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Geologic Descriptions and Coal Analyses for 1982 Coal Drilling in the Daniel Boone National Forest, Eastern Kentucky

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KENTUCKY GEOLOGICAL SURVEY
UNIVERSITY OF KENTUCKY, LEXINGTON SERIES XI,
Donald C. Haney, Director and State Geologist

GEOLOGIC DESCRIPTIONS AND COAL ANALYSES FOR 1982 COAL DRILLING IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY

Raymond R. Bergeron
U.S. Geological Survey

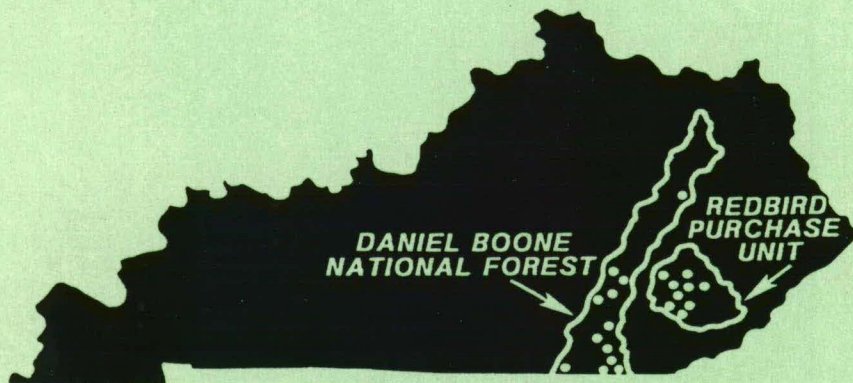
James C. Cobb

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Prepared in cooperation with the U.S. Minerals Management Service



INFORMATION CIRCULAR 12
SERIES XI, 1983



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*Prepared in cooperation with the U.S. Department of the
Interior, Minerals Management Service, under
Joint Funding Agreements 1-6130-0074 (for 1981-82)
and 2-6130-0037 (for 1981-83)*

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GEOLOGIC DESCRIPTIONS AND COAL ANALYSES FOR 1982 COAL DRILLING

IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY

By Raymond R. Bergeron,* U.S. Geological Survey, and
James C. Cobb, Ernie R. Slucher, and Richard A. Smath,
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ABSTRACT

This report contains core descriptions, lithologic logs, and analyses of coal from 21 stratigraphic test holes drilled in 1982 in the Daniel Boone National Forest, including the Redbird Purchase Unit, in eastern Kentucky.

The test holes ranged in depth from 85 to 1,988 feet and averaged about 700 feet. A total of 89 coal samples were analyzed. Results of analyses (on the as-received basis) showed the following ranges: ash, 2.37 to 28.8 percent; sulfur, 0.3 to 8.4 percent; and Btu, 9,017 to 14,550 per pound.

INTRODUCTION

The U.S. Geological Survey and the Kentucky Geological Survey conducted a joint core-drilling project in 1981 and 1982. The 21 holes were drilled in the Eastern Kentucky Coal Field on land within the Daniel Boone National Forest, including the Redbird Purchase Unit (fig. 1). Twelve core holes were drilled in the main part of the Daniel Boone National Forest, designated D-1 through D-13 (D-8 was not drilled). Nine holes were drilled in the Redbird Purchase Unit; these were designated R-1 through R-9.

The core descriptions, lithologic logs, and results of the analyses are presented in this report.

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NOTE: In the Carter coordinate grid system the larger rectangles, designated by letters in a north-south direction and numbers in an east-west direction, are bounded by 5 minutes of latitude and 5 minutes of longitude. Each of these is subdivided into 25 numbered sections which are 1 minute by 1 minute. Oil and gas records at the Kentucky Geological Survey are filed by Carter coordinate location.

5-P-64
EXAMPLE
OF LOCATION
DESIGNATION

5	4	3	2	1
6	7	8	9	10
15	14	13	12	11
16	17	18	19	20
25	24	23	22	21

KEY TO DIVISION OF
5' RECTANGLES

64

0 10 20 30 40
SCALE IN MILES

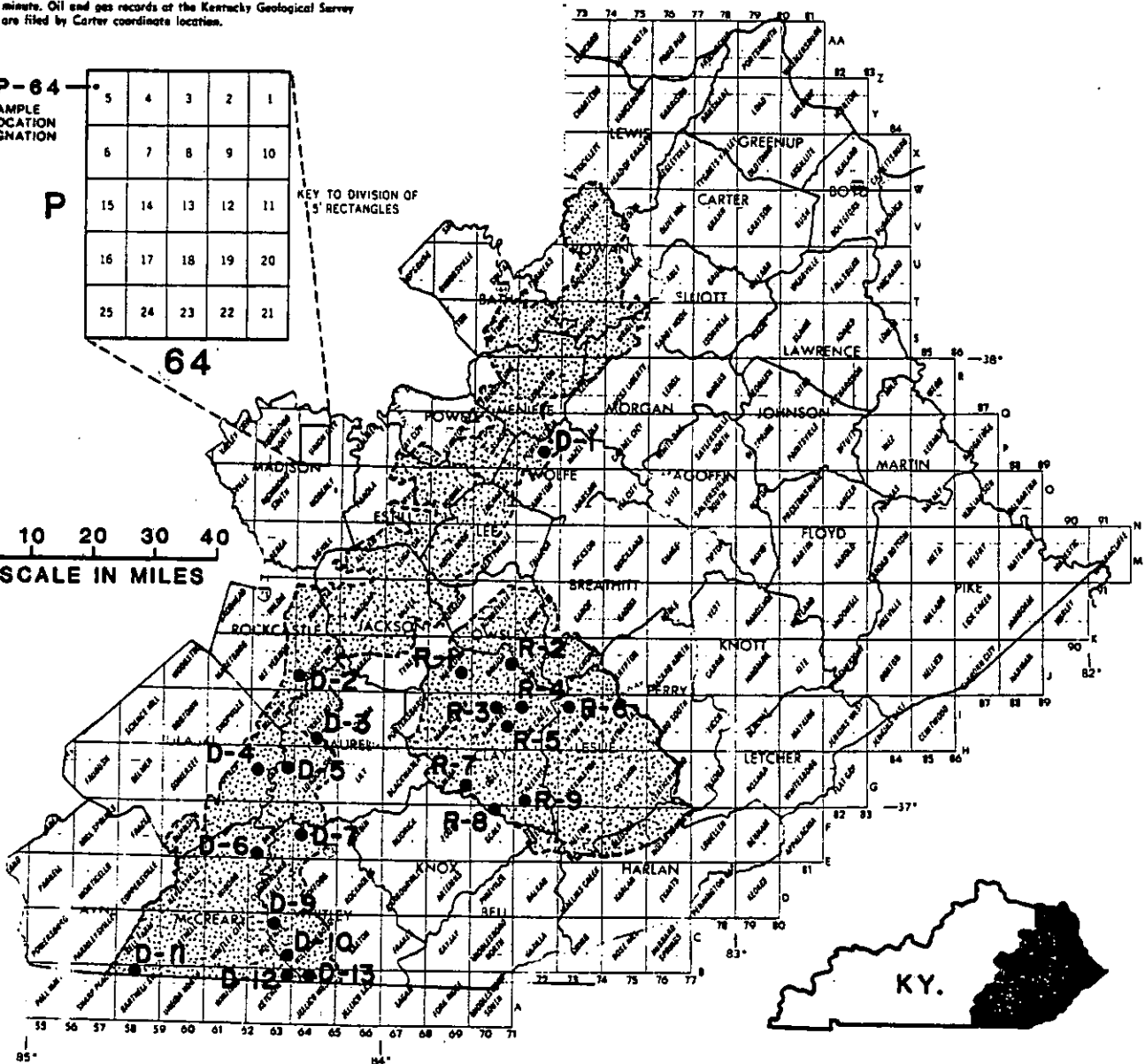


Figure 1. Index map showing locations of test holes drilled in 1982 in the Daniel Boone National Forest and the Redbird Purchase Unit.

The cores are stored at the Kentucky Geological Survey Core and Well Sample Library and are available for public inspection.

Stratigraphic test holes in the main part of the Daniel Boone National Forest were located in Wolfe, Rockcastle, Laurel, Pulaski, McCreary, and Whitley Counties. These holes ranged in depth from 85 to 1,981 feet, but most of them were about 500 feet deep. Coal greater than about 0.4 foot thick was sampled for standard analysis. A total of 32 coal samples from Cores D-1 through D-13 were analyzed. The coal ranged from 2.37 to 26.2 percent ash, 0.3 to 8.4 percent sulfur, and 9,612 to 14,111 Btu per pound (on the as-received basis).

Test holes in the Redbird Purchase Unit were located in Clay and Leslie Counties. These holes ranged in depth from 412 to 1,988 feet, but most were about 1,000 feet deep. Coal greater than about 0.6 foot in thickness was sampled from cores R-1 through R-9. A total of 57 coal samples from these cores were analyzed. The coals ranged from 3.1 to 28.8 percent ash, 0.6 to 6.7 percent sulfur, and 9,017 to 14,550 Btu per pound (on the as-received basis).

ACKNOWLEDGMENTS

This project was performed under two joint-funding agreements between the Kentucky Geological Survey and the U.S. Geological Survey. William Markewich was the project coordinator for the 1981-82 agreement (Control Number 1-6130-0074), and Raymond R. Bergeron was the project officer for the 1982-82 agreement (Control Number 2-6130-0037).

The information presented in this report resulted from the combined efforts of personnel from both the Kentucky Geological Survey and the U.S. Geological Survey.

The following U.S. Geological Survey geologists contributed to the geological descriptions of cores: Ken Adams, Raymond R. Bergeron, Carol Grant, Ron Law, William Markewich, Jeff Nolder, and Sharon O'Donnell. Carol Grant and Jeff Nolder served as field supervisors for the core drilling. The following Kentucky Geological Survey geologists contributed to geological descriptions of cores: Ken Gill, Ron Rea, and Kelly Waymire.

We would like to acknowledge H. L. Retcofsky, Division Manager, and his staff, of the U.S. Department of Energy, Pittsburgh Energy and Technological Center, Analytical Chemistry Division, who performed the coal analyses.

The core descriptions were edited by Margaret Luther and typed by Norma Reynolds, both on the staff of the Kentucky Geological Survey.

Geophysical well logs were run in each borehole; copies may be purchased from the National Geophysical Data Center, NOAA, Code D62, 325 Broadway, Boulder, Colorado 80303.

HOLE NO.: D-1
COUNTY, STATE: Wolfe, Kentucky, DRILLED DEPTH: 560 ft.
SURFACE ELEV.: 1197 ft. (alt.)^{1/} QUAD.: Pomeroyton 7.5 min.
LOCATION: 14-P-72, 2650 FEL X 4925 FSL

<u>Depth (Feet)</u>	<u>Description</u>
0-14.8 (14.8)	Cased interval, unconsolidated and weathered material.
14.8-34.9 (20.1)	Shale, medium- to very dark-gray; slightly sandy in top 1.0 foot; micaceous from 27.0-30.5 feet; sharp lower contact.
34.9-58.0 (23.1)	Sandstone, medium-gray; very fine grained; argillaceous; very burrowed; becomes silty and micaceous at 50.0 feet; gradational lower contact.
58.0-60.6 (2.6)	Shale, very dark-gray; very fissile.
60.6-60.8 (0.2)	COAL, bright-banded; some flat, platy pyrite; argillaceous.
60.8-65.4 (4.6)	Shale, very dark- to medium-gray; carbonaceous; very fissile; gradational lower contact.
65.4-71.2 (5.8)	Sandstone, light-gray; very fine grained; occasional dark-gray shale interbeds; slightly burrowed at top; gradational lower contact.
71.2-77.1 (5.9)	Sandstone, light-gray; very fine to medium grained; occasional shale laminae in upper part; abrupt grain size change to medium- to coarse-grained sandstone at 73.8 feet; sparse coal stringers at top of coarse zone; coarsens downward; sharp lower contact.
77.1-77.2 (0.1)	Siltstone, dark-gray; argillaceous; sharp lower contact.
77.2-78.4 (1.2)	Sandstone, light-brown to light-gray; very fine to medium grained; dark-gray shale laminae in middle third; scattered, well rounded shale clasts up to 0.1 foot in diameter in bottom third; grain size decreases toward middle of unit; sharp lower contact.

^{1/} Elevation determined by altimeter.

- 78.4-81.5 (3.1) Shale, very dark-gray; fissile; sharp lower contact.
- 81.5-84.3 (2.8) Sandstone, medium-gray; fine-grained; argillaceous; abundant light-brown shale clasts; very burrowed.
- 84.3-87.3 (3.0) Sandstone, light-gray; fine to medium grained; scattered, very dark-gray to light-brown shale clasts from 85.1 to 86.6 feet; 0.2 foot of shale clasts at base; sharp lower contact.
- 87.3-91.2 (3.9) Shale, very dark-gray; fissile; gradational lower contact.
- 91.2-164.1 (72.9) Sandstone, light-gray; very fine to fine grained; well sorted; sparse, very thin shale laminae; occasional light-gray sandy shale beds in upper part; micaceous in lower part.
- 164.1-166.5 (2.4) Sandstone, light-gray; fine grained; zones of abundant shale clasts.
- 166.5-234.0 (67.5) Sandstone, light-brown; fine to very coarse grained; 0.2 foot zone of quartz pebbles at 207.6 feet; 0.2 foot zone of coal clast at 209.2 feet; grain size changes from medium to coarse grained in lower quarter of unit; coarsens downward; sparse quartz pebbles at base; rapidly gradational lower contact.
- 234.0-235.5 (1.5) Conglomerate; quartz pebbles up to 0.02 foot in diameter, well rounded; sandstone matrix.
- 235.5-276.2 (40.7) Sandstone, light-brown; medium to coarse grained; sparse to occasional quartz pebbles; generally coarsens downward.
- 276.2-279.7 (3.5) Conglomerate; quartz pebbles up to 0.06 foot in diameter; sandstone matrix.
- 279.7-344.8 (65.1) Sandstone, light-gray; medium grained; abundant quartz pebbles up to 0.08 foot in diameter in lower 2.3 feet.

- 344.8-347.7 (2.9) Conglomerate, light-gray; quartz pebbles and sparse shale clasts; medium-grained sandstone matrix; sharp lower contact.
- 347.7-349.7 (2.0) Shale, medium dark-gray; slightly sandy.
- 349.7-350.1 (0.4) COAL, bright-banded; moderately well developed cleats; occasional lenses of pyrite.
- 350.1-351.6 (1.5) Shale, dark-gray; fissile.
- 351.6-357.6 (6.0) Shale and sandstone, interbedded; dark-gray shale, interbedded with thin, lenticular, light-gray, very fine-grained sandstone; burrowed.
- 357.6-371.0 (13.4) Shale, slightly sandy near base; sharp lower contact.
- 371.0-375.8 (4.8) Shale, very light- to dark-gray; clayey in upper part; color darkens downward; sharp lower contact.
- 375.8-409.1 (33.3) Shale; slightly sandy; thin, light-gray sandstone laminae occur below 377.0 feet.
- 409.1-409.5 (0.4) Clay, light-gray; plastic.
- 409.5-417.0 (7.5) Shale, dark-gray; sparse, light-gray, very fine-grained sandstone laminae below 410.0 feet.
- 417.0-418.1 (1.1) COAL, bright-banded. Sample D0101.
- 418.1-419.4 (1.3) Shale, light-gray; clayey in part.
- 419.4-441.1 (21.7) Shale and sandstone, interbedded; dark-gray shale with thinly interbedded, light-gray, very fine-grained sandstone; moderately to abundantly burrowed.
- 441.1-442.9 (1.8) COAL, bright-banded; well developed cleats; 0.5 foot shale parting 1.0 foot below top. Sample D0102.
- 442.9-443.2 (0.3) Shale, sandy; firm.
- 443.2-445.0 (1.8) Claystone, medium-gray; plastic in upper part.

- 445.0-472.9 (27.9) Shale, dark- to very dark-gray; slightly silty; slightly clayey zone 0.7 foot thick at 466.2 feet; sparse, very fine-grained sandstone laminae in top and bottom parts of unit; sandstone laminae increase in bottom few feet; sharp lower contact.
- 472.9-473.3 (0.4) Sandstone; very abundant shale clasts.
- 473.3-475.0 (1.7) Shale, sandy; sparse, light-gray, very fine-grained sandstone laminae.
- 475.0-476.5 (1.5) Shale, black; fissile.
- 476.5-476.6 (0.1) COAL, bright-banded.
- 476.6-478.0 (1.4) Claystone; firm; slickensided surfaces; nonfissile.
- 478.0-478.2 (0.2) Shale, medium-green.
- 478.2-560.0 (81.8) No lithologic description available.
- *Total Depth: 560.0

*Hole electric logged to 560.0 feet.

HOLE NO.: D-2
COUNTY, STATE: Rockcastle, Kentucky DRILLED DEPTH: 465.7 ft.
SURFACE ELEV.: 1369 ft. (topo)^{1/} QUAD.: Livingston 7.5 min.
LOCATION: 16-J-64, 1100 FEL X 4230 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-69.9 (69.9)	Casing; weathered material.
69.9-92.5 (22.6)	Sandstone, pale-red to yellowish-brown to light-gray; fine to medium grained; occasional zones of shale laminae; rippled to crossbedded; very weathered in parts; carbonaceous laminae and coal clasts from 80.4 to 83.3 feet; sparse shale clasts; sharp lower contact.
92.5-93.1 (0.6)	Claystone, light-gray; sandy; micaceous; coarsens downward; gradational lower contact.
93.1-109.6 (16.5)	Sandstone, medium- to light-gray; medium to very fine grained; slightly micaceous; scattered zones of black to dark-gray shale interbeds; rippled; occasional burrows in lower part; rare shale clasts; several small fining-upward sequences within unit; gradational lower contact.
109.6-118.8 (9.2)	Shale, dark-gray to black; clayey to silty; light-gray, fine- to medium-grained, rippled sandstone interbeds in upper part; moderate to abundant burrowing; slightly calcareous from 112.4 to 117.7 feet; generally coarsens upward; 0.1 foot siderite band at base; gradational lower contact.
118.8-132.6 (13.8)	Shale and sandstone, interbedded; medium-light- to medium-dark-gray, clayey to silty shale, interbedded with thin- to medium-bedded, medium-light- to light-gray, very fine- to fine-grained sandstone; rippled; occasional burrows; sparse plant fragments; bottom 0.6 foot weathered dark yellowish orange.

^{1/} Elevation determined from topographic quadrangle map.

- 132.6-170.0 (37.4) Sandstone, grayish-orange to light-gray; medium to fine grained; micaceous, sparse shale laminae; massive to crossbedded to rippled; scattered coal and shale clasts in lower 1.0 foot; slightly calcareous in parts; sharp, angular basal contact.
- 170.0-178.3 (8.3) Shale, medium-dark- to dark-gray; clayey to sandy; siderite bands and nodules; lower part very burrowed; coarsens downward; sharp, irregular basal contact.
- 178.3-178.7 (0.4) Shale, dark-gray; clayey; occasional burrows; sharp irregular base.
- 178.7-186.5 (7.8) Shale and sandstone, interbedded; medium-dark-gray shale interbedded with flat, medium-light-gray, very fine-grained, carbonaceous sandstone; siderite bands; very rare burrows; fines downward; gradational lower contact.
- 186.6-195.7 (9.1) Shale, dark-gray; clayey, silty at upper and lower contacts; sparse siderite bands; rapidly gradational lower contact.
- 195.7-200.3 (4.6) Shale, medium- to olive-gray; sandy; disseminated clay; sparse slickensided surfaces; rooted in upper part; underclay; fines downward.
- 200.3-201.4 (1.1) Sandstone, light-olive-gray; fine-grained; argillaceous; rooted.
- 201.4-214.8 (13.4) Shale, medium-dark-gray to grayish-black; abundant clay laminae; occasional siderite nodules; lower 0.5 foot is slightly carbonaceous and very clayey, with abundant slickensided surfaces; gradational lower contact.
- 214.8-216.3 (1.5) Claystone, light-olive-gray; fissile; rooted; slickensided surfaces; gradational lower contact.

- 216.3-218.1 (1.8) Sandstone, light-olive-gray to medium-gray with depth; argillaceous; rooted; sharp, irregular base.
- 218.1-220.9 (2.8) Claystone and siltstone, interbedded; olive-black to light-olive-gray, silty claystone interbedded with medium-dark-gray to olive-gray, clayey siltstone; sparse slickensided surfaces; disseminated siderite grains in claystone; sparse roots in lower part.
- 220.9-233.9 (13.0) Shale and sandstone; dark-gray, sandy shale coarsens downward into light-gray, very fine- to fine-grained sandstone; sparse siderite nodules; very burrowed; calcareous in lower 1.3 feet; sharp, burrowed lower contact.
- 233.9-243.1 (9.2) Shale, dark-gray; sandy with depth; sparse clay laminae; burrowing, increasing downward; rapid gradational lower contact.
- 243.1-247.7 (4.6) Sandstone and shale, interbedded; light-gray, very fine-grained sandstone interbedded with flat, medium-dark- to dark-gray, carbonaceous shale; burrowed; sparse siderite bands; fines downward slightly; rapidly gradational lower contact.
- 247.7-250.7 (3.0) Sandstone, light-gray; very fine-grained; shale and carbonaceous fragments; very burrowed; noncalcareous; occasional Lingula in lower 0.15 foot.
- 250.7-251.4 (0.7) Shale, grayish- to brownish-black; silty; slightly carbonaceous; Lingula in upper 0.15 foot; sharp lower contact.
- 251.4-253.6 (2.2) Sandstone, light-olive-gray to light-gray; very fine grained; sparse clay laminae and siderite nodules; rooted in lower 0.8 foot.

- 253.6-264.5 (10.9) Sandstone, very light-gray to pale-yellowish-brown; very fine to fine grained; mottled; petroliferous in parts; scattered shale laminae; rippled to crossbedded in lower part; siderite nodules at base; sharp, irregular lower contact.
- 264.5-271.9 (7.4) Shale, medium-dark-gray; silty; scattered siderite nodules and bands; sparse plant fragments; sharp lower contact.
- 271.9-272.1 (0.2) Claystone, grayish-black; carbonaceous; coal stringers; dark-gray, silty shale clasts; gradational lower contact.
- 272.1-272.2 (0.1) Bone coal; slickensided surfaces; bright coal stringers; gradational lower contact.
- 272.2-273.1 (0.9) COAL, bright-banded; occasional fusain lenses; sparse pyrite. Sample D0201.
- 273.1-274.6 (1.5) Shale, medium-gray; clayey; rooted; slickensided surfaces; scattered siderite nodules; rapidly gradational lower contact.
- 274.6-276.9 (2.3) Sandstone, very light-gray; very fine grained; occasional light-olive- to dark-gray shale laminae; rooted; gradational lower contact.
- 276.9-283.0 (6.1) Sandstone and shale, interbedded; sandstone, light-gray, calcareous from 278.4 to 282.7 feet; shale, dark-gray; rippled; sparse burrows, becoming very burrowed from 280.2 to 283.0 feet; gradational lower contact.
- 283.0-306.3 (23.3) Shale, medium-dark-gray; scattered sandstone laminae, decreasing in occurrence downward; occasional burrows and siderite nodules; gradational lower contact.
- 306.3-307.1 (0.8) Shale, medium-dark-gray; sandy; very burrowed; siderite nodules; carbonaceous in lower 0.1 foot; sharp lower contact.

- 307.1-307.2 (0.1) COAL, bright-banded; calcite along cleats.
- 307.2-309.3 (2.1) Siltstone, dark- to light-olive-gray; sandy; very rooted; sparse pyrite along rootlets; gradational lower contact.
- 309.3-316.6 (7.3) Sandstone, medium-light- to light-olive-gray; very fine grained; occasional thin shale laminae and beds; silty and rooted in upper 2.0 feet and lower 1.5 feet; gradational lower contact.
- 316.6-322.1 (5.5) Sandstone and shale, interbedded; light-gray, very fine-grained sandstone interbedded with dark-gray shale; rippled, sparse burrows; sandstone beds calcareous in part; sparse siderite bands; sharp lower contact.
- 322.1-326.8 (4.7) Shale, grayish-black, clayey; occasional thin sandstone laminae; siderite bands and nodules.
- 326.8-327.1 (0.3) COAL, bright-banded; sparse pyrite along cleats; badly broken.
- 327.1-330.9 (3.8) Sandstone, light- to medium-gray; very fine grained; mottled; rooted; occasional shale laminae sparse vitrain stringers.
- 330.9-336.7 (5.8) Sandstone, very light-gray; very fine to fine grained; occasional shale laminae; petroliferous in parts; sharp lower contact.
- 336.7-339.0 (2.3) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, very fine-grained sandstone; rippled; occasional burrows; sharp burrowed lower contact.
- 339.0-342.9 (3.9) Shale, dark-gray to grayish-black; sandy to clay in part; burrowed below 339.5 feet; rare siderite bands.
- 342.9-343.5 (0.6) COAL, dull-banded; bony; sparse slickensided surfaces; badly broken.

- 343.5-347.7 (4.2) Claystone, medium-dark- to light-olive-gray; color lightens downward; rooted; plastic; siderite nodules; slickensided surfaces; coarsens downward; gradational lower contact.
- 347.7-353.4 (5.7) Sandstone, light-gray to yellowish-brown; very fine to fine grained; mottled; very petroliferous.
- 353.4-354.2 (0.8) Shale, olive-gray; very sandy; light-gray, very fine-grained sandstone laminae in middle part; rapid gradational lower contact.
- 354.2-360.5 (6.3) Shale, grayish-black to black; clayey; occasional sandstone laminae; burrows; sparse siderite bands; sharp lower contact.
- 360.5-370.9 (10.4) Sandstone, medium-light-gray; fine grained; shale laminae; very burrowed; siderite nodules; gradational lower contact.
- 370.9-376.7 (5.8) Shale, medium- to dark-gray; upper half contains light-gray, fine-grained sandstone; lower part clayey; burrowed; occasional siderite nodules in lower part; rare vitrain stringers in upper part; gradational lower contact.
- 376.7-378.2 (1.5) Sandstone, medium- to medium-dark-gray; argillaceous; burrowed; scattered siderite nodules; rare pyritized plant fragments; gradational lower contact.
- 378.2-378.9 (0.7) Shale, medium-dark gray; sandy to clayey; sparse pyrite along bedding planes.
- 378.9-379.0 (0.1) Coal, bright-banded; pyrite along cleats.
- 379.0-380.2 (1.2) Siltstone, dark- to light-olive-gray; rooted; gradational lower contact.
- 380.2-380.9 (0.7) Sandstone, light to light-olive-gray; very fine-grained; mottled; rooted; gradational lower contact.

- 380.9-395.1 (14.2) Siltstone, medium-dark-gray to olive-gray to grayish-black; scattered, very fine-grained sandstone laminae in parts; mottled; rooted; slumped below 387.2 feet; disseminated siderite grains; slickensided surfaces; sharp, irregular lower contact.
- 395.1-402.8 (7.7) Shale, dark-gray to black; slightly clayey; carbonaceous in lower 0.8 feet; sparse pyrite; gradational lower contact.
- 402.8-402.9 (0.1) Bone coal.
- 402.9-403.3 (0.4) COAL, bright-banded. No sample.
- 403.3-404.1 (0.8) Siltstone, olive-gray; sparse vitrain stringers; rooted; carbonaceous and sandy in upper 0.1 foot; gradational lower contact.
- 404.1-414.7 (10.6) Sandstone, medium-dark-gray to light-olive-gray; very fine to fine grained; upper 1.0 foot is ganister; upper part rooted; sparse shale laminae in lower part; slumped at 413.0 feet; sharp, irregular lower contact.
- 414.7-416.0 (1.3) Shale, dark-gray; occasional thin sandstone laminae and lenses; bedding at angle down to 415.4 feet; slickensided surfaces at 415.5 feet; gradational lower contact.
- 416.0-416.6 (0.6) Shale, grayish-black to black; silty to clayey; carbonaceous; sparse, very thin sandstone laminae; plastic, dark-gray claystone at base.
- 416.6-416.7 (0.1) Bone coal; clayey; gradational lower contact.
- 416.7-418.8 (2.1) Shale, medium- to medium-dark-gray; clayey to silty; rooted; clayey zones, frequently contain slickensided surfaces; sparse siderite nodules.
- 418.8-419.1 (0.3) Shale, black; carbonaceous; vitrain stringers; slickensided surfaces.

- 419.1-420.3 (1.2) Shale, dark-gray to light-olive-gray; sandy; rooted; occasional slickensided surfaces; fines downward.
- 420.3-422.1 (1.8) Sandstone, olive- to medium-dark-gray; very fine grained; rooted; sparse siderite nodules; gradational lower contact.
- 422.1-424.1 (2.0) Shale, medium-gray; silty to clayey; disseminated siderite grains; coarsens upward; irregular lower contact.
- 424.1-426.4 (2.3) Shale, medium-dark-greenish-gray to medium-olive-gray; silty to clayey; sparse slickensided surfaces; rare burrows; sharp lower contact.
- 426.4-426.8 (0.4) Dolostone, yellowish-gray; microcrystalline; sparse greenish-gray shale laminae; gradational lower contact.
- 426.8-428.5 (1.7) Shale, dark-greenish-gray; thin limestone interbeds in middle third; lower third is clayey; calcareous; sparse burrows and glauconite grains; rapid gradational lower contact.
- 428.5-433.6 (5.1) Shale and limestone, interbedded; dark-greenish-gray clay shale with medium-bedded, medium-gray to light-greenish-gray, very fine-crystalline limestone; occasional burrows; shale sandy in lower third; occasional brachiopods in lower part.
- 433.6-444.3 (10.7) Sandstone, greenish-gray; very fine grained; argillaceous; calcareous; mottled; gray to greenish-gray, sandy shale bed in upper part; burrowed; rare siderite nodules; sharp, burrowed lower contact.
- 444.3-453.4 (9.1) Shale and sandstone, interbedded; medium-dark-gray to greenish-gray clay shale interbedded with very fine- to fine-grained sandstone; rippled; occasional thin limestone beds in lower part; burrowed; sparse plant fragments in upper part; gradational lower contact.

453.4-465.7 (12.3)

Limestone and shale, interbedded; medium-dark-gray to olive-gray limestone with occasional interbeds of medium-dark-gray clay shale; very fine- to coarse-crystalline limestone; abundant invertebrate fossils throughout.

Total Depth: 465.7

HOLE NO.: D-3
COUNTY, STATE: Laurel, Kentucky DRILLED DEPTH: 528.9 ft.
SURFACE ELEV.: 1254 ft. (alt.) QUAD.: Bernstadt 7.5 min.
LOCATION: 9-H-64, 4700 FEL X 150 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-21.0 (21.0)	Casing interval, unconsolidated and weathered material.
21.0-53.8 (32.8)	Sandstone, pink to light-brown; very fine-grained; well sorted; friable.
53.8-63.0 (9.2)	Hole caving; additional casing placed to 63.0 feet.
63.0-100.5 (37.5)	Sandstone, pinkish-red to light-brown; fine grained; well sorted; sparse clay fragments in lower 10.0 feet; sharp lower contact.
100.5-108.4 (7.9)	Shale, medium- to dark-gray; top 1.0 feet very slightly plastic; fissile.
108.4-109.2 (0.8)	COAL, bright-banded; somewhat broken. Sample D0301.
109.2-110.0 (0.8)	Shale, dark-gray; coarsens downward into very fine-grained sandstone with thin shale laminae.
110.0-182.1 (72.1)	Sandstone, light-gray; very fine grained; thin, dark-gray shale interbeds in upper part.
182.1-183.2 (1.1)	Shale, dark-gray; occasional light-gray sandstone interbeds.
183.2-188.9 (5.7)	Sandstone, light-gray; fine grained; sparse, dark-gray shale laminae; well cemented.
188.9-203.6 (14.7)	Shale, dark-gray; sparse, light-gray sandstone laminae; sparse plant fragments.
203.6-213.1 (9.5)	Shale, dark-gray; very sandy; massive.
213.1-214.5 (1.4)	Sandstone, light-gray; scattered, dark-gray shale laminae and clasts.
214.5-230.5 (16.0)	Shale, dark-gray; sandy; massive; rapidly gradational contact.

- 230.5-271.2 (40.7) Sandstone, light-gray; fine to coarse grained; micaceous; sparse, very thin carbonaceous shale laminae in lower part; coal clast at 250.8 feet; shale, siderite, and coal clasts in lower 0.65 foot; coarsens downward; sharp base.
- 271.2-279.5 (8.3) Shale, medium-dark- to dark-gray; very fine grained sandstone laminae that coarsen downward; burrowed; siderite nodules in top 0.04 foot; very carbonaceous in bottom 0.04 foot; gradational lower contact.
- 279.5-280.6 (1.1) COAL, bright-banded; good cleats; pyrite lenses in upper and lower 0.2 foot; sparse bone streaks. Sample D0302.
- 280.6-281.3 (0.7) Shale, dark-gray to grayish-black; clayey and vitrain stringers in upper part; rooted.
- 281.3-309.5 (28.2) Shale and sandstone, interbedded; dark-gray to grayish-black shale interbedded with very thin- to medium-bedded, light-gray, very fine-grained sandstone; silty in part; sparse siderite bands and burrows; sandstone calcareous in lower 3.0 feet; rooted in upper 3.0 feet; gradational lower contact.
- 309.5-311.6 (2.1) Shale, grayish-black; sandy; sparse siderite bands; gradational lower contact.
- 311.6-314.4 (2.8) Claystone, olive-black to olive-gray; vitrain stringers; slickensided surfaces; color lightens downward; fissile; gradational lower contact.
- 314.4-315.1 (0.7) Shale, medium-gray; sandy; rooted; sharp, irregular lower contact.
- 315.1-319.5 (4.4) Sandstone, light-gray; fine grained; very thin shale laminae; rippled; 0.1 foot siltstone bed in middle of unit; rooted to 316.0 feet; sharp lower contact.

- 319.5-327.7 (8.2) Sandstone and shale, interbedded; light-gray, very fine- to medium-grained, crossbedded to rippled sandstone with occasional thin, medium-dark-gray shale beds and laminae; sparse burrows; sandstone beds frequently have sharp lower contacts; sharp angular lower contact.
- 327.7-382.6 (54.9) Sandstone, light- to medium-light-gray; very fine to medium grained; well to poorly sorted; sparse, very thin shale laminae; massive to crossbedded to rippled; sparse thin zones of coarse to very coarse grains in upper part; in bottom 3.0 feet sandstone is medium to very coarse grained with scattered quartz pebbles, coal clasts, and graded beds; rapid gradational lower contact.
- 382.6-383.5 (0.9) Conglomerate, light-gray; abundant quartz pebbles in top and bottom 0.25 foot; sandstone matrix is light gray, medium to coarse grained; sparse shale laminae in middle third; sharp lower contact.
- 383.5-398.2 (14.7) Sandstone, light-gray; medium to very coarse grained; scattered quartz pebbles; sparse, very thin shale laminae; massive to crossbedded to rippled; generally coarsens upward; sharp lower contact.
- 398.2-399.8 (1.6) Shale, dark-gray to grayish-black; sandy; micaceous; burrowed; Lingula below 399.5 feet; coarsens downward; gradational lower contact.
- 399.8-401.7 (1.9) Sandstone and shale, interbedded, mottled; medium-light- to dark-gray, very fine- to fine-grained, burrowed sandstone interbedded with dark-gray to grayish-black, sandy shale; sandstone beds have disseminated pyrite and sharp irregular lower contacts.

- *401.7-407.8 (6.1) Sandstone, light-gray; very fine to fine grained; hard; rooted; scattered shale laminae below 405.1 feet; top 0.1 foot is ganister; rippled and burrowed in bottom 1.0 foot; gradational lower contact.
- 407.8-415.6 (7.8) Shale, medium- to dark-gray; occasional sandstone laminae and interbeds in upper quarter; clayey in lower part; rare plant fragments and siderite bands; burrowed in top 2.0 feet; sparse slickensided surfaces at base; sharp lower contact.
- 415.6-427.7 (12.1) Sandstone, light-gray; very fine grained; sparse shale beds with siderite bands; rippled in lower part; gradational lower contact.
- 427.7-438.1 (10.4) Shale, dark-gray; siderite bands and nodules; few plant fragments; sharp lower contact.
- 438.1-438.3 (0.2) COAL, dull-banded to bright-banded in lower 0.05 foot; gradational lower contact.
- 438.3-446.4 (8.1) Sandstone, light-gray; fine grained; carbonaceous laminae; top 3.0 feet rooted; sparse shale laminae; fines upward; sharp lower contact.
- 446.4-453.0 (6.6) Sandstone and shale, interbedded; light-gray, fine-grained sandstone with dark-gray shale interbeds; rippled; occasional burrows; fairly sharp lower contact.
- 453.0-458.6 (5.6) Shale, dark-gray; clayey in lower part; occasional carbonaceous laminae.
- 458.6-459.3 (0.7) COAL, bright-banded; poor cleats; some calcite along cleats; pyrite in middle of unit; sharp lower contact. Sample D0303.

*Probable 2 to 3 feet core lost.

- 459.3-471.5 (12.2) Siltstone, brown to gray; clayey to sandy in parts; rooted; siderite nodules; becomes shaly with very thin sandstone laminae downward; occasional slickensided surfaces; gradational lower contact.
- 471.5-480.1 (8.6) Sandstone, very light-gray; fine grained; scattered, dark-gray shale laminae; calcareous in top 3.0 feet; very burrowed; sparse small siderite nodules; gradational lower contact.
- 480.1-510.2 (30.1) Shale, dark-gray; clayey to silty in part; scattered medium-gray, fine-grained sandstone laminae and beds; burrowed; sparse siderite bands and nodules; amount of sandstone increases downward; gradational lower contact.
- 510.2-510.5 (0.3) Sandstone, dark- to medium-gray; fine grained; argillaceous; mottled; burrowed; vitrain stringer at base; sharp irregular base.
- 510.5-510.9 (0.4) Claystone, black; very carbonaceous; some pyrite along vitrain stringers; gradational lower contact.
- 510.9-513.4 (2.5) Shale, medium-dark-gray to olive-gray; clayey to silty; rooted; slickensided surfaces; mottled in part; fines upward; sparse, small pyrite nodules; sharp lower contact.
- 513.4-515.2 (1.8) Sandstone, dark-gray to medium-gray to grayish-green; very fine to fine grained; argillaceous; sparse siderite-replaced rootlets; mottled in part; bottom 0.3 foot burrowed.
- 515.2-516.3 (1.1) Shale, grayish-green; clayey; fine-grained sandstone-filled burrows; sparse roots and siderite nodules; sharp lower contact.
- 516.3-516.9 (0.6) Limestone, grayish-yellowish-green; microcrystalline; slightly argillaceous; burrowed; rapidly gradational lower contact.

- 516.9-517.9 (1.0) Shale, grayish-green; burrowed; nodular limestone in lower part; sharp lower contact.
- 517.9-524.7 (6.8) Sandstone, light- to medium-light-gray; very fine grained to silty; rippled; moderately burrowed in top 1.2 feet, sparse elsewhere.
- 524.7-526.0 (1.3) Shale, grayish-green; silty in lower part; limestone nodules; calcareous; burrowed in lower part; gradational lower contact.
- 526.0-527.5 (1.5) Sandstone and dolostone, interbedded; greenish-gray, very fine-grained to silty sandstone with interbedded medium-olive-gray dolostone; slightly rippled; burrowed; gradational lower contact.
- 527.5-528.1 (0.6) Dolostone, light-olive-greenish-gray; microcrystalline; burrowed; gradational lower contact.
- 528.1-528.9 (0.8) Shale, dark-gray to dark-greenish-gray; clayey; mottled; burrowed; slightly calcareous.

Total Depth: 528.9

HOLE NO.: D-4
COUNTY, STATE: Pulaski, Kentucky DRILLED DEPTH: 287.9 ft.
SURFACE ELEV.: 1193 ft. (alt.) QUAD.: Ano 7.5 min.
LOCATION: 2-G-62, 1915 FEL X 4100 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-22.6 (22.6)	Casing, unconsolidated and weathered material.
22.6-36.5 (13.9)	Sandstone, light- to medium-gray; very fine to medium grained; upper part weathered pink to brown; occasional medium-gray, clayey shale beds; massive to crossbedded; sparse coarse grains in lower 2.0 feet.
36.5-41.8 (5.3)	Sandstone and shale, interbedded; light-gray, very fine- to fine-grained sandstone with medium-dark-gray clayey shale interbeds; thin to medium bedded; sandstone and shale contacts are sharp to gradational and frequently burrowed.
41.8-43.4 (1.6)	Sandstone, light-gray; very fine to fine grained; well sorted; massive; sparse shale streaks; sharp, irregular lower contact.
43.4-46.6 (3.2)	Shale and sandstone, interbedded; medium-dark-gray, clayey shale interbedded with light-gray, fine-grained, rippled sandstone; shale beds commonly have very thin sandstone laminae and burrows; sharp lower contact.
46.6-48.8 (2.2)	Sandstone; light-gray; very fine to fine grained; massive to crossbedded to rippled; thin, medium-dark-gray, clayey shale bed in middle; sharp lower contact.
48.8-55.8 (7.0)	Sandstone and shale, interbedded; light-gray, very fine- to fine-grained, rippled sandstone interbedded with medium-dark-gray, clayey shale; burrowed; occasional thin sandstone laminae in shale beds; unit orange to brown and weathered in bottom 1.5 feet; sharp lower contact.

- 55.8-58.8 (3.0) Sandstone, grayish-orange-pink to medium-reddish-orange; fine to coarse grained; crossbedded; graded beds; rare shale clasts; bottom 0.1 foot rippled; sharp lower contact.
- 58.8-60.9 (2.1) Sandstone and shale, interbedded; pale-orange to yellowish-brown, fine-to coarse-grained, rippled sandstone interbedded with medium-dark-gray to pale-yellowish-brown, clayey to silty shale; weathered in part; sharp angular lower contact.
- 60.9-69.2 (8.3) Sandstone, grayish-orange-pink to light-brown; fine to coarse grained, crossbedded to rippled; occasional graded beds in lower part; occasional thinly laminated to bedded, medium-dark-gray to yellowish-brown, clayey shale beds; weathered in part; sparse shale clasts in sandstone.
- 69.2-109.6 (40.4) Sandstone, light-gray to orange-pink to yellow-brown; fine to medium grained; mottled; weathered in part; occasional thin shale laminae and beds in part; crossbedded to massive; sparse quartz pebbles and coarse-grained zones in lower 15 feet; gradational lower contact.
- 109.6-138.8 (29.2) Sandstone, pale-red to grayish-orange to very light-gray; medium to very coarse grained; scattered quartz pebbles and granules throughout; mottled; massive to crossbedded; occasional graded beds; gradational lower contact.
- 138.8-139.8 (1.0) Conglomerate, approximately 95 percent quartz pebbles; sandstone matrix, medium- to very coarse-grained; slightly crossbedded; gradational lower contact.
- 139.8-141.2 (1.4) Sandstone, pale-red to grayish-brown; medium to very coarse grained; sparse quartz pebbles; low-angle crossbeds.

- 141.2-144.3 (3.1) Conglomerate, pale-red to dusky-yellowish-brown; abundant quartz pebbles and granules; sandstone matrix, medium- to very coarse-grained; mottled; sparse, low-angle crossbeds.
- 144.3-147.8 (3.5) Sandstone, orange-pink to yellowish-brown; medium to very coarse grained; mottled; occasional quartz pebble zones; massive to low-angle crossbedding; coarsens downward.
- 147.8-159.9 (12.1) Sandstone, medium-pink to dark-yellowish-brown; coarse to very coarse grained; conglomeratic; mottled; coarsens downward.
- 159.9-171.2 (11.3) Adjustment for core lost in upper part of drill hole.
- 171.2-179.9 (8.7) Sandstone, orange-pink to medium-brown; medium to very coarse grained; conglomeratic; massive to crossbedded; sparse voids in sandstone; quartz pebbles as large as 0.06 foot in diameter; sharp, irregular lower contact.
- 179.9-190.3 (10.4) Sandstone, light-gray; fine to very fine grained; sparse to abundant, thin, dark-gray shale laminae; rippled to crossbedded; sparse shale and siderite clasts; sharp, irregular lower contact.
- 190.3-192.1 (1.8) Shale, grayish-black; clayey; very fissile.
- 192.1-192.3 (0.2) COAL, bright-banded; no shale or pyrite.
- 192.3-192.7 (0.4) Shale, very dark-gray.
- 192.7-193.2 (0.5) Clay, medium-gray, firm.
- 193.2-194.3 (1.1) Sandstone, very light-gray; very fine grained; silty; sharp lower contact.
- 194.3-194.6 (0.3) Clay, grayish-brown; firm.
- 194.6-195.1 (0.5) Clay, black; semi-plastic.

195.1-200.8 (5.7)	Claystone, light-gray to medium-gray-brown; plastic in upper part; color darkens downward.
200.8-218.5 (17.7)	Shale, medium- to dark-gray; silty at bottom; sparse, thin, light-gray sandstone laminae in bottom 5 feet; rare, small pyrite nodules; sharp lower contact.
218.5-219.8 (1.3)	Sandstone, light-gray; very fine grained; thin, dark-gray shale interbeds in lower part.
219.8-221.2 (1.4)	Shale, dark-gray; sandy; very thin sandstone laminae throughout.
221.2-228.3 (7.1)	Sandstone and shale, interbedded; very light-gray, very fine-grained sandstone with very dark-gray shale interbeds; very burrowed.
228.3-228.7 (0.4)	COAL, bright-banded; no pyrite or shale.
228.7-244.2 (15.5)	Sandstone, light-gray to very light-gray; very fine grained; silty and dark gray in top 2.0 feet; occasional thin, dark-gray shale laminae and burrows in lower 4.0 feet; shale clast at 242.3 feet; sharp lower contact.
244.2-248.0 (3.8)	Claystone, light-gray; semi-plastic at top to firm at bottom.
248.0-257.5 (9.5)	Shale and sandstone, interlaminated; dark-gray, silty shale with thin, light-gray sandstone laminae.
257.5-258.1 (0.6)	COAL, bright-banded; 0.04 foot pyrite band at 257.75 feet; disseminated pyrite throughout; calcite along cleats. Sample D0401.
258.1-259.6 (1.5)	Clay, dark-gray; semi-plastic, rooted.
259.6-287.9 (28.3)	Shale, medium-gray to alternating red and green in lower 10 feet; very fissile; slickensided surfaces.
Total Depth:	287.9

HOLE NO.: D-5
COUNTY, STATE: Laurel, Kentucky DRILLED DEPTH: 517.7 ft.
SURFACE ELEV.: 1245 ft. (alt.) QUAD.: Ano 7.5 min.
LOCATION: 2-G-63, 4585 FEL X 1240 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-31.0 (31.0)	Cased interval, unconsolidated and weathered material.
31.0-46.4 (15.4)	Shale, medium- to dark-gray; very thin sandstone laminae and sparse burrowing in upper part; clayey; sparse siderite bands; sparse plant fossils; 0.1 foot siderite band at base; sharp lower contact.
46.4-53.5 (7.1)	Sandstone and shale, interlaminated; medium-gray, very fine-grained sandstone interlaminated with medium-dark-gray shale; scattered plant fossils and siderite bands and nodules; rippled; sparse burrows; clayey in lower 1.3 feet; 0.06 foot siderite band at base.
53.5-62.1 (8.6)	Shale, grayish-black to black; clayey; carbonaceous; very thin sandstone laminae and burrows in upper part; abundant vitrain stringers in part; sparse sandstone laminae and siderite band at base.
62.1-68.0 (5.9)	Claystone, medium-dark- to dark-gray; silty in middle part; abundant roots; rare vitrain stringers; slickensided surfaces in part; gradational lower contact.
68.0-68.9 (0.9)	Shale, medium-dark-gray; silty; occasional medium-gray, very fine-grained sandstone beds; very rooted; rapidly gradational lower contact.
68.9-72.1 (3.2)	Sandstone, medium- to medium-light-gray; very fine grained; argillaceous in part; rooted to 71.0 feet; sparse, very thin vitrain stringers in lower part; sharp, irregular lower contact.

- 72.1-73.1 (1.0) Shale and sandstone, interbedded; medium-dark-gray shale interbedded with medium-light-gray, very fine-grained sandstone; occasional small pebbles and thin beds of siderite; occasional slickensided surfaces; contorted bedding; sharp lower contact.
- 73.1-73.2 (0.1) Shale, black; carbonaceous; occasional thin vitrain stringers; sparse, very thin sandstone laminae; gradational lower contact.
- 73.2-74.3 (1.1) COAL, bright-banded; moderate to very thin dull bands; moderate pyrite lenses in top 0.3 foot. Sample D0501.
- 74.3-75.8 (1.5) Seat rock, dark-gray; clayey to silty; rooted; sparse siderite-replaced rootlets in lower 0.3 feet; coarsens downward; gradational lower contact.
- 75.8-76.8 (1.0) Shale, dark-gray; silty; occasional very thin sandstone laminae; rooted; coarsens downward; occasional siderite-replaced rootlets; gradational lower contact.
- 76.8-77.5 (0.7) Shale, sandy, mudflow; rooted; very deformed; gradational lower contact.
- 77.5-125.6 (48.1) Shale and sandstone, interbedded; dark-gray shale interbedded with medium-light-gray, very fine-grained sandstone; rippled; sandstone slightly calcareous in part; rare to moderate burrows; rooted in top 5.0 feet; occasional siderite bands and replaced burrows; sandstone beds less abundant in lower part; gradational lower contact.
- 125.6-126.3 (0.7) Shale, grayish-black; slightly silty; rare plant fossils.

- 126.3-127.8 (1.5) Shale and sandstone, interlaminated; dark-gray shale interlaminated with medium-light-gray, very fine-grained sandstone; rippled; sandstone calcareous in lower 0.9 foot; burrows; rapidly gradational lower contact.
- 127.8-135.8 (8.0) Shale, grayish-black; silty; rapidly gradational lower contact.
- 135.8-141.0 (5.2) Sandstone, medium-gray; very fine grained; argillaceous; very burrowed; Lingula at 137.4 feet; slightly to very calcareous; siderite nodules in lower 2.0 feet; fines downward; gradational lower contact.
- 141.0-149.6 (8.6) Shale and sandstone, interbedded; dark-gray shale interbedded with very thin, very fine-grained sandstone; shale, carbonaceous and micaceous in upper part; very burrowed in upper part; sparse, very thin siderite bands; sandstone beds decrease downward; rapidly gradational lower contact.
- 149.6-150.4 (0.8) Siltstone, medium-light-olive-gray; occasional roots; sharp lower contact.
- 150.4-152.6 (2.2) Shale, dark-gray; clayey; rare pyrite laminae; sharp lower contact.
- 152.6-193.8 (41.2) Sandstone, light-gray to yellowish-brown to orange-pink; very fine to fine grained; micaceous in part; light-olive-gray siltstone and shale laminae in upper part; massive to crossbedded to rippled; sparse shale clasts in upper part; sharp, irregular lower contact.
- 193.8-217.5 (23.7) Sandstone, light- to very light-gray; fine to very fine grained; rare to moderate, very thin shale laminae; massive to crossbedded to rippled; medium-bedded, dark-gray shale with very thin sandstone laminae occurs approximately every 4.0 feet; sharp lower contact.

- 217.5-221.5 (4.0) Shale and sandstone, interlaminated; dark-gray, silty shale very thinly interlaminated with sandstone; rippled; sparse burrows in upper part; coarsens downward; gradational lower contact.
- 221.5-279.3 (57.8) Sandstone, light- to medium-light-gray; very fine to medium grained; occasional very thin carbonaceous shale laminae; massive to crossbedded to rippled; occasional graded beds; coal bands and clasts at 254.5 feet and below 270.3 feet; sharp lower contact.
- 279.3-284.3 (5.0) Claystone, brownish-black to grayish-black; carbonaceous; slickensided surfaces; occasional sulfide streaks.
- 284.3-300.4 (16.1) Sandstone, medium-light- to light-gray; medium to very fine grained; coal and shale clasts in upper 3.0 feet; scattered shale laminae in lower part; disseminated pyrite in coal; coarsens upward.
- 300.4-300.6 (0.2) Conglomerate; siderite pebbles; medium- to coarse-grained sandstone matrix.
- 300.6-332.7 (32.1) Sandstone, medium-light- to light-gray; fine to very coarse grained; sparse to moderate, very thin shale laminae; occasional quartz pebbles; 0.06 foot conglomeratic zone at 317.8 feet; massive to crossbedded to rippled; sparse graded beds; rare vitrain streaks; coarsens downward; gradational lower contact.
- 332.7-334.6 (1.9) Conglomerate; abundant quartz pebbles; sparse siderite pebbles; rare coal streaks; sharp lower contact.
- 334.6-337.7 (3.1) Sandstone, medium-grained; very thin shale laminae; sparse, very coarse-grained zones; crossbedded; sharp lower contact.
- 337.7-339.0 (1.3) Conglomerate, light-gray; abundant granule-sized grains; coarse- to very coarse-grained sandstone matrix.

- 339.0-349.3 (10.3) Sandstone, light-gray; medium to very coarse grained; moderate quartz pebbles in upper part; occasional, very thin shale laminae; rare siderite pebbles; crossbedded in part; sharp, irregular lower contact.
- 349.3-349.7 (0.4) COAL, bright-banded; layering very irregular; probably a large clast.
- 349.7-357.7 (8.0) Sandstone, light-olive-gray to medium-gray-green; fine to coarse grained; micaceous in lower part; occasional quartz pebbles in upper part; sparse carbonaceous streaks; massive to crossbedded; lower 0.6 foot has greenish hue; sharp lower contact.
- 357.7-358.0 (0.3) Conglomerate, grayish-blue-green; abundant quartz and siderite pebbles; medium-grained sandstone matrix; sharp lower contact.
- 358.0-377.4 (19.4) Shale, dark-gray; clayey; occasional very thin sandstone laminae in upper 1.7 feet; rare to sparse burrows; sparse siderite bands; occasional disseminated pyrite in burrows; gradational lower contact.
- 377.4-378.3 (0.9) Siltstone, dark-gray; sandy; burrowed; siderite nodules in middle of unit; gradational lower contact.
- 378.3-382.4 (4.1) Claystone, grayish-black; no fossils; sharp lower contact.
- 382.4-382.8 (0.4) Sandstone, medium-gray; very fine grained; carbonaceous films; hard; dense; sharp lower contact.
- 382.8-382.9 (0.1) Siderite band; vitrain streaks; rooted.
- 382.9-387.0 (4.1) Siltstone, light-olive-gray; clay laminae and siderite grains in lower part; rooted, decreasing downward; rapidly gradational lower contact.

