# GEOLOGICAL SURVEY OF KENTUCKY.

JOHN R. PROCTER, DIRECTOR.

## PRELIMINARY REPORT

ON THE

# GEOLOGY OF MORGAN, JOHNSON, MAGOFFIN, AND FLOYD COUNTIES,

## WITH MAP.

BY A. R. CRANDALL.

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# INTRODUCTORY LETTER.

J. R. PROCTER, *Director Kentucky Geological Survey:*

DEAR SIR: The report transmitted herewith is based on work inadequate for a final geological report. But the results of study in this field are sufficient to make the general stratography of this extensive region reasonably clear; and this, with the sections that have been made somewhat in detail at various points, will be a sufficient showing for an intelligent view of the possibilities of this region, and so will serve as a key to the development of its mineral resources. At the same time, should appropriations be made warranting more detailed work at typical points in these counties, by drilling or by excavation, it would, doubtless, by confirming much that is now necessarily left to be inferred, aid very much in bringing this field into favorable notice.

The accompanying map is made up from such railroad and river surveys as could be obtained, with additions, made under the direction of the Survey, to fill out and complete the map so far as possible. The parts of the map not made up from actual surveys are distinguished by the absence of names of residents, and are based on sketches made in connection with the geological work, or on inquiry.

The following surveys have been placed at my disposal, and have been used in the preparation of the map: The Portsmouth and Pound Gap Railroad Survey, two lines; the Eastern Kentucky Survey to Paintsville; the United States Improvement Survey of the Big Sandy River, by Captain Merrill, and the United States Improvement Survey of the Licking River, above Hammond's Mill-site, by C. Shenck. The survey of the western outcrop of the coal-measures, by Lesley, has also contributed considerably; but the greater part has been done under the direction of the Geological Sur-

vey by C. Shenck, Prof. J. G. White, of the Agricultural and Mechanical College, C. G. Blakeley, and myself, with assistants. Compiled from so many sources, there must necessarily be some inaccuracies; but the geography of this country is represented with sufficient accuracy for all present requirements.

The attention of Professor Shaler was called to the original name of the Big Sandy river soon after the Survey was placed under his directorship, and the desirability of preserving it was recognized by the use of the original name of the main river in the various reports on that region. In the map of this region, and in my report, I have continued to use the name Chattarawha, as being the original Indian name, in preference to the name "Big Sandy." It is hardly probable that the former will supersede the latter in the popular mind; but the need of preserving so much of the history of this river as is embodied in its name will be conceded by nearly every one. It may be objected that the name Chattaroi has come into common use in connection with the railroad of that name. As to this, it may be granted that the sanction of custom, if that should be given to this name, would settle the matter so far as the popular designation is concerned; but it would not satisfy the claim of the original uncorrupted name for recognition, nor would it preserve one of the links to the chain of charming Indian names that will be prized the more as time advances.

And in respect to the West Fork of the Chattarawha or Big Sandy river, there has for some time been a complaint that the published maps and reports incorrectly designate this Fork. The best information I have been able to obtain, through the late Judge Ferguson, who had taken a special interest in all that pertains to the valley of this river, is to the effect that the name, as known by all the older inhabitants, is Levisa Fork; that the name was derived from *Levice*, a word found by early settlers carved on a tree towards the head of the Fork—a French name probably, which was pronounced by the settlers Levisee, and finally Levisa.

The founding of Louisa Court House at the forks of the river has caused this stream to be known outside as the Louisa Fork, and this name has crept into use in maps, reports, &c. In this report, and the accompanying map, I have used the name Levisa Fork, in conformity with the usage of the older inhabitants of this valley.

Yours,

A. R. CRANDALL.

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# PRELIMINARY REPORT ON THE GEOLOGY OF MORGAN, JOHNSON, MAGOFFIN, AND FLOYD COUNTIES, WITH MAP.

All the territory comprising the counties included in this report is within the coal-field of Eastern Kentucky, the western boundary of Morgan falling within the general outline of the coal-measures as determined by Lesley (volume IV, Old Series of Reports on Geology of Kentucky).

In any report on the resources of this region the coal-beds are of central importance. Along with these the minor mineral deposits, the rock formations, as giving character to the soil and supplying building materials, and finally the timber and other products of the soil, are subjects of interest, and altogether constitute no inconsiderable part of the natural wealth of the country, as will be found in any well-directed effort to develop the resources of these counties.

The stratigraphical geology of this section forms the basis for the study of all the features that fall within the province of this report. There are, so far as known, no true vein deposits of value, nor are there antecedent reasons for supposing that mineral deposits occur otherwise than conformably with the stratification of the inclosing rocks.

The topography of this region is closely related to the stratigraphical geology. The dip to the southeast along the western border causes a succession of rocks of widely different character in that direction from line of outcrop of the coal-measures. The same is true in the opposite direction of the formations below; the Lower Carboniferous, Devonian, Upper and Lower Silurian rocks following in their order with characteristic surface features.* The western part of Morgan shows

*See report on the proposed line of the Elizabethtown, Lexington and Big Sandy Railroad.

something of the characteristic topography of the Lower Carboniferous formations, the valleys being excavated in part out of the Waverly group of sandstones and shales, the Sub-carboniferous formation forming a bench upon its limestone walls above. But the massive Conglomerate sandstone from merely capping the hills on the western outcrop rapidly becomes the predominating rock to the eastward, where it is exposed in cliffs and ragged escarpments, which in turn give place to the characteristic topography of the shales and sandstones of the coal-measures proper; the Conglomerate formation falling below the drainage. About two hundred feet thickness of the Waverly formation is shown in the Licking Valley at the western border of Morgan county. The Sub-carboniferous limestone which rests upon the Waverly, without any considerable thickness of transition rocks intervening, has an average thickness of about fifty feet. The Conglomerate formation has a maximum thickness of two hundred feet, and is separated from the limestone below by from ten to fifty feet of shale, including a thin bed of coal. The belt of country in which these rocks are exposed is comparatively narrow. The dip to the southeast is from thirty to fifty feet to the mile, and the Conglomerate sand-rock disappears below the drainage of the Licking Valley half a mile below the mouth of the Elk Fork. An axis of upthrow extending from the border of Elliott county into Johnson, nearly at right angles to the ordinary outcrop line, brings the Conglomerate rocks into prominence further to the eastward, and extends the characteristic topography of this formation in a narrow belt across to within a few miles of Paintsville. This wave-like elevation was not so sharply drawn as to become also a well-defined water-shed. On the other hand, it falls across the head-waters of Big Blaine, and extends into the valley of Big Paint Creek, and the Conglomerate cliffs are exposed in valleys cutting across the axis of upheaval. On Keaton's Fork of Blaine thirty feet of Conglomerate is shown, on the Laurel Creeks one hundred and twenty-five feet, Hood Creek cuts through this axis exposing ninety feet, while Big

and Little Paint Creeks have cut through one hundred and fifty feet or more of this rock.

The northward dip described in the report on the geology of Lawrence county, and also represented on map diagram of dips in Greenup, Carter, Boyd, and Lawrence counties, will be more readily understood by its relation to this axis of upthrow. To the southward the dip is not so well marked, and it is soon lost with the relatively greater elevation of the whole series in that direction.

East and south from the Conglomerate sand-rock belt, the shales and sandstones of the series above the Conglomerate make up the whole height of the hills, which vary from three hundred to seven hundred feet. As the latter falls considerably below the drainage at points where the hills are the highest, the whole thickness of the productive series above may be placed at about eight hundred feet, or about the same as is exposed in the block of counties to the north. (See general section, report on three counties.) The dip of the rocks in all this region is slight, and the topography is such as should be expected from like conditions—crooked streams—dividing ridges of great complexity with minor ridges and spurs, completing an elaborate and tortuous system of drainage. The height of the hills in the eastern part of Morgan and in Magoffin is from 300 to 450 feet. To the westward they reach 550 feet, and to the eastward, in the valley of the Levisa Fork of the Chattarawha or Big Sandy river 700 feet. The increased height in either case is in the direction of the drainage, so that the water-shed between the Licking and Sandy waters is not a prominent feature in the profile of the country. The accompanying profile section from the North Fork of Licking River to West Liberty, Salyersville, and Prestonsburg, will serve to represent such facts respecting the topography and its relation to the stratigraphical geology as may be shown diagramatically. It will also, in a general way, show the relation of the coal-beds to the drainage.

## COALS, ORES, &C.

Beginning at the base of the Carboniferous series, the first coal-bed is found in the shales between the Sub-carboniferous limestone and the Conglomerate sandstone—the great cliff-forming member of the coal-measures. This is the Sub-conglomerate coal of previous reports on portions of the coal-field of Eastern Kentucky, which include the western outcrop. (Lesley's Report on the Western Margin of the Eastern Coal-field, volume IV, Old Series; Report on the Geology of Greenup, Carter, &c., volume I, part 1, Second Series; Report on the Proposed Line of the E., L. & B. S. R. R., volume I, part 10; Report on the Geology of Menifee County, volume IV, part 2.)

This coal is not known at any place in Morgan county as a workable bed for more than local purposes—for blacksmiths' use, &c. It is in quality an excellent coal, and will be found nearly always, where the Sub-conglomerate shales are exposed, in thickness varying from a few inches to two feet. Section 3, plate 1, near the mouth of Greasy Creek, shows this coal below high-water mark, accompanied by another thin seam. Eastward from here it falls below the drainage, and is not again seen in this region. The whole thickness of the Conglomerate formation near the mouth of Greasy Creek is less than two hundred feet, mostly made up of coarse thick-bedded, somewhat conglomeratic sand-rock, with prominent illustration of cross-bedding, having slant lines to the south-east, as usual in this region. On Mine Fork of Little Paint Creek, in Johnson county, near the house of Gilbert Penix, a twenty-inch coal seam is exposed in a rock-house, under one hundred feet or more of Conglomerate rock, and fifty feet above the bed of the creek. A considerable thickness of shale is exposed below at a number of points on this creek, and at one point, nearer the mouth, a dark slaty shale has embedded in it an unusual abundance of claystone iron ore. At other points a coarse sand-rock appears to occupy most of the space from the base of the main cliff to the creek bed. It is reasonable to suppose that these rocks,

including the coal, are a part of the Conglomerate formation; and also that the Conglomerate, as a whole, is very much thickened in this direction, as it is known to have a thickness very much exceeding 1,000 feet along the Cumberland and the Pine Mountain escarpments. Several beds of coal, with accompanying shale, are included in this thickness. It is not probable that the maximum thickness, as exposed along these mountains, is attained by an abrupt increase in the thickness of the deposits that go to make up this formation. On the other hand, evidences from drilled wells indicate a gradual thickening from the outcrop line southeastward. But this subject will be discussed more fully in a report on the salt-producing portions of Eastern Kentucky.

The next coal in the series, as found in this region, is above the Conglomerate formation. Section 2, plate 1, near the head of Yocum Creek, and section 5, plate 1, on the Licking river, show the position and surroundings of this bed along the western border. It is the No. 1 of the Greenup and Carter region, and, as in these counties, it is found in the shales above the Conglomerate at a vertical distance, varying with the thickness of these beds. The vertical section, in which shale very largely predominates, varies from one hundred to two hundred feet or more, and includes clay shale, slaty bituminous beds, with thin beds of coal, sandy shales merging into shaly and slaty sandstone, and in some localities thick-bedded sandstone forming ledges and cliffs. The clay shales generally contain kidneys of limonite iron ore, when of a buff color, and of carbonate ore where darker and somewhat bituminous. The sandy beds are more prominent above Coal 1, and appear in their relation to the shales below, and the predominating sand-rock above Coal 2, as transition beds. The shales of this horizon are not so constant in character as to be readily recognized, wherever exposed, in a definite order of the kinds of rock described; but, as a whole, they may generally be recognized in the characters as given; and a further aid may be found in calcareous bands and lenticular

limestone masses, which, though not always present, are often prominent features, and, in a general way, good horizon marks. These calcareous rocks vary from a calcareous sandstone to a limestone, containing more or less clayey and silicious matter; and they appear in continuous layers, or in jointed bands or in lenticular masses imbedded in shale, according as they have the appearance of sandstone, or approach more nearly to a true limestone. Jointed layers and lenticular concretions occur somewhat at random in the shaly rocks below, and sometimes above Coal No. 1. The more sandy calcareous layers occur near the top of the shale series up to, and sometimes above Coal 2. These features are wanting, or so obscure as not to have been noticed in some localities where the including rocks are exposed; but they extend from Lawrence county to the Kentucky river, and have been observed at so many points in Morgan, Breathitt, Magoffin, Perry, Johnson, Floyd, and Letcher counties, that they may be regarded as characteristics* of the horizon of Coals 1 and 2.

