UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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

By

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U.S. Bureau of Land Management

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Introduction

Twenty-one coreholes were drilled 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 (figs. 1, 2). This open-file report presents the results of the drilling program in the southwestern Virginia coal field and includes descriptive lithologic data, correlations, and geophysical logs. Of the 13 coreholes drilled in this phase of the program; six were along Pine Mountain (fig. 3) on the northwestern limb of the Middlesboro syncline, five were along Stone Mountain (fig. 4) on the limb common to the Powell Valley anticline and the Middlesboro syncline, and two were in the Powell Mountain area (fig. 4) along the southeastern limb of the Powell Valley anticline. Most of the coal beds tested in these areas are in the Lee, Norton, and Wise Formations of Early to Middle Pennsylvanian age (fig. 5). Minor occurrences of coal were also noted in the Bluestone and Pocahontas Formations of Late Mississippian to Early Pennsylvanian age. The results of drilling in the Valley coal fields are presented in Parts 3 (Englund and others, 1983) and 4 (Simon and Englund, 1983b).

Location

Federal mineral properties are on the fringes of the southwestern Virginia coal field principally in three discontinuous northeast-trending belts: (1) along the southeastern slope of Pine Mountain in parts of Wise and Dickenson Counties; (2) along the northwestern slope of Stone Mountain in parts of Lee and Wise Counties; and (3) in the Powell Mountain area in parts of Scott and Wise Counties (figs. 3, 4). Within these belts, the locations of corehole sites were selected largely on the basis of readily available access and the proximity of a water source for drilling. Depths for coreholes were established to collectively test the entire coal-bearing sequence in each of the three belts (figs. 6, 7).

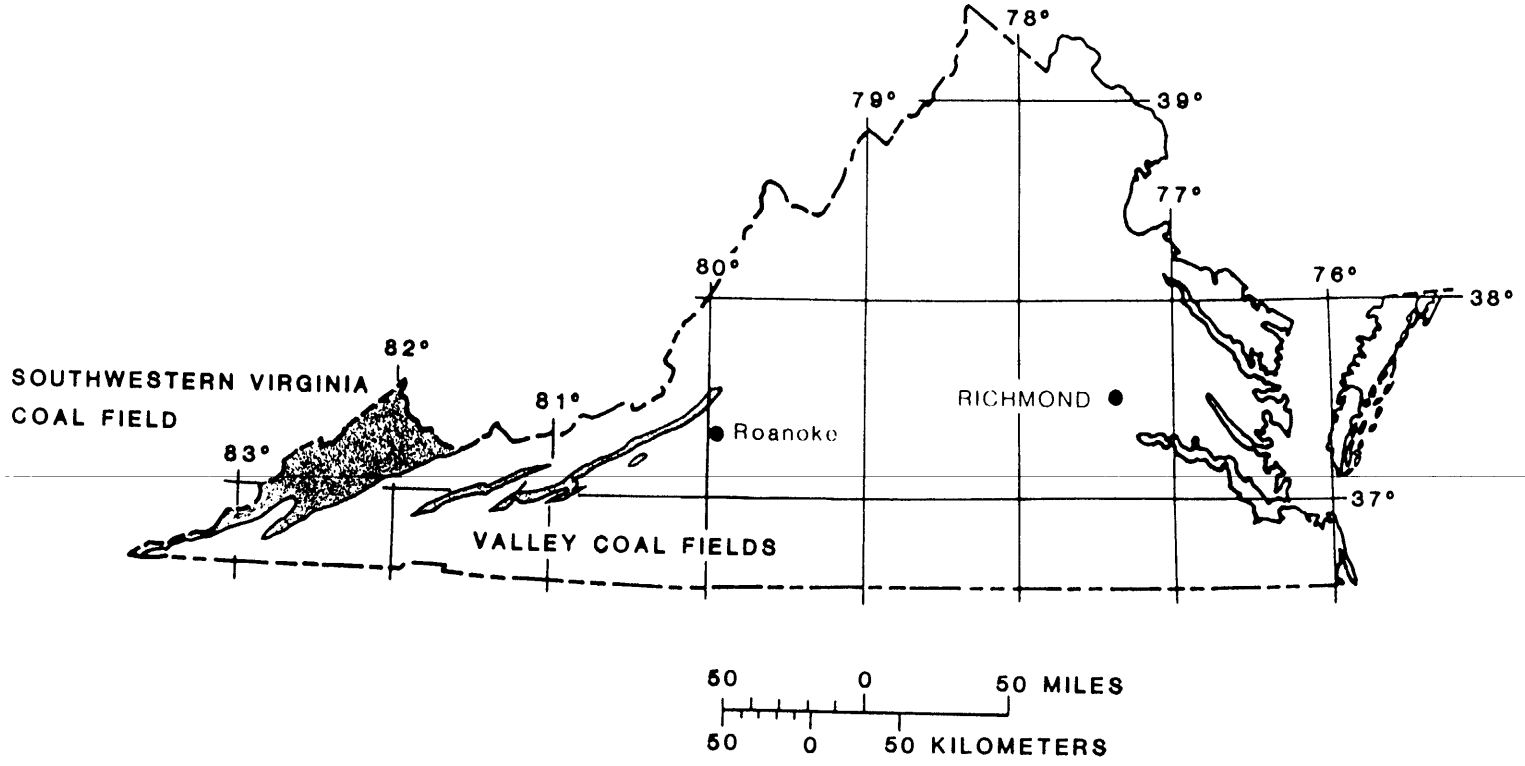


Figure 1. Index map of coal fields in southwestern Virginia

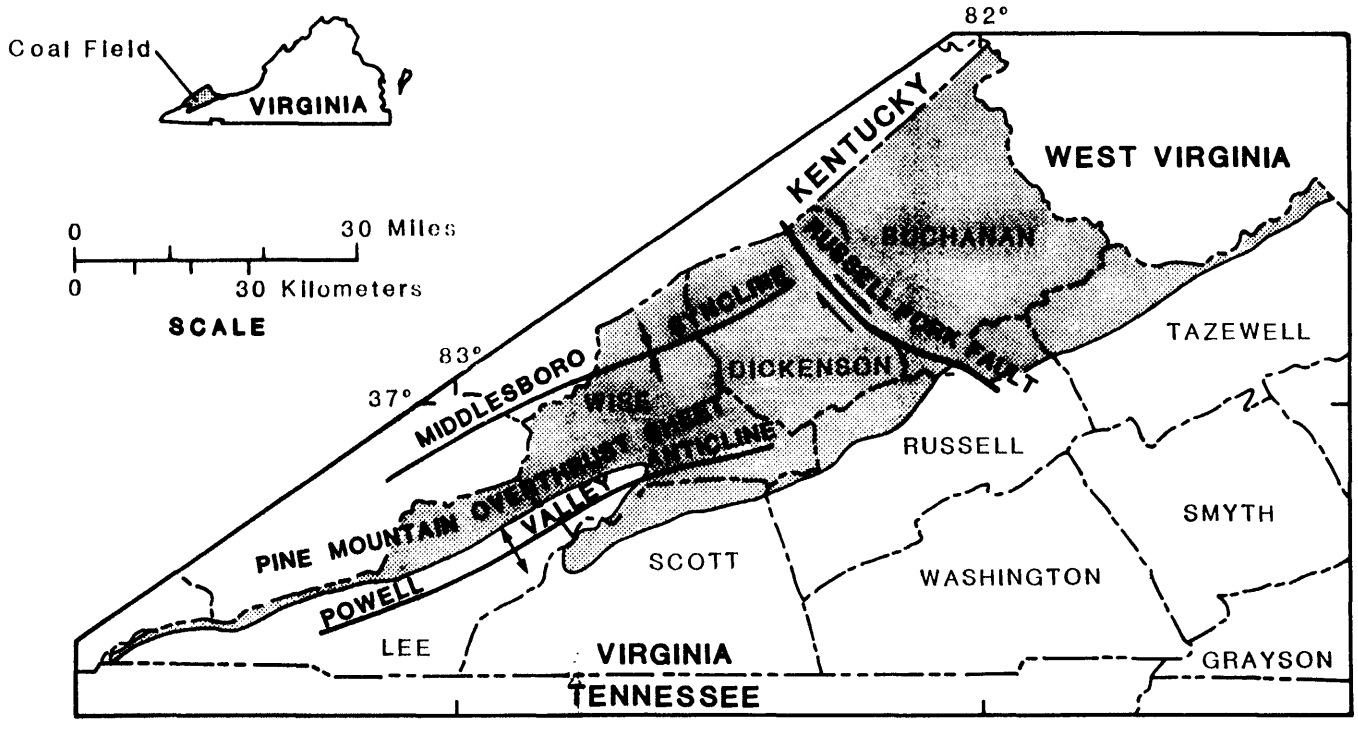


Figure 2. Index map of southwestern Virginia coal field (shaded).

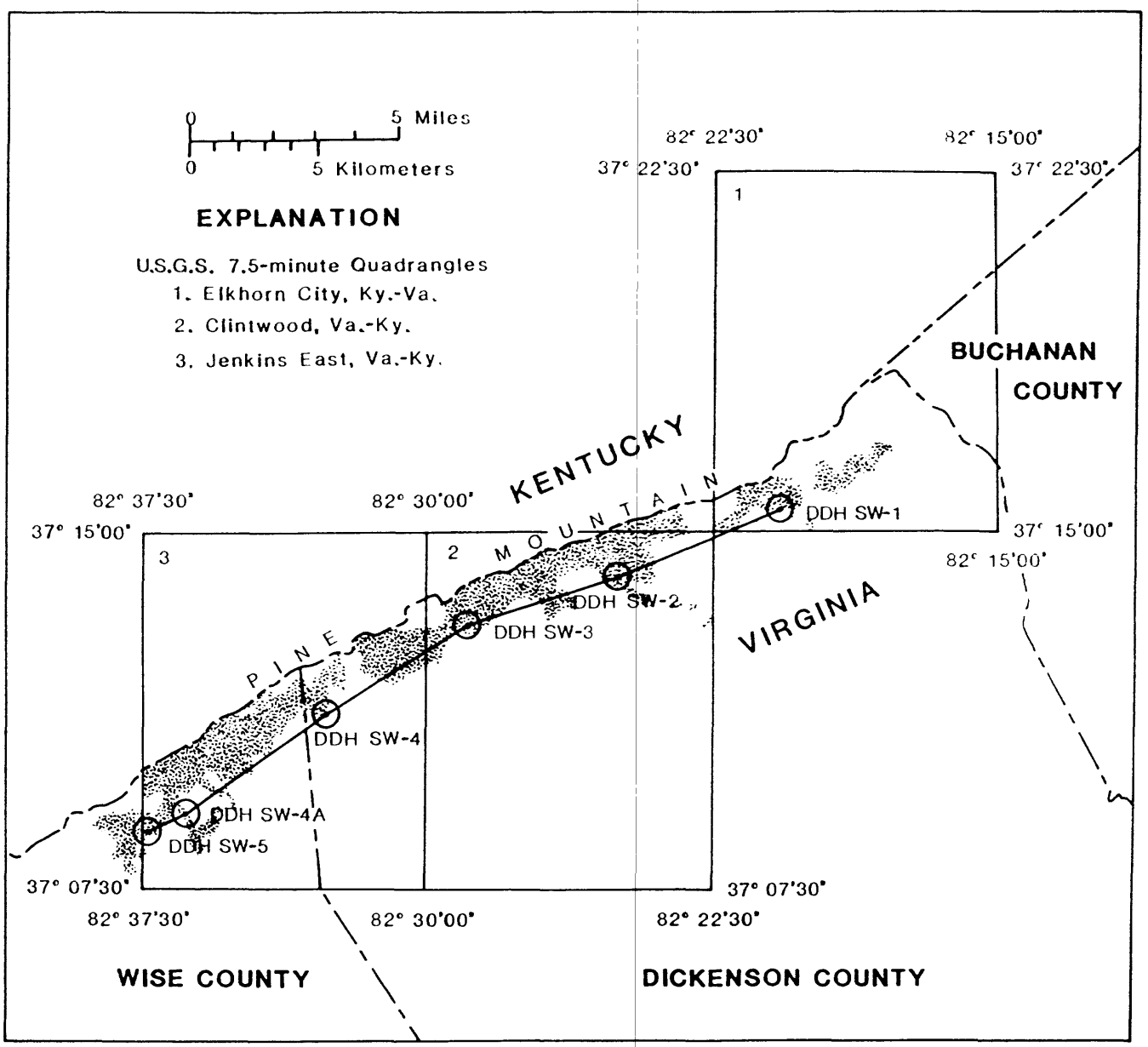


Figure 3. Location of coreholes DDH SW-1 to 5 in the Pine Mountain area. Stippled pattern indicates approximate areas of Federal mineral ownership.

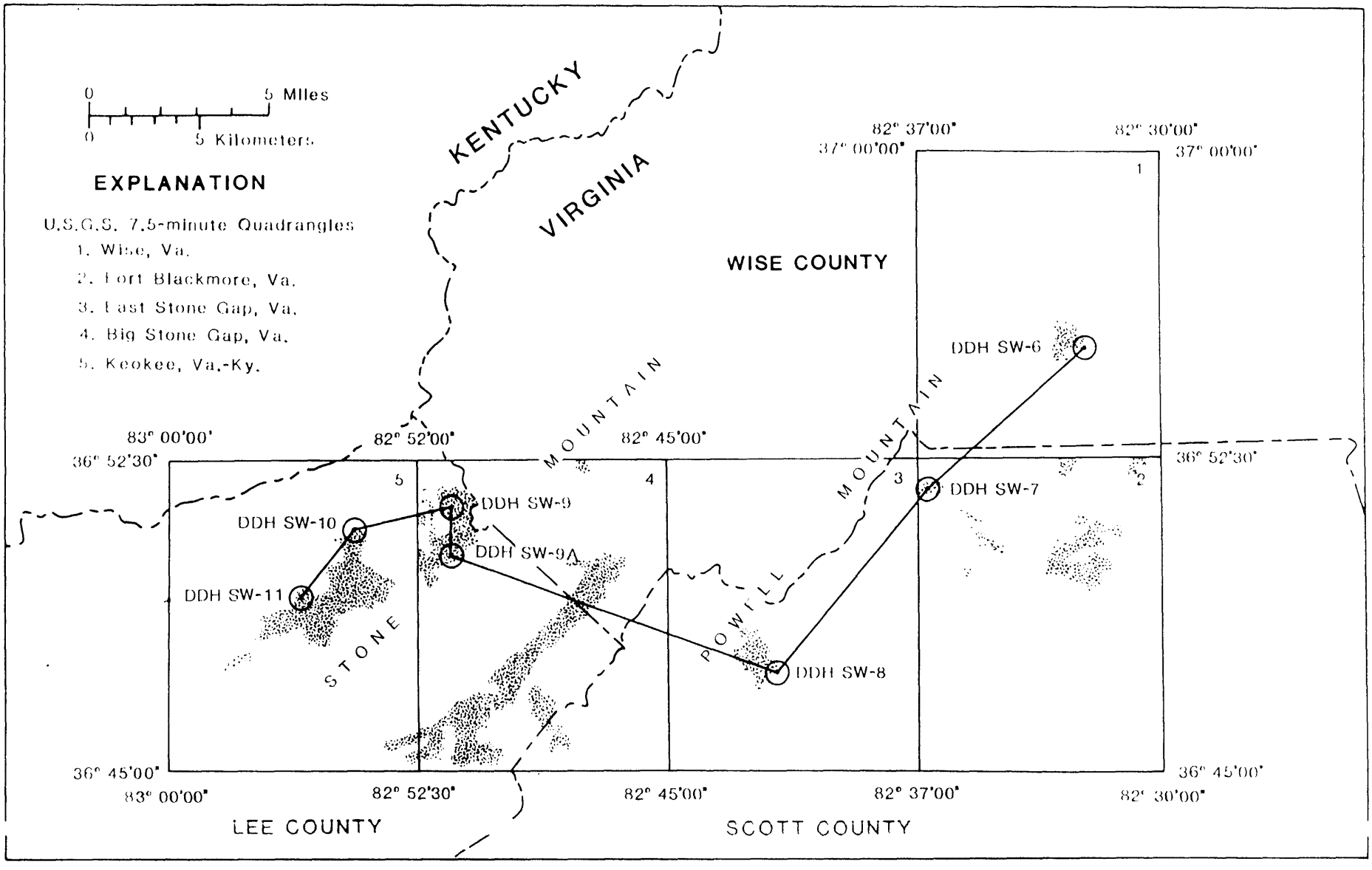


Figure 4. Location of coreholes DDH SW-6 to 11 in the Stone and Powell Mountain areas. Stippled pattern indicates approximate areas of Federal mineral ownership.

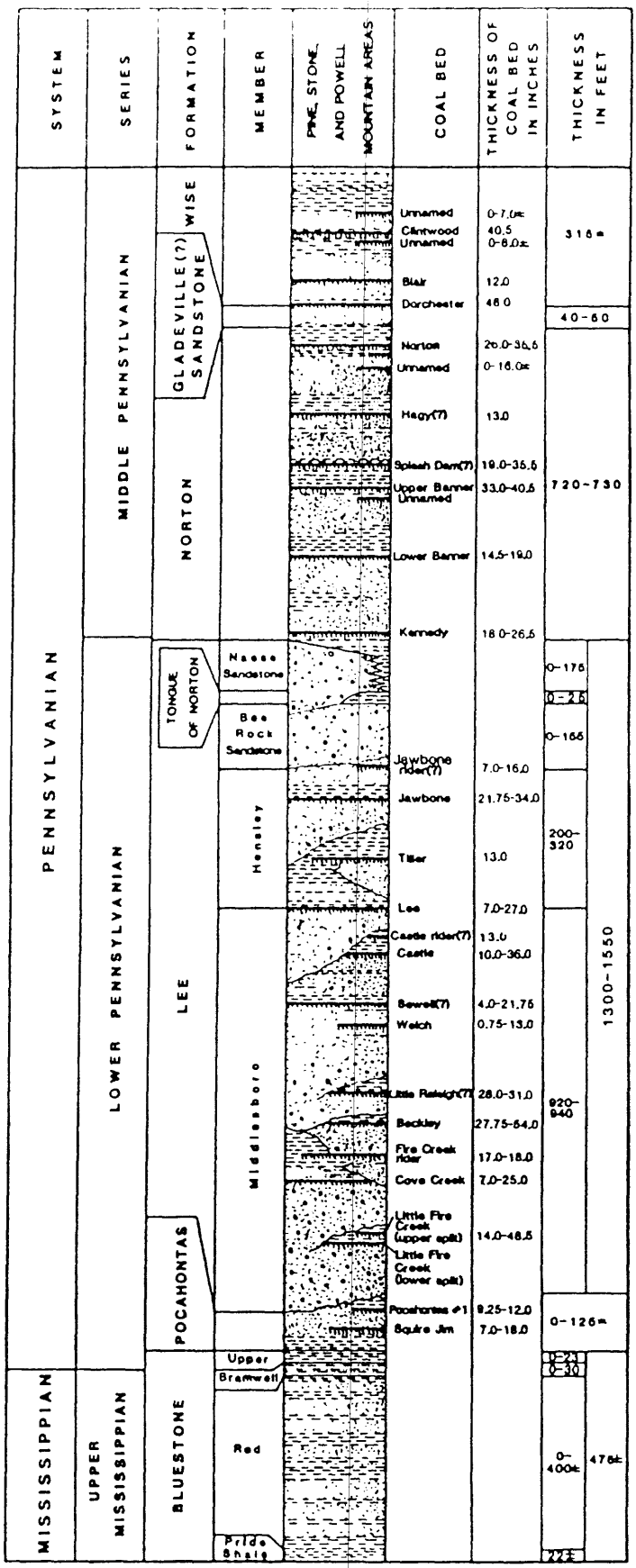


Figure 5. Generalized section of coal-bearing sequences.

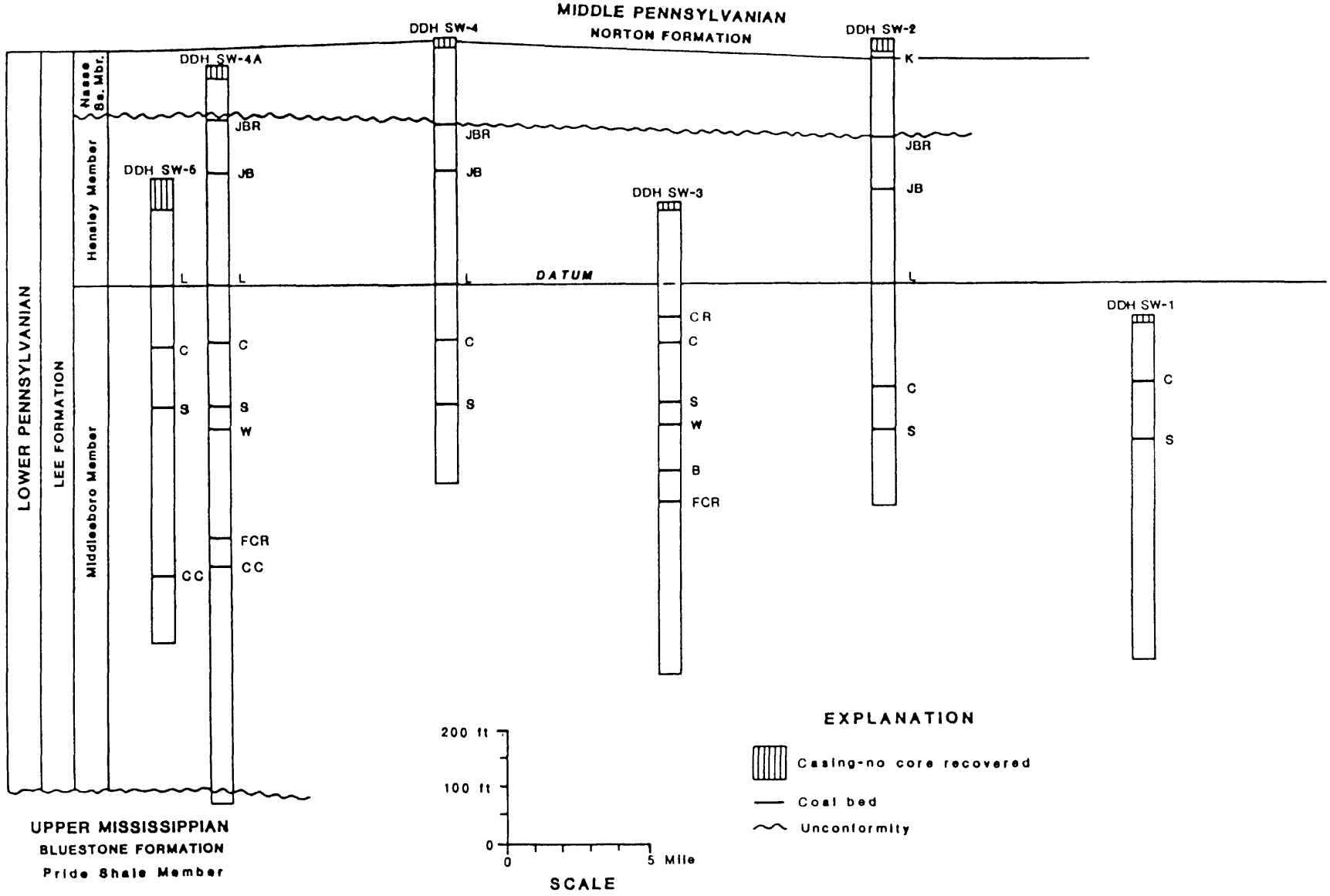


Figure 6. Correlation of coreholes in the Pine Mountain area. See Table 2 for names of coal beds, and Figures 3, 8-13 for locations of coreholes.

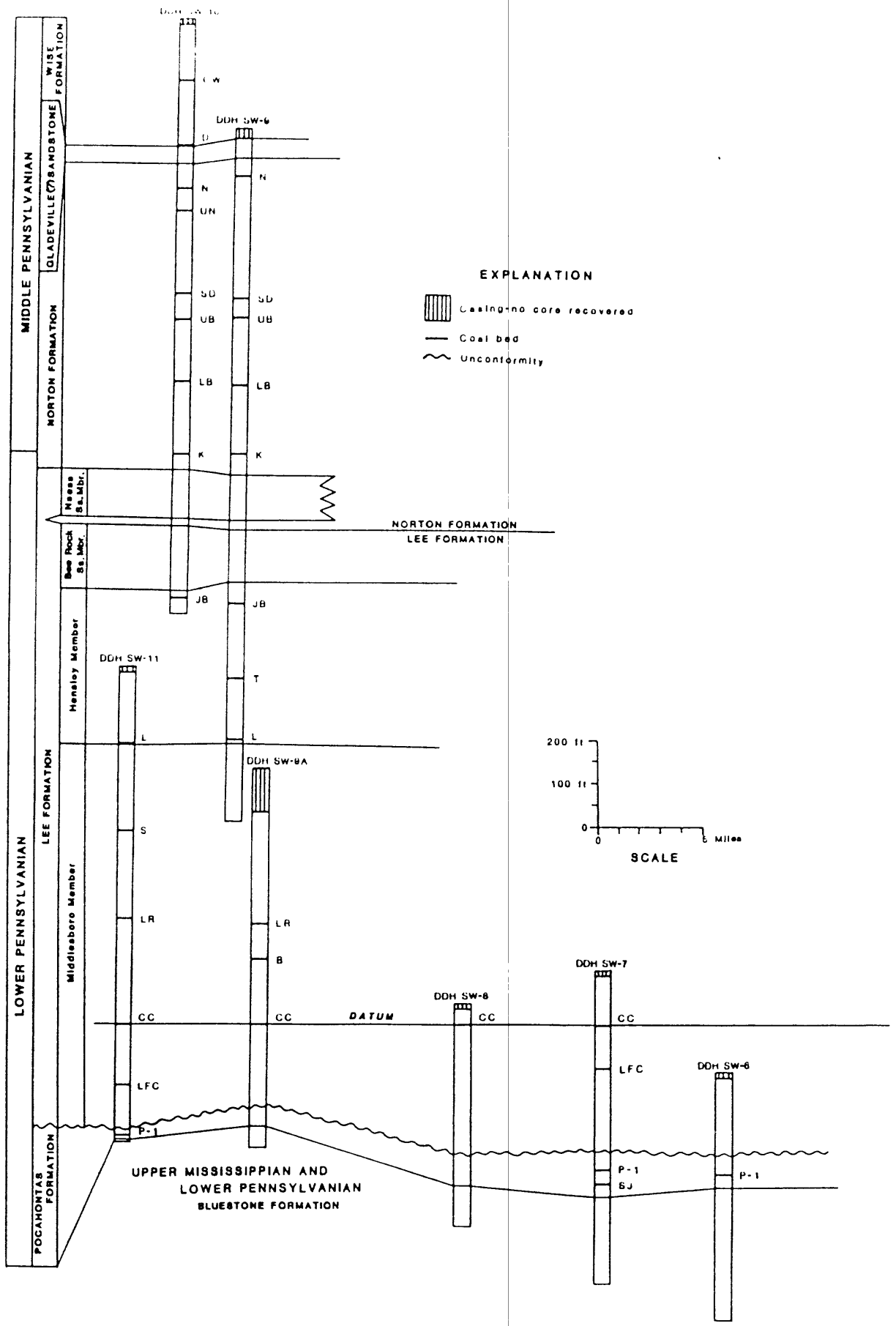


Figure 7. Correlation of coreholes in the Stone and Powell Mountain areas. See Table 2 for names of coal beds and Figures 4, 14-20 for locations of coreholes.

Previous investigations

Early investigations of coal-bearing rocks in the southwestern Virginia coal field were made by Lesley (1873), Stevenson (1881), Boyd (1887), and McCreath and d'Invilliers (1888). These studies furnished preliminary assessments of coal occurrences which provided the incentive for later comprehensive efforts to map the coal (Campbell, 1893; Butts, 1914; and Hinds, 1916). By the early 1920's a relatively standardized set of coal-bed names had been established in county reports (Hinds, 1918; Harnsberger, 1919; Giles, 1921, 1925; Wentworth, 1922; Eby, 1923). Subsequent reports covered a broad range of stratigraphic studies, economic assessments, and geologic mapping that delineated coal occurrences (Cooper, 1944; Wanless, 1946; Brown and others, 1952; Englund and Smith, 1960; Read and Mamay, 1964; and Miller, 1965). Recent reports emphasize both geologic mapping and regional stratigraphic studies of coal-bearing formations (Englund and DeLaney, 1966; Englund, 1968, 1974, 1981; Englund and others, 1979; Meissner, 1978; Meissner and Miller, 1981; R.L. Miller, 1969; M.S. Miller, 1974; Miller and Meissner, 1978; Miller and Roen, 1971).

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 Joy Manufacturing Company of LaPort, Indiana cored the drill holes under contract to the USGS; Riley, Mannon and Sturgeon Ltd. of Huntington, West Virginia conducted geophysical logging. USGS geologists were on site during the drilling to measure, describe, and box the core and to sample the coal beds. X-ray radiographs were made of the coal cores to identify partings and impurities in the coal samples before submittal for analysis. When the core drilling and geophysical logging where completed, the coreholes were cemented and the sites restored and seeded by the drilling contractor. The locations of coreholes and the generalized geology of the drill sites are shown in Figures 8-20 and drilled intervals together with correlations are indicated on Figures 6 and 7. An explanation for Figures 8-20 is presented in Table 1.

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, D. Polick, K. Branham, and H. Southerland for their aid in the selection, preparation, and restoration of the drill sites. The writers wish to thank their associates in the USGS for assistance during the drilling program, especially: T.M. Kehn and J.M. Back for describing and sampling drill core, P.L. Johnson for editing core descriptions, and R.W. Stanton and T.A. Moore for preparing X-ray radiographs of coal cores. The writers also sincerely appreciate the information and access kindly extended by private and corporate landowners in nearby areas.

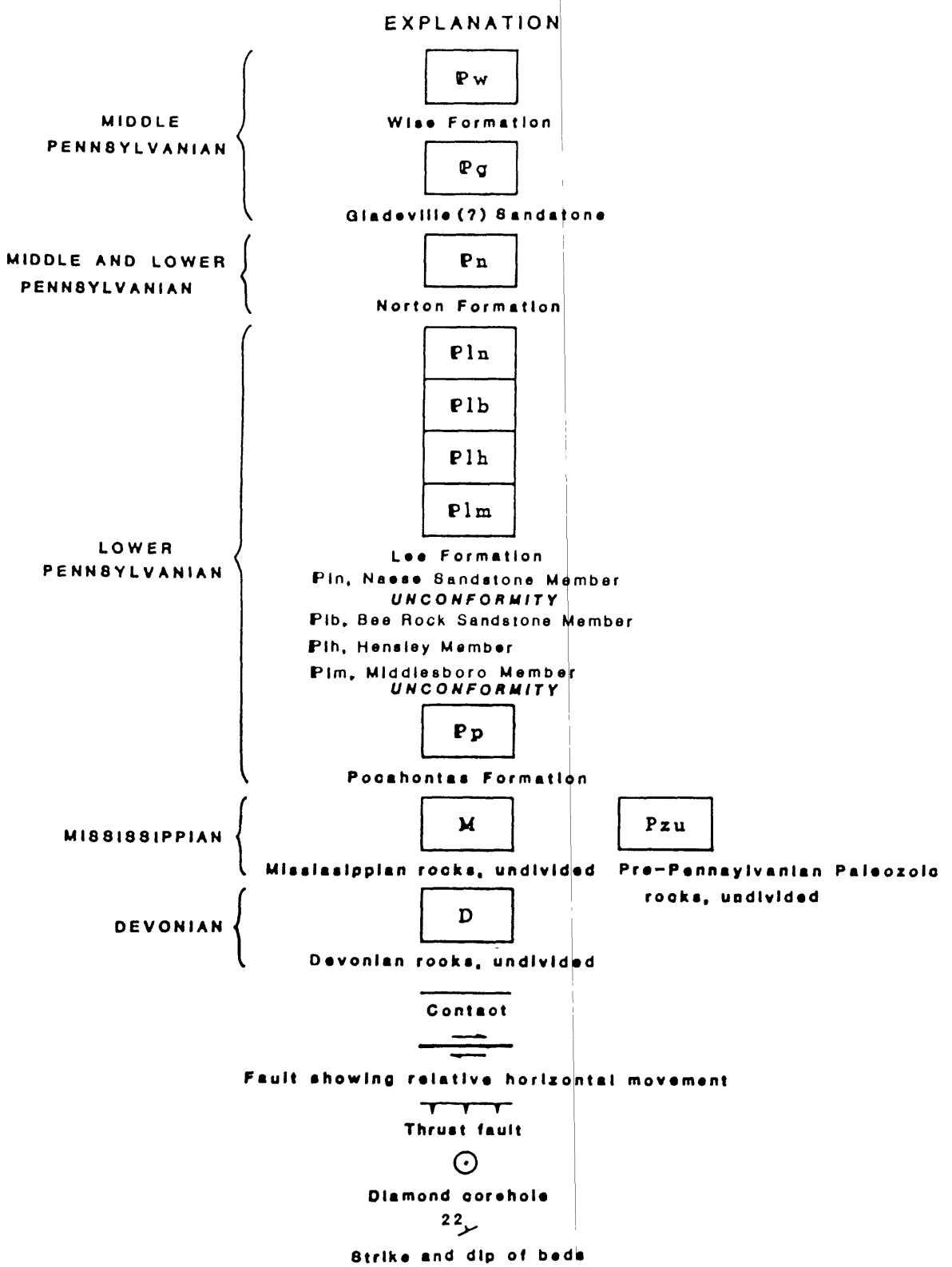


Table 1. Explanation for Figures 8-20.

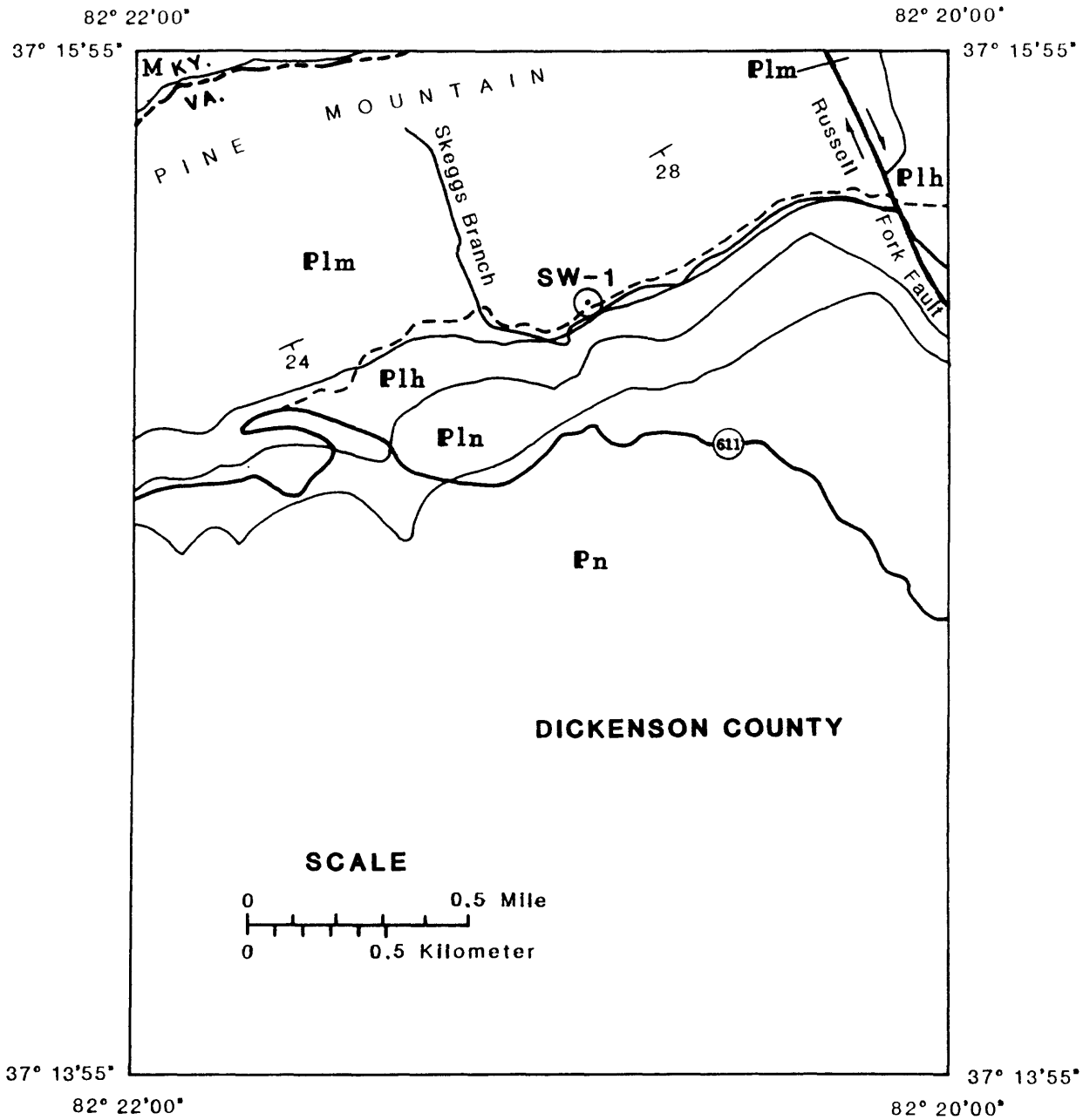


Figure 8. Location of corehole SW-1. See Table 1 for explanation of symbols.

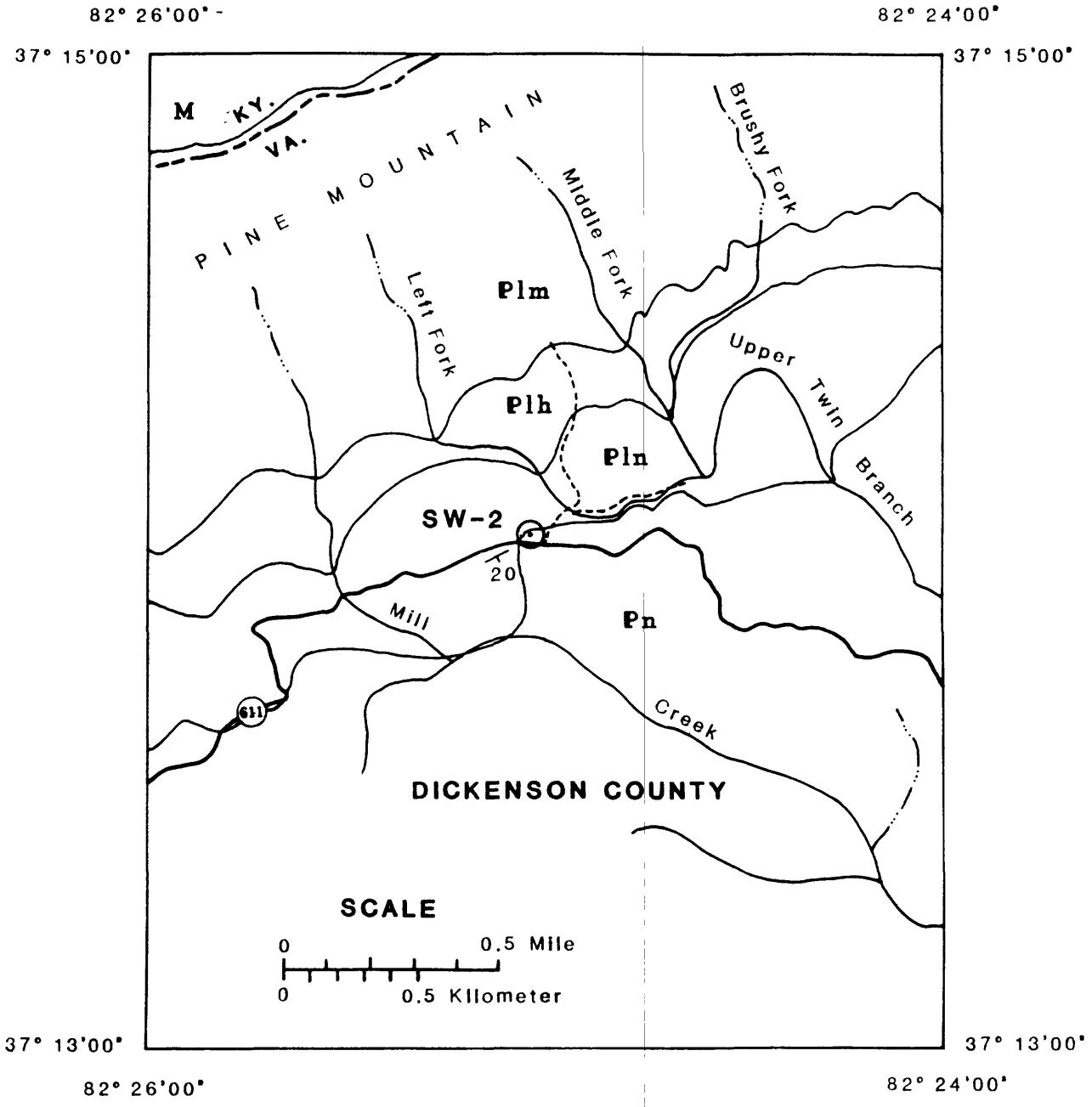


Figure 9. Location of corehole SW-2. See Table 1 for explanation of symbols.

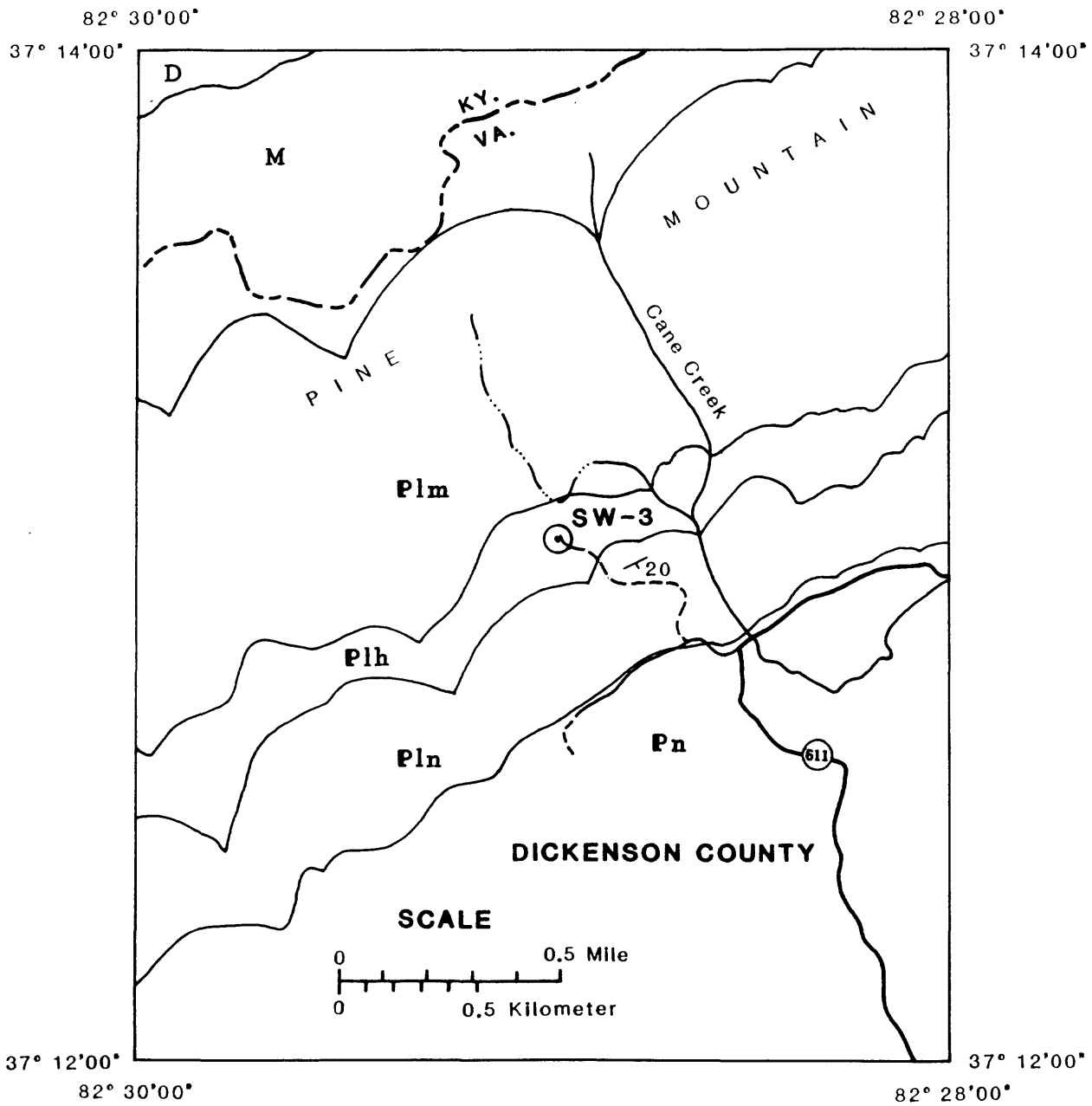


Figure 10. Location of corehole SW-3. See Table 1 for explanation of symbols.

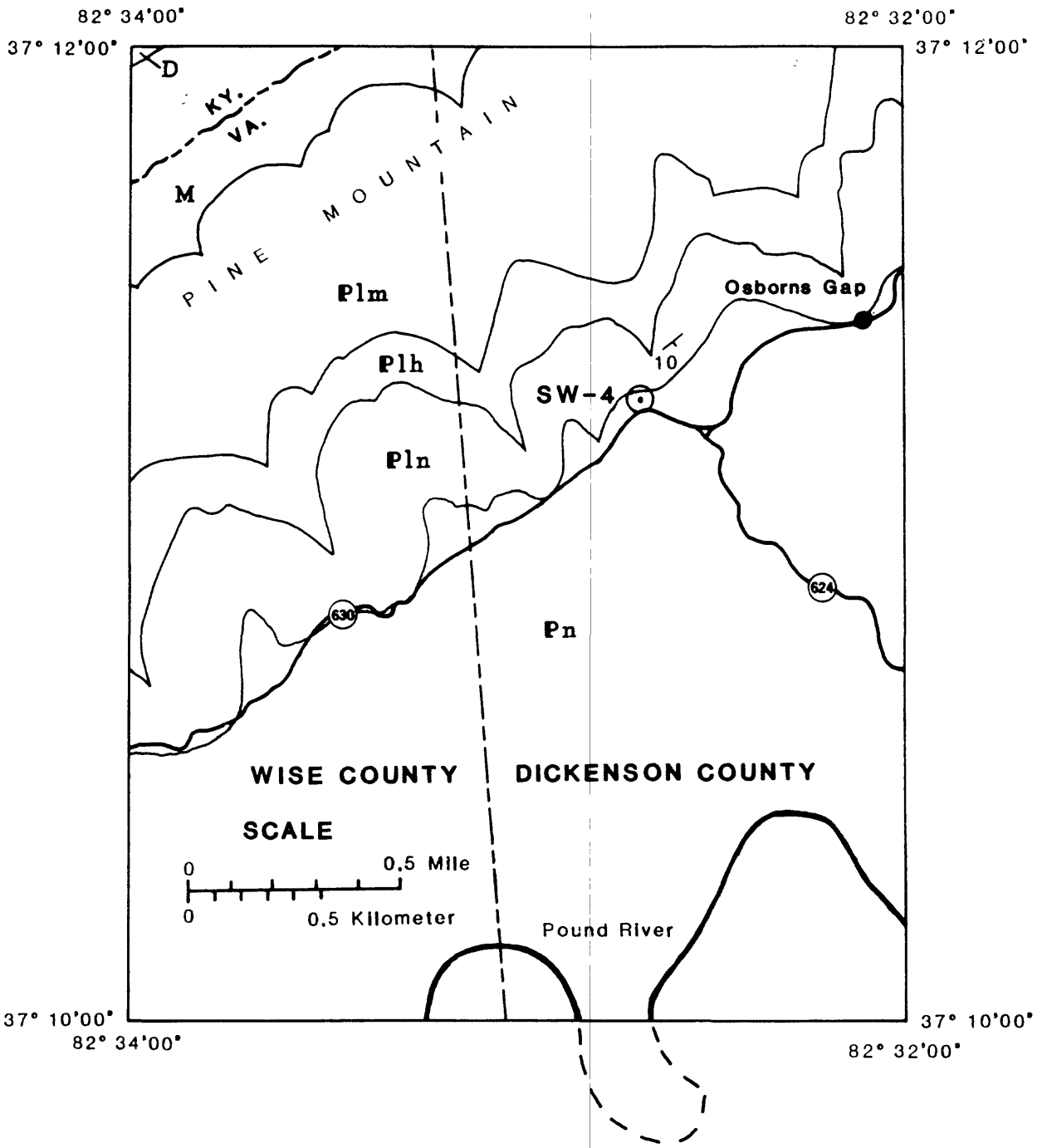


Figure 11. Location of corehole SW-4. See Table 1 for explanation of symbols.

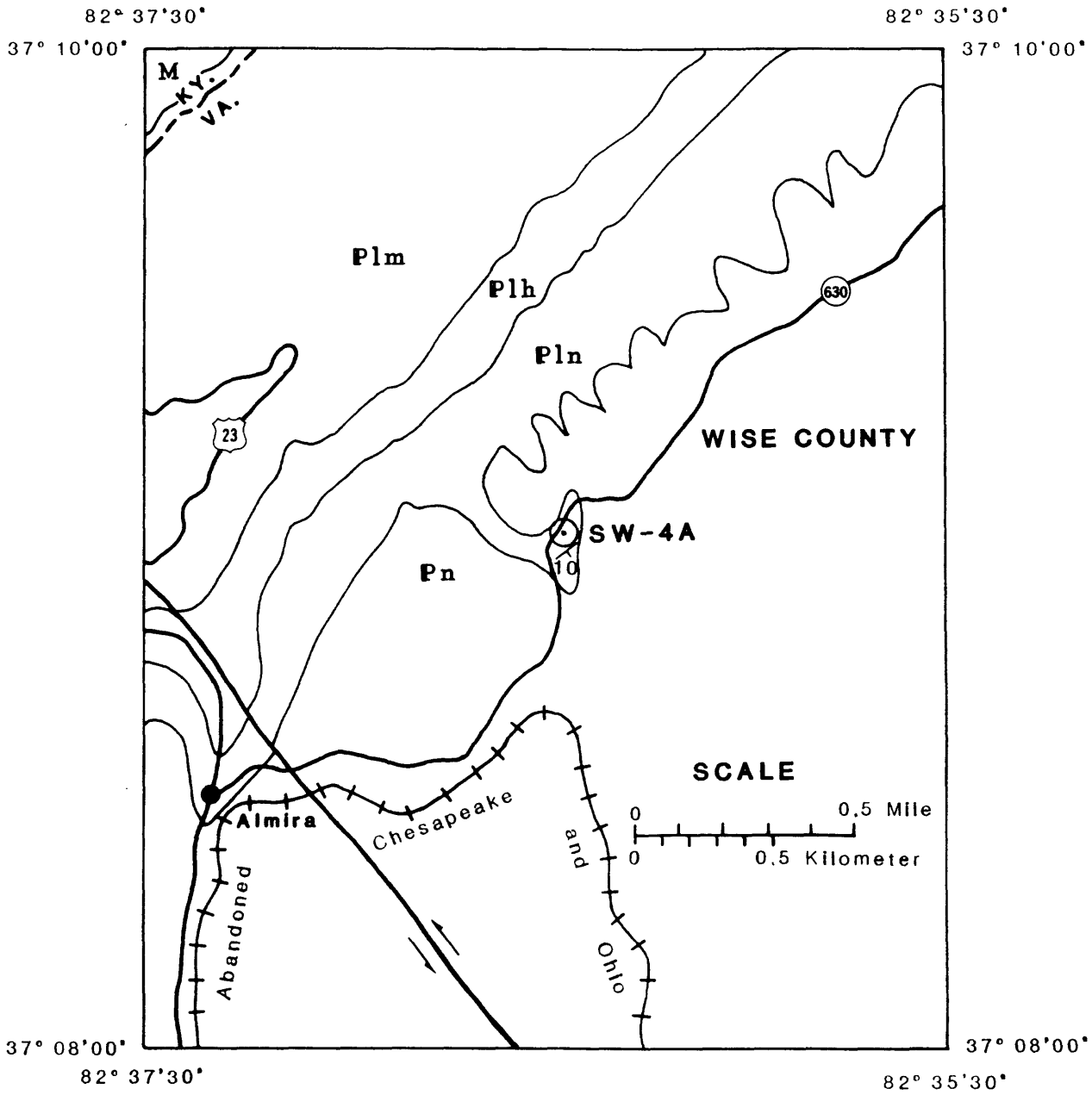


Figure 12. Location of corehole SW-4A. See Table 1 for explanation of symbols.

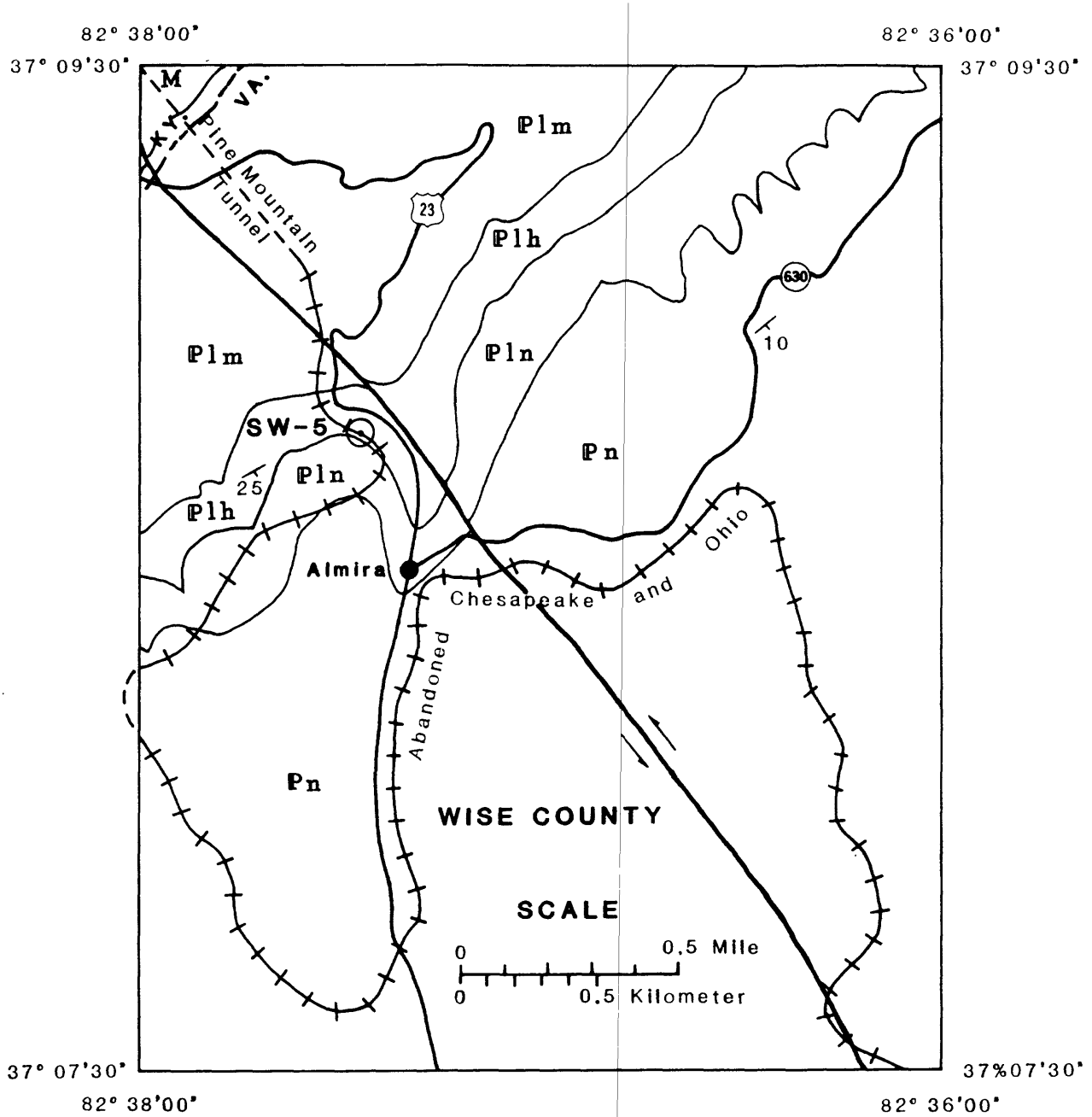


Figure 13. Location of corehole SW-5. See Table 1 for explanation of symbols.

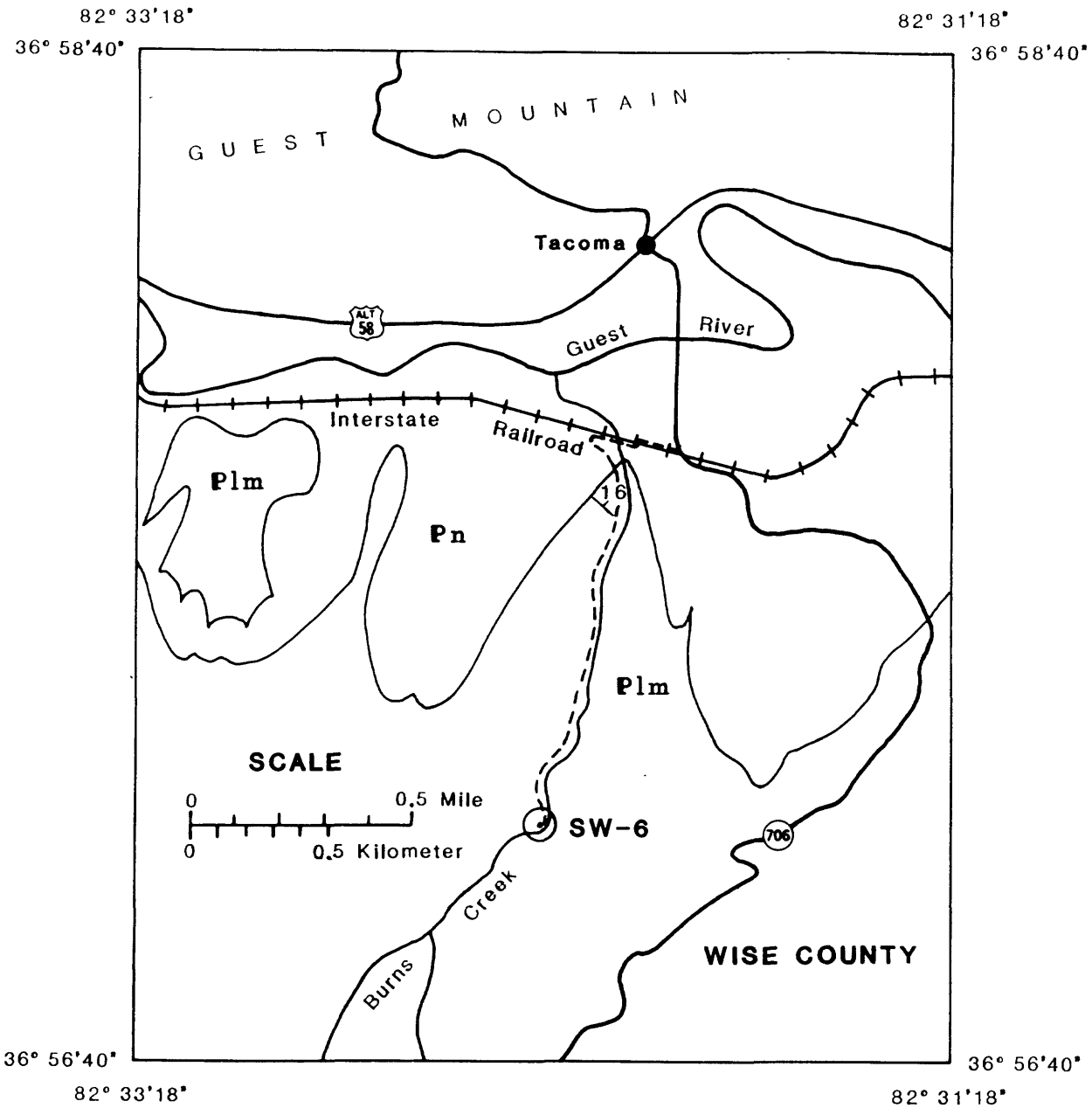


Figure 14. Location of corehole SW-6. See Table 1 for explanation of symbols.

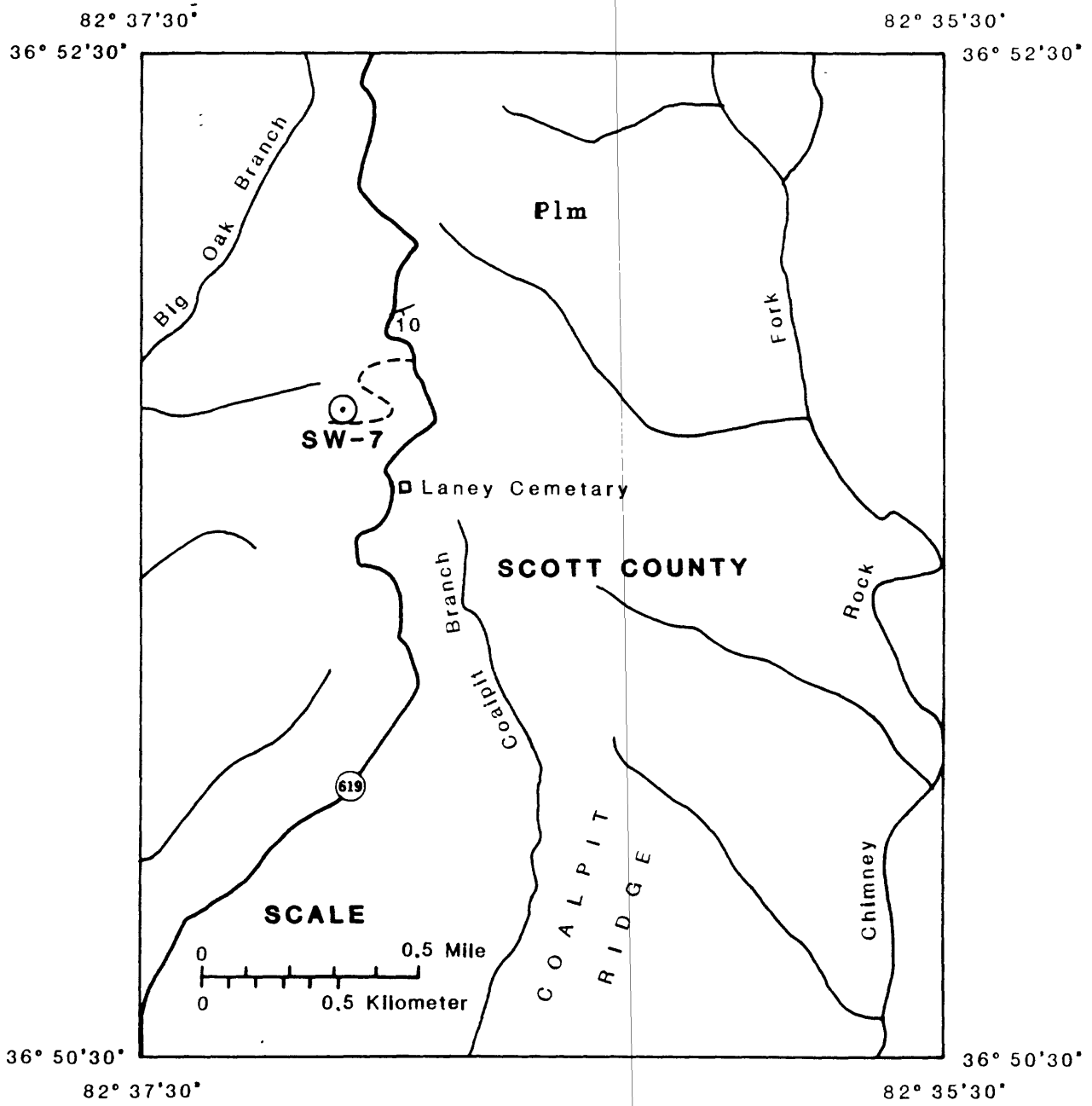


Figure 15. Location of corehole SW-7. See Table 1 for explanation of symbols.

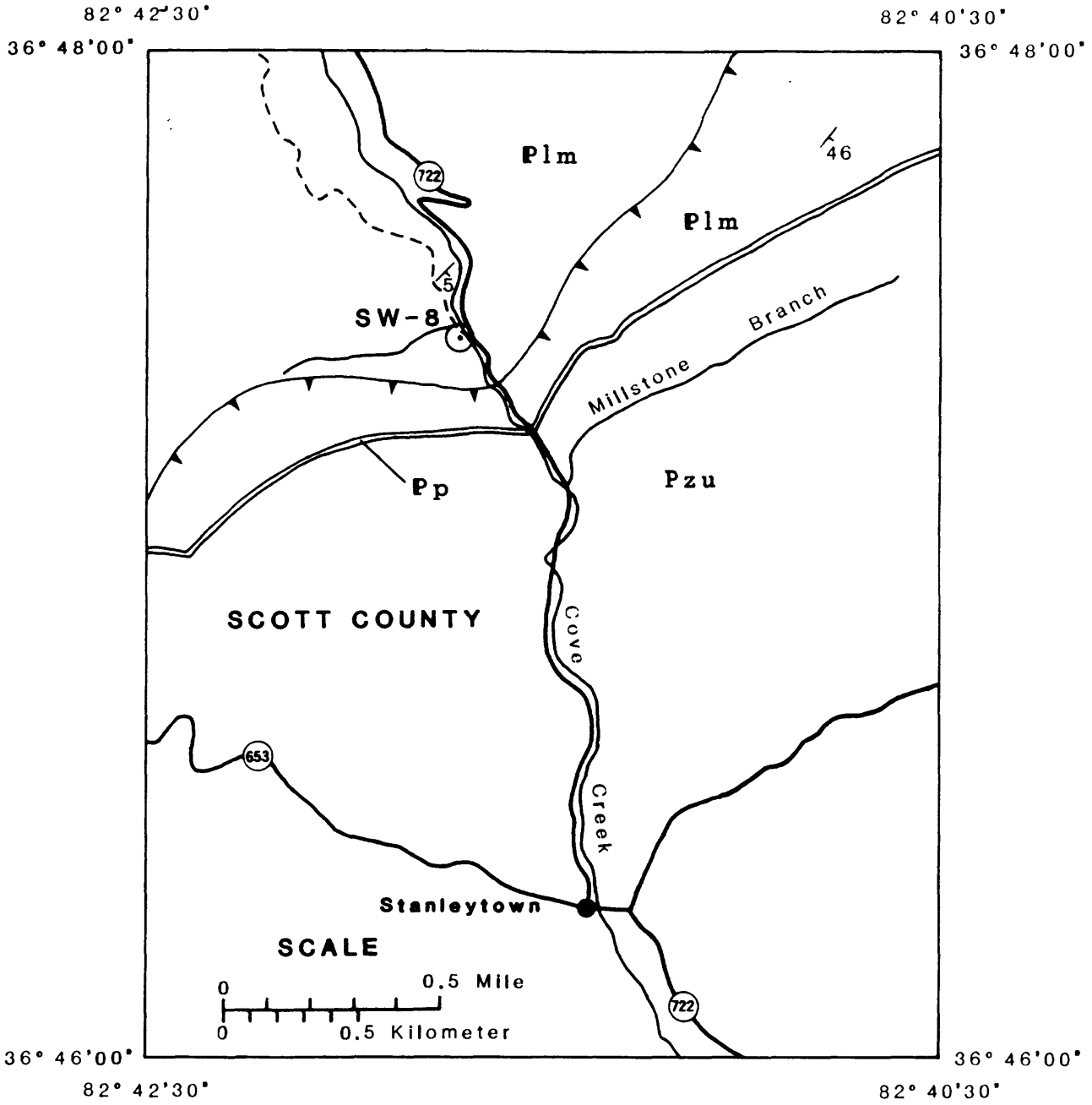


Figure 16. Location of corehole SW-8. See Table 1 for explanation of symbols.

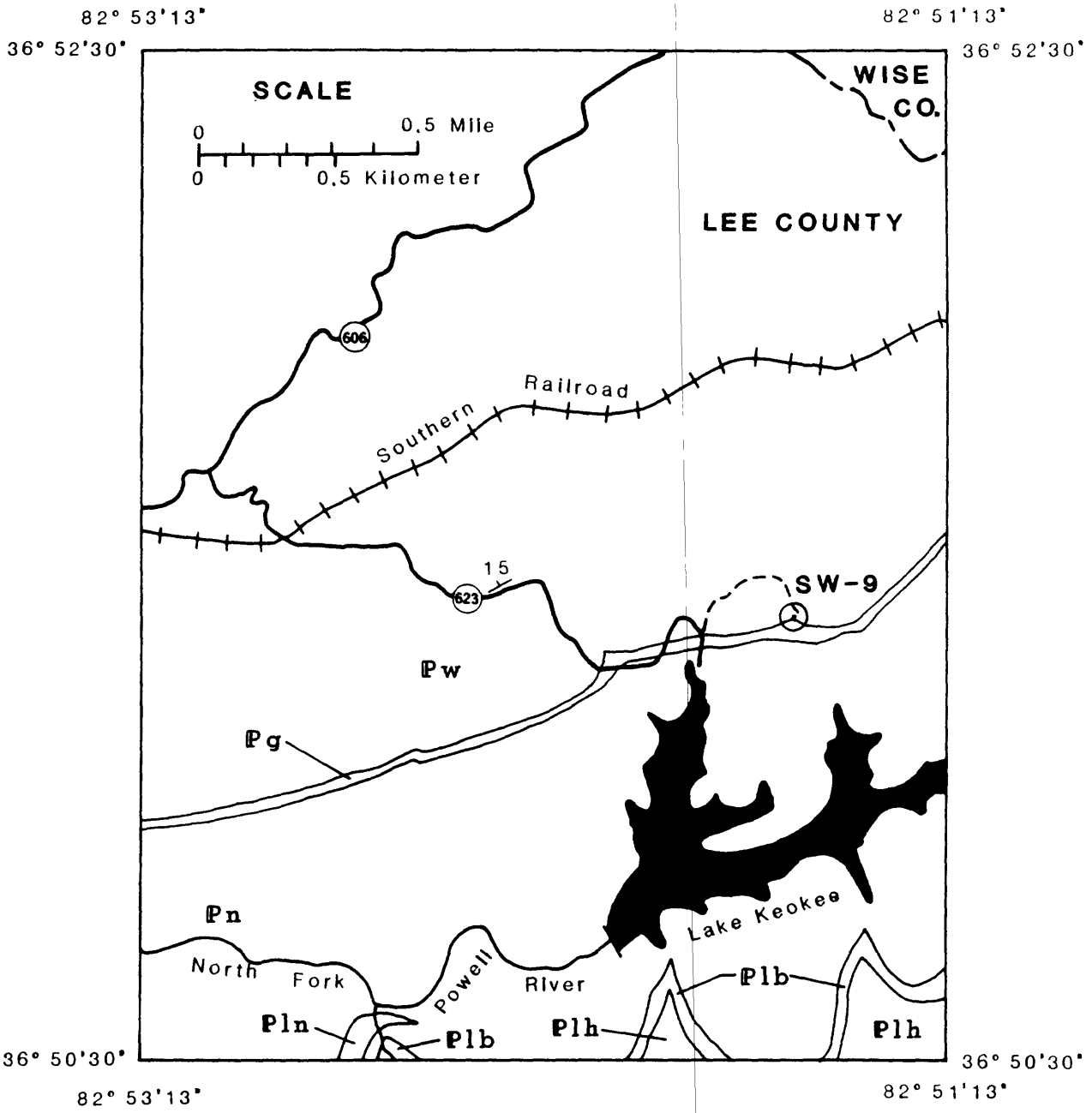


Figure 17. Location of corehole SW-9. See Table 1 for explanation of symbols.

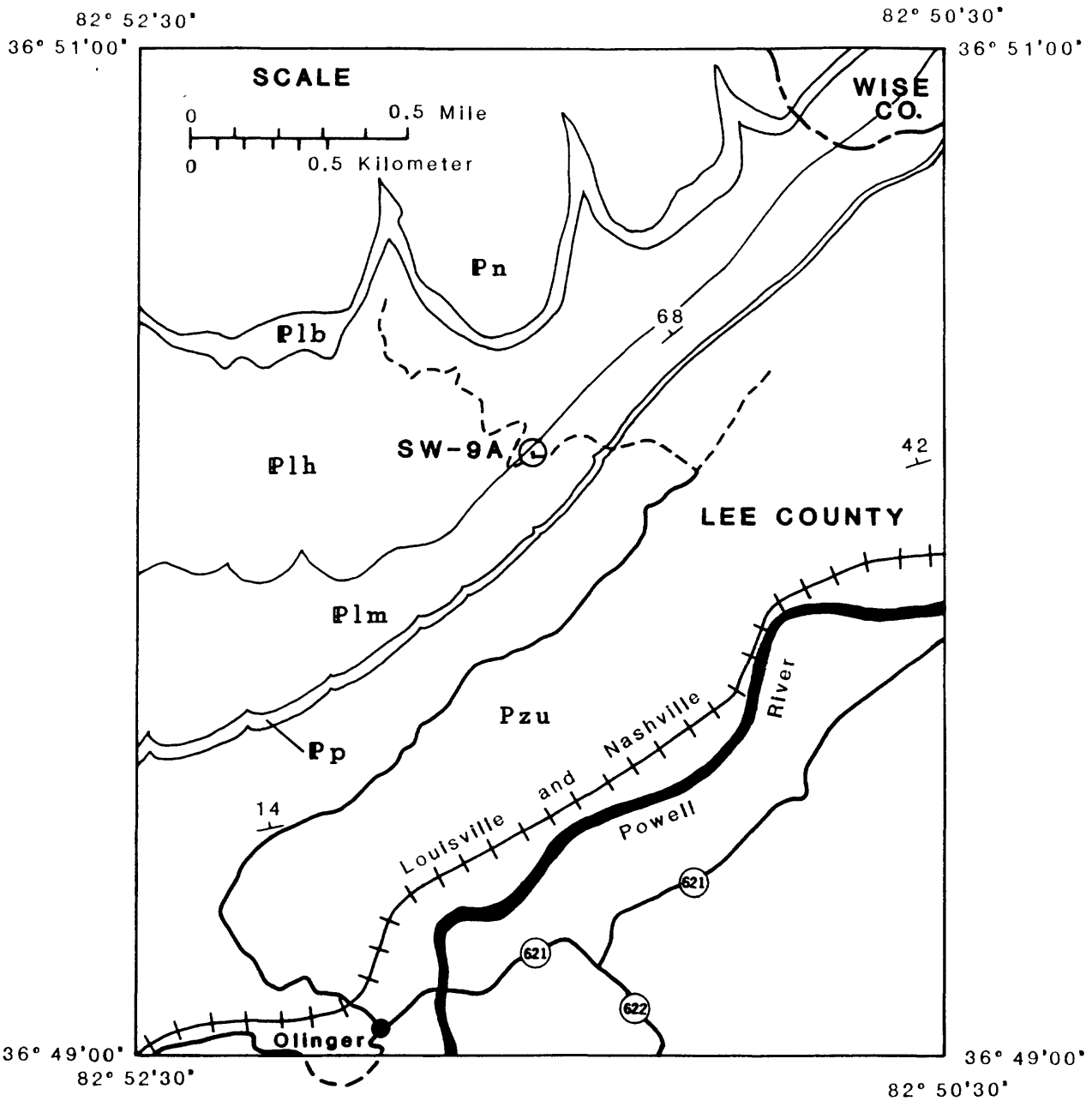


Figure 18. Location of corehole SW-9A. See Table 1 for explanation of symbols.

