UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

TEST DRILLING FOR COAL IN 1982-83 IN THE JEFFERSON NATIONAL FOREST, VIRGINIA

Part 3: Lithologic descriptions and geophysical logs of coreholes in the Valley coal fields, Bland, Botetourt, Montgomery, Pulaski, Smyth, and Wythe Counties, Virginia

By

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U.S. Geological Survey

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U.S. Bureau of Land Management

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Introduction

Coreholes were drilled at 21 sites in the Jefferson National Forest of southwestern Virginia for the U.S. Bureau of Land Management. Drilling was in progress from October, 1982 to February, 1983 to determine the general distribution, thickness, and quality of potentially minable coal on Federal mineral properties in the southwestern Virginia and Valley coal fields (fig. 1). The results of drilling in the southwestern Virginia coal field are presented in Parts 1 (Englund and others, 1983) and 2 (Simon and Englund, 1983a) of this program. The results of drilling in the Valley coal fields are presented in Part 3 (this report) which includes descriptive lithologic data, correlations, and geophysical logs and in Part 4 which includes the analyses of the coal cores (Simon and Englund, 1983b). Coreholes were drilled at eight widely spaced sites in the Valley coal fields along two discontinuous outcrop belts of the coal-bearing Price Formation of Early Mississippian age. Partial redrills were made at three of these sites in attempts to recover additional coal from beds with significant core loss.

Location

Federal mineral properties in the Valley coal fields are located principally in two discontinuous northeast-trending belts: (1) along Brush Mountain in Montgomery and Pulaski Counties and Brushy Mountain in Wythe County with a northeast extension along North Mountain in Botetourt County and a southeasterly extension along Caseknife and Brushy Ridges in Pulaski and Wythe Counties and (2) along Brushy and Little Brushy Mountains in Bland and Smyth Counties (fig. 2). Within these belts, the locations and depths

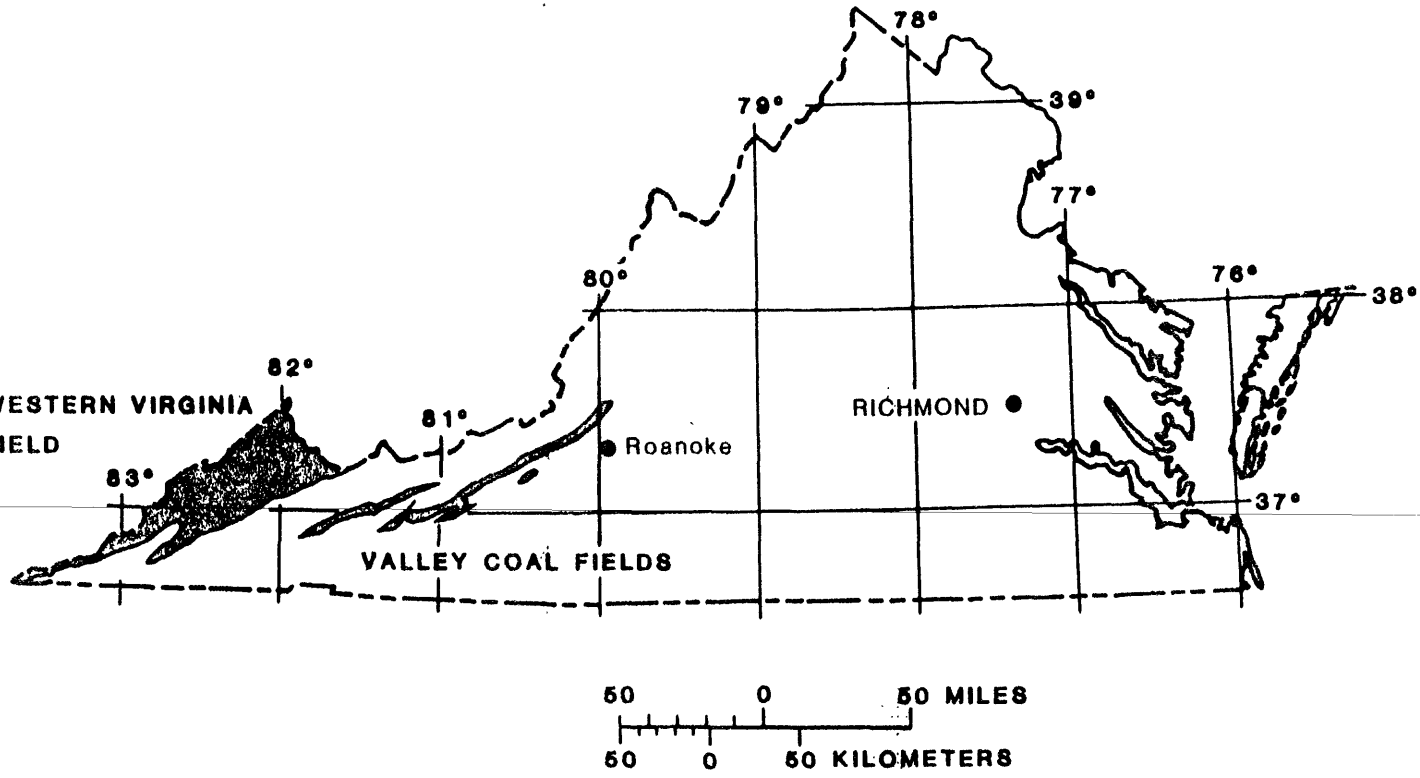


Figure 1. Index map of coal fields in southwestern Virginia

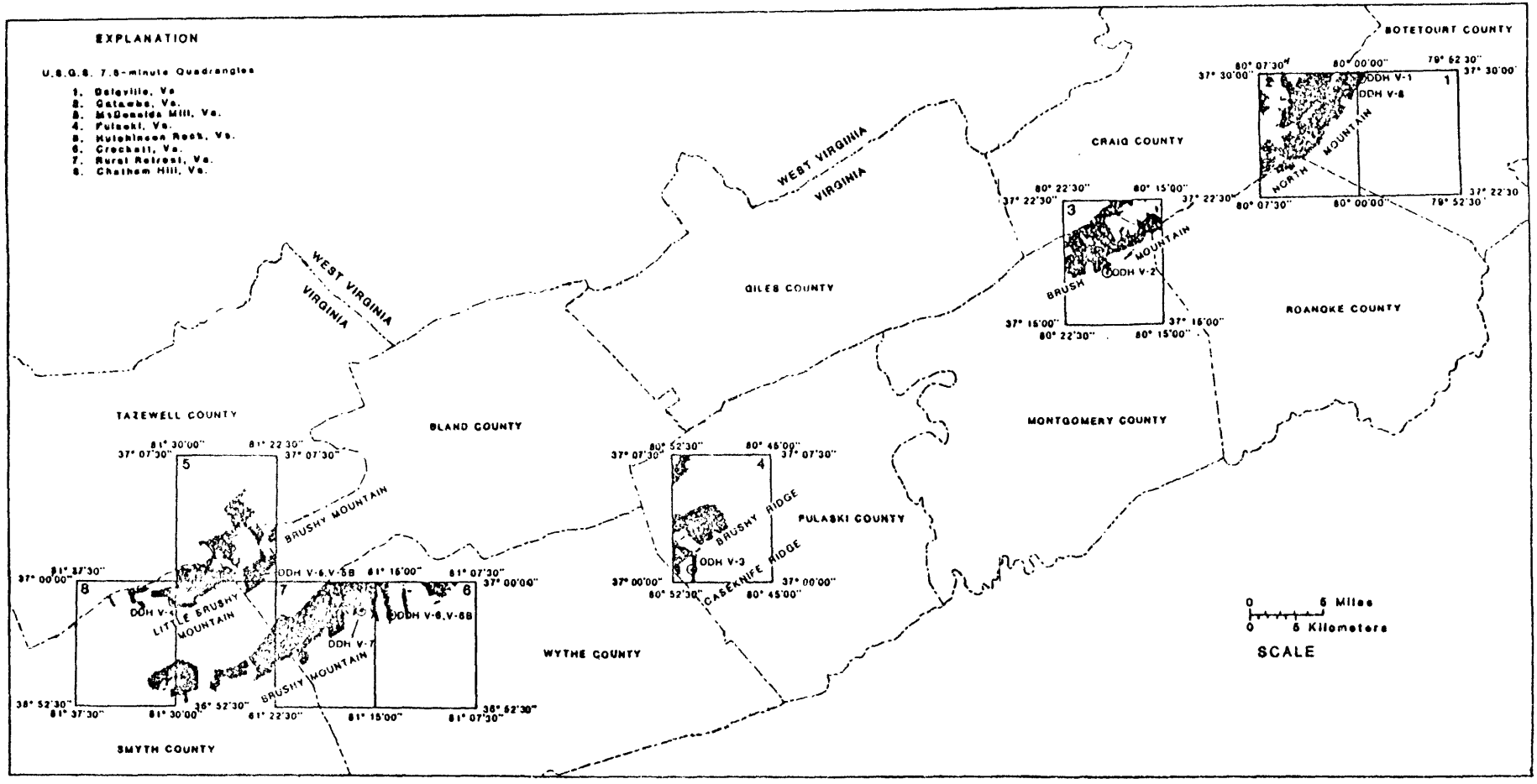


Figure 2. Location of coreholes in the Valley coal fields. Stippled pattern indicates approximate areas of Federal mineral ownership in proximity of drill sites.

of coreholes were chosen to test the coal-bearing Price Formation. Site selection was also based on readily available access and proximity to a source of drilling water.

Previous investigations

The coal-bearing strata of the Valley coal fields were assigned to the Price Formation by Campbell (1894, p. 77). In a later report, Campbell (1925) mapped the Price Formation and described the general geology, geologic structure, and economic geology of coal field areas. Regional geologic investigations by Butts (1933, 1940) and Cooper (1961) also included maps and descriptions of the Price Formation. The most recent reports dealing with the Price Formation include geologic mapping (Bartholomew and Loury, 1979) and a coal-bed methane evaluation (Stanley and Schultz, 1983) in the Blacksburg, Virginia area.

Present investigations

This core drilling program in the Jefferson National Forest was initiated and funded by the U.S. Bureau of Land Management and implemented by the U.S. Geological Survey (USGS). The drilling was contracted to Joy Manufacturing Company of LaPorte, Indiana by the USGS and the geophysical logging was subcontracted to Riley, Mannon, and Sturgeon, Ltd. of Huntington, West Virginia. USGS field personnel were on-site during the drilling to measure, describe, and box the core and to sample the coal cores; X-ray radiographs were used to identify partings in the coal cores prior to analysis. The locations of coreholes and the generalized geology in the vicinity of the drill sites are shown in Figures 3 to 9. A generalized geologic section of the Price Formation and the Maccrady Shale is indicated in Figure 10 and the correlation and drilled interval of each corehole are shown in Figure 11. An explanation for figures 3 to 9 is presented in Figure 12. Upon completion of the core drilling and geophysical logging, the coreholes were cemented and the sites were restored and seeded by the drilling contractor.

Acknowledgements

The cooperation of U.S. Forest Service personnel in the Jefferson National Forest is gratefully acknowledged. Special thanks are due to W.D. Blackburn, J.F. McIntyre, and D. Polick for their aid in the selection, preparation, and restoration of drill sites. The writers also wish to thank their associates in the USGS for assistance during the drilling program, especially: J.O. Maberry, J.M. Back, and P.C. Lyons for describing and sampling drill core, P.L. Johnson for aid in formating core descriptions and R.W. Stanton and T.A. Moore for preparing X-ray radiographs of coal cores. Also, sincere appreciation is extended to private and corporate landowners for information and access provided to the drill sites.

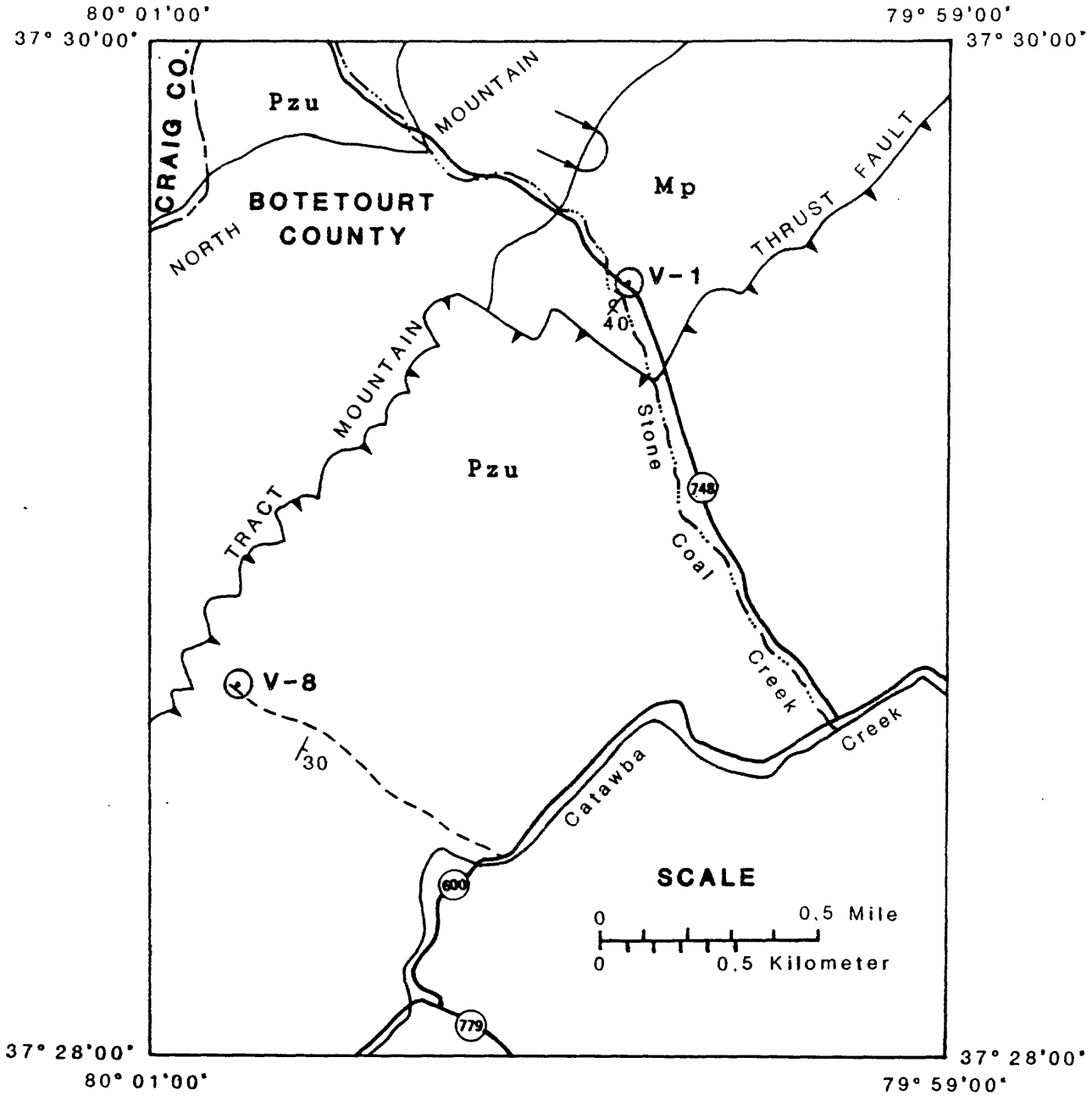


Figure 3. Location of coreholes V-1 and V-8. See Figure 12 for explanation.

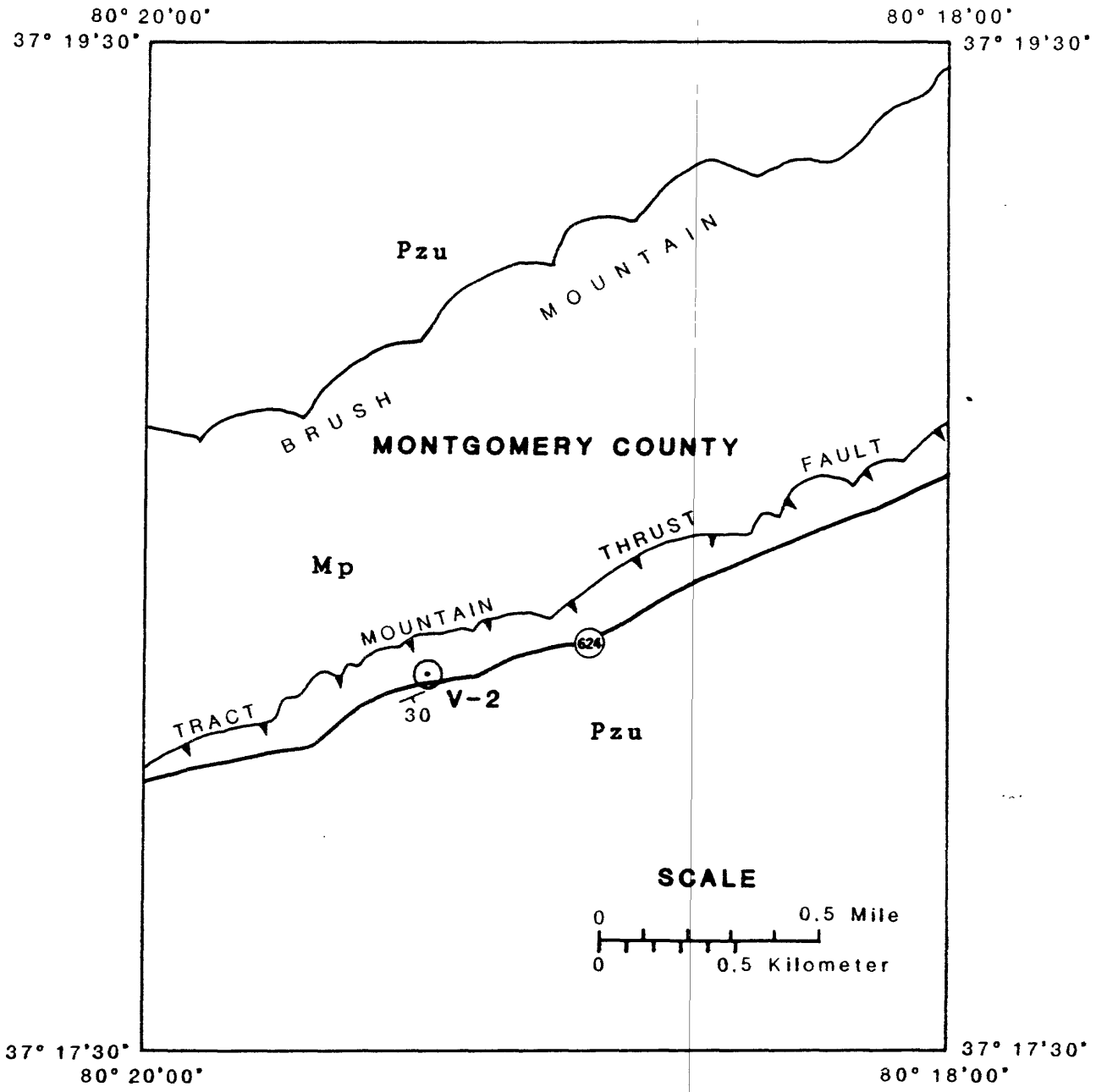


Figure 4. Location of corehole V-2. See Figure 12 for explanation.

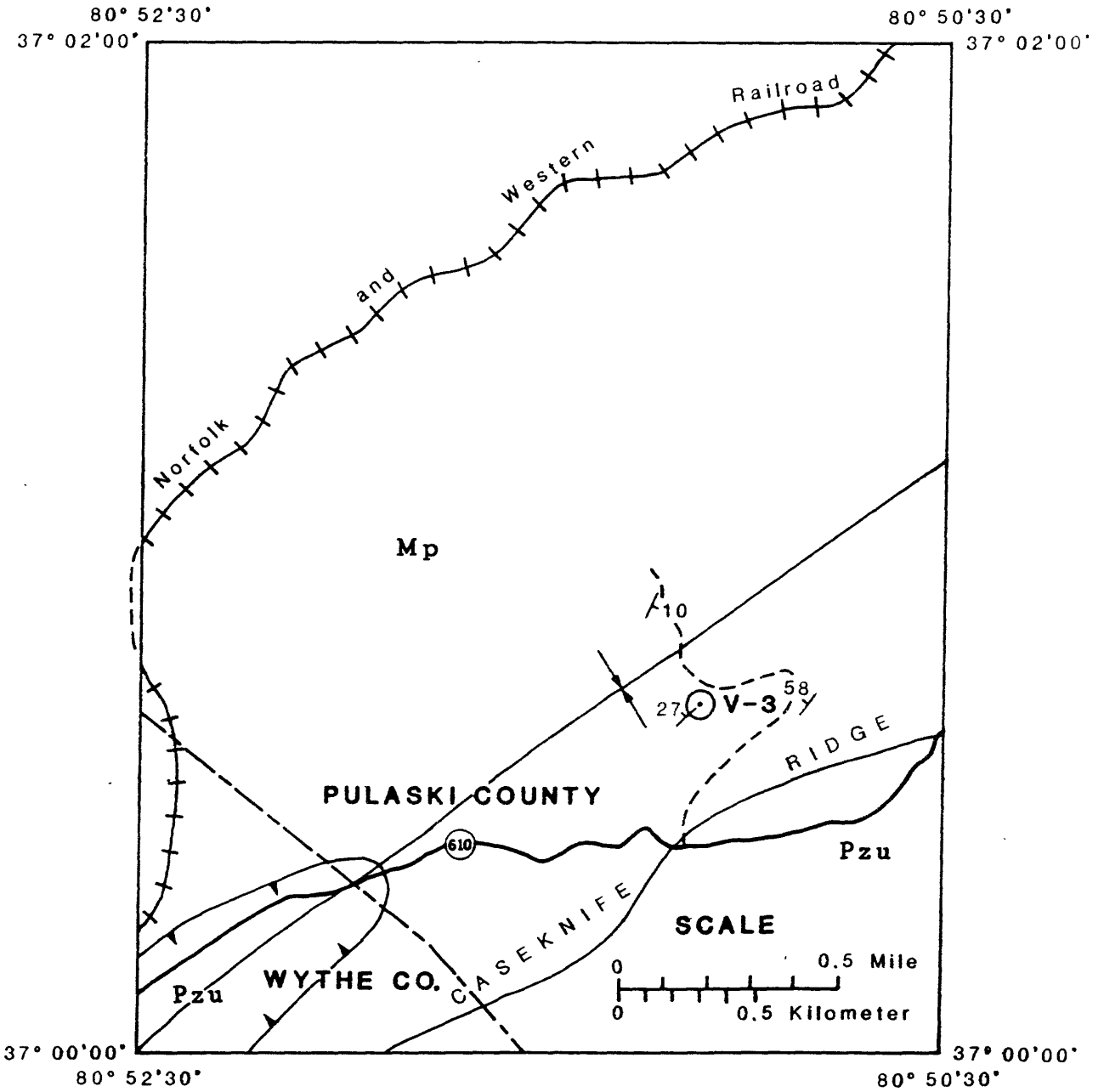


Figure 5. Location of corehole V-3. See Figure 12 for explanation.

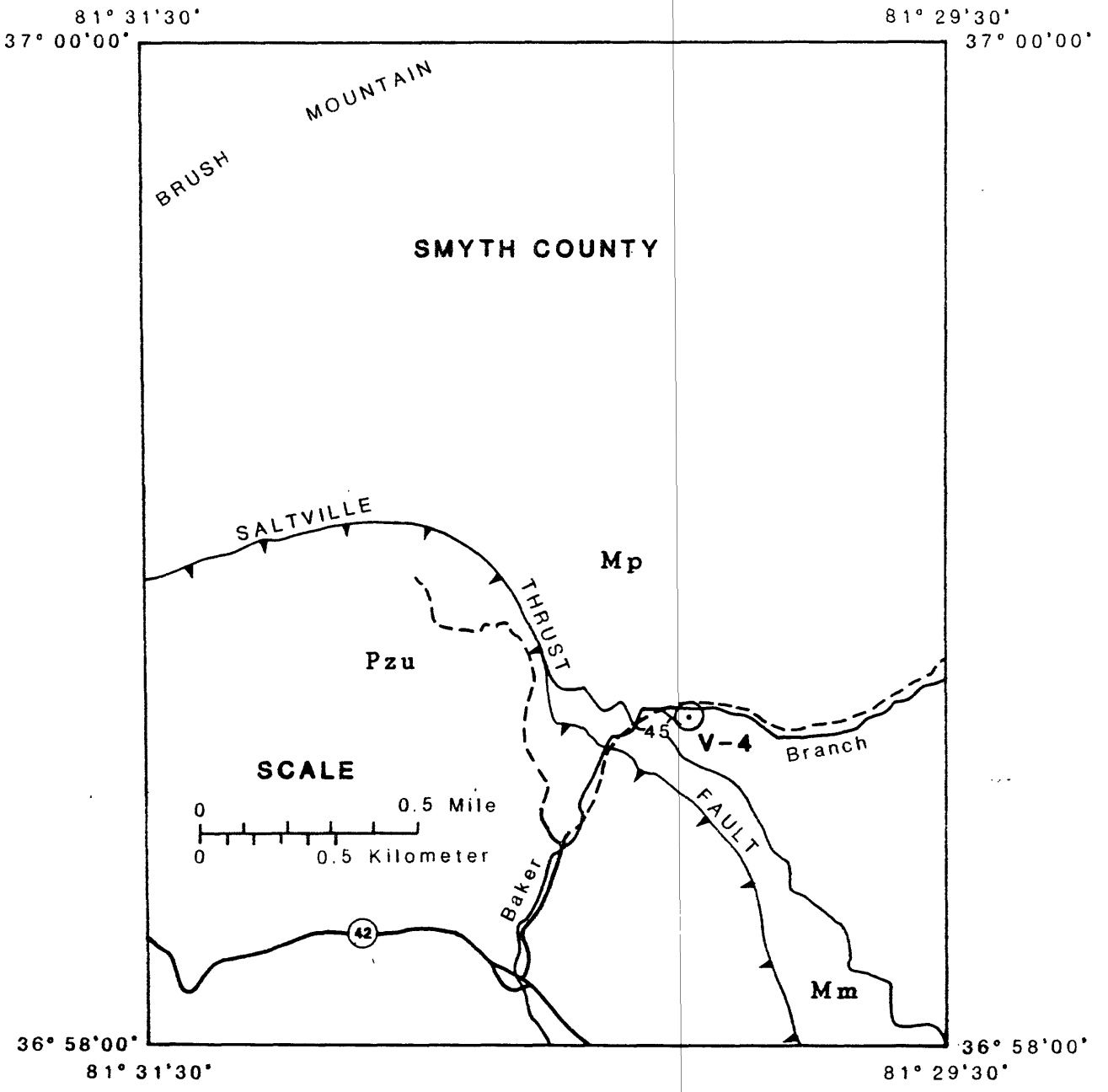


Figure 6. Location of corehole V-4. See Figure 12 for explanation.

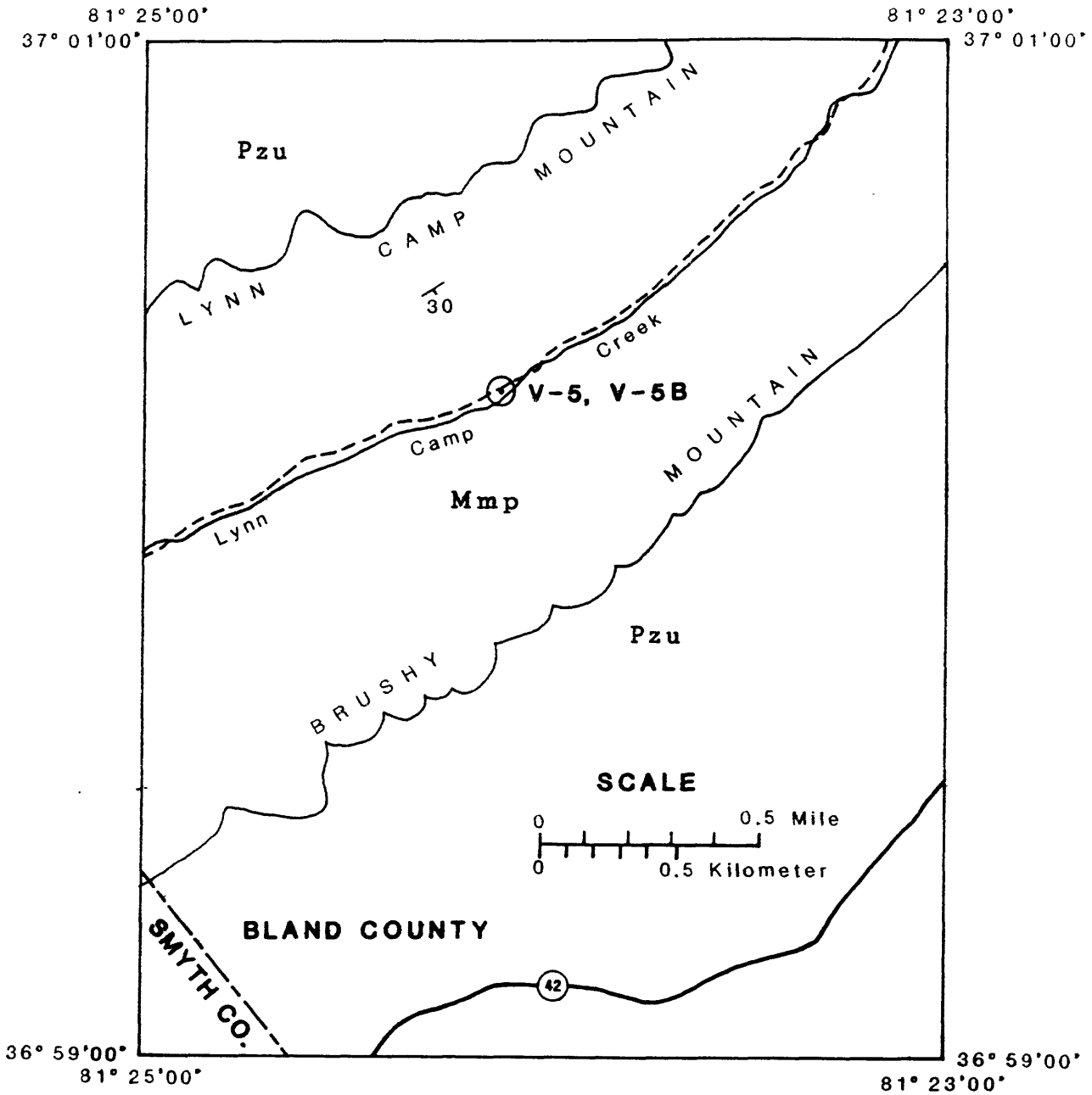


Figure 7. Location of coreholes V-5 and ~~V-5B (redrill)~~. ~~See Figure~~ 12 for explanation.

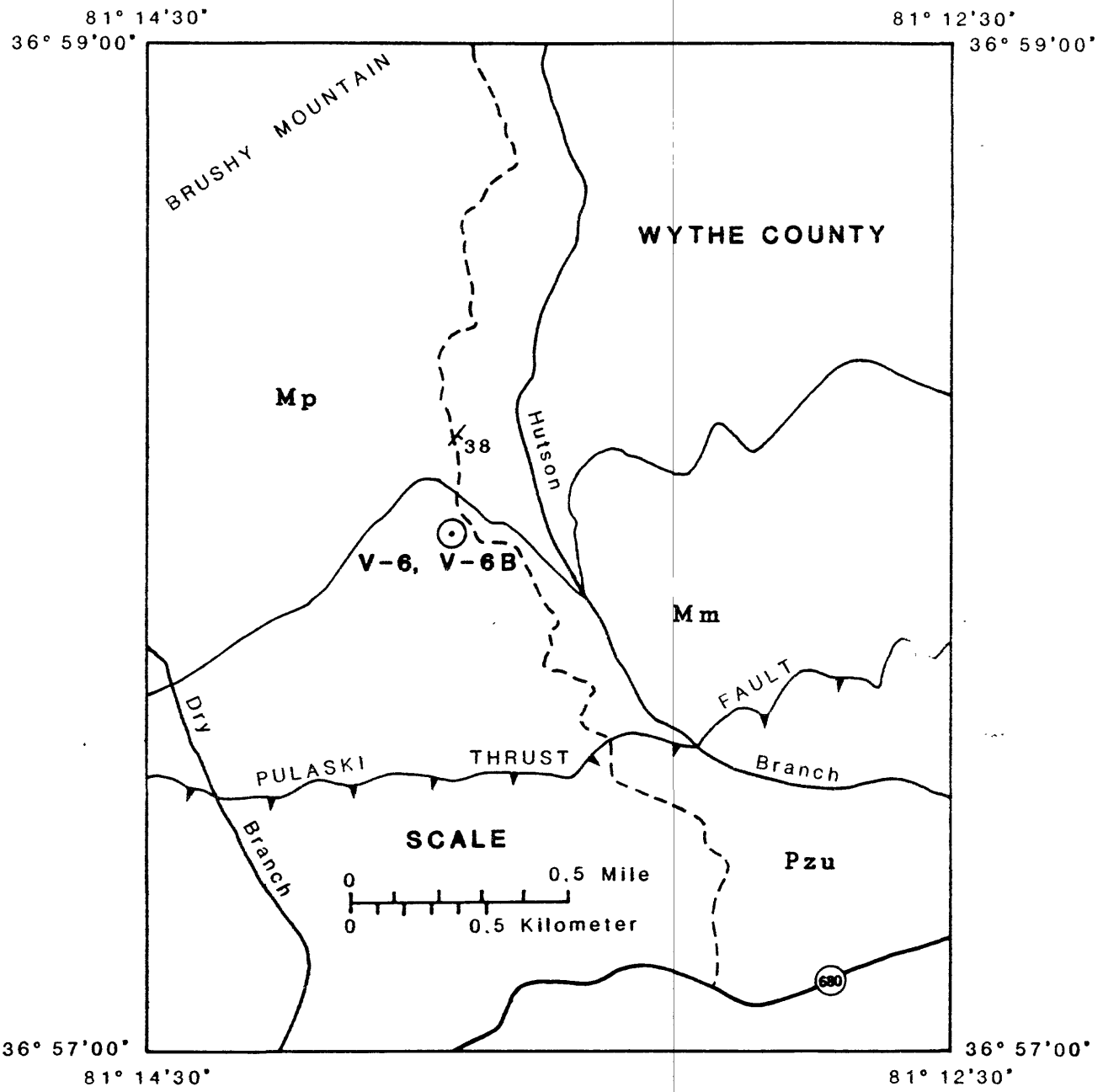


Figure 8. Location of coreholes V-6 and V-6B (redrill). See Figure 12 for explanation.

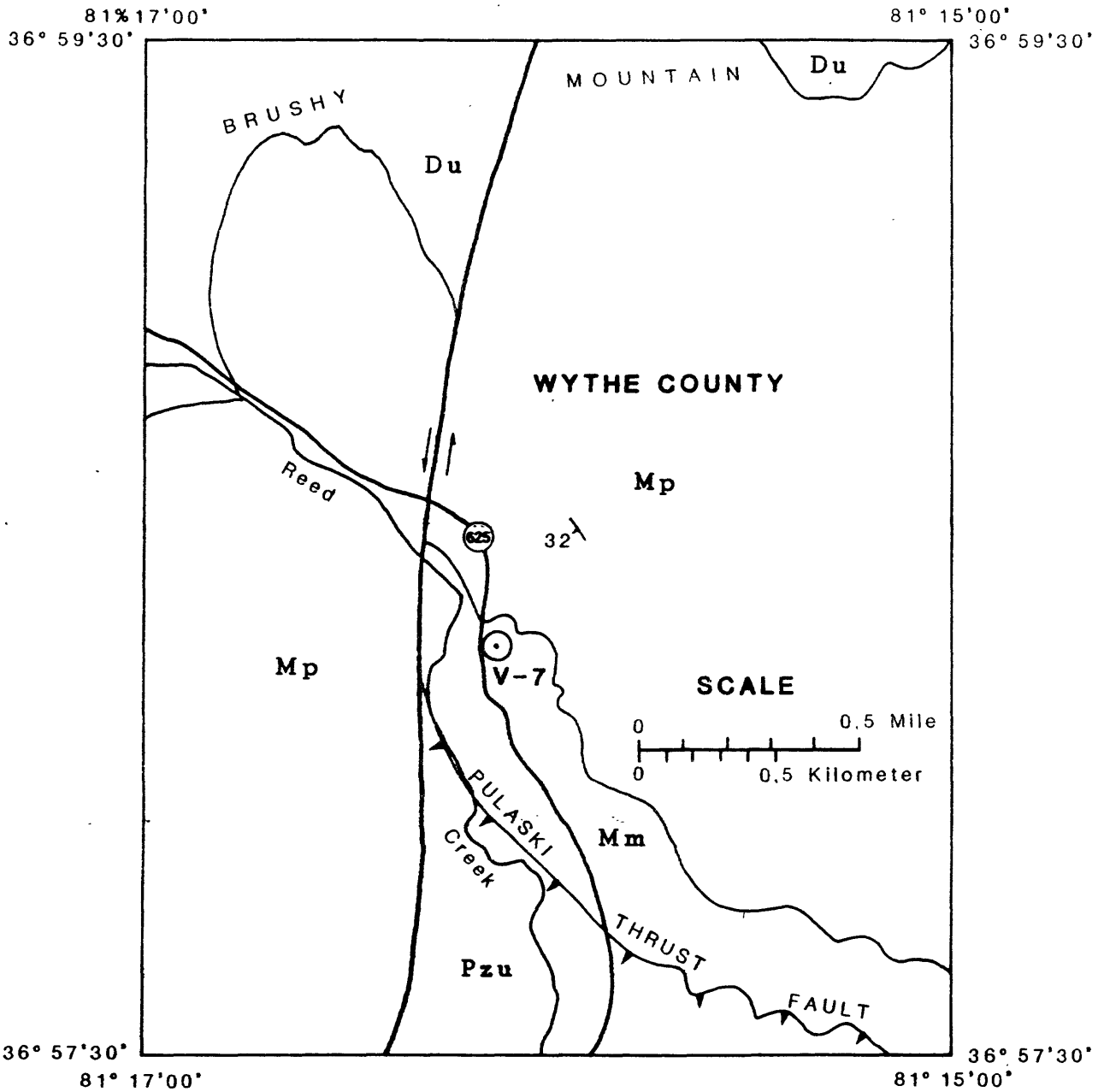


Figure 9. Location of corehole V-7. See Figure 12 for explanation.

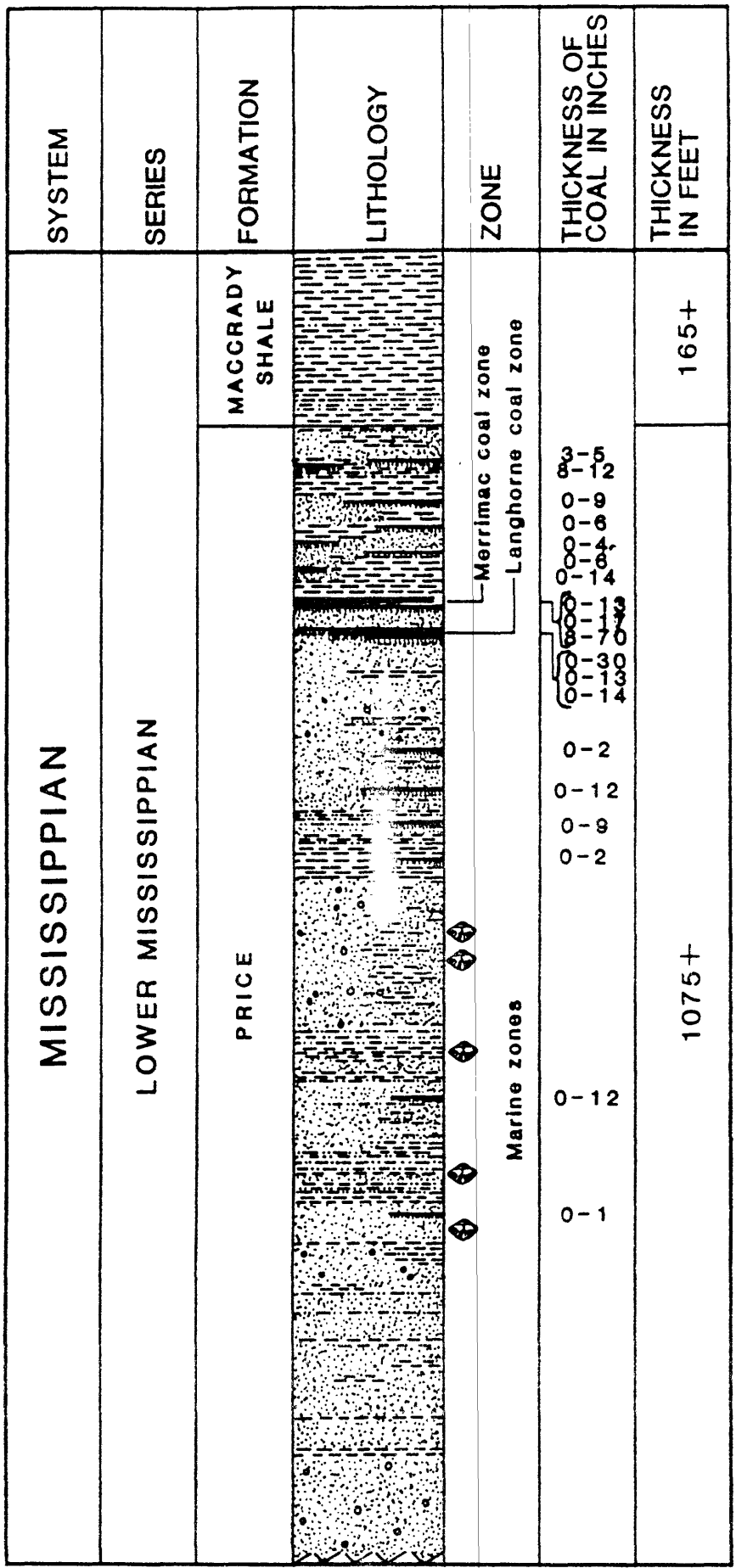


Figure 10. Generalized section of the Maccrady Shale and the coal-bearing Price Formation.

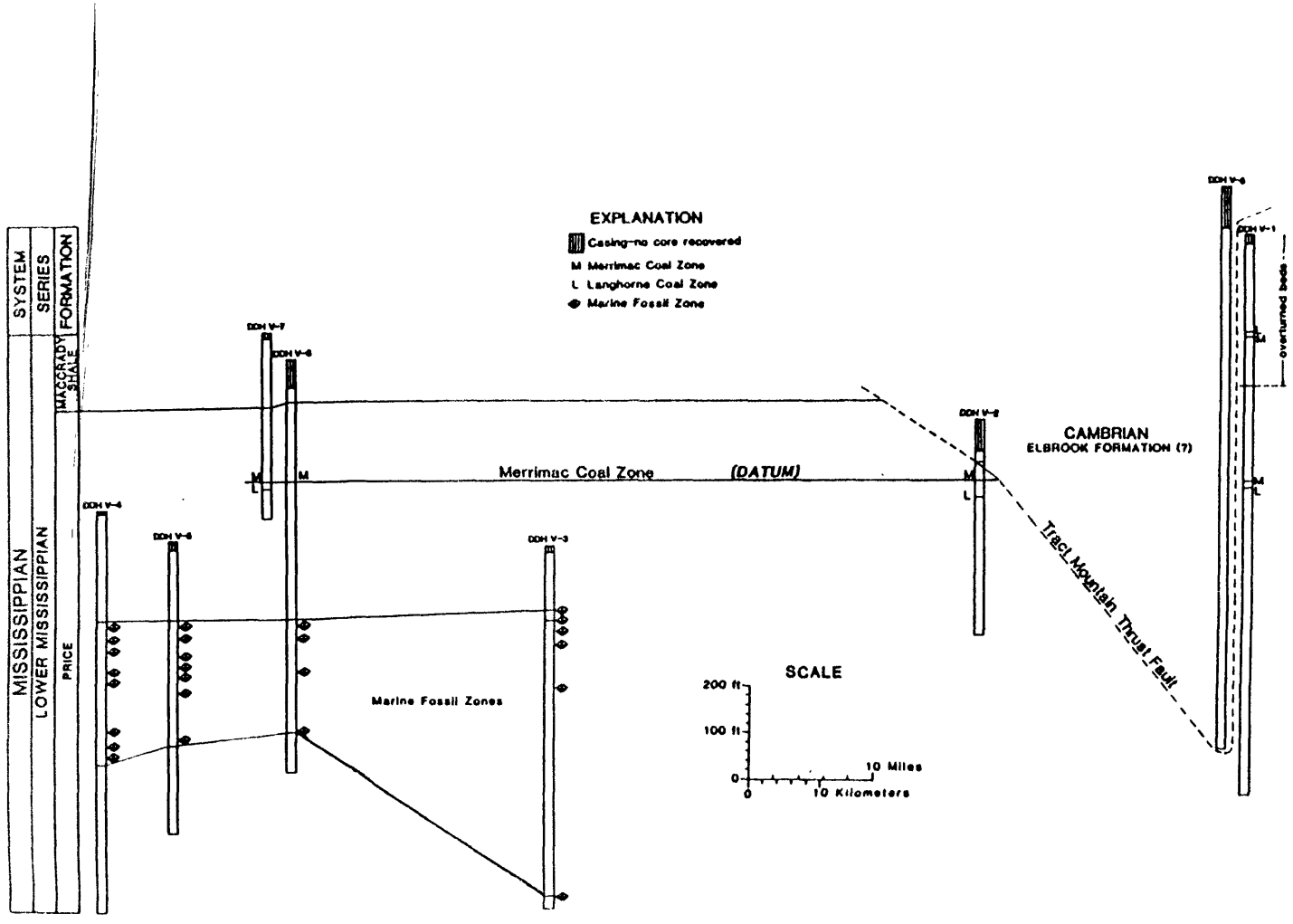


Figure 11. Correlation of coreholes in the Valley coal fields. See Figure 2 for location of coreholes.

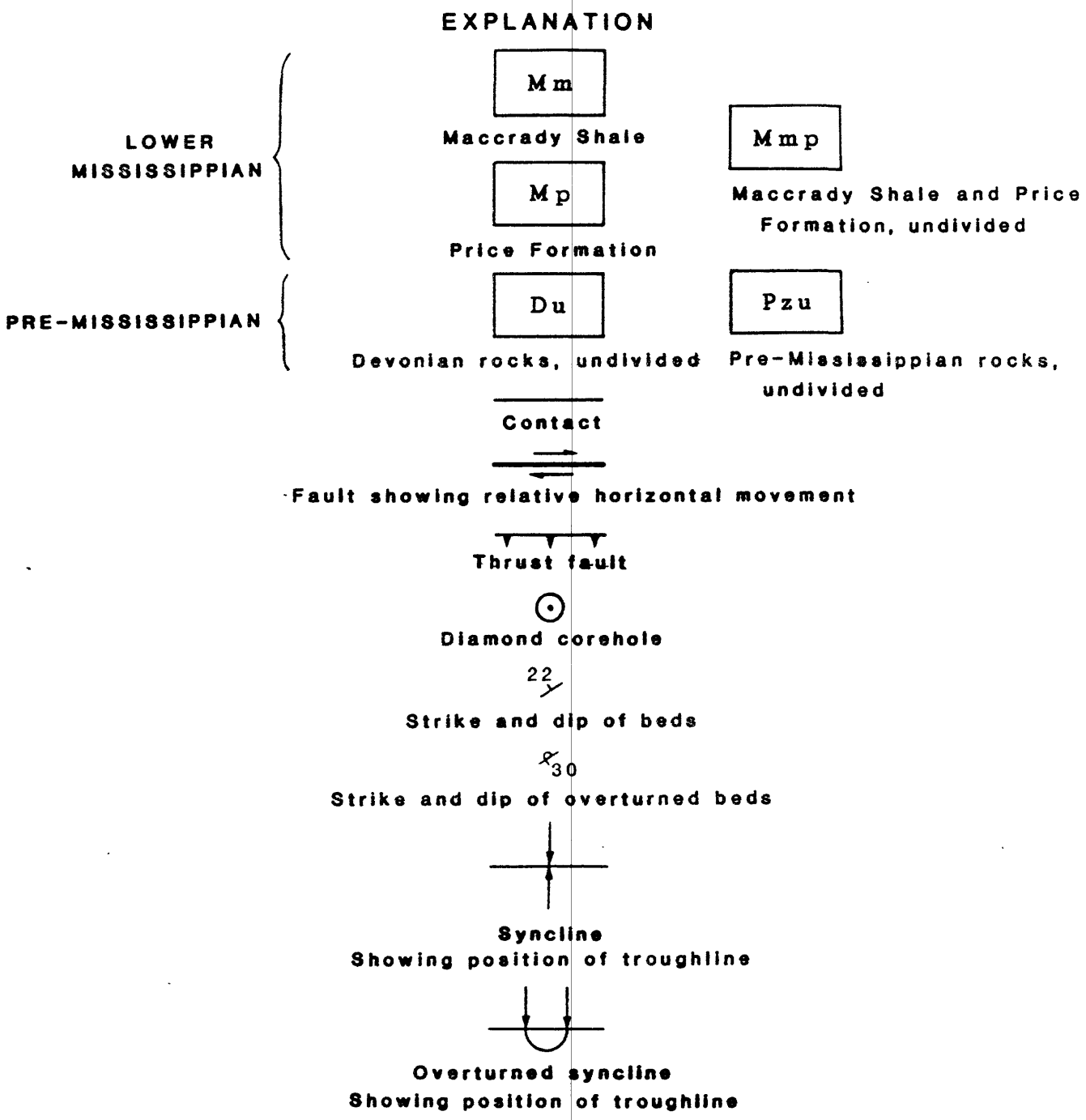


Figure 12. Explanation for Figures 3-9.

Stratigraphy

Coal-bearing strata tested in the Valley coal fields are assigned to the Price Formation of Early Mississippian age. Two principal coal zones -- Langhorne and Merrimac -- in the formation provided most of the 20 samples submitted for analysis (Table 1). The analytical results are presented in Part 4 of this study (Simon and Englund, 1983b).

The Maccrady Shale of Early Mississippian age and Cambrian carbonate rocks, tentatively assigned to the Elbrook Formation, were also encountered in the drilling (fig. 4).

Pre-Mississippian Paleozoic rocks, undivided. Rocks older than the Price Formation in the proximity of the drill sites are identified collectively in Figures 3 to 9 as Pre-Mississippian Paleozoic rocks, undivided. Lithically, these rocks vary from Cambrian and Ordovician carbonates to Silurian and Devonian sandstone, siltstone, and shale. Devonian rocks, including the Brallier Shale and the Chemung Formation, are also differentiated and identified in Figure 9. The Elbrook Formation of Cambrian age was penetrated above the Tract Mountain thrust fault in corehole V-2. It is a thick-bedded dolomite with sparse limestone and shale interbeds. An unsuccessful attempt to drill through the Tract Mountain overthurst in corehole V-8 penetrated 1,200 feet of beds of similar lithology which are tentatively assigned to the Elbrook Formation.

Price Formation. Coal-bearing rocks of the Valley coal fields, the target of this drilling program, are assigned to the Lower Mississippian Price Formation. It contains the geologically oldest commercially mined coal in the United States, in a sequence of interbedded sandstone, siltstone, shale, and underclay. The Price is subdivided informally into a basal quartz-pebble conglomerate (Cloyd Conglomerate Member of Butts, 1940), a lower marine member, and an upper continental coal-bearing member. The Cloyd Conglomerate Member, which may be at the base of corehole V-4, forms a resistant ridge crest along the outcrop belt of the Price Formation. It is overlain by as much as 1,150 feet (Stanley and Schultz, 1983) of sandstone, siltstone, and shale with marine fossils including a few coquina beds. The rocks of this marine member are slightly calcareous and burrowed and most likely represent deposition in a nearshore marine environment. The upper continental member consists of dark-gray carbonaceous shale and siltstone, fine- to medium-grained sandstone, rooted underclay, and coal. As many as 15 coal beds occur in the upper member including two widely recognized coal zones--Merrimac and Langhorne. Each of these coal zones is as much as 20 feet thick and includes several beds or splits of coal and impure coal ranging from a few inches to about 70 inches thick. The relative position of sampled beds or splits within these zones is indicated in Table 1 by the designations: lower, middle, and upper splits. Regional continuity or correlation of each split is not implied. About 10 to 20 feet of carbonaceous shale, underclay, and sandstone commonly occur between the two zones. The upper member of the Price Formation attains a maximum thickness of about 350 feet in the drilled sequence.

Table 1. -- Thicknesses of sampled coal beds.

Corehole	Unit no. (Lithic desc.)	Field sample no.	Coal Zone	Drilled depth to top of coal bed (ft-in.)	Drilled thickness of coal sampled (in.)	Approximate dip of bed	Calculated thickness of sampled bed (in.)
V-1	11.	v1-1a	unnamed shale	30-0	21.0	40°	16.1
	12.	v1-1b	unnamed coal	31-9	15.0	40°	11.5
	19.	v1-1c	unnamed shale	50-9	22.0	35°	18.0
	25.	v1-1d	unnamed shale	59-6	12.0	33°	10.1
	74.	v1-1e	Merrimac	215-6	16.0	40°	12.3
	191.,193., 195.	v1-c1	Merrimac	544-4	32.5	20°	30.5
	206.	v1-c2	Langhorne (upper split)	570-5	20.0	20°	18.8
	208.,210.	v1-c3	Langhorne (middle split)	573-4	13.0	20°	12.2
	299.,301.	v1-c4	unnamed coal	828-11	20.0	5°	19.9
V-2	19.	v2-c2	Merrimac (upper split)	129-1	13.0	35°	10.6
	23.,25	v2-c3	Merrimac (middle split)	131-7	17.0	35°	13.9
	28.	v2-c4	Merrimac (lower split)	138-11	8.0	35°	6.6
	39.,41., 43.,45., 47.,49.	v2-c5	Langhorne (upper split)	159-9	30.0	30°	26.0
	53.,55., 57.	v2-c6	Langhorne (lower split)	168-6	14.0	30°	12.1
V-6	103.	v6-c1	Merrimac (lower split)	259-0	36.0	11°	35.3
V-6B	11.	v6B-c1	Merrimac (upper split)	255-11	10.0	10°	9.8
	14.	v6B-c2	Merrimac (lower split)	258-10	70.0	10°	68.9
V-7	70.,71., 72.	v7-ca	Merrimac(?) (middle split)	317-5	14.0	25°	12.7
	74.,75., 76.,77.	v7-cb	Merrimac(?) (lower split)	321-3	32.0	25°	27.2
	86.,87., 88.	v7-cc	Langhorne(?)	334-8	19.0	20°	17.8

Maccrady Shale. The lithically distinct Maccrady Shale of Early Mississippian age conformably overlies the Price Formation and consists predominantly of grayish-red and greenish-gray, partly calcareous shale and siltstone and a few thin sandstone beds. About 160 feet of beds in the lower part of the Maccraddy are the youngest strata penetrated by this drilling.

Structural setting

The Valley coal fields of Virginia are in the highly faulted and folded rocks of the Valley and Ridge physiographic province. The coal-bearing Price Formation is preserved in the troughs or on the flanks of synclines bounded to the southeast by major thrust faults. In the vicinity of the drill sites, the strata generally strike northeastward and dip from about 30° to 50° SE. With depth, there is a general decrease in the dip of strata. All thicknesses indicated in Figure 10, in the section of lithic descriptions, and on the geophysical logs are drilled thicknesses that have not been corrected for dip. The drilled thicknesses, dips, and calculated thicknesses (normal to bedding) of the sampled coal beds are listed in Table 1.

The Tract Mountain thrust fault was penetrated at a depth of 86 feet 8 inches beneath the Elbrook Formation in corehole V-2. Another attempt was made to drill through the overthrust at corehole V-8 to check the extent of a thick coal-bearing sequence encountered in corehole V-1. Penetration of 1,200 feet of the Elbrook(?) Formation in corehole V-8 suggests that the major portion of the thick coal-bearing sequence in corehole V-1 may not extend southwestward beneath the thrust sheet. In corehole V-1, approximately the upper 330 feet of the Price Formation is overturned to the northwest resulting in a repetition and increase in the thickness of the coal-bearing sequence.

Lithologic descriptions and geophysical logs

Detailed lithologic descriptions of the core are presented for each drill hole followed by the geophysical log (at a scale of 1 inch = 20 feet). Because of core losses during the drilling of coreholes V-5 and V-6, partial redrills were made and are indicated as V-5B (redrill) and V-6B (redrill), respectively. About 5 feet of core loss was also noted in the Merrimac coal zone at a depth of 220 feet in corehole V-1. Two unsuccessful redrills were made in an attempt to recover additional coal for analyses. Due to the intensely sheared and flaky character of the coal core, complete recovery was not practical. Analyses of the recovered coal (Simon and Englund, 1983b, Table 2a) and geophysical logs indicate that the unrecoverable core was primarily impure coal and shale.

Corehole V-1

Location: Botetourt County; Daleville, Va., 7.5 minute quadrangle; on Stone Coal Creek northwest of its confluence with Catawba Creek. Accessible by State Route 748.

Coordinates: Latitude 37°29'33"N Longitude 79°59'52"W

Altitude: 1,460 ft Drilled depth: 1,137 ft

Dip of strata: Mostly 30° to 40° (overturned) to depth of 330 ft. Below 330 ft the dip decreases from about 40° (normal) to nearly flat lying at base of corehole.

Date drilled: October 10, 1982 to November 23, 1982

Core description: J.F. Windolph, Jr., K.J. Englund, J.O. Maberry II, P.C. Lyons, R.E. Thomas, J.C. Weber, and J.M. Back

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER MISSISSIPPIAN SERIES		
	Price Formation		
1.	Soil and weathered rock (casing set - no core recovered).....	15	0
		(15	0)
2.	Siltstone, medium-dark-gray, carbonaceous, sandy.....	0	2
		(15	2)
3.	Sandstone, medium-light-gray, very fine to fine-grained, finely micaceous, contains 50 percent quartz, scattered coal laminae, few siderite and medium-dark-gray shale clasts up to 2 in. thick, few rootlets in basal 6 in. few calcite-filled high-angle fractures, thin and unevenly bedded.....	4	9
		(19	11)
4.	Coal, impure, dull.....	0	5
		(20	4)
5.	Sandstone, medium-gray, very fine grained, contains 40 percent quartz, 50 percent dark-gray shale laminae, few coal laminae, scattered small-scale faults and high-angle fractures, cross-bedded, thin and unevenly bedded; base grades.....	1	4
		(21	8)
6.	Siltstone, medium-gray, carbonaceous, contains scattered dark-gray shale and light-gray very fine grained sandstone laminae, few coal laminae, few slickensided surfaces, thin and unevenly bedded.....	1	2
		(22	10)

Unit Number	Description	Thickness (Depth) ft	in.
7.	Siltstone, medium- to dark-gray, carbonaceous, contains 40 percent dark-gray shale laminae, scattered small-scale faults and high-angle fractures, burrowed, cross-laminated, thin and unevenly bedded.....	2	7
		(25	5)
8.	Siltstone, medium- to medium-dark-gray, few shale clasts and pyrite nodules, thin and unevenly bedded.....	3	0
		(28	5)
9.	Siltstone, medium-light-gray, contains few coal and dark-gray carbonaceous shale and coal laminae, bioturbated, poorly bedded, few high-angle.....	1	4
		(29	9)
10.	Siltstone, medium- to dark-gray, contains 50 percent carbonaceous shale laminae, thin and evenly bedded.....	0	3
		(30	0)
11.	Shale, dark-gray to black, carbonaceous, silty, pyritic, highly sheared.....	1	9
		(31	9)
12.	Coal, impure, highly sheared.....	1	3
		(33	0)
13.	Sandstone, medium- to medium-dark-gray, very fine to fine-grained, finely micaceous, pyritic, contains 40 percent quartz, few dark-gray shale laminae, scattered small dark-gray shale clasts at base, scattered rootlets, abundant slickensides and high-angle fractures, thin and unevenly bedded.....	2	8
		(35	8)
14.	Siltstone, medium-light- to medium-gray, sandy in top 4 in., contains 40 percent dark-gray shale laminae, thin and irregularly bedded.....	1	0
		(36	8)
15.	Sandstone, medium-light-gray, very fine to fine-grained, finely micaceous, contains 50 percent quartz, cross-laminated, thin-bedded.....	0	3
		(36	11)
16.	Siltstone, medium-gray; contains few coal, dark-gray shale and light-gray very fine grained sandstone laminae; few rootlets 1 ft 2 in. below top; few small scale faults, slickensided surfaces and high-angle fractures; thin and unevenly bedded.....	11	0
		(47	11)
17.	Sandstone, medium-gray, fine-grained, finely micaceous, contains 45 percent quartz, 10 percent dark-gray shale laminae.....	0	3
		(48	2)

Unit Number	Description	Thickness (Depth) ft	in.
18.	Siltstone, medium-gray, argillaceous at base, contains abundant dark-gray shale and light-gray very fine grained sandstone laminae, few rootlets, thin-bedded.....	2	7
		(50	9)
19.	Shale, dark-gray to black, carbonaceous, highly sheared and fractured.....	1	10
		(52	7)
20.	Shale, brownish-black, carbonaceous, contains few coal laminae in top 2 in., few pyrite nodules, evenly bedded, few rootlets.....	0	5
		(53	0)
21.	Coal, dull, impure, highly sheared.....	0	6.5
		(53	6.5)
22.	Siltstone, medium-gray, contains 40 percent dark-gray shale laminae, thin and evenly bedded.....	2	10.5
		(56	5)
23.	Sandstone, medium- to dark-gray, fine grained, micaceous, contains 50 percent quartz, few dark-gray shale lamine, abundant quartz-filled high-angle fracture, thin and unevenly bedded.....	2	11
		(59	4)
24.	Underclay, dark-gray, very carbonaceous, few rootlets; base grades.....	0	2
		(59	6)
25.	Shale, dark-gray, very carbonaceous, highly sheared, sparsely pyritic.....	1	0
		(60	6)
26.	Shale, medium- to dark-gray, carbonaceous, silty, contains few coal laminae, few slickensided high-angle fractures.....	0	3
		(60	9)
27.	Siltstone, medium-gray, contains 40 percent dark-gray carbonaceous shale laminae, few rootlets in top 1 ft 10 in., abundant slickensided and quartz-filled high-angle fractures, thin and unevenly bedded.....	7	4
		(68	1)
28.	Sandstone, light- to medium-light-gray, very fine grained, contains 45 percent quartz, scattered dark-gray shale laminae, few high-angle fractures and slickensided surfaces, thin and evenly bedded.....	1	6
		(69	7)

Unit Number	Description	Thickness (Depth) ft	in.
29.	Shale, brownish-black, carbonaceous, silty, few rootlets.....	2	0
		(71	7)
30.	Sandstone, light- to medium-gray, fine-grained, contains 40 percent quartz, few dark-gray shale laminae, thin and unevenly bedded.....	1	7
		(73	2)
31.	Siltstone, medium-dark-gray, contains few coal laminae, abundant calcite-filled high-angle fractures, thin and unevenly bedded.....	6	7
		(79	9)
32.	Shale, dark-gray, silty, grades to impure coal at base and top, few rootlets, evenly bedded.....	1	1
		(80	10)
33.	Siltstone, medium- to dark-gray, contains 50 percent dark-gray shale laminae, few coal and light-gray very fine grained sandstone laminae, abundant well preserved plant fragments, few high-angle calcite-filled fractures, thin-bedded.....	3	1
		(83	11)
34.	Siltstone, dark-gray, carbonaceous, finely micaceous, contains 20 percent dark-gray shale laminae.....	0	7
		(84	6)
35.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 50 percent quartz, 10 percent dark-gray shale lamine, few coal laminae, scattered high-angle fractures, thin and unevenly bedded.....	4	0
		(88	6)
36.	Siltstone, dark-gray, carbonaceous, sandy, abundant slickensided surfaces, thin and unevenly bedded.....	0	11
		(89	5)
37.	Sandstone, light- to medium-gray, very fine to fine-grained, silty, contains 45 percent quartz, scattered dark-gray shale laminae and beds, few rootlets, abundant calcite-filled high-angle fractures, thin-bedded.....	7	7
		(97	0)
38.	Siltstone, medium- to medium-dark-gray, contains scattered dark-gray shale and medium-light-gray very fine grained sandstone laminae, abundant slickensided surfaces and calcite-filled high-angle fractures, thin and unevenly bedded.....	6	0
		(103	0)
39.	Shale, medium- to medium-dark-gray.....	0	8
		(103	8)

Unit Number	Description	Thickness (Depth) ft	in.
40.	Siltstone, medium- to medium-dark-gray, contains scattered dark-gray shale and medium-light-gray very fine grained sandstone laminae, abundant slickensided surfaces and calcite-filled high-angle fractures, thin and unevenly bedded.....	9	4
		(113	0)
41.	Sandstone, medium-gray, very fine grained, silty, contains 40 percent quartz, 30 percent dark-gray shale laminae, few quartz-filled high-angle fractures, thin and unevenly bedded.....	1	9
		(114	9)
42.	Siltstone, medium- to dark-gray, thin and evenly bedded.....	1	2
		(115	11)
43.	Coal, dull, impure, sheared.....	0	2
		(116	1)
44.	Shale, dark-gray, sheared.....	0	3
		(116	4)
45.	Coal, dull, impure, sheared.....	0	2
		(116	6)
46.	Shale, black, very carbonaceous, evenly bedded, sheared.....	0	6
		(117	0)
47.	Siltstone, light- to medium-gray, dark-gray and carbonaceous in basal 1 ft, abundant siderite nodules, few rootlets, scattered calcite-filled fractures.....	5	6
		(122	6)
48.	Coal, bright attritus, highly sheared.....	0	1
		(122	7)
49.	Siltstone, medium-gray, abundant slickensided surfaces, few calcite-filled high-angle fractures, few rootlets.....	2	2
		(124	9)
50.	Shale, dark-gray, carbonaceous, silty.....	0	5
		(125	2)
51.	Coal, impure, contains few dark-gray shale laminae.....	0	3
		(125	5)
52.	Siltstone, medium-dark-gray, contains 40 percent dark-gray carbonaceous shale laminae and beds, few coal laminae, few rootlets, scattered fractures and small-scale faults, thin and unevenly bedded.....	3	10
		(129	3)

Unit Number	Description	Thickness (Depth) ft	in.
53.	Shale, black, very carbonaceous	0	3
		(129	6)
54.	Siltstone, medium-gray, contains 50 percent dark-gray carbonaceous shale laminae, few rootlets and slickenslided surfaces, highly fractured	1	0
		(130	6)
55.	Sandstone, medium-gray, very fine grained, contains 40 percent quartz, few dark-gray clasts, few rootlets, thin and unevenly bedded	0	5
		(130	11)
56.	Shale, dark-gray, carbonaceous, contains few medium-gray siltstone laminae and beds, abundant slickensided surfaces and calcite-filled fractures	0	10
		(131	9)
57.	Siltstone, medium-gray, few rootlets, scattered slickenslided surfaces and calcite-filled high-angle fractures	1	4
		(133	1)
58.	Siltstone, medium-gray, contains 20 percent dark-gray carbonaceous shale laminae, 20 percent light-gray very fine grained sandstone laminae, abundant slickensided surfaces and calcite-filled high-angle fractures, thin and unevenly bedded	13	11
		(147	0)
59.	Siltstone, dark-gray, finely micaceous, contains 50 percent dark-gray carbonaceous shale laminae	1	11
		(148	11)
60.	Sandstone, medium- to medium-dark-gray, very fine grained, contains 45 percent quartz, few dark-gray carbonaceous shale laminae, few calcite-filled high-angle fractures	1	0
	fractures.	(149	11)
61.	Siltstone, medium-gray, contains 30 percent dark-gray shale laminae; scattered slickensided surfaces, small-scale faults and calcite-filled high-angle fractures, cross-laminated in part, thin-bedded	13	6
		(163	5)
62.	Coal, bright attritus, sheared	0	1
		(163	6)
63.	Underclay, medium- to dark-gray, silty to sandy, scattered siderite nodules, abundant rootlets, fractured	27	0
		(190	6)
64.	Sandstone, medium- to dark-gray, contains few coal and dark-gray carbonaceous shale laminae, thin and unevenly bedded	1	3
		(191	9)

Unit Number	Description	Thickness (Depth) ft	in.
65.	Sandstone, medium-gray, fine-grained, few calcite-filled high-angle fractures, abundant rootlets.....	0	8
		(192	5)
66.	Coal, impure, contains scattered dark-gray shale laminae.....	0	2
		(192	7)
67.	Shale, dark-gray to black, silty, few rootlets.....	0	9
		(193	4)
68.	Siltstone, medium-gray, contains scattered coal and dark-gray shale laminae, abundant rootlets.....	5	10
		(199	2)
69.	Coal, Langhorne coal zone, impure, sheared.....	0	3.5
		(199	5.5)
70.	Shale, dark-gray to black, carbonaceous, pyritic, contains 50 percent medium-light-gray siltstone and very fine grained sandstone laminae.....	0	4.5
		(199	10)
71.	Siltstone, medium- to dark-gray, sandy, contains 20 percent dark-gray shale laminae, few siderite nodules.....	8	2
		(208	0)
72.	Siltstone, medium- to medium-dark-gray, sandy, few rootlets, thin and unevenly bedded.....	3	11
		(211	11)
73.	Underclay, medium-gray, silty, contains few impure coal and dark-gray shale beds up to 6 in. thick, abundant rootlets, highly sheared and brecciated.....	3	7
		(215	6)
74.	Coal, Merrimac coal zone; interbedded bright attritus, impure coal and shale, highly sheared, 5 ft core loss.....	7	2
		(222	8)
75.	Shale, dark-gray to black, very carbonaceous in top 1 ft, contains abundant coal laminae in top 1 ft, abundant slickensided surfaces, evenly bedded, fissile.....	3	2
		(255	10)
76.	Underclay, medium- to medium-dark-gray, abundant rootlets, sheared.....	1	10
		(227	8)
77.	Coal, dull, impure, contains 1 in. dark-gray shale bed 1 in. below top, sheared.....	0	6
		(228	2)

Unit Number	Description	Thickness (Depth) ft	in.
78.	Shale, medium- to dark-gray, carbonaceous, few rootlets, evenly bedded, fissile	1	2
		(229	4)
79.	Coal, dull, impure sheared	0	2
		(229	6)
80.	Underclay, medium-dark- to dark-gray, sandy at base, very carbonaceous in top 2 ft, abundant rootlets, few small-scale faults	3	6
		(233	0)
81.	Sandstone, medium-gray, very fine grained, silty, contains 45 percent quartz, abundant coal and dark-gray shale clasts, few rootlets and small-scale faults, abundant calcite-filled fractures 2 ft below top, thin and unevenly bedded	4	7
		(237	7)
82.	Underclay, medium-gray, very sandy, abundant rootlets	1	8
		(239	3)
83.	Shale, dark-gray to black, carbonaceous, evenly bedded	0	6
		(239	9)
84.	Underclay, medium-gray, very sandy and silty, abundant rootlets, scattered coal and dark-gray shale fragments in basal 5 in	1	4
		(241	1)
85.	Coal, dull, impure, sheared	0	2
		(241	3)
86.	Underclay, medium- to medium-dark-gray, very silty, abundant rootlets, abundant fractures and slickenslided surfaces	1	3
		(242	6)
87.	Shale, medium-dark- to dark-gray, contains few medium-gray siltstone laminae, scattered calcite-filled high-angle fractures, evenly bedded	1	1
		(243	7)
88.	Shale, dark-gray to black, carbonaceous, evenly bedded, very fissile	0	2
		(243	9)
89.	Underclay, medium-dark- to dark-gray, contains few medium-gray siltstone laminae and beds, abundant rootlets	2	6
		(246	3)

Unit Number	Description	Thickness (Depth) ft	in.
90.	Shale, black, carbonaceous, evenly bedded	0	3
		(246	6)
91.	Underclay, medium-dark- to dark-gray, contains few dark-gray shale laminae and beds, few medium-gray siltstone laminae, scattered siderite nodules and beds at base, abundant rootlets	8	3
		(254	9)
92.	Siltstone, medium- to medium-dark-gray, argillaceous, contains few medium-light-gray very fine grained sandstone laminae	1	6
		(256	3)
93.	Underclay, medium- to medium-dark-gray, very silty in basal 5 ft contains few dark-gray shale laminae, abundant calcite-filled fractures 1 ft 1 in. below top, scattered rootlets	12	1
		(268	4)
94.	Siltstone, medium-gray, mottled greenish-gray, very sandy, contains few dark-gray shale laminae, abundant dark-gray shale clasts in basal 2 in., scattered dolomite-filled fractures	4	2
		(272	6)
95.	Shale, medium- to medium-dark-gray, slightly silty, few rootlets in basal 1 ft, few carbonate-filled low-angle fractures, unevenly bedded	5	8
		(278	2)
96.	Shale, black, carbonaceous	0	6
		(278	8)
97.	Siltstone, medium-gray, contains scattered light-gray very fine grained sandstone laminae, thin and unevenly bedded	2	7
		(281	3)
98.	Underclay, medium- to medium-dark-gray, contains few medium-gray siltstone and dark-gray shale laminae, abundant rootlets, few slickenslided surfaces	8	10
		(290	1)
99.	Shale, dark-gray to black, few rootlets and slickenslided surfaces, evenly bedded, very fissile	0	10
		(290	11)
100.	Underclay, medium- to medium-dark-gray, silty, very carbonaceous from 7 ft below top to base, abundant rootlets	7	5
		(298	4)
101.	Coal, dull, impure	0	6
		(298	10)

