Geology of the Dingus Area, Kentucky

GEOLOGICAL SURVEY BULLETIN 1047

This bulletin was printed as separate chapters, A and B

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1963

UNITED STATES DEPARTMENT OF THE INTERIOR

STEWART L. UDALL, *Secretary*

GEOLOGICAL SURVEY

Thomas B. Nolan, *Director*

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[The letters in parentheses preceding the titles designate separately published chapters]

Geology and Coal Resources of the Salyersville North Quadrangle, Magoffin Morgan, and Johnson Counties Kentucky

GEOLOGICAL SURVEY BULLETIN 1047-B

Prepared in cooperation with the Commonwealth of Kentucky, University of Kentucky, and Kentucky Geological Survey

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By W. L. ADKISON *and* J. E. JOHNSTON

GEOLOGY OF THE DINGUS AREA, KENTUCKY

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For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington 25, D.C.

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GEOLOGY AND COAL RESOURCES OF THE SALYERSVILLE NORTH QUADRANGLE, MAGOFFIN, MORGAN, AND JOHNSON COUNTIES, KENTUCKY

By W. L. Adkison and J. E. Johnston

ABSTRACT

The Salyersville North quadrangle lies in the north-central part of the Eastern Kentucky coal field and includes an area of about 59 square miles in Magoffin, Morgan, and Johnson Counties, Ky. All the bedrock exposed in the quadrangle is of Pennsylvanian age and is equivalent to part of the Lee and most of the Breathitt formations. The regional southeast dip of the rocks is mostly obliterated in the quadrangle by the west flank of the Paint Creek uplift, the Irvine-Paint Creek fault, parts of the Caney anticline and the Mine Fork dome, and the Johnson Creek fault; in most of the area the rocks dip to the west about 70 feet per mile.

The total thickness of the bedrock exposures is about 1,000 feet. The exposed part of the Lee formation consists of, in ascending order, about 90 feet of shale, the Mine Fork coal bed, and 110 to 140 feet of sandstone. The Breathitt formation is composed mainly of sandstone, siltstone, and shale, and subordinate amounts of underclay, coal, and limestone. Thirteen coal beds in the Breathitt—the Wheelersburg, Howard(?), Lacey Creek, Tom Cooper, Cannel City, Whitesburg, Fire Clay, Hamlin(?), Colvin, Index, Nickell, Sebastian, and Hindman(?)—are more than 14 inches thick in parts of the quadrangle. Coal has been mined by residents for local use, but extensive mining has not been undertaken because most of the coal beds are thin. The estimated original coal reserves in beds more than 14 inches thick total at least 172.4 million tons, of which 16.6 million tons is in beds more than 28 inches thick.

The Salyersville North quadrangle includes the western half of the Oil Springs oil pool and the westernmost part of the Win gas pool. The oil is produced from the Weir sand, of Early Mississippian age, and the gas in the Win pool is produced from the Corniferous limestone of former usage, of Devonian and Silurian age, and the Big Six sand, of Silurian age. Secondary recovery by waterflooding coupled with hydraulic fracturing of producing rocks has been very successful in the Oil Springs pool. The latest figure for cumulative oil production from this pool is about 10 million barrels (1953), and that for cumulative gas production from the Win pool is about 800 million cubic feet (1953).

INTRODUCTION

The U.S. Geological Survey has conducted investigations of the geology and coal resources of the area in and adjacent to the Salyersville North quadrangle in the Eastern Kentucky coal field (fig. 7). The Salyersville North quadrangle lies between lat. 37°45′ and 37°52′30″ N., and long. 83°00′ and 83°07′30″ E.; it is a 7½-minute quadrangle in the southeast quarter of the Dingus 15-minute area which also includes the Dingus, Lenox, and White Oak 7½-minute quadrangles (fig. 8). The present report is the second for the 15-minute Dingus area; a report by Adkison (1957) has been published for the White Oak quadrangle and a third report is in preparation for the Lenox quadrangle. Other published reports for quadrangles in the vicinity are those by Englund (1955) for Cannel City to the west; Bergin (1962) for Seitz to the southwest; and Hauser (1953) for Paintsville to the east.

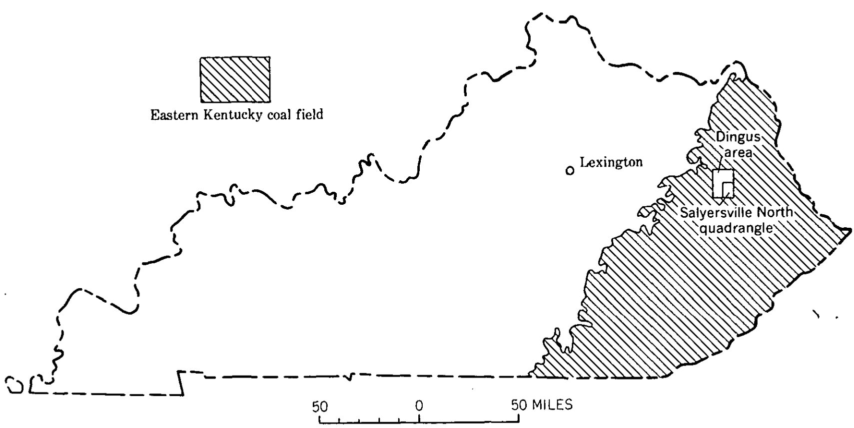

FIGURE 7.—Index map of Kentucky showing location of the Salyersville North quadrangle and the Dingus area in relation to the Eastern Kentucky coal field.

The Salyersville North quadrangle includes an area of about 59 square miles. Most of it is in Magoffin County, but small parts are in Morgan and Johnson Counties. The town of Salyersville, county seat of Magoffin County, is on the Licking River at the south boundary of the quadrangle. U.S. Highway 460 crosses the southern part of the quadrangle and State Highways 7 and 30 also serve the southern part of the area. The remainder of the quadrangle is served by a system of gravel and dirt roads. There were no railroads operating in the quadrangle in 1958, and no tracks cross the area. The closest rail connection is that of the Chesapeake and Ohio Railroad Co. at Sublett, 5½ miles to the southeast on the Licking River.

PREVIOUS INVESTIGATIONS

In 1861 Lyon (p. 538–541) reported on the coal beds and associated rocks along a base line that passed through the northern part of the Salyersville South quadrangle. In a preliminary report on

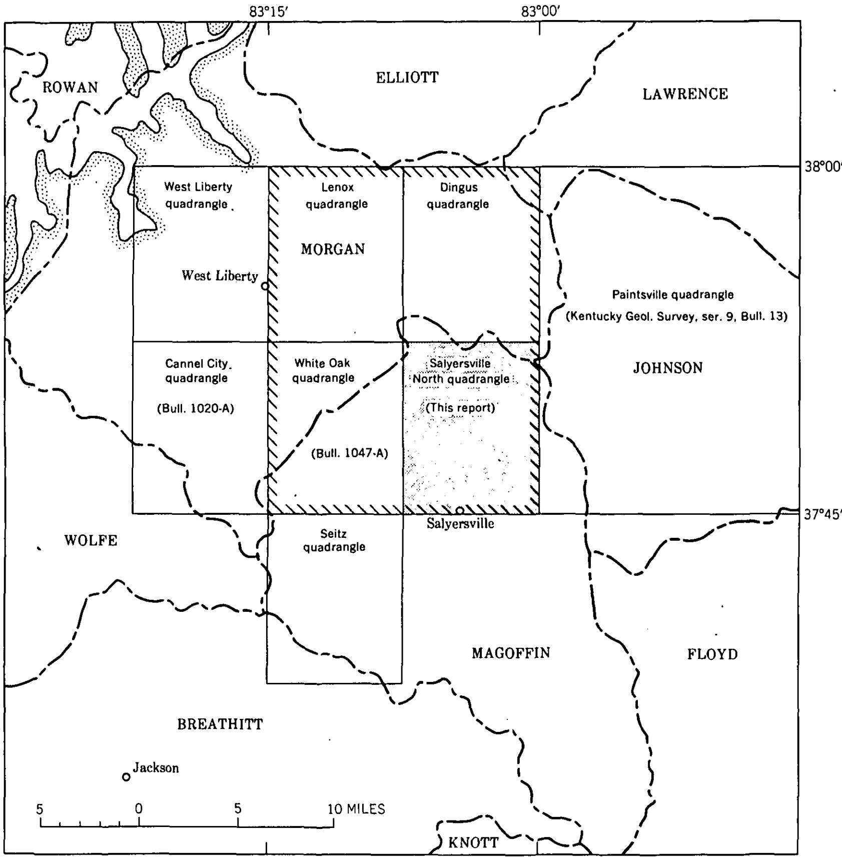

FIGURE 8.—Map showing the position of the Salyersville North 7½-minute quadrangle (shaded) within the Dingus area (hachured), its relation to the west boundary of Pennsylvanian strata (stippled), and its relation to other nearby quadrangles mentioned in the text.

Morgan, Johnson, Magoffin, and Floyd Counties, Crandall (1880? p. 9, 15, 19) described coal beds on Buck Branch, Mine Fork, and in the vicinity of Salyersville. In a later report Crandall (1910) described the coal beds at several places in the Salyersville North quadrangle.

