GEOLOGICAL SURVEY OF KENTUCKY.

N. S. SHALER, DIRECTOR.

ON THE GEOLOGY

OF

HANCOCK COUNTY,

BY P. N. MOORE.

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ON THE GEOLOGY OF HANCOCK COUNTY.

SURFACE FEATURES.

Hancock county is one of the smallest counties of Western Kentucky. It has an area of 168 square miles. Its northern boundary is the Ohio river, which, while flowing around this county, makes two large bends toward the north, so that the point where the county line comes to the river at the mouth of Blackford creek, on the western edge of the county, is further north than the point where the eastern line leaves it below Cloverport. Breckinridge county joins Hancock on the east, Ohio lies on the south, and Daviess on the west.

The principal stream of Hancock county is Blackford creek, which drains a larger part of its area than any other, and forms the county line on the west for a considerable distance. Yellow, Lead, and Indian creeks are other streams flowing into the Ohio river, which drain the northern part of the county, while the head branches of Panther creek drain the extreme southeastern corner, beyond the branches of Blackford creek.

This county does not present a great variety in its topographical features. The highest part of the county is in the extreme southeastern corner, at the head of Panther creek and Tar Fork, where the hills reach a height of more than 400 feet above the Ohio river. From here there is a gradual descent towards the west or northwest, until the hills of the main dividing ridges rarely rise higher than 200 feet above the river, while the general level of the country is much less.

Accompanying this decrease in height, toward the west, there is a change in the character of the hills. The slopes are not so steep, and there is a much larger proportion of level or gently rolling land. Toward the heads of the streams, in

the southeastern corner of the county, the hills are steep and the valleys narrow. The type of topography here seems to be produced by frequently alternating shales and sandstones, no one bed of which is of any great thickness or prominence. It is also partly due to the fact that, lying so near the heads of the streams, erosion has not been so great, as the amount of water in the streams is only that which has fallen upon it, and not the accumulation from above.

Near the Ohio river, in the upper part of the county, above Hawesville, the Conglomerate sandstone is present in considerable thickness, and gives rise to a topography, the principal features of which are comparatively even ridges, with gorge-like valleys and steep cliffs.

The Big Clifty or Tar Spring sandstone, at the base of the Chester Group, is also so heavy and coarse that it produces nearly the same result in the extreme eastern edge of the county, where the Conglomerate does not occur.

The heavy sandstones above the Conglomerate continue this type of topography, though with much less prominent features, and steadily growing less and less so, as far to the west as Hawesville, and for five or six miles back from the river. From here to the southern edge of the county these sandstones grow thinner and less prominent, and the hills lower, with more gentle slopes.

The topography of the western part of the county presents even less variety and fewer prominent features than the eastern portion. The hills are lower, and, especially toward the Ohio river, more gently sloping, and the valleys are wider. The streams, except at their heads, are sluggish, and have wide flat bottoms. In fact, the bottom lands of the Ohio river and the principal creeks form, probably, over one half the total area of the western part of Hancock county.

The prevailing rocks, as indicated by the topography and the exposures, which, however, are rare, are shales or shaly sandstones. On some of the higher ridges a coarse, friable sandstone occurs; but it is so soft and easily worn away that it has little more effect on the topography than if it were shale.

From the larger proportion of bottom land, and the more gentle slope of the hills, this part of Hancock county is much the best agricultural region. The wide and fertile bottoms of the Ohio river afford rich and valuable farms, while the hill land is all tillable, though not so valuable as the bottoms.

GEOLOGY.

The geological formations represented in Hancock county embrace only Carboniferous and Sub-carboniferous rocks, as follows:

Carboniferous, - -	}	Coal measures.
Sub-carboniferous, -	}	Chester Group.
	}	St. Louis Group.

By far the greater portion of the county is embraced within the coal measures, which cover all of the western half of the county, and a large part of the eastern. The Sub-carboniferous rocks are found only in the eastern portion of the county; and as they are, both by area and comparative economic value, of less importance than the coal measures, they will be briefly treated.

The St. Louis Group is represented in this county in a very few places, and then only a very small thickness of the upper limestone is exposed. It is found only in the northeastern corner of the county, below the Big Clifty or Tar Spring sandstone. It is of no economic importance, and is hardly worthy of mention in this place, except as the lowest formation of the county.

THE CHESTER GROUP.

The Chester Group has been so often and fully described in the recent reports of the Geological Survey, that it is not necessary to repeat the description here. The character, thickness, etc., of the rocks of this group, and their area in this county, have been stated in the accompanying report on the "geology of the region adjacent to the eastern border of the western coal field," so that a brief statement is all that

is necessary here. The reader is referred to the above-mentioned report for more detailed information, should he desire it.

The whole thickness of the Chester Group, from the Big Clifty or Tar Spring sandstone, at the base, to the marly shales and marls at the top, is found in Hancock county, and both of the above-mentioned members are remarkably well developed. Chester rocks are found along the whole eastern border of the county, and extend from three to five miles to the west, inside the county, before they pass entirely beneath the drainage. In almost all this area the ridges, at least, are capped with coal measures; but there are a few isolated corners where the whole area is covered by Chester rocks.

One of these is near the Ohio river, at the northeastern corner of the county; but it is only of very small extent. Here occur the extensive marly shale deposits of the Buffalo Wallow, which have been described in the just mentioned report. These marly shales extend back from the river, along the eastern border of the county, nearly to its southern line; but they decrease in thickness in that direction. They are at their maximum near the river. These shales are also found further to the west near the river, and on Indian creek; but here, too, the thickness is comparatively small.

The Chester limestone is found along the river almost to Hawesville; but the last stream near the river in which it is seen is Indian creek. Back from the river, beyond the head of Indian creek, the Hawesville and Fordsville road may be roughly indicated as a boundary line, to the west of which the Chester rocks will not be found above drainage. This limit is given in more detail in the same report above referred to.

Occasionally, in the eastern portion of the county, a thin coal is found in the Chester rocks. It shows near the river above Indian creek, and is reported at low water in the bank of the Ohio river, above Hawesville. It is of no economic value, as it is never workable; but, in spite of this fact, time and labor are occasionally spent by parties in digging into this

coal, in the vain hope that it will prove thicker when followed underground some distance—a hope which, it is needless to say, is never realized.

COAL MEASURES.

The boundary of the coal measures of this county has been already given in the accompanying report, which has been so frequently referred to, and it is shown in the accompanying map by Mr. Page.

Coal-measure rocks are found over nearly the whole of the county, although in the eastern portion they cap only the tops of the hills, the larger part of the area being Chester rocks. From the just indicated line of the disappearance of the Chester rocks, westward to the limits of the county, nothing but coal-measure rocks are found.

We find in Hancock county a maximum thickness of about 475 feet of coal measures, from the base in the eastern part of the county to the highest rocks on the Blackford Creek hills in the western. The greatest thickness measured in any one section is about 200 feet, so that the following general section is obtained by the combination of three typical sections from the eastern, middle, and western portions of the county. Like all general sections, it serves only as an outline or key to the stratification of the county, and is subject to much variation locally. Moreover, in this county the changes in the rocks, which occupy the same geological horizon, are very great, expecially the change from coarse sandstone to shale, and *vice versa;* hence the necessity of the indefinite statement "shale and sandstone," which is used occasionally in the general section. For more detailed illustrations of the character and changes in the rock strata of this county, the reader is referred to the accompanying plates of sections which are drawn from actual measurements at the points named. These sections, with others not published, are the material from which the general section is constructed; but they are more accurate than it is possible to make a general section, which must be averaged from them all:

GENERAL SECTION FOR HANCOCK COUNTY.

24.	Sandstone and shale	20 to 30 feet.	
23.	Coal (?) reported in well	1 "	6 inches
22.	Coarse, friable sandstone	20 to 30 "	
21.	Shale	15 to 20 "	
20.	Coal, Lewsport coal	3 to 4 "	
19.	Shale and sandstone	40 to 45 "	
18.	Coal	1 "	
17.	Shale and shaly sandstone	15 to 25 "	
16.	Limestone	2 to 12 "	
15.	Coal, Adams', Lawson's, Bruner's, &c.	2 to 4 "	
14.	Shale and shaly sandstone	40 to 50 "	
13.	Coal, Jas. Mason's	2 "	
12.	Shale and sandstone	70 to 88 "	
11.	Coal		4 to 10 "
10.	Coarse sandstone locally changing to shale	50 to 80 "	
9.	Coal, Main Hawesville	2 to 4 "	
8.	Shale and sandstone	40 to 50 "	
7.	Coal?		4 "
6.	Shale	25 to 30 "	
5.	Coarse sandstone; upper member of Conglomerate?	20 to 30 "	
4.	Shale	20 to 30 "	
3.	Coal		7 "
2.	Shale	4 to 8 "	
1.	Conglomerate sandstone	35 to 60 "	
	Top of Chester limestone.		

The above section holds good for all of the northern and western portions of the county, and as far south, at the centre of the county, as Sulphur Fork of Blackford creek. The southern and southeastern portions, however, present a very different section, and one that is not so well known as yet. Here the section embraces not more than 150 feet of coal measures, which include two or three thin coals. The rocks are not well exposed, but seem to be thin-bedded sandstones and shales. Exposures and developments are so rare that sufficient time has not been devoted to this region to construct a general section which will be of value. The general section given in the accompanying report for the region adjacent to the eastern border of the coal field is more applicable to the southeastern part of Hancock county than the one just given.

The Conglomerate sandstone is not known in this part of the county, or, if represented at all, it is by a coarse, friable sandstone, which is sometimes found below the lowest coal. Going toward the north, the Conglomerate is first found on Caney and Lead creeks, and near the Ohio river it forms a prominent member of the rock series. It will be referred to further along.

In the plates of sections accompanying this report is reproduced the general section by Dr. D. D. Owen for Hancock county, published in volume I, first series Kentucky Geological Reports. The section as originally published embraced also the Sub-carboniferous rocks of Hancock and Breckinridge counties; but that portion of it is not republished, as it is not of especial interest in the present discussion. Dr. Owen, at the time of the publication of his section, had evidently not examined the western part of Hancock county, as he does not include the highest rocks of the county by about 150 feet—his section extending no higher than the rocks immediately below Hawesville, in the hill above the old Hawes shaft.

A comparison of Dr. Owen's section with the sections in the accompanying plates, and the general section just given, will show considerable differences. The upper part of the section corresponds very closely with the sections obtained by the writer, both in thickness and character of rocks, with the single exception that Dr. Owen records a coal eight inches thick, the second coal above the main Hawesville seam, of which the writer has seen no satisfactory evidence.

The lower portion of the section, from the Main Hawesville coal to the base, is, according to Dr. Owen, about fifty feet thicker than any measurements by the writer; and it also shows one more coal than has been seen by him. Dr. Owen, in his report, states that the evidence upon which he placed this coal in his section was obtained from borings made near Cannelton, Indiana, on the opposite side of the river from Hawesville. There was probably some mistake made in the records of the borings, or, if this coal be present on the Indiana side, it is not on this, for the rocks have been seen at too many exposures to leave any doubt in the matter. It is but due to Dr. Owen also to state, that, in publishing this section, he expressly states that it is only preliminary, and subject to correction.

In volume III, first series Kentucky Geological Reports, page 458, Mr. S. S. Lyon publishes the following addition to

Dr. Owen's section for Hancock county, beginning with the upper coal of that section, and including the higher measures of the western part of the county:

Soft yellow sandstone	20	feet.		
Sandy shale	8	"		
Marly shale, with segregations of limestone	3	"		
Black bituminous shale	4	"		
Lewisport coal	4	"	4	inches.
Covered space	36	"		
Sandy shale	6	"		
Sandstone	2	"		
Coal	1	"		
Covered space	14	"		
Limestone	9	"		
Thin sandstone and sandy shale	16	"		
Calcareous chert beds	7	"		
Marly, sandy, indurated mud	1	"	7	"
Very hard, black, pyritiferous limestone			7	"
Coal. Top of Dr. Owen's section	1	"	6	"

The coal at the base of this section is the coal at the top of the hill above the old Hawes shaft, near Hawesville, the coal mined by Mr. Adams on Lead creek, and the coal found to the southwest, in the vicinity of Utility, and on Caney and Blackford creeks.

This section of Mr. Lyon corresponds very closely with those obtained by the writer in his examinations in this county, some of which are given in the accompanying plates; but there is probably a mistake in the number and thickness of the limestones which are shown at the bottom of the above section. There should be but one limestone here, the same which is shown at the top of Dr. Owen's section. This limestone is from two to ten feet thick, and is usually overlaid by shale or shaly sandstone. There is nowhere in this county, within the observation of the writer, any such thickness of cherty rock, or any second limestone overlying this, as represented by Mr. Lyon.

The limestone above referred to is one of the most persistent strata in the whole county. It has been traced all through the western part of the county, from Hawesville, where it disappears, going up the river to Blackford creek. Through all this region it retains its identity remarkably well, and, in consequence, serves as a valuable geological datum.

