

Kentucky Geological Survey, 1904-12

CHARLES J. NORWOOD, Director

BULLETIN No. 12.

Coals of the Lower Measures

ALONG THE
WESTERN BORDER OF THE EASTERN COALFIELD

By A. M. MILLER

OFFICE OF THE SURVEY: LEXINGTON, KY.

1910

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LETTER OF TRANSMITTAL.

To His Excellency, AUGUSTUS E. WILLSON,
Governor of Kentucky.

Sir: This report on the coals included in the series of sandstones and shales constituting what in Kentucky geology is commonly known as the Conglomerate Formation, along the western border of the Eastern Coalfield, was turned over to the then public printer in 1908, and it has been in type many months; the reason for the delay in putting it through the press is not known by the present writer, and the delay has been beyond his control.

Since it may appear that the author of the report has written in a critical spirit concerning some of the work done by his predecessors (A. R. Crandall and G. M. Sullivan) in the region he has traversed, as well as elsewhere in the Eastern Coalfield, it seems proper to say here that for the views expressed the author alone is responsible. Prof. Crandall's position with reference to the "Conglomerate Formation," which apparently is not fully understood by the author of this report, is based on field-work that has carried him over nearly all parts of the Field. He has not felt that sufficient information has been obtained to warrant undertaking detailed correlations of the conglomerate sandstones, or even of the shales and sandstones immediately above them, everywhere throughout the Eastern Field, though within the last two years material progress toward correlations and subdivisions of the conglomerates has been made.

It will be noted that Prof. Miller has made quite an innovation in the system of numbering of the coal beds, in that his numbering begins with the lowest coal noted by him in the "Rockcastle Series" ("Conglomerate Formation") and is carried in continuous order up to and including the highest

bed above the conglomerate formation seen by him. According to this system, Prof. Miller designates as "No. 4" what has by many been regarded as "No. 1" according to the nomenclature that has been in use for many years in the Eastern Coalfield; while the Jellico seam, which for long was regarded as correlating with "No. 3" of the type section, is designated as "No. 7." In order that confusion elsewhere in the Eastern Coalfield may be avoided, it is to be understood that Prof. Miller's system of numbering is only for purposes of this report; it has not been adopted by the Survey for wider application, nor will the older system of numbering—where numbers are used at all—be materially changed, if changed at all. Indeed, it has for some time been plain that, while numbers served very well to designate the several coal beds in that northern part of the Field first studied by Prof. Crandall, attempts to carry numbers throughout the Eastern Coalfield are unwise, while the numbering of coals in the conglomerate series leads only to confusion; the Survey is, therefore, substituting names for numbers. (See Biennial Report of Progress for 1908-'09, page 36 et seq., and Bulletin No. 11.) Fortunately, Prof. Miller has used names as well as numbers, hence there is less chance for confusion than otherwise would have been the case.

Acknowledgments are due Prof. L. N. Taylor for assistance rendered in the examination of coals in Pulaski County.

Very respectfully,

CHARLES J. NORWOOD,

Director, State Geological Survey.

Lexington, Ky., December 24, 1910.



THE LOWER MEASURES ALONG THE WESTERN BORDER OF THE EASTERN COAL FIELD SOUTH OF BATH COUNTY, KENTUCKY.

The area embraced in this report lies mainly within the limits of the Williamsburg, London, Manchester, Richmond and Beattyville Quadrangles of the Federal Survey, and is included in the counties of Whitley, Pulaski, Laurel, Rockcastle, Jackson, Madison, Owsley, Estill, Lee, Breathitt, Powell, Wolfe and Menefee.

As dealing with the geology and mineral resources of portions of this region may be enumerated the following older reports issued by the Kentucky Geological Survey: On the Country Along the Outcrop Base Line of the Eastern Coal Field, by Joseph Lesley, Jr., Vol. 4, Old Series, pages 479-488 (submitted in 1859, published in 1864). Geology of Whitley County and a Part of Pulaski, by A. R. Crandall, 1885. Geology of Menefee county, by A. R. Crandall, 1878. Geology of Parts of Jackson and Rockcastle Counties, by G. M. Sullivan, 1891. Geology of a Section from Near Campton to Mouth of Troublesome Creek, by P. N. Moore, 1878. Also, the London and Richmond Folios, by M. R. Campbell, issued by the United States Geological Survey, 1898.*

*A revised report on Menefee county, by Prof. Crandall, and extracts from Mr. Moore's report on the section from near Campton to the mouth of Troublesome creek are included in Bulletin No. 10 of the present Survey. The other reports of the Kentucky Survey named are out of print.—C. J. N.

STRATIGRAPHY.

The prevalence of pebbles in the sandstone series which constitute the base of the Coal Measures, both in Eastern and Western Kentucky Fields, has led to the name "Conglomerate Measures" being applied to them. Owen, in his report as State Geologist for the years 1858-9, recognized a conglomerate member, and though he realized it did not lie actually at the base of the Coal Measures, but along the western margin of the Eastern Field and had "sometimes two and even three coal beds below it," still he identified it with the conglomerate at the base of the Coal Measures in his home country, England, where it was called the "Farewell Rock," and refused to admit these "sub-conglomeritic coals" into full Carboniferous fellowship. In another connection he refers to these measures below the conglomerate as the "False Coal Measures." In accordance with his preconceived geological notions—a relic of the teachings of Werner—there was to be no place provided for these coals in his scheme of numbering; in fact we are given every reason to believe that the discovery of these productive beds below what by all principles of Wernerian Geology should be the "Farewell Rock," was a very unwelcome fact to Owen.

His numbering of coals, then, began with the "first coal above the conglomerate," and from that day to this, "Number One" and the others that follow, up to about twelve, have had this significance. Owen even attempted to correlate these individual seams specifically with those occurring in the same order in the English Field. Thus "No. 1," of Kentucky, was recognized as the equivalent of the "Low Main Coal," of England.

Crandall and Sullivan, in their reports listed above, follow common usage in applying the name "Conglomerate Measures" and "Conglomerate Formation" to the basal mem-

ber of the coal-bearing strata of the Eastern Field. On account of the development of the conglomeritic sandstones along the Rockcastle river, Crandall suggests that the name "Rockcastle Group" would be an appropriate designation for the series.

No attempt was made by these men to further sub-divide the formation, unless Prof. Crandall's quasi-endorsement of Lesley's classification into Conglomerate and Sub-Conglomerate can be taken as such an attempt. Mr. Campbell, in his London and Richmond Folios, was the first to recognize a distinction in the Conglomerates themselves, and to insist upon the lens-like character of them.

In the southern part of the field he described a Lower, or Rockcastle Lentil separated by a shale interval from an Upper, or Corbin Lentil. In the northern part of the field he also describes two lentils, but is not so sure the lower is to be correlated with the Rockcastle.

Campbell's Rockcastle Lentil is Crandall's Rockcastle Series in the main. The latter, however, appears to have included the Corbin with the Rockcastle whenever it showed conglomeritic characters. In other cases he mapped it with the "Measures above the Conglomerate."

Campbell identified the lower lentil as far south as Middle Tennessee and traced it northward to where it "abruptly terminated along a line which crosses Wood creek a mile from its junction with Hazel Patch creek, Hawk creek in the middle of its course, and mouth of Line creek." This is in the Rockcastle Drainage. Eastward he identified it as passing below drainage at Cumberland Falls, and westward in Pulaski county, noted its disappearance before reaching Buck creek, though the horizon of it is found even west of that creek.

The Lower Conglomerate in the northern portion of the area, which Campbell provisionally correlates with the Rock-

castle, begins abruptly on the Rockcastle at the mouth of Roundstone, and extends thence northward, as traced in exposures in the drainage of this creek, to the head and thence over on to the head waters of Silver creek in Madison county.

He noted how this conglomerate fills a channel eroded there some 50 to 60 feet into the St. Louis Limestone. Mr. Campbell also noted isolated patches of the same formation in the valley of Horse Lick creek, Jackson county.

The Corbin Lentil of Campbell is named by him from Corbin, a town in Whitley county, junction of the Cumberland Valley Division with the main Knoxville Line of the Louisville & Nashville Railroad.

The name is not a fortunate selection, as only the top of the formation is exposed in the vicinity of this town, and it does not there exhibit its typical lithological characters. There are much better exposures along the line of the Cincinnati Southern Railroad, between Whitley and Pine Knot, as for instance at Stearns. Between the latter station and South Fork of the Cumberland River, along the line of the Coal and Lumber Road recently constructed, there is a magnificent section of this formation as well as the whole conglomerate series.

It was to this whole series of shales with their included sandstones and conglomerations, considered as lenses, that Mr. Campbell gave the name "Lee Formation," from Lee county, Va. He assigned a maximum thickness of 1,000 feet to this formation. Mr. Campbell drew the line for the top of the Lee at the top of the Corbin, or at the horizon of the latter, in case it were absent. All the coal measures above this to an undefined upper limit, but with an assigned thickness of at least 550 feet, Mr. Campbell termed "Breathitt," from Breathitt county, Kentucky.

It has been the customary practice of geologists, who have studied the conglomerate measures surrounding in out-

crop the Appalachian Coal Field, to correlate them with the Pottsville of Pennsylvania. Mr. Campbell definitely states that the "Lee is nearly equivalent to the Pottsville of Pennsylvania, but that about one-quarter of the latter is lacking from the base and that the top is in the bed of black shale which overlies the Corbin Conglomerate."

He bases his conclusions on the evidence supplied by fossil plants. More recently, Mr. Ashley, in his report on the Measures of the Cumberland Gap Field, has drawn the top of the Pottsville far up in the Series above the conglomerate measures, basing his conclusions also on plant evidence.

In this report the terms Lee and Breathitt will be used as defined by Campbell.

The maps, A(1), B(2), and C(3), which accompany this report, have had indicated upon them the minute meridians and lines of parallel.

This divides the whole area in small unit areas, each in extent one minute of latitude from north to south and one minute of longitude from east to west and containing 1.06 square miles. By placing the numbers which would designate these minute meridians of longitude and parallels of latitude opposite the ends of the vertical and horizontal columns thus formed so that each comes just east of the meridian and south of the parallel to which it belongs, this affords a method of locating position on the map, which will be made much use of, especially in referring to coal seams.

Thus, Map A 23-59 locates position of McKee Mine opening as indicated by the X.

LEE FORMATION.

Estimates as to the thickness of shales, sandstones and conglomerates which make up this series vary a great deal. Mr. Campbell assigned to his Lee a maximum thickness of 1,000 feet in the southern part of the area in question and 600

feet in the middle part. Prof. Crandall's section for the Conglomerate Measures in Whitley and Pulaski counties shows about 450 feet, but he generally failed to recognize and include the Corbin in his sections. Mr. Louis Bryant, a mining engineer, who has worked much in this region, estimates the total thickness at about 900 feet. The Series has its maximum thickness in the south. The northward thinning, however, is perhaps not so great as has been supposed. The exaggerated notion has been derived from observing the thinning out and disappearance of individual lenses of conglomerate.

It is not easy to find continuous short sections of the whole formation that will permit of accurate measurements being made. In the following measured sections, the barometer has been the main reliance for the determinations.

1. From the top of the Yellowish Pennington Limestone near the mouth of Roaring Paunch creek to Stearns Hotel within seventy-five feet of the top of the Corbin, in a distance of three and three-quarter miles the interval as measured by the writer is 480 feet (825 feet according to Mr. Bryant.) A well drilled near Pine Knot, starting near top of Corbin, struck the limestone at 807 feet.

2. In the Cumberland river region, near the mouth of Mill creek, there is an interval of 500 feet from top of Pennington to top of highest hills in vicinity, which are near or in Corbin.

3. From the level of Rockcastle river, in the vicinity of Rockcastle Springs, to the nearest outcrop of Breathitt on the London road, a distance of about 6 miles, the interval is about 550 feet. The river at the Springs is not far above the top of the Pennington.

4. Further north there is a good section exposed along the line of the Louisville & Nashville Railroad from the Rockcastle river at mouth of Hazel Patch to Altamont, in a distance of about 6 miles. Hazel Patch Station, not over 50

feet above the base of the Lee, has an elevation of 834 A. T., and Altamont, at top of Corbin, has an elevation of 1160, giving a thickness for the Lee of about 350 feet.

5. The Rockcastle river at Livingston is near base of the Lee, and the hill on the east side of Roundstone creek overlooking the town is capped by Corbin. The interval is about 350 feet, so the whole thickness of the formation here could not have been far from 400 feet originally.

6. In the neighborhood of McKee, Jackson county, the barometer gives 400 feet as probable thickness of the Lee.

7. On Contrary creek, Lee county, the thickness of the Lee is about 400 feet.

8. On Sinking creek, a little north of the last section, the thickness is 350 feet.

9. At the mouth of Lineman creek, Lee county, a drill hole gives the thickness as 365 feet.

10. Near Natural Bridge, Powell county, in the Red River Drainage, the thickness is about 300 feet.

11. On the south side of Red river, near the mouth of Chimney Top, the thickness of the conglomerate sandstones exposed is about 300 feet. In this portion of Wolfe county, there is a friable sandstone at the top very similar to that at the base of the Corbin in the southern portion of the Field.

12. On the north side of Red river near the mouth of Copperas creek, the thickness is about 260 feet.

13. On Gladie creek in C 36-52 the thickness is about 240 to 270 feet. (315 feet according to Prof. Crandall.)

14. Near Frenchburg in the section exposed on the old State road in C 38-57 the thickness is about 210 feet.

15. Not far from Scranton in the extreme northeastern corner of the Beattyville Quadrangle the thickness is about 250 feet.

The Rockcastle Series.—Where best developed along the lower Rockcastle river, this formation consists of three prom-

inent sandstone members or lenses, separated by intervals of shale. Of these sandstones the lowest is most massive, conglomeritic and persistent. It is the ledge over which the river drops at Cumberland Falls. This lens has been called the "Big Conglomerate." The pebbles in the conglomeritic portions are of clear glassy quartz and generally of good size—from that of hailstones to the size of pigeon eggs. The cementing material is firm, and the rock therefore very resistant to atmospheric and stream erosion. Streams cut deep narrow gorges into it, with falls or "devil's jumps" in their courses where they flow over the more resistant ledges. By the recession of their sources the creeks and branches tend to form at their virtual heads vast cirques or rock houses. The deep damp hollows formed by the steep rocky slopes are filled with a characteristic plant growth, a very conspicuous element of which is the laurel and rhododendron (the "ivy" and the "laurel" of the mountaineer); and from out the tangled mass shoot up the tall straight hemlock or spruce pine.

Where the conglomerate rises much above drainage and forms the summits of the dividing ridges it carries as its characteristic timber the chestnut and the yellow pine.

The Rockcastle has a somewhat greater extent in the southern part of the Field than Mr. Campbell mapped out for it under the term "Rockcastle Lentil." Instead of passing below drainage on the Cumberland at the Falls, it is only the lowest or "Big Conglomerate," that a short distance above there sinks from view. The topmost member does not sink below the level of the river till beyond the mouth of Jellico Creek, and extends up Jellico Creek to about A 17-42. It extends up Marsh creek as far as A 21-40, and up the western tributaries of Marsh creek to within a mile or two of the Cincinnati Southern Railroad. In the South Fork Region it extends to beyond the State Line. The northern limit of it crosses the Cincinnati Southern at Alpine.

As has been stated it reaches a very great development in the Lower Rockcastle River Drainage, up which it extends to the mouth of Pine creek, with isolated patches cut in to along Hawk and Wood creeks. Little and Big Clifty, Lick, Beech, Upper and Lower Troublesome, Bear and Polebridge creeks, all tributaries to the Rockcastle river from the west, are deeply incised in this formation, but it does not reach as far west as Buck creek.

It extends up Sinking creek to a little above the mouth of White Oak, in B. 13-6. Fine exposures are found on Cane creek. Up Laurel river it extends some distance above Barton's Mill in A 10-58. Bark Camp, Devil and Dog Slaughter creeks are bedded in this formation for the greater part of their courses. All the "clifty country," marked by Rockcastle Conglomerate outcrops, is very thinly populated. The stream valleys are so narrow, and commonly so choked with boulders, that no roads traverse them. In many instances there are no trails even.

The very pebbly conglomerate referred to before as showing up suddenly at the mouth of Roundstone creek, and extending in a narrow belt up the drainage area of this stream to the head and over on to the headwaters of Silver creek; and which also appears in patches on Horse Lick Creek, and has been somewhat doubtfully correlated by Campbell with his Rockcastle, appears to the writer to be in all probability a different lens of sandstone. Its position is in a channel cut out of the limestone. The material is very pebbly, and the cementing substance so soluble, that under the influence of the weather it breaks down into beds of gravel. This in the vicinity of the Sinks, Rockcastle county, has attracted attention as a gravel suitable to be used in the manufacture of concrete, and quite a good deal has been shipped away from there for that purpose. According to Col. Johnston, of Louisville, who has made contributions both to the history and

geology of the region through which this branch of the Louisville & Nashville Railroad passes, the name "Roundstone" applied to the stream in the drainage of which this conglomerate mainly lies, is derived from the abundance of the loose quartz conglomerate pebbles in the bed of the stream in its lower course. Campbell, in his Report on the London Quadrangle, derived the name from the presence of quartz concretions, weathered from the Waverly Formation which is exposed in the upper courses of this stream.

