STATE OF ARKANSAS

ARKANSAS GEOLOGICAL COMMISSION

Norman F. Williams, State Geologist

INFORMATION CIRCULAR 20-C

GEOLOGY OF THE BARBER QUADRANGLE, SEBASTIAN COUNTY AND VICINITY, ARKANSAS[1]

---

by
BOYD R. HALEY
U. S. Geological Survey
Denver, Colorado

Prepared in cooperation with the
U. S. Geological Survey

1966

[1] Publication authorized by the Director, U. S. Geological Survey

CONTENTS

ILLUSTRATIONS

Plates

Figures

Tables

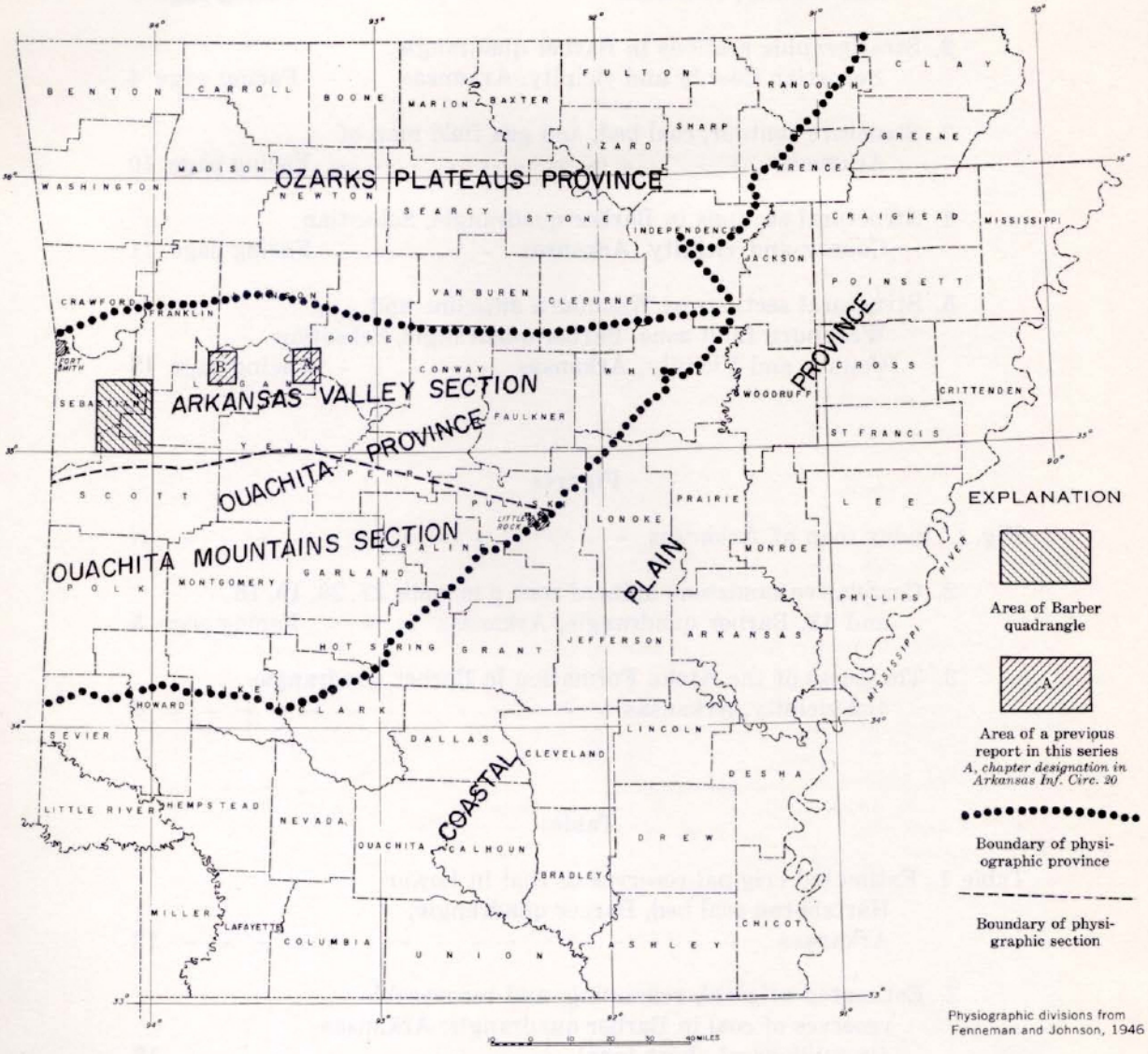


FIGURE 1–INDEX MAP OF ARKANSAS

GEOLOGY OF THE BARBER QUADRANGLE,

SEBASTIAN COUNTY AND VICINITY, ARKANSAS

ABSTRACT

The Barber quadrangle is in west-central Arkansas between 35°00'00" and 35°15'00" north latitudes and 94°00'00" and 94°15'00" west longitudes. It includes an area of about 244 square miles in parts of Sebastian, Scott, Logan, and Franklin Counties.

Sedimentary rocks of Middle Pennsylvanian age and unconsolidated sediments of Quaternary age are exposed at the surface and sedimentary rocks of Middle and Early Pennsylvanian age have been penetrated by wells drilled in or near the quadrangle. The rocks of Pennsylvanian age, consisting of shale, siltstone, sandstone, and minor amounts of limestone and coal, belong to the Morrow Series and to the Atoka, Hartshorne, McAlester, and Savanna Formations.

The rocks in the quadrangle have been folded into eastward- and northeastward-trending synclines and anticlines. Structural relief, as measured from the base of the Hartshorne Sandstone on the reverse-faulted Washburn anticline to the base of the Hartshorne Sandstone in the Bloomer syncline, is estimated to be more than 12,000 feet.

Coal beds are present in the Atoka, Hartshorne, McAlester, and Savanna Formabut only the Lower Hartshorne coal bed in the lower part of the McAlester Formation and the Paris coal bed in the upper part of the Savanna Formation have been economically important. Remaining reserves of coal in the Lower Hartshorne coal bed are estimated to be about 82 million short tons. All the coal is of low-volatile bituminous rank.

The first commercial quantity of natural gas found in Arkansas was discovered in the Mansfield gas field in 1902 in the Barber quadrangle. The two other gas fields subsequently found in the Barber quadrangle are the Gragg gas field, discovered in 1955 and the Booneville gas field, discovered in 1958. All natural gas in the Barber quadrange has been produced from sandstone units in the middle three-fifths of the Atoka Formation.

Poor quality building stone can be obtained from the Atoka, Hartshorne, and Savanna Formations. Road metal can be obtained from all formations and from the gravel-bearing parts of the alluvial deposits.

GEOLOGY OF THE BARBER QUADRANGLE, SEBASTIAN COUNTY AND VICINITY, ARKANSAS

INTRODUCTION

This report on the geology of the Barber quadrangle, Sebastian County and vicinity, Arkansas, is one in a series of reports being prepared by the U.S. Geological Survey in cooperation with the Arkansas Geological and Conservation Comm. It has been prepared to: (1) provide a geologic map of the quadrangle, (2) show the extent and thickness of all coal beds, (3) evaluate the reserves of coal, (4) provide geologic data and interpretations relevant to the location of petroleum and natural gas, and (5) provide information about sources of building stone, gravel, sand, and clay.

The Barber quadrangle is between 35°00′00″ and 35°15′00″ north latitudes and 94°00′00″ and 94°15′00″ west longitudes. It covers an area of approximately 244 square miles in parts of Sebastian, Scott, Logan, and Franklin Counties. (See fig. 1.) The area includes the small communities of Abbott, Lucas, Ione, Milltown, Barber, Washburn, and Burnville, and the eastern parts of Mansfield and Greenwood—two small towns near the western boundary. The extreme southern part of the area includes a part of the Ouachita National Forest, and the northern part of the area includes a part of the Camp Chaffee Military Reservation.

U.S. Highway 71 extends across the southwestern part of the quadrangle, Arkansas State Highway 10 extends across the northern part of the quadrangle, State Highway 96 extends across the northwest corner, and State Highway 23 extends across the southeast corner. These highways and U.S. Army, U.S. Forest Service, County, and private roads provide easy access to most parts of the quadrangle. The Chicago, Rock Island and Pacific Railroad extends across the central part of the quadrangle.

Elevations in the quadrangle range from about 1,740 feet above sea level in the southwestern corner to about 450 feet above sea level in the east-central part.

Geologic features in the quadrangle were mapped on the 1:24,000 scale, 7½-minute topographic quadrangle maps of Burnville, Barber, Abbott, and Ione during the years 1954 to 1957.

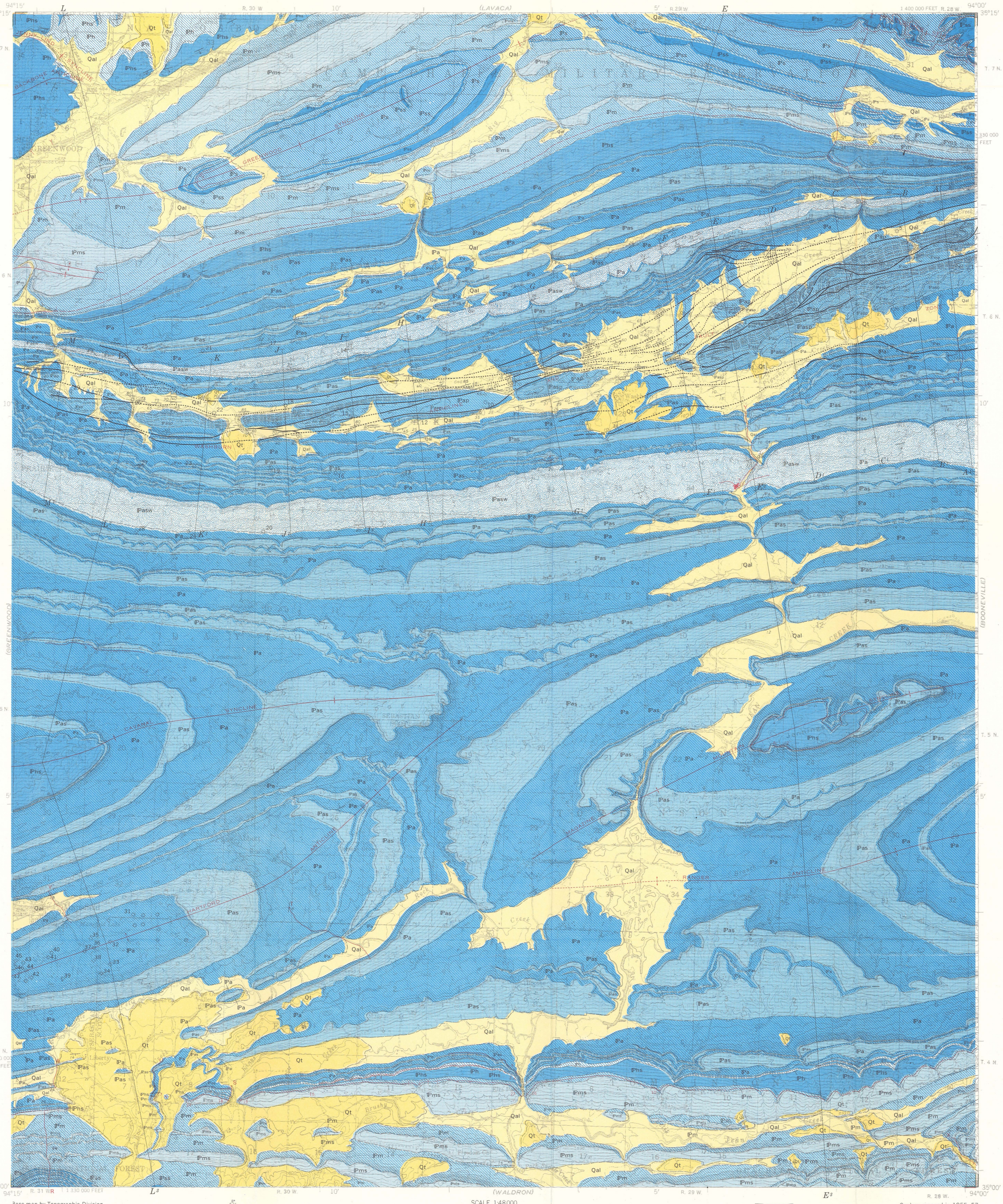
Reconnaissance and generalized geologic reports pertaining to all or to parts of the Barber quadrangle have been written by Croneis (1930) and Haley (1960).

A detailed geologic report by Collier (1907), containing descriptions of the geology of the northern and western parts of Barber quadrangle, grouped the rocks of the Arkansas Valley coal field in six formations which, in ascending order were the Atoka Formation and the Hartshorne Sandstone, with type sections in Oklahoma, and the Spadra Shale, Fort Smith Formation, Paris Shale, and Savanna Formation with type sections in Arkansas. Hendricks and Parks (1937 and 1950) included the northern part and some of the western part of the Barber quadrangle in their detailed reports on the geology of the Fort Smith district. In these two reports and in reports by Hendricks and Read (1934), Hendricks, Dane, and Knechtel (1936), Hendricks (1937), and Hendricks and others (1939), the boundaries of the Atoka Formation, Hartshorne Sandstone, McAlester Shale, Savanna Sandstone, and Boggy Shale were traced wherever possible from their type localities in Oklahoma into Arkansas, thereby either supporting or replacing the nomenclature established by Collier. The stratigraphic nomenclature of Hendricks and Parks has been modified by Merewether and Haley 1960 to conform with Miser's (1954) Oklahoma terminology of McAlester Formation, Savana Formation, and Boggy Formation, and to Oakes' (1953) classification of the Krebs Group which includes the Hartshorne Sandstone, and the McAlester, Savanna, and Boggy Formations.

The writer wishes to acknowledge the information and assistance furnished by the following people and organizations: Mr. N. F. Williams, Arkansas Geological and Conservation Comm., Mr. G. Oglesby and Mr. W. Barton, Reynolds Mining Corp., Mr. B. W. Miller, Gulf Oil Corp., Mr. C. Couser, Carter Oil Co., Miss G. Kelley, Kelley Realty Co., and the U.S. Army, Camp Chaffee.

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PLATE 1



Base map by Topographic Division
U.S. Geological Survey, 1947

TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1963

SCALE 1:48000

1 ½ 0 1 2 3 MILES

3000 0 3000 6000 9000 12000 15000 FEET

1 .5 0 1 2 3 KILOMETERS

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ARKANSAS
QUADRANGLE LOCATION

Geology mapped in 1955–57

EXPLANATION

QUATERNARY

Recent

Qal

Alluvium[1]

Deposits along stream channels. In some places includes parts of the lowermost terrace

Pleistocene

Qt

Terrace deposits[1]

Alluvial deposits on two terrace levels

UNCONFORMITY

CARBONIFEROUS
PENNSYLVANIAN

Des Moines

Krebs Group

Ps
Pss

Savanna Formation

Alternating units of predominant shale or predominant sandstone.
Ps, *shale, siltstone, and thin beds of silty sandstone.*
Pss, *sandstone, silty sandstone, or interbedded sandstone, siltstone, and shale*

Pm
Pms

McAlester Formation

Alternating units of predominant shale or predominant sandstone.
Pm, *shale, siltstone, and thin beds of sandstone or silty sandstone.*
Pms, *sandstone, silty sandstone, or interbedded sandstone, siltstone, and shale*

Ph
Phs

Hartshorne Sandstone

Alternating units of predominant shale or predominant sandstone.
Ph, *shale, siltstone, and thin beds of sandstone or silty sandstone.*
Phs, *sandstone, silty sandstone, or interbedded sandstone, siltstone, and shale*

Atoka

Pa
Pas
Pasw
Pap
Pasp

Atoka Formation

Alternating units of predominant shale or predominant sandstone.
Pa, *shale, siltstone, and thin beds of sandstone or silty sandstone.*
Pas, *sandstone, silty sandstone, or interbedded sandstone siltstone, and shale.*
Pasw, *sandstone, silty sandstone, or interbedded sandstone, siltstone, and shale; zone* w.
Pap, *shale, siltstone, and thin beds of sandstone or silty sandstone; zone* p.
Pasp, *sandstone, silty sandstone, or interbedded sandstone, siltstone, and shale; zone* p.

Dashed where approximately located

Coal bed
Dashed where approximately located

Thrust fault
Dashed where approximately located; dotted where concealed
T designates upper plate

Axis of anticline
Dotted where concealed

Axis of syncline
Dotted where concealed

14
Strike and dip of beds

Strike of vertical beds

85
Strike and dip of overturned beds

10
Natural or manmade exposure of coal bed
Number is thickness of coal in inches

27
Surface opening on coal bed
Number is thickness of coal in inches

Quarry

E ——— E³
Line of structural section shown on plates 4 and 5
Letters identify section

Z
Line of stratigraphic section
Letter identifies section shown on plate 2 and described in appendix

WELL SYMBOLS
Number designates well listed on table 3

31
Producing gas well

30
Well with show of gas

39
Well with no show of gas

3
Well being drilled as of Mar. 15, 1962

[1]Strike and dip symbols in areas of alluvial deposits were measured on bedrock exposures too small to be shown on this map

GEOLOGIC MAP OF BARBER QUADRANGLE, SEBASTIAN COUNTY AND VICINITY, ARKANSAS

By
Boyd R. Haley
U.S. Geological Survey

1963

STRATIGRAPHY

Rocks of Pennsylvanian and Quaternary age are exposed and have been penetrated by wells in the quadrangle. The areal extent of these rocks is shown on plate 1 and, excepting the rocks of Quaternary age, is shown graphically on plate 2 and described in detail in the appendix of this report.

The Pennsylvanian rocks consist of shale, siltstone, and sandstone and minor amounts of coal and limestone. The Quaternary deposits consist of unconsolidated clay, sand, and gravel in stream terrace deposits and stream alluvium.

PENNSYLVANIAN SYSTEM

MORROW SERIES

The Morrow Series in Arkansas consists of the Hale Formation and the overlying Bloyd Shale. The Hale Formation is sandstone, siltstone, and shale and a minor amount of limestone, whereas the Bloyd Shale is predominantly shale and limestone with minor amounts of limy sandstone and siltstone.

A sequence of sandstone, siltstone, shale, and limestone overlain by shale and limestone has been penetrated by two wells (pl. 2, sections 4 and 23) drilled in the Barber quadrangle. This rock sequence, corresponding in gross lithology to the upper part of the Hale Formation and the overlying Bloyd Shale elsewhere in Arkansas, is in the upper part of the Morrow Series in the Barber quadrangle. Neither well penetrated the entire Morrow Series.

The sandstone in the Morrow Series is light to medium gray, very fine to fine grained, limy, and in part silty. The siltstone is medium gray, light to medium gray very finely sandy and limy, or medium to dark gray limy fossiliferous and pyritic. The shale is medium gray to grayish black, and is in part limy, silty, and pyritic. The limestone is medium to dark gray, granular to very finely crystalline, fossiliferous, and in part very finely sandy, oolitic, and silty. The Reynolds Mining Corp. No. 1 Tomlin well (well 23 of this report) in sec. 33, T. 6 N., R. 30 W penetrated 713 feet of rocks of the Morrow Series, and The Gulf Oil Corp. No. 1 Borum well (well 4 of this report) in sec. 18, T. 6 N., R. 28 W. penetrated 694 feet of rocks of the Morrow Series (pl. 2 and appendix).

ATOKA SERIES

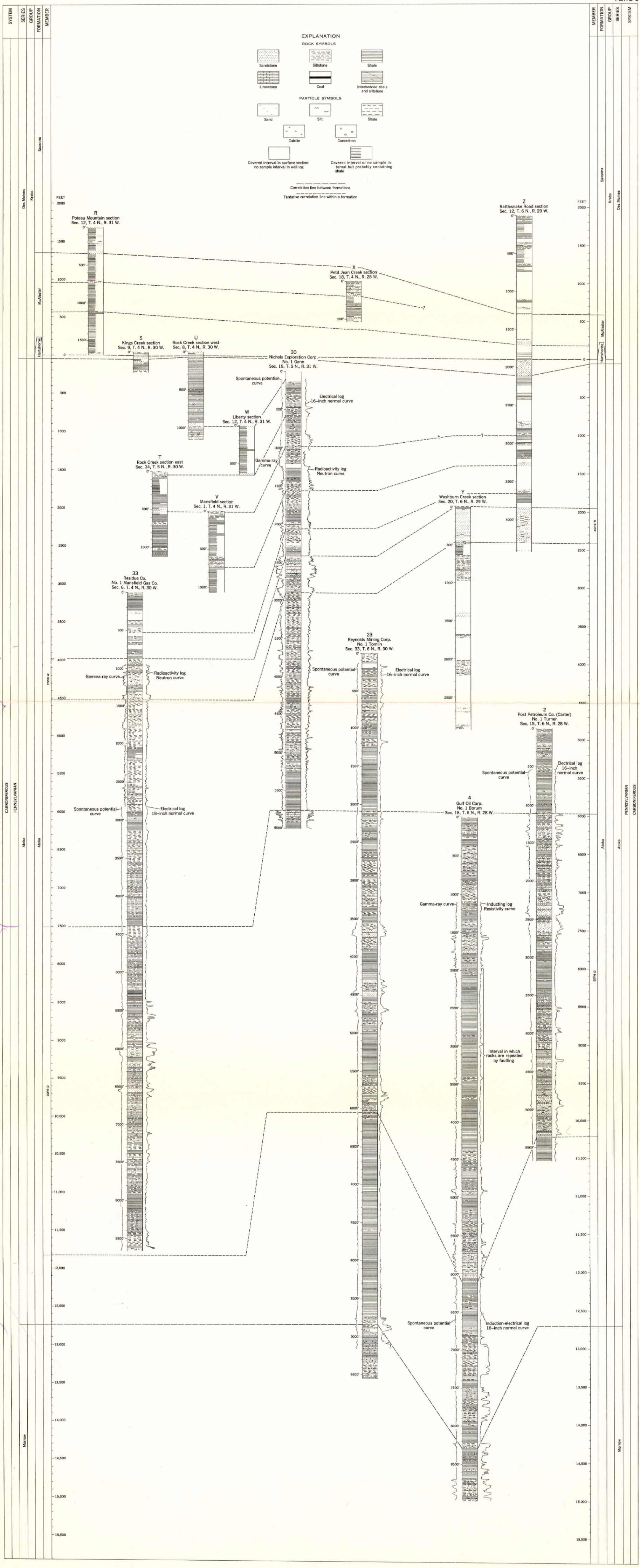
In Arkansas the Atoka Series is comprised of the Atoka Formation. In northern Arkansas the Atoka Formation rests unconformably on rocks of Morrow age but in the Barber quadrangle the nature of the contact is unknown. In the area of this report and elsewhere in Arkansas where the contact between the Atoka Formation and the Morrow Series is not exposed but has been penetrated by wells, it is placed at the base of the first sandstone unit above a sequence of rocks having typical Morrow lithology (limestone, limy sandstone, and limy siltstone).

The lithic criteria used to determine the contact between the two rock units are substantiated by the presence of a "light-colored bentonitic(?) shale" (Frezon and Schultz, 1961, p. C82-84) immediately above the first sandstone unit of the Atoka Formation in the Borum well. In every known occurrence of the "bentonitic(?) shale" in Arkansas and Oklahoma, where the Atoka and the underlying rocks of Morrow age can be differentiated with certainty, the lowermost "bentonitic(?) shale" is less than 200 feet above the base of the Atoka Formation.

The Atoka Formation in the Barber quadrangle is predominantly shale with considerable amounts of siltstone and sandstone. At least six coal beds are present in the upper 3,500 feet of the formation. The shale is dark gray to grayish black, micaceous, and in some places slightly silty to silty. Locally, the shale contains ironstone concretions, plant fossils, pyrite, and thin beds of siltstone or sandstone. The siltstone is very light to dark gray, micaceous, clayey in part, very finely sandy in part, locally well cemented, and locally contains macerated plant fragments. Some of the siltstone in the lower part of the Atoka Formation is very quartzose. (See log of Gulf Oil Corp. No. 1 Borum well in appendix.) The sandstone in the formation is light to medium gray, mostly very fine grained but ranges upward to medium grained, and is very slightly silty to very silty. It is micaceous in many places and in others contains abundant coalified plant fragments.

Parts of the Atoka Formation in the Barber quadrangle have lithologic characteristics that tend to set them apart. Two parts of the Atoka have been designated as zone p and zone w in this report because they contain lithologically distinctive sandstone. Zone p is best exposed along Pleasant Ridge in T. 6 N., Rs. 28 and 29 W. Zone w is best exposed along Washburn Creek in sec. 35, T. 6 N., R. 29 W.

Zone p, the lower of the two zones, (pl. 2) ranges from about 5,800 feet stratigraphically below the top of the Atoka Formation in the northern part of the quadrangle to about 7,500 feet below the top of the formation in the southern part of the quadrangle. It is about 4,100



STRATIGRAPHIC SECTIONS IN BARBER QUADRANGLE, SEBASTIAN COUNTY AND VICINITY, ARKANSAS

By
Boyd R. Haley
U.S. Geological Survey
1963

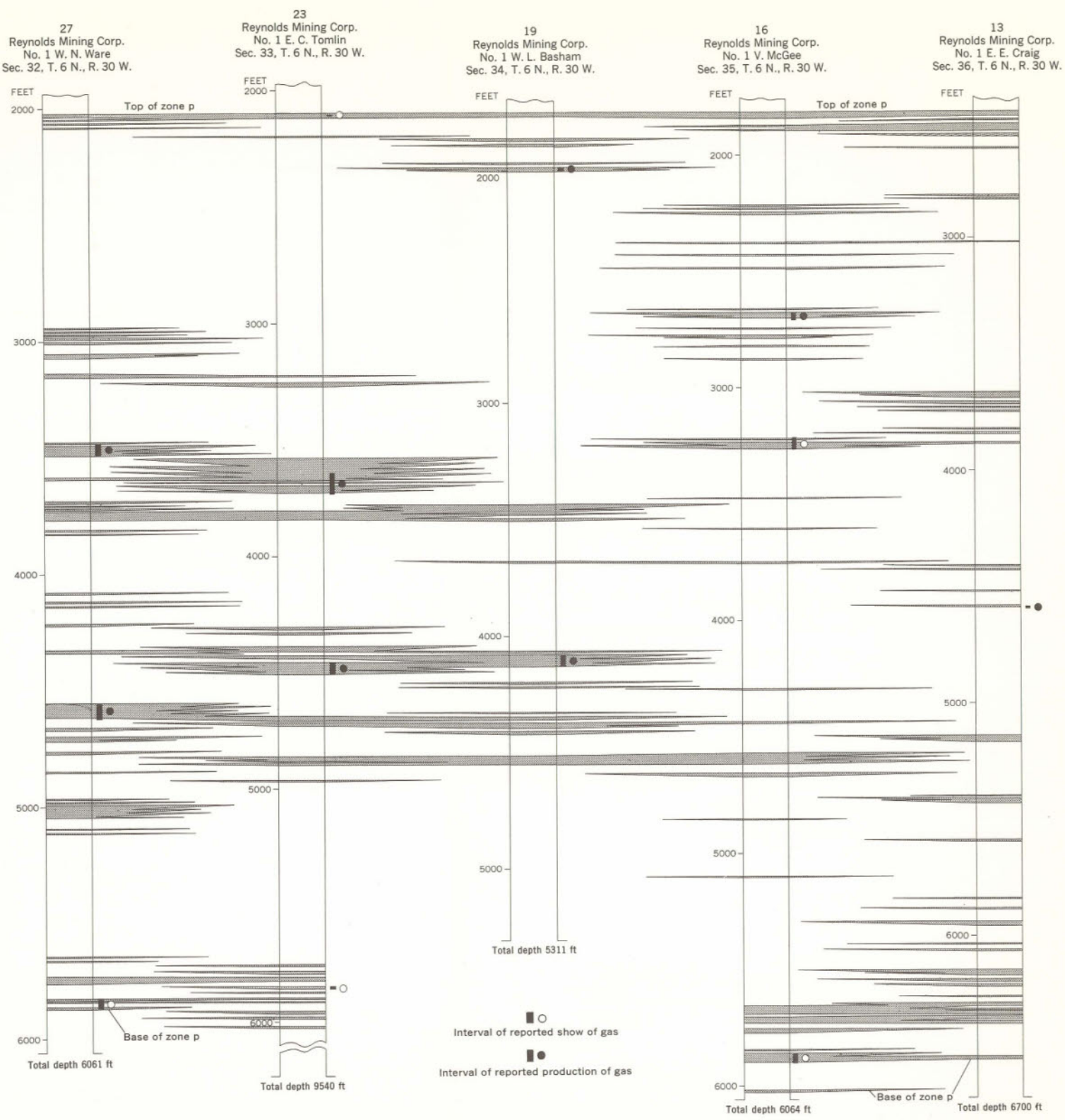


FIGURE 2—CORRELATIVE SANDSTONE UNITS OF ZONE P IN WELLS 27, 23, 19, 16, AND 13, BARBER QUADRANGLE, ARKANSAS

feet thick and consists of about equal amounts of sandstone, siltstone, and shale. The upper part of zone p is exposed on Pleasant Ridge (eastern part of Washburn anticline) in the northeastern part of the quadrangle and along the Washburn anticline and fault zone in the north-central part of the quadrangle. A part, if not all, of zone p has been penetrated by every well drilled in or near Barber quadrangle from 1950 to the present (1962). The shale and siltstone in zone p is not lithologically different from the shale and siltstone in the rest of the Atoka Formation, but the sandstone in zone p is distinctive because: (1) it is coarser grained (fine to medium) than most of the sandstone (very fine to fine) in the rest of the Atoka Formation; (2) coarse to granule size quartz grains are common; and (3) some of the sandstone is slightly limy to limy and fossiliferous, particularly in the eastern part of the quadrangle. The author has placed the upper limit of zone p at the top of the first sandstone unit that has some or all of the above lithologic characteristics. In all wells in which the section is unfaulted and on the surface, this sandstone unit is beneath a zone (about 700 feet thick) of dark-gray to grayish-black shale containing minor amounts of medium- to dark-gray siltstone. It is quite possible that the top of zone p is not at the top of the same sandstone unit everywhere in the quadrangle; however, it is within 50 feet of the same stratigraphic position everywhere in the quadrangle. The lower limit of zone p cannot be defined by a change in the gross lithology of the rocks. For convenience, it is placed at the base of the lowermost sandstone unit that has some or all of the above lithologic characteristics. The base of zone p is not at the base of the same sandstone unit everywhere in the quadrangle, but it is thought to be within 250 feet of the same stratigraphic position. Possible correlation of sandstone units within zone p are shown on figure 2.

Correlation of sandstone beds in zone p is difficult because beds are lenticular and their lithology varies laterally. Individual sandstone beds in zone p cannot be traced for a distance of more than 1 mile on the surface or correlated between wells drilled as close as 1 mile apart. The character of a sandstone bed can change within a distance of a quarter of a mile from a few inches of very silty well-cemented very fine grained sandstone to as much as 20 feet of friable medium-grained sandstone. Crossbedding and ripple marks are rare where the sandstone bed is thin, silty, and well cemented, but are more common where the sandstone is thicker, less silty, and coarser grained.

Units composed of interbedded sandstone, siltstone, and shale beds in zone p can be traced for as much as 3 miles on the surface. However, the lithology of these and similar units changes laterally with such rapidity that the units cannot be correlated with certainty for a distance of three miles between five wells spaced 1 mile apart in an east-west line. (See fig. 2.)

Some units of two or more sandstone beds in zone p range in thickness from 10 to 80 feet within half a mile along the outcrop on Pleasant Ridge. Where the unit is thick the sandstone is in beds as thick as 20 feet, and is very light gray, fine to medium grained with scattered coarse to granule size quartz sand grains, quartzose, and friable. Where the unit is thin the sandstone is in beds less than 3 feet thick, and is medium gray, very fine to fine grained, very silty, and well cemented.

Other sandstone units in zone p exposed on Pleasant Ridge are more persistent in thickness and lithology and are of two general types. One type is 5 to 20 feet thick and contains thin to thick beds of sandstone that is very light to light gray, fine to medium grained with scattered coarse to granule size quartz sand grains, slightly limy to limy in part, and fossiliferous in part. The other type is 6 inches to 3 feet thick and contains from one to five beds of sandstone that is medium to dark gray, very fine to fine grained, very silty, and well cemented.

The upper contacts of the sandstone units with shale in zone p are sharp, the lower contacts are generally sharp but are gradational with siltstone in some places.

Zone w, the higher of the named zones (pl. 2), ranges from about 1,700 feet stratigraphically below the top of the Atoka Formation in the northern part of the quadrangle to about 4,000 feet below the top of the formation in the southern part of the quadrangle. It ranges in thickness from 440 to 600 feet and it is best exposed along Washburn Creek in sec. 35, S. 6 N., R. 29 W. Zone w is nearly all sandstone where exposed but lateral lithic gradations do occur within the zone. Sandstone with small amounts of siltstone and shale are present in the zone in the Nichols Exploration Corp. No. 1 Gann well (well 30) in sec. 15, T. 5 N., R. 31 W. The zone is comprised of sandstone and contains larger amounts of siltstone and shale in the Residue Co. No. 1 Mansfield Gas Company well (well 33) in sec. 6, T. 4 N., R. 30 W. (pl. 2). Where exposed, zone w grades downward into an underlying siltstone and underlies shale with a sharp contact. In general, the grain size of

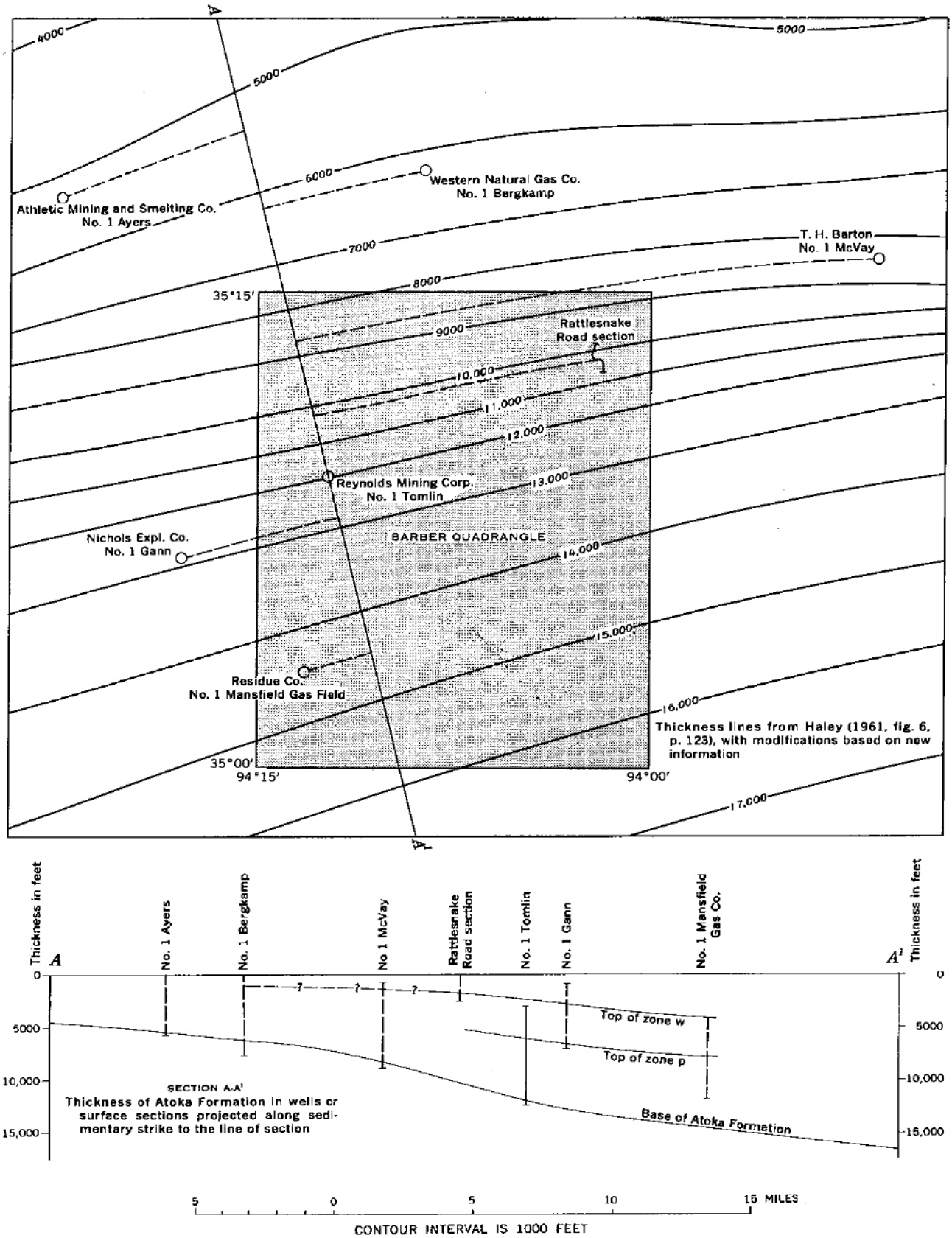


FIGURE 3–THICKNESS OF THE ATOKA FORMATION IN BARBER QUADRANGLE AND VICINITY, ARKANSAS

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PLATE 3

EXPLANATION

1558

Structure contours drawn on base of Hartshorne Sandstone
Dashed where projected above surface. Contour interval 100 feet; datum is mean sea level

1472

Structure contours drawn on base of Atoka Formation
Contour interval 200 feet; datum is mean sea level

Trace of synclinal axis

Trace of anticlinal axis

Surface trace of contact between Hartshorne Sandstone and Atoka Formation

A——A¹
Line of structural section shown on plates 4 and 5

COAL BEDS

Unnamed coal bed in Savanna Formation

Paris coal bed

Charleston coal bed or beds

Lower Hartshorne coal bed

Unnamed coal bed in Hartshorne Sandstone

Unnamed coal beds in Atoka Formation

×49
Exposure of coal
Number indicates thickness of coal in inches

27
Surface opening on coal bed
Number indicates thickness of coal in inches

●51
Drill hole or mine in Lower Hartshorne coal bed
Number indicates thickness of coal in inches

Mined area in Lower Hartshorne coal bed

——20——
Lower Hartshorne coal thickness line
Number indicates thickness of coal in inches

----------1000----------
Lower Hartshorne coal bed overburden thickness line
Number indicates thickness of overburden in feet

Boundary between measured and indicated reserves and inferred reserves of coal
Square on side of area of measured and indicated reserves of coal

WELL SYMBOLS

Number designates company name and lease name as shown on table 3

☼31
Producing gas well

☼30
Well with show of gas

☼39
Well with no show of gas

○3
Well being drilled as of Mar. 15, 1962

Gas field
Name of field and name of discovery well shown

Base map by Topographic Division
U.S. Geological Survey, 1947

Geology mapped in 1955–57

APPROXIMATE MEAN DECLINATION, 1963
TRUE NORTH
MAGNETIC NORTH

SCALE 1:48000
1 0 1 2 3 MILES
3000 0 3000 6000 9000 12000 15000 FEET
1 .5 0 1 2 3 KILOMETERS

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ARKANSAS
QUADRANGLE LOCATION

STRUCTURE CONTOUR, COAL BED, AND GAS FIELD MAP OF BARBER QUADRANGLE, SEBASTIAN COUNTY AND VICINITY, ARKANSAS

By
Boyd R. Haley
U.S. Geological Survey

1963

the sandstone and the thickness of the bedding increase upward and the amount of siltiness decreases upward. A coal bed is present in the upper 20 feet of zone w in sec. 35, T. 6 N., R. 29 W., and a carbonaceous zone is present in sec. 36, T. 6 N., R. 31 W. (along the county road west of the quadrangle).

