# Kentucky Geological Survey

CHARLES J. NORWOOD, Director.

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REPORT ON

# The Coalfield Adjacent to Pineville Gap

IN

## BELL AND KNOX COUNTIES.

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By
ALBERT R. CRANDALL
and
GEORGE M. SULLIVAN.

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## PREFATORY.

*His Excellency,* JAMES B. MCCREARY,

*Governor of Kentucky.*

*Sir*: There have been many calls for this report since its preparation was announced in my Report of Progress for 1906-1907, and the public has not understood why its publication has not promptly followed the announcement. It is deemed well, therefore, to make this explanation.

As now presented, the report is a reproduction, with additions, of one that was prepared and submitted in the latter part of 1907, during the administration of Governor Beckham. An order for printing the report was promptly made by the Printing Commission at the time, and the manuscript was duly turned over to the then contractor for the public printing. While in the hands of the latter, the manuscript was lost, but the fact did not develop until after about two years had elapsed, such delays in the printing of other reports that had been placed in the printer's hands (and were still in his hands) having occured that the disappearance of this report was not suspected. The report was then reproduced, with such additions as the necessary field work indicated as desirable, and placed in the hands of the contractor for public printing July 31, 1911.

The present writer, having no control of the printing and no authority whatever in the matter, has been powerless to do more than could be accomplished by frequent and insistent urging that the printing should proceed; he has not failed to do all that possibly could be done in that respect. To speak plainly, conditions with respect to publication of the Survey's reports that existed throughout four years were intolerable, and there seemed to be no

remedy available, so far as the writer could observe, until within recent months. It is to be hoped that better conditions will prevail in the future. The State maintains the Geological Survey as a business proposition, and reports should, therefore, be printed within a reasonable time after their preparation; unreasonable delays in publication not only work an injustice to the State and disappoint the public, but they promote unmerited criticism of those who are responsible for the operations of the Survey.

As appears in its title, the map accompanying the report was prepared in 1907. The writer having been authorized to see to its engraving, it was promptly printed and delivered, so that had the report been printed with equal expedition the public would have had no cause for complaint. Though some additions would be necessary to bring it up to date with respect to mining developments and branch railroad extensions, the map will still serve the purpose for which it was intended. Page-maps with the text supply certain of the details of developments made subsequent to the date of the map.

There have been some changes in the names of coal companies within the time that has elapsed since the report was reproduced, and some additional mining operations have been established, but the usefulness of the report for present purposes is not materially affected thereby.

Though his name is not associated with those of Messrs. Crandall and Sullivan on the title page—the names of the authors being as designated by Mr. Crandall—the assistance rendered by Mr. R. C. B. Thruston, who participated in the work when the survey of the regions covered was originally undertaken, should be fully recognized. Mr. Thruston furnished considerable material, in the way of field notes and sections, used in the preparation of the report, for which Mr. Crandall has given him credit in the text.

Very respectfully,

CHARLES J. NORWOOD,

June, 1912. *Director.*

# REPORT ON THE COALFIELD ADJACENT TO THE PINEVILLE GAP IN BELL AND KNOX COUNTIES.

## INTRODUCTION.

The field work on which this report on the Middlesborough–Log Mountain Region, the Straight Creek Region, and the several fields on Greasy, Brush, Four Mile and Stinking Creeks is partly based, was in progress previous to 1893, when the survey was suspended. Since the resumption of the Survey, the notes of the earlier work have been gathered up so far as possible, and field work has been carried on in furtherance and enlargement of the original plan. The larger part of the field work in the Middlesborough–Log Mountain and Straight Creek fields, was done by former Assistant George M. Sullivan whose written report is embodied with such additions as will serve to bring the work up to date. Former Assistant R. C. B. Thruston, together with J. I. Profitt and H. M. McConathy, had shared in the field work in parts of the region, Mr. Thruston having done most of the preliminary work for Bell county. More recently, Messrs. J. M. Hodge, J. H. Gardner, J. S. Shaw, and C. G. Montgomery have contributed field notes which are embodied in the report as relates to the Straight creek, Four Mile and Stinking creeks, the work of Shaw and Montgomery having to do with the elevation of beds above tide-water in the Straight Creek and Four Mile districts. My own aquaintance with this field at large is such as has come from the supervision of the field work from the first to the present time;* with such personal field studies, in extension of previous results, as could be made in 1907 and 1910. The final results are not so full

*This report was originally prepared near the close of 1907. It was lost while in the printer's hands, and its reproduction required that some field work be done in 1910. —C. J. N.

as should be desired, or so definitely worked out for all localities as to solve all problems relating to the stratigraphy and economic geology of the region; but for the purpose which falls within the range of possibility it may be hoped that an account of the several fields may be derived which will be both interesting as a description of this coal field, and suggestive as to the possibilities of profitable development. The foundation is laid for the work in close detail that is involved in preparation of county reports that are to follow.

The Southeastern coal region of Kentucky is separated by the Pine Mountain uplift into two characteristic fields, namely, the upper Cumberland Basin, formed by the Pine Mountain and Cumberland uplifts, and the outlying plateau-like Coal Measures which rest nearly horizontally on the Conglomerate formation, northwestward to its outcrop at the border of the Eastern Coalfield. The areas of this report include the Yellow creek and the Clear creek valleys, tributary to the Cumberland river, in the former, and the Greasy creek, Brush, Straight and Stinking creek valleys, with smaller tributaries of the Cumberland river below the river gap in Pine Mountain, in the latter field. The rocks of the Coal Measures above the Conglomerate formation make up the height of the hills in both fields, exposing a maximum of nearly twenty-four hundred feet height in the Upper Cumberland basin and a maximum of about eighteen hundred feet in the outlying field. Up to the height of the hills in the latter, the rocks and the included coals of the two fields from the Conglomerate upward are the same; with greatly varying thickness and structural features, as will be seen by comparison of vertical sections.

The rocks of the Coal Measures of Southeastern Kentucky are alternating shales and sandstones in greatly varying distribution both vertical and horizontal, so that the sandrock benches are not an unfailing guide in the tracing of equivalent beds. Calcareous fossil beds have been noted at several horizons, besides the calcareous concretions which occur in the shales below and above the Pineville coal seam, which, when traced more widely, may serve as



horizon marks in this field. But as yet any attempt to establish over the several districts a nomenclature, for a series of equivalent sub-divisions of the rocks of the coal-measures, based on the character or succession of cliff- or bench-forming sandrocks, would prove misleading. Too little, also, has been done to collect and compare the fossil evidences of faunal horizons on which to base epoch divisions of the coal-bearing rocks of this region, or of the East Kentucky coal field at large.

In the districts included in this report, the Pineville Straight creek, Mason coal seam and the Dean-Hignite coal and other well-known beds offer convenient reference levels for the purpose of description and identification of beds, and are so used in the reports on the several districts.

Elevations above the sea level are given in the Clear creek and Straight creek districts, and at a few points in the Brush creek district.

A. R. CRANDALL.

# TOPOGRAPHY AND GENERAL GEOLOGY.

By A. R. Crandall.

The Eastern Kentucky Coalfield is made up of two large but very unequal areas which are separated by the Pine Mountain. The lesser field is readily described as the Upper Cumberland basin. The larger field includes all Coal Measures northward from the Pine Mountain and westward to the conglomerate capped hills which are in retreat from the Blue Grass Anticline of Central Kentucky* and is continuous with the West Virginia and Ohio coal fields. In all this Tri-State field there are no barrier uplifts to give rise to geological basins of the type of the Upper Cumberland basin. There are many undulations in the rock layers, forming anticlinal waves and synclinal basins in continuous formations transverse to the original southeast dip, and broader waves which give rise to the river valleys which head to the southeast; but no considerable fault-scarp interrupts the continuity of the Coal Measures except the Pine Mountain uplift, which in its northeast extension declines to an anticlinal wave of the larger field as described in the reports on the geology of the Big Sandy River Valley.

The areas described in this report are parts of both of these fields, including the Cumberland Gap region and the Log Mountains of Bell county in the Upper Cumberland basin, and the drainage valleys tributary to the Cumberland river west of Pine Mountain from the north and south to Barbourville in Knox, in the larger field.

The crest of the Cumberland Mountain is at once a part of the boundary of the Upper Cumberland basin and between the States of Kentucky and Virginia, from a point a little to the southwest of Cumberland Gap to Cranks Gap. From that point southeastward, diverging from the Cumberland Mountain, the Little and the Big Black Mountains constitute the watershed of the Cumberland river, as well as the State line, to a point where the Big Black

*Known as the Cincinnati Geanticline.

unites with the Pine Mountain on the border of Letcher county, near Pound Gap.

The southwest extension of the Pine Mountain into Tennessee, with the watershed between the Clear Fork waters south of the Log Mountains and the waters of Yellow creek and of Big Clear creek, completes the boundary of the Upper Cumberland basin, which has been estimated by Thruston to include about 460,000 acres of land.

The Pineville water gap is the only drainage outlet for this basin. Between the Cumberland and Pine Mountains, ridges which are in nearly parallel lines, this basin is a broad synclinal of Carboniferous rocks upturned in both ridges to expose underlying Devonian beds in the outer faces and to form the crest walls of the Conglomerate sandstone which is the underlying formation in the center of the valley. The Pine Mountain crest rises 1,200 to 1,600 feet above the principal drainage. The Cumberland ridge rises in places considerably higher but declines to nearly the same minimum with narrow depressions or gaps at few points, only one of which offers a feasible way for a moderately good wagon road, namely, the Cumberland Gap through which the old Wilderness Turnpike has served as a line for travel and traffic, through Pineville water gap, between Virginia, Tennessee and Central Kentucky. The Log Mountains and the Black Mountains, between these uplift ridges, represent the maximum thickness of the Coal Measures above the Conglomerate series, in erosion peaks, ridges and spurs, some of which rise 2,000 to 2,300 feet above the main river or creek drainage, or much higher than the basin walls of upturned Conglomerate.* As the Conglomerate formation also shows a maximum thickness here, the Carboniferous rocks above the Subcarboniferous limestone presents a greater vertical range in thickness of beds than is found outside of this basin in Kentucky. The nearest approach to this vertical range found in the larger field is in the Flat Woods region in Pike county, as described in a recent report (Bulletin 4) on the Coals of the Big Sandy Valley. There, the whole thickness is about

*Big Black Mountain attains, at its highest point in Harlan County, an elevation of about 4,000 feet above sea. This is the highest point in the State.—C. J. N.



3,200 feet or about 500 feet less than in this basin. The high hills at the head of Straight creek and of Greasy creek approximate 3,000 feet. The vertical sections of these high ridges are undoubtedly for the most part equivalents, though the details are not readily correlated, as will be seen by comparison. (See Section at head of Marrowbone Creek, Bulletin 4, and Sections at the head of Greasy creek, and of New Cabin branch in this report.)

The topography in the Upper Cumberland Valley resulting from the conditions of the basin formation described, with subsequent drainage sculpture into a widening river course, with many deep cut tributary valleys, and numberless mountain ravines and gorges, is at once characteristic and striking. The river course is close to the foot of the Pine Mountian slope with short, white pebble-bedded streams on the side emerging from the laurel thickets, which mark their course down the rockbound slope as small rivulets or flood torrents; and on the other, long creeks or larger forks of the river some of which head against the Cumberland Mountain slope and fall into line with the trend of its broken foot wall. This is the case especially with Martins fork in Harlan and Clear fork of Yellow creek in Bell county. Southwest of Pineville Gap, the Big Clear creek falls into line with the foot of Pine Mountain, repeating the features of the Cumberland valley to the northeast, but with tributaries from the Log Mountain side shortened by the water shed of the Yellow creek valley. The valley of Yellow creek is unlike the other creek valleys of the Upper Cumberland basin, for though of the palmate type of drainage, like all the streams that head in the Log or the Black Mountains, a large area of this drainage is a wide valley showing a more advanced stage of erosion than any part of the main river course in the Upper Cumberland basin.

This is doubtless in large measure explained by the evidence of fracture and fault lines which traverse this valley in various directions. but which do not extend beyond the limits of the open valley. Although broken, or in folds, or displaced more or less along fault lines, the rocks both above and below this valley plain are mostly

the shales above the Conglomerate formation. In the Log Mountains, which rise above this plain from 1,000 to 2,300 feet, alternating sandstones and shales, unbroken and dipping in slight waves only, followed each other in succession plains, which make the more prominent refractory sandrock ledges, higher in the series, a protection to underlying shales against every form and direction of erosion. Not so in what is now the valley of the Yellow creek. The whole series, having been rent and upturned in three or four directions by short folds and faults, more or less connected with the Cumberland Gap–Rocky Face fault, described by Prof. Shaler and his field assistants, has yielded to the attacking forces of erosion and transportation until one has but to stand on the the Pinnacle, a favorite outlook point at Cumberland Gap, to see a resulting broad valley spread out with its basin-floor studded by small knobs still standing above the flood plain of the creek, but with the mountain sources of its short tributary creek valleys rising to mountain heights. Rocky Face mountain, toward the mouth of Yellow creek, is more than a shale and sandstone knob which lags behind the flood plains of the valley by a hundred feet, more or less, as do the many rounded knolls. It is a mass of conglomerate rock locally upturned along a fault, in which it is a culminating point, and stands in illustration of resistance to eroding agencies with a rugged height of 900 to 1,000 feet above the valley plain. Rocky Face mountain has been described by Prof. C. J. Norwood, now Director of the Kentucky Geological Survey, in a report on the then proposed (now operating) line of railway from Livingston to Cumberland Gap (Ky. Geol. Survey Reports, N. S., Vol. 2, Part VI, 1877). R. C. B. Thruston, in an unpublished report, called attention to the fact that the Cumberland Gap–Rocky Face fault line extended northward falls in line with the Pineville Gap which shows evidences of having been cut through the Pine Mountain along vertical fractures and displacements of the refractory rocks that constitute this barrier ridge; and that a few miles again to the northward White Face mountain, resembling Rocky Face mountain, is a center of fault uplift and of varying dips and local disturbances. Time and



means have not been taken to trace out the geological conditions which these coincidences suggest. The White Face mountain will be described in connection with the Caney Creek coals.

Excepting the Yellow Creek valley and the rugged conglomerate slopes of the Cumberland and Pine Mountain ridges, the topographical features of hills and valleys of the upper Cumberland basin suggest little more than the normal erosion of rocks inclined within narrow limits to water plains; and comparatively free from faults and folds which would interfere with the mining of included coal beds. Mr. Thruston described the dip in the Upper Cumberland valley in Harlan county as in general 40 feet or more per mile from the foot of Cumberland Mountain to near the Cumberland river or with the creek drainage.* The southeast dip prevails in the Rocky Face Mountain region to the Yellow creek.

In his preliminary study of the field adjacent to Pineville Gap, Mr. Thruston describes two fossil calcareous beds, a sandy limestone of some feet thickness having a few species of brachiopod fossils, and a black, bituminous limestone higher up in the vertical section having many species of fossil forms. These beds will be shown in sections in which they occur. He also described a cliff-forming conglomerate sandstone still higher in the mountains, about 250 feet above the black fossil lime, or 1,200 to 1,500 feet above the drainage. This pebble-bearing sandrock, whatever its relation may be to the Mahoning sandstone of the earlier reports, in other districts is perhaps more constant as a bench or cliff-forming rock than any other in the Upper Cumberland basin. Its thickness is apparently from 40 to 70 feet. This rock varies from a coarse glistening sandstone, with few quartz pebbles of small size, to a true conglomerate or largely made up in some of its layers of water worn quartz pebbles like the "hailstone grit" of the Conglomerate formation below. But this ledge as a coarse sandrock also weathers like the conglomerate beds, forming the base of the Coal Measures.

In the upper reaches of the Coal Measures in this

*For discussion of this region see Bulletin 13, report of J. M. Hodge.

basin, made up of alternating shales and sandstone ledges, the latter are prominent bench-forming members, with occasional cliff horizons above that just described. Very generally, the prominent benches mark the levels of prominent coals. The lower part of the section above the Conglomerate formation, for 500 to 600 feet, is more largely of shale and slaty rock with sand ledges, some of which near the base become in localities so prominent and enduring or jagged, as exposed ledges, as to be mistaken for—or possibly rightly regarded as—a member of the Conglomerate Section. The latter view has not been taken by some of the assistants of the Kentucky Geological Survey as it is the exceptional rather than the general succession of beds in the various parts of the East Kentucky field. The cliff points along the Cumberland river known as the Seven Sisters, and somewhat similar ledge points, towards the head of the North Fork of the Kentucky river, are illustrations of the local sandrocks in question. Very generally, however, along the axis of maximum thickness of the Coal Measures, from the Tug Fork district to Jellico, Tenn., 500 to 600 feet of beds strongly in contrast with the Conglomerate series below are, as transition beds, more consistently joined, by likeness of character, with coal-bearing beds above. The equivalent beds in various parts of East Kentucky have been spoken of as "the shales above the Conglomerate" and they, like other members of the Coal Measures (including the Conglomerate beds), decrease rapidly in thickness towards the northwestern outcrop.

The Conglomerate formation, which has been spoken of as forming the crest and southeast slope of Pine Mountain, as also the crest and northwest slope of the Cumberland ridge, is made up of a coarse, largely cross-bedded sandrock and conglomerate ledges, separated in vertical section, by shales and slaty rocks, into five to six unequal erosion benches, as noted in mountain exposures. In drilled wells, the records give a section less striking in contrasting reaches of enduring and shaly rocks, but in a general way they agree with the outcrop section. Like the rocks of the Coal Measures above, the thickness and character of the typical beds are so variable as to make the question



of the continuity of some of them more or less a matter of opinion from what is known of them. The thickness of the series has been variously estimated from 1,200 to 1,500 feet, or even more; no accurate measurement has been made in this basin.

The transition from the Lower Carboniferous limestone and shales, which are representatives of the St. Louis and Chester groups of West Kentucky, Tennessee, Missouri and Illinois, is marked by shale rocks which are coal-bearing, like the intervening shales of the Conglomerate series, and variable in character and thickness, but readily distinguished from the Chester shales by the tendency to bituminous dark layers rather than to calcareous and red or greenish deposits. The thickness of this lowest coal-bearing shale is not shown by exposures in this basin. It is evidently less than one hundred feet thick at Cumberland Gap and includes no coal bed worthy of note. It may be recalled that at one point in Menefee county a 30-inch coal seam is found 15 feet above the limestone (see Bulletin 10). In Jackson county a local cannel coal 33 inches thick is found at 15 feet above the top of the Chester shales; and in Pulaski county and in Whitley, on the South Fork of the Cumberland river, the "Bryvan coal" shows a thickness of four to five feet, the position of the bed being less than fifty feet above the top of the Chester, with an intervening thin coal 30 feet below the thicker seam. Evidently, these coal beds and the coals in the Inter-Conglomerate shales are less prominent in the Upper Cumberland region than in the western exposures in Laurel and Pulaski counties, where the aggregate thickness of the formation is only half as great, or from 600 to 700 feet. For this reason, and from the fact that these rocks are exposed only along the uplift ridges, with dips varying from 20 to 60 degrees or more, a detailed study of this formation has been left to follow that of the Coal Measures above. The reader may, however, correlate this formation as a whole with the New River series of West Virginia, which includes coal beds of special value from both thickness and quality, and in a general way with the Pottsville conglomerate of Pennsylvania and the so-called Lee formation of Virginia. The

change in thickness southeastward from the outcrop in Ohio and Northern Kentucky, from a few feet to 1,200 feet or more in the Pine and Cumberland Mountains, is not progessively the same in stratigraphy or thickness to wards all parts of the axis of maximum thickness, as represented by the extension of this formation northeastward through West Virginia and Pennsylvania and southwestward into Tennessee; but it is attended with features common enough to make such a correlation natural and necessary for an intelligent view of the great Eastern Coalfield as a whole, or of any of its parts.

The oil well near Chenoa on Clear creek gives the unweathered section of a large part of the Conglomerate formation. The log of the well, beginning about 480 feet below the Poplar Lick coal seam of that region or below the horizon of the Mason coal, follows. The top of the Conglomerate series probably begins at 591, or otherwise at 648 feet.

RECORD OF THE CHENOA WELL.

| | Feet. | |
|---|---|---|
| Clay and slate | 72 | |
| Sandstone | 5 | 77 |
| Coal (Blue Gem) | 4 | 81 |
| Slate and Sandrock | 164 | 245 |
| Coal | 4 | 249 |
| Slate and shale | 60 | 309 |
| Coal | 2 | 311 |
| Slate | 20 | 331 |
| Coal | 2 | 333 |
| Slate and sandstone | 78 | 411 |
| Chenoa Cannel coal | 4 | 415 |
| Fire clay | 2 | 417 |
| Slate | 37 | 454 |
| Sandstone | 30 | 484 |
| Slate | 8 | 492 |
| Sandstone | 9 | 501 |
| Slate and shale | 90 | 591 |
| Sandstone | 22 | 613 |
| Slate | 38 | 648 |
| Sandstone | 5 | 653 |
| Sandstone | 5 | 658 |
| Sandstone (white) | 11 | 669 |
| Slate | 3 | 672 |
| Sandstone (white) | 11 | 683 |
| Slate | 30 | 713 |
| Sandstone | 65 | 778 |
| Slate | 15 | 793 |
| Sandstone | 10 | 803 |
| Slate | 35 | 838 |
| Sandstone | 2 | 840 |
| Slate | 35 | 875 |
| Sandstone (dark) | 10 | 885 |
| Slate | 15 | 900 |
| Sandstone (white) | 50 | 950 |
| Slate | 38 | 988 |
| Sandstone | 256 | 1244 |
| Slate | 4 | 1248 |
| Sandstone (white) | 84 | 1332 |
| Coal | 4 | 1336 |
| Sandstone | 176 | 1512 |
| Slate | 5 | 1517 |
| Sandstone (white) | 11 | 1628 |
| Shale | 5 | 1633 |
| Sandstone (white) | 74 | 1707 |
| Coal | 2 | 1709 |
| Sandstone (white) | 72 | 1781 |
| Coal | 6 | 1787 |
| Sandstone | 30 | 1817 |

The topography north and west of Pineville Gap is such as results from the drainage sculpture of the Carboniferous shales and sandstones above the Conglomerate series more or less inclined to the water level, but varying in the proportion of shale and durable sandrock ledges from valley to valley and in the thickness of the measures by the more or less rapid decrease west and northward. The decrease in the height of the hills outward from Pine Mountain is noticeable in this region. The drainage level of the river and of the larger creeks is nearer the top of the shales next above the Conglomerate near Pine Mountain than in the Cumberland basin above the Pineville Gap, as will be seen by the height above sea level, and above drainage, of equivalent coals in the two regions; but this does not continue northwestward. At Pineville, 1,000 feet above tide, the top of Conglomerate formation is about 500 feet below the bed of the river. At Barbourville, 950 feet above tide it is less than 300 feet. At Corbin, 1,060 feet above tide, the upper member of the Conglomerate shows in the bed of Lynn Camp creek, a tributary of the Cumberland. At East Bernstadt, in Laurel county, at 1,159 feet the same ledge is less than 50 feet below the surface, cropping out at Altamont one mile to the northwest. The dip from Altamont to the foot of Pine Mountain is, therefore, more than 600 feet. The hills towards the outcrop show a reduced section of the shales and bands of sandrock which are below the river at Pineville. The hills, in general near to Pine Mountain show the equivalent of only a part of the Log Mountain section, though the upper member of the Conglomerate is reached in that region at about 1,050 feet above tide water as compared with about 500 feet along the northwest face of Pine Mountain. This difference is approximately the difference in level of equivalent beds on opposite sides of Pine Mountain ridge, but the Log Mountains rise in high ridges to an elevation of 3,100 feet or more above the ocean, while the hills outside the Pine Mountain fault reach a maximum elevation of about 2,500 feet above tide water only at the head of the right fork of Straight creek and at the head of Greasy creek. At Altamont, the highest knobs rise to a level not much above 1,200 feet.

The topography northwestward from Pineville Gap is

one of rapid change, from high hills and narrow valleys to low, knob-like hills and open valleys with widening flood plains.

## THE COAL BEDS.

The number of coal seams in the Log Mountains may be said to be more than thirty; but the beds which have a thickness greater than thirty inches number ten or possibly more, including local thickening of beds which are too thin, as known, to serve other purpose than as horizon marks. Of this number, seven are found in the hills northwest of Pine Mountain. Some of these are recognized as equivalent of beds in the Log Mountains and in other districts. Others are less clearly traceable from one district to another. Some of the coal beds are thin or wanting in one field and prominent in the other. And the names of the coal seams are more or less local so that beds which extend over wide areas would appear from the nomenclature to be limited to localities. The equivalency of all beds in the several localities is not fully established by the developments made up to the present time, but the following synonomy will serve to show, in a general way at least, the stratigraphic relations of the several localities:

The most widely developed coal bed in Southeastern Kentucky is the "Pineville coal," one of the lower seams in the Coal Measures above the Conglomerate sandstone. This bed is also the "Straight Creek coal," the "Four Mile seam," the "Pogues Branch coal," the "Mason seam" of Clear creek, the "Ferndale seam" of Cannon creek, the "Lower Cranes creek bed," the "Mingo coal" of the Bennetts fork region, the "Hyslop coal" of Tackets creek, the "Douglas seam" of the Big Creek Gap region, the "Birdseye coal" of the Halsey district in Whitley, the "Jellico seam" of the Jellico region, and the "North Jellico coal" of Knox county. This coal bed is, in general terms, 400 to 600 feet above the Conglomerate formation, near the top of a series of rocks in which shales make up a large part of the vertical section.



At 500 to 600 feet higher in the series is the place of the Dean coal as known northward from the Pine Mountains. Above this, 30 to 90 feet, is the McGuire coal or the Upper Dean seam. These beds are known as the Upper and Lower Hignite coals in the Middlesborough-Log Mountain region, and are from 3 to 30 feet apart.

Between the Pineville (Mason, etc.), seam and the Dean-Hignite horizon several prominent coal beds are found, the extension of which is not so well shown by practical development or prospecting, and the equivalency of beds is not so clearly indicated for the several districts mentioned. The Pineville and Dean coal horizons will therefore be used as reference levels in the description of beds. Above the latter, one or two prominent coals are found in the higher hills north of the Pine Mountain. The coals above the Dean-Hignite levels, however, are chiefly notable in number and prominence (in the area covered by this report) in the higher Log Mountain ridges in which higher Coal Measures come in above the Conglomerate, or the Coal Measures proper of this region have a thickness of about 2,400 feet. This great thickness of rock beds, as compared with the Coal Measures toward the northwestern outcrop, is partly from the thickening of beds, in general, southeastward, and partly by the greater wearing away, down the wider valleys, toward the outcrop of the Carboniferous series.

Recent developments (1910) on clear Creek show a greater dip in the Log Mauntain area than was supposed by Mr. Sullivan, and so greater intervals occur towards the base of sections. They also show a greater prominence of the Mason seam, which is nearly 500 feet above the Chenoa cannel seam. Corrections and additions, tracing this coal around to the Rocky Face region and to Cranes, Hance and Toms creeks are added to Mr. Sullivan's report in an appendix.

## COALS OF THE LOG MOUNTAIN REGION.

By G. M. Sullivan.

The region covered by this report lies in the southern portion of Bell county, west of the Cumberland Valley division of the Louisville & Nashville Railroad and southeast of the Pine Mountain ridge; it also extends a short distance into Tennessee, on the head waters of Bennetts fork of Yellow creek. The approximate area of this region is 100 to 110 square miles.

There is a marked contrast between the topography of the Log Mountains and that of the Pine Mountain on the northwest and the Cumberland mountain on the southeast. The Log mountains exceed both in height by 500 to 600 feet, and have by their numerous ridges and spurs the palmate drainage which is characteristic of the horizontal Coal Measures. The Pine and Cumberland mountains extend as monoclinal barriers and give rise to small branches, which, cutting their way through conglomerate ledges, flow into the creeks at the foot of their slopes.

The Log mountain coal-measures are practically horizontal; the varying dip at its greatest being about 20 to 30 feet to the mile, except as involved in the slopes of the Pine and Cumberland monoclines, along the foot of these barriers. The thickness of the Conglomerate formation which is upturned in these monoclinal ridges, forming a trough in which the Coal-Measures above make up the whole height of the Log mountains, is probably more than 1,200 feet, or about half the thickness of the Log Mountain coal bearing series. The latter culminates in ridges and peaks rising about 1,700 to 2,100 feet above the main drainage, or 2,800 to 3,200 above sea level.

The Log Mountain region is drained by three main creeks, tributaries of the Cumberland river system. Yellow creek and its tributaries, Little Yellow creek, Bennetts, Stony, Beans, and Lick forks drain the eastern part of the southern portion of this region, or that part around Middlesborough. Big Clear creek and its main tributary,



Little Clear creek, drain the northern and western parts. Big Clear creek flowing through its whole length at the foot of the Pine mountain slope, is on the western border. A part of the western and southern portion is drained by tributaries of the Clear fork of the Cumberland river which flow southward into Claiborne county, Tennessee.

The plan for the development of this region was to make, by cuttings, vertical sections, exposing all the coal beds from the bottom to the top of the mountains. Following out this plan at many points well distributed over the region has given a view of the number, thickness and character of the coal beds, and a knowledge of the equivalency of beds in the different parts of the field, which otherwise could not have been obtained.

