GEOLOGICAL SURVEY OF KENTUCKY.

N. S. SHALER, DIRECTOR.

ON THE GEOLOGY

OF PORTIONS OF THE

UPPER CUMBERLAND RIVER VALLEY,

IN

BELL AND HARLAN COUNTIES.

BY A. R. CRANDALL AND P. N. MOORE.

PART XII. VOL. IV. SECOND SERIES.

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ON THE GEOLOGY OF PORTIONS OF THE UPPER CUMBERLAND RIVER VALLEY, IN BELL AND HARLAN COUNTIES.

During the summer of 1876, some time was spent by the writers in the country drained by the upper Cumberland river, for the purpose of constructing the geological sections accompanying this report, and of which it is chiefly explanatory, inasmuch as no detailed discussion of the geology of this valley can be attempted, until the whole of it shall have been thoroughly examined.

The first and principal section (plate I) is from Cumberland Mountain, at Chadwell's Gap, to Straight creek, crossing Pine Mountain a short distance below the mouth of Browney's creek. The course of this section line is about N. 40° W., and it follows in a general way the direction of Browney's creek, crossing Brush Mountain and various spurs of the Black Mountains.

The measurements upon which it is based are all instrumental. The survey of Browney's creek, by which the horizontal measurement of the central portion of the section was determined, was by Mr. E. Underwood, jr. The vertical sections of horizontal coal-measure strata in the Black Mountains were made with an aneroid barometer.

Time failed for the construction of a complete section across the valley near Mt. Pleasant, but a section of the Cumberland Mountain at Crank's Gap was carefully measured, and is given herewith (plate II), as also a number of sections (plate III) of the coal-measure rocks in the Black Mountains, near Mt. Pleasant, Harlan county.

The section at Crank's Gap is from instrumental measurements by the writers, except the horizontal and vertical

distances from Crank's Gap to the "Poor Valley," on the Virginia side of the mountain, which were determined by Mr. C. Schenk.

The valley of the Cumberland river above Pineville, where the river cuts through and leaves the Pine Mountain, on its way to the Ohio, is one of the long, straight, and narrow Appalachian valleys which are so characteristic of the topography of East Tennessee and Southwestern Virginia. It owes its shape to the same cause — the long parallel mountains which determine the course of the stream. In this case the mountains which bound and determine the valley are the Cumberland and the Pine, the last to the northwest of the Appalachian series of mountains.

The Cumberland river, from the head of its longest and main branch, the Poor Fork, flows close to the foot of the Pine Mountain, never leaving it for any great distance. It therefore receives no branches of any size from the northwest, all of its tributaries flowing into it from the area between the river and the Cumberland Mountain. Its principal tributaries are Clover and Martin's Forks. Yellow, Browney's, and Puckett's creeks also drain a considerable area of the valley. Above the mouth of Clover and Martin's Forks the river is known as the Poor Fork.

From the section (plate I) it will be seen that the Cumberland valley or basin is a synclinal valley, although the mountains which terminate it on either side are of very different ages of elevation. The evidence of this statement will be referred to further on. The Cumberland and Pine Mountains, which constitute the edges of this basin, are formed of upturned strata, of age from the Carboniferous to the Silurian, those on the Cumberland dipping to the northwest, passing beneath the surface, and reappearing on the Pine Mountain, where they dip to the southeast.

The Black Mountains, which is the term applied to the palmate mountains lying between the Cumberland and the Pine, are formed of horizontal coal-measure strata, the low-

est of which are geologically above the highest of the Cumberland and the Pine Mountains.

Brush Mountain, through which the section (plate I) passes, is analogous in its structure to, and is really at one point a part of, the Cumberland. It was probably formed at the same time and by the same force which elevated the Cumberland Mountain to such a height. It is but a few miles in length, and lies parallel to Cumberland Mountain. It is joined to, and identical with, it at the head of Martin's Fork and Shillaleh creek, which flow in opposite directions, and separate the two mountains by narrow valleys. The section (plate I) crosses Martin's Fork near its head.

The Conglomerate, or rather the members of the Conglomerate series at the base of the coal measures, are the determining rocks, of greatest topographical value, in the three mountains, the Cumberland, Brush, and Pine.

The Cumberland Mountain is the wasted edge of what was once a grand anticlinal arch, reaching nearly to the Holston river. Since its elevation, therefore, Cumberland Mountain has, in consequence of erosive action, retreated a distance of several miles. The evidence of this, and the discussion of the dynamical geology of this region, will be found in the reports of the Director of the Survey; so that the mere statement of the fact is all that is necessary here.

Brush Mountain, as shown by the section (plate I), is formed by the uplift of, and a great fold in, the Conglomerate series, by which these beds have been raised nearly or quite three thousand feet above their original level, and still left in a horizontal position. This singular position must have resulted from a yielding of the strata to a force acting more nearly vertical than seems to have been usual in the faults and folds of this portion of the Appalachians, but still acting from the southeast.

Lying horizontally, the beds resist erosion most readily; and it is owing to this fact that the mountain retains such a height, and that the valley between it and the Cumberland is so narrow and shallow.

On the northwest slope of the mountain these same Conglomerate beds are dipping very steeply, from 70° to 85°, or almost vertical. This change in dip is due to a fold or bend in the strata, and not to a fault.

The actual bend in the lowest member of the Conglomerate shown on this mountain was exposed as shown in the section (plate I). This stratum is a coarse pebbly sandstone about 100 feet thick. In a hollow at the head of a small drain, a bend of about 85° in this rock was seen. This was probably very near the axis of the fold, and, in consequence, the rock had not been shattered as much as higher up on the arch of the fold. The section shows how much of the folded rocks has been eroded. It will also be seen that the higher members of the Conglomerate series have been entirely eroded from the top of Brush Mountain. On the slope of the mountain a thickness of 1,350 feet of steeply inclined Conglomerate and inter-conglomerate beds has been measured, and it is probable, from certain slope indications, that there is an additional thickness above this of 200 to 400 feet which is not well exposed, and was not measured.