Mr. Lyon has shown the proper number and position of the coals in the above section.

The general section of Hancock county shows, therefore, a total of nine different coal seams; four of which, namely, the Main Hawesville, the Mason, the Adams or Hawes Hill, and the Lewisport coals, are well-known persistent seams, and are or have been worked. The other seams, especially the two below the Main Hawesville coal, are thin, of no economic importance, and so little has been seen of them that it is impossible to say whether they are persistent or not, and really deserve a place in the general section.

The equivalency of these seams with those in other parts of Western Kentucky is not entirely determined. The section seems not to exactly resemble any other, heretofore published, for the western coal field. In fact, the changes in this county toward the southeast corner are such as to render identification of seams across even that short distance difficult or impossible. The character of the section in the northern and western parts of the county is such that the coal seams can be much more easily traced and identified. There is a large unexamined area around this county to the south and west, between it and other parts of Western Kentucky, where the coal seams have been identified and numbered; but until this area has been carefully surveyed, and the coals traced across it and connected with those of Hancock county, no certain equivalency can be asserted. It is probable that when this is done some of the coals will be found occupying the positions of certain of the more persistent and trustworthy seams of the western coal field, and that others will be found to be local. In the meantime, the equivalencies which seem the most probable may be stated, but it will be subject to revision.

In the report of the Geological Survey of Indiana for 1872, page 98, Mr. E. T. Cox, the State Geologist of Indiana, while discussing the geology of Perry county, Indiana, which lies across the Ohio river from Hancock county, Kentucky, gives a section at the Hawes mine, including the hill above. This section extends from the Main Hawesville to the Adams

coal, the upper coal of Dr. Owen's general section for this county. Mr. Cox's section is as follows:

Slope.			
Sandstone "Anvil Rock?"			
Sandy shale.			
Limestone	6	feet.	
Coal K, with 12 inches of clay parting	2	"	6 inches.
Sandstone and shale	60	"	
Coal I.			
Sandstone and shale	80	"	
Coal H	1	"	6 "
Sandstone	30	"	
Coal G.	1	"	
Hard, bluish shale	25	"	
Black bituminous shale	15	"	
Coal F, "Hawes Coal"	4	"	

The above section is copied exactly as published by Mr. Cox. He has used his Indiana nomenclature for the different seams, for the purpose of comparison with his sections for Perry county, Indiana. The measurements of this section agree fairly well with those obtained at the same place by the writer, except that the total distance from the main Hawesville coal to the coal at the top of the section is some ten feet greater. Mr. Cox, however, records a coal G, which the writer of this has no certain evidence of. It is probable that Mr. Cox has placed it in the section, from the report of its having been found in the Hawes shaft. It is stated that there was such a coal passed through in sinking the shaft, but it is also denied on equally good authority; and as there is little evidence of it at any other point, it has not been deemed best by the writer to give it a place in the section.

In volume III, 1st series Kentucky Geological Reports, page 563, Mr. Cox, who was then an Assistant of the Kentucky Geological Survey, identifies the coal at the top of this section as No. 11 of the Kentucky general section. This identification is apparently from palæontological evidence only. In the Report of the Indiana Geological Survey, above referred to, he repeats his belief in this identification, and refers to the surprise of himself and Prof. Lesquereux "on finding at Hawes' mine, near Hawesville, the whole of the coal-measure strata, from the 'Anvil Rock' sandstone to the Conglomerate sandstone."

That Prof. Lesquereux did not agree with Mr. Cox in this identification as No. 11, is evident from the fact, that, in his report, volume III, 1st series Kentucky Geological Reports, page 535, he refers to this coal as No. 3. That Mr. Cox is mistaken is readily ascertained by a short examination of the stratigraphy of the western part of Hancock county. The character of the rocks here is shown by the general section and the sections of the accompanying plates. It is shown in these sections that there is a thickness of about 125 feet of strata, including two, and perhaps three seams of coal, one of which is of workable thickness, and is one of the most trustworthy coals in the county, above the coal which Mr. Cox identified as No. 11, and the sandstone which he calls the "Anvil Rock." Of this fact there is the most complete stratigraphical evidence, for the rocks which identify and connect the sections can be traced without difficulty from the Hawes hill to the western part of the county, where they pass under the sections which show the Lewisport coal. This coal is the second seam above the coal at the top of Mr. Cox's section. The distance between is from 60 to 70 feet.

Prof. Lesquereux, in volume III, first series Kentucky Geological Reports, page 544, identifies the Lewisport coal as No. 9. This identification, like that of Mr. Cox, seems to be based entirely upon palæontological evidence. Prof. Lesquereux has, therefore, identified one coal as No. 9, while another, which is known, from the best stratigraphical evidence, to be only 70 feet below, he has called No. 3. Mr. Cox has called the same coal No. 11.

According to Dr. Owen's general section for the western coal field, the normal distance from coal No. 9 to coal No. 3 is about 500 feet. The distances, according to Dr. Owen's section, are undoubtedly somewhat too great, as shown by Mr. Norwood's more recent sections in the central and southern part of the field; but no such great decrease in the thickness is known as would be indicated by the above identification.

These discrepancies and mistakes afford a striking instance of the incompetency of palæontological evidence alone, even

when in the ablest hands, for the identification of coal seams over any great distances. Palæontological evidence is undoubtedly of great value, when used in connection with and as corroborative of stratigraphical evidence, but alone, it is insufficient to give a trustworthy basis for conclusions.

The identification by Prof. Lesquereux of the Lewisport coal as No. 9 is possibly correct, although it is by no means certainly determined, as it yet lacks the stratigraphical evidence necessary to settle its equivalency beyond a doubt; but the position of the coal, its persistence and uniformity of thickness, as well as the evidence from its palæontology, which convinced Prof. Lesquereux, all tend to prove that it is the No. 9 coal, or coal D, using Mr. Norwood's temporary nomenclature for the coal seams of Western Kentucky. If this be the case, it shows a thinning of the section of the western coal field, much beyond even that indicated by Mr. Norwood's sections, in the region adjacent to the Louisville, Paducah and Southwestern Railroad.

The coals of the lower part of the section for Hancock county have not yet, and cannot, in the present state of our knowledge, be positively identified and numbered with the seams of the general section for the western coal field. It has been deemed best, therefore, to give them only the local names, which will serve to identify them throughout the county, and to leave the final numbering until the connection has been traced across the interval which now separates them from parts of the coal field where the identity and equivalency of the coals have been well established.

The number of coals in the general section for the western coal field, and the final nomenclature to be adopted, have not as yet been determined, and it is therefore best, before forcing a classification in any one section, to wait until the field has been more widely studied, and it can be found which coals are persistent and thick over the whole field, and which are only local.

DESCRIPTIVE GEOLOGY.

The geology of the southeastern part of this county has been outlined in the discussion of the topography; and it has been stated that it differs in the character of its prevailing rocks from that part nearer the river. The Conglomerate sandstone is here missing, and there is a greater prevalence of shales and thin sandstones. With one very valuable exception, the coals seem to be thin. It is but justice to say, however, that exposures are rare, and that thorough prospecting does not seem to have been done over much of the region; but where seen, the coals were mostly thin, and they are reported thin at other places where not seen.

The exception above referred to is the celebrated Breckinridge cannel coal, the mines of which lie in the edge of Hancock county, on one of the head branches of Tar Fork. This coal has been made the subject of a special report by Mr. Norwood, in which its value is discussed at length. To this report the reader is referred for detailed information. It is necessary here to repeat only a few facts in regard to its position, etc., in its relation to the general section of the county.

It is a cannel coal of excellent quality, from 24 to 33 inches thick, occurring from 25 to 30 feet above the Chester limestone, with a coarse, micaceous, soft sandstone between. The hills in the vicinity of the mines rise about 100 feet above the coal. There are but few exposures of the rocks above the coal, and a full section has not been obtained. The following section, obtained at a shaft recently sunk in this vicinity, shows a portion of the rocks in the ridge above the coal in more detail than anything heretofore published. The records of the shaft were obtained from Mr. M. R. Taylor, of Cloverport, by whom it was sunk. At the time of visit, the shaft was full of water. The bottom of this shaft is probably 10 or 15 feet above the coal. The exact level was not determined. The location of the shaft is not more than one half mile distant from the entries in the valley:

SECTION.

Soil	9	feet.		
Grey shale	10	"		
Shaly coal			2	inches.
Light shale	10	"		
Band of iron ore			1½	"
Dark bituminous shale	8	"		
Coal			3	"
Very black shale	18	"		
Sandy shale	3	"		
Total	58	"	6½	"

This coal, like all cannel coals, seems to lie in a basin of limited extent, and at a distance of a few miles on all sides it is no longer found. The present mines are in the dividing ridge between a branch of Tar Fork and Panther creek. The drifts are all on the Tar Fork side. On the Panther creek side of the ridge it is reported that the coal has been found at a number of localities; but it was long since the explorations were made, and the openings have all fallen in, so that nothing can now be seen of the coal at any of them.

To the west of this the coal has not been seen by the writer, and very little has been heard in regard to it. At the time of the development of the property extensive explorations were made by the company operating the mines; but nothing has been learned as to the results which they attained. It is probable, however, that the results were negative, or the facts would be known. To the southwest, on Adams' Fork, in Ohio county, is an exposure of cannel coal or cannel shale, which probably occupies the position of this coal. It has been described in the accompanying report on the "Geology of the Region Adjacent to the Eastern Border of the Western Coal Field."

The equivalency of the Breckinridge cannel coal has long been a matter of discussion. It is undoubtedly the lowest workable coal of the section, and, as such, the equivalent of coal No. 1B of the old reports, or coal L, using Mr. Norwood's temporary nomenclature; but, in the opinion of the writer, it occupies an independent basin, and cannot be traced to an absolute identity with any other seam, although it may occupy nearly the same position.

On Panther creek few coals have been seen; but those reported are mostly thin, and have never been worked to any extent, though often opened for exploration.

The Chester limestone disappears below the drainage on Panther creek, near Mr. S. G. Lane's. From here to the western border of the county, in the vicinity of Pellville, the dip of the rocks is slight, not over 20 to 30 feet to the mile. The total thickness of rock above the base of the coal measures is not more than from 200 to 250 feet. The principal features of the topography have been before described. Toward the west the hills decrease in height, and slope more gently, while the prevailing rock is shale. There is a considerable area in the southwestern portion of this county and the adjoining region, in Ohio county, where these characteristics prevail, and where there is an unusual thinning of the coals. The coal best known seems to be the equivalent of the Fordsville coal, described in the accompanying report. It is, however, usually thin, rarely measuring as much as 24 inches in thickness, and more commonly 18. The only workable coal known in this region is at Mr. R. S. Lanum's, in Ohio county, about one and a half miles southwest of Roseville. The coal here at the mouth of the entry, and for some distance back, is only about 20 inches thick; but it gradually increases in thickness, until at end of the drift, about 100 yards in, it measures 40 inches, including 3 inches of slaty coal at the bottom. The equivalency of this coal was not satisfactorily determined, but it is probably coal H. It lies here very near the drainage level, and probably passes below to the west. The following is an analysis by Dr. Peter and Mr. Talbutt of a sample of coal from this bank:

Moisture	6.00	
Volatile combustible matter	37.80	
Fixed carbon	48.70	Coke 56.20
Ash	7.50	
Total	100.00	
Sulphur	3.180	
Specific gravity	1.242	

Going toward the Ohio river, coarse, hard sandstones occur in increasing frequency and thickness, and, in consequence, outcrops are more numerous, and it becomes easier to trace the strata across the country, and to determine the geological horizon at any point.

The most prominent of these sandstones is the Conglomerate. This here, as almost everywhere else in Western Kentucky, is very irregular in its occurrence and thickness. It is first seen going toward the north, near the heads of Caney and Lead creeks. To the west it disappears below the drainage on Caney creek, a short distance above the crossing of the Hawesville and Pellville road; on Lead creek at the same road crossing, and on the Ohio river at the branch which runs through the upper part of the town of Hawesville. Its further continuation to the westward is here cut off by a fault, and a fold or bend in the strata, which bring the rocks on one side of the ravine about 90 feet lower than they are on the other. The absolute fault or slide in the rocks is probably not more than 20 or 25 feet; but there is a very steep dip close to the line of this fault, which brings the rocks down the remainder of this distance before it is modified. This is proved by the fact that the coal has been worked up to the fault line at several places, so that the dip can be very closely followed.

The Conglomerate here consists of two members, only one of which, however, the lower, is commonly known as the Conglomerate. This is here from 35 to 45 feet thick. Above it, separated by from 15 to 30 feet of shale, is another coarse sandstone, from 20 to 35 feet thick, which is also, at places, conglomeratic, being largely composed of small and rather angular quartz pebbles. These pebbles are more abundant further up the river, toward Indian creek, than near Hawesville. There is a thin coal in the shale between these two sandstones, from five to eight feet above the top of the lower. It has occasionally been dug into, in the hope of finding it thick enough for profitable working; but the greatest thickness reported is seven inches.