The first detailed geologic report on Magoffin County was that by Browning and Russell (1919). The report included descriptions and correlations of the coal beds and associated rocks and a description and map of the structure of the county. A structure map of Magoffin County by Browning was published in 1921, and a similar map of the Paint Creek uplift in Floyd, Johnson, Magoffin, Morgan, Lawrence, and Elliott Counties was compiled by Hudnall and Browning in 1924. A regional study of Pennsylvanian rocks in the Appalachian coal field by Wanless (1939) included the rocks in Magoffin and Morgan Counties. From field data collected by the authors, K. J. Englund prepared several of the coal-bed maps for coal-reserve estimates of the Salyersville North quadrangle; these are included in a report by Huddle and others (1962) on the coal reserves of eastern Kentucky.

PRESENT INVESTIGATION

The geology of the Salyersville North quadrangle was mapped by the Geological Survey as part of a general investigation of the coal resources of eastern Kentucky. Fieldwork for this report required about 5 man-months and was done by the authors in the fall of 1952, the spring of 1953, and the spring of 1958. The work consisted of measuring and describing several hundred coal outcrops at small mines, road cuts, and natural outcrops. Stratigraphic sections were measured and described along roads and trails at many places. The geologic data were recorded on aerial photographs and on a topographic map of the quadrangle (scale 1:20,000, contour interval 20 ft.). The published scale of the geologic map (pl. 5) is 1:24,000 and the contour interval is 20 feet. Most of the altitudes of coal beds and other key beds were determined by aneroid-barometer traverses; the rest were determined by hand leveling from points of known altitude. No coal samples were taken for analysis because the coal was weathered at all exposures.

ACKNOWLEDGMENTS

This report was prepared in cooperation with the University of Kentucky and the Kentucky Geological Survey. The writers wish to thank the local residents and mine operators for their help and cooperation during the fieldwork for this report. J. W. Huddle took the photographs and aided in the fieldwork for about 1 week. Others who assisted in the field for short periods include Chabot Kilburn, S. W. Welch, M. J. Bergin, and W. E. T. Brown.

TOPOGRAPHY

The Salyersville North quadrangle lies near the west edge of the highly dissected Cumberland Plateau. Here the plateau has been intricately eroded into ridges and spurs having a dendritic pattern separated by narrow creek valleys and hollows. Almost all the land is in steep hillsides, which commonly consist of alternating benches and slopes formed by differential erosion of sandstone and shale. The only relatively level land is in the valley bottoms of the larger creeks and the Licking River. The lowest point in the quadrangle, about 735 feet above sea level, is in the northeast corner along Big Mine Fork. Many points on the ridges are as much as 1,300 feet above sea level. Local relief is 300 to 400 feet.

DRAINAGE

Most of the area is drained by the Licking River and several of its tributaries, including Rockhouse and Lick Creeks and State Road Fork; the river flows west and northwest to join the Ohio River. The northeastern part of the quadrangle is drained by Big Mine Fork which flows northeast to join the Big Sandy River.

STRATIGRAPHY

PENNSYLVANIAN SYSTEM

The rocks exposed in the Salyersville North quadrangle are of Pennsylvanian age and include the upper part of the Lee formation and most of the overlying Breathitt formation. These rocks are about 1,000 feet thick.

LEE FORMATION

The Lee formation was defined from exposures in Lee County, Va., by Campbell (1893, p. 36, 37), who later extended usage of the name into Kentucky (1898a, p. 3). The upper 200 feet of this formation is above drainage in the northeastern part of the quadrangle, but only the uppermost 110 to 140 feet of strata are well exposed, (pl. 6, sections 17 and 18). The lower part of the Lee that is above drainage is largely covered, but at the mouth of Lacey Creek, Browning and Russell (1919, p. 262) reported that it consists of "* * * 90 feet of bluish-gray shales below the conglomerate sandstone * * *". The shale is overlain by a bed of medium-gray underclay about 1 foot thick which is overlain by the Mine Fork coal bed. This coal was named by Browning and Russell (1919, p. 27) from exposures on Big Mine Fork where it is commonly 14 to 20 inches thick (pl. 7, sections 1–4). The coal is overlain by a variable sequence of gray shale and siltstone, which ranges in thickness from 0 to 9 feet.

The upper part of the Lee formation consists of massive cliff-forming quartzose sandstone about 110 to 140 feet thick (pl. 6, sections 17, 18), which is commonly called the First Salt sand or Beaver sand by drillers. The sandstone is very light gray, fine to coarse grained, conglomeratic in part, and locally ironstained; conspicuous crossbedding is very common (figs. 9, 10). White well-rounded quartz pebbles as much as three-quarters of an inch in diameter occur in lenses or in beds of coarse-grained sandstone a few inches thick. The lowermost part of the sandstone contains stringers and lenses of coal as much as 3 inches thick. The lower contact of this sandstone unit of the Lee is sharp and undulatory, indicating an erosional disconformity. The upper contact, which marks the top of the Lee formation, is sharp at most localities and it occurs at the top of the near-vertical cliffs.

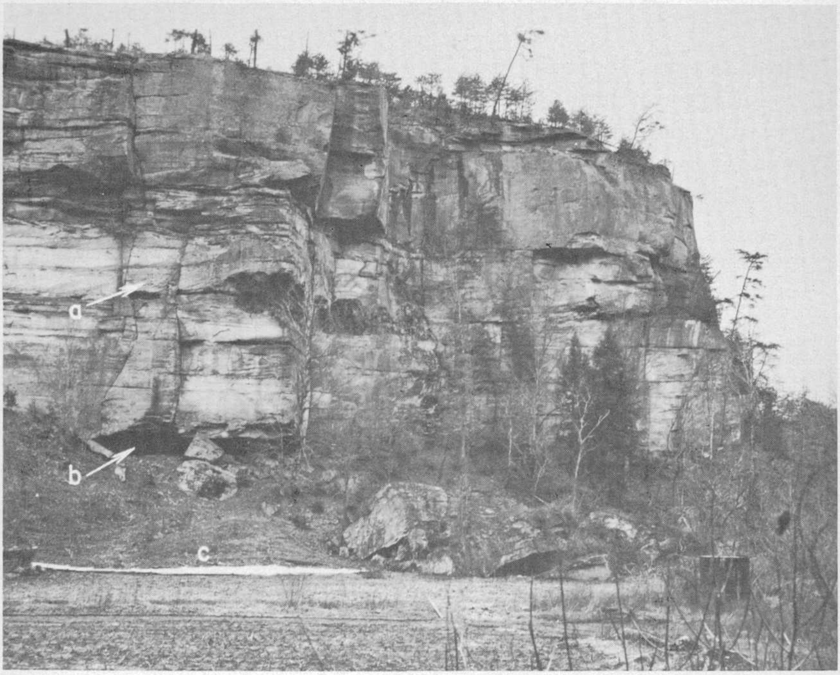

FIGURE 9.—Exposure of the upper sandstone in the Lee formation at the mouth of Rocky Branch of Big Mine Fork showing (a) massive crossbedded cliff-forming sandstone and (b) position of the Mine Fork coal bed. A tobacco seedbed (c) is in the left side of the picture.

BREATHITT FORMATION

The Breathitt formation was named by Campbell (1898b, p. 3) from exposures in Breathitt County, Ky., where it includes all Pennsylvanian rocks above the Lee formation. The Breathitt formation is considered by Wanless (1946, p. 10) to be about equivalent to the upper Norton, Gladeville, Wise, and Harlan formations of Campbell (1893, p. 28, 31–36) in Virginia and to the Briceville, Jellico, Scott, and Anderson formations of Keith (revised by Glenn, 1925, p. 16–36) in Tennessee.

The maximum composite thickness of the Breathitt formation in the Salyersville North quadrangle is about 800 feet. The oldest beds are exposed in the northeastern part of the area on the west flank of the Paint Creek uplift; the youngest beds are poorly exposed on the ridges in the west part of the quadrangle.

The Breathitt formation consists mainly of sandstone, siltstone, and shale, and includes small amounts of underclay, coal, and limestone. Some beds of sandstone, siltstone, and shale are calcareous and a few beds contain marine fossils. The depositional environment for most of this formation was probably nonmarine, but marine conditions prevailed for short periods during deposition of the fossiliferous beds.

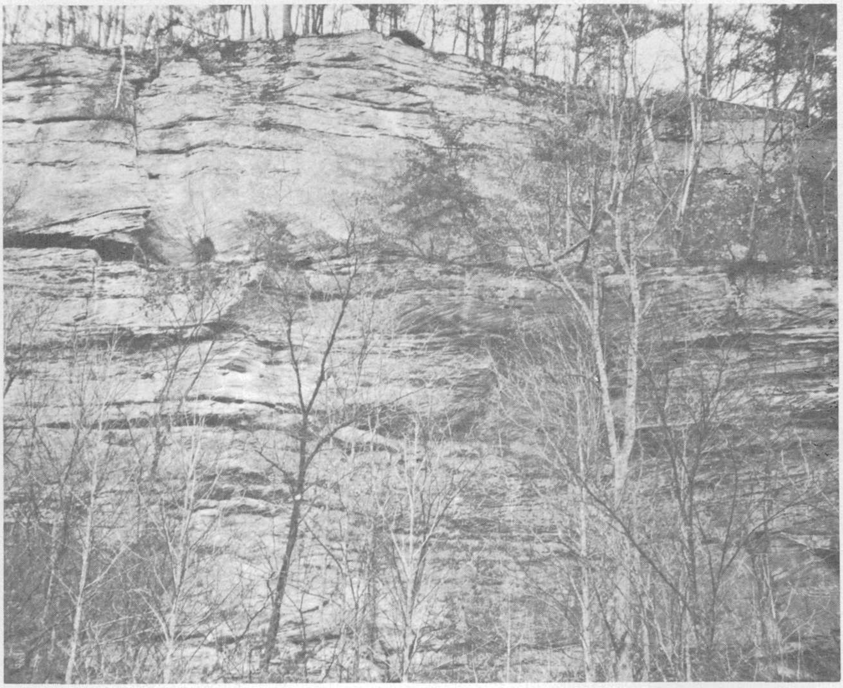

FIGURE 10.—Exposure of the upper sandstone in the Lee formation along the west side of Big Mine Fork between the mouth of Lacey Creek and the mouth of Rocky Branch showing prominent foreset bedding.