Sandstone in the upper 5,000 feet of the Atoka Formation, except that in zone w, is in units ranging in thickness from 0 to a maximum of 120 feet. In the areas where the sandstone units are thickest the sandstone is generally coarser grained, less silty, and thicker bedded; bedding is irregular to regular; ripple marking is rare; crossbedding is common; convolute bedding is locally common; and the basal sandstone bed overlies siltstone or shale with a channel-type contact in many places. In the areas where the sandstone units are thin, the sandstone is generally very fine grained, silty, very thin to thin bedded, irregularly to regularly bedded, and ripple marked; crossbedding and convolute bedding are rare.

Siltstone in the upper 5,000 feet of the Atoka Formation is in units ranging in thickness from 0 to a maximum of 80 feet. The siltstone, where exposed, is mostly irregularly bedded although some is regularly, and some lenticularly bedded; ripple marks are common; and crossbedding is common in some places. A siltstone unit generally grades downward into shale. Siltstone is generally overlain by shale at a sharp contact, but in some places it is overlain by sandstone with which it has either a sharp or gradational contact.

Shale in the upper part of the Atoka Formation is dark gray, micaceous, slightly silty or silty in many places, and fissile or thin bedded. In the lower part of the Atoka the shale is dark gray to grayish black, free of mica and silt in many places, and pyritic in many places.

The coal beds in the Atoka Formation are generally in shale within 20 feet above or below a sandstone unit. The coal beds are thin and of small extent although the one in the uppermost part of zone w is thought to extend eastward from the quadrangle for more than 30 miles.

The Atoka Formation is about 12,000 feet thick in the vicinity of the Tomlin well (well 23) on the Washburn anticline and is estimated to be about 14,500 feet thick in the vicinity of the Residue Co. No. 1 Mansfield Gas Company well (well 33) (sec. 6, T. 4 N., R. 30 W.) on the Hartford anticline. Haley (1961, p. 6) reports the Atoka Formation to be about 8,330 feet thick in the T. H. Barton No. 1 McVay well in sec. 22, T. 7 N., R. 27 W., and the Atoka is 6,305 feet thick in the Western Natural Gas Co. No. 1 Bergkamp well in sec. 1, T. 7 N., R. 30 W. (Sheldon, 1954, p. 168) reports the Atoka base at a depth of 5,439 feet in the Athletic Mining and Smelting Co. No. Ayers well No. 6 in sec. 11, T. 7 N., R. 32 W.; subtracting 200 feet of post-Atoka rocks from this depth leaves a thickness of 5,239 feet for the Atoka Formation in the vicinity of the well. The rate of thickening for the Atoka Formation can be estimated by projecting these wells along the Atoka depositional strike to a generally north-south line through the Tomlin well (fig. 3). From the Mansfield Gas Company well to the Tomlin well the Atoka Formation thickens at a rate of about 385 feet per mile; from the Tomlin well to the McVay well it thickens at the rate of about 650 feet per mile; from the McVay well to the Bergkamp well it thickens at the rate of about 400 feet per mile; and from the Bergkamp well to the Ayers well it thickens at the rate of about 220 feet per mile. By using these thickening rates and the depositional strike of the Atoka Formation, the writer estimates that the thickness of the Atoka Formation ranges from about 7,500 feet in the northwestern corner of the Barber quadrangle to about 16,500 feet in the southeastern corner of the quadrangle.

The estimated thickness of 14,500 feet in the vicinity of Mansfield is far greater than the thickness of 9,000 feet estimated by Hendricks and Parks (1950, p. 71). However, the estimated thickness of 16,500 feet in the southeastern part of the Barber quadrangle is compatible with the thickness of 19,000 feet postulated by Reinemund and Danilchik (1957) for the Atoka Formation in the vicinity of Waldron, Ark. (about 9 miles south of the Barber quadrangle).

The upper part of the Atoka Formation thickens from the northern boundary of the quadrangle to the Washburn anticline, but the lower part of the Atoka thickens at a greater rate and by a larger amount. (See section A-A', fig. 3.) Across and southward from the Washburn anticline, the upper part of the Atoka Formation thickens more rapidly than the lower part. (See pl. 2 and fig. 3.) That part of the Atoka Formation above zone w is about 1,730 feet thick in the Rattlesnake Road section in sec. 12, T. 6 N., R. 29 W., about 2,580 feet thick in the vicinity of the Nichols Exploration Corp. No. 1 Gann well (well 30) in sec. 15, T. 5 N., R. 31 W., and about 4,000 feet thick in the Mansfield Gas Co. well (well 33), sec. 6, T. 4 N., R. 30 W.

Invertebrate fossils are extremely rare in the upper 5,500 feet of the Atoka Formation; however, fragments of bryozoa, crinoids, pelecypods, and brachiopods are rare to common in the sandstones of zone p. Plant fossils are common in the upper 4,000 feet of the Atoka Formation. Carbonized plant fragments are present in much of the sandstone and siltstone and in some of the shale. Well-preserved plant fossils are common in the shale above the sandstone units, in the shale below and above the coal beds, and in a zone, 2 to 20 feet thick, of shale and siltstone below the Hartshorne Sandstone.

DES MOINES SERIES

Krebs Group

The Krebs Group in ascending order consists of the Hartshorne Sandstone, and the McAlester, Savanna, and Boggy Formations. The Hartshorne Sandstone, McAlester Formation, and most of the Savanna Formation are present in the Barber quadrangle.

Hartshorne Sandstone. — The Hartshorne Sandstone of this report is a continuation of the Hartshorne Sandstone described by Hendricks and Read (1934, p. 1052) as the first continuous sandstone below the Lower Hartshorne coal bed, and as equivalent to the lower sandstone member of the Hartshorne Sandstone in Oklahoma. The Hartshorne Sandstone rests unconformably on the Atoka Formation in the Barber quadrangle. The contact between the formations is well exposed in the following localities: (1) west of the Barber quadrangle along U.S. Highway 71 in sec. 25, T. 5 N., R. 31 W., where the uppermost Atoka rock is clayey siltstone containing coalified plant fragments and coal lenses as much as 1 inch thick and 10 inches long; (2) along a county road in sec. 30, T. 5 N., R. 30 W., where the uppermost Atoka is siltstone; (3) along State Highway 10 in sec. 16, T. 6 N., R. 30 W., where the uppermost Atoka is a series of truncated sandstone beds; and (4) along a road through Big Creek Narrows in sec. 12, T. 6 N., R. 30 W., where the uppermost Atoka rocks are shale, siltstone, and sandstone. Along the road through Big Creek Narrows, the uppermost sandstone and shale of the Atoka Formation are folded into a U-shape and the Hartshorne overlies the truncated ends at an angle of as much as 13°. In the vicinity of Big Creek Narrows, the Hartshorne Sandstone dips northward about 15° and a sandstone about 70 feet below the top ofthe Atoka Formation dips northward about 14°; thus, it seems likely that the sharp angular unconformity exposed along the the road is a slump feature resulting from channel cutting and filling during the time of the Hartshorne deposition.

Hendricks and Parks (1950, p. 73) believed that late Atoka uplift and pre-Hartshorne erosion account for the thinning of the uppermost Atoka strata in the area of Biswell Hill and Lavaca gas field. (The southern part of Biswell Hill is in the northwestern part of Barber quadrangle andLavaca gas field is 4 miles northeast of Biswell Hill.) They do not report the amount of Atoka strata that has been removed, but in figure 6 (p. 72) they show as much as 200 feet of thinning in the area of Biswell Hill. An east to west thinning of the uppermost Atoka strata in the area southeast of Biswell Hill has been noted by the author of this report. An Atoka sandstone that is 290 feet below the Hartshorne Sandstone in sec. 1, T. 6 N., R. 29 W. (Backbone Narrows, about 10 miles east of Biswell Hill) is only 65 feet below the Hartshorne Sandstone in sec. 12, T. 6 N., R. 303 W. (about 6 miles southeast of Biswell Hill), and it is immediately below the Hartshorne Sandstone in sec. 16, T. 6 N., R. 30 W. (about 4 miles south of Biswell Hill). Thus the late Atoka uplift and pre-Hartshorne erosion postulated by Hendricks and Parks have removed at least 290 feet of uppermost Atoka strata in an east to west distance of 9 miles in the north-central part of Barber quadrangle.

The sandstone in the Atoka that is 290 feet below the Hartshorne Sandstone in sec. 1, T. 6 N., R. 29 W. (Backbone Narrows) is only 20 feet below the Hartshorne Sandstone in sec. 5, T. 6 N., R. 28 W. (a west to east distance of 2 miles). It seems likely that another late Atoka uplift is present east or northeast of the Barber quadrangle. The size of the area uplifted and the amount of upper Atoka strata removed by pre-Hartshorne erosion are unknown, except that the amount exceeded 270 feet. The rate of thinning of 135 feet per mile on the west limb of this uplift is much greater than that of 32 feet per mile on the east limb of the Biswell Hill uplift.

The Hartshorne Sandstone in the Barber quadrangle ranges in thickness from about 6 feet to about 200 feet. In the northern and central parts of the quadrangle the Hartshorne Sandstone is predominantly very light to light-gray very fine to fine-grained sandstone. Some of the sandstone beds contain lenses of grayish-black shale. Pebbles, cobbles,a nd plates of dark-gray shale or siltstone are present in some of the sandstone beds. In the southern part of the

quadrangle the Hartshorne Sandstone changes from a single bed of light-gray very fine grained sandstone in the southwest to three beds of very light to light-gray very fine to fine-grained sandstone separated by dark-gray to grayish-black shale in the southeast. The uppermost unit of shale contains two coal beds, in secs. 10, 11, and 12, T. 4 N., R. 30 W., and sec. 7, T. 4 N., R. 29 W.

Bedding characteristics of the sandstone in the Hartshorne Sandstone vary throughout the quadrangle. Exposed sandstone beds are thin and regular, or thin and irregular, or thin to massive, irregular, lenticular, and crossbedded, or in some places massive, irregular, and convolute bedded.

McAlester Formation.—The McAlester Formation of this report is the McAlester Shale of Hendricks and Parks (1950, p. 74). It conformably overlies the Hartshorne Sandstone and ranges in thickness from about 600 feet in the northern part of the quadrangle to more than 1,300 feet in the southern part of the quadrangle.

The formation is mostly shale, with minor amounts of sandstone, siltstone, and two coal beds. The shale in the McAlester Formation is dark gray, micaceous, slightly silty to silty in part, and in some places contains thin beds of siltstone and sandstone. Some of the shale in the southern part of the quadrangle is distinctive in that it weathers to a dark greenish gray.

The siltstone in the McAlester Formation is light to medium gray, micaceous, and very finely sandy in part. The siltstone beds are thin, irregular, and lenticular. The tops of beds are commonly ripple marked.

Sandstone units in the McAlester Formation range in thickness from a featheredge to 160 feet. They are abruptly lenticular and thin from 100 feet to 15 feet within a mile along the outcrop. Generally, the sandstone is lighter colored (very light to light gray), coarser grained (very fine to fine), and thicker bedded in those areas where the unit is thickest. The bedding in the thicker part of a sandstone unit is usually more lenticular, more massive, and more crossbedded.

In the southern part of the Barber quadrangle, the lowermost sandstone unit in the McAlester Formation is in the same stratigraphic position as the upper sandstone member of the Hartshorne Sandstone in Oklahoma. In addition, like the upper sandstone member of Oklahoma, it is very light gray, very fine to fine grained, and quartzose. This sandstone unit is continuous from the southern part of the Barber quadrangle westward, for a distance of 8 miles, to the town of Hartford, Ark.; northeastward from Hartford the unit is present discontinuously to sec. 24, T. 6 N., R. 31 W. (about one-half mile west of the Barber quadrangle) where it lenses out. The unit is not present in the northern part of the Barber quadrangle. The eastward and southward extent of this sandstone unit is unknown, but a similar lithologic unit is about 20 feet above the Lower Hartshorne coal bed in the Waldron quadrangle (Reinemund and Danilchik, 1957, fig. 3).

Impressions of plant fragments and coalified plant fragments are common in the siltstone of the McAlester Formation, and coalified plant fragments are common in the sandstone. Well-preserved fern pinnules and stigmaria can be found in many places in the shale above and below the Lower Hartshorne coal bed. Well-preserved annularia and fern pinnules are present in a sandy siltstone along Petit Jean Creek in the SW¼ sec. 17, T. 4 N., R. 28 W.

Savanna Formation.—The Savanna Formation of this report is the Savanna Sandstone of Hendricks and Parks (1950, p. 76). It overlies the McAlester Formtion with a contact that Hendricks and Parks (p. 76) reported to be a minor unconformity.

The Savanna Formation is about 1,700 feet thick in the northeastern part of the Barber quadrangle. The part of the Savanna Formation present in the southern part of the Barber quadrangle is about 1,300 feet thick.

The formation is predominantly shale with minor amounts of sandstone and siltstone, four coal beds, and four limestone beds. The shale is dark gray, micaceous, slightly silty to silty in part, and contains thin beds of siltstone and very fine grained sandstone. The siltstone is light to medium gray, micaceous, thin and irregularly bedded, and is commonly ripple marked. The sandstone ranges from a light-gray very fine to fine-grained quartzose sandstone to a light-to medium-gray micaceous very fine grained very argillaceous sandstone. The quartzose sandstone is thin to thick bedded, irregularly to regularly bedded, ripple marked in some places, and crossbedded in some places. The argillaceous sandstone is thin bedded, irregularly to regularly bedded, ripple marked in some places, and convolute bedded in some places.

Two coal beds are present near the base of the formation. One and perhaps both of these coal beds are thought to be equivalent to the Charleston coal bed. The Paris coal bed is about

450 feet below the top of the formation in the northeastern part of the quadrangle. The Paris coal bed and a coal bed about 50 feet above it are well exposed in sec. 32, T. 7 N., R. 28 W. Coal beds of the Savanna Formation are not exposed in the southern part of the quadrangle.

The limestone beds are in the upper part of the Savanna Formation. The limestone is dark gray, very finely sandy in part, silty in part, argillaceous, iron rich, and fossiliferous (mostly brachiopods, some pelecypods, and a few crinoid fragments). The limestone beds are less than 10 inches thick and most of them, where exposed, extend less than 150 feet along the outcrop. The limestone beds above the Paris coal bed are best exposed in the strip-pit and along the hillside in sec. 32, T. 7 N., R. 28 W. The limestone beds below the Paris coal bed are exposed in the ditch on the west side of Rattlesnake road in sec. 36, T. 7 N., R. 29 W.

Medium- to dark-gray micaceous slightly silty shale, containing ostracodes, pelecypods, gastropods, phosphate pellets, and fish bones, teeth, and scales, is present above the Paris coal bed in sec. 32, T. 7 N., R. 28 W.

Fragments of rock composed mostly of fish scales and containing fish bones, ostracodes, pelecypods, phosphate pellets, and eroded crinoid fragments are found in the coal mine dumps in sec. 32, T. 7 N., R. 28 W. This rock was not found in place but must be present in thin layers within the shale removed during mining of the Paris coal bed.

QUATERNARY SYSTEM

Terrace deposits

Quarternary deposits of alluvial material are present in two terraces along some of the streams in the Barber quadrangle. The base of the upper terrace is from 50 to 60 feet above the present stream drainage and the base of the lower terrace is from 6 to 15 feet above the present stream drainage. The deposits consist of clay, silt, sand, pebbles and cobbles of siltstone and sandstone, and boulders of sandstone as large as 3 feet thick, 4 feet wide, and 6 feet long. Some of the large boulders are as far as 3 miles from the nearest possible source bed. Hendricks and Parks (1950, p. 78 and pl. 13) tentatively correlate the uppermost terrace with the Gerty Sand of Oklahoma. Miser (1954) dated the Gerty Sand as Pleistocene in age.

Alluvium

Alluvium has been deposited along many of the streams in the Barber quadrangle. It consists of clay, silt, sand, and pebbles of shale, siltstone, and sandstone; in some places cobbles and boulders of siltstone and sandstone are present at the base of the deposits. All the alluvial material is thought to have a local source.

STRUCTURE

The Barber quadrangle is in the southwestern part of the Arkansas Valley section of the Ouachita Province (fig. 1). The rocks in the quadrangle have been strongly folded into eastward- and northeastward-trending synclines and anticlines, one of which has been broken along the crest by reverse faulting. Structural relief on the base of the Hartshorne Sandstone is more than 12,000 feet from 1,400 feet below sea level in the Bloomer syncline to an estimated 11,000 feet above sea level on the Washburn anticline and fault zone. (See pls. 3 and 4.)

FOLDS

Synclines

The following synclines are present in the Barber quadrangle: Jenny Lind syncline extends eastward into the northwest corner of the quadrangle; Greenwood syncline extends across the northwest corner of the quadrangle; Bloomer syncline extends across the northeast corner of the quadrangle; Cavanal syncline extends eastward into the west-central part of the quadrangle; Magazine Mountain syncline extends into the east-central part of the quadrangle; and the north limb of Poteau syncline extends across the southern part of the quadrangle.

Anticlines

The following anticlines are present in the Barber quadrangle: the Backbone anticline extends eastward into the northwestern corner of the quadrangle; the faulted Washburn anticline extends across the north-central part of the quadrangle; the Hartford anticline extends eastward into the southwestern part of the quadrangle; and the Ranger anticline extends westward into the southeastern part of the quadrangle.

The Washburn anticline is the dominant structural feature in the quadrangle. It is asymmetrical with the north limb overturned in the western and eastern parts of the quadrangle. The surface trace of the anticlinal axis can be mapped only in the western part of the quadrangle; elsewhere it has been destroyed by re-

verse faults. The magnitude of the Washburn anticline diminishes with depth because: (1) it is a disharmonic fold; (2) it has been faulted; and (3) the Atoka Formation thickens. The magnitude of the rest of the folds in the Barber quadrangle diminishes with depth because of thickening in the Atoka Formation. (See pl. 5.)

FAULTS

Reverse faults, south-dipping fault planes, and northward-moving upthrown plates are present along Washburn anticline in the north-central part of the quadrangle. Movement along these faults probably occurred after the anticline was folded to nearly its present shape and thus relieved the pressure that caused the anticline.

Movements along these faults occurred in zones as thick as 100 feet and the rocks in these zones, generally shale or shale and siltstone, are so macerated that the dip of the fault plane can be determined only by observing the dip of the fault zone. The dip of some concealed fault zones in the area of Pleasant Ridge can be estimated by observing the geographic and vertical relationships of the rocks in the upthrown plate to the rocks in the undersheet.

On the surface, the angle between a fault zone and the bedding of the rocks in the undersheet has considerable range and can be used as a parameter in classifying the faults into three general types: (1) the southernmost fault zones along the anticline that are parallel to the bedding; (2) the fault zones near the crest of the anticline that are from nearly parallel to 90° to the bedding of the undersheet; and (3) the northernmost fault zones that are from 90° to parallel to the overturned bedding in the undersheet. (See section A-A', pl. 5.) In the subsurface, little evidence is available pertaining to the angle between the fault zone and the bedding of the rocks in the undersheet. Fault zones known to be present at the surface cannot be projected with certainty into wells that penetrate the fault zones, nor can fault zones be correlated with certainty between wells. However, the general type of a fault zone in any well can be determined by relating the position of the fault zone in the well to the position of the anticlinal axis.

The amount of movement along any particular fault cannot be measured nor can it be estimated with any certainty, but the apparent amount of movement increases with the increase in angle between the fault and the bedding of the rocks in the undersheet. The combined amount of movement along all reverse faults also cannot be estimated with any certainty but is probably in excess of 5,000 feet in the area of Pleasant Ridge.

It is the author's opinion that all faults in the area of the Washburn anticline are relatively shallow and probably die out above the base of the Atoka Formation. The relation of these faults to the Atoka Formation and to the rocks of the Morrow Series is shown on plates 4 and 5.

ECONOMIC GEOLOGY

COAL

Coal beds are present in the Atoka Formation, Hartshorne Sandstone, and the McAlester and Savanna Formations. Only the Lower Hartshorne coal bed and the Paris coal bed have been mined to any great extent. The outcrops of all known coal beds are shown on plate 1 and the outcrops, location, and thickness of all known exposures of coal, and mined areas are shown on plate 3.

All coal in the Barber quadrangle is classified as low-volatile bituminous (Haley, 1960, pl. 62), based on the percentage of dry mineral-matter-free fixed carbon in the coal, in accordance with the specifications of the American Society for Testing Materials (1954) p. 1-6.

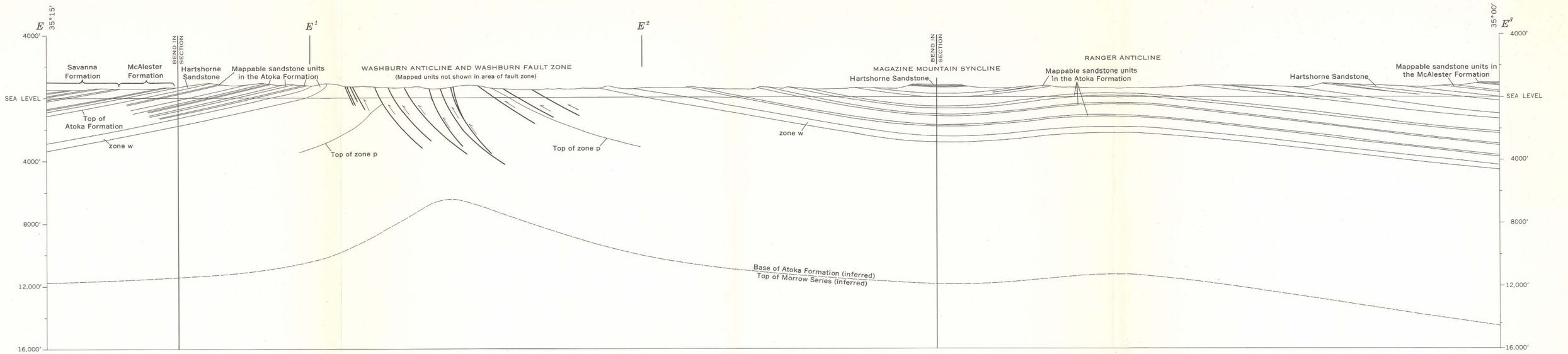
Coal beds in the Atoka Formation

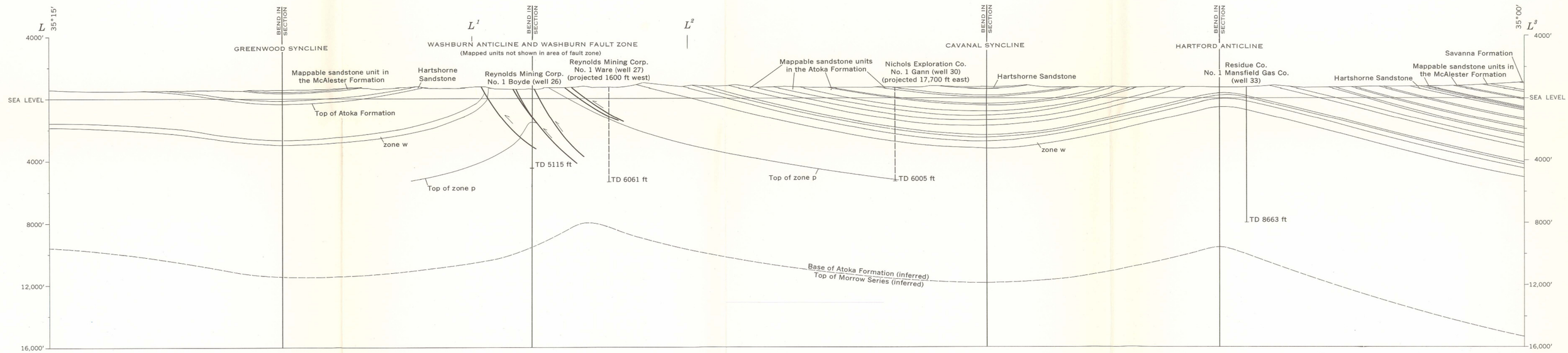
The coal beds in the Atoka Formation are generally thin and of local extent. The coal bed near the top of zone w is an exception in that it is thought to extend eastward for more than 30 miles beyond the quadrangle. This coal bed has been mined int he bed of Washburn Creek in SE¼ NW¼ sec. 35, T. 6 N., R. 29 W., by local inhabitants. A shallow hole was driven to the same coal bed in NW¼ NE¼ SE¼ sec. 33, T. 6 N., R. 29 W. The coal bed beneath the Hartshorne Sandstone in secs. 14, 23, and 24, T. 5 N., R. 29 W. was explored by shallow drifts. The coal bed near the top of the Atoka Formation in secs. 8 and 9, T. 4 N., R. 30 W., was penetrated by shallow slope mines where it is exposed along Rock Creek and Kings Creek. A coal bed, equivalent to that exposed in NW¼ NW¼ sec. 17, T. 5 N., R. 30 W., was penetrated by core holes drilled in SW¼ NW¼ sec. 21 and NE¼ NE¼ sec. 29, T. 5 N., R. 29 W. The same coal bed was reported to have been penetrated by a water well in SW¼ SE¼ sec. 31, T. 5 N., R. 29 W.

Each of the known coal beds of the Atoka Formation in the Barber quadrangle is less than

Table 1.—Estimated original reserves of coal in the Lower Hartshorne coal bed, Barber quadrangle, Arkansas

Overburden (feet)	Reserves, in millions of short tons, in beds of thickness stated											
	Measured and indicated original reserves				Inferred original reserves				Total original reserves, all categories			
	Thickness of the coal (inches)			Total	Thickness of the coal (inches)			Total	Thickness of the coal (inches)			Total
	14 to 28	28 to 42	42+		14 to 28	28 to 42	42+		14 to 28	28 to 42	42+	
Franklin County												
0 to 1,000	.....	.....	.....	.....	2.430	.....	.....	2.430	2.430	.....	.....	2.430
1,000 to 2,000	.....	.....	.....	.....	.310	.....	.....	.310	.310	.....	.....	.310
Total	.....	.....	.....	.....	2.740	.....	.....	2.740	2.740	.....	.....	2.740
Scott County												
0 to 1,000	5.020	.....	.....	5.020	9.850	.....	.....	9.850	14.870	.....	.....	14.870
1,000 to 2,000	.640	.....	.....	.640	1.690	.....	.....	1.690	2.330	.....	.....	2.330
Total	5.660	.....	.....	5.660	11.540	.....	.....	11.540	17.200	.....	.....	17.200
Sebastian County												
0 to 1,000	3.580	1.000	9.610	14.190	25.480	26.300	1.380	53.160	29.060	27.300	10.990	67.350
1,000 to 2,000	.....	.....	.....	.....	.450	1.310	.....	1.760	.450	1.310	.....	1.760
Total	3.580	1.000	9.610	14.190	25.930	27.610	1.380	54.920	29.510	28.610	10.990	69.110
All Counties												
0 to 1,000	8.600	1.000	9.610	19.210	37.760	26.300	1.380	65.440	46.360	27.300	10.990	84.650
1,000 to 2,000	.640	.....	.....	.640	2.450	1.310	.....	3.760	3.090	1.310	.....	4.400
Total	9,240	1.000	9.610	19.850	40.210	27.610	1.380	69.200	49.450	28.610	10.990	89.050





1 ½ 0 1 2 3 MILES

DATUM IS MEAN SEA LEVEL

STRUCTURAL SECTIONS E–E^3 AND L–L^3 IN BARBER QUADRANGLE, SEBASTIAN COUNTY AND VICINITY, ARKANSAS

(Quaternary deposits not shown)

By
Boyd R. Haley
U.S. Geological Survey

1963

15 inches thick and there is no reason to believe that unexposed coal beds of the Atoka Formation elsewhere in the Barber quadrangle are thicker.

Coal beds in the Hartshorne Sandstone

A thin coal bed is present in shale of the Hartshorne Sandstone in the south-central part of the quadrangle. Shallow trenches have been dug to explore this coal bed in secs. 10, 11, and 12, T. 4 N., R. 30 W., and the coal is exposed in a road cut in the center of sec. 7, T. 4 N., R. 29 W. Another thin coal bed has been reported in the above road cut.

Coal beds in the McAlester Formation

The Lower Hartshorne coal bed of this report is a zone of coal beds present near the base of the McAlester Formation. It is the thickest, most widespread, and most economically important coal bed in the Barber quadrangle, and has been mined in the southwestern and northwestern parts of the quadrangle. Its thickness ranges from 36 inches in the southwestern part of the quadrangle to less than 10 inches in the southeastern part of the quadrangle, and from 63 inches in the northwest to less than 11 inches in the northeast. (See pl. 3.) The coal is in from one to five beds in the south and in from one to three beds in the north. The continuity and extent of the beds cannot be determined but it seems likely that the lowermost bed is the most continuous.

Surface exploration for the Lower Hartshorne coal bed should start at the upper contact of the Hartshorne Sandstone and extend stratigraphically upward through the McAlester Formation until the coal bed or beds are exposed. The thickness ofthe coal (coal beds minus partings), the amount of overburden, the mined area, and the outcrop of the Lower Hartshorne coal bed are shown on plate 3.

The reserves of coal in the Lower Hartshorne coal bed before mining began are tabulated in categories of overburden, thickness, and abundance and reliability of thickness data (table 1), in accordance with the standards and procedure adopted by the U.S. Geological Survey (Haley, 1960, p. 800-816).

Coal production records for the area of the Barber quadrangle are not available but the amount of coal mined and lost in mining can be estimated. An estimate of the original reserves, amount of coal mined and lost in mining, remaining reserves, and recoverable reserves in the area of the Barber quadrangle are tabulated in table 2.

The Upper Hartshorne coal bed is from 60 to 90 feet above the base of the McAlester Formation in the area west of the quadrangle (Haley, 1960, p. 819 and pl. 60). This coal bed may extend into the Barber quadrangle, though the author could not find surface exposures of the coal.

Coal beds in the Savanna Formation

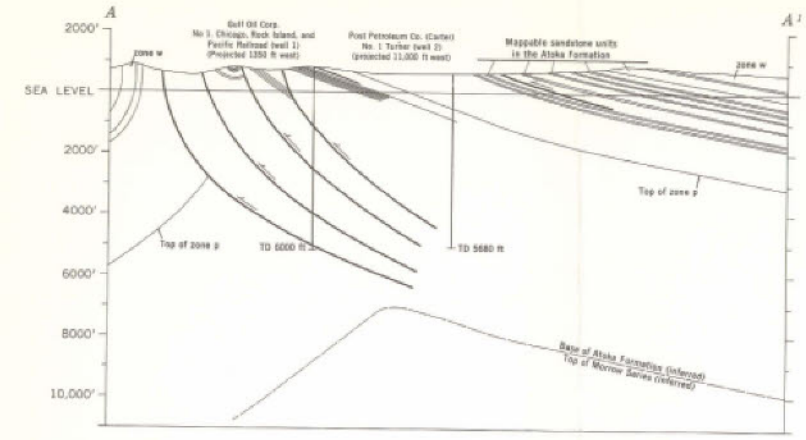
The Savanna Formation contains at least four coal beds in the northern part of the quadrangle. The author could not find any exposures of coal in that part of the Savanna Formation present in the southern part of the quadrangle. Reinemund and Danilchik (1957, fig. 6) report three coal beds in the Savanna in the area south of the quadrangle.

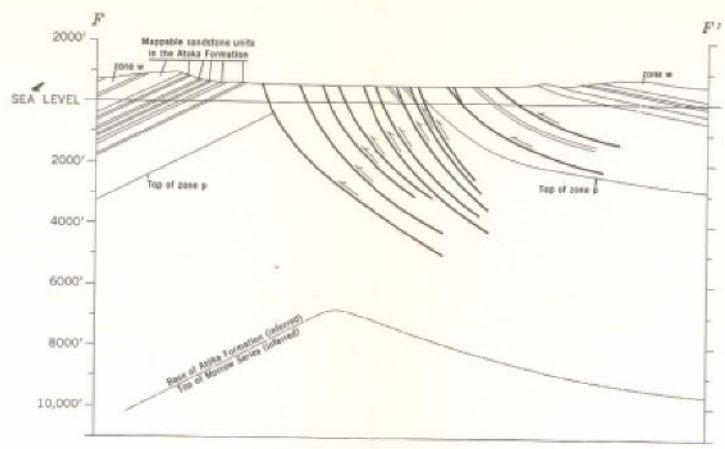
The lower two coal beds in the Savanna in the Barber quadrangle are in the sandstone beds at the base of the formation. The stratigraphic position of these coal beds is similar to that of the Charleston coal bed and one or perhaps both of them may be equivalent to the Charleston coal bed. Where exposed in NE¼ NW¼ sec. 9, T. 6 N., R. 30 W., and in NW¼ NW¼ NE¼ sec. 1, T. 6 N., R. 29 W., the coal beds are less than 8 inches thick.