- 387.0-399.7 (12.7) Sandstone, very light-gray; very fine grained; disseminated siderite grains in top 1.0 foot; very thin, rippled shale and carbonaceous shale laminae; rare siderite pebbles; sharp, irregular lower contact.
- 399.7-401.0 (1.3) Shale and sandstone, interlaminated; carbonaceous shale interlaminated with light-gray, very fine-grained sandstone; rippled; burrowed; sharp lower contact.
- 401.0-407.7 (6.7) Shale, dark-gray; clayey; rare siderite bands; sparse burrows; occasional vitrain stringers in lower 0.2 foot.
- 407.7-407.8 (0.1) COAL, dull-banded; sparse pyrite lenses; badly broken.
- 407.8-407.9 (0.1) Shale, grayish-black; carbonaceous; semi-flint clay; poorly developed slickensided surfaces; sharp, irregular lower contact.
- 407.9-414.4 (6.5) Sandstone, light- to very light-gray; very fine to fine grained; very thin shale laminae in lower part; rooted to 413.0 feet; Stigmaria; gradational lower contact.
- 414.4-421.1 (6.7) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, very fine-grained sandstone; sparse burrows; rare vitrain stringers and plant fragments; sandstone beds thin and decrease in occurrence downward; sharp lower contact.
- 421.1-423.3 (2.2) Shale, dark-gray; clayey; sparse siderite bands; gradational lower contact.
- 423.3-423.8 (0.5) COAL, dull-banded; calcite along cleats; badly broken. Not sampled.
- 423.8-423.9 (0.1) Bone coal.

- 423.9-428.5 (4.6) Shale, grayish-black to medium-gray to light-olive-gray; silty to clayey; slightly plastic; rooted; occasional siderite-replaced roots; seat rock; color lightens downward; gradational lower contact.
- 428.5-437.0 (8.5) Shale, light-olive-gray to dark-gray; sandy; burrowed; very sandy in middle part; occasional siderite bands and grains; gradational lower contact.
- 437.0-440.2 (3.2) Shale, grayish-black to black; silty; rare plant fragments.
- 440.2-441.0 (0.8) COAL, bright- and dull-banded; broken. Sample D0502.
- 441.0-441.4 (0.4) Siltstone, brownish-black; rooted; rapidly gradational lower contact.
- 441.4-452.0 (10.6) Sandstone, light-olive-gray to light-gray; very fine grained; argillaceous in lower part; rooted in upper part; sparse siderite-replaced roots; bedding appears disrupted in lower part; fines downward; gradational lower contact.
- 452.0-461.6 (9.6) Sandstone and shale, interlaminated; light-gray, very fine-grained sandstone interlaminated with brown-gray, carbonaceous shale; burrowed in part; siderite bands and nodules; slumped and slickensided surfaces from 452.0 to 456.2 feet; fines downward; fairly sharp lower contact.
- 461.6-463.5 (1.9) Shale, dark-gray; clayey; siderite bands and nodules; carbonaceous at base.
- 463.5-464.2 (0.7) COAL, bright-banded; good two-direction cleats; occasional pyrite and calcite along cleats; fairly sharp lower contact. Sample D0503.
- 464.2-465.0 (0.8) Shale, black to brown-gray; carbonaceous at top; clayey; siderite nodules; rooted.

465.0-470.0 (5.0)	Shale, gray-green; very clayey; siderite nodules at top; sandy in part; occasional slickensided surfaces; bedding appears disrupted; gradational lower contact.
470.0-493.6 (23.6)	Sandstone, gray to light-gray, gray-green zones at top; fine grained; dark-gray shale laminae, decreasing downward; sharp lower contact.
493.6-517.7 (24.1)	Shale, purplish to brownish-red to gray-green; very clayey; sandy in parts; occasional slickensided surfaces.
Total Depth: 517.7	

HOLE NO.: D-6
COUNTY, STATE: McCreary, Kentucky DRILLED DEPTH: 666.7 ft.
SURFACE ELEV.: 1241 ft. (alt.) QUAD.: Sawyer 7.5 min.
LOCATION: 12-E-62, 4185 FEL X 300 FNL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-15.0 (15.0)	Cased interval; unconsolidated and weathered material.
15.0-18.3 (3.3)	Sandstone, medium-gray; fine grained; silty; sparse siltstone clasts.
18.3-19.7 (1.4)	Clay, medium- to dark-gray; sandy at base; semiplastic.
19.7-24.7 (5.0)	Sandstone, medium-gray; fine grained; silty to clayey; coarsens upward.
24.7-28.1 (3.4)	Clay, light-gray; sandy; plastic.
28.1-39.4 (11.3)	Sandstone and shale, interbedded; very light- to light-gray, fine- to very fine-grained sandstone thinly interbedded with greenish-gray to medium-gray shale; occasional burrows; amount of sandstone decreases downward; sharp lower contact.
39.4-46.4 (7.0)	Shale, medium-dark-gray; abundant plant fossils and burrows in top part; occasional siderite nodules; sharp lower contact.
46.4-47.2 (0.8)	COAL, bright-banded; well developed cleats. Sample D0601.
47.2-49.6 (2.4)	Shale, dark- to medium-gray; carbonaceous in top 1.0 foot; very thin sandstone laminae in lower part; plant fossils; siderite nodules; rooted; gradational lower contact.
49.6-63.7 (14.1)	Sandstone, light-greenish-gray; fine to very fine grained; occasional thin shale laminae and beds; occasional siderite nodules; gradational lower contact.

- 63.7-73.2 (9.5) Sandstone and shale, interbedded; light-greenish-gray, fine- to very fine-grained sandstone interbedded with thin shale; amount of sandstone decreases downward; gradational lower contact.
- 73.2-153.2 (80.0) Shale, dark- to medium-gray; silty in part; thin, light-gray, very fine-grained sandstone laminae and beds in part; occasional burrowing.
- 153.2-154.8 (1.6) Sandstone, very light-gray; very fine grained; sparse, very thin shale laminae.
- 154.8-159.7 (4.9) Shale, medium- to dark-gray; sandy; sparse, very thin sandstone laminae; sharp lower contact.
- 159.7-169.1 (9.4) Sandstone, very light-gray; very fine grained; argillaceous at top.
- 169.1-170.0 (0.9) Clay, light-gray; very sandy; firm.
- 170.0-175.0 (5.0) Sandstone, very light-gray; very fine to fine grained; well sorted; coarsens downward; sharp lower contact.
- 175.0-175.4 (0.4) Sandstone, light- to medium-gray; silty; sharp lower contact.
- 175.4-307.9 (132.5) Sandstone, light-gray; medium grained; sparse coal clasts in top part; sparse, coarse-grained zone in lower 30.0 feet; zones of faint horizontal fractures 0.02 to 0.08 foot apart in lower 30.0 feet.
- 307.9-308.2 (0.3) Conglomerate; quartz pebbles up to 0.08 foot in diameter.
- 308.2-344.8 (36.6) Sandstone, light-gray; fine to medium grained; rare to frequent zones of small quartz pebbles in upper part; sparse, thin, dark shale laminae in lower part; scattered quartz pebbles near base; sharp lower contact.
- 344.8-359.0 (14.2) Shale; clayey; slightly plastic in part; plant fossils; slickensided surfaces.

- 359.0-359.1 (0.1) COAL; shaly; abundant pyrite.
- 359.1-364.0 (4.9) Shale, dark-gray; light-gray sandstone laminae in lower 3.0 feet; sandstone increases downward; gradually grades into sandstone.
- 364.0-392.4 (28.4) Sandstone, light-gray; very fine to fine grained; rare to sparse, thin, dark shale laminae in parts.
- 392.4-407.2 (14.8) Shale, dark-gray; no sandstone; fissile; sharp lower contact.
- 407.2-410.4 (3.2) Sandstone, light gray; medium grained.
- 410.4-439.7 (29.3) Sandstone and shale, interbedded; light-gray, very fine-grained sandstone interbedded with dark-gray shale; moderately burrowed.
- 439.7-443.2 (3.5) COAL, bright-banded; well developed cleats; two pyrite bands. Sample D0602.
- 443.2-452.2 (9.0) Siltstone, sandy; sparse slickensided surfaces; coarsens downward; firm; gradational lower contact.
- 452.2-461.8 (9.6) Sandstone, light-gray; fine grained; occasional dark-gray thin shale laminae; rare coal laminae; sharp lower contact.
- 461.8-466.4 (4.6) Shale, dark-gray; clayey; core badly broken.
- 466.4-467.7 (1.3) COAL, bright-banded; two irregular shale and siderite partings up to 0.04 foot thick; some pyrite. Sample D0603.
- 467.7-471.5 (3.8) Shale, very dark-gray; becoming sandy at 469.0 feet; gradational lower contact.
- 471.5-486.3 (14.8) Sandstone, light-gray; very fine to fine grained; dark-gray shale beds and laminae common in upper part; rippled; siderite nodules near base; fairly sharp lower contact.

- 486.3-492.2 (5.9) Sandstone and shale, interbedded; light-gray, fine-grained sandstone interbedded with dark-gray shale; very burrowed; siderite at base; fairly sharp lower contact.
- 492.2-505.0 (12.8) Shale, dark-gray; clayey; siderite bands and nodules; Lingula(?) at 493.0 feet; fissile.
- 505.0-505.3 (0.3) COAL, bright-banded; calcite along cleats.
- 505.3-511.8 (6.5) Shale, light-gray; semiplastic; slickensided surfaces; becoming silty downward; fairly sharp lower contact.
- 511.8-522.0 (10.2) Sandstone, very light- to light-gray; very fine grained; sparse, thin, dark-gray shale beds in lower part.
- 522.0-522.8 (0.8) Shale, dark-gray.
- 522.8-528.9 (6.1) Sandstone and shale, interbedded; light-gray, very fine-grained sandstone interbedded with dark-gray shale interbeds; lower 0.3 feet burrowed.
- 528.9-529.2 (0.3) Shale, very dark-gray; clayey, slickensided surfaces.
- 529.2-529.5 (0.3) COAL, bright-banded.
- 529.5-530.0 (0.5) Claystone, dark-gray; abundant plant fossils; firm; gradational lower contact.
- 530.0-542.0 (12.0) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, very fine- to fine-grained sandstone; burrowed; amount of sandstone slightly increases downward; gradational lower contact.
- 542.0-544.3 (2.3) Shale, dark- to very dark-gray with depth.
- 544.3-544.7 (0.4) COAL, bright-banded; well developed cleats.

- 544.7-571.0 (26.3) Shale and sandstone, interlaminated; dark-gray shale interlaminated with light-gray, very fine-grained sandstone; burrowed in upper part; amount of sandstone increases toward middle of unit; gradational lower contact.
- 571.0-574.0 (3.0) Claystone, medium-gray; firm; coarsens downward; very gradational lower contact.
- 574.0-576.0 (2.0) Sandstone, light- to medium-gray; very fine grained; very gradational lower contact.
- 576.0-579.0 (3.0) Shale, medium-gray; sandy.
- 579.0-594.5 (15.5) Sandstone, light-gray; fine to medium grained; coarsens downward; zone of quartz pebbles below 583.0 feet; abundant zones of horizontal fractures; sharp lower contact.
- 594.5-604.9 (10.4) Shale, dark-gray to dark-greenish-gray; clayey to silty; calcareous in part; sparse, light-gray, microcrystalline dolostone beds; burrows; gradational lower contact.
- 604.9-609.3 (4.4) Shale and sandstone, interbedded; dark-gray shale interbedded with fine-grained sandstone; rippled; burrows; sparse, disseminated pyrite.
- 609.3-610.3 (1.0) Shale, light- to dark-gray; calcareous; abundant fossil shell fragments in lower 0.25 feet.
- 610.3-614.6 (4.3) Dolostone, medium-light- to light-gray; very fine crystalline; sharp lower contact.
- 614.6-618.0 (3.4) Shale, medium-dark-gray to dark-greenish-gray; clayey to silty; sparse, thin limestone interbeds in part; calcareous, burrowed, and slickensided surfaces in part; gradational lower contact.

- 618.0-632.0 (14.0) Shale and sandstone, interbedded; dark-gray to greenish-gray shale interbedded with thin, calcareous sandstone; rippled; burrows; scattered plant fossils in upper 2.0 feet; occasional fossiliferous limestone beds in lower 3.0 feet; amount of sandstone increases downward; gradational lower contact.
- 632.0-649.1 (17.1) Limestone, dark-gray to olive-black; very fine crystalline to microcrystalline; sparse, thin shale laminae; brecciated in upper part; vugs filled with calcite and dolomite in lower part; occasional burrows and brachiopods; rapidly gradational lower contact.
- 649.1-666.7 (17.6) Limestone, light-gray-brown to medium-olive-gray; very fine to coarse crystalline; scattered greenish-black to greenish-gray, clayey shale laminae and beds; burrowed; sparse to abundant brachiopods; nodular bedded in part.

Total Depth: 666.7

HOLE NO.: D-7
COUNTY, STATE: Whitley, Kentucky DRILLED DEPTH: 744.9 ft.
SURFACE ELEV.: 1213.0 ft. (alt.) QUAD.: Vox 7.5 min.
LOCATION: 25-F-64, 2600 FEL X 4300 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-8.0 (8.0)	Cased interval; unconsolidated and weathered material.
8.0-86.8 (78.8)	Sandstone, light-tan to pinkish-brown to light-gray; fine to medium-grained; sparse zones of very thin shale laminae; zones of coarse- and very coarse-grained, graded-bedded sandstone in part; coal clasts and bands below 81.9 feet; sharp lower contact.
86.8-90.3 (3.5)	Shale, medium-dark-gray.
90.3-90.4 (0.1)	Bone coal.
90.4-95.0 (4.6)	Shale, medium-dark-gray; rooted; underclay.
95.0-104.3 (9.3)	Shale, medium-dark-gray; occasional thin sandstone laminae; amount of sandstone increases downward; sideritic at top; crossbedded; gradational lower contact.
104.3-199.8 (95.5)	Sandstone, light-gray; fine to medium grained; occasional thin shale laminae in part; massive to crossbedded; coal and siderite clasts at 184.5 feet and in lower 3.5 feet; siderite and shale pebble conglomerate in bottom 0.6 foot; sharp lower contact.
199.8-281.8 (82.0)	Shale and sandstone, interlaminated; medium-dark-gray shale interlaminated with sparse to abundant, thin sandstone; burrowed, rippled, and plant fossils in part; very burrowed at 228.0 feet; sharp lower contact.
281.8-289.3 (7.5)	Shale, light-brown-gray to medium-gray; very sandy; seat rock; sand content decreases toward middle of unit; sandstone laminae in lower 3.0 feet; sharp lower contact.

- 289.3-367.1 (77.8) Sandstone, very light- to light-gray; very fine to coarse grained; micaceous; occasional thin, dark-gray shale and carbonaceous shale laminae; rare quartz pebbles; rippled to crossbedded; occasional graded beds in lower part; occasional coal and siderite clasts below 330.0 feet, most abundantly near base; fines upward; sharp lower contact.
- 367.1-368.2 (1.1) COAL, bright-banded; fair cleats; abundant pyrite lenses. Sample D0701.
- 368.2-372.0 (3.8) Shale, dark-gray; abundant plant fragments and coaly bands; disseminated pyrite; rooted in lower part.
- 372.0-393.4 (21.4) Sandstone, gray; very fine to fine grained; argillaceous; scattered clayey shale laminae and ripples in lower part; siderite bands and nodules; plant fragments and coal bands in part; rooted in upper few feet; gradational lower contact.
- 393.4-395.8 (2.4) Shale, carbonaceous; bone and coal bands throughout; pyrite; 0.15 foot coal at base; slickensided surfaces; fairly sharp lower contact.
- 395.8-398.9 (3.1) Shale, brown-gray; silty at top; rooted; siderite nodules; carbonaceous laminae in part; clayey in lower part; sharp lower contact.
- 398.9-426.6 (27.7) Sandstone, light-gray; fine grained; sparse, dark-gray shale laminae; occasional zones of quartz pebbles; graded beds; horizontal fractures at 400.0 feet; conglomeratic at base; sharp lower contact.
- 426.6-427.6 (1.0) COAL, bright-banded; pyrite lenses; 0.04 foot shale at top. Sample D0702.

- 427.6-461.7 (34.1) Shale, dark-gray to gray-black; clayey in top few feet; occasional coal bands and plant fragments; siderite nodules; slickensided surfaces; thin, light-gray, burrowed sandstone laminae in upper part; gradational lower contact.
- 461.7-461.9 (0.2) Shale, black; slightly carbonaceous; plant fragments.
- 461.9-462.2 (0.3) COAL, bright-banded; well developed cleats.
- 462.2-463.8 (1.6) Siltstone; coarsens downward; abundant plant fragments; occasional well rounded sandstone clasts; sparse coal stringers.
- 463.8-472.2 (8.4) Sandstone and shale, interlaminated; light-gray, very fine-grained sandstone interlaminated with very dark-gray to black shale; coarsens upward; gradational lower contact.
- 472.2-489.5 (17.3) Shale, dark-gray to black; sparse, thin laminae of very fine-grained sandstone in upper part; gradational lower contact.
- 489.5-499.8 (10.3) Sandstone, light-gray; fine grained; irregular dark-gray shale clasts common in upper part.
- 499.8-508.9 (9.1) Sandstone and shale, interbedded; light-gray, fine-grained sandstone interbedded with dark shale.
- 508.9-523.2 (14.3) Sandstone, light-gray to white; fine grained; sparse, thin shale laminae; well cemented; sharp lower contact.
- 523.2-523.8 (0.6) COAL, bright-banded; sparse pyrite; badly broken. Sample D0703.
- 523.8-524.2 (0.4) Shale, black; nonplastic.
- 524.2-538.3 (14.1) Siltstone, medium- to dark-gray; occasional thin, medium-olive-gray, very fine-grained sandstone beds and laminae; sparse plant fragments; sparse slickensided surfaces in upper 4.0 feet; rapidly gradational lower contact.

- 538.3-541.7 (3.4) Sandstone, medium-light-olive-gray to medium-gray; mottled; sparse to abundant silty shale laminae; rippled; bedding slightly contorted in part; siderite nodules at base; sharp; irregular lower contact.
- 541.7-542.5 (0.8) Siltstone, dark-gray; micaceous; rare, thin sandstone laminae; rapidly gradational lower contact.
- 542.5-554.9 (12.4) Sandstone and shale, interbedded; medium-light-gray, very fine-grained sandstone interbedded with very thin, dark-gray shale; rippled; zones of abundant shale clasts; rare siderite clasts; sharp lower contact.
- 554.9-555.1 (0.2) COAL, bright-banded; fairly well developed cleats.
- 555.1-557.9 (2.8) Siltstone, light- to medium-light-olive-gray; rooted; sparse pyrite-replaced rootlets; sparse, thin sandstone laminae; coarsens downward into fine-grained sandstone at base; sharp lower contact.
- 557.9-558.2 (0.3) Shale, medium-light-olive-gray; scattered, thin sandstone laminae; roots; sparse, thin siderite bands; rapidly gradational lower contact.
- 558.2-559.8 (1.6) Sandstone, light-olive-gray to medium-light-gray; very fine to fine-grained; occasional very thin shale laminae; rooted in upper part; sharp, irregular lower contact.
- 559.8-568.6 (8.8) Sandstone and shale, interlaminated; medium-light-gray, very fine-grained sandstone interlaminated with dark-gray shale; rippled; sparse to rare burrows; occasional siderite bands; amount of sandstone decreases downward; lower 0.6 foot silty and burrowed; sharp lower contact.
- 568.6-573.7 (5.1) Shale, dark-gray; sparse siderite-replaced burrows; lower 0.2 foot clayey.
- 573.7-574.0 (0.3) Siltstone, medium- to dark-gray; rooted; color darkens downward.

- 574.0-574.9 (0.9) COAL, bright-banded, bright bands increasing downward; sparse pyrite lenses; calcite along cleats; badly broken. Sample D0704.
- 574.9-579.6 (4.7) Siltstone, medium-light-olive-gray; clayey; rooted; poorly developed slickensided surfaces; gradational lower contact.
- 579.6-580.5 (0.9) Shale, grayish-black; carbonaceous; rooted; rapidly gradational lower contact.
- 580.5-588.9 (8.4) Shale, medium-light-olive-gray to dark-gray; very thin sandstone laminae, increasing downward; rooted in upper part; occasional ripples and siderite streaks; rapidly gradational lower contact.
- 588.9-602.5 (13.6) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, very fine-grained sandstone; very burrowed; sideritic zones; slightly calcareous at 598.1 to 599.3 feet; siderite nodules in lower 0.6 feet; rapidly gradational lower contact.
- 602.5-606.8 (4.3) Shale, dark-gray; slightly silty; sparse siderite nodules; plant fragments; rapidly gradational lower contact.
- 606.8-610.1 (3.3) Siltstone, light-olive-gray; sideritic; rooted; underclay; rapidly gradational lower contact.
- 610.1-612.8 (2.7) Sandstone, yellowish-gray; fine grained; rooted; sharp, irregular lower contact.
- 612.8-615.1 (2.3) Shale, light-olive-gray; silty; rooted; rapidly gradational lower contact.
- 615.1-616.0 (0.9) Shale, grayish-black; slightly silty; carbonaceous; gradational lower contact.
- 616.0-622.0 (6.0) Shale, dark-gray; silty in upper part; occasional flat, carbonaceous fragments; gradational lower contact.

- 622.0-622.5 (0.5) Bone coal; occasional vitrain bands.
- 622.5-625.8 (3.3) Shale, light-olive-gray to dark-gray; clayey to silty; rooted in upper 1.0 foot; occasional siderite-replaced rootlets; coarsens downward; gradational lower contact.
- 625.8-636.7 (10.9) Sandstone, medium-light-gray; very fine to fine grained; scattered shale and siltstone laminae and beds; rippled; rooted to 634.0 feet; convolute bedded in part; contains several small, fining-upward sequences; sharp, irregular lower contact.
- 636.7-639.5 (2.8) Shale and sandstone, interbedded; dark-gray, silty shale interbedded with light-gray, very fine-grained sandstone; rippled; burrowed in lower 0.3 feet; rapidly gradational lower contact.
- 639.5-642.8 (3.3) Sandstone, medium-light-gray; very fine to fine grained; scattered, very thin shale laminae; rippled; shale clasts at 640.1 to 640.5 feet; rapidly gradational lower contact.
- 642.8-666.0 (23.2) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, very fine-grained sandstone interbeds; rippled; sparse convolute beds; rare siderite nodules; gradational lower contact.
- 666.0-669.3 (3.3) Sandstone, light-gray; fine grained; sparse, thin, dark-gray shale laminae; abundant rounded shale clasts in lower 0.5 foot; sharp lower contact.
- 669.3-675.6 (6.3) Shale, dark-gray; sparse, thin sandstone laminae in lower 2.0 feet; gradational lower contact.
- 675.6-677.6 (2.0) Shale, black; fissile.
- 677.6-678.3 (0.7) COAL, bright-banded; occasional thin shale bands. Sample D0705.
- 678.3-686.5 (8.2) Clay, light-gray; plastic in part.

- 686.5-687.9 (1.4) Siltstone, medium-gray; scattered, thin sandstone laminae; sharp lower contact.
- 687.9-690.4 (2.5) Sandstone, light-gray; very fine grained; sparse, thin, dark-gray shale laminae.
- 690.4-695.5 (5.1) Sandstone and shale, interbedded; light-gray sandstone interbedded with very silty shale; bed thicknesses very irregular; rapidly gradational lower contact.
- 695.5-701.8 (6.3) Sandstone, very fine- to medium-grained; coarsens downward; scattered quartz pebbles.
- 701.8-704.4 (2.6) Conglomerate; quartz pebbles up to 0.06 foot in diameter; medium-grained sandstone matrix; rare coal clasts.
- 704.4-716.4 (12.0) Sandstone, light-gray; very fine grained; sparse to abundant, thin, dark-shale laminae; gradational lower contact.
- 716.4-717.4 (1.0) Sandstone, light-gray; fine grained; occasional quartz pebbles up to 0.02 foot in diameter.
- 717.4-725.4 (8.0) Sandstone, light-gray; fine grained; no quartz to abundant quartz pebbles, occurrence increasing downward; gradational lower contact.
- 725.4-729.4 (4.0) Conglomerate; well rounded quartz pebbles up to 0.08 foot in diameter, medium-grained sandstone matrix.
- 729.4-744.9 (15.5) Sandstone, light-gray; fine to medium grained; scattered quartz pebbles in lower part; coarsens downward.

Total Depth: 744.9

HOLE NO.: D-9
COUNTY, STATE: Whitley, Kentucky DRILLED DEPTH: 699.2 ft.
SURFACE ELEV.: 1348.0 ft. (alt.) QUAD.: Hollyhill 7.5 min.
LOCATION: 6-C-63, 1350 FEL X 3850 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-65.6 (65.6)	Cased interval; unconsolidated and weathered material.
65.6-92.6 (27.0)	Sandstone, orange to pink to light-gray; fine grained; scattered small shale and coal clasts; upper part weathered; sharp, irregular lower contact.
92.6-93.4 (0.8)	Shale, gray to black; micaceous; carbonaceous; scattered sandstone laminae; amount of sandstone decreases downward.
93.4-121.3 (27.9)	Sandstone, light-gray; very fine to fine grained; micaceous in part; abundant shale clasts in upper and middle part; sparse siderite pebbles; sharp lower contact.
121.3-131.2 (9.9)	Shale, dark-gray; rippled sandstone laminae throughout; abundant plant fragments; gradational lower contact.
131.2-135.7 (4.5)	Sandstone and shale, interbedded; light-gray, fine-grained sandstone interbedded with dark-gray shale; rippled; gradational lower contact.
135.7-229.1 (93.4)	Sandstone, light-gray; fine grained; micaceous; scattered shale and carbonaceous shale laminae; crossbedded in part; occasional siderite bands; calcareous at 220.0 to 222.0 feet; coal clast at base; sharp lower contact.
229.1-229.2 (0.1)	Shale, dark-gray; plant fragments; 0.02 foot pyrite band at base.
229.2-229.4 (0.2)	Shale, black; coaly; disseminated pyrite; abundant plant fragments; gradational lower contact.

- 229.4-231.0 (1.6) Shale, medium-dark-gray; abundant plant fragments; disseminated pyrite; grades into black carbonaceous shale at base.
- 231.0-231.3 (0.3) COAL, dull-banded; poorly cleated; pyrite; gradational lower contact.
- 231.3-234.9 (3.6) Shale, dark-olive-gray; rooted; siderite nodules; carbonaceous at upper and lower contacts; gradational lower contact.
- 234.9-235.0 (0.1) Bone coal, brown; pyrite.
- 235.0-260.5 (25.5) Shale, olive-gray; abundant siderite bands and nodules; rooted in upper 2.0 feet and from 248.0 to 256.3 feet; rare sandstone laminae in upper part; rippled sandstone laminae increase downward in lower part; gradational lower contact.
- 260.5-262.8 (2.3) Sandstone, light-gray; fine grained; abundant thin shale laminae; rippled; sharp lower contact.
- 262.8-329.7 (66.9) Sandstone, light- to medium-gray; fine to medium grained; locally, abundant dark-gray shale and carbonaceous shale laminae; sparse siderite nodules; fines upward; sharp lower contact.
- 329.7-332.9 (3.2) Shale and sandstone, interlaminated; dark-gray shale interlaminated with light-gray sandstone; rippled; sparse burrows; gradational lower contact.
- 332.9-334.9 (2.0) Sandstone, very light-gray; fine grained; occasional gray black shale laminae; abundant carbonaceous laminae; occasional siderite nodules; disseminated pyrite in carbonaceous laminae; fairly sharp lower contact.
- 334.9-335.2 (0.3) Bone coal.
- 335.2-335.3 (0.1) COAL, bright-banded; pyrite lenses.
- 335.3-335.9 (0.6) Shale, black; carbonaceous; thin coal laminae throughout; gradational lower contact.

- 335.9-340.0 (4.1) Shale, dark-gray; clayey; occasional coal stringers; rooted; slickensided surfaces; pyrite; fairly sharp lower contact.
- 340.0-356.5 (16.5) Sandstone and shale, interbedded; light-gray, fine-grained sandstone interbedded with dark-gray shale; rippled; occasional burrows; sharp lower contact.
- 356.5-368.3 (11.8) Shale, dark-gray; silty to clayey; rooted at upper contact; sparse slickensided surfaces; disseminated siderite grains; gradational lower contact.
- 368.3-376.1 (7.8) Shale, dark-gray; very thin, light-gray sandstone laminae and beds, increasing downward; rippled in part; sparse siderite nodules and carbonaceous fragments; sharp, irregular lower contact.
- 376.1-385.3 (9.2) Sandstone, light-gray; fine to medium grained; scattered carbonaceous shale fragments; crossbedded; core badly broken, very poor recovery.
- 385.3-397.3 (12.0) 12.0 feet core lost.
- 397.3-431.1 (33.8) Sandstone, light-gray; medium to coarse grained; sparse siderite pebbles in lower part; occasional thin shale laminae in upper part; coal clasts and sparse quartz pebbles from 424.5 to 427.6 feet; rare graded beds in lower 4.0 feet; rippled to crossbedded; gradational lower contact.
- 431.1-434.5 (3.4) Sandstone; conglomeratic; abundant quartz pebbles and sparse 1 to 2 inch siderite clasts; medium-grained sandstone matrix; gradational lower contact.

- 434.5-446.8 (12.3) Sandstone, pale-yellowish-brown to light-gray with depth; sparse quartz pebbles in upper 4.0 feet; coal clast at 438.4 to 438.9 feet; several vertical fractures and slickensided surfaces in lower 8.0 feet; fractures occasionally filled with talc; sharp, angular base.
- 446.8-447.2 (0.4) Siltstone, medium-dark-gray; slickensided surfaces at upper contact; sharp lower contact.
- 447.2-452.8 (5.6) Sandstone, light-gray; very fine to fine grained; occasional vertical carbonaceous laminae; concretion(?); lower 0.4 foot broken.
- 452.8-455.1 (2.3) Siltstone, dark-gray; hard; rooted; rare thin sandstone interbeds; poorly recovered in upper 0.6 foot; sharp, irregular lower contact.
- 455.1-482.2 (27.1) Sandstone, medium-light- to very light-gray; very fine to medium grained; scattered thin shale laminae and silty beds; rippled to crossbedded to massive; sparse, flat shale clasts in lower 3.0 feet; rare siderite nodules and grains in upper 9.0 feet; sharp lower contact.
- 482.2-483.6 (1.4) Shale and sandstone, interbedded; dark-gray, silty shale interbedded with rippled, very fine-grained sandstone; occasional burrows in lower 0.7 feet.
- *483.6-540.0 (56.4) Sandstone, very light- to light-gray; fine to coarse grained; sparse to abundant shale laminae; rare to sparse quartz pebbles; sparse graded beds; rippled to crossbedded; coal clast at 498.1 feet; scattered coal, shale, and siderite clasts from 531.2 to 534.3 feet; several fining upward sequences; sharp lower contact.

*Hole moved 10.0 feet and redrilled. Overlap begins at 534.0 feet.

- 540.0-540.1 (0.1) Conglomerate, light-gray; abundant quartz pebbles.
- 540.1-550.8 (10.7) Sandstone, light-gray; fine grained; scattered coal clasts; abundant siderite clasts from 542.8 to 543.8 feet; rare pyrite in coal clasts; occasional shale clasts in lower 1.1 feet; sharp lower contact.
- 550.8-552.0 (1.2) Shale, very dark-gray; slickensided surfaces; sharp lower contact.
- 552.0-555.3 (3.3) COAL, bright-banded; well developed cleats; pyrite lenses at 552.3 to 553.0 feet; bony laminae near base. Samples D0901 and D0902.
- 555.3-555.8 (0.5) Shale, black; carbonaceous; sparse coal laminae; pyritized plant fragments.
- 555.8-556.2 (0.4) COAL, bright-banded; well developed cleats. Sample D0903.
- 556.2-556.7 (0.5) Shale, medium-dark-gray; abundant plant fossils.
- 556.7-557.7 (1.0) Shale, medium-brownish-gray; thin sandstone laminae, increasing downward; sharp lower contact.
- 557.7-558.8 (1.1) Underclay, brownish-gray; siderite pebbles in lower 0.2 foot.
- 558.8-562.3 (3.5) Shale, light-brownish-gray; silty; thin sandstone laminae, increasing downward; gradational lower contact.
- 562.3-564.3 (2.0) Shale, medium-dark-gray; occasional slickensided surfaces; rare siderite nodules; gradational lower contact.
- 564.3-566.4 (2.1) Shale, medium-gray; silty; thin sandstone laminae in upper part; occasional plant fossils; sharp lower contact.
- 566.4-567.9 (1.5) Sandstone, medium-light-gray; very fine to fine grained; gradational lower contact.
- 567.9-568.6 (0.7) Shale, medium-gray; plant fragments at base; sharp lower contact.

- *568.6-611.5 (42.9) Sandstone, medium-light- to light-gray; very fine to medium grained; occasional very thin shale laminae; sparse, thin zones of quartz pebbles; rare shale beds; slightly crossbedded; gradational lower contact.
- 611.5-618.0 (6.5) Sandstone, medium-light- to light-gray; fine to coarse grained; conglomeratic in part; very thin shale laminae and slightly crossbedded in lower 5.0 feet; sharp lower contact.
- 618.0-618.4 (0.4) Sandstone, light-brownish-gray; fine grained; abundant coal laminae; siderite pebbles at base; sharp lower contact.
- 618.4-639.1 (20.7) Sandstone, light-gray; medium grained; frequent quartz pebbles from 629.2 to 631.0 feet; occasional well rounded, dark-gray shale clasts from 631.0 to 633.0 feet; sparse, very thin shale laminae in lower 4.0 feet; sharp lower contact.
- 639.1-649.2 (10.1) Shale, dark-gray; clayey in part; fissile.
- 649.2-649.7 (0.5) COAL, bright-banded; core badly broken; one thin shale parting.
- 649.7-653.3 (3.6) Shale, dark-gray; clayey in upper part; underclay; firm in lower 1.0 foot.
- 653.3-660.0 (6.7) Sandstone, light-gray; very fine grained; sparse, dark-gray shale laminae; burrowed down to 659.2 feet; gradational lower contact.
- 660.0-664.0 (4.0) Sandstone and shale, interlaminated; gradational lower contact.

*Wedge placed at 583.0 feet. Remainder of core drilled with Bx core.

664.0-699.2 (35.2)

Shale, medium-gray to very dark-gray with depth; silty; sparse, light-gray, very fine-grained sandstone laminae throughout.

*Total Depth: 699.2

*Core barrel stuck at 695.0 feet.

HOLE NO.: D-10
COUNTY, STATE: Whitley, Kentucky DRILLED DEPTH: 873.6 ft.
SURFACE ELEV.: 1075.0 ft. (alt.) QUAD.: Hollyhill 7.5 min.
LOCATION: 2-B-63, 4300 FEL X 3075 FSL

<u>Depth (feet)</u>	<u>Lithology</u>
0-21.0 (21.0)	Cased interval; unconsolidated and weathered material.
21.0-25.8 (4.8)	Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, fine-grained sandstone; rippled; burrowed.
25.8-47.0 (21.2)	Shale, dark-gray; silty in part; scattered sandstone laminae and burrows, decreasing downward; contorted from 35.0 to 35.4 feet; gradational lower contact.
47.0-60.1 (13.1)	Shale, dark-gray; clayey to silty; sparse siderite bands in lower part; coarsens downward; sharp lower contact.
60.1-63.1 (3.0)	Shale, light-greenish-olive-gray; clayey to silty; burrowed, decreasing downward; rapidly gradational lower contact.
63.1-74.8 (11.7)	Shale, dark-gray; silty; very burrowed, sparsely disseminated pyrite- and siderite-filled burrows to 70.7 feet; calcareous from 69.8 to 70.0 feet; sparse sandstone laminae in lower 4.0 feet; gradational lower contact.
74.8-86.3 (11.5)	Shale and sandstone, interbedded; medium-dark- to dark-gray shale interbedded with light-gray, very fine-grained sandstone; bedding varies from very thin to thick; rippled; sandstone calcareous from 75.8 to 78.7 feet; sparse burrows in lower part.
86.3-101.3 (15.0)	Shale, medium-dark- to dark-gray; clayey; rare burrows; scattered plant fragments in lower 3.0 feet.

- 101.3-105.7 (4.4) Underclay, light-olive-gray; clayey to silty; rooted; pyrite nodules from 103.2 to 103.4 feet; generally coarsens downward.
- 105.7-109.7 (4.0) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray sandstone; rippled; rooted; scattered burrows; amount of sandstone decreases downward; gradational lower contact.
- 109.7-183.6 (73.9) Shale, dark-gray; rare to moderate, thin sandstone laminae; abundant to sparse burrows; sparse siderite nodules; bivalve fossil at 174.9 feet; sandstone and burrowing decreases downward; rare disseminated pyrite in lower 20.0 feet.
- 183.6-188.7 (5.1) Sandstone and shale, interbedded; light-gray sandstone interbedded with dark-gray shale; rippled.
- 188.7-194.6 (5.9) Shale, medium- to dark-gray; clayey.
- 194.6-197.8 (3.2) Shale, medium-gray; thin sandstone laminae; sparse burrows.
- 197.8-198.4 (0.6) Sandstone, medium-gray; fine grained; thin, dark-gray shale laminae throughout; slightly calcareous; rippled.
- 198.4-232.0 (33.6) Shale and sandstone, interbedded; dark- to medium-gray, silty shale interbedded with medium- to light-gray, fine-grained sandstone; rippled; grades from predominantly shale in upper part to predominantly sandstone in lower part; sparse, disseminated pyrite; sharp lower contact.
- 232.0-232.4 (0.4) COAL, bright-banded; poor cleats; calcite-filled cleats; bony near base; disseminated pyrite.
- 232.4-234.4 (2.0) Shale, dark-gray; silty; plant fragments; coal stringers in upper 0.4 feet; slightly burrowed and thin sandstone laminae in lower 2.0 feet; rapidly gradational lower contact.

- 234.4-266.5 (32.1) Shale and sandstone, interbedded; dark- to medium-gray silty shale interbedded with medium- to dark-gray, fine-grained micaceous sandstone; rippled in part; very burrowed in upper 2.1 feet to slightly burrowed elsewhere; scattered plant fragments; gradational lower contact.
- 266.5-280.4 (13.9) Sandstone, light-gray; medium grained; massive to crossbedded; occasional medium- to dark-gray shale clasts; occasional plant fragments in shale; gradational lower contact.
- 280.4-284.5 (4.1) Sandstone, light-gray; medium grained; massive to crossbedded; disseminated pyrite; gradational lower contact.
- 284.5-371.1 (86.6) Sandstone, light-gray; fine to coarse grained; massive to crossbedded; slightly calcareous; sparse, medium- to dark-gray, thin shale beds and laminae; pyrite nodule at 337.1 feet; carbonaceous laminae and siderite nodules from 355.7 to 355.8 feet; sharp lower contact.
- 371.1-375.7 (4.6) Shale, dark-gray; silty; rare sandstone laminae in lower part; gradational lower contact.
- 375.7-391.2 (15.5) Shale and sandstone, interbedded; dark-gray, silty shale interbedded with medium-gray, very fine-grained, rippled sandstone; occasional burrows; horizontal fractures from 380.0 to 381.3 feet; sandstone beds increase with depth.
- 391.2-391.9 (0.7) Sandstone, light-gray; fine to coarse grained; slightly calcareous; horizontal fractures.
- 391.9-392.7 (0.8) Sandstone, light-gray; fine to very coarse grained; conglomeratic; calcareous; siderite pebbles in lower part.
- 392.7-394.7 (2.0) Shale, dark-gray; silty; occasional siderite nodules.

- 394.7-395.0 (0.3) Conglomerate; shale, siderite, and quartz pebbles and clasts; massive; slightly calcareous.
- 395.0-397.8 (2.8) Shale, dark-gray; silty; occasional siderite nodules.
- 397.8-474.2 (76.4) Sandstone, light-gray; fine to coarse grained; rare quartz pebbles; occasional shale laminae; occasional coal clasts with pyrite in lower part; zone of quartz pebbles from 473.8 to 474.2 feet; sharp lower contact.
- 474.2-474.6 (0.4) Shale, dark-gray to black; silty.
- 474.6-478.4 (3.8) Shale; dark-gray to black; carbonaceous; clayey; occasional coal stringers; sandy in lower 0.2 foot; gradational lower contact.
- 478.4-479.2 (0.8) Sandstone and shale, interlaminated; light-gray, fine-grained sandstone interbedded with dark-gray, silty shale laminae; rippled.
- 479.2-541.8 (62.6) Sandstone, light- to medium-gray; very fine to coarse grained; occasional shale laminae and beds; occasional coal clasts and quartz pebbles below 520.6 feet; occasional graded beds; siderite pebbles at base; sharp, irregular lower contact.
- 541.8-554.7 (12.9) Sandstone, medium-gray; very fine to fine grained; massive; scattered shale clasts; occasional silty shale laminae and beds; sharp, irregular lower contact.
- 554.7-565.0 (10.3) Sandstone and shale, interbedded; light-gray, very fine-grained sandstone interbedded with dark-gray shale; rippled; occasional burrows and siderite nodules; amount of sandstone decreases downward.
- 565.0-565.3 (0.3) Sandstone, light-gray; medium grained; sparse quartz pebbles; massive.
- 565.3-567.2 (1.9) Shale, dark-gray; clayey in part; sandstone laminae.

- 567.2-568.0 (0.8) COAL, dull-banded; scattered pyrite lenses; bony in lower part.
- 568.0-569.7 (1.7) Shale, dark-gray; silty; rooted; siderite nodules; slickensided surfaces; gradational lower contact.
- 569.7-572.6 (2.9) Sandstone, medium-light-gray; very fine grained; micaceous; shale laminae; occasional burrows; rooting and siderite nodules in upper part.
- 572.6-573.3 (0.7) Shale, sandy, mudflow; contorted bedded.
- 573.3-583.7 (10.4) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray sandstone; rippled; scattered burrows; sparse siderite nodules; contorted from 578.3 to 578.5 feet; amount of sandstone decreases downward.
- 583.7-645.8 (62.1) Shale, dark-gray; clayey to silty in part; sparse to moderate sandstone laminae; scattered siderite bands; sparsely to abundantly burrowed; rippled in part; rare plant fragments.
- 645.8-649.6 (3.8) Shale, dark-gray; clayey; occasional plant fragments; sharp lower contact.
- 649.6-650.4 (0.8) COAL, bright-banded; occasional calcite-filled cleats; bony in upper and lower 0.2 feet; occasional pyrite.
- 650.4-654.0 (3.6) Sandstone, black to brown-gray with depth; very fine grained; rooted; gradational lower contact.
- 654.0-664.8 (10.8) Shale, brown-gray to dark-gray with depth; clayey; thin sandstone laminae in upper 3.0 feet; siderite bands and nodules; very burrowed from 656.7 to 658.2 feet; sparsely rooted; slickensided surfaces in part; sharp lower contact.

- 664.8-668.1 (3.3) Sandstone, brown-gray to light-gray with depth; very fine to fine grained; sparse, thin shale laminae; slightly burrowed; sharp lower contact.
- 668.1-671.0 (2.9) Shale, brown-gray to dark-gray; clayey to silty; coarsens downward; coal stringer at 670.2 feet; gradational lower contact.
- 671.0-710.6 (39.6) Sandstone, brown-gray to light-gray; fine grained; massive to crossbedded; shale laminae in part; sideritic and burrowed in upper 3.2 feet; occasional carbonaceous laminae in lower 2.5 feet; sharp lower contact.
- 710.6-711.0 (0.4) COAL, bright-banded; badly broken; 0.5 inch pyrite band near top.
- 711.0-714.0 (3.0) Sandstone, brown-gray; very fine to medium grained; rooted; coarsens downward; gradational lower contact.
- 714.0-727.1 (13.1) Sandstone, gray to light-gray; fine grained; thin shale laminae; rippled; sparse burrows; occasional siderite nodules near base of unit; sharp lower contact.
- 727.1-727.5 (0.4) Bone coal; cleated; some pyrite; gradational lower contact.
- 727.5-727.9 (0.4) Clay, black to very dark-gray; coal stringers; pyrite lenses; gradational lower contact.
- 727.9-733.0 (5.1) Sandstone, brown to gray; very fine grained to silty; rooted; disseminated siderite grains in lower part; gradational lower contact.
- 733.0-737.8 (4.8) Sandstone and shale, interlaminated; light-gray, fine-grained sandstone interlaminated with dark-gray shale; rippled; sandstone increases with depth; fairly sharp lower contact.

- 737.8-745.8 (8.0) Sandstone, light-gray; fine grained; occasional thin, dark gray shale and carbonaceous shale laminae; rippled in upper 1.0 foot; graded beds in lower part; occasional zones of siderite nodules; sharp lower contact.
- 745.8-746.0 (0.2) COAL, bright-banded; well cleated; pyrite; gradational lower contact.
- 746.0-768.1 (22.1) Sandstone, brown-gray; very fine grained to silty; rooted at upper contact; scattered siderite nodules; grades into sandstone with dark-gray shale laminae in lower part; rippled; sparse coal stringers; clayey and rooted from 760.0 to 764.0 feet; gradational lower contact.
- 768.1-779.8 (11.7) Sandstone and shale, interbedded and interlaminated; rippled; sharp lower contact.
- 779.8-796.0 (16.2) Shale, medium-dark-gray; silty; sparse sandstone laminae; rare plant fragments; sharp lower contact.
- 796.0-802.7 (6.7) Sandstone, medium-light-gray; fine grained; micaceous; scattered shale laminae, decreasing with depth; rippled; sharp lower contact.
- 802.7-810.8 (8.1) Shale, dark-gray; clayey in part; light-gray sandstone laminae; scattered burrows; fairly sharp lower contact.
- 810.8-822.0 (11.2) Sandstone, very light-gray to brown-gray in upper few inches; very sparse clay-shale laminae; very burrowed in upper few inches; horizontal fractures at 814.8 and 815.4 to 815.6 feet; greenish color in sandstone increases with depth; coarsens upward; fairly sharp lower contact.
- 822.0-840.3 (18.3) Shale and sandstone, interlaminated; dark-gray shale interlaminated with light-gray sandstone; occasional coal stringers, plant fragments, pyrite, and siderite bands; rippled; amount of sandstone increases downward; sharp lower contact.

- 840.3-842.2 (1.9) Shale, gray-black; carbonaceous; slickensided surfaces; occasional stringers of bony coal; clayey with sandstone laminae toward base; sharp lower contact.
- 842.2-864.2 (22.0) Sandstone, very light-gray; very fine to fine grained; shale laminae in upper part; green shale laminae in lower part; horizontal fractures from 854.8 to 855.0 feet; irregular beds at base; fairly sharp lower contact.
- 864.2-872.6 (8.4) Limestone, gray to brown-gray; occasional fossil shell fragments; fairly sharp lower contact.
- 872.6-873.6 (1.0) Shale, red and green; very clayey.
- Total Depth: 873.6

HOLE NO.: D-11
COUNTY, STATE: McCreary, Kentucky DRILLED DEPTH: 520.0 ft.
SURFACE ELEV.: 157 ft. (alt.) QUAD.: Barthell SW 7.5 min.
LOCATION: 12-B-58, 1360 FEL X 2565 FSL

<u>Depth (feet)</u>	<u>Lithology</u>
0-23.0 (23.0)	Cased interval; unconsolidated and weathered material.
23.0-59.8 (36.8)	Sandstone, yellowish-brown to grayish-orange-pink; fine to very coarse grained; weathered; scattered liesegang rings; occasional crossbeds; sparse shale laminae; sparse quartz granules in lower 10.0 feet; friable, coarsens downward; sharp lower contact.
59.8-84.9 (25.1)	Shale and sandstone, interlaminated; dark-gray, clayey to silty shale interlaminated with abundant sandstone; rare carbonaceous fragments; fissile in upper 8.0 feet; core badly broken in part.
84.9-91.3 (6.4)	Core lost.
91.3-102.1 (10.8)	Shale, dark-gray; fissile.
102.1-110.5 (8.4)	Shale, medium-gray; sandstone laminae, increasing with depth.
110.5-110.9 (0.4)	Clay, light-gray.
110.9-134.0 (23.1)	Sandstone, pale-orange to yellowish-brown; very fine to medium grained; scattered clayey shale laminae; crossbedded to rippled to massive; occasional clay-shale clasts from 122.7 to 124.8 feet; occasional vugs below 132.4 feet; sharp lower contact.
134.0-138.0 (4.0)	Mudflow; sandy shale with occasional very light-gray sandstone beds; siderite nodules in upper part; very contorted bedding; sharp, irregular lower contact.

- 138.0-165.0 (27.0) Sandstone, very light-gray; fine to medium grained; occasional zones of coarse grains; occasional graded beds; shale and carbonaceous, micaceous shale laminae; coarsens from 150.7 to 156.0 feet; crossbedded to rippled to flat.
- 165.0-167.0 (2.0) Conglomerate; abundant siderite pebbles and occasional quartz pebbles; medium- to very coarse-grained sandstone matrix; sparse pyrite lenses and pebbles; some siderite pebbles surrounded by vitrain; sharp lower contact.
- 167.0-171.3 (4.3) Shale, medium-dark- to dark-gray; clayey; siderite bands and nodules; sharp lower contact.
- 171.3-171.8 (0.5) COAL, bright-banded; scattered dull bands.
- 171.8-172.9 (1.1) Bone coal; occasional thin bright bands.
- 172.9-173.2 (0.3) Claystone, medium-dark-gray to grayish-black; sparse thin vitrain stringers.
- 173.2-178.7 (5.5) Shale, medium-gray; clayey to silty; rooted; occasional siderite nodules; gradational lower contact.
- 178.7-178.8 (0.1) Claystone, grayish-black; sparse, thin vitrain stringers; slickensided surfaces; gradational lower contact.
- 178.8-179.4 (0.6) Shale, medium-dark-gray; slightly clayey; rooted; plant fragments; gradational lower contact.
- 179.4-189.4 (10.0) Shale, greenish-gray to medium-dark-gray with depth; clayey to silty with depth; rooted in upper part; occasional sandstone laminae in lower part; rare to sparse siderite-replaced rootlets; siderite bands; sparse vitrain stringers in lower part; coarsens toward middle of unit; gradational lower contact.

- 189.4-189.6 (0.2) Claystone, brownish-black; carbonaceous; scattered, thin vitrain stringers; rapidly gradational lower contact.
- 189.6-198.9 (9.3) Shale, medium-dark- to dark-gray; silty; sparse, thin clayey laminae; sparse siderite nodules and bands; plant fragments; sparse sandstone laminae; gradational lower contact.
- 198.9-211.7 (12.8) Shale and sandstone, interbedded; medium-dark- to dark-gray silty shale interbedded with light-gray, very fine-grained, rippled sandstone; burrowed; shale beds frequently grade up into sandstone beds; sparse plant fragments in shale; gradational lower contact.
- 211.7-218.0 (6.3) Sandstone, light-gray; very fine to fine grained; thin shale laminae throughout; occasional thin- to medium-bedded, silty shale beds; occasional burrows; slightly calcareous in part; gradational lower contact.
- 218.0-229.3 (11.3) Shale and sandstone, interbedded; medium-dark- to dark-gray, silty shale interbedded with medium-light- to light-gray, fine- to medium-grained, rippled sandstone; shale and sandstone beds vary from 0.2 to 1.7 feet thick; sandstone beds thicken and shale beds thin with depth; thin shale and sandstone laminae common in sandstone and shale beds, respectively; sparse to abundant burrowing; sandstone calcareous in part; generally grades into lower unit.
- 229.3-248.6 (19.3) Sandstone, light- to medium-light-gray; fine to coarse grained; scattered thin shale laminae; sparse thin shale beds in upper part; rippled to crossbedded; faint graded beds; generally coarsens downward; 0.23 foot coal clast at 247.4 feet; sparse quartz pebbles in lower 1.0 foot; sharp, very irregular lower contact.

- 248.6-261.0 (12.4) Shale, dark-gray; clayey; scattered sandstone laminae and beds; siderite nodules and rooted in upper 4.5 feet; occasional burrows; sharp lower contact.
- 261.0-261.5 (0.5) Claystone, dark-gray; slickensided surfaces; rooted(?).
- 261.5-271.4 (9.9) Shale, dark-gray; clayey in part; sandstone laminae; sparsely burrowed; sparse siderite bands and nodules; sharp, slightly irregular lower contact.
- 271.4-272.0 (0.6) Sandstone, medium-gray; fine grained; slightly calcareous; siderite-filled burrows; rapidly gradational lower contact.
- 272.0-277.0 (5.0) Shale and sandstone, interbedded; dark-gray shale interbedded with medium-light-gray, fine-grained sandstone; very burrowed; slightly calcareous in part; sandstone increases slightly downward; siderite nodules at base; sharp lower contact.
- 277.0-277.8 (0.8) Shale, medium-dark-gray; clayey; pyrite-filled burrows; vitrain stringers in lower 0.1 foot; gradational lower contact.
- 277.8-278.2 (0.4) Bone coal; poorly cleated; calcite along cleats; some pyritized fusain fragments.
- 278.2-278.3 (0.1) Pyrite band; Stigmara in middle of band.
- 278.3-283.3 (5.0) Shale, dark-gray; clayey; rooted; slickensided surfaces; occasional siderite nodules; plant fragments; gradational lower contact.
- 283.3-287.6 (4.3) Sandstone, light-olive-gray; very fine grained; clayey; rooted; poorly developed slickensided surfaces; disseminated siderite grains; fines downward; gradational lower contact.

- 287.6-324.2 (36.6) Shale and sandstone, interbedded; light-olive-gray to grayish-black shale interbedded with light-gray, very fine-grained, thin to thick sandstone; rippled; thin sandstone and shale laminae common in shale and sandstone beds, respectively; sideritic in part; scattered burrows; shale and sandstone beds commonly have gradational contacts; sandstone beds slightly calcareous from 294.8 to 318.8 feet; gradational lower contact.
- 324.2-334.9 (10.7) Shale, grayish-black to dark-gray; clayey to very silty in lower 3.8 feet; Lingula at 328.1 feet; burrowed in lower part; sparse siderite nodules and bands; color darkens downward; gradational lower contact.
- 334.9-340.9 (6.0) Siltstone, grayish-black; sandy; burrowed; gradational lower contact.
- 340.9-342.1 (1.2) Sandstone; silty to fine grained; burrowed; calcareous from 341.3 to 341.8 feet; sideritic in lower 0.2 feet; rapidly gradational lower contact.
- 342.1-347.9 (5.8) Shale and sandstone, interlaminated; grayish-black to dark-gray silty shale interlaminated with medium-light-gray, fine- to very fine-grained sandstone; rippled; abundantly to sparsely burrowed; disseminated pyrite in upper 1.5 feet; yellowish brown and calcareous from 343.6 to 344.1 feet; rare siderite bands; sharp lower contact.
- 347.9-350.0 (2.1) Sandstone, medium-light-gray; very fine grained; thin shale laminae; very burrowed; calcareous in part; gradational lower contact.
- 350.0-351.2 (1.2) Sandstone and shale, interlaminated; medium-light-gray, very fine-grained sandstone interlaminated with dark-gray shale; rippled; sparse to abundant burrowing; sharp lower contact.