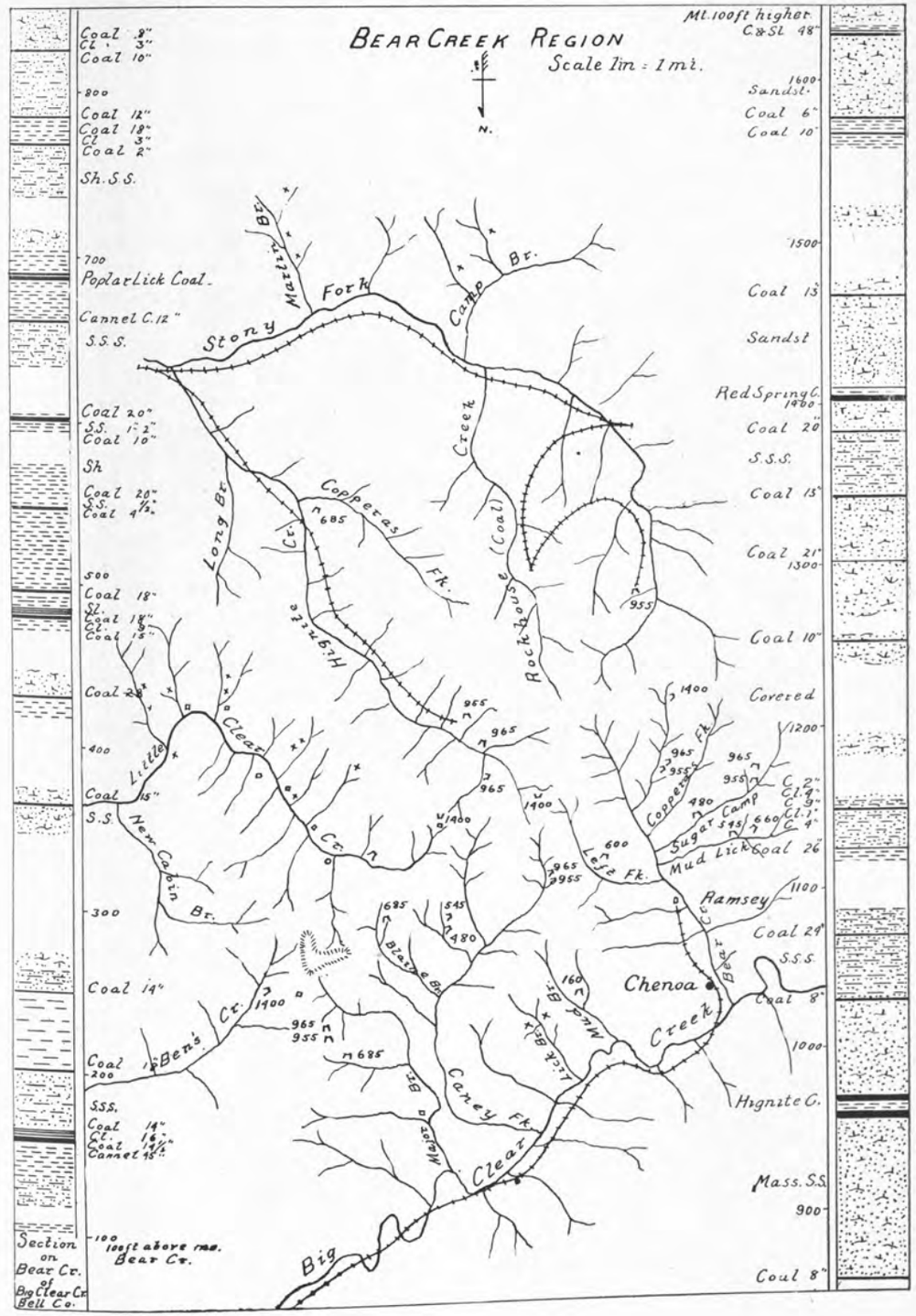
The number of coal horizons exceeds thirty; of which ten or more perhaps will prove to be workable seams at some points. Many variations in the bedding and in the prominence of the coals of economic value, and in the character of the inclosing rocks, were found in tracing the beds from valley to valley across the whole region, but some beds prove to be recognizable horizon marks. Such are the so-called Poplar Lick coal, best known in the Big Clear creek district, and found in character on the heads of Stony fork, the Hignite seam 250 feet higher in the series, a cannel slate five feet or more in thickness about 200 feet below the Poplar Lick seam, and a coal in the interval between the last named beds having a bituminous sandstone parting one half to three inches thick and continuous over most of the region. These serve to give more or less of assurance of the identity, or of the local intercalation of other coals, less constant in bedding, character and surroundings and at varying intervals in vertical distribution; but more especially they serve to establish the synchronism of the principal coal seams for the whole region, so far as they may be found above the drainage.

To facilitate the description of the coal beds and the associated rocks, page-maps are made the basis for the exhibit of the local developments. On these the locations of openings of workable coals are represented by the usual conventions, each with figures which show

its place in the vertical section as drawn at the right or left of the page-map. The cross is used to show the places of openings which are described in connection with an adjoining, overlapping, page-map. These page-maps are drawn from the maps of the American Association Limited, and of the Log Mountain Coal, Coke and Lumber Company; maps made principally from land surveys. Additions of small branches are made as necessary to show locations of coal cuttings.

The scale of the maps is one inch to the mile. The vertical scale of the sections, at the right and left edges of these maps, is one inch to one hundred feet, unless otherwise indicated. The maps are drawn with reference to the relation of local developments to the vertical sections rather than in relation to the conventional north; magnetic north is therefore indicated on each map. Elevations given are from barometric measurements and are subject to correction. These elevations are from assumed bases suited to the section of the locality rather than from some point in the main drainage of the region or from sea level.

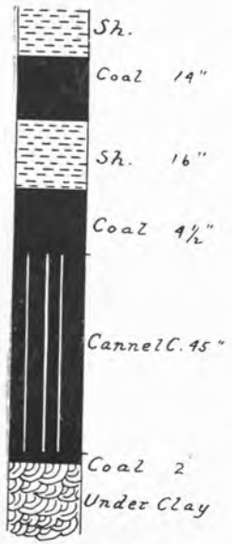
All analyses of coals were made in the laboratory of the Survey, unless otherwise stated.



## Bear Creek Region on Big Clear Creek.

Commencing on the western border of the field and next to the Pine Mountains, this region will be the first to come under discussion and the others will be taken up in their natural order across to the Cumberland mountains. The typical vertical section of this region was made on Bear creek; partial sections being made on Major branch and Caney fork showing the economic beds only. The Bear creek section was made as full as possible under the press of time and circumstances, showing all the coals developed from the base to the summit of the mountain, a vertical height varying from 1600 to 1800 feet. As most of the slopes are badly covered with debris, it is possible that some of the thin beds escaped detection. It is not probable that any prominent bed has been overlooked, since the development was not confined to any one particular point but was carried over the whole valley. The first workable coal in the series of this region is the cannel coal bed on Mud branch, one hundred and fifty feet above the mouth of Bear creek. There is remarkably fine exposure of coal at this point; but it has not been found as a prominent cannel coal elsewhere than at this point in the whole territory. It has bed section near the outcrop as in the cut here given. A sample taken from cannel only gave the following on analysis:

Fig 1




Cannel Coal, Mud Br., Big Clear Cr.

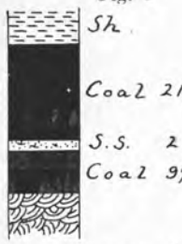
| | |
|---|---|
| Moisture | 1.11 |
| Vol. com. matter | 51.60 |
| Fixed carbon | 40.40 |
| Ash | 7.00 |
| | 100.00 |
| Sulphur | 0.739 |

This coal shows a tendency to that peculiar cleavage known as the Birdseye fracture similar to a cannel



coal across the Pine Mountain in Whitley county. (Report on Whitley county by Prof. A. R. Crandall, p. 37). Below the horizon of this, three thin coals were noted on Major branch which are not shown in the Bear creek section. At the 545-foot level, a coal is found which has a hard bituminous sandstone parting that is a continuous feature from one side of the field to the other. As opened on Caney fork, it shows bed section as in accompanying cut. On Bear creek it has practically the same section. Between this bed and the cannel, five thin coals were opened; the thickness and position of which are shown in the vertical section. Sixty feet below this coal, there is a bed of cannel slate five to ten feet thick. This was noted at several points between the Pine and Cumberland mountains. At an elevation of 685 feet above Clear creek, the second economic coal is reached. This coal is known as the "Poplar Lick coal." The bed section is shown in the following cut. The bed when sampled was not driven to firm roof; but the coal was hard and apparently free from infiltered clay. An analysis of the coal gave results as follows:

Fig. 2




Coal 160 ft below Poplar Lick bed. Caney Fk., Big Clear Cr.

Fig. 3


Poplar Lick Coal Bear Creek.

| | |
|---|---|
| Moisture | 1.80 |
| Vol. comb. matter | 33.00 |
| Fixed carbon | 60.10 |
| Ash | 5.10 |
| | 100.00 |
| Sulphur | 0.656 |

A preliminary test was made of this coal as to its coking qualities. The test was made by cutting sufficient coal from the whole face of the bed to fill an ordinary nail keg, and this by the

courtesy of the Cumberland Valley Colliery Company, was placed in the ovens at Pineville and allowed to coke with the usual 48-hour charge. All of the preliminary coking tests of this section were made in this manner. The coke thus made had a firm columnar structure, and the following chemical composition:

| | |
|---|---|
| Volatile combustible matter | 1.03 |
| Fixed carbon | 90.97 |
| Ash | 8.00 |
| | 100.00 |
| Sulphur | 0.693 |

The percentage of volatile combustible matter indicates that the coking process was not quite complete. Although preliminary, these tests will serve to indicate what the possibilities of the beds are. An opening was made in this bed in Major branch also. Here it had bed section as shown in the detailed cut. The opening was driven to rock roof but the coal was too badly weathered to be sampled for analysis. Between the Poplar Lick and the coal with the sandstone parting, two coals were noted; neither of them being of any special importance.

Fig. 4


Poplar Lick Coal, Major Br., Big Clear Creek

At the 950-foot level is found what is probably the most important economic bed of the whole field. It is known as the Lower Hignite bed, taking its name from the creek on which it was first found. It is usually accompanied by another coal above it and separated by from 3 to 30 feet of shale. Of the two, the Lower Hignite is the one



Fig. 5


of greatest importance being the most uniform both in thickness and quality of all the beds of the Log Mountain region. The accompanying cut shows both the Upper and the Lower in detail and the relation of the two to each other as opened on main Bear creek. The beds were driven to the solid roof rock and the samples taken for analysis were from firm coal, though probably not entirely free from clay. The following is the result of the analysis:

| | UPPER HIGNITE | LOWER HIGNITE |
|---|---|---|
| Moisture | 2.00 | 1.60 |
| Vol. comb. matter | 22.80 | 33.40 |
| Fixed carbon | 59.50 | 61.52 |
| Ash | 5.70 | 3.48 |
| | 100.00 | 100.00 |
| Sulphur | 0.986 | 0.794 |

A preliminary coking test was made of coal from both beds. A firm columnar coke resulted from the Lower, but the Upper proved to be less valuable as coking coal. The analysis here given will show their composition.

| | UPPER. | LOWER. |
|---|---|---|
| Vol. Comb. matter | 0.10 | 0.43 |
| Fixed carbon | 87.58 | 91.86 |
| Ash | 11.62 | 7.71 |
| Moisture (air dried) | .60 | |
| | 100.00 | 100.00 |
| Sulphur | 0.909 | 0.637 |

Fig. 6


Hignite Coals Sugar Camp Br., Bear Creek.

On Sugar Camp branch of Bear creek a second opening was made in these beds. Their relation and bed section in detail are shown in cut. This opening was also driven to firm roof rock but the coal was slightly weathered and contained some infiltered clay. A sample for analysis was taken from each bed.

| | UPPER BED. | LOWER BED. |
|---|---|---|
| Moisture | 1.80 | 2.66 |
| Vol. comb. matter | 35.60 | 34.14 |
| Fixed carbon | 58.30 | 59.70 |
| Ash | 4.30 | 3.50 |
| | 100.00 | 100.00 |
| Sulphur | 0.599 | 0.840 |

The Lower bed was tested for its coking qualities. The coke was similiar to that just previously mentioned in structure and showed as follows on analysis:

| | |
|---|---|
| Vol. comb. matter | 0.39 |
| Fixed carbon | 92.61 |
| Ash | 7.00 |
| | 100.00 |
| Sulphur | 0.530 |



Fig. 7


Hignite Coals, Caney Fk, Big Clear Creek.

Near the head of Caney fork of Big Clear creek an opening was made showing as section here given. Their chemical composition is as follows:

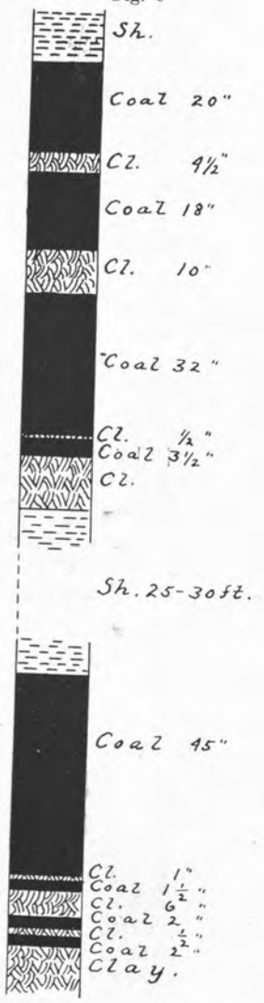
| | UPPER BED. | LOWER BED. |
|---|---|---|
| Moisture | 2.50 | 2.40 |
| Vol. comb. matter | 32.16 | 33.90 |
| Fixed carbon | 57.54 | 60.50 |
| Ash | 7.80 | 3.20 |
| | 100.00 | 100.00 |
| Sulphur | 0.556 | 0.632 |

The lower bed alone was opened on Major branch. No sample was taken for analysis as the coal was too badly weathered to give trustworthy results. The details of the bed are shown in cut. This was as far northward as this bed was traced on the Big Clear creek side. On the opposite or east side of Log Mountains from the Bear creek openings these coals were again opened, on the head of Hignite creek in detail. Here the whole of the Upper and most of the Lower beds are exposed in the bed of the creek, and was reported by the people of the country, as well as others from hasty observations, to be anywhere from ten to twenty feet thick of clean coal. Both beds have been opened and driven to solid roof; showing as in accompanying section. Following is the analysis of these coals:

Fig. 8


Lower Hignite Coal, Major Branch, Big Clear Cr.

Fig. 9




Hignite Coals, Hignite Cr.

| | UPPER HIGNITE. | LOWER HIGNITE. |
|---|---|---|
| Moisture | 2.50 | 3.00 |
| Vol. comb. matter | 29.70 | 30.40 |
| Fixed carbon | 62.80 | 64.00 |
| Ash | 5.00 | 2.60 |
| | 100.00 | 100.00 |
| Sulphur | 0.554 | 0.601 |

This opening properly belongs in the Stony fork of Yellow creek region as does the one next described; but as they are not shown in any vertical section on either side they are mentioned in connection with the region to which they are nearest.

These coals as exposed in Hignite branch were reportedby Dr. Owen (Vol. 1, page 222) for details of which see section. An outcrop sample gave the following results:

Fig. 10


Lower Hignite Coal, Head Stony Fork.

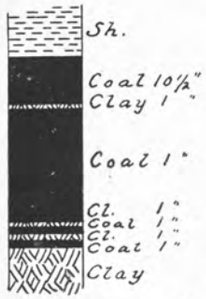
An opening was made in the Lower Hignite on the head of Stony fork of Yellow creek; the following results:



| | |
|---|---|
| Moisture | 3.00 |
| Vol. comb. matter | 31.96 |
| Fixed carbon | 62.04 |
| Ash | 3.00 |
| | 100.00 |
| Sulphur | 0.478 |

It will be seen from the position of these openings that this coal has an extension each way through the main Log mountain. In the intervening space between the Poplar Lick and Hignite coals, a distance of two hundred and seventy feet, four coals were found, none of which was of workable thickness in this region. Here there are generally 75 to 100 feet of thick bedded sandstone below the Hignite coals but, although noted at several points in the Log Mountain region, it does not always occur. At the 1,400-foot level, the next and last workable coal in this section is found. It is known as the Red Spring coal. An opening was made in this bed on the head of Bear creek which showed a thickness as in detailed cut. A sample, slightly weathered and not free from clay gave the following:

Fig. 11




Red Spring Coal. Hd. Bear Cr.

| | |
|---|---|
| Moisture | 2.60 |
| Vol. comb. matter | 33.20 |
| Fixed carbon | 60.20 |
| Ash | 4.00 |
| | 100.00 |
| Sulphur | 0.670 |

A preliminary coking test was made of this coal and and analysis of the coke is here given.

| | |
|---|---|
| Volatile combustible matter | 0.34 |
| Fixed carbon | 91.16 |
| Ash | 8.50 |
| | 100.00 |
| Sulphur | 0.416 |

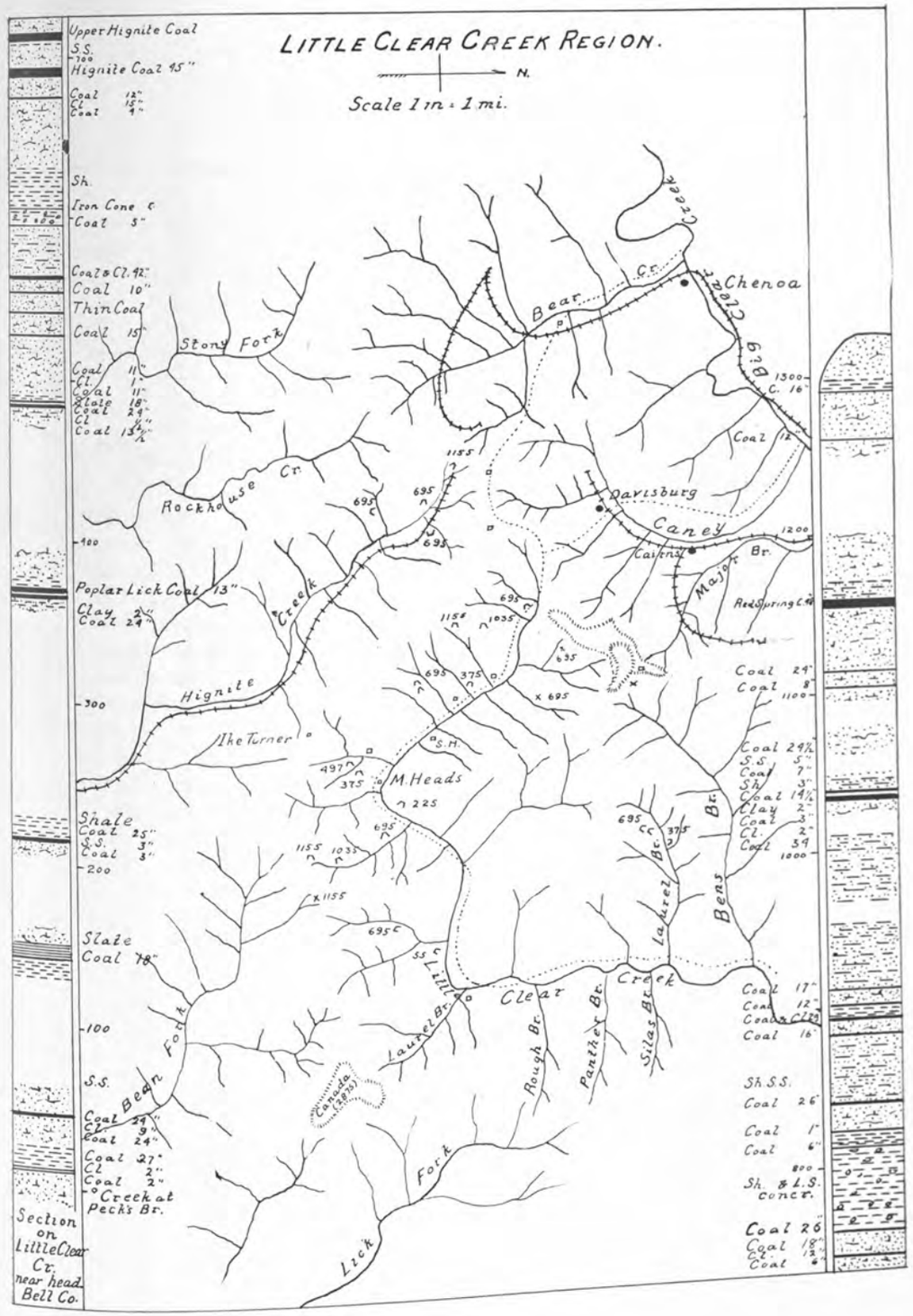
The greater portion of this bed is a hard splinty coal which, in the coking process, does not fuse together sufficiently to make a firm coke. A second opening was made in this coal on the head of Hignite creek. For detail section of which see cut. The sample from whole face gave the following analysis:

Fig. 12


Red Spring Coal, Hd Hignite Cr.

| | |
|---|---|
| Moisture | 2.20 |
| Vol. comb. matter | 34.20 |
| Fixed carbon | 60.40 |
| Ash | 3.20 |
| | 100.00 |
| Sulphur | 0.576 |

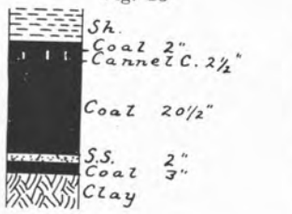
A preliminary test was also made of this coal as to its coking qualities, and the results were as unfavorable as in the preceding. It will be seen from the analysis that the coals, as a whole, of this region have a small percentage both of ash and sulphur. Eight thin coals were developed between the Red Spring and the Hignite coal; the thickest being only 29 inches. Their order is represented in the vertical section. Between the Red Spring coal and the summit of the mountain, four coals are shown, all being small beds.



## Little Clear Creek Region.

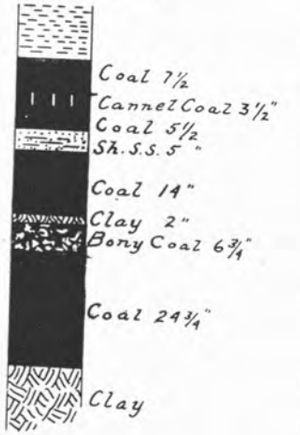
The typical section of this region was made on Polk branch near the head of the creek and about thirteen miles above Pineville. Several partial sections were made both above and below Polk branch to test the extension of the principal coals in each direction. The relation of this region to the preceding can be seen from the map of either. The mouth of Pecks branch, which is about two hundred feet lower than that of Polk branch, is taken as the basis of the section. Just below the mouth of Pecks branch, the two coals, which are shown at the bottom of the vertical section, are opened; the upper one being thirty-six inches thick with eight inches of clay near the top of the lower thirty-one with two inches of clay near the bottom. These two beds occupy, practically, the same horizon as the Ralston coal to be hereafter described in the Bryson Mountain region. The bed with the sandstone parting is opened at the mouth of Polk branch on the right hand side of Little Clear creek and has section as here given. Seventy-five feet below this bed, the cannel slate shows five feet thick over eighteen inches of coal. At the 375-foot level, the first coal of special importance to this region is found. This is the Poplar Lick coal. As opened on the left side of the creek, above Mart Head's house,

Fig. 13




Coal, 160 ft below Poplar Lick Coal, Little Clear Cr.

Fig. 14




Poplar Lick Coal near Mart Heads, Little Clear Cr.



it gave section as in engraving. The following results were obtained by analysis of sample from outcrop:

| | |
|---|---|
| Moisture | 1.60 |
| Vol. comb. matter | 34.40 |
| Fixed carbon | 59.40 |
| Ash | 4.60 |
| | 100.00 |
| Sulphur | 0.408 |

Fig. 15

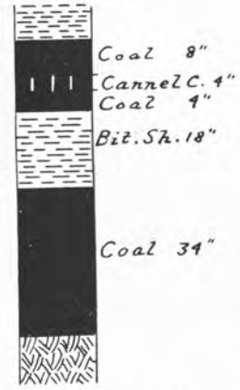

Poplar Lick Coal near Hd., Little Clear Cr.

Three fourths of a mile above the preceding opening, it goes below the drainage of Little Clear creek. Detail section gives thickness as opened here.

Analysis as follows:

| | |
|---|---|
| Moisture | 1.20 |
| Vol. comb. matter | 35.60 |
| Fixed carbon | 58.20 |
| Ash | 5.00 |
| | 100.00 |
| Sulphur | 0.408 |

Fig. 16

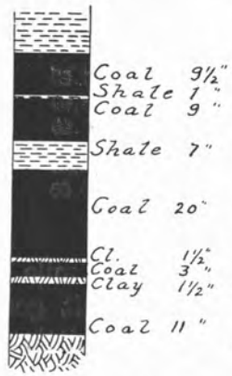



Poplar Lick Coal, Hignite Creek.

On Hignite creek, about two miles from the mouth, an opening was made by the American Association (Limited) in this coal. The quality and thickness are shown by analysis and cut.

| | |
|---|---|
| Moisture | 2.60 |
| Vol. comb. matter | 33.40 |
| Fixed carbon | 59.20 |
| Ash | 4.80 |
| | 100.00 |
| Sulphur | 0.549 |

Fig. 17

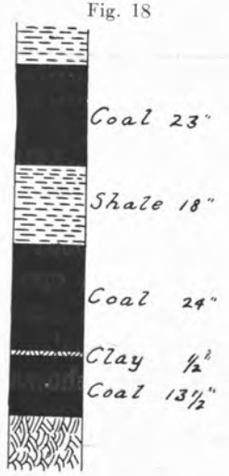



Coal 125 ft. above Poplar Lick bed, Little Clear Cr.

One hundred and twenty-five feet above the Poplar Lick coal and at the 495-foot level there is a thick coal opened on Polk branch; but it is badly split with partings as shown in the cut. No sample was taken from this opening. This bed is known as the Klondike seam. One half mile farther up the creek, on Moses branch, this coal was again opened and sampled for analysis. For comparison of beds see detailed sections.

| | |
|---|---|
| Moisture | 2.30 |
| Vol. comb. matter | 34.90 |
| Fixed carbon | 56.40 |
| Ash | 6.40 |
| | 100.00 |
| Sulphur | 0.766 |

Fig. 18




Coal 125 ft. above Poplar Lick Coal, Moses Br., Little Clear Cr.

In the Big Clear creek region, the horizon of this bed is occupied by one or more thin coals.

At the 695-foot level, the Hignite coal, is found in this region. The lower bed as opened on Polk branch, four hundred feet above bed of main creek, is shown in the accompanying section. The analysis of coal was:

Fig. 19


Lower Hignite Coal, Polk Br. Hignite Cr.



Fig. 20


Hignite Coals near Hd. Little Clear Cr.

| | |
|---|---|
| Moisture | 2.20 |
| Vol. comb. matter | 33.40 |
| Fixed carbon | 61.60 |
| Ash | 2.80 |
| | 100.00 |
| Sulphur | 0.601 |

One mile further up and about three hundred feet above the creek, the Upper and Lower Hignites are opened in connection. Their bed sections and relation are shown in the engraving. As the coal of both was badly weathered, no sample was taken. Near the head of Little Clear creek and one half mile above last, the Hignite is found at drainage. Here an opening was made in the lower bed and sampled for analysis. See section below.

| | |
|---|---|
| Moisture | 2.30 |
| Vol. comb. matter | 33.90 |
| Fixed carbon | 60.40 |
| Ash | 3.40 |
| | 100.00 |
| Sulphur | 0.629 |

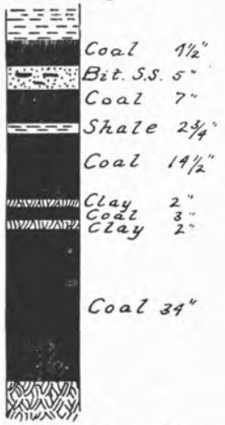
Fig. 21


Lower Hignite Coal, Hd. Little Clear Cr.

On Pecks branch the Lower Hignite as opened, showed the smallest bed section that was noted in this coal in the Log Mountain region; the thickness being thirty-three inches with two thin shale partings. In the intervening two hundred feet between the coal

one hundred and twenty-five feet above the Poplar Lick and the Hignite, seven thin coals were opened.

Fig. 22




Coal 350 ft. above Hignite bed, Polk Br. Little Clear Cr.

Their thickness and relation are shown in the vertical section. Three hundred and fifty feet above the Hignite coal on Polk branch, a thick coal bed is opened. The exposition of the bed is shown by the descriptive section. A sample from the outcrop which was very earthy gave:

| | |
|---|---|
| Moisture | 2.20 |
| Vol. comb. matter | 32.80 |
| Fixed carbon | 54.60 |
| Ash | 10.40 |
| | 100.00 |
| Sulphur | 0.408 |

In the preceding region this horizon was represented by several thin beds. Between this and the Hignite, nine coals were opened; their relation being given in the general section. At the 1155-foot level and 1020 feet above the mouth of Polk branch the Red Spring coal is opened. The detail section of this bed is shown in the accompanying engraving. A sample was cut from the forty-eight-inch bench only, as the upper ten inches was too earthy. The results of analysis gave:

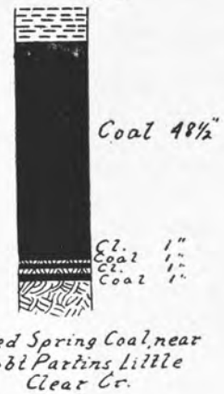
Fig. 23


Red Spring Coal, Polk Br, Little Clear Creek

| | |
|---|---|
| Moisture | 3.40 |
| Vol. comb. matter | 32.40 |
| Fixed carbon | 59.20 |
| Ash | 5.00 |
| | 100.00 |
| Sulphur | 0.563 |



Fig. 24




Red Spring Coal, near Robt Parkins Little Clear Cr.

