneath cover, attaining to its maximum depths of from 340 ft. to 440 ft. below the general valley levels along the bottom of the Moorman Syncline, beyond which it gently rises to the northern edge of the sheet.

Positive knowledge as to the thickness and general condition of this coal is limited almost entirely to the southern half of the sheet. Within this province, however, a large amount of data was available, both in the coal's outcrop area and in its deeply buried districts, sufficient to establish the fact that it is generally present in minable condition, with a thickness varying from 3′ 6″ to 5′ 6″, the average being 4′ 6″. The quality of the coal is everywhere good. No partings of consequence occur. The characteristic black, sheety shale is everywhere found overlying the coal. The underlying stratum is clay.

The data available over the northern half of the sheet were scant and unsatisfactory, and entirely insufficient to warrant definite conclusions concerning the general condition of the coal in this territory. Knowledge of the unusually persistent qualities of this vein, however, and information obtained in the surrounding regions, lead to the belief that the bed will probably be found in workable condition over by far the greater part of this area; but since the horizon lies everywhere buried by strata from 260 ft.

to 440 ft. thick, the problem rests for solution mainly with the driller rather than with the geologist.

Several large mines and a considerable number of country banks are operating in the seam within this quadrangle.

The follwoing sections, etc., were obtained:

Sec. 56. Section exposed at bank on the Jack Uzzle Farm, located 4½ miles southwest of Earles.

1.	Soil.	
2.	Sandstone	30′0″
3.	Shale, gray	10′0″
4.	Shale, black, sheety	2′6″
5.	No. 9 Coal	5′4″
6.	Fireclay	3′0″
7.	Shale, brown	15′0″
8.	Limestone, blue on fracture, non-fossiliferous soft, weathers a dingy yellow	1′0″
9.	Clay	1′0″
10.	Sandstone, brown	3′0″

This exposure extended lower down the geological section than any other found.

Sec. 62. Section exposed at the south opening of the Kington Coal Company's White City Mines, located 4 miles east of Barnsley.

1.	Soil.	
2.	Sandstone	10′0″
3.	No. 12 Coal	1′0″
4.	Clay	6′0″
5.	No. 11 Coal	1′3″
6.	Clay	3′0″
7.	Concealed	33′0″
8.	Sandstone	30′0″
9.	Shale, blue	6′0″
10.	Shale, carbonaceous, sheety	2′6″
11.	No. 9 Coal	4′8″
12.	Fireclay.	

The coal in this mine ranges from 4′ 4″ to 5′ 2″ in thickness, the thickness given in the section above being the average. The overlying black shale was here noteworthy, not only on account of the excellent roof it afforded, but also because of the unusually large number of hard, rounded limestone concretions occurring in it. These were conspicuous by their number displayed on the dump. There also appeared to be an unusually large number of fossil forms in the shale here.

The company was taking out the coal from two openings, the second opening, (63), being on the north side of the valley.

Sec. 69. Section exposed at mine on W. A. Wilkerson's Farm, located 3 miles east of Barnsley.

1.	Soil.	
2.	Shale, gray	5′0″
3.	Shale, black, sheety	2′0″
4.	No. 9	4′6″

Sec. 55. Section at bank on farm of Sam Green, located 3 miles southwest of Earles.

1.	Soil.	
2.	Sandstone, massive	25′0″
3.	Shale, blue	4′0″
4.	Shale, carbonaceous, sheety	2′0″
5.	No. 9 Coal	4′9″
6.	Fireclay.	

No. 9 is mined in a small way on the Marcellus Tyson farm, located 2½ miles southwest of Earles. (No. 51.) The coal measured 4′ 6″ in thickness. The usual black shale was present, being 1′ 6″ thick.

Sec. 38. Section exposed at bank on land owned by the Kentucky Midland Coal Company, located 2 miles south of Earles.

1.	Soil.	
2.	Shale, sandy	10′0″
3.	Shale, hard, black, sheety	2′6″
4.	No. 9	5′6″
5.	Fireclay, blue	1′6″

Sec. 49. Section exposed in road and including an abandoned mine on Tom Matthews farm, located ½ mile south of Pleasant Hill Church.

1.	Soil.	
2.	Sandstone	20′0″
3.	Concealed	10′0″
4.	No. 11 coal, outcrop	5′0″
5.	Clay	6′0″
6.	Shale, sandy, and concealed	40′0″
7.	Shale, black, sheety	3′0″
8.	No. 9 Coal, reported	5′0″

Bank completely fallen shut.

Sec. 44. Section at bank on B. F. Coleman's farm, located 2½ miles west of Graham.

1.	Soil.	
2.	Shale	10′0″
3.	Shale, black	2′0″
4.	No. 9 Coal, reported	5′3″

The bank was full of water at the time of my visit, and no measurements could be made. The thickness of the coal given in the section was obtained from B. F. Coleman.

In the Skibo and Graham Mines of the W. G. Duncan Coal Company, at Graham, the thickness of No. 9 ranges from 4′ 6″ to 5′ 6″, a fair average being 5′ 2″. These mines are two of the largest and best known mines in western Kentucky.

Sec. 111. Record of Reinecke Coal Company's Shaft, located ½ mile west of Madisonville.

		Thick.	From	To
1.	Clay red	18′6″	0′0″	18′6″
2.	Sandstone, red, (water)	3′0″	18′6″	21′6″
3.	Sandstone, blue	1′6″	21′6″	23′0″
4.	Limestone, blue, (Upper Madisonville)	4′6″	23′0″	27′6″
5.	Clay, blue	2′4″	27′6″	29′10″
6.	Limestone, blue	0′10″	29′10″	30′8″
7.	Fireclay, blue	6′6″	30′8″	37′2″
8.	Sandstone, red	10′0″	37′2″	47′2″
9.	Clay, red	13′0″	47′2″	60′2″
10.	Limestone, (Madisonville), and water	4′0″	60′2″	64′2″
11.	Soapstone	18′0″	64′2″	82′2″
12.	Sandstone, blue	98′0″	82′2″	180′2″
13.	Slate, soft black	20′0″	180′2″	200′2″
14.	No. 13 Coal	2′4″	200′2″	202′6″
15.	Fireclay	3′0″	202′6″	205′6″
16.	Sandstone, red	6′0″	205′6″	211′6″
17.	Slate, black	26′0″	211′6″	237′6″
18.	Limestone	1′7″	237′6″	239′1″
19.	No. 12 Coal	4′6″	239′1″	243′7″
20.	Fireclay	0′10″	243′7″	244′5″
21.	Limestone, blue	6′0″	244′5″	250′5″
22.	Clay and stone	0′6″	250′5″	250′11″
23.	Slate, black	0′10″	250′11″	251′9″
24.	No. 11 Coal	6′6″	251′9″	258′3″
25.	Fireclay	0′11″	258′3″	259′2″
26.	Limestone	1′0″	259′2″	260′2″
27.	Sandstone, red	60′0″	260′2″	320′2″
28.	No. 10 Coal	1′6″	320′2″	321′8″
29.	Sandstone, red	14′0″	321′8″	335′8″
30.	Slate, black	32′0″	335′8″	357′8″
31.	No. 9 Coal	5′4″	357′8″	363′0″

The Reinecke Mine is one of the largest and most well known mines in western Kentucky. The coal at present operated is No. 11.

Sec. 105. Partial record of the Sunset Mine at Madisonville. Authority W. D. Coil, Manager.

1.	No. 12 Coal at 208′ 7″		2′0″		
2.	Jolly Limestone		4′0″		
3.	Shale, black		0′5″		
4.	No. 11 Coal.. coal	5′2″			
	clay	0′2″			
	coal	1′8″	7′0″	215′0″	222′0″
5.	No. 9 Coal at 300′		4′9″	300′0″	304′9″

No. 9 is the vein operated. It is reported free from parting.

Sec. 161. Record of test well on the William Cardwell farm, located 1 mile east of Anton.

		Thick.	From	To
1.	Clay	15′0″	0′0″	15′0″
2.	Limestone	22′0″	15′0″	37′0″
3.	Shale	10′0″	37′0″	47′0″
4.	Limestone	4′0″	47′0″	51′0″
5.	Shale	24′0″	51′0″	75′0″
6.	Sandstone, dark	28′0″	75′0″	103′0″
7.	Soapstone	106′0″	103′0″	209′0″
8.	No. 12 Coal	2′6″	209′0″	211′6″
9.	Shale, light	21′0″	211′6″	232′6″
10.	Limestone	10′1″	232′6″	242′7″
11.	No. 11 Coal	6′5″	242′7″	249′0″
12.	Fireclay	1′0″	249′0″	250′0″
13.	Limestone	7′0″	250′0″	257′0″
14.	Soapstone	12′0″	257′0″	269′0″
15.	Sand, white	61′0″	269′0″	330′0″
16.	Sand, white	7′0″	330′0″	337′0″
17.	Slate, gray	3′0″	337′0″	340′0″
18.	Slate, black	2′0″	340′0″	342′0″
19.	No. 9 Coal	3′6″	342′0″	345′6″

Sec. 162. Record of test on the John Jackson farm, located 1¼ miles northwest of Anton.

		Thick.	From	To
1.	Clay	15′0″	0′0″	15′0″
2.	Soapstone	69′0″	15′0″	84′0″
3.	Limestone	8′0″	84′0″	92′0″
4.	Soapstone	15′0″	92′0″	107′0″
5.	Limestone	19′0″	107′0″	126′0″
6.	Soapstone	8′0″	126′0″	134′0″
7.	Lime shale	31′0″	134′0″	165′0″
8.	Soapstone, blue	68′0″	165′0″	233′0″
9.	Shale, sandy	9′0″	233′0″	242′0″
10.	Soapstone	41′0″	242′0″	283′0″
11.	Soapstone	33′0″	283′0″	316′0″
12.	Limestone, Jolly	8′0″	316′0″	324′0″
13.	Shale	7′0″	324′0″	331′0″
14.	Lime shale	15′0″	331′0″	346′0″
15.	Sandrock, white	97′0″	346′0″	443′0″
16.	Slate, gray	8′8″	443′0″	451′8″
17.	Slate, black	1′0″	451′8″	452′8″
18.	No. 9 Coal	4′4″	452′8″	457′0″

The third test made near Anton, viz., the well on the E. P. Nall Farm, located 3 miles northeast of Anton, went through No. 11 coal only. See Sec. 164.

Neither the T. M. Jones test, at Hanson, nor the B. M. Brooks tests at Slaughtersville, were sunk deep enough to reach No. 9. See Sections 149 and 127, pages 00, and 00 respectively.

Following is a record of the well drilled by the Pure Oil Company, as a test for oil near Faith.

Sec. 126. Record of well drilled by the Pure Oil Company, on the D. E. Bell Farm, located 2 miles northwest of Faith.

1.	To rock	28′
2.	White slate	33′
3.	Black slate and coal	45′
4.	White slate	230′
5.	Coal, and black slate	240′
6.	White slate	250′
7.	Limestone	265′
8.	Red Rock	272′
9.	White slate	400′
10.	Black slate	450′
11.	White slate	510′
12.	Salt sand	550′
13.	Black slate	575′
14.	Sand	585′
15.	White slate	610′
16.	Coal	618′
17.	Slate	650′
18.	Sand	670′
19.	Black slate	700′
20.	White slate	750′
21.	Soft lime	775′
22.	Coal	810′
23.	Sand, water	820′
24.	Black slate	860′
25.	Limestone	920′
26.	Limestone	950′
27.	Water at 960′.	
28.	Sand	990′
29.	Slate	1000′

Started on Jan. 3, 1908, completed to 1000 ft., Jan. 31, 1909. G. B. M. Stephenson, contractor.

No. 5 of this record is about where No. 9 coal would be expected. As will be noted, the thickness of the coal is not shown, and, according to Mr. Nigel, of the Pure Oil Company, no measurements concerning the thicknesses

of the various veins encountered, were turned in to the company. The following measurements were secured from Mr. Bell, upon whose farm the well was drilled, and who was present while the drilling was being done.

1. Coal at 30 ft. 3′0″ thick,
2. Coal at 210 ft. 4′6″ thick.
3. Coal at 230 ft. 10′0″ thick.
4. Coal at 610 ft, 8′0″ thick.
5. Coal at 928 ft. 7′6″ thick

These data, if correct, would show that several valuable beds of coal were present here. As has been previously noted, however, such measurements obtained from oil well drillers, as a rule, should not be implicitly relied upon.

Sec. 118. Record of well drilled by J. S. Thomas on the Floyd Bates Farm, located ½ mile southeast of Sacramento. Authority, E. F. Doudna.