Of this great thickness of rock only about 700 feet remain on the top of the mountain, where the beds are horizontal.

On the face of Cumberland Mountain a thickness of the Conglomerate series occurs which approximates 2,000 feet. The relation which these beds hold to those on Brush Mountain has not yet been satisfactorily determined. If there be simply another bend or fold along the valley of Martin's Fork, this series must come below the Brush Mountain rocks, and we then would have a total thickness of the Conglomerate series of between three and four thousand feet, a thickness which is greater than is certainly known to occur at any other point. For this reason it seems probable that there is a fault between the two mountains, along the upper Martin's Fork valley, and it has been so indicated in the section. This fault has, in fact, probably determined the course of Martin's Fork.

The section (plate II) of Cumberland Mountain at Crank's Gap, between fifteen and twenty miles further up the moun-

tain, shows a structure somewhat similar to that just discussed, only in this case the fold has not been as great, and, in consequence, erosion has not had so great an effect. The mountain is, therefore, undivided by any valley, and the rocks are still intact at the folds.

The forces of elevation have evidently acted in the same direction, and we have here the two changes in dip—a steep dip on the northwest slope, a much more gentle dip on the main body of the mountain, and a steeper dip again at the crest. The first change in dip, as on Brush Mountain, is due to a fold, while it is also uncertain if the upper change be due to a fold or a fault. If it be a fold, there is here shown a thickness of about 2,600 feet of the Conglomerate series; if a fault, about 2,000 feet. There is, however, very slight evidence of a fault.

Pine Mountain is a simple monoclinal mountain, formed by an uplift along a fault line which has a course of about N. 30° E. The rocks are the same as on the Cumberland Mountain, except that they do not extend as low down.

The highest rocks of the Pine Mountain are those of the Conglomerate series. At the time of its elevation the Carboniferous strata, which originally covered all this region, and which are now found in the Black Mountains, covered the Pine Mountain, which was therefore of far greater height than at present; but as these rocks are comparatively soft and friable, they have been eroded.

The mountain is of comparatively recent elevation, as is proved by the fact that the crest has retreated but a short distance from the fault line. At some few places, one of which happens to be where the section line (plate I) crosses, the retreat of the crest has been as much as a half mile; but at many other places it is only a few hundred feet. Undisturbed horizontal coal measures are found to the northwest of the fault line, and but a few hundred feet from it.

The amount of uplift along this fault has not yet been accurately determined, for the reason that the exact geological position of the horizontal coal measures on the opposite side

of the fault line is not known. The uplift is certainly over three thousand feet, for that thickness of strata is found on Pine Mountain at the point crossed by the section (plate I). It was impossible here, as generally on Pine Mountain, to obtain a complete section, as the lower rocks are mostly covered by a great thickness of talus from those above.

The Conglomerate series here is two thousand feet thick. It is not as well exposed as on Cumberland Mountain. The lower rocks, the Sub-carboniferous limestone, the Waverly, and the Devonian, &c., are so imperfectly exposed that no reliable estimates of their thickness can be given.

The Black Mountains are irregular ridges and peaks, presenting the familiar topographical features which are formed by the action of water upon horizontal strata.

They are the continuation of the Log Mountains to the northeast, and the geological equivalents of the "Cumberland table-land" of Tennessee.

They frequently reach a height above the valley of about two thousand feet, equivalent to 3,400 to 3,500 feet above tide.

The character of their rock structure will be seen from the sections (plates I and III). The prevailing type of rock is shaly or thin-bedded sandstone. These are diversified by occasional harder, massive sandstones, which are more common toward the upper part of the sections. Limestones, except as occasional calcareous concretions, are not found. The thickness of coal measures in this valley is greater than in any other part of Kentucky by many hundred feet. The number of coals is also greater, and they differ widely in position from any other region. Sufficient work has not been done to enable us to give a general section which will serve as a key to the stratification of this whole valley; but a single comparison of the general section for Greenup, Carter, and Boyd counties, by Mr. Crandall, the only one heretofore constructed for any portion of Eastern Kentucky, with the sections of this report, will show the great difference in the structure of this region. It shows also the impossibility of making a general section which will hold over a large area.

The section in the Black Mountains (plate I) shows 11 different coals. The section of Gray's Peak (plate III) shows 9 coals. Neither of these sections are by any means complete. It is probable that, on more thorough examination, several other coal beds will be discovered. A section of one of the Log Mountains, made in 1875 by Mr. Crandall, showed no less than 17 different coals. It will be seen from the sections of plate III that the covered spaces, where the rocks were not exposed, aggregate from one third to one half the whole thickness. There is, therefore, every reason to suppose that other coals will be found occupying some of these spaces. There is the more reason for this in the fact that this region is almost entirely undeveloped. There has been no search for coal; and in making sections, reliance has been placed entirely upon natural exposures. The coals vary in thickness from a few inches to five feet. The most common thickness, so far as seen, is about two feet; but workable seams of three feet and upwards are known at four or five different levels.

The quality of the coals of this valley is most excellent. The proportion of ash and sulphur is very low in all that have yet been analyzed, with the exception of one cannel coal, and the fixed carbon is high.

The following analyses, by Dr. Peter and Mr. Talbutt, of two samples from the vicinity of Mt. Pleasant, Harlan county, show the excellent quality just referred to:

	No. 1.	No. 2.
Moisture	1.70	5.20
Volatile combustible matter	35.70	31.26
Fixed carbon	59.60	60.08
Ash	3.00	3.46
Total	100.00	100.00
Coke	62.60	65.54
Sulphur	0.750	0.618
Specific gravity	1 289	1.356

No. 1 is from Howard's bank, Clover Fork.