- 351.2-354.2 (3.0) Sandstone, medium-light-gray; very fine grained; occasional grayish-black, micaceous shale laminae; rippled; burrowed; calcareous in part; sideritic in part; gradational lower contact.
- 354.2-368.4 (14.2) Sandstone and shale, interlaminated; medium- to medium-light-gray, very fine-grained sandstone interlaminated with grayish-black, silty shale laminae; rippled; sparse to abundant burrowing; sandstone decreases with depth; gradational lower contact.
- 368.4-375.7 (7.3) Shale, dark-gray to grayish-black with depth; sandstone laminae in upper part; occasional siderite bands; carbonaceous band in lower 1.0 foot; gradational lower contact.
- 375.7-379.0 (3.3) Shale, black; thin sandstone laminae; scattered plant and fusain fragments; sparse siderite bands.
- 379.0-380.1 (1.1) COAL, bright-banded; good cleats; sparse pyrite lenses; calcite along cleats. Sample D1101.
- 380.1-380.2 (0.1) Bone coal; sparse bright bands.
- 380.2-380.3 (0.1) COAL, bright-banded.
- 380.3-381.9 (1.6) Claystone, dark-gray; plastic; rooted; slickensided surfaces; sparse pyrite lenses; sparse vitrain stringers; gradational lower contact.
- 381.9-382.0 (0.1) COAL, dull-banded; pyrite lenses at base.
- 382.0-385.0 (3.0) Siltstone, olive-gray; rooted; disseminated pyrite; color lightens downward; gradational lower contact.
- 385.0-391.0 (6.0) Sandstone, light-gray to light-olive-gray; very fine grained; mottled; rooted; disseminated siderite grains; clayey shale laminae in lower 0.6 foot; sharp lower contact.

- 391.0-396.5 (5.5) Shale, grayish-black to dark-gray with depth; clayey to silty; light-gray, very fine-grained, rippled sandstone laminae below 392.0 feet; sandstone laminae increase to 394.3 feet then decrease to base; occasionally burrowed; sparse siderite bands.
- 396.5-396.6 (0.1) Bone coal.
- 396.6-396.9 (0.3) COAL, bright-banded; good cleats; calcite along cleats; sparse pyrite lenses.
- 396.9-397.1 (0.2) Claystone; black; carbonaceous; gradational lower contact.
- 397.1-397.7 (0.6) Shale, medium-olive-gray; clayey; rooted; sparse siderite nodules; gradational lower contact.
- 397.7-409.8 (12.1) Sandstone, olive-gray to light-gray with depth; very fine to fine grained; mottled and siderite nodules in upper 1.5 feet; rooted to 401.3 feet; sparse to abundant carbonaceous laminae; crossbedded to rippled in lower 5.0 feet; occasional siderite nodules; coarsens upward; rapidly gradational lower contact.
- 409.8-412.4 (2.6) Shale and sandstone, interlaminated; dark-gray shale interlaminated with light-gray, very fine-grained, rippled sandstone; sparse burrows; scattered plant fragments.
- 412.4-412.9 (0.5) Shale, light-olive-gray; clayey; disseminated siderite grains; gradational lower contact.
- 412.9-443.4 (30.5) Shale, dark-gray; clayey in part; sparsely scattered sandstone laminae; sparsely to moderately burrowed; sparse siderite bands; sparsely rooted in upper 5.5 feet; siderite band calcareous at 438.7 feet; sharp lower contact.

- 443.4-455.7 (12.3) Shale, dark-gray to grayish-black at base; silty; sparse clayey zones; occasional siderite bands and nodules; burrowed in part; coarsens downward; rare sandstone laminae in lower part; gradational lower contact.
- 455.7-456.1 (0.4) Bone coal; occasional thin bright bands; gradational lower contact.
- 456.1-456.2 (0.1) Claystone, grayish-black; carbonaceous; occasional slickensided surfaces; conchoidal fracture; gradational lower contact.
- 456.2-456.4 (0.2) Bone coal.
- 456.4-456.5 (0.1) Claystone, brownish-black; carbonaceous; sharp, irregular lower contact.
- 456.5-462.1 (5.6) Sandstone, very light- to medium-gray; very fine to fine grained; carbonaceous laminae; rare grayish-black shale beds; occasional roots; crossbedded and rippled in part; color darkens and is mottled in lower 3.0 feet; sharp lower contact.
- 462.1-462.7 (0.6) Coal, dull-banded; fair cleats; sharp lower contact.
- 462.7-463.8 (1.1) Siltstone, dark-gray to medium-olive-gray with depth; slightly clayey; Stigmaria sparse slickensided surfaces; rapidly gradational lower contact.
- 463.8-471.7 (7.9) Sandstone, light-gray to olive-gray; very fine grained; mottled; massive; rooted(?); gradational lower contact.
- 471.7-472.2 (0.5) Shale, dark-gray; very silty; rooted; plant fragments; poorly developed slickensided surfaces; sharp lower contact.

- 472.2-476.2 (4.0) Sandstone, very light-gray to olive-gray; very fine grained; occasional grayish-black shale laminae in upper 1.0 foot; shale and calcareous siderite clasts from 472.9 to 473.3 feet; silty, rooted, and calcareous in part in lower 3.0 feet; angular erosional contact at 473.3 feet; bedding contorted below erosional contact; gradational lower contact.
- 476.2-477.4 (1.2) Shale, medium-olive-gray to olive-gray; silty to clayey; rooted(?); rapidly gradational lower contact.
- 477.4-495.1 (17.7) Sandstone, light-olive-gray to light-gray; very fine grained; scattered silty interbeds; scattered vitrain stringers; greenish-gray shale clast from 492.0 to 494.0 feet; partly calcareous in lower 12.0 feet; bedding flat to contorted; slumped in part.
- 495.1-495.7 (0.6) Conglomerate; pale-yellowish-brown dolostone and greenish-gray shale clasts; medium- to fine-grained, slightly calcareous sandstone matrix; sharp lower contact.
- 495.7-501.2 (5.5) Sandstone, greenish-gray; very fine to fine grained; occasional carbonaceous fragments; rippled to crossbedded; abundant greenish-gray clay matrix and yellowish-gray to reddish-brown clast.
- 501.2-509.8 (8.6) Shale, greenish-gray to olive-black to grayish-red; clayey; slickensided surfaces; occasional yellowish-brown dolostone beds and nodules; gradational lower contact.
- 509.8-511.8 (2.0) Dolostone, pale-greenish-gray; microcrystalline; burrowed; nodular dolostone in greenish-gray shale in lower 0.8 foot.
- 511.8-513.3 (1.5) Shale, greenish-gray to olive-black; clayey.

513.3-520.0 (6.7)

Dolostone, medium-light-gray to olive-gray; microcrystalline; dusky-green clay-shale interbeds in part; grayish-red shale clast from 516.1 to 516.6 feet; dolostone nodular in part.

Total Depth: 520.0

HOLE NO.: D-12

COUNTY, STATE: McCreary, Kentucky DRILLED DEPTH: 85.3 ft.

SURFACE ELEV.: 1314.0 ft. (alt.) QUAD.: Ketchen 7.5 min.

LOCATION: 20-B-62, 1750 FEL X 1525 FSL

<u>Depth (feet)</u>	<u>Lithology</u>
0-22.0 (22.0)	Cased interval; unconsolidated and weathered material.
22.0-44.0 (22.0)	Shale and sandstone, interlaminated; dark-gray shale interlaminated with sandstone; occasional siderite bands; shale becomes silty downward; sharp lower contact.
44.0-46.6 (2.6)	Sandstone, fine-grained; shale clasts and laminae; sharp lower contact.
46.6-47.2 (0.6)	Claystone, light-gray; silty; underclay(?); gradational lower contact.
47.2-49.5 (2.3)	Siltstone, light-gray; sandy; occasional shale laminae and siderite nodules; gradational lower contact.
49.5-56.0 (6.5)	Sandstone and shale, interbedded; light-gray, fine-grained sandstone interbedded with thin shale beds and laminae; rippled to flat; sharp lower contact.
56.0-56.6 (0.6)	Shale, dark-gray; scattered sandstone laminae.
56.6-56.8 (0.2)	COAL, dull-banded; sparse bright bands; gradational lower contact.
56.8-58.2 (1.4)	Claystone, grayish-black to dark-gray; carbonaceous in upper part; rooted; underclay; gradational lower contact.
58.2-67.8 (9.6)	Sandstone and shale, interbedded; light-gray sandstone interbedded with dark-gray shale; occasional roots and burrows; rippled to flat; gradational lower contact.

67.8-85.3 (17.5)

Shale, dark-gray; sandstone laminae;
occasional siderite bands and
burrows; fines downward.

*Total Depth: 85.3

*Severe caving resulted in early abandonment of core hole.

HOLE NO.: D-13

COUNTY, STATE: Whitley, Kentucky DRILLED DEPTH: 1981.2 ft.

SURFACE ELEV.: 2159 ft. (alt.) QUAD.: Jellico W 7.5 min.

LOCATION: 18-B-64, 2050 FEL X 4900 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-31.0 (31.0)	Cased interval; unconsolidated and weathered material.
31.0-32.6 (1.6)	Sandstone; very fine grained; thin shale laminae; liesegang rings; gradational lower contact.
32.6-38.5 (5.9)	Siltstone, medium-gray; micaceous; occasional thin, very fine-grained sandstone laminae; rooted; sparse vitrain stringers; very poor recovery in part; gradational lower contact.
38.5-46.2 (7.7)	Sandstone; fine grained to silty; shale laminae; occasional roots; gradational lower contact.
46.2-52.3 (6.1)	Shale, medium-dark- to medium-gray; clayey to silty; occasional siderite bands in upper part; sparse sandstone laminae in lower part; rooted below 51.7 feet; plant fragments; gradational lower contact.
52.3-55.0 (2.7)	Siltstone, medium-gray; occasional fine-grained sandstone laminae; rooted in upper 0.7 foot; gradational lower contact.
55.0-58.4 (3.4)	Shale, medium-gray; silty; sparse siderite bands; sparse vitrain stringers; plant fragments.
58.4-58.5 (0.1)	Bone coal.
58.5-58.7 (0.2)	Claystone, dark-gray; plastic; plant fragments.
58.7-59.1 (0.4)	COAL, bright-banded; badly broken.
59.1-66.6 (7.5)	Shale, medium-gray to dark-greenish-gray in lower 5.0 feet; silty to clayey; rooted to 65.0 feet; occasional slickensided surfaces; siderite nodules in lower part.

- 66.6-67.2 (0.6) Sandstone, medium-gray; very fine grained; micaceous; gradational lower contact.
- 67.2-68.9 (1.7) Shale, medium-gray; silty; siderite nodules in part; slight greenish tint; shaly lower contact.
- 68.9-76.6 (7.7) Siltstone, medium-gray; clayey and sandy laminae in part; calcareous from 71.8 to 72.9 feet; sparse liesegang rings; sharp lower contact.
- 76.6-104.5 (27.9) Sandstone, pale-orange to medium-brown to medium-light-gray; fine grained; micaceous; calcareous from 79.5 to 79.9, 84.9 to 85.4, and 85.7 to 92.2 feet; crossbedded to rippled; coal clast and bands in lower 3.5 feet; very thin shale laminae; liesegang rings.
- 104.5-112.0 (7.5) Core lost.
- 112.0-112.6 (0.6) Sandstone, light-gray; very fine to fine grained; shale and coal laminae; siderite nodules; sharp, irregular lower contact.
- 112.6-138.0 (25.4) Shale, medium-gray; silty; occasional sandstone laminae; burrowed; occasional plant fragments; gradational lower contact.
- 138.0-149.9 (11.9) Shale, medium-gray to grayish-black; clayey; occasional siderite nodules and bands; calcareous; scattered gastropods, bivalves, cephalopods, and brachiopods; noncalcareous, silty bed with plant fossils from 144.1 to 145.5 feet; rare vitrain stringers; color darkens downward.
- 149.9-150.9 (1.0) Limestone, dark-gray; argillaceous; microcrystalline; scattered brachiopods.
- 150.9-153.2 (2.3) Shale, dark-gray to black with depth; silty to clayey; calcareous; abundant invertebrate fossils; burrowed; pyritized fossils in lower part; most of the fossils are small bivalves.

- 153.2-153.4 (0.2) Shale, black, carbonaceous; dark-gray limestone nodules; disseminated pyrite in limestone; shell fragments in limestone; gradational lower contact. Base of Magoffin Member.
- 153.4-153.6 (0.2) COAL, bright-banded; well developed cleats.
- 153.6-153.8 (0.2) Shale, carbonaceous; pyrite.
- 153.8-153.9 (0.1) COAL, bright-banded; blocky.
- 153.9-156.7 (2.8) Shale, medium-dark-gray; sandy; rooted; occasional sandstone laminae; gradational lower contact.
- 156.7-163.0 (6.3) Sandstone; very fine to fine grained; rooted and siderite nodules in upper 3.5 feet; rippled and shale laminae in lower 2.0 feet; gradational lower contact.
- 163.0-172.0 (9.0) Shale, medium-dark-gray to gray-black with depth; sandstone laminae; siderite bands; coarsens downward; gradational lower contact.
- 172.0-189.5 (17.5) Sandstone, very light- to light-gray; very fine to fine grained; rare shale laminae; vugs from 172.0 to 175.0 feet; vertical fractures with Liesegang rings from 172.0 to 175.0 and 188.0 to 189.5 feet; coarsens downward.
- 189.5-201.4 (11.9) Shale, medium-dark-gray; occasional siderite bands; plant fragments; sandstone laminae that decrease downward; carbonaceous in lower 0.4 foot.
- 201.4-201.7 (0.3) COAL, bright-banded; good cleats. Sample D1301.
- 201.7-201.8 (0.1) Shale; plant fragments.
- 201.8-203.4 (1.6) COAL, bright-banded; good cleats; slightly bony at base. Sample D1301.
- 203.4-213.1 (9.7) Shale, medium-gray; sandy near base; slickensided surfaces; rooted; underclay; coarsens downward; sharp lower contact.

- 213.1-215.9 (2.8) Sandstone, medium-gray; micaceous; flat to rippled; shale laminae; shale clast from 214.4 to 214.7 feet; sparse coal laminae in lower part; sharp, burrowed lower contact.
- 215.9-216.8 (0.9) Shale, dark-gray; silty; sandstone laminae, decreasing with depth; rapidly gradational lower contact.
- 216.8-221.8 (5.0) Sandstone, medium-light-gray to medium-brown; very fine to fine grained; shale laminae in upper part; liesegang rings in part; occasional coal clasts in lower part; sharp lower contact.
- 221.8-224.5 (2.7) Shale, medium-dark-gray to grayish-black; clayey in part; sparse siderite bands; plant fragments; pyrite in grayish-black zones; gradational lower contact.
- 224.5-226.1 (1.6) Shale, medium-gray; silty; sandstone laminae and occasional beds; sharp lower contact.
- 226.1-228.2 (2.1) Sandstone, medium-light-gray; fine grained; scattered carbonaceous laminae; rippled; rare shale laminae; sharp lower contact.
- 228.2-230.1 (1.9) Shale, medium-dark-gray; sparse sandstone laminae and plant fragments; gradational lower contact.
- 230.1-235.9 (5.8) Claystone, grayish- to brownish-black to black; siderite nodules and slightly plastic in lower part; Lingula from 231.0 to 232.1 feet; burrows; plant fragments; sharp lower contact.
- 235.9-241.0 (5.1) Claystone, greenish-blue-gray; silty in part; siderite nodules; rooted; slickensided surfaces; gradational lower contact.

- 241.0-251.3 (10.3) Siltstone, medium-dark-greenish-blue-gray to medium-dark-gray in lower 8.0 feet; siderite nodules and roots in upper 2.5 feet; scattered rippled to flat sandstone laminae and beds; occasional burrows; siderite bands in lower part; gradational lower contact.
- 251.3-252.8 (1.5) Sandstone, medium-gray; fine grained; occasional shale laminae and silty shale clast; occasional burrows; sharp lower contact.
- 252.8-257.2 (4.4) Shale and sandstone; dark-gray silty shale with medium-dark-gray, fine-grained, rippled sandstone laminae and beds; sandstone beds commonly have gradational and sharp upper and lower contacts, respectively; sharp lower contact.
- 257.2-282.4 (25.2) Sandstone, medium-gray; fine to medium grained; massive to rippled to crossbedded; scattered shale clasts in upper 10.0 feet; sparse shale and siderite laminae in lower part; coal clast from 278.3 to 280.0 feet; rare siderite nodules in lower part; sharp, angular lower contact.
- 282.4-288.7 (6.3) Siltstone, medium-dark-gray; sparse sandstone laminae; occasional siderite laminae and nodules; bedding at slight angle; rare vitrain stringers; sharp lower contact.
- 288.7-289.5 (0.8) Claystone, black to grayish-brown; plastic; pyrite; abundant coal stringers; gradational lower contact.
- 289.5-289.7 (0.2) COAL, dull-banded; bony streak in middle.
- 289.7-291.9 (2.2) Claystone, dark-gray to grayish-black; rooted; plant fragments; disseminated pyrite; carbonaceous in upper and lower 0.2 foot.
- 291.9-292.2 (0.3) COAL, dull-banded; sparse pyrite lenses; core badly broken. Sample D1302.

- 292.2-292.3 (0.1) Claystone, grayish-black; carbonaceous.
- 292.3-292.4 (0.1) COAL, bright-banded; core broken. Sample D1302.
- 292.4-292.6 (0.2) Claystone, grayish-black, vitrain stringers; pyrite.
- 292.6-292.7 (0.1) COAL, bright-banded; sparse calcite along cleats. Sample D1302.
- 292.7-293.0 (0.3) Claystone, grayish-black; carbonaceous; vitrain stringers.
- 293.0-293.1 (0.1) COAL, bright-banded; occasional pyrite along cleats. Sample D1302.
- 293.1-294.9 (1.8) Shale, medium-gray; silty; rooted; slickensided surfaces; carbonaceous at upper contact.
- 294.9-302.1 (7.2) Siltstone, medium-gray; scattered sandstone laminae and beds; rare burrows; sparse siderite bands; roots; 0.15 foot gray-black carbonaceous bed at 295.5 feet; gradational lower contact.
- 302.1-302.7 (0.6) Shale, dark-gray to grayish-black at base; clayey; rooted; siderite nodules in upper part.
- 302.7-302.8 (0.1) COAL, banded.
- 302.8-306.5 (3.7) Claystone, grayish-black to light-olive-gray to greenish-gray to dark-gray; very rooted; pyrite granules from 305.5 to 305.9 feet; carbonaceous at base; underclay; slickensided surfaces.
- 306.5-310.1 (3.6) Shale, dark-gray; rooting; slickensided surfaces; thin sandstone laminae, increasing downward; flat to rippled; rooting, decreasing downward; gradational lower contact.
- 310.1-310.6 (0.5) Sandstone, medium-gray; fine to medium grained; rooted; plant fragments; calcareous; gradational lower contact.

- 310.6-311.8 (1.2) Shale and sandstone, interlaminated; dark-gray shale interlaminated with sideritic, flat to rippled sandstone; rare siderite bands; gradational lower contact.
- 311.8-312.0 (0.2) Shale, medium-dark-gray; clayey; sharp lower contact.
- 312.0-312.8 (0.8) Bentonite, light-olive-gray; very plastic; very slightly silty; fissile; sharp lower contact.
- 312.8-313.9 (1.1) Claystone, dark-gray to black; very carbonaceous; slickensided surfaces; vitrain stringers; rapidly gradational lower contact.
- 313.9-316.7 (2.8) Shale, medium-gray; clayey in upper part; occasional siltstone beds; rooted; occasional slickensided surfaces; gradational lower contact.
- 316.7-323.5 (6.8) Siltstone, medium-dark-gray; occasional sandstone laminae and beds; rooted; sparse clayey laminae; sideritic in part; gradational lower contact.
- 323.5-326.1 (2.6) Sandstone, medium-gray; fine grained; scattered shale laminae; rippled in part; fines downward; gradational lower contact.
- 326.1-326.7 (0.6) Siltstone, dark-gray; sparse sandstone laminae and burrows in lower part; gradational lower contact.
- 326.7-337.5 (10.8) Sandstone and shale; medium-gray to medium-olive-gray, fine-grained sandstone with scattered shale interbeds and laminae; rippled; crossbedded below 330.4 feet; sparse carbonaceous laminae.
- 337.5-399.0 (61.5) Sandstone, medium- to medium light-gray; very fine to medium grained; micaceous; massive to crossbedded; abundant shale laminae in upper part; coal and siderite clasts at 368.4 and 371.4 feet; coal clast at 379.0 and 382.9 feet; occasional coal bands in lower 20.0 feet.

- 399.0-408.1 (9.1) Shale, dark-gray; sandstone laminae in upper part; siderite nodules; gradational lower contact.
- 408.1-411.1 (3.0) Shale, black; slightly silty; coarsens downward; Lingula in upper 1.5 feet; very burrowed in lower 0.8 foot; gradational lower contact.
- 411.1-412.0 (0.9) Shale, dark-gray; clayey; burrowed in upper 0.3 foot; vitrain stringers and pyrite lenses at base.
- 412.0-414.0 (2.0) COAL, bright-banded; occasional pyrite along cleats; sparse bony streaks. Sample D1303.
- 414.0-414.8 (0.8) Claystone, medium-olive-gray; slickensided surfaces; rooted; carbonaceous at top; gradational lower contact.
- 414.8-416.0 (1.2) Siltstone, olive-gray; rooted; rare siderite nodules; gradational lower contact.
- 416.0-421.2 (5.2) Sandstone and shale, interbedded; medium- to medium-light-gray sandstone and dark-gray shale interbedded; shale medium dark greenish gray in upper 1.0 foot; rippled; rooted to 419.0 feet; sparse burrows in lower 2.0 feet; gradational lower contact.
- 421.2-426.8 (5.6) Shale, dark-gray; scattered thin sandstone laminae; sparse siltstone beds; rare siderite bands; sharp, irregular lower contact.
- 426.8-432.2 (5.4) Sandstone, medium-light-gray; very fine grained; occasional shale laminae; burrowed in upper 0.3 foot; rippled; sharp lower contact.
- 432.2-470.2 (38.0) Shale and sandstone, interlaminated; medium-dark- to dark-gray shale interlaminated with medium-light-gray, very fine-grained sandstone; rippled; burrowed; sandstone laminae decrease with depth; mudflow from 464.1 to 464.5 feet; generally coarsens upwards; gradational lower contact.

- 470.2-477.3 (7.1) Shale, dark-gray; clayey; occasional thin sandstone laminae in upper 1.0 foot; Pecten(?) at 471.15 feet; gradational lower contact.
- 477.3-488.1 (10.8) Shale, medium-dark-gray; silty; sandstone laminae, increasing toward middle; burrowed; mudflow from 485.5 to 486.2 feet; rare plant fragments; gradational lower contact.
- 488.1-488.9 (0.8) Shale, grayish-black; clayey; occasional burrows; gradational lower contact.
- 488.9-493.6 (4.7) Shale, dark-gray; scattered sandstone laminae; very burrowed; rare siderite bands; gradational lower contact.
- 493.6-507.1 (13.5) Shale, dark-gray to grayish-black with depth; clayey; sparse invertebrate fossil fragments; slightly calcareous in lower 6.0 feet; siderite bands and nodules.
- 507.1-507.2 (0.1) Limestone, dark-gray; argillaceous; microcrystalline.
- 507.2-507.3 (0.1) Shale, black; silty; micaceous.
- 507.3-510.7 (3.4) Shale, dark-gray to grayish-black; sandstone laminae; very sandy in upper 0.3 foot; rooted; siderite nodules; sandstone laminae decrease with depth; gradational lower contact.
- 510.7-525.1 (14.4) Shale, dark-gray; sparse siderite bands; rare plant fragments; abundant small clayey blebs; burrowed, many burrows replaced by pyrite; 0.05 foot pyrite band at base.
- 525.1-526.2 (1.1) COAL, bright-banded; good cleats; pyrite lenses; 0.02 foot bone band at 525.7 feet; becomes bony and contains more pyrite near base. Sample D1304.
- 526.2-526.4 (0.2) COAL, bony; pyrite; gradational lower contact.
- 526.4-534.9 (8.5) Shale, medium-dark-gray; rooted; grades into sandy shale at base; sharp lower contact.

- 534.9-539.2 (4.3) Sandstone, light-gray; very fine grained; scattered shale laminae and beds; rippled to flat; burrowed in part; shale increases toward base; sharp lower contact.
- 539.2-555.1 (15.9) Shale and sandstone; medium- to dark-gray silty shale with sandstone laminae and interbeds; rippled; carbonaceous at 547.1 and 553.4 feet; rooted; medium-gray underclay from 553.4 to 555.1 feet; occasional siderite bands; sandstone decreases toward 547.1 feet then increases toward base; gradational lower contact.
- 555.1-560.0 (4.9) Sandstone; very fine to fine grained; shale laminae; rippled; rooted at top; sparse burrows; gradational lower contact.
- 560.0-564.8 (4.8) Shale, medium-gray; silty; sandstone laminae; rippled; shale darkens and siderite nodules at base; coarsens upward; sharp lower contact.
- 564.8-595.3 (30.5) Sandstone, medium-light- to light-gray; fine grained; shale laminae throughout; scattered burrows above 578.2 feet; coal clasts at 580.4 and 591.4 feet; shale laminae increase toward base.
- 595.3-632.8 (37.5) Shale and sandstone; medium-dark- to dark-gray shale with medium-light-gray, very fine-grained sandstone laminae and interbeds; rippled; scattered roots; sparse carbonaceous fragments; gradational lower contact.
- 632.8-636.9 (4.1) Shale, grayish-black; clayey; siderite bands and nodules.
- 636.9-638.1 (1.2) Shale, medium-greenish-gray; rooted; disseminated siderite grains; silty in lower part; siderite band at top; gradational lower contact.

- 638.1-646.0 (7.9) Sandstone, medium-gray; very fine grained; micaceous; silty; rooted to 641.0 feet; rippled; occasional dark-gray shale interbeds; scattered siderite grains in upper part; gradational lower contact.
- 646.0-647.8 (1.8) Shale and sandstone, interlaminated; dark-gray shale interlaminated with medium-gray, very fine-grained sandstone; rippled; gradational lower contact.
- 647.8-648.3 (0.5) Siltstone, dark-gray to grayish-black; massive.
- 648.3-654.4 (6.1) Shale and sandstone, interlaminated; dark- to medium-dark-gray shale interlaminated with medium-gray, very fine- to fine-grained sandstone; rippled; occasional burrows; sparse carbonaceous fragments; sparse pyritized plant fragments; amount of sandstone varies throughout; gradational lower contact.
- 654.4-655.6 (1.2) Siltstone, medium-dark- to dark-gray; massive; rapidly gradational lower contact.
- 655.6-667.8 (12.2) Shale and sandstone, interlaminated; dark-gray to grayish-black shale interlaminated with medium-gray, fine- to very fine-grained sandstone; rippled; scattered burrows; sandstone sideritic and calcareous from 666.7 to 667.4 feet; no burrows below calcareous zone; sharp lower contact.
- 667.8-669.6 (1.8) Siltstone, medium-dark-gray; occasional convolute beds; mudflow.
- 669.6-672.2 (2.6) Shale and sandstone, interlaminated; dark-gray, slightly silty shale interlaminated with medium-light-gray, fine-grained sandstone; rippled; sparse burrows; plant fragments in shale.
- 672.2-673.1 (0.9) Siltstone, medium-dark-gray; convolute beds in lower 0.24 foot.

- 673.1-716.3 (43.2) Shale and sandstone, interlaminated; dark-gray, silty shale interlaminated with medium-light-gray, fine- to very fine-grained sandstone laminae; rippled; sandstone laminae, decreasing with depth; scattered burrows; occasional plant fragments; gradational lower contact.
- 716.3-724.0 (7.7) Shale, medium-dark-gray to black with depth; siderite bands and nodules; burrowed; pyrite-filled burrows below 719.0 feet; occasional roots from 718.0 to 720.5 feet; rare plant fragments; silty and very burrowed from 717.1 to 718.0 feet; gradational lower contact.
- 724.0-724.2 (0.2) Siltstone, medium- to dark-gray; very burrowed; coal fragments at base; lower contact bioturbated and irregular.
- 724.2-724.4 (0.2) COAL, bright-banded; good cleats.
- 724.4-724.5 (0.1) Pyrite band.
- 724.5-724.6 (0.1) COAL, dull-banded; pyritized fusain fragments; gradational lower contact.
- 724.6-724.9 (0.3) Bone coal; sparse bright bands; gradational lower contact.
- 724.9-727.0 (2.1) Siltstone, dark-gray; clayey; rooted; carbonaceous in upper 0.1 foot.
- 727.0-729.7 (2.7) Shale and sandstone, interlaminated; dark-gray, slightly clayey shale interlaminated with medium-gray, very fine-grained sandstone; rippled; moderate rooting; sharp lower contact.
- 729.7-730.9 (1.2) Sandstone, medium-gray; very fine grained; massive; sparse roots; calcareous; sharp, irregular lower contact.

- 730.9-742.9 (12.0) Shale, dark-gray to grayish-black with depth; medium-gray, very fine-grained sandstone laminae and beds in upper part; sparse siderite bands; rooted in upper part; disseminated pyrite in lower part; coarsens upward; rapidly gradational lower contact.
- 742.9-746.0 (3.1) Sandstone and shale, interbedded; medium-gray sandstone interbedded with grayish-black shale; very burrowed; gradational lower contact.
- 746.0-764.0 (18.0) Shale, black to grayish-black; sandstone laminae and beds, decreasing with depth; burrowed; sparse siderite bands in lower part; calcareous at 749.0 feet; gradational lower contact.
- 764.0-778.4 (14.4) Siltstone, black to grayish-black; argillaceous; burrowed; pyrite lenses and filled burrows; occasional siderite bands; occasional sandstone laminae near base; sharp lower contact.
- 778.4-778.5 (0.1) COAL, banded; sparse pyrite lenses.
- 778.5-779.0 (0.5) Claystone, grayish-black to brownish-black; carbonaceous; sparse slickensided surfaces; sparse pyrite lenses.
- 779.0-779.4 (0.4) COAL, bright-banded; good cleats; disseminated pyrite; calcite along cleats.
- 779.4-784.0 (4.6) Siltstone, medium-dark-gray to medium-olive-gray; very rooted; sparse clayey zones; scattered siderite grains; disseminated pyrite in upper part; coarsens downward; color lightens with depth; gradational lower contact.
- 784.0-790.6 (6.6) Shale, medium-dark-greenish-gray to dark-gray with depth; rippled sandstone laminae; rooted to 787.3 feet; amount of sandstone decreases with depth; sparse siderite bands; gradational lower contact.

- 790.6-791.0 (0.4) Shale, black to dark-greenish-gray; clayey; carbonaceous stringers; sparse slickensided surfaces.
- 791.0-791.4 (0.4) COAL, banded. Sample D1305.
- 791.4-791.5 (0.1) Bone coal.
- 791.5-793.2 (1.7) COAL, banded; scattered fusain lenses. Sample D1305.
- 793.2-793.6 (0.4) Claystone, black; carbonaceous; slickensided surfaces.
- 793.6-795.4 (1.8) Siltstone, medium-dark-gray; very rooted; gradational lower contact.
- 795.4-802.2 (6.8) Shale, gray; silty; sparse sandstone laminae and thin interbeds; rooted to 797.0 feet; scattered burrows; generally coarsens downward.
- 802.2-815.7 (13.5) Sandstone, medium-gray; fine to very fine grained; sparse silty shale interbeds; coal clast at base; sharp, irregular lower contact.
- 815.7-816.6 (0.9) COAL, banded; fairly well developed cleats; scattered fusain lenses. Sample D1306.
- 816.6-818.5 (1.9) Shale, medium-dark-greenish-gray; clayey; rooted; scattered small siderite nodules; slickensided surfaces; gradational lower contact.
- 818.5-823.0 (4.5) Shale and sandstone, interbedded; dark-gray shale interbedded with medium-light-gray, very fine-grained sandstone; rippled; rooted to 819.5 feet; sparse burrows; sharp lower contact.
- 823.0-824.0 (1.0) Shale, medium-dark-gray; silty; occasional sandstone laminae; plant fragments; micaceous; gradational lower contact.
- 824.0-825.3 (1.3) Sandstone and shale, interlaminated; light-gray, fine-grained sandstone interlaminated with dark-gray, carbonaceous, micaceous shale; rapidly gradational lower contact.

- 825.3-848.3 (23.0) Sandstone, light-gray; very fine grained; micaceous; massive to rippled; calcareous in part; scattered carbonaceous laminae; rare silty shale bed; sharp lower contact.
- 848.3-850.1 (1.8) Shale, dark-gray; silty; bedding at angle and somewhat contorted; slickensided surfaces.
- 850.1-871.0 (20.9) Sandstone, medium- to medium-light-gray; fine- to very fine-grained; scattered shale and carbonaceous laminae; rippled to crossbedded to massive; coal clasts and siderite nodules from 850.1 to 851.9, and 859.0 to 864.1 feet; sharp, irregular lower contact.
- 871.0-871.7 (0.7) Shale, dark-gray; carbonaceous stringers; plant fragments; slickensided surfaces; sharp lower contact.
- 871.7-872.0 (0.3) COAL, banded; well developed cleats; bony; sharp lower contact.
- 872.0-872.6 (0.6) Sandstone, light-gray; fine grained; dark-gray shale laminae; rippled; gradational lower contact.
- 872.6-879.1 (6.5) Shale, dark-gray; sandy to clayey; coarsens upward; occasional siderite bands; Lingula(?) at 873.3 feet; sparse slickensided surfaces; fairly sharp lower contact.
- 879.1-887.0 (7.9) Sandstone, brown to gray; silty to clayey; rooted; siderite nodules; very disturbed at top; gradational lower contact.
- 887.0-903.0 (16.0) Sandstone, light-gray; fine grained; abundant dark-gray shale laminae; rippled; scattered burrows; sparse carbonaceous laminae with pyrite; gradational lower contact.
- 903.0-913.5 (10.5) Shale, dark-gray; occasional sandstone laminae; clayey with depth; siderite bands.

- 913.5-915.4 (1.9) COAL, bright-banded; well developed cleats; sparse pyrite lenses. Sample D1307.
- 915.4-934.2 (18.8) Shale, dark-gray; clayey; rooted at top; siderite nodules and bands; shell fragments at 920.6 feet; roots pyrite-filled.
- 934.2-939.0 (4.8) Siltstone, brown to gray; clayey; abundant plant fragments near top; occasional carbonaceous shale laminae and coal stringers; siderite nodules in part; gradational lower contact.
- 939.0-987.3 (48.3) Shale, brown-gray to medium-dark-gray to black with depth; silty in part; sparse to abundant roots; rippled; sandstone laminae; burrowed; siderite bands; sandstone laminae increase to 946.4 feet then decrease to base; occasional Lingula(?) or Naiadites(?) in lower 16.7 feet.
- 987.3-988.1 (0.8) COAL, dull-banded; blocky; pyriiferous; 0.04 foot shale parting at 988.0 feet. Sample D1308.
- 988.1-990.1 (2.0) Shale, dark-gray; sandstone laminae, increasing toward base; siderite nodules at base; burrows.
- 990.1-993.5 (3.4) Sandstone; scattered shale laminae, increasing toward base; siderite; burrows; gradational lower contact.
- 993.5-999.7 (6.2) Shale, dark-gray; scattered rippled sandstone laminae; siderite in lower 2.4 feet.
- 999.7-1014.8 (15.1) Shale, medium-dark-gray to grayish-black with depth; abundant siderite bands; Lingula throughout.
- 1014.8-1038.6 (23.8) Shale, dark-gray; clayey; siderite bands; slickensided surfaces.
- 1038.6-1042.1 (3.5) Core lost.
- 1042.1-1060.1 (18.0) Shale, dark-gray; clayey; siderite bands.

- 1060.1-1060.7 (0.6) COAL bright-banded; well developed cleats; becomes bony at base. Sample D1308A.
- 1060.7-1061.1 (0.4) Shale, black; carbonaceous; plant fragments.
- 1061.1-1064.3 (3.2) Siltstone, light-brown to medium-gray with depth; clayey to sandy with depth; plastic in part; plant fragments; gradational lower contact.
- 1064.3-1085.4 (21.1) Sandstone and shale, interlaminated; light-gray, very fine-grained, sandstone interlaminated with very dark-gray shale; sparse plant fragments; sandstone content varies throughout..
- 1085.4-1087.1 (1.7) Sandstone, light-gray; fine grained; scattered shale clasts up to 0.25 feet thick.
- 1087.1-1110.6 (23.5) Sandstone, light- to very light-gray; fine grained; sparse, thin shale laminae; rare coal clasts; occasional shale clasts; sharp lower contact.
- 1110.6-1111.0 (0.4) Siltstone, dark-gray; sandy; scattered light-gray sandstone laminae.
- 1111.0-1114.2 (3.2) Sandstone, light-gray; fine grained; abundant coal and shale clasts; sharp lower contact.
- 1114.2-1178.3 (64.1) Shale, very dark- to dark-gray; siderite bands; silty with depth; scattered plant fragments; bedding at slight angle from 1175.0 to 1177.0 feet; sharp, irregular lower contact.
- 1178.3-1182.9 (4.6) Sandstone and shale, medium-gray, fine-grained sandstone with shale; abundant rooting in upper 1.0 foot; bedding at slight angle in lower part.
- 1182.9-1187.7 (4.8) Sandstone, medium gray, fine grained rooted, argillaceous, sharp lower contact.

- 1187.7-1189.0 (1.3) COAL, bright-banded to banded; calcite along cleats; core badly broken, thickness questionable. Sample D1309.
- 1189.0-1190.8 (1.8) Underclay, medium-dark-gray to medium-olive-gray; silty; clayey at upper and lower contacts; rooted.
- 1190.8-1191.0 (0.2) COAL, banded; good cleats; calcite along cleats.
- 1191.0-1192.3 (1.3) Siltstone, dark-gray; rooted; scattered vitrain stringers; gradational lower contact.
- 1192.3-1197.7 (5.4) Sandstone, light- to medium-gray; very fine to fine grained; siltstone and shale laminae; scattered roots; darker and very rooted at 1193.0 feet; olive gray below 1193.2 feet; bedding at angle in parts; slumped(?); scattered vitrain stringers; irregular lower contact.
- 1197.7-1197.8 (0.1) Bone coal.
- 1197.8-1212.0 (14.2) Sandstone, medium-light- to light-gray; very fine to fine grained; scattered shale laminae; rippled; rooted in upper 1.0 foot; shale laminae increase with depth; gradational lower contact.
- 1212.0-1239.0 (27.0) Shale, dark-gray; sandstone laminae; siderite nodules and bands in lower part; gradational lower contact.
- 1239.0-1240.4 (1.4) Shale, dark-gray; sharp lower contact.
- 1240.4-1278.8 (38.4) Shale and sandstone, interlaminated; dark-gray shale interlaminated with light-gray, fine-grained sandstone; sandstone laminae decrease with depth; gradational lower contact.
- 1278.8-1288.0 (9.2) Shale, dark-gray; fissile; sharp lower contact.
- 1288.0-1295.0 (7.0) Sandstone, light-gray; fine grained; scattered thin, dark shale laminae; rapidly gradational lower contact.

- 1295.0-1325.9 (30.9) Shale, dark-gray to black with depth; clayey; fissile.
- 1325.9-1326.3 (0.4) COAL, bright-banded.
- 1326.3-1326.7 (0.4) Shale, black; fissile.
- 1326.7-1327.3 (0.6) Clay, light-brown; plastic.
- 1327.3-1365.3 (38.0) Shale, dark-gray; thin sandstone laminae in upper 14.0 feet; sandstone laminae rare below 1341.3 feet; sharp lower contact.
- 1365.3-1366.5 (1.2) Siltstone, light-gray; argillaceous; sharp lower contact.
- 1366.5-1432.1 (65.6) Shale, dark- to medium-gray; sparse sandstone laminae; coarsens downward; sandy in lower 30.0 feet.
- 1432.1-1435.1 (3.0) Shale and sandstone, interlaminated.
- 1435.1-1450.8 (15.7) Shale, medium-gray; sandy; rare sandstone laminae.
- 1450.8-1462.0 (11.2) Shale and sandstone, interbedded; medium-gray, sandy shale with thin to thick, light-gray, fine-grained sandstone interbeds; coarsens downward.
- 1462.0-1510.5 (48.5) Sandstone, light-gray; fine grained; sparse shale laminae; sparse coal stringers.
- 1510.5-1510.6 (0.1) COAL, bright-banded.
- 1510.6-1613.8 (103.2) Sandstone, light-gray; fine to very fine grained; micaceous; massive to crossbedded; scattered coal clasts in upper 4.0 feet; occasional shale clasts; thin shale laminae in part; coarsens to medium grained with occasional quartz pebbles from 1573.4 to 1579.5 feet; pyrite lens at 1577.7 feet; scattered carbonaceous partings.
- *1613.8-1619.0 (5.2) Core lost.

*Drill bit stuck in hole, lost 12.5 feet of outer core

- 1619.0-1629.4 (10.4) Sandstone, light-gray; fine to medium grained; sparse carbonaceous shale laminae; sharp lower contact.
- 1629.4-1629.9 (0.5) Shale, medium-dark-gray; clayey; sparse burrows, siderite nodules, and slickensided surfaces; gradational lower contact.
- 1629.9-1639.6 (9.7) Shale and sandstone, interbedded; medium-dark- to dark-gray, silty shale interbedded with light- to medium-light-gray, very fine- to fine-grained sandstone; rippled; thin to thick bedded; sandstone beds commonly have sharp bases and grade upward into shale beds; burrowed in part; rare siderite nodules; sharp lower contact.
- 1639.6-1683.9 (44.3) Sandstone, medium-light- to light-gray; very fine to coarse grained; coarsens downward; shale and carbonaceous laminae; rippled to crossbedded to massive; rare, dark-gray shale beds; scattered small, grayish-black shale clasts at 1642.7 and 1644.8 feet; occasional graded beds; quartz pebbles in lower 2.4 feet; siderite pebbles at base; sharp lower contact.
- 1683.9-1687.8 (3.9) Shale and sandstone, interbedded; dark-gray silty shale interbedded with light- to medium-light-gray; very fine- to fine-grained sandstone; medium to thick bedded; rippled; sparse burrows and siderite nodules; sharp, irregular lower contact.
- 1687.8-1692.6 (4.8) Sandstone, light-gray; medium to very coarse grained; sparse to abundant quartz pebbles; scattered shale and siderite clasts; sharp, irregular lower contact.
- 1692.6-1693.2 (0.6) COAL, dull-banded; fairly well developed cleats; core broken, thickness questionable. Sample D1310.

barrel and bit in hole. Switched from Nx to Bx core.

- 1693.2-1693.4 (0.2) Shale, brownish-gray; silty; rooted; slickensided surfaces.
- 1693.4-1694.6 (1.2) Sandstone; olive-gray-black; very fine grained; rooted; Stigmaria; vitrain stringers; sharp lower contact.
- 1694.6-1696.8 (2.2) Sandstone, light-gray to pale-yellowish-brown in lower 0.4 foot; fine grained; rooted in upper 0.6 foot; sparse shale laminae; noncalcareous; sharp, irregular lower contact.
- 1696.8-1697.0 (0.2) Shale, dark-gray to pale-yellowish-brown; silty; thin sandstone laminae; sharp, slightly irregular lower contact.
- 1697.0-1707.0 (10.0) Sandstone, light-gray to pale-yellowish-brown in part; micaceous; occasional silty shale laminae; massive to rippled; occasional shale clasts; quartz pebbles and coal clast in lower 3.0 feet; sharp base.
- 1707.0-1708.2 (1.2) Shale and sandstone; medium-dark-gray, silty shale interbedded and interlaminated with light-gray, very fine- to medium-grained sandstone; sparse burrows; sparse ripples.
- 1708.2-1775.6 (67.4) Sandstone, light-gray; very fine- to very coarse-grained; coarsens downward; scattered shale laminae; occasional graded beds; massive to crossbedded to rippled; zones of coarse grains below 1718.0 feet; rare quartz pebbles; siderite pebbles and shale clast in lower 4.0 feet.
- 1775.6-1775.8 (0.2) Conglomerate, siderite pebbles in medium- to coarse-grained sandstone matrix.
- 1775.8-1784.2 (8.4) Sandstone, light-gray; medium to fine grained; scattered carbonaceous shale laminae; rippled to crossbedded to massive; sparse shale clasts and siderite pebbles; coal laminae in lower 0.2 foot; sharp, irregular lower contact.

- 1784.2-1790.6 (6.4) Shale, dark-gray; slightly clayey; sandstone laminae; burrowed; sparse siderite bands; sparse pyrite lenses and filled burrows; rapidly gradational lower contact.
- 1790.6-1791.5 (0.9) Sandstone, medium-light- to medium-dark-gray; argillaceous; mottled; very burrowed; siderite nodules in upper 0.25 foot; rapidly gradational lower contact.
- 1791.5-1799.8 (8.3) Shale, medium-dark- to dark-gray; slightly silty to clayey; scattered sandstone laminae; burrows; occasional siderite bands and nodules.
- 1799.8-1799.9 (0.1) COAL, dull-banded; core broken.
- 1799.9-1800.3 (0.4) Shale, grayish-black to dark-gray; poorly developed slickensided surfaces; thin bone band at base.
- 1800.3-1801.3 (1.0) Siltstone, grayish-black to medium-gray with depth; roots; coarsens downward; irregular lower contact.
- 1801.3-1803.0 (1.7) Sandstone, light-gray; fine grained; Stigmaria; rapidly gradational lower contact.
- 1803.0-1804.2 (1.2) Shale and sandstone, interbedded; light-olive-gray, sandy shale interbedded with light-gray, fine-grained sandstone; sharp, irregular lower contact.
- 1804.2-1941.0 (136.8) Sandstone, light-gray; very fine to medium grained; coarsens downward; massive to rippled to crossbedded; occasional shale laminae; calcareous from 1836.0 to 1841.0 and 1844.0 to 1848.0 feet; coal clast from 1939.9 to 1940.6 feet; sharp lower contact.
- 1941.0-1941.2 (0.2) Conglomerate; siderite pebbles in medium-grained sandstone matrix; sharp, slightly irregular lower contact.

1941.2-1976.1 (34.9) Sandstone, very light- to light-gray; very fine to fine grained; scattered carbonaceous shale laminae; massive to crossbedded to rippled; sharp, irregular lower contact.

1976.1-1976.3 (0.2) Sandstone, dark- to dusky-yellowish-brown; slightly calcareous; hard; sharp lower contact.

1976.3-1981.2 (4.9) Sandstone, light-gray; fine grained; sparse carbonaceous shale laminae; massive to crossbedded to rippled.

*Total Depth: 1981.2

*Unable to return core barrel to bottom of hole. Could not get past 1595.0 feet.

HOLE NO.: R-1
COUNTY, STATE: Clay, Kentucky DRILLED DEPTH: 412.4 ft.
SURFACE ELEV.: 811.0 ft. (alt.) QUAD.: Maulden 7.5 min.
LOCATION: 12-J-69, 2850 FEL X 1925 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-30.0 (30.00)	Cased interval; unconsolidated and weathered material.
30.0-43.3 (13.3)	Shale, medium- to dark-gray; sandy; occasional sandstone and clay laminae; rare coal stringers; burrowed; siderite bands and nodules; gradational lower contact.
43.3-43.4 (0.1)	Bone coal, dull-banded; well developed cleats; rare pyrite bands.
43.4-46.5 (3.1)	Shale, grayish-black to greenish-gray; very sandy; occasional clay laminae; rooted; siderite nodules; rare coal stringers; gradational lower contact.
46.5-47.9 (1.4)	Sandstone, medium-gray; very fine grained; argillaceous in part; gray-green shale clasts throughout; sparse carbonaceous and clay laminae, increasing with depth; burrowed in lower part; sharp lower contact.
47.9-63.3 (15.4)	Sandstone, light-gray; fine to medium grained; abundant dark-gray shale laminae; rippled; siderite bands, increasing toward base; rare plant fossils; gradational lower contact.
63.3-78.6 (15.3)	Shale, dark-gray; clayey; abundant light-gray sandstone laminae; burrowed throughout; rippled; sparse plant fossils; gradational lower contact.
78.6-86.0 (7.4)	Shale, dark-gray; very clayey; rare carbonaceous laminae in lower part; siderite bands and nodules; gradational lower contact.
86.0-118.5 (32.5)	Shale, medium- to dark-gray; clayey; sandy, silty in lower part; occasional sandstone; burrowed; rippled; plant fossils; siderite bands at base; sharp lower contact.

- 118.5-118.9 (0.4) COAL, bright-banded; good cleats; 0.02 foot pyrite band at top; pyritized plant fossils.
- 118.9-119.7 (0.8) Sandstone, gray to brown; silty; clayey at top; rooted; septarian siderite nodules; plant fossils at top; fairly sharp lower contact.
- 119.7-126.5 (6.8) Sandstone, light- to medium-gray; fine grained; dark-gray shale laminae; lower half of section medium-gray sandstone in sharp contact with upper light-gray sandstone; rooted; extensively burrowed; graded beds; dip of beds increases with depth; fairly sharp lower contact.
- 126.5-225.5 (99.0) Sandstone, light-gray; fine to medium grained; sparse dark-gray clayey shale laminae; rippled to crossbedded; sparse pyritic coal clasts and carbonaceous laminae; medium-gray shaly sandstone zone from 147.8 to 149.7 feet; sharp lower contact.
- 225.5-227.7 (2.2) Shale, dark-gray; sandstone laminae; quartz pebbles in lower 0.3 feet; sparse siderite nodules.
- 227.7-231.1 (3.4) Sandstone, light-gray; conglomeratic in upper 0.3 feet; coal bands; sparse burrows filled with siderite; sharp lower contact.
- 231.1-235.2 (4.1) Shale, dark-gray; sandstone laminae; sparse carbonaceous shale laminae; sparse burrows; sharp lower contact.
- 235.2-237.6 (2.4) Sandstone, light-gray; fine grained; shale laminae; gradational lower contact.
- 237.6-239.7 (2.1) Shale, dark-gray; sparse sandstone and carbonaceous laminae; gradational lower contact.
- 239.7-290.2 (50.5) Sandstone, light-gray; fine to coarse grained; occasional shale laminae; occasional coal clasts and quartz pebbles in lower 24 feet.

290.2-351.8 (61.6)	Sandstone, conglomeratic, light-gray; fine to coarse grained; sparse shale laminae; rare crossbedding; coal clasts; abundant siderite nodules; sharp lower contact.
351.8-360.1 (8.3)	Shale, dark-olive-gray; silty at base; rooted at top; sharp lower contact.
360.1-363.3 (3.2)	Siltstone, light-brownish-gray; plant fossils.
363.3-365.2 (1.9)	Shale and sandstone, interbedded; dark-olive-gray shale interbedded with very fine-grained, light-gray sandstone; gradational lower contact.
365.2-365.9 (0.7)	Shale, bright-green.
365.9-368.6 (2.7)	Sandstone, very fine-grained; shale laminae; contorted; rippled.
368.6-376.8 (8.2)	Shale, dark-olive-gray; rare pyrite; rare plant fossils.
376.8-382.6 (5.8)	Sandstone, very fine-grained; calcareous; silty toward base; gradational lower contact.
382.6-388.4 (5.8)	Shale, dark-olive-gray; silty; calcareous; fossil zone in lower part.
388.4-412.4 (24.0)	Shale, alternating red, gray, and green zones; silty; occasional calcareous zones throughout; sparse fossil zone in lower part.
Total Depth:	412.4

HOLE NO.: R-2
COUNTY, STATE: Clay, Kentucky DRILLED DEPTH: 797.5 ft.
SURFACE ELEV.: 1072.0 ft. (alt.) QUAD.: Oneida 7.5 min.
LOCATION: 7-J-71, 2750 FEL X 2220 FSL

<u>Depth (feet)</u>	<u>Lithology</u>
0-36.0 (36.0)	Cased interval; unconsolidated and weathered material.
36.0-44.6 (8.6)	Sandstone, grayish-green; medium grained; micaceous; occasional coal streaks; fairly sharp lower contact.
44.6-59.6 (15.0)	Shale, medium- to dark-gray; gradational lower contact.
59.6-62.8 (3.2)	Shale, greenish- to medium-gray; rare sandstone laminae; pyritic coal stringer at 59.3 feet; siderite nodules in upper part; rooted; abundant plant fossils; sharp lower contact.
62.8-72.3 (9.5)	Sandstone, greenish-gray; fine grained; shale laminae, increasing with depth; sparsely burrowed; gradational lower contact.
72.3-87.8 (15.5)	Shale, medium-gray; abundant sandstone laminae; burrowed throughout; plant fossils increasing with depth; sharp lower contact.
87.8-100.9 (13.1)	Sandstone, greenish-gray; fine grained; abundant shale laminae, decreasing downward and contorted at base; calcareous zone from 96.1 to 98.1 feet; gradational lower contact.
100.9-103.0 (2.1)	Shale and sandstone, interlaminated; medium-gray shale interlaminated with light-greenish-gray sandstone; gradational lower contact.
103.0-107.1 (4.1)	Shale, medium-gray; occasional sandstone laminae; abundant plant fossils increasing toward base.

- 107.1-133.9 (26.8) Shale, medium- to dark-gray; occasional rippled sandstone laminae; sandstone decreases with depth; siderite bands in upper part; sparse Lingula(?) in lower part; sharp lower contact.
- 133.9-141.6 (7.7) Sandstone, greenish-gray; fine grained; occasional shale laminae; gradational lower contact.
- 141.6-152.6 (11.0) Shale, brownish-gray; abundant sandstone laminae; gradational lower contact.
- 152.6-163.7 (11.1) Sandstone, greenish-gray; fine grained; abundant shale laminae; calcareous from 158.2 to 161.9 feet; rare plant fossils; sharp lower contact.
- 163.7-175.6 (11.9) Shale, medium- to dark-gray; sparse sandstone laminae in lower 1.5 feet; sparse siderite bands and large nodules; burrowed; rare pyritized plant fossils.
- 175.6-175.8 (0.2) COAL; well developed cleats.
- 175.8-185.1 (9.3) Sandstone, greenish-gray; fine grained; occasional shale laminae; rippled and crossbedded in lower part; sparse plant fossils in upper part.
- 185.1-215.8 (30.7) Shale, medium-gray; sandstone laminae abundant in upper part; burrowed in upper part; sparse siderite bands throughout; sparse plant fossils.
- 215.8-216.5 (0.7) Sandstone, greenish-gray; fine grained; occasional shale laminae; sharp lower contact.
- 216.5-218.1 (1.6) Shale, dark-gray; occasional sandstone laminae.
- 218.1-220.0 (1.9) COAL; well developed cleats. Sample R0201.
- 220.0-222.0 (2.0) Underclay, brownish-gray; rooted; abundant plant fossils; gradational lower contact.

- 222.0-277.8 (55.8) Shale, medium- to dark-gray; abundant sandstone laminae; sparse ripples; burrowed; sparse siderite bands and nodules; abundant plant fossils in lower part.
- 277.8-279.0 (1.2) Sandstone, light-greenish-gray; fine grained; occasional shale laminae; gradational lower contact.
- 279.0-280.7 (1.7) Shale, medium- to dark-gray; contorted sandstone laminae at top; plant fossils near base; sharp lower contact.
- 280.7-330.2 (49.5) Sandstone, light- to medium-gray; fine to medium grained; abundant shale laminae, decreasing in lower 20 feet; sparse coal clasts; pyritized plant fossils in shale laminae.
- 330.2-339.9 (9.7) Sandstone, brownish-gray; fine grained; sparse shale laminae, increasing with depth; sparse siderite nodules.
- 339.9-389.8 (49.9) Sandstone, light-gray to brownish-gray; fine grained; abundant shale laminae, decreasing with depth; occasional siderite nodules.
- 389.8-405.9 (16.1) Shale, medium- to dark-gray; abundant sandstone laminae, increasing downward; burrowed; gradational lower contact.
- 405.9-409.9 (4.0) Sandstone, light-greenish-gray; fine grained; occasional shale laminae.
- 409.9-416.9 (7.0) Shale, medium- to dark-gray; sandstone laminae, decreasing with depth; siderite nodules in lower part; burrowed in upper part.
- 416.9-418.0 (1.1) COAL; well developed cleats. Sample R0202.
- 418.0-421.7 (3.7) Shale, medium- to dark-gray; abundant sandstone laminae; slickensided surfaces; extensively burrowed in upper part; occasional plant fossils.