Unit Number	Description	Thickness (Depth) ft	in.
102.	Underclay, dark- to very dark gray, very carbonaceous, abundant rootlets and root slicks, sheared, evenly bedded, fissile.....	3	8
		(302	6)
103.	Underclay, medium-gray, dark-gray and carbonaceous in basal 2 ft, very silty, contains few dark-gray shale laminae, few siderite nodules and beds, abundant rootlets, few dolomite-filled low-angle fractures; base grades.....	9	11
		(312	5)
104.	Shale, medium-gray, silty, contains few medium-light-gray siltstone and very fine grained sandstone laminae in basal 1 ft 2 in., few rootlets.....	6	6
		(318	11)
105.	Underclay, medium- to medium-dark-gray, sandy, abundant rootlets; base grades.....	6	2
		(325	1)
106.	Shale, medium-gray, mottled greenish-gray, very silty; base grades.....	1	8
		(326	9)
107.	Shale, medium- to medium-dark-gray, very silty, carbonaceous in top 8 in., evenly bedded; base sharp.....	3	3
		(330	0)
108.	Sandstone, medium-gray, very fine grained, silty, contains 40 percent quartz, few medium-gray shale laminae and beds up to 3 in. thick, abundant siderite laminae and beds at 2 ft 10 in. below top, cross-laminated; thin-bedded.....	3	1
		(333	1)
109.	Shale, medium- to medium-dark-gray, very silty, contains few medium-light-gray very fine grained sandstone laminae at 1 ft 9 in. below top.....	2	10
		(335	11)
110.	Siltstone, medium- to medium-dark-gray, contains few medium-light-gray very fine grained sandstone laminae, few siderite nodules and laminae, cross-laminated, thin-bedded; base sharp.....	3	10
		(339	9)
111.	Sandstone, medium-gray, very fine to fine-grained, very silty 5 ft below top, contains 45 percent quartz, scattered dark mineral grains, few dark-gray shale laminae, cross-laminated, thin-bedded; base grades.....	8	5
		(348	2)

Unit Number	Description	Thickness (Depth) ft	in.
112.	Siltstone, medium- to medium-dark-gray, very sandy in top 4 in., thin-bedded	0	9
		(348	11)
113.	Shale, medium- to medium-dark-gray, few rootlets in top 3 in., contorted bedding	1	7
		(350	6)
114.	Underclay, light-brownish- to medium-gray, very silty in basal 2 ft 8 in., abundant rootlets	5	3
		(355	9)
115.	Shale, medium- to medium-dark-gray, silty, sideritic in basal 5 in., contains few discontinuous medium-light-gray siltstone and very fine grained sandstone laminae	5	1
		(360	10)
116.	Underclay, medium-dark-gray, carbonaceous, abundant rootlets; base sharp	0	10
		(361	8)
117.	Sandstone, medium-gray, very fine to fine-grained, silty, contains 40 percent quartz, thin-bedded	0	5
		(362	1)
118.	Shale, medium- to medium-dark-gray, silty, faintly bedded	0	4
		(362	5)
119.	Siltstone, medium- to medium-dark-gray, contains 40 percent medium-light-gray very fine grained sandstone lamine, few dark-gray shale laminae, thin and unevenly bedded	1	8
		(364	1)
120.	Shale, medium- to medium-dark-gray, silty, carbonaceous in basal 6 ft 1 in., contains few medium-gray siltstone laminae, few coal laminae 2 ft 3 in. above base, scattered siderite beds up to 1 in. thick, evenly bedded, fissile	13	5
		(377	6)
121.	Coal, dull, impure, sheared and slickensided	0	10
		(378	4)
122.	Underclay, medium- to medium-dark-gray, very silty in basal 10 in., few siderite nodules in basal 8 in., abundant rootlets, few quartz-filled fractures	1	8
		(380	0)
123.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, brecciated and fractured in part, thick-bedded	1	7
		(381	7)

Unit Number	Description	Thickness (Depth) ft	in.
124.	Shale, medium-gray, few plant fragments, evenly bedded, fair fissility; base grades	1	1
		(382	8)
125.	Shale, dark-gray to black, very carbonaceous, contains 20 percent coal laminae in basal 5 in.; base grades abruptly	1	8
		(384	4)
126.	Underclay, medium-gray, few siderite nodules in basal 6 in., abundant root slicks; base grades	3	2
		(387	6)
127.	Shale, medium-gray, dark-gray in basal 8 in., few plant fragments and slickensided surfaces, evenly bedded; base grades	3	2
		(390	8)
128.	Underclay, medium-light- to medium-gray, silty in basal 1 ft 9 in., abundant siderite nodules in basal 1 ft 9 in., scattered rootlets	2	4
		(393	0)
129.	Shale, medium- to medium-dark-gray, silty, contains 40 percent medium-gray siltstone laminae and beds, evenly bedded, poor fissility; base grades	2	9
		(395	9)
130.	Siltstone, medium-gray, poor fissility; base grades	1	5
		(397	2)
131.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 40 percent quartz, 30 percent medium-gray siltstone and shale laminae, thin-bedded; base grades	3	4
		(400	6)
132.	Shale, medium-dark-gray, poor fissility; base sharp	0	3
		(400	9)
133.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 15 percent medium-gray siltstone and shale laminae, few quartz- and pyrite-filled fractures, thin-bedded; base sharp	3	2
		(403	11)
134.	Shale, medium-dark- to dark-gray, abundant plant fragments, poor fissility; base grades	1	7
		(405	6)
135.	Underclay, medium-gray, silty from 1 ft 7 in. to 2 ft 5 in. below top, few rootlets, few quartz-filled fractures in basal 1 ft; base grades	5	5
		(410	11)

Unit Number	Description	Thickness (Depth) ft	in.
136.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent medium-gray siltstone and shale laminae, few quartz-filled fractures, brecciated in basal 6 in., thin-bedded; base grades.....	11	10
		(422	9)
137.	Shale, medium-gray, silty, brecciated in part, evenly bedded; base grades.....	0	11
		(423	8)
138.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 25 percent medium-gray siltstone laminae, fractured and brecciated, thin and evenly bedded; base grades.....	0	11
		(424	7)
139.	Shale, dark-gray, evenly bedded, fissile; base grades.....	0	7
		(425	2)
140.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, thin and evenly bedded; base sharp.....	0	6
		(425	8)
141.	Shale, medium-dark-gray, few siderite nodules, poor fissility; base grades abruptly.....	0	6
		(426	2)
142.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, scattered quartz-filled fractures, crossbedded; base grades.....	0	4
		(426	6)
143.	Shale, medium-dark-gray, contains 2 in. medium-gray very fine grained sandstone bed 7 in. below top, scattered siderite nodules up to 0.5 in. thick, abundant plant fragments in basal 1 ft, evenly bedded, fair fissility.....	3	10
		(430	4)
144.	Coal, impure, contains 50 percent dark-gray carbonaceous shale laminae.....	0	5
		(430	9)
145.	Underclay, medium-gray, few quartz-filled fractures, scattered rootlets; base grades.....	2	4
		(433	1)
146.	Shale, black, very carbonaceous, contains scattered coal laminae.....	1	0
		(434	1)

Unit Number	Description	Thickness (Depth) ft	in.
147.	Coal, dull, impure	0	6
		(434	7)
148.	Underclay, dark-gray, very carbonaceous, few coal and dark-gray shale clasts, abundant root slicks	0	7
		(435	2)
149.	Underclay, medium- to medium-dark-gray, few rootlets; base grades	1	10
		(437	0)
150.	Shale, medium-dark-gray, evenly bedded, fair fissility; base grades	3	1
		(440	1)
151.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 40 percent medium-gray siltstone and shale laminae and beds, few quartz-filled fractures, thin-bedded	1	0
		(441	1)
152.	Shale, medium-dark- to dark-gray, very carbonaceous in basal 2 ft., contains 10 percent medium-light-gray very fine grained sandstone laminae and beds, abundant siderite beds, scattered slickensided surfaces and quartz-filled fractures, evenly bedded, fair fissility	7	0
		(448	1)
153.	Underclay, medium-gray, abundant rootlets; base grades	1	5
		(449	6)
154.	Siltstone, medium-light-gray, finely micaceous, contains 20 percent medium-gray very fine grained sandstone laminae in basal 7 ft 6 in., thin-bedded, poor fissility; base sharp	10	5
		(459	11)
155.	Shale, dark-gray, carbonaceous, evenly bedded, fair fissility; base grades	2	3
		(462	2)
156.	Underclay, medium-gray, silty in basal 1 ft, abundant rootlets; base grades	1	10
		(464	0)
157.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few quartz-filled fractures, thin-bedded; base grades	2	7
		(466	7)
158.	Shale, medium- to medium-dark-gray, contains 25 percent light-gray very fine grained sandstone laminae and beds, few scattered plant fragments, poor fissility; base grades	6	10
		(473	5)

Unit Number	Description	Thickness (Depth) ft	in.
159.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent medium-light-gray siltstone beds, thin- to thick-bedded; base grades.....	11	1
		(484	6)
160.	Siltstone, medium-light-gray, contains 20 percent light-gray very fine grained sandstone beds, thin-bedded; base sharp.....	4	4
		(488	10)
161.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded.....	0	6
		(489	4)
162.	Shale, dark-gray, carbonaceous, contains few coal laminae, evenly bedded.....	0	2
		(489	6)
163.	Coal, mostly bright attritus.....	0	2
		(489	8)
164.	Underclay, medium-dark-gray, carbonaceous in basal 3 ft, abundant rootlets.....	15	1
		(504	9)
165.	Coal, dull to bright attritus.....	0	3
		(505	0)
166.	Shale, black, very carbonaceous, contains 10 percent coal (vitrain) laminae, fissile.....	0	10
		(505	10)
167.	Underclay, medium-gray, very silty from 9 in. to 1 ft 6 in. below top and in basal 1 ft, abundant rootelts; base grades.....	4	0
		(509	10)
168.	Siltstone, medium-dark-gray, thin and evenly bedded; base grades.....	0	6
		(510	4)
169.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, 10 percent medium-light-gray siltstone laminae; scattered quartz-, pyrite-, and gypsum-filled fractures; 1 in. siderite bed 3 ft above base, thin-bedded; base grades.....	9	5
		(519	9)
170.	Shale, medium-dark- to dark-gray, silty in top 1 ft, evenly bedded, fair fissility; base grades.....	5	1
		(524	10)
171.	Underclay, medium- to medium-dark-gray, slightly carbonaceous, abundant rootlets.....	1	1
		(525	11)

Unit Number	Description	Thickness (Depth) ft	in.
172.	Coal, dull attritus, impure	0	3
		(526	2)
173.	Underclay, medium- to medium-dark-gray, abundant rootlets; base sharp	1	8
		(527	10)
174.	Coal, dull, impure	0	1
		(527	11)
175.	Shale, dark-gray to black, carbonaceous	0	1
		(528	0)
176.	Coal, dull to bright attritus, sheared	0	1
		(528	1)
177.	Shale, dark-gray, carbonaceous	0	1
		(528	2)
178.	Coal, impure, contains few dark-gray shale laminae	0	1
		(528	3)
179.	Shale, dark-gray, carbonaceous, evenly bedded	0	10.5
		(529	1.5)
180.	Coal, bright attritus	0	0.5
		(529	2)
181.	Shale, black, carbonaceous	0	1
		(529	3)
182.	Coal, dull to bright attritus	0	4
		(529	7)
183.	Underclay, dark-gray, carbonaceous	0	3
		(529	10)
184.	Coal, impure, sheared	0	1
		(529	11)
185.	Coal, dull, impure	0	4
		(530	3)
186.	Coal, bright attritus	0	5
		(530	8)
187.	Coal, dull attritus, impure	0	4
		(531	0)
188.	Shale, black, carbonaceous, contains few coal laminae	1	1
		(532	1)

Unit Number	Description	Thickness (Depth) ft	in.
189.	Underclay, medium-dark-gray, carbonaceous, abundant rootlets; base grades	6	7
		(538	8)
190.	Shale, dark-gray to black, carbonaceous, fissile, contains few plant fragments	5	8
		(544	4)
	Merrimac Coal Zone (units 191 to 200)		
191.	Coal, dull and bright attritus, sheared	0	10
		(545	2)
192.	Shale, black, carbonaceous	0	1.5
		(545	3.5)
193.	Coal, bright attritus	0	3.5
		(545	7)
194.	Shale, dark-gray, carbonaceous, silty	0	4
		(545	11)
195.	Coal, dull and bright attritus, sheared	1	7
		(547	6)
196.	Coal, dull attritus, impure	0	3
		(547	9)
197.	Shale, black, very carbonaceous, contains few impure coal laminae and beds	2	1
		(549	10)
198.	Coal, dull to bright attritus, impure, contains few dark-gray shale laminae, highly sheared	1	8
		(551	6)
199.	Shale, dark-gray to black, carbonaceous, contains few light-gray very fine grained sandstone laminae	3	1
		(554	7)
200.	Coal, dull and bright attritus, impure, sheared	0	6
		(555	1)
201.	Underclay, medium-dark-gray, contains 20 percent light-gray very fine grained laminae in basal 8 in., few quartz-filled fractures	5	8
		(560	9)
202.	Coal, dull and bright attritus, impure, contains few light-gray very fine grained sandstone laminae, sheared	0	6
		(561	3)

Unit Number	Description	Thickness (Depth) ft	in.
203.	Underclay, medium-gray, rootlets.....	4	0
		(565	3)
204.	Shale, medium-dark- to dark-gray, poor fissility, few rootlets, silty in basal 3 in.....	3	4
		(568	7)
205.	Shale, black, carbonaceous, contains few coal laminae.....	1	10
		(570	5)
	Langhorne coal zone (units 206 to 223)		
206.	Coal, dull and bright attritus.....	1	8
		(572	1)
207.	Underclay, medium-dark-gray, abundant rootlets.....	1	3
		(573	4)
208.	Coal, dull attritus, impure.....	0	10
		(574	2)
209.	Siltstone, brownish-gray.....	0	1
		(574	3)
210.	Coal, dull attritus, impure.....	0	3
		(574	6)
211.	Underclay, medium-dark-gray, few rootlets.....	1	4
		(575	10)
212.	Shale, dark-gray, carbonaceous, contains impure coal laminae and beds.....	0	8
		(576	6)
213.	Underclay, dark-gray, contains few rootlets, scattered coal laminae.....	1	2
		(577	8)
214.	Shale, black, carbonaceous, contains 40 percent coal laminae.....	0	7
		(578	3)
215.	Underclay, medium-dark-gray, very carbonaceous, rootlets; base grades.....	3	0
		(581	3)
216.	Shale, black, carbonaceous, contains 10 percent coal laminae; base grades.....	1	2
		(582	5)
217.	Coal, dull, impure.....	0	8
		(583	1)

Unit Number	Description	Thickness (Depth) ft	in.
218.	Underclay, medium-dark-gray, silty, few rootlets; base grades.....	1	3
		(584	4)
219.	Shale, dark-gray, silty, contains 20 percent light-gray very fine grained sandstone laminae, evenly bedded; base grades.....	0	8
		(585	0)
220.	Sandstone, light-gray, fine-grained, sparsely micaceous, contains 50 percent quartz, few dark-gray shale laminae in top 5 in., few dark-gray shale clasts at base, massive; base sharp.....	4	9
		(589	9)
221.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 15 percent dark-gray shale laminae, thin-bedded; base grades.....	0	9
		(590	6)
222.	Shale, medium-dark-gray, contains 20 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded.....	1	0
		(591	6)
223.	Coal, mostly bright attritus, flakey, highly fractured.....	0	7
		(592	1)
224.	Siltstone, medium-gray, few rootlets in top 1 ft, thin-bedded; base grades.....	2	2
		(594	3)
225.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded.....	0	4
		(594	7)
226.	Siltstone, medium-gray, thin-bedded, poor fissility.....	1	0
		(595	7)
227.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base sharp.....	0	11
		(596	6)
228.	Siltstone, medium-gray, contains scattered light-gray very fine grained sandstone laminae and beds ~~up to 4 in. thick~~, bioturbated in part, thin bedded.....	65	6
		(662	0)
229.	Shale, black, very carbonaceous, contains scattered coal (vitrain) laminae.....	0	2
		(662	2)
230.	Siltstone, medium-gray, contains 20 percent light-gray very fine grained sandstone laminae and beds, thin-bedded.....	0	3
		(662	5)

Unit Number	Description	Thickness (Depth) ft	in.
231.	Sandstone, medium-light- to medium-gray, very fine grained, micaceous, contains 50 percent quartz, scattered dark and light mineral grains, 25 percent medium-gray siltstone beds; base sharp.....	3	11
		(666	4)
232.	Sandstone, medium- to medium-dark-gray, very fine grained, micaceous, contains 50 percent quartz, 10 percent coal laminae, scattered medium-dark-gray siltstone laminae and beds; base grades.....	0	4
		(666	8)
233.	Sandstone, medium-light- to medium-gray, very fine grained, micaceous, contains 50 percent quartz, scattered dark and light mineral grains, few medium- to medium-dark-gray siltstone beds; base grades.....	2	11
		(669	7)
234.	Sandstone, medium-gray, very fine grained, contains 50 percent quartz, 20 percent medium- to medium-dark-gray siltstone beds, scattered coal laminae in top 2 in., few slickensided surfaces, thin-bedded; base grades.....	0	4.5
		(669	11.5)
235.	Sandstone, medium-light- to medium-gray, very fine grained, micaceous, contains 50 percent quartz, 20 percent medium dark-gray siltstone laminae and beds, scattered siderite clasts up to 1.25 in. in diameter, thin- to thick-bedded; base sharp.....	11	5.5
		(681	5)
236.	Sandstone, medium-light- to medium-gray, very fine grained, micaceous, contains 60 percent quartz, 15 percent medium-gray siltstone laminae, few quartz- and calcite-filled high-angle fractures; base sharp.....	3	7
		(685	0)
237.	Sandstone, medium-gray, very fine grained, micaceous, contains 60 percent quartz, 40 percent coal and medium-gray siltstone laminae in top 3.5 in., thin- to thick-bedded; base sharp.....	2	5
		(687	5)
238.	Sandstone, medium- to medium-dark-gray, very fine grained, silty, slightly micaceous, contains 50 percent quartz, few coal laminae in top 2 in.; base grades.....	2	11
		(690	4)
239.	Siltstone, medium- to medium-dark-gray, sandy, contains abundant coal laminae and clasts in top 2 in.; base shar.p.....	0	4
		(690	8)

Unit Number	Description	Thickness (Depth) ft	in.
240.	Coal, impure, contains scattered vitrain bands up to 0.25 in. thick, abundant dark-gray carbonaceous shale laminae in basal 2 in.; base grades	0	4
		(691	0)
241.	Siltstone, medium- to medium-dark-gray, micaceous, sandy in top 2 in., contains scattered coal laminae	1	5
		(692	5)
242.	Sandstone, medium-light- to medium-gray, very fine grained, micaceous, contains 60 percent quartz, 20 percent medium-gray siltstone laminae, 5 percent coal laminae, scattered siderite nodules in basal 8 in., thin-bedded; base sharp	1	4.5
		(693	9.5)
243.	Siltstone, medium- to medium-dark-gray, micaceous, contains scattered coal laminae in top 3 in., thin-bedded; base grades	0	6.5
		(694	4)
244.	Siltstone, medium- to medium-dark-gray, contains scattered coal laminae, thin-bedded; base sharp	1	2
		(695	6)
245.	Sandstone, medium-light- to medium-gray, very fine grained, micaceous, contains 50 percent quartz, few medium-dark-gray siltstone laminae in top 3 in.; base grades	0	11
		(696	5)
246.	Siltstone, medium-gray, micaceous, contains few coal laminae in basal 9 in.; base grades	1	5
		(697	10)
247.	Sandstone, medium-light- to medium-gray, very fine grained, micaceous, contains 50 percent quartz, scattered coal laminae in top 3 in., thin-bedded; base sharp	2	5
		(700	3)
248..	Sandstone, medium-light- to medium-gray, very fine grained, contains 50 percent quartz, scattered coal and dark-gray carbonaceous shale laminae; base grades	0	4.5
		(700	7.5)
249.	Siltstone, medium- to medium-dark-gray, carbonaceous; base grades.	1	1.5
		(700	9)
250.	Siltstone, medium- to medium-dark-gray, carbonaceous, abundant plant fragments; base grades	1	1
		(701	10)
251.	Siltstone, medium- to medium-dark-gray, contains 10 percent medium-gray shale laminae, few angular medium-gray siltstone clasts up to 2 in. in diameter; base sharp	1	11.5
		(703	9.5)

Unit Number	Description	Thickness (Depth) ft	in.
252.	Siltstone, medium- to medium-dark-gray, contains scattered coal and dark-gray carbonaceous shale laminae, abundant dark-gray shale clasts up to 1 in. in diameter in basal 7 in.; base grades	1	2.5
		(705	0)
253.	Siltstone, medium-gray, carbonaceous, sandy in top 7 in., contains few medium-dark-gray shale clasts up to 2.5 in. in diameter; base grades	1	10
		(706	10)
254.	Siltstone, medium- to medium-dark-gray, very carbonaceous, sandy in basal 4 in., base sharp and uneven	4	3
		(711	1)
255.	Siltstone, medium- to medium-dark-gray, carbonaceous, sandy at base, contains 10 percent dark-gray carbonaceous shale laminae, thin-bedded, few contorted beds; base sharp	4	0
		(715	1)
256.	Shale, medium-dark- to dark-gray, contains scattered medium-light gray very fine grained sandstone laminae, few slickensided surfaces, evenly bedded, fissile; base grades	0	2
		(715	3)
257.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, abundant angular dark-gray shale clasts up to 4 in. thick, few siderite nodules up to 1 in. thick, thin-bedded; base sharp	7	7
		(722	10)
258.	Siltstone, medium-dark- to dark-gray, carbonaceous, contains few dark-gray shale laminae at top, few slickensided surfaces and small-scale slump structures, thin-bedded; base grades	7	5
		(730	3)
259.	Siltstone, medium- to medium-dark-gray, sparsely micaceous, contains 50 percent medium-dark-gray shale laminae, few quartz-filled fractures and slickensided surfaces, thin-bedded, fair fissility	4	10
		(735	1)
260.	Shale, medium-dark- to dark-gray, carbonaceous, contains 20 percent medium- to medium-dark-gray siltstone beds, few medium-gray fine-grained sandstone laminae, scattered slickensided surfaces and low-angle quartz-filled fractures, evenly bedded; base grades	2	2
		(737	3)

Unit Number	Description	Thickness (Depth) ft	in.
261.	Shale, medium-dark- to dark-gray, carbonaceous, evenly bedded, fair fissility; base sharp.....	0	3
		(737	6)
262.	Coal, bright attritus, sheared.....	0	10
		(738	4)
263.	Sandstone, medium-light- to medium-gray, very fine grained, finely micaceous, contains 40 percent quartz, 20 percent medium-dark-gray shale and siltstone laminae and beds, few rootlets and slickensides surfaces; base grades.....	5	5
		(743	9)
264.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent dark-gray shale and medium-gray siltstone beds, few coal laminae, scattered quartz-filled fractures; base sharp.....	4	11
		(748	8)
265.	Shale, medium-light-gray, fissile.....	0	2
		(748	10)
266.	Shale, medium- to medium-dark-gray, finely micaceous, contains 40 percent medium- to medium-dark-gray siltstone laminae and beds, scattered plant fragments, fair fissility; base grades.....	3	2
		(752	0)
267.	Shale, medium-dark- to dark-gray, contains 20 percent medium-gray siltstone beds, abundant plant fragments; base sharp.....	1	6
		(753	6)
268.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 15 percent medium-gray shale and siltstone laminae and beds, abundant medium-dark-gray shale clasts in top 2 ft and basal 6 in., thin- to thick-bedded; base sharp.....	4	1
		(757	7)
269.	Shale, medium-dark- to dark-gray, carbonaceous, contains 30 percent medium gray siltstone and very fine grained sandstone laminae in top 3 ft and basal 1 ft, scattered plant fragments, evenly bedded, fissile; base sharp.....	7	9
		(765	4)
270.	Sandstone, medium-light- to medium-gray, very fine grained, finely micaceous, contains 40 percent quartz, few dark-gray carbonaceous shale laminae, thin-bedded; base sharp.....	2	11
		(768	3)
271.	Siltstone, medium- to medium-dark-gray, micaceous, contains scattered dark-gray carbonaceous shale and light-gray, very fine grained sandstone laminae and beds, thin-bedded; base grades.....	2	1
		(770	4)

Unit Number	Description	Thickness (Depth) ft	in.
272.	Siltstone, medium-light- to medium-gray, sandy, abundant dark-gray shale laminae in top 1 ft, thin-bedded; base sharp.....	4	0
		(774	4)
273.	Shale, medium-dark-gray, contains 20 percent medium-gray siltstone beds, poor fissility; base grades.....	0	7
		(774	11)
274.	Sandstone, medium-light- to medium-gray, very fine grained, contains 40 percent quartz, few dark-gray shale laminae in basal 2 in., few quartz-filled fractures; base grades.....	1	8
		(776	7)
275.	Shale, dark-gray, very carbonaceous, contains 5 percent medium-gray siltstone laminae, few coal laminae, abundant slickensided surfaces.....	0	9
		(777	4)
276.	Underclay, medium-dark-gray, abundant rootlets.....	2	0
		(779	4)
277.	Coal, impure, sheared and slickensided.....	0	8
		(780	0)
278.	Siltstone, medium-gray, contains 40 percent dark-gray shale laminae, scattered rootlets, thin-bedded; base sharp and uneven.....	8	8
		(788	8)
279.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, sparsely micaceous, contains 50 percent quartz, few slickensided surfaces and quartz-filled fractures; base sharp and uneven.....	2	0
		(790	8)
280.	Shale, medium-dark- to dark-gray; contains abundant medium-light-gray siltstone and very fine grained sandstone laminae and beds in top 1 ft 6 in., decreasing to 15 percent in basal 6 in.; fair fissility; base sharp.....	3	3
		(793	11)
281.	Siltstone, medium-dark-gray, carbonaceous; base grades.....	0	2
		(794	1)
282.	Shale, dark-gray, carbonaceous, contains few coalified plant impressions; base sharp.....	0	1
		(794	2)
283.	Siltstone, medium- to medium-dark-gray, finely micaceous, argillaceous, contains 40 percent dark-gray shale laminae and beds, few plant fragments, thin-bedded; base sharp.....	8	3
		(802	5)

Unit Number	Description	Thickness (Depth) ft	in.
284.	Shale, medium-dark- to dark-gray, contains scattered medium-gray siltstone laminae, evenly bedded, fissile; base grades.....	0	4
		(802	9)
285.	Sandstone, medium-light-gray, very fine to fine-grained, finely micaceous, contains 45 percent quartz.....	0	8
		(803	5)
286.	Siltstone, medium-gray, contains 40 percent dark-gray shale laminae, thin-bedded.....	2	1
		(805	6)
287.	Shale, medium-dark- to dark-gray, carbonaceous, contains 20 percent medium-gray siltstone laminae, few coal laminae, abundant slickenslided surfaces in basal 8 in.; base grades.....	5	0
		(810	6)
288.	Shale, dark-gray, very carbonaceous, sheared.....	0	2
		(810	8)
289.	Coal, dull to bright attritus, sheared.....	0	8
		(811	4)
290.	Underclay, medium-gray, silty, finely micaceous, very carbonaceous with abundant coal laminae in top 3 in., scattered rootlets; base sharp.....	0	8
		(812	0)
291.	Siltstone, medium- to medium-dark-gray, finely micaceous, contains 20 percent dark-gray shale laminae, scattered slickensided surfaces, thin-bedded; base sharp.....	4	5
		(816	5)
292.	Shale, medium-dark-gray, contains 40 percent medium-gray siltstone laminae, contorted bedding.....	0	7
		(817	0)
293.	Coal, dull to bright attritus, few vitrain bands, sheared.....	1	0
		(818	0)
294.	Siltstone, medium-light-gray, very finely micaceous, contains 10 percent dark-gray shale laminae, 10 percent light-gray very fine grained sandstone laminae and beds up to 1 in. thick, scattered rootlets, thin and contorted bedding; base grades.....	2	10
		(820	10)
295.	Sandstone, medium-light-gray, very fine grained, sparsely micaceous, contains 45 percent quartz; base grades.....	0	6
		(821	4)

Unit Number	Description	Thickness (Depth) ft	in.
296.	Siltstone, medium-gray, contains 40 percent dark-gray shale laminae, thin-bedded; base grades	0	11
		(822	3)
297.	Sandstone, medium-light-gray, very fine to fine-grained, contains few medium-gray siltstone laminae in top 3 in., thin-bedded; base sharp	3	5
		(825	8)
298.	Shale, medium-dark- to dark-gray, carbonaceous, contains few coal laminae, abundant slickensided surfaces, fissile; base sharp	3	3
		(828	11)
299.	Coal, mostly bright attritus	1	3
		(830	2)
300.	Shale, black, very carbonaceous, fissile	0	2.5
		(830	4.5)
301.	Coal, mostly dull attritus	0	5
		(830	9.5)
302.	Underclay, medium-dark-gray, carbonaceous, abundant rootlets	1	5.5
		(832	3)
303.	Coal, dull to bright attritus, few vitrain bands	0	3
		(832	6)
304.	Shale, dark-gray, few plant fragments, evenly bedded, fair fissility; base grades abruptly	1	11
		(834	5)
305.	Shale, medium-dark-gray, abundant quartz-filled fractures from 1 ft to 1 ft 4 in. below top; base grades	1	5
		(835	10)
306.	Shale, black, very carbonaceous, poor fissility	0	8
		(836	6)
307.	Shale, medium-dark-gray, evenly bedded	0	9
		(837	3)
308.	Coal, bright and dull attritus	0	10
		(838	1)
309.	Sandstone, light- to medium-light-gray, very fine grained, silty, contains 40 percent quartz, bioturbated; base grades	0	4
		(838	5)
310.	Shale, medium-dark to dark-gray, bioturbated, contorted bedding; base sharp	0	4
		(838	9)

Unit Number	Description	Thickness (Depth) ft	in.
311.	Shale, black, very carbonaceous, evenly bedded, poor fissility....	0	8
		(839	5)
312.	Siltstone, medium-dark- to dark-gray, contains 30 percent light-gray very fine grained sandstone laminae, bioturbated, abundant quartz-filled fractures in top 3 in.; base grades.....	2	7
		(842	0)
313.	Shale, dark-gray to black, carbonaceous, silty, poor fissility; base grades.....	1	5
		(843	5)
314.	Underclay, dark-gray, abundant rootlets; base grades.....	2	3
		(845	8)
315.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent dark-gray shale laminae, bioturbated in top 6 in., few slickensided surfaces and quartz-filled fractures 2 ft below top, thin- to thick-bedded; base sharp.....	5	4
		(851	0)
316.	Shale, black, carbonaceous, evenly bedded.....	0	3.5
		(851	3.5)
317.	Sandstone, medium- to medium-dark-gray, very fine to fine-grained, contains 40 percent quartz, 30 percent medium-dark-gray siltstone and shale laminae and beds, thin-bedded.....	3	5.5
		(854	9)
318.	Shale, medium-dark-gray, contains 20 percent light-gray very fine grained sandstone laminae and beds, slightly burrowed, evenly bedded; base grades abruptly.....	1	9
		(856	6)
319.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-dark-gray siltstone and shale laminae and beds, abundant medium-dark-gray shale clasts, thin-bedded, contorted bedding in top 8 in.....	4	10
		(861	4)
320.	Shale, black, carbonaceous.....	0	1.5
		(861	5.5)
321.	Coal, thin to thick vitrain bands, bright attrital matrix.....	0	6
		(861	11.5)
322.	Underclay, dark-gray, silty in basal 6 in., carbonaceous, abundant rootlets; base grades.....	1	4.5
		(863	4)
323.	Siltstone, medium-gray, bioturbated, thin to faintly bedded; base grades abruptly.....	3	4
		(866	8)

Unit Number	Description	Thickness (Depth) ft	in.
324.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent dark-gray silty shale laminae, bioturbated in basal 1 ft 6 in., thin-bedded.....	3	1
		(869	9)
325.	Shale, black, very carbonaceous, contains 25 percent coal and impure coal laminae, few plant fragments; base sharp and uneven...	1	6
		(871	3)
326.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, 5 percent dark-gray silty shale laminae, abundant rootlets in top 1 ft, thin-bedded.....	3	4
		(874	7)
327.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 45 percent quartz, 30 percent medium-dark-gray siltstone and shale laminae, ripple-bedded.....	1	4
		(875	11)
328.	Sandstone, light-gray, very fine grained, silty, contains 40 percent quartz, 50 percent medium-dark-gray siltstone and shale laminae, cross-laminated thin-bedded; base sharp and uneven.....	1	10
		(877	9)
329.	Sandstone, medium-light-gray, fine- to medium-grained, contains 40 percent quartz, few dark-gray shale clasts, 1 in. siderite clast at base, few small-scale faults, thin and irregularly bedded.....	0	1.5
		(877	10.5)
330.	Shale, dark-gray, carbonaceous, slightly silty, contains for coal laminae and coalified plant fragments, few siderite nodules in basal 4 ft, evenly bedded, fissile.....	18	3.5
		(896	2)
331.	Sandstone, medium-light-gray, fine to medium-grained, contains 40 percent quartz, few coal laminae and lenses, few dark-gray shale laminae, irregularly bedded.....	0	4.5
		(896	6.5)
332.	Shale, medium-dark- to dark-gray, carbonaceous, very silty, contains few coal laminae, abundant plant fragments, scattered slickensided surfaces, evenly bedded, fissile.....	0	9.5
		(897	4)
333.	Sandstone, medium-light-gray, fine-grained, contains 45 percent quartz, 40 percent dark-gray shale laminae, few plant fragments and well rounded siderite clasts, slightly burrowed, thin and irregularly bedded.....	0	9
		(898	1)

Unit Number	Description	Thickness (Depth) ft	in.
334.	Underclay, medium- to medium-dark-gray, very silty, abundant rootlets, few siderite nodules and slickensided surfaces.....	1	9
		(899	10)
335.	Sandstone, medium- to medium-dark-gray, very fine to fine-grained, silty, contains 40 percent quartz, abundant rootlets, thin-bedded.	0	8
		(900	6)
336.	Shale, medium-dark- to dark-gray, very silty, contains few light-gray very fine grained sandstone lenses, abundant plant fragments, evenly bedded, few contorted beds.....	2	0
		(902	6)
337.	Sandstone, light- to medium-light-gray, fine- to medium-grained, contains 50 percent quartz, few coal and dark-gray silty shale laminae, few plant fragments and siderite clasts, thin and irregularly bedded; base grades.....	1	1
		(903	7)
338.	Sandstone, medium-dark-gray, very fine to fine-grained, carbonaceous, contains 40 percent quartz, few coal and dark-gray shale laminae, thin-bedded; base sharp and uneven.....	0	9
		(904	4)
339.	Sandstone, very light gray, very fine to fine-grained, contains 65 percent quartz, 10 percent dark-gray shale laminae, few stylolites; base sharp and uneven.....	2	4.5
		(906	8.5)
340.	Shale, dark-gray, carbonaceous, contains 30 percent light-gray very fine grained sandstone laminae, few dark-gray shale and light-gray sandstone clasts, abundant slickensided surfaces.....	0	6.5
		(907	3)
341.	Sandstone, light-gray, fine- to medium-grained, sparsely micaceous, contains 65 percent quartz, scattered dark-gray shale laminae and beds; abundant coal, siderite and dark-gray shale clasts from 1 ft 4 in. to 8 ft 9 in. below top and in basal 11 ft 7 in.; few small-scale faults, crossbedded in part, thin- to thick-bedded; base sharp and uneven.....	25	3
		(932	6)
342.	Sandstone, medium-gray, very fine to fine-grained, silty, contains 45 percent quartz, scattered dark-gray shale laminae; few siderite, dark-gray shale and light-gray sandstone clasts; crossbedded, thin- to thick-bedded; base sharp.....	11	11
		(944	5)
343.	Sandstone, medium-gray, very fine grained, contains 40 percent quartz, 30 percent dark-gray shale laminae, few siderite nodules, cross-laminated, thin-bedded; base sharp.....	1	5
		(945	10)

Unit Number	Description	Thickness (Depth) ft	in.
344.	Shale, medium-dark- to dark-gray, silty, carbonaceous, contains 40 percent light-gray siltstone and very fine grained sandstone laminae, cross-laminated, evenly bedded.....	0	10
		(946	8)
345.	Sandstone, medium-gray, fine-grained, micaceous, contains 40 percent quartz, 40 percent dark-gray shale and medium-gray siltstone laminae, few siderite clasts and nodules, slightly burrowed, thin-bedded; base sharp.....	4	2
		(950	10)
346.	Shale, dark-gray, carbonaceous, silty, contains 5 percent medium-gray siltstone laminae, few plant fragments, evenly bedded, fissile.....	0	8
		(951	6)
347.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 45 percent quartz, abundant dark-gray shale laminae in top 3 in., abundant angular dark-gray shale clasts in basal 4 in., thin-bedded.....	0	8
		(952	2)
348.	Shale, medium-dark- to dark-gray, carbonaceous, silty, contains 5 percent medium-light-gray siltstone and very fine grained sandstone laminae and beds, few small-scale faults, evenly bedded; base sharp.....	2	2
		(954	4)
349.	Sandstone, medium-dark- to dark-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent dark-gray shale laminae, few siderite clasts, thin-bedded; base sharp.....	0	8
		(955	0)
350.	Coal, mostly dull attritus, few thin vitrain bands, sheared.....	0	8
		(955	8)
351.	Underclay, dark-gray, silty, abundant rootlets, few coalified plant fragments; base grades.....	3	6.5
		(959	2.5)
352.	Sandstone, medium-gray, very fine to fine-grained, silty, micaceous, contains 45 percent quartz, 25 percent dark-gray shale laminae and beds up to 2 in. thick, few plant fragments and rootlets; base grades.....	2	2
		(961	4.5)
353.	Sandstone, medium-gray, very fine to fine-grained, silty, micaceous, contains 45 percent quartz, 30 percent dark-gray shale laminae, abundant rootlets; few quartz pebbles, coal, dark-gray shale, and medium-light-gray sandstone clasts in basal 3 in.; few quartz-filled fractures; base sharp.....	5	2
		(966	6.5)

Unit Number	Description	Thickness (Depth) ft	in.
354.	Shale, black, carbonaceous, contains few coal laminae.....	1	4
		(967	10.5)
355.	Sandstone, medium-light-gray, medium-grained, contains 40 percent quartz, 10 percent dark-gray shale laminae, thin-bedded; base sharp.....	0	2
		(968	0.5)
356.	Sandstone, medium-gray, fine-grained, contains 45 percent quartz, 40 percent dark-gray carbonaceous shale laminae, abundant rootlets, thick-bedded; base sharp.....	1	4
		(969	4.5)
357.	Siltstone, medium- to medium-dark-gray, contains scattered dark-gray shale and light-gray very fine to fine-grained sandstone laminae, slightly burrowed, cross-laminated, thin-bedded; base grades.....	2	8
		(972	0.5)
358.	Shale, medium-dark- to dark-gray, carbonaceous, silty, contains 30 percent medium-light-gray siltstone and very fine grained sandstone laminae, abundant plant fragments, contorted bedding; base grades.....	3	4
		(975	4.5)
359.	Shale, dark-gray to black, very carbonaceous, contains few medium-gray siltstone laminae in basal 2.5 in.....	1	3
		(976	7.5)
360.	Coal, mostly dull attritus, pyritic, contains few thin vitrain bands and medium-gray siltstone laminae.....	0	10
		(977	5.5)
361.	Shale, dark-gray to black, very carbonaceous, silty, contains few coal laminae.....	1	7.5
		(979	1)
362.	Shale, black, very carbonaceous, contains few coal laminae.....	0	9
		(979	10)
363.	Shale, medium-dark- to dark-gray, contains 30 percent medium-gray siltstone laminae, sheared; base sharp.....	0	9
		(980	7)
364.	Shale, black, very carbonaceous.....	0	1
		(980	8)
365.	Shale, dark-gray, carbonaceous, contains 45 percent medium-gray siltstone laminae; base grades.....	0	7
		(981	3)

Unit Number	Description	Thickness (Depth) ft	in.
366.	Shale, medium-dark- to dark-gray, pyritic, carbonaceous, contains few coal laminae in top 2 ft 10 in., scattered medium-gray siltstone laminae in basal 15 ft, few well-preserved plant fragments, slightly burrowed, evenly bedded; base grades.....	22	6
		(1003	9)
367.	Shale, medium-dark- to dark-gray, very silty, carbonaceous, contains 10 percent medium-light-gray siltstone and very fine grained sandstone laminae and beds, few coal laminae, cross-laminated in part, evenly bedded; base sharp and uneven.....	9	8
		(1013	5)
368.	Sandstone, very light gray, fine- to medium-grained, pyritic, contains 60 percent quartz, scattered dark-gray shale laminae and lenses up to 0.5 in. thick, irregularly bedded.....	0	7
		(1014	0)
369.	Shale, medium-dark- to dark-gray, contains abundant light-gray very fine grained sandstone lenses up to 1.5 in. thick; base sharp and uneven.....	0	6
		(1014	6)
370.	Sandstone, very light gray, fine- to medium-grained, pyritic contains 60 percent quartz, abundant dark-gray shale laminae and clasts up to 0.5 in. thick, thin-bedded.....	0	7
		(1015	1)
371.	Shale, medium-dark-gray, very silty, carbonaceous, contains few medium-light-gray fine-grained sandstone beds up to 0.5 in. thick, evenly bedded.....	0	8
		(1015	9)
372.	Sandstone, very light gray, fine- to medium-grained, contains 60 percent quartz, thin-bedded.....	0	3
		(1016	0)
373.	Shale, medium-dark- to dark-gray, silty, carbonaceous, contains 20 percent medium-gray siltstone and fine-grained sandstone laminae, evenly bedded.....	1	4
		(1017	4)
374.	Sandstone, very light gray, contains 60 percent quartz, few angular dark-gray shale clasts; base sharp and angular.....	0	4
		(1017	8)
375.	Underclay, medium-gray, abundant rootlets and plant fragments.....	0	9
		(1018	5)
376.	Sandstone, medium-light-gray, coarse-grained, contains 60 percent quartz, abundant white quartz granules and pebbles up to 0.5 in. in diameter, few well-rounded medium-dark-gray shale clasts, normally graded.....	0	8
		(1019	1)

Unit Number	Description	Thickness (Depth) ft	in.
377.	Sandstone, medium-light-gray, fine- to coarse-grained, calcareous from 9 ft 8 in. to 10 ft 2 in. below top, contains 50-60 percent quartz, abundant quartz granules and pebbles and well rounded siderite clasts in basal 3 ft 6 in., few high-angle quartz-filled fractures, thick-bedded; base sharp and uneven.....	21	0
		(1040	1)
378.	Siderite, brownish-gray, lenticular.....	0	2
		(1040	3)
379.	Shale, medium-dark-gray, carbonaceous, contains few medium-light-gray coarse grained sandstone lenses up to 0.5 in. thick in basal 3 in., evenly bedded; base sharp.....	1	0
		(1041	3)
380.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 10 percent dark-gray shale and medium-gray siltstone laminae, thin-bedded; base sharp.....	0	4
		(1041	7)
381.	Shale, medium- to medium-dark-gray, silty, contains few coal laminae, abundant plant fragments, evenly bedded; base sharp.....	7	5
		(1049	0)
382.	Sandstone, very light gray, fine- to medium-grained, contains 65 percent quartz, few dark and light mineral grains, abundant medium-dark-gray shale laminae 1 ft 8 in. below top, scattered siderite clasts, few stylolites.....	2	11
		(1051	11)
383.	Shale, medium- to medium-dark-gray, very silty, carbonaceous, contains few medium-light-gray very fine grained sandstone laminae and beds, evenly bedded; base sharp.....	0	7
		(1052	6)
384.	Sandstone, medium-light-gray, fine- to medium-grained, contains 65 percent quartz, few dark-gray shale laminae and beds in top 5 in., scattered siderite and angular medium-dark-gray shale clasts, thin- to thick-bedded.....	2	2
		(1054	8)
385.	Sandstone, light- to medium-light-gray, fine- to medium-grained, contains 65 percent quartz, few dark-gray silty shale laminae and and beds 4 in. below top, thin- to thick-bedded.....	4	10
		(1059	6)
386.	Sandstone, very light gray, very fine to fine-grained, pyritic, contains 65 percent quartz, few coal and dark-gray shale laminae and clasts, few calcite-filled fractures; base sharp.....	1	4
		(1060	10)

Unit Number	Description	Thickness (Depth) ft	in.
387.	Shale, medium-dark- to dark-gray, silty, carbonaceous, contains scattered medium-light-gray siltstone and very fine grained sandstone laminae and beds up to 0.75 in. thick, few pyrite laminae, abundant plant fragments, slightly burrowed; base sharp.....	5	5
		(1066	3)
388.	Siltstone, medium- to medium-dark-gray, mottled brownish-gray in basal 8 in., few plant fragments, thin and unevenly bedded, few contorted beds in top 4 in.....	2	0
		(1068	3)
389.	Sandstone, medium-gray, very fine to fine grained, silty, micaceous, contains 40 percent quartz, 5 percent medium-dark-gray siltstone laminae, thin-bedded; base grades abruptly.....	1	5
		(1069	8)
390.	Siltstone, medium-dark-gray, thin-bedded, poor fissility; base grades abruptly.....	0	11
		(1070	7)
391.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 45 percent quartz, 5 percent medium-gray siltstone laminae, few dark-gray shale clasts in top 5 in. and basal 3 in., thin- to thick-bedded; base sharp.....	9	6
		(1080	1)
392.	Siltstone, medium-gray, finely micaceous, few plant fragments, thin-bedded, poor fissility; base grades abruptly.....	0	9
		(1080	10)
393.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	0	3
		(1081	1)
394.	Shale, medium-dark-gray, silty, few plant fragments, thin-bedded, poor fissility; base sharp.....	0	8
		(1081	9)
395.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 55 percent quartz, abundant siderite and small medium-dark-gray shale clasts, crossbedded, thin and irregularly bedded; base sharp.....	1	0
		(1082	9)
396.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, abundant dark-gray shale laminae in top and basal 1 in.; base grades.....	0	6
		(1083	3)

Unit Number	Description	Thickness (Depth) ft	in.
397.	Shale, dark-gray to black, carbonaceous, contains 1 in. light-gray very fine grained sandstone bed 0.5 in. below top, evenly bedded, fissile; base grades.....	2	8
		(1085	11)
398.	Shale, medium-dark-gray, slightly silty, evenly bedded, fair fissility; base grades abruptly.....	1	9
		(1087	8)
399.	Siltstone, medium-gray, finely micaceous, thick-bedded, poor fissility; base grades.....	0	10
		(1088	6)
400.	Sandstone, light- to medium-light-gray, fine- to medium-grained, contains 45 percent quartz, 10 percent medium-gray siltstone laminae, abundant siderite clasts up to 0.25 in. thick and medium-dark-gray shale clasts up to 0.5 in. thick, thin-bedded; base grades abruptly.....	1	3
		(1089	9)
401.	Sandstone, medium-light-gray, fine-grained, contains 50 percent quartz, 10 percent medium-dark-gray silty shale laminae in basal 2 in., abundant small siderite and medium-dark-gray shale clasts in basal 6 in., thin-bedded; base sharp.....	5	0
		(1094	9)
402.	Siltstone, medium-gray, micaceous, thin and irregularly bedded, poor fissility; base sharp and uneven.....	1	4
		(1096	1)
403.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, abundant medium-dark-gray shale clasts, abundant siderite clasts in basal 2 in., thin- to thick-bedded; base sharp.....	3	0
		(1099	1)
404.	Sandstone, medium-light- to medium-gray, very fine grained, silty, contains 40 percent quartz, thin-bedded, few contorted beds; base grades abruptly.....	0	11
		(1100	0)
405.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, abundant siderite clasts, few medium-dark-gray shale clasts; base grades.....	0	4
		(1100	4)
406.	Siltstone, medium-dark-gray, contains 20 percent medium-light-gray very fine grained sandstone laminae and beds, abundant well-preserved plant fragments, thin-bedded, poor fissility; base grades abruptly.....	1	6
		(1101	10)

Unit Number	Description	Thickness (Depth) ft	in.
407.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, scattered siderite and medium-dark-gray shale clasts, irregularly bedded; base sharp and uneven.....	0	6
		(1102	4)
408.	Sandstone, medium-gray, very fine grained, finely micaceous, contains 40 percent quartz, few plant fragments, thin-bedded; base uneven.....	3	5
		(1105	9)
409.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few coal laminae 10 in. above base, abundant siderite and medium-dark-gray shale clasts in top 3 in. and in basal 10 in., thin-bedded; base sharp.....	2	9
		(1108	6)
410.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 20 percent medium-dark-gray shale laminae and beds, 0.5 in. siderite bed 7 in. above base, slightly burrowed, thin and irregularly bedded; base sharp.....	1	6
		(1110	0)
411.	Shale, dark-gray, pyritic, silty, contains 10 percent light gray very fine grained sandstone laminae, slightly burrowed, evenly bedded; base sharp.....	2	10
		(1112	10)
412.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few medium-dark-gray shale clasts up to 0.5 in. in diameter; base sharp.....	0	2
		(1113	0)
413.	Shale, dark-gray, silty.....	0	0.5
		(1113	0.5)
414.	Sandstone, light- to medium-light-gray, fine-grained, micaceous, contains 45 percent quartz, 25 percent dark-gray shale and medium-gray siltstone laminae and beds, scattered siderite and dark-gray shale clasts, slightly burrowed, thin-bedded; base sharp.....	5	6
		(1118	6.5)
415.	Shale, medium-dark- to dark-gray, contains 35 percent medium-light-gray siltstone and very fine grained sandstone laminae and beds, few pyrite nodules, few siderite nodules and beds up to 1 in. thick, slightly burrowed, evenly bedded; base sharp.....	5	2
		(1123	8.5)

Unit Number	Description	Thickness (Depth) ft	in.
416.	Sandstone, medium-gray, fine-grained, contains 50 percent quartz, 10 percent medium-dark-gray micaceous siltstone laminae, few siderite clasts, few high-angle fractures, thin-bedded; base sharp.....	1	11
		(1125	7.5)
417.	Shale, medium-dark- to dark-gray, contains 5 percent medium-gray siltstone and very fine grained sandstone laminae and beds up to 1 in. thick, few siderite nodules 7.5 in. above base, slightly burrowed; base grades.....	4	2.5
		(1129	10)
418.	Sandstone, medium-gray, very fine to fine-grained, silty, contains 45 percent quartz, 45 percent medium-dark-gray siltstone and shale laminae and beds, thin-bedded; base sharp.....	1	0
		(1130	10)
419.	Sandstone, light- to medium-light-gray, fine-grained, finely micaceous, contains 60 percent quartz, 10 percent medium-dark-gray shale laminae, few medium-dark-gray shale clasts, scattered slickensided bedding planes, cross-laminated, thin-bedded.....	1	10
		(1132	8)
420.	Sandstone, light-gray, medium-grained, contains 60-80 percent quartz, few dark mineral grains, few quartz-and pyrite-filled high-angle fractures, thick-bedded.....	4	4
		(1137	0)

BOTTOM OF HOLE
TOTAL DEPTH 1,137 ft

GEOPHYSICAL LOG

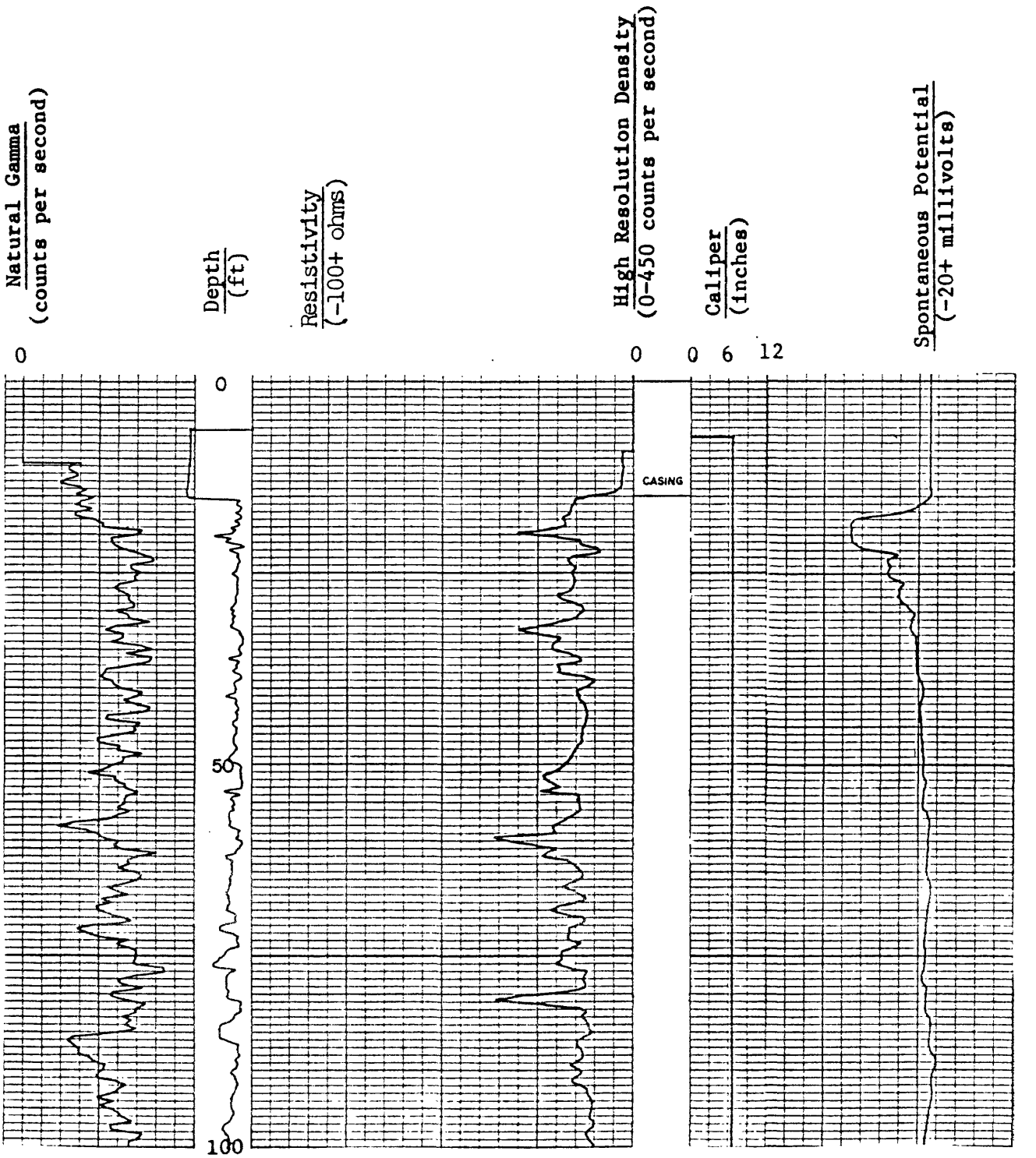
Corehole: V-1 Date: 11/23/82 State: Virginia County: Botetourt

Quadrangle: Daleville, Va. Latitude: 37°29'33"N Longitude: 79°59'52"W

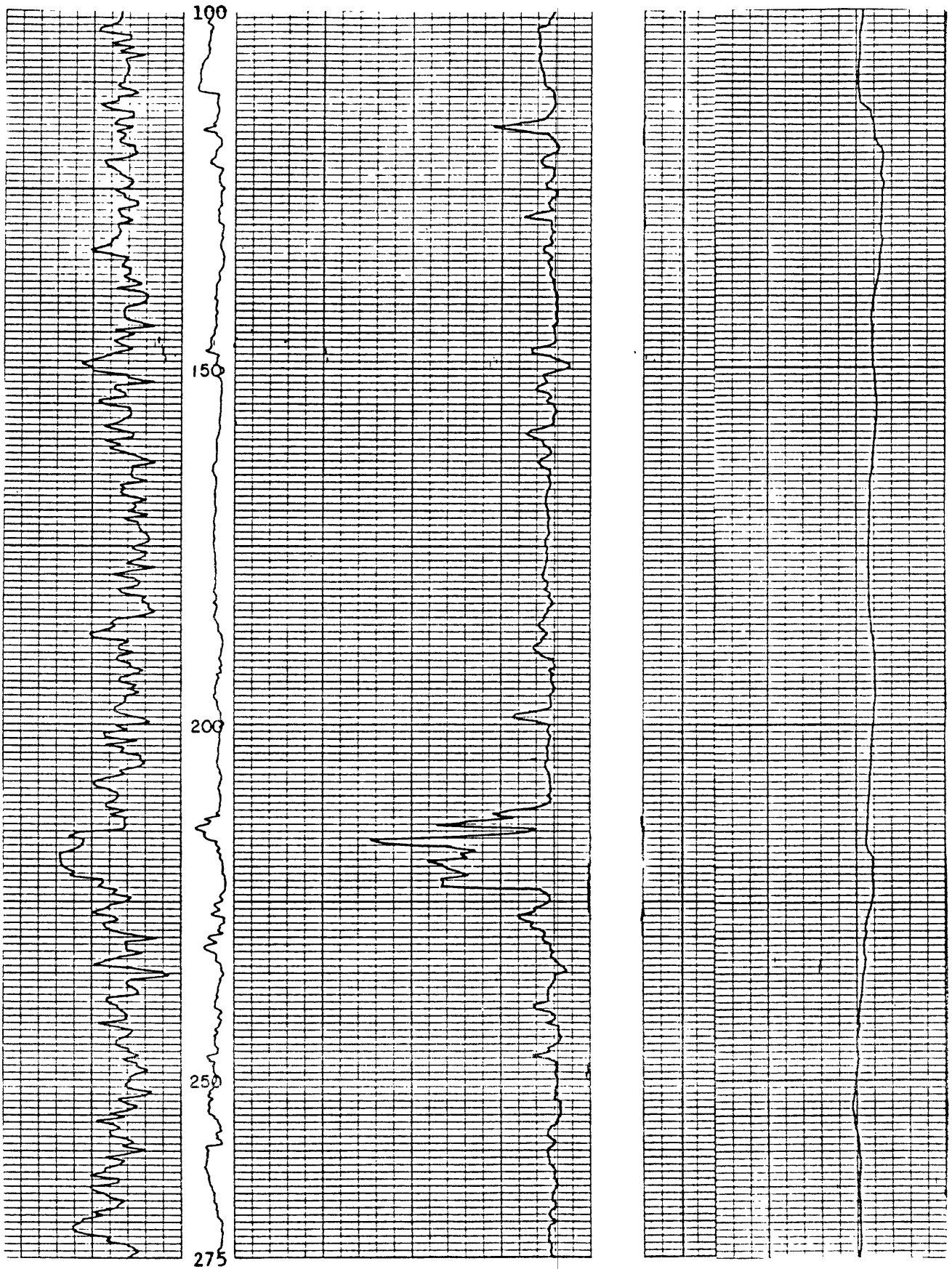
Altitude: 1,460 ft Logged Depth: 1,137 ft Drilled Depth: 1,137 ft

Logging Speed: 20 ft/min (SP 30 ft/min) Natural Gamma Time Constant: 1

High Resolution Density Time Constant: 1



Corehole: V-1 continued



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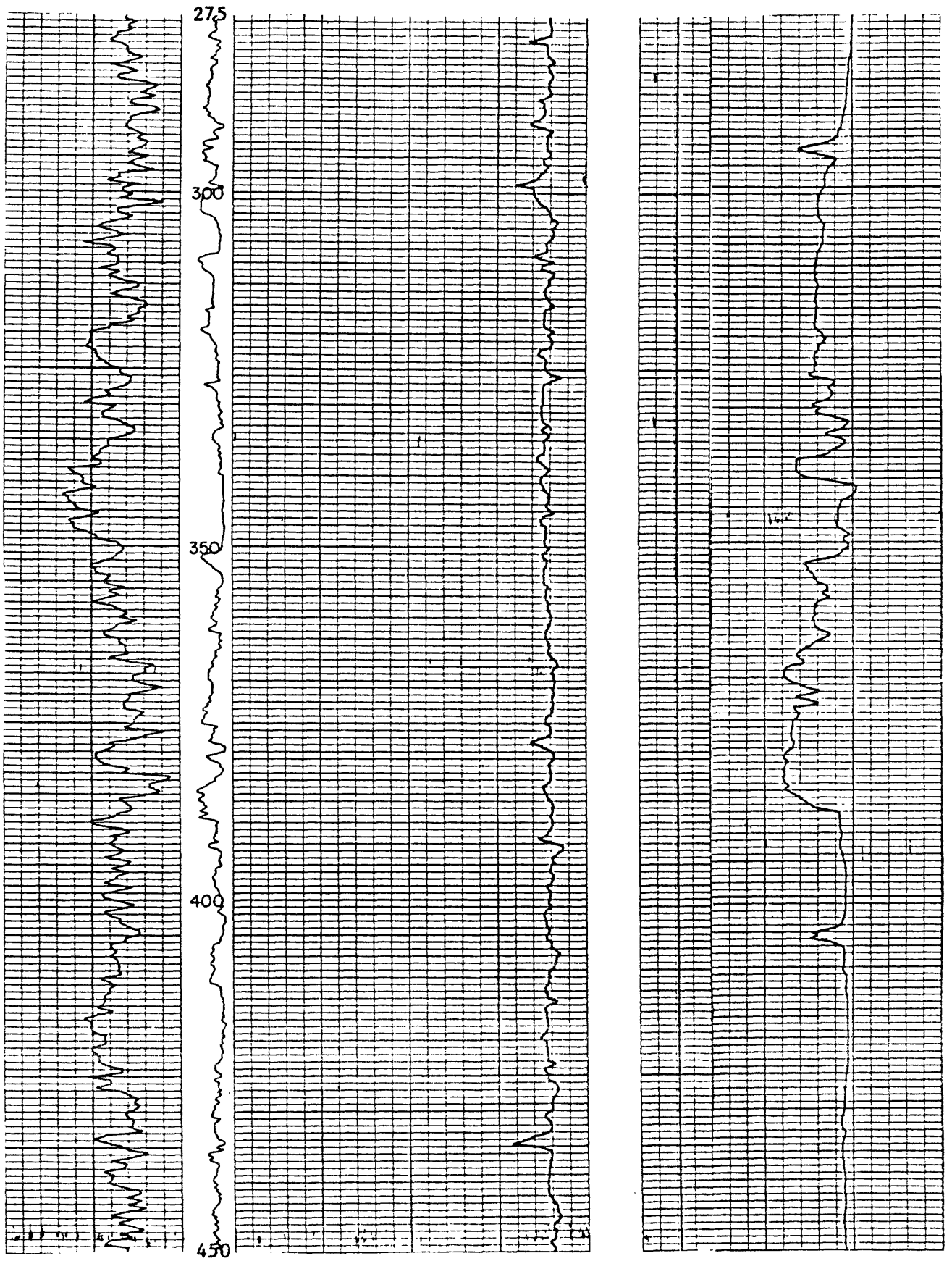

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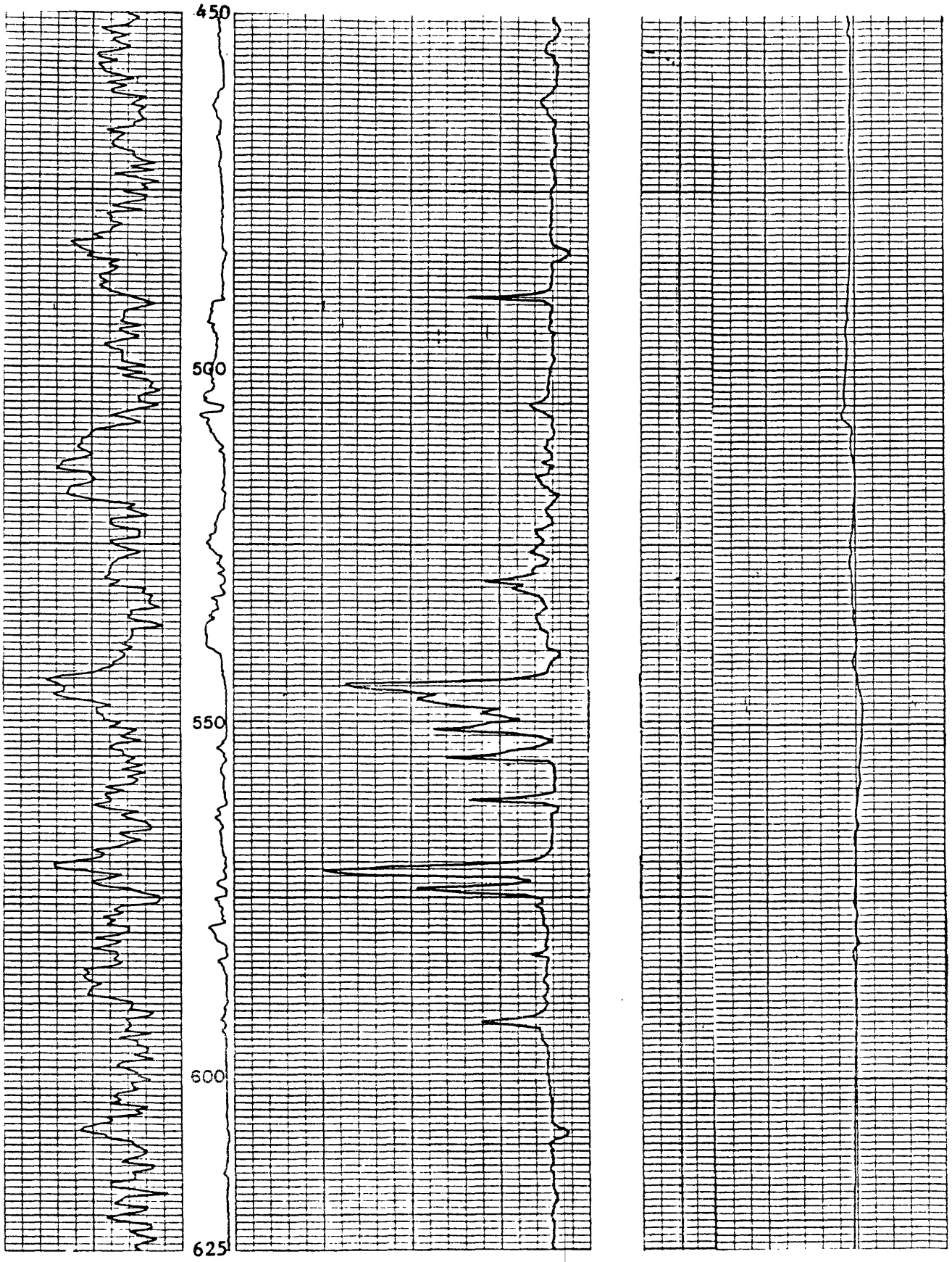

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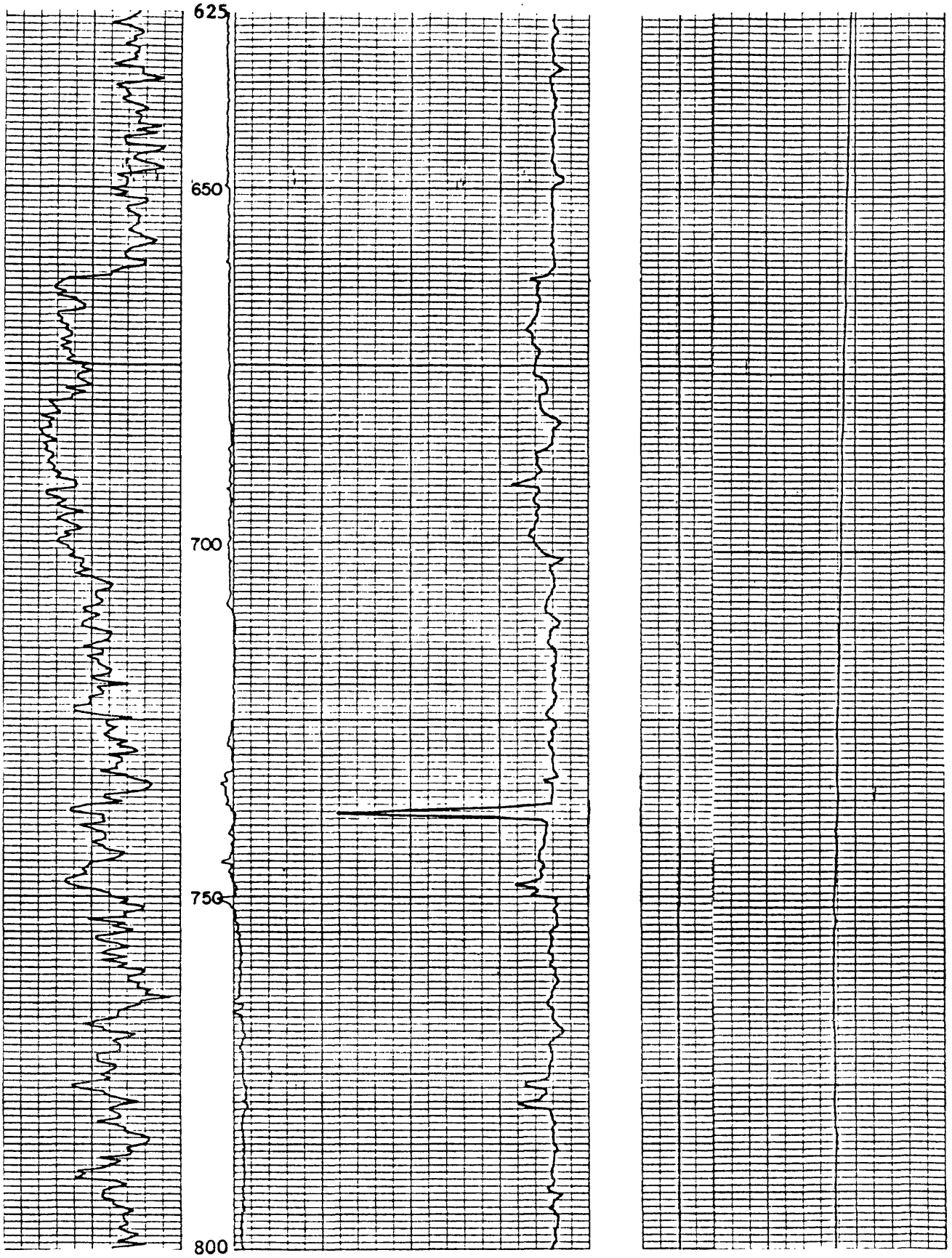

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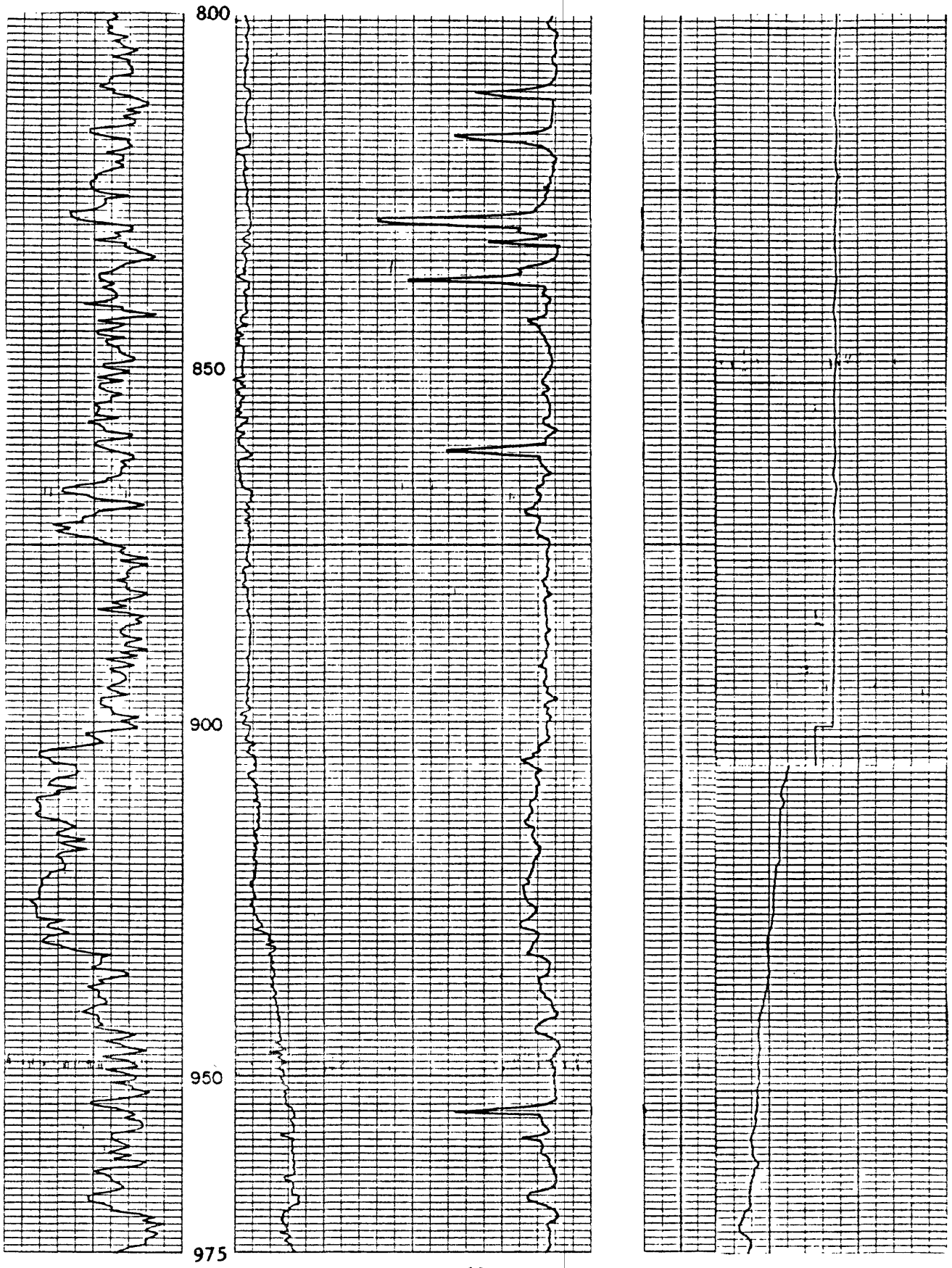