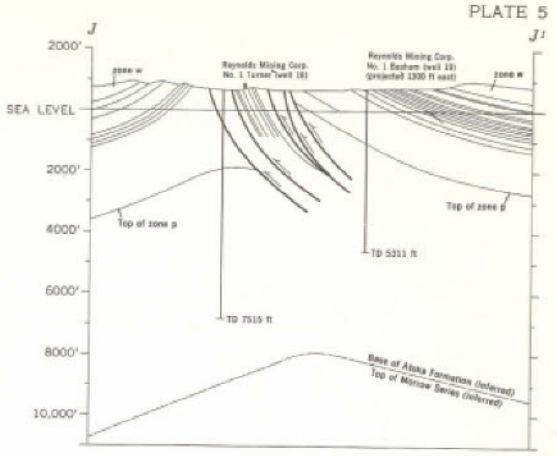
The upper two coal beds in the Savanna are about 50 feet apart stratigraphically, and about 450 feet stratigraphically below the top of the formation. The Paris coal bed is the lower of these two and has been mined rather extensively in the subsurface and on the surface in secs. 29, 30, 31, and 32, T. 7 N., R. 28 W. It ranges in thickness from 15 inches to 18 inches. The coal

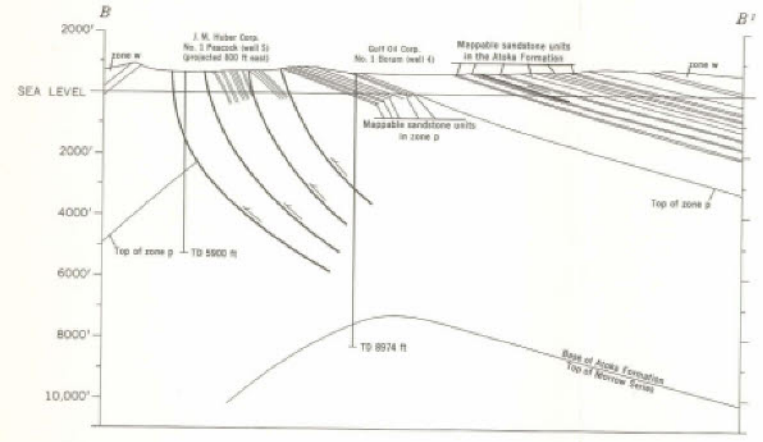
Table 2.—Estimated original, remaining, and recoverable reserves of coal in Barbar quadrangle, Arkansas (in millions of short tons)

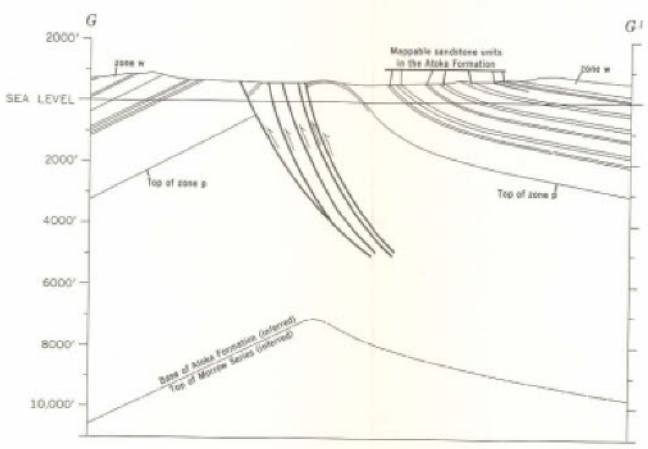
County	Estimated original reserves	Estimated amount of coal mined and lost in mining	Estimated remaining reserves	Estimated recovarable reserves
Franklin	2.740	.....	2.740	1.370
Scott	17.200	0.200	17.000	8.500
Sebastian	69.110	6.750	62.360	31.180
All Counties	89.050	6.950	82.100	41.050

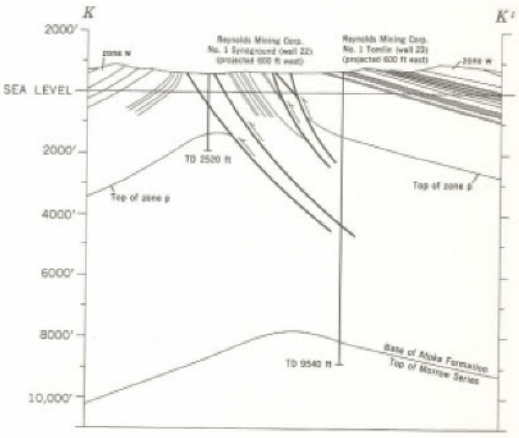


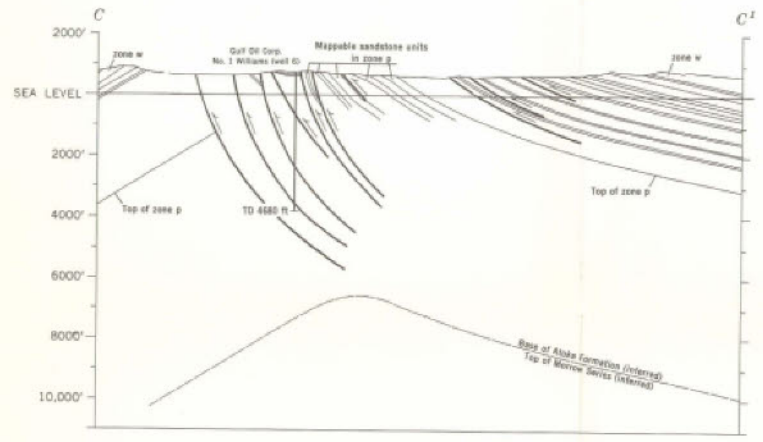


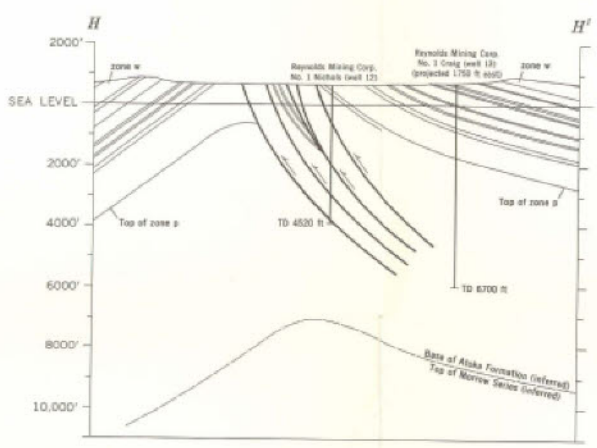


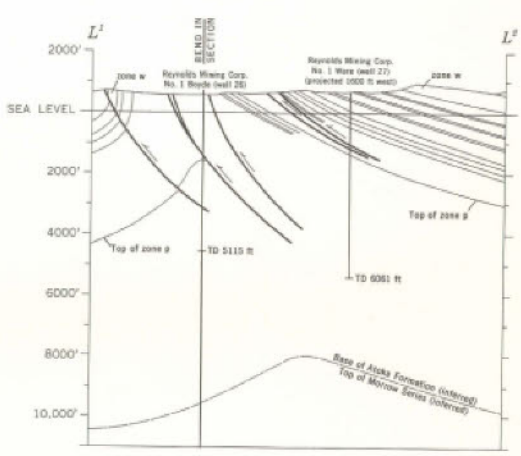


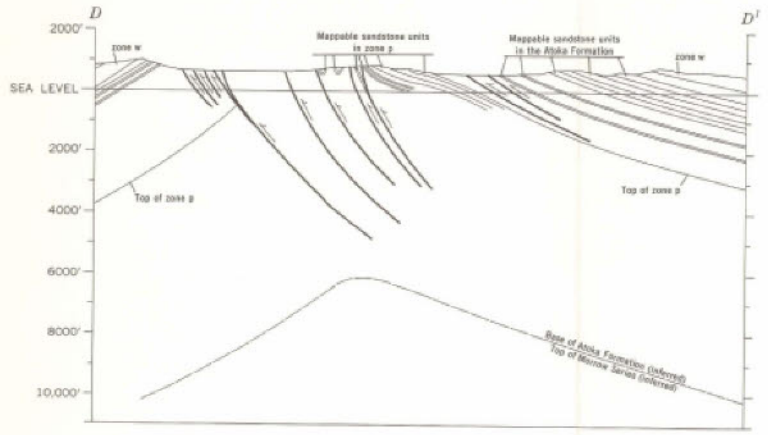


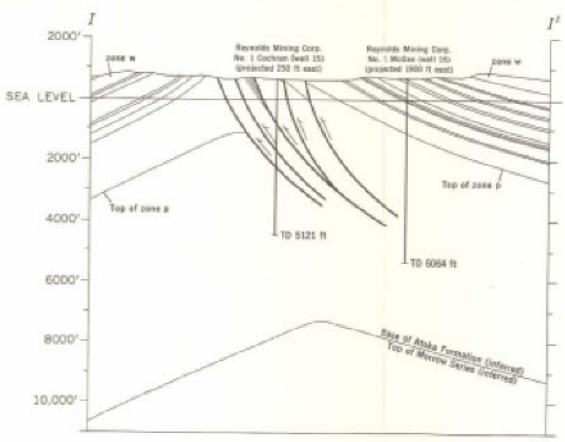


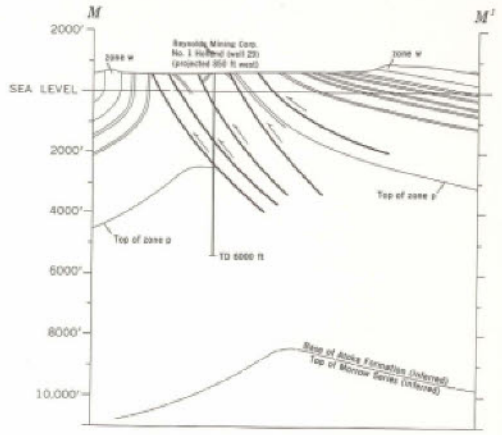


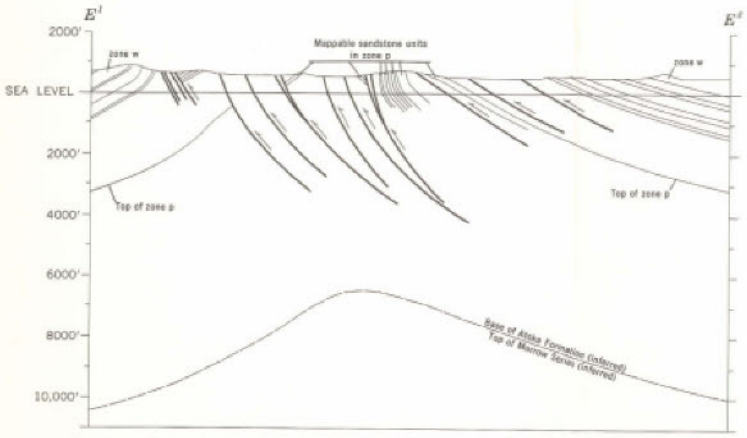












1 ½ 0 1 MILE

DATUM IS MEAN SEA LEVEL

STRUCTURAL SECTIONS OF WASHBURN ANTICLINE AND WASHBURN FAULT ZONE, BARBER QUADRANGLE, SEBASTIAN COUNTY AND VICINITY, ARKANSAS

(Quaternary deposits not shown)

By
Boyd R. Haley
U.S. Geological Survey

1963

Table 3.—Description of selected wells drilled in or near Barber quadrangle, Arkansas, as of March 15, 1962

Well locality on plates 1 through 5	Company name	Lease name	Location	Total Depth (feet)	Reported elevation (feet)[1]	Electrical log	Stratigraphic zone of production	Reported depth of production (feet)	Reported production (cu. ft. per day)	Completion date	Remarks
1	Gulf Oil Corp.	No. 1 Chicago, Rock Island & Pacific Railroad.	Cen. SESENW sec. 17, T.6 N., R.28 W.	6,000	685	Yes	Lower part of zone p.	5,713-5,725	183,000	June 1958	Rock samples examined and logged by the author.
2	Post Petroleum Co.	No. 1 H. E. Turner.	Cen. SWSE sec. 15, T.6 N., R.28 W. (about 9,300 ft. east of Barber quadrangle, Arkansas)	5,680	[2]604	Yes	Middle part of zone p.	2,577-2,701	1,750,000	Nov. 1959	Originally drilled by Carter Oil Co. in 1953-54. Rock samples examined and logged by the author.
3	Gulf Oil Corp.	No. 1 L. Beck	Cen. SWNE sec. 32, T.6 N., R.28 W.	.....	...	...	.....	.....	.....	...	Being drilled.
4	Gulf Oil Corp.	No. 1 F. R. Borum.	Cen. SENWSE sec. 18, T. 6 N., R.28 W.	8,974	681	Yes	Upper part of zone p.	1,565-1,570	Very slight show of gas.	Jan. 1958	Discovery well of Booneville gas field; bottom of well is in rocks of Morrow Series. Rock samples examined and logged by author.
							Upper part of zone p.	1,665- ?	Slight show of gas.		
							Lower part of zone p.	4,888-4,910	2,200,000		
							Lower part of zone p.	6,040-6,060	Show of gas.		
							650 ft above base of Atoka Formation.	7,593 - ?	Slight show of gas.		
5	J. M. Huber Corp.	No. 1 N. Peacock	Cen. NWSW sec. 7, T.6 N., R.28 W.	5,910	686	Yes	Lower part of zone p (thrust sheet).	1,122-1,126	Show of gas.	Sept. 1960	Rock samples examined and logged by the author.
							Upper part of zone p.	3,354-3,402	33,500,000		
							Upper part of zone p.	4,368-4,526	2,480,000		
							Middle part of zone p.	5,704-5,764	6,300,000		
6	Gulf Oil Corp.	No. 1 P. X. Williams	Cen. SESWNE sec. 13, T.6 N., R.29 W.	4,680	763	Yes	Middle part of zone p.	1,470-1,554	771,000	July 1958	Rock samples examined and logged by the author.
							Middle part of zone p.	1,582-1,710	225,000		
							Lower part of zone p.	4,524-4,535	268,000		
7	R. T. Smith	No. 1 M. Graham	Cen. SENW sec. 21, T.6 N., R.29 W.	5,431	596	Yes	Middle part of zone p.	3,614-3,678	3,075,000	July 1961	spudded by Gulf Oil Corp. in June 1961.
8	Gulf Oil Corp.	No. 1 A. M. Duckett.	Cen. NWSE sec. 20, T.6 N., R.29 W.	6,751	608	Yes	Upper part of zone p.	4,183-4,220	20,000,000	May 1961	

Table 3.—Description of selected wells drilled in or near Barber quadrangle, Arkansas, as of March 15, 1962—(Continued)

Well locality on plates 1 through 5	Company name	Lease name	Location	Total Depth (feet)	Reported elevation (feet)[1]	Electrical log	Stratigraphic zone of production	Reported depth of production (feet)	Reported (cu. ft. production per day	Completion date	Remarks
9	Wheeler and Ryan	No. 1 C. J. Connors.	Cen. NWSW sec. 19, T.6 N. R.29 W.	5,361	654	Yes	Middle part of zone p.	5,159-5,216	6,400,000	Mar. 1962	
10	J. M. Huber Corp.	No. 1 Gipson	Cen. NWSWNE sec. 30, T.6 N., R.29 W.	2,947	630	Yes	Middle part of zone p.	2,809-2,843	3,550,000	Sept. 1960	
11	Wheeler and Ryan	No. 1 Dawson	Cen. NESW sec. 24, T.6 N., R.30 W.	------	----	----	------	------	------	----	Being drilled.
12	Reynolds Mining Corp.	No. 1 J. T. Nichols	Cen. NWSE sec. 25, T.6 N., R.30 W.	4,520	633	Yes	Middle part of zone p. Middle part of zone p. Lower part of zone p. Lower part of zone p. Lower part of zone p.	1,352-1,380 2,422-2,458 3,072-3,104 3,260-3,282 3,510-3,534	1,250,000 89,000 995,000 2,540,000 127,000	May 1957	Rock samples examined and logged by the author.
13	Reynolds Mining Corp.	No. 1 E. E. Craig	Cen. SWSWNW sec. 36, T.6 N., R.30 W.	6,700	702	Yes	Middle part of zone p.	4,583-4,591	1,825,000	Oct. 1958	Rock samples examined and logged by the author.
14	Wheeler and Ryan	No. 1 C. H. Gragg.	Cen. SWNSW sec. 23, T.6 N., R.30 W.	------	----	----	------	------	------	----	Being drilled.
15	Reynolds Mining Corp.	No. 1 N. Cochran	Cen. NWSE sec. 26, T.6 N., R.30 W.	5,121	671	Yes	Lower part of zone p. Lower part of zone p. Lower part of zone p.	2,218 3,982-4,010 4,436-4,460	336,000 4,500,000 7,410,000	June 1957	Rock samples examined and logged by the author.
16	Reynolds Mining Corp.	No. 1 V. McGee	Cen. SWSWNW sec. 35, T.6 N., R.30 W.	6,064	706	Yes	Upper part of zone p. Middle part of zone p. Lower part of zone p.	2,678-2,702 3,216-3,256 5,851-5,901	755,000 Slight show of gas. Show of gas.	May 1958	Rock samples examined and logged by author.
17	Wheeler and Ryan	No. 1 T. W. Bradley.	Cen. NESW sec. 22, T.6 N., R.30 W.	------	----	----	------	------	------	----	Being drilled.

Table 3.—Description of selected wells drilled in or near Barber quadrangle, Arkansas, as of March 15, 1962—(Continued)

Well locality on plates 1 through 5	Company name	Lease name	Location	Total Depth (feet)	Reported elevation (feet)[1]	Electrical log	Stratigraphic zone of production	Reported depth of production (feet)	Reported production (cu. ft. per day	Completion date	Remarks
18	Reynolds Mining Corp.	No. 1 C. W. Turner.	Cen. SESWNE sec. 27, T.6 N., R.30W.	7,515	666	Yes	Upper part of zone p. Upper part of zone p. Lower part of zone p. Lower part of zone p.	2,553-2,569 2,774-2,792 5,306-5,318 5,586-5,604	5,200,000 3,000,000 155,000 Slight show of gas.	June 1956	Rock samples examined and logged by author.
19	Reynolds Mining Corp.	No. 1 W. L. Basham.	Cen. SESENW sec. 34, T.6 N., R.30 W.	5,311	725	Yes	Upper part of zone p. Lower part of zone p.	1,980-2,000 4,078-4,121	1,918,000 2,250,000	June 1958	Rock samples examined and logged by author.
20	Ambassador Oil Corp.	No. 1 A. H. Foote.	Cen. NESENW sec. 3, T.5 N., R.30 W.	6,222	751	Yes	Upper part of zone p. Middle part of zone p.	3,091-3,329 5,574-5,694	2,900,000 1,612,000	Jan. 1962	
21	J. M. Huber Corp.	No. 1 R. Jones	Cen. SENESW sec. 21, T.6 N., R.30 W.	6,002	695	Yes	Upper part of zone p. Middle part zone p.	3,490- ? 5,023-5,078	Show of gas. 6,800,000	Nov. 1961	
22	Reynolds Mining Corp.	No. 1 E. Synoground.	Cen. NWNWSE sec. 28, T.6 N., R.30 W.	2,520	670	Yes	Upper part of zone p. Upper part of zone p. Upper part of zone p.	1,938-2,002 2,172-2,196 2,248-2,260	11,000,000 6,000,000 724,000	Feb. 1957	Rock samples examined and logged by author.
23	Reynolds Mining Corp.	No. 1 E. C. Tomlin.	Cen. SESENW sec. 33, T.6 N., R.30 W.	9,540	717	Yes	Upper part of zone p. Upper part of zone p. Middle part of zone p. Lower part of zone p.	2,110- ? 3,634-3,730 4,448-4,497 5,850- ?	750,000 1,000,000 588,000 Show of gas.	June 1958	Bottom of well is in rocks of Morrow Series. Rock samples examined and logged by author.
24	Ambassador Oil Corp.	No. 1 Sanderson	Cen. SENW sec. 4, T.5 N., R.30 W.	6,349	751	Yes	Upper part of zone p. Upper part of zone p. Lower part of zone p.	3,278-3,288 4,200-4,250 5,662-5,962	856,015 529,497 1,914,160	Dec. 1961	
25	J. M. Huber Corp.	No. 1 Laster	Cen. SWNSE sec. 20, T.6 N., R.30 W.	5,965	690	Yes	Middle part of zone p.	5,680-5,730	75,000	Nov. 1961	

Table 3.—Description of selected wells drilled in or near Barber quadrangle, Arkansas, as of March 15, 1962—(Continued)

Well locality on plates 1 through 5	Company name	Lease name	Location	Total Depth (feet)	Reported elevation (feet)[1]	Electrical log	Stratigraphic zone of production	Reported depth of production (feet)	Reported production (cu. ft. per day	Completion date	Remarks
43	Choctaw Brick & Gas Co.	No. 18 W. T. Parkhill.	4,875 ft from NL and 550 ft from EL sec. 2, T.4 N., R.31 W.	2,788	655	No	Middle part of zone w. 300 ft below zone w.	1,440 2,044	Show of [3]Gas	Aug. 1926	
44	Choctaw Brick & Gas Co.	No. 14 W. T. Parkhill.	5,525 ft from NL and 350 ft from EL sec. 2, T.4 N., R.31 W.	1,257	655	No	400 ft above zone w.	582	[3]Gas	----	May have been completed in June 1920.
45	Choctaw Brick & Gas Co.	No. 15 J. Y. Horton.	4,700 ft from NL and 1,300 ft from EL sec. 2, T.4 N., R.31 W.	2,513	660	No	Middle part of zone w. Lower part of zone w.	1,300-1,325 1,600-1,625	Show of gas. [3]Gas	Feb. 1924	
27	Reynolds Mining Corp.	No. 1 M. N. Ware	Cen. SWSWNE sec. 32, T.6 N., R.30 W.	6,061	738	Yes	Middle part of zone p. Lower part of zone p. Lower part of zone p.	3,438-3,484 4,548-4,614 5,826-5,860	1,675,000 2,300,000 150,000	Aug. 1958	Rock samples examined and logged by Harold J. Hyden.
28	Ambassador Oil Corp.	No. 1 C. A. Tucker.	Cen. SWNE sec. 5, T.5 N., R.30 W.	7,238	773	Yes	.....	.....	Dry	Nov. 1961	
29	Reynolds Mining Corp.	No. 1 I. A. Holland.	Cen. NWSWNE sec. 30, T.6 N., R.30 W.	6,000	582	Yes	.....	.....	Dry	Nov. 1956	Rock samples examined and logged by author.
30	J. W. Nichols Explor, Co.	No. 1 Gann	Cen. NESW sec. 15, T.5 N., R.31 W. (about 14,000 ft west of Barber quadrangle, Arkansas)	6,005	565	Yes	.....	.....	Dry	Sept. 1957	Gas escaping around casing in Mar. 1958. Rock samples examined and logged by author.
31	Mansfield Gas Co.	No. 1 T. P. Edwards.	SW cor. SESE sec. 32, T.5 N., R.30 W.	2,788	665	No	Middle part of zone w. 350 ft below zone w.	1,440 2,044	Show of Gas [3]Gas	Aug. 1926	
32	Choctaw Oil & Gas Co.	No. 4	2,500 ft from NL and 1,250 ft from WL sec. 6, T.4 N., R.30 W.	970	635	No	400 ft above zone w. Upper part of zone w.	280, 390, and 410 800 and 855	[3]Gas [3]Gas	May 1902	

Table 3.—Description of selected wells drilled in or near Barber quadrangle, Arkansas, as of March 15, 1962—(Continued)

Well locality on plates 1 through 5	Company name	Lease name	Location	Total Depth (feet)	Reported elevation (feet)[2]	Electrical log	Stratigraphic zone of production	Reported depth of production (feet)	Reported production (cu. ft. per day	Completion date	Remarks
26	Reynold Mining Corp.	No. 1. Boyde	Cen. SESENW sec. 29, T.6 N., R.30 W.	5,115	571	Yes	Lower part of zone p. Lower part of zone p. Lower part of zone p.	4,112-4,123 4,285-4,291 4,511-4,532	2,500,000 667,000 917,000	June 1955	Discovery well of Gragg gas field; spudded Spencer Chem. Co. Sept. 1954. Rock samples examined and logged by author.
37	Choctaw Oil & Gas Co.	No. 5	3,600 ft from NL and 1,350 ft from EL sec. 1, T.4 N., R.31 W.	1,050	635	No	Upper part of zone w. Upper part of zone w.	885 967 and 978	Show of gas. [3]Gas	1902	Spudded in May 1902.
38	Choctaw Oil & Gas Co.	No. 6	4,550 ft from NL and 400 ft from EL sec. 1, T.4 N., R.31 W.	950	635	No	.....	.....	Dry	1902	
39	Mansfield Gas Co.	No. 11	6,500 ft from NL and 3,450 ft from EL sec. 1, T.4 N., R.31 W.	1,180	660	No	600 ft above zone w.	310	[3]Gas	1914	Spudded in June 1914.
40	Mansfield Gas Co.	No. 14	3,800 ft from NL and 2,200 ft from WL sec. 1, T.4 N., R.31 W.	2,100	635	No	600 ft above zone w. Upper part of zone w. Middle part of zone w. Lower part of zone w. 300 ft below zone w. 450 ft below zone w.	380 1,080 1,220 and 1,235 1,600 1,913, 1,916 and 1,930 2,082	Show of gas. Show of gas. [3]Gas Show of gas. [3]Gas [3]Gas	Nov. 1930	
41	Choctaw Oil & Gas Co.	No. 1 Duncan	4,300 ft from NL and 1,900 ft from WL sec. 1, T.4 N., R.31 W.	2,382	635	No	700 ft above zone w. 250 ft above zone w. Upper part of zone w. 600 ft below zone w.	197 648 930 2,090	Show of gas. Show of gas. Show of gas. [3]Gas	1901	Spudded in March 1901
42	Mansfield Gas Co.	No. 8	6,450 ft from NL and 250 ft from WL sec. 1, T.4 N., R.31 W.	1,130	660	No	670 ft above zone w. Upper part of zone w. Upper part of zone w.	280 950 and 1,010 1,060-1,100	[3]Gas [3]Gas [3]Gas	July 1913	

Table 3.—Description of selected wells drilled in or near Barber quadrangle, Arkansas, as of March 15, 1962—(Continued)

Well locality on plates 1 through 5	Company name	Lease name	Location	Total Depth (feet)	Reported elevation (feet)[2]	Electrical log	Stratigraphic zone of production	Reported depth of production (feet)	Reported production (cu. ft. per day	Completion date	Remarks
33	The Residue Co.	No. 1 Mansfield Gas Co.	4,900 ft from NL and 1,300 ft from WL sec. 6, T.4 N., R.30 W.	8,663	675	Yes	300 ft below zone w.	1,706	500,000	Aug. 1952	Rock samples examined and logged by Ernest E. Glick.
34	Mansfield Gas Co.	No. 13 (No. 1 Norris).	5,800 ft from NL and 550 ft from WL sec. 6, T.4 N., R.30 W.	2,977	660	No	580 ft above zone w. Middle part of zone w. Lower part of zone w.	365 1,210 1,475 and 1,505	Show of gas. Show of gas. [3]Gas	Mar. 1930	
35	Choctaw Oil & Gas Co.	No. 7	2,250 ft from NL and 650 ft from EL sec. 1, T.4 N., R.31 W.	1,450	630	No	Upper part of zone w. Middle part of zone w.	980 and 1,014 1,136	[3]Gas [3]Gas	1902	
36	Choctaw Oil & Gas Co.	No. 2 Duncan	3,250 ft from NL and 350 ft from EL sec. 1, T.4 N., R.31 W.	1,125	635	No	Upper part of zone w. Middle part of zone w.	863-873 1,125	[3]Gas 550,000	March 1902	Discovery well of Mansfield gas field.
46	Choctaw Brick & Gas Co.	No. 16 W. T. Parkhill.	5,400 ft from NL and 1,300 ft from EL sec. 2, T.4 N., R.31 W.	2,402	660	No	Upper part of zone w.	1,240	Show of gas.	April 1926	
47	Choctaw Brick & Gas Co.	No. 17 W. T. Parkhill.	5,900 ft from NL and 850 ft from EL sec. 2, T.4 N., R.31 W.	1,615	660	No	Lower part of zone w.	1,609-1,615	[3]Gas	May 1926	

[1] Elevations for wells 31-47 are estimated.
[2] Derrick floor.
[3] Quantity unknown, see plate 1 for company designation of commercial or noncommercial well.

bed above the Paris coal bed ranges in thickness from 4 inches to 9 inches.

OIL AND GAS

Oil has not been discovered in the Barber quadrangle, but the first producing gas well in Arkansas was drilled on the Hartford anticline south of Mansfield in 1902. This well, the Choctaw Oil and Gas Co. No. 2 Duncan (well 36) is the discovery well for the Mansfield gas field. The discovery wells for two other gas fields in the Barber quadrangle are: the Reynolds Mining Corp. No. 1 Boyde (well 26) in the Gragg gas field and the Gulf Oil Corp. No. 1 Borum (well 4) in the Booneville gas field. A description of these wells and of others drilled in or near the Barber quadrangle is given in table 3.

All gas in the Barber quadrangle has been produced from sandstone units in the middle three-fifths of the Atoka Formation. Elsewhere in Arkansas, large quantities of gas have been found in rocks of the lower part of the Atoka Formation and of the upper part of the Morrow Series. These rocks in the Barber quadrangle did not contain gas where penetrated by two wells, the Reynolds Mining Corp. No. 1 Tomlin (well 23) in sec. 33, T. 6 N., R. 30 W., and the Gulf Oil Corp. No. 1 Borum (well 4) in sec. 18, T. 6 N., R. 28 W.

Gas in the Mansfield gas field (see pl. 3) has been produced from sandstone units mostly in zone w. Drillers' logs of wells drilled in this field report gas from 32 intervals which can be separated as follows: 21 in zone w; 5 from 400 to 700 feet above zone w; 5 from 250 to 450 feet below zone w; and 1 that is 600 feet below zone w. Croneis (1930, p. 374) attributed the "spotted occurrence" of the gas in the field to differences in the porosity of the sandstone. Hendricks and Parks (1937, p. 217) stated that the different levels of production in these sandstone units were "controlled by the variations in the character of the sands." The author of this report agrees with these postulations concerning stratigraphically entrapped gas. Production of gas from the Mansfield gas field will continue to decline unless more reserves of gas are found in additional stratigraphic traps in or near zone w. It seems likely that the gas 300 feet below zone w in the No. 1 Mansfield Gas Field well (drilled in 1952) is produced from such a trap. Wells drilled for gas in stratigraphic traps should be located on the limbs of the Hartford anticline, preferably on the south and southwest limbs. Deeper reserves of gas in the area of the Mansfield Gas Field may be present but the most likely reservoir, zone p, is dry where penetrated by the No. 1 Mansfield Gas Field well. The next most likely reservoir, the lower part of the Atoka Formation and the upper part of the Morrow Series, is deeper than 10,500 feet and was not reached by the above well.

All the gas in the Gragg and in the Booneville gas fields (pl. 3) has been produced from sandstone units in zone p. Completion reports of 26 wells drilled in these fields report gas from 54 intervals. These intervals have been separated by the author as follows: 18 in the upper part of zone p; 14 in the middle part; 21 in the lower part; and 1 interval 1,500 feet below zone p. Most of the gas produced in these fields comes from stratigraphic traps. Some of the gas is produced from fault bonded reservoirs (fault traps) in the Washburn fault zone. Some of these fault traps may be parts of prefaulted gas-filled stratigraphic traps; others may be parts of a dry sandstone unit that was filled after faulting with gas escaping from a nearby reservoir along a fault zone. Such a fault zone is responsible for the gas seep in the stock pond in NE¼ NE¼ NE¼ SE¼ sec. 21, T. 6 N., R. 29 W.

It is difficult to correlate the sandstone units of zone p between wells because of: (1) lenticularity of the units; (2) rapid lithologic changes in the units; or (3) a combination of lenticularity and lithologic changes. Correlation difficulties are increased by the folds and faults along the crest of the Washburn anticline. Possible correlation of the sandstone units penetrated by an east-west line of wells along the southern limb of the Washburn anticline is shown on figure 2. Generally, the commercial deposits of gas are in a coarser grained (very fine to medium with scattered coarse to very coarse grains) and less silty and argillaceous sandstone unit than are the reported shows of gas. However, many fine- to medium-grained nonsilty and nonargillaceous sandstone units have been penetrated without any reported shows of gas. These sandstone units are dry because: (1) the gas has migrated along a fault zone or fracture zone to a higher sandstone unit; (2) the unit was penetrated too low structurally; or (3) the unit has never contained gas. A study of the available lithologic information did not result in any generalization concerning distribution of the gas deposits in zone p except that most of the reported gas is from the lower 3,000 feet. The three "dry" holes (wells 25, 28, and 29) drilled near the western edge of the Gragg gas field may indicate the western limit of gas in zone p, but the northern, southern, and eastern lim-

its of the gas in zone p have not been determined. Gas may also be present in the lower part of the Atoka Formation and the upper part of the Morrow Series along the Washburn anticline, however this sequence of rocks was dry in the Borum well and the Tomlin well.

Gas may be present in zone w and zone p along Ranger anticline in the Barber quadrangle, despite the negative evidence afforded by the Arkansas-Oklahoma No. 1 S. B. Wall well (sec. 29, T. 5 N., R. 27 W., 5 miles east of the quadrangle). This well penetrated all of zone w and the upper 700 feet of zone p without a reported show of gas. The absence of gas in this well should not condemn the gas potential of these two zones on the Ranger anticline because (1) zone w crops out about 1 mile northeast of the well; (2) most of the gas produced in the Gragg and Booneville gas fields comes from sandstone units more than 1,000 feet below the top of zone p; and (3) one dry hole cannot condemn the gas potential of an area in which gas entrapment is so dependent upon lithologic changes.

The J. W. Nichols Exploration Co. No. 1 Gann well (well 30) in sec. 15, T. 5 N., R. 31 W. (3 miles west of the quadrangle) is reported to be dry, but when the author visited the well site in 1958 enough gas was escaping around the casing to carry water in the sump to a height of 6 inches. The gas is from a stratigraphic trap because all of the rock units penetrated by this well are exposed updip from the well within 6 miles to the northeast.

In summary, a dry hole on a limb of an anticline in or near the area of the Barber quadrangle does not mean that gas is not present nearby. The gas could be laterally along the anticline or even downdip from the dry hole.

BUILDING STONE

Slabs and blocks of weathered sandstone from the Atoka Formation have been used as flagstone and as exterior finish on many of the houses in the area. Most of this stone is float blocks from sandstone outcrops. Some stone was quarried in sec. 30, T. 5 N., R. 29 W.

The Hartshorne Sandstone, the source of good quality building stone elsewhere in Arkansas, has not been quarried in the Barber quadrangle. The author did not observe any sandstone beds of the type (even-bedded foreset beds 50 feet long and 2 inches to 6 inches thick) quarried elsewhere in Arkansas. Generally, the sandstone beds are too thick, thin, irregular, lenticular, or crossbedded.

Some building stone was quarried from a sandstone in the Savanna Formation in sec. 10, T. 6 N., R. 30 W.

ROAD METAL

Shale and interbedded shale and siltstone from the Atoka, McAlester, and Savanna Formations have been used for road metal. Sandstone of the Atoka Formation (sec. 35, T. 6 N., R. 29 W.) has been quarried and crushed for use as road metal, as could the sandstone in the sandstone units in all the formations.

GRAVEL, SAND, AND CLAY

Deposits of sand and gravel are present in all of the stream terraces and at the base of the stream alluvium. Deposits of nonsilty and nonsandy clay are rare in the stream alluvium. The best quality clay deposits are zones (1 feet to 3 feet thick) of weathered shale underneath some of the higher terrace deposits.

REFERENCES CITED

American Society for Testing Materials, 1939, Standard specifications for classifications of coals by rank (A.S.T.M. designation: D 388-38), in 1939 Book of A.S.T.M. Standard, pt. 3, p. 1-6: Philadelphia, Pa.

COLLIER, A. J., 1907, The Arkansas coal field. With reports on the paleontology by David White and G. H. Girty: *U.S. Geol. Survey Bull.* 326, 158 p.

CRONEIS, C. G., 1930, Geology of the Arkansas Paleozoic area, with special reference to oil and gas possibilities: *Arkansas Geol. Survey Bull* 3, 457 p.

FENNEMAN, N. M., and JOHNSON, D. W., 1946, Physical divisions of the United States: *U. S. Geol. Survey May* (reprinted 1949).

FREZON, S. E., and SCHULTZ, L. G., 1961, Possible bentonite beds in the Atoka Formation in Arkansas and Oklahoma in Short papers in the geologic and hydrologic sciences: *U. S. Geol. Survey Prof.* Paper 424-C, p. C82-C84.

GODDARD, E. N., chm., and others, 1948, Rock-color chart: *Natl. Research Council;* 2d printing, 1951, by *Geol. Soc. America.*

HALEY, B. R., 1960, Coal resources of Arkansas, 1954, *U. S. Geol. Survey Bull.* 1072-P. p. 795-831.

————1961, Post-Atoka rocks of northwestern Arkansas: *Paper in Proc. of Seventh Biennial Geol. Symposium,* p. 115-125, *Univ. Oklahoma Press,* Norman, Okla.

————1961, Geology of Paris quadrangle, Logan County, Arkansas: *Arkansas Geol. and Conserv. Comm. Inf. Circ.* 20-B, p. 40.

HENDRICKS, T. A., 1937, Pennsylvanian sedimentation in Arkansas coal field: *Am. Assoc. Petroleum Geologists Bull.* v. 21, no. 11, p. 1403-1421.

HENDRICKS, T. A., DANE, C. H., and KNECHTEL, M. M., 1936, Stratigraphy of the Arkansas-Oklahoma coal basin *Am. Assoc. Petroleum Geologists Bull.*, v. 20, no. 10, p. 1342-1356.

HENDRICKS, T. A., KNECHTEL, M. M. DANE, C. H., ROTHROCK, H. E., and WILLIAMS, J. S., 1939, Geology and fuel resources of the southern part of the Oklahoma coal field: *U. S. Geol. Survey Bull.* 874, 300 p.

HENDRICKS, T. A., and PARKS, BRYAN, 1937, Geology and mineral resources of the western part of the Arkansas coal field: *U. S. Geol. Survey Bull.* 847-E, p. 189-224.

————1950, Geology of the Fort Smith district, Arkansas: *U. S. Geol. Survey Prof. Paper* 221-E, 67-94.

HENDRICKS, T. A., and READ, C. B., 1934, Correlations of Pennsylvanian strata in Arkansas and Oklahoma coal fields: *Am. Assoc. Petroleum Geologists Bull.*, v. 18, no. 8, p. 1050-1058.

MAHER, J. C., 1959, The composite interpretive method of logging drill cuttings: *Oklahoma Geol. Survey Guidebook VIII,* 48 p.

MEREWETHER, E. A., and HALEY, B. R., 1960, Geology of the Delaware quadrangle, Logan County and Vicinity, Arkansas: *Arkansas Geol. and Conserv. Comm. Inf. Circ.* 20-A, p. 30.

MISER, H. D., 1954, Geologic Map of Oklahoma: *U. S. Geol. Survey.*

OAKES, M. C., 1953, Krebs and Cabaniss groups, of Pennsylvanian age, in Oklahoma: *Am. Assoc. Petroleum Geologists Bull.* v. 37, no. 6, p. 1523-1526.

REINEMUND, J. A., and DANILCHIK, WALTER, 1957, Preliminary geologic map of the Waldron quadrangle and adjacent areas, Scott County, Arkansas: *U. S. Geol. Survey Oil and Gas Inv. Map* OM-192.

SHELDON, M.G., 1954, Sample descriptions and correlations for selected wells in northern Arkansas: *Arkansas Resources and Devel. Comm., Div. Geology Inf. Circ.* 17, 222 p.

WENTWORTH, C. K., 1922, A scale of grade and class terms of clastic sediment: *Jour. Geology,* v. 30, no. 5, p. 377-392.

APPENDIX

The surface and subsurface sections described in this appendix are shown graphically on plate 2 and their geographic positions (excepting the Turner and the Gann wells) are shown on plate 1. Each surface section is keyed to the plates by letter and each subsurface section by arabic numeral. The lithologic descriptions of the surface sections were obtained by field observations. The lithologic descriptions of the subsurface sections were obtained by a concurrent examination of the drill cuttings and the electrical logs for each well. The technique of examining and logging drill cuttings and describing rock units is similar to that described by Maher (1959).

The colors given in the descriptions correspond to those of the Rock Color Chart issued by the National Research Council (Goddard and others, 1948), and the grain sizes are described in accordance with the Wentworth grade scale (1922). Each stratigraphic section is arranged so that the youngest rock unit is described first.

SURFACE STRATIGRAPHIC SECTIONS

Section R

Poteau Mountain section

Secs. 12, 13, and 24, T. 4 N., R. 31 W., Sebastian County, Ark. Lower part of Savanna Formation and McAlester Formation. All rock units described below are poorly exposed. This section is described below and shown graphically on plate 2 to help establish a thickening trend for the McAlester Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Savanna Formation**
20.0	0- 20.0	Sandstone, light-gray, very fine grained, beds from 6 in. to 24 in. thick.
85.0	20.0-105.0	Covered interval, probably shale.
15.0	105.0-120.0	Sandstone, light-gray, very fine grained, beds from 2 in. to 24 in. thick.
55.0	120.0-175.0	Covered interval, probably shale.
40.0	175.0-215.0	Sandstone, light-gray, very fine grained, silty, well-cemented, beds from 4 in. to 48 in. thick.
13.0	215.0-228.0	Covered interval, probably shale and siltstone.
4.0	228.0-232.0	Sandstone, light-gray, very fine grained, beds from 6 in. to 10 in. thick.
93.0	232.0-325.0	Covered interval, probably shale and siltstone.
20.0	325.0-345.0	Sandstone, light-gray, very fine to fine-grained, silty, irregularly bedded, beds from 2 in. to 24 in. thick. Base of unit is base of Savanna Formation.
		McAlester Formation
290.0	345.0-635.0	Covered interval, probably shale.
70.0	635.0-705.0	Shale, dark-gray, beds as much as ¼ in. thick.
25.0	705.0-730.0	Sandstone, light- to medium-gray, very fine grained, silty, irregularly bedded, cross-bedded, beds from 3 in. to 24 in. thick.
380.0	730.0-1110.0	Covered interval, probably shale.
15.0	1110.0-1125.0	Sandstone, medium-gray, very fine grained, silty, irregularly bedded, beds from 2 in. to 18 in. thick.
20.0	1125.0-1145.0	Shale, dark-gray, beds as much as ¼ in. thick.
510.0	1145.0-1655.0	Covered interval, probably shale.
10.0	1655-1665.0	Sandstone, light-to medium-gray, very fine grained, silty, crossbedded, convolute-bedded, beds from 2 in. to 48 in. thick, overlies shale with channel-type contact.
10.0	1665.0-1675.0	Shale, dark-gray, ironstone concretions, beds as much as ¼ in. thick. End of section.