- 421.7-440.2 (18.5) Sandstone, light- to medium-gray; fine to medium grained; sparse shale laminae; sparse siderite nodules; pyrite at 436.6; sharp lower contact.
- 440.2-496.0 (55.8) Shale, dark-gray; sandstone laminae, increasing with depth; sparse siderite bands and nodules; burrowed throughout; coal stringer near base; gradational lower contact.
- 496.0-499.4 (3.4) Sandstone, brownish-gray; fine grained; clayey; sparse carbonaceous laminae; sharp lower contact.
- 499.4-584.2 (84.8) Sandstone, light-gray; fine to medium grained; occasional dark-gray shale laminae and beds; conglomeratic in part; rippled to crossbedded; zones of quartz pebbles, siderite and shale clasts from 566.6 to 569.3 feet; horizontal fractures at 565.2 to 565.7 feet; siderite pebbles at base; sharp lower contact.
- 584.2-587.2 (3.0) COAL, bright-banded; well developed cleats; abundant pyrite laminae; top 0.17 foot are carbonaceous shale; sparse calcite along cleats. Sample R0203.
- 587.2-589.7 (2.5) Shale, medium- to dark-gray; very clayey, coarsens downward into sandstone.
- 589.7-596.0 (6.3) Sandstone, medium- to dark-gray; very shaly; rooted; occasional plant fossils; gradational lower contact.
- 596.0-608.0 (12.0) Sandstone, light-gray; very fine to fine grained; abundant shale laminae; 0.2 foot shale bed in lower part; siderite nodules in lower part; burrowed; rippled.
- 608.0-614.5 (6.5) Shale, medium- to dark-gray; sandstone bed at 612.2 feet; rare siderite bands; occasional plant fossils.

- 614.5-617.2 (2.7) Sandstone and shale, interbedded; light-gray sandstone interbedded with occasional dark-gray shale beds; occasional siderite nodules and plant fossils.
- 617.2-618.2 (1.0) Shale, dark-gray; occasional carbonaceous laminae.
- 618.2-619.0 (0.8) Bone coal and carbonaceous shale.
- 619.0-621.6 (2.6) Underclay, medium-gray; rooted; siderite nodules at base.
- 621.6-622.1 (0.5) Shale, dark-gray; rooted.
- 622.1-632.2 (10.1) Sandstone, light-gray; fine grained; micaceous; occasional shale laminae and beds; burrowed in part.
- 632.2-682.7 (50.5) Sandstone, light-gray; fine to coarse grained; occasional shale and coal laminae; crossbedded; quartz pebbles throughout; shale and siderite pebbles from 674.0 to 675.7 feet; siderite at base; sharp lower contact.
- 682.7-689.2 (6.5) Sandstone, light-brownish-gray; fine grained; micaceous; occasional shale laminae with thin bed at base; occasional plant fossils.
- 689.2-742.2 (53.0) Sandstone, light-gray; fine to coarse grained; abundant shale laminae with 0.17 foot shale bed at 721.0 feet; crossbedded in part; coarsens downward; occasional horizontal fractures; quartz pebbles from 696.7 to 697.9 feet and in lower 20 feet; siderite bands at 697.6 feet.
- 742.2-747.2 (5.0) Shale, dark-gray to dark-olive-gray; plant fossils and siderite nodules in upper 2 feet.
- 747.2-747.8 (0.6) Dolostone, pale-yellowish-brown; burrowed, gradational lower contact.
- 747.8-752.6 (4.8) Shale, greenish-black; slightly silty; slickensided surfaces; gradational lower contact.

- 752.6-756.0 (3.4) Sandstone, pale-greenish-gray to medium-blue-gray; very fine grained; mottled; shale laminae; horizontal fractures in lower part; burrowed; sharp, irregular lower contact.
- 756.0-759.4 (3.4) Shale, dusky-green to greenish-black with depth; pale-yellow dolostone in upper 0.7 foot.
- 759.4-769.6 (10.2) Shale, dusky-green and dark-reddish-brown; dolomitic in upper 2 feet; mottled in part and along lower contact; slickensided surfaces; burrowed; gradational lower contact.
- 769.6-773.2 (3.6) Shale, greenish-black to dark-gray; very clayey; rapidly gradational lower contact.
- 773.2-775.3 (2.1) Dolostone, olive-gray; microcrystalline; sparse shell fossils.
- 775.3-779.3 (4.0) Limestone, dark-gray; microcrystalline; shale interbeds increasing in lower 2 feet; scattered burrows and rare fossil shells.
- 779.3-789.1 (9.8) Shale, dark-gray to olive-gray to greenish-black; very clayey in upper 2 feet; occasional limestone laminae and beds; rare siderite nodules; brachiopod fossils at 781.4 to 781.6 feet; burrowed in lower part.
- 789.1-797.5 (8.4) Shale, dark-reddish-brown, mottled red and green at 792.0 to 795.0 feet; slightly silty; occasional limestone nodules; sparse calcareous granules in lower 3 feet; rare silver, gray, and black slickensided surfaces; very burrowed.

Total Depth: 797.5

HOLE NO.: R-3
COUNTY, STATE: Clay, Kentucky DRILLED DEPTH: 716.5 ft.
SURFACE ELEV.: 841.0 ft. (alt.) QUAD.: Barcreek 7.5 min.
LOCATION: 10-I-70, 2615 FEL X 525 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-23.0 (23.0)	Cased interval; unconsolidated and weathered material.
23.0-28.4 (5.4)	Claystone, dark-gray; occasional slickensided surfaces; sparse plant fossils.
28.4-31.1 (2.7)	Shale, medium-gray; occasional sandstone laminae.
31.1-35.5 (4.4)	Siltstone, medium-brownish-gray; mottled in upper 4 feet; pyrite at 34.3 to 34.5 feet; sparsely rooted; gradational lower contact.
35.5-53.0 (17.5)	Shale and sandstone, interbedded; medium- to dark-gray shale with beds of light gray, very fine grained sandstone; burrowed; rippled; gradational lower contact.
53.0-81.4 (28.4)	Shale, medium- to dark-gray; clayey in upper part; occasional sandstone laminae; extensively burrowed from 71.8 to 78.9 feet; siderite nodules and bands throughout.
81.4-84.9 (3.5)	Siltstone, light-gray; siderite at 83.0 feet; gradational lower contact.
84.9-109.4 (24.5)	Shale, medium- to dark-gray; abundant sandstone laminae, sandstone bed at 87.1 feet to 88.1 feet; siderite bands and nodules throughout; rare plant fossils.
109.4-110.9 (1.5)	COAL; well developed cleats. Sample R0301.
110.9-111.8 (0.9)	Shale, medium- to dark-gray; abundant plant fossils; gradational lower contact.
111.8-115.8 (4.0)	Shale, very light- to light-gray; sandy; occasional sandstone laminae; siderite band at base; abundant plant fossils.

- 115.8-117.4 (1.6) Sandstone, very light-gray; fine grained; occasional shale laminae; crossbedded in lower part.
- 117.4-161.8 (44.4) Shale, medium- to dark-gray; clayey; sandstone laminae, decreasing with depth; coal stringer at 134.8 feet; siderite nodules and bands; abundant Lingula at 160.8 feet.
- 161.8-177.6 (15.8) Sandstone, light- to medium-gray; fine grained; occasional shale laminae, decreasing with depth; rare siderite bands; burrowed at 169.1 feet; gradational lower contact.
- 177.6-178.2 (0.6) Shale, medium-gray; silty; occasional sandstone laminae; gradational lower contact.
- 178.2-185.7 (7.5) Sandstone, very light-gray; very fine to fine grained; occasional shale laminae; massive.
- 185.7-191.6 (5.9) Sandstone and shale, interbedded; light-gray, fine-grained sandstone interbedded with occasional medium- to dark-gray shale; shale has occasional siderite bands; sharp lower contact.
- 191.6-200.0 (8.4) Sandstone, medium-light-gray; fine grained; sparse shale and siderite bands; massive; sharp lower contact.
- 200.0-201.4 (1.4) Shale, medium- to dark-gray; occasional sandstone laminae; gradational lower contact.
- 201.4-209.6 (8.2) Sandstone, light- to medium-gray; fine grained; abundant shale laminae and occasional shale beds; siderite nodules and bands; sharp lower contact.
- 209.6-211.8 (2.2) Shale, medium- to dark-gray; sandstone laminae, decreasing downward; sharp lower contact.

- 211.8-247.4 (35.6) Sandstone, light- to medium-gray; fine to medium grained; clayey in part; abundant shale laminae, decreasing with depth; zone of shale pebbles with occasional siderite replacement at 243.2 to 244.3 feet; sharp lower contact.
- 247.4-257.4 (10.0) Shale, dark-gray; sandstone laminae in upper part; siderite bands at 252.3 and 253.1 feet; burrowed in upper part; rare plant fossils; sharp lower contact.
- 257.4-269.8 (12.4) Sandstone, light- to medium-gray; fine to medium grained; clayey in part; occasional shale laminae; pyrite at base; sharp lower contact.
- 269.8-270.2 (0.4) Sandstone, greenish-gray; very clayey and argillaceous.
- 270.2-276.2 (6.0) Shale, light-greenish-gray to medium-dark-gray; occasional sandstone laminae, becoming silty with depth; burrowed in upper 4 feet; occasional plant fossils.
- 276.2-280.7 (4.5) Shale and sandstone, interlaminated; dark-gray shale interlaminated with medium-light-gray, fine-grained sandstone.
- 280.7-341.5 (60.8) Shale, medium- to dark-gray; occasional sandstone laminae; silty from 298.6 to 338.6 feet; coal stringers at 336.0 and 339.2 feet; sparse siderite nodules and burrows; plant fossils, increasing downward; some pyritized fossils at base.
- 341.5-348.8 (7.3) Shale and sandstone, interbedded; medium-dark-gray shale interbedded with light-gray, very fine- to fine-grained sandstone; rare plant fossils and siderite nodules in upper 0.5 foot.
- 348.8-381.3 (32.5) Sandstone, light-gray; fine grained; shale laminae, decreasing with depth; pyrite at 379.2 feet; shale pebbles and siderite nodules at base; sharp lower contact.

- 381.3-396.5 (15.2) Shale, medium-gray; sandstone laminae; burrowed; rare plant fossils.
- 396.5-396.8 (0.3) Bone coal, black; dull.
- 396.8-398.5 (1.7) Claystone; abundant plant fossils; slickensided surfaces throughout.
- 398.5-399.8 (1.3) Shale, medium-gray; sparse sandstone laminae; plant fossils, decreasing with depth; sharp lower contact.
- 399.8-403.4 (3.6) Sandstone, light-gray; very fine grained; shale laminae, increasing downward.
- 403.4-411.3 (7.9) Shale and sandstone, interbedded; medium-dark-gray shale interbedded with light-gray, very fine-grained sandstone; sharp lower contact.
- 411.3-479.1 (67.8) Sandstone, light-gray; very fine to fine grained; abundant shale laminae; small laminae of coarse-grained sandstone and isolated quartz pebbles in lower 18 feet; bony coal clasts with pyrite at 452.9 feet; sharp lower contact.
- 479.1-480.2 (1.1) Conglomerate; abundant subangular quartz pebbles with occasional mica flakes, feldspar clasts, and shale laminae; sharp lower contact.
- 480.2-504.9 (24.7) Sandstone, conglomeratic, light-gray; medium grained; occasional clayey and argillaceous laminae; bone coal clasts at 504.1 feet.
- 504.9-512.2 (7.3) Sandstone, light-gray; fine grained; occasional shale laminae.
- 512.2-512.5 (0.3) Conglomerate; abundant subrounded quartz pebbles, occasional shale pebbles, some replaced by siderite.
- 512.5-516.2 (3.7) Sandstone, light-gray; fine grained; shale laminae at top; abundant quartz pebbles; conglomeratic zone at base.

- 516.2-520.1 (3.9) Sandstone and shale, interlaminated; light-gray; fine-grained sandstone interlaminated with greenish-gray shale; quartz pebbles at base.
- 520.1-530.5 (10.4) Sandstone, light-gray; fine grained; occasional shale laminae; coal clasts at 525.0 and 528.5 feet; large siderite cobbles at top; sparse plant fossils in shale laminae.
- 530.5-531.7 (1.2) Conglomerate; abundant quartz pebbles; cobbles of shale and shale replaced by siderite; sharp lower contact.
- 531.7-536.8 (5.1) Shale, medium- to dark-gray; siderite band at top; coal clast at 532.7 feet; sparse plant fossils.
- 536.8-542.3 (5.5) Sandstone, light-gray; fine grained; occasional shale laminae; sparse shale pebbles.
- 542.3-543.7 (1.4) Shale, medium-dark-gray; occasional sandstone laminae.
- 543.7-603.6 (59.9) Sandstone, light-gray; fine to medium grained; sparse to abundant quartz pebbles; conglomeratic zones, increasing with depth; occasional shale laminae; sparse feldspar pebbles in upper 25.0 feet; sharp lower contact.
- 603.6-611.3 (7.7) Shale, medium-to dark-gray; clayey; sandstone laminae in lower 5.0 feet; burrowed at 608.5 feet; rare plant fossils.
- 611.3-624.4 (13.1) Sandstone, light-gray; fine to medium grained; occasional shale laminae; abundant conglomeratic zones and isolated quartz pebbles; bone coal clasts at 616.8 and 623.6 feet.
- 624.4-640.5 (16.1) Sandstone, light-gray; fine to medium grained; calcareous in upper 2 feet; sparse shale laminae; crossbedded.

640.5-659.4 (18.9)	Sandstone, light-gray; fine to medium grained; shale laminae; abundant conglomeratic zones; sparse feldspar pebbles; bone coal clasts in lower 5.0 feet.
659.4-660.2 (0.8)	Conglomerate; abundant quartz and siderite pebbles; sharp lower contact.
660.2-685.2 (25.0)	Shale, greenish-gray to medium-dark-gray; occasional sandstone laminae; sparse siderite bands; rare plant fossils.
685.2-685.6 (0.4)	COAL; well developed cleats; gradational lower contact.
685.6-692.1 (6.5)	Shale, medium-gray; sandy; sparse sandstone laminae; coal clasts at 691.4 and 691.6 feet; abundantly rooted; abundant plant fossils.
692.1-702.2 (10.1)	Shale, greenish-gray; sandy near base; rare sandstone laminae at base; slickensided surfaces; coal clasts in upper part; rooted; siderite nodules; gradational lower contact.
702.2-716.5 (14.3)	Shale, alternating red and green to greenish-gray; slightly sandy.
Total Depth: 716.5	

HOLE NO.: R-4

COUNTY, STATE: Clay, Kentucky

DRILLED DEPTH: 1058.2 ft.

SURFACE ELEV.: 1267.0 ft. (alt.)

QUAD.: Big Creek 7.5 min.

LOCATION: 9-I-71, 470 FEL X 2140 FSL

Depth (feet)

Lithology

0-8.0 (8.0)	Cased interval; unconsolidated and weathered material.
8.0-8.9 (0.9)	Sandstone, light-gray to stained pale-yellowish-brown; fine grained; occasional shale laminae.
8.9-10.6 (1.7)	Claystone, medium-gray to pale-yellowish-brown; occasional vitrain stringers; rooted; slickensided surfaces common.
10.6-64.7 (54.1)	Sandstone, light-gray; fine to medium grained; occasional shale and carbonaceous laminae; calcareous zone from 16.5 to 22.3 feet; occasional vitrain stringers; rippled in upper 4 feet; siderite nodules throughout; siderite bands at base.
64.7-64.9 (0.2)	Underclay, medium- to light-gray.
64.9-65.4 (0.5)	COAL, bright-banded; moderately well developed cleats.
65.4-65.5 (0.1)	Underclay, light-gray.
65.5-65.8 (0.3)	Sandstone, very light-gray; fine grained; coal cleats.
65.8-67.2 (1.4)	Underclay, light-gray; sandy at base; rooted; sharp lower contact.
67.2-74.1 (6.9)	Sandstone, very light-gray; fine grained; occasional shale laminae; sharp lower contact.
74.1-87.5 (13.4)	Shale, medium- to dark-gray; silty, slightly carbonaceous; occasional sandstone laminae; occasional siderite nodules and bands; abundant plant fragments, decreasing toward base.
87.5-87.6 (0.1)	COAL, bright-banded; fairly well developed cleats.

- 87.6-102.9 (15.3) Shale, medium- to dark-gray; very silty at top; occasional sandstone laminae, increasing with depth; coal stringer at 101.7 feet, sparsely rooted and burrowed; sparse siderite bands; occasional plant fossils.
- 102.9-107.7 (4.8) Underclay, light-brown to gray; sandy; sandstone laminae, increasing with depth; abundantly rooted; siderite nodules.
- 107.7-110.7 (3.0) Shale, medium-gray; silty, micaceous; sandstone laminae and beds, increasing with depth.
- 110.3-147.4 (37.1) Sandstone, light-gray; very fine grained; micaceous; abundant shale laminae with occasional carbonaceous shale laminae in upper 15.0 feet; calcareous zone from 130.0 to 141.0 feet; crossbedded in lower part; sparse coal clasts; sparse siderite nodules and shale clast in lower 10.0 feet; sharp lower contact.
- 147.4-168.6 (21.2) Shale, medium- to dark-gray; silty; occasional sandstone laminae; rooted in upper part; pyrite-filled burrows in lower 6.0 feet; occasional siderite nodules; very rare plant fossils.
- 168.6-169.7 (1.1) Sandstone, light-gray; fine grained; micaceous; sparse shale laminae; gradational lower contact.
- 169.7-171.5 (1.8) Shale, medium-gray to black with depth; carbonaceous in lower 0.3 foot; sparse sandstone laminae; occasional siderite bands; plant fossils.
- 171.5-171.8 (0.3) COAL, dull-banded; bony at base; poorly developed cleats.
- 171.8-172.0 (0.2) Shale, black; carbonaceous.
- 172.0-177.6 (5.6) Underclay, medium-gray; shaly; occasional sandstone laminae; rooted; siderite bands; abundant plant fossils; gradational lower contact.

- 177.6-177.9 (0.3) Shale, gray to black; carbonaceous; sparse siderite nodules; plant fossils.
- 177.9-178.4 (0.5) COAL, bright-banded; moderately well developed cleats.
- 178.4-179.4 (1.0) Underclay, medium-gray; slightly silty; rooted; siderite nodules; gradational lower contact.
- 179.4-182.4 (3.0) Shale, greenish-gray; occasional sandstone laminae; rooted and burrowed in part; abundant siderite nodules and bands; gradational lower contact.
- 182.4-185.4 (3.0) Shale and sandstone, interlaminated; medium- to dark-gray shale interlaminated with rippled sandstone; burrowed; siderite; occasional siderite bands; sharp lower contact.
- 185.4-189.9 (4.5) Shale, gray to black; carbonaceous; siderite bands and nodules; occasional plant fossils.
- 189.9-190.9 (1.0) COAL, bright- to dull-banded with depth; pyrite along cleats; moderately well developed cleats. Sample R0401.
- 190.9-192.2 (1.3) Underclay, medium-gray; sandy; rooted and burrowed.
- 192.2-193.8 (1.6) Sandstone; occasional shale laminae; rooted and burrowed; siderite nodules; plant fossils; gradational lower contact.
- 193.8-207.9 (14.1) Shale, medium- to dark-gray; sandstone laminae decreasing with depth; burrowed in part; occasional siderite-filled burrows; occasional plant fossils.
- 207.9-210.0 (2.1) Sandstone; occasional shale laminae; burrowed; abundant plant fossils replaced by siderite and pyrite.

- 210.0-215.2 (5.2) Shale, medium- to dark-gray; silty; sandstone laminae and beds; sparse burrows in upper part; occasional carbonaceous plant fossils.
- 215.2-236.8 (21.6) Sandstone and shale, interbedded; sparse calcareous sandstone zones.
- 236.8-241.1 (4.3) Shale, medium-gray; silty; sparse sandstone laminae; siderite bands and nodules in lower part; rare plant fossils.
- 241.1-248.2 (7.1) Sandstone, light-gray; fine grained; occasional shale laminae; shale pebbles in upper part; gradational lower contact.
- 248.2-254.3 (6.1) Shale; occasional sandstone laminae; occasional siderite nodules; burrowed; coal stringers at base.
- 254.3-258.4 (4.1) Sandstone, light- to medium-gray; fine grained; carbonaceous at top; occasional shale laminae; rippled; burrowed at base; sparse coal clasts.
- 258.4-261.9 (3.5) Underclay, medium-gray; slightly sandy at top, silty in lower part; rooted; gradational lower contact.
- 261.9-266.9 (5.0) Shale; sandstone laminae, increasing with depth; burrowed; gradational lower contact.
- 266.9-267.4 (0.5) Sandstone, light- to medium-gray; fine grained; occasional shale laminae; rippled; sparse burrows.
- 267.4-268.0 (0.6) Shale and sandstone, interbedded; dark-gray, silty shale interbedded with light-gray, fine-grained sandstone; sandstone rippled.
- 268.0-269.2 (1.2) Sandstone, light- to medium-gray; fine grained; occasional shale laminae; sharp lower contact.
- 269.2-269.8 (0.6) Shale and sandstone, interbedded; dark-gray, silty shale interbedded with light-gray, fine-grained sandstone; occasional carbonaceous shale beds; sharp lower contact.

- 269.8-275.0 (5.2) Sandstone, light- to medium-gray; fine to medium grained; micaceous; occasional shale laminae and pebbles; carbonaceous zone at 271.8 feet; rippled to slightly crossbedded.
- 275.0-276.8 (1.8) Shale, medium- to dark-gray; silty and clayey in part; sandstone laminae and beds, decreasing with depth; burrowed; gradational lower contact.
- 276.8-279.0 (2.2) Siltstone, medium- to dark-gray; massive sandstone laminae in lower 0.2 foot; occasional plant fossils; gradational lower contact.
- 279.0-282.0 (3.0) Shale, medium- to dark-gray; silty to clayey in part; occasional sandstone laminae, decreasing with depth; sparse siderite bands; rare plant fossils; gradational lower contact.
- 282.0-294.9 (12.9) Shale, dark-gray to grayish-black with depth; silty to clayey; fines downward; occasional siderite bands and nodules; sparse pyrite, increasing with depth; vitrain stringers in lower 0.04 foot; rare plant fossils.
- 294.9-296.3 (1.4) COAL, bright-banded; rare pyrite. Sample R0402.
- 296.3-296.8 (0.5) Shale, medium-gray to black; carbonaceous in upper 0.03 foot; silty in lower part; rooted.
- 296.8-298.7 (1.9) Siltstone, medium-gray; micaceous, occasional shale laminae; rooted, gradational lower contact.
- 298.7-301.8 (3.1) Sandstone and shale, interbedded; light-gray, fine-grained sandstone interbedded with dark-gray, silty shale; rooted; pyrite pebbles in upper part; gradational lower contact.
- 301.8-303.3 (1.5) Sandstone, light- to medium-gray; very fine to fine grained; occasional silty shale interbeds; rippled; sharp lower contact.

- 303.3-307.8 (4.5) Shale, medium- to dark-gray; occasional sandstone laminae and beds; clayey and silty in part; burrowed in part.
- 307.8-314.3 (6.5) Sandstone, light- to medium-gray; fine grained; micaceous, carbonaceous shale laminae, increasing with depth; calcareous zone from 309.4 to 310.8 feet; rippled in upper 0.7 foot; sharp lower contact.
- 314.3-315.6 (1.3) Siltstone, medium- to dark-gray; sparse sandstone laminae; rooted; gradational lower contact.
- 315.6-316.6 (1.0) Sandstone, light- to medium-gray; very fine grained; sparse shale laminae; rippled; occasional siderite bands; gradational lower contact.
- 316.6-319.6 (3.0) Shale and sandstone, interbedded; medium- to dark-gray, silty shale interbedded with light-gray sandstone; rippled; occasional siderite bands; siltstone bed from 317.3 to 317.5 feet; sparsely burrowed; gradational lower contact.
- 319.6-323.0 (3.4) Sandstone, light- to medium-gray; very fine to fine grained; occasional silty shale laminae and beds; calcareous zone from 322.1 to 322.7 feet; rippled; rare burrows; gradational lower contact.
- 323.0-339.1 (16.1) Shale and sandstone, interbedded; dark-gray, silty to clayey shale interbedded with light- to medium-gray, very fine-grained sandstone; shale has occasional carbonaceous laminae; occasional siderite bands in sandstone; rippled, decreasing with depth; sparse burrows.
- 339.1-355.0 (15.9) Shale, medium-gray; clayey and silty in part; sandstone laminae, decreasing with depth; burrowed; siderite bands; gradational lower contact.
- 355.0-355.5 (0.5) Siltstone, medium- to dark-gray; micaceous; mottled; very burrowed; siderite nodules.

- 355.5-356.4 (0.9) Sandstone, medium-gray; very fine grained; micaceous; sparse shale clasts; very burrowed; siderite nodules; sharp lower contact.
- 356.4-358.6 (2.2) Shale, medium-gray to grayish-black with depth; vitrain stringers in lower part.
- 358.6-359.3 (0.7) COAL, dull-banded; sparse bright bands; argillaceous in part; rare pyrite lenses. Sample R0403.
- 359.3-360.4 (1.1) Shale, dark- to medium-gray with depth; clayey; abundant slickensided surfaces; rooted, disseminated pyrite along roots; gradational lower contact.
- 360.4-363.7 (3.3) Siltstone, medium-gray; argillaceous; occasional sandstone laminae; abundant roots, decreasing with depth; gradational lower contact.
- 363.7-372.5 (8.8) Shale, medium- to dark-gray; silty; occasional sandstone laminae; sparse siderite bands; gradational lower contact.
- 372.5-377.6 (5.1) Sandstone and shale, interbedded; light-gray, very fine-grained sandstone interbedded with dark-gray, silty shale; rippled; lenticular to flaser bedding.
- 377.6-396.9 (19.3) Sandstone, medium-gray; very fine to fine grained; micaceous in lower part; shale laminae and beds, decreasing with depth; rippled; massive in lower 6.0 feet; occasional siderite nodules; sparse coal clasts; sharp lower contact.
- 396.9-397.8 (0.9) Claystone, brownish-black; carbonaceous; abundant plant fossils.
- 397.8-399.4 (1.6) COAL, bright- to dull-banded; well developed cleats; sparse pyrite laminae; rare calcite in cleats. Sample R0404.
- 399.4-403.8 (4.4) Shale, dark-gray; silty; sandstone laminae, increasing with depth; rooted; gradational lower contact.

- 403.8-406.1 (2.3) Sandstone, medium-gray; fine grained; occasional shale laminae; rippled; sharp lower contact.
- 406.1-414.1 (8.0) Shale, medium- to dark-gray; micaceous in lower part; abundant sandstone laminae.
- 414.1-427.7 (13.6) Sandstone, medium-gray; very fine to fine grained; abundant micaceous shale laminae; rippled and crossbedded in lower 5.0 feet; coal bands from 426.75 to 427.7 feet.
- 427.7-444.9 (17.2) Shale, dark-gray to grayish-black; clayey; occasional siderite bands; scattered Lingula in upper part; sparse burrows in lower 6.0 feet.
- 444.9-446.4 (1.5) Siltstone, grayish-black; very burrowed; occasional siderite nodules; gradational lower contact.
- 446.4-451.4 (5.0) Sandstone, medium-gray to grayish-black; very fine grained; calcareous; mottled; very burrowed; sharp lower contact.
- 451.4-451.7 (0.3) Shale, black; carbonaceous; occasional vitrain stringers.
- 451.7-451.8 (0.1) COAL, dull-banded.
- 451.8-454.1 (2.3) Shale, dark-gray to black; clayey; occasional vitrain stringers; disseminated pyrite; sparse burrows and roots; sparse plant fossils; sharp lower contact.
- 454.1-462.9 (8.8) Sandstone, medium-gray; fine to coarse grained; micaceous; occasional shale laminae; shale lens at 461.1 to 462.0 feet; rippled and crossbedded from 458.0 to 459.6 feet; coarsens downward; occasional coal clasts; sparse plant fossils; sharp, slightly irregular lower contact.
- 462.9-488.8 (25.9) Shale, medium-gray to grayish-black with depth; clayey; silty in lower part; sparse sandstone laminae; sparsely rooted and burrowed with occasional fillings of pyrite; occasional siderite bands.

- 488.8-489.6 (0.8) COAL, bright-banded; well developed cleats. Sample R0405.
- 489.6-491.4 (1.8) Siltstone, medium- to dark-gray; rare slickensided surfaces; occasional siderite and pyrite nodules; gradational lower contact.
- 491.4-493.2 (1.8) Shale, dark-gray; occasional sandstone laminae; rooted; siderite nodules in lower part and at base.
- 493.2-494.2 (1.0) Sandstone and shale, interlaminated; light- to medium-gray, fine-grained sandstone interlaminated with dark-gray shale; rippled; burrowed; occasional siderite bands and nodules; gradational lower contact.
- 494.2-495.7 (1.5) Shale, grayish-black; sparse sandstone laminae; sparsely burrowed; siderite bands; rapidly gradational contact.
- 495.7-496.3 (0.6) Sandstone, medium-gray; fine grained; occasional shale laminae; rippled; gradational lower contact.
- 496.3-517.6 (21.3) Sandstone and shale, interlaminated; light-gray, fine- to medium-grained sandstone interlaminated with medium- to dark-gray shale; rippled; sparsely burrowed; gradational lower contact.
- 517.6-524.2 (6.6) Shale, medium- to dark-gray; clayey; rare sandstone laminae; sparse siderite bands.
- 524.2-536.6 (12.4) Sandstone, light-gray; fine to medium grained; abundant shale laminae; rippled; burrowed in upper part; rare plant fossils; gradational lower contact.
- 536.6-562.4 (25.8) Shale, medium- to dark-gray; clayey in lower part; sandstone laminae, decreasing with depth; sparse siderite bands; sparsely burrowed; sharp lower contact.
- 562.4-562.9 (0.5) Siltstone, dark-gray; sparse sandstone laminae; burrowed in lower 0.3 foot; gradational lower contact.

- 562.9-566.5 (3.6) Shale, grayish-black; slightly clayey; rare siltstone laminae; sparse vitrain stringers in lower 0.5 foot; sparse siderite bands; pyritized fossil shells at 563.8.
- 566.5-572.2 (5.7) Sandstone, medium-gray to light-olive-gray to yellowish-brown; mottled; very fine grained; argillaceous; rooted; burrowed; sparse coal clasts; sparse siderite and sulfide nodules; gradational lower contact.
- 572.2-618.7 (46.5) Shale, dark-gray; silty to clayey in part; abundant sandstone laminae; burrowed; occasional siderite bands; disseminated pyrite; rare plant fossils.
- 618.7-618.9 (0.2) Claystone, black; carbonaceous.
- 618.9-619.8 (0.9) COAL, bright-banded; well developed cleats with rare calcite; sparse pyrite lenses. Sample R0406.
- 619.8-636.4 (16.6) Shale, dark-gray; silty to clayey; occasional sandstone laminae in lower 2.0 feet; rooted; occasional siderite bands and nodules; disseminated pyrite; rapidly gradational lower contact.
- 636.4-638.2 (1.8) Sandstone, medium-gray; fine grained; micaceous; occasional shale laminae; occasional shale clasts and siderite nodules; sparse plant fossils; sharp lower contact.
- 638.2-642.2 (4.0) Shale, medium- to dark-gray; silty in part; occasional sandstone laminae; sparse siderite bands; sharp lower contact.
- 642.2-643.5 (1.3) Siltstone, medium- to dark-gray; sparse shale laminae; siderite nodules; rapidly gradational lower contact.
- 643.5-655.8 (12.3) Shale, dark-gray; slightly silty; sparse sandstone laminae; siderite bands.

- 655.8-656.5 (0.7) COAL, bright-banded; 0.1 foot pyrite band at base. Sample R0407.
- 656.5-656.6 (0.1) Shale, grayish-black; rooted; slickensided surfaces.
- 656.6-656.7 (0.1) COAL, bright-banded.
- 656.7-658.6 (1.9) Underclay, olive-gray; clayey to silty; rooted; gradational lower contact.
- 658.6-660.2 (1.6) Siltstone, medium- to dark-gray; siderite nodules; siderite-replaced rootlets in part; gradational lower contact.
- 660.2-700.2 (40.0) Shale, dark-gray to grayish-black; clayey and silty in part; sparse sandstone laminae; sparsely rooted and burrowed; coal clasts at 663.7 feet; siderite bands and nodules; gradational lower contact.
- 700.2-764.6 (64.4) Sandstone, light- to medium-gray; very fine to medium grained; micaceous; rare to occasional shale laminae and beds; calcareous zone from 710.4 to 711.2 feet; rippled to crossbedded; rare coal bands and clasts; talc-filled fractures from 752.7 feet to 758.6 feet; siderite bands at base; sharp, irregular lower contact.
- 764.6-767.8 (3.2) Shale, medium- to dark-gray; silty; occasional sandstone laminae; burrowed; plant fossils and siderite at base; sharp, irregular lower contact.
- 767.8-774.9 (7.1) Sandstone, medium-gray; very fine to fine-grained; sparse crossbedding; shale clasts and siderite pebbles; occasional coal clasts; sharp, irregular lower contact.
- 774.9-776.3 (1.4) Underclay, medium-gray; occasional sandstone streaks; rooted; gradational lower contact.
- 776.3-786.0 (9.7) Shale and sandstone, interbedded; dark-gray shale.

- 786.0-788.2 (2.2) Shale, dark-gray; fissile; siderite layers.
- 788.2-797.1 (8.9) Sandstone and shale, interbedded; rippled; slickensided surfaces.
- 797.1-802.5 (5.4) Sandstone, medium-gray; fine grained; abundant shale laminae; coal stringers; sharp lower contact.
- 802.5-803.6 (1.1) Shale, dark-gray; occasional sandstone laminae; gradational lower contact.
- 803.6-832.8 (29.2) Sandstone, medium-gray; fine grained; abundant shale laminae; rippled and crossbedded in part; rooted; coal clasts; abundant plant fossils; sharp lower contact.
- 832.8-846.0 (13.2) Shale, dark-gray to black with depth; carbonaceous with depth; pyrite and siderite bands, increasing with depth; abundant vitrain stringers in lower 0.6 feet.
- 846.0-850.1 (4.1) Shale, medium-gray; clayey; carbonaceous band from 849.3 to 849.6 feet; rooted; slickensided surfaces; pyrite nodules in upper 2.0 feet; occasional plant fossils; gradational lower contact.
- 850.1-855.6 (5.5) Siltstone, medium- to dark-gray; occasional sandstone laminae; gradational lower contact.
- 855.6-860.9 (5.3) Shale and sandstone, interbedded; dark-gray shale interbedded with medium-gray, fine-grained sandstone; rippled; gradational lower contact.
- 860.9-861.5 (0.6) Bone coal; poorly developed cleats; abundant pyrite lenses.
- 861.5-861.7 (0.2) Shale, dark-olive-gray; sparse sandstone laminae; rooted; slickensided surfaces; abundant plant fossils.
- 861.7-866.9 (5.2) Shale and sandstone, interbedded; dark-gray, silty shale interbedded with medium- to dark-gray, fine-grained sandstone; rooted.

- 866.9-969.9 (103.0) Sandstone light- to medium-gray; fine to medium grained; abundant to sparse shale laminae with depth; shale interbeds from 868.5 to 869.1 feet and 924.1 to 925.3 feet; scattered shale clasts; micaceous; calcareous zone from 905.9 to 907.6 feet; conglomeratic zone from 925.3 to 931.9 feet; rippled to crossbedded; massive in lower part; occasional horizontal fractures; sparse coal clasts; occasional siderite bands and nodules; rare plant fossils; sharp lower contact.
- 969.9-971.5 (1.6) Shale, dark-gray to black; occasional pyrite bands; occasional plant fossils.
- 971.5-971.9 (0.4) COAL, bright-banded; well developed cleats with some calcite; pyrite bands and nodules; bone coal in upper and lower 0.04 foot.
- 971.9-1055.5 (83.6) Sandstone, brownish-gray to light-gray with depth; very fine to medium grained; occasional shale laminae and clasts; quartz-pebble conglomeratic zone from 981.4 to 981.8; rippled to crossbedded; horizontal fractures; sparse coal bands; sparse plant fossils, slickensided surfaces and siderite nodules at base; sharp lower contact.
- 1055.5-1058.2 (2.7) Shale, dark-gray; sandy with occasional sandstone laminae; burrowed; slickensided surfaces; rare plant fossils.

*Total Depth: 1058.2

*Unable to return core barrel to bottom of hole. Drilling terminated.

HOLE NO.: R-5
COUNTY, STATE: Clay, Kentucky DRILLED DEPTH: 959.1 ft.
SURFACE ELEV.: 870 ft. (alt.) QUAD.: Barcreek 7.5 min.
LOCATION: 24-I-71, 425 FEL X 5540 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-20.0 (20.0)	Cased interval; unconsolidated and weathered material.
20.0-24.1 (4.1)	Shale, medium-gray; abundant to sparse sandstone laminae with depth; occasional siderite bands; burrowed; abundant plant fossils.
24.1-49.9 (25.8)	Shale, dark-gray to black; abundant siderite bands; rare pyrite lenses; sandy in lower 0.5 feet; <u>Lingula</u> at 37.5 feet, rare plant fossils; gradational lower contact.
49.9-60.3 (10.4)	Sandstone, light-gray; micaceous; occasional shale laminae; heavily burrowed; abundant siderite nodules; rare coal clasts; abundant plant fossils in lower part.
60.3-62.4 (2.1)	Shale, medium-gray; silty; occasional sandstone laminae; rooted and burrowed; gradational lower contact.
62.4-63.1 (0.7)	Shale, black; carbonaceous, pyrite band at 62.9 feet.
63.1-63.7 (0.6)	Bone coal.
63.7-64.3 (0.6)	Underclay, grayish-black; rooted; occasional pyrite.
64.3-69.2 (4.9)	Shale, olive- to dark-gray; occasional sandstone laminae; siderite bands; rare pyrite; occasional plant fossils.
69.2-71.5 (2.3)	Sandstone, light-gray; fine to medium grained; shale laminae in upper part; siderite bands and nodules; sharp lower contact.

- 71.5-95.9 (24.4) Shale, medium-gray; sandstone streaks, decreasing to 85.5 feet; siderite bands from 88.5 to 95.8 feet; calcite in siderite nodule at 93.4 feet; occasional plant fragments.
- 95.9-115.4 (19.5) Shale, medium- to dark-gray; sandstone laminae; rooted in upper part; occasional siderite nodules.
- 115.4-116.3 (0.9) COAL, dull-banded; poorly developed cleat; pyrite lens at top and at 115.8 feet. Sample R0501.
- 116.3-117.5 (1.2) Underclay, medium-gray; sandstone laminae, increasing with depth; rooted; gradational lower contact.
- 117.5-146.8 (29.3) Shale, medium-gray; silty; abundant sandstone laminae; sandstone bed at 121.3 feet; rooted; occasional siderite bands; plant fossils, increasing with depth.
- 146.8-158.8 (12.0) Shale, dark-gray to black; occasional siderite bands and nodules.
- 158.8-196.0 (37.2) Shale, light- to medium-gray; silty to clayey in part; abundant sandstone laminae and beds; pyrite nodules at 192.7 feet; occasional plant fossils.
- 196.0-198.4 (2.4) Shale, black; slightly silty; sparse pyrite nodules.
- 198.4-200.8 (2.4) Underclay, brownish-gray; sandy; rooted in upper part.
- 200.8-213.3 (12.5) Sandstone, light-gray; very fine to fine grained; occasional siltstone and shale laminae; shale bed from 207.4 to 207.8 feet; rooted and burrowed; occasional siderite bands; rare coal clasts; sharp lower contact.

- 213.3-249.1 (35.8) Shale, medium-dark-gray to grayish-black; silty to clayey with depth; occasional sandstone laminae; sparse siderite bands; rooted and burrowed in part; rare disseminated pyrite; pelecypods from 239.3 to 242.4 feet; slickensided surfaces at base; gradational lower contact.
- 249.1-250.9 (1.8) Siltstone, medium- to olive-gray; rooted; sparse slickensided surfaces; gradational lower contact.
- 250.9-253.2 (2.3) Shale, medium-greenish- to dark-gray; occasional sandstone laminae and beds; sparse siderite bands; rooted in part.
- 253.2-271.5 (18.3) Sandstone, light-gray; very fine to fine grained; abundant shale laminae and interbeds; calcareous in lower 10.0 feet; sandy shale mudflow from 264.3 to 264.8 feet; rippled in part; sparse siderite bands; coal clasts in upper 3.0 feet.
- 271.5-277.9 (6.4) Shale, dark-gray; calcareous; sandstone laminae, decreasing with depth; burrowed in part; occasional siderite nodules and bands.
- 277.9-279.3 (1.4) Shale and sandstone, interbedded; dark-gray shale interbedded with light- to medium-gray, fine-grained sandstone; calcareous in part; sparse siderite bands; plant fossils; gradational lower contact.
- 279.3-286.4 (7.1) Shale, dark-gray to grayish-black; occasional sandstone laminae; burrowed throughout, some burrows replaced by pyrite in the lower 0.2 foot; siderite bands; claystone clasts along lower contact.
- 286.4-286.7 (0.3) Claystone, dark-gray; pyrite-replaced burrows.
- 286.7-289.1 (2.4) COAL, bright-banded; rare dull bands; sparse pyrite lenses. Sample R0502.
- 289.1-289.8 (0.7) Shale, black; clayey; rooted in top 0.13 foot; abundant slickensided surfaces.

- 289.8-289.9 (0.1) COAL, bright-banded.
- 289.9-290.0 (0.1) Shale, black; clayey.
- 290.0-290.6 (0.6) Claystone, medium- to olive-gray; very rooted; abundant slickensided surfaces.
- 290.6-292.3 (1.7) Siltstone, medium-gray; rooted; plant fossils.
- 292.3-293.5 (1.2) Shale, dark-gray; silty, occasional sandstone laminae; burrowed in lower part; sparse siderite nodules; irregular lower contact.
- 293.5-297.6 (4.1) Siltstone, dark-gray; argillaceous in part; occasional sandstone laminae; sparsely burrowed; occasional siderite nodules.
- 297.6-328.3 (30.7) Shale, dark-gray; clayey in part; occasional sandstone laminae; occasional siderite bands; gradational lower contact.
- 328.3-339.0 (10.7) Sandstone, light- to dark-gray, mottled; very fine grained; argillaceous; micaceous; very burrowed; occasional siderite bands and nodules; gradational lower contact.
- 339.0-349.5 (10.5) Siltstone, grayish-black to black; carbonaceous; pyrite-replaced burrows in part; coarsens upward; sparse siderite bands.
- 349.5-386.7 (37.2) Sandstone, very light- to medium-light-gray; very fine to fine grained; occasional shale laminae; rippled to crossbedded to massive in part; horizontal fractures in lower 7.0 feet.
- 386.7-388.7 (2.0) Shale, dark-gray; slightly clayey; occasional slickensided surfaces.
- 388.7-389.3 (0.6) Conglomerate; siderite, sandstone, and shale clasts in a silty shale matrix; sharp, slightly irregular lower contact.

- 389.3-391.4 (2.1) Sandstone, light-gray to yellowish-brown; very fine to fine grained; occasional shale laminae.
- 391.4-391.5 (0.1) COAL, dull-banded.
- 391.5-391.8 (0.3) Conglomerate, sandstone and siderite pebbles in a shale matrix.
- 391.8-392.0 (0.2) COAL, banded, banding at an angle; siderite and sandstone lenses in middle part; appears reworked.
- 392.0-392.2 (0.2) COAL, dull-banded; occasional thin, bright bands.
- 392.2-413.0 (20.8) Shale, olive- to dark-gray; slightly silty; carbonaceous in part; sparse sandstone laminae; burrowed and rooted; occasional siderite nodules and bands; pelecypods at 409.2 feet.
- 413.0-413.6 (0.6) Shale, black; pyrite lenses; burrowed; shell fossils.
- 413.6-414.1 (0.5) Bone coal; sparse, bright bands.
- 414.1-425.4 (11.3) Sandstone and shale, interbedded; light-gray sandstone interbedded with greenish-gray to dark-gray, silty shale; sparsely rooted and burrowed; sparse coal stringers; sparse plant fossils.
- 425.4-435.4 (10.0) Sandstone, light-gray; fine grained; occasional carbonaceous shale laminae, increasing with depth; calcareous zone from 430.1 to 433.0 feet; burrowed.
- 435.4-444.4 (9.0) Shale, dark-gray; clayey; sandstone laminae; slumped; occasional slickensided surfaces; sparse siderite nodules and olive-gray shale clasts.
- 444.4-444.6 (0.2) Conglomerate, siderite pebbles in calcareous sandstone matrix.
- 444.6-449.4 (4.8) Shale, dark-gray; silty to clayey; abundant sandstone laminae; burrowed in upper part; siderite nodules in lower 1.4 feet.

- 449.4-451.5 (2.1) Limestone, dark-gray; microcrystalline; argillaceous; cone-in-cone structure throughout.
- 451.5-457.9 (6.4) Shale, dark-gray to grayish-black; clayey; occasional sandstone laminae burrowed; siderite nodules, disseminated pyrite.
- 457.9-458.1 (0.2) COAL, bright-banded; argillaceous.
- 458.1-463.5 (5.4) Siltstone, medium- to dark-gray; occasional micaceous sandstone interbeds; abundant carbonaceous fragments; rooted and burrowed; pyrite lenses.
- 463.5-465.0 (1.5) Shale, dark-gray; clayey; sandstone laminae; siderite bands.
- 465.0-466.4 (1.4) Claystone, olive-gray to grayish-black; carbonaceous shale bed from 465.7 to 465.8 feet; rooted; siderite bands; sharp lower contact.
- 466.4-534.8 (68.4) Sandstone, light- to medium-gray; fine to medium grained; calcareous zone from 493.6 to 494.7 feet; micaceous; occasional shale laminae; rippled to crossbedded; massive in lower 2.0 feet; rare siderite pebbles and coal clasts.
- 534.8-536.1 (1.3) Shale and sandstone, interbedded; dark-gray, silty shale interbedded with light-gray, fine-grained, rippled sandstone.
- 536.1-556.5 (20.4) Sandstone, light- to medium-gray; very fine to fine grained; sparse carbonaceous shale laminae; rippled in part; siderite pebbles at base.
- 556.5-557.0 (0.5) Conglomerate, dark-gray shale pebbles in light-gray, fine-grained sandstone matrix.
- 557.0-578.1 (21.1) Sandstone, light- to medium-gray; fine to medium grained; slightly micaceous; abundant carbonaceous shale laminae; crossbedded and rippled in part; siderite nodules in lower part; sharp, irregular lower contact.

- 578.1-581.3 (3.2) Shale, dark-gray to grayish-black; sandstone laminae and cobbles; slumped; minor slickensided surfaces; siderite pebbles; sharp, irregular lower contact.
- 581.3-599.7 (18.4) Sandstone, light-gray to yellowish-olive-gray; fine to medium grained; sparse shale laminae; calcareous zone from 593.1 to 594.2 feet; rippled to crossbedded in part; abundant shale and siderite pebbles; coal clasts and bands throughout.
- 599.7-599.9 (0.2) Conglomerate, siderite pebbles and sparse coal clasts; sharp, irregular lower contact.
- 599.9-600.2 (0.3) COAL, bright-banded; pyrite lenses and nodules.
- 600.2-601.6 (1.4) Siltstone, olive-gray to black, mottled; rooted; sharp; irregular lower contact.
- 601.6-605.0 (3.4) Sandstone, light- to medium-gray; very fine to fine grained; sparse shale laminae; rooted; horizontal fractures; sharp lower contact.
- 605.0-605.2 (0.2) Siltstone, dark-gray; occasional sandstone laminae.
- 605.2-607.2 (2.0) Sandstone, light- to medium-gray; shale laminae; rooted; rippled; sharp lower contact.
- 607.2-608.4 (1.2) Siltstone and sandstone, interbedded; dark-gray siltstone interbedded with light- to medium-gray, fine-grained sandstone; rippled in upper part.
- 608.4-657.5 (49.1) Sandstone, light- to medium-gray; very fine to medium gray; occasional silty shale laminae; slightly micaceous; graded beds; rippled to crossbedded; rare siderite pebbles; sharp lower contact.
- 657.5-659.3 (1.8) Shale and sandstone, interbedded; dark-gray, carbonaceous, silty shale interbedded with light-gray sandstone; rippled; burrowed, sharp lower contact.

- 659.3-722.3 (63.0) Sandstone, light-gray; very fine to medium grained; occasional carbonaceous shale laminae; alternating quartz-pebble conglomerate and fine-grained sandstone from 675.3 to 681.6 feet; rippled to crossbedded; occasional coal bands; sparse siderite pebbles.
- 722.3-724.2 (1.9) Shale, dark-gray.
- 724.2-878.2 (154.0) Sandstone, light-gray; fine to coarse grained; occasional shale laminae; conglomeratic zones and scattered quartz pebbles throughout; rippled to crossbedded; graded beds; sparse coal clasts and siderite bands; rare pyritized plant fossils; gradational lower contact.
- 878.2-880.0 (1.8) Shale, medium- to dark-gray; slightly silty; gradational lower contact.
- 880.0-896.3 (16.3) Sandstone, light-gray; fine grained; abundant shale laminae and interbeds; heavily burrowed; rippled; occasional siderite bands; rare coal bands.
- 896.3-899.5 (3.2) Shale, medium- to dark-gray; slightly silty; massive.
- 899.5-900.0 (0.5) COAL, bright-banded; occasional pyrite lenses. Sample R0503.
- 900.0-913.7 (13.7) Shale, light- to dark-gray; sandy to silty with depth; occasional sandstone laminae; slickensided surfaces; occasional siderite bands; Lingula in lower 5.0 feet.
- 913.7-914.6 (0.9) COAL, dull-banded; poorly developed cleats; pyrite band at top. Sample R0504.
- 914.6-916.4 (1.8) Underclay, dark-gray; silty; siderite nodules; gradational lower contact.
- 916.4-941.9 (25.5) Shale, dark-gray; sparse sandstone laminae; burrowed in part; siderite nodules in upper 4.0 feet; abundant plant fossils.

- 941.9-945.0 (3.1) Sandstone and shale, interbedded; heavily burrowed; abundant plant fossils.
- 945.0-946.9 (1.9) Sandstone, light-gray; very fine grained; shale laminae, decreasing with depth; calcareous in part.
- 946.9-947.8 (0.9) COAL, dull-banded; bony; poorly developed cleat; abundant pyrite lenses. Sample R0505.
- 947.8-953.9 (6.1) Underclay, light- to dark-gray; very sandy; rooted; sharp, angular lower contact.
- 953.9-959.1 (5.2) Shale, medium- to dark-green; silty in part; interbedded maroon shale beds below 957.3 feet.

Total Depth: 959.1

HOLE NO.: R-6
COUNTY, STATE: Leslie, Kentucky DRILLED DEPTH: 1601.5 ft.
SURFACE ELEV.: 1422 ft. (topo) QUAD.: Hyden W 7.5 min.
LOCATION: 7-I-73, 2350 FEL X 1400 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-24.0 (24.0)	Cased interval; unconsolidated and weathered material.
24.0-34.6 (10.6)	Shale; very fine-grained sandstone laminae throughout; plant fragments; very weathered.
34.6-88.6 (54.0)	Sandstone; fine grained; micaceous; siderite pebbles from 65.0 to 66.3 and 70.4 to 71.8 feet; coal clasts at 36.9, 47.2, and 71.2 feet; iron stained in part.
88.6-110.3 (21.7)	Sandstone and shale, interbedded; plant fragments; occasional coal clasts near top.
110.3-112.1 (1.8)	Underclay, medium-dark-gray; silty with depth; rooted; gradational lower contact.
112.1-113.1 (1.0)	Shale; silty; scattered sandstone laminae; rooted at top; burrowed base.
113.1-116.9 (3.8)	Sandstone, light-gray; very fine grained; scattered shale laminae; rippled; rooted in upper part; sharp lower contact.
116.9-124.1 (7.2)	Shale, medium-gray; sandstone laminae, decreasing with depth; siderite bands, increasing with depth.
124.1-124.5 (0.4)	Shale; carbonaceous; bony.
124.5-128.9 (4.4)	Underclay, medium-gray; silty; rooted.
128.9-130.4 (1.5)	Shale, dark-gray to gray-black with depth; carbonaceous in lower part.
130.4-131.1 (0.7)	Bone coal; shale laminae and slickensided surfaces in upper part; pyrite in lower 0.3 foot.

- 131.1-133.1 (2.0) Underclay; silty; sandstone laminae; rooted.
- 133.1-146.5 (13.4) Shale, medium- to dark-gray with depth; sandstone laminae in upper half; plant fragments.
- 146.5-147.0 (0.5) COAL, dull-banded; 0.04 foot pyrite band at top; thin shale laminae throughout.
- 147.0-149.6 (2.6) Underclay, medium-light-gray; coarsens downward; rooted; gradational lower contact.
- 149.6-156.8 (7.2) Sandstone, light-gray; very fine to fine grained; rooted to 150.5 feet; shale and carbonaceous laminae to 152.4 feet.
- 156.8-157.3 (0.5) Shale; silty; burrowed.
- 157.3-158.3 (1.0) Sandstone; shale laminae; sparse carbonaceous laminae; slumped.
- 158.3-175.3 (17.0) Shale, medium-dark-gray; sandstone laminae, decreasing with depth; occasional siderite bands; slumped from 165.3 to 166.5 feet; burrowed in upper part; gradational lower contact.
- 175.3-177.7 (2.4) Shale, dark-gray; siderite bands; siderite nodules at base.
- 177.7-180.6 (2.9) Sandstone and shale, interlaminated; burrowed; pyritized plant fragments; 0.125 foot pyrite nodule at 178.3 feet; sparse siderite bands; gradational lower contact.
- 180.6-188.2 (7.6) Sandstone; scattered shale laminae; rippled; shale increases in lower part; burrowed near base; sparse siderite bands; gradational lower contact.
- 188.2-202.7 (14.5) Shale, medium-dark- to dark-gray with depth; silty; sandstone laminae, decreasing in lower 3.0 feet; burrowed in part; fines downward; siderite bands.
- 202.7-202.8 (0.1) Bone coal.

