Coal Geology of the Seitz Quadrangle Breathitt, Magoffin Morgan, and Wolfe Counties, Kentucky

GEOLOGICAL SURVEY BULLETIN 1122-C

Prepared in cooperation with the Kentucky Geological Survey

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By M. J. BERGIN

CONTRIBUTIONS TO ECONOMIC GEOLOGY

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COAL GEOLOGY OF THE SEITZ QUADRANGLE, BREATHITT, MAGOFFIN, MORGAN, AND WOLFE COUNTIES, KENTUCKY

By M. J. Bergin

ABSTRACT

The Seitz 7½-minute quadrangle covers about 59 square miles of the eastern Kentucky coal field in parts of Breathitt, Magoffin, Morgan, and Wolfe Counties. The outcropping bedrock, which has a maximum stratigraphic thickness of about 700 feet, is Middle Pennsylvanian in age and is assigned to the Breathitt formation. The formation is composed mainly of beds of sandstone, siltstone, and shale, and fewer beds of coal, underclay, and limestone. Sandstone, the predominant rock, ranges in thickness from less than 1 foot to as much as 100 feet. The beds of limestone, the least common rock, are as much as 2 feet thick; concretionary masses of limestone attain a thickness of as much as 5 feet and a diameter of as much as 10 feet. The beds of coal and limestone are the most persistent and widespread. Continental, paludal, and marine environments of deposition are represented by the strata.

The dominant structural feature is the Middle Fork anticline located in the east-central part of the quadrangle. The gentle dip of the strata to the north, west, and south from this high area is modified at several places to form the smaller structural features including the Wagers basin, Paxton syncline, Paxton and Wilhurst anticlines, and the Cow Creek dome. The Johnson Creek fault, a major structural feature in Magoffin County, crosses the extreme northwestern corner of the quadrangle where it has a normal displacement of 70 to 100 feet.

Original coal reserves totaling 155,140,000 short tons were estimated for seven of the coal beds in the area: Gun Creek, Fire Clay, Haddix, Prater, Oakley, Fugate, and Hindman(?). None of the coal beds has been mined extensively, and only the Oakley was being mined commercially in 1953. The coal is ranked as high-volatile bituminous and lies under less than 1,000 feet of overburden.

The locations of 10 wells (dry holes) drilled to test for oil and gas in the quadrangle are shown on the geologic map; information including total depths, formation tops, and depths of oil and gas shows is reported in tabular form. Producing formations are listed for oil and gas fields in nearby areas.

INTRODUCTION

The Seitz 7½-minute quadrangle, the northwestern quarter of the Bays 15-minute quadrangle, includes about 59 square miles in parts of

Breathitt, Magoffin, Morgan, and Wolfe Counties in the eastern Kentucky coal field (figs. 1 and 2). No towns or villages are in the quadrangle. Seitz is a post office near the junction of Puncheon Creek and Right Fork in the central part of the quadrangle (pl. 1). Salyersville, the seat of Magoffin County, is about 3 miles east of the northeastern corner of the quadrangle (fig. 2). Jackson, the seat of Breathitt County, is about 25 miles southwest of Salyersville, and West Liberty, the seat of Morgan County, is about 20 miles north (fig. 2). The populations of these towns in 1950 were Salyersville, 1,174; Jackson, 1,978; and West Liberty, 931.

Kentucky State Route 30 crosses the southeastern corner of the quadrangle along Left Middle Fork, Spruce Pine Fork, and Little Caney Creek; Kentucky State Route 134 crosses the northwestern corner along Johnson Creek. An improved secondary road crosses the central part of the quadrangle along Right Fork of Middle Fork. Many unimproved roads along the main valley bottoms give additional access to the area. No railroads enter the quadrangle; the nearest is the Chesapeake and Ohio Railway which services Royalton, about 6 miles southeast of Salyersville (fig. 2). The railroad extends southward from Royalton to serve the producing coal mines at Evanston and Tiptop in the Tiptop quadrangle.

The climate of the area is temperate and humid. Average annual precipitation ranges between 30 and 50 inches. The land is covered by forest, brush, and soil mantle that effectively mask outcrops. Usually only isolated outcrops of steep sandstone cliffs are exposed on the hillsides. Most information on strata in the area was obtained at outcrops in the valleys of the smaller streams and from exposures in mines, prospects, and road cuts.

Farming is the principal occupation in the area. Corn and tobacco are the main crops grown on the level bottom lands along streams and on the steep hillsides from which timber and brush have been cleared. A small amount of lumbering is done occasionally.

PHYSIOGRAPHY

The Seitz quadrangle lies across the boundary between the maturely dissected Allegheny Plateau on the north and the submaturely dissected Cumberland Plateau on the south, according to the physiographic subdivisions and boundaries given by Fenneman (1938, p. 290–304, 333–342). Streams south of the Breathitt-Magoffin County line in the southern part of the quadrangle flow southward and form part of the Kentucky River drainage; streams north of the county line flow northward and form part of the Licking River drainage. A physiographic diagram of Kentucky by Lobeck (*in* McFarlan, 1943,

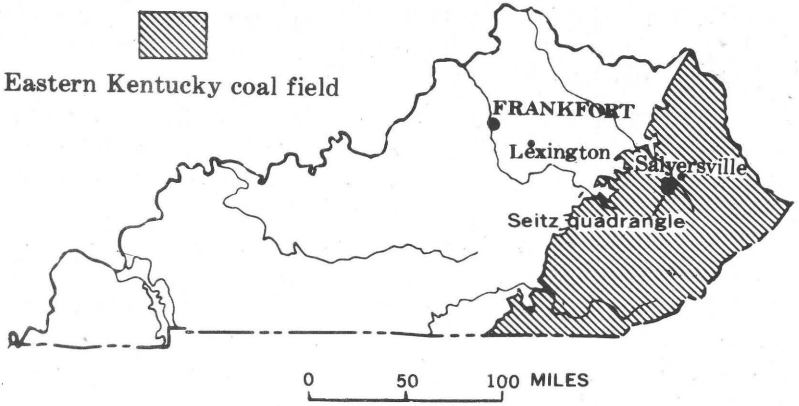

FIGURE 1.—Map of Kentucky showing the location of the Seitz quadrangle in the eastern Kentucky coal field.

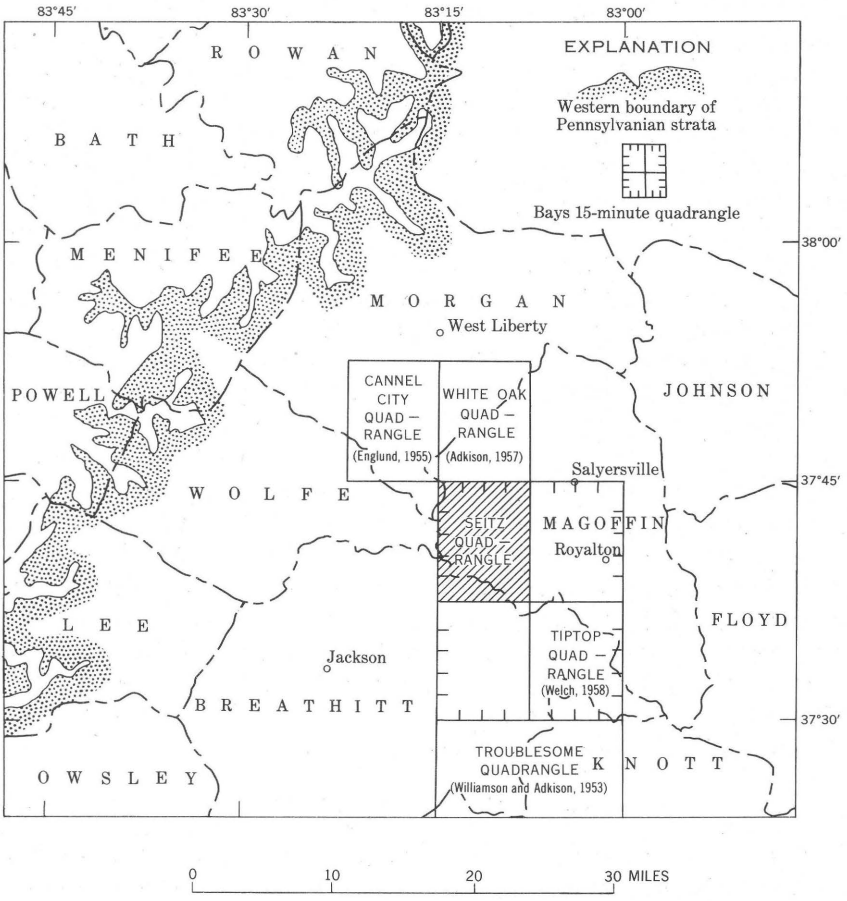

FIGURE 2.—Map showing the location of the Seitz 7½-minute quadrangle within the Bays 15-minute quadrangle and the relation to the western boundary of Pennsylvanian strata and adjacent mapped quadrangles.

p. 3), shows that part of Kentucky in which the Seitz quadrangle is located, between the Pottsville escarpment on the east and Pine Mountain on the southwest, as the Cumberland Plateau. The U.S. Geological Survey map of the physical divisions of the United States (Fenneman, 1946) shows the part of Kentucky in which the Seitz quadrangle is located as the Kanawha section of the Appalachian Plateau.

Most of the Seitz quadrangle is drained by tributaries of Johnson Creek and Middle Fork; both are tributaries of the Licking River. A small area in the southern part of the quadrangle is drained by Hunting Creek, Wolf Creek, and Little Caney Creek, all tributaries of Quicksand Creek that is a main tributary of the North Fork of the Kentucky River. The streams are fed by numerous springs and contain some water during the entire year except in periods of extreme drought.

The Seitz quadrangle is classified geomorphically as being in a mature stage of dissection. Flatlands are present only as narrow flood plains along major streams. The widest flood plain, 1,500 feet wide, is along Middle Fork near Gullett in the northeastern corner of the quadrangle. The flood plains, as much as 1,000 feet wide at the junction of the Right and Left Forks of Middle Fork, narrow upstream to extinction near the headwaters. Flood plains along Johnson Creek, Left Fork of Johnson Creek, and Cow Creek locally attain widths as much as 600 feet. The smaller streams and tributaries have narrow, steepsided, V-shaped valleys that head into the high, narrow ridges that form the drainage divides.

Hillsides in the area are very steep and are usually comprised of alternating benches and slopes formed by differential erosion of the underlying, relatively resistant sandstone and the softer, less resistant shale beds.

The lowest altitude is about 820 feet above sea level along Hunting Creek in the southwestern corner of the quadrangle. Altitudes range between 830 and 840 feet above sea level along Middle Fork and Johnson Creek where these streams cross the northern edge of the quadrangle. The highest point, 1,475 feet above sea level, is on the ridge between Horse Pen Branch and Left Fork of Johnson Creek north of the Breathitt-Magoffin County line near the west-central edge of the quadrangle (pl. 1). Maximum relief in the area is about 655 feet, and local relief ranges from 400 to 500 feet.

PREVIOUS INVESTIGATIONS

Coal beds and associated rocks along Johnson Creek in the Seitz quadrangle were described as early as 1858 by Lyon (1861, p. 536–

539). Crandall (1910, p. 16–20) described and correlated several coal beds that crop out along Johnson Creek, Right Fork, Left Fork, and Crafts Fork. The coal beds on Hunting Creek, Wolf Creek, and Little Caney Creek in the Breathitt County part of the quadrangle were described by Fohs (1912, p. 43–54) as part of the investigation of coal in the region drained by the Quicksand Creeks. A detailed investigation of the coal beds and the structural features of Magoffin County was made by Browning and Russell (1919). Stith (1939, p. 4–5) also described several coal beds on Little Caney Creek as part of a later investigation of coal in the Quicksand area.