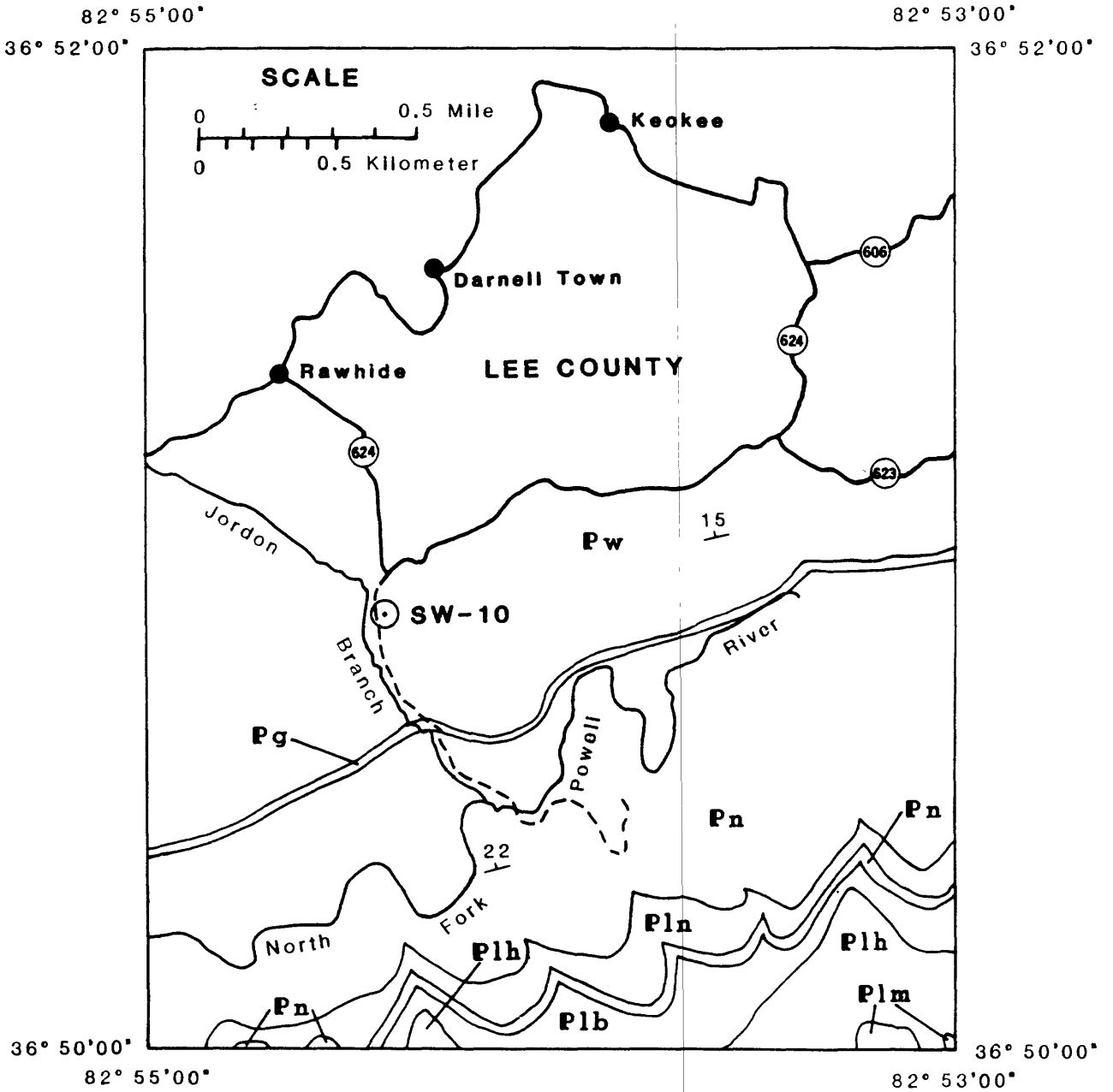


Figure 19. Location of corehole SW-10. See Table 1 for explanation of symbols.

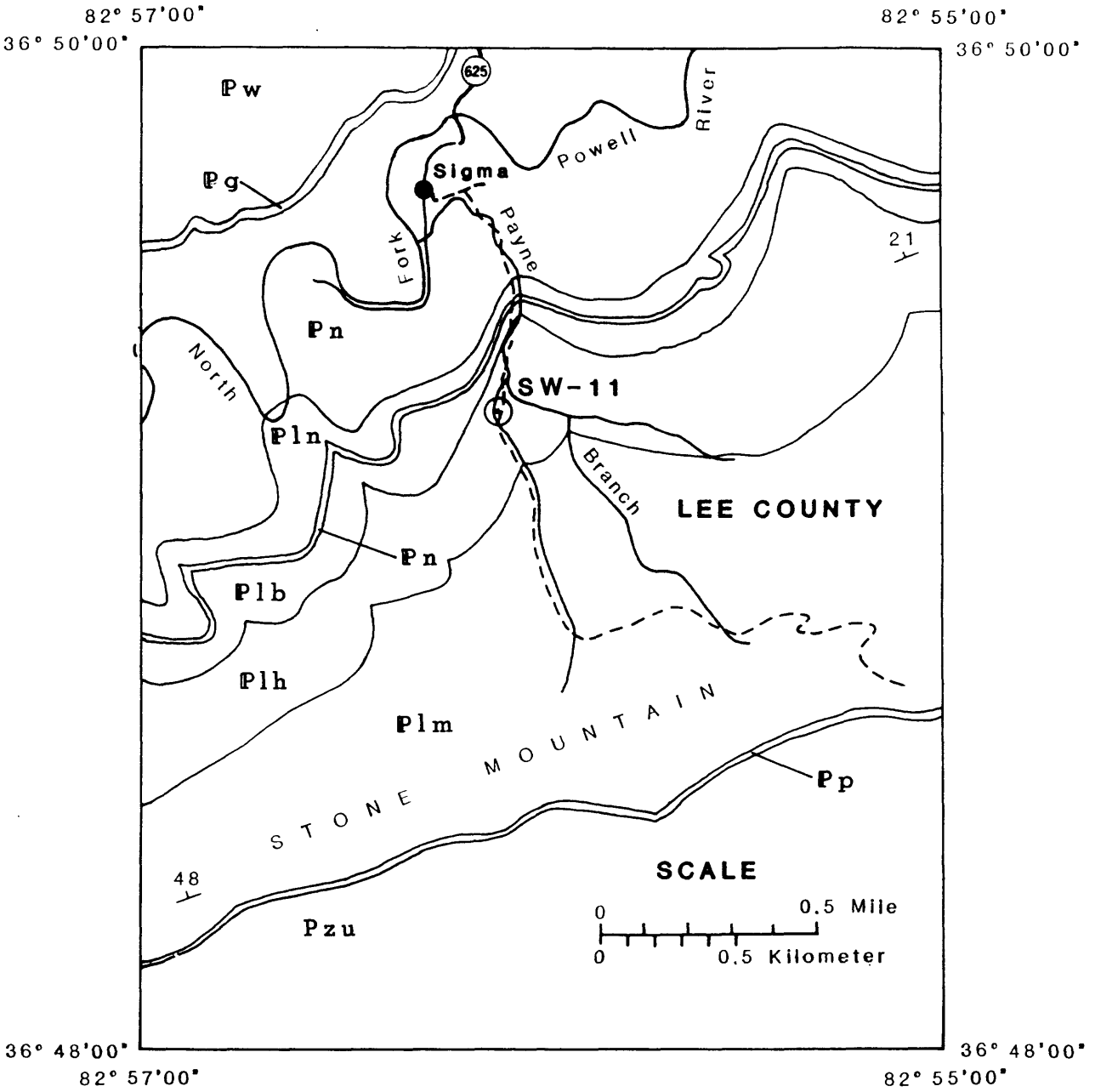


Figure 20. Location of corehole SW-11. See Table 1 for explanation of symbols.

Stratigraphy

Coal-bearing strata tested in the southwestern Virginia coal field are assigned to the Bluestone, Pocahontas, Lee, and Norton Formations, Gladeville Sandstone, and Wise Formation of Late Mississippian to Middle Pennsylvanian age (fig. 5). Twenty-six coal beds ranging from about 1 to 4.5 feet in thickness in the Pocahontas, Lee, Norton, and Wise Formations provided 52 samples for analysis (table 2). The analytical results are presented in Part 2 of this study (Simon and Englund, 1983a).

Bluestone Formation.-- The oldest strata penetrated during this drilling program in the southwestern Virginia coal field are assigned to the Bluestone Formation of Late Mississippian to Early Pennsylvanian age. It conformably underlies the Pocahontas Formation of Early Pennsylvanian age in the Stone and Powell Mountain areas. Northwestward across the coal field, most of the Bluestone and the entire Pocahontas Formation are truncated laterally by the unconformity at the base of the Lee Formation. In the Pine Mountain area, only the Pride Shale Member at the base of the Bluestone was encountered below the unconformity. This member consists of dark-gray, evenly bedded shale that is locally silty or is interlaminated with siltstone or very fine grained sandstone. Drilling extended approximately 25 feet into the member in corehole SW-4A. In the Powell Mountain area, where the entire sequence of the Bluestone is present, drilling penetrated about 265 feet of the red member in the upper part of the formation. The red member is dominantly grayish-red and greenish-gray, partly calcareous shale, siltstone, and sandstone. Coal occurs locally in the member in southwestern Virginia but none appeared in the core. The overlying Bramwell Member includes several inches of coal at its base overlain by carbonaceous and calcareous shale, siltstone, and sandstone. It ranges from 13 to 55 feet in thickness and contains brackish-water to marine fauna including ostracodes, pelecypods, and brachiopods. The overlying upper member of the Bluestone Formation consists of as much as 23 feet of grayish-red and greenish-gray shale that commonly contains an Early Pennsylvanian flora (Gillespie and Pfefferkorn, 1979).

Pocahontas Formation.-- The lower part of the Pocahontas Formation of Early Pennsylvanian age occurs in the Stone and Powell Mountain areas where it is as much as 120 feet thick. It is a northwestward thinning wedge of sandstone, siltstone, shale, coal, and underclay that is truncated by the unconformity at the base of the Lee Formation.

The Pocahontas is absent in the Pine Mountain area. Two thin coal beds, correlated with the Squire Jim and Pocahontas No. 1, were encountered by drilling in the Stone and Powell Mountain areas.

Lee Formation.-- Early Pennsylvanian rocks characterized by beds of massive conglomeratic quartzose sandstone, separated by less resistant feldspathic sandstone, siltstone, shale, coal, and underclay, are assigned to the Lee Formation. Thicknesses of the formation range from about 1,300 feet along Pine Mountain to 1,600 feet along Stone Mountain. A complete thickness is not present in the Powell Mountain area because of the erosion of members in the upper part of the formation. Four members -- Middlesboro, Hensley, Bee Rock Sandstone, and Naese Sandstone -- were identified in the drilled

Table 2. -- Thicknesses of sampled coal beds.

Corehole	Unit no. (lithic desc.)	Field sample no.	Coal bed name	Symbol used in figs. 6-7	Drilled depth to top of coal bed (ft-in.)	Drilled thickness of coal bed (in.)	Approximate dip of bed	Calculated thickness of bed (in.)
SW-1	17	sw1-c1	Sewell(?)	S	230-0	20	25°	18.1
SW-2	3	sw2-c1	Kennedy	K	35-0	40	10°	39.4
	39	sw2-c2	Jawbone	JB	279-9	25	11°	24.5
	95	sw2-c3	Castle(?)	C	646-4	20	10°	19.7
SW-3	36	sw3-c1	Castle rider(?)	CR	207-2	13	20°	12.2
	68	sw3-c2	Sewell(?)	S	359-10	13.5	20°	12.7
	90	sw3-c3	Welch(?)	W	404-1	13	20°	12.2
	103	sw3-c4	Beckley	B	486-11	54	20°	50.7
	125	sw3-c5	Fire Creek rider	FCR	546-5	17	18°	16.2
SW-4	19	sw4-c1	Jawbone rider	JBR	152-8	13	5°	13.0
	29	sw4-c2	Jawbone	JB	240-4	34	5°	34.0
	46	sw4-c3	Upper split of Lee	L	456-5	7	5°	7.0
	49	sw4-c4	Lower split of Lee	L	458-1	7	5°	7.0
	58	sw4-c5	Castle(?)	C	553-3	25	5°	24.9
	91	sw4-c6	Sewell(?)	S	668-3	21.75	5°	21.7
SW-4A	25	sw4a-c2	Jawbone	JB	194-6	27	7°	26.8
	56	sw4a-c3	Lee	L	399-3	11.5	4°	11.5
	155	sw4a-c4	Fire Creek rider	FCR	846-8	18	5°	17.9
	162	sw4a-c5	Cove Creek	CC	899-11	14	6°	13.9

(continued)

Table 2. -- Thicknesses of sampled coal beds (cont.)

Corehole	Unit no. (lithic desc.)	Field sample no.	Coal bed name	Symbol used in figs. 6-7	Drilled depth to top of coal bed (ft-in.)	Drilled thickness of coal bed (in.)	Approximate dip of bed	Calculated thickness of bed (in.)
SW-5	35	sw5-c1	Castle(?)	C	303-5	36	20°	33.8
SW-6	47	sw6-c1	Pocahontas No. 1	P-1	252-11.5	12	5°	12.0
SW-7	50	sw7-c1	Upper Split of Cove Creek	CC	127-2	18	9°	17.8
	58	sw7-c2	Lower Split of Cove Creek	CC	139-6	10.5	8°	10.4
	68	sw7-c3	Upper Split of Little Fire Creek (?)	LFC	226-7	14	8°	13.9
	77	sw7-c4	Lower Split of Little Fire Creek (?)	LFC	251-3	25	9°	24.7
	109	sw7-c5	Pocahontas No. 1	P-1	486-8	9.25	12°	9.1
	120	sw7-c6	Squire Jim	SJ	520-9	18	8°	17.8
SW-8	19	sw8-c1	Lower Split of Cove Creek	CC	57-8	17	9°	16.8
SW-9	10	sw9-c1	Norton	N	110-1	26	15°	25.1
	65	sw9-c4	Splash Dam(?)	SD	402-8	35.5	15°	34.3
	70	sw9-c5	Upper Banner	UB	450-8	40.5	10°	39.9
	97	sw9-c6	Lower Banner	LB	616-3	19	7°	18.9
	132	sw9-c7	Kennedy	K	781-4	26.5	5°	26.4
	216	sw9-c8	Jawbone	JB	1138-0	28	9°	27.7
	241	sw9-c9	Tiller	T	1320-8	13	2°	13.0
	252	sw9-c10	Lee	L	1463-11	27	0°	27.0
SW-9A	17	sw9a-c1	Little Raleigh(?)	LR	381-10	31	18°	29.5
	38	sw9a-c2	Beckley	B	462-7	27.75	10°	27.3
	73	sw9a-c3	Cove Creek	CC	622-8	25	8°	24.8

Table 2. -- Thicknesses of sampled coal beds (cont.)

Corehole	Unit no. (lithic desc.)	Field sample no.	Coal bed name	Symbol used in figs. 6-7	Drilled depth to top of coal bed (ft-in.)	Drilled thickness of coal bed (in.)	Approximate dip of bed	Calculated thickness of bed (in.)
SW-10	29	sw10-c2	Clintwood	CW	149-1.5	40.5	10°	39.9
	61	sw10-c4	Dorchester	D	310-11	48	10°	47.3
	79	sw10-c5	Norton	N	402-1	35.5	10°	35.0
	94	sw10-c6	Unnamed	UN	460-5	16	0°	16.0
	123	sw10-c7	Splash Dam(?)	SD	667-1	19	1°	19.0
	135	sw10-c8	Upper Banner	UB	729-4	33	2°	33.0
	193	sw10-c9	Lower Banner	LB	885-3	14.5	2°	14.5
	226	sw10-c10	Kennedy	K	1065-10	18	2°	18.0
	259	sw10-c11	Jawbone	JB	1398-9	21.75	1°	21.75
SW-11	28	sw11-c1	Lee	L	181-3	22.5	8°	22.3
	161	sw11-c2	Little Fire Creek (?)	LFC	1003-2	48.5	12°	47.4
	185	sw11-c3	Pocahontas No. 1	P-1	1131-7	12	10°	11.8

sequence. A fifth member -- White Rocks Sandstone -- may be included in the base of the Middlesboro Member in corehole SW-11. The possibility that the White Rocks Sandstone Member may occur in this immediate area was indicated by Miller (1969).

The Middlesboro Member at the base of the Lee Formation commonly consists of four tongues of conglomeratic quartzose sandstone that thin and diverge eastward (Englund and DeLaney, 1966). Intervening beds are feldspathic sandstone, siltstone, shale, coal, and underclay. The overlying Hensley Member of the Lee Formation is mostly nonresistant sandstone, siltstone, and shale. Two or three relatively persistant coal beds in the member are widely recognized in the southwestern Virginia coal field. The top of the Lee Formation along Stone Mountain in the Big Stone Gap quadrangle is at the top of the Bee Rock Sandstone Member, a prominent conglomeratic quartzose sandstone (Miller, 1965). In the outcrop belt along Pine Mountain the top of the Lee Formation is at the top of the stratigraphically higher Naese Sandstone Member, also a prominent conglomeratic quartzose sandstone (Ashley and Glenn, 1906, p. 35). The Bee Rock and Naese Sandstone Members converge northwestward and, because of a shortened stratigraphic sequence, the Bee Rock is most likely truncated to the northwest.

Norton Formation.-- The Norton Formation conformably overlies the Lee Formation and consists of about 720-740 feet of medium- to dark-gray shale and siltstone with lesser amounts of fine- to medium-grained sandstone, underclay, and coal. Regionally, a quartzose conglomeratic sandstone tongue of the Lee Formation wedges out eastward in the lower part of the Norton (Englund and DeLaney, 1966; Miller, 1974, p. 101). The boundary between the Lower and Middle Pennsylvanian Series is placed at the base of the Kennedy coal bed in the lower part of the formation in the southwestern Virginia coal field (Englund, 1981).

Gladeville (?) Sandstone.-- The Gladeville (?) Sandstone, used to identify the boundary between the Norton and Wise Formations, consists of 40 to 50 feet of feldspathic to moderately quartzose, fine- to medium-grained sandstone. Problems associated with the regional correlation of the Gladeville were pointed out by Miller (1969, p. 11-18) and, for this reason, the formation is tentatively identified on the basis of its stratigraphic position between the Norton and Dorchester coal beds.

Wise Formation.-- The Wise Formation of Middle Pennsylvanian age conformably overlies the Gladeville(?) Sandstone. It is a sequence of intercalated sandstone, siltstone, shale, coal, and underclay that is lithically similar to the Norton Formation. About 300 feet of beds in the lower part of the formation were drilled in corehole SW-10.

Structural setting

Federal mineral properties in the southwestern Virginia coal field are in the Cumberland Mountain section of the Appalachian Plateaus physiographic province. These areas are also in the northeastern part of the Pine Mountain overthrust sheet, which includes two parallel but rootless folds--the Powell Valley anticline and the Middlesboro syncline. Faults bordering the thrust

sheet near the areas of drilling are the Russell Fork fault at the northeastern edge (fig. 8) and the Pine Mountain thrust fault at the northwestern edge. The latter fault is exposed in Kentucky, parallel to Pine Mountain, and dips southeastward beneath the area of drilling. Faulted pre-Pennsylvanian Paleozoic strata of the Valley and Ridge physiographic province border the southeastern edge of the overthrust (fig. 16). Strike-slip faults of undetermined displacement are locally present within the thrust sheet (fig. 12).

Strata in the vicinity of the drill sites strike N65°E and dip about 30°SE along Pine Mountain, strike N65°E and dip as much as 70°NW along Stone Mountain, and strike N50°E and dip 10° to 60°NW or SE in the Powell Mountain area. The dip of strata in the drill holes generally decreased with depth. All thicknesses indicated in Figures 6 and 7, individual beds in the lithic descriptions, and on the geophysical logs are drilled thicknesses that have not been corrected for dip. Drilled thicknesses, dips, and calculated thicknesses (normal to bedding) of the sampled coal beds are listed in Table 2.

Lithologic descriptions and geophysical logs

Detailed lithologic descriptions of the core from each drill hole is followed by the geophysical log at a scale of 1 inch = 20 feet. High resolution-density logs of coal beds about one foot or more in thickness are also given at a scale of 1 inch = 2 feet.

Corehole SW-1

Location: Dickenson County; Elkhorn City, Ky.-Va., 7.5 minute quadrangle; on Skeggs Branch about 0.7 mi southeast of Kentucky-Virginia state line. Accessible by gravel road extending 0.8 mi northeastward from State Route 611.

Coordinates: Latitude 37°15'23" N Longitude 82°20'55"W

Altitude: 1,640 ft Drilled depth: 642 ft

Dip of strata: Ranges from 25° to 30° to depth of 520 ft, decreasing to 19° at base of corehole.

Date drilled: January 26, 1983 to February 8, 1983

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

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER PENNSYLVANIAN SERIES Lee Formation Middlesboro Member		
1.	Soil and weathered rock (casing set - no core recovered).....	14	0
		(14	0)
2.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, few dark mineral grains, few coal and medium-gray micaceous siltstone laminae, abundant medium-dark-gray shale clasts up to 2 in. in diameter at base, thin- to thick-bedded, some contorted bedding; base sharp.....	17	9
		(31	9)
3.	Sandstone, medium-light-gray, fine- to medium-grained, sparsely micaceous, conglomeratic with abundant well rounded white quartz pebbles up to 0.25 in. in diameter, contains 65 percent quartz, few dark and light mineral grains, scattered coal laminae; base sharp and angular.....	9	3
		(41	0)
4.	Sandstone, light-gray, very fine to fine-grained, contains 90 percent quartz, few scattered dark and light mineral grains, few dark-gray carbonaceous shale laminae 7 ft below top, petroliferous from 14 ft 5 in. to 15 ft 5 in. below top, few scattered well rounded white quartz pebbles up to 0.5 in. in diameter in basal 30 ft, crossbedded, thick-bedded to massive; base sharp and uneven.....	49	9
		(90	9)
5.	Coal, dull to bright attritus, few pyritic fusain laminae.....	0	5
		(91	2)

Unit Number	Description	Thickness (Depth) ft	in.
6.	Underclay, medium-gray, abundant rootlets, sandy at base; base grades.....	1	7
		(92	9)
7.	Sandstone, light- to medium-light-gray, petroliferous and mottled brownish-gray in part, fine- to medium-grained, micaceous, contains 65 percent quartz, abundant dark and light mineral grains, few medium-gray shale clasts 3 ft. 11 in. above base, thick-bedded to massive; base sharp.....	24	0
		(116	9)
8.	Shale, medium-dark-gray, very silty, contains 40 percent light gray very fine grained sandstone laminae, carbonaceous in basal 4 in., evenly bedded.....	1	0
		(117	9)
9.	Sandstone, medium-gray, very fine grained, silty, contains 45 percent quartz, 40 percent dark-gray silty shale laminae; base sharp.....	0	5
		(118	2)
10.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, abundant dark and light mineral grains, abundant coal laminae and clasts, few scattered quartz granules and siderite clasts; base sharp and angular.....	7	0
		(125	2)
11.	Coal, Castle(?) coal bed, dull to bright attritus, few vitrain bands.....	1	0
		(126	2)
12.	Underclay, medium-gray, very silty, abundant rootlets.....	2	7
		(128	9)
13.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 65 percent quartz, 10 percent medium-gray shale laminae and beds up to 1 in. thick, few small-scale slump structures, few dark-gray shale clasts in basal 2 ft 5 in., thin-bedded, few contorted beds; base sharp.....	7	6
		(136	3)
14.	Sandstone, light-gray, fine- to medium-grained, contains 90 percent quartz, few dark-gray shale and coal laminae, few scattered well rounded white quartz pebbles up to 0.5 in. in diameter in basal 43 ft, 1 in. thick coal clast 4 ft 2 in. above base; base sharp and uneven.....	72	5
		(208	8)

Unit Number	Description	Thickness (Depth) ft	in.
15.	Shale, medium-dark- to dark-gray, silty, carbonaceous, contains 15 percent light-gray very fine grained silty sandstone laminae, few scattered siderite beds and nodules, few plant fragments, burrowed, evenly bedded, fair fissility; base sharp.....	21	2
		(229	10)
16.	Shale, dark-gray, carbonaceous, fair fissility.....	0	2
		(230	0)
17.	Coal, Sewell (?) coal bed (thickness-1 ft 8 in.)		
	17a. Coal, dull and bright attritus, few vitrain bands.....	1	0
		(231	0)
	17b. Coal, very pyritic.....	0	1
		(231	1)
	17c. Coal, dull attritus, few vitrain bands.....	0	7
		(231	8)
18.	Underclay, medium- to medium-dark-gray, carbonaceous, abundant rootlets and root slicks.....	1	4
		(233	0)
19.	Coal, dull to bright attritus, few shale laminae.....	0	1
		(233	1)
20.	Underclay, medium-gray, silty in basal 8 in.....	3	5
		(236	6)
21.	Siltstone, medium-gray, contains 10 percent dark-gray shale laminae and 10 percent light-gray very fine grained silty sandstone laminae, few coal laminae, evenly bedded.....	1	6
		(238	0)
22.	Shale, medium-gray, silty, slightly carbonaceous, contains few light-gray very fine grained sandstone laminae in basal 2 in., evenly bedded, fair fissility; base sharp.....	0	6
		(238	6)
23.	Shale, medium- to medium-dark-gray, contains 10 percent light-gray very fine grained silty sandstone laminae and beds, fair fissility; base sharp.....	7	2
		(245	8)
24.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, thick-bedded; base sharp.....	0	11
		(246	7)
25.	Siderite, brownish-gray.....	0	0.5
		(246	7.5)

Unit Number	Description	Thickness (Depth) ft	in.
26.	Shale, medium- to medium-dark-gray, carbonaceous, few plant fragments, fair fissility; base grades.....	2	3.5
		(248	11)
27.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, few medium-dark-gray shale laminae and beds in top 1 in.; base sharp.....	0	9
		(249	8)
28.	Shale, medium- to medium-dark-gray, evenly bedded, fissile.....	0	2.5
		(249	10.5)
29.	Siltstone, medium-gray, argillaceous, poorly bedded.....	1	1.5
		(251	0)
30.	Sandstone, light- to medium-light-gray, very fine to fine-grained contains 65 percent quartz, few medium-dark-gray silty shale laminae, few rootlets in top 3 in., crossbedded, thin- to thick-bedded; base sharp.....	6	7
		(257	7)
31.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, few dark-gray micaceous siltstone laminae, petroliferous top 1 ft 5 in., few scattered well rounded white quartz pebbles up to 0.5 in. in diameter in basal 47 ft; base grades.....	76	0
		(333	7)
32.	Sandstone, white to very light gray, fine- to medium-grained, contains 90 percent quartz, few scattered well rounded white quartz pebbles and granules mostly from 0.25 in. to 0.5 in. in diameter, few stylolites, crossbedded, thick-bedded to massive.....	30	5
		(364	0)
33.	Sandstone, white to very light gray, medium-grained, conglomeratic with well rounded white quartz pebbles and granules up to 1 in. in diameter, contains 90 percent quartz, few coal clasts 4 ft 3 in. below top, few siderite clasts, crossbedded, massive; base grades.....	11	4
		(375	4)
34.	Sandstone, white to very light gray, mottled brownish-gray from 9 ft 5 in. to 11 ft 8 in. below top, fine- to medium-grained, mostly medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles in basal 68 ft 3 in., few stylolites, massive; base sharp.....	84	3
		(459	7)
35.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, few medium-dark-gray shale clasts from 1 ft to 3 ft below top; abundant angular medium-dark-gray shale, siderite and coal clasts in basal 1 ft; thick-bedded to massive, contorted bedding in basal 1 ft.....	8	9
		(468	4)

Unit Number	Description	Thickness (Depth) ft	in.
36.	Shale, dark-gray to black, carbonaceous, contains few coal laminae, abundant plant fragments, 0.5 in. pyrite bed 4 ft 4 in. below top, evenly bedded, fair fissility	31	7
		(499	11)
37.	Coal, dull to bright attritus, scattered dark-gray shale laminae	0	2
		(500	1)
38.	Underclay, black, carbonaceous, abundant rootlets; base grades	0	4
		(500	5)
39.	Shale, dark-gray to black, carbonaceous, silty, few rootlets and Stigmaria in top 1 ft., evenly bedded, poor fissility; base grades	4	3
		(504	8)
40.	Shale, dark-gray, silty in top 8 ft, contains 10 percent medium-gray siltstone laminae in top 8 ft, abundant siderite beds up to 0.5 in. thick, scattered pyrite nodules 1 ft 8 in. below top, scattered plant fragments, evenly bedded, fissile; base grades	15	4
		(520	0)
41.	Shale, dark-gray to black, carbonaceous, very carbonaceous in basal 4 ft 8 in., contains 5 percent medium-gray siltstone laminae in top 3 ft, scattered coal laminae and beds up to 0.25 in. thick in basal 7 ft, scattered siderite beds up to 1 in. thick; base grades	14	0
		(534	0)
42.	Underclay, medium-gray, abundant rootlets, Stigmaria, non-fissle; base grades	0	7
		(534	7)
43.	Shale, medium-dark-gray, slightly silty, scattered siderite nodules and beds, scattered plant fragments, poor fissility; base grades	7	3
		(541	10)
44.	Siltstone, medium-gray, finely micaceous, contains 10 percent light-gray very fine grained sandstone laminae, thin- to poorly bedded, poor fissility; base grades	3	10
		(545	8)
45.	Sandstone, light-gray, very fine grained, micaceous, contains 45 percent quartz, 5 percent dark-gray shale laminae; base sharp and uneven	0	4
		(546	0)

Unit Number	Description	Thickness (Depth) ft	in.
46.	Siltstone, medium-gray, finely micaceous, contains 10 percent dark-gray shale laminae, thin to faintly bedded; base sharp.....	0	4
		(546	4)
47.	Sandstone, medium-light-gray, very fine grained, contains 45 percent quartz, few small-scale slump structures, thin-bedded.....	0	2
		(546	6)
48.	Siltstone, medium-gray, finely micaceous, slightly carbonaceous in basal 3 in., contains 10 percent light-gray very fine grained sandstone laminae, non-fissle; base grades.....	1	0
		(547	6)
49.	Sandstone, light- to medium-light-gray, very fine grained, very micaceous, contains 50 percent quartz, 15 percent medium-gray siltstone laminae, abundant dark mineral grains, thin-bedded; base grades.....	1	7
		(549	1)
50.	Sandstone, light-gray, very fine grained, contains 45 percent quartz, 45 percent dark-gray shale laminae, thin and evenly bedded; base grades.....	2	10
		(551	11)
51.	Sandstone, light-gray, fine-grained, micaceous, calcareous from 4 ft 2 in. to 6 ft 8 in. below top, contains 40 percent quartz, 20 percent dark-gray silty shale beds up to 5 in. thick, thick-bedded in beds up to 2 ft 10 in. thick, slightly burrowed; base grades.....	16	2
		(568	1)
52.	Shale, medium-dark-gray to black, contains 20 percent light-gray very fine grained sandstone laminae and beds up to 6 in. thick, few siderite beds, slightly burrowed, evenly bedded; base grades...	8	5
		(576	6)
53.	Sandstone, light-gray, very fine grained, contains 60 percent quartz, 20 percent dark-gray silty shale laminae and beds up to 3 in. thick, thin and evenly bedded; base sharp.....	1	8
		(578	2)
54.	Shale, dark-gray to black, carbonaceous, very carbonaceous in top 8 ft, abundant siderite beds, evenly bedded, fissile; base grades.....	9	0
		(587	2)
55.	Shale, dark-gray, silty, contains 10 percent light-gray siltstone and very fine grained sandstone laminae, abundant siderite beds, evenly bedded; base grades.....	7	10
		(595	0)

Unit Number	Description	Thickness (Depth) ft	in.
56.	Shale, dark-gray to black, carbonaceous, very carbonaceous from 7 ft 3 in. to 8 ft 6 in. and 10 ft 4 in. to 11 ft 5 in. below top, contains 5 percent light-gray siltstone and very fine grained sandstone laminae and beds up to 1 in. thick, abundant siderite beds, few slickensided surfaces 15 ft 6 in. below top, evenly bedded, fissle; base grades	36	4
		(631	4)
57.	Shale, dark-gray, silty, contains 20 percent light-gray very fine grained calcareous sandstone laminae and beds up to 4 in. thick, evenly bedded, burrowed	10	8
		(642	0)

BOTTOM OF HOLE
TOTAL DEPTH 642 ft

GEOPHYSICAL LOG

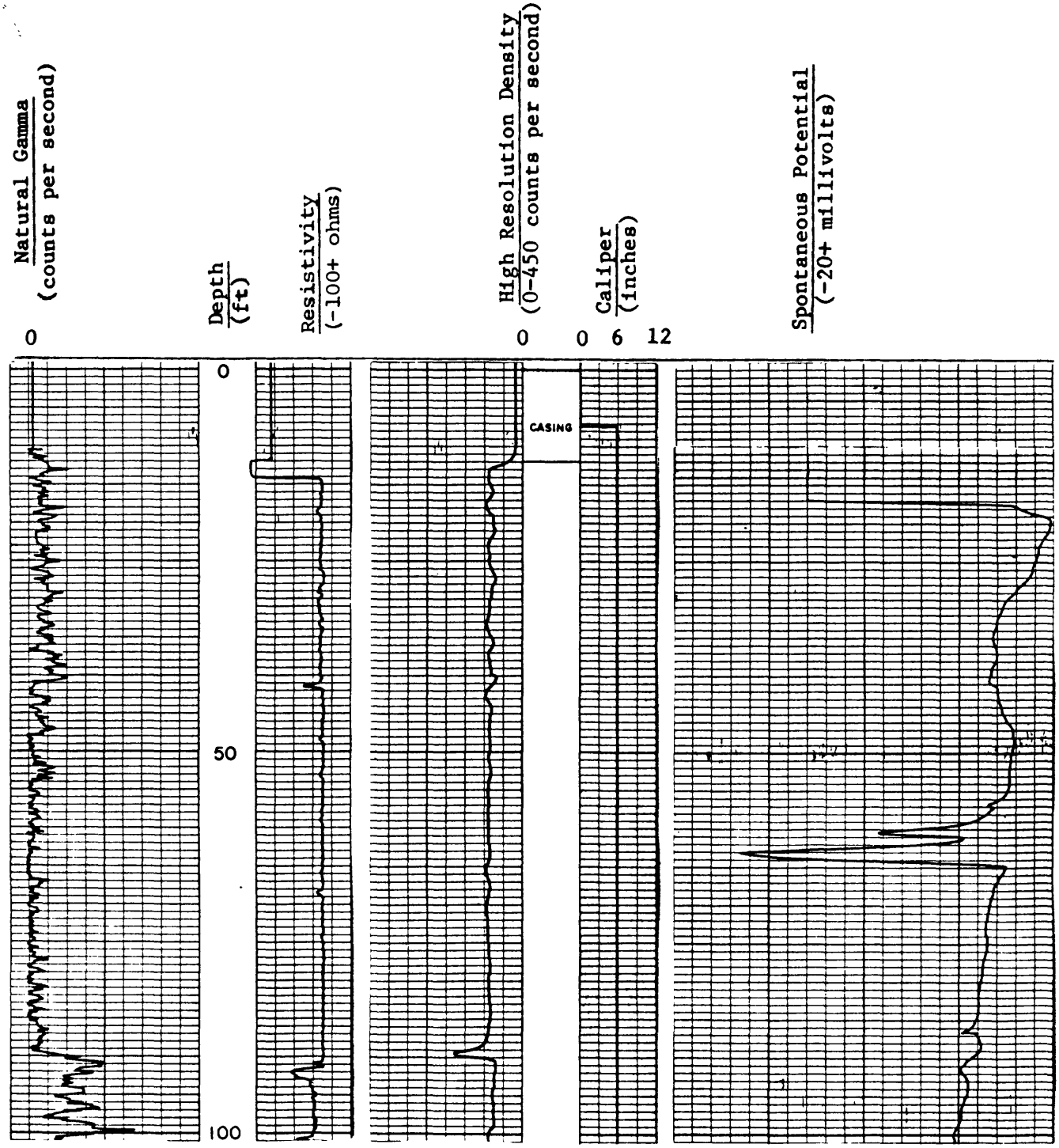
Corehole: SW-1 Date: 2/08/83 State: Virginia County: Dickenson

Quadrangle: Elkhorn City, Ky.-Va. Latitude: 37°15'23"N Longitude: 82°20'55"W

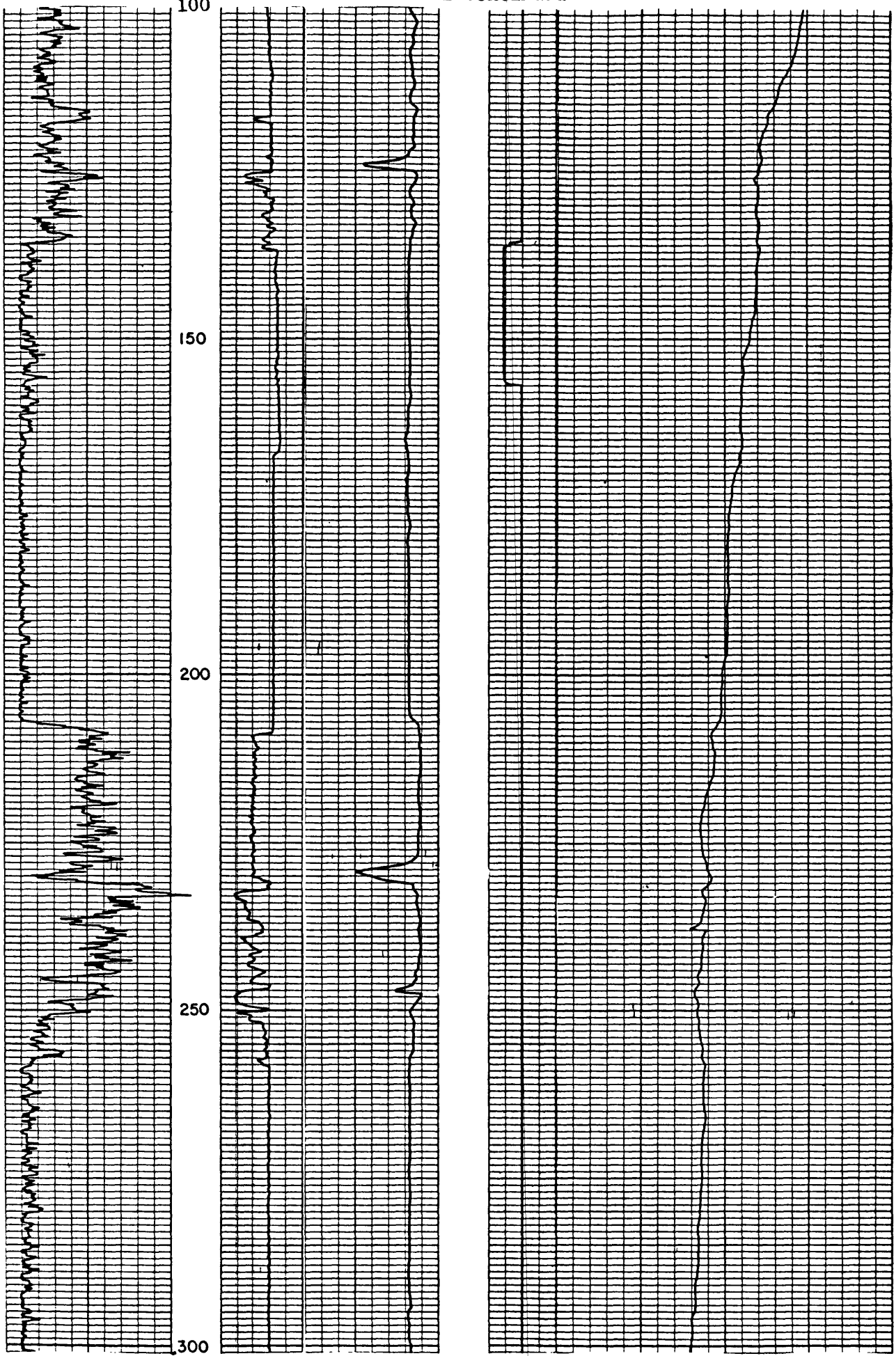
Altitude: 1,640 ft Logged Depth: 642 ft Drilled Depth: 642 ft

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

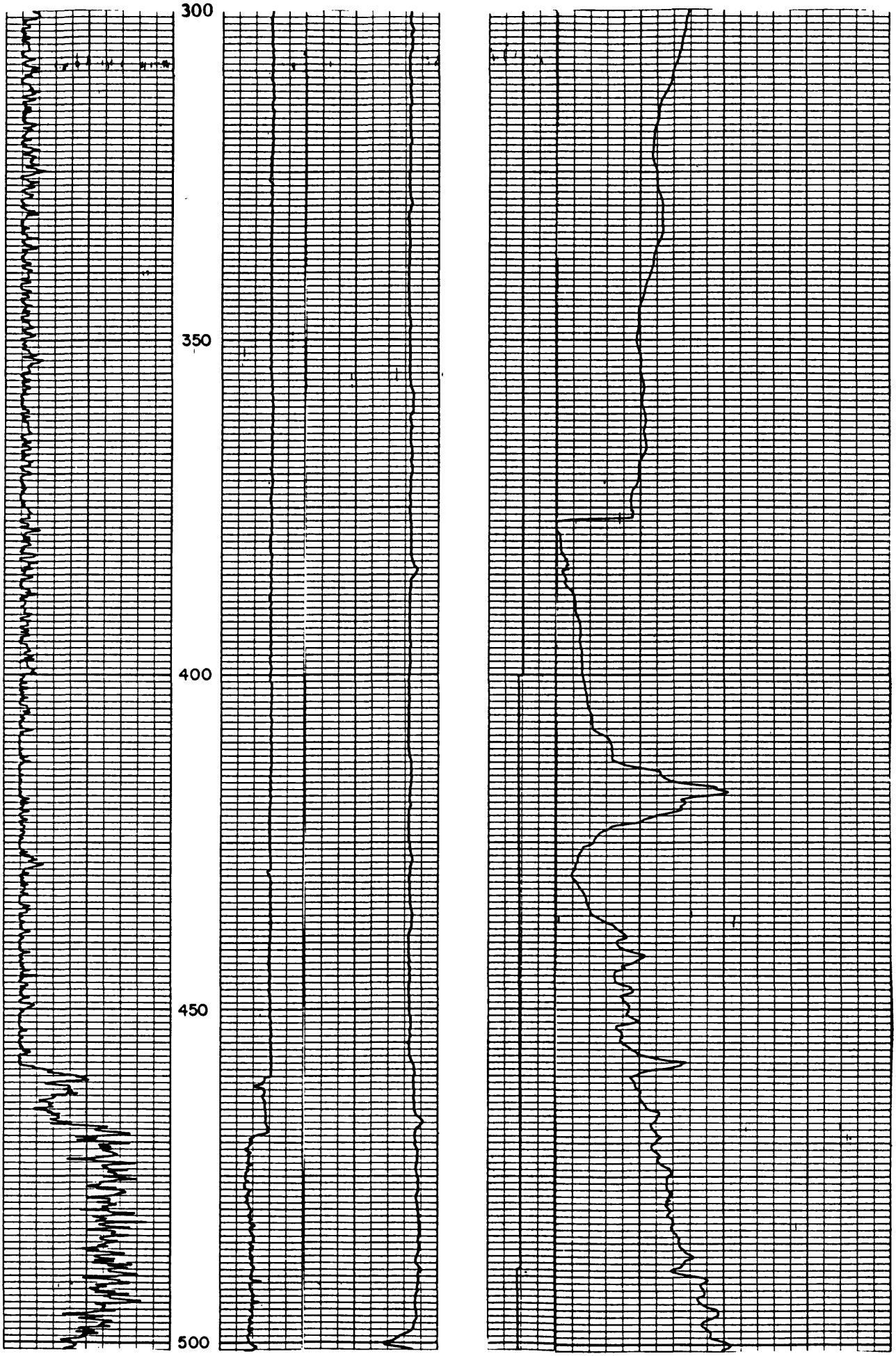
High Resolution Density Time Constant: 1



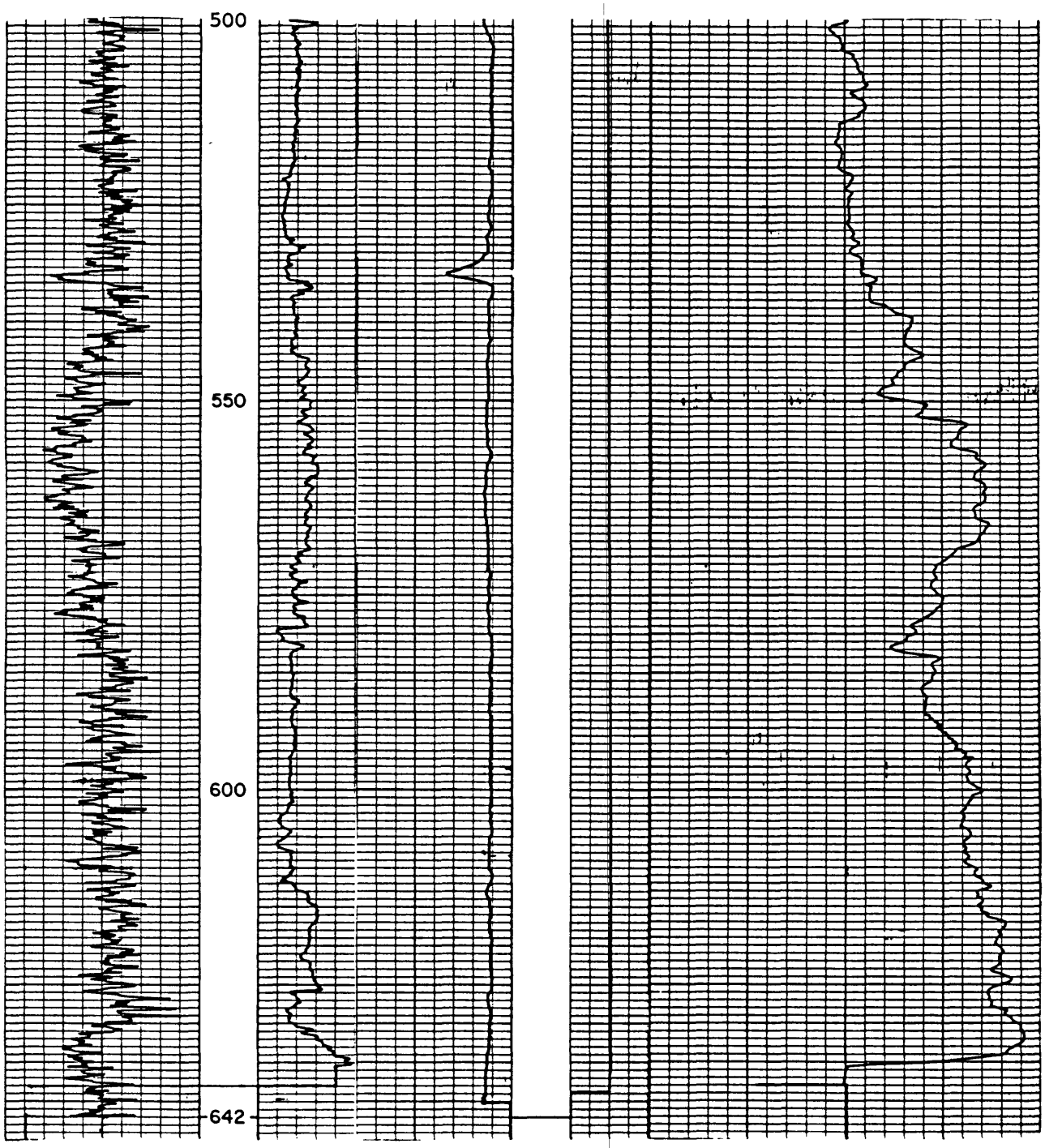
Corehole: SW-1 continued



Corehole: SW-1 continued

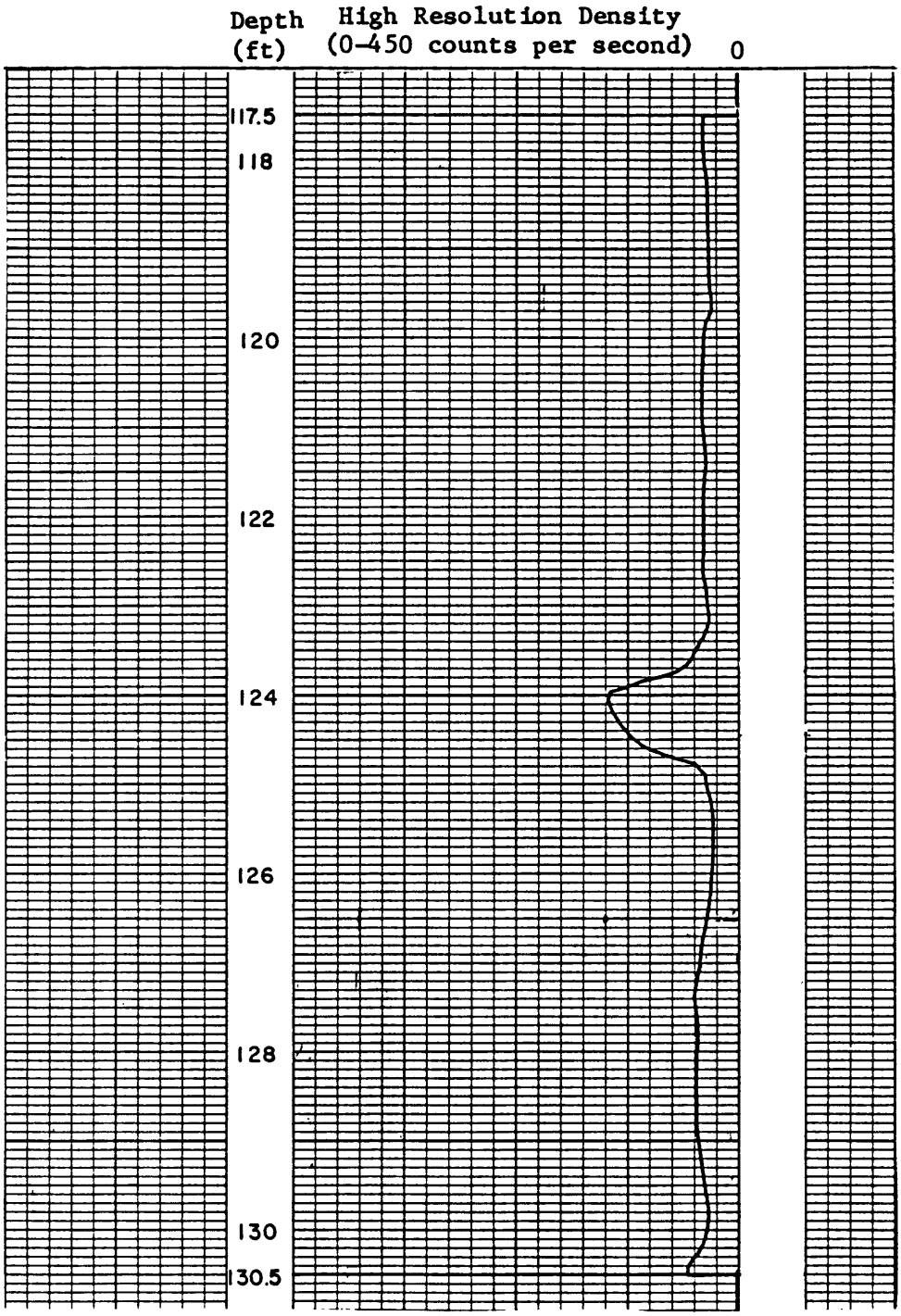


Corehole: SW-1 continued

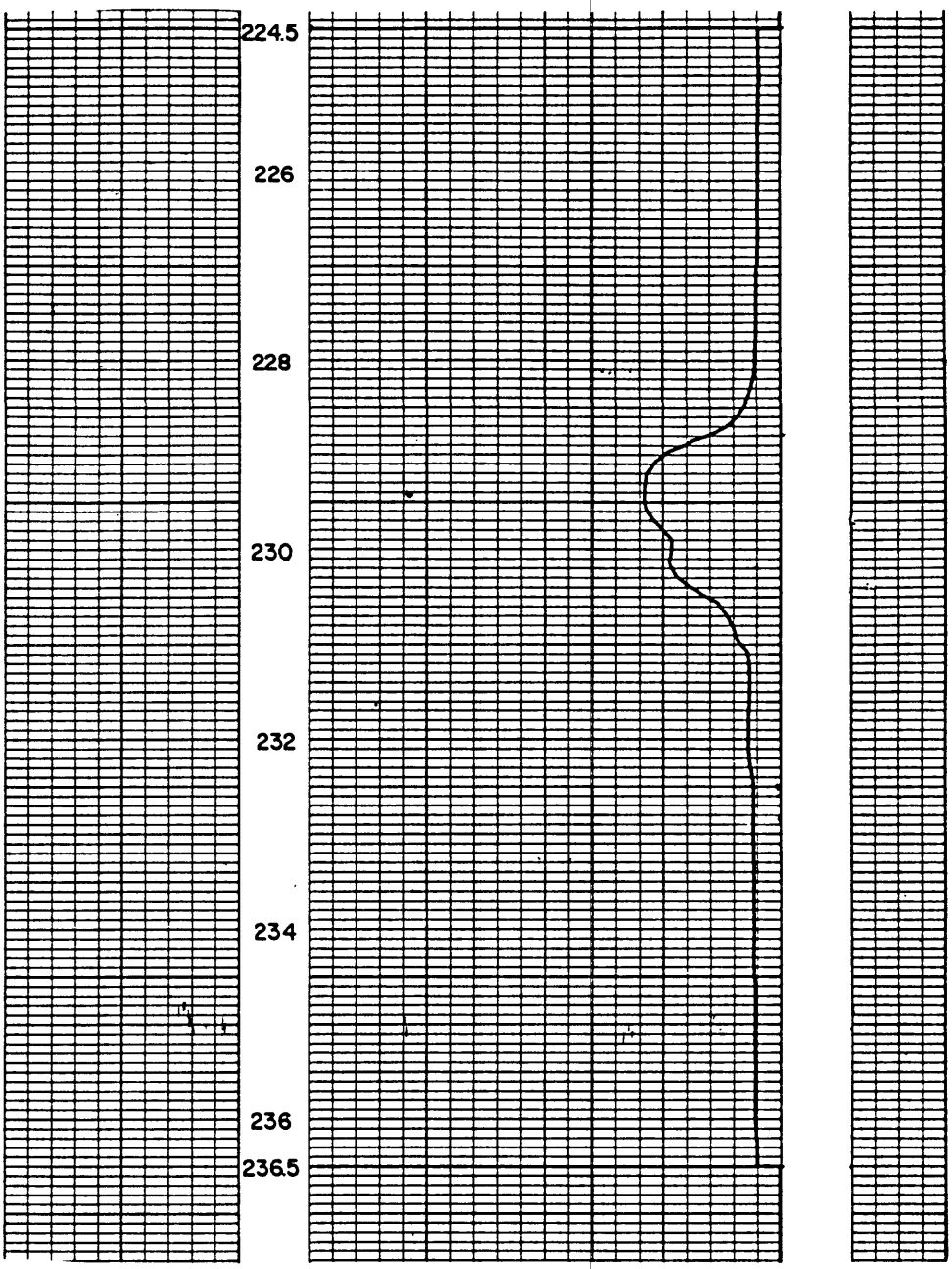


DETAIL LOG

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



Corehole: **SW-1** continued



Corehole SW-2

Location: Dickenson County; Clintwood, Va.-Ky., 7.5 minute quadrangle; approximately 1.2 mi south of Virginia-Kentucky state line between Mill Creek and Left Fork of Upper Twin Branch. Accessible by State Route 611.

Coordinates: Latitude 37°14'03"N, Longitude 82°25'01"W

Altitude: 1,833 ft Drilled depth: 855 ft

Dip of strata: Ranges mostly from 10° to 20° to depth of 720 ft and decreases to about 5° below depth of 720 ft.

Date drilled: January 20, 1983 to February 8, 1983

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

Unit Number	Description	Thickness (Depth) ft	in.
	MIDDLE PENNSYLVANIAN SERIES Norton Formation		
1.	Soil and weathered rock (casing set - no core recovered).....	23	0
		(23	0)
2.	Shale, medium-dark-gray, abundant plant fragments in basal 4 ft, evenly bedded, fissle.....	12	1
		(35	1)
3.	Coal, Kennedy coal bed (thickness-3 ft 4 in.)		
3a.	Coal, mostly bright attritus.....	0	11
		(36	0)
3b.	Shale, dark-gray, carbonaceous.....	0	4
		(36	4)
3c.	Coal, mostly bright attritus, few discontinuous pyrite laminae.....	1	10
		(38	2)
3d.	Shale, black, carbonaceous, contains scattered coal laminae; base sharp.....	0	3
		(38	5)
4.	Underclay, medium-gray, few rootlets; base grades.....	1	10
		(40	3)

Unit Number	Description	Thickness (Depth) ft	in.
5.	Shale, medium-dark-gray, evenly bedded, fissile; base grades.....	1	3
		(41	6)
6.	Siltstone, medium-dark-gray, micaceous, contains 10 percent light-gray very fine grained sandstone laminae, thin and evenly bedded; base grades abruptly.....	0	11
		(42	5)
7.	Shale, medium-dark-gray, silty, contains 10 percent medium-gray siltstone laminae, evenly bedded, fissle.....	0	7
		(43	0)
8.	Coal, mostly bright attritus.....	0	0.25
		(43	0.25)
	LOWER PENNSYLVANIAN SERIES Lee Formation Naese Sandstone Member		
9.	Underclay, medium-gray, few rootlets; base sharp.....	0	3.75
		(43	4)
10.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent white-weathered feldspar, abundant dark mineral grains, crossbedded, massive; base grades abruptly...	5	4
		(48	8)
11.	Shale, medium-gray, very silty, evenly bedded, fair fissility; base sharp.....	0	2
		(48	10)
12.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 5 percent dark-gray shale laminae and beds including a 4 in. bed 4 ft 9 in. above base, massive; base sharp.....	18	5
		(67	3)
13.	Shale, medium-gray, silty, evenly bedded, fair fissility; base sharp.....	0	3
		(67	6)
14.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 5 percent dark-gray silty shale laminae, few well rounded white quartz granules, crossbedded, massive; base grades.....	9	0
		(76	6)
15.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, few scattered dark mineral grains, few stylolites, crossbedded, massive; base grades.....	40	6
		(117	0)
16.	Sandstone, light-gray, fine- to medium-grained, contains 90 percent quartz, 10 percent dark-gray silty shale laminae, thin-bedded; base grades.....	1	5
		(118	5)
17.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, crossbedded, massive; base grades.....	6	7
		(125	0)

Unit Number	Description	Thickness (Depth) ft	in.
18.	Sandstone, very light to light-gray, fine- to medium-grained, contains 90 percent quartz, few scattered dark-gray silty shale laminae, few stylolites, abundant coal clasts up to 1 in. in diameter; well rounded to angular siderite clasts and well rounded white quartz pebbles in basal 3 ft 6 in.; base sharp.....	58	7
		(183	7)
	Lee Formation Hensley Member		
19.	Coal, Jawbone rider coal bed, mostly bright attritus, few thin vitrain bands.....	0	7
		(184	2)
20.	Shale, black, carbonaceous, contains few coal laminae in top 1 in.; base grades.....	0	3
		(184	5)
21.	Underclay, medium-gray, abundant rootlets; base grades abruptly...	1	11
		(186	4)
22.	Shale, black, very carbonaceous, contains 20 percent coal laminae; base grades.....	0	4
		(186	8)
23.	Coal, mostly bright attritus.....	0	3
		(186	11)
24.	Shale, black, carbonaceous, contains 20 percent coal laminae.....	0	2
		(187	1)
25.	Underclay, medium-gray, abundant rootlets; base grades.....	3	7
		(190	8)
26.	Shale, medium-gray, silty, few plant fragments, evenly bedded, poor fissility; base grades abruptly.....	4	10
		(195	6)
27.	Shale, medium- to medium-dark-gray, carbonaceous in basal 1 in., contains scattered plant fragments, evenly bedded, fair fissility.	2	3
		(197	9)
28.	Coal, mostly bright attritus, few vitrain bands.....	0	5.5
		(198	2.5)
29.	Sandstone, medium-light-gray, mottled brownish-gray, very fine grained, silty, contains 40 percent quartz, abundant rootlets in top 2 ft 8 in., faintly bedded; base grades...	3	8.5
		(201	11)
30.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 45 percent quartz, thin-bedded; base sharp.....	8	8
		(210	7)

Unit Number	Description	Thickness (Depth) ft	in.
31.	Shale, dark-gray, silty, finely micaceous, evenly bedded; base sharp	0	1
		(210	8)
32.	Sandstone, medium-light-gray, fine- to medium-grained, very micaceous, contains 50 percent quartz, scattered dark and light mineral grains, thick-bedded to massive; base sharp	2	6
		(213	2)
33.	Coal, impure, dull to bright attritus, abundant siderite and dark-gray shale laminae	0	4
		(213	6)
34.	Underclay, medium-gray, abundant rootlets; base sharp	1	0
		(214	6)
35.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, few scattered dark-gray carbonaceous shale laminae, scattered dark and light mineral grains, abundant coal clasts and laminae in basal 4 ft	31	4
		(245	10)
36.	Shale, dark-gray to black, carbonaceous, evenly bedded, fissle; base grades	4	11
		(250	9)
37.	Shale, dark-gray, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded, fissle, burrowed; base grades	4	6
		(255	3)
38.	Shale, dark-gray to black, carbonaceous in top 14 ft 6 in., very carbonaceous in basal 10 ft, contains scattered siderite beds up to 0.5 in. thick, few plant fragments, evenly bedded, fissile	24	6
		(279	9)
39.	Coal, Jawbone coal bed, thin to thick vitrain bands, bright attrital matrix	2	1
		(281	10)
40.	Underclay, medium-gray, mottled brownish-gray, silty, few rootlets; base grades	3	2
		(285	0)
41.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, silty in top 4 ft, contains 45 percent quartz, thin-bedded; base grades abruptly	9	2
		(294	2)

Unit Number	Description	Thickness (Depth) ft	in.
42.	Shale, dark-gray to black, carbonaceous, silty in top 3 in., evenly bedded, fissile	0	9
		(294	11)
43.	Coal, mostly bright attritus	0	3.5
		(295	2.5)
44.	Underclay, medium-dark-gray, abundant rootlets	0	6.5
		(295	9)
45.	Coal, mostly bright attritus	0	3
		(296	0)
46.	Underclay, medium-gray, mottled brownish-gray, silty, scattered rootlets; base grades	3	6
		(299	6)
47.	Sandstone, light-gray, fine- to medium-grained, very micaceous, contains 55 percent quartz, scattered dark and light mineral grains, thick-bedded; base grades	1	1
		(300	7)
48.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, 10 percent medium-gray shale laminae, scattered dark and light mineral grains, thin-bedded, few contorted beds in basal 4 in.; base grades abruptly	0	10
		(301	5)
49.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, scattered dark mineral grains, petroliferous in basal 1 ft 4 in., massive	3	10
		(305	3)
50.	Sandstone, light-gray, very fine grained, micaceous, contains 45 percent quartz, 5 percent medium-dark-gray shale laminae, thin-bedded, cross-laminated; base-sharp	0	2
		(305	5)
51.	Sandstone, light-gray, fine- to medium-grained, very micaceous, contains 55 percent quartz, scattered dark mineral grains, few scattered coal laminae, scattered petroliferous zones, crossbedded, thick-bedded; base grades abruptly	28	3
		(333	8)
52.	Sandstone, light-gray, very fine to fine-grained, very micaceous, contains 45 percent quartz, 10 percent medium-gray siltstone laminae, abundant dark and light mineral grains; base grades abruptly	0	9
		(334	5)

Unit Number	Description	Thickness (Depth) ft	in.
53.	Sandstone, light-gray, medium-grained, micaceous, contains 55 percent quartz, scattered dark and light mineral grains, abundant small medium-dark-gray shale clasts from 6 ft to 7 ft below top; abundant coal clasts up to 1 in. in diameter and small angular medium-dark-gray shale clasts in basal 2 ft; thick-bedded to massive; base sharp.....	15	2
		(349	7)
54.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz 10 percent dark-gray silty shale laminae, scattered dark and light mineral grains, thin- to thick-bedded; base sharp.....	8	4
		(357	11)
55.	Sandstone, light-gray, medium-grained, micaceous, contains 60 percent quartz; scattered dark, light and green mineral grains; few medium-dark-gray shale clasts, scattered well rounded siderite clasts, thick-bedded; base sharp.....	2	1
		(360	0)
56.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, scattered dark and light mineral grains, abundant angular medium-dark-gray shale clasts, few coal laminae; base grades abruptly.....	1	7
		(361	7)
57.	Sandstone, light- to medium-light-gray, medium-grained, micaceous, contains 60 percent quartz, scattered dark and light mineral grains abundant siderite and medium-dark-gray shale clasts from 3 ft 6 in. to 4 ft 6 in. below top, scattered coal clasts in basal 1 ft including a 2 in. thick clast 3 in. above base; base grades.....	8	10
		(370	5)
58.	Shale, medium-dark-gray, contains 20 percent light-gray very fine grained sandstone laminae and beds, burrowed, flaser-bedded; base grades.....	7	1
		(377	6)
59.	Sandstone, light-gray, very fine grained, micaceous, contains 40 percent quartz, 15 percent dark-gray shale laminae and beds, cross-laminated, thin-bedded; base grades.....	8	1
		(385	7)
60.	Sandstone, light-gray, fine-grained, very micaceous, contains 45 percent quartz, 5 percent dark-gray shale laminae, abundant dark mineral grains, few coal laminae, thin- to thick-bedded.....	5	8
		(391	3)

Unit Number	Description	Thickness (Depth) ft	in.
61.	Sandstone, light-gray, very fine grained, micaceous, contains 40 percent quartz, 40 percent dark-gray shale laminae and beds, scattered plant fragments, scattered siderite beds up to 0.25 in. thick, thin and evenly bedded, cross-laminated.....	15 (406	1 4)
62.	Siltstone, medium-gray, contains 40 percent dark-gray shale laminae, few light-gray very fine grained sandstone laminae, few coal laminae, abundant plant fragments, few scattered siderite nodules, thin and evenly bedded, few contorted beds.....	4 (410	5 9)
63.	Shale, medium-dark-gray, contains 50 percent light-gray siltstone and very fine grained sandstone laminae, few siderite nodules in top 1 in., few small-scale slump structures, burrowed, unevenly bedded.....	2 (412	1 10)
64.	Shale, medium-dark-gray, silty, carbonaceous, contains 25 percent light-gray siltstone and very fine grained sandstone laminae and beds up to 2 in. thick, few siderite beds and nodules, few plant fragments, burrowed, evenly bedded.....	36 (449	11 9)
65.	Sandstone, medium-light-gray, very fine to fine-grained, finely micaceous, contains 65 percent quartz, scattered dark and light mineral grains, thick-bedded to massive; base sharp.....	6 (456	4 1)
66.	Shale, medium-gray, silty, few plant fragments, evenly bedded.....	0 (456	1 2)
67.	Coal, impure.....	0 (456	0.5 2.5)
68.	Shale, medium-gray, poorly bedded.....	0 (456	0.5 3)
69.	Shale, dark-brownish-gray, carbonaceous, canneloid.....	0 (456	1 4)
70.	Underclay, medium-dark-gray, carbonaceous, few rootlets, faintly bedded.....	0 (456	6 10)
71.	Shale, medium- to medium-dark-gray, very silty, contains few light-gray very fine grained sandstone laminae, few siderite beds, evenly bedded, fair to poor fissility.....	4 (461	10 8)

Unit Number	Description	Thickness (Depth) ft	in.
72.	Siltstone, medium-gray, contains 40 percent dark-gray shale laminae, 20 percent light-gray very fine grained sandstone laminae and beds, few siderite beds, burrowed, thin to poorly bedded; base grades	1	9
		(463	5)
73.	Sandstone, medium-light-gray, very fine grained, silty, micaceous, contains 50 percent quartz, 10 percent medium-dark-gray shale laminae and beds up to 6 in. thick, thin- to thick-bedded	31	0
		(494	5)
74.	Shale, medium-dark-gray, contains 30 percent light-gray very fine grained silty sandstone laminae in top 6 in., burrowed, unevenly bedded; base sharp	0	11
		(495	4)
75.	Sandstone, light-gray, very fine grained, silty, contains 60 percent quartz, cross-laminated in basal 9 in	1	7
		(496	11)
76.	Shale, medium-dark-gray, contains 10 percent light-gray very fine grained silty sandstone laminae and beds, burrowed, evenly bedded.	3	7
		(500	6)
	Lee Formation Middlesboro Member		
77.	Sandstone, light-gray, very fine grained, silty, contains 60 percent quartz, 40 percent dark-gray shale beds in basal 1 ft, burrowed, thin-bedded, few contorted beds; base grades	2	3
		(502	9)
78.	Shale, medium-dark-gray, silty, carbonaceous, contains 10 percent light-gray siltstone and very fine grained silty sandstone laminae, burrowed, fair fissility; base sharp	1	2
		(503	11)
79.	Sandstone, light-gray, very fine grained, silty, contains 50 percent quartz, 30 percent dark-gray shale laminae and beds up to 1 ft thick, few medium-gray siltstone laminae, slightly burrowed; base sharp	5	3
		(509	2)
80.	Shale, medium-dark-gray, contains 20 percent light-gray siltstone and very fine grained silty sandstone laminae, burrowed, unevenly bedded	1	0
		(510	2)
81.	Sandstone, light-gray, very fine grained, silty, contains 55 percent quartz, includes 5 in. dark-gray shale bed 6 in. below top; base sharp	1	10
		(512	0)

Unit Number	Description	Thickness (Depth) ft	in.
		(512	0)
82.	Shale, medium-dark-gray, silty, carbonaceous, contains 10 percent light-gray very fine grained sandstone laminae and beds up to 3 in. thick, evenly bedded; base sharp.....	3	5
		(515	5)
83.	Sandstone, light-gray, very fine grained, contains 65 percent quartz, 10 percent medium-dark-gray shale laminae and beds up to 6 in. thick, few siderite beds in basal 2 ft 8 in., slightly burrowed, thin- to thick-bedded.....	15	8
		(531	1)
84.	Shale, medium-dark-gray, contains 30 percent medium-gray siltstone laminae, 20 percent light-gray very fine grained sandstone beds, slightly burrowed, cross-laminated, thin- to thick-bedded; base sharp and uneven.....	2	4
		(533	5)
85.	Sandstone, light-gray, very fine grained, silty, finely micaceous, contains 60 percent quartz, 15 percent dark-gray silty shale laminae, slightly burrowed, crossbedded.....	9	1
		(542	6)
86.	Shale, medium-dark-gray, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, burrowed, evenly bedded..	0	10
		(543	4)
87.	Siltstone, medium-gray, sandy, contains 25 percent light-gray very fine grained sandstone laminae and beds, 30 percent dark-gray shale beds, burrowed, cross-laminated; base grades.....	3	10
		(547	2)
88.	Shale, medium-dark-gray, carbonaceous, very silty, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, slightly burrowed, evenly bedded.....	1	11
		(549	1)
89.	Sandstone, light-gray, very fine grained, finely micaceous, contains 65 percent quartz, 5 percent medium-dark-gray shale laminae and beds, crossbedded, thin-bedded.....	3	6
		(552	7)
90.	Sandstone, light-gray, fine-to medium-grained, contains 65 percent quartz, few dark-gray carbonaceous shale laminae; base sharp.....	20	7
		(573	2)
91.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles and granules up to 0.5 in. in diameter, scattered coal clasts and laminae, abundant angular siderite clasts in basal 10 in., few stylolites, thick-bedded to massive; base sharp.....	46	9
		(619	11)

Unit Number	Description	Thickness (Depth) ft	in.
92.	Shale, medium-dark-gray, very silty, contains 30 percent light-gray siltstone and very fine grained sandstone laminae and beds up to 2 in. thick, burrowed; base grades	2	8
		(622	7)
93.	Sandstone, light-gray, very fine grained, silty, micaceous, contains 50 percent quartz, 25 percent medium-dark-gray silty shale beds up to 2 in. thick, thin-bedded; base grades	2	0
		(624	7)
94.	Shale, medium-dark-gray, silty, very carbonaceous in basal 1 ft 4 in., finely micaceous, contains 30 percent light-gray very fine grained sandstone laminae in top 6 in., decreasing to 10 percent in remainder of unit; few coal laminae in basal 2 in., slightly burrowed, evenly bedded, fair fissility	21	9
		(646	4)
95.	Coal, Castle (?) coal bed (thickness - 1 ft 8 in.)		
	95a. Coal, mostly bright attritus, few thin vitrain bands	0	7.5
		(646	11.5)
	95b. Coal, mostly dull attritus	0	2.5
		(647	2)
	95c. Coal, impure, scattered dark-gray shale laminae	0	2.5
		(647	4.5)
	95d. Coal, thick vitrain bands, bright attrital matrix, few pyrite nodules	0	7.5
		(648	0)
96.	Shale, black, carbonaceous, contains 10 percent coal laminae, few rootlets, evenly bedded	0	10
		(648	10)
97.	Shale, medium-dark-gray, silty from 8 in. to 1 ft 1 in. below top, pyritic in top 1 in., few rootlets; base sharp	1	4
		(650	2)
98.	Sandstone, medium-light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, few scattered well rounded white quartz pebbles, abundant well rounded siderite and white quartz pebbles in basal 3 ft 5 in., thick-bedded to massive; base sharp	18	9
		(668	11)
99.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, few scattered well rounded white quartz pebbles, thick-bedded to massive	4	6
		(673	5)
100.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few coal laminae and clasts in basal 4 ft 3 in., 1 in. shale clasts 9 ft. below top, few stylolites, thick-bedded to massive; base sharp	14	3
		(687	8)

Unit Number	Description	Thickness (Depth) ft	in.
101.	Shale, dark-gray to black, silty, carbonaceous, evenly bedded, fissle; base sharp.....	1	5
		(689	1)
102.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, few well rounded white quartz pebbles and coal clasts in top 1 ft, thick-bedded to massive; base sharp...	5	4
		(694	5)
103.	Shale, dark-gray, silty, contains 40 percent light-gray very fine grained silty sandstone laminae, slightly burrowed, evenly bedded, fissile; base grades.....	3	0
		(697	5)
104.	Sandstone, light-gray, very fine grained, contains 10 percent dark-gray shale laminae, cross-laminated, thin-bedded; base grades.....	1	5
		(698	10)
105.	Shale, dark-gray, contains 20 percent light-gray very fine grained sandstone laminae, burrowed, evenly bedded.....	26	3
		(725	1)
106.	Coal, Sewell (?) coal bed, mostly bright attritus, scattered thin vitrain bands.....	0	11
		(726	0)
107.	Underclay, medium-gray, mottled brownish-gray, carbonaceous in top 2 in., very silty, abundant rootlets, Stigmaria; base grades..	1	11
		(727	11)
108.	Sandstone, light-gray, very fine grained, contains 65 percent quartz, few rootlets and Stigmaria in top 10 in., thin-bedded; base grades.....	2	3
		(730	2)
109.	Siltstone, medium-gray, contains 20 percent light-gray very fine grained sandstone laminae, few small-scale slump structures, thin-bedded; base grades.....	0	10
		(731	0)
110.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 30 percent dark-gray shale laminae, thin-bedded, few contorted beds; base grades.....	1	4
		(732	4)
111.	Shale, black, carbonaceous, poor fissility.....	0	2
		(732	6)
112.	Underclay, medium-gray, abundant rootlets, Stigmaria; base grades.	1	8
		(734	2)