No. 2 is from Skidmore's bank, Martin's Fork.

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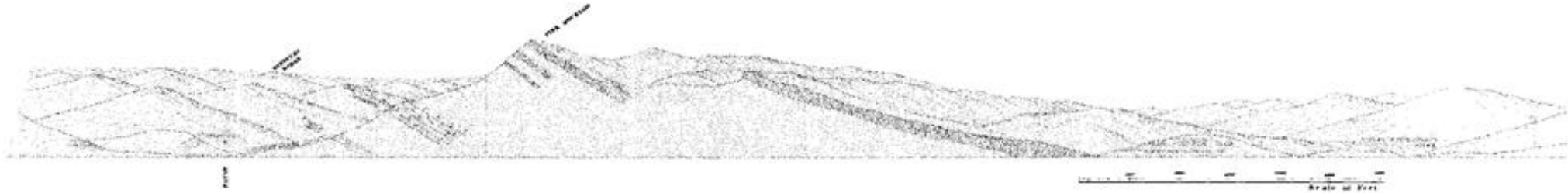
GEOLOGICAL SURVEY OF KENTUCKY.

1876.

N. S. SHALER, DIRECTOR.

SECTION FROM
CUMBERLAND MOUNTAIN,
AT CHADWELL'S GAP THROUGH
PINE MOUNTAIN
NEAR MOUTH OF BROWNEY'S CREEK
BY A.R. CRANDALL AND P.N. MOORE.
SCALE 1000.00
Vertical and Horizontal the same.



GEOLOGICAL SURVEY OF KENTUCKY.

1876.

N. S. SHALER, DIRECTOR.

SECTION FROM CUMBERLAND MOUNTAIN,

AT CHADWELL'S GAP THROUGH

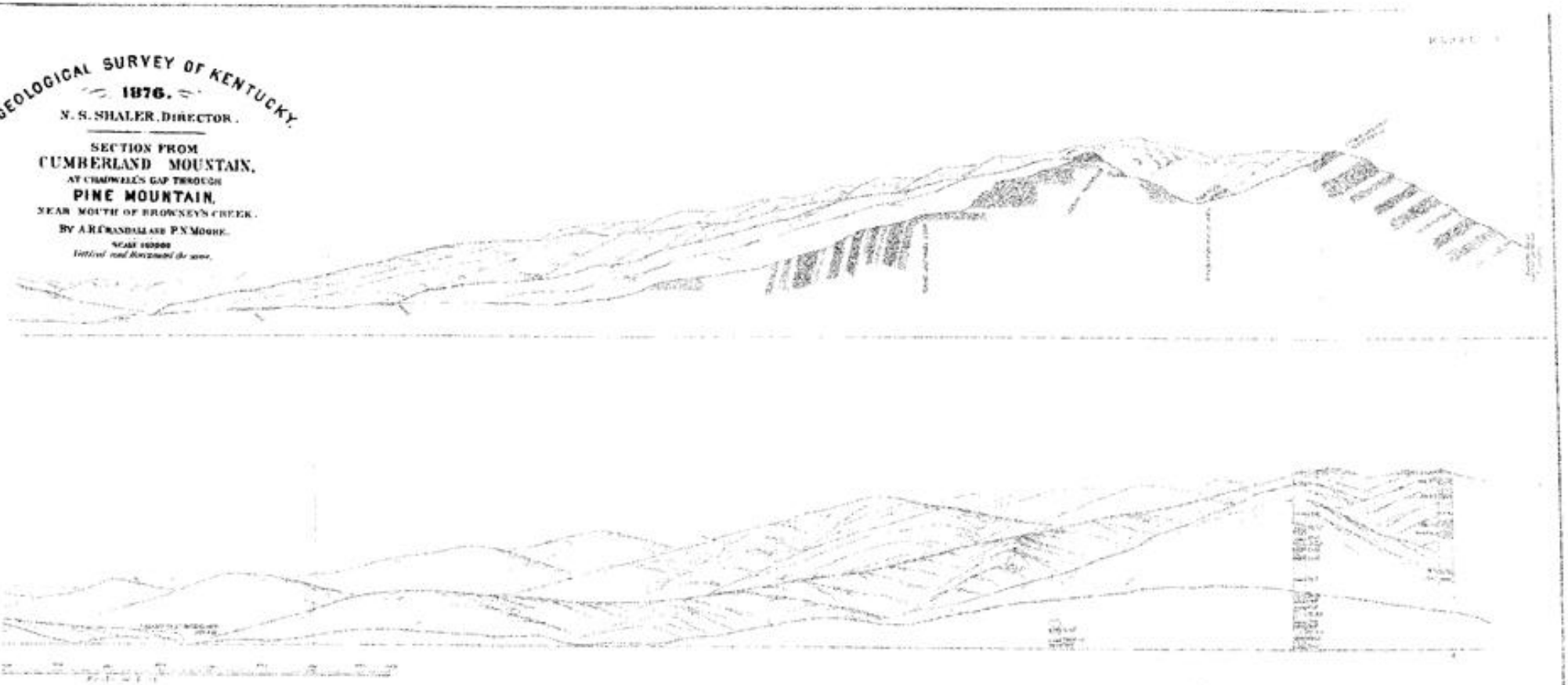
PINE MOUNTAIN,

NEAR MOUTH OF BROOKEY'S CREEK.

BY A. R. CRANDALL AND P. N. MOORE.

SCALE 1/62500

Vertical and Horizontal the same.



GEOLOGICAL SURVEY OF KENTUCKY

1876.