Geologic structural maps that cover various parts of the Seitz quadrangle have been published as follows: Magoffin County by Browning (1921), Breathitt County by Browning (1927), Wolfe County by Robinson (1927), and Morgan County by Robinson and Hudnall (1925).

PRESENT INVESTIGATION

The geology and coal resources of the Seitz quadrangle were mapped by the U.S. Geological Survey as a part of a general investigation of the coal resources of eastern Kentucky. A total of about 5 months was spent in the field during the spring of 1952 and during the spring and fall of 1953 to obtain data for this report. Several hundred exposures of coal and other key beds were measured and described at mines, prospects, road cuts, and outcrops. Several stratigraphic sections were also measured and described where they were well exposed along roads and trails. Localities at which measurements and descriptions were made were plotted in the field on a topographic base map at a scale of 1 : 20,000. Most altitudes of the coal and other key beds were determined by aneroid barometer traverses corrected for atmospheric conditions. Altitudes at some localities were determined by hand leveling. Criteria used in correlating coal beds included physical and lithologic characteristics of the coal bed, characteristics of sediments directly overlying and underlying the coal bed, intervals to other coal beds, intervals to a limestone member, and extent of prospecting and mining of the coal bed.

ACKNOWLEDGMENTS

The writer wishes to thank the many local residents and mine operators who kindly permitted access to their properties and contributed information for this report. John L. Snider, W. E. T. Brown, and J. A. Van Lieu gave valuable assistance during the field seasons.

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Information about drilled wells in the area was obtained from the Kentucky-West Virginia Gas Co. and from open-file records of the Kentucky Geological Survey. The coal samples were analyzed by the U.S. Bureau of Mines. This report was prepared with the cooperation of the Kentucky Geological Survey.

STRATIGRAPHY

PENNSYLVANIAN SYSTEM—BREATHITT FORMATION

The bedrock exposed in the Seitz quadrangle is assigned to the Breathitt formation of Middle Pennsylvanian age which was named by Campbell (1898, p. 3) for exposures in Breathitt County, Ky. Campbell included in the formation all rocks of Carboniferous age lying above the top of the Lee formation; no specific top of the Breathitt formation was designated. Wanless (1939, p. 78) recognized the Breathitt formation as the upper division of the Pennsylvanian system in eastern Kentucky and included in it all beds above the Lee formation. More recently, the Breathitt formation has been considered by Wanless (1946, p. 10) to be about equivalent to the upper Norton, Gladeville, Wise, and Harlan formations in Virginia and to the Briceville, Jellico (Glenn, 1925), Scott, and Anderson formations in Tennessee.

Neither the top nor the base of the Breathitt formation is exposed in the Seitz quadrangle. The part of the formation that is exposed reaches a maximum thickness of about 700 feet. Rocks of Pennsylvanian age that stratigraphically overlie those exposed in this quadrangle are found in Breathitt County in the Tiptop quadrangle to the southeast (Welch, 1958). The oldest beds exposed in the Seitz quadrangle crop out along Middle Fork in the northeastern corner of the quadrangle and may be as much as 300 feet above the base of the formation. The youngest beds are along the high ridge at the junction of the Breathitt, Magoffin, and Wolfe county lines at the heads of Hunting Creek, Right Fork of Middle Fork, and Left Fork of Johnson Creek near the west-central edge of the area.

The informal stratigraphic names used in this report for coal beds and fossiliferous marine beds are, in ascending order: Gun Creek coal, Kendrick shale member,[1] Lower Whitesburg coal, Fire Clay coal, Hamlin coal, Magoffin member,[1] Haddix coal, Prater coal, Oakley coal, Fugate coal, Hindman(?) coal, and Lower Skyline coal (pl. 2). The probable correlations of coal bed names as used in this report with those used previously by other authors in this and nearby areas are given in table 1.

[1] After preparation of this report, usage reverted to Kendrick shale of Jillson (1919) and Magoffin beds of Morse (1931).

TABLE 1.—*Probable correlation of coal-bed names used in this report with those used in previous reports on the same or nearby areas*

[See figure 2 for locations of areas. Question marks not in parentheses indicate uncertainty as to the correlation of the bed]

Troublesome quadrange (Williamson and Adkison, 1953)	Tiptop quadrange (Welch, 1958)	Seitz quadrangle (Bergin, this report)	Magoffin County (Browning and Russell, 1919)	White Oak quadrangle (Adkison, 1957)
Flint Ridge flint of Morse	Flint Ridge flint of Morse? Upper Skyline?			
Knob$_3$?				
Knob$_2$?	Lower Skyline?	Lower Skyline?	Hindman?	
Knob$_1$?		?	Fugate?	
Hindman?	Hindman	Hindman(?)?	Flag?	
Flag-Hazard No. 7 [1]	Fugate	Fugate?	?	Sebastian.
	Oakley	Oakley	Hazard	Nickell.
			Whittaker [2]?	Index.
Hazard?	Prater?	Prater?	Young [2]?	
Haddix?	Upper Haddix? Lower Haddix?	Haddix?	Trace Fork?	Colvin.
Magoffin beds of Morse	Magoffin beds of Morse	Magoffin member [3]	Fossil limestone	Magoffin beds of Morse.
Hamlin?	Upper Hamlin? Lower Hamlin?	Upper Hamlin? Lower Hamlin?	Haddix? Hamlin?	Hamlin(?).
Fire Clay Rider	Fire Clay Rider	Fire Clay Rider	Fire Clay Rider?	
Fire Clay	Fire Clay	Fire Clay	Fire Clay	Fire Clay.
Whitesburg	Whitesburg?	Upper Whitesburg(?) Lower Whitesburg	Whitesburg?	Whitesburg(?).
	Gun Creek	Gun Creek	Gun Creek	Cannel City.
	Tom Cooper		Tom Cooper	Tom Cooper.

[1] See Welch (1958, p. 590).

[2] In the area of the Seitz quadrangle, Browning and Russell assigned the name Young to the Prater coal bed of the present report and the name Whittaker to a coal bed occurring about halfway between the Young coal bed and the Hazard coal bed above. However, Welch (1958, footnote 2 to table 1, page 590) states that data indicate that the Prater coal bed is equivalent to the Whittaker coal where it was named by Browning and Russell in the area east of the Tiptop quadrangle.

[3] Usage should be Magoffin beds of Morse.

As shown on plate 2, the Breathitt formation in the Seitz quadrangle consists predominantly of sandstone, siltstone, and shale, and some underclay, limestone, and coal. Continental, paludal, and marine environments of deposition are represented by the rocks in the formation.

The sandstone is composed mainly of subrounded, fine- to medium-sized grains of quartz, with fewer grains of dark accessory minerals. Cementing material in the sandstone is clay, iron oxide, silica, or calcium carbonate. A fresh surface of sandstone is light gray, whereas a weathered surface is usually a shade of reddish brown. Sandstone deposits range from very thin beds less than 1 foot in thickness to massive beds many feet thick. Crossbedding is common throughout most of the sandstone units. Many of the sandstone deposits were laid down in channels cut into the underlying strata by ancient stream erosion (pl. 2). The base of the sandstone channel deposit is sharp and undulating, whereas the upper contact and contacts of other sandstone deposits usually grade into finer grained sediments. Inclusions of shale and thin coal lenses occur in the lower few feet of many of the sandstone channel deposits. Brachiopods were found in a few of the sandstone beds (pl. 2).

The siltstone is generally light to medium gray and ranges from quartzose to clayey. Bedding can not be distinguished in siltstone at most fresh exposures, but the tendency for the siltstone to weather to irregular, thin-to-thick plates and chunks upon exposure indicates that it is poorly bedded. Siltstone lying beneath underclay or coal beds is usually nonbedded and stigmarian.

The shale is light gray to black. Shale beds only a few feet thick, especially those associated with coal beds, are dark gray to black and very carbonaceous, whereas shale in thicker units is usually light gray to medium dark gray. Many of the shale beds are silty and contain thin interbeds of siltstone. The shale commonly weathers to shades of olive green and iron-stained brown. Pencil and concretionary weathering of many of the silty shale units are conspicuous at several localities (fig. 3). Usually no bedding planes can be seen in fresh exposures of shale. Ironstone occurs as nodules and bands less than 2 inches thick in many of the shale units. Plant imprints are found in many of the shale beds and are very abundant in the black shale beds. Invertebrate marine fossils were found in medium-dark bluish-gray shale in the Magoffin member (Morse, 1931; Huddle and others, 1962) and the Kendrick shale member (Jillson, 1919; Huddle and others, 1962) (pl. 2).

Underclay is light gray to dark gray in fresh exposures and light gray and yellowish to reddish iron-stained brown on a weathered sur-

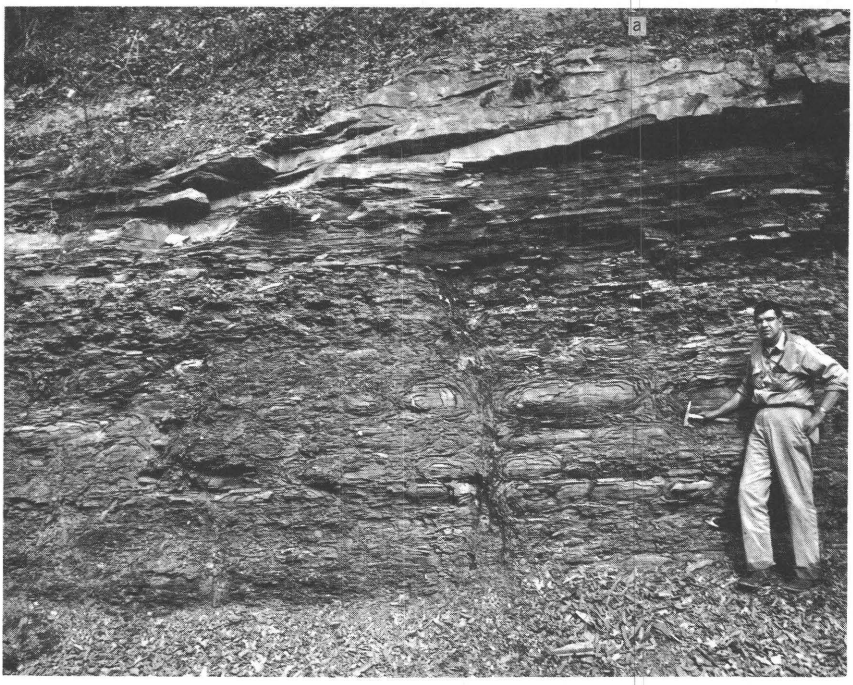

FIGURE 3.—Typical pencil and concretionary weathering of silty shale in roadcut along Hunting Creek. Bloom of Upper Hamlin coal (a) at top of exposure.

face. The underclay is typically nonbedded, stigmarian, and clayey, but at some places it is silty or sandy. Ironstone nodules, averaging less than 1 inch in diameter, are commonly scattered throughout the lower part of the underclay beds.