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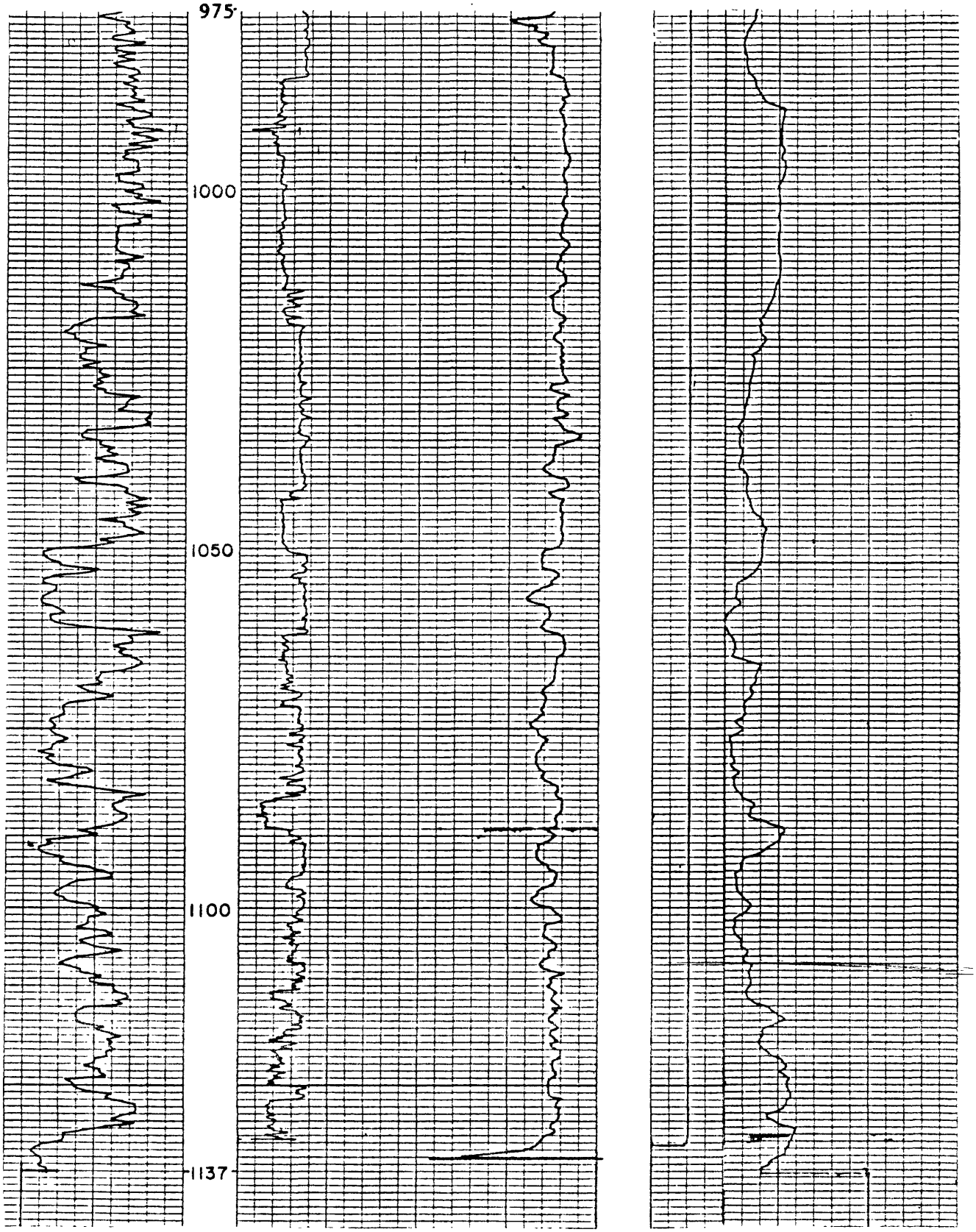
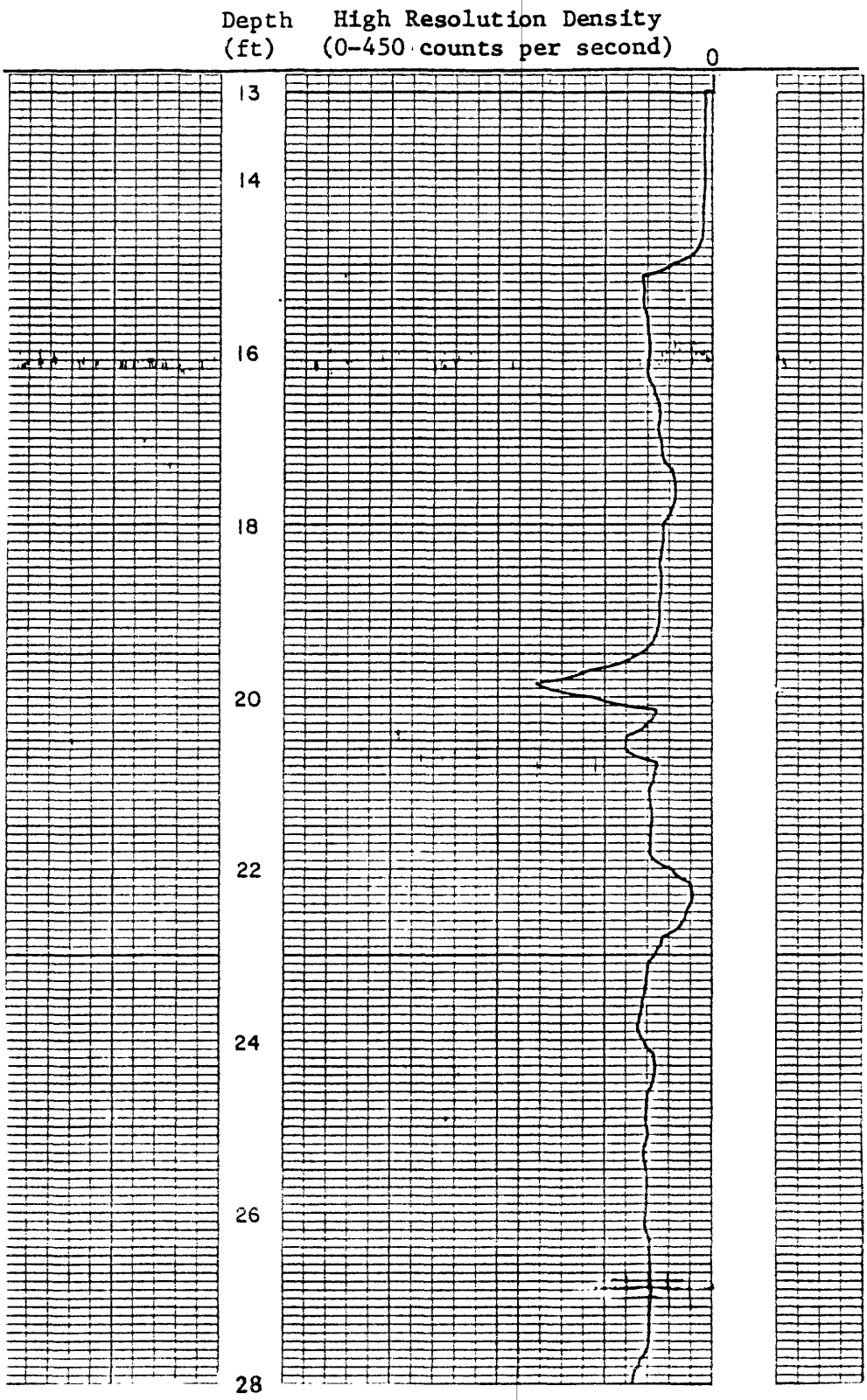
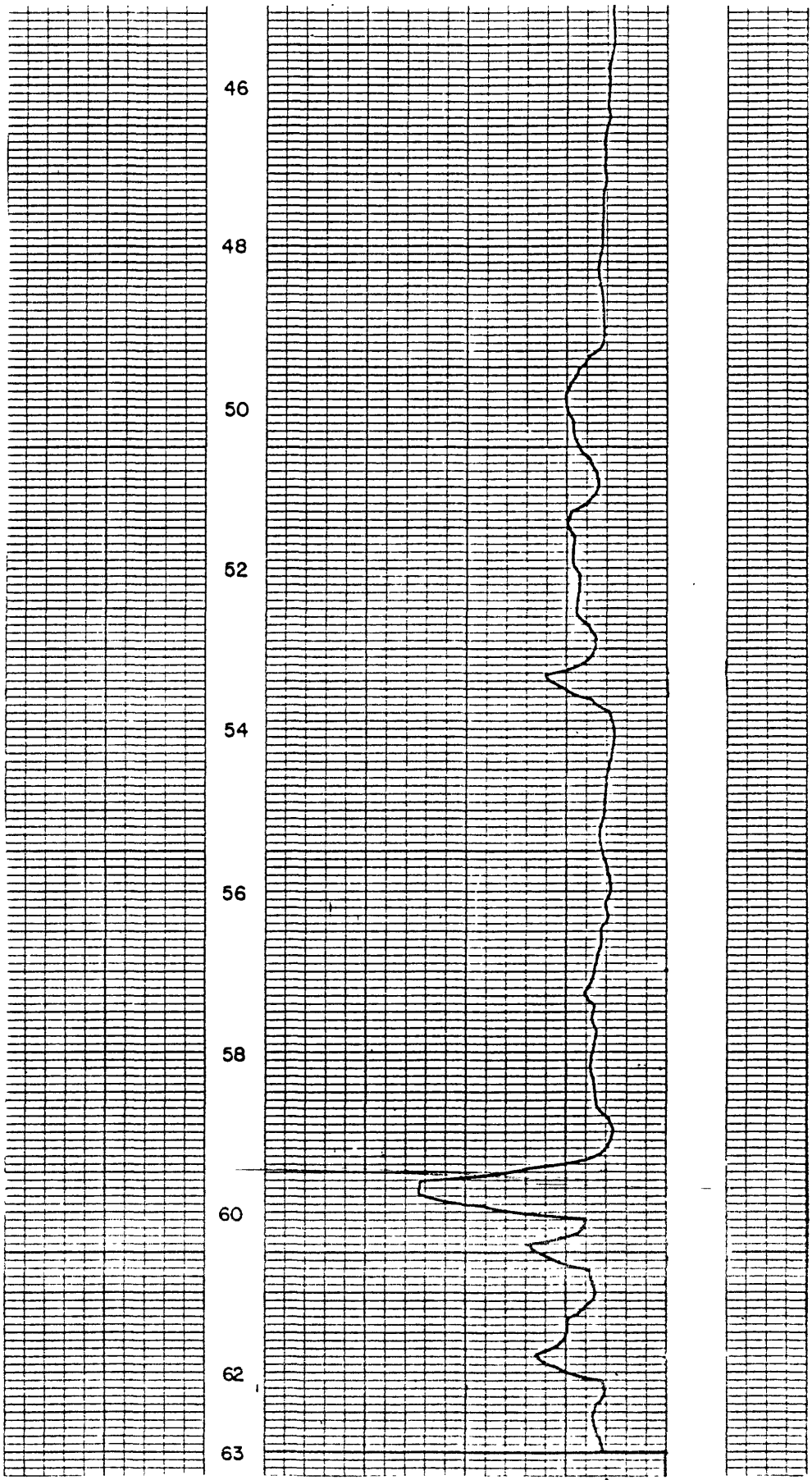


DETAIL LOG

Corehole: V-1 Logging Speed: 20 ft/min Time Constant: 1



Corehole: V-1 continued



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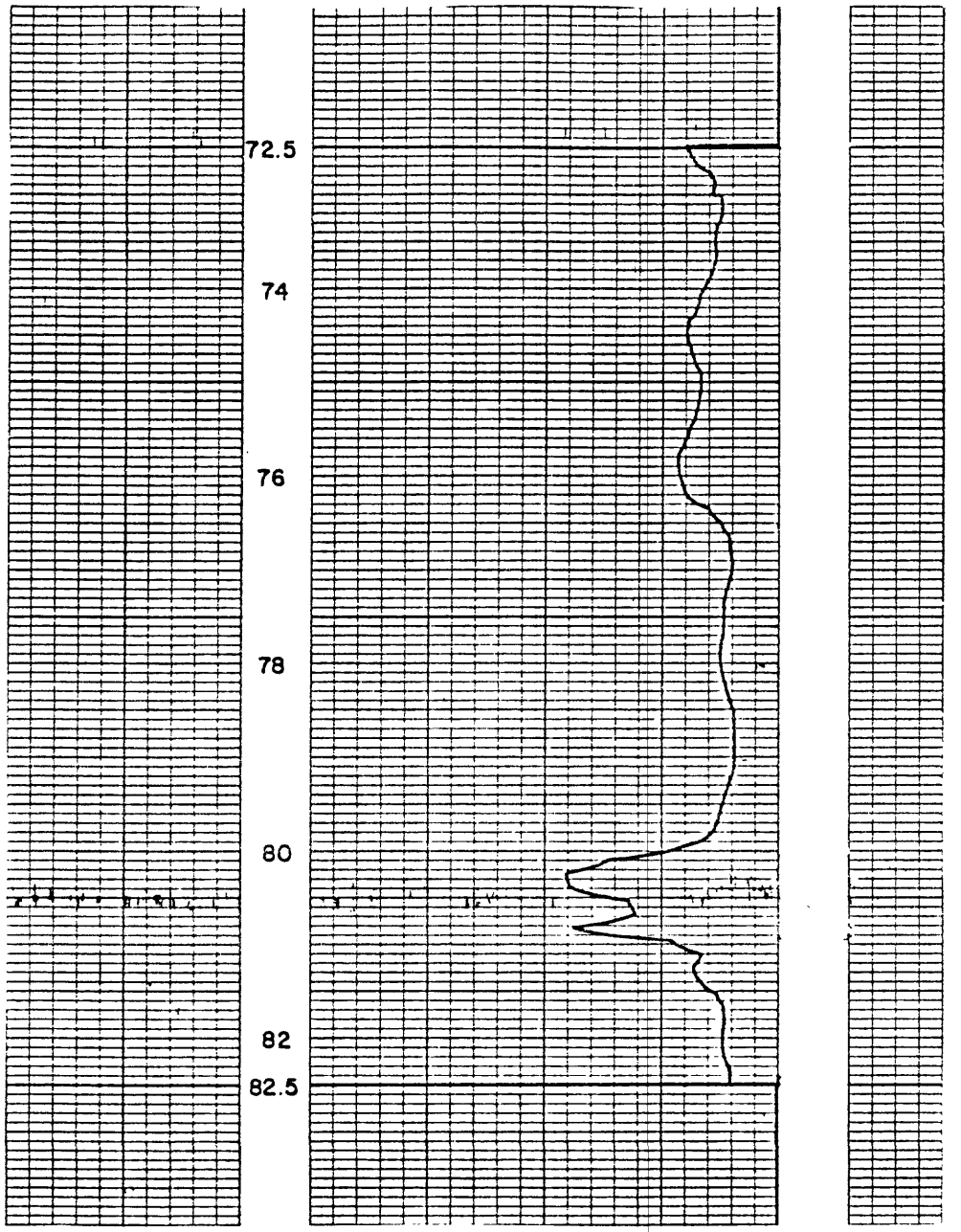

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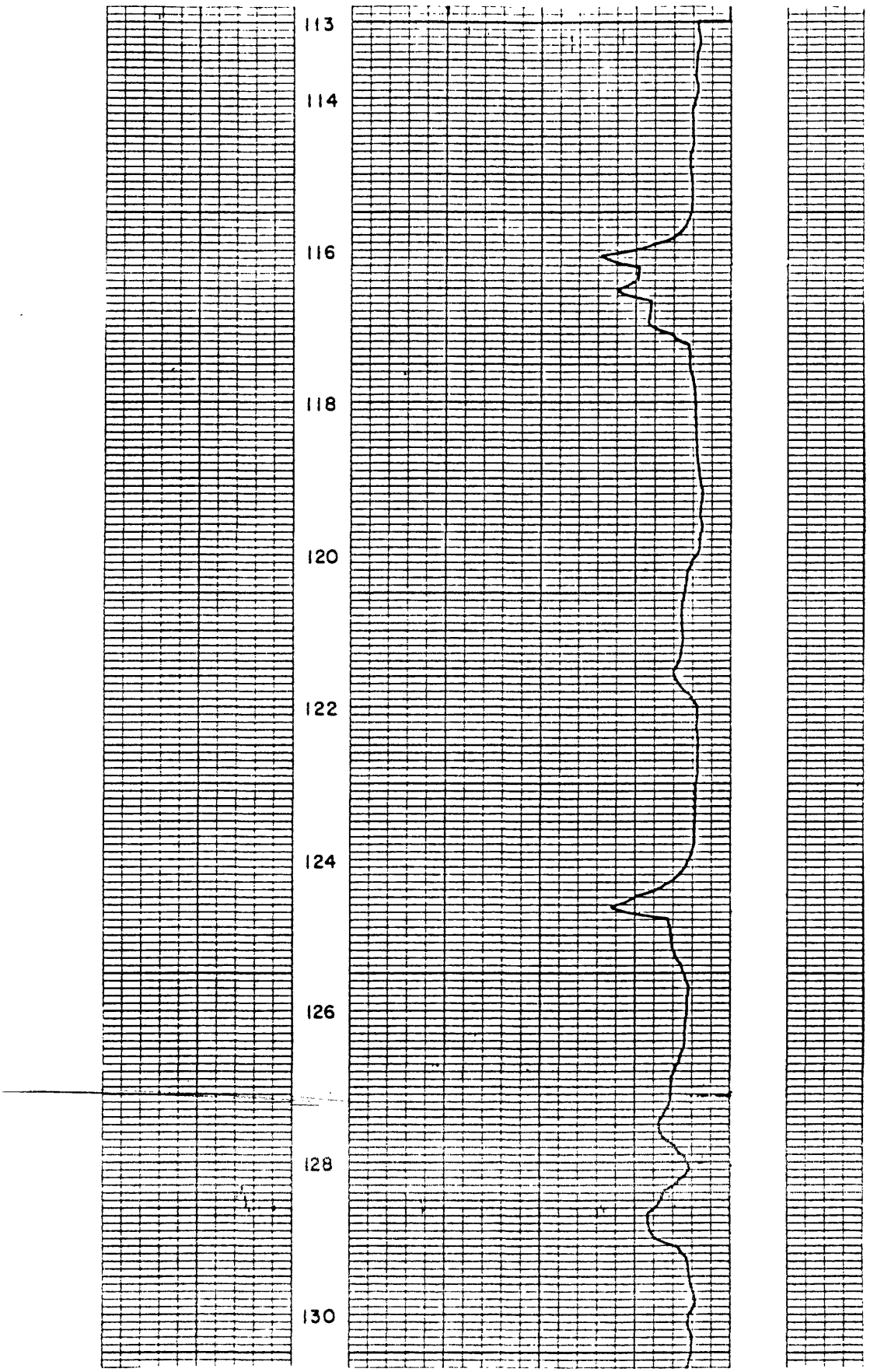

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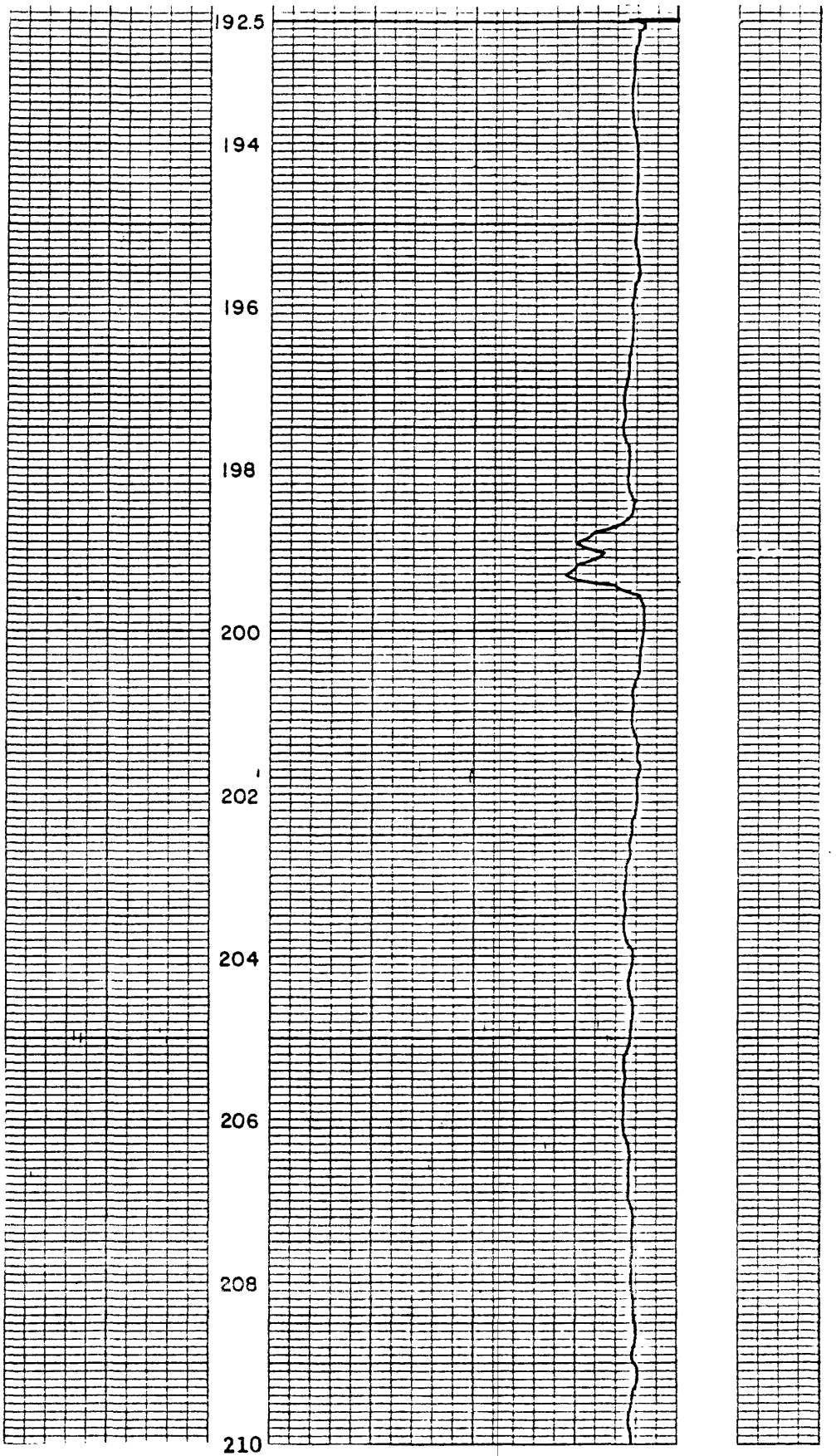

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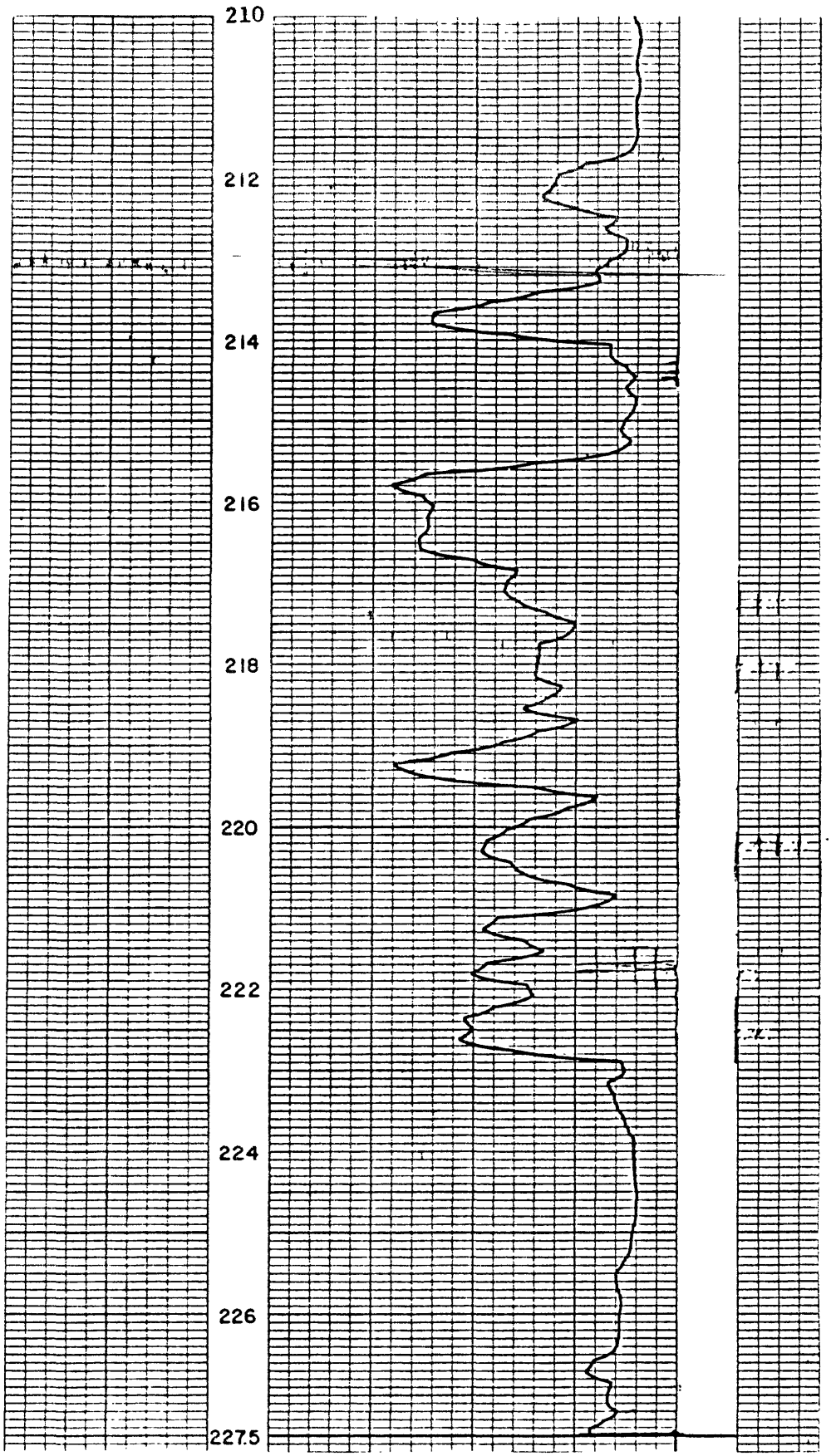

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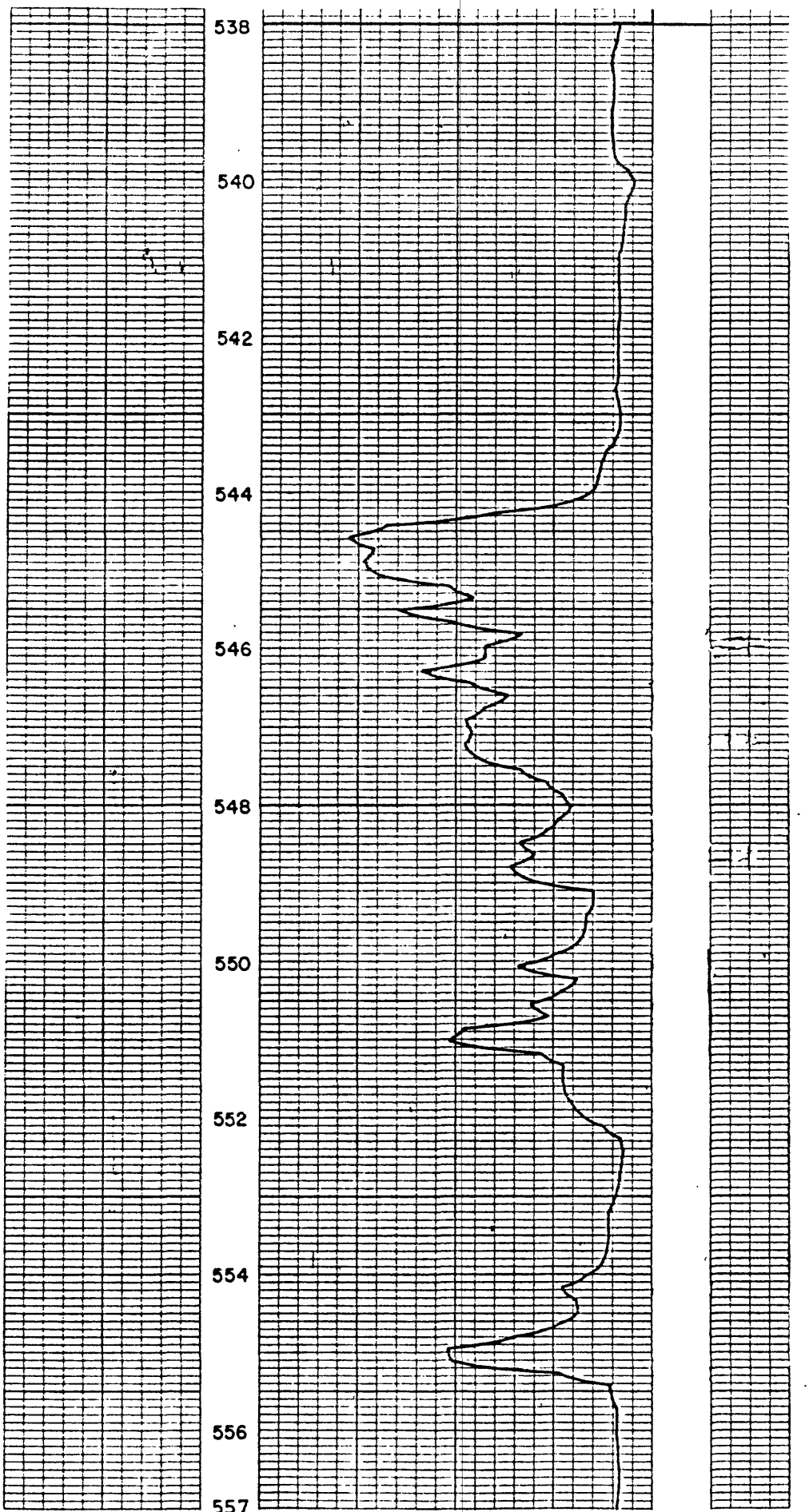

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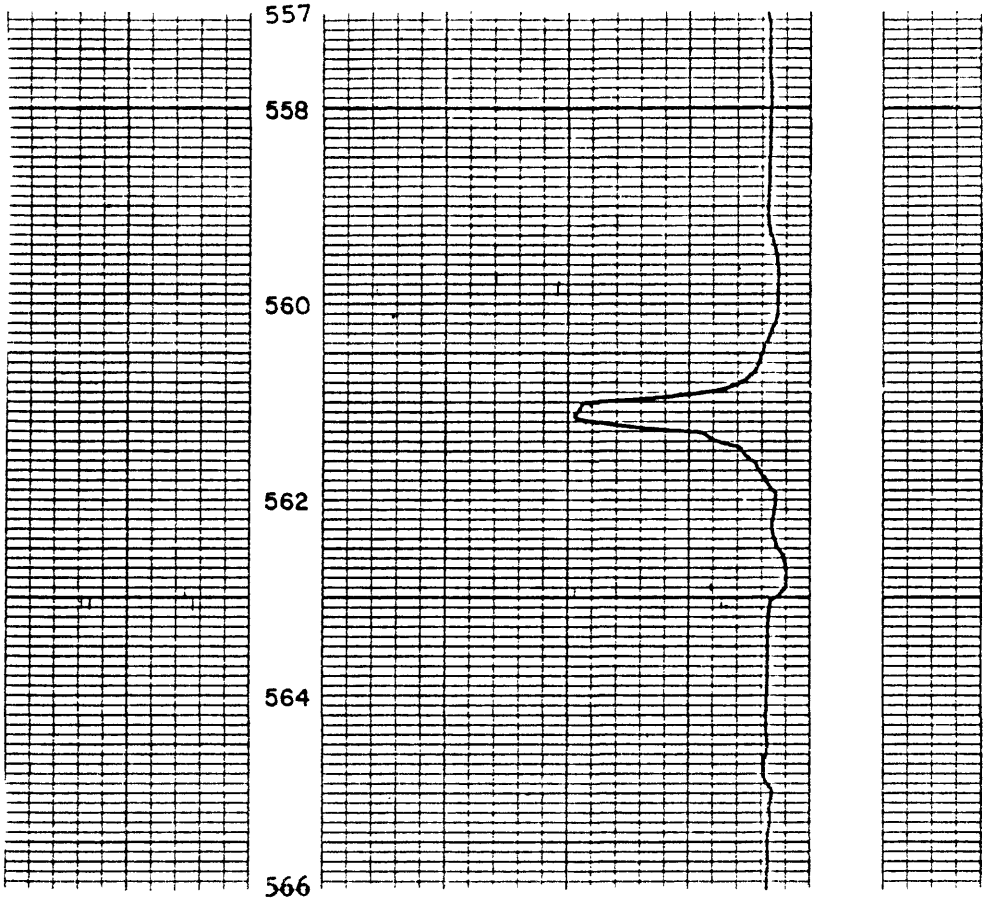

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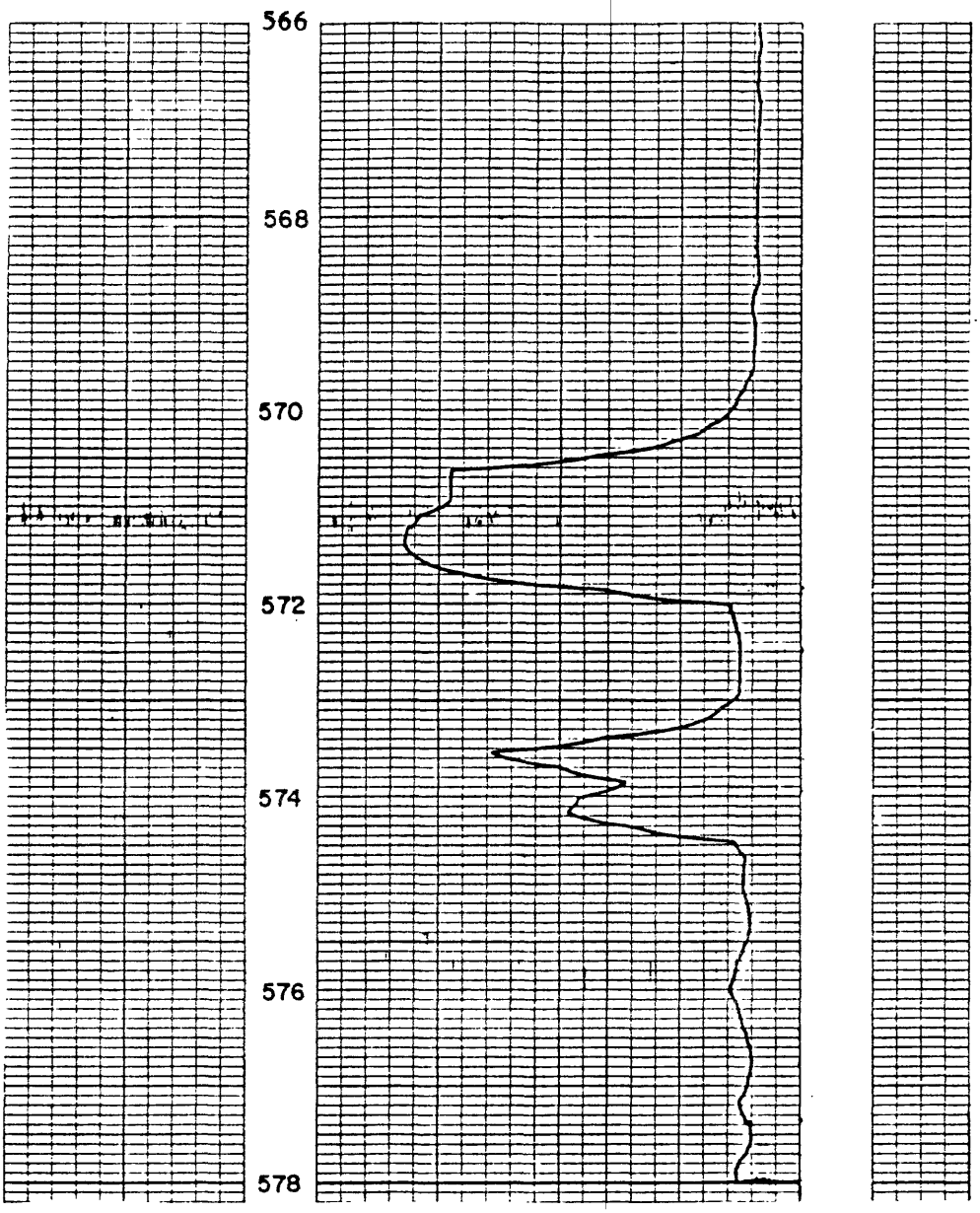

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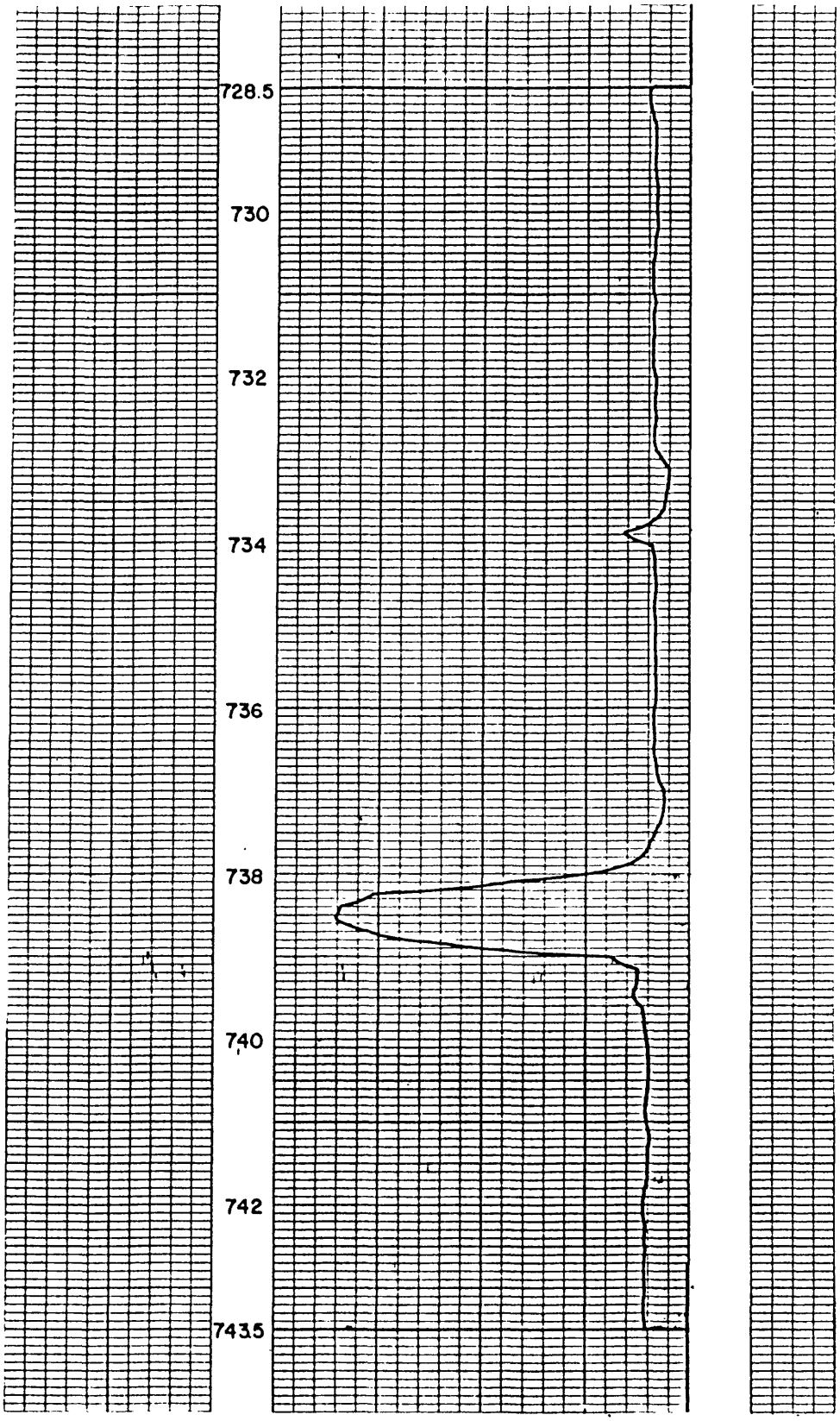

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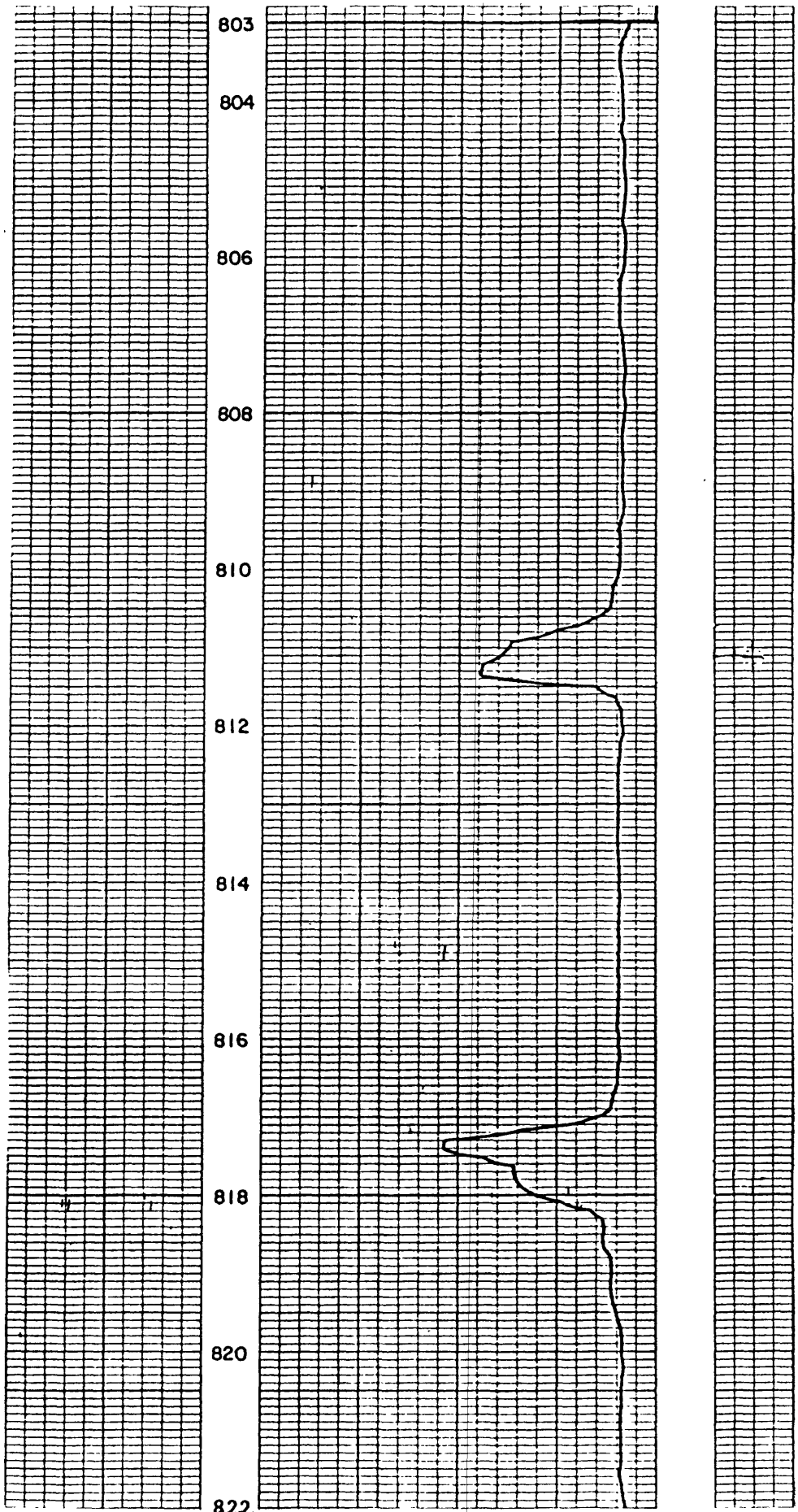

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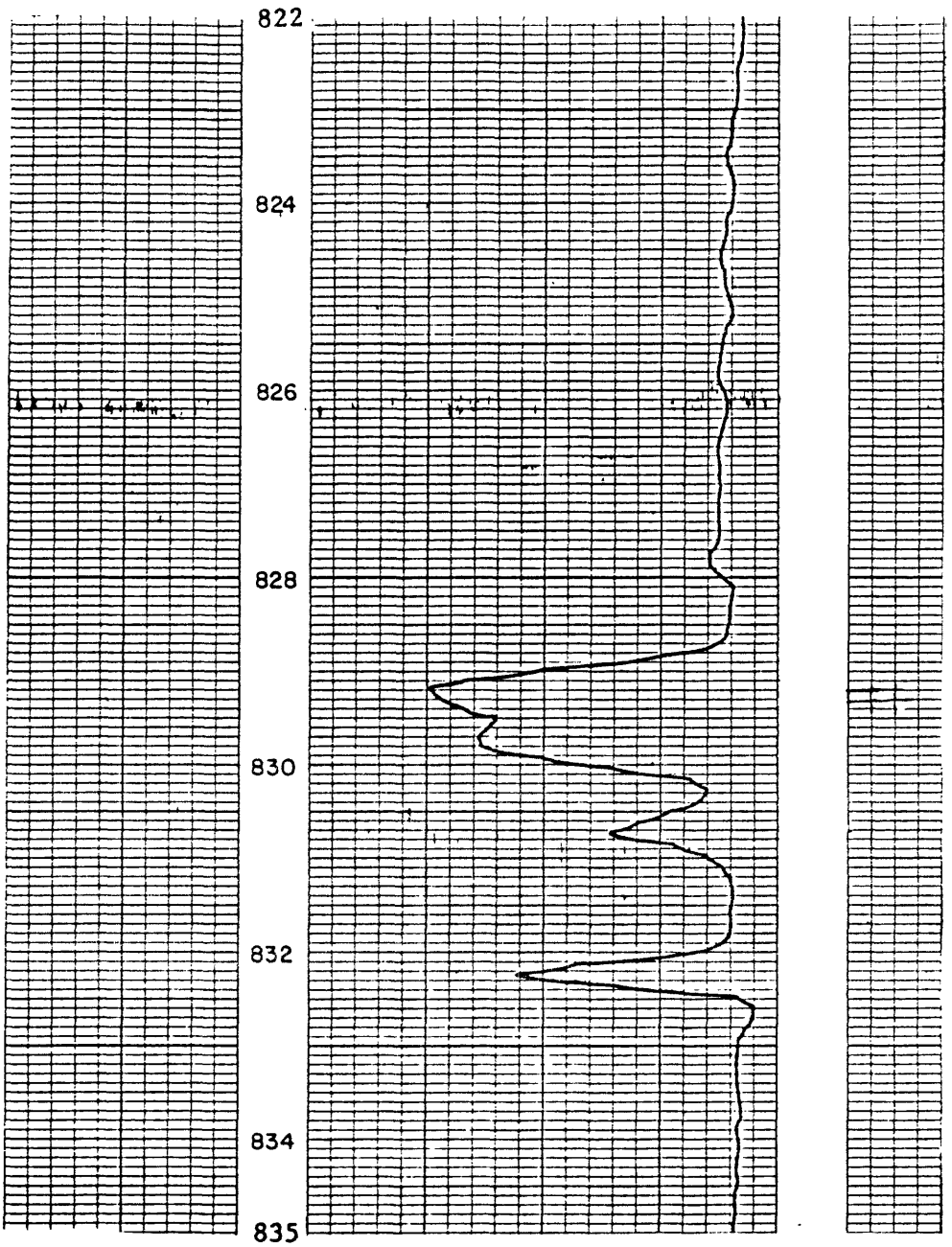

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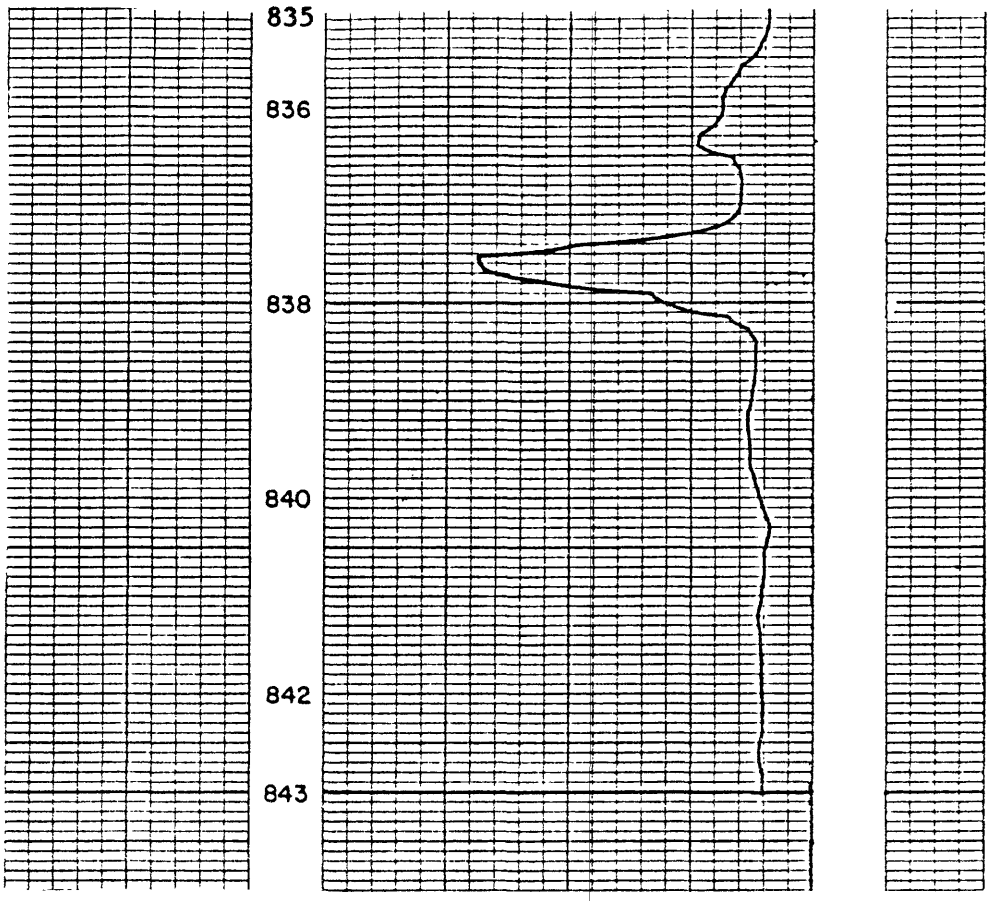

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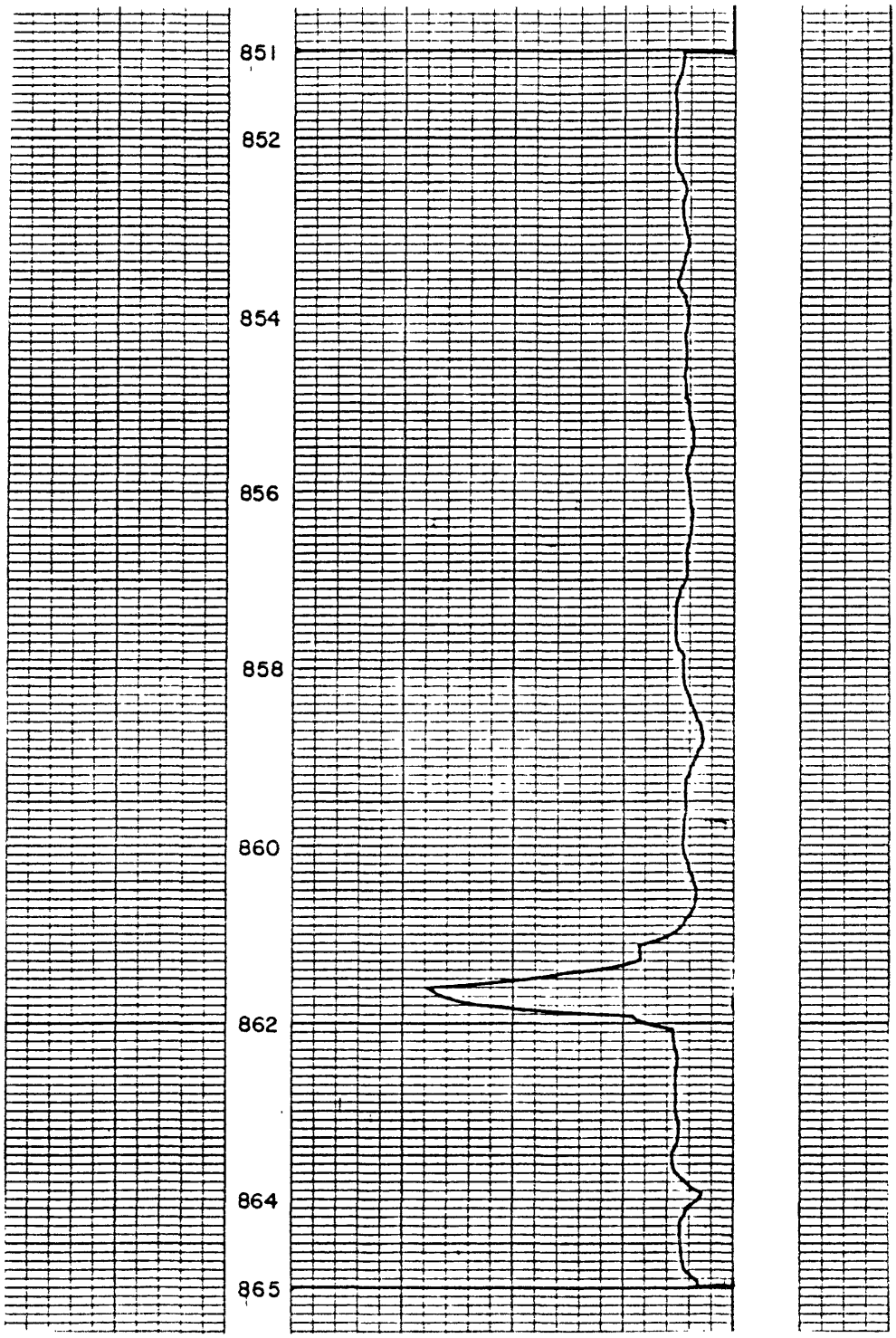

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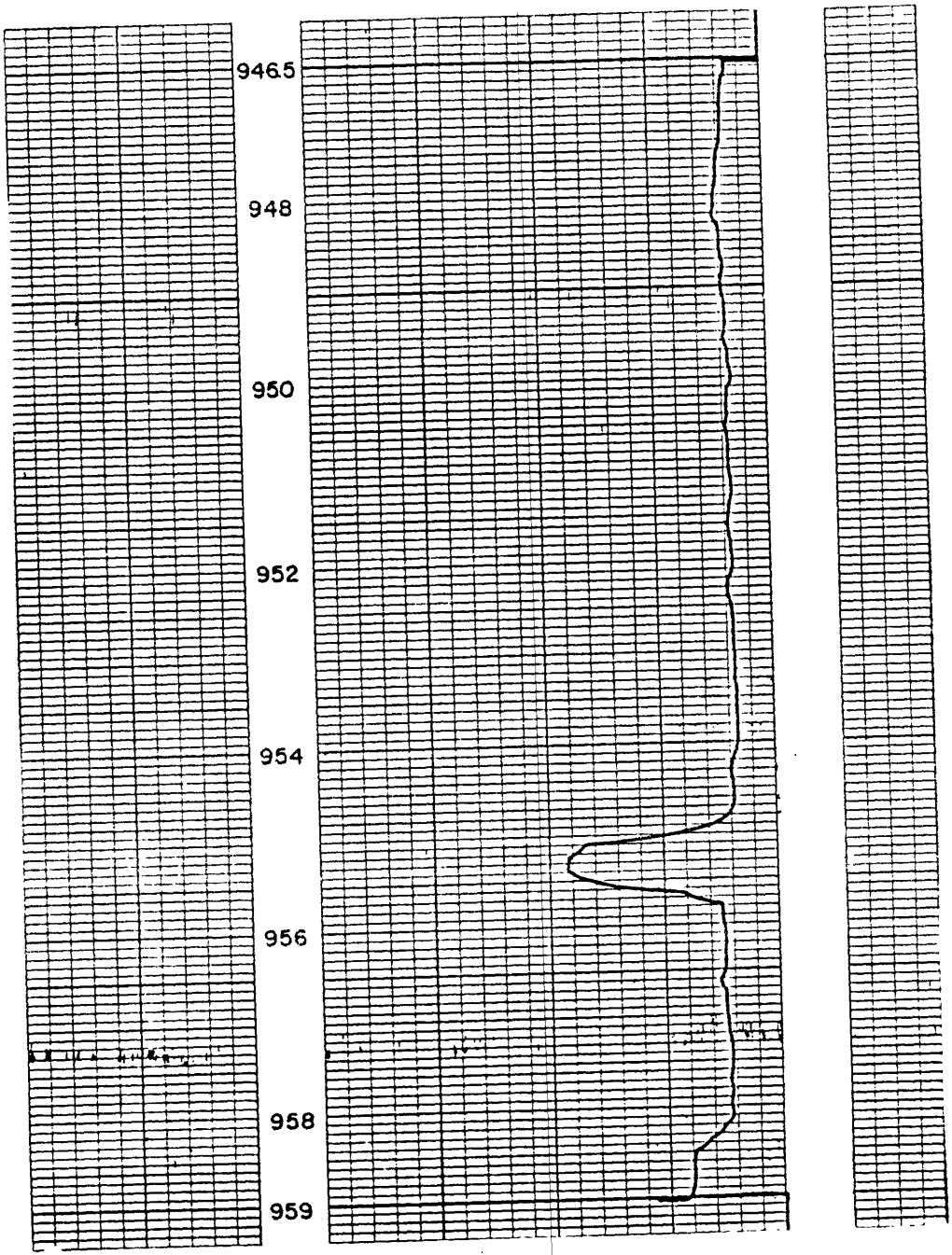


Corehole V-2

Location: Montgomery County; McDonalds Mill, Va., 7.5 minute quadrangle; along the southeast slope of Brush Mountain, accessible by State Route 624.

Coordinates: Latitude 37°18'17"N Longitude 80°19'30"W

Altitude: 2,048 ft Drilled depth: 459 ft

Dip of strata: Ranges from 20° to 35° throughout corehole and averages 30°.

Date drilled: November 17, 1982 to December 6, 1982

Core description: K.J. Englund, R.E. Thomas, J.F. Windloph, Jr., J.C. Weber, and J.M. Back

Unit Number	Description	Thickness (Depth) ft	in.
	MIDDLE AND UPPER CAMBRIAN SERIES Elbrook Formation		
1.	Soil and weathered rock (casing set - no core recovered).....	70 (70	0 0)
2.	Dolomite, light- to medium-light-gray, finely crystalline, contains abundant calcite-filled fractures, few clay-filled solution cavities from 3 ft to 3 ft 6 in. below top, highly fractured; base sharp and uneven.....	16 (86	8 8)
	Tract Mountain Thrust Fault LOWER MISSISSIPPIAN SERIES Price Formation		
3.	Coal, dull to bright attritus, pyritic, contains few brownish-gray sandstone fragments, sheared and brecciated.....	1 (87	0 8)
4.	Siltstone, medium-dark- to dark-gray, argillaceous, pyritic in part, highly fractured with few quartz-filled fractures, contorted bedding; base grades.....	3 (90	0 8)
5.	Sandstone, medium- to medium-dark-gray, very fine grained, silty, contains 40 percent quartz, few slickensided surfaces and quartz- and pyrite-filled fractures, contorted bedding; base grades.....	2 (93	9 5)
6.	Siltstone, medium-dark- to dark-gray, argillaceous, contains scattered slickensided surfaces and high-angle quartz-filled fractures, contorted bedding; base sharp and uneven.....	2 (95	6 11)

Unit Number	Description	Thickness (Depth) ft	in.
7.	Shale, dark-gray to black, very carbonaceous, silty, contains scattered slickensided surfaces and quartz-filled fractures, contorted bedding, poor fissility; base grades.....	3	5
		(99	4)
8.	Siltstone, medium-dark- to dark-gray, argillaceous, contains scattered slickensided surfaces and quartz-filled high-angle fractures, few small-scale faults, unevenly bedded; base grades.....	2	7
		(101	11)
9.	Sandstone, medium-dark- to dark-gray, very fine to fine-grained, contains 45 percent quartz, few quartz-filled fractures; base grades.....	0	8
		(102	7)
10.	Siltstone, medium-dark- to dark-gray, argillaceous, carbonaceous at 5 ft below top, pyritic in part, scattered slickensided surfaces and quartz-filled fractures, unevenly bedded; base grades.....	14	10
		(117	5)
11.	Shale, medium-dark- to dark-gray, carbonaceous, contains few plant fragments and high-angle quartz-filled fractures; base grades.....	1	4
		(118	9)
12.	Shale, dark-gray to black, very carbonaceous, abundant slickensided surfaces and fractures, very fissile and sheared.....	4	2
		(122	11)
	Merrimac coal zone (units 13-28)		
13.	Coal, dull to bright attritus, sheared.....	0	4
		(123	3)
14.	Shale, dark-gray to black, very carbonaceous, contains few coal laminae, few rootlets and slickensided surfaces.....	2	1
		(125	4)
15.	Coal, impure.....	0	10
		(126	2)
16.	Shale, medium-dark- to dark-gray, very carbonaceous, contains few rootlets.....	2	3
		(128	5)
17.	Coal, impure, dull attritus.....	0	4
		(128	9)
18.	Shale, black, carbonaceous.....	0	4
		(129	1)

Unit Number	Description	Thickness (Depth) ft	in.
19.	Coal, mostly bright attritus, few fusain laminae, sheared.....	1	1
		(130	2)
20.	Underclay, dark-gray, plastic, few rootlets.....	0	11
		(131	1)
21.	Coal, dull to bright attritus, sheared.....	0	4
		(131	5)
22.	Coal, impure.....	0	2
		(131	7)
23.	Coal, mostly bright attritus, few thick vitrain bands, sheared....	1	0
		(132	7)
24.	Shale, black, carbonaceous, sheared.....	0	3
		(132	10)
25.	Coal, mostly bright attritus, scattered vitrain bands, few fusain laminae.....	0	5
		(133	3)
26.	Underclay, medium-dark-gray, carbonaceous in part, very carbonaceous in basal 8 in., abundant high-angle fractures and rootlets.....	5	3
		(138	6)
27.	Shale, black, carbonaceous, contains few coal laminae.....	0	5
		(138	11)
28.	Coal, mostly bright attritus, few thin to thick vitrain bands.....	0	8
		(139	7)
29.	Underclay, medium-dark-gray, very carbonaceous from 6 in. to 10 in. below top, abundant rootlets, scattered quartz- filled fractures and slickensides; base grades abruptly.....	5	6
		(145	1)
30.	Sandstone, medium-gray, very fine grained, contains 40 percent quartz, few medium-dark-gray siltstone laminae; base sharp.....	0	7
		(145	8)
31.	Shale, medium-dark- to dark-gray, lenticular; base sharp.....	0	1
		(145	9)
32.	Sandstone, medium-gray, very fine grained, contains 40 percent quartz, few dark-gray shale laminae, thin-bedded; base grades abruptly.....	0	4.5
		(146	1.5)

Unit Number	Description	Thickness (Depth) ft	in.
33.	Shale, medium-dark- to dark-gray, silty in basal 4 in., few small-scale faults, evenly bedded; base grades abruptly.....	0	7.5
		(146	9)
34.	Sandstone, medium- to medium-dark-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent medium-dark-gray shale and siltstone laminae, few small-scale faults and quartz-filled fractures, thin-bedded.....	5	5
		(152	2)
35.	Shale, medium-dark- to dark-gray, contains few light-gray very fine grained sandstone laminae, few quartz-filled fractures, thin-bedded; base grades.....	0	5
		(152	7)
36.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 40 percent quartz, few high-angle quartz-filled fractures, thin-bedded.....	0	8
		(153	3)
37.	Shale, medium-dark- to dark-gray, contains 40 percent medium-gray very fine grained sandstone laminae and beds up to 5 in. thick, few quartz-filled fractures; base grades abruptly.....	3	3
		(156	6)
38.	Sandstone, medium-gray, fine- to medium-grained, contains 45 percent quartz; scattered slickensided surfaces, small-scale faults and quartz-filled fractures; thin- to thick-bedded.....	3	3
		(159	9)
	Langhorne coal zone (units 39-57)		
39.	Coal, bright attritus, sheared.....	0	3
		(160	0)
40.	Coal, impure, sheared.....	0	8
		(160	8)
41.	Coal, bright attritus, sheared.....	0	5
		(161	1)
42.	Shale, black, carbonaceous.....	1	6
		(162	7)
43.	Coal, bright attritus, sheared.....	0	6.5
		(163	1.5)
44.	Coal, impure.....	0	9
		(163	10.5)

Unit Number	Description	Thickness (Depth) ft	in.
45.	Coal, bright attritus, sheared	0	6.5
		(164	5)
46.	Coal, impure, sheared	0	4
		(164	9)
47.	Coal, bright attritus, sheared	0	3
		(165	0)
48.	Coal, impure, sheared	0	3
		(165	3)
49.	Coal, bright attritus, sheared	0	6
		(165	9)
50.	Coal, very dull, impure	0	3
		(166	0)
51.	Underclay, dark-gray, abundant rootlets and root slickensides	1	11
		(167	11)
52.	Coal, very impure, contains abundant black carbonaceous shale laminae	0	7
		(168	6)
53.	Coal, bright, flaky	0	5
		(168	11)
54.	Coal, very dull, impure	0	1
		(169	0)
55.	Coal, bright, flaky	0	3
		(169	3)
56.	Coal, very dull, impure	0	6
		(169	9)
57.	Coal, mostly bright attritus, very flaky	0	6
		(170	3)
58.	Shale, black, very carbonaceous	0	10
		(171	1)
59.	Coal, dull to bright attritus, impure in part	0	3
		(171	4)
60.	Underclay, dark-gray, abundant rootlets and root slickensides	1	9
		(173	1)
61.	Shale, dark-gray to black, carbonaceous, contains few coal laminae	2	7
		(175	8)

Unit Number	Description	Thickness (Depth) ft	in.
62.	Underclay, dark-gray, contains few coal laminae, abundant rootlets and root slickensides; base grades abruptly.....	3	9
		(179	5)
63.	Sandstone, medium-gray, very fine grained, contains 40 percent quartz, 20 percent dark-gray shale laminae, few quartz-filled fractures and small-scale faults, thin-bedded; base grades abruptly.....	4	7
		(184	0)
64.	Shale, dark-gray, contains 20 percent medium-gray siltstone and very fine grained sandstone laminae, few quartz-filled fractures, evenly bedded.....	0	10
		(184	10)
65.	Coal, bright, flaky.....	0	2
		(185	0)
66.	Underclay, medium-dark-gray, abundant rootlets and root slickensides.....	0	3
		(185	3)
67.	Sandstone, medium-dark-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent dark-gray shale laminae, abundant quartz-filled fractures, thin- to thick-bedded; base sharp.....	3	9
		(189	0)
68.	Shale, dark-gray, contains 25 percent medium-gray very fine grained sandstone laminae, few quartz-filled fractures, evenly bedded; base sharp.....	0	9
		(189	9)
69.	Sandstone, medium-gray, very fine to fine-grained, contains 40 percent quartz, few quartz-filled fractures; base grades.....	1	9
		(191	6)
70.	Shale, dark-gray to black, carbonaceous, contains 25 percent medium-gray, very fine grained sandstone laminae, few quartz-filled fractures, thin-bedded, contorted bedding.....	0	5
		(191	11)
71.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, few dark-gray shale clasts 2 ft 6 in. below top, abundant high-angle quartz-filled fractures, thin- to thick-bedded; base grades.....	10	2
		(202	1)
72.	Sandstone, light-gray, fine- to medium-grained, contains 50 percent quartz, abundant white weathered feldspar, abundant large dark-gray shale clasts in basal 12 ft; base grades.....	13	6
		(215	7)

Unit Number	Description	Thickness (Depth) ft	in.
73.	Sandstone, light-gray, fine- to medium-grained, mostly medium-grained, contains 55 percent quartz, abundant dark-gray shale laminae and clasts from 1 ft 6 in. to 3 ft below top, abundant quartz-filled high-angle fractures in top 2 ft 6 in., crossbedded, thick-bedded to massive; base grades	32 (248	7 2)
74.	Conglomerate, medium-gray, contains abundant siderite clasts up to 1 in. in diameter, fine- to medium-grained sandstone matrix; base grades	0 (248	5 7)
75.	Sandstone, light-gray, medium- to coarse-grained, contains from 60-80 percent quartz, 5 percent medium-dark-gray siltstone laminae, quartz-filled fractures, large siderite clast 18 ft 8 in. below top, thick-bedded to massive; base sharp	24 (272	3 10)
76.	Sandstone, medium-light-gray, fine-grained, finely micaceous, contains 60 percent quartz, few dark-gray shale laminae, few slickensided surfaces, thin-bedded	(2	9 7)
77.	Sandstone, medium- to medium-dark-gray, medium-grained, contains 60-80 percent quartz, few high-angle and stylolitic quartz-filled fractures, thick-bedded to massive; base sharp and uneven	4 (278	10 5)
78.	Sandstone, medium-gray, medium- to coarse-grained, contains 60-80 percent quartz, few high-angle quartz-filled fractures, thick-bedded; base sharp	3 (282	10 3)
79.	Shale, dark-gray to black, carbonaceous, silty	0 (282	3.5 6.5)
80.	Coal, bright, flaky	0 (282	1.5 8)
81.	Sandstone, brownish-black, carbonaceous, very fine to fine-grained, contains 40 percent quartz, 10 percent dark-gray shale laminae in basal 1 ft 2 in., abundant rootlets, few high-angle quartz-filled fractures, faintly bedded; base sharp and undulatory	4 (286	3 11)
82.	Shale, black, very carbonaceous, abundant slickensided surfaces; base very irregular	1 (288	2 1)

Unit Number	Description	Thickness (Depth) ft	in.
83.	Sandstone, dark-gray, carbonaceous, contains 40 percent quartz, contorted bedding; base sharp.....	0	5
		(288	6)
84.	Shale, black, very carbonaceous, abundant slickensided surfaces; base grades.....	0	6
		(289	0)
85.	Siltstone, dark-gray, carbonaceous, contorted bedding; base sharp and undulatory.....	1	9
		(290	9)
86.	Shale, black, carbonaceous, abundant slickensided surfaces; base sharp.....	0	4
		(291	1)
87.	Siltstone, dark-gray to black, abundant high-angle fractures, faintly bedded, slickensided, poor fissility; base grades.....	1	2
		(292	3)
88.	Sandstone, dark-gray to black, very fine to fine-grained, contains 40 percent quartz, scattered slickensided high-angle fractures, few quartz- and calcite-filled fractures, contorted bedding; base sharp.....	3	4
		(295	7)
89.	Siltstone, dark-gray to black, carbonaceous, abundant slickensided bedding planes, faintly bedded; base grades.....	0	6
		(296	1)
90.	Shale, black, carbonaceous, abundant fractures and slickensides; base sharp.....	0	4
		(296	5)
91.	Sandstone, medium-dark- to dark-gray, fine-grained, contains 40 percent quartz, 25 percent dark-gray shale and siltstone laminae, abundant slickensided high-angle fractures, few quartz-filled fractures, thin and contorted bedding; base sharp and uneven.....	9	10
		(306	3)
92.	Shale, black, carbonaceous, abundant slickensided bedding planes, evenly bedded, fair fissility; base grades abruptly.....	0	3
		(306	6)
93.	Sandstone, medium- to dark-gray, fine-grained, contains 40 percent quartz, 10 percent dark-gray shale laminae, few few slickensided bedding planes, thin-bedded.....	0	2
		(306	8)

Unit Number	Description	Thickness (Depth) ft	in.
94.	Shale, dark-gray, contains 40 percent medium-gray fine-grained sandstone laminae, evenly bedded; base sharp.....	2	4
		(309	0)
95.	Shale, dark-gray to black, contains 20 percent light-gray fine-grained sandstone laminae, abundant slickensided fractures in basal 8 in., evenly bedded, poor fissility.....	1	9
		(310	9)
96.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, abundant high-angle quartz-filled fractures; base grades.....	5	4
		(316	1)
97.	Sandstone, medium-gray, fine-grained, contains 40 percent quartz, 20 percent dark-gray shale laminae, abundant quartz-filled high-angle fractures, thin and evenly bedded.....	2	9
		(318	10)
98.	Shale, dark-gray to black, silty, few quartz-filled fractures, evenly bedded, poor fissility; base grades abruptly.....	0	7
		(319	5)
99.	Sandstone, light-gray, fine- to medium-grained, contains 65 percent quartz, 5 percent dark-gray shale laminae, massive; base grades.....	1	10
		(321	3)
100.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 20 percent dark-gray shale laminae, thin-bedded.....	1	0
		(322	3)
101.	Coal, bright, sheared, flaky.....	0	5
		(322	8)
102.	Underclay, medium-gray, scattered rootlets and root slickensides; base grades.....	0	8
		(323	4)
103.	Shale, medium-dark-gray, silty, contains 10 percent medium-light-gray siltstone and very fine grained sandstone laminae, abundant plant fragments; base sharp.....	3	2
		(326	6)
104.	Sandstone, light-gray, fine-grained, micaceous, contains 40 percent quartz, 30 percent dark-gray shale laminae, bioturbated and few siderite nodules in basal 3 ft 8 in., thin-bedded.....	10	4
		(336	10)

Unit Number	Description	Thickness (Depth) ft	in.
105.	Sandstone, medium-light-gray, fine- to medium-grained, contains 65 percent quartz, few coal and dark-gray shale laminae from 4 ft to 5 ft below top, few quartz-filled high-angle fractures, thick-bedded to massive.....	10	6
		(347	4)
106.	Shale, medium-dark-gray, contains 40 percent light-gray fine-grained sandstone laminae, evenly bedded; base sharp.....	1	7
		(348	11)
107.	Sandstone, light-gray, fine-grained, micaceous, contains 60 percent quartz, massive; base sharp.....	1	11
		(350	10)
108.	Shale, dark-gray, finely micaceous, contains 15 percent light-gray fine-grained sandstone laminae and beds up to 2 in. thick, evenly bedded, fissile.....	3	7
		(354	5)
109.	Sandstone, medium-light-gray, very fine to fine-grained, contains 50 percent quartz, few high-angle quartz-filled fractures, abundant siderite clasts in basal 1 in., thick-bedded to massive.....	2	10
		(357	3)
110.	Shale, medium-dark- to dark-gray, contains 30 percent medium-gray siltstone laminae, evenly bedded; base sharp.....	2	1
		(359	4)
111.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz; base sharp.....	0	9
		(360	1)
112.	Shale, medium-dark- to dark-gray, contains 10 percent medium-gray siltstone laminae, slightly burrowed, evenly bedded.....	1	0
		(361	1)
113.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, few quartz-filled fractures; base sharp.....	1	0
		(362	1)
114.	Shale, dark-gray, contains 40 percent medium-light-gray siltstone and very fine grained sandstone laminae, evenly bedded; base sharp.....	2	4
		(364	5)
115.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, few high-angle quartz-filled fractures, thin- to thick-bedded.....	4	3
		(368	8)