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SECTION FROM
CUMBERLAND MOUNTAIN,
AT CHADWELL'S GAP THROUGH
PINE MOUNTAIN,
NEAR MOUTH OF BROWNEY'S CREEK.

By A. R. CRANDALL and P. N. MOORE.

NEAR VIRGIL

Vertical and Horizontal the same.

PLATE II.

To Accompany Part XII, Vol. IV,

SECOND SERIES,

GEOLOGICAL SURVEY OF KENTUCKY.

PLATE II.

SECTION OF THE

CUMBERLAND MOUNTAIN

AT

CRANK'S GAP.

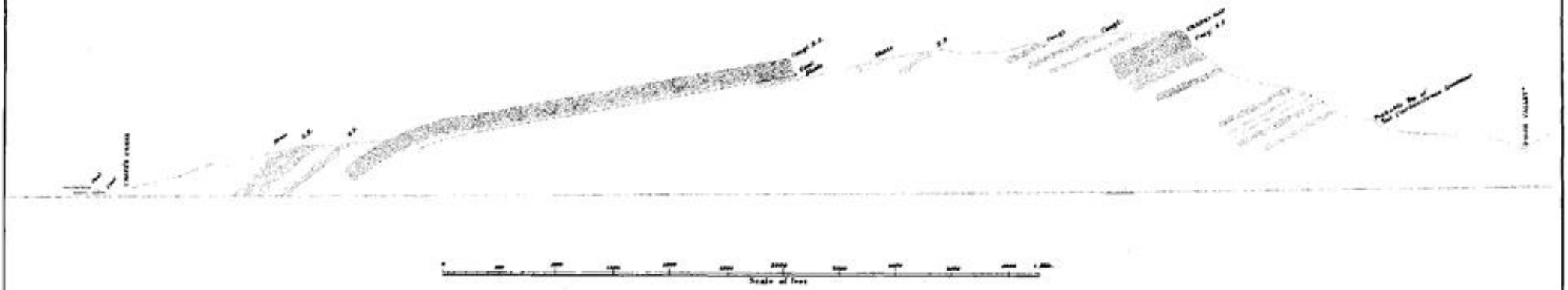
HARLAN COUNTY, KY.

BY A.R. CRANDALL AND P.S. MOORE

1876.

Scale 1: 10,000

Vertical and Horizontal the same



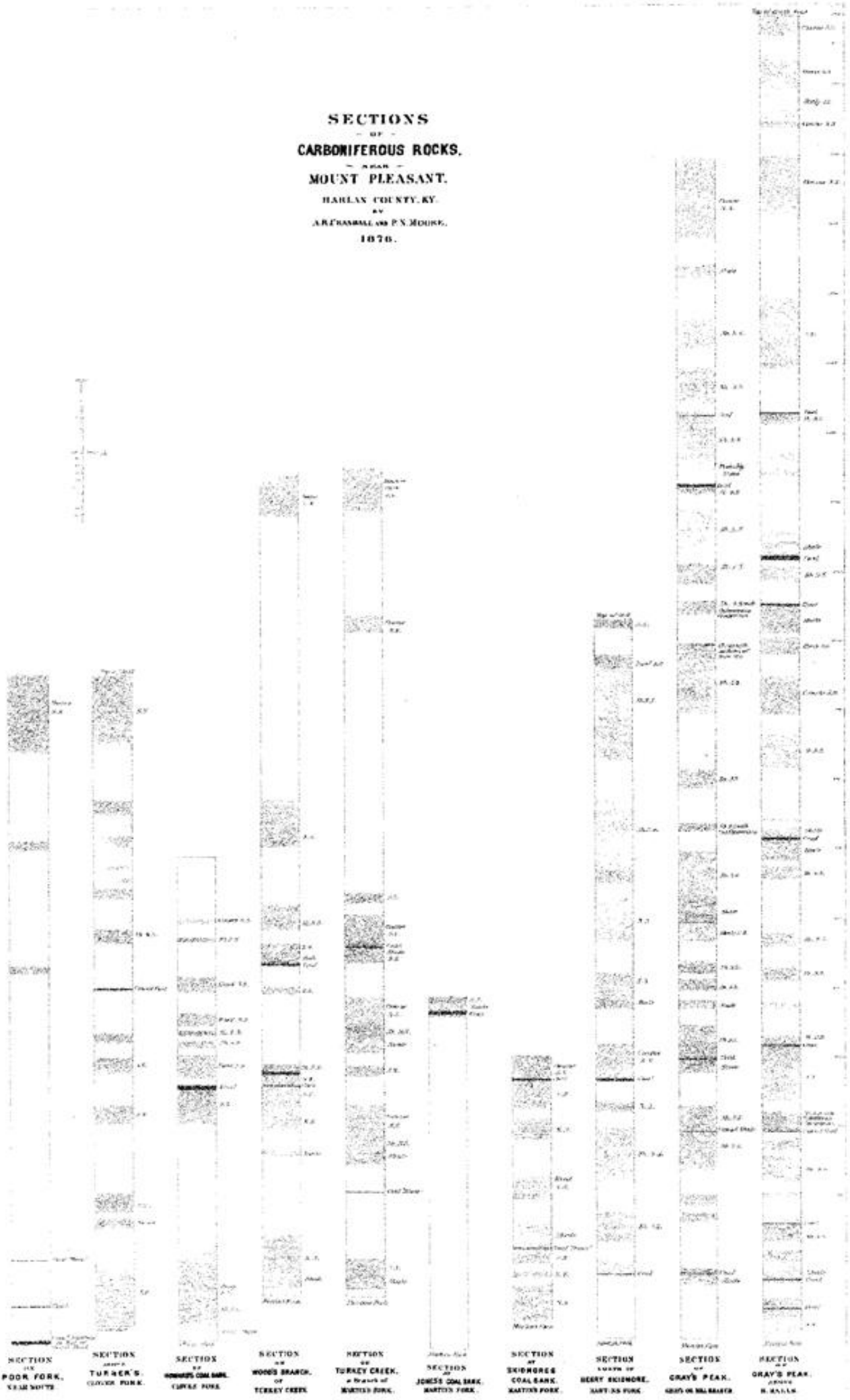
SECTIONS
— OF —
CARBONIFEROUS ROCKS,
— NEAR —
MOUNT PLEASANT.