The presence of two Conglomerates, with a coal between, is not an unusual occurrence in the western coal field. They occur in Edmonson county, and are shown in the sections of part II, volume II, second series Kentucky Geological Reports. They are also noted on the western border of the field, in Livingston county, by Mr. Norwood, in his report, part VII, volume I, second series.

Both of these sandstones, near Hawesville, furnish excellent building stone. They have both been largely quarried, but the upper one most extensively. From the quarries here a large part of the rock for the locks on Green river, for the Government building at Memphis, and other extensive public works, was obtained. A sample of the stone from this quarry received an award at the Centennial Exhibition in Philadelphia in 1876.

About three miles from Hawesville the two sandstones can no longer be distinguished as independent beds, but instead, we have a massive Conglomerate, very conspicuous and frequent in outcrop, about 75 feet in thickness, which seems to represent them both. The change by which this is effected is obscure and has not been traced in as great detail as could be desired; but it is the only hypothesis which satisfactorily explains certain apparent great changes in the position of the coals above.

About 60 feet above the lower Conglomerate, and 20 feet above the upper or quarry sandstone, in the river hills above Hawesville, a thin coal is reported to have been found at several places. It is stated as only four inches thick, and therefore of no economic importance. It has not been seen by the writer except in very indistinct outcrop; but the authority upon which it is reported is so good, that there is little hesitation in placing it in the section. It is shown in plate I of the accompanying sections. This coal, and the other thin coal lying close to the top of the lower Conglomerate, occur on the opposite side of the river in Indiana, and are shown in the sections of Mr. Cox's report on the geology of Perry county. These sections of Mr. Cox uniformly show

greater distances between coals than have been obtained by the most careful measurements on the Kentucky side of the river; but otherwise they generally bear a close resemblance in the character and order of the different strata.

There is but a very small area in Hancock county where these two coals are known, as they pass below the drainage to the west about the same time the Conglomerate does, and to the east the lower one disappears with the change in the Conglomerate just referred to, while the upper of the two, even if it extend as far as the underlying Conglomerate, has but a very limited range. It is only known in the immediate vicinity of Hawesville.

THE MAIN HAWESVILLE COAL.

At 110 feet above the lower or main Conglomerate, occurs the coal which is best known, has been most worked, and is of most value in Hancock county. It is generally known as the Main Hawesville coal, a name which was used in the 1st series Kentucky Geological Reports, and which will be retained here. It is the same coal as the Cannelton coal of Perry county, Indiana.

The coal varies greatly in thickness, occurring over considerable areas, ridges, as it were, in the coal seam, where it is hardly more than a streak, and then covering other areas, where it is from 3 to 4 feet thick. In the mines where it is worked, it varies from 2 to 4 feet, with an average of perhaps a little more than 3. Below the coal, between it and the fireclay, is commonly found a very hard bituminous slate, which ranges from 4 inches upward, becoming thicker as the coal thins, until it often forms the main body of the seam. The upper part of the seam is usually of a semi-cannel coal, but this is only a few inches. The main portion is a rather dry bituminous coal, of very good quality.

The distance between this coal and the main Conglomerate is not as great as stated in the reports of Dr. Owen, nor as reported in Perry county, Indiana, by Mr. Cox, who places the distance at 148 feet, in Cannelton. It has been measured

carefully with aneroid barometer, hand level, and finally with spirit level and rod; and in no case has it, near Hawesville, been found more than 115 feet. This coal, above Hawesville, at the old mines, is about 150 feet above high water in the Ohio river. From here it dips to the west, until, just above Hawesville, it is about 100 feet above. The fault and bend in the rocks before referred to, at the upper edge of Hawesville, bring the coal down to 10 or 15 feet above, and at the lower edge of town it is near the level of high water or a little below. Here another fold occurs, which increases the dip, until, less than a mile below, the coal was found in the old Hawes shaft, before referred to, 70 feet below high water in the Ohio. These disturbances in the rocks do not seem to extend to the south beyond Lead creek. The coal has been worked through the hill from Hawesville to Lead creek, west of the fault line. There is probably a cross-fault running down the valley of Lead creek; for, on the north of the creek, where this coal has been worked, it is about 25 feet above the creek, while on the hill south, in the old Pellville road, the same coal is 135 feet above. This fault does not seem to extend more than one half mile above the Pellville road crossing, as above this the coal occupies very nearly the same level on both sides of the creek.

At the Hancock mines, in the ridge between the waters of Indian and Lead creeks, a little more than three miles southeast of Hawesville, this coal is only from 50 to 55 feet above the top of the Conglomerate, which is here at its maximum thickness. The different members cannot be distinguished here, and it is probable that the upper and the lower are united. The space between the top of the Conglomerate and the main coal is covered, so that nothing could be learned as to the presence of the thin coal next below it. The decrease in the distance between the main coal and the Conglomerate, at this place, is marked. It is even less than the usual distance from the top of the second Conglomerate or quarry sandstone to the coal, and about half the distance from the lower Conglomerate. This decrease occurs in less

than two miles distance from some of the old drifts above Hawesville, where the coal is at its normal height above the Conglomerate.

If this decrease in the distance between the coal and Conglomerate toward the southeast be continued beyond the head of Lead creek, it strengthens the hypothesis of the equivalency of the Main Hawesville and the Breckinridge cannel coals, both of which were classed as No. 1B by Prof. Lesquereux, in volume III, first series Kentucky Geological Reports. The stratigraphical evidence has, heretofore, seemed strongly against any such equivalency; but the disappearance of one of the thin coals below the Main Hawesville seam, and the probable disappearance of the other, the persistence of the main seam, and the lessening of the distance between it and the Conglomerate, all tend to encourage the hypothesis that further to the southeast this coal may be the lowest coal of the basin, as it is here undoubtedly the lowest workable seam. This, however, has not as yet been proved, and cannot be until the coal has been carefully traced across the intervening space between the Hancock and the Breckinridge mines—a matter of much difficulty as yet, as hardly any openings have been made, and natural outcrops are extremely rare.

The Hancock mines are the most extensively worked, at present, of any in this county. They are owned by the American Cannel Coal Company, of Cannelton, Indiana. The coal is shipped to the river by a railroad about two and one half miles in length, the grade of which is sufficient to allow the cars to run of their own weight to the river, from which they are hauled back by mule power.

The main coal has been mined in the vicinity of Hawesville for more than thirty years past. The old Reverdy and Trabue mines were among the first and largest on the lower Ohio. At present, however, nearly all of the available coal in the river hills near Hawesville, between the river and Lead creek, has been exhausted, and no mining is now carried on here, save in a desultory manner for local supply, in corners and patches, which were left unexhausted when the large mines

were abandoned. All of these mines were worked by drifts. At the old Hawes mine, below Hawesville, the coal was reached by a shaft variously reported from 60 to 80 feet deep. The mine, however, running under the Ohio river bottoms, was a very wet one, and finally had to be abandoned on account of the great influx of water, although the coal available from the shaft was not exhausted.

In the vicinity of Hawesville, the coal is reported to have been very irregular in thickness, frequently occurring over considerable areas entirely too thin to be worked. These areas probably occur at the summits or ridges of waves in the coal seam. In the country back of Hawesville there is yet a large area of this coal of workable thickness, good quality, and wholly undeveloped. In fact, it has hardly been fairly prospected; but enough is known to justify the assertion that there is here a vast amount of cheaply available coal. It is to this region that the people of Hawesville and the central part of Hancock county must look for a renewal of their former mining prosperity. The supply of coal is ample, both in thickness and area, for many years of continued and extensive mining operations.

In the ridge between Lead and Caney creeks, south of Hawesville, this coal has been opened at a number of places, but at only one of these, near the Hartford road, was it seen. This is called the Breckinridge bank. The coal is here 44 inches thick, but this includes 6 inches of bituminous slate at the bottom; so that the clear coal measures only 38 inches. Near the old Pellville road, the coal has been opened in two places; but they have now fallen in, so that nothing could be seen of the thickness. It is reported to be 3 feet thick; but this is denied by others, and the statement is made that it was found too thin to work. The fact that the drifts were abandoned without mining any amount of coal tends to confirm this statement. The coal dips rapidly to the west from the old Pellville road, where, as already stated, it is 135 feet above Lead creek, until it is only found above the drainage level a short distance west of the new Pellville road. This rapid dip

is probably produced by the continuation to the southward of one of the folds which were noted at Hawesville. The same coal is now being worked in a small way on the waters of Lead creek, between the creek and the river, some distance above the Hartford road. Here, at the time of visit, the coal measured 34 inches, and the under slate 14. Little is known of the coal on the south branches of Lead creek, above here, until at the head of the creek, in the ridge between it, Caney creek, and Sulphur fork of Blackford, where a bank was formerly opened, and the coal hauled to Cloverport. It is reported to be nearly 4 feet thick at this place, but access could not be had to it to measure it, as the drift had partially fallen in. From what could be seen, however, it seems likely that the thickness is not very greatly overestimated.

On Caney creek, and in the ridge between that stream and Blackford creek, this coal is well developed, and has been opened at a number of localities sufficiently well to show its character and thickness. The nearest opening to the one just described is at Mr. J. Richey's. Here the coal is so near the level of the creek that the drifts had filled with water at time of visit, and the coal could not be measured; but it is reported to be three feet thick.

About one mile west, at the Jesse Rice bank, the coal has been opened, and shows a thickness of forty-seven inches, including three inches of bottom slate.

Still further down the creek Mr. Jacob Royall has a drift in this coal, where it is forty-two inches thick. This drift is near the Pellville road.

There is a marked undulation in the rocks along Caney creek between the crossings of the Fordsville and the Pellville roads. At Mr. Richey's, in the Fordsville road, the coal is near the level of the creek. At the Jesse Rice bank it is 30 to 40 feet above. Between the Hartford and the Pellville roads, at Mr. T. Burkis', the Conglomerate rises to 20 or 30 feet above the creek level, descending rapidly again to the west, and passing below the creek before the Pellville road is

reached. The coal at the Royall bank is about 60 feet above Caney creek.

This reversal of dip may be due to some as yet undiscovered fault or faults, the continuation to the southward of the more marked disturbances at the river; but the region has not yet been studied in sufficient detail to justify the positive assertion that this is the case.

On the Blackford creek side of the ridge the coal has only been seen well exposed at one locality—Mr. John C. Schafer's bank. It is on a small branch running into Blackford creek below the Pellville road crossing, and about one mile distant from the creek. It is about 50 feet above the creek. The coal here is of excellent quality, being freer from sulphur than at any other place from which a sample has been analyzed. It is 43 inches thick, including about one and one half inches of shale parting.

The same coal was formerly opened on the old Taylor place, near the Blackford Meeting-house, on the Pellville road. It is reported to be about the same thickness as at the Schafer bank. South of Blackford creek the coal was formerly opened at Mr. Glover's, on the Pellville road; but it cannot be seen now. It is reported 30 inches thick. At Mr. Baker's, where it is next seen beyond Mr. Glover's, it is only 18 inches thick. Beyond Mr. Baker's to the south, the coal has not been positively identified. To the westward it passes below the drainage between the Pellville and Knottsville roads, and a higher coal becomes the best known seam.

QUALITY OF THE MAIN HAWESVILLE COAL.

The following analyses, by Dr. Peter and Mr. Talbutt, Chemists of the Survey, from samples selected by the writer, serve to show the chemical composition of the coal from this seam. The samples were intended to be as nearly representative of the whole thickness of the coal as possible:

	1	2	3	4	5
Moisture	5.12	3.30	5.20	5.10	7.46
Volatile combustible matter	36.28	39.00	38.70	41.20	33.14
Fixed carbon	47.60	50.50	48.50	46.60	55.20
Ash	11.00	7.20	7.60	7.10	4.20
Total	100.00	100.00	100.00	100.00	100.00
Coke	58.60	57.70	56.10	53.70	59.40
Sulphur	4.038	3.373	2.266	3.331	1.368
Specific gravity	1.357	1.268	1.336	1.292	1.308

No. 1 is from the Hancock mines.

No. 2 is from the Davidson bank, near Lead creek, above Hawesville.

No. 3 is from the Bergenroth bank, Lead creek.

No. 4 is from the Bridenbach bank, south of Lead creek.

No. 5 is from the Schafer bank, near Blackford creek.

It is probable that, in selecting the sample No. 1 from the Hancock mine, too much coal was taken from the lower part of the seam, where it is becoming slaty; hence the per centage of ash is probably shown larger than the proper average of the whole seam.

The character of the rocks above the Hawesville coal is subject to great variation. Shales and coarse sandstones alternately overlie the coal, and change from one to the other frequently. Near the Hancock mines, it is reported that in one of the exploration shafts sunk when the property was in process of development, a thickness of 50 feet of shale was passed through before reaching the coal. Above this shale, however, a coarse sandstone from 20 to 25 feet thick occurs.