We suggest for this channel filling conglomerate (and hence doubtfully of marine origin), the name "Livingston Conglomerate."

The Corbin Conglomerate.—This, where typically developed, is a coarse friable sandstone or fine grained conglomerate. Campbell refers to it as a "pink conglomerate." The pebbles in it in the southern part of the Field are always small—not larger than peas. It forms the top of the highest ridges throughout most of the areas south of the Kentucky river. North of the divide between the Kentucky and Red rivers the Corbin as a member distinct from the Rockcastle, has never been differentiated. In the region where developed, it sinks to drainage along the eastern margin of the district covered by this report. Though not so resistant as the Rockcastle, yet it is more so than the shales with which it is interbedded and gives rise to the same kind of topography as the lower conglomerate, and carries the same kind of vegetation. Forming as it does the top of the Conglomerate Series it has constituted in the past a local base level at which the denudation was arrested for a time. It is this very much dissected old structural plain that is now known throughout this whole region as the "Flatwoods." North of the Cumberland, east of the Rockcastle and south of the Kentucky all the interstream areas within the Lee outcrop, which reach an elevation of between 1,200 and 1,300 feet above tide, are capped with

this conglomerate. It also extends across the Rockcastle into Rockcastle county along the high ridges which reach up to these contours. Southward in Pulaski county it is not found west of the Rockcastle and north of the Cumberland, probably because of the rising of the formations in this direction and the absence of contours high enough to catch it.

South of the Cumberland river it is first met with along the high ridge road between Cumberland Falls Station and Cumberland Falls, where it reaches the 1,400 foot contour westerly. Along the line of the Cincinnati Southern southward from Marshall Siding to Pine Knot, this formation is at track level and also forms the tops of the ridges in the immediate vicinity. In passing eastward up the Cumberland river, the formation, which has in this direction gradually changed to a thin bedded shaly sandstone, is still above drainage at Williamsburg, and about 40 feet thick. The base is here about 40 feet above the river and rests on a very black shale. In the western part of the area the formation reaches a maximum thickness of from 100 to 150 feet. A splendid section is shown of the Corbin in cuts of the Louisville & Nashville Railroad in coming up on to the ridge at Altamont from the waters of Laurel Branch of Hazel Patch creek. Eastward and north-eastward from here, on the waters of Little and Big Raccoon creeks, Upper Hazel Patch creek, White Oak creek, tributaries of the Rockcastle from the south, and Moore and Pond creeks, tributaries from the north, there is quite a large area in which the Corbin is very thin or wanting entirely. When wanting it is quite difficult to know where to draw the line between the Lee and Breathitt, unless the Lily Coal (No. 1 of the older Reports) can be identified. This is always due a short distance, usually within 20 feet, above the top of the Corbin, or the horizon of the Corbin. The ridge roads over a large portion of the middle and southern parts of the district covered by this report are bedded upon Corbin, and

on account of their sandy character and level grades are in fair condition for the entire year. These ridge roads form the best highways of intercommunication in the region. The Great Wilderness Road, over which the pioneers mostly came from Virginia into the Blue Grass Region of Kentucky, after it ascends from the Rockcastle River to follow the ridge which marks the boundary between Jackson and Rockcastle counties, and through which stretch it is known as "The Big Hill" is bedded for the most part on Corbin.

The soil of these ridges, as might be expected from its sandy character is naturally quite poor. Still the experience of the German-Swiss Colonists, who under such fair promises were induced to settle on these Corbin Ridge lands west of the Louisville & Nashville Railroad in its stretch from Altamont to Pittsburg, has shown that by careful tillage it can be made to produce rather bountifully.

Whether it is the result of such demonstration or not, certain it is a fact that the attention of the population through this mountain district seems of late years to have been turned to these ridge lands as suitable for cultivation, and as furnishing desirable sites for homes. Perhaps the introduction of the practice of drilling deep wells for water has had much to do with the making of these dry ridges habitable. These wells from which the water is drawn in long cylindrical galvanized buckets by the aid of an iron pulley mechanism, afford copious supplies of purest sand-filtered soft water. The conditions on these ridges are ideal for fruit culture and the Swiss colonists have demonstrated that the finest varieties can here be raised in great abundance.

The original timber on these ridges was mainly chestnut and pine. Where more remote from market still much of it remains. This is particularly true of the pine in the region about McKee, in Jackson county.

COALS OF THE LEE FORMATION.

There is an opinion widely current among geologists and coal men that coal seams in the Conglomerate Measures are few and unimportant. Owen voiced this notion in the fifties, when he characterized these as the "False Coal Measures." Crandall, however, has called attention to the fact that the ratio of coal to strata is greater in these conglomerate measures than in those above, and Ashley from his investigations in the Cumberland Gap Region, has come to the same conclusion.

The chief factor that has militated against the greater development of these coals is their inaccessibility on account of the ruggedness of the country. As regards general persistence, some of the seams will compare favorably with those higher up in the Series.

There are indications that the peaty beds, from which coal was formed, were cut out in places by the same shifting currents or stream courses as deposited the sands and gravels. These "cut-outs," however, are apt to be local, and do not interfere so much with the general continuity of the beds. On account of the great unconformity which exists at the base of the Coal Measures, as well as by reason of the lenticular character of the sandstone members, it is very difficult to correlate seams exposed for the most part only at widely spaced intervals.

The base of the Lee will sometimes be found to rest upon the eroded surface of the Pennington shale and impure limestone (Upper Chester), and sometimes upon that of the Newman Limestone. The upper part of the latter turns out upon investigation to be Ste. Genevieve, and the lower part St. Louis. In the southern portion of the field—that lying in the Rock-

castle, Cumberland and South Fork Drainage—the Pennington is commonly the top member of the Mississippian upon which the Lee rests. At the top of the Pennington here, when it has not been eroded, is a rather massive impure yellow limestone, having a maximum thickness of about eight feet, with greenish shales and thin yellowish limestones below.

Campbell assigns to the Pennington in this region a maximum thickness of 90 feet. The writer has never been able to measure any section showing over 20 feet.

Fossils prove the Pennington to be of Chester age.

The farthest north Pennington has been observed by the writer is at Heidelberg, on the Kentucky river just opposite the mouth of Sturgeon creek.

But exposures of this formation are quite rare long before the Kentucky river is reached in going northward. It all but disappears north of Jackson county. Even in the district where it may be expected, it is frequently wanting on account of removal by erosion, before the deposition of the Coal Measures, or if present, on account of its shaly character so covered as not to be seen at all.

For this reason there is always an element of uncertainty in the correlation of coal seams obtained by measuring upwards from the top of "the limestone." Usually it is the Newman Limestone whose top is most likely to be recognized, and the real base of the Coal Measures may be some 20 feet above this. If there are any sections as thick as Campbell estimates, the base might be as much as 90 feet above "The (Newman) Limestone."

As an illustration of how unreliable "height above the limestone," meaning the pure or Newman Limestone, may be for purposes of correlation, it is only necessary to consult sections recorded in this Report, that have been obtained in the vicinity of Livingston. There is no doubt that the coal here identified as No. 2, is the same seen throughout this

mining district, but note how the interval between it and the top of the pure limestone—the Newman—varies.

The Lee Coals of the Cumberland River and South Fork Regions.—Leslie, in his Report previously referred to, identified five coals in this region. Two of these were considered workable. All well classed erroneously as “Sub-Conglomerate.” He also refers to a coal in the vicinity of the Rockcastle river, which we considered to be above the Conglomerate and hence belonging to the “true coal measures.” This is doubtless but one of the five coals previously enumerated, only in this case an additional lens of sandstone has intervened.

Prof. Crandall enumerates six coals in the Cumberland and South Fork Region as belonging to the “Rockcastle Series.” Three of these he considered workable. These would be, counting from the base of the Lee upward, his Nos. 2, 4 and 6.* In this report they will be given the Numbers 1, 2 and 3, and openings on these coals will be designated in the Lee as they are on the map, by crosses accompanied by the appropriate number. Corresponding names for these seams are the Hudson, Beaver Creek and Barren Fork, respectively. Mr. L. N. Taylor in his examination of the coals of Pulaski county during the summer of 1906, placed two more coals in the Lee above the Barren Fork, but in so doing he reckoned the Cumberland Falls Station, Cogar, and Williams Siding Coal as some 50 feet above the Barren Fork. Crandall identifies all these coals as the same and also includes the Beaver Creek in the category. Crandall is wrong in the last instance, but undoubtedly right in his first correlations above.

In a section along the line of the Cincinnati Southern Railroad made in 1901, the writer enumerated eleven coals

*It should be understood, however, that Prof. Crandall, knowing the vagaries of “Inter-Conglomerate” coal beds, did not really give numbers to such beds. See Appendix.—C. J. N.

(counting all that were three inches and upwards,) between Alpine and Barren Fork Station.

The main coal exposed from Cumberland Falls Station to Barren Fork is the No. 10 of this Series. No. 11 is the thin coal seen a short distance above 10 at the tunnel cut just south of Cumberland Falls Station.

The Coals in the Cumberland River Region of Pulaski County.

Lee No. 1 Seam (The Hudson Coal).—This is the most persistent coal or group of coals (for it is frequently split up) in the conglomerate measures. There are few places along the western border of the Eastern Coal Field in Kentucky where some trace of this coal may not be found a short distance above the top of the highest limestone. Outside of the Cumberland river and South Fork Regions, however, it is generally thin, seldom showing over 24 inches of coal free from any partings. And what in one opening is a thin parting of a few inches scarcely interfering with the commercial mining of the coal may in a short distance thicken up to several feet, so that neither of the two thin seams here can be economically mined at all.

For instance, at the old McKee opening on the Cumberland, a short distance below the mouth of the Rockcastle, there is shown 63 inches of coal with a 25-inch shale parting 37 inches from the base, while at Rockcastle Springs, about four miles up the Rockcastle from the mouth, this parting has increased to about 30 feet, and the aggregate thickness of the coal in the two benches has decreased to 39 inches. In other places the coal may show a division into three seams, and perhaps even more. The height of this coal above the base of the Coal Measures may vary from as great as 100 feet in the southern portion of the district covered by this

report, to almost zero in the northern part. The quality of the coal is generally excellent.

Probably the earliest opening upon this seam where mining was carried on for commercial purposes in the days of attempted river transportation for these "Cumberland River Coals," was on the south bank of the Cumberland river in A 19-56. This was known as the "Hudson Mine." The level of the coal is here 30 feet above the river and shows at the entrance 34 inches of coal under shale. It is reported to be a "double seam" further back. It was also opened across the river at about the same elevation. It passes below drainage about the mouth of Laurel river in A 18-57.

Further down the river, beginning about one mile below the mouth of the Rockcastle, and extending to the mouth of Addison branch, this seam had formerly many openings made upon it. The hazards of river navigation, chief among which were those of Smith Shoals, caused exploitation of these mines to become unprofitable and it was abandoned. Some of the more celebrated of these mines were the Edwards in about A 22-58, thickness of coal 34 inches, the McKee already referred to in A 23-59, thickness 88 inches with a 25-inch parting 26 inches from the base; and the Boyer near the mouth of Addison branch in A 26-58.

Aneroid measurements give 100 feet as the height of the McKee opening above the top of the Yellow Pennington Limestone, and 165 feet as the height above the Cumberland river. Lesley, in his Report gives the height of the McKee opening above "the limestone" as from 80 to 93 feet.

Prof. Crandall gives the analyses of this coal from the Edwards and McKee Mines as follows:

	Edwards.	McKee.
Moisture.....	3.40	2.80
Volatile combustibles	34.40	33.80
Fixed carbon	57.20	53.60
Ash	5.00	9.80
Sulphur .....	.687	2.58

An opening was also made on this coal on the south side of the Cumberland River in about A 27-58.

Lee No. 2, or the Beaver Creek Seam.—Like the No. 1, this was also formerly much worked along this part of the Cumberland river in Pulaski county, where it was reckoned as the main seam. More recently the seam was worked at Beaver creek, but at present the mines here have been abandoned. At entry Number One, Beaver Creek Mines, the thickness of the coal is 48 inches; at entry Number Two, 46 inches. An average of four analyses made of samples collected from different entries and different parts of the seam gives the following:

Specific Gravity.	1.358	
Moisture.....		2.8
Volatile combustibles.....		34.09
Fixed carbon.....		52.88
Ash		11.84
Sulphur		2.85

This seam has been opened on nearly every branch flowing into the Cumberland between the "Big Bend" and the mouth of Rockcastle river. It has also been opened on the banks of the Cumberland itself in this stretch and also farther up. It goes under drainage on the river at the mouth of Dog Slaughter creek in A 19-52. This is in Whitley county.

Prof. Crandall made this No. 2 coal his No. 4, counting thick and thin alike, and estimated it as coming 70 to 90 feet above No. 1. Lesley also made it No. 4 in the series, and placed it 65 feet above the "McKee Seam" or No. 1. Among the more celebrated mines located on this seam and worked in the palmy days of Cumberland River Coal Mining and Transportation, may be mentioned the Rayburn "Slipup," situated on the "Big Bend" of the river in A 27-59, thickness 40 inches. The Addison branch in A 26-59, thickness 54 inches, the Huling in A 27-57, thickness 42 inches; the

Dolin in about A 25-59 near head of Little Lick Branch; the Doyle, the exact location of which is unknown to the writer; the Brown-Owens located by Talbutt, who collected samples of the coal, as "two miles south of the Cumberland River and nine miles from Rockcastle Springs," and finally the Curd, 38 inches thick in A 18-56. The latter mine is in Whitley County.

Other openings have been made on this coal in A 25-57, near the head of Big Lick Branch, and on Big Branch in 26-59.

South of the Cumberland the south and east dip rapidly carries this coal below drainage and it is not known in the district east of the Cincinnati Southern and south of the Beaver Creek Mines.

The analyses of the No. 2 coal from most of the foregoing openings are as follows:

	Beaver Creek.	Rayburn Slipup.	Addison Branch.	Brown- Owens.	Doolin.
Moisture	2.8	2.00	2.40	2.40	2.00
Volatile combustibles ...	34.09	34.00	35.60	36.79	35.30
Fixed carbon	52.38	55.20	54.40	50.24	52.94
Ash	11.34	8.00	7.60	10.60	9.78
Sulphur	2.877	1.20	1.70	2.494	3.565
Specific gravity	1.358			1.357	1.367

In going south on the Cincinnati Southern Railroad, the No. 1 coal shows up at Alpine, the point where the road enters the great Eastern Coal Field. It is here split into two seams and not workable. Crandall estimates the height of the Alpine Coal above the Chester Limestone as from 50 to 60 feet, but the real coal worked at Alpine is Number 2, and is higher up than that.

Along the South Fork of the Cumberland, this No. 1 coal has been opened at a number of places. The highest up recorded by Crandall is at Big Creek in A 32-48, and extending from there to the Devil's Jumps in A 32-41. At the latter

place it is the lower division, 30 inches thick with analyses as follows:

Moisture	1.50
Volatile combustibles	39.40
Fixed carbon	53.88
Ash	5.40
Sulphur	1.089

No. 1 is the lower coal now so extensively worked by the Stearns Lumber and Mining Co., with openings in A 32-41 and A 32-42. In the latter minute quadrangle they are situated near the mouth of the Worley and Stover branches, respectively, and are here 30 feet above the top of the Pennington Yellow Limestone—the same that a little farther down the South Fork is used in the manufacture of mineral wool. The seam in this region ranges from 49 to 56 inches. Crandall gives the accompanying section for the “Bryvan Coal” at the mouth of Worley Branch. My own measurements did not indicate a thickness of over 49 inches for this coal as at present mined.

An average of three analyses made from samples collected by Capt. Crozer, Mr. Thruston and Prof. Crandall and also an analysis of the coke, resulted as follows:

	Av. of Three Analyses	Coke
Moisture	3.00	2.10
Volatile combustibles	35.74	....
Fixed carbon	56.41	90.46
Ash	5.13	7.44
Sulphur .....	.797	.665

Prof. Crandall gives other measurements for this coal in the South Fork Region as follows: Near mouth of Rock creek (Wayne county), in A 23-43, 56 inches. “In the point of the ridge between Nigger and Big Creek, 54 inches in two benches, 31 and 35 inches, separated by 9 inches of shale. The lower 23 inches is a splint coal.

No. 2 in the South Fork drainage is found at its assigned horizon. It is the upper coal worked by the Stearns Mining and Lumber Company on Paunch Creek at Barthell, in A 31-41. Here it is 52 inches thick and closer to the top of the Pennington than usual, being here by aneroid measurement 80 feet above the top of the Pennington Impure Limestone. The same seam shows up near the heads of Worley and Stover branches in A 32-42.