The small amount of limestone in the Breathitt formation in the Seitz quadrangle occurs as thin beds and ellipsoidal-shaped concretions associated with calcareous shale and siltstone. The fresh limestone is medium to dark bluish gray, whereas the weathered limestone is a shade of reddish brown. The limestone is hard, dense, and argillaceous to silty. The beds of limestone rarely exceed 1 foot in thickness, but the concertions attain a thickness of as much as 5 feet and a diameter of as much as 10 feet. Many of the concretions are septarian and some contain cone-in-cone structures. Invertebrate marine fossils are usually present in the limestone beds and to a lesser extent in the concretions, where they are associated with fossiliferous shale. The limestone beds grade laterally into calcareous fossiliferous siltstone and sandstone at many localities.

Coal beds as much as 48 inches thick (partings excluded) are persistent enough to be traced throughout the quadrangle. Analyses show

that the rank of the coal is high volatile bituminous. The beds consist primarily of shiny vitrain bands in a groundmass of attrital coal; minor amounts of impure coal (bone containing mixed attrital coal and clay), fusain (soft carbonaceous material resembling charcoal), iron sulfides (pyrite or marcasite), shale, underclay, and sandstone are common as stringers, partings, and thin layers of varying thickness and persistence in the coal beds. A few beds contain benches of cannel coal which is characterized by its conchoidal fracture, light weight, and lack of banding. Near the ground surface the coal is cleated to form brick-shaped to cubical blocks of various sizes.

Detailed descriptions of individual coal beds, whose stratigraphic positions are shown on plate 2, will be found on page C–26 under the heading, "Coal."

In order to give a more detailed description, the Breathitt formation in this report is informally and arbitrarily subdivided into lithologic units separated by the bases of mappable coal beds. The rocks making up these units are described from oldest to youngest. The coal beds that mark the boundaries of the units are, in ascending order: Gun Creek, Lower Whitesburg, Fire Clay, Oakley, Hindman(?), and Lower Skyline (pl. 2). Other named coal beds in these units are: Hamlin, Haddix, Prater, and Fugate (pl. 2). An additional subdivision is made for the Magoffin member that serves as one of the useful stratigraphic marker units in the formation (pl. 2).

STRATA BELOW THE GUN CREEK COAL BED

The lowest exposed strata of the Breathitt formation in the Seitz quadrangle crop out along Middle Fork in the northeastern corner of the area where the Gun Creek coal is only about 20 feet above drainage level. The rocks in this 20-foot interval below the Gun Creek coal bed are poorly exposed but seem to be interbedded siltstone and shale. At some localities the Gun Creek coal bed is directly underlain by shale or siltstone which forms the top bed of the rock sequence; at other exposures the Gun Creek coal bed is directly underlain by underclay.

STRATA FROM THE GUN CREEK COAL BED TO THE LOWER WHITESBURG COAL BED

The part of the Breathitt formation from the base of the Gun Creek coal bed to the base of the Lower Whitesburg coal bed ranges from 65 to 80 feet in thickness and is composed mainly of siltstone and lesser amounts of coal, shale, sandstone, and underclay. This unit is exposed only in the northern half of the quadrangle and along Hunting Creek in the southwestern corner. Rocks in the interval lie below drainage in most of the southern half of the quadrangle.

The lowest bed in this unit is the Gun Creek coal that was named from the extensive small-scale mining of the bed on Gun Creek in Magoffin County a few miles southeast of the Seitz quadrangle (Browning and Russell, 1919, p. 32, 464). The bed is equivalent to the Cannel City bed (Englund, 1955, p. 8, 17–18; Adkison, 1957, p. 6, 16) and the Amburgy coal bed of the North Fork of the Kentucky River (Hodge, 1915, p. 282).

Overlying the Gun Creek coal bed is a rock sequence, about 45 feet thick, containing at the base about 10 feet of medium-gray to black shale that abruptly grades upward to medium-dark-gray silty shale and siltstone. Included in the silty shale are many large, ellipsoidal, calcareous sandstone or sandy limestone concretions that attain thicknesses of 5 feet and diameters as much as 8 feet. The concretions are dark bluish gray, hard, and dense and occur at several stratigraphic positions. This sequence is assigned to the Kendrick shale member (Jillson, 1919, p. 96–104; Huddle and others, 1962). Invertebrate marine fossils, mainly brachiopods, were found in a black shale bed about 2 feet thick in this sequence in a road cut along Kentucky State Route 30 just east of the quadrangle (pl. 1; pl. 2, section 3).

A bed of massive, calcareous sandstone ranging from 10 to 15 feet in thickness overlies the Kendrick shale member in most localities. The remaining thickness of this unit, 10 to 20 feet, is composed mainly of medium-gray silty to sandy shale with thin sandstone lentils. The underclay of the Lower Whitesburg coal bed is the top bed of the unit.

STRATA FROM THE LOWER WHITESBURG COAL BED TO THE FIRE CLAY COAL BED

The unit from the base of the Lower Whitesburg coal to the base of the Fire Clay coad bed ranges in thickness from 35 to 50 feet. The rocks are below drainage in the southern third of the quadrangle except for a small area along Hunting Creek in the southwestern corner.

The basal bed of the unit is the Lower Whitesburg coal (Huddle and others, 1962). The coal bed was called Whitesburg by Browning and Russell (1919, p. 33). The coal is composed of thin vitrain bands in a dull to moderately bright attritus. No reserves were computed for the bed because the thickness of the coal is 14 inches or less where it is exposed in the quadrangle. However, the Lower Whitesburg coal bed is useful for correlation, subdivision, and structural interpretation in the Breathitt formation because it is easily recognized by thickness, position in relation to key beds, and by the characteristic black shale that directly overlies it. This overlying shale, which ranges in thickness from less than 1 inch to 10 feet, is black, laminated, hard, fissile, and brittle. The black shale is overlain by medium-dark-gray silty

shale and siltstone, which make up the remaining thickness of the unit at most localities. A thin coal bed, usually less than 1 foot thick is found about 15 to 25 feet above the Lower Whitesburg coal bed at several places (pl. 2, sections 1 and 2). The bed probably represents the Upper Whitesburg coal bed (Huddle and others, 1962). In some areas along the Left Fork of Johnson Creek and the forks of Cow Creek, a massive sandstone more than 10 feet thick, probably a channel deposit, lies between this upper coal and the Fire Clay coal bed (pl. 2, sections 1 and 2). Fossils of the lingula type were found in a calcareous, silty sandstone bed, 3 feet thick, that was exposed in the road cut where section 3 on plate 2 was measured. Fossils of this type have also been reported from the roof rock of the Whitesburg coal (Browning and Russell, 1919, p. 34). The underclay of the Fire Clay coal bed forms the top of this unit.

STRATA FROM THE FIRE CLAY COAL BED TO THE MAGOFFIN MEMBER

The part of the Breathitt formation from the base of the Fire Clay coal bed to the base of the Magoffin member ranges in thickness from 65 to 85 feet in the Seitz quadrangle. Massive sandstone is the predominanat rock type; but several thin beds of coal, underclay, shale, and siltstone occur in the unit (pl. 2). The rock sequence is exposed, wholly or in part, along streams throughout the quadrangle.

The basal bed of the unit is the Fire Clay coal, which was named by Hodge (1908, p. 40–41). This key bed is identifiable in most of the eastern Kentucky coal field by its characteristic flint-clay parting. At most localities in the Seitz quadrangle only one coal bed contains the parting, but at some localities as many as three thin coal beds occur in an interval of 10 to 15 feet in this stratigraphic position (fig. 4). The flint clay parting is usually in the highest bed. The flint clay, which ranges in thickness from less than 1 inch to 5 inches, may be at the top, the base, or as a parting within the coal bed (fig. 5). Locally the coal is absent and the flint clay occurs in black, carbonaceous shale. Typical flint clay is medium brownish gray to brownish black, mottled, hard, dense, nonbedded, and has a conchidal fracture (fig. 6). The flint clay is well developed in the Seitz quadrangle except in exposures along Hunting Creek in the southwestern part of the quadrangle and upstream from Pond Branch on the Left Fork of Johnson Creek in the west-central part, where it is soft and very thin or absent.

At several localities in the northern part of the quadrangle and along Hunting Creek in the southwestern part, a coal bed and associated underclay occurs from 6 to 15 feet above the Fire Clay coal bed (pl. 2, sections 1 and 2) and is probably the Fire Clay rider coal bed

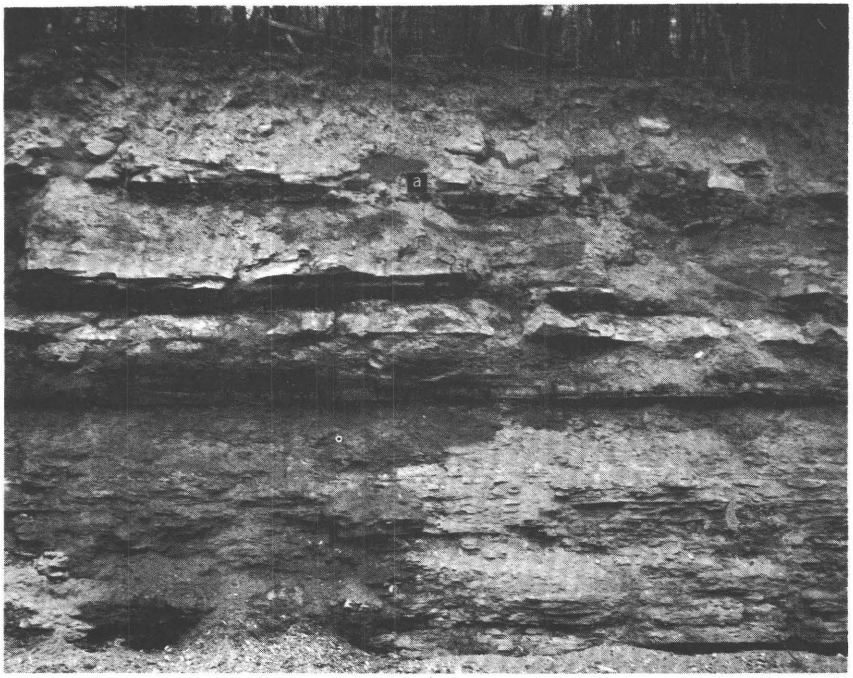

FIGURE 4.—Fire Clay and two underlying coal beds exposed in road cut at the mouth of Crafts Fork. Fire Clay coal (a) at top of cut is about 16 inches thick.

(Hodge, 1908, p. 41). Thin beds of shale, siltstone, and sandstone lie between the Fire Clay coal bed and the rider bed. The rider bed is overlain by medium-gray shale that grades upward into siltstone that is in turn overlain unconformably by massive, channel-fill sandstone. The shale and siltstone contain large, sandy limstone concretions; and, where these beds are replaced by massive sandstone, a concretionary weathering, calcareous sandstone bed is near the top of the sandstone sequence (pl. 2, section 5).