Nearer Hawesville, at the old Reverdy mines, a coarse sandstone occurs from 15 to 20 feet above the coal; the space between is probably filled with shale, but it is covered so that it was not seen.

At the upper part of the town of Hawesville there is a thickness of about 50 feet of shale above the main coal, between it and the massive sandstone which caps the hill here.

Near the top of this shale a thin coal is reported, but has only been seen here by the writer as a "stain."

It is probable that this is the first coal given in the general section above the main coal. Below the fault at this place the sandstone comes rapidly down to the coal, until at the old drifts, in the lower part of town, it is almost immediately above, separated by only from 5 to 7 feet of shale. A second sandstone appears here about 30 feet above the first, and the coal next above the Main Hawesville lies between them, about 60 feet above it. This coal was once opened here, it is reported, and found to be about one foot thick. The character of the rocks here is shown by a section in plate I. South of Lead creek, as far as Blackford creek, the coal is closely overlaid by a coarse sandstone about 30 feet thick. Beyond Blackford creek this sandstone disappears.

The fold in the rocks, at the lower edge of the town of Hawesville, brings the coal next above the main seam down to the level of a small branch called Persimmon run, about one half mile below town. The coal is here washed bare in the bed of the branch. It is only 4 inches thick, but is overlaid by from 2 to 3 feet of very bituminous shale, which gradually changes at the top to clay shale. The section here is as follows:

Hard sandstone	6 feet
Covered space	10 "
Clay shale	10 "
Bituminous shale	2 "
Coal	4 inches.

This is probably the same coal which was once opened a little above high water mark, near the mouth of the old Hawes shaft. Its position is shown in the section at this place, plate II. The coal, which is reported to have been formerly exposed in the bed of Lead creek, at the crossing of the Owensboro and Hawesville road, is also probably referable to this seam, but, relatively, it is 20 or 30 feet higher than the usual position of the seam. Beyond this, to the west or south, this coal is not again seen above the drainage in this county, and nothing is known of it.

About 90 feet above this coal, and from 40 to 50 feet below the limestone near the top of the Hawes hill, is another seam of coal, which has about the same easterly limit as the one just described, but extends considerably further to the west, above drainage. It has been seen as a "stain" at a number of places, sections at some of which are shown in the accompanying plates; but it has only been opened so that it could be well examined at one place, Mr. James Mason's bank, about six miles below Hawesville. The coal is here 24 inches thick, in addition to 6 inches of bituminous slate at the bottom. The bank is worked considerably for the supply of the neighborhood. The position of the coal is shown by a section of plate II.

This coal has not been seen west of this in Hancock county, as it probably soon passes below the drainage, but not far below; for it is seen just above low water, in the bank of Blackford creek, a short distance from its mouth, at a locality known as the Shaw Hills, in Daviess county. A section here is shown in plate III. Blackford creek is here the line between Daviess and Hancock counties. The coal was imperfectly seen here, so that no measurement of thickness could be obtained. It is reported to be nearly 3 feet thick; but the accuracy of this report is not vouched for. There is a very slight reversal of dip, which brings the coal to the drainage level here.

The western limit of this coal for Hancock county, where it lies above drainage, is a line running nearly south from Mr. Mason's, striking Blackford creek below the mouth of Caney.

The following analysis, by Dr. Peter and Mr. Talbutt, from a sample selected by the writer, shows the quality of the coal at Mr. Mason's bank. The sample was not quite satisfactory, as the coal was near the outcrop and muddy at the seams; hence, it probably contains too much ash:

Moisture	4.80	
Volatile combustible matter	38.90	
Fixed carbon	50.06	Coke 56.30.
Ash	6.24	
Total	100.00	
Sulphur	2.316	
Specific gravity	1.289	

The coal at this place has been incorrectly referred by Mr. Lyon in volume III, first series Kentucky Geological Reports, page 463, to the seam beneath the limestone at the Hawes mine hill. This seam is shown by its "stain," immediately under the limestone, in the ravine, about 50 feet above the Mason coal. Mr. Lyon is also probably mistaken in referring the sandstone at the bluffs above Mr. Mason's house to the sandstone immediately over the Main Hawesville coal, and stating that the coal is here not more than 30 feet below the surface. The position of the sandstone is shown in a section of plate II. The base of it is less than one hundred feet below the Hawes Hill limestone, and hence more than that distance above the Main Hawesville coal.

Next above the just described coal lies the coal which has been already so many times referred to as occurring immediately under the Hawes Hill limestone. The eastern limit of this coal is a line running nearly south 20° west from the Ohio river, at the lower edge of the town of Hawesville, at the fold heretofore described, to the southern boundary of the county. This coal does not at any point extend far east of the Hawesville and Knottsville road; and, in an approximate way, it might be taken as the eastern limit of the coal.

To the west this coal extends to the county line and beyond. In the lower valley of Yellow creek it lies very near the drainage level, and at some places a little below it, but at no point more than a few feet. The same is true of the Blackford creek valley for some distance below the crossing of the Hawesville and Owensboro road; but lower down, at

the Shaw Hills, already referred to, this coal is above high water mark. (See plate III.)

At the Ohio river, where first seen, the coal is too thin to be of any great value. Near the old opening, at the Hawes hill, it is only 25 inches thick. At the Adams bank, two miles below, it is about the same thickness. Going south, this coal thickens, and becomes the most valuable and accessible coal of the central part of the county. Between Lead and Caney creeks, at the Wilson and Lawson banks, it is 30 and 32 inches thick, while further south, between Caney and Blackford creeks, at the H. Bruner bank, it is a fine seam of 44 inches thickness, including, however, a parting of 2 inches. South of Blackford creek, just across the line in Daviess county, near the Friendly Grove school-house, at the Duncan bank, this coal is 48 inches thick, without parting. Through all this region this coal lies well above the drainage, and can be readily mined. In the western part of the county it has been rarely opened; and, although the limestone which overlies it is often seen, the coal is rare in outcrop. A drift was run in this coal at the Shaw Hills, on Blackford creek, but had fallen in at the time of visit, so that the coal could not be measured. It is reported between 2 and 3 feet in thickness. The section here is shown in plate III.

The following analyses, by Dr. Peter and Mr. Talbutt, from samples taken by the writer, show the character of this coal:

	I.		II.	
Moisture	5.40		6.20	
Volatile combustible matter	34.80		41.90	
Fixed carbon	49.30	Coke 59.80.	47.40	Coke 51.90.
Ash	10.50		4.50	
Total	100.00		100.00	
Sulphur	2.398		3.743	
Specific gravity	1.353		1.285	

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No. 1 is from Milton Lawson's bank, near Hawesville and Knottsville road.

No. 2 is from the Duncan bank, Friendly Grove schoolhouse, Daviess county.

The limestone above this last coal has been referred to several times. It is quite persistent in occurrence, although varying locally in thickness. At places near the river, near its eastern limit, it is 8 or 10 feet in thickness; but toward the west it decreases to 2 feet. Where it is thick, the bottom is usually cherty, but where thin, it is a moderately pure, dark-colored limestone.

About 20 to 30 feet above the last described coal lies another, which is as yet known only at a few places in the western portion of the county; but it has been seen frequently enough, and its place so well determined, as to justify giving it a place in the general section. It is the coal at the base of the hill below the old Lewisport mines, the coal reported to have been found in the well at Mr. J. Colbert's, the coal at the old lick above Mr. D. Driscoll's, and the coal showing as a "stain" in the roadside at the crossing of Blackford creek by the Owensboro and Hawesville road. It is also probably the coal reported by Gen. Adair, of Hawesville, as occurring above the limestone in the Hawes hill.

At none of these places is it more than 18 inches thick; and hence it is not probable that it will be found thick enough to be of economic value. It is not worked in this county.

We now come to the coal known as the Lewisport seam, which is the most valuable coal of the western part of Hancock county, and perhaps the most trustworthy coal as regards thickness of any in the county. It is called the Lewisport seam, from the fact that it was formerly mined back of, and shipped from, the place of that name. Its position is 40 to 50 feet above the last described coal, or about 275 feet above the Main Hawesville seam.

The field of the coal lies in the ridge between the waters of Blackford and Yellow creeks, and out on the spurs toward

Blackford creek. Unfortunately, this area is not large in Hancock county, as it embraces but a few square miles.

To the east, it does not extend beyond the head of the South Fork of Yellow creek, as the rise of the rocks in this direction brings the coal to the tops of the hills. To the west, it extends to Blackford creek, the boundary of the county. The dip of the coal is, to the west, from 25 to 50 feet to the mile, this latter, however, being probably local, as the rate was only observed at one place. Some levels have been run at the different exposures of this coal, partly by Mr. Page and partly by the writer, for the purpose of determining the dip. At the Robert Estes bank, which is the most eastern opening at present, the coal is 101 feet above high water in the Ohio river. From here south, the coal lies nearly horizontal or rises a little. At the Colbert bank the coal is at the same level; at the Billings bank it is 6 feet higher, while at Wm. Richardson's, on the Owensboro and Hawesville road, it is 114 feet above high water. At G. W. Lott's, west of this place, on the same road, the coal is only 56 feet above high water, and at the old Lewisport mines it is 59 feet above.

This coal has been mined at a number of places, both on the Yellow and Blackford creek slopes, and is usually from four to four and one half feet thick, without parting of any appreciable thickness. Several of these openings have been mentioned above. But few of them are now worked, and these only for local supply, as no coal is now shipped by the river. The old Lewisport mines, whence the coal was shipped, were opened in a very narrow ridge, where the coal was soon exhausted. There is an abundant supply in the main ridges a little further back from the river, where the coal is regular in thickness, and situated very favorably for cheap mining.

The following analysis, by Dr. Peter and Mr. Talbutt, of a sample of coal collected by the writer from the Estes bank, will serve to show the quality of the coal of this seam:

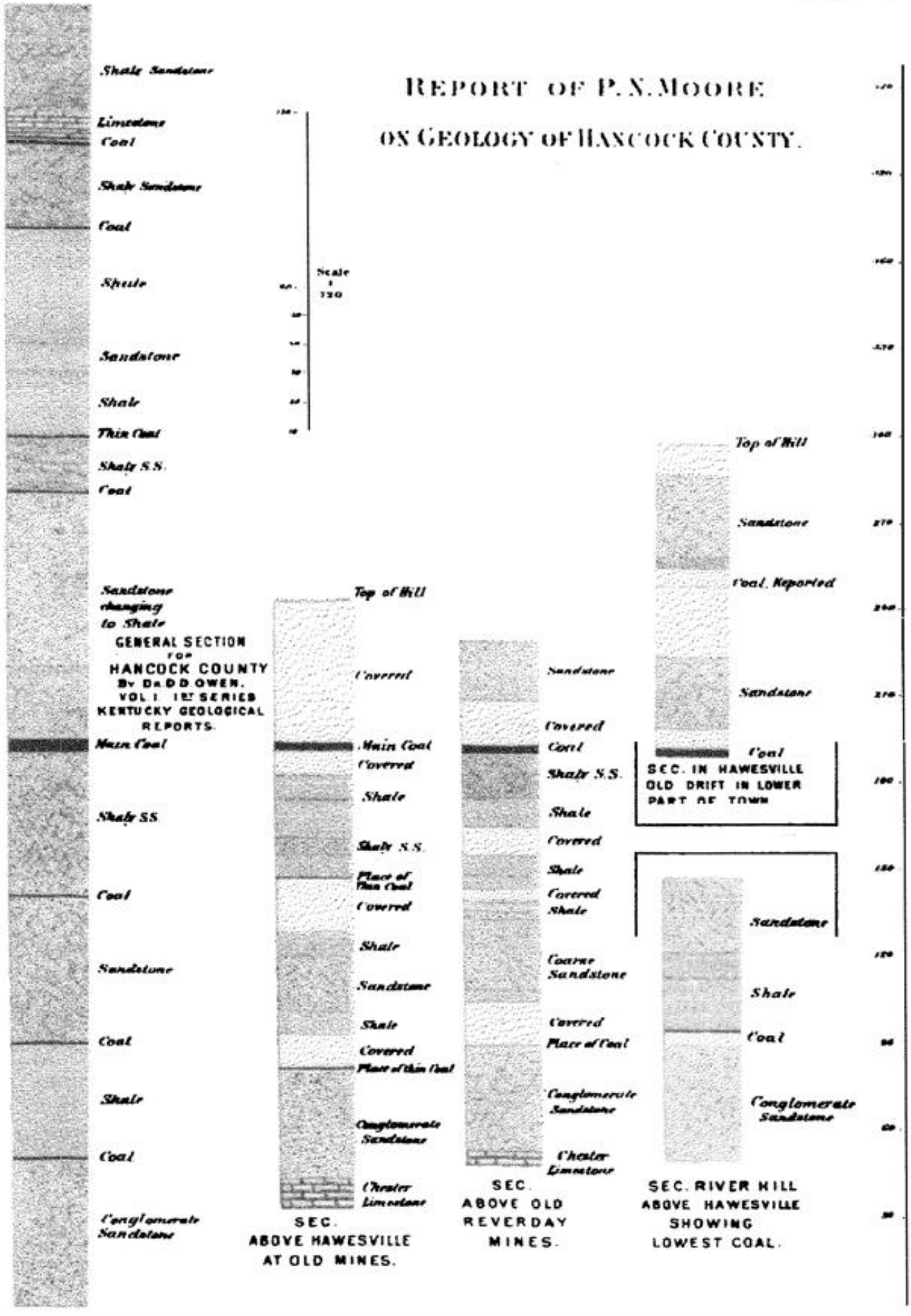
Moisture	3.50	
Volatile combustible matter	43.40	
Fixed carbon	45.56	Coke 53.10.
Ash	7.54	
Total	100.00	
Sulphur	4.155	
Specific gravity	1.323	