The sandstone is composed chiefly of subangular to subrounded very fine-size to medium-size quartz grains cemented by clay, silica, iron oxide, or calcite. The fresh rock is generally light to medium light gray; it weathers to yellowish brown and reddish brown. The sandstone beds range from a fraction of an inch to a few feet in thickness and simple, planar, and trough cross-stratification are fairly common. Many of the sandstone lentils lie in channels that were cut in the underlying rocks. The lower contact of a sandstone channel deposit is generally sharp and undulating, but the upper contact is commonly gradational into finer grained sediments.

The siltstone is generally medium light gray, quartzose, micaceous, and very finely sandy. Much of the siltstone contains very finely divided carbonaceous material, and some siltstone has plant fossils on the bedding planes. Bedding ranges from about one-sixteenth of an inch to a few inches, and laminae of gray shale are common. Some of the siltstone is nonbedded, stigmarian, and contains scattered ironstone nodules; the stigmarian siltstone generally grades upward into silty underclay.

The term "shale" is used in this report to include a wide range of lithologic types ranging from claystone to clayey siltstone. The shale is medium light gray to black, but most of it is medium gray.

Weathering produces shades of olive gray, medium brown, and reddish brown; locally the shale is heavily stained by iron oxide. Generally the gray shale is silty and commonly contains siltstone laminae. Most of the shale is laminated to very thin bedded (½–2 inches) and plant imprints and fragments of carbonaceous material are present on many bedding planes. Ironstone nodules, commonly less than 2 inches thick, occur in fairly regular courses or as nearly continuous bands in many of the shale units. The black shale is very carbonaceous and locally contains pyrite and thin stringers or films of coal; some of the black shale contains laminae of light-gray siltstone. Bedding is generally laminated to platy (less than half an inch) and weathering produces a high degree of fissility in some outcrops. In the upper part of the Breathitt formation some of the black shale is poorly bedded and somewhat resembles underclay.

The term "underclay" has been adopted to include nonbedded clay or fire-clay beds associated with coal beds regardless of their relative position to any particular coal bed. Underclay beds, with few exceptions, are present beneath all the coal beds and also occur as partings as much as 3 feet thick in coal beds; locally underclay forms the roof rock of some coal beds. The fresh rock is typically medium light gray but ranges from light to dark gray, and iron-oxide staining is common where the underclay is weathered. It is nonbedded, well indurated, plastic when wet, locally silty, and contains stigmaria imprints. Ironstone nodules are commonly scattered within the underclay in contrast to the more uniform arrangement in courses or beds in the shale.

A small part of the Breathitt formation is composed of limestone which occurs either in beds as much as 18 inches thick or as ellipsoidal concretions 6 inches to 3 feet thick and as much as 6 feet in diameter. The fresh limestone is medium gray to dark bluish gray and the weathered limestone is yellowish brown to dark reddish brown. The limestone beds are hard, very fine grained, fossiliferous, and silty to finely sandy; at many places the limestone beds grade laterally to calcareous shale, siltstone, or sandstone. The limestone concretions are hard, very fine grained, silty to finely sandy, and commonly septarian. Marine fossils are present in some of the concretions and plant fossils in others. At a few localities the concretions contain both marine and plant fossils.

For a more detailed description of the strata, the Breathitt formation is subdivided into eight informal units. With the exception of the Magoffin beds of Morse (1931), the boundaries between the units are at the bases of several extensive coal beds.

BASE OF BREATHITT FORMATION TO BASE OF TOM COOPER COAL

The lower unit of the Breathitt formation (below the Tom Cooper coal bed) is about 238 feet thick where it is completely exposed in the northeast quarter of the quadrangle (pl. 6, section 19). As interpreted from drillers logs, the unit is about 150 feet thick near the mouth of Buffalo Creek, 270 feet in the vicinity of Salyersville, and about 290 feet in the southwest corner of the quadrangle. The lower unit includes, in ascending order, the Wheelersburg, Howard(?), and Lacey Creek coal beds.

In the area of outcrop near Wheelersburg the basal part of the lower unit consists of about 42 feet of light-gray very fine grained to fine-grained sandstone (fig. 11), which is referred to in this report as the transition beds (pl. 6, section 19). This sandstone differs from sandstone in the Lee formation in that it is finer grained, contains many beds of shale and siltstone ranging from a fraction of an inch to a few feet in thickness, and does not exhibit the prominent foreset bedding that is so common in the Lee. The transition beds may grade laterally into the upper part of the Lee formation, and they probably are included in the First Salt sand by drillers.

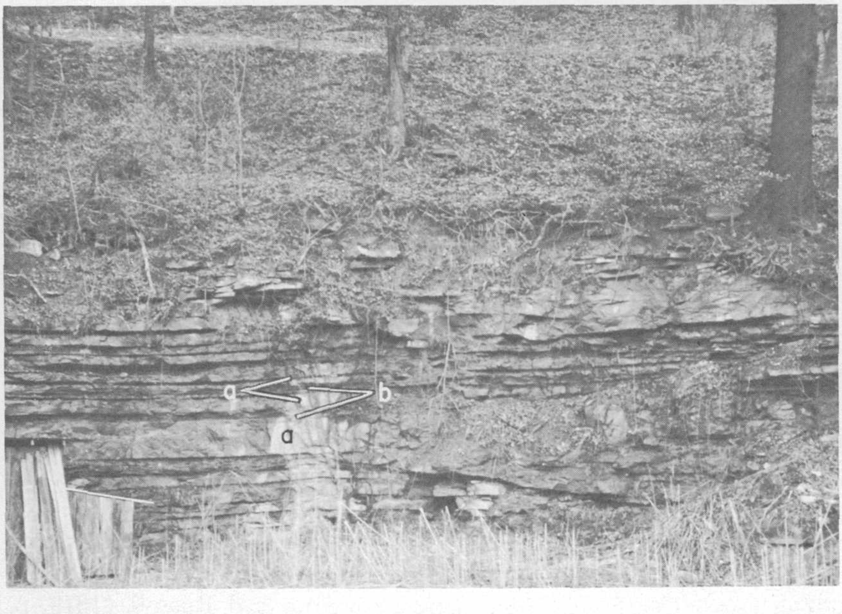

FIGURE 11.—Exposure of the transition beds in the basal part of the Breathitt formation at Wheelersburg on Big Mine Fork about 350 feet below the mouth of Litteral Fork showing (a) thin to medium beds of sandstone separated by (b) thin beds of gray shale and siltstone.

The strata in the lower part of the lower unit seem to be extremely variable, for on Big Mine Fork just below the mouth of Flat Fork (pl. 6, section 18) the basal sequence consists of gray shale 55 feet thick.

The part of the lower unit lying above the transition beds is composed chiefly of gray shale, siltstone, and several lentils as much as

33 feet thick of light-gray very fine grained to fine-grained sandstone. Parts of the sandstone lentils are calcareous, very hard, and weather to yellowish-brown or reddish-brown rounded concretion-like masses.

The lower unit of the Breathitt contains 3 named coal beds and 1 or 2 unnamed beds. All these beds are thin and some have been mined for local use. These coal beds are difficult to correlate because with few exceptions they were seen at widely scattered localities and none have distinguishing characteristics. Therefore the correlation of the coal in the lower unit of the Breathitt formation must be considered tentative. The stratigraphically lowest coal bed occurs about 67 feet above the base of the formation in the vicinity of Wheelersburg (pl. 6, sections 19, 20). This unnamed bed is deeply weathered but it seems to be only a few inches thick.

The next coal, in ascending order, is the Wheelersburg coal bed, which was described by Browning and Russell (1919, p. 27, 28, 273) from a small mine northeast of Wheelersburg. The Wheelersburg coal bed lies about 142 feet above the base of the Breathitt formation and 47 to 74 feet above the thin unnamed coal. Near the head of Flat Fork a 10-inch bed of very fine grained to fine-grained fossiliferous sandstone is present about 37 feet above a 10- to 12-inch-thick coal, which is tentatively correlated with the Wheelersburg coal. The fossiliferous sandstone, exposed in a road cut 250 feet east of the road junction (alt. 957 ft.), is decalcified and heavily iron stained and grades laterally into ironstone.

A coal bed tentatively correlated with the Howard coal of Browning and Russell (1919, p. 28) is present about 40 to 45 feet above the Wheelersburg coal bed on Jellicoe Branch and Lacey Creek (pl. 7, sections 7–9). The Howard(?) coal is 6 to 10 inches thick in the head of Raccoon Creek (pl. 6, section 12), but in the head of Big Mine Fork (pl. 6, section 20) it seems to have been eroded because sandstone occurs at the position of the coal. A zone of gray silty unfossiliferous limestone concretions occurs about 15 feet above the Howard(?) coal in the head of Raccoon Creek (pl. 6, section 12).