Unit Number	Description	Thickness (Depth) ft	in.
113.	Siltstone, medium-gray, few rootlets, faintly bedded, poor fissility.....	0	10
		(735	0)
114.	Shale, medium-gray, slightly silty, contains few plant fragments, evenly bedded, poor fissility; base sharp.....	3	0
		(738	0)
115.	Sandstone, light-gray, very fine grained, very micaceous, contains 45 percent quartz, 5 percent dark-gray shale laminae, thin and lenticularly bedded; base grades.....	1	4
		(739	4)
116.	Shale, medium-gray, contains few siderite beds, scattered plant fragments including Calamites.....	0	8
		(740	0)
117.	Sandstone, light-gray, very fine grained, very silty, micaceous, contains 40 percent quartz, thin-bedded; base grades.....	0	3
		(740	3)
118.	Shale, dark-gray, very silty, finely micaceous, contains 5 percent medium-gray siltstone laminae, 10 percent light-gray very fine grained sandstone beds up to 2 in. thick, few siderite beds, few plant fragments including Calamites, evenly bedded, fair fissility; base grades.....	3	8
		(743	11)
119.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, abundant dark mineral grains; base sharp.....	0	2
		(744	1)
120.	Shale, medium-gray, evenly bedded, fissile; base grades abruptly..	0	0.5
		(744	1.5)
121.	Sandstone, light-gray, fine-grained, sparsely micaceous, contains 65 percent quartz, scattered dark mineral grains.....	0	4.5
		(744	6)
122.	Shale, medium-dark- to dark-gray, very carbonaceous in basal 1 ft 1 in., contains 30 percent light-gray very fine grained sandstone laminae in top 10 in., abundant siderite beds up to 0.5 in. thick, few plant fragments; base sharp.....	3	3
		(747	9)
123.	Sandstone, light-gray, very fine to fine-grained, very micaceous, contains 65 percent quartz, 5 percent dark-gray shale laminae, thin and lenticularly bedded; base sharp.....	3	3
		(751	0)
124.	Shale, dark-gray, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded; base sharp.....	0	3.5
		(751	3.5)

Unit Number	Description	Thickness (Depth) ft	in.
125.	Sandstone, light-gray, very fine grained, micaceous, contains 65 percent quartz, scattered dark mineral grains; base sharp.....	0	1
		(751	4.5)
126.	Shale, dark-gray, silty, evenly bedded, fair fissility; base sharp.....	0	9.5
		(752	2)
127.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, thin-bedded; base grades.....	0	4
		(752	6)
128.	Shale, medium-dark-gray, contains 10 percent light-gray very fine grained sandstone laminae in top 1 ft, few siderite beds, evenly bedded, fissile; base sharp.....	1	7
		(754	1)
129.	Sandstone, very light gray, fine-grained, contains 65 percent quartz, scattered dark and green mineral grains; base sharp.....	0	8
		(754	9)
130.	Sandstone, light-gray, very fine grained, micaceous, contains 60 percent quartz, 15 percent dark-gray shale laminae, thin and lenticularly bedded; base sharp.....	0	7
		(755	4)
131.	Shale, medium- to medium-dark-gray, very carbonaceous in basal 1 in., few siderite beds, few plant fragments, evenly bedded, fissile.....	1	1
		(756	5)
132.	Coal, thin vitrain bands, dull to bright attrital matrix.....	0	7
		(757	0)
133.	Underclay, medium-gray, contains few coal laminae in top in., abundant rootlets; base sharp.....	2	0
		(759	0)
134.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few scattered dark mineral grains, few rootlets in top 8 in., few stylolites, well sorted, thick-bedded to massive; base sharp.....	24	7
		(783	7)
135.	Sandstone, light-gray, very fine grained, micaceous, contains 50 percent quartz, 30 percent dark-gray silty shale laminae and beds up to 2 in. thick, cross-laminated, thin and evenly bedded; base grades.....	4	2
		(787	9)

Unit Number	Description	Thickness (Depth) ft	in.
136.	Siltstone, medium-dark-gray, sandy in top 4 in., evenly bedded, fissile; base grades	0	7
		(788	4)
137.	Sandstone, light-gray, very fine grained, contains 65 percent quartz, 40 percent dark-gray shale and silty shale laminae and beds up to 7 in. thick, thin- to thick-bedded; base sharp	3	0
		(791	4)
138.	Sandstone, very light gray, very fine to fine-grained, contains 90 percent quartz, thick-bedded; base sharp	1	9
		(793	1)
139.	Shale, medium-dark to dark-gray, contains 30 percent light-gray very fine grained sandstone laminae in basal 3 in., evenly bedded; base sharp	0	6
		(793	7)
140.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few stylolites, well sorted, thick-bedded to massive; base grades	23	6
		(817	1)
141.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles from 0.25 in. to 0.5 in. in diameter, few stylolites, massive; base grades	20	6
		(837	7)
142.	Sandstone, very light gray, coarse-grained, contains 90 percent quartz, very conglomeratic with abundant well rounded white quartz pebbles up to 0.5 in. in diameter, few medium-dark-gray shale clasts, abundant siderite clasts in basal 2 ft 9 in., few coal laminae in basal 1 ft, few green mineral grains, sandstone-filled Calamites near base, massive; base sharp	3	4
		(840	11)
143.	Sandstone, light-gray, fine-grained, very micaceous, slightly calcareous, contains 65 percent quartz, few dark-gray siltstone laminae, scattered dark mineral grains, thick-bedded; base sharp	3	1
		(844	0)
144.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, thick-bedded to massive	11	0
		(855	0)

BOTTOM OF HOLE
TOTAL DEPTH 855 ft

GEOPHYSICAL LOG

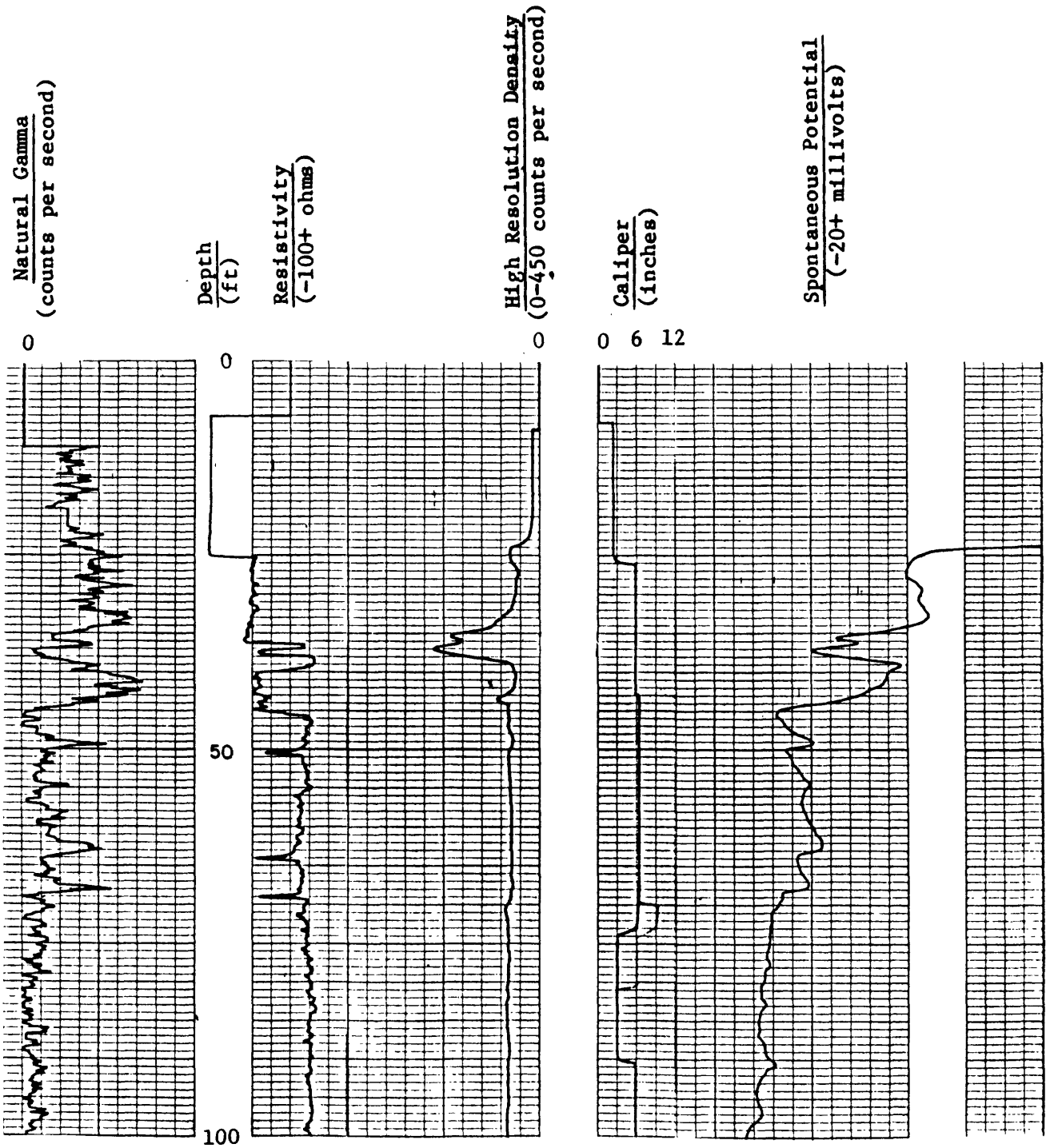
Corehole: SW-2 Date: 2/08/83 State: Virginia County: Dickenson

Quadrangle: Clintwood, Va.-Ky. Latitude: 37°14'03"N Longitude: 82°25'01"W

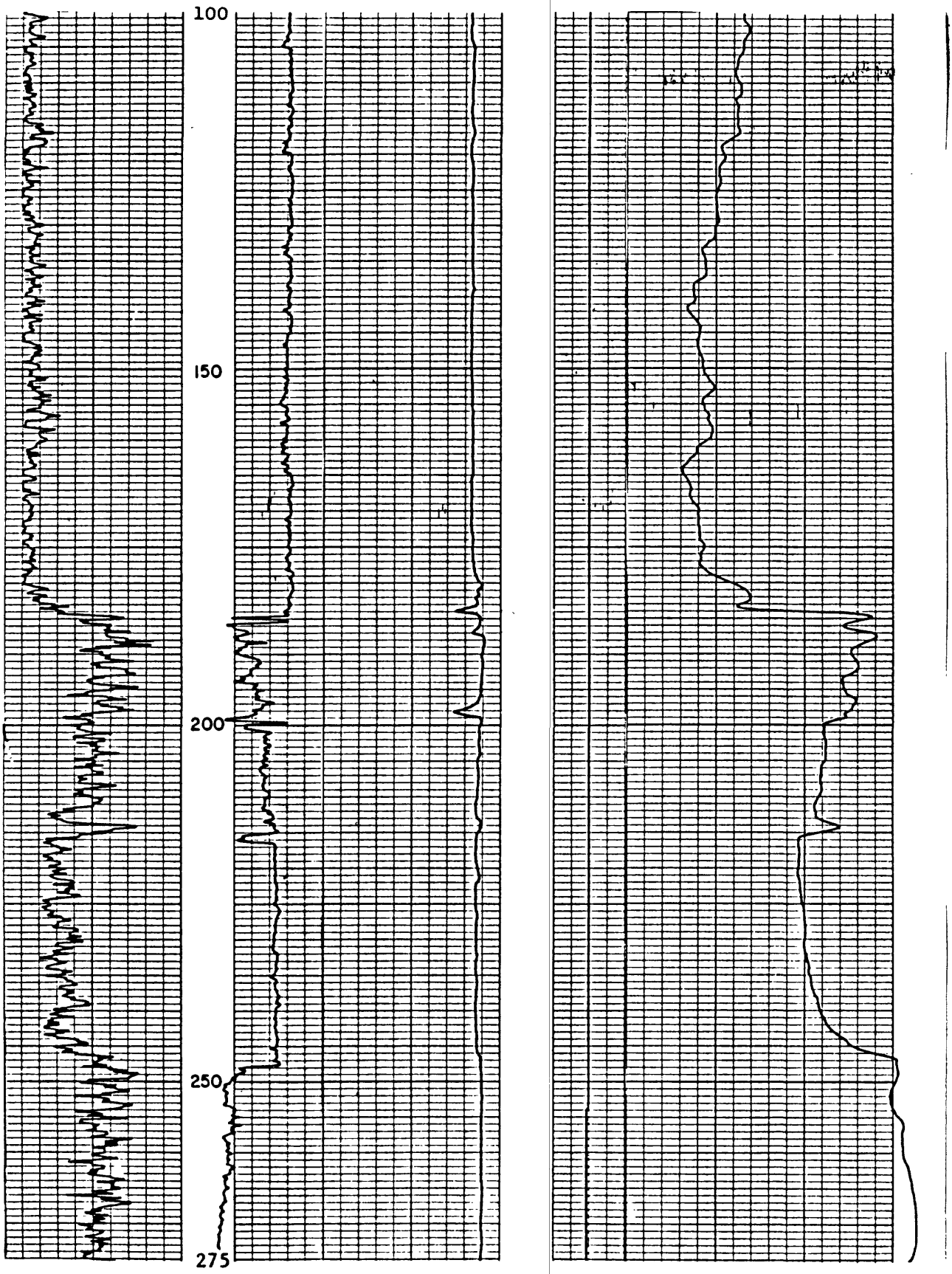
Altitude: 1,833 ft Logged Depth: 855 ft Drilled Depth: 855 ft

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

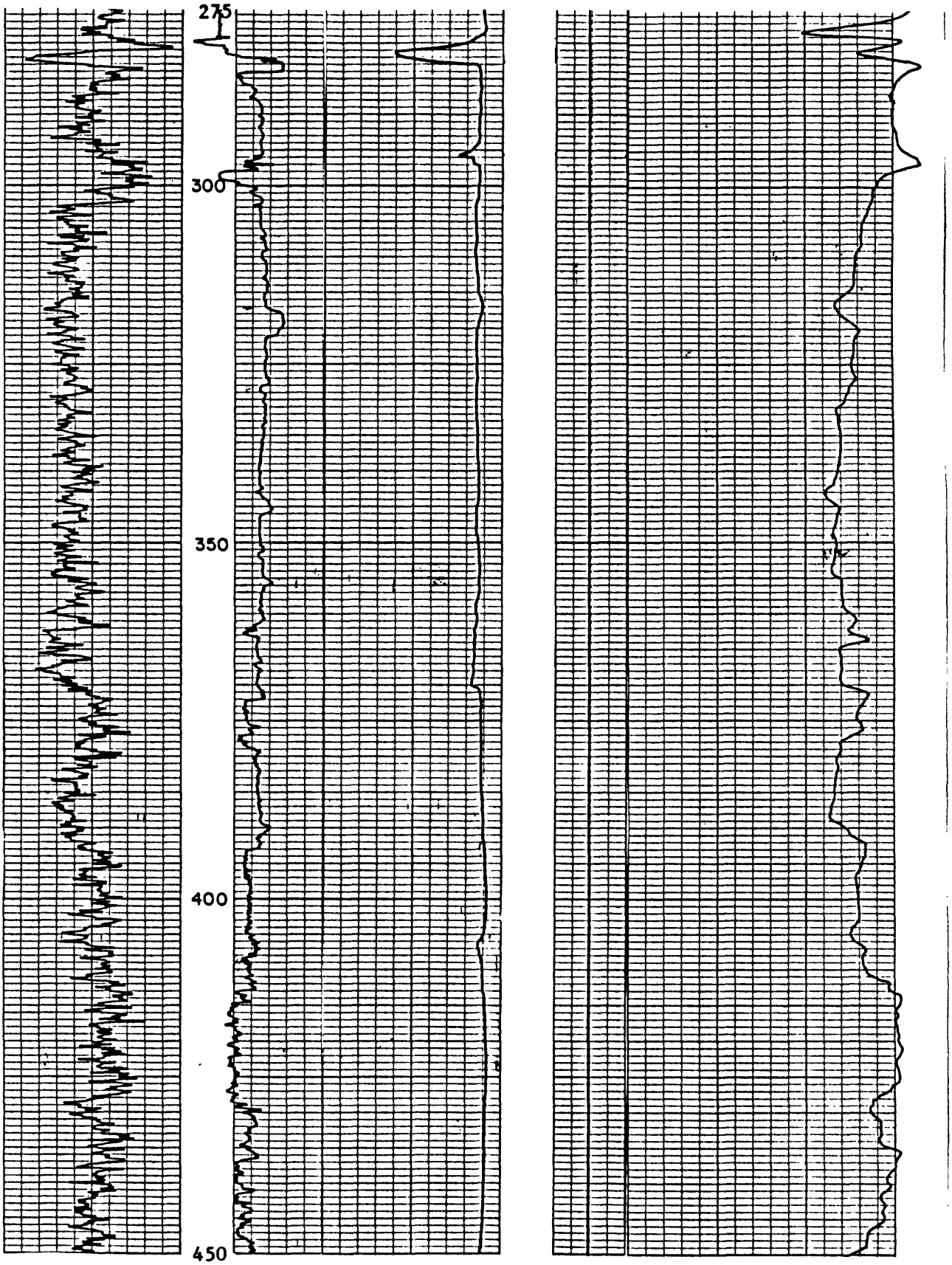
High Resolution Density Time Constant: 1



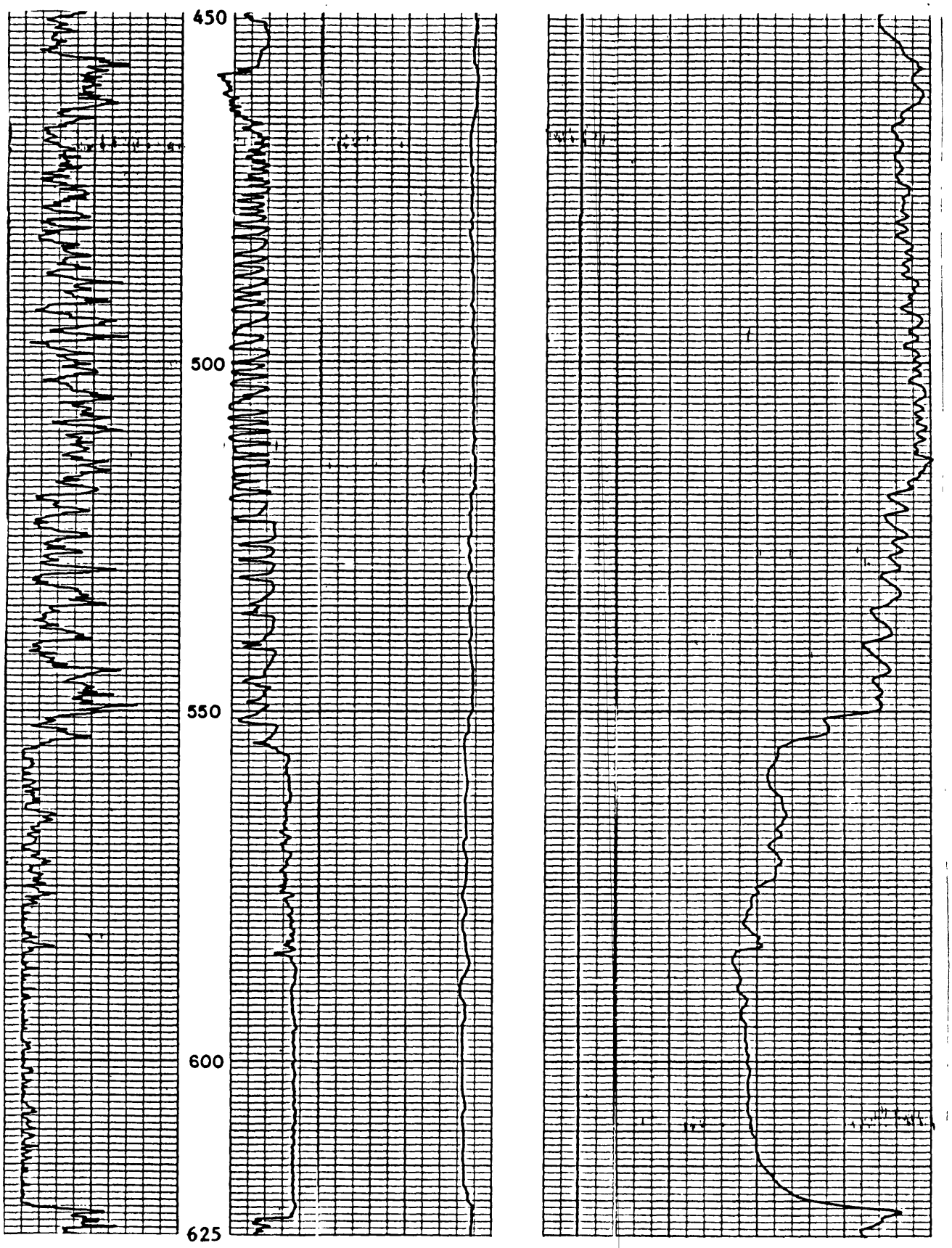
Corehole: SW-2 continued



Corehole: SW-2 continued

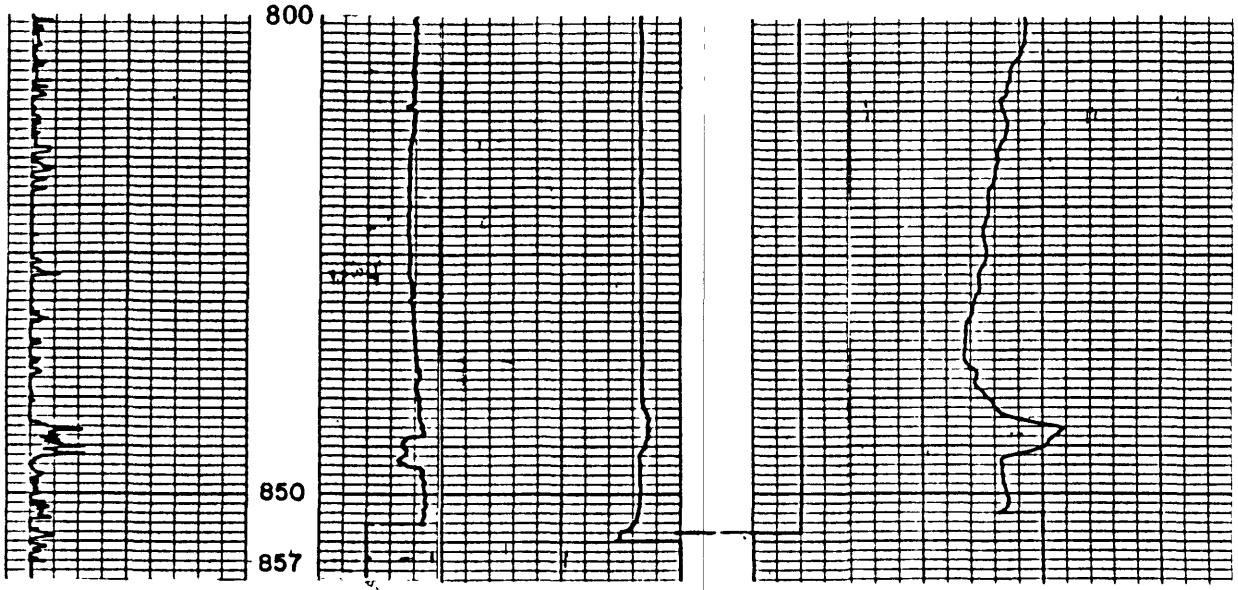


Corehole: SW-2 continued



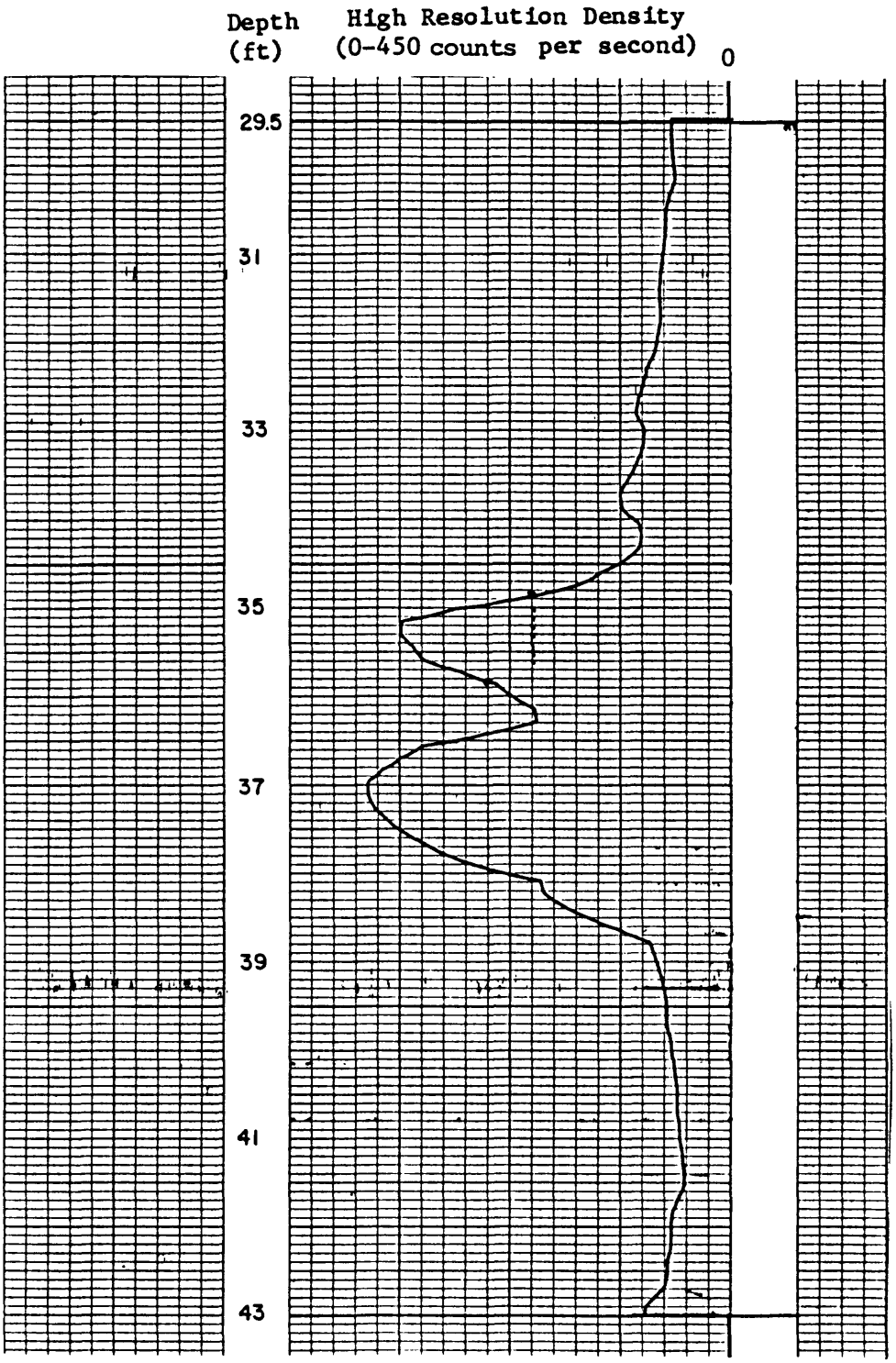
Corehole: SW-2 continued

Corehole: SW-2 continued

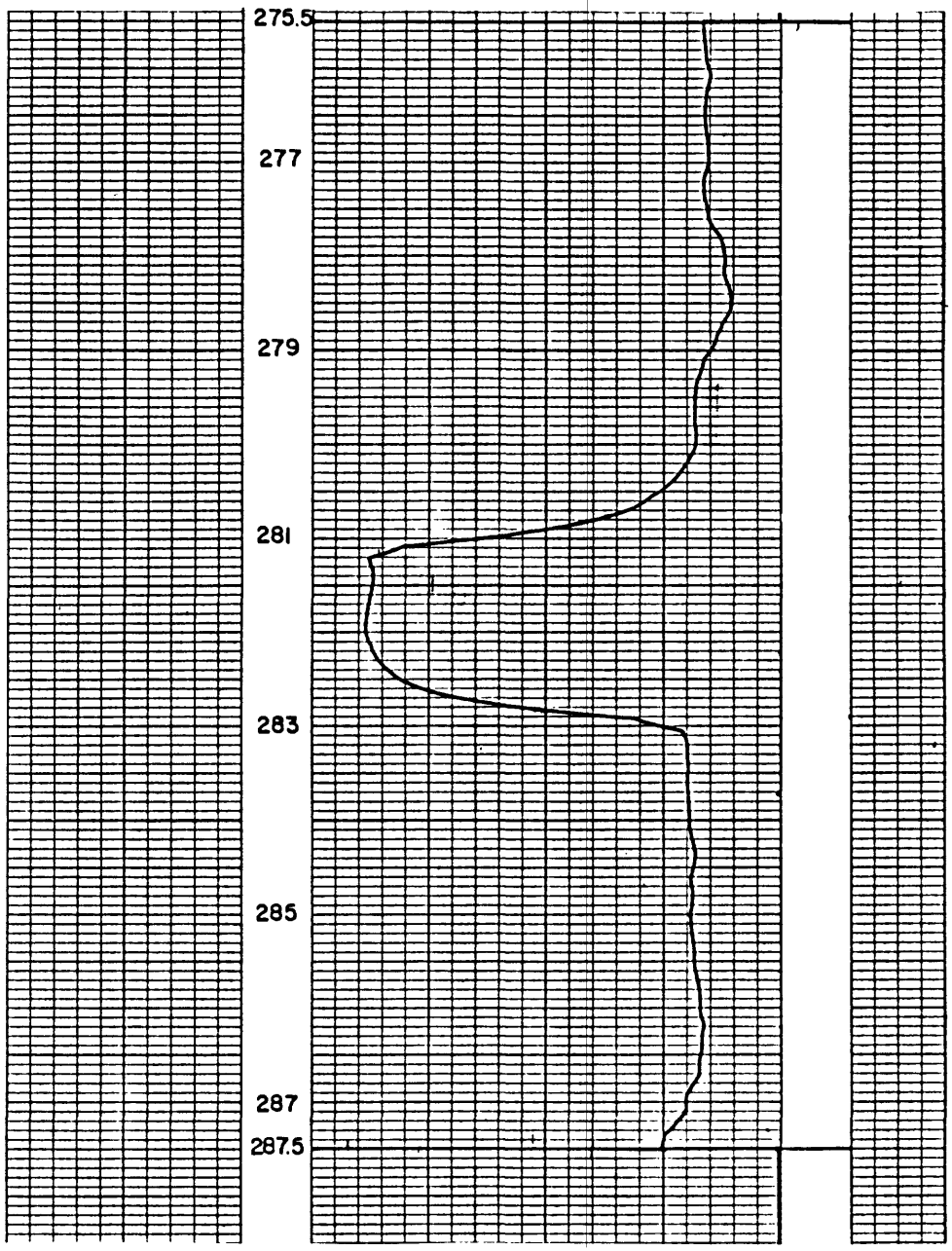


DETAIL LOG

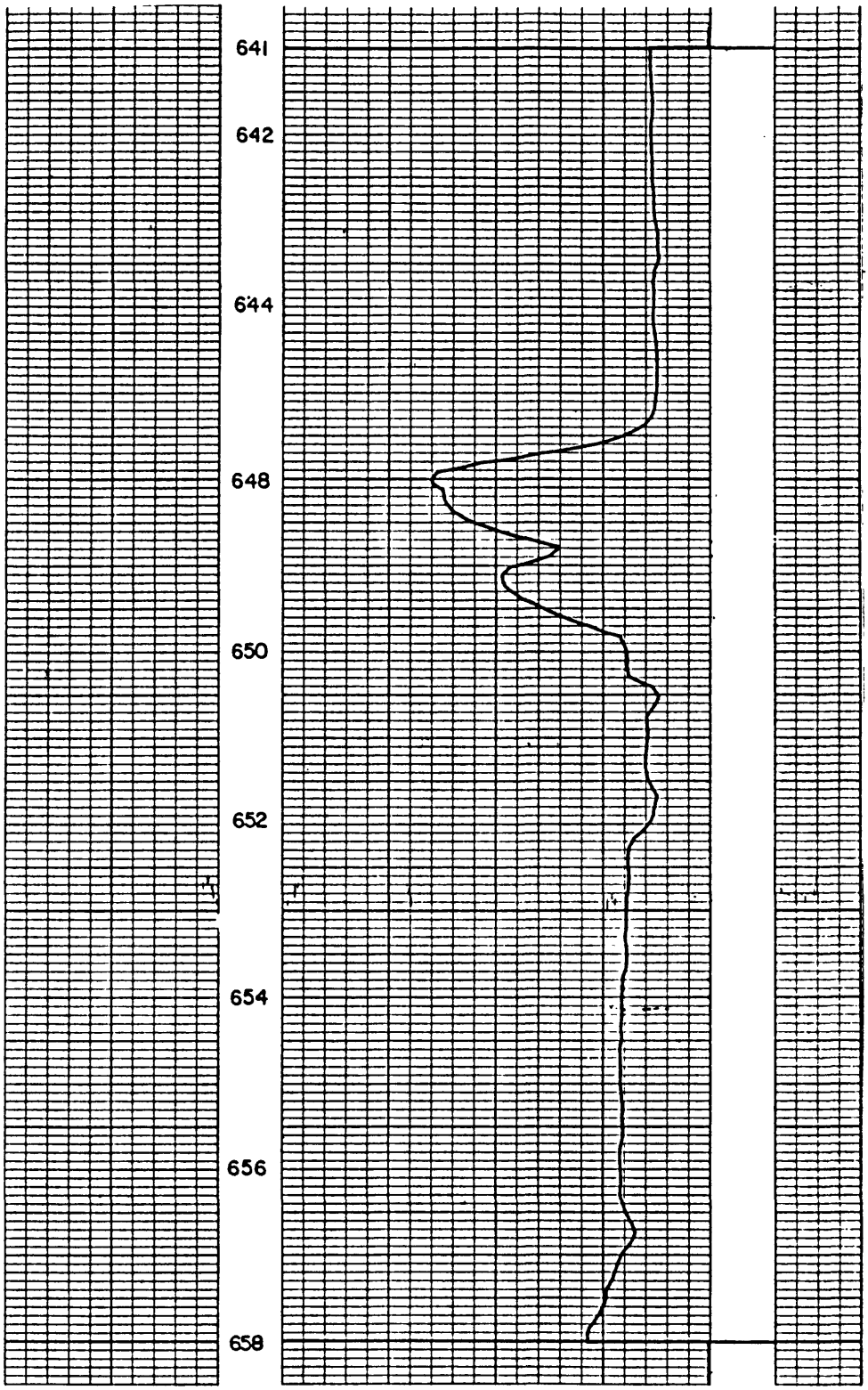
Corehole: SW-2 Logging Speed: 5 ft/min Time Constant: 1



Corehole: SW-2 continued



Corehole: SW-2 continued



Corehole SW-3

Location: Dickenson County; Clintwood, Va.-Ky., 7.5 minute quadrangle; between Cane Creek and Little Pine Branch approximately 1 mi south of Kentucky-Virginia state line. Accessible by Mullins Road which extends northward from State Route 611.

Coordinates: Latitude 37°13'02"N Longitude: 82°28'58"W

Altitude: 2,140 ft Drilled depth: 865 ft

Dip of strata: 20° to depth of about 500 ft decreasing to 10° at base of corehole.

Date drilled: January 13, 1983 to February 3, 1983

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

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER PENNSYLVANIAN SERIES		
	Lee Formation		
	Hensley Member		
1.	Soil and weathered rock (casing set - no core recovered).....	12	0
		(12	0)
2.	Sandstone, medium-light-gray, weathered brownish-gray, very fine to fine-grained, silty, finely micaceous, contains 65 percent quartz, crossbedded, thin-bedded; base sharp.....	5	0
		(17	0)
3.	Siltstone, medium-gray, weathered brownish-gray, argillaceous, thin-bedded.....	2	8
		(19	8)
4.	Shale, medium-gray, silty, contains few light-gray very fine grained silty sandstone laminae, burrowed, evenly bedded; base sharp.....	8	11
		(28	7)
5.	Shale, medium-dark-gray, silty, contains 5 percent light-gray siltstone and very fine grained sandstone laminae, slightly burrowed, fissile; base sharp.....	43	11
		(72	6)
6.	Shale, medium-gray, very silty, contains few light-gray siltstone and very fine grained sandstone laminae, few rootlets, evenly to poorly bedded; base grades.....	3	11
		(76	5)

Unit Number	Description	Thickness (Depth) ft	in.
7.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, thin-bedded, base grades.....	0	6
		(76	11)
8.	Siltstone, medium-gray, argillaceous, contains few light-gray, very fine grained sandstone laminae; base grades.....	0	10
		(77	9)
9.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, scattered medium-dark-gray shale laminae, thin-bedded; base grades.....	0	6
		(78	3)
10.	Siltstone, medium-gray, argillaceous, contains few coal laminae, slightly burrowed; base grades.....	1	0
		(79	3)
11.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, thin-bedded; base grades.....	0	3
		(79	6)
12.	Shale, medium- to medium-dark-gray, very silty in top 8 in., contains few light-gray very fine grained sandstone laminae, fissile; base sharp.....	1	6
		(81	0)
13.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, 45 percent dark-gray silty shale laminae and beds up to 1 in. thick, thin and lenticularly bedded; base sharp...	0	3
		(81	3)
14.	Sandstone, medium-light-gray, very fine grained, silty, contains 65 percent quartz, 10 percent medium-dark-gray shale laminae in top 2 ft, few coal laminae in basal 5 ft, partly crossbedded, thin- to thick-bedded; base sharp.....	12	6
		(93	9)
15.	Shale, medium-dark to dark-gray, very carbonaceous in basal 4 in., abundant rootlets.....	6	6
		(100	3)
16.	Coal, impure, contains abundant dark-gray shale laminae in top 2 in.....	0	4
		(100	7)

Unit Number	Description	Thickness (Depth) ft	in.
17.	Underclay, medium- to dark-gray, very carbonaceous, abundant rootlets.....	0	6
		(101	1)
18.	Coal, dull to bright attritus, pyritic.....	0	7
		(101	8)
19.	Underclay, medium-gray, abundant rootlets; base sharp and angular.	0	3
		(101	11)
20.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 45 percent quartz, scattered medium-dark-gray shale laminae and beds up to 1 in. thick, abundant rootlets in top 10 in., crossbedded, thin-bedded.....	2	4
		(104	3)
21.	Shale, medium-dark-gray, evenly bedded.....	0	1
		(104	5)
22.	Coal, impure.....	0	1
		(104	4)
23.	Underclay, medium-gray, abundant rootlets, poorly bedded.....	2	7
		(107	0)
24.	Shale, medium- to medium-dark-gray, silty, contains 10 percent light-gray siltstone and very fine grained sandstone laminae and beds up to 1 in. thick, few plant fragments including Calamites 6 in. below top, evenly bedded, fair fissility; base grades.....	20	6
		(127	6)
25.	Sandstone, medium-light-gray, very fine to fine-grained, silty contains 50 percent quartz, 40 percent dark-gray shale laminae and beds, burrowed, cross-laminated, thin-bedded; base sharp and uneven.....	3	4
		(130	10)
26.	Shale, medium-dark-gray, contains abundant plant fragments including well preserved Calamites, evenly bedded, fair fissility; base sharp.....	1	9
		(132	7)
27.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 50 percent quartz; base sharp.....	0	3
		(132	10)
28.	Shale, medium-gray, silty, contains 40 percent light-gray very fine grained sandstone laminae, slightly burrowed, evenly bedded; base sharp.....	0	11
		(133	9)

Unit Number	Description	Thickness (Depth) ft	in.
29.	Sandstone, medium-light-gray, fine- to medium-grained, silty, contains 55 percent quartz, 10 percent dark-gray shale laminae and beds, few coal laminae including scattered coalified plant fragments in basal 4 in., crossbedded, thin-bedded; base sharp and uneven.....	12	0
		(145	9)
30.	Shale, medium-dark-gray, poor fissility, base sharp.....	3	4
		(149	1)
	Lee Formation Middlesboro Member		
31.	Sandstone, light to medium-light-gray, coarse-grained, contains 65 percent quartz, few quartz granules, abundant small angular medium-dark-gray shale clasts; base sharp and uneven.....	1	2
		(150	3)
32.	Shale, medium- to medium-dark-gray, contains few lenses of light-gray coarse-grained sandstone in top 8 in.; base sharp.....	1	3
		(151	6)
33.	Sandstone, light-gray, weathered brownish-gray in part, coarse-grained, conglomeratic with scattered well rounded white quartz pebbles, contains 90 percent quartz; abundant well rounded white quartz pebbles, coal, and siderite clasts up to 2 in. in diameter in basal 6 in.; thick-bedded to massive; base sharp and uneven....	51	7
		(203	1)
34.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, abundant coal and dark-gray shale laminae, thin and irregularly bedded; base grades.....	3	6
		(206	7)
35.	Shale, medium-dark-gray, evenly bedded, fair fissility; base sharp.....	0	7
		(207	2)
36.	Coal, Castle rider (?) coal bed, dull to bright attritus, few vitrain bands and fusain laminae.....	1	1
		(208	3)
37.	Underclay, medium-gray, abundant rootlets.....	0	9
		(209	0)
38.	Shale, medium-dark-gray, contains few coal laminae, abundant well preserved plant fragments including Calamites, few rootlets and Stigmaria, evenly bedded, fissile; base sharp.....	5	2
		(214	2)

Unit Number	Description	Thickness (Depth) ft	in.
39.	Siltstone, medium-gray, argillaceous, contains 20 percent light-gray very fine grained sandstone laminae, few small coal clasts, slightly burrowed, thin-bedded.....	1	10
		(216	0)
40.	Shale, medium-dark- to dark-gray, carbonaceous, very silty, evenly bedded, poor fissility.....	3	10
		(219	10)
41.	Underclay, medium-gray, abundant rootlets, poorly bedded.....	3	7
		(223	5)
42.	Siltstone, medium-gray, contains 20 percent light-gray very fine grained sandstone laminae and beds, 20 percent dark-gray shale laminae, contorted bedding; base sharp and uneven.....	4	4
		(227	9)
43.	Sandstone, medium-light-gray, fine- to medium-grained, contains 50 percent quartz; base sharp and irregular.....	0	3
		(228	0)
44.	Shale, medium- to dark-gray, carbonaceous, silty in top 2 ft 5 in., abundant well preserved plant fragments, evenly bedded, fissile.....	11	4
		(239	4)
45.	Siltstone, medium- to medium-dark-gray, finely micaceous, contains 20 percent light-gray very fine grained sandstone laminae, 10 percent dark-gray shale laminae, cross-laminated, thin-bedded, few contorted beds; base sharp.....	5	8
		(245	0)
46.	Shale, medium-dark-gray, silty, evenly bedded; base grades.....	0	7
		(245	7)
47.	Siltstone, medium-gray, finely micaceous, argillaceous, contains 20 percent light-gray very fine grained sandstone laminae, cross-laminated, thin and evenly bedded.....	1	10
		(247	5)
48.	Shale, medium- to medium-dark-gray, abundant well preserved plant fragments, evenly to poorly bedded; base sharp.....	2	6
		(249	11)
49.	Sandstone, medium-light-gray, very fine grained, silty, finely micaceous, contains 45 percent quartz, few medium-dark-gray shale clasts at base.....	0	4
		(250	3)

Unit Number	Description	Thickness (Depth) ft	in.
50.	Shale, medium-gray, silty, contains few siderite nodules, evenly to poorly bedded; base sharp.....	1	3
		(251	6)
51.	Sandstone, medium-light-gray, very fine grained, silty, contains 50 percent quartz, few calcite-filled fractures.....	0	4
		(251	10)
52.	Shale, medium-dark-gray, slightly silty, evenly bedded; base sharp.....	2	3
		(254	1)
53.	Sandstone, medium-light-gray, very fine to fine-grained, finely micaceous, contains 45 percent quartz; base sharp.....	1	4
		(255	5)
54.	Coal, dull to bright attritus, few vitrain bands, impure in top 0.5 in.....	0	3
		(255	8)
55.	Underclay, medium-dark-gray, carbonaceous, silty in basal 10 in., abundant rootlets, few siderite nodules.....	3	3
		(258	11)
56.	Coal, impure, dull attritus, few fusain laminae.....	0	4
		(259	3)
57.	Underclay, medium-gray, silty, abundant rootlets.....	0	3
		(259	6)
58.	Sandstone, medium-light-gray, fine- to medium-grained, sparsely micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark mineral grains, few rootlets in top 5 in., few coal laminae, massive; base grades.....	14	3
		(273	9)
59.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, massive; base grades.....	16	3
		(290	0)
60.	Sandstone, light-gray, coarse-grained, micaceous, contains 60 percent quartz, 10 percent feldspar, abundant dark mineral grains, scattered well rounded white quartz pebbles from 0.25 in. to 0.5 in. in diameter, few coal laminae from 1 ft to 2 ft below top, massive; base sharp.....	5	1
		(295	1)

Unit Number	Description	Thickness (Depth) ft	in.
61.	Sandstone, very light gray, fine- to medium- grained, contains 90 percent quartz, crossbedded, massive; base grades.....	14	10
		(309	11)
62.	Sandstone, light-gray, mottled light-greenish-gray in top 6 in., fine- to medium-grained, contains 90 percent quartz, few well rounded white quartz pebbles up to 0.5 in. in diameter, massive; base grades.....	6	11
		(316	10)
63.	Sandstone, light-greenish-gray, medium- to coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles up to 1 in. in diameter, massive; base grades.....	8	5
		(325	3)
64.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles up to 0.5 in. in diameter, scattered stylolites, cross-bedded, massive; base grades.....	20	8
		(345	11)
65.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles up to 1 in. in diameter, few coal laminae in top 1 ft 9 in.; abundant quartz pebbles, coal clasts up to 0.25 in. in diameter and angular to well rounded siderite clasts in basal 10 in.; base sharp.....	10	3
		(356	2)
66.	Sandstone, light-gray, medium-grained, very micaceous, contains 60 percent quartz, abundant dark mineral grains; scattered coal, siderite, and medium-dark-gray shale clasts in basal 2 in.; massive; base sharp.....	1	4
		(357	6)
67.	Shale, dark-gray, evenly bedded, fissile; base sharp.....	2	4
		(359	10)
68.	Coal, Sewell (?) coal bed (thickness-1 ft 1.5 in.)		
	68a. Coal, mostly bright attritus.....	0	1.5
		(359	11.5)
	68b. Shale, black, very carbonaceous.....	0	1
		(360	0.5)
	68c. Coal, mostly bright attritus.....	0	7.5
		(360	8)
	68d. Coal mostly dull attritus, few vitrain bands.....	0	3.5
		(360	11.5)

Unit Number	Description	Thickness (Depth) ft	in.
69.	Sandstone, medium-dark-gray, very fine grained, silty, micaceous, contains 40 percent quartz, abundant rootlets; base grades.....	3	7.5
		(364	7)
70.	Sandstone, medium-light- to medium-dark-gray, very fine to fine-grained, silty, contains 40 percent quartz, 40 percent medium-gray siltstone laminae, few rootlets in top 2 ft, thin-bedded; base sharp.....	3	10
		(368	5)
71.	Shale, dark-gray to black, carbonaceous, slightly silty, evenly bedded; base grades.....	1	9
		(370	2)
72.	Coal, impure, dull attritus.....	0	1
		(370	3)
73.	Shale, black, carbonaceous, contains 20 percent coal laminae.....	0	2
		(370	5)
74.	Underclay, medium-gray, abundant rootlets; base grades.....	0	11
		(371	4)
75.	Shale, dark-gray, silty, abundant plant fragments, faintly bedded, poor fissility; base grades.....	2	7
		(373	11)
76.	Underclay, medium-gray, few rootlets; base grades.....	1	1
		(375	0)
77.	Sandstone, light-gray, fine-grained, very micaceous, contains 50 percent quartz, thin- to thick-bedded; base grades.....	2	4
		(377	4)
78.	Shale, dark-gray, contains few plant fragments, 1.5 in. siderite bed 5 in. above base, evenly bedded; base grades.....	2	10
		(380	2)
79.	Underclay, medium-gray, few rootlets; base grades.....	0	7
		(380	9)
80.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz; base grades.....	0	7
		(381	4)
81.	Shale, dark-gray, carbonaceous in basal 5 in., silty in top 10 in., scattered siderite nodules in basal 5 in., evenly bedded; base grades.....	2	3
		(383	7)

Unit Number	Description	Thickness (Depth) ft	in.
82.	Shale, medium-gray, silty, plastic in top 1 ft, faintly bedded; base grades	1	6
		(385	1)
83.	Shale, dark-gray, silty, contains 30 percent light-gray very fine grained sandstone laminae in top 4 in., few siderite beds up to 0.5 in. thick; base grades	6	1
		(391	2)
84.	Sandstone, medium-light-gray, very fine grained, silty, micaceous, contains 45 percent quartz, 20 percent medium-gray siltstone laminae, cross-laminated, thin-bedded; base grades	1	0
		(392	2)
85.	Shale, dark-gray, silty, faintly bedded; base grades	0	10
		(393	0)
86.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, silty, micaceous contains 40 percent quartz, thin-bedded; base grades	4	1
		(397	1)
87.	Sandstone, brownish-gray, medium-grained, petroliferous, contains 40 percent quartz, thick-bedded; base sharp	1	10
		(398	11)
88.	Siltstone, medium-dark-gray, micaceous, faintly bedded; base grades	3	4
		(402	3)
89.	Shale, dark-gray, silty, very carbonaceous in basal 4 in., evenly bedded	1	10
		(404	1)
90.	Coal, Welch (?) coal bed (thickness - 1 ft 1 in.)		
	90a. Coal, impure, contains abundant dark-gray shale laminae	0	2
		(404	3)
	90b. Coal, mostly bright attritus	0	11
		(405	2)
91.	Underclay, dark-gray, carbonaceous, abundant rootlets; base grades	1	1
		(406	3)
92.	Shale, dark-gray, contains few plant fragments, evenly bedded, fissile; base grades	5	9
		(412	0)

Unit Number	Description	Thickness (Depth) ft	in.
93.	Siltstone, light- to medium-gray, contains 20 percent light-gray very fine grained sandstone laminae, thin and evenly bedded; base grades.....	0	8
		(412	8)
94.	Shale, medium-dark-gray, contains few medium-gray siltstone laminae in basal 1 ft, evenly bedded, fissile; base grades.....	4	4
		(417	0)
95.	Shale, dark-gray, silty, contains 20 percent light-gray very fine grained sandstone laminae and beds, slightly burrowed, evenly bedded, fissile; base grades abruptly.....	5	8
		(422	8)
96.	Sandstone, light-gray, very fine grained, micaceous, contains 40 percent quartz, 40 percent dark-gray shale laminae, thin-bedded; base grades.....	1	1
		(423	9)
97.	Shale, dark-gray, contains 20 percent light-gray very fine grained sandstone laminae, evenly bedded, fissile; base grades.....	2	1
		(425	10)
98.	Sandstone, light-gray, very fine grained, micaceous, contains 50 percent quartz, cross-laminated, thin-bedded; base grades.....	1	0
		(426	10)
99.	Shale, dark-gray, silty, contains 20 percent light-gray very fine grained sandstone laminae, evenly bedded.....	0	8
		(427	6)
100.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles; abundant well rounded white quartz pebbles and siderite clasts up to 0.5 in. in diameter and few coal clasts in basal 2 ft 7 in.; few normally graded beds, crossbedded, massive; base sharp and undulatory.....	50	8
		(478	2)
101.	Shale, medium-dark-gray, contains few siderite beds up to 0.5 in. thick, abundant plant fragments in basal 2 ft, evenly bedded, fissile; base grades abruptly.....	8	6
		(486	8)
102.	Shale, dark-gray to black, abundant plant fragments, evenly bedded, fissile; base sharp.....	0	3
		(486	11)
103.	Coal, Beckley coal bed, mostly bright attritus.....	4	6
		(491	5)

Unit Number	Description	Thickness (Depth) ft	in.
104.	Underclay, dark-gray, carbonaceous, abundant rootlets; base grades.....	0	4
		(491	9)
105.	Sandstone, light- to medium-gray, very fine grained, silty, micaceous, contains 40 percent quartz, 30 percent dark-gray silty shale laminae, abundant rootlets, thin-bedded; base grades.....	1	9
		(493	6)
106.	Sandstone, light-gray, medium-grained, micaceous, contains 60 percent quartz, scattered dark and light mineral grains, scattered rootlets and coal laminae in top 2 ft 3 in., thick-bedded to massive; base sharp.....	5	1
		(498	7)
107.	Shale, dark-gray, silty, evenly bedded, fissile; base grades.....	0	3
		(498	10)
108.	Shale, black, carbonaceous, canneloid, fissile; base grades.....	0	8
		(499	6)
109.	Coal, canneloid, few thin vitrain bands, 0.25 in. pyrite lens 0.5 in. above base.....	0	3.5
		(499	9.5)
110.	Shale, black, carbonaceous, pyritic in basal 0.5 in.....	0	2.5
		(500	0)
111.	Coal, canneloid, impure.....	0	1
		(500	1)
112.	Shale, black, carbonaceous, silty, evenly bedded, fissile; base sharp.....	0	7
		(500	8)
113.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz.....	0	1
		(500	9)
114.	Shale, black, carbonaceous, silty in basal 5 in., contains few plant fragments; base grades.....	1	2
		(501	11)
115.	Sandstone, light- to medium-light-gray, fine-grained, micaceous, contains 45 percent quartz, 10 percent dark-gray siltstone laminae, abundant coal laminae in basal 7 in.; base sharp.....	5	6
		(507	5)

Unit Number	Description	Thickness (Depth) ft	in.
116.	Coal, dull to bright attritus.....	0	3
		(507	8)
117.	Underclay, medium- to medium-dark-gray, silty in basal 1 ft 6 in., abundant rootlets; base grades abruptly.....	2	7
		(510	3)
118.	Sandstone, very light gray, very fine to fine-grained, contains 65 percent quartz, well sorted, massive; base sharp.....	5	2
		(515	5)
119.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-gray shale and siltstone laminae, thin-bedded; base grades abruptly.....	0	6
		(515	11)
120.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base sharp.....	2	1
		(518	0)
121.	Shale, medium-dark-gray, silty, contains 20 percent light-gray very fine grained sandstone laminae, evenly bedded, fair fissility; base grades.....	0	8
		(518	8)
122.	Sandstone, light-gray, very fine grained, contains 50 percent quartz, 25 percent medium-dark-gray shale laminae and beds, cross-laminated, thin bedded; base grades.....	3	4
		(522	0)
123.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 55 percent quartz, 5 percent dark-gray shale laminae increasing to 25 percent in basal 3 ft 8 in., few scattered siderite clasts, thin- to thick-bedded; base sharp.....	21	4
		(543	4)
124.	Shale, black, carbonaceous, contains scattered coal laminae, fissle.....	3	1
		(546	5)
125.	Coal, Fire Creek rider coal bed, dull to bright attritus.....	1	5
		(547	10)

Unit Number	Description	Thickness (Depth) ft	in.
126.	Underclay, medium-dark-gray, carbonaceous, silty in basal 1 ft, abundant rootlets and root slicks; base grades.....	4	2
		(552	0)
127.	Shale, medium-dark-gray, silty, finely micaeous, contains 25 percent light-gray very fine grained sandstone laminae, evenly bedded; base grades.....	0	9
		(552	9)
128.	Sandstone, light-gray, very fine grained, contains 45 percent quartz, 10 percent medium-gray silty shale laminae and beds, cross-laminated, thin-bedded; base grades.....	0	8
		(553	5)
129.	Shale, medium-dark-gray, silty, contains 25 percent light-gray very fine grained silty sandstone laminae, slightly burrowed, fair fissility; base grades abruptly.....	0	11
		(554	4)
130.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 55 percent quartz, thin-bedded, few contorted beds; base grades.....	1	8
		(556	0)
131.	Shale, medium-dark-gray, silty, finely micaceous, contains 25 percent light-gray very fine grained silty sandstone laminae, evenly bedded, fissile; base grades.....	1	1
		(557	1)
132.	Sandstone, light-gray, very fine to fine-grained, finely micaceous, contains 45 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base grades abruptly.....	2	9
		(559	10)
133.	Shale, medium-dark-gray, very silty, contains 40 percent light-gray very fine grained silty sandstone laminae, evenly bedded, fair fissility; base grades abrupty.....	0	8
		(560	6)
134.	Sandstone, light-gray, very fine to fine-grained, very micaceous, contains 50 percent quartz, 10 percent medium-dark-gray shale laminae and beds up to 1 in. thick, thin- to thick-bedded.....	5	6
		(566	0)
135.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 55 percent quartz, 5 percent medium-dark-gray shale and siltstone laminae and beds, thin- to thick-bedded; base grades.....	28	4
		(594	4)

Unit Number	Description	Thickness (Depth) ft	in.
136.	Sandstone, very light to light-gray, fine- to medium-grained, micaceous, petroliferous from 7 ft to 10 ft below top, contains 65 percent quartz, 10 percent coal laminae from 24 ft 6 in. to 28 ft below top; scattered dark, light, and green mineral grains; abundant angular dark-gray shale clasts in basal 5 ft 8 in., thick-bedded to massive; base sharp.....	54	6
		(648	10)
137.	Shale, medium-dark-gray, silty, contains 5 percent light-gray very fine grained sandstone laminae in basal 2 ft, evenly bedded, fair fissility; base sharp.....	8	1
		(656	11)
138.	Shale, dark-gray, contains 15 percent light-gray very fine grained sandstone laminae in basal 3 in., scattered siderite nodules and beds, evenly bedded, fissile; base grades abruptly....	15	7
		(672	6)
139.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, 20 percent medium-dark-gray shale laminae in top 5 in., 1 in. medium-dark-gray shale bed 1 ft 2 in. below top, abundant small medium-dark-gray shale clasts from 1 ft 4 in. to 1 ft 8 in. above base, thin- to thick-bedded; base sharp.....	4	7
		(677	1)
140.	Shale, medium-dark-gray, contains 30 percent light-gray very fine grained sandstone laminae and beds up to 2 in. thick, evenly bedded, fair fissility; base sharp.....	0	9
		(677	10)
141.	Sandstone, very light gray, very fine to fine-grained, contains 65 percent quartz, thick-bedded; base sharp.....	1	5
		(679	3)
142.	Shale, medium-dark-gray, silty, finely micaceous, contains 10 percent light-gray very fine grained sandstone laminae, fissile..	4	3
		(683	6)
143.	Sandstone, light-gray, very fine grained, micaceous, contains 60 percent quartz, 10 percent dark-gray shale laminae, scattered dark mineral grains, thin-bedded; base sharp.....	2	5
		(685	11)
144.	Sandstone, light-gray, very fine grained, micaceous, contains 50 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base sharp.....	3	11
		(698	10)
145.	Shale, medium-dark- to dark-gray, silty, finely micaceous, contains 10 percent light-gray very fine grained silty sandstone laminae, fissle.....	1	0
		(690	10)

Unit Number	Description	Thickness (Depth) ft	in.
146.	Sandstone, light- to medium-light-gray, very fine grained, silty, micaceous, contains 50 percent quartz, 25 percent medium-dark-gray shale laminae and beds up to 2.5 in. thick, thin-bedded; base grades	8	10
		(699	8)
147.	Siltstone, medium-dark-gray, finely micaceous, contains 20 percent light-gray very fine grained silty sandstone laminae in basal 5 in., thin-bedded; base grades	0	8
		(700	4)
148.	Sandstone, light- to medium-light-gray, fine-grained, micaceous, contains 65 percent quartz, 5 percent medium-gray siltstone laminae, few siderite clasts 1 ft 7 in. below top, thin- to thick-bedded; base sharp	3	3
		(703	7)
149.	Shale, medium-dark-gray, very silty, finely micaceous, faintly bedded, poor fissility; base grades	1	2
		(704	9)
150.	Sandstone, light-gray, very fine to fine-grained, contains 60 percent quartz, 35 percent dark-gray shale laminae and beds up to 2 in. thick, cross-laminated, thin-bedded; base grades	3	4
		(708	1)
151.	Sandstone, light-gray, fine-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, abundant angular siderite and dark-gray shale clasts from 5 ft 6 in. to 5 ft 10 in. below top, thick-bedded	6	11
		(715	0)
152.	Shale, dark-gray, contains 25 percent light-gray very fine grained sandstone laminae, evenly bedded, fissile; base grades	0	5
		(715	5)
153.	Sandstone, light- to medium-light-gray, very fine grained, contains 55 percent quartz, 30 percent dark-gray silty shale laminae, scattered angular dark-gray shale clasts in basal 4 in., thin- to thick-bedded, few contorted beds from 6 in. to 10 in. above base; base grades	6	7
		(722	0)
154.	Sandstone, light-gray, fine- to medium-grained, micaceous, petroliferous from 8 ft 7 in. to 11 ft below top, contains 65 percent quartz, angular dark-gray shale clasts in basal 2 ft, scattered dark mineral grains, thick-bedded to massive; base grades	15	10
		(737	10)

Unit Number	Description	Thickness (Depth) ft	in.
155.	Sandstone, medium-gray, medium-grained; conglomeratic with abundant angular medium-dark to dark-gray shale clasts, scattered well rounded white quartz pebbles and siderite clasts; contains 65 percent quartz, petroliferous from 3 ft 11 in. to 5 ft 10 in. below top; base grades.....	8	3
		(746	1)
156.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, scattered siderite clasts; base grades.....	2	4
		(748	5)
157.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, scattered dark mineral grains, abundant dark-gray shale clasts up to 5 in. in diameter, scattered siderite clasts and quartz pebbles in basal 3 in., petroliferous in top 1 ft; base sharp.....	3	9
		(752	2)
158.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, 5 percent medium-dark-gray siltstone and shale laminae and beds up to 1 in. thick, scattered dark mineral grains, petroliferous in top 8 in. and from 6 ft 5 in. to 6 ft 10 in. below top, thin- to thick-bedded; base grades.....	8	0
		(760	2)
159.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, 5 percent dark-gray siltstone laminae from 5 ft 6 in. to 7 ft 4 in. below top, petroliferous in top 1 ft, few widely scattered well rounded white quartz pebbles, few stylolites, thick-bedded to massive; base grades.....	36	6
		(796	8)
160.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles up to 1.5 in. in diamter, petroliferous in basal 1 ft, abundant coal laminae and clasts in top 2 ft 4 in., crossbedded, massive; base grades.....	6	6
		(803	2)
161.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded quartz pebbles up to 0.5 in. in diameter, crossbedded, massive; base grades.....	10	0
		(813	2)
162.	Sandstone, white to very light gray, medium-grained, contains 90 percent quartz, conglomeratic with abundant well rounded quartz pebbles up to 1 in. in diameter, coal clast from 3 ft 1 in. to 3 ft 10 in. below top, scattered coal clasts and laminae in basal 5 ft; base grades.....	20	8
		(833	10)

Unit Number	Description	Thickness (Depth) ft	in.
163.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, abundant dark mineral grains, abundant quartz granules in basal 6 in., massive.....	6	1
		(839	11)
164.	Conglomerate, very light gray, contains well rounded white quartz pebbles from 0.5 in. to 1 in. in diameter, well rounded siderite clasts up to 1 in. in diameter, medium-grained moderately quartzose sandstone matrix; base sharp and uneven.....	1	4
		(841	3)
165.	Sandstone, light-gray, fine-grained, very micaceous, contains 50 percent quartz, 15 percent continuous and discontinuous medium-gray siltstone laminae, thin-bedded; base sharp.....	3	0
		(844	3)
166.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, few dark mineral grains, conglomeratic with well rounded white quartz pebbles and siderite clasts from 0.25 in. to 0.5 in. in diameter in basal 2 ft, thick-bedded to massive; base sharp.....	3	4
		(847	7)
167.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, thick-bedded to massive; base grades.....	11	10
		(859	5)
168.	Sandstone, very light gray, mottled brownish-gray in basal 4 ft 4 in., fine- to medium-grained, contains 90 percent quartz, conglomeratic with scattered well rounded white quartz pebbles up to 0.5 in. in diameter.....	5	7
		(865	0)

BOTTOM OF HOLE
TOTAL DEPTH 865 ft

GEOPHYSICAL LOG

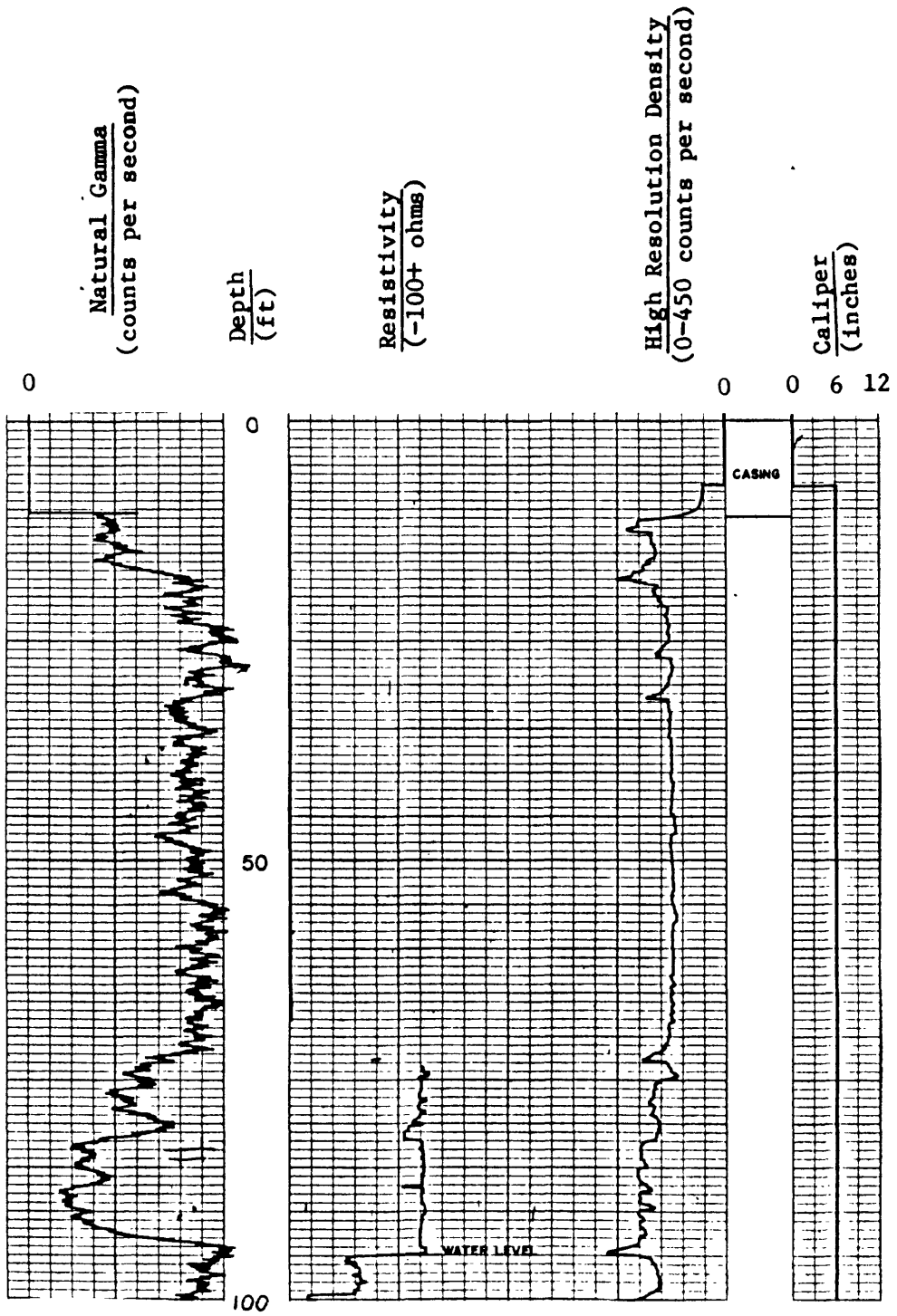
Corehole: SW-3 Date: 2/03/83 State: Virginia County: Dickenson

Quadrangle: Clintwood, Va.-Ky. Latitude: 37°13'02"N Longitude: 82°28'58"W

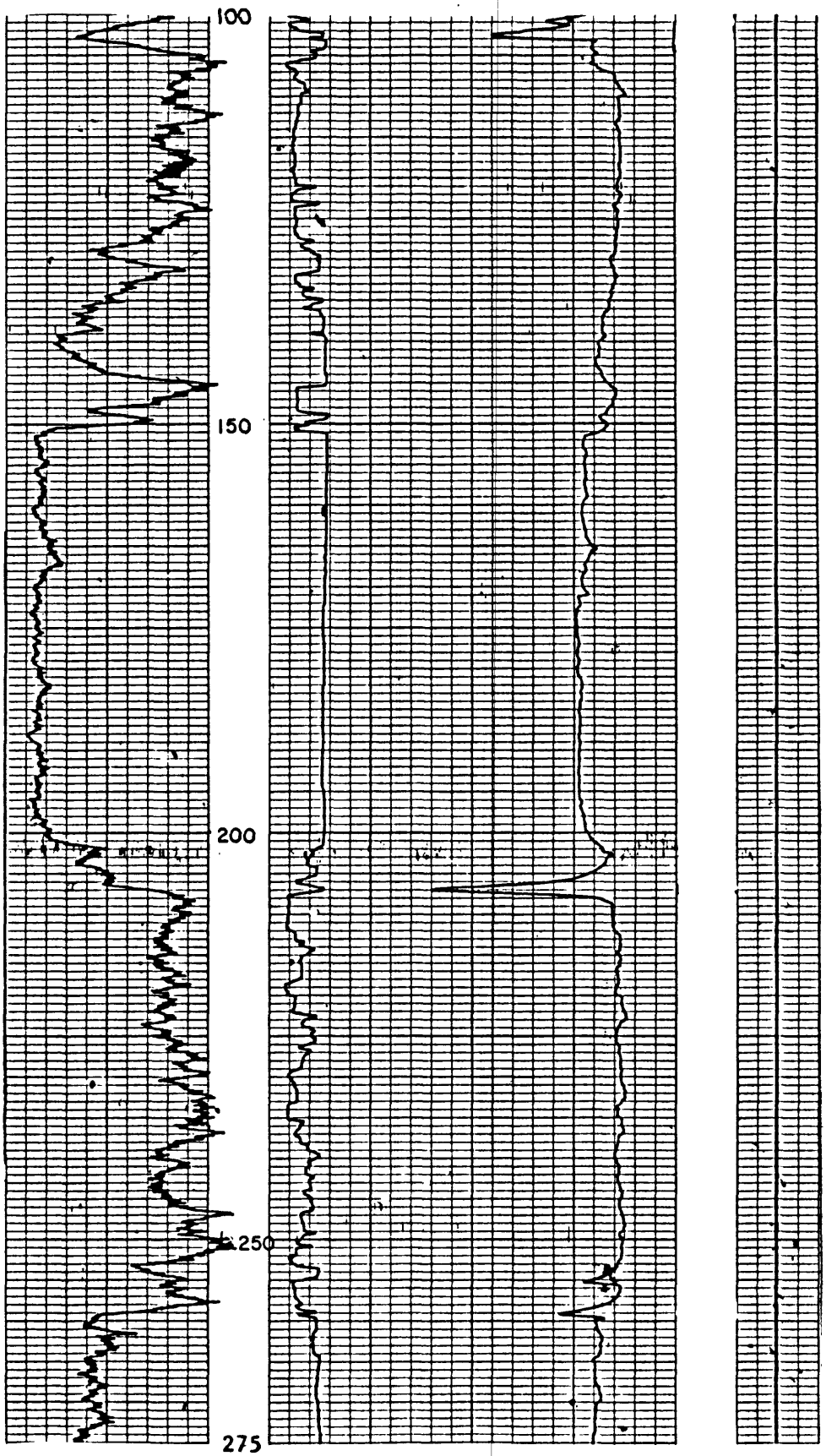
Altitude: 2,140 ft Logged Depth: 865 ft Drilled Depth: 865 ft

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

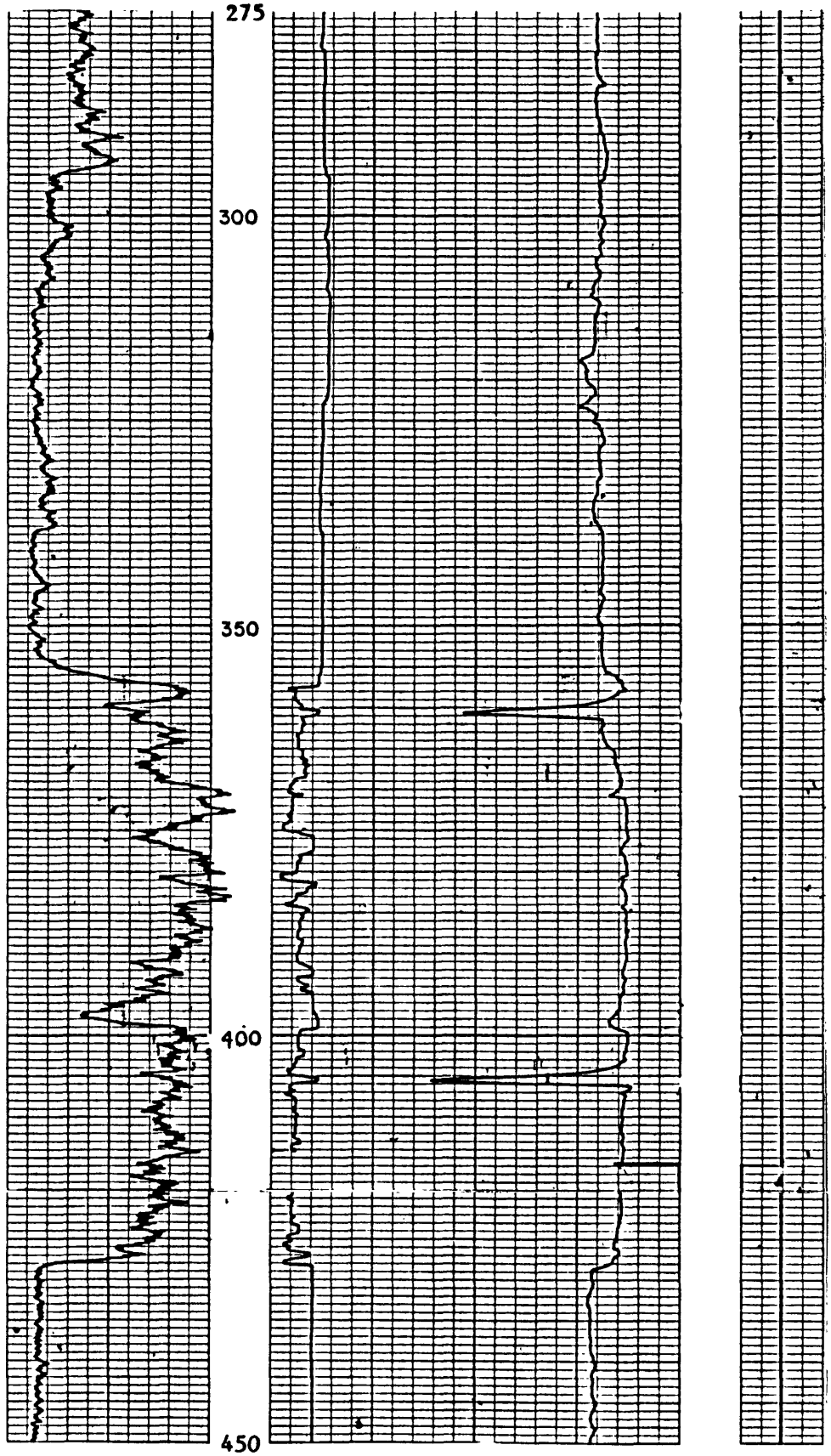
High Resolution Density Time Constant: 1