- 202.8-203.5 (0.7) Claystone, gray-black; pyritized plant fragments.
- 203.5-204.1 (0.6) Bone coal; moderately developed cleats; moderate pyrite.
- 204.1-205.4 (1.3) Underclay; dark-gray; sandy; rooted.
- 205.4-219.3 (13.9) Sandstone and shale; light-gray, fine- to medium-grained sandstone with shale laminae and interbeds; occasional burrows; rooted to 208.0 feet; coarsens downward; rippled.
- 219.3-241.4 (22.1) Sandstone, medium-light-gray; medium grained; occasional shale laminae to 230.0 feet; shale and coal clasts from 230.0 to 238.0 feet; zones of fine sandstone from 230.5 to 237.8 feet; sharp lower contact.
- 241.4-245.8 (4.4) Shale, medium-dark-gray; silty; sandstone laminae increase downward; gradational lower contact.
- 245.8-248.2 (2.4) Sandstone; scattered shale laminae.
- 248.2-249.8 (1.6) COAL, bright-banded; well developed cleats; pyrite at top. Sample R0601.
- 249.8-250.2 (0.4) Bone coal.
- 250.2-250.5 (0.3) COAL, dull-banded; poor cleats. Sample R0601.
- 250.5-257.3 (6.8) Underclay, medium-gray; silty; rooted.
- 257.3-258.6 (1.3) Shale, medium-dark-gray; sandstone laminae; siderite bands; plant fragments.
- 258.6-259.8 (1.2) COAL, bright-banded; good cleats; pyrite lens at 259.2 feet; slightly bony at base. Sample R0602.
- 259.8-260.2 (0.4) Underclay, dark-gray; rooted; plant fragments at base.
- 260.2-261.2 (1.0) Sandstone; shale laminae; coal clast at base; rooted; slumped(?).

- 261.2-268.0 (6.8) Shale and sandstone, interbedded; medium-light- to dark-gray, silty shale interbedded with very fine-grained sandstone; burrowed; siderite bands; sandstone decreases downward.
- 268.0-269.4 (1.4) Shale, dark-gray to gray-black; siderite bands; siderite nodules at base.
- 269.4-270.9 (1.5) Sandstone and shale, interbedded; rippled; burrowed; rooted.
- 270.9-272.9 (2.0) Sandstone, light-gray; fine grained; shale laminae; crossbedded; sharp lower contact.
- 272.9-274.8 (1.9) Shale, medium-dark-gray; silty; siderite bands; occasional pyritized plant fragments.
- 274.8-275.5 (0.7) Shale, gray-black; carbonaceous; slickensided surfaces; plant fragments.
- 275.5-276.1 (0.6) COAL, dull-banded; moderate cleats; abundant pyrite at top.
- 276.1-278.3 (2.2) Sandstone, medium-gray; argillaceous; rooted; coal clast at 276.5 feet.
- 278.3-302.8 (24.5) Sandstone; fine to medium grained; scattered shale laminae; sparse coal clasts; shale clast from 286.7 to 287.0 feet; crossbedded.
- 302.8-303.1 (0.3) COAL, dull-banded; good cleats; pyrite; calcite along cleats.
- 303.1-304.9 (1.8) Sandstone; scattered shale laminae grades into shale with sandstone laminae in lower part; rooted to 304.5 feet.
- 304.9-309.1 (4.2) Shale, gray; gradational lower contact.
- 309.1-311.4 (2.3) Sandstone and shale, interlaminated.
- 311.4-315.6 (4.2) Shale, dark-gray; sparse sandstone laminae.

315.6-318.3 (2.7)	Sandstone and shale, interbedded; fine- to medium-grained sandstone; rooted.
318.3-319.1 (0.8)	COAL; bony in upper and lower 0.17 feet; gradational lower contact. Sample R0603.
319.1-319.2 (0.1)	Shale, black; carbonaceous.
319.2-322.5 (3.3)	Sandstone, gray; medium grained; shale laminae, increasing with depth; rooted; gradational lower contact.
322.5-332.9 (10.4)	Shale, dark-gray; sandstone laminae, increasing with depth; gradational lower contact.
332.9-344.2 (11.3)	Sandstone; medium-grained; shale laminae; occasional coal clasts; gradational lower contact.
344.2-351.3 (7.1)	Sandstone, gray; massive; sparse, small shale clasts; gradational lower contact.
351.3-362.3 (11.0)	Sandstone, gray; medium grained; scattered black shale laminae; sharp lower contact.
362.3-367.0 (4.7)	Siltstone, gray; deformed; mudflow.
367.0-393.8 (26.8)	Shale, gray to dark-gray; scattered sandstone laminae.
393.8-396.6 (2.8)	Sandstone, gray; medium grained; gray shale laminae; gradational lower contact.
396.6-409.2 (12.6)	Shale, gray; scattered sandstone laminae; gradational lower contact.
409.2-410.4 (1.2)	Shale, dark-gray to black; carbonaceous at base.
*410.4-411.3 (0.9)	COAL; core badly broken. Sample R0604.
411.3-413.2 (1.9)	Shale, dark-gray; sandstone laminae.

*Approximate thickness.

- 413.2-423.9 (10.7) Sandstone and shale, interbedded; gray, medium-grained sandstone interbedded with dark-gray shale; burrowed in part; sharp lower contact.
- 423.9-431.3 (7.4) Shale, gray; occasional siltstone and sandstone laminae.
- 431.3-444.3 (13.0) Sandstone and shale, interbedded; gray sandstone interbedded with dark-gray shale; mottled in part.
- 444.3-490.3 (46.0) Shale, gray; occasional sandstone laminae; mottled and burrowed in upper 7.0 feet; occasional siderite bands in lower part; gradational lower contact.
- 490.3-491.3 (1.0) Shale, black; carbonaceous.
- 491.3-491.6 (0.3) COAL, bright-banded; good cleats; gradational lower contact.
- 491.6-493.3 (1.7) Siltstone, gray; plant fragments; gradational lower contact.
- 493.3-495.7 (2.4) Sandstone, gray; silty; dark-gray shale laminae; scattered, thin coal stringers; rooted; gradational lower contact.
- 495.7-504.0 (8.3) Sandstone, gray; medium grained; massive in part; occasional shale laminae; sharp lower contact.
- 504.0-509.4 (5.4) Shale, gray; sandstone laminae, increasing downward; gradational lower contact.
- 509.4-524.1 (14.7) Shale, gray; sparse sandstone and siltstone laminae; color darkens with depth; sharp lower contact.
- 524.1-525.2 (1.1) COAL, bright-banded; good cleats; sharp lower contact. Sample R0605.
- 525.2-527.4 (2.2) Shale, dark-gray; gradational lower contact.
- 527.4-528.1 (0.7) COAL, bright-banded; good cleats; gradational lower contact. Sample R0606.

- 528.1-540.4 (12.3) Shale, gray; sandstone laminae; some sideritic sandstone beds and siderite nodules down to 532.4 feet; gradational lower contact.
- 540.4-553.8 (13.4) Sandstone, gray; shale laminae; gradational lower contact.
- 553.8-582.7 (28.9) Shale, gray; sandstone laminae.
- 582.7-590.9 (8.2) Shale, gray; occasional siderite bands; sharp lower contact.
- 590.9-591.7 (0.8) Siltstone, gray; plant fragments.
- 591.7-593.5 (1.8) Shale, gray; sandstone laminae; occasional siderite nodules; gradational lower contact.
- 593.5-599.1 (5.6) Shale, black; sandstone laminae; burrowed in part; gradational lower contact.
- 599.1-601.8 (2.7) Shale, black; plant fragments; Naiadites; gradational lower contact.
- *601.8-602.0 (0.2) COAL, bright-banded; core broken.
- 602.0-607.7 (5.7) Shale, dark-gray; silty; rooted; siderite nodules in lower part; coarsens downward; gradational lower contact.
- 607.7-608.0 (0.3) Sandstone, medium-light-gray; shale laminae; rippled; rooted; siderite nodules at base; gradational lower contact.
- 608.0-608.4 (0.4) Shale, dark-gray; silty; rooted; vitrain stringers in upper 0.1 foot; gradational lower contact.
- 608.4-617.1 (8.7) Sandstone, medium-light-gray; shale and carbonaceous laminae; rooted in upper 2.0 feet; crossbedded to rippled; gradational lower contact.

*Approximate thickness.

- 617.1-619.4 (2.3) Shale, dark-gray; light-gray sandstone laminae, increasing with depth; occasional siderite bands; sparse roots and burrows in lower part.
- 619.4-620.5 (1.1) Shale, dark-gray; clayey; siderite bands and nodules; Calamites.
- 620.5-621.0 (0.5) COAL, bright-banded; well cleated; thin bone band in lower part; "peacock" coal.
- 621.0-621.2 (0.2) Claystone, dark-gray; roots; slickensided surfaces; gradational lower contact.
- 621.2-621.5 (0.3) Shale and sandstone, interlaminated; dark-gray-green shale with medium-light-gray sandstone laminae; rooted.
- 621.5-626.8 (5.3) Sandstone, medium-greenish-gray to dark-gray with depth; fine to very fine grained; shale laminae throughout; occasional burrows; rooted; rippled; sparse siderite-replaced rootlets; gradational lower contact.
- 626.8-629.0 (2.2) Shale and sandstone, interbedded; dark-gray shale interbedded with medium-light-gray sandstone; rippled; occasional carbonaceous laminae; burrowed; gradational lower contact.
- 629.0-634.2 (5.2) Shale, medium-dark-gray; scattered sandstone laminae in upper 4.0 feet; clayey in lower part; sparse siderite bands; lower 0.3 foot grayish black; fines downward.
- 634.2-635.5 (1.3) COAL, bright-banded; good cleats; thin dull bands in upper 0.3 foot; calcite along cleats. Sample R0607.
- 635.5-637.9 (2.4) Shale, dark-gray; clayey in upper part; rooted; occasional vitrain stringers; sparse slickensided surfaces.

- 637.9-639.5 (1.6) Shale, black to grayish-black; sandstone laminae, decreasing with depth; occasional siderite bands in upper part; Lingula from 638.5 to 639.3 feet; siderite nodules at base.
- 639.5-653.5 (14.0) Shale, dark-gray; silty; sandstone laminae; very burrowed; sharp lower contact.
- 653.5-656.3 (2.8) Sandstone, medium-gray; fine grained; occasional shale laminae; pale-yellowish-brown and calcareous in upper part; burrowed in lower part; coal clast at base; sharp lower contact.
- 656.3-656.4 (0.1) COAL, banded; bony bands.
- 656.4-657.6 (1.2) Claystone, medium-gray; plant fragments; roots; plastic; gradational lower contact.
- 657.6-659.5 (1.9) Siltstone, medium-gray; slightly clayey; rooted; gradational lower contact.
- 659.5-684.0 (24.5) Sandstone, medium-gray; fine to medium grained; micaceous; shale and carbonaceous laminae in part; occasional shale interbeds in the upper 2.0 feet; rippled to crossbedded; occasional shale clasts from 662.5 to 671.4 feet; calcareous from 678.0 to 680.9 feet; sharp, irregular lower contact.
- 684.0-687.9 (3.9) Shale, dark-gray; slightly clayey; sparse sandstone laminae; sharp lower contact.
- 687.9-689.9 (2.0) Siltstone, medium-gray; light-gray, fine-grained sandstone laminae; rooted; gradational lower contact.
- 689.9-692.7 (2.8) Sandstone and shale, interlaminated; light-gray, fine-grained sandstone interlaminated with shale; rippled; rooted; occasional coal stringers; gradational lower contact.

- 692.7-699.3 (6.6) Sandstone, light-gray; medium to fine grained; micaceous; occasional shale laminae; rippled; sharp lower contact.
- 699.3-718.2 (18.9) Shale, dark-gray; sandstone laminae, decreasing with depth; rare burrows; sharp lower contact.
- 718.2-719.2 (1.0) COAL, bright-banded; sparse pyritized fusain lenses. Sample R0608.
- 719.2-721.5 (2.3) Underclay; occasional plant fragments; rooted, gradational lower contact.
- 721.5-723.1 (1.6) Shale, dark-gray; rippled; sandstone laminae; burrowed; sparse siderite bands; sharp lower contact.
- 723.1-731.0 (7.9) Sandstone, light-gray; fine grained; micaceous; shale laminae with depth; rippled.
- 731.0-764.5 (33.5) Shale, dark-gray; scattered sandstone laminae, decreasing with depth; occasional siderite bands; pyrite lenses; brachiopods and bivalves, some of which are pyritized, from 760.0 to 764.5 feet.
- 764.5-764.8 (0.3) Siltstone, burrowed.
- 764.8-772.5 (7.7) Shale, dark-gray; sandstone laminae, decreasing with depth; burrowed; 0.2 foot sandstone bed in lower 1.0 foot; silty at base; sharp lower contact.
- 772.5-773.7 (1.2) Sandstone; shale laminae throughout; rippled; gradational lower contact.
- 773.7-797.9 (24.2) Shale, dark-gray; occasional sandstone laminae; occasional siderite bands; abundant Lingula below 795.5 feet.
- 797.9-798.1 (0.2) Bone coal.
- 798.1-801.9 (3.8) Underclay; sandy with depth; carbonaceous at top; rooted; gradational lower contact.

- 801.9-804.1 (2.2) Sandstone, light-gray; shale laminae, increasing with depth; occasional siderite band.
- 804.1-804.8 (0.7) Siltstone, dark-gray; occasional siderite-filled burrows; gradational lower contact.
- 804.8-817.2 (12.4) Sandstone and shale, interbedded; light-gray sandstone interbedded with dark-gray shale; rippled to flat bedded; occasional siderite bands; grades slowly into unit below.
- 817.2-847.0 (29.8) Shale, dark-gray; occasional sandstone laminae, decreasing with depth; rare burrows and siderite bands; Naiadites at 835.5 feet; small horn coral at 845.9 feet.
- 847.0-850.7 (3.7) Sandstone, light-gray; fine grained to silty; rooted.
- 850.7-861.3 (10.6) Sandstone, light-gray; fine grained; shale laminae; flat-bedded alternating sequences; sharp lower contact.
- 861.3-878.6 (17.3) Sandstone, light-gray; fine to medium grained; scattered shale laminae; slightly to very calcareous from 861.3 to 868.1 feet; coarsens downward; sideritic from 861.3 to 862.3 feet; gradational lower contact.
- 878.6-892.4 (13.8) Shale, dark-gray; sandstone laminae; occasional siderite bands; scattered burrows.
- 892.4-892.5 (0.1) COAL, bright-banded; good cleats.
- 892.5-892.6 (0.1) Shale, black; carbonaceous.
- 892.6-896.5 (3.9) Underclay, medium-light-gray; rooted; coarsens downward; gradational lower contact.
- 896.5-899.2 (2.7) Sandstone, light-gray; shale laminae; rippled to crossbedded; sharp lower contact.
- 899.2-899.8 (0.6) Shale, dark-gray; sandstone laminae.

- 899.8-904.6 (4.8) Sandstone, light-gray; medium to fine grained; shale laminae; upper 1.0 foot rooted; shale clast at base; sharp lower contact.
- 904.6-906.2 (1.6) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, fine-grained sandstone; burrowed in part; medium bedded; gradational lower contact.
- 906.2-959.1 (52.9) Sandstone, medium-light-gray; fine to coarse grained; scattered shale and carbonaceous laminae; micaceous; coal clasts from 919.3 to 928.4 and 937.9 to 948.7 feet; calcareous from 929.6 to 937.9 feet; siderite pebbles at base; coarsens downward; rippled to crossbedded to massive.
- 959.1-963.9 (4.8) Sandstone, medium-light-gray; very fine to fine grained; scattered shale laminae and beds; rippled; hard; gradational lower contact.
- 963.9-965.3 (1.4) Shale and sandstone, interlaminated; dark-gray shale interlaminated with light-gray, fine grained sandstone; rippled; gradational lower contact.
- 965.3-1037.8 (72.5) Sandstone, medium-light- to very light-gray; very fine to coarse grained; micaceous in part; scattered shale and carbonaceous laminae; calcareous from 977.7 to 978.4, 989.9 to 990.5, and 1021.7 to 1023.0 feet; scattered coal clasts from 1010.6 to 1037.8 feet; sparse siderite pebbles throughout; massive to crossbedded to rippled; coarsens downward; sharp, irregular lower contact.
- 1037.8-1039.2 (1.4) Conglomerate; dark-gray shale pebbles in medium-grained sandstone matrix.
- 1039.2-1047.5 (8.3) Sandstone, medium-light- to light-gray; fine to coarse grained; micaceous; sparse shale and carbonaceous laminae; massive to crossbedded; occasional coarsening-upward sequences; sharp lower contact.

- 1047.5-1048.1 (0.6) Claystone, grayish-black to black; carbonaceous; vitrain stringers; disseminated pyrite.
- 1048.1-1048.3 (0.2) COAL, bright-banded; sparse dull bands; disseminated pyrite.
- 1048.3-1049.5 (1.2) Claystone, dark-gray to black; carbonaceous; roots; occasional pyrite lenses.
- 1049.5-1049.9 (0.4) Shale, medium-greenish-gray; roots; sandy in lower part; gradational lower contact.
- 1049.9-1052.9 (3.0) Sandstone, medium-light-greenish-gray; very fine grained; shale laminae; rippled; roots in upper part; sparse burrows; gradational lower contact.
- 1052.9-1055.1 (2.2) Sandstone and shale, interbedded; medium-light-greenish-gray sandstone interbedded with medium-greenish-gray to dark-gray, silty shale; rippled; 0.125 foot siderite band at 1054.5 feet.
- 1055.1-1123.8 (68.7) Sandstone, light-gray; fine to coarse grained; shale laminae and beds throughout; rippled to crossbedded; sideritic in part; occasional coal clasts in lower 17.0 feet; coarsens downward; sharp lower contact.
- 1123.8-1124.0 (0.2) COAL, bright-banded; good cleats.
- 1124.0-1124.7 (0.7) Shale, black; gradational lower contact.
- 1124.7-1124.8 (0.1) COAL, bright-banded; gradational lower contact.
- 1124.8-1128.5 (3.7) Shale, dark-gray; rare siltstone laminae; gradational lower contact.
- 1128.5-1131.9 (3.4) Shale and siltstone, interlaminated; scattered thin coal stringers; gradational lower contact.
- 1131.9-1134.5 (2.6) Shale, dark-gray; scattered sandstone laminae.

- 1134.5-1134.6 (0.1) COAL, bright-banded; good cleats; pyritized fusain fragments.
- 1134.6-1135.4 (0.8) Shale, dark-gray; sharp lower contact.
- 1135.4-1135.6 (0.2) Underclay; plastic; sharp lower contact.
- 1135.6-1135.7 (0.1) COAL, bright-banded; gradational lower contact.
- 1135.7-1137.8 (2.1) Shale, dark-gray; sandstone laminae; sharp lower contact.
- 1137.8-1232.8 (95.0) Sandstone, light- to medium-gray; fine to coarse grained; micaceous in part; scattered shale laminae; occasional beds of dark-gray shale in upper 6.0 feet; calcareous from 1163.4 to 1167.0 feet; coal clast at 1222.0 feet; thin shale bed with shell fossil at 1209.5 feet; gradational lower contact.
- 1232.8-1235.2 (2.4) Conglomerate; rounded to angular shale and siderite clasts; gradational lower contact.
- 1235.2-1264.7 (29.5) Sandstone, medium-light-gray; medium to fine grained; micaceous and carbonaceous in part; sharp lower contact.
- 1264.7-1265.0 (0.3) Bone coal.
- 1265.0-1266.8 (1.8) Shale, dark-gray to black; scattered sandstone laminae; siderite bands; sandstone interbeds in lower 1.0 foot; gradational lower contact.
- 1266.8-1273.0 (6.2) Sandstone; fine to medium grained; dark-gray shale laminae; gradational lower contact.
- 1273.0-1291.1 (18.1) Shale and sandstone, interbedded; black shale interbedded with silty to fine-grained, medium- to thick-bedded sandstone; plant fragments; shale laminae in sandstone beds; sharp lower contact.

- 1291.1-1348.5 (57.4) Sandstone; fine to coarse grained; occasional shale laminae; occasional zones of quartz pebbles; crossbedded in part; horizontal fractures and abundant quartz pebbles in lower 0.5 foot; sharp lower contact.
- 1348.5-1351.2 (2.7) COAL, bright-banded; good cleats; pyrite lenses throughout; argillaceous near base. Sample R0609.
- 1351.2-1353.4 (2.2) Underclay, medium-gray; rooted; siderite nodules; silty toward base.
- 1353.4-1355.5 (2.1) Sandstone, light-gray; fine grained; shale laminae; occasional roots; burrows; gradational lower contact.
- 1355.5-1356.1 (0.6) Siltstone, medium-dark-gray.
- 1356.1-1372.0 (15.9) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, fine-grained sandstone; medium bedded; sandstone beds have sharp bases; burrowed in upper 1.0 foot; rooted down to 1258.0 feet; rooted in lower 2.0 feet; rippled in part; gradational lower contact.
- 1372.0-1373.6 (1.6) Claystone, dark-gray to black; vitrain stringers; occasional pyrite lens; gradational lower contact.
- 1373.6-1376.0 (2.4) Shale, medium-dark-gray to grayish-black; mottled; abundant plant fragments and roots; gradational lower contact.
- 1376.0-1380.0 (4.0) Shale, medium-gray; scattered sandstone laminae and occasional beds in lower part; roots, increasing with depth; shale is dark gray to black at 1378.3 feet; looks like underclay below 1378.7 feet.
- 1380.0-1383.7 (3.7) Shale, medium-gray; silty; sparse sandstone laminae; sharp, irregular lower contact.

- 1383.7-1453.8 (70.1) Sandstone, very light- to medium-light-gray; scattered shale and carbonaceous laminae; crossbedded to rippled; scattered quartz granules and pebbles, increasing with depth; graded beds in lower part; conglomeratic zones below 1445.8 feet; horizontal fractures at 1397.3 to 1399.0 and 1409.2 feet; coal and siderite clasts in lower 1.0 foot; sharp lower contact.
- 1453.8-1456.4 (2.6) Shale, grayish-black; carbonaceous; rippled sandstone laminae; occasional burrows; gradational lower contact.
- 1456.4-1457.4 (1.0) Shale and sandstone, interlaminated; dark-gray, silty shale interlaminated with light-gray, very fine-grained sandstone; rippled; sparse burrows; gradational lower contact.
- 1457.4-1461.0 (3.6) Sandstone, very light-gray; very fine to fine grained; shale laminae; rippled; occasional shale and siderite clasts.
- 1461.0-1464.7 (3.7) Shale and sandstone, interlaminated; grayish-black to black, silty, micaceous shale interlaminated with very light-gray, very fine-grained sandstone; burrowed; rapidly gradational lower contact.
- 1464.7-1472.5 (7.8) Sandstone, very light-gray; very fine grained; occasional grayish-black, micaceous shale laminae; scattered burrows; rippled; occasional sideritic zones; very burrowed at base; sharp lower contact.
- 1472.5-1475.8 (3.3) Shale, grayish-black; sandstone laminae; burrows; sparse plant fragments and siderite bands.
- 1475.8-1480.0 (4.2) Shale, dark-gray; clayey; sparse burrows; carbonaceous fragments; rare siderite bands.

- 1480.0-1484.4 (4.4) Shale, grayish-black to black; carbonaceous; clayey in lower 1.5 feet; scattered, very small Lingula; sparse Productus(?); pyrite-filled burrows in upper 1.0 foot; sharp lower contact.
- 1484.4-1487.0 (2.6) Siltstone, brownish-gray; light-olive-gray claystone and very fine-grained sandstone laminae; sparse burrows at top; fines downward; gradational lower contact.
- 1487.0-1497.9 (10.9) Shale, dark-gray; sandstone laminae down to 1492.7 feet; siderite bands; bedding at slight angle in upper part; abundant plant fragments; becomes clayey with depth.
- 1497.9-1498.5 (0.6) COAL, banded; occasional pyrite lenses; slightly bony. Sample R0610.
- 1498.5-1498.6 (0.1) Bone coal.
- 1498.6-1498.8 (0.2) Flint clay, grayish-black to dusky-yellowish-brown; hard; brittle; conchoidal fracture; roots.
- 1498.8-1500.2 (1.4) Underclay, medium- to light-olive-gray; clayey to silty; rooted; coarsens downward.
- 1500.2-1503.6 (3.4) Sandstone, medium- to light-olive-gray, mottled; very fine grained; argillaceous; clay laminae in lower 1.0 foot; rapidly gradational lower contact.
- 1503.6-1508.0 (4.4) Shale, grayish-black; sandstone laminae; sparse siderite nodules; plant fragments.
- 1508.0-1508.1 (0.1) COAL, banded.
- 1508.1-1508.6 (0.5) Shale, dusky-yellowish-brown to black; hard; brittle; conchoidal fracture; rooted; bony; semi-flint clay.
- 1508.6-1508.9 (0.3) Shale, medium-olive-gray; silty; rooted; sharp lower contact.

- 1508.9-1551.0 (42.1) Sandstone, white to very light-gray; very fine to coarse grained; scattered, light-olive-gray, clayey shale laminae down to 1521.3 feet; massive to crossbedded to rippled; hard; coarser grained material around 1543.0 feet; horizontal fractures from 1550.1 to 1550.7 feet; sharp, irregular lower contact.
- 1551.0-1551.6 (0.6) Shale, light-olive-gray; silty; sandstone cobbles; contorted.
- 1551.6-1577.7 (26.1) Sandstone, very light-gray to white; very fine to medium grained; occasional greenish-gray shale laminae; mottled, very light-gray to grayish-green to pale-yellowish-brown in upper 4.0 feet; sparse graded beds; scattered sideritic zones; siderite nodule at base; sharp lower contact.
- 1577.7-1578.5 (0.8) Sandstone, pale-yellowish-green to medium-yellowish-brown to light-gray at base; very fine grained; occasional greenish-gray shale laminae; hard; sharp lower contact.
- 1578.5-1581.6 (3.1) Sandstone and limestone; pale-yellowish-green, calcareous sandstone and yellowish-gray, finely crystalline limestone; sharp, vertical to near vertical contact; shale film between sandstone and limestone; occasional grayish-green shale laminae in sandstone; amount of sandstone decreases with depth; horizontal fractures in limestone from 1581.1 to 1581.5 feet; sharp, irregular lower contact.
- 1581.6-1585.4 (3.8) Limestone, dark- to medium-olive-gray; finely to moderately crystalline; scattered shale laminae; abundant shell fossils; sharp lower contact.
- 1585.4-1589.0 (3.6) Shale, dusky-green to grayish-green; slightly silty; slightly calcareous; burrowed; slickensided surfaces; gradational lower contact.

- 1589.0-1590.8 (1.8) Shale, mottled-grayish-black to dusky-green to grayish-red; silty; nodular dolostone in lower 0.2 foot.
- 1590.8-1595.8 (5.0) Dolostone, grayish-green to light-olive-gray; microcrystalline; burrowed in part; sparse, dusky-green shale interbeds; gradational lower contact.
- 1595.8-1598.2 (2.4) Dolostone, medium-light-gray; nodular; dusky-green to grayish-red, plastic shale between nodules.
- 1598.2-1601.1 (2.9) Shale, mottled, grayish-red to dusky-yellowish-green; silty; plastic; occasional dolostone nodules.
- 1601.1-1601.5 (0.4) Dolostone, light-gray; microcrystalline; dense; hard.
- Total Depth: 1601.5

HOLE NO.: R-7
COUNTY, STATE: Clay, Kentucky DRILLED DEPTH: 1155.5 ft.
SURFACE ELEV.: 1068 ft. (alt.) QUAD.: Hima 7.5 min.
LOCATION: 19-G-69, 1375 FEL X 2890 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-30.0 (30.0)	Cased interval; unconsolidated and weathered material.
30.0-35.9 (5.9)	Shale, dark-gray; clay laminae in middle part; coal stringers in upper part; rooted in lower part; sparse slickensided surfaces.
35.9-36.1 (0.2)	COAL, bright-banded.
36.1-38.0 (1.9)	Sandstone, light-gray; fine grained; carbonaceous shale laminae.
38.0-42.6 (4.6)	Shale, dark-gray; clayey; occasional sandstone laminae; burrowed and rooted; siderite bands.
42.6-42.8 (0.2)	Shale, black; carbonaceous.
42.8-43.2 (0.4)	Shale, medium- to dark-gray; clayey; occasional carbonaceous beds.
43.2-46.6 (3.4)	Siltstone, medium-gray; rooted and burrowed; plant fossils.
46.6-48.7 (2.1)	Shale, dark-gray to grayish-black; clayey to silty; siderite nodules and vitrain stringers in lower part; plant fossils.
48.7-48.8 (0.1)	COAL, bright-banded.
48.8-48.9 (0.1)	Shale, black; carbonaceous.
48.9-50.3 (1.4)	Claystone, medium- to dark-gray; occasional vitrain stringers and siderite nodules; plant fossils.
50.3-50.4 (0.1)	Shale, grayish-black; clayey; vitrain stringers.
50.4-51.5 (1.1)	COAL, bright-banded; pyrite lenses. Sample R0701.
51.5-52.0 (0.5)	Shale, medium- to dark-gray; silty; rooted; occasional slickensided surfaces.

- 52.0-52.4 (0.4) Siltstone, dark-gray; occasional sandstone laminae; burrowed.
- 52.4-55.3 (2.9) Sandstone, light-gray; fine grained; micaceous; carbonaceous shale interbeds; burrowed and rooted.
- 55.3-58.1 (2.8) Shale, medium- to dark-gray; silty; occasional sandstone laminae; rooted and burrowed.
- 58.1-60.0 (1.9) Siltstone, grayish-green; sandy in upper part; rooted; siderite nodules in lower 0.7 foot.
- 60.0-62.7 (2.7) Shale, dark-gray; occasional sandstone laminae; rooted; occasional siderite nodules.
- 62.7-63.5 (0.8) Sandstone and shale, interbedded; light-gray, rippled sandstone interbedded with dark-gray shale.
- 63.5-67.9 (4.4) Shale, dark-gray to grayish-black; clayey; sparse sandstone laminae; burrowed; siderite bands.
- 67.9-70.9 (3.0) Sandstone, light-gray; fine grained; carbonaceous shale laminae, increasing downward; rooted and burrowed; irregular lower contact.
- 70.9-73.3 (2.4) Shale and sandstone, interbedded; grayish-black shale interbedded with light-gray sandstone; rooted and burrowed; coal stringers; plant fossils.
- 73.3-75.8 (2.5) Shale, dark-gray; occasional sandstone laminae; rooted; siderite bands.
- 75.8-76.7 (0.9) Siltstone, dark-gray; occasional shale laminae; rooted.
- 76.7-83.8 (7.1) Shale, dark-gray to black; sparse sandstone laminae in upper part; siderite bands; Lingula in lower 1.7 feet.

- 83.8-105.6 (21.8) Sandstone, light-gray to medium-gray to grayish-brown; fine grained; sparse sandstone laminae; calcareous zone from 98.4 to 99.3 feet; burrowed and rooted; massive to rippled; rare siderite nodules.
- 105.6-107.5 (1.9) Shale and sandstone, interlaminated; black, micaceous, carbonaceous shale interlaminated with light-gray, fine-grained sandstone; pyrite nodules.
- 107.5-112.2 (4.7) Shale, dark-gray; silty in upper part; occasional sandstone laminae and interbeds; burrowed; rippled; siderite nodules.
- 112.2-116.1 (3.9) Siltstone, dark-gray; occasional sandstone laminae; slightly rippled.
- 116.1-116.6 (0.5) Sandstone, light- to medium-gray; fine grained; slightly calcareous; sparse shale laminae.
- 116.6-121.0 (4.4) Siltstone, dark-gray; occasional sandstone laminae.
- 121.0-127.1 (6.1) Shale and sandstone, interbedded; dark-gray, silty shale interbedded with light-gray, fine-grained, rippled sandstone; burrowed.
- 127.1-128.6 (1.5) Shale, dark-gray; silty; occasional sandstone laminae; burrowed.
- 128.6-133.3 (4.7) Shale and sandstone; dark-gray, silty shale interlaminated with light-gray, rippled sandstone; burrowed.
- 133.3-133.7 (0.4) Sandstone, light-gray; abundant silty and carbonaceous shale laminae; rippled.
- 133.7-134.9 (1.2) Siltstone, dark-gray; sandstone laminae and occasional carbonaceous bands.
- 134.9-135.6 (0.7) Sandstone, light- to medium-gray; siltstone band from 135.3 to 135.4 feet; rooted.
- 135.6-138.0 (2.4) Shale, dark-gray; silty; occasional sandstone laminae; burrowed.

- 138.0-140.1 (2.1) Shale and sandstone; dark-gray shale with flat laminae of light-gray sandstone; burrowed; occasional plant fossils.
- 140.1-140.5 (0.4) Siltstone, dark-gray; massive; sparsely rooted.
- 140.5-168.3 (27.8) Shale, dark-gray to grayish-black with depth; silty; sandstone laminae in upper part; siderite bands; pyrite lenses in lower 7.0 feet; sparse plant fossils.
- 168.3-168.9 (0.6) COAL, banded; argillaceous; moderately developed cleats with some calcite filling; pyrite lenses. Sample R0702.
- 168.9-169.3 (0.4) Shale, grayish-green; silty in lower part; rooted; slickensided surfaces.
- 169.3-171.0 (1.7) Siltstone, medium-grayish-green; sandy in part; rooted; occasional pyrite nodules.
- 171.0-173.2 (2.2) Shale, medium-grayish-green; sandstone laminae and interbeds.
- 173.2-209.5 (36.3) Sandstone, light-greenish-gray to medium-gray; very fine to medium grained; micaceous in part, calcareous at 185.0 feet; shale laminae in upper part; rippled to crossbedded; shale pebbles and coal bands throughout.
- 209.5-210.0 (0.5) Shale, medium-gray; occasional sandstone laminae; plant fossils.
- 210.0-212.1 (2.1) Shale and sandstone; alternating beds of dark-gray, silty shale and medium-gray sandstone; sandstone has sharp, irregular contacts; occasional siderite nodules and coal clasts.
- 212.1-220.8 (8.7) Sandstone, light-gray; fine to medium grained; occasional carbonaceous shale laminae; massive to lightly crossbedded; occasional coal clasts and siderite pebbles.

- 220.8-221.5 (0.7) Shale, medium- to dark-gray; occasional sandstone laminae with load casts; sparse siderite nodules.
- 221.5-255.2 (33.7) Sandstone, light- to medium-gray; fine to medium grained; micaceous; sparse carbonaceous shale laminae; massive to crossbedded in part; sparse coal bands; siderite nodules; sharp. irregular lower contact.
- 255.2-276.2 (21.0) Shale, dark-gray to grayish-black; clayey; burrowed; siderite bands; slickensided surfaces; Lingula.
- 276.2-276.7 (0.5) Siltstone, dark-gray; sparse pyrite lenses; burrowed.
- 276.7-277.3 (0.6) Shale, black; slightly silty; sparsely burrowed; slickensided surfaces disseminated pyrite.
- 277.3-277.5 (0.2) COAL, bright-banded.
- 277.5-277.8 (0.3) Siltstone, grayish-black; sparse sandstone laminae; rooted; disseminated pyrite.
- 277.8-278.8 (1.0) Shale and sandstone, interbedded; dark-gray shale and light-gray, rippled sandstone; rooted; burrowed.
- 278.8-280.0 (1.2) Shale; sandy; mudflow.
- 280.0-280.2 (0.2) Shale and sandstone; dark-gray shale interlaminated with light-gray, rippled sandstone; rooted; burrowed.
- 280.2-287.6 (7.4) Sandstone, light-gray; very fine to fine grained; calcareous; occasional shale laminae; rippled.
- 287.6-310.5 (22.9) Shale, dark gray; burrowing, siderite bands, sparse plant fragments in lower part.
- 310.5-310.6 (0.1) Bone coal.
- 310.6-311.0 (0.4) Shale, black; carbonaceous; occasional sandstone laminae; rooted and burrowed; siderite bands; plant fossils.

- 311.0-315.0 (4.0) Shale and sandstone; dark-gray shale interbedded with light- to medium-gray sandstone; slightly carbonaceous; siderite bands; plant fossils.
- 315.0-316.1 (1.1) Siltstone, dark-yellowish-brown, mottled; clayey; occasional sandstone and carbonaceous shale laminae; burrowed.
- 316.1-316.6 (0.5) Shale and sandstone, interlaminated; dark-gray shale interlaminated with light-gray sandstone; burrowed; rippled.
- 316.6-317.7 (1.1) Sandstone, light-gray; occasional carbonaceous and shale laminae; rippled.
- 317.7-324.0 (6.3) Shale, dark-gray to black, mottled; clayey; occasional sandstone interbeds; sparse bone coal and siderite bands.
- 324.0-327.2 (3.2) Sandstone, light-gray; very fine to fine grained; carbonaceous bands; rippled; rooted; siderite nodules; coal bands.
- 327.2-368.1 (40.9) Shale, dark-gray to grayish-black; clayey; occasional sandstone laminae; burrowed; siderite bands and nodules; sparse pyrite lenses; sparse plant fossils.
- 368.1-368.4 (0.3) Shale, black; carbonaceous; some coal stringers with pyrite lenses.
- 368.4-369.2 (0.8) COAL, bright-banded; pyrite lenses. Sample R0703.
- 369.2-375.1 (5.9) Siltstone, light-olive-gray to dark-gray, mottled; sparse sandstone laminae in lower 2.0 feet; rooted; coal bands.
- 375.1-377.5 (2.4) Shale, dark-gray; sandstone laminae; some pyrite-filled burrows.
- 377.5-378.1 (0.6) Sandstone, light-gray; fine grained; carbonaceous shale laminae; rippled.

- 378.1-384.6 (6.5) Shale, dark-gray; slightly silty; sparse sandstone laminae.
- 384.6-406.0 (21.4) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, fine-grained, rippled sandstone; calcareous; sparsely burrowed.
- 406.0-419.2 (13.2) Shale, dark-gray; silty in part; occasional sandstone laminae; siderite pebbles; irregular, sharp lower contact.
- 419.2-419.4 (0.2) Bone coal; clayey; abundant slickensided surfaces; thin vitrain bands.
- 419.4-434.2 (14.8) Shale, dark-gray to grayish-black; silty to clayey; sandstone laminae in upper part; burrowed in part; siderite bands and nodules; disseminated pyrite.
- 434.2-441.3 (7.1) Siltstone, light- to dark-gray, mottled; argillaceous to sandy; burrowed; occasional siderite nodules and siderite at the base; sharp, irregular lower contact.
- 441.3-468.5 (27.2) Shale, medium- to dark-gray; clayey; silty to micaceous in lower 2.0 feet; burrowed; sparse siderite nodules; Calamites at 465.3 feet.
- 468.5-469.3 (0.8) Sandstone, light-gray; fine grained; occasional shale laminae; rippled; burrowed; siderite bands.
- 469.3-469.5 (0.2) Shale; sandy; mudflow.
- 469.5-470.1 (0.6) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, fine-grained rippled sandstone; carbonaceous in part; sharp lower contact.
- 470.1-471.0 (0.9) Sandstone, light-gray; fine to medium grained; micaceous; occasional shale laminae; rippled; siderite bands; sharp, irregular lower contact.

- 471.0-472.5 (1.5) Shale and sandstone, interbedded; dark-gray shale and light-gray, rippled sandstone; occasional carbonaceous and siderite bands; burrowed.
- 472.5-473.7 (1.2) Sandstone, light-gray; fine grained; calcareous; micaceous; sparse carbonaceous shale laminae.
- 473.7-492.0 (18.3) Shale, dark-gray to grayish-black; silty to clayey; occasional sandstone laminae; burrowed; siderite bands; plant fossils.
- 492.0-492.7 (0.7) Siltstone, dark-gray to grayish-black; burrowed; siderite band at base.
- 492.7-510.7 (18.0) Shale, dark-gray to grayish-black; clayey in lower part; sandstone laminae in upper part; siderite bands; vitrain bands at base; Lingula below 497.0 feet; pyrite-filled burrows in part.
- 510.7-510.9 (0.2) COAL, bright-banded.
- 510.9-515.0 (4.1) Underclay, dark-gray to light-olive-gray, mottled; silty to clayey; rooted; slickensided surfaces throughout; pyrite and siderite nodules.
- 515.0-523.2 (8.2) Shale, greenish- to dark-gray; silty in lower part; occasional sandstone laminae; rooted in upper part; siderite bands and plant fossils in lower 2.0 feet.
- 523.2-528.7 (5.5) Shale and sandstone, interbedded; dark-gray to grayish-black, silty shale interlaminated with light-gray, fine-grained, rippled sandstone; burrowed.
- 528.7-536.3 (7.6) Shale, dark-gray to grayish-black; carbonaceous in part; occasional sandstone interbeds; burrowed.
- 536.3-537.2 (0.9) Sandstone, light-gray; fine to medium grained; micaceous; occasional shale laminae; crossbedded.

- 537.2-538.8 (1.6) Shale, dark-gray; silty; occasional sandstone laminae; occasional carbonaceous fragments.
- 538.8-539.3 (0.5) Sandstone, light-gray; fine to medium grained; occasional shale laminae; rippled.
- 539.3-542.8 (3.5) Shale, dark-gray; silty to micaceous; occasional sandstone laminae; sandstone bed with horizontal fractures from 541.6 to 561.8 feet; burrowed in part.
- 542.8-545.6 (2.8) Shale and sandstone; grayish-black shale with light-gray, medium- to fine-grained sandstone interbeds and laminae; medium to thick bedded; rippled; occasional carbonaceous fragments.
- 545.6-557.5 (11.9) Sandstone, medium- to light-gray to yellow-brown in part; fine to medium grained; scattered shale laminae; coal clast from 553.4 to 556.7 feet; occasional siderite pebbles; carbonaceous laminae in part; sharp lower contact.
- 557.5-557.8 (0.3) Siltstone and sandstone; dark-gray siltstone grading into light-gray, medium- to fine-grained, crossbedded sandstone with shale laminae.
- 557.8-561.2 (3.4) Shale, dark-gray; silty, scattered, light-gray sandstone laminae; rippled; sparse burrows in upper part.
- 561.2-562.6 (1.4) Siltstone and sandstone; dark-gray siltstone with light-gray sandstone laminae and interbeds; rippled; sharp, irregular lower contact.
- 562.6-577.1 (14.5) Sandstone, light-gray to pale-yellowish-brown; scattered carbonaceous laminae; coal clast from 567.3 to 567.8 feet; occasional siderite pebbles and shale clasts in lower 3.0 feet; massive to crossbedded to rippled; sharp, irregular lower contact.

- 577.1-578.0 (0.9) Siltstone, dark-gray; sparse plant fragments and siderite bands.
- 578.0-605.4 (27.4) Sandstone, light-gray; very fine to medium grained; scattered shale and carbonaceous laminae; shale laminae flat to rippled; crossbedded in part.
- 605.4-610.6 (5.2) Sandstone, light-gray; very fine grained; calcareous; hard.
- 610.6-612.4 (1.8) Sandstone, light-gray; medium- to fine-grained; coal clasts and carbonaceous laminae; rippled; sideritic pebbles at base.
- 612.4-617.8 (5.4) Siltstone and sandstone; dark-gray siltstone with rippled sandstone beds and shale laminae; sandstone beds commonly have sharp bases.
- 617.8-622.4 (4.6) Sandstone, light- to medium-gray; fine to medium grained; scattered shale and carbonaceous laminae; calcareous from 619.4 to 620.2 feet; shale clast from 621.4 to 621.7 feet; rare siltstone beds.
- 622.4-624.5 (2.1) Conglomerate, dark-gray; silty shale clasts; occasional siderite pebbles; light-gray, fine-grained sandstone matrix.
- 624.5-635.7 (11.2) Sandstone, light-gray; fine to very fine grained; scattered carbonaceous shale laminae; rippled; sparse shale clasts; calcareous from 628.2 to 628.5 feet; sharp, irregular lower contact.
- 635.7-639.8 (4.1) Conglomerate; dark-gray shale with siderite nodules; fine-grained sandstone matrix.
- 639.8-644.7 (4.9) Sandstone, light-gray; fine to medium grained; sparse shale laminae; sharp lower contact.
- 644.7-645.3 (0.6) Conglomerate; dark-gray, silty shale, with sparse siderite pebbles; very light-gray, fine-grained sandstone matrix.

- 645.3-688.5 (43.2) Sandstone, light-gray; very fine- to medium-grained; occasional shale laminae; carbonaceous laminae and coal clasts from 649.6 to 652.0 feet; rippled to crossbedded to massive; calcareous from 682.4 to 688.5 feet; shale clast from 683.1 to 683.9 feet.
- 688.5-740.0 (51.5) Shale, medium-dark-gray; sandstone laminae, decreasing with depth; rare siderite bands; scattered burrows; gradational lower contact.
- 740.0-744.3 (4.3) Shale, dark-gray; clayey with depth; pyrite-filled burrows; siderite bands and nodules.
- 744.3-750.2 (5.9) Shale, dark-gray; scattered sandstone laminae; siderite bands and nodules; disseminated pyrite in upper 0.6 foot; sparse burrows.
- 750.2-750.9 (0.7) Claystone, grayish-black; slickensided surfaces; thin bone band at top; rooted.
- 750.9-751.3 (0.4) COAL, dull-banded; core badly broken; thin claystone laminae 0.3 foot from base.
- 751.3-758.9 (7.6) Shale, medium-dark-gray; silty; rooted; scattered vitrain stringers; fines downward, plant fragments.
- 758.9-759.1 (0.2) Bone coal.
- 759.1-760.9 (1.8) Shale, dark-gray; silty; rooted; occasional siderite and pyrite-replaced rootlets; sparse vitrain stringers; sharp lower contact.
- 760.9-768.3 (7.4) Sandstone, medium-light- to light-gray; medium to very fine grained; scattered shale laminae; rare siltstone beds; crossbedded to rippled; fines upward; sharp lower contact.
- 768.3-769.8 (1.5) Shale, dark-gray; sandstone laminae with depth; sharp, irregular lower contact.

- 769.8-777.3 (7.5) Sandstone, light-gray; fine to coarse grained; abundant coal bands and shale laminae from 770.8 to 772.8 feet; rippled to crossbedded; graded beds in lower part; coarsens downward; sharp, irregular lower contact.
- 777.3-805.7 (28.4) Sandstone, very light- to light-gray; very fine to medium grained; scattered carbonaceous shale laminae; sparse quartz pebbles below 799.0 feet; crossbedded to rippled; graded beds in part; coaly laminae at 790.4 to 790.7 feet; coarsens downward; sharp lower contact.
- 805.7-828.8 (23.1) Sandstone, white to light-gray; fine to coarse grained; scattered shale laminae; coal clasts at 818.3 feet and in lower 5.0 feet; scattered zones of quartz pebbles; zone of yellowish-brown sandstone from 813.9 to 814.2 feet; occasional graded beds.
- 828.8-829.7 (0.9) Conglomerate; siderite and quartz pebbles; sparse, light-olive-gray shale clasts; light-gray, medium- to fine-grained sandstone matrix; sharp lower contact.
- 829.7-830.8 (1.1) Sandstone, light-gray; fine to very fine grained; coal clast at top.
- 830.8-831.9 (1.1) COAL, dull-banded; pyrite lenses throughout. Sample R0704.
- 831.9-832.0 (0.1) Bone coal.
- 832.0-833.4 (1.4) Siltstone, medium-greenish-gray; rooted; gradational lower contact.
- 833.4-835.7 (2.3) Sandstone, very light-gray; fine grained; greenish-gray shale laminae throughout; rippled; rooted; pyrite-replaced roots in lower part; gradational lower contact.
- 835.7-843.8 (8.1) Siltstone, dark-gray; hard; sparse roots; sparse sideritic zone; occasional sandstone laminae.

- 843.8-849.6 (5.8) Sandstone, light-gray; fine to very fine grained; scattered carbonaceous shale laminae; rare siltstone and shale interbeds; rippled; gradational lower contact.
- 849.6-850.8 (1.2) Shale, dark-gray; silty; light-gray sandstone laminae; burrowed; rippled; sharp lower contact.
- 850.8-853.7 (2.9) Sandstone, very light-gray; fine to very fine grained; hard; shale laminae; rippled; gradational lower contact.
- 853.7-858.7 (5.0) Shale and sandstone; dark-gray, silty shale interbedded and interlaminated with light-gray, rippled sandstone; scattered burrows; occasional plant fragments; siderite band at base.
- 858.7-859.4 (0.7) Shale, black; carbonaceous; gradational lower contact.
- 859.4-860.5 (1.1) Shale, grayish-black to dark-gray; siltstone laminae in lower part; occasional siderite bands.
- 860.5-865.3 (4.8) Sandstone and shale; light-gray sandstone interbedded and interlaminated with dark-gray silty shale; rippled; scattered burrows; shale beds thicken with depth.
- 865.3-875.0 (9.7) Shale, dark-gray; silty; sparse to abundant, light-gray sandstone laminae; rippled; scattered burrows; occasional siderite bands in zones of sparse sandstone; sharp lower contact.
- 875.0-910.9 (35.9) Sandstone, light- to very light-gray; very fine to coarse grained; scattered shale laminae; rippled to crossbedded; horizontal fracture at 895.9 feet; scattered quartz pebbles and graded bed below 903.7 feet; coal clast at base; sharp, irregular lower contact.

- 910.9-957.3 (46.4) Sandstone, very light- to medium-light-gray; very fine to very coarse grained, coarsening downward; scattered shale laminae; coal clasts and laminae from 920.0 to 926.4 feet and 937.1 to 945.6 feet; occasional pyrite in coal clasts; calcareous from 935.1 to 935.9 feet; quartz pebbles and graded beds below 937.3 feet; sharp lower contact.
- *957.3-964.8 (7.5) Sandstone, yellowish-gray to light-gray; very fine to fine grained; shale laminae throughout; rippled; calcareous in upper 2.0 feet.
- 964.8-966.6 (1.8) Sandstone, medium-gray; massive; approximately 15 percent rock fragments; gradational lower contact.
- 966.6-987.5 (20.9) Sandstone, light-gray; fine grained; shale laminae throughout; rippled; occasional coal laminae; occasional quartz pebbles; coarsens downward; rapidly gradational lower contact.
- 987.5-988.2 (0.7) Conglomerate; quartz pebbles in a coarse-grained sandstone matrix.
- 988.2-1077.2 (89.0) Sandstone, light-gray; fine to coarse grained; scattered shale laminae; rippled to crossbedded to massive; calcareous from 990.6 to 991.9 feet; scattered quartz pebbles below 997.2 feet; coal clasts from 1043.7 to 1047.0 feet; coarsens downward; sharp, irregular lower contact.
- 1077.2-1077.8 (0.6) COAL, bright-banded; pyrite lenses throughout; some "peacock" colors. Sample R0705.
- 1077.8-1083.0 (5.2) Shale, medium- to dark-olive-gray; silty to clayey; rooted; fines downward; Stigmaria.

*Broken bit resulted in badly broken core below 961.0 feet.

- 1083.0-1090.5 (7.5) Shale, dark-gray; clayey with depth; occasional siderite nodules and bands; rare plant fragments and pyrite lenses; slickensided surfaces in upper part.
- 1090.5-1091.2 (0.7) COAL, dull-banded; pyrite lenses throughout. Sample R0706.
- 1091.2-1099.0 (7.8) Claystone, dark-gray; rooted to 1098.0 feet; occasional burrows in lower part; rare siltstone laminae in lower 2.0 feet; gradational lower contact.
- 1099.0-1131.9 (32.9) Shale and sandstone, interlaminated; dark-gray to dark-olive-gray, clayey shale interlaminated with light-gray, fine-grained sandstone; rippled; burrowed; rare siderite bands; rare sandstone interbeds; sandstone bed with calcareous nodules at 1119.1 feet; silty with thin coal stringer at base.
- 1131.9-1132.3 (0.4) COAL, dull-banded; 0:04 foot pyrite band at 1132.1 feet.
- 1132.3-1134.2 (1.9) Siltstone, dark-gray to dark-olive-gray with depth; rooted; hard.
- 1134.2-1142.3 (8.1) Sandstone, medium-light-olive-gray; silty to very fine grained; scattered green shale clasts; gradational lower contact.
- 1142.3-1145.2 (2.9) Sandstone, medium-light-olive-gray to dusky-yellowish-green to very light-gray, mottled; green increases with depth; fine grained to silty; slumped from 1143.4 to 1145.2 feet; sharp, irregular lower contact.
- 1145.2-1146.1 (0.9) Shale, medium-light-olive-gray to medium-greenish-gray with depth; clayey; slickensided surfaces; gradational lower contact.
- 1146.1-1148.1 (2.0) Siltstone, grayish-olive-green to dusky-green; clayey in part; burrowed; disseminated siderite(?) grains in upper 0.5 foot; gradational lower contact.

1148.1-1155.5 (7.4)

Shale, grayish-olive-green to dusky-yellowish-green to grayish-red; silty to clayey in part; slightly plastic; occasional burrows; nodular, yellowish-gray dolostone from 1149.3 to 1149.7 feet.

Total Depth: 1155.5

HOLE NO.: R-8
COUNTY, STATE: Clay, Kentucky DRILLED DEPTH: 1655.5 ft.
SURFACE ELEV.: 1257 ft. (alt.) QUAD.: Scalf 7.5 min.
LOCATION: 1-F-70, 2375 FEL X 4375 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-30.0 (30.0)	Cased interval; unconsolidated and weathered material.
30.0-36.0 (6.0)	Sandstone, light-gray; fine grained; occasional shale laminae, decreasing with depth; sparse coal bands; burrowed; rippled; sharp lower contact.
36.0-37.1 (1.1)	Shale, light-gray; clayey; occasional sandstone laminae.
37.1-37.3 (0.2)	Sandstone, light-gray; fine grained; occasional shale laminae; rippled; gradational lower contact.
37.3-38.2 (0.9)	Shale, light-gray; occasional sandstone laminae; burrowed; siderite band at 37.4 feet; gradational lower contact.
38.2-44.1 (5.9)	Sandstone, light-gray; fine grained; shale laminae, decreasing with depth; massive in middle part; sparse coal clasts; gradational lower contact.
44.1-49.6 (5.5)	Shale, dark-gray to black; clayey in lower 2.0 feet; massive; burrowed and rooted; occasional siderite bands and nodules; sparse coal bands; sharp lower contact.
49.6-50.9 (1.3)	COAL, bright-banded; occasional dull bands; well developed cleats; occasional pyrite. Sample R0801.
50.9-51.1 (0.2)	Underclay; rooted; sharp lower contact.
51.1-55.9 (4.8)	Siltstone, gray; argillaceous; rooted and burrowed; gradational lower contact.
55.9-73.8 (17.9)	Shale, dark-gray; occasional sandstone laminae; burrowed; siderite nodules in lower 1.0 foot; gradational lower contact.