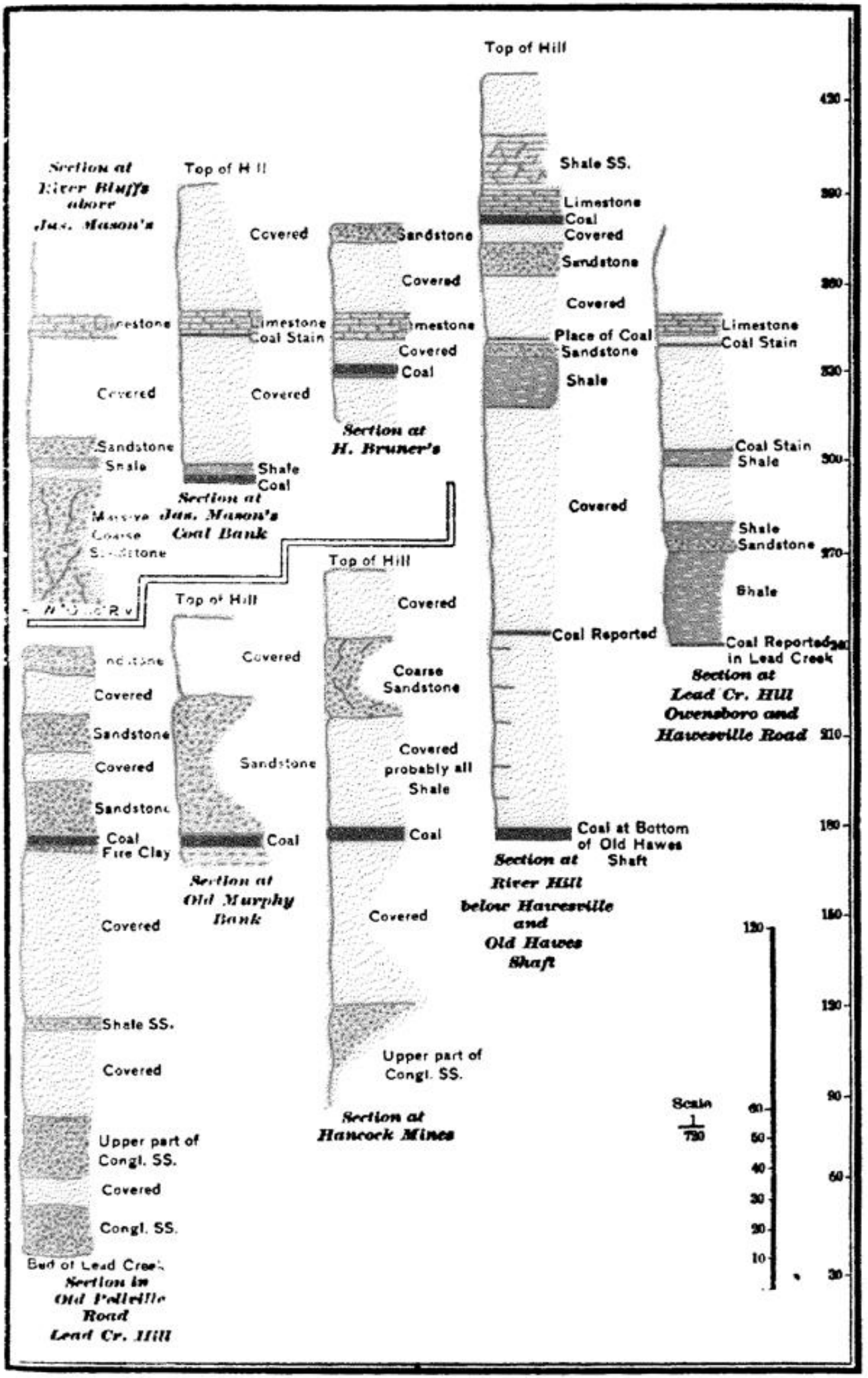
The coal at No. 23 of the general section, about 50 feet above the Lewisport seam, has been given a place in the section provisionally and with extreme hesitation. It is known at only one place—Wm. Richardson's, on the Owensboro and Hawesville road—where it is reported to have been cut through in sinking a well, and that it was 18 inches thick.

There are but few places in this county where the hills are sufficiently high to contain this coal; so that, even if it were thick enough to be workable, it could be of no economic importance.

Plate I

REPORT OF P. N. MOORE
ON GEOLOGY OF HANCOCK COUNTY.





N. Y. Map and Relief-Line Eng. Co., 17 Warren St.

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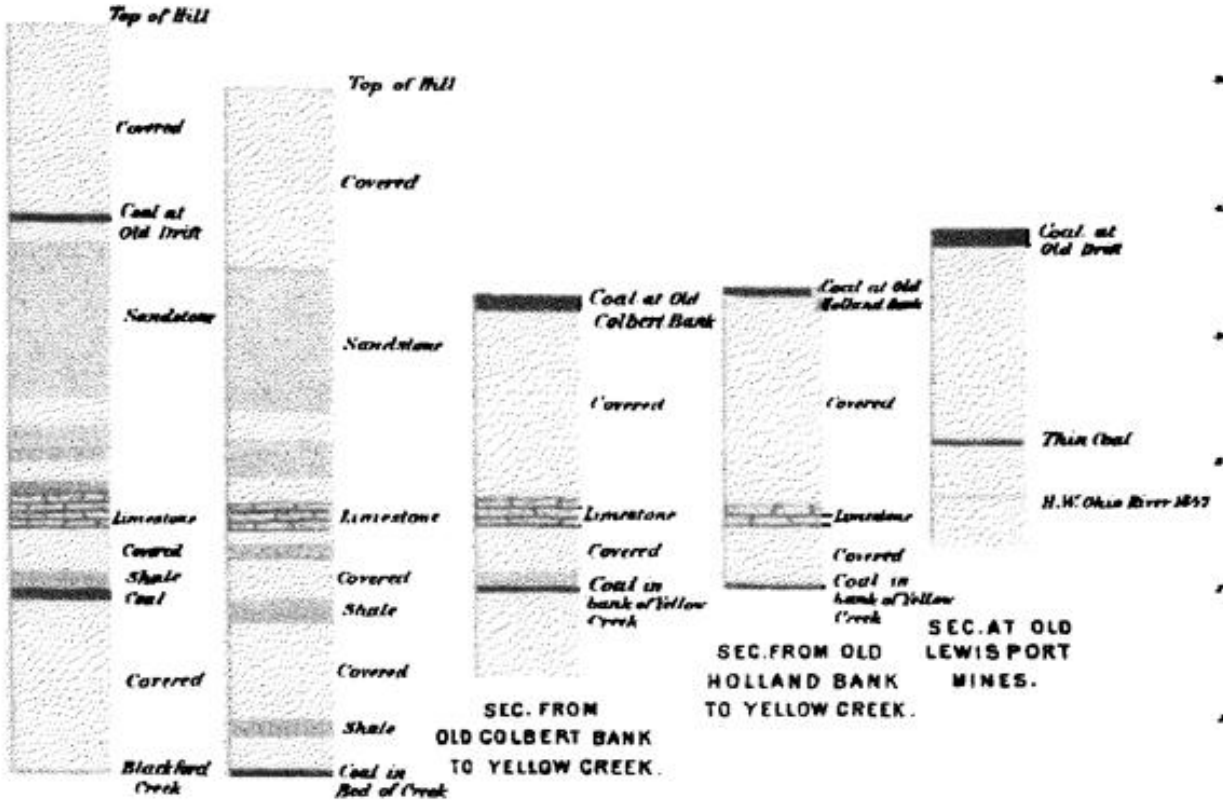
REPORT OF P. N. MOORE

ON GEOLOGY OF HANCOCK COUNTY.



SEC NEAR JA^{s} MOORES SHAW HILLS.

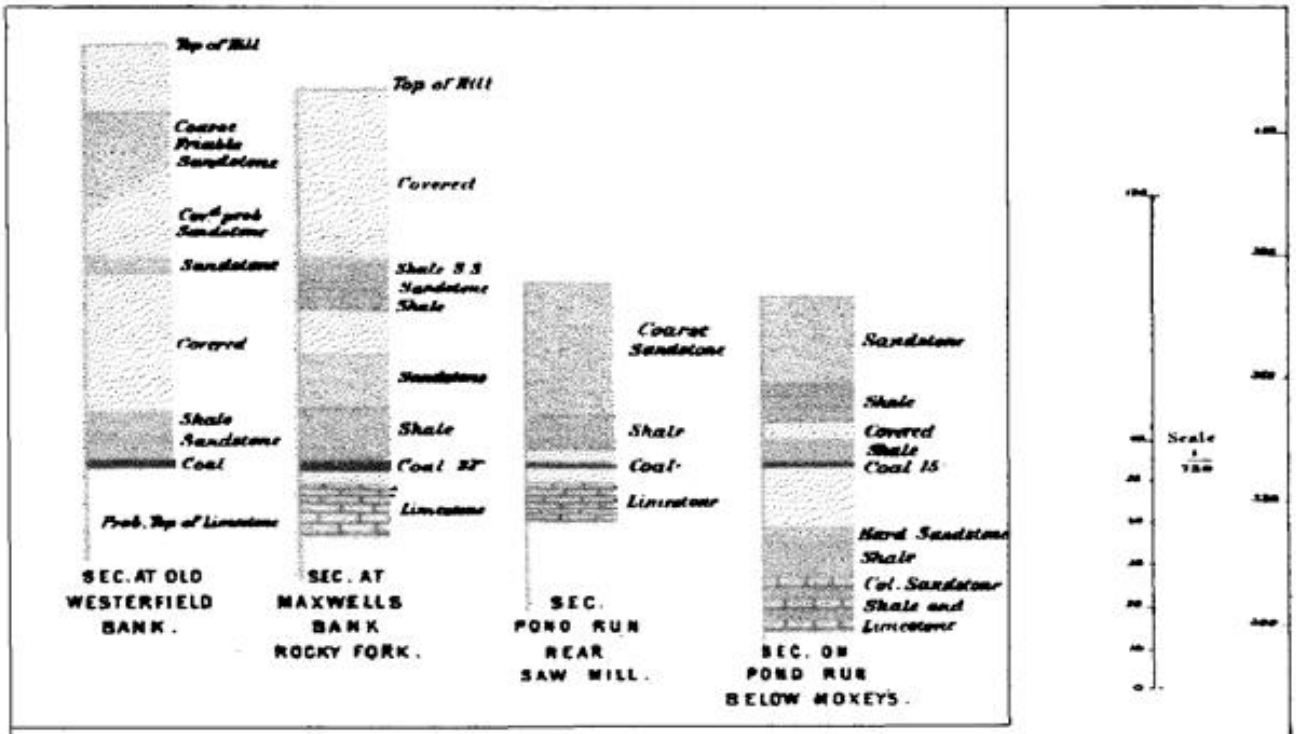
SEC. ON BLACKFORD CREEK SHAW HILLS.

SEC. FROM OLD COLBERT BANK TO YELLOW CREEK.