Unit Number	Description	Thickness (Depth) ft	in.
116.	Sandstone, medium-light-gray, fine- to medium-grained, contains 50 percent quartz, massive; base sharp.....	2	7
		(371	3)
117.	Sandstone, light- to medium-gray, fine- to medium-grained, contains 50-80 percent quartz, scattered siderite and dark-gray shale clasts 8 ft 3 in. below top and in basal 2 in., few slickensided bedding planes and high-angle fractures, thin- to thick-bedded; base grades.....	8	4
		(379	7)
118.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 60-80 percent quartz, few coal laminae from 1 ft to 1 ft 2 in. below top, few scattered medium-gray siltstone laminae, few slickensided surfaces and high-angle fractures; abundant coal laminae and clasts and few siderite clasts in basal 9 in., thick-bedded; base sharp.....	13	0
		(392	7)
119.	Sandstone, medium-gray, very fine grained, contains 40 percent quartz, 25 percent medium-dark-gray silty shale laminae; few slickensided surfaces, low- to high-angle quartz-filled fractures and fractures showing lateral displacement; cross-laminated, thin and lenticularly bedded.....	6	9
		(399	4)
120.	Sandstone, medium-light- to medium-gray, very fine grained, contains 60 percent quartz, 5 percent medium-dark-gray siltstone laminae, abundant quartz granules in basal 1 in., few quartz-filled vertical fractures, thin and evenly bedded; base sharp.....	2	5
		(401	9)
121.	Sandstone, medium-light- to medium-gray, fine- to medium-grained, contains 50 percent quartz, 10 percent dark-gray shale laminae and beds up to 1.5 in. thick, thin- to thick-bedded; base sharp.....	11	7
		(413	4)
122.	Conglomerate, medium-gray, contains abundant medium-dark-gray well rounded shale clasts up to 2 in. in diameter, few small siderite clasts, few quartz granules at base, fine- to medium-grained sandstone matrix; base sharp.....	0	9
		(414	1)
123.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 50 percent quartz, 15 percent medium-dark-gray shale laminae, abundant quartz granules from 1.5 in to 2.5 in. below top, bioturbated, thin-bedded; base grades.....	2	5
		(416	6)

Unit Number	Description	Thickness (Depth) ft	in.
124.	Shale, medium- to medium-dark-gray, scattered pyrite nodules up to 0.25 in. in diameter, fissile; base grades.....	11	10
		(428	4)
125.	Sandstone, medium-gray, very fine grained, slightly micaceous, contains 40 percent quartz, large siderite clast 1 ft 4 in. below top, bioturbated; base sharp.....	2	8
		(431	0)
126.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 50 percent quartz, abundant quartz granules 1 ft below top and in basal 2 in., few dark-gray shale clasts in basal 2 in., few high-angle quartz-filled fractures at 7 in. and 1 ft 8 in. below top, normally graded; base grades abruptly.....	4	1
		(435	1)
127.	Sandstone, medium-gray, fine- to medium-grained, contains 50 percent quartz; abundant quartz granules, siderite, and dark-gray shale clasts in basal 2 in.; normally graded.....	0	9
		(435	10)
128.	Sandstone, medium-gray, fine- to medium-grained, contains 50 percent quartz, 5 percent medium-dark-gray shale laminae and beds, few small well rounded dark-gray shale clasts in basal 2 in., cross-laminated in part, thin- to thick-bedded; base sharp.....	4	7
		(440	5)
129.	Sandstone, medium-gray, fine-grained, micaceous, contains 50 percent quartz, few coal laminae 4 ft 6 in. above base; scattered pyrite, siderite and dark-gray shale clasts in basal 2 ft 6 in.; few high-angle quartz-filled fractures 6 ft 10 in. below top, thin- to thick-bedded.....	18	7
		(459	0)

BOTTOM OF HOLE
TOTAL DEPTH 459 ft

GEOPHYSICAL LOG

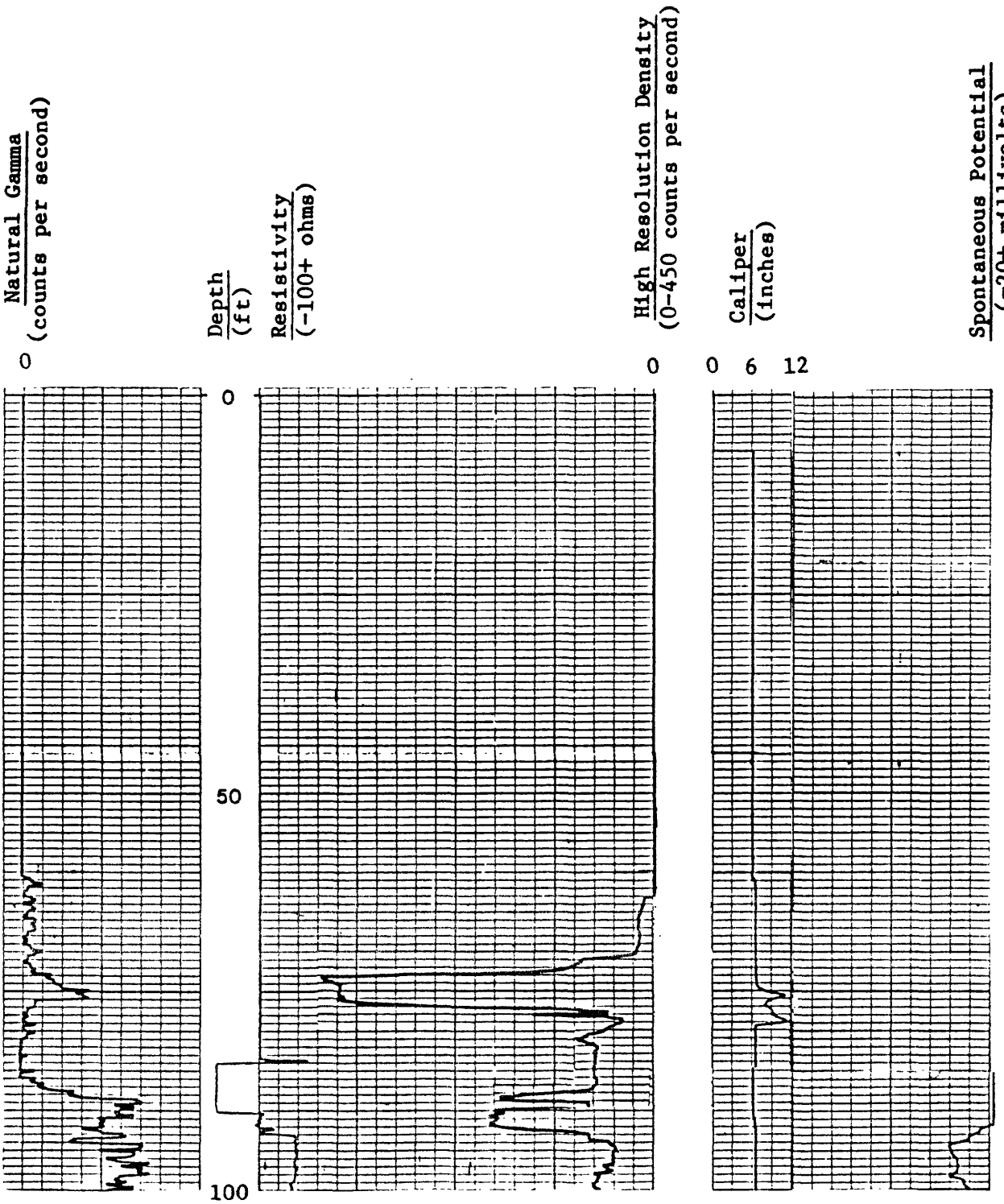
Corehole: V-2 Date: 12/06/82 State: Virginia County: Montgomery

Quadrangle: McDonalds Mill, Va. Latitude: 37°18'17"N Longitude: 80°19'30"W

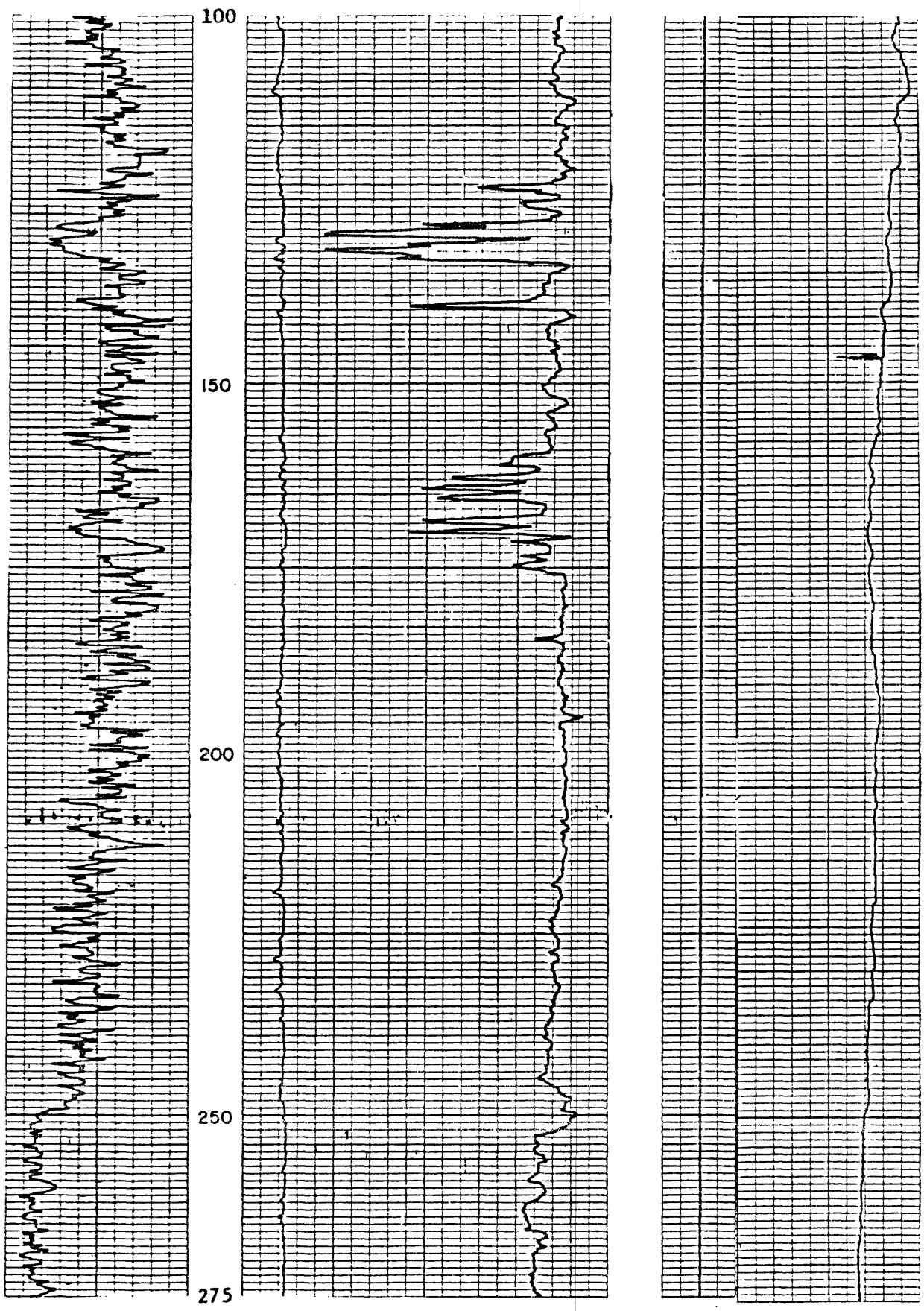
Altitude: 2,048 ft Logged Depth: 430 ft Drilled Depth: 459 ft

Logging Speed: 20 ft/min (SP 30 ft/min) Natural Gamma Time Constant: 1

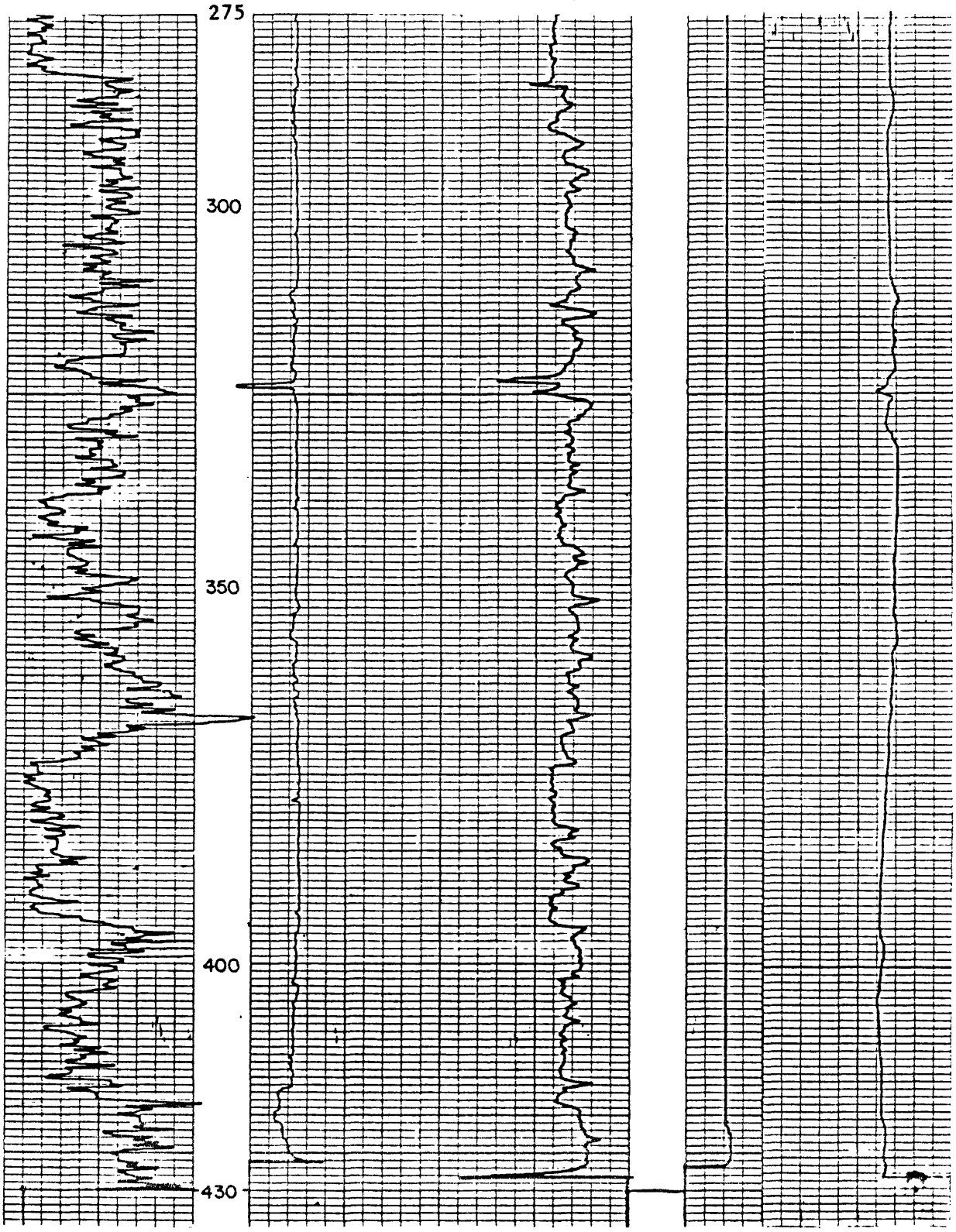
High Resolution Density Time Constant: 1



Corehole: V-2 continued

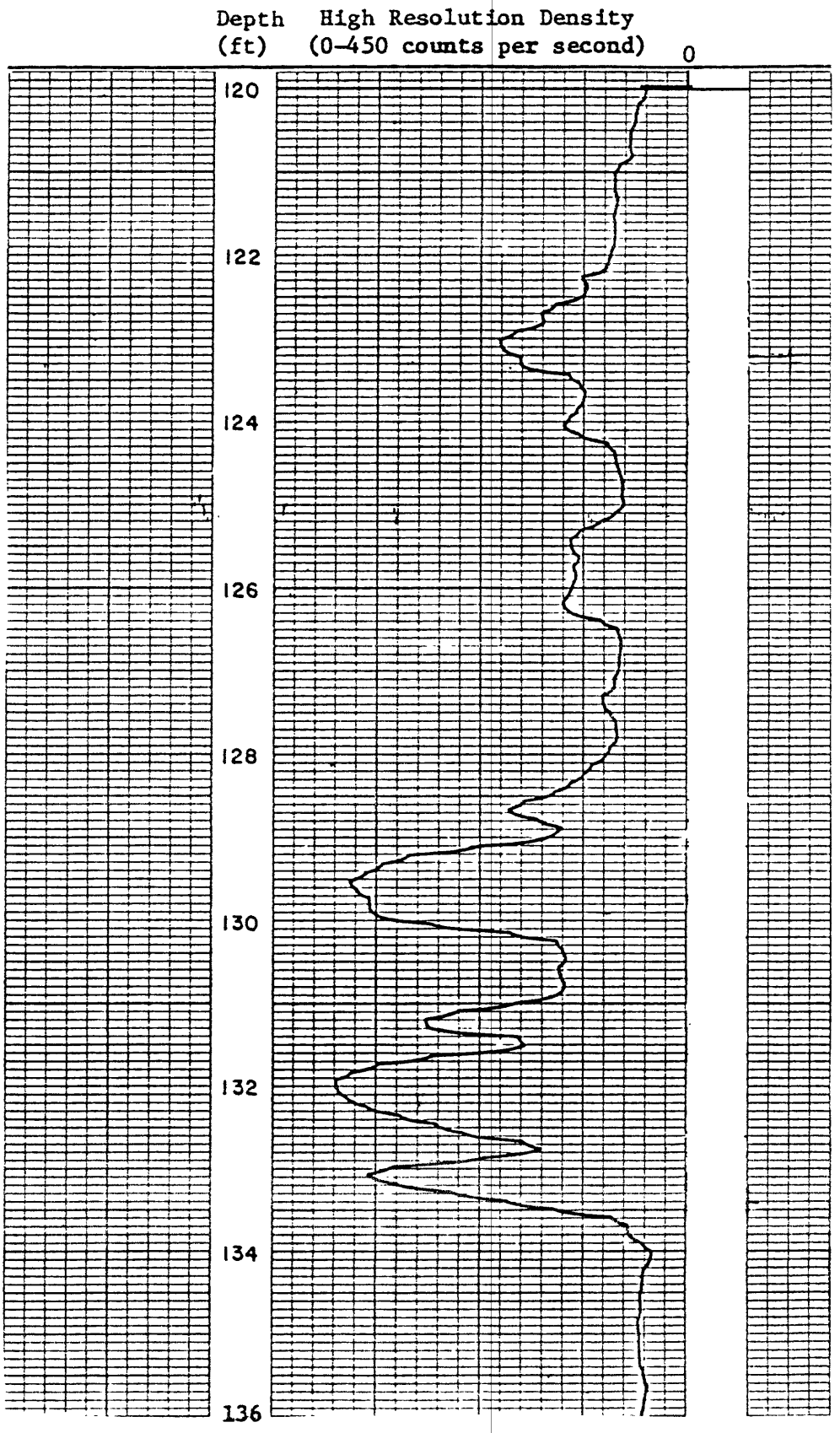


Corehole: V-2 continued

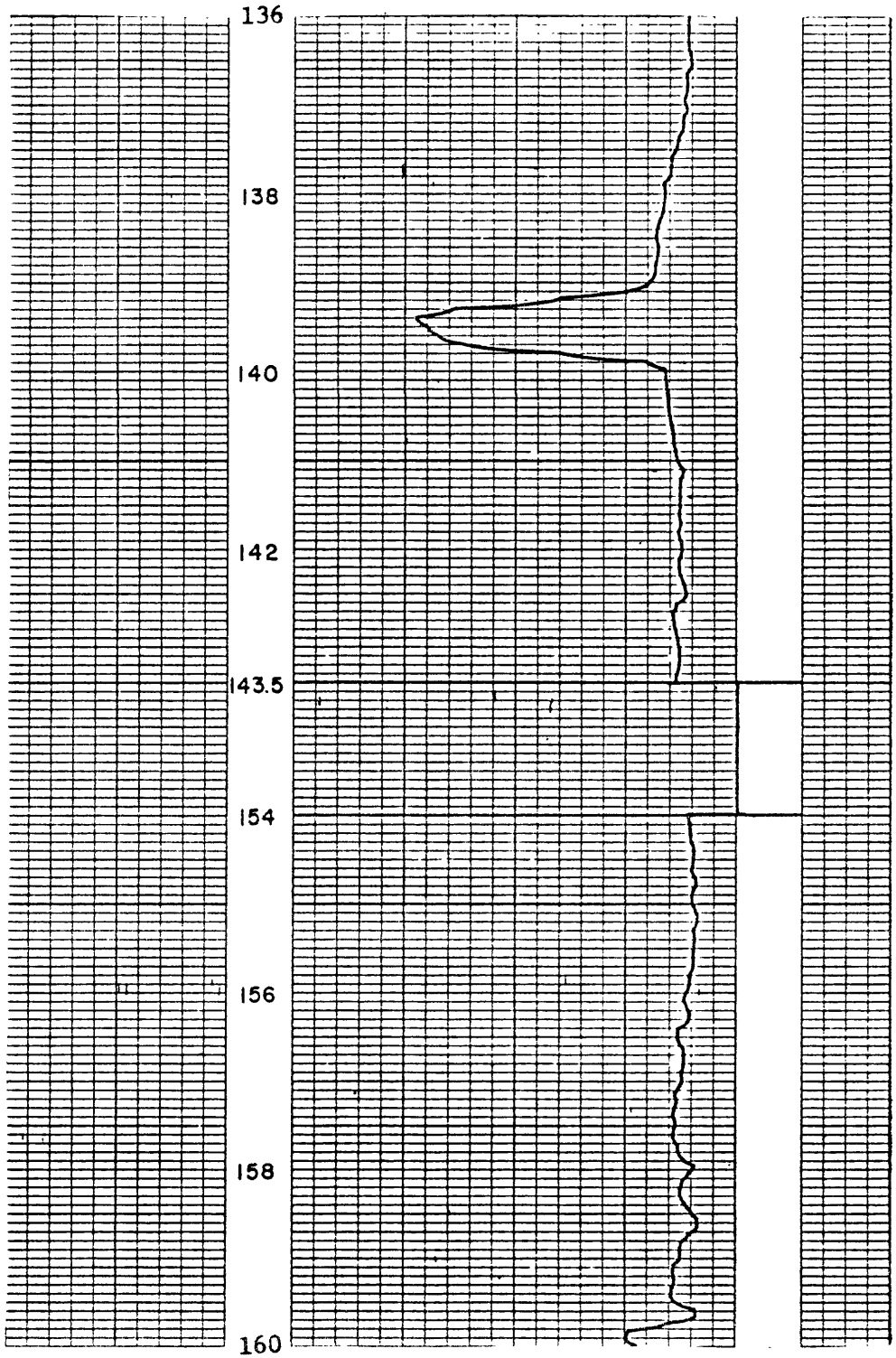


DETAIL LOG

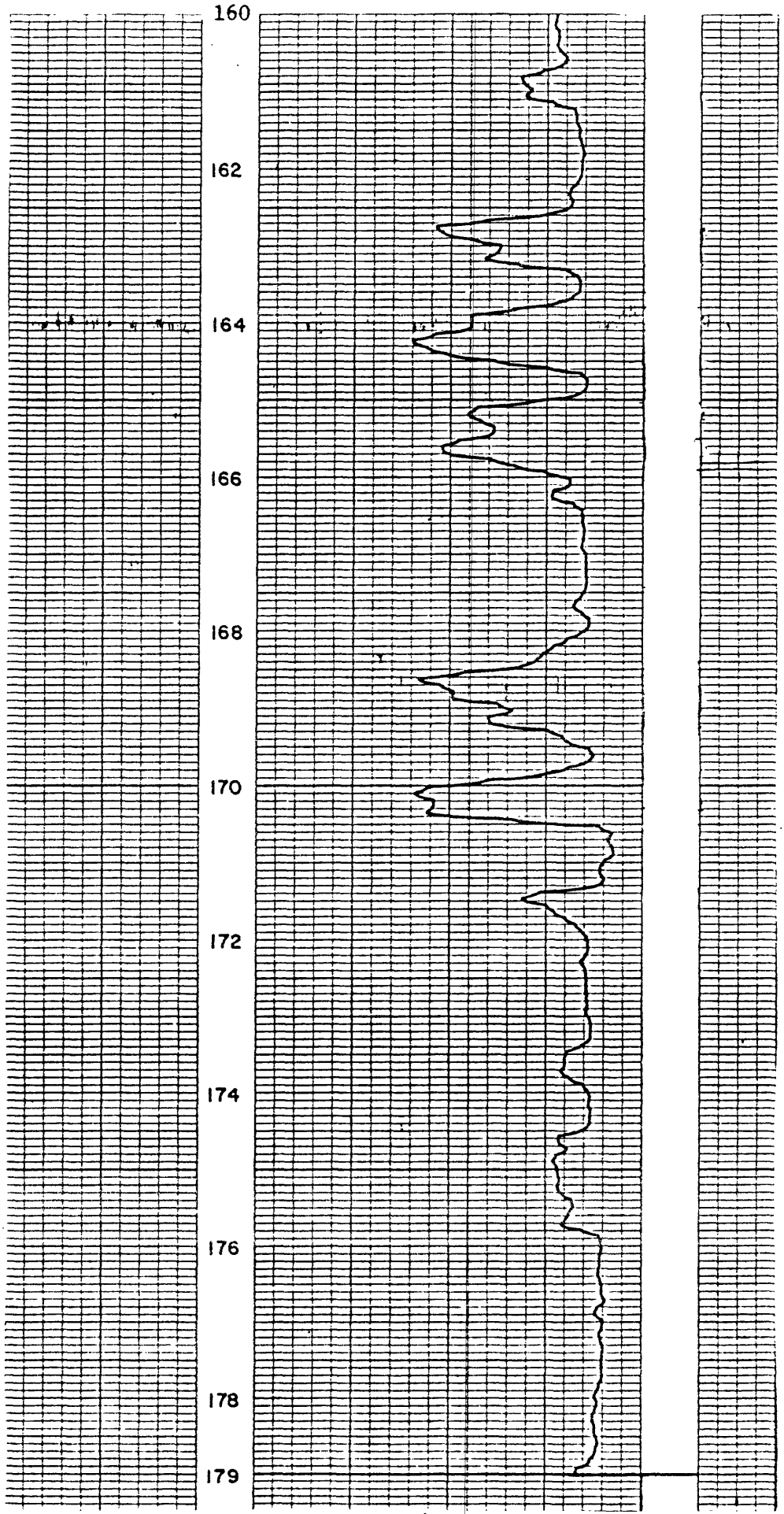
Corehole: V-2 Logging Speed: 5 ft/min Time Constant: 1



Corehole: V-2 continued



Corehole: V-2 continued



Corehole V-3

Location: Pulaski County; Pulaski, Va., 7.5 minute quadrangle; approximately 0.8 mi northeast of Pulaski-Wythe County line, between East Fork and Cricket Hollow, near Caseknife Ridge. Accessible by Forest Service road extending north from State Route 610.

Coordinates: Latitude 37°00'40"N Longitude 80°51'10"W

Altitude: 2,460 ft Drilled depth: 790 ft

Dip of strata: Decreases from 40° to 10° at a depth of 200 ft, abruptly increases to 60° and then decreases to nearly horizontal at base of corehole.

Date drilled: October 27, 1982 to November 15, 1982

Core description: K.J. Englund, J.O. Maberry II, P.C. Lyons, J.F. Windolph, Jr., J.C. Weber, and R.E. Thomas

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER MISSISSIPPIAN SERIES		
	Price Formation		
1.	Soil and weathered rock (casing set - no core recovered).....	14	0
		(14	0)
2.	Sandstone, medium-gray, weathered light-brownish-gray, very fine to fine-grained, finely micaceous, contains 45 percent quartz, few medium-gray silty shale laminae and beds up to 1 in. thick, thin and contorted bedding; base sharp.....	2	2
		(16	2)
3.	Siltstone, medium-gray, micaceous, contains few light-gray very fine-grained sandstone laminae and beds, few medium-gray shale clasts, thin-bedded.....	2	9
		(18	11)
4.	Sandstone, medium-gray, weathered light-brownish-gray, very fine grained, contains 45 percent quartz, few medium-gray siltstone laminae and beds at base, few siderite clasts, thin-bedded.....	4	10
		(23	9)
5.	Sandstone, medium-gray, weathered light-brownish-gray, fine- to medium-grained, contains 50 percent quartz, few slickensided surfaces, thin-bedded.....	3	4
		(27	1)
6.	Siltstone, medium-dark-gray, argillaceous in part, contains few light-gray very fine grained sandstone laminae and beds up to 0.5 in. thick, few dark-gray shale laminae at base, few small-scale faults, burrowed, cross-laminated, thin-bedded.....	2	4
		(29	5)

Unit Number	Description	Thickness (Depth) ft	in.
7.	Sandstone, medium-light-gray, weathered light-brownish-gray, very fine grained, contains 50 percent quartz, few high-angle fractures; base sharp.....	0	6
		(29	11)
8.	Siltstone, medium-light- to medium-gray, contains 20 percent light-gray very fine ftained sandstone laminae, few dark-gray shale laminae, burrowed, thin and unevenly bedded.....	4	10
		(34	9)
9.	Sandstone, medium-light- to medium-gray, very fine grained, silty, contains 40 percent quartz, few dark-gray carbonaceous shale laminae; base sharp.....	0	6
		(35	3)
10.	Siltstone, medium- to medium-dark-gray, contains few dark-gray shale and medium-light-gray very fine grained sandstone laminae, burrowed, thin and unevenly bedded.....	2	2
		(37	5)
11.	Sandstone, medium-gray, very fine grained, finely micaceous, contains 40 percent quartz, abundant dark-gray shale and medium-light-gray siltstone laminae from 11 in. to 1 ft 6 in. below top, few pyrite clasts, thin and unevenly bedded.....	1	10
		(39	3)
12.	Sandstone, medium-light-gray, fine- to medium-grained, pyritic at base, contains 45 percent quartz, few white quartz granules and pebbles up to 0.25 in. in diameter, normally graded, thin and unevenly bedded.....	1	4
		(40	7)
13.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, few dark-gray shale clasts up to 1.5 in. in diameter, slightly burrowed, thin and unevenly bedded.....	4	5
		(45	0)
14.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, scattered dark-gray shale laminae and beds up to 0.75 in. thick, few white quartz granules, fractured; base grades.....	2	0
		(47	0)
15.	Siltstone, medium- to medium-dark-gray, argillaceous at base, contains few dark-gray shale and light-gray sandstone laminae, few small-scale faults, few slickensided surfaces, slightly burrowed.....	1	7
		(48	7)

Unit Number	Description	Thickness (Depth) ft	in.
16.	Sandstone, light- to medium-light-gray, fine-grained, contains 45 percent quartz, few medium-gray siltstone laminae, slightly burrowed, thin-bedded.....	1	3
		(49	10)
17.	Sandstone, medium-gray, very fine to fine-grained, contains 45 percent quartz, few dark-gray shale laminae and beds, bioturbated.....	2	3
		(52	1)
18.	Sandstone, medium- to medium-brownish-gray, very fine to fine-grained, contains 45 percent quartz, few dark-gray shale laminae in top 8 in., few quartz-filled fractures.....	2	0
		(54	1)
19.	Siltstone, medium-gray, argillaceous at base, contains few medium-light-gray medium-grained sandstone beds in top 3 in., few dark-gray shale laminae, few high-angle fractures, bioturbated in part, thin-bedded.....	6	0
		(60	1)
20.	Sandstone, medium-gray, very fine grained, micaceous, contains 40 percent quartz, scattered dark-gray shale laminae, thin and unevenly bedded.....	2	0
		(62	1)
21.	Siltstone, medium- to dark-gray, contains few dark-gray shale and light-gray fine-grained sandstone laminae, bioturbated in part, thin and unevenly bedded.....	2	0
		(64	1)
22.	Sandstone, medium-light-gray, weathered dark-yellowish-gray, fine- to medium-grained, contains 45 percent quartz, few quartz granules.....	3	6
		(67	7)
23.	Siltstone, medium-gray, contains scattered light-gray fine-grained sandstone laminae, few pyrite nodules, slightly burrowed, unevenly bedded.....	1	8
		(69	3)
24.	Shale, dark-gray, carbonaceous, pyritic, few rootlets, fractured, faintly bedded, fissile; base grades.....	1	6
		(70	9)
25.	Siltstone, medium-light- to medium-gray, contains abundant light-gray very fine grained sandstone and dark-gray shale laminae, bioturbated.....	6	11
		(77	8)

Unit Number	Description	Thickness (Depth) ft	in.
26.	Siltstone, medium- to dark-gray, argillaceous, contains few dark-gray shale laminae and beds up to 0.5 in. thick, few light-gray very fine grained sandstone laminae, slightly burrowed, thin and unevenly bedded.....	4	4
		(82	0)
27.	Shale, dark-gray, carbonaceous, silty, fractured.....	1	0
		(83	0)
28.	Siltstone, medium-gray, abundant slickensided fractures, bioturbated, faintly bedded.....	3	0
		(86	0)
29.	Siltstone, medium- to dark-gray, argillaceous, slightly carbonaceous, contains few light-gray very fine grained sandstone laminae, few high-angle slickensided surfaces; base grades.....	10	0
		(96	0)
30.	Sandstone, medium-light to medium-gray, fine- to medium-grained, contains 55 percent quartz, scattered dark-gray shale laminae and beds up to 0.25 in. thick, few coal laminae and clasts, scattered high-angle slickensided and quartz-filled fractures, thin- to thick-bedded.....	37	5
		(133	5)
31.	Sandstone, medium-light- to medium-gray, medium- to coarse-grained, contains 45 percent quartz, few subangular to well rounded white quartz pebbles, scattered dark-gray shale laminae and beds.....	1	9
		(135	2)
32.	Sandstone, medium-gray, fine- to coarse-grained, silty, contains 45 percent quartz, scattered dark-gray carbonaceous shale laminae and clasts, few high-angle pyrite-filled fractures.....	1	10
		(137	0)
33.	Shale, dark-gray, carbonaceous, pyritic, few slickensided surfaces.....	0	1
		(137	1)
34.	Sandstone, medium- to medium-dark-gray, fine- to coarse-grained, contains 45 percent quartz, scattered invertebrate fossil fragments.....	0	8
		(137	9)
35.	Sandstone, medium-gray, very fine grained, silty, contains 45 percent quartz, 20 percent dark-gray shale laminae, few high-angle fractures, slightly burrowed, thin and evenly bedded.....	3	2
		(140	11)

Unit Number	Description	Thickness (Depth) ft	in.
36.	Sandstone, medium-light- to medium-gray, fine- to medium-grained, contains 45 percent quartz, conglomeratic with abundant lenses of sandstone pebbles up to 1.25 in. in diameter, thick-bedded; base sharp.....	1	5
		(142	4)
37.	Siltstone, medium-dark- to dark-gray, pyritic, contains 40 percent dark-gray shale laminae and beds up to 0.5 in. thick, thin and evenly bedded.....	2	6
		(144	10)
38.	Shale, dark-gray, very carbonaceous, silty, fractured.....	0	5
		(145	3)
39.	Shale, dark-gray, carbonaceous, pyritic, contains few medium-gray siltstone laminae.....	0	8
		(145	11)
40.	Sandstone, medium-gray, very fine grained, silty, contains 40 percent quartz, thin and evenly bedded; base grades.....	1	11
		(147	10)
41.	Sandstone, medium-gray, medium- to coarse-grained, contains 40 percent quartz, abundant well rounded shale and fine- to medium-grained sandstone pebbles; base grades.....	0	6
		(148	4)
42.	Siltstone, medium- to medium-dark-gray, contains 40 percent dark-gray carbonaceous shale laminae and beds, few medium-gray very fine grained sandstone laminae and beds, scattered pyrite nodules, cross-laminated in basal 2 ft 9 in., few high-angle fractures.....	7	9
		(156	1)
43.	Sandstone, medium-gray, very fine grained, contains 45 percent quartz, 45 percent dark-gray carbonaceous shale laminae.....	2	0
		(158	1)
44.	Sandstone, medium-gray, very fine grained, contains 45 percent quartz, scattered rounded sandstone pebbles up to 1.25 in. in diameter, few black carbonaceous shale laminae, contorted bedding; base sharp.....	0	2
		(158	3)
45.	Siltstone, dark-gray, pyritic, contains scattered dark-gray carbonaceous shale laminae and beds, few medium-gray very fine grained sandstone laminae, thin and evenly bedded.....	3	2
		(161	5)

Unit Number	Description	Thickness (Depth) ft	in.
46.	Sandstone, medium- to medium-light-gray, very fine to fine-grained, contains 45 percent quartz, few dark-gray to black carbonaceous shale laminae, scattered pyrite nodules up to 0.5 in. in diameter, scattered pyrite-filled high-angle fractures, scattered invertebrate fossil shell fragments, bioturbated, thin and unevenly bedded.....	5	7
		(167	0)
47.	Shale, medium-dark-gray, evenly bedded, poor fissility; base sharp.....	0	2
		(167	2)
48.	Sandstone, medium-light- to medium-gray, fine-grained, calcareous, contains 40 percent quartz, contorted bedding; base sharp.....	0	5
		(167	7)
49.	Shale, medium-dark-gray, evenly bedded, fair fissility; base grades.....	0	4
		(167	11)
50.	Sandstone, light- to medium-light-gray, fine-grained, calcareous, contains 40 percent quartz, few pyrite- and quartz-filled fractures, few slickensided surfaces; base sharp.....	0	6
		(168	5)
51.	Shale, medium-dark-gray, silty, finely micaceous, contains 20 percent medium-gray siltstone laminae, few pyrite-filled high-angle fractures, bioturbated in part, evenly bedded; base sharp.....	5	6
		(173	11)
52.	Sandstone, medium-light-gray, fine-grained, contains 40 percent quartz, faintly-bedded; base grades.....	0	4
		(174	3)
53.	Siltstone, medium-gray; base grades.....	3	7
		(177	10)
54.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, abundant subrounded medium-dark gray shale clasts from 4 ft to 4 ft 4 in. below top, few angular dark-gray shale clasts in basal 6 in., thin- to thick-bedded; base sharp.....	8	6
		(186	4)
55.	Shale, medium-dark-gray, contains 20 percent medium-gray siltstone laminae, evenly bedded.....	0	5
		(186	9)

Unit Number	Description	Thickness (Depth) ft	in.
56.	Sandstone, medium-light-gray, very fine grained, calcareous, contains 40 percent quartz, abundant medium-dark-gray shale clasts in top 6 in., few quartz-filled fractures, thick-bedded to massive; base sharp.....	2	9
		(189	6)
57.	Shale, medium-dark-gray, evenly bedded; base grades.....	0	4
		(189	10)
58.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 40 percent quartz, abundant invertebrate fossil fragments; base sharp.....	0	3
		(190	1)
59.	Siltstone, medium-gray, contains 15 percent dark-gray shale beds, few medium-dark-gray shale clasts 1 ft below top, thin-bedded; base grades.....	1	9
		(191	10)
60.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few pyrite-filled high-angle fractures, thick-bedded; base sharp.....	1	3
		(193	1)
61.	Shale, dark-gray, carbonaceous, evenly bedded, poor fissility; base sharp.....	0	3
		(193	4)
62.	Sandstone, light- to medium-gray, very fine to fine-grained, calcareous, contains 40 percent quartz, abundant invertebrate fossil fragments in top 5 in., few quartz-filled fractures; base sharp.....	15	4
		(208	8)
63.	Siltstone, light- to medium-gray, sandy in basal 1 ft, few quartz- and pyrite-filled slickensided fractures, mostly thin-bedded; base sharp.....	2	0
		(210	8)
64.	Underclay, medium-gray, silty, very carbonaceous in top 1.5 in., few quartz-filled fractures; base grades.....	0	6
		(211	2)
65.	Sandstone, light- to medium-gray, fine-grained, contains 40 percent quartz, abundant quartz-filled fractures, thick-bedded to massive; base sharp.....	16	6
		(227	8)
66.	Shale, black, very carbonaceous; base grades.....	0	4
		(228	0)

Unit Number	Description	Thickness (Depth) ft	in.
67.	Shale, medium-dark-gray, few slickensided fractures, contorted bedding.....	2	0
		(230	0)
68.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, thick-bedded to massive; base sharp.....	1	3
		(231	3)
69.	Shale, dark-gray, carbonaceous, contorted bedding; base grades....	0	5
		(231	8)
70.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few dark-gray shale laminae and beds 10 in. below top, contorted bedding; base sharp.....	1	8
		(233	4)
71.	Shale, medium-dark-gray; base grades.....	0	3
		(233	7)
72.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, scattered quartz-filled fractures; base sharp.....	3	0
		(236	7)
73.	Shale, medium-dark-gray, contains few medium-gray siltstone laminae 10 in. below top, abundant fractures; base grades abruptly.....	1	7
		(238	2)
74.	Conglomerate, medium-light-gray, contains abundant white quartz granules and pebbles, fine-grained sandstone matrix; base grades.....	1	2
		(239	4)
75.	Sandstone, medium-gray, very fine to fine-grained, contains 40 percent quartz, silty in top 8 in.; base sharp.....	1	3
		(240	7)
76.	Conglomerate, contains abundant white quartz pebbles mostly 0.5 in. in diameter and well rounded siderite clasts, fine-grained sandstone matrix.....	1	2
		(241	9)
77.	Shale, dark-gray, silty, contains 20 percent light-gray siltstone and very fine grained sandstone laminae, bioturbated; base grades.....	18	8
		(260	5)

Unit Number	Description	Thickness (Depth) ft	in.
78.	Sandstone, light- to medium-gray, fine-grained, contains 40 percent quartz, 5 percent dark-gray carbonaceous shale laminae, few quartz granules in top 8 in., bioturbated, abundant fractures; base sharp.....	4	6
		(264	11)
79.	Shale, medium-dark- to dark-gray, contains 20 percent medium-gray siltstone laminae and lenses.....	1	10
		(266	9)
80.	Shale, medium-dark- to dark-gray, very silty, contains 10 percent medium-light-gray siltstone and fine-grained sandstone laminae, few siderite beds and nodules, evenly bedded; silty at base.....	6	0
		(272	9)
81.	Sandstone, medium-light to medium-gray, very fine to fine-grained, contains 45 percent quartz, abundant dark and light mineral grains, scattered well rounded white quartz pebbles 2 ft below top, few medium-dark-gray silty shale laminae in top 5 in., few calcite- and pyrite-filled fractures, few slickensided surfaces, thick-bedded to massive; base sharp.....	11	0
		(283	9)
82.	Shale, medium-dark-gray, contains 20 percent medium-light-gray siltstone and fine-grained sandstone laminae, few pyrite nodules 11 in. below top, thin and contorted bedding; base grades.....	3	4
		(287	1)
83.	Sandstone, medium-light- to medium-gray, fine- to coarse-grained, contains 55 percent quartz, scattered dark-gray shale laminae, few dark-gray shale clasts in basal 1 in., few quartz- and calcite-filled fractures 4 ft 9 in. below top, thick-bedded to massive.....	8	8
		(295	9)
84.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, silty, contains 45 percent quartz, few dark-gray shale laminae and beds, few pyrite-filled high-angle fractures, thin- to thick-bedded; base sharp and irregular.....	1	5
		(297	2)
85.	Shale, medium-dark- to dark-gray, silty, contains few light-gray siltstone and very fine grained sandstone laminae, poorly bedded; base sharp.....	0	4
		(297	6)

Unit Number	Description	Thickness (Depth) ft	in.
86.	Sandstone, medium-gray, very fine grained, silty, contains 40 percent quartz, abundant dark-gray shale laminae, few calcite- and quartz-filled fractures, slightly burrowed, thin-bedded; base sharp and uneven.....	2	6
		(300	0)
87.	Siltstone, medium-light- to medium-gray, sandy at base, contains 10 percent dark-gray shale laminae, burrowed in top 6 in., thin-bedded; base grades.....	2	0
		(302	0)
88.	Sandstone, medium-light- to medium-gray, fine- to coarse-grained, silty, contains 40 percent quartz; few pyrite-, quartz- and calcite-filled high-angle fractures; thin and unevenly bedded.....	0	5
		(302	5)
89.	Siltstone, medium-gray, contains few dark-gray shale laminae in top 3 in. and in basal 1 in., few light-gray very fine grained sandstone laminae, slightly burrowed, thin-bedded; base sharp and uneven.....	0	6
		(302	11)
90.	Siltstone, medium-light-gray, mottled light-grayish-brown, slightly sandy, contains abundant invertebrate fossils, few small shale clasts; base sharp.....	0	3
		(303	2)
91.	Shale, medium- to medium-dark-gray, very silty, contains abundant medium-light-gray siltstone and very fine grained sandstone laminae, few siderite nodules 2 ft below top, bioturbated in part, unevenly bedded.....	3	9
		(306	11)
92.	Siltstone, medium-light-gray, contains few medium- to medium-dark-gray shale laminae and beds up to 1 in. thick in top 1 ft 4 in., abundant light-gray very fine grained sandstone laminae; few pyrite-, quartz- and calcite-filled high-angle fractures; thin-bedded; base sharp and uneven.....	3	0
		(309	11)
93.	Siltstone, medium- to medium-dark-gray, contains few dark-gray shale laminae and beds and very fine grained sandstone laminae, few quartz- and calcite-filled fractures, burrowed in part, thin and irregularly bedded.....	21	11
		(331	10)
94.	Siltstone, medium-dark- to dark-gray, argillaceous, contains scattered dark-gray shale and light-gray very fine grained sandstone laminae and beds, few fractures and small-scale slump structures, highly contorted bedding.....	37	10
		(369	8)

Unit Number	Description	Thickness (Depth) ft	in.
95.	Sandstone, medium-gray, fine-grained, silty, contains 40 percent quartz, few medium-dark-gray shale laminae and beds up to 1 in. thick, thin and unevenly bedded.....	1	1
		(370	9)
96.	Shale, medium-dark-gray, silty, contains 50 percent medium-gray siltstone laminae, unevenly bedded; base grades.....	1	2
		(371	11)
97.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base grades.....	0	2
		(372	1)
98.	Shale, medium-dark-gray, contains 35 pecent light-gray very fine grained sandstone laminae and beds, bioturbated; base grades.....	0	4
		(372	5)
99.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base sharp.....	0	2
		(372	7)
100.	Shale, medium-dark-gray, contains few medium-gray siltstone laminae, evenly bedded; base sharp.....	0	2.5
		(372	9.5)
101.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 20 percent medium-dark-gray shale laminae in basal 2 in., burrowed in basal 2 in.; base grades.....	0	4.5
		(373	2)
102.	Shale, medium-dark-gray, contains 40 percent light-gray siltstone and very fine grained sandstone laminae and beds, bioturbated, evenly bedded; base grades abruptly.....	1	4
		(374	6)
103.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 10 percent dark-gray shale laminae, bioturbated, thin-bedded; base sharp.....	5	7
		(380	1)
104.	Siltstone, medium-light- to medium-gray, contains 10 percent light-gray very fine grained sandstone laminae and beds, few siderite laminae and beds 1 in. above base, bioturbated, thin-bedded; base grades.....	2	11
		(383	0)
105.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base sharp.....	0	3.5
		(383	3.5)

Unit Number	Description	Thickness (Depth) ft	in.
106.	Siltstone, medium-light- to medium-gray, contains 20 percent light-gray very fine grained sandstone laminae and beds, bioturbated; base grades	7	11.5
		(391	3)
107.	Shale, medium-dark-gray, contains few medium-gray siltstone laminae, evenly bedded; base sharp	0	5
		(391	8)
108.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, few dark-gray shale laminae 2 in. above base, few dark-gray shale clasts, thin-bedded; base grades abruptly	0	8
		(392	4)
109.	Siltstone, medium-light- to medium-gray, bioturbated, contorted bedding	0	5
		(392	9)
110.	Shale, medium-dark-gray, contains 40 percent light-gray very fine grained sandstone laminae and beds, evenly bedded	1	4
		(394	1)
111.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 25 percent medium-dark-gray shale and siltstone laminae, bioturbated in part, thin-bedded; base sharp	6	0
		(400	1)
112.	Shale, medium-dark-gray, very silty, few quartz- and pyrite-filled high-angle fractures, poor fissility; base sharp	1	7
		(401	8)
113.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base sharp	0	5
		(402	1)
114.	Shale, medium-dark-gray, contains 30 percent medium-gray siltstone and very fine grained sandstone laminae, evenly bedded; base grades	6	6
		(408	7)
115.	Shale, medium-dark-gray, evenly bedded, poor fissility; base sharp	1	11
		(410	6)
116.	Shale, medium-light- to medium-gray, silty, contains 20 percent light-gray siltstone and very fine grained sandstone laminae, few pyrite nodules, few slickensided surfaces and quartz-filled high-angle fractures, evenly bedded, poor fissility	9	8
		(420	2)

Unit Number	Description	Thickness (Depth) ft	in.
117.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, very fractured and brecciated with abundant quartz-filled fractures, contorted bedding; base very uneven	1	10
		(422	0)
118.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, abundant fractures, brecciated in part	1	8
		(423	8)
119.	Shale, medium-gray, silty, contains few medium-light-gray very fine grained sandstone laminae and beds in basal 6 in., few quartz-filled fractures and slickensided surfaces, evenly bedded, contorted and near vertical bedding in part	3	11
		(427	7)
120.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent medium-gray shale and siltstone laminae, few quartz-filled fractures, slightly burrowed, bioturbated from 2 ft to 3 ft 6 in. above base; base sharp	8	4
		(435	11)
121.	Siltstone, medium-light- to medium-gray, contains 20 percent light-gray very fine grained sandstone laminae and beds, slightly burrowed, thin-bedded; base grades	2	9
		(438	8)
122.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-gray siltstone beds, few quartz-filled fractures, brecciated from 1 ft to 2 ft above base	3	1
		(441	9)
123.	Siltstone, medium-gray, contains 20 percent light-gray very fine grained sandstone beds, bioturbated, thin-bedded	2	4
		(444	1)
124.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 25 percent medium-gray siltstone laminae and beds, few quartz-filled fractures; base grades	4	4
		(448	5)
125.	Siltstone, medium- to medium-dark-gray, contains 30 percent light-gray very fine grained sandstone beds up to 1.5 in. thick, 10 percent medium-dark-gray shale laminae and beds, few quartz-filled fractures and slickensided surfaces, bioturbated, thin-bedded, poor fissility	5	5
		(453	10)

Unit Number	Description	Thickness (Depth) ft	in.
126.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, few quartz-filled fractures at base, brecciated in part, thin-bedded; base sharp.....	1	0
		(454	10)
127.	Shale, medium-dark-gray, abundant slickensided surfaces; base grades.....	1	9
		(456	7)
128.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 40 percent medium-dark-gray silty shale beds, few quartz-filled fractures and slickensided surfaces, thin-bedded; base sharp.....	7	8
		(464	3)
129.	Shale, medium-dark-gray, few high-angle slickensided fractures, poor fissility; base grades.....	0	10
		(465	1)
130.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 20 percent dark-gray shale laminae and beds, few slickensided surfaces, few quartz-and pyrite-filled fractures, thin-bedded; base sharp.....	0	4
		(465	5)
131.	Shale, medium-dark-gray, silty, contains 20 percent light-gray very fine grained sandstone laminae and beds, few siderite nodules and slickensided surfaces; base grades.....	9	7
		(475	0)
132.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, scattered near vertical quartz-filled fractures and slickensided surfaces, thin-bedded; base grades.....	0	4
		(475	4)
133.	Shale, medium-dark-gray, contains 10 percent medium-gray siltstone and very fine grained sandstone laminae, few high-angle slickensided fractures, slightly burrowed, poor fissility; base grades abruptly.....	18	3
		(493	7)
134.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin and contorted bedding; base sharp.....	0	5
		(494	0)
135.	Shale, medium-dark-gray, few slickensided bedding plans, fissile.....	0	2
		(494	2)

Unit Number	Description	Thickness (Depth) ft	in.
136.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 45 percent quartz, 10 percent dark-gray shale laminae and beds, abundant slickensided fractures, few quartz-filled fractures, brecciated and bioturbated in part, thin-bedded.....	5	0
		(499	2)
137.	Shale, medium-dark-gray, contains 20 percent medium-gray siltstone laminae and beds, few high-angle slickensided fractures, silty in basal 10 in.; base grades abruptly.....	2	3
		(501	5)
138.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 20 percent medium-dark-gray shale laminae and beds, scattered quartz-filled fractures and slickensided surfaces.....	4	3
		(505	8)
139.	Shale, medium-dark-gray, silty, contains 20 percent medium-light-gray very fine grained sandstone laminae and beds, few quartz-filled fractures, evenly bedded.....	0	4
		(506	0)
140.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, abundant quartz-filled fractures; base sharp.....	0	5
		(506	5)
141.	Shale, medium-dark-gray, silty, contains 10 percent medium- to medium-light-gray siltstone and very fine grained sandstone laminae and beds, few pyrite nodules and quartz-filled fractures 6 ft below top, few slickensided bedding planes, evenly bedded; base grades.....	18	0
		(524	5)
142.	Shale, medium-dark-gray, silty, pyritic, contains 25 percent medium-gray very fine grained sandstone beds, slightly burrowed, contorted bedding; base sharp.....	0	6
		(524	11)
143.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, few quartz-filled fractures, thin- to thick-bedded; base grades abruptly.....	3	11
		(528	10)
144.	Shale, medium-dark-gray, contains 30 percent light-gray siltstone and very fine grained sandstone laminae and beds, 1.5 in. siderite nodule at base, abundant quartz-filled fractures, few slickensided bedding planes.....	4	8
		(533	6)

Unit Number	Description	Thickness (Depth) ft	in.
145.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, few medium-dark-gray shale laminae in basal 1 in., thin-bedded	0	4
		(533	10)
146.	Shale, medium-dark-gray, contains 5 percent light-gray very fine grained sandstone laminae and beds, few quartz-filled fractures; base grades abruptly	1	2
		(535	0)
147.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base sharp	0	3.5
		(535	3.5)
148.	Shale, medium-dark-gray, contains 25 percent medium-gray siltstone beds, few slickensided bedding planes, poor fissility	2	4.5
		(537	8)
149.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 25 percent medium-dark-gray shale and siltstone laminae and beds, few quartz-filled fractures; base sharp	1	8
		(539	4)
150.	Shale, medium-dark-gray, silty, contains 25 percent medium-light-gray siltstone and very fine grained sandstone beds, slightly burrowed; base grades	1	4
		(540	8)
151.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 40 percent quartz, 40 percent medium-dark-gray shale and siltstone laminae, thin-bedded	3	4
		(544	0)
152.	Shale, medium-dark- to dark-gray, contains 25 percent medium- to medium-dark-gray siltstone beds, scattered quartz-filled fractures and slickensided surfaces, fair fissility; base sharp	1	11
		(545	11)
153.	Siltstone, medium- to medium-dark-gray, sandy at top, contains abundant quartz-filled fractures and slickensided surfaces, poor fissility; base grades	1	2
		(547	1)
154.	Siltstone, medium-gray, contains 20 percent medium-dark- to dark-gray shale laminae, scattered quartz-filled fractures and slickensided surfaces, bioturbated; base grades	1	1
		(548	2)

Unit Number	Description	Thickness (Depth) ft	in.
155.	Siltstone, medium- to medium-dark-gray, silty, contains scattered medium-dark- to dark-gray shale laminae, few quartz-filled fractures, brecciated in part, normally graded, few slickensided surfaces, thin- to thick-bedded; base grades	4	5
		(552	7)
156.	Siltstone, medium- to medium-dark-gray, silty, contains 20 percent medium-dark to dark-gray shale beds, few high-angle quartz-filled fractures, thin- to thick-bedded; base sharp	4	4
		(556	11)
157.	Shale, dark-gray, silty at base, abundant slickensided surfaces, scattered quartz-filled fractures at base, evenly bedded, very fissile; base sharp	0	8
		(557	7)
158.	Sandstone, medium- to medium-light-gray, very fine to fine-grained, sparsely micaceous, silty at base, contains 50 percent quartz, 10 percent medium-dark- to dark-gray shale laminae, few quartz-filled fractures, few slickensided surfaces; base grades	0	8
		(558	3)
159.	Shale, medium-dark- to dark-gray, contains scattered medium-gray very fine grained sandstone laminae and beds up to 0.25 in. thick, few slickensided surfaces, fair fissility; base sharp	1	0
		(559	3)
160.	Siltstone, medium-dark-gray, contains 40 percent dark-gray shale beds, scattered quartz-filled fractures, bioturbated in top 5 in.; base grades	0	10
		(560	1)
161.	Siltstone, medium- to medium-dark-gray, micaceous, contains 10 percent medium-dark- to dark-gray shale laminae and beds, scattered quartz-filled fractures and slickensided surfaces, normally graded, fissile; base grades	4	6
		(564	7)
162.	Siltstone, medium- to medium-dark-gray, micaceous, sandy at base, contains 5 percent medium-dark-gray shale laminae, bioturbated, few slickensided surfaces, thin and unevenly bedded; base sharp	2	5
		(567	0)
163.	Shale, dark-gray, contains 10 percent medium- to medium-dark-gray siltstone laminae; base sharp	2	6
		(569	6)

Unit Number	Description	Thickness (Depth) ft	in.
164.	Siltstone, medium- to medium-dark-gray, sparsely micaceous, slightly calcareous, contains 5 percent dark-gray shale laminae, brecciated with abundant calcite-filled fractures 2 ft 3 in. above base, thin-bedded; base uneven.....	2	9
		(572	3)
165.	Breccia, medium- to medium-dark-gray, contains abundant angular siltstone and shale fragments and quartz-filled fractures, vuggy; base uneven.....	0	3
		(572	6)
166.	Siltstone, medium- to medium-dark-gray, slightly calcareous, contains 5 percent medium- to medium-dark-gray shale laminae, scattered fractures, few calcite-filled fractures in basal 6 in.; base grades.....	1	5
		(573	11)
167.	Breccia, medium-light- to medium-gray, contains abundant angular to subangular siltstone and shale fragments and calcite-filled vugs and fractures; base uneven.....	1	1
		(575	0)
168.	Siltstone, medium- to medium-dark-gray, pyritic, sparsely micaceous, contains 10 percent dark-gray shale laminae and beds, few slickensided surfaces, thin-bedded; base sharp.....	2	11
		(577	11)
169.	Siltstone, medium-light- to medium-gray, pyritic, micaceous, contains 10 percent medium-dark- to dark-gray shale laminae, fair fissility; base grades.....	5	3
		(583	2)
170.	Siltstone, medium-light- to medium-gray, contains 25 percent medium-dark- to dark-gray shale beds, bioturbated in part, thin and unevenly bedded; base grades.....	1	8
		(584	10)
171.	Siltstone, medium- to medium-dark-gray, finely micaceous, contains 15 percent medium-dark- to dark-gray shale laminae and beds, 5 percent light-gray very fine grained sandstone laminae and beds up to 0.25 in. thick, slightly burrowed, thin-bedded; base grades.....	4	5
		(589	3)
172.	Siltstone, medium-dark-gray, pyritic, finely micaceous, contains 25 percent medium-dark- to dark-gray shale laminae and beds, few small-scale slump structures and faults, few slickensided surfaces, normally graded in basal 2 ft, bioturbated, thin and unevenly bedded; base grades.....	3	8
		(592	11)

Unit Number	Description	Thickness (Depth) ft	in.
173.	Shale, medium-dark-gray, pyritic, contains 25 percent medium-gray siltstone laminae, few quartz-filled fractures, fissile; base grades	0	9.5
		(593	8.5)
174.	Siltstone, medium-gray, finely micaceous, slightly calcareous, contains 25 percent medium-dark-gray shale laminae and beds, few high-angle fractures, bioturbated, thin- to thick-bedded, poor fissility; base sharp	1	8.5
		(595	5)
175.	Shale, dark-gray, contains 40 percent medium-gray siltstone laminae, few quartz-filled fractures and slickensided surfaces, slightly burrowed in basal 3 in., evenly bedded, poor fissility; base grades	2	7
		(598	0)
176.	Siltstone, medium- to medium-dark-gray, finely micaceous, contains 10 percent dark-gray shale laminae, few quartz-filled low-angle fractures, fissile	1	2
		(599	2)
177.	Siltstone, medium- to medium-dark-gray, contains 40 percent medium-dark- to dark-gray shale beds, 10 percent light-gray very fine grained sandstone laminae and beds in basal 2 in., burrowed, thin and unevenly bedded; base grades	5	10
		(605	0)
178.	Siltstone, medium- to medium-dark-gray, contains 10 percent medium-dark-gray shale laminae and beds, few calcite-filled low-angle fractures; base grades	1	5
		(606	5)
179.	Shale, medium-dark-gray, contains 40 percent medium-gray siltstone laminae, burrowed, unevenly bedded, poor fissility; base grades	1	0
		(607	5)
180.	Siltstone, medium- to medium-dark-gray, contains 20 percent medium-dark- to dark-gray shale beds, few quartz-filled low-angle fractures, burrowed, thin- to thick-bedded, fair fissility; base sharp	5	1
		(612	6)
181.	Shale, medium-dark- to dark-gray, contains 40 percent medium-light-gray siltstone beds, few slickensided surfaces and quartz- and calcite-filled low-angle fractures, bioturbated; base uneven	7	5
		(619	11)

Unit Number	Description	Thickness (Depth) ft	in.
182.	Siltstone, medium- to medium-dark-gray, slightly carbonaceous, contains 25 percent medium-dark- to dark-gray shale laminae, few quartz-filled low-angle fractures, few slickensided surfaces, bioturbated, fair fissility; base grades.....	3	10
		(623	9)
183.	Shale, medium-dark- to dark-gray, slightly calcareous, contains 40 percent medium-gray siltstone laminae, few siderite nodules 3 ft above base, few quartz-filled fractures, few slickensided surfaces, bioturbated, evenly bedded, fair fissility; base grades.....	9	1
		(632	10)
184.	Siltstone, medium-light- to medium-gray, slightly calcareous, contains 5 percent dark-gray shale laminae and beds, few pyrite- and quartz-filled fractures, scattered slickensided surfaces; base grades.....	3	6
		(636	4)
185.	Shale, medium- to medium-dark-gray, contains 40 percent medium-gray siltstone laminae, few quartz- and pyrite-filled fractures, thin and unevenly bedded; base sharp.....	3	11
		(640	3)
186.	Breccia, medium- to medium-light-gray, contains abundant angular medium-gray siltstone fragments up to 0.5 in. thick, abundant quartz-filled fractures, few slickensided surfaces; base uneven.....	0	10
		(641	1)
187.	Shale, medium-dark-gray, slightly calcareous, contains 25 percent medium-gray siltstone laminae, few quartz- and pyrite-filled fractures, few slickensided surfaces, burrowed, unevenly bedded; base uneven.....	4	3
		(645	4)
188.	Siltstone, medium-dark-gray, calcareous, abundant pyrite- and quartz-filled fractures, brecciated in top 2 in., unevenly bedded; base grades.....	0	10
		(646	2)
189.	Shale, dark-gray, contains 40 percent medium-gray siltstone laminae, few quartz- and pyrite-filled fractures, burrowed, unevenly bedded, fair fissility.....	6	8
		(652	10)
190.	Conglomerate, medium-gray, contains abundant subrounded to rounded white quartz granules and pebbles up to 0.5 in. in diameter, fine-grained sandstone matrix, normally graded; base uneven.....	1	2
		(654	0)

Unit Number	Description	Thickness (Depth) ft	in.
191.	Breccia, medium-gray, contains abundant angular medium-dark-gray siltstone fragments and well rounded white quartz pebbles, abundant quartz- and calcite-filled fractures; base uneven.....	0	2
		(654	2)
192.	Conglomerate, medium-gray, contains scattered well rounded white quartz pebbles and few medium-gray siltstone clasts up to 1 in. in diameter, fine-grained sandstone matrix; base sharp.....	2	1
		(656	3)
193.	Siltstone, medium-dark-gray, finely micaceous, contains 20 percent medium-dark- to dark-gray shale beds, few quartz-filled fractures, few slickensided surfaces, bioturbated, unevenly bedded; base grades.....	4	7
		(660	10)
194.	Siltstone, medium- to medium-dark-gray, contains 40 percent dark-gray shale laminae, few slickensided surfaces, bioturbated, unevenly bedded, poor fissility; base sharp and uneven.....	3	9
		(664	7)
195.	Shale, medium-dark- to dark-gray contains 5 percent medium- to medium-dark-gray siltstone laminae and beds, few slickensided surfaces, bioturbated, evenly bedded, fair fissility; base sharp.....	18	5
		(683	0)
196.	Siltstone, medium-gray, contains 20 percent medium-dark-gray shale laminae, scattered pyrite-filled fractures, unevenly bedded; base sharp.....	5	5
		(688	5)
197.	Shale, medium-dark- to dark-gray, contains 25 percent medium-light- to medium-gray siltstone laminae and beds, few pyrite-filled high-angle fractures, bioturbated, unevenly bedded, poor fissility; base sharp.....	0	10
		(689	3)
198.	Siltstone, medium-gray, contains scattered medium-dark-gray shale beds, thin- to thick-bedded, poor fissility; base sharp and uneven.....	1	1
		(690	4)
199.	Siltstone, medium-gray, contains 30 percent medium-dark-gray shale laminae and beds, bioturbated, unevenly bedded, poor fissility; base grades.....	0	11
		(691	3)

Unit Number	Description	Thickness (Depth) ft	in.
200.	Shale, medium- to medium-dark-gray, pyritic, contains 25 percent medium-gray siltstone beds, few low-angle fractures, bioturbated, evenly bedded, fair fissility; base grades.....	3	7
		(694	10)
201.	Siltstone, medium-gray, contains 10 percent medium-dark-gray shale laminae and beds, scattered high-angle and quartz-filled fractures; base sharp and uneven.....	2	3
		(697	1)
202.	Shale, medium-dark-gray, contains scattered medium- to medium-dark-gray siltstone laminae and beds, few pyritic slickensided fractures; base grades.....	1	3
		(698	4)
203.	Siltstone, medium-gray, contains 10 percent medium-dark-gray shale laminae and beds, few quartz-filled fractures, scattered pyritic slickensided surfaces; base sharp.....	1	5
		(699	9)
204.	Shale, medium-dark-gray, contains 25 percent medium-gray siltstone beds, poor fissility; base grades.....	0	9
		(700	6)
205.	Siltstone, medium-light- to medium-gray, contains 40 percent medium-dark-gray shale laminae and beds, few fractures, thin- to thick-bedded; base grades.....	4	3
		(704	9)
206.	Shale, medium-gray, contains 30 percent light-gray very fine grained sandstone laminae, few dark-gray silty shale laminae, evenly bedded, poor fissility; base sharp.....	14	5
		(719	2)
207.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few medium-dark-gray shale clasts in basal 2 in., thin-bedded; base sharp and undulatory.....	1	2
		(720	4)
208.	Shale, medium-gray, contains 20 percent light-gray very fine grained sandstone laminae and beds, evenly bedded, poor fissility; base grades.....	1	4
		(721	8)
209.	Sandstone, medium-light-gray, very fine grained, contains 50 percent quartz, few medium-dark-gray shale clasts; base sharp.....	0	8
		(722	4)
210.	Shale, medium-gray, silty, contains 40 percent light-gray very fine grained sandstone laminae and beds, slightly burrowed; base grades.....	3	8
		(726	0)

Unit Number	Description	Thickness (Depth) ft	in.
211.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, thin-bedded; base sharp.....	0	5
		(726	5)
212.	Shale, medium-gray, silty, evenly bedded.....	0	7
		(727	0)
213.	Sandstone, medium-light-gray, mottled grayish-red, very fine grained, contains 40 percent quartz, thin- to thick-bedded; base grades.....	6	9
		(733	9)
214.	Shale, medium-gray, evenly bedded, fair fissility; base sharp.....	0	3
		(734	0)
215.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thick-bedded.....	0	8
		(734	8)
216.	Shale, medium-dark-gray, contains 30 percent light-gray very fine grained sandstone laminae and beds, evenly bedded, fissile; base sharp.....	1	3
		(735	11)
217.	Sandstone, medium-light-gray, mottled grayish-red, very fine grained, silty, contains 40 percent quartz, few calcite-filled vertical fractures from 6 in. to 1 ft 9 in. below top, thin- to thick-bedded.....	12	4
		(748	3)
218.	Sandstone, medium-gray, mottled grayish-red, very fine grained, contains 40 percent quartz, abundant medium-dark-gray shale and medium-gray sandstone clasts; base grades.....	0	8
		(748	11)
219.	Sandstone, medium-gray, very fine grained, silty, pyritic, contains 40 percent quartz, few slickensided surfaces; base grades.....	1	5
		(750	4)
220.	Sandstone, medium-light-gray, mottled grayish-red, very fine grained, contains 40 percent quartz, abundant invertebrate fossils; base grades.....	1	8
		(752	0)
221.	Sandstone, medium-light-gray, mottled grayish-red, very fine grained, contains 40 percent quartz, scattered invertebrate fossil fragments; base sharp.....	2	2
		(754	2)

Unit Number	Description	Thickness (Depth) ft	in.
222.	Shale, medium-dark-gray, pyritic, evenly bedded, fissile; base grades	0	8
		(754	10)
223.	Sandstone, medium-light-gray, mottled grayish-red, very fine grained, silty, contains 40 percent quartz, scattered medium-gray shale laminae and beds in top 8 in.; base sharp	6	2
		(761	0)
224.	Shale, medium-dark-gray, evenly bedded, fissile; base grades	0	5
		(761	5)
225.	Siltstone, medium-gray, mottled grayish-red, few medium-dark-gray shale clasts 7 ft below top, few pyrite- and quartz-filled fractures 3 ft 4 in. below top, thin-bedded, fair to poor fissility; base grades	12	8
		(774	1)
226.	Shale, medium-dark-gray, very silty, contains 25 percent light-gray very fine grained sandstone beds, abundant dark-gray shale clasts in top 1.5 in	5	8
		(779	9)
227.	Siltstone, medium-light-gray, contains 25 percent light-gray very fine grained sandstone laminae and beds, few high-angle fractures at base, thin-bedded; base sharp	2	4
		(782	1)
228.	Shale, dark-gray, carbonaceous, silty in basal 2 in., evenly bedded; base grades abruptly	0	8
		(782	9)
229.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, abundant angular dark-gray shale clasts; base sharp	1	0
		(783	9)
230.	Siltstone, medium-gray, mottled grayish-red, few slickensided surfaces; base sharp and uneven	2	11
		(786	8)
231.	Shale, medium-gray, few slickensided surfaces, poor fissility	0	2
		(786	10)
232.	Siltstone, medium-gray, mottled grayish-red; base grades	0	5
		(787	3)
233.	Shale, medium-gray, silty, few fractures, evenly bedded	0	7
		(787	10)

Unit Number	Description	Thickness (Depth) ft	in.
234.	Sandstone, light-brownish-gray, mottled moderate-reddish-brown, very fine to fine-grained, silty, pyritic, contains 45 percent quartz, few quartz-filled fractures, few slickensided surfaces, thin- to thick-bedded.....	2 (790	2 0)

BOTTOM OF HOLE
TOTAL DEPTH 790 ft

GEOPHYSICAL LOG

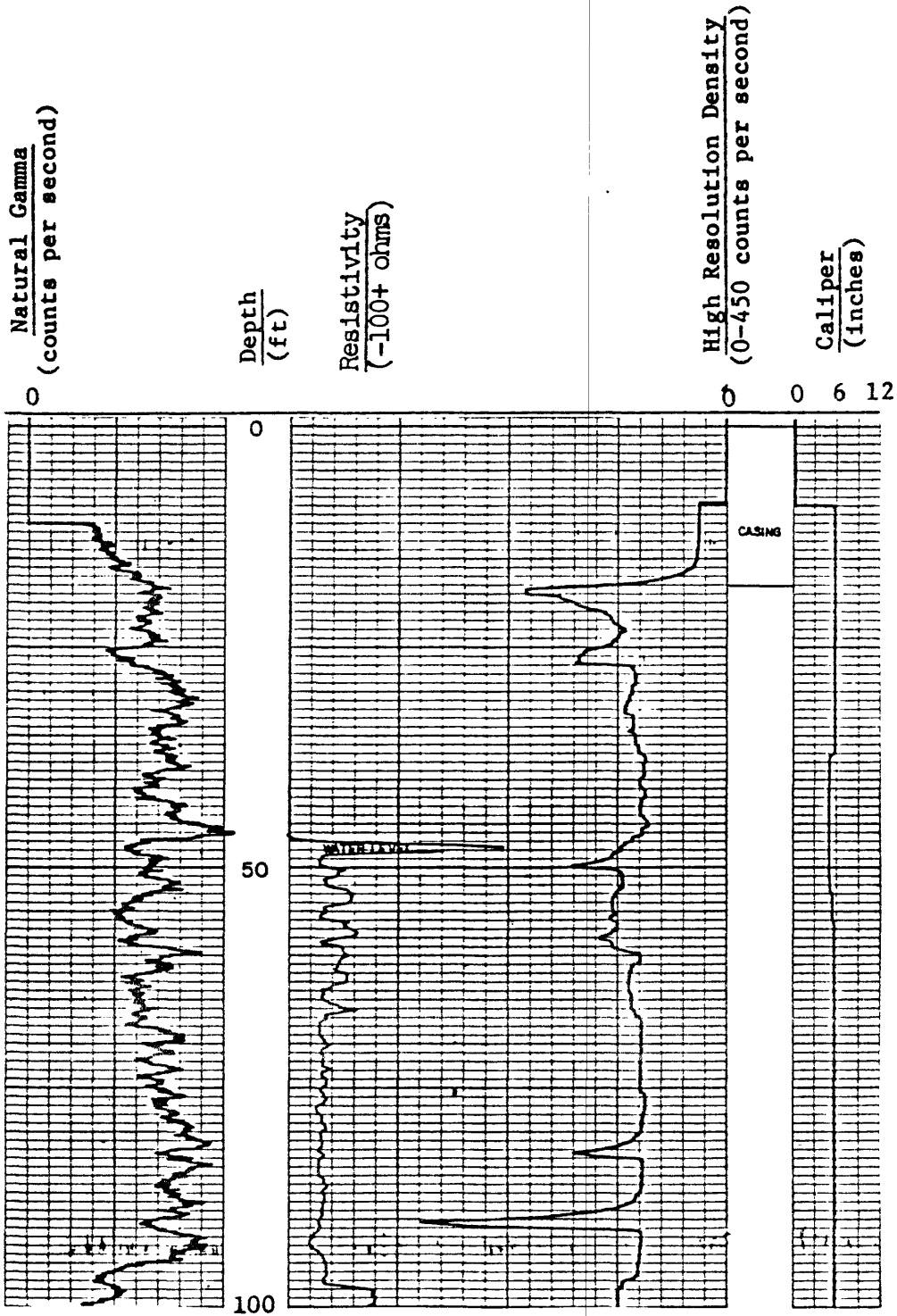
Corehole: V-3 Date: 11/16/82 State: Virginia County: Pulaski