From its place in the series Coal 1 is below the drainage in a large part of the eastern portion of Morgan, and also in a considerable part of Magoffin. It is exposed along the river at West Liberty at a maximum thickness of three feet, with a thin bed lower down. It would doubtless be found in all the valleys west of Caney Creek, rising to the westward, as indicated by the profile section. It is under the drainage on the head of North Fork of Licking river, as also at the head of Fannin Fork of Elk, and of all the tributaries of Elk Fork from the west. The larger branches of North Fork, from the west and north, doubtless expose this bed, rising to the tops of the hills beyond the county line, though it has not been traced definitely in this direction. It is exposed along the Open Fork of Paint Creek, rising from the bed of the creek towards the head, to nearly 150 feet above where the

*Some beds of calcareous sandstone, and also layers more nearly approaching limestone, have been observed at wide intervals higher up in the series. So far as known, they do not occur in any regular relation to the coal-beds of the region. It seems most likely, however, that some of these beds at least are representatives of the limestone layers described in the counties to the north, and which are still more prominent in Ohio. Sufficient data for the discussion of this point are not yet in hand.

Conglomerate rises above the drainage. Where opened, as on Meeting-house Branch and Smith's Branch, and on the main creek at Mr. Hill's, a thickness of thirty inches without parting is shown under a sandstone ledge. (See section 7, plate 2.)

In Johnson and Floyd counties this bed has a thickness varying from thirty inches to five feet. On George's Creek, near Lomansville, it is opened in many places near the bed of the creek, having an average thickness of thirty-six inches. On Tom's Creek, rising from the bed near the head to seventy-five feet above, near the mouth, it shows from thirty-six to forty-two inches. Around Paintsville, averaging a little more than 100 feet above the bed of the river, a thickness of from thirty-six to sixty inches is shown, the greatest thickness being found in Wheeler's bank on the Levisa Fork of Sandy, one mile below the mouth of Paint Creek, fifty-four inches being about the average in openings, which show a maximum of five feet. Turner's bank, two miles above Paintsville, on Paint Creek, shows forty-eight inches. Two miles above the mouth of Paint Creek, on the Levisa Fork, opposite Hager's Mill, the thickness is thirty-six inches. In this locality a thin cannel coal crops out about fifty feet lower down, and sandstone replaces a considerable part of the shales of this horizon. (See section 17, plate 4.)

Towards the head of Jenny's Creek, at the mill of A. J. Rice, this coal is thirty-six inches thick, and it shows about the same at the bed of the creek near the Narrows, still further up. A greater thickness is found on Lick Fork of Jenny's Creek and on Sandy Little Paint Creek, and also on John's Creek, east of Levisa Fork, where it ranges from thirty-six to forty-eight inches, and is near high-water mark. Harris' bank, near Prestonsburg, shows forty-four inches, and is one hundred feet above the river bed. Fitzpatrick's bank, three miles further up Middle Creek, shows thirty-six inches near the creek bed. (See sections 20 and 21, plate IV.) Openings on Abbott's Creek show the same decrease in thickness westward from the river, and in Magoffin county

this coal will probably be found less reliable as a workable bed than in the Chattarawha or Big Sandy Valley. For that reason it is not so readily recognized, and it is opened in a few places only to show its thickness and quality. It is probable that the coal near the mouth of Elk Creek, below Salyersville, and just above the river bottom, is No. 1. The thickness is twenty-four inches of coal closely resembling that of No. 1, and with similar surroundings. Coal 1 is distinctly traceable from Floyd into Perry and Letcher counties. It is above the drainage in Breathitt and Wolfe counties, rising to the westward in the latter as in Morgan. It is almost uniformly without parting, and is separated from the Conglomerate sand-rock by an increasing thickness of shales and shaly sandstone eastward, and it is often accompanied by one or more thin beds of coal below, especially to the eastward, but so irregularly that these beds are of little value as indications of the place of the main coal.

There appears to be no regular bed or horizon of iron ore with anything like a definite relation to Coal 1, either below or above; though wherever the ferruginous shales appear they usually carry segregations of iron as kidney ore, and occasionally a rough block ore is seen in the shâly rock of this series.

The following analysis of Coal 1 by Dr. Peter, from average samples carefully made by the writer, will no doubt interest those who care to know something of the quality of this coal:

TABLE OF ANALYSES OF COAL 1.

| | Smith's Branch of Paint Creek. | Wheeler's Bank, near Paintsville. | Rice's Bank, head of Jenny's Cr'k. | Hatcher's Bank, mouth of Abbott's Creek, Floyd Co. | Harris Bank, Middle Creek. |
|---|---|---|---|---|---|
| Moisture | 2.90 | 2.66 | 3.10 | 2.50 | 2.50 |
| Volatile combustible matter. | 39.10 | 38.04 | 38.68 | 38.56 | 40.80 |
| Fixed carbon | 51.34 | 56.30 | 53.50 | 53.44 | 53.46 |
| Ash | 6.66 | 3.00 | 4.80 | 5.50 | 3.24 |
| Total | 100.00 | 100.00 | 100.08 | 100.00 | 100.00 |
| Specific gravity | 1.358 | 1.281 | 1.294 | 1.307 | 1.274 |
| Sulphur | 4 527 | 1.291 | 1.735 | 1.915 | 1.895 |

It will be seen that Coal 1 occupies a place not only at the base of the series above the Conglomerate sand-rock, but it is found at the foot of the hills of the main valleys over an area that includes most of the region under consideration, as also the adjoining counties to the south. This fact is of no small importance when it is remembered that seven hundred feet of rock includes Coal 1, and nearly all the other valuable coal-beds, six or seven in number, of Eastern Kentucky. With the place of Coal 1 established, the few sections that it has been possible to work up in the brief time allotted to this field, will go very far towards indicating the number and character of the beds in the various localities, the height of the hills being known.

The next one hundred to one hundred and thirty feet of the vertical section includes the main cannel coal beds of this region. It will be remembered that the main cannel coal of the Greenup and Carter region is No. 4, having below it No. 3 (in places 2A), No. 2, and No. 1, all common bituminous coal, with a few exceptions in the case of No. 2, towards the head-waters of the Little Sandy, and also in the valley of the Levisa Fork of the Chattarawha River, in the southern part of Lawrence county. Southward from these localities, as has already been intimated, Coal 2 becomes a prominent, and, so far as its general extension is concerned, a reliable cannel coal. In some localities Coal 2A shares in the change to cannel, while Coal 4, so far as it is known, loses its prominence as a workable cannel seam, being largely or in places wholly splint or common bituminous coal. The presence of two cannel beds so near together in the vertical section, and the varying intervals between the beds in general, make it difficult in some exposures where but one is found to determine which bed is represented. It is probable, however, that No. 2 continues to be the main bed in these counties, and that it is represented by the Pierat cannel bed on Blackwater Creek, by the Rush Branch cannel, and its extension on to the head-waters of the North Fork, and to the

adjacent tributaries of Elk Fork, by the Buck Branch cannel coal in Elliott county and by Lykens and Prater's cannel, near the head of Caney Creek, and probably by Cox's coal, near West Liberty. It seems likely that the Spaw's Creek cannel, the Lyken's cannel, on the Licking near the mouth of Pricy Creek, and Colvin's cannel in Magoffin county, represent No. 2A, but this is by no means certain.

Eastward in the valley of the Levisa Fork Coal 2 is not so thick where opened, but it is generally present, and will doubtless be found in some localities a workable bed. It is the cannel of the Open Fork of Paint Creek, of George's and Tom's Creeks, of Lick Branch, ten miles above Peach Orchard, near the Levisa Fork, also of Daniel's Creek, and of Jenny's Creek, in Johnson county, of Abbott Creek, in Floyd, and of the Rockhouse Branch of Burning Fork, in Magoffin county.

The following descriptive table of these cannel beds will serve to show the place, thickness, and quality in some of the localities where it has been seen:

| | Height above drainage, where seen. | Thickness of cannel. | Specific gravity. | Moisture. | Volatile combustible matter. | Fixed carbon. | Ash. | Sulphur. |
|---|---|---|---|---|---|---|---|---|
| Pierat Cannel, Blackwater Creek . . | . . . . . | 36 inches. | 1.230 | 2.06 | 49.64 | 43.20 | 5.10 | 0.955 |
| Rush Branch Cannel . . . . . | 20 feet. | 58 inches. | 1.332 | 1.60 | 44.00 | 38.86 | 15.54 | 0.961 |
| Adkins' coal on Worth Fork . . . . | 5 feet. | 40 inches. | 1.348 | 4.26 | 42.48 | 33.76 | 19.50 | 1.535 |
| Mordecai Creek Cannel. . . . . | at bed. | 36 inches. | 1.373 | 3.90 | 39.30 | 38.80 | 18.00 | 1.106 |
| Maynheir's Bank, Elk Fork . . . . . | 75 feet. | 26 inches. | 1.331 | 2.30 | 41.60 | 44.70 | 11.40 | 1.271 |
| Cox's Cannel, near West Liberty . . | 180 feet. | 24 inches. | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
| Spaw's Creek Cannel . . . . . | . . . | 18 inches. | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
| Caney Cr'k, at Walnut Grove (No. 2) | bed of br. | 24 inches | 1.294 | 2.20 | 40.50 | 50.30 | 7.00 | .805 |
| Lykens' Can'l, on Lick'g r, Mag. co. | 160 ft. | 18 inches. | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
| Colvin's Bank, Magoffin county . . . | 170 ft. | 36 inches. | 1.215 | 2.30 | 51.90 | 37.56 | 8.24 | 1.415 |
| Salyersville bed . . . . . | 180 ft. | 14 inches. | 1.275 | 1.80 | 45.60 | 43.40 | 9.20 | 0.688 |
| George's Creek, Johnson county. . . | 50 feet. | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
| Tom's Creek, Johnson county . . . . | 80 feet. | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
| Lick Branch, Johnson county . . . . | 75 feet. | 27 inches. | 1.291 | 2.00 | 38.20 | 51.00 | 8.80 | .956 |
| Daniel's Creek, Johnson county . . . | 5 feet. | 22 inches. | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
| Jenny's Creek, Johnson county . . . | 15 feet. | 24 inches | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |
| Abbott Creek, Floyd county. . . . . | 100 feet. | 26 inches. | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |

* Above the Licking river.