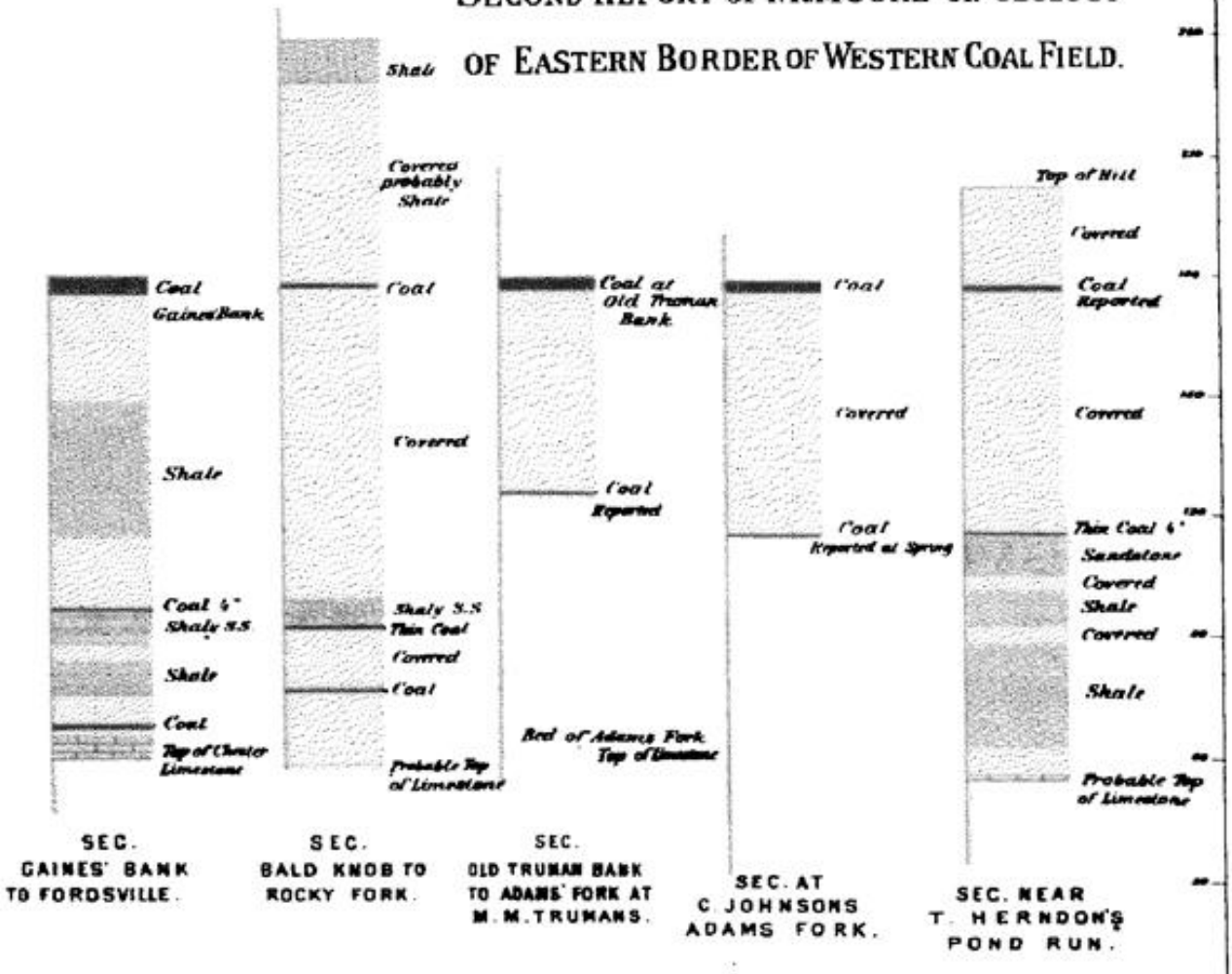
SEC. FROM OLD HOLLAND BANK TO YELLOW CREEK.

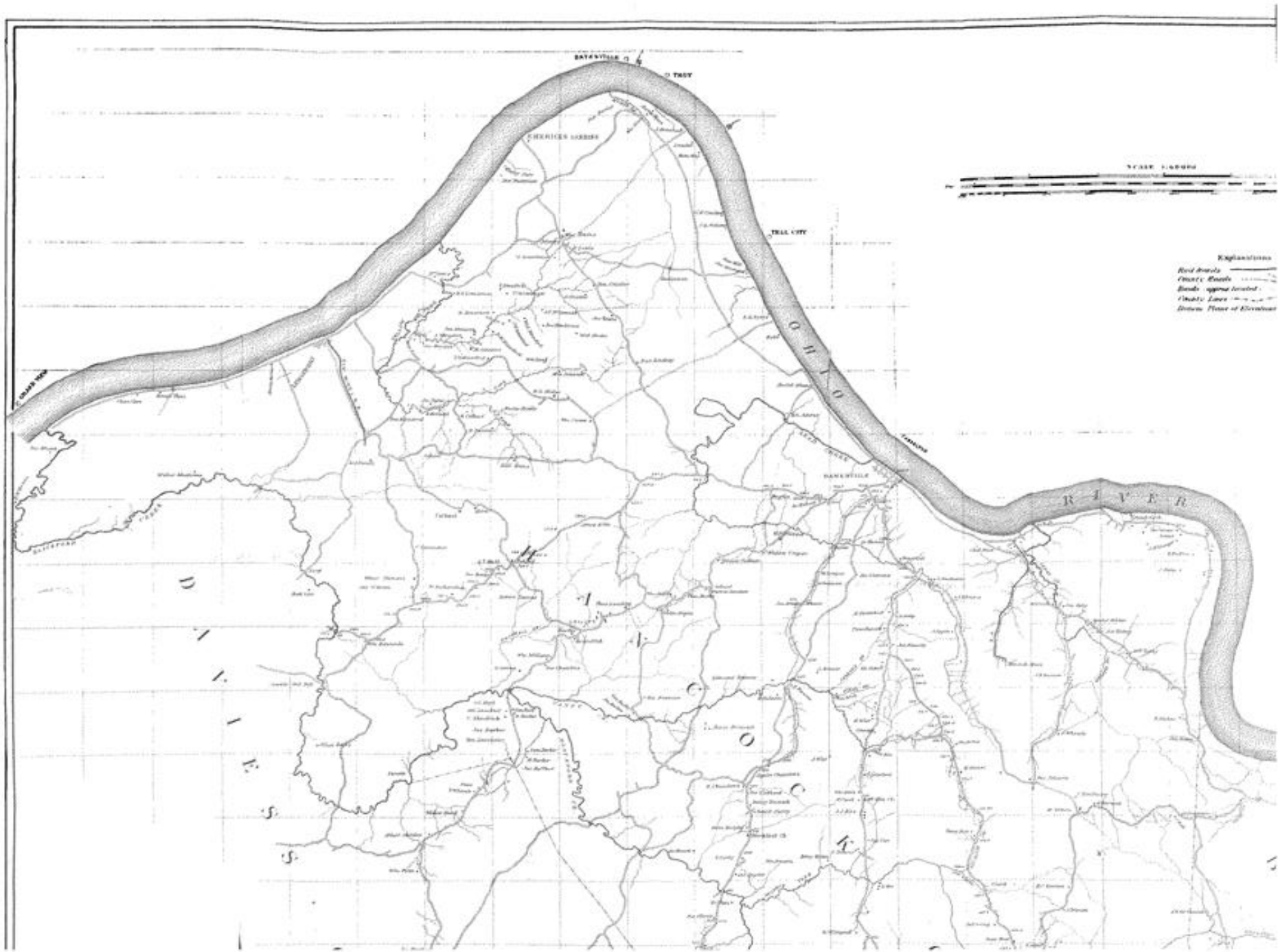
SEC. AT OLD LEWISPORT MINES.

Plate IV.



SECOND REPORT OF P.N.MOORE ON GEOLOGY OF EASTERN BORDER OF WESTERN COAL FIELD.




O H I O
R I V E R
TROY
TELL CITY
HAWESVILLE

Sheet 1.

KENTUCKY GEOLOGICAL SURVEY.
N. S. SHALER, Director.

MAP OF

HANCOCK COUNTY,

AND PARTS OF

OHIO, GRAYSON AND BRECKINRIDGE.

SHOWING EASTERN OUTLINE

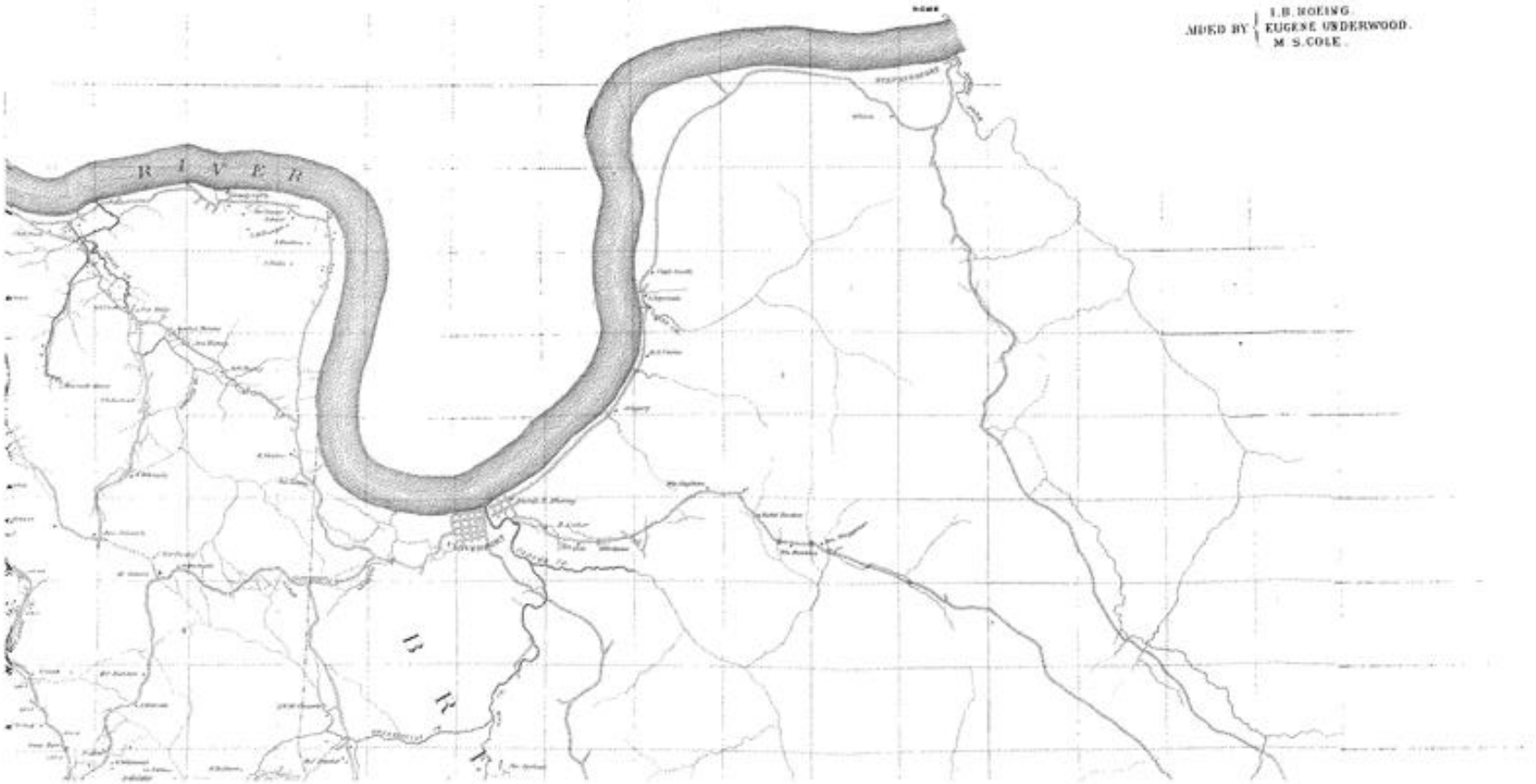
OF THE

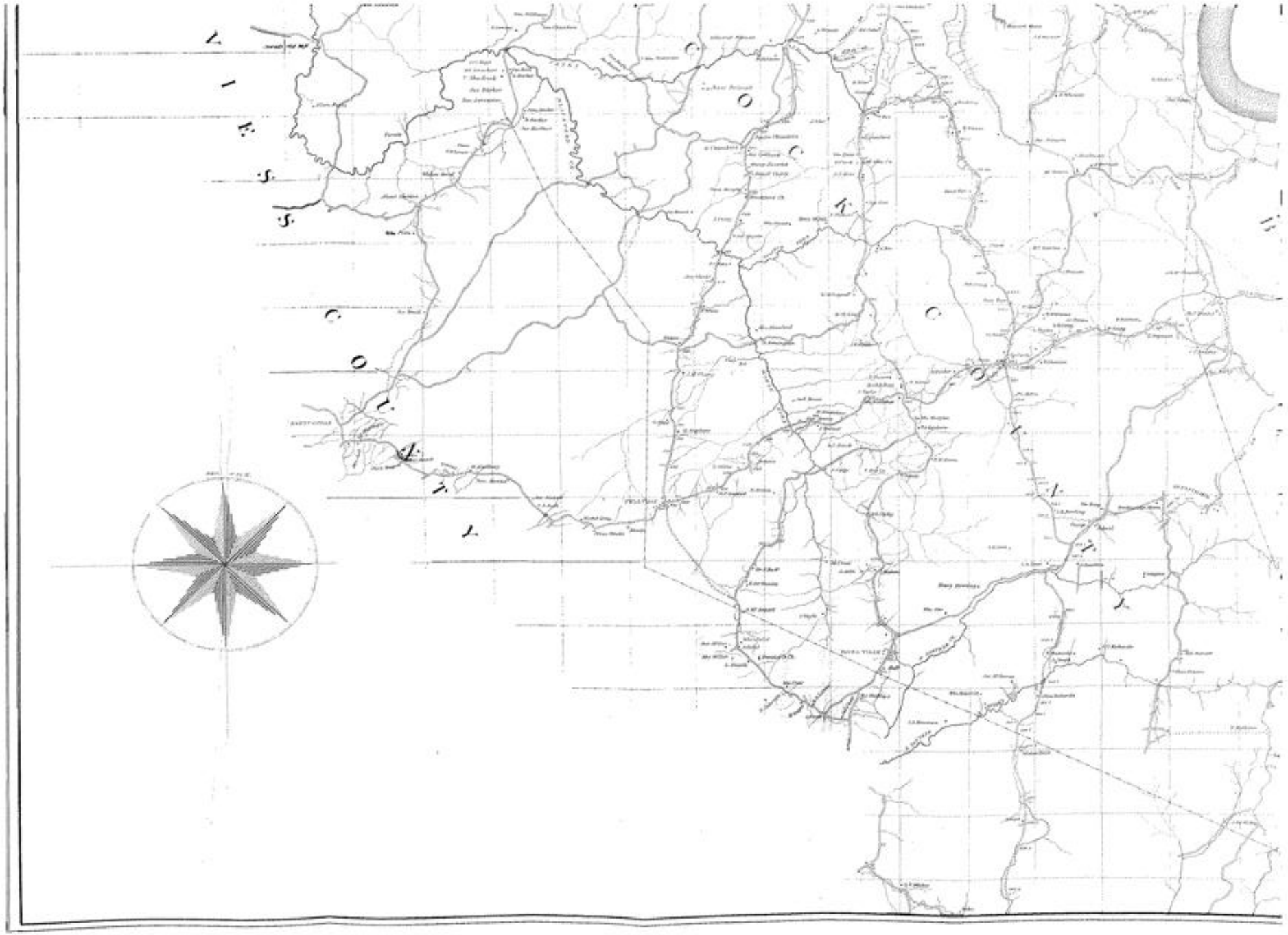
WESTERN COAL FIELD.