- 73.8-75.9 (2.1) Sandstone, light-gray; occasional shale laminae; burrowed; rippled; gradational lower contact.
- 75.9-83.5 (7.6) Shale, dark-gray; sandy; abundant sandstone laminae and interbeds; burrowed; sharp lower contact.
- 83.5-85.1 (1.6) Sandstone, light-gray; fine grained; occasional shale laminae; rapidly gradational lower contact.
- 85.1-85.5 (0.4) Sandstone and shale, interlaminated; light-gray, fine-grained sandstone interlaminated with dark-gray, silty shale; shale contains plant fragments; burrowed at base.
- 85.5-86.8 (1.3) Shale, dark-gray; silty.
- 86.8-87.4 (0.6) Sandstone, light-gray; fine grained; shale laminae in upper part; sharp lower contact.
- 87.4-90.5 (3.1) Shale and sandstone, interbedded; dark-gray, silty shale interbedded with light-gray sandstone; burrowed.
- 90.5-92.1 (1.6) Sandstone, light-gray; fine grained; occasional shale laminae; slumped.
- 92.1-93.4 (1.3) Shale and sandstone, interbedded; dark-gray, sandy shale interbedded with light-gray, fine-grained sandstone; rooted.
- 93.4-94.7 (1.3) Sandstone, light-gray; very fine grained; calcareous zones throughout.
- 94.7-102.2 (7.5) Shale and sandstone, interbedded; dark-gray, sandy shale interbedded with light-gray, very fine- to fine-grained sandstone; burrowed in part; sparse siderite and coal bands.
- 102.2-104.0 (1.8) Siltstone, dark-gray; occasional thin sandstone laminae; plant fossils.
- 104.0-105.8 (1.8) Shale, dark-gray; slightly silty.
- 105.8-111.7 (5.9) Siltstone, medium- to dark-gray.

- 111.7-113.0 (1.3) Sandstone and shale; interbedded; light-gray; very fine-grained sandstone interbedded with dark-gray shale.
- 113.0-114.8 (1.8) Shale, dark-gray; slightly clayey and silty; sparse sandstone laminae; rooted; rare siderite bands; plant fossils.
- 114.8-115.1 (0.3) Sandstone, light-gray; very fine grained; sharp, irregular lower contact.
- 115.1-132.1 (17.0) Shale, medium- to dark-gray; sandy to silty; occasional thin sandstone laminae; burrowed in part; siderite nodules; sparse pyrite lenses.
- 132.1-132.2 (0.1) Shale, black; carbonaceous; thin vitrain bands; Lepidodendron fossils.
- 132.2-139.1 (6.9) Shale, medium- to dark-gray; occasional sandstone laminae; clayey in part; slickensided surfaces; sparse vitrain bands; abundant pyritized plant fossils.
- 139.1-178.0 (38.9) Sandstone, light-gray; fine to medium grained; occasional shale laminae; rippled to crossbedded; slumped from 145.0 to 146.4 feet; occasional siderite bands; abundant coal clasts in lower 10.0 feet.
- 178.0-179.9 (1.9) Bone coal; poorly developed cleats; abundant pyrite. Sample R0802.
- 179.9-181.4 (1.5) Underclay, olive-gray; rooted.
- 181.4-212.8 (31.4) Sandstone, light- to medium-gray; fine grained; occasional shale laminae; coarsens downward; rippled to crossbedded; burrowed and rooted; abundant siderite in lower part; occasional coal clasts; sharp lower contact.
- 212.8-225.6 (12.8) Shale, dark-gray; occasional sandstone laminae; burrowed; siderite bands; sharp lower contact.

- 225.6-226.5 (0.9) Sandstone, light-gray; fine grained; occasional shale laminae; gradational lower contact.
- 226.5-235.7 (9.2) Shale, dark-gray; sandstone laminae; occasional siderite bands; gradational lower contact.
- 235.7-236.4 (0.7) Siltstone, gray; argillaceous; sharp lower contact.
- 236.4-263.9 (27.5) Shale, dark-gray; sandy; occasional sandstone laminae, increasing with depth; calcite-filled fractures from 243.5 to 243.9 feet; rooted and burrowed; occasional siderite bands; coal bands in lower 4.0 feet; sharp lower contact.
- 263.9-266.4 (2.5) Sandstone, light-gray; fine to medium grained; shale laminae, increasing with depth; gradational lower contact.
- 266.4-267.2 (0.8) Shale, dark-gray; sandy in upper part.
- 267.2-293.4 (26.2) Sandstone, light-gray; fine grained; occasional shale laminae; rippled; burrowed throughout, with a heavily burrowed zone from 286.2 to 286.5 feet; abundant siderite and coal clasts; sharp lower contact.
- 293.4-317.7 (24.3) Shale, black; sparse sandstone laminae; burrowed; occasional siderite; coal clasts in lower 0.167 foot.
- 317.7-319.3 (1.6) COAL, dull-banded; occasional bright bands; moderately developed cleats; bony in upper 0.33 foot. Sample R0803.
- 319.3-319.6 (0.3) Underclay; rooted; occasional coal clasts and pyrite.
- 319.6-322.8 (3.2) Shale, gray; silty; rooted; burrowed; occasional plant fossils.
- 322.8-357.8 (35.0) Sandstone, light-gray; fine grained; micaceous shale laminae; occasional siderite and coal bands.

- 357.8-389.0 (31.2) Shale, dark-gray to grayish-black; sandy, sparse sandstone laminae; abundant burrows and siderite-filled burrows; sharp lower contact.
- 389.0-389.2 (0.2) COAL, bright-banded.
- 389.2-389.5 (0.3) Shale, black; carbonaceous; rooted; occasional coal bands; rapidly gradational contact.
- 389.5-392.3 (2.8) Shale, dark-gray; occasional sandstone laminae; pyrite-replaced burrows; occasional plant fossils; sharp lower contact.
- 392.3-392.9 (0.6) Sandstone, light-gray; very fine grained; shale laminae; rippled; burrowed; rapidly gradational lower contact.
- 392.9-405.4 (12.5) Shale, dark-gray; occasional sandstone laminae; occasional siderite-filled burrows and bands.
- 405.4-406.0 (0.6) COAL, dull-banded; sparse bright bands; moderately developed cleats. Sample R0804.
- 406.0-406.3 (0.3) Shale, black; carbonaceous; rooted; sharp lower contact.
- 406.3-406.9 (0.6) COAL, bright-banded; pyrite along partings. Sample R0805.
- 406.9-407.2 (0.3) Shale, black, carbonaceous; rooted and burrowed; sharp lower contact.
- 407.2-407.4 (0.2) COAL, bright-banded.
- 407.4-408.5 (1.1) Shale, black; carbonaceous; thin coal bands; rooted in part.
- 408.5-409.5 (1.0) COAL, bright-banded; blocky. Sample R0806.
- 409.5-410.0 (0.5) Underclay; rooted; gradational lower contact.
- 410.0-411.4 (1.4) Sandstone; argillaceous, with occasional shale laminae; rippled; burrowed; sparse siderite nodules.

- 411.4-414.4 (3.0) Sandstone and shale, interbedded; occasional siderite-filled burrows; gradational lower contact.
- 414.4-415.9 (1.5) Shale, dark-gray; occasional sandstone laminae; siderite-filled burrows; sparse coal bands; sharp lower contact.
- 415.9-416.1 (0.2) COAL, bright-banded; blocky.
- 416.1-418.7 (2.6) Underclay; rooted; burrowed; occasional siderite bands; coal stringers; gradational lower contact.
- 418.7-423.8 (5.1) Sandstone and shale, interbedded; light-gray, fine-grained sandstone interbedded with dark-gray shale; rippled; burrowed.
- 423.8-445.4 (21.6) Shale, dark-gray to grayish-black; occasional sandstone laminae; burrowed; occasional siderite bands.
- 445.4-452.6 (7.2) Shale, black; carbonaceous, occasional sandstone laminae; sparse siderite bands.
- 452.6-454.6 (2.0) Siltstone, light-gray; argillaceous; burrowed.
- 454.6-464.9 (10.3) Sandstone, light-gray; fine grained; occasional shale laminae and interbeds; occasional siderite bands.
- 464.9-467.6 (2.7) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, fine-grained sandstone; rippled; gradational lower contact.
- 467.6-469.0 (1.4) Shale, dark-gray; occasional sandstone laminae; burrowed.
- 469.0-472.0 (3.0) Shale and sandstone; dark-gray shale and light-gray, fine-grained, rippled sandstone.
- 472.0-525.4 (53.4) Shale, dark-gray; abundant sandstone laminae; burrowed; occasional siderite bands.
- 525.4-528.9 (3.5) Shale, black; carbonaceous; sandstone laminae; burrowed; occasional siderite bands; sharp lower contact.

- 528.9-529.4 (0.5) COAL, dull-banded, with occasional bright bands.
- 529.4-533.0 (3.6) Underclay, gray; rooted; sparse pyrite; gradational lower contact.
- 533.0-543.1 (10.1) Shale, dark-gray; occasional sandstone laminae; burrowed; sparse siderite bands.
- 543.1-544.6 (1.5) Shale, black; carbonaceous; burrowed.
- 544.6-548.1 (3.5) Siltstone, dark-gray; carbonaceous; pyrite at base; gradational lower contact.
- 548.1-548.8 (0.7) COAL, bright-banded; blocky; moderately well developed cleats. Sample R0807.
- 548.8-549.5 (0.7) Underclay; carbonaceous; rooted; disseminated pyrite.
- 549.5-564.8 (15.3) Shale, dark-gray; silty in lower 2.0 feet; occasional sandstone laminae; siderite-filled burrows; thin coal band at 563.4 feet; abundant pyrite in lower part; occasional plant fossils in upper part; gradational lower contact.
- 564.8-565.0 (0.2) Sandstone, light-gray; very fine grained; silty; occasional shale laminae; rippled; rooted; sharp lower contact.
- 565.0-565.8 (0.8) Siltstone, dark-gray; occasional shale laminae; gradational lower contact.
- 565.8-570.5 (4.7) Sandstone, light-gray; fine grained; shale laminae, increasing with depth; crossbedded; burrowed; occasional siderite nodules; gradational lower contact.
- 570.5-574.8 (4.3) Sandstone and shale, interbedded; light-gray sandstone interbedded with dark-gray shale; occasional flow structures(?); sharp lower contact.
- 574.8-578.4 (3.6) Sandstone, light-gray; fine grained; occasional shale laminae; rippled in part; sharp lower contact.

- 578.4-587.4 (9.0) Sandstone and shale, interbedded; light-gray, fine-grained sandstone interbedded with dark-gray shale; sharp lower contact.
- 587.4-589.7 (2.3) Siltstone, dark-gray; argillaceous; gradational lower contact.
- 589.7-606.7 (17.0) Shale, dark-gray; occasional sandstone laminae; burrowed in upper part; siderite bands; coal band at base.
- 606.7-607.0 (0.3) Underclay; sharp lower contact.
- 607.0-611.6 (4.6) Shale, dark-gray; silty; rooted; burrowed, occasional siderite bands; sharp lower contact.
- 611.6-627.5 (15.9) Sandstone, light-gray; fine grained; occasional shale laminae; coarsens downward; rippled; burrowed; plant fossils.
- 627.5-635.8 (8.3) Shale, dark-gray; sandstone laminae; burrowed; gradational lower contact.
- 635.8-690.6 (54.8) Sandstone, light-gray; fine grained; abundant shale laminae; massive from 671.3 to 676.5 feet; crossbedded in part; burrowed with siderite replacement in part; coal bands and clasts; gradational lower contact.
- 690.6-691.3 (0.7) Sandstone and shale; light-gray sandstone and dark-gray shale; coal stringers.
- 691.3-692.3 (1.0) Sandstone, light-gray; fine grained; occasional shale laminae; burrowed.
- 692.3-704.8 (12.5) Sandstone and shale, interbedded; burrowed; plant fossils, sharp lower contact.
- 704.8-710.4 (5.6) Sandstone, light-gray; fine grained; occasional shale laminae; burrowed; rooted; siderite; sparse coal bands; plant fossils; sharp lower contact.

- 710.4-726.4 (16.0) Shale, black; carbonaceous; burrowed with some pyrite and siderite replacement; siderite bands; abundant coal clasts in lower 0.167 foot; plant fossils.
- 726.4-732.3 (5.9) Underclay, gray to brown; rooted.
- 732.3-747.9 (15.6) Shale, dark-gray; sandstone laminae, decreasing with depth; burrowed; siderite bands; sharp lower contact.
- 747.9-748.2 (0.3) Siltstone, black; carbonaceous; coal stringers; gradational lower contact.
- 748.2-748.9 (0.7) COAL, bright-banded; blocky. Sample R0808.
- 748.9-752.1 (3.2) Underclay; silty; rooted; burrowed; gradational lower contact.
- 752.1-782.0 (29.9) Sandstone, light-gray; fine grained; abundant shale laminae; crossbedded; burrowed; abundant carbonaceous clasts; siderite bands.
- 782.0-786.9 (4.9) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, fine-grained sandstone; rippled in part; burrowed; gradational lower contact.
- 786.9-792.2 (5.3) Siltstone, dark-gray; argillaceous; burrowed; gradational lower contact.
- 792.2-793.6 (1.4) Shale and sandstone, interbedded; burrowed, rippled in part; sharp lower contact.
- 793.6-841.5 (47.9) Shale, dark-gray; occasional sandstone and siltstone laminae; burrowed in upper part; sparse siderite bands; gradational lower contact.
- 841.5-843.0 (1.5) Sandstone, light-gray; abundant shale laminae; burrowed; gradational lower contact.
- 843.0-854.5 (11.5) Shale, dark-gray; occasional sandstone laminae.

- 854.5-857.1 (2.6) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray sandstone; sandstone increasing with depth; gradational lower contact.
- 857.1-859.2 (2.1) Shale, dark-gray; occasional sandstone laminae; sharp lower contact.
- 859.2-865.8 (6.6) Sandstone and shale, interbedded; medium-gray; crossbedded; sandstone interbedded with dark-gray shale; sharp lower contact.
- 865.8-922.3 (56.5) Sandstone, gray; medium grained; abundant shale laminae and coal bands.
- 922.3-923.9 (1.6) Shale, dark-gray to black; carbonaceous.
- 923.9-932.8 (8.9) Sandstone, very light- to medium-gray; fine to medium grained; carbonaceous shale laminae; occasional coal bands; rippled.
- 932.8-954.1 (21.3) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray calcareous sandstone; burrowed in part.
- 954.1-956.7 (2.6) Sandstone, very light-gray; fine grained; slightly calcareous; sparse shale laminae; crossbedded.
- 956.7-957.3 (0.6) Shale, medium- to dark-gray; sandy; sandstone laminae at base.
- 957.3-957.7 (0.4) Shale, black; silty.
- 957.7-959.9 (2.2) Sandstone, light-gray; fine grained; abundant shale laminae.
- 959.9-963.3 (3.4) Shale and sandstone; alternating beds of dark-gray, silty shale and light-gray, fine-grained sandstone.
- 963.3-973.6 (10.3) Sandstone, light-gray; fine grained; shale laminae, increasing with depth; calcareous zone from 965.9 to 967.1 feet.

- 973.6-973.8 (0.2) Shale, dark-gray; sparse sandstone laminae.
- 973.8-1001.4 (27.6) Sandstone, light-gray; medium to coarse grained; slightly micaceous; occasional shale laminae and clasts; siderite nodules and coal clasts; plant fossils at base; sharp lower contact.
- 1001.4-1007.6 (6.2) Shale, dark-gray; siderite bands.
- 1007.6-1008.1 (0.5) COAL, dull-banded, with rare bright bands; poorly developed cleats; conchoidal fracture; pyrite. Sample R0809.
- 1008.1-1009.3 (1.2) Underclay, grayish-black; slickensided surfaces; thin coal band at base; plant fossils; gradational lower contact.
- 1009.3-1016.2 (6.9) Shale, olive- to dark-gray; abundant sandstone laminae; plant fossils; gradational lower contact.
- 1016.2-1017.1 (0.9) Sandstone and shale, interbedded; light-gray, medium-grained sandstone interbedded with dark-gray shale; burrowed.
- 1017.1-1018.8 (1.7) Sandstone, light-gray; fine to medium grained; sparse shale laminae; crossbedded; sharp lower contact.
- 1018.8-1019.3 (0.5) Shale, medium-gray; sandy, with occasional sandstone laminae; sharp lower contact.
- 1019.3-1154.5 (135.2) Sandstone, light-gray; fine to coarse grained; micaceous; abundant shale laminae in upper part; crossbedded; graded bedding; occasional coal clasts and bands; sparse siderite nodules; conglomeratic zone at the base; coarsens downward; sharp lower contact.
- 1154.5-1169.5 (15.0) Shale, dark-gray; occasional sandstone laminae; rare coal band; sparse plant fossils.

- 1169.5-1169.8 (0.3) COAL, dull- to bright-banded with depth; well developed cleat; pyrite band in upper part.
- 1169.8-1170.3 (0.5) Shale, dark-gray; bony in upper part; occasional sandstone laminae.
- 1170.3-1174.1 (3.8) Sandstone, gray; very fine grained; burrowed; gradational lower contact.
- 1174.1-1174.8 (0.7) Shale, dark-gray; occasional sandstone laminae; plant fossils.
- 1174.8-1179.9 (5.1) Sandstone, light- to medium-gray; fine to medium grained; slightly micaceous; occasional shale laminae; crossbedded at 1175.1 feet.
- 1179.9-1181.2 (1.3) Shale and sandstone, interlaminated; dark-gray shale interlaminated with light-gray, fine-grained sandstone.
- 1181.2-1186.3 (5.1) Sandstone, light-gray; very fine to fine grained; sparse shale laminae; sharp lower contact.
- 1186.3-1186.5 (0.2) Shale, dark-gray; sandstone band at 1186.4 feet; sharp lower contact.
- 1186.5-1188.5 (2.0) Sandstone, light-gray; very fine to fine grained; shale laminae, increasing with depth; sharp lower contact.
- 1188.5-1189.4 (0.9) Shale, dark-gray; occasional sandstone laminae; sharp lower contact.
- 1189.4-1254.0 (64.6) Sandstone, light-gray; fine to coarse grained; occasional shale laminae and beds; graded beds; crossbedded in part; scattered quartz pebbles; rare coal bands.
- 1254.0-1254.9 (0.9) Conglomerate; quartz and shale pebbles in light-gray, medium- to coarse-grained sandstone matrix; sharp lower contact.
- 1254.9-1257.4 (2.5) COAL, bright-banded; well developed cleats; conchoidal fractures in middle part; pyrite bands. Sample R0810.

- 1257.4-1262.5 (5.1) Shale, dark-gray; siderite in lower part; occasional plant fossils.
- 1262.5-1268.0 (5.5) Sandstone, gray; very fine to fine grained; slightly carbonaceous; sparse shale laminae; siderite nodules; rare plant fossils.
- 1268.0-1273.2 (5.2) Shale, dark-gray; occasional sandstone laminae; plant fossils.
- 1273.2-1388.7 (115.5) Sandstone, light- to medium-gray; fine to coarse grained; micaceous; occasional shale and carbonaceous laminae and beds; scattered quartz pebbles and conglomeratic zones throughout; occasional graded bedding, crossbedded in part; rare coal bands with pyrite; sparse shell fossil fragments at 1315.8 feet.
- 1388.7-1405.8 (17.1) Conglomerate; quartz and siderite pebbles in a light-gray, medium- to coarse-grained sandstone matrix; sparse shale laminae; rare coal clasts; sharp lower contact.
- 1405.8-1425.8 (20.0) Shale and sandstone, interbedded and interlaminated; dark-gray shale and light-gray to gray, fine-grained sandstone; siderite nodules; rare plant fossils.
- 1425.8-1428.7 (2.9) Sandstone, light-gray to gray; fine grained; sparse, micaceous, shale laminae; rare siderite nodules.
- 1428.7-1429.9 (1.2) Shale, dark-gray; abundant sandstone laminae; burrowed; slickensided surfaces; sharp lower contact.
- 1429.9-1487.1 (57.2) Sandstone, light-gray to gray; fine to coarse grained; shale laminae and beds, decreasing with depth; occasional graded bedding; crossbeds in lower part; scattered quartz pebbles, becoming conglomeratic zones in lower part; siderite nodules; coal bands in lower part.
- 1487.1-1488.6 (1.5) Shale, dark-gray; sparse sandstone laminae; rare plant fossils; sharp lower contact.

- 1488.6-1491.5 (2.9) Sandstone, light-gray; fine to medium grained; rare shale laminae; quartz and siderite pebbles in upper part; sharp lower contact.
- 1491.5-1497.6 (6.1) Shale, dark-gray; sandy, with occasional sandstone laminae; burrowed; siderite nodules; rare plant fossils.
- 1497.6-1514.9 (17.3) Sandstone, light-gray to gray; very fine to fine grained; occasional shale laminae; slickensided surfaces; burrowed; crossbedded in middle part; siderite nodules; rare plant fossils; sharp, angular lower contact.
- 1514.9-1516.4 (1.5) Shale, gray to dark-gray; occasional sandstone laminae; sparse load casts; siderite bands at base.
- 1516.4-1545.9 (29.5) Sandstone, light-gray; very fine to fine grained; sparse shale laminae; graded bedding; sharp lower contact.
- 1545.9-1552.3 (6.4) Shale and sandstone, interlaminated; gray to dark-gray shale interlaminated with light-gray, fine-grained sandstone; burrowed; abundant pyrite nodules and bands; coal stringers at base; occasional plant fossils.
- 1552.3-1561.7 (9.4) Shale, grayish-black to black; thin pyrite laminae and nodules; coal stringers near base; plant fossils.
- 1561.7-1563.5 (1.8) COAL, bright-banded; moderately well developed cleat; some calcite along cleats; abundant pyrite bands. Sample R0811.
- 1563.5-1565.9 (2.4) Shale, dark-gray; clayey; sparse coal clasts.
- 1565.9-1567.0 (1.1) COAL, bright-banded; moderately developed cleat; some calcite along cleats; pyrite bands. Sample R0812.
- 1567.0-1569.9 (2.9) Shale, black; carbonaceous; bony; coal clasts; rare pyrite; gradational lower contact.

- 1569.9-1576.1 (6.2) Sandstone, dark- to light-gray with depth; fine grained; very argillaceous; carbonaceous laminae in upper part; 0.4 foot silty shale band at 1574.8 feet; slickensided surfaces; plant fossils.
- 1576.1-1578.6 (2.5) Shale, gray; silty to sandy; coarsens downward; occasional slickensided surfaces; plant fossils.
- 1578.6-1589.2 (10.6) Sandstone, light-gray; very fine to fine grained; argillaceous with occasional shale bands; occasional graded beds; sparse coal clasts and plant fossils.
- 1589.2-1594.3 (5.1) Shale, gray to brownish-gray with depth; occasional sandstone laminae; abundant slickensided surfaces; sharp lower contact.
- 1594.3-1594.8 (0.5) COAL, bright-banded; bony at base.
- 1594.8-1614.2 (19.4) Shale, gray to dark-gray; clayey in upper part, becoming sandy with depth; burrowed; slickensided surfaces; rare plant fossils.
- 1614.2-1615.0 (0.8) Shale, grayish-black to black; clayey; bony in lower part.
- 1615.0-1616.5 (1.5) COAL, dull- to bright-banded with depth; bony at base; moderately developed cleat. Sample R0813.
- 1616.5-1617.5 (1.0) Shale, black to grayish-black; clayey; rare slickensided surfaces.
- 1617.5-1618.9 (1.4) Claystone, gray; very coaly in lower part; rooted.
- 1618.8-1620.0 (1.2) COAL, bright-banded; well developed cleats; pyrite bands; bony in lower 0.6 foot.
- 1620.0-1621.3 (1.3) Claystone, gray to blackish-gray; burrowed; rare slickensided surfaces; plant fossils; gradational lower contact.
- 1621.3-1622.6 (1.3) Shale, gray; slickensided surfaces; burrowed; plant fragments.

- 1622.6-1624.9 (2.3) Sandstone, light- to dark-gray; very fine to fine grained; occasional carbonaceous laminae with pyrite; burrowed.
- 1624.9-1638.6 (13.7) Sandstone and shale, interbedded; brownish-gray, fine-grained sandstone interbedded with black, carbonaceous shale; rooted; slickensided surfaces.
- 1638.6-1642.6 (4.0) Sandstone, grayish-white to light-gray; fine grained; sparse shale laminae, with slickensided surfaces; rippled; sharp lower contact.
- 1642.6-1655.5 (12.9) Shale, olive-green to brownish-gray; clayey at top, sandy with sandstone laminae in lower 5.0 feet; burrowed.

*Total Depth: 1655.5

*Core hole terminated because of severe caving.

HOLE NO.: R-9
COUNTY, STATE: Clay, Kentucky DRILLED DEPTH: 1987.7 ft.
SURFACE ELEV.: 1556 ft. (alt.) QUAD.: Creekville 7.5-min.
LOCATION: 21-G-71, 4515 FEL X 5410 FSL

<u>Depth (Feet)</u>	<u>Lithology</u>
0-21.0 (21.0)	Cased interval; unconsolidated and weathered material.
21.0-21.7 (0.7)	Sandstone; fine grained; micaceous; shale laminae, increasing with depth.
21.9-26.4 (5.1)	Siltstone, medium-gray; sandy; siderite bands, increasing with depth; abundant pyrite at base.
26.4-26.9 (0.5)	Shale, medium-gray.
26.9-29.9 (3.0)	COAL, bright-banded with occasional dull bands; blocky; occasional pyrite. Sample R0901.
29.9-31.8 (1.9)	Underclay, gray; rooted; sharp lower contact.
31.8-34.1 (2.3)	Sandstone, gray; very fine grained; micaceous; occasional shale laminae.
34.1-35.4 (1.3)	Shale, medium-gray; sandstone laminae, increasing with depth.
35.4-36.1 (0.7)	Sandstone, fine-grained; rippled; shale laminae, increasing with depth.
36.1-37.5 (1.4)	Shale, medium-gray; occasional sandstone laminae.
37.5-37.6 (0.1)	COAL; badly broken.
37.6-43.3 (5.7)	Underclay, gray; heavily rooted; pyrite and siderite nodules; sharp lower contact.
43.3-79.7 (36.4)	Sandstone, very light-gray; fine to coarse grained with depth; abundant shale laminae; thin coal bands at 64.4 feet; rippled to crossbedded; abundant siderite and shale pebbles in lower 1.5 feet; sharp lower contact.

- 79.7-80.3 (0.6) Siltstone, medium-gray; sandstone laminae; burrows; sharp lower contact.
- 80.3-83.3 (3.0) Sandstone, light-gray; coarse to fine grained with depth; crossbedded; abundant coal clasts; sparse siderite pebbles; sharp lower contact.
- 83.3-87.4 (4.1) Siltstone, light-gray; carbonaceous; planar bedding; slickensided surfaces.
- 87.4-88.2 (0.8) Sandstone, light-gray; fine to medium grained; coal clasts at base; irregular lower contact.
- 88.2-88.5 (0.3) Claystone, black; sparse carbonaceous material; slickensided surfaces.
- 88.5-89.0 (0.5) Sandstone, light- to medium-gray; fine grained; abundant coal clasts; irregular base.
- 89.0-91.0 (2.0) Shale, medium- to dark-gray; clayey; siderite bands; rare plant fossils.
- 91.0-91.7 (0.7) Siltstone, light- to medium-gray; slumped throughout; sharp, irregular lower contact.
- 91.7-92.3 (0.6) Sandstone, light-gray; fine to medium grained; calcareous; sparse coal clasts; sharp lower contact.
- 92.3-110.6 (18.3) Shale, medium- to dark-gray; silty to clayey; siderite nodules and bands; marine invertebrate fossils in lower 3.0 feet; calcareous in lower part.
- 110.6-111.4 (0.8) Limestone, dark-gray; finely crystalline; abundant marine invertebrate fossils.
- 111.4-112.5 (1.1) Siltstone, medium-gray; micaceous; rippled; rooted in part; limestone nodules; abundant marine fossils.
- 112.5-113.7 (1.2) Shale, dark-gray; abundant rippled sandstone laminae.
- 113.7-133.1 (19.4) Sandstone, light-gray; shale laminae, increasing with depth; rippled.

- 133.1-134.6 (1.5) Shale; sandy; mudflow.
- 134.6-143.6 (9.0) Sandstone, light-gray; fine grained; shale laminae; rippled; conglomeratic at base.
- 143.6-157.0 (13.4) Shale, dark-gray; occasional sandstone laminae; burrowed; siderite nodules; gradational lower contact.
- 157.0-158.8 (1.8) Sandstone and shale; interbedded; scoured lower contact.
- 158.8-159.6 (0.8) Shale; sandy; mudflow.
- 159.6-169.1 (9.5) Sandstone, light-gray; fine grained; occasional shale laminae; burrowed; massive in lower part; shale clasts; siderite nodules; sharp lower contact.
- 169.1-172.0 (2.9) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, fine-grained sandstone; shale pebbles.
- 172.0-177.0 (5.0) Sandstone, light-gray; fine grained; massive; conglomeratic zones at top and base; coal clasts in lower 1.0 foot.
- 177.0-178.7 (1.7) COAL, bright-banded; sparse dull bands; thin carbonaceous shale laminae; pyrite along cleats. Sample R0902.
- 178.7-178.8 (0.1) Underclay; rooted.
- 178.8-180.7 (1.9) Siltstone, gray; rooted.
- 180.7-192.4 (11.7) Shale, medium- to dark-gray; sandy; rooted to burrowed; mudflow at base.
- 192.4-192.9 (0.5) Siltstone, dark-gray; massive.
- 192.9-196.7 (3.8) Shale, dark-gray; sandy, occasional sandstone laminae; mudflow at 193.5 feet; siltstone bed from 195.4 to 195.7 feet; burrowed; siderite bands.
- 196.7-201.0 (4.3) Sandstone, light-gray; fine grained; occasional shale laminae; rooted; rippled in part; siderite bands.

- 201.0-208.8 (7.8) Shale, dark-gray; light-gray, fine-grained sandstone interbeds; burrowed; occasional plant fossils.
- 208.8-209.9 (1.1) Sandstone, light- to medium-gray; fine grained; micaceous to argillaceous; burrowed; siderite bands.
- 209.9-227.2 (17.3) Shale, medium-greenish-gray to dark-gray; clayey in part; siltstone laminae throughout; rooted in middle part; rare slickensided surfaces; Stigmaria at 220.6 feet.
- 227.2-228.0 (0.8) Sandstone, light-gray; occasional shale laminae; coal bands.
- 228.0-235.7 (7.7) Shale, dark-gray to black; clayey to carbonaceous; rooted; rare slickensided surfaces; sparse coal stringers.
- 235.7-238.1 (2.4) Siltstone and shale, interbedded; light-gray siltstone interbedded with medium-gray, sandy shale; rooted.
- 238.1-277.2 (39.1) Sandstone, light- to medium-gray; fine to medium grained; micaceous in part; occasional shale laminae; siltstone bed from 239.0 to 240.7 feet; sparse coal bands; crossbedded to massive in part.
- 277.2-284.3 (7.1) Shale, dark-gray to black; clayey in part; occasional sandstone laminae; sparse coal stringers; rooted; rare slickensided surfaces; occasional plant fossils, Stigmaria in upper 0.4 foot; sharp lower contact.
- 284.3-294.0 (9.7) Shale and sandstone, interbedded; dark-gray, medium-bedded shale interbedded with light-gray, fine-grained, rippled sandstone; occasional thin coal stringers.
- 294.0-296.6 (2.6) Shale, dark-gray to grayish-black; siderite bands; sparse slickensided surfaces; plant fossils; gradational lower contact.

- 296.6-297.7 (1.1) Shale, black; carbonaceous and clayey; rooted; abundant slickensided surfaces; siderite nodules in lower 0.5 foot.
- 297.7-299.6 (1.9) Shale, greenish-gray to dark-gray; slightly silty; rooted; slickensided surfaces; plant fossils.
- 299.6-300.8 (1.2) Siltstone, medium-gray; massive; rooted.
- 300.8-308.8 (8.0) Shale, dark-gray; silty, occasional sandstone laminae; rooted; sideritic in part.
- 308.8-310.3 (1.5) Siltstone, medium- to dark-gray; plant fossils; mudflow at base.
- 310.3-312.6 (2.3) Shale and siltstone, interbedded; dark-gray, sandy shale interbedded with dark-gray, flat-bedded siltstone.
- 312.6-313.4 (0.8) Siltstone, dark-gray; micaceous; massive; mudflow at base; sparse plant fossils.
- 313.4-315.6 (2.2) Shale, dark-gray; silty with occasional rippled sandstone laminae; burrowed.
- 315.6-319.5 (3.9) Siltstone, dark-gray; occasional thin sandstone laminae.
- 319.5-324.3 (4.8) Shale, dark-gray; coarsens downward; siltstone at base; burrowed; Lingula at 322.5 feet.
- 324.3-324.4 (0.1) COAL, bright-banded.
- 324.4-324.7 (0.3) Shale, black; carbonaceous; rooted.
- 324.7-326.0 (1.3) Underclay, light-olive-gray; silty; flat bedding.
- 326.0-328.7 (2.7) Siltstone, medium- to dark-greenish-gray; rooted.
- 328.7-364.4 (35.7) Sandstone, light-gray; fine to medium grained; micaceous, abundant shale laminae; sparse coal clasts; rippled to crossbedded; sharp lower contact.

- 364.4-365.6 (1.2) Shale, dark-gray to grayish-black; clayey to carbonaceous; rare coal bands.
- 365.6-365.7 (0.1) COAL, bright-banded.
- 365.7-369.1 (3.4) Shale, medium-gray; silty with occasional sandstone laminae; rooted.
- 369.1-371.9 (2.8) Sandstone, light-gray; fine grained; shale laminae, decreasing with depth; rippled; mudflow at base.
- 371.9-375.9 (4.0) Siltstone, dark-gray; occasional shale laminae; sparse coal stringers.
- 375.9-377.2 (1.3) Shale, dark-gray; silty to clayey with depth; siderite bands; sparse plant fossils.
- 377.2-378.2 (1.0) COAL, bright-banded; sparse bone bands. Sample R0903.
- 378.2-379.5 (1.3) Underclay, olive- to dark-gray; silty; slightly micaceous; rooted.
- 379.5-383.3 (3.8) Shale, greenish-gray to grayish-black; clayey to carbonaceous in upper part; sparse sandstone laminae in lower part; rooted; slickensided surfaces; siderite nodules.
- 383.3-417.4 (34.1) Sandstone, light-gray; fine grained; calcareous in part; sparse shale laminae; rippled to crossbedded; massive in part; abundant coal clasts; occasional siderite pebbles; irregular lower contact.
- 417.4-455.4 (38.0) Shale, dark-gray to grayish-black; occasional sandstone laminae; burrowed; siderite nodules; sparse plant fossils.
- 455.4-455.7 (0.3) Siltstone, dark-gray; carbonaceous; rooted.
- 455.7-455.8 (0.1) Shale, black; carbonaceous; coal clasts.

- 455.8-459.1 (3.3) Sandstone and shale, interbedded; light- to medium-gray, fine-grained, medium-bedded sandstone interbedded with dark-gray, silty shale; siltstone bed at 457.4 feet; rooted in upper part; burrows in lower part; siderite nodules; sparse plant fossils.
- 459.1-459.2 (0.1) Bone coal.
- 459.2-459.5 (0.3) COAL, bright-banded.
- 459.5-460.5 (1.0) Shale, dark-greenish-gray; clayey; rooted.
- 460.5-463.0 (2.5) Siltstone, dark-gray; rooted.
- 463.0-468.9 (5.9) Sandstone, light-gray; fine grained; occasional shale laminae; thin siltstone bed at 464.2 feet; rippled to crossbedded.
- 468.9-469.7 (0.8) Shale, dark-gray; occasional sandstone laminae.
- 469.7-490.3 (20.6) Sandstone, light- to medium-gray; fine to medium grained; micaceous; calcareous in part; occasional shale laminae; crossbedded; sharp lower contact.
- 490.3-490.4 (0.1) Bone coal.
- 490.4-490.9 (0.5) COAL, bright-banded.
- 490.9-492.5 (1.6) Sandstone, light-gray; very fine grained; rooted; thin coal stringers in upper part.
- 492.5-494.1 (1.6) Siltstone, medium-gray; rooted.
- 494.1-506.8 (12.7) Shale, dark-gray; occasional sandstone laminae; siltstone bed from 497.9 to 498.7 feet; burrowed and rooted.
- 506.8-513.0 (6.2) Sandstone, light-gray; fine grained; micaceous; occasional shale laminae; abundantly burrowed; siderite nodules; pyritized plant fossils.
- 513.0-531.4 (18.4) Shale, dark-gray; abundant sandstone laminae; burrowed.

- 531.4-534.0 (2.6) Sandstone and shale, interbedded; dark-gray, fine-grained sandstone interbedded with dark-gray shale; siltstone clasts; sharp lower contact.
- 534.0-558.1 (24.1) Siltstone, light- to dark-gray; fine grained; occasional shale laminae; consistent banding; massive in lower 2.0 feet.
- 558.1-572.9 (14.8) Shale, medium- to dark-gray; clayey to silty siltstone bed from 562.2 to 562.8 feet; rooted; siderite nodules; irregular base.
- 572.9-578.2 (5.3) Siltstone, medium- to dark-gray; clayey to micaceous; sparse shale laminae; rooted; pyritized plant fossils.
- 578.2-588.1 (9.9) Shale, medium- to dark-gray; clayey to silty; sparse sandstone laminae; carbonaceous bands in lower 4.0 feet; rooted; siderite nodules; disseminated pyrite.
- 588.1-593.8 (5.7) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, fine- to medium-grained sandstone; rippled; sparse coal stringers and siderite bands.
- 593.8-602.0 (8.2) Sandstone, light-gray; fine to medium grained; coarsens downward; occasional shale laminae; coal laminae; rippled to crossbedded; irregular lower contact.
- 602.0-606.3 (4.3) Siltstone, dark-gray to black; argillaceous in part; crossbedded in part; pyrite nodules; plant fossils; sharp lower contact.
- 606.3-607.1 (0.8) Sandstone and shale; alternating light-gray, fine- to medium-grained, massive sandstone and black, carbonaceous shale; sharp lower contact.
- 607.1-618.9 (11.8) Sandstone, light-gray; fine to medium grained; sparse shale laminae; massive to crossbedded; coal clasts; sharp lower contact.

- 618.9-638.6 (19.7) Siltstone, medium-gray; sandy to clayey; burrowed; coarsens downward.
- 638.6-643.2 (4.6) Shale, medium-gray; clayey; siderite nodules; disseminated pyrite; sparse plant fossils; irregular lower contact.
- 643.2-645.6 (2.4) COAL, bright- to dull-banded with depth; sparse bone coal bands; pyrite lenses in upper 0.3 foot. Sample R0904.
- 645.6-645.7 (0.1) Shale, black; carbonaceous.
- 645.7-648.0 (2.3) Siltstone, medium- to dark-gray; coarsens downward; rooted; occasional pyrite.
- 648.0-656.7 (8.7) Shale and sandstone, interbedded; medium- to dark-gray shale interlaminated and interbedded with light-gray, fine-grained, rippled sandstone; burrowed in part; gradational lower contact.
- 656.7-676.0 (19.3) Sandstone, light-gray; fine- to medium-grained; micaceous; sparse shale laminae; rippled to crossbedded; sparse coal laminae; sharp, irregular lower contact.
- 676.0-683.0 (7.0) Shale, dark-gray; occasional sandstone laminae; burrowed; siderite nodules.
- 683.0-689.5 (6.5) Siltstone, dark-gray; coarsens downward; burrowed; siderite nodules; pyritized plant fossils; sharp, irregular lower contact.
- 689.5-701.4 (11.9) Shale, dark-gray to grayish-black; silty to clayey; sandstone bed from 697.7 to 698.2 feet; burrowed; siderite nodules; plant fossils.
- 701.4-705.8 (4.4) Sandstone and shale, interbedded; light-gray, fine-grained sandstone interbedded with dark-gray, silty shale; rippled; sparse coal stringers.
- 705.8-707.4 (1.6) COAL, bright-banded with thin band of bone coal. Sample R0905.

- 707.4-707.5 (0.1) Claystone, grayish-black; rooted; slickensided surfaces.
- 707.5-710.6 (3.1) Siltstone, medium-gray; sparse shale laminae; rooted.
- 710.6-716.9 (6.3) Shale, dark-gray; abundant sandstone laminae; siltstone bed at 712.3 feet; coal stringers; rooted; plant fossils.
- 716.9-718.3 (1.4) Sandstone, light- to medium-gray; very fine to fine grained; silty; rooted in part; coal laminae; siderite nodules; plant fossils.
- 718.3-726.2 (7.9) Shale, medium-greenish-gray; occasional sandstone laminae; sparse coal stringers; siderite nodules; occasional plant fossils.
- 726.2-728.2 (2.0) Siltstone, medium-dark-gray; occasional sandstone laminae; burrowed; siderite nodules.
- 728.2-731.2 (3.0) Siltstone and sandstone, interbedded; medium- to dark-gray siltstone interbedded with light-gray, fine-grained sandstone; rooted; minor slickensided surfaces.
- 731.2-732.7 (1.5) Shale, medium- to dark-gray; clayey; rooted; slickensided surfaces; plant fossils.
- 732.7-738.8 (6.1) Siltstone, medium-gray; occasional sandstone laminae; siderite bands; rooted.
- 738.8-739.7 (0.9) Shale, grayish-black; clayey; rooted; slickensided surfaces; thin pyrite lenses.
- 739.7-740.8 (1.1) COAL, bright-banded; well developed cleats. Sample R0906.
- 740.8-741.5 (0.7) Shale, dark-gray to black; carbonaceous to clayey; rooted; rare pyrite bands; plant fossils.
- 741.5-742.5 (1.0) COAL, bright- to dull-banded with occasional bone coal. Sample R0907.

- 742.5-744.2 (1.7) Siltstone, dark-gray; occasional shale laminae; rooted; Stigmaria.
- 744.2-745.3 (1.1) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, fine-grained sandstone; rooted and burrowed; siderite nodules; plant fossils.
- 745.3-758.1 (12.8) Sandstone, light-gray; fine to medium grained; occasional shale laminae and coal clasts; crossbedded; coarsens downward; rare slickensided surfaces; irregular lower contact.
- 758.1-759.5 (1.4) Shale, dark-gray; clayey; rare slickensided surfaces; slumped.
- 759.5-767.7 (8.2) Sandstone, light-gray; fine to medium grained; micaceous; sparse shale laminae; occasional coal clasts; crossbedded to rippled; siderite and shale pebbles.
- 767.7-767.9 (0.2) Conglomerate; siderite and coal clasts.
- 767.9-805.0 (37.1) Sandstone, light-gray; fine to medium grained; micaceous in part; sparse shale laminae, carbonaceous shale beds in lower part; rippled to crossbedded to massive in part; coal clasts.
- 805.0-806.1 (1.1) Shale, dark-gray; abundant sandstone laminae; siderite nodules.
- 806.1-810.9 (4.8) Sandstone, light-gray; fine to medium grained; shale laminae in upper part; conglomeratic zone near base; rippled; siderite nodules and coal clasts; irregular lower contact.
- 810.9-846.0 (35.1) Shale, medium- to dark-gray; clayey in part; occasional sandstone laminae; siderite bands and nodules; sparse plant fossils.
- 846.0-847.7 (1.7) Shale, black; carbonaceous; pyrite lenses; burrowed; Lingula at 846.6 feet.
- 847.7-848.0 (0.3) COAL, bright-banded.

- 848.0-850.9 (2.9) Siltstone, olive-gray; clayey; slickensided surfaces.
- 850.9-865.1 (14.2) Shale, dark-gray; clayey; occasional sandstone laminae; rooted; burrowed; siderite bands; Lingula at 854.4 feet.
- 865.1-867.1 (2.0) Siltstone, dark-gray; massive.
- 867.1-869.4 (2.3) Shale, grayish-black; silty; pyrite lenses and nodules; sparse coal bands.
- 869.4-870.2 (0.8) COAL, bright-banded; pyrite nodules in upper part.
- 870.2-870.8 (0.6) Shale, dark-gray; slightly silty; rooted.
- 870.8-872.2 (1.4) Siltstone; clayey; rooted; slickensided surfaces.
- 872.2-932.5 (60.3) Shale, dark-gray to grayish-black; abundant sandstone laminae and interbeds; rooted; burrowed; siderite bands; plant fossils.
- 932.5-948.5 (16.0) Sandstone and shale, interbedded; rippled and burrowed; abundant plant fossils; calcareous at top.
- 948.5-957.7 (9.2) Shale, medium-gray; sandy with abundant sandstone laminae, increasing with depth; burrowed; siderite nodules.
- 957.7-958.3 (0.6) Sandstone, very light-gray; fine grained; shale pebbles; coarsens with depth; plant fossils; sharp lower contact.
- 958.3-959.2 (0.9) Shale, dark-gray; clayey.
- 959.2-959.3 (0.1) Bone coal.
- 959.3-968.9 (9.6) Shale, medium- to dark-gray; silty to sandy; rooted; abundant plant fossils.
- 968.9-971.4 (2.5) Sandstone, very light-gray; fine to medium grained; shale laminae; rippled; coal clasts.

- 971.4-976.3 (4.9) Shale, medium-gray to dark-olive-gray; sandy; plant fossils.
- 976.3-981.8 (5.5) Underclay, light- to medium-gray; silty to sandy; rooted.
- 981.8-982.9 (1.1) Sandstone, very light-gray; fine grained; occasional shale laminae; rippled.
- 982.9-983.3 (0.4) Underclay, light-gray; sandy.
- 983.3-1011.1 (27.8) Sandstone, light-gray; very fine to medium grained; calcareous in part; micaceous; occasional shale laminae; crossbedded to rippled; coal clasts.
- 1011.1-1020.9 (9.8) Shale, dark-gray; occasional sandstone interbeds.
- 1020.9-1028.0 (7.1) Sandstone, light-gray; fine grained; abundant shale laminae; coal clasts; siderite pebbles.
- 1028.0-1056.2 (28.2) Shale, dark-gray to grayish-black; silty to clayey; sparse sandstone laminae; burrowed in part; abundant slickensided surfaces; siderite nodules; disseminated pyrite; sparse Lingula.
- 1056.2-1056.5 (0.3) COAL, bright-banded; pyrite lenses.
- 1056.5-1056.6 (0.1) Shale, black; carbonaceous; pyrite lenses.
- 1056.6-1057.8 (1.2) Siltstone, mottled greenish-gray to dark-gray.
- 1057.8-1075.5 (17.7) Shale, olive-gray to dark-gray, mottled in part; clayey; occasional sandstone laminae; siderite bands; Lingula in lower 3.0 feet.
- 1075.5-1075.7 (0.2) COAL, bright-banded.
- 1075.7-1087.6 (11.9) Shale, dark-gray; clayey, occasional sandstone laminae; burrowed in part; siderite bands; abundant plant fossils; Lingula at 1084.6 feet.
- 1087.6-1090.2 (2.6) COAL, bright-banded; thin shale band. Sample R0908.

- 1090.2-1098.4 (8.2) Siltstone, grayish-brown to dark-gray; slightly carbonaceous; shale bed from 1095.2 to 1095.5 feet; coarsens downward; rooted.
- 1098.4-1102.9 (4.5) Sandstone and shale; alternating beds of light-gray, fine-grained, rippled sandstone and dark-gray shale; sharp, irregular lower contact.
- 1102.9-1105.6 (2.7) Siltstone, dark-gray; occasional sandstone laminae; 0.7 foot sandstone bed in middle part; sparse shale laminae.
- 1105.6-1127.4 (21.8) Sandstone, light-gray; fine to medium grained; slightly micaceous; sparse shale laminae; occasional coal clasts; crossbedded to rippled; siderite pebbles.
- 1127.4-1127.5 (0.1) Bone coal; sparse slickensided surfaces.
- 1127.5-1177.7 (50.2) Sandstone, light-gray; very fine to medium grained; micaceous; calcareous in part; occasional shale laminae, coal clasts; crossbedded to rippled to massive; sparse siderite bands; sharp lower contact.
- 1177.7-1179.2 (1.5) Shale and siltstone; grayish-black, silty shale; lower 0.2 foot dark-gray, burrowed siltstone; siderite nodules.
- 1179.2-1248.3 (69.1) Sandstone, light-gray; very fine to fine grained; calcareous in part; occasional shale laminae; crossbedded to massive; sparse coal clasts.
- 1248.3-1253.7 (5.4) Shale and sandstone, interbedded; dark-gray shale interbedded with light-gray, very fine- to fine-grained, rippled sandstone; burrowed in part.
- 1253.7-1255.5 (1.8) Siltstone, dark-gray; light-gray sandstone interbeds.
- 1255.5-1257.6 (2.1) Sandstone, light-gray; fine to medium grained; occasional coal bands; siderite pebbles and pyrite lenses.

- 1257.6-1264.9 (7.3) Shale, dark-gray; silty; occasional sandstone laminae; siderite nodules; sparse Lingula in upper 2.0 feet.
- 1264.9-1267.4 (2.5) Siltstone, dark-gray; occasional sandstone laminae.
- 1267.4-1268.8 (1.4) Shale and sandstone, interbedded; dark-gray, silty shale interbedded with light-gray, rippled sandstone.
- 1268.8-1277.1 (8.3) Siltstone, dark-gray; sparse sandstone laminae; occasional carbonaceous plant fossils.
- 1277.1-1282.6 (5.5) Core lost.
- 1282.6-1296.6 (14.0) Shale, dark-gray; abundant light-gray sandstone interbeds; occasional coal clasts; carbonaceous plant fossils; sharp lower contact.
- 1296.6-1317.6 (21.0) Sandstone, light-gray; fine to medium grained; micaceous; abundant dark shale beds; plant fossils.
- 1317.6-1318.6 (1.0) Shale and sandstone, interlaminated; dark-gray to grayish-black shale interlaminated with light-gray, fine-grained sandstone; sparse plant fossils.
- 1318.6-1414.0 (95.4) Sandstone, light-gray; very fine to medium grained; micaceous in part; abundant shale laminae and interbeds, decreasing with depth; occasional coal bands; crossbedded; siderite pebbles and coal clasts throughout; sparse plant fossils; sharp, irregular lower contact.
- 1414.0-1415.5 (1.5) Conglomerate, dark-gray; shale pebbles in sandstone matrix.
- 1415.5-1522.5 (107.0) Sandstone, very light- to light-gray; very fine to coarse grained; abundant shale laminae, decreasing with depth; quartz pebbles and conglomeratic zones throughout; rippled to crossbedded to massive; occasional siderite pebbles and coal clasts.
- 1522.5-1523.3 (0.8) Conglomerate; siderite pebbles in medium-grained sandstone matrix.

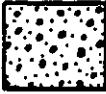

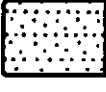






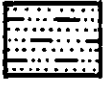


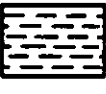



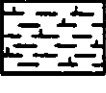

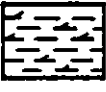

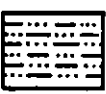

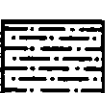

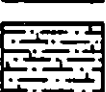
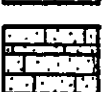
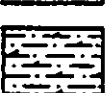





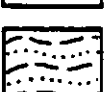

- 1523.3-1526.5 (3.2) Sandstone, very light- to light-gray; medium grained; sparse carbonaceous shale laminae; crossbedded; siderite pebbles.
- 1526.5-1527.1 (0.6) Conglomerate; siderite pebbles in medium-grained sandstone matrix; sparse pyrite nodules.
- 1527.1-1529.1 (2.0) Sandstone, very light-gray; fine to medium grained; coal bands; massive to slightly crossbedded.
- 1529.1-1530.9 (1.8) Siltstone, dark-gray to grayish-black; sparse sandstone laminae; rooted.
- 1530.9-1533.1 (2.2) Sandstone, light-gray; fine grained; shale laminae; rippled.
- 1533.1-1535.7 (2.6) Shale and sandstone, interbedded; grayish-black silty shale interbedded with light-gray, fine-grained, rippled sandstone.
- 1535.7-1538.5 (2.8) Sandstone, light-gray; very fine to medium grained; slightly micaceous; sparse shale laminae; 0.5 foot siltstone bed at 1537.5 feet.
- 1538.5-1540.9 (2.4) Shale, dark-gray; clayey with depth; sandstone laminae in upper part; plant fossils.
- 1540.9-1544.9 (4.0) Siltstone, dark-gray; clayey; rooted.
- 1544.9-1593.2 (48.3) Sandstone, light-gray; fine to coarse grained with depth; abundant shale laminae; quartz pebbles in lower part; crossbedded, graded bedding in part; sparse siderite pebbles.
- 1593.2-1594.7 (1.5) Conglomerate; quartz pebbles in sandstone matrix; occasional coal clasts.
- 1594.7-1595.6 (0.9) Sandstone, light-gray; medium grained; slightly crossbedded; occasional coal clasts.
- 1595.6-1597.5 (1.9) COAL, bright-banded; pyrite lenses. Sample R0909.

- 1597.5-1599.4 (1.9) Siltstone, dark-gray; rooted to burrowed; sparse slickensided surfaces.
- 1599.4-1605.7 (6.3) Sandstone and shale, interbedded; light-gray, fine-grained, medium-bedded, rippled sandstone interbedded with dark-gray shale.
- 1605.7-1624.8 (19.1) Sandstone, light-gray; medium grained; abundant shale laminae and bands; rippled to crossbedded; burrowed in part; quartz pebbles in lower 1.2 feet.
- 1624.8-1638.3 (13.5) Sandstone and shale; alternating sequence of light-gray, rippled sandstone and dark-gray shale; burrowed; sharp lower contact.
- 1638.8-1741.3 (102.5) Sandstone, light-gray; very fine to coarse grained; occasional shale laminae; quartz pebbles and conglomeratic zones throughout; crossbedded in part; occasional graded bedding; pyrite lenses.
- 1741.3-1741.9 (0.6) COAL, bright-banded; moderately well developed cleats; sparse pyrite.
- 1741.9-1743.1 (1.2) Shale, dark-gray to grayish-black; sandy in part; slickensided surfaces; carbonaceous plant fossils.
- 1743.1-1756.0 (12.9) Shale, dark-gray to grayish-black; clayey to sandy with depth; coal stringers in upper part; gradational lower contact.
- 1756.0-1760.1 (4.1) Sandstone, light-gray; fine grained; irregular shale laminae; burrowed; rippled; occasional carbonaceous plant fossils.
- 1760.1-1771.9 (11.8) Shale and sandstone, interlaminated; dark-gray shale interlaminated with light-gray, fine-grained, rippled sandstone; occasional pyrite; sharp lower contact.


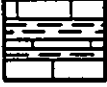

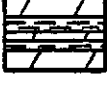

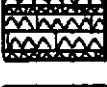



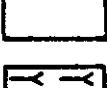

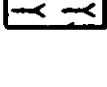
- 1771.9-1848.0 (76.1) Sandstone, light-gray; fine to coarse grained; abundant shale laminae; graded beds; scattered quartz pebbles; horizontal fractures; siderite nodules; sparse bone-coal clasts.
- 1848.0-1850.7 (2.7) Conglomerate; quartz and siderite pebbles in fine- to coarse-grained sandstone matrix; sharp lower contact.
- 1850.7-1852.6 (1.9) Shale and sandstone, interlaminated; dark-gray shale interlaminated with light-gray, fine-grained rippled sandstone; siderite nodules.
- 1852.6-1853.7 (1.1) COAL, bright-banded; poorly developed cleats; abundant pyrite. Sample R09 10.
- 1853.7-1854.3 (0.6) Shale, grayish-black to dark-gray; sandy; bony in upper part; burrowed; gradational lower contact.
- 1854.3-1867.6 (13.3) Sandstone, light-brown to light-gray with depth; fine grained; abundant shale laminae; rippled; burrowed; slickensided surfaces; gradational lower contact.
- 1867.6-1872.8 (5.2) Shale, dark-gray to grayish-black; sparse carbonaceous laminae; occasional pyrite bands and nodules; slickensided surfaces; plant fossils.
- 1872.8-1873.5 (0.7) COAL, bright-banded; bony at top; well developed cleat; pyrite nodule at base. Sample R0911.
- 1873.5-1873.8 (0.3) Shale, grayish-black; plant fossils.
- 1873.8-1880.3 (6.5) Sandstone, brownish-gray; very fine to fine grained; clayey to shaly; rooted; slickensided surfaces; gradational lower contact.
- 1880.3-1891.5 (11.2) Shale, dark-gray; sandy to clayey; calcite(?) laminae at base; rare pyrite-filled burrows; rooted; slickensided surfaces.