Near Robt. Parton's house farther up and about seven hundred and eighty feet above Little Clear creek, this bed was opened again with results as in cut. An outcrop sample gave:

| | |
|---|---|
| Moisture | 3.40 |
| Vol. comb. matter | 31.36 |
| Fixed carbon | 58.24 |
| Ash | 7.00 |
| Sulphur | 0.601 |

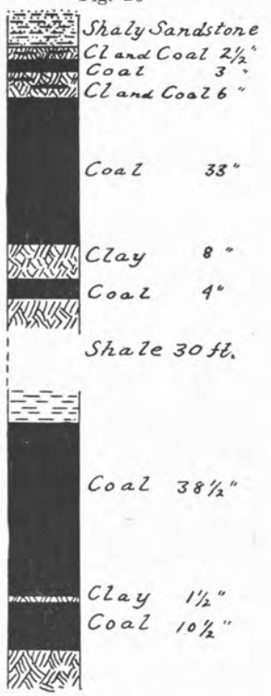
Fig. 25


Poplar Lick Coal, Jas. Masons, Little Clear Cr.

The vertical section gives the thin coals opened above and below this bed. About three miles below the mouth of Polk branch, on Lower Laurel branch, near James Mason's house there is a partial section in the principal coals. The openings are in the divide between Big and Little Clear creeks. The Poplar Lick shows as in section, at an elevation of four hundred and eighty feet above the bed of Little Clear creek. No sample was taken as the coal was badly weathered. The cannel slate bed five feet thick is opened below the last, and is commonly reported through the country as a cannel coal of excellent quality. Eight hundred and thirty feet above the mouth of Laurel, both beds of the Hignite coal are opened in the relation shown in the accompanying cut. The lower bed alone was sampled, as the upper was too badly weathered. The following is analysis of same:

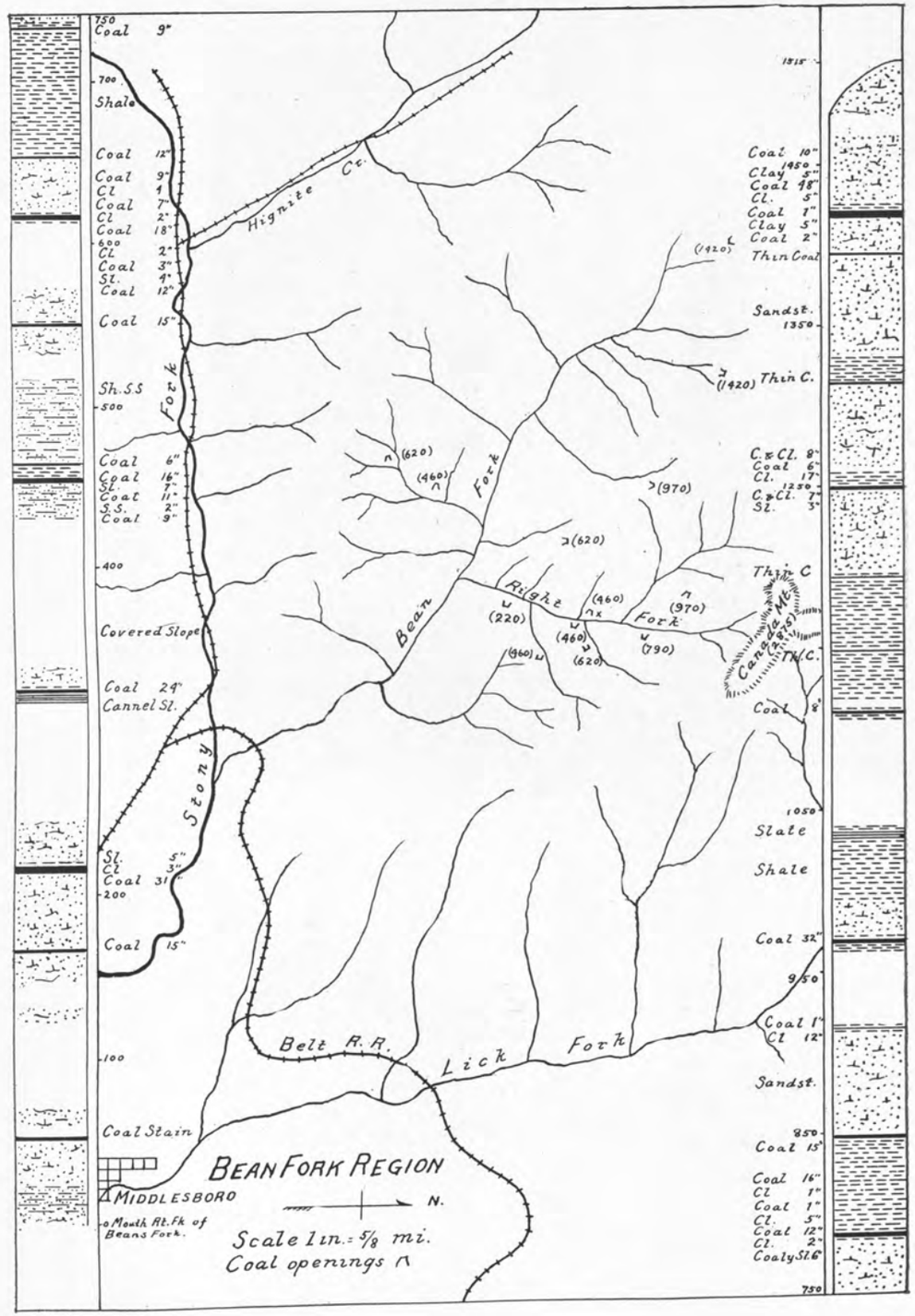
| | |
|---|---|
| Moisture | 4.90 |
| Vol. comb. matter | 29.54 |
| Fixed carbon | 62.36 |
| Ash | 3.20 |
| | 100.00 |
| Sulphur | 0.758 |

Fig. 26




Hignite Coals at Jas. Masons, Little Clear Creek.

The openings on Laurel are as far northward as the economic beds were traced in this region. Near the head of Little Clear creek is the only place in Log Mountain Field where the Poplar Lick and Hignite coals are found at the drainage of the main creek, this being due here to the great fall of the creek from its head waters, about three hundred feet to the mile.

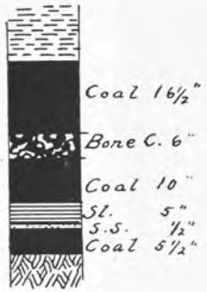


## Beans Fork Region.

This creek, as will be seen from the page map, is a tributary of Stony fork of Yellow creek. A complete section was made on the right and a partial on the left side of this fork. Canada Mountain has an altitude of 2,875 to 2,900 feet above tide. Being the highest point in this part of the Log Mountains, it was chosen as the place to make a typical section for this part of the field. The relation of the Canada Mountain to the Little Clear Creek region can be seen from page map of this region. The openings on this mountain show the extension of the coals in an eastward direction or towards Middlesborough from the last region. The dip of the rock on this side of the mountain is not so regular as on Little Clear creek, the direction and angle, especially near the mouth of the creek, being changed and somewhat increased by the several faults which cross the Yellow creek valley and end in this vicinity. The general direction of the dip is northwest or up the main creek. The mouth of the Right fork, which is about four hundred and fifty feet above that of the main creek, is taken as the base of the section. Below the mouth of Right fork only three coals were noted; the thickest showing thirty inches where measured. This bed was worked for local use but on account of the increased dip and the badly broken roof it has been abandoned. On Right fork, near its mouth, a coal was opened by the American Association (Limited). The position of this bed and its thickness are shown at an elevation of 220 feet. At four hundred and sixty feet above the mouth of the Right fork and about nine hundred above that of main creek, the coal with the bituminous sandstone parting was opened at four different point as indicated on map page. The following cuts show the beds in detail. The bed was not sampled for analysis in this region.



Fig. 27




Coal at 460 Beans Fork Sect.

Fig. 28

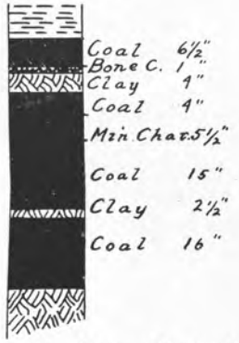

Coal at 460, Bean Fk Sect.

Fig. 29


Coal, Cow Branch 460 Bean Fork Section.

The position of the cannel slate below this bed, is shown in its usual place in the series. At the six hundred and twenty foot level of this section and about eleven hundred and fifty feet above Middlesborough, three openings have been made by the American Association in the Poplar Lick bed of the preceding regions. One on the Right fork and two on the main creek as shown on map. The detailed bed sections below represent the two openings which are on main creek. Neither of the two was sampled for analysis.

Fig. 30

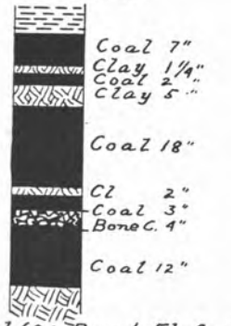



Coal 620 Bean Fk Sect.

Fig. 31


Coal 620 Bean Fk. Sect.

Fig. 32




Coal 620, Bean's Fk. Sect.

The section of bed on the Right Fork is shown by accompanying figure. An analysis gave composition as follows:

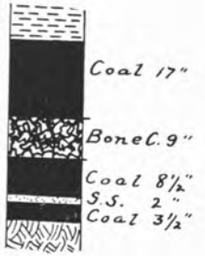
| | |
|---|---|
| Moisture | 2.08 |
| Vol. comb. matter | 32.92 |
| Fixed carbon | 59.94 |
| Ash | 5.06 |
| | 100.00 |
| Sulphur | 0.906 |

On Cow branch, this bed has a thickness less than either of the preceding. Here it showed coal fifteen, clay two, and coal sixteen inches. At the 970-foot level the Lower Hignite coal was opened. The accompanying cut gives bed section. The Red Spring coal shows at an elevation of about seventeen hundred feet above the mouth of Beans fork and within one hundred feet of the top of Canada mountain. No opening was made in the thick stain which was noted at this point, since it was very badly covered with debris by a slip. As the opening in this bed for the Little Clear Creek region was made in the gap at the head of Polk branch and Beans fork, this was taken as a representative of the Beans Fork region also. (For description and analysis of this bed see same in the Little Clear Creek region.) For thickness and number of thick coals below this and the other beds see vertical section.

Fig. 33


Lower Hignite Coal, Bean Fork.

Fig. 34




Coal Lick Fork 460 Lick Fk. Sect.



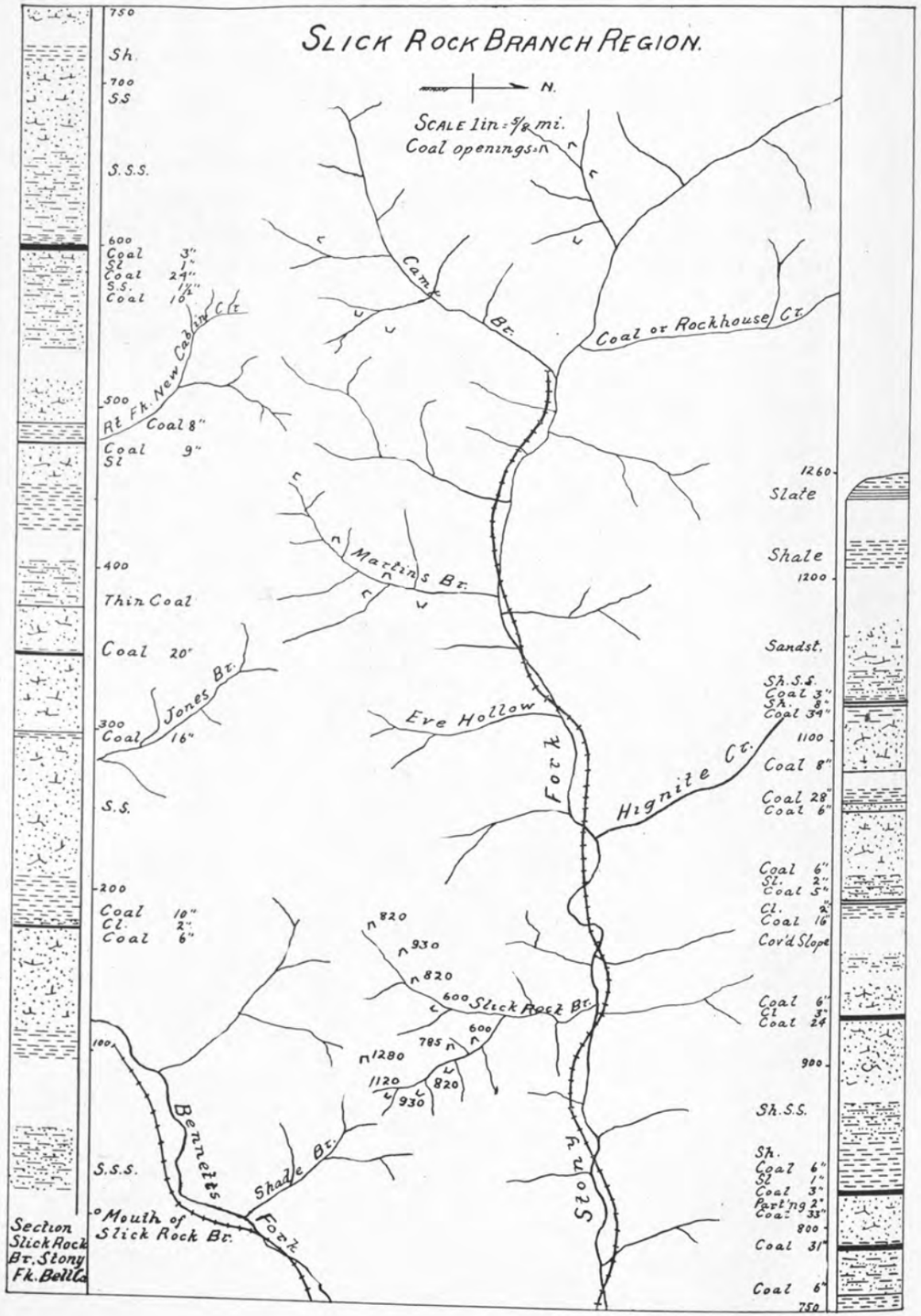
As a whole the economic beds on Canada Mountain appear to be rather lean. On Lick Fork of Yellow creek, which is on the north side of Canada from Beans fork, a partial section was made to test the extension of the economic beds in this direction. The results showed about as on Beans fork. The coal with the bituminous sandstone parting is shown in the engraving as opened here. Several beds were opened below this coal, but they are all thin. One hundred and seventy feet above this the Poplar Lick was opened as in figure. This was not sampled, being too badly weathered. Above this the Lower Hignite showed a bed-section as in the accompanying cut, at the point where it was opened. This like the preceding bed was very badly weathered at the outcrop. All of the beds opened in this and the Beans Fork region were driven to firm rock roof. The Upper Hignite coal may possibly be represented here by the cannel slate bed 70 to 75 feet above the Lower or principal Hignite coal.

Fig. 35


Poplar Lick Coal, Lick Fork.

Fig. 36


Hignite Coal, Lick Fk.






## Slick Rock Branch Region.

Two sections were made on Slick Rock, one on the left and the other on the right fork. This branch is about three and one half miles above Middlesborough. The mouth of the creek, which is about 150 feet above Middlesborough, is taken as the basis of the section. The coal carrying the sandstone parting is found at the 600-foot level of this section. The cuts below give the details of this bed as opened on both the Right and Left forks. The opening on the Right fork is the only one noted in the Log Mountain territory that does not show the characteristic parting, and very probably would here if driven to solid coal.

Fig. 37


Coal, Left Fk. Slick Rock. 600 ft. Slick Rock Sect.

Fig. 38


Coal Right Fk. Slick Rock 600 ft. Slick Rock Sect.

The following results were obtained from samples taken from these openings:

| | LEFT FORK | RIGHT FORK |
|---|---|---|
| Moisture | 2.60 | 1.40 |
| Vol. comb. matter | 32.20 | 32.86 |
| Fixed carbon | 57.30 | 58.14 |
| Ash | 7.90 | 7.60 |
| | 100.00 | 100.00 |
| Sulphur | 0.548 | 0.549 |

Six thin coals were opened below this horizon as indicated in the vertical section. The first bed below it

here, as elsewhere, is that with the cannel slate roof. At the horizon of the Poplar Lick bed of the previously described regions, a coal was opened on the Left fork which showed only thirty-one inches of coal with one fourth inch of clay fifteen inches from the top. No opening was made at this horizon on the Right fork.

At the 820-foot level or forty feet above the horizon of the Poplar Lick coal, a bed was opened on both forks of this branch which gave sections as in the subjoined cuts.

Fig. 39


Coal, Left Fk. Slick Rock. 820 ft Slick Rock Sect.

Fig. 40


Coal Rt. Fk. Slick Rock. 820 Slick Rock Sect.

The results of the analysis of coal from these openings were:

| | LEFT FORK. | RIGHT FORK. |
|---|---|---|
| Moisture | 1.20 | 2.00 |
| Vol. comb. matter | 34.00 | 33.50 |
| Fixed carbon | 56.60 | 55.30 |
| Ash | 8.20 | 9.20 |
| | 100.00 | 100.00 |
| Sulphur | 2.471 | 0.288 |

This is the first point at which this coal was noted as a workable bed. In the Beans Fork region, it was found as a thin coal with a cannel slate roof (see vertical section, Beans Fork region 660-foot elevation). One hundred and ten feet above this or one hundred and fifty feet above the horizon of the Poplar Lick seam, a coal was opened which



Fig 41

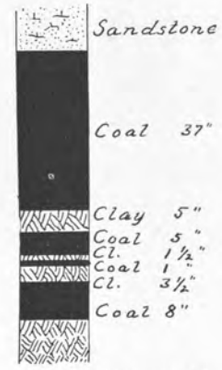

Coal Right Fk. Slick Rock, 930 Slick Rock Section.

gave on the Left Fork, coal six, clay three, and coal twenty-four inches, and on the Right Fork as in the accompanying enlarged section.

A coal was noted at this horizon on Beans Fork and it may be referred to the horizon of the thick bed with partings which was noted one hundred and twenty feet above the Poplar Lick coal in the Little Clear Creek region.

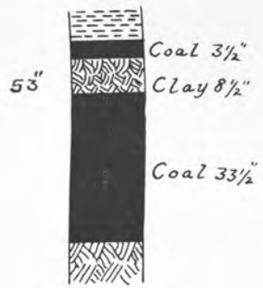
At an elevation of eleven hundred and twenty feet above the mouth of Slick Rock, the Hignite coal was opened. The sections below give the details of the bed as opened on both the Right and Left forks.

Fig. 43



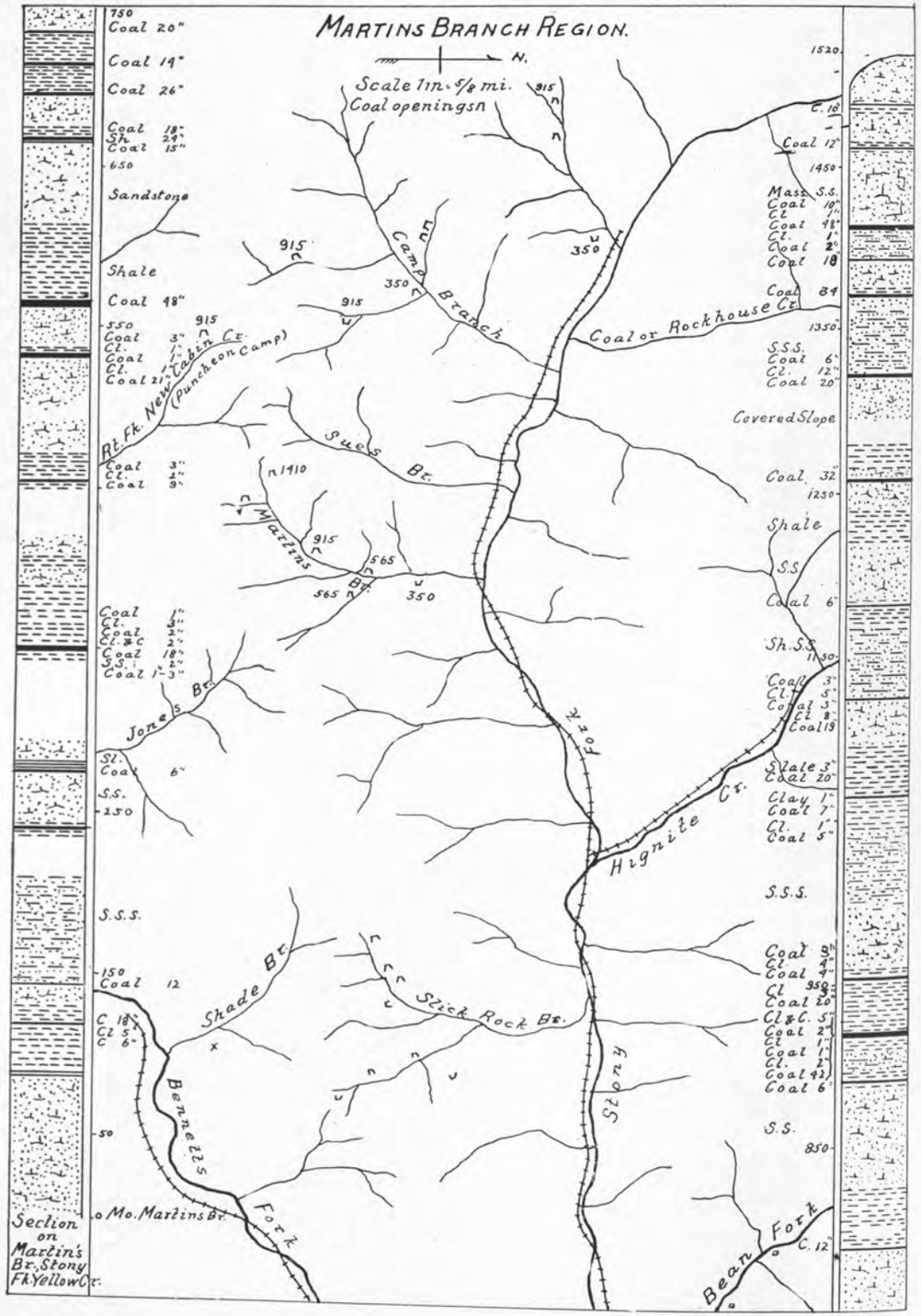

Hignite Coal, Rt. Fk. Slick Rock. Jr., Stony Fk., Bell Co.

Fig. 42




Hignite Coal, Left Fk Slick Rock Sect.

Both facings were too badly weathered to be sampled for analysis. The position and thickness of the several thin beds of coal opened can be seen from the vertical section. All of the openings on the Right fork, except one at the 600-foot level, were made by the American Association (Limited). A partial section was also made by them on Eves Hollow branch which is one mile above Slick Rock, but these openings were not visited.






## Martins Branch Region.

The third and most complete section on Stony fork was made on Martins branch. This branch is about eleven miles above Middlesborough, and its relation to the previous region can be seen from the map. The mouth of Martins branch is about three hundred and eighty feet above Middlesborough and the summit of the mountain at this point is about nineteen hundred ft., or twenty-nine hundred and sixty above tide. Three hundred and fifty feet above the mouth of the branch, which was taken as the base of the section, the coal with the sandstone parting was opened having bed section as in the accompanying engraving. No sample was taken from this bed for analysis at this point. The position of the cannel slate bed and the other thin coals below are shown in the vertical section. At the horizon of the Poplar Lick bed, a coal was opened which gave:

Fig. 44


Coal 350 Martins Br. Section.

| | |
|---|---|
| Coal | 3 in. |
| Clay | 1 " |
| Coal | 1 " |
| Clay | 1 " |
| Coal | 21 " |

Thirty feet above the preceding, or five hundred and sixty-five feet above the mouth of the branch, the first bed of economical importance in this region was opened. The opening showing forty-eight inches as in cut following was made on a left branch and the bed represented by the other detail section, by the American Association, on the main Martins branch.

Fig. 45


Coal 565 Martins Br. Section.

Fig. 46


Coal 565 Martin's Br. Section.

A sample from the forty-eight inch bed gave on analysis:

| | |
|---|---|
| Moisture | 1.40 |
| Vol. comb. matter | 32.80 |
| Fixed carbon | 53.80 |
| Ash | 12.00 |
| | 100.00 |
| Sulphur | 0.990 |

Fig. 47


Hignite Coals, Martin's Br. Stony Fk. Yellow Cr.

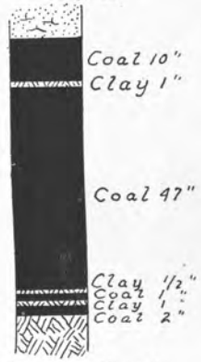
This bed occurs at the same horizon as the 820-foot coal of the Slick Rock region, and the one which is one hundred and ten feet above it shows on Martins branch eighteen inches of coal, twenty-four of clay, and fifteen of coal. At the 915-foot level the Lower Hignite coal, and at 945 the Upper Hignite, was opened. Their bed sections and relations are shown in the accompanying cut. A sample was taken from the outcrop of the lower bed which was driven to firm roof, but the coal was slightly weathered and contained some infiltered clay.



| | |
|---|---|
| Moisture | 2.20 |
| Vol. comb. matter | 35.00 |
| Fixed carbon | 60.20 |
| Ash | 2.60 |
| | 100.00 |
| Sulphur | 0.637 |

One hundred and ten feet above the Hignite, a coal was opened which showed thirty-two inches in thickness and had for roof five feet of cannel slate. This slate was noted at the same horizon in both the Slick Rock and the Beans Fork region. At an elevation of 1255 feet in the vertical section, a 32-inch bed of coal was opened, which occupies the same horizon as the coal at the 1035-foot level in the Little Clear Creek region. One hundred and fifteen feet above this a 34-inch bed was exposed.

Fig. 48




Red Spring Coal, Martins Br.

Fourteen hundred and ten feet above the bed of the creek at the mouth of Martins branch and within one hundred and ten feet of the top of the mountain, the Red Spring coal of the previous region was found. Here it has as roof fifty feet of massive sandstone similar to that found over it on Bear branch of Big Clear creek. Bed section is shown by engraving. No sample for analysis was taken from the badly weathered outcrop.

Fig. 49


Coal on Camp Br. 350 Martin's Br. Sect.

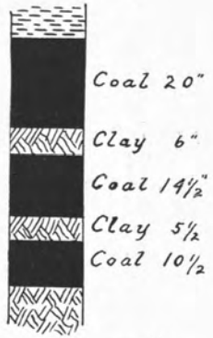
For position and thickness of the several thin coals, reference can be had to the vertical section. Two partial sections were made on Stony fork above Martins branch; one on Camp branch, the other on the small branch at the end of the Belt R. R. The location of these two branches and of the principal openings on them is shown on the page-map of the Martins Branch region. The thickness of the coal with the sandstone part-

ing is shown in cut as opened on Camp branch. The horizon of the Poplar Lick bed is occupied on this branch as on Martins by a thin coal. The thickness was as follows:

| | |
|---|---|
| Coal | 4 in. |
| Clay | 1 " |
| Coal | 28 " |

The coal thirty feet above this bed is a shaly slate. About three hundred feet above the coal carrying the sandstone parting, a coal was opened on Camp branch and on the branch one half mile above, having bed section as in enlarged sections below. This bed occupies the same level as the bed found at the 665-foot horizon on Martins branch.

Fig. 50




Coal on Camp Br.
350 Martin's Br. Sect.

Fig. 51


Coal ½ mi. above Camp Br.
665 Martin Br. Sect.

A sample from the opening on the branch at the end of the Belt Railroad gave on analysis:

| | |
|---|---|
| Moisture | 2.20 |
| Vol. comb. matter | 35.40 |
| Fixed carbon | 59.46 |
| Ash | 2.94 |
| | 100.00 |
| Sulphur | 1.347 |

The openings of the Lower Hignite coal made on Camp branch and the one half mile above, are given in detail in the sections following. The two facings made of this bed on Camp branch showed the same bed sections.



Fig. 52


Lower Hignite Coal,
Camp Br.