The Lacey Creek coal, named by Browning and Russell (1919, p. 29), is the stratigraphically highest named coal of the lower unit of the Breathitt formation and is the first coal below the Tom Cooper coal. As defined by Browning and Russell, the Lacey Creek coal bed ranges from 22 to 32 inches in thickness and occurs 30 to 40 feet below the Tom Cooper coal. On Lacey Creek the stratigraphic relation between the Lacey Creek and Tom Cooper coal beds is not entirely clear. In the detailed descriptions of the mined coals on Lacey Creek, Browning and Russell (1919, p. 265–267) apparently described the Lacey Creek coal bed, at least in part, from exposures of the Tom Cooper coal. The writers of the present report use the name Lacey Creek coal as defined on earlier pages of the Browning and Russell report (1919, p. 29). The Lacey Creek coal probably is equivalent to the Grassy coal bed in the Cannel City quadrangle to the west (Englund, 1955, p. 7).

BASE OF TOM COOPER COAL TO BASE OF FIRE CLAY COAL

This unit of the Breathitt formation ranges in thickness from 125 feet in the northwestern part of the quadrangle to 170 feet in the southeastern part. In general, shale and siltstone compose about two-thirds of the unit, but light-gray, very fine-grained to medium-grained sandstone beds as much as 60 feet thick are common. The sandstone beds, which locally are calcareous in part, are discontinuous and pinch out abruptly or grade laterally into siltstone or shale (pl. 6). In addition to the Tom Cooper coal at the base, the unit contains three fairly widespread coal beds and one fossiliferous shale sequence; these beds are, in ascending order, the Cannel City coal, Kendrick shale of Jillson (1919), Whitesburg coal, and an unnamed coal bed.

The Tom Cooper coal was named by Browning and Russell (1919, p. 29–31) from exposures on Brushy Fork of Lick Creek. It is equivalent to the Little Caney coal bed of Englund (1955, p. 7, 15, 17), the Upper Elkhorn No. 3 of Welch (1958, p. 589), and the Van Lear coal bed of the Paintsville area.

At most localities the roof of the Tom Cooper coal bed is black carbonaceous shale as much as 5 feet thick. The black shale is very useful in identifying the coal bed, but it has been eroded and replaced by channel-fill siltstone and sandstone at several places on Lick Creek near the mouth of Buffalo Creek (pl. 7, sections 35–37; pl. 6, section 8). Sandstone also forms the roof of the Tom Cooper coal at several places in the southern part of the quadrangle (pl. 7, sections 47–49).

The black shale above the Tom Cooper coal bed is overlain by 36 to 50 feet of gray shale and siltstone, sandstone, and some underclay (pl. 6); beds of coal a few inches thick are present locally. Although shale and siltstone compose most of the strata, sandstone lentils as much as 31 feet thick are fairly common. Medium-dark-gray silty limestone concretions occur in the shale or siltstone at a few localities (pl. 6, sections 14, 16, 20).

The Cannel City coal bed, which is 38 to 52 feet above the Tom Cooper coal bed, was named from mining operations at Cannel City, Ky. (Englund, 1955, p. 8). In the Salyersville North quadrangle this bed was called the Gun Creek coal by Browning and Russell (1919, p. 32, 33), but that name is not used here because of the uncertainty of correlation with the type section. The Cannel City was correlated with the Amburgy coal bed on the North Fork of the Kentucky River by Englund (1955, p. 4, 8). In the Salyersville North quadrangle the Cannel City coal bed is commonly less than 14 inches thick and contains partings, but it is a useful bed for correlation in the south half of the quadrangle because it contains a distinctive 1/8- to 1/2-inch parting of hard dense medium-grayish-brown to dark-brown flint clay at many localities (pl. 7, sections 50–54).

The Cannel City coal is overlain by a variable sequence of shale, siltstone, and sandstone which ranges in thickness from 42 to 73 feet. Locally, one or more of the shale beds contain gray silty limestone concretions. One or more beds of coal or underclay a few inches thick also occur at a few places. At several localities (pl. 6, sections 5, 8, 14, 19) the lower part of this sequence includes the Kendrick shale of Jillson (1919, p. 96–104), which is widespread over eastern Kentucky and at many localities contains marine fossils. It generally consists of dark-gray to black shale 5 to 10 feet thick which is fossiliferous in part; where fossils are very sparse or absent the Kendrick is difficult to identify. The Kendrick shale contains a 4- to 7-inch bed of fossiliferous siltstone in the vicinity of Wheelersburg (pl. 6, section 19) and in the creek bed of Phipps Fork about 0.43 mile west of Phipps school (pl. 5). The most abundant fossils at the Wheelersburg locality are brachiopods, gastropods, and pelecypods. The Kendrick shale contains *Lingula* and other brachiopods, and gastropods at a locality opposite the mouth of Improvement Branch of Raccoon Creek (pl. 6, section 5). The sandstone lentils in the 42 to 73 feet of strata above the Cannel City coal bed are light gray, fine grained to medium grained, and crossbedded in part. At the head of Brushy Fork of Lick Creek (pl. 6, section 13) one of these sandstone lentils is about 61 feet thick; northeast and southeast of that locality the sandstone apparently splits into two parts (pl. 6, sections 19–21).

A coal bed 42 to 73 feet above the Cannel City coal and 38 to 67 feet below the Fire Clay coal in the Salyersville North quadrangle (pl. 6) has been called the Whitesburg coal by Browning and Russell (1919, p. 33–36). Although the type section of the Whitesburg coal is in Letcher County many miles to the southeast the correlation seems valid. Huddle and others (1962) called this bed the Lower Whitesburg coal in the Salyersville North quadrangle, but this has not been completely demonstrated by detailed mapping. The Whitesburg coal, although thin (less than 14 inches) or parted at many places in the quadrangle, is a good marker bed because it crops out at a relatively low position on the hills in much of the area and is overlain by a distinctive bed of black shale.

The strata between the Whitesburg and Fire Clay coal beds are chiefly sandstone, siltstone, and shale. One to three beds of coal a few inches thick and associated beds of underclay are present in this sequence. At many localities the roof rock of the Whitesburg coal bed consists of black fissile carbonaceous shale as much as 5 feet thick (pl. 7, sections 59–73, 76–78). The black shale is very useful in identifying the Whitesburg coal bed, especially where the Fire Clay coal was not seen or could not be identified with certainty. One coal bed 19 to 36 feet above the Whitesburg coal seems to be fairly widespread (pl. 6) and may be equivalent to the Little Fire Clay coal bed of the area near the North Fork of the Kentucky River. Channel-fill sandstone is present at many places in the sequence between the Whitesburg and Fire Clay coal beds. One sandstone lentil in the northwestern part of the area is calcareous in part (pl. 6, sections 2, 5, 7), and at one place near the mouth of Wesley Fork a lens of coal about 8 inches thick is in the upper part of this sandstone (fig. 12).

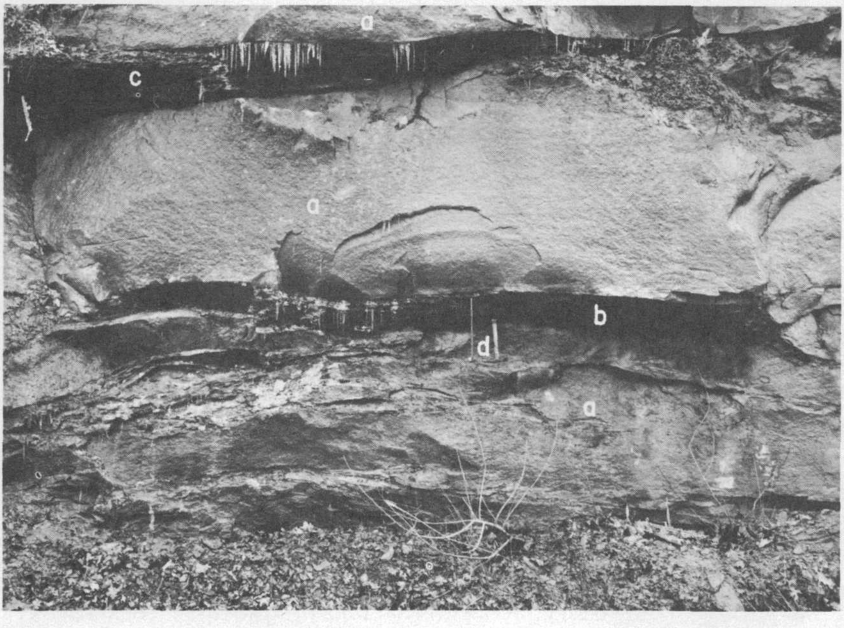

FIGURE 12.—Exposure of strata 18 feet below the Fire Clay coal bed (pl. 6, basal part of section 2) about 0.15 mile southwest of the mouth of Wesley Fork showing (a) massive sandstone, (b) coal lens 8 inches thick, (c) gray silty shale wedge, and (d) hammer and steel tape.

BASE OF FIRE CLAY COAL TO MAGOFFIN BEDS OF MORSE

The rocks of this unit are 47 to 72 feet thick and are composed chiefly of sandstone, siltstone, and shale. The Hamlin(?) coal bed occurs near the middle of the unit and is present throughout most of the quadrangle.

656172 O—63——3

The Fire Clay coal bed, named by Hodge (1908, p. 40, 41), is present throughout most of the area but it is difficult to identify at many places because the characteristic flint-clay parting is absent; in these places the Fire Clay bed was usually identified by its position in relation to other coal beds or to the Magoffin beds of Morse. The flint-clay parting, which is present in the Fire Clay coal in much of eastern Kentucky, is commonly a medium-brownish-gray hard dense nonbedded claystone 2 to 6 inches thick. The flint clay typically breaks with a sharp conchoidal fracture and upon weathering disintegrates into angular granule-size or smaller fragments. At many places in the western part of the quadrangle the flint clay is rather soft and breaks with a poor subconchoidal fracture. It contains carbonaceous films and coal stringers a fraction of an inch thick at many places; locally it seems to grade into bony impure coal.