In many areas, especially along the Left Middle Fork, massive crossbedded sandstone lying in channels makes up the entire thickness of strata between the Fire Clay coal bed and one or two thin coal beds about 35 to 40 feet above, which are correlated with the Hamlin coal bed (Hodge, 1915, p. 8; Browning and Russell, 1919, p. 41–42; Welch, 1958, p. 592) (pl. 2, section 3). Where two coal beds are present in this part of the section, they are referred to as the Upper and Lower Hamlin coal beds. Strata between the Hamlin coal beds consist of dark-gray shale at the base, which grades upward to silty shale that weathers pencil and concretionary (fig. 3). A thin sandstone bed is usually present between the silty shale and the overlying Upper

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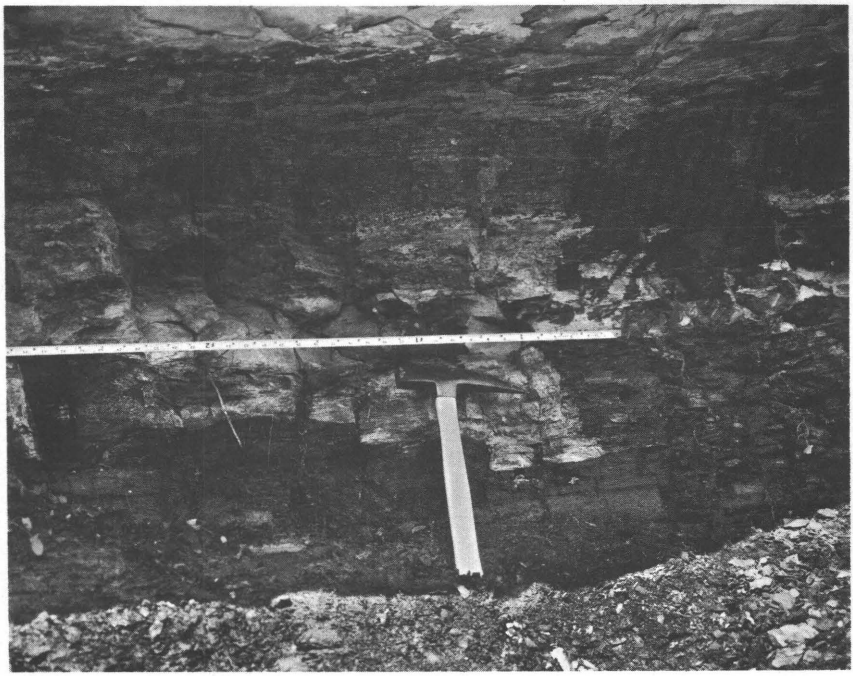

FIGURE 5.—Exposure of Fire Clay coal bed in stratigraphic section 3 (pl. 2). Rule lies along flint clay parting, about 5 inches thick, near center of the coal bed.

Hamlin coal bed. Overlying the Upper Hamlin coal bed is massive sandstone as much as 25 feet thick that lies in broad channels. At many places the standstone may attain a greater thickness where the channels were eroded through the Hamlin coal beds.

At many places the 15-foot zone of rocks directly underlying the Magoffin member may contain one or two coal beds less than 1 foot thick (pl. 2, sections 2–5 and 7). These coal beds are in the stratigraphic position of the Copland coal bed (Morse, 1931, p. 296–302).

THE MAGOFFIN MEMBER [2]

The Magoffin member (Morse, 1931, p. 301–303; Huddle and others, 1962) is present throughout but is well exposed only in the southern two-thirds of the Seitz quadrangle. The member has a distinctive lithologic character, is abundantly fossiliferous, and is easily recognizable; it thus serves as a useful marker and key bed for correlation and structural interpretation in the Breathitt formation. This part of the section was referred to as the Fossil limestone by Browning and Russell (1919, p. 24).

[2] See footnote 1, p. C–6.

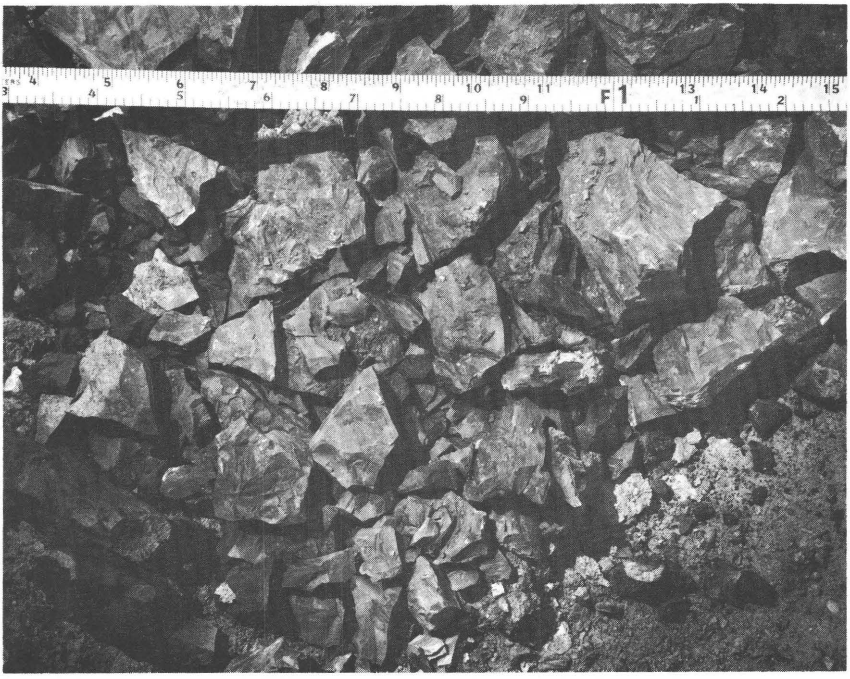

FIGURE 6.—Flint clay from parting in the Fire Clay coal bed showing typical mottled appearance and conchoidal fracture.

Where it is typically developed, the Magoffin member consists of a basal bed of limestone overlain by shale that contains a layer of limestone concretions (fig. 7; pl. 2, sections 4, 6, and 7). The basal limestone, which ranges from 2 to 10 inches in thickness, is medium dark gray, hard, dense, and silty and may overlie coal, shale, or siltstone (pl. 2). Abundant macerated fossil shell fragments, crinoid stem segments, and brachiopods occur in the "crinoidol" basal limestone bed. The overlying shale is dark bluish gray to very dark gray, poorly bedded, and calcareous and reaches a maximum thickness of about 15 feet. The shale contains marine fossils, mainly brachiopods, which become less abundant upward. The limestone concretions, which range from 1 to 2 feet in thickness, are medium to dark bluish gray, hard, dense, and silty (fig. 8). Many of the concretions have septaria and cone-in-cone structure. The layer of concretions may occupy a position in the shale anywhere between half a foot and 5 feet above the basal limestone bed. Marine fossils (brachiopods) are sparse in the concretions.

As shown in plate 2 (sections 4, 5, 6, and 7) and in figures 7 and 8, a fossiliferous sandstone bed 3 to 10 feet in thickness occurs at places

FIGURE 7.—The Magoffin member exposed in roadcut along Crafts Fork in the extreme southeastern corner of the Seitz quadrangle. (a) Basal "crinoidal" limestone bed (adz rests on top of bed), (b) dark-gray fossiliferous shale, (c) fossiliferous, concretionary limestone bed, (d) dark-gray fossiliferous shale, (e) fossiliferous (spiriferoid brachiopods) sandstone.

above the shale of the Magoffin member. The sandstone is light gray, very fine grained, and calcareous and contains brachiopods (spiriferoid) that are locally abundant. The sandstone beds were exposed only in the southern half of the quadrangle. The extent of this sandstone bed, part of the Magoffin member in this report, could not be accurately determined because of lack of exposures and the presence of sandstone-filled channels eroded into this part of the section.

Locally a massive sandstone deposited in channels occupies the position of the sandstone, upper shale, and concretionary limestone layer of the Magoffin member (pl. 2, sections 2 and 3). At several localities in the northern half of the quadrangle the Magoffin member is probably represented by a single bed of fossiliferous, calcareous siltstone, 3 to 6 inches thick, in medium-gray shale.

STRATA FROM THE MAGOFFIN MEMBER TO THE OAKLEY COAL BED

Strata between the top of the Magoffin member and the base of the Oakley coal bed, 125 to 140 feet above, (pl. 2) occur throughout the

FIGURE 8.—Exposure of the Magoffin member in roadcut near the head of Right Fork of Middle Fork; (a) concretionary, fossiliferous limestone bed, (b) dark-gray fossiliferous shale, and (c) fossiliferous (spiriferoid brachiopods) sandstone.

quadrangle. This unit is composed of beds of sandstone, siltstone, shale, and underclay, and as many as six nonpersistent coal beds, of which only two, the Haddix and the Prater, are named. Over much of the central third of the quadrangle these rocks were partially eroded, and the channels are filled by massive sandstone (pl. 2, sections 3 and 4). The beds in this unit are nonpersistent; lateral changes in lithology are abrupt; individual beds vary greatly in thicknesses at different localities. These factors, in addition to the abundance of channel-fill sandstone in the unit, make mapping of coal beds difficult and correlations questionable.

The Haddix coal bed (Hodge, 1908, p. 41–42; Welch, 1958, p. 594) lies about 35 to 50 feet above the base of the Magoffin member (pl. 2). One to three coal beds may occur in this stratigraphic position in a shale and underclay sequence as much as 15 feet thick. Where there is more than one coal bed, the uppermost is arbitrarily called the Haddix. These coal beds lie in the stratigraphic position of the Trace Fork coal of Browning and Russell (1919, p. 44). One of the coal beds is probably equivalent to the Colvin coal bed (Adkison,

1957, p. 11, 17–19). Welch (1958, p. 594) reports two coal beds in this stratigraphic position and refers to them as the lower and upper Haddix. Rocks lying betweeen the Haddix coal bed and the Magoffin member below are usually thin, alternating beds of shale, siltstone, and sandstone in addition to the coal and associated underclay already mentioned (pl. 2, section 7). The Haddix coal is overlain in most places by massive sandstone which fills broad channels; in the central third of the quadrangle this sandstone was deposited on a surface that had been eroded in some places to the shale below the concretionary limestone bed of the Magoffin member (pl. 2, sections 3 and 4).

The Prater coal bed (Welch, 1958, p. 595) lies about 65 to 75 feet above the base of the Magoffin member (pl. 2). At most localities, underclay, which ranges in thickness from a few inches to 3 feet separates the base of the Prater coal bed and the top of the sandstone that overlies the Haddix coal bed (pl. 2, section 7). At other localities the strata between the Haddix and Prater coal beds consist mainly of shale (pl. 2, section 5); in these places the Prater coal is usually split into several thin beds less than 14 inches thick. The Prater coal bed was recognized and traced with certainty only in the southern half of the Seitz quadrangle; it is replaced by sandstone-filled channels over much of the rest of the area. The coal bed called Prater in this report was referred to as the Young coal bed by Browning and Russell (1919, p. 45) and is probably equivalent to the Hazard coal of the North Fork of the Kentucky River (Hodge, 1908, p. 42–43) and of the Troublesome quadrangle (Williamson and Adkison, 1953).

A coal bed less than 1 foot thick lies above a sequence of shale, siltstone, sandstone, and underclay that ranges from 5 to 15 feet in thickness and overlies the Prater coal. At some localities a discontinuous flint-clay bed 1 to 3 inches thick occurs in the rocks between the coal beds, but usually it is in the underclay below the upper coal bed (pl. 2, section 7). On the basis of this flint-clay bed, the upper coal is tentatively correlated with the Index coal bed of Adkison (1957, p. 12, 19). At many localities in the southeastern part of the quadrangle the thin coal is overlain by silty shale, 5 to 10 feet thick, that contains calcareous sandstone concretions as much as 2 feet thick and 4 feet in diameter. The shale, in turn, is overlain by massive channel-filled sandstone which at some places in the northern and western parts of the quadrangle was deposited in channels that were incised to the massive sandstone below the Prater coal. In some areas, therefore, the stratigraphic section from the Magoffin member up to and including the sandstone above the coal that is believed

to be correlative with the Index bed, is composed entirely of one or more massive channel-filled sandstones (pl. 2, sections 3 and 4).