		Thick.	From	To
1.	Clay	10′0″	0′0″	10′0″
2.	Gray slate	108′0″	10′0″	118′0″
3.	Coal, stray, (14)	2′2″	118′0″	120′2″
4.	Lime, shale, cave formation	40′0″	120′2″	160′2″
5.	Light shale	10′0″	160′2″	170′2″
6.	White sand	85′0″	170′2″	255′2″
7.	Sandy shale	16′0″	255′2″	271′2″
8.	Coal	0′6″	271′2″	271′8″
9.	Coal slate } No. 11?	1′0″	271′8″	272′8″
10.	Coal	2′0″	272′8″	274′8″
11.	Fireclay	3′0″	274′8″	277′8″
12.	Lime shale	1′6″	277′8″	279′2″
13.	White sand	23′0″	279′2″	302′2″
14.	Sandy shale	61′0″	302′2″	363′2″
14.	Black slate	5′6″	363′2″	368′7″
16.	No. 9 Coal	0′3″	368′7″	368′10″
17.	Fireclay	2′0″	368′10″	370′10″

As will be noted, No. 9 has a recorded thickness of only 3 inches in the above log. However, the 5′ 6″ of black slate overlying the coal is at least 3 ft. greater than is ordinarily possessed by this stratum, and it seems possible

that the driller confused the two horizons. The fact that the coal was found to be 5′ 6″ thick three miles further southeast, and averaging 5′ 0″ six miles further south, lends color to this supposition. See sections 240, 247 and 253, of the report on the Central City Quadrangle, pages 00 and 00.

Further testing is warranted in this locality.

Coals below No. 9. The coal horizons occurring below No. 9 on the Madisonville Sheet are everywhere buried, and but one record deep enough to penetrate them has been drilled, viz.: the well drilled by the Pure Oil Company on the D. E. Bell Farm, located two miles northeast of Faith. (For full record see Sec. 126.)

Two beds belonging to the deeper coals are recorded in the Company's record, these being 618 and 810 ft. deep, respectively, but of these the thicknesses are not given. The following data were secured from Mr. Bell, upon whose farm the well was drilled.

Coal at 610 ft. 8′ thick.
Coal at 928 ft. 7′ 6″ thick.

THE CALHOUN QUADRANGLE.

Location. The Calhoun Quadrangle, which bounds the Madisonville Quadrangle on the north, is inclosed by parallels 37° 30′ and 37° 45′ north, and by meridians 87° 15′ and 87° 30′ west. It includes parts of Daviess, McLean, Henderson, Hopkins and Webster counties, and derives its name from the town of Calhoun, which is the principal town on the sheet. It has an area of 240 sq. miles.

Drainage. Green River is the governing feature in the distribution of the drainage. This stream enters the sheet about 3 miles north of its southeastern corner, thence, pursuing an uneven course, extends northwestward to a point just east of the center of the western boundary, thence, curving to the northeast, leaves the sheet about 3 miles west of its northeastern corner.

The remainder of the streams are of relatively little importance in so far as the drainage of this sheet is concerned. Of these the largest are Pond River, and Panther, Cypress and Long Falls Creeks, in the order named.

Relief. The rugged uplands are limited principally to a small area in the southwestern corner, and to the central and eastern-central portions of the sheet. The highest hill, which is contoured at slightly more than 640 ft., is situated one mile southwest of Beechgrove.

The balance of the upland areas, and by far the greater part, is largely of the type called rolling uplands. The rolling uplands are best developed in the northwestern corner of the sheet, where, also, is to be found the best farming land.

The river flats are composed almost entirely of the overflow basin of Green River. This flood-plain varies from one to two miles in width, except at the mouths of tributary streams where the bottom lands sometimes attain

to a width of four miles. The lowest recorded elevation is 350 ft., which is the elevation, at low water, of Green River at Curdsville.

Culture. Green River is the principal means of transportation on this sheet. In addition to the packets plying between Evansville and Bowling Green, which have been previously mentioned, several smaller boats run from Calhoun to Livermore, meeting the trains at the latter place.

The St. Louis line of the L. & N. R. R., though barely touching the southwestern corner of the sheet, follows closely parallel to, and just west of, the western boundary, affording railway facilities to the western portion of the sheet.

Mining is carried on in a small way over the northern two-thirds of the quadrangle. All of the mines now operating, which are sixteen in number, are country banks operated solely for the local trade, except the Utopia Mine two miles below Curdsville. This large mine ships considerable coal by barge down Green River to Evansville, and other river points, and in addition supplies more or less coal to the Green River steamers.

Calhoun, which is the county seat of McLean County, Beechgrove, West Louisville, and Curdsville, are the principal towns.

GEOLOGY.

Structure. The Rough Creek Anticline, which has been hereinbefore discussed, is the principal structural feature. The crest of this fold enters the sheet one mile south of Guffie, thence extends slightly north of west to a point near Beechgrove, thence trending in an almost due western course leaves the sheet at a point ¾ mile southwest of Eastwood Ferry.

North of the anticline, until interrupted by the Curds-

ville Fault, the rocks dip principally to the northwest, at a rate varying from 30 to 60 ft. per mile.

West of the Curdsville Fault the rocks dip to the west at a rate varying from 15 to 20 ft. to the mile.

The rate of dip from the crest of the Anticline southward to the Livermore Fault is largely conjectural, but the balance of the evidence indicates that it is generally in excess of 200 ft. per mile, and locally far exceeds this figure.

From this fault southward the dip leessens to an average rate of about 10 ft. per mile.

No prominent synclines occur; a small one, however, extends northwest and southeast through Jolly P. O.

Rocks Exposed. The rocks regularly outcropping over the Calhoun Quadrangle extend from a point about 200 ft. above the Madisonville Limestone down to a point about 100 ft. below No. 9 coal. The highest rocks occur in the southwestern corner of the sheet, the lowest in the area between Calhoun and Beechgrove, along the top of the Rough Creek Anticline. The vertical section is 600 ft. in height.

In addition to the rocks mentioned above as occurring in regular outcrop over the sheet, some of the deeper rocks, including part of the Chester Measures, have been brought to the surface along the uplift between Calhoun and Guffie, and Beechgrove.

General Section.

Following is the General Section for the quadrangle:

	General Section.	Av.	Min.	Max.
1.	Sandstone, soft, reddish-brown	10′0″	5′0″	15′0″
2.	Clay, blue	7′0″	4′0″	10′0″
3.	No. 15c Coal, impure, sometimes absent	1′0″	0′4″	2′0″
4.	Clay, blue	5′0″	3′0″	10′0″
5.	Shale, sandy, blue	3′6″	3′0″	4′0″
6.	Sandstone, shaly, micaceous	30′0″	20′0″	70′0″
7.	Clay. light blue	1′6″	0′0″	5′0″
8.	No. 15b Coal, impure	1′2′	1′0″	1′8″
9.	Clay, blue, heavy	3′0″	2′0″	4′0″
10.	Shale, siliceous at bottom, blue	15′0″	12′0″	20′0″
11.	Sandstone, shaly, micaceous	25′0″	20′0″	35′0″
12.	Shale, sometimes diaplaced by sandstone	10′0″	6′0″	12′0″
13.	Shale, black, usually absent	2′0″	0′0″	2′0″
14.	No. 15 Coal, good	2′0″	1′1″	3′0″
15.	Clay, blue	3′0″	0′0″	10′0″
16.	Sandstone and shale	11′0″	3′10″	30′0″
17.	Shale, hard, gray	1′0″	0′0″	3′0″
18.	No. 14a Coal, usually absent	1′0″	0′0″	3′0″
19.	Fireclay	3′4″	3′4″	3′4″
20.	Sandstone, dark	1′0″	0′8″	2′0″
21.	Madisonville Limestone, hard, gray, fossiliferous	4′0″	3′4″	5′0″
22.	Clay, blue	5′0″	3′0″	8′ (?)
23.	Sandstone, with shaly streaks	40′0″	35′0″	47′0″
24.	Shale, gray, dark at bottom	10′0″	5′0″	24′2″
25.	Sandstone, shaly at bottom	20′0″	15′0″	30′0″
26.	No. 14 Coal (?) usually impure, frequently absent	2′0″	0′5″	4′0″
27.	Fireclay	1′6″	1′0″	3′0″
28.	Shale, siliceous	15′0″	10′0″	20′0″
29.	Coal, (No. 13?), usually absent	1′1″	0′0″	
30.	Fireclay	2′0″	1′0″	3′0″
31.	Sandstone, shaly	30′0″	20′0″	50′0″
32.	Shale, siliceous, soft	10′0″	0′0″	20′0″
33.	Sandstone, soft, brown, with reddish streaks	45′0″	30′0″	50′0″
34.	No. 12 Coal	1′0″	1′4″	2′0″
35.	Fireclay	3′0″	2′0″	5′0″
36.	Jolly Limestone, hard, gray, usually in one ledge, but sometimes in two, filled with brachiopod shells and crinoidal stems	4′0″	3′0″	6′0″
37.	No. 11 Coal, hard, pure	1′0″	1′6″	2′11″
38.	Shale, soft, gray	8′0″	3′0″	12′0″
39.	Sandstone, hard, with shaly streaks	8′0″	4′0″	10′0″
40.	No. 10 Coal, usually absent	1′6″		
41.	Sandstone, usually soft, sometimes hard	30′0″	25′0″	40′0″
42.	Shale, soft, gray, siliceous	30′0″	15′0″	40′0″
43.	Shale. carbonaceous, sheety	2′0″	1′0″	4′0″
44.	No. 9 Coal	4′4″	4′0″	4′10″
45.	Fireclay	3′6″	3′0″	4′0″
46.	Limestone	2′0″	0′0″	3′0″
47.	Space, containing sandstones and shales	97′0″		
	Total	537′5″		

DETAILS CONCERNING THE COAL BEDS.

Coals above Madisonville Limestone. The coals occurring above the Madisonville Limestone are limited in their area of occurrence exclusively to the region lying west of Green River, in the southwestern corner of the quadrangle. Within this area are three or four coals, the correlation of which is imperfect, that are of no more than minor importance commercially, as is the case in the Madisonville Quadrangle. That portion of the general section extending above the Madisonville Limestone, therefore, is not regarded as determined beyond question, but as what seems, in view of all the facts known, as most probably correct.

The following sections and other data were obtained:

Sec. 109. Record of test well on lot owned by C. I. Mahurin at Onton. Drilled by E. F. Doudna. Authority C. I. Mahurin.

	Strata.	Thickness	From	To
1.	Soil	11′0″	0′0″	11′0″
2.	Sandrock	11′0″	11′0″	22′0″
3.	Soapstone	4′0″	22′0″	26′0″
4.	Sand, black	5′8″	26′0″	31′8″
5.	Slate, gray	1′0″	31′8″	32′8″
6.	Coal (14a)	3′0″	32′8″	35′8″
7.	Fireclay	3′4″	35′8″	39′0″
8.	Sand, black	0′8″	39′0″	39′8″
9.	Limestone, (Madisonville)	3′4″	39′8″	43′0″
10.	Sand	1′0″	43′0″	44′0″
11.	Sand, gray	11′0″	44′0″	55′0″
12.	Coal and sand, black and gray slate	8′0″	55′0″	63′0″
13.	Sand and coal	26′10″	63′0″	89′10″
14.	Slate, black and gray	24′2″	89′10″	114′0″
15.	Slate, black	2′6″	114′0″	116′6″
16.	Fireclay	9′6″	116′6″	126′0″
17.	Fireclay, and soapstone	12′0″	126′0″	138′0″
18.	Coal, (No. 14?)	0′5″	138′0″	138′5″
19.	Fireclay	1′7″	138′5″	140′0″
20.	Limerock	0′4″	140′0″	140′4″
22.	Shale, sandy	10′0″	145′0″	155′0″
23.	Coal, (No. 13?)	1′1″	155′0″	156′1″
24.	Fireclay	2′0″	156′1″	158′1″
25.	Limerock	1′5″	158′1″	159′6″
26.	Gob	5′6″	159′6″	165′0″
27.	Slate, gray	5′0″	165′0″	170′0″

	Strata.	Thickness	From	To
28.	Sandrock	15′0″	170′0″	185′0″
29.	Soapstone	5′0″	185′0″	190′0″
30.	Sandrock	1′0″	190′0″	191″0′
31.	Soapstone	1′0″	191′0″	192′0″
32.	Limerock	7′8″	192′0″	199′8″
33.	Gob	0′1″	199′8″	199′9″
34.	Slate, black	1′1″	199′9″	200′10″
35.	Fireclay	1′2″	200′10″	202′0″
36.	Soapstone	4′0″	202′0″	206′0″
37.	Slate, gray	1′0″	206′0″	207′0″
38.	Limerock	0′5″	207′0″	207′5″
39.	Slate, gray	2′6″	207′5″	209′11″
40.	Slate, black	2′1″	209′11″	212′0″
41.	Coal	0′11″	212′0″	212′11″
42.	Fireclay	18′1″	212′11″	230′2″
43.	Sandrock	0′6″	230′2″	230′8″
44.	Slate, gray	1′6″	230′8″	232′2″

This well started a distance of 40 ft. above the Madisonville Limestone, and was drilled a distance of 192 ft. below that stratum. Since No. 11 coal underlies the Madisonville Limestone a distance of from 200 to 225 ft. it is obvious that the well would have had to be sunk only a few feet further to reach that coal. An additional distance of about 95 ft. would have been necessary here to reach No. 9 coal.