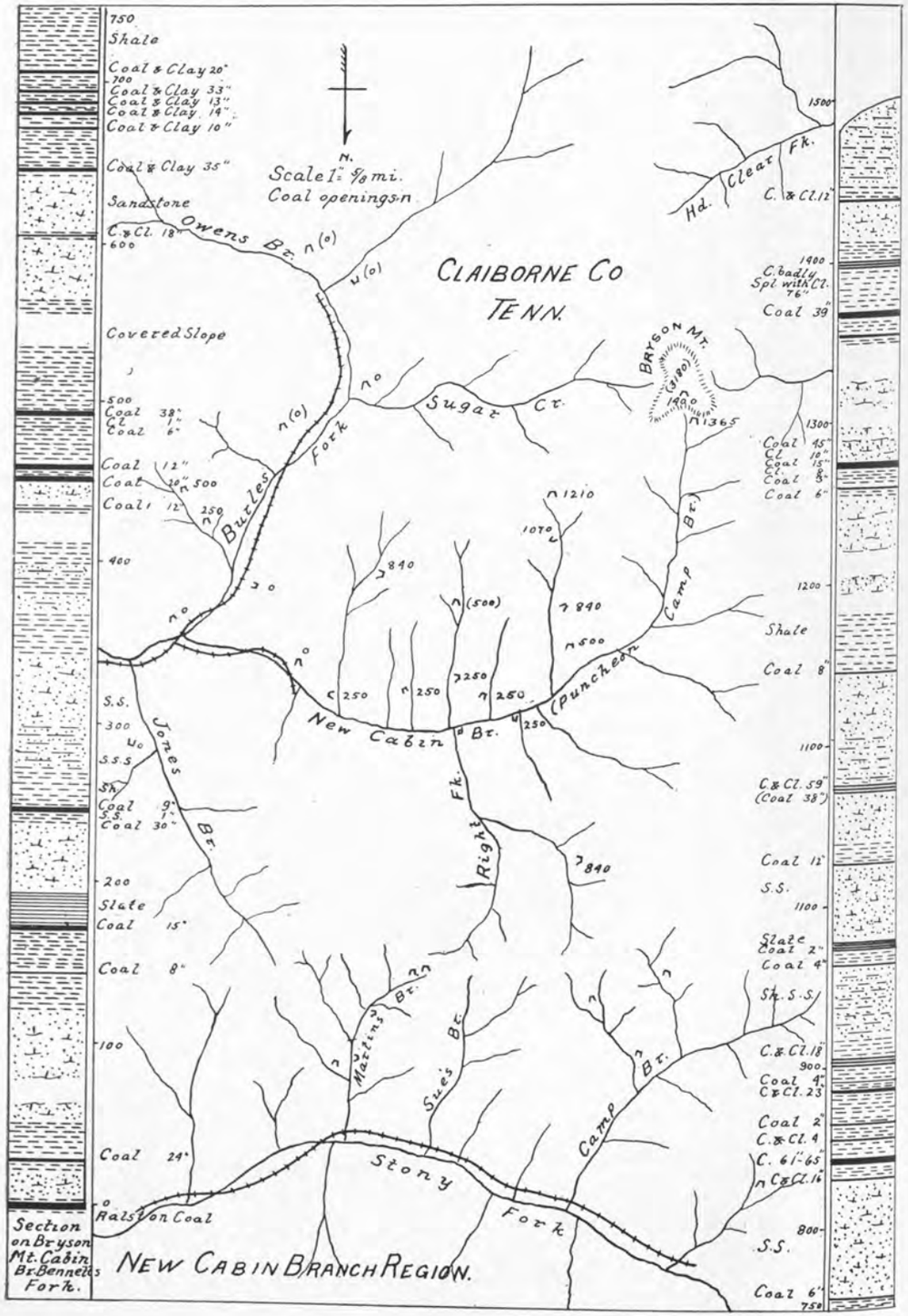
Fig. 53


Lower Hignite Coal,
½ mi above Camp Br.

A sample for analysis from one of the openings on Camp branch gave the following results:

| | |
|---|---|
| Moisture | 3.00 |
| Vol. comb. matter | 31.62 |
| Fixed carbon | 62.18 |
| Ash | 3.20 |
| | 100.00 |
| Sulphur | 0.274 |

Between Martins branch and Camp branch two coals were opened twenty feet apart. The upper one is twenty-two and the lower twenty-six inches, with two inches of clay eight inches from the bottom. These two beds lie below a sandstone ledge twenty-five to thirty feet thick and occupy the same horizon as the Ralston coal which will be noticed under the Bryson Mountain or New Cabin branch region.






## Bryson Mountain Region.

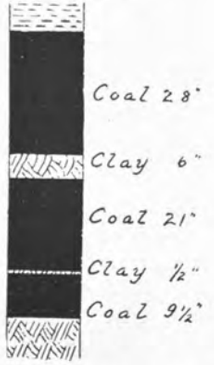
Bryson Mountain, from which this region takes its name, lies just outside the borders of Bell county, in the State of Tennessee between the head waters of the Clear fork of the Cumberland and of Bennetts fork of Yellow creek. This is the highest point in the Log Mountain region, having barometric elevation of 3,150 feet above tide, and for this reason, although out of the State, it was selected as the place to make a typical section for this part of the territory. The section accompanying the page-map of the region, was made on New Cabin branch, also known as Puncheon Camp creek, a tributary of Bennetts, fork having its source at the top of Bryson. The mouth of New Cabin is about six miles above Middlesborough and the railroad grade at this point is about four hundred feet above the level of the town. The exposition of the coal beds, thirty-five in number, and of the intervening rock is as complete as possible under the circumstances. A partial section was made on Red Oak branch of Burles fork of Bennetts fork about one half mile above the mouth of New Cabin branch. A great many openings were made under the immediate direction of the American Association (Limited) on Bennetts fork above and below this region; but these openings were so widely scattered that only the two or three that fell in the immediate neighborhood of the section were taken advantage of. The beds reported formerly opened on Langleys or Wassons branch, below New Cabin, or on Sugar branch, above were not reopened for examination, as it was impossible to find anyone who knew where the openings were made. The first economic bed of this region is the one known as the Ralston coal, and is found at the base of the section. This coal is being worked at several different points above and around the mouth of New Cabin Creek branch.

This coal has been the basis of the coking industry in the Middlesborough region. At the mouth of New Cabin about one hundred and sixty feet above the railroad grade, this bed is worked by the Mingo Mountain

Fig. 54


Ralstons Coal, Mo. New Cabin Cr.

Fig. 55

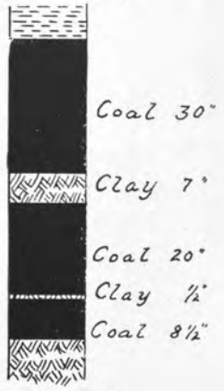



Ralston Coal, Mingo Mt. Co's Upper Opening.

Coal and Coke Co., the output being used to supply their coke ovens at this point. The accompanying detail section was drawn from a measurement made in the main entry about two hundred feet from the mouth. No sample was taken from this opening for analysis. About one mile above the preceding and on Burles fork a second opening has been made by the same company. The detail section represents this bed as measured near the mouth of the main entry. The sample cut from the twenty-eight and the twenty-one inch benches gave on analysis:

| | |
|---|---|
| Moisture | 1.80 |
| Vol. comb. matter | 32.50 |
| Fixed carbon | 58.76 |
| Ash | 6.94 |
| | 100.00 |
| Sulphur | 1.096 |

Fig. 56

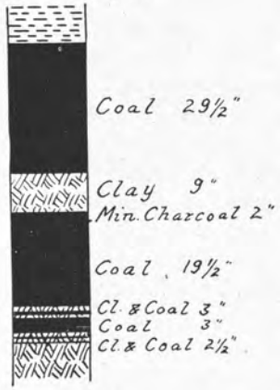



Ralston Coal, Reliance Co's opening.

About midway between these last two openings, and on the opposite side of the creek, this bed was opened by the Reliance Coal and Coke Co. The accompanying illustration shows bed in detail as measured fifty feet in main entry. No sample was taken.



Fig. 57




Ralston Coal, C.W. Livermore's entry.

Two openings have been made at this horizon above the upper plant of the Mingo Mountain Coal Co., one being at the mouth of Sugar branch and the other about one half mile farther up at the mouth of Owens branch. At the latter place it has been opened by Mr. C. W. Livermore almost at the level of the creek. The accompanying cut gives details of bed fifteen feet from mouth of entry. Below, the chemical composition of sample taken from same is given.

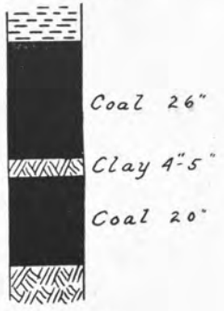
| | |
|---|---|
| Moisture | 0.12 |
| Vol. comb. matter | 37.88 |
| Fixed carbon | 58.00 |
| Ash | 4.00 |
| | 100.00 |
| Sulphur | 0.824 |

Fig. 59


Ralston Coal, Jones Br. Bennett Fk. Bell Co.

On New Cabin about one mile from the mouth, two exposures have been made in this coal; one on each side of the creek. The one on the right is being worked and has section as in cut. The bed was measured in main entry about fifty feet from the mouth. This was not sampled for analysis. On Jones branch of Bennetts

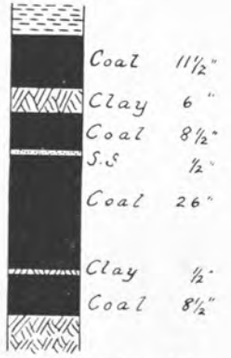
Fig. 58




Ralston Coal New Cabin Cr.

fork which is about one-eighth of a mile below the mouth of New Cabin, an opening gave bed section as in figure. This opening was only driven to roof. The detail section of this coal at the Mingo Mountain Coal and Coke Company's openings and at that of the Reliance Co.'s were made from measurements taken before the entries were driven in any great distance. No measurements have been made at any of these points since that time, and the variations of the bed sections are not known to the writer. No developments, so far as the writer is informed, have been made on Little Yellow creek to show the eastward or on Tacketts to show the southward, extension of the bed from this region. In the regions northward and westward from the Bryson territory, the horizon of this bed is occupied by two thin coals, ten to twenty feet apart, as indicated in the Martins branch and in the Little Clear Creek regions. Two hundred and fifty feet above the Ralston coal the bed having the characteristic sandstone parting was opened at several points. Above the mouth of New Cabin and in the ravine opposite the Reliance Co., this bed has section as shown in cut. A sample was taken from the head of the entry which has been driven in about fifty feet by the Mingo Mountain Co. The results were:

Fig. 60




Coal, Burles Fk., 250 Bryson Sect.

| | |
|---|---|
| Moisture | 0.76 |
| Vol. comb. matter | 32.82 |
| Fixed carbon | 56.42 |
| Ash | 10.00 |
| | 100.00 |
| Sulphur | 0.576 |

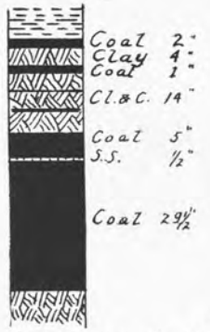
On New Cabin branch, above and below the mouth of the Right fork, four cuttings were made at this horizon. The bed sections of three of the openings are given:



Fig. 61


Coal 250 Bryson Sect. Below mo. Rt. Fk. New Cabin.

Fig. 62




Coal 250 Bryson Sect.

Fig. 63


Hignite Coal, Right Fk. New Cabin Br.

A sample was taken from the opening below the mouth of the New Cabin which shows forty-one inches of coal with one-half inch sandstone six inches from the top gave the following results:

| | |
|---|---|
| Moisture | 2.00 |
| Vol. comb. matter | 33.00 |
| Fixed carbon | 57.80 |
| Ash | 7.20 |
| | 100.00 |
| Sulphur | 0.551 |

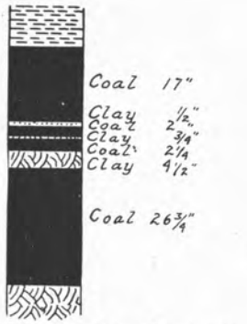
The cannel slate bed as exposed on New Cabin below this level has a thickness of twenty feet over twenty inches of coal. At the horizon of the Poplar Lick seam, a bed was opened on the left side of Burles fork on Red Oak branch which has a bed section as in engraving. An outcrop sample gave:

Fig. 64


Coal 250 Bryson Sect

| | |
|---|---|
| Moisture | 2.10 |
| Vol. comb. matter | 35.50 |
| Fixed carbon | 56.68 |
| Ash | 5.72 |
| | 100.00 |
| Sulphur | 0.728 |

Fig. 65




Poplar Lick Coal, Burles Fk.

On New Cabin branch three thin coals were noted about this horizon. Thirty-five feet above this bed on Red Oak branch of Burles fork coal was found occupying the horizon of the forty-eight inch coal at the 565-foot level in the Martins Branch region. The section of the bed as exposed here is given in the accompanying cut. The opening was driven to roof but the coal was too badly weathered to sample. On New Cabin, five hundred feet above the Ralston seam, this bed was opened at two points; one below and the other a mile above the mouth of Right fork. The sections of both beds are here given below.

Fig. 66


Coal, Burles Fork
500 Bryson Section.

Fig. 67


Coal 500 Bryson Mt. Sect

A sample, weathered and containing infiltered clay, was taken from the bed below the mouth of Right fork. The analysis was as follows:

| | |
|---|---|
| Moisture | 2.80 |
| Vol. comb. matter | 30.48 |
| Fixed carbom | 56.98 |
| Ash | 9.74 |
| | 100.00 |
| Sulphur | 0.989 |

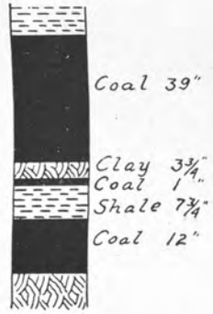


Coal from the thirty-nine inch bench of the upper opening, which was badly weathered although driven to firm roof rock, gave:

| | |
|---|---|
| Moisture | .96 |
| Vol. comb. matter | 31.14 |
| Fixed carbon | 55.90 |
| Ash | 12.00 |
| | 100.00 |
| Sulphur | 0.302 |

The Hignite coal was opened at the 840-foot level of this region. The bed was exposed at three points; one on the right made by the American Association, one on main creek below and the other above the mouth of the Right fork. The cuts following indicate the sections of the bed as opened at these different points.

Fig. 68

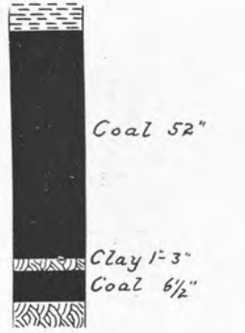



Coal 500 Bryson Mt. Sect.
1 mi above Right fork.

Fig. 69


Hignite Coal,
840 Bryson Sect.

Fig. 70

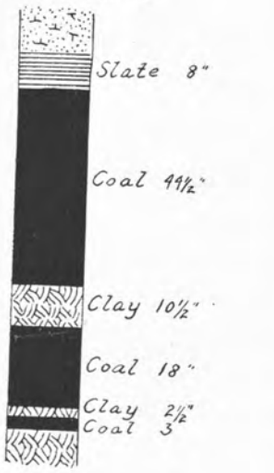



Hignite Coal, Bryson Sect.
1 mi above Rt. Fk., New Cabin.

An anlysis of the coal from the 52-inch bench of the upper opening gave:

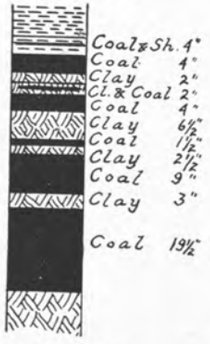
| | |
|---|---|
| Moisture | 2.00 |
| Vol. comb. matter | 35.20 |
| Fixed carbon | 59.00 |
| Ash | 7.60 |
| | 100.00 |
| Sulphur | 0.673 |

Fig. 71




Red Spring Coal, Bryson Sect.

Fig. 72

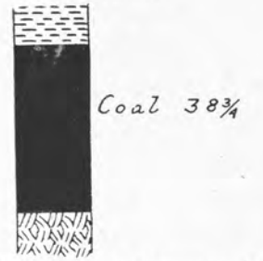



Coal 1070 Bryson Sect.

The other two openings were too badly weathered and clayey to sample for analysis. The Hignite coal through this and the Martins branch region is found at the top of a massive sandstone outcrop 75 to 100 feet thick as in the Big Clear Creek region. Between this and the bed previously described ten thin coals were opened as indicated in the vertical section. Four hundred and thirty feet above the Hignite or at the 1,270 foot level, the Red Spring coal was opened, showing as in the accompanying engraving. The opening was driven to firm roof, but the coal contained too much clay to show the character of the bed by analysis. This bed was noted at another point on Bryson, but not opened. Two hundred feet below the last, a bed 58 inches thick, split up with partings as in the accompanying cut, was opened. This opening is 1070 feet above the base of the section. The other coal exposures were made between the Hignite and Red Spring coals; but they were all thin beds.



Fig. 73




Coal 1365 Bryson Sect.

Thirteen hundred and sixty-five feet above the Ralston seam, a coal was opened having a thickness as in illustrated section. This bed is on the lower bench of the clearing on top of Bryson. The analysis of coal from outcrop was:

| | |
|---|---|
| Moisture | 3.40 |
| Vol. comb. matter | 33.40 |
| Fixed carbon | 55.20 |
| Ash | 8.00 |
| | 100.00 |
| Sulphur | 0.741 |

Fig. 74


Coal 1400 Bryson Sect.

Fourteen hundred feet above the base of the section, a coal was opened in the spring one hundred feet below summit of Bryson. The accompanying engraving gives details of this bed. This and the coal previously described are the highest coals opened in the Log Mountain region.

## APPENDIX TO COALS OF LOG MOUNTAIN REGION.

By A. R. CRANDALL.

More recent developments of the Lower Hignite seam by the Louisville Property Co., under the direction of General Manager Thomas Cairnes, has added valuable data as to its extension and character.

On Major branch of Big Clear creek the bed shows a thickness of 46 inches with a parting of ½ inch or less 10 inches from the bottom.

On Bear creek (2,285 a. t.). Roof shale; coal 40 inches, shale 1 inch, coal 9 inches; underclay with plant impressions.

On Piney Spurr. Coal 42 inches, shale clay 1 inch, coal 8 inches to underclay.

Laurel Fork, coal 40 inches, parting 1 inch, coal 8 inches.

Brush Spurr. Coal 50 inches, parting 2 inches, coal 8 inches.

Head of Persimmon Hollow, 53-inch seam with 1 inch parting.

On the head of Sowders creek this bed is reported as varying little from the preceding bed section.

The five locations last named are on the head waters of the Clear fork of the Cumberland river.

On the head of the Ben branch of Little Clear creek a coal recently opened 330 feet above the Lower Hignite seam shows a bed section as follows:

| | | |
|---|---|---|
| Roof shale. | | |
| Coal | 10 inches | |
| Clay shale | | 1 inch |
| Coal | 44 " | |
| Bench seam | | ½ " or less |
| Coal | 3 " | |
| | 57 " | 1½ " |

This coal is about 100 feet below the Red Spring seam and is the same as the bed opened 350 feet above the



Hignite seam on Polk branch and described by Mr. Sullivan. (See page map of Little Clear creek region and cut of bed section.) This bed is covered by 150 to 200 feet of ridge on Ben branch. It is an excellent coal as here exposed, and adds interest and value to this region as a coalfield.

The Mason coal seam of the Clear Creek region which, as formerly opened, gave little promise of value for extensive mining operations in the Bear Creek region, has recently come to be recognized as one of the important coals of the district including that part of the Clear Creek ridge which is drained by the Caney fork, Major branch, Furnace Ridge branch, the Mason branches of Big Clear creek and some of the branches of Little Clear creek, and it is the principal coal in that part of the Log Mountains which extend in ridges and spurs of reduced height between the Clear Creek waters Cumberland river, and the waters of Cannon Creek. It is also a workable coal seam on the Clear Fork waters, Cranes creek and William's creek tributaries of Yellow creek, and Hance's creek, which flows into the Cumberland river. The latter region has not been made the subject of a detailed study as a coal district, but shows an unexpected area of unbroken coal beds extending between the Cumberland Conglomerate slope and the Rocky Face Mountain, a local Conglomerate uplift which separates this region from the Cannon Creek district by a short ridge widely divergent from the Cumberland Mountain axis.

Openings of the Mason coal have been made at a number of points in the Clear Creek region above the mouth of the Little Clear creek, at levels varying from 1793 to 1610 feet above the sea, or 792 to 611 feet, omitting fractions of feet, above the railroad grade at Pineville. The location of some of these openings is indicated on the accompanying map. The data of recent developments together with that of the Mason seam down the valley of Big Clear creek and on the waters of Cannon creek and of the Poplar Lick coal in the higher ridges between Big Clear creek and the Stony and Beans forks of Yellow creek, the Laurel fork and Sowders creek of Clear fork of the Cumberland river were supplied by Mr. Thomas

Cairns, General Agent of the Louisville Property Company, and are here given for reference in tabular form. The outcrop levels were carefully made by J. R. Justice, C. E. The Mason seam is generally without partings of slate or clay. The thickness given of the Poplar Lick coal is of coal exclusive of partings. The added figures give thickness of clay or slate of the bed section.

The intervals given in the table are subject to corrections for the dip of the beds, which is somewaht variable and could not be accurately determined from the data obtained. Plus and minus signs are therefore added to figures in this column to suggest an increase or a decrease of intervals as the case may be. The variation in vertical distance between these coals, as between other beds of the the region, is probably as much as one-sixth of the average thickness of the intervening rocks.



## THE MASON AND POPLAR LICK COALS OF THE LOG MOUNTAIN REGION.

| | Locality. | Coal bed. | Ht. above tide in feet. | Above R. R. Pineville. | Thickness of bed in inches. | Intervals bet. beds in feet. |
|---|---|---|---|---|---|---|
| Cannon Cr. | Hd. of Jerrys Br. N. Fk. | Mason | 1723 | 724 | 36 | .. |
| | Hd. of Petes Bt. N. Ek. | " | 1664 | 665 | 36 | .. |
| | Hd. Green Cove Br. N. Fk. | " | 1647 | 648 | .. | .. |
| | Cranes creek, E. of Rocky Face Mt. | " | .. | 360 | 44 | .. |
| | Hd. of Lick Cr. trib. of Big Clear Cr. | " | 1662 | 663 | 36 | .. |
| Little Clear Creek | Near Petes Gap | " | 1776 | 777 | .. | .. |
| | Hd. of Bull Br. | " | 1715 | 716 | .. | .. |
| | Opposite h'd of main Cannon Br. | " | 1700 | 701 | .. | .. |
| | Laurel Branch | Poplar Lick | 1981 | 982 | .. | .. |
| | | Mason C | 1610 | 611 | 48 | 371 |
| | Ben Br. Left side | " | 1638 | 639 | 50 | .. |
| | " " " " nr. hd. | P. Lick | 2039 | 1040 | 57–15 | .. |
| | " " " " | Mason | 1602 | 603 | .. | 437+ |
| | Near hd. Lit. Clear Cr. | P. Lick | 1974 | 975 | 57–7 | .. |
| Big Clear Creek | Hd. of left Br. | Mason | 1672 | 673 | 37 | .. |
| | " " Rife Mason Br. | " | 1711 | 712 | 43 | .. |
| | Hd. of Mason Br. | P. Lick | 2108 | 1109 | .. | .. |
| | | Mason | 1711 | 712 | 45 | 397+ |
| | Webb Br. | P. Lick | 2108 | 1109 | 55–8 | .. |
| | | Mason | 1749 | 750 | 48 | .. |
| | Hd. of Left Br. | " | 1793 | 794 | .. | .. |
| | " of Furnace Br. | " | 1788 | 789 | 48 | .. |
| | " " " " | Poplar Lick | 2061 | 1062 | 57–12 | .. |
| | Hd of Major Br. | Mason | 1696 | 697 | .. | .. |
| | " " " | " | 1750 | 751 | 48 | .. |
| | " " " L. br. | P. Lick | 2036 | 1037 | .. | .. |
| | Hd. Lft. Fk. Caney Cr. | Mason | 1662 | 663 | 35 | 374+ |
| | Ridge hd. of Caney Cr. | P. Lick | 2050 | 1051 | 38–8 | .. |
| | Oil-well hd. Bear Cr. | " | 2'34 | 1135 | 49–5 | .. |
| | | Mason | 1714 | 715 | .. | 420 |
| | Ridge hd. of Bear Cr. | P. Lick | 2017 | 1018 | 51–5 | .. |
| | Hd. of Partins Br. | " | 2099 | 1100 | .. | .. |
| Yellow Cr. | Hd. Hignite Cr. | " | 1980 | 981 | 37–2 | .. |
| | Hd. of Stony Fk. | " | 2035 | 1036 | .. | .. |
| Clear Fork | Hd. of Laurel Fk. | " | 2005 | .. | .. | .. |
| | 1 mi. S.W. down Laurel. | " | 2005 | .. | .. | .. |
| | ¾ mi. E. of preceding | " | 1940 | .. | 43–6 | .. |
| | Hd. of Sowders Cr. | " | 1954 | .. | 63–18 | .. |
| | 1 mi. S. of preceding | " | 2016 | .. | .. | .. |

In the Cannon creek region, on the North Fork, the Mason coal has been developed and an outcrop survey record gives its elevation above the main drainage as varying somewhat irregularly from 765 to 561 feet, or from 1816 to 1612 feet above sea level, dipping towards Rocky Face. The average thickness of the coal is 36 inches, excluding partings, which at some points add a few inches to the thickness of the bed.

On the main Cannon creek, in Saw Mill ridge, the same seam is opened at the Mary Moore Mine, about 570 feet above Yellow creek, and 555 feet above the Barner coal, which has been described in former reports.

The section of the hill here, on the Yellow creek side of the Saw Mill ridge, is given by F. J. Fohs, of the State Geological Survey, as follows:

| | Ft. | In. |
|---|---|---|
| Covered to top of hill. | | |
| Coal | 4 | |
| (Reported by d'Invilliers.) (Moss coal.) | | |
| Interval | 100 | |
| Coal worked at Mary Moore mine. Thickness of bed including partings of 3 ft. 4 in. (Mason Coal. Mingo.) | 8 | 8 |
| Interval, including 6 ft. of sandstone at the base | 110 | |
| Coal | 2 | 2 |
| Interval | 120 | .. |
| Coal | 1 | 3 |
| Sandstone | 2 | .. |
| Coal | ... | 2 |
| Interval, with sandstone ledge at 80 ft. below preceding | 135 | .. |
| Coal, thin. | | |
| Interval, with sandstone at base | 25 | .. |
| Interval, about | 93 | .. |
| Coal, split in places; nothing to | 1 | .. |
| Sandstone | 4 | .. |
| Slate, nothing to | 3 | .. |
| Coal | 1 | .. |
| Interval, with slate at top, about | 58 | .. |
| Coal (Barner) | 3 | 6 |
| (Is the cannel coal of Chenoa.) | | |

I have indicated, in the section, in parentheses, the probable equivalent coals.

The coal of the Excelsior mine, east of the Louisville & Nashville railroad, also at the horizon of the Mason coal, has the following bed-section:



| | Inches. | Inches. |
|---|---|---|
| Coal | 4 | .. |
| Shale | .. | 4–18 |
| Coal | 30–36 | .. |
| Parting | .. | 3–10 |
| Coal | 18 | .. |
| | 52–58 | 7–28 |

Bed-section in same ridge, as reported by d'Invilliers:

| | Inches. | Inches. |
|---|---|---|
| Roof, sandrock. | | |
| Coal | 12 | .. |
| Shale | .. | 1 |
| Coal | 11 | .. |
| Clay shale | .. | 7 |
| Coal | 2 | .. |
| Clay | .. | 1 |
| Coal | 23.5 | .. |
| | 48.5 | 9 |

The following is analysis given by McCreath of the latter coal:

| | |
|---|---|
| Moisture | 2.412 |
| Volatile combustible matter | 37.148 |
| Fixed carbon | 54.677 |
| Ash (dark red) | 4.750 |
| Sulphur | 1.013 |
| | 100.000 |

The bed section of the Barner seam as developed in core drill hole at tipple of the Excelsior mines two and one half miles from Middlesboro is as follows:

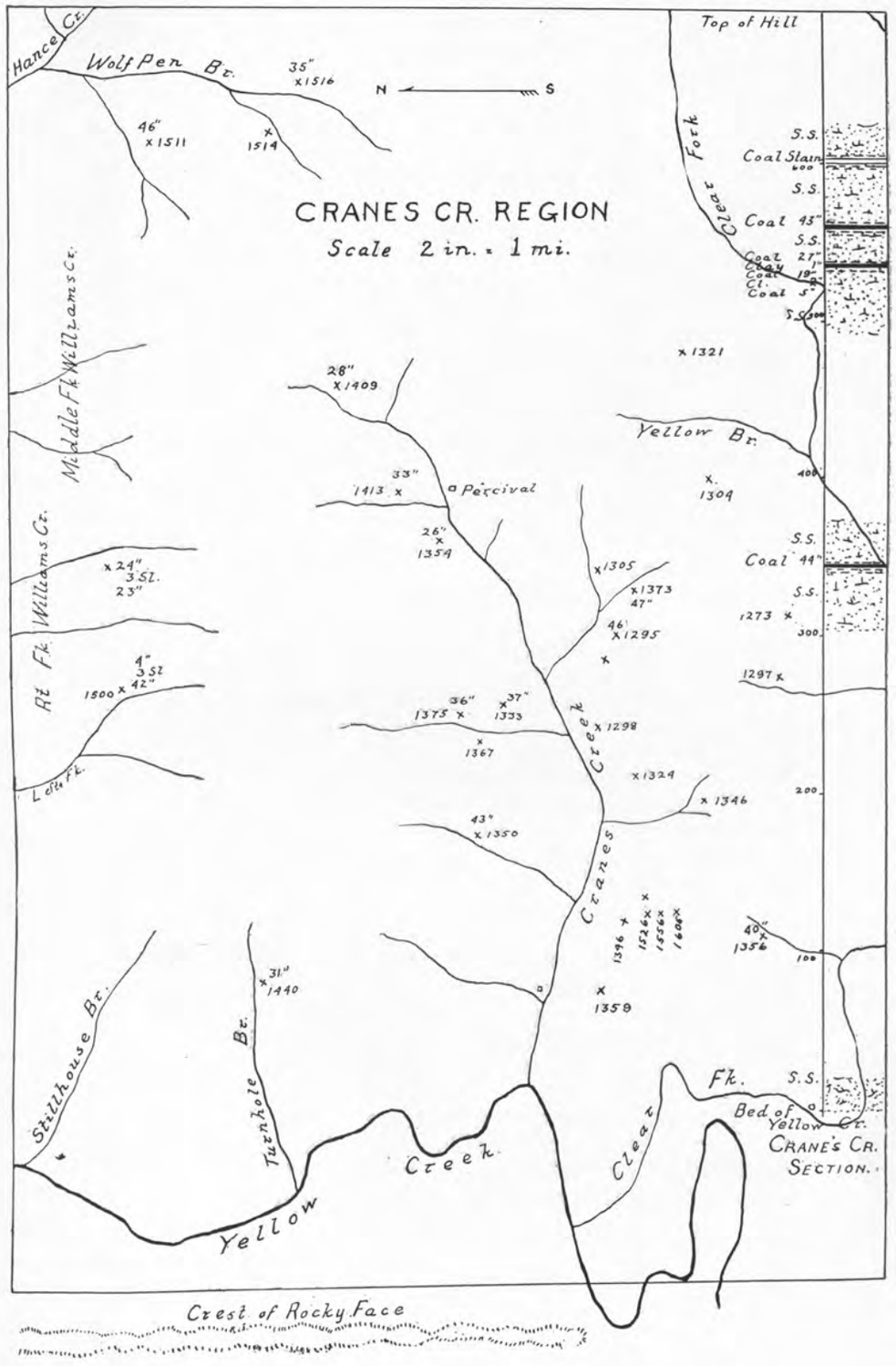
| | Inches. | Inches. |
|---|---|---|
| Roof, sandy slate. | | |
| Coal | 1½ | .. |
| Parting | .. | 2 |
| Coal | 2 | .. |
| Parting | .. | 3 |
| Coal | 32 | .. |
| Parting | .. | 2 |
| Coal | 1½ | .. |
| | 37 | 7 |
| Fireclay (plastic) | 2 | 10 |

The displacement of beds attending the Rocky Face uplift is not very great apparently in the region around this conglomerate ridge, though a number of fault lines

have been noted as probable offshoots of the Cumberland Gap fault and of the Rocky-face upheaval.