Section S

Kings Creek section

Sec. 9, T. 4 N., R. 30 W., Scott County, Ark. Lower part of McAlester Formation, Hartshorne Sandstone, and upper part of the Atoka Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		McAlester Formation
2.0	0- 2.0	Sandstone, very light gray, very fine grained, crossbedded, beds from 4 in. to 12 in. thick.
7.0	2.0- 9.0	Covered interval.
4.0	9.0- 13.0	Shale, dark-gray to grayish-black, scattered ironstone concretions, beds as much as ¼ in. thick.
4.5	13.0- 17.5	Claystone, brownish-gray, weathered, abundant ironstone concretions, beds as much as 4 in. thick.
3.6	17.5- 21.1	Shale, grayish-black, carbonaceous, scattered ironstone concretions, beds as much as ¼ in. thick.
1.0	21.1- 22.1	Shale, grayish-black, abundant ironstone concretions, beds as much as ⅛ in. thick.
2.3	22.1- 24.4	Claystone, brownish-gray, weathered, plant fragments, beds as much as 4 in. thick.
1.3	24.4- 25.7	Shale, grayish-black.
1.2	25.7- 26.9	Coal, mostly vitrain, thick-banded.
7.6	26.9- 34.5	Shale, dark-gray to grayish-black, silty lenses, ironstone concretions.
0.5	34.5- 35.0	Coal, mostly vitrain.
0.5	35.0- 35.5	Shale, black, carbonaceous.
3.8	35.5- 39.3	Shale, dark-gray to grayish-black.
1.5	39.3- 40.8	Coal, mostly vitrain, dominantly medium banded.
3.0	40.8- 43.8	Shale, dark-gray, beds as much as ⅛ in. thick.
7.0	43.8- 50.8	Covered interval, base of unit is base of McAlester Formation.
		Hartshorne Sandstone
5.8	50.8- 56.6	Sandstone, light-gray, very fine to fine-grained, crossbedded, beds from 4 in. to 8 in. thick.
23.0	56.6- 79.6	Covered interval, probably sandstone.
4.0	79.6- 83.6	Sandstone, light-gray, very fine to fine-grained, crossbedded, beds from 4 in. to 6 in. thick. Base of unit is base of Hartshorne Sandstone.
		Atoka Formation
34.6	83.6-118.2	Covered interval, probably dark-gray shale.
2.0	118.2-120.2	Sandstone, medium-gray, very fine to fine-grained, well-cemented, crossbedded, beds from 2 in. to 6 in. thick.
6.6	120.2-126.8	Sandstone, medium-gray, very fine to fine-grained, beds from 1 in. to 6 in. thick.
0.7	126.8-127.5	Sandstone, medium-gray, very fine grained, beds from 1 in. to 4 in. thick, grades into underlying siltstone.
25.0	127.5-152.5	Siltstone, medium-gray, beds from ½ in. to 4 in. thick, grades into underlying shale.
58.1	152.5-210.6	Shale, medium- to dark-gray, very silty at top.
0.2	210.6-210.8	Coal, mostly vitrain, dominantly medium banded.
0.4	210.8-211.2	Shale, black, carbonaceous, beds as much as ⅛ in. thick.
0.3	211.2-211.5	Coal.
1.4	211.5-212.9	Shale, black, carbonaceous, beds as much as ⅛ in. thick.
1.1	212.9-214.0	Coal, mostly vitrain.
1.2	214.0-215.2	Shale, black, carbonaceous, streaks of coal, beds as much as ⅛ in. thick.
0.3	215.2-215.5	Underclay, light- to medium-gray.
4.3	215.5-219.8	Covered interval, probably contains dark-gray shale.
8.8	219.8-228.6	Shale, medium- to dark-gray, silty, beds as much as ½ in. thick.
1.4	228.6-230.0	Sandstone, dark-gray, very fine grained, ripple-marked, beds from 1 in. to 6 in. thick.
0.8	230.0-230.8	Sandstone, dark-gray, very fine grained, silty, beds as much as ½ in. thick.
0.8	230.8-231.6	Sandstone, medium-gray, very fine grained, ripple-marked, one bed.
4.1	231.6-235.7	Siltstone, dark-gray, very finely sandy, ripple-marked, beds from 1 in. to 4 in. thick.
0.6	235.7-236.3	Sandstone, medium-gray, very fine grained, one bed.
6.6	236.3-242.9	Shale, dark-gray, ironstone concretions, beds as much as ¼ in. thick.
9.2	242.9-252.1	Siltstone, dark-gray, very finely sandy, ironstone concretions, ripple-marked, beds from ½ in. to 4 in. thick.
		End of section.

Section T

Rock Creek section (east)

Secs. 34 and 35, T. 5 N., R. 30 W., and Secs. 2 and 3, T. 4 N., R. 30 W., Scott County, Ark. Upper part of Atoka Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
25.0	0- 25.0	Sandstone, light-gray, very fine to fine-grained, silty, plant fragments, crossbedded, beds from 2 in. to 24 in. thick.
3.8	25.0- 28.8	Sandstone, medium-gray, very fine grained, silty, crossbedded, beds as much as 6 in. thick.
10.6	28.8- 39.4	Sandstone, medium-gray, very fine grained, beds as much as 4 in. thick; and shale, dark-gray, silty, beds as much as ¼ in. thick.
7.8	39.4- 47.2	Siltstone, dark-gray, beds as much as ½ in. thick; and sandstone, medium-gray, very fine grained, silty, beds as much as 1 in. thick.
8.9	47.2- 56.1	Siltstone, medium- to dark-gray, very finely sandy in upper 2 ft., beds as much as 2 in. thick.
26.5	56.1- 82.6	Shale, grayish-black, slightly silty in upper 3 ft., beds as much as ¼ in. thick.
181.1	82.6-263.7	Covered interval, probably dark-gray shale.
120.7	263.7-384.4	Shale, grayish-black, beds as much as ¼ in. thick.
17.2	384.4-401.6	Covered interval, probably dark-gray shale.
57.5	401.6-459.1	Shale, dark-gray, beds as much as ¼ in. thick.
17.2	459.1-476.3	Covered interval, probably dark-gray shale.
7.0	476.3-483.3	Sandstone, medium- to dark-gray, very fine grained, silty, carbonaceous streaks, ripple-marked, beds from 1 in. to 6 in. thick.
14.2	483.3-497.5	Covered interval.
7.8	497.5-505.3	Sandstone, dark-gray, very fine grained, silty, carbonaceous streaks, ripple-marked, beds from 1 in. to 6 in. thick.
27.8	505.3-533.1	Covered interval, probably shale and siltstone.
46.0	533.1-579.1	Shale, dark-gray, beds as much as ¼ in. thick.
34.5	579.1-613.6	Siltstone, medium-gray, beds as much as ½ in. thick; and shale, dark-gray, beds as much as ⅛ in. thick.
57.5	613.6-671.1	Siltstone, medium-gray, beds as much as ½ in. thick.
17.2	671.1-688.3	Sandstone, medium-gray, very fine grained, silty, beds as much as 4 in. thick.
34.6	688.3-722.9	Siltstone, medium- to dark-gray, beds as much as 4 in. thick.
247.2	722.9-970.1	Shale, dark-gray, slightly silty, beds as much as ¼ in. thick.
2.0	970.1-972.1	Shale, dark-gray, silty, very finely sandy, beds as much as ¼ in. thick.
78.5	972.1-1050.6	Shale, grayish-black, beds as much as ½ in. thick.
0.1	1050.6-1050.7	Sandstone, dark-gray, very fine grained, finely micaceous, one bed.
13.2	1050.7-1063.9	Shale, as above.
0.2	1063.9-1064.1	Sandstone, as above.
24.0	1064.1-1088.1	Shale, as above.
		End of section.

Section U

Rock Creek section (west)

Sec. 8, T. 4 N., R. 30 W., Scott County, Ark. Lower part of McAlester Formation, Hartshorne Sandstone and upper part of Atoka Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		McAlester Formation
27.0	0- 27.0	Sandstone, brownish-gray, weathered, very fine grained, well-cemented, one bed.
10.0	27.0- 37.0	Covered interval, probably dark-gray shale.
2.0	37.0- 39.0	Clay, brownish-gray, weathered.
2.6	39.0- 41.6	Shale, black, carbonaceous, beds as much as ⅛ in. thick.
1.2	41.6- 42.8	Claystone, grayish-brown, weathered, abundant ironstone concretions.
0.8	42.8- 43.6	Shale, black, carbonaceous, beds as much as ⅛ in. thick.
2.2	43.6- 45.8	Coal, bony; and shale, black, carbonaceous.
1.9	45.8- 47.7	Shale, black, carbonaceous, coal streaks.
0.2	47.7- 47.9	Coal, medium-banded, mostly vitrain.
1.8	47.9- 49.7	Shale, black.
1.4	49.7- 51.1	Coal, mostly vitrain.
1.2	51.1- 52.3	Underclay, light-gray.
17.2	52.3- 69.5	Covered interval, probably dark-gray shale. Base of unit is base of McAlester Formation.
		Hartshorne Sandstone
4.3	69.5- 73.8	Sandstone, light-gray, very fine to fine grained, crossbedded, beds as much as 12 in. thick. Base of unit is base of Hartshorne Sandstone.
		Atoka Formation
24.8	73.8- 98.6	Shale, black, beds as much as ¼ in. thick.
8.6	98.6- 107.2	Siltstone, medium-gray, beds as much as 2 in. thick.
5.4	107.2- 112.6	Sandstone, light- to medium-gray, crossbedded, beds from 2 in. to 12 in. thick.
74.8	112.6- 187.4	Shale, grayish-black, silty in upper 6 ft., beds as much as ¼ in. thick.
4.3	187.4- 191.7	Claystone, dark-gray, plant fragments.
0.3	191.7- 192.0	Coal, mostly vitrain, medium-banded.
1.4	192.0- 193.4	Shale, black, very carbonaceous, coal streaks, beds as much as ⅛ in. thick.
1.2	193.4- 194.6	Coal, badly weathered.
0.8	194.6- 195.4	Shale, black, carbonaceous, beds as much as ⅛ in. thick.
649.9	195.4- 845.3	Shale, grayish-black, beds as much as ¼ in. thick.
17.2	845.3- 862.5	Covered interval, probably sandstone as below.
4.0	862.5- 866.5	Sandstone, greenish-gray, very fine grained, well-cemented, one bed.
3.0	866.5- 869.5	Shale, grayish-black, beds as much as ¼ in. thick.
3.1	869.5- 872.6	Siltstone, greenish-gray, well-cemented, beds as much as 4 in. thick.
7.7	872.6- 880.3	Claystone, greenish-gray.
3.3	880.3- 883.6	Siltstone, greenish-gray, well-cemented, beds as much as 24 in. thick.
4.2	883.6- 887.8	Claystone, greenish-gray, slightly silty, beds as much as 4 in. thick.
1.4	887.8- 889.2	Sandstone, medium-gray, very fine grained, beds as much as 6 in. thick.
137.3	889.2-1026.5	Shale, grayish-black, scattered ironstone concretions.
1.9	1026.5-1028.4	Sandstone, medium-gray, very fine grained, well-cemented, ripple-marked.
8.0	1028.4-1036.4	Siltstone, medium-gray, beds as much as 4 in. thick. End of section.

Section V

Mansfield section

Sec. 1, T. 4 N., R. 31 W., and sec. 31, T. 5 N., R. 31 W., Sebastian and Scott Counties, Ark. Upper part of Atoka Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
3.0	0- 3.0	Sandstone, medium-gray, very fine grained, very silty, finely micaceous, beds as much as 10 in. thick.
11.5	3.0- 14.5	Covered interval.
17.3	14.5- 31.8	Siltstone, medium-gray, very finely sandy, beds from ½ in. to 2 in. thick.
57.5	31.8- 89.3	Shale, dark-gray, silty, beds as much as ½ in. thick.
28.7	89.3- 118.0	Covered interval, probably dark-gray shale.
51.7	118.0- 169.7	Shale, dark-gray.
118.3	169.7- 288.0	Covered interval, probably dark-gray shale.
23.0	288.0- 311.0	Shale, dark-gray, beds as much as ¼ in. thick.
275.1	311.0- 586.1	Covered interval, probably dark-gray shale.
4.7	586.1- 590.8	Sandstone, light-gray, very fine grained, ripple-marked, irregularly bedded, beds as much as 6 in. thick.
21.4	590.8- 612.2	Siltstone, medium- to dark-gray, beds as much as 2 in. thick; and shale, dark-gray, finely micaceous, ripple-marked, beds from ¼ in. to 2 in. thick.
0.5	612.2- 612.7	Siltstone, medium-gray, very finely sandy, beds from ½ in. to 2 in. thick.
9.8	612.7- 622.5	Siltstone, medium-gray, beds as much as ½ in. thick; and sandstone, light-gray, very fine grained, beds as much as 4 in. thick.
16.5	622.5- 639.0	Shale, dark-gray to grayish-black, beds as much as ¼ in. thick; and siltstone, light-gray, beds as much as ½ in. thick.
4.4	639.0- 643.4	Sandstone, medium-gray, very fine grained, silty, crossbedded, ripple-marked, ripple marks indicate current from N. 60° E.
17.8	643.4- 661.2	Sandstone, light- to medium-gray, very fine to fine-grained, plant fragments, cross-bedded, beds from ½ in. to 6 in. thick.
11.1	661.2- 672.3	Siltstone, medium-gray, very finely sandy, beds from ¼ in. to 2 in. thick.
9.3	672.3- 681.6	Shale, grayish-black, very finely micaceous, beds as much as ¼ in. thick.
51.0	681.6- 732.6	Siltstone, medium-gray, beds as much as 2 in. thick.
20.0	732.6- 752.6	Shale, dark-gray, beds as much as ¼ in. thick.
		End of section. End of section is about 300 ft. stratigraphically above the top of the Residue Co. No. 1 Mansfield Gas Field well in sec. 6, T. 4 N., R. 30 W.

Section W

Liberty section

Sec. 12, T. 4 N., R. 31 W., Sebastian County, Ark. Upper part of Atoka Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
8.0	0- 8.0	Sandstone, medium- to dark-gray, very fine grained, very silty, very finely micaceous, irregularly bedded, beds from 6 in. to 12 in. thick.
308.0	8.0- 316.0	Covered interval, probably dark-gray shale.
1.0	316.0- 317.0	Shale, dark-gray, beds as much as ¼ in. thick.
302.0	317.0- 619.0	Covered interval, probably dark-gray shale.
10.8	619.0- 629.8	Sandstone, light-gray, very fine grained, finely to medium micaceous, ironstone, concretions, irregularly bedded, crossbedded, beds from 2 in. to 10 in. thick. End of section.

Section X

Petit Jean Creek section

Secs. 17, and 18, T. 4 N., R. 28 W., Scott County, Ark. Middle part of McAlester Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **McAlester Formation**
5.0	0- 5.0	Sandstone, light-gray, very fine to fine-grained, irregularly bedded, beds from 1 in. to 12 in. thick.
8.5	5.0- 13.5	Shale, dark-gray, slightly silty, beds as much as ¼ in. thick.
4.3	13.5- 17.8	Shale, dark-gray, beds as much as ½ in. thick; and siltstone, medium- to dark-gray, argillaceous, irregularly bedded, lenticular beds in part, ironstone concretions as much as 5 in. in diameter.
5.6	17.8- 23.4	Shale, dark-gray, beds as much as ½ inch thick; and siltstone, medium- to dark-gray, beds as much as 2 in. thick.
2.4	23.4- 25.8	Siltstone, medium- to dark-gray, argillaceous, irregularly bedded, beds from ½ in. to 2 in. thick.
18.6	25.8- 44.4	Shale, dark-gray, beds as much as ¼ in. thick.
28.7	44.4- 73.1	Covered interval.
3.9	73.1- 77.0	Shale, dark-gray, beds as much as ¼ in. thick.
8.6	77.0- 85.6	Covered interval.
5.7	85.6- 91.3	Sandstone, medium-gray, very fine grained, silty, finely micaceous, irregularly bedded, beds from 2 in. to 8 in. thick.
2.0	91.3- 93.3	Covered interval.
5.7	93.3- 99.0	Sandstone, as above.
2.0	99.0- 101.0	Shale, dark-gray, beds as much as ½ in. thick.
2.4	101.0- 103.4	Siltstone, medium-gray, ironstone concretions.
3.8	103.4- 107.2	Shale, dark-gray, silty; and siltstone, dark-gray.
5.7	107.2- 112.9	Covered interval.
11.5	112.9- 124.4	Shale, medium-gray, silty.
6.0	124.4- 130.4	Sandstone, medium-gray, very fine grained, very silty, beds from 4 in. to 24 in. thick, overlies shale with channel-type contact.
30.4	130.4- 160.8	Sandstone, medium-gray, very fine grained, very silty, beds from 2 in. to 12 in. thick; and shale, dark-gray, slightly silty, beds as much as ¼ in. thick, abundant plant fossils (annularia and calamite) in upper 20 ft.
4.8	160.8- 165.6	Sandstone, medium-gray, very fine grained, very silty, ripple-marked, crossbedded, beds from 1 in. to 6 in. thick; and shale, dark-gray, silty, in lenses as much as 4 in. thick.
2.0	165.6- 167.6	Shale, dark-gray, beds as much as ¼ in. thick; and siltstone, medium-gray, beds as much as 2 in. thick.
1.0	167.6- 168.6	Sandstone, medium-gray, very fine grained, very silty, very argillaceous.
36.5	168.6- 205.1	Sandstone, light- to medium-gray, very fine grained, silty, ripple-marked, crossbedded, irregularly bedded, beds as much as 24 in. thick.
76.3	205.1- 281.4	Covered interval.
5.0	281.4- 286.4	Sandstone, light-gray, very fine to fine-grained, finely to medium micaceous, dark-gray shale pebbles as much as ½ in. in diameter.
6.6	286.4- 293.0	Sandstone, very light gray, fine- to medium-grained, finely to medium micaceous, black shale pebbles as much as 1½ in. diameter, ripple-marked, irregularly bedded, beds from 1 in. to 12 in. thick.
21.7	293.0- 314.7	Shale, dark-gray, ironstone concretions, beds as much as ½ in. thick.
12.1	314.7- 326.8	Shale, dark-gray; and siltstone, dark-gray, plant fragments.
14.6	326.8- 341.4	Shale, dark-gray, beds as much as ¼ in. thick; and siltstone, dark-gray, in lenses ¼ in. thick and 7 ft. long.
20.5	341.4- 361.9	Siltstone, dark-gray, beds as much as 2 in. thick; and shale, dark-gray, beds as much as ¼ in. thick.
92.0	361.9- 453.9	Shale, dark-gray, ironstone concretions, beds as much as ¼ in. thick.
23.0	453.9- 476.9	Covered interval, probably dark-gray shale.
16.0	476.9- 492.9	Sandstone, medium-gray, very fine grained, silty, finely micaceous, crossbedded, irregularly bedded, beds from 4 in. to 24 in. thick.
28.7	492.9- 521.6	Covered interval, probably dark-gray shale.
2.0	521.6- 523.6	Sandstone, medium-gray, very fine grained, silty, ripple-marked, beds from 2 in. to 6 in. thick.
		End of section.

Section Y

Washburn Creek section

Sec. 20, T. 6 N., R. 28 W. and secs. 26 and 35, T. 6., N., R. 29 W., Logan and Sebastian Counties, Ark. Upper part of Atoka Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
3.0	0- 3.0	Shale, dark-gray to grayish-black.
1.4	3.0- 4.4	Sandstone, dark-gray, very fine grained, very silty, irregularly bedded, beds from 2 in. to 6 in. thick, overlies siltstone with channel-type contact. Top of unit is top of zone w.
6.1	4.4- 10.5	Siltstone, dark-gray, very finely sandy, argillaceous, ripple-marked, beds from 4 in. to 12 in. thick.
4.0	10.5- 14.5	Shale, dark-gray to grayish-black, ironstone concretions, plant fossils, thin stringers of coal.
0.7	14.5- 15.2	Coal, predominantly vitrain.
1.0	15.2- 16.2	Shale, dark-gray to grayish-black.
1.7	16.2- 17.9	Shale, dark-gray, ironstone concretions, plant fragments.
0.7	17.9- 18.6	Siltstone, dark-gray, argillaceous, finely micaceous, ironstone concretions.
0.3	18.6- 18.9	Siltstone, dark-gray, very finely sandy, argillaceous.
3.2	18.9- 22.1	Sandstone, medium-gray, very fine grained, silty, finely to coarsely micaceous, beds from 2 in. to 8 in. thick.
1.0	22.1- 23.1	Shale, dark-gray, very silty, finely to medium micaceous, beds as much as ½ in. thick.
4.7	23.1- 27.8	Sandstone, medium-gray, very fine grained, very silty, finely to coarsely micaceous, beds from ½ in. to 12 in. thick.
72.7	27.8- 100.5	Sandstone, light-gray, fine-grained, plant fragments, irregularly bedded, beds from 2 in. to 48 in. thick.
228.3	100.5- 328.8	Sandstone, light-gray, fine-grained, finely to very coarsely micaceous, convolute bedded, beds from 2 in. to 48 in. thick.
5.2	328.8- 334.0	Sandstone, light-gray, fine-grained, beds from 2 in. to 48 in. thick.
6.6	334.0- 340.6	Sandstone, light-gray, very fine grained, beds from 4 in. to 24 in. thick.
22.5	340.6- 363.1	Sandstone, light-gray, very fine to fine-grained, ripple-marked, abundant plant fragments, crossbedded, beds from 24 in. to 48 in. thick.
4.5	363.1- 367.6	Sandstone, light-gray, very fine grained, very finely to finely micaceous, ¼-inch-thick bands of black carbonaceous shale, streaks of coal, beds from 4 in. to 24 in. thick.
10.2	367.6- 377.8	Sandstone, light-gray, very fine grained, micaceous, ripple-marked, beds 4 in. to 24 in. thick.
13.3	377.8- 391.1	Siltstone, medium- to dark-gray; shale, dark-gray, silty; and sandstone, medium-gray, very fine grained, silty, ripple-marked.
5.7	391.1- 396.8	Covered interval.
12.4	396.8- 409.2	Sandstone, light-gray, very fine grained, finely micaceous, beds 12 in. to 36 in. thick.
33.5	409.2- 442.7	Covered interval, probably dark-gray shale.
17.6	442.7- 460.3	Sandstone, as above.
7.5	460.3- 467.8	Sandstone, light-gray, very fine to fine-grained, silty, medium micaceous, beds 2 in. to 12 in. thick. Base of unit is base of zone w.
24.4	467.8- 492.2	Shale, dark-gray, few thin stringers of medium-gray siltstone.
30.0	492.2- 522.2	Covered interval, probably shale and siltstone (as above).
120.0	522.2- 642.2	Covered interval, probably dark-gray shale.
34.5	642.2- 676.7	Shale, dark-gray; and siltstone, medium- to dark-gray, very finely sandy.
3.2	676.7- 679.9	Sandstone, medium- to dark-gray, fine- to medium-grained, irregularly bedded, beds from 2 in. to 12 in. thick.
17.2	679.9- 697.1	Siltstone, medium-gray, finely to medium micaceous, beds as much as 2 in. thick.
35.9	697.1- 733.0	Siltstone, medium-gray, finely to medium micaceous, beds from ¼ in. to 2 in. thick; and sandstone, medium-gray, very fine grained, streaks of coal, beds from 2 in. to 4 in. thick.
48.0	733.0- 781.0	Siltstone, medium-gray, finely micaceous, beds from ½ in. to 4 in. thick; and shale, dark-gray to grayish-black, beds as much as ½ in. thick.
6.5	781.0- 787.5	Sandstone, medium-gray, very fine grained, silty, finely micaceous, beds from 4 in. to 12 in. thick.
38.9	787.5- 826.4	Siltstone, medium-gray, slightly very finely sandy, finely to medium micaceous, beds from ¼ in. to 12 in. thick.
3.8	826.4- 830.2	Shale, dark-gray, silty, beds as much as ¼ in. thick; and siltstone, dark-gray, beds from ¼ in. to 2 in. thick.
11.7	830.2- 841.9	Covered interval.
9.0	841.9- 850.9	Sandstone, light- to medium-gray, fine-grained, beds from 12 in. to 24 in. thick.
51.1	850.9- 902.0	Sandstone, medium-gray, very fine grained, very silty, finely to medium micaceous, beds from 2 in. to 48 in. thick.
11.7	902.0- 913.7	Covered interval, probably siltstone as below.

Section Y—(Continued)

Thickness in feet	Interval in feet	Description
64.0	913.7- 977.7	Siltstone, medium- to dark-gray, finely to medium micaceous, beds from 2 in. to 12 in. thick.
415.3	977.7-1393.0	Covered interval.
63.2	1393.0-1456.2	Sandstone, light- to medium-gray, very fine to fine-grained, medium micacecous, beds as much as 48 in. thick.
221.4	1456.2-1677.6	Covered interval.
20.1	1677.6-1697.7	Shale, medium- to dark-gray, silty, very finely micaceous.
10.8	1697.7-1708.5	Sandstone, medium-gray, very fine grained, silty, very finely micaceous, beds from 2 in. to 4 in. thick.
23.0	1708.5-1731.5	Sandstone, medium-gray, very fine grained, silty, very finely micacecous, beds as much as 48 in. thick.
278.5	1731.5-2010.0	Covered interval.
65.2	2010.0-2075.2	Siltstone, dark-gray, beds from ½ in. to 2 in. thick; and sandstone, dark-gray, very fine grained, very silty, beds from 1 in. to 12 in. thick.
25.9	2075.2-2101.1	Sandstone, medium- to dark-gray, very fine grained, very silty, finely micaceous, irregularly bedded, beds from 1 in. to 12 in. thick.
26.6	2101.1-2127.7	Covered interval, probably siltstone.
23.0	2127.7-2150.7	Siltstone, dark-gray, beds from ½ in. to 2 in. thick; and sandstone, dark-gray, very fine grained, very silty, beds from 4 in. to 10 in. thick.
7.7	2150.7-2158.4	Sandstone, dark-gray, very fine grained, very silty, finely micaceous, ripple-marked, irregularly bedded, beds from 2 in. to 12 in. thick.
34.5	2158.4-2192.9	Siltstone, dark-gray, finely micaceous, ripple-marked, irregularly bedded, beds from ½ in. to 2 in. thick.
17.2	2192.9-2210.1	Shale, dark-gray, slightly silty, very finely micaceous, beds as much as ¼ in. thick.
437.3	2210.1-2647.4	Covered interval.
0.8	2647.4-2648.2	Sandstone, medium- to dark-gray, very fine grained, very silty, very finely to medium micaceous.
57.7	2648.2-2705.9	Covered interval.
0.4	2705.9-2706.3	Sandstone, medium-gray, very fine grained, very silty, finely micaceous, argillaceous, shale pebbles as much as ½ in. in diameter.
161.0	2706.3-2867.3	Covered interval.
11.5	2867.3-2878.8	Siltstone, dark-gray, very finely sandy, finely to medium micaceous, beds from 2 in. to 4 in. thick; and sandstone, medium- to dark-gray, very fine grained, very silty, finely to medium micaceous, beds from 2 in. to 6 in. thick.
11.5	2878.8-2890.3	Shale, dark-gray, silty, finely to medium micaceous, beds as much as ½ in. thick. End of section. End of section is about 40 ft. stratigraphically above the top of the Post Petroleum Co. (Carter) No. 1 H. E. Turner well in sec. 15, T. 6 N., R. 28. W., Logan County, Arkansas.

Section Z

Rattlesnake Road section

Secs. 1 and 12, T. 6 N., R. 29 W., and 25 and 36, T. 7 N., R. 29 W., Logan, Franklin, and Sebastian Counties, Ark. Middle and lower part of Savanna Formation, McAlester Formation, Hartshorne Sandstone, and upper part of Atoka Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Savanna Formation**
4.0	0- 4.0	Sandstone, light-gray, very fine grained, beds from 1 in. to 8 in. thick.
6.5	4.0- 10.5	Siltstone, light-gray, argillaceous, beds from ¼ in. to 2 in. thick.
1.2	10.5- 11.7	Shale, dark-gray to grayish-black, beds as much as ¼ in. thick.
0.4	11.7- 12.1	Coal, vitrain is thick banded.
3.8	12.1- 15.9	Underclay, light- to medium-gray, nonbedded, stigmaria.
18.9	15.9- 34.8	Shale, medium-gray, silty, beds from ¼ in. to 2 in. thick.
2.0	34.8- 36.8	Siltstone, medium-gray, ripple-marked, beds 2 in. thick.
27.7	36.8- 64.5	Shale, dark-gray, beds from ¼ in. to 1 in. thick, few 1 in. beds of ironstone.
6.3	64.5- 70.8	Shale, dark-gray; and sandstone, light-gray, very fine grained, silty, slightly limy.
1.3	70.8- 72.1	Sandstone, light-gray, very fine grained, silty, beds from 2 in. to 8 in. thick.
10.7	72.1- 82.8	Shale, dark-gray, 2-in. beds of ironstone.
12.0	82.8- 94.8	Shale, dark-gray to grayish-black, beds as much as ¼ in. thick.
1.3	94.8- 96.1	Coal, vitrain is thin to thick banded. Unit is the Paris coal bed.
132.1	96.1- 228.2	Covered interval, probably dark-gray shale.
40.0	228.2- 268.2	Shale, dark-gray, beds as much as 1 in. thick.
0.2	268.2- 268.4	Limestone, dark brownish-gray, iron-rich, abundant brachiopods and gastropods.
0.2	268.4- 268.6	Ironstone, yellowish-brown.
34.9	268.6- 303.5	Shale, as above.
55.7	303.5- 359.2	Covered interval.
35.9	359.2- 395.1	Shale, as above.
28.5	395.1- 423.6	Shale, dark-gray, beds as much as 1 in. thick; and shale, dark-gray, silty, beds 1 inch thick.
7.5	423.6- 431.1	Siltstone, medium-gray, beds as much as 4 in. thick.
129.3	431.1- 560.4	Covered interval.
6.1	560.4- 566.5	Sandstone, light-gray, very fine grained, well-cemented, beds from 2 in. to 12 in. thick.
73.4	566.5- 639.9	Covered interval.
3.3	639.9- 643.2	Sandstone, medium-gray, very fine grained, well-cemented, ripple-marked, beds from 2 in. to 24 in. thick.
0.8	643.2- 644.0	Shale, medium-gray, silty, very finely micaceous.
13.1	644.0- 657.1	Shale, dark-gray, ironstone concretions.
62.4	657.1- 719.5	Covered interval.
11.2	719.5- 730.7	Shale, dark-gray.
379.1	730.7-1109.8	Covered interval.
8.8	1109.8-1118.6	Sandstone, medium-gray, very fine grained, silty, argillaceous, micaceous, beds from 2 in. to 4 in. thick.
11.0	1118.6-1129.6	Shale, dark-gray, beds as much as 2 in. thick, ironstone beds as much as 2 in. thick.
0.6	1129.6-1130.2	Coal, weathered, vitrain is thin to thick banded. Unit is Charleston coal bed.
3.0	1130.2-1133.2	Shale, dark-gray, plant fragments.
69.0	1133.2-1202.2	Covered interval.
22.0	1202.2-1224.2	Covered interval, probably sandstone.
57.5	1224.2-1281.7	Covered interval.
11.5	1281.7-1293.2	Siltstone, medium- to dark-gray, beds as much as 2 in. thick; and shale, dark-gray, beds as much as ¼ in. thick.
5.8	1293.2-1299.0	Sandstone, light- to medium-gray, very fine grained, silty, beds from 2 in. to 12 in. thick. Base of unit is base of Savanna Formation.
		McAlester Formation
335.1	1299.0-1634.1	Covered interval.
0.3	1634.1-1634.4	Siltstone, medium-gray, beds 2 in. to 4 in. thick.
31.0	1634.4-1665.4	Covered interval.
2.4	1665.4-1667.8	Sandstone, light- to medium-gray, very fine grained, finely micaceous, beds from 2 in. to 12 in. thick.
8.7	1667.8-1676.5	Covered interval.
5.0	1676.5-1681.5	Sandstone, as above.
7.9	1681.5-1689.4	Covered interval.
2.0	1689.4-1691.4	Sandstone, as above.
9.5	1691.4-1700.9	Covered interval.
5.7	1700.9-1706.6	Sandstone, as above.

Section Z—(Continued)

Thickness in feet	Interval in feet	Description
95.8	1706.6-1802.4	Covered interval.
13.0	1802.4-1815.4	Shale, dark-gray, beds as much as ¼ in. thick.
10.4	1815.4-1825.8	Covered interval.
0.3	1825.8-1826.1	Shale, as above.
38.9	1826.1-1865.0	Covered interval.
15.0	1865.0-1880.0	Siltstone, medium-gray, finely micaceous, beds from ½ in. to 2 in. thick.
1.4	1880.0-1881.4	Siltstone, medium-gray, very finely sandy, finely micaceous, beds from 2 in. to 6 in. thick.
6.3	1881.4-1887.7	Siltstone, medium- to dark-gray, micaceous, beds from ½ in. to 4 in. thick.
3.9	1887.7-1891.6	Sandstone, medium-gray, very fine grained, very silty, finely micaceous, beds from 4 in. to 24 in. thick.
6.6	1891.6-1898.2	Siltstone, medium- to dark-gray, well-cemented, very finely micaceous.
1.6	1898.2-1899.8	Siltstone, medium- to dark-gray, argillaceous, beds from ¼ in. to 2 in. thick. Base of unit is base of McAlester Formation.
		Hartshorne Sandstone
6.4	1899.8-1906.2	Sandstone, dark-gray, very fine grained, very silty, finely to medium micaceous, beds from ¼ in. to 24 in. thick.
6.7	1906.2-1912.9	Sandstone, medium-gray, very fine grained, very silty; and shale, dark-gray, silty.
12.6	1912.9-1925.5	Covered interval, probably sandstone as above.
33.7	1925.5-1959.2	Sandstone, very light gray, very fine- to fine-grained, crossbedded, beds from 2 in. to 48 in. thick.
8.1	1959.2-1967.3	Covered interval.
11.5	1967.3-1978.8	Sandstone, very light gray, fine-grained, coarsely micaceous, beds as much as 48 in. thick.
30.0	1978.8-2008.8	Covered interval, probably sandstone as above.
7.0	2008.8-2015.8	Sandstone, as above.
11.0	2015.8-2026.8	Covered interval, probably sandstone as above.
9.7	2026.8-2036.5	Sandstone, as above.
24.0	2036.5-2060.5	Sandstone, light-gray, very fine- to fine-grained, micaceous, beds as much as 48 in. thick.
5.0	2060.5-2065.5	Covered interval, probably sandstone as above.
31.5	2065.5-2097.0	Sandstone, as above. Base of unit is base of Hartshorne Sandstone.
		Atoka Formation
131.9	2097.0-2228.9	Shale, dark-gray, poorly exposed.
103.2	2228.9-2332.1	Covered interval.
44.4	2332.1-2376.5	Shale, dark-gray, poorly exposed.
14.0	2376.5-2390.5	Shale, dark-gray, beds as much as ¼ in. thick; ½-inch layer of ironstone 8 ft. above base.
1.0	2390.5-2391.5	Shale, black, very carbonaceous, thin stringers of coal.
0.3	2391.5-2391.8	Coal, bony coal, and shale.
0.2	2391.8-2392.0	Coal, vitrain is thin banded.
4.4	2392.0-2396.4	Shale, dark-gray to grayish-black, beds as much as ¼ in. thick.
23.5	2396.4-2419.9	Sandstone, medium-gray, very fine grained, very silty, finely to medium micaceous, beds from 2 in. to 24 in. thick.
1.5	2419.9-2421.4	Shale, dark-gray.
273.3	2421.4-2694.7	Covered interval.
19.0	2694.7-2713.7	Sandstone, light-gray, very fine grained, medium micaceous, ripple-marked, beds from 2 in. to 12 in. thick.
11.2	2713.7-2724.9	Sandstone, light- to medium-gray, very fine grained, silty, argillaceous, ripple-marked, dark-gray shale pebbles in lower 3 ft., beds from 1 in. to 12 in. thick.
11.5	2724.9-2736.4	Covered interval.
28.0	2736.4-2764.4	Sandstone, light- to medium-gray, very fine grained, very silty, scattered ½-inch shale pebbles, beds from 2 in. to 12 in. thick.
24.7	2764.4-2789.1	Sandstone, light-gray, very fine- to fine-grained, medium micaceous.
41.0	2789.1-2830.1	Shale, dark-gray, finely micaceous, beds as much as ½ in. thick.
6.7	2830.1-2836.8	Shale, dark-gray, beds as much as ¼ in. thick; and siltstone, medium-gray, beds from ¼ in. to 2 in. thick.
20.9	2836.8-2857.7	Shale, dark-gray, slightly silty, very finely micaceous, beds as much as ½ in. thick.
5.4	2857.7-2863.1	Siltstone, medium-gray, finely to medium micaceous, lower 22 in. is very finely sandy.
2.7	2863.1-2865.8	Shale, dark-gray; and siltstone, medium-gray.
4.7	2865.8-2870.5	Shale, dark gray, very finely micaceous, beds as much as ½ in. thick.
2.2	2870.5-2872.7	Siltstone, light-gray, very finely sandy, argillaceous, finely to coarsely micaceous, irregularly bedded.
9.7	2872.7-2882.4	Sandstone, light- to medium-gray, very fine grained, very silty, finely to medium micaceous, beds from 2 in. to 12 in. thick.
7.2	2882.4-2889.6	Shale, dark-gray, silty, beds as much as ¼ in. thick; and siltstone, medium- to dark-gray, beds as much as 2 in. thick.