Sec. 84. Section of shaft on A. W. Williams' heirs farm, located 2½ miles west of Onton.

1.	Soil	3′0″
2.	Sandstone	21′0″
3.	No. 15b	2′6″
4.	Fireclay	3′0″

This mine had been operated in the past and abandoned, but was being re-opened at the time of my visit. The coal appeared to be free from impurities, and was reported as being a good stove coal.

Sec. 85. Section exposed in road and at mine 2 miles west of Onton.

1.	Soil.	
2.	Sandstone, thin-bedded	25′0″
3.	Shale	10′0″
4.	Coal, good, No. 15	2′0″
5.	Fireclay, blue	2′0″
6.	Clay, red	4′0″
7.	Clay, blue	3′0″

The bank here was abandoned and fallen shut.

Sec. 124. Record of shaft on the L. Springfield farm located 1½ miles northwest of Belcourt. Authority, L. Springfield.

1.	Sandstone and soil	10′0″
2.	Coal, No. 15	3′0″
3.	Sandstone and shale	82′0″
4.	Coal	5′0″

The shaft is now abandoned, but, judging from the size of the dump, considerable coal has been removed. Mr. Springfield reports that both veins found were of good quality.

Sec. 107. Record of test well drilled by E. F. Doudna on the R. N. Carlisle Farm, located ¾ mile north of Belcourt. Authority, L. B. Henry, of Dixon, Ky.

		Thickness	From	To
1.	Soil	9′0″	0′0″	9′0″
2.	Sandstone	4′0″	9′0″	13′0″
3.	Soapstone	5′0″	13′0″	18′0″
4.	Sandrock	1′0″	18′0″	19′0″
5.	Soapstone	3′0″	19′0″	22′0″
6.	Soapstone, sandy	2′0″	22′0″	24′0″
7.	Shale, sandy	3′0″	24′0″	27′0″
8.	Shale, gray	3′0″	27′0″	30′0″
9.	Sand, black	2′6″	30′0″	32′6″
10.	Slate, gray	4′6″	32′6″	37′0″
11.	Soapstone	2′0″	37′0″	39′0″
12.	Slate, gray	13′2″	39′0″	52′3″
13.	Coal, No. 15, (?)	5′8″	52′3″	57′11″
14.	Fireclay	1′1″	57′11″	59′0″
15.	Shale, sandy and fireclay	1′2″	59′0″	60′2″
16.	Slate, sandy	3′10″	60′2″	64′0″
17.	Soapstone	13′0″	64′0″	77′0″
18.	Slate, gray, and limerock	10′0″	77′0″	87′0″
19.	Slate, gray	7′1″	87′0″	94′1″
20.	Coal	4′1″	94′1″	98′2″
21.	Fireclay	5′10″	98′2″	104′0″
22.	Sandstone, gray	22′0″	104′0″	126′0″
23.	Sand, white	9′0″	126′0″	135′0″
24.	Sand, gray	4′0″	135′0″	139′0″
25.	Sand, black	11′0″	139′0″	150′0″
26.	Slate, gray	16′0″	150′0″	168′0″
27.	Slate, black	6′0″	168′0″	174′0″
28.	Fireclay	3′0″	174′0″	177′0″

Drilling was begun October 3, 1910, and finished in one week on October 10th.

Sec. 102. Section exposed in road by coal bank on arm of Tom Nelson, located 2 miles west of Ashbyburg.

1.	Sandstone and sandy shale	20′0″
2.	Clay, light blue	5′0″
3.	Sandstone, soft, brown, shaly	25′0″
4.	Shale, black	2′0″
5.	Coal, No. 15	1′9″
6.	Fireclay.	

An entry had been driven here a distance of 100 ft., but the vein was entirely too thin for profitable mining and the bank was abandoned, and at the time of my visit, was completely fallen shut. The thickness of the coal given in the section above was reported by Mr. Nelson.

Sec. 103. Section showing in road, located 2½ miles west of Ashbyburg.

1.	Sandstone, soft, brown	20′0″
2.	Clay, light blue	5′0″
3.	Coal, (outcrop), No. 15b	1′8″
4.	Clay, blue	2′0″

Sec. 104. Section showing in road four miles west of Ashbyburg.

1.	Sandstone, soft, reddish-brown	10′0″
2.	Coal, (outcrop), No. 15c	0′4″
3.	Clay, blue	10′0″
4.	Sandstone, soft, shaly	20′0″

Sec. 105. Section exposed in road 3 miles south of Onton.

1.	Sandstone, soft	15′0″
2.	Clay, light blue	4′0″
3.	Coal, No. 15b	1′0″
4.	Clay, blue, heavy	4′0″
5.	Shale, blue, sandy at bottom	20′0″
6.	Sandstone, shaly, micaceous	20′0″

Sec. 106. An old shaft has been sunk to a depth of 20 ft. on the Campbell Mounts farm, located 1½ miles

southeast of Belcourt. The coal which was found underlying a thickness of 18 ft. of soil and sandstone was reported 2′ 2″ thick, and of good quality. Only a few bushels had ever been taken out, and the shaft was closed at the time of my visit.

Sec. 83. Section exposed in road 2 miles south of Belcourt.

1.	Sandstone, reddish-brown	5′0″
2.	Clay and shale	10′0″
3.	Coal, No. 15c	2′0″
4.	Clay, white	3′0″
5.	Clay, and sandy shale	3′0″
6.	Sandstone, and sandy shale	70′0″

Sec. 108. Record of shaft sunk by C. P. Dunville, located 2 miles south of Onton.

1.	Soil	8′0″
2.	Sandstone, shaly	3′0″
3.	Slate, black, with limestone, concretious	4′0″
4.	Coal, good, No. 15	2′4″

An immense flow of water was struck in the coal which prevented further development.

No. 14 Coal. The correllation of No. 14 on this sheet is by no means positive. If it occurs at all it is simply as a thin vein of irregular distribution and of no economic importance. Its area of possible occurrence is confined tc the southwestern corner of the sheet.

In the C. I. Mahurin test at Onton a vein about 5 inches thick, and overlain with soapstone, which was struck about 100 ft. below what is presumably the Madisonville Limestone, would seem to be at about the horizon of No. 14.

One other possible occurrence is an outcrop of coal in the west bank of Green River at Ashbyburg. At this point the top of the coal shows between the water's edge and the base of the hill, the coal dipping 20 degrees to the east. The thickness of the coal could not be determined from the outcrop, but in a shaft which was sunk about 50 yds. west of this point the coal was found to be 4 ft.

thick, and overlain with 30 ft. of sandstone. The mine was never successfully operated, though the coal was reported of good quality.

No other possible occurrences of No. 14 are known on this sheet.

No. 13 Coal. No data were obtained which positively indicate the occurrence of No. 13 on this quadrangle. A vein of coal about 1 ft. thick was found at a distance of 115 ft. below what appears to be the Madisonville Limestone in the C. I. Mahurin Test at Onton, and this bed possibly represents the No. 13 horizon. The correllation is doubtful, however. No other possible occurrences of this bed are known.

No. 12 Coal. This vein possess little or no commercial value on this sheet, since its range of thickness is from 1 to 2 ft. only, with an average of only 1′ 4″. It underlies practically the entire quadrangle except that portion of the disturbed region lying east of Beechgrove, where it has been carried above the hills by the high folding of the rocks, and the overflow areas of Green River, from which it has been removed by erosion. It rarely appears in outcrop, however, being covered by the soft, flowing sand above.

The bed has been opened in a few places, but never mined with any degree of success. It overlies No. 9 an average distance of 94 ft., and the variance from this figure rarely exceeds 5 ft.

The following sections were obtained:

Sec. 76. Section exposed at abandoned drift mine on the J. H. Mackey farm located 2 miles south of Delaware.

1.	Soil.	
2.	Sandstone, solid, hard, fine-grained, yellow	30′0″
3.	No. 12	1′11″
4.	Fireclay.	

The bed had been opened into here, but only a few wagon loads had been removed. The coal was solid, hard, and without parting.

Sec. 12. Section exposed at strip bank located on south side of road at sharp bend 1 mile east of Jolly P. O.

1.	Soil.	
2.	No. 12, (not exposed, but reported).....	1′8″
3.	Clay.....	5′0″
4.	Jolly Limestone.....	4′0″

From the appearance of the dump it would seem that only a few bushels of coal had been taken out here.

Sec. 98. Section located 1½ miles southeast of Niagara.

1.	Soil.	
2.	Sandstone.....	10′0″
3.	No. 12 coal, (reported).....	1′8″
4.	Fireclay.	

The vein had been opened here and mined in a small way, but the bank was abandoned and closed at the time of my visit. The coal was reported by the farmer who opened it to be good quality.

Sec. 95. In the William Hayes Shaft, at Coraville, No. 12 was 2′ 0″ thick and was overlain and underlain by soft sandstone and fireclay, respectively. See Sec. 95, page 00.

No. 11 Coal. What is true of No. 12 in a general way on the Calhoun Sheet is also true of No. 11, which occurs from 10 to 14 ft. lower down in the stratigraphical column. Like No. 12 this bed has little or no economic importance in the quadrangle; and the areas of occurrence of the two coals are practically the same.

No. 11, however, is, if any difference, of somewhat more irregular occurrence than No. 12, and has a slightly greater range of thickness, ranging from 1′ 0″ to 2′ 11″, with an average of about 1′ 6″. The bed is closely overlain with the Jolly Limestone, and is underlain with fireclay. No partings of consequence are known. The quality of the coal appears to be the same as on the Madisonville and Central City Sheets. It is separated from No. 9 by an interval of from 78′ to 88′.

The following sections were obtained:

Sec. 60a. Section exposed on the Guy Wright Farm, located 2 miles north of Beechgrove.

1.	Soil.	
2.	Jolly Limestone	3′0″
3.	No. 11 (reported)	2′11″
4.	Fireclay.	

A bank was being opened by Monroe Sandefur at this point, but only a showing of coal had been obtained up to the time of the writer's visit. The thickness given above was reported by Mr. Wright as having been obtained in a test well drilled by him a few feet further up the hill. Later reports indicate that the opening being made by Mr. Sandefur finally reached the full thickness of the bed, and that the coal was being developed.

Sec. 68. Section exposed at old strip bank, located on north side of road 3 miles south of St. Joseph.

1.	Sandstone and soil	30′0″
2.	Jolly Limestone	3′0″
3.	No. 11 Coal, (reported)	1′8″
4.	Fireclay	4′0″

Sec. 71. Reported section of shaft on the Lawson farm, located 2 miles south of Curdsville.

1.	Soil	10′0″
2.	Sandstone	30′0″
3.	No. 12 Coal	2′0″
4.	Jolly Limestone	3′0″
5.	No.11 Coal	1′10″
6.	Fireclay	3′0″

The shaft had been abandoned for years and was partially filled up at the time of my visit. But little of a satisfactory value could be learned, but, so far as could be learned, little was ever done toward developing the coals beyond sinking the shaft.

Sec. 73a. A small vein of coal, which was reported as having a limestone roof, has been mined in the banks of Delaware Creek near the bridge, one-half mile east of Delaware. This coal would seem to be the No. 11 vein. and a heavy bed of limestone located near the mouth of

Delaware Creek, and which was identified as the Jolly Limestone, bears out the statement. This bed has a reported thickness of 1′ 6″.

No. 10 Coal. No. 10 is known to occur only in the vicinity of West Louisville on this sheet. In the mines at that place it averaged 1′ 6″ in thickness and was separated from No. 9 by an average interval of 66 ft. The overlying stratum was hard sandstone, the floor was blue, siliceous shale.

No. 9 Coal. The No. 9 vein is the only coal outcropping over the sheet that has other than local value. It occurs generally over all the region lying north of the Rough Creek Anticline, and may be expected to occur under all of the upland area lying south of the anticline. It has been removed by erosion from practically all of the valleys included in the Green River Flood Plain, and from that portion of the faulted area lying east of Beechgrove. In thickness the vein varies from 4′ 10″ to 4′ 1″, without parting.

The following data show the coal and its associated rocks as they occur over the northern half of the sheet, or in the region lying north of the Anticline.

Sec. 4. Section exposed at M. A. Hayden Slope Mine, located ½ mile north of Cleopatra. Elevation of No. 9 coal, 443 ft.

1.	Soil.	
2.	Shale, sandy	10′0″
3.	Shale, black, sheety	2′0″
4.	No. 9	3′8″
5.	Fireclay	3′0″

This mine, at the time of my visit, had apparently not been worked for some years, and could not be entered on account of dangerous condition.