Farther up the South Fork, at the Devil's Jumps, this coal analyses as follows:

Moisture.....	.90
Volatile combustibles.....	39.86
Fixed carbon.....	47.30
Ash.....	11.90
Sulphur.....	3.741

Bryant reports this seam exposed from point to point along the South Fork all the way up to and beyond the state line, and particularly in A 31-40 and 33-37.

Northward from the Stearns openings on this seam, it is reported by Crandall as probably the Wilson on Little Indian Creek, somewhat beyond the limits of the map accompanying this report, and according to Bryant it is the coal at present worked at Alpine.

An analysis of a coal from Alpine, whether of No. 1 or No. 2 does not appear, is as follows:

Moisture.....	1.40
Volatile combustibles.....	36.20
Fixed carbon.....	56.80
Ash.....	5.80
Sulphur.....	1.043

**Lee No. 3 (the Barren Fork Seam) in Pulaski and Whitley
Counties South of the Cumberland River.**

This seam occurs above the "Big Conglomerate Ledge," and where typically developed, is about two hundred feet above the Beaver Creek Seam.

In going south along the Cincinnati Southern Railroad, it is first met with at the first tunnel cut south of Cumberland Falls Station. It is here at track level and 36 inches thick (39 according to Crandall, with 18 inches above separated by 8 inches of clay shale) There is a thin streak (about 4 inches) 40 feet higher up, which may represent what Mr. Bryant considers a "split" from the No. 3, and which Mr. Taylor refers to as the upper coal opened, but never worked, at Flat Rock Station, further south.

This Barren Fork coal really first shows near the line of the Railroad at Greenwood, where it is above track level.

The seam dips rapidly to the southeast; so that in consequence of this and the rising of the grade of the railroad, when Barren Fork is reached, the mine openings are, according to Prof. Crandall, 150-180 feet below track level. The elevation of Cumberland Falls Station is 1,240 A. T. and Barren Fork Station about 1,260. This gives a dip of 120 to 150 feet in these four miles, or about 32 to 37 feet per mile.

As mined at Williams Siding in A 30-50, it is 42 inches thick (according to Mr. Taylor), as measured by the writer in the Railroad cut, 36 inches. The same seam is mined between here and Barren Fork, at Stations Cogar and Flat Rock.

At Barren Fork mines, where this seam has been extensively worked, it ranges in thickness, according to Crandall.

from 32 to 36 inches. Mr. Taylor gives 36 inches as the thickness at the "New Mine."

Eastward, away from the railroad, this seam has been opened at several places on Barren and the Cogar Forks of Indian creek, as for instance, on Cogar Fork. It is here 27 inches thick and about 20 feet above drainage (180 feet below base of Corbin), and dips with the fall of the stream through A 25-49 and 24-48. Still further east in Whitley county, it may be found under a sandstone cliff above the one the Cumberland river flows over at the Falls. It is the thin coal about 60 feet above the river at the Falls. In going up the river from here it sinks to drainage near the mouth of Marsh and Indian creeks, in A 21-48.

The coal, which shows up in the bed of Marsh creek about two and one half miles from the mouth and in the bed of Hens Nest creek, a little above its junction with Marsh creek, both exposures being in A 22-47, is also this Barren Fork Seam, according to Mr. Bryant, but Mr. Taylor thinks this to be a higher seam—the Upper Flat Rock Coal. The real Barren Fork Seam, according to the latter, is the one exposed in the bed of the creek just above the mouth of Brush, in A 22-47. He estimates it to be 60 inches thick here.

	Greenwood	Barren Fork	Barren Fork	Barren Fork
Moisture	2.50	1.54	2.32	2.12
Volatile combustibles	36.20	33.80	32.48	31.56
Fixed carbon	52.10	58.26	59.10	59.02
Ash	5.80	6.40	6.10	7.30
Sulphur	2.601	1.54	1.079	1.878

**The Lee Coals North of the Cumberland River in Pulaski,
Whitley and Laurel Counties.**

No. 1 Seam.—Northward from the Cumberland river and still in Pulaski county the No. 1 or Hudson Seam, can be easily traced into the Buck Creek Drainage. It shows at the cross roads known as Poplarville in A 27-2. Near the head of Baker Hollow, in A 30-3, it is 46 to 50 inches thick with the typical clay parting of the McKee opening. It is here about 80 feet above the nearest outcrop of Newman Limestone. Near Colo P. O., in the other prong of Baker Hollow, in A 20-5, it is 34 to 40 inches thick, with a 5-inch clay parting.

West of here, in the Pitman Hills, beyond the limits of the map, this same seam has been opened along with No. 2 above it. On the East side of Buck creek, in 25-9, there is a coal 50 feet above the top of "The Limestone," probably Newman, which may represent this seam. Other coals in the neighborhood are reported by Taylor as respectively 75 and 175 feet above "The Limestone." It is not easy to properly place all these coals, but the lowest one is certainly the Hudson.

At the head of Price's Valley, in 21-10, is an opening on a coal reported to be three feet thick, which is probably the Hudson seam, and near Public P. O., in B 24-11, may be seen the bloom of three coals in the road distributed through a vertical distance of 25 feet, which is the same seam in a split-up condition. The lowest is 35 feet above the top of the Pennington. Near Old Dallas P. O., on a knob, which is an outlier of the Lee, in B 29-11, Peter Brady's place, this coal is 18-20 inches thick and about 80 feet above the top of the Newman Limestone.

No. 2.—This seam is also present in the Buck Creek Drainage. Its presence westward in the divide between Buck and Pitman creeks has already been referred to. The thin coal in A 25-8, given by Mr. Taylor as 125 feet above the (Newman?) Limestone, may represent this coal, though it may be the thin seam that is due a short distance below No. 2.

The higher coal in A 30-3 is probably this seam, and also the 24 inch coal in A 30-7, near School House No. 88. Here it is 160 feet above the (Newman?) Limestone.

The No. 3, or Barren Fork Seam.—It is more than likely that the coal near the top of the ridge between the Rockcastle river and Buck creek is this No. 3.

At Mt. Victory (Mt. Starling), in A 25-2, in drilling a well, a coal was struck at the depth of 42 feet. The surface of the ground is here 1,200 feet A. T., and Mr. Taylor estimates that this coal must be 200 feet above the No. 2 Seam, exposed under the overhanging cliff of the great Rockhouse near the head of Bear creek about one and one-half miles south.

The 46-inch coal on the land of Mr. Clonts, in 23-8, is about 225 feet above the top of the nearest (Newman?) Limestone, and the four-foot coal in 24-8 is about the same distance above this datum line, and hence both are provisionally assigned to this No. 3 horizon.

Rockcastle Drainage in Pulaski County.

In going north along the Rockcastle river, in Pulaski county, the No. 1 Seam shows as two seams at Rockcastle Springs with an interval of 30 feet between. The lower is 22 to 25 inches thick and has been opened for hotel use. The upper is 14 inches thick. Across the river at the ford where the London road crosses and hence in Laurel county, the same two coals show their bloom, and near by, on land of Joe Wells, in

A 19-1, on the Laurel side, an opening has been made on one of them where it shows 18 inches. A short distance above here this coal horizon falls below drainage, and when it should next appear in about A 20-3, as the result of the rising of the formations, the coal itself cannot with certainty be recognized, nor do we again find undoubted No. 1 until the mouth of Line creek is passed.

The No. 2 Seam is exposed near the head of Bear creek in A 23-1, under an overhanging "rock house" cliff. Prof. Crandall gives its thickness as 42 inches and its analysis as follows:

Moisture.....	2.40
Volatile combustibles.....	34.00
Fixed carbon.....	54.20
Ash.....	9.40
Sulphur.....	.467

Also upon the head of Little Troublesome, the next stream above Bear creek, in A 22-1, the same coal occurs with a thickness according to Mr. Taylor of 52 inches, the upper 10 inches being cannel.

Still on the Pulaski side of the river, at Sublimity, Prof. Crandall reports the seam, on the authority of Montrose Graham, to be 48 inches thick with the upper 18 inches a splint coal.

On the lower part of Beech creek and again in the same relative situation on Lick creek, tributaries from the west next above Sublimity, Mr. David Jones, of Mt. Victory, reports openings on what may be this coal. These are in about A 20-3 and A 20-5 respectively.

On a tributary of Big Clifty, in 21-7, Mr. Taylor reports a seam opened on Mr. Parkey's land which is 48 inches thick and apparently 170 feet above the (Newman?) Limestone.

On a tributary of Big Clifty, in 19-7, a coal is reported 36 inches thick, which may be No. 2. Still further north

in 19-9, at the falls of a south tributary of Little Clifty, is a trace of a coal under lowest cliff of the Rockcastle sandstone, which may be No. 2. It was on Mr. Gilmour's land.

On little Clifty itself, on land of Chas. Whitaker, in 18-9, this same coal shows up 30 inches thick by uncertain measurement. It is 20 feet below the base of the sandstone cliff.

A little below the mouth of Line creek and still on this same (Pulaski) side, about one mile below the mouth of the creek, in 18-10, is an impure slaty coal 12 to 24 inches thick and close up under the same cliff of sandstone.

The Lee Coals of Whitley County East of the Cumberland and South of the Laurel River.

No. 1.—No openings have been made on this seam, as it is below drainage here.

No. 2.—The only opening on this seam is near the mouth of Devil creek in A 19-54.

No. 3.—This seam shows near water level on the Cumberland opposite the mouths of Marsh and Indian creeks in A 21-48, and again further down the river up a small tributary coming in from the north in A 21-50.

The coal exposed well up in the courses of those tributaries flowing into the Cumberland from the east in the northward stretch of the river between Cumberland Falls and the mouth of the Laurel river, is probably this seam. Mr. Bryant locates the seam on both Dog Slaughter and Bark Camp creeks in this district.

The Lee Coals of Laurel County.

No. 1 has been opened in A 19-57, across the river from the Hudson Mine, and the Joe Wells opening at the ford of the Rockcastle river in A 19-1 has already been referred to. These are about the only two openings on this seam in this end of the county. In B 16-13, not far from Andrews P. O., on land of Robert Bustle is a coal 25 inches thick which may be No. 1.

On Hazel Patch creek in the vicinity of Hazel Patch station, a number of openings have been made on a coal occupying about the horizon of Number One, which here seems to be in a split-up condition. The lowest member shows up in B 13-14 at the mouth of Happy Hollow, and is here 20 feet above the stream. It is 28 inches thick. Further up the creek in B 11-14, on a small tributary from the south are two openings on J. McNeal's and Owsley's land which expose 26 inches of coal. This seems to be the upper member of No. 1. The same has been opened by the roadside in B 12-14 and worked to some extent, though not over 18 inches thick. Near by on Wood creek the same seam has been opened in B 12-14 on the Owsley-McNeal land where it shows 36 inches of coal. This is as far north in Laurel county as openings on this seam have been noted.

No. 2.—The most southerly opening on this seam in Laurel county is that reported by Prof. Crandall as being near Vox P. O. on Craig creek. The writer identifies this as the one he saw in the bed of the creek in about A 15-59.

Prof. Crandall gives its thickness as 51 inches and its analysis as follows:

Moisture.....	1.70
Volatile combustibles.....	83.50
Fixed carbon.....	57.20
Ash.....	7.60
Sulphur.....	1.785

On Sam's Branch west of the Craig Creek Opening and in A 16-59 is a coal 24-25 inches thick under a Sandstone Cliff, which may be this coal or else a thin seam next above it. It is found exposed on lands belonging to J. C. Clark, James Godwin and Green Steel.

Mr. Reuben Morgan, who lives on Cane creek in A 16-3, reports four distinct seams of coal exposed in the drainage of this stream; the lowest is in the bed of the stream near the mouth, the second under a sandstone ledge in bed of creek at the forks, the third under the topmost cliff of Rockcastle in A 16-3, and the fourth under the Corbin Cliff. The second of these is probably No. 2.

A thin coal in A 17-6, in the River Hill, may represent No. 2, also the one in 17-6 a short distance below the mouth of Sinking creek. It is here 15 feet below the Rockcastle Cliff. In 17-10 on Line creek near the mouth the same coal is opened close up under this sandstone cliff. It is here 23-25 inches thick. At this point the massive conglomerates, so characteristic of the Lower Rockcastle, suddenly disappear and nothing like them can be seen along the river until Livingston is reached.

On Hawk creek, on land of Unthank Jones, in B 13-11, about 6 feet above branch level is a seam reported to be 48 inches thick. This is probably Seam No. 2. Also near the head of Wood creek, on the Owsley-McNeal land, in B 12-12, is an opening showing 48 inches, the lowest 36 inches being clean coal. This has pyrite kidneys in it very like those so frequently found in No. 2 of Pulaski county and seems to be at about the same horizon. It is first seen higher up on the creek than where the Rockcastle Lentil is developed, but the same seam has been opened further down, in the stretch where the Rockcastle thickens up into massive hemlock covered ledges, and still lower down where they

disappear altogether, as in B 12-14. All these openings are on the large Owsley-McNeal tract of land comprising about 1,000 acres. On Happy Hollow Branch, a southward flowing tributary into Hazel Patch, in B 12-16, is an opening on a thin coal which may be on this seam. Much further up the river, near the ford where the Old Wilderness Road crosses, is the bloom of a thin coal about 40 feet above the water and 35 feet below the base of the Rockcastle Sandstone, which may be this seam.

No. 3.—The coal that Prof. Crandall describes as showing near the mouth of Cane creek at the Winding Stair Gap and correlates with the Hudson Seam, Mr. Bryant says is the Barren Fork Seam. The bloom of this coal can be seen going up from the Rockcastle river at the ford on the London Road in A 19-1. It is here under the second prominent sandstone cliff and is 250 feet above the river.

Prof. Crandall gives this coal as showing 42 inches with a 9 inch clay parting, 8 inches from the top. His published analysis is as follows:

Moisture	1.80
Volatile combustibles	36.40
Fixed carbon	56.00
Ash	5.801
Sulphur	1.650

On land of Reuben Morgan, in A 14-13, valley of Cane creek, under uppermost cliff of Rockcastle, and 30 feet above the stream, is a 15-inch coal which appears to represent this No. 3 Seam.

On land belonging to Mary Bryant, in 13-6, valley of Sinking creek, under uppermost cliff of Rockcastle, and 30 feet above the stream is a 38-inch coal which also seems to belong at about the same horizon. Also on Mr. W. M. French's land in B 16-14 is a 36-41 inch coal probably best correlated with this seam.

No more exposures that could be correlated with the No. 3 were found in passing up the Rockcastle river in this county, until a short distance below where the Lee passes below drainage.

Here we have in B 5-18, on both sides of the river a 35-38 inch coal exposed only 8 feet above the ordinary stage of water. There is a 25 to 35 foot massive sandstone above. The opening on the Laurel side of the river is on Harvey Cornelius' land.

Rockcastle County—Rockcastle Drainage.

No. 1 Seam.—Quite near the margin of the Coal Field, on Joseph Bullock's place in B 22-14, is a coal 27 inches thick and 30 feet above the top of the Pennington, which appears to be No. 1. It is on the south side of the Kinkead Ridge in the Line creek drainage. On the same ridge and further out toward the margin of the Field is an opening on Mr. W. T. Evans place showing 14 inches of coal 60 feet above the Newman Limestone. The Pennington may possibly be here under cover. In which case the seam would be near enough to the base of the Measures to be correlated with No. 1. On Buffalo creek in the southern portion of the county there is an opening on a thin coal in B 19-13, which may belong to this horizon, though by uncertain measurement it is 140 feet above the top of the Newman Limestone.

Further north in the Skaggs Creek Drainage, in the ridge between East and Dry Forks of the stream, there is a seam which has been extensively worked for neighborhood use and to supply Mt. Vernon. It is provisionally correlated with No. 1, though if the Newman Limestone is here the top member of the Mississippian, it places the seam rather high up above the base of the Coal Measures. There is a strong probability, however, that the Pennington is here present

under cover. One of the characteristics by which this coal may be identified throughout the district is its "cannel slate" roof.

On Mr. O. Niceley's land in B 22-17, it is 36 inches thick under 6 to 8 inches of cannel slate and 80 feet above the top of the Newman Limestone.

In B 21-17 there is an opening on land belonging to the Ralph heirs.

In B 21-17 there is also an opening on land belonging to Wade Graves which is 85 feet above the Newman Limestone. It is here 45-50 feet inches thick including 20 inches of a combustible cannel slate on top.

In B 21-19, on Buck Cummin's land, it is 37 inches thick with 12 inches of cannel slate on top. Its height above the Newman Limestone is about 100 feet. Twenty feet below the seam is a prominent sandstone, which may represent the Livingston Conglomerate.