It will be noted from the elevations, as distributed on the map, that the beds in question dip somewhat irregularly from the Clear Creek region southeastward into the valley of Cannon creek, and that farther southwest this dip is interrupted by a counter dip, which falls from the higher lands that rise in the mountain ridges, spurs, and peaks of the head waters of the Yellow creek. This forms a synclinal basin, the axis of which is represented approximately by a line drawn along the ridge between the heads of Little Clear creek, Bean fork, Hignite creek, the head of Stony fork and of Sowders creek, on the one side, and the head of Laurel fork, of Clear fork, of the Cumberland and of the heads of the principal tributaries of Big Clear Creek excepting the head of Little Clear creek, on the other. This basin is formed within the greater Synclinal between the Pine and Cumberland ridges by the oblique uplift wave of the series of beds which make up these higher ridges. Northeastward, this wave fades out into the wide basin of the Yellow creek and the Cumberland river. This basin is broken by the Rocky Face uplift, already mentioned, and modified by many local changes of dip which can be described only when the coal and other beds have been traced in detail with the development of the country.

There may be some question as to the Cranes creek coal which is here placed at the Mason seam horizon. This is presuming that the dip into the Cannon creek valley above mentioned continues beyond the Rocky Face fault which Professor Shaler regarded as one of several connected with the Cumberland Gap fault. A similar abrupt scarp is described in the report on the Straight Creek region, the Whiteface Mountain, which sunders the rock strata and thus disguises the serial relation of beds on either side of the upturned underlying Conglomerate series.



## Cranes Creek Region.

In the Cranes creek locality the coal seam in question is three hundred and fifty feet above the Yellow creek, exposing so much of a section of rocks like those below the Mason seam or Straight creek coal. The maximum interval between this seam and the top of the Conglomerate formation is in general about six hundred feet. Here, except in Rocky Face, this formation is probably below the drainage, 200 feet or more.

The coal beds above this seam may also be compared with those above the Straight Creek seam. The vertical section at right of page map shows results of barometric measurement of intervals, one half to one and a half miles from the mouth of the creek, a section which is repeated essentially at several points in the Cranes creek valley and with considerable variation on Clear fork, Williams branch and Hance creek, in about the same relation to the main drainage. The thickness of the Mason coal at this place is 44 inches without parting.

The lower seam is opened at various points in this region as represented on the accompanying page map of Cranes creek region, showing variations in thickness from 56 to 26 inches generally without parting, but on the head of Williams branch with a maximum thickness of bed section, including 3 inches of slate. The dip of the beds in this region is shown by the elevations above tide as recently determined by the Asher Coal Co. The lesser figures indicate thickness of bed in inches at the several locations.

The coals about 200 feet higher up have not been so fully prospected in the Cranes creek region. The two beds here 25 to 30 feet apart are supposed to be the Hance seams of the Asher Company's Colliery in the ridge between Hance creek and Brownies creek valley up the Cumberland river.

A thick bed of coal with three to five slate partings is reported higher in the hills around the head of Cranes creek, which has not been seen by the writer. It may be at the place of the prominent coal stain noted in the vertical



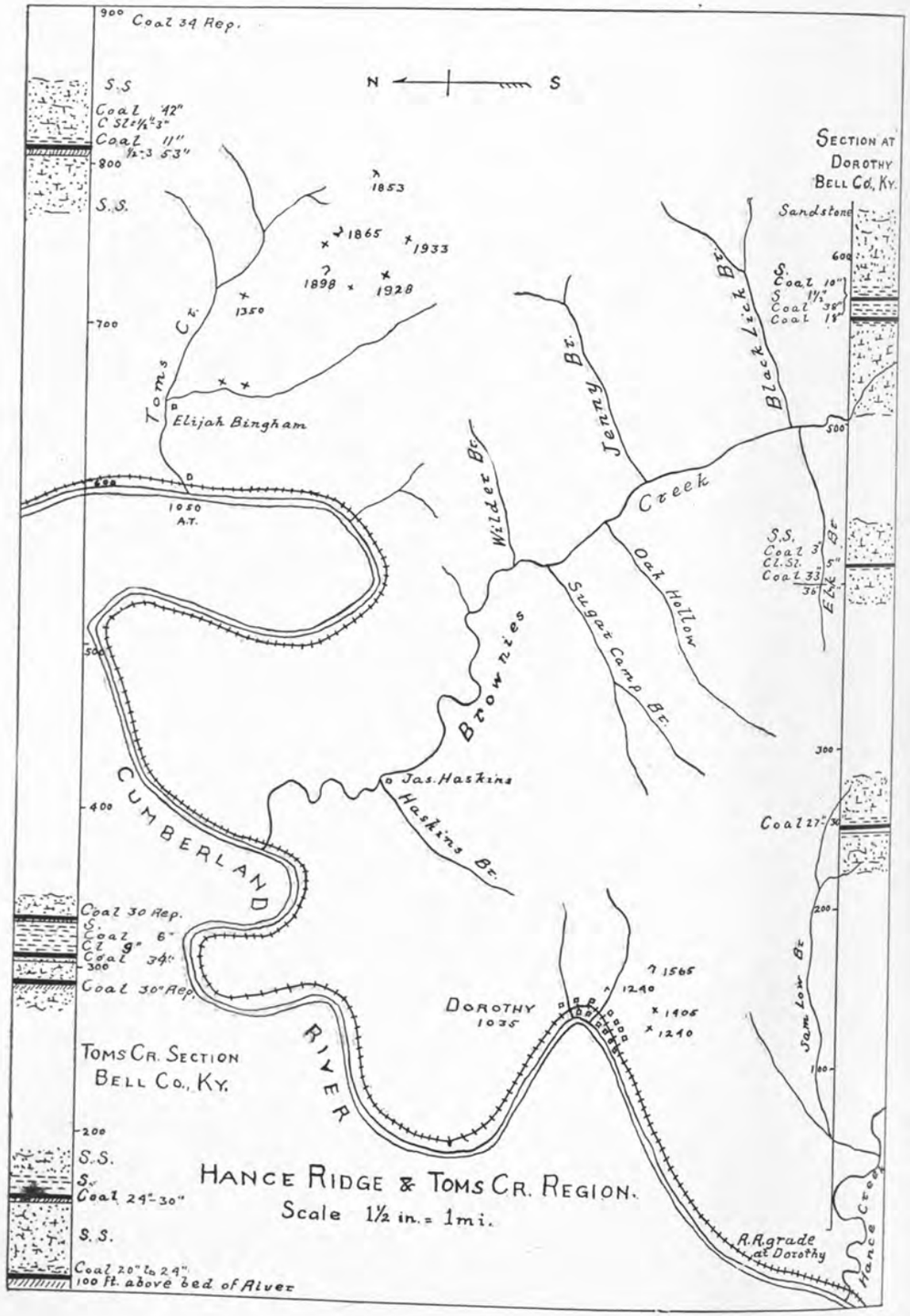
section; said to be the place of a thick coal. These so called Hance coals are workable beds one or both over a larger area as will be seen from the sections on the accompanying page map of the Hance ridge and Toms Creek regions, the data of which is made up largely from the developments made by the Asher Coal Company, under the direction of General Manager Osborne.

The general dip of the beds from the Cranes creek region up the Cumberland river is northeastward changing more to the northward on the heads of Toms creek.

At Dorothy the seam being developed is the upper Hance coal. The entry driven 1400 feet south 50 degrees east, shows a local dip of 31 feet in that direction having a normal thickness averaging about 48 inches including 1½ to 2 inches of bituminous slate 10 inches from the top. This compares well with the 43 inches on Cranes creek. The lower Hance seam here is only about 18 inches in thickness in shales 15 feet below the entry described. Towards the head of Pitmans creek the order is more nearly as in Cranes creek the thicker bed being the lower and including similar partings, the upper seam being reduced in importance.

As mined at Dorothy a considerable portion of the seam is a black coal by fracture, though the percent of ash is less than is found in black coals in general.

The lower coals of the section are less prominent in thickness and occur at increased intervals as compared with sections in neighboring localities, but appear to represent beds of importance in the general order of coals of the region at large. Comparison may be made with the vertical order of beds as more fully described in the Log Mountains and with the series as shown in the Straight Creek region, making the Straight creek seam, the Mason and the Mingo, the basis of comparison.






## Hance Ridge—Toms Creek.

In the Toms creek region the larger of the Hance coals is at the 1360-foot level above tide, (the determination of height above the river being barometric.) Twenty feet below, a 30-inch coal is reported, and 30 feet above also a 30-inch coal, local in occurrence or possibly the upper Hance seam. The thicker bed is in this district under a sandrock ledge, and at this point separated from a sandrock floor by only 12 inches of underclay. The bed section is given in the section at the left of the page map of the region.

The most important coal of this locality is 500 feet or more higher in the mountain. The relative elevations of openings at this horizon determined by an outcrop survey are as here given connected with the benches of the U. S. Survey by barometric observations. This is the horizon of the Creech coal as reported by R. C. B. Thruston, former assistant on the Kentucky Geological Survey. Four hundred and fifty feet still higher in the series is the Wallens creek coal reported by him, and described more in detail by Ashley and Glenn in a report on the Cumberland Gap Coalfield issued by the U. S. Geological Survey in cooperation with the Curator of the Kentucky Geological Department, 1903.

The Creech seam has recently been developed in the Toms creek region, over a large area, by the Asher Coal Company, showing a general dip of nearly 50 feet to the mile to the northward, but near the river modified by the eastward fall of beds from the Cranes and Hances creek region, which is nearly 75 feet to the mile. Compare elevations in the Dorothy and Toms creek sections. The thickness of the Creech or Toms creek coal varies, as exposed along the outcrop survey, from 31 to 61 inches, having an average of about 52 inches with a parting of ½ inch to 3 inches.

The place of this coal in the general section of the country is a matter of some uncertainty. The interval from the Mason coal to the Hignite seam is about 600 feet in the Clear creek-Log Mountain section, as also in the Straight

creek region. The interval from the Mason seam (as formerly identified in its extension from the Chenoa region to Rocky Face Mountain and to Cranes creek) to the Hance coals is nearly 200 feet, and the Toms creek coal is more than 500 feet above the Hance seams as opened immediately below the Toms creek bed. This gives an interval of more than 700 feet between the Mason and Toms creek seam. If the latter be regarded as at the Lower Hignite horizon the interval between the two seams is increased by 100 feet or more as compared with the Straight creek section. Perhaps this should be expected since the interval decreases from Straight creek northwestward to 500 feet in the next 8 or 9 miles, and this is according to a well known law of thinning of formations at right angles to the axis of maximum deposit, an axis which is well marked by the higher mountain elevations along the Cumberland valley in Bell and Harlan counties. Following this line of suggestion would place Creech coal at the horizon of the Hignite seam and the Wallens creek coal at the horizon of the Red Spring seam of the Log mountain district, a view which has also some probability of correctness from the general succession of bench-forming sandrocks in the Black and Log Mountains. A fuller exposition of the vertical distribution of the coals of this region may be required to correlate the several beds here with these of the Log Mountains.

The Wallens creek coal in the Toms creek region has not been seen by the writer. It is reported as present in Jackson Mountain at the elevation given above. It is a prominent coal in the district from which it derives its name.

The following table of analyses is made up from tests of the coal of the several beds cut from the whole face of each by Manager Osborne.

The results by this plan conscientiously carried out discount the commercial value, somewhat, especially in the block coal, by including the slack (waste) which is eliminated in the handling of the mine product.

No. 1. Mason seam Cranes creek.



No. 2. Hance coal, tested by N. P. Pratt of Atlanta, Ga.

No. 3. Hance Coal, tested by Commercial Testing Co., Chicago.

No. 4. Toms creek coal, tested by Commercial Testing Co., Chicago.

| | No. 1 | No. 2. | No. 3. | No. 4. |
|---|---|---|---|---|
| Moisture | 1.00 | 1.12 | 2.20 | 1.60 |
| Vol. comb. matter | 37.50 | 35.23 | 39.11 | 38.62 |
| Fixed carbon | 57.10 | 56.27 | 51.23 | 53.22 |
| Ash | 4.40 | 7.38 | 7.46 | 6.56 |
| | 100.00 | 100.00 | 100.00 | 100.00 |
| Sulphur | 1.45 | 2.17 | 1.95 | 1.22 |
| B. t. u | 14,592 | 14,172 | 13,690 | 13,915 |

All of these coals coke with products of greater or less promise, but they are not by structure and composition especially coking seams. The coke of the Toms creek seam by analysis shows results which, if found to be representative of the seam as a whole or of any available part of the screened product, will give to it a recognized value in addition to the rank which it will take as a fuel coal.

The following is the analysis reported of coke made of this coal, by N. P. Pratt, of Atlanta:

| | Per cent. |
|---|---|
| Moisture | .24 |
| Volatile combustible matter | .62 |
| Carbon | 90.71 |
| Ash | 8.43 |
| | 100.00 |
| Sulphur | 2.24 |
| Phosphorus | 0.013 |

The developments in these two regions have added a large area of rich territory to the immediate mining interest of Southeastern Kentucky.

# THE STRAIGHT CREEK REGION.

By A. R. CRANDALL
AND
G. M. SULLIVAN and R. C. B. THRUSTON, Field Assistants.*

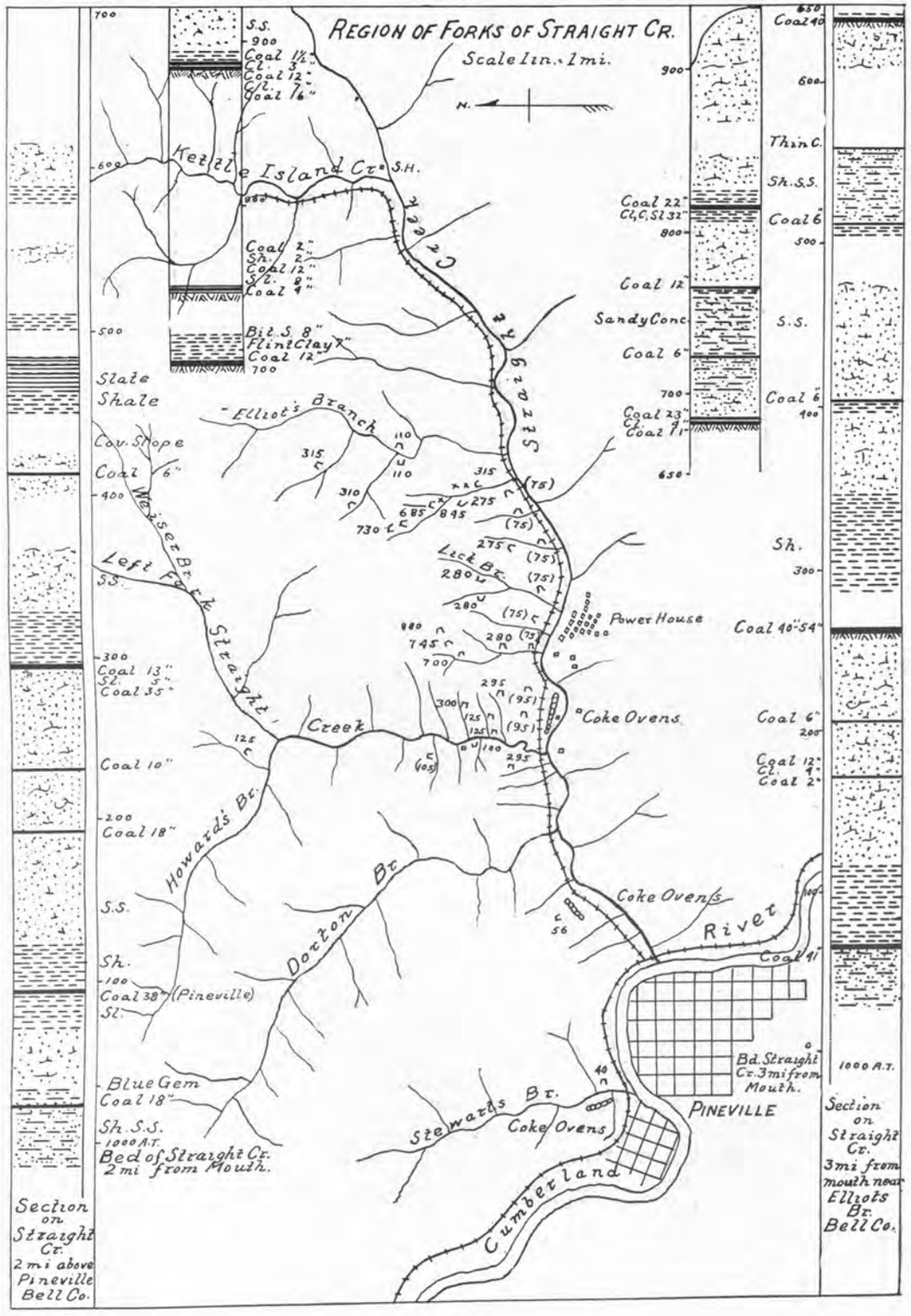
Straight creek drains a region of about 100 square miles northwest of Pine Mountain and northeast of the Cumberland river below Pineville water gap. The main stream of this creek flows at the base of the Pine Mountain fault-scarp in a long straight valley, with springs and rivulets on one side and tributary creeks and branches draining a large field on the other, the reverse of the drainage on the opposite side of the mountain. This field, including the river valley to Flat Lick, presents to view the shales, sandstones and coal beds of the lower half of the Coal Measures above the Conglomerate formation.

These beds are broken at the fault line in the face of Pine Mountain and abut against the upturned Subcarboniferous and Devonian rocks which underlie the Conglomerate measures, here upraised 2,600 feet or more to form the long monoclinal ridge, Pine Mountain, which separates the upper Cumberland basin from the larger field of which the Straight Creek region is only a small part.

A considerable part of this region has been worked up in detail to serve as a key to adjoining regions. Much of the work has been done in the ordinary progress of preparation for mining, by the Straight Creek Coal and Coke Company and other companies now carrying on mining operations in this region, but most of the details of the many sections which represent diagramatically the geology of the region are the work of the Survey as previously indicated. The elevation figures on the page maps which follow are readily changed to sea level by adding to the datum elevation above tide 1,000 feet at the bottom of the vertical sections at the sides of the page maps.

In the same way figures at openings located on these

*These gentlemen were Assistants when the earlier examinations, upon which much of this section of the report is based, were made. Dr. Crandall, however, has revisited most of the ground, has verified or revised former conclusions and has, through the collection of additional data, brought the report well up to date.—C. J. N.



maps give both height above the creek or branch and above tide water.

In the illustrations of the kinds of rock-beds, the usual abbreviations are used: l. s. for limestone; s. s. for sandstone; s or sh for shale; sl for slate; s. s. s. for shaly sandstone; cl for clay; c for coal, c. c. for cannel coal; f. c. for fireclay.

Two prominent coal beds, the Straight creek coal and the Dean seam are indicated on the maps, the former by an over-score and the latter by including the elevation figures in parenthesis. This will indicate the dip and direction of inclination of beds in the areas covered by the page maps and also the relation of the beds to the drainage plain.

The other coal beds of the vertical sections of the district are more variable in thickness and character or in some instances local; or a thickening of a thin bed as known in neighboring localities.

### From Mouth of Left Fork to Elliott Branch.

A typical section of rocks and coal beds of the Straight creek region is that of the ridge in the forks, two miles from the mouth of the main creek. Here the Straight Creek seam is at the 95-foot level, 125 feet above the Main creek and 1,095 feet above the sea; dipping up the Main creek about 20 feet to the mile but rising northward up the branches. The page map and vertical sections by G. M. Sullivan give the drainage and the order of beds from the mouth of the Left fork up the ridge including the waters of Elliot branch. The mines of the Straight Creek Coal and Coke Co. are located in the former place, operating with a well organized plant chiefly on the Straight Creek seam, which makes up in quality for what it lacks in thickness. The bed-section is 36 to 38 inches here, increasing in thickness up the creek, as will be seen.

An average of six analyses made in the Laboratory of the Survey* of samples from points in this district and also the results of an analysis of coke made from this seam in the ovens of this plant shows as follows:

*All analyses are as made in the Laboratory of the Survey and samples represent the whole bed, unless otherwise stated.



AVERAGES FROM SIX OPENINGS.

| | Coal. | Coke. |
|---|---|---|
| Moisture | 1.52 | .40 |
| Volatile combustible matter | 35.13 | .30 |
| Fixed carbon | 61.16 | 94.90 |
| Ash | 2.17 | 4.40 |
| Sulphur | .666 | .492 |

Openings of the Straight Creek seam up the Main creek at the 75-foot level and on Elliot branch at the 127-foot level as indicated on the page map show little variation from the two bed sections here shown in cuts drawn to the usual scale of 36 inches to the inch.

Fig. 75


Pineville Coal
Straight Cr near mouth
Elliot's Branch.

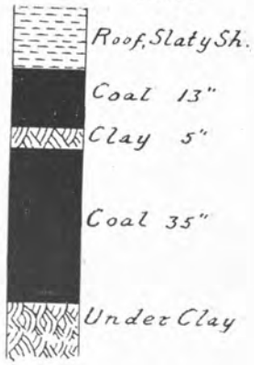
Fig. 76


Pineville Coal, Elliot's Br.
Straight Cr.

About 70 feet below this coal is a thin seam which, varying from 18 to 30 inches, is nearly co-extensive with the straight Creek seam, but unlike that bed is known by one name in all the districts. Though having a thickness which gives it more than a local value in few places, it has exceptional value as a fuel coal and as mined on a small scale in the Jellico district has been preferred to all others as such and has come to be known as the "Blue Gem" coal. The interval between that and the Straight seam varies considerably as will be seen in the description of beds in the several districts.

Above the Straight Creek seam about 100 in this district is a bed known as the Moss coal, from the development of this bed in the Fourmile district by M. J. Moss of Pineville. In this page map region it is not a workable bed.

Fig. 77




Coal 200 ft above Straight Creek Seam.

Near the 300-foot level is a coal which is more prominent in some parts of the Straight Creek valley than in other valleys of this part of the larger field. As opened at the Straight Creek mines this seam shows a maximum thickness as represented in the subjoined cut, and the character of the coal can in some measure be inferred from the analysis given.

| | |
|---|---|
| Moisture | 2.20 |
| Volatile combustible matter | 34.70 |
| Fixed carbon | 58.36 |
| Ash | 4.74 |
| | 100.00 |
| Sulphur | 1.128 |

This bed is known locally as the "B" coal. On the Lick or Big Run branch two openings show 40 to 54 inches of good coal without parting. On Elliot branch this seam is reduced to less than three feet in average thickness as exposed and entry driven well under roof rock. The thickness is increased to 40 inches further up Straight creek.

The interval at the mines from this bed to the Dean coal horizon is about 400 feet and it is found with its two

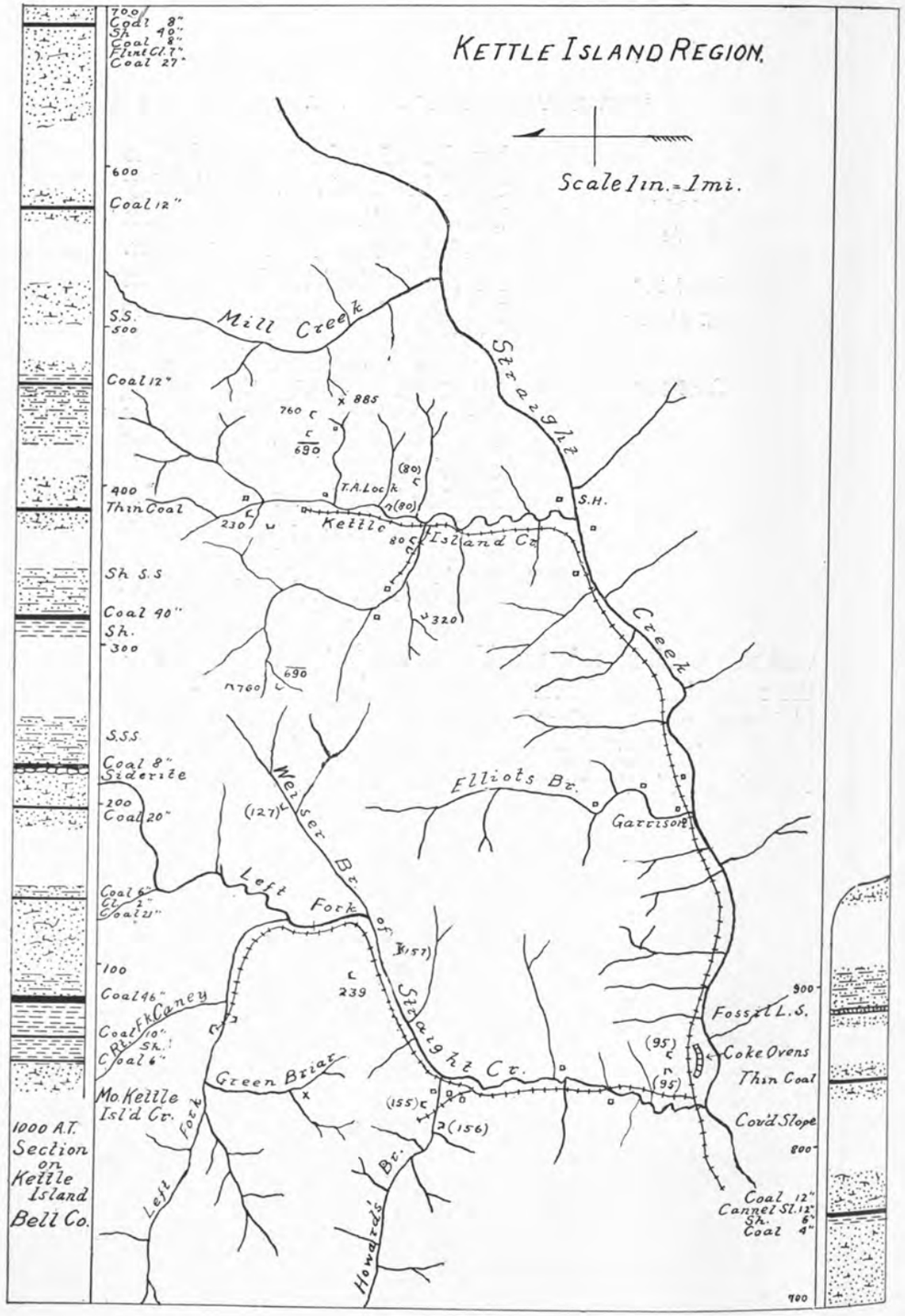




Fig. 78


Bed 200 ft. above Pineville Coal, Straight Creek.

benches of coal separated by the usual band of now plastic clay but too thin to be of more than local interest at the present. At the head of the branch next below Elliot branch a distance of little more than a mile this seam is without parting in a bench of 40 inches thick under a sandstone ledge. The characteristic flint clay parting is lacking in Elliot branch locality and on Left fork waters generally. Forty feet above the Dean coal in both sections is the McGuire seam which, though not a workable coal in this neighborhood, is present as one of the recognized coal seams of the region in general. Still higher, near the 900-foot level, under a coarse sandrock cliff ledge (which here forms the crest of the ridge about 100 feet higher), is the upper coal of the section.






## The Region of Kettle Island Creek.

To one going up the Main creek from Elliot branch to Kettle Island creek the outlook of the extension of the coalfield is very unpromising. An outlying Conglomerate ridge, beginning near Elliot branch, extends along the left side of the widened valley of Kettle Island creek, which cuts through it, and on to Mill creek, which also empties into Straight creek through a water gap of conglomerate. East of Mill creek this ridge is known as Hampton ridge with which it terminates eastward. This ridge is the remains of a fold which involves the Sub-Carboniferous limestone and the Waverly group below it, both of which are exposed in the widened valley between Kettle Island and Mill creek and the lower members of the Conglomerate formation which, resisting erosion rise, to the height of 500 to 700 feet on the north side, resting at an angle of 65 to 75 degrees against the nearly horizontal Coal Measures of the Straight creek region, which rise in the ridge beyond to the height of 1,000 feet above the bed of Straight creek.

It will be seen that Kettle Island and Mill creek have practically the same hill section as has been described in the region below.

Fig. 79


Pineville Coal at Abe Lock's, Kettle Island Cr., Straight Cr.

The Straight Creek coal seam is at the 80-foot level on the Kettle Island creek at the forks; locally Abraham Lock's coal, having a thickness of 46 inches. A parting of shale varying from a mere streak to one inch thick was noted in one of the entries which was driven in 10 feet or more. In another opening by Mr. Sullivan the coal has no parting.