Sec. 34. Section obtained at Charley Smith's coal mine, located one mile north of Guffie. Elevation of No. 9 coal, 424 ft.

1.	Soil.			
2.	Sandstone, coarse, brown, (and concealed)..			45′0″
3.	Limestone			4′0″
4.	Shale, sandy			25′0″
5.	Sandstone and shale			27′0″
6.	Soapstone			6′0″
7.	Shale, sandy, gray			
8.	Shale, carbonaceous, sheety			1′6″
9.	No. 9 Coal...	Bone coal	0′3″	
		Rash coal	0′1″	
		Coal, good	4′1″	
		Coal, rash	0′1″	4′6″
10.	Fireclay			3′0″
11.	Limestone, (reported).			

Thin, white lenses of "sulphur" occur throughout the coal.

Sec. 21. Section of shaft at the Stallings Mine, located 2 miles east of West Louisville. Elevation of No. 9 coal, 408 ft.

1.	Soil.			
2.	Soapstone			12′0″
3.	Slate, gray, with clay ironstone at base			31′0″
4.	Pennywinkle rock			0′9″
5.	Slate, black, sheety			1′3″
6.	No. 9 Coal...	Bone coal	0′1½″	
		Coal	0′10½″	
		Sulphur band hard	0′¾″	
		Coal	3′1¾″	4′2″
7.	Clay, blue			3′0″

The hard, sulphur band renders it necessary in shooting to locate the holes rather high, in order to bring down the coal above it. The mine is now abandoned.

Four shaft mines are located at West Louisville, viz.; the Lawson, No. 19; the D. M. Coomes, No. 20; the J. M. O'Bryan, No. 25; and the J. R. Thomas, No. 70. The coal here is of the usual No. 9 type, and ranges from 4′ 6 to 4′ 10″ in thickness. Faults the thickness of the coal frequently occur in these mines, and a larger fault, having a downthrow of at least 30 ft., occurs between the Thomas Mine, and the remainder of the mines to the south.

The following is a generalized section of the records of these shafts.

1.	Clay	20′0″
2.	Sandstone, soft	8′0″
3.	Sandstone, hard	3′0″
4.	No. 10 Coal, (?)	1′6″
5.	Shale, blue, siliceous	65′0″
6.	Coal, No. 9	4′7″
7.	Fireclay	3′0″

Sec. 93a. Record of shaft at J. H. Wilson's Mine, located on Green River, 4 miles west of Curdsville. Elevation of No. 9 coal, 356 ft.

1.	Soil	3′0″
2.	Sandstone	10′0″
3.	Shale, gray	25′0″
4.	Shale, black, sheety	1′8″
5.	No. 9 Coal, average	4′1″
6.	Fireclay	3′0″

No. 9 varies in the mine from 3′ 10″ to 4′ 4″ in thickness, the average being as shown in section above.

Sec. 92. Section exposed at the Happy Mine of the Utopia Coal Company, located on Green River 2 miles west of Curdsville. Elevation of No. 9 coal, 375 ft.

1.	Soil.	
2.	Sandstone	40′0″
3.	Soapstone	10′0″
4.	Shale	3′0″
5.	Shale, with clay ironstones	12′0″
6.	Pennywinkle rock	1′63″
7.	Shale, black, sheety	2′0″
8.	No. 9 Coal	4′0″
9.	Fireclay	3′6″

The Utopia Mine is the only large mine on the Calhoun Sheet.

Sec. 95. Record of shaft sunk at Coraville by William Hayes. Now operated by Nathanial Dill, of Henderson, Kentucky. Elevation of No. 9 coal, 292 ft.

1.	Soil	8′0″
2.	Sandstone, soft	17′0″
3.	No. 12 Coal	2′0″
4.	Fireclay	3′0″
5.	Jolly Limestone	6′0″
6.	Soapstone, soft	8′0″
7.	Flinty rock	6′0″
8.	Soapstone, soft	10′0″
9.	Sandstone	30′0″
10.	Slate, gray	30′0″
11.	Slate, carbonaceous, sheety	2′0″
12.	No. 9 Coal	4′0″
13.	Fireclay	4′0″

This shaft was sunk in 1898 to a depth of 121 ft. where such a strong flow of water was struck in the black shale that the enterprise was abandoned. In 1909, however, Nathaniel Dill gained possession of the shaft, completed it to the coal, and has been operating since.

In the region shown on the map as being more or less faulted, several small mines have been operating a vein, or veins, of uncertain correllation, but in one of those mines, viz., the Styles Mine on the Dr. W. N. Short Farm, the coal appears to be No. 9.

Following is a record of the shaft.

Sec. 46. Record of shaft at the Styles Mine on the W. N. Short Farm, located ¼ mile west of Poverty.

1.	Soil			6′0″
2.	Sandstone, reddish			10′0″
3.	Soapstone			5′0″
4.	Sandstone, gray, micaceous			4′0″
5.	Slate, black			2′0″
6.	No. 9 (?) Coal	sulphur	0′1″	
		coal, hard	1′1¼″	
		sulphur	0′½″	
		coal	2′1″	
		clay	0′1½″	
		coal, irridescent	1′5½″	4′10¾″
7.	Limestone.			

The coal in this mine could not be seen by the writer, but according to reports is very similiar in appearance to No. 9; and the black slate above also shows a likeness to that above No. 9. Further, a limestone in the top of the hill immediately to the south bears a striking resemblance to the Jolly Limestone. These facts, together, would seem to indicate the coal to be No. 9. If so, this is its first re-appearance in the hills after its journey over the anticline.

Coals below No. 9. One or more of the beds occurring below the No. 9 vein are brought to the surface along the crest of the Rough Creek Anticline east of Beechgrove. A number of country banks are operating these veins, but, except over very small areas, none has commercial value. The severe amount of faulting which the region has undergone, would preclude successful mining on a large scale.

The correct correllation of these coals could not be ascertained on account of the complexity of the faulting, and of the consequent extreme difficulty of determining the correct sequence of strata. The mines operating in a small way in the hills southeast of Beechgrove, however, are believed to be working the same vein of coal. This bed which is usually overlain with sandstone would seem to be the No. 5 of the Western Kentucky Series.

The following detailed data concerning the Beechgrove coals was obtained:

Sec. 42. Section exposed at the Tom Owen coal bank, located two miles southeast of Beechgrove.

1.	Clay	10′0″ to 15′0″
2.	Sandstone, partially covered	90′0″
3.	Shale	6′0″
4.	Sandstone, yellow, sandy slate at bottom	3′0″
5.	Coal, slaty and hard	3′0″ to 4′0″
6.	Fireclay.	

The coal is from 3 to 4 ft. thick. It is of an unusually slaty nature, exceedingly hard, due to compression and induration, the result of proximity to the Rough Creek Uplift. There is a little sulphur in the coal, in flat thin layers, but altogether it is an excellent coal. The bed is faulted more or less by north-south faults, of varying size. The elevation of the coal is 492 ft.

Sec. 78. Section exposed at the L. F. Wilhite mine, located 1 mile east of Wrightsburg.

1.	Soil.	
2.	Sandstone	20′0″
3.	Block coal	1′6″
4.	Sandstone, about	30′0″
5.	Coal	3′0″
6.	Soapstone	30′0″
7.	Coal, from 3 to 4½ ft.; average	4′0″
8.	Fireclay, free from sulphur	5′0″

The uppermost part of the section was furnished by Mr. Wilhite. The coal which is No. 7 of the section is the one being mined. It is a hard slate-like coal containing little sulphur, and said to leave no clinker when burned.

Some of the coal shows irridescence and the bed is often interrupted with faults of varying size, the fissures in some instances being filled with grayish clay. One fault dipped 55 degrees east, the strike being due north. The coal dipped to the south about 1 inch per foot. The elevation of the coal is 417 ft.

Sec. 37. The coal in the William Hoover mine, located 2½ miles southeast of Beechgrove, is similiar to that at the Owen and Wilhite mines, and averages about 3′ 6″ in thickness. The roof is soapstone which is followed by sandstone. Faulting of the bed is common, some of the faults being many feet in extent. The elevation of the coal is 415 ft.

Sec. 39, located 1 mile east of Beechgrove, is an abandoned shaft in which what is probably the same coal as at the Owen Bank was formerly mined in a limited way. The bed here, however, was reported as being only 3′ 0″ thick. The shaft seems to have been abandoned partly on account of water. The elevation of the coal is 376 ft.

Sec 40, located 1½ miles southeast of Beechgrove, is an abandoned opening, the coal probably being the same as at the Owen Bank. The elevation of the coal is 437 ft.

In addition to the coals in the hills near Beechgrove and Wrightsburg one or possibly two veins occur in the hills between Calhoun and Guffie, but of these nothing of value was learned. Two or three banks have been opened, but all were abandoned long ago, and are now completely closed. In one of the mines, (114), the coal was reported as being 3 ft. thick, and in another, (113), the bed was reported as being 2′ 6″ thick. These coals probably belong near the bottom of the western Kentucky series since they occur in close proximity to the outcrop on the Ezra Ashton farm (105) of conglomeratic sandstone and Subcarboniferous limestone, which are believed to mark the base of the Coal Measures and the top of the Chester measures, respectively. They doubtless have no commercial value whatever.

THE NEWBERG QUADRANGLE.

Location. The Newberg Quadrangle, which lies just to the north of the Calhoun Quadrangle, is limited by meridians 87° 15′ and 87° 30′, and by parallels 37° 45′ and 38° 00′, and lies partly in Indiana and partly in Kentucky. Only that portion lying in Kentucky, however, consisting of about two-thirds of the total area of the quadrangle, is treated in this report. The region investigated comprises parts of Henderson and Daviess counties, and has an area of 160 square miles.

The quadrangle derives its name from Newberg, which is the principal town on the sheet.

Drainage. Green River enters the sheet about 3 miles west of its southeastern corner, thence pursues a course diagonally northeastward across the center of the area investigated, and empties into the Ohio River at a point just east of where that stream crosses the western boundary of the sheet. Practically all of the drainage empties directly into Green River. Race and Lick Creeks are the principal streams emptying from the west. A large number of small sluggish sloughs, but no large streams, empty from the east.

Relief. Practically two forms of relief, only, are present in this area treated, viz., rolling uplands and river flats. The latter cover all the region lying betwen Ohio and Green Rivers and north of Rhodes Creek, and, in addition, fringe the western bank of Green River; the former are confined wholly to the region lying west of Green River, except for an area of about two square miles in the southeastern corner of the sheet. The areas covered by each are about equal in extent, there being about eighty square miles of uplands, and about eighty square miles of river flats.

The highest hill in this area, which is located one mile west of Spottsville, is contoured at slightly more than 560

feet; the lowest elevation is 334 ft., this being the elevation of Green River, at low water, below the Spottsville Dam.

Culture. Several small, though thriving, towns are located on the sheet, the principal ones being Baskett, Spottsville, Zion, Bluff City and Hebbardsville. More or less mining is carried on at each of these places, but large mines are located at Baskett, Spottsville and Bluff City, only. Means of transportation are furnished by the Louisville, Henderson & St. Louis R. R., and by Green and Ohio Rivers. The uplands are generally in a high state of cultivation, while the extensive bottom lands, where properly drained, are unexcelled for productiveness.

GEOLOGY.

Structure. The geological structure is represented on an appropriate map.

No contours are drawn over the alluvial areas included between Green and Ohio Rivers, this fact being due to the absence of rock exposures, or other data essential to the determination of structure.

But slight folding has occurred in the upland districts, and no prominent structural features, except the Curdsville Fault, are present. This fault, which, as previously mentioned, probably follows the channel of Green River rather closely, has a downthrow of about 180 ft. on this sheet.

The general dip of the rocks is slightly westward. East of the fault the rate is about 30 ft. per mile; to the west the dip, as far as Bluff City, is about 20 ft. per mile; at Bluff City the rocks flatten out into a broad terrace on which are located a broad, low dome and a correspondingly broad, shallow basin. The latter is located 2 miles west of Bluff City, and the former 3 miles further north; west of the terrace the dip is uniformly about 15 ft. to the mile to the western edge of the sheet.

Rocks Exposed. The stratified rocks appearing at the surface of the area investigated extend from a point near the horizon of No. 15. Coal down to a point about 20 ft. below the No. 9 bed. Of the uppermost strata, however, which are contained in the high knob located 2 miles northwest of Baskett, only, no sections were obtained, and these strata, therefore, are not embraced in the general section given below. The general section includes the rocks from a point about 50 ft. above the horizon of the No. 13 coal down to a point 20 ft. below No. 9 coal, only, and the vertical distance between its highest and lowest members is about 200 feet.

GENERAL SECTION.