Two coal beds, each less than 1 foot thick, are found in a shale sequence about 20 feet thick that lies from 90 to 110 feet above the base of the Magoffin member (pl. 2, section 3). The lower coal bed is reported to be 30 inches thick on Stevens Fork of Cow Creek, but no exposures could be seen. On the basis of stratigraphic position and distance above the Magoffin member, the lower coal bed is tentatively correlated with the Adele coal bed of Englund (1955, p. 11 and 18); the upper coal is probably the bed referred to as the Whittaker by Browning and Russell (1919, p. 47–50). The shale that contains the two coal beds is overlain by massive sandstone, 10 to 45 feet thick that fills channels that were eroded into the shale and coal beds in much of the southern half of the quadrangle (pl. 2, sections 5, 6, and 7).

Shale ranging from 1 to 10 feet in thickness usually overlies the massive sandstone. The underclay of the Oakley coal bed is the top bed in the stratigraphic unit.

STRATA FROM THE OAKLEY COAL BED TO THE HINDMAN(?) COAL BED

The part of the Breathitt formation from the base of the Oakley coal bed to the base of the Hindman(?) coal bed ranges in thickness from 65 to 90 feet. Rocks in this unit are poorly exposed throughout the quadrangle.

The Oakley coal bed (Crandall, 1910, p. 21; Welch, 1958, p. 596) is the basal bed of this unit. This persistent bed has been artificially exposed extensively in the southern half of the quadrangle and in many places in the northern half; it thus serves as a useful key bed for correlation within the formation.

The Oakley coal bed is the one described as the Hazard coal bed by Browning and Russell (1919, p. 50–52). The bed is probably equivalent to the Nickell coal bed of Englund (1955, p. 11, 19) and Adkison (1957, p. 12, 19), and the Hazard No. 7 coal bed of Perry County, Ky., (Williamson and Adkison, 1953; Welch, 1958, p. 596). Fohs (1912, p. 6, 45–54) called this bed the Dean coal in the Breathitt County part of the quadrangle.

At many localities directly overlying the Oakley coal bed is a bed of impure cannel coal that ranges in thickness from 0 to 2 feet and that grades laterally through black thin-bedded shale to gray poorly bedded shale. Gray, silty shale that ranges in thickness from 0 to 15 feet overlies the coal or the equivalent shale. At many localities this silty shale contains one or two coal beds, each less than 1 foot

thick, that may occur anywhere within 12 feet above the top of the Oakley coal bed. A massive sandstone at least 20 feet thick usually overlies the shale; where it occupies channels eroded into the shale, the sandstone may attain a thickness as much as 35 feet.

A coal bed, which was observed only at a few scattered localities (pl. 1, locs. 155, 156, 157), lies about 30 to 35 feet above the Oakley coal bed and is probably the Fugate coal bed (Hodge, 1915, p. 5, 79; Welch, 1958, p. 596–597). This bed is equivalent to the Flag coal bed of the northern part of the Troublesome quadrangle (Williamson and Adkison, 1953) and probably equivalent to the Sebastian coal bed (Adkison, 1957, p. 13, 20). This coal may be the unnamed bed that Browning and Russell (1919, p. 52) described between their Hazard and Flag coal beds. Less than 2 feet of gray shale overlies the Fugate coal bed at a few localities, but usually a massive, channel-fill sandstone overlies the coal. In most of the Seitz quadrangle this sandstone lies in channels where the coal has been eroded (pl. 2, section 7). In the southwestern part of the quadrangle, above the position of the Fugate coal bed, there is about 45 feet of silty shale, containing, near the middle, a coal bed less than 1 foot thick. The correlation of this coal is not clear, but it is probably a rider bed to the Fugate coal. The silty shale grades upward to underclay that underlies the Hindman(?) coal bed and forms the top bed of this unit.

STRATA FROM THE HINDMAN(?) COAL BED TO THE LOWER SKYLINE COAL BED

The part of the Breathitt formation from the base of the Hindman(?) coal bed to the base of the Lower Skyline coal bed ranges in thickness from 160 to 170 feet. Rocks of the unit are poorly exposed on the highest hills and ridges in the quadrangle. The rocks are well exposed only in the road cuts at the head of Right Fork of Middle Fork (pl. 2, section 4).

A coal tentatively correlated with the Hindman coal (Hodge, 1908, p. 43; Welch, 1958, p. 597–598) is the basal bed of this unit of rocks. The name is questioned in this report because of the doubtful correlation with the type Hindman coal bed in Knott County. This bed is probably that described as the Flag coal by Browning and Russell (1919, p. 52–54).

Directly overlying the Hindman(?) coal bed is about 10 feet of strata that grade upward from dark-gray shale at the base to gray siltstone at the top. The overlying 30 feet of rock is composed of alternating beds of sandstone and shale. Browning and Russell (1919, p. 54) report a coal bed that they called the Flag coal rider occurring 10 to 30 feet above their Flag coal (Hindman(?) coal bed of this report); only an underclay bed occupies this position in the

Seitz quadrangle (pl. 2, sections 4 and 5). Massive, cliff-forming sandstone, as much as 80 feet thick, lies above this rider coal or underclay position. This sandstone was called the High Rock sandstone by Browning and Russell (1919, p. 15, 52–53).

Two coal beds were found between the so-called High Rock sandstone and the Lower Skyline coal bed. The lower coal bed lies about 100 feet above the Hindman(?) coal bed and about 320 feet above the base of the Magoffin member (pl. 2, sections 4 and 5). The coal observed was less than 14 inches thick in the quadrangle. About 5 feet of underclay and 10 feet of silty shale separate this lower coal and the top of the High Rock sandstone below. The upper coal lies about 135 feet above the Hindman(?) coal bed and about 350 feet above the base of the Magoffin member (pl. 2, section 4). The two coals are separated by massive cliff-forming sandstone as much as 25 feet thick and an overlying underclay about 5 feet thick. This sandstone forms a part of the Puncheon Creek sandstone of Browning and Russell (1919, p. 13–14). The upper coal is 37 inches thick (including a 3-inch parting) where prospected on the ridge between Wolf Creek and Richie Branch near the southern edge of the quadrangle (pl. 2, section 6). At other scattered prospects the coal was less than 14 inches thick. Rocks between the higher coal and the shale and underclay that underlie the Lower Skyline coal bed are concealed throughout most of the quadrangle.

STRATA ABOVE THE BASE OF THE LOWER SKYLINE COAL BED

At least 100 feet of strata is poorly exposed above the base of the Lower Skyline coal bed in the Seitz quadrangle. The Lower Skyline coal bed, which was named by Welch (1958, p. 598–599), lies about 165 feet above the Hindman(?) coal bed and about 390 feet above the base of the Magoffin member (pl. 2, sections 4 and 6). The bed is probably equivalent to the $Knob_2$ coal bed of the northern part of the Troublesome quadrangle (Williamson and Adkinson, 1953). Browning and Russell (1919, p. 55, 89–90, 114) called this bed the Hindman coal where they saw a 4-foot bloom exposed on a knob, locally known as Town Flats, on the ridge at the head of the Left Fork of Johnson Creek. A few scattered localities in the southern part of the Seitz quadrangle have been prospected for the coal. Exposures of the bed and associated rocks are poor because the bed lies close to the tops of the high ridges and knobs; sandstone or shale directly overlying it at places where the coal has been prospected, and isolated outcrops of cliff-forming sandstone at other places on the high points of the "County line" ridge in the southern part of the quadrangle, constitute the only exposures seen of rocks above the coal bed.

QUATERNARY SYSTEM—ALLUVIUM

Alluvium, consisting of unconsolidated deposits of silt, sand, gravel, and a few boulders, occurs in most of the valley bottoms and grades into slopewash on the hillsides. The alluvial deposits were mapped only in the wider valley bottoms along the larger streams in the northern part of the area (pl. 1).

STRUCTURE

The Seitz quadrangle lies north of the Eastern Kentucky syncline (McFarlan, 1943, p. 137; Huddle and others, 1962). The axis of the syncline, one of the major structural features in the coal basin, is located about 1 or 2 miles south of the southern edge of the quadrangle. Regionally, the rocks of Pennsylvanian age in this part of Kentucky dip to the south and east into the syncline, but in the Seitz quadrangle this regional dip is not apparent because of the reversals in dip associated with a low upfold trending westward across the central part of the quadrangle and a normal fault in the extreme northwest corner.

The general structure of the strata in the Breathitt formation in the Seitz quadrangle is shown on plate 1 by the structure contours drawn on the top of the basal limestone bed of the Magoffin member. This bed was used for contouring because it is more easily recognized over a larger part of the quadrangle than any other key bed. The contour lines are dashed in much of the northern part of the quadrangle and in a small area in the southern part, where the position of the limestone bed was approximated by reference to the Fire Clay and Oakley coal beds. As shown by the structure contours, the beds dip gently to the north, west, and south from the Middle Fork anticline (Middle Fork dome of Browning, 1921), the structurally highest area in the quadrangle. Variations in the general dip have formed smaller structual features consisting of domes, terraces, noses, synclines, and basins (pl. 1). The most prominent of these features is a northeast-elongated basin, here designated Wagers basin, in the south-central part of the quadrangle (pl. 1). The axis of the eastward-plunging Paxton syncline (Browning, 1927) extends into the quadrangle from the west and terminates in Wagers basin. The eastern end of the eastward-plunging Wilhurst anticline (Browning, 1927) extends for a short distance into the quadrangle just south of and parallel to the Paxton syncline. Lying north of the Paxton syncline is the eastward-plunging Paxton anticline (Robinson, 1927) that barely juts into the quadrangle. The Cow Creek dome (Browning, 1921) is a structure with small closure lying on the saddle between

the Middle Fork and Paxton anticlines. The rocks south of Wagers basin dip southward into the Eastern Kentucky syncline (referred to as the Big Caney syncline by Welch, 1958, p. 600, pl. 51).

The trace of the Johnson Creek fault (Browning and Russell, 1919, p. 20, 89, 100–104, 106, 328), a major structural feature in Magoffin County, crosses the extreme northwestern corner of the quadrangle in an east-northeast direction. The fault is normal with an approximate displacement of 70 to 100 feet in the map area. Rocks north of the fault have been elevated relative to those on the south side. The beds on the south side of the fault dip north with a noticeable increase in dip near the trace of the fault; a dip of 5° was measured near the mouth of Wheel Rim Fork of Johnson Creek. The rocks on the north side of the fault also dip north but at a lesser degree. No exposures of the fault plane were observed in the quadrangle, but the approximate trace of the fault was located by mapping the displacement of the Fire Clay coal bed. At an exposure on Kentucky State Route 134 along Johnson Creek in the White Oak quadrangle to the north, the fault plane dips 40° to the south (Adkison, 1957, p. 14–15, fig. 6).

MINERAL RESOURCES

COAL

RESERVES

The Breathitt formation exposed in the Seitz quadrangle contains 12 coal beds that are known or reported to exceed 14 inches in thickness at some localities, and at least 7 other coal beds that are not known to attain a thickness of 14 inches. Adequate data from which coal reserve estimates could be made were obtained on only 7 of the 12 beds that exceed 14 inches in thickness; they are, in ascending order: Gun Creek, Fire Clay, Haddix, Prater, Oakley, Fugate, and Hindman(?). The total original coal reserves of 155,140,000 short tons were estimated for these 7 coal beds in the Seitz quadrangle (table 2).