Samples for analyses were collected at different times by the writer (1) and by Mr. Thruston (2).

| | (1) | (2) |
|---|---|---|
| Moisture | 1.90 | 1.40 |
| Vol. comb. matter | 37.50 | 35.34 |
| Fixed carbon | 57.90 | 60.26 |
| Ash | 2.70 | 3.00 |
| | 100.00 | 100.00 |
| Sulphur | 1.519 | 1.222 |

This percentage of sulphur is doubtless local, as the usual result is about one-third of the finding in these samples.

The extension of this coal up the right fork of Straight creek must be determined by core drill wells as in that direction it falls below the drainage by the southeast dip and by the rise of the creek bed.

The coal 65 to 70 feet higher in the section is probably the Moss seam. The interval is reduced and the interval above to the "B" coal is increased and includes two thin coal seams and a considerable showing of siderite iron ore. Coal "B" is here shown without parting, showing a 40-inch bench. The Dean coal with the characteristic flint clay parting is at the 690-foot level, and the McGuire seam showing cannel slate is apparently 60 feet higher in the hill, and a fossil limestone was found 125 feet higher in the ridge between Kettle Island creek and Mill creek.

In the bed of Kettle Island creek, near its mouth and dipping at an angle of about 70 degrees north 65 west, a coal bed measured and sampled with much difficulty under the running water showed 48 inches of soft coal with iron pyrite diffused through its layers in evidence of a considerable percentage of sulphur. This coal is probably the lower bed of the Conglomerate Measures involved in the Rocky Face fold.

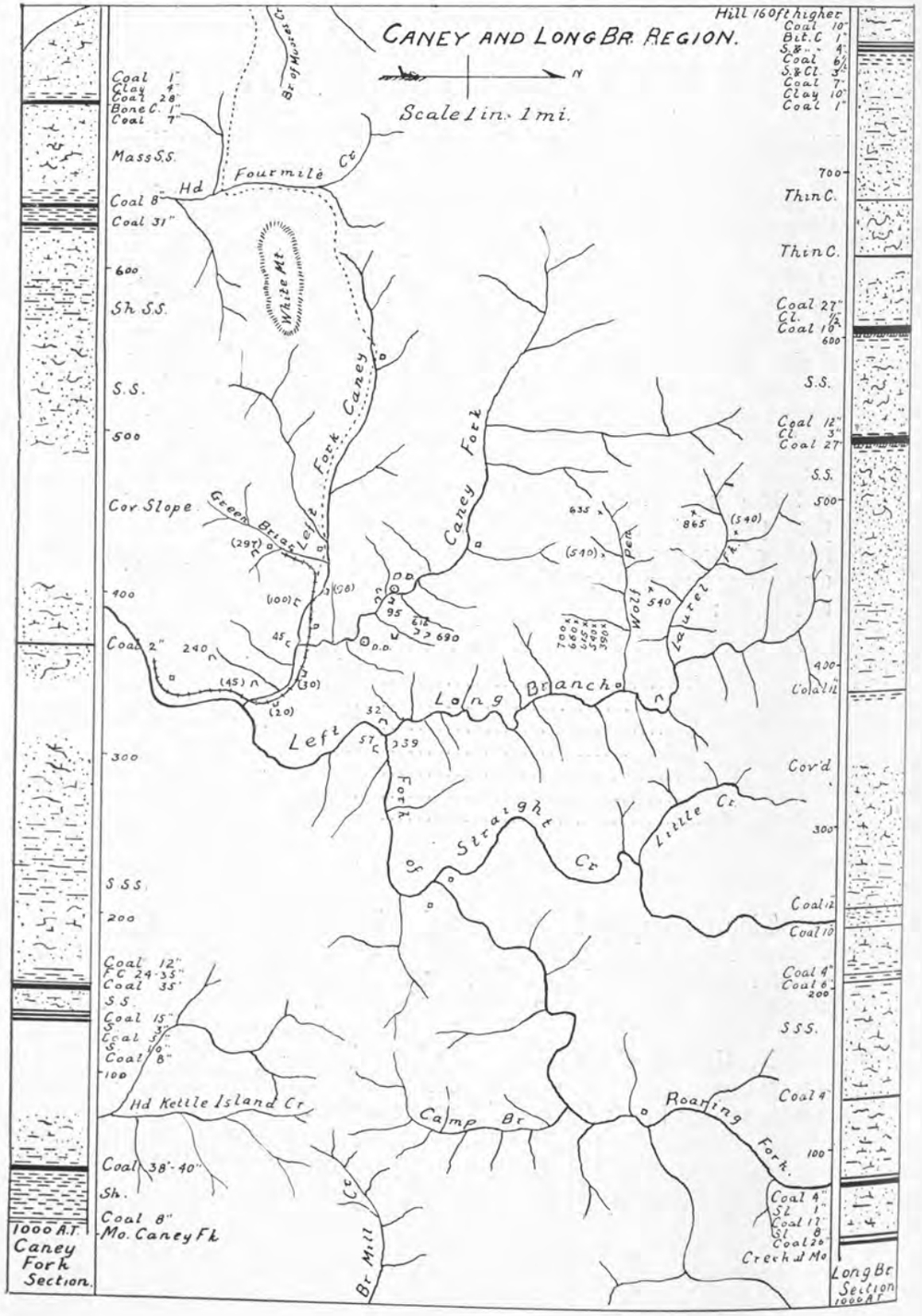
On Stony fork a coal is opened two miles or more from the mouth 36 to 40 inches thick but somewhat distorted and broken. This bed is about twenty feet above the creek bed. It may be the Pineville coal locally uplifted and crushed. The dip of the beds is not readily traced by reason of the nearness of the Rocky Face fold or overturn, but that it is up the Main creek is shown by the recognition of the Dean coal at the drainage level near the head of the creek. The flint clay parting is not present here, but over the Kentucky ridge on Middle fork at this level the characteristic Dean parting is found with other evidences of the identity of this bed. The Dean coal as imperfectly opened on the head of the Right fork of Straight creek shows about 36 inches without parting. Nearly 600 feet higher in the ridge, at the head of Peter creek, a prominent coal is opened under a sandstone ledge, showing 43 inches of coal over a dark sulphur slate parting of 2 to 4 inches, below which coal to a thickness of 18 inches, probably, was perfectly exposed. Just across on head of Spruce Pine branch of Middle fork, one mile distant, apparently at the same level, the bed section is as follows:



| | In. | In. |
|---|---|---|
| Coal | 18 | .. |
| Black slate | .. | 8 |
| Coal | 4 | .. |
| Black slate | .. | 3 |
| Coal | 39 | .. |
| Slate | .. | 1 |
| Coal | 1 | .. |
| | 52 | 12 |

This coal may be compared with one of the upper Bryson Mountain beds as described in the Log Mountain report. The interval there is about 500 feet from the Hignite (Dean) seam to the Red Spring coal.

Further up the Right fork of Straight creek coal beds are exposed but the regular coals have not been traced continuously beyond the Mill creek region.






## The Caney Creek and Long Branch Region.

The White Mountain upthrow is the feature around which the mining operations of the Caney creek and Howards branch must be adjusted. This short Conglomerate axis is between the left fork of Caney creek, Howards branch and the head of Fourmile creek; as an anticlinal the uplift continues westward across the heads of Pogue branch and Sandy branch to the region of Flat Lick, and a branch anticline may also be seen on Moores creek by which the beds dip right and left along that stream. Eastward, the fault scarp merges suddenly into a short anticline which fades out into moderate dips up and down the left fork. Close to the axis of Whiteface Mountain the coal beds are more or less upturned by the upthrust of the conglomerate beds against which they rest. On the Caney side the Straight Creek coal seam dips from 225 feet above the Left fork at the head of Green Brier branch to 100 feet below the bed of the Right fork one mile above the forks of the creek. An entry of the Big Hill Coal Mining Company, on the left side of the Left fork, driven south 20 degrees west, shows 15 to 17 per cent. rise the first 400 feet; nearly horizontal for 200 feet; and 40 per cent. with increasing rise as far as driven towards the axis of Whiteface Mountain. An entry on the right side shows 15 per cent. dip in the opposite direction. Near the mouth of Caney, the Coleman Mining Company has driven an entry north 44 degrees east, starting 10 feet above the bed of the creek, with a 5 per cent. dip gradually decreasing to 2 per cent. in 400 feet.

On the Howard branch side the coal beds are left more nearly horizontal, abutting against the upturned conglomerate rock without much displacement, except dipping to the Dorton branch region, where displacements not yet measured complicate somewhat the problem of mining the equivalent coals of the surrounding region.

Thruston estimates the uplift of White Mountain at 1500 to 1800 feet, a displacement which in the region of the maximum must involve great minor disturbances of the rock beds and this is shown in part by fault lines with

the dip and local confusion of beds towards the head of the Left fork of Caney creek, beginning near Bailey's; or near the mouth of Pounding Mill branch.

The vertical section of this region shows some variations from that of the two preceding regions. The Straight Creek coal increases in thickness up the Left fork and loses nothing in quality, showing some variations in bed section. The elevations above tide are shown at various points in the region around Whiteface Mountain as follows, omitting fractions of the foot: On the left side of the Left fork, ¾ mile from its mouth, 1,102, or 102 feet above the 1,000 feet datum. On Howard branch, 1,157. One and one-fourth mile above Howard branch, on the right side, the Hayes coal 1,157 feet. On Wiser branch 1,120 and 1,127 feet. Near the mouth of Caney creek, Coleman entry, 1,030. Near the mouth of Left fork of Caney, the Big Hill Company's entries, 1,098 and 1,100. On the Green Brier, 1,297. Following this bed down Straight creek, to show the dip in this direction, the elevations are: At the mouth of the Left fork, the Straight Creek Coal and Coke Company's entry, 1,093, as previously stated. Near the mouth of Dorton branch 1,132. At Wallsend (West Pineville), on Stewart branch, 1,034 and 1,039.

Fig. 80


Pineville Coal at Howard's Left Fk. Straight Cr.

The bed-section of this coal on Howard branch and the analyses as given by Thruston are as follows:

| | Coal. | Coke. |
|---|---|---|
| Moisture | 1.10 | .20 |
| Vol. comb. matter | 36.44 | |
| Fixed carbon | 59.66 | 94.20 |
| Ash | 2.80 | 5.60 |
| | 100.00 | 100.00 |
| Sulphur | .613 | .601 |



An average of two analyses of samples from the two principal openings on Caney creek, taken before the recent mining operations began shows the following results:

| | |
|---|---|
| Moisture | 1.10 |
| Volatile combustible matter | 35.80 |
| Fixed carbon | 61.14 |
| Ash | 2.13 |
| | 100.17 |
| Sulphur | .521 |

Fig. 81.


Coal 100 ft. above Pineville Coal, Caney Fork of Left Fork, Straight Cr.

The Moss coal bed is opened on the Right fork of Caney creek a few feet above the bed of the creek. The bed section is illustrated by the cut here given which is representative for this bed in the Left fork region. The measurements of the bed as exposed at the mouth of Long branch are given in the hill section at the right margin of the page map of this region.

A local bed of coal and fireclay is opened on the Right fork of Caney over a sandrock ledge and 25 feet above the Moss seam. This bed is opened at two points right and left side of valley 250 yards apart in line of the 15 per cent dip from the White Mountain but indicating very nearly horizontal rock layers, or the foot of White Mountain dip in this direction, an indication which is sustained by the Long Branch section. The two openings show as follows:

| | WESTWARD SIDE. | EASTWARD SIDE. |
|---|---|---|
| Roof | Slate. | Slate. |
| Coal | 14 inches | 12 inches |
| Plastic fireclay | 35 " | 24 " |
| Coal | 34 " | 35 " |
| Underclay | ? | 20 " |

This bed is not prominent in the field at large and is not of special value unless a demand for plastic clay shall warrant the mining of coal and clay as commercial products.

In the entry of the Straight Creek Mining Company at the mouth of Howard branch the thickness is the same, but the upper bench is increased two inches and the lower is reduced to 29 inches. The entry, driven north 40 degrees west, rises to a 2 per cent. grade.

The Hayes coal shows a face varying from 43 to 45 inches. The Wiser branch opening shows bunching by a slip; it is probably a 3-foot bed. The Coleman entry has 40 inches without parting at the head of the entry.

The Big Hill Company's entry developed 38 to 40 inches of good coal and the core drill wells on the Right fork of Caney creek show 38 and 40 inches without parting. Following are records of three holes put down in 1909:

### CHURN DRILL HOLE ON SLUSHER FARM.

Following is the log of a drill bore hole (R. G. Rider, driller) on Straight creek, Bell county, J. Slusher farm, one and one-half miles south of the mouth of Long branch:

| | |
|---|---|
| 19 feet of surface | 19 feet |
| 34 sand rock | 15 " |
| 40 gravel and sand | 6 " |
| 54 sandstone | 14 " |
| 91 slate | 37 " |
| 102 slate | 11 " |
| 110 coal and slate (Moss coal) | 8 " |
| 116 slate | 6 " |
| 132 sandrock | 16 " |
| 133 coal | 3 " |
| 146 sandrock | 11 " |
| 150 sandrock | 4 " |
| 164 slate | 14 " |
| 176 sandrock | 12 " |
| 184 slate | 8 " |
| 194 sandrock | 10 " |
| 203 sandrock | 9 " |
| Near the horizon of the Straight Creek Coal. | |



The upper coals of this region are in the order noted in preceding localities. The details of these beds are given in the sections of the region. The "B" Coal appears to be thin or wanting. The dip of the beds on Long branch is apparently about the same as on the Right fork of Caney. A drill well at the mouth of Wolf Pen branch of Long branch would probably reach the Straight Creek seam about 125 to 150 feet down from the bed of the creek.

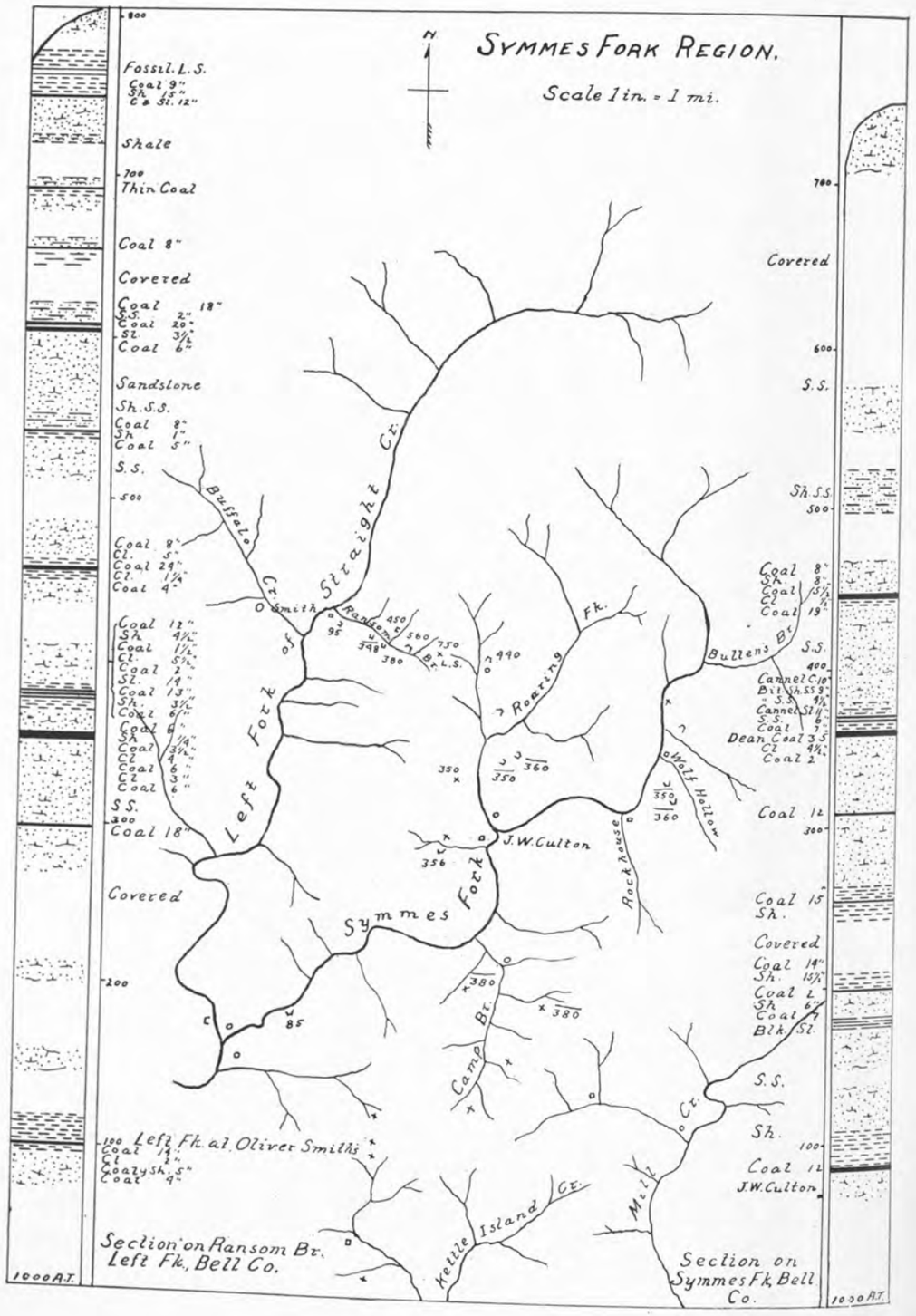
Following are two holes put down with a core-drill by the Big Hill Coal Company. No. 1 is one-half mile up the Right fork of Caney creek. No. 2 is 4,000 feet further up Right fork:

No. 1 Hole.

| Ft. | In. | | Ft. | In. |
|---|---|---|---|---|
| 2 | 9 | Drift | .. | .. |
| 4 | 7 | Sandstone | 7 | 4 |
| 9 | 0 | Sandstone | 16 | 4 |
| 1 | 8 | Sandstone | 18 | 0 |
| 16 | 10 | Sandstone and dark shale | 34 | 10 |
| 25 | 2 | Sandy shale and dark slate | 60 | 0 |
| 10 | 2 | Sandy shale and slate | 70 | 2 |
| 27 | 0 | Sandstone | 97 | 2 |
| 3 | 6 | Shale | 100 | 8 |
| 3 | 2 | Coal (Straight Creek) | 103 | 10 |
| 9 | 3.5 | Shale | 113 | 1.5 |

No. 2 Hole.

| Ft. | In. | | Ft. | In. |
|---|---|---|---|---|
| 6 | 3 | Soil, etc | .. | .. |
| 2 | 0 | Broken sandstone | 8 | 3 |
| 23 | 9 | Sandstone | 32 | 0 |
| 8 | 6 | Dark shale | 40 | 6 |
| 7 | 6 | Light shale | 48 | 0 |
| 24 | 6 | Sandstone with thin coal | 72 | 6 |
| 30 | 4 | Sandstone | 102 | 10 |
| 10 | 1 | Sandstone and slate | 112 | 11 |
| 3 | 4 | Coal | 116 | 3 |
| 0 | 9 | Fireclay | 117 | 0 |
| 10 | 2 | Slate and sandy shale | 127 | 2 |
| 11 | 6 | Sandstone with thin coal | 138 | 8 |
| 14 | 7 | Shaly sandstone and slate | 153 | 3 |
| 3 | 8 | Sandstone and shale | 156 | 11 |
| 32 | 9 | Limestone and dark slate | 189 | 8 |
| 20 | 1 | Hard seamy sandstone | 209 | 9 |
| 5 | 7 | Blue slate | 215 | 4 |
| 3 | 0 | Coal | 218 | 4 |
| 2 | 3 | Dark slate | 220 | 7 |



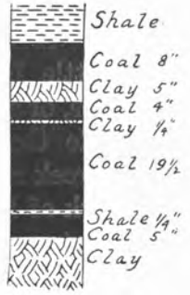



## The Symmes Fork and Left Fork Region.

The dip up the Left fork continues with varying inclination to the head so that the lower beds fall below the bed of the creek at a rate which is on the whole considerably greater than would result from the fall of the stream. The section by Sullivan on Ransom branch (also known as Smith's branch) shows the order of beds for the valley.

The "B" Coal, 200 feet above the Straight Creek seam, if present in this region, is below the bed of the creek. The thin coal bed at Oliver Smith's house is in a barren interval in the general section for the Straight Creek region. At the 348-foot level (1348 above the sea) the Dean coal as opened by Mr. Sullivan has a bed-section as in the the subjoined cuts, and 32 feet above it is the McGuire seam as here illustrated.

Fig. 82

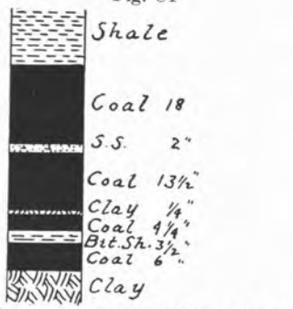



McGuire Coal at Ransom Br. Left Fk., Straight Cr.

Fig. 83

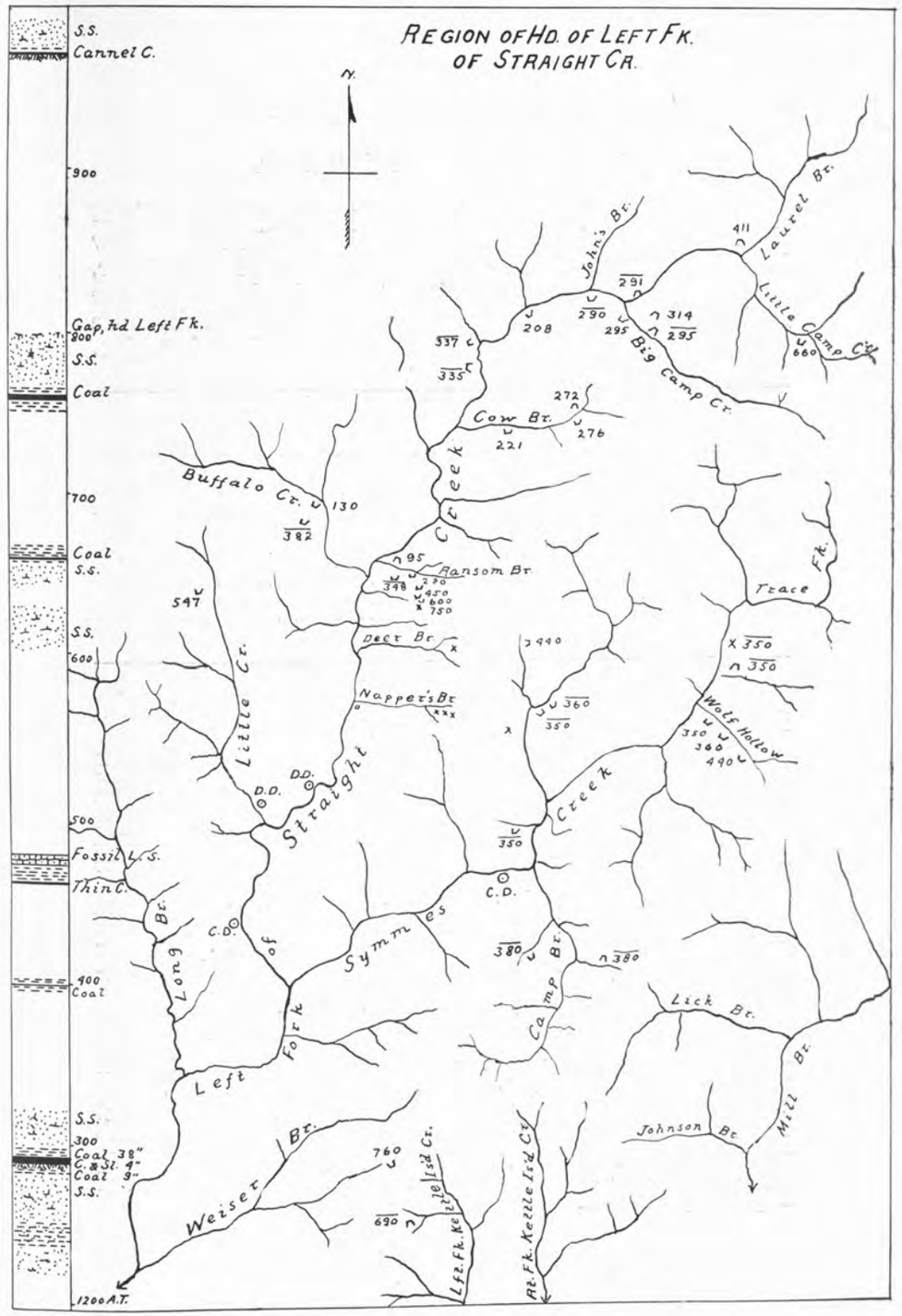

Dean Coal at Ransom Br. on Left Fork of Straight Cr.

Fig. 84




Bed 250ft above Dean Coal
Ransom Br, Left Fork,
Straight Creek.

The upper coal seams follow in the order represented. The seam 250 feet above the Dean coal shows 41 inches of good coal with comparatively thin partings, as shown in cut. One of the partings is sandstone. This is not the horizon of the sandstone parting coal of the Log Mountain region. The fossil limestone still higher is one of the bands previously mentioned. A few openings were made at other points, as near the head of Little Creek where the Dean seam at the 547-foot level shows 38 inches of coal with 2½ inches of parting. Also on Buffalo creek three-quarters of a mile from the mouth the same bed at the 382-foot level is 30 inches without parting of any kind. The openings on Symmes fork are rather widely distributed as will be seen by the page map. The order of beds varies little from that on Ransom branch. The Dean seam is found by Mr. Sullivan at levels varying from 380 on Camp branch to 350 towards the head of this fork. If this is true there is about 300-feet dip from the Kettle Island-Mill Creek ridge in a distance of about two miles, or a fault line between the two localities. It is possible that the Camp branch is the "B" seam of the Straight creek region. This seam shows a 40-inch bench on the Left fork of Kettle Island creek. The decrease in the interval between the Dean and McGuire is very noticeable up the Left fork. Some semblance of cannel coal is generally present in the latter bed.



## Region at Head of Left Fork.

Towards the head of Left fork some of the coals of the region have been opened at points indicated on Cow branch at the 221-foot level and also 51 to 54 feet higher, neither of which shows promise of workable beds. On the Main fork and branches the following table will show the results of developments of the Dean seam in this region.

| Levels | 335 | 337 | 291 | 290 | 299 |
|---|---|---|---|---|---|
| Roof | Slate | S. S. | Slate | Slate | Slate |
| Coal | 33 inches | 30 inches | 38 inches | 30 inches | 33 inches |
| S. Parting | 3.5 " | 3 " | 4 " | 2 " | 1 " |
| Coal | 3.5 " | 6 " | 9 " | 5.5 " | 4 " |
| S. Parting | ..... | ..... | ..... | 12 " | 1.5 " |
| Coal | ..... | ..... | ..... | ..... | 6 " |
| S. Parting | ..... | ..... | ..... | ..... | 6 " |
| Coal | ..... | ..... | ..... | ..... | 10 " |
| Underclay. | | | | | |

Openings at elevations 290-291 and 299 were made by Mr. Charles Knuckles at his place.

The seam as opened at 337, 290, 291, and 299 is known as the Knuckles coal. At 335 as Slusher's coal. The bed at the horizon, 411, 416, 420 has less than 30 inches of coal with from one to three partings. At the 660-foot level Asher's coal, not fully opened, indicates 30 to 36 inches or more without partings.

Mr. Thruston mentions the black fossil limestone as occurring on the bench above the Knuckles coal. The interval is somewhat reduced as compared with the Kettle Island creek section.

Coals have been noted at heights above the Dean seam as indicated by the vertical section at the left of the page map of the region. Little has been done to develop the beds in the Main ridge. The elevations in this section are barometric and subject to correction. The fossil limestone is placed in relation to the principal coal, as shown at C. B. Slusher's place a mile below the mouth of Big Camp branch.



Recently some developments by Judge Logan of Pineville have added some important data to that of this report, (since the latter was first placed in the printer's hands, three years ago,) and are here summarized.

The core drill wells near the mouth of Little creek and one-third of a mile up Left fork, with the ordinary drill hole one-half mile above the mouth of Symmes fork, give the dip of the beds below the drainage and confirm estimates previously made from exposures above the creek. See log of these wells on pages following.

The Moss coal, which has been mentioned as a few feet above the mouth of Long branch, is shown by the log of the drill hole next above Symmes fork to be 110 feet below the bottom land of the valley; at the mouth of Little creek 150 feet; and near Mrs. Lucy Napier's 163 feet. The Dean coal opened near the head of the short branch at this place, heading to the east, is 325 feet above the creek, 488 feet above the Moss coal seam, and 593 feet above the Straight creek seam as reached by No. 2 core drill well. As 600 feet is the average interval between the Straight creek and Dean beds, the result is of special interest to those who are interested in the coals of the Left fork region as well as to members of the State Survey who have studied this region.

An unusual feature of the Dean horizon is the additional seam of coal near the place of the upper Dean seam. The Coleman section, showing also a thick coal higher up, is as follows:

| | | |
|---|---|---|
| 460 ft. above creek, Slate roof. | | |
| Coal to thin layer of mother coal | 8 inches | |
| Coal | 5 " | |
| Slate | .. | ½–1 inch |
| Coal | 36 " | .. |
| | 49 " | 1 |
| Interval sandrock and shale, 65 ft. | | |
| Coal with sh. roof | 14 " | |
| Clay slate | .. | 12 " |
| Coal | 8 " | |
| Slate and coal | 14 " | 8 " |
| | 36 " | 20 " |

Interval of S. S. and shale, 40 in.

| | | |
|---|---|---|
| Coal with S roof, thin sl. at middle | 10 inches | |
| Clay shale | 7 " | 8 inches |
| Coal | 7 " | |
| Clay shale | 6 " | 30 " |
| Coal | 6 " | |
| Slate | | 3 " |
| Coal | 24 " | |
| | 47 " | 31 " |

Interval to Dean coal (fallen in) 25 feet.