On John Marler's land, in B 22-19, the opening on the seam shows 20 inches of coal with 8 inches of cannel slate above.

At the head of Dry Fork, an outlier of the Coal Measures occurs in B 22-19. An opening has been made here on a coal about 50 feet above the Newman Limestone.

No. 2 Seam has not been identified with certainty in the lower part of Rockcastle county, but it is somewhat probable that:

No. 3 is the coal opened on J. L. Cooper's land in B 18-11 at head of a small branch flowing into the Rockcastle river. It is 41 inches under shale and 235 feet above the top of the Pennington.

Roundstone Creek Drainage—Mainly.

No. 1 Seam was formerly much worked in vicinity of Livingston. There are few openings on it there now. It is here a double seam with a 6 to 18 inch clay parting.

By the side of the Mt. Vernon-Livingston Road in B 14-18 it shows up 51 inches with a 15 inch clay parting. It is here 35 feet above the top of the nearest outcrop of Newman Limestone. This mine belongs to Mr. Henry Owens.

In B 14-19 the seam has been opened by the roadside at Cal Mullins, showing 28 inches of coal exclusive of a shale parting 6 to 18 inches thick.

In B 15-19, by the roadside (road to Pine Hill) the same coal is opened 36 inches thick and 35 feet above the Newman Limestone.

Analysis of the coal (No. 1 Seam?) from the "Grisham Mine" near Livingston:

	Upper "brashy" two feet.	Lower 9 inches Block Coal.
Moisture.....	2.20	2.10
Volatile combustibles.....	35.86	39.50
Fixed carbon.....	54.94	49.86
Ash.....	7.00	8.54
Sulphur.....	4.302	2.933
Specific Gravity.....	1.327	1.374

On Piney Branch of Roundstone creek there are a number of openings on coal at this No. 1 horizon as well as on the one next higher.

To No. 1 must be assigned the 36 inch coal opened near the head of branch on Jeff. Lovel's place. This is in B 19-20, 40 feet above the Newman Limestone.

In the same minute quadrangle on E. W. Hansel's place, near the Livingston Mt. Vernon Road, is an opening now fallen in in which the coal was 65 feet above the Newman Limestone.

Not far from Mt. Vernon at a school-house in B 20-21 on this same Mt. Vernon-Livingston road is an old opening now fallen in, and in B 20-22 still nearer Mt. Vernon, is an opening on a very thin coal, which is 40 feet above the top of the Newman Limestone.

At Pine Hill near the Forks of the two prongs of Piney Branch in B 17-20, there has been considerable development of coal and clay. Three coals show in this section, the lowest 45, the middle 70 and the top one 200 feet above the top of the Newman Limestone.

The two lower coals belong to the No. 1 horizon. It is the upper division of No. 1 which is the main clay seam here. This shows 10 feet of clay with a 12 inch coal seam 4 feet from the base and a 2 to 4 inch coal on top. An analysis by Dr. Robert Peter in 1875 indicated that it contained of alkalies, potash 3.083 and of soda .524 per cent.—too much according to Dr. Peter to permit of its being a refractory clay. It seems admirably adapted, however, for compounding with limestone to make Portland cement.

The only other openings examined in Rockcastle county, which were made upon a coal seemingly belonging to this horizon, were on the waters of Crooked creek in B 11-23. One of these, 65 feet above the Pennington and reported 38 inches thick, is on the land of John Solomon, and the other in Barnett Valley on Albert Allen's land is 30 inches thick and 45 feet above the Newman Limestone.

No. 2.—This is the coal that has been most worked in recent years about Livingston. In the hill slope to the west of the town the old openings now fallen in were on a coal at this horizon. These are in B 14-18.

Across Roundstone creek, in B 13-19, is an old opening 70 feet above the top of the Livingston Conglomerate.

Across the Rockcastle river, but still in Rockcastle county by reason of the boundary taking a short cut across the narrow portion of the big bend in the river instead of following it, are the openings of the New Livingston Coal Co. A tram car line operated with electricity connects the mine with the railroad at a point just across the river from Livingston. The coal is 32 to 40 inches thick and about 120 feet above the top of the Livingston Conglomerate here 20 feet above the river.

Near Sinks, this seam is 24-25 inches thick and 110 feet above the top of the Newman Limestone, which here has abundant Pentremities in it and is therefore probably Ste. Genevieve. The Livingston Conglomerate here rests almost directly upon this Limestone. This is in B 15-21.

At Pine Hill the upper and main coal seems best identified with this coal, though it is 200 feet above the base of the Coal Measures, and might possibly be No. 3. It is 28 to 30 inches thick.

On Brush creek at the mines of the Big Hill Coal Co., now abandoned, in B 16-24, this seam is 175 feet above the top of the Newman Limestone, which is here closely succeeded by about 25 feet of Livingston Sandstone. About 24 inches of coal shows at the entrance, but in other portions of the ridge, as for instance in B 14-26, it reaches nearly 6 feet. On the Crooked creek side at L. J. Scott's it is 110 feet above the water. There is a 25 to 35-foot massive sandstone above. The Newman Limestone and is 48 inches thick. In the ridge between Brush creek and Roundstone creek there are old openings indicating the presence of the coal there about 50 feet below the top of the ridge. The position of some of these openings is indicated in B 17-24 and 25.

Trace Branch Tributary to Rockcastle River.

On Jack Sam's place in bed of the Branch in about B 11-20, is a coal which may belong to No. 2 or No. 1. It is reported 34 to 35 inches thick. Sullivan correlates it with the "Spievy Coal." It is here about 25 feet above a sandstone which looks like the Livingston. On Mr. Wm. Brummet's place in B 12-19, the same seam is 16-18 inches thick and 25 feet above the same sandstone.

In the older Chemical Reports of the Kentucky Geological Survey are analyses of Rockcastle county coals which probably belong to the No. 2 Horizon.

They are as follows:

	Myzner and Myer's Bank, Livingston Entry No. 1 (Crandall.)	Myzner and Myer's Bank, Livingston Entry No. 2 (Crandall.)	Crooked Cr. Coffee Br. 36 in. thick. (Sullivan)	"Spievy Coal" near Livingston, 33 in. thick and 84 feet above the Limestone. (Sullivan)	Tarlton Clarks on Brush Cr. 4½ mi. from mouth 52 in. thick and 85 feet above the Limestone. (Sullivan)
Sp. gr	1.318	1.357			
Moisture	3.00	2.20	3.80	4.20	4.40
Volatile combustibles:...	36.66	36.50	31.00	33.70	31.00
Fixed carbon	51.94	51.70	56.20	55.90	60.20
Ash	9.40	9.60	9.00	6.20	4.40
Sulphur	2.205	4.802	0.412	0.968	0.494

JACKSON COUNTY.

Mr. Geo. Sullivan in his report on Jackson county enumerates four coals averaging respectively about 15, 30, 45, and 55 feet above the "Limestone," which probably all refer to Number 1. He also enumerates four more coals above these which he places respectively 75 to 95, 120 to 160, 185 to 215,

and 250 feet above the "Limestone." Some of these are very thin, and it is probable that the workable seams may be reduced to one and the same coal—the Number 2.

Horse Lick Drainage.

No. 1.—The lowest member of this group is generally a cannel here. On Horse Lick itself, near the mouth of Raccoon in B 7-23, this portion of the seam shows 6 inches of cannel over 12 inches of common coal. According to Mr. Sullivan it rests directly upon the Chester (Pennington?). About one-half mile above this, on the main stream, on land belonging to Dave Jackson in B 7-24, this same coal is 35 inches thick and 20 feet above the Yellow Pennington Limestone. This is evidently the "Jack Carpenter" coal of Mr. Sullivan, estimated by him to be 36 inches thick and 15 feet above the Limestone. The same seam, where it shows the cannel phase, was formerly opened on Dry Fork of Horse Lick in B. 9-25. The land here is now owned by Judge Goodloe. It has not been worked for so long a time that the opening has completely fallen in. It is 10 feet above the (Newman?) Limestone, and seems to be the coal referred to in the Sullivan Report as the Ballard Cannel Coal 45 inches thick. This coal was formerly hauled to Richmond where it commanded a good price. On Horse Lick, about half way between its mouth and the mouth of Dry Fork on James Durham's land in B 9-22, is a seam 25 inches thick under 8-10 feet of black shale with a sandstone (equals Livingston?) above that. The seam is 10 feet above the average stage of the water. Mr. Sullivan refers to a coal on Phillip's Branch in about B 8-25, which he gives as 22 inches thick and 30 feet above the "Limestone." He also speaks of its being opened at Jack Jones' on Big Clover Branch, 21 inches thick and 15 feet above the "Limestone." The upper 13 inches is cannel.

On the old Judge Martin place, in B 10-27, there is a coal reported by Mr. Sullivan 35 feet above the "Limestone" and 30-36 inches thick. He also speaks of a coal on Dry Fork of Horse Lick which is 12 inches thick and 50 feet above the "Limestone."

The Geo. Privit opening, in about B 7-28 on Garden Hollow Branch of Big Clover, is 50-60 feet above the "Limestone" and shows a seam $30\frac{3}{4}$ inches thick with a one inch shale parting $23\frac{3}{4}$ inches from the base.

On Big Clover creek itself, Sullivan describes a coal on Mace Jones' land 45 feet above the "Limestone" and showing 52 inches of coal with a parting of $9\frac{3}{4}$ inches, 25 inches from the base.

Mr. Sullivan also reports an opening near Thos. Alcorn's store on Gravel Lick which is about 23 inches thick and 60 feet above the "Limestone." This is in about B 6-28.

Analysis of the foregoing Horselick coals.

	Jack Carpenter Coal B7-24	Ballard Cannel. B9-25	Mace Jones Coal.
Moisture	3.60	1.80	3.20
Volatile combustible.s...	33.20	42.40	32.10
Fixed carbon.....	56.80	46.60	51.70
Ash	6.40	9.20	13.00
Sulphur.....	.494	.645	.08

No. 2.—The openings and exposures which are most likely upon coal belonging to this horizon are as follows:

The stain at the Old Judge Martin place, 85 feet above the top of the "Limestone."

The 12-18 inch coal on Big Clover creek 50 feet above the Mace Jones No. 1, and 95 feet above the "Limestone."

The 17 inch coal on Sugar Camp Branch 75 feet above the "Limestone;" the Joes Lick Branch opening showing 36 inches of coal 200 feet above the "Limestone" (Sullivan); the Stone Coal Lick exposure in bed of branch in B 6-25 one

mile from the mouth and 200 feet above the "Limestone"; the opening in B 8-24 showing 25 inches of coal 170 feet above the "Limestone;" probably Mr. Sullivan's Spice Lick Coal 27 inches thick and 160 feet above the "Limestone;" the Si Carpenter opening on Dry Fork, 27 inches thick and 160 feet above the "Limestone;" the Rock Lick Branch of Big Clover creek opening, 30 inches thick and 150 feet above the "Limestone" (Sullivan); the Dry Branch opening in B 6-25, on land of the Thomas heirs, 31 inches thick and 145 feet above the "Limestone" (215 feet according to Sullivan); an opening on Gravel Lick Branch of Big Clover, 36 inches thick and 200 feet above the "Limestone" (Sullivan); and finally the Phillips Branch opening in B 8-25, about 20 inches thick and 130 feet above the "Limestone" (Sullivan).

The analyses of coal from four of these Horselick Drainage openings are as follows:

	Brock opening, Rock Lick Branch of Big Clover Creek	Joes Branch opening of Raccoon Creek	Dry Branch opening	Wells opening on Gravel Lick Creek
Moisture	1.70	1.70	1.80	3.20
Volatile combustibles.....	35.10	37.60	42.40	32.80
Fixed carbon.....	58.56	49.10	46.60	55.80
Ash	4.64	11.60	9.20	8.20
Sulphur.....	.824	2.307	.645	.782

Middle Fork Drainage.

No. 1.—In B 1-23, on Sugar Camp Hollow of Laurel Fork of Middle Fork of Rockcastle river is a 24-inch opening, which probably belongs to this No. 1 coal horizon. This is on the land of the Rockcastle Timber Oil and Mining Company.

In B 1-27, on Birch Lick of Indian creek, on land of Dan Morris, is an opening at horizon of No. 1, which is re-

ported 40 inches thick. A number of openings have been made on this coal up Birch Lick, as for instance on land of Doc. Morris, is an opening at horizon of No. 1, which is reported coal, 65 feet above the Newman Limestone, and on land of W. M. Morris in B 2-28, 45 feet above the same Limestone.

What is probably the same coal has been opened one-fourth mile up Stone Coal Branch. It is here 28 inches thick.

Mr. Sullivan estimates these openings to be 30 feet above the "Limestone." He also refers to an opening on Hurst Branch of Birchlick in about B 3-29 at the same elevation as the last. It shows a thickness of 23 inches.

On Bills Branch of Indian creek, near McKee, Mr. Sullivan locates an 8-12 inch coal at a distance of 15-20 feet above the Chester (Pennington), which he takes to be the equivalent of the Horselick Cannel Seam.

Lower down on Indian creek, near the mouth of Outen Branch, in B 3-26, are two openings, one on the east side of the creek on Jake Gabbards', and the other on the west side on John Roberts' land. These show a thickness of 38 inches. The height above the Newman Limestone is about 75 feet. Mr. Sullivan estimated the height at 90 feet. He ranks this as the 5th coal in the series, but it probably belongs to No. 1.

The analysis of this coal from samples collected near the outcrop is as follows:

Moisture.....	4.60
Volatile Combustibles.....	27.30
Fixed Carbon.....	58.10
Ash.....	10.00
Sulphur.....	.522

No. 2.—In the Indian Creek Drainage of Middle Fork this coal has been opened on Mr. Isaacs' place on May-apple Branch of Birch Lick in B 4-28. It is here 200 feet above the Newman Limestone and about 130 feet above No. 1, opened on the same branch.

On Bills Branch of Indian creek above McKee, on land of John Lanceford in B 60-28, is an opening reported four feet thick, but it is almost certainly less. It is 65 feet above the bed of the branch below and 145 feet above McKee, which place is about at the top of the "Limestone." This opening is probably the same as Mr. Sullivan's "Dickson and Harrison Bank", which he estimates to be 36 inches thick and 95 feet above the Chester (Pennington).

On the west prong of Indian creek, about one mile from the mouth at McKee and in B 60-27, is an opening on land of Mrs. Hignite which shows 28 inches under shale and over clay. Another nearby opening shows 26 inches. This is about 115 feet above the top of the "Limestone," reckoning the top of the Limestone to be at McKee. This is probably the opening which Mr. Sullivan estimates to be 125 feet above the Chester (Pennington).

On Mash Branch near the head of Birch Lick, Mr. Sullivan refers to a coal 29 inches thick which is 150 feet above the "Limestone."

Below is an analysis of coal from the Dickson-Harrison Bank:

Moisture.....	3.40
Volatile combustibles.....	36.60
Fixed carbon.....	57.70
Ash.....	6.30
Sulphur.....	1.648

As other openings on a coal in the Rockcastle Drainage which may be No. 2, may be mentioned one exposed in bed of Robinson Branch in B 8-21, and on Mill Creek about one third of a mile from its mouth where it empties into Laurel Fork. The latter is in B 60-24 and is 22-24 inches thick. It is 60 feet above Laurel Fork.

Station Camp Creek Drainage.

No. 1.—One of this group of coals has been opened in this drainage at a height averaging about 50 feet above the base of the Lee Formation.

On the Big Hill Ridge at the head waters of Silver, Clear and South Fork of Station Camp creeks where the counties of Jackson, Madison and Rockcastle join, a number of openings have been made on this seam, and formerly considerable coal was mined and shipped out by wagon to Richmond. At Andy McGuire's Coal Bank in B 14-32, a little over the line in Rockcastle county, the seam is 34 inches thick and 30 feet above the Newman Limestone. The top six inches is a cannel shale. At the old Cox opening on Big Hill, about 45 feet above the "Limestone" (Sullivan), it is 36 inches thick.

The analyses of coal from this vicinity are as follows:

	Old Cox Opening	M. Moran Bank.
Moisture.....	2.66	1.90
Volatile combustibles.....	33.68	45.76
Fixed carbon.....	56.16	44.86
Ash.....	7.60	7.48
Sulphur.....	.824	2.888

West of here, in Bear Knob in Madison county, in B 16-32 and 33, this coal shows up 40 feet above the top of the highest Newman Limestone.

In B 12-32 and 13-32 there are a number of old coal openings by the side of the Berea-Clover Bottom road. These are now fallen in and the thickness could not be obtained.

On land of Mr. Curtis Lane, in B 10-32, this seam is by aneroid 55 feet above the top of the Newman Limestone (by hand leveling 68-78 feet).

On Mr. Ike Dean's place in B 10-31 the seam is 55 feet above the Newman Limestone. The opening is now fallen in.

On Mr. Dan Click's place, in B 9-31, it is 36 inches thick and 65 feet above the Newman Limestone.