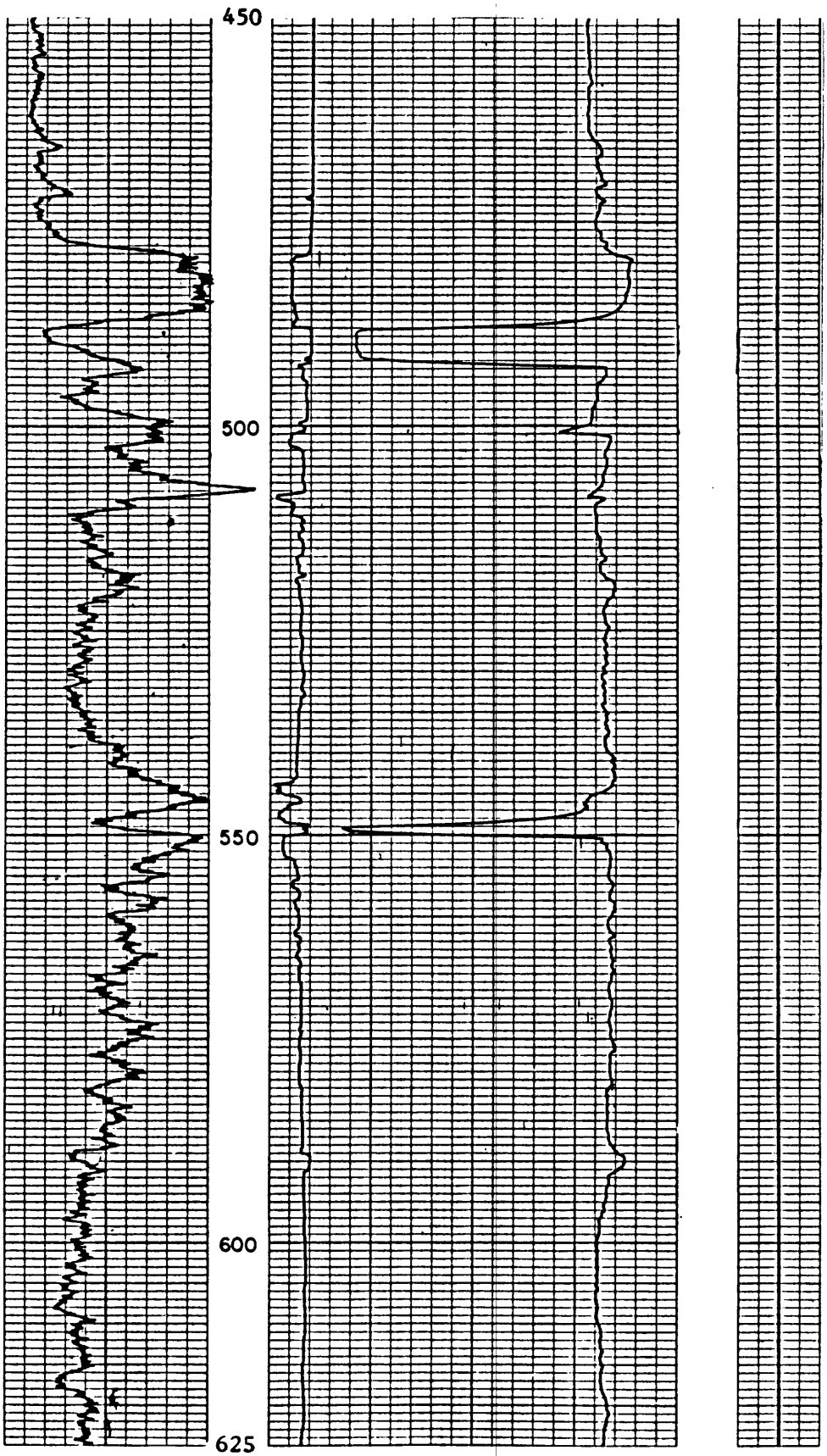
Corehole: SW-3 continued



Corehole: SW-3 continued

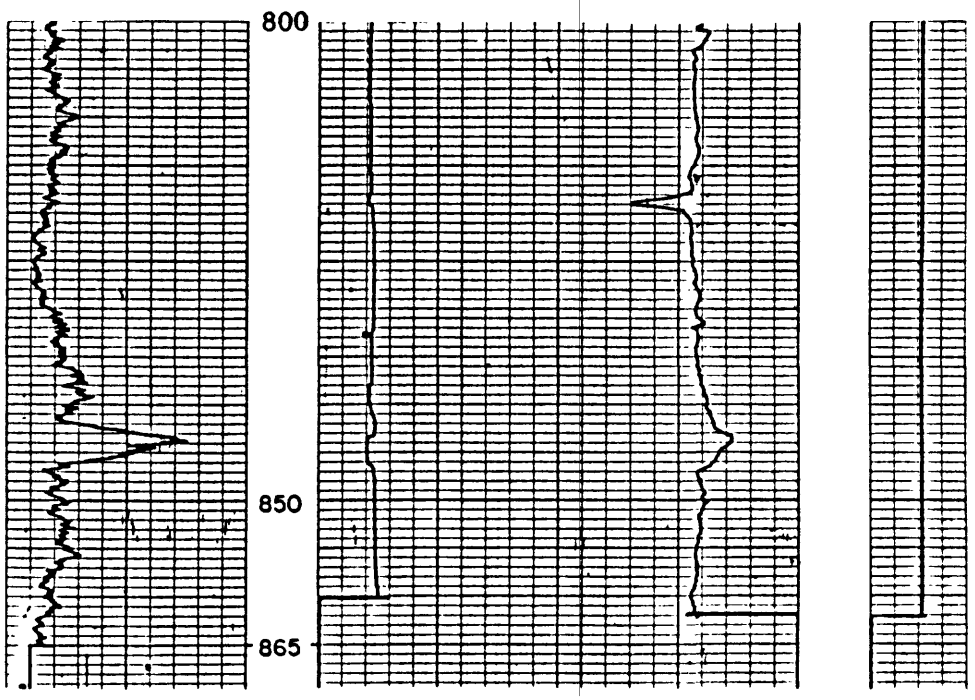


Corehole: SW-3 continued



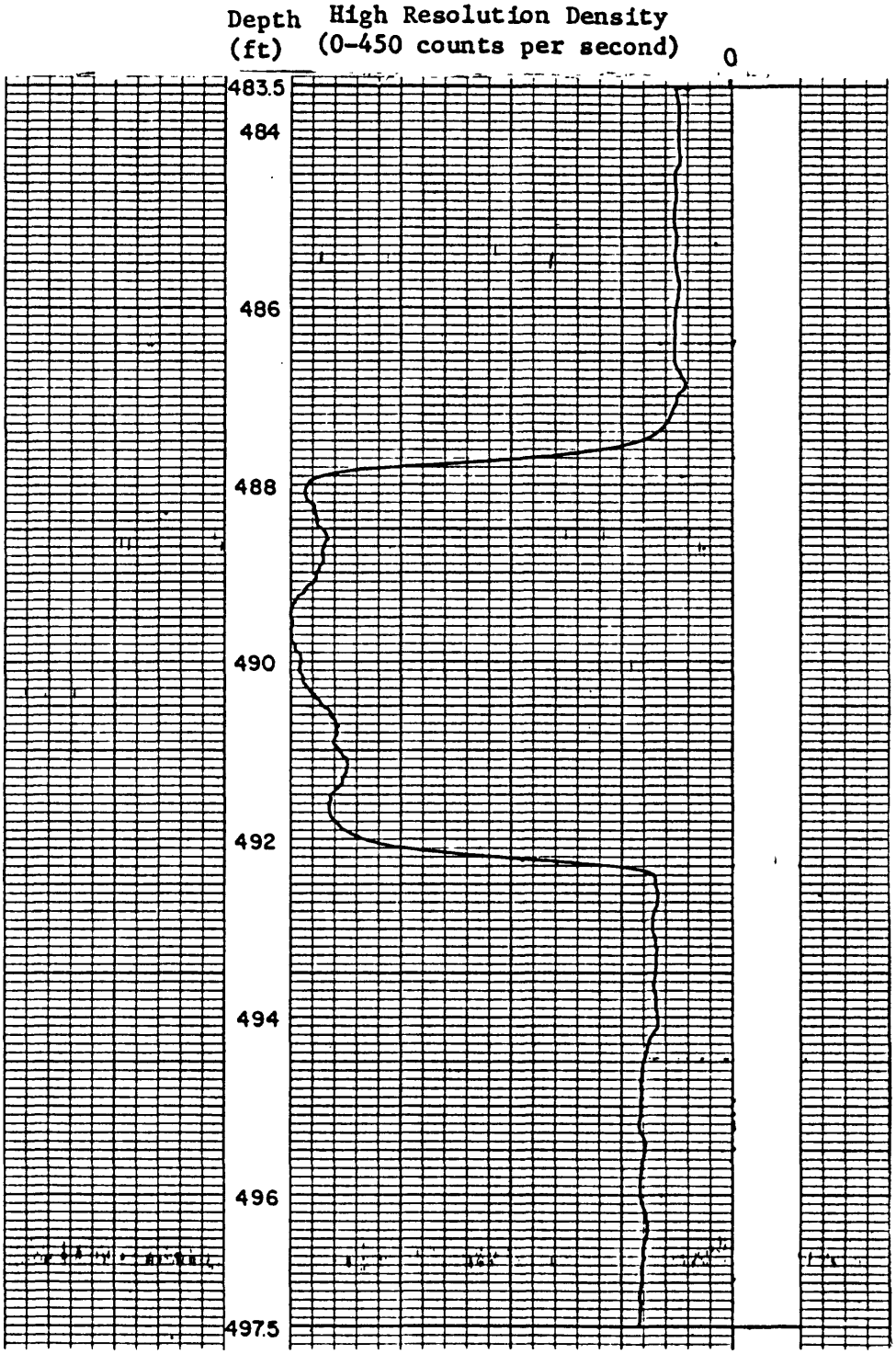
Corehole: SW-3 continued

Corehole: SW-3 continued

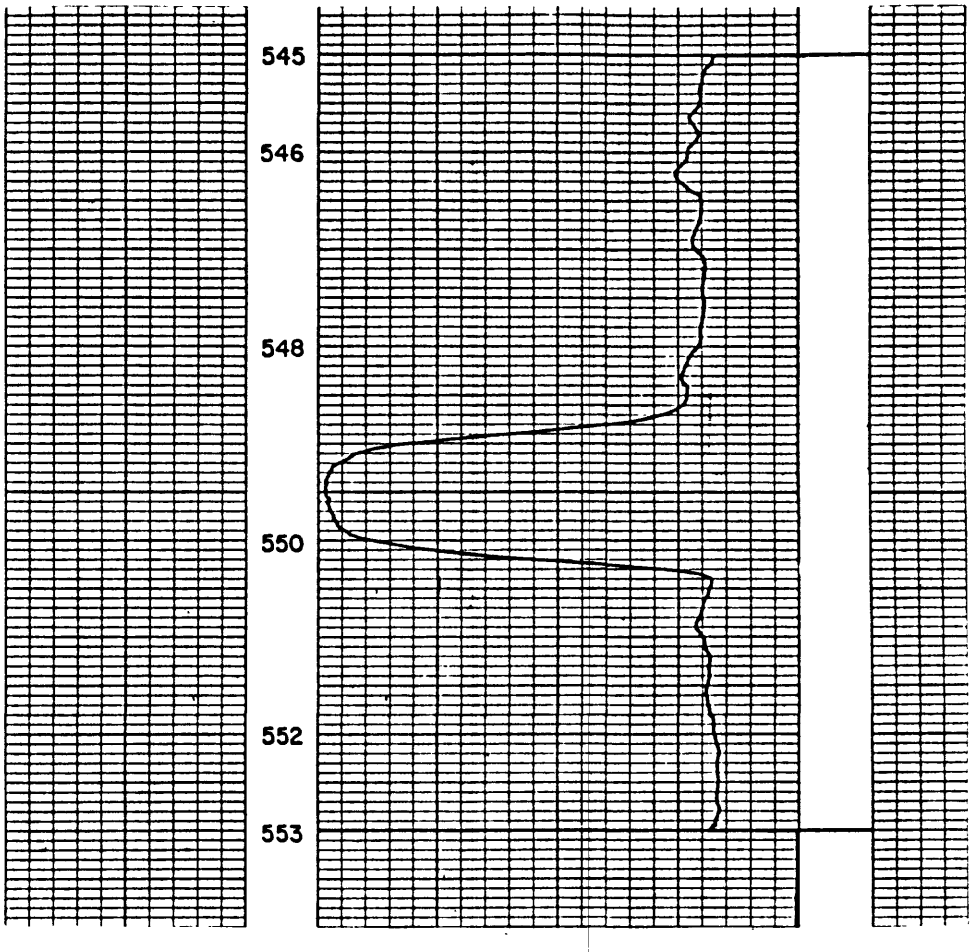


DETAIL LOG

Corehole: SW-3 Logging Speed: 5 ft/min Time Constant: 1



Corehole: SW-3 continued



Corehole SW-4

Location: Dickenson County; Jenkins East, Va.-Ky., 7.5 minute quadrangle; approximately 1 mi south of the Kentucky-Virginia state line and 0.4 mi east of the Dickenson-Wise county line. Accessible by State Route 630 from U.S. 23.

Coordinates: Latitude 37°11'15"N Longitude 82°32'41"W

Altitude: 2,055 ft Drilled Depth: 810 ft 7 in.

Dip of strata: Approximately 5° from surface to bottom of corehole.

Date drilled: November 23, 1982 to December 8, 1982

Core description: K.J. Englund, T.M. Kehn, J.F. Windolph, Jr., J.C. Weber, and R.E. Thomas

Unit Number	Description	Thickness (Depth) ft	in.
	MIDDLE PENNSYLVANIAN SERIES		
	Norton Formation		
1.	Soil and weathered rock (casing set - no core recovered).....	15	0
		(15	0)
2.	Shale, medium-gray, slightly silty, few plant fragments, few siderite nodules, evenly bedded, fair fissility; base grades abruptly.....	6	6
		(21	6)
3.	Shale, black, carbonaceous, few coalified plant fragments, evenly bedded.....	0	6
		(22	0)
4.	Shale, medium-dark-gray, few plant fragments, evenly bedded.....	0	8
		(22	8)
5.	Shale, black, very carbonaceous, few plant fragments.....	0	2
		(22	10)
6.	Underclay, medium-gray, few rootlets, faintly bedded; base sharp.....	1	1
		(23	11)

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER PENNSYLVANIAN SERIES		
	Lee Formation		
	Naese Sandstone Member		
7.	Sandstone, very light gray, weathered brownish-gray in basal 5 in., fine-grained, contains 90 percent quartz, massive; base grades	3	0
		(26	11)
8.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, 10 percent medium-gray siltstone laminae; base sharp	2	9
		(29	8)
9.	Shale, medium-dark-gray, slightly silty, finely micaceous, evenly bedded, fair fissility; base grades	3	8
		(33	4)
10.	Shale, medium-gray, very silty, evenly bedded, poor fissility; base grades	1	6
		(34	10)
11.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base grades	0	3
		(35	1)
12.	Shale, medium-gray, slightly silty, poor fissility; base sharp	1	1
		(36	2)
13.	Sandstone, medium-light-gray, very fine grained, contains 65 percent quartz; thick-bedded; base sharp	0	6
		(36	8)
14.	Shale, medium-gray, silty, finely micaceous, evenly bedded, fair fissility	0	1
		(36	9)
15.	Sandstone, medium-light-gray, fine-grained, contains 65 percent quartz, 10 percent medium-gray micaceous siltstone laminae, cross-laminated, thin- to thick-bedded; base grades	5	7
		(42	4)
16.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, 40 percent dark-gray shale laminae in basal 4 in., thick-bedded; base sharp	1	7
		(43	11)
17.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, 5 percent dark-gray silty shale laminae in top 8 ft 6 in., abundant coal laminae in basal 4 ft, cross-bedded, thick-bedded to massive; base grades	14	6
		(58	5)

Unit Number	Description	Thickness (Depth) ft	in.
18.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, few scattered quartz granules and pebbles up to 0.25 in. in diameter, 0.25 in. coal clast 68 ft 6 in. below top, abundant siderite clasts up to 1 in. in diameter, well rounded white quartz pebbles up to 0.5 in. in diameter and coal clasts in basal 9 in., few stylolites, thick-bedded to massive; base sharp and undulatory	94	3
		(152	8)
	Lee Formation Hensley Member		
19.	Coal, Jawbone rider coal bed (thickness-1 ft 0 in.)		
19a.	Coal, mostly bright attritus	0	2.5
		(152	10.5)
19b.	Pyrite, nodular	0	2.5
		(153	1)
19c.	Coal, thin to thick vitrain bands, bright attrital matrix	0	7
		(153	8)
20.	Underclay, medium-gray, silty, abundant rootlets; base grades	0	2
		(153	10)
21.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 60 percent quartz, abundant dark and light mineral grains, abundant rootlets; base sharp	3	8
		(157	6)
22.	Shale, medium-gray, silty, micaceous, evenly bedded; base sharp	0	1
		(157	7)
23.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, 15 percent weathered white feldspar, scattered dark mineral grains, massive; base grades	2	5
		(160	0)
24.	Shale, medium-gray, silty, contains 30 percent light-gray very fine grained sandstone beds up to 1.5 in. thick, evenly bedded, fissile; base grades	1	5
		(161	5)
25.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, scattered feldspar and dark mineral grains, 5 percent discontinuous medium-gray siltstone laminae, thin-bedded to massive; base grades	11	1
		(172	6)

Unit Number	Description	Thickness (Depth) ft	in.
26.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, abundant dark and light mineral grains, thick-bedded to massive; base sharp.....	27	7
		(200	1)
27.	Shale, dark-gray to black, carbonaceous, contains 5 percent light-gray very fine grained sandstone laminae, scattered siderite nodules and beds up to 2 in. thick, slightly burrowed, evenly bedded; base grades.....	18	1
		(218	2)
28.	Shale, medium-dark- to dark-gray, carbonaceous, contains 5 percent light-gray very fine grained sandstone laminae, scattered siderite beds up to 0.5 in. thick, few plant fragments, few slickensided surfaces, evenly bedded.....	22	2
		(240	4)
29.	Coal, Jawbone coal bed (thickness - 2 ft 10 in.)		
	29a. Coal, impure.....	0	4
		(240	8)
	29b. Coal, dull to bright attritus, 0.125 in. pyrite lense 1 in. above base.....	0	11
		(241	7)
	29c. Coal, thin to thick vitrain bands, bright attrital matrix...	1	7
		(243	2)
30.	Underclay, medium- to medium-dark-gray, plastic, carbonaceous, abundant rootlets.....	1	0
		(244	2)
31.	Siltstone, medium-gray, scattered rootlets; base grades.....	1	6
		(245	8)
32.	Sandstone, medium-light-gray, very fine grained, contains 50 percent quartz, few rootlets, thick-bedded to massive; base grades.....	3	8
		(249	4)
33.	Sandstone, light- to medium-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, scattered coal clasts, thick-bedded to massive; base sharp.....	24	4
		(273	8)
34.	Sandstone, light-gray, mottled brownish-gray, contains 50 percent quartz, few coal clasts, ripple-bedded; base grades.....	1	0
		(274	8)

Unit Number	Description	Thickness (Depth) ft	in.
35.	Sandstone, medium-light-gray, medium-grained, contains 50 percent quartz, abundant quartz granules, abundant medium-dark-gray shale clasts and coal clasts in basal 8 in., contorted bedding; base sharp.....	1	6
		(276	2)
36.	Sandstone, light-gray, coarse-grained, micaceous, contains 65 percent quartz, abundant well rounded white quartz pebbles and granules up to 0.25 in. in diameter, scattered dark mineral grains, few coalified plant fragments; base sharp and uneven.....	18	5
		(294	7)
37.	Shale, medium-gray to black, carbonaceous, contains few siderite beds, few slickensided surfaces, evenly bedded.....	0	6
		(295	1)
38.	Sandstone, light-gray, coarse-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, massive, base sharp.....	9	8
		(304	9)
39.	Coal, mostly bright attritus, pyritic.....	0	2
		(304	11)
40.	Sandstone, light- to medium-gray, medium- to coarse-grained, contains 60 percent quartz, scattered medium-gray shale beds and clasts, scattered coal clasts in basal 1 ft, thin-bedded; base sharp.....	3	8
		(308	7)
41.	Shale, dark-gray to black, carbonaceous, contains few siderite nodules, evenly bedded, fissile; base grades.....	17	3
		(325	10)
42.	Shale, medium-dark-gray, contains 40 percent light-gray very fine grained sandstone laminae and beds, cross-laminated, evenly bedded; base sharp and uneven.....	12	11
		(338	9)
43.	Sandstone, medium-light-gray, fine-grained, silty, contains 40 percent quartz, 10 percent dark-gray shale laminae, thin- to thick-bedded; base sharp.....	7	4
		(346	1)
44.	Shale, dark-gray, carbonaceous, contains 50 percent light-gray siltstone and very fine grained sandstone laminae and beds, scattered siderite nodules up to 1 in. in diameter, evenly bedded; base grades.....	42	0
		(388	1)

Unit Number	Description	Thickness (Depth) ft	in.
45.	Shale, dark-gray, carbonaceous, contains 10 percent light-gray siltstone and very fine grained sandstone laminae and beds, scattered rootlets in top 15 ft, few slickensided surfaces in basal 1 ft, evenly bedded; base sharp	68	4
		(456	5)
46.	Coal, Upper split of Lee coal bed, dull to bright attritus, few scattered vitrain bands, pyritic	0	7
		(457	0)
47.	Underclay, dark-gray, carbonaceous, abundant rootlets, few root slicks	0	2
		(457	2)
48.	Shale, dark-gray to black, very carbonaceous	0	11
		(458	1)
49.	Coal, Lower split of Lee coal bed, impure, dull attritus, pyritic	0	7
		(458	8)
50.	Underclay, dark-gray, carbonaceous, few rootlets	0	1
		(458	9)
	Lee Formation Middlesboro Member		
51.	Sandstone, medium-light-gray, very fine grained, contains 45 percent quartz, scattered rootlets; base sharp and uneven	2	4
		(461	1)
52.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, few dark-gray shale laminae, scattered well rounded white quartz pebbles in basal 8 ft, massive; base grades	80	5
		(541	6)
53.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, abundant coal clasts up to 0.5 in. in diameter in top 4 in., scattered stylolites in basal 1 ft, massive; base sharp	5	9.5
		(547	3.5)
54.	Conglomerate, very light gray, contains abundant well rounded white quartz pebbles up to 0.5 in. in diameter and medium-dark-gray shale clasts, medium- to coarse-grained quartzose sandstone matrix, thick-bedded; base grades	0	2.5
		(547	6)

Unit Number	Description	Thickness (Depth) ft	in.
55.	Sandstone, light-gray, medium-grained, contains 90 percent quartz, few well rounded white quartz pebbles in basal 11 in.; base sharp.....	1	7
		(549	1)
56.	Shale, medium-dark-gray, contains 30 percent light-gray very fine grained sandstone laminae, cross-laminated, evenly bedded, fair fissility; base grades.....	3	10
		(552	11)
57.	Shale, dark-gray, few pyritic siderite nodules 1 in. below top, evenly bedded, fissile.....	0	4
		(553	3)
58.	Coal, Castle (?) coal bed (thickness - 2 ft 1 in.)		
58a.	Coal, mostly bright attritus, few discontinuous pyrite laminae 1 in. below top.....	0	10
		(554	1)
58b.	Coal, impure, contains abundant dark-gray carbonaceous shale laminae.....	0	9
		(554	10)
58c.	Coal, thin to thick vitrain bands, dull to bright attrital matrix, few pyrite laminae in basal 1 in.	0	6
		(555	4)
59.	Underclay, medium-dark-gray, slightly carbonaceous, contains few coal laminae from 1 ft 10 in. to 4 ft 3 in. below top, abundant rootlets; base sharp.....	4	7
		(559	11)
60.	Coal, thick vitrain bands, bright attrital matrix, contains 0.25 in. dark-gray shale bed.....	0	1.5
		(560	0.5)
61.	Underclay, medium-dark-gray, contains few coal laminae 2 in. below top, abundant rootlets; base sharp.....	0	4.5
		(560	5)
62.	Coal, mostly thick vitrain bands.....	0	0.5
		(560	5.5)
63.	Underclay, medium-dark-gray, abundant rootlets; base grades.....	0	10.5
		(561	4)
64.	Shale, medium-dark-gray, contains few coal laminae in basal 1 in., few plant fragments including Calamites 2 ft 11 in. below top, evenly bedded, fissile.....	4	7
		(565	11)

Unit Number	Description	Thickness (Depth) ft	in.
65.	Shale, black, carbonaceous, contains few coal laminae.....	0	1
		(566	0)
66.	Underclay, medium-dark-gray, contains 0.5 in. light-gray very fine grained sandstone bed at top, few rootlets; base grades.....	0	10
		(566	10)
67.	Shale, medium-dark-gray, slightly silty, very silty in basal 7 in., poor fissility; base sharp.....	3	3
		(570	1)
68.	Sandstone, medium-light-gray, very fine grained, sparsely micaceous, contains 60 percent quartz; base sharp.....	1	3
		(571	4)
69.	Siltstone, medium-gray, very finely micaceous, thin-bedded, fair fissility; base grades.....	1	10
		(573	2)
70.	Shale, medium-gray, very silty in top 5 in., evenly bedded, fissile; base sharp.....	0	7
		(573	9)
71.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, very silty in top 5 in., contains 60 percent quartz, abundant feldspar and dark mineral grains, thin-bedded; base grades.....	2	11
		(576	8)
72.	Sandstone, light- to medium-light-gray, medium-grained, micaceous, contains 60 percent quartz, 5 percent medium-gray micaceous siltstone laminae, abundant feldspar and dark mineral grains, thin-bedded; base sharp.....	14	4
		(591	0)
73.	Shale, medium-dark-gray, evenly bedded, fissile; base grades.....	0	4
		(591	4)
74.	Sandstone, light- to medium-light-gray, medium-grained, contains 65 percent quartz, 20 percent medium-gray siltstone laminae in top 1 ft, scattered dark mineral grains, 0.5 in. medium-dark-gray shale clast at base, thin- to thick-bedded; base sharp.....	2	0
		(593	4)
75.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark mineral grains, abundant contorted coal and medium-dark-gray shale clasts in basal 9 in., thick-bedded; base sharp.....	1	8
		(595	0)

Unit Number	Description	Thickness (Depth) ft	in.
76.	Coal, vitrain	0	1
		(595	1)
77.	Sandstone, light-gray, medium-grained, micaceous, contains 60 percent quartz, 10 percent feldspar, 0.5 in. dark-gray shale clast 3 in. below top, thick-bedded to massive; base grades	2	2
		(597	3)
78.	Sandstone, very light to light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark mineral grains, massive; base grades	15	11
		(613	2)
79.	Sandstone, light-gray, medium- to very coarse grained, contains 65 percent quartz, 15 percent feldspar, scattered dark mineral grains, few coal clasts, massive; base grades	6	8
		(619	10)
80.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, scattered feldspar and dark mineral grains, abundant small medium-dark-gray shale clasts from 1 ft to 3 ft below top and at 5 ft 6 in. below top, massive; base grades	6	11
		(626	9)
81.	Sandstone, very light to light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, abundant feldspar and dark mineral grains, abundant dark-gray shale clasts up to 1 in. in diameter, thick-bedded; base sharp	2	6
		(629	3)
82.	Sandstone, very light to light-gray, medium-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles up to 0.5 in. in diameter in basal 3 ft, few coal clasts 3 in. above base, few scattered dark mineral grains, massive; base sharp	13	11
		(643	2)
83.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles up to 1 in. in diameter and coal clasts in basal 1 ft 2 in., few large coal clasts 1 ft 8 in. and 2 ft 3 in. below top, well sorted, massive; base grades	3	6
		(646	8)
84.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz; scattered well rounded white quartz pebbles, coal, and medium-dark-gray shale clasts; thick-bedded; base sharp	1	9
		(648	5)

Unit Number	Description	Thickness (Depth) ft	in.
85.	Coal, vitrain.....	0	3
		(648	8)
86.	Sandstone, white to very light gray, medium-grained, micaceous, contains 90 percent quartz; abundant siderite, coal, and medium-dark-gray shale clasts; base sharp and uneven.....	0	3
		(648	11)
87.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, massive; base grades.....	3	11
		(652	10)
88.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, scattered feldspar and dark mineral grains, abundant coal clasts from 4 ft 5 in. to 5 ft below top, abundant coal and medium-dark-gray shale clasts in basal 9 in., thick-bedded to massive; base sharp.....	12	3
		(665	1)
89.	Shale, medium-dark-gray, very silty, finely micaceous, contains 40 percent light-gray very fine grained sandstone laminae, burrowed, evenly bedded, fissile; base sharp.....	2	11
		(668	0)
90.	Shale, black, carbonaceous, contains 25 percent coal laminae, evenly bedded.....	0	3
		(668	3)
91.	Coal, Sewell (?) coal bed (thickness - 1 ft 9.75 in.)		
	91a. Coal, impure, contains scattered dark-gray shale laminae....	0	2.5
		(668	5.5)
	91b. Coal, mostly bright attritus, few vitrain bands in top 3 in., pyritic in basal 1 in.	1	7.25
		(670	0.75)
92.	Underclay, medium-dark-gray, very silty in basal 8 in., carbonaceous in top 1 in., abundant rootlets; base grades abruptly.....	5	2.25
		(675	3)
93.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, scattered feldspar and dark mineral grains, thick-bedded to massive; base grades.....	3	3
		(678	6)
94.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, abundant dark mineral grains, few coal laminae 2 ft 1 in. below top, abundant coal and medium-dark-gray shale clasts in basal 2 ft, massive; base sharp.....	19	8
		(698	2)

Unit Number	Description	Thickness (Depth) ft	in.
95.	Sandstone, light-gray, fine-grained, micaceous, contains 60 percent quartz, scattered dark and light mineral grains, 10 percent coal and medium-gray siltstone laminae, thin- to thick-bedded; base grades.....	16	10
		(715	0)
96.	Sandstone, medium-light-gray, fine- to medium-grained, very micaceous, contains 60 percent quartz, few dark-gray carbonaceous shale laminae, massive; base sharp.....	2	10
		(717	10)
97.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, scattered dark and light mineral grains, abundant dark-gray shale laminae and clasts in basal 1 ft 9 in., thick-bedded; base sharp.....	9	5
		(727	3)
98.	Shale, medium-dark- to dark-gray, very silty, contains 40 percent light-gray very fine grained silty sandstone beds up to 1 in. thick, evenly bedded; base sharp and uneven.....	0	7
		(727	10)
99.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, scattered dark and light mineral grains, scattered medium-dark-gray shale laminae and clasts, thin- to thick-bedded; base sharp.....	6	3
		(734	1)
100.	Shale, medium-dark-gray, slightly silty, very silty in basal 4 in., evenly bedded; base sharp.....	2	5
		(736	6)
101.	Sandstone, medium-light-gray, medium- to coarse-grained, very micaceous, contains 55 percent quartz, abundant dark and light mineral grains, scattered coal and dark-gray carbonaceous shale laminae, abundant medium-dark-gray shale laminae and clasts in basal 9 in.; base grades.....	13	2
		(749	8)
102.	Sandstone, white to very light gray, fine- to medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles, coal and dark-gray shale clasts, conglomeratic with abundant well rounded white quartz pebbles from 22 ft 2 in. to 22 ft 1 in. below top, massive.....	60	11
		(810	7)

BOTTOM OF HOLE
TOTAL DEPTH 810 ft 7 in.

GEOPHYSICAL LOG

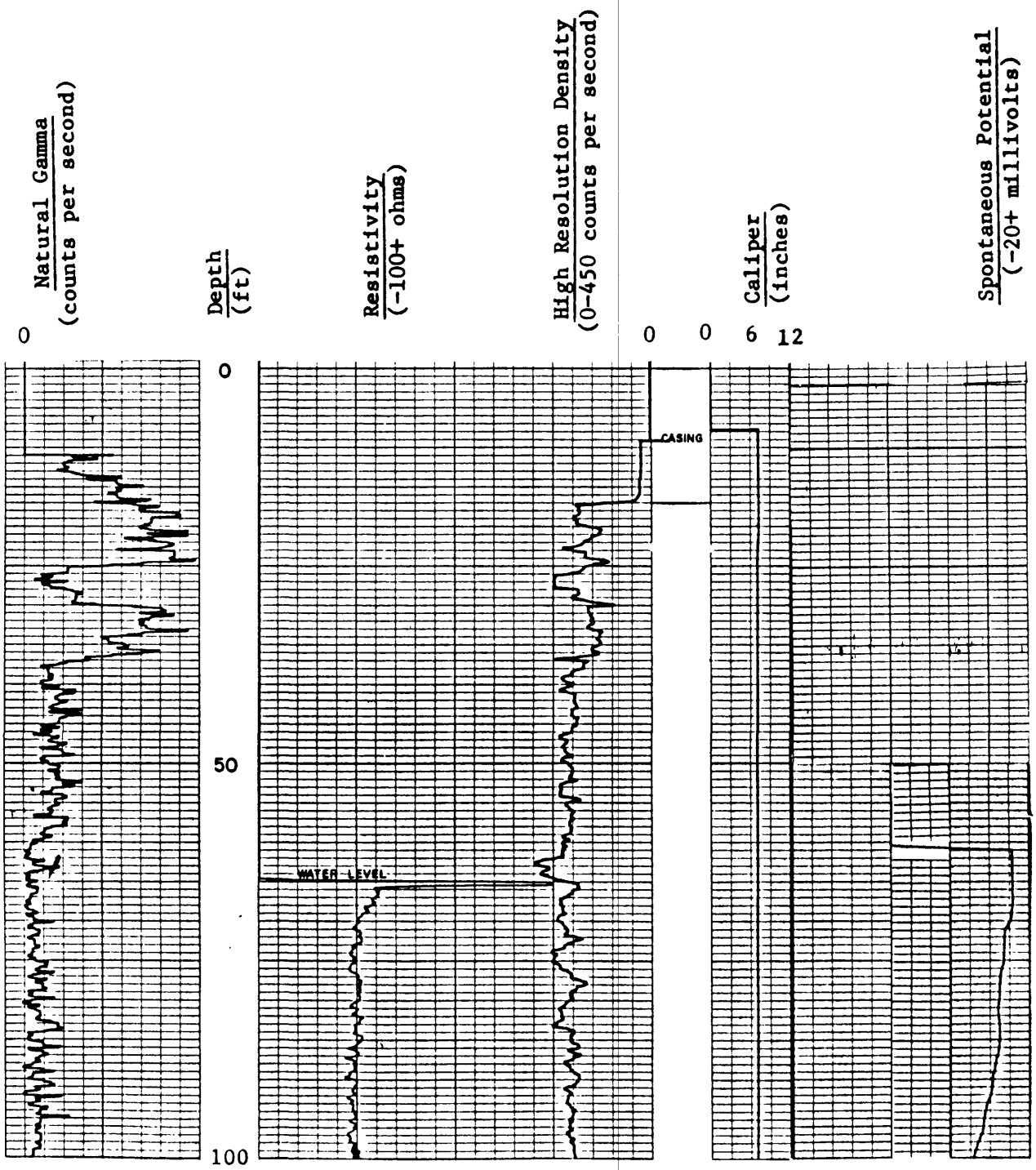
Corehole: SW-4 Date: 12/08/82 State: Virginia County: Dickenson

Quadrangle: Jenkins East, Va.-Ky. Latitude: 37°11'15"N Longitude: 82°32'41"W

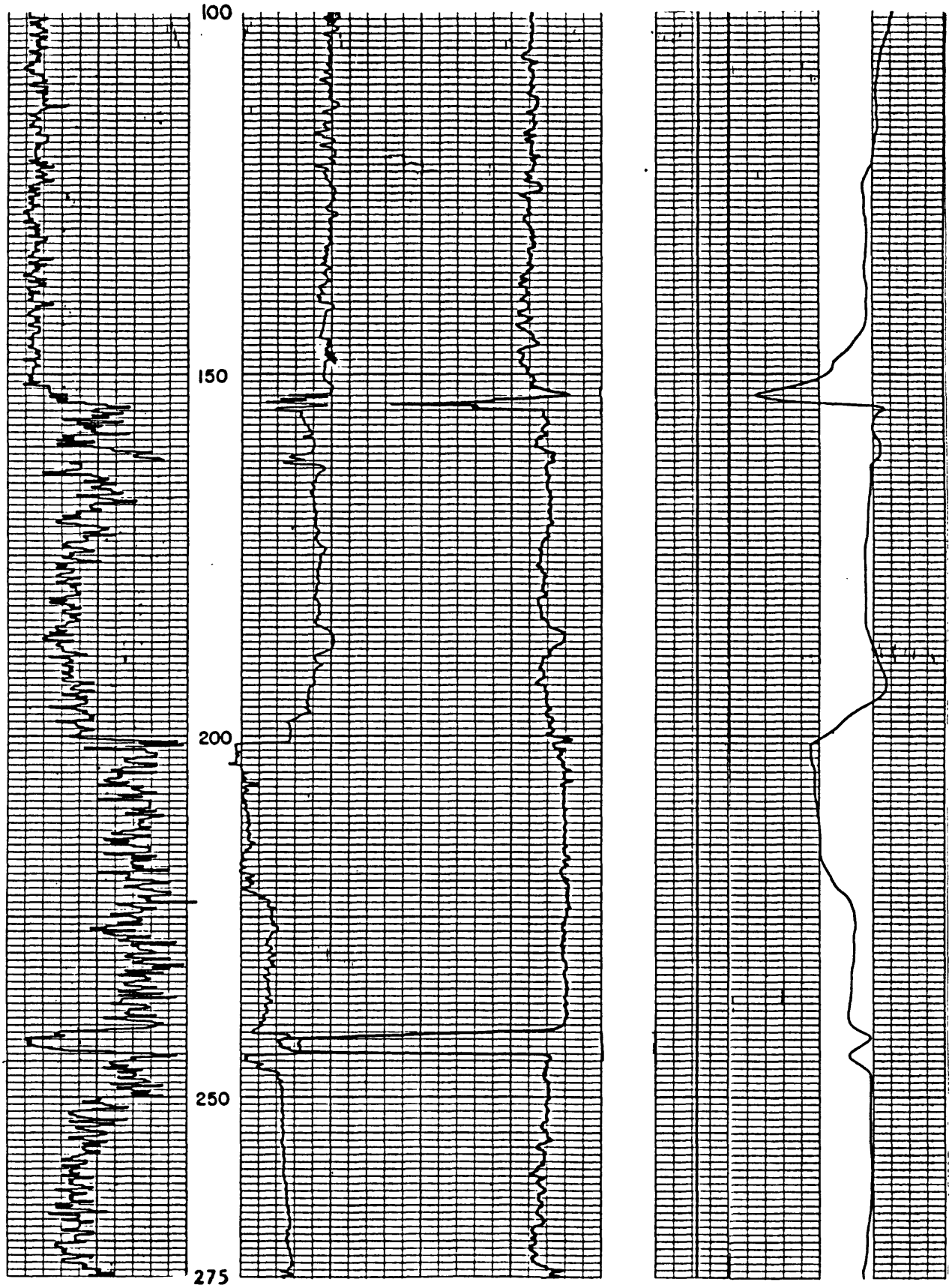
Altitude: 2,055 ft Logged Depth: 809 ft Drilled Depth: 810 ft 7 in.

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

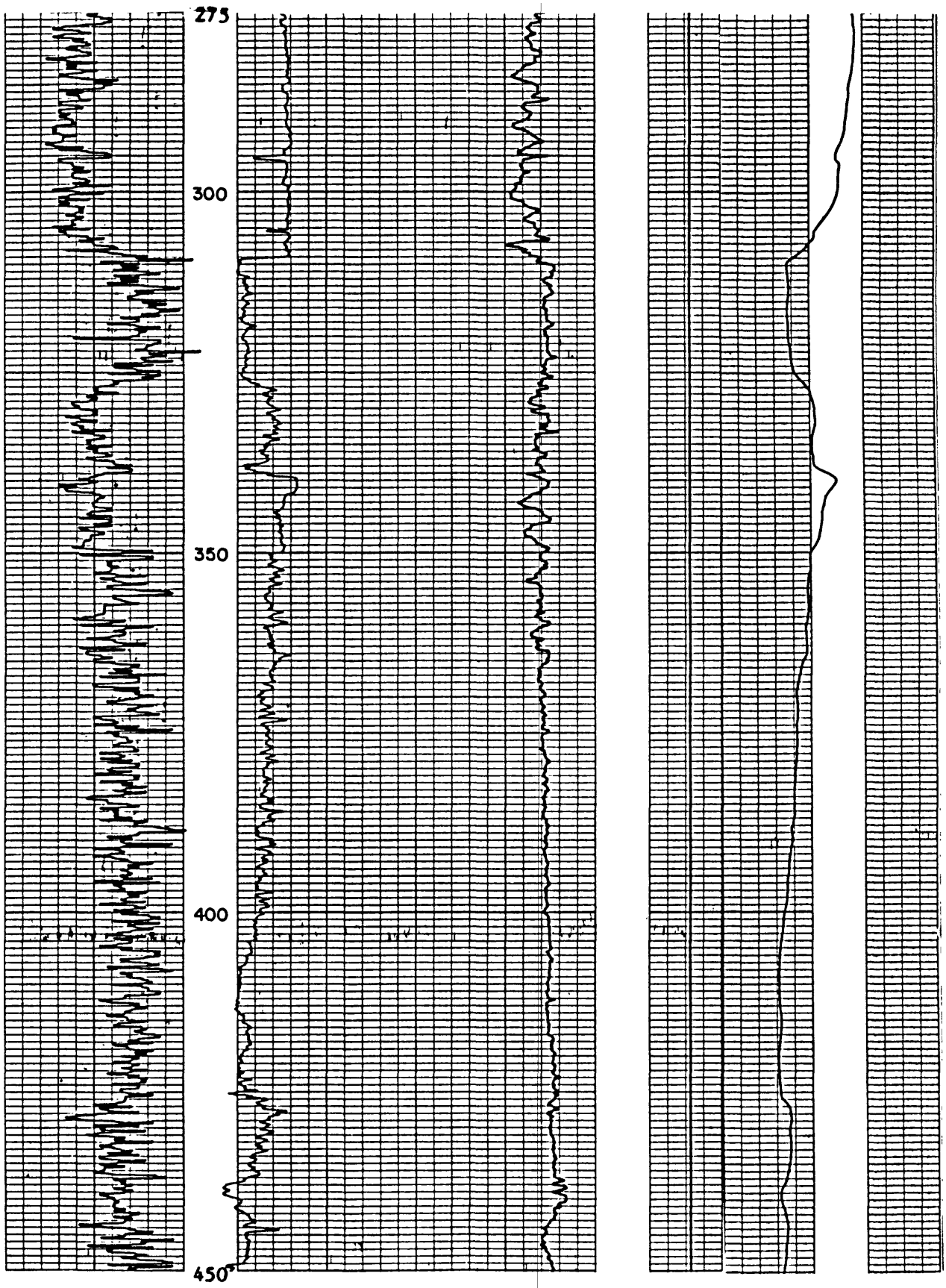
High Resolution Density Time Constant: 1



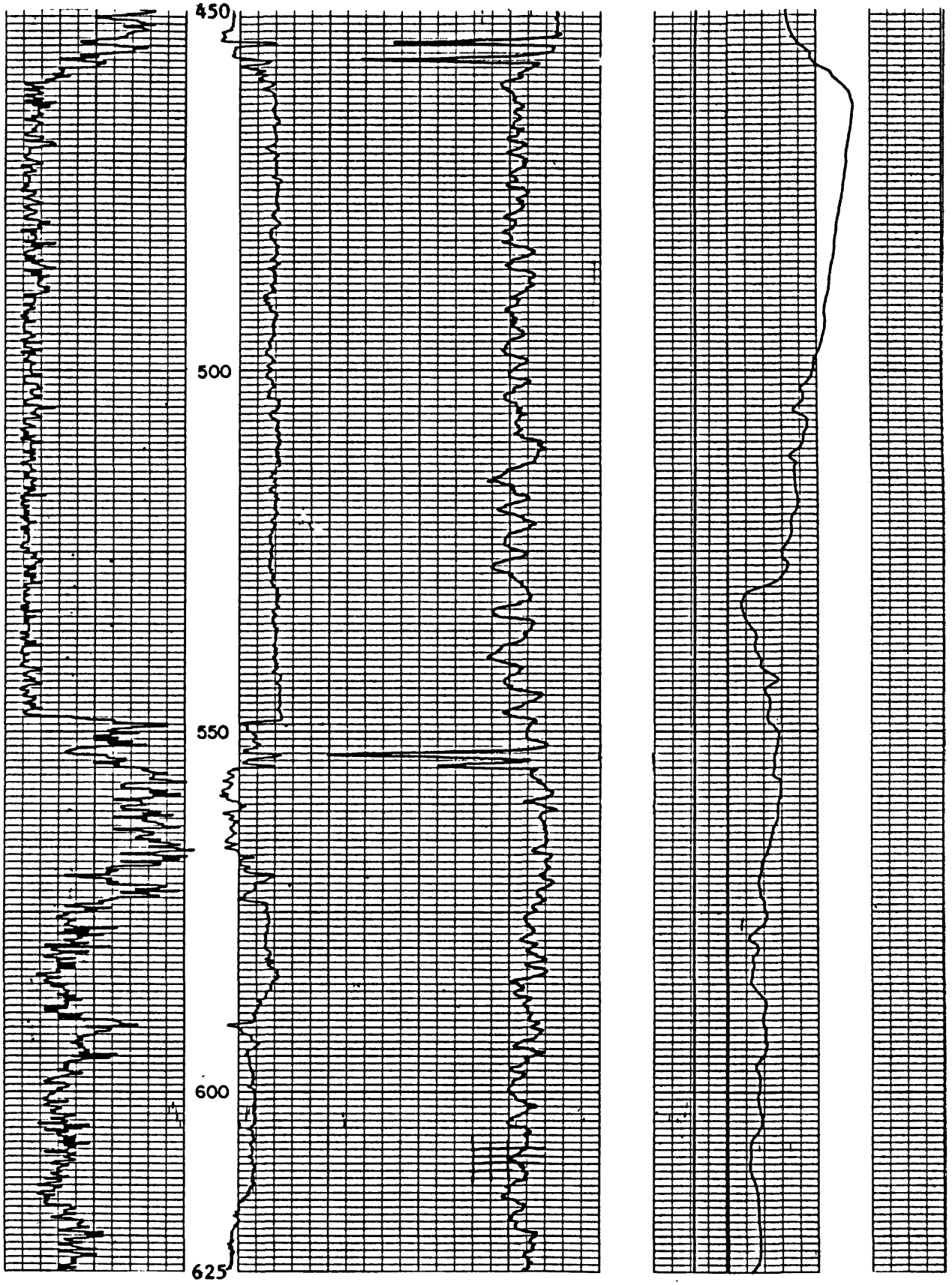
Corehole: SW-4 continued



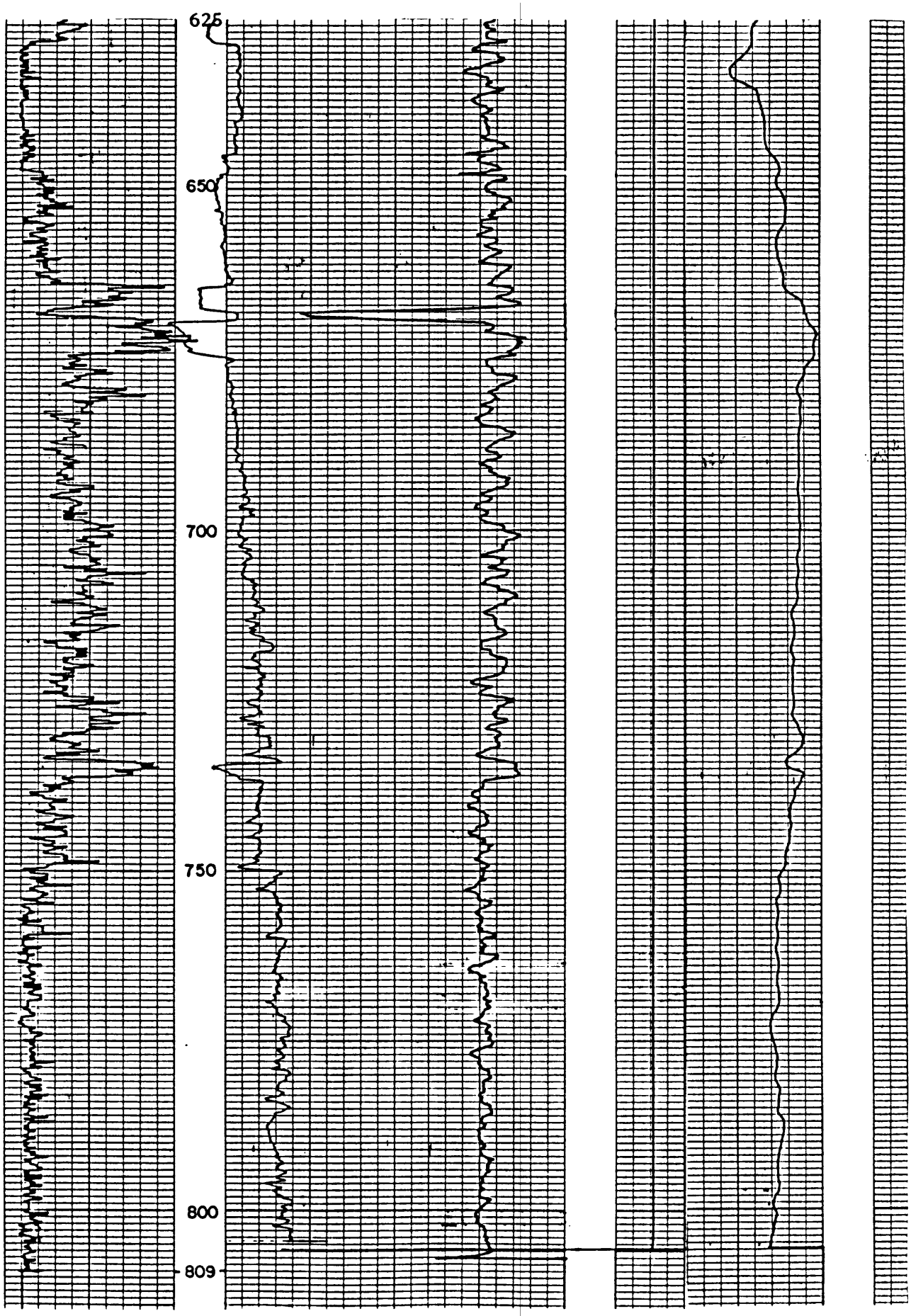
Corehole: SW-4 continued



Corehole: SW-4 continued

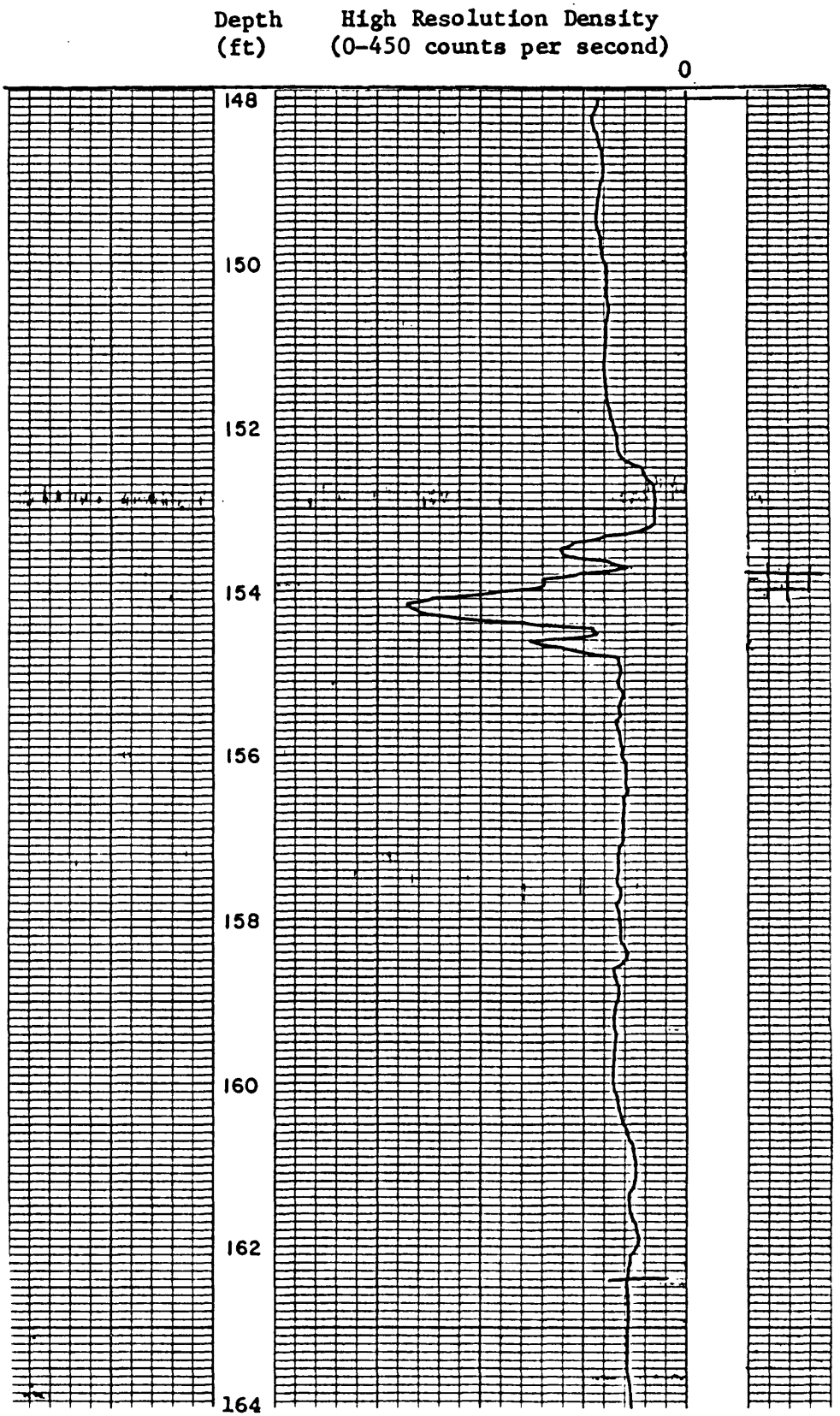


Corehole: SW-4 continued

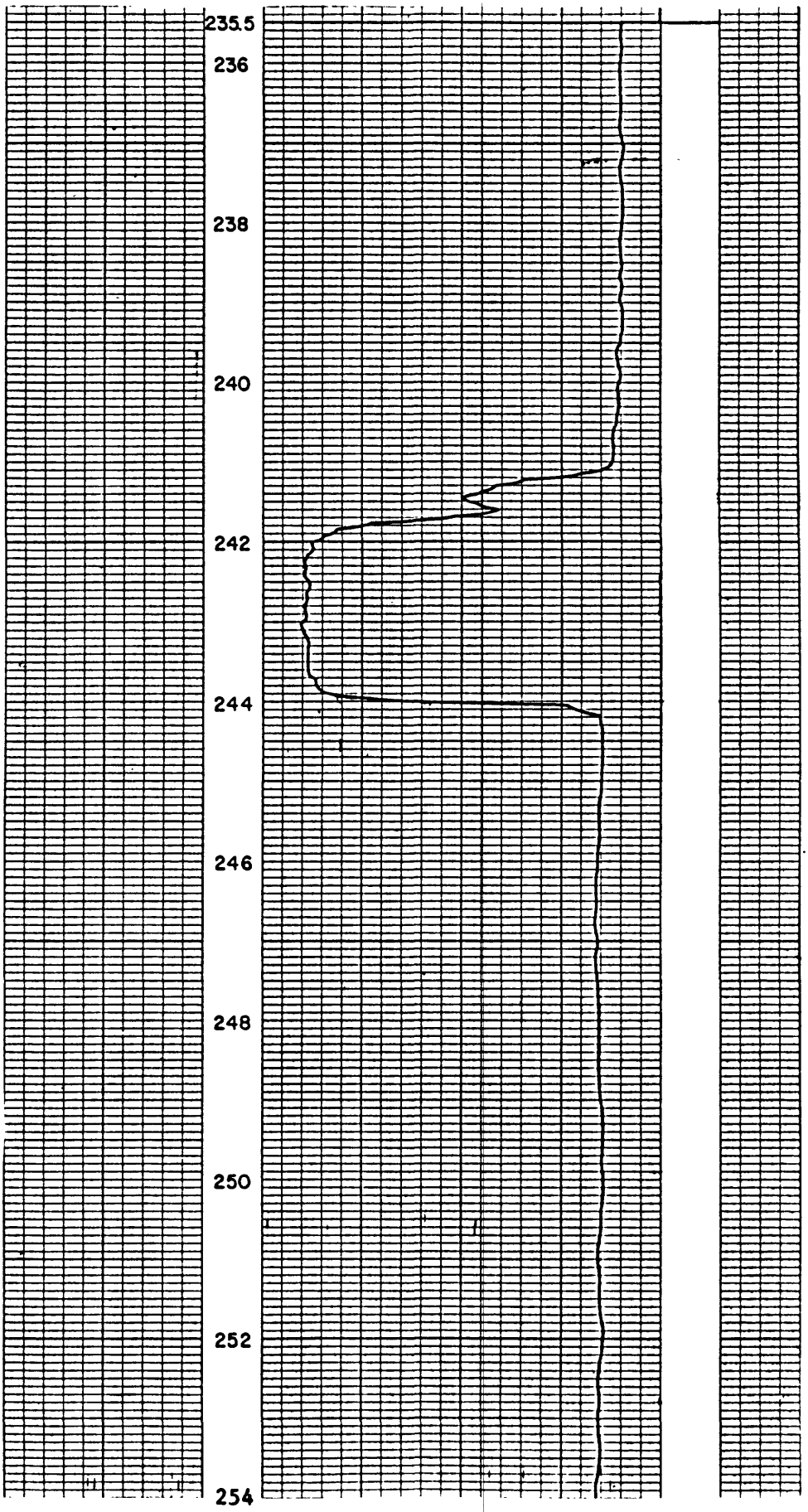


DETAIL LOG

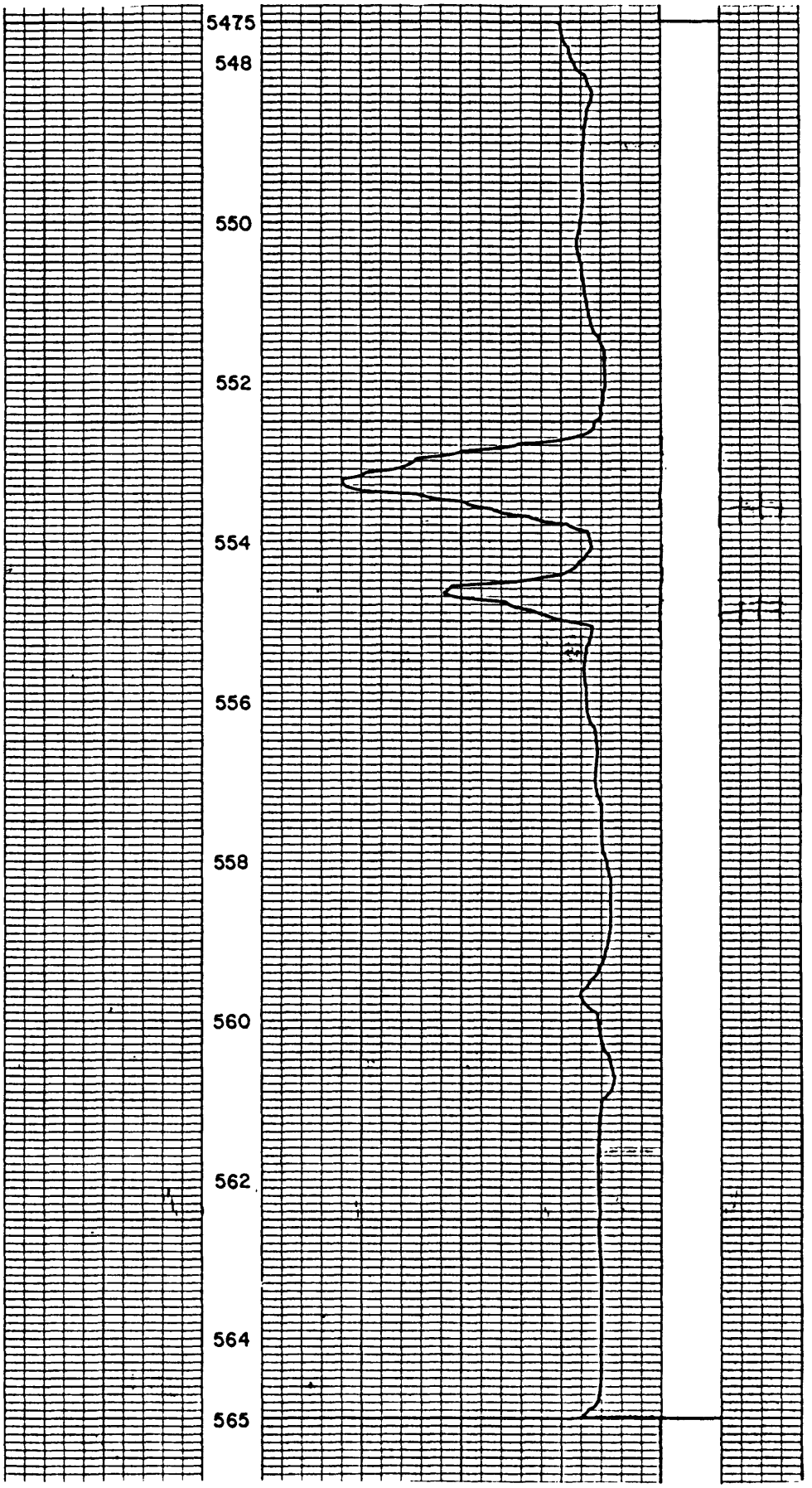
Corehole: SW-4 Logging Speed: 5 ft/min Time Constant: 1



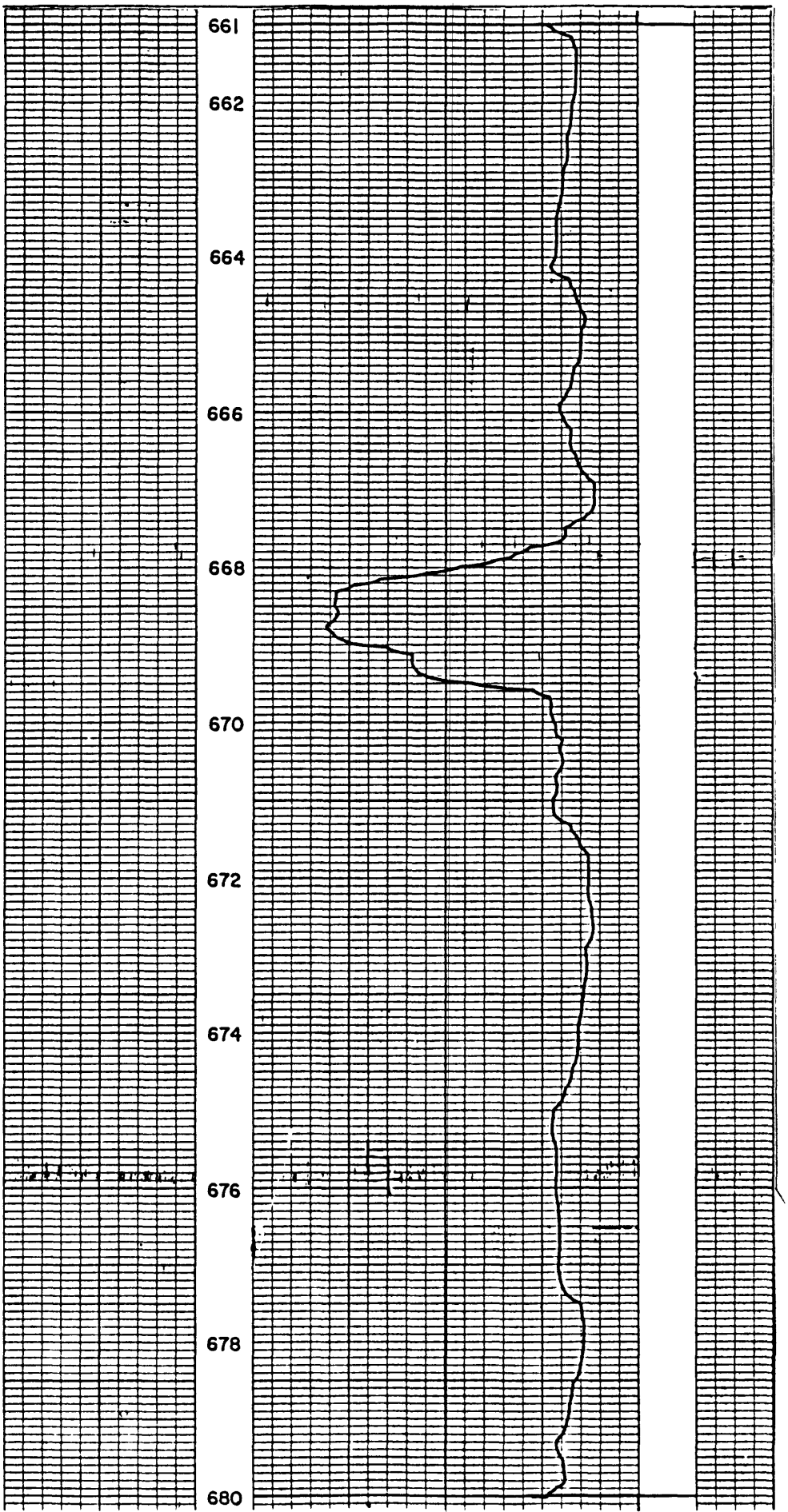
Corehole: SW-4 continued



Corehole: SW-4 continued



Corehole: SW-4 continued



Corehole SW-4A

Location: Wise County; Jenkins East, Va.-Ky., 7.5 minute quadrangle; at head of Mud Branch 1 mi northeast of Almira, Va. Accessible by State Route 630 extending northeastward from U.S. 23 at Almira.

Coordinates: Latitude 37°09'03"N Longitude 82°36'27"W

Altitude: 1,760 ft Drilled depth: 1,339 ft

Dip of Strata: Ranges from 3° to 15° and is mostly 5° to 10°.