	Strata.	Av. Th.	Min. Th.	Max. Th.
1.	Clay and shale	20′00″	10′0″	30′0″
2.	Sandstone, incoherent, light brown	12′0″	10′0″	15′0″
3.	Shale, soft, light blue	1′6″	1′0″	2′0″
4.	No. 13 Coal	1′7″	1′6″	1′8″
5.	Fireclay	0′7″	0′6″	0′8″
6.	Sandstone, incoherent, orange colored	27′0″	25′0″	30′0″
7.	Shale, siliceous, gray	10′0″	5′0″	15′0″
8.	Sandstone, coarse, brown, hard	20′0″	10′0″	25′0″
9.	Shale, blue, sandy at top	0′4″	0′2″	0′6″
10.	No. 12 Coal, pure	1′4″	1′0″	1′8″
11.	Fireclay, blue	1′6″	1′0″	2′0″
12.	Clay, blue, greenish on outcrop	3′6″	3′0″	4′0″
13.	Limestone, Jolly Limestone, dingy gray, blue on fracture, weathers in rectangular boulders from 3 to 8 ft. across, carries an abundance of crinoids and brachiopods, these being thickest near the top	5′0″	3′0″	8′0″
14.	Shale, calcareous, gray	0′5″	0′4″	0′6″
15.	No. 11 Coal, hard, usually without parting	1′6″	0′1″	3′6″
16.	Clay, blue	1′6″	1′0″	2′0″
17.	Sandrock, hard, in places calcareous	3′0″	2′0″	4′0″
18.	Sandrock, gray	6′0″	4′0″	8′0″
19.	Shale, grayish, blue	8′0″	8′0″	10′0″
20.	Sandstone, incoherent, coarse, brown	18′0″	10′0″	20′0″
21.	No. 10 Coal	0′2″	0′0″	0′2″
22.	Shale, gray, siliceous at top	27′0″	20′0″	30′0″
23.	Shale, carbonaceous, sheety, hard	1′8″	1′6″	3′0″
24.	No. 9 Coal, solid, hard	4′2″	4′1″	4′4″
25.	Fireclay, blue	3′0″	2′6″	4′6″
26.	Limestone, blue	2′8″	2′6″	3′0″
27.	Sandstone	18′0″	15′0″	20′0″
	Total,			

DETAILS CONCERNING THE COAL BEDS.

No. 13 Coal No. 13 Coal, the highest coal found on the area surveyed, is known to occur at only one point, viz., in the shaft sunk by I. O. Oldham, of Sorgho, Ky., in the southeastern corner of the sheet. In this shaft the coal was found to be 1′ 6″ thick and was overlain by soapstone and underlain by fireclay. The interval separating this bed from No. 11 coal in the same shaft, was 102 ft. See Section 24.

Lying, as it does, more than 100 feet above No. 11, No. 13 is elevated above the tops of the hills over the remainder of the sheet, except for two high knobs previously mentioned, one of which is located 1 mile west of Spottsville, and the other 2 miles northwest of Baskett. No knowledge was obtained of the occurrence of the coal in these two hills.

No. 12 Coal. This bed is of general occurrence over the upland portions of the area investigated, but at no known point is it of commercial importance. In thickness it ranges from zero up to 1′ 8″, with an average of 1′ 3″. It is overlain with sandstone and underlain with clay. It underlies No. 11 from 8 to 12 ft. only, and No. 9 a distance varying from 95 to 85 ft. A few farmers have opened into the coal on their respective places, but none of the openings were operated to any considerable extent.

The following sections were obtained:

No. 12 was observed in outcrop in the road one-half mile north of Spottsville. It showed here simply as a smut in the road and was closely underlain by the Jolly limestone. (See Sec. 27.)

In the Coxon, Conolly and Conaway shaft, located one-half mile south of Spottsville, however, No. 12 was wholly absent. It is possible, though, that it may have been eroded away at this point. (Sec. 26.)

In the Zion Coal Company's shaft at Zion, No. 12 was found to be only 6 inches thick. It was imbedded in clay. (Sec. 14.)

Section 21. Section located 3 miles southwest of Hebbardsville on farm of R. A. Priest.

1.	Soil.	
2.	Sandstone, hard, fine-grained, light brown..	12′0″
3.	Shale, sandy, blue.....	
4.	No. 12 Coal, solid.....	1′6″
5.	Fireclay.....	3′0″

The bed has been mined slightly by Mr. Priest, who reports that it burns with strong heat and leaves but little clinker.

About 2 miles further west, the coal has again been opened into. This bank, as was the case with several other small openings in the neighborhood, has been merely opened and then abandoned, and had long since fallen shut, so that nothing could be seen. The coal was reported as averaging 1′ 6″ in thickness and of good quality.

On the Langley Farm, near Baskett, the following section was obtained.

Section No. 25. Section located on the Langley farm, 2 miles southeast of Baskett.

1.	Soil.	
2.	Sandstone.....	20′0″
3.	No. 12 Coal.....	1′6″

The thickness of the coal was obtained from Mr. Langley, who had dug through it in a spring.

This bed seems to have been entirely missing in the shaft sunk by Dr. Oldham, 1½ miles east of Hamilton Ferry. Its proper horizon was here filled with siliceous shale. (Sec. 24).

No. 11 Coal. No. 11 Coal is of irregular occurence, and, except in certain small localities, is of little or no commercial importance. It has a reported maximum thickness of 6′2″, but usually runs about 1′ 6″ or less. It is thickest in the southeastern corner of the sheet from which it thins gradually westward, wedging out completely along the western edge of the area investigated. It is everywhere overlain with the Jolly Limestone, and underlain by the usual fireclay. It was found in outcrop in the hills surrounding

Hebbardsville, only, being elsewhere either absent or beneath cover. It's quality appears to be good.

The following sections were obtained.

Section 24. Record of shaft sunk by Dr. Oldham, of Sorgho, Kentucky, 3 miles southeast of Berk. Authority Dr. Oldham.

1.	Clay	30′0″	0′0″	30′0″
2.	Sandstone, greenish, conglomerate	18′0″	30′0″	48′0″
3.	Soapstone	1′6″	48′0″	49′6″
4.	Coal (No. 13)	1′6″	49′6″	51′0″
5.	Fireclay	0′7″	51′0″	51′7″
6.	Sandstone	30′0″	51′7″	81′7″
7.	Shale, soft, siliceous	16′0″	81′7″	97′7″
8.	Limestone, blue, fine-grained, with fossils, (Jolly)	3′6″	97′7″	101′1″
9.	Shale	0′6″	101′1″	101′7″
10.	No. 11 Coal.. Coal 3′4″ / Fireclay 0′½″ to 1½″ / Coal 2′6″ to 3′0″	6′2″	101′7″	107′9″
11.	Fireclay	4′0″	107′9″	111′9″

The names given above were supplied by the writer. The thickness of 6′ 2″ given above for No. 11 is greater by at least three feet than is usual in the surrounding regions, and is probably due to a local thickening.

Section 33. Section at bank located 3 miles southeast of Hebbardsville.

1.	Soil.			
2.	Sandstone			20′0″
3.	Concealed			8′0″
4.	Shale, greenish-colored			3′0″
5.	Jolly Limestone, massive			4′0″
6.	Shale, carbonaceous			0′3″
7.	No. 11 — Coal, good	2′6″		
	Clay	0′1″		
	Coal	1′0″		3′7″
8.	Fireclay			1′0″

The coal here has locally thickened into workable condition. It's quality appears to be equally as good as in the regions further south where this vein is so extensivcly worked.

It is interesting to compare the elevation of the vein here and in the Dr. Oldham shaft located 3½ miles east. Its elevation above sea level at this point is 463 feet, while in the Oldham shaft it is only 251 feet. This difference in elevation of 212 feet is due, not to the dip of the rocks, which is really in the opposite direction, but principally to the Curdsville Fault.

Section 34. Section on the E. L. Butler Farm, located 2 miles S. W. of Hebbardsville.

1.	Soil.		
2.	Sandstone		12′0″
3.	Concealed		10′0″
4.	Limestone	3′9″	
	Clay, blue	1′6″	
	Limestone	1′6″	6′9″
5.	No. 11 Coal		2′6″

In the Coxon, Connolly & Conaway shaft near Spottsville, No. 11 existed as a mere show, only 2″ thick. No. 12 had possibly been removed by erosion here, but that could not have been the case with No. 11, which was overlain by the Jolly Limestone.

In the Zion Coal Company's shaft at Zion, no trace was found of No. 11.

No. 10 Coal. No. 10 coal is known to occur in only one place, namely, in the Coxon, Connolly and Conaway shaft near Spottsville. It was there separated from No. 9 by an interval of 44 ft. and has a thickness of only 1 inch.

The information obtained would seem to indicate that it is absent elsewhere.

No. 9 Coal. No. 9 may be expected under the entire upland area of the sheet. It outcrops in the left bank of Green River near Spottsville (28) and again in the hills lying to the west of Green River, and to the S. E. of Hebbardsville (5). (Just across the river from this point, as a result of the Curdsville Fault, No. 9 lies buried a depth of approximately 320 ft. below the surface.) Elsewhere over the sheet, exclusive of the two places named above, the coal

is under cover, ranging from 30 ft. below the valleys at Hebbardsville to 110 ft. at Baskett.

The bed preserves a remarkable uniformity in thickness, everywhere, ranging from 3′ 11″ to 4′ 3″, the total variance being 4″ only. The usual carbonaceous shale forms its roof, its average thickness being 2 feet. There are three large mines now operating No. 9, namely, the Pittsburg Coal Company's mine at Baskett (30), the Spottsville Mine at Spottsville (34), though this mine was and had been idle for some time at the time of our visit, and the John Archbold Mine at Bluff City (8). The Rankin Mine, a large mine formerly opened at Spottsville, is now idle.

In addition to the commercial mines named above, five small mines, which are operated solely for the home market, are now in operation. All of these, except the Sam Goodly Mine (5), which is a small drift mine of the country bank class, are shaft mines operating a number of men. Two of these shaft mines are located at Hebbardsville, one near Spottsville, and one at Zion.

The following sections were obtained.

Section 5. Section exposed at coal bank on the Sam Goodly Farm located 4 miles S. E. of Hebbardsville.

1.	Soil.	
2.	Shale, carbonaceous, sheety	1′10″
3.	No. 9 Coal	4′3″
4.	Clay	2′0″

The coal had just been entered here. No partings of consequence were present.

Section No. 8. Section in airshaft of the John Archbold mine at Bluff City. Authority Edwin Archbold.

1.	Soil, red shale, etc	18′0″
2.	Shale, blue	10′0″
3.	Shale, gray, hard	39′0″
4.	Shale, black, sheety	3′0″
5.	No. 9 Coal	4′2″
6.	Fireclay	4′6″

The excellent character of the roof afforded by the shale above No. 9 is well illustrated in this vein. In many

large rooms, and even the main entry for a distance of several hundred yards, no props at all are employed.

Section No. 3. Section of rocks in shaft of Spillman and Fisher Mine located one-half mile S. W. of Hebbardsville.

1.	Soil	8′0″
2.	Shale, soft, blue	10′0″
3.	Shale, gray, hard	25′6″
4.	Shale, hard, black, sheety	2′6″
5.	No. 9 Coal	4′3″
6.	Fireclay	3′6″
	Total depth of shaft is 53′9″.	

Section 14. Record of shaft of the Zion Coal Company's Mine at Zion. Authority Wm. H. Hayes, Mgr.

1.	Soil, clay, etc	20′0″
2.	No. 12 Coal	0′6″
3.	Clay	2′6″
4.	Jolly Limestone, hard, flinty	4′0″
5.	Clay	4′0″
6.	Soapstone, soft, blue	8′0″
7.	Sandstone, soft, shaly	30′0″
8.	Shale, gray	49′0″
9.	Shale, carbonaceous, sheety	3′0″
10.	No. 9 Coal	3′6″
11.	Fireclay	
	Total depth of shaft, 123′6.″	

This mine is practically free from water at all times of the year, about 2 barrels, only, being pumped out per week. The coal is usually shot on the solid.

Section 26. Section of shaft of the Coxon, Connolly and Conaway mine, located 1 mile S. W. of Spottsville. Authority Thomas Connolly.

1.	Soil	30′0″
2.	Limestone, Jolly, very hard	3′0″
3.	Coal, No. 11, only a show	0′1″
4.	Fireclay	2′6″
5.	Limestone, sandy	2′0″
6.	Sandrock, gray	7′0″
7.	Shale, blue and gray	20′0″
8.	Shale, dark gray	2′0″
9.	Coal, No. 10	0′1″
10.	Shale, bluish-gray	41′0″
11.	Shale, block, hard	2′6″
12.	Coal No. 9	4′0″
13.	Fireclay	3′0″

This shaft was sunk in the fall of 1909 and had just been finished at the time of my visit.

Coals Below No. 9. The coal horizons occuring below No. 9 do not outcrop on the Newberg Sheet, and but one test sufficiently deep to penetrate them has been made.