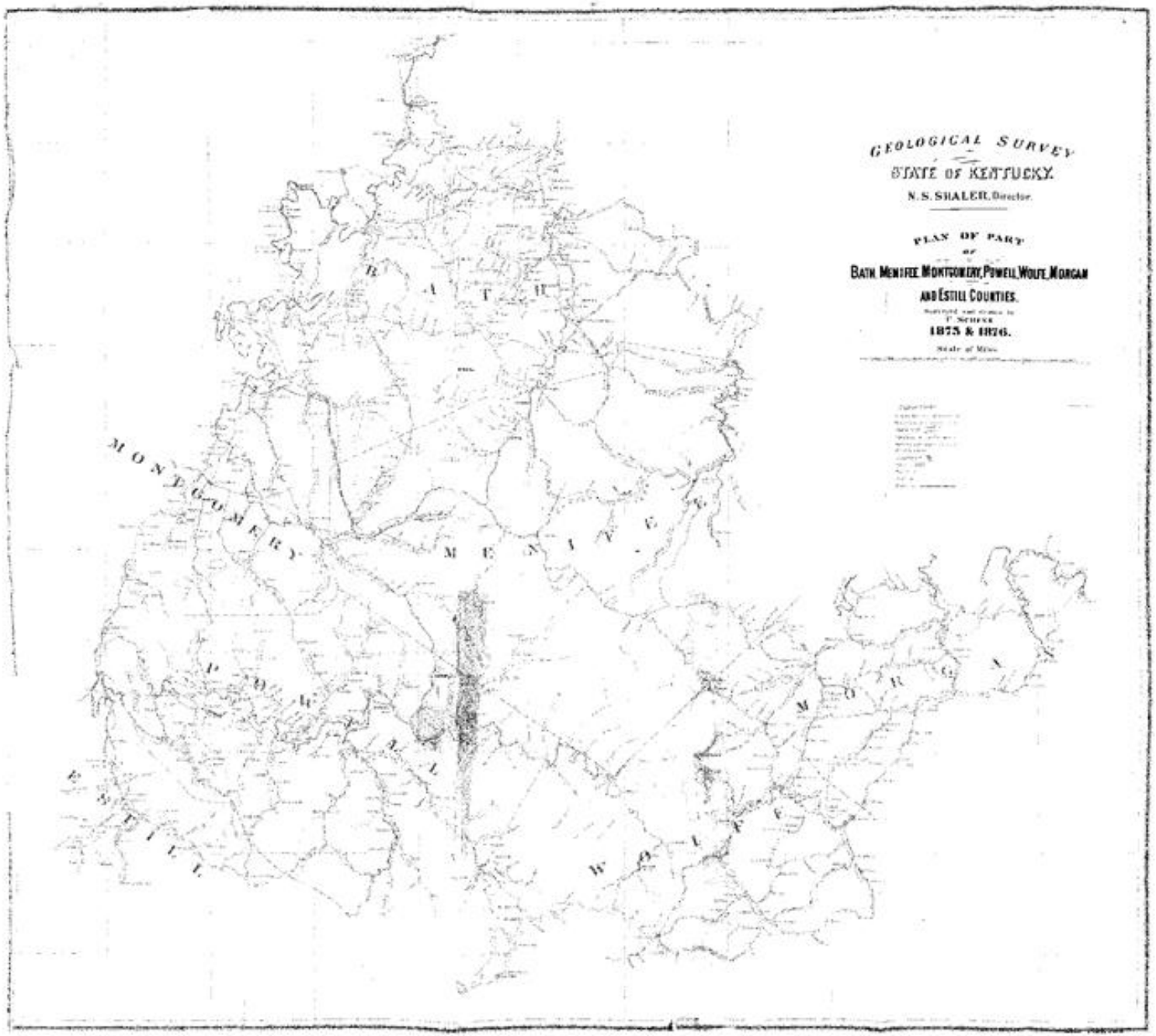
HARLAN COUNTY, KY.