In B 11-33 there is a bloom of an 18 inch coal, 55 feet above the Newman Limestone, which doubtless represents this seam.

On Mr. Jones' land in B 8-32 the seam is 40 feet above the Newman Limestone and 23 inches thick. Here it is overlaid by about three inches of cannel shale.

On Lafe Williams land, in B 8-32, there is a seam 90 feet above the Newman Limestone and 24 inches thick, which may be this coal or the one next above.

On Mr. Jas. Powell's place in B 7-33, just over the divide in the Red Lick Drainage is an opening now fallen in on a seam 92 feet above the nearest outcrop of Newman Limestone and 62 feet above a pebbly sandstone which looks like it must be the Livingston Conglomerate. This seam may be No. 2 instead of No. 1.

There is a strong probability that all of these openings are upon the same seam, though the last two may be on the one next higher.

On Cavanaugh creek, a tributary of South Fork of Station Camp from the south near the mouth of the latter on land belonging to Elihu Lakes in B 58-31 is an opening on a seam 36 inches thick at the entrance and 35 to 40 feet above the top of the Newman Limestone. The upper 12 inches of this seam is cannel. On Turkey Foot Branch of War Fork of Station Camp on land of Thomas heirs in B 55-28 is an exposure formerly worked that seems to be about at the same horizon as the previously described coal. Mr. Sullivan reports a coal near the head of Turkey Foot Branch which may be the same coal or the one next higher. He gives it as 41 inches thick and 75 feet above the "Limestone."

The analysis of this coal is as follows:

Moisture.....	4.40
Volatile combustibles.....	36.60
Fixed carbon.....	55.90
Ash.....	3.10
Sulfur.....	1.098

It is very doubtful if any Lee coal higher than No. 2 can be identified in Jackson county, though the 35-38 inch coal already referred to as opened on both sides of the Rockcastle river in B 5-18, and the 12 inch coal described by Mr. Sullivan as exposed on Mr. T. J. Ballard's place by side of the old State Road at the top of the ridge in about A 10-26, may represent the Barren Fork Seam. The height of the latter exposure above the Newman Limestone is 250 feet.

ESTILL COUNTY.

Very little coal bearing strata occur in this county. This is because the rapid westward rising of the strata along the margin of the Field has permitted denudation to remove the Measures from all but the tops of the highest ridges.

These consist exclusively of the Lee Formation, to which in this region a maximum thickness of 350 feet may be assigned. This thickness is attained only along the eastern border of the county, where there are normally developed in it two massive sandstones. The lower one is from 10 to 25 feet thick and usually about 85 feet above the base of the measures. It is non-pebbly. The upper may reach a thickness of about 150 feet with the base of it 80 to 100 feet above the top of the Lower Sandstone. It is invariably conglomeritic.

Only one coal, the No. 1, is certainly known to occur in this county. Its farthest western exposure is in C 3-38 (Richmond Quadrangle), on land of John Adams, on

ridge between Red Lick and headwaters of Drowning creek. It is here only about 20 inches thick and within 12 feet of the base of the Coal Measures.

The bloom of this coal occurs within 20 feet of the top of the Newman Limestone along the Dividing Ridge just east of the Station Camp creek, and was at one time opened in C 57-39 on Tom Lunsford's place. There is a bloom of a thin coal in C 55-37 on this ridge which may possibly mark the place of No. 2. It is here about 135 feet above top of nearest outcrop of Newman Limestone.

Joseph Lesley in the report which has been referred to, mentions the occurrence of this coal near the Estill Furnace and gives its thickness as 24 inches.

OWSLEY COUNTY.

A narrow belt of Lee marked by the outcrop of a massive sandstone, which seems to correspond to the Corbin, extends up Main and Little Sturgeon creeks nearly to the heads, and up South Fork of the Kentucky beyond the limits of the county, but no workable coals occur in it.

On Main Sturgeon near where Little Sturgeon joins it (Manchester Quadrangle 49-29) on Mr. H. G. Brandenburg's place is a thin coal (12-14 inches thick) in the middle of a sandstone cliff which marks the place of No. 2.

LEE COUNTY.

By rather striking coincidence, that portion of the Coal Measures which is so typically developed in Lee county, Va., also constitutes the leading formation for Lee county, Ky. In the western part of the county the stratigraphy is much the same as in the neighboring portion of Estill. The thickness is about the same (350 to 400 feet) and there are the same two sandstones with about the same interval between.

In passing eastward, however, into the drainage of Sturgeon creek, South Fork, and the two small streams, Crystal and Silver creeks, flowing into the Kentucky at Beattyville, they lose their massive and other distinctive characters (especially the conglomeritic for the upper sandstone) and become split up into a number of thinner lenses. This is particularly true in the region adjacent to Beattyville.

Eastward from the longitude of Beattyville there is a strong southeast dip which rapidly carries these different sandstones below drainage and the uppermost one finally disappears from view on the South Fork a short distance over the line in Breathitt county.

On the North Fork the top member of the Conglomerate Series remains higher above the level of the stream than at corresponding positions on the Middle Fork, and at the eastern edge of the Beattyville Quadrangle, which is over the line in Breathitt county, it is still a considerable distance above drainage. The pebbly character of the sandstones is also here quite pronounced.

No. 1 Coal.—South of the Kentucky River the No. 1 Coal has been opened in C 53-35 on Ross Creek, where it is 39 inches thick under black shale and about 20 feet above top of Newman Limestone. This is on Williams-Congleton land. Traces of this coal may be seen on Sturgeon creek, but it is very thin. The main coal here is:

No. 2 (Beattyville) Coal.—The No. 2 coal is generally known in Lee county by the name "Beattyville Coal." While as we have already noted the horizon of this coal occurs on this creek in Owsley county, it is not till the boundary line is passed into Lee county that this coal attains a thickness to make it commercially valuable.

In C 49-31 on land belonging to Judge Gourley this seam occurs just on top of the lowest sandstone cliff fronting the

creek and at an elevation of about 120 feet above the nearest outcrop of Newman Limestone. It is here 41 inches thick. The same seam shows up in bed of Stone Coal Branch in same minute quadrangle. Also in 50-32 on Upper Sinking creek near the mouth the seam is found 32 inches thick at the entrance and 130 feet above the Newman Limestone.

On Duck Fork of Sturgeon this coal has been opened in C 47-32 by the L. & A. Coal Co., who are constructing a branch road out to the Mines from Heidelberg. It is reported here as 42 inches thick, but the writer found the maximum thickness near the entrance to be 37 inches. It is here 40 feet above Duck Fork and 100 feet above the top of the Newman Limestone exposed at the mouth of the Fork. The southward dip here would increase this interval to perhaps 130 feet.

The coal goes under drainage a little above the forks of Duck Fork in C 46-32. It is here reported 38 inches thick. It has the same stratigraphical relations on Duck Fork as on Main Sturgeon, being just above a prominent sandstone, with another sandstone cliff some 30 to 40 feet high about 30 feet above this lower cliff.

Between the mouth of Sturgeon and where the coal passes below drainage of the Kentucky river a short distance above Beattyville, it is exposed and mined at the "Norman Mine" in C 44-34. It is here 100 feet above the Kentucky river. In the days of river transportation for this coal it was also mined at a number of points on the south side of the river between here and Beattyville, but, with the exception of the Norman Mine, all of these have been abandoned.

In the town of Proctor, the bloom of this coal shows in the road at an elevation above the river of about 100 feet.

In passing up the South Fork the bloom also shows from point to point till the coal finally passes below drainage in

about C 42-33. Prof. Joseph Lesley gives the elevation A. T. of the A. McGuire bank on the South Fork as 610.

A short distance above the bridge across the river at Beattyville old openings now fallen in indicate a height for the coal above the river of about 25-30 feet. This points to a sharp dip up stream from Proctor, and indeed a short distance further on the coal seems to have sunken beneath the river. Prof. Joseph Lesley gives the elevation A. T. of the "Todd bank on the Main River above Proctor as 680 feet."

North of the Kentucky River.

North of the Kentucky river, the No. 1 coal has been opened on the Right Fork of Contrary Creek in C 45-36. It is here 18 to 24 inches thick and 21 feet above the Newman Limestone.

In the drainage of Millers Creek this seam has been opened in C 48-39 and 45-39. In the former minute quadrangle where it is on land belonging to the Pulaski Timber and Stave Co., it is 25 to 26 inches thick and about 40 feet above the top of nearest exposed Newman Limestone. A conglomerate cliff 75 to 100 feet thick caps the hill above the base of the cliff, being about 125 feet above the coal seam.

The seam in 45-39 is 24 inches thick and about 15 feet above top of the Newman Limestone. It has been mined here for use on the Narrow Gauge Railroad, which runs about 65 feet below along the dry bed of the sunken Sinking creek. The presence of this coal is also reported on Little Sinking creek in about C 45-41, and also on Billys Fork of Millers creek which forms the boundary between Lee and Estill counties. It is here near the head of the Fork in C 45-44 and 44-44.

No. 2.—This has been extensively worked in the vicinity of Beattyville in C 42-35 and 36 and C 43-35 and 36

In these minute quadrangles the openings, now mostly abandoned, are on both sides of Crystal and Silver creeks. The latter is better known in the region as Stufflebean. The coal does not appear to be over 22 inches thick on Crystal creek. It is always about 10 feet below a massive sandstone cliff which is from 10 to 15 feet thick. The dip of the coal is down stream. The only mines at present worked on Crystal creek belong to the McGuire Coal Company. The only mine operating on Silver creek is the Richardson with its openings in a deserted valley of a stream connecting with Silver creek on the east and the Kentucky river at a point about a mile below town and which is traversed by the L. & A. Railroad in getting into Beattyville. The coal is about 36 inches thick in this mine and its elevation above Silver creek is about 70 feet.

On Mr. John Steel's land the coal shows up 24 inches at entrance (31 inches further back). On the opposite side of the creek is an opening on Judge Gourley's land. These two openings are in 43-36. The same stratigraphic relations obtain on Silver as on Crystal creek. West of the Richardson Mine other openings now abandoned show on the sides of the deserted valley to where it joins on to that of the Kentucky river. Joseph Lesley's elevation for the Stufflebean openings is 717 A. T.

The next mines operated below here are those of the Beattyville Block on Mikes Branch in C 44-35 and of the White Ash Coal Company on Derrickson Branch in C 45-34. Joseph Lesley's elevation for the Phillips bank on Mikes Branch is 762 A. T.

The thickness in these two mines is about the same 34 to 44 inches and the elevation above tide, as given by aneroid, about 710 feet (110 feet above the Kentucky river). The dip of the coal as calculated by Joseph Lesley is $\frac{3}{4}$ of a degree S. 52 degrees E.

The farthest down the river this coal has been traced is to Heidelberg, where there is an opening back of the village which shows 24 inches of coal at the entrance and is 140 feet above the top of the Yellow Pennington Limestone. This opening and exposure of Pennington, which is the farthest north this latter has been traced, is in C 46-34.

POWELL COUNTY.

No. 1.—Openings on a coal within ten to thirty feet below base of the Conglomerate Cliff, which seems to be the lower sandstone lens, are reported on the head of South Fork of Red river in C 48-47, and near High Rock in C 47-48 is an opening, now fallen in, which is 30 feet above the top of the Newman Limestone. Prof. Lesley describes this as a “double bed” each part being 12 inches thick with 4 feet of shale between, and the lowest 15 feet above the “sub carboniferous Limestone.”

In C 43-49, on Clear Branch, tributary to Middle Fork, is an opening not now worked which is 24 inches thick and 15 feet above the top of the Newman Limestone. On the same stream and in C 42-48 this coal is 17 to 24 inches thick and 15 feet 8 inches above the Limestone. Coal is now mined from this latter opening by Ase Bowen.

On Mill creek traces of a coal very close up under the Main Conglomerate Cliff is found which is very thin. It is also within 50 feet of the top of the Newman Limestone, here very thin. This coal is probably No. 1. It is too thin to be worked. In C 41-48 is an opening on the No. 1, which is 24 inches thick under shale and within 20 feet of the top of the Newman Limestone. It is beside the Mountain Central Narrow Gauge Railroad and from it coal has been obtained for use on the engines of this road.

These comprise the known openings of any consequence in Powell county though the presence of No. 1 has been noted on the north side of Main Red river along the tributaries Spruce and Short creeks.

The presence of No. 2 has not certainly been recognized. It appears to be cut out.

WOLFE COUNTY.

No. 1 coal is known to occur on Mill creek and in the drainage of Main Red river as far up as the mouth of Swift's Camp Creek, as for instance on Chimney Top, but there are no openings on it of importance.

No. 2 coal seems to be absent entirely.

MENEFEE COUNTY.*

No. 1 Seam is generally present at a distance not greater than 50 feet above the top of the Newman Limestone, here mainly St. Genevieve and ranging in thickness from 10 to 70 feet.

It appears to be best developed on waters of Indian creek where it has been mined considerably.

In C 38-56 at the Cope Mine it is 28 inches thick, including about 6 inches cannel at the top. It is here 40-50 feet above the Newman Limestone.

In 39-56 on Amos' Fork it is mined by the Red River Railroad Company. It is here 31 inches thick and is higher than 25 feet above the Limestone. Prof. Lesley refers to a coal on "Amet's Branch which is double, there being 12 feet between the two thin veins."

*For information concerning the coals of Menefee county see Bulletin No. 10, on the Coals of the Licking Valley, etc., by A. R. Crandall.—C. J. N.

In 41-56 it is reported 30 inches thick on O. S. Ingram's place. Also on H. H. Profit's land in 41-56 it is reported 22-23 inches thick. There are a number of abandoned openings at the head of Indian creek in C 41-57, and also lower down in 41-55 on Spass creek there is an opening in C 54-43.

At the head of Middle Fork of Cane creek in C 47-55, 56 is an abandoned opening.

This seam was formerly worked in the hill to the north of Rothwell in 43-56.

South of Frenchburg, the coal was formerly worked by the side of the Old State Road where it descends from the ridge on to the waters of Beaver creek. These openings are in C 38-57.

Further down Beaver creek, at a point just south of Scranton in 31-59, this seam is at present worked at George Wooten's. It shows 24 inches thick at the entrance and is within 10 feet of the Limestone.

No. 2 Seam is not known to exist in this county.

THE BREATHITT FORMATION.

By the term "Breathitt Formation," Mr. Campbell included all the Coal Measures of the London Quadrangle which lay above the Corbin Conglomerate. He refers to them as "composed of shale and sandstone with occasional coal seams, but with no individual bed of sufficient importance to be shown as an independent formation."

He assigns to the formation in the vicinity of London a thickness of 550 feet, but nowhere attempts to define the upper limits.

Prof. Crandall, in his report previously referred to, describes them under the term "Measures above the Conglomerate." We have already found that this leaves their

base not very accurately defined, as Prof. Crandall generally failed to recognize the distinctness of the Corbin as a separate division of the Conglomerate, or even the presence of its horizon where it had lost its conglomeritic character. We find him therefore sometimes mapping it with the Rockcastle Series and sometimes with the "Measures above the Conglomerate."

As an illustration of his failure to detect the presence of the Corbin in the district where it is present but non-conglomeritic and indeed hardly even sandy, may be cited his reference to his "No. 1 coal" (the Lily Coal) at Albert Mahan's, on Paint Branch of Jellico creek, in Whitley county as being there nearly 100 feet above the Conglomerate Measures. In reality it is there as close to the top of the Corbin horizon as in any other section, and in the region under discussion this interval is never more than 30 feet.

Prof. Crandall assigns a thickness of a little over 700 feet to his Measures above the Conglomerate in Whitley county.

The Williamsburg Sheet in its southern part gives contours enough for 1,200 feet of measures above the Conglomerate.*

Prof. Crandall, like Mr. Campbell, made no attempt to define the upper limits of any formation which had as its base a contact with the Conglomerate Series.

The former noted in the lower two hundred feet of the Measures above the Conglomerate the presence of calcareous concretions, which are so characteristic of the horizon of the first coal above the Conglomerate in the northeastern portion of the State. They seem to be distributed through a greater

*It should be understood, however, that the Williamsburg topographic sheet, hurriedly prepared some years ago by the U. S. Geological Survey, is admittedly subject to considerable correction.—C. J. N.

thickness of the strata, however. He also calls attention to the presence of "ochreous clays" in this portion of the formation.

Topographically this formation is very different from the Lee when the latter has its conglomerate members well developed.

In striking contrast to the flat table-like ridges of the Conglomerate outcrops, with the deep gorges incised into them by the streams, and giving to the landscape as looked at from a distance and somewhat from above the not inapt appellation "Flatwoods," lower Breathitt topography is characterized by rounded hills, even slopes and wide valleys. With the coming in, however, of intercalated sandstones in the shales, the country rises abruptly to a level 500 to 1,000 feet higher. This in the southern part of the area—that south of the Cumberland river—is known as "Jellico Mountain."