Section 6, plate 1, shows both cannel coals No. 2 and 2A, separated by an unusual thickness of intervening rock. The following section, as seen at Walnut Grove, near the head of

Caney Creek, also shows both seams in their relation to Nos. 3 and 4:

TOP OF HILL.

| | | |
|---|---|---|
| Covered space | 10 | feet. |
| Coarse Sandstone | 10 | " |
| Shale and Shaly Sandstone, with Kidney Iron Ore | 20 | " |
| Covered | 50 | " |
| Cannel Coal (No. 4)* | 1 | " |
| Coal | ½ | " |
| Under Clay—thickness not seen. | | |
| Mostly covered Sandstone and Shale | 42 | " |
| Coal stain (No. 3). | | |
| Covered space | 23 | " |
| Sandstone ledge | 18 | " |
| Covered | 20 | " |
| Sandstone | 20 | " |
| Shale | 5 | " |
| Coal | 10 | inches. |
| Slate parting | 1½ | " |
| Cannel Coal (No. 2A) | 24 | " |
| Impure Coal and Clay, with thin Iron Ore | 20 | " |
| Under Clay | 18 | " |
| Shaly rock and covered surface | 50 | feet. |
| Coal | 5 | inches. |
| Cannel Coal (No. 2) | 24 | " |
| Clay Shale | 24 | " |
| Coal | 6 | " |
| Clayey Sandstone, containing ferruginous nodules and abundant stigmariæ, | 18 | " |
| Clay Shale, with Limestone concretions | 30 | feet. |
| Sandstone and Shaly Sandstone | 20 | " |
| Coal in bed of Creek—thickness not known. (Possibly No. 1.) | | |

A comparison of this section with that part of the general section of Greenup and Carter which includes the first four coals, does not show many points of agreement. This want of similarity misled Dr. Owen as to the equivalency of these Morgan county beds. (See vol. III, page 29.) A study of sections 8 and 11, plate 2, makes it reasonably certain that the two lower cannel beds are below Coal 3. This order is indicated especially by the position of the limestone ore in the latter section, which has been distinctly traced across Elliott county† into Carter, where its relation to the beds below is well known. Coal 3 is also readily traceable across Elliott into Morgan. It is in fact the great common bitumin-

*Reported nearly two feet on the white oak side of the hill.

†See forthcoming Report on the Geology of Elliott County.

ous coal of both counties, and, though it shows a wide range of variation in the thickness and character of the coal, it is one of the most persistent beds in that part of Eastern Kentucky which has been studied thoroughly enough to make the extension and relation of coal-beds more than a matter of opinion. The upper part of the section at Walnut Grove reaches the place of the limestone ore, and the fragments of ore on the surface, near the top of the hill, probably represent that bed. Iron ore, having the distinctive character of the gray limestone ore, has not been noted south of the Licking river, though readily and certainly recognized on Elk Fork, where, in several places, as at the head of Mordecai Creek and on Rush Branch, it is associated with a considerable body of the characteristic gray limestone, as known northward in Kentucky and Ohio. The presence of the limestone ore is of greatest importance as extending the Greenup, Carter, and Elliott iron-making region into Morgan. But also as relates to the descriptive geology of this region, it serves to make the identification of Coal 3 reasonably certain, so far as it extends; and as No. 3 is the most prominent common bituminous coal of this region, its identification South and East—as the "Big Bed" in the hill south of West Liberty, as the "Davis Coal," and "Judge Day's Coal," up the Licking river, carries the key to this series across the valley of the Licking, and the two cannel seams below must, in a general way, at least, be regarded as No. 2 and 2A, though they are rather irregularly disposed in their relation to Coals 1 and 3. The upper cannel bed at Walnut Grove becomes No. 4, the equivalent of the Chinn's Branch, Indian Run, Hunnewell, and Stinson Creek cannel coals in Greenup and Carter counties, while Cox's cannel, of necessity, becomes No. 2 or 2A from its place below Coal 3. The Rush Branch cannel, as seen at many points in the valley of Elk Fork, and on the head of North Fork, is definitely Coal 2, being readily traced from Carter across Elliott into Morgan, along with the beds above.

The identification of these beds of coal as to equivalency is not of very great importance, so far as the actual local

economic value is concerned; for each seam in every region must—questions of accessibility aside—depend on its ascertained thickness and quality for its value. But in studying so large and so diversified a field as is offered in Eastern Kentucky to obtain a knowledge on which its development can be most successfully based, the equivalency of beds becomes a matter of very great importance. It should be understood, however, that the many changes in the character of the rocks south and east from Carter county, where the whole series has been studied the most carefully in detail, and especially the varying, but, as a whole, the increased thickness in the direction of Pine Mountain, makes it difficult to recognize with certainty, at wide intervals, even the best marked horizons. Coal-beds are exposed at many points in this field, the place of which could not be determined without a greater expenditure of time and money than has at any time been at command. But the general horizons of the first four regular beds of coal may be said to be fairly established over the valley of the Licking river, and on the adjacent waters of the Chattarawha. These are the beds of Morgan and Magoffin counties and the beds of the lower part of the vertical section for the valleys of the Levisa and Tug Forks of the Chattarawha, south of the great northward dip between Louisa and McHenry's coal-banks, as described in a former report. In the western part of Morgan these beds disappear in succession at the tops of the hills, as already described. The foot of the dip which brings about this result appears to be along a line passing near to West Liberty, Hazel Green, and Compton. Eastward from this line the rock strata are so nearly conformable to the general level, as indicated by the beds of the main streams, that the height of the hills determines the number of beds that will be found. Some qualification of this statement will be found necessary from the wave-like undulations of the strata that are known to exist, but which have not as yet been definitely traced. To the regular beds as described, possible, and even probable, local workable beds may be added; but it should be remembered that the

probability is also quite as great that some of the regular beds will locally disappear or become so thin or so impure as to be practically worthless.

The coals of Magoffin county are in general the equivalents of those described in Morgan. They are exposed at fewer points, and are not, so far as known, accompanied by any distinct horizon marks. Sections 12 and 14, plate 3, show the occurrence of the usual number of beds. None of them are opened to show the thickness and character at many points. Colvin's cannel coal, near the Licking river, five miles northwest of Salyersville, is one of the best in Eastern Kentucky, as will be seen from the descriptive table above. Stacy's bank, a little further down the river, on Johnson's Creek, which shows forty-eight inches of common bituminous coal, is also among the best of its kind. (See section 13, plate 3.)

The following is the result of an analysis by Dr. Peter of an average from the whole face of this coal:

| | |
|---|---|
| Moisture | 3.70 |
| Volatile combustible matter | 36.64 |
| Fixed carbon | 54.68 |
| Ash | 4.98 |
| Total | 100.00 |
| Specific gravity | 1.270 |
| Sulphur | .944 |

The Salyersville coal (section 14, plate 3) is 32 inches thick, with the lower 14 inches cannel and splint. The Gardiner Branch coal is the same, but more slaty.

The following is an analysis of the upper part of the Salyersville bed; that of the lower part will be found in the descriptive table of the lower cannel beds:

| | |
|---|---|
| Thickness of upper part | 18 inches. |
| Moisture | 2.70 |
| Volatile combustible matter | 38.04 |
| Fixed carbon | 51.62 |
| Ash | 7.64 |
| Total | 100.00 |
| Specific gravity | 1.290 |
| Sulphur | 1.470 |

Three feet of coal is exposed near the bed of Rockhouse Branch of Burning Fork, near Wallace Bailey's, with six inches of cannel at the bottom.

The shale series next above the Conglomerate formation is partly above the drainage in all the larger valleys, marked by the characteristic limestone concretions and calcareous bands. In places a coarse thick-bedded sandstone occupies that part of the vertical section which rises from the bed of the river. At K. N. Fletcher's, on the Licking, above the mouth of Stinson Creek, one hundred feet of sand-rock is shown upward from the river bed. It is not certain that this and other instances noted are not illustrations of the varying conditions under which the rocks of the same horizon have been deposited in adjoining sea areas, though doubtless undulations of a greater or less magnitude will be found to mark the course of any bed or set of beds across so wide a stretch of country that owes its elevation above the sea to forces that could hardly be supposed to unite in producing a uniform movement. The varying intervals between well known beds, indicating unequal subsidences during the time when the rocks included were being deposited, are of themselves sufficient to produce local dips in particular beds. A study of the questions that arise under these heads has not been attempted for this region. They are referred to as offering a most interesting field for any one who has the time and a desire to look into the details of the history of these rock deposits, and with the hope especially that young men of this region will interest themselves in working out the solution of these and other problems that need only intelligent observation, and the accumulated facts of a few years of odd-time study, to make them a source of pleasant recreation, and a well-recognized means of self-improvement.

The sections on plate 4 are a key to the economic geology of Johnson, Floyd, and Martin counties, and the southeast portion of Lawrence. A part of Johnson, including most of Big and Little Paint Creeks, and the head-waters of Tom's and George's Creeks, includes only the lower beds of the

vertical section as shown on this plate on account of the lessened height of the hills in this direction, and of the rise of the Conglomerate above the drainage level. The first four coals are the same as those of Morgan and Magoffin, and of the lower coals of the general section for Greenup, Carter, Boyd, and Lawrence as published, part 2, volume 2, New Series. The coals above are not readily recognized as equivalents of coals in that general section. The greenish clay shale, which marks the horizon of Coals 7 and 8 in all the counties north of Johnson, including, however, only a part of Lawrence, is not distinguishable to the southward, and as the gray limestone ore and the kidney ores of this part of the section are also wanting, it becomes an open question whether Coals 7 and 8, one or both, have disappeared with the gradual thinning out of the greenish shale, or whether the shale has been replaced by sandstone without interrupting the continuity of these beds. On this point I am less inclined to give an opinion than after the first hasty glance at this region; and also, it must be owned that Coals 5 and 6 must be recognized much more from the serial order of beds than from any distinctive character or surroundings as known in the field where they have been previously studied. It must suffice, therefore, for the present to show that the high hills of this part of the Chattarawha Valley carry the great common bituminous coal-beds of Eastern Kentucky. This is shown by sections 17 and 18 combined, neither section showing all the beds that are present where the hills reach a height of six hundred feet. The eight-foot seam of the Paintsville section (17) is undoubtedly present in the region of section 18, as it is opened at several points on the head of Nat's Creek, a little way to the north, where it is known as the "eight-foot-bed." In a former report this coal was regarded as the equivalent of No. 8, but it is at least doubtful whether that number indicates its proper place in the series.

No. 3 is badly split up with slate partings in a part of this region. It is the Peach Orchard bed which has so excellent a reputation in Lawrence county. No. 2 is a good cannel,

as in Morgan, but is not known to exceed thirty inches in thickness. No. 4, where known, is a splint coal overlaid at some points, as in section 18, by a so-called black band iron ore. The next bed above is the six-foot bed shown on Scaffold Lick Branch of Rockcastle Creek. In that locality it is without parting, and of excellent quality throughout: unfortunately the sample for analysis was lost. Another coal is reported on the next bench above this bed, and below the "eight-foot" bed. The eight-foot seam is also without partings of more than a few inches of clay, where seen west of the Levisa Fork. An analysis of an average sample of the whole thickness from near the outcrop at the head of Nat's Creek is here copied from a previous report, though the ash is considerably increased by adhering clay:

| | |
|---|---|
| Moisture | 3.50 |
| Volatile combustible matter | 31.90 |
| Fixed carbon | 52.06 |
| Ash | 12.50 |
| Total | 99.96 |
| Specific gravity | 1.367 |
| Sulphur | .873 |

Above this bed a thin cannel coal is reported, and fragments have been noted on the surface near the tops of hills in this region, but no exposure of cannel in place has been seen.

Very little has been done to develop any of the coals of this part of the valley of the Chattarawha or Big Sandy, except No. 1, which supplies the wants of the region, and therefore is opened in many places for local use.

The aggregate thickness of coal in the workable beds, as known, may be seen from the following summary:

| | Thickness where opened. |
|---|---|
| Coal 1, the "Prestonsburg coal" (average) | 3 feet 6 inches. |
| Coal 2, cannel | 2 feet. |
| Coal 3, the "Peach Orchard bed" | 6 feet. |
| "Six-foot bed" | 6 feet. |
| "Eight-foot bed" | 8 feet. |
| Total thickness of five beds | 25 feet 6 inches. |

It is hardly probable that these beds will average so thick as represented by these figures, except Coal 1. The Peach Orchard seam retains its full thickness over a wide range, but at some points, as near Paintsville, it is so split up with partings as to render it impracticable to remove the whole bed. The "eight-foot" bed also shows a number of slate partings west of the Levisa Fork; but at the least estimate the body coal in the valley of the Chattarawha is large enough to challenge an interest in this region, which has not heretofore been taken in it as a coal-mining district.