Coal reserve estimates are necessarily categorized according to the amount and reliability of data, thickness of coal excluding partings, and depth of overburden. Reserve estimates are reported in these categories by individual bed. Each category is totaled, and these totals in turn are added to give the total coal reserves in the quadrangle (table 2). In computation, the coal was assumed to weigh 1,800 tons per acre-foot.

TABLE 2.—*Estimated original coal reserves of the Seitz quadrangle*

[In thousands of short tons, covered by less than 1,000 feet of overburden]

Bed	Indicated reserves in beds				Inferred reserves in beds				Total reserves in beds			
	14–28 in. thick	28–42 in. thick	>42 in. thick	Total	14–28 in. thick	28–42 in. thick	>42 in. thick	Total	14–28 in. thick	28–42 in. thick	>42 in. thick	Total
Hindman(?)	2,130	----------	----------	2,130	5,610	340	----------	5,950	7,740	340	----------	8,080
Fugate	----------	----------	----------	----------	3,960	970	----------	4,930	3,960	970	----------	4,930
Oakley	10,300	30,670	7,270	48,240	13,570	2,700	----------	16,270	23,870	33,370	7,270	64,510
Prater	14,780	16,060	----------	30,840	5,180	----------	----------	5,180	19,960	16,060	----------	36,020
Haddix	----------	1,540	----------	1,540	5,760	----------	----------	5,760	5,760	1,540	----------	7,300
Fire Clay	11,330	----------	----------	11,330	4,030	----------	----------	4,030	15,360	----------	----------	15,360
Gun Creek	4,890	4,080	----------	8,970	8,450	1,520	----------	9,970	13,340	5,600	----------	18,940
Total	43,430	52,350	7,270	103,050	46,560	5,530	----------	52,090	89,990	57,880	7,270	155,140

On the basis of amount and reliability of data, the reserves are reported as indicated and inferred. Indicated reserves were calculated where the extent and thickness of the coal bed are well defined. This arbitrarily includes coal lying within three-quarters of a mile of an outcrop along which the thickness of the bed was measured about every quarter of a mile, and within a half a mile of an outcrop along which the thickness observation points were spaced from more than a quarter of a mile apart to a maximum of 1 mile apart. Inferred reserves were calculated for coal that was assumed to lie beyond the area of indicated reserves to a maximum of 2 miles from a point where the thickness of the bed was measured. Inferred reserves were calculated also for coal lying within three-fourths of a mile of scattered isolated localities at which the thickness of the coal bed was either measured or reported.

Coal reserves are reported in the following categories based on the thickness of the bed, excluding partings more than three-eighths of an inch thick: 14 to 28 inches, 28 to 42 inches, and more than 42 inches. Beds or parts of beds made up of alternating layers of thin coal and partings were excluded if the partings make up more than half the total thickness. Layers of coal that lie above or below thick partings and that would be left in mining were excluded also, as were beds of "dirty" and impure coal that are not usually mined.

All beds for which coal reserves were calculated underlie less than 1,000 feet of overburden.

Outcrop lines and points of control for eight coal beds (the Lower Skyline in addition to those on which reserves were calculated) and the Magoffin member are shown on plate 1. Control points are also shown for those localities where the Lower Whitesburg coal was measured. The lines of outcrop show only the stratigraphic position and approximate altitude of the bed; no thickness of the bed can be interpreted from the outcrop line. The outcrop line for an individual bed was discontinued in areas where little or no data were available; therefore, the outcrop line may not indicate the total areal extent of the bed. The control points indicate a locality where a bed was measured or where the position of the bed was reported. Description and thicknesses of the coal beds were not obtained at many of the mines because they were completely caved when visited. The graphic sections in figures 9 through 14 and plate 4 show the thicknesses and descriptions of the coal beds where they were measured; the numbers at the top of the individual graphic sections are the locality numbers shown on plate 1. Plate 3 shows the thickness and the generalized distribution of coal in the Gun Creek, Fire Clay, Prater, and Oakley coal beds.

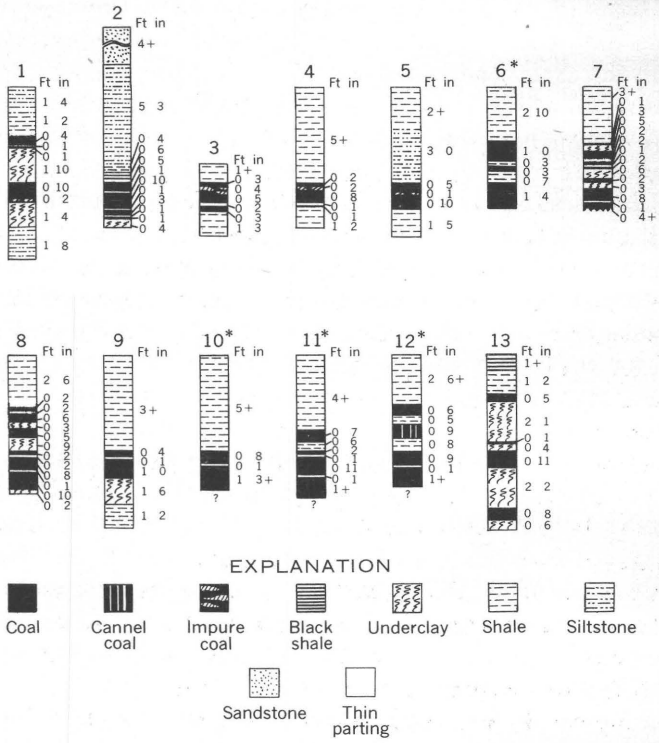

FIGURE 9.—Sections of the Gun Creek coal bed in the Seitz quadrangle, Kentucky. Location of sections shown on plate 1. Sections marked with asterisks (*) from Browning and Russell (1919).

DESCRIPTION OF BEDS

GUN CREEK COAL BED

The Gun Creek coal bed has been mined for local use where it crops out along the Right and Left Forks of Middle Fork in the northeastern quarter of the quadrangle (pl. 3). Where the coal is exposed, it ranges in thickness from 14 to 37 inches excluding partings. The bed changes in thickness abruptly and may consist of as many as nine benches of coal separated by partings. Usually, where the coal is the thickest, it contains many partings of impure coal, shale, and underclay (fig. 9, sections 1–13). The coal contains thin to thick vitrain bands in a matrix of moderate to bright attritus. Cannel coal was reported in the bed at locality 12 (fig. 9).

About 18,940,000 tons of original reserves was estimated for the Gun Creek coal bed, but this figure would be increased if data were available on the bed underlying drainage level over most of the quadrangle (table 2). Coal mined and lost in mining in the Gun Creek bed is negligible.

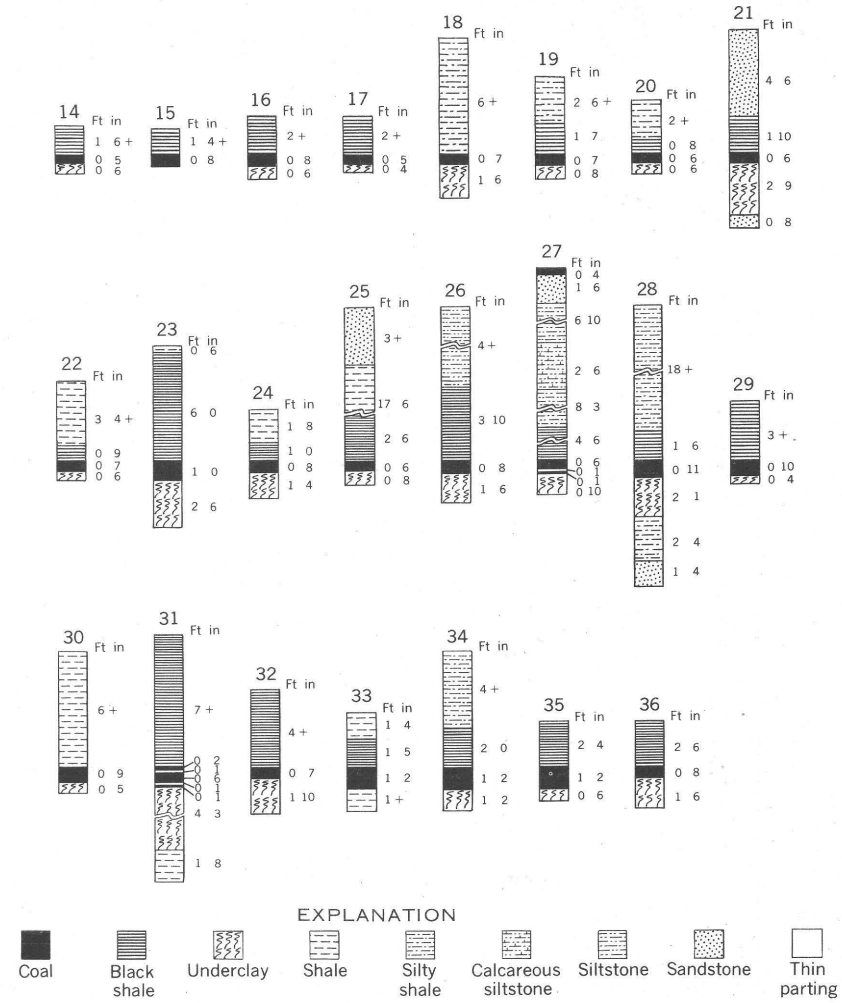

FIGURE 10.—Sections of the Lower Whitesburg coal bed in the Seitz quadrangle, Kentucky. Location of sections shown on plate 1.

	As received (percent)	Moisture-free (percent)	Moisture- and ash-free (percent)
Proximate analysis:			
Moisture	5. 01		
Volatile matter	35. 35	37. 20	41. 90
Fixed carbon	49. 02	51. 60	58. 10
Ash	10. 62	11. 20	
Total	100. 00	100. 00	100. 00
Sulfur	3. 08	3. 24	3. 65
Heating value Btu	12, 720	13, 390	15, 070

Air-dry loss	percent	2. 39
Specific gravity		1. 324

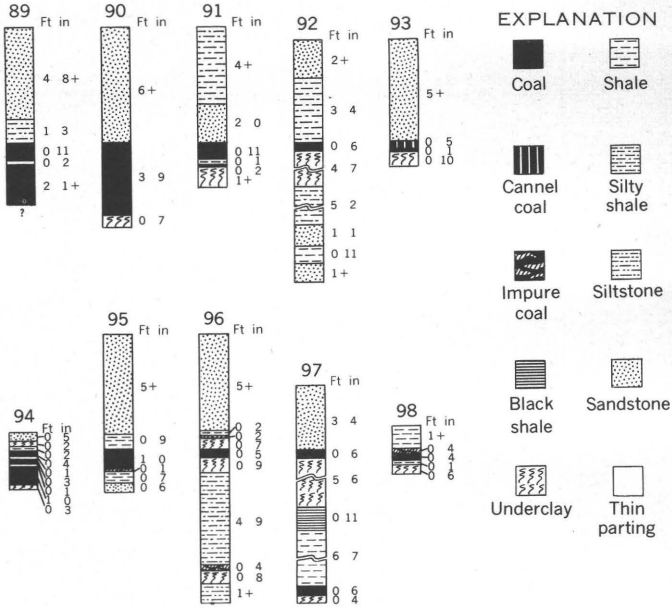

FIGURE 11.—Sections of the Haddix coal bed in the Seitz quadrangle, Kentucky. Location of sections shown on plate 1.