Quadrangle: Pulaski, Va. Latitude: 37°00'40"N Longitude: 80°51'10"W

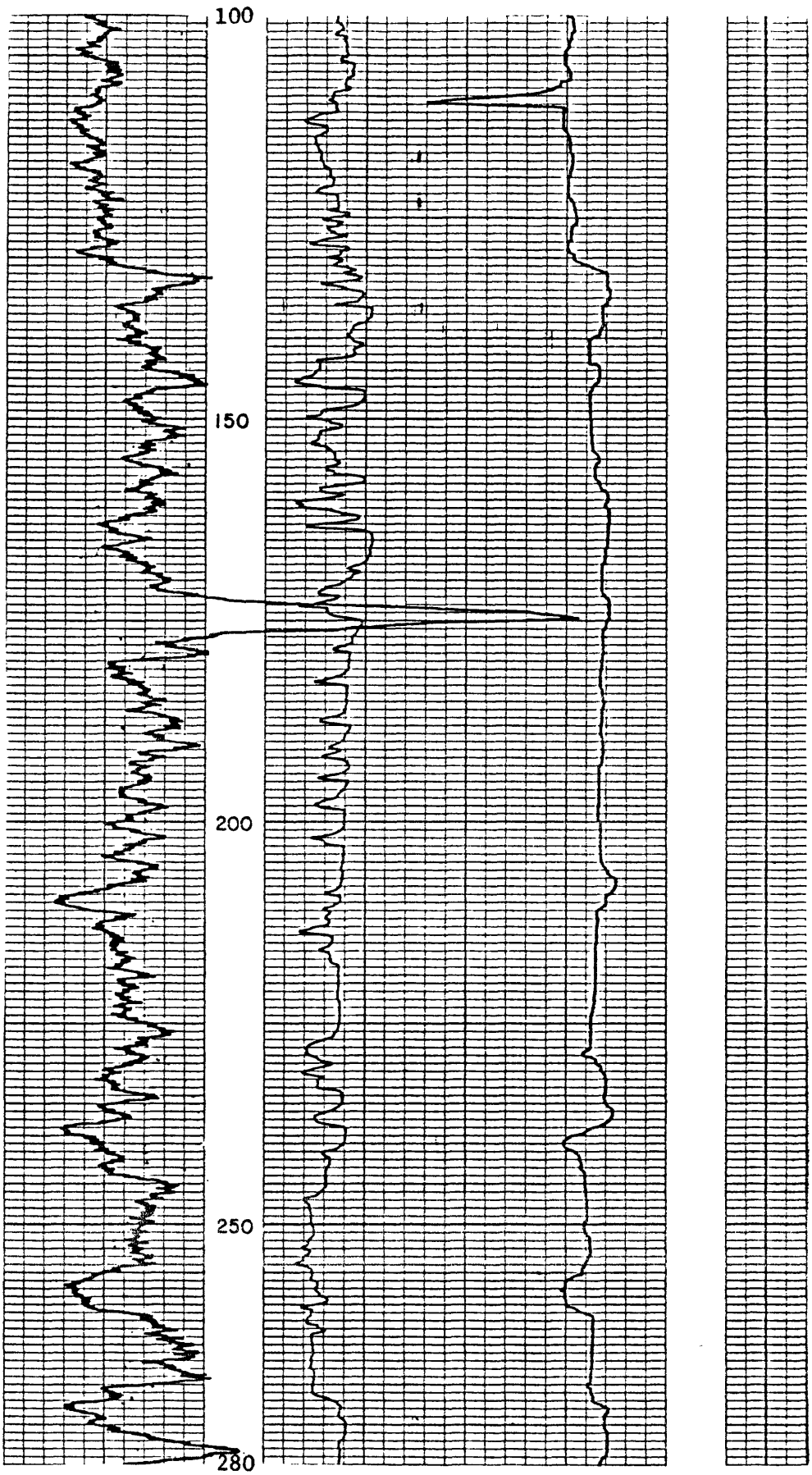
Altitude: 2,460 ft Logged Depth: 780 ft Drilled Depth: 790 ft

Logging Speed: 20 ft/min (SP not run) Natural Gamma Time Constant: 1

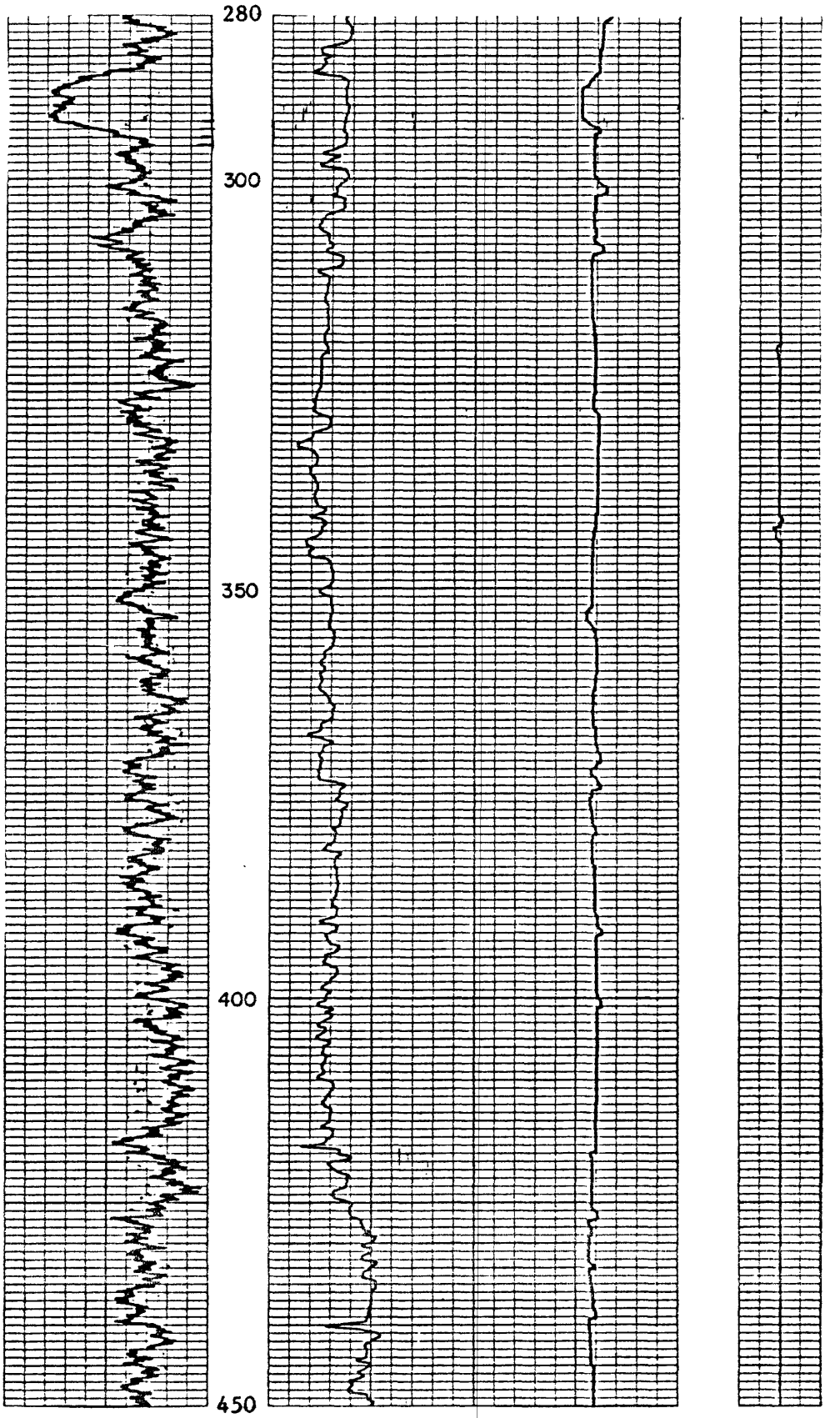
High Resolution Density Time Constant: 1



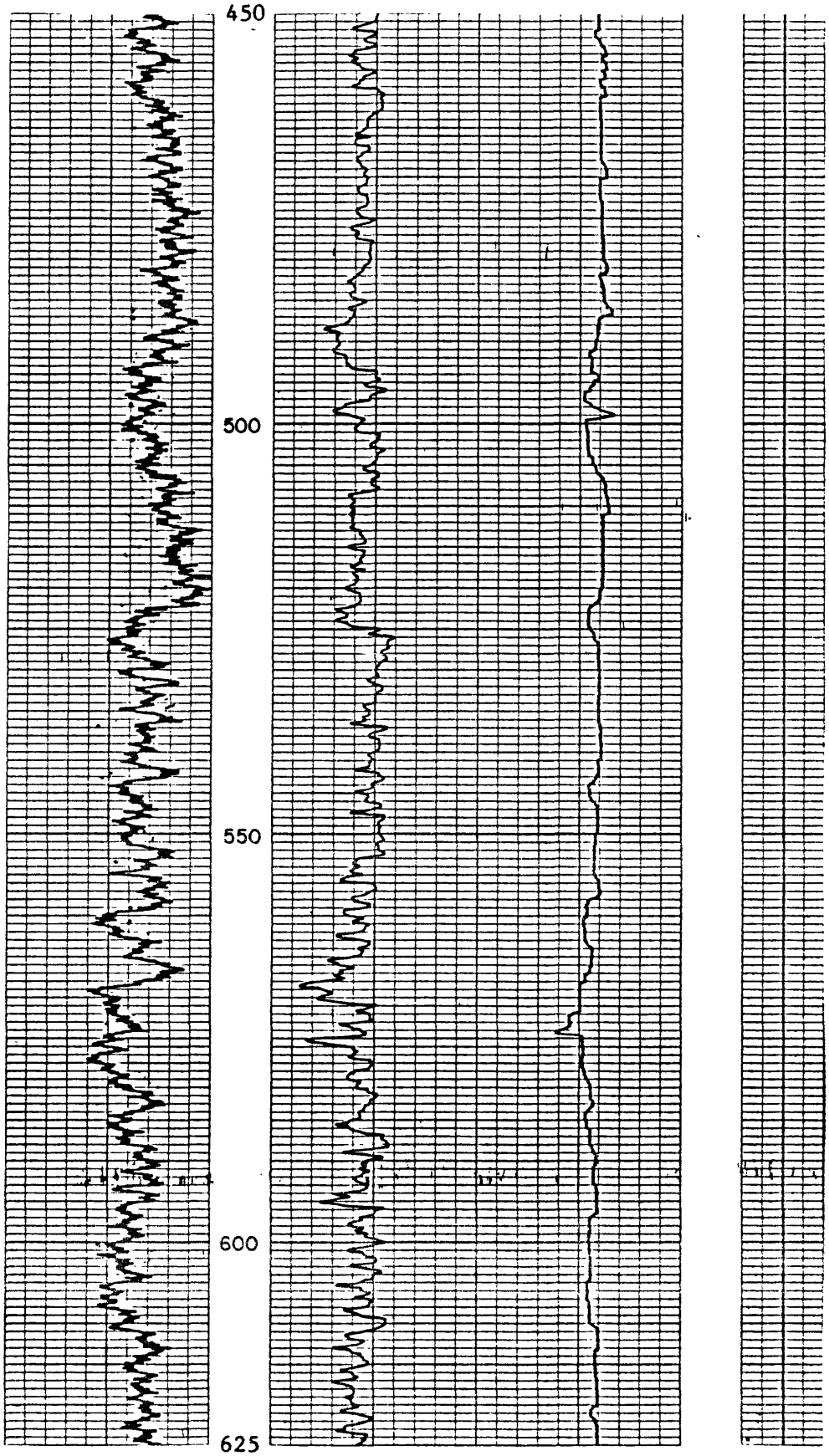
Corehole: V-3 continued



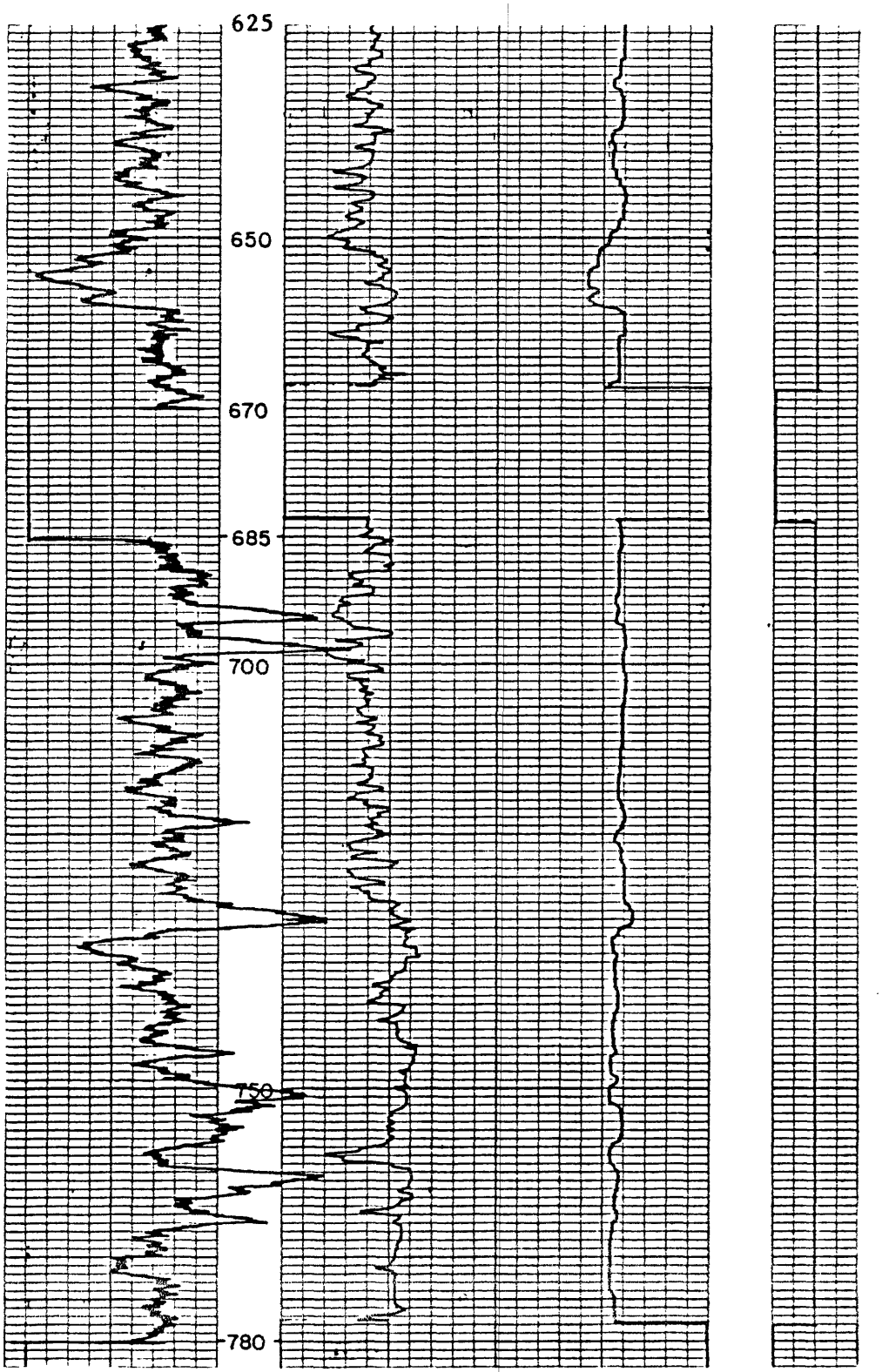
Corehole: V-3 continued



Corehole: V-3 continued



Corehole: V-3 continued



Corehole V-4

Location: Smyth County; Chatham Hill, Va., 7.5 minute quadrangle; on Baker Branch about 0.8 mi northeast of State Route 42. Accessible by State Route 623 and Forest Service road 614.

Coordinates: Latitude 36°58'38"N Longitude 81°30'07"W

Altitude: 2,240 ft Drilled depth: 868 ft

Dip of strata: Ranges from 30° to 45° in top 300 ft, increasing to 70° at a depth of 450 ft, and decreases to nearly horizontal at base of corehole.

Date drilled: October 19, 1982 to November 5, 1982

Core description: J.F. Windolph, Jr., K.J. Englund, J.O. Maberry II, R.E. Thomas, and J.C. Weber

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER MISSISSIPPIAN SERIES		
	Price Formation		
1.	Soil and weathered rock (casing set - no core recovered).....	5	0
		(5	0)
2.	Sandstone, medium-light-gray, medium-grained, contains 45 percent quartz, few moderate-reddish-brown shale fragments in basal 6 in., abundant feldspar grains, weathered along fractures, thick-bedded.....	2	9
		(7	9)
3.	Sandstone, medium-gray, very fine grained, contains 45 percent quartz, abundant angular to subrounded brownish-gray shale fragments, few dark-gray carbonaceous shale laminae, few slickensided surfaces, thin-bedded; base sharp.....	4	2
		(11	11)
4.	Sandstone, medium-light-gray, fine- to medium-grained, contains 45 percent quartz, few dark-gray shale laminae, thick-bedded.....	5	1
		(17	0)
5.	Coal, impure; contains bright attritus, pyrite, and medium-gray silty shale laminae.....	0	8
		(17	8)
6.	Sandstone, medium-light-gray, fine-grained, contains 45 percent quartz, abundant dark-gray carbonaceous shale laminae, few pyritic coal laminae, fractured.....	0	3
		(17	11)

Unit Number	Description	Thickness (Depth) ft	in.
7.	Sandstone, medium-light-gray, medium- to coarse-grained, contains 45 percent quartz, abundant coal and medium-dark-gray shale fragments.....	0	2
		(18	1)
8.	Shale, medium- to medium-dark-gray, silty, slightly carbonaceous, contains scattered light-gray siltstone and very fine grained sandstone laminae, few slickensided surfaces, evenly bedded.....	2	0
		(20	1)
9.	Siltstone, medium-gray, sandy, contains few dark-gray shale laminae and slickensided surfaces, thin and evenly bedded.....	3	0
		(23	1)
10.	Shale, medium- to medium-dark-gray, carbonaceous in part, pyritic, silty few high-angle small-scale faults, evenly bedded.....	2	3
		(25	4)
11.	Siltstone, medium-gray, contains abundant medium-gray fine- to coarse-grained sandstone laminae, few dark-gray shale laminae, few quartz- and pyrite-filled fractures and vugs, few slickensided surfaces, thin and contorted bedding.....	5	6
		(30	10)
12.	Sandstone, medium-light- to medium-gray, silty, contains 45 percent quartz, 2 in. thick medium-dark-gray shale bed 3 ft below top, few small-scale faults, scattered high-angle quartz-filled fractures in top 2 ft, thin and contorted bedded; base grades.....	4	8
		(35	6)
13.	Siltstone, medium-gray, argillaceous at base, contains abundant dark-gray shale laminae and beds, thin-bedded.....	1	0
		(36	6)
14.	Shale, medium- to medium-dark-gray, pyritic, carbonaceous in part, contains scattered medium-gray siltstone and very fine grained sandstone laminae, few slickensided surfaces and small-scale faults.....	6	6
		(43	0)
15.	Shale, medium-dark-gray, carbonaceous, slightly silty, evenly bedded.....	0	10
		(43	10)
16.	Sandstone, medium-light-gray, fine- to medium-grained, contains 45 45 percent quartz, abundant dark-gray shale laminae in basal 7 in., 5 in. thick medium-gray silty shale bed 5 ft 2 in. below top, few quartz-filled fractures and vugs, few small-scale faults, thick-bedded.....	11	9
		(55	7)

Unit Number	Description	Thickness (Depth) ft	in.
17.	Shale, light-brownish-gray, few root slickensides.....	0	2
		(55	9)
18.	Sandstone, medium-light-gray, medium-grained, contains 45 percent quartz, few quartz- and pyrite-filled high-angle fractures, massive.....	2	7
		(58	4)
19.	Siltstone, medium-gray, faintly bedded.....	0	5
		(58	9)
20.	Sandstone, medium-light-gray, fine- to medium-grained, contains 45 percent quartz, few high-angle fractures, few small-scale faults, thick-bedded.....	8	0
		(66	9)
21.	Siltstone, medium-gray, sandy, pyritic, contains abundant dark-gray shale beds in basal 4 in., few root slicks, highly fractured.....	4	0
		(70	9)
22.	Shale, medium-dark-gray, very silty, few pyrite lenses, few slickensided surfaces.....	3	6
		(74	3)
23.	Sandstone, medium- to medium-light-gray, very fine grained, silty, contains 45 percent quartz; abundant siderite, pyrite and coal laminae in basal 10 in.; thick-bedded.....	6	9
		(81	0)
24.	Siltstone, medium-gray, pyritic, contains abundant dark-gray carbonaceous shale laminae, scattered siderite nodules, highly fractured; base sharp.....	0	8
		(81	8)
25.	Shale, medium-dark- to olive-gray, carbonaceous, scattered siderite nodules, evenly to poorly bedded.....	7	0
		(88	8)
26.	Shale, dark-gray to black, very carbonaceous, slightly pyritic, evenly bedded.....	0	7
		(89	3)
27.	Siltstone, medium-gray, slightly pyritic, contains abundant dark-gray carbonaceous shale laminae, thin and contorted bedding.....	1	1
		(90	4)
28.	Shale, medium- to medium-dark-gray, very carbonaceous, contains scattered coal and dark-gray shale laminae, evenly bedded, fissile; base uneven.....	1	9
		(92	1)

Unit Number	Description	Thickness (Depth) ft	in.
29.	Sandstone, medium-light-gray, very fine- to medium-grained, contains 45 percent quartz, scattered dark-gray shale laminae, thin-bedded	2	6
		(94	7)
30.	Shale, dark-gray to black, very carbonaceous, slightly pyritic, few slickensided surfaces, fissile	0	5
		(95	0)
31.	Siltstone, medium- to medium-dark-gray, thin and unevenly bedded, fractured	0	8
		(95	8)
32.	Sandstone, medium-light-gray, fine-grained, contains 45 percent quartz, massive; base sharp	3	0
		(98	8)
33.	Shale, medium- to medium-dark-gray, slightly carbonaceous, slightly pyritic, sandy, slightly burrowed, evenly bedded	1	4
		(100	0)
34.	Siltstone, medium-light- to- medium-gray, pyritic, contains scattered light-gray fine- to medium-grained sandstone laminae and beds, abundant dark-gray shale fragments, thin and unevenly bedded	1	10
		(101	10)
35.	Sandstone, medium light-gray, very fine to fine-grained, contains 45 percent quartz, few coal laminae at base	4	2
		(105	0)
36.	Sandstone, medium-gray, fine- to medium-grained, contains 40 percent quartz, abundant coal fragments and laminae in top 2 ft and at base, unevenly bedded; base sharp	3	6
		(108	6)
37.	Shale, medium- to medium-dark-gray, slightly carbonaceous, scattered siderite nodules, few rootlets and plant fragments, few slickensided surfaces, evenly to poorly bedded	4	6
		(113	0)
38.	Siltstone, medium-gray, pyritic, contains few coal laminae, abundant dark-gray shale fragments, base sharp and uneven	1	2
		(114	2)
39.	Sandstone, medium- to olive-gray, very fine grained, contains 40 percent quartz, abundant coal laminae from 1 ft 9 in. to 2 ft 2 in. below top, few quartz-filled high-angle fractures, thick-bedded to massive	13	2
		(127	4)

Unit Number	Description	Thickness (Depth) ft	in.
40.	Siltstone, medium- to medium-dark-gray, few quartz and pyrite-filled fractures, highly fractured.....	1	0
		(128	4)
41.	Sandstone, medium-light-gray, very fine to medium-grained, slightly pyritic, silty, contains 40 percent quartz, abundant dark-gray shale laminae and fragments, few quartz- and calcite-filled high-angle fractures, few slickensided surfaces, thick-bedded to massive.....	55	8
		(184	0)
42.	Coal, dull to bright attritus, few calcite-filled fractures, few thick pyrite bands, impure.....	0	2
		(184	2)
43.	Sandstone, medium-light-gray, fine- to medium-grained, contains 45 percent quartz, 0.25 in. to 0.5 in. thick coal lense 1 ft below top 0.25 in. thick grayish-red shale fragments 7 ft below top, abundant contorted coal laminae 3 in. above base; base sharp.....	9	6
		(193	8)
44.	Shale, very dark gray to black, carbonaceous, pyritic, very fissile.....	0	1
		(193	9)
45.	Shale, dark-gray, slightly burrowed, few high-angle fractures, evenly bedded.....	9	3
		(203	0)
46.	Shale, medium-dark- to dark-gray, silty, contains 30 percent medium-gray sandstone laminae, slightly burrowed, few slickensided surfaces and contorted beds.....	18	5
		(221	5)
47.	Siderite, light-grayish-brown- to medium-dark-gray, silty, weathered.....	0	4
		(221	9)
48.	Siltstone, medium- to medium-dark-gray, sandy, contains scattered dark-gray shale laminae and lenses, slightly burrowed.....	2	4
		(224	1)
49.	Sandstone, medium- to medium-dark-gray, very fine grained, silty, contains 45 percent quartz, 3 in. dark-gray carbonaceous shale bed with few coal laminae 3 ft 5 in. below top, 0.25 in. dark-gray shale bed at base, few calcite-filled fractures, few slump structures, thin-bedded.....	5	4
		(229	5)

Unit Number	Description	Thickness (Depth) ft	in.
50.	Siltstone, medium-dark-gray, contains few dark-gray shale laminae and beds up to 1 in. thick, few slump-structures, highly fractured	1	4
		(230	9)
51.	Shale, medium-dark- to dark-gray, carbonaceous, few light-gray siltstone and very fine grained sandstone laminae and beds, evenly bedded	1	2
		(231	11)
52.	Siltstone, medium-dark-gray, contains few dark-gray carbonaceous shale laminae	0	11
		(232	10)
53.	Sandstone, medium-light- to medium-gray, very fine grained, silty, contains 40 percent quartz, few dark-gray shale laminae	1	0
		(233	10)
54.	Siltstone, medium-gray, evenly bedded	0	2
		(234	0)
55.	Shale, medium-dark-gray, evenly bedded	0	3
		(234	3)
56.	Shale, dark-gray, very carbonaceous, contains 0.25 in. black shale bed at top	0	2
		(234	5)
57.	Siltstone, medium- to medium-dark-gray, contains 0.25 in. dark-gray carbonaceous shale bed 4 in. below top, evenly bedded	0	7
		(235	0)
58.	Shale, medium- to medium-dark-gray, slightly carbonaceous, contains 10 percent medium-dark-gray siltstone laminae, slightly burrowed, evenly to irregularly bedded	5	2
		(240	2)
59.	Shale, medium-dark-gray, silty, abundant siderite nodules and marine invertebrate fossils	0	8
		(240	10)
60.	Shale, medium- to medium-dark-gray, slightly carbonaceous, evenly bedded	3	7
		(244	5)
61.	Conglomerate, medium-light to medium-gray, contains abundant rounded quartz pebbles up to 0.5 in. in diameter	0	2
		(244	7)

Unit Number	Description	Thickness (Depth) ft	in.
62.	Siltstone, medium- to medium-dark-gray, carbonaceous, contains scattered medium-dark- to dark-gray shale laminae and beds in basal 3 ft 3 in., few calcite- and quartz-filled fractures, few brecciated beds and slump structures, crossbedded, thin and evenly bedded	8	7
		(253	2)
63.	Siltstone, medium-gray, pyritic, few calcite- and dolomite-filled vertical fractures, thin and evenly bedded	3	6
		(256	8)
64.	Shale, medium- to medium-dark-gray, very silty, pyritic, contains few medium-gray very fine grained sandstone laminae, few coal laminae, scattered siderite nodules up to 0.5 in. in diameter in basal 4 in., few slump structures, scattered calcite-filled high-angle fractures, slightly burrowed, irregularly bedded	3	4
		(260	0)
65.	Siltstone, medium-dark-gray, calcareous, pyritic, contains few coal laminae, abundant marine invertebrate fossils, few slump structures, irregularly bedded	1	5
		(261	5)
66.	Shale, pyritic, contains 40 percent medium-gray siltstone laminae and beds, medium-dark-gray, few coal laminae and beds up to 0.25 in. thick, scattered siderite laminae in top 4 in., brecciated, contorted bedding	1	6
		(262	11)
67.	Sandstone, medium-gray, very fine grained, silty, contains 45 percent quartz, few irregular medium-dark-gray shale laminae, burrowed, unevenly bedded	0	8
		(263	7)
68.	Siltstone, medium-gray, contains scattered medium-dark-gray shale laminae in top 3 in., burrowed in basal 2 in., irregularly bedded	0	8
		(264	3)
69.	Shale, dark-gray, very carbonaceous, some root slickensides, poorly bedded	0	3
		(264	6)
70.	Siltstone, medium-gray, contains 45 percent medium-dark-gray shale laminae and beds, scattered pyrite nodules up to 1.5 in. in diameter, few calcite-filled fractures, few slump structures	1	6
		(266	0)
71.	Shale, dark-gray, very carbonaceous, pyritic, few root slickensides	0	5
		(266	5)

Unit Number	Description	Thickness (Depth) ft	in.
72.	Siltstone, medium-gray, contains few siderite laminae in basal 10 in., few calcite-filled high-angle fractures, few slump structures, contorted bedding in basal 10 in.....	2	0
		(268	5)
73.	Shale, dark-gray, very carbonaceous, contains few medium-gray siltstone and very fine grained sandstone laminae and beds, burrowed.....	0	11
		(269	4)
74.	Shale, medium- to medium-dark-gray, dark-gray and carbonaceous in basal 3 in., contains scattered medium-gray siltstone and very fine grained sandstone laminae, few dark-gray shale pebbles and marine invertebrate fossils 11 in. below top.....	1	8
		(271	0)
75.	Siltstone, medium- to medium-dark-gray, sandy, few calcite-filled high-angle fractures.....	2	3
		(273	3)
76.	Coquina, light-gray, slightly calcareous, contains abundant marine invertebrate fossil fragments.....	0	4
		(273	7)
77.	Siltstone, medium-gray, contains few dark-gray carbonaceous shale laminae, thin and evenly bedded.....	1	9
		(275	4)
78.	Shale, medium- to dark-gray, carbonaceous, very silty in basal 3 in., poorly bedded.....	0	5
		(275	9)
79.	Siltstone, medium- to medium-dark-gray, slightly calcareous, contains scattered dark-gray shale laminae, thin and evenly bedded, irregularly bedded in basal 7 in.....	7	3
		(283	0)
80.	Siltstone, medium- to medium-dark-gray, slightly calcareous 5 in. evenly bedded dark-gray shale bed 3 in. below top, few siderite nodules at base, abundant marine invertebrate fossil fragments, burrowed.....	2	0
		(285	0)
81.	Siltstone, medium- to medium-dark-gray, slightly calcareous, contains scattered medium-gray very fine grained sandstone laminae and lenses, few medium-dark-gray shale beds up to 1.5 in. thick, burrowed.....	11	0
		(296	0)

Unit Number	Description	Thickness (Depth) ft	in.
82.	Siltstone, medium- to medium-dark-gray, slightly calcareous, very sandy in top 6 in., contains 2 in. dark-gray carbonaceous shale bed 1 ft 5 in. below top, thin and evenly bedded.....	3	8
		(299	8)
83.	Shale, medium- to medium-dark-gray, few coal and medium-gray siltstone laminae, slightly burrowed, evenly bedded.....	4	1
		(303	9)
84.	Siltstone, medium- to medium-dark-gray, scattered glauconite laminae and grains, few calcite-filled fractures, scattered slump structures, few marine invertebrate fossil fragments, thin and evenly bedded.....	2	1
		(305	10)
85.	Shale, medium-dark- to dark-gray, few medium-gray siltstone laminae, burrowed, evenly to irregularly bedded, fractured and broken in basal 1 ft 1 in.....	2	1
		(307	11)
86.	Sandstone, medium-grayish-green to medium-dark-gray, very fine- to fine-grained, glauconitic, few dark-gray shale laminae, few calcite-filled high-angle fractures, contains abundant marine invertebrate fossil fragments from 9 in. to 2 in. above base, burrowed.....	1	6
		(309	5)
87.	Siltstone, medium- to medium-dark-gray, slightly calcareous, contains few dark-gray shale laminae; calcite- quartz- and dolomite-filled fractures 3 ft 4 in. below top, scattered pyrite nodules, few slump structures, burrowed, evenly to irregularly bedded.....	13	0
		(322	5)
88.	Shale, medium- to medium-dark-gray, very carbonaceous in top 4 in., contains scattered medium-gray siltstone and very fine grained stone laminae, slightly burrowed, evenly to irregularly bedded.....	2	0
		(324	5)
89.	Siltstone, medium- to medium-dark-gray, contains few medium-gray very fine grained sandstone laminae and beds, few calcite-filled high-angle fractures, few slump structures, slightly burrowed, thin and evenly bedded, base sharp and uneven.....	7	8
		(332	1)
90.	Shale, medium-dark- to dark-gray, calcareous, contains few medium-gray siltstone and very fine grained sandstone laminae, scattered pyrite nodules, abundant marine invertebrate fossil fragments, few large rounded dark-gray shale fragments, scattered calcite-filled fractures, bioturbated, evenly to unevenly bedded.....	10	4
		(342	5)

Unit Number	Description	Thickness (Depth) ft	in.
91.	Coquina, medium- to medium-dark-gray, calcareous, contains abundant marine invertebrate fossil fragments, scattered glauconite grains	0	8
		(342	5)
92.	Siltstone, medium- to medium-dark-gray, sandy, calcareous in top 3 in. and in basal 4 ft 6 in., few pyrite nodules 8 ft 6 in. below top, calcite- and quartz-filled high angle fractures, few slump structures, bioturbated, thin and unevenly bedded	16	0
		(359	1)
93.	Shale, dark-gray, very carbonaceous, scattered pyrite nodules, evenly bedded	0	6
		(359	7)
94.	Siltstone, medium-to medium-dark-gray, contains scattered dark-gray shale laminae, glauconitic, brecciated from 9 ft to 9 ft 3 in. below top, scattered marine invertebrate fossil fragments, bioturbated from 2 ft to 5 ft below top, thin and evenly bedded	12	6
		(372	1)
95.	Shale, medium- to medium-dark-gray, few medium-gray siltstone and very fine grained sandstone laminae, few pyrite nodules, few calcite-filled fractures, bioturbated, evenly to unevenly bedded	1	4
		(373	5)
96.	Siltstone, medium- to medium-dark-gray, evenly bedded	0	8
		(374	1)
97.	Siltstone, medium- to medium-dark-gray, contains abundant dark-gray shale laminae, few pyrite- and calcite-filled high-angle fractures, few slump structures, bioturbated, convoluted bedding	25	0
		(399	1)
98.	Shale, medium- to medium-dark-gray, slightly carbonaceous, contains abundant medium-gray siltstone and very fine grained sandstone laminae, few pyrite nodules, scattered slickensided surfaces	13	0
		(412	1)
99.	Siltstone, medium- to medium-dark-gray, few pyrite- and calcite-filled fractures, few slump structures, thin and evenly bedded	11	0
		(423	1)
100.	Siltstone, medium- to medium-dark-gray, sandy, contains few dark-gray shale laminae, bioturbated	2	2
		(425	3)

Unit Number	Description	Thickness (Depth) ft	in.
101.	Sandstone, medium-light-gray, fine- to medium-grained, contains 45 percent quartz, few dark-gray shale laminae in top 5 in., few calcite- and dolomite-filled fractures, bioturbated, thin and unevenly bedded	5	9
		(431	0)
102.	Siltstone, medium- to medium-dark-gray, pyritic, few slump structures and low-angle fractures, bioturbated, poorly bedded	9	9
		(440	9)
103.	Sandstone, medium- to medium-light-gray, very fine grained, contains 45 percent quartz, few dark-gray shale laminae, few slump structures, bioturbated, thin and unevenly bedded	6	9
		(447	6)
104.	Siltstone, medium- to medium-dark-gray, contains medium-gray very fine grained sandstone beds 3 ft below top, few calcite-filled fractures, bioturbated	7	10
		(455	4)
105.	Sandstone, medium-light- to medium-gray, very fine grained, contains 40 percent quartz, silty in basal 4 ft 2 in., few dark-gray carbonaceous shale laminae, bioturbated, thin-bedded	8	8
		(464	0)
106.	Coquina, medium- to medium-dark-gray, contains marine invertebrate fossil fragments, sandy and glauconitic at base, thin-bedded	0	6
		(464	6)
107.	Shale, medium-dark- to dark-gray, carbonaceous, contains medium-gray siltstone and very fine grained sandstone laminae, few pyrite-filled fractures, some brecciation and slump structures, abundant marine invertebrate fossil fragments 1 ft below top, bioturbated	2	6
		(467	0)
108.	Siltstone, medium-gray, sandy, convoluted bedded	0	3
		(467	3)
109.	Shale, dark-gray, contains abundant medium-gray siltstone and very fine to fine-grained sandstone laminae, few calcite-filled high-angle fractures, few slump structures, evenly to unevenly bedded	3	6
		(470	9)
110.	Shale, dark-gray, silty, pyritic, scattered high-angle fractures	0	9
		(471	6)
111.	Shale, medium-dark- to dark-gray, very silty, contains scattered medium-gray siltstone and very fine grained sandstone laminae, few pyrite nodules, few slump structures, bioturbated, few slickensided surfaces	11	0
		(482	6)

Unit Number	Description	Thickness (Depth) ft	in.
112.	Siltstone, medium-gray, pyritic, contains scattered dark-gray shale and medium-light-gray very fine grained sandstone laminae, few high-angle fractures, thin and unevenly bedded.....	3	8
		(486	2)
113.	Siltstone, medium-dark- to dark-gray, contains few medium-gray very fine grained sandstone laminae, abundant dark-gray shale laminae in basal 1 ft 3 in., scattered pyrite nodules up to 0.25 in. in diameter, few high-angle slickensided surfaces, few calcite-filled fractures, bioturbated, thin and unevenly bedded...	6	3
		(492	5)
114.	Sandstone, medium-light- to medium-gray, very fine- to fine-grained, silty, contains 45 percent quartz, abundant dark-gray shale beds and siderite nodules in basal 1 ft 5 in., few calcite-filled fractures, burrowed.....	3	7
		(496	0)
115.	Sandstone, medium-light-gray, fine-grained, slightly calcareous, contains 45 percent quartz; base sharp.....	0	5
		(496	5)
116.	Siltstone, medium-light-gray, contains 20 percent light-gray very fine grained sandstone laminae, bioturbated; base sharp.....	2	6
		(498	11)
117.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, few high-angle fractures; base sharp.....	0	4
		(499	3)
118.	Shale, medium-dark-gray, bioturbated, contorted bedding; base grades.....	0	10
		(500	1)
119.	Siltstone, medium-light-gray, contains 30 percent light-gray very fine grained sandstone laminae, 10 percent dark-gray shale laminae, bioturbated, contorted bedding.....	2	3
		(502	4)
120.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz; base sharp.....	0	7
		(502	11)
121.	Shale, medium-dark-gray, contains 0.5 in. medium-gray siltstone bed 2 in. below top, contorted bedding; base grades.....	0	4
		(503	3)
122.	Siltstone, medium-light-gray, contorted bedding; base grades.....	0	3
		(503	6)
123.	Shale, medium-dark-gray, bioturbated; base sharp.....	0	8
		(504	2)

Unit Number	Description	Thickness (Depth) ft	in.
124.	Siltstone, medium-light-gray, few quartz-filled high-angle fractures, brecciated from 11 in. to 1 ft 1 in. below top, bioturbated	1	3
		(505	5)
125.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, bioturbated, base sharp	0	9
		(506	2)
126.	Shale, black, very carbonaceous, contains 20 percent coal laminae	0	3
		(506	5)
127.	Shale, medium-dark-gray, abundant slickensided surfaces, bioturbated; base grades	0	8
		(507	1)
128.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, 10 percent dark-gray shale laminae, abundant coal laminae from 1 ft 2 in. to 1 ft 3 in. and 1 ft 7 in. to 1 ft 8 in. below top; base sharp	3	1
		(510	2)
129.	Shale, medium-dark-gray, contains 20 percent medium-gray siltstone laminae, bioturbated	1	6
		(511	8)
130.	Sandstone, medium-light-gray, mottled brownish-gray from 4 in. to 1 ft above base, very fine grained, silty, calcareous, contains 40 percent quartz, abundant marine invertebrate fossils in basal 1 ft 6 in	3	9
		(515	5)
131.	Shale, medium-dark-gray, contains 10 percent medium-gray siltstone laminae, bioturbated, contorted bedding; base grades abruptly	11	8
		(527	1)
132.	Siltstone, medium-light-gray, abundant marine invertebrate fossils	0	5
		(527	6)
133.	Shale, medium-dark-gray, bioturbated; base grades	0	3
		(527	9)
134.	Sandstone, medium-light-gray, very fine- to fine grained, contains 40 percent quartz; base sharp	0	5
		(528	2)
135.	Shale, medium-dark-gray, contains 30 percent medium-gray siltstone laminae, few calcite-filled high-angle fractures, bioturbated; base sharp	1	10
		(530	0)

Unit Number	Description	Thickness (Depth) ft	in.
136.	Siltstone, medium-gray, few fractures, faintly bedded; base sharp	1	9
		(531	9)
137.	Shale, medium-dark-gray, silty, contains 30 percent medium-gray siltstone laminae, bioturbated; base grades	2	6
		(534	3)
138.	Siltstone, medium-light-gray, bioturbated; base sharp	1	5
		(535	8)
139.	Coal, dull, impure	0	1
		(535	9)
140.	Shale, medium-dark-gray, abundant root slickensides; base grades	1	1
		(536	10)
141.	Shale, medium-dark-gray, contains 10 percent medium-gray siltstone laminae, bioturbated; base grades	2	10
		(539	8)
142.	Sandstone, light- to light-brownish-gray, very fine to fine-grained, contains 40 percent quartz, contorted bedding in basal 11 in.; base grades	6	2
		(545	10)
143.	Shale, medium-dark- to dark-gray, contains 30 percent light-gray siltstone and very fine grained sandstone, scattered coal laminae and beds up to 0.25 in. thick; base grades	6	9
		(552	7)
144.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent dark-gray shale laminae in top 11 in., abundant marine invertebrate fossil fragments from 4 in. to 7 in. below top, thin- to thick-bedded	1	10
		(554	5)
145.	Shale, dark-gray to black, carbonaceous, contains 10 percent medium-dark-gray siltstone laminae, few slickensided surfaces, irregularly bedded	1	3
		(555	8)
146.	Sandstone, light-gray, very fine to fine-grained, silty in top 4 in., contains 40 percent quartz, thin-bedded	1	0
		(556	8)
147.	Shale, medium- to dark-gray, silty, contains 25 percent light-gray siltstone and very fine grained sandstone and laminae and beds, bioturbated; base sharp	1	3
		(557	11)

Unit Number	Description	Thickness (Depth) ft	in.
148.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, contorted bedding; base sharp.....	0	4.5
		(558	3.5)
149.	Siltstone, medium- to medium-dark-gray, contains 25 percent dark-gray shale laminae beds, 15 percent medium-light-gray very fine grained sandstone laminae and beds, few quartz granules from 2 ft to 2 ft 6 in. below top, evenly to irregularly bedded; base grades.....	6	3.5
		(564	6)
150.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base grades.....	0	4
		(564	11)
151.	Siltstone, medium- to medium-dark-gray, contains 25 percent medium-dark-gray shale laminae, contorted bedding.....	0	10
		(565	9)
152.	Sandstone, light- to light-brownish-gray, very fine grained, contains 40 percent quartz, abundant siderite clasts up to 0.5 in. in diameter in top 4 in., massive; base sharp.....	3	8
		(569	5)
153.	Shale, dark-gray, evenly bedded, fissile; base sharp.....	0	2
		(569	7)
154.	Sandstone, light- to light-brownish-gray, very fine to fine grained, contains 40 percent quartz, massive; base sharp.....	2	2
		(571	9)
155.	Shale, dark-gray, evenly bedded, fissile.....	0	4
		(572	1)
156.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 25 percent dark-gray shale laminae in top 6 in., thin to thick-bedded.....	1	4
		(573	5)
157.	Shale, black, very carbonaceous, contains few coal laminae, evenly bedded; base grades.....	0	5
		(573	10)
158.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent dark-gray shale laminae in top 1 ft 8 in., thin- to thick-bedded; base sharp.....	2	7
		(576	5)
159.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine grained sandstone beds up to 2 in. thick, bioturbated, fissile; base sharp.....	2	1
		(578	6)

Unit Number	Description	Thickness (Depth) ft	in.
160.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 25 percent medium- to medium-dark-gray siltstone and shale laminae, slightly burrowed, thin and contorted bedding; base grades abruptly.....	1	8
		(580	2)
161.	Sandstone, dark-gray, very fine to fine-grained, contains 40 percent quartz, thin- to thick-bedded; base sharp.....	0	10
		(581	0)
162.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 30 percent dark-gray shale and siltstone laminae and beds.....	1	0
		(582	0)
163.	Sandstone, light-gray, very fine- to fine-grained, contains 40 percent quartz, few high-angle fractures, thin- to thick-bedded; base sharp.....	1	1
		(583	1)
164.	Siltstone, medium- to medium-dark-gray, contains 20 percent light-gray very fine grained sandstone laminae and beds up to 2 in. thick, 10 percent dark-gray shale beds; base grades.....	3	1
		(586	2)
165.	Sandstone, light- to medium-gray, very fine grained, contains 40 percent quartz, thin- to thick-bedded; base sharp.....	0	9
		(586	11)
166.	Shale, dark-gray, contains 25 percent light-gray siltstone and very fine grained sandstone beds, evenly bedded; base sharp...	0	6
		(587	5)
167.	Sandstone, light- to light-brownish-gray, very fine to fine-grained, contains 40 percent quartz, few dark-gray shale laminae in top 6 in., thick-bedded to massive; base sharp.....	3	1
		(590	6)
168.	Siltstone, medium- to medium-dark-gray, contains 20 percent dark-gray shale beds, 10 percent light-gray very fine grained sandstone beds, bioturbated in part; base grades.....	2	1
		(592	7)
169.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz; base sharp.....	0	4
		(592	11)
170.	Shale, medium-dark-gray, silty, bioturbated; base grades.....	0	3
		(593	2)
171.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz; base grades.....	0	3
		(593	5)

Unit Number	Description	Thickness (Depth) ft	in.
172.	Shale, dark-gray, fissile; base sharp.....	0	4
		(593	9)
173.	Sandstone, light-gray, very fine to fine-grained, slightly silty, contains 40 percent quartz; base sharp.....	0	10
		(594	7)
174.	Siltstone, medium-gray, contains 20 percent dark-gray shale laminae, bioturbated in part, contorted bedding; base grades.....	2	1
		(596	8)
175.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz; base sharp.....	1	5
		(598	1)
176.	Shale, medium-dark-gray, silty, contains 25 percent medium-gray siltstone laminae and beds, irregularly bedded; base grades.....	3	3
		(601	4)
177.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, few quartz-filled fractures, thin bedded.....	6	0
		(607	4)
178.	Sandstone, brownish-gray, fine- to coarse-grained, contains 40 percent quartz, scattered well rounded quartz granules, few siderite clasts in basal 2 in., massive; base uneven.....	4	8
		(612	0)
179.	Sandstone, light-gray, fine-grained, contains 40 percent quartz, 25 percent dark-gray shale laminae, slightly burrowed, thin-bedded.....	0	4
		(612	4)
180.	Sandstone, light- to light-brownish-gray, fine- to medium-grained, contains 40 percent quartz, few medium-gray shale beds, scattered high-angle fractures, thick-bedded- to massive; base sharp.....	4	6
		(616	10)
181.	Shale, medium-dark-gray, fissile; base sharp.....	0	7
		(617	5)
182.	Conglomerate, medium-light-gray, contains abundant white quartz granules and pebbles, fine-grained sandstone matrix, thin-bedded; base sharp.....	0	8
		(618	1)
183.	Sandstone, light- to light-brownish-gray, fine grained, contains 40 percent quartz, few medium-dark-gray shale beds at top and at base, scattered quartz granules and pebbles up to 1 in. in diameter; base sharp.....	0	5
		(618	6)

Unit Number	Description	Thickness (Depth) ft	in.
184.	Conglomerate, white to brownish-gray, contains abundant well rounded quartz pebbles and siderite nodules up to 0.5 in. in diameter.....	0	4
		(618	10)
185.	Sandstone, light-gray fine- to medium-grained, contains 55 percent quartz, abundant quartz granules from 2 ft to 2 ft 6 in. below top, thin- to thick-bedded; base grades.....	7	7
		(626	5)
186.	Sandstone, white to very light gray, fine- to medium-grained, contains 65 percent quartz, thick-bedded- to massive.....	2	7
		(629	0)
187.	Siltstone, medium- to medium-dark-gray, contains 20 percent medium-gray very fine grained sandstone beds, few quartz-filled fractures, evenly bedded, lenticularly bedded in part; base grades.....	11	8
		(640	8)
188.	Sandstone, medium-gray, fine grained, contains 55 percent quartz, few quartz-filled fractures, massive, lenticularly bedded in part; base sharp.....	9	7
		(650	3)
189.	Sandstone, medium-light-gray, fine grained, micaceous, contains 50 percent quartz, few quartz-filled fractures, thin-bedded; base grades.....	1	9
		(652	0)
190.	Sandstone, light-gray, fine- to medium-grained, contains 60 percent quartz, massive; base grades.....	4	10
		(656	10)
191.	Sandstone, medium-light-gray, fine grained, contains 50 percent quartz, thin- to thick-bedded; base sharp.....	3	3
		(660	1)
192.	Siltstone, medium-gray, contains 10 percent medium-dark-gray shale laminae, thin-bedded, few contorted beds, fractured; base grades.....	4	1
		(664	2)
193.	Shale, medium-dark-gray, silty; base sharp.....	0	2
		(664	4)
194.	Sandstone, light-gray, fine- to medium-grained, contains 60 percent quartz, massive, fractured; base very uneven.....	15	0
		(679	4)
195.	Sandstone, medium-light-gray, medium-grained, contains 60 percent quartz, massive; base sharp.....	12	11
		(692	3)

Unit Number	Description	Thickness (Depth) ft	in.
196.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent medium-dark-gray shale laminae, thin-bedded; base sharp.....	5	10
		(698	1)
197.	Shale, medium-dark-gray, contains 40 percent light gray siltstone and very fine grained sandstone laminae, evenly bedded; base grades.....	1	5
		(699	6)
198.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 25 percent medium-dark-gray shale laminae, thin-bedded; base sharp.....	9	6
		(709	0)
199.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, silty, contains 45 percent quartz; base grades.....	1	2
		(710	2)
200.	Sandstone, light-gray, fine- to medium-grained, contains 60 percent quartz, massive; base grades.....	10	3
		(720	5)
201.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 45 percent quartz, abundant fractures; base sharp.....	4	8
		(725	1)
202.	Shale, medium-dark-gray, silty, contains 5 percent medium-light-gray very fine grained sandstone laminae, evenly bedded; base sharp.....	0	7
		(725	8)
203.	Sandstone, medium-light-gray, fine grained, contains 50 percent quartz, 20 percent medium-dark-gray shale and siltstone laminae, thin-bedded.....	2	0
		(727	8)
204.	Sandstone, light- to medium-light-gray, fine- to medium-grained, contains 55 percent quartz, thick-bedded to massive; base sharp.....	2	5
		(730	1)
205.	Shale, medium-dark-gray, contains 30 percent light-gray very fine grained sandstone laminae and beds, slightly burrowed, evenly bedded; base sharp.....	3	5
		(733	6)
206.	Sandstone, medium-light-gray, fine grained, contains 55 percent quartz, abundant quartz-filled fractures in basal 3 ft, massive; base grades.....	6	3
		(739	9)

Unit Number	Description	Thickness (Depth) ft	in.
207.	Sandstone, very-light-gray, medium-grained, contains 65 percent quartz, abundant quartz-filled fractures in basal 4 ft, massive...	9 (748	0 9)
208.	Sandstone, light- to medium-light-gray, fine- to medium-grained, contains 60 percent quartz, abundant high-angle fractures.....	3 (752	4 1)
209.	Shale, medium-dark-gray, evenly bedded, fair fissility; base sharp.....	1 (753	4 5)
210.	Sandstone, light- to medium-light-gray, fine- to medium-grained, contains 45 percent quartz, few medium-dark-gray shale clasts in top 8 in. and basal 8 in.; base sharp.....	2 (756	7 0)
211.	Shale, medium-dark-gray, contains 10 percent medium-gray siltstone laminae and beds, slightly burrowed, evenly bedded; base sharp....	4 (760	6 6)
212.	Sandstone, medium-gray, fine- to medium-grained, contains 45 percent quartz, few scattered quartz granules; base grades.....	2 (762	4 10)
213.	Shale, medium-dark-gray, silty, faintly bedded, poor fissility; base grades.....	0 (763	11 9)
214.	Sandstone, medium-gray, fine- to medium-grained, contains 45 percent quartz, few medium-dark-gray shale clasts, scattered quartz granules; base grades.....	1 (765	5 2)
215.	Shale, medium-dark-gray, evenly bedded, fissile; base grades.....	1 (766	3 5)
216.	Sandstone, medium-light-gray, medium- to coarse-grained, contains 65 percent quartz, abundant well rounded quartz granules and pebbles up to 0.5 in. in diameter, massive; base grades.....	24 (791	7 0)
217.	Sandstone, medium-light-gray, fine- to medium-grained, contains 50 percent quartz, thin- to thick-bedded; base sharp.....	1 (792	9 9)
218.	Shale, medium-dark-gray, evenly bedded, fissile; base sharp.....	0 (792	2 11)
219.	Sandstone, medium-light-gray, fine- to medium-grained, contains 65 percent quartz, few medium-dark-gray shale clasts, massive; base grades.....	15 (808	5 4)

Unit Number	Description	Thickness (Depth) ft	in.
220.	Sandstone, light-gray, medium-grained, sparsely micaceous, contains 65 percent quartz, scattered angular medium-dark-gray shale clasts and white quartz granules from 12 ft to 13 ft below top; base grades.....	17	0
		(825	4)
221.	Sandstone, light-gray, medium- to coarse-grained, contains 65 percent quartz, scattered well rounded quartz pebbles and granules, few high-angle quartz-filled fractures.....	42	8
		(868	0)

BOTTOM OF HOLE
TOTAL DEPTH 868 ft

GEOPHYSICAL LOG

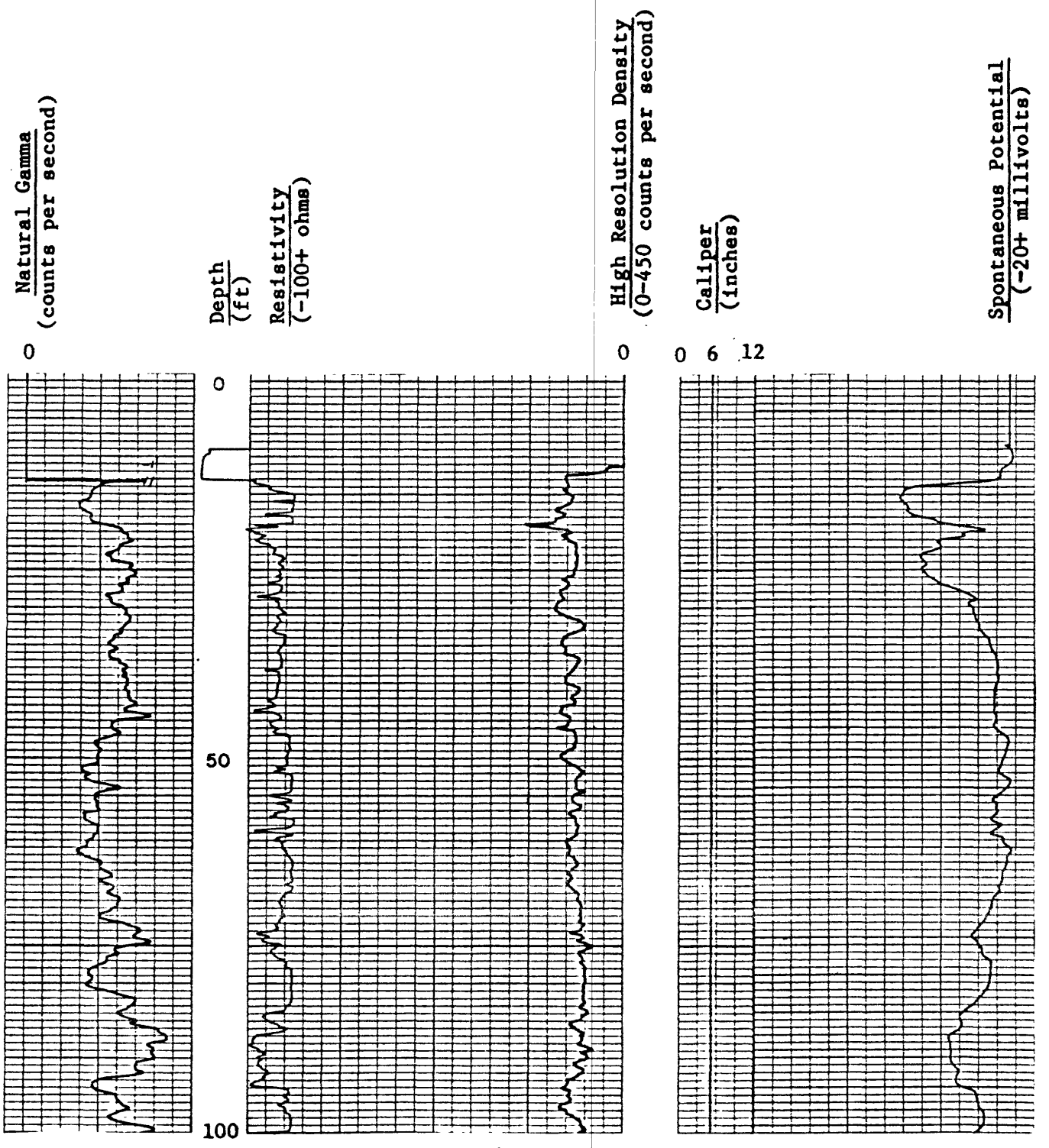
Corehole: V-4 Date: 11/05/82 State: Virginia County: Smyth

Quadrangle: Chatham Hill, Va. Latitude: 36°58'38"N Longitude: 81°30'07"W

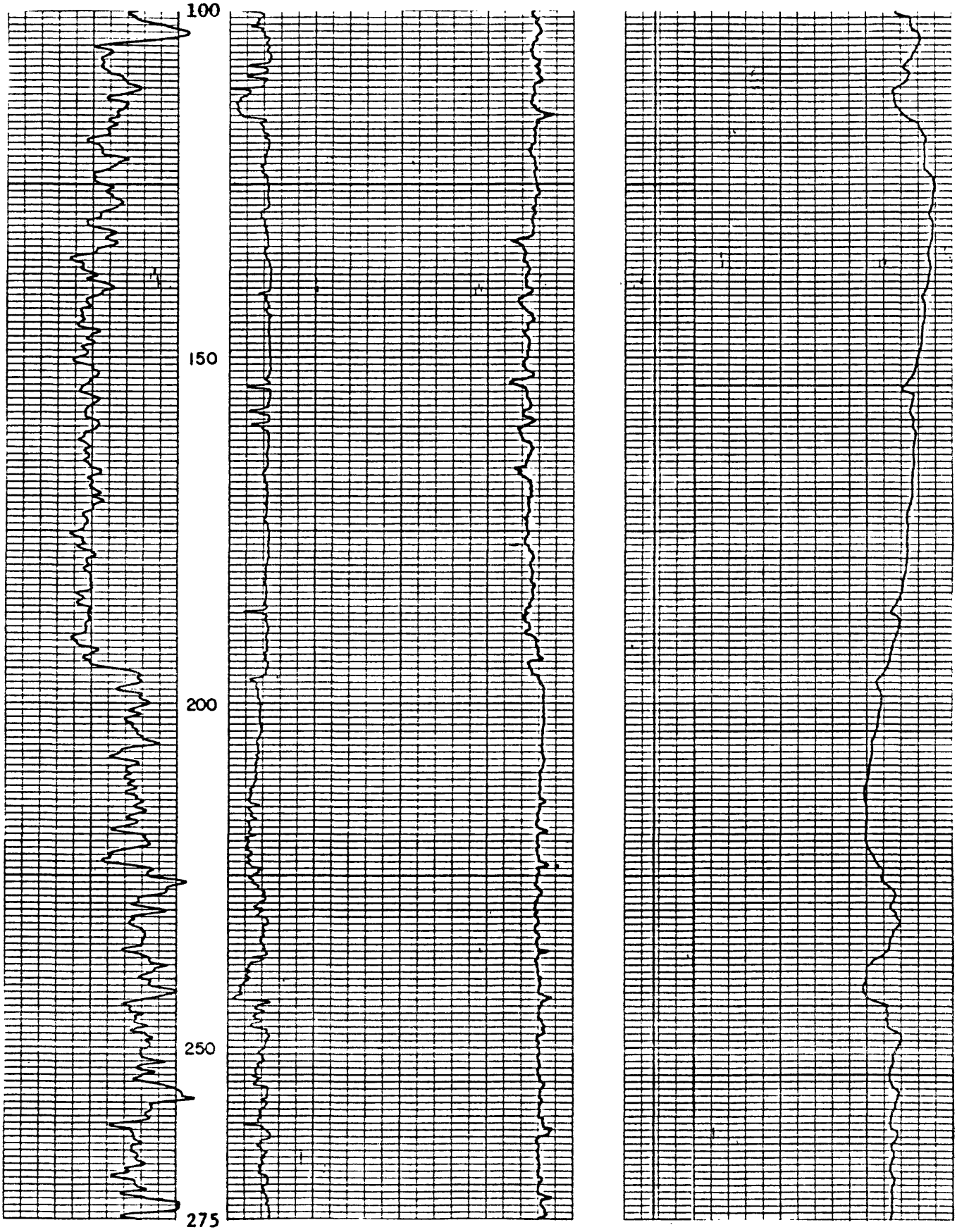
Altitude: 2,240 ft Logged Depth: 868 ft Drilled Depth: 868 ft

Logging Speed: 20 ft/min (SP 30 ft/min) Natural Gamma Time Constant: 1

High Resolution Density Time Constant: 1



Corehole: V-4 continued



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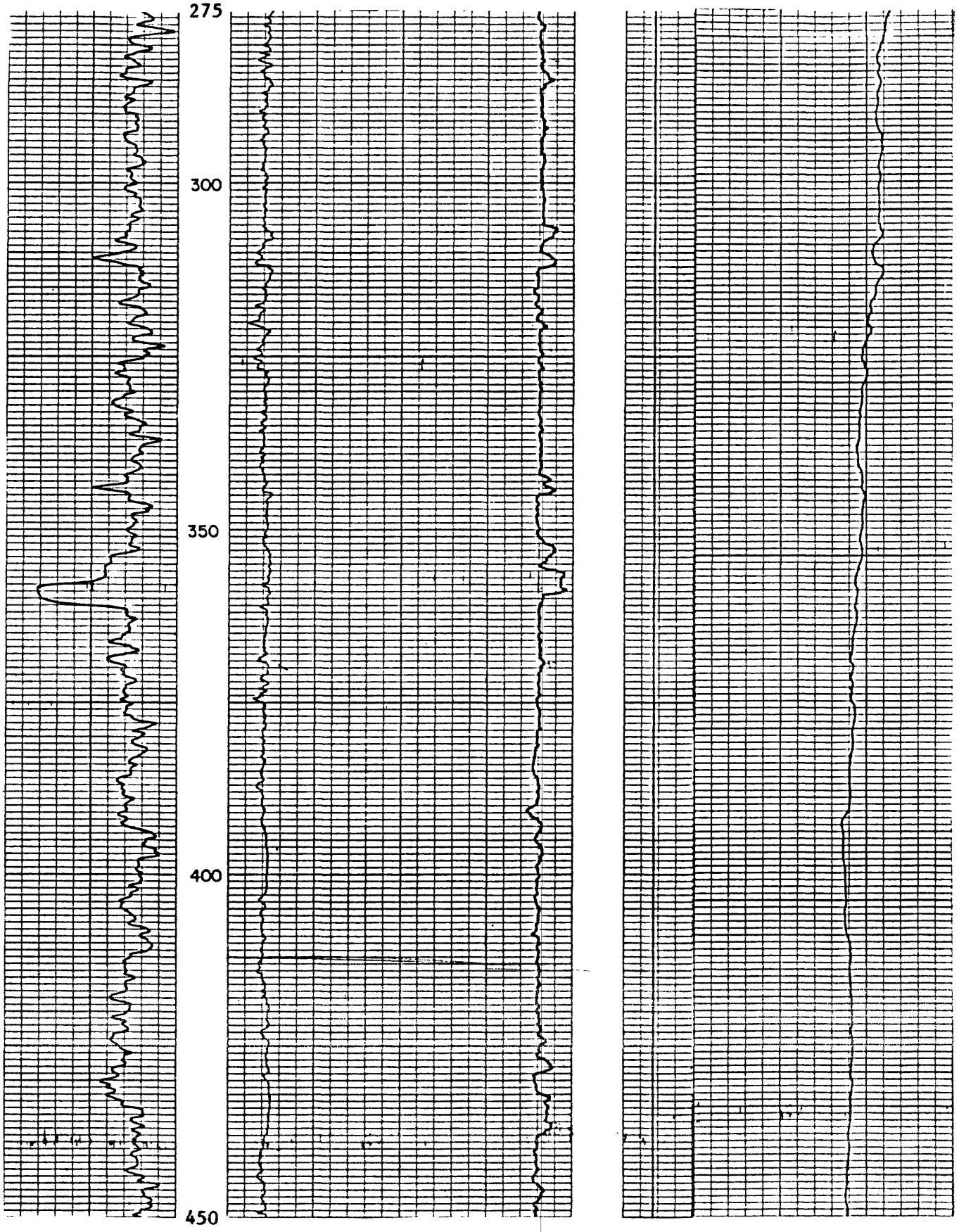

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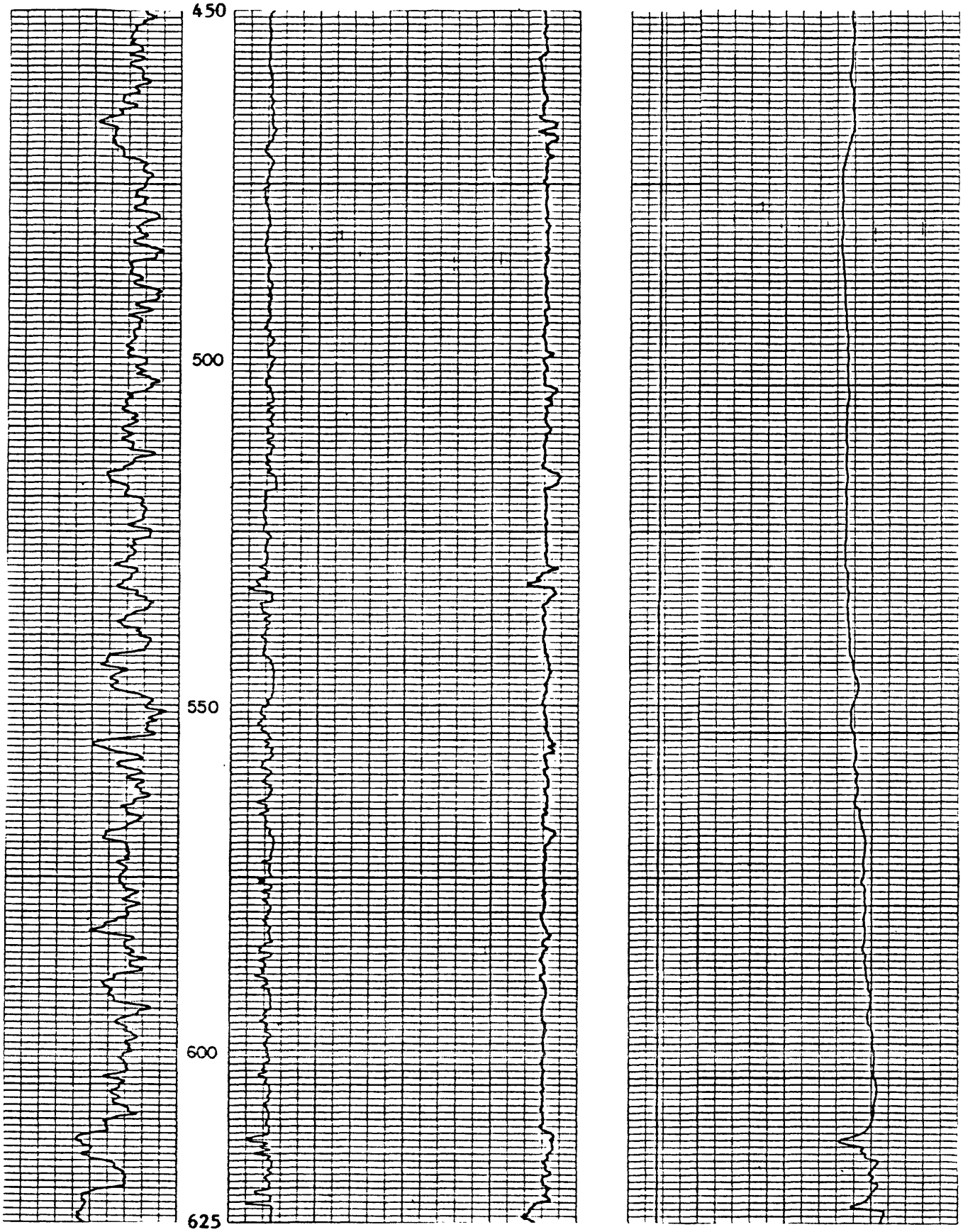
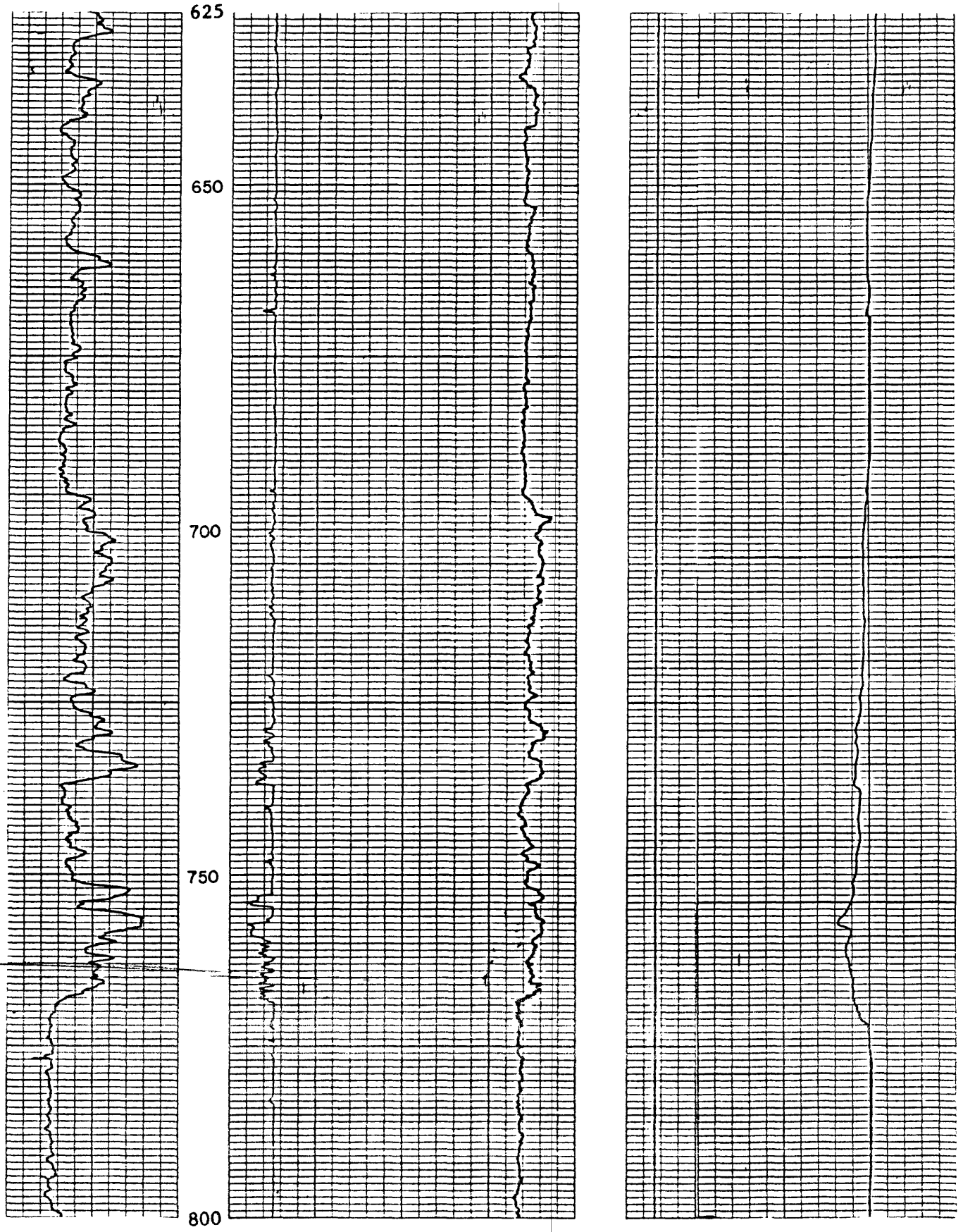
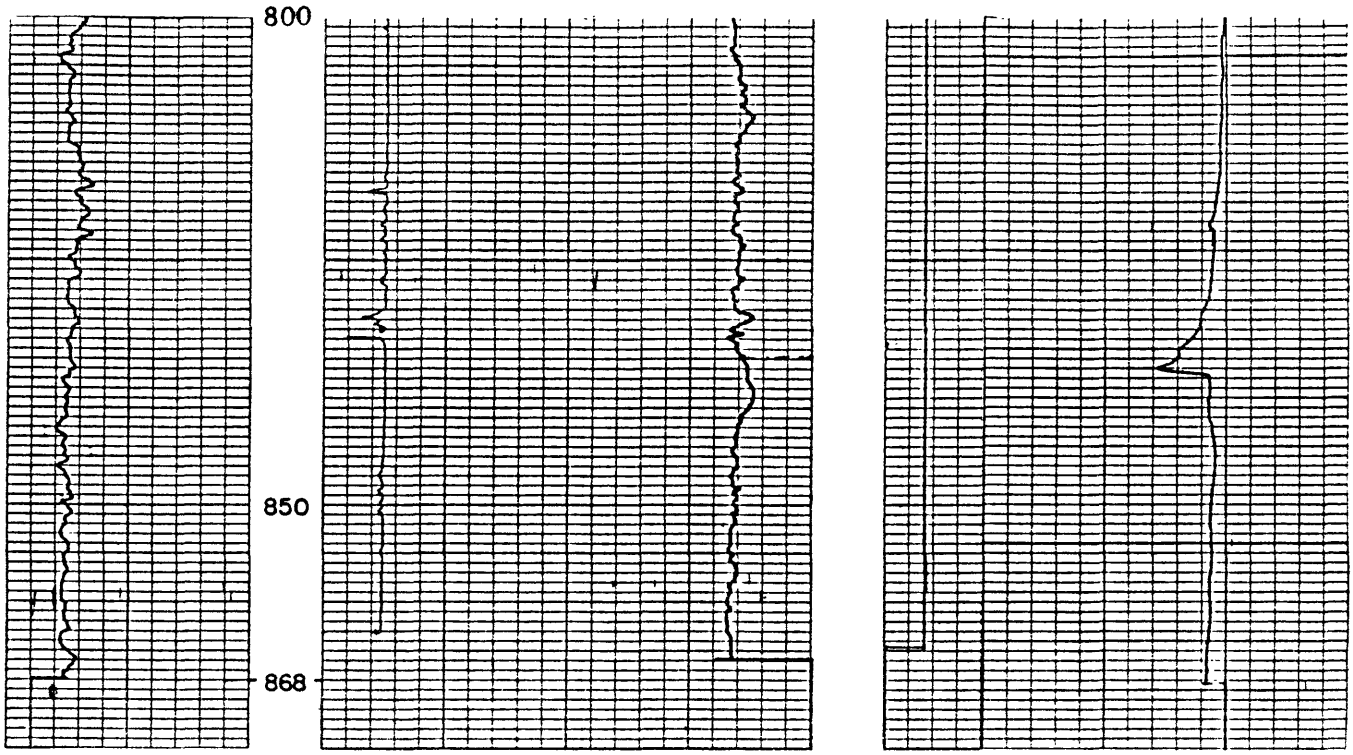


Corehole: V-4 continued



Corehole: V-4 continued



Corehole V-5

Location: Bland County; Hutchinson Rock, Va., 7.5 minute quadrangle. Located on Lynn Camp Creek between Brushy and Lynn Camp Mountains. Accessible by unimproved road that parallels Lynn Camp Creek.