The change in the character of the vegetation, especially the timber growth, in passing from the Lee to the Breathitt is as marked as the change in the topography. The pine and the hemlock disappear and the chestnut is less common. On the other hand the oaks increase in variety and luxuriance of growth. As especially characteristic may be mentioned the Willow Oak (*Quercus phellos*) and the Laurel oak (*Quercus laurifolia*). Among other hard wood trees the Black gum (*Nyssa multiflora*) is particularly abundant.

THE COALS OF THE BREATHITT FORMATION. WHITLEY COUNTY.

Prof. Crandall in his report on Whitley county, enumerates nine seams in the Measures above the Conglomerate. Whether all of these will be finally included in the Breathitt is yet to be determined. Not all of these coals are workable.

By far the most important of them is the one known as the Main Jellico Seam. This is the seventh workable coal, counting from the base of the Coal Measures—the fourth, counting from the base of the Breathitt in accordance with the numbering of coals in Kentucky inaugurated by Owen.*

This is as high up in the series as the writer's investigations extended. The other seams in ascending order from the base of the Breathitt are the Lily and the Lower and Upper Blue Gems (the latter sometimes corrupted to "Blue Jim" by the miners). These two Blue Gems are not thick enough to be worked under any considerable extent of territory. In the southern part of the Field the Lower Blue Gem seems to be workable only in the vicinity of Corbin. Here on Bacon creek it has been extensively opened for local use. I have named it the Bacon Creek Seam.

As measured by the writer, the intervals between the foregoing four coals of the Breathitt, starting at the base, are about 150, 70 and 90 feet respectively.

The Lily Seam. No. 4.—This is the No. 1 of the older writers on Kentucky stratigraphy. It is named from Lily, a station in Laurel county on the Louisville & Nashville Railroad.

This coal horizon is probably the most persistent of any in Kentucky. It has been identified as present where due at so many points in the Eastern Coal Field, just back of the outcrop of the Lee Formation, as to make it probable that it will some day be mapped in continuous outcrop all the way

*Prof. Crandall correlates the Jellico seam with the Elkhorn bed of the Big Sandy and Kentucky River regions, which was formerly tentatively regarded as "No. 3" of the Boyd-Greenup-Carter-Lawrence section by Prof. Crandall, Mr. Hodge, and Mr. Sullivan. Those gentlemen, whose experience has been longer and whose field-work has been broader, in the Eastern Coalfield of Kentucky, than that of other geologists, did not give a definite number to each bed of coal, thick or thin, for reasons which appear in their reports. The report of Mr. Hodge on the Coals of the Three Forks of the Kentucky River, and that of Prof. Crandall and Mr. Sullivan on the Coals of the Pineville Gap Region, afford illustrations of the difficulties attending the numbering of coals. As the result of more recent work in the Big Sandy Valley, Prof. Crandall now considers the Elkhorn seam as the southward extension of the "No. 1" coal of the section for Boyd, Greenup, Carter, and Lawrence counties.—C. J. N.

across the State from where it enters from Tennessee to where it leaves in passing across the Ohio river into Ohio.

In the region under discussion it is seldom over three feet thick. Occasionally it thickens up to six feet. Sometimes it is split up.

In coming north on the Cincinnati Southern Railroad the horizon of this coal is intersected soon after crossing the Tennessee-Kentucky line.

Near Strunks Lane (Silerville), two miles from the State line, it is mined by the West Jellico Coal Company in A 26-37. It is here 28 inches thick under shale and over clay shale. This is on the east side of the railroad. On the same side of the railroad and nearer to Marsh creek, on Daniel Strunk's place, the same coal is opened. This is in 25-26, and must be very near the place where Mr. Crozier collected samples for analysis in June, 1882. It was described as coming from Mr. J.R. Ryan's and from an opening where it measured up 36 inches. The analysis is as follows:

Sp. gr.	1.275	
Moisture.		2.08
Volatile combustibles.		35.58
Fixed carbon.		58.90
Ash.		3.44
Sulphur.		5.67

Still in the drainage of Marsh creek, at A. Z. Creekmore's in A 22-38 it is reported 30 inches thick. It has also been opened on this stretch of Upper Marsh creek on John Meadows', R. V. Lovett's and Wm. Hays' land.

Along the line of the Cincinnati Southern from Strunk's Lane to within one mile of Pine Knot this coal was formerly worked rather extensively. It seems now to have been mined out in this district. At the abandoned mines of the Pine Knot Coal Company, about two miles south of Pine Knot, it is 39 inches thick. Within one mile of the Station are abandoned mines where the thickness could not be measured on account

of the openings being fallen in. These and the mines of the Pine Knot Coal Company are in A 26-39. North of here a rapid rising of the formations brings the Corbin Sandstone to and above track level.

Jellico Creek Drainage.

In the Drainage of Jellico Creek the Lily Coal has been opened in A 16-37 on Rock creek on Judge Findley's land, also on Jefferson Creekmore's. It is here very close down upon the Corbin. The coal is here thin, being only 21 inches thick.

In A 14-38 this seam is about 30 inches thick as indicated by the bloom. In A 17-41 and 18-41, on Pleasant Run this seam is found not over ten feet above the top of the Corbin. This is on lands belonging to W. B. Creekmore, Lizzie Perkins and Tom Meadows. The thickness of it could not be measured, but both the Blue Gems and the Main Jellico show up in the hill section, which is the northern front of Jellico Mountain. The intervals between these four coals in ascending order are 160, 80 and 60 feet respectively.

Prof. Crandall, in his report on Whitley county and part of Pulaski, refers to a coal near Steeley's store on M. E. White's place that must be in the vicinity of these last described. Reference has already been made to the opening on this coal at Albert Mahan's in the bed of Paint Branch in A 18-42. It was by Prof. Crandall erroneously estimated as being here 100 feet above the top of the Conglomerate Series.

In the Clear Fork Drainage of the Cumberland river the Lily coal, never very high above drainage, can be traced all the way up from Williamsburg to a little above Saxton.

In A 8-39 this is the coal reported five feet thick which is lifted from the bed of the stream by Drew Beans, Wm. Rider and others. On Jackson fork of Clear fork the horizon of this coal extends up as far as A 10-39, where it was formerly

opened on Crit. Moses land not over 10 feet above branch level. The top of the Corbin is here about at branch level.

Near Williamsburg, on Benjamin Bennett's place in A 9 and 10-43, this is the lowest coal worked. The openings are by the roadside and are within ten feet of the top of the Corbin. The same coal is mined across Clear Fork from here. Across the river from Williamsburg this coal has been mined in A 9-45, within ten feet of the top of the Corbin, here forming the River Cliff. It is here 30 inches thick. From this point it can be readily traced across the road to the north into the drainage of Watts creek where it has been opened in A 9-46 on land of Ben Moore. It is here 24-29 inches thick. In the same Minute Quadrangle, back of school house by side of road to Rockhold it was formerly opened, but the opening has now fallen in. On the opposite side of the creek from here, in A 9-51, this seam was formerly opened and mined commercially. The tip-house is still in good repair at the end of the tramway built from the mine to the railroad.

No other openings were found on this seam near the line of the railroad until Rockhold is reached. Here in A 8-51, on a small tributary of Carr Fork of Watts creek on land belonging to J. B. Hamlin, is a semi-cannel coal 24 inches thick which is at the horizon of this Lily coal.

North of here along the line of the railroad, the horizon of this coal is below drainage until Corbin is reached. The coal itself, however, does not show at Corbin. West of the railroad as far as the western margin of the Breathitt outcrop, there are traces of this coal, but no important openings seem to have been made upon it.

The Bacon Creek, Lower Blue Gem, or No. 5 Seam.

This seam, while very persistent, is generally thin, being workable, in the absence of other openings in the same hill on other coals, only in the district on Bacon creek near Corbin.

It ranges from 120 to 170 feet above the top of the Corbin. In the Jellico Mountain region it ranges in thickness from one foot to 18 inches.

In A 18-41 and 40 this seam shows up in same section with all the coals from the Lily to the Jellico inclusive. It is here about 160 feet above the Lily coal.

In the Clear Fork region where this coal has sometimes been opened and worked in connection with the Main Jellico Seam, it is known as the Lower Blue Gem. No analysis seems ever to have been recorded of it, but it is of excellent quality.

At the Burk Hollow Coal Company's Mines in A 7-36, its bloom is seen in the section 60 feet below the "Upper Blue Gem" and 170 feet below the Main Jellico.

In A 10-39, in the Jackson Fork region, the bloom of it is 60 feet below the Upper Blue Gem, and 140 feet above Jackson Fork which has Corbin in its creek bed.

In A 8-41, in the hill west of Pleasant View, this seam is 90 feet above the Louisville & Nashville station and 80 feet below the Upper Blue Gem.

In the same Minute Quadrangle, in the section seen going up to the Main Jellico Seam, it is 190 feet above the level of Clear creek and 70 feet below the Upper Blue Gem.

In A 9-42, at the Fair Day Coal Company's Mine, it is 17 to 18 inches thick and 55 feet below the Upper Blue Gem.

In A 10-43, on Benjamin Bennet's place it is 160 feet above the Lily and 75 feet below the Upper Blue Gem.

In passing north from the Cumberland river, little is seen of this seam until the head waters of Watts creek is reached. Here, a little above Brummet Station, on Widow Mauney's

land, it has been opened with a reported thickness of 30 inches. This is in A 7-53.

In A 8-53, on J. B. Powers place it is reported to show 24 inches. In A 7-54, on Charles Setzer's place it has been opened 26 inches thick under shale and over clay. The elevation here is about 110 feet above the railroad.

Green Taylor has an opening on the same seam on the opposite side of the railroad from here.

In A 10-53, near the head of Carr Fork of Watt's creek, on lands belonging to J. G. Sharp and Sampson Campbell, a coal from 23 to 30 inches is reported to have been opened, which is either at this horizon or the one next higher.

On the headwaters of Lynn Camp creek, an land belonging to B. D. Le Force, in A 8-54, this seam shows 25 inches. It is here about 110 feet above the Louisville & Nashville track level.

Going down this stream, on the northwest side, openings have been made between here and Woodbine on land belonging to Frank Mooney, E. Burnet and Hiram Taylor.

It is on Bacon creek, however, that the most numerous openings have been made, and is from here that the designation, "Bacon Creek," is taken.

Near the head of the stream the openings are on both sides, but in the middle and lower course the stream marks the northern termination of the highland or "mountain," which is always formed by that portion of the Breathitt which contains coals 5 to 7 (of this report) inclusive. Practically every farm on the east side of this creek has had coal Number 5 opened on it. Most of these show abundant plant impressions in the roofing shales. Beginning near the head of the stream and naming in order on the east side the owners of the farms having coal openings upon them, they are as follows:

Wm. Rogers, J. V. Cheney, T. S. Williams, J. Wells, Josiah Davis (27 inches, abundant plant impressions), Geo. Steel (two or three openings showing coal 26 to 27 inches and 125 feet above Bacon creek), John Andres (three openings), Charles Gants and J. H. Hatfield (25 to 27 inches).

On the west side of the creek, beginning at the head and coming down the stream in the same way, the farm owners are Frank Rogers, John Rogers, Wm. Rogers, Robert Wells, Marion Roaden, Richard Roaden and Wm. Floyd.

All these openings are in A 6, 7, 8 and 9-55 and 56; also in 9-56, at head of North Prong of Bacon creek, on Joe Mullins' place, this coal has been opened where it shows up 25 inches thick.

North of here in the district examined this coal has not been identified.

West and southwest of here the seam is found in the hills that are high enough to catch this horizon, as for instance in A 13-52 on land of Mr. Crit. Roads, where it has been opened 21-22 inches thick and about 185 feet above the top of the Corbin.

The "Blue Gem" or No. 6 Seam.—This is frequently called the "Upper Blue Gem." In the district examined this is of commercial importance only in the Clear Fork of Cumberland River Drainage, and in this region only because it usually occurs in the same hill with No. 7 or the Jellico Seam, and can be mined in connection with the latter. In the region south of the Cumberland river it generally has the advantage of the Bacon creek, or Lower Blue Gem, as regards thickness of the bed. Its height above the Corbin ranges from 225 to 240 feet. The interval between it and the Main Jellico is 80 to 110 feet. Its range in thickness is from 8 to 22 inches in all the openings examined.

In A 7-36, in the mountain northeast from Jellico, it has been opened by the Burk Hollow Coal Company at a distance

below the Main Jellico of 110 feet, and is reported 20 to 30 inches thick.

In A 10-38 it has been opened at the Kensee Mines at a vertical distance below the Main Jellico of 80 feet.

In A 10-39, in the road going down to Jackson Fork, the bloom of this coal may be seen 65 feet above the Bacon creek.

In A 7-39, opposite the town of Saxton, it has been worked along with the Main Jellico. It is reported to be 20 to 30 inches thick.

In A 8-41 it has been opened in the mountain west of Pleasant View 21 inches thick and 165 feet above the level of the Louisville & Nashville railroad. It is here 75 to 80 feet above the Bacon creek.

In the same Minute Quadrangle, but a little farther north, it has been opened by L. Stowe and Roads 70 feet above the Bacon Creek and 85 feet below the Main Jellico. It is very thin here, not exhibiting over 9 inches at the entrance.

In A 9-42, at the Fair Day Company's Mines, it is 18 inches thick. The interval here between it and No. 5 is 55 feet and between it and No. 7 the interval is 85 feet.

In A 10-43, on Benjamin Bennet's place it is 20 to 22 inches thick and 75 feet above the Bacon Creek Seam.

Westward from Clear Fork it may be found in the whole Jellico Mountain region. One place where there is an admirable section for giving its relation to the coals above and below is in A 18-40 and 41, in the mountain side eastward from Pleasant Run Branch. It is here 60 feet below the Main Jellico, 80 feet above the Bacon creek and 240 feet above the Lily. The latter is near creek level.

The Jellico or No. 7 Seam.—This coal, which is called the "Main Jellico," is the most important mining seam in this portion of the coal field. Its vertical distance above the top of the Corbin is about 300 feet. It belongs to that

portion of the Breathitt which tends to become mountainous.

It is confined to the southeastern portion of the district covered by Map A. The western boundary of the Jellico outcrop may be roughly traced as follows:

Beginning at the Tennessee line in the mountain east of Marsh creek, it proceeds thence with the upper part of the mountain slope on the east side of Marsh creek valley to the crossing of the Pine Knot and Williamsburg road at Holy Hill; thence with the same portion of the mountain slope on the east side of the road to its crossing with Jellico creek; thence with the western face of the mountain to where it overlooks the Cumberland river in the prominent headland just west of Williamsburg which is known as Mount Morgan.

North of the Cumberland it follows the same upper slope of the mountain on the east side of the Louisville & Nashville Railroad until the station Rockhold is reached. North of here nothing was seen of the seam near the line of the railway, and the boundary appears to turn more to the eastward and to enter Clay county.

This seam, according to Prof. Crandall, ranges in thickness from 30 to 62 inches and is usually separated by a clay parting into two benches. A hard layer of sandstone frequently forms the roof but sometimes the roof is shale, and then generally marked with abundant plant impressions. The coal is almost uniformly of excellent quality.

Among the most celebrated of the mines being operated on this seam in Kentucky near the Tennessee line are the Procter and the Kensee. The former has its openings in A 11-37 and the latter in 10-37 and 38. Each exhibits the same one inch parting; in the former it is 21 inches and in the latter 30 inches from the base.

The total thickness of the seam is 43 inches at the Procter and 44 inches at the Kensee mines.

The analysis of the Procter with that of the same seam on Pigeon creek is as follows:

	Procter Mine Whole face	Main Jellico on Pigeon Creek
Moisture	2.00	1.90
Volatile combustibles . . .	33.70	32.86
Fixed carbon	61.90	63.19
Ash	2.40	2.14
Sulphur .....	.796	.700

The height of the seam above the Clear Fork of the Cumberland river is about 50 feet less at the Kensee than at the Procter Mines. This seam has been opened up at a number of places in the Jellico Creek region. Prof. Crandall refers to one opening near R. F. Creekmore's, about one mile from the Tennessee line in which the clay parting is increased to 7 inches.

In A 15-37 this seam is 360 feet above Jellico creek and 260 feet above the top of the Corbin. The thickness is 63 inches with a 9 inch clay parting 22 inches from the base. A bloom of what is probably the Lily coal is seen in the road 10 feet above the top of the Corbin. This makes the interval between the two horizons here 250 feet.

The Creekmore coal of Prof. Crandall must be somewhere in this vicinity. He gives the analysis of it as follows:

	Upper bench.	Lower bench
Moisture.....	2.00	1.70
Volatile combustibles	31.30	37.40
Fixed carbon	62.94	59.36
Ash.....	3.76	1.54
Sulphur.....	.901	1.721
Specific Gravity	1.285.	

In A 18-40 the Jellico is opened on the north side of the mountain overlooking Pleasant Run and opposite Lone or Peak Mountain. It is here 380 feet above the stream and 300 feet above the Lily coal. It is quite thin there.