Not much can be said of iron ores in this valley, or in the Licking valley, outside of the "limestone ore"* district, so far as the surface indications go to establish their presence.

Very much might be said of the timber growth of the counties included in this report; but I am satisfied that it is more needful, even now, to take measures to preserve the grand old forests of Eastern Kentucky than to encourage the destructive agencies of commerce by descriptions of the valuable timbers. A sufficient amount of study has not been given to those subjects which, on the other hand, relate more especially to forestry as a science, to warrant the publication of a report at the present time.

The soil of these counties is moderately productive, after the rich vegetable mould of the forests has been exhausted; but the richness of the newly-cleared land is so out of proportion with that which, under the prevailing methods in Eastern Kentucky, has been cropped for a series of years, that the tendency is to destroy the forest on the one hand, and abandon the cleared land to briers and weeds on the other. With this destructive tendency stopped, all of the region in question could be made to sustain a very greatly increased population without a wholesale devastation of woodlands. For judicious husbandry the soil and topography is all that is needed for generous living in rural homes. But if this destructive tendency is to be simply augmented by the increase in population, the time is not far distant when the soil

*See forthcoming Report on the Geology of Elliott County.

will be found too thin for profitable cultivation, and when the hills will be all the more bleak for the copious rains that fall upon them. What is needed is not a better soil, or a different kind of soil, but a proper treatment of the soil as it is, and it will be time enough to speak of the soil as poor when that has been fairly tried and failed. The river valleys differ somewhat in the character of the soil, as should be anticipated from the character of the rock forming the hills. The large proportion of shale in the Licking Valley is marked in the soil by the clay loam of the hill-sides and the finer sandy loam of the larger valleys, while the great masses of sandstone in the Chattarawha Valley make the coarser sandy loams more prominent. Also the topography offers some choice of situation. In the Conglomerate belt the arable land is on the broad hill-tops above the narrow and often cliff-bound valleys. Elsewhere the farms will, for the most part, stretch along the streams, leaving the hill-tops and steeper slopes in timber.

The greatest present need of this region, as an agricultural district, is roads properly laid out and maintained. Most of the so called "big roads" are practically impassable for a load on wheels, while some of them are barely passable on horseback; and this is rarely the fault of the country, as is shown by here and there a well-directed attempt at grading. So long as the roads are regarded as passways, without any claim for location that any one owning land is bound to respect, the transportation of farm products will remain difficult and expensive, and there can be little hope of improvement in the social condition of the country as the result of industrial prosperity, independently of the coal deposits.

There are certainly present the necessary elements for prosperous husbandry and generous living in the hill lands of Eastern Kentucky, as well as in the equally hilly lands of Western New York and Pennsylvania, if only the conditions of prosperity are as promptly met by provision for the common welfare. Good roads may be said to be an important element of the soil of a farming community. Without them, the richest soil is not wholly desirable; and with them, the poorest soil is very much enhanced in value.

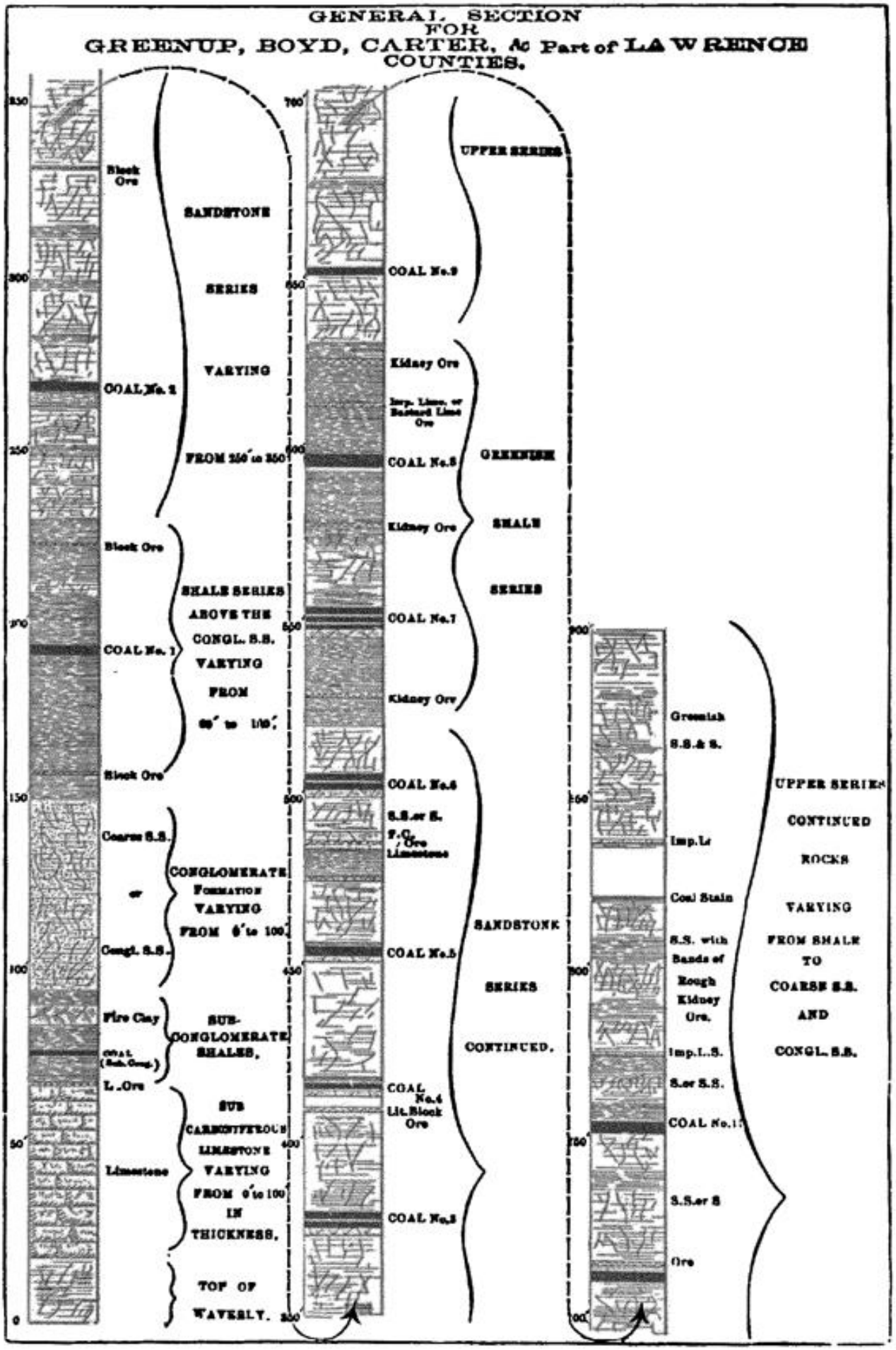
GENERAL SECTION
FOR
GREENUP, BOYD, CARTER, & Part of LAWRENCE
COUNTIES.
850
300
250
200
150
100
50
0
Block Ore
SANDSTONE
SERIES
VARYING
COAL No. 2
FROM 250' to 350'
Block Ore
SHALE SERIES
ABOVE THE
CONGL. S.S.
VARYING
FROM
COAL No. 1
Block Ore
Coarse S.S.
or
CONGLOMERATE
FORMATION
VARYING
FROM 0' to 100'
Congl. S.S.
Fire Clay
SUB-
CONGLOMERATE
SHALES.
Coal (Sub. Cong.)
L. Ore
SUB
CARBONIFEROUS
LIMESTONE
VARYING
FROM 0' to 100'
IN
THICKNESS.
Limestone
TOP OF
WAVERLY.
700
650
600
550
500
450
400
350
UPPER SERIES
COAL No. 9
Kidney Ore
Imp. Lime. or
Banded Lime
Ore
COAL No. 8
GREENISH
SHALE
SERIES
Kidney Ore
COAL No. 7
Kidney Ore
COAL No. 6
S.S. or S.
F.C.
Ore
Limestone
SANDSTONE
SERIES
CONTINUED.
COAL No. 5
COAL
No. 4
Lit. Block
Ore
COAL No. 3
900
850
800
750
700
Greenish
S.S. & S.
Imp. Li
Coal Stain
S.S. with
Bands of
Rough
Kidney
Ore.
Imp. L. S.
S. or S.S.
COAL No. 1
S.S. or S
Ore
UPPER SERIES
CONTINUED
ROCKS
VARYING
FROM SHALE
TO
COARSE S.S.
AND
CONGL. S.S.

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PLATE I

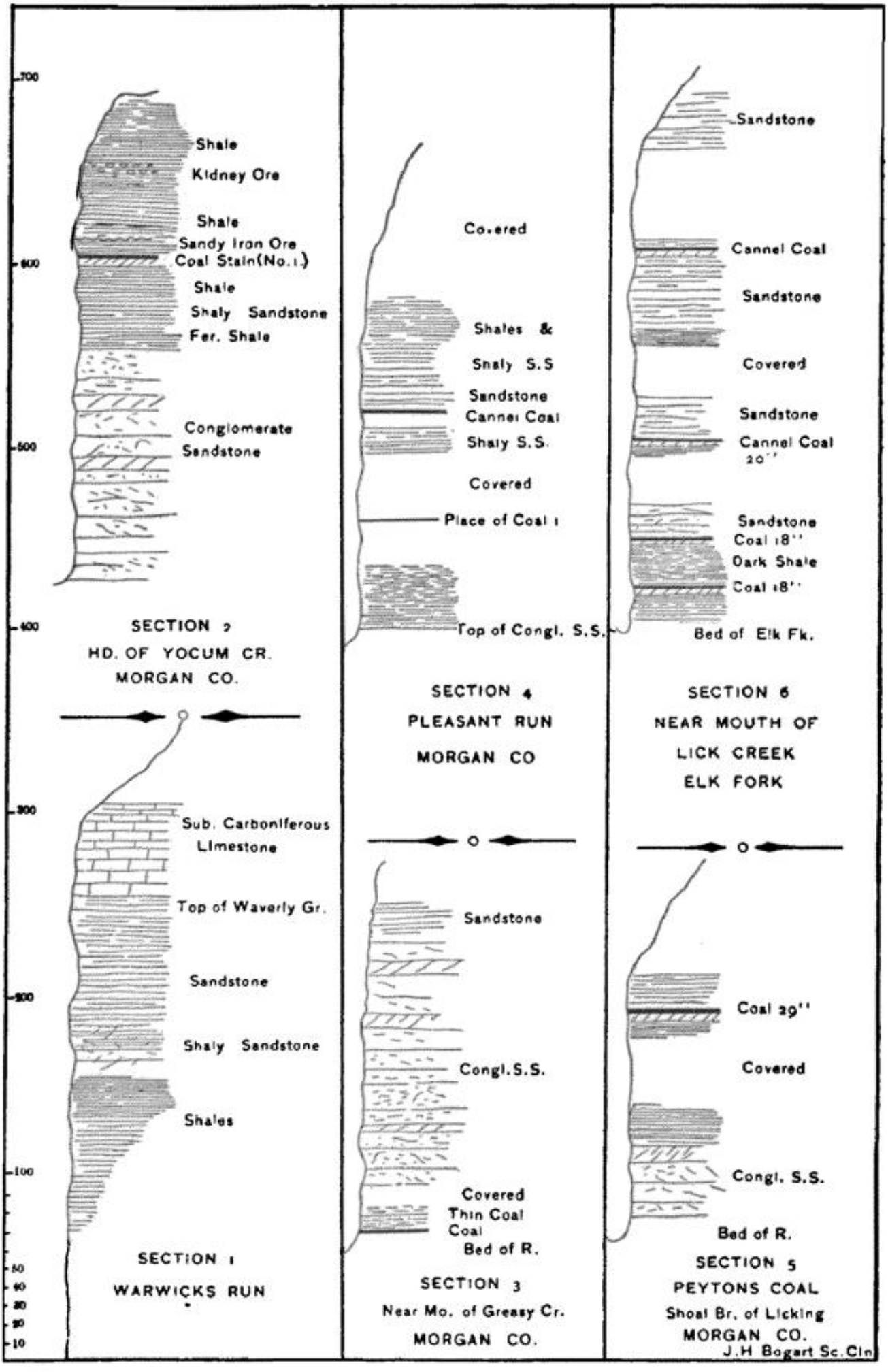
700
600
500
400
300
200
100
50
40
30
20
10
Shale
Kidney Ore
Shale
Sandy Iron Ore
Coal Stain(No.1)
Shale
Shaly Sandstone
Fer. Shale
Conglomerate
Sandstone
SECTION 2
HD. OF YOCUM CR.
MORGAN CO.
Sub. Carboniferous
Limestone
Top of Waverly Gr.
Sandstone
Shaly Sandstone
Shales
SECTION 1
WARWICKS RUN
Covered
Shales &
Shaly S.S
Sandstone
Cannel Coal
Shaly S.S.
Covered
Place of Coal 1
Top of Congl. S.S.
SECTION 4
PLEASANT RUN
MORGAN CO
Sandstone
Congl.S.S.
Covered
Thin Coal
Coal
Bed of R.
SECTION 3
Near Mo. of Greasy Cr.
MORGAN CO.
Sandstone
Cannel Coal
Sandstone
Covered
Sandstone
Cannel Coal
20''
Sandstone
Coal 18''
Dark Shale
Coal 18''
Bed of Elk Fk.
SECTION 6
NEAR MOUTH OF
LICK CREEK
ELK FORK
Coal 29''
Covered
Congl. S.S.
Bed of R.
SECTION 5
PEYTONS COAL
Shoal Br. of Licking
MORGAN CO.
J.H Bogart Sc. Cin