The roof of the Fire Clay coal bed generally consists of gray shale a few inches to 25 feet thick. At most localities the shale is less than 10 feet thick and is commonly overlain by a sandstone bed having an average thickness of about 25 feet (pl. 6). Locally sandstone forms the roof of the Fire Clay coal. On Wesley Fork in the northwestern part of the area the sandstone seems to be a channel-fill (pl. 6, section 2). In the head of Bend Branch (fig. 4, section 4) the Fire Clay coal and overlying shale seem to have been completely eroded before the sandstone was deposited.

A persistent coal bed less than 14 inches thick at many places occurs 21 to 47 feet above the Fire Clay coal bed. This coal was called the Haddix coal in the area between Phipps Fork and Hammond Fork by Browning and Russell (1919, p. 253–255), but the writers believe it is approximately equivalent to the Hamlin coal bed which was named by Hodge (1908) in Perry County.

Shale and siltstone 22 to 35 feet thick comprise most of the strata between the Hamlin(?) coal bed and the Magoffin beds of Morse. Some sandstone is present, and a coal bed commonly 1 to 6 inches thick and associated underclay are present locally in the southwestern part of the area (pl. 6, sections 8, 9).

MAGOFFIN BEDS OF MORSE

The Magoffin beds of Morse (1931, p. 302) are present in all of the quadrangle except the southwestern part where this unit and the overlying shale have been eroded and their position occupied by massive sandstone (pl. 6, section 8). Although the Magoffin beds are commonly less than 5 feet thick they are one of the most useful stratigraphic markers in the Breathitt formation in much of eastern Kentucky. Where these beds are well developed, as at the head of Raccoon Creek (pl. 6, section 12), they are composed of a lower bed of medium-dark-gray silty fossiliferous limestone a few inches thick and an overlying bed of gray to black shale a few feet thick.

The shale contains hard medium-dark-gray very fine grained silty limestone concretions as much as 2 feet thick. The concretions are commonly septarian and break with a subconchoidal fracture. At some localities the Magoffin beds include a few inches of gray fossiliferous shale at the base. The lower limestone bed which is heavily iron stained at most places contains many macerated shell fragments, crinoid-stem plates, and brachiopods. The overlying shale and concretionary limestone are locally fossiliferous.

At many places in the quadrangle (pl. 6, sections 1–6, 9, 11, 13) the Magoffin unit is composed of a bed of heavily ironstrained fossiliferous siltstone or very fine grained sandstone generally less than 1 foot thick and an overlying bed of gray to black locally fossiliferous shale. The shale is a few feet thick and at some localities contains medium-dark-gray limestone concretions. At one place about 0.4 mile north of Falcon (pl. 6, section 21) the Magoffin beds consist of a zone of dark-gray fossiliferous (chiefly brachiopods) limestone concretions about 9 inches thick and an overlying bed of dark-gray fossiliferous (gastropods and pelecypods) shale about 2 feet thick. Another facies present in the extreme northwest corner of the quadrangle (near section 113) consists of a lower bed 8 to 10 inches thick of dark-gray siltstone containing chiefly brachiopods, a medium-gray shale bed nearly 3 feet thick containing gastropods and pelecypods, and an upper bed 1.5 feet thick of medium-dark to dark-gray massive limestone containing crinoid fragments and brachiopods.

TOP OF MAGOFFIN BEDS OF MORSE TO BASE OF INDEX COAL

The rocks of this unit of the Breathitt formation range in thickness from 51 to 86 feet and consist largely of shale and siltstone in the lower part and sandstone and siltstone in the middle and upper parts. The lower part of the unit includes the Colvin coal bed at several localities (pl. 6) and the remainder contains one or two unnamed coals and associated beds of underclay.

The lower part of this unit consists of gray shale and siltstone 12 to 20 feet thick in most of the quadrangle (pl. 6). At one place in the head of Bend Branch (pl. 6, section 4) a 10-inch bed of dark-gray to black shale 16 feet above the Magoffin beds contains very sparse impressions of questionable brachiopods. In the southwestern part of the area (pl. 6, sections 8, 9) the lower part of the unit is composed mainly of channel-fill sandstone; in much of the southwestern part the channels cut below the Magoffin beds of Morse.

The Colvin coal bed, which lies 12 to 20 feet above the Magoffin beds of Morse, was named from exposures on Buck Branch in the White Oak quadrangle (Adkison, 1957, p. 11). This bed was first described but not named by Crandall (1880(?), p. 19), and it was later called the Haddix coal by Browning and Russell (1919, p.

333–335). That name is not used in the present report because of the uncertainty in correlation with the type section of the Haddix coal bed in Breathitt County.

In the northwestern part of the quadrangle (pl. 6, sections 1–5) the rocks between the Colvin and Index coal beds are 38 to 51 feet thick and consist mainly of light-gray fine- to medium-grained sandstone, crossbedded in part, and lesser amounts of gray shale, siltstone, and underclay. On Wright Branch of Lacey Creek in the northern part of the area (pl. 6, section 11), the rocks between the Colvin and Index coals are about 45 feet thick and consist mainly of sandstone, shale, and underclay. One 7-inch coal occurs about 6 feet above the Colvin coal and may be an upper split of that bed. Elsewhere in the quadrangle the strata between the Colvin and Index coals are poorly exposed for the most part.

BASE OF INDEX COAL TO BASE OF SEBASTIAN COAL

Strata between the Index and Sebastian coal beds are best exposed in the northwestern part of the quadrangle where they are 61 to about 90 feet thick (pl. 6, sections 1–4); elsewhere these rocks are poorly exposed. The rocks are mainly shale and siltstone, but sandstone lentils as much as 33 feet thick are present. The Nickell coal bed occurs near the middle of the unit.

The Index coal was named from mine exposures in the eastern part of the West Liberty quadrangle (Adkison, 1957, p. 12) where it contains a parting of flint clay similar to that in the Fire Clay coal bed. The Index coal is generally overlain by 29 to 39 feet of gray shale and siltstone and lesser amounts of sandstone and underclay. The roof rock of this coal is shale at many places, but it is medium-gray to medium-dark-gray underclay at the mouth of Trace Branch of Rockhouse Creek (pl. 7, section 115) and near the mouth of Raccoon Creek (pl. 7, sections 121, 122). At section 122 the upper part of the underclay contains very thin lenses of dense medium-brown claystone similar to flint clay.

The Nickell coal bed, which was named from exposures in the southern part of the Cannel City quadrangle (Englund, 1955, p. 11), occurs about halfway between the Index and Sebastian coals. Rocks between the Nickell and Sebastian coal beds are mainly gray shale and siltstone about 40 feet thick, but some dark-gray to black shale is present. A fossiliferous shale zone commonly less than 2 feet thick is present 16 to 25 feet above the Nickell coal bed in the northwestern part of the area (pl. 6, sections 1, 4). This zone is also present in the ridge about 0.45 mile west of Head of Pricy school and in a road cut in the head of Improvement Branch of Raccoon Creek. The shale is medium gray to black and the fossils are chiefly brachiopods and some pelecypods. The fossiliferous shale is equivalent to a similar bed 13 to 17 feet above the Nickell coal bed in the northwestern part of the White Oak quadrangle (Adkison, 1957, p. 13, and pl. 2, section 3).

ABOVE BASE OF SEBASTIAN COAL

The uppermost unit of the Breathitt formation is a poorly exposed sequence composed mainly of sandstone, siltstone, and shale; the maximum thickness is 210 feet. In addition to the Sebastian coal this unit includes the Hindman (?) coal bed in the southwestern part of the quadrangle.

The Sebastian coal bed was named from exposures in the western part of the White Oak quadrangle (Adkison, 1957, p. 13). It was seen at several localities in the western part of the Salyersville North quadrangle (pl. 6, sections 1, 3, 4; pl. 7, sections 125, 126) where it occurs high on the ridges. The roof rock of the Sebastian coal bed is composed of massive light-gray fine-grained sandstone as much as 54 feet thick (pl. 6, section 1).

Coal has been mined for local use from a bed about 0.4 mile northwest of the mouth of May Branch (pl. 5) in the southwestern part of the area. The coal, which occurs as small outliers on the ridge, is about 70 feet above the Sebastian coal bed and about 290 feet above the Fire Clay coal bed. It was called the Flag coal in this vicinity by Browning and Russell (1919, p. 344), but the present writers prefer a tentative correlation with the Hindman(?) coal bed in the Seitz quadrangle to the southwest (Bergin, 1962). The roof rock of the Hindman(?) coal in the Salyersville North quadrangle consists of silty shale more than 5 feet thick.

QUATERNARY SYSTEM

ALLUVIUM

Deposits of unconsolidated silt and sand and larger fragments of sandstone, siltstone, and shale are present in most creek valleys and in the valley of the Licking River (pl. 5). The deposits, which commonly merge into the slope wash on the hillsides, seem to be derived entirely from the Pennsylvanian bedrock. During Recent time the creeks have cut through the alluvial deposits at many places and have exposed Pennsylvanian rocks in the streambeds, but such outcrops of bedrock are too narrow to be shown on the geologic map and are included in the alluvium.