Date drilled: December 13, 1982 to January 20, 1983

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

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER PENNSYLVANIAN SERIES		
	Lee Formation Naese Sandstone Member		
1.	Soil and weathered rock (casing set - no core recovered).....	25	0
		(25	0)
2.	Sandstone, white to very light gray, fine-grained, contains 90 percent quartz, few medium-gray micaceous siltstone laminae, 0.5 in. thick coal clast 9 in. above base, few stylolites, crossbedded, thick-bedded to massive; base grades.....	11	5
		(36	5)
3.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles up to 0.5 in. in diameter, 0.5 in. thick coal clasts at 11 in. and 18 ft 10 in. below top, few scattered dark mineral grains, crossbedded, massive; base grades.....	46	4
		(82	9)
4.	Sandstone, white to very light gray to white, coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles mostly from 0.25 to 0.5 in. in diameter, abundant well rounded siderite clasts in basal 1 ft; base sharp.....	6	6
		(89	3)
	Lee Formation Hensley Member		
5.	Sandstone, light gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 10 percent white-weathered feldspar, 1 in. coal clast 3 ft 6 in. below top, few coal laminae from 7 in. to 9 in. below top, thick-bedded to massive; base sharp.....	4	6
		(93	9)

Unit Number	Description	Thickness (Depth) ft	in.
6.	Coal, Jawbone rider coal bed (thickness - 1 ft 4 in.)		
	6a. Coal, mostly bright attritus.....	0	2
		(93	11)
	6b. Sandstone, light gray, lenticular.....	0	0.5
		(93	11.5)
	6c. Coal, dull to bright attritus, thick vitrain bands.....	0	5.5
		(94	5)
	6d. Coal, abundant vitrain bands, bright attrital matrix.....	0	8
		(95	1)
7.	Underclay, medium-gray, abundant rootlets; base grades.....	1	9
		(96	10)
8.	Siltstone, medium-gray, finely micaceous, sandy at base, abundant rootlets in top 1 ft 2 in., faintly bedded; base grades abruptly.....	2	6
		(99	4)
9.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, scattered dark and light mineral grains, thick-bedded; base grades.....	3	4
		(102	8)
10.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, abundant coal laminae at 10 ft and 14 ft below top; base grades.....	15	1
		(117	9)
11.	Sandstone, light-gray, medium- to coarse-grained, micaceous contains 65 percent quartz, 10 percent feldspar, scattered dark mineral grains, few coal laminae in basal 4 in., massive; base grades abruptly.....	20	9
		(138	6)
12.	Sandstone, light-gray, medium-grained, micaceous, contains 60 percent quartz, 5 percent medium-gray siltstone laminae, scattered dark and light mineral grains, thin- to thick-bedded; base grades abruptly.....	1	6
		(140	0)
13.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, massive; base sharp.....	3	9
		(143	9)
14.	Shale, medium-dark-gray, contains scattered siderite beds up to 1 in. thick, abundant siderite beds and nodules in basal 5 ft, evenly bedded, fissile.....	30	4
		(174	1)

Unit Number	Description	Thickness (Depth) ft	in.
15.	Shale, medium-gray, contains abundant plant stems and pinnules, faintly bedded, fair fissility.....	1	11
		(176	0)
16.	Coal, dull to bright attritus.....	0	6
		(176	6)
17.	Underclay, medium-gray, abundant rootlets; base grades.....	1	1
		(177	7)
18.	Siltstone, medium-gray, micaceous, contains 10 percent light-gray very fine grained sandstone laminae, thin-bedded, poor fissility; base grades.....	1	8
		(179	3)
19.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent discontinuous medium-gray siltstone laminae, cross-laminated, thin-bedded.....	7	4
		(186	7)
20.	Shale, medium-dark-gray, silty, evenly bedded; base sharp.....	2	0
		(188	7)
21.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, abundant dark and light mineral grains, crossbedded, thick-bedded; base sharp and uneven.....	2	5
		(191	0)
22.	Siltstone, medium-gray, contains 30 percent dark-gray shale laminae, thin-bedded; base grades.....	1	4
		(192	4)
23.	Shale, medium-gray, contains abundant siderite beds up to 1 in. thick, evenly bedded, fissile; base grades.....	1	9
		(194	1)
24.	Shale, black, carbonaceous, evenly bedded, fissile.....	0	5
		(194	6)
25.	Coal, Jawbone coal bed, thin to thick vitrain bands, dull to bright attrital matrix	2	3
		(196	9)
26.	Underclay, medium-gray, mottled brownish-gray, carbonaceous in top 4 in., abundant rootlets; base grades.....	1	6
		(198	3)
27.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, abundant rootlets in top 1 ft 6 in., massive; base grades abruptly.....	4	3
		(202	6)

Unit Number	Description	Thickness (Depth) ft	in.
28.	Sandstone, light- to medium-light-gray, medium-grained, micaceous, contains 55 percent quartz, abundant dark and light mineral grains, crossbedded, massive.....	6	11
		(209	5)
29.	Sandstone, light-gray, medium- to coarse-grained, very micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark mineral grains, massive; base sharp.....	2	6
		(211	11)
30.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, abundant dark and light mineral grains; base grades abruptly.....	2	3
		(214	2)
31.	Sandstone, light- to medium-light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 15 percent feldspar, scattered dark mineral grains; base sharp and uneven.....	9	0
		(223	2)
32.	Sandstone, light-gray, coarse-grained, very micaceous, contains 65 percent quartz, scattered feldspar and dark mineral grains, crossbedded; base sharp.....	7	8
		(230	10)
33.	Sandstone, light- to medium-light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, scattered feldspar and dark mineral grains, normally graded; base grades abruptly.....	3	3
		(234	1)
34.	Sandstone, light-gray, coarse-grained, very micaceous, contains 65 percent quartz, petroliferous from 4 ft 8 in. to 5 ft 6 in. below top; scattered feldspar, dark, and green mineral grains; few siderite grains in top 2 ft, scattered dark-gray shale clasts from 4 ft 6 in. to 6 ft 2 in. below top; abundant quartz granules and coal and siderite clasts in basal 5 ft; base grades abruptly.....	18	2
		(252	3)
35.	Sandstone, light-gray, mottled brownish-gray from 4 ft to 6 ft 3 in. below top, medium- to coarse-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, abundant quartz granules and few coal clasts in basal 9 in; base sharp and undulatory.....	8	3
		(260	6)
36.	Shale, medium- to medium-dark-gray, carbonaceous, contains 5 percent light-gray siltstone laminae, evenly bedded, fissile; base grades.....	30	0
		(290	6)

Unit Number	Description	Thickness (Depth) ft	in.
37.	Shale, medium-dark-gray, carbonaceous, evenly bedded, fissile; base grades	34	0
		(324	6)
38.	Shale, medium-dark- to dark-gray, carbonaceous, contains few scattered siderite beds up to 1 in. thick, evenly bedded, fissile; base grades	15	0
		(339	6)
39.	Shale, medium-dark-gray, contains 10 percent light-gray, very fine grained silty sandstone laminae, slightly burrowed, evenly bedded, fissile; base grades	3	7
		(343	1)
40.	Shale, medium-dark-gray, carbonaceous, contains scattered siderite beds up to 1 in. thick, few plant fragments, evenly bedded; base grades	11	6
		(354	7)
41.	Siltstone, medium- to medium-dark-gray, contains 20 percent light-gray very fine grained sandstone laminae, 20 percent dark-gray shale laminae, bioturbated, thin and evenly bedded; base grades	2	3
		(356	10)
42.	Shale, medium-dark-gray, contains few siderite beds up to 2 in. thick, evenly bedded, fissile; base grades	7	6
		(364	4)
43.	Shale, black, very carbonaceous, fissile; base grades	1	3
		(365	7)
44.	Sandstone, medium-gray, very fine-grained, silty, contains 40 percent quartz, few rootlets in top 3 in., thin-bedded; base grades	2	1
		(367	8)
45.	Shale, medium-dark-gray, few plant fragments, evenly bedded, poor fissility	1	1
		(368	9)
46.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 20 percent medium-dark-gray silty shale laminae, few siderite beds up to 0.5 in. thick, cross-laminated	4	5
		(373	2)
47.	Shale, medium-dark-gray, evenly bedded, fissile	0	9
		(373	11)
48.	Shale, black, carbonaceous, contains few coal laminae	0	3
		(374	2)

Unit Number	Description	Thickness (Depth) ft	in.
49.	Coal, thin vitrain bands, dull attrital matrix	0	2
		(374	4)
50.	Underclay, medium-dark-gray, silty, abundant rootlets; base grades abruptly	1	11
		(376	3)
51.	Sandstone, light- to medium-light-gray, very fine grained, silty, micaceous, contains 40 percent quartz, 30 percent medium-gray shale and siltstone laminae, burrowed, thin-bedded; base grades	1	8
		(377	11)
52.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded	0	7
		(378	6)
53.	Siltstone, medium- to medium-dark-gray, contains 20 percent light-gray very fine grained sandstone, 10 percent dark-gray shale laminae and beds, few siderite beds up to 0.5 in. thick in basal 4 in., thin-bedded; base grades abruptly	3	2
		(381	8)
54.	Shale, medium-dark-gray, contains 5 percent light- to medium-light-gray siltstone and very fine grained sandstone laminae, evenly bedded, fissile; base grades	5	11
		(387	7)
55.	Shale, medium-dark-gray, silty, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded	11	8
		(399	3)
56.	Coal, Lee coal bed (thickness - 11.5 in.)		
56a.	Coal, mostly bright attritus	0	5
		(399	8)
56b.	Pyrite	0	0.25
		(399	8.25)
56c.	Coal, mostly moderately dull attritus	0	1.75
		(399	10)
56d.	Coal, mostly bright attritus	0	3.5
		(400	1.5)
56e.	Coal, mostly dull attritus	0	1
		(400	2.5)

Unit Number	Description	Thickness (Depth) ft	in.
57.	Underclay, medium- to medium-dark-gray, abundant rootlets; base grades	1	3.5
		(401	6)
	Lee Formation Middlesboro Member		
58.	Sandstone, light- to medium-gray, very fine grained, silty, contains 40 percent quartz, 30 percent medium-gray siltstone laminae and beds, thin-bedded; base grades	1	6
		(403	0)
59.	Sandstone, light- to medium-light-gray, medium-grained, micaceous, petroliferous, contains 55 percent quartz, thin and lenticularly bedded; base sharp	11	7
		(414	7)
60.	Shale, medium-dark-gray, silty, micaceous, contains 15 percent medium-light-gray siltstone laminae, evenly bedded; base sharp	0	2
		(414	9)
61.	Sandstone, light- to medium-light-gray, medium-grained, micaceous, contains 60 percent quartz; scattered dark and light mineral grains; base sharp	0	8
		(415	5)
62.	Shale, medium-dark-gray, silty, evenly bedded	0	1
		(415	6)
63.	Sandstone, light- to medium-light-gray, medium-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains; base sharp	0	4
		(415	10)
64.	Shale, medium-dark-gray, silty, evenly bedded, fair fissility; base sharp	0	3
		(416	1)
65.	Sandstone, light- to medium-light-gray, mottled brownish-gray and petroliferous in part, medium-grained, contains 65 percent quartz; base grades	3	6
		(419	7)
66.	Sandstone, very light- to light-gray, medium-grained, contains 90 percent quartz, scattered dark mineral grains, few stylolites; base sharp	6	7
		(426	2)
67.	Shale, medium-dark-gray, contains 5 percent light-gray very fine grained sandstone laminae and beds up to 0.25 in. thick, evenly bedded; base sharp	0	3
		(426	5)

Unit Number	Description	Thickness (Depth) ft	in.
68.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 55 percent quartz, 5 percent black carbonaceous shale laminae and beds up to 1 in. thick; base sharp.....	1	3
		(427	8)
69.	Shale, medium-dark- to dark-gray, contains 10 percent light-gray very fine grained sandstone laminae in top 6 in., evenly bedded; base grades.....	1	4
		(429	0)
70.	Sandstone, light- to medium-light-gray, fine grained, micaceous, contains 60 percent quartz, scattered dark and light mineral grains; base sharp.....	1	6
		(430	6)
71.	Sandstone, medium-light-gray, very fine grained, silty, contains 10 percent dark gray shale laminae and beds, thin and evenly bedded; base sharp.....	0	3
		(430	9)
72.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz; few coal laminae 2 ft 4 in. above base, and 1 ft 4 in. below top; few dark-gray shale laminae from 8 in. to 10 in. above base, few scattered dark mineral grains, few stylolites; base grades..	8	5
		(439	2)
73.	Sandstone, light-gray, mottled brownish-gray and petroliferous in basal 3 ft, medium-grained, contains 90 percent quartz, few scattered dark mineral grains and well rounded white quartz pebbles, few coal clasts at base, crossbedded.....	7	11
		(447	1)
74.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, few well rounded white quartz pebbles up to 0.25 in. in diameter; base grades.....	2	3
		(449	4)
75.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, petroliferous in top 1 ft, few dark and green mineral grains, scattered well rounded white quartz pebbles up to 0.5 in. in diameter, few stylolites, few siderite clasts in basal 1 ft; base sharp.....	32	4
		(481	8)
76.	Sandstone, medium-light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, thin- to thick-bedded; base grades.....	2	2
		(483	10)

Unit Number	Description	Thickness (Depth) ft	in.
77.	Conglomerate, light-gray, contains abundant well rounded siderite clasts up to 2 in. in diameter and few medium-dark-gray shale clasts, medium-grained sandstone matrix (contains 65 percent quartz); base sharp.....	0	6
		(484	4)
78.	Shale, dark-gray to black, carbonaceous, contains scattered siderite beds from 5 ft below top to base, evenly bedded, fissile.....	11	7
		(495	11)
79.	Coal, thin to thick vitrain bands, bright attrital matrix.....	0	10
		(496	9)
80.	Underclay, medium-gray, mottled brownish-gray, slightly carbonaceous, slightly sandy in basal 2 in., abundant rootlets; base grades.....	1	4
		(498	1)
81.	Sandstone, medium-gray, fine-grained, micaceous, slightly silty in top 10 in., contains 60 percent quartz, scattered dark mineral grains, thick-bedded; base grades.....	14	5
		(512	6)
82.	Sandstone, medium-light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark mineral grains, massive; base sharp.....	7	2
		(519	8)
83.	Shale, dark-gray to black, carbonaceous in top 3 in. and in basal 9 in., evenly bedded, fissile; base sharp.....	4	9
		(524	5)
84.	Sandstone, light-gray, very fine grained, contains 60 percent quartz, 40 percent dark-gray silty shale laminae, thin-bedded; base grades.....	0	3
		(524	8)
85.	Shale, medium- to medium-dark-gray, slightly carbonaceous, contains scattered siderite beds up to 1 in. thick; base grades.....	2	10
		(527	6)
86.	Shale, black, very carbonaceous, contains scattered coal laminae in top 0.5 in. and from 4 to 5 in. below top, few plant fragments; base grades.....	1	2
		(528	8)
87.	Shale, medium-gray, evenly bedded, fair fissility.....	9	5
		(538	1)
88.	Underclay, medium-gray, scattered root slicks; base sharp.....	1	11
		(540	0)

Unit Number	Description	Thickness (Depth) ft	in.
89.	Siltstone, medium-gray, sandy, thin-bedded; base sharp.....	1	3
		(541	3)
90.	Shale, medium-gray, siderite nodule from 1 ft to 1 ft 2 in. below top, evenly bedded, fair fissility; base sharp.....	2	10
		(544	1)
91.	Sandstone, light- to medium-light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz; base sharp and uneven.....	0	8
		(544	9)
92.	Shale, medium- to medium-dark-gray, carbonaceous, very carbonaceous from 1 ft 4 in. to 1 ft 7 in. below top, contains 10 percent light-gray siltstone laminae from 2 ft below top to base, scattered siderite beds; base sharp.....	4	11
		(549	8)
93.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, few plant stems; base sharp and irregular.....	0	6
		(550	2)
94.	Shale, medium-dark-gray, slightly silty, evenly bedded, fissile; base sharp.....	0	1
		(550	3)
95.	Sandstone, medium-light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark mineral grains, few dark-gray shale laminae and beds up to 0.5 in. thick, thin- to thick-bedded.....	4	10
		(555	1)
96.	Sandstone, medium-light-gray, medium- to coarse-grained, micaceous, contains 60 percent quartz, 20 percent feldspar, scattered dark mineral grains, thick-bedded; base sharp.....	6	9
		(561	10)
97.	Sandstone, medium-light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 15 percent feldspar, scattered dark mineral grains, few quartz pebbles 1 ft 11 in. below top, few scattered dark-gray shale laminae in basal 2 ft, thick-bedded; base grades abruptly.....	13	3
		(575	1)
98.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, few dark-gray shale laminae, few stylolites, crossbedded.....	4	9
		(579	10)

Unit Number	Description	Thickness (Depth) ft	in.
99.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles in top 10 ft, massive; base grades.....	20	5
		(600	3)
100.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles up to 0.5 in. in diameter, massive; base sharp.....	1	2
		(601	5)
101.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, few scattered well rounded white quartz pebbles and granules, large contorted coal clast from 6 in. to 1 ft below top, massive; base sharp.....	2	4
		(603	9)
102.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, thick-bedded to massive; base grades.....	10	1
		(613	10)
103.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 65 percent quartz, 20 percent dark-gray shale laminae in top 2 in., scattered dark mineral grains, abundant siderite clasts and contorted coal clasts in basal 3 in., massive.....	2	1
		(615	11)
104.	Shale, dark-gray, contains 25 percent light-gray siltstone laminae, scattered siderite nodules, slightly burrowed, evenly bedded, fissile.....	2	11
		(618	10)
105.	Coal, dull to bright attritus, few thick vitrain bands.....	0	6
		(619	4)
106.	Underclay, medium-gray, slightly silty, abundant rootlets.....	3	11
		(623	3)
107.	Siltstone, medium- to medium-dark-gray, contains 10 percent light-gray very fine grained sandstone laminae, abundant plant fossils including Calamites; base sharp.....	7	2
		(630	5)
108.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 50 percent quartz; base sharp and irregular.....	0	2
		(630	7)

Unit Number	Description	Thickness (Depth) ft	in.
109.	Shale, medium- to medium-dark-gray, contains few plant fragments, evenly bedded, fair fissility; base grades.....	0	7
		(631	2)
110.	Sandstone, medium-light-gray, fine-grained, contains 45 percent quartz, 20 percent dark-gray shale laminae in top 2 in.; base sharp and irregular.....	0	4
		(631	6)
111.	Shale, dark-gray, few slickensided surfaces, evenly bedded, fair fissility; base sharp.....	0	9
		(632	3)
112.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, petroliferous, contains 50 percent quartz; base grades.....	3	0
		(635	3)
113.	Sandstone, medium-gray, fine-grained, micaceous, contains 45 percent quartz, 5 percent coal laminae, thin-bedded; base grades.....	2	1
		(637	4)
114.	Sandstone, light- to medium-light-gray, medium-grained, micaceous, contains 50 percent quartz, few coal laminae, thin-bedded; base grades.....	1	8
		(639	0)
115.	Sandstone, light- to medium-light-gray, medium-grained, micaceous, contains 45 percent quartz, few dark-gray shale laminae, thick-bedded to massive; base grades.....	7	7
		(646	7)
116.	Sandstone, medium-light-gray, medium- to coarse-grained, micaceous, contains 50 percent quartz, thick-bedded.....	1	0
		(647	7)
117.	Sandstone, medium-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, 5 percent medium-dark-gray silty shale laminae, thin-bedded; base grades.....	1	5
		(649	0)
118.	Sandstone, medium-light-gray, medium-grained, petroliferous, contains 55 percent quartz, thick bedded.....	0	10
		(649	10)
119.	Sandstone, medium-gray, medium- to coarse-grained, petroliferous, contains 55 percent quartz, thick-bedded; base sharp.....	0	11
		(650	9)

Unit Number	Description	Thickness (Depth) ft	in.
120.	Sandstone, light- to medium-light-gray, fine- to medium-grained, micaceous, contains 45 percent quartz, 15 percent coal laminae, few siderite clasts 4 in. above base; base grades.....	1	8
		(652	5)
121.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, scattered feldspar and dark mineral grains, thick-bedded to massive; base sharp.....	12	8
		(665	1)
122.	Coal, mostly bright attritus, few thin vitrain bands.....	0	0.75
		(665	1.75)
123.	Shale, medium- to dark-gray, few siltstone clasts up to 0.5 in. thick; base grades.....	0	5.25
		(665	7)
124.	Shale, dark-gray, carbonaceous, few slickensided surfaces, evenly bedded, fair fissility; base sharp.....	1	7
		(667	2)
125.	Sandstone, light-gray, medium- to coarse-grained, petroliferous, micaceous, contains 65 percent quartz, scattered dark and light mineral grains; base sharp.....	3	3
		(670	5)
126.	Shale, medium-dark-gray, contains 10 percent light-gray siltstone laminae in top 8 in., scattered siderite beds up to 1 in. thick, few slickensided surfaces, evenly bedded, fissile; base sharp.....	6	4
		(676	9)
127.	Sandstone, medium-light-gray, medium- to coarse-grained, contains 65 percent quartz, few large well rounded coal clasts; base sharp.....	0	3
		(677	0)
128.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, 5 percent medium-gray siltstone laminae, thin- to thick-bedded; base sharp.....	2	3
		(679	3)
129.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, few medium-gray siltstone laminae, thick-bedded; base grades.....	2	3
		(681	6)
130.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, scattered feldspar and dark mineral grains; base grades.....	8	0
		(689	6)

Unit Number	Description	Thickness (Depth) ft	in.
131.	Sandstone, light- to medium-light-gray, medium- to coarse-grained, micaceous, contains 60 percent quartz, abundant well rounded white quartz pebbles from 5 ft 5 in. to 6 ft 2 in. below top, abundant medium-dark-gray shale clasts from 6 ft 7 in. to 7 ft 7 in. below top and in basal 1 ft 1 in.; base sharp.....	15	0
		(704	6)
132.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 45 percent medium-gray siltstone and dark-gray shale laminae, thin-bedded; base sharp.....	2	5
		(706	11)
133.	Shale, medium-dark- to dark-gray, contains 5 percent light-gray siltstone laminae, evenly bedded, fissile; base sharp.....	0	7
		(707	6)
134.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, 40 percent dark-gray shale laminae and beds up to 1.5 in. thick in top 10 in., thick-bedded to massive; base sharp.....	4	3
		(711	9)
135.	Shale, medum-dark to dark-gray, evenly bedded, fissile; base sharp.....	0	3
		(712	0)
136.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, scattered dark mineral grains, few dark-gray shale clasts; base grades.....	3	4
		(715	4)
137.	Sandstone, light-gray, fine-grained, petroliferous in part, contains 90 percent quartz, scattered well rounded white quartz pebbles up to 0.75 in. in diameter; base sharp and irregular.....	2	0
		(717	4)
138.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, few well rounded white quartz pebbles in basal 2 ft, few stylolites, massive, base grades.....	3	2
		(720	6)
139.	Sandstone, very light-gray, fine- to medium-grained, contains 90 percent quartz, thick-bedded to massive, few stylolites; base grades.....	9	10
		(730	4)

Unit Number	Description	Thickness (Depth) ft	in.
140.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few dark mineral grains, scattered well rounded white quartz pebbles up to 0.5 in. in diameter, few coal laminae in basal 1 ft 3 in., few stylolites, thick-bedded to massive; base grades	24	9
		(755	1)
141.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few dark mineral grains, few stylolites, thick-bedded to massive; base sharp	12	3
		(767	4)
142.	Shale, medium-dark-gray, contains 10 percent light-gray siltstone laminae, evenly bedded; base sharp	1	1
		(768	5)
143.	Shale, medium-dark-gray, contains 5 percent light-gray discontinuous siltstone laminae, evenly bedded, fissile; base grades	1	11
		(770	4)
144.	Shale, medium-dark-gray, silty, contains 15 percent light-gray siltstone laminae, evenly bedded, fissile; base grades	3	4
		(773	8)
145.	Shale, dark-gray, carbonaceous, slightly silty in top 2 ft 6 in., scattered siderite beds, evenly bedded, fissile; base grades	10	5
		(784	1)
146.	Shale, black, carbonaceous, canneloid; base grades	0	6
		(784	7)
147.	Shale, dark-gray, slightly silty, contains few plant fragments, evenly bedded; base sharp and irregular	1	0
		(785	7)
148.	Sandstone, medium-light-gray, fine-grained, contains 40 percent quartz, 35 percent dark-gray silty shale laminae, cross-laminated in part, thin-bedded; base sharp	3	10
		(789	5)
149.	Sandstone, medium-light-gray, very fine to fine-grained, silty, sparsely micaceous, contains 40 percent quartz, 20 percent dark-gray silty shale laminae; base sharp and uneven	3	2
		(792	7)
150.	Shale, medium-dark-gray, silty, contains 20 percent light-gray very fine grained sandstone laminae and beds in top 1 ft 2 in., evenly bedded, fissile; base grades	5	6
		(798	1)

Unit Number	Description	Thickness (Depth) ft	in.
151.	Shale, medium-dark- to dark-gray, contains 10 percent medium-light-gray siltstone laminae, few siderite beds, and plant fragments, evenly bedded; base grades.....	6	7
		(804	8)
152.	Shale, black, carbonaceous, evenly bedded, fissile; base sharp.....	0	9
		(805	5)
153.	Underclay, medium-gray, mottled brownish-gray, carbonaceous in top 1 in., very silty in basal 1 ft 2 in., abundant rootlets; base grades abruptly.....	2	1
		(807	6)
154.	Sandstone, very light gray, medium-grained, petroliferous 3 ft 4 in. below top, contains 90 percent quartz, scattered dark mineral grains, scattered quartz granules from 22 to 28 ft below top, massive, contorted bedding from 4 ft to 10 ft below top; base sharp.....	39	2
		(846	8)
155.	Coal, Fire Creek rider coal bed, thin to thick vitrain bands, bright attrital matrix, high fractured.....	1	6
		(848	2)
156.	Underclay, dark gray to black, very carbonaceous in top 1 in., contains few coal laminae from 3 to 4 in. below top, abundant rootlets.....	1	3
		(849	5)
157.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent dark-gray shale laminae, abundant rootlets, thin-bedded; base grades.....	3	11
		(853	4)
158.	Sandstone, light-gray, fine-grained, contains 45 percent quartz, 10 percent dark-gray shale laminae, slightly burrowed, thin-bedded.....	3	10
		(857	2)
159.	Shale, medium-dark-gray, silty, contains 30 percent light-gray very fine grained sandstone laminae and beds, some small-scale slump structures and contorted bedding from 9 ft to 9 ft 6 in. below top, slightly burrowed; base grades.....	10	0
		(867	2)
160.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent dark-gray shale laminae, thin-bedded; base sharp.....	13	10
		(881	0)

Unit Number	Description	Thickness (Depth) ft	in.
161.	Shale, dark-gray to black, carbonaceous, very carbonaceous in basal 1 ft 4 in., contains scattered siderite beds up to 0.5 in. thick, evenly bedded, fissile.....	18	11
		(899	11)
162.	Coal, Cove Creek(?) coal bed, mostly bright attritus.....	1	2
		(901	1)
163.	Underclay, medium-dark-gray, silty, carbonaceous in top 3 in., abundant rootlets.....	2	0
		(903	1)
164.	Siltstone, medium- to medium-dark-gray, sparsely micaceous, thin-bedded; base grades.....	1	3
		(904	4)
165.	Shale, medium-dark to dark-gray, silty, contains 5 percent light-gray siltstone laminae, scattered siderite nodules, evenly bedded; base grades.....	3	8
		(908	0)
166.	Siltstone, medium-dark- to dark-gray, contains 40 percent dark-gray shale laminae, few siderite nodules, scattered plant fragments, few slickensided surfaces, thin and unevenly bedded; base grades.....	1	7
		(909	7)
167.	Shale, medium-dark- to dark-gray, silty, contains 20 percent medium-light-gray siltstone laminae in basal 1 ft, few siderite nodules, irregularly bedded; base grades.....	2	9
		(912	4)
168.	Sandstone, medium-gray, very fine to fine-grained, slightly silty, sparsely micaceous, contains 45 percent quartz, 25 percent dark-gray shale laminae and beds up to 2 in. thick in top 3 ft and in basal 1 ft 7 in.; base grades.....	8	2
		(920	6)
169.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, 45 percent dark-gray shale laminae and beds, thin-bedded; base sharp.....	0	11
		(921	5)
170.	Sandstone, medium-light-gray, very fine to fine-grained, contains 60 percent quartz, 45 percent dark-gray shale laminae and beds from 1 ft to 9 in. above base; base grades.....	2	11
		(924	4)
171.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 50 percent dark-gray shale laminae and beds, thin and irregularly bedded; base grades.....	4	5
		(928	9)

Unit Number	Description	Thickness (Depth) ft	in.
172.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, few siderite clasts, scattered dark-gray shale clasts in basal 2 in., few contorted beds; base sharp.....	2	2
		(930	11)
173.	Shale, medium-dark- to dark-gray, contains 35 percent light-gray very fine grained sandstone laminae and beds, evenly bedded, fissile; base sharp and uneven.....	2	4
		(933	3)
174.	Sandstone, light-gray, very fine to fine-grained contains 65 percent quartz; base sharp.....	0	2
		(933	5)
175.	Shale, medium-dark- to dark-gray, slightly silty, evenly bedded, fissile; base sharp.....	0	2
		(933	7)
176.	Sandstone, light-gray, fine-grained, micaceous, contains 65 percent quartz, few plant fragments, thick-bedded; base sharp.....	0	7
		(934	2)
177.	Shale, dark-gray, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded, fissile; base sharp.....	0	3
		(934	5)
178.	Sandstone, light-gray, fine- to medium-grained, contains 65 percent quartz, thick-bedded.....	0	3
		(934	8)
179.	Shale, medium-dark- to dark-gray, evenly bedded, fissile; base sharp.....	0	2
		(934	10)
180.	Sandstone, light-gray, fine- to medium-grained, contains 65 percent quartz, scattered dark mineral grains; base sharp.....	0	3
		(935	1)
181.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 35 percent dark-gray shale laminae, thin and lenticularly bedded; base grades.....	1	0
		(936	1)
182.	Shale, medium-dark- to dark-gray, contains 5 percent light-gray very fine grained sandstone laminae; base sharp.....	0	8
		(936	9)

Unit Number	Description	Thickness (Depth) ft	in.
183.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 45 percent quartz, few siderite clasts, few coal laminae at base.....	0	5
		(937	2)
184.	Shale, medium-dark- to dark-gray, contains 10 percent medium-light-gray very fine grained sandstone laminae, evenly bedded; base sharp.....	0	5
		(937	7)
185.	Sandstone, very light to light-gray, medium-grained, contains 65 percent quartz, 15 percent dark-gray carbonaceous siltstone laminae, thin- to thick-bedded; base grades.....	1	4
		(938	11)
186.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, thick-bedded; base sharp.....	0	5
		(939	4)
187.	Shale, medium-dark-gray, contains 40 percent light-gray, very fine grained sandstone laminae, thin-bedded.....	0	2
		(939	6)
188.	Sandstone, light-gray, medium-grained, contains 90 percent quartz, few medium-gray siltstone laminae, few dark mineral grains, thick-bedded; base sharp.....	9	0
		(948	6)
189.	Shale, medium-dark-gray, contains 35 percent light-gray very fine grained sandstone laminae, evenly bedded, fissile; base sharp.....	0	9
		(949	3)
190.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, few dark-gray shale laminae; base grades.....	0	8
		(949	11)
191.	Sandstone, light-gray, fine- to medium-grained, contains 65 percent quartz, 5 percent dark-gray shale laminae, scattered dark mineral grains, very few scattered well rounded white quartz pebbles, few siderite clasts in basal 4 in.; base grades.....	9	3
		(959	2)
192.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, thin-bedded; base grades.....	0	7
		(959	9)

Unit Number	Description	Thickness (Depth) ft	in.
193.	Shale, medium-dark-gray, contains 45 percent light-gray, very fine grained sandstone laminae, cross-laminated, evenly bedded; base sharp	1	0
		(960	9)
194.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, 5 percent dark-gray silty shale laminae, scattered dark mineral grains, thick-bedded; base grades	3	8
		(964	5)
195.	Sandstone, very light to light-gray, fine-grained, contains 90 percent quartz, few scattered dark mineral grains, thick-bedded; base grades	0	7
		(965	0)
196.	Sandstone, light- to medium-light-gray, fine- to medium-grained, micaceous, sideritic from 1 ft 2 in. to 1 ft 3 in. below top, contains 65 percent quartz, scattered dark mineral grains, thick-bedded; base grades	4	6
		(969	6)
197.	Sandstone, light-gray, fine-grained, contains 90 percent quartz, few dark mineral grains, crossbedded, massive; base grades	2	8
		(972	2)
198.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 90 percent quartz, scattered dark mineral grains; base grades	5	9
		(977	11)
199.	Sandstone, very light to light-gray, fine- to medium-grained, contains 90 percent quartz, few dark mineral grains, abundant angular medium-dark-gray shale clasts in top 9 in., few shale clasts and coal laminae in basal 2 ft, thick-bedded to massive; base sharp	15	11
		(993	10)
200.	Shale, medium-dark- to dark-gray, silty, micaceous, 0.5 in. thick light-gray very fine grained sandstone bed 2 in. below top, evenly bedded, fissile; base sharp	0	4
		(994	2)
201.	Sandstone, very light to light-gray, fine- to medium-grained, contains 90 percent quartz, few dark mineral grains, scattered coal laminae, 1 in. dark-gray shale clast 2 in. below top; base sharp	2	3
		(996	5)

Unit Number	Description	Thickness (Depth) ft	in.
202.	Shale, medium-dark- to dark-gray, contains 10 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded, fissile; base grades.....	3	10
		(1000	3)
203.	Sandstone, very light to light-gray, fine-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, few scattered coal laminae, thin- to thick-bedded.....	5	5
		(1005	8)
204.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, few scattered coal laminae, thick-bedded to massive.....	5	3
		(1010	11)
205.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few dark mineral grains, few well rounded white quartz pebbles in basal 4 ft 6 in., well-sorted, massive; base grades.....	17	10
		(1028	9)
206.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, 20 percent medium-gray siltstone laminae, thin-bedded; base sharp.....	0	5
		(1029	2)
207.	Sandstone, white to very light gray, mottled brownish-gray from 12 ft to 14 ft below top, medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles up to 0.25 in. in diameter in top 1 ft 4 in., few small white quartz pebbles from 14 ft 6 in. to 16 ft below top and in basal 5 ft, few medium-dark-gray shale clasts from 33 ft 8 in. to 34 ft 8 in. below top; base grades.....	44	0
		(1073	2)
208.	Sandstone, very light gray to white, mottled brownish-gray in top 1 ft 2 in., medium- to coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles up to 1 in. in diameter, massive; base sharp.....	3	4
		(1076	6)
209.	Siltstone, black, very carbonaceous, sandy, contains 30 percent light-gray, very fine grained sandstone laminae, thin and evenly bedded; base grades.....	0	3
		(1076	9)

Unit Number	Description	Thickness (Depth) ft	in.
210.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 65 percent quartz, 5 percent medium-dark-gray siltstone and silty shale laminae, scattered dark and light mineral grains; base grades abruptly.....	10	9
		(1087	6)
211.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles; base sharp.....	3	7
		(1091	1)
212.	Sandstone, light- to medium-light-gray, very fine to fine-grained, carbonaceous in top 2 in. and basal 1 in., contains 50 percent quartz; base sharp.....	0	4
		(1091	5)
213.	Conglomerate, contains abundant well rounded white quartz pebbles from 0.5 in. to 1 in. in diameter, medium-grained quartzose sandstone matrix.....	0	7
		(1092	0)
214.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains; base grades abruptly.....	1	4
		(1093	4)
215.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, abundant well rounded white quartz pebbles and large angular dark-gray shale clasts in top 2 ft 4 in. and basal 2 ft 5 in., scattered large siderite clasts in basal 1 ft 2 in.; base sharp..	6	5
		(1099	9)
216.	Coal clast, mostly bright attritus.....	0	2
		(1099	11)
217.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, abundant coal clasts, few siderite clasts at base, massive; base sharp.....	1	4
		(1101	3)
218.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, 5 percent dark-gray silty shale laminae in top 3 ft, thick-bedded to massive; base grades.....	5	4
		(1106	7)
219.	Sandstone, very light gray, medium-grained, few fine-grained sandstone lenses in top 2 ft 6 in., contains 90 percent quartz, massive, quartz-filled fracture 10 ft below top, base grades.....	24	3
		(1130	10)

Unit Number	Description	Thickness (Depth) ft	in.
220.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles from 0.25 in. to 0.5 in. in diameter, scattered siderite clasts, few coal laminae from 2 ft 9 in. to 3 ft 8 in. below top; base grades.....	5	6
		(1136	4)
221.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, few scattered well rounded white quartz pebbles, crossbedded, thick-bedded to massive; base sharp.....	11	11
		(1148	3)
222.	Sandstone, medium-light- to medium-gray, fine- to medium-grained, contains 40 percent quartz, thin-bedded; base grades abruptly.....	0	7
		(1148	10)
223.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles from 0.25 to 0.5 in. in diameter; abundant well rounded white quartz pebbles, siderite and coal clasts up to 2 in. in diameter from 3 ft to 5 ft above base; few stylolites, massive; base sharp.....	44	0
		(1192	10)
224.	Shale, dark-gray, slightly micaceous, evenly bedded, fissile; base grades.....	1	4
		(1194	2)
225.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 55 percent quartz, thin-bedded; base sharp.....	1	10
		(1196	0)
226.	Shale, dark-gray, carbonaceous, contains few plant fragments, evenly bedded, fissile; base sharp.....	3	1
		(1199	1)
227.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 55 percent quartz, 10 percent medium-dark-gray shale laminae in top 2 in., thin-bedded; base sharp.....	8	7
		(1207	8)
228.	Shale, dark-gray to black, evenly bedded, fissile; base sharp.....	0	9.5
		(1208	5.5)
229.	Sandstone, light-gray, very fine to fine-grained, very micaceous, contains 50 percent quartz, 5 percent dark-gray silty shale laminae, thin-bedded; base sharp.....	1	3.5
		(1209	9)

Unit Number	Description	Thickness (Depth) ft	in.
230.	Sandstone, light-gray, fine-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, few siderite clasts 4 ft below top; base sharp.....	10	4
		(1220	1)
231.	Shale, dark-gray, silty, contains 50 percent light-gray, very fine-grained sandstone laminae from 2 in. to 5 in. below top and in basal 0.5 in., evenly bedded; base sharp.....	0	11
		(1221	0)
232.	Sandstone, light-gray, fine-grained, micaceous, contains 60 percent quartz, 5 percent dark-gray silty shale laminae, crossbedded, massive; base sharp.....	1	10
		(1222	10)
233.	Shale, dark-gray to black, evenly bedded, fissile; base grades....	0	5
		(1223	3)
234.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, 5 percent medium-gray siltstone laminae; base grades.....	0	8
		(1223	11)
235.	Shale, dark-gray, contains 30 percent light-gray siltstone and very fine grained sandstone laminae and beds, evenly bedded, flaser-bedded; base sharp.....	0	4
		(1224	3)
236.	Sandstone, light-gray, fine-grained, micaceous, contains 55 percent quartz, scattered dark mineral grains, massive; base sharp.....	7	1
		(1231	4)
237.	Shale, dark-gray, carbonaceous, evenly bedded; base sharp.....	0	10.5
		(1232	2.5)
238.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, 5 percent dark-gray siltstone laminae in top 2 ft, few scattered dark mineral grains, scattered stylolites, well-sorted, crossbedded, thick-bedded to massive, thin-bedded in top 2 ft; base grades.....	52	0
		(1284	2.5)
239.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles, 1 in. dark-gray silty shale clast 10 ft 8 in. below top, massive; base grades.....	14	7.5
		(1298	10)

Unit Number	Description	Thickness (Depth) ft	in.
240.	Conglomerate, very light to light-gray, contains abundant well rounded white quartz pebbles from 0.5 in. to 1 in. in diameter, 4 in. dark-gray shale clast from 10 ft 8 in. to 11 ft below top, abundant dark-gray shale and siderite clasts up to 1 in. in diameter in basal 2 ft 2 in., few coal clasts in basal 2 ft 2 in., coarse-grained quartzose sandstone matrix, massive; base sharp.....	15	10
		(1314	8)
	UPPER MISSISSIPPIAN SERIES Bluestone Formation Pride Shale Member		
241.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 10 percent dark-gray shale laminae, few small siderite clasts from 10 in. to 1 ft 8 in. below top, abundant small dark-gray shale and siderite clasts from 11 ft 1 in. to 12 ft 5 in. below top, cross-laminated, ripple-bedded; base grades.....	13	5
		(1328	1)
242.	Shale, dark-gray, micaceous, contains 20 percent light-gray very fine grained sandstone laminae, few plant fragments, slightly burrowed, evenly bedded, flaser-bedded; base grades abruptly.....	7	2
		(1335	3)
243.	Sandstone, light-gray, fine- to medium-grained, contains 50 percent quartz, abundant coal laminae; few pyritic coal clasts, dark-gray shale and siderite clasts; thin and irregularly bedded; base sharp.....	1	7
		(1336	10)
244.	Shale, dark-gray, contains 5 percent medium-light-gray siltstone laminae, mostly slumped bedding.....	2	2
		(1339	0)
	BOTTOM OF HOLE TOTAL DEPTH 1,339 ft		

GEOPHYSICAL LOG

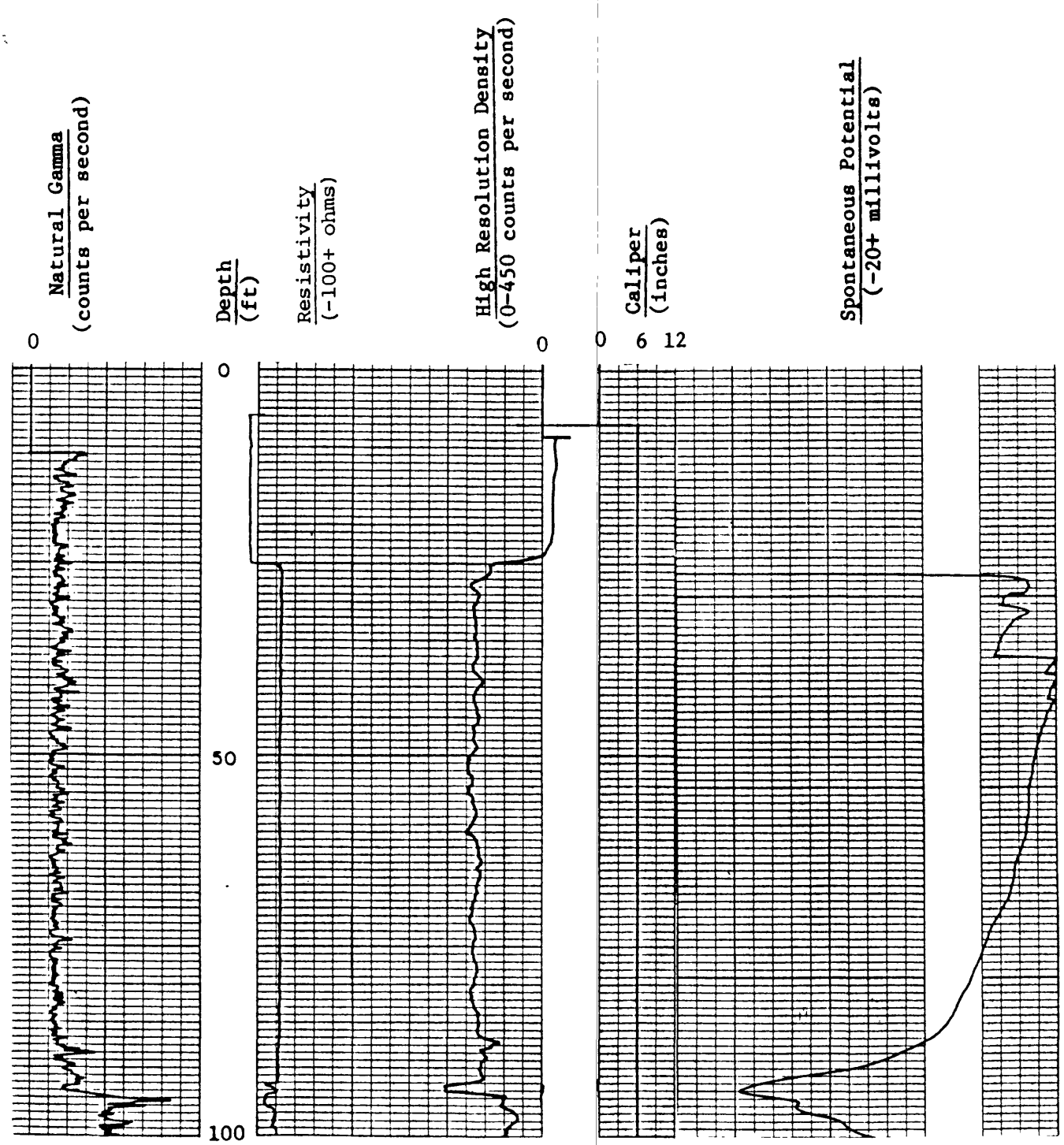
Corehole: SW-4A Date: 1/20/83 State: Virginia County: Wise

Quadrangle: Jenkins East, Va.-Ky. Latitude: 37°09'03"N Longitude: 82°36'27"W

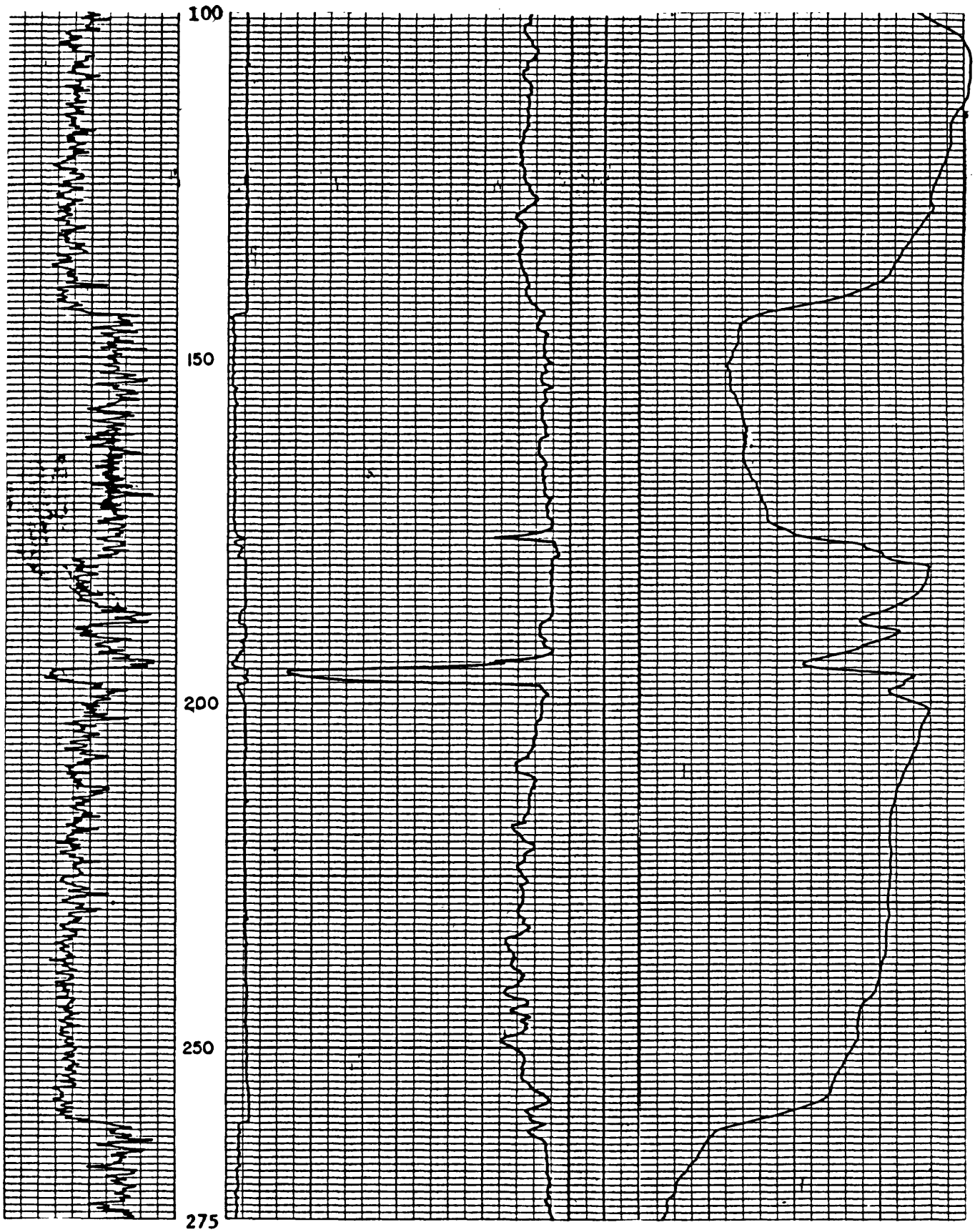
Altitude: 1,760 ft Logged Depth: 1,339 ft Drilled Depth: 1,339 ft

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

High Resolution Density Time Constant: 1



Corehole: SW-4A continued



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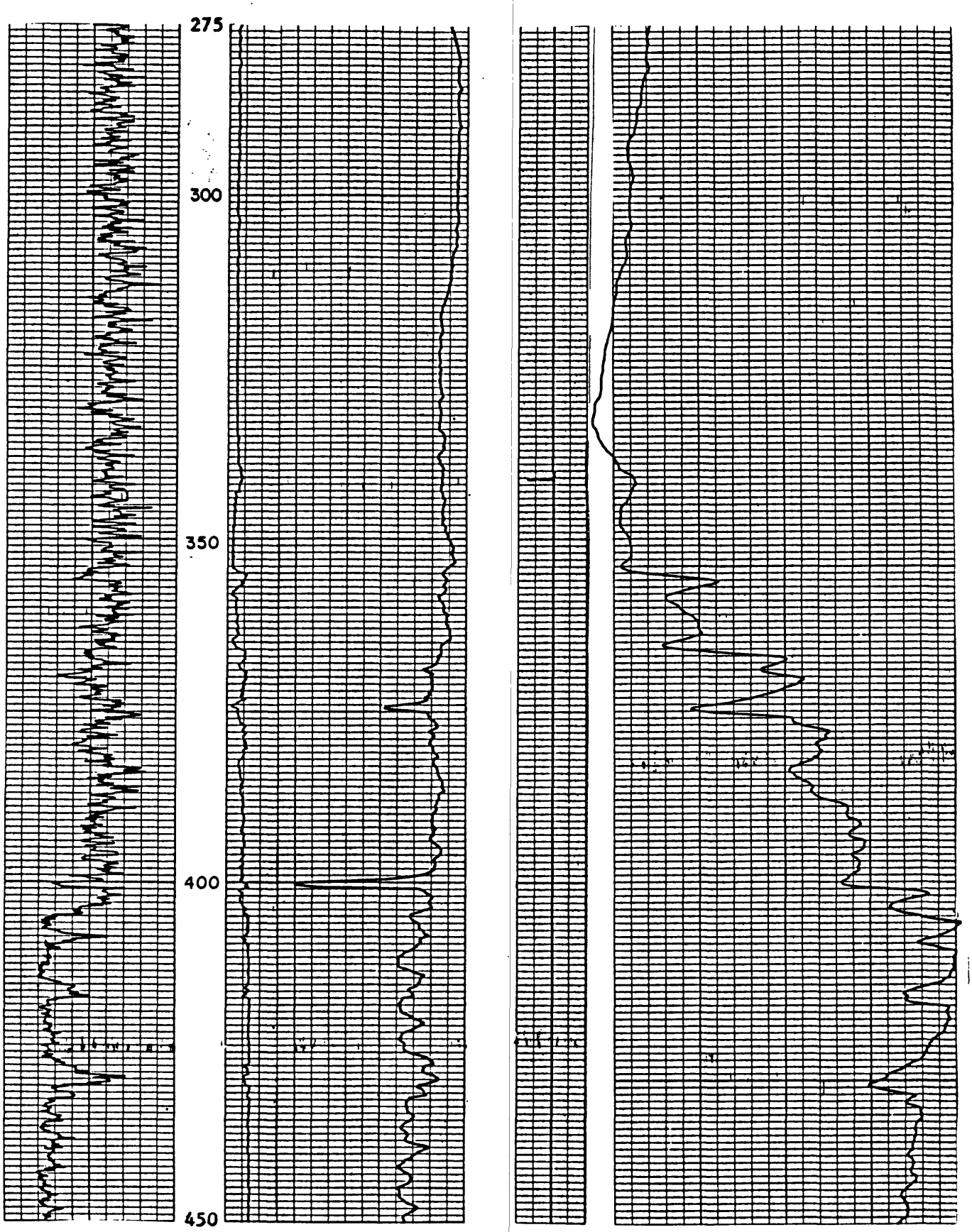
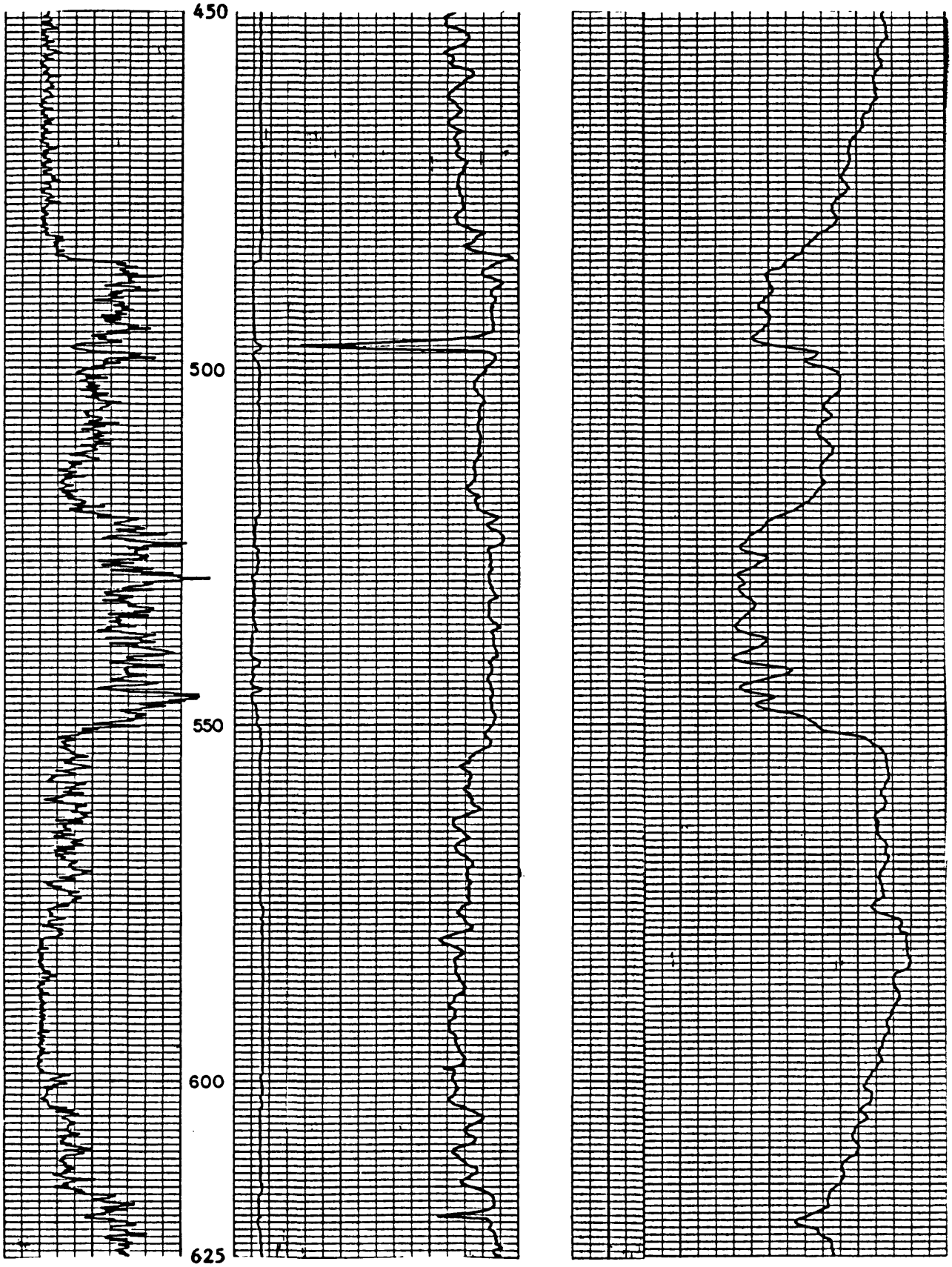


Corehole: SW-4A continued



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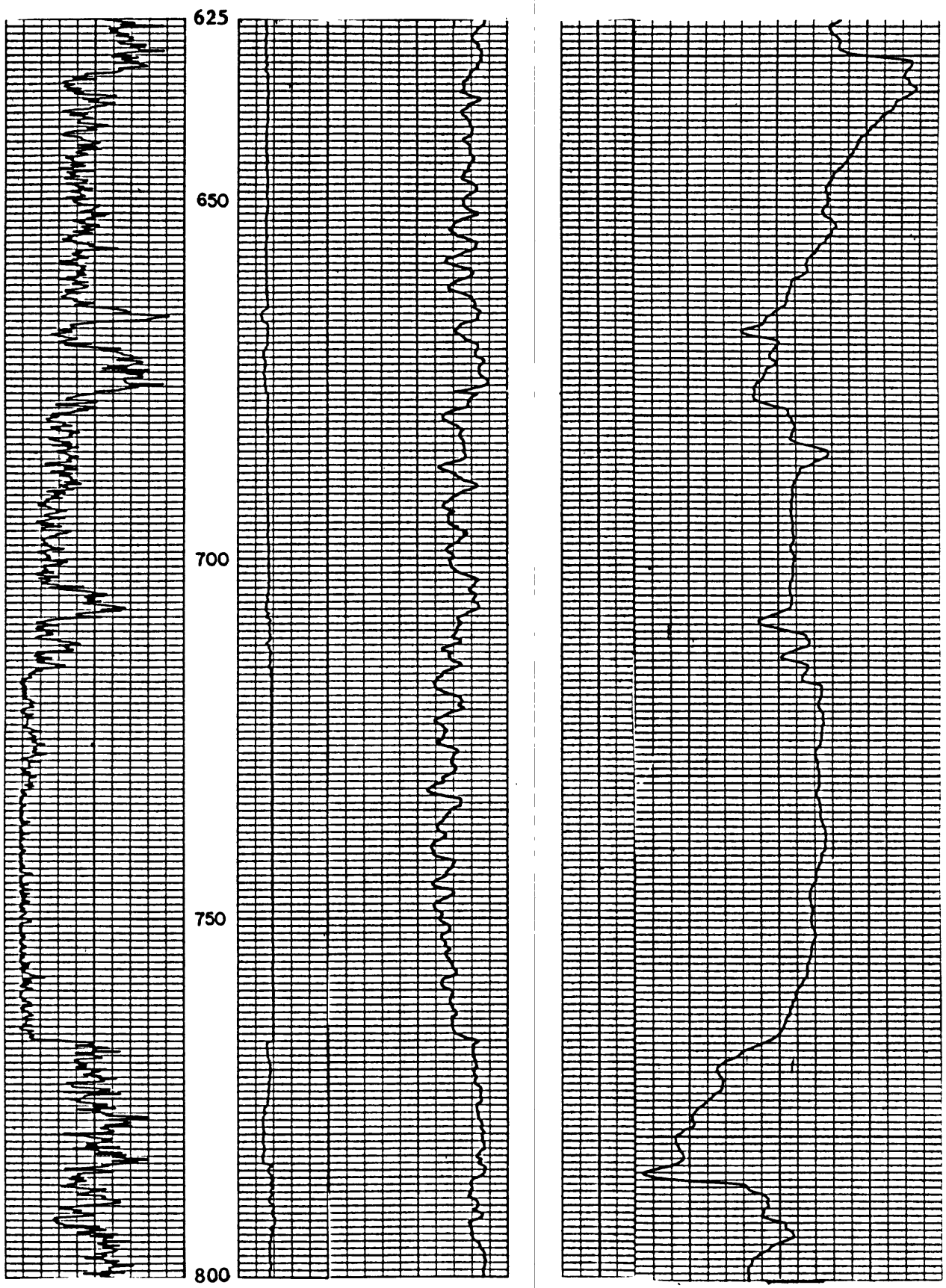

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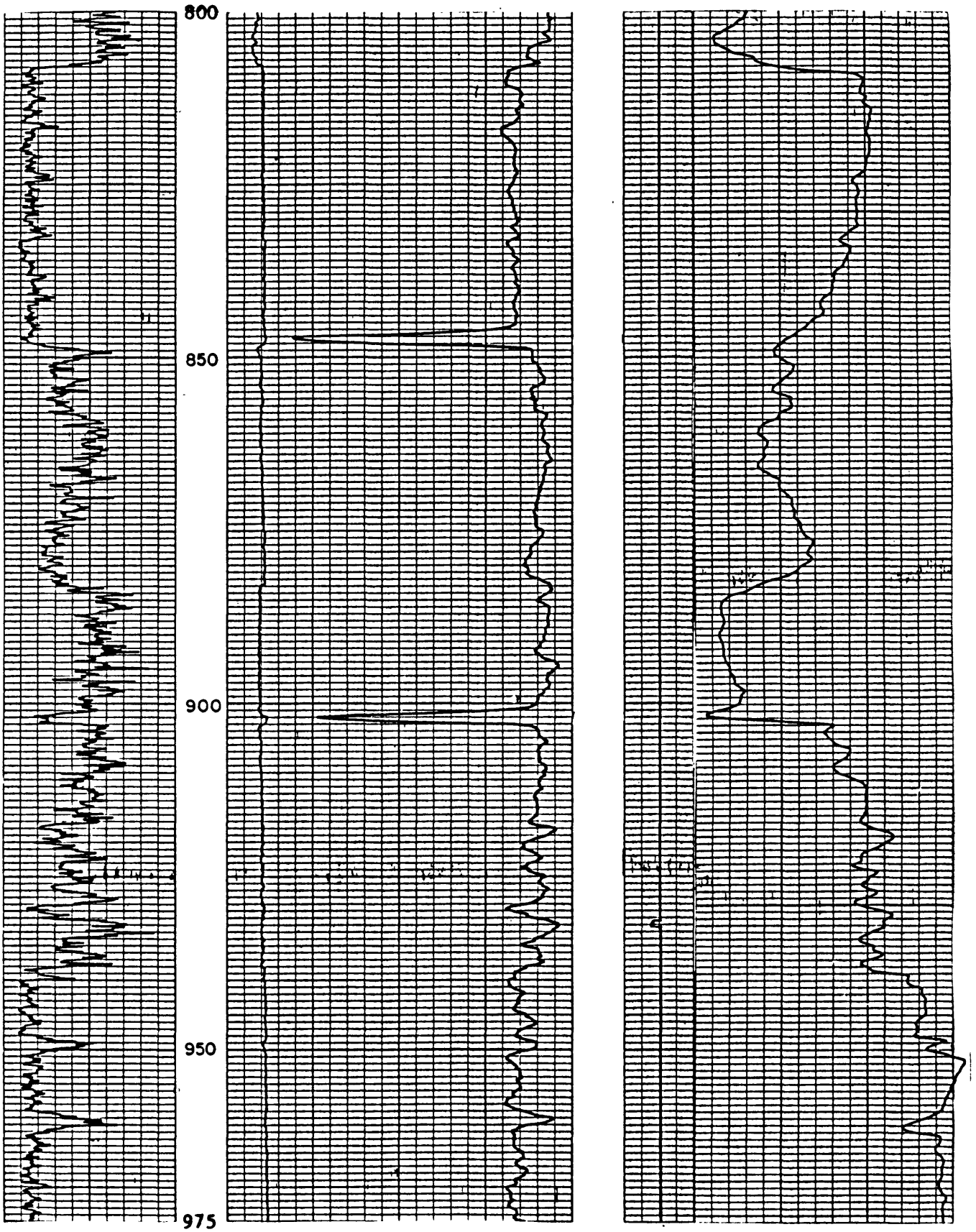
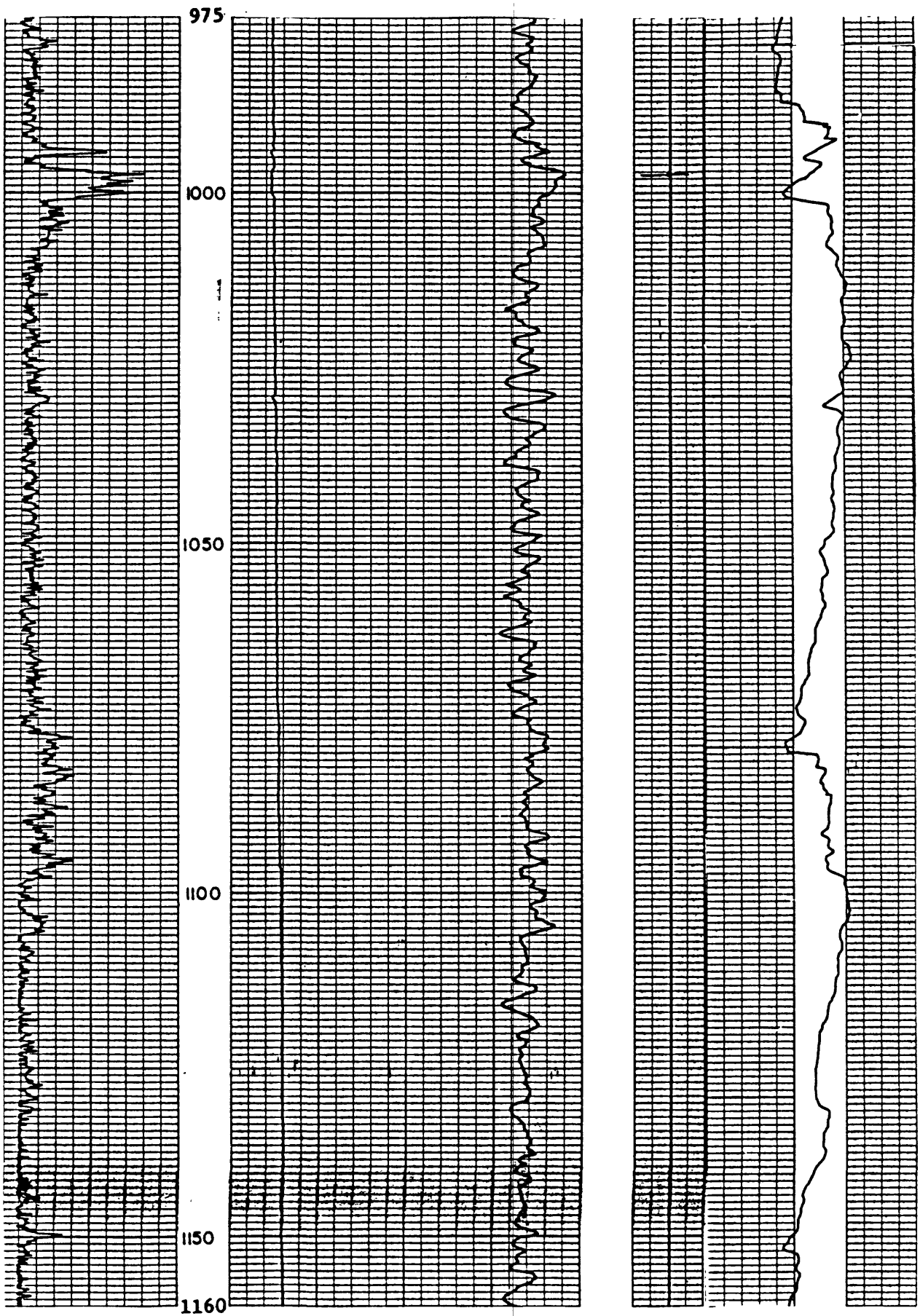
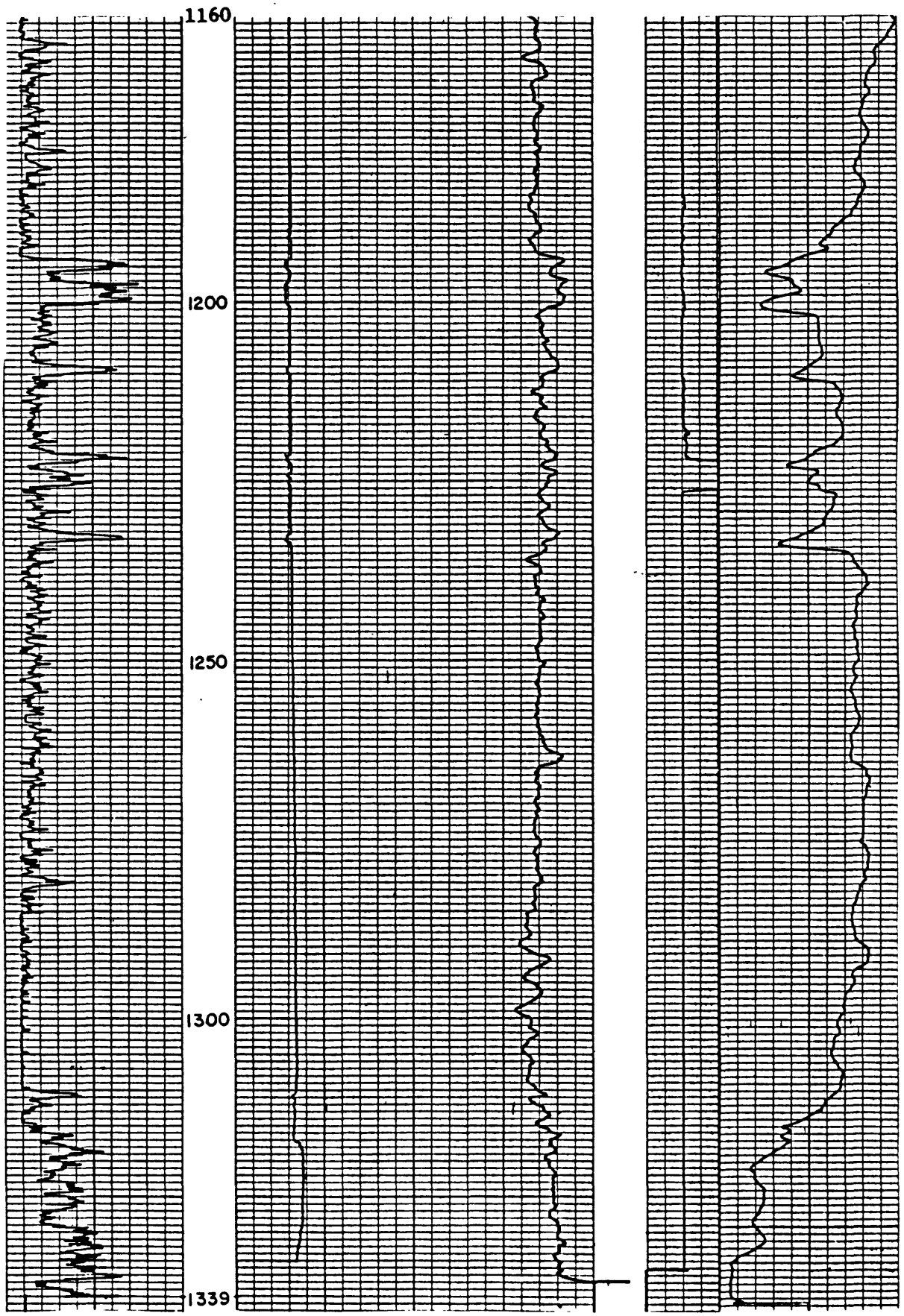


Corehole: SW-4A continued

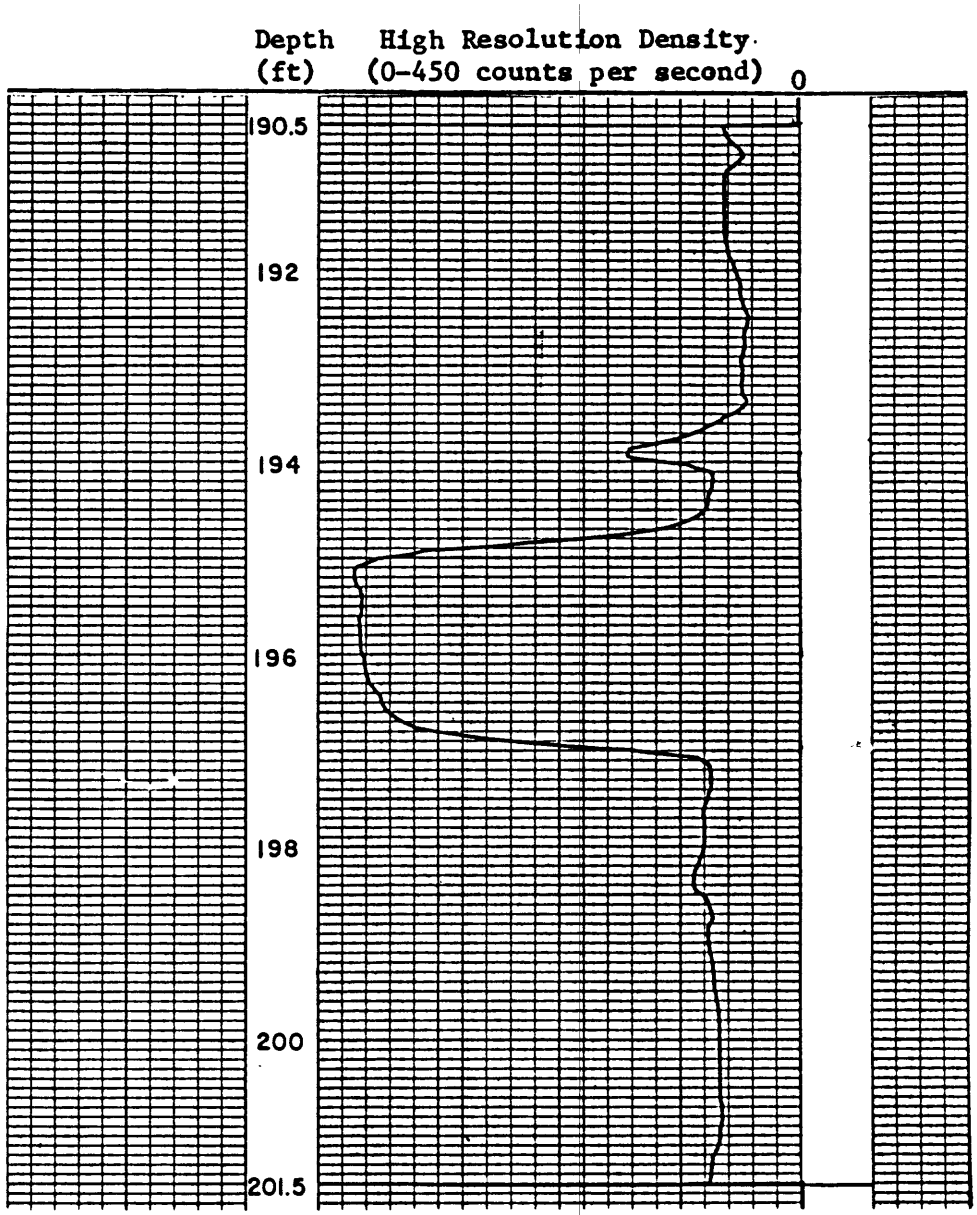


Corehole: SW-4A continued

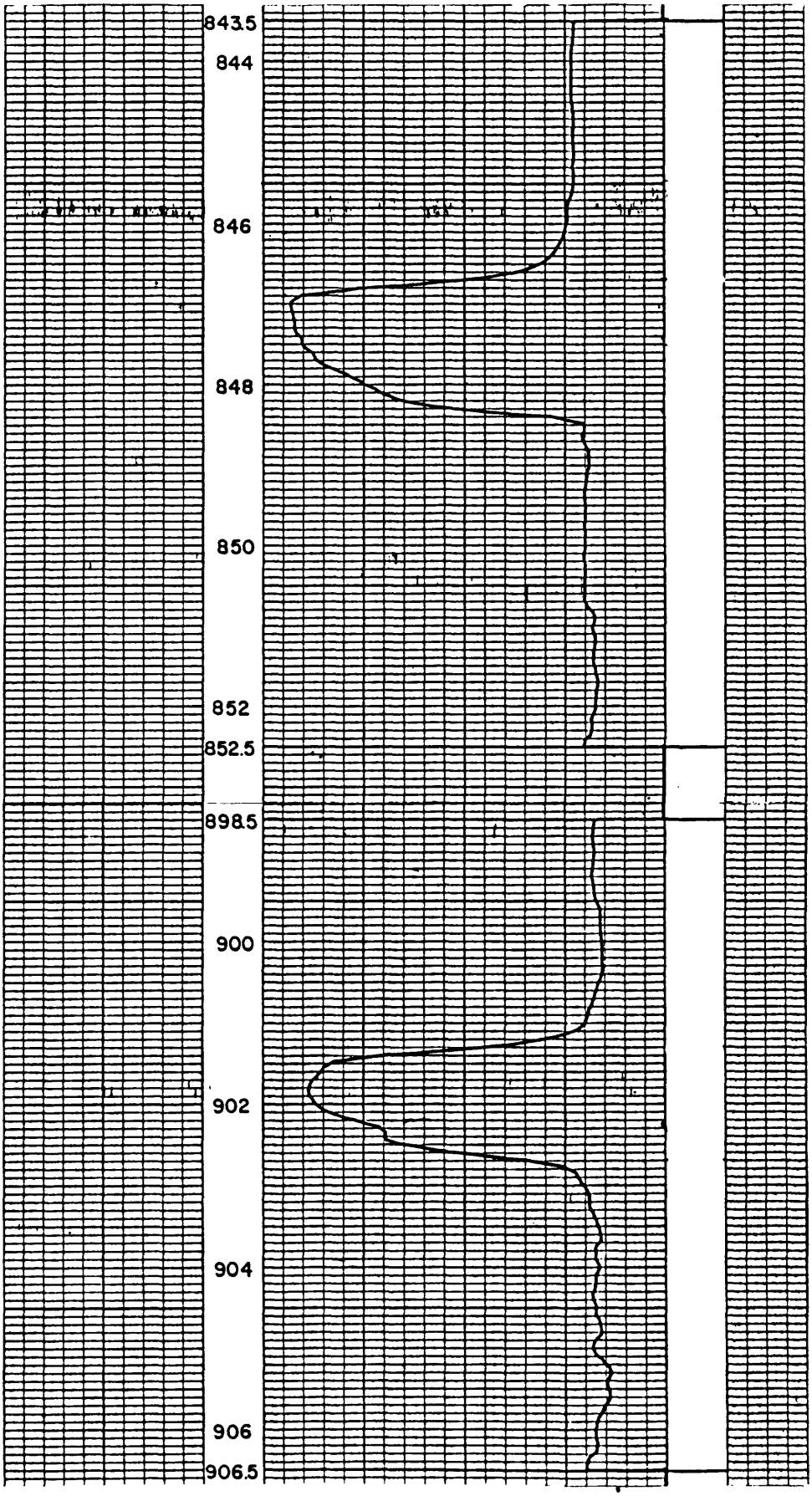


DETAIL LOG

Corehole: SW-4A Logging Speed: 5 ft/min Time Constant: 1



Corehole: SW-4A continued



Corehole SW-5

Location: Wise County; Jenkins East Va.-Ky., 7.5 minute quadrangle; approximately 1 mi south of the Kentucky-Virginia state line on the south side of Pine Mountain. Accessible along abandoned Chesapeake and Ohio railroad grade from old U.S. 23.

Coordinates: Latitude 37°08'47" N Longitude: 82°37'26"W

Altitude: 1,867 ft Drilled depth: 825 ft

Dip of strata: Ranges from 15° to 20° from surface to depth of 400 ft, decreases to 3° to 10° from depth of 400 ft to base of corehole.