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PLATE II

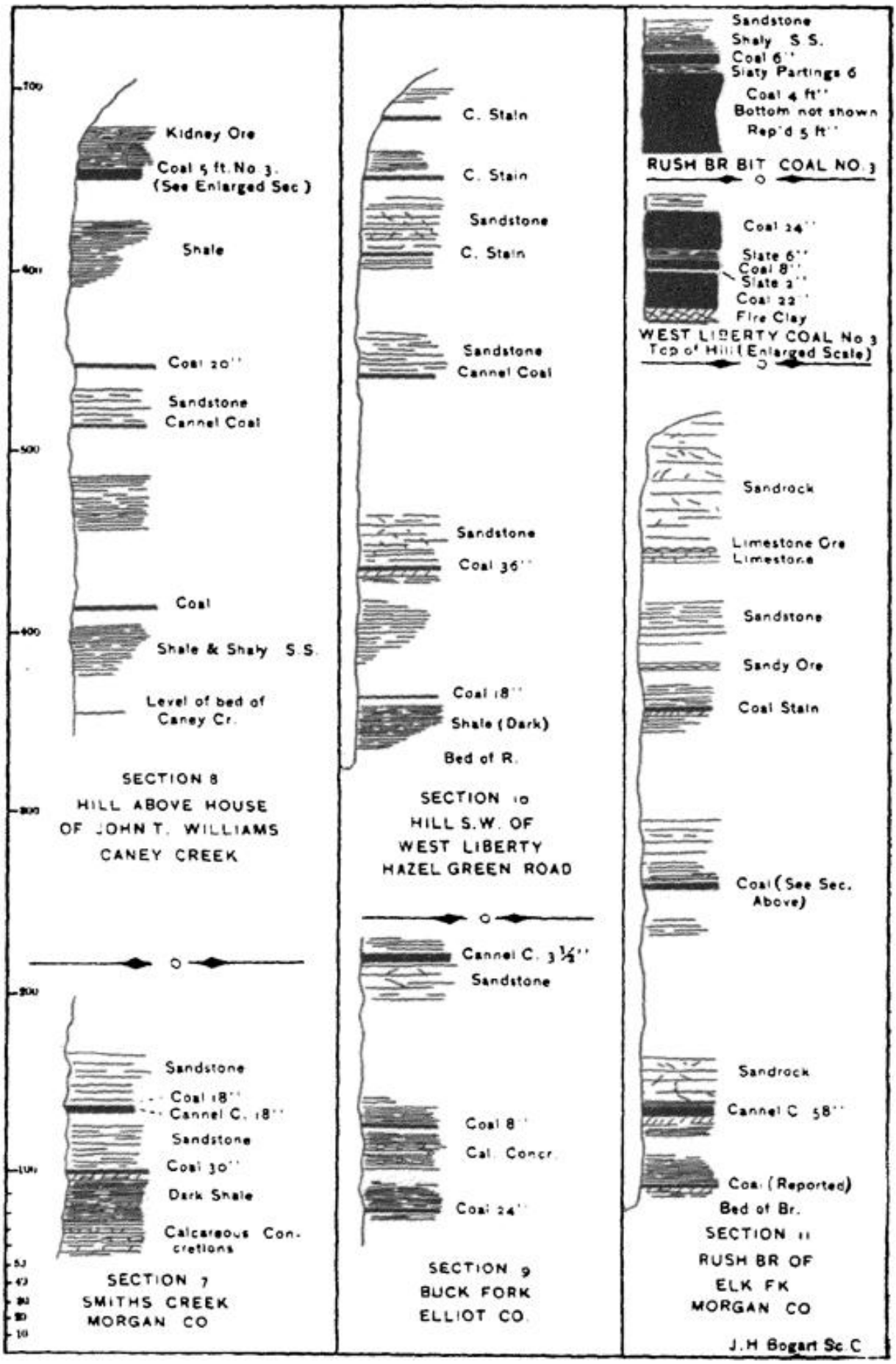
Kidney Ore
Coal 5 ft. No 3.
(See Enlarged Sec.)
Shale
Coal 20''
Sandstone
Cannel Coal
Coal
Shale & Shaly S.S.
Level of bed of
Caney Cr.
SECTION 8
HILL ABOVE HOUSE
OF JOHN T. WILLIAMS
CANEY CREEK
Sandstone
Coal 18''
Cannel C. 18''
Sandstone
Coal 30''
Dark Shale
Calcareous Con-
cretions
SECTION 7
SMITHS CREEK
MORGAN CO
C. Stain
C. Stain
Sandstone
C. Stain
Sandstone
Cannel Coal
Sandstone
Coal 36''
Coal 18''
Shale (Dark)
Bed of R.
SECTION 10
HILL S.W. OF
WEST LIBERTY
HAZEL GREEN ROAD
Cannel C. 3½''
Sandstone
Coal 8''
Cal. Concr.
Coal 24''
SECTION 9
BUCK FORK
ELLIOT CO.
Sandstone
Shaly S.S.
Coal 6''
Slaty Partings 6
Coal 4 ft''
Bottom not shown
Rep'd 5 ft''
RUSH BR BIT COAL NO. 3
Coal 24''
Slate 6''
Coal 8''
Slate 2''
Coal 22''
Fire Clay
WEST LIBERTY COAL No 3
Top of Hill (Enlarged Scale)
Sandrock
Limestone Ore
Limestone
Sandstone
Sandy Ore
Coal Stain
Coal (See Sec.
Above)
Sandrock
Cannel C 58''
Coal (Reported)
Bed of Br.
SECTION 11
RUSH BR OF
ELK FK
MORGAN CO
J.H Bogart Sc C

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PLATE III

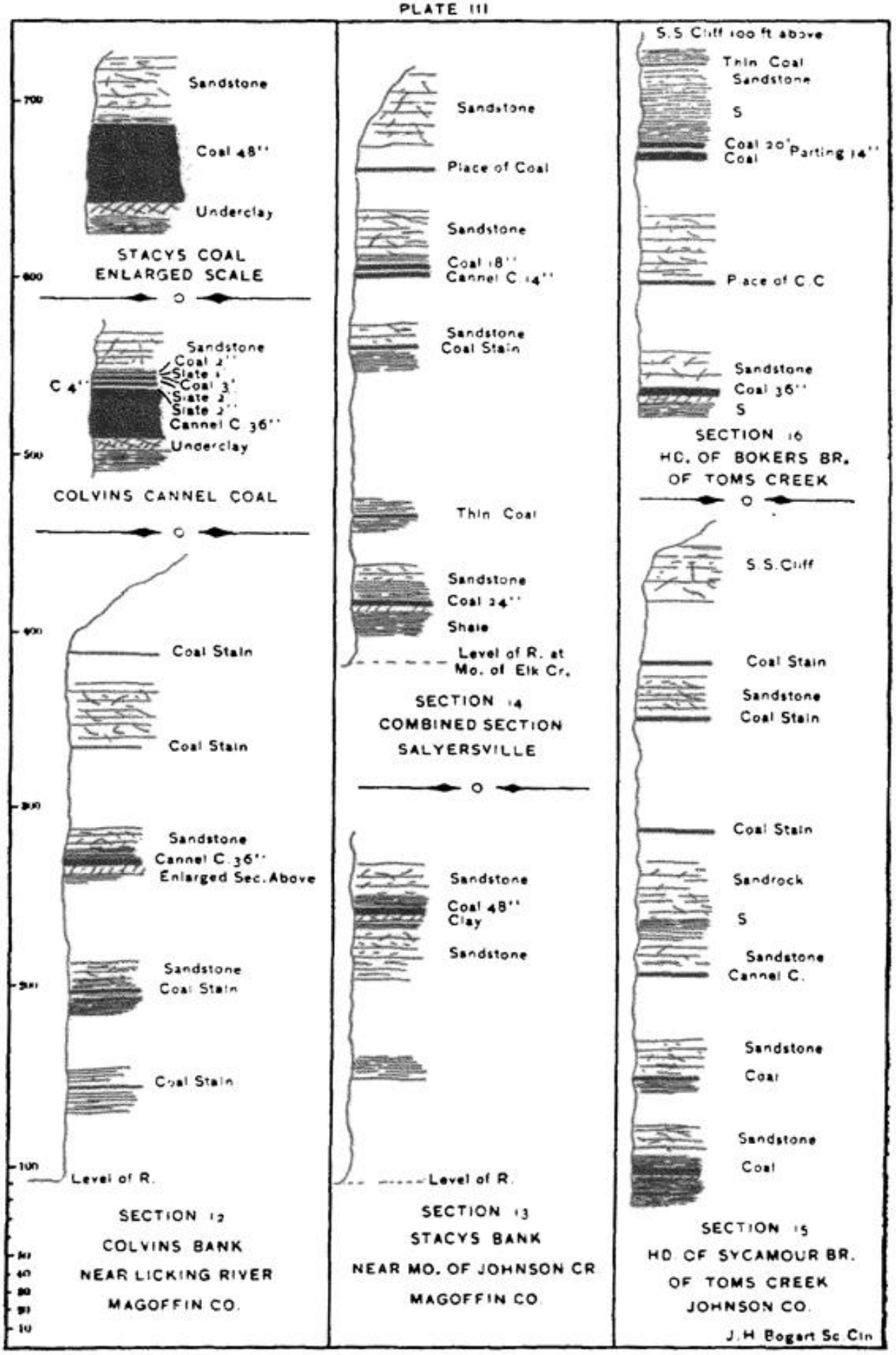
Sandstone
Coal 48''
Underclay
STACYS COAL
ENLARGED SCALE
Sandstone
Coal 2''
Slate 1''
C 4''
Coal 3''
Slate 2''
Slate 2''
Cannel C 36''
Underclay
COLVINS CANNEL COAL
Coal Stain
Coal Stain
Sandstone
Cannel C 36''
Enlarged Sec. Above
Sandstone
Coal Stain
Coal Stain
Level of R.
SECTION 12
COLVINS BANK
NEAR LICKING RIVER
MAGOFFIN CO.
Sandstone
Place of Coal
Sandstone
Coal 18''
Cannel C 14''
Sandstone
Coal Stain
Thin Coal
Sandstone
Coal 24''
Shale
Level of R. at
Mo. of Elk Cr.
SECTION 14
COMBINED SECTION
SALYERSVILLE
Sandstone
Coal 48''
Clay
Sandstone
Level of R.
SECTION 13
STACYS BANK
NEAR MO. OF JOHNSON CR
MAGOFFIN CO
S.S Cliff 100 ft above
Thin Coal
Sandstone
S
Coal 20'
Coal
Parting 14''
Place of C.C
Sandstone
Coal 36''
S
SECTION 16
HD. OF BOKERS BR.
OF TOMS CREEK
S.S.Cliff
Coal Stain
Sandstone
Coal Stain
Coal Stain
Sandrock
S
Sandstone
Cannel C.
Sandstone
Coal
Sandstone
Coal
SECTION 15
HD OF SYCAMOUR BR.
OF TOMS CREEK
JOHNSON CO.
J.H Bogart Sc Cin