Section Z—(Continued)

Thickness in feet	Interval in feet	Description
45.5	2889.6-2935.1	Shale, dark-gray, slightly silty, beds as much as ¼ in. thick, very silty in upper 8 ft.
18.1	2935.1-2953.2	Siltstone, medium-gray, medium micaceous, beds as much as 2 in. thick.
28.0	2953.2-2981.2	Covered interval.
20.3	2981.2-3001.5	Shale, dark-gray, beds as much as ¼ in. thick.
2.4	3001.5-3003.9	Siltstone, medium-gray, beds as much as 2 in. thick.
6.1	3003.9-3010.0	Siltstone, medium-gray, very finely sandy, medium to coarsely micaceous, beds as much as 12 in. thick, ironstone concretions as much as 2 in. thick and 6 in. in diameter.
13.7	3010.0-3023.7	Siltstone, medium-gray, finely to medium micaceous, beds as much as 4 in. thick.
58.5	3023.7-3082.2	Covered interval.
44.7	3082.2-3126.9	Shale, dark-gray, abundant ironstone concretions.
62.8	3126.9-3189.7	Shale, dark-gray, silty, finely micaceous, beds as much as ½ in. thick.
50.0	3189.7-3239.7	Covered interval.
2.8	3239.7-3242.5	Sandstone, medium-gray, very fine grained, well-cemented, ironstone concretions as much as ½ in. in diameter.
14.2	3242.5-3256.7	Siltstone, medium-gray, beds from ½ in. to 2 in. thick; and sandstone, medium-gray, very fine grained, very silty, beds from ½ in. to 2 in. thick.
7.3	3256.7-3264.0	Covered interval, probably sandstone as above.
1.3	3264.0-3265.3	Sandstone, medium-gray, very fine grained, silty.
8.0	3265.3-3273.3	Covered interval, probably sandstone as above.
2.3	3273.3-3275.6	Sandstone, medium- to dark-gray, very fine grained, silty, finely micaceous.
4.8	3275.6-3280.4	Covered interval.
5.8	3280.4-3286.2	Sandstone, light- to medium-gray, very fine to fine-grained, finely micaceous, beds from 12 in. to 24 in. thick.
321.2	3286.2-3607.4	Covered interval.
1.0	3607.4-3608.4	Sandstone, medium-gray, very fine grained, very silty, beds from ¼ in. to 2 in. thick.
2.3	3608.4-3610.7	Sandstone, medium- to dark-gray, very fine to fine-grained, ironstone concretions.
4.5	3610.7-3615.2	Shale, dark-gray, silty.
1.2	3615.2-3616.4	Sandstone, medium-gray, very fine grained, very silty, beds from 2 in. to 4 in. thick.
12.9	3616.4-3629.3	Shale, dark-gray; and siltstone, medium-gray, very finely sandy.
1.9	3629.3-3631.2	Siltstone, medium-gray, beds from 1 in. to 4 in. thick, ripple-marked; and sandstone, medium-gray, very fine grained, very silty, ripple-marked, beds from 1 in. to 4 in. thick.
9.1	3631.2-3640.3	Shale, medium-gray, silty, finely micaceous, beds as much as ½ in. thick.
3.6	3640.3-3643.9	Sandstone, medium-gray, very fine grained, very silty, beds as much as 3 in. thick; and siltstone, medium-gray, beds as much as 2 in. thick.
131.8	3643.9-3775.7	Shale, dark-gray to grayish-black, very finely micaceous, beds as much as ½ in. thick.
57.4	3775.7-3833.1	Covered interval.
18.7	3833.1-3851.8	Sandstone, light-gray, very fine grained, finely micaceous, ripple-marked, beds from 4 in. to 24 in. thick. Top of unit is top of zone w.
15.0	3851.8-3866.8	Covered interval, probably sandstone as above.
26.5	3866.8-3893.3	Sandstone, light-gray, very fine to fine-grained, beds from 12 in. to 48 in. thick.
5.3	3893.3-3898.6	Sandstone, light-gray, fine-grained, coarsely micaceous, beds as much as 24 in. thick.
25.9	3898.6-3924.5	Sandstone, light-gray, very fine to fine-grained, scattered rounded medium sand grains, finely to coarsely micaceous, beds as much as 24 in. thick.
10.6	3924.5-3935.1	Covered interval.
7.1	3935.1-3942.2	Sandstone, light-gray, very fine to fine-grained, finely to coarsely micaceous, ironstone concretions as much as 2 in. in diameter, beds as much as 24 in. thick.
12.5	3942.2-3954.7	Sandstone, light-gray, very fine grained, silty, beds as much as 24 in. thick.
19.2	3054.7-3973.9	Sandstone, light- to medium-gray, very fine grained, silty, finely to medium micaceous, shale pebbles as much as ½ in. in diameter, beds from 4 in. to 12 in. thick.
4.4	3973.9-3978.3	Covered interval.
15.5	3978.3-3993.8	Sandstone, light-gray, very fine grained, silty.
15.7	3993.8-4009.5	Covered interval.
15.9	4009.5-4025.4	Sandstone, light-gray, very fine grained, silty, poorly exposed.
2.3	4025.4-4027.7	Sandstone, light-gray, very fine to fine-grained, silty, widely scattered rounded medium sand grains.
21.2	4027.7-4048.9	Sandstone, light-gray, very fine grained, very silty, finely to medium micaceous, beds from 2 in. to 12 in. thick.
2.2	4048.9-4051.1	Sandstone, light-gray, very fine to fine-grained, silty, medium micaceous, beds as much as 18 in. thick.
19.0	4051.1-4070.1	Sandstone, light-gray, very fine grained, very silty, finely micaceous, beds from 2 in. to 4 in. thick.
10.6	4070.1-4080.7	Covered interval.
63.9	4080.7-4144.6	Sandstone, light-gray, very fine grained, finely micaceous, beds from 2 in. to 12 in. thick.
5.3	4144.6-4149.9	Sandstone, light-gray, very fine grained, very silty, finely micaceous, beds from 2 in. to 4 in. thick.

Section Z—(Continued)

Thickness in feet	Interval in feet	Description
5.8	4149.9-4155.7	Sandstone, light-gray, very fine grained, finely to medium micaceous, beds from 2 in. to 4 in. thick.
8.0	4155.7-4163.7	Sandstone, light-gray, very fine grained, very silty, beds from ½ in. to 4 in. thick.
7.5	4163.7-4171.2	Sandstone, light-gray, very fine to fine-grained, silty, beds from 12 in. to 24 in. thick.
12.5	4171.2-4183.7	Sandstone, light-gray, very fine grained, silty, finely to coarsely micaceous, beds from 2 in. to 4 in. thick.
16.8	4183.7-4200.5	Sandstone, light-gray, very fine to fine-grained, finely micaceous, beds from 4 in. to 24 in. thick.
9.9	4200.5-4210.4	Sandstone, light-gray, very fine to fine-grained, silty, beds from 2 in. to 12 in. thick.
7.0	4210.4-4217.4	Sandstone, light-gray, very fine to fine-grained, very silty, beds from 1 in. to 4 in. thick.
23.0	4217.4-4240.4	Sandstone, light-gray, very fine grained, silty, very finely micaceous, plant fragments, beds from 2 in. to 48 in. thick.
26.4	4240.4-4266.8	Sandstone, light-gray, very fine to fine-grained, plant fragments, beds from 2 in. to 24 in. thick.
25.0	4266.8-4291.8	Sandstone, light-gray, very fine grained, silty, micaceous, plant fragments, beds from 2 in. to 24 in. thick. Base of unit is base of zone w.
96.0	4291.8-4387.8	Covered interval.
17.5	4387.8-4405.3	Sandstone, light-gray, very fine grained, very finely micaceous. End of section.

SUBSURFACE STRATIGRAPHIC SECTIONS

Section of well 33

The Residue Company No. 1 Mansfield Gas Company

Sec. 6, T. 4 N., R. 30 W., Scott County, Ark. Elevation: 684 ft. (Kelly bushing); total depth: 8,663 ft. Rock samples examined and logged by Ernest E. Glick. Middle part of the Atoka Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
10	0- 10	(No sample.)
40	10- 50	Shale, dark-gray, slightly silty, finely micaceous.
135	50- 185	Shale, dark-gray to black, very finely micaceous.
25	185- 210	(No sample.)
16	210- 226	Shale, dark-gray to black, very finely micaceous, pyrite.
35	226- 261	(No sample.)
9	261- 270	Sandstone, medium light gray, very fine grained, silty, micaceous, pyrite.
97	270- 367	(No sample.)
6	367- 373	Shale, dark-gray to black, very finely micaceous.
42	373- 415	Siltstone, medium dark gray, finely micaceous.
2	415- 417	Shale, dark-gray, finely micaceous.
4	417- 421	(No sample.)
31	421- 452	Shale, dark-gray, finely micaceous.
18	452- 470	(No sample.)
20	470- 490	Siltstone, medium dark gray, very finely sandy, micaceous.
20	490- 510	Siltstone, medium dark gray, argillaceous, micaceous.
25	510- 535	Siltstone, medium dark gray, finely sandy, argillaceous, micaceous.
46	535- 581	(No sample.)
3	581- 584	Shale, dark-gray, finely micaceous.
3	584- 587	Siltstone, medium dark gray, finely micaceous.
3	587- 590	Shale, as above.
5	590- 595	Siltstone, as above.
5	595- 600	Shale, as above.
4	600- 604	Siltstone, as above.
3	604- 607	Shale, as above.
3	607- 610	Siltstone, as above.
4	610- 614	Shale, as above.
6	614- 620	Siltstone, as above.
3	620- 623	Shale, as above.
5	623- 628	Siltstone, as above.
2	628- 630	Shale, as above.
20	630- 650	(No sample.)
3	650- 653	Shale, as above.
4	653- 657	Siltstone, as above.
3	657- 660	Shale, as above.
5	660- 665	Siltstone, as above.
3	665- 668	Shale, as above.
4	668- 672	Siltstone, as above.
3	672- 675	Shale, as above.
8	675- 683	Siltstone, as above.
3	683- 686	Shale, as above.
62	686- 748	(No sample.)
32	748- 780	Shale, black.
10	780- 790	Shale, dark-gray, silty, finely micaceous.
5	790- 795	(No sample.)
12	795- 807	Shale, as above.
26	807- 833	(No sample.)
25	833- 858	Shale, black, very fine micaceous.
21	858- 879	Siltstone, medium dark gray, finely micaceous.
61	879- 940	Siltstone, medium-gray, very finely sandy, finely micaceous.
2	940- 942	Shale, black, micaceous.
6	942- 948	Siltstone, medium dark gray, finely micaceous, fragments of black carbonaceous shale in 942 to 948. Top of unit is top of zone w.

Section of well 33—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
3	948- 951	Shale, as above.
5	951- 956	Siltstone, as above.
21	956- 977	Sandstone, medium light gray, very fine grained, slightly silty, finely micaceous.
10	977- 987	(No sample.)
15	987-1002	Sandstone as above.
9	1002-1011	Sandstone, light-gray, very fine to fine-grained, micaceous, drills free.
14	1011-1025	Sandstone, medium-gray, very fine grained, micaceous.
12	1025-1037	Shale, dark-gray, finely micaceous.
13	1037-1050	Siltstone, medium dark gray, finely micaceous.
20	1050-1070	Sandstone, medium-gray, fine- to medium-grained, silty, micaceous; dark-gray siltstone at 1060 to 1061 and 1066 to 1067.
23	1070-1093	Siltstone, medium dark gray, very finely sandy, finely micaceous.
6	1093-1099	(No sample.) Probably sandstone as below.
12	1099-1111	Sandstone, medium light gray, very fine to fine-grained, silty, finely micaceous.
19	1111-1130	(No sample.) Probably sandstone as above.
15	1130-1145	Sandstone, medium light gray, fine- to medium-grained, slightly silty, micaceous.
20	1145-1165	Sandstone, light-gray, very fine grained, slightly silty, finely micaceous.
10	1165-1175	Sandstone, light-gray, very fine to fine-grained, slightly silty, finely micaceous.
12	1175-1187	Sandstone, medium-gray, very fine grained, silty, micaceous.
8	1187-1195	Sandstone, medium light gray, fine- to medium-grained, slightly silty, micaceous.
11	1195-1206	Sandstone, light-gray, fine-grained, slightly silty, micaceous.
14	1206-1220	Sandstone, medium-gray, very fine grained, silty, micaceous.
78	1220-1298	Shale, dark-gray, silty, finely micaceous.
32	1298-1330	(No sample.) Probably siltstone as below.
5	1330-1335	Siltstone, medium dark-gray, very finely sandy, micaceous.
24	1335-1359	Sandstone, light-gray, fine-grained, slightly silty, micaceous.
11	1359-1370	(No sample.) Probably sandstone as above.
19	1370-1389	Sandstone, as above.
6	1389-1395	(No sample.) Probably sandstone as above.
5	1395-1400	Sandstone, as above. Base of unit is base of zone w.
28	1400-1428	Siltstone, medium-gray, very finely sandy, micaceous.
22	1428-1450	(No sample.) Probably siltstone as below.
52	1450-1502	Siltstone, medium dark gray, argillaceous, finely micaceous.
29	1502-1531	(No sample.) Probably siltstone as above.
74	1531-1605	Siltstone, medium dark gray, micaceous.
23	1605-1628	(No sample.) Probably siltstone as above.
32	1628-1660	Siltstone, medium-gray, very finely sandy, micaceous.
10	1660-1670	(No sample.) Probably siltstone as above.
20	1670-1690	Siltstone, as above.
15	1690-1705	Siltstone, medium light gray, very finely sandy, micaceous.
5	1705-1710	Sandstone, medium light gray, very fine grained, silty, micaceous.
15	1710-1725	(No sample.) Probably sandstone as above.
35	1725-1760	Sandstone, medium light gray, very fine grained, widely scattered fine sand, silty, micaceous, slightly porous.
12	1760-1772	Sandstone, medium-gray, very fine grained, silty, micaceous.
29	1772-1801	(No sample.) Probably sandstone as above.
27	1801-1828	Siltstone, medium dark gray, finely micaceous.
24	1828-1852	Siltstone, medium-gray, finely micaceous.
23	1852-1875	(No sample.) Probably siltstone as above.
61	1875-1936	Siltstone, medium-gray, micaceous.
19	1936-1955	(No sample.) Probably siltstone as above.
26	1955-1981	Siltstone, medium dark gray, argillaceous, micaceous.
9	1981-1990	(No sample.) Probably siltstone as above.
31	1990-2021	Siltstone as above.
19	2021-2040	(No sample.) Probably siltstone as above.
35	2040-2075	Shale, dark-gray, silty, finely micaceous.
45	2075-2120	Shale, dark-gray to black, micaceous.
10	2120-2130	(No sample.) Probably shale as above.
13	2130-2143	Shale, as above.
38	2143-2181	(No sample.) Probably shale as above.
34	2181-2215	Shale, dark-gray, slightly silty, finely micaceous.
39	2215-2254	Siltstone, medium dark gray, argillaceous, finely micaceous.
34	2254-2288	(No sample.) Probably siltstone as above.
29	2288-2317	Siltstone, medium-gray, finely micaceous.

Section of well 33—(Continued)

Thickness in feet	Interval in feet	Description Pennsylvanian System Atoka Formation
23	2317-2340	(No sample.) Probably siltstone as above.
66	2340-2406	Siltstone as above.
39	2406-2445	(No sample.) Probably siltstone as above.
35	2445-2480	Siltstone, as above.
37	2480-2517	Siltstone, medium dark gray, argillaceous, finely micaceous.
28	2517-2545	(No sample.) Probably shale as below.
35	2545-2580	Shale, dark-gray, silty, micaceous.
10	2580-2590	Sandstone, medium light gray, very fine grained, slightly silty, micaceous.
10	2590-2600	Siltstone, medium dark gray, argillaceous, micaceous.
41	2600-2641	(No sample.) Probably shale as above.
50	2641-2691	Shale, as above.
17	2691-2708	(No sample.) Probably shale as above.
12	2708-2720	Shale, as above.
14	2720-2734	(No sample.) Probably shale as above.
28	2734-2762	Siltstone, medium dark gray, micaceous.
28	2762-2790	(No sample.) Probably shale as above.
10	2790-2800	Shale, dark-gray, silty, micaceous.
24	2800-2824	Siltstone, medium dark gray, argillaceous, micaceous.
5	2824-2829	(No sample.) Probably siltstone as above.
36	2829-2865	Siltstone, as above.
115	2865-2980	Shale, as above.
160	2980-3140	Shale, dark-gray to black, finely micaceous.
120	3140-3260	Siltstone, medium dark gray, micaceous.
20	3260-3280	Shale, dark-gray, silty, micaceous.
10	3280-3290	Siltstone, medium dark gray, argillaceous, finely micaceous.
55	3290-3345	Shale, dark-gray, silty, finely micaceous.
10	3345-3355	Siltstone, medium-gray, micaceous.
45	3355-3400	Shale, dark-gray, silty, micaceous.
30	3400-3430	Siltstone, medium dark gray, argillaceous, micaceous.
50	3430-3480	Shale, as above.
75	3480-3555	Siltstone, as above.
35	3555-3590	Shale, as above.
30	3590-3620	Siltstone, as above.
45	3620-3665	Shale, as above.
10	3665-3675	Siltstone, as above.
10	3675-3685	Shale, dark-gray, silty, finely micaceous.
3	3685-3688	Shale, pale reddish brown and grayish-yellow, waxy, red pinpoint-size inclusions (bentonite?).
192	3688-3880	Shale, dark-gray, silty, finely micaceous.
10	3880-3890	Siltstone, medium-gray, micaceous.
110	3890-4000	Shale, dark-gray, silty, micaceous.
280	4000-4280	Shale, medium dark-gray, silty, micaceous.
110	4280-4390	Shale, black.
150	4390-4540	Siltstone, medium dark gray, micaceous. Top of unit is thought to be top of zone p.
685	4540-5225	Shale, dark-gray, silty, micaceous.
155	5225-5380	Shale, dark-gray to black.
6	5380-5386	Sandstone, light-gray, very fine to fine-grained, widely scattered rounded medium quartz sand grains, slightly silty, micaceous, plant fossils, slightly porous.
51	5386-5437	Shale, dark-gray to black.
6	5437-5443	Sandstone, medium light gray, very fine to fine-grained, silty, micaceous.
109	5443-5552	Shale, dark-gray, very finely micaceous.
20	5552-5572	Sandstone, medium light gray, very fine to fine-grained, silty, micaceous, plant fossils, porous.
19	5572-5591	Shale, dark-gray to black, micaceous.
9	5591-5600	Sandstone, medium light-gray, very fine to fine-grained, widely scattered rounded medium quartz sand grains, silty, micaceous.
5	5600-5605	Shale, dark-gray, finely micaceous.
45	5605-5650	Siltstone, dark-gray, argillaceous, finely micaceous.
228	5650-5878	Shale, dark-gray, silty, finely micaceous.
5	5878-5883	Sandstone, medium light gray, very fine grained, silty, well-cemented.
3	5883-5886	Shale, black.
4	5886-5890	Sandstone, as above.
30	5890-5920	Shale, black, very finely micaceous.

Section of well 33—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
11	5920-5931	Sandstone, as above.
23	5931-5954	Shale, dark-gray, silty.
2	5954-5956	Sandstone, medium light gray, very fine to fine-grained, slightly silty, micaceous.
34	5956-5990	Shale, dark-gray to black, slightly silty.
107	5990-6097	Sandstone, medium light gray, very fine to fine-grained, widely scattered rounded medium to coarse quartz sand grains, silty, micaceous, glauconite in 6035 to 6040.
72	6097-6169	Shale, dark-gray to black, silty in 6106 to 6108 and 6138 to 6142.
31	6169-6200	Sandstone, medium light gray, very fine to fine-grained, widely scattered rounded medium quartz sand grains, silty, micaceous.
16	6200-6216	Siltstone, dark-gray, finely micaceous.
6	6216-6222	Sandstone, medium light gray, very fine to fine-grained, silty, micaceous.
6	6222-6228	Shale, dark-gray, micaceous.
12	6228-6240	Sandstone, as above.
4	6240-6244	Shale, as above.
3	6244-6247	Sandstone, as above.
3	6247-6250	Shale, as above.
3	6250-6253	Sandstone, medium light gray, very fine to fine-grained, silty.
2	6253-6255	Siltstone, medium dark gray, micaceous, slightly limy.
4	6255-6259	Sandstone, as above.
4	6259-6263	Siltstone, as above.
8	6263-6271	Sandstone, medium light gray, very fine to fine-grained, silty, micaceous.
9	6271-6280	Shale, as above.
4	6280-6284	Sandstone, as above.
6	6284-6290	Shale, dark-gray, silty, micaceous.
2	6290-6292	Sandstone, as above.
8	6292-6300	Shale, as above.
3	6300-6303	Siltstone, medium-gray, micaceous.
17	6303-6320	Shale, as above.
2	6320-6322	Siltstone, as above.
19	6322-6341	Shale, as above.
3	6341-6344	Siltstone, as above.
20	6344-6364	Shale, as above.
4	6364-6368	Siltstone, as above.
3	6368-6371	Shale, as above.
3	6371-6374	Siltstone, as above.
12	6374-6386	Shale, as above.
4	6386-6390	Siltstone, as above.
65	6390-6455	Shale, as above.
10	6455-6465	Sandstone, medium light gray, very fine to fine-grained, silty, well-cemented.
30	6465-6495	Shale, dark-gray, silty.
15	6495-6510	Sandstone, medium light gray, fine-grained, micaceous.
22	6510-6532	Shale, dark-gray, micaceous.
35	6532-6567	Sandstone, medium light gray, very fine to fine-grained, rounded medium quartz sand grains in 6550 to 6567, micaceous, plant fossils, porous.
43	6567-6610	Shale, dark-gray, very finely sandy, silty.
11	6610-6621	Sandstone, medium-gray, very fine grained, silty.
5	6621-6626	Shale, dark-gray.
9	6626-6635	Sandstone, dark-gray, silty, finely micaceous.
18	6635-6653	Shale, dark-gray, silty, finely micaceous.
3	6653-6656	Siltstone, medium-gray.
36	6656-6692	Shale, as above.
3	6692-6695	Siltstone, as above.
20	6695-6715	Shale, as above.
3	6715-6718	Siltstone, as above.
23	6718-6741	Shale, as above.
3	6741-6744	Siltstone, as above.
47	6744-6791	Shale, as above.
3	6791-6794	Siltstone, as above.
57	6794-6851	Shale, as above.
3	6851-6854	Siltstone, as above.
6	6854-6860	Shale, as above.
4	6860-6864	Siltstone, as above.
40	6864-6904	Shale, as above.
3	6904-6907	Siltstone, as above.
35	6907-6942	Shale, as above.

Section of well 33—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
3	6942-6945	Siltstone, as above.
36	6945-6981	Shale, as above.
3	6981-6984	Siltstone, as above.
31	6984-7015	Shale, as above.
4	7015-7019	Siltstone, as above.
66	7019-7085	Shale, as above.
3	7085-7088	Siltstone, as above.
24	7088-7112	Shale, as above.
8	7112-7120	Sandstone, medium light gray, very fine grained, silty, micaceous.
6	7120-7126	Shale, dark-gray.
7	7126-7133	Sandstone, medium light gray, very fine grained, silty, micaceous, quartz crystals.
15	7133-7148	Shale, as above.
3	7148-7151	Sandstone, medium light gray, very fine grained, silty, micaceous.
129	7151-7280	Shale, dark-gray, silty, finely micaceous.
60	7280-7340	Siltstone, medium dark gray, argillaceous, finely micaceous.
45	7340-7385	Shale, dark-gray, finely micaceous.
35	7385-7420	Siltstone, medium-gray, argillaceous.
27	7420-7447	Shale, dark-gray, silty, finely micaceous.
2	7447-7449	Siltstone, medium-gray.
7	7449-7456	Shale, as above.
3	7456-7459	Siltstone, as above.
31	7459-7490	Shale, as above.
3	7490-7493	Siltstone, as above.
20	7493-7513	Shale, as above.
3	7513-7516	Siltstone, as above.
259	7516-7775	Shale, as above.
4	7775-7779	Shale, dark-gray, siliceous, limy.
111	7779-7890	Shale, dark-gray, silty, finely micaceous.
15	7890-7905	Siltstone, medium-gray.
95	7905-8000	Shale, dark-gray, very finely micaceous.
140	8000-8140	Shale, dark-gray to black, very finely micaceous.
290	8140-8430	Shale, dark-gray, slightly silty, finely micaceous.
10	8430-8440	Siltstone, medium dark gray, argillaceous, finely micaceous.
27	8440-8467	Shale, dark-gray, silty.
4	8467-8471	Sandstone, medium-gray, very fine grained, well-cemented.
19	8471-8490	Siltstone, as above.
3	8490-8493	Sandstone, as above.
52	8493-8545	Siltstone, as above.
55	8545-8600	Siltstone, medium dark gray, argillaceous, very finely sandy, micaceous.
20	8600-8620	Shale, dark-gray, finely micaceous.
43	8620-8663	Sandstone, medium-gray, very fine to fine-grained, silty, scattered rounded medium to coarse quartz sand grains, finely to coarsely micaceous.

Total depth: 8,663 ft.

Section of well 30

Nichols Exploration Corporation No. 1 Gann

Sec. 15, T. 5 N., R. 31 W., Sebastian County, Ark. (Drilled approximately 14,000 ft. west of Barber quadrangle, Arkansas.) Elevation: 565 ft.; total depth: 6,005 ft. Rock samples examined and logged by Boyd R. Haley. Upper part of the Atoka Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
140	0- 140	(No sample).
45	140- 185	Shale, dark-gray, silty, finely micaceous, crystals of calcite in 150 to 180.
40	185- 225	Shale, dark-gray, very finely micaceous.
30	225- 255	Shale, dark-gray, silty, very finely micaceous.
35	255- 290	Shale, dark-gray, very finely micaceous.
3	290- 293	Shale, medium- to dark-gray, silty, very finely micaceous; stringers of medium gray very fine grained sandstone.
9	293- 302	Shale, grayish-black, pyrite.
30	302- 332	Shale, dark-gray, slightly silty, finely micaceous.
8	332- 340	Siltstone, medium- to dark-gray, very finely sandy, finely micaceous.
23	340- 363	Shale, dark-gray.
19	363- 382	Siltstone, medium- to dark-gray, finely micaceous.
75	382- 457	Shale, dark-gray, silty to very silty, finely micaceous; reddish-brown shale stringers in 440 to 445.
4	457- 461	Siltstone, dark-gray, very finely sandy, finely micaceous.
8	461- 469	Shale, dark-gray.
1	469- 470	Coal.
1	470- 471	Shale, dark-gray to grayish-black.
6	471- 477	Sandstone, light- to medium-gray, very fine grained, very silty, medium-micaceous, carbonized plant fragments.
18	477- 495	Sandstone, medium- to dark-gray, very fine grained, very silty, medium micaceous.
31	495- 526	Shale, dark-gray, silty, finely micaceous.
4	526- 530	Siltstone, medium- to dark-gray, very finely sandy, medium-micaceous.
9	530- 539	Siltstone, dark-gray, medium-micaceous.
12	539- 551	Sandstone, medium- to dark-gray, very silty, medium-micaceous, very slightly limy, pyritized ostracode.
8	551- 559	Siltstone, dark-gray, medium-micaceous.
5	559- 564	Sandstone, medium- to dark-gray, very silty, medium-micaceous.
2	564- 566	Siltstone, as above.
7	566- 573	Sandstone, as above.
3	573- 576	Siltstone, as above.
5	576- 581	Sandstone, as above.
74	581- 655	Shale, dark-gray, silty, finely micaceous.
10	655- 665	Shale, dark-gray, very finely to finely micaceous.
13	665- 678	Shale, grayish-black, very finely micaceous.
3	678- 681	Siltstone, dark-gray, finely micaceous.
6	681- 687	Shale, as above.
3	687- 690	Siltstone, as above.
9	690- 699	Shale, as above.
66	699- 765	Shale, dark-gray, slightly silty, finely micaceous.
40	765- 805	Shale, grayish-black, very finely micaceous.
9	805- 814	Siltstone, dark-gray, very finely sandy, finely micaceous.
15	814- 829	Shale, dark-gray, silty, finely micaceous.
8	829- 837	Sandstone, medium- to dark-gray, very fine grained, very silty, finely micaceous, very slightly limy.
7	837- 844	Shale, as above.
11	844- 855	Sandstone, as above.
2	855- 857	Shale, as above.
10	857- 867	Sandstone, light- to medium-gray, very fine grained, silty, medium-micaceous, very slightly limy.
9	867 876	Siltstone, dark-gray, finely micaceous.
4	876- 880	Sandstone, medium-gray, very fine grained, silty, finely micaceous.
6	880- 886	Siltstone, as above.
19	886- 905	Sandstone, light- to medium-gray, very fine grained, silty, finely micaceous, very slightly limy.
6	905- 911	Siltstone, dark-gray, very finely sandy, medium micaceous.
14	911- 925	Sandstone, medium- to dark-gray, very fine grained, very silty, medium micaceous, coal streaks.
3	925- 928	Shale, dark-gray.

Section of Well 30—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
11	928- 939	Sandstone, medium-gray, very fine grained, silty, medium-micaceous, very slightly limy.
11	939- 950	Siltstone, dark-gray, finely micaceous.
10	950- 960	Sandstone, medium- to dark-gray, very fine grained, very silty, finely micaceous.
2	960- 962	Siltstone, as above.
8	962- 970	Sandstone, as above.
5	970- 975	Siltstone as above.
5	975- 980	Sandstone, dark-gray, very fine grained, very silty, medium-micaceous.
20	980-1000	Shale, dark-gray, slightly silty, finely to medium-micaceous.
9	1000-1009	Sandstone, light- to medium-gray, very fine grained, very silty, medium-micaceous.
1	1009-1010	Shale, as above.
4	1010-1014	Sandstone, as above.
2	1014-1016	Shale, as above.
10	1016-1026	Sandstone, as above.
4	1026-1030	Siltstone, dark-gray, finely micaceous.
10	1030-1040	(No sample.)
3	1040-1043	Shale, dark-gray, silty, finely micaceous.
11	1043-1054	Sandstone, medium-gray, very fine grained, silty, finely micaceous.
6	1054-1060	Shale, as above.
2	1060-1062	Sandstone, as above.
10	1062-1072	Shale, dark-gray, finely micaceous.
10	1072-1082	Sandstone, light- to medium-gray, very fine grained, very silty, finely micaceous.
7	1082-1089	Shale, dark-gray, silty, medium micaceous.
1	1089-1090	Sandstone, medium- to dark-gray, very fine grained, very silty, finely to medium micaceous.
3	1090-1093	Siltstone, medium-to dark-gray, finely to medium-micaceous.
3	1093-1096	Sandstone, as above.
4	1096-1100	Siltstone, as above.
4	1100-1104	Sandstone, as above.
22	1104-1126	Siltstone, dark-gray, finely to medium-micaceous.
4	1126-1130	Sandstone, medium-gray, very fine grained, very silty, finely micaceous.
5	1130-1135	Shale, dark-gray, silty, finely micaceous.
10	1135-1145	Siltstone, dark-gray, very finely sandy, finely micaceous.
55	1145-1200	Shale, dark-gray, silty, finely micaceous.
60	1200-1260	(No sample.)
60	1260-1320	Shale, dark-gray, finely micaceous.
48	1320-1368	Shale, grayish-black, very finely micaceous.
35	1368-1403	Shale, grayish-black.
5	1403-1408	Siltstone, dark-gray.
20	1408-1428	Shale, as above.
4	1428-1432	Siltstone, medium- to dark-gray, very finely sandy, finely micaceous.
8	1432-1440	Shale, grayish black, finely micaceous.
6	1440-1446	Sandstone, medium- to dark-gray, very fine grained, very silty, finely micaceous.
3	1446-1449	Shale, dark-gray, silty.
11	1449-1460	Sandstone, as above.
10	1460-1470	Siltstone, medium- to dark-gray, very finely sandy, finely micaceous.
7	1470-1477	Shale, dark-gray, silty, finely micaceous.
17	1477-1494	Sandstone, dark-gray, very fine grained, silty finely to medium micaceous.
1	1494-1495	Shale, as above.
5	1495-1500	Sandstone, as above.
7	1500-1507	Shale, as above.
3	1507-1510	Siltstone, medium-gray, very finely sandy, finely micaceous.
6	1510-1516	Shale, as above.
4	1516-1520	Sandstone, medium-gray, very fine grained, silty, finely micaceous.
10	1520-1530	Sandstone, light- to medium-gray, fine-grained, slightly silty.
8	1530-1538	Shale, as above.
13	1538-1551	Sandstone, light- to medium-gray, fine-grained, scattered rounded medium quartz sand grains, slightly silty, medium-micaceous.
14	1551-1565	Shale, dark-gray, silty, finely micaceous.
3	1565-1568	Sandstone, medium-gray, very fine grained, very silty, finely to medium micaceous.
2	1568-1570	Shale, as above.
9	1570-1579	Sandstone, as above.
31	1579-1610	Siltstone, dark-gray, finely micaceous, very finely sandy in 1588 to 1595.
40	1610-1650	Shale, dark-gray, slightly silty, finely micaceous.
22	1650-1672	Siltstone, medium-gray, very finely sandy, finely micaceous.

Section of Well 30—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
3	1672-1675	Shale, grayish-black.
5	1675-1680	Siltstone, as above.
8	1680-1688	Siltstone, dark-gray, finely micaceous.
2	1688-1690	Shale, as above.
8	1690-1698	Siltstone, dark-gray, very finely sandy, finely micaceous.
2	1698-1700	Shale, as above.
3	1700-1703	Siltstone, dark-gray, finely micaceous.
2	1703-1705	Shale, as above.
10	1705-1715	Siltstone, dark-gray, slightly very finely sandy, finely micaceous.
3	1715-1718	Shale, as above.
3	1718-1721	Siltstone, dark-gray, finely micaceous.
5	1721-1726	Siltstone, dark-gray, slightly very finely sandy, finely micaceous.
2	1726-1728	Shale, as above.
7	1728-1735	Siltstone, dark-gray, very finely micaceous.
2	1735-1737	Shale, as above.
120	1737-1857	Shale, dark-gray, slightly silty to silty, very finely micaceous.
31	1857-1888	Shale, dark-gray, very finely micaceous.
79	1888-1967	Shale, grayish-black.
4	1967-1971	Sandstone, medium-gray, very fine grained, silty, well-cemented.
4	1971-1975	Shale, dark-gray, very finely micaceous.
5	1975-1980	Siltstone, medium-gray, very finely sandy, finely micaceous.
3	1980-1983	Shale, as above.
7	1983-1990	Sandstone, light-gray, very fine grained, slightly silty.
6	1990-1996	Sandstone, light-gray, fine-grained, drills free.
2	1996-1998	Shale, as above.
4	1998-2002	Sandstone, light-gray, very fine to fine grained, well-cemented.
4	2002-2006	Shale, as above.
7	2006-2013	Sandstone, as above.
6	2013-2019	Sandstone, medium-gray, very fine grained, very silty, finely micaceous.
11	2019-2030	Siltstone, dark-gray, very finely micaceous.
5	2030-2035	Sandstone, light-gray, fine grained, drills free.
2	2035-2037	Shale, dark-gray, very finely micaceous.
17	2037-2054	Sandstone, medium-gray, very fine grained, very silty, very finely micaceous.
19	2054-2073	Shale, dark-gray, slightly silty, very finely micaceous.
28	2073-2101	Siltstone, medium-gray, very finely sandy, finely micaceous.
14	2101-2115	Shale, as above.
5	2115-2120	Sandstone, light-gray, fine-grained, drills free.
6	2120-2126	Shale, as above.
12	2126-2138	Siltstone, medium-gray, finely micaceous.
5	2138-2143	Siltstone, dark-gray, very finely sandy.
2	2143-2145	Shale, dark-gray, silty, very finely micaceous.
5	2145-2150	Siltstone, dark-gray, very finely micaceous.
3	2150-2153	Siltstone, dark-gray, very finely sandy.
4	2153-2157	Sandstone, dark-gray, very fine grained, very silty, finely micaceous.
18	2157-2175	Siltstone, as above.
2	2175-2177	Shale, as above.
5	2177-2182	Sandstone, as above.
2	2182-2184	Shale, as above.
8	2184-2192	Sandstone, as above.
4	2192-2196	Shale, as above.
3	2196-2199	Sandstone, as above.
2	2199-2201	Shale, as above.
3	2201-2204	Sandstone, as above.
6	2204-2210	Shale, as above.
3	2210-2213	Siltstone, as above.
7	2213-2220	Shale, as above.
2	2220-2222	Sandstone, as above.
2	2222-2224	Shale, as above.
4	2224-2228	Sandstone, as above.
2	2228-2230	Shale, as above.
2	2230-2232	Siltstone, as above.
4	2232-2236	Shale, as above.
4	2236-2240	Siltstone, as above.
40	2240-2280	(No sample).

Section of Well 30—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
6	2280-2286	Siltstone, medium-gray, finely micaceous.
2	2286-2288	Shale, dark-gray, very finely micaceous.
6	2288-2294	Siltstone, as above.
2	2294-2296	Shale, as above.
4	2296-2300	Siltstone, as above.
6	2300-2306	Shale, dark-gray, slightly silty, finely micaceous.
2	2306-2308	Shale, grayish-black, very finely micaceous.
3	2308-2311	Shale, dark-gray, slightly silty, finely micaceous.
26	2311-2337	Shale, grayish-black, very finely micaceous.
7	2337-2344	Shale, dark-gray, slightly silty, very finely micaceous.
2	2344-2346	Shale, grayish-black, very finely micaceous.
4	2346-2350	Shale, dark-gray, slightly silty, very finely micaceous.
70	2350-2420	Shale, dark-gray to grayish-black, very finely micaceous.
8	2420-2428	Sandstone, light-gray, very fine to fine-grained, scattered subrounded medium quartz sand grains. Top of unit is top of zone w.
5	2428-2433	Sandstone, light-gray, very fine to fine-grained, silty, drills free.
2	2433-2435	Shale, dark-gray, very finely micaceous.
5	2435-2440	Sandstone, as above.
2	2440-2442	Shale, as above.
4	2442-2446	Sandstone, light-gray, very fine to fine-grained, scattered rounded medium quartz sand grains, drills free.
4	2446-2450	Shale, as above.
4	2450-2454	Sandstone, very light gray, very fine to fine-grained.
2	2454-2456	Shale, as above.
13	2456-2469	Sandstone, light-gray, very fine to fine-grained, slightly silty, finely micaceous.
4	2469-2473	Shale, as above.
9	2473-2482	Sandstone, very light gray, very fine to fine-grained.
2	2482-2484	Shale, as above.
10	2484-2494	Sandstone, light-gray, fine-grained, drills free.
2	2494-2496	Shale, as above.
5	2496-2501	Sandstone, light-gray, very fine grained, very silty, finely micaceous.
6	2501-2507	Shale, dark-gray, silty, finely micaceous.
4	2507-2511	Sandstone, as above.
5	2511-2516	Shale, as above.
6	2516-2522	Sandstone, as above.
3	2522-2525	Shale, as above.
6	2525-2531	Sandstone, as above.
3	2531-2534	Shale, as above.
6	2534-2540	Sandstone, light-gray, very fine to fine-grained, silty.
10	2540-2550	Sandstone, very light gray, fine-grained, drills free.
2	2550-2552	Shale, as above.
18	2552-2570	Sandstone, very light gray, fine-grained, abundant subrounded medium quartz sand grains, drills free.
8	2570-2578	Sandstone, very light gray, very fine to fine-grained, drills free.
8	2578-2586	Sandstone, very light gray, fine-grained, drills free.
6	2586-2592	Shale, grayish-black, very finely micaceous.
5	2592-2597	Sandstone, light-gray, very fine to fine-grained, drills free.
15	2597-2612	Sandstone, light-gray, very fine grained, slightly silty.
18	2612-2630	Sandstone, very light gray, very fine to fine-grained, drills free.
10	2630-2640	Sandstone, very light gray, fine-grained, scattered subrounded medium quartz sand grains, drills free.
2	2640-2642	Shale, dark-gray, very finely micaceous.
8	2642-2650	Sandstone, light-gray, very fine grained, silty.
2	2650-2652	Shale, as above.
16	2652-2668	Sandstone, light-gray, very fine to fine-grained, slightly silty, well-cemented.
3	2668-2671	Shale, as above.
5	2671-2676	Sandstone, as above.
3	2676-2679	Shale, as above.
11	2679-2690	Sandstone, light- to medium-gray, very fine to fine-grained.
2	2690-2692	Shale, as above.
8	2692-2700	Sandstone, medium-gray, very fine to fine-grained, silty.
2	2700-2702	Shale, as above.
14	2702-2716	Sandstone, medium-gray, very fine grained, silty.
6	2716-2722	Shale, dark-gray, silty, very finely micaceous.
8	2722-2730	Siltstone, medium-gray, very finely sandy, finely micaceous.