Date drilled: December 9, 1982 to January 11, 1983

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

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER PENNSYLVANIAN SERIES Lee Formation Hensley Member		
1.	Soil and weathered rock (casing set- no core recovered).....	51 (51	6 6)
2.	Sandstone, light-gray, weathered brownish-gray from 15 ft 4 in. to 19 ft 2 in. below top, fine- to medium-grained, micaceous, contains 60 percent quartz, abundant dark mineral grains, few slickensided surfaces and high angle fractures, thick-bedded; base grades abruptly.....	20 (71	3 9)
3.	Sandstone, light- to medium-light-gray, medium-grained, micaceous, contains 65 percent quartz, abundant dark mineral grains, some lineation and elongation of dark mineral grains, thick-bedded; base sharp and uneven.....	0 (72	9 6)
4.	Sandstone, medium-light-gray to gray, weathered brownish-gray from 1 ft 1 in. to 3 ft 7 in. below top, fine- to medium-grained, micaceous, contains 55 percent quartz, abundant dark mineral grains, abundant slickenslided surfaces, thick-bedded; base grades abruptly.....	8 (80	3 9)

Unit Number	Description	Thickness (Depth) ft	in.
5.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, abundant dark mineral grains, few dark-gray carbonaceous shale laminae in top 2 in., scattered slickensided surfaces, few small-scale faults with up to 2 in. of displacement, thin-bedded; base sharp and uneven.....	0	5
		(81	2)
6.	Sandstone, medium-light-gray, very fine to fine-grained, contains 50 percent quartz, 20 percent dark-gray shale laminae, few slickensided surfaces, thin-bedded; base sharp.....	0	6
		(81	8)
7.	Sandstone, light- to medium-light-gray, medium-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, scattered coal clasts in top 1 in.; base grades.....	0	4
		(82	0)
8.	Sandstone, light- to medium-light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, abundant dark mineral grains, scattered dark-gray shale laminae from 7 ft 5 in. to 12 ft below top, few slickensided surfaces, scattered high-angle calcite filled fractures in basal 5 ft 5 in., thick-bedded; base grades abruptly.....	13	5
		(95	5)
9.	Sandstone, medium-light-gray, medium- to coarse-grained, contains 65 percent quartz, scattered dark mineral grains, few slickensided surfaces normally graded, thick-bedded; base sharp.....	3	0
		(98	5)
10.	Shale, medium-dark-gray, slightly carbonaceous, contains few siderite beds in top 2 ft 3 in., abundant fractures and slickensided surfaces, evenly bedded, fissile; base grades.....	53	7
		(152	0)
11.	Shale, medium-dark-gray, contains 10 percent light-gray very fine grained silty sandstone beds, scattered plant fragments, slightly burrowed, fractured in part, evenly bedded, fissile; base grades abruptly.....	19	4
		(171	4)
12.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 25 percent dark-gray shale laminae, bioturbated; base sharp.....	1	2
		(172	6)

Unit Number	Description	Thickness (Depth) ft	in.
13.	Shale, dark-gray, evenly bedded, fissile; base sharp.....	0	8
		(173	2)
14.	Siltstone, medium-gray, contains 40 percent light-gray very fine grained sandstone laminae in top 2 in., bioturbated in top 2 in.; base sharp.....	0	6
		(173	8)
15.	Shale, medium-dark- to dark-gray, contains 25 percent medium-gray siltstone laminae in top 6 ft, scattered siderite beds up to 1 in. thick from 4 ft to 6 ft 8 in. below top, slightly burrowed, evenly bedded.....	9	3
		(182	11)
16.	Shale, medium-gray, very silty, evenly bedded, fissile; base sharp.....	1	9
		(184	8)
17.	Shale, medium- to medium-dark-gray, evenly bedded, fissile; base sharp.....	0	11
		(185	7)
18.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, 2 in. dark-gray shale bed 1 in. below top, few small-scale faults with up to 2 in. of displacement; base sharp...	0	6
		(186	1)
19.	Shale, medium-gray, silty, evenly bedded, fair fissility; base sharp.....	0	6
		(186	8)
20.	Sandstone, medium-light- to medium-gray, fine-grained, contains 45 percent quartz, thin- to thick-bedded; base grades abruptly....	0	7
		(187	3)
21.	Shale, medium-dark-gray, contains 15 percent light-gray siltstone and very fine grained sandstone laminae and beds up to 1 in. thick, slightly burrowed, evenly bedded.....	2	3
		(189	6)
22.	Coal, Lee coal bed, thin vitrain bands, dull to bright attrital matrix.....	1	0
		(190	6)
23.	Shale, dark-gray to black, carbonaceous, abundant slickensided surfaces.....	0	1
		(190	7)
24.	Coal, impure.....	0	1
		(190	8)

Unit Number	Description	Thickness (Depth) ft	in.
25.	Underclay, medium-gray, mottled brownish-gray, silty, abundant rootlets; base sharp.....	0	9
		(191	5)
	Lee Formation Middlesboro Member		
26.	Sandstone, medium-light-gray, mottled brownish-gray, fine-grained, micaceous, petroliferous, contains 65 percent quartz, scattered dark mineral grains; base grades.....	1	8
		(193	1)
27.	Sandstone, very light gray, very fine to fine-grained, contains 90 percent quartz, petroliferous in top 9 ft 4 in. and from 23 ft 10 in. to 24 ft 9 in. below top, few scattered dark mineral grains, few dark-gray shale clasts 14 ft 3 in. below top, few quartz granules in basal 3 ft, scattered stylolites, massive, base grades.....	26	7
		(219	8)
28.	Sandstone, very light gray, mottled brownish-gray, fine-grained, petroliferous, contains 90 percent quartz, scattered well rounded white quartz pebbles and granules, scattered stylolites, thick-bedded to massive; base grades.....	17	3
		(236	11)
29.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles in top 1 ft 3 in., few dark-gray shale laminae from 12 ft 2 in. to 12 ft 6 in. below top, scattered stylolites, thick-bedded to massive; base sharp.....	24	3
		(261	2)
30.	Coal clast, thin vitrain bands, dull attrital matrix.....	0	2
		(261	4)
31.	Sandstone, very light gray, petroliferous and mottled brownish-gray, fine- to medium-grained, contains 90 percent quartz, abundant siderite clasts in basal 2 in., scattered coal laminae from 2 ft 6 in. to 5 ft 6 in. above base, massive; base sharp.....	9	9
		(271	1)
32.	Sandstone, very light gray, very fine to fine-grained, contains 90 percent quartz, few scattered dark mineral grains, scattered medium-dark-gray siltstone laminae, massive; base sharp.....	9	9
		(280	10)
33.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few scattered dark mineral grains, petroliferous in basal 1 ft 3 in.; base sharp.....	16	11
		(297	9)

Unit Number	Description	Thickness (Depth) ft	in.
34.	Shale, dark-gray, carbonaceous, few plant fragments, scattered siderite nodules, evenly bedded, fissile	5	8
		(303	5)
35.	Coal, Castle (?) coal bed (thickness- 3 ft)		
	35a. Coal, mostly bright attritus	1	1
		(304	6)
	35b. Pyrite, lenticular	0	0.125
		(304	6.125)
	35c. Coal, thin to thick vitrain bands, bright attrital matrix, discontinuous pyrite laminae 5 in. below top	0	7.75
		(305	1.875)
	35d. Coal, mostly bright attritus	0	5.125
		(305	7)
	35e. Coal, thin to thick vitrain bands, bright attrital matrix, 0.125 in. pyrite lens 5 in. below top	0	10
		(306	5)
36.	Underclay, medium- to dark-gray, abundant rootlets; base grades	1	5
		(307	10)
37.	Sandstone, light-gray, very fine to fine-grained, silty, micaceous, contains 45 percent quartz, thick-bedded; base grades	1	9
		(309	7)
38.	Shale, medium-gray, poorly bedded, poor fissility; base grades	0	4
		(309	11)
39.	Sandstone, medium-light-gray, medium-grained, micaceous, contains 55 percent quartz, abundant dark and light mineral grains, massive; base sharp	5	1
		(315	0)
40.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent dark-gray siltstone laminae, thin-bedded; base sharp	5	4
		(320	4)
41.	Shale, dark-gray, carbonaceous, evenly bedded, fissile; base grades abruptly	1	4
		(321	8)
42.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent medium-gray siltstone laminae, thin-bedded; base grades	1	4
		(323	0)

Unit Number	Description	Thickness (Depth) ft	in.
43.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, massive; base sharp.....	7	11
		(323	11)
44.	Underclay, medium-gray, abundant rootlets and root slicks.....	3	0
		(333	11)
45.	Siltstone, light- to medium-gray, sandy, contains 30 percent light-gray sandstone laminae, thin-bedded.....	4	8
		(338	7)
46.	Sandstone, light-gray, medium-grained, contains 55 percent quartz, small medium-dark-gray shale clast 2 ft 10 in. above base, thick-bedded to massive; base grades.....	9	4
		(347	11)
47.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, petroliferous in top 4 ft, scattered well rounded white quartz pebbles in basal 15 ft 9 in., scattered dark mineral grains, thick-bedded to massive; base grades abruptly.....	19	9
		(367	8)
48.	Sandstone, white to very light gray, medium-grained, contains 90 percent quartz, petroliferous in top 2 ft 6 in., few scattered dark mineral grains, few stylolites, massive; base grades.....	15	5
		(383	1)
49.	Sandstone, white, medium- to coarse-grained, contains 90 percent quartz, petroliferous from 2 ft 6 in. to 3 ft 6 in. below top, conglomeratic with abundant well rounded white quartz pebbles up to 0.5 in. in diameter, few stylolites, massive, base sharp.....	12	2
		(395	3)
50.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, 5 percent medium-gray siltstone laminae, abundant dark mineral grains, few small medium-dark-gray shale clasts in basal 1 ft 6 in., cross-laminated, thin- to thick-bedded.....	17	7
		(412	10)
51.	Coal, Sewell (?) coal bed, bright attritus, few thin to thick vitrain bands.....	0	4
		(413	2)
52.	Underclay, medium-gray, abundant rootlets; base grades.....	2	5
		(415	7)

Unit Number	Description	Thickness (Depth) ft	in.
53.	Sandstone, light- to medium-light-gray, very fine to fine-grained, silty in top 6 in., micaceous, contains 60 percent quartz, abundant dark and light mineral grains, thin-bedded; base grades abruptly..	2	5
		(418	0)
54.	Sandstone, medium-light-gray, mottled brownish gray and petroliferous in top 2 ft 6 in., micaceous, contains 60 percent quartz, thick-bedded to massive; base grades abruptly.....	3	7
		(421	7)
55.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 55 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base sharp.....	1	1
		(422	8)
56.	Siltstone, medium-gray, finely micaceous, few rootlets, faintly bedded; base grades.....	1	6
		(424	2)
57.	Underclay, medium-gray, abundant rootlets and root slicks; base grades.....	4	1
		(428	3)
58.	Shale, medium-gray, evenly bedded, fair fissility; base sharp.....	1	1
		(429	4)
59.	Sandstone, light-gray, very fine to fine-grained, very micaceous, contains 45 percent quartz; base sharp.....	1	5
		(430	9)
60.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, massive; base grades abruptly.....	2	2
		(432	11)
61.	Shale, medium-gray, evenly bedded, fissile.....	0	2.5
		(433	1.5)
62.	Sandstone, light-gray, fine-grained, very micaceous, contains 60 percent quartz, thin- to thick-bedded; base grades.....	7	11.5
		(441	1)
63.	Sandstone, very light to light-gray, medium-grained, micaceous, contains 65 percent quartz, 5 percent medium-gray siltstone laminae in basal 1 ft 5 in., scattered dark and light mineral grains, few small medium-dark-gray shale clasts from 2 ft 4 in. to 2 ft 7 in. below top, thick-bedded to massive; base sharp.....	5	7
		(446	8)
64.	Shale, medium-gray, silty, contains 10 percent light-gray siltstone laminae, evenly bedded, fissile; base grades abruptly...	8	11
		(455	7)

Unit Number	Description	Thickness (Depth) ft	in.
65.	Sandstone, light- to medium-light-gray, very fine grained, micaceous, contains 40 percent quartz, 20 percent medium-gray silty shale laminae, thin-bedded; base grades.....	2	0
		(457	7)
66.	Shale, medium-gray, silty, finely micaceous, contains 10 percent light-gray siltstone laminae, evenly bedded, fissile; base grades.....	4	4
		(461	11)
67.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-gray silty shale laminae and beds, cross-laminated in basal 1 ft, thin-bedded; base sharp and uneven.....	3	8
		(465	7)
68.	Shale, medium-dark-gray, silty, contains 20 percent light-gray very fine grained sandstone beds, evenly bedded, fair fissility; base grades.....	0	10
		(466	5)
69.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 50 percent quartz, 5 percent medium-gray siltstone laminae, few medium-dark-gray shale clasts from 1 ft 4 in. to 2 ft 2 in. below top, thin- to thick bedded; base grades.....	6	3
		(472	8)
70.	Sandstone, light-gray, fine- to medium-grained, very micaceous, contains 60 percent quartz, 10 percent white weathered feldspar, scattered dark mineral grains, thick-bedded to massive; base sharp.....	3	0
		(475	8)
71.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 55 percent quartz, abundant dark and light mineral grains, thick-bedded to massive; base grades abruptly.....	2	3
		(477	11)
72.	Sandstone, light-gray, medium-grained, very micaceous, contains 65 percent quartz, 5 percent medium-gray siltstone laminae; scattered dark, light, and green mineral grains; thick-bedded; base sharp.....	4	5
		(482	4)
73.	Sandstone, light-gray, medium- to coarse-grained, micaceous; scattered dark, light, and green mineral grains; contains 65 percent quartz, slightly petroliferous in basal 4 ft 1 in., scattered small angular dark-gray shale clasts in basal 10 in., massive; base sharp.....	10	1
		(492	5)

Unit Number	Description	Thickness (Depth) ft	in.
74.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base sharp.....	0	1.5
		(492	6.5)
75.	Sandstone, light-gray, medium- to coarse-grained, contains 65 percent quartz, 15 percent feldspar; scattered dark, light, and green mineral grains; massive.....	3	8.5
		(496	3)
76.	Sandstone, medium-light-gray, fine- to medium-grained, very micaceous, contains 50 percent quartz, thin- to thick-bedded; base sharp.....	2	7
		(498	10)
77.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 15 percent feldspar; scattered dark, light, and green mineral grains; thick-bedded to massive; base sharp.....	7	5
		(506	3)
78.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, petroliferous from 10 in. to 2 ft 3 in., below top, well sorted, few stylolites, thick-bedded to massive; base grades.....	15	0
		(521	3)
79.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles in basal 16 ft 5 in., few stylolites, massive; base grades.....	19	5
		(540	8)
80.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles from 0.25 in. to 0.5 in. in diameter, scattered siderite clasts up to 2 in. in diameter in basal 6 ft 6 in., scattered stylolites, massive; base sharp.....	30	4
		(571	0)
81.	Shale, medium-dark-gray, silty, contains 5 percent medium-gray siltstone laminae, evenly bedded, fissile; base grades.....	1	11
		(572	11)
82.	Shale, dark-gray, scattered siderite nodules up to 0.5 in. in diameter, evenly bedded, fair fissility; base grades.....	3	11
		(576	10)
83.	Shale, black, carbonaceous, few plant fragments, evenly bedded, fissile; base grades.....	6	1
		(582	11)

Unit Number	Description	Thickness (Depth) ft	in.
84.	Shale, black, carbonaceous, contains 20 percent coal laminae.....	0	3
		(583	2)
85.	Coal, thin vitrain bands, bright attrital matrix.....	0	2
		(583	4)
86.	Shale, black, carbonaceous, contains scattered coal laminae.....	0	1
		(583	5)
87.	Underclay, medium-dark-gray, very carbonaceous and plastic from 8 in. to 1 ft 2 in. above base, abundant rootlets and root slicks; base grades.....	3	2
		(586	7)
88.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 40 percent medium-dark-gray siltstone laminae and beds up to 4 in. thick, cross-laminated; base grades.....	2	6
		(589	1)
89.	Sandstone, light-gray, fine-grained, micaceous, contains 45 percent quartz, thin- to thick-bedded; base grades.....	2	1
		(591	2)
90.	Sandstone, light-gray, very fine grained, silty, micaceous, contains 45 percent quartz, 30 percent medium-gray siltstone laminae; base sharp.....	1	7
		(592	9)
91.	Sandstone, light- to medium-light-gray, very fine to medium-grained, contains 45 percent quartz, 20 percent medium-gray siltstone laminae in basal 1 ft 8 in., thin- to thick-bedded; base grades.....	3	2
		(595	11)
92.	Shale, medium-dark- to dark-gray, evenly bedded, fissile; base grades.....	3	7
		(599	6)
93.	Shale, medium-dark- to dark-gray, silty, contains 20 percent medium-light-gray siltstone laminae, evenly bedded, fissle; base grades.....	1	6
		(601	0)
94.	Shale, dark-gray, carbonaceous, evenly bedded, fissle.....	9	0
		(610	0)
95.	Shale, black, carbonaceous, contains scattered plant fragments, evenly bedded, fissile; base grades.....	2	4
		(612	4)

Unit Number	Description	Thickness (Depth) ft	in.
96.	Coal, impure, mostly dull attritus.....	0	1
		(612	5)
97.	Underclay, medium-dark-gray, silty, carbonaceous in top 5 in., abundant rootlets; base grades.....	1	4
		(613	9)
98.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 55 percent quartz, few dark-gray carbonaceous shale laminae, thin-bedded; base grades abruptly.....	1	11
		(615	8)
99.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, petroliferous in top 10 ft, scattered well rounded white quartz pebbles from 0.25 in. to 0.5 in. in diameter, few scattered dark mineral grains, abundant well rounded white quartz pebbles, scattered siderite clasts and few coal clasts in basal 6 ft, massive; base sharp.....	22	0
		(637	8)
100.	Shale, dark-gray to black, very carbonaceous, contains abundant coal laminae; base sharp.....	0	4
		(638	0)
101.	Sandstone, medium-gray, very fine to fine-grained, silty, contains 40 percent quartz, abundant rootlets, thin and irregularly bedded; base grades.....	3	6
		(641	6)
102.	Siltstone, medium-dark-gray, contains 25 percent light-gray very fine grained sandstone laminae, abundant rootlets; base grades.....	2	9
		(644	3)
103.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 20 percent dark-gray shale laminae, few rootlets, thin-bedded; base grades.....	10	3
		(654	6)
104.	Sandstone, light- to medium-light-gray, very fine grained, micaceous, contains 45 percent quartz, 5 percent discontinuous dark-gray shale laminae, thin- to thick-bedded; base grades.....	4	10
		(659	4)
105.	Sandstone, light- to medium-light-gray, very fine grained, contains 45 percent quartz, 20 percent dark-gray shale laminae and beds, few siderite beds up to 0.5 in. thick, few small-scale faults, slightly burrowed, flaser-bedded; base grades.....	30	2
		(689	6)

Unit Number	Description	Thickness (Depth) ft	in.
106.	Shale, dark-gray, silty, contains 20 percent light-gray siltstone laminae in top 9 in., few siderite nodules and slickensided surfaces from 4 ft 5 in., to 5 ft 3 in. below top, evenly bedded, fissile; base sharp.....	10	10
		(700	4)
107.	Coal, Cove Creek coal bed (thickness- 1 ft 7 in.)		
	107a. Coal, mostly bright attritus.....	0	6
		(700	10)
	107b. Shale, dark-gray.....	0	3
		(701	1)
	107c. Coal, impure.....	0	10
		(701	11)
108.	Underclay, medium-dark-gray, abundant rootlets and root slicks; base grades.....	1	2
		(703	1)
109.	Siltstone, medium-dark- to dark-gray, micaceous, few siderite nodules, few slickenslided surfaces, brecciated in part, thin-bedded; base grades.....	4	9
		(707	10)
110.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 10 percent dark-gray carbonaceous siltstone laminae, thin-bedded; base grades.....	1	0
		(708	10)
111.	Siltstone, medium-dark- to dark-gray, micaceous, contains few light-gray very fine grained sandstone laminae, few plant fragments, few slickensided surfaces, thin-bedded, poor fissility; base grades.....	11	8
		(720	6)
112.	Siltstone, medium-dark- to dark-gray, contains 15 percent light-gray very fine grained sandstone laminae, few small-scale faults with displacements up to 0.5 in., 0.25 in. thick siderite bed at base, cross-laminated; base sharp.....	13	3
		(723	9)
113.	Sandstone, medium-light- to medium-gray, very fine grained, micaceous, contains 40 percent quartz, 10 percent dark-gray carbonaceous siltstone and shale laminae and beds, brecciated in top 1 ft 3 in., thin-bedded; base grades.....	4	1
		(727	10)

Unit Number	Description	Thickness (Depth) ft	in.
114.	Sandstone, medium-light- to medium-gray, fine-grained, micaceous, contains 40 percent quartz, 40 percent dark-gray silty shale laminae, few small-scale faults 2 ft 1 in. below top, thin- to thick-bedded	2	7
		(730	5)
115.	Shale, medium-dark-gray, silty, evenly bedded, poor fissility; base grades	0	3
		(730	8)
116.	Siltstone, medium-dark- to dark-gray, micaceous, contains 40 percent light-gray very fine grained sandstone laminae and beds, thin and evenly bedded; base sharp	1	8
		(732	4)
117.	Shale, dark-gray, silty, faintly bedded, poor fissility; base sharp	0	2
		(732	6)
118.	Sandstone, medium-light-gray, very fine grained, contains 45 percent quartz, 20 percent dark-gray silty shale laminae, thin-bedded; base sharp and uneven	0	4
		(732	10)
119.	Shale, dark-gray, poor fissility; base sharp	0	2
		(733	0)
120.	Sandstone, medium-light- to medium-gray, fine-grained, micaceous, contains 45 percent quartz, 40 percent dark-gray shale laminae and beds up to 1 in. thick, few slickensided fractures, thin and evenly bedded; base grades	4	6
		(737	6)
121.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 15 percent dark-gray shale laminae, cross-laminated, thin-bedded; base sharp	3	8
		(741	2)
122.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 10 percent dark-gray carbonaceous siltstone and shale laminae, scattered angular dark-gray shale and siderite clasts in basal 3 ft 5 in.; base sharp and uneven	7	4
		(748	6)
123.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 40 percent dark-gray shale laminae; base sharp and irregular	0	6
		(749	0)

Unit Number	Description	Thickness (Depth) ft	in.
124.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, scattered dark-gray shale clasts from 5 ft 5 in. to 5 ft 10 in. below top, scattered siderite clasts 10 ft 4 in. and 14 ft 3 in. below top, thick-bedded to massive; base sharp.....	15	5
		(764	5)
125.	Sandstone, light- to medium-light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, few dark-gray carbonaceous shale laminae 2 ft 8 in. below top, thick-bedded to massive; base grades.....	5	2
		(769	7)
126.	Sandstone, light- to medium-light-gray, fine- to medium-grained, sparsely micaceous, contains 65 percent quartz, scattered dark mineral grains, thick-bedded to massive; base sharp.....	4	2
		(773	9)
127.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, 30 percent dark-gray shale laminae in top 4 in; base grades.....	1	1
		(774	10)
128.	Sandstone, light- to medium-light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, 10 percent dark-gray shale laminae, thin-bedded; base grades.....	1	2
		(776	0)
129.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 50 percent medium-gray siltstone laminae, petroliferous from 5 ft 6 in. to 5 ft 9 in., below top, scattered feldspar and dark mineral grains, thin- to thick-bedded; base grades.....	13	0
		(789	0)
130.	Sandstone, light-gray, fine- to medium-grained, contains 65 percent quartz, massive; base grades.....	2	3
		(791	3)
131.	Sandstone, medium-light-gray, fine-grained, contains 65 percent quartz, 10 percent dark-gray silty shale laminae, thin- to thick-bedded.....	3	7
		(794	10)
132.	Sandstone, very light to light-gray, very fine to fine-grained, contains 65 percent quartz, few scattered dark mineral grains, few quartz granules in basal 16 ft.....	30	2
		(825	0)

BOTTOM OF HOLE
TOTAL DEPTH 825 ft

GEOPHYSICAL LOG

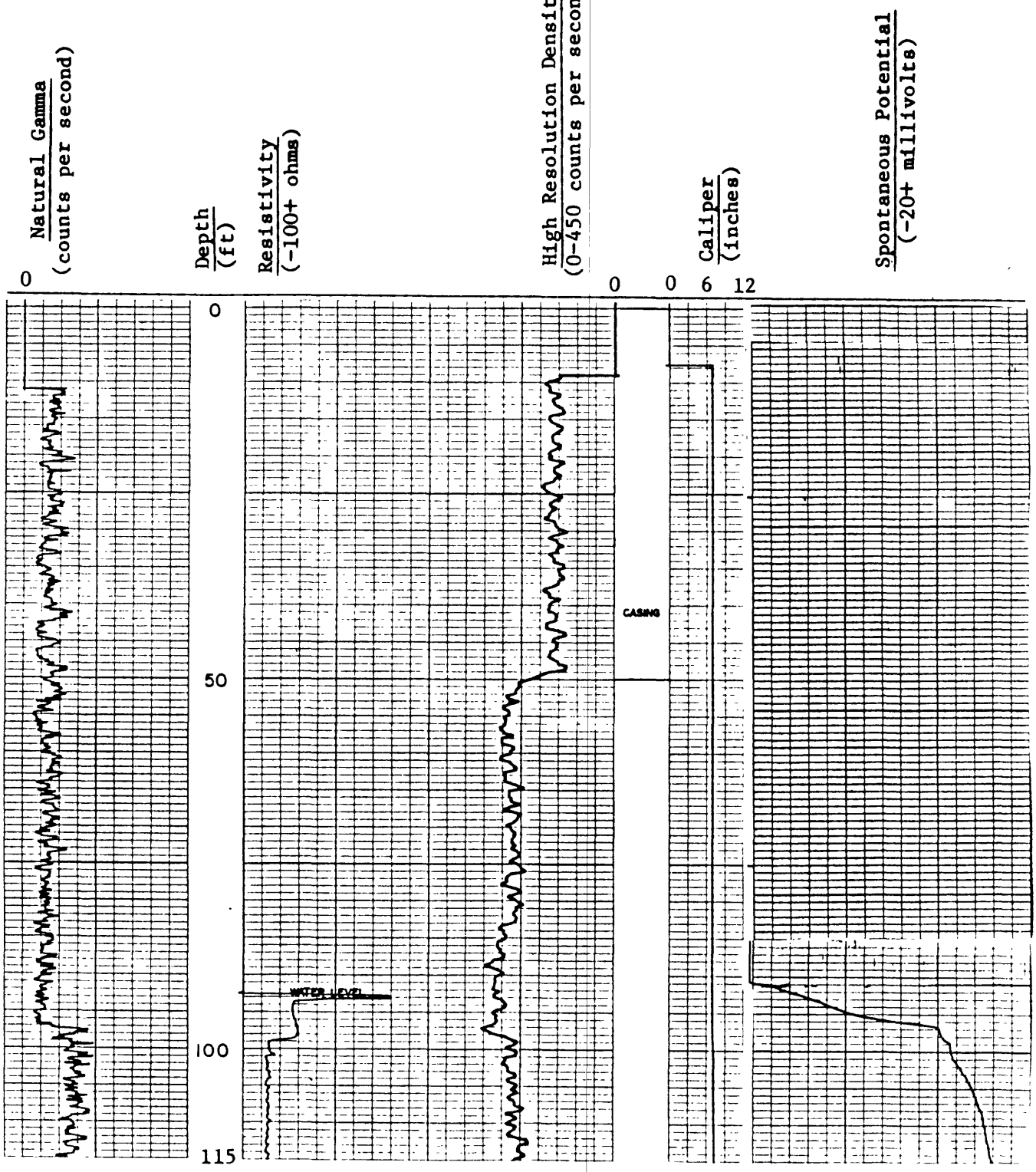
Corehole: SW-5 Date: 1/11/83 State: Virginia County: Wise

Quadrangle: Jenkins East, Va.-Ky. Latitude: 37°08'47"N Longitude: 82°37'26"W

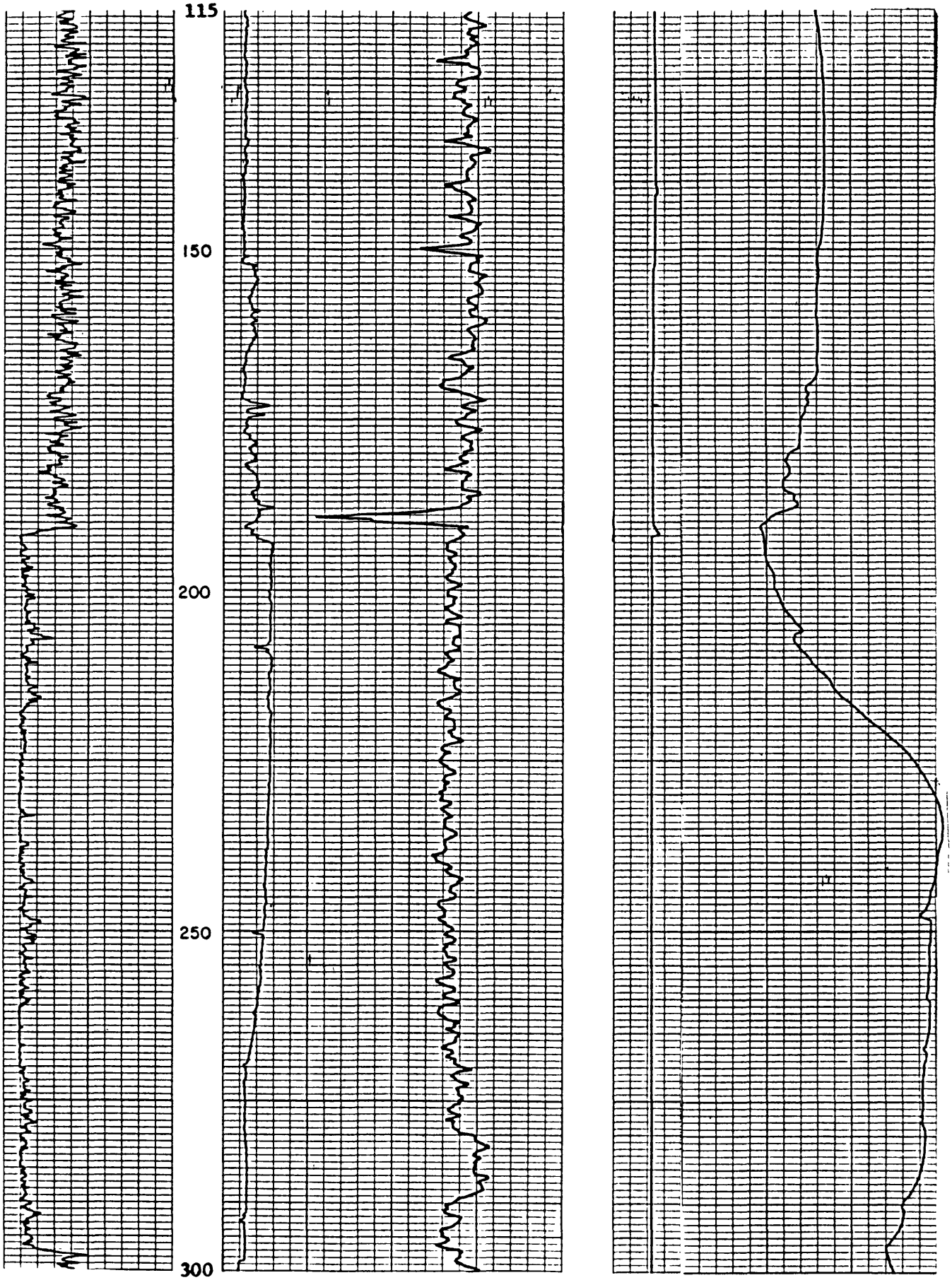
Altitude: 1,867 ft Logged Depth 825 ft Drilled Depth 825 ft

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

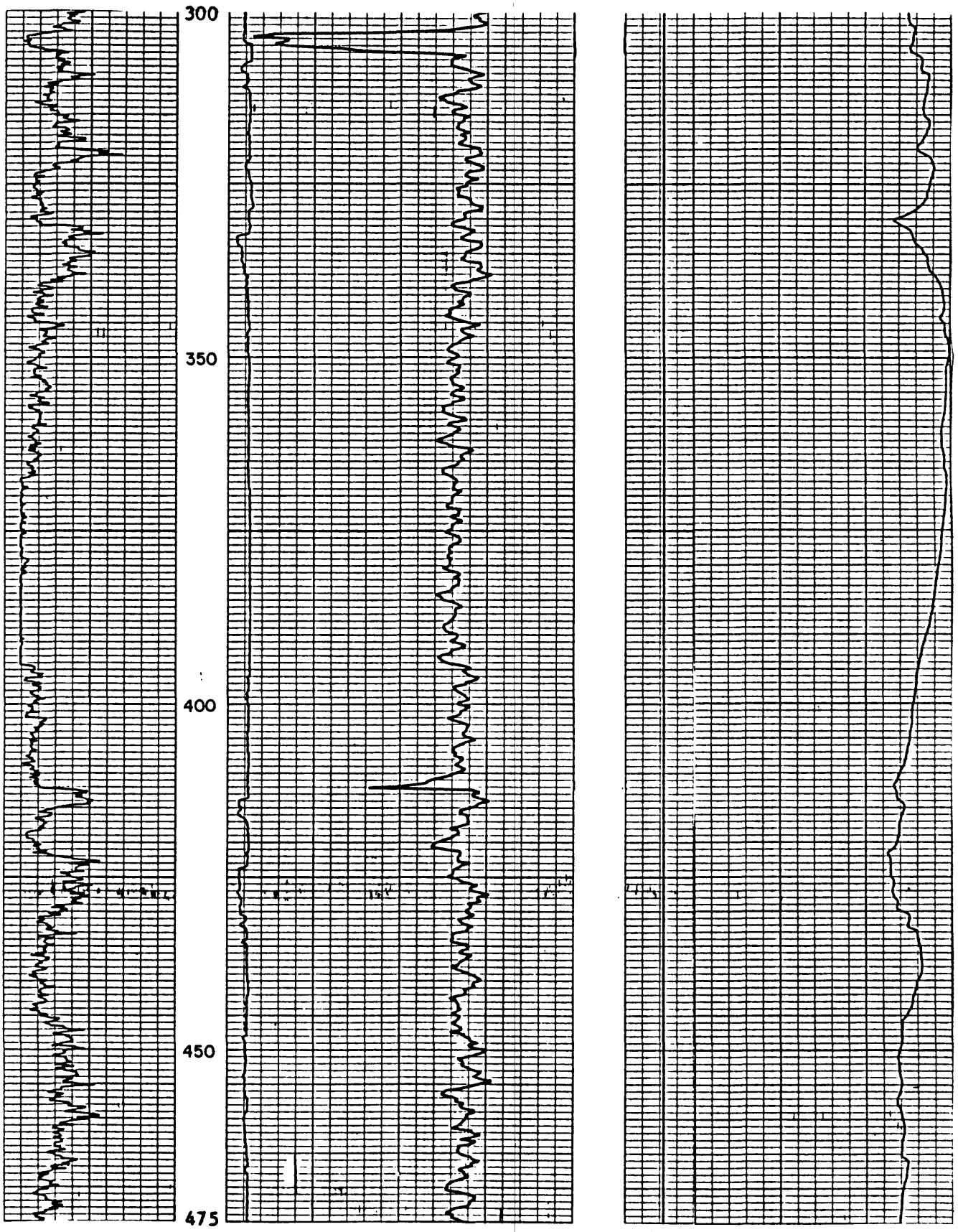
High Resolution Density Time Constant: 1



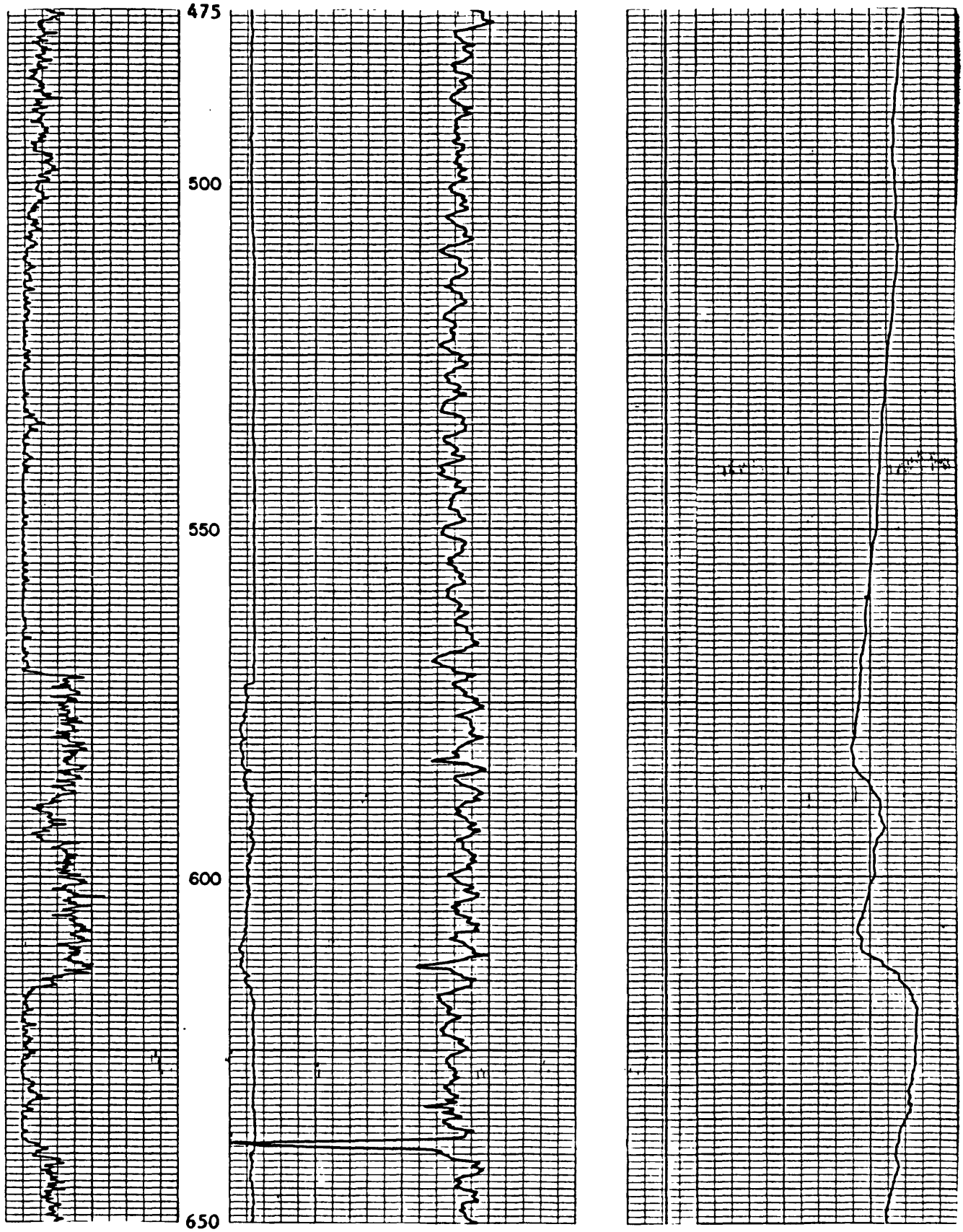
Corehole: SW-5 continued



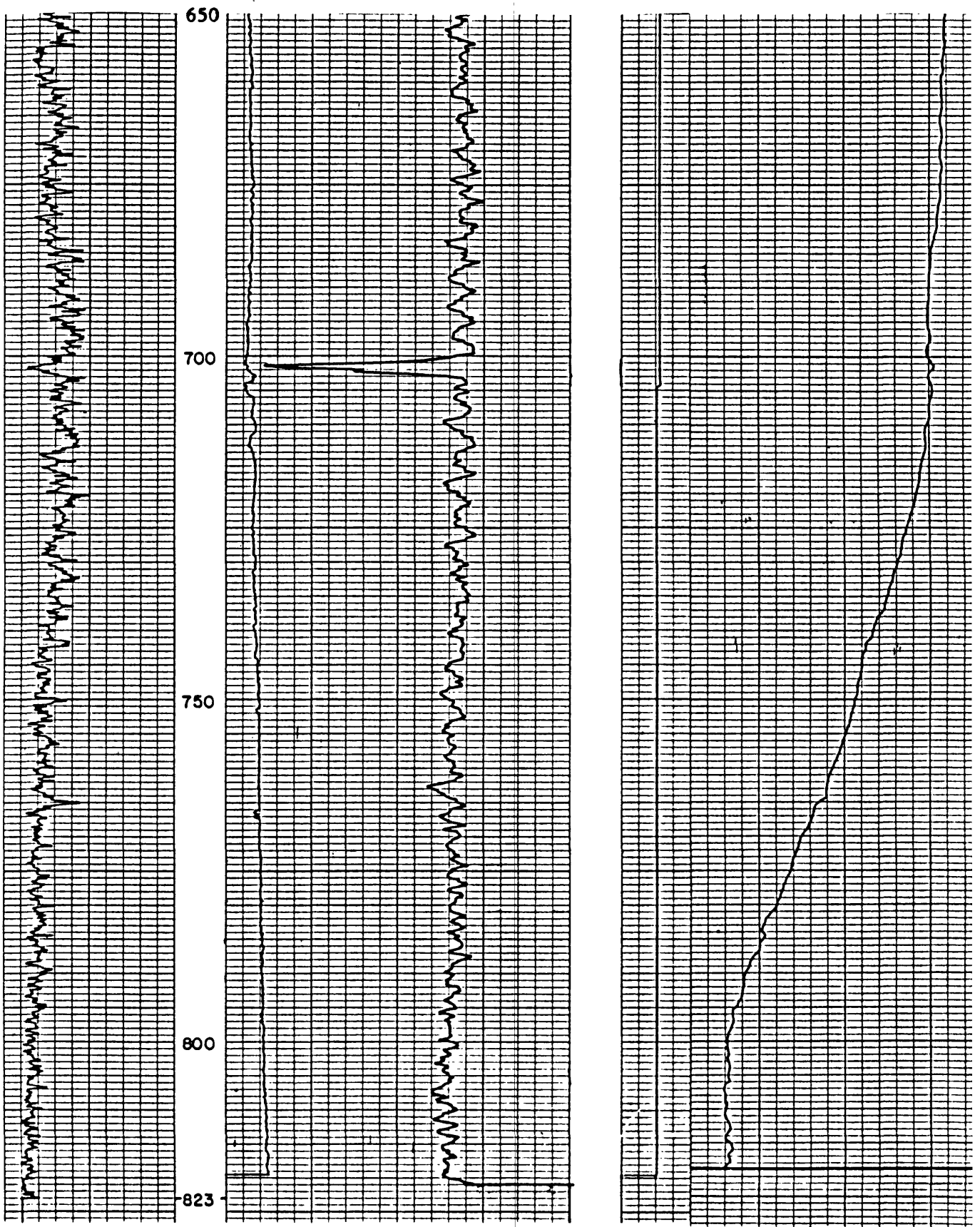
Corehole: SW-5 continued



Corehole: SW-5 continued

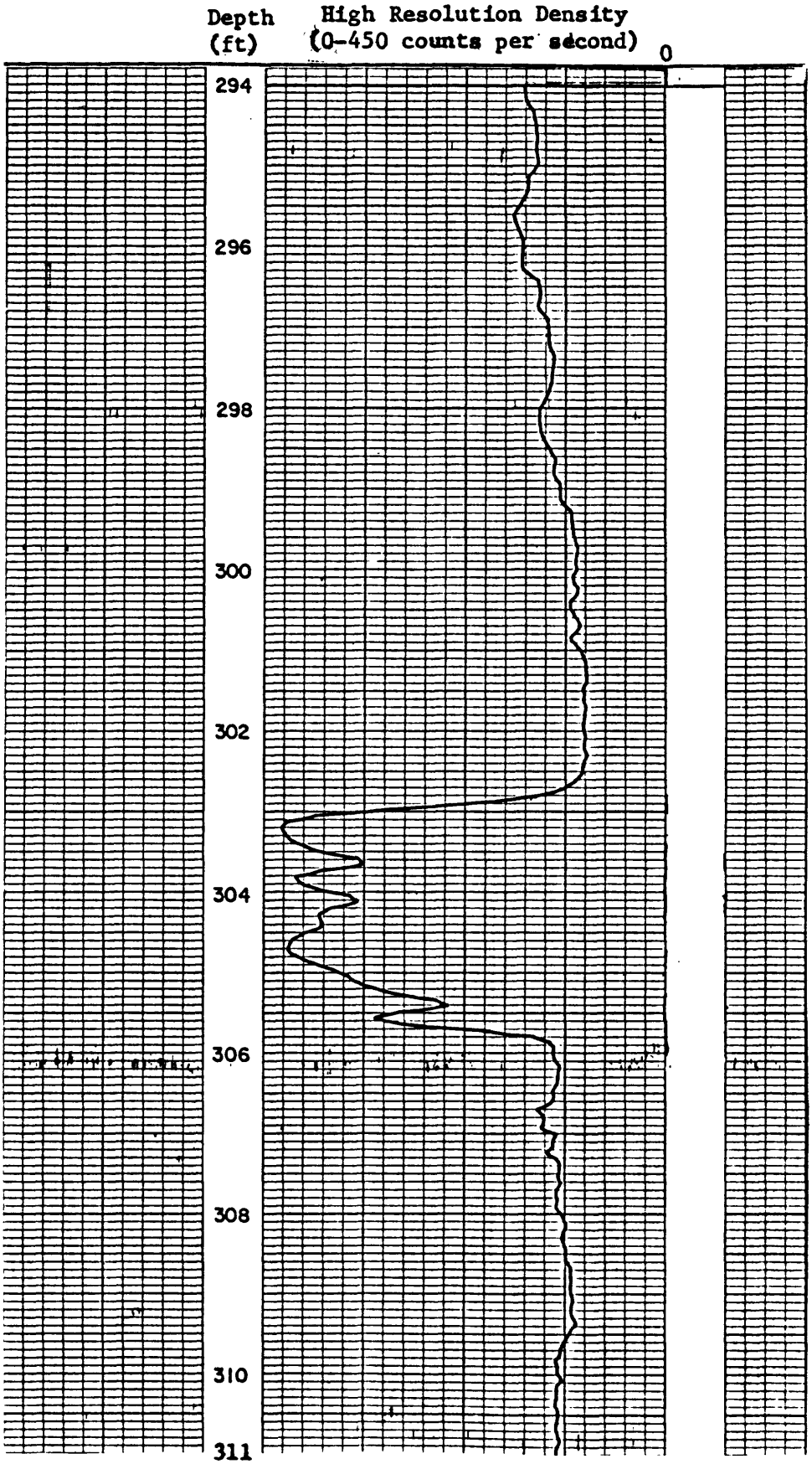


Corehole: SW-5 continued

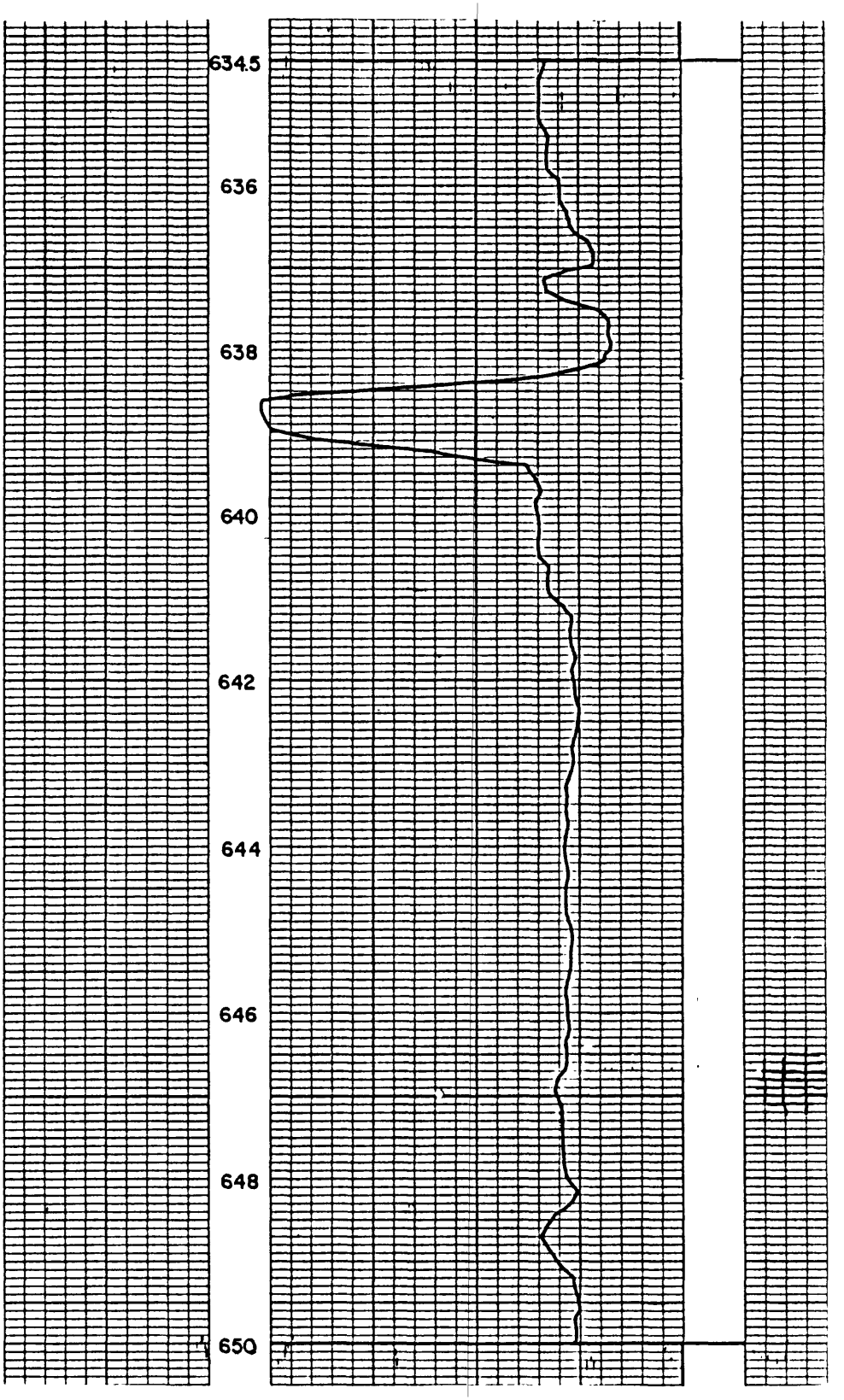


DETAIL LOG

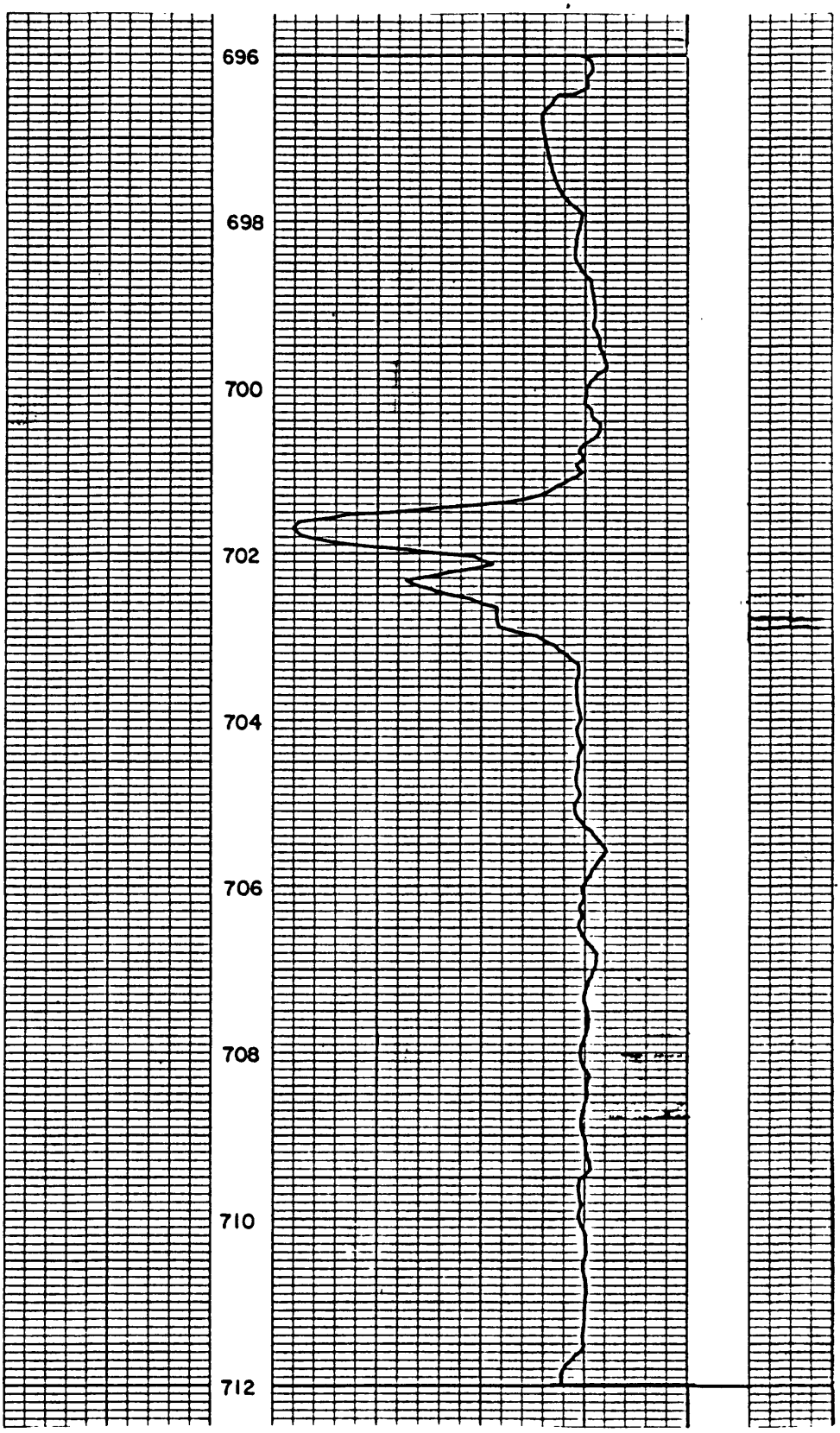
Corehole: SW-5 Logging Speed: 5 ft/min Time Constant: 1



Corehole: SW-5 continued



Corehole: SW-5 continued



Corehole SW-6

Location: Wise County; Wise, Va., 7.5 minute quadrangle; on Burns Creek on the north side of Stone Mountain. Accessible by unimproved road extending from State Route 706 at approximately 0.5 mi south of Tacoma, Va.

Coordinates: Latitude 36°15'06"N Longitude 82°32'14"W

Altitude: 2,240 ft Drilled depth: 600 ft

Dip of strata: Ranges from 10° to 14° and averages 12° throughout corehole.

Date drilled: November 12, 1982 to November 29, 1982

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

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER PENNSYLVANIAN SERIES Lee Formation Middlesboro Member		
1.	Soil and weathered rock (casing set - no core recovered).....	15	0
		(15	0)
2.	Sandstone, weathered brownish-gray, fine- to medium-grained, contains 90 percent quartz, thick-bedded to massive; base grades.....	16	8
		(31	8)
3.	Sandstone, white to very light gray, weathered brownish-gray in top 8 in., medium- to coarse-grained, contains 90 percent quartz, scattered quartz pebbles and granules, abundant coal laminae and clasts from 1 ft 3 in. to 2 ft 7 in. above base, thick-bedded to massive; base grades.....	20	8
		(52	4)
4.	Sandstone, white to very light gray, fine- to medium-grained, contains 90 percent quartz, few dark-gray silty shale laminae, few stylolites, thick-bedded to massive; base grades.....	19	4
		(71	8)
5.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded quartz pebbles, coal and siderite clasts in basal 3 ft, thick-bedded to massive; base sharp.....	17	4
		(89	0)
6.	Shale, medium-gray, silty, evenly bedded, fair fissility; base grades.....	1	1
		(90	1)

Unit Number	Description	Thickness (Depth) ft	in.
7.	Sandstone, light- to medium-light-gray, very fine grained, silty, contains 45 percent quartz, 30 percent medium-dark-gray silty shale laminae; base grades.....	0	5
		(90	6)
8.	Shale, medium-dark-gray, silty, contains 10 percent medium-light-gray siltstone laminae, evenly bedded; base sharp.....	1	7
		(92	1)
9.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, thin-bedded; base grades.....	0	4
		(92	5)
10.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine-grained silty sandstone laminae; base grades.....	2	4
		(94	9)
11.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent medium-gray siltstone laminae.....	0	7
		(95	4)
12.	Shale, medium-dark-gray, silty, contains 10 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded; base grades.....	4	10
		(100	2)
13.	Sandstone, light-gray, fine-grained, micaceous, contains 55 percent quartz, thick-bedded; base sharp.....	0	9
		(100	11)
14.	Shale, medium-dark-gray, silty, contains 10 percent light-gray siltstone laminae; base sharp.....	0	9
		(101	8)
15.	Sandstone, light-gray, fine-grained, micaceous, contains 65 percent quartz, 5 percent medium-light-gray siltstone laminae, abundant large angular medium-dark-gray shale clasts in basal 3 ft 9 in., thin- to thick-bedded; base sharp.....	17	5
		(119	1)
16.	Siltstone, medium-dark-gray, contains 10 percent light-gray very fine grained sandstone laminae and beds, thin and evenly bedded.....	0	6
		(119	7)
17.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, 5 percent medium-gray siltstone laminae, scattered siderite clasts 1 ft 10 in. above base, crossbedded, thick-bedded to massive; base sharp.....	6	4
		(125	11)

Unit Number	Description	Thickness (Depth) ft	in.
18.	Shale, dark-gray, carbonaceous, silty, contains 5 percent light-gray very fine grained sandstone laminae, fissile; base sharp.....	5	1
		(131	0)
19.	Sandstone, very light gray to white, coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded quartz pebbles up to 0.25 in. in diameter, base grades.....	7	1
		(138	1)
20.	Sandstone, very light gray, medium- to coarse-grained, sparsely micaceous, contains 65 percent quartz, 5 percent dark-gray silty shale laminae, very few scattered well rounded white quartz pebbles 3 ft 6 in. above base, scattered dark mineral grains, crossbedded, thick-bedded to massive; base sharp.....	9	6
		(147	7)
21.	Conglomerate, white to very light gray, contains well rounded white quartz pebbles mostly 0.5 in. in diameter, medium-grained quartzose sandstone matrix; base sharp.....	0	8
		(148	3)
22.	Sandstone, white to very light gray, fine- to medium-grained, contains 90 percent quartz, scattered dark mineral grains, scattered stylolites, thick-bedded to massive; base sharp.....	8	9
		(157	0)
23.	Sandstone, medium-gray, fine- to medium-grained, micaceous, contains 45 percent quartz, abundant plant fragments and coal clasts; base sharp.....	0	6
		(157	6)
24.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 50 percent quartz, contorted bedding near base; base grades.....	1	9.5
		(159	3.5)
25.	Sandstone, light-gray, fine- to medium-grained, contains 90 percent quartz, abundant well rounded white quartz pebbles, scattered coal and siderite clasts at base; base sharp	1	7.5
		(160	11)
26.	Sandstone, light-gray, fine-grained, micaceous, contains 60 percent quartz, 10 percent dark-gray shale laminae from 10 in. to 1 ft 6 in. below top; base sharp.....	5	4
		(166	3)
27.	Conglomerate, very light gray, contains well rounded white quartz pebbles up to 1 in. in diameter and well rounded siderite clasts, coarse-grained quartzose sandstone matrix; base grades.....	0	8
		(166	11)

Unit Number	Description	Thickness (Depth) ft	in.
28.	Sandstone, very light gray, mottled brownish-gray in top 6 in., fine-grained, contains 90 percent quartz, 5 percent dark-gray silty shale laminae, conglomeratic with scattered well rounded white quartz pebbles mostly 0.5 in. in diameter; base grades.....	10	11
		(177	10)
29.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, very conglomeratic with abundant well rounded white quartz pebbles up to 1 in. in diameter, few scattered dark mineral grains; base grades.....	3	1
		(180	11)
30.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few dark mineral grains, few well rounded white quartz pebbles, few stylolites; base grades.....	1	10
		(182	9)
31.	Conglomerate, very light gray, contains well rounded white quartz pebbles up to 1 in. in diameter, few scattered siderite and coal clasts, medium-grained quartzose sandstone matrix; base grades.....	11	8
		(194	5)
32.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few scattered dark mineral grains, few well rounded white quartz pebbles, few stylolites; base sharp and uneven.....	7	9
		(202	2)
33.	Shale, medium-dark-gray, slightly silty, fissile; base sharp.....	0	5
		(202	7)
34.	Sandstone, light-gray, medium-grained, contains 90 percent quartz, abundant angular shale clasts, base sharp and irregular...	0	2.5
		(202	9.5)
	Pocahontas Formation		
35.	Siltstone, medium-gray, sandy in basal 1 ft, argillaceous in top 1 ft, contains 10 percent medium-dark-gray shale laminae, normally graded, cross-laminated; base grades.....	4	4.5
		(207	2)
36.	Sandstone, medium-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent medium-gray siltstone laminae in basal 1 ft 6 in., abundant dark mineral grains, thin- to thick-bedded; base sharp.....	3	2.5
		(210	4.5)

Unit Number	Description	Thickness (Depth) ft	in.
37.	Shale, medium-dark-gray, slightly silty, contains 20 percent light-gray very fine grained silty sandstone laminae in basal 8 in., cross-laminated, fissile.....	3	7.5
		(214	0)
38.	Sandstone, medium-gray, mottled brownish-gray at base, very fine to fine-grained, micaceous, contains 45 percent quartz, 5 percent dark-gray silty shale laminae in basal 8 in., thin- to thick-bedded; base sharp and uneven.....	3	2
		(217	2)
39.	Shale, medium-dark-gray, poor fissility; base grades.....	1	4
		(218	6)
40.	Shale, medium-gray, slightly silty in top 1 ft, few rootlets, poor fissility; base grades.....	5	1
		(223	7)
41.	Siltstone, medium-light-gray, finely micaceous, contains 10 percent dark-gray shale laminae in basal 6 ft, some contorted bedding, non-fissile; base sharp.....	12	2
		(235	9)
42.	Shale, medium-dark- to dark-gray contains 10 percent medium-light-gray siltstone laminae, fair fissility; base sharp.....	0	4
		(236	1)
43.	Siderite, brownish-gray.....	0	2
		(236	3)
44.	Shale, medium-dark- to dark-gray, slightly silty, fair fissility; base sharp.....	0	4
		(236	7)
45.	Sandstone, light- to medium-light-gray, very fine grained, micaceous, silty, contains 50 percent quartz, 30 percent dark-gray shale laminae and beds up to 2 in. thick, few plant fragments, irregularly bedded; base grades.....	15	6
		(252	1)
46.	Shale, medium-dark- to dark-gray, poor fissility.....	0	10.5
		(252	11.5)
47.	Coal, Pocahontas No. 1 coal bed, mostly bright attritus.....	1	0
		(253	11.5)
48.	Sandstone, medium-light-gray, very fine grained, micaceous, silty, contains 40 percent quartz, 10 percent medium-dark-gray shale laminae in basal 5 in., scattered rootlets; base grades.....	2	2
		(256	1.5)

Unit Number	Description	Thickness (Depth) ft	in.
49.	Sandstone, medium-light-gray, very fine grained, micaceous, contains 65 percent quartz, few scattered rootlets, scattered dark mineral grains, few small-scale slump structures and siderite clasts at base, thin- to thick-bedded; base sharp and irregular	1 (257	1 2.5)
50.	Sandstone, light- to medium-light-gray, very fine grained, contains 65 percent quartz, few medium-gray siltstone laminae, scattered dark mineral grains, few small-scale slump structures, cross-bedded	4 (261	2.5 5)
51.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 65 percent quartz, 10 percent medium-gray siltstone laminae, 40 percent dark-gray shale beds up to 1.5 in. thick in basal 2 ft 11 in., thin- to thick-bedded; base sharp	14 (276	11 4)
52.	Coal, Squire Jim (?) coal bed, mostly bright attritus, includes 2 in. thick shale parting 5 in. above base	1 (277	1 5)
53.	Underclay, medium-dark- to dark-gray, mottled brownish-gray, very silty, finely micaceous, scattered rootlets; base grades	1 (278	3 8)
54.	Sandstone, light- to medium-light-gray, very fine grained, silty, micaceous, contains 50 percent quartz, scattered dark mineral grains; base sharp	3 (281	3 11)
	UPPER MISSISSIPPIAN AND LOWER PENNSYLVANIAN SERIES		
	Bluestone Formation		
	Upper member		
55.	Shale, medium-light- to medium-gray, mottled greenish-gray, contains 20 percent light-greenish-gray very fine grained sandstone laminate and beds in top 10 in., poorly bedded	2 (284	5 4)
56.	Shale, greenish-gray, mottled reddish-gray in top 1.5 in., very silty at base	1 (286	11 3)
57.	Siltstone, medium-light-gray, mottled greenish-gray, calcareous, few limestone nodules; base grades	0 (286	5.5 8.5)

Unit Number	Description	Thickness (Depth) ft	in.
58.	Sandstone, greenish-gray to dark-greenish-gray, very fine grained, micaceous, contains 40 percent quartz, 15 percent siltstone laminae; base sharp.....	2 (288	0.5 9)
59.	Shale, olive-gray, mottled reddish-gray, slightly silty, few slickensided surfaces, poor fissility, base sharp and uneven.....	8 (296	0 9)
60.	Shale, dark-greenish-gray, very silty; base sharp and uneven.....	0 (297	8 5)
61.	Shale, dark-greenish-gray, mottled reddish-gray from 2 ft 3 in. to 3 ft 6 in. above base, slightly silty in top 2 ft, contains 30 percent light-gray very fine grained sandstone laminae in top 1 ft, few calcite filled fractures.....	7 (305	8 1)
	Bluestone Formation Bramwell Member		
62.	Siltstone, dark-greenish-gray, few light-gray very fine grained sandstone laminae, thick-bedded; base sharp.....	1 (306	3.5 4.5)
63.	Shale, medium-gray, mottled greenish-gray in top 1 ft 3 in., few slickensided surfaces, fissile; base sharp.....	5 (312	8.5 1)
64.	Siltstone, medium-greenish-gray, very sandy, contains 50 percent light-gray very fine-grained calcareous sandstone laminae in top 9 in., 15 percent medium-dark-gray shale laminae, fair fissility; base sharp.....	7 (319	3 4)
65.	Sandstone, light-gray, very fine grained, silty, calcareous, micaceous, contains 40 percent quartz, abundant dark mineral grains, 15 percent medium-dark-gray silty shale laminae, thin and irregularly bedded, some contorted bedding in basal 5 in.; base sharp.....	6 (325	1 5)
66.	Shale, medium-dark- to dark-gray, mottled greenish-gray in top 1 ft 10 in., mottled brownish-gray and silty from 1 ft 10 in. to 3 ft 4 in. below top, contains abundant pelecypods and ostracodes, abundant limestone nodules in basal 5 ft; base grades.....	9 (334	4 9)

Unit Number	Description	Thickness (Depth) ft	in.
	Bluestone Formation Red member		
67.	Siltstone, dark-greenish-gray, micaceous, slightly sandy, calcareous, thin- to thick-bedded; base grades.....	1	5
		(336	2)
68.	Shale, dark-greenish-gray, mottled reddish-gray, silty in top 3 in.; base sharp.....	3	4
		(339	6)
69.	Siltstone, dark-greenish-gray, sandy at base.....	1	2
		(340	8)
70.	Sandstone, medium-greenish-gray, silty, calcareous, contains 40 percent quartz, few limestone nodules, thin- to thick-bedded, base sharp and irregular.....	5	2
		(345	10)
71.	Shale, medium-dark-gray, mottled reddish-gray, silty at base; irregularly bedded, poor fissility; base grades.....	5	2
		(351	0)
72.	Sandstone, medium-greenish-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, abundant dark mineral grains, thick-bedded.....	0	9
		(351	9)
73.	Mudstone, reddish-gray, plastic, poor fissility; base grades.....	8	0
		(359	9)
74.	Mudstone, grayish-red, mottled greenish-gray, silty in basal 2 ft, thick-bedded, poor fissility; base grades.....	3	10
		(363	7)
75.	Siltstone, medium-greenish-gray, slightly calcareous, argillaceous; base grades.....	2	7
		(366	2)
76.	Sandstone, greenish-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent medium-dark-gray shale laminae and beds up to 6 in. thick, scattered subangular medium-dark-gray shale clasts from 24 ft to 25 ft 4 in. below top, thin- to thick-bedded; base grades abruptly.....	25	4
		(391	6)
77.	Sandstone, medium-gray, mottled greenish-gray, micaceous, contains 60 percent quartz, 10 percent dark-gray shale laminae; base sharp..	11	0
		(402	6)
78.	Siltstone, dark-greenish-gray, contains 10 percent dark-gray shale and light-gray very fine grained sandstone beds up to 3.5 in. thick, thick-bedded; base sharp.....	3	4
		(405	10)

Unit Number	Description	Thickness (Depth) ft	in.
79.	Shale, reddish-gray, mottled greenish-gray, thick-bedded, fair fissility; base sharp	9	8
		(415	6)
80.	Siltstone, medium-greenish-gray, argillaceous to sandy, thick-bedded; base grades	5	2
		(420	8)
81.	Shale, dark-greenish-gray, mottled reddish-gray from 5 ft 6 in. below top to base, slightly calcareous, few slickensided surfaces, scattered limestone nodules, mostly evenly bedded, fair fissility; base grades	10	7
		(431	3)
82.	Sandstone, greenish-gray to medium-greenish-gray, mottled reddish-gray, very fine to fine-grained, calcareous, micaceous, silty in top 6 in., contains 45 percent quartz, thin- to thick-bedded; base sharp	5	11
		(437	2)
83.	Shale, reddish-gray, mottled greenish-gray in part, scattered limestone nodules in basal 7 in., few calcite filled fractures, thin- to thick-bedded, poor fissility; base grades	10	1
		(447	3)
84.	Siltstone, dark-greenish-gray, mottled reddish-gray, argillaceous, few limestone nodules	2	0
		(449	3)
85.	Sandstone, dark-greenish-gray, very fine to fine-grained, slightly calcareous, contains 40 percent quartz, 30 percent greenish-gray siltstone laminae, abundant limestone nodules in basal 5 in., thin-bedded	2	7
		(451	10)
86.	Shale, greenish-gray, mottled reddish-gray, evenly bedded, fissile; base grades	2	0
		(453	10)
87.	Shale, grayish-red, mottled yellowish-gray from 4 ft to 5 ft below top, scattered limestone nodules in basal 11 in., evenly bedded; base grades	7	0
		(460	10)
88.	Shale, grayish-red, mottled greenish-gray, few limestone nodules 3 ft 7 in. below top, evenly bedded, fissile; base grades abruptly	6	3
		(467	1)

Unit Number	Description	Thickness (Depth) ft	in.
89.	Sandstone, medium-gray, mottled greenish-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	4	4
		(471	5)
90.	Shale, grayish-red, mottled greenish-gray in top 4 in., evenly bedded, fissile; base grades.....	11	8
		(483	1)
91.	Sandstone, medium-greenish-gray, mottled grayish-red in part, very fine grained, abundant grayish-red shale and silty shale clasts; base grades.....	4	4
		(487	5)
92.	Sandstone, light-gray to light-greenish-gray, very fine to fine-grained, sparsely micaceous, contains 40 percent quartz; base sharp.....	29	7
		(517	0)
93.	Shale, grayish-red, mottled greenish-gray in top 5 in., evenly bedded; base grades.....	2	8
		(519	8)
94.	Shale, greenish-gray, faintly bedded, poor fissility; base grades.....	4	8
		(524	4)
95.	Shale, black, very carbonaceous, grades to impure coal in top 11 in., fair fissility; base grades.....	1	0
		(525	4)
96.	Underclay, medium-dark-gray, plastic, abundant rootlets; base grades.....	1	4
		(526	8)
97.	Siltstone, medium-gray, few rootlets, faintly bedded; base grades.....	1	4
		(528	0)
98.	Sandstone, light-greenish-gray, very fine to fine-grained, contains 40 percent quartz, few rootlets in top 1 ft, few shale clasts in basal 1 ft 6 in.; base sharp.....	27	5
		(555	5)
99.	Shale, greenish-gray, silty, contains 10 percent light-greenish-gray very fine grained sandstone laminae, evenly bedded; base sharp.....	0	6
		(555	11)
100.	Sandstone, light-greenish-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	6	5
		(562	4)

Unit Number	Description	Thickness (Depth) ft	in.
101.	Shale, dark-greenish-gray, evenly bedded, fissile; base grades....	3	3
		(565	7)
102.	Shale, dark-greenish-gray, contains 20 percent light-gray very fine grained sandstone laminae, evenly bedded; base grades.....	2	10
		(568	5)
103.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent dark-greenish-gray siltstone laminae, burrowed, thin and lenticularly bedded, flaser-bedded; base sharp.....	21	10
		(590	3)
104.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent dark-greenish-gray siltstone laminae, few siderite clasts, thin- to thick-bedded, partly lenticular bedded.....	9	9
		(600	0)

BOTTOM OF HOLE
TOTAL DEPTH 600 ft

GEOPHYSICAL LOG

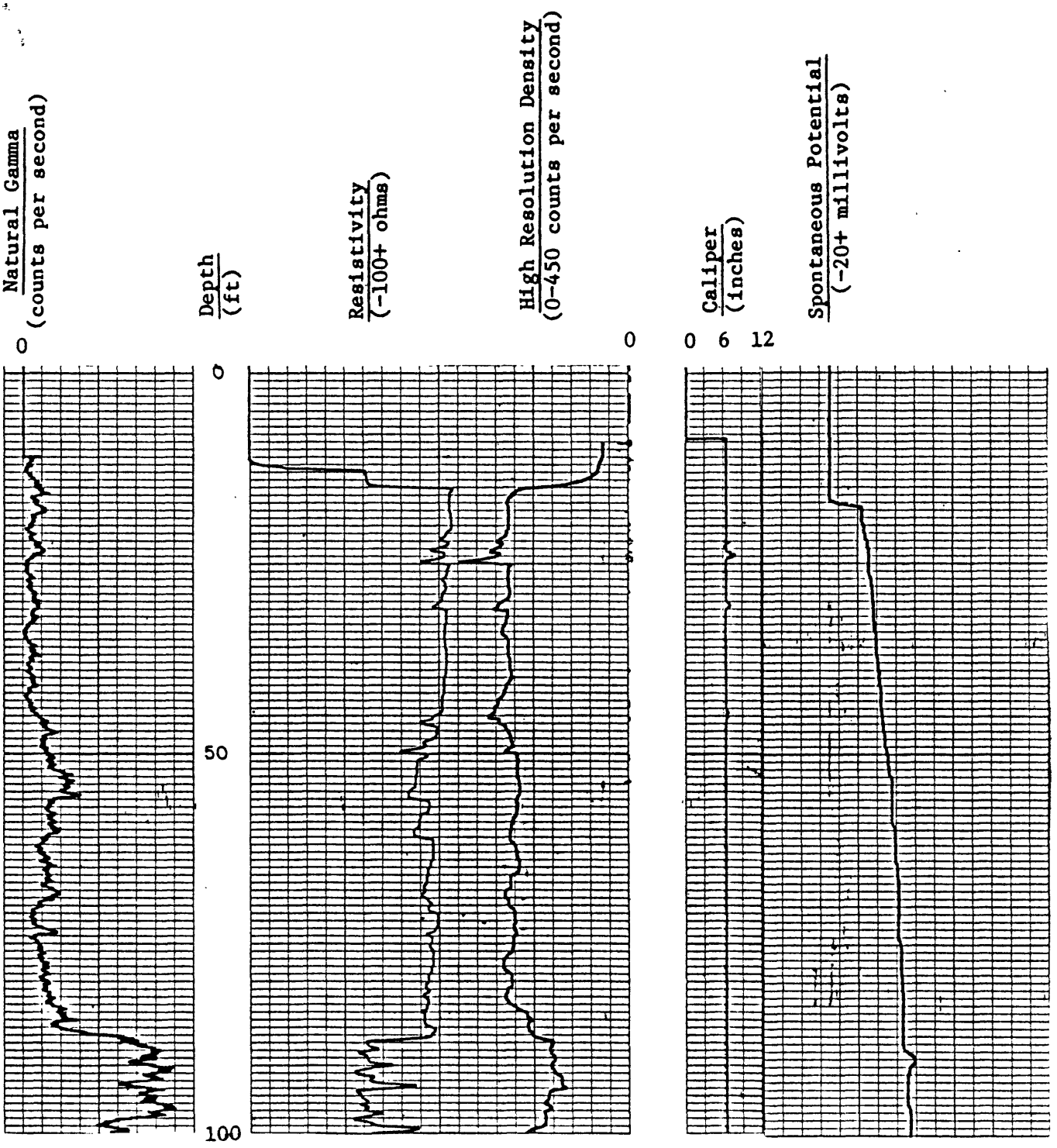
Corehole: SW-6 Date: 11/29/82 State: Virginia County: Wise

Quadrangle: Wise, Va. Latitude: 36°15'06"N Longitude: 82°32'14"W

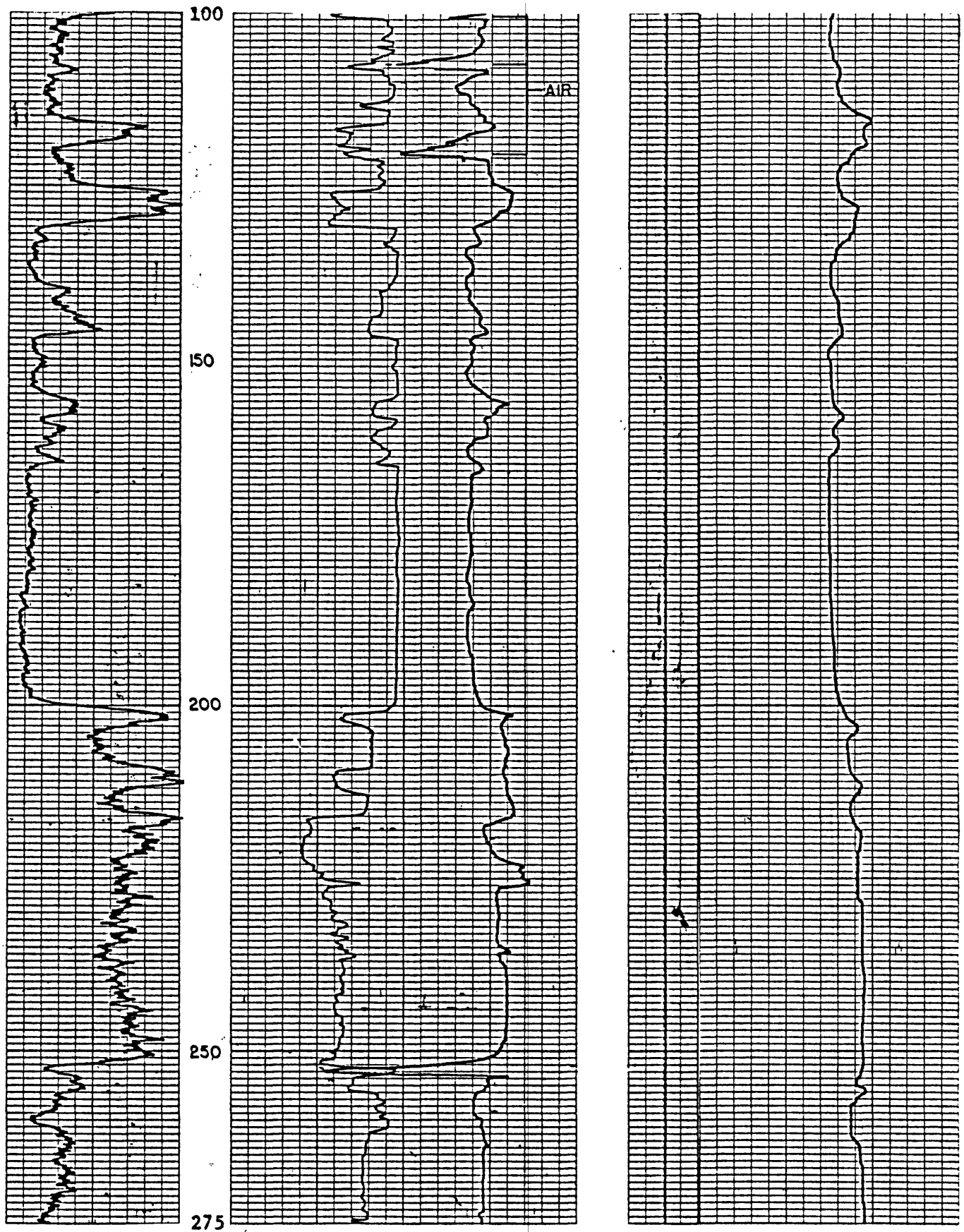
Altitude: 2,240 ft Logged Depth: 598 ft Drilled Depth: 600 ft