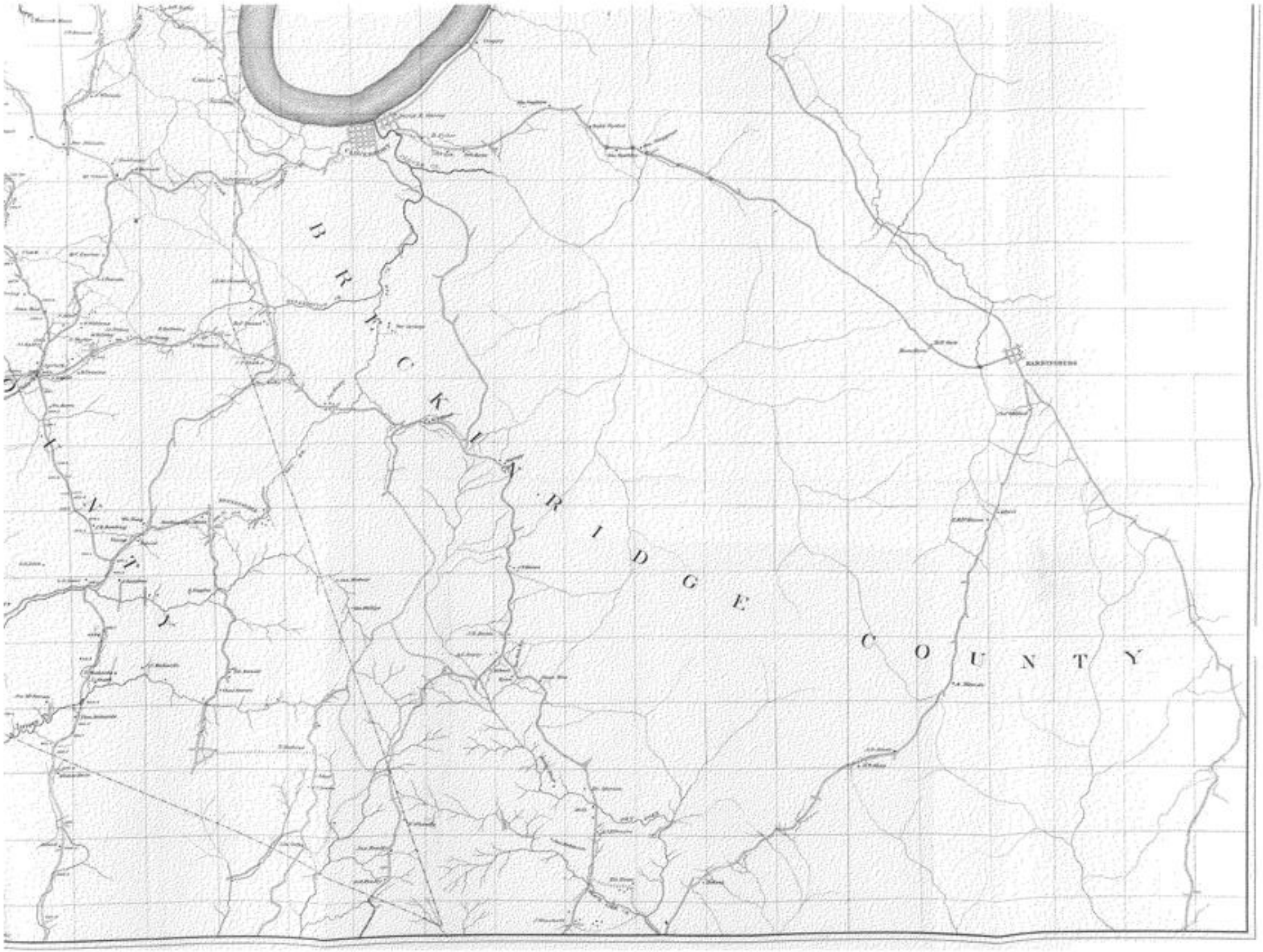
GEOLOGY BY P. S. MOORE.
TOPOGRAPHY BY W. B. PAGE.
AIDED BY I. B. HOEING. EUGENE UNDERWOOD. M. S. COLE.

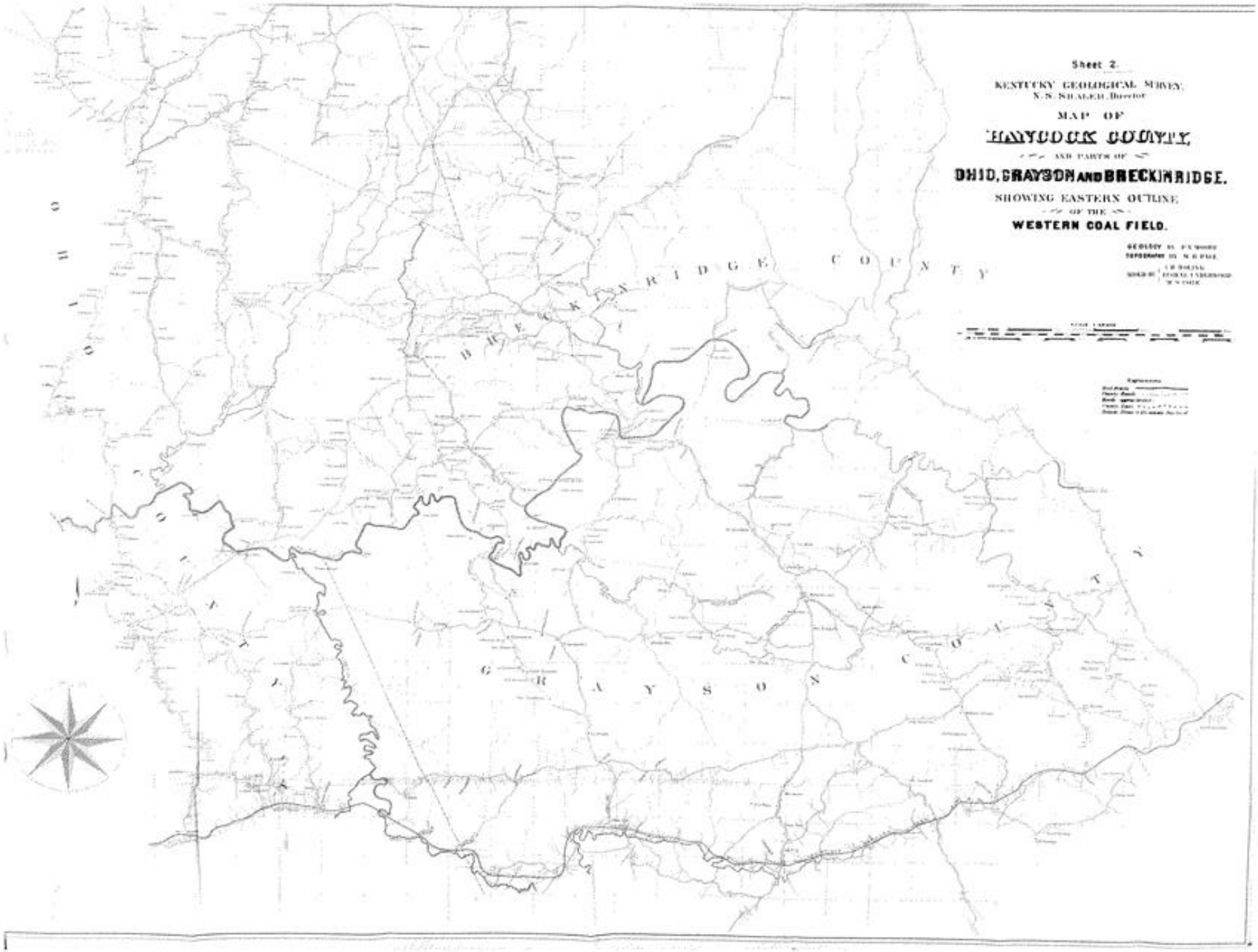
SCALE 1:62500

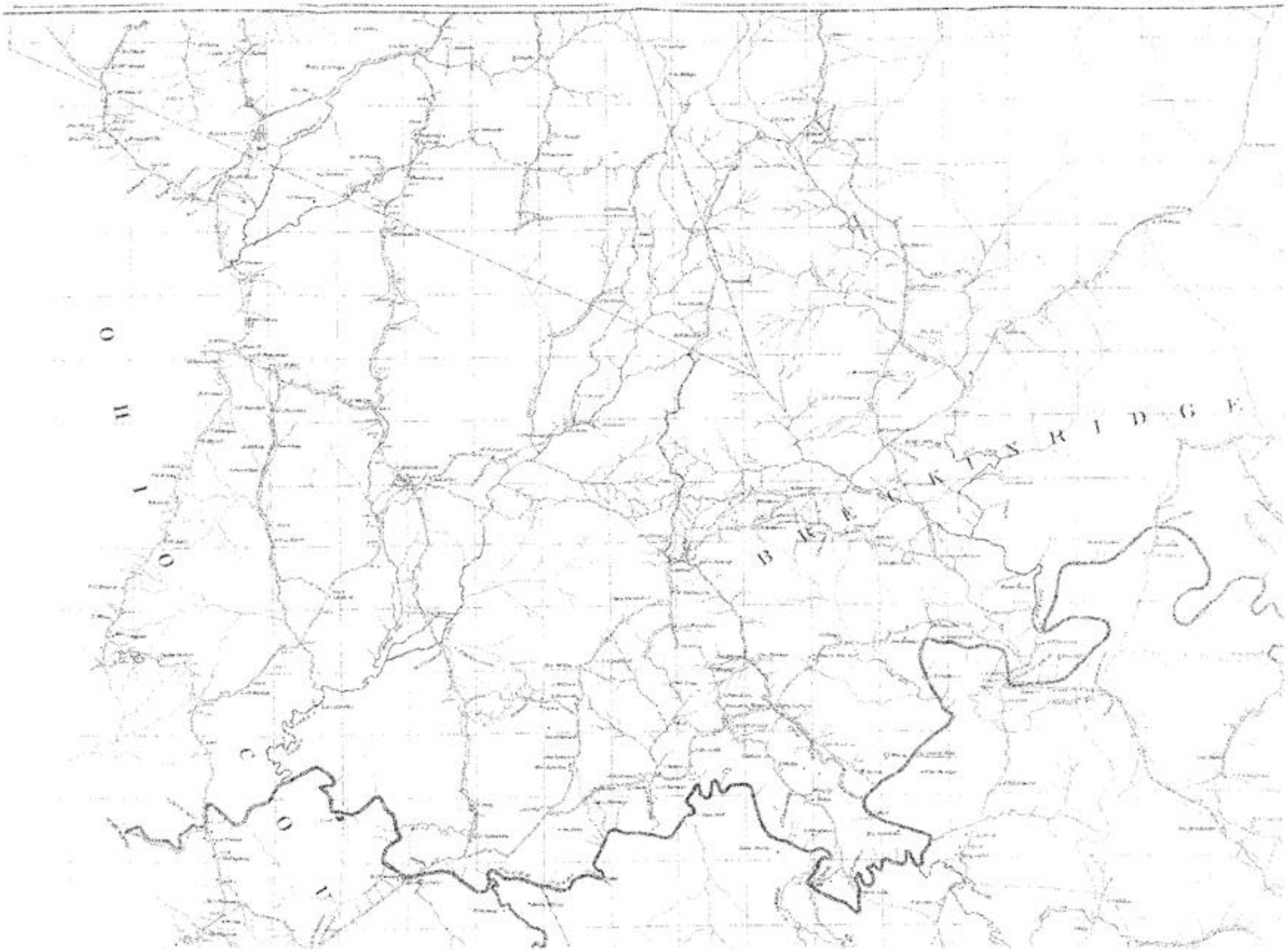
Explanations.
Rail Roads
County Roads
Roads (approximated)
County Lines
Datum Plane of Elevations Sea Level