A recently dug mine that contained coal suitable for analysis could not be found in the Gun Creek bed in the Seitz quadrangle. However, Browning and Russell (1919, p. 542) report the analysis on page C–27, determined by the Kentucky State laboratory, for coal from the Gun Creek bed along Left Middle Fork.

FIRE CLAY COAL BED

The Fire Clay coal bed in the Seitz quadrangle has been mined for local use only. The bed serves as a useful stratigraphic marker, but is considered to be economically important only locally because it does not attain a thickness of 28 inches excluding partings. A map of the bed (pl. 3) shows the areas of thickest coal in the quadrangle to be in the north-central part along Cow Creek, near the eastern edge along Left Middle Fork, and near the western edge at the heads of the Left Fork of Johnson Creek and Hunting Creek. The coal is composed of thin to medium-thick vitrain bands in a matrix of dull attritus. Where the bed is thickest, cannel coal occurs in the basal part (pl. 4, section 78; pl. 3). The bed contains the flint-clay parting described on page C–12. Usually a few inches of impure coal either directly overlies or underlies the flint clay parting. The estimated original reserves in the Fire Clay coal bed in the area total 15,360,000 tons, all of which are in the 14- to 28-inch thickness category (table 2). Amount of coal mined and lost in mining of the bed is probably insignificant.

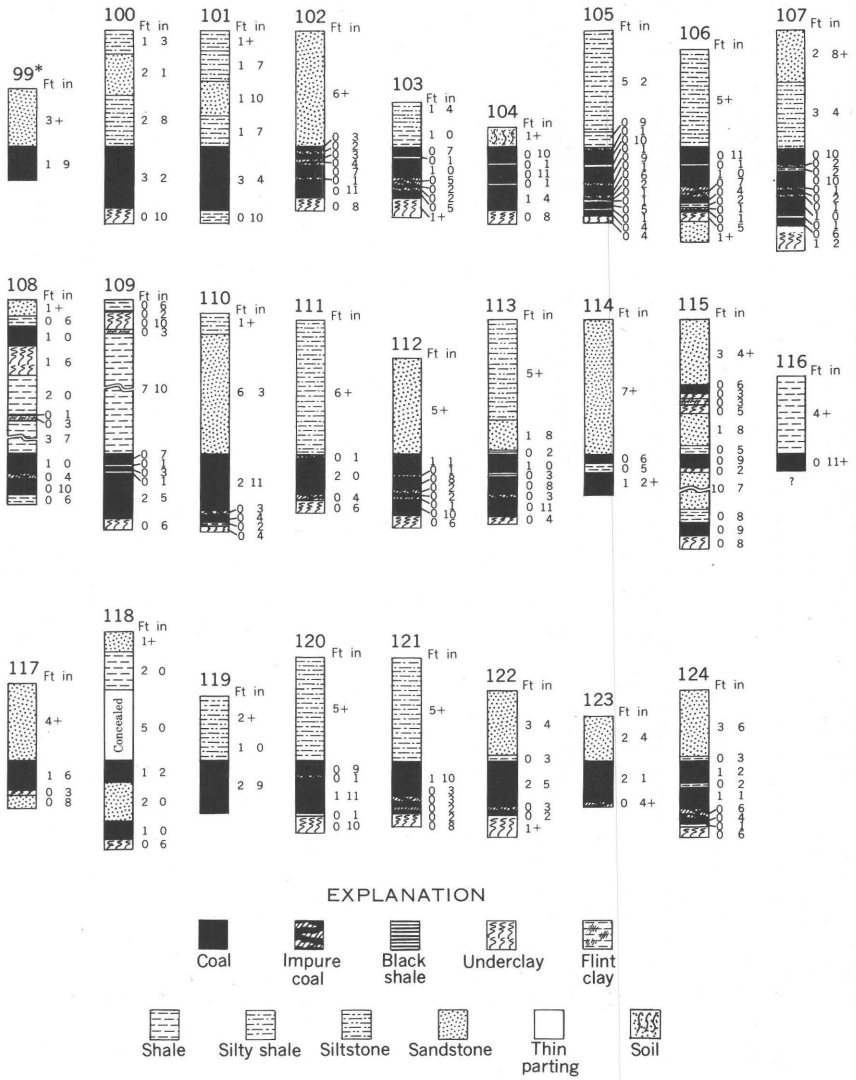

FIGURE 12.—Sections of the Prater coal bed in the Seitz quadrangle, Kentucky. (Location of sections shown on plate 1. Sections marked with asterisks (*) from Browning and Russell (1919).

HADDIX COAL BED

Small truck mines, now abandoned, were operated from the Haddix coal bed on Long Branch of Johnson Creek in the northwestern part of the quadrangle where the coal, excluding partings, is as much as 45 inches thick (pl. 1; fig. 11 sections 89 and 90). The Haddix coal bed also has been mined for local use near the head of Spruce Pine

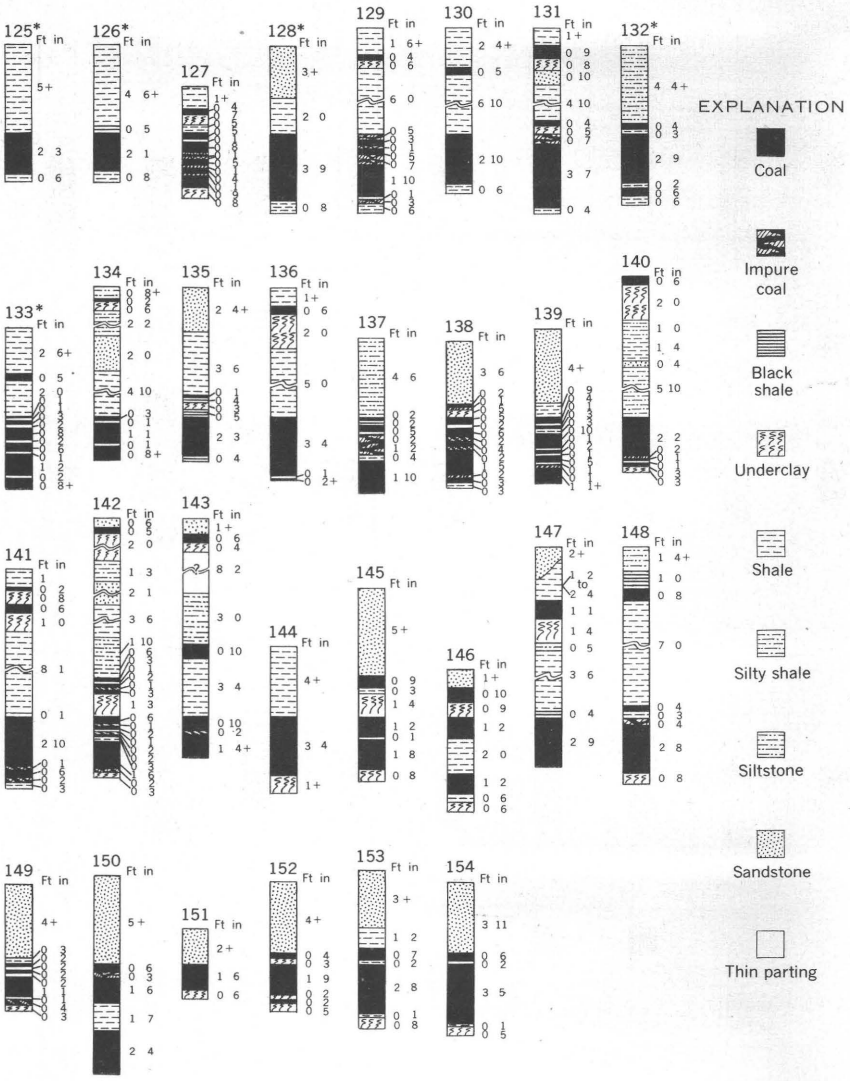

FIGURE 13.—Sections of the Oakley coal bed in the Seitz quadrangle, Kentucky. Location of sections shown on plate 1. Sections marked with asterisks (*) from Browning and Russell (1919).

Branch of Right Fork in the central part of the quadrangle where the bed, excluding partings, is 19 inches thick (pl. 1; fig. 11, section 94). Only at these two localities was the coal bed observed to exceed 14 inches in thickness. The coal is composed of thin to medium-thick vitrain bands in a dull to bright attrital matrix.

Estimated original reserves for the Haddix coal bed in the quadrangle total 7,300,000 tons (table 2). Of this amount, 1,540,000 tons

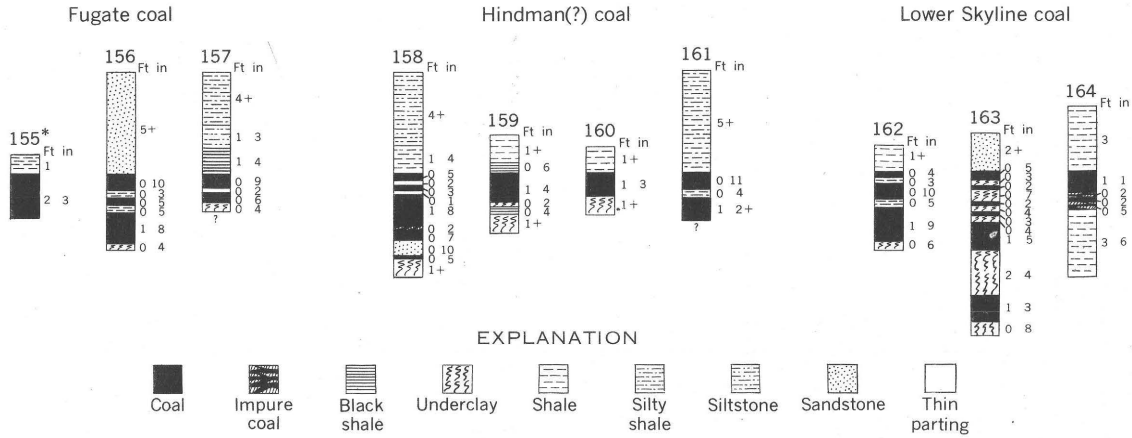

FIGURE 14.—Sections of the Fugate, Hindman(?), and Lower Skyline coal beds in the Seitz quadrangle, Kentucky. Location of sections shown on plate 1. Section 155* from Browning and Russell (1919).

is in the 28- to 42-inch thickness category. No reserves were estimated in the more than 42-inch category because of the irregular thickness of the coal and the small area that would be included. It is probable that a significant amount of thick coal has been mined and left standing as pillars in the area on Long Branch, but no production or mining data were available.

PRATER COAL BED

In the southeastern quarter of the Seitz quadrangle (pl. 1; pl. 3), the Prater coal bed has been mined both in small truck mines and in mines for local use. The coal, excluding partings, reaches a maximum thickness of 41 inches. The general areas of thickest coal are shown by the lines of thickness on plate 3 and the measured thicknesses of the bed are shown by graphic sections 99 through 104 on figure 12.