Section of Well 30—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
5	2730-2735	Shale, grayish-black, very finely micaceous.
17	2735-2752	Sandstone, medium-gray, very fine grained, very silty, finely micaceous.
3	2752-2755	Shale, dark-gray, slightly silty, very finely micaceous.
8	2755-2763	Siltstone, medium- to dark-gray, very finely sandy, finely micaceous.
42	2763-2805	Shale, as above.
19	2805-2824	Siltstone, as above.
8	2824-2832	Sandstone, medium-gray, very fine grained, very silty, very finely micaceous.
2	2832-2834	Shale, as above.
14	2834-2848	Sandstone, medium-gray, very fine to fine-grained, slightly silty, drills free.
2	2848-2850	Shale, as above.
7	2850-2857	Sandstone, light-gray, very fine grained, well-cemented.
24	2857-2881	Sandstone, light- to medium-gray, very fine grained, slightly silty.
2	2881-2883	Shale, as above.
17	2883-2900	Sandstone, medium-gray, very fine grained, silty. Base of unit is base of zone w.
11	2900-2911	Siltstone, medium-gray, finely micaceous, well-cemented.
4	2911-2915	Shale, dark-gray, very finely micaceous.
21	2915-2936	Siltstone, as above.
2	2936-2938	Shale, as above.
12	2938-2950	Siltstone, as above.
3	2950-2953	Shale, as above.
16	2953-2969	Siltstone, as above.
31	2969-3000	Shale, dark-gray, silty to very silty, very finely micaceous.
27	3000-3027	Siltstone, medium-gray, very finely micaceous.
3	3027-3030	Shale, dark-gray, silty, very finely micaceous.
24	3030-3054	Siltstone, as above.
2	3054-3056	Shale, as above.
10	3056-3066	Siltstone, as above.
5	3066-3071	Shale, as above.
17	3071-3088	Siltstone, as above.
2	3088-3090	Shale, as above.
8	3090-3098	Siltstone, as above.
2	3098-3100	Shale, as above.
5	3100-3105	Siltstone, as above.
1	3105-3106	Shale, as above.
12	3106-3118	Siltstone, as above.
2	3118-3120	Shale, as above.
9	3120-3129	Siltstone, as above.
2	3129-3131	Shale, as above.
5	3131-3136	Siltstone, as above.
4	3136-3140	Siltstone, medium-gray, very finely sandy, very finely micaceous.
4	3140-3144	Siltstone, medium-gray, very finely micaceous.
1	3144-3145	Shale, as above.
5	3145-3150	Siltstone, as above.
5	3150-3155	Siltstone, medium-gray, slightly very finely sandy, very finely micaceous.
5	3155-3160	Siltstone, medium-gray, very finely micaceous.
6	3160-3166	Siltstone, medium-gray, slightly very finely sandy, very finely micaceous.
2	3166-3168	Shale, as above.
5	3168-3173	Siltstone, medium-gray, very finely sandy, very finely micaceous.
7	3173-3180	Siltstone, medium-gray, very finely micaceous.
3	3180-3183	Siltstone, medium-gray, very finely sandy, very finely micaceous.
39	3183-3222	Siltstone, medium-gray, very finely micaceous.
2	3222-3224	Shale, as above.
7	3224-3231	Siltstone, as above.
2	3231-3233	Shale, as above.
8	3233-3241	Siltstone, as above.
6	3241-3247	Siltstone, medium-gray, slightly very finely sandy; very finely micaceous.
18	3247-3265	Siltstone, medium-gray, very finely micaceous.
5	3265-3270	Siltstone, medium-gray, very finely sandy, very finely micaceous.
15	3270-3285	Siltstone, medium-gray, very finely micaceous.
5	3285-3290	Siltstone, medium-gray, very finely sandy, very finely micaceous.
15	3290-3305	Siltstone, medium-gray, very finely micaceous.
5	3305-3310	Siltstone, medium-gray, slightly very finely sandy, very finely micaceous.
38	3310-3348	Siltstone, medium-gray, very finely micaceous.
2	3348-3350	Shale, as above.
12	3350-3362	Siltstone, as above.

Section of Well 30—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
2	3362-3364	Shale, as above.
19	3364-3383	Siltstone, as above.
2	3383-3385	Shale, as above.
5	3385-3390	Siltstone, as above.
7	3390-3397	Sandstone, light-gray, very fine-grained, very silty, very finely micaceous.
3	3397-3400	Shale, as above.
7	3400-3407	Siltstone, as above.
1	3407-3408	Shale, as above.
3	3408-3411	Siltstone, as above.
1	3411-3412	Shale, as above.
18	3412-3430	Siltstone, as above.
5	3430-3435	Siltstone, medium-gray, slightly very finely sandy, very finely micaceous.
2	3435-3437	Shale, as above.
7	3437-3444	Siltstone, medium gray, very finely micaceous.
3	3444-3447	Shale, black, very carbonaceous.
5	3447-3452	Siltstone, as above.
1	3452-3453	Shale, dark-gray, very finely micaceous.
15	3453-3468	Siltstone, as above.
1	3468-3469	Shale, grayish-black, very finely micaceous.
11	3469-3480	Siltstone, as above.
2	3480-3482	Shale, as above.
6	3482-3488	Siltstone, as above.
2	3488-3490	Shale, as above.
24	3490-3514	Siltstone, as above.
1	3514-3515	Shale, dark-gray, very finely micaceous.
6	3515-3521	Siltstone, as above.
1	3521-3522	Shale, as above.
13	3522-3535	Siltstone, as above.
1	3535-3536	Shale, as above.
5	3536-3541	Siltstone, as above.
1	3541-3542	Shale, as above.
29	3542-3571	Siltstone, as above.
34	3571-3605	Shale, medium- to dark-gray, silty to very silty, very finely to finely micaceous.
12	3605-3617	Shale, dark-gray, slightly silty, very finely micaceous.
10	3617-3627	Siltstone, medium-gray, very finely micaceous.
1	3627-3628	Shale, dark-gray, very finely micaceous.
11	3628-3639	Siltstone, as above.
1	3639-3640	Shale, as above.
13	3640-3653	Siltstone, as above.
10	3653-3663	Sandstone, medium-gray, very fine grained, very silty, very finely micaceous
21	3663-3684	Shale, dark-gray, silty, very finely micaceous.
26	3684-3710	Siltstone, as above.
3	3710-3713	Shale, as above.
9	3713-3722	Sandstone, light- to medium-gray, very fine grained, very silty, very finely to finely micaceous.
8	3722-3730	Shale, as above.
33	3730-3763	Sandstone, as above.
5	3763-3768	Shale, as above.
4	3768-3772	Sandstone, as above.
2	3772-3774	Shale, as above.
5	3774-3779	Siltstone, medium-gray, finely micaceous.
1	3779-3780	Shale, dark-gray, silty, finely micaceous.
10	3780-3790	Siltstone, as above.
1	3790-3791	Shale, as above.
6	3791-3797	Siltstone, as above.
1	3797-3798	Shale, as above.
7	3798-3805	Siltstone, as above.
5	3805-3810	Shale, as above.
3	3810-3713	Siltstone, as above
2	3813-3815	Shale, as above
5	3815-3820	Siltstone, medium-gray, very finely sandy, finely micaceous.
2	3820-3822	Shale, as above.
7	3822-3829	Siltstone, as above.
11	3829-3840	Shale, as above.
3	3840-3843	Siltstone, as above.

Section of Well 30—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
2	3843-3845	Shale, as above.
5	3845-3850	Siltstone, light-gray, very finely sandy, finely micaceous.
9	3850-3859	Siltstone, medium-gray, finely micaceous.
6	3859-3865	Shale, as above.
14	3865-3879	Siltstone, light- to medium-gray, very finely sandy, finely micaceous.
15	3879-3894	Shale, medium- to dark-gray, very silty, finely micaceous.
6	3894-3900	Siltstone, light- to medium-gray, finely micaceous, well-cemented.
6	3900-3906	Siltstone, medium-gray, finely micaceous.
1	3906-3907	Shale, dark-gray, very silty.
10	3907-3917	Siltstone, as above.
2	3917-3919	Shale, as above.
6	3919-3925	Siltstone, as above.
10	3925-3935	Siltstone, light- to medium-gray, very finely sandy, finely micaceous.
5	3935-3940	Sandstone, light-gray, very fine grained, silty, finely to medium micaceous.
6	3940-3946	Siltstone, medium-gray, very finely sandy, finely micaceous.
86	3946-4032	Shale, dark-gray, silty, finely micaceous.
9	4032-4041	Shale, medium- to dark-gray, very silty, finely micaceous.
30	4041-4071	Siltstone, medium-gray, finely micaceous.
51	4071-4122	Shale, dark-gray, silty to very silty, finely micaceous.
6	4122-4128	Siltstone, light-gray, finely micaceous, well-cemented.
4	4128-4132	Shale, as above.
10	4132-4142	Sandstone, very light gray, very fine grained, very silty, finely micaceous, well-cemented.
10	4142-4152	Shale, dark-gray, silty, finely micaceous.
12	4152-4164	Siltstone, medium-gray, finely micaceous.
2	4164-4166	Shale, as above.
15	4166-4181	Siltstone, as above.
1	4181-4182	Shale, as above.
8	4182-4190	Sandstone, light-gray, very fine grained, silty, finely micaceous, well-cemented.
8	4190-4198	Siltstone, medium-gray.
2	4198-4200	Shale, as above.
5	4200-4205	Siltstone, as above.
7	4205-4212	Siltstone, light-gray, very finely sandy, finely micaceous, well-cemented.
3	4212-4215	Shale, dark-gray, silty, finely micaceous.
6	4215-4221	Siltstone, as above.
2	4221-4223	Shale, as above.
17	4223-4240	Siltstone, as above.
5	4240-4245	Shale, as above.
5	4245-4250	Siltstone, as above.
10	4250-4260	(No sample.)
6	4260-4266	Siltstone, as above.
71	4266-4337	Shale, dark-gray to grayish-black.
3	4337-4340	Siltstone, medium-gray, very finely sandy, finely micaceous.
11	4340-4351	Siltstone, medium-gray, finely micaceous.
1	4351-4352	Shale, dark-gray to grayish-black, very finely micaceous.
4	4352-4356	Siltstone, medium- to dark-gray, finely micaceous.
5	4356-4361	Shale, as above.
9	4361-4370	Siltstone, as above.
2	4370-4372	Shale, as above.
11	4372-4383	Siltstone, as above.
2	4383-4385	Shale, as above.
11	4385-4396	Siltstone, as above.
1	4396-4397	Shale, as above.
15	4397-4412	Siltstone, as above.
4	4412-4416	Shale, as above.
13	4416-4429	Siltstone, as above.
6	4429-4435	Shale, as above.
5	4435-4440	Sandstone, light-gray, very fine grained, silty, well-cemented.
6	4440-4446	Shale, dark-gray, finely micaceous.
3	4446-4449	Siltstone, medium-gray, slightly very finely sandy, very finely micaceous.
3	4449-4452	Shale, as above.
7	4452-4459	Sandstone, light- to medium-gray, very fine grained, very silty, finely micaceous
3	4459-4462	Shale, as above.
10	4462-4472	Sandstone, as above.
3	4472-4475	Shale, as above.
9	4475-4484	Siltstone, medium-gray, very finely sandy, finely micaceous.

Section of Well 30—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
6	4484-4490	Shale, dark-gray, silty, very finely micaceous.
8	4490-4498	Siltstone, medium-gray, finely micaceous.
5	4498-4503	Shale, as above.
7	4503-4510	Siltstone, as above.
16	4510-4526	Shale, dark-gray, very silty, finely micaceous.
22	4526-4548	Siltstone, medium-gray, very finely micaceous.
66	4548-4614	Shale, dark-gray, silty to very silty, very finely micaceous.
26	4614-4640	Siltstone, as above.
40	4640-4680	Shale, dark-gray, silty, very finely micaceous.
20	4680-4700	(No sample.)
5	4700-4705	Shale, grayish-black.
5	4705-4710	Shale, dark-gray, silty, very finely micaceous.
30	4710-4740	(No sample.)
4	4740-4744	Shale, as above.
2	4744-4746	Shale, grayish-black.
8	4746-4754	Shale, dark-gray, silty, very finely micaceous.
11	4754-4765	Shale, grayish-black.
8	4765-4773	Siltstone, medium-gray, slightly very finely sandy, finely micaceous.
2	4773-4775	Shale, as above.
5	4775-4780	Shale, dark-gray, silty, very finely micaceous.
2	4780-4782	Shale, grayish-black.
10	4782-4792	Shale, dark-gray, silty, very finely micaceous.
1	4792-4793	Shale, grayish-black.
5	4793-4798	Shale, dark-gray, silty, very finely micaceous.
3	4798-4801	Shale, grayish-black.
7	4801-4808	Siltstone, medium-gray, slightly silty, finely micaceous.
2	4808-4810	Shale, dark-gray, very finely micaceous.
5	4810-4815	Siltstone, as above.
12	4815-4827	Shale, as above.
12	4827-4839	Shale, grayish-black.
17	4839-4856	Siltstone, medium- to dark-gray, very finely micaceous.
13	4856-4869	Shale, grayish-black, very finely micaceous.
82	4869-4951	Shale, dark-gray, slightly silty to silty, very finely micaceous.
9	4951-4960	Siltstone, light-gray, very finely sandy, finely micaceous.
10	4960-4970	Shale, as above.
8	4970-4978	Siltstone, dark-gray, very finely micaceous.
2	4978-4980	Shale, grayish-black, very finely micaceous.
11	4980-4991	Siltstone, as above.
1	4991-4992	Shale, as above.
6	4992-4998	Siltstone, as above.
1	4998-4999	Shale, as above.
2	4999-5001	Siltstone, as above.
4	5001-5005	Shale, as above.
5	5005-5010	Siltstone, as above.
40	5010-5050	Shale, dark-gray, silty, very finely micaceous.
29	5050-5079	Siltstone, light- to medium-gray, slightly very finely sandy, finely micaceous.
2	5079-5081	Shale, dark-gray, silty, very finely micaceous.
9	5081-5090	Siltstone, medium-gray, very finely micaceous.
2	5090-5092	Shale, as above.
3	5092-5095	Siltstone, as above.
2	5095-5097	Shale, as above.
4	5097-5101	Siltstone, as above.
1	5101-5102	Shale, as above.
15	5102-5117	Siltstone, as above.
19	5117-5136	Shale, grayish-black.
12	5136-5148	Siltstone, dark-gray, finely to medium micaceous.
4	5148-5152	Shale, dark-gray, very finely micaceous.
8	5152-5160	Siltstone, medium- to dark-gray, finely to medium-micaceous.
2	5160-5162	Shale, as above.
3	5162-5165	Siltstone, as above.
2	5165-5167	Shale, as above.
6	5167-5173	Siltstone, as above.
2	5173-5175	Shale, as above.
6	5175-5181	Siltstone, as above.
5	5181-5186	Shale, as above.

Section of Well 30—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
7	5186-5193	Siltstone, as above.
2	5193-5195	Shale, as above.
10	5195-5205	Siltstone, as above, pyrite.
1	5205-5206	Shale, as above.
12	5206-5218	Siltstone, as above.
4	5218-5222	Shale, as above.
9	5222-5231	Siltstone, as above.
1	5231-5232	Shale, as above.
8	5232-5240	Siltstone, as above.
2	5240-5242	Shale, as above.
6	5242-5248	Siltstone, as above.
1	5248-5249	Shale, as above.
3	5249-5252	Siltstone, as above.
11	5252-5263	Shale, grayish-black, very finely micaceous.
7	5263-5270	Shale, dark-gray, very finely micaceous, pyrite.
3	5270-5273	Shale, grayish-black, very finely micaceous.
5	5273-5278	Shale, dark-gray, very finely micaceous.
12	5278-5290	Shale, grayish-black, very finely micaceous.
8	5290-5298	Shale, dark-gray, very finely micaceous.
4	5298-5302	Shale, grayish-black, very finely micaceous, pyrite.
18	5302-5320	Shale, dark-gray, very finely micaceous.
78	5320-5398	Shale, dark-gray, slightly silty, finely micaceous.
220	5398-5618	Shale, grayish-black, pyrite in 5420 to 5460, 5510 to 5520, 5540 to 5550, and 5560 to 5610.
145	5618-5763	Shale, dark-gray, slightly silty, very finely micaceous, pyrite in 5620 to 5630, 5680-5690, and 5700 to 5720.
7	5763-5770	Sandstone, light- to medium-gray, very fine grained, very silty, finely micaceous. Top of unit is top of zone p.
10	5770-5780	(No sample.)
9	5780-5789	Sandstone, light-gray, very fine to fine-grained, scattered angular medium quartz sand grains, finely micaceous.
2	5789-5791	Shale, dark-gray, very finely micaceous.
16	5791-5807	Sandstone, light-gray, fine-grained, scattered subangular medium quartz sand grains, medium micaceous.
6	5807-5813	Sandstone, medium-gray, very fine grained, silty, finely micaceous.
7	5813-5820	Shale, as above.
14	5820-5834	Sandstone, very light gray, very fine to fine-grained, drills free.
5	5834-5839	Shale, as above.
14	5839-5853	Sandstone, medium-gray, very fine grained, very silty, finely micaceous.
7	5853-5860	Shale, as above.
8	5860-5868	Sandstone, medium-gray, very fine grained, scattered rounded fine to medium quartz sand grains, very silty, finely micaceous.
9	5868-5877	Shale, as above.
3	5877-5880	Sandstone, medium-gray, very fine grained, very silty, finely micaceous.
1	5880-5881	Shale, as above.
7	5881-5888	Sandstone, light-gray, very fine to fine-grained, very silty, medium micaceous.
2	5888-5890	Shale, as above.
7	5890-5897	Sandstone, light-gray, very fine to fine-grained, silty.
9	5897-5906	Shale, grayish-black.
4	5906-5910	Siltstone, dark-gray, very finely micaceous.
95	5910-6005	Shale, as above.
		Total depth: 6005.

Section of well 23

Reynolds Mining Corp. No. 1 E. C. Tomlin

Sec. 33, T. 6 N., R. 30 W., Sebastian County, Ark. Elevation: 717 ft.; total depth: 9,540 ft. Rock samples examined and logged by Boyd R. Haley. Middle and lower part of Atoka Formation and upper part of Morrow Series.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
5	0- 5	(No sample.)
18	5- 23	Shale, dark-gray, silty, very finely micaceous.
10	23- 33	Siltstone, light-gray, very finely sandy, very finely micaceous.
19	33- 52	Sandstone, light-gray, very fine grained, silty, finely micaceous.
20	52- 72	Silstone, dark-gray, very finely micaceous.
10	72- 82	Shale, dark-gray, very silty, very finely micaceous.
8	82- 90	Sandstone, light-gray, very fine grained, silty, slightly limy, finely micaceous, trace of glauconite.
13	90- 103	Siltstone, medium-gray, very finely sandy, well-cemented.
27	103- 130	Shale, grayish-black.
50	130- 180	(No sample.)
9	180- 189	Sandstone, light-gray, very fine grained, very silty, slightly limy, finely micaceous, pyrite.
1	189- 190	Shale, dark-gray, very finely micaceous.
5	190- 195	Sandstone, as above.
25	195- 220	Shale, as above.
8	220- 228	Siltstone, light- to medium-gray, very finely sandy, finely micaceous.
4	228- 232	Shale, as above.
8	232- 240	Siltstone, as above.
22	240- 262	Shale, dark-gray, silty, very finely micaceous.
7	262- 269	Siltstone, as above.
11	269- 280	Shale, grayish-black, very finely micaceous.
5	280- 285	Siltstone, dark-gray.
6	285- 291	Shale, as above.
5	291- 296	Siltstone, as above.
3	296- 299	Shale, as above.
3	299- 302	Siltstone, as above.
2	302- 304	Shale, as above.
11	304- 315	Shale, dark-gray, silty, very finely micaceous.
28	315- 343	Shale, grayish-black, very finely micaceous.
7	343- 350	Shale, dark-gray, silty, very finely micaceous.
11	350- 361	Siltstone, dark-gray, very finely micaceous.
3	361- 364	Shale, dark-gray to grayish-black.
9	364- 373	Siltstone, dark-gray, slightly very finely sandy, very finely micaceous.
2	373- 375	Shale, as above.
5	375- 380	Siltstone, as above.
2	380- 382	Shale, as above.
6	382- 388	Siltstone, as above.
5	388- 393	Shale, as above.
12	393- 405	Sandstone, light-gray, very fine grained, silty, slightly limy, very finely micaceous, pyrite.
6	405- 411	Siltstone, dark-gray, very finely micaceous.
8	411- 419	Siltstone, light- to medium-gray, very finely sandy, very finely micaceous.
6	419- 425	Siltstone, dark-gray, very finely sandy.
6	425- 431	Siltstone, light- to medium-gray, very finely sandy, very finely micaceous.
5	431- 436	Siltstone, dark-gray, very finely micaceous.
4	436- 440	Siltstone, light-gray, very finely sandy, very finely micaceous.
2	440- 442	Siltstone, dark-gray, very finely micaceous.
8	442- 450	Siltstone, light- to medium-gray, very finely sandy, very finely micaceous.
19	450- 469	Shale, dark-gray to grayish-black, very finely micaceous.
1	469- 470	Siltstone, dark-gray, finely micaceous.
2	470- 472	Shale, grayish-black.
12	472- 484	Siltstone, as above.
2	484- 486	Shale, as above.
18	486- 504	Siltstone, as above.
4	504- 508	Shale, as above.
32	508- 540	Siltstone, dark-gray, very finely sandy, very finely micaceous.
10	540- 550	Sandstone, light-gray, very fine grained, silty, very slightly limy, finely to medium micaceous.

Section of well 23—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
10	550- 560	Shale, dark-gray, very finely micaceous.
37	560- 597	Shale, dark-gray, silty, very finely micaceous.
58	597- 655	Shale, grayish-black, very finely micaceous.
5	655- 660	Sandstone, light-gray, very fine grained, very silty, finely micaceous.
10	660- 670	(No sample.)
46	670- 716	Sandstone, as above.
4	716- 720	Shale, dark-gray, silty, finely micaceous.
20	720- 740	Siltstone, light-gray, very finely sandy, finely micaceous.
20	740- 760	(No sample.)
14	760- 774	Shale, as above.
39	774- 813	Shale, grayish-black, very finely micaceous.
26	813- 839	Siltstone, dark-gray, finely micaceous.
16	839- 855	Shale, as above.
25	855- 880	Siltstone, dark-gray, very finely micaceous.
40	880- 920	Shale, dark-gray, silty, very finely micaceous.
2	920- 922	Shale, grayish-black, very finely micaceous.
5	922- 927	Shale, dark-gray, silty, very finely micaceous.
12	927- 939	Shale, grayish-black, very finely micaceous.
4	939- 943	Shale, dark-gray, silty, very finely micaceous.
8	943- 951	Shale, grayish-black, very finely micaceous.
70	951-1021	Shale, dark-gray, slightly silty to silty, very finely micaceous.
6	1021-1027	Shale, grayish-black, very finely micaceous.
61	1027-1088	Shale, dark-gray, slightly silty to silty, very finely micaceous.
48	1088-1136	Shale, grayish-black, very finely micaceous.
34	1136-1170	Siltstone, medium-gray, finely micaceous.
12	1170-1182	Sandstone, very light gray, very fine grained, very silty, very finely micaceous.
4	1182-1186	Shale, as above.
19	1186-1205	Sandstone, as above.
7	1205-1212	Siltstone, as above.
34	1212-1246	Shale, dark-gray, silty, finely micaceous.
848	1246-2094	Shale, grayish-black, pyrite in 1320 to 1330, 1340 to 1350, 1360 to 1370, 1380 to 1390, 1410 to 1440, 1720 to 1730, 1740 to 1760, and 2020 to 2030.
10	2094-2104	Sandstone, light-gray, very fine grained, very silty. Top of unit is top of zone p.
8	2104-2112	Sandstone, light-gray, fine-grained, abundant rounded medium sand grains.
23	2112-2135	Shale, as above.
14	2135-2149	Siltstone, medium-gray, very finely to finely sandy.
40	2149-2189	Shale, as above.
14	2189-2203	Sandstone, very light gray, fine-grained, scattered subrounded medium sand grains, medium micaceous.
17	2203-2220	Shale, dark-gray, silty, very finely micaceous.
10	2220-2230	Siltstone, medium-gray, very finely sandy.
21	2230-2251	Siltstone, medium- to dark-gray.
55	2251-2306	Shale, dark-gray, silty, very finely micaceous.
64	2306-2370	Shale, dark-gray, very finely micaceous.
80	2370-2450	Shale, dark-gray, silty, very finely micaceous.
50	2450-2500	Shale, dark-gray, very finely micaceous.
30	2500-2530	Shale, grayish-black, very finely micaceous, pyrite.
20	2530-2550	Shale, dark-gray, slightly silty, very finely micaceous, pyrite.
46	2550-2596	Shale, dark-gray to grayish-black, very finely micaceous, pyrite in 2550 to 2560 and 2570 to 2580.
4	2596-2600	Shale, dark-gray, slightly silty, very finely micaceous.
13	2600-2613	Shale, dark-gray to grayish-black, very finely micaceous.
4	2613-2617	Shale, dark-gray, slightly silty, very finely micaceous.
3	2617-2620	Shale, dark-gray to grayish-black, very finely micaceous.
55	2620-2675	Shale, dark-gray, very finely micaceous.
15	2675-2690	Siltstone, medium-gray, very finely micaceous.
50	2690-2740	Shale, dark-gray, slightly silty, very finely micaceous.
27	2740-2767	Siltstone, dark-gray, very finely micaceous.
48	2767-2815	Siltstone, light- to medium-gray, very finely micaceous.
31	2815-2846	Shale, dark-gray, silty, very finely micaceous.
19	2846-2865	Siltstone, medium-gray, very finely micaceous.
19	2865-2884	Siltstone, light-gray, very finely micaceous.
6	2884-2890	Shale, dark-gray, silty, very finely micaceous.
30	2890-2920	Shale, dark-gray, very finely micaceous.
6	2920-2926	Siltstone, light- to medium-gray, very finely micaceous.

Section of well 23—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
48	2926-2974	Shale, dark-gray to grayish-black, very finely micaceous.
26	2974-3000	Siltstone, dark-gray, very finely micaceous.
22	3000-3022	Siltstone, medium-gray, very finely micaceous, well-cemented.
10	3022-3032	Shale, dark-gray, silty, very finely micaceous.
13	3032-3045	Siltstone, medium-gray, very finely micaceous.
6	3045-3051	Siltstone, light-gray, very finely sandy, silt almost very fine sand size (more than .062 mm in diameter).
45	3051-3096	Shale, dark-gray, very silty, very finely micaceous.
12	3096-3108	Shale, grayish-black.
44	3108-3152	Siltstone, dark-gray, argillaceous, very finely micaceous.
28	3152-3180	Shale, dark-gray, silty, very finely micaceous.
20	3180-3200	Siltstone, as above.
20	3200-3220	Shale, as above.
3	3220-3223	Sandstone, light-gray, very fine to fine-grained, well-cemented.
7	3223-3230	Shale, grayish-black.
20	3230-3250	Siltstone, medium-gray, very finely sandy, well-cemented.
10	3250-3260	(No sample.)
10	3260-3270	Sandstone, light-gray, very fine grained, slightly silty.
17	3270-3287	Shale, dark-gray to grayish-black, very finely micaceous.
8	3287-3295	Siltstone, medium- to dark-gray, very finely sandy.
44	3295-3339	Shale, dark-gray, very silty, very finely micaceous.
24	3339-3363	Shale, grayish-black.
49	3363-3412	Shale, dark-gray, very finely micaceous.
23	3412-3435	Siltstone, medium- to dark-gray, very finely micaceous.
31	3435-3466	Shale, grayish-black.
18	3466-3484	Shale, dark-gray, slightly silty, very finely micaceous.
26	3484-3510	Shale, dark-gray to grayish-black, very finely micaceous, slickensided fragments in 3484 to 3490.
45	3510-3555	Shale, dark-gray, slightly silty, very finely micaceous.
22	3555-3577	Siltstone, medium-gray, very finely micaceous.
18	3577-3595	Sandstone, medium-gray, very fine grained, very silty.
5	3595-3600	Sandstone, light-gray, fine-grained, abundant subangular medium quartz sand grains, drills free.
11	3600-3611	Sandstone, light- to medium-gray, very fine to fine-grained, scattered subrounded medium quartz sand grains.
1	3611-3612	Shale, dark-gray, very finely micaceous.
7	3612-3619	Sandstone, light-gray, very fine to fine-grained, very silty.
1	3619-3620	Shale, as above.
7	3620-3627	Sandstone, as above.
1	3627-3628	Shale, as above.
4	3628-3632	Sandstone, as above.
1	3632-3633	Shale, as above.
17	3633-3650	Sandstone, light-gray, fine- to medium-grained.
21	3650-3671	Sandstone, light-gray, very fine to fine-grained, drills free.
2	3671-3673	Shale, grayish-black.
7	3673-3680	Sandstone, light-gray, very fine grained.
25	3680-3705	Sandstone, light-gray, very fine to fine-grained, abundant rounded medium quartz sand grains, slightly silty.
3	3705-3708	Sandstone, light-gray, very fine grained, drills free.
42	3708-3750	Shale, grayish-black.
10	3750-3760	Siltstone, medium- to dark-gray, very finely sandy.
39	3760-3799	Siltstone, dark-gray, very finely micaceous.
21	3799-3820	Sandstone, medium-gray, very fine grained, very silty.
10	3820-3830	Sandstone, light-gray, very fine to fine-grained, drills free.
4	3830-3834	Shale, dark-gray, silty, very finely micaceous.
4	3834-3838	Sandstone, as above.
75	3838-3913	Shale, as above.
38	3913-3951	Shale, grayish-black, very finely micaceous, pyrite in 3940 to 3950.
349	3951-4300	Shale, grayish-black, pyrite in 3951 to 3990, 4000 to 4010, 4080 to 4090, and 4120 to 4190.
10	4300-4310	Sandstone, medium-gray, very fine to fine-grained, scattered rounded medium quartz sand grains, well-cemented.
20	4310-4330	(No sample.)
3	4330-4333	Sandstone, light-gray, very fine to fine-grained.
11	4333-4344	Shale, as above.
36	4344-4380	Siltstone, light-gray, very finely sandy, very finely micaceous.

Section of well 23—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
10	4380-4390	Sandstone, very light gray, very fine to fine-grained, silty.
14	4390-4404	Sandstone, very light gray, fine- to medium-grained, scattered rounded coarse sand grains.
14	4404-4418	Shale, as above.
19	4418-4437	Sandstone, light-gray, very fine to fine-grained, scattered rounded medium sand grains, very silty.
11	4437-4448	Shale, as above.
17	4448-4465	Sandstone, light-gray, very fine to medium-grained.
15	4465-4480	Sandstone, light-gray, medium- to coarse-grained.
8	4480-4488	Sandstone, light-gray, fine- to medium-grained, scattered rounded coarse quartz sand grains, drills free.
2	4488-4490	Shale, as above.
16	4490-4506	Sandstone, as above.
79	4506-4585	Shale, dark-gray to grayish-black, very finely micaceous.
45	4585-4630	Shale, dark-gray, very finely micaceous.
35	4630-4665	Siltstone, medium-gray, slightly very finely sand, very finely micaceous.
15	4665-4680	Siltstone, medium-gray, very finely sandy, very finely micaceous.
29	4680-4709	Sandstone, light- to medium-gray, very fine to fine-grained, scattered subrounded medium quartz sand grains, silty.
2	4709-4711	Shale, grayish-black.
12	4711-4723	Sandstone, light-gray, fine-grained, scattered subrounded medium quartz sand grains, drills free.
10	4723-4733	Shale, dark-gray, silty, very finely micaceous.
10	4733-4743	Shale, grayish-black.
55	4743-4798	Shale, dark-gray, slightly silty, very finely micaceous.
3	4798-4801	Shale, grayish-black.
24	4801-4825	Siltstone, medium-gray, slightly very finely sandy, finely micaceous.
5	4825-4830	Shale, as above.
16	4830-4846	Shale, dark-gray, silty, very finely micaceous.
6	4846-4852	Shale, grayish-black.
9	4852-4861	Sandstone, light-gray, very fine to fine-grained, very silty.
1	4861-4862	Shale, as above.
12	4862-4874	Sandstone, as above.
4	4874-4878	Shale, as above.
5	4878-4883	Sandstone, light-gray, very fine grained, drills free.
2	4883-4885	Shale, as above.
3	4885-4888	Sandstone, as above.
15	4888-4903	Shale, dark-gray, very finely micaceous.
9	4903-4912	Shale, grayish-black.
6	4912-4918	Shale, dark-gray, very finely micaceous.
8	4918-4926	Shale, grayish-black.
12	4926-4938	Shale, dark-gray, very finely micaceous.
17	4938-4955	Shale, grayish-black.
6	4955-4961	Sandstone, light- to medium-gray, very fine to fine-grained, very silty.
592	4961-5553	Shale, grayish-black, pyrite in 5150 to 5180, 5210 to 5230, 5290 to 5300, and 5380 to 5400.
20	5553-5573	Shale, dark-gray, very silty, finely micaceous.
8	5573-5581	Shale, grayish-black.
5	5581-5586	Shale, dark-gray, very silty, finely micaceous.
3	5586-5589	Shale, grayish-black.
9	5589-5598	Siltstone, medium-gray, slightly very finely sandy, finely micaceous.
2	5598-5600	Shale, as above.
21	5600-5621	Siltstone, as above.
2	5621-5623	Shale, as above.
6	5623-5629	Siltstone, as above.
2	5629-5631	Shale, as above.
4	5631-5635	Siltstone, light- to medium-gray, very finely sandy, finely micaceous.
2	5635-5637	Shale, as above.
6	5637-5643	Siltstone, as above.
12	5643-5655	Shale, grayish-black, very finely micaceous.
18	5655-5673	Siltstone, dark-gray, very finely micaceous.
4	5673-5677	Shale, as above.
9	5677-5686	Siltstone, as above.
1	5686-5687	Shale, as above.
4	5687-5691	Siltstone, as above.
2	5691-5693	Shale, as above.

Section of well 23—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
7	5693-5700	Siltstone, as above.
2	5700-5702	Shale, as above.
13	5702-5715	Siltstone, medium-gray, slightly very finely sandy.
16	5715-5731	Siltstone, medium-gray, very finely sandy.
7	5731-5738	Shale, dark-gray, very finely micaceous.
19	5738-5757	Siltstone, as above.
3	5757-5760	Shale, as above.
3	5760-5763	Sandstone, light- to medium-gray, very fine grained, very silty.
2	5763-5765	Shale, grayish-black.
6	5765-5771	Sandstone, as above.
7	5771-5778	Shale, as above.
11	5778-5789	Sandstone, light-gray, very fine to fine-grained, scattered rounded medium quartz sand grains, silty, well-cemented.
2	5789-5791	Shale, as above.
10	5791-5801	Sandstone, as above.
7	5801-5808	Shale, as above.
14	5808-5822	Sandstone, very light gray, fine-grained, drills free.
20	5822-5842	Shale, grayish-black, very finely micaceous.
8	5842-5850	Sandstone, light-gray, very fine to fine-grained, abundant subangular medium quartz sand grains, slightly silty.
13	5850-5863	Sandstone, very light gray, fine- to medium-grained.
5	5863-5868	Shale, as above.
8	5868-5876	Sandstone, light-gray, very fine to fine-grained, abundant subrounded medium quartz sand grains, silty.
2	5876-5878	Shale, as above.
3	5878-5881	Sandstone, light- to medium-gray, very fine to fine-grained, very silty, finely micaceous.
1	5881-5882	Shale, as above.
6	5882-5888	Sandstone, as above.
2	5888-5890	Shale, as above.
20	5890-5910	(No sample.)
22	5910-5932	Shale, as above.
4	5932-5936	Siltstone, dark-gray, very finely micaceous.
6	5936-5942	Shale, grayish-black.
6	5942-5948	Siltstone, as above.
2	5948-5950	Shale, as above.
15	5950-5965	Sandstone, dark-gray, very fine to fine-grained, very silty.
13	5965-5978	Siltstone, dark-gray, very finely sandy, very finely micaceous.
5	5978-5983	Sandstone, light- to medium-gray, very fine grained, very silty, well-cemented.
17	5983-6000	Siltstone, as above.
5	6000-6005	Siltstone, medium-gray, very finely sandy, well-cemented.
15	6005-6020	Shale, dark-gray, silty, very finely micaceous.
3	6020-6023	Sandstone, dark-gray, very fine grained, well-cemented.
10	6023-6033	Siltstone, medium-gray, very finely sandy, well-cemented. Base of unit is base of zone p.
22	6033-6055	Shale, grayish-black, very finely micaceous.
7	6055-6062	Shale, dark-gray, very silty, very finely micaceous.
18	6062-6080	Shale, grayish-black, very finely micaceous.
11	6080-6091	Shale, dark-gray, very silty, very finely micaceous.
11	6091-6102	Shale, grayish-black, very finely micaceous.
10	6102-6112	Siltstone, dark-gray, well-cemented.
6	6112-6118	Shale, grayish-black.
3	6118-6121	Siltstone, as above.
4	6121-6125	Shale, as above.
9	6125-6134	Siltstone, as above.
48	6134-6182	Shale, as above.
21	6182-6203	Shale, dark-gray, slightly silty, very finely micaceous.
77	6203-6280	Shale, dark-gray to grayish-black, very finely micaceous, pyrite.
23	6280-6303	Shale, grayish-black, pyrite.
52	6303-6355	Shale, dark-gray, very finely micaceous, pyrite.
135	6355-6490	Shale, grayish-black.
85	6490-6575	Shale, dark-gray to grayish-black, very finely micaceous.
365	6575-6940	Shale, grayish-black, pyrite in 6600 to 6640, 6650 to 6670, 6680 to 6700, 6720 to 6760, and 6840 to 6890.
82	6940-7022	Shale, dark-gray, very finely micaceous, pyrite in 6950 to 6960.
88	7022-7110	Shale, grayish-black, pyrite in 7060 to 7070.
53	7110-7163	Shale, dark-gray, very finely micaceous, pyrite in 7150 to 7160.