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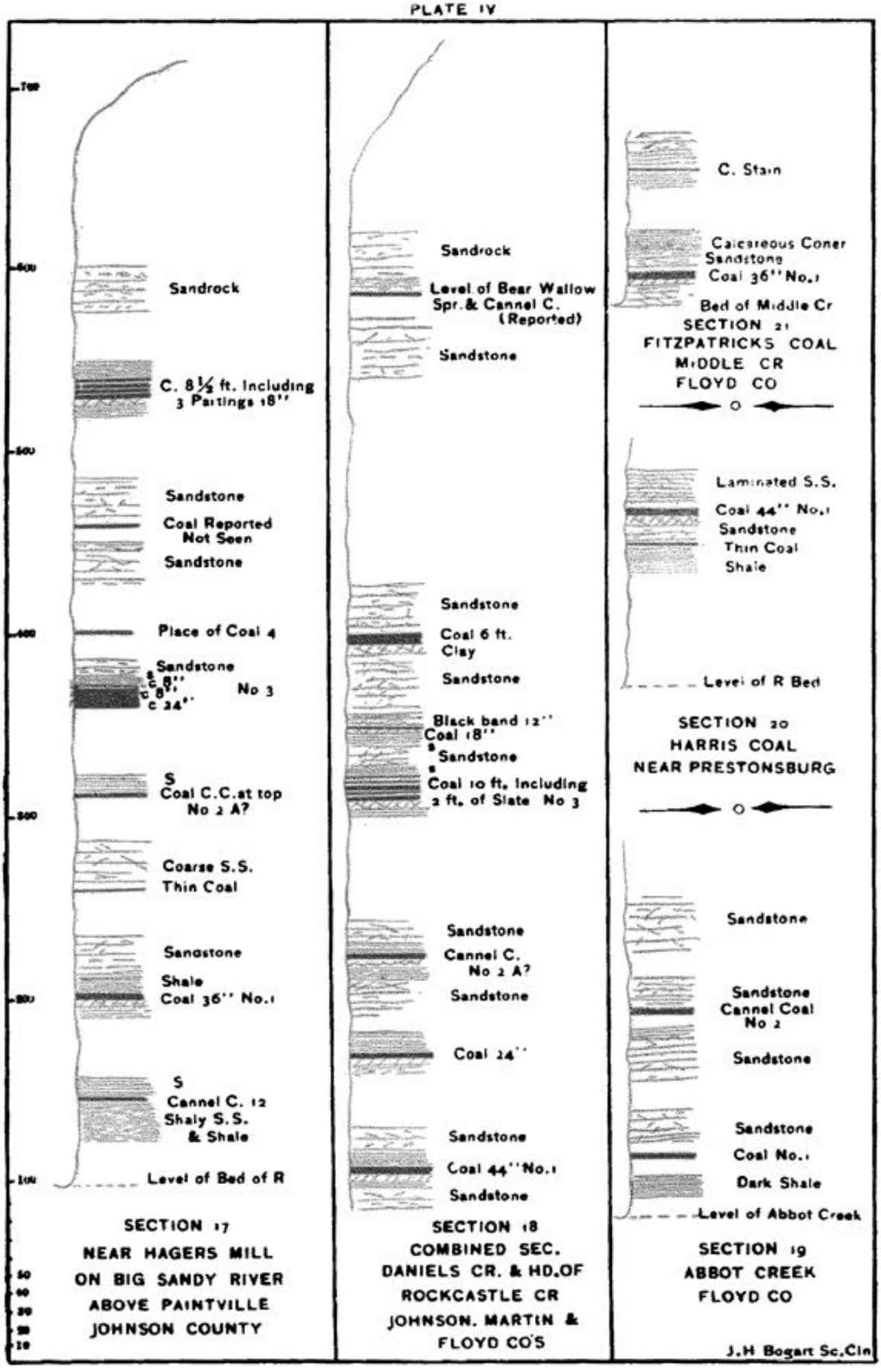
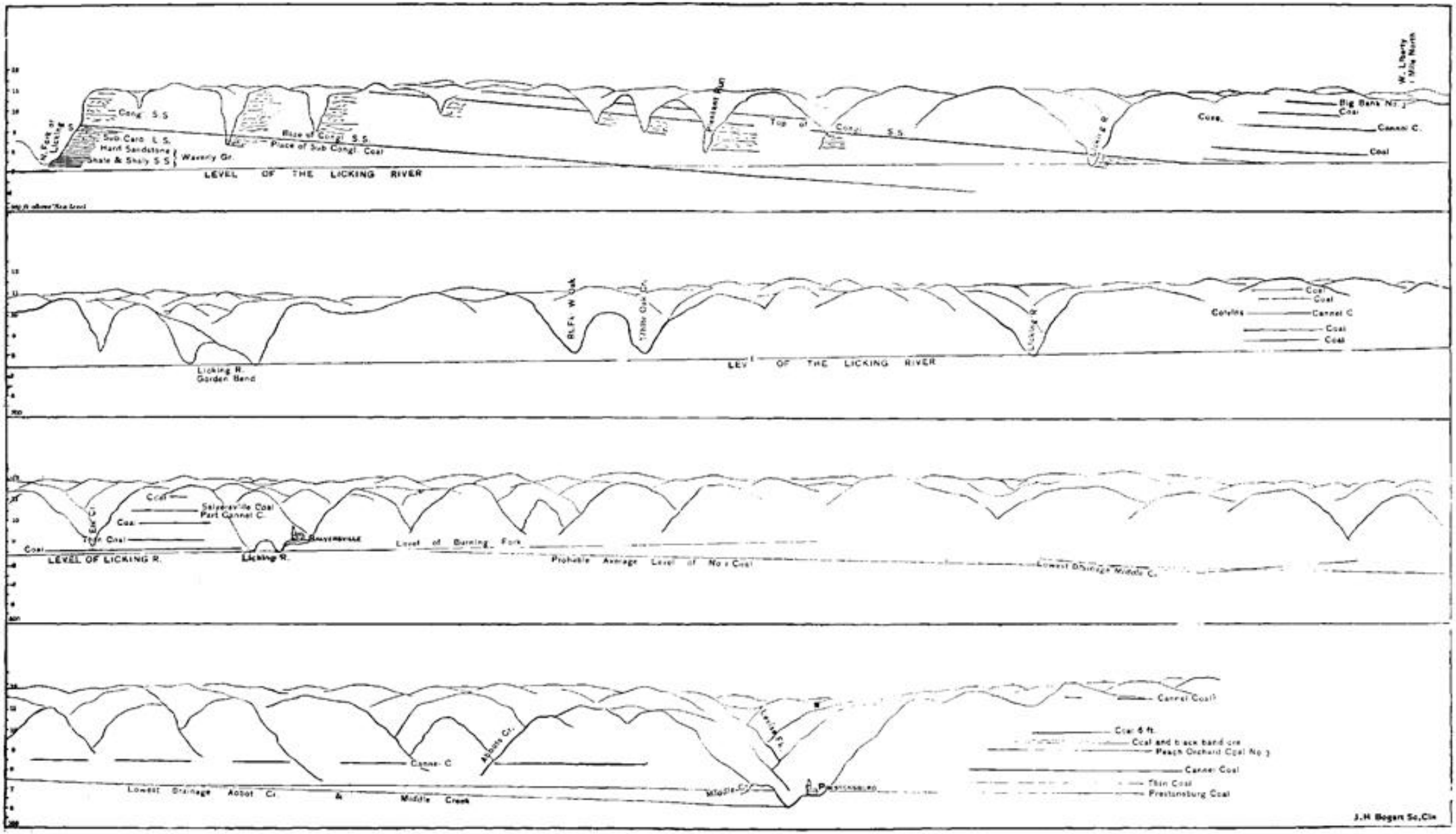