The distribution of the alluvium in the creek valleys in the northeastern part of the quadrangle is strikingly controlled by the upper sandstone of the Lee formation (pl. 5). This thick sandstone is much more resistant to erosion that the overlying rocks in the Breathitt formation; as a result in areas upstream from outcrops of the Lee formation the creeks have relatively low gradients and wider valleys. Alluvium is not present in mappable quantities along the parts of the creeks that flow across the sandstone in the Lee, but a narrow band of alluvium is present along Big Mine Fork below Lacey Creek where the valley is developed in the thick shale sequence beneath the cliff-forming upper sandstone of the Lee.

TERRACE DEPOSITS

Several small areas in the valleys of Licking River, Lick Creek, and Raccoon Creek have the topographic form of terraces that are controlled by the bedrock. The terraces, shown on plate 5, are 20 to 40 feet above the alluvium and are covered by a mantle of deeply weathered silt, sand, and soil, which is generally yellowish brown to reddish brown. The terraces probably are of Recent age but some might be as old as late Pleistocene.

STRUCTURE

The Salyersville North quadrangle lies on the west flank of the eastern Kentucky structural basin, but the regional dip to the southeast is altered by several structural features to a general west dip averaging 70 feet per mile. Features within the quadrangle include the Irvine-Paint Creek fault, the east end of the Caney anticline, the western part of the Mine Fork dome, and the Johnson Creek fault. The structural features are shown on plate 5 by structure contours on the Fire Clay coal bed. The structure-contour interval is 20 feet and the total structural relief is about 760 feet.

The Caney uplift, which lies almost entirely to the west of the area, was first reported by Crandall (1910, p. 13, 16) and later mapped by Browning and Russell (1919), Browning (1921), Hudnall and Browning (1924), and Robinson (1925). The most recent mapping of this structural feature was by Englund (1955) and Adkison (1957).

Browning and Russell (1919, p. 19–21) described the Irvine–Paint Creek fault (Caney fault), the Johnson Creek fault, and the Mine Fork dome.

The Irvine–Paint Creek fault, which crosses the northern part of the quadrangle, is a normal fault having a vertical displacement of about 145 to 260 feet; the greatest displacement is in the northwest corner of the quadrangle. The fault plane is poorly exposed in a road cut along the Rockhouse Creek about a quarter of a mile south of Logville (fig. 13). Elsewhere the approximate trace of the fault was determined by the displacement of key beds and by abrupt changes in the dip of the rocks as the fault was crossed. The rocks on the north (upthrown) side dip to the north and northwest at 120 to 160 feet per mile; rocks on the south side dip more sharply to the north and northwest. The dip on the south side commonly increases as the fault is approached, especially near the west edge of the quadrangle where dips of 9° to 21° were measured. The general

FIGURE 13.—Exposure of Irvine-Paint Creek fault 0.25 mile south of Logville on Rockhouse Creek showing (a) poorly exposed fault plane dipping about 50° S., (b) sandstone above the Index coal bed, and (c) weathered shale and siltstone about 30 feet below the Fire Clay coal bed. Displacement at this locality is about 190 feet.

trace of the Irvine–Paint Creek fault is readily located on Big Mine Fork because of the displacement of the massive cliff-forming sandstone in the Lee formation.

The east end of the Caney anticline dies out a third of a mile inside the west border of the quadrangle. The axis of this anticline lies 1½ miles south of the Irvine-Paint Creek fault and is subparallel to it. A structural saddle separates the Caney anticline from the westward- and northwestward-dipping strata to the east. Rocks in the central and west-central parts of the quadrangle dip to the west at 50 to 80 feet per mile off the Mine Fork dome. The westward dip is interrupted by several small flexures.

The Mine Fork dome extends beyond the east border of the quadrangle into the Paintsville 15-minute quadrangle where it was mapped by Hauser (1953, pl. 4B) who considered it to be part of the Paint Creek uplift. This dome is somewhat elongate and subparallel to the Irvine-Paint Creek fault. The southwestern part of the Mine Fork dome passes into a southward-plunging nose, which splits near the mouth of Twin Lick Fork (pl. 5).

The Johnson Creek fault, which is present in the southern part of the quadrangle, is a normal fault having a maximum vertical displacement of about 190 feet (pl. 5). It is subparallel to the Irvine-Paint Creek fault and is also upthrown on the north side. The fault is poorly exposed for the most part and dies out in the ridge east of Twenty Two Mile Branch in a small narrow synclinal fold; the synclinal fold extends nearly 2 miles eastward from the end of the fault. The rocks on the north side of the Johnson Creek fault in the vicinity of Long Branch and May Branch dip to the northwest and north at about 200 feet per mile. To the east a narrow anticlinal fold of very low structural relief is present about 0.15 mile north of the fault and parallel to it (pl. 5). On the south side of the fault the northward dip of the rocks commonly increases as the fault is approached; dips as great as 11° were measured.

In addition to the major faults described above, several small faults were seen in the Salyersville North quadrangle. A normal fault is present in the right fork of Round Hole Branch of State Road Fork (pl. 5). The fault, which strikes east and is downthrown on the south side, seems to be less than half a mile long; maximum vertical displacement is about 40 feet. Another normal fault, having less than 20 feet of displacement and unknown linear extent, was seen in the bed of Burton Fork in the southeast corner of the area. This fault, not shown on plate 5, is located about 400 feet upstream from the mouth of the second hollow on the north side of the stream; the strike seems to be east. A very small reverse fault was seen in the bank of Raccoon Creek about 1,400 feet downstream from the mouth of Scaffold Fork (fig. 14). At this locality, not

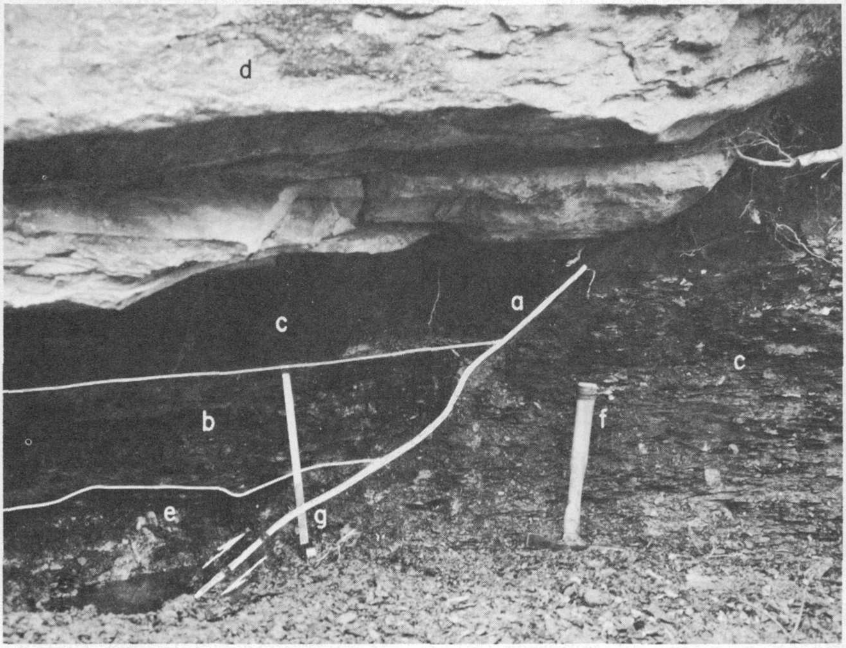

FIGURE 14.—Exposure of small reverse fault in the bank of Raccoon Creek about 1,400 feet downstream from the mouth of Scaffold Fork showing (a) fault plane, (b) Howard(?) coal bed 10 inches thick, (c) gray shale, (d) massive sandstone, (e) underclay, (f) hammer resting on top of Howard(?) coal bed, and (g) steel tape.

shown on plate 5, the Howard(?) coal bed is displaced 1.6 feet vertically and 3 feet horizontally. Many additional faults of small displacement probably are present in the quadrangle, but they are effectively concealed by the slopewash and vegetation.

DESCRIPTION OF COAL BEDS AND COAL RESERVES

The upper part of the Lee formation contains 1 coal bed and the Breathitt formation contains at least 13 coal beds that are more than 14 inches thick locally. Several of the coal beds are more than 28 inches thick locally, but areas containing coal of this thickness are small. Because the coal is generally thin there have been no large coal-mining operations within the quadrangle. Coal-outcrop lines and locations where coal beds were seen are shown on plate 5, but thickness data were not obtained at many of the locations. Most of the small mines that formerly produced coal for domestic use were completely caved when visited. Many of the coal locations shown on plate 5 consist of coal blooms in old roads, trails, and natural outcrops; these blooms can be very misleading in regard to thickness, composition, and partings in the beds.

Coal reserves of 11 coal beds, including the 1 bed in the Lee formation, were divided into the following categories: (a) indicated reserves that include coal lying within three-fourths of a mile of an outcrop along which the extent and thickness of the coal are reasonably well defined; and (b) inferred reserves that include the remaining coal lying beyond the area of indicated reserves. The outer boundary of the area of inferred coal is variable since it is based upon thickness trends of the coal. The reserves were further subdivided according to the coal thickness, excluding partings. Thickness maps were prepared for each of the coal beds at a scale of 1:20,000 (1 in. equals 1,667 ft.), based on these categories of reserves. The areas containing coal were then measured with a polar planimeter, and the planimeter areas were converted to acres. The weight of coal (tons) in a given area is the product of the area (acres), the thickness (feet), and the weight of coal per acre-foot (assumed to be 1,800 tons).