Section of well 23—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
132	7163-7295	Shale, grayish-black, pyrite in 7190 to 7210 and 7250 to 7260.
100	7295-7395	Shale, dark-gray, very finely micaceous.
199	7395-7594	Shale, grayish-black, pyrite in 7450 to 7460 and 7490 to 7500.
12	7594-7606	Shale, dark-gray, silty, very finely micaceous, abundant pyrite.
19	7606-7625	Shale, black, slickensided fragments.
237	7625-7862	Shale, grayish-black, pyrite in 7620 to 7760.
73	7862-7935	Shale, black.
380	7935-8315	Shale, grayish-black, pyrite in 7970 to 7990 and 8040 to 8050.
14	8315-8329	Shale, dark-gray, slightly silty, very finely micaceous.
37	8329-8366	Shale, grayish-black, very finely micaceous.
19	8366-8385	Shale, dark-gray, slightly silty, very finely micaceous.
354	8385-8739	Shale, grayish-black, pyrite in 8460 to 8510 and 8640 to 8650.
4	8739-8743	Siltstone, light-gray, very finely sandy, slightly limy, well-cemented.
12	8743-8755	Shale, dark-gray, very finely micaceous.
9	8755-8764	Sandstone, light-gray, fine-grained, widely scattered subrounded medium sand grains, silty.
6	8764-8770	Shale, dark-gray.
15	8770-8785	Sandstone, medium-gray, very fine grained, very silty, well-cemented.
4	8785-8789	Shale, as above.
3	8789-8792	Siltstone, medium-gray, very finely sandy, slightly limy, well-cemented.
35	8792-8827	Siltstone, medium- to dark-gray, well-cemented. Base of unit is base of Atoka Formation.
		Morrow Series
13	8827-8840	Shale, dark-gray.
10	8840-8850	Shale, dark-gray, slightly limy, crinoids.
9	8850-8859	Siltstone, medium-gray, slightly very finely sandy, well-cemented.
2	8859-8861	Shale, grayish-black.
17	8861-8878	Siltstone, medium- to dark-gray, well-cemented.
7	8878-8885	Shale, dark-gray, very finely micaceous.
5	8885-8890	Limestone, medium- to dark-gray, very finely crystalline, slightly very finely sandy, crinoids.
35	8890-8925	(No sample.) Probably limestone as above.
3	8925-8928	Siltstone, medium-gray, well-cemented.
2	8928-8930	Shale, grayish-black.
3	8930-8933	Siltstone, as above.
2	8933-8935	Shale, as above.
5	8935-8940	Siltstone, as above.
23	8940-8963	Shale, grayish-black, slightly limy.
7	8963-8970	Limestone, dark-gray, very silty, crinoids.
80	8970-9050	Shale, grayish-black, pyrite in 8970 to 8990, crinoids in 8980 to 8900.
7	9050-9057	Limestone, medium-gray, very fine crystalline, silty, crinoids.
6	9057-9063	Shale, grayish-black, pyrite.
7	9063-9070	Limestone, medium-gray, very finely crystalline, very finely to finely sandy, silty, pyrite, crinoids.
19	9070-9089	Limestone, medium-gray, dense to very fine crystalline, slightly silty, pyrite, crinoids.
7	9089-9096	Shale, as above.
33	9096-9129	Limestone, dark-gray, granular, slightly very finely sandy, silty, pyrite in 9096, to 9100 and 9110 to 9120, crinoids.
11	9129-9140	Sandstone, light-gray, very fine to fine-grained, very limy.
10	9140-9150	Limestone, medium- to dark-gray, granular, very finely sandy, silty.
14	9150-9164	Sandstone, very light to light-gray, very fine grained, silty, limy.
22	9164-9186	Shale, dark-gray, limy, crinoids and brachiopods in 9170 to 9175.
19	9186-9205	Shale, grayish-black, pyrite.
16	9205-9221	Siltstone, medium-gray, silty, limy.
24	9221-9245	Shale, grayish-black, very slightly limy, pyrite.
5	9245-9250	Limestone, medium- to dark-gray, silty.
15	9250-9265	Limestone, medium-gray, very finely sandy, silty, pyrite.
15	9265-9280	Shale, dark-gray to grayish-black, limy, pyrite.
30	9280-9310	Shale, grayish-black, slightly limy, pyrite.
10	9310-9320	Limestone, dark-gray, very silty.
10	9320-9330	Shale, grayish-black, limy, pyrite.
10	9330-9340	Limestone, dark-gray, very silty.
10	9340-9350	Sandstone, light- to medium-gray, very fine to fine grained, limy, pyrite.
9	9350-9359	Sandstone, medium-gray, very fine grained, limy, pyrite.
68	9359-9427	Siltstone, light- to medium-gray, very finely sandy, limy, well-cemented.
14	9427-9441	Shale, grayish-black.

Section of well 23—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Morrow Series**
29	9441-9470	Siltstone, light- to medium-gray, very finely sandy, very slightly limy.
8	9470-9478	Shale, grayish-black.
3	9478-9481	Siltstone, dark-gray, well-cemented.
1	9481-9482	Shale, as above.
8	9482-9490	Siltstone, as above.
15	9490-9505	Sandstone, light- to medium-gray, very fine grained, silty, limy.
20	9505-9525	Shale, grayish-black, slightly limy.
10	9525-9535	Sandstone, light- to medium-gray, very fine grained, slightly silty, very limy.
5	9535-9540	Limstone, medium-gray, very finely sandy.
		Total depth: 9540 ft.

Section of well 4

Gulf Oil Corp. No. 1 F. R. Borum

Sec. 18, T. 6 N., R. 28 W., Logan County, Ark. Elevation: 681 ft.; total depth: 8,974 ft. Samples examined and logged by Boyd R. Haley. Middle and lower part of the Atoka Formation and upper part of the Morrow Series.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
30	0- 30	Shale, very light to dark-gray and brownish-gray, slightly silty, very finely micaceous. Top of unit is 40 feet below the top of zone p.
19	30- 49	Shale, dark-gray, slightly silty, very finely micaceous.
2	49- 51	Shandstone, light-gray, fine-grained, iron-stained.
29	51- 80	Shale, grayish-red, light-gray streaks, slightly silty, very finely micaceous, crinoids in 60 to 70, fine calcite crystals in 60 to 80.
5	80- 85	Sandstone, moderate reddish-brown, very fine to fine-grained, silty.
15	85- 100	Shale, dark-gray, very finely micaceous.
8	100- 108	Siltstone, dark-gray, finely micaceous.
1	108- 109	Sandstone, light-gray, very fine grained, well-cemented.
10	109- 119	Shale, dark-gray, very silty, finely micaceous.
1	119- 120	Sandstone, medium-gray, very fine grained, very silty.
4	120- 124	Siltstone, medium-gray, slightly very finely sandy, very finely micaceous.
1	124- 125	Sandstone, as above.
10	125- 135	Siltstone, as above.
2	135- 137	Sandstone, as above.
3	137- 140	Siltstone, as above.
17	140- 157	Shale, dark-gray, silty, very finely micaceous.
3	157- 160	Sandstone, light-gray, very fine grained, very silty, well-cemented.
14	160- 174	Shale, as above.
6	174- 180	Siltstone, dark-gray, very finely micaceous.
2	180- 182	Sandstone, medium-gray, very fine grained, very silty.
6	182- 188	Siltstone, as above.
12	188- 200	Sandstone, medium-gray, very fine grained, very silty, very finely micaceous, well-cemented.
2	200- 202	Siltstone, as above.
8	202- 210	Sandstone, as above.
2	210- 212	Siltstone, as above.
5	212- 217	Sandstone, as above.
3	217- 220	Siltstone, as above.
4	220- 224	Sandstone, as above.
23	224- 247	Shale, dark-gray, very finely micaceous, pyrite in 224 to 230.
3	247- 250	Siltstone, medium-gray.
3	250- 253	Sandstone, light- to medium-gray, very fine grained, very silty.
1	253- 254	Siltstone, as above.
4	254- 258	Sandstone, as above.
2	258- 260	Siltstone, as above.
30	260- 290	(No sample.)
45	290- 335	Shale, as above.
35	335- 370	Shale, dark-gray, slightly silty to silty, very finely micaceous.
2	370- 372	Siltstone, dark-gray, very finely micaceous.
8	372- 380	Sandstone, light-gray, very fine grained, silty, very finely micaceous.
16	380- 396	Shale, dark-gray, very finely micaceous.
2	396- 398	Sandstone, medium-gray, very fine grained, very silty, very finely micaceous, well-cemented.
4	398- 402	Shale, dark-gray, silty, very finely micaceous.
2	402- 404	Sandstone, as above.
4	404- 408	Shale, as above.
2	408- 410	Sandstone, as above.
3	410- 413	Shale, as above.
17	413- 430	Sandstone, light- to medium-gray, very fine grained, silty, very finely micaceous.
10	430- 440	Sandstone, medium-gray, very fine grained, very silty, very finely micaceous, well-cemented.
10	440- 450	Sandstone, light- to medium-gray, very fine grained, silty, very finely micaceous, pyrite.
10	450- 460	(No sample.)
5	460- 465	Sandstone, light-gray, very fine grained, slightly silty.
5	465- 470	Sandstone, medium- to dark-gray, very fine grained, very silty.
2	470- 472	Shale, as above.
8	472- 480	Sandstone, as above.
2	480- 482	Shale, as above.

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
7	482- 489	Sandstone, medium-gray, very fine grained, silty, very finely micaceous, well-cemented.
5	489- 494	Sandstone, light- to medium-gray, very fine grained, very silty, very finely micaceous, well-cemented.
2	494- 496	Shale, as above.
5	496- 501	Sandstone, as above.
2	501- 503	Shale, as above.
4	503- 507	Sandstone, as above.
3	507- 510	Shale, as above.
10	510- 520	Sandstone, as above.
1	520- 521	Shale, as above.
3	521- 524	Sandstone, medium- to dark-gray, very fine grained, very silty, very finely micaceous.
6	524- 530	Siltstone, dark-gray, very finely micaceous.
2	530- 532	Sandstone, as above.
12	532- 544	Shale, as above.
4	544- 548	Sandstone, as above.
2	548- 550	Shale, as above.
9	550- 559	Sandstone, as above.
1	559- 560	Shale, as above.
4	560- 564	Sandstone, as above.
2	564- 566	Shale, as above.
19	566- 585	Sandstone, as above, pyrite in 580 to 585.
5	585- 590	Shale, as above, slickensided fragments.
3	590- 593	Sandstone, as above.
4	593- 597	Shale, as above.
3	597- 600	Sandstone, as above.
2	600- 602	Shale, as above.
5	602- 607	Sandstone, as above.
6	607- 613	Shale, as above, slickensided fragments.
17	613- 630	Sandstone, as above.
2	630- 632	Shale, as above.
6	632- 638	Sandstone, as above.
7	638- 645	Shale, as above.
9	645- 654	Sandstone, as above.
9	654- 663	Shale, as above.
3	663- 666	Sandstone, as above.
12	666- 678	Shale, as above.
2	678- 680	Sandstone, as above.
15	680- 695	Siltstone, dark-gray, very finely micaceous.
22	695- 717	Shale, as above.
6	717- 723	Siltstone, medium- to dark-gray, very finely sandy, very finely micaceous, pyrite.
23	723- 746	Shale, as above.
4	746- 750	Siltstone, as above.
65	750- 815	Shale, dark-gray, very finely micaceous, pyrite in 790-800.
15	815- 830	Shale, dark-gray, silty, very finely micaceous.
4	830- 834	Siltstone, as above.
6	834- 840	Sandstone, light- to medium-gray, very fine grained, very silty, very finely micaceous.
27	840- 867	Shale, dark-gray, slightly silty to very silty, very finely micaceous, pyrite in 860 to 867.
7	867- 874	Sandstone, as above.
3	874- 877	Shale, as above.
3	877- 880	Sandstone, as above.
16	880- 896	Siltstone, medium- to dark-gray, very finely micaceous.
4	896- 900	Sandstone, medium-gray, very fine grained, very silty.
24	900- 924	Siltstone, medium- to dark-gray, very finely sandy, very finely micaceous.
16	924- 940	Shale, dark-gray, silty, very finely micaceous.
15	940- 955	Sandstone, very light to medium-gray, very fine grained, slightly silty.
10	955- 965	Sandstone, very light to light gray, very fine grained, scattered rounded fine to medium quartz sand grains, slightly silty, porous.
2	965- 967	Shale, as above.
6	967- 973	Sandstone, very light gray, very fine grained, very silty.
2	973- 975	Shale, as above.
8	975- 983	Sandstone, light-gray, very fine grained, silty.
7	983- 990	Siltstone, medium-gray, very finely sandy, very finely micaceous.
8	990- 998	(No sample.)
2	998-1000	Siltstone, as above.
8	1000-1008	(No sample.)
2	1008-1010	Sandstone, medium-gray, very fine grained, very silty.

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
10	1010-1020	(No sample.)
6	1020-1026	Siltstone, medium-gray, very finely micaceous.
34	1026-1060	Shale, dark-gray, slightly silty to silty, very finely micaceous, pyrite in 1030 to 1040.
3	1060-1063	Siltstone, medium-gray, very finely to finely sandy, very finely micaceous.
11	1063-1074	Siltstone, dark-gray, very finely to finely sandy, very finely micaceous.
4	1074-1078	(No sample.)
2	1078-1080	Siltstone, dark-gray, very finely micaceous.
8	1080-1088	(No sample.)
2	1088-1090	Siltstone, medium- to dark-gray, very finely sandy, very finely micaceous.
4	1090-1094	Shale, dark-gray, silty, very finely micaceous.
2	1094-1096	Sandstone, light- to medium-gray, very fine grained, silty.
12	1096-1108	(No sample.)
8	1108-1116	Sandstone, medium-gray, very fine grained, silty, very finely micaceous.
2	1116-1118	Shale, dark-gray, very finely micaceous.
2	1118-1120	(No sample.)
17	1120-1137	Shale, grayish-black, pyrite in 1120 to 1130.
3	1137-1140	Sandstone, medium-gray, very fine to fine-grained, silty, very finely micaceous.
12	1140-1152	Shale, as above, pyrite.
6	1152-1158	Shale, medium- to dark-gray, very finely sandy, silty, very finely micaceous.
2	1158-1160	Shale, grayish-black.
37	1160-1197	Siltstone, medium- to dark-gray, very finely sandy, finely micaceous.
9	1197-1206	Sandstone, light-gray, fine-grained, scattered, rounded, medium quartz sand grains, glauconite.
19	1206-1225	Shale, dark-gray, very finely micaceous.
45	1225-1270	Shale, dark-gray, silty, very finely micaceous, slightly very finely sandy in 1250 to 1260, pyrite in 1230 to 1240 and 1250 to 1260.
8	1270-1278	Siltstone, dark-gray, very finely micaceous.
44	1278-1322	Shale, grayish-black, very finely micaceous, pyrite in 1280 to 1290.
35	1322-1357	Shale, dark-gray, silty, very finely micaceous, pyrite in 1330 to 1340.
3	1357-1360	Siltstone, medium- to dark-gray, very finely micaceous.
3	1360-1363	Shale, as above.
5	1363-1368	Siltstone, as above.
2	1368-1370	Shale, as above.
20	1370-1390	(No sample.)
5	1390-1395	Siltstone, medium-gray, well-cemented.
20	1395-1415	Shale, medium- to dark-gray, silty, very finely micaceous, pyrite in 1400 to 1410.
41	1415-1456	Shale, grayish-black.
2	1456-1458	Siltstone, medium-gray, very finely micaceous.
5	1458-1463	Shale, as above.
3	1463-1466	Siltstone, as above.
4	1466-1470	Shale, as above.
6	1470-1476	Siltstone, medium-gray, very finely sandy, finely micaceous.
14	1476-1490	Shale, dark-gray, silty, very finely micaceous, slickensided fragments.
29	1490-1519	Shale, grayish-black, very finely micaceous.
2	1519-1521	Sandstone, light-gray, very fine grained, very silty, well-cemented.
1	1521-1522	Shale, dark-gray, very finely micaceous.
6	1522-1528	Sandstone, as above.
4	1528-1532	Siltstone, as above.
3	1532-1535	Sandstone, as above.
6	1535-1541	Shale, as above.
9	1541-1550	Sandstone, light-gray, very fine grained, silty, abundant pyrite.
10	1550-1560	Shale, grayish-black, very finely micaceous.
3	1560-1563	Sandstone, medium-gray, very finely grained, very silty, very finely micaceous.
3	1563-1566	Shale, as above.
26	1566-1592	Sandstone, light-gray, very fine to fine grained, slightly silty, finely to medium micaceous.
16	1592-1608	Siltstone, medium-gray, very finely sandy, finely micaceous.
3	1608-1611	Shale, grayish-black.
9	1611-1620	(No sample.)
5	1620-1625	Siltstone, dark-gray, very finely sandy, very finely micaceous.
8	1625-1633	Sandstone, medium-gray, very silty, very finely micaceous.
5	1633-1638	Siltstone, as above.
3	1638-1641	Sandstone, as above.
4	1641-1645	Siltstone, as above.
25	1645-1670	Sandstone, as above.
10	1670-1680	(No sample.)

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
10	1680-1690	Sandstone, as above.
23	1690-1713	Siltstone, as above.
7	1713-1720	Shale, grayish-black.
10	1720-1730	Siltstone, as above.
10	1730-1740	(No sample.)
3	1740-1743	Siltstone, as above.
26	1743-1769	Sandstone, very light gray, very fine grained, finely to medium micaceous.
11	1769-1780	Shale, dark-gray, silty, finely micaceous.
51	1780-1831	Shale, dark-gray, slightly silty, very finely micaecous, pyrite in 1820 to 1830.
10	1831-1841	Siltstone, light- to medium-gray, well-cemented.
5	1841-1846	Siltstone, medium- to dark-gray, very finely micaceous.
10	1846-1856	Shale, grayish-black, slickensided fragments.
16	1856-1872	Siltstone, medium-gray, very finely sandy, finely micaceous, pyrite in 1860 to 1870.
9	1872-1881	Shale, dark-gray, silty, very finely micaceous.
10	1881-1891	Shale, grayish-black, pyrite.
19	1891-1910	Shale, dark-gray, silty, very finely micaceous, pyrite in 1900 to 1910.
23	1910-1933	Shale, grayish-black, very finely micaceous.
8	1933-1941	Sandstone, light-gray, very fine to fine-grained, abundant subangular to rounded medium sand grains.
38	1941-1979	Shale, dark-gray to grayish-black, very finely micaceous.
68	1979-2047	Shale, dark-gray, silty, very finely micaceous, pyrite in 2000 to 2010 and 2040 to 2047, slickensided fragments in 1980 to 1990.
62	2047-2109	Shale, grayish-black, pyrite in 2050 to 2060 and 2070 to 2090, slickensided fragments in 2060 to 2100.
28	2109-2137	Shale, dark-gray, very finely micaceous.
39	2137-2176	Shale, dark-gray to grayish-black, pyrite in 2150 to 2160, slickensided fragments in 2150 to 2176.
34	2176-2210	Shale, grayish-black, pyrite, slickensided fragments in 2176 to 2180.
2	2210-2212	Shale, medium-gray, silty, very finely micaceous.
650	2212-2862	Shale, grayish-black, pyrite in 2220 to 2250, 2270 to 2290, 2330 to 2340, 2590 to 2600, 2620 to 2680, 2700 to 2730, and 2770 to 2840, slickensided fragments in 2540 to 2580 and 2790 to 2800.
6	2862-2868	Siltstone, dark-gray, very finely micaceous.
162	2868-3030	Shale, grayish-black, pyrite in 2870 to 2950, 2990 to 3010, and 3040 to 3050, slickensided fragments in 2880 to 2890, 2940 to 2950, and 3020 to 3030.
79	3030-3109	Shale, dark-gray.
299	3109-3408	Shale, grayish-black, pyrite in 3180 to 3210, 3230 to 3240, and 3250 to 3400.
6	3408-3414	Siltstone, dark-gray, very finely micaceous, pyrite.
2	3414-3416	Shale, grayish-black.
9	3416-3425	Siltstone, medium- to dark-gray, very finely sandy, very finely micaceous, pyrite.
20	3425-3445	Siltstone, medium- to dark-gray, very finely micaceous, pyrite.
100	3445-3545	Shale, dark-gray to grayish-black, pyrite in 3500 to 3540.
65	3545-3610	Shale, grayish-black.
10	3610-3620	(No sample.)
2	3620-3622	Siltstone, dark-gray, very finely micaceous.
10	3622-3632	Shale, as above.
3	3632-3635	Siltstone, as above.
44	3635-3679	Shale, as above, pyrite in 3640 to 3650.
21	3679-3700	Shale, dark-gray.
90	3700-3790	Shale, dark-gray to grayish-black, pyrite.
40	3790-3830	Shale, grayish-black, pyrite.
305	3830-4135	Shale, dark-gray to grayish-black, very finely micaceous, pyrite.
70	4135-4205	Shale, grayish-black, pyrite, gastropod in 4150 to 4160.
65	4205-4270	Shale, dark-gray to grayish-black, very finely micaceous, pyrite.
21	4270-4291	Shale, dark-gray, very finely micaceous, pyrite.
24	4291-4315	Shale, grayish-black, very finely micaceous, pyrite.
6	4315-4321	Shale, dark-gray, very finely micaceous.
30	4321-4351	Shale, dark-gray to grayish-black, very finely micaceous, pyrite.
28	4351-4379	Shale, dark-gray, very finely micaceous, pyrite.
3	4379-4382	Siltstone, medium-gray, very finely sandy, well-cemented.
2	4382-4384	Shale, dark-gray, very finely micaceous.
3	4384-4387	Siltstone, as above.
5	4387-4392	Shale, as above.
8	4392-4400	Siltstone, medium-gray, very finely micaceous.
15	4400-4415	Shale, as above.
3	4415-4418	Siltstone, as above.

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
12	4418-4430	Shale, as above.
5	4430-4435	Siltstone, as above.
3	4435-4438	Shale, as above.
5	4438-4443	Siltstone, as above.
9	4443-4452	Shale, as above.
9	4452-4461	Siltstone, as above.
2	4461-4463	Shale, as above.
7	4463-4470	Siltstone, medium-gray, very finely sandy, very finely micaceous.
9	4470-4479	Shale, as above.
2	4479-4481	Siltstone, as above.
9	4481-4490	Shale, as above.
5	4490-4495	Siltstone, medium gray, slightly very finely sandy, very finely micaceous.
11	4495-4506	Siltstone, medium-gray, very finely micaceous.
12	4506-4518	Shale, as above.
7	4518-4525	Siltstone, as above.
8	4525-4533	Siltstone, medium-gray, very finely sandy, very finely micaceous.
11	4533-4544	Shale, as above.
10	4544-4554	Siltstone, medium-gray, very finely micaceous.
2	4554-4556	Shale, as above.
5	4556-4561	Siltstone, as above.
5	4561-4566	Shale, as above.
2	4566-4568	Siltstone, as above.
37	4568-4605	Shale, as above.
6	4605-4611	Siltstone, light- to medium-gray.
2	4611-4613	Shale, as above.
6	4613-4619	Siltstone, light- to medium-gray, very finely sandy.
3	4619-4622	Shale, as above.
10	4622-4632	Siltstone, as above.
6	4632-4638	Siltstone, light- to medium-gray.
33	4638-4671	Shale, as above.
29	4671-4700	Shale, grayish-black to black.
25	4700-4725	Shale, dark-gray to grayish-black, very finely micaceous.
30	4725-4755	Shale, grayish-black to black.
6	4755-4761	Shale, dark-gray to grayish-black, very finely micaceous.
8	4761-4769	Siltstone, medium-gray.
11	4769-4780	Shale, as above.
5	4780-4785	Siltstone, as above.
10	4785-4795	Shale, as above.
7	4795-4802	Siltstone, as above.
3	4802-4805	Shale, as above.
3	4805-4808	Siltstone, as above.
4	4808-4812	Shale, as above.
7	4812-4819	Siltstone, as above.
3	4819-4822	Shale, as above.
7	4822-4829	Siltstone, as above.
4	4829-4833	Shale, as above.
7	4833-4840	Siltstone, as above.
1	4840-4841	Shale, as above.
6	4841-4847	Siltstone, as above.
6	4847-4853	Shale, as above.
8	4853-4861	Siltstone, as above.
1	4861-4862	Shale, as above.
9	4862-4871	Siltstone, as above.
1	4871-4872	Shale, as above.
6	4872-4878	Siltstone, as above.
1	4878-4879	Shale, as above.
6	4879-4885	Siltstone, as above.
5	4885-4890	Sandstone, very light gray, fine-grained, abundant rounded medium quartz sand grains, silty.
22	4890-4912	Sandstone, light-gray, fine- to medium-grained, abundant rounded coarse quartz sand grains.
2	4912-4914	Shale, dark-gray.
15	4914-4929	Sandstone, very light gray, fine- to medium-grained, abundant rounded coarse quartz sand grains, granules of light-gray shale, quartz crystals.
30	4929-4959	Shale, medium- to dark-gray, silty, very finely micaceous.
20	4959-4979	Shale, dark-gray.

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
45	4979-5024	Shale, dark-gray to grayish-black, pyrite in 5010 to 5020.
18	5024-5042	Shale, dark-gray, very silty, very finely micaceous, pyrite in 5024 to 5030.
33	5042-5075	Shale, dark-gray.
65	5075-5140	Shale, dark-gray to grayish-black, pyrite in 5110 to 5120.
20	5140-5160	(No sample.)
105	5160-5265	Shale, dark-gray, slightly silty to silty, very finely micaceous, pyrite in 5170 to 5190.
5	5265-5270	Siltstone, medium-gray, very finely micaceous.
2	5270-5272	Shale, dark-gray, silty, very finely micaceous.
7	5272-5279	Siltstone, as above.
1	5279-5280	Shale, as above.
5	5280-5285	Siltstone, as above.
1	5285-5286	Shale, as above.
4	5286-5290	Siltstone, as above.
1	5290-5291	Shale, as above.
5	5291-5296	Siltstone, as above.
2	5296-5298	Shale, as above.
10	5298-5308	Siltstone, as above.
2	5308-5310	Shale, as above.
7	5310-5317	Siltstone, as above.
3	5317-5320	Shale, as above.
4	5320-5324	Siltstone, as above.
1	5324-5325	Shale, as above.
5	5325-5330	Siltstone, as above.
2	5330-5332	Shale, as above.
7	5332-5339	Sandstone, light- to medium-gray, very fine grained, very silty.
2	5339-5341	Shale, as above.
8	5341-5349	Sandstone, as above.
12	5349-5361	Siltstone, as above, pyrite.
7	5361-5368	Siltstone, light- to medium-gray, very finely sandy, very finely micaceous.
22	5368-5390	Shale, dark-gray, very finely micaceous.
8	5390-5398	Siltstone, light- to medium-gray, very finely micaceous.
2	5398-5400	Shale, dark-gray, silty, very finely micaceous.
9	5400-5409	Siltstone, as above.
1	5409-5410	Shale, as above.
7	5410-5417	Siltstone, as above.
2	5417-5419	Shale, as above.
9	5419-5428	Siltstone, as above.
1	5428-5429	Shale, as above.
2	5429-5431	Siltstone, as above.
12	5431-5443	Shale, dark-gray, very silty, very finely micaceous.
3	5443-5446	Sandstone, light-gray, very fine grained, widely scattered rounded, fine to medium quartz sand grains, finely micaceous.
11	5446-5457	Shale, as above.
2	5457-5459	Sandstone, as above.
1	5459-5460	Shale, as above.
3	5460-5463	Sandstone, as above.
6	5463-5469	Shale, as above.
1	5469-5470	Sandstone, as above.
10	5470-5480	Shale, as above.
2	5480-5482	Sandstone, as above.
13	5482-5495	Shale, as above.
5	5495-5500	Sandstone, as above.
9	5500-5509	Shale, as above.
1	5509-5510	Sandstone, as above.
19	5510-5529	Shale, dark-gray, slightly silty, very finely micaceous.
3	5529-5532	Siltstone, light- to medium-gray, very finely sandy, widely scattered rounded fine to medium quartz sand grains, very finely micaceous.
3	5532-5535	Shale, as above.
5	5535-5540	Siltstone, as above.
1	5540-5541	Shale, as above.
22	5541-5563	Siltstone, as above, pyrite in 5550 to 5560.
7	5563-5570	Sandstone, very light gray, very fine grained, very silty, very finely micaceous, well-cemented.
13	5570-5583	Siltstone, as above.
7	5583-5590	Sandstone, very light gray, very fine to medium-grained, silty.
5	5590-5595	Shale, dark-gray, very finely micaceous.

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
15	5595-5610	Sandstone, very light gray, very fine to fine-grained, scattered rounded medium quartz sand grains, silty.
8	5610-5618	Sandstone, very light gray, fine-grained, scattered rounded medium quartz sand grains, slightly silty, quartz crystals.
3	5618-5621	Shale, as above.
8	5621-5629	Sandstone, very light gray, very fine to fine-grained, silty, very finely to finely micaceous.
3	5629-5632	Shale, as above.
17	5632-5649	Sandstone, as above.
3	5649-5652	Shale, as above.
7	5652-5659	Sandstone, as above.
3	5659-5662	Shale, as above.
15	5662-5677	Sandstone, very light gray, fine- to medium-grained, widely scattered rounded coarse quartz sand grains, slightly silty, well-cemented, very fine limy fragments (shells?).
8	5677-5685	Shale, dark-gray, silty, very finely micaceous.
2	5685-5687	Sandstone, very light gray, very fine to medium-grained, silty, finely micaceous.
3	5687-5690	Shale, as above.
2	5690-5692	Sandstone, as above.
9	5692-5701	Shale, as above.
5	5701-5706	Sandstone, very light gray, fine- to medium-grained, silty, finely micaceous.
1	5706-5707	Shale, as above.
9	5707-5716	Sandstone, as above.
2	5716-5718	Shale, as above.
3	5718-5721	Sandstone, as above.
2	5721-5723	Shale, as above.
9	5723-5732	Sandstone, as above.
4	5732-5736	Shale, as above.
5	5736-5741	Sandstone, as above.
4	5741-5745	Shale, as above.
8	5745-5753	Sandstone, very light to light-gray, fine- to coarse-grained, silty, finely to medium micaceous.
4	5753-5757	Shale, as above.
10	5757-5767	Sandstone, light-gray, fine-grained, scattered rounded medium quartz sand grains, silty, finely micaceous.
1	5767-5768	Shale, as above.
2	5768-5770	Sandstone, as above.
1	5770-5771	Shale, as above.
5	5771-5776	Sandstone, as above.
10	5776-5786	Sandstone, light-gray, fine- to medium-grained, scattered rounded coarse quartz sand grains, finely micaceous.
3	5786-5789	Shale, as above.
4	5789-5793	Sandstone, very light gray, fine- to medium-grained.
5	5793-5798	Shale, as above.
5	5798-5803	Sandstone, as above.
2	5803-5805	Shale, as above.
10	5805-5815	Sandstone, very light gray, fine- to medium-grained, slightly silty.
5	5815-5820	Shale, as above.
8	5820-5828	Sandstone, very light gray, fine- to medium-grained, scattered rounded coarse quartz sand grains.
1	5828-5829	Shale, as above.
7	5829-5836	Sandstone, as above.
1	5836-5837	Shale, as above.
10	5837-5847	Sandstone, as above.
1	5847-5848	Shale, as above.
5	5848-5853	Sandstone, as above.
5	5853-5858	Shale, as above.
2	5858-5860	Sandstone, light-gray, very fine to medium-grained, silty.
7	5860-5867	Sandstone, light-gray, fine- to medium-grained, silty, finely micaceous.
1	5867-5868	Shale, as above.
14	5868-5882	Sandstone, as above.
4	5882-5886	Shale, as above.
5	5886-5891	Sandstone, as above.
4	5891-5895	Shale, as above.
6	5895-5901	Sandstone, as above.
6	5901-5907	Shale, as above.
13	5907-5920	Sandstone, as above.

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
20	5920-5940	(No sample.)
8	5940-5948	Sandstone, light-gray, fine- to medium-grained, scattered rounded coarse quartz sand grains, silty.
2	5948-5950	Shale, as above.
9	5950-5959	Sandstone, as above.
1	5959-5960	Shale, as above.
8	5960-5968	Sandstone, as above.
2	5968-5970	Shale, as above.
15	5970-5985	Sandstone, light-gray, very fine to medium-grained.
1	5985-5986	Shale, as above.
4	5986-5990	Sandstone, light-gray, fine- to medium-grained, silty.
10	5990-6000	(No sample.)
3	6000-6003	Shale, as above.
7	6003-6010	Sandstone, light-gray, fine- to medium-grained.
10	6010-6020	Shale, as above.
3	6020-6023	Sandstone, very light gray, fine- to medium-grained.
1	6023-6024	Shale, as above.
16	6024-6040	Sandstone, as above.
10	6040-6050	(No sample.)
2	6050-6052	Sandstone, as above.
1	6052-6053	Shale, as above.
7	6053-6060	Sandstone, light-gray, fine- to medium-grained.
5	6060-6065	Shale, as above.
5	6065-6070	Sandstone, as above.
10	6070-6080	(No sample.)
16	6080-6096	Shale, grayish-black, very finely micaceous.
2	6096-6098	Sandstone, light-gray, fine-grained.
5	6098-6103	Shale, as above.
2	6103-6105	Sandstone, as above. Base of unit is base of zone p.
165	6105-6270	Shale, as above, pyrite in 6160 to 6180, 6220 to 6230, and 6240 to 6270.
41	6270-6311	Shale, dark-gray, slightly silty, very finely to finely micaceous, pyrite in 6280 to 6290.
32	6311-6343	Shale, dark-gray to grayish-black, pyrite.
32	6343-6375	Shale, dark-gray, silty, very finely micaceous, pyrite.
10	6375-6385	Siltstone, medium- to dark-gray, argillaceous, very finely micaceous.
4	6385-6389	Shale, dark-gray, very silty, very finely micaceous.
31	6389-6420	Shale, dark-gray to grayish-black.
37	6420-6457	Shale, dark-gray, silty, very finely micaceous.
239	6457-6696	Shale, dark-gray to grayish-black, pyrite in 6520 to 6530, 6540 to 6560, 6610 to 6630, 6650 to 6660, and 6670 to 6680.
18	6696-6714	Shale, dark-gray, silty, very finely micaceous.
27	6714-6741	Shale, grayish-black, very finely micaceous.
4	6741-6745	Siltstone, dark-gray.
5	6745-6750	Shale, grayish-black, finely to medium micaceous, pyrite.
8	6750-6758	Siltstone, dark-gray, finely micaceous, pyrite.
6	6758-6764	Shale, dark-gray, finely micaceous.
6	6764-6770	Shale, medium- to dark-gray, very silty, finely micaceous.
6	6770-6776	Shale, dark-gray, finely micaceous.
8	6776-6784	Shale, medium- to dark-gray, very silty, finely micaceous.
4	6784-6788	Shale, dark-gray, finely micaceous.
10	6788-6798	Shale, medium- to dark-gray, very silty, finely micaceous.
2	6798-6800	Shale, dark-gray, finely micaceous.
3	6800-6803	Shale, medium- to dark-gray, very silty, finely micaceous, pyrite.
24	6803-6827	Shale, dark-gray finely micaceous, pyrite in 6820 to 6827.
15	6827-6842	Siltstone, medium- to dark-gray, finely micaceous, pyrite.
18	6842-6860	Siltstone, dark-gray, argillaceous, finely micaceous, pyrite.
11	6860-6871	Siltstone, medium-gray, finely micaceous.
30	6871-6901	Shale, dark-gray to grayish-black, pyrite in 6890 to 6900.
29	6901-6930	Shale, dark-gray, very finely micaceous, pyrite.
25	6930-6955	Siltstone, light- to medium-gray, slightly very finely to finely sandy, finely micaceous, well-cemented, silt is almost very fine sand size (more than .062 mm in diameter).
3	6955-6958	Shale, as above.
56	6958-7014	Siltstone, very light gray, very fine to finely sandy, well-cemented, quartzose, pyrite in 7000 to 7014.
4	7014-7018	Shale, as above.
12	7018-7030	Sandstone, very light gray, very fine grained, very silty, quartzose, pyrite.
1	7030-7031	Shale, as above.

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
17	7031-7048	Sandstone, as above, pyrite in 7031 to 7040.
2	7048-7050	Shale, as above.
30	7050-7080	Sandstone, as above.
28	7080-7108	Siltstone, as above.
2	7108-7110	Shale, grayish-black, very finely micaceous.
10	7110-7120	Siltstone, very light gray, quartzose.
1	7120-7121	Shale, as above.
8	7121-7129	Siltstone, as above.
1	7129-7130	Shale, as above.
3	7130-7133	Siltstone, light-to medium-gray.
1	7133-7134	Shale, as above.
31	7134-7165	Siltstone, as above.
5	7165-7170	Siltstone, light- to medium-gray, slightly very finely sandy, very finely micaceous.
30	7170-7200	Siltstone, medium-gray, very finely micaceous, well-cemented.
1	7200-7201	Shale, as above.
3	7201-7204	Siltstone, as above.
3	7204-7207	Shale, as above.
5	7207-7212	Siltstone, as above.
6	7212-7218	Shale, as above.
3	7218-7221	Siltstone, as above.
1	7221-7222	Shale, as above.
2	7222-7224	Siltstone, as above.
6	7224-7230	Shale, as above.
19	7230-7249	Siltstone, light- to medium-gray, slightly very finely sandy, very finely micaceous, well-cemented.
2	7249-7251	Shale, as above.
18	7251-7269	Siltstone, as above.
1	7269-7270	Shale, as above.
10	7270-7280	Siltstone, medium-gray, very finely micaceous, well-cemented.
23	7280-7303	Siltstone, medium- to dark-gray, very finely micaceous.
14	7303-7317	Siltstone, light-gray, slightly very finely sandy, well-cemented, quartzose.
4	7317-7321	Shale, as above.
4	7321-7325	Siltstone, medium-gray, very finely micaceous, well-cemented.
57	7325-7382	Shale, dark-gray to grayish-black, very finely micaceous.
7	7382-7389	Siltstone, medium-gray, well-cemented.
102	7389-7491	Shale, grayish-black, pyrite in 7410 to 7420, 7440 to 7450, and 7470 to 7480.
6	7491-7497	Siltstone, light-gray, well-cemented.
6	7497-7503	Shale, as above.
6	7503-7509	Siltstone, as above.
3	7509-7512	Shale, as above.
8	7512-7520	Siltstone, as above.
9	7520-7529	Shale, as above.
2	7529-7531	Siltstone, as above.
5	7531-7536	Shale, as above.
8	7536-7544	Siltstone, as above.
2	7544-7546	Shale, as above.
4	7546-7550	Siltstone, as above.
8	7550-7558	Shale, as above.
8	7558-7566	Sandstone, light-gray, very fine grained, very silty.
4	7566-7570	Shale, as above.
9	7570-7579	Siltstone, light- to medium-gray, very finely micaceous, well-cemented.
2	7579-7581	Shale, as above.
7	7581-7588	Siltstone, as above.
1	7588-7589	Shale, as above.
1	7589-7590	Siltstone, as above.
3	7590-7593	(No sample.) Core chips from 7593 to 7598.
5	7593-7598	Siltstone, dark-gray, very finely micaceous, well-cemented.
14	7598-7612	Siltstone, light- to medium-gray, very finely micaceous, well-cemented.
2	7612-7614	Shale, as above.
7	7614-7621	Siltstone, as above.
2	7621-7623	Shale, as above.
6	7623-7629	Siltstone, as above.
1	7629-7630	Shale, as above.
2	7630-7632	Siltstone, as above.
1	7632-7633	Shale, as above.