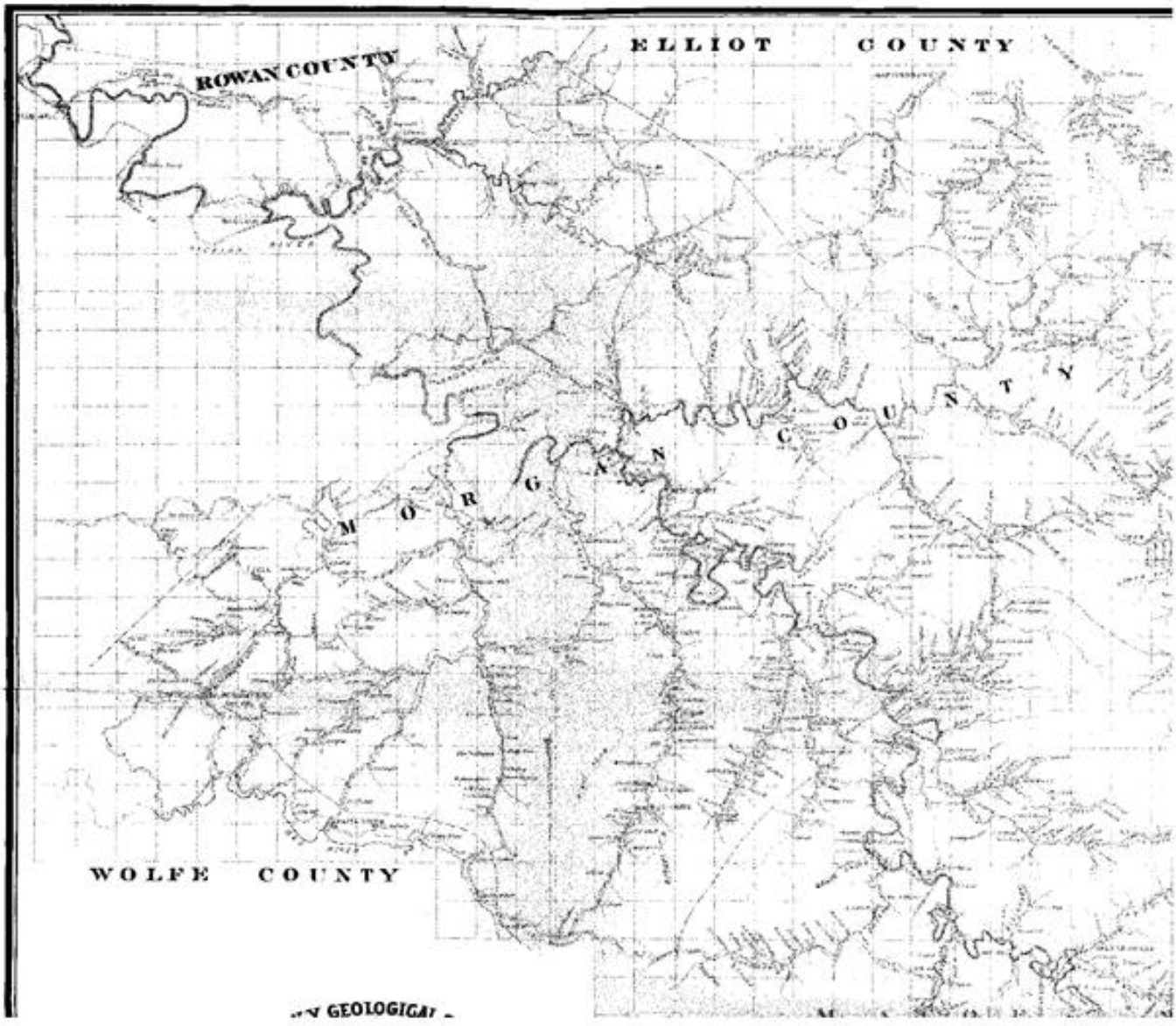
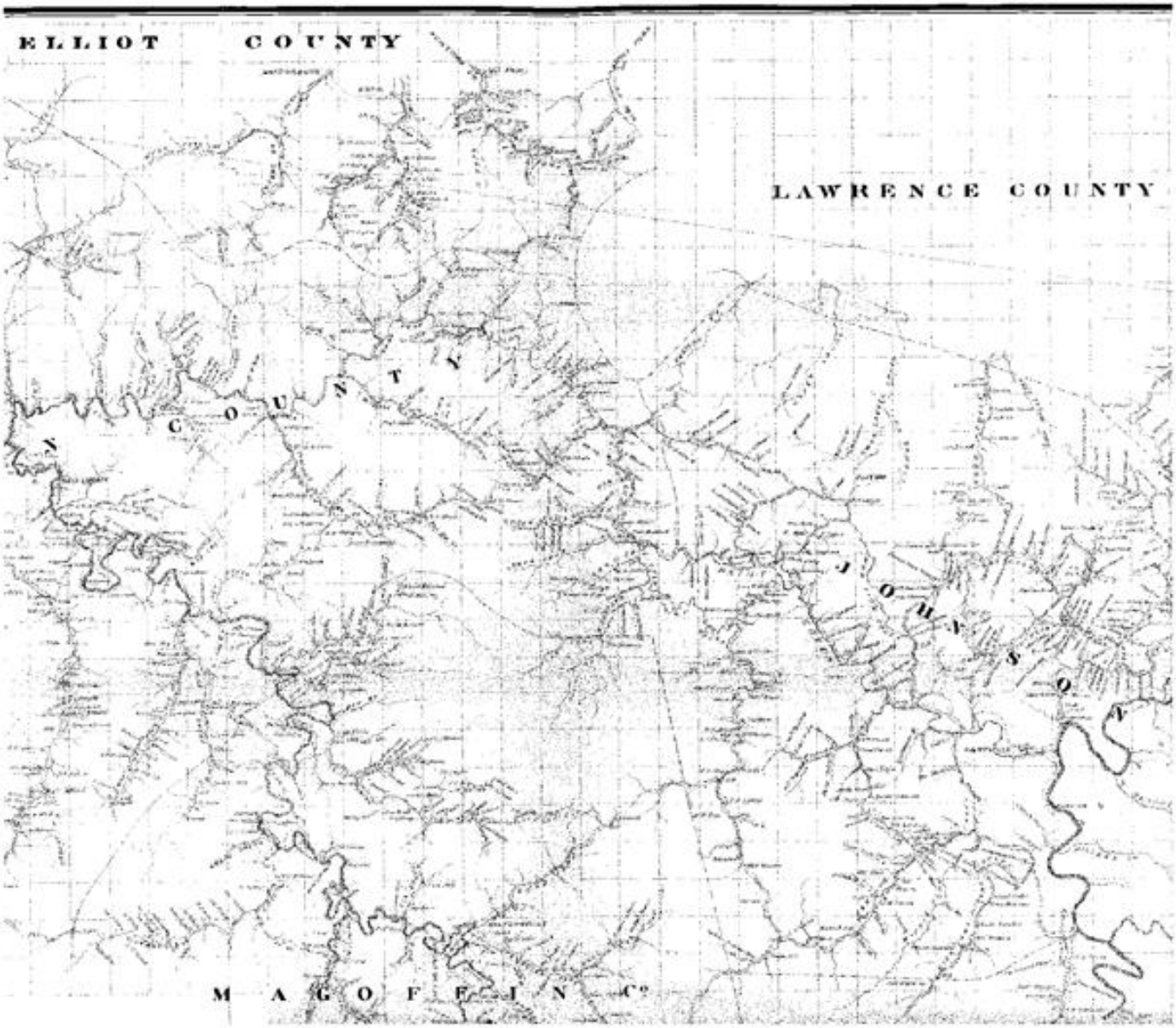
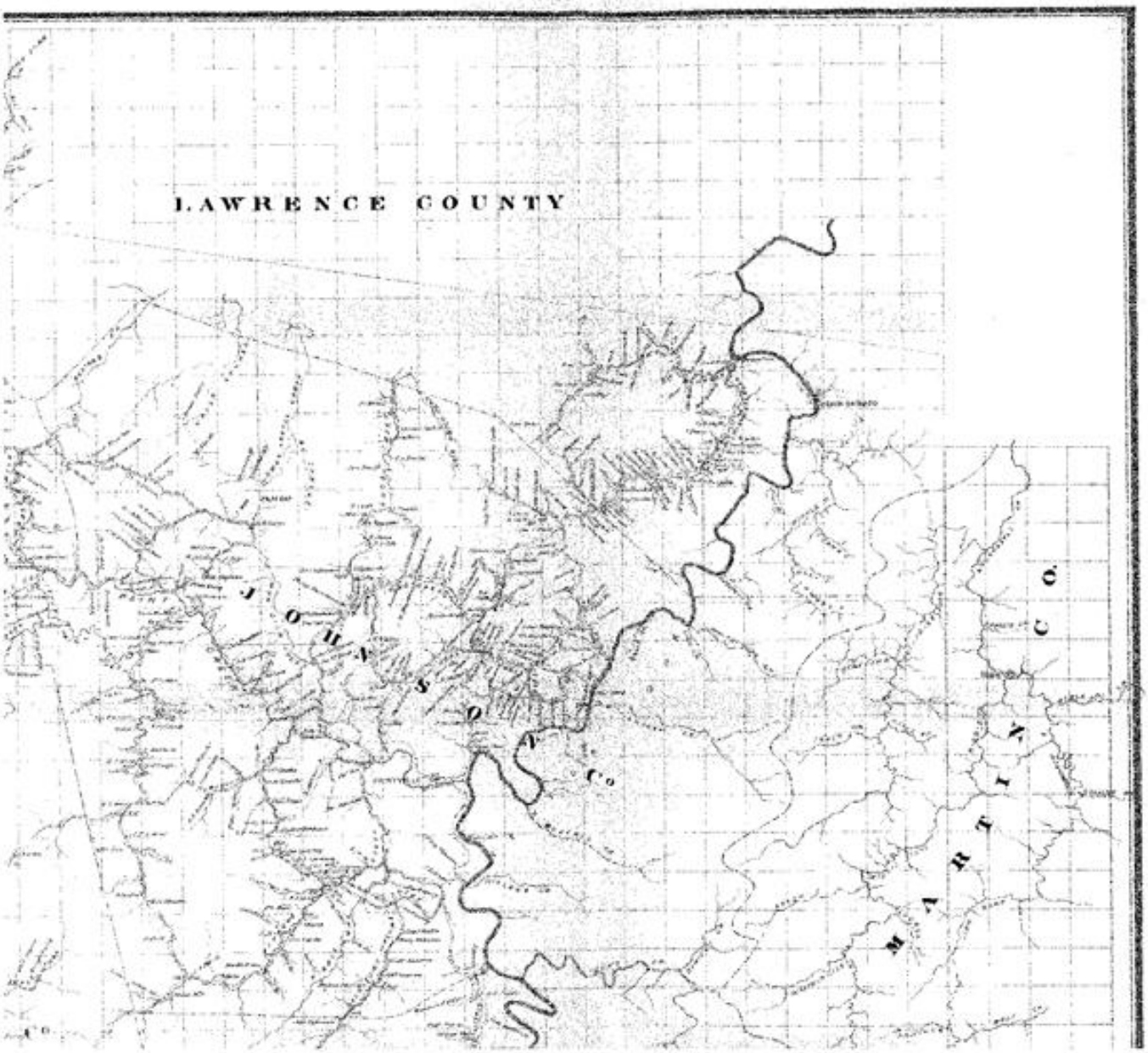
PLATE IV