Coordinates: Latitude 37°00'19"N Longitude 81°24'06"W

Altitude: 2,380 ft Drilled depth: 630 ft

Dip of strata: Approximately 20° throughout corehole.

Date drilled: October 13, 1982 to October 21, 1982

Core description: K.J. Englund, J.F. Windolph, Jr., J.O. Maberry II, R.E. Thomas, and J.W. Dryden

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER MISSISSIPPIAN SERIES		
	Price Formation		
1.	Soil and weathered rock (casing set - no core recovered).....	20	0
		(20	0)
2.	Siltstone, medium-gray, sandy, faintly bedded; base grades.....	4	3
		(24	3)
3.	Siltstone, medium-gray, contains 30 percent light-gray very fine grained sandstone laminae, thin-bedded, poor fissility; base grades.....	0	8
		(24	11)
4.	Underclay, medium-gray, plastic, few slickensided surfaces; base grades.....	4	6
		(29	5)
5.	Siltstone, medium-light- to medium-gray, sparsely micaceous, contains few light-gray very fine grained sandstone laminae; base grades.....	0	8
		(30	1)
6.	Underclay, medium-gray, carbonaceous, contains few dark-gray shale laminae and beds 1 ft 5 in. above base, few rootlets, scattered slickensided surfaces; base grades.....	5	11
		(36	0)
7.	Underclay, medium-dark-gray, contains few coal and dark-gray carbonaceous shale laminae, few rootlets.....	2	4
		(38	4)

Unit Number	Description	Thickness (Depth) ft	in.
8.	Core loss, see corehole V-5B (re-drill).....	4	8
		(43	0)
9.	Shale, dark-gray, carbonaceous, contains 20 percent coal laminae in top 4 in.; base grades.....	1	10
		(44	10)
10.	Underclay, medium-dark-gray, abundant rootlets; base sharp.....	0	4
		(45	2)
11.	Coal, bright attritus, pyritic, sheared.....	0	1
		(45	3)
12.	Shale, black, very carbonaceous.....	0	0.5
		(45	3.5)
13.	Shale, dark-gray, pyritic, evenly bedded.....	0	3
		(45	6.5)
14.	Coal, impure, pyritic, contains few dark-gray shale laminae.....	0	1.5
		(45	8)
15.	Shale, dark-gray, pyritic, evenly bedded.....	0	1
		(45	9)
16.	Coal, impure, pyritic, sheared.....	0	1
		(45	10)
17.	Sandstone, medium-dark-gray, fine- to medium-grained, contains 40 percent quartz, few coal laminae and rootlets in top 3 in., thin and irregularly bedded; base grades.....	7	5
		(53	3)
18.	Sandstone, medium-gray, very fine grained, silty, micaceous, contains 40 percent quartz, 5 percent coal laminae, thin and irregulary bedded; base sharp.....	1	8
		(54	11)
19.	Siltstone, medium-gray, few calcite-filled high-angle fractures, faintly bedded; base grades.....	3	4
		(58	3)
20.	Sandstone, light- to medium-gray, very fine to medium-grained, contains 40 percent quartz, 30 percent medium-gray siltstone laminae, few coal laminae, thin-bedded; base sharp.....	0	7
		(58	10)
21.	Siltstone, medium-gray, faintly bedded; base sharp.....	1	0
		(59	10)

Unit Number	Description	Thickness (Depth) ft	in.
22.	Sandstone, light-gray, very fine to medium-grained, contains 50 percent quartz, 15 percent feldspar, abundant coal laminae, few pyrite nodules, crossbedded, massive; base sharp.....	5	11
		(65	9)
23.	Shale, medium-gray, silty, faintly bedded; base grades.....	4	2
		(69	11)
24.	Siltstone, medium-gray, contains 20 percent light-gray very fine grained sandstone laminae in basal 1 ft 6 in., faintly bedded; base sharp.....	3	1
		(73	0)
25.	Coal, dull, impure.....	0	8
		(73	8)
26.	Underclay, medium-gray, silty, few rootlets; base grades.....	2	1
		(75	9)
27.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few coal and medium-dark-gray shale laminae, thin-bedded; base grades.....	1	11
		(77	8)
28.	Shale, medium-dark-gray, contains 50 percent medium-light-gray very fine grained sandstone laminae, evenly bedded; base sharp....	2	8
		(80	4)
29.	Sandstone, light-gray, fine- to medium-grained, very micaceous, contains 50 percent quartz, scattered dark and light mineral grains, crossbedded, massive; base grades.....	10	0
		(90	4)
30.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, thin- to thick-bedded; base sharp.....	13	2
		(103	6)
31.	Shale, medium-gray, contains 40 percent medium-light-gray very fine grained sandstone beds, evenly bedded; base grades.....	4	8
		(108	2)
32.	Sandstone, very light- to light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, thin-bedded; base grades...	5	8
		(113	10)
33.	Sandstone, light-gray, fine- to medium-grained, contains 50 percent quartz, abundant angular to well rounded quartz pebbles up to 0.5 in. in diameter in basal 5 in.; base sharp.....	2	2
		(116	0)

Unit Number	Description	Thickness (Depth) ft	in.
34.	Siltstone, medium-gray, contains 20 percent light-gray very very fine grained sandstone laminae, bioturbated in top 1 ft 2 in., thin and irregularly bedded; base grades.....	3	5
		(119	5)
35.	Sandstone, light- to medium-light-gray, very fine to fine-grained, silty, contains 40 percent quartz, irregularly bedded; base grades.....	1	3
		(120	8)
36.	Siltstone, medium-gray, contains 30 percent medium-dark-gray shale laminae and 30 percent light-gray very fine grained sandstone laminae, bioturbated, irregularly bedded; base grades.....	2	1
		(122	9)
37.	Sandstone, light-gray, fine-grained, contains 40 percent quartz, faintly bedded; base sharp and uneven.....	2	1
		(124	10)
38.	Siltstone, light- to medium-gray, contains 40 percent medium-dark-gray shale laminae, slightly burrowed, evenly bedded.....	1	4
		(126	2)
39.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	1	6
		(127	8)
40.	Shale, medium-gray, silty, contains 30 percent light-gray very fine grained sandstone laminae, bioturbated, unevenly bedded; base grades.....	1	3
		(128	11)
41.	Sandstone, light-gray, very fine to fine-grained, sparsely micaceous, contains 40 percent quartz, faintly bedded; base grades.....	3	8
		(132	7)
42.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 40 percent medium-gray shale and siltstone beds, irregularly bedded; base sharp.....	2	0
		(134	7)
43.	Shale, medium- to dark-gray, contains 20 percent light-gray very fine grained sandstone laminae, bioturbated, irregularly bedded; base grades.....	0	4
		(134	11)
44.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 30 percent dark-gray shale laminae and beds, cross-laminated, thin- to thick-bedded; base sharp.....	2	8
		(137	7)

Unit Number	Description	Thickness (Depth) ft	in.
45.	Siltstone, light- to medium-gray, contains 20 percent medium-dark-gray shale laminae, 20 percent light-gray very fine grained sandstone laminae, slightly burrowed, irregularly bedded; base grades	3	7
		(141	2)
46.	Sandstone, light- to medium-gray, very fine grained, slightly silty, contains 40 percent quartz, 40 percent dark-gray shale laminae and beds, thin and evenly bedded; base grades	4	0
		(145	2)
47.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, thick-bedded; base sharp	3	7
		(148	9)
48.	Siltstone, medium-gray, contains 20 percent light-gray very fine grained sandstone laminae, 20 percent dark-gray shale laminae, irregularly bedded; base sharp	0	7
		(149	4)
49.	Sandstone, light- to medium-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, scattered dark-gray shale laminae, few calcite filled high-angle fractures; base sharp	2	5
		(151	9)
50.	Shale, dark-gray, silty, slightly carbonaceous; contains 10 percent medium-gray very fine grained sandstone laminae, increasing to 40 percent in basal 4 ft; bioturbated in basal 3 ft, evenly bedded; base grades	20	1
		(171	10)
51.	Sandstone, very light to light-gray, fine- to medium-grained, contains 60 percent quartz, scattered medium-dark-gray shale laminae and clasts, scattered invertebrate fossils 9 in. below top, few calcite filled high-angle fractures, cross-bedded, massive; base grades	7	8
		(179	6)
52.	Shale, dark-gray, finely micaceous, contains 20 percent medium-gray siltstone laminae, slightly burrowed, crossbedded, ripple-bedded; unevenly bedded; base sharp	5	2
		(184	8)
53.	Sandstone, very light to light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, scattered subangular to well rounded white quartz pebbles up to 0.5 in. in diameter in top 6 in., scattered calcite-filled high-angle fractures in top 8 in., slightly burrowed, thick-bedded to massive; base grades	4	8
		(189	4)

Unit Number	Description	Thickness (Depth) ft	in.
54.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 10 percent dark-gray shale laminae, few coal laminae, scattered calcite-filled fractures and slickensided surfaces, bioturbated in part, thin and unevenly bedded; base sharp.....	6	0
		(195	4)
55.	Sandstone, very light to light-gray, very fine to fine-grained, pyritic in top 5 in., contains 50 percent quartz, scattered calcite-filled high-angle fractures, massive; base sharp.....	5	2
		(200	6)
56.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 50 percent quartz, 5 percent dark-gray shale laminae, scattered invertebrate fossils from 1 ft 3 in. to 2 ft 11 in. below top, bioturbated, thick-bedded to massive; base grades.....	5	7
		(206	1)
57.	Sandstone, light- to medium-light-gray, very fine grained, micaceous, silty, contains 40 percent quartz, scattered coal and dark-gray shale laminae, cross-bedded in part, slightly burrowed; base grades.....	1	2
		(207	3)
58.	Sandstone, very light to light-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent dark-gray shale laminae, few siderite beds at base, scattered invertebrate fossils in basal 2 ft, slightly burrowed, cross-bedded, thick-bedded; base sharp.....	5	9
		(213	0)
59.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent dark-gray shale laminae, slightly burrowed, thin-bedded; base sharp.....	1	1
		(214	1)
60.	Sandstone, light-gray, very fine to fine-grained, pyritic, micaceous, contains 40 percent quartz, scattered medium- to dark-gray shale laminae, few coal laminae in basal 4 in., thin-bedded.....	1	10
		(215	11)
61.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, scattered dark-gray shale laminae, few siderite clasts in top 5 in., slightly burrowed, thin- to thick-bedded.....	7	8
		(223	7)
62.	Sandstone, light-gray, fine- to medium-grained, slightly calcareous in top 3 in., contains 40 percent quartz; base grades..	1	6
		(225	1)

Unit Number	Description	Thickness (Depth) ft	in.
63.	Sandstone, light-gray, very fine grained, slightly calcareous, contains 40 percent quartz, 15 percent medium-dark-gray shale laminae, slightly burrowed, thin-bedded; base grades.....	2	6
		(227	7)
64.	Sandstone, light-gray, mottled light-brownish-gray, fine- to medium-grained, contains 50 percent quartz, 5 percent medium-dark-gray shale laminae, thin- to thick-bedded; base sharp.....	3	7
		(231	2)
65.	Sandstone, light- to medium-gray, very fine to fine-grained, contains 40 percent quartz, bioturbated; base grades.....	0	8
		(231	10)
66.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent medium-dark-gray shale laminae, thin-bedded; base uneven.....	3	1
		(234	11)
67.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, bioturbated; base grades.....	1	11
		(236	10)
68.	Sandstone, light- to medium-light-gray, fine-grained, silty, contains 40 percent quartz, scattered medium-dark-gray shale clasts, burrowed; base grades.....	1	6
		(238	4)
69.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 5 percent medium-dark-gray shale laminae, scattered calcite-filled high-angle fractures, bioturbated in basal 2 ft, thin- to thick-bedded.....	6	7
		(244	11)
70.	Sandstone, light-gray, fine-grained, slightly calcareous, contains 40 percent quartz, 50 percent medium-gray shale laminae and beds, slightly burrowed, thin and irregularly bedded.....	2	7
		(247	6)
71.	Siltstone, light- to medium-gray, contains 30 percent light-gray very fine grained sandstone laminae, few invertebrate fossils in top 5 in., bioturbated, evenly to irregularly bedded; base grades.....	7	0
		(254	6)
72.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz; base grades.....	0	4
		(254	10)

Unit Number	Description	Thickness (Depth) ft	in.
73.	Shale, medium-dark-gray, contains 20 percent medium-light-gray siltstone and very fine grained sandstone laminae, bioturbated, irregularly bedded; base grades.....	3	11
		(258	9)
74.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, bioturbated, thin-bedded; base grades.....	1	4
		(260	1)
75.	Shale, medium-dark-gray, contains 30 percent medium-light-gray siltstone and very fine grained sandstone beds, slightly burrowed, evenly bedded; base grades.....	6	0
		(266	1)
76.	Sandstone, medium- to dark-gray, mottled greenish-gray, very fine grained, silty, slightly calcareous, contains 40 percent quartz, abundant invertebrate fossils; base sharp and uneven.....	1	5
		(267	6)
77.	Siltstone, medium-light-gray, contains 30 percent light-gray very fine grained sandstone beds up to 3 in. thick, irregularly bedded, ripple-bedded in part; base grades.....	2	8
		(270	2)
78.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 30 percent medium-gray shale and siltstone laminae and beds, bioturbated, thin and irregularly bedded; base grades.....	5	6
		(275	8)
79.	Siltstone, medium-gray, contains 30 percent light-gray very fine grained sandstone laminae and beds, few calcite-filled high-angle fractures, faintly bedded; base grades.....	5	11
		(281	7)
80.	Sandstone, light- to medium-light-gray, mottled greenish-gray in top 1 ft, very fine- to fine-grained, contains 40 percent quartz, 20 percent medium-gray siltstone and dark-gray shale laminae, scattered invertebrate fossils in top 1 ft 6 in., scattered calcite-filled fractures, thin- to thick-bedded, few contorted beds; base grades.....	15	1
		(296	8)
81.	Siltstone, light- to medium-gray, contains 30 percent light-gray very fine grained sandstone laminae and beds up to 3 in. thick, burrowed 1 ft 1 in. below top, thin-bedded; base grades.....	2	2
		(298	10)

Unit Number	Description	Thickness (Depth) ft	in.
82.	Sandstone, medium-light-gray, very fine to fine-grained, silty, finely micaceous, contains 40 percent quartz, 20 percent medium-gray siltstone laminae, scattered medium-gray siltstone and dark-gray shale clasts in basal 1 ft; base sharp.....	4	9
		(303	7)
83.	Shale, medium-gray, silty, evenly bedded; base sharp.....	0	4
		(303	11)
84.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, burrowed, thin-bedded; base grades....	4	11
		(308	10)
85.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, abundant dark-gray shale clasts in basal 2 ft 6 in., crossbedded, thick-bedded to massive; base sharp and uneven.....	6	9
		(315	7)
86.	Sandstone, light- to medium-gray, fine-grained, very silty, contains 40 percent quartz, 40 percent medium-dark-gray shale and siltstone laminae and beds, burrowed, thin and irregularly bedded; base grades abruptly.....	6	4
		(321	11)
87.	Siltstone, medium-gray, mottled reddish-gray, hematitic, micaceous; base grades.....	0	10
		(322	9)
88.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, burrowed, irregularly bedded; base sharp and irregular.....	1	10
		(324	7)
89.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-dark-gray shale laminae, abundant invertebrate fossils from 8 in. to 1 ft 3 in. below top, thin-bedded; base grades.....	2	2
		(326	9)
90.	Sandstone, light-gray, mottled brownish-gray, fine-grained, contains 40 percent quartz, few medium-dark-gray shale clasts, abundant invertebrate fossils in basal 1 ft, crossbedded in part, thin- to thick-bedded; base uneven.....	2	8
		(329	5)
91.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 30 percent medium-dark-gray shale and siltstone laminae and beds, burrowed, thin-bedded; base grades.....	8	5
		(337	10)

Unit Number	Description	Thickness (Depth) ft	in.
92.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, thin and evenly bedded; base sharp.....	0	10
		(338	8)
93.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 40 percent dark-gray shale and siltstone laminae and beds, slightly burrowed, thin-bedded; base grades.....	1	11
		(340	7)
94.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, bioturbated, massive; base sharp.....	3	6
		(344	1)
95.	Shale, dark-gray, silty, contains 30 percent medium-light-gray very fine grained sandstone laminae.....	1	1
		(345	2)
96.	Shale, medium-dark-gray, silty, contains 25 percent medium-light-gray very fine grained sandstone laminae, burrowed, irregularly bedded; base sharp.....	11	1
		(356	3)
97.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 25 percent medium-gray siltstone and dark-gray shale laminae and beds.....	7	3
		(363	6)
98.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few medium-dark-gray shale clasts, few calcite-filled high-angle fractures at base, slightly burrowed, thin- to thick bedded; base sharp.....	4	2
		(367	8)
99.	Shale, dark-gray, silty, finely micaceous, evenly bedded; base grades.....	0	7
		(368	3)
100.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent medium-dark-gray shale and siltstone laminae, thin- to thick-bedded; base sharp.....	2	2
		(370	5)
101.	Shale, dark-gray, contains 30 percent medium-light-gray very fine grained sandstone laminae, slightly burrowed, evenly bedded; base sharp.....	0	8
		(371	1)
102.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz; base sharp.....	0	8
		(371	9)

Unit Number	Description	Thickness (Depth) ft	in.
103.	Shale, dark-gray, evenly bedded; base sharp.....	0	2
		(371	11)
104.	Sandstone, light-gray, mottled light-brownish-gray, very fine to fine-grained, contains 40 percent quartz, dark-gray shale laminae, thick-bedded; base sharp.....	1	6
		(373	5)
105.	Siltstone, light- to medium-light-gray, contains 30 percent dark-gray shale laminae, 30 percent medium-light-gray very fine grained sandstone laminae and beds, slightly burrowed, irregularly bedded.....	2	11
		(376	4)
106.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, few dark-gray shale clasts; base grades.....	0	8
		(377	0)
107.	Shale, medium-dark-gray, silty, contains 20 percent light-gray very fine grained sandstone laminae, few medium-gray siltstone laminae, burrowed; base grades abruptly.....	2	8
		(379	8)
108.	Sandstone, medium-light- to light-gray, very fine to fine-grained, silty, contains 40 percent quartz, 5 percent medium-light-gray siltstone laminae, burrowed.....	4	[illegible]
		(383	11)
109.	Siltstone, medium-light-gray, contains 10 percent dark-gray shale and 10 percent light-gray very fine grained sandstone laminae, bioturbated; base sharp.....	1	11
		(385	10)
110.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent medium-gray siltstone and shale laminae; base grades.....	1	7
		(387	5)
111.	Sandstone, light-gray, very fine to fine-grained, silty, contains 40 percent quartz, 30 percent medium-gray siltstone and shale laminae, burrowed, thin and irregularly bedded; base sharp.....	3	8
		(391	1)
112.	Siltstone, medium-light-gray, contains 30 percent dark-gray shale and 20 percent light-gray very fine-grained sandstone laminae, irregularly bedded; base uneven.....	1	10
		(392	11)
113.	Shale, dark-gray, contains 20 percent medium-light-gray siltstone and very fine grained sandstone laminae, slightly burrowed, cross-laminated, evenly to irregularly bedded.....	4	9
		(397	8)

Unit Number	Description	Thickness (Depth) ft	in.
114.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 15 percent dark-gray shale laminae, scattered siderite clasts; base grades	1	5
		(399	1)
115.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, scattered calcite-filled high-angle fractures, thick-bedded; base sharp	1	0
		(400	1)
116.	Shale, dark-gray, evenly bedded; base uneven	0	1
		(400	2)
117.	Sandstone, light-gray, fine-grained, contains 40 percent quartz, scattered medium-dark-gray shale clasts in top 1 in., thick-bedded to massive; base sharp	3	0
		(403	2)
118.	Sandstone, light-gray, mottled brownish-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp	2	0
		(405	2)
119.	Shale, dark-gray, evenly bedded; base grades abruptly	0	3
		(405	5)
120.	Sandstone, light-gray, very fine-grained, contains 40 percent quartz, 20 percent medium-gray siltstone laminae, thin-bedded; base sharp	1	1
		(406	6)
121.	Siltstone, medium-light-gray, thin-bedded; base grades	0	4
		(406	10)
122.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent dark-gray shale laminae, abundant dark-gray shale clasts from 7 in. to 11 in. below top, brecciated from 5 ft 3 in. to 5 ft 8 in. below top, thin- to thick-bedded; base sharp	7	0
		(413	10)
123.	Shale, dark-gray, contains 30 percent medium-gray very fine grained sandstone beds, irregularly bedded; base sharp	2	1
		(415	11)
124.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent medium-dark-gray shale laminae, few medium-dark-gray shale clasts; base sharp	1	5
		(417	4)
125.	Siltstone, medium-gray, faintly bedded; base grades	0	4
		(417	8)

Unit Number	Description	Thickness (Depth) ft	in.
126.	Sandstone, light-gray, very fine-grained, contains 40 percent quartz, 5 percent dark-gray shale laminae; base sharp.....	0	11
		(418	7)
127.	Siltstone, medium-gray, irregularly bedded; base grades.....	0	5
		(419	0)
128.	Sandstone, light- to medium-light-gray, mottled brownish-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	1	10
		(420	10)
129.	Siltstone, medium-gray, contains 2 in. thick medium-light-gray very fine-grained sandstone bed 3 in. below top; base grades.....	0	6
		(421	4)
130.	Sandstone, light- to medium-light-gray, mottled brownish-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	1	7
		(422	11)
131.	Siltstone, medium-light-gray, contains 25 percent dark-gray shale laminae, 20 percent light-gray very fine grained sandstone laminae, thin-bedded.....	3	0
		(425	11)
132.	Sandstone, light-gray, very fine grained, contains 4 percent quartz, 40 percent medium-dark-gray shale and siltstone beds, slightly burrowed, irregularly bedded; base sharp.....	6	10
		(432	9)
133.	Sandstone, light- to medium-light-gray, very fine grained, silty, contains 40 percent quartz, 10 percent medium-dark-gray shale and medium-gray siltstone laminae.....	2	9
		(435	6)
134.	Sandstone, light-gray, fine-grained, micaceous, contains 40 percent quartz, thick-bedded to massive.....	0	11
		(436	5)
135.	Siltstone, medium-light-gray; base sharp.....	0	6
		(436	11)
136.	Shale, medium-gray, silty; base sharp.....	0	3
		(437	2)
137.	Sandstone, medium-light-gray, fine-grained, silty, contains 40 percent quartz, slightly burrowed, thin- to thick-bedded; base grades.....	5	5
		(442	7)

Unit Number	Description	Thickness (Depth) ft	in.
138.	Sandstone, medium-light-gray, mottled brownish-gray, fine- to medium-grained, slightly calcareous, contains 45 percent quartz, scattered siderite and medium-dark-gray shale clasts, abundant invertebrate fossils.....	2	4
		(444	11)
139.	Sandstone, light-gray, fine- to medium-grained, contains 50 percent quartz, 15 percent dark-gray shale laminae, cross laminated, thin- to thick bedded; base sharp.....	1	6
		(446	5)
140.	Shale, medium-dark-gray, evenly bedded; base sharp.....	0	1
		(446	6)
141.	Sandstone, light-gray, fine- to medium-grained, contains 50 percent quartz, few dark-gray shale clasts, massive; base sharp.....	1	0
		(447	6)
142.	Sandstone, light- to medium-light-gray, mottled brownish-gray, fine- to medium-grained, contains 50 percent quartz, massive; base grades.....	0	11
		(448	5)
143.	Conglomerate, white and brownish-gray, contains scattered well rounded white to dark-reddish-brown pebbles up to 0.25 in. in diameter, very fine grained sandstone matrix, well sorted.....	1	3
		(449	8)
144.	Sandstone, light-gray, fine-grained, sparsely micaceous, contains 55 percent quartz, thin- to thick-bedded; base grades....	1	10
		(451	6)
145.	Sandstone, very-light-gray, medium-grained, contains 60 percent quartz, massive; base sharp.....	1	7
		(453	1)
146.	Shale, dark-gray, contains 20 percent medium-gray siltstone laminae, evenly bedded; base sharp.....	0	5
		(453	6)
147.	Sandstone, light-gray, very fine grained, silty, contains 40 percent quartz, thick-bedded; base sharp.....	0	8
		(454	2)
148.	Shale, dark-gray, contains 10 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded; base sharp....	2	4
		(456	6)
149.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, thin-bedded.....	0	5
		(456	11)

Unit Number	Description	Thickness (Depth) ft	in.
150.	Shale, dark-gray, contains 10 percent light-gray very fine grained sandstone laminae and beds, evenly bedded; base sharp.....	2	8
		(459	7)
151.	Sandstone, white to very light gray, medium-grained, silty in top 1 in., contains 60 percent quartz, pyrite on fractures, massive; base grades abruptly.....	3	10
		(463	5)
152.	Sandstone, medium-light-gray, fine to medium-grained, micaceous, contains 60 percent quartz, scattered quartz granules at 3 ft 11 in. and 4 ft 8 in. below top, massive; base grades.....	10	5
		(473	10)
153.	Sandstone, light- to medium-light-gray, mottled brownish-gray, fine-grained, micaceous, contains 60 percent quartz, scattered quartz pebbles and granules at 8 ft 11 in. and 14 ft below top, few calcite- and quartz-filled high-angle fractures; base grades abruptly.....	14	11
		(488	9)
154.	Sandstone, light- to medium-light-gray, very fine to fine-grained, very micaceous, silty, contains 60 percent quartz, thin and lenticularly bedded; base grades.....	11	1
		(499	10)
155.	Sandstone, light-gray, fine-grained, contains 40 percent quartz, 40 percent medium-dark-gray silty shale laminae and beds, few coal laminae and beds up to 0.5 in. thick, cross-laminated in part, lenticularly to irregularly bedded; base grades.....	30	5
		(530	3)
156.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, 50 percent dark-gray silty shale and siltstone beds, lenticular and irregularly bedded; base grades.....	16	0
		(546	3)
157.	Sandstone, light- to medium-light-gray, fine-grained, micaceous, contains 50 percent quartz, 5 percent dark-gray silty shale laminae, few dark-gray shale clasts from 22 ft 2 in. to 22 ft 5 in. below top, thin- to thick-bedded; base grades.....	25	6
		(571	9)
158.	Sandstone, light-gray, fine- to medium-grained, contains 60 percent quartz, few dark-gray shale laminae, scattered quartz-filled vertical fractures, thick-bedded to massive; base sharp....	15	1
		(586	10)

Unit Number	Description	Thickness (Depth) ft	in.
159.	Shale, dark gray, silty.....	0	2
		(587	0)
160.	Sandstone, very light to light-gray, medium-to coarse-grained, micaceous, contains 60 percent quartz, few white quartz granules from 1 ft 1 in. to 2 ft 9 in. below top, scattered dark-gray shale clasts, few coal laminae, few slickensided surfaces and quartz and pyrite-filled high-angle fractures, thick bedded.....	43	0
		(630	0)

BOTTOM OF HOLE
TOTAL DEPTH 630 ft

Corehole V-5B (redrill)

Location: Bland Co.; Hutchinson Rock, Va., 7.5 minute quadrangle; approximately 5 ft east of corehole V-5.

Coordinates: Latitude 37°00'19"N Longitude 81°24'06"W

Altitude: 2,380 ft Drilled depth: 76 ft 8 in

Dip of strata: Approximately 30° throughout corehole.

Date drilled: October 26, 1983

Core description: K. J. Englund and R. E. Thomas

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER MISSISSIPPIAN SERIES Price Formation		
1.	Soil and weathered rock (casting set-no core recovered).....	18	0
		(18	0)
2.	Shale medium-light gray, silty, few slickensided surfaces, contorted bedding.....	3	9
		(21	9)
3.	Shale, medium- to dark-gray, carbonaceous.....	0	1
		(21	10)
4.	Underclay, medium-gray, silty in basal 6 in., abundant root slickensides; base grades abruptly.....	0	2
		(23	1)
5.	Shale, medium-dark- to dark-gray, carbonaceous.....	0	2
		(23	3)
6.	Underclay, medium-gray, few rootlets; base grades.....	1	2
		(24	5)
7.	Shale, medium-gray, silty, few slickensided surfaces, poorly bedded; base grades.....	9	0
		(33	5)
8.	Shale, medium-gray, poorly bedded; base grades.....	0	5
		(33	10)
9.	Underclay, medium-dark- to dark-gray,.....	3	8
		(37	6)

Unit Number	Description	Thickness (Depth) ft	in.
10.	Siltstone, medium-gray, poorly bedded.....	0	8
		(38	2)
11.	Shale, black, carbonaceous, contains scattered coal laminae, highly sheared.....	1	8
		(39	10)
12.	Siltstone, medium- to medium-dark-gray, poorly bedded; base grades.....	1	2
		(41	0)
13.	Underclay, dark-gray, carbonaceous.....	0	4
		(41	4)
14.	Coal, dull attritus, impure.....	0	3
		(41	7)
15.	Shale, dark-gray- to black, carbonaceous, poorly bedded.....	0	2
		(41	9)
16.	Coal, dull attritus, impure.....	0	3
		(42	0)
17.	Shale, dark-gray, very carbonaceous, poorly bedded.....	0	7
		(42	7)
18.	Coal, bright attritus.....	0	3
		(42	10)
19.	Shale, dark-gray, carbonaceous.....	0	6
		(43	4)
20.	Coal, bright attritus.....	0	3
		(46	8)
21.	Sandstone, medium-gray, very fine- to fine-grained, contains 40 percent quartz, few coal laminae; base sharp.....	3	1
		(46	8)
22.	Shale, medium-gray, silty, contains 5 percent medium light-gray siltstone laminae, irregularly bedded; base sharp.....	0	5
		(47	1)
23.	Sandstone, medium-light-gray, fine-grained, contains 40 percent quartz, few medium-dark-gray shale laminae and clasts; base sharp.....	1	2
		(48	3)
24.	Shale, medium-gray, silty, abundant coal laminae, poorly bedded...	5	0
		(53	3)

Unit Number	Description	Thickness (Depth) ft	in.
25.	Shale, medium-gray, silty, irregularly bedded; base grades abruptly	1	3
		(54	6)
26.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 20 percent medium-gray siltstone laminae, thin-bedded	0	5
		(54	11)
27.	Siltstone, medium-gray, micaceous, poorly bedded, poor fissility; base sharp	1	5
		(56	4)
28.	Sandstone, light- to medium-light-gray, medium-grained, contains 50 percent quartz, 20 percent feldspar, abundant coal laminae; base sharp	5	8
		(62	0)
29.	Shale, medium-gray, silty, poorly bedded, poor fissility	3	2
		(65	2)
30.	Siltstone, medium-gray, poorly bedded; base grades	0	7
		(65	2)
31.	Shale medium-gray, silty; base grades	0	11
		(66	8)
32.	Siltstone, medium-gray, contains 5 percent medium-light-gray very fine grained sandstone laminae	1	9
		(68	5)
33.	Shale, dark-gray to black, contains scattered impure coal laminae.	0	4
		(68	9)
34.	Underclay, dark-gray to black, silty, very carbonaceous	1	6
		(70	3)
35.	Coal, impure, sheared	0	9
		(71	0)
36.	Underclay, dark-gray, silty, carbonaceous	0	7
		(71	7)
37.	Coal, bright attritus	0	1
		(71	8)
38.	Underclay, dark-gray, silty	0	3
		(71	11)
39.	Coal, mostly bright attritus	0	2
		(72	1)

Unit Number	Description	Thickness (Depth) ft	in.
40.	Underclay, dark-gray, silty, few siderite modules; base grades....	0	2
		(72	3)
41.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, scattered dark-gray shale laminae, thin bedded.....	4	5
		(76	8)

BOTTOM OF HOLE
TOTAL DEPTH 76 ft 8 in

GEOPHYSICAL LOG

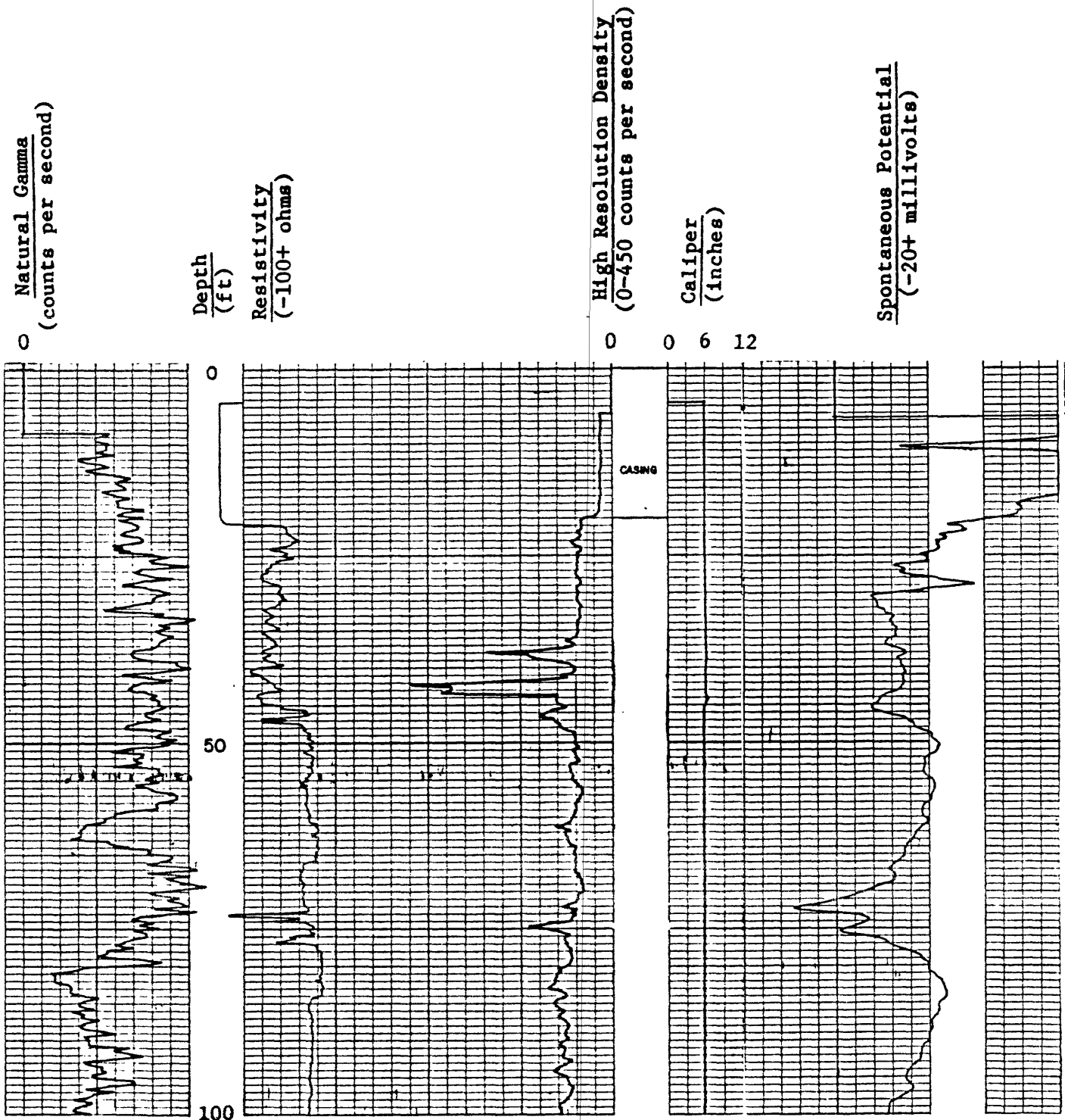
Corehole: V-5 Date: 10/22/82 State: Virginia County: Bland

Quadrangle: Hutchinson Rock, Va. Latitude: 37°00'19"N Longitude: 81°24'06"W

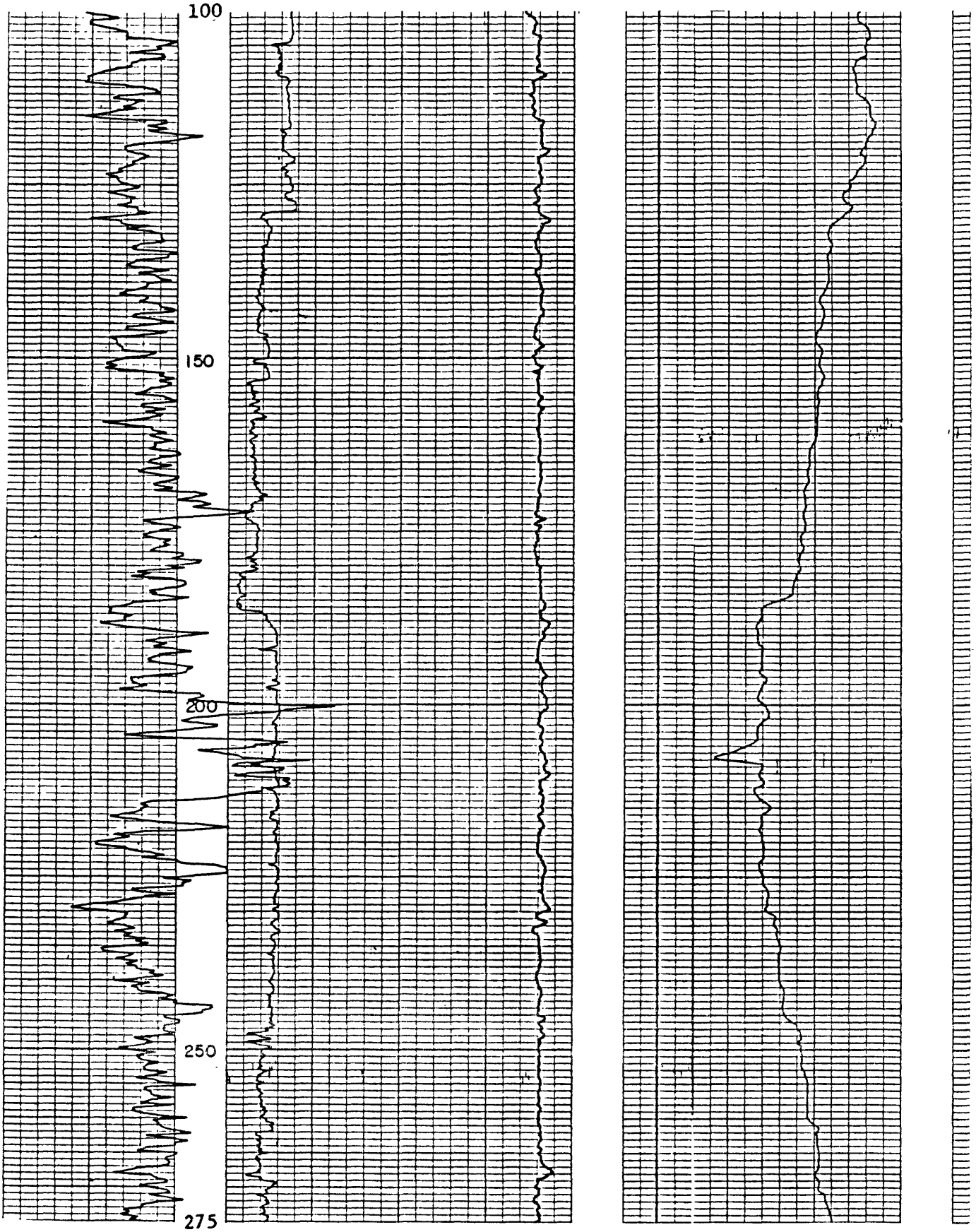
Altitude: 2,380 ft Logged Depth: 630 ft Drilled Depth: 630 ft

Logging Speed: 20 ft/min (SP 30 ft/min) Natural Gamma Time Constant: 1

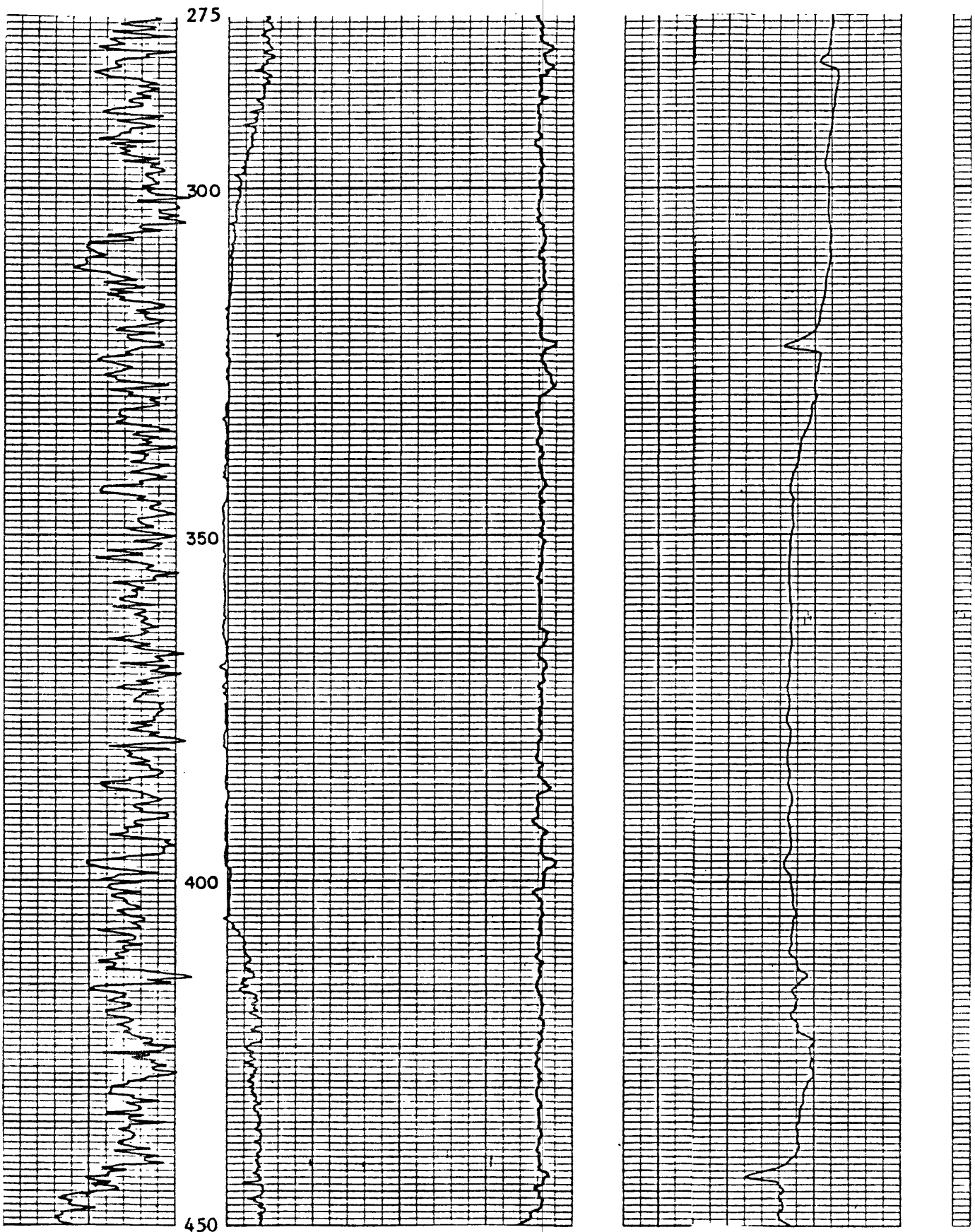
High Resolution Density Time Constant: 1



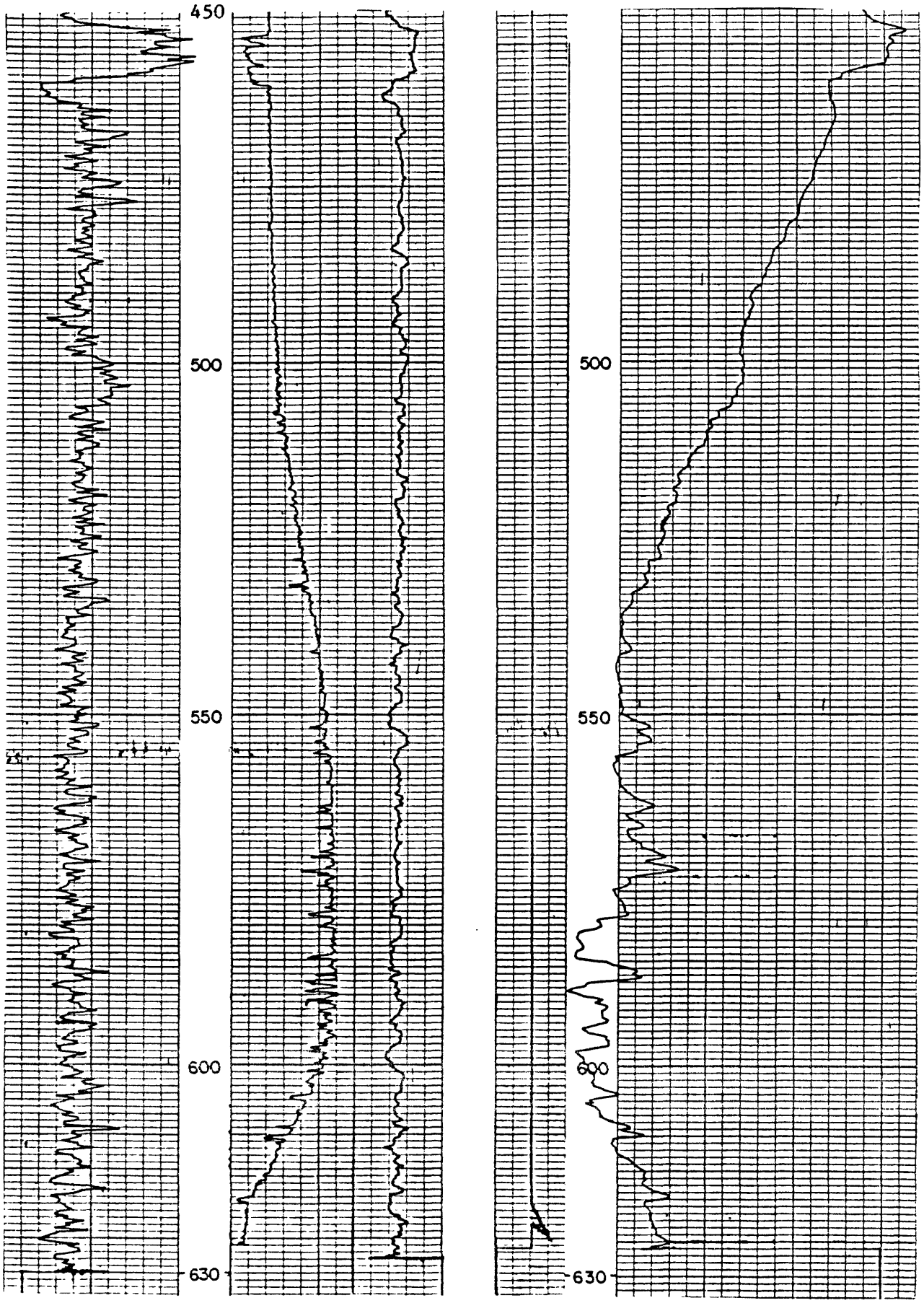
Corehole: V-5 continued



Corehole: V-5 continued

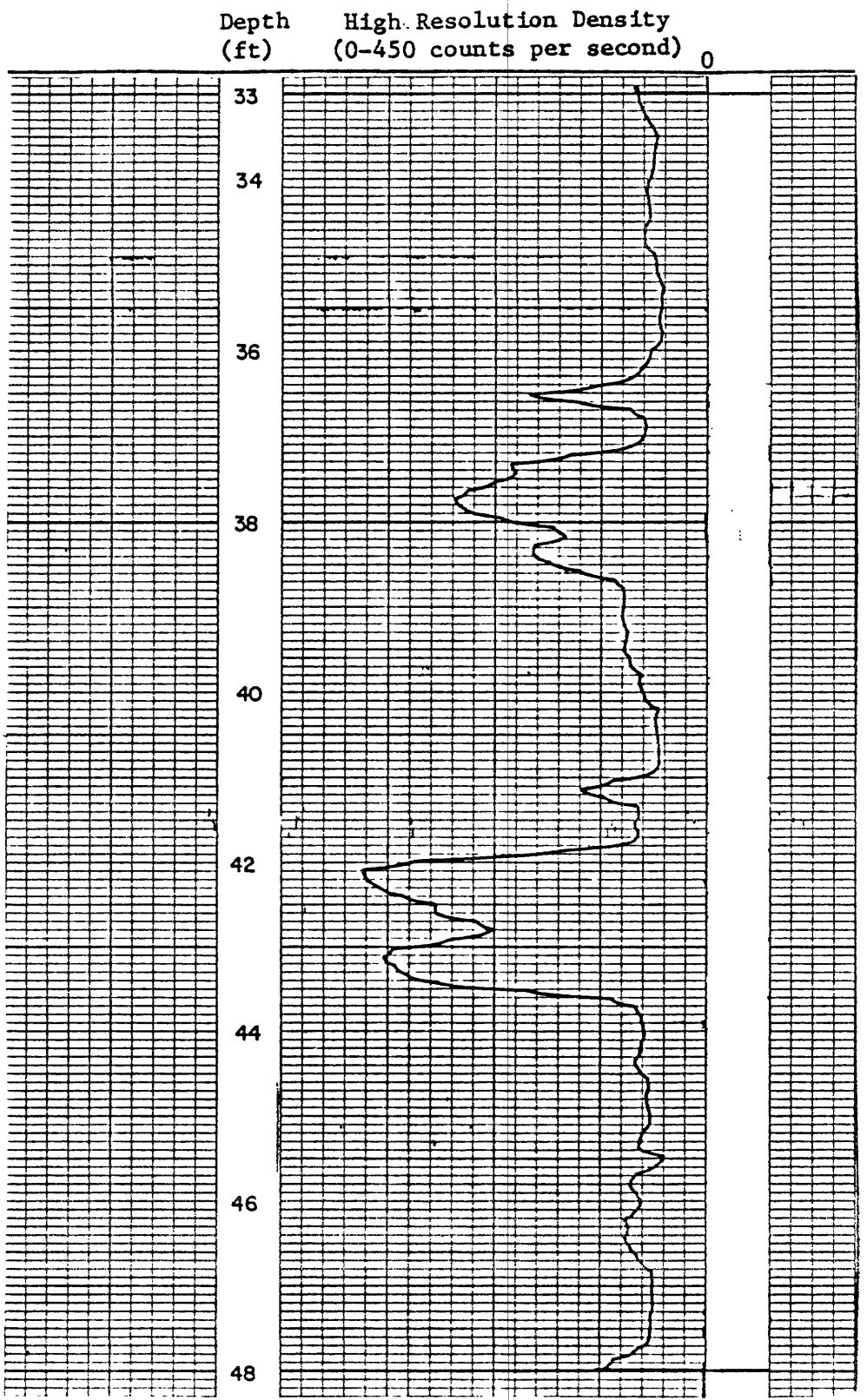


Corehole: V-5 continued



DETAIL LOG

Corehole: V-5 Logging Speed: 5 ft/min Time Constant: 1



Corehole V-6

Location: Wythe County; Crockett, Va., 7.5 minute quadrangle; approximately 2 mi southeast of Browns Peak between Dry and Hutson Branches of Reed Creek. Accessible by unimproved road which extends northward from State Route 680.

Coordinates: Latitude 36°58'03"N Longitude 81°13'45"W

Altitude: 2,731 ft Drilled depth: 885 ft

Dip of strata: Approximately 20° to a depth of 270 ft, decreasing to 10° to depth of 630 ft, and then gradually decreasing to horizontal at the bottom of the corehole.

Date drilled: October 20, 1982 to November 3, 1982

Core description: K.J. Englund, R.E. Thomas, J.F. Windolph, Jr., and J.O. Maberry II

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER MISSISSIPPIAN SERIES Maccrady Shale		
1.	Soil and weathered rock (casing set - no core recovered).....	60 (60	0 0)
2.	Mudstone, greenish-gray, mottled grayish-red, weathered brownish-gray in part, slightly silty; base grades.....	1 (61	8 8)
3.	Mudstone, moderate-red to moderate-reddish-brown, silty, fractured.....	6 (68	11 7)
4.	Mudstone, reddish-brown, mostly weathered brownish-gray, silty; base grades.....	1 (69	1 8)
5.	Sandstone, moderate-reddish-brown, very fine to fine-grained, contains 45 percent quartz, thin-bedded, base grades.....	1 (71	4 0)
6.	Mudstone, medium-light-gray, silty.....	3 (74	10 10)
7.	Mudstone, medium-yellowish-brown, silty, base grades.....	1 (76	2 0)
8.	Mudstone, medium-light-gray, silty, contains thin vuggy zone 2 ft below top, faintly bedded; base grades.....	3 (79	8 8)

Unit Number	Description	Thickness (Depth) ft	in.
9.	Mudstone, greenish-gray to medium-gray, mottled grayish-red, contains 0.25 in. thick dark-gray carbonaceous shale at top, faintly bedded; base grades abruptly.....	1	7
		(81	3)
10.	Mudstone, medium-light-gray, mottled green, vuggy; base grades....	1	6
		(82	9)
11.	Mudstone, light-greenish-gray, mottled grayish-red; base grades...	1	11
		(84	8)
12.	Claystone, light-greenish-gray; base grades.....	2	0
		(86	8)
13.	Claystone, light-greenish-gray, mottled grayish-red.....	1	4
		(88	0)
14.	Claystone, light-greenish-gray; base grades abruptly.....	0	5
		(88	5)
15.	Claystone, dark-gray, carbonaceous, faintly bedded.....	0	1
		(88	6)
16.	Claystone, light-greenish-gray, few root slicks at top; base grades.....	4	9
		(93	3)
	Price Formation		
17.	Shale, medium-gray, poorly bedded; base grades.....	1	7
		(94	10)
18.	Shale, dark-gray, carbonaceous, unevenly bedded.....	1	4
		(96	2)
19.	Shale, black, very carbonaceous, contains few coal laminae.....	0	3
		(96	5)
20.	Underclay, medium-light- to medium-gray, silty, few rootlets; base grades.....	1	5
		(97	10)
21.	Mudstone, medium-light-gray, silty, abundant vugs; base grades....	1	6
		(99	4)
22.	Siltstone, light-gray, mottled light-greenish-gray, few vugs, faintly bedded; base grades abruptly.....	6	4
		(105	8)
23.	Shale, dark-gray, carbonaceous; base grades abruptly.....	0	1
		(105	9)

Unit Number	Description	Thickness (Depth) ft	in.
24.	Shale, medium-light-gray, silty, contains 5 percent light-gray siltstone laminae; base grades.....	2	2
		(107	11)
25.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, 10 percent dark-gray shale laminae, thin-bedded.....	0	3
		(108	2)
26.	Shale, black, very carbonaceous, abundant coal laminae.....	0	0.5
		(108	2.5)
27.	Shale, medium-gray, silty, poor fissility; base grades abruptly...	3	6.5
		(111	9)
28.	Sandstone, light-gray, very fine grained, contains 45 percent quartz; base sharp.....	0	2
		(111	11)
29.	Shale, medium-gray, evenly bedded, fair fissility; base grades abruptly.....	3	6
		(115	5)
3	Shale, black, very carbonaceous, poor fissility; base grades abruptly.....	0	3
		(115	8)
31.	Shale, medium-gray, fair fissility; base grades.....	1	0
		(116	8)
32.	Siltstone, medium-light-gray, thin-bedded; base grades.....	0	10
		(117	6)
33.	Sandstone, light-gray, grades to medium-dark-gray at base, contains 50 percent quartz, few coal laminae in basal 6 in.	4	0
		(121	6)
34.	Siltstone, medium- to dark-gray, contains 20 percent dark-gray carbonaceous shale laminae, thin and evenly bedded; base grades...	2	6
		(124	0)
35.	Shale, black, very carbonaceous.....	0	1
		(124	1)
36.	Shale, dark-gray, carbonaceous, contains 10 percent medium-gray siltstone laminae, few rootlets in top 9 in.; base grades....	5	0
		(129	1)
37.	Shale, black, very carbonaceous, contains 20 percent coal laminae.....	0	2
		(129	3)

Unit Number	Description	Thickness (Depth) ft	in.
38.	Siltstone, medium-gray, few rootlets in top 6 in.; base grades....	2	0
		(131	3)
39.	Shale, medium-gray, silty; base grades.....	3	0
		(134	3)
40.	Siltstone, medium-gray, thin-bedded, poor fissility.....	1	2
		(135	5)
41.	Shale, black, very carbonaceous, poor fissility.....	3	2
		(138	7)
42.	Coal, impure, contains 50 percent dark-gray carbonaceous shale laminae.....	0	3
		(138	10)
43.	Underclay, medium-dark-gray, few rootlets.....	0	5
		(139	3)
44.	Shale, black, very carbonaceous, contains scattered coal laminae.....	2	2
		(141	5)
45.	Underclay, medium-dark-gray, plastic, scattered rootlets and root slickensides.....	0	7
		(142	0)
46.	Coal, impure.....	0	1.5
		(142	1.5)
47.	Siltstone, grayish-black, argillaceous.....	0	4.5
		(142	6)
48.	Shale, black, very carbonaceous, contains scattered coal laminae..	0	2
		(142	8)
49.	Shale, black, very carbonaceous, poor fissility.....	1	4
		(144	0)
50.	Underclay, medium-dark-gray, few rootlets; base grades.....	2	3
		(146	3)
51.	Shale, black, very carbonaceous, poor fissility.....	0	10
		(147	1)
52.	Coal, mostly bright attritus, highly fractured.....	0	5
		(147	6)
53.	Coal, impure.....	0	1.5
		(147	7.5)

Unit Number	Description	Thickness (Depth) ft	in.
54.	Coal, mostly bright attritus, high fractured.....	0	3.5
		(147	11)
55.	Shale, black, very carbonaceous.....	0	2
		(148	1)
56.	Siltstone, dark-gray, carbonaceous, few rootlets.....	0	7
		(148	8)
57.	Shale, black, very carbonaceous, contains 30 percent light-gray siltstone laminae, bioturbated from 1 ft to 1 ft 6 in. above base.....	8	5
		(157	1)
58.	Shale, black, very carbonaceous, contains 40 percent light-gray siltstone laminae, evenly bedded.....	5	0
		(162	1)
59.	Shale, black, very carbonaceous, evenly bedded, fissile.....	4	4
		(166	5)
60.	Siltstone, medium- to dark-gray, thin-bedded; base grades.....	0	5
		(166	10)
61.	Shale, dark-gray to black, carbonaceous, contains 5 percent medium- to dark-gray siltstone laminae, evenly bedded.....	7	1
		(173	11)
62.	Shale, black, very carbonaceous.....	0	8
		(174	7)
63.	Underclay, medium-dark-gray, few rootlets.....	1	2
		(175	9)
64.	Shale, black, very carbonaceous, contains 20 percent light-gray siltstone laminae, evenly bedded.....	0	8
		(176	5)
65.	Shale, medium-gray, poor fissility; base grades.....	2	9
		(179	2)
66.	Shale, black, very carbonaceous, poor fissility.....	0	8
		(179	10)
67.	Coal, bright attritus, highly fractured.....	0	9
		(180	7)
68.	Shale, medium-dark-gray, contains 5 percent medium-gray siltstone laminae, evenly to poorly bedded; base grades.....	3	9
		(184	4)

Unit Number	Description	Thickness (Depth) ft	in.
69.	Shale, dark-gray to black, carbonaceous, contains 5 percent medium-gray siltstone laminae, few coal laminae in basal 4 in.....	5	0
		(189	4)
70.	Siltstone, medium-dark-gray, scattered black shale laminae, crossbedded in part, thin and evenly bedded.....	3	8
		(193	0)
71.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	0	6
		(193	6)
72.	Shale, dark-gray, contains 20 percent light-gray very fine grained sandstone laminae 2 ft 7 in. below top, unevenly bedded.....	0	11
		(194	5)
73.	Shale, black, very carbonaceous.....	1	2
		(195	7)
74.	Shale, black, very carbonaceous, contains scattered coal laminae.....	0	1
		(195	3)
75.	Underclay, medium-gray, abundant rootlets; base grades.....	0	9
		(196	5)
76.	Shale, dark-gray to black, evenly bedded, fissile; base grades....	4	9
		(201	2)
77.	Shale, medium- to medium-dark-gray, evenly bedded, fissile; base sharp.....	4	4
		(205	6)
78.	Sandstone, medium- to medium-dark-gray, fine- to medium-grained, contains 50 percent quartz, scattered quartz- and calcite-filled vertical fractures, thick-bedded to massive; base sharp.....	13	6
		(219	0)
79.	Claystone, very plastic, nonbedded.....	0	3
		(219	3)
80.	Coal, bright attritus, sheared.....	0	8
		(219	11)
81.	Underclay, dark-gray, abundant rootlets.....	1	4
		(221	3)
82.	Underclay, medium-dark-gray, contains scattered medium-gray siltstone laminae, scattered coal laminae, abundant rootlets; base grades.....	1	6
		(222	9)

Unit Number	Description	Thickness (Depth) ft	in.
83.	Siltstone, medium-dark-gray, scattered rootlets; base grades.....	1	3
		(224	0)
84.	Shale, dark-gray, carbonaceous, some slickensided surfaces, few rootlets, poor fissility.....	2	10
		(226	10)
85.	Coal, bright attritus, fractured.....	0	3
		(227	1)
86.	Sandstone, light- to dark-gray, very fine to fine-grained, contains 45 percent quartz, few rootlets; base sharp and irregular.....	0	9
		(227	10)
87.	Shale, dark-gray to black, carbonaceous, few slickensided surfaces and rootlets; base sharp.....	1	4
		(229	2)
88.	Shale, medium-dark-gray, carbonaceous, silty, few slickensided surfaces, evenly bedded, fair fissility; base sharp.....	4	7
		(233	9)
89.	Sandstone, light-gray, fine- to medium-grained, contains 50 percent quartz, thick-bedded to massive; base sharp.....	4	0
		(237	9)
90.	Shale, medium-dark- to dark-gray, few slickensided surfaces, evenly bedded.....	2	4
		(240	1)
91.	Shale, black, very carbonaceous, few slickensided surfaces, evenly bedded, fissile; base grades.....	3	1
		(243	2)
92.	Underclay, medium-dark-gray, abundant rootlets.....	3	10
		(247	0)
93.	Shale, medium-dark-gray, abundant coal laminae and slickensided surfaces, poor fissility.....	6	0
		(253	0)
94.	Coal, dull attritus, sheared, impure.....	0	3
		(253	3)
95.	Siltstone, dark-gray, carbonaceous, slickensided surfaces.....	1	1
		(254	4)
96.	Shale, black, very carbonaceous.....	0	6
		(254	10)

Unit Number	Description	Thickness (Depth) ft	in.
97.	Coal, dull to bright attritus, mostly impure, highly sheared.....	1	1
		(255	11)
98.	Shale, black, very carbonaceous, abundant coal laminae, few slickensided surfaces, poor fissility.....	0	7
		(256	6)
99.	Coal, bright, highly sheared, partly impure.....	0	9
		(257	3)
100.	Underclay, dark-gray, very carbonaceous, abundant rootlets.....	0	7
		(257	10)
101.	Coal, impure, highly sheared.....	0	2
		(258	0)
102.	Shale, black, carbonaceous, contains 40 percent light-gray siltstone laminae, bioturbated.....	1	0
		(259	0)
103.	Coal, Lower split of Merrimac coal zone, mostly bright attritus, highly sheared.....	3	0
		(262	0)
104.	Core loss, see corehole V-6B (redrill).....	4	5
		(266	5)
105.	Shale, dark-gray, very carbonaceous, few slickensided surfaces, poor fissility.....	0	4
		(266	9)
106.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, scattered dark-gray shale laminae, thin- to thick-bedded.....	1	11
		(268	8)
107.	Shale, dark-gray, evenly bedded; base sharp.....	0	5
		(269	1)
108.	Sandstone, light-gray, fine-grained, contains 40 percent quartz, few dark-gray shale laminae, thin-bedded; base sharp.....	1	0
		(270	1)
109.	Siltstone, medium-light-gray, contains few dark-gray shale laminae, thin-bedded; base sharp.....	0	4
		(270	5)
110.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, scattered high-angle fractures, thin-bedded; base sharp.....	0	8
		(271	1)

Unit Number	Description	Thickness (Depth) ft	in.
111.	Shale, medium-dark-gray, evenly bedded; base sharp.....	0	4
		(271	5)
112.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, few dark-gray shale laminae, thin- to thick-bedded; base sharp.....	1	11
		(273	4)
113.	Shale, medium-dark-gray, silty, contains 40 percent medium-gray siltstone laminae, fissile, unevenly bedded; base sharp.....	1	7
		(274	11)
114.	Sandstone, light- to medium-light-gray, very fine grained, contains 50 percent quartz, 10 percent dark-gray shale laminae, slightly burrowed, thin-bedded.....	1	5
		(276	4)
115.	Shale, medium-dark-gray, contains 30 percent light-gray siltstone laminae, evenly bedded, fissile.....	1	2
		(277	6)
116.	Shale, black, very carbonaceous, contains 30 percent coal laminae.....	0	4
		(277	10)
117.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, few quartz-filled high-angle fractures, crossbedded, massive; base sharp.....	31	11
		(309	9)
118.	Shale, dark-gray, very silty in top 1.5 in., slightly burrowed evenly bedded; base grades.....	0	4
		(310	1)
119.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, 10 percent medium-gray siltstone laminae in top 7 in., thin- to thick-bedded; base sharp.....	3	3
		(313	4)
120.	Shale, medium- to medium-dark-gray, silty, sandy from 5 in. to 8 in. below top, evenly bedded.....	1	1
		(314	5)
121.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent medium-gray siltstone laminae, abundant large medium-dark-gray shale clasts in basal 4 in., thin-bedded.....	1	0
		(315	5)
122.	Shale, medium-dark-gray, slightly silty, evenly bedded; base grades.....	0	9
		(316	2)

Unit Number	Description	Thickness (Depth) ft	in.
123.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base grades	0	1
		(316	3)
124.	Shale, medium-dark-gray, evenly bedded; base sharp	0	1
		(316	4)
125.	Sandstone, light-gray to light-brownish-gray, very fine to fine-grained, contains 40 percent quartz, few calcite-filled high-angle fractures; base sharp	1	2
		(317	6)
126.	Shale, medium-dark-gray, contains 30 percent light-gray siltstone and very fine grained sandstone laminae; base sharp	0	4
		(317	10)
127.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded	0	1
		(317	11)
128.	Shale, medium-dark-gray, evenly bedded; base sharp	0	2
		(318	1)
129.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, 10 percent medium-gray shale and siltstone laminae in top 2 ft 5 in., scattered dark-gray shale clasts up to 1 in. in diameter in top 11 ft 6 in., thick-bedded to massive; base sharp	12	2
		(330	3)
130.	Shale, medium-dark-gray, contains 30 percent light-gray, siltstone and very fine grained sandstone laminae, evenly bedded; base sharp	1	2
		(331	5)
131.	Siltstone, medium-gray, finely micaceous, evenly bedded; base sharp	1	1
		(332	6)
132.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, abundant dark-gray shale clasts in basal 7 in., few large siderite clasts, massive	3	9
		(336	3)
133.	Shale, medium-dark-gray, silty, contains 30 percent light-gray siltstone and very fine grained sandstone beds, unevenly bedded; base sharp	1	4
		(337	7)
134.	Sandstone, light-gray, fine-grained, micaceous, contains 40 percent quartz, few pyrite-filled high-angle fractures, massive; base sharp	5	9
		(343	4)

Unit Number	Description	Thickness (Depth) ft	in.
135.	Shale, medium-dark-gray, silty, slightly burrowed, evenly bedded; base grades abruptly.....	0	5
		(343	9)
136.	Sandstone, white to light-gray, fine- to coarse-grained, contains 45 percent quartz, few quartz granules, abundant dark-gray shale clasts, slightly burrowed, thick-bedded.....	0	6
		(344	3)
137.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, few pyrite-filled fractures, massive; base sharp.....	16	11
		(361	2)
138.	Shale, dark-gray, evenly bedded, fissile; base sharp.....	0	7
		(361	9)
139.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, thin- to thick-bedded; base sharp.....	1	11
		(363	8)
140.	Shale, medium-dark-gray, evenly bedded; base sharp.....	0	6
		(364	2)
141.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base grades.....	0	1
		(364	3)
142.	Shale, medium-dark-gray, silty, evenly bedded; base sharp.....	0	1
		(364	4)
143.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, thick-bedded; base sharp.....	1	5
		(365	9)
144.	Shale, medium-dark-gray, contains 20 percent light-gray siltstone and very fine-grained sandstone laminae, evenly bedded; base sharp.....	2	3
		(368	0)
145.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, few dark-gray shale laminae, thin-bedded; base sharp.....	0	4
		(368	4)
146.	Shale, medium-dark-gray, evenly bedded; base sharp.....	0	1
		(368	5)
147.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, few dark-gray shale clasts in basal 2 in.; base sharp.....	0	11
		(369	4)

Unit Number	Description	Thickness (Depth) ft	in.
148.	Shale, medium-dark-gray, evenly bedded; base sharp.....	0	5
		(369	9)
149.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, abundant quartz granules from 2 ft 2 in. to 2 ft 5 in. below top, few quartz granules in basal 10 in., thin- to thick-bedded; base grades.....	7	2
		(376	11)
150.	Conglomerate, light-gray, contains abundant white quartz granules and pebbles up to 0.125 in. in diameter, fine-grained sandstone matrix, well sorted; base sharp.....	0	10
		(377	9)
151.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, few quartz granules and pebbles in basal 7 in., massive; base grades.....	12	3
		(390	0)
152.	Conglomerate, white to light-gray, contains abundant quartz granules and pebbles up to 0.125 in. in diameter, fine-grained sandstone matrix; base sharp.....	0	8
		(390	8)
153.	Sandstone, light-gray, fine-grained, micaceous, contains 60 percent quartz, scattered quartz granules from 7 in. to 1 ft 9 in. above base, scattered dark and light mineral grains, thick-bedded to massive; base grades.....	8	6
		(399	2)
154.	Conglomerate, light-gray, contains abundant well rounded quartz pebbles up to 0.5 in. in diameter and siderite clasts up to 2 in. in diameter, very fine to fine-grained sandstone matrix; base sharp.....	0	7
		(399	9)
155.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, bioturbated; base grades.....	5	0
		(404	9)
156.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, thick-bedded to massive; base grades.....	25	8
		(430	5)
157.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent medium-light-gray siltstone laminae, scattered calcite-filled high-angle fractures, abundant dark-gray shale and large siderite clasts in basal 4 in., thin- to thick-bedded.....	5	3
		(435	8)