- 1891.5-1892.5 (1.0) COAL, bright-banded; well developed cleats; slightly bony at base. Sample R0912.
- 1892.5-1899.9 (7.4) Shale, dark-gray; clayey; pyrite-filled burrows; rooted; slickensided surfaces.
- 1899.9-1981.8 (81.9) Sandstone, grayish-white to yellowish-gray; medium grained; very clayey; slightly micaceous; crossbedded; horizontal fractures; sparse pyrite.
- 1981.8-1984.5 (2.7) Shale, olive-gray; sandy; slumped in part; irregular lower contact.
- 1984.5-1987.4 (2.9) Limestone, light-brownish-gray; occasional shale laminae; slickensided surfaces; shell fossils.
- 1987.4-1987.7 (0.3) Shale, olive-gray; slickensided surfaces.
- Total Depth: 1987.7

































EXPLANATION OF SYMBOLS USED ON LITHOLOGIC LOGS

	CONGLOMERATE		INTERBEDDED SHALE and RIPPLE-BEDDED SANDSTONE
	SANDSTONE		INTERBEDDED SANDSTONE and SILTSTONE or SILTY SHALE
	RIPPLE-BEDDED SANDSTONE		INTERBEDDED RIPPLE-BEDDED SANDSTONE and SILTSTONE or SILTY SHALE
	CROSSBEDDED SANDSTONE		INTERBEDDED SILTSTONE or SILTY SHALE and RIPPLE-BEDDED SANDSTONE
	ARGILLACEOUS or SHALY SANDSTONE		INTERBEDDED SANDSTONE and SANDY SHALE
	CALCAREOUS SANDSTONE		INTERBEDDED RIPPLE-BEDDED SANDSTONE and SANDY SHALE
	CLAY or CLAY SHALE		INTERBEDDED SANDY SHALE and RIPPLE-BEDDED SANDSTONE
	UNDERCLAY		SLUMPED SHALE
	CALCAREOUS SHALE		SLUMPED SILTSTONE or SILTY SHALE
	DOLOMITIC SHALE		SLUMPED SANDY SHALE
	SANDY SHALE		CONVOLUTE BEDDING
	SILTSTONE or SILTY SHALE		LIMESTONE
	CALCAREOUS SILTSTONE		SANDY LIMESTONE
	DOLOMITIC SILTSTONE		ARGILLACEOUS or SHALY LIMESTONE
	CARBONACEOUS or BLACK SHALE		SILTY LIMESTONE
	INTERBEDDED SANDSTONE and SHALE		DOLOMITIC LIMESTONE
	INTERBEDDED RIPPLE-BEDDED SANDSTONE and SHALE		DOLOSTONE

EXPLANATION OF SYMBOLS-Continued

	SANDY DOLOSTONE		INTERBEDDED LIMESTONE and SHALE
	ARGILLACEOUS or SHALY DOLOSTONE		INTERBEDDED DOLOSTONE and SHALE
	SILTY DOLOSTONE		(LIMESTONE) with CONE-IN-CONE STRUCTURE
	FOSSILS		COAL
	FOSSILIFEROUS LIMESTONE		BONE
	FOSSILIFEROUS DOLOSTONE		BENTONITE

ADDITIONAL SYMBOLS

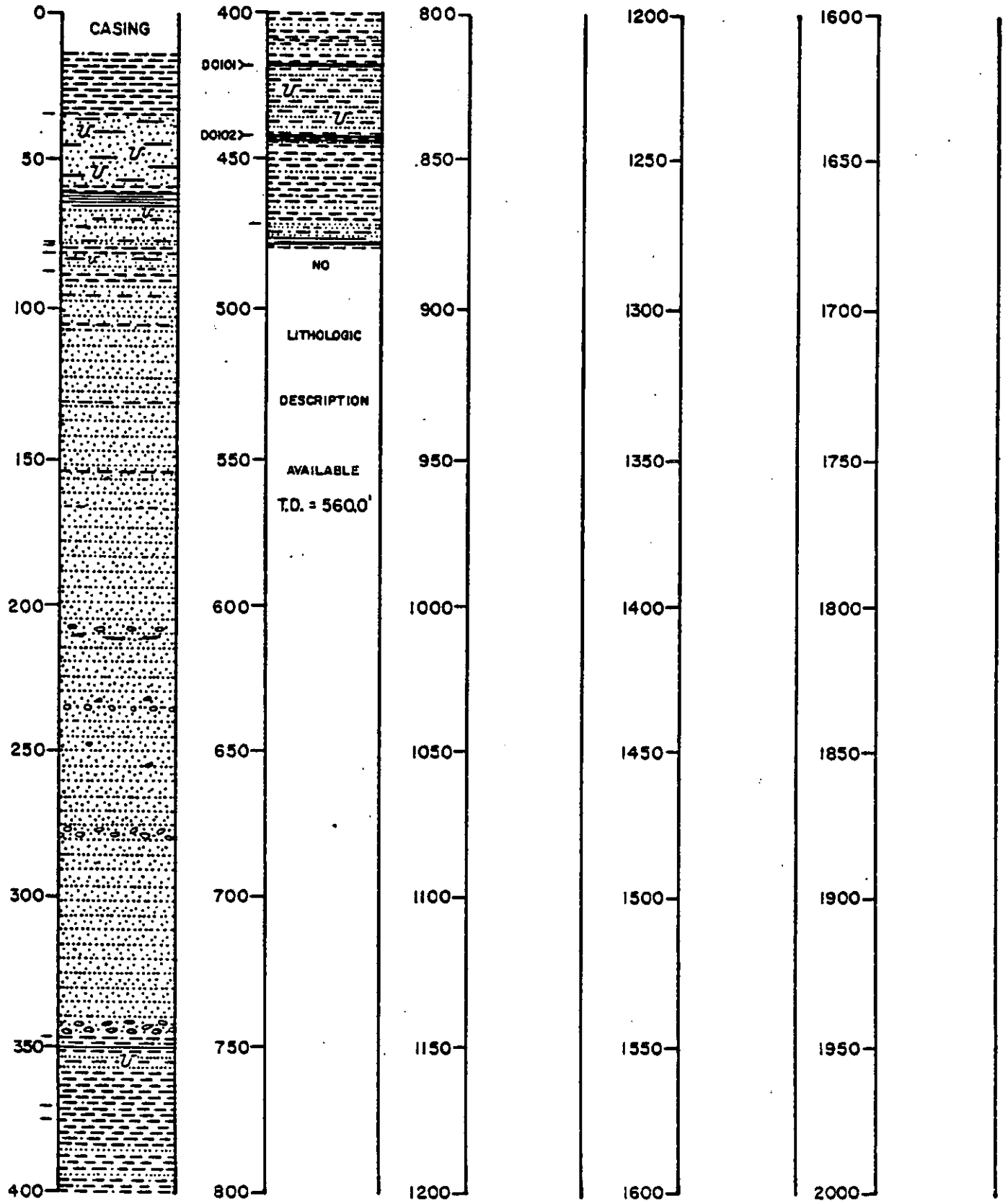
	LINGULA		SIDERITE
	GASTROPOD		FELDSPAR
	CEPHALOPOD		PYRITE
	BRACHIOPOD		BONE CLAST
	HORN CORAL		CALCITE-FILLED NODULE
	PELECYPOD		TALC-FILLED NODULE
	FOSSILS (in general)		SHALE PEBBLE
	FOSSILS (abundant)		SIDERITE PEBBLE
	FOSSILS (sparse)		QUARTZ PEBBLE
	FOSSILS (brackish-water)		LIMESTONE NODULE
	FOSSILS (marine)		COAL CLAST
	PLANT REMAINS		COAL BAND
	ROOTING		COAL SAMPLED with sample number
	BURROWING		(SHALE) CLAST
	PETROLIFEROUS		(SHALE or SANDSTONE) LAMINAE
	VUGS		dash denotes SHARP CONTACT

DRILL HOLE STRIP LOG

Hole No. D-1

Elevation: 1197 feet

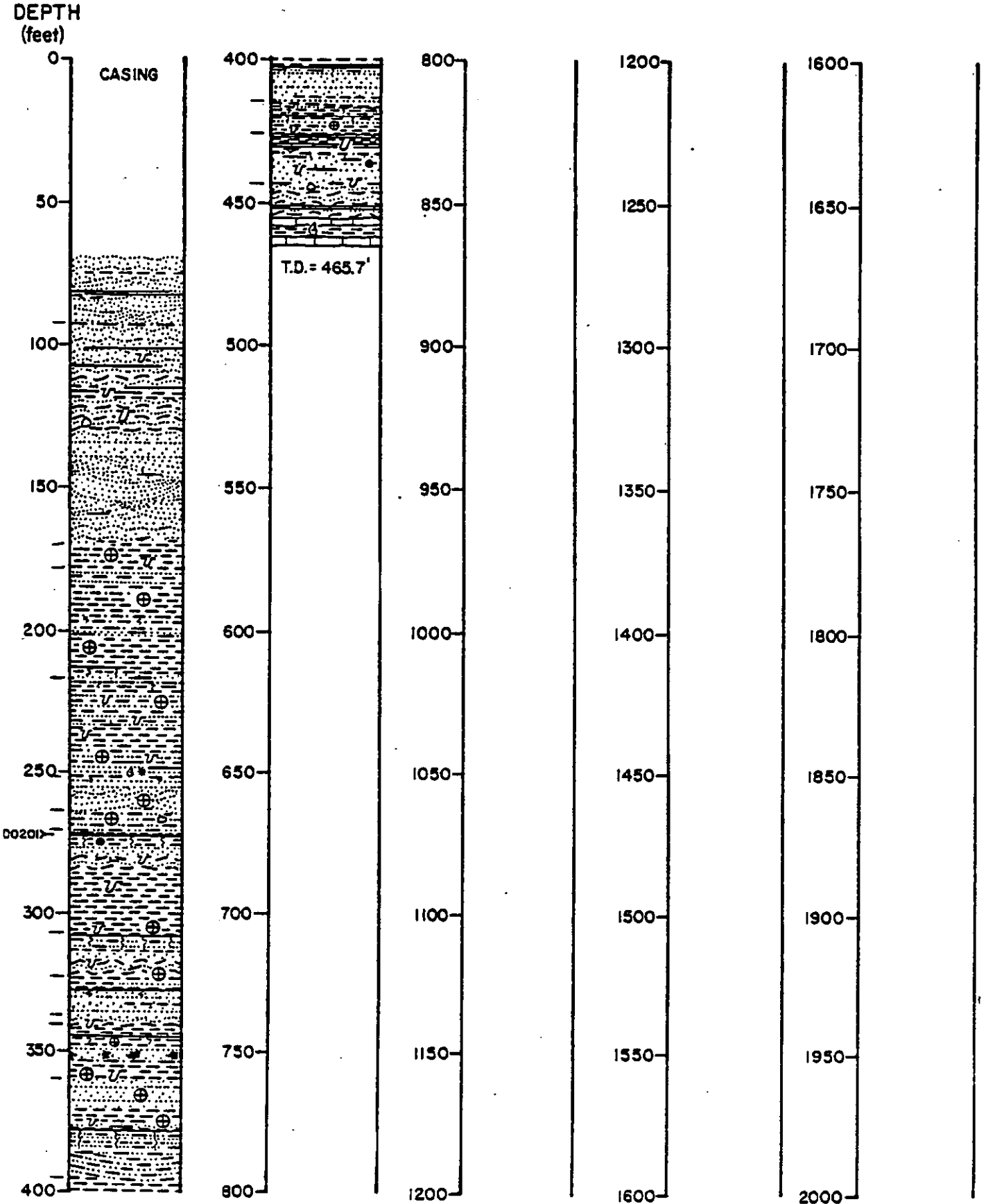
DEPTH
(feet)



DRILL HOLE STRIP LOG

Hole No. D-2

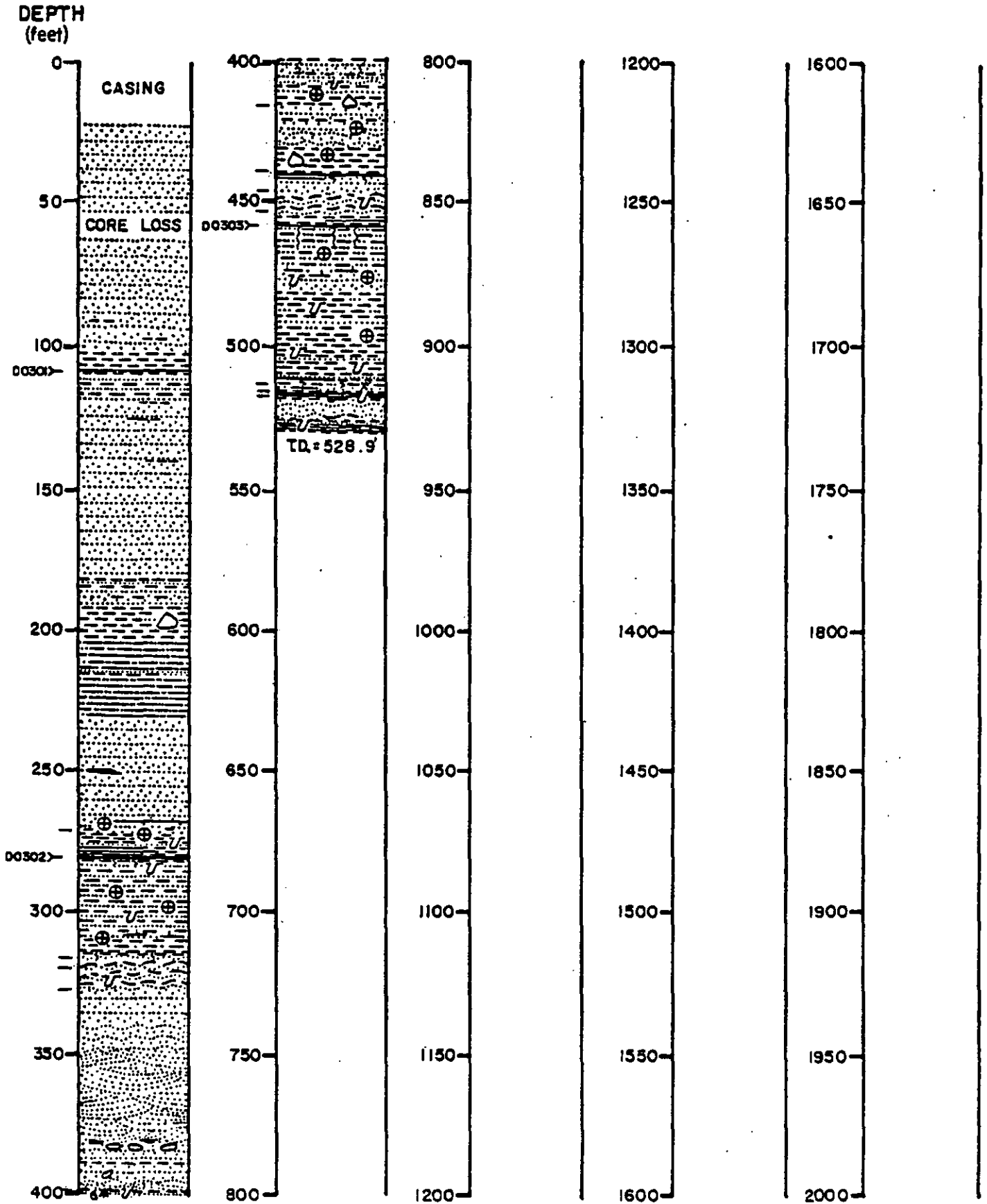
Elevation: 1369 feet



DRILL HOLE STRIP LOG

Hole No. D-3

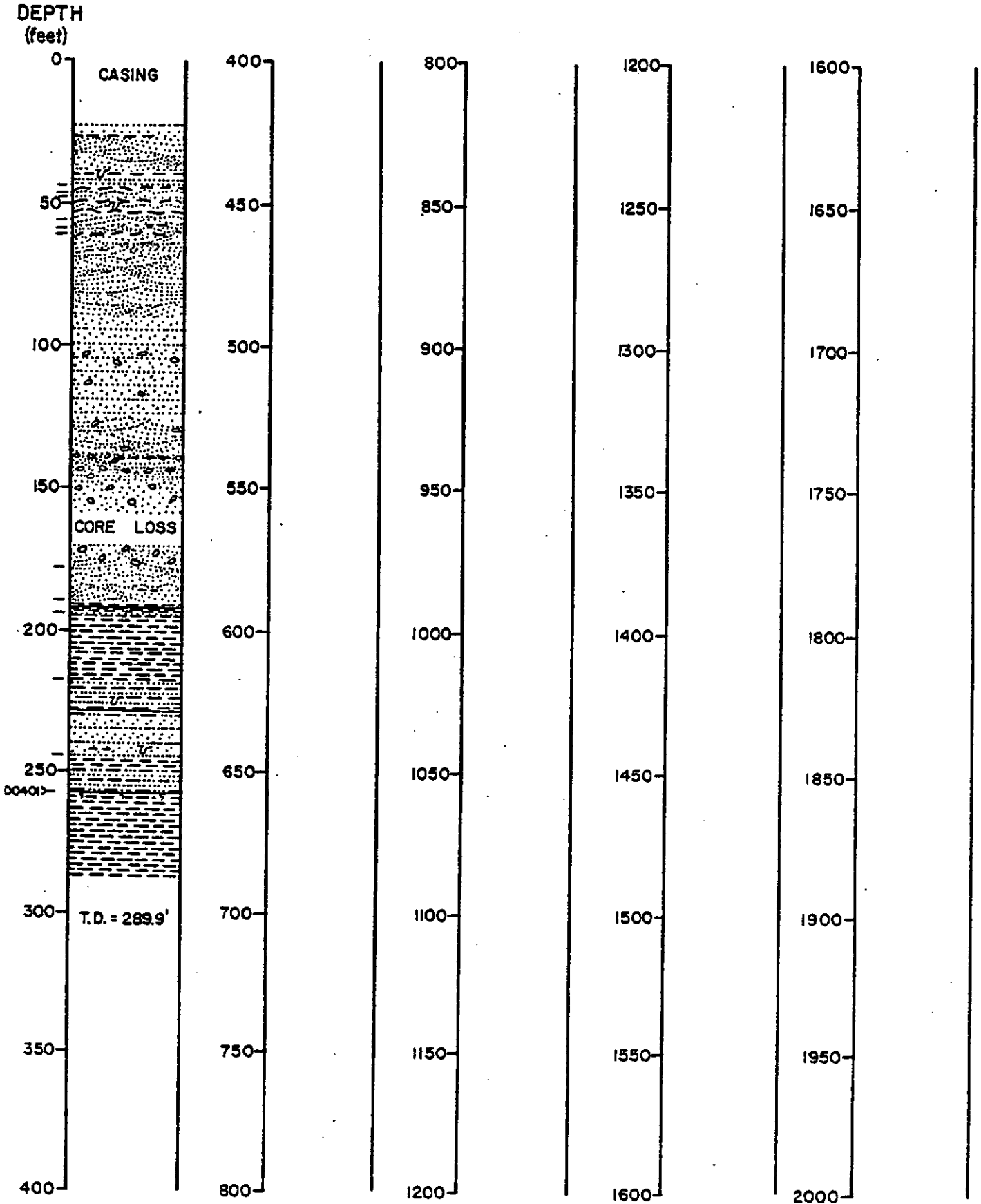
Elevation: 1254 feet



DRILL HOLE STRIP LOG

Hole No. D-4

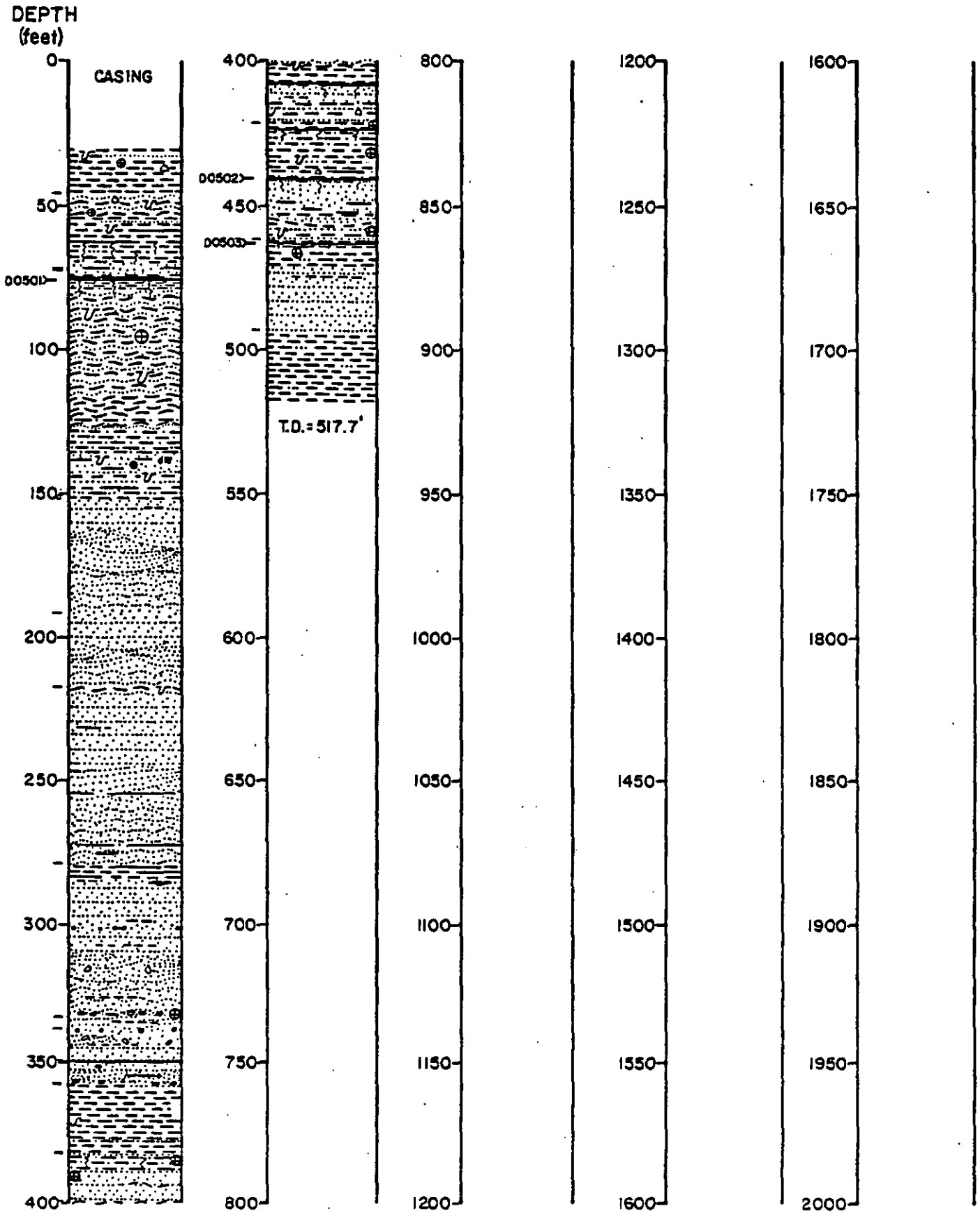
Elevation: 1193 feet



DRILL HOLE STRIP LOG

Hole No. D-5

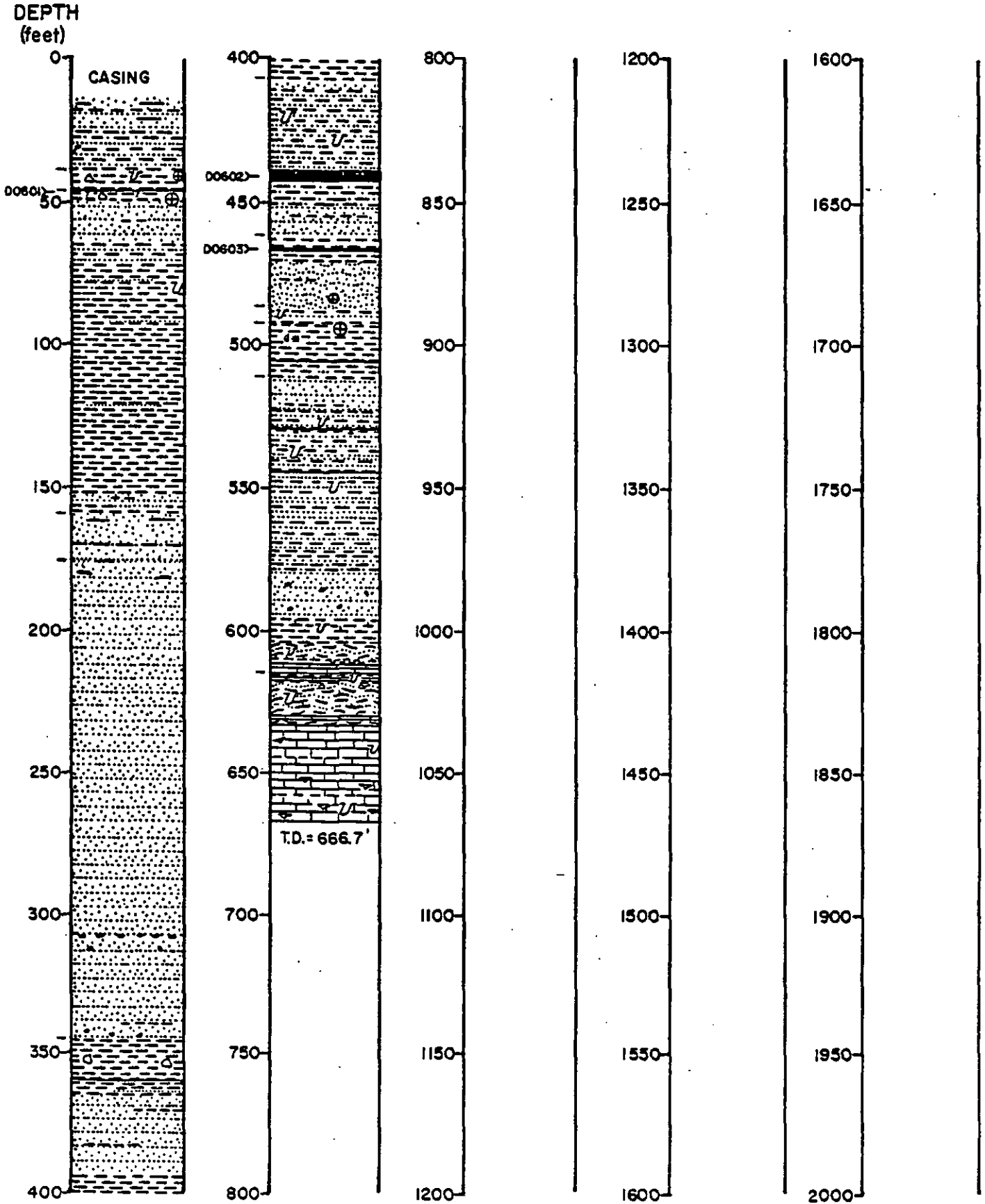
Elevation: 1245 feet



DRILL HOLE STRIP LOG

Hole No. D-6

Elevation: 1241 feet

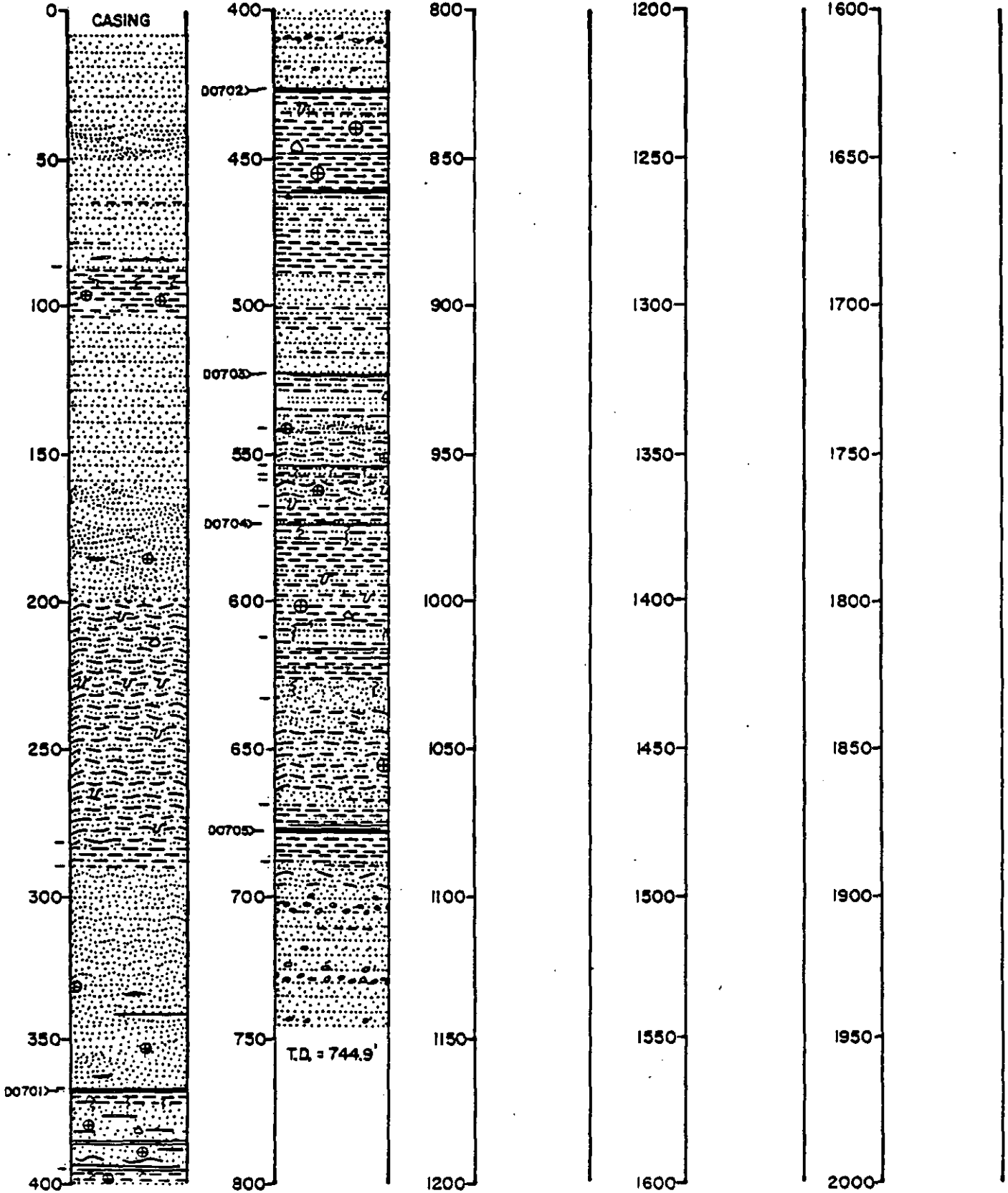


DRILL HOLE STRIP LOG

Hole No. D-7

Elevation: 1213 feet

DEPTH
(feet)

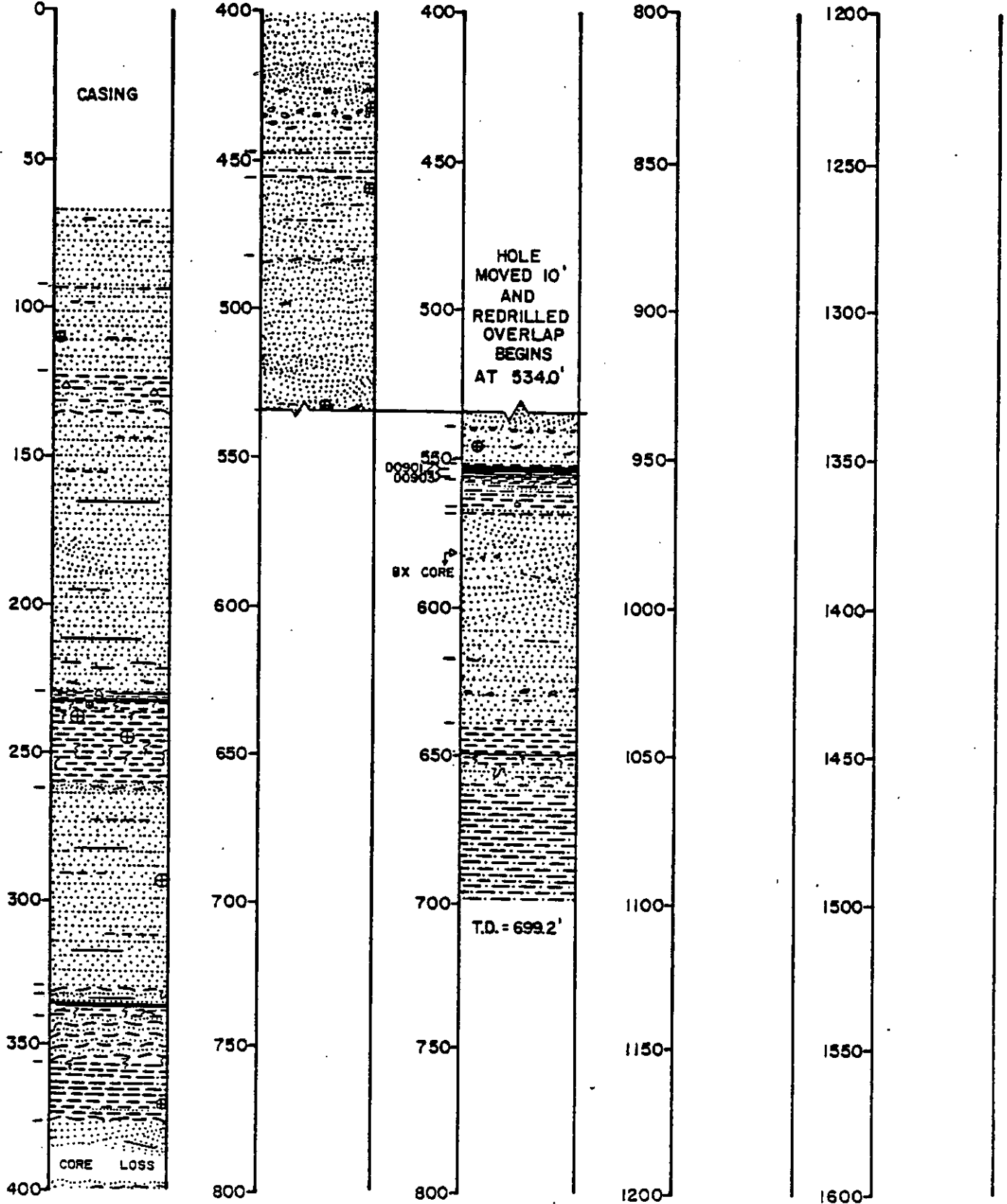


DRILL HOLE STRIP LOG

Hole No. D-9

Elevation: 1348 feet

DEPTH
(feet)

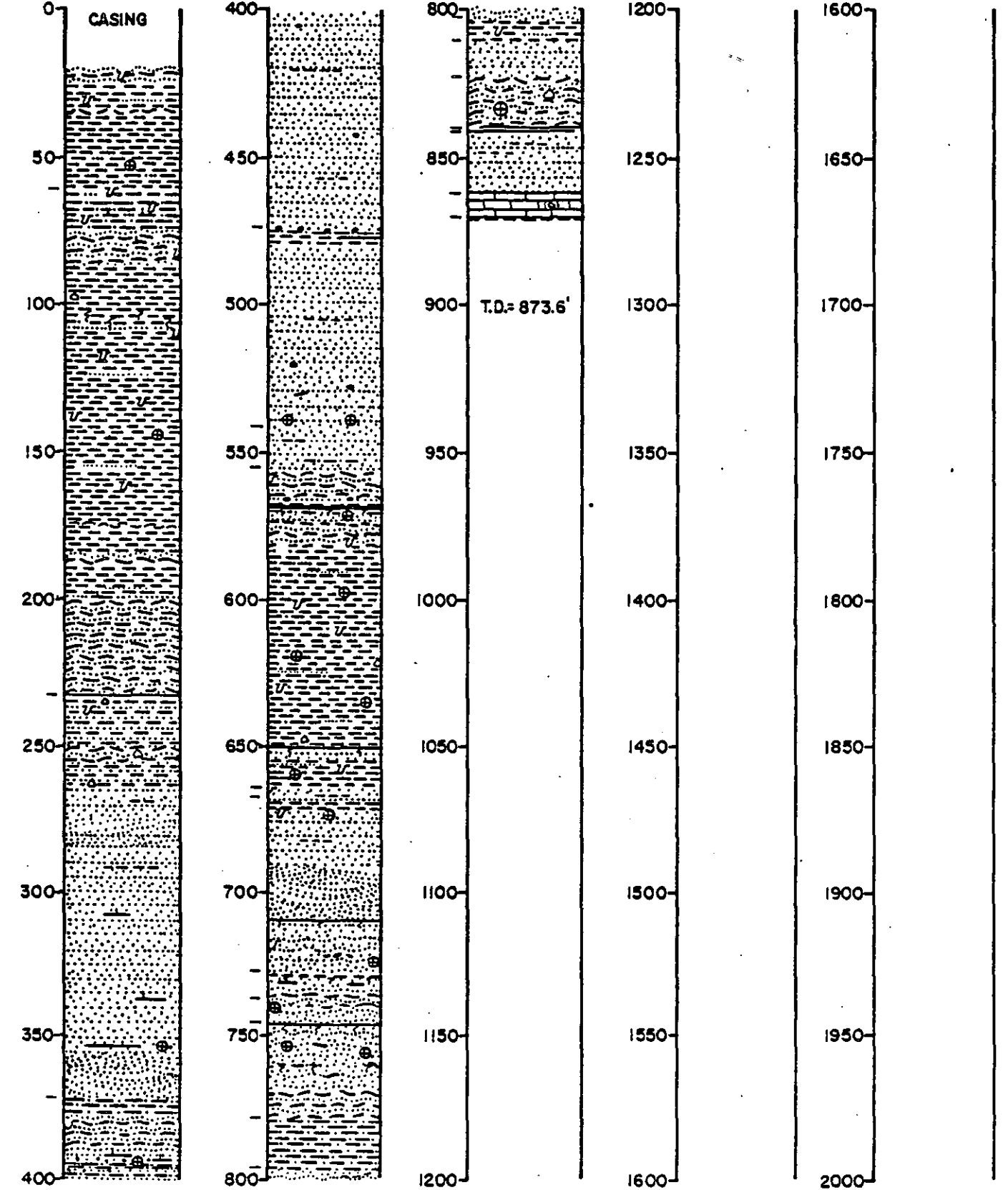


DRILL HOLE STRIP LOG

Hole No. D-10

Elevation: 1075 feet

DEPTH
(feet)

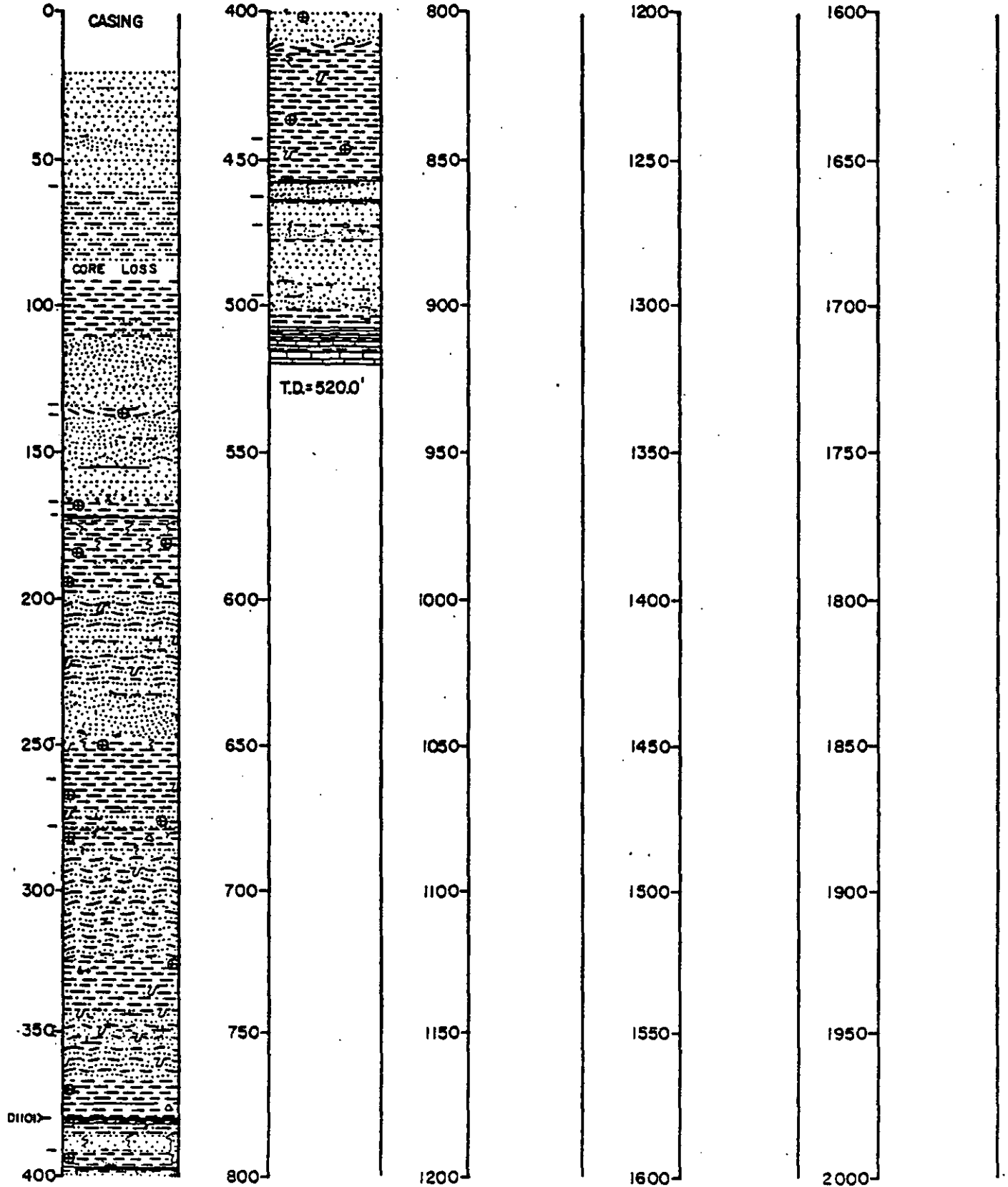


DRILL HOLE STRIP LOG

Hole No. D-11

Elevation: 157.3 feet

DEPTH
(feet)

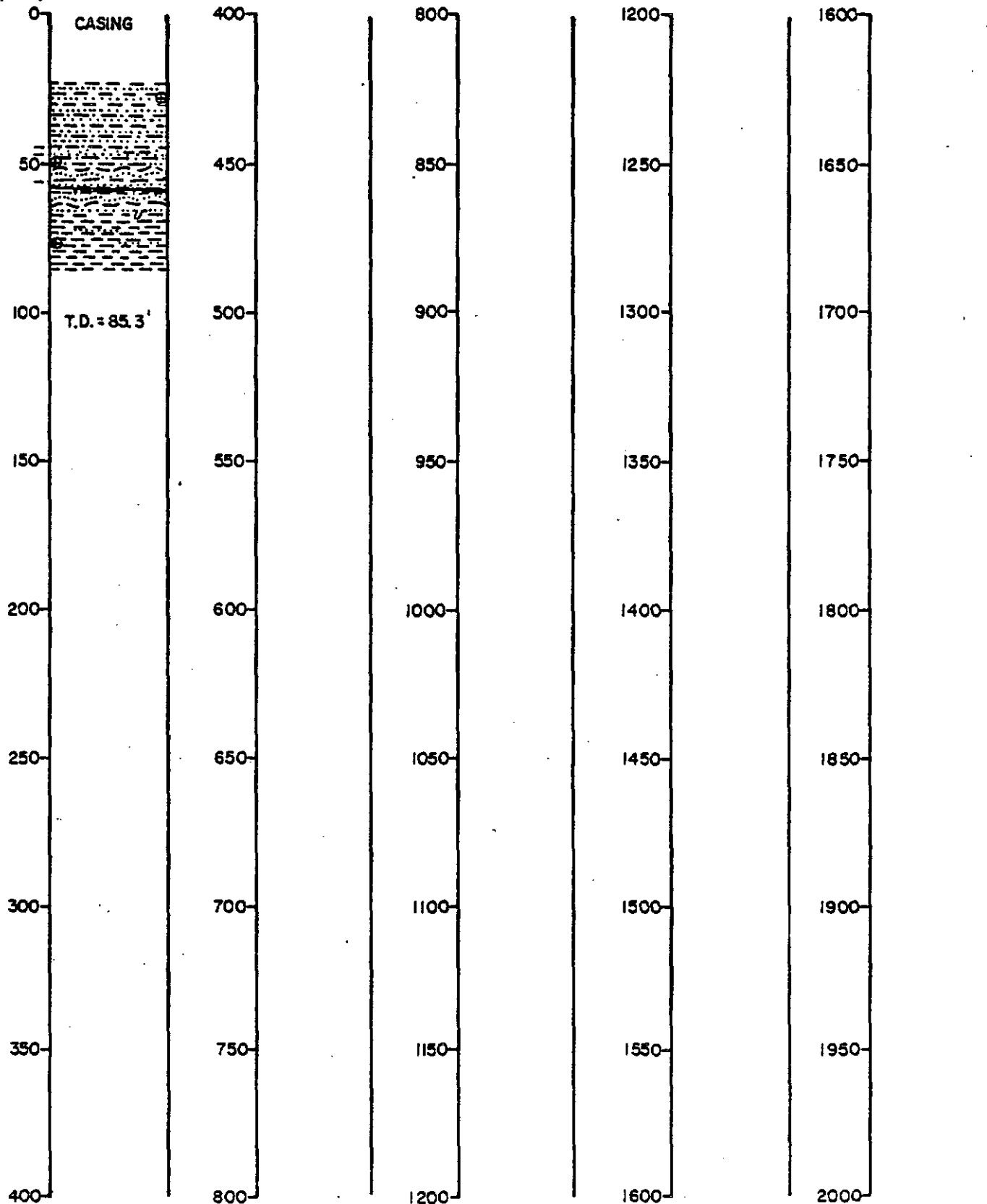


DRILL HOLE STRIP LOG

Hole No. D-12

Elevation: 1314 feet

DEPTH
(feet)

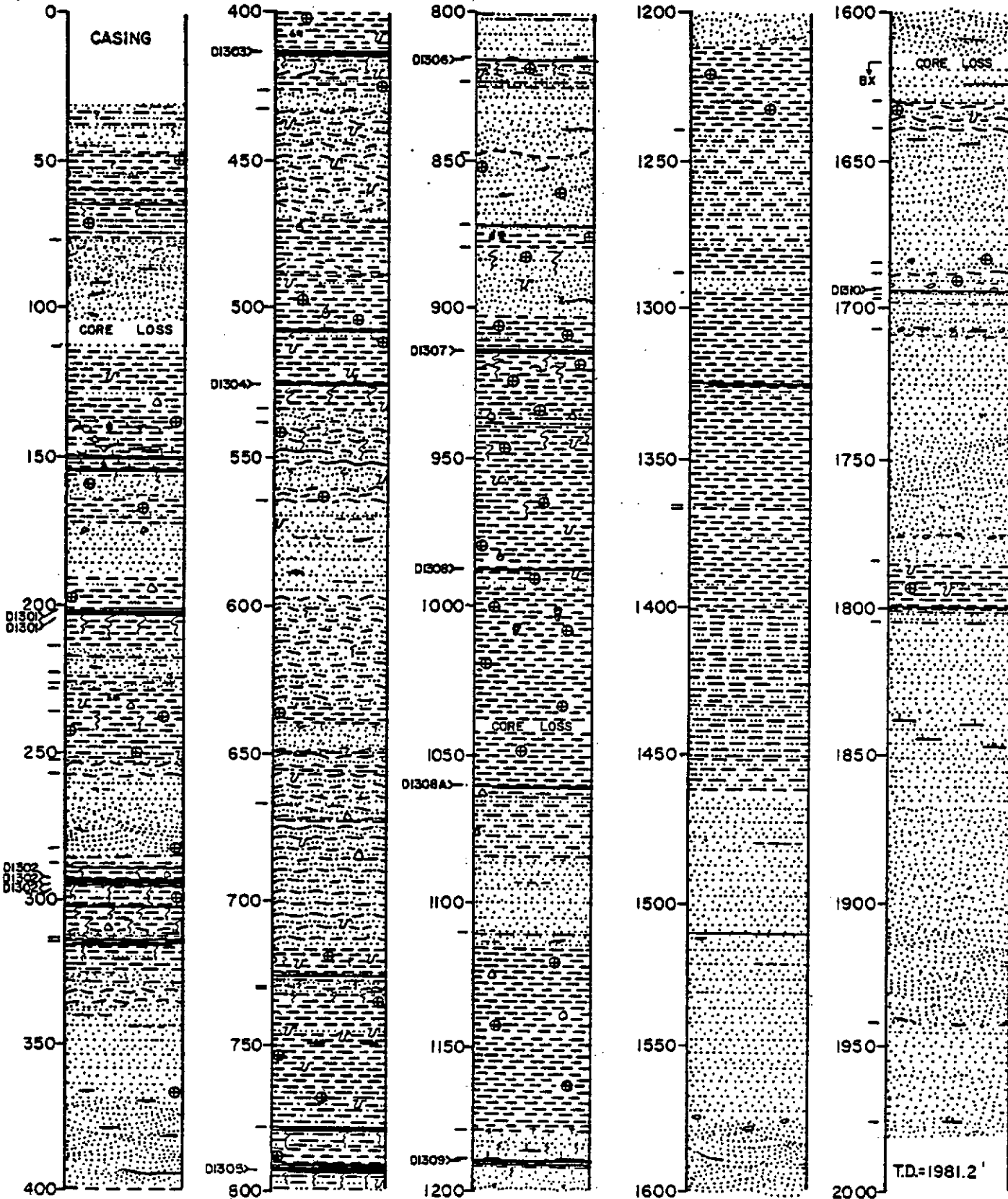


DRILL HOLE STRIP LOG

Hole No. D-13

Elevation: 2159 feet

DEPTH
(feet)

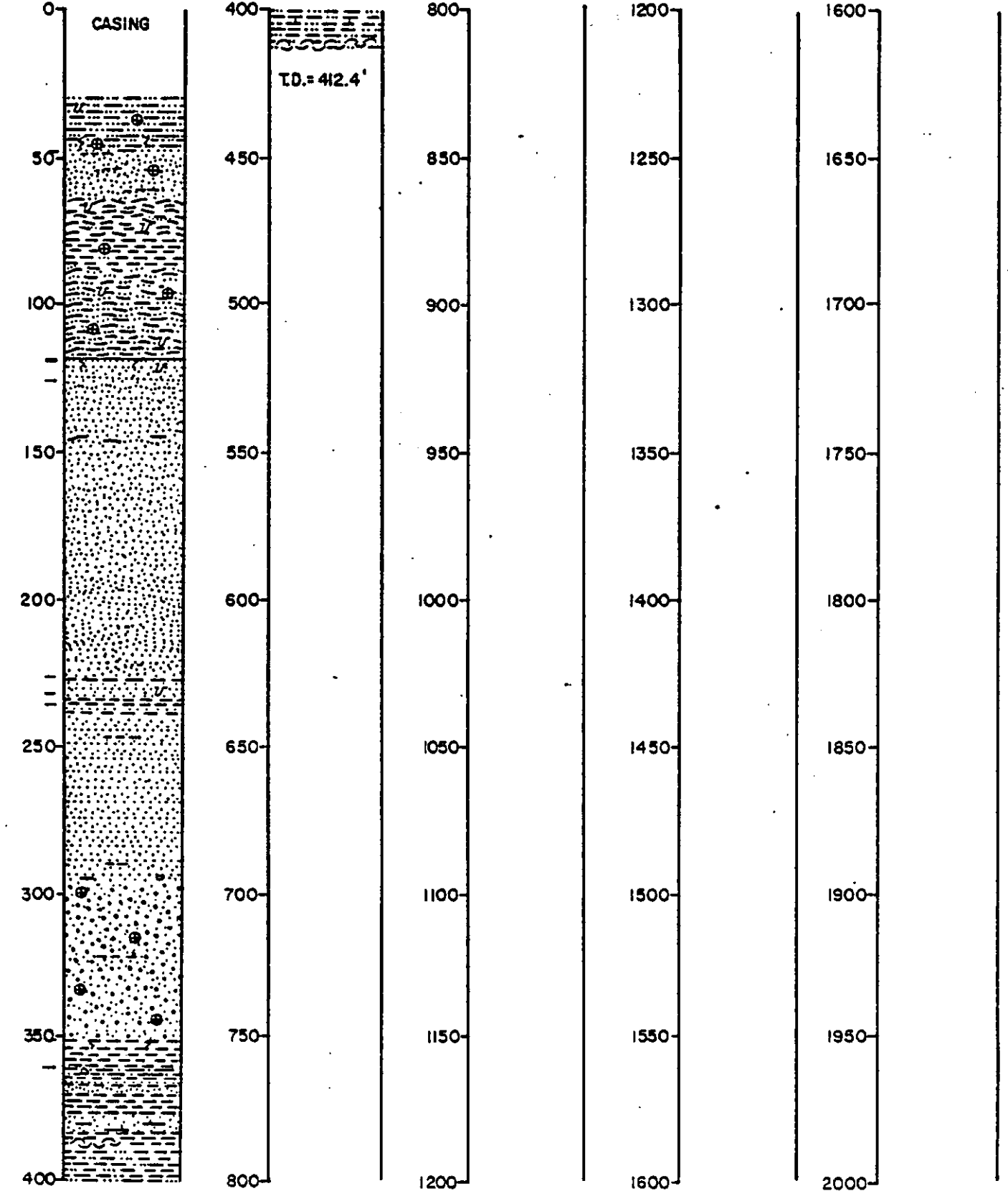


DRILL HOLE STRIP LOG

Hole No. R-1

Elevation: 811 feet

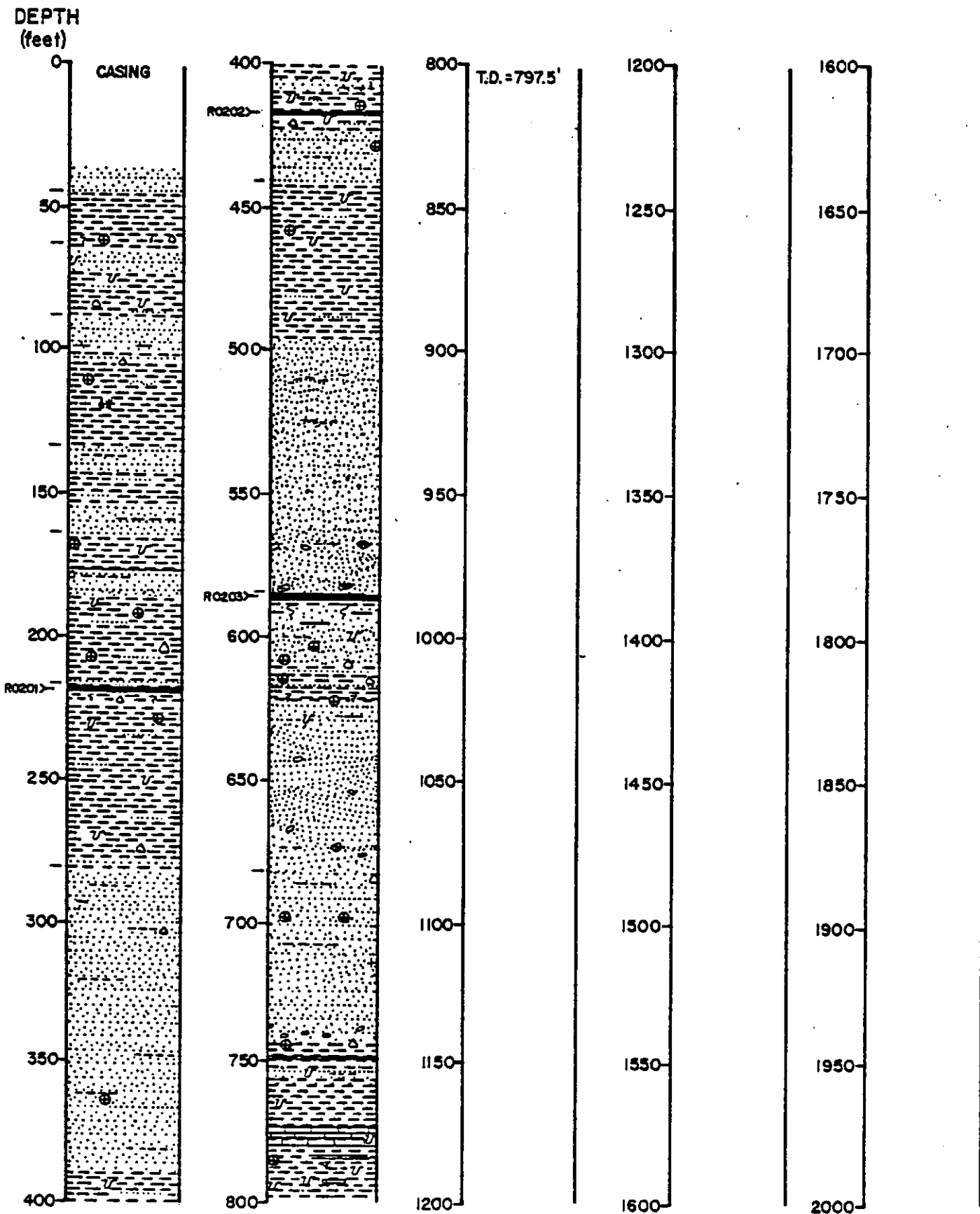
DEPTH
(feet)