In A 18-41, in Peak Mountain, the same seam has been opened on land belonging to C. E. Stevens.

According to Prof. Crandall, this is probably the coal opened on land belonging to M. E. Mahan in A 10-40. He estimates it here to be 250 feet above Wolf creek.

On Possum branch of Wolf creef, in A 9-41, Prof. Crandall refers to the Jellico being mined on land belonging to James Cox and also on land belonging to Joseph Cox; 39 and 36 inches respectively with traces of a clay seam 15 inches from the top.

The seam is 280 feet above local drainage and analyzes as follows:

Moisture.....	1.84
Volatile combustibles.....	33.84
Fixed carbon.....	59.96
Ash.....	4.39
Sulphur.....	2.18

On the west side of the Clear Fork Valley itself, the Jellico is opened on almost continuous abutting property from near Jellico to near Williamsburg.

In A 7-36, on the north face of the mountain it is worked by the Burk Hollow Coal Company at a height above drainage of 290 feet, and with Nos. 5 and 6 below respectively 110 and 170 feet. The Jellico is about 32 inches thick under sandstone and over shale.

At the mines of the East Tennessee Coal Company in A 8-37, the seam is 44 inches thick with a bone coal parting of one inch 30 inches from the base.

The analysis is as follows:

Moisture.....	2.00
Volatile combustibles.....	36.00
Fixed carbon.....	60.00
Ash.....	2.00
Sulphur.....	.631

No. 6 is about 80 to 90 feet below the Main Jellico here and is reported 30 to 32 inches thick.

A little above Saxton in about A 7-38 the seam is extensively mined by a company using electricity for drawing the coal from the mines. It is here 35 to 37 inches thick and 300 feet above drainage here at the top of the Corbin.

In 9-41, opposite and below Pleasant View, at a mine belonging to Stowe and Rhoads, the seam is 40 to 41 inches thick with a 3 inch parting 18 inches from the base. It is 345 feet above drainage, and has had opened below it, in the same hill slope, Nos. 5 and 6, distant below it 155 and 85 feet respectively. This is in about the same Minute Quadrangle as the Lawson Opening and the Bird Opening, 45 and 40 inches thick respectively. The coal from the Bird Opening analyzes as follows:

Moisture	2.40
Volatile combustibles	34.80
Fixed carbon	58.80
Ash	4.00
Sulphur .....	.522

In A 9-42 the Fair Day Coal Company operates on the main Jellico and has made openings on Nos. 5 and 6 as well.

The Main Jellico is 36 inches thick with a three inch parting 12 inches from the base. The height above drainage here, which is also the height above the Corbin, is 250 to 300 feet. The height above No. 6 is 85 feet and above No. 5 it is 135 feet.

Prof. Crandall speaks of this coal being opened on Briar creek near the head in about A 12-43 and gives its thickness

as 30 inches. The analysis of the coal at the opening on Mr. M. Richardson's place and also on the Jones and Greer places is as follows:

	Richardson's	Jones'	Greer's
Moisture	1.94	1.90	1.90
Volatile combustibles	38.92	36.10	37.40
Fixed carbon	56.84	59.50	58.60
Ash	2.36	2.50	2.10
Sulphur.....	.764	.997	.928

In Jones' Peak on the Jellico creek side the total thickness of the seam including three partings is $49\frac{1}{2}$ inches. The lower parting is $1\frac{1}{2}$ inches, $7\frac{1}{2}$ inches from the base, and the upper is 5 inches, 12 inches from the base.

The analysis is as follows:

Moisture	1.76
Volatile combustibles	37.86
Fixed carbon	53.98
Ash	6.40
Sulphur .....	.607

In A 11-40, west of Williamsburg, the seam is opened in the prominent headland known as Mount Morgan. It is here, as measured in an old entry, 29 inches thick under a sandstone roof and 275 feet above the top of the Corbin.

The analysis of the coal is as follows:

Moisture.....	2.00
Volatile combustibles	34.00
Fixed carbon	58.44
Ash	4.80
Sulphur.....	1.428

“East of Clear Fork the Jellico coal has been traced to the Pine Mountain, where it terminates at the fault line in the face of the mountain.”—Crandall.

In the neighborhood of Pleasant View Prof. Crandall estimates the height of the seam above Clear Fork as 340 feet, and the thickness at from 37 to 41 inches. The most prominent mine in the vicinity of this village is the Mt. Nash in A 7-40.

In A 5-41 the Terril Siler Coal on Tackett's creek is 41 inches thick and the analysis is as follows:

Moisture.....	2.10
Volatile combustibles	36.60
Fixed carbon.....	57.70
Ash.....	3.30
Sulphur.....	.708

Prof. Crandall was of the opinion when he published his report on Whitley county that a coal known as the "Birdseye Cannel" was a seam next lower in the series than the Jellico, in other words that it was No. 6, but Prof. Norwood, who has made a more recent examination of the region in question, that east of Clear Fork, has determined that the "Birdseye" character is only a phase of the Jellico in this area.* Assuming the latter view to be correct, and locating the leading openings, they are with their character and thickness as follows:

Cane (or Caney) Creek Drainage.—A 4-39, plain bituminous phase, 24-42 inches, birdseye cannel phase in another mine, 24 inches.

Other openings have been made on this seam at frequent intervals all the way to the head of the creek.

On Buck Creek the coal shows 30 inches in A 6-40.

On Little Patterson Creek in 4 and 5-40, 35 to 41 inches.

*This fact is now generally recognized by those familiar with the Jellico coal, especially since entries have been driven direct from the seam where it shows the common bituminous phase into openings where the "birdseye cannel" phase is predominant.—C. J. N.

In 5-41, 52 inches; in 5-4, in the mountain between Little and Big Patterson creeks, 36 inches.

Prof. Crandall mentions a coal—the Jones coal—having some resemblance to the Jellico, as being 100 feet above the head of Little Patterson creek. He gives its thickness as 36 inches with a part of it splint, and the analysis of it as follows:

Moisture	2.14
Volatile combustibles.....	36.06
Fixed carbon	59.20
Ash	2.60
Sulphur .....	.755

Main Patterson Creek.

On Big Patterson Creek and Tributaries the seam has been extensively opened.

On Rose Fork in A 2-40, 28 inches, in 1-40, 36 inches.

Also with the birdseye cannel phase in 2-40, 28 inches; and in 3-40, 30 inches.

Near head of Main or Big Patterson creek, in 3-39, 24 to 27 inches. On Bennet's Fork, near head in 1-41, also in 2-40 and 2-41, both ordinary bituminous and birdseye. In 3-39, birdseye cannel and bituminous, 31 inches. On a tributary of Big Patterson creek in 3-40, bituminous 30 inches and birds-eye 30 inches, making a seam 53 inches thick.

Big Cane Creek.

On Big Cane or Caney Creek and its tributaries the seam has been opened on a large scale.

Particularly in 1-39, on Lick Fork of Cane creek, the birdseye phase is here exhibited and also in A 2-38 and 39.

It is also opened on Little Cane creek in A 4-38 and 39.

Prof. Crandall speaks of it as being 36 inches thick on Little Cane creek.

The seam has been opened on Little Mud creek, in the ridge between it and Big Cane, and on the west side in the slope of Pine Mountain as far as the fault line.

Prof. Crandall gives the thickness in the ridge between Mud and Cane creeks as 37 inches without parting, and refers to its being opened at Wymer Siler's in the face of the Pine Mountain, 275 feet above Mud creek. The thickness of the coal here is 40 inches and the analysis is as follows:

Moisture.....	2.51
Volatile combustibles.....	33.12
Fixed carbon.....	62.70
Ash.....	1.67
Sulphur.....	.60

North of the Cumberland river the Jellico Seam may be traced without a break in the region east of the Louisville & Nashville Railroad as far as Rockhold.

In the drainage of Brown creek the seam has been opened exhibiting all of its characteristics, and particularly the clay parting. A great deal of the land here belongs to the King Mountain Coal Company. On this property the coal is reported from 44 to 46 inches thick.

Beginning at Timothy Perkins' on the north side of the creek, about one mile from the mouth, openings have been made on the lands of Wm. Beaver and Mr. McKeon. On the south side of the creek, opposite to Mr. Perkins, Hon. J. A. Sullivan owns most of the mountain coal land, 1,800 acres.

On the Perkins land in A 7-47, an opening driven through from the Watts creek side at Mahan Station shows 50 to 51 inches with a 3 inch parting 21 inches from the base. The coal is here over a 9 inch sandstone and that over a clay.

It is the Jellico seam that the Watts Creek Jellico Coal Company is working at Mahan Station in A 8-48. The seam is here 300 feet above the Station and 270 feet above the top of the Corbin. It is 55 inches thick with a 6 inch clay parting

22 inches from the base. This is the parting that thins down to 3 inches in passing through the mountain to the Perkins opening referred to above.

The No. 6 Seam is 60 feet below No. 7 here and 21 inches thick. Prof. Crandall gives the "Mahan Station Coal" as 40 inches thick and its analysis as follows:

Moisture.....	4.60
Volatile combustibles.....	32.80
Fixed carbon.....	59.00
Ash.....	3.60
Sulphur.....	.742

At the station next north of here, in A 7-48 and 49, the seam is 47 to 52 inches thick with a 4 to 14 inch parting about the middle. The roof is generally sandstone. The seam is about 300 feet above the top of the Corbin here about the level of Watts creek.

On Tyes Fork of Watts creek several openings have been made on this seam, and it is mined by the Imperial Jellico Coal Company in A 6-50, a spur of railroad being run out to it from Rockhold Station. The seam is here 42 inches thick, with 4 inches of it impure and slaty. The roof is very fossiliferous, exhibiting mainly calamite and lepidodendron leaf impressions.

In A 4-51, on land of Mr. Ed King, the seam is 42 inches thick under this same calamite shale.

In the mountain on the west side of the railroad, southwest from Rockhold Station, the seam has been opened on Mr. Ben Sharp's land, where it is reported 22 inches thick. This is in A 8-50.

Prof. Crandall gives the thickness of the seam on Tyes Fork, two and one half miles from Rockhold Station (evidently at the Imperial Jellico Company's mines), as 42 inches with

a "slate" parting of one inch, 18 inches from the base, and the analysis as follows:

Moisture	1.80
Volatile combustibles.....	37.00
Fixed carbon.....	57.80
Ash	3.40
Sulphur .....	.961

LAUREL COUNTY.

The only coal of the Breathitt formation opened in Laurel county is the Lily or the No. 4 of this report.

On account of its importance in this county from the commercial point of view it has long been known as the "Laurel Coal." In passing north into the county along the line of the Louisville & Nashville Railroad, it is first seen in the railroad cut south of Lily. It is here only 15 inches thick.

At Lily, northeast of the station in A 4 and 3-2, this seam has been extensively mined. It is here in the valley of Big Laurel river and close to water level, being as measured at one place only 16 feet above it. It ranges in thickness from 36 to 40 inches. It cannot be over 20 feet above the top of the Corbin here. The company operating here is the Lily Jellico Coal Co.

An analysis of the coal, which is probably typical, is as follows:

Moisture	1.80
Volatile combustibles	37.60
Fixed carbon.....	58.10
Ash	2.90
Sulphur	1.085

A semi-cannel coal listed in Chemical Analysis, Volume A, Part 3, of the Survey, as from within a distance of one and

one-half miles of Lily, is probably from the same horizon. Its analysis is there given as follows:

Moisture	1.20
Volatile combustibles.....	38.00
Fixed carbon	46.60
Ash	14.20
Sulphur .....	.797

Along the line of the Louisville & Nashville Railroad north of Lily few openings have been made on this seam until vicinity of London is reached. At latter place it is below drainage and has to be reached by shafting. A shaft was sunk to the level of this coal by the side of the railroad in the limits of the town itself in B 6-8.

It is near the stations of Pittsburg, East Bernstadt and Altamont, however, that most of the mining in Laurel county is carried on.

At Pittsburg (Old Pitman Station) this seam has been worked by different companies for a great many years.

As measured from an old opening just across the branch west of the Pitman Hotel, the distance of the seam above the top of the Corbin is about 20 feet. This is in B 8-10.

Originally the openings on the seam were mainly on the west side of the railroad, but now most of the mining is carried on east of the railroad.

Three analyses of the coal made for the Survey are as follows:

	Pitman Coal Co. Seam 36½ inches thick	Laurel Coal Co. Exclusive of upper 2 inches	Pitman Coal Co. Collected for coking test
Moisture	2.82	2.72	2.56
Volatile combustibles ...	35.30	35.32	34.56
Fixed carbon	59.10	58.60	59.58
Ash	2.80	3.36	3.30
Sulfur .....	.650	.679	.895

West of the railroad indications of old openings are seen by the side of the London-Bernstadt Colony road in B 9-9 and 10-9, and nearer Pittsburg in 8-10 and 7-10. All of these are very close to the top of the Corbin.

Near the station East Bernstadt, on the west side of the railroad, old openings are in B 8-12, and a branch track has been run out to the openings on the east side of the railroad in B 6-12 on Little Raccoon creek. These are entrances to the mines of the Phenix-Jellico Coal Company. The coal shows 37 inches thick near the entrance and is reported 49 inches thick further back in the entries, with no "blackjack." In quite a good deal of the coal territory in this vicinity the latter thickens up so much at the expense of the good coal as to render mining of the coal a very discouraging proposition.

An analysis was made of the East Bernstadt coal from samples collected in 1882 by John R. Procter, and reported to have come from near the head of Raccoon creek (whether Little or Big is not stated but from within one mile of the Station). This analysis is as follows:

Specific Gravity.....	1.245
Moisture	3.30
Volatile combustibles	34.44
Fixed carbon	60.96
Ash	1.80
Sulphur.....	10.55

Other openings in the vicinity, though now fallen in, are those on Big Raccoon creek in B 5-12 and due north of this on Little Raccoon creek in the same Minute Quadrangle.

Not far from Atlanta P. O., in B 4-15, on Widow Swan's land, the Lily seam is 18 to 20 inches thick with a parting between it and a 4 inch seam above.

In the Upper Hazel Patch Creek Drainage this seam has been opened years ago in B 8-17.

In the Big Raccoon Creek Drainage the seam once had an opening made on it in B 2-13.

ROCKCASTLE COUNTY.

There is only one little patch of Breathitt Formation in Rockcastle county. This is in B 11 and 12-22. The Lily coal has not been found in it.

JACKSON COUNTY.

The Lily coal is not important in this county.

In the drainage of Pond creek, not far from Settle store, in about B 58-20, is the bloom of a cannel coal which belongs at about this horizon.

In B 55-23, near Moore's Mill, headwaters of Laurel Fork of Rockcastle river, a coal has been lifted from the bed of the stream on land belonging to H. Vaughn, which seems undoubtedly to be the Lily Coal. Also on land belonging to Neal Moore in B 56-23 is a 24 inch seam which has about the same elevation above tide as the Vaughn Coal, but is rather high above the top of the conglomerate sandstone, here supposed to be the Corbin. It is 90 feet above this sandstone.

In the Sturgeon Creek Drainage the Lily Coal can be identified as coming pretty constantly within 40 feet of the top of the Corbin. In B 52-25, in a hollow on the west side of the creek, on land belonging to McLean Gibson it is reported to be 34 inches thick. Another opening on the opposite side of the hollow was measured by aneroid and found to be 40 feet above the top of the Corbin.

In B 53-26, in the valley of Grassy creek on land of Wm. Bowles, is a cannel seam 14 inches thick, which is at the Lily Coal horizon. Also on land of W. A. Whicker there is an opening on what is probably the same seam.

Also in B 52-26, just below the mouth of the creek, there is an 18 inch seam 80 feet above Sturgeon creek and above a massive sandstone (Corbin?), which seems to be the same coal.

In B 52-27, on Travis creek there is a thin coal exposed in the bed of the creek on land of Bud Hughes, that comes above a massive sandstone. This coal is almost certainly the Lily.

The only signs of a coal seen in Jackson county higher than the Lily was in 55-19 on the divide going over from head of Little Sexton to head of Pond Fork of Rockcastle river.

There are several openings here, one on land of James Robinson perhaps a little over the line in Clay county, and the other on land belonging to J. W. Mullins. These openings are now fallen in, but they seem to be on the same seam. The former is reported to be 36 inches with the upper 19 inches cannel and the latter 46 inches with 36 inches of it cannel or cannel shale at top. This coal is probably best correlated with the Jellico.

OWSLEY COUNTY.

The topmost member of the Lee Conglomerate Series, probably the Corbin, is exposed along the head waters of Big Sturgeon, Little Sturgeon and Buck creeks, as well as along the South Fork of the Kentucky river up to and beyond the Owsley-Clay county line.