This test was the well drilled at Newman, (No. 32), by the Freehold Oil Company, and of which the record is given below. It was started in Ohio River Alluvium below the horizon of No. 9 Coal, and was drilled to a depth of 1,050 ft. It therefore, probably penetrated almost, if not quite, to the base of the Coal Measures. A reference to the record will show no coal at all was found.

NEWMAN WELL.

Following is the record of the well drilled by the Freehold Oil and Gas Company on the G. A. Jett farm, at Newman. Authority, W. E. Morris, in charge of drilling:

		Thick.	From	To
1.	Soil	5′	0′	5′
2.	Clay	5′	5′	10′
3.	Sand and gravel (10″ cas. 94′)	115′	10′	125′
4.	Shale (8″ casing 125′)	15′	125′	140′
5.	Sand	10′	140′	150′
6.	Shale	80′	150′	230′
7.	Sand	20′	230′	250′
8.	Shale	50′	250′	300′
9.	Lime	15′	300′	315′
10.	Sand	25′	315′	340′
11.	Shale	10′	340′	350′
12.	Sand	25′	350′	375′
13.	Shale, blue	25′	375′	400′
14.	Slate, white	25′	400′	425′
15.	Shale	25′	425′	450′
16.	Sand	20′	450′	470′
17.	Shale	10′	470′	480′
18.	Sand	10′	480′	490′
19.	Shale	10′	490′	500′
20.	Shale, white	25′	500′	525′
21.	Sand	10′	525′	535′
22.	Shale	15′	535′	550′
23.	Sand	50′	550′	600′
24.	Shale, black (6¼″ casing 617′)	25′	600′	625′
25.	Shale, white	25′	625′	650′
26.	Sand, black	25′	650′	675′
27.	Shale, white	25′	675′	700′

		Thick.	From	To
28.	Shale, black	25′	700′	725′
29.	Shale, white	45′	725′	770′
30.	Salt Sand	45′	770′	815′
31.	Slate	5′	815′	820′
32.	Sand, white	5′	820′	825′
33.	Sand, black	55′	825′	880′
34.	Slate	10′	880′	890′
35.	Sand, white	25′	890′	915′
36.	Sand, black	25′	915′	940′
37.	Sand, black, (5″ casing, 958′)	18′	940′	958′
38.	Sand, white	17′	958′	975′
39.	Sand, light	55′	975′	1030′
40.	Slate, black	20′	1030′	1050′

At 32 ft. good vein of fresh water. At 90 ft. good vein of fresh water. At 770 ft. struck vein of mineral saltwater, which two hours after being struck was overflowing the casing.

The writer visited this well after it had been completed to a depth of 1,050 ft., when the record given above was obtained. The well was afterward deepened to a reported depth of 1,200 ft., but the record of the last 150 ft. was never obtained. No oil or gas, however, appears to have been found.

That all the veins, as was found to be the case at Newman, are generally absent over all that portion of the Newberg Quadrangle covered by this report, may be doubted. This record, however, when added to the balance of the information at hand, but further indicates that there is small likelihood of finding a workable vein under the area in question.

Ohio-Green River Flats. The extensive alluvial area, extending southward from the Ohio River to and beyond Green River, has been eroded to depths varying from 125 to about 150 ft. This amount of erosion has been sufficient to remove all coals down to point 100 ft. or more below the No. 9 bed, or, if the usual interval prevails here, as may be expected, to a point just below the horizon of the No. 8 vein of coal. Only those veins lying below the No. 8 Coal, therefore, could possibly be expected generally to occur under this region, and since these beds, if not wholly absent, are probably thin, it would appear, that this region is practically valueless for coal purposes.

The direction and extent of the principal faults and synclines as described in this bulletin and drawn on the accompanying maps may be very much changed by future work in this field. As at present outlined, the data on which their locations are based by the author would seem to be entirely too meager to justify any such definite conclusions as are drawn by him.

J. B. Hoeing,

State Geologist.

Frankfort, Ky.,
November, 1913.

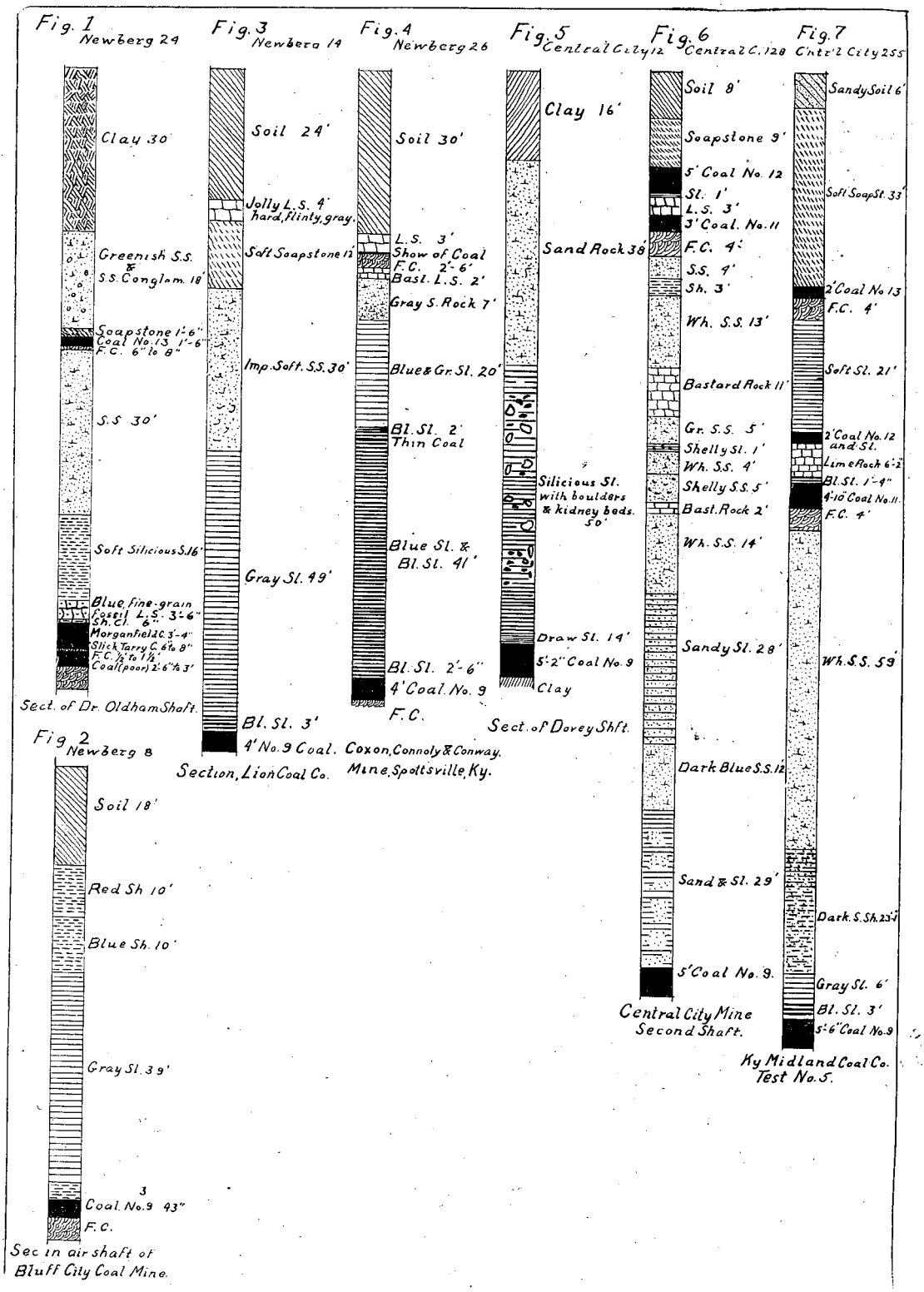
Fig. 1
Newberg 24
Clay 30'
Greenish S.S. & S.S. Conglom. 18'
Soapstone 1'-6"
Coal No. 13 1'-6"
F.C. 6" to 8"
S.S 30'
Soft Silicious S. 16'
Blue fine-grain fossil L.S. 3'-6"
Sh. Cl. 6"
Morganfield C. 3'-4"
Slick Tarry C. 6" to 8"
F.C. ½ to 1½'
Coal (poor) 2'-6" to 3'
Sect. of Dr. Oldham Shaft
Fig. 3
Newberg 14
Soil 24'
Jolly L.S. 4' hard, flinty, gray.
Soft Soapstone 11'
Imp. Soft. S.S. 30'
Gray Sl. 49'
Bl. Sl. 3'
4' No. 9 Coal.
Section, Lion Coal Co.
Fig. 4
Newberg 26
Soil 30'
L.S. 3'
Show of Coal
F.C. 2'-6"
Basl. L.S. 2'
Gray S. Rock 7'
Blue & Gr. Sl. 20'
Bl. Sl. 2'
Thin Coal
Blue Sl. & Bl. Sl. 41'
Bl. Sl. 2'-6"
4' Coal No. 9
F.C.
Coxon, Connoly & Conway.
Mine, Spottsville, Ky.
Fig. 5
Central City 12
Clay 16'
Sand Rock 38'
Silicious Sl. with boulders & kidney beds. 50'
Draw Sl. 14'
5'-2" Coal No. 9
Clay
Sect. of Dovey Shft.
Fig. 6
Central C. 128
Soil 8'
Soapstone 9'
5' Coal No. 12
Sl. 1'
L.S. 3'
3' Coal. No. 11
F.C. 4'
S.S. 9'
Sh. 3'
Wh. S.S. 13'
Bastard Rock 11'
Gr. S.S. 5'
Shelly Sl. 1'
Wh. S.S. 4'
Shelly S.S. 5'
Bast. Rock 2'
Wh. S.S. 14'
Sandy Sl. 28'
Dark Blue S.S. 12'
Sand & Sl. 29'
5' Coal No. 9.
Central City Mine
Second Shaft.
Fig. 7
Cntr'l City 255
Sandy Soil 6'
Soft Soapst. 33'
2' Coal No. 13
F.C. 4'
Soft Sl. 21'
2' Coal No. 12 and Sl.
Lime Rock 6'-2"
Bl. Sl. 1'-9"
4'-10" Coal No. 11.
F.C. 4'
Wh. S.S. 59'
Dark. S. Sh. 23'-7"
Gray Sl. 6'
Bl. Sl. 3'
5'-6" Coal No. 9
Ky Midland Coal Co.
Test No. 5.
Fig 2
Newberg 8
Soil 18'
Red Sh 10'
Blue Sh. 10'
Gray Sl. 39'
3
Coal No. 9 43"
F.C.
Sec in air shaft of
Bluff City Coal Mine.