DRILL HOLE STRIP LOG

Hole No. R-2

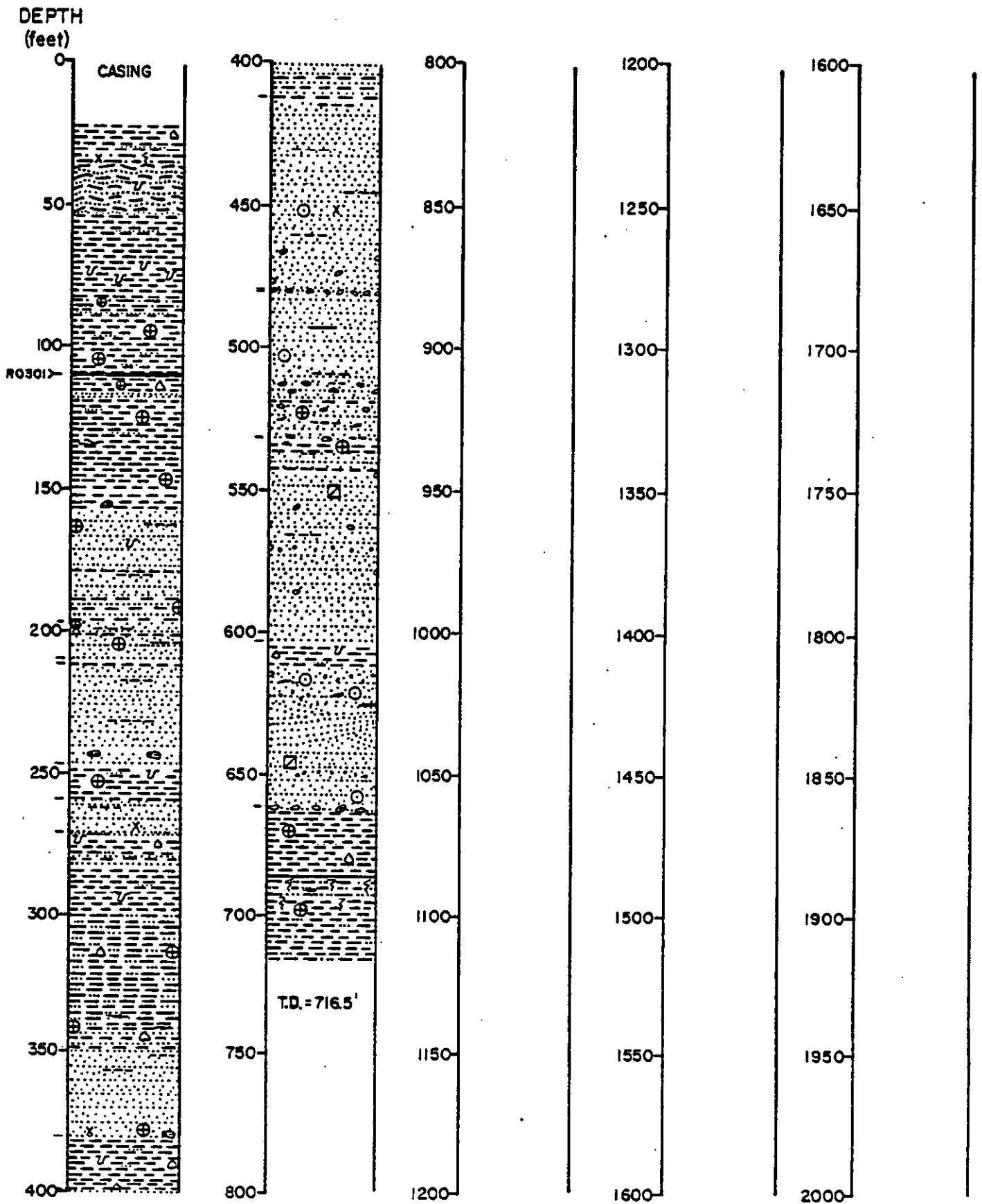
Elevation: 1072 feet



DRILL HOLE STRIP LOG

Hole No. R-3

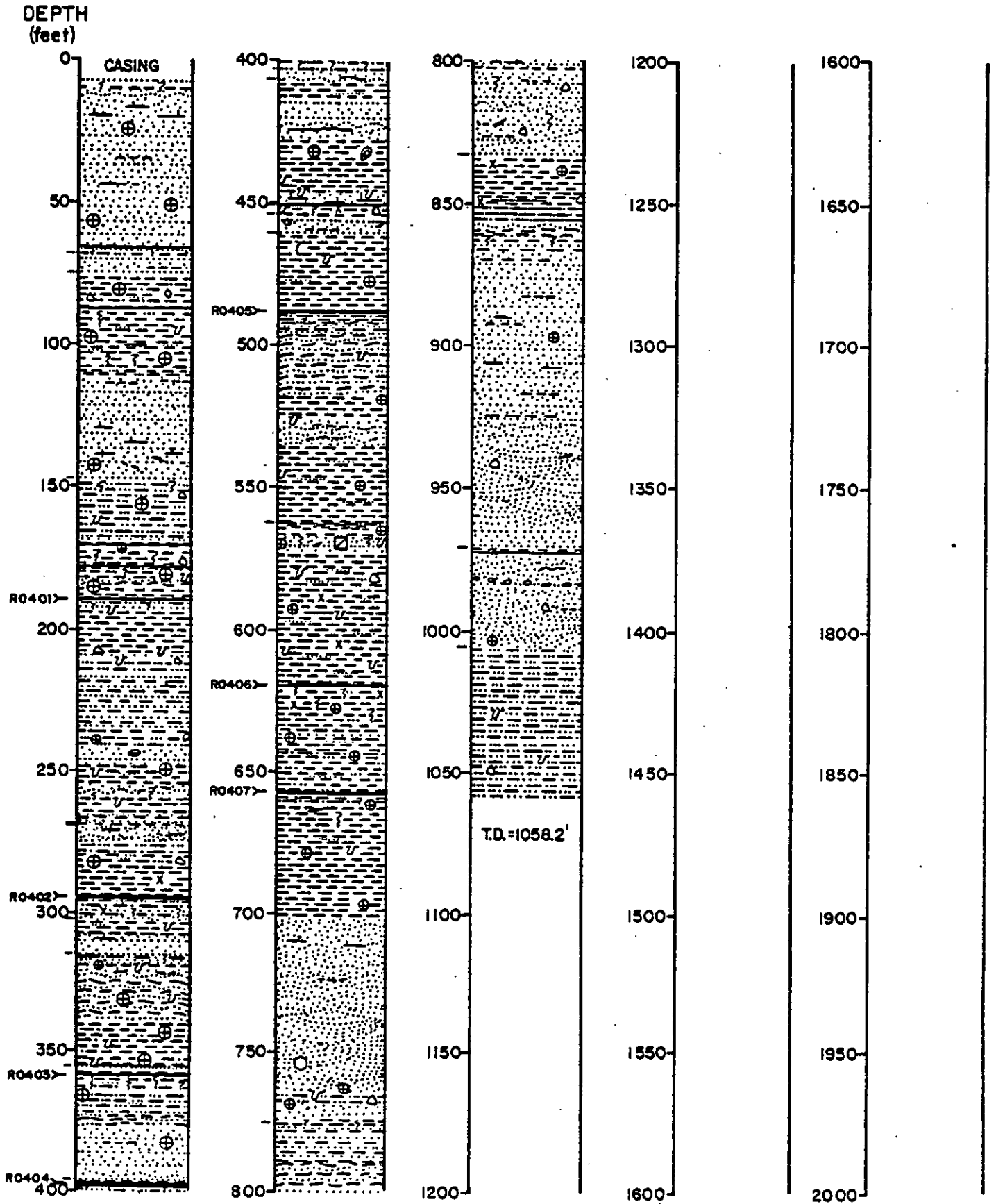
Elevation: 841 feet



DRILL HOLE STRIP LOG

Hole No. R-4

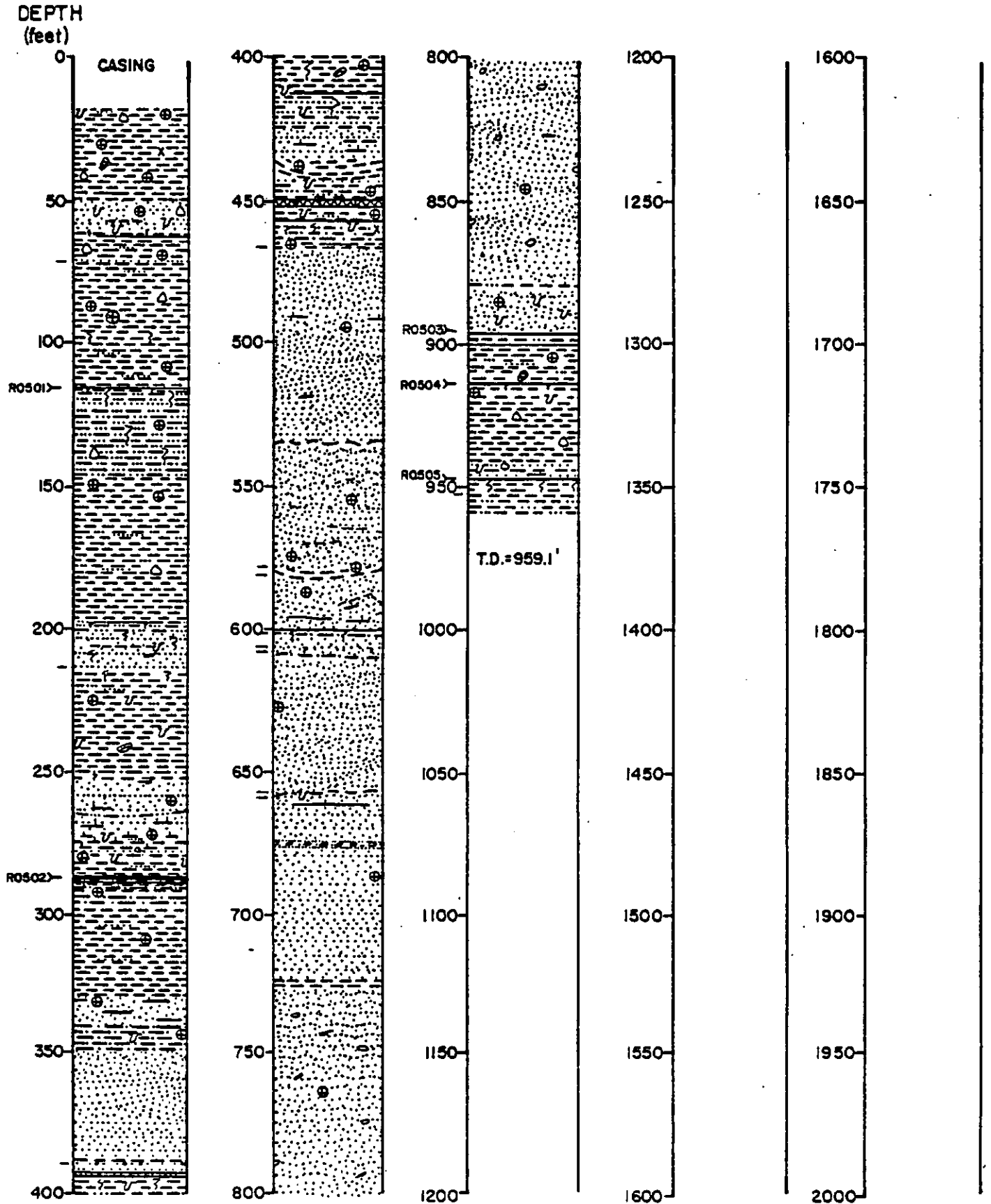
Elevation: 1267 feet



DRILL HOLE STRIP LOG

Hole No. R-5

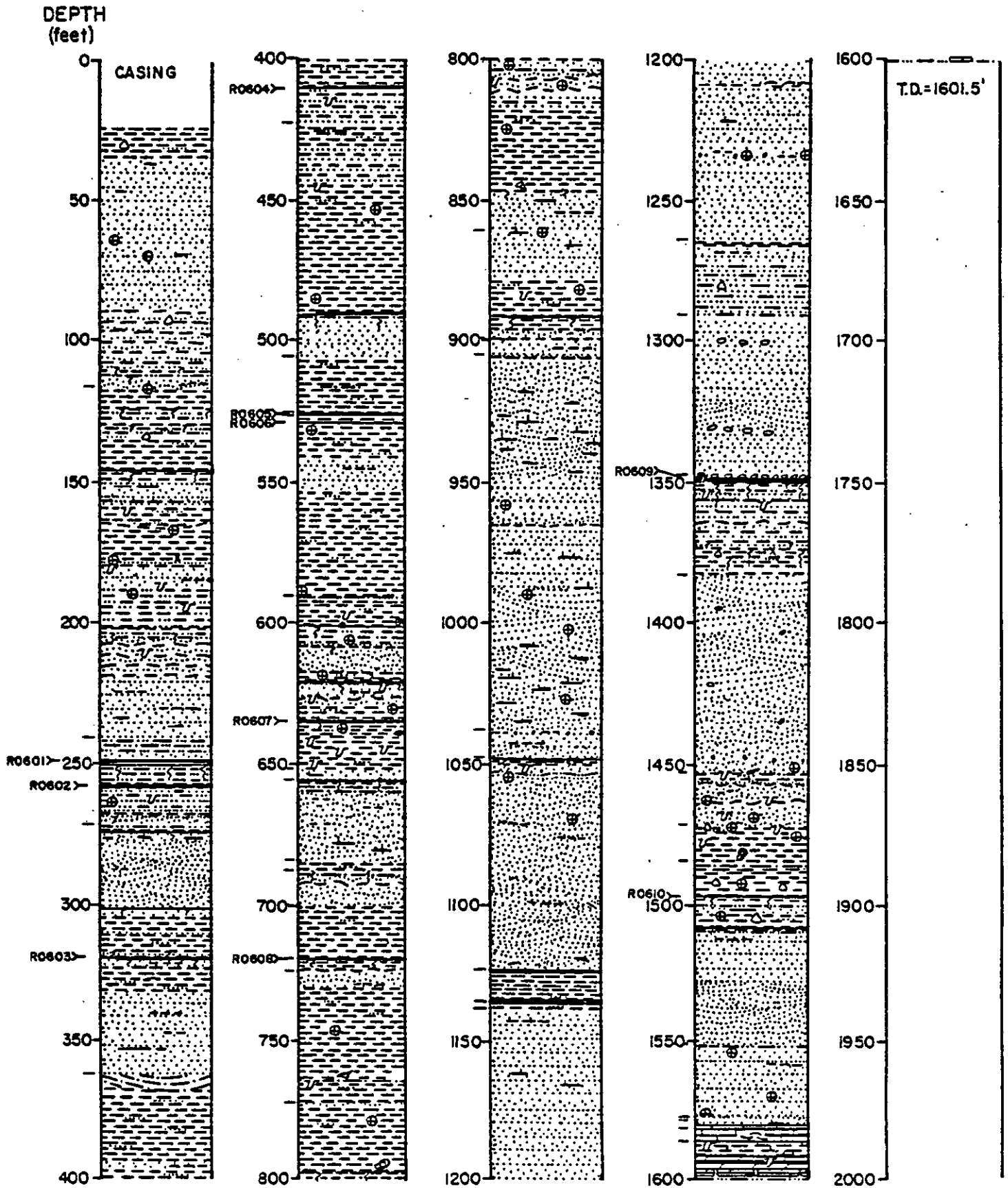
Elevation: 870 feet



DRILL HOLE STRIP LOG

Hole No. R-6

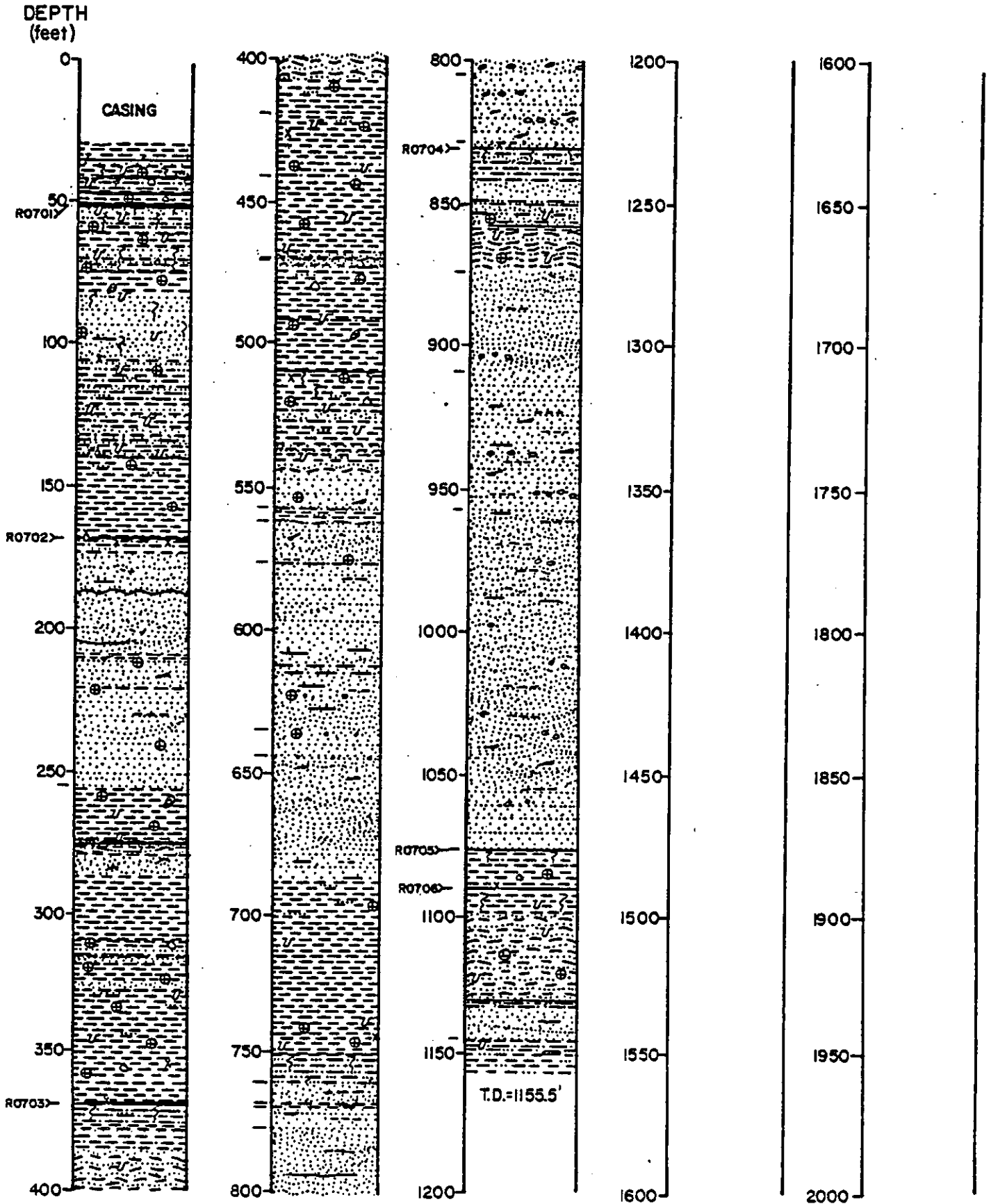
Elevation: 1422 feet



DRILL HOLE STRIP LOG

Hole No. R-7

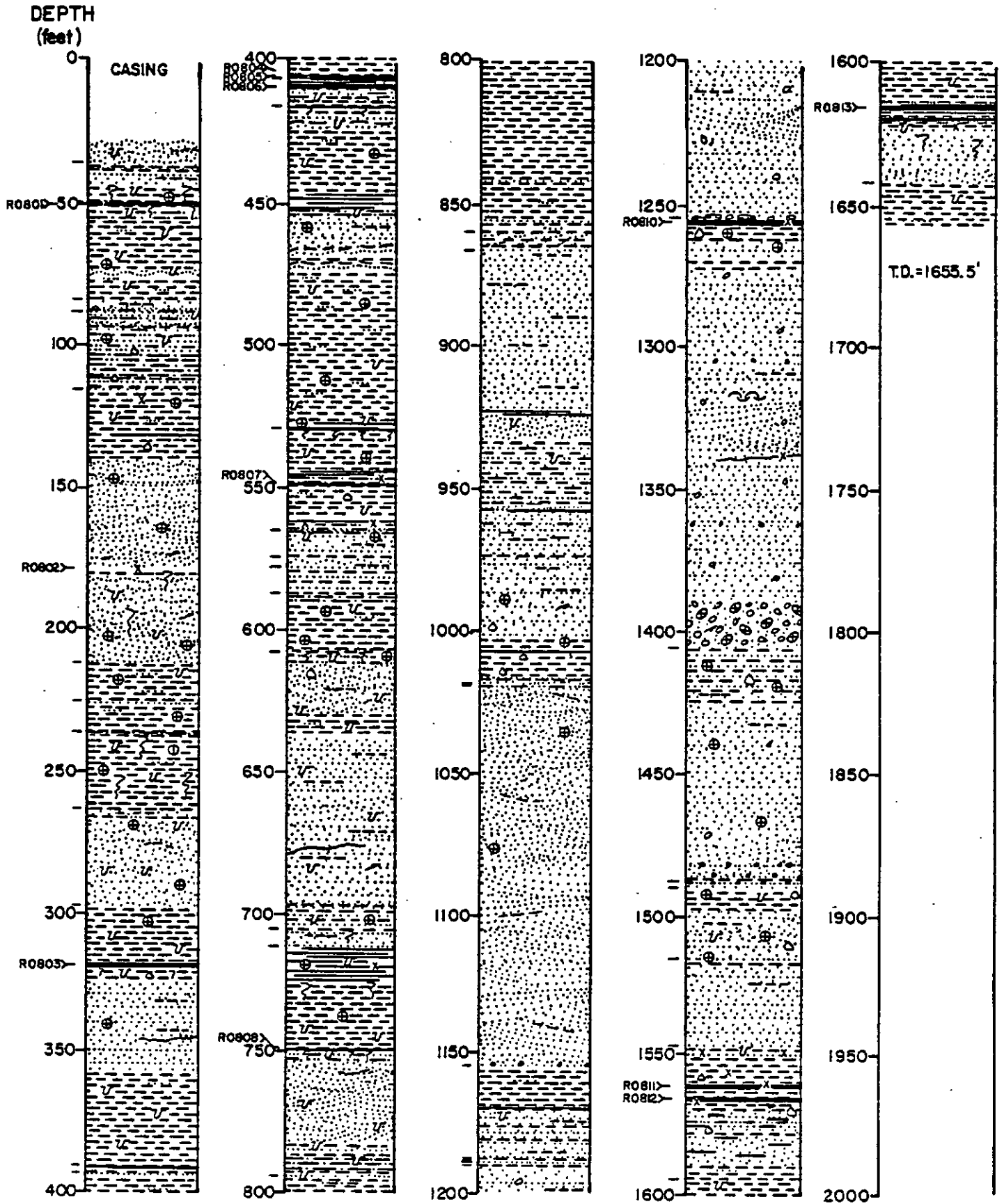
Elevation: 1068 feet



DRILL HOLE STRIP LOG

Hole No. R-8

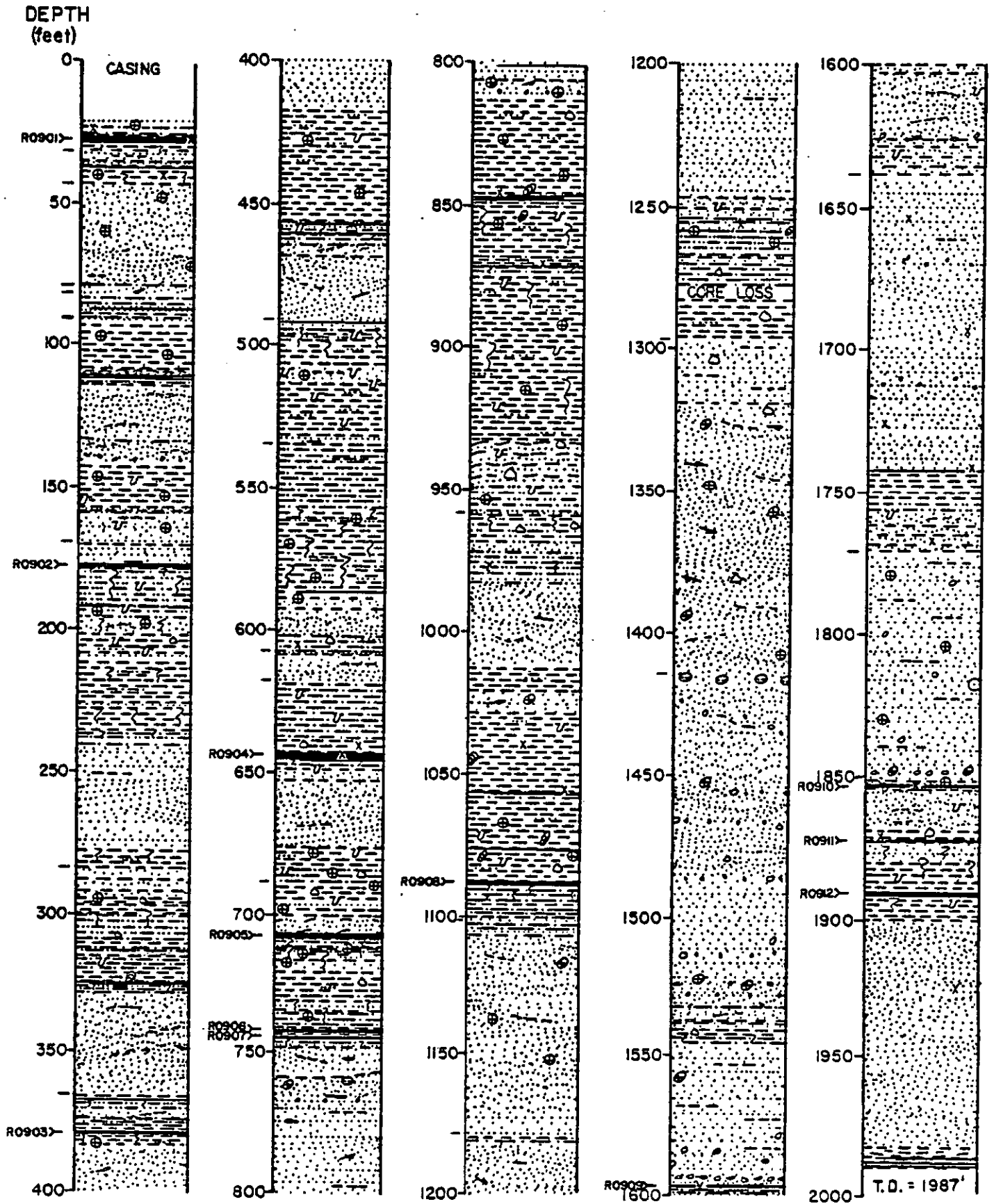
Elevation: 1257 feet



DRILL HOLE STRIP LOG

Hole No. R-9

Elevation: 1987.7 feet



ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY
 [Hole locations and sample depths given in core descriptions and lithologic logs. All analyses in percent,
 except for heating values, ash temperatures, and free swelling index.]

Hole No.	<u>D-1</u>		<u>D-2</u>		<u>D-3</u>	
Sample No.	D101	D102	D201	D301	D302	D303
Coal Thickness (ft.).....	1.1	1.8	0.9	0.76	1.06	0.7
Proximate Analysis (as received)						
Moisture	8.5	7.1	5.26	4.9	3.2	4.05
Volatile Matter	33.1	36.1	37.93	38.4	38.6	40.18
Fixed Carbon	51.9	45.6	54.44	49.5	49.7	49.30
Ash	6.5	11.2	2.37	7.2	8.5	6.47
Ultimate Analysis (as received)						
Hydrogen	5.5	5.3	5.79	5.6	5.3	5.55
Carbon	68.8	66.6	77.27	72.3	71.0	73.64
Nitrogen	1.2	1.3	1.42	1.5	1.5	1.25
Sulfur	3.9	1.3	.86	3.2	5.6	4.09
Oxygen (indirect)	14.0	14.3	12.29	10.3	8.0	8.99
Ash	6.5	11.2	2.37	7.2	8.5	6.47
Heating Value (as received)						
Btu per lb.	12,425	11,911	13,766	13,159	12,973	13,418
Ash (°F)						
Initial Deformation	1,830	2,745	2,000	1,905	1,970	2,020
Softening temperature	1,900	2,835	2,090	1,985	2,065	2,110
Fluid temperature	1,985	2,910	2,180	2,055	2,145	2,200
Sulfur Forms (as received)						
sulfate	0.01	0.01	0.01	0.01	0.15	0.01
pyritic	3.54	0.91	0.28	2.98	5.09	3.02
organic	0.40	0.39	0.57	0.19	0.40	1.05
Free Swelling Index	2.5	2.5	3.5	4.5	3.5	4.0

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>D-4</u>		<u>D-5</u>			<u>D-6</u>
Sample No.	D401	D501	D502	D503	D601	D602
Coal Thickness (ft.)	0.6	1.1	0.8	0.7	0.8	3.50
Proximate Analysis (as received)						
Moisture	4.3	5.9	6.1	6.3	9.8	2.7
Volatile Matter	35.2	38.2	34.8	28.8	29.1	39.8
Fixed Carbon	40.9	47.5	49.1	43.5	40.3	47.2
Ash	19.6	8.4	10.0	21.4	20.8	10.3
Ultimate Analysis (as received)						
Hydrogen	4.6	5.6	5.4	4.8	5.0	5.5
Carbon	59.7	70.2	69.9	58.7	57.2	71.2
Nitrogen	1.0	1.4	1.2	1.2	1.2	1.3
Sulfur	8.4	2.8	1.4	1.5	0.9	3.1
Oxygen (indirect)	6.7	11.6	12.2	12.4	14.9	8.6
Ash	19.6	8.4	10.0	21.4	20.8	10.3
Heating Value (as received)						
Btu per lb.	10,879	12,756	12,359	10,386	10,154	12,989
Ash (°F)						
Initial Deformation	1,900	1,880	2,470	2,610	2,605	1,960
Softening temperature	1,970	1,960	2,560	2,720	2,730	2,045
Fluid temperature	2,030	2,070	2,650	2,830	2,845	2,125
Sulfur Forms (as received)						
sulfate	0.02	0.01	0.01	0.01	0.01	0.01
pyritic	6.22	2.72	1.18	1.31	0.46	2.51
organic	2.14	0.10	0.17	0.21	0.44	0.61
Free Swelling Index	3.5	2.5	4.5	3.5	2.5	4.5

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ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>D-6</u>			<u>D-7</u>		
Sample No.	D603	D701	D702	D703	D704	D705
Coal Thickness (ft.)	1.3	1.1	1.0	0.6	0.9	0.7
Proximate Analysis (as received)						
Moisture	4.8	4.4	4.2	5.6	3.1	5.4
Volatile Matter	36.8	36.4	41.9	34.8	37.0	31.9
Fixed Carbon	49.5	49.6	48.9	46.2	47.9	10.6
Ash	8.9	9.6	5.0	13.4	12.0	52.1
Ultimate Analysis (as received)						
Hydrogen	5.3	5.2	5.8	5.2	5.2	3.3
Carbon	72.0	69.1	75.4	66.3	70.3	32.2
Nitrogen	1.3	1.6	1.4	1.1	1.2	0.7
Sulfur	0.7	5.8	3.0	4.8	3.0	0.3
Oxygen (indirect)	11.7	8.5	9.4	9.1	8.3	11.3
Ash	8.9	9.6	5.0	13.4	12.0	52.1
Heating Value (as received)						
Btu per lb.	12,632	12,687	13,735	12,048	12,680	5,389
Ash (°F)						
Initial Deformation	1,960	1,860	1,930	1,800	1,850	2,910
Softening temperature	2,035	1,930	2,010	1,870	1,960	2,910
Fluid temperature	2,115	1,980	2,100	1,960	2,040	2,910
Sulfur Forms (as received)						
sulfate	0.01	0.02	0.01	0.01	0.01	0.01
pyritic	0.25	5.72	2.74	4.55	2.65	0.12
organic	0.46	0.08	0.20	0.26	0.34	0.16
Free Swelling Index	5.0	4.5	4.5	4.0	4.5	1.0

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>D-9</u>			<u>D-11</u>		<u>D-13</u>	
Sample No.	D901	D902	D903	D1101	D1301	D1302	
Coal Thickness (ft.)	3.1	1.3	0.4	1.07	1.9	0.6	
Proximate Analysis (as received)							
Moisture	3.5	3.3	2.8	4.9	2.9	3.6	
Volatile Matter	34.4	32.6	28.8	39.6	41.4	39.6	
Fixed Carbon	47.0	44.8	38.6	44.8	45.1	50.6	
Ash	15.1	19.3	29.8	10.7	10.6	6.2	
Ultimate Analysis (as received)							
Hydrogen	5.0	4.8	4.2	5.3	5.4	5.6	
Carbon	66.1	62.5	53.7	68.7	69.9	74.5	
Nitrogen	1.4	1.4	1.2	1.2	1.5	1.7	
Sulfur	3.9	3.5	2.0	4.2	3.5	1.8	
Oxygen (indirect)	8.5	8.5	9.1	9.8	9.1	10.2	
Ash	15.1	19.3	29.8	10.7	10.6	6.2	
Heating Value (as received)							
Btu per lb.	11,916	11,257	9,612	12,506	12,814	13,461	
Ash (°F)							
Initial Deformation	1,960	2,070	2,560	1,865	1,930	1,920	
Softening temperature	2,090	2,170	2,630	1,955	2,000	2,000	
Fluid temperature	2,210	2,290	2,720	2,035	2,080	2,110	
Sulfur Forms (as received)							
sulfate	0.01	0.01	0.01	0.01	0.01	0.00	
pyritic	3.61	3.23	1.48	3.28	2.41	1.26	
organic	0.29	0.27	0.47	0.95	1.04	0.51	
Free Swelling Index	3.5	3.5	3.0	6.0	4.5	4.5	

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>D-13</u>					
Sample No.	D1303	D1304	D1305	D1306	D1307	D1308
Coal Thickness (ft.)	2.0	1.1	2.14	0.9	1.9	0.8
Proximate Analysis (as received)						
Moisture	3.7	3.4	3.77	3.5	3.5	2.9
Volatile Matter	38.8	39.3	38.26	40.0	37.9	41.6
Fixed Carbon	51.3	44.0	53.70	53.9	53.6	48.8
Ash	6.2	13.3	4.27	2.6	5.0	6.7
Ultimate Analysis (as received)						
Hydrogen	5.5	5.2	5.55	5.8	5.6	5.7
Carbon	74.8	67.4	76.66	78.3	76.4	74.6
Nitrogen	1.8	1.5	1.77	1.9	2.0	2.1
Sulfur	2.3	3.6	1.65	1.7	0.8	2.0
Oxygen (indirect)	9.3	8.9	10.10	9.7	10.1	8.8
Ash	6.2	13.3	4.27	2.6	5.0	6.7
Heating Value (as received)						
Btu per lb.	13,472	12,311	13,780	14,111	13,728	13,593
Ash (°F)						
Initial Deformation	1,810	1,880	1,900	2,010	2,030	1,890
Softening temperature	1,900	2,030	2,010	2,100	2,110	2,000
Fluid temperature	1,990	2,120	2,080	2,230	2,220	2,120
Sulfur Forms (as received)						
sulfate	0.01	0.01	0.01	0.01	0.01	0.01
pyritic	2.01	3.00	1.44	1.31	0.13	1.56
organic	0.30	0.59	0.20	0.38	0.66	0.41
Free-Swelling Index	3.5	4.5	7.0	5.0	3.5	4.5

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>D-13</u>	
Sample No.	D1309	D1310
Coal Thickness (ft.)	1.3	0.6
Proximate Analysis (as received)		
Moisture	2.7	1.9
Volatile Matter	39.1	29.1
Fixed Carbon	51.7	42.8
Ash	6.5	26.2
Ultimate Analysis (as received)		
Hydrogen	5.6	4.3
Carbon	76.3	59.8
Nitrogen	1.8	1.1
Sulfur	0.7	0.7
Oxygen (indirect)	9.1	7.8
Ash	6.5	26.2
Heating Value (as received)		
Btu per lb.	13,703	10,528
Ash (°F)		
Initial Deformation	2,840	2,910
Softening temperature	2,910	2,910
Fluid temperature	2,910	2,910
Sulfur Forms (as received)		
sulfate	0.01	0.01
pyritic	0.11	0.22
organic	0.57	0.48
Free Swelling Index	6.0	3.5

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>R-2</u>			<u>R-3</u>		<u>R-4</u>	
Sample No.	R201	R202	R203	R301	R401	R402	
Coal Thickness (ft.)	1.95	1.05	2.73	1.5	1.0	1.4	
Proximate Analysis (as received)							
Moisture	1.9	2.8	2.2	2.8	5.3	2.7	
Volatile Matter	35.6	38.2	35.7	36.5	39.5	38.0	
Fixed Carbon	56.7	52.2	45.7	55.8	50.4	54.0	
Ash	5.8	6.8	16.4	4.9	4.8	5.3	
Ultimate Analysis (as received)							
Hydrogen	5.4	5.5	4.9	5.5	5.7	5.5	
Carbon	78.7	76.4	65.4	78.6	75.4	76.7	
Nitrogen	1.7	1.5	1.3	1.7	1.5	1.5	
Sulfur	0.9	2.1	6.7	0.6	2.5	3.4	
Oxygen (indirect)	7.5	7.6	5.4	8.6	10.0	7.6	
Ash	5.8	6.8	16.4	4.9	4.8	5.3	
Heating Value (as received)							
Btu per lb.	14,077	13,847	12,118	14,081	13,670	13,939	
Ash (°F)							
Initial Deformation	2,720	1,900	2,000	2,710	1,970	1,960	
Softening temperature	2,790	1,990	2,090	2,800	2,060	2,070	
Fluid temperature	2,880	2,090	2,180	2,880	2,150	2,170	
Sulfur Forms (as received)							
sulfate	0.01	0.02	0.02	0.01	0.02	0.01	
pyritic	0.23	1.71	5.43	0.05	1.82	2.56	
organic	0.64	0.40	1.23	0.57	0.65	0.85	
Free Swelling Index	8.0	8.0	6.5	8.0	6.5	6.5	

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>R-4</u>					<u>R-5</u>
Sample No.	R403	R404	R405	R406	R407	R501
Coal Thickness (ft.)	0.62	1.6	0.83	0.94	0.7	0.9
Proximate Analysis (as received)						
Moisture	1.9	2.7	2.4	3.0	3.3	2.02
Volatile Matter	40.4	38.0	40.7	38.3	37.8	40.25
Fixed Carbon	45.4	52.6	50.2	53.1	53.1	50.03
Ash	12.3	6.7	6.7	5.6	5.8	7.70
Ultimate Analysis (as received)						
Hydrogen	5.3	5.4	5.7	5.5	5.6	5.51
Carbon	70.2	75.8	75.3	76.4	76.9	74.34
Nitrogen	1.6	1.7	1.6	1.7	1.5	1.43
Sulfur	3.6	2.2	4.0	3.3	2.5	5.29
Oxygen (indirect)	7.0	8.2	6.7	7.3	7.7	5.73
Ash	12.3	6.7	6.7	5.6	5.8	7.70
Heating Value (as received)						
Btu per lb.	12,996	13,737	13,883	13,926	13,896	13,682
Ash (°F)						
Initial Deformation	1,900	2,010	1,870	2,080	1,850	2,050
Softening temperature	2,010	2,100	1,980	2,170	1,950	2,160
Fluid temperature	2,080	2,160	2,080	2,240	2,030	2,240
Sulfur Forms (as received)						
sulfate	0.02	0.02	0.02	0.01	0.02	0.02
pyritic	2.49	1.43	2.89	2.82	1.85	4.87
organic	1.07	0.74	1.08	0.51	0.63	0.41
Free Swelling Index	6.0	6.0	6.0	6.5	8.0	5.0

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>R-5</u>				<u>R-6</u>	
Sample No.	R502	R503	R504	R505	R601	R602
Coal Thickness (ft.)	2.41	0.5	0.9	0.86	1.78	1.2
Proximate Analysis (as received)						
Moisture	1.85	1.33	1.39	1.85	2.82	3.86
Volatile Matter	38.84	39.54	39.87	34.92	38.25	42.17
Fixed Carbon	51.31	48.83	48.34	43.94	48.53	49.57
Ash	8.00	10.30	10.40	19.29	10.40	4.38
Ultimate Analysis (as received)						
Hydrogen	5.46	5.39	5.29	4.82	5.46	5.80
Carbon	75.19	73.57	74.34	64.53	71.95	76.01
Nitrogen	1.56	1.31	1.22	1.08	1.58	1.73
Sulfur	3.35	5.36	3.16	3.84	1.50	1.96
Oxygen (indirect)	6.45	4.07	5.60	6.44	9.11	10.11
Ash	8.00	10.30	10.40	19.29	10.40	4.38
Heating Value (as received)						
Btu per lb.	13,744	13,558	13,463	11,791	12,976	13,815
Ash (°F)						
Initial Deformation	1,920	1,970	1,900	2,310	2,410	1,870
Softening temperature	2,030	2,050	2,010	2,400	2,500	1,960
Fluid temperature	2,120	2,170	2,100	2,510	2,590	2,060
Sulfur Forms (as received)						
sulfate	0.01	0.02	0.01	0.01	0.01	0.00
pyritic	2.97	4.59	2.63	3.21	1.08	1.25
organic	0.36	0.75	0.52	0.62	0.41	0.71
Free Swelling Index	5.0	5.0	5.0	5.5	4.5	4.5

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>R-6</u>						
Sample No.	R603	R604	R605	R606	R607	R608	R609
Coal Thickness (ft.)	0.8	0.85	1.1	0.65	1.39	1.0	2.67
Proximate Analysis (as received)							
Moisture	2.19	4.90	2.15	3.83	3.42	2.65	2.4
Volatile Matter	39.12	37.06	40.94	36.92	36.68	42.53	34.5
Fixed Carbon	52.95	54.24	48.30	51.67	56.65	49.88	50.4
Ash	5.74	3.80	8.61	7.58	3.25	4.94	12.7
Ultimate Analysis (as received)							
Hydrogen	5.53	5.72	5.56	5.37	5.58	5.85	5.1
Carbon	77.94	76.33	72.23	75.10	78.85	76.76	70.1
Nitrogen	1.59	1.77	1.59	1.60	1.77	1.71	1.4
Sulfur	0.73	0.69	3.96	0.93	0.66	3.18	4.1
Oxygen (indirect)	8.47	11.69	7.04	9.42	9.90	7.57	6.6
Ash	5.74	3.80	8.61	7.58	3.25	4.94	12.7
Heating Value (as received)							
Btu per lb.	13,971	13,765	13,509	13,389	14,124	14,049	12,742
Ash (°F)							
Initial Deformation	2,910	2,910	1,820	2,680	2,640	1,860	1,840
Softening temperature	2,910	2,910	1,940	2,770	2,760	2,020	1,940
Fluid temperature	2,910	2,910	2,070	2,870	2,840	2,090	2,030
Sulfur Forms (as received)							
sulfate	0.01	0.01	0.01	0.01	0.01	0.01	0.02
pyritic	0.07	0.04	2.30	0.14	0.04	2.64	3.17
organic	0.65	0.64	1.64	0.79	0.61	0.54	0.91
Free Swelling Index	4.5	6.0	4.5	5.5	7.0	5.5	5.0

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>R-6</u>			<u>R-7</u>			
Sample No.	R610	R701	R702	R703	R704	R705	R706
Coal Thickness (ft.)	0.62	1.1	0.6	0.8	1.1	0.58	0.69
Proximate Analysis (as received)							
Moisture	1.8	3.1	1.7	2.6	2.02	2.9	2.2
Volatile Matter	33.6	39.9	48.5	39.3	37.88	38.4	39.6
Fixed Carbon	47.1	51.1	44.4	50.6	47.05	49.7	51.1
Ash	17.5	5.9	5.4	7.5	13.05	9.0	7.1
Ultimate Analysis (as received)							
Hydrogen	4.8	5.5	6.0	5.3	5.10	5.3	5.5
Carbon	65.6	74.9	75.5	73.2	68.99	73.8	75.4
Nitrogen	1.3	1.8	1.8	1.6	1.47	1.1	1.4
Sulfur	6.1	3.1	4.2	5.0	5.88	4.5	4.2
Oxygen (indirect)	4.8	8.8	7.0	7.3	5.52	6.2	6.5
Ash	17.5	5.9	5.4	7.5	13.05	9.0	7.1
Heating Value (as received)							
Btu per lb.	12,139	13,633	14,174	13,493	12,734	13,449	13,787
Ash (°F)							
Initial Deformation	1,820	1,950	2,230	2,240	1,820	1,830	2,100
Softening temperature	1,940	2,060	2,320	2,330	1,940	1,950	2,200
Fluid temperature	2,030	2,150	2,400	2,410	2,050	2,050	2,280
Sulfur Forms (as received)							
sulfate	0.02	0.01	0.01	0.01	0.01	0.01	0.02
pyritic	4.77	1.65	3.78	2.59	3.73	4.30	3.53
organic	1.27	1.41	0.46	2.45	2.14	0.22	0.65
Free Swelling Index	2.5	3.0	3.0	5.0	5.5	5.0	5.0

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>R-8</u>						
Sample No.	R801	R802	R803	R804	R805	R806	R807
Coal Thickness (ft.)	1.3	1.9	1.6	0.6	0.6	1.0	0.7
Proximate Analysis (as received)							
Moisture	2.1	3.6	1.6	2.3	1.9	2.2	1.4
Volatile Matter	39.1	40.4	38.5	37.7	33.8	38.9	42.1
Fixed Carbon	52.4	43.4	48.1	55.5	47.8	55.8	47.9
Ash	6.4	12.6	11.8	4.5	16.5	3.1	8.6
Ultimate Analysis (as received)							
Hydrogen	5.5	5.3	5.1	5.4	4.6	5.6	5.5
Carbon	76.1	68.8	71.2	77.3	64.2	78.9	73.3
Nitrogen	1.7	1.4	1.3	1.6	1.4	1.7	1.4
Sulfur	1.0	2.7	3.8	1.0	6.6	1.2	4.2
Oxygen (indirect)	9.2	9.2	6.7	10.2	6.7	9.6	6.9
Ash	6.4	12.6	11.8	4.5	16.5	3.1	8.6
Heating Value (as received)							
Btu per lb.	13,816	12,656	12,962	14,052	11,989	14,321	13,627
Ash (°F)							
Initial Deformation	2,910	2,090	2,300	2,910	2,110	2,200	2,000
Softening temperature	2,910	2,140	2,350	2,910	2,170	2,250	2,050
Fluid temperature	2,910	2,240	2,520	2,910	2,220	2,300	2,100
Sulfur Forms (as received)							
sulfate	0.01	0.01	0.03	0.02	0.05	0.01	0.01
pyritic	0.30	1.84	2.64	0.22	5.17	0.30	3.00
organic	0.74	0.84	1.14	0.80	1.33	0.87	1.18
Free Swelling Index	6.0	4.5	5.0	6.0	6.0	5.0	6.0

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>R-8</u>					
Sample No.	R808	R809	R810	R811	R812	R813
Coal Thickness (ft.)	0.7	0.5	2.5	1.8	1.1	1.5
Proximate Analysis (as received)						
Moisture	1.1	1.6	1.2	1.2	1.4	1.9
Volatile Matter	41.7	36.4	37.1	39.3	33.7	29.7
Fixed Carbon	47.7	54.1	47.8	49.7	36.1	58.8
Ash	9.5	7.9	13.9	9.8	28.8	9.6
Ultimate Analysis (as received)						
Hydrogen	5.4	5.2	5.1	5.5	3.4	4.8
Carbon	72.1	76.7	69.7	74.4	55.1	76.6
Nitrogen	1.5	1.4	1.4	1.3	0.9	1.2
Sulfur	6.4	1.4	4.4	3.6	1.2	0.6
Oxygen (indirect)	5.1	7.4	5.5	5.5	10.6	7.2
Ash	9.5	7.9	13.9	9.8	28.8	9.6
Heating Value (as received)						
Btu per lb.	13,499	13,788	12,865	13,634	9,017	13,424
Ash (°F)						
Initial Deformation	1,970	2,910	1,960	1,900	2,690	2,490
Softening temperature	2,020	2,910	2,040	2,000	2,780	2,590
Fluid temperature	2,070	2,910	2,160	2,120	2,870	2,650
Sulfur Forms (as received)						
sulfate	0.03	0.02	0.01	0.01	0.00	0.01
pyritic	4.73	0.58	4.20	2.50	0.78	0.45
organic	1.62	0.80	0.21	1.05	0.39	0.16
Free Swelling Index	6.5	7.5	5.5	5.5	7.0	8.0

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>R-9</u>					
Sample No.	R901	R902	R903	R904	R905	R906
Coal Thickness (ft.)	3.0	1.7	1.0	2.4	1.6	1.1
Proximate Analysis (as received)						
Moisture	2.0	1.7	1.9	1.1	2.2	2.1
Volatile Matter	33.1	44.2	39.9	38.3	38.6	39.0
Fixed Carbon	45.7	45.0	50.6	47.8	55.7	56.7
Ash	19.2	9.1	7.6	12.8	3.5	2.2
Ultimate Analysis (as received)						
Hydrogen	4.6	5.4	5.4	5.1	5.5	5.7
Carbon	64.5	72.4	75.5	71.0	80.1	80.7
Nitrogen	1.3	1.4	1.6	1.2	1.6	1.8
Sulfur	1.8	3.6	1.9	4.0	0.8	1.1
Oxygen (indirect)	8.6	8.0	7.9	5.9	8.5	8.6
Ash	19.2	9.1	7.6	12.8	3.5	2.2
Heating Value (as received)						
Btu per lb.	11,598	13,398	13,662	13,017	14,318	14,550
Ash (°F)						
Initial Deformation	2,910	2,140	2,910	2,020	2,490	2,050
Softening temperature	2,910	2,190	2,910	2,080	2,550	2,100
Fluid temperature	2,910	2,240	2,910	2,140	2,910	2,150
Sulfur Forms (as received)						
sulfate	0.02	0.02	0.01	0.01	0.01	0.00
pyritic	0.89	2.47	0.75	2.77	0.09	0.30
organic	0.87	1.07	1.15	1.26	0.71	0.80
Free Swelling Index	5.0	5.0	6.5	5.5	7.0	5.0

ANALYSES OF COAL FROM DRILL HOLES IN THE DANIEL BOONE NATIONAL FOREST, EASTERN KENTUCKY--cont'd.

Hole No.	<u>R-9</u>					
Sample No.	R907	R908	R909	R910	R911	R912
Coal Thickness (ft.)	1.0	2.6	1.9	1.1	0.7	1.0
Proximate Analysis (as received)						
Moisture	2.0	2.2	1.1	1.2	1.1	0.9
Volatile Matter	34.9	38.1	34.9	34.5	37.0	30.4
Fixed Carbon	48.7	54.8	44.9	44.9	48.4	60.4
Ash	14.4	4.9	19.1	19.4	13.5	8.3
Ultimate Analysis (as received)						
Hydrogen	5.1	5.6	4.8	4.8	5.0	5.4
Carbon	69.3	78.2	65.0	66.0	68.9	76.5
Nitrogen	1.5	1.7	1.2	1.0	1.2	1.2
Sulfur	0.8	1.2	5.2	3.7	8.9	4.5
Oxygen (indirect)	9.0	8.4	4.8	5.0	2.6	4.1
Ash	14.4	4.9	19.1	19.4	13.5	8.3
Heating Value (as received)						
Btu per lb.	12,549	14,139	12,043	12,004	12,939	14,028
Ash (°F)						
Initial Deformation	2,910	2,350	1,940	2,040	2,230	2,020
Softening temperature	2,910	2,400	2,030	2,150	2,320	2,130
Fluid temperature	2,910	2,602	2,120	2,250	2,440	2,240
Sulfur Forms (as received)						
sulfate	0.01	0.01	0.01	0.01	0.02	0.01
pyritic	0.16	0.34	3.65	3.16	7.62	4.29
organic	0.65	0.85	1.53	0.54	1.23	0.18
Free Swelling Index	5.0	7.0	4.5	4.0	5.0	5.0