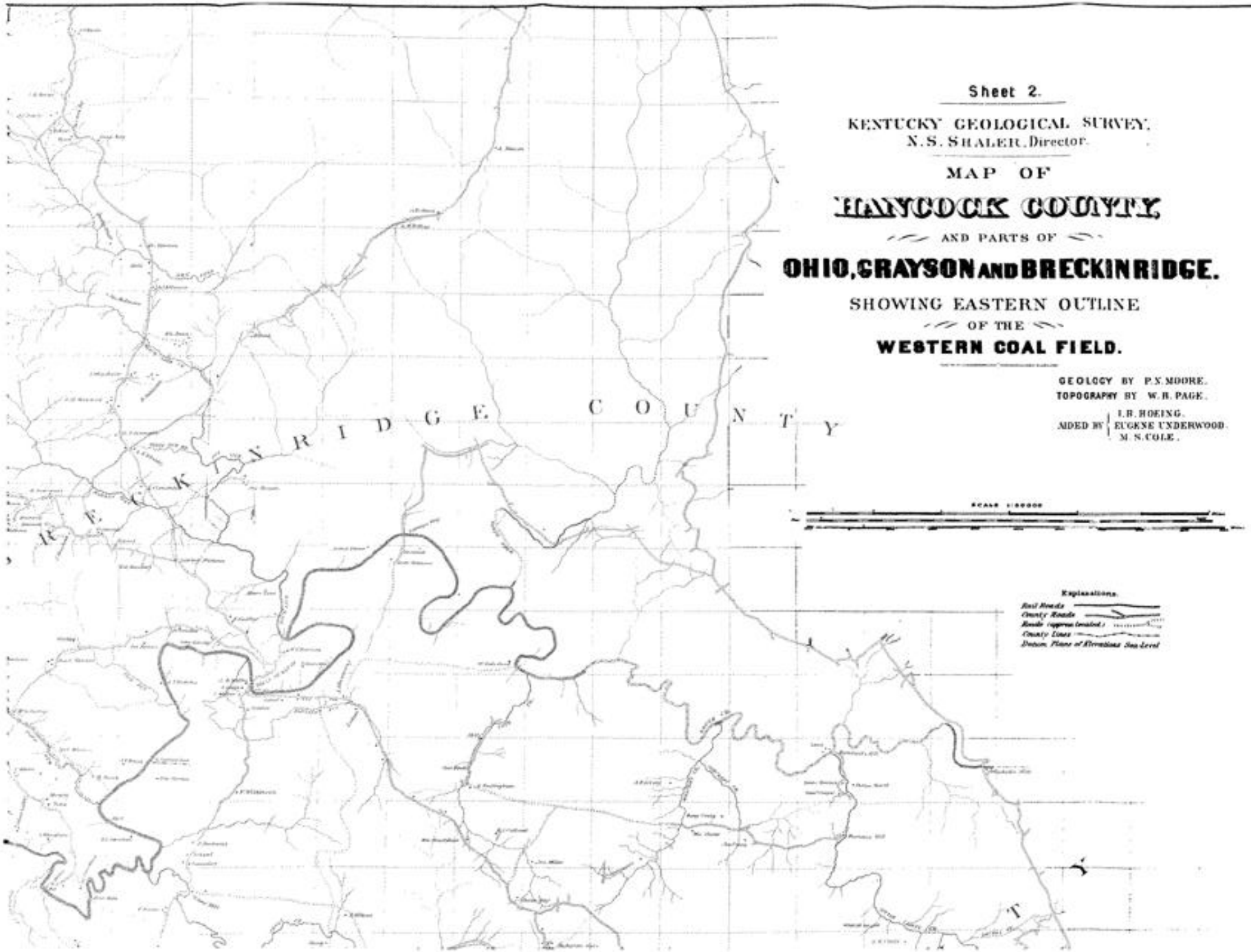





BRECKINRIDGE
COUNTY


Sheet 2.
KENTUCKY GEOLOGICAL SURVEY.
N. S. SHALER, Director.
MAP OF
HANCOCK COUNTY,
AND PARTS OF
OHIO, GRAYSON AND BRECKINRIDGE.
SHOWING EASTERN OUTLINE
OF THE
WESTERN COAL FIELD.
BRECKINRIDGE COUNTY
GRAYSON COUNTY


O H I O
B L U E R I D G E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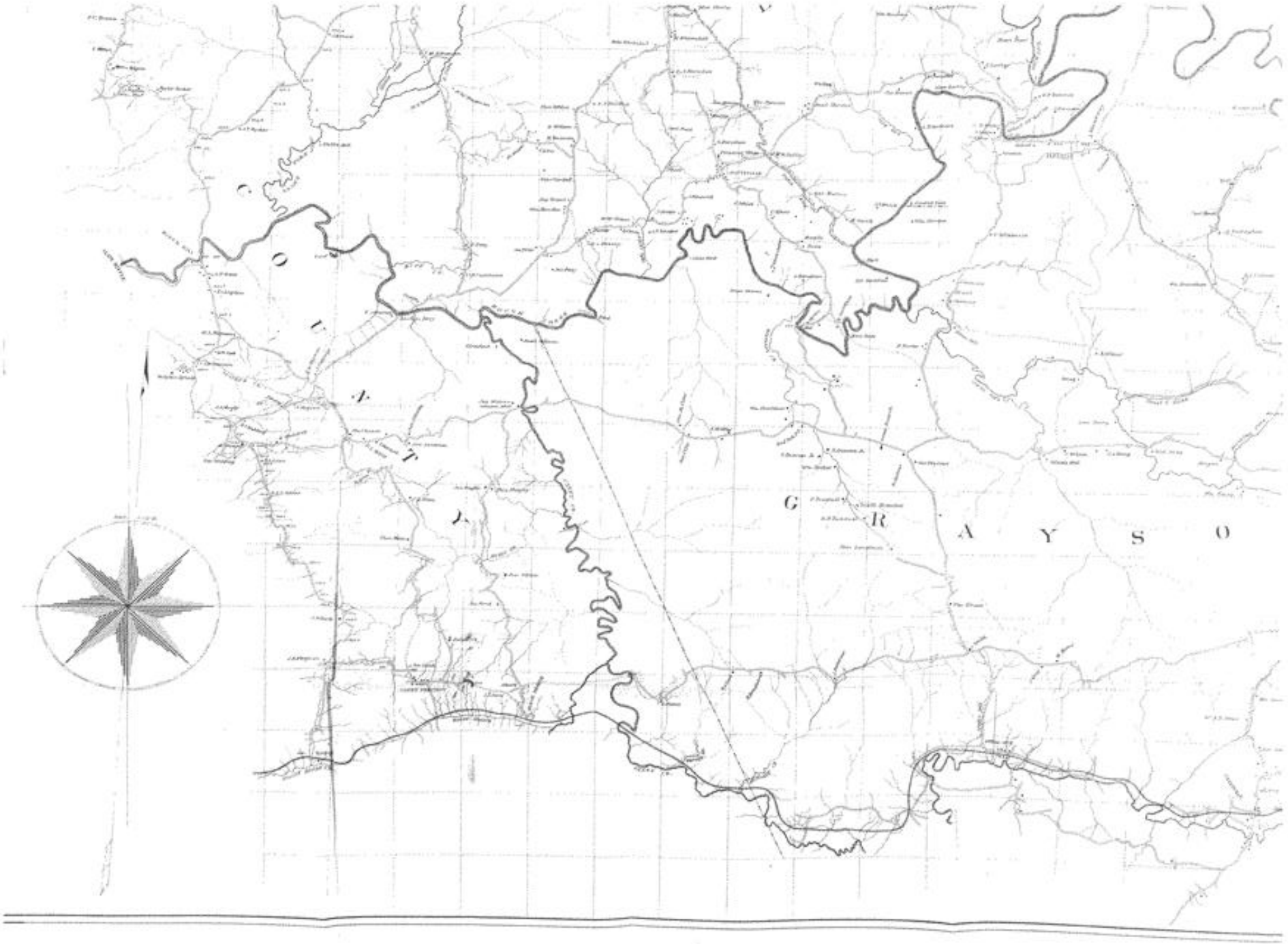
OF THE
WESTERN COAL FIELD.
GEOLOGY BY P.S. MOORE.
TOPOGRAPHY BY W.R. PAGE.
AIDED BY I.R. HOEING. EUGENE UNDERWOOD. M.S. COLE.
SCALE 1:62500
Explanations.
Rail Roads
County Roads
Roads (approximated)
County Lines
Datum Plane of Elevations Sea Level
BRECKINRIDGE COUNTY
OHIO COUNTY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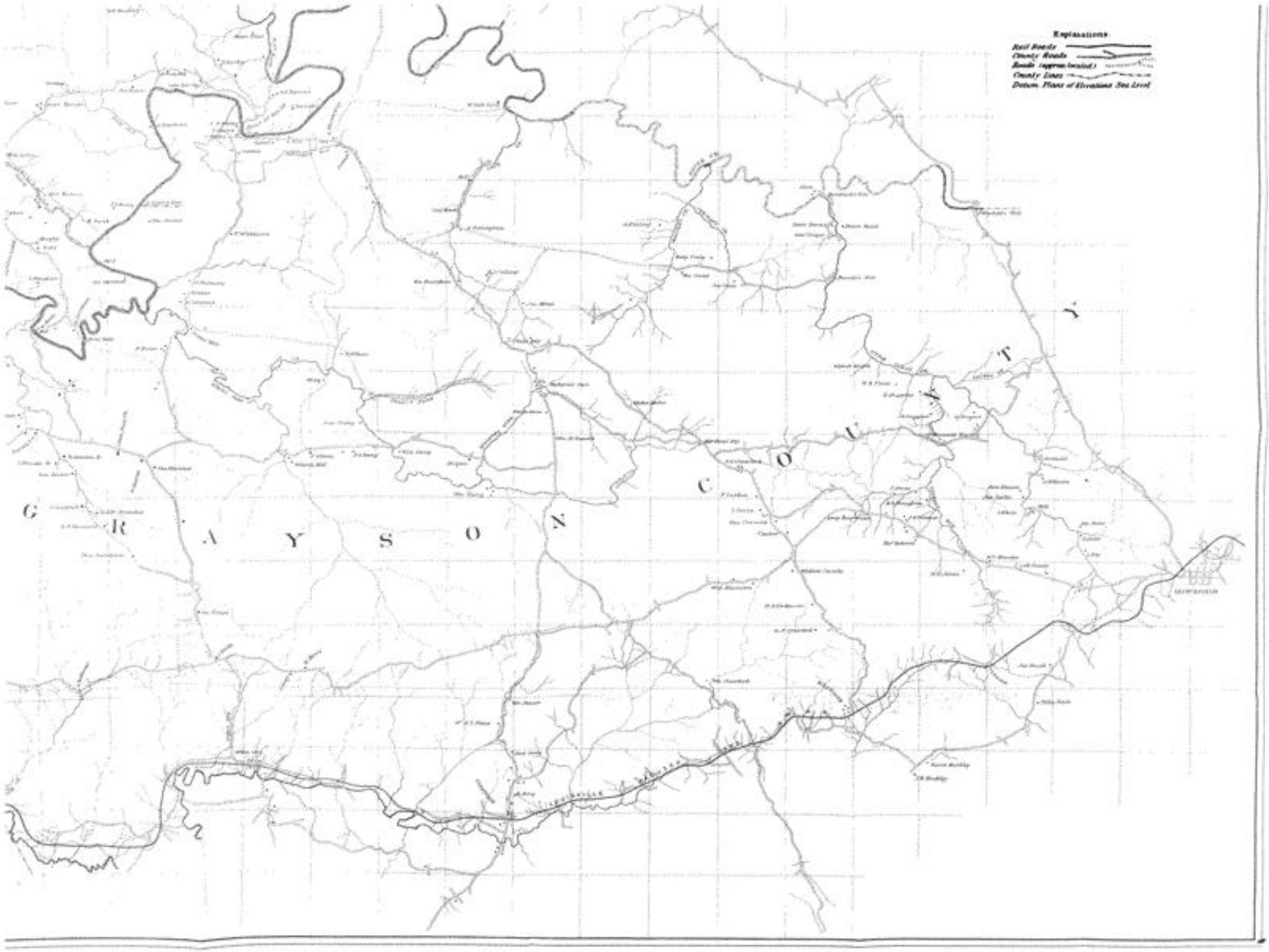
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