The estimated original coal reserves in beds more than 14 inches thick total 172,446,000 tons, of which 16,613,000 tons is in beds 28 to 42 inches thick (table 1). The figures in table 1 differ from those of Huddle and others (1962) because in this report the coal-bed maps were modified to include more recent data, the number of decimal places rounded off is less, and more coal beds are considered here. The Lee formation (Mine Fork coal bed) contains 6,730,000 tons in the 14- to 28-inch thickness category. The Breathitt formation (10 coal beds) contains 165,716,000 tons in all categories. All the calculated reserves are under less than 1,000 feet of cover.

TABLE 1.—*Estimated original coal reserves of the Salyersville North quadrangle*

[In thousands of short tons; covered by less than 1,000 ft of overburden. In part after a report by Huddle and others (1962)]

Bed	Indicated reserves in beds—			Inferred reserves in beds—			Total reserves in beds—		Grand total
	Thickness		Total	Thickness		Total	Thickness		
	14–28 in.	28–42 in.		14–28 in.	28–42 in.		14–28 in.	28–42 in.	
Sebastian	447	175	622	2,503	--------	2,503	2,950	175	3,125
Nickell	1,872	--------	1,872	2,151	--------	2,151	4,023	--------	4,023
Index	6,090	--------	6,090	713	--------	713	6,803	--------	6,803
Hamlin(?)	4,153	891	5,044	8,026	--------	8,026	12,179	891	13,070
Fire Clay	16,783	7,625	24,408	4,953	--------	4,953	21,736	7,625	29,361
Whitesburg	15,418	[1] 5,133	20,551	2,097	--------	2,097	17,515	5,133	22,648
Cannel City	2,280	--------	2,280	--------	--------	--------	2,280	--------	2,280
Tom Cooper	45,130	1,648	46,778	13,360	--------	13,360	58,490	1,648	60,138
Lacey Creek	14,421	1,141	15,562	3,848	--------	3,848	18,269	1,141	19,410
Wheelersburg	2,892	--------	2,892	1,966	--------	1,966	4,858	--------	4,858
Mine Fork	3,040	--------	3,040	3,690	--------	3,690	6,730	--------	6,730
Total, all beds	112,526	16,613	129,139	43,307	--------	43,307	155,833	16,613	172,446

[1] Includes about 91,000 tons in beds more than 42 inches thick.

LEE FORMATION

MINE FORK COAL BED

The Mine Fork coal has been mined by local residents along Big Mine Fork and its tributaries in the northeastern part of the quadrangle. It occurs as a single bed 14 to 18.5 inches thick (pl. 7, sections 1–4), but it may be absent locally because of erosion prior to the deposition of the overlying upper sandstone of the Lee formation. The coal is fairly bright, consisting of bands of vitrain in a moderately bright attrital matrix; some dull attrital matrix is present in the lower part. The estimated original reserves in the Mine Fork coal bed, all in the 14- to 28-inch thickness category, total 6,730,000 tons. The amount of coal already mined is small.

BREATHITT FORMATION

WHEELERSBURG COAL BED

The Wheelersburg coal bed has been mined for local use at a few places in the northeastern part of the area, but very little data concerning the coal were obtained during the fieldwork. At Wheelersburg the coal is 19 inches thick (pl. 7, section 6), and at a small strip mine on Jellicoe Branch it is more than 18 inches thick (pl. 7, section 5). The estimated original reserves in the Wheelersburg coal bed total 4,858,000 tons, all of which are in the 14- to 28-inch thickness category. Mined areas are probably very small.

HOWARD(?) COAL BED

The Howard (?) coal bed is commonly 6 to 14 inches thick, but on Browns Fork of Lacey Creek (pl. 7, section 7) a coal tentatively correlated with this bed is more than 20 inches thick. Coal reserves were not calculated because of the sparse data and the apparent general thinness of the coal.

LACEY CREEK COAL BED

The Lacey Creek coal bed has been mined for local use at several places in the northeastern part of the area where it attains a thickness of 16 to more than 29 inches. A parting of shale or sandstone is present in the upper part of the bed at several places on Lacey Creek and its tributaries (pl. 7, sections 10–13). Southward the coal apparently splits into three benches separated by shale or underclay in the heads of Raccoon Creek and Twin Lick Fork (pl. 7, sections 15–18); the lower bench is the thickest, ranging from 8 to 16 inches. The Lacey Creek coal consists of bands of vitrain in a bright attrital matrix; some dull attrital matrix is present in the lower part of the bed. This coal is below drainage over most of the remainder of the quadrangle, but where observed it is less than 14 inches thick. The Lacey Creek coal bed contains estimated original reserves of 18,269,000 tons in the 14- to 28-inch thickness category and 1,141,000 tons in the 28- to 42-inch thickness category. Mined areas probably are small.

TOM COOPER COAL BED

The Tom Cooper coal has been mined for local use at many places in the quadrangle, primarily because of its low position in the hills. It is more than 14 inches thick nearly everywhere except in the southwestern part of the area (pl. 8). The Tom Cooper coal bed is below drainage in the northwestern part of the quadrangle, but it may be more than 14 inches thick in that area. The thickness of this bed averages 20 inches and is more uniform than that of the other coals for it exceeds 28 inches in only a few small areas in the northeastern part of the quadrangle (pl. 8). The maximum observed thickness of the coal was 32 inches on Lacey Creek (pl. 7, sections 20, 21).

Most of the Tom Cooper coal bed is composed of bands of vitrain in a bright attrital matrix but the uppermost part, about 1 to 4 inches thick, includes much dull attrital matrix at many places. The lower part of the bed also includes much dull attrital matrix locally. The coal contains no partings throughout most of the area, but stringers a fraction of an inch thick of fusain, pyrite, or underclay are present at a few places. The estimated original reserves in the Tom Cooper coal bed total 60,138,000 tons, of which 1,648,000 tons is in the 28- to 42-inch thickness category. The amount of coal mined is unknown.

CANNEL CITY COAL BED

The Cannel City coal bed is less than 14 inches thick except for a few small areas in the southern part of the quadrangle. In these small areas the coal generally contains one or more partings of shale or underclay as much as 3 inches thick (pl. 7, sections 50–55). The estimated original reserves in this bed total 2,280,000 tons in the 14- to 28-inch thickness category. Mined areas are believed to be negligible.

WHITESBURG COAL BED

The Whitesburg coal bed has been mined for local use at many places in the eastern part of the quadrangle where it is more than 28 inches thick over a fairly large area (pl. 8). Although the maximum observed thickness was 64½ inches near locality 70 on Round Hole Branch, the area containing coal more than 35 inches thick is very small.

The Whitesburg coal bed is composed largely of thin to medium bands of vitrain in a moderate to bright attrital matrix; some dull attrital matrix is present in the lower part at several places. Partings of underclay, shale or fusain are present locally (pl. 7, sections 58, 61, 62, 67, 70, 80).

The estimated original reserves in the Whitesburg coal bed total 22,648,000 tons. The reserves in the 28- to 42-inch thickness category total 5,133,000 tons; this includes about 91,000 tons in the more than 42-inch thickness category. The amount of coal already mined is unknown, but the areas containing coal more than 35 inches thick are thought to be largely mined out.

FIRE CLAY COAL BED

Local mining operations in the Fire Clay coal bed have been mainly in the southern and western parts of the quadrangle where the coal is more than 28 inches thick in several areas (pl. 8). The coal generally is composed of bands of vitrain in a moderately dull to bright attrital matrix; locally the bed contains much bony impure coal. Part of the bed in the northwestern part of the area is composed of cannel coal (pl. 7, sections 81, 83).

The flint-clay parting, for which the Fire Clay coal bed was named, is rather sporadically distributed especially where the coal is only a few inches thick. This parting is present in most of the areas where the coal is more than 18 inches thick; other partings of shale and underclay are fairly common in the Fire Clay coal bed.

The estimated original reserves in the Fire Clay coal bed total 29,361,000 tons, of which 7,625,000 tons is in the 28- to 42-inch thickness category. Mined areas are unknown, but most of the thickest coal in the vicinity of Salyersville probably has been mined out.

HAMLIN(?) COAL BED

The Hamlin(?) coal bed has been mined for local use on Phipps Fork of Rockhouse Creek and in the ridge east of Improvement Branch of Raccoon Creek (pl. 5) where the observed thickness of the coal is as much as 35 inches (pl. 7, sections 106, 107), excluding the partings. Browning and Russell (1919, p. 247, 253) called this bed on Phipps Fork the Haddix coal and reported a maximum thickness of 62 inches, but the type Haddix coal in Breathitt County occurs above the Magoffin beds of Morse. Therefore the coal mined on Phipps Fork is most logically correlated with the Hamlin coal of Perry County which occurs below the Magoffin beds. Elsewhere in the quadrangle the coal generally is only 12 to 15 inches thick. The Hamlin(?) coal bed is a bright coal composed of bands of vitrain in a moderate to bright attrital matrix. It contains one or more partings 0 to 6 inches thick of bony impure coal, carbonaceous shale, or underclay at most places (pl. 7, sections 105–111). The estimated original reserves in the Hamlin(?) coal bed total 13,070,000 tons, of which 891,000 tons are in the 28- to 42-inch thickness category. Much of the thickest coal on Phipps Fork probably is mined out; mined areas in other parts of the quadrangle are very small.

COLVIN COAL BED

The Colvin coal bed is probably less than 14 inches thick in most of the quadrangle for local mining of this bed was not seen by the writers. Browning and Russell (1919, p. 338) reported 28.5 inches of coal, which they correlated with the Haddix coal bed, in a small mine near the mouth of Long Branch in the southwestern part of the quadrangle; this coal probably is the Colvin. The maximum thickness of coal noted by the writers was 16 inches on Wesley Fork of Phipps Fork (pl. 7, section 114). Reserves for the Colvin bed were not calculated because of the apparent thinness of the coal and the lack of information.