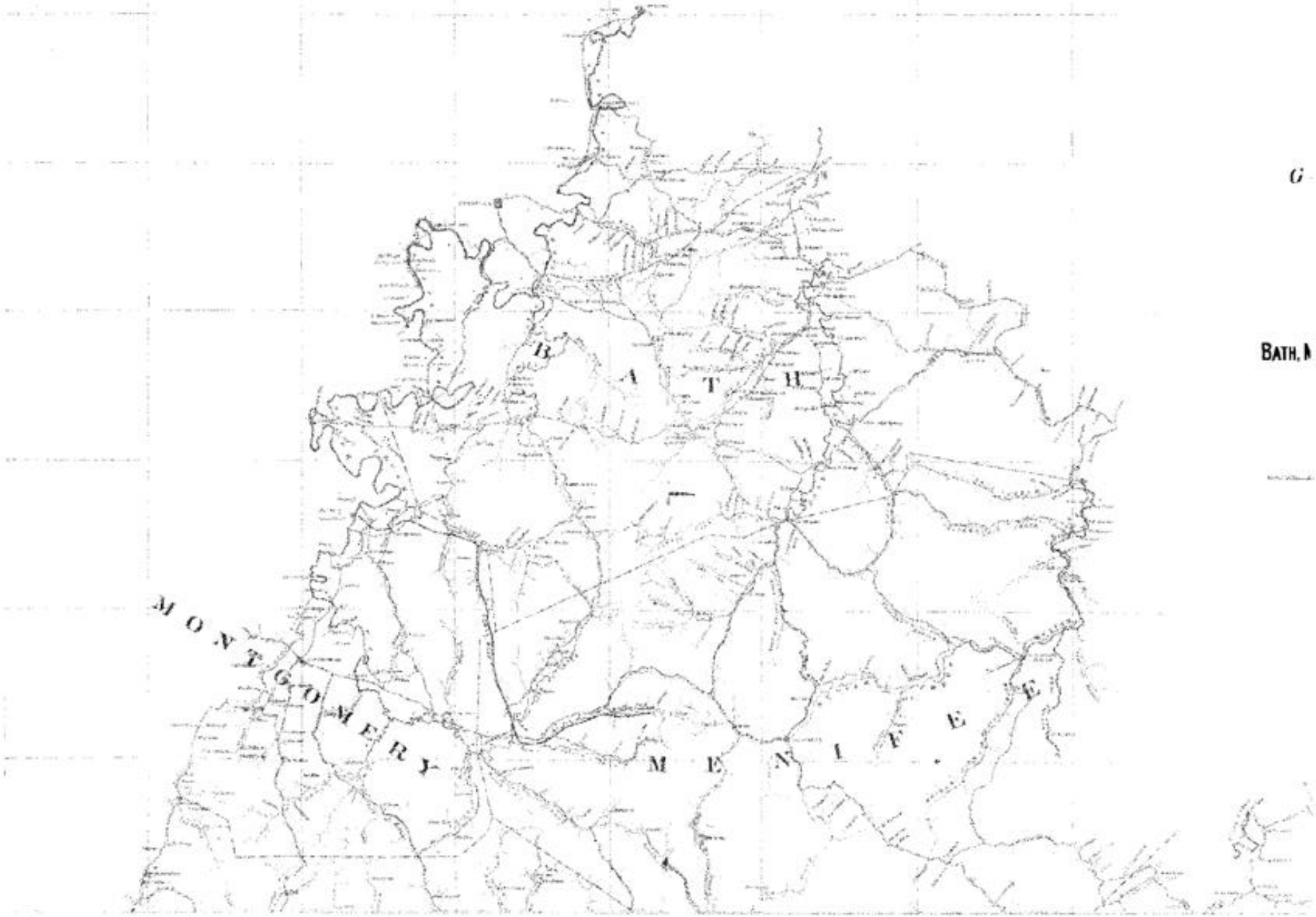
BY

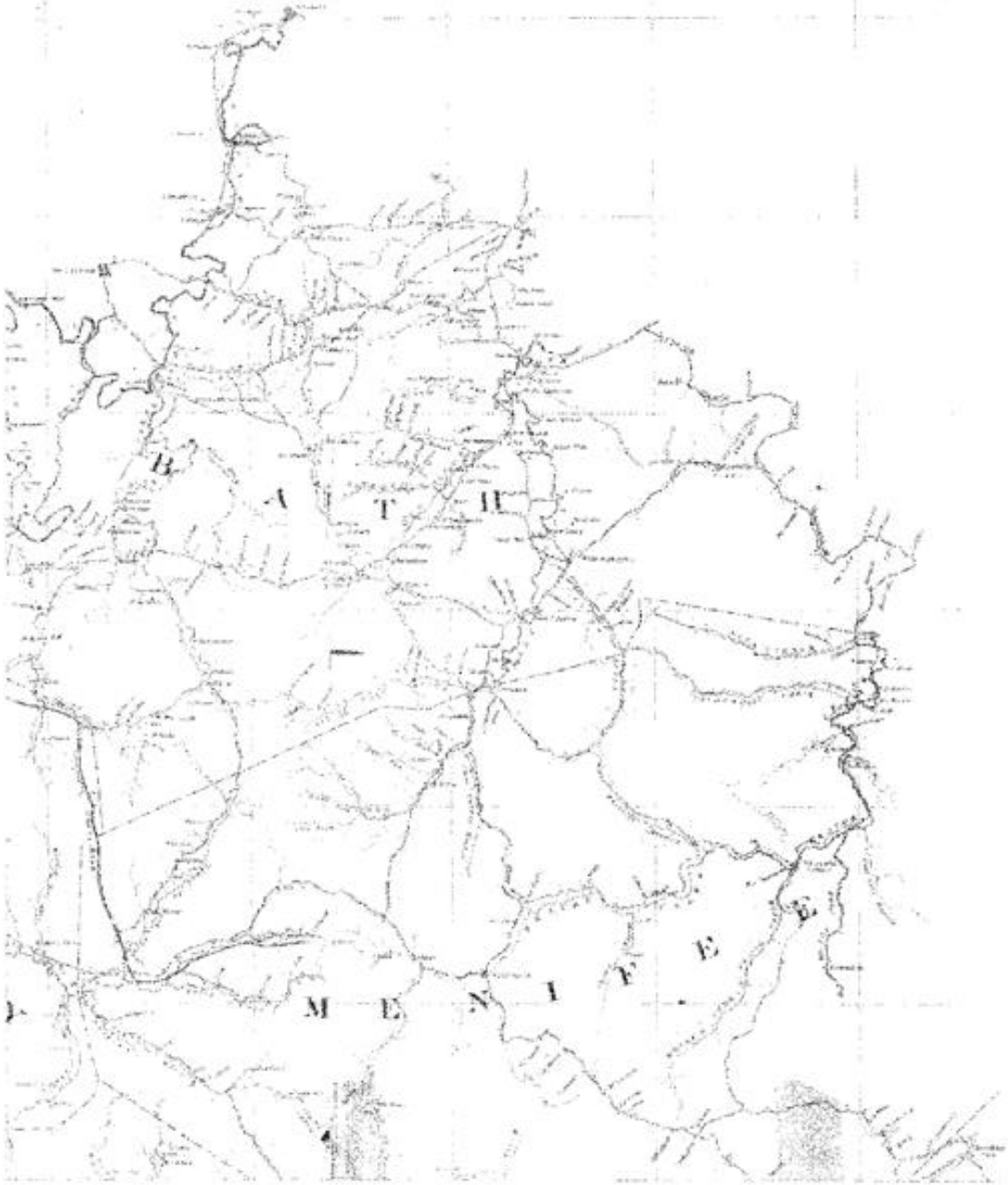
A.R. CRANDALL AND P.N. MOORE.