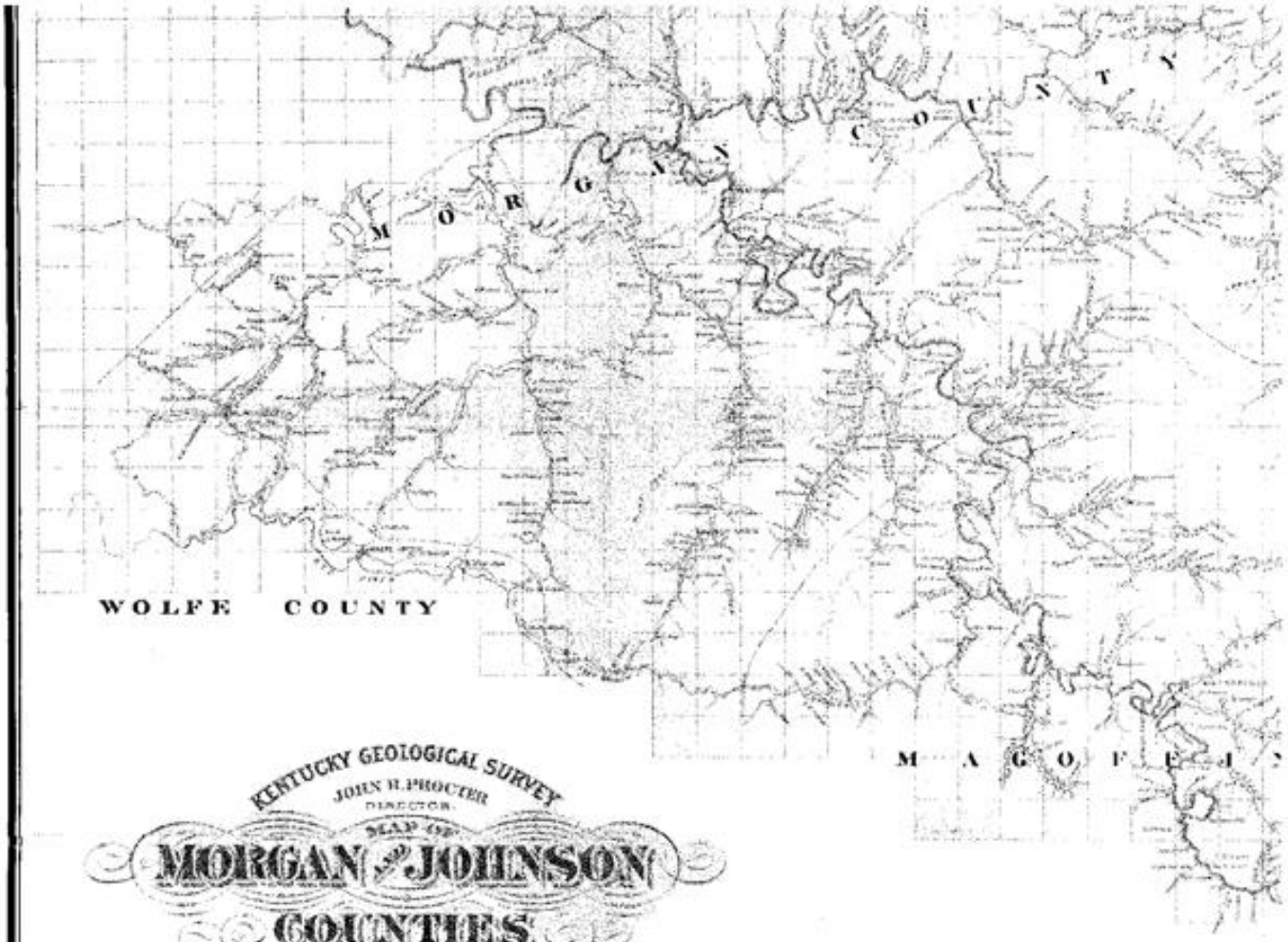

Sandrock
C. 8½ ft. Including 3 Partings 18"
Sandstone
Coal Reported Not Seen
Sandstone
Place of Coal 4
Sandstone
c 8"
c 8"
c 24"
No 3
S
Coal C.C.at top
No 2 A?
Coarse S.S.
Thin Coal
Sandstone
Shale
Coal 36" No.1
S
Cannel C. 12
Shaly S.S. & Shale
Level of Bed of R
SECTION 17
NEAR HAGERS MILL
ON BIG SANDY RIVER
ABOVE PAINTVILLE
JOHNSON COUNTY
Sandrock
Level of Bear Wallow Spr. & Cannel C. (Reported)
Sandstone
Sandstone
Coal 6 ft.
Clay
Sandstone
Black band 12"
Coal 18"
Sandstone
Coal 10 ft. Including 2 ft. of Slate No 3
Sandstone
Cannel C.
No 2 A?
Sandstone
Coal 24"
Sandstone
Coal 44" No.1
Sandstone
SECTION 18
COMBINED SEC.
DANIELS CR. & HD.OF
ROCKCASTLE CR
JOHNSON. MARTIN &
FLOYD CO'S
C. Stain
Calcareous Coner Sandstone
Coal 36" No.1
Bed of Middle Cr
SECTION 21
FITZPATRICKS COAL
MIDDLE CR
FLOYD CO
Laminated S.S.
Coal 44" No.1
Sandstone
Thin Coal
Shale
Level of R Bed
SECTION 20
HARRIS COAL
NEAR PRESTONSBURG
Sandstone
Sandstone
Cannel Coal No 2
Sandstone
Sandstone
Coal No.1
Dark Shale
Level of Abbot Creek
SECTION 19
ABBOT CREEK
FLOYD CO
J.H Bogart Sc.Cin


W. Fork of Licking R.
Cong. S.S.
Sub Carb. L.S.
Hard Sandstone
Shale & Shaly S.S.
Waverly Gr.
Rise of Congl. S.S.
Place of Sub Congl. Coal
LEVEL OF THE LICKING RIVER
Pleasant Run
Top of Congl. S.S.
Licking R.
W. Liberty 1 Mile North
Conn.
Big Bank No. 1 Coal
Cannel C.
Coal
Licking R.
Garden Bend
LEVEL OF THE LICKING RIVER
R.Fk. W. Oak
Timber Oak Cr.
Licking R.
Coal
Coal
Cotylis
Cannel C
Coal
Coal
Coal
Salyersville Coal
Part Cannel C.
Coal
Thin Coal
Coal
LEVEL OF LICKING R.
Licking R.
Level of Burning Fork
Probable Average Level of No 1 Coal
Lowest Drainage Middle Cr.
Cannel Coal?
Coal 6 ft.
Coal and black band ore
Peach Orchard Coal No 3
Cannel Coal
Thin Coal
Prestonsburg Coal
Cannel C
Abbots Cr.
Lowest Drainage Abbot Cr. & Middle Creek
J.H Bogart Sc,Cin


ROWAN COUNTY
ELLIOT COUNTY
MORGAN COUNTY
WOLFE COUNTY


ELLIOT COUNTY
LAWRENCE COUNTY
COUNTY
JOHNSON
MAGOFFIN Co


LAWRENCE COUNTY
JOHNSON Co
MARTIN Co




KENTUCKY GEOLOGICAL SURVEY
JOHN R. PROCTER
DIRECTOR.

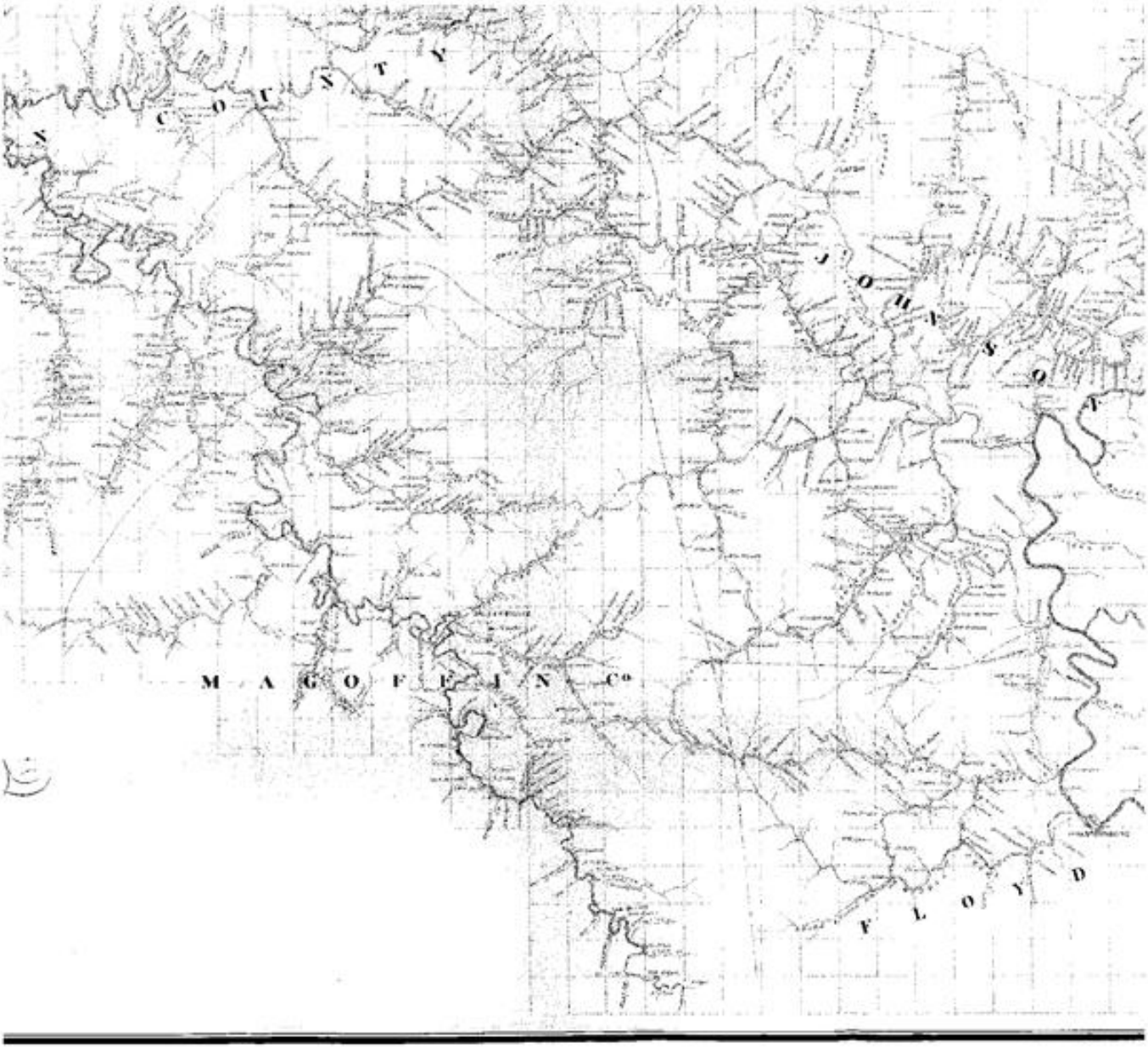
# MAP OF MORGAN & JOHNSON COUNTIES

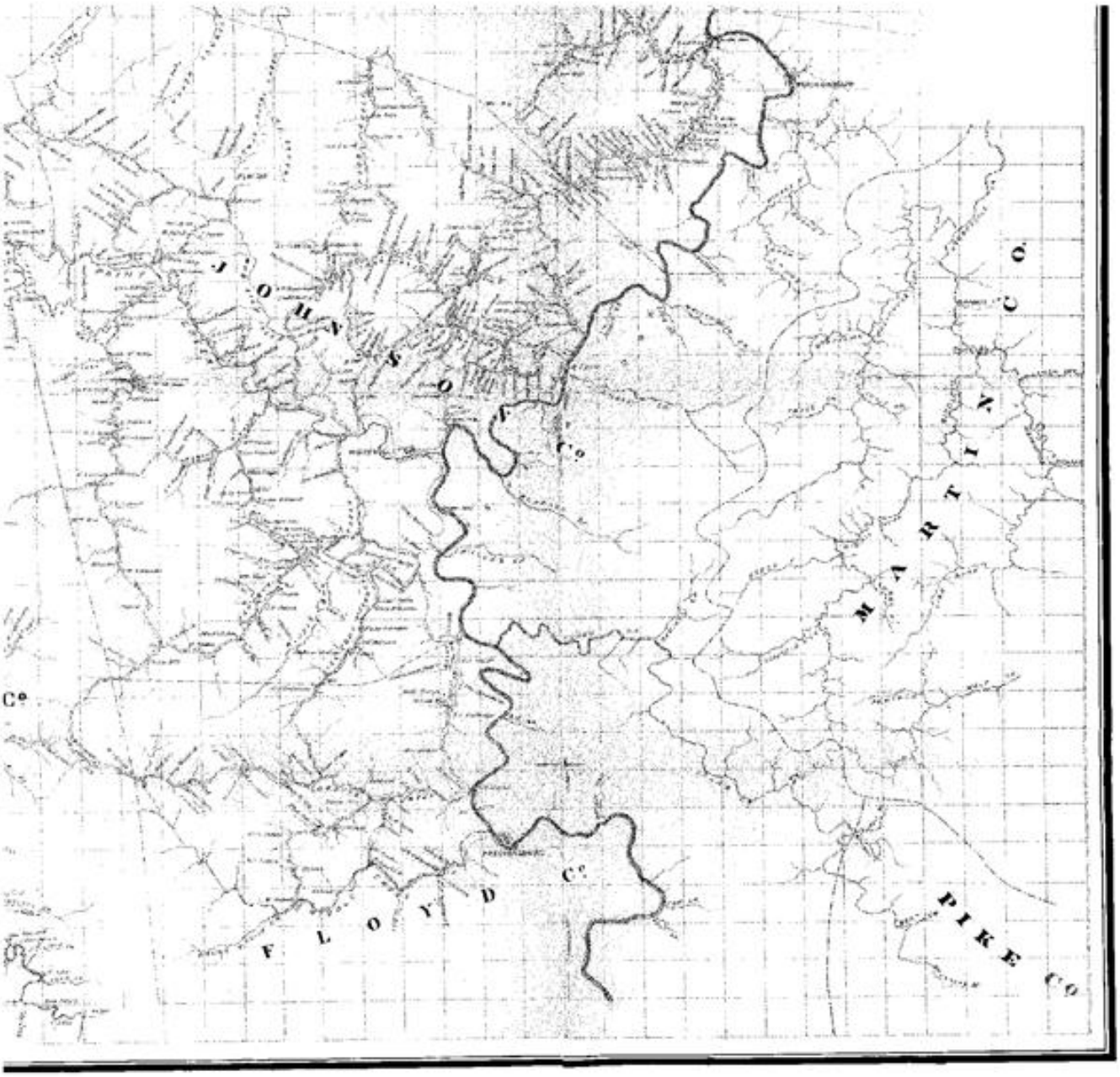
AND PARTS OF

MAGOFFIN, FLOYD & MARTIN.

GEOLOGY BY

A. R. CRANDALL.


C O N S T Y
J O H N S O N
M A G O F F I N Co
F L O Y D


JOHNSON Co
MARTIN Co
FLOYD Co
PIKE Co
Co