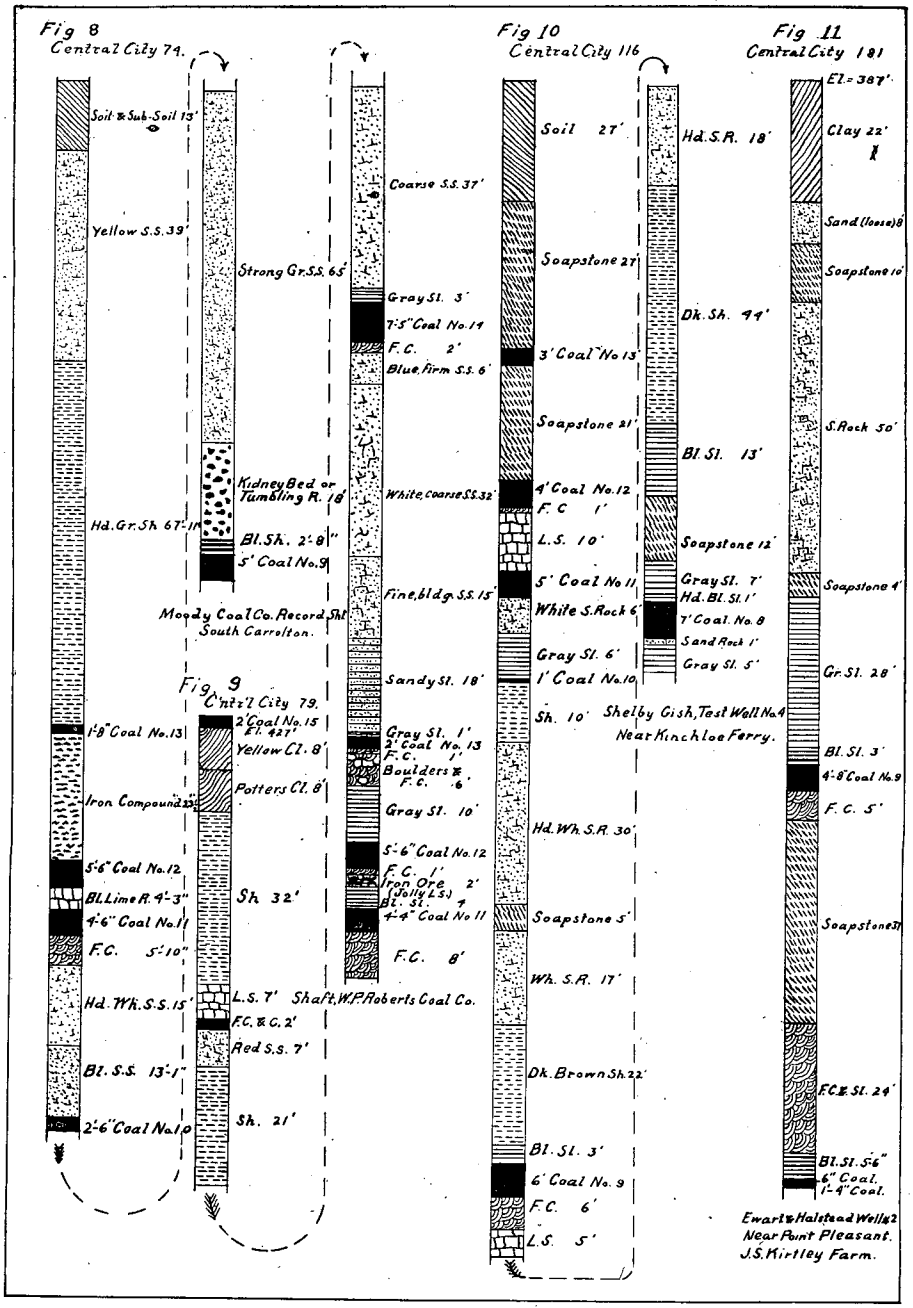
Fig 8
Central City 74.
Soil & Sub-Soil 13'
Yellow S.S. 39'
Hd. Gr. Sh 67'-11"
1'-8" Coal No. 13
Iron Compound 2"
5'-6" Coal No. 12
Bl. Lime R. 4'-3"
4'-6" Coal No. 11
F.C. 5'-10"
Hd. Wh. S.S. 15'
Bl. S.S. 13'-1"
2'-6" Coal No. 10
Strong Gr. S.S. 65'
Kidney Bed or Tumbling R. 18'
Bl. Sh. 2'-8"
5' Coal No. 9
Moody Coal Co. Record Sht South Carrollton.
Fig 9
Cntr'l City 79.
2' Coal No. 15
El. 427'
Yellow Cl. 8'
Potters Cl. 8'
Sh 32'
L.S. 7'
F.C. & C. 2'
Red S.S. 7'
Sh. 21'
Shaft, W.P. Roberts Coal Co.
Coarse S.S. 37'
Gray Sl. 3'
7'-5" Coal No. 14
F.C. 2'
Blue Firm S.S. 6'
White coarse S.S. 32'
Fine, bldg. S.S. 15'
Sandy Sl. 18'
Gray Sl. 1'
2' Coal No. 13
F.C. 1'
Boulders & F.C. 6'
Gray Sl. 10'
5'-6" Coal No. 12
F.C. 1'
Iron Ore 2'
(Jolly L.S.)
Bl. Sl. 4'
4'-4" Coal No. 11
F.C. 8'
Fig 10
Central City 116
Soil 27'
Soapstone 27'
3' Coal No. 13'
Soapstone 21'
4' Coal No. 12
F.C 1'
L.S. 10'
5' Coal No. 11
White S. Rock 6'
Gray Sl. 6'
1' Coal No. 10
Sh. 10'
Hd. Wh. S.R. 30'
Soapstone 5'
Wh. S.R. 17'
Dk. Brown Sh. 22'
Bl. Sl. 3'
6' Coal No. 9
F.C. 6'
L.S. 5'
Hd. S.R. 18'
Dk. Sh. 94'
Bl. Sl. 13'
Soapstone 12'
Gray Sl. 7'
Hd. Bl. Sl. 1'
7' Coal No. 8
Sand Rock 1'
Gray Sl. 5'
Shelby Gish, Test Well No. 4
Near Kinchloe Ferry.
Fig 11
Central City 181
El. = 387'
Clay 22'
Sand (loose) 8'
Soapstone 10'
S. Rock 50'
Soapstone 4'
Gr. Sl. 28'
Bl. Sl. 3'
4'-8" Coal No. 9
F.C. 5'
Soapstone 37'
F.C. & Sl. 24'
Bl. Sl. 5'-6"
6" Coal.
1'-4" Coal.
Ewart & Halstead Wells 2
Near Point Pleasant.
J.S. Kirtley Farm.

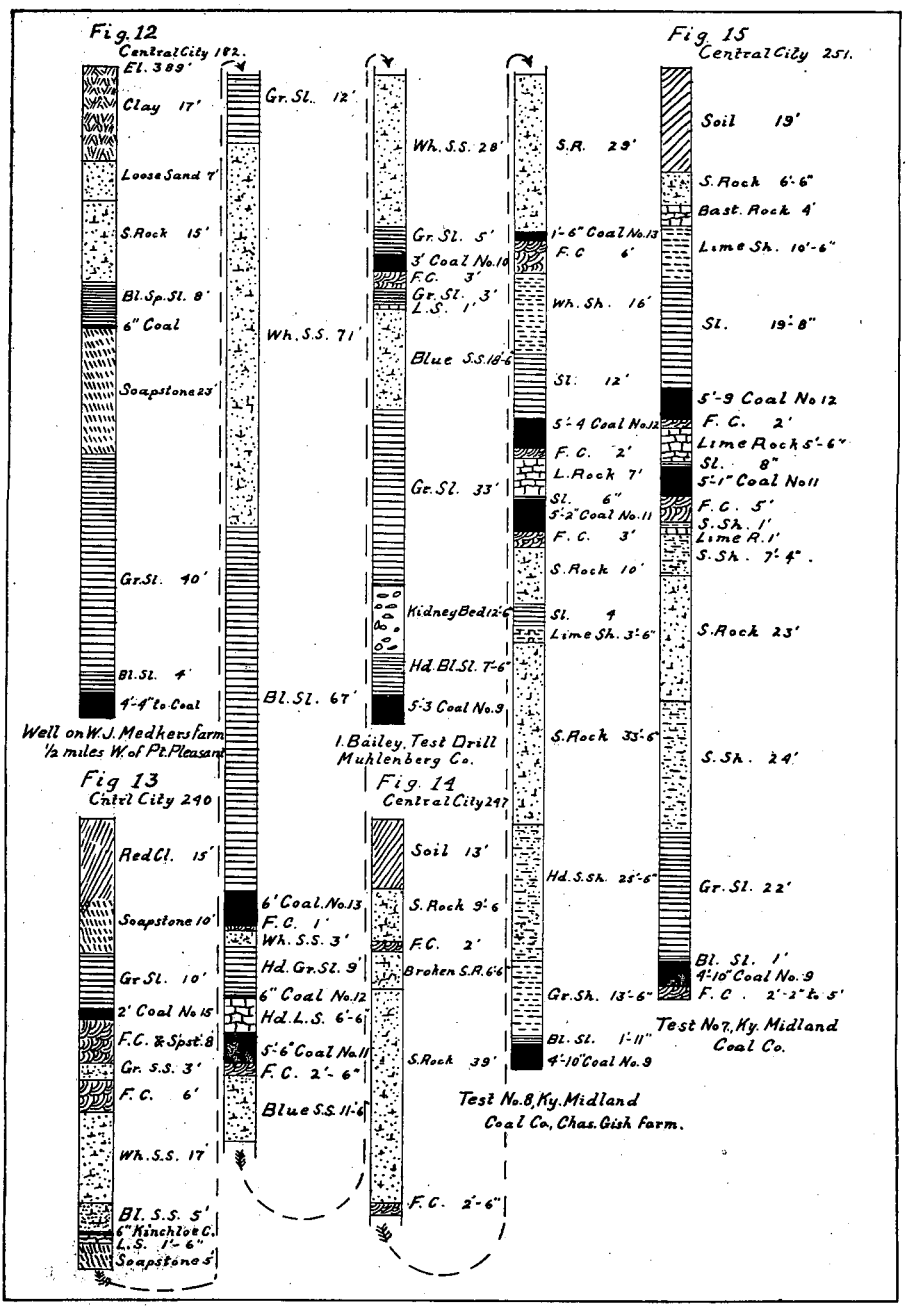
Fig. 12
Central City 182.
El. 389'
Clay 17'
Loose Sand 7'
S. Rock 15'
Bl. Sp. Sl. 8'
6" Coal
Soapstone 23'
Gr. Sl. 40'
Bl. Sl. 4'
1'-4" to Coal
Well on W. J. Medkers farm
½ miles W. of Pt. Pleasant
Gr. Sl. 12'
Wh. S.S. 71'
Bl. Sl. 67'
Wh. S.S. 28'
Gr. Sl. 5'
3' Coal No. 14
F.C. 3'
Gr. Sl. 3'
L.S. 1'
Blue S.S. 18'-6
Gr. Sl. 33'
Kidney Bed 12'-6
Hd. Bl. Sl. 7'-6"
5'-3 Coal No. 9
I. Bailey, Test Drill
Muhlenberg Co.
S.R. 29'
1'-6" Coal No. 13
F.C 6'
Wh. Sh. 16'
Sl. 12'
5'-4 Coal No. 12
F.C. 2'
L. Rock 7'
Sl. 6"
5'-2" Coal No. 11
F.C. 3'
S. Rock 10'
Sl. 4
Lime Sh. 3'-6"
S. Rock 33'-6
Hd. S. Sh. 25'-6"
Gr. Sh. 13'-6"
Bl. Sl. 1'-11"
4'-10" Coal No. 9
Test No. 8, Ky. Midland
Coal Co., Chas. Gish Farm.
Fig. 15
Central City 251.
Soil 19'
S. Rock 6'-6"
Bast. Rock 4'
Lime Sh. 10'-6"
Sl. 19'-8"
5'-9 Coal No. 12
F.C. 2'
Lime Rock 5'-6"
Sl. 8"
5'-1" Coal No. 11
F.C. 5'
S. Sh. 1'
Lime R. 1'
S. Sh. 7'-4".
S. Rock 23'
S. Sh. 24'
Gr. Sl. 22'
Bl. Sl. 1'
4'-10" Coal No. 9
F.C. 2'-2" to 5'
Test No. 7, Ky. Midland
Coal Co.
Fig 13
Civil City 240
Red Cl. 15'
Soapstone 10'
Gr. Sl. 10'
2' Coal No. 15
F.C. & Spst. 8
Gr. S.S. 3'
F.C. 6'
Wh. S.S. 17'
Bl. S.S. 5'
6" Kinchloe C.
L.S. 1'-6"
Soapstone 5'
6' Coal No. 13
F.C. 1'
Wh. S.S. 3'
Hd. Gr. Sl. 9'
6" Coal No. 12
Hd. L.S. 6'-6"
5'-6" Coal No. 11
F.C. 2'-6"
Blue S.S. 11'-6
Fig. 14
Central City 247
Soil 13'
S. Rock 9'-6
F.C. 2'
Broken S.R. 6'-6
S. Rock 39'
F.C. 2'-6"