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Atoka Formation
7	7633-7640	Siltstone, as above.
4	7640-7644	Shale, as above.
7	7644-7651	Siltstone, as above.
14	7651-7665	Shale, as above.
13	7665-7678	Siltstone, dark-gray, very finely micaceous.
1	7678-7679	Shale, as above.
12	7679-7691	Siltstone, light- to medium-gray, well-cemented.
1	7691-7692	Shale, as above.
13	7692-7705	Siltstone, as above.
4	7705-7709	Shale, as above.
8	7709-7717	Siltstone, as above.
2	7717-7719	Shale, as above.
3	7719-7722	Siltstone, as above.
1	7722-7723	Shale, as above.
7	7723-7730	Siltstone, as above.
25	7730-7755	Shale, as above.
14	7755-7769	Siltstone, very light gray, slightly very finely sandy, well-cemented.
1	7769-7770	Shale, as above.
10	7770-7780	Siltstone, as above.
1	7780-7781	Shale, as above.
16	7781-7797	Siltstone, as above.
6	7797-7803	Shale, as above.
7	7803-7810	Siltstone, light-gray, very finely sandy, quartzose.
10	7810-7820	Siltstone, light-gray, slightly very finely sandy, well-cemented, quartzose.
10	7820-7830	(No sample.)
7	7830-7837	Siltstone, medium-gray, well-cemented.
1	7837-7838	Shale, as above.
3	7838-7841	Siltstone, as above.
1	7841-7842	Shale, as above.
21	7842-7863	Siltstone, as above.
4	7863-7867	Shale, as above.
19	7867-7886	Siltstone, light-gray, well-cemented, quartzose.
4	7886-7890	Shale, as above.
3	7890-7893	Siltstone, as above.
9	7893-7902	Shale, as above.
4	7902-7906	Siltstone, medium-gray, well-cemented.
3	7906-7909	Shale, as above.
24	7909-7933	Siltstone, very light gray, quartzose.
11	7933-7944	Shale, as above.
6	7944-7950	Siltstone, as above.
19	7950-7969	Shale, as above.
4	7969-7973	Siltstone, medium-gray, well-cemented.
2	7973-7975	Shale, as above.
6	7975-7981	Siltstone, as above.
2	7981-7983	Shale, as above.
4	7983-7987	Siltstone, as above.
2	7987-7989	Shale, as above.
4	7989-7993	(No sample.)
81	7993-8074	Shale, as above.
139	8074-8213	Shale, grayish-black, pyrite in 8180 to 8200.
11	8213-8224	Siltstone, dark-gray, very finely micaceous.
2	8224-8226	Shale, very light gray, flaky, very fine crystals of dolomite, bentonite?
14	8226-8240	Sandstone, light-gray, very fine to fine-grained, limy, drills free.
16	8240-8256	Sandstone, light- to medium-gray, very fine grained, silty, limy. Core chips from 8256 to 8303.
4	8256-8260	Sandstone, medium-gray, very fine grained, very silty, slightly limy; and siltstone, dark-gray, very finely sandy, argillaceous, very finely micaceous, pelecypods, bryozoans.
3	8260-8263	Sandstone, medium-gray, very fine to fine-grained, very limy, fine to medium black oolites, crinoids, brachiopods, bryozoans, petroliferous odor.
2	2863-8265	Sandstone, dark-gray, very fine grained, silty, limy, crionoids, bryozoans.
1	8265-8266	Sandstone, dark-gray, very fine grained, silty, limy.
3	8266-8269	Shale, grayish-black.
11	8269-8280	Siltstone, dark-gray, very finely sandy, argillaceous, very finely micaceous, well-cemented, carbonaceous streaks. Base of unit is base of Atoka Formation.

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Morrow Series
51	8280-8331	Siltstone, dark-gray, argillaceous, very finely micaceous, grayish-black shale streaks, pyrite in 8288 to 8289. Core chips from 8349 to 8380.
18	8331-8349	Shale, grayish-black, grayish-black concretions, pyrite, crinoids.
1	8349-8350	Shale, grayish-black.
4	8350-8354	Limestone, dark-gray, very finely sandy, silty, black shale stringers in 8352 to 8354, crinoids, brachiopods, bryozoans.
2	8354-8356	Limestone, dark-gray, very argillaceous, fine to medium black oolites, pyrite, crinoids, brachiopods, bryozoans, gastropods, scattered pyritic oolites and pyritic crinoids.
3	8356-8359	Limestone, dark-gray, dense, slightly very finely to finely sandy, abundant oolites, crinoids, brachiopods.
3	8359-8362	Limestone, dark-gray, granular, abundant crinoids, brachiopods, gastropods.
1	8362-8363	Limestone, dark-gray, very argillaceous, crinoids, brachiopods.
2	8363-8365	Shale, grayish-black.
2	8365-8367	Limestone, dark-gray, very finely crystalline, silty, crinoids, brachiopods.
2	8367-8369	Limestone, dark-gray, very finely sandy, crinoids, brachiopods.
2	8369-8371	Limestone, dark-gray, very finely crystalline, abundant crinoids.
2	8371-7373	Shale, grayish-black, very fine sandy concretions, crinoid fragments.
13	8373-8386	Limestone, dark-gray, very finely sandy, silty, crinoids.
12	8386-8398	Shale, grayish-black.
2	8398-8400	Siltstone, dark-gray, limy, crinoids.
4	8400-8404	Shale, grayish-black.
3	8404-8407	Siltstone, dark-gray, limy, crinoids.
36	8407-8443	Shale, as above.
2	8443-8445	Siltstone, dark-gray, limy, crinoids.
29	8445-8474	Shale, grayish-black, slightly silty, very finely micaceous. Core chips from 8474 to 8505.
9	8474-8483	Limestone, dark-gray, silty, widely scattered very fine sand grains, dark-gray medium oolites, crinoids, brachiopods, bryozoa, gastropods, cephalopods, pelecypods.
26	8483-8509	Shale, grayish-black, well-cemented.
2	8509-8511	Limestone, dark-gray, silty, pyrite, dark gray oolites, crinoids, brachiopods.
1	8511-8512	Shale, grayish-black, well-cemented.
50	8512-8562	Shale, grayish-black.
5	8562-8567	Limestone, medium-gray, silty, crinoids.
3	8567-8570	Shale, as above.
3	8570-8573	Limestone, as above.
1	8573-8574	Shale, as above.
15	8574-8589	Limestone, as above, crinoids.
1	8589-8590	Shale, as above.
7	8590-8597	Limstone, medium-gray, very silty, crinoids.
14	8597-8611	Shale, as above.
4	8611-8615	Limestone, medium-gray, slightly silty, crinoids.
2	8615-8617	Shale, as above.
5	8617-8622	Limestone, as above, crinoids.
6	8622-8628	Shale, as above.
3	8628-8631	Limestone, medium-gray, silty.
37	8631-8668	Shale, dark-gray, very finely micaceous.
37	8668-8705	Shale, grayish-black.
11	8705-8716	Siltstone, medium-gray, very slightly very finely sandy, limy, crinoids.
2	8716-8718	Shale, as above.
12	8718-8730	Siltstone, medium-gray, limy.
10	8730-8740	Shale, as above.
9	8740-8749	Siltstone, medium-gray.
11	8749-8760	Shale, as above.
12	8760-8772	Siltstone, medium-gray, slightly very finely sandy.
8	8772-8780	Shale, dark-gray, silty, very finely micaceous.
16	8780-8796	Sandstone, light-gray, very fine to fine-grained, silty, limy.
3	8796-8799	Shale, grayish-black.
4	8799-8803	Sandstone, light-gray, very fine grained, very silty, limy.
1	8803-8804	Shale, as above.
10	8804-8814	Sandstone, as above.
2	8814-8816	Shale, as above.
6	8816-8822	Siltstone, light-gray, slightly very finely sandy, limy.
1	8822-8823	Shale, as above.
7	8823-8830	Siltstone, light- to medium-gray, slightly limy.
1	8830-8831	Shale, as above.

Section of well 4—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System
		Morrow Series
8	8831-8839	Siltstone, as above.
1	8839-8840	Shale, as above.
8	8840-8848	Siltstone, as above.
1	8848-8849	Shale, as above.
2	8849-8851	Siltstone, as above.
11	8851-8862	Shale, as above.
7	8862-8869	Siltstone, medium-gray.
1	8869-8870	Shale, as above.
15	8870-8885	Siltstone, light- to medium-gray, slightly very finely sandy, slightly limy.
20	8885-8905	Siltstone, light- to medium-gray, very finely sandy, slightly limy.
12	8905-8917	Siltstone, medium-gray, slightly limy, well-cemented.
18	8917-8935	Shale, as above.
14	8935-8949	Sandstone, light- to medium-gray, very fine grained, very silty, limy. Core chips from 8960 to 8974.
11	8949-8960	Limestone, medium-gray, very finely to finely sandy.
6	8960-8966	Limestone, dark-gray, very finely to finely sandy, pyrite, crinoids, brachiopods.
5	8966-8971	Limestone, medium- to dark-gray, finely crystalline, very finely to finely sandy, carbonaceous streaks, pyrite, crinoids, brachiopods.
2	8971-8973	Limestone, medium-to dark-gray, very finely sandy, crinoids, brachiopods.
1	8973-8974	Siltstone, dark-gray, very finely sandy, limy, well-cemented.
		Total depth 8974.

Section of well 2

Post Petroleum Co. (Carter) no. 1 H. E. Turner

Sec. 15, T. 6 N., R. 28 W., Logan County, Ark. (Drilled approximately 9,300 ft. east of Barber quadrangle, Arkansas.) Elevation: 604 feet (derrick floor); total depth: 5,680 feet. Rock samples examined and logged by Boyd R. Haley. Middle part of the Atoka Formation.

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
7	0- 7	Soil.
28	7- 35	Shale, grayish-black, silty, very finely micaceous.
7	35- 42	Siltstone, dark-gray.
8	42- 50	Siltstone, dark-gray, very finely sandy.
40	50- 90	Shale, grayish-black, silty, very finely micaceous.
10	90- 100	Shale, grayish-black, silty, very finely micaceous, very thin streaks of coal—probably coalified plant fragments.
33	100- 133	Shale, grayish-black, silty, very finely micaceous.
22	133- 155	Shale, grayish-black, silty, very finely micaceous; stringers of medium- to dark-gray very finely sandy siltstone.
50	155- 205	Shale, grayish-black, very finely micaceous.
28	205- 233	Shale, grayish-black, silty, very finely micaceous.
12	233- 245	Siltstone, dark-gray, very finely sandy, calcite crystals.
10	245- 255	Shale, grayish-black, silty, very finely micaceous, calcite crystals.
5	255- 260	Siltstone, dark-gray, very finely sandy, very finely micaceous.
5	260- 265	Sandstone, light-gray, very fine grained, finely micaceous, very slightly limy.
60	265- 325	Shale, grayish-black, silty, very finely micaceous.
8	325- 333	Shale, grayish-black, very finely micaceous, very slightly limy, slickensided fragments.
20	333- 353	Sandstone, medium-gray, very fine grained, finely micaceous, very slightly limy, calcite crystals from farctures(?) in the sandstone unit.
37	353- 390	Shale, grayish-black, silty, very finely micaceous.
5	390- 395	Shale, grayish-black, very finely micaceous.
20	395- 415	Shale, grayish-black; stringers of limestone or calcite (fracture filling?), argillaceous, pyritic.
45	415- 460	Shale, grayish-black.
10	460- 470	Shale, grayish-black, silty, very finely micaceous.
25	470- 495	Shale, grayish-black, very slightly limy.
15	495- 510	Shale, grayish-black, silty.
30	510- 540	Siltstone, dark-gray, very finely micaceous.
5	540- 545	Siltstone, as above; stringers of pyritic calcite.
15	545- 560	Shale, grayish-black, silty, very finely micaceous.
5	560- 565	Siltstone, grayish-black, very finely micaceous, very slightly limy.
60	565- 625	Shale, grayish-black.
20	625- 645	Shale, grayish-black, very slightly limy.
5	645- 650	Shale, as above; stringers of calcite.
25	650- 675	Shale, grayish-black, very slightly limy.
8	675- 683	Shale, as above; stringers of calcite.
20	683- 703	Shale, grayish-black.
27	703- 730	Shale, grayish-black, very slightly limy.
5	730- 735	Shale, as above; stringers of calcite.
75	735- 810	Shale, dark-gray.
10	810- 820	Shale, grayish-black, silty, very finely micaceous.
30	820- 850	Shale, dark-gray to black, very finely micaceous.
2	850- 852	Shale, light-gray, flaky, dolomitic (or limy?), finely sandy, bentonite?
23	852- 875	Shale, dark-gray, very finely micaceous.
10	875- 885	Siltstone, grayish-black, very finely micaceous.
10	885- 895	Shale, grayish-black.
5	895- 900	Shale, grayish-black, silty.
10	900- 910	Shale, very slightly limy, pyrite.
25	910- 935	Shale, grayish-black, very finely micaceous, pyrite in 920 to 930.
50	935- 985	Shale, grayish-black, pyrite in 980 to 985.
3	985- 988	Sandstone, medium-gray, very fine grained, slightly silty, very finely micaceous.
17	988-1005	Shale, grayish-black, very thin veins of calcite in 990 to 995.
10	1005-1015	Shale, grayish-black, slightly silty, very micaceous.
75	1015-1090	Shale, grayish-black, very finely micaceous.
15	1090-1105	Siltstone, dark-gray, very finely sandy.
13	1105-1118	Shale, dark-gray to black, slightly silty, finely micaceous.
26	1118-1144	Sandstone, medium-gray, fine-grained, scattered rounded coarse to very coarse quartz sand grains, very slightly limy. Top of unit is top of zone p.

Section of well 2—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
21	1144-1165	Shale, grayish-black, silty.
35	1165-1200	Siltstone, dark-gray, medium micaceous, well-cemented.
5	1200-1205	Siltstone, as above, very finely sandy.
25	1205-1230	Shale, dark-gray, slightly silty, very finely micaceous.
27	1230-1257	Siltstone, dark-gray to black, finely micaceous.
11	1257-1268	Sandstone, light- to medium-gray, very fine to fine-grained, scattered subrounded coarse to very coarse frosted quartz sand grains, widely scattered glauconite.
4	1268-1272	Sandstone, medium-gray, fine-grained, widely scattered rounded medium to coarse frosted quartz sand grains, slightly limy.
19	1272-1291	Sandstone, medium-gray, very fine to fine-grained, scattered angular to subrounded coarse to very coarse frosted quartz sand grains.
27	1291-1318	Shale, grayish-black, silty, very finely micaceous.
5	1318-1323	Siltstone, dark-gray to black, well-cemented.
22	1323-1345	Sandstone, medium-gray, fine-grained, scattered rounded medium to coarse quartz sand grains, coarsely to very coarsely micaceous, widely scattered glauconite in 1330 to 1340.
18	1345-1363	Sandstone, medium-gray, very fine grained, scattered rounded medium quartz sand grains, silty, medium-micaceous, very thin carbonaceous streaks, widely scattered glauconite.
2	1363-1365	Shale, grayish-black.
5	1365-1370	Sandstone, light-gray, very fine to fine-grained, scattered rounded coarse to very coarse quartz sand grains, silty.
9	1370-1379	Siltstone, medium- to dark-gray.
11	1379-1390	Sandstone, medium-gray, very fine to fine-grained, scattered medium to coarse quartz sand grains.
8	1390-1398	Sandstone, light- to medium-gray, very fine grained, scattered subrounded medium to coarse quartz sand grains, silty.
11	1398-1409	Siltstone, medium-gray, very finely sandy.
3	1409-1412	Sandstone, light-gray, very fine grained, silty, coarsely micaceous.
21	1412-1433	Sandstone, light-gray, very fine to fine-grained, widely scattered medium to coarse quartz sand grains, silty, coarsely micaceous.
8	1433-1441	Shale, grayish-black.
8	1441-1449	Sandstone, light-gray, very fine grained, silty, finely to medium-micaceous.
7	1449-1456	Shale, grayish-black, silty.
14	1456-1470	Siltstone, light-gray, very finely sandy, finely micaceous.
15	1470-1485	Shale, grayish-black, silty, very finely micaceous.
9	1485-1494	Siltstone, dark-gray, finely micaceous.
9	1494-1503	Shale, dark-gray to black slightly silty, finely micaceous.
10	1503-1513	Siltstone, dark-gray, very finely sandy, finely micaceous.
9	1513-1522	Shale, dark-gray to black, slightly silty, very finely micaceous.
3	1522-1525	Sandstone, medium-gray, very fine to fine-grained, scattered rounded medium to coarse quartz sand grains, silty, coarsely micaceous.
11	1525-1536	Sandstone, medium-gray, fine- to medium-grained, abundant rounded coarse quartz sand grains, limy.
4	1536-1540	Shale, grayish-black, silty.
10	1540-1550	Sandstone, medium-gray, fine- to medium-grained, abundant rounded coarse to very coarse quartz sand grains, very coarse rounded fragments of dark-gray shale and medium-gray dense limestone, slightly limy, calcite crystals.
5	1550-1555	Shale, grayish-black.
10	1555-1565	Siltstone, dark-gray, very finely sandy.
9	1565-1574	Sandstone, medium-gray, fine- to medium-grained, widely scattered subangular to rounded coarse quartz sand grains, silty, slightly limy.
3	1574-1577	Shale, black, abundant slickensided fragments.
11	1577-1588	Sandstone, light- to medium-gray, fine-grained, widely scattered rounded medium quartz sand grains, widely scattered rounded very coarse medium-gray shale sand grains, silty, slightly limy.
2	1588-1590	Shale, grayish-black, silty, very finely micaceous.
2	1590-1592	Siltstone, light- to medium-gray.
63	1592-1655	Shale, grayish-black, silty, very finely micaceous.
24	1655-1679	Shale, grayish-black, silty, finely micaceous.
3	1679-1682	Sandstone, medium-gray, very fine grained, finely micaceous.
3	1682-1685	Shale, grayish-black, silty, very finely micaceous.
2	1685-1687	Sandstone, medium-gray, very fine grained, finely micaceous.
8	1687-1695	Shale, dark-gray to black.
5	1695-1700	Siltstone, medium- to dark-gray, very finely sandy.
23	1700-1723	Siltstone, medium- to dark-gray.

Section of well 2—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
12	1723-1735	Sandstone, medium-gray, fine-grained, widely scattered rounded medium to coarse quartz sand grains, silty, coarsely micaceous.
5	1735-1740	Shale, grayish-black, very finely micaceous.
10	1740-1750	Siltstone, medium-gray, finely to medium sandy.
15	1750-1765	Shale, grayish-black, silty, very finely micaceous.
3	1765-1768	Sandstone, light-gray, very fine grained, widely scattered subangular to rounded medium to coarse quartz sand grains, silty.
2	1768-1770	Shale, grayish-black.
10	1770-1780	Sandstone, light-gray, very fine grained, widely scattered subangular to rounded quartz sand grains, silty.
8	1780-1788	Siltstone, grayish-black.
12	1788-1800	Sandstone, medium-gray, very fine to fine-grained, widely scattered rounded meduim to coarse quartz sand grains.
4	1800-1804	Shale, grayish-black.
8	1804-1812	Sandstone, medium- to dark-gray, fine-grained, well-cemented.
2	1812-1814	Shale, grayish-black.
7	1814-1821	Sandstone, medium-gray, fine-grained, scattered rounded medium quartz sand grains.
4	1821-1825	Siltstone, medium-gray, finely sandy.
6	1825-1831	Siltstone, grayish-black.
13	1831-1844	Sandstone, medium- to dark-gray, very fine grained, widely scattered rounded medium quartz sand grains, silty, finely to medium-micaceous.
11	1844-1855	Siltstone, medium- to dark-gray, very finely to finely sandy, widely scattered rounded medium quartz sand grains.
10	1855-1865	Shale, grayish-black, slightly silty, very finely micaceous.
30	1865-1895	Shale, dark-gray to grayish-black.
10	1895-1905	Siltstone, grayish-black, finely micaceous, pyrite in 1895 to 1900.
22	1905-1927	Shale, grayish-black, very finely micaceous.
8	1927-1935	Siltstone, grayish-black, finely micaceous.
13	1935-1948	Shale, as above.
7	1948-1955	Siltstone, grayish-black, finely to coarsely micaceous.
30	1955-1985	Shale, grayish-black, silty.
10	1985-1995	Shale, grayish-black.
10	1995-2005	Siltstone, grayish-black.
5	2005-2010	Shale, as above.
82	2010-2092	Shale, grayish-black, slightly silty.
19	2092-2111	Sandstone, medium-gray, very fine grained, slightly silty, finely to coarsely micaceous, carbonaceous streaks.
3	2111-2114	Shale, grayish-black.
16	2114-2130	Sandstone, medium-gray, very fine grained, silty.
10	2130-2140	Shale, grayish-black, slightly silty, very finely micaceous.
5	2140-2145	Sandstone, light- to medium-gray, very fine grained, silty.
50	2145-2195	Siltstone, dark-gray, finely micaceous.
15	2195-2210	Siltstone, grayish-black, very finely sandy, finely micaceous.
10	2210-2220	Sandstone, medium-gray, very fine grained, silty, finely micaceous.
32	2220-2252	Siltstone, dark-gray, very finely sandy, finely micaceous.
39	2252-2291	Sandstone, dark-gray, very fine grained, silty, medium-micaceous, pyrite in 2265 to 2270.
4	2291-2295	Shale, grayish-black.
7	2295-2302	Sandstone, very light gray, very fine grained.
9	2302-2311	Sandstone, light- to medium-gray, very fine grained, well-cemented.
5	2311-2316	Shale, grayish-black.
14	2316-2330	Sandstone, light-gray, fine-grained, widely scattered rounded medium to coarse quartz sand grains, slightly silty, very slightly limy.
5	2330-2335	Sandstone, dark-gray, very fine grained, slightly limy.
5	2335-2340	Sandstone, light-gray, very fine grained, very slightly limy.
3	2340-2343	Shale, grayish-black.
12	2343-2355	Sandstone, very light to light-gray, very fine to fine-grained, finely to coarsely micaceous, very slightly limy.
5	2355-2360	Sandstone, medium-gray, very fine grained, well-cemented, very fine quartz crystals and very fine calcite crystals in fracture fillings.
5	2360-2365	Shale, grayish-black, slightly silty.
5	2365-2370	Siltstone, grayish-black, very finely sandy.
25	2370-2395	Sandstone, light- to medium-gray, very fine to fine-grained, medium-micaceous, very slightly limy.
5	2395-2400	Sandstone, light-gray, very fine to fine-grained, widely scattered rounded coarse quartz sand grains, finely to coarsely micaceous, very slightly limy.

Section of well 2—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
5	2400-2405	Sandstone, dark-gray, very fine grained, scattered rounded medium quartz sand grains,
9	2405-2414	Sandstone, light-gray, fine- to medium-grained, medium-micaceous.
3	2414-2417	Sandstone, dark-gray, very fine to fine-grained, medium-micaceous, limy.
2	2417-2419	Sandstone, light-gray, very fine to fine-grained, medium-micaceous, slightly limy.
2	2419-2421	Shale, grayish-black.
12	2421-2433	Sandstone, medium-gray, very fine to fine-grained, medium-micaceous, very slightly limy.
2	2433-2435	Shale, grayish-black.
8	2435-2443	Sandstone, light- to medium-gray, very fine grained, medium-micaceous, very slightly limy.
7	2443-2450	Sandstone, dark-gray, very fine grained, slightly silty.
10	2450-2460	Shale, grayish-black, slightly silty, very finely micaceous.
4	2460-2464	Sandstone, medium-gray, fine-grained, abundant rounded very coarse quartz sand grains, very coarse rounded fragments of dark-gray shale, finely to coarsely micaceous.
6	2464-2470	Shale, dark-gray to black.
5	2470-2475	Siltstone, grayish-black, very finely sandy.
21	2475-2496	Shale, black, slightly silty, very finely micaceous.
4	2496-2500	Sandstone, medium-gray, very fine grained, well-cemented.
10	2500-2510	Siltstone, grayish-black, very finely sandy, finely micaceous.
5	2510-2515	Shale, grayish-black, slightly silty.
7	2515-2522	Sandstone, light- to medium-gray, very fine grained, angular to rounded coarse quartz sand grains, silty, medium-micaceous, slightly limy, pyrite.
8	2522-2530	Shale, grayish-black, silty, some slickensided fragments.
15	2530-2545	Siltstone, dark-gray, very finely sandy.
5	2545-2550	Sandstone, dark-gray, very fine grained, silty, finely micaceous.
15	2550-2565	Sandstone, medium-gray, very fine grained, subrounded to rounded coarse quartz sand grains, limy.
5	2565-2570	Sandstone, dark-gray, very fine grained, slightly silty, very slightly limy.
16	2570-2586	Sandstone, medium-gray, very fine to fine-grained, abundant subrounded medium to very coarse quartz sand grains, slightly limy.
4	2586-2590	Sandstone, medium-gray, fine-grained, rounded coarse to very coarse quartz sand grains, very coarse fragments of medium-gray argillaceous calcite (fracture filling?), very coarse rounded fragments of dark-gray shale, eroded fragments of bryozoa.
12	2590-2602	Sandstone, medium-gray, fine-grained, abundant rounded coarse quartz sand grains, limy, eroded fragments of bryozoa, crinoids, gastropods, and pelecypods.
21	2602-2623	(No sample.) Probably sandstone as above.
5	2623-2628	Sandstone, medium-gray, fine-grained, rounded coarse quartz sand grains, limy; stringers of dark-gray siltstone. Core from 2628 to 2633.
5	2628-2633	Sandstone, light-gray, fine-grained, abundant rounded coarse quartz sand grains, limy, brachiopods; streaks of dark-gray siltstone.
14	2633-2647	(No sample.) Probably sandstone as above. Core from 2657 to 2683.
18	2647-2665	Siltstone, dark-gray, very finely sandy, widely scattered rounded coarse quartz sand grains, medium-micaceous; stringers of grayish-black shale, black carbonaceous shale, and coal.
10	2665-2675	Shale, grayish-black, slightly silty, finely to medium-micaceous; stringers of dark-gray siltstone.
10	2675-2685	Siltstone, dark-gray, medium-micaceous.
5	2685-2690	Sandstone, medium-gray, very fine grained, rounded coarse quartz sand grains, silty, fragments of medium-gray limestone, eroded fragments of bryozoa.
15	2690-2705	Sandstone, dark-gray, very fine to fine-grained, scattered medium to coarse quartz sand grains.
3	2705-2708	Shale, grayish-black.
4	2708-2712	Sandstone, light-gray, very fine to fine-grained, scattered medium to coarse quartz sand grains, medium-micaceous.
16	2712-2728	Shale, grayish-black, silty, finely micaceous.
7	2728-2735	Siltstone, grayish-black, medium-micaceous. Core from 2736 to 2774.
21	2735-2756	Shale, grayish-black, silty, finely micaceous.
9	2756-2765	Shale, black, slickensided fragments.
9	2765-2774	Shale, grayish-black, silty, medium micaceous, pyrite.
16	2774-2790	(No sample.) Probably shale as above.
14	2790-2804	Shale, grayish-black, silty, medium micaceous.
12	2804-2816	Siltstone, medium- to dark-gray, very finely sandy, finely micaceous.
9	2816-2825	Siltstone, dark-gray, very finely sandy, finely micaceous, well-cemented.
15	2825-2840	Shale, grayish-black, silty.

Section of well 2—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
20	2840-2860	Shale, grayish-black,
20	2860-2880	Shale, grayish-black, slightly silty, medium-micaceous.
30	2880-2910	Shale, grayish-black.
5	2910-2915	Sandstone, dark-gray, very fine grained, silty, well-cemented.
15	2915-2930	Shale, grayish-black, slightly silty, pyrite in 2920 to 2925.
65	2930-2995	Shale, grayish-black.
45	2995-3040	Shale, black, pyrite in 3020 to 3040.
15	3040-3055	Shale, grayish-black, slightly silty, pyrite.
60	3055-3115	Shale, black, pyrite in 3055 to 3075.
190	3115-3305	Shale, grayish-black, pyrite in 3140 to 3160.
5	3305-3310	Shale, grayish-black, very finely sandy.
122	3310-3432	Shale, black.
23	3432-3455	Shale, grayish-black, silty, finely micaceous.
15	3455-3470	Shale, grayish-black, slightly silty.
52	3470-3522	Shale, grayish-black, pyrite in 3490 to 3495 and 3515 to 3520.
2	3522-3524	Sandstone, dark-gray, fine-grained, slightly limy.
54	3524-3578	Shale, grayish-black, slightly silty.
2	3578-3580	Sandstone, medium-gray, very fine grained, well-cemented.
10	3580-3590	Shale, grayish-black, silty, finely micaceous.
2	3590-3592	Sandstone, as above.
16	3592-3608	Shale, as above.
2	3608-3610	Sandstone, as above.
20	3610-3630	Shale, dark-gray.
5	3630-3635	Sandstone, medium-gray, very fine grained, silty, very finely micaceous.
19	3635-3654	Shale, black.
6	3654-3660	Sandstone, medium-gray, fine-grained, scattered rounded medium to coarse quartz sand grains, medium-micaceous, well-cemented.
7	3660-3667	Shale, grayish-black.
2	3667-3669	Sandstone, light-gray, very fine to fine-grained, well-cemented.
6	3669-3675	Shale, as above.
4	3675-3679	Sandstone, medium-gray, very fine grained, silty.
11	3679-3690	Shale, grayish-black, slightly silty.
10	3690-3700	Sandstone, light- to medium-gray, very fine grained, widely scattered medium to coarse quartz sand grains, silty, medium-micaceous.
5	3700-3705	Sandstone, light-gray, very fine grained.
5	3705-3710	Siltstone, light-gray, very finely sandy, medium to coarsely micaceous.
3	3710-3713	Sandstone, light- to medium-gray, very fine grained, silty.
7	3713-3720	Shale, grayish-black, slightly silty.
5	3720-3725	Siltstone, medium-gray, very finely sandy.
29	3725-3754	Shale, grayish-black, silty.
16	3754-3770	Shale, grayish-black, silty, finely to medium-micaceous.
20	3770-3790	Siltstone, dark-gray, medium micaceous.
23	3790-3813	Shale, grayish black, slightly silty, very finely micaceous.
2	3813-3815	Sandstone, medium-gray, very fine grained, silty, well-cemented.
40	3715-3855	Shale, grayish-black, slightly silty, very finely micaceous.
5	3855-3860	Shale, grayish-black, silty, very finely sandy.
15	3860-3875	Siltstone, dark-gray, stringers of light-gray very fine grained sandstone.
10	3875-3885	Shale, grayish-black.
5	3885-3890	Sandstone, light-gray, very fine grained, silty, finely micaceous.
15	3890-3905	Siltstone, dark-gray, very finely sandy.
3	3905-3908	Sandstone, very light to light-gray, very fine to fine-grained, very slightly limy.
10	3908-3918	Shale, as above.
15	3918-3933	Sandstone, light-gray, very fine to fine-grained, scattered rounded medium quartz sand grains, silty, finely to medium-micaceous.
8	3933-3941	Shale, as above.
9	3941-3950	Shale, dark-gray, stringers of light-gray silty very fine grained sandstone.
5	3950-3955	Shale, grayish-black.
5	3955-3960	Sandstone, light-gray, very fine grained, quartz crystals.
2	3960-3962	Shale, as above.
11	3962-3973	Sandstone, light-gray, fine-grained, widely scattered rounded coarse quartz sand grains, quartz crystals.
3	3973-3976	Shale, as above.
9	3976-3985	Sandstone, light-gray, fine-grained.
20	3985-4005	Shale, grayish-black, slightly silty.
15	4005-4020	Siltstone, dark-gray, very finely sandy.

Section of well 2—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
11	4020-4031	Sandstone, light- to medium-gray, very fine to fine-grained, silty, medium-micaceous.
7	4031-4038	Siltstone, medium- to dark-gray.
3	4038-4041	Siltstone, medium- to dark-gray, very finely sandy.
9	4041-4050	Siltstone, dark-gray.
7	4050-4057	Sandstone, medium- to dark-gray, fine-grained, silty, well-cemented.
5	4057-4062	Shale, as above.
24	4062-4086	Siltstone, dark-gray, very finely sandy, finely micaceous.
6	4086-4092	Shale, grayish-black, slightly silty.
17	4092-4109	Sandstone, medium-gray, very fine to fine-grained, medium-micaceous.
12	4109-4121	Shale, grayish-black.
9	4121-4130	Sandstone, dark-gray, fine- to medium-grained, scattered angular to rounded coarse quartz sand grains, quartz crystals.
5	4130-4135	Siltstone, dark-gray, finely sandy.
18	4135-4153	Siltstone, dark-gray.
7	4153-4160	Sandstone, dark-gray, very fine grained, silty, finely to very coarsely micaceous.
15	4160-4175	Siltstone, dark-gray, medium-micaceous.
15	4175-4190	Sandstone, medium- to dark-gray, very fine to fine-grained, silty, medium-micaceous.
10	4190-4200	Sandstone, dark-gray, very fine to fine-grained, pyrite.
30	4200-4230	Shale, black.
20	4230-4250	Shale, grayish-black, slightly silty.
27	4250-4277	Shale, grayish-black.
18	4277-4295	Shale, grayish-black, slightly silty.
30	4295-4325	Shale, black.
3	4325-4328	Sandstone, medium-gray, fine-grained, medium-micaceous.
5	4328-4333	Shale, grayish-black.
22	4333-4355	Sandstone, very light to light-gray, very fine to fine-grained, well-cemented.
19	4355-4374	Sandstone, very light gray, very fine to fine-grained, porous.
6	4374-4380	Shale, grayish-black, slightly silty.
15	4380-4395	Siltstone, dark-gray, very finely sandy.
35	4395-4430	Shale, grayish-black.
10	4430-4440	Siltstone, dark-gray, finely to medium-micaceous.
10	4440-4450	Sandstone, medium-gray, very fine grained, silty, medium micaceous.
11	4450-4461	Sandstone, dark-gray, very fine grained, silty.
5	4461-4466	Siltstone, grayish-black, medium micaceous.
34	4466-4500	Shale, black, slightly silty.
31	4500-4531	Shale, grayish-black.
24	4531-4555	Shale, dark-gray, slightly silty.
40	4555-4595	Shale, black.
63	4595-4658	Shale, black, slightly silty to silty.
2	4658-4660	Sandstone, light-gray, very fine grained.
7	4660-4667	Shale, grayish-black.
3	4667-4670	Sandstone, as above.
30	4670-4700	Shale, black.
15	4700-4715	Shale, grayish-black, silty.
25	4715-4740	Shale, grayish-black.
40	4740-4780	Shale, grayish-black, slightly silty.
15	4780-4795	Sandstone, medium-gray, very fine grained, silty, medium micaceous.
5	4795-4800	Sandstone, medium-gray, fine-grained, silty, medium micaceous.
2	4800-4802	Shale, grayish-black.
9	4802-4811	Sandstone, medium-gray, very fine grained, silty.
2	4811-4813	Shale, as above.
12	4813-4825	Sandstone, medium-gray, very fine to fine-grained, widely scattered rounded coarse quartz sand grains, well-cemented.
2	4825-4827	Shale, as above.
8	4727-4835	Sandstone, medium-gray, fine-grained, coarsely micaceous.
5	4835-4840	Siltstone, dark-gray, very finely sandy, medium micaceous.
15	4840-4855	Sandstone, medium-gray, very fine grained, silty, medium-micaceous
5	4855-4860	Shale, as above.
15	4860-4875	Sandstone, medium-gray, fine-grained, coarsely micaceous, well-cemented.
3	4875-4878	Shale, as above.
11	4878-4889	Sandstone, medium-gray, fine-grained, coarsely micaceous, well-cemented, quartz crystals.
3	4889-4892	Shale, as above.
4	4892-4896	Sandstone, light- to medium-gray, fine-grained, well-cemented.
6	4896-4902	Siltstone, dark-gray, finely micaceous.

Section of well 2—(Continued)

Thickness in feet	Interval in feet	Description
		Pennsylvanian System **Atoka Formation**
9	4902-4911	Sandstone, medium-gray, very fine grained, quartz crystals.
3	4911-4914	Shale, as above.
5	4914-4919	Sandstone, medium-gray, fine-grained, coarsely micaceous, well-cemented.
7	4919-4926	Shale, as above.
29	4926-4955	Sandstone, medium-gray, fine-grained, widely scattered rounded coarse quartz sand grains, coarsely micaceous, very slightly limy.
5	4955-4960	Shale, grayish-black, slightly silty.
18	4960-4978	Sandstone, medium-gray, very fine to fine-grained, silty, coarsely micaceous.
27	4978-5005	Shale, grayish-black, slightly silty to silty.
5	5005-5010	Siltstone, dark-gray, very finely sandy, widely scattered rounded coarse quartz sand grains, pyrite.
19	5010-5029	Shale, grayish-black, slightly silty.
6	5029-5035	Sandstone, medium-gray, very fine grained, silty, very slightly limy.
10	5035-5045	Shale, grayish-black.
5	5045-5050	Sandstone, medium-gray, very fine grained.
5	5050-5055	Shale, as above.
10	5055-5065	Sandstone, medium-gray, fine-grained, well-cemented.
5	5065-5070	Shale, grayish-black, silty.
4	5070-5074	Sandstone, medium-gray, very fine grained, well-cemented.
56	5074-5130	Shale, dark-gray, slightly silty, slickensided fragments in 5105 to 5110.
10	5130-5140	Siltstone, dark-gray, very finely sandy.
58	5140-5198	Shale, grayish-black, slightly silty to silty.
5	5198-5203	Sandstone, light-gray, very fine grained.
7	5203-5210	Shale, grayish-black.
25	5210-5235	Siltstone, medium- to dark-gray, very finely sandy.
9	5235-5244	Sandstone, medium-gray, very fine grained, silty.
11	5244-5255	Shale, as above.
5	5255-5260	Siltstone, dark-gray, very finely sandy.
8	5260-5268	Sandstone, medium-gray, very fine grained, rounded medium to coarse quartz sand grains, silty.
5	5268-5273	Sandstone, medium-gray, very fine grained, well-cemented.
3	5273-5276	Shale, as above.
14	5276-5290	Sandstone, medium-gray, fine-grained, medium- to coarsely micaceous.
3	5290-5293	Shale, as above.
7	5293-5300	Sandstone, medium-gray, fine-grained.
8	5300-5308	Shale, as above.
10	5308-5318	Sandstone, medium-gray, fine-grained, quartz crystals.
2	5318-5320	Shale, black, slickensided fragments.
10	5320-5330	Sandstone, light- to medium-gray, fine-grained, well-cemented.
10	5330-5340	Shale, grayish-black.
5	5340-5345	Sandstone, dark-gray, very fine grained, silty.
13	5345-5358	Shale, grayish-black, slightly silty.
2	5358-5360	Sandstone, light-gray, very fine to fine-grained, well-cemented. Base of unit is base of zone p.
10	5360-5370	Shale, grayish-black, silty. Core from 5444 to 5464 and from 5475 to 5480.
110	5370-5480	Shale, black, very finely micaceous, slickensided fragments in 5447 to 5455.
200	5480-5680	Shale, grayish-black, very slightly limy.
		Total depth 5680.