Unit Number	Description	Thickness (Depth) ft	in.
158.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, thick-bedded to massive; base sharp.....	3	10
		(439	6)
159.	Shale, black, very carbonaceous.....	0	1.5
		(439	7.5)
160.	Siltstone, dark-gray, bioturbated; base grades abruptly.....	0	9.5
		(440	5)
161.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 15 percent dark-gray shale laminae, slightly burrowed; base sharp.....	1	1
		(441	6)
162.	Sandstone, light-gray, mottled light-brownish-gray in top 5 in., fine-grained, contains 45 percent quartz; base sharp.....	1	9
		(443	3)
163.	Shale, medium-dark-gray, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded.....	0	8
		(443	11)
164.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, 10 percent dark-gray shale laminae in top 1 ft 9 in., thin- to thick-bedded; base sharp and uneven.....	4	2
		(448	1)
165.	Shale, dark-gray, contains 20 percent light-gray very fine grained sandstone lenses; base uneven.....	0	2
		(448	3)
166.	Conglomerate, light-gray, contains abundant well rounded quartz pebbles up to 0.25 in. in diameter, few siderite and dark-gray shale clasts up to 1 in. in diameter; base sharp.....	0	4
		(448	7)
167.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, 10 percent dark-gray shale lenses up to 0.5 in. thick, bioturbated, thin- to thick-bedded; base sharp.....	4	4
		(452	11)
168.	Shale, medium-dark- to dark-gray, contains 30 percent light-gray siltstone and very fine to fine-grained sandstone lenses, bioturbated in top 1 ft 5 in., thin-bedded.....	3	9
		(456	8)
169.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, few pyrite-filled vertical fractures thin-bedded; base grades.....	0	6
		(457	2)

Unit Number	Description	Thickness (Depth) ft	in.
170.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-dark-gray shale laminae, few pyrite-filled vertical fractures, thin-bedded; base grades.....	1	2
		(458	4)
171.	Sandstone, light-gray, fine-grained, contains 40 percent quartz, few pyrite-filled vertical fractures, thick-bedded to massive; base sharp.....	4	4
		(462	8)
172.	Shale, medium-dark-gray, unevenly bedded; base sharp.....	0	2
		(462	10)
173.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, few pyrite-filled vertical fractures, massive; base sharp.....	2	10
		(465	8)
174.	Shale, dark-gray, contains 25 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded; base grades abruptly.....	0	10
		(466	6)
175.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, 5 percent dark-gray shale laminae in top 11 in., thin- to thick-bedded.....	1	10
		(468	4)
176.	Shale, medium-dark- to dark-gray, contains 30 percent medium-dark-gray siltstone beds, evenly bedded.....	0	5
		(468	9)
177.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, 10 percent dark-gray shale laminae and clasts in top 8 in., thick-bedded to massive; base grades.....	17	9
		(486	6)
178.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent dark-gray shale laminae, slightly burrowed, contorted bedding.....	2	11
		(489	5)
179.	Sandstone, light-gray, fine-grained, contains 45 percent quartz, massive; base sharp.....	2	5
		(491	10)
180.	Siltstone, medium-light- to light-gray, contains 20 percent dark-gray shale and light-gray very fine grained sandstone laminae, evenly bedded; base sharp.....	3	4
		(495	2)

Unit Number	Description	Thickness (Depth) ft	in.
181.	Shale, black, very carbonaceous, silty, contains few scattered white quartz granules and pebbles up to 0.5 in. in diameter; base sharp.....	0	9
		(495	11)
182.	Siltstone, medium-gray, sandy in top 5 in., faintly bedded, massive; base grades.....	4	8
		(500	7)
183.	Conglomerate, medium-gray, contains abundant well-rounded white quartz pebbles up to 0.5 in. in diameter, siltstone matrix.....	0	2
		(500	9)
184.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-dark-gray shale laminae and beds, slightly burrowed, evenly bedded; base grades.....	3	10
		(504	7)
185.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent dark-gray shale laminae, 0.5 in. thick siderite clast at 11 in. below top, few vertical fractures; base sharp.....	1	5
		(506	0)
186.	Shale, dark-gray, carbonaceous, contains 10 percent medium-light-gray very fine grained sandstone laminae, evenly bedded; base grades abruptly.....	1	4
		(507	4)
187.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, massive; base sharp.....	2	7
		(509	11)
188.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, 10 percent medium-gray shale laminae and lenses, massive; base grades.....	7	9
		(517	8)
189.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, scattered quartz granules and pebbles in basal 1 ft 6 in.; base grades.....	5	10
		(523	6)
190.	Conglomerate, white to brownish-gray, contains abundant quartz pebbles up to 0.25 in. in diameter, scattered siderite clasts up to 0.5 in. in diameter, fine-grained sandstone matrix; base sharp.....	0	4
		(523	10)

Unit Number	Description	Thickness (Depth) ft	in.
191.	Shale, dark-gray, evenly bedded; base grades	0	2.5
		(524	0.5)
192.	Sandstone, medium-light-gray, very fine grained, contains 50 percent quartz, few dark-gray shale clasts at 11 in. below top and in basal 2 in., thin-bedded	2	6.5
		(526	7)
193.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, few pyrite- and calcite-filled vertical fractures, massive; base sharp	23	11
		(550	6)
194.	Shale, dark-gray, contains 10 percent light-gray siltstone and very fine to fine-grained sandstone laminae, slightly burrowed, evenly bedded; base sharp	0	10
		(551	4)
195.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp	0	4
		(551	8)
196.	Shale, medium- to dark-gray, contains 30 percent medium-gray siltstone and very fine to fine-grained sandstone laminae, evenly bedded; base sharp	1	3
		(552	11)
197.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp	0	4
		(553	3)
198.	Shale, dark-gray, evenly bedded; base grades	0	6
		(553	9)
199.	Sandstone, light- to medium-light-gray, silty, very fine to fine-grained, contains 40 percent quartz; base sharp	0	10
		(554	7)
200.	Siltstone, medium-light-gray, contains 30 percent dark-gray shale laminae	0	7
		(555	2)
201.	Sandstone, light-gray, very fine to fine-grained, silty, contains 40 percent quartz, 20 percent dark-gray shale and siltstone beds, slightly burrowed; base sharp	1	0
		(556	2)
202.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 45 percent dark-gray shale and siltstone beds, thin- to thick-bedded; base sharp	3	3
		(559	5)

Unit Number	Description	Thickness (Depth) ft	in.
203.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent dark-gray shale laminae, slightly burrowed, thin- to thick-bedded; base grades.....	4	7
		(564	0)
204.	Shale, medium-dark to dark-gray, contains 20 percent light-gray very fine grained sandstone laminae, slightly burrowed, evenly bedded; base grades.....	0	5
		(564	5)
205.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 15 percent medium-dark to dark-gray shale and siltstone laminae; base grades.....	2	7
		(567	0)
206.	Shale, medium-dark to dark-gray, contains 20 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded.....	0	10
		(567	10)
207.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, 1 in. siderite bed 8 in. below top, abundant invertebrate fossil fragments from 3 ft 4 in. to 3 ft 6 in. below top, thin- to thick-bedded.....	6	6
		(574	4)
208.	Sandstone, light- to medium-light-gray, very fine grained, silty, contains 50 percent quartz, 20 percent dark-gray shale and siltstone laminae, bioturbated.....	3	7
		(577	11)
209.	Conglomerate, light-brownish-gray, contains abundant siderite clasts and white quartz pebbles up to 1 in. in diameter, siltstone matrix; base sharp.....	0	3
		(578	2)
210.	Shale, medium-dark-gray, silty, contains few light-gray sandstone laminae, evenly bedded.....	0	2
		(578	4)
211.	Sandstone, light-gray, very fine grained, contains 40 percent quartz; base sharp.....	0	1
		(578	5)
212.	Shale, medium-dark-gray, silty, few plant fragments; base sharp...	0	4
		(578	9)
213.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, few medium-dark-gray shale clasts; base grades abruptly.....	0	9
		(579	6)

Unit Number	Description	Thickness (Depth) ft	in.
214.	Shale, dark-gray, silty, evenly bedded; base sharp.....	0	1
		(579	7)
215.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, abundant medium-dark-gray shale clasts from 5 in. to 8 in. below top, thin-bedded; base sharp.....	1	6
		(581	1)
216.	Shale, dark-gray, slightly silty; base sharp.....	0	2
		(581	3)
217.	Sandstone, light-gray, fine-grained, contains 40 percent quartz, abundant invertebrate fossils from 6 ft 1 in. to 7 ft 3 in. below top, massive; base grades.....	10	3
		(591	6)
218.	Sandstone, light- to medium-light-gray, fine-grained, contains 40 percent quartz, abundant invertebrate fossils.....	0	4
		(591	10)
219.	Conglomerate, medium-light-gray, contains abundant white quartz granules, fine-grained sandstone matrix.....	0	6
		(592	4)
220.	Shale, medium-dark-gray, contains 40 percent light-gray siltstone laminae, slightly burrowed, evenly bedded; base sharp.....	2	5
		(594	9)
221.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, scattered dark-gray shale beds up to 1.5 in. thick in basal 10 in., thick-bedded.....	1	8
		(596	5)
222.	Shale, medium-dark-gray, evenly bedded; base grades.....	0	6
		(596	11)
223.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 10 percent dark-gray shale laminae, thick-bedded; base sharp.....	4	1
		(601	0)
224.	Shale, medium- to medium-dark-gray, contains 20 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded; base grades.....	0	5
		(601	5)
225.	Sandstone, medium-light-gray, very fine grained, finely micaceous, contains 40 percent quartz, 30 percent dark-gray shale beds, few siderite nodules, slightly burrowed, bioturbated in basal 2 ft, thin-bedded.....	9	7
		(611	0)

Unit Number	Description	Thickness (Depth) ft	in.
226.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent medium-dark-gray shale laminae, scattered high-angle fractures, thin- to thick-bedded; base sharp.....	4	6
		(615	6)
227.	Shale, medium-dark-gray, silty, evenly bedded; base sharp.....	0	4
		(615	10)
228.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few pyrite-filled near vertical fractures, burrowed; base sharp.....	0	9
		(616	7)
229.	Shale, dark-gray, carbonaceous, silty, slightly burrowed, evenly bedded, fissile.....	0	8
		(617	3)
230.	Sandstone, light- to medium-light-gray, mottled brownish-gray from 2 ft to 2 ft 6 in. below top, very fine to fine-grained, contains 45 percent quartz; abundant siderite and dark-gray shale clasts and quartz granules from 3 ft to 3 ft 4 in. below top; few dark-gray shale beds from 5 ft 4 in. to 5 ft 8 in. below top, bioturbated in top 2 ft, thin- to thick-bedded; base grades..	7	6
		(624	9)
231.	Conglomerate, contains abundant white quartz granules and pebbles, scattered siderite and dark-gray shale clasts, fine-grained sandstone matrix; base sharp.....	0	6
		(625	3)
232.	Shale, medium- to medium-dark-gray, contains 30 percent light-gray siltstone and very fine grained sandstone laminae and beds, slightly burrowed, evenly bedded; base sharp.....	11	5
		(636	8)
233.	Sandstone, light-gray, fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	0	2
		(636	10)
234.	Siltstone, medium-light-gray, sandy, thin-bedded.....	0	10
		(637	8)
235.	Shale, medium-dark-gray, contains 20 percent medium-light-gray siltstone and very fine grained sandstone laminae, slightly burrowed, evenly bedded; base grades.....	1	6
		(639	2)
236.	Siltstone, medium-light-gray, contains 40 percent medium-dark-gray shale beds, scattered quartz granules in basal 4 in., burrowed, evenly bedded; base grades.....	3	5
		(642	7)

Unit Number	Description	Thickness (Depth) ft	in.
237.	Conglomerate, medium-light-gray, contains abundant subrounded to angular white quartz granules, few dark-gray shale clasts, siltstone matrix.....	0	6
		(643	1)
238.	Shale, medium-dark- to dark-gray, contains 20 percent light-gray very fine grained silty sandstone laminae, few siderite nodules in top 1 in., slightly burrowed, evenly bedded; base sharp.....	1	7
		(644	8)
239.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 10 percent dark-gray shale laminae 4 in. below top, slightly burrowed, thin-bedded.....	0	8
		(645	4)
240.	Shale, medium-dark-gray, contains 40 percent light-gray siltstone and very fine grained sandstone laminae, bioturbated in part, evenly bedded; base grades.....	3	8
		(649	0)
241.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 20 percent medium-dark-gray shale and siltstone laminae, bioturbated, thin and unevenly bedded.....	8	3
		(657	3)
242.	Shale, dark-gray, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded.....	0	2
		(657	5)
243.	Sandstone, medium-light-gray, very fine to fine-grained, finely micaceous, contains 40 percent quartz, bioturbated in part; base grades.....	4	9
		(662	2)
244.	Shale, medium-dark-gray, evenly bedded; base grades.....	0	1
		(662	3)
245.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few high-angle fractures, abundant invertebrate fossils from 10 in. to 18 in. below top; base grades.....	2	0
		(664	3)
246.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, 20 percent dark-gray shale laminae and lenses, few quartz-filled fractures, slightly burrowed, thin-bedded.....	4	4
		(668	7)

Unit Number	Description	Thickness (Depth) ft	in.
247.	Shale, medium- to dark-gray, contains 25 percent light-gray siltstone and very fine grained sandstone laminae, bioturbated in part, evenly bedded.....	1	11
		(670	6)
248.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent medium-dark-gray shale laminae, few medium-dark-gray shale clasts, slightly burrowed, thin- to thick-bedded.....	1	10
		(672	4)
249.	Siltstone, medium- to medium-dark-gray, bioturbated; base grades.....	1	1
		(673	5)
250.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, 20 percent medium-dark-gray siltstone and shale laminae, thin- to thick-bedded; base grades abruptly.....	5	5
		(678	11)
251.	Underclay, medium-gray, contains abundant medium-light-gray siltstone laminae in top 8 in., abundant rootlets and root slicks, few quartz- and pyrite-filled fractures; base grades.....	8	3
		(687	)
252.	Siltstone, medium-gray, few fractures, contorted bedding; base grades.....	1	5
		(689	0)
253.	Underclay, medium-gray, abundant root slicks, few quartz-filled fractures; base grades.....	1	0
		(690	0)
254.	Siltstone, medium-gray, few rootlets, few quartz-filled fractures, unevenly bedded; base grades abruptly.....	2	4
		(692	4)
255.	Sandstone, medium-light-gray, fine- to medium-grained, contains 60 percent quartz, few scattered dark-gray shale clasts, thin-bedded; base sharp.....	0	7
		(692	11)
256.	Shale, medium-dark-gray, contains 30 percent medium-light-gray very fine grained sandstone laminae, evenly bedded, few contorted beds; base grades abruptly.....	0	5
		(693	4)
257.	Sandstone, medium-light-gray, sideritic and mottled brownish-gray in part, fine- to medium-grained, contains 50 percent quartz, thick-bedded; base sharp.....	1	1
		(694	5)

Unit Number	Description	Thickness (Depth) ft	in.
258.	Sandstone, medium-light-gray, very fine to fine-grained contains 50 percent quartz, thick-bedded; base sharp.....	0	8
		(695	1)
259.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, abundant siderite clasts up to 0.5 in. in diameter; base sharp.....	0	6
		(695	7)
260.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, slightly burrowed, mostly contorted bedding; base grades.....	2	4
		(697	11)
261.	Siltstone, medium-light- to medium-gray, few near-vertical fractures, unevenly bedded; base grades.....	13	1
		(711	0)
262.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, slightly burrowed, thin- to thick-bedded; base sharp.....	1	7
		(712	7)
263.	Shale, medium-dark-gray, poor fissility; base sharp.....	0	2
		(712	9)
264.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 40 percent quartz, few medium dark-gray shale clasts 5 in. below top, thick-bedded; base sharp.....	2	6
		(715	3)
265.	Shale, medium-dark-gray, evenly bedded; base grades.....	0	4
		(715	7)
266.	Sandstone, medium-light-gray, fine-grained, contains 40 percent quartz, abundant siderite and dark-gray shale clasts in basal 4 in., thin-bedded; base grades.....	1	1
		(716	8)
267.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few pyrite-filled near-vertical fractures, thick-bedded; base sharp and very uneven.....	5	3
		(721	11)
268.	Underclay, medium- to dark-gray, very carbonaceous, contains few coal laminae, abundant rootlets, highly sheared; base grades.....	3	7
		(725	6)
269.	Sandstone, dark-gray, very fine to medium-grained, pyritic, contains 40 percent quartz, scattered rootlets, nonbedded; base grades.....	0	9
		(726	3)

Unit Number	Description	Thickness (Depth) ft	in.
270.	Underclay, dark-gray, very carbonaceous, pyritic, contains few impure coal lenses, highly sheared; base grades.....	3	3
		(729	6)
271.	Sandstone, medium-light-gray, fine-grained, silty from 3 ft 1 in. to 3 ft 5 in. below top, contains 45 percent quartz, few quartz-filled fractures, contorted bedding; base sharp and uneven.....	5	10
		(735	4)
272.	Shale, medium-dark-gray, silty, evenly bedded.....	0	5
		(735	9)
273.	Sandstone, medium-light-gray, fine-grained, contains 45 percent quartz, highly fractured.....	0	9
		(736	6)
274.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 30 percent dark-gray shale laminae in top 1 ft, few high-angle fractures, thin- to thick-bedded; base sharp.....	3	9
		(740	3)
275.	Shale, medium-dark-gray, silty, contains 20 percent light-gray siltstone and very fine grianed sandstone laminae, contorted bedding; base grades.....	3	9
		(744	0)
276.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 5 percent dark-gray shale laminae, thin-bedded.....	0	5
		(744	5)
277.	Shale, medium- to medium-dark-gray, contains 40 percent light-gray siltstone and very fine grained sandstone beds, slightly burrowed, evenly bedded; base sharp.....	0	9
		(745	2)
278.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-dark-gray shale and siltstone laminae, thin- to thick-bedded.....	3	6
		(748	8)
279.	Shale, medium- to medium-dark-gray, contains 25 percent medium-gray siltstone and very fine grained sandstone beds, evenly bedded.....	0	8
		(749	4)
280.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 25 percent medium-dark-gray shale and siltstone beds, thin- to thick-bedded; base grades.....	1	7
		(750	11)

Unit Number	Description	Thickness (Depth) ft	in.
281.	Shale, medium-dark-gray, silty, contains 40 percent light-gray siltstone and very fine grained sandstone beds, slightly burrowed, evenly and lenticularly bedded.....	13	0
		(763	11)
282.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, abundant dark-gray shale clasts from 3 in. to 8 in. below top, few siderite clasts in basal 1 ft 1 in., scattered well rounded quartz pebbles up to 0.5 in. in diameter in basal 7 in.; base grades.....	1	10
		(765	9)
283.	Sandstone, light- to medium-light-gray, fine- to medium-grained, contains 50 percent quartz, scattered siderite and dark-gray shale clasts in top 2 ft 8 in., thick-bedded to massive; base sharp.....	5	11
		(771	8)
284.	Shale, dark-gray, very carbonaceous, evenly bedded; base sharp....	1	10
		(773	6)
285.	Sandstone, medium-light-gray, medium-grained, contains 50 percent quartz, crossbedded, thick-bedded; base sharp.....	0	7
		(774	1)
286.	Shale, dark-gray, contains 5 percent medium-dark-gray siltstone laminae, evenly bedded, fissile; base grades.....	4	1
		(778	2)
287.	Sandstone, medium-light-gray, light-brownish-gray in top 1 ft 5 in., very fine grained, contains 40 percent quartz, 40 percent dark-gray shale and siltstone laminae, bioturbated.....	1	4
		(779	6)
288.	Shale, medium-dark- to dark-gray, contains 10 percent light-gray siltstone and very fine grained sandstone laminae, few siderite beds in top 1 ft, evenly bedded, fissile.....	13	2
		(792	8)
289.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded.....	0	1.5
		(792	9.5)
290.	Shale, dark-gray, abundant invertebrate fossils 1 ft below top, slightly burrowed, evenly bedded, fissile; base grades abruptly.....	3	10.5
		(796	8)
291.	Sandstone, medium-light-gray, fine-grained, contains 40 percent quartz, dark-gray shale laminae 4 in. below top, thick-bedded; base sharp.....	0	8
		(797	4)

Unit Number	Description	Thickness (Depth) ft	in.
292.	Sandstone, medium-light-gray, mottled brownish-gray and siderite in top 3 in., very fine grained, contains 40 percent quartz, 40 percent dark-gray shale beds, slightly burrowed, thin-bedded; base sharp.....	1	11
		(799	3)
293.	Shale, dark-gray, contains 20 percent light-gray siltstone and very fine grained sandstone laminae, slightly burrowed, evenly bedded.....	1	2
		(800	5)
294.	Siltstone, light-brownish-gray, contains abundant invertebrate fossils.....	0	2
		(800	7)
295.	Shale, medium- to medium-dark-gray, contains 15 percent light- to medium-gray siltstone and very fine grained sandstone laminae, evenly bedded, fair fissility.....	6	10
		(807	5)
296.	Siderite, light-brownish-gray.....	0	2
		(807	7)
297.	Shale, medium- to medium-dark-gray, contains 20 percent light- to medium-gray siltstone and very fine grained sandstone laminae and beds to 1.5 in. thick, slightly burrowed, evenly bedded; base grades.....	4	6
		(812	1)
298.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 40 percent dark-gray shale and siltstone laminae, 1.5 in. thick siderite bed 7 in. below top; base sharp.....	2	6
		(814	7)
299.	Shale, medium-dark-gray, silty, contains 20 percent light-gray siltstone and very fine grained sandstone laminae, slightly burrowed, evenly bedded.....	4	0
		(818	7)
300.	Siderite, brownish-gray.....	0	2
		(818	9)
301.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, 40 percent medium-dark-gray silty shale and siltstone beds, slightly burrowed; base sharp.....	5	7
		(824	4)
302.	Shale, dark-gray, carbonaceous, contains 15 percent light-gray very fine grained sandstone laminae, evenly bedded, fair fissility; base sharp.....	10	5
		(834	9)

Unit Number	Description	Thickness (Depth) ft	in.
303.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 40 percent dark-gray shale laminae and beds, abundant dark-gray shale clasts in basal 1 ft 6 in., slightly burrowed	11	3
		(846	0)
304.	Shale, medium-dark- to dark-gray, silty, contains 10 percent medium-gray siltstone and very fine grained sandstone laminae, slightly burrowed, evenly bedded	5	5
		(851	5)
305.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 40 percent dark-gray shale laminae and beds, slightly burrowed	4	6
		(855	11)
306.	Shale, dark-gray, carbonaceous, evenly bedded, fissile	2	0
		(857	11)
307.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 15 percent medium-dark-gray shale and siltstone laminae, burrowed, thin- to thick-bedded; base sharp	3	6
		(861	5)
308.	Siltstone, medium- to medium-dark-gray, contains 20 percent medium-light-gray very fine grained sandstone laminae, 10 percent dark-gray shale laminae, bioturbated in part; base sharp	6	7
		(868	0)
309.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 10 percent dark-gray shale laminae, abundant dark-gray shale clasts from 7 in. to 9 in. below top; base grades	7	5
		(875	5)
310.	Sandstone, light-gray, mottled light-brownish-gray, fine- to medium-grained, contains 50 percent quartz, few quartz-filled high-angle fractures, thick-bedded; base grades	6	2
		(881	7)
311.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent dark-gray shale laminae, scattered siderite clasts 1 ft 6 in. below top, few quartz-filled high-angle fractures, thin- to thick-bedded	3	5
		(885	0)

BOTTOM OF COREHOLE
TOTAL DEPTH 885 ft

Corehole V-6B (redrill)

Location: Wythe County; Crockett, Va., 7.5 minute quadrangle; approximately 6 ft west of corehole V-6.

Coordinates: Latitude 36°58'03"N Longitude 81°13'45"W

Altitude: 2,731 ft Drilled depth: 270 ft

Dip of strata: Ranges from about 10° to 25° throughout corehole.

Date drilled: November 9, 1982 to November 10, 1982

Core description: K.J. Englund and J.C. Weber

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER MISSISSIPPIAN SERIES		
	Maccrady Shale and Price Formation		
1.	Rotary drilled (no samples recovered).....	240	0
		(240	0)
	Price Formation		
2.	Shale, black, carbonaceous, very carbonaceous in basal 7 in., fissile.....	1	5
		(241	5)
3.	Underclay, medium-gray, contains few coal laminae, scattered rootlets, few high-angle fractures; base grades.....	7	6
		(248	11)
4.	Shale, medium- to medium-dark-gray, contains few quartz-filled high-angle fractures, evenly bedded, contorted bedding from 1 ft 6 in. to 2 ft 6 in. below top, fair fissility.....	5	0
		(253	11)
5.	Coal, impure, highly sheared.....	0	4
		(254	3)
6.	Coal, impure, contains abundant dark-gray shale laminae.....	0	3.5
		(254	6.5)
7.	Coal, dull to bright attritus, impure, highly sheared, few pyrite crystals on fractured surfaces.....	0	5.5
		(255	0)

Unit Number	Description	Thickness (Depth) ft	in.
8.	Coal, impure, contains few dark-gray shale laminae.....	0	2.5
		(255	2.5)
9.	Coal, bright attritus, few dull and impure bands, highly sheared..	0	5.5
		(255	8)
10.	Underclay, black, very carbonaceous.....	0	3
		(255	11)
11.	Coal, Merrimac coal zone - upper split (thickness - 1 ft)		
11a.	Coal, dull to bright attritus, impure, highly sheared.....	0	5
		(256	4)
11b.	Shale, black, carbonaceous, sheared.....	0	2
		(256	6)
11c.	Coal, dull to bright attritus, impure, highly sheared.....	0	5
		(256	11)
12.	Shale, black, contains few coal laminae, pyrite crystals on slickensided surfaces, fissile; base sharp.....	1	2
		(258	1)
13.	Shale, dark-gray to black, contains 50 percent light-gray siltstone and very fine grained sandstone laminae.....	0	9
		(258	10)
14.	Coal, Merrimac coal zone - lower split (thickness - 5 ft 11 in.)		
14a.	Coal, mostly bright attritus, sheared.....	0	4
		(259	2)
14b.	Coal, impure, dull attritus.....	0	1
		(259	3)
14c.	Coal, mostly bright attritus, contains few high-angle fractures, sheared.....	4	9
		(264	0)
14d.	Coal, dull, impure, sheared.....	0	2
		(264	2)
14e.	Coal, bright attritus, sheared.....	0	3
		(264	5)
14f.	Coal, dull, impure, sheared.....	0	1.5
		(264	6.5)
14g.	Coal, bright attritus, sheared.....	0	2.5
		(264	9)

Unit Number	Description	Thickness (Depth) ft	in.
15.	Coal, dull attritus, impure, contains 50 percent dark-gray shale laminae and beds, highly sheared.....	1	3
		(266	0)
16.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, few medium-dark-gray silty shale laminae, thin- to thick-bedded.....	4	0
		(270	0)

BOTTOM OF COREHOLE
TOTAL DEPTH 270 ft

GEOPHYSICAL LOG

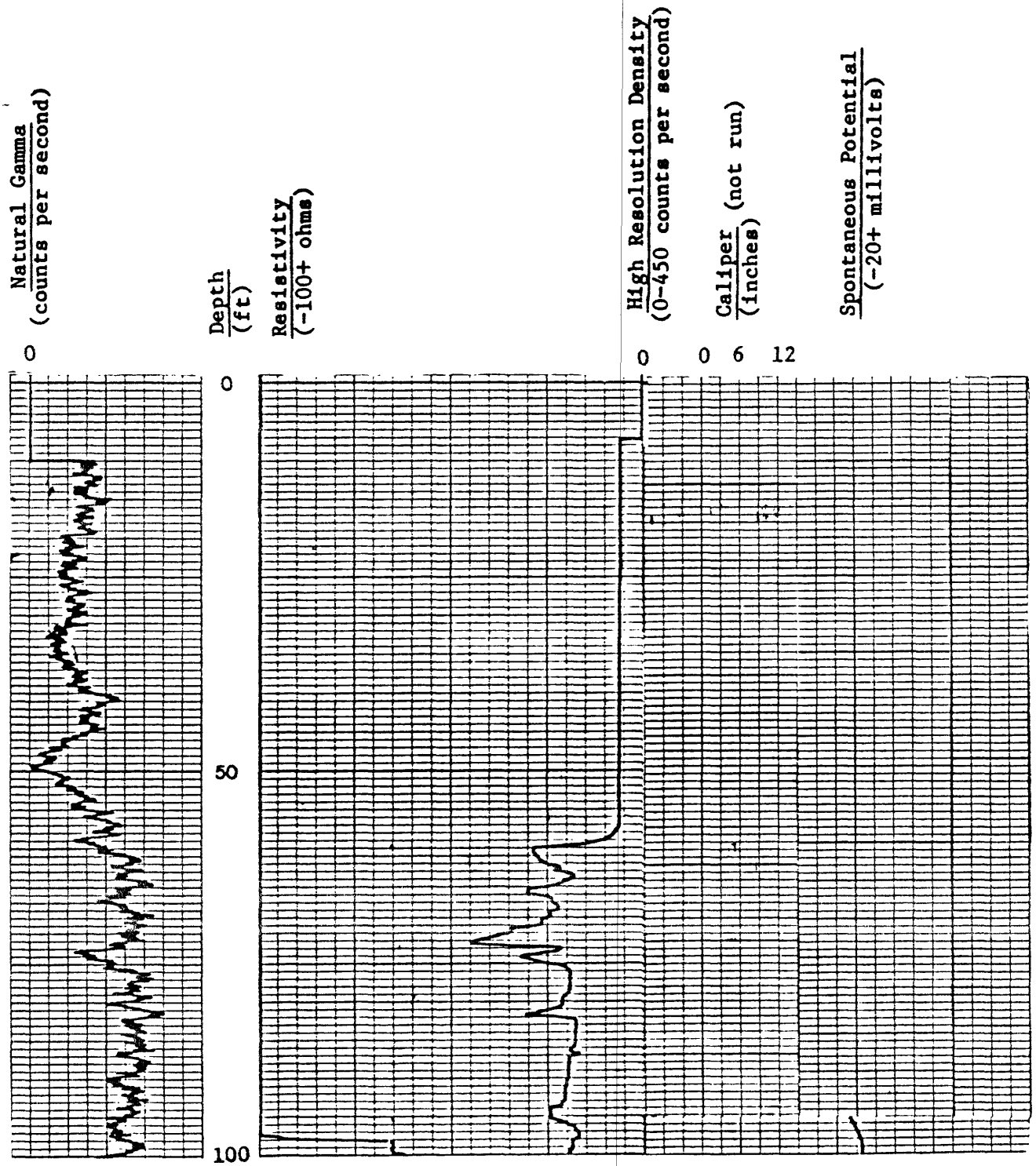
Corehole: V-6 Date: 11/03/82 State: Virginia County: Wythe

Quadrangle: Crockett, Va. Latitude: 36°58'03"N Longitude: 81°13'45"W

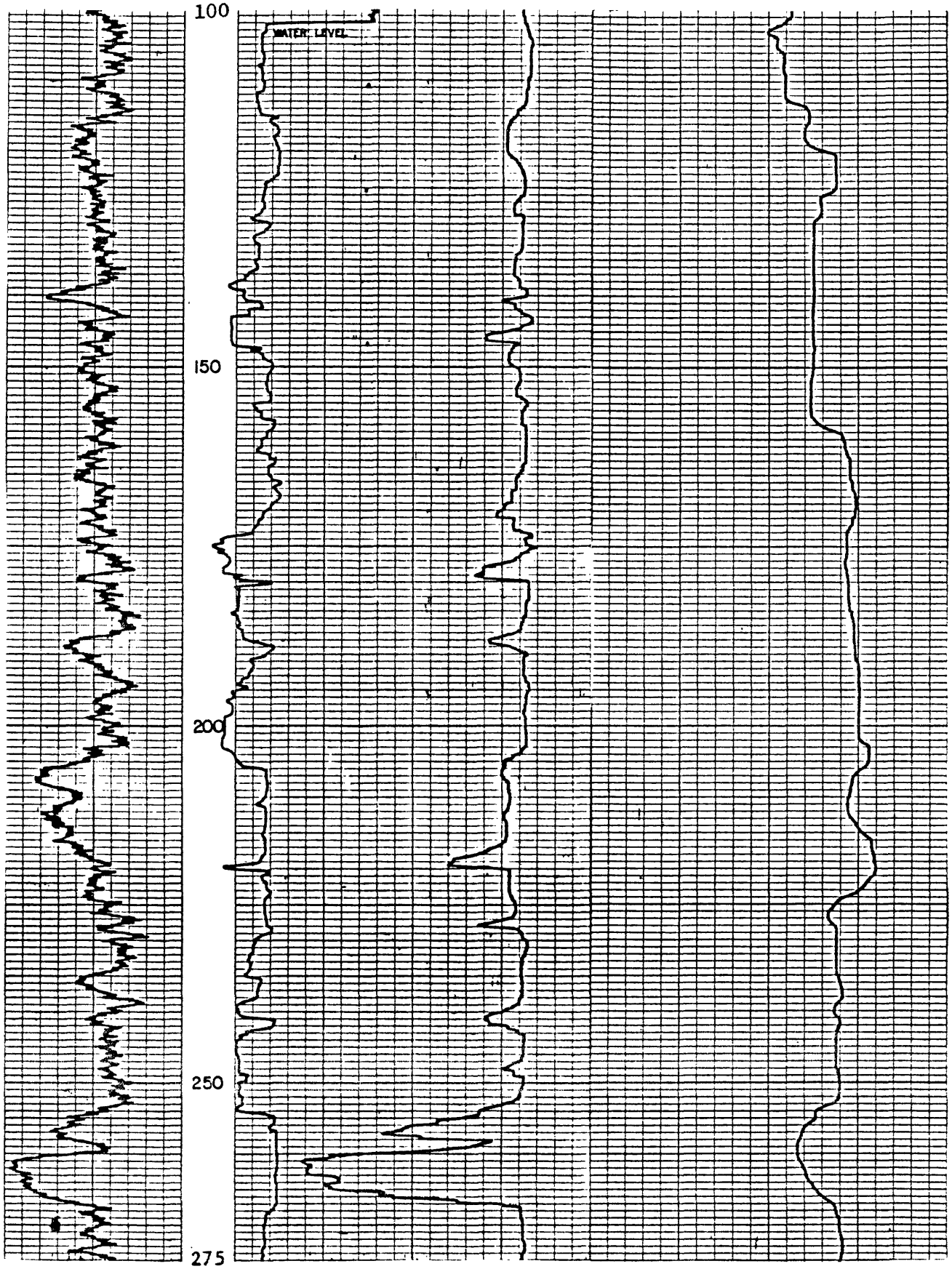
Altitude: 2,731 ft Logged Depth: 885 ft Drilled Depth: 885 ft

Logging Speed: 20 ft/min (SP 30 ft/min) Natural Gamma Time Constant: 1

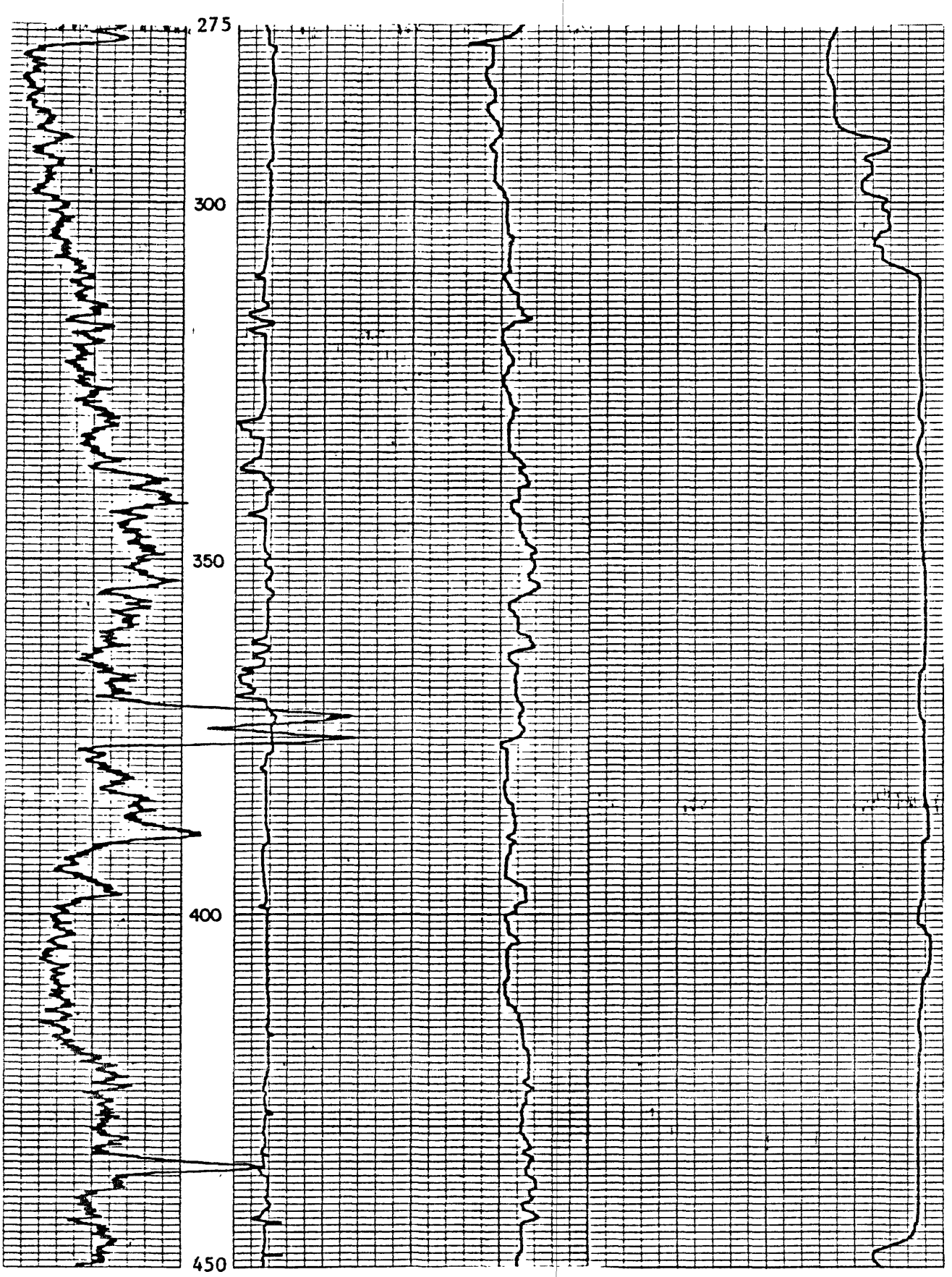
High Resolution Density Time Constant: 1



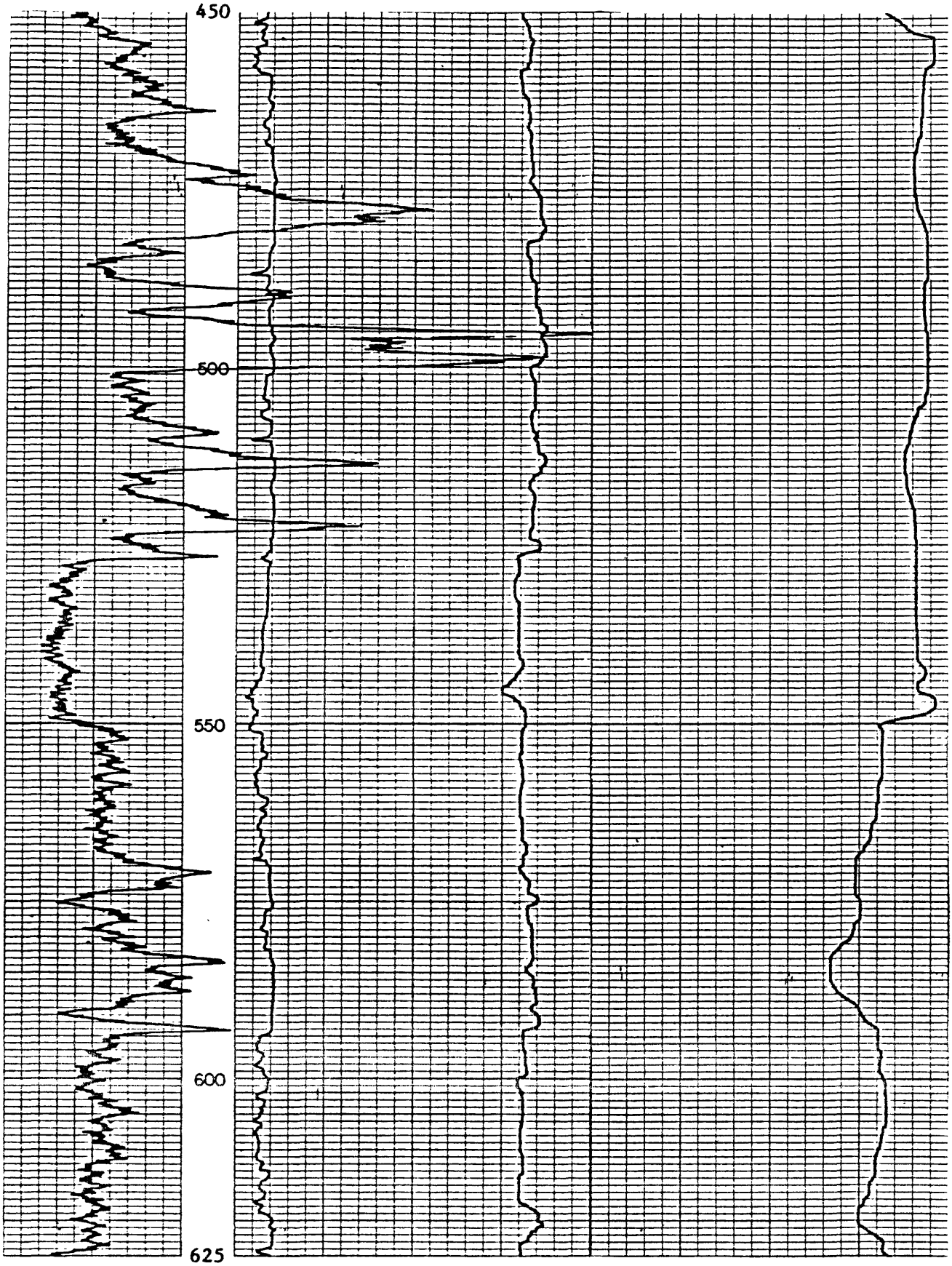
Corehole: V-6 continued



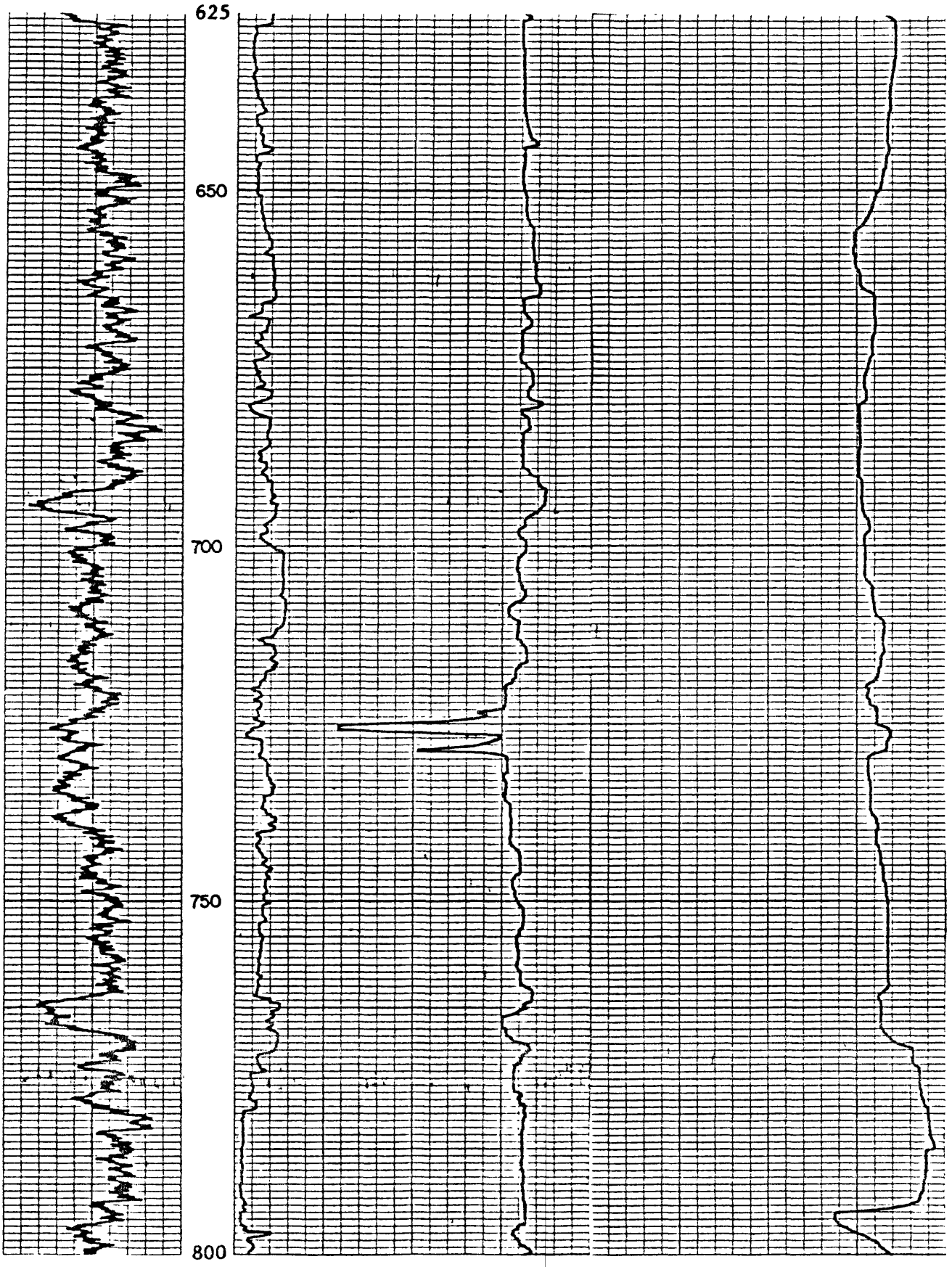
Corehole: V-6 continued



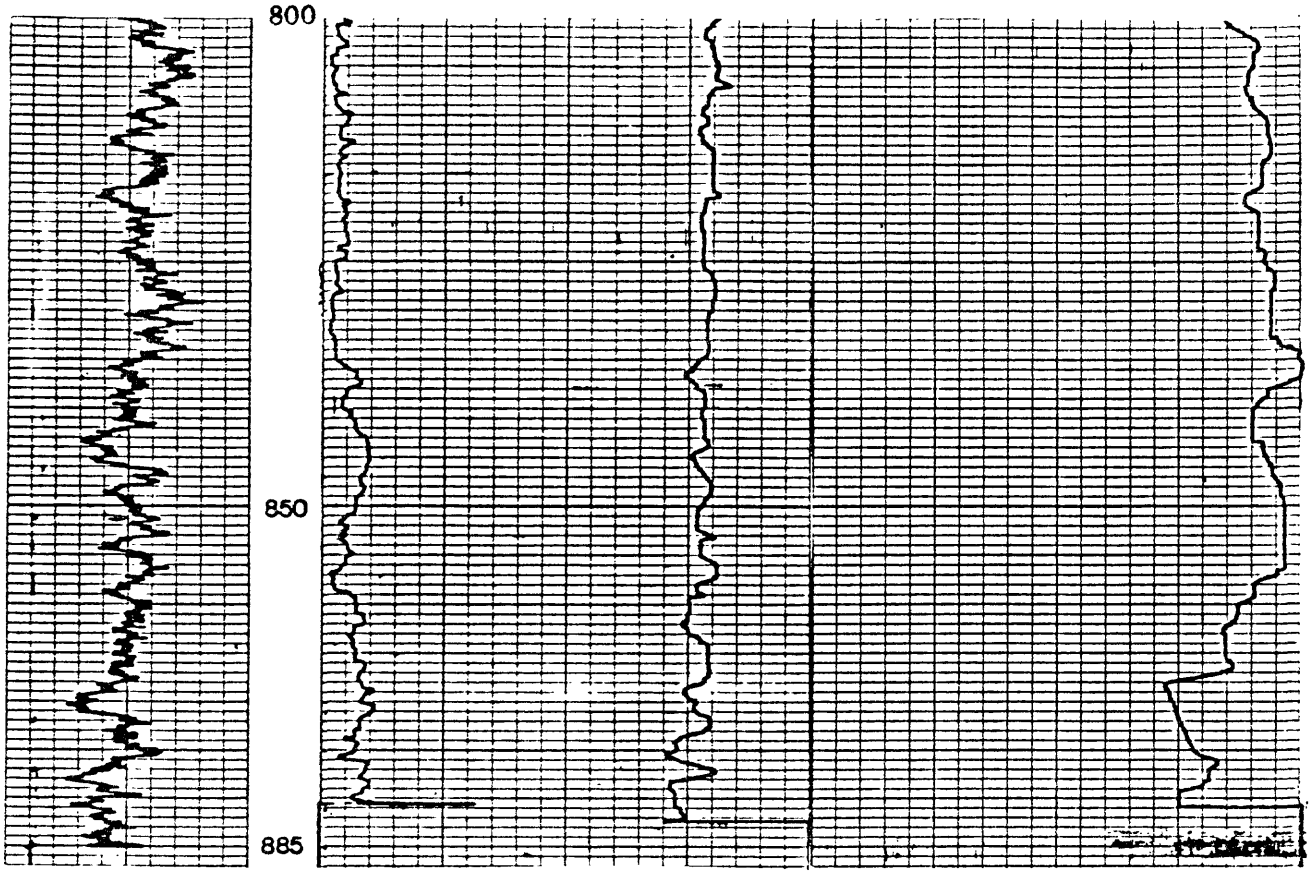
Corehole: V-6 continued



Corehole: V-6 continued

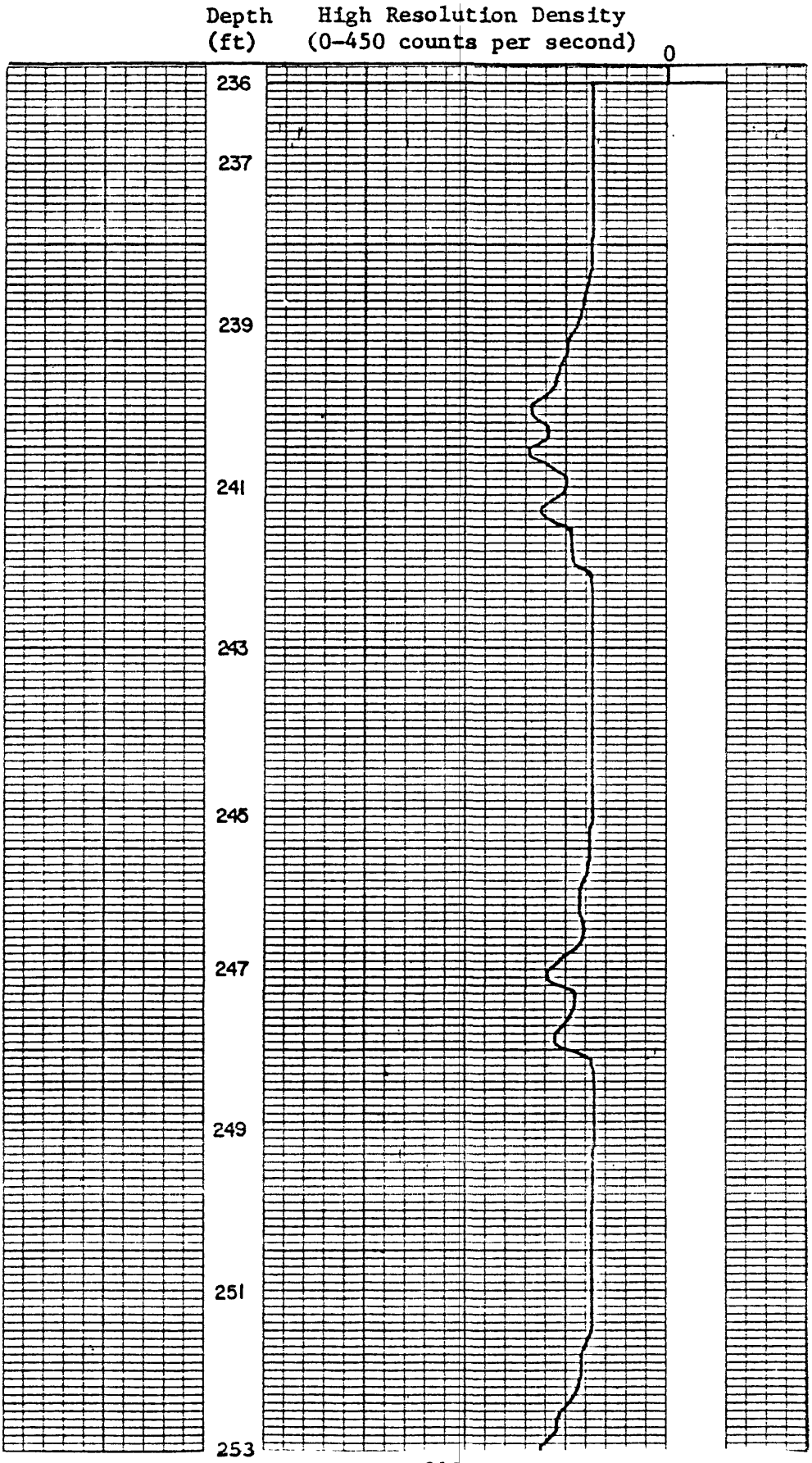


Corehole: V-6 continued

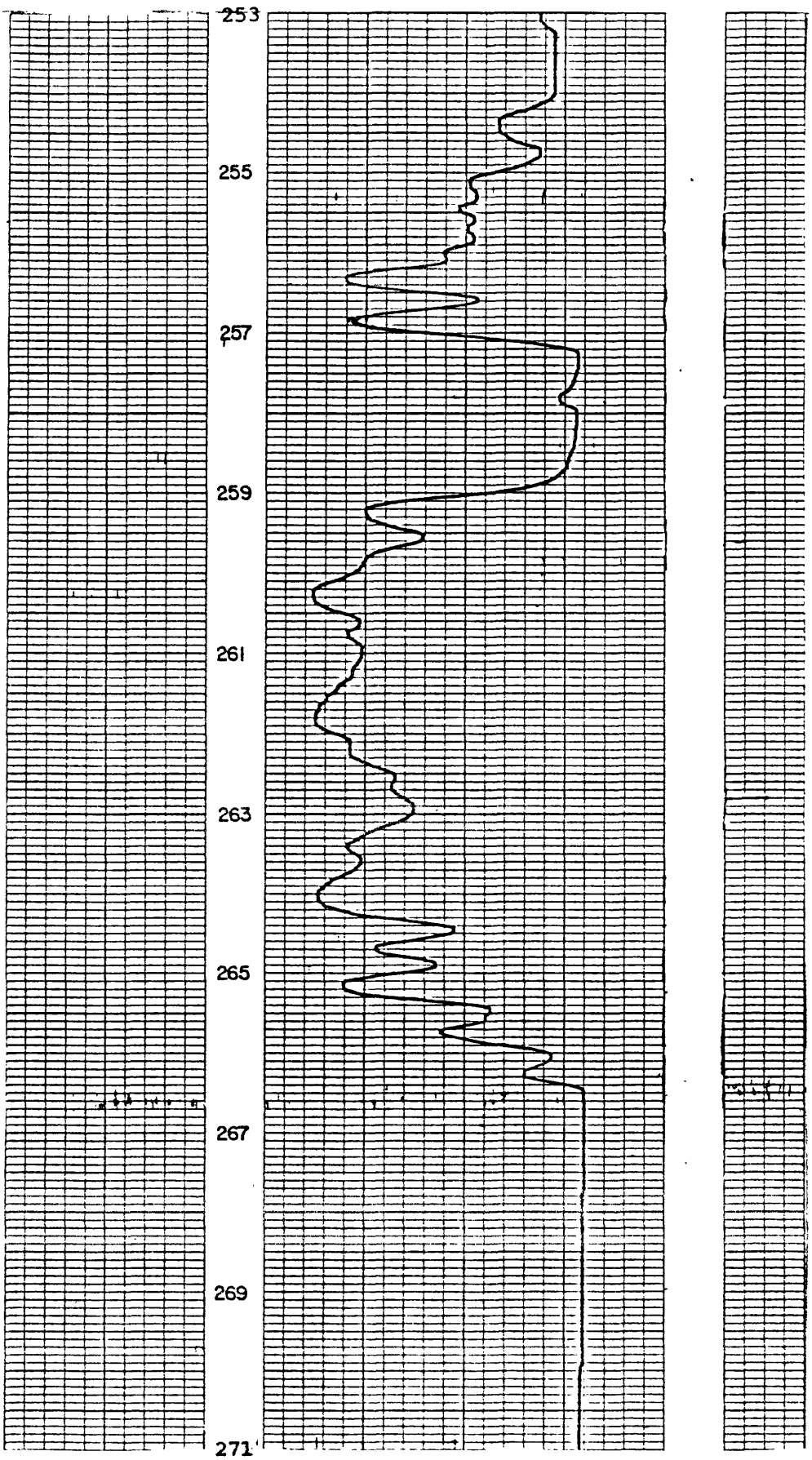


DETAIL LOG

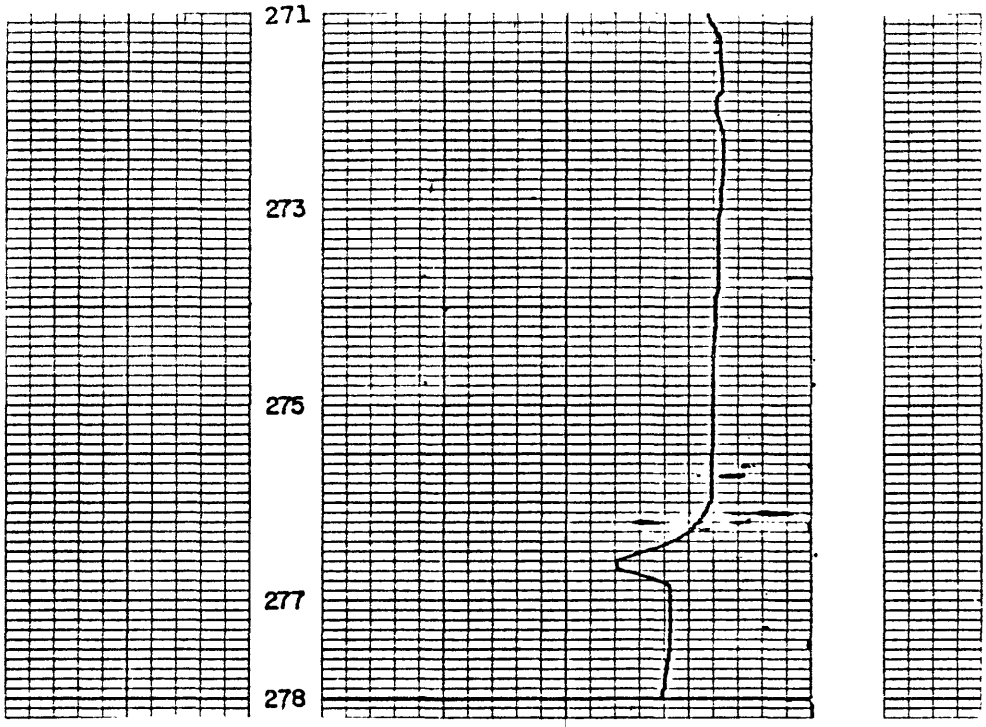
Corehole: V-6 Logging Speed: 5 ft/min Time Constant: 1



Corehole: V-6 continued



Corehole: V-6 continued



Corehole V-7

Location: Wythe County; Rural Retreat, Va., 7.5 minute quadrangle; east of Reed Creek, on a tributary located between Whetstone Hollow and Ann Grubb Hollow, along the south slope of Brushy Mountain. Accessible by State Route 625.

Coordinates: Latitude 36°15'17"N Longitude 81°16'05"W

Altitude: 2,340 ft Drilled depth: 404 ft 7 in.

Dip of strata: Approximately 30° to a depth of 200 ft, decreasing to 20° at the base of the corehole.

Date drilled: October 20, 1982 to October 21, 1982

Core description: J.F. Windolph, Jr., K.J. Englund, and R.E. Thomas

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER MISSISSIPPIAN SERIES		
	Maccrady Shale		
1.	Soil and weathered rock (casing set- no core recovered).....	14	0
		(14	0)
2.	Shale, greenish-gray, mottled grayish-red, partly calcareous, contains scattered greenish-gray siltstone laminae, few calcite-filled high-angle fractures, slightly burrowed, evenly to poorly bedded.....	43	5
		(57	5)
3.	Shale, greenish-gray, fractured.....	1	8
		(59	1)
4.	Shale, greenish-gray to medium-dark-gray, slightly carbonaceous...	1	0
		(60	1)
5.	Mudstone, greenish-gray, few root slicks.....	0	7
		(60	8)
6.	Mudstone, greenish- to medium-dark-gray, slightly silty and carbonaceous, calcareous, few rootlets.....	16	5
		(77	1)
7.	Mudstone, grayish-red to medium-dark-gray, calcareous, pyritic, few plant fragments.....	2	11
		(80	0)

Unit Number	Description	Thickness (Depth) ft	in.
8.	Shale, greenish-gray, mottled grayish-red, very silty and calcareous, scattered light-greenish-gray siltstone and very fine grained sandstone laminae, evenly bedded, slightly burrowed	5	0
		(85	0)
9.	Shale, greenish- to medium-dark-gray, few calcite-filled fractures, evenly bedded	0	4
		(85	4)
10.	Anhydrite (?), light-grayish-brown to olive-gray	0	6
		(85	10)
11.	Shale, greenish-gray, mottled grayish-red from 2 ft 1 in. to 3 ft 9 in. below top, contains few light-greenish-gray siltstone laminae, scattered slickensided fractures, mostly evenly bedded	19	2
		(105	0)
12.	Siltstone, medium-dark-gray, very calcareous, contains few light-greenish-gray fine grained sandstone laminae	2	7
		(107	7)
13.	Shale, dark-greenish-gray, calcareous, contains scattered limestone and anhydrite (?) nodules up to 1 in. in diameter, poorly bedded	1	3
		(108	10)
14.	Siltstone, medium- to medium-dark-gray, contains scattered light-greenish-gray very fine grained sandstone laminae, few calcite-filled high-angled fractures, unevenly bedded	0	8
		(109	6)
15.	Shale, greenish-gray, silty, few calcite-filled high-angle fractures	10	6
		(120	0)
16.	Mudstone, greenish-gray, mottled grayish-red, few slickensided fractures, few rootlets	2	10
		(122	10)
17.	Siltstone, greenish-gray, argillaceous	2	3
		(125	1)
18.	Mudstone, grayish-red, mottled greenish-gray and yellowish brown, slightly calcareous, few rootlets	4	9
		(129	10)
19.	Shale, greenish-gray, contains few limestone and anhydrite nodules and laminae, few slickensided surfaces, poorly bedded	1	2
		(131	0)

Unit Number	Description	Thickness (Depth) ft	in.
20.	Shale, greenish-gray, silty, contains scattered anhydrite (?) nodules, evenly bedded	7	0
		(138	0)
21.	Mudstone, greenish-gray, mottled grayish-red, slightly carbonaceous rootlets	2	0
		(140	0)
22.	Shale, greenish-gray, poorly bedded	10	1
		(150	1)
23.	Shale, greenish-gray to medium-dark-gray, slightly carbonaceous, contains few light-greenish-gray very fine grained sandstone laminae, few rootlets, poorly bedded	5	3
		(155	4)
24.	Shale, greenish-gray, contains scattered light-greenish-gray siltstone laminae in basal 6 ft 9 in., poorly bedded; base sharp	9	5
		(164	9)
	Price Formation		
25.	Shale, dark-gray to black, very carbonaceous, pyrite and calcite along slickensided fractures, fissle	0	10
		(165	7)
26.	Shale, medium-dark-gray, silty, few high-angled fractures, sandy at base	3	4
		(168	11)
27.	Shale, medium-dark-gray, contains 45 percent medium-light-gray siltstone and very fine grained sandstone laminae, burrowed	2	0
		(170	11)
28.	Shale, medium-dark-gray, slightly carbonaceous, pyritic, contains few medium-light-gray siltstone and very fine grained sandstone laminae, evenly bedded	6	1
		(177	0)
29.	Shale, medium-dark-gray, few rootlets, faintly bedded, base uneven	4	4
		(181	4)
30.	Sandstone, medium-light-gray, fine to- medium-grained, contains 50 percent quartz, very calcareous, few angular shale clasts, few dark-gray shale, laminae, few calcite-filled fractures, slightly burrowed; base uneven	0	7
		(181	11)
31.	Underclay, medium-dark-gray, abundant rootlets	5	6
		(187	5)

Unit Number	Description	Thickness (Depth) ft	in.
32.	Sandstone, medium-light-gray, mottled brownish-gray, silty, very fine grained, contains 50 percent quartz, calcite and pyrite along high-angle fractures, poorly bedded, few rootlets....	3	9
		(191	2)
33.	Sandstone, medium-light-gray, very fine grained, silty, calcareous, contains 45 percent quartz, scattered medium-dark-gray shale laminae, pyrite along high-angle fractures, unevenly bedded.....	8	10
		(200	0)
34.	Siltstone, medium-gray, contains 45 percent dark-gray carbonaceous shale laminae, pyrite-filled high-angle fractures, burrowed, thin and unevenly bedded; base sharp.....	3	1
		(203	1)
35.	Sandstone, medium-light-gray, fine-grained, contains 45 percent quartz, few dark-gray carbonaceous shale laminae, thin-bedded; base sharp.....	0	7
		(203	8)
36.	Coal, dull attritus, pyritic.....	0	0.25
		(203	8.25)
37.	Shale, dark-brownish-gray, silty, few pyrite-filled fractures.....	0	6.75
		(204	3)
38.	Shale, dark-gray, silty, carbonaceous contains 45 percent medium-gray siltstone and sandstone laminae, few laminae.....	15	0
		(219	3)
39.	Shale, dark-gray, very carbonaceous, pyritic along high-angle fractures.....	0	3
		(219	6)
40.	Coal, dull and bright attritus, pyritic, sheared.....	0	2
		(219	8)
41.	Underclay, medium-dark- to dark-gray, rootlets, pyritic.....	1	2
		(220	10)
42.	Coal, dull attritus, impure, pyritic.....	0	7
		(221	5)
43.	Underclay, medium- to medium-dark-gray, contains few medium-light-gray siltstone laminae, rootlets.....	2	6
		(223	11)
44.	Shale, medium-dark- to dark-gray, very carbonaceous, contains few siltstone laminae at base, evenly bedded.....	5	3
		(229	2)

Unit Number	Description	Thickness (Depth) ft	in.
45.	Siltstone, medium-gray, pyritic, contains 45 percent dark-gray shale laminae, few coal laminae, thin and unevenly bedded.....	1	6
		(230	8)
46.	Shale, medium-dark-gray, pyritic, silty, few calcite-filled high-angle fracture, evenly bedded.....	4	6
		(235	2)
47.	Siltstone, medium-gray, argillaceous, few dark-gray shale laminae, crossbedded, evenly bedded.....	4	3
		(239	5)
48.	Sandstone, medium-light- to medium-gray, fine- to medium-grained, contains 55 percent quartz, abundant medium-dark-gray shale laminae from 7 in. to 1 ft 8 in. below top, few coal laminae 3 ft 3 in. below top, scattered coal and dark-gray shale clasts in basal 8 ft 5 in., thin- to thick-bedded; base sharp and uneven.....	17	7
		(257	0)
49.	Shale, medium-dark-gray, slightly carbonaceous, evenly bedded.....	0	10
		(257	10)
50.	Sandstone, medium-light-gray, fine-grained, contains 50 percent quartz, few calcaite-filled high-angle fractures, few coal laminae 1 in. below top.....	0	10
		(258	8)
51.	Shale, medium- to medium-dark-gray, slightly carbonaceous, contains few medium-light-gray siltstone and very fine grained, laminae in basal 1 ft, few rootlets, faintly bedded.....	3	0
		(261	8)
52.	Shale, dark-gray, very carbonaceous, few rootlets.....	0	2
		(261	10)
53.	Coal, dull attritus, sheared.....	0	6
		(262	4)
54.	Underclay, dark-gray, abundant rootlets, few slickensided surfaces.....	0	3
		(262	7)
55.	Shale, dark-gray, very carbonaceous, pyritic, contains 45 percent medium-light-gray siltstone and very fine grained sandstone laminae, burrowed, few small-scale slump structures; grades to 0.5 in. thick, impure coal at base	1	8
		(264	3)
56.	Underclay, medium- to medium-dark-gray, abundant rootlets, includes 1 in. of pyritic coal 6 ft 6 in. below top, faintly bedded.....	7	8
		(271	11)

Unit Number	Description	Thickness (Depth) ft	in.
57.	Coal, dull attritus, impure, sheared	0	4
		(272	3)
58.	Sandstone, medium-light-gray, fine- to medium-grained, contains 45 percent quartz, 2 in. thick coal clast at 4 in. below top, abundant siderite and coal clasts in basal 1 ft, thin- to thick-bedded; base sharp and uneven	6	10
		(279	1)
59.	Shale, medium-dark-gray, slightly carbonaceous, few calcite-filled high-angle fractures, few rootlets in top 1 ft, evenly bedded	4	0
		(283	1)
60.	Underclay, medium-dark-gray, few siderite nodules, abundant rootlets	4	5
		(287	6)
61.	Coal, dull to bright attritus	0	1
		(287	7)
62.	Shale, dark-gray, very carbonaceous, pyritic, evenly bedded	0	3
		(287	10)
63.	Coal, dull to bright attritus, few fusain laminae, pyritic, contains few dark-gray shale laminae in basal 1 in	0	5
		(288	3)
64.	Shale, medium-dark-gray, contains abundant medium-gray siltstone laminae, few pyrite and calcite-filled high-angle fractures, few small-scale slump structures, few rootlets in top 1 ft, evenly bedded	5	8
		(293	11)
65.	Siltstone, medium-light- to medium-gray, contains few dark-gray shale laminae, scattered impure coal laminae 6 in. above base, few calcite- and pyrite-filled fractures, thin and unevenly bedded	3	10
		(297	9)
66.	Shale, medium- to medium-dark-gray, silty, contains few medium-gray siltstone laminae 3 ft above base, few pyrite- and calcite-filled fractures, evenly bedded	11	0
		(308	9)
67.	Shale, medium- to medium-dark-gray, contains few medium-gray siltstone laminae in basal 2 ft 6 in., pyrite and calcite along fractures, evenly thick-bedded	6	6
		(315	3)

Unit Number	Description	Thickness (Depth) ft	in.
	Merrimac(?) Coal Zone (units 68-77)		
68.	Coal, mostly dull attritus, impure, sheared.....	0	6
		(315	9)
69.	Shale, medium-dark- to dark-gray, pyritic, contains 20 percent impure coal laminae, sheared.....	1	8
		(317	5)
70.	Coal, dull attritus, impure, fractured.....	0	7
		(318	0)
71.	Shale, dark-gray, very carbonaceous, pyritic.....	0	2
		(318	2)
72.	Coal, dull attritus, impure, sheared.....	0	5
		(318	7)
73.	Shale, medium-dark- to dark-gray, carbonaceous, slightly silty, few rootlets, evenly to nonbedded.....	2	8
		(321	3)
74.	Coal, mostly dull to bright attritus, flaky.....	0	6
		(321	9)
75.	Coal, bright attritus, sheared.....	1	3
		(323	0)
76.	Coal, mostly dull attritus, impure, sheared.....	0	5
		(323	5)
77.	Coal, mostly bright attritus, slightly impure in basal 4 in., sheared.....	0	6
		(323	11)
78.	Underclay, medium-gray, pyritic, scattered medium-gray contains siltstone laminae in basal 1 ft, few high-angle fractures, abundant rootlets.....	2	11
		(326	10)
79.	Sandstone, medium-light- to light-gray, very fine to fine-grained, contains 40 percent quartz, few calcite-filled vertical fractures..	0	8
		(327	6)
80.	Shale, medium-dark-gray, evenly bedded.....	0	9
		(328	3)
81.	Siltstone, medium-gray, contains few dark-gray shale laminae.....	1	0
		(329	3)

Unit Number	Description	Thickness (Depth) ft	in.
82.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few quartz- and calcite-filled fractures up to 0.25 in. thick	1	7
		(330	10)
83.	Shale, medium-dark-gray, very silty in top 10 in., carbonaceous in basal 8 in., evenly bedded	1	8
		(332	6)
	Longhorne (?) Coal Zone (units 84-88)		
84.	Coal, mostly dull attritus, impure, sheared	0	7
		(333	1)
85.	Sandstone, medium-dark-gray, fine-grained, contains 50 percent quartz, abundant dark-gray shale laminae, few siderite nodules at 1 ft 2 in. below top; base sharp	1	7
		(334	8)
86.	Coal, mostly dull attritus, flaky, sheared	0	5.5
		(335	1.5)
87.	Coal, dull attritus, impure, sheared	0	1
		(335	2.5)
88.	Coal, bright attritus, sheared	1	0.5
		(336	3)
89.	Sandstone, medium-dark-gray, very fine to fine-grained, silty, micaceous, pyritic, contains 45 percent quartz, few rootlets; base sharp	0	6
		(336	9)
90.	Shale, medium- to medium-dark-gray, silty, few rootlets, unevenly bedded; base grades	0	11
		(337	8)
91.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, unevenly bedded; base sharp	0	2
		(337	10)
92.	Shale, medium- to medium-dark-gray, very silty, unevenly bedded	0	5.5
		(338	3.5)
93.	Sandstone, light- to medium-light-gray, fine-grained, slightly micaceous, contains 50 percent quartz, thick-bedded to massive; base sharp	14	3.5
		(352	7)
94.	Sandstone, medium-dark-gray, very fine to fine-grained, silty, contains 45 percent quartz; base grades	0	3
		(352	10)

Unit Number	Description	Thickness (Depth) ft	in.
95.	Sandstone, light-gray, fine- to medium-grained, slightly silty, micaceous, contains 45 percent quartz, few scattered quartz granules in top 3 in., mostly thin-bedded; base sharp.....	6	0
		(358	10)
96.	Shale, medium-gray, evenly bedded; base sharp.....	0	3
		(359	1)
97.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent dark-gray shale laminae, few calcite-filled high-angle fractures, thin-bedded; base sharp.....	0	6
		(359	7)
98.	Shale, medium-gray, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, slightly burrowed, unevenly bedded; base grades abruptly.....	3	3
		(362	10)
99.	Sandstone, light-gray to light-brownish-gray, very fine grained, contains 40 percent quartz, unevenly bedded; base sharp.....	0	2
		(363	0)
100.	Shale, medium-gray, silty, contains 20 percent medium-light-gray siltstone laminae, slightly burrowed; base grades.....	2	2
		(365	2)
101.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, thin-bedded; base sharp.....	0	7
		(365	9)
102.	Shale, medium-gray, evenly bedded.....	1	1
		(366	10)
103.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base grades.....	2	3
		(369	1)
104.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, crossbedded, thin- to thick-bedded; base sharp....	1	4
		(370	5)
105.	Shale, medium-gray, evenly bedded, base sharp.....	0	3
		(370	8)
106.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz; base sharp.....	0	5
		(371	1)
107.	Shale, medium-dark-gray, evenly bedded; base sharp.....	0	4
		(371	5)

Unit Number	Description	Thickness (Depth) ft	in.
108.	Sandstone, light- to medium-light-gray, mottled brownish-gray from 3 in. to 5 in. below top, very fine to fine-grained, contains 50 percent quartz, scattered calcite-filled high-angle fractures, thin- to thick-bedded; base sharp.....	6	10
		(378	3)
109.	Shale, medium-dark- to dark-gray, evenly bedded; base grades.....	0	6
		(378	9)
110.	Sandstone, medium-light- to light-gray, very fine to fine-grained, contains 45 percent quartz, thin- to thick-bedded; base sharp.....	3	5
		(382	2)
111.	Shale, medium-dark-gray, evenly bedded; base grades.....	3	4
		(385	6)
112.	Shale, medium-dark- to dark-gray, contains 25 percent light-gray siltstone and very fine grained sandstone laminae, slightly burrowed, evenly bedded; base sharp.....	5	4
		(390	10)
113.	Sandstone, light- to medium-light-gray, fine-grained, micaceous, contains 50 percent quartz, thick-bedded; base grades.....	8	7
		(399	5)
114.	Sandstone, light-gray, medium- to coarse-grained, contains 50 percent quartz, 10 percent feldspar, few scattered dark-gray shale clasts; base sharp.....	0	9
		(400	2)
115.	Sandstone, medium-light-gray, fine-grained, contains 50 percent quartz, few siderite clasts 2 in. from top, thick-bedded to massive.....	4	5
		(404	7)

BOTTOM OF HOLE
TOTAL DEPTH 404 ft 7 in.