INDEX COAL BED

The Index coal has been mined by residents chiefly in the northwestern part of the quadrangle where it is generally 20 to 24 inches thick. One or more partings of underclay or bony impure coal less than 3 inches thick are present in the lower part of the bed at most localities (pl. 7, sections 115, 118–122). The coal is composed mainly of bands of vitrain in a moderately dull to bright attrital matrix; some dull attrital matrix is present in the uppermost part. The estimated original reserves in the Index coal bed total 6,803,000 tons in the 14- to 28-inch thickness category. Mined areas are probably small.

NICKELL COAL BED

The Nickell coal bed has been mined for local use at only a few places in the northwestern part of the quadrangle, although the measured sections in this area (pl. 6, sections 1–4) indicate that the coal is present. The coal was measured at one place on Brushy Fork of Raccoon Creek (pl. 7, section 124) where it consists of bands of vitrain in a moderately dull to bright attrital matrix. Possibly this coal section should be correlated with the Index coal bed. The estimated original reserves in the Nickell coal bed total 4,023,000 tons in the 14- to 28-inch thickness category. Mined areas are very small.

SEBASTIAN COAL BED

The Sebastian coal bed seems to be present throughout the western half of the quadrangle where it is high in the hills. A few scattered prospects indicate that it is about 20 to 33 inches thick and contains one or more partings of black carbonaceous poorly bedded shale less than 3 inches thick (pl. 7, sections 125, 126). The coal consists chiefly of bands of vitrain in a moderately bright attrital matrix; the upper part of the bed contains considerable dull attrital matrix. The estimated original reserves in the Sebastian coal bed, largely inferred, total 3,125,000 tons, of which 175,000 tons is in the 28- to 42-inch thickness category. Mined areas are believed to be insignificant.

HINDMAN(?) COAL BED

The Hindman(?) coal has been mined by local residents at a few places in the southwestern part of the quadrangle. At locality 127 the bed is about 23 inches thick, excluding several partings, and is composed of bands of vitrain in a bright attrital matrix. Reserves for this bed were not calculated because of the lack of information.

COAL QUALITY AND RANK

Although the coals of this quadrangle were not sampled and analyzed, there are reported coal analyses of most of these beds from the surrounding areas (Adkison, 1957, p. 18; Englund, 1955, p. 16; and Welch, 1958, p. 602). The analyses, which include coal samples from the Tom Cooper to the Sebastian coal beds, show a wide range of values for each component of both the proximate and ultimate analyses as reported in percentages, and this range of values is true of coal samples analyzed both on an "as received" or on a "moisture and ash free" basis. The volatile matter of the proximate analyses ranges from 35.0 to 49.0 percent, fixed carbon from 43.1 to 60.5 percent, and ash from 2.0 to 21.2 percent. The sulfur of the ultimate analyses ranges from 0.7 to 4.0 percent, hydrogen from 5.1 to 7.1 percent, carbon from 63.1 percent to 83.1 percent, nitrogen from 1.2 to 1.9 percent, and oxygen from 6.8 to 16.4 percent. Heat values on an "as received" basis range from 11,360 to 13,690 Btu, and on a "moisture and ash free" basis from 14,390 to 15,580 Btu. The coking quality of these coals was not determined but the free-swelling indexes range from 1 to 5.

The rank of all the coal sampled in the vicinity is classed as high-volatile "A" or "B" bituminous and all the cannel coal analyzed is high volatile "A."

OIL AND GAS

The Salyersville North quadrangle includes the western half of the Oil Springs oil pool and the westernmost part of the Win gas pool (fig. 15). The wells shown on plate 5 are the same as those

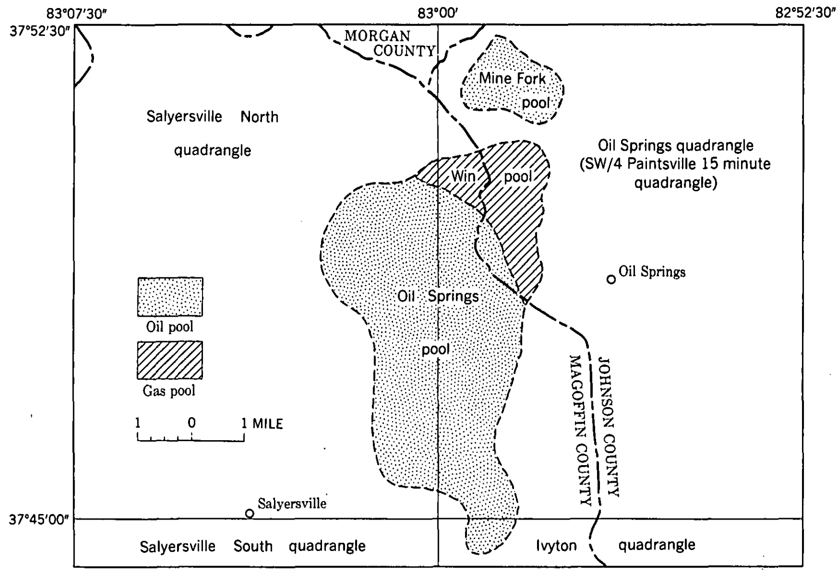

FIGURE 15.—Map showing location of the Oil Springs, Win, and Mine Fork pools in the Salyersville North quadrangle and adjacent areas (after Hauser, 1953).

on the topographic base map; all the wells in the area are not shown. The Mine Fork oil pool lies about half a mile east of the quadrangle and is considered to be an extension of the Oil Springs pool.

Drilled wells in the vicinity of the Salyersville North quadrangle have penetrated rocks that range in age from Pennsylvanian to Cambrian (Freeman, 1953, p. 188–194, 222–223). The writers did not examine cuttings from any of the wells as description of the subsurface geology of the area was not intended for the purpose of this report. A generalized description of the subsurface rocks in the Paintsville 15-minute quadrangle to the east is included in a report by Hauser (1953, p. 10, 11, 28–32) and for the most part his description is believed to be applicable to the subsurface rocks in the Salyersville North quadrangle. Detailed sample descriptions for two wells in the western part of the Paintsville 15-minute quadrangle were given by Freeman (1953, p. 188–194, 222–223). One of the wells, the Ashland Oil and Refining Co. Wallace Williams 8, sec.

19-R-79 (Carter coordinates), Johnson County, is located about 5.5 miles northeast of the Salyersville North quadrangle; it penetrated rocks of Pennsylvanian, Mississippian, Devonian, Silurian, Ordovician, and Cambrian ages. The other well, the Cumberland Petroleum Co. L. C. Bailey 44, NW¼ sec. 6-R-79 (Carter coordinates), Magoffin County, is in the Oil Springs pool about half a mile east of the Salyersville North quadrangle (about 1.4 miles northeast of Falcon). This was an old well which was deepened into rocks of Ordovician age; samples were missing for the upper 2,300 feet.

A dark viscous oil seep is present in the lower part of the upper sandstone unit of the Lee formation at one locality on Big Mine Fork about a quarter of a mile north of the mouth of Lacey Creek (pl. 7, section 1). The first discovery of commercial quantities of oil or gas in the vicinity of the Salyersville North quadrangle occurred in 1917 when a well was drilled in a gas seep on the Mine Fork dome (Hauser, 1953, p. 50). The Oil Springs pool (fig. 15) was discovered in June 1919 by a well drilled by the Bedrock Petroleum Co. on the Milt Wheeler farm on Litteral Fork of Big Mine Fork (Hauser, 1953, p. 52). In this pool of about 5,500 acres oil is produced from the Weir sand of Early Mississippian age at depths of 900 to 1,200 feet depending on the surface altitude and the position on the geologic structure (Simmons, 1956, p. 25 and 27). Initial oil production in the Oil Springs pool ranged from 10 to 150 barrels per well per day and averaged 30 barrels per well per day; cumulative production is about 10 million barrels (Hauser, 1953, p. 52, 53).

The Win gas field was discovered in November 1917, by a well drilled by the Bedrock Petroleum Co. on the W. H. Conley farm; gas production, estimated at 1 million cubic feet, was from the Weir sand at a depth of 850 feet (Hauser, 1953, p. 54). Gas was later discovered in the underlying Berea sand, Corniferous limestone of former usage, and Big Six sand (Hauser, 1953, p. 52, 54). Drillers' logs in the Salyersville North quadrangle indicate that the interval between the top of the Weir sand and the Berea is about 100 to 160 feet. The Corniferous limestone is about 650 to 700 feet below the top of the Weir, and the Big Six is about 300 to 390 feet below the top of the Corniferous. Cumulative production in the Win field is about 800 million cubic feet from about 40 wells in about 2,000 acres (Hauser, 1953, p. 54). According to Hauser (1953, p. 54–55), the accumulation of oil in the Oil Springs pool and gas in the Win pool is controlled in part by the structure and in part by permeability barriers in the reservoir rock.

The first secondary-recovery operations in the Oil Springs pool began in the early thirties and consisted of air-gas repressuring; waterflooding of the Weir sand reservoir in this pool began in 1948

(Simmons, 1956, p. 29). The waterflooding project has been very successful, for the average daily oil production in the Oil Springs pool increased from about 500 barrels per day in 1950 to slightly more than 6,000 barrels per day in the early part of 1956 (Simmons, 1956, p. 29).

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