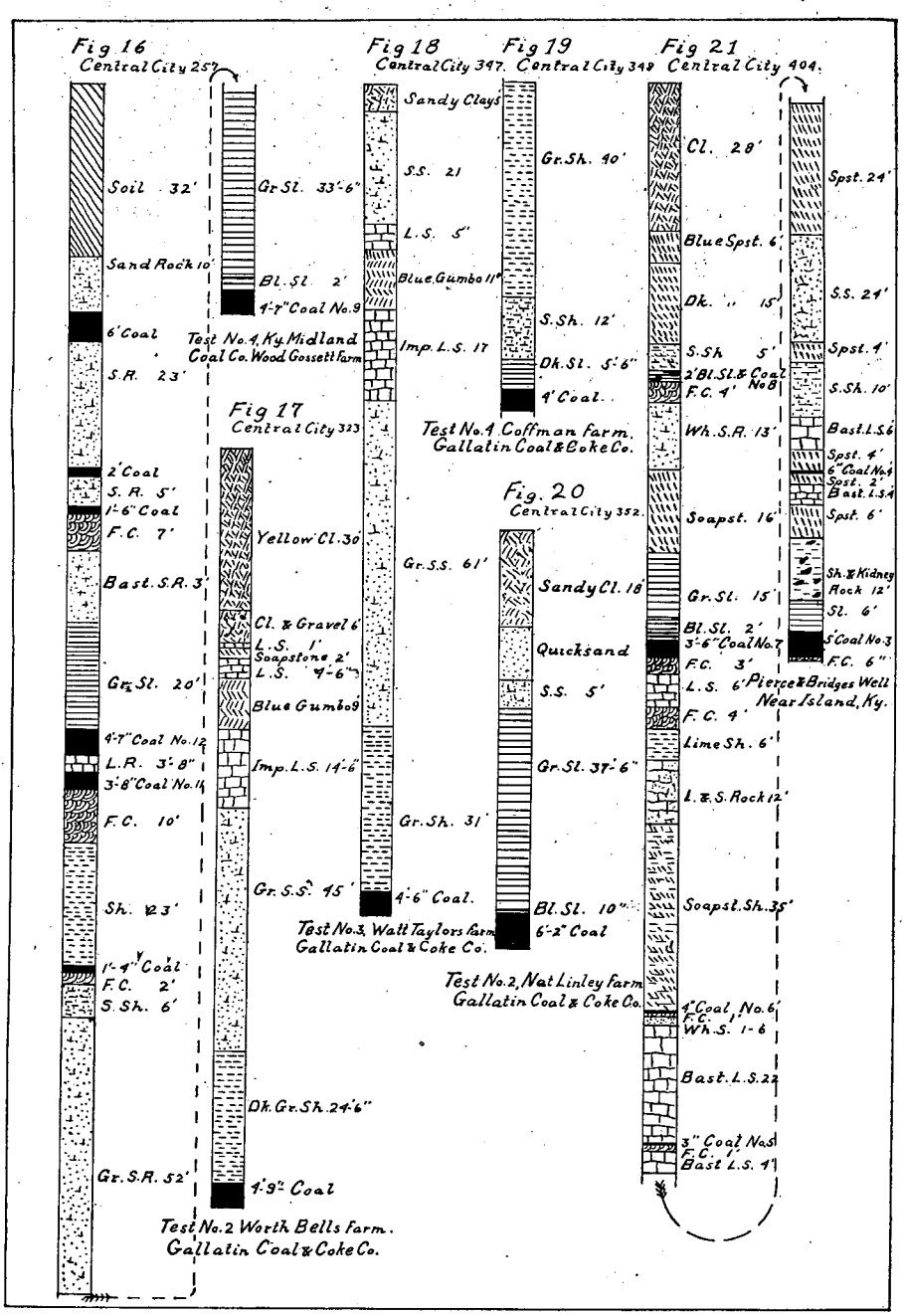
Fig 16
Central City 257
Soil 32'
Sand Rock 10'
6' Coal
S.R. 23'
2' Coal
S. R. 5'
1'-6" Coal
F. C. 7'
Bast. S.R. 3'
Gr. Sl. 20'
4'-7" Coal No. 12
L.R. 3'-8"
3'-6" Coal No. 11
F. C. 10'
Sh. 23'
1'-4" Coal
F.C. 2'
S. Sh. 6'
Gr. S.R. 52'
Gr. Sl. 33'-6"
Bl. Sl. 2'
4'-7" Coal No. 9
Test No. 1, Ky. Midland Coal Co. Wood Gossett farm
Fig 17
Central City 323
Yellow Cl. 30'
Cl. & Gravel 6'
L.S. 1'
Soapstone 2'
L.S. 4'-6"
Blue Gumbo 9'
Imp. L.S. 14'-6"
Gr. S.S. 15'
Dk. Gr. Sh. 24'-6"
1'-9½" Coal
Test No. 2 Worth Bells farm.
Gallatin Coal & Coke Co.
Fig 18
Central City 347.
Sandy Clays
S.S. 21'
L.S. 5'
Blue Gumbo 11'
Imp. L.S. 17'
Gr. S.S. 61'
Gr. Sh. 31'
4'-6" Coal.
Test No. 3, Walt Taylors farm
Gallatin Coal & Coke Co.
Fig 19
Central City 348
Gr. Sh. 40'
S. Sh. 12'
Dk. Sl. 5'-6"
4' Coal.
Test No. 1 Coffman farm.
Gallatin Coal & Coke Co.
Fig. 20
Central City 352
Sandy Cl. 18'
Quicksand
S.S. 5'
Gr. Sl. 37'-6"
Bl. Sl. 10"
6'-2" Coal
Test No. 2, Nat Linley farm
Gallatin Coal & Coke Co.
Fig 21
Central City 404.
Cl. 28'
Blue Spst. 6'
Dk. " 15'
S. Sh 5'
2' Bl. Sl. & Coal
F.C. 4'
Wh. S.R. 13'
Soapst. 16'
Gr. Sl. 15'
Bl. Sl. 2'
3'-6" Coal No. 7
F.C. 3'
L.S. 6'
F. C. 4'
Lime Sh. 6'
L. & S. Rock 12'
Soapst. Sh. 35'
4' Coal, No. 6
F.C. 1'
Wh. S. 1'-6
Bast. L.S. 22'
3" Coal No. 5
F.C. 1'
Bast L.S. 11'
Spst. 24'
S.S. 24'
Spst. 4'
S. Sh. 10'
Bast. L.S. 6'
Spst. 4'
6" Coal No. 4
Spst. 2'
Bast. L.S. 4'
Spst. 6'
Sh. & Kidney Rock 12'
Sl. 6'
5' Coal No. 3
F.C. 6"
Pierce & Bridges Well
Near Island, Ky.

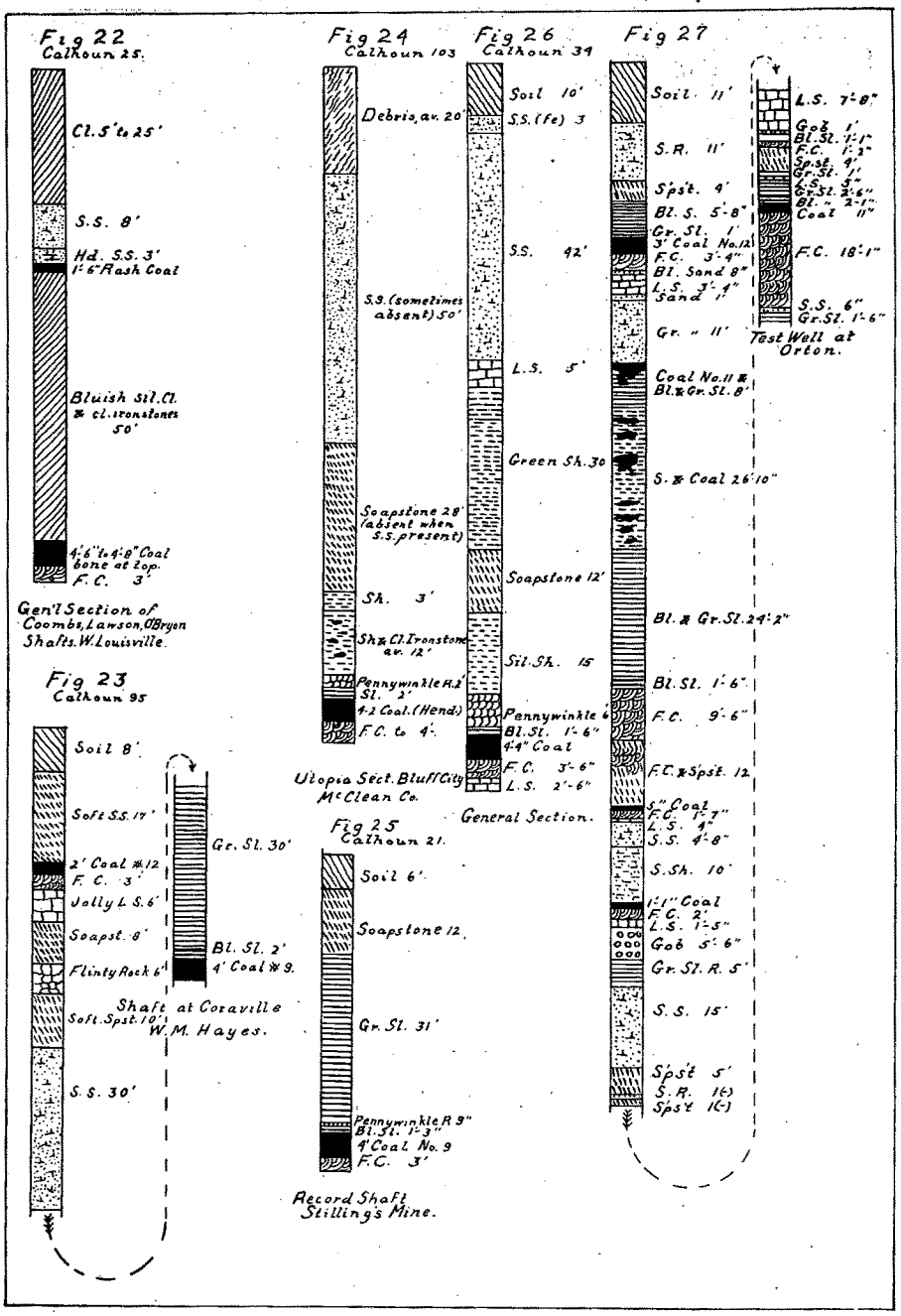
Fig 22
Calhoun 25.
Cl. 5' to 25'
S.S. 8'
Hd. S.S. 3'
1'-6" Rash Coal
Bluish Sil. Cl. & cl. ironstones 50'
4'-6" to 4'-8" Coal bone at top.
F.C. 3'
Gen'l Section of Coombs, Lawson, O'Bryon Shafts. W. Louisville.
Fig 23
Calhoun 95
Soil 8'
Soft S.S. 17'
2' Coal #12
F.C. 3'
Jolly L.S. 6'
Soapst. 8'
Flinty Rock 6'
S.S. 30'
Gr. Sl. 30'
Bl. Sl. 2'
4' Coal #9.
Shaft at Coraville
Soft. Spst. 10'
W.M. Hayes.
Fig 24
Calhoun 103
Debris, av. 20'
S.S. (sometimes absent) 50'
Soapstone 28' (absent when S.S. present)
Sh. 3'
Sh. & Cl. Ironstone av. 12'
Pennywinkle R. 2' Sl. 2'
4-2 Coal. (Hend.)
F.C. to 4'.
Utopia Sect. Bluff City
McClean Co.
Fig 25
Calhoun 21.
Soil 6'
Soapstone 12'
Gr. Sl. 31'
Pennywinkle R 9"
Bl. Sl. 1'-3"
4' Coal No. 9
F.C. 3'
Record Shaft
Stilling's Mine.
Fig 26
Calhoun 34
Soil 10'
S.S. (Fe) 3
S.S. 92'
L.S. 5'
Green Sh. 30
Soapstone 12'
Sil. Sh. 15
Pennywinkle 6
Bl. Sl. 1'-6"
4'-4" Coal
F.C. 3'-6"
L.S. 2'-6"
General Section.
Fig 27
Soil 11'
S.R. 11'
Spst. 4'
Bl. S. 5'-8"
Gr. Sl. 1'
3' Coal No. 12
F.C. 3'-4"
Bl. Sand 8"
L.S. 3'-4"
Sand 1'
Gr. " 11'
Coal No. 11 & Bl. & Gr. Sl. 8'
S. & Coal 26'-10"
Bl. & Gr. Sl. 24'-2"
Bl. Sl. 1'-6"
F.C. 9'-6"
F.C. & Spst. 12
4" Coal
F.C. 1'-7"
L.S. 4"
S.S. 4'-8"
S.Sh. 10'
1'-1" Coal
F.C. 2'
L.S. 1'-5"
Gob 5'-6"
Gr. Sl. R. 5'
S.S. 15'
Spst 5'
S.R. 1(-)
Spst (-)
L.S. 7'-8"
Gob 1'
Bl. Sl. 1'-1"
F.C. 1'-2"
Spst. 9"
Gr. Sl. 1'
L.S. 3'
Gr. Sl. 2'-6"
Bl. " 2'-1"
Coal 11"
F.C. 18'-1"
S.S. 6"
Gr. Sl. 1'-6"
Test Well at Orton.

Fig 28
Madisonville 150

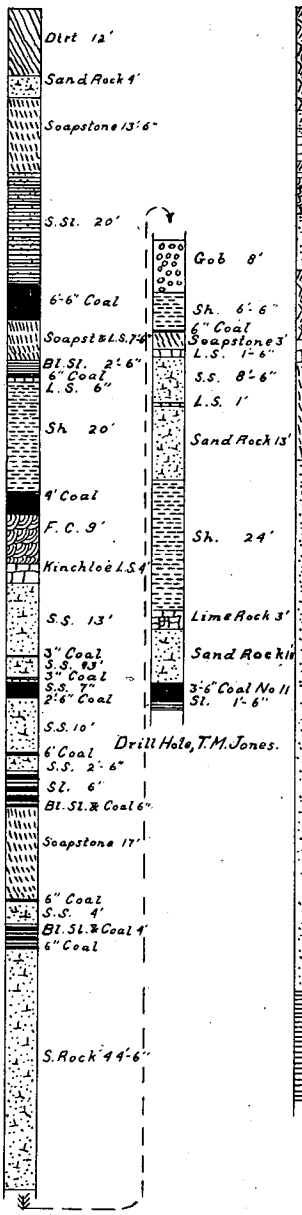

Fig 29
Madisonville 111.