The upper seam, 300 feet or more below the hill top, adds largely to the coal resource of this locality. The Dean seam as opened towards the head of Deer branch, 290 feet above the mouth of the branch, measures as follows:

| | | |
|---|---|---|
| Roof, slate. | | |
| Coal | 40 inches | |
| Slate | | 5 inches |
| Coal | 4 " | |
| Underclay | | |
| | 44 " | 5 " |

The bench 15 feet above this coal shows outcropping evidences of alternations of coal and slate as in the preceding section with reduced interval.



## DIAMOND DRILL HOLE ON MILLER FARM.

Following is the log of a bore hole, No. 1, put down with a Diamond Drill, on Little Caney creek, Left fork of Straight Creek, on the John Miller farm, R. J. Koch, driller:

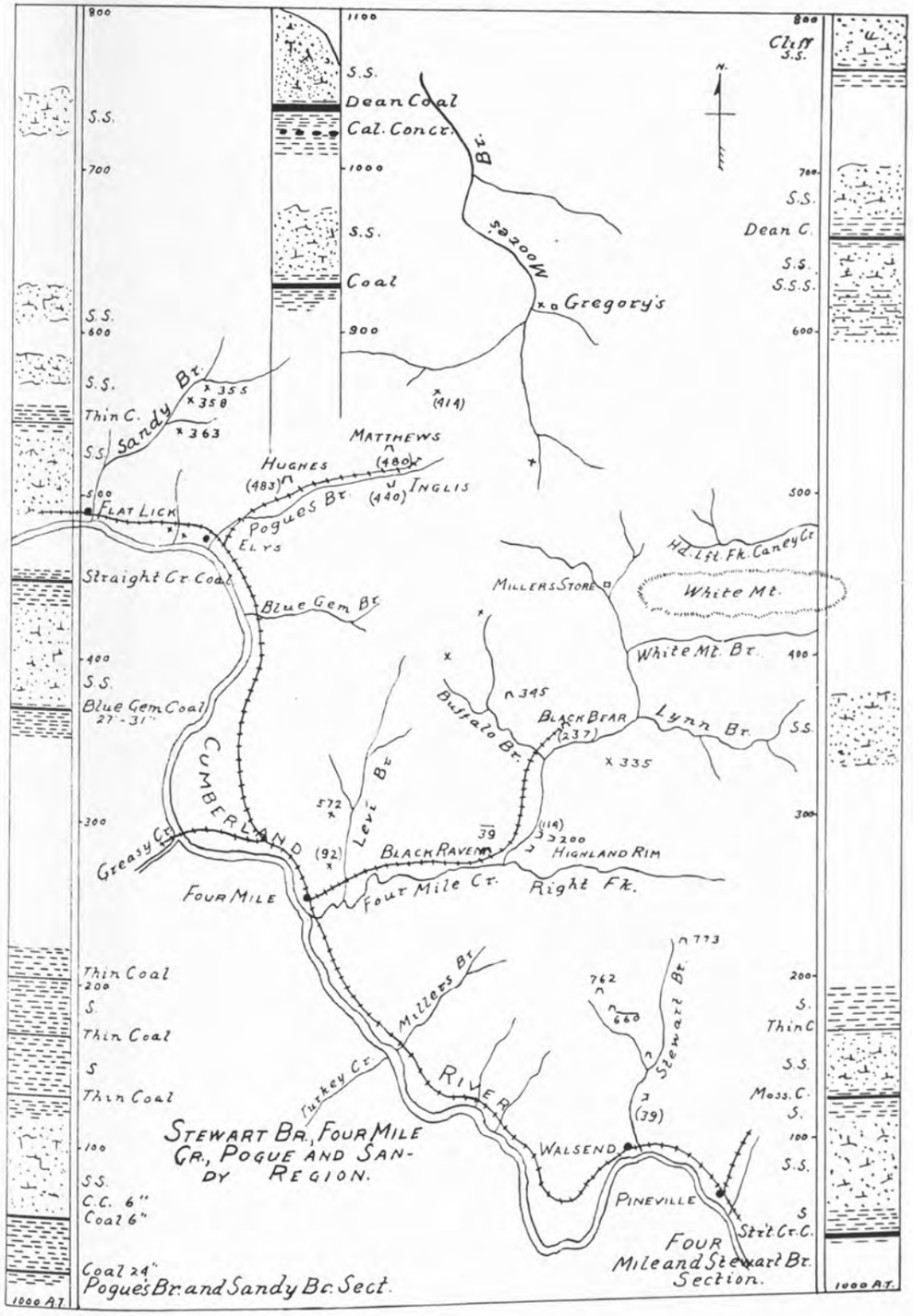
| Substance. | Feet. | Inches. | Total Depth. Feet. | Total Depth. Inches. |
|---|---|---|---|---|
| Surface | 2 | 3 | 2 | 3 |
| Light slate | 5 | .. | 7 | 3 |
| Light sand slate | 11 | 3 | 18 | 6 |
| Black slate | 8 | 2 | 26 | 8 |
| Coal | .. | 10 | 27 | 6 |
| Fireclay parting | .. | 11 | 28 | 5 |
| Coal | .. | 2 | 28 | 7 |
| Fireclay parting | .. | 2 | 28 | 9 |
| Coal | .. | 2 | 28 | 11 |
| Fireclay parting | .. | 1 | 29 | .. |
| Coal | .. | 1 | 29 | 1 |
| Fireclay parting | .. | 6 | 29 | 7 |
| Coal | .. | 4 | 29 | 11 |
| Fireclay | 3 | 1 | 33 | .. |
| Sandstone | 50 | .. | 83 | .. |
| Light slate | 58 | 10 | 141 | 10 |
| Coal | 5 | .. | 146 | 10 |
| Fireclay parting | .. | 8 | 147 | 6 |
| Coal | 2 | 3 | 149 | 9 |
| Fireclay parting | .. | 3 | 150 | .. |
| Coal | .. | 4 | 150 | 4 |
| Fireclay | 1 | 8 | 152 | .. |
| Sandstone | 4 | .. | 156 | .. |
| Sandstone | 6 | 3 | 162 | 3 |
| Coal | .. | 3 | 162 | 6 |
| Fireclay | 1 | 2 | 163 | 8 |
| Sandstone and slate | 7 | 10 | 171 | 6 |
| Sandstone | 12 | .. | 183 | 6 |
| Sand slate | 19 | .. | 203 | .. |
| Dark slate | 6 | 10 | 209 | 10 |
| Fireclay | 1 | 2 | 211 | .. |
| Light sand slate | 38 | 3 | 249 | .. |
| Coal, Straight Cr. coal | 2 | 11 | 252 | 2 |
| Fireclay and sandstone | 1 | 2 | 253 | 4 |
| Dark slate | 2 | 8 | 256 | .. |

Moss coal

## NO. 2 BORE HOLE, MRS. NAPIER'S FARM.

Following is the log of No. 2 bore hole, near Mrs. Lucy Napier's, Left fork of Straight creek, R. J. Koch, driller:

| Substance. | Feet. | Inches. | Total Depth. Feet. | Inches. |
|---|---|---|---|---|
| Surface | 11 | 1 | 11 | 1 |
| Light sand slate | 22 | 7 | 33 | 8 |
| Black slate | 5 | .. | 38 | 8 |
| Coal | .. | 8 | 39 | 4 |
| Fireclay | 3 | .. | 42 | 4 |
| Sand slate | 6 | 9 | 49 | 1 |
| Coal "E" coal | .. | 2 | 49 | 3 |
| Fireclay | .. | 10 | 50 | 6 |
| Coal | .. | 8 | 51 | 2 |
| Light sand slate | 4 | 10 | 59 | .. |
| Sandstone | 46 | 6 | 105 | 6 |
| Dark slate | 9 | 6 | 115 | .. |
| Light slate | 38 | 11 | 153 | 11 |
| Coal | .. | 1 | 154 | .. |
| Fireclay | .. | 2 | 154 | 2 |
| Coal | .. | 2 | 154 | 4 |
| Fireclay | .. | 5 | 154 | 9 |
| Coal | 4 | 8 | 159 | 5 |
| Fireclay | .. | 8 | 160 | 1 |
| Coal (Moss coal) | 1 | 6 | 161 | 7 |
| Fireclay | .. | 5 | 162 | .. |
| Coal | .. | 5 | 162 | 5 |
| Fireclay | .. | 9 | 163 | 2 |
| Coal | .. | 5 | 163 | 7 |
| Sandy slate | 9 | 10 | 173 | 5 |
| Coal | .. | 5 | 173 | 10 |
| Fireclay | .. | 6 | 174 | 4 |
| Sandstone | 18 | 8 | 193 | .. |
| Sand slate | 21 | .. | 214 | .. |
| Black slate | 4 | .. | 218 | .. |
| Fireclay | 1 | 6 | 219 | 6 |
| Sandstone | 3 | 6 | 223 | .. |
| Light sand slate | 6 | .. | 229 | .. |
| Sandstone | 32 | 10 | 261 | 10 |
| Light slate | .. | 6 | 262 | 4 |
| Coal. Straight Cr. coal | 1 | 8 | 264 | ... |
| Sandy slate | 4 | .. | 268 | .. |
| Dark slate | 14 | 10 | 282 | 10 |
| Coal | .. | 2 | 283 | .. |
| Fireclay | 3 | .. | 286 | .. |
| Dark slate | 3 | .. | 289 | .. |
| Sandy slate | 12 | 6 | 301 | 6 |
| Coal | .. | 9 | 302 | 3 |
| Fireclay | 2 | 3 | 304 | 6 |
| Dark slate | 16 | 2 | 320 | 8 |
| Coal | .. | 6 | 321 | 2 |
| Fireclay | 1 | .. | 322 | 2 |
| Sand slate | 7 | .. | 329 | 6 |
| Coal | .. | 1 | 329 | 7 |
| Sandstone | 18 | 5 | 348 | .. |
| Sand slate | 107 | .. | 455 | .. |
| Coal | .. | 2 | 455 | 2 |
| Sandstone | 5 | 4 | 460 | 6 |



## Stewart Branch, Fourmile Creek, Pogue and Sandy Branch Region.

The belt of territory drained by these and other smaller tributaries of the Cumberland river has for its principal coal the Straight creek seam; though several other beds have been made the basis of mining operations locally in this region. The Coal Measure rocks exposed in this region include a large part of the series next above the Conglomerate formation. This is the result of the extension from the White Mountain uplift of an anticlinal into this bed towards Barbourville, arching the series of beds so that the Straight creek coal bed rises from 1,030 feet or less above the sea to near the 1,500-foot level, along the ridge from the head of Fourmile creek northwestward. Excepting the short abrupt fault along the face of White Mountain at the head of Fourmile creek, there appears to be no considerable break in the continuity of the rock beds of the region, which is mostly on the southwest slope of the anticlinal extension of the White Mountain uplift. The northeast slope is irregular and broken for a short distance from this local axis of uplift, and continues more uniformly up all the streams that head in the Kentucky ridge. This slope includes the valley of Stinking creek, which as a regional area will in turn be described.

The hill section of Stewarts branch begins with the Straight creek coal seam, as at the mouth of Straight creek, well above the high water mark of the Cumberland river which has been given as 990-feet above sea level. At the entry of the Wallsend Coal and Coke Company, the elevation above tide is 1,039 feet, or 39 feet above the 1,000-feet datum at the base of the page map section. The entries of the Black Raven mines, one mile up Fourmile creek and 10 feet above the creek, start also at the 39-foot level; rising 2 per cent., north 35 degrees west in the main entry, and at a greater angle to the northeastward, as will be seen.

The entries of the Highland Rim Coal Company on the opposite side of the creek and above the Right fork,



are at higher levels. The upper entry one-half mile above the Black Raven plant is at 114 feet above the 1,000-foot datum for this region, and the Black Bear Coal Company's principal entry, two and a half miles from the mouth of the creek, is at 257 feet showing, a dip down the creek, or southwestward, of 218 feet in a distance of one and a half miles or an average dip of about eight per cent. This dip increases to 30 degrees up the creek near the forks of the road and creek; and at Miller's store the fault line of White Mountain crosses the creek and rocks are exposed nearly vertical. The thickness of this seam on Fourmile creek varies from 36 to 40 inches in one unbroken bench.

The Blue Gem coal seam was formerly opened at a number of points on Fourmile creek holding its place in the series but too thin for profitable mining. Further down the river on a small branch now known as Blue Gem branch, this bed is made the basis of a mining enterprise, the bed being from 27 to 37 inches thick at an elevation of 174 feet, and the same bed is opened towards the head of Pogues branch showing 34 inches of coal at an elevation of 337 feet. On Sandy branch this coal shows an average of 29 inches at three openings as indicated on the page map, towards the head of the branch, at levels 362, 358 and 355 feet. This bed is under a cliff-forming sandrock which aids in its identification in this region.

The Straight creek seam on Pogues branch rises towards the head in the ridge between this and Sandy branch. The Hughes Jellico Coal Company entry is at the 483-foot level. The Matthews Mine further up the ridge is near the same level, the Main entry rising to a one per cent. grade northwestward to near the middle of the ridge beyond which the dip is towards the Sandy branch drainage. The Ingles mine on the opposite side of Pogue branch is at a lower level, of which accurate data is wanting but assumed from barometric levels to be at 440 feet, as in the Pogue and Sandy branch section. The thickness of the bed in this locality varies from 37 to 48 inches including 2 to 7 inches of shale parting which separates the coal in two nearly equal benches.

The structure of the coal and the comparative freedom from impurities which enhances the value of the Straight creek seam is maintained with slight variation over the locality as well as over the Straight creek valley. The records of the Laboratory of the Survey include the following analyses of the Straight creek coal samples obtained by Thruston at openings on Fourmile creek one mile and two and a half miles from the mouth.

| | | |
|---|---|---|
| Moisture | 2.00 | 4.60 |
| Volatile combustible matter | 34.60 | 28.80 |
| Fixed carbon | 60.40 | 63.60 |
| Ash | 3.00 | 3.00 |
| Sulphur | 0.507 | 0.506 |

Below the Blue Gem coal the rock beds are mostly shales and slaty sandstone. Between Elys station and Sand Lick station these beds are exposed to a thickness of 360 feet. Thin coals, as are represented in the section of the page map, are included in increased number. The horizon of the Clear creek (Chenoa) cannel coal is doubtless included in this part of the section, and the top of the Conglomerate comes near to the drainage level, or possibly may be exposed at some points in this locality.

The next coal seam above the Straight creek bed is shown at its maximum on Fourmile creek and is mined by the Highland Rim Coal Co. It is 85 feet above the Straight creek seam and has the following bed section at mouth of entry:

| Slate roof to sand rock ledge above. | Inches. | Inches. |
|---|---|---|
| Coal including two thin streaks of clay | 24 | .. |
| Clay shale | .. | 5 |
| Coal, solid bench | 30 | .. |
| Clay shale | .. | 10 |
| Coal | 10 | .. |
| Coal and clay | 64 | 15 |

This is also the maximum thickness of this seam for the several regions of the Straight creek field. The quality of the coal is good but inferior to that of the Straight Creek seam. The dip of the bed at this point is three per cent. to the southwestward. The openings examined by



Thruston in this region, seven in number, now fallen in, showed that the bed is very variable having from 41 to 60 inches of coal and from 3 to 21 inches of shale distributed in one to seven partings; in nearly all so as to render mining expensive at the present time, to the point of unprofitableness. His tabular description is here given.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Coal | .. | .. | 1½ | 1 | .. | .. | .. |
| Shale | .. | .. | 1½ | 1 | .. | .. | .. |
| Coal | 28 | 24 | 20 | 15 | 24 | 26 | 24 |
| Shale | 4 | 8 | 11 | 2 | 3 | 2 | 2 |
| Coal | 5 | 2 | 2 | 8 | .. | 2 | 2 |
| Shale | 5 | 2 | 3 | 9 | .. | 1 | 1 |
| Coal | .. | 3 | .. | .. | .. | 3 | 3 |
| Shale | .. | 3 | .. | .. | .. | 6 | 5 |
| Coal | 1 | 1 | .. | 1 | .. | 1 | 2 |
| Shale | 1 | 1 | .. | 1 | .. | 1 | 1 |
| Coal | 16 | 14 | 18 | 13 | 29 | 16 | 15 |
| Shale | 7 | .. | .. | .. | .. | 6 | 6 |
| Coal | .. | .. | .. | .. | .. | 8 | 7 |
| Shale | 2 | .. | 6 | .. | .. | 4 | 2 |
| Coal | 10 | 7 | 5 | .. | .. | 4 | 5 |
| Whole thickness | 72 | 72 | 68 | 51 | 56 | 80 | 75 |
| Coal " | 60 | 51 | 46 | 38 | 53 | 60 | 58 |

Nos. 1 and 2, in the divide near the head of Pogues branch, Nos. 3 and 4, on the left side of Fourmile creek, and Nos. 5, 6 and 7, on the right side of the valley, show the lower 10 inches of coal as seen at that entry.

There is on record at the Laboratory of the Survey an analysis of an average sample of this coal as taken by Thruston from an opening one and one-half miles from the mouth of the creek. Weathered coal was included as is indicated by the per cent. of moisture.

| | |
|---|---|
| Moisture | 4.40 |
| Volatile combustible matter | 29.50 |
| Carbon in coke | 60.60 |
| Ash | 5.50 |
| | 100.00 |
| Sulphur | 0.975 |

The interval between this coal and the Dean seam is about 500 feet. Sandrock ledges largely predominate in this part of the section and no prominent coal has been developed in it, in this belt, though an outcrop of coal about 100 feet below the Dean seam is reported in this region by Thruston and Sullivan, the equivalent of the Vanderpool coal in the field to the Southwest, and mined in the Halsey district.

The Dean coal seems to have been noted more as a horizon than as a coal bed. On Stewart's branch a thickness of 40 inches of weathered coal was exposed in a facing at the 660-foot level. Between this point and the head of Miller's branch, Mr. Thruston found the characteristic Dean parting of flint clay 5 inches thick between an upper bench of weathered coal, thickness not shown, and a lower 36-inch bench of firm coal. In a high point near the head of Pogue branch this bed is partially exposed near the top. The upper Tuckehoe coal entry at the 592 foot level near Fourmile station was presumbaly in this seam. The entry was abandoned and no record of the bed section is available.*

The place of the Dean coal is readily found in all the ridges of this region conforming to the dips indicated by the lower coals as described. Across the river this coal gives special value to the region as a coal mining district; as will be seen in report on Brush and Greasy creek valleys.

The McGuire cannel seam or the upper Dean coal at the 762-foot level on Stewart branch is continuous over a large part of this region rising to the crests of the hills near the head of the Pogue branch. The cannel portion of the bed is not so constant a feature either in thickness

*According to measurements made by myself in 1903, the thickness of the bed, including coal and clay, ranges from 40 to 50 inches. The thickness of individual members varies as follows:

| | In. | | In. |
|---|---|---|---|
| Coal | ½ | to | ½ |
| Clay | 13 | " | 20 |
| Coal, blocky | 8 | " | 13 |
| Clay | 3 | " | 5½ |
| Coal | 13 | " | 17 |

The lower bench exhibits slickensides and crumbles quickly when removed from the bed.—C. J. N.



or quality as to give value to this coal seam. On the right fork of Stewart branch as faced up for examingtion but not driven to solid coal the whole thickness was 59 inches of which the bottom bench of cannel coal was 17 inches. A greater thickness has been reported near the head of Miller's branch. But at the head of the left prong of Stewart's branch and in the point to the westward Mr. Thruston measured 38 inches of common coal and 13 inches of cannel, and 39 inches and 13 respectively.

This bed marks a horizon which has recurring local areas of cannel coal in connection with ordinary soft coal; it extends over a large field in greater or less thickness, with here and there "pockets" of cannel coal added to its bed section or taking the place of some of its layers as the case may be, but it has only at wide intervals bodies of cannel which separately may be made the basis of a mining industry. It has been known locally as the McGuire seam, having been made the basis of a mining enterprise on Stewart branch under this name.

## Analyses and Calorific Values.

Following are analyses and calorific values of the Straight Creek coal and of the seam which occurs 200 feet above that bed, together with an analysis of the Jellico coal as seen at the mine of the Mt. Morgan Jellico Coal Co., near Williamsburg, Whitley county, the latter being given for comparison.

No. 1. From Straight Creek Coal & Coke Co.'s mines; Straight Creek seam, North entry of No. 2 mine. Composite sample from average sample in room 27, 4th entry and the head of the 5th North entry. Thickness of seam, 37 and 35 inches. Collected by A. G. Spillman, Assistant Inspector of Mines. Analysis for the Survey by Dr. Chase Palmer; calorific determination by Dr. A. M. Peter, Chemist of the Survey.

No. 2. No. 3 Mine, Straight Creek Coal & Coke Co.; Straight Creek seam, head of the 4th Right entry and from face of Main entry. Composite of average sample. Thickness of seam, 30 and 31 inches. Collected by A. G. Spillman. Analysis for the Survey by Dr. Chase Palmer; calorific determination by A. M. Peter, using Parr's calorimeter.

No. 3. From the Wallsend Coal & Coke Co.'s Mine No. 1; Straight Creek seam. Composite sample from two average samples. Thickness 30 inches. Average samples by A. G. Spillman.

No. 4. Big Hill Coal Co.'s Mine. Average sample from Main heading. Thickness 43 inches. Sampled by J. S. Cheyney. Analysis and calorific determination by Dr. A. M. Peter.

No. 5. Straight Creek Coal & Coke Co.'s land; seam 200 feet above the Straight Creek coal. Sampled by J. S. Cheyney. Analysis and calorimeter determination by Dr. A. M. Peter.

No. 6. Straight Creek Coal & Coke Co.'s Mine No. 2. Composite of a sample from from Straight Creek seam by J. S. Cheyney. Analysis and calorific determination by Dr. A. M. Peter.

No. 7. Left fork of Caney creek, Chad Bailey land, Straight Creek seam, 39 inches. Average sample by Prof. C. J. Norwood. Analysis and calorific determination by Dr. A. M. Peter.



No. 8. Howard branch, Straight Creek seam, 43½ inches, omitting 3 inches of clay parting. Average sample by Prof. C. J. Norwood. Analysis and calorific determination by Dr. A. M. Peter.

No. 9. At forks of Caney creek, opposite the old Bingham dwelling on the Rice tract, Straight Creek seam. Average sample by Prof. C. J. Norwood; analysis by Dr. A. M. Peter.

No. 10. Mt. Morgan Jellico coal, Whitley county. Composite of average samples from No. 4 Entry and room 24 of No. 11 Entry, by A. G. Spillman. Thickness 34 and 32 inches. Analysis for the Survey by Dr. Chase Palmer; calorific determination by Dr. A. M. Peter. For comparison.

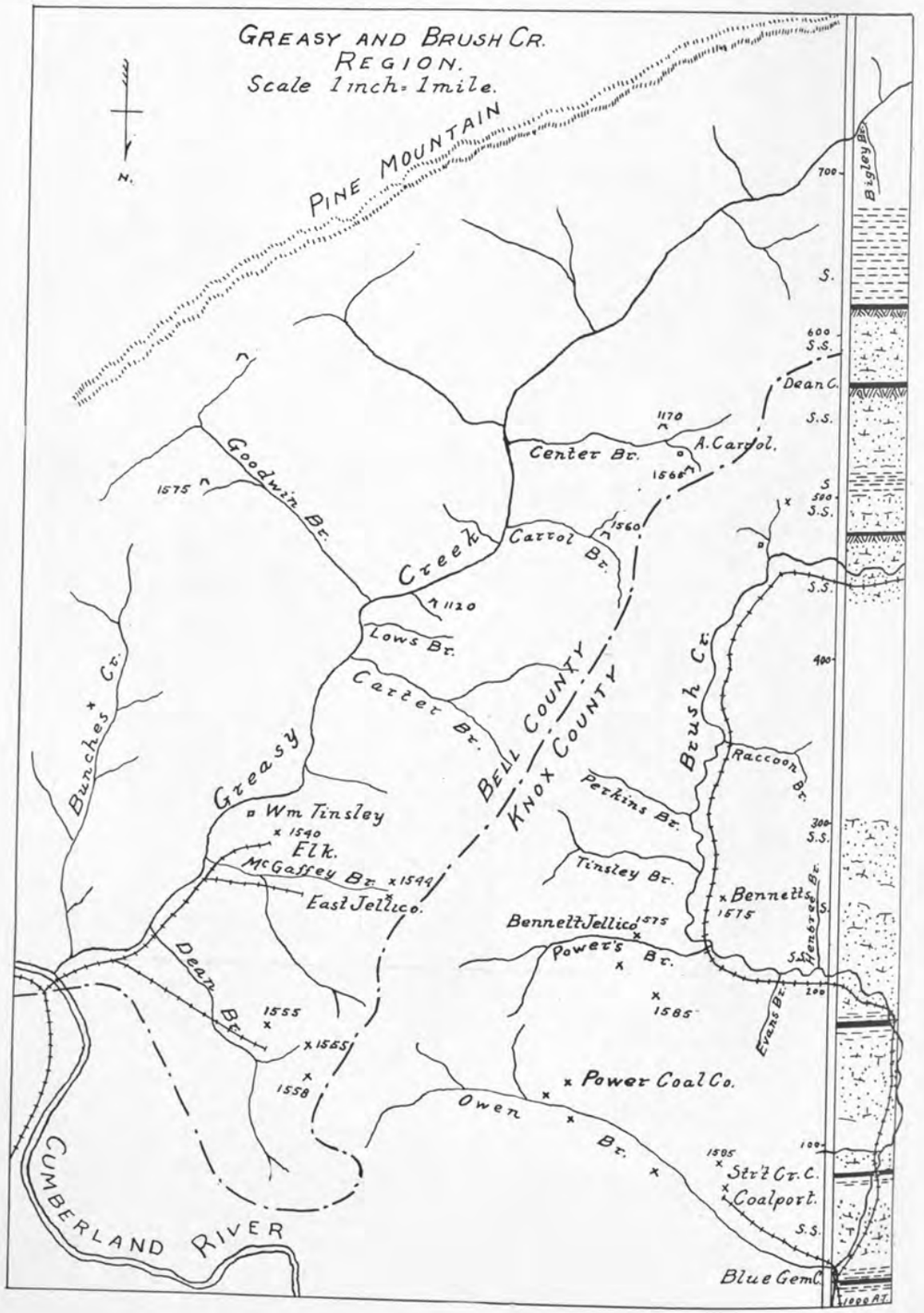
STRAIGHT CREEK

| | No. 1. | No. 2. | No. 3. | No. 4. |
|---|---|---|---|---|
| Moisture | 1.29 | 0.92 | 1.18 | 2.47 |
| Volatile combustible matter | 36.51 | 35.92 | 36.65 | 39.03 |
| Fixed carbon | 60.15 | 60.75 | 60.54 | 37.16 |
| Ash | 2.00 | 2.39 | 1.61 | 1.34 |
| Sulphur | 0.760 | 0.620 | 0.645 | 0.77 |
| Phosphorus | .... | .... | .... | 0.013 |
| Coke | 62.15 | 63.14 | 62.17 | 58.50 |
| Specific gravity | .... | .... | .... | 1.256 |
| Total carbon (Parr's Calorimeter | 78.60 | 79.20 | 78.30 | 78.95 |
| B. T. U. per pound of coal (by Parr's Calorimeter) | 14,141 | 14,173 | 14,329 | 14,952 |



BELL COUNTY COALS.

| No. 5. | No. 6. | No. 7 | No. 8. | No. 9. | No. 10. |
|---|---|---|---|---|---|
| 2.26 | 2.30 | 2.26 | 2.06 | 1.98 | 1.245 |
| 39.68 | 37.69 | 38.12 | 27.40 | 38.30 | 37.69 |
| 51.64 | 56.85 | 57.84 | 57.97 | 58.59 | 57.24 |
| 6.42 | 3.16 | 1.78 | 2.57 | 1.13 | 3.82 |
| 3.222 | 0.899 | 1.110 | 0.80 | 0.73 | 1.995 |
| 0.009 | 0.031 | .... | .... | .... | .... |
| 58.06 | 60.01 | 59.62 | 60.54 | 59.72 | 61.06 |
| 1.320 | 1.265 | 1.276 | 1.274 | 1.268 | .... |
| 78.11 | 79.84 | 78.95 | 78.90 | .... | 76.50 |
| 14,173 | 14,641 | 13,985 | 14,235 | .... | 14,111 |



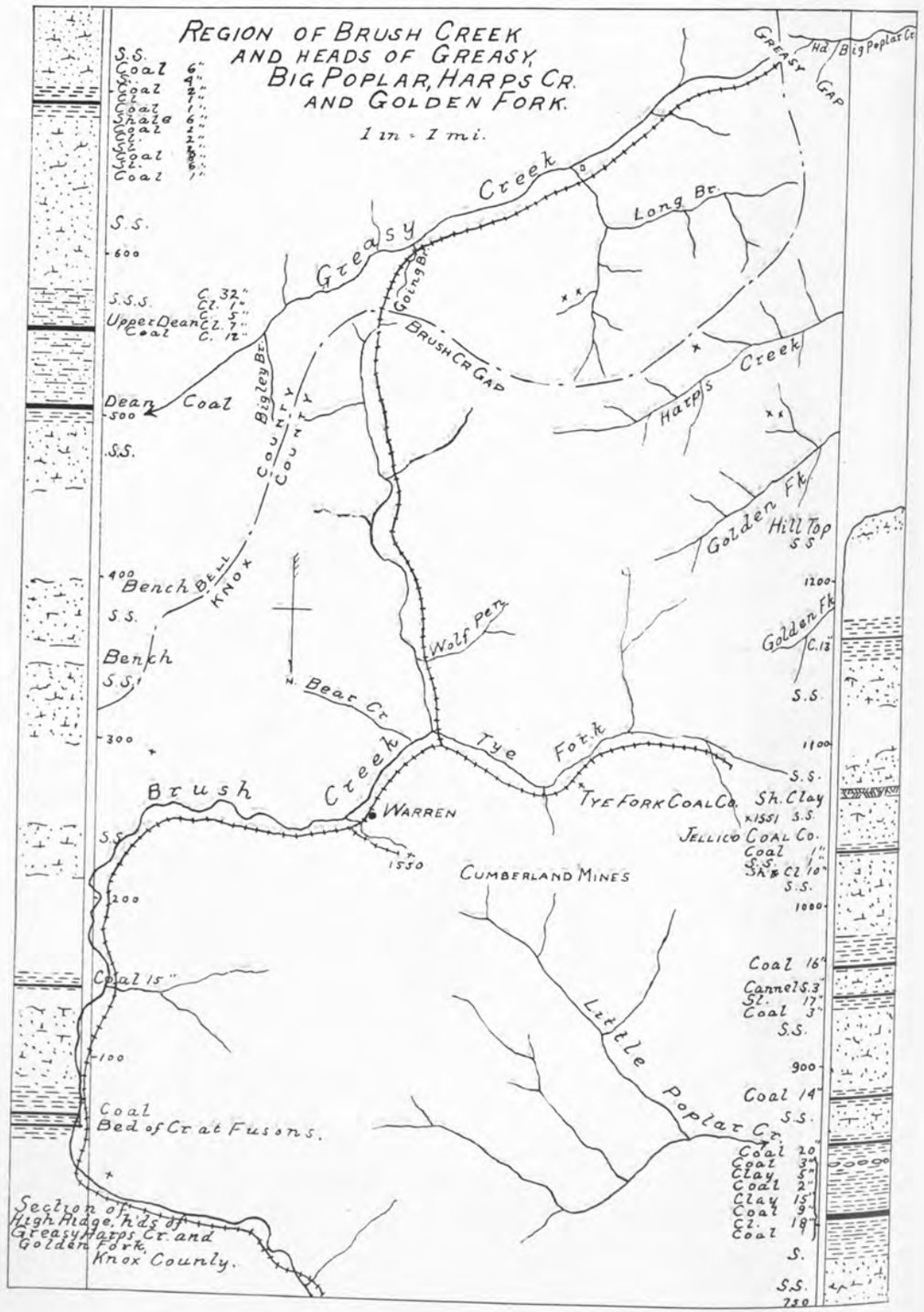



## THE BRUSH AND GREASY CREEKS REGION.

The coal measure rocks of this region are very nearly the same as in the preceding regions, but the economic conditions are in striking contrast with the districts which are separated from it by the Cumberland river as well a with these which are more really separated from it by the Pine Mountain uplift.