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

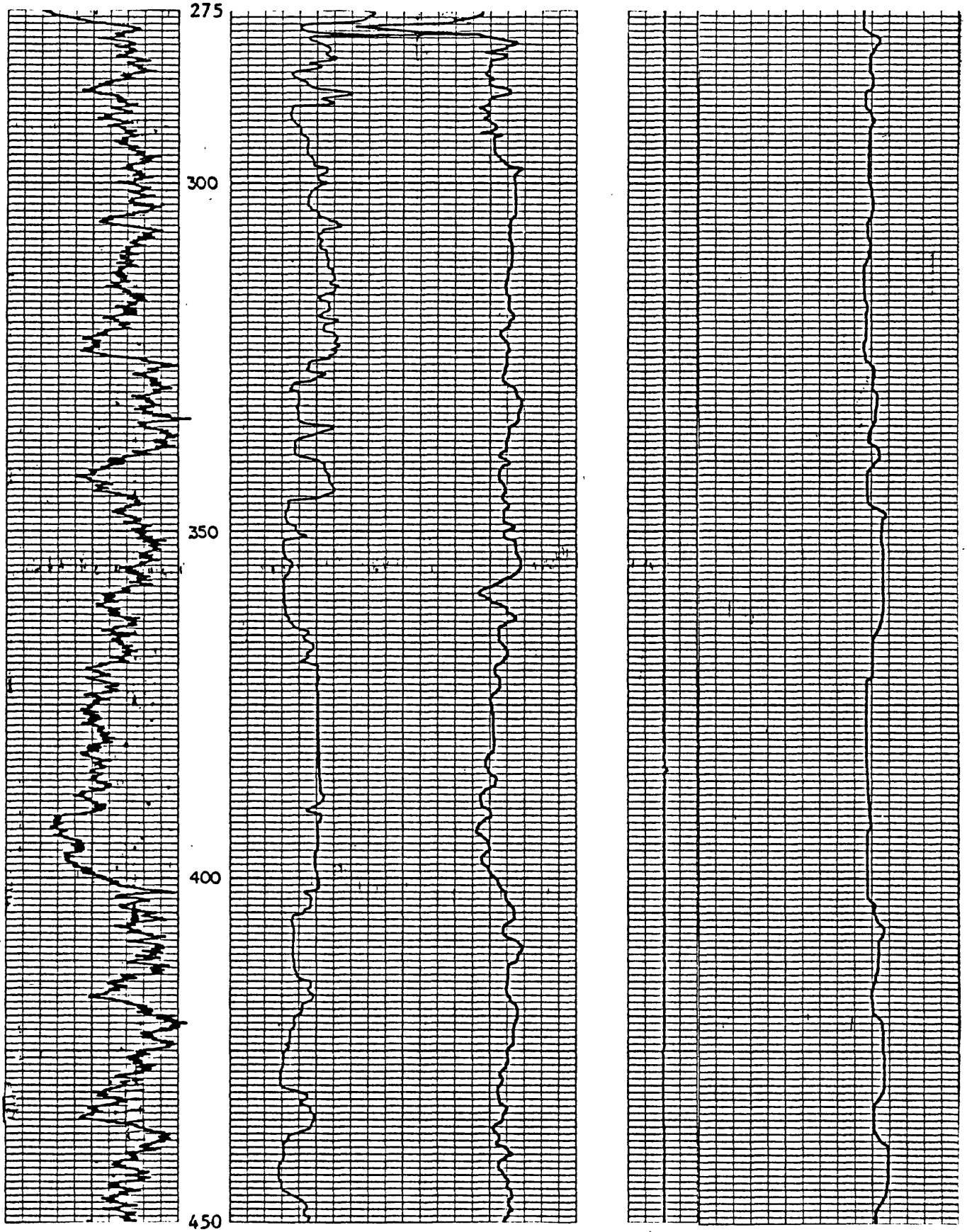
High Resolution Density Time Constant: 1



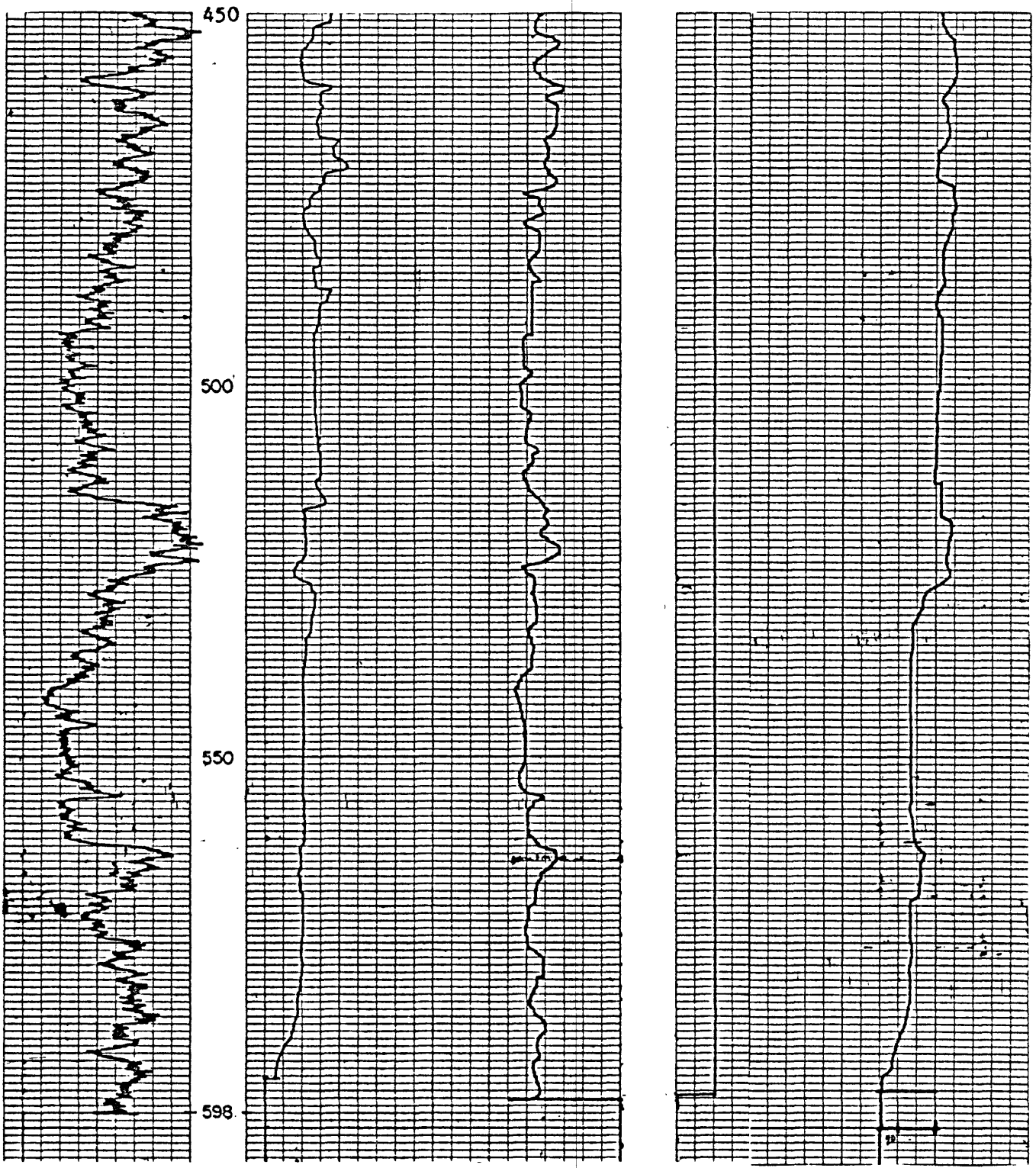
Corehole: SW-6 continued



Corehole: SW-6 continued

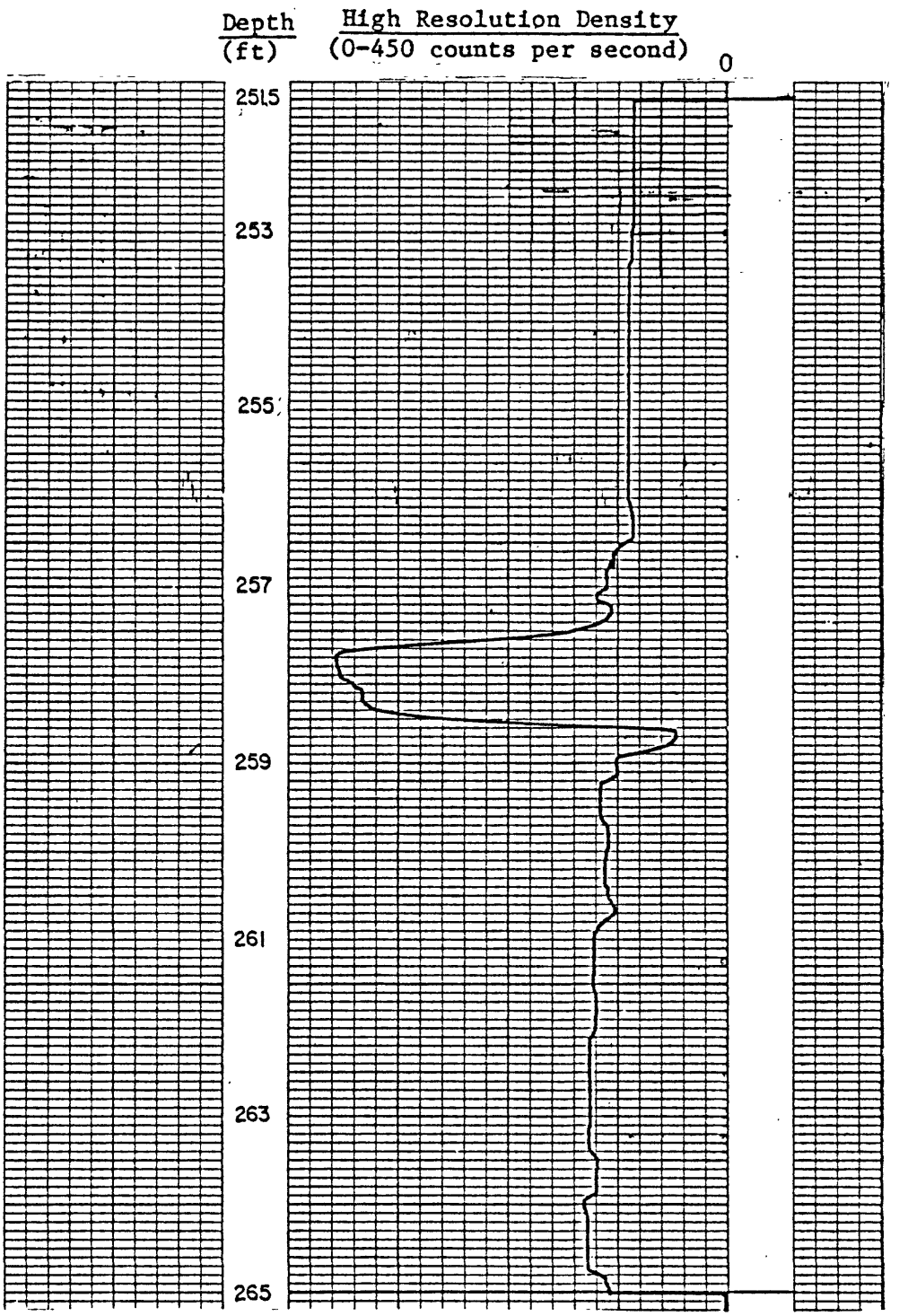


Corehole: SW-6 continued

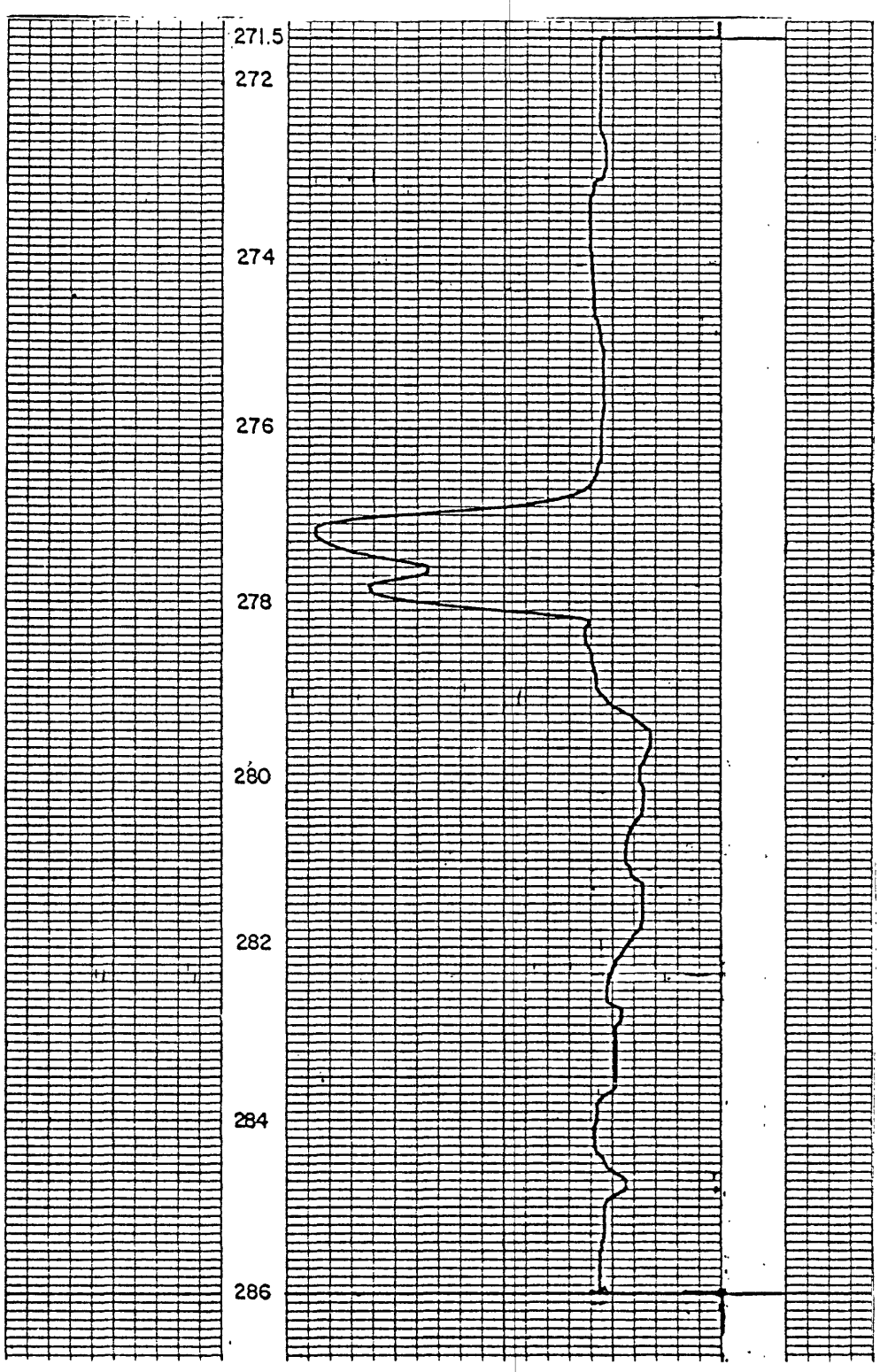


DETAIL LOG

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



Corehole: SW-6 continued



Corehole SW-7

Location: Scott County; Fort Blackmore, Va., 7.5 minute quadrangle; near the head of Big Oak Branch, 0.2 mi northwest of Laney Cemetery. Accessible by gravel road extending southwestward from State Route 619.

Coordinates: Latitude 36°51'17"N Longitude 82°36'29"W

Altitude: 3,270 ft Drilled depth: 765 ft

Dip of strata: Ranges from 8° to 12° to depth of 555 ft, decreases to 5° to base of corehole.

Date drilled: November 10, 1982 to November 22, 1982

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

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER PENNSYLVANIAN SERIES		
	Lee Formation		
	Middlesboro Member		
1.	Soil and weathered rock (casing set - no core recovered).....	20	0
		(20	0)
2.	Sandstone, light-gray, fine-grained, very micaceous, silty in basal 3 ft, contains 45 percent quartz, 10 percent dark-gray shale laminae, abundant dark and light mineral grains, thin and evenly bedded; base sharp.....	2	1
		(22	1)
3.	Shale, medium-gray, evenly bedded; base grades abruptly.....	0	2
		(22	3)
4.	Sandstone, medium-gray, fine-grained, very micaceous, contains 40 percent quartz, 10 percent shale laminae, abundant dark and light mineral grains, thin and evenly bedded; base sharp.....	6	3
		(28	6)
5.	Shale, medium-gray, evenly bedded, fissile; base grades.....	0	2
		(28	8)
6.	Sandstone, light-gray, very fine to fine-grained, very micaceous, contains 40 percent quartz, 20 percent medium-gray shale laminae; base grades.....	0	5
		(29	1)
7.	Shale, medium-gray, evenly bedded, fissile; base sharp.....	0	6
		(29	7)

Unit Number	Description	Thickness (Depth) ft	in.
8.	Sandstone, light-gray, fine-grained, micaceous, contains 40 percent quartz, 5 percent medium-dark-gray shale laminae, cross-laminated, thin-bedded.....	0	7
		(30	2)
9.	Shale, medium-gray, silty in top 4 in., evenly bedded, fissile; base grades.....	7	11
		(38	1)
10.	Shale, medium-gray, silty, contains 15 percent light-gray siltstone laminae, slightly burrowed, cross-laminated, evenly bedded, fissile.....	0	5
		(38	6)
11.	Shale, medium- to medium-dark-gray, slightly silty in basal 3 ft 10 in., scattered well preserved plant pinnules and stems, evenly bedded, fissile; base grades.....	7	4
		(45	10)
12.	Siltstone, medium-gray, micaceous, thin-bedded, poor fissility; base grades.....	1	8
		(47	6)
13.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base sharp.....	2	4
		(49	10)
14.	Shale, medium-gray, silty, contains 10 percent very fine to fine-grained sandstone laminae, evenly bedded, poor fissility; base grades.....	6	9
		(56	7)
15.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded.....	0	5.5
		(57	0.5)
16.	Shale, medium-gray, silty, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded, poor fissility; base grades.....	1	9.5
		(58	10)
17.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent medium-gray silty shale laminae, few small-scale slump structures; base grades.....	0	7
		(59	5)
18.	Shale, medium-gray, silty, evenly bedded, poor fissility; base sharp and uneven.....	0	3
		(59	8)

Unit Number	Description	Thickness (Depth) ft	in.
19.	Sandstone, light- to medium-light-gray, very fine grained, micaceous, contains 40 percent quartz, 20 percent medium-gray silty shale laminae, thin-bedded; base grades abruptly.....	0	5.5
		(60	1.5)
20.	Shale, medium-gray, silty, contains 40 percent light-gray very fine grained sandstone laminae, scattered small-scale slump structures, evenly bedded, poor fissility; base sharp.....	0	8.5
		(60	10)
21.	Siltstone, medium- to medium-dark-gray, siderite nodule at base, lenticularly bedded, non-fissile; base grades.....	0	11
		(61	9)
22.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent medium-dark-gray silty shale laminae, few small scale slump structures in top 3 in., cross-laminated, thin-bedded; base grades.....	0	11.5
		(62	8.5)
23.	Shale, medium-gray, silty, few small-scale slump structures, evenly bedded, fair fissility; base grades.....	0	6
		(63	2.5)
24.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent medium-gray siltstone laminae, cross-laminated, thin-bedded; base sharp.....	0	8.5
		(63	11)
25.	Shale, medium-gray, silty, few siderite nodules, evenly bedded, fair fissility; base sharp.....	0	4
		(64	3)
26.	Shale, medium-gray, silty, contains 20 percent light-gray very fine grained sandstone beds, evenly bedded, poor fissility; base grades.....	3	1
		(67	4)
27.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent medium-dark-gray shale beds, sandstone dike extending across bedding 2 in. above base, thin-bedded; base sharp.....	1	6
		(68	10)
28.	Siltstone, medium-light- to medium-gray, contains 20 percent light-gray very fine grained sandstone beds, few siderite nodules, small-scale slump structures, irregularly bedded with a sandstone dike extending from 2 ft 11 in. to 3 ft 3 in. below top; base grades.....	7	2.5
		(76	0.5)

Unit Number	Description	Thickness (Depth) ft	in.
29.	Shale, medium-gray, silty, contains 5 percent light-gray very fine grained sandstone beds, scattered siderite nodules, evenly bedded; base grades abruptly.....	3	1.5
		(79	2)
30.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, few large dark-gray shale clasts, thin and irregularly bedded; base grades.....	0	4
		(79	6)
31.	Siltstone, medium-gray, contains 5 percent light-gray very fine grained sandstone lenses, scattered siderite nodules up to 1 in. in diameter, thin and unevenly bedded, non-fissile.....	2	0
		(81	6)
32.	Shale, medium-gray, contains 10 percent light-gray very fine grained sandstone laminae and beds, evenly bedded, fissile.....	0	10
		(82	4)
33.	Shale, medium-gray, contains 40 percent light-gray fine grained sandstone beds, few siderite nodules and shale clasts, irregularly bedded; base uneven.....	1	0
		(83	4)
34.	Coal clast, mostly vitrain.....	0	1
		(83	5)
35.	Sandstone, light-gray, fine- to medium-grained, contains 65 percent quartz, scattered coal laminae and shale clasts, well rounded siderite and coal clasts up to 5 in. thick in basal 4 in., thick-bedded; base sharp.....	3	3
		(86	8)
36.	Sandstone, light-gray, very fine grained, contains 50 percent quartz, 40 percent medium-dark-gray shale beds, cross-laminated, flaser bedded; base sharp.....	1	10
		(88	6)
37.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, scattered siderite and medium-gray shale clasts; base sharp.....	0	4
		(88	10)
38.	Sandstone, light-gray, very fine grained, contains 45 percent quartz, 30 percent medium-dark-gray shale laminae and beds, cross-laminated, flaser-bedded.....	1	10
		(90	8)
39.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, abundant medium-dark-gray shale clasts; base sharp.....	0	3
		(90	11)

Unit Number	Description	Thickness (Depth) ft	in.
40.	Sandstone, medium-light-gray, very fine grained, contains 45 percent quartz, 40 percent medium-dark-gray shale laminae and beds, cross-laminated, flaser-bedded, thin and evenly bedded; base sharp.....	1	2
		(92	1)
41.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, 15 percent medium-dark-gray shale laminae, 0.5 in. siderite nodule 2 in. below top, scattered coal laminae in basal 4 in., thin-bedded, partly flaser-bedded; base sharp.....	1	7
		(93	8)
42.	Sandstone, medium-light-gray, very fine grained, contains 45 percent medium-dark-gray shale beds, flaser-bedded; base grades abruptly.....	0	7
		(94	3)
43.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 30 percent medium-dark-gray shale laminae, 0.5 in. siderite nodule 2 in. below top, flaser-bedded.....	4	7
		(98	10)
44.	Sandstone, very light to light- gray, fine- to medium-grained, contains 65 percent quartz, abundant coal laminae and siderite clasts in basal 7 in., thin- to thick-bedded; base sharp.....	1	10
		(100	8)
45.	Shale, medium-dark-gray, contains 30 percent light-gray fine-grained sandstone beds up to 0.5 in. thick, evenly bedded; base sharp.....	2	11
		(103	7)
46.	Sandstone, very light gray, fine- to medium-grained, contains 65 percent quartz, abundant siderite clasts, thick-bedded; base sharp.....	0	9
		(104	4)
47.	Shale, medium-dark- to dark-gray, contains 30 percent light-gray sandstone beds up to 3 in. thick, flaser-bedded; base grades.	4	9
		(109	1)
48.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, 10 percent dark-gray shale laminae, few siderite nodules in top 9 in.; base sharp.....	1	11
		(111	0)
49.	Shale, medium-dark-gray, dark-gray in basal 5 ft, silty, contains 10 percent medium-light-gray siltstone laminae, few siderite nodules, slightly burrowed, evenly bedded; fissile.....	16	2
		(127	2)

Unit Number	Description	Thickness (Depth) ft	in.
50.	Coal, Upper split of Cove Creek coal bed (thickness-1 ft 6 in.)		
	50a. Coal, mostly bright attritus, scattered vitrain bands.....	0	1.25
		(127	3.25)
	50b. Shale, dark-gray, carbonaceous.....	0	0.75
		(127	4)
	50c. Coal, mostly bright attritus, scattered vitrain bands few fusain laminae in basal 2.5 in., few pyrite lenses 1 in. above base.....	1	4
		(128	8)
51.	Underclay, medium-gray, mottled brownish-gray, very silty, very carbonaceous in top 2 in., few coal laminae in top 2 in., abundant rootlets; base grades.....	3	7
		(132	3)
52.	Siltstone, medium-gray, contains 20 percent light-gray very fine grained sandstone beds, thin-bedded, poor fissility, few rootlets; base grades.....	1	6
		(133	9)
53.	Shale, medium-dark- to dark-gray, contains 20 percent light-gray very fine grained sandstone beds, evenly bedded; base sharp.....	2	6
		(136	3)
54.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 5 percent shale laminae, cross-laminated, thin-bedded; base grades.....	0	6
		(136	9)
55.	Shale, dark-gray, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded.....	0	6
		(137	3)
56.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 5 percent medium-dark-gray shale laminae, cross-laminated, thin-bedded; base grades.....	0	4
		(137	7)
57.	Shale, dark-gray, carbonaceous, contains 15 percent light-gray very fine to fine-grained sandstone laminae in top 9 in., very plastic in basal 4 in., evenly bedded, fissile in top 1 ft 7 in.	1	11
		(139	6)
58.	Coal, Lower split of Cove Creek coal bed, dull to bright attritus, few thick vitrain bands.....	0	10.5
		(140	4.5)

Unit Number	Description	Thickness (Depth) ft	in.
59.	Sandstone, medium-gray, mottled brownish-gray, very fine to fine-grained, very micaceous, contains 60 percent quartz, abundant rootlets, grades to medium-grained at base; base grades	4	1.5
		(144	6)
60.	Sandstone, white to very light gray, fine- to medium-grained, contains 65 percent quartz, scattered medium-gray siltstone laminae, thick-bedded; base grades	2	9
		(147	3)
61.	Siltstone, medium-gray, slightly sandy, thin and evenly bedded, fair fissility; base grades	0	3.5
		(147	6.5)
62.	Sandstone, white to very light gray, contains 65 percent quartz, 5 percent medium-gray micaceous siltstone laminae; base grades abruptly	2	6
		(150	0.5)
63.	Siltstone, medium-gray, thin-bedded, poor fissility; base sharp	0	8.5
		(150	9)
64.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, 5 percent medium-gray micaceous siltstone laminae, silty in basal 2 in.; base sharp	1	6
		(152	3)
65.	Sandstone, white, medium-grained, contains 90 percent quartz, few styolites, cross bedded, massive; base grades	43	3
		(195	6)
66.	Sandstone, white, coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles mostly from 0.25 in. to 0.5 in. in diameter, abundant siderite and coal clasts in basal 6 in., scattered stylolites, massive; base sharp	30	6
		(226	0)
67.	Shale, medium-dark-gray, evenly bedded, fissile	0	7
		(226	7)
68.	Coal, Upper split Little Fire Creek (?) coal bed (thickness-1 ft 2 in.)		
68a.	Coal, mostly bright attritus, few thin vitrain bands	0	4
		(226	11)
68b.	Coal, mostly bright attritus	0	1
		(227	0)

Unit Number	Description	Thickness (Depth) ft	in.
	68c. Coal, dull to bright attritus, few pyrite lenses up to 0.125 in. thick	0	7
		(227	7)
	68d. Coal, bright attritus, few small pyrite nodules	0	2
		(227	9)
69.	Underclay, medium-dark-gray, abundant rootlets, few coalified plant fragments; base grades	1	5
		(229	2)
70.	Shale, medium-dark-gray, silty, contains 10 percent light-gray siltstone laminae, few plant fragments, evenly bedded, fair fissility; base grades abruptly	3	7
		(232	9)
71.	Sandstone, medium-light-gray, very fine grained, micaceous, contains 45 percent quartz, 20 percent medium-dark-gray silty shale laminae, slightly burrowed, cross-laminated, thin and evenly bedded; base grade abruptly	1	2
		(233	11)
72.	Shale, medium-dark-gray, contains 5 percent medium-light-gray siltstone laminae, evenly bedded, fissile; base grades	6	8
		(240	7)
73.	Shale, medium-dark-gray, very silty, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded; base grades abruptly	5	1
		(245	8)
74.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 10 percent medium-dark-gray silty shale laminae, cross-laminated, irregularly bedded; base grades	0	5
		(246	1)
75.	Shale, medium-dark-gray, very silty, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded	4	5
		(250	6)
76.	Shale, black, carbonaceous, scattered slickensided surfaces, abundant plant stems, evenly bedded, fissile; base sharp	0	9
		(251	3)
77.	Coal, Lower split Little Fire Creek (?) coal bed (thickness-2 ft 1 in.)		
	77a. Coal, dull to bright attritus, scattered thin to thick vitrain bands, few pyrite laminae	0	3
		(251	6)

Unit Number	Description	Thickness (Depth) ft	in.
	77b. Shale, black.....	0	2
		(251	8)
	77c. Coal, dull to bright attritus, few thin vitrain bands.....	1	0.5
		(252	8.5)
	77d. Underclay, dark-gray, rootlets.....	0	1.5
		(252	10)
	77e. Coal, dull to bright attritus, medium vitrain bands.....	0	6
		(253	4)
78.	Sandstone, medium- to medium-light-gray, very fine grained, contains 45 percent quartz, silty in top 3 in. with abundant coal laminae, few black shale clasts in basal 1 in.; base sharp and uneven.....	0	5
		(253	9)
79.	Shale, black, very carbonaceous, few slickensided surfaces, poor fissility; base grades abruptly.....	0	11
		(254	8)
80.	Underclay, medium-gray, very plastic, silty in basal 1 ft 1 in., scattered rootlets; base grades abruptly.....	2	11
		(257	7)
81.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base grades.....	0	6
		(258	1)
82.	Siltstone, medium- to dark-gray, micaceous, thin bedded, poor fissility; base grades abruptly.....	3	4
		(261	5)
83.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 10 percent medium-gray siltstone laminae, evenly bedded; base grades.....	0	3
		(261	8)
84.	Siltstone, medium-gray, finely micaceous, thin and evenly bedded, poor fissility; base grades.....	1	9
		(263	5)
85.	Shale, black, carbonaceous, evenly bedded, fair fissility; base grades.....	0	4
		(263	9)
86.	Siltstone, medium-gray, micaceous, thin-bedded, poor fissility; base sharp.....	0	2
		(263	11)

Unit Number	Description	Thickness (Depth) ft	in.
87.	Sandstone, white to very light gray, fine- to medium-grained, contains 65 percent quartz, 5 percent medium-gray micaceous siltstone laminae, thin- to thick-bedded; base grades.....	1	8
		(265	7)
88.	Sandstone, very light gray, medium-grained, contains 65 percent quartz, 5 percent medium-gray siltstone laminae, thick-bedded to massive; base grades.....	3	5
		(269	0)
89.	Sandstone, white to very light gray, medium- to coarse-grained contains 90 percent quartz, crossbedded, thick-bedded to massive; base grades abruptly.....	22	8
		(291	8)
90.	Sandstone, white to light-gray, fine- to medium-grained, contains 65 percent quartz, 10 percent medium-gray micaceous siltstone laminae, thin- to thick-bedded, burrowed in basal 6 in.; base grades.....	11	4
		(303	0)
91.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered dark mineral grains and well rounded white quartz pebbles, styolites, thick-bedded to massive; base sharp.....	13	11
		(316	11)
92.	Sandstone, light-gray, very fine grained, abundant coal laminae...	0	0.5
		(316	11.5)
93.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles up to 0.25 in. in diameter, few coal laminae 1 ft 8 in. below top, abundant coal and small dark-gray shale clasts in basal 1 ft 3 in., scattered stylolites; base grades.....	26	0.5
		(343	0)
94.	Sandstone, white to very light gray, medium-grained, contains 90 percent quartz, few stylolites, thick-bedded to massive; base grades.....	32	10
		(375	10)
95.	Sandstone, white to very light gray, coarse-grained, contains 90 percent quartz, conglomeratic with well rounded white quartz pebbles 0.5 to 0.75 in. in diameter, scattered medium-gray shale clasts, abundant coal laminae and clasts from 16 ft to 21 ft below top, few stylolites, massive; base grades....	29	10
		(405	8)

Unit Number	Description	Thickness (Depth) ft	in.
96.	Conglomerate, contains white quartz pebbles mostly 0.75 in. in diameter, scattered siderite clasts up to 1 in. in diameter, very light gray coarse-grained, quartzose sandstone matrix; base grades	1	6
		(407	2)
97.	Sandstone, white to very light gray, coarse-grained, contains 90 percent quartz, few well rounded white quartz pebbles, crossbedded, massive; base grades	3	11
		(411	1)
98.	Sandstone, white to very light gray, coarse-grained, contains 90 percent quartz, scattered coal laminae, contains 2 in. thick coal clasts 4 in. below top and 6 in. above base, scattered well rounded white quartz pebbles and siderite clasts; base grades	3	6
		(414	7)
99.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles, 1.5 in. siderite clast 3 ft 6 in. above base, abundant medium-dark-gray shale clasts in basal 7 in., thick-bedded to massive; base sharp and uneven	20	2
		(434	9)
	Pocahontas Formation		
100.	Sandstone, light-gray, fine-grained, micaceous, contains 55 percent quartz, 5 percent medium-dark-gray shale laminae, abundant siderite clasts and coal laminae and clasts in basal 2 ft 4 in., thin-bedded	8	0
		(442	9)
101.	Underclay, medium-light- to medium-dark-gray, abundant rootlets; base grades	3	8
		(446	5)
102.	Shale, medium-gray, evenly bedded, fair fissility; base grades sharply	5	6
		(451	11)
103.	Shale, dark-gray, carbonaceous, evenly bedded, fair fissility; base grades	0	3
		(452	2)
104.	Underclay, medium- to medium-dark-gray, mottled brownish-gray; base grades	1	9
		(453	11)
105.	Siltstone, medium-gray, scattered siderite nodules, irregularly bedded, nonfissile; base grades	2	1
		(456	0)

Unit Number	Description	Thickness (Depth) ft	in.
106.	Sandstone, medium-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 15 percent medium-dark-gray siltstone laminae, 20 percent dark-gray shale laminae in basal 2 ft 7 in., cross-laminated, thin and irregularly bedded; base sharp.....	19	3
		(475	3)
107.	Shale, dark-gray to grayish-black, silty, contains 20 percent medium-gray siltstone laminae, evenly bedded; base grades.....	3	8
		(478	11)
108.	Shale, grayish-black, carbonaceous, scattered siderite beds up to 0.5 in. thick from 2 ft 1 in. to 6 ft 1 in. below top, few plant fragments, evenly bedded, fissile.....	7	9
		(486	8)
109.	Coal, Pocahontas No. 1 coal bed, dull to bright attritus, scattered vitrain bands; base sharp and uneven.....	0	9.25
		(487	5.25)
110.	Underclay, medium- to medium-dark-gray, very carbonaceous in top 2 in., scattered coal laminae 2 in. below top, few siderite nodules; base grades.....	1	7.75
		(489	1)
111.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, few rootlets, poorly bedded, massive; base grades.....	2	3
		(491	4)
112.	Sandstone, medium-light to medium-gray, very fine grained, contains 40 percent quartz, 10 percent medium-dark-gray shale laminae, 0.5 in. siderite nodule 2 ft 6 in. below top, 1.5 in. siderite nodules 6 ft 1 in. and 8 ft 4 in. below top, scattered rootlets in top 2 ft 2 in., thin and evenly bedded; base sharp.....	10	5
		(501	9)
113.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, scattered siderite clasts 7.5 in. below top, few coal laminae in basal 6 in., thick-bedded to massive.....	2	6
		(504	3)
114.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, contains 45 percent quartz, 10 percent dark-gray, carbonaceous shale laminae, evenly bedded; base sharp and uneven.....	0	10
		(505	1)
115.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, thick-bedded to massive; base sharp.....	2	2
		(507	3)

Unit Number	Description	Thickness (Depth) ft	in.
116.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 10 percent dark-gray carbonaceous shale laminae, few siderite clasts up to 1 in. thick.....	2	0
		(509	3)
117.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 20 percent dark-gray carbonaceous shale laminae, thin-bedded.....	1	9
		(511	0)
118.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, few siderite clasts, 15 percent dark-gray carbonaceous shale laminae, cross-laminated, thin- to thick-bedded.....	3	0
		(514	0)
119.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, 10 percent dark-gray carbonaceous shale and siltstone laminae, cross-laminated, thin- to thick-bedded; base sharp.....	6	9
		(520	9)
120.	Coal, Squire Jim (?) coal bed, dull attritus, abundant thin to thick vitrain bands.....	1	6
		(522	3)
121.	Shale, black, very carbonaceous, contains 15 percent coal laminae in top 2 in., scattered plant stems; base grades.....	0	8
		(522	11)
122.	Underclay, dark-gray to black, very carbonaceous, scattered rootlets.....	4	0
		(526	11)
123.	Shale, black, very carbonaceous, poor fissility; base grades.....	0	4
		(527	3)
124.	Underclay, medium-dark-gray, silty, abundant rootlets; base grades abruptly.....	4	6
		(531	9)
125.	Sandstone, medium-dark-gray, very fine to fine-grained, contains 40 percent quartz, abundant carbonaceous debris, thin- to thick-bedded; base grades abruptly.....	4	0
		(535	9)
126.	Shale, dark-gray to black, carbonaceous, abundant medium-dark-gray shale clasts from 6 in. to 10 in. below top, numerous plant fragments; base grades abruptly.....	1	3
		(537	0)

Unit Number	Description	Thickness (Depth) ft	in.
127.	Sandstone, medium-dark-gray, very fine to fine-grained, contains 40 percent quartz, thin- to thick-bedded; base grades abruptly	1	8
		(538	8)
128.	Siltstone, medium-dark- to dark-gray, abundant medium-dark-gray shale clasts in basal 3 in., scattered rootlets, irregularly bedded	1	4
		(540	0)
129.	Siltstone, dark-gray, abundant rootlets, poorly bedded, nonfissile; base grades	3	10
		(543	10)
130.	Sandstone, medium-dark-gray, very fine grained, silty, contains 40 percent quartz, abundant dark-gray shale clasts in basal 3 in., thin and irregularly bedded; base sharp	3	3
		(547	1)
	UPPER MISSISSIPPIAN SERIES Bluestone Formation Bramwell Member		
131.	Shale, dark-greenish-gray, abundant siderite beds and nodules, evenly bedded, poor fissility	3	3
		(550	4)
132.	Sandstone, light- to dark-gray, very fine grained, silty, contains 40 percent quartz, 30 percent dark-gray siltstone and silty shale laminae, thin-bedded, slightly burrowed; base sharp	4	3
		(554	7)
133.	Shale, dark-gray, mottled greenish-gray, contains abundant marine invertebrate fossils in basal 1 ft 6 in., evenly bedded, fair fissility; base grades	4	5
		(559	0)
134.	Shale, black, very carbonaceous, fissile	0	5
		(559	5)
	Bluestone Formation Red member		
135.	Coal, dull to bright attritus	0	4
		(559	9)
136.	Sandstone, light- to dark-greenish-gray, very fine grained, silty, contains 40 percent quartz, scattered rootlets in top 1 ft 6 in., thin-bedded; base sharp and undulating	2	9
		(562	6)

Unit Number	Description	Thickness (Depth) ft	in.
137.	Shale, dark-greenish-gray, scattered limestone nodules 4 ft 4 in. below top and in basal 1 ft 4 in., evenly bedded, poor fissility.....	4	4
		(566	10)
138.	Shale, dark-greenish-gray, mottled reddish-gray, contains scattered limestone nodules from 6 ft to 15 ft below top, poor fissility; base grades abruptly.....	17	3
		(584	1)
139.	Sandstone, light-greenish-gray, very fine to fine-grained, contains 55 percent quartz, 5 percent dark-greenish-gray siltstone laminae, thick-bedded; base grades abruptly.....	16	5
		(600	6)
140.	Sandstone, light-greenish-gray, medium-grained, contains 55 percent quartz, 5 percent dark-gray siltstone laminae, abundant medium-dark-gray shale and limestone clasts in basal 5 ft, thin- to thick-bedded; base sharp.....	7	4
		(607	10)
141.	Shale, dark-greenish-gray, slightly silty, evenly bedded; base sharp.....	2	8
		(610	6)
142.	Sandstone, light-greenish-gray, fine- to medium-grained, abundant dark-greenish-gray shale clasts in top 3 ft.....	4	1
		(614	7)
143.	Shale, dark-greenish-gray, silty, very silty in basal 1 ft, some contorted bedding, fissile; base grades.....	3	3
		(617	10)
144.	Siltstone, medium-light-gray, mottled greenish-gray, very sandy at base, contains 15 percent medium-dark-gray shale laminae, thin and irregularly bedded; base grades.....	0	4
		(618	2)
145.	Sandstone, light- to medium-light-gray, mottled greenish-gray, fine- to medium-grained, micaceous, contains 40 percent quartz, few medium-gray shale laminae, scattered shale clasts in basal 2 ft, 2 in. limestone nodules and large shale clast 6 in. above base, abundant dark mineral grains, poorly sorted; base sharp.....	5	10.5
		(624	0.5)
146.	Shale, medium-light- to medium-gray, mottled grayish-red and greenish-gray, poor fissility; base grades.....	3	4.5
		(627	5)

Unit Number	Description	Thickness (Depth) ft	in.
147.	Shale, greenish- to dark-greenish-gray, very silty, scattered limestone nodules; base grades.....	1	4.5
		(628	9.5)
148.	Siltstone, greenish- to dark-greenish-gray, contains 20 percent light-gray, very fine grained sandstone laminae, scattered limestone nodules, 3 in. medium-dark-gray shale bed at base; base grades.....	4	7.5
		(633	5)
149.	Shale, medium-dark-gray, mottled greenish-gray to grayish-red, silty, poor fissility; base grades.....	5	9
		(639	2)
150.	Shale, dark-greenish-gray, mottled grayish-red, very silty, scattered limestone lenses; base sharp and uneven.....	7	10.5
		(647	0.5)
151.	Sandstone, greenish- to dark-greenish-gray, very fine to fine-grained, contains 40 percent quartz, few dark mineral grains, few medium-gray shale laminae and beds up to 0.5 in. thick, thin and irregularly bedded; base grades.....	2	2.5
		(649	3)
152.	Sandstone, greenish-gray, fine-grained, partly calcareous, micaceous, slightly silty, contains 40 percent quartz, 20 percent dark-gray shale laminae, scattered dark mineral grains, some siderite nodules near base, cross-laminated, thin and irregularly bedded.....	4	11
		(654	2)
153.	Sandstone, dark-greenish-gray, fine-grained, very calcareous, micaceous, contains 45 percent quartz, abundant dark mineral grains, crossbedded, thin and irregularly bedded; base sharp.....	0	6
		(654	8)
154.	Shale, medium-dark-gray, very silty, contains 45 percent greenish- to dark-greenish-gray, fine-grained, very calcareous sandstone beds, scattered small siderite nodules, few convoluted beds, evenly bedded; base grades.....	3	4
		(658	0)
155.	Sandstone, very light to light-gray, mottled greenish-gray, fine-grained, micaceous, calcareous, contains 40 percent quartz, abundant dark mineral grains, 10 percent medium-gray siltstone laminae, thin-bedded; base sharp.....	1	3
		(659	3)

Unit Number	Description	Thickness (Depth) ft	in.
156.	Sandstone, greenish- to dark-greenish-gray, fine-grained, silty, micaceous, calcareous, contains 20 percent quartz, abundant dark mineral grains, scattered coal and medium-gray shale clasts, few medium-gray silty shale laminae near top, cross-laminated, thin-bedded; base grades.....	1	8
		(660	11)
157.	Shale, dark-greenish-gray, very silty in top 1 in., fair to poor fissility.....	0	2
		(661	1)
158.	Sandstone, greenish-gray, fine-grained, calcareous, very micaceous, contains 40 percent quartz, abundant contorted coal and medium-dark-gray shale clasts, numerous dark and light mineral grains, few siderite clasts, thin- to thick-bedded; base sharp and uneven.....	1	2.5
		(662	3.5)
159.	Shale, medium-dark-gray, mottled greenish-gray and grayish-red, abundant limestone nodules in basal 7 ft 3 in., poor fissility; base grades.....	7	8
		(669	11.5)
160.	Shale, greenish-gray, silty, abundant limestone nodulates, irregularly bedded, poor fissility; base grades.....	3	2
		(673	1.5)
161.	Siltstone, light-greenish- to greenish-gray, contains 15 percent very fine grained calcareous sandstone laminae, scattered limestone nodules; base grades.....	2	3.5
		(675	5)
162.	Shale, grayish-red, contains 10 percent greenish-gray silty shale laminae, scattered limestone nodules, evenly bedded, fissile; base grades.....	0	4
		(675	9)
163.	Shale, dark-greenish-gray, silty, scattered limestone nodules in basal 2 in., fair fissility; base sharp and uneven.....	1	8
		(677	5)
164.	Siltstone, dark-greenish-gray, contains 20 percent very fine grained calcareous sandstone beds, scattered limestone nodules; base grades.....	2	7
		(680	0)
165.	Shale, dark-greenish-gray, mottled grayish-red, scattered limestone nodules, irregularly bedded, fair fissility; base grades.....	6	9
		(686	9)

Unit Number	Description	Thickness (Depth) ft	in.
166.	Shale, grayish-red, mottled greenish-gray, evenly bedded, fair fissility; base sharp.....	6	3
		(693	0)
167.	Siltstone, greenish- to dark-greenish-gray; base grades.....	0	2
		(693	2)
168.	Shale, grayish-red, mottled greenish-gray in top 1 ft 10 in. and basal 2 ft 6 in., abundant limestone nodules.....	9	1
		(702	3)
169.	Siltstone, light-grayish-red, argillaceous, scattered nodular limestone, very poor fissility.....	0	11
		(703	2)
170.	Siltstone, light-gray, mottled grayish-red, scattered nodular limestone; base grades.....	2	6
		(705	8)
171.	Shale, grayish-red, mottled greenish-gray, evenly bedded, fissile; base grades.....	3	0
		(708	8)
172.	Shale, medium- to medium-dark-gray, mottled greenish-gray, silty, evenly bedded, fissile; base sharp.....	2	5
		(711	1)
173.	Sandstone, medium-light- to medium-gray, mottled greenish-gray, very fine to fine-grained, calcareous in basal 4 ft, contains 40 percent quartz, less than 5 percent medium-dark-gray shale laminae, scattered medium-dark-gray shale clasts 2 ft 6 in. to 4 ft 10 in. above base; base sharp and uneven.....	33	2
		(744	3)
174.	Shale, grayish-red to greenish-gray, abundant limestone nodules, poor fissility; base sharp.....	2	6
		(746	9)
175.	Siltstone, greenish- to dark-greenish-gray, contains 20 percent light-gray very fine grained sandstone laminae.....	0	6
		(747	3)
176.	Sandstone, medium-greenish-gray, very fine grained, contains 40 percent quartz; base grades.....	0	7
		(747	10)
177.	Siltstone, medium-greenish-gray, very sandy in top 1 ft 8 in., 15 percent greenish-gray shale beds, cross-laminated; base sharp.....	3	3
		(751	1)

Unit Number	Description	Thickness (Depth) ft	in.
178.	Sandstone, light-greenish- to dark-greenish-gray, very fine to fine-grained, calcareous, 15 percent dark-greenish-gray siltstone beds, scattered limestone nodules, cross-laminated, thin-bedded; base sharp.....	7	4
		(758	5)
179.	Shale, medium- to dark-greenish-gray, mottled grayish-red, evenly bedded, fair fissility; base grades.....	0	9.5
		(759	2.5)
180.	Siltstone, medium-greenish- to dark-greenish-gray, calcareous, very shaley in basal 1 ft, scattered limestone nodules, thin and evenly bedded; base sharp.....	2	2
		(761	4.5)
181.	Sandstone, medium-greenish- to dark-greenish-gray, medium- to coarse-grained, contains 40 percent quartz, cross-laminated; base sharp.....	0	8.5
		(762	1)
182.	Shale, grayish-red, mottled greenish-gray, slightly calcareous, evenly bedded, fissile.....	2	9
		(765	0)

BOTTOM OF HOLE
TOTAL DEPTH 765 ft

GEOPHYSICAL LOG

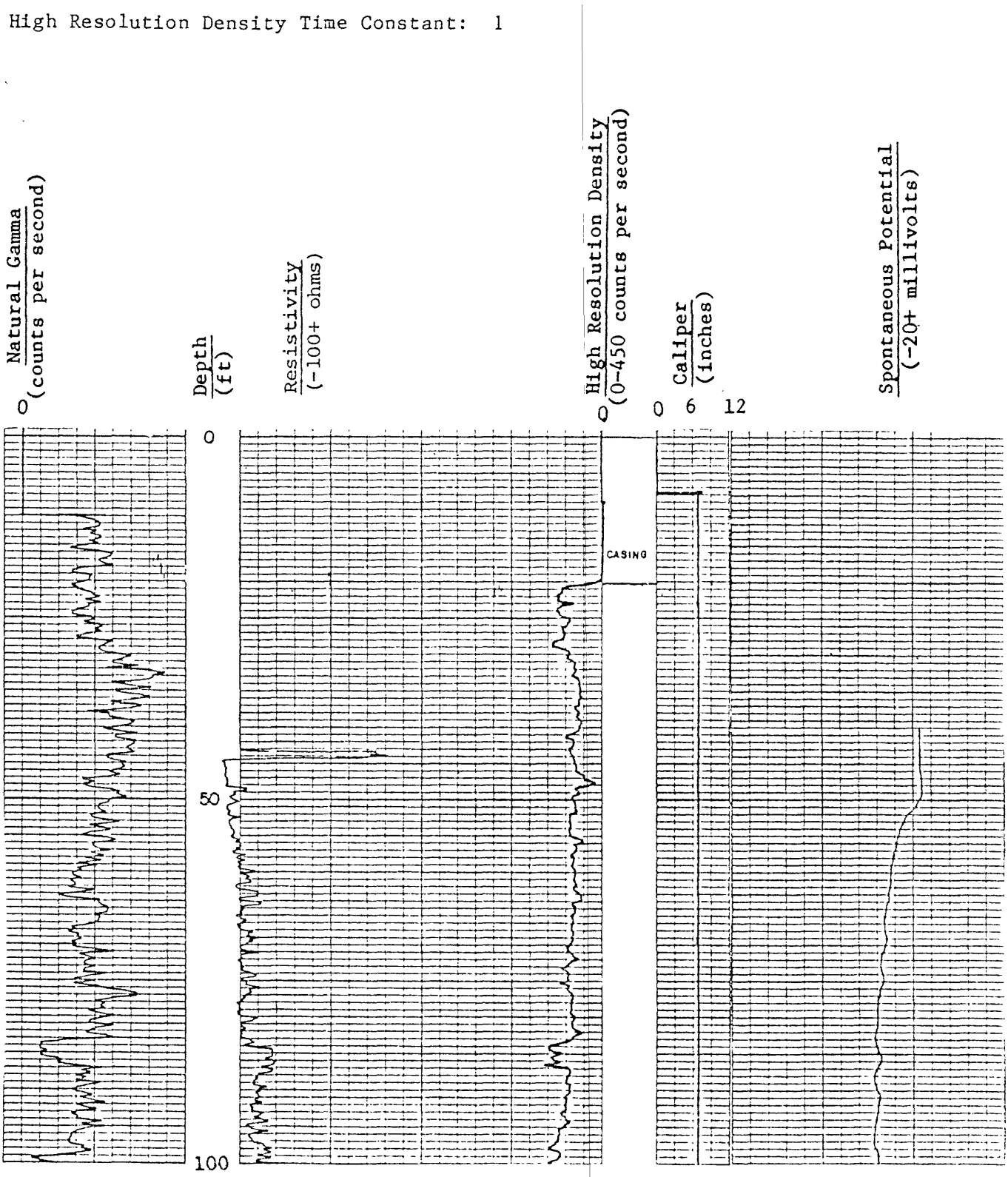
Corehole: SW-7 Date: 11/22/83 State: Virginia County: Scott

Quadrangle: Fort Blackmore, Va. Latitude: 36°51'17"N Longitude: 82°36'29"W

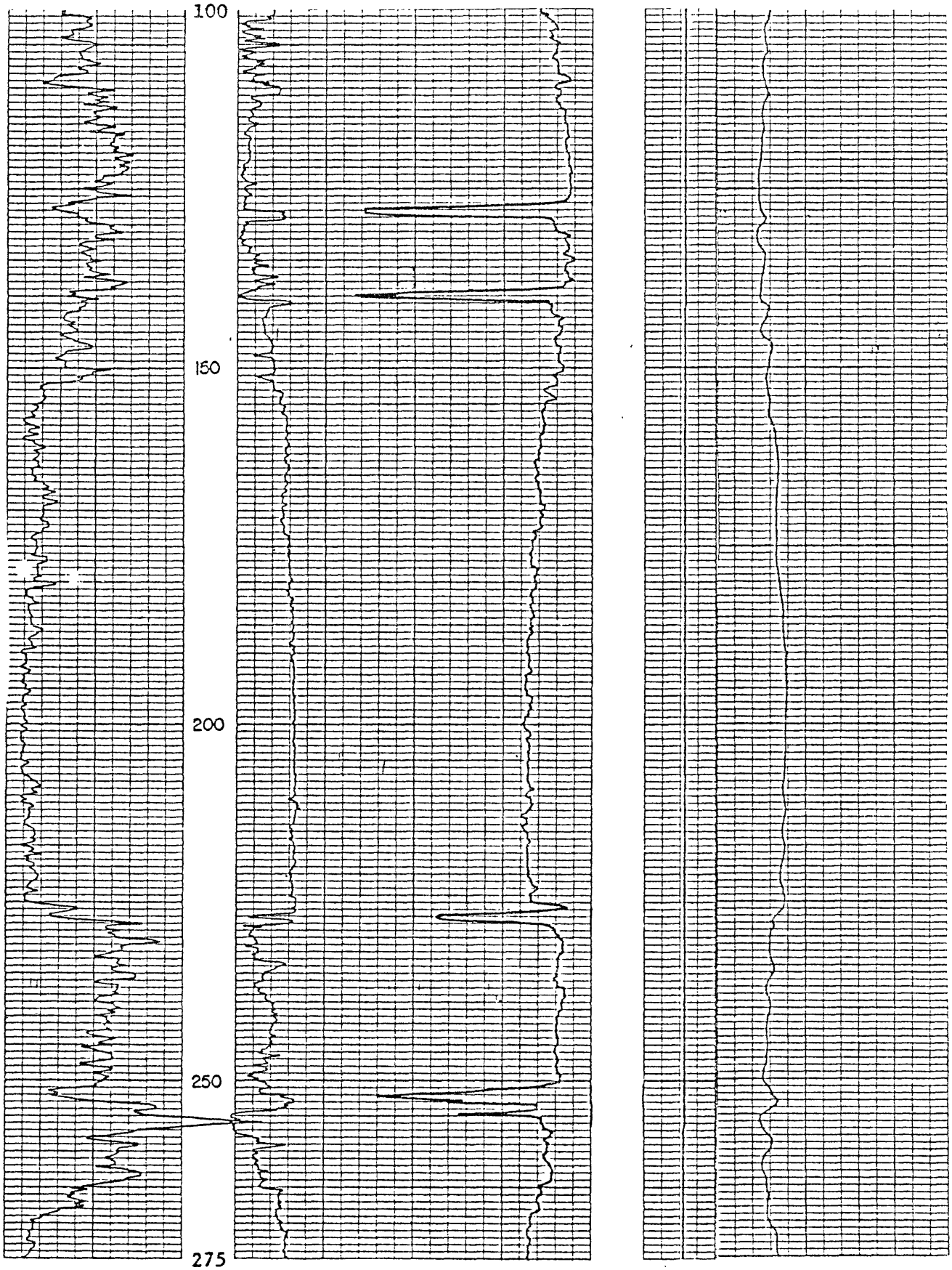
Altitude: 3,270 ft Logged Depth 765 ft Drilled Depth: 765 ft

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

High Resolution Density Time Constant: 1



Corehole: SW-7 continued



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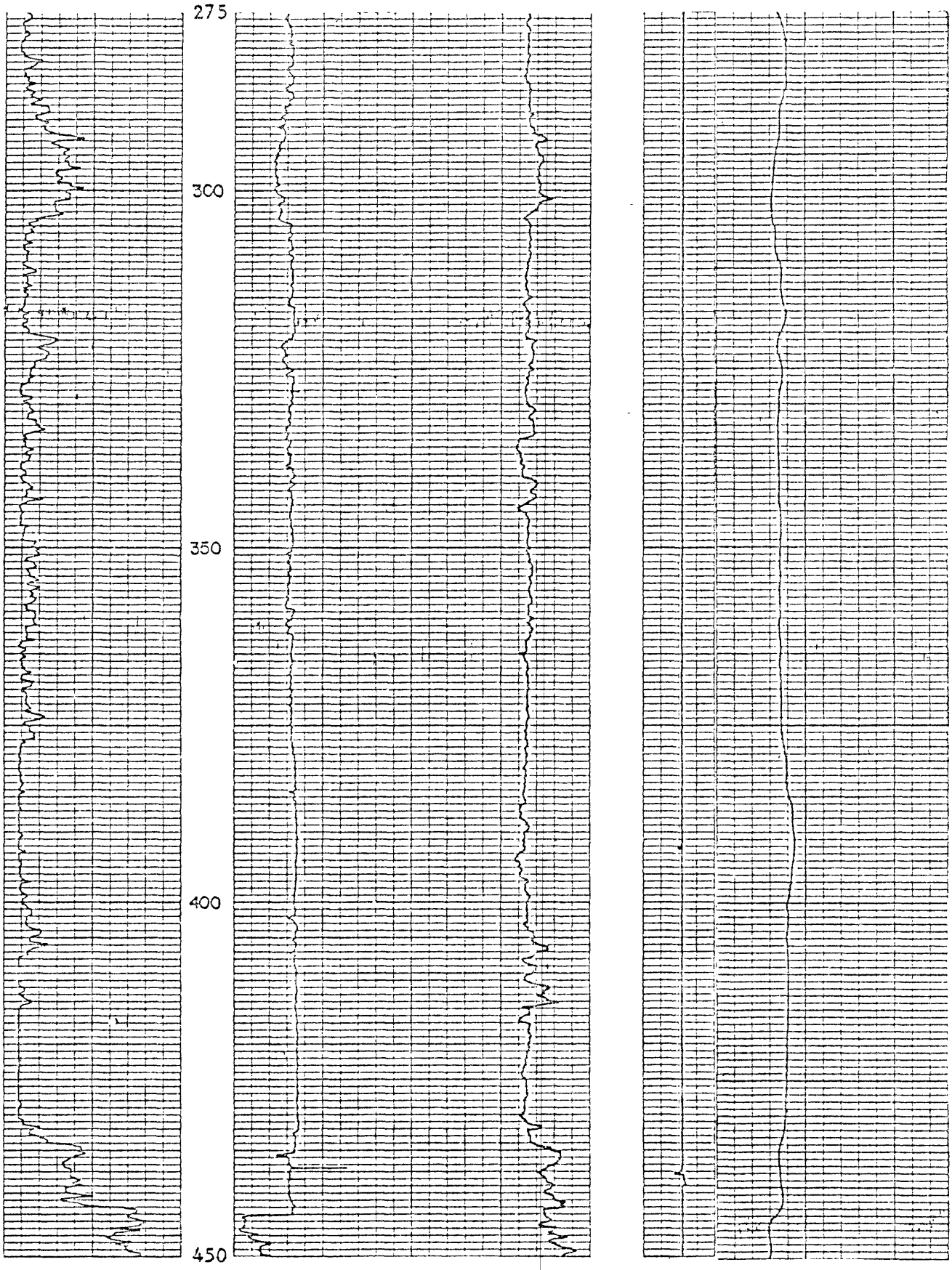

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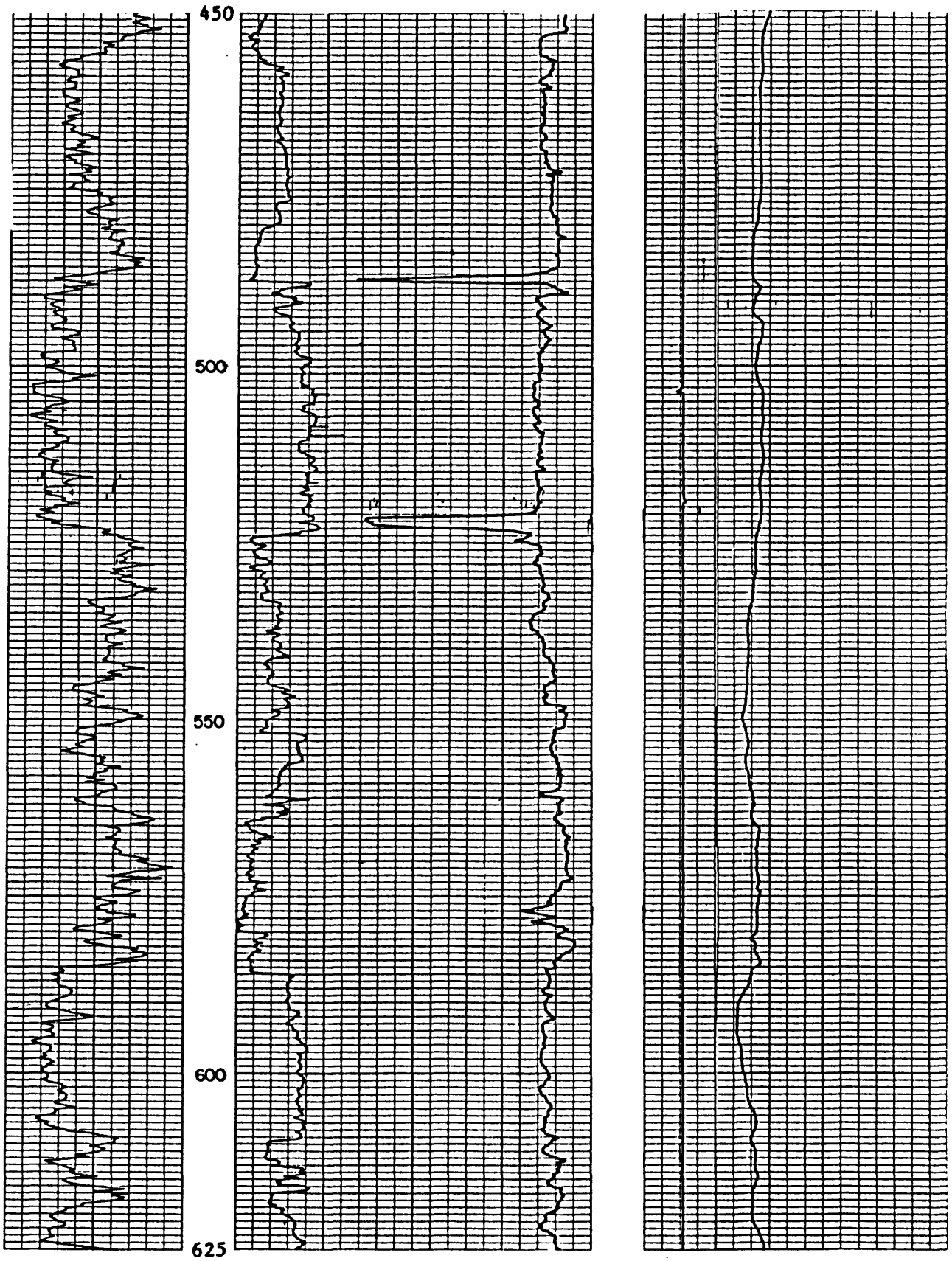
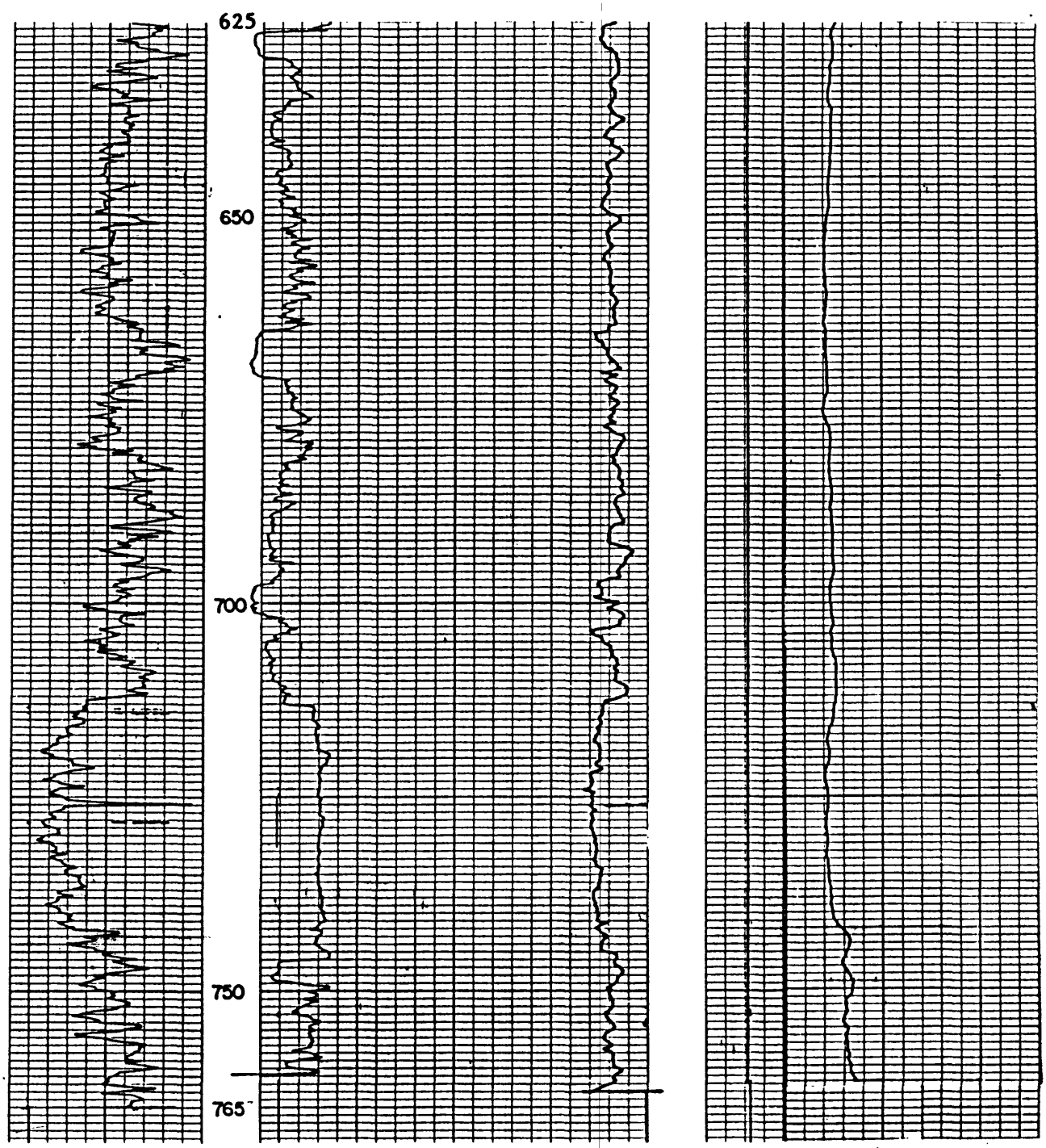
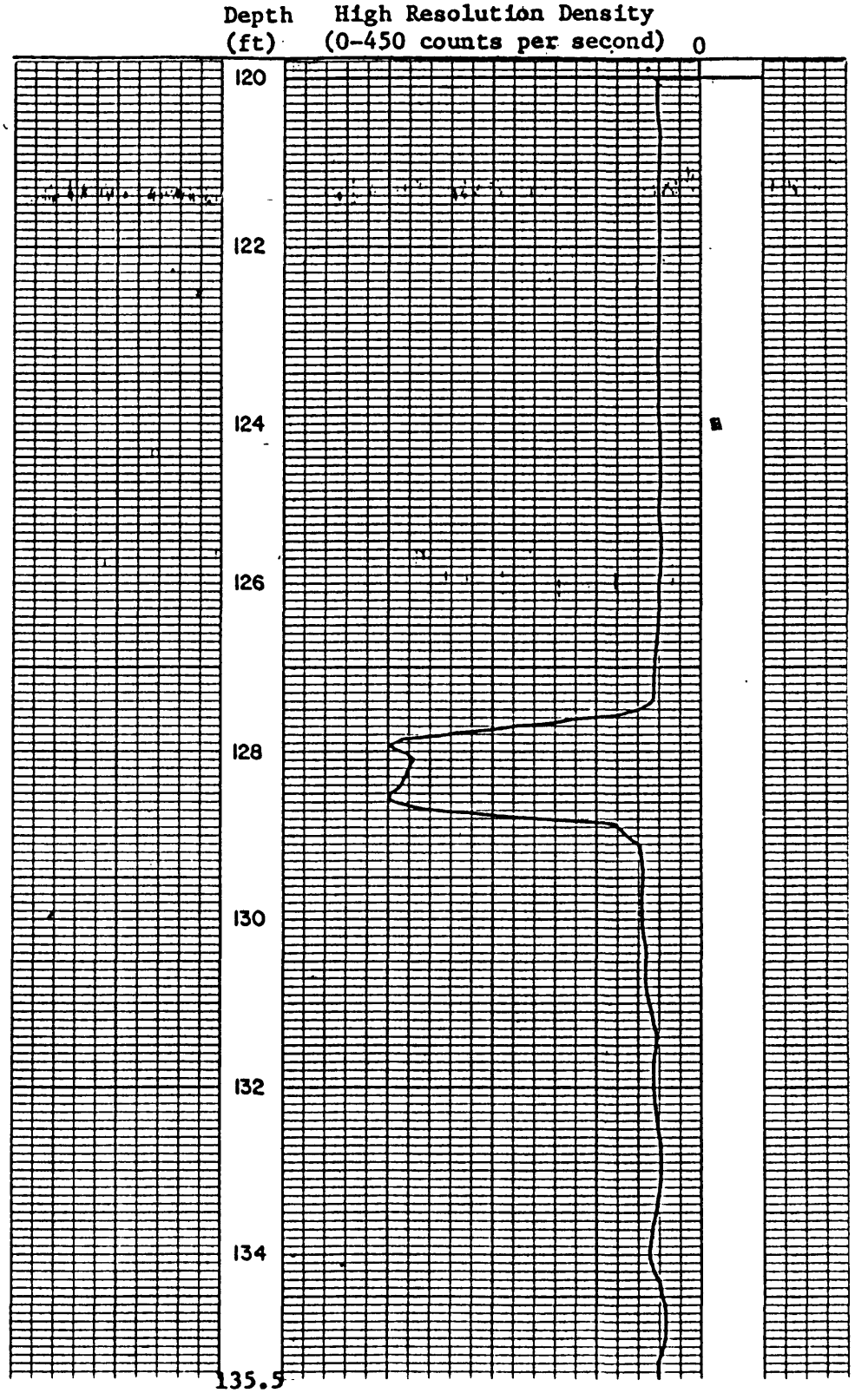