1876.




GEOLOGICAL SURVEY
STATE OF KENTUCKY.
N. S. SHALER, Director.
PLAN OF PART
OF
BATH, MENIFEE, MONTGOMERY, POWELL, WOLFE, MORGAN
AND ESTILL COUNTIES.
1875 & 1876.
BATH
MONTGOMERY
MENIFEE
POWELL
ESTILL
WOLFE
MORGAN


BATH
MONTGOMERY
MENIFEE



GEOLOGICAL SURVEY.

STATE OF KENTUCKY.

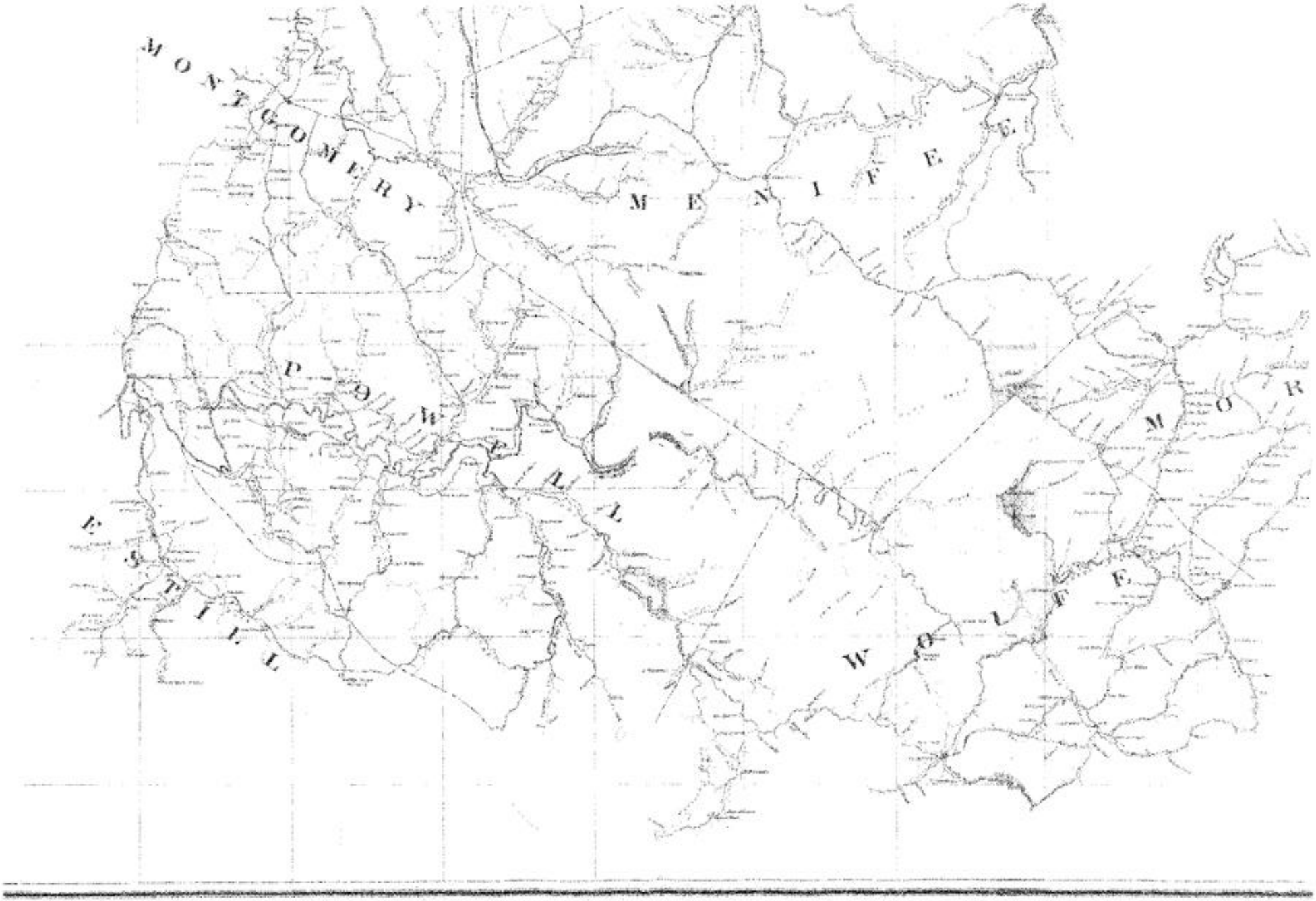
N. S. SHALER, Director.

PLAN OF PART OF BATH, MENIFEE, MONTGOMERY, POWELL, WOLFE, MORGAN AND ESTILL COUNTIES.

Surveyed and drawn by
C. SCHENK.

1875 & 1876.