Across the Cumberland river, the lower coals are for the present the available beds for mining operations, as has been shown by the descriptions of the coal horizons of the several regions in that part of the field. The lower coals of the region south of the river decrease in prominence, and the Dean coal and the McGuire (or Upper Dean seam) become prominent beds, the former especially forming the basis of the mining enterprises in this region.

The Dean bed was developed by Mr. R. C. Ballard Thruston on the Stull house branch, now known as the Dean branch of Greasy creek, as early as 1878, and a column showing the thickness of the bed was obtained by him for the Louisville Exposition and the Cotton Exposition of New Orleans in 1886. This bed is characterized, as has been mentioned in connection with the localities north of the river, by a parting of indurated or nonplastic fireclay; a feature which, with slight local modifications, is constant in this region. With greater changes in character and with local reversions to clay slate, this parting is still an evidence of the identity of this seam over a large part of the Kentucky river drainage and of the Upper Cumberland field. The Straight creek coal and the Blue Gem are found in this region, but the beds between the Straight Creek seam and the Dean coal as found in Straight creek, or as developed in the Log Mountain region, have not been developed and are probably much less prominent, if not wanting as workable beds. The equivalency of the Dean and Hignite coals has already been spoken of as an assumed basis of comparison of the order of succession of beds in the several regions, as also the Jellico, Straight creek, and Mingo seam. These beds are more persistent as horizon marks by character and surrounding in the






several regions than the intervening coals, and the increased thickness southeastward from the outcrop border of the Coal Measures in Kentucky appears to have been largely by the intercalation of beds between these more constant horizons; a mode of increase in thickness towards the axis of maximum rock deposit which appears to be repeated between the Dean-Hignite level and other well marked horizons above.

Near the river, in this region, the ridges rise above the Dean coal to form a cover of 100 to 300 feet of overlying rocks.

The overlying rocks and this area of coal bed are increased towards the heads of Brush and Greasy creeks, with a maximum of 700 feet or more rising above the Dean horizon in the divide between these creeks and the forks of Poplar creek, as indicated by the section bordering the accompanying page map including that region.

The average thickness of the Dean seam is about five feet.

The following tabular view of this bed shows the local variation in the bed-section for the region. Thickness is given in inches.

| Locality | Roof | Coal | Ptg. | Coal | Ptg. | Coal | Flint Clay | Coal | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Coal | Ptg. |
| Coalport.... | Sl. | 24 | 18 | 24 | 12 | 39 | 5 | 32 | 119 | 35 |
| Bennetts.... No. 1 Mine. | Sl. | | | | | 36 | 6 | 33 | 69 | 6 |
| Bennetts.... No. 2 Mine. | Sl. | | | | | 46 | 5 | 10 | 56 | 5 |
| Brush Cr. C Co. Bays Br. | | | | | | 34 | 4 | 10 | 44 | 4 |
| Cumberland C. Co..... | Sl. to ss | | | 16 | 4 | 38 | 6 | 12 | 66 | 10 |
| The Amis opening.... | | | | | | 36 | 6 | 28 | 64 | 6 |
| Dean Br. R.C.B.T.... | Sh. 12 to ss | | | | | 35 | 5 | 35 | 70 | 5 |

(Table Continued.)

| Locality | Roof | Coal | Ptg. | Coal | Ptg. | Coal | Flint Clay | Coal | Total Coal | Total Ptg. |
|---|---|---|---|---|---|---|---|---|---|---|
| Bell Jellico Mines..... | F. C. | | | 6 | ½ | 28 | 4 | 36 | 70 | 4½ |
| E. Jellico Mines..... | Cl. S. | | | | | 37 | 5 | 33 | 70 | 5 |
| Elk C. Co... | | | | 15 | 2½ | 25 | 5 | 39 | 79 | 7½ |
| Carroll Br... | S S | | | 10 | 22 | 36 | 9 | 10 | 50 | 31 |
| Center Br... | S S | | | | | 27 | 8 | 7 | 34 | 8 |
| Hd. of Greasy Cr.... | Sl. | | | | | 50 | 7 | 3 | 53 | 7 |
| Hd. of Golden Fk..... | | | | | | | | | | |
| Hd. of Harps Cr..... | S S | | | 6 | 1 | | | 44½ | 50½ | 1 |

The upper bench of the Coalport coal is said to be nearly 4 feet. As measured in a roof-fall, the thickness was not fully exposed.

The Bennett No. 1 mine of the Trosper Coal Company, on Powers branch, has a coal seam 10 feet above the Dean as given in the Table, reported 62 inches thick, including 20 inches of shale parting.

The No. 2 mine, on the opposite side of the main creek, has a 30-inch bed 12 feet above the regular seam The Amis opening was made at an early day in the river hill one mile above Flat Lick, and measured by Thruston. The 42-inch thickness of the bed on Center branch shows a local thinning of this coal, under a prominent sandrock ledge. On Carroll branch the third bench of coal, under sandrock roof, is also separated from the main seam by 22 inches of sandstone. On the head of Greasy creek, the Dean parting or nonplastic clay is near the bottom of the seam. On Bunche's branch, near the head, the upper bench is 15 inches over 3 to 5 inches of nonplastic clay,



and the lower bench is separated into two parts, 18 inches each, by 3 inches of clay shale. The roof is sandstone, with a thin coal imbedded 5 feet up from the coal.

In Round Top Mountain, 2 miles west of Pineville, the roof is slate; the upper bench is impure cannel coal, 9 inches; the indurated parting is 9 inches; and the lower bench is 36 inches, as measured by Thruston.

Analysis of the Dean coal as opened on Dean branch and sampled by Thruston, and on the head of Harps creek by G. M. Sullivan, is as follows:

| | UPPER BENCH. | LOWER BENCH. | HARPS CR. |
|---|---|---|---|
| Moisture..... | 1.60 | 1.66 | 4.00 |
| Vol. comb. matter..... | 33.80 | 36.34 | 31.20 |
| Fixed carbon..... | 57.14 | 58.04 | 59.00 |
| Ash..... | 7.46 | 3.96 | 5.80 |
| | 100.00 | 100.00 | 100.00 |
| Sulphur..... | 1.110 | 0.651 | 0.521 |

Analyses were made by the Survey Chemist.

The upper Dean coal, about 40 feet higher in the general section, is opened in a few places only. In the ridge at the head of Greasy creek it shows 57 inches, including 8 inches of clay shale, as developed by G. M. Sullivan. Both of these coals were opened with nearly the same section of the head of Golden fork. In this ridge the beds are practically horizontal. The outcrop of this bed shows under a sandstone cliff at the Bennett No. 2 mine, in about the same relation to the Dean seam. Mr. F. F. Whittekin, General Superintendent of the Cumberland Railway, who has given considerable time to the Brush creek region, reports this bed as averaging 48 inches thick, 20 to 50 feet above the Dean seam. On Goodwin branch of Greasy creek a seam, part cannel coal, which probably represents this bed, shows as follows at the 1575-foot level (barometric):

| | In. | In. |
|---|---|---|
| Roof sandstone. | | |
| Coal | 8 | .. |
| Shale | .. | 4 |
| Coal | 35 | .. |
| Shale | .. | 2 |
| Cannel coal | 6 | .. |
| | 49 | 6 |

At the head of Right fork of Goodwin branch a bed having a thickness of 46 inches, the lower 14 inches splint coal, and a slaty coal layer one and one-half inches near the top of the bed, was recently opened at this level, the lower Dean being 70 feet below.

With the further development of this territory, this bed will be found to add largely to the coal resources of the region.

The coals above the Dean seams, as opened by the Survey, correspond on a general way with those of the Bryson Mountain section, but do not show the thickness or character of the Red Spring and other prominent beds of that section. The order of the beds in the region between Greasy, Brush and upper tributaries of Big Poplar creek is shown in the page map section, which includes beds probably nearly as high in the Coal Measures as are found in Bryson Mountain, though the elevation above sea is about 600 feet less.

The coals below the Dean horizon have not been made the objects of special prospecting and are so little known as to give an impression of lack of importance, which may probably be corrected somewhat when fuller development of the region has been reached. Few openings have been made in this region to show the Straight creek Jellico coal. On Powers branch 36 inches in one bench is shown. In the Newport locality, two 18 inch benches with a thin slate parting. Near Goodwin Church 29 inches without parting is exposed.

The Moss seam shows on Greasy creek as in the following table. The other intervening coals are not prominent enough to be readily traced by outcroppings.



| Locality. | Roof | Coal | Ptg. | Coal | Ptg. | Coal | Total. Coal | Total. Ptg. |
|---|---|---|---|---|---|---|---|---|
| Rt. Fk. Goodwin Br | Sl. | 14 | 54 | 18 | 18 | 20 | a38 | a20 |
| Center Br. of Greasy Cr | Sl. | 14 | 12 | 15 | 18 | 21 | 50 | 30 |
| Hd. of Greasy Cr | Sh. | 18 | 96 | 7 | 7 | 24 | a31 | a7 |

a—Omitting upper benches.

The Blue Gem seam shows a few points near the river, 26 to 32 inches thick. Up the river, two miles from the mouth of Brush creek, a 35-inch coal, 60 feet above drainage, probably represents the Blue Gem.

The composition of this coal is shown by analysis made by Dr. Peter, Chemist of the Survey, is as follows:

| | |
|---|---|
| Moisture | 1.20 per cent. |
| Volatile combustible matter | 35.08 " |
| Fixed carbon | 58.92 " |
| Ash | 4.80 " |
| | 100.00 |
| Sulphur | 0.8766 |

Opposite Flat Lick this bed measures 31 inches, and is 120 feet above the river, rising with the uplift already described north of the river, but rapidly declining to the general level of this bed south of the river.

## STINKING CREEK REGION.

### PRELIMINARY REPORT.

Stinking creek drains a large region lying between the Kentucky ridge and the Cumberland river. The length of the creek is about eighteen miles. Three principal forks head against Kentucky ridge: Road fork, which heads against Hammon's fork of Collins fork of Goose creek, and Otter creek of the Left fork of Goose creek. This fork flows southward and in a long bend to the eastward joins the Main creek six miles from the mouth and about four miles from Flat Lick. The Middle fork heads against the Left fork of Goose creek of the Kentucky river waters, is about seven miles long and joins the Big Creek fork two miles above the mouth of Road fork. Big creek, as a fork, is about ten miles long and heads against the Left fork of Goose creek and the Left fork of Straight creek of the Cumberland river drainage. Other creeks, Elliot, Trace, Lost fork and Rolling fork, head against the Left fork; and Moore's creek opposite Left fork and Fourmile creek of regions previously described.

No map of this creek has been made that is accurate enough to be of more than general use as a basis for descriptive topography.

This region, extending as it does northwestward in the direction of rapid decrease in the thickness of equivalent parts of the Coal Measures, as described in the Log Mountain and Straight creek regions, presents many difficulties in carrying the nomenclature of coals of those regions. Excepting the Straight creek coal and the Dean seams, which are continuous beds over a large part of the Southeast Kentucky Coalfield, there appears to be little in the order of beds or in the thickness and character of the intervening rocks, on which to predicate equivalency of beds other than these with those of the General section for the Log Mountains, or even of the neighboring Straight creek region.

The lower part of the Stinking creek valley shares in the disturbances of the rock strata attending the White



Mountain uplift. This is most noticeable on Moore's creek, which heads against the White Mountain ridge. The fault line of this ridge has been described as crossing the head of Fourmile creek near Miller's storehouse and marked by vertical rock beds. A secondary axis of uplift diverges from this line and shows above Robert Gregory's house on Moore's creek as an anticlinal, crossing the road and creek obliquely to the westward and exposing locally masses of the conglomerate formation. This axis is broken and irregular, decreasing in prominence down Moore's creek, but is probably continuous as an anticline extending towards the Barbourville region.

Southward from Moore's creek the dip is in general like that of the Straight creek region up the main valley to near the heads of the main forks, where the beds are nearly horizontal or reversed by rise of a few feet to the mile. As at the head of the main forks of Straight creek the Dean coal is at the base of the Kentucky ridge, so is it at the heads of the forks of Stinking creek. The place of this seam is on the first bench of the ridge and shows as a prominent outcrop in the road over Kentucky ridge to Goose creek.

**Gregory Straight Creek Coal.**

The Straight Creek seam is opened on Mud Lick branch of Moore's creek near the old Gregory place 300 feet above the main creek bed. The drift facing had fallen in but 36 inches of the bed could be seen under slate roof. At Robert Gregory's, near the anticline previously described, the Blue Gem seam is opened, dipping 15 per cent. northeastward. The thickness of the coal is 36 inches, under slate roof. Around the point of the hill, down the creek, this bed is 34 inches without parting and nearly horizontal; and at the mouth of Simmons branch 32 inches of coal, 10 feet above the creek, under horizontal sandrock roof, represents this bed. On the opposite side of the valley, one-half mile from the

**Gregory's Blue Gem Coal.**

**Simmon's Branch Coal.**

mouth of Moore's creek, this bed is reported 40 feet above the creek and dipping nearly 15 per cent. to the southwest. Here the bed section is as follows:

**Epperson's Coal.**

| Roof shale. | In. | In. |
|---|---|---|
| Coal | 3 | .. |
| Shale | .. | 3 |
| Coal | 26 | .. |
| Sandrock floor. | | |

Opposite the mouth of Moore's creek at Daniel Bingham's this bed is 110 feet above the Mud Lick branch of Stinking creek, showing the following bed section:

**Bingham's Blue Gem Coal.**

| Roof slate. | In. | In. |
|---|---|---|
| Coal | 20 | |
| Shale | .. | 11 |
| Coal | 12 | .. |
| Underclay. | | |

The parting here is an unusual feature of this bed. At 190 feet above the bench, on the opposite side, the Straight Creek coal has been mined for local use, now so fallen in as to be inaccessible. The reported thickness is 36 inches without parting. This appears to be sustained by the outcrop exposure.

On Fighting creek, three miles northeast of Barbourville, at the Noah Wiggins place, a bed was formerly opened and examined by Mr. Thruston who found the following bed section:

| Roof slate. | Inches. | Inches. |
|---|---|---|
| Coal | 18½ | |
| Shale | .. | 2½ |
| Coal | 10 | .. |
| Shale | .. | 6 |
| Coal | 19 | .. |
| | 47½ | 8½ |

The bed is described as an excellent block coal, which by analysis shows the following results:



| | |
|---|---|
| Moisture | 1.80 |
| Volatile combustible matter | 34.00 |
| Carbon in coke | 59.40 |
| Ash | 4.80 |
| | 100.00 |
| Sulphur | 0.981 |

A coal facing made at the head of Mud Lick branch of Stinking creek, the valley of which is opposite the mouth of Moore's creek, shows the following bed section:

| Roof shale. | Inches. | Inches. |
|---|---|---|
| Coal | 8 | .. |
| Shale | .. | 6 |
| Coal | 22 | .. |
| Clay | .. | ¼ |
| Coal | 12 | .. |
| Shale | .. | ½ |
| Coal | 6 | .. |
| | 48 | 6¾ |

This bed is about 440 feet above the Main creek. It is like the preceding coal in appearance and may be its equivalent. The Blue Gem bed is generally supposed to be represented by the coal in the vicinity of Barbourville, 50 to 75 feet above the drainage and 24 to 27 inches thick, under a sandrock ledge.

The drill wells of the region in general do not give a satisfactory clue to the stratigraphy down to the Conglomerate formation. No considerable beds of coal are reported in the imperfectly kept records of the oil wells of the region as far up the valley of Stinking creek as the Brice's creek wells. If this is correct, the lower beds, the Straight creek and Blue Gem, are here locally wanting, as will be seen from the descriptions of the coals above. The Barbourville well, 465 feet deep, reaches the Conglomerate rock at 350 feet, apparently placing the Blue Gem coal at about 400 feet above the Conglomerate, instead of about 500 feet as in the Pineville region. On Fighting creek, less than three miles from Barbourville, the top of the Conglomerate is reached at 273 feet with a local coal at 50 feet below the surface. In a well one-fourth mile to the southwest no coal is recorded, and the Conglomerate formation is reached at 272 feet. If this record is correct, the Fighting

creek coal, previously described, is 773 feet above this formation, and might be compared with the coal seam 200 feet above the Straight creek coal on main Straight creek. On the Road fork of Stinking creek, one mile from the mouth, this formation is struck at 497 feet in the Logan well; and on Brice's creek, in the well on the J. G. Baker farm, one and a half miles up that creek, at 700 feet. On this creek, the equivalent of the McGuire cannel, of the Stewart branch (Wallsend) locality, also previously spoken of as the Upper Dean seam, is opened about 400 feet above the creek, or 1100 feet above the Conglomerate Measures instead of more than 1,200 feet as near Pineville, The bed section near the mouth of the creek, Williamson's coal, and at the Walker place one and a half miles up the creek, is as follows:

| | WILLIAMSON'S | WALKER'S |
|---|---|---|
| | In. | In. |
| Coal | 15 | 22 |
| Cannel coal | .. | 5 |
| Clay | .. | 1 |
| Cannel coal | 15 | 9 |
| | 30 | 36 |

The ridge here rises about 150 feet above this cannel seam, which, towards the heads of the forks of the main Stinking creek, is perhaps the best horizon mark of this part of the region, or has been more persistently traced than any other coal seam, and may be used as a reference horizon for the region. As with cannel horizons generally, this seam is one of common bituminous coal of varying thickness locally replaced or thickened by basins or pockets of cannel coal. The eastward dip indicated by the records of the two wells last mentioned, which are less than two miles apart, has little confirmation in the beds above the drainage, so far as observed and may be in part an error of interpretation of the loosely kept records.

The inclination of beds, as indicated by the cannel seam, is to the east of north, this bed being nearer the drainage towards the head of Big creek than to the Road and Middle forks. The fall of this bed to the head of Road



fork from Brice's creek openings is about 125 feet in a distance of six miles. The average dip from the Moore's creek region is considerably greater. This bed was traced by G. M. Sullivan over the greater part of the region, and many facings made to determine its thickness. At a few points, this cannel seam is locally a notable coal, chiefly towards the head of Road fork.

At Davis Bright's, seven miles from the mouth of the fork, on the west side, a maximum of 41 inches of cannel coal is shown in the central part of a lenticle of good cannel which decreases in all directions. As a workable cannel seam it is limited to a portion of the ridge between the Main fork and Spring branch. Here, this bed is nearly 300 feet above the main creek n a ridge 400 to 450 feet high. An average sample of this coal was taken by J. M. Hodge, which by analysis by A. M. Peter, Chemist of the Survey, gives the following results:

| | |
|---|---|
| Moisture | 1.41 |
| Volatile combustible matter | 41.39 |
| Fixed carbon | 46.88 |
| Ash | 10.52 |
| | 100.00 |
| Sulphur | 1.05 |

**Mills Branch Cannel Coal.**

On the Mills branch, at the Anderson Mills entry, this bed shows a maximum of 45 inches, the upper 5 inches being part splint coal, in a pocket limited as a workable bed to the ridge between Mills branch and Dickey branch on the north. The elevation above the main creek is about 280 feet, the spur ridge having a height of 360 to 380 feet.

On the Broughton branch at the B. D. Allen entry, 34 inches of cannel coal is found; the bed decreasing, like the preceding, in thickness and replaced in part or in places entirely by

**Allen Cannel Pocket.**

a thin bed of common bituminous coal. This pocket of cannel coal is 220 feet above the Main fork, which rises rapidly to the head, and this seam falls below the drainage as a thin bed, part cannel and part soft coal. Many cuts were made in this region exposing this bed without developing other prominent pockets of cannel coal.

On the Middle fork a few openings have been made. On Brown's branch, opposite the Walker entry of Brice creek, the bed is said to have about the same thickness as at the Walker entry.

The distance through the hill is probably not more than 300 yards. On the east side, in the ridge between Middle fork and Big creek, openings were made, but only soft coal was found at this horizon. On the Big creek side a splint coal 12 to 18 inches thick, is shown in openings at this geological level.

**Jeff Hammond's Cannel.**

The height above the drainage on the Jeff Hammond fork of Middle fork is 375 feet; here it is a thin bed, 6 to 8 inches of which is cannel. In the divide between the previous and the Salt Gum fork of Middle fork two openings were made, on Tom's and on Wash branch of the Left fork of Salt Gum, showing a bed section as follows 375 feet above the creek:

**Salt Gum Fork C. C.**

| | TOMS BR. | | WASH BR. | |
|---|---|---|---|---|
| | Inches. | Inches. | Inches. | Inches. |
| Slate | .. | 9 | .. | 18 |
| Cannel slate | .. | 5 | .. | 5 |
| Cannel coal | 11 | .. | 9 | .. |
| | 11 | 14 | 9 | 23 |

On the Right fork of Salt Gum, in an entry at this level, this bed shows:



| | Inches. | Inches. |
|---|---|---|
| Slate | .. | 24 |
| Bituminous sandstone | .. | 18 |
| Cannel coal | 6 | .. |
| Clay | .. | 15 |
| Coal | 8 to. 12 | .. |
| | 18 | 57 |

**Acorn Branch Cannel.**

On Buckeye and on Acorn branch of Big creek, which head against the head waters of Salt Gum fork, the cannel seam is 13 inches.

**Taylor Cannel Coal.**

Near the Isaac Taylor place, on Big creek, four miles from the head 210 feet up from creek, the following details of this bed were shown:

| | Inches. | Inches. |
|---|---|---|
| Roof shale. | .. | 9 |
| Coal and shale | 9 | .. |
| Cannel coal | .. | 1½ |
| Shale | 3 | .. |
| Coal | .. | 4 |
| Shale | 18 | .. |
| Coal | | |
| | 30 | 14½ |

**Big Creek Cannel Coal between Elliott and Buckeye Creeks.**

Half a mile below the mouth of Elliott creek three and a half miles from the head of Big creek, the cannel seam is opened on the west side and the following bed section is exposed, 200 feet above the main creek:

| | Inches. | Inches. |
|---|---|---|
| Roof shale. | 6 | .. |
| Coal | 8 | .. |
| Cannel coal | .. | 24 |
| Shale and bone coal | 10 | .. |
| Coal | | |
| | 24 | 24 |

On the Left fork of Moore's creek, 10 to 22 inches of cannel coal has been found 300 feet above the fork. The place of this bed is readily traced in this locality. There may be some doubt whether this is the Road fork cannel,

as it appears to be 60 feet or more lower in the series. By resemblance it could be readily assumed to be the representative of the Upper Dean seam of this region.

Above this horizon, about 200 feet, is another cannel seam towards the head of the main creek, as at the head of the Left fork of Straight creek. This bed has been opened on the Kentucky river waters on the north side of Kentucky Ridge, opposite the head of the Middle fork in this region, and traced to the ridge between this fork and Big creek; and at J. M. Bingham's, towards the mouth of Middle fork, the following bed section is shown:

**Bingham's Upper Cannel.**

| | Inch. |
|---|---|
| Coal | 3 |
| Cannel coal | 13 |
| Coal | 24 |
| | 40 |

Here this bed is 650 feet above the main creek and about 100 feet below the top of the narrow ridge. On the Big creek side, at Acy Messer's, a mile or more from Bingham's entry, the bed is as follows:

**Messer's Upper Cannel.**

| | Inches. |
|---|---|
| Cannel coal | 12 |
| Coal | 24 |
| | 36 |

This coal is obtained for neighborhood use by benching and is readily traced by outcropping cannel, especially on the Big creek side. It is reported on the ridge on the south side of Big creek, but its place and character have not been verified. On the Middle fork side, two miles or more above Bingham's entry, the following section is shown in an entry driven 30 feet under roof.

**Hubbard Branch Coal.**



| | In. | In. |
|---|---|---|
| Coal | 17 | .. |
| Clay and clay slate | .. | 10 |
| Coal | 12 | .. |
| Cannel coal | 1 | .. |
| Coal | 26 | .. |
| Cannel | 2 to 4 | .. |
| | 60 | 10 |

Here this coal is 650 feet above the creek and 75 feet below the top of the ridge.

At 560 feet above the creek near Hubbard's Mill, as measured by J. M. Hodge, Pleasant Hubbard has an opening of coal as follows:

| | In. | In. |
|---|---|---|
| Roof shale. | | |
| Block coal | 18 | .. |
| Shale | .. | 8 |
| Coal | 10 | .. |
| Shale | .. | 1 |
| Coal | 5 | .. |
| Shale | .. | 1 |
| Coal | 34 | .. |
| Black slate floor. | | |
| | 67 | 10 |

The coals below the McGuire cannel or the Upper Dean seam have not been traced with reference to continuity or equivalency of beds between this cannel seam and the Straight creek coal; there are only a few openings at wide intervals and they show very few specific characters by which identity as continuous beds could be predicated with a reasonable degree of certainty.

The Dean seam is represented by a 37-inch coal opened at several points near the head of Road fork, 60 to 75 feet below the cannel bed of this locality, the interval being increased. It is without parting, in shale under a sandstone ledge of considerable prominence, but without any trace of the indurated clay which generally accompanies this bed as a parting or in the underclay.

**M. Jackson Coals Road Fork.**

At Milton Jackson's, on Road fork 160 feet above the creek, as noted by Mr. J. M. Hodge, a thin bed (20 inches) has been exposed south of the house. At 250 feet, in the hollow back of the house, a seam was measured as follows:

| | | |
|---|---|---|
| Coal | 17 | .. |
| Shale | .. | 4 |
| Coal | 5 | .. |
| Shale with bands of coal | .. | 20 |
| Coal | 8 | .. |
| | 30 | 24 |

**Hammond's Coal Brice's Creek.**

In the locality of the Walker cannel coal of Brice's creek, 150 feet below that bed, a coal is mined for local consumption which has the following measurements:

| Roof shale. | Inches. | Inches. |
|---|---|---|
| Coal | 8 | .. |
| Clay shale | .. | 11 |
| Coal | 28 | .. |
| | 36 | 11 |

**Larkin Hubbard's Coal.**

On the Middle fork, at Hubbard's Mill, two miles from the mouth of the fork, 30 to 33 inches of coal in black slaty shale is exposed in the rock cliff formed by the creek and the black shale shows down the stream in places for a mile or more with from 20 to 30 inches of coal. This bed is 400 feet below the cannel horizon.

On Holly branch of Middle fork, 200 feet above the creek, 24 inches of coal are exposed. The gap to Brices creek is 200 feet higher

Thin coals have been noted at many points which, with present lack of study of the region at large, contribute little to a knowledge of the place, character, and continuity of the beds above and below the Dean seams.

While this report on the Stinking Creek is no more than preliminary in character, the data obtained for it will serve as a much needed working-basis for a more detailed study of the distribution of economic beds that should be expected to show the extension of most of the beds of the Straight creek region into this drainage, with some of the changes that attend the thinning out of the coal measures towards the outcrop to the northwest.