The only place where any coal-bearing strata of the Lee might be exposed is in the northwest corner of the county along Big Sturgeon in the vicinity of the mouth of Wild Dog creek. It is possible that there may be here a thin representative of the Beattyville (Beaver creek) Seam. Practically all of the coal bearing strata of Owsley county, however, is Breathitt.

The Lily Coal.—This has not been certainly identified in the southwestern portion of the county. A coal opened at Harve Price's in 46-28 may be this seam. It is reported to be 53 inches thick. In the northern portion of the county and west of the South Fork, a thin coal has been opened near the head of Duck Fork in 44 and 45-31. Beginning with Andrew Combs' in 44-31 and coming down the creek, we have in order the openings on Sheridan Farley's, Add. Farley's, James Combs' (28-29 inches), then in the same Minute Quadrangle one showing 24 inches, then Arther Garret's reported 48 inches, then in bed of creek at Pebworth one reported 24 inches, then on W. B. Robinson's and finally on Squire P. Howell's.

The Jellico Seam.—This is probably the highest coal found in that portion of the county west of the South Fork of the Kentucky river. As belonging to it we have identified certain openings made on the coal found in the dividing ridge between the waters of Sexton and Little Sturgeon creeks.

On Robert Wood's place in 49-22 this seam shows a thickness of 36 to 37 inches with abundant plant impressions in the roofing shales.

On James Pearson's place in 49-23 the same seam shows up 36 inches thick.

On John Wilson's place in same Minute Quadrangle is a seam reported to be 22 inches thick, which may be the same as the Jellico, but the aneroid makes it 75 feet lower.

On land belonging to Judge Brewer in 47-23 is an opening showing 40 inches with an 18 inch parting 12 inches from the base, that by aneroid is about 200 feet lower than the Pearson opening, but Judge Brewer thinks they are the same seam and that they level up about the same.

There are some openings on Buck creek, but they were not examined, and no opinion can be advanced as to the seam they are on.

In 40-29, on Gabbard branch near Booneville, is an opening showing 28 inches of coal, with a cannel seam about 30 feet above it which is reported to be 24 inches thick.

The probable horizons of these coals were not determined.

In the northeastern portion of the county, in the ridge between Buffalo creek and the heads of Pawpaw, Long Shoal, and Lineman creeks the crest of which forms the Owsley-Lee boundary, is a coal which is a considerable distance up in the Breathitt, probably about 230 feet above the top of the Lee, and hence somewhere near the horizon of the Jellico. One of the openings on this coal is on Nick Moore's land in about 38-31. It is now fallen in but the coal in it is above 27 inches thick.

LEE COUNTY.

The Lily Coal.—This seam is opened in the northern part of the county in C 43-34. It is between 24 and 30 inches thick and is within 10 feet of the top of a conglomerate-like sandstone.

In the northern part of the county the same coal is opened about Zachariah P. O. at the head of one prong of Walker's creek and Brushy fork of Big Sinking creek. Most of these openings are in C 42-43 and are within 20 to 50 feet of the top

of the conglomerate sandstone. The maximum thickness of the coal is about 36 inches.

In that portion of Lee county lying between the "Two-Forks" of the Kentucky river (the North and Middle) only thin coals are known to occur. What seems to be the Lily coal has been opened on top of a sandstone cliff (equals Corbin?) in C 31-37 on land belonging to Sam Jett. It is reported 36 inches thick. The seam is said to be opened on Mr. Sam Gabbard's land in about C 33-38.

In that portion of the county south of the Middle Fork and east of the South Fork of the Kentucky river, what is probably the Lily coal has been opened in C 41-34 on land belonging to Mr. W. J. Brandenburg on Blain creek. It is here 32 inches thick and a little above the top of a massive sandstone cliff over which the stream falls about ten feet.

The Jellico Coal.—The Jellico Seam is probably represented in the same southeastern portion of the county in a coal that has been opened a number of places near the top of the ridges.

This is the same coal that was referred to as occurring in the northeastern portion of Owsley county. It will be found ranging from 230 to 300 feet above the top of the Lee Formation as indicated by the presence of a rather massive sandstone.

In C 40-32 near the head of Pawpaw creek the Widow Brandenburg has an opening on this coal which is about 36 inches thick and 300 feet above the top of a massive sandstone (Corbin?)

In C 37-33 near head of a tributary of Lineman creek the Crawford heirs have an opening which is about 300 feet above the top of a rather massive sandstone which looks much like it might be the Corbin. The seam is 42-49 inches thick with a 1-3 inch clay parting, 4 inches from the top.

What is probably the bloom of this coal may also be seen in C 38-34 near top of divide between Long Shoal creek and head of Coal creek.

Further up Lineman creek, in C 36-33 on land belonging to Jack Napier this same coal is opened where it shows 60 to 65 inches with a 3-5 inch parting 5 inches from the top. The roof is micaceous sandstone. The height above the bed of Lineman creek is about 325 feet.

At the head of the right hand fork of the creek on land belonging to Elijah Gibson is an opening reported to show a thickness of 36 inches.

In C 37-31 at the head of the main prong of Lineman creek on Al. Wilson's land the seam averages in thickness 41 inches. The coal is worked here for the K. P. Narrow Gauge Railroad, which runs out from the Lexington & Eastern Railroad in the vicinity of Tallega and passing up Lineman creek crosses the divide over on to Meadow creek. The openings on this seam are located just to the west of the road in the gap. The elevation of the openings are about 1,115 A. T.

About 100 feet above this the presence of another seam is reported which is 24 inches thick.

WOLFE COUNTY.

Lily Coal.—This seam has been opened and is now worked along with another one about 130 feet above it on the different Devil creeks that empty into the North Fork of the Kentucky river from the north. In C 36-40 along side the road on the ridge between Lower and Upper Devil creeks this first coal above the Conglomerate was formerly worked by stripping. It is about 920 A. T. and within 20 feet of the top of the Conglomerate.

In C 35-42 down from the top of the ridge at an elevation of 935 this coal has been opened on land belonging to Ned. Drake where it is 44 inches thick with a 6 inch clay parting 25 inches from the base. It is a hard glossy coal. The top of the Conglomerate is about ten feet below.

In C 35-42 still lower down from the top of the ridge there is an opening on this coal which belongs to Joe Bryant. The seam shows 50 inches with a 5 inch clay parting 27 inches from the base and a "brashy" coal parting 2 inches thick in the upper part of the seam. This leaves 43 inches clear coal. The elevation A. T. is about 895.

In C 34-42 near base of ridge between Left Fork and Bear Pen Fork of Upper Devil creek, at elevation of about 920, this coal has been opened by Greeley Cabell where it shows 24 inches with a thin clay parting about the middle of the seam.

In same Minute Quadrangle, on Henry Alexander's place the seam is 61 inches thick with a 16 inch clay parting 29 inches from the base, then three inches brashy coal, on top of the parting, then 3 inches brashy coal, then 3 inches coal, then 3 inches brashy coal, then 7 inches impure coal. It is here just on top of the main Conglomerate Sandstone and at an elevation of about 850 A. T.

In C 33-42 at elevation of 850 A. T. and 100 feet above Main fork of Upper Devil creek, Mr. G. H. Perry has opened

The equivalency of the next workable coal in the series is uncertain. It does not at present seem possible to correlate it with any of the coals above the Lily coal south of the Kentucky river and especially with any of those in the Cumberland River Region. In this county the area in which it is workable is the same as for the Lily coal. Its average height above the Lily is 130 feet.

In coming north on the road along the ridge between Lower Devil creek and Left Fork of Upper Devil creek this coal first shows as a thin stain in C 35-43. It is here 105 feet above the top of the Conglomerate.

In the ridge between Left Fork and Bear Pen Fork numerous openings have been made on this seam. Coming south from Campton the first one is in C 34-43, the Elkin's Coal Opening. It is here 42 inches thick with a 5 inch parting 24 inches from the base.

Next, in the same Minute Quadrangle is the Horton Opening, showing 43 inches with a 5 inch parting 23 inches from the base.

There are other openings in this same Minute Quadrangle, mostly now fallen in. All are within 50 feet of the top of the ridge. One of these, the W. E. White opening, is about 120 feet above the Conglomerate.

In C 34-42 is the bloom of this same coal 135 feet above the top of the Conglomerate.

In the ridge between Bear Pen and Main Upper Devil creek, in C 33-43, there is an opening on this seam now fallen in which makes its height above the Conglomerate 150 feet.

On the headwaters of Upper Devil's creek east of Bear Pen this coal has been opened on Joe Allen's and Wm. Tyler's land in C 32-43 and on W. E. Terrills' in C 31-42. It is reported 60 inches thick with partings at the Tyler opening and is there 150 feet above the top of the Conglomerate. At the Terrill opening which is 125 feet above the Conglomerate it is 51 inches thick with two shale partings each 8 inches thick, the one 10 inches and the other 26 inches from the base.

Across the divide on the drainage of Shackelford Fork, this coal has been opened on the farms of Widow Fortner, Arthur Taulbee, Wm. Terrill, Henry Chillis, A. J. Holland, Rene Allen and Lee Taulbee. All of these are about in C 31 and 32, 42 and 41.

Rene Allen's bank in at head of hollow in C 32-41 gives the following section for the coal.

	inches
Coal	10
Shale	2 to 4
Coal	12
Shale	9
Coal	12

A little over the line in the Salyersville Quadrangle the coal shows up in about 30-39 on Gardner Fletcher's place 33 inches thick with a 2-3 inch parting 12 inches from the base. It is here 120 feet above the Conglomerate.

In C 31-43 there is a bloom of a coal in the gap going over on to drainage of Stillwater creek which is probably this same seam. It is about 120 feet above the top of the nearest Conglomerate exposure.

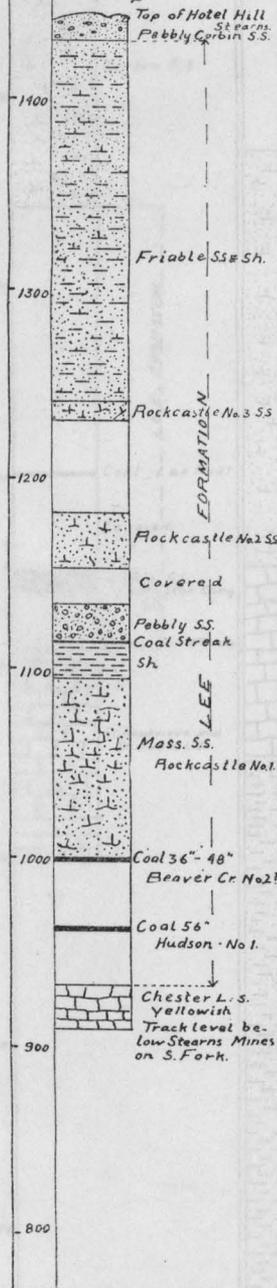
In C 32-44 there is also a bloom of a coal which may belong to this seam, and again in C 33-45 in the eastern edge of Camp-ton. The bloom of a coal near head of Trace Fork in C 32-45 is at an elevation above tide (about 990) to indicate that it may also belong to this seam, though the openings further east on Nancy Center's land (in C 31-45) and on Steve Poses' land (in C 31-45) may be on this coal. The latter is 110 5 A. T. and measures 30 inches thick at the entrance. It appears to be about 115 feet above the Conglomerate.



Section along Coal and Lumber Road, Stearns to South Fork of Cumberland Whitley Co. Ky.

A. 29-30, 31 and 32-42 and 41.

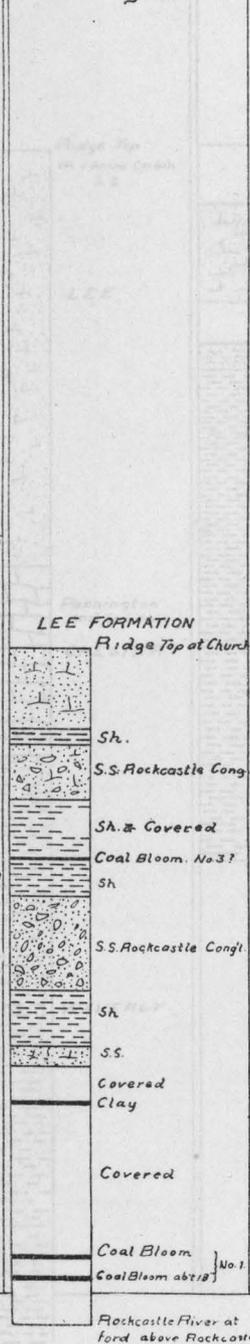
Fig. 1.



Section going up from Rockcastle Springs on London Road Laurel Co. Kentucky.

A. 18 and 19-1.

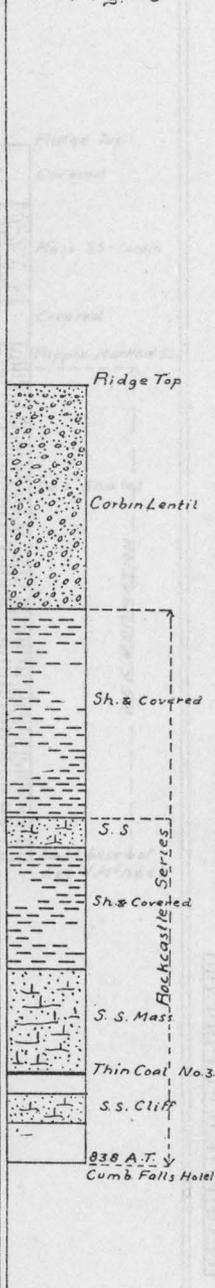
Fig. 2.



Section on Cumberland Falls, Corbin Road near Cumberland Falls, Whitley Co. Ky.

A. 19 and 20-51

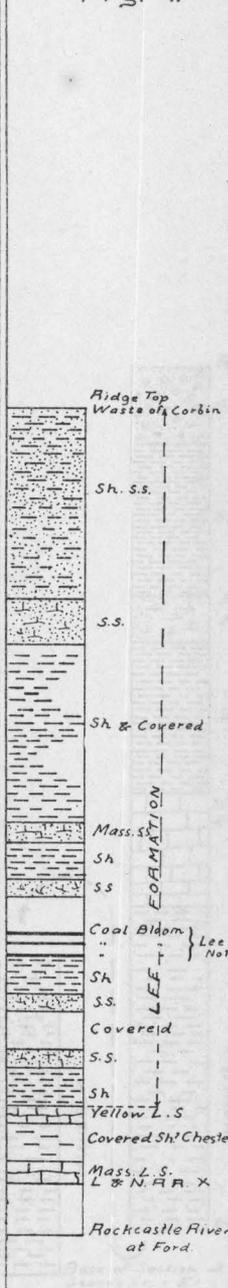
Fig. 3.



Section on Livingston and Pittsburg Road across the Rockcastle River South of Livingston, Rockcastle and Laurel Counties.

B. 14 and 13-18 and 17

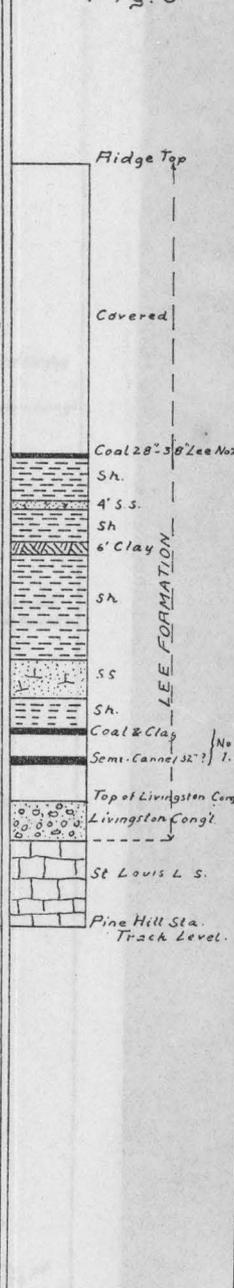
Fig. 4.



Section at Pine Hill Rockcastle Co.

B. 18-20.

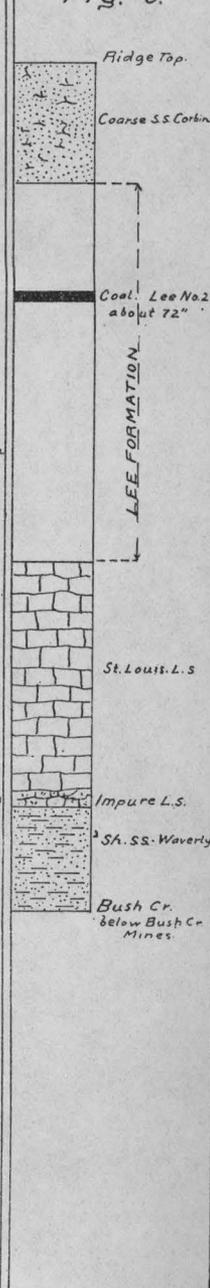
Fig. 5.



Section on Brush Creek at old Brush Creek Mines. Rockcastle Co.

B. 14-26.

Fig. 6.



Rockcastle River at Ford above Rockcastle Spr.