Scale of Miles


MONTGOMERY
MENIFEE
POWELL
ESTILL
MOR
WOLFE

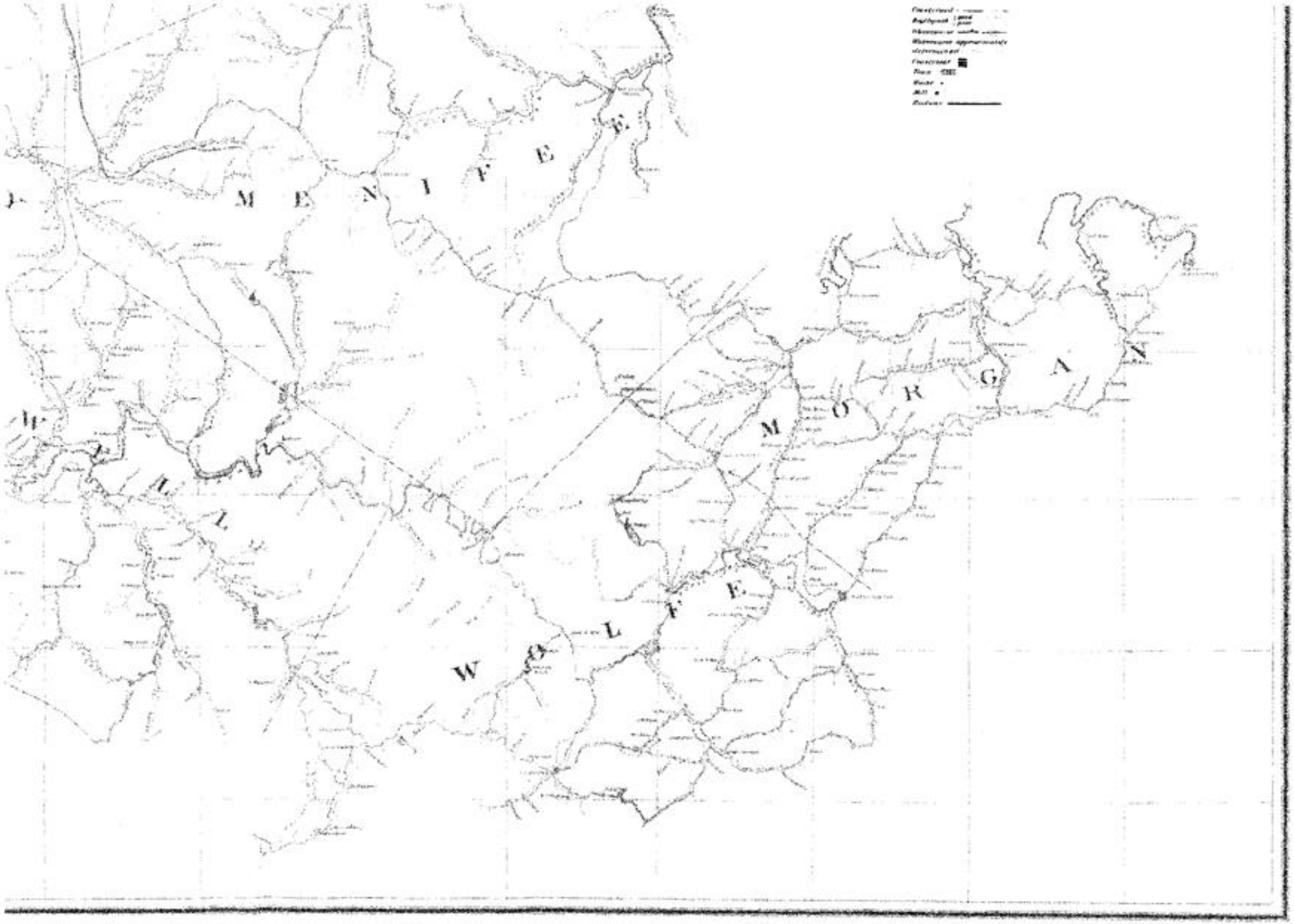
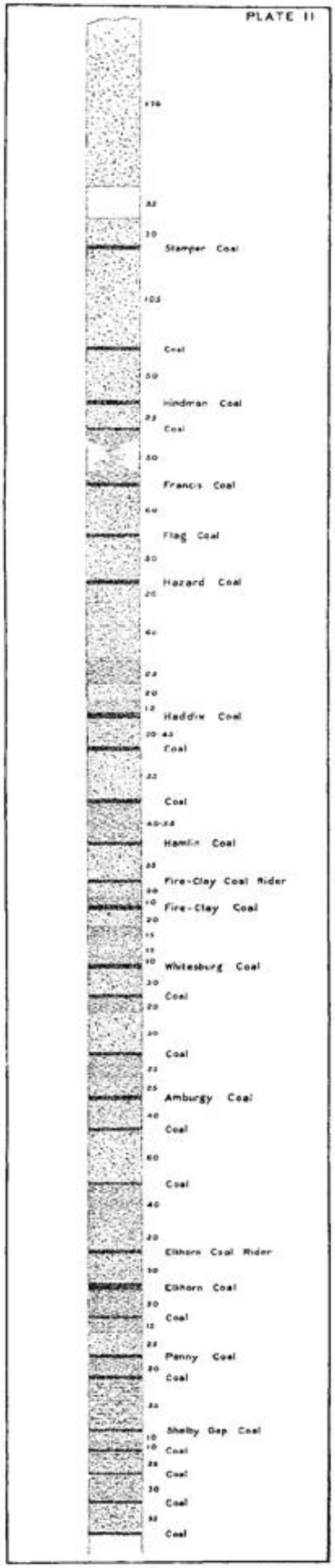

M E N I F E E
M O R G A N
L L
F E
L
W O

PLATE II



GENERAL SECTION NORTH OF PINE MOUNTAIN