GEOPHYSICAL LOG

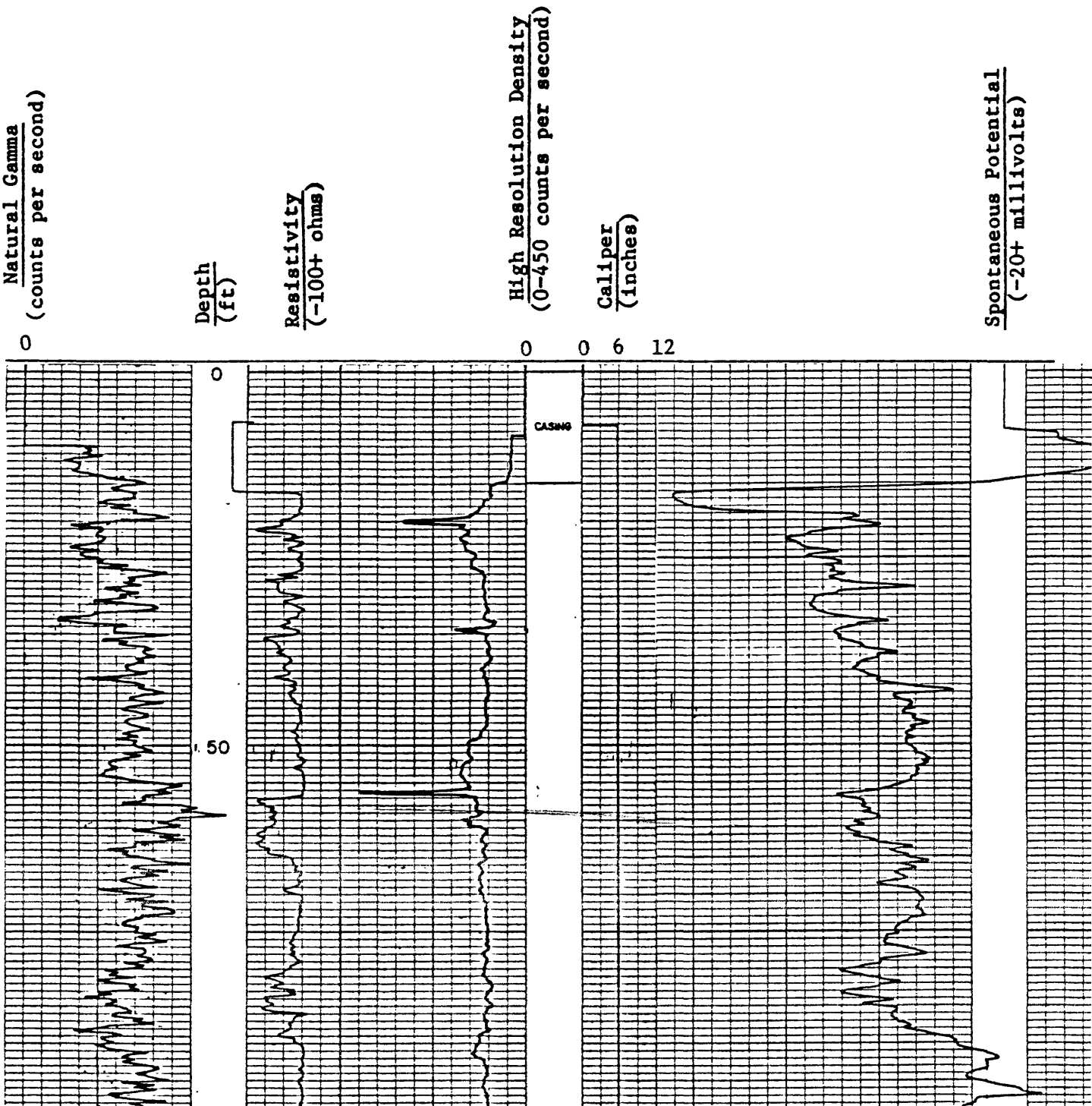
Corehole: V-7 Date: 10/22/82 State: Virginia County: Wythe

Quadrangle: Rural Retreat, Va. Latitude: 36°15'17"N Longitude: 81°16'05"W

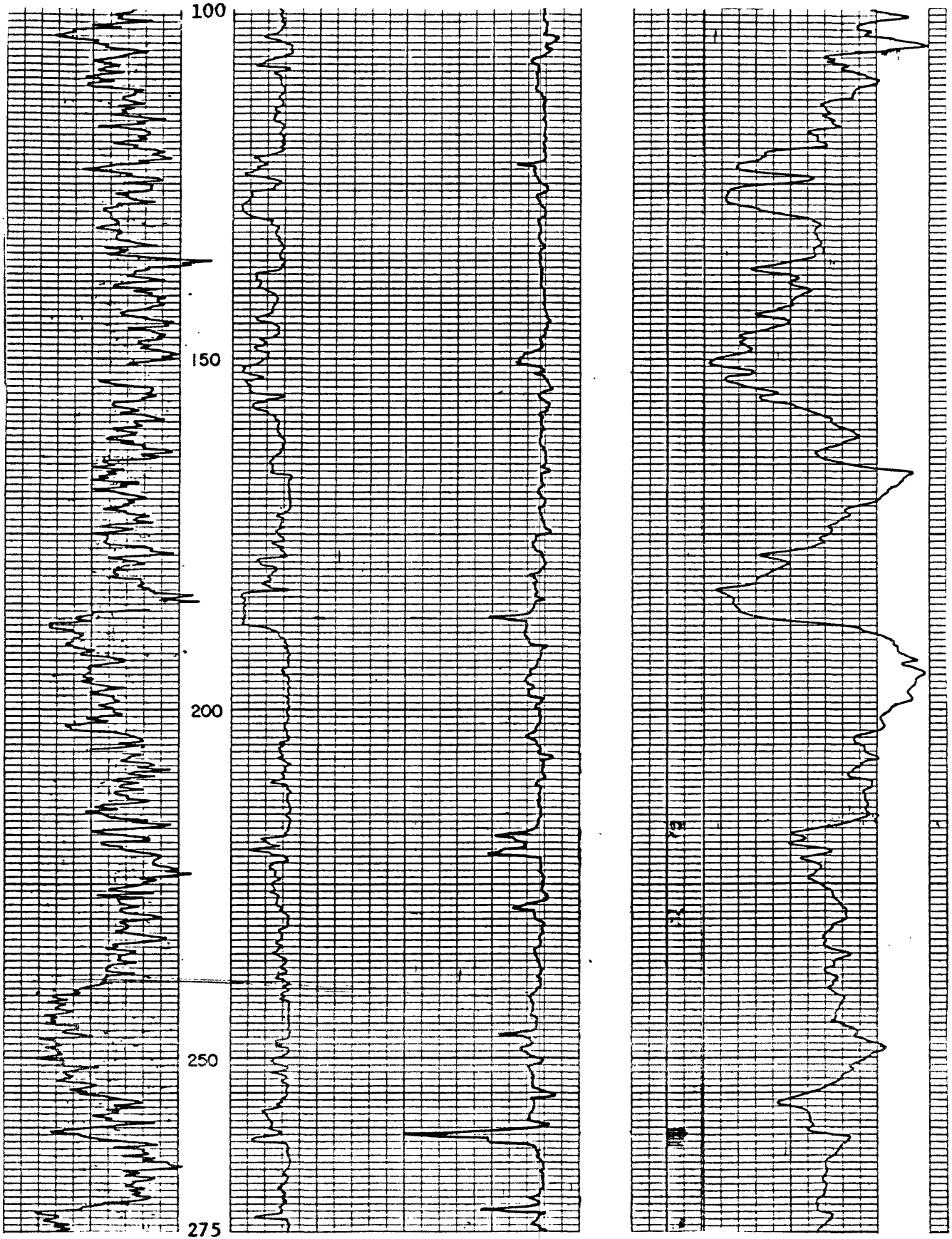
Altitude: 2,340 ft Logged Depth: 402 ft Drilled Depth: 404 ft 7 in.

Logging Speed: 20 ft/min (SP 30 ft/min) Natural Gamma Time Constant: 1

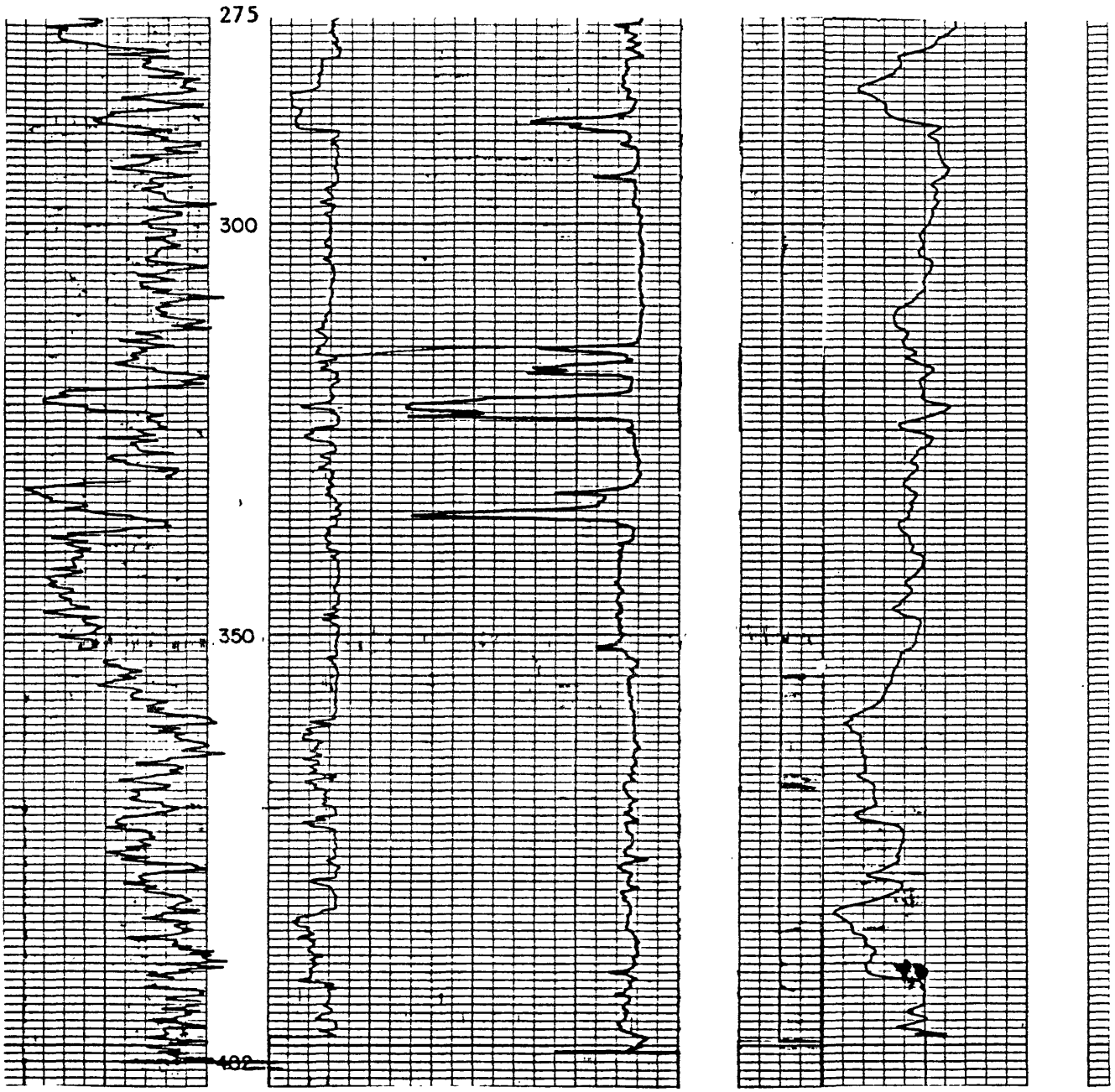
High Resolution Density Time Constant: 1



Corehole: V-7 continued

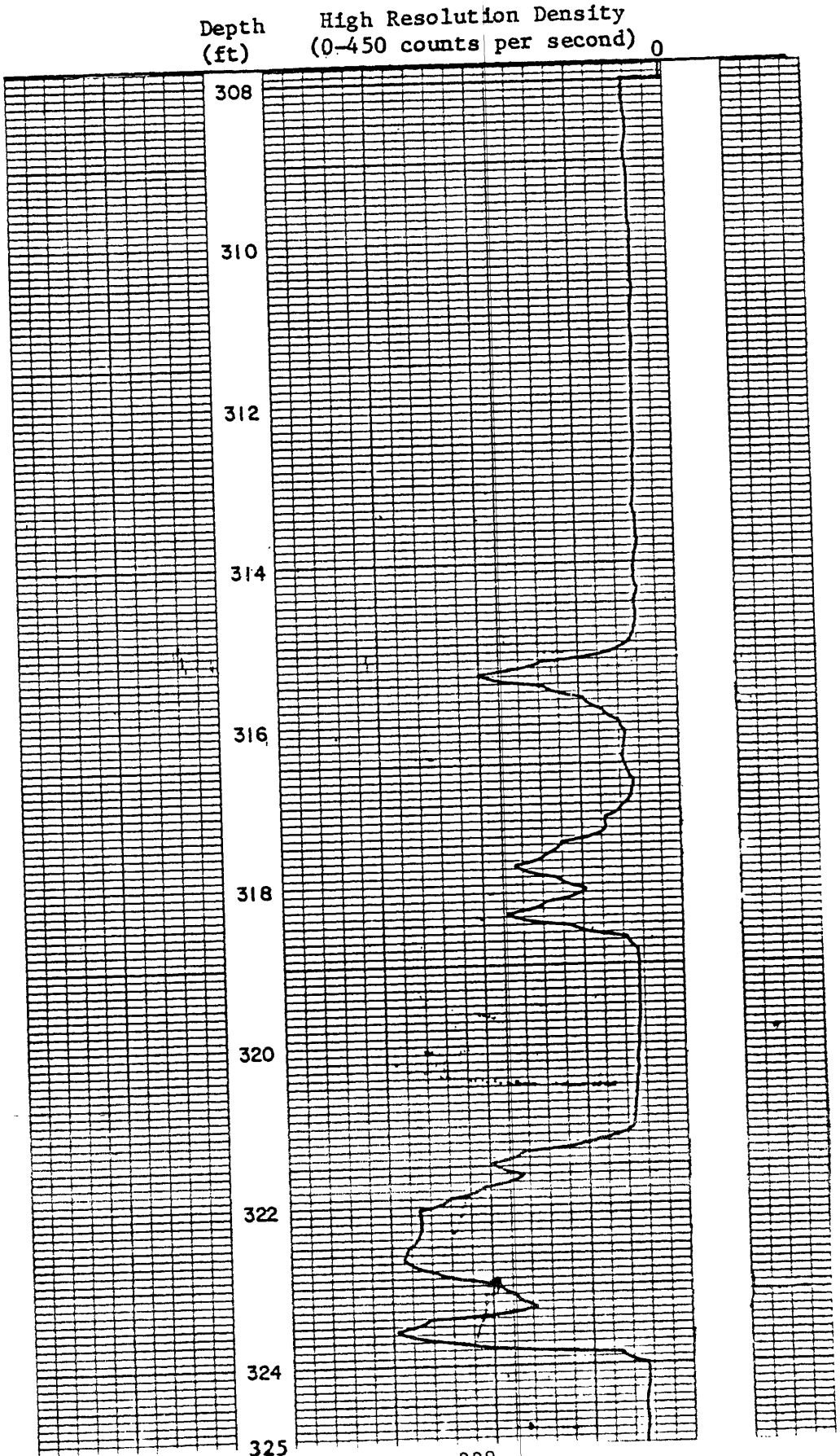


Corehole: V-7 continued

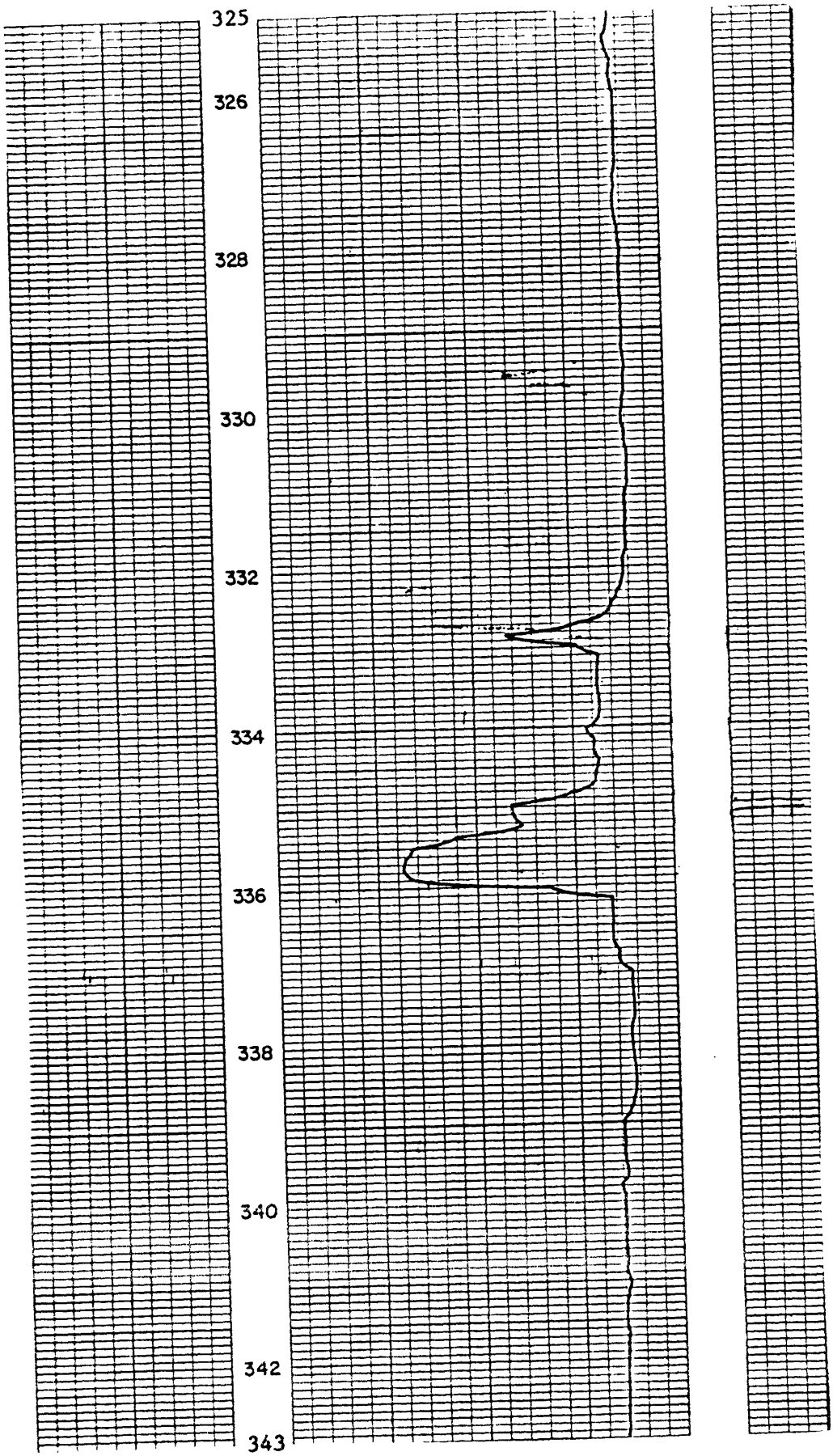


DETAIL LOG

Corehole: V-7 Logging Speed: 5 ft/min Time Constant: 1



Corehole: V-7 continued



Corehole V-8

Location: Botetourt County; Catawba, Va., 7.5 minute quadrangle; approximately 0.75 mi northwest of Little Catawba Creek, near the intersection of State Routes 600 and 770 on the east flank of North Mountain. Accessible by unimproved road extending northwestward from State Route 600.

Coordinates: Latitude 37°28'44"N Longitude 80°00'45"W

Altitude: 1,662 ft Drilled depth: 1,200 ft

Dip of strata: Mostly about 50° throughout the corehole.

Date drilled: December 23, 1982 to January 2, 1983

Core description: K.J. Englund, J.F. Windolph, Jr., R.E. Thomas, J.C. Weber, and J.W. Dryden

Unit Number	Description	Thickness (Depth) ft	in.
	MIDDLE AND UPPER CAMBRIAN SERIES		
	Elbrook Formation		
1.	Soil and weathered rock (casing set - no core recovered).....	90	0
		(90	0)
2.	Dolomite, light-brownish-gray, microcrystalline, few calcite nodules and high-angle fractures; base grades.....	14	0
		(104	0)
3.	Dolomite, very light to light-gray, microcrystalline, few calcite nodules 6 ft below top, scattered high-angle calcite-filled fractures; base grades.....	12	0
		(116	0)
4.	Dolomite, very light gray, microcrystalline, few stylolites, massive, ribbon-bedded in part; base sharp.....	5	10
		(121	10)
5.	Dolomite, very light gray, microcrystalline, few calcite-filled high-angle fractures, massive; base grades.....	8	8
		(130	6)
6.	Dolomite, light- to medium-gray, very finely crystalline, few small calcite nodules, massive, few contorted beds; base grades.....	7	5
		(137	11)
7.	Dolomite, white to very light gray, very finely crystalline, scattered stylolites and high-angle fractures, massive; base grades.....	45	3
		(183	2)
8.	Dolomite, light-brownish-gray, very finely crystalline, scattered high-angle fractures, massive; base grades.....	5	0
		(188	2)

Unit Number	Description	Thickness (Depth) ft	in.
9.	Dolomite, white to very light gray, microcrystalline, few stylolites and high-angle fractures, massive; base grades.....	31	0
		(219	2)
10.	Dolomite, light-gray, very finely crystalline, few high-angle fractures, thin- to thick-bedded; base grades.....	52	4
		(271	6)
11.	Dolomite, very light gray, very finely crystalline, brecciated and recemented from 13 ft 9 in. to 15 ft below top, scattered high-angle fractures, massive, few contorted beds; base grades.....	44	8
		(316	2)
12.	Dolomite, medium-light-gray, very finely to finely crystalline, thin-bedded; base sharp.....	1	11
		(318	1)
13.	Dolomite, very light to light-gray, very finely crystalline, contains few medium-gray dolomitic shale laminae in basal 4 in., brecciated and recemented from 79 ft 3 in. to 79 ft 9 in. below top, few high-angle calcite-filled fractures, thin- to thick-bedded; base grades.....	109	0
		(427	1)
14.	Shale, medium-gray, dolomitic, contains 10 percent light-gray dolomite beds, evenly bedded; base sharp.....	1	3
		(428	4)
15.	Dolomite, very light gray, very finely crystalline, few high angle calcite-filled fractures, thin- to thick-bedded; base sharp.....	4	8
		(433	0)
16.	Dolomite, light-gray, very finely crystalline, contains few medium-gray dolomitic shale laminae in basal 6 in., evenly bedded.....	2	7
		(435	7)
17.	Dolomite, medium-gray, very finely crystalline, contains 10 percent medium-gray dolomitic shale laminae from 2 ft 10 in. to 3 ft 5 in. below top; thin, nodular bedding; base grades.....	4	7
		(440	2)
18.	Dolomite, light-gray, very finely crystalline, scattered high-angle calcite-filled fractures, thick-bedded to massive; base grades.....	24	9
		(464	11)

Unit Number	Description	Thickness (Depth) ft	in.
19.	Dolomite, light-gray, very finely crystalline, contains 25 percent medium-gray dolomitic shale laminae, thin and evenly bedded.....	8	0
		(472	11)
20.	Dolomite, light-gray, very finely crystalline, few stylolites, massive, nodular-bedding in basal 4 ft; base grades.....	11	3
		(484	2)
21.	Dolomite, light-gray, very finely crystalline, contains 45 percent medium-gray dolomitic shale laminae; base grades.....	3	6
		(487	8)
22.	Dolomite, light-gray, very finely crystalline, contains few medium-gray dolomitic shale laminae; base grades.....	1	2
		(488	10)
23.	Dolomite, light-gray, very finely crystalline, few high-angle calcite-filled fractures, mostly nodular bedding; base sharp.....	5	8
		(494	6)
24.	Dolomite, medium-light-gray, very finely crystalline, contains 20 percent medium-dark-gray dolomitic shale laminae, scattered calcite-filled fractures, contorted bedding; base grades.....	1	1
		(495	7)
25.	Dolomite, medium-light- to medium-gray, very finely to finely crystalline, contains 10 percent medium-gray dolomitic shale laminae, thin- to thick-bedded; base grades.....	3	10
		(499	5)
26.	Dolomite, light- to medium-light-gray, very finely crystalline, few stylolites and high-angle calcite-filled fractures, thin- to thick-bedded, nodular bedding in top 3 ft; base grades.....	22	0
		(521	5)
27.	Dolomite, light- to medium-light-gray, very finely crystalline, mostly nodular bedding; base grades.....	8	7
		(530	0)
28.	Dolomite, very light gray, very finely crystalline, contains few medium-gray dolomitic shale laminae, few calcite-filled fractures, thick-bedded to massive; base sharp and uneven.....	7	8
		(537	8)

Unit Number	Description	Thickness (Depth) ft	in.
29.	Shale, medium-gray, dolomitic, contains 5 percent light-gray dolomite laminae and beds, evenly bedded; base sharp.....	2	5
		(540	1)
30.	Dolomite, very light to light-gray, very finely crystalline, contains few dolomitic shale laminae, scattered high-angle calcite-filled fractures, thin- to thick-bedded; base sharp.....	16	8
		(556	9)
31.	Dolomite, very light to light-gray, very finely crystalline, few high-angle calcite-filled fractures, mostly nodular bedding; base sharp.....	8	2
		(564	11)
32.	Shale, medium-gray, dolomitic, contains 20 percent light-gray very finely crystalline dolomite laminae and beds, evenly bedded; base grades.....	1	9
		(566	8)
33.	Dolomite, light-gray, very finely crystalline, contains few high-angle calcite-filled fractures, massive; base grades.....	9	8
		(576	4)
34.	Dolomite, light-gray, very finely crystalline, few stylolites; thin, nodular bedding.....	45	0
		(621	4)
35.	Dolomite, light-gray, very finely crystalline, contains 20 percent medium-gray dolomitic shale laminae, thin- to thick-bedded; base grades.....	2	11
		(624	3)
36.	Dolomite, light-gray, very finely crystalline; mostly thin, nodular bedding; base grades.....	9	8
		(633	11)
37.	Dolomite, light-gray, very finely crystalline, few calcite-filled fractures, thick-bedded to massive; base sharp.....	15	8
		(649	7)
38.	Shale, medium-gray, dolomitic, contains 10 percent light-gray dolomite laminae and beds, evenly bedded.....	0	8
		(650	3)
39.	Dolomite, light-gray, very finely crystalline; thin, nodular bedding; base grades.....	3	2
		(653	5)

Unit Number	Description	Thickness (Depth) ft	in.
40.	Dolomite, light-gray, very finely crystalline, few high-angle carbonate-filled fractures, thin- to thick-bedded, nodular bedding from 11 ft 4 in. to 12 ft below top; base sharp.....	32	3
		(685	8)
41.	Shale, medium-gray, dolomitic, contains 20 percent light-gray very finely crystalline dolomite laminae and beds, evenly bedded; base grades.....	7	7
		(693	3)
42.	Dolomite, light-gray, very finely crystalline, contains few medium-gray dolomitic shale laminae, scattered calcite-filled fractures up to 0.5 in. thick, thin- to thick-bedded; base grades.....	12	3
		(705	6)
43.	Shale, medium-gray, few carbonate-filled fractures, evenly bedded, fair fissility; base grades.....	3	5
		(708	11)
44.	Dolomite, light-gray, very finely crystalline, contains abundant high-angle carbonate-filled fractures, thick-bedded to massive; base grades.....	3	8
		(712	7)
45.	Dolomite, light- to medium-gray, finely crystalline, few carbonate-filled fractures up to 1 in. thick; base grades.....	3	7
		(716	2)
46.	Dolomite, light- to medium-gray, very finely crystalline, brecciated and recemented from 2 ft 10 in. to 4 ft below top, abundant carbonate-filled fractures; base sharp.....	5	11
		(722	1)
47.	Dolomite, light- to medium-gray, very finely crystalline, brecciated and recemented from 13 ft to 13 ft 8 in. below top, abundant high-angle carbonate-filled fractures up to 0.5 in. thick, few stylolites.....	29	0
		(751	1)
48.	Dolomite, light-brownish-gray, very finely crystalline, thin-bedded; base grades.....	3	4
		(754	5)
49.	Dolomite, medium-gray, finely to medium-crystalline, slightly brecciated, few calcite-filled fractures, thin-bedded, few nodular and contorted beds; base sharp and angular.....	10	0
		(764	5)

Unit Number	Description	Thickness (Depth) ft	in.
50.	Dolomite, light-gray, very finely to finely crystalline, few dolomite-filled vugs in top 1 ft.....	4	9
		(769	2)
51.	Dolomite, light-brownish-gray, very finely crystalline, brecciated and recemented 8 ft 6 in. below top, few stylolites and calcite-filled fractures, thin and unevenly bedded.....	26	2
		(795	4)
52.	Dolomite, light-brownish-gray, very finely crystalline, scattered stylolites, contorted bedding; base uneven.....	15	0
		(810	4)
53.	Shale, medium-dark-gray, dolomitic, contains scattered medium-gray dolomite beds 2 ft below top, evenly bedded; base grades.....	6	7
		(816	11)
54.	Dolomite, medium-light-gray, very finely to finely crystalline, contains few argillaceous dolomite lenses 2 ft 3 in. below top, thin-bedded.....	5	0
		(821	11)
55.	Dolomite, light- to medium-light-gray, microcrystalline, few stylolites, evenly bedded.....	3	10
		(825	9)
56.	Dolomite, medium-gray, very finely crystalline, few stylolites; base sharp.....	6	3
		(832	0)
57.	Dolomite, medium-gray, finely to medium-crystalline, thin and discontinuous bedding, few contorted beds in top 8 in. and at base; base sharp and stylolitic.....	4	7
		(836	7)
58.	Dolomite, medium-gray, very finely crystalline, argillaceous 1 ft 10 in. below top, thick-bedded.....	3	8
		(840	3)
59.	Dolomite, medium- to medium-dark-gray, microcrystalline, scattered dolomite-filled fractures in basal 1 ft 5 in., thin-bedded; base sharp.....	16	11
		(857	2)
60.	Dolomite, medium- to medium-dark-gray, microcrystalline, very finely crystalline at base, few high-angle dolomite-filled fractures in top 1 ft, few stylolites; base grades.....	9	8
		(866	10)

Unit Number	Description	Thickness (Depth) ft	in.
61.	Shale, dark-gray, dolomitic, evenly bedded, fissile.....	0	9
		(867	7)
62.	Dolomite, medium- to medium-dark-gray, very finely to finely crystalline, contains few medium-dark-gray dolomitic shale laminae 7 ft 8 in. below top, abundant high-angle carbonate-filled fractures in basal 3 ft, thin-bedded, few contorted beds, nodular bedding in basal 2 ft; base grades.....	19	5
		(887	0)
63.	Dolomite, medium-gray, very finely crystalline, argillaceous in top 10 ft, contains 10 percent dark-gray dolomitic shale laminae, few dolomite-filled fractures, evenly bedded in top 10 in., discontinuous bedding in basal 3 ft 1 in.; base sharp.....	3	11
		(890	11)
64.	Dolomite, medium-dark-gray, very finely crystalline, thin and unevenly bedded; base sharp and uneven.....	3	7
		(894	6)
65.	Dolomite, medium- to medium-dark-gray, very finely to finely crystalline, irregularly bedded; base grades.....	5	3
		(899	9)
66.	Dolomite, medium-gray, very finely crystalline, contains few dark-gray dolomitic shale laminae, thin-bedded; base grades.....	12	3
		(912	0)
67.	Dolomite, light- to medium-gray, very finely to finely crystalline, contains intraformational conglomerate in basal 9 in., thin-bedded; base sharp and angular.....	5	2
		(917	2)
68.	Dolomite, medium- to medium-dark-gray, finely to medium-crystalline, contains 45 percent medium-dark-gray dolomitic shale laminae, brecciated, contorted bedding; base sharp and uneven.....	1	11
		(919	1)
69.	Dolomite, medium- to medium-dark-gray, medium- to coarsely crystalline, contains 5 percent dark-gray dolomitic shale laminae and beds from 2 ft to 7 ft 8 in. below top, few dolomite-filled fractures, thin- to thick-bedded; base sharp.....	16	0
		(935	1)

Unit Number	Description	Thickness (Depth) ft	in.
70.	Dolomite, medium- to medium-dark-gray, microcrystalline, finely crystalline in basal 1 ft, contains 20 percent dark-gray dolomitic shale laminae and beds, few small-scale faults, thin-bedded.....	13	8
		(948	9)
71.	Shale, medium- to medium-dark-gray, dolomitic, contains 10 percent medium-gray very finely to finely crystalline dolomite beds, thin-bedded; base sharp and stylolitic.....	6	1
		(954	10)
72.	Dolomite, light-gray, finely to medium-crystalline, recrystallized, abundant vugs.....	1	6
		(956	4)
73.	Dolomite, medium-gray, very finely to finely crystalline, contains few medium-dark-gray dolomitic shale laminae, few vugs in top 1 ft 8 in., thin-bedded.....	20	11
		(977	3)
74.	Dolomite, medium-gray, very finely to finely crystalline, recrystallized; contains abundant vugs in top 3 ft 9 in., and from 7 ft 1 in. to 7 ft 9 in. below top; thin-bedded; base grades.....	8	5
		(985	8)
75.	Shale, medium-dark-gray, dolomitic, evenly bedded; base sharp.....	1	2
		(986	10)
76.	Dolomite, light-brownish- to medium-gray, very finely to finely crystalline, contains abundant dark-gray dolomitic shale laminae and beds from 3 ft 4 in. to 4 ft 4 in. above base, thin-bedded.....	8	9
		(995	7)
77.	Dolomite, light-gray, very finely crystalline, contains abundant vugs; base sharp.....	2	7
		(998	2)
78.	Dolomite, light-brownish- to medium-gray, very finely to finely crystalline, contains scattered medium-dark-gray dolomitic shale laminae in basal 2 in., few stylolites and high-angle dolomite-filled fractures, thin-bedded; base sharp.....	3	9
		(1001	11)
79.	Dolomite, brownish-gray, very finely to finely crystalline, abundant vugs, contorted bedding; base grades.....	8	2
		(1010	1)

Unit Number	Description	Thickness (Depth) ft	in.
80.	Dolomite, brownish-gray, very finely to finely crystalline, scattered dolomite-filled fractures up to 0.5 in. thick in top 10 in., thin-bedded; base sharp.....	10	4
		(1020	5)
81.	Shale, medium- to medium-dark-gray dolomitic, evenly bedded.....	2	7
		(1023	0)
82.	Dolomite, brownish- to medium-dark-gray, very finely crystalline, contains few small-scale faults, few vugs in basal 1 ft, thin-bedded; base sharp.....	6	0
		(1029	0)
83.	Dolomite, light-brownish- to medium-gray, very finely crystalline, contains 10 percent medium-dark-gray dolomitic shale laminae, few small-scale faults, thin-bedded; base sharp and uneven.....	7	3
		(1036	3)
84.	Dolomite, light-brownish to brownish-gray, very finely to finely crystalline, few calcite-filled vugs in top 1 ft 5 in., few stylolites, thin-bedded, few contorted beds, unevenly bedded in top 3 ft 10 in.; base grades.....	18	7
		(1054	10)
85.	Dolomite, brownish-gray, very finely to finely crystalline, contains 50 percent dark-gray dolomitic shale laminae; abundant vugs in top 2 ft 10 in., and from 6 ft 11 in. to 8 ft, and 10 ft to 18 ft 7 in. below top.....	18	7
		(1073	5)
86.	Dolomite, brownish- to medium-dark-gray, very finely to finely crystalline, contains 5 percent medium-dark-gray dolomitic shale laminae from 6 ft 3 in. to 7 ft 3 in. below top, 50 percent medium-dark-gray dolomitic shale laminae in basal 7 in., abundant vugs from 2 ft 4 in. to 5 ft 4 in. below top, thin-bedded; base sharp and stylolitic.....	7	10
		(1081	3)
87.	Dolomite, medium-light-gray, very finely to finely crystalline, recrystallized, slightly argillaceous in top 2 in., contains few stromatolites, few high-angle dolomite-filled fractures, scattered vugs; base grades.....	1	2
		(1082	5)
88.	Dolomite, medium-gray, very finely crystalline, contains few stromatolites, few high-angle dolomite-filled fractures; base sharp and stylolitic.....	4	0
		(1086	5)

Unit Number	Description	Thickness (Depth) ft	in.
89.	Dolomite, light-brownish- to medium-gray, very finely crystalline, few high-angle fractures, scattered vugs, thin-bedded; base sharp.....	2	0
		(1088	5)
90.	Shale, medium- to medium-dark-gray, dolomitic, few small-scale faults, evenly bedded; base sharp.....	1	4
		(1089	9)
91.	Dolomite, medium-gray, very finely to finely crystalline, contains 5 percent medium-dark-gray dolomitic shale laminae and beds, few high-angle fractures, thin-bedded.....	2	0
		(1091	9)
92.	Dolomite, brownish-gray, very finely to finely crystalline, few vugs, thin-bedded; base sharp.....	0	11
		(1092	8)
93.	Dolomite, medium- to medium-dark-gray, very finely crystalline, thin-bedded; base grades.....	2	10
		(1095	6)
94.	Dolomite, light-brownish- to medium-gray, very finely to coarsely crystalline, contains few medium-dark-gray dolomitic shale beds from 10 ft 6 in. to 14 ft 5 in. below top, scattered stromatolites, few high-angle fractures, small-scale faults and stylolites, thin-bedded; base uneven.....	28	11
		(1124	5)
95.	Dolomite, light-brownish-gray, very finely to medium-crystalline, few high-angle and dolomite-filled fractures, scattered stylolites and vugs; base sharp and uneven.....	7	6
		(1131	11)
96.	Shale, medium- to medium-dark-gray, silty, dolomitic, evenly bedded, nodular bedding in part; base sharp.....	2	0
		(1133	11)
97.	Dolomite, brownish- to medium-dark-gray, very finely crystalline, thin-bedded, few contorted beds in top 8 in.....	5	6
		(1139	5)
98.	Dolomite, brownish- to medium-dark-gray, very finely crystalline; base uneven.....	4	0
		(1143	5)
99.	Dolomite, light- to light-brownish-gray, microcrystalline to very finely crystalline, few stylolites.....	1	0
		(1144	5)

Unit Number	Description	Thickness (Depth) ft	in.
100.	Dolomite, light- to light-brownish-gray, microcrystalline to very finely crystalline, few stylolites.....	0	8
		(1145	1)
101.	Dolomite, brownish-gray, very finely to finely crystalline, brecciated from 5 ft 5 in. to 8 ft 5 in. above base, few dolomite-filled fractures, scattered stylolites, thin- to thick-bedded; base sharp and uneven.....	33	7
		(1178	8)
102.	Dolomite, light-brownish-gray to gray, very finely to finely crystalline, brecciated, few vugs; base uneven.....	1	9
		(1180	5)
103.	Dolomite, light-brownish-gray to gray, very finely to finely crystalline, brecciated from 7 ft 5 in. to 9 ft 7 in. below top, few small-scale faults and high-angle dolomite-filled fractures, thin-bedded; base sharp and uneven.....	12	3
		(1192	8)
104.	Dolomite, brownish-gray, very finely to medium-crystalline, brecciated and recemented in part, thin- to thick-bedded.....	7	4
		(1200	0)

BOTTOM OF HOLE
TOTAL DEPTH - 1200 ft

GEOPHYSICAL LOG

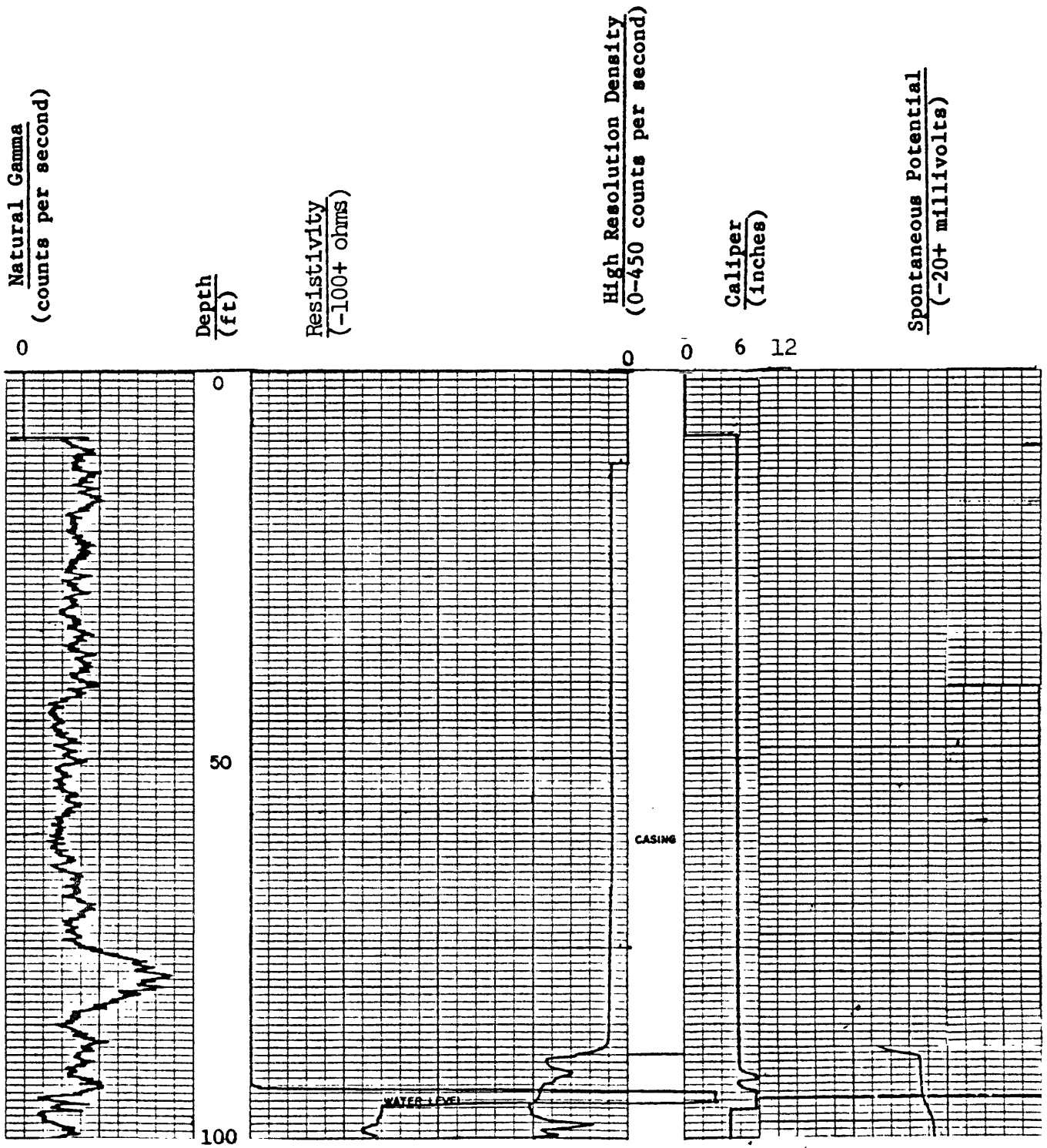
Corehole: V-8 Date: 2/02/83 State: Virginia County: Botetourt

Quadrangle: Catawba, Va. Latitude: 37°28'44"N Longitude: 80°00'45"W

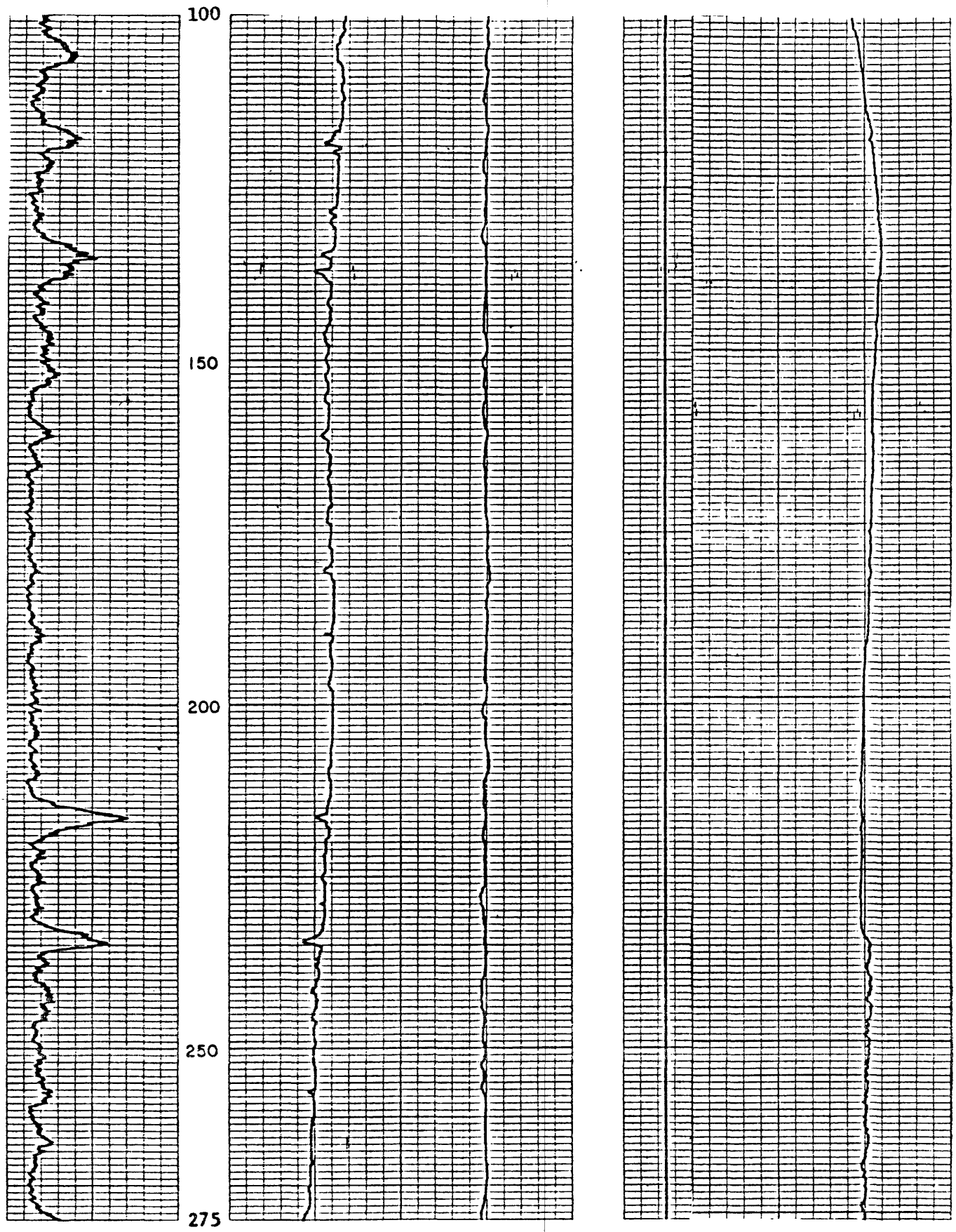
Altitude: 1,662 ft Logged Depth: 1,200 ft Drilled Depth: 1,200 ft

Logging Speed: 20 ft/min (SP 30 ft/min) Natural Gamma Time Constant: 1

High Resolution Density Time Constant: 1



Corehole: V-8 continued



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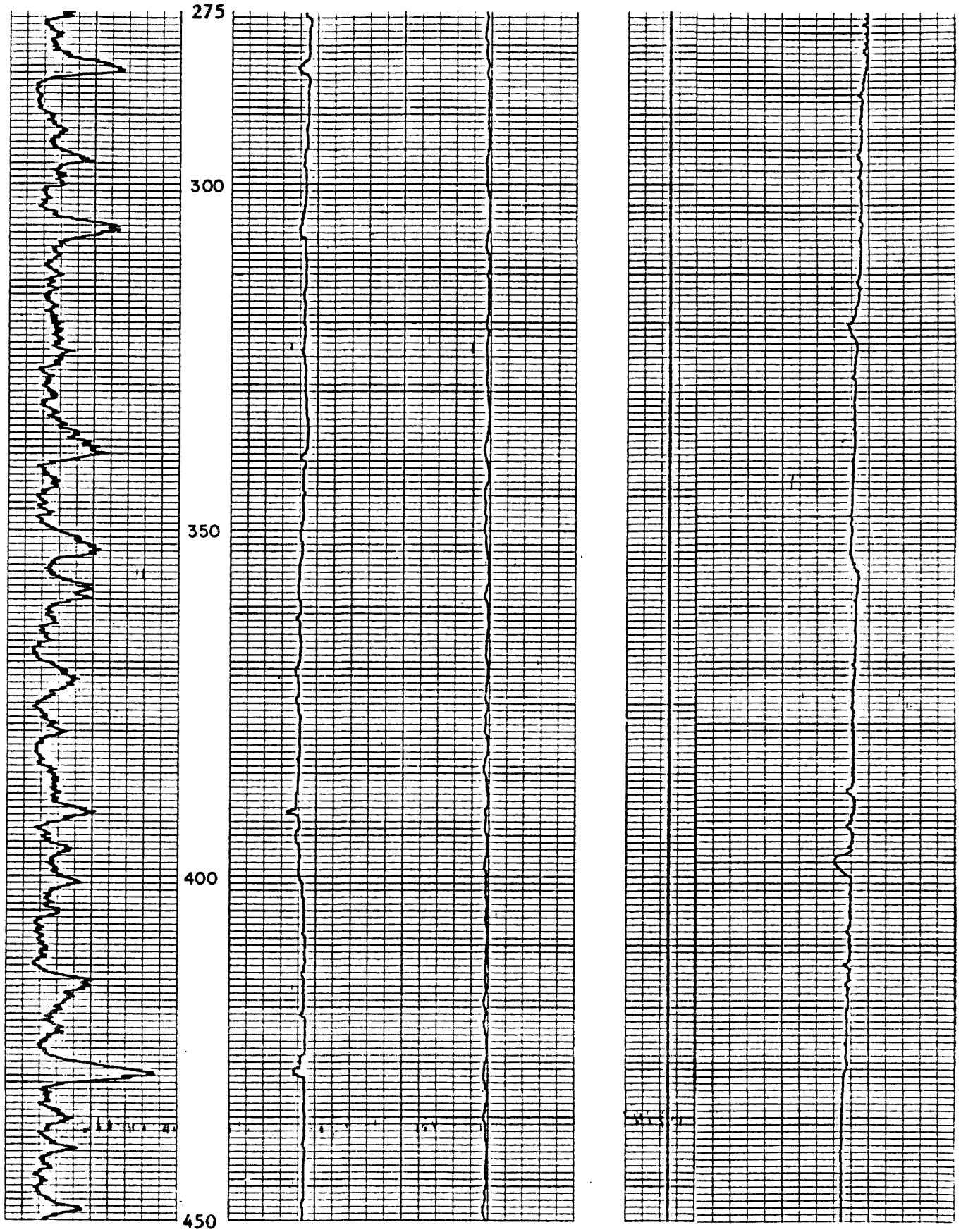

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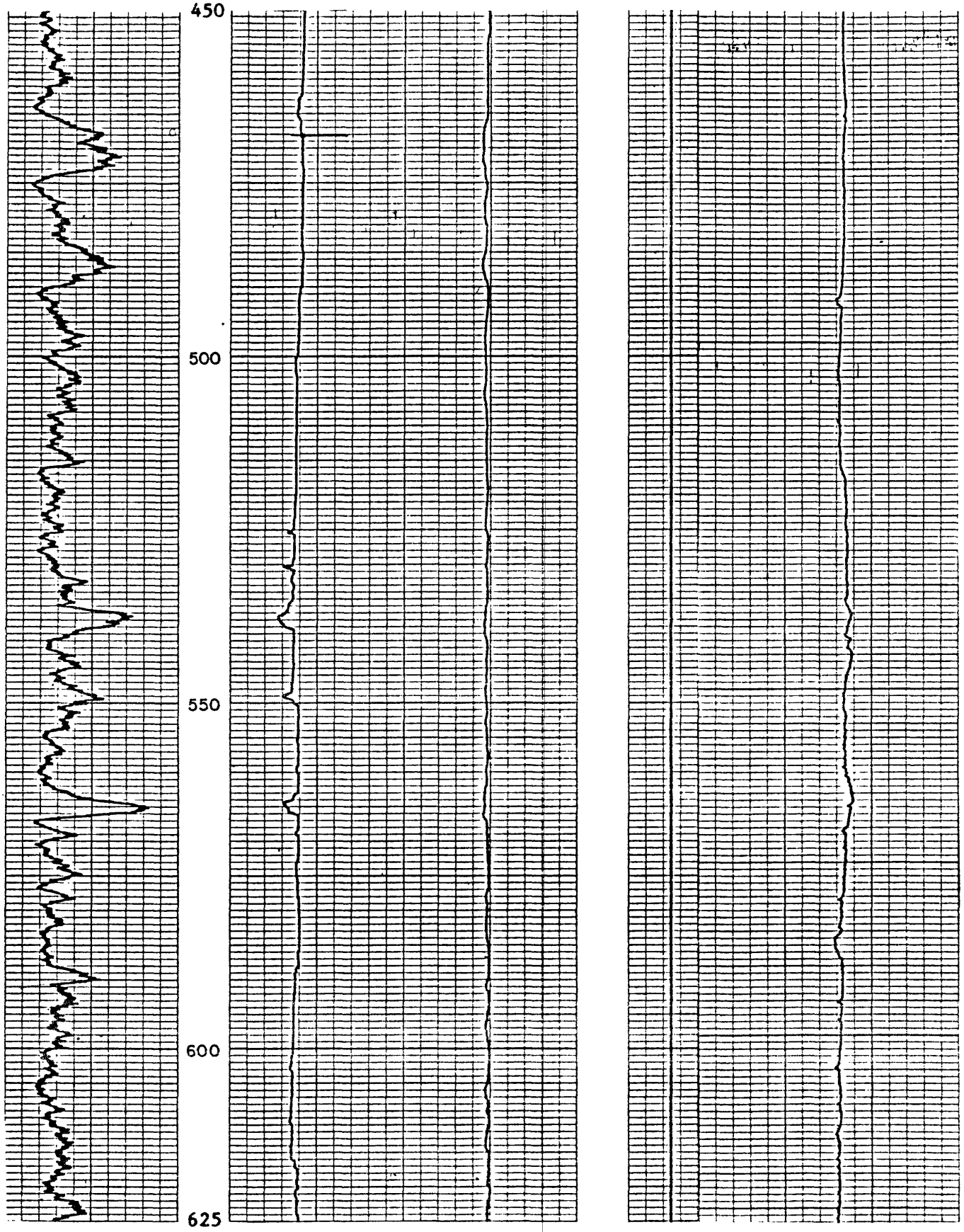

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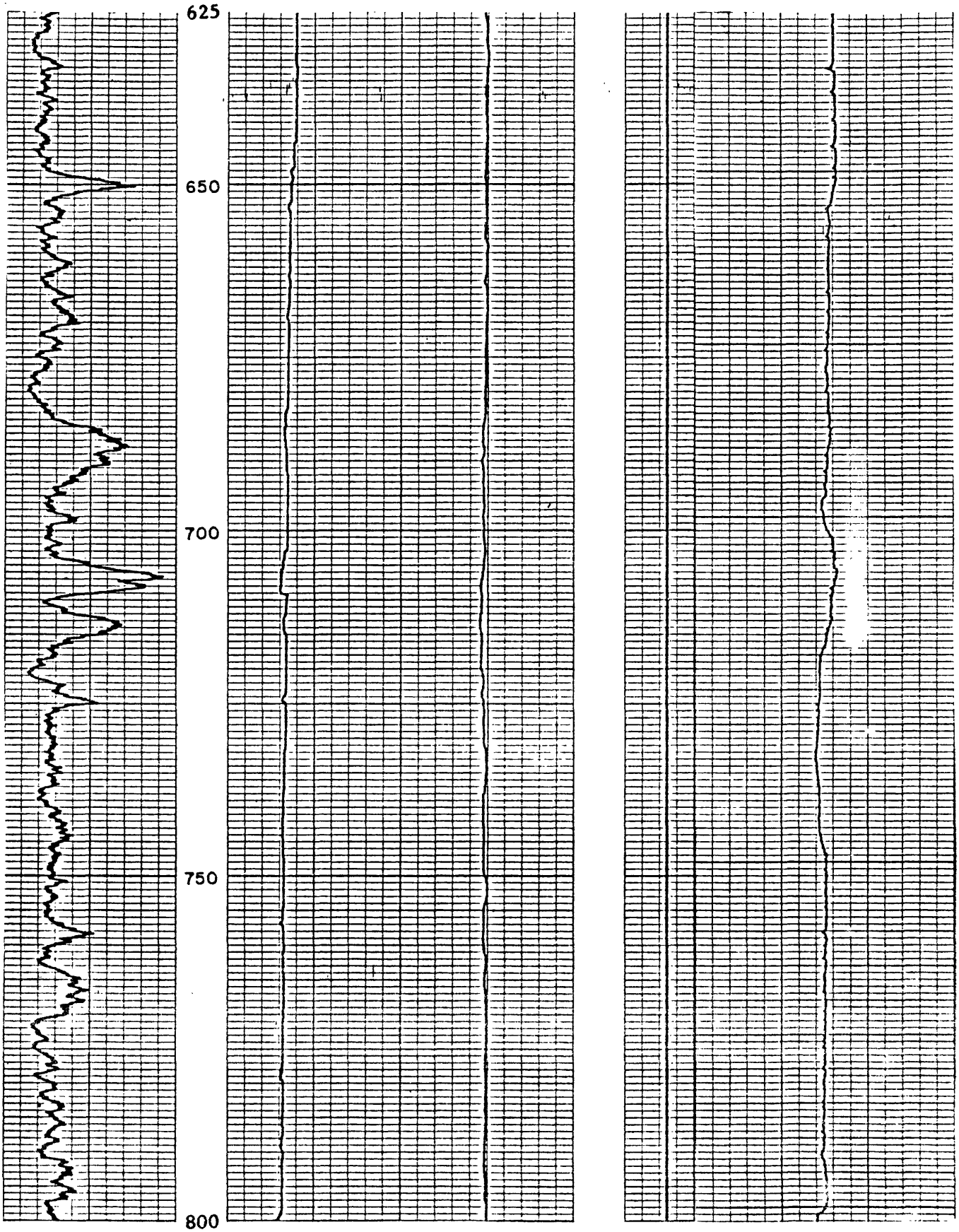

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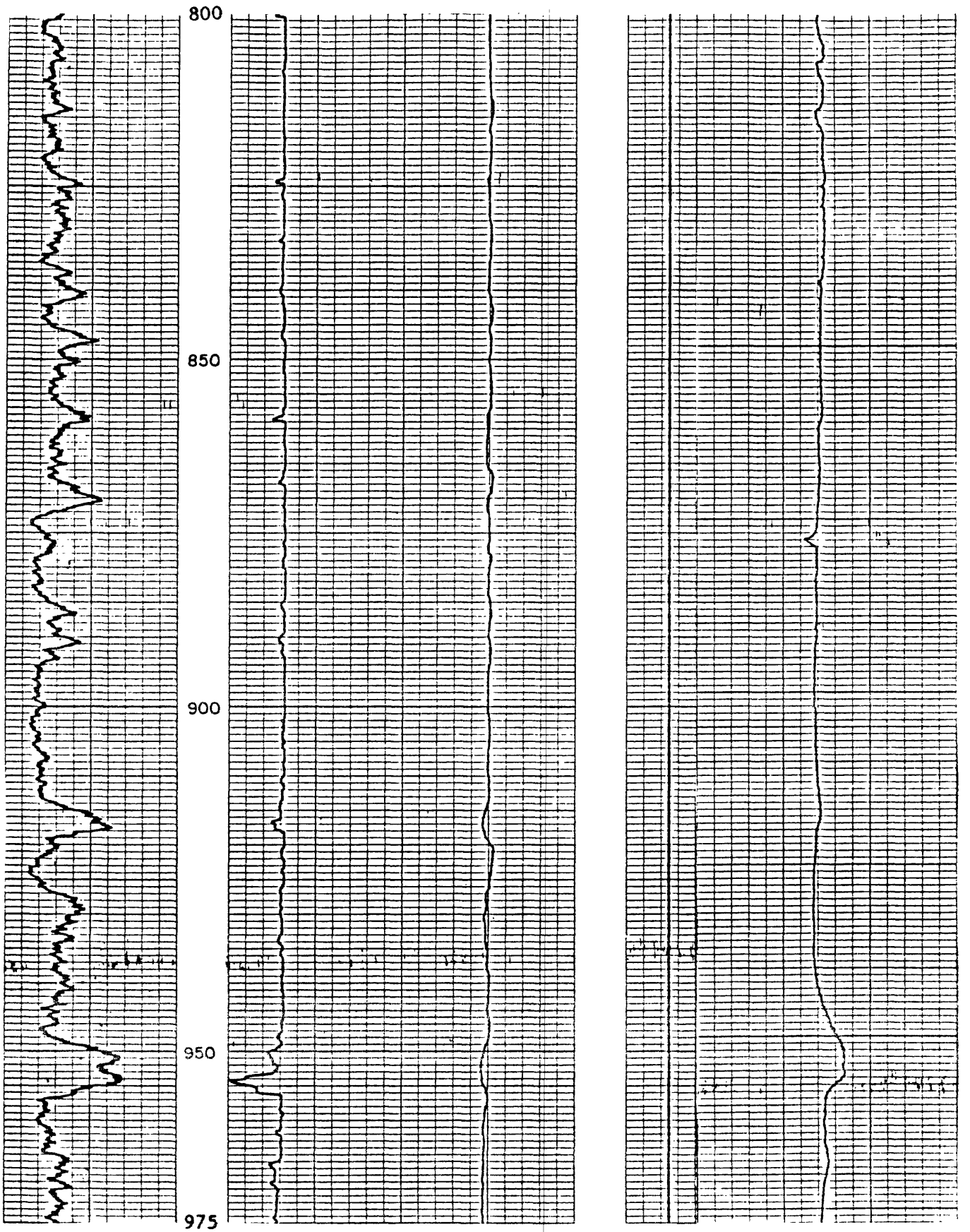

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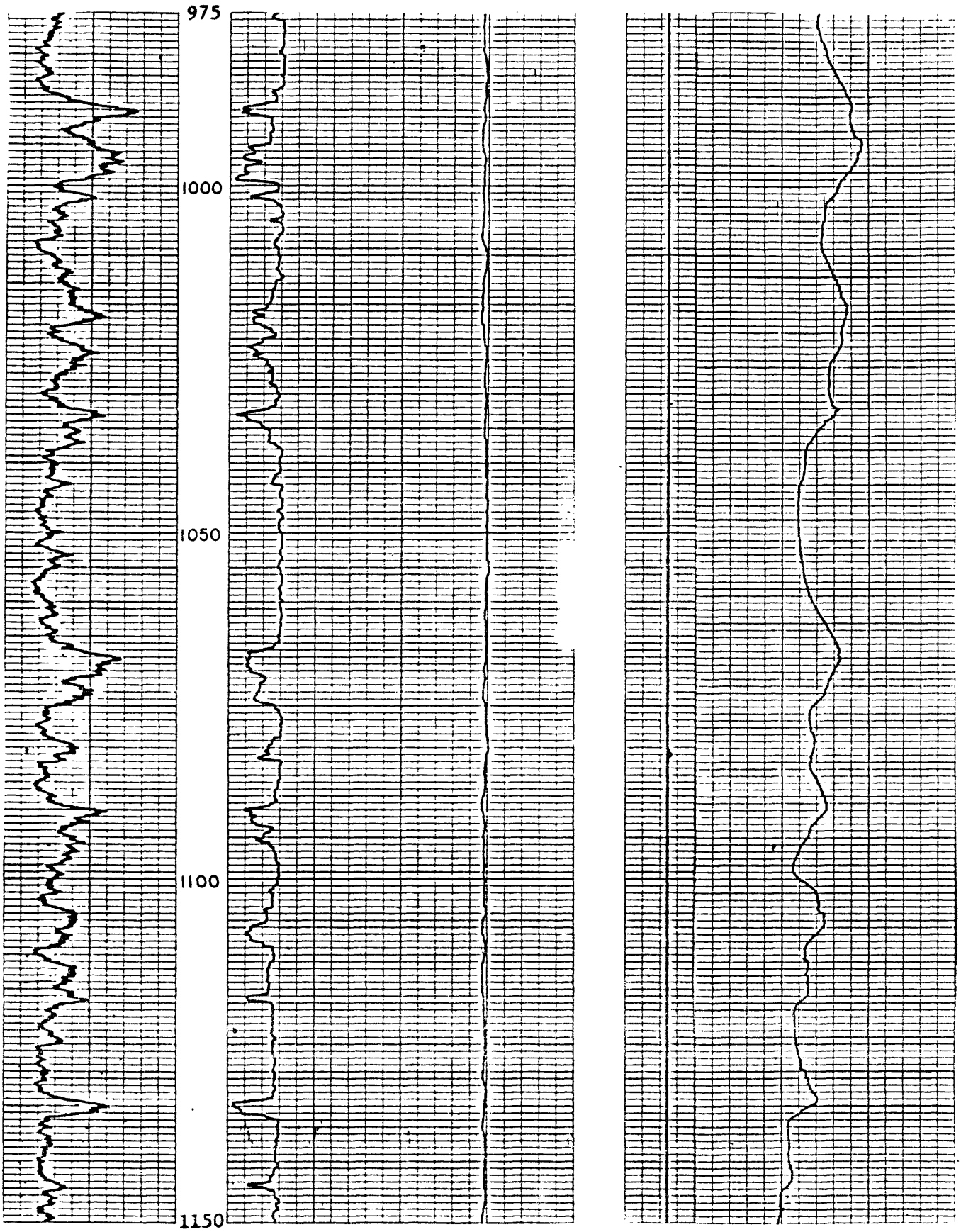

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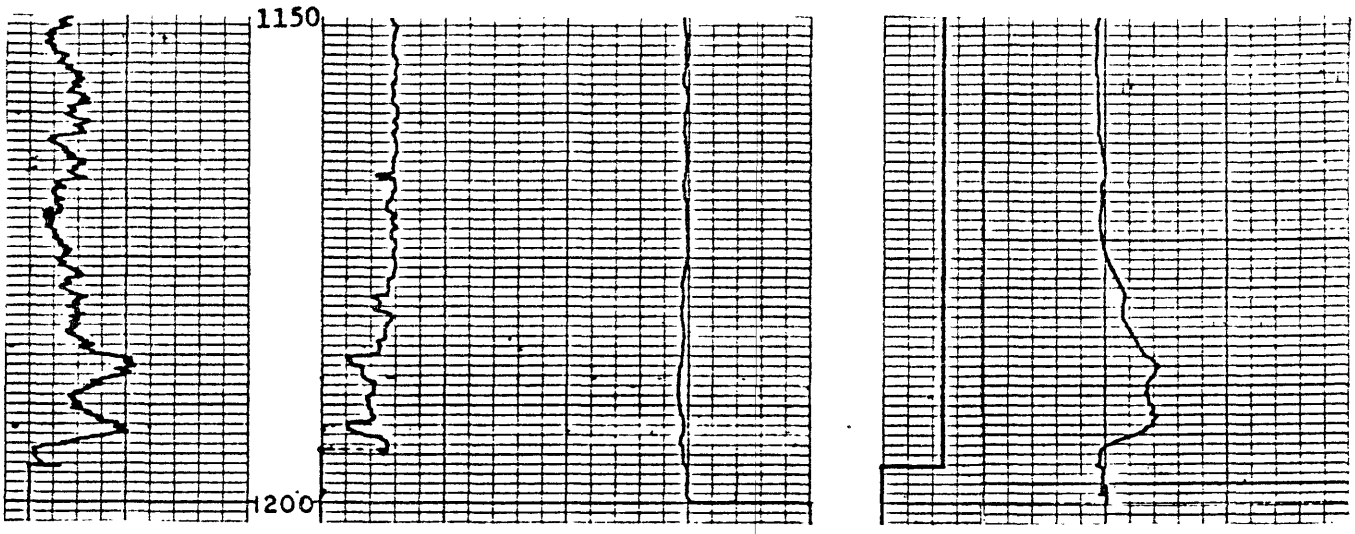

References

Bartholomew, M.J. and Lowry, W.D., 1979, Geology of the Blacksburg quadrangle, Virginia: Virginia Division of Mineral Resources Publication 14GM-81B.

Butts, Charles, 1933, Geologic map of the Appalachian Valley of Virginia, with explanatory text: Virginia Geological Survey Bulletin 42, 56 p., map.

_____, 1940, Geology of the Appalachian Valley of Virginia - Part 1, Geologic text and illustrations: Virginia Geological Survey Bulletin 52, Part 1, 568 p.

Calver, J.L. and Hobbs, C.R.B., Jr., (eds.), 1963, Geologic map of Virginia: Virginia Division of Mineral Resources, scale 1:500,000.

Campbell, M.R., 1894, Paleozoic overlaps in Montgomery and Pulaski Counties, Virginia: Geologic Society America Bulletin, vol. 5, 77-190 p.

Campbell, M.R., and others, 1925, The Valley coal fields of Virginia: Virginia Division of Mineral Resources Bulletin 25, 322 p.

Cooper, B.N., 1961, Grand Appalachian field excursion: Virginia Polytechnic Institute Engineering Extension Service Geologic Guidebook No. 1.

Englund, K.J., Windolph, J.F., Jr., Weber, J.C., Thomas, R.E., and Dryden, J.W., 1983, Test drilling for coal in 1982-83, in the Jefferson National Forest, Virginia, Part 1: Lithologic descriptions and geophysical logs of coreholes in the southwestern Virginia coal field, Dickenson, Lee, Scott, and Wise Counties, Virginia: U.S. Geological Survey open-file report OF-83-628.

Simon, F.O., and Englund, K.J., 1983a, Test drilling for coal in 1982-83 in the Jefferson National Forest, Part 2: Analyses of coal cores from the southwestern Virginia coal fields: U.S. Geological Survey open-file report OF-83-620.

_____, 1983b, Test drilling for coal in 1982-83 in the Jefferson National Forest, Part 4: Analyses of coal cores from the Valley coal fields: U.S. Geological Survey open-file report OF-83-626.

Stanley, C.B., and Schultz, A.P., 1983, Coal-bed methane resource evaluation, Montgomery County, Virginia: Virginia Division of Mineral Resources report to U.S. Department of Energy (Contract No. DE-FG44-81R410431), 98 p.