The coal has sparse, medium to thick vitrain bands in an attrital matrix that is usually dull but at places is bright. The coal usually contains several hard streaks that are slightly impure but which do not separate from the blocks when the coal is mined. A few shale partings, in addition to the hard streaks, are common in the coal. A sample of the Prater coal bed, collected at locality 106 (pl. 1) along Kentucky State Route 30 on a southern tributary of Spruce Pine Fork of Left Middle Fork in the southeastern part of the quadrangle, shows the following analysis:

Analysis of the Prater coal bed, Seitz quadrangle, Kentucky

[Locality 106, pl. 1. Sampled by M. J. Bergin and E. J. Lyons, U.S. Geol. Survey, 1954. Analysis by U.S. Bureau of Mines, Lab. No. E–40284, 1954]

	As received (percent)	Moisture-free (percent)	Moisture- and ash-free (percent)
Proximate analysis:			
Moisture	4. 5	----------	----------
Volatile matter	35. 6	37. 3	41. 2
Fixed carbon	50. 8	53. 2	58. 8
Ash	9. 1	9. 5	----------
Total	100. 0	100. 0	100. 0
Ultimate analysis:			
Hydrogen	5. 2	4. 9	5. 4
Carbon	71. 6	75. 0	82. 9
Nitrogen	1. 4	1. 5	1. 6
Oxygen	11. 9	8. 2	9. 2
Sulfur	. 8	. 9	. 9
Ash	9. 1	9. 5	----------
Total	100. 0	100. 0	100. 0
Heating value Btu	12, 760	13, 360	14, 760

Free-swelling index 1½
Fusibility of ash-initial deformation temperature ° F 2,910+
Rank of coal High volatile A bituminous

The estimated original reserves calculated for the Prater coal in the Seitz quadrangle total 36,020,000 tons; 16,060,000 tons is in the 28- to 42-inch thickness category (table 2). The amount of coal mined, lost in mining, and left standing in pillars is unknown because information about the extent of workings in the many abandoned mines is not available, but it is probably a significantly large tonnage figure that should be estimated before the bed is exploited.

OAKLEY COAL BED

The Oakley bed is the most extensively mined for coal in the quadrangle. Many truck mines and mines for local use have been driven into this bed throughout the southern half of the quadrangle. The coal has also been mined for local use at several places in the northern half of the area. During 1953 truck mines were operated in the Oakley coal bed on the southern tributary of Spruce Pine Fork of Left Middle Fork, on the left fork of Little Caney Creek, and near the head of Wolf Creek in the southern part of the quadrangle. The coal bed is very persistent and reaches a maximum thickness of 48 inches. A general map of the thickness of the Oakley coal bed is shown on plate 3, and measured thicknesses of the bed are shown in figure 13 (sections 125 through 154).

The coal is usually composed of sparse to moderately abundant thin to medium-thick vitrain bands in a dull to moderately bright attritus. The bed commonly contains partings of shale and hard streaks of impure coal. The coal is hard and blocky. At many localities the upper 2 to 6 inches of the bed is an impure cannel coal that grades laterally to black, fissile shale, a feature, that aids in the correlation of the bed throughout the quadrangle. A sample of the Oakley coal bed was collected at a truck mine near the head of a left fork of Little Caney Creek (pl. 1, loc. 154; fig. 13, section 154). Analysis of the sample, as determined by the U.S. Bureau of Mines, is given in the following table.

Analysis of the Oakley coal bed, Seitz quadrangle, Kentucky

[Locality 154, pl. 1. Sampled by M. J. Bergin and E. J. Lyons, U.S. Geol. Survey, 1954. Analysis by U.S. Bureau of Mines, Lab. No. E–40283, 1954]

	As received (percent)	Moisture-free (percent)	Moisture- and ash-free (percent)
Proximate analysis:			
Moisture	4. 8	----------	----------
Volatile matter	37. 6	39. 5	42. 4
Fixed carbon	51. 1	53. 7	57. 6
Ash	6. 5	6. 8	----------
Total	100. 0	100. 0	100. 0
Ultimate analysis:			
Hydrogen	5. 4	5. 1	5. 5
Carbon	73. 6	77. 3	82. 9
Nitrogen	1. 6	1. 6	1. 8
Oxygen	12. 0	8. 3	8. 8
Sulfur	. 9	. 9	1. 0
Ash	6. 5	6. 8	----------
Total	100. 0	100. 0	100. 0
Heating value Btu	13, 100	13, 760	14, 760

Free-swelling index 4
Fusibility of ash-initial deformation temperature °F 2, 910+
Rank of coal High volatile A bituminous

The estimated original reserves calculated for the Oakley coal bed in the Seitz quadrangle total 64,510,000 tons, of which 33,370,000 tons is in the more than 28-inch thickness category (table 2). A considerable amount of coal from the Oakley bed has probably been mined and lost in mining, but production data and mine maps could not be obtained to calculate this amount.

FUGATE COAL BED

At a few scattered localities in the quadrangle, the Fugate coal bed has been mined for domestic use only. At the three localities where the coal was observed to be more than 14 inches thick, the measurements, excluding partings, were 27, 35, and 15 inches (fig. 14, sections 155–157). The Fugate coal bed underlies a sizable area only in the southern part of the quadrangle along the ridge at the Magoffin-Breathitt County line; the bed lies just below the tops of the highest hills in the northern part of the quadrangle.

The coal is moderately bright attritus with moderately abundant, very thin to thin vitrain bands. Two shale partings, as much as 5 inches thick, commonly occur in the coal. The bench of coal above the upper parting has many fusain and pyrite stringers and lenses as large as 1 inch thick.

The estimated original reserves calculated for the Fugate coal in the Seitz quadrangle total 4,930,000 tons, of which 970,000 tons is in the 28- to 42-inch thickness category (table 2). All reserves were put in the inferred category because of the few isolated points of measurement obtained on the coal bed.

HINDMAN(?) COAL BED

The Hindman(?) coal bed has been prospected and mined for domestic use at scattered localities in the quadrangle. The bed lies just under the top of the highest hills in the northern part of the quadrangle. Like the Fugate coal bed, the Hindman(?) would underlie a sizable area only on the "County line" ridge in the southern part of the quadrangle.

The thickness of the bed was obtained at only two other places in addition to the blooms exposed in stratigraphic sections 4 and 6 (pl. 2). In the northeastern part of the quadrangle the coal was measured in an abondoned mine on the ridge at the head of Patton Branch of Middle Fork (fig. 14, section 158). Here the coal is 35 inches thick, excluding the three partings of shale and impure coal that total 5 inches, and contains sparse thin vitrain bands in a dull attrital matrix and several pyrite lenses less than 1 inch thick. The Hindman(?) coal bed is more than 25 inches thick, excluding a 4-inch parting in the middle of the bed at locality 161 (fig. 14) near the southern edge of the quadrangle. Thicknesses ranging from 23 to 48 inches were reported at other mines and prospects that were completely caved when visited. A total of 8,080,000 tons was estimated as original reserves in the Hindman(?) coal bed. Of this total, 340,000 tons was inferred in the 28- to 42-inch category (table 2).

LOWER SKYLINE COAL BED

No reserves have been calculated for the Lower Skyline coal bed in the area of this report because adequate data about the thickness are not available. However, the following statements are thought to be worthy of mention here because of the large amount of coal that has been produced from the bed at Evanston and Tiptop in the Tiptop quadrangle, and because of the possible interest of coal companies in tracing this bed northward.

The Lower Skyline coal bed is exposed in road cuts at the heads of Left Fork of Johnson Creek and Right Fork of Middle Fork (pls. 1 and 2, section 4; fig. 14, sections 162 and 163). At these localities the total thickness of the bed is 43 and 80 inches respectively, including many thin shale and underclay partings that total 8 inches at the first locality and 46 inches at the other. The coal was also seen in a

prospect on the ridge between Wolf Creek and Richie Branch near the southern edge of the quadrangle, where the coal, including impure layers, is 22 inches thick (fig. 14, section 164). The Lower Skyline coal bed probably underlies only a very small area near the top of the hills along the high ridges in the southern part of the quadrangle where the position of the bed is shown by outcrop lines on plate 1.

OIL AND GAS

As of December 1953, no oil or gas had been produced from wells drilled in the Seitz quadrangle. In the Salyersville South quadrangle to the east, gas is produced from wells drilled to the Corniferous and Big Six formations, names used by drillers and oil and gas company personnel (see McFarlan, 1943, p. 283–363), on Right Fork and Beetree Branch of Oakley Creek and on Stinson Creek as close as 2½ miles to the eastern edge of the Seitz quadrangle. Wells near Royalton in the Salyersville South quadrangle (fig. 2) produce gas from the so-called Big Six formation; gas is also produced from that formation on Hard (Howard) Fork in the extreme northwestern corner of the Tiptop quadrangle about 1 mile from the southeastern corner of the Seitz quadrangle. Oil and gas are produced from the so-called Weir sandstone of Mississippian age (Wier, as described by McFarlan, 1943, p. 295) in the Oil Spring field located about 10 miles northeast of Salyersville on the boundary between Magoffin and Johnson Counties. The Lee formation of Pottsville age produces gas in Wolfe County near the head of Red River less than 1 mile west of the Seitz quadrangle; short-lived gas production has been reported from the Lee formation on Elk Creek in the southern part of the Salyersville North quadrangle about 2 miles northwest of Salyersville.

The approximate locations of 10 wells drilled to test for oil and gas in the Seitz quadrangle are shown on the geologic map (pl. 1). Information for six of the test holes, obtained from private company and open-file records of the Kentucky Geological Survey, is given in table 3; data for the other wells could not be located. Logs of these test wells report the presence of the Big Lime and Big Six, as known to drillers, and the Berea sandstone, all of which produce oil or gas at some place in eastern Kentucky. (See McFarlan, 1943, p. 291, 295, 296.) All the wells were abandoned as dry holes, but shows of oil and gas were found in a few of them at depths indicated in table 3. As these shows occurred at relatively shallow depths, generally less than 2,500 feet, and because strata that are known to be productive of oil and gas elsewhere are present in this area, the structural features shown on the geologic map (pl. 1) may be worthy of consideration for future testing. The smaller geologic structural features shown on the

TABLE 3.—*Information from wells drilled for oil and gas in the Seitz quadrangle, Kentucky*

[Information obtained from the open-file records of the Kentucky Geological Survey. All elevations and depths are in feet]

Well No. (pl. 1)	Year drilled	Company	Farm	Top hole elevation	Depth to top Big Lime [1] (Mississippian)	Depth to top Berea sandstone (Mississippian)	Depth to top Big Six [1] (Silurian)	Total depth	Depth of gas show	Depth of oil show
1	?	Kentucky-West Virginia Gas Co	W. M. Keaton	?	812	1,306?	1,915?	1,987		1,838
2	1947	do	Jesse Williams	?	842	1,376	2,078	2,587	1,385–1,420 2,090 2,561	1,322–1,328
3	1937	do	Ed Roark	?	816	1,357	2,047?	2,350	1,000 1,833 2,090	
4	1947	do	B. E. Dyer	973	884	1,302	2,246	2,314		
5	1920	do	George Moore	950	842	1,440	2,092	2,184	2,004	
6	1950	Red Rock Petroleum Co	Courtney Arnett	?	910?	1,535	2,228	2,296		1,075–1,085

[1] Name used in eastern Kentucky by drillers and oil and gas companies. (See McFarlan, 1943, p. 283–363.)

map may not be present in rocks older than the Breathitt formation, but the larger structurally high area (Middle Fork anticline) at the east-central edge of the Seitz quadrangle may be present in the underlying strata (pl. 1).

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