Corehole: SW-7 continued

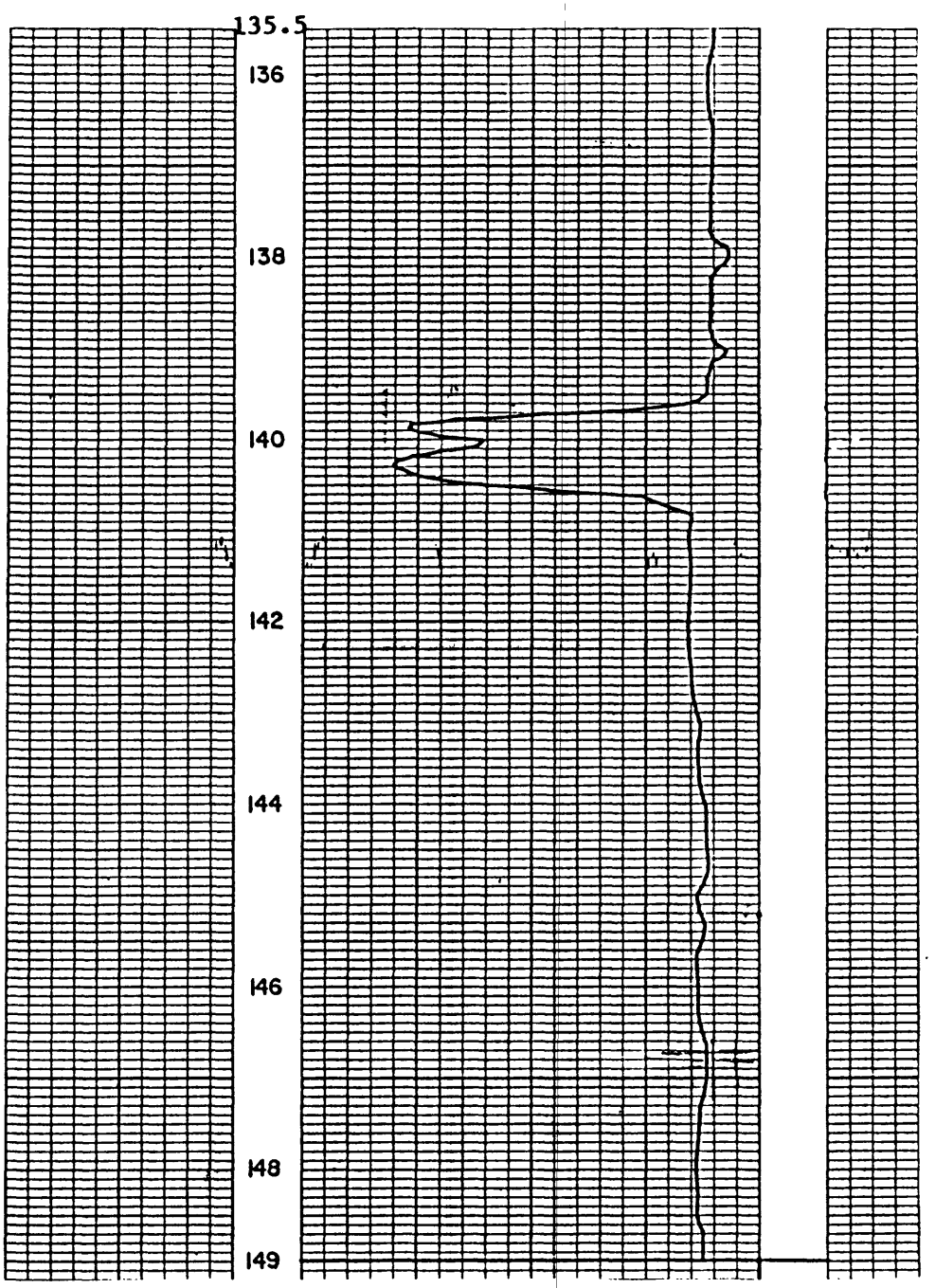


DETAIL LOG

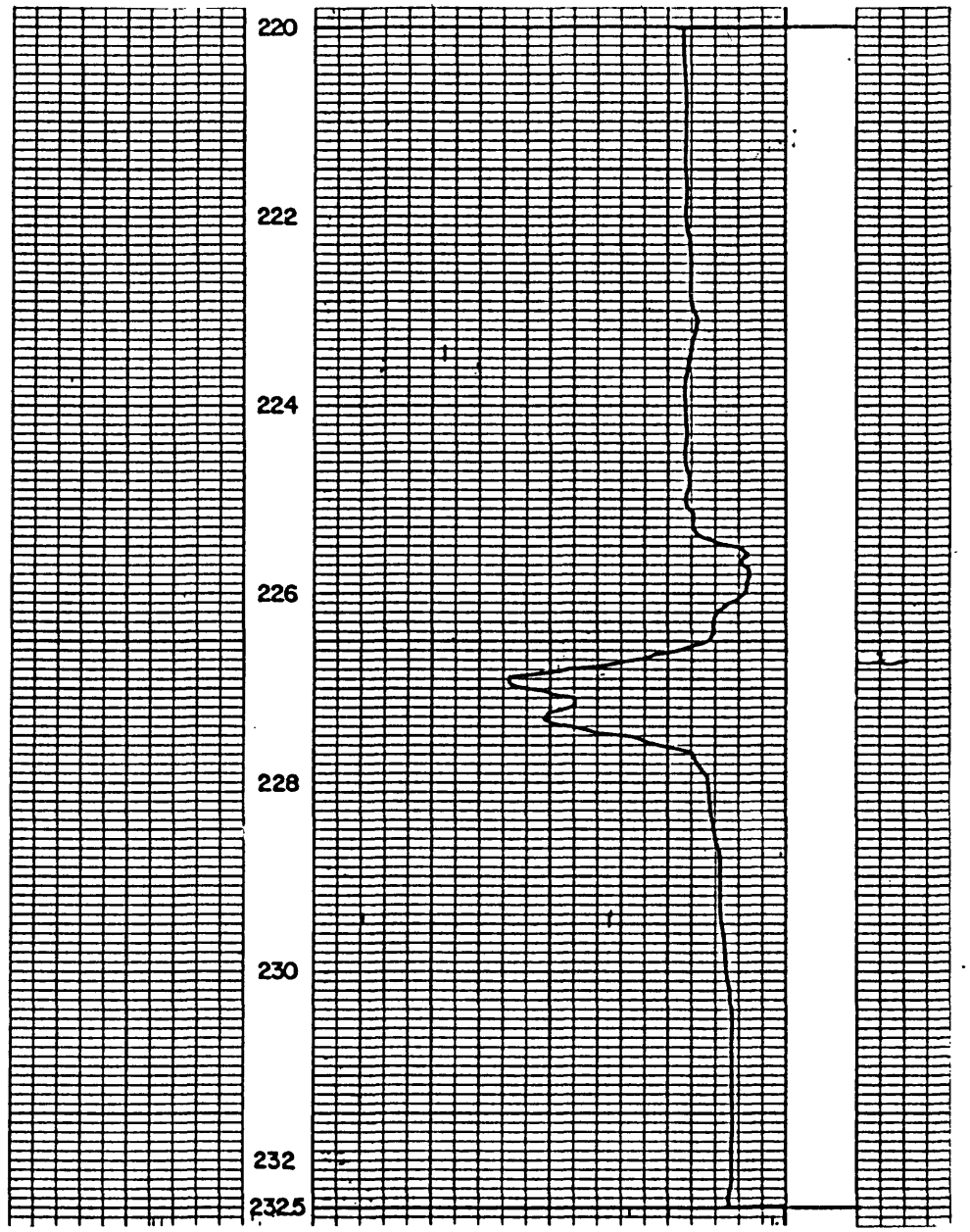
Corehole: SW-7 Logging Speed: 5 ft/min Time Constant: 1



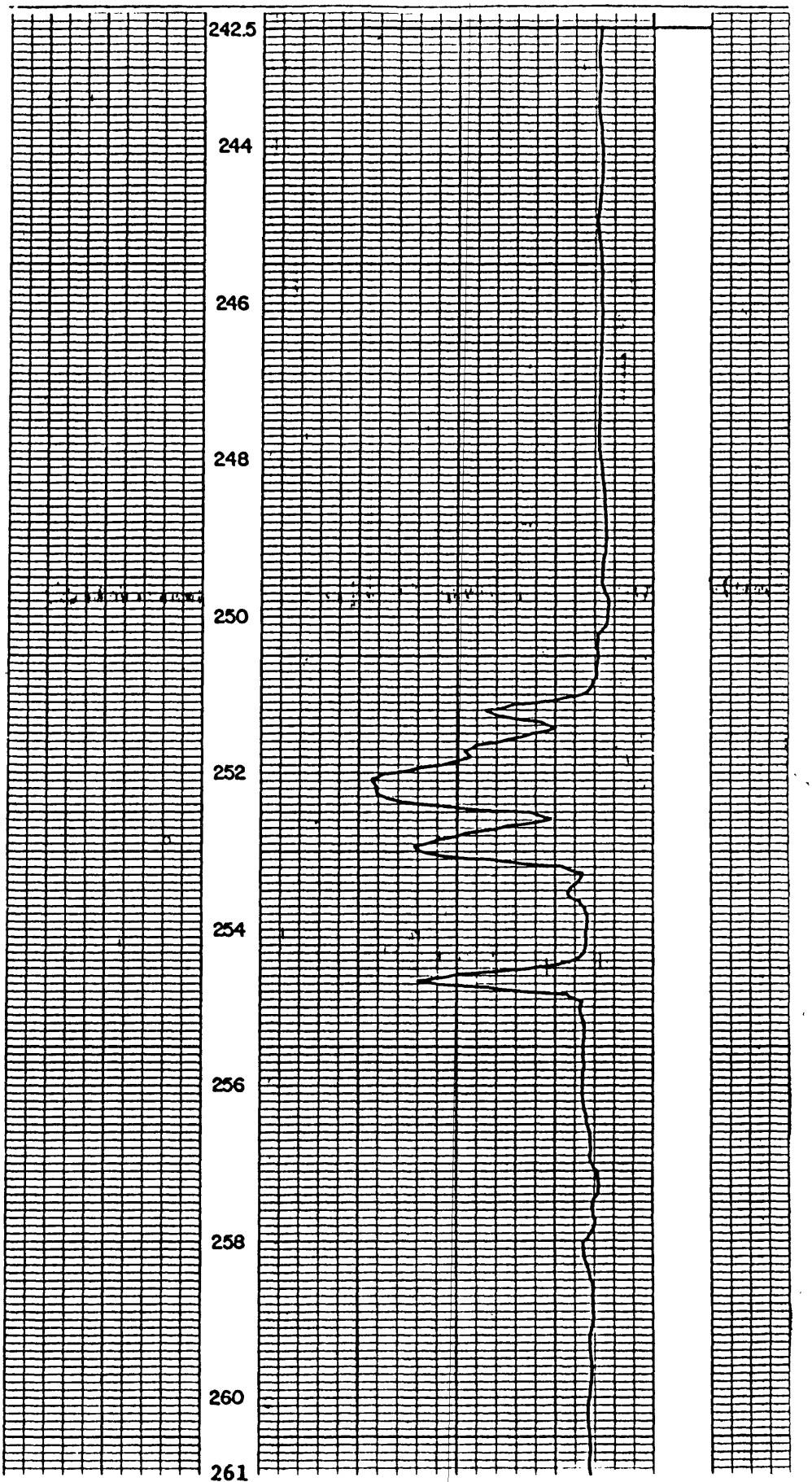
Corehole: SW-7 continued



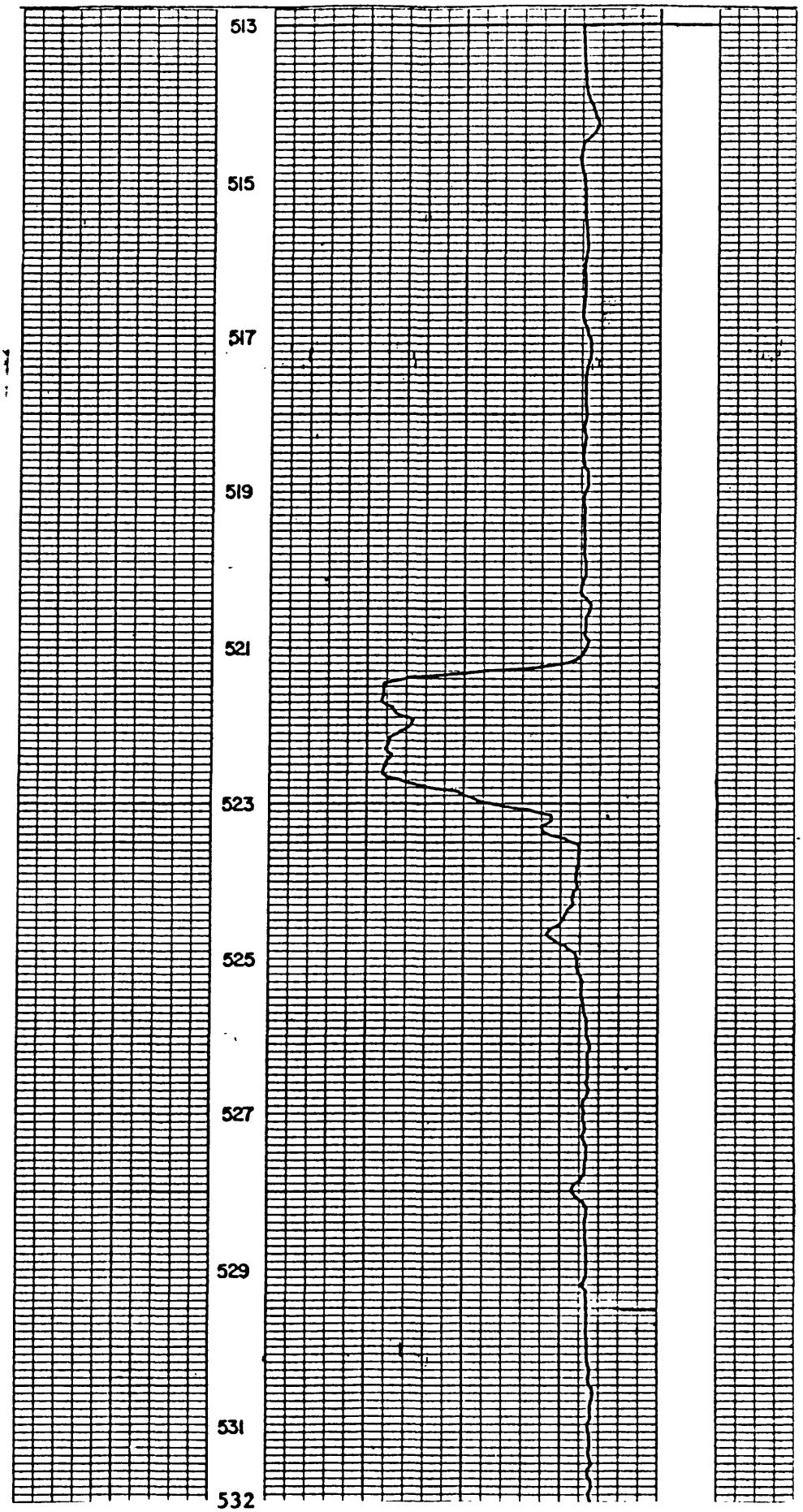
Corehole: SW-7 continued



Corehole: SW-7 continued



Corehole: SW-7 continued



Corehole SW-8

Location: Scott County; East Stone Gap, Va., 7.5 minute quadrangle; on Cove Creek 1.5 mi northwest of Stanleytown. Accessible by gravel road extending north from State Route 653 at Stanleytown, Va.

Coordinates: Latitude 36°47'32"N Longitude 82°41'44"W

Altitude: 1,772 ft Drilled depth: 550 ft

Dip of strata: Decreases from 9° at surface to 0° at depth of 390 ft approximately flat lying to base of corehole.

Date drilled: October 26, 1982 to November 5, 1982

Core description: K.J. Englund, R.E. Thomas, and J.C. Weber

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER PENNSYLVANIAN SERIES Lee Formation Middlesboro Member		
1.	Soil and weathered rock (casing set - no core recovered).....	15	0
		(15	0)
2.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 30 percent dark-gray shale laminae, thin-bedded, unevenly bedded; base sharp.....	6	7
		(21	7)
3.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, 5 percent dark-gray shale laminae, unevenly bedded, thin-bedded; base grades.....	3	4
		(24	11)
4.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, 25 percent dark-gray shale laminae, mostly ripple bedded; base grades.....	6	0
		(30	11)
5.	Sandstone, light-gray, fine-grained, micaceous, contains 40 percent quartz, 15 percent dark-gray shale laminae; base sharp.....	1	3
6.	Shale, medium-dark-gray, contains 40 percent light-gray, very fine grained sandstone laminae, evenly bedded; base grades.....	1	1
		(33	3)
7.	Shale, medium-dark-gray, silty, micaceous, evenly bedded; base grades.....	10	7
		(43	10)

Unit Number	Description	Thickness (Depth) ft - in.
8.	Shale, dark-gray, very carbonaceous, contains abundant plant pinnules and stems, evenly bedded; base grades.....	1 3 (45 1)
9.	Coal, Upper split of Cove Creek coal bed, mostly bright attritus.....	1 0 (46 1)
10.	Underclay, medium-dark-gray, rootlets; base sharp.....	1 7 (47 8)
11.	Sandstone, light-gray, very fine to fine-grained contains 50 percent quartz, 5 percent dark-gray shale laminae and beds up to 0.5 in. thick, few rootlets, poorly bedded; base sharp.....	2 9 (50 5)
12.	Shale, medium-dark-gray, contains 5 percent sandstone laminae, unevenly bedded; base sharp.....	1 2 (51 7)
13.	Sandstone, medium-light-gray, very fine grained, contains 45 percent quartz, 5 percent dark-gray shale laminae, ripple-bedded; base grades.....	0 6 (52 1)
14.	Shale, medium-dark-gray, evenly bedded; base sharp.....	2 3 (54 4)
15.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz.....	0 2 (54 6)
16.	Shale, medium-dark-gray, contains abundant plant fragments, evenly bedded; base sharp.....	1 0 (55 6)
17.	Sandstone, light-gray, very fine grained, contains 40 percent quartz; base sharp.....	0 2 (55 8)
18.	Shale, medium-dark-gray, contains few plant fragments.....	2 0 (57 8)
19.	Coal, Lower split of Cove Creek coal bed; scattered vitrain bands, bright attrital mattrix.....	1 5 (59 1)
20.	Underclay, medium-light-gray, plastic, abundant rootlets; base grades.....	2 7 (61 8)

Unit Number	Description	Thickness (Depth) ft - in.
21.	Siltstone, medium-gray, few rootlets, faintly bedded; base grades abruptly.....	1 4 (63 0)
22.	Sandstone, very light gray, fine- to medium-grained, micaceous, contains 65 percent quartz, crossbedded; base sharp.....	7 3 (70 3)
23.	Shale, medium-gray, silty, evenly bedded.....	0 2 (70 5)
24.	Sandstone, very light gray, fine- to medium-grained, micaceous, contains 65 percent quartz, massive; base sharp.....	1 0 (71 5)
25.	Shale, medium-gray, silty, evenly bedded; base sharp.....	0 2 (71 7)
26.	Sandstone, very light gray, fine- to medium-grained, micaceous contains 65 percent quartz, micaceous, crossbedded; base sharp.....	8 3 (79 10)
27.	Shale, medium-dark-gray, evenly bedded; base sharp.....	0 3 (80 1)
28.	Sandstone, very light gray, medium-grained, contains 65 percent quartz, crossbedded, massive; base sharp.....	21 1 (101 2)
29.	Shale, dark-gray, very silty, contains 25 percent medium-light-gray siltstone laminae, evenly bedded, fair fissility; base sharp.....	1 1 (102 3)
30.	Sandstone, white to very light gray, fine- to medium-grained (grades to medium-grained at base), contains 90 percent quartz, crossbedded, massive; base grades.....	8 0 (110 3)
31.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles up to 0.5 in. in diameter; base grades.....	39 9 (150 0)
32.	Sandstone, white, medium- to coarse-grained, contains 90 percent quartz, few well rounded white quartz pebbles, crossbedded, massive; base grades.....	1 7 (151 7)

Unit Number	Description	Thickness (Depth) ft - in.
33.	Conglomerate, white, contains well rounded quartz pebbles up to 0.25 in. in diameter, few coal clasts, medium- to coarse-grained quartzose sandstone matrix; base sharp.....	0 9 (152 4)
34.	Sandstone, white, medium- to coarse-grained, contains 90 percent quartz.....	4 0 (156 4)
35.	Sandstone, light-brownish-gray, fine- to medium-grained, sideritic, micaceous.....	0 4 (156 8)
36.	Sandstone, white to medium-light-gray, medium- to coarse-grained, contains 90 percent quartz, abundant angular shale clasts in top 5 in., scattered well rounded quartz pebbles, few medium-dark-gray micaceous siltstone laminae in upper 3 ft., crossbedded, massive; base grades.....	36 0 (192 8)
37.	Sandstone, light-gray to light-brownish-gray, medium-grained, contains 90 percent quartz, well sorted, massive; base grades.....	2 10 (195 6)
38.	Sandstone, white to very light gray to white, medium-grained, contains 90 percent quartz, crossbedded, massive; base grades.....	5 3 (200 9)
39.	Sandstone, white, medium- to coarse-grained, contains 90 percent quartz, crossbedded, massive; base grades.....	7 1 (207 10)
40.	Sandstone, white, medium- to coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded quartz pebbles from 0.25 to 0.5 in. in diameter, few stylolites; base sharp.....	7 8 (215 6)
41.	Sandstone, light-gray, medium-grained, sparsely micaceous, contains 65 percent quartz, scattered dark and light mineral grains; base grades.....	0 11 (216 5)
42.	Sandstone, light-gray, medium- to coarse-grained, contains 65 percent quartz, scattered well rounded white quartz pebbles mostly 0.5 in. in diameter, abundant coal laminae and lenses up to 1 in. thick; base grades.....	1 10 (218 3)
43.	Sandstone, light-gray, medium-grained, contains 65 percent quartz, 5 percent micaceous siltstone laminae in upper 5 ft, crossbedded; base grades.....	7 2 (225 5)

Unit Number	Description	Thickness (Depth) ft - in.
44.	Sandstone, very light gray, medium-grained (grades to coarse-grained at base), contains 65 percent quartz, 5 percent micaceous siltstone laminae, crossbedded; base sharp.....	5 3 (230 8)
45.	Shale, medium-dark-gray, carbonaceous, evenly bedded; base sharp.....	0 5 (231 1)
46.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, 5 percent dark-gray shale laminae.....	1 0 (232 1)
47.	Shale, dark-gray, contains 10 percent light-gray siltstone laminae, evenly bedded; base sharp.....	4 6 (236 7)
48.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, 5 percent dark-gray discontinuous shale laminae; base grades.....	1 8 (238 3)
49.	Shale, dark-gray, evenly bedded, fissile; base sharp.....	0 8 (238 11)
50.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, 5 percent dark-gray silty-shale laminae, thin- to thick-bedded.....	1 10 (240 9)
51.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, few dark-gray shale clasts, massive.....	2 6 (243 3)
52.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 25 percent dark-gray shale laminae; base grades.....	1 1 (244 4)
53.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, 5 percent discontinuous medium-light-gray siltstone laminae, thin- to thick-bedded; base grades.....	5 5 (249 9)
54.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, massive; base sharp.....	18 6 (268 3)

Unit Number	Description	Thickness (Depth) ft - in.
55.	Siltstone, medium- to medium-dark-gray, contains 20 percent dark-gray shale laminae; base grades.....	0 2
		(268 5)
56.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, 5 percent medium-gray siltstone laminae, thin to thick-bedded; base grades.....	3 0
		(271 5)
57.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, abundant large angular dark-gray shale clasts in basal 7 in.....	6 9
		(278 2)
58.	Sandstone, very light gray, medium-grained, contains 65 percent quartz, few white well rounded quartz pebbles and siderite clasts in basal 1 ft, crossbedded, massive; base sharp.....	8 11
		(287 1)
59.	Sandstone, medium-light-gray, very fine grained, silty, contains 50 percent quartz.....	0 1
		(287 2)
60.	Conglomerate, white to very light gray, contains well rounded quartz pebbles from 0.5 to 1 in. in diameter, well rounded to angular siderite clasts up to 2 in. in diameter, medium- to coarse-grained quartzose sandstone matrix; base sharp.....	6 4
		(293 6)
61.	Sandstone, white to very light gray, medium-grained, contains 90 percent quartz, 5 percent medium-gray micaceous siltstone laminae, few siderite clasts in basal 1 ft, thick-bedded to massive.....	6 2
		(299 8)
62.	Sandstone, white, medium- to coarse-grained, contains 90 percent quartz, few dark-gray shale and siderite clasts 39 ft 6 in. below top, few stylolites, crossbedded, massive; base grades.....	62 1
		(361 9)
63.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded quartz pebbles mostly 0.5 in. in diameter, 2 in. thick coal clast 1 ft 3 in. below top, crossbedded, massive; base grades.....	4 8
		(366 5)

Unit Number	Description	Thickness (Depth) ft - in.
64.	Conglomerate, white to very light gray, contains scattered well rounded quartz pebbles, angular dark-gray shale clasts up to 2 in. in diameter, abundant angular to well rounded siderite clasts up to 4 in. in diameter, medium- to coarse-grained quartzose sandstone matrix; base sharp.....	3 7 (370 0)
	Pocahontas Formation	
65.	Shale, medium-gray, fissile, contains few plant stems, evenly bedded; base grades.....	0 7 (370 7)
66.	Shale, medium-gray, silty, evenly bedded, poor fissility; base grades.....	3 0 (373 7)
67.	Shale, medium-gray, silty in basal 4 ft 6 in., contains few scattered siderite nodules, evenly bedded; base grades abruptly.....	6 1 (379 8)
68.	Shale, medium-dark-gray, silty, poor fissility; base sharp.....	1 3 (380 11)
69.	Sandstone, light- to medium-light-gray, very fine to fine-grained, thin-bedded; base sharp.....	0 5 (381 4)
70.	Shale, medium-dark-gray, very silty, contains 20 percent light-gray siltstone laminae, evenly bedded, poor fissility; base grades abruptly.....	1 0 (382 4)
71.	Siltstone, medium- to medium-light gray, micaceous, contains 20 percent light-gray very fine grained sandstone laminae and beds.....	1 8 (384 0)
72.	Sandstone, medium-light-gray, fine-grained, contains 50 percent quartz, massive; base grades.....	1 7 (385 7)
73.	Sandstone light- to medium-light-gray, very fine to fine-grained, finely micaceous, silty, contains 40 percent quartz, 20 percent medium-dark-gray shale and siltstone laminae, few dark-gray shale clasts, thin and evenly bedded.....	3 7 (389 2)
74.	Shale, medium-dark-gray, very silty, contains 20 percent medium-light-gray siltstone laminae, evenly bedded.....	2 6 (391 8)

Unit Number	Description	Thickness (Depth) ft - in.
		(391 8)
75.	Sandstone, medium- to medium-light-gray, very fine to fine-grained, contains 50 percent quartz, 20 percent medium-dark-gray silty-shale laminae, few siderite clasts in basal 2 in., thin-bedded; base sharp.....	11 1
		(402 9)
76.	Shale, dark-gray, silty in top 2 ft, fissile, carbonaceous, contains abundant siderite beds up to 6 in. thick.....	11 8
		(414 5)
77.	Coal, few thick vitrain bands, dull to bright attrital matrix.....	0 7
		(415 0)
78.	Underclay, light-brownish-gray, very silty, black and carbonaceous in top 1 in., abundant rootlets; base grades.....	2 2
		(417 2)
79.	Sandstone, light- to medium-light-gray, fine-grained, micaceous, contains 40 percent quartz, 10 percent dark-gray shale laminae and beds up to 1 in. thick, thin-bedded; base grades.....	6 5
		(423 7)
80.	Sandstone, light-gray, fine-grained, micaceous, contains 60 percent quartz, 5 percent medium-gray siltstone laminae, scattered dark mineral grains, thin-bedded; base grades.....	12 7
		(436 2)
81.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, thin- to thick-bedded; base grades.....	9 6
		(445 8)
82.	Sandstone, light-gray, fine-grained, contains 40 percent quartz, 40 percent dark-gray shale laminae, flaser-bedded; base grades.....	3 5
		(449 1)
83.	Sandstone, light-gray, fine- to medium-grained, contains 40 percent quartz, abundant coal laminae and clasts, scattered siderite clasts, very irregularly bedded; base sharp.....	2 8
		(451 9)
	UPPER MISSISSIPPIAN SERIES Bluestone Formation Bramwell Member	
84.	Shale, light-greenish-gray, calcareous, contains 10 percent light-gray siltstone laminae, evenly bedded; base grades.....	4 4
		(456 1)
85.	Shale, medium-dark-gray, silty, burrowed, evenly bedded, poor fissility.....	4 0
		(460 1)

Unit Number	Description	Thickness (Depth) ft - in.
86.	Siltstone, medium-dark-gray, contains abundant marine invertebrate fossils in basal 1 ft 4 in. including 2 in. thick coquina at base, thin-bedded, poor fissility.....	1 11 (462 0)
87.	Shale, medium-dark-gray, silty, contains 10 percent medium-light-gray siltstone laminae, abundant marine invertebrate fossils from 2 ft to 2 ft 8 in. and 4 ft to 4 ft 6 in. below top; base grades.....	4 9 (446 9)
88.	Shale, dark-gray, silty, contains 30 percent light-gray very fine grained sandstone laminae, burrowed, flaser-bedded.....	11 0 (477 9)
89.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, 5 percent medium-gray silty-shale laminae, thin- to thick-bedded; base grades.....	27 4 (505 1)
90.	Shale, medium- to medium-dark-gray, finely micaceous, silty, finely micaceous, contains 10 percent medium-light-gray siltstone laminae, evenly bedded.....	1 7 (506 8)
	Bluestone Formation Red Member	
91.	Coal, mostly dull attritus.....	0 3 (506 11)
92.	Shale, medium-gray, silty in basal 6 ft 1 in., contains few scattered limestone nodules, faintly bedded, poor fissility; base grades.....	8 7 (515 6)
93.	Shale, reddish-gray, faintly bedded, poor fissility; base grades.....	2 8 (518 2)
94.	Siltstone, medium-light-gray, mottled greenish-gray and grayish-red; base grades.....	2 0 (520 2)
95.	Siltstone, medium-light-gray, mottled greenish-gray, sandy, slightly calcareous; base sharp.....	1 0 (521 2)
96.	Shale, medium-light-gray, mottled greenish-gray, silty; base grades..	0 10 (522 0)

Unit Number	Description	Thickness (Depth) ft - in.
97.	Shale, grayish-red, faintly bedded, poor fissility; base grades.....	1 2 (523 2)
98.	Shale, medium-gray, mottled greenish-gray, silty, slightly calcareous.....	1 10 (525 0)
99.	Shale, grayish-red, mottled light-gray in part, faintly bedded, poor fissility; base grades abruptly.....	12 1 (537 1)
100.	Sandstone, medium-light-gray, mottled greenish-gray, very fine to fine-grained, micaceous, slightly calcareous, contains 40 percent quartz, few limestone nodules, thin- to thick-bedded; base grades.....	3 0 (540 1)
101.	Shale, grayish-red, silty at base, evenly bedded.....	0 9 (540 10)
102.	Siltstone, medium-gray, mottled grayish-red, evenly bedded; base grades.....	1 9 (542 7)
103.	Shale, grayish-red, few slickensided surfaces, faintly bedded, poor fissility.....	7 5 (550 0)

BOTTOM OF HOLE
TOTAL DEPTH 550 ft

GEOPHYSICAL LOG

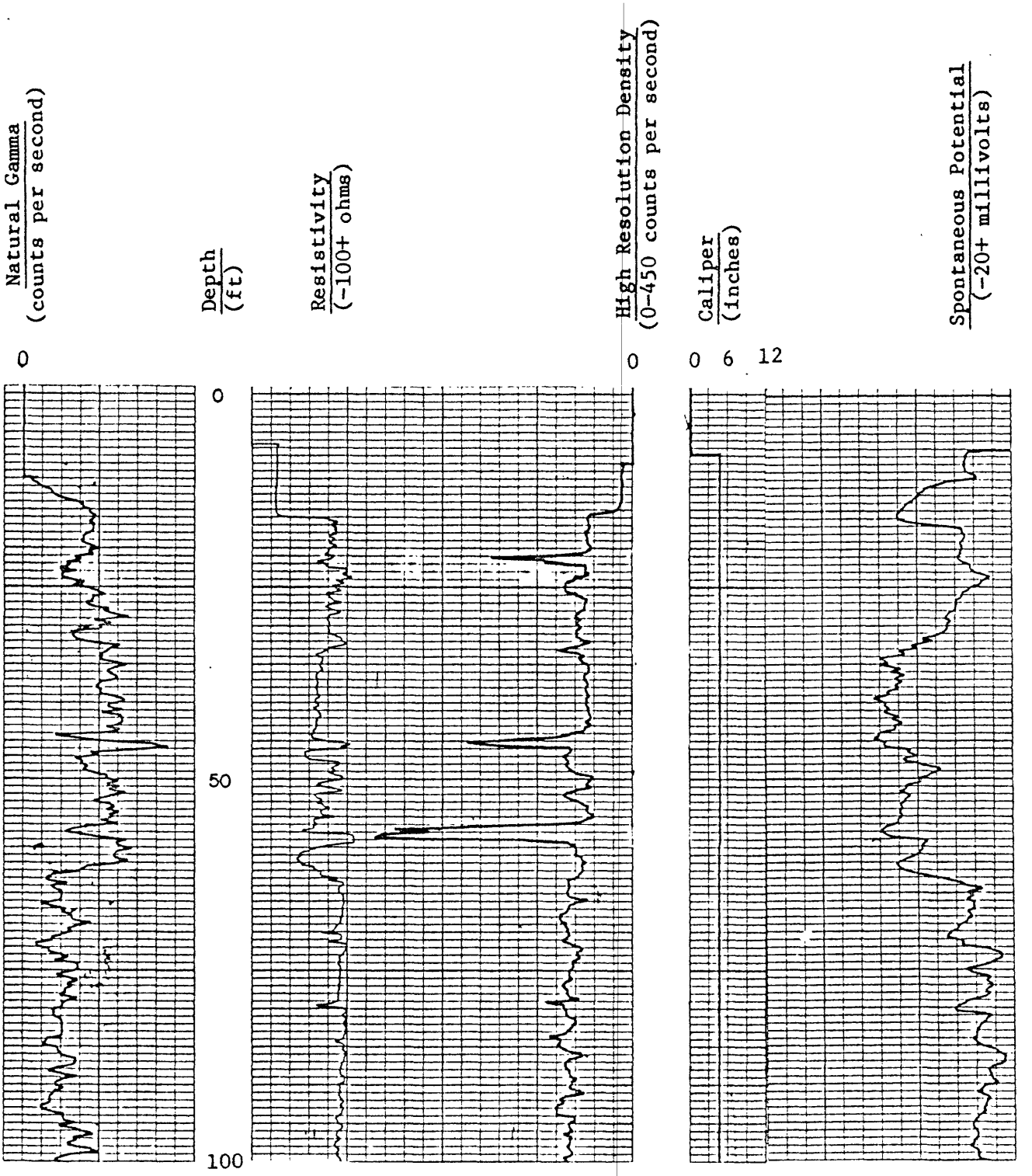
Corehole: SW-8 Date: 11/05/82 State: Virginia County: Scott

Quadrangle: East Stone Gap, Va. Latitude: 36°47'32"N Longitude: 82°41'44"W

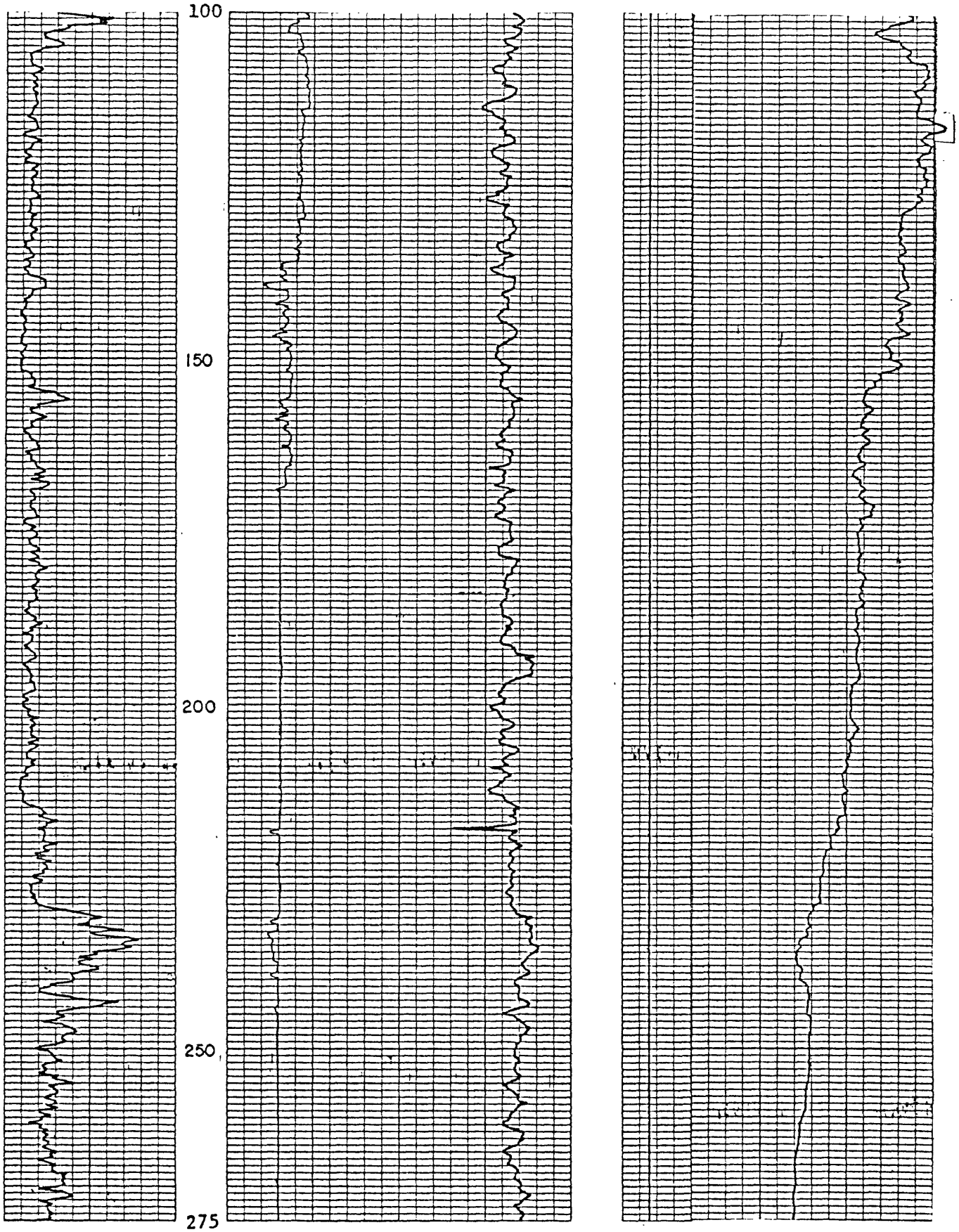
Altitude: 1,772 ft Logged Depth: 550 ft Drilled Depth: 550 ft

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

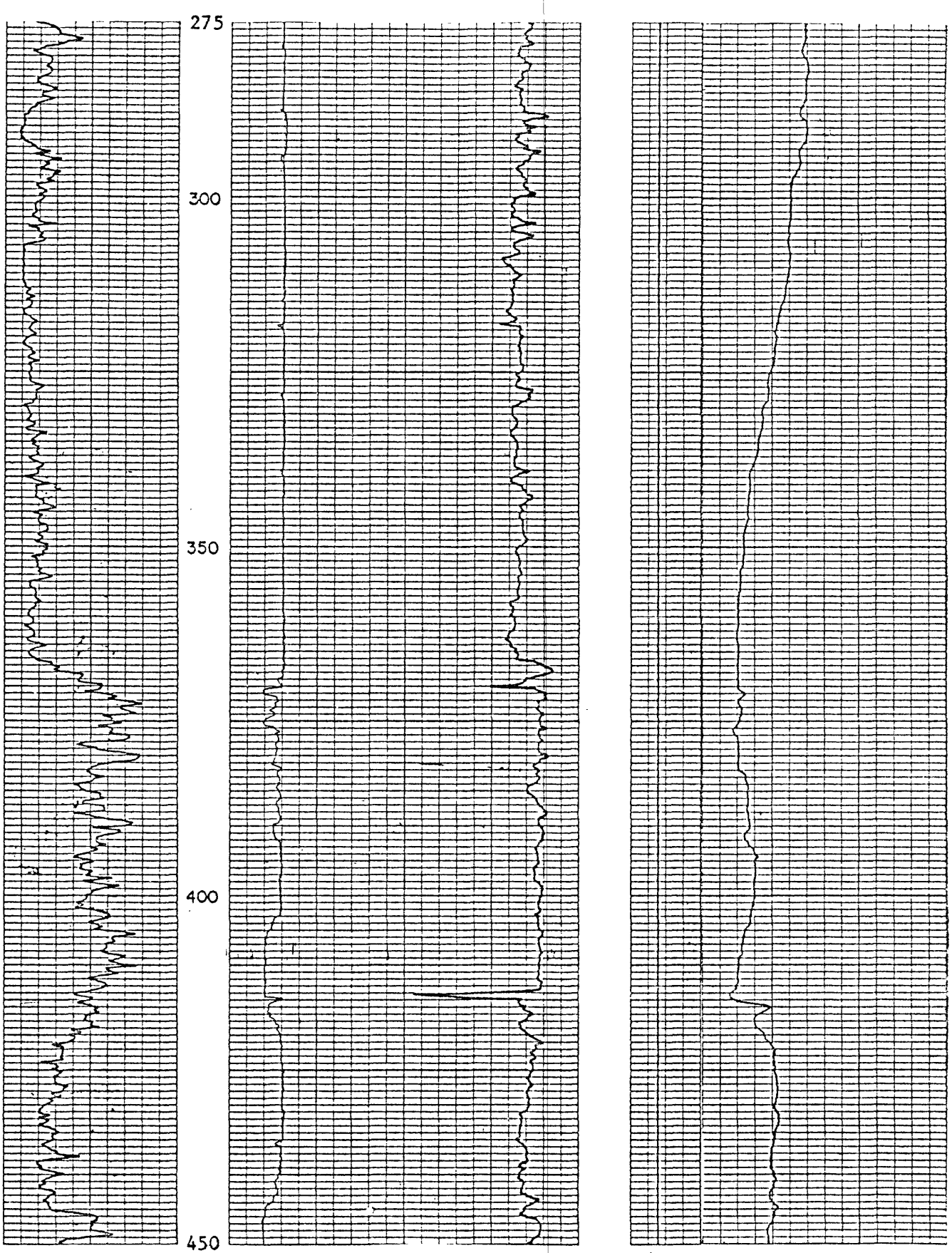
High Resolution Density Time Constant: 1



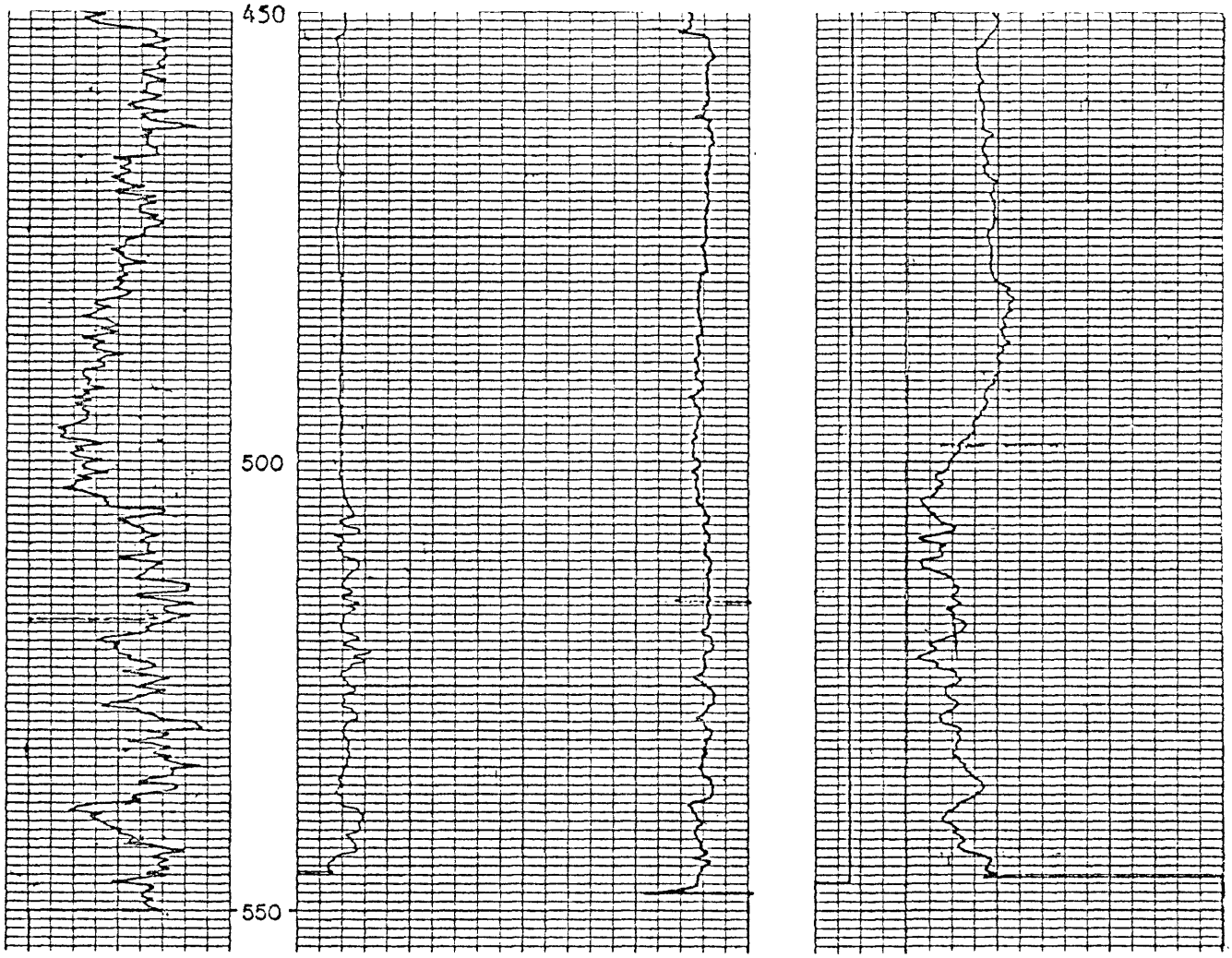
Corehole: SW-8 continued



Corehole: SW-8 continued

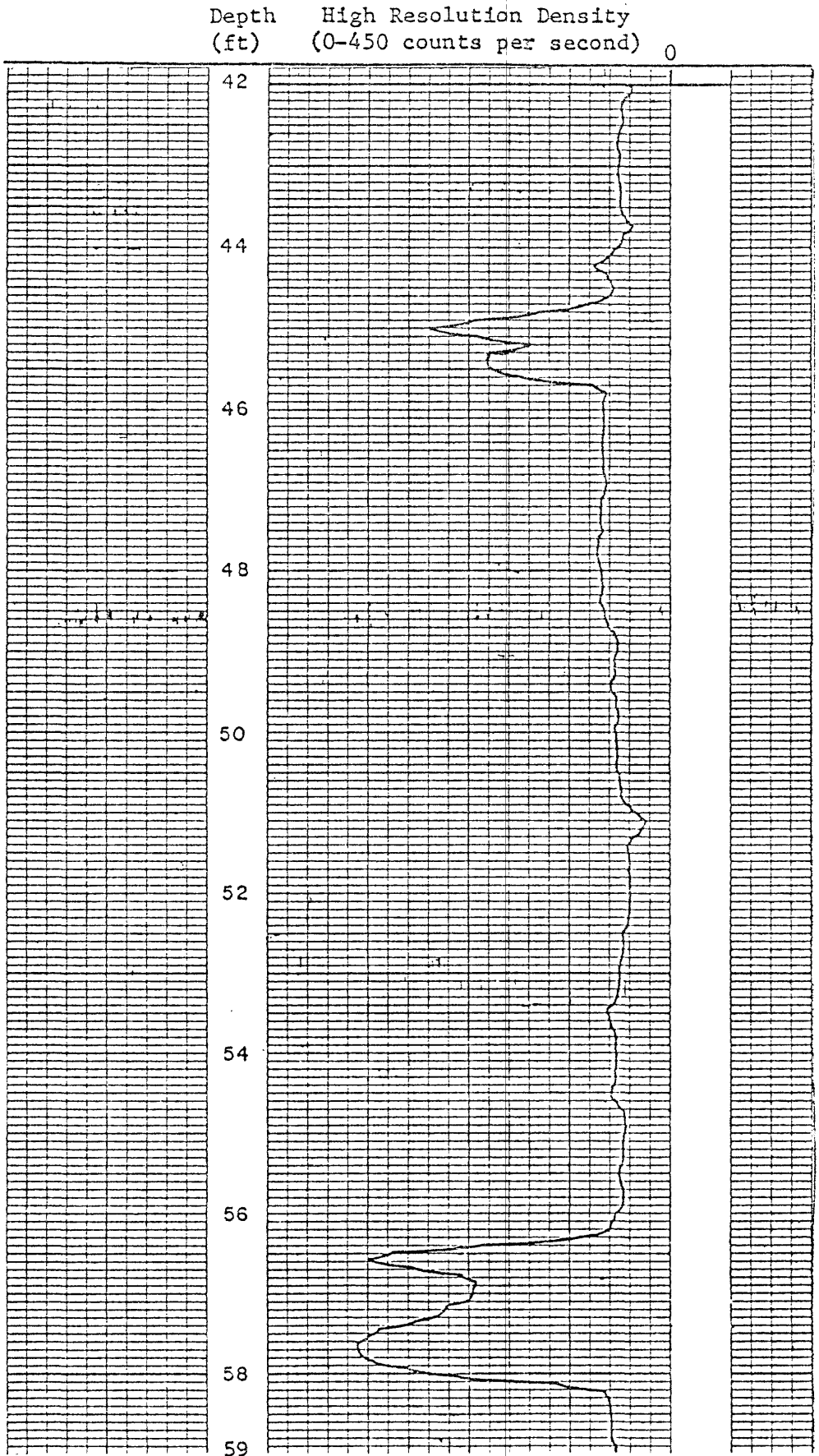


Corehole: SW-8 continued



DETAIL LOG

Corehole: SW-8 Logging Speed: 5 ft/min Time Constant: 1



Corehole SW-9

Location: Lee County; Big Stone Gap, Va., 7.5 minute quadrangle; on ridge between Wells Branch and Lake Keokee. Accessible by Forest Service road extending eastward from road to Lake Keokee.

Coordinates: Latitude 36°51'13" N Longitude: 82°51'34"W

Altitude: 2,345 ft Drilled depth: 1,662 ft

Dip of strata: Ranges from 10° to 20° to depth of 500 ft, decreasing to about 5° at depth of 1,300 ft and 0° to 3° to base of corehole.

Date drilled: November 29, 1982 to January 13, 1983

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

Unit Number	Description	Thickness (Depth) ft	in.
	MIDDLE PENNSYLVANIAN SERIES		
	Wise Formation		
1.	Soil and weathered rock (casing set- no core recovered).....	20	0
		(20	0)
	Gladeville (?) Sandstone		
2.	Sandstone, light-gray, fine- to medium-grained, sparsely micaceous, contains 65 percent quartz, scattered dark mineral grains and feldspar, few dark-gray shale laminae, thin- to thick-bedded, few contorted beds; base sharp.....	4	3
		(24	3)
3.	Sandstone, light-gray, weathered brownish-gray, medium-grained, contains 60 percent quartz, crossbedded, thin- to thick-bedded; base sharp.....	12	0
		(36	3)
4.	Shale, dark-gray, silty, micaceous, evenly bedded, fissle; base sharp.....	0	2
		(36	5)
5.	Sandstone, light-gray, medium-grained, contains 65 percent quartz, few scattered coal and dark-gray shale laminae, thin- to thick-bedded; base sharp.....	30	11
		(67	4)

Unit Number	Description	Thickness (Depth) ft	in.
	Norton Formation		
6.	Shale, dark-gray, carbonaceous, silty, contains scattered medium-gray siltstone laminae, few plant fragments, fissile.....	22	6
		(89	10)
7.	Shale, dark-gray to black, very carbonaceous, silty, contains few medium-gray siltstone laminae and beds, very fissle; base sharp...	4	10
		(94	8)
8.	Siltstone, light- to medium-gray, contains 25 percent light-gray very fine grained sandstone laminae, thin-bedded, few contorted beds in top 6 in. and basal 3 ft; base grades.....	14	11
		(109	7)
9.	Shale, dark-gray, carbonaceous, few plant fragments; base sharp...	0	6
		(110	1)
10.	Coal, Norton coal bed, mostly bright attritus, pyrite along cleats.....	2	2
		(112	3)
11.	Underclay, medium-dark to dark gray, plastic, abundant rootlets; base sharp.....	0	0.5
		(112	3.5)
12.	Sandstone, light-gray, very fine grained, contains 65 percent quartz, 5 percent medium-gray siltstone laminae, thin and contorted bedding; base sharp.....	2	2.5
		(114	6)
13.	Shale, medium-gray, contains 40 percent light- gray siltstone and very fine grained sandstone laminae and beds, irregularly bedded; base sharp.....	1	11
		(116	5)
14.	Coal, impure.....	0	1
		(116	6)
15.	Shale, dark-gray, carbonaceous from 2 ft 7 in. to 4 ft below top, contains 20 percent light-gray very fine grained sandstone laminae and beds, few rootlets and root slicks in top 3 ft; base grades.....	11	0
		(127	6)
16.	Shale, dark-gray, very carbonaceous, evenly bedded; base grades...	0	2
		(127	8)
17.	Coal, Unnamed coal bed, dull to bright attritus.....	0	7
		(128	3)
18.	Underclay, dark-gray, abundant rootlets.....	2	9
		(131	0)

Unit Number	Description	Thickness (Depth) ft	in.
19.	Shale, medium gray, evenly bedded, fissile; base sharp.....	3	8
		(134	8)
20.	Coal, impure.....	0	1
		(134	9)
21.	Sandstone, light-gray, fine-grained, contains 45 percent quartz, thin-bedded.....	0	3
		(135	0)
22.	Shale, dark-gray, carbonaceous.....	0	4
		(135	4)
23.	Coal, impure.....	0	1
		(135	5)
24.	Underclay, medium-gray, abundant rootlets.....	0	3
		(135	8)
25.	Shale, medium-dark- to dark-gray, carbonaceous, contains few coal laminae 1 ft below top; base grades.....	3	0
		(138	8)
26.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, micaceous, cotains 45 percent quartz, 20 percent dark-gray shale laminae, few slickensided surfaces, thin-bedded; base grades.....	1	1
		(139	9)
27.	Siltstone, medium-dark-gray, contains 45 percent light-gray very fine grained sandstone laminae, few coal laminae, thin-bedded, few contorted beds at top; base grades.....	1	3
		(141	0)
28.	Shale, dark-gray, abundant slickensided surfaces, evenly bedded; base sharp.....	0	8
		(141	8)
29.	Coal, mostly bright attritus.....	0	0.75
		(141	8.75)
30.	Shale, dark-gray, carbonaceous.....	0	0.25
		(141	9)
31.	Coal, impure, contains scattered dark-gray shale laminae.....	0	2
		(141	11)
32.	Underclay, dark-gray, carbonaceous, abundant rootlets; base grades.....	0	2
		(142	1)

Unit Number	Description	Thickness (Depth) ft	in.
33.	Shale, medium-gray, silty, few rootlets, evenly bedded; base grades	2	7
		(144	8)
34.	Shale, medium- to medium-dark-gray, scattered plant fragments, few slickensided surfaces, evenly bedded; base sharp	1	11
		(146	7)
35.	Siltstone, medium-gray, contains 40 percent light-gray very fine grained sandstone laminae and beds, cross-laminated, ripple-bedded; base sharp	4	1
		(150	8)
36.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, 20 percent dark-gray shale laminae, few plant fragments 4 ft above base, cross-laminated, ripple-bedded; base sharp	11	8
		(162	4)
37.	Shale, medium-dark-gray, silty in top 2 ft, carbonaceous in basal 1 ft, evenly bedded; fissle; base grades	3	11
		(166	3)
38.	Siltstone, medium-gray, argillaceous, evenly bedded; base sharp	2	11
		(169	2)
39.	Shale, dark-gray, carbonaceous, evenly bedded; base sharp	2	2
		(171	4)
40.	Siltstone, medium-gray, contains 50 percent light-gray very fine grained sandstone laminae, thin-bedded, few contorted beds; base grades	2	4
		(173	8)
41.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, 20 percent dark-gray silty shale beds, few dark-gray shale clasts in basal 2 ft 2 in., thick-bedded; base sharp and uneven	31	5
		(205	1)
42.	Sandstone, light-gray, very fine grained, contains 55 percent quartz, 35 percent dark-gray siltstone and silty shale laminae and beds, thin- to thick-bedded; base sharp	10	2
		(215	3)
43.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, few dark-gray siltstone and silty shale laminae, few medium-dark-gray shale clasts from 6 ft 4 in. to 6 ft 8 in. below top, few coal laminae in basal 6 in., thin- to thick-bedded; base sharp and uneven	11	3
		(226	6)

Unit Number	Description	Thickness (Depth) ft	in.
44.	Sandstone, light-gray, fine-grained, contains 45 percent quartz, 40 percent dark-gray carbonaceous shale laminae and beds, cross-laminated, ripple-bedded; base grades	4	3
		(230	9)
45.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, 40 percent dark-gray silty shale laminae and beds in top 1 ft and basal 1 ft 2 in., few coal laminae 5 ft 6 in. below top, thin- to thick-bedded; base sharp	8	6
		(239	3)
46.	Siltstone, medium-dark-gray, finely micaceous, contains 20 percent light-gray very fine grained sandstone laminae and beds up to 0.5 in. thick, few coal laminae, thick-bedded; base sharp	35	4
		(274	7)
47.	Coal, Hagy (?) coal bed (thickness - 1 ft 1 in.)		
	47a. Coal, dull to bright attritus	0	4
		(274	11)
	47b. Coal, impure, contains scattered dark-gray shale laminae	0	9
		(275	8)
48.	Underclay, dark-gray, very carbonaceous, abundant rootlets; base sharp	0	2
		(275	10)
49.	Shale, medium- to dark-gray, carbonaceous at base, scattered siderite nodules up to 1 in. in diameter, evenly bedded; base sharp	3	11
		(279	9)
50.	Sandstone, light- to medium-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 10 percent dark-gray silty shale laminae and beds up to 1 in. thick, scattered dark mineral grains, few coal clasts, massive; base sharp	35	9
		(315	6)
51.	Siltstone, dark-gray, carbonaceous, contains 10 percent medium-light-gray fine-grained sandstone laminae and beds up to 1 ft 3 in. thick, thin- to thick-bedded, few invertebrate fossils 19 ft below top	47	0
		(362	6)
52.	Coal, impure	0	2
		(362	8)

Unit Number	Description	Thickness (Depth) ft	in.
53.	Underclay, dark-gray, carbonaceous, abundant rootlets in top 8 in.; base grades	0	6
		(363	2)
54.	Coal, impure in top 1 in., dull to bright attritus in basal 2 in.	0	3
		(363	5)
55.	Underclay, dark-gray, carbonaceous, abundant rootlets in top 8 in.; base grades	1	0
		(364	5)
56.	Siltstone, medium-gray, dark-gray and carbonaceous in top 2 ft, contains 40 percent light-gray very fine grained sandstone laminae and beds up to 0.5 in. thick, 15 percent dark-gray shale laminae and lenses, cross-laminated, thin-bedded, few rippled beds; base grades	3	7
		(368	0)
57.	Shale, dark-gray, very silty, carbonaceous, contains 15 percent light-gray siltstone and very fine grained sandstone laminae and beds up to 0.5 in. thick, scattered plant fragmens, evenly bedded, cross-laminated in part; base grades	19	2
		(387	2)
58.	Sandstone, medium-light-gray, very fine grained, contains 45 percent quartz, 40 percent dark-gray silty shale laminae and beds in top 1 ft, thin- to thick-bedded, cross-laminated and ripple-bedded in top 1 ft; base grades	3	6
		(390	8)
59.	Siltstone, dark-gray, contains 20 percent medium-gray very fine grained sandstone laminae and beds, thin-bedded; base grades	1	0
		(391	8)
60.	Shale, medium-dark- to dark-gray, silty, contains few medium-light-gray siltstone and very fine grained sandstone laminae and beds, evenly bedded	3	4
		(395	0)
61.	Coal, Unnamed coal bed (thickness - 5 in.)		
	61a. Coal, mostly bright attritus	0	2
		(395	2)
	61b. Coal, impure	0	3
		(395	5)
62.	Underclay, medium-gray, very silty, few rootlets; base grades	0	5
		(395	10)

Unit Number	Description	Thickness (Depth) ft	in.
63.	Siltstone, medium-gray, contains 30 percent light-gray very fine grained sandstone laminae and beds, few plant fragments, few rootlets; base grades	3	10
		(399	8)
64.	Shale, medium- to dark-gray, carbonaceous, very carbonaceous in basal 6 in., abundant plant fragments, few slickensided surfaces; base sharp and uneven	3	0
		(402	8)
65.	Coal, Splash Dam (?) coal bed (thickness - 2 ft 11.5 in.)		
65a.	Coal, impure	0	1
		(402	9)
65b.	Shale, black, carbonaceous	0	1
		(402	10)
65c.	Coal, impure	0	1
		(402	11)
65d.	Underclay, medium-dark-gray, abundant rootlets	0	10
		(403	9)
65e.	Coal, dull to bright attritus	0	1.5
		(403	10.5)
65f.	Shale, black, carbonaceous	0	1.5
		(404	0)
65g.	Coal, impure	0	1.5
		(404	1.5)
65h.	Shale, dark-gray, slightly carbonaceous	0	7
		(404	8.5)
65i.	Coal, mostly bright attritus	0	11
		(405	7.5)
66.	Siltstone, dark-gray, carbonaceous in top 2 in., few coal laminae, abundant rootlets in top 4 in., thin and irregularly bedded, few rippled beds; base grades	4	10.5
		(410	6)
67.	Shale, dark-gray to black, carbonaceous, contains 5 percent medium-light-gray siltstone laminae and beds, few coal laminae, evenly bedded, fissile; base grades	16	8
		(427	2)

Unit Number	Description	Thickness (Depth) ft	in.
68.	Siltstone, medium-gray to black, micaceous, carbonaceous, contains 10 percent light-gray siltstone and very fine grained sandstone laminae and beds, ripple-bedded; base sharp.....	6	6
		(433	8)
69.	Shale, dark-gray to black, carbonaceous, silty, fair fissility; base sharp.....	17	0
		(450	8)
70.	Coal, Upper Banner coal bed (thickness 3 ft 4.5 in.)		
70a.	Coal, dull to bright attritus, few fusain laminae and vitrain bands.....	1	4
		(452	0)
70b.	Coal, dull, pyritic.....	0	0.5
		(452	0.5)
70c.	Coal, bright attritus, thin to thick vitrain bands.....	2	0
		(454	0.5)
71.	Underclay, medium- to dark gray, abundant rootlets; base grades...	1	1.5
		(455	2)
72.	Siltstone, light- to medium-gray, micaceous, contains few dark gray shale laminae, few small-scale slump structures in basal 1 ft, cross-laminated; base grades.....	3	9
		(458	11)
73.	Shale, medium-dark-gray, plastic and few rootlets in basal 2 in., few slickensided surfaces, evenly bedded.....	2	5
		(461	4)
74.	Coal, impure.....	0	3
		(461	7)
75.	Underclay, medium-gray, silty at base, abundant rootlets; base grades.....	1	2
		(462	9)
76.	Siltstone, medium-gray, contains 30 percent light-gray very fine grained sandstone laminae, few dark-gray shale laminae and beds; base grades.....	2	3
		(465	0)
77.	Sandstone, light- to medium-gray, very fine grained, contains 40 percent quartz, 30 percent dark-gray silty shale laminae and beds, cross-laminated, ripple-bedded; base grades.....	1	4
		(466	4)

Unit Number	Description	Thickness (Depth) ft	in.
78.	Shale, medium-gray, evenly bedded, fissile; base sharp.....	1	9
		(468	1)
79.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 45 percent dark-gray silty shale laminae, few coal laminae, thin-bedded; base grades.....	6	0
		(474	1)
80.	Shale, medium- to dark-gray, silty in top 1 ft, unevenly bedded; base sharp.....	1	0
		(475	1)
81.	Coal, mostly bright attritus, few vitrain bands and pyrite nodules.....	0	6
		(475	7)
82.	Underclay, medium-dark-gray, abundant rootlets; base grades.....	0	8
		(476	3)
83.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 20 percent dark-gray shale laminae, few plant fragments, thin-bedded.....	3	4
		(479	7)
84.	Coal, dull to bright attritus, impure in top 1 in.....	0	4
		(479	11)
85.	Underclay, medium-dark-gray, abundant rootlets; base grades.....	1	1
		(481	0)
86.	Siltstone, light- to medium-gray, finely micaceous, argillaceous; base sharp.....	2	10
		(483	10)
87.	Sandstone, light-gray, very fine grained, micaceous, contains 50 percent quartz, 10 percent dark-gray silty shale laminae and beds, thin- to thick-bedded; base grades.....	7	6
		(491	4)
88.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, few coal laminae and clasts, abundant angular dark-gray shale clasts from 37 ft to 38 ft 4 in. below top, abundant well rounded siderite clasts 32 ft below top; base sharp.....	47	7
		(538	11)
89.	Shale, dark-gray, very silty, slightly carbonaceous, few plant fragments; base sharp.....	1	2
		(540	1)
90.	Sandstone, medium-gray, very fine grained, silty, micaceous, contains 40 percent quartz, scattered dark-gray shale laminae, few plant fragments; base grades.....	2	10

Unit Number	Description	Thickness (Depth) ft	in.
		(542	11)
91.	Shale, dark-gray to black, very carbonaceous, contains scattered siderite beds, abundant plant fragments, evenly bedded, fissile; base sharp and uneven	22	8
		(565	7)
92.	Sandstone, medium-light- to medium-gray, fine-grained, contains 40 percent quartz, thin and irregularly bedded	0	4
		(565	11)
93.	Shale, medium-dark- to dark-gray, very silty, contains few light-gray very fine grained silty sandstone beds, few coal laminae, few siderite nodules; base grades	1	10
		(567	9)
94.	Siltstone, medium-gray, contains 40 percent medium-light-gray very fine grained sandstone laminae and beds, 10 percent dark-gray shale laminae, few plant fragments and coal laminae, burrowed in part, thin and irregularly bedded; base grades	17	4
		(585	1)
95.	Shale, medium-dark-gray, very silty, contains 5 percent medium-gray siltstone laminae, few siderite beds up to 0.5 in. thick, evenly bedded; base grades	26	7
		(611	8)
96.	Shale, medium-dark-gray to black, carbonaceous, very carbonaceous in basal 8 in., contains few coal laminae, few plant fragments, evenly bedded, fissile; base sharp and uneven	4	7
		(616	3)
97.	Coal, Lower Banner coal bed, dull to bright attritus, few vitrain bands and fusain laminae, pyrite on some cleats	1	7
		(617	10)
98.	Underclay, medium-gray, contains 5 percent light-gray siltstone and very fine grained sandstone laminae in basal 6 in., abundant rootlets, thin-bedded in part	1	2
		(619	0)
99.	Sandstone, medium-light-gray, very fine grained, micaceous, contains 45 percent quartz, few coal laminae; base sharp and uneven	0	3
		(619	3)
100.	Shale, medium- to medium-dark-gray, slightly carbonaceous, contains few scattered light-gray siltstone and very fine grained sandstone laminae, few rootlets; base sharp	0	11
		(620	2)

Unit Number	Description	Thickness (Depth) ft	in.
101.	Shale, medium-dark- to dark-gray, very carbonaceous, contains few coal laminae at base; base sharp.....	0	3.5
		(620	5.5)
102.	Underclay, medium-gray, contains few siderite nodules and beds, few rootlets, thin-bedded, irregularly bedded in top 1.5 in.; base sharp and uneven.....	3	0.5
		(623	6)
103.	Sandstone, medium-light-gray, very fine to fine-grained, sparsely micaceous, silty, contains 55 percent quartz, abundant coal laminae in basal 2 in., thin-bedded.....	0	8
		(624	2)
104.	Shale, medium-dark-gray, very silty, slightly carbonaceous, contains 50 percent light-gray siltstone and very fine grained sandstone laminae in basal 1.25 in., abundant coal laminae at base; base sharp and uneven.....	0	5
		(624	7)
105.	Sandstone, medium-light-gray, fine- to medium-grained, sparsely micaceous, contains 60 percent quartz, few coal and dark-gray shale laminae and clasts; base sharp.....	2	3
		(626	10)
106.	Shale, dark-gray to black, carbonaceous, very carbonaceous 10 in. below top, very silty in basal 4 in., contains 5 percent light-gray siltstone and very fine grained sandstone laminae, slightly burrowed in basal 3 in., evenly bedded, fissile; base grades.....	2	10
		(629	8)
107.	Sandstone, medium-light- to medium-gray, very fine grained, silty, contains 40 percent quartz, 30 percent dark-gray shale laminae, thin-bedded; base sharp.....	0	4
		(630	0)
108.	Shale, medium-dark-gray, very silty, slightly carbonaceous, evenly bedded; base sharp and uneven.....	0	4
		(630	4)
109.	Sandstone, medium-light-gray, very fine grained, silty, micaceous, contains 40 percent quartz, 10 percent medium-dark-gray shale laminae, thin and irregularly bedded.....	0	1.5
		(630	5.5)
110.	Shale, medium-dark-gray, very silty, contains 30 percent light-gray siltstone and very fine grained sandstone laminae and beds, unevenly bedded; base grades.....	0	9.5
		(631	3)

Unit Number	Description	Thickness (Depth) ft	in.
111.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 40 percent quartz, 10 percent medium-dark-gray silty shale laminae, thin and evenly bedded.....	0	7
		(631	10)
112.	Sandstone, medium-light-gray, very fine grained, contains 45 percent quartz, 50 percent medium-dark-gray shale beds, slightly burrowed, thin-bedded; base sharp.....	0	7
		(632	5)
113.	Sandstone, medium-light-gray, very fine to fine-grained, finely micaceous, contains 45 percent quartz, 25 percent medium-dark-gray shale laminae, abundant coal laminae and clasts in basal 3 in., bioturbated, thin-bedded.....	3	9
		(636	2)
114.	Shale, medium-dark-gray, very silty, contains few light-gray very fine grained sandstone laminae, few coal laminae at base, evenly bedded.....	0	4
		(636	6)
115.	Shale, medium-dark-gray, very silty, contains 30 percent medium-light-gray very fine grained silty sandstone laminae and beds, few siderite nodules in top 1 in., slightly burrowed, cross-laminated, evenly bedded.....	7	7
		(644	1)
116.	Sandstone, medium-light-gray, very fine grained, very silty, contains 45 percent quartz, 20 percent dark-gray shale laminae and beds, thin-bedded; base grades.....	6	9
		(650	10)
117.	Shale, medium-dark-gray, contains 35 percent medium-light-gray siltstone and very fine grained sandstone laminae and beds, few scattered plant fragments, burrowed in basal 2 ft, evenly bedded; base grades.....	11	10
		(662	8)
118.	Shale, medium-dark- to dark-gray, carbonaceous, contains 10 percent light-gray siltstone and very fine grained sandstone laminae in top 4 ft slightly burrowed in top 4 ft, evenly bedded, fissle; base sharp.....	27	6
		(690	2)
119.	Coal, impure.....	0	1
		(690	3)
120.	Underclay, medium-gray, silty, abundant rootlets, Stigmaria, contains few siderite nodules.....	1	8
		(691	11)

Unit Number	Description	Thickness (Depth) ft	in.
121.	Siltstone, medium-light- to medium-gray, contains 40 percent light-gray very fine grained silty sandstone and dark-gray shale laminae and beds, slightly burrowed, cross-laminated, thin-bedded; base grades	11	4
		(703	3)
122.	Shale, medium- to medium-dark-gray, contains 5 percent light-gray siltstone and very fine grained sandstone laminae, slightly burrowed, evenly bedded; base grades	10	3
		(713	6)
123.	Shale, medium-dark- to dark-gray, slightly carbonaceous, contains few siderite beds 2 ft above base, evenly bedded, fissile; base sharp	5	4
		(718	10)
124.	Shale, medium- to medium-dark-gray, very silty, contains few light-gray siltstone and very fine grained sandstone laminae, few rootlets in top 7 in., evenly bedded, fissile; base sharp	7	2
		(726	0)
125.	Sandstone, medium-light- to medium-gray, very fine grained, silty, contains 45 percent quartz, 20 percent medium-dark-gray shale laminae, cross-laminated, thin-bedded	1	2
		(727	2)
126.	Siltstone, medium-light- to medium-gray, finely micaceous, argillaceous, contains 25 percent light-gray very fine grained sandstone and medium-dark-gray shale laminae, cross-laminated in part, thin-bedded	8	6
		(735	8)
127.	Sandstone, medium-light-gray, very fine to fine-grained, very silty, contains 45 percent quartz, few medium-gray siltstone laminae in top 1 ft, few plant fragments, thick-bedded; base sharp	5	10
		(741	6)
128.	Shale, medium-dark-gray, silty, evenly bedded; base sharp	0	1.5
		(741	7.5)
129.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 60 percent quartz, scattered coal and dark-gray shale laminae, thin- to thick-bedded; base grades	9	3.5
		(750	11)
130.	Sandstone, light- to medium-light-gray, fine-grained, contains 65 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base sharp	25	0
		(775	11)

Unit Number	Description	Thickness (Depth) ft	in.
131.	Shale, dark-gray to black, carbonaceous, contains few scattered siderite beds, evenly bedded, fissile.....	5	5
		(781	4)
132.	Coal, Kennedy coal bed, mostly bright attritus, pyrite nodule at 9 in. above base.....	2	2.5
		(783	6.5)
	LOWER PENNSYLVANIAN SERIES Norton Formation (cont.)		
133.	Underclay, medium-dark-gray, few rootlets; base grades.....	1	5
		(784	11.5)
134.	Coal, impure, contains scattered dark-gray shale laminae.....	0	1.5
		(785	1)
135.	Underclay, medium-dark-gray, few rootlets; base grades.....	1	9
		(786	10)
136.	Shale, medium-gray, silty in basal 1 ft 10 in., few plant fragments, evenly bedded, poor fissility; base sharp.....	3	11
		(790	9)
	Lee Formation Naese (?) Sandstone Member		
137.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 40 percent medium-dark-gray silty shale laminae, cross-laminated, thin-bedded; base grades.....	0	7
		(791	4)
138.	Shale, medium-dark-gray, silty, evenly bedded; base grades.....	0	3
		(791	7)
139.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 50 percent medium-gray siltstone laminae, cross-laminated, thin-bedded; base grades.....	0	9
		(792	4)
140.	Shale, medium-dark-gray, evenly bedded; base grades abruptly.....	0	2.5
		(792	6.5)
141.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-gray siltstone and medium-dark-gray shale laminae; base grades abruptly.....	0	3
		(792	9.5)
142.	Shale, medium- to medium-dark-gray, very silty, contains 30 percent medium-gray siltstone laminae, 30 percent light-gray very fine grained sandstone laminae in basal 4 in., evenly bedded.....	2	0.5
		(794	10)

Unit Number	Description	Thickness (Depth) ft	in.
143.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base grades	1	2
		(796	0)
144.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent medium-gray siltstone and medium-dark-gray shale laminae, cross-laminated, thin-bedded	2	1
		(798	1)
145.	Shale, medium-dark-gray, silty, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded	0	4
		(798	5)
146.	Sandstone, light-gray, fine-grained, contains 45 percent quartz, 5 percent discontinuous medium-gray siltstone laminae, thin-bedded; base sharp	0	11
		(799	4)
147.	Shale, medium-dark-gray, silty, contains 25 percent light-gray siltstone and very fine grained sandstone laminae; base sharp	0	2
		(799	6)
148.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, 5 percent discontinuous medium-gray siltstone laminae; base sharp	0	3
		(799	9)
149.	Shale, black, very carbonaceous, evenly bedded, fissile; base grades	0	4
		(800	1)
150.	Shale, medium-gray, silty in basal 8 in., contains 30 percent medium-light-gray siltstone laminae in basal 8 in., normally graded, faintly bedded, fair fissility; base sharp	3	1
		(803	2)
151.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-gray siltstone laminae, thin-bedded; base grades abruptly	0	6
		(803	8)
152.	Shale, dark-gray, slightly silty, evenly bedded, fissile; base sharp	0	3
		(803	11)
153.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 20 percent dark-gray silty shale laminae from 1 ft 9 in. to 2 ft 3 in. below top, 5 percent discontinuous medium-gray siltstone laminae scattered throughout; base grades abruptly	4	9
		(808	8)

Unit Number	Description	Thickness (Depth) ft	in.
154.	Siltstone, medium-light- to medium-gray, contains 20 percent light-gray very fine grained sandstone and 10 percent medium-dark-gray shale laminae, thin-bedded; base grades abruptly.....	0	7
		(809	3)
155.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, 10 percent medium-gray siltstone laminae, thin-bedded; base sharp.....	6	11.5
		(816	2.5)
156.	Shale, dark-gray, silty, evenly bedded; base sharp.....	0	1.5
		(816	4)
157.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, 5 percent discontinuous medium-gray siltstone laminae, cross-laminated, thin-bedded; base sharp.....	2	6
		(818	10)
158.	Shale, medium-dark-gray, silty, contains 2.5 in. light-gray very fine grained sandstone bed 1 in. below top, evenly bedded; base grades.....	0	6
		(819	4)
159.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base grades.....	13	5
		(832	9)
160.	Sandstone, light-gray, fine-grained, contains 45 percent quartz, 15 percent medium-dark-gray shale laminae in top 3 ft, thin-bedded; base grades.....	5	3
		(838	0)
161.	Sandstone, white to very light gray, fine- to medium-grained, contains 90 percent quartz, few scattered dark mineral grains, few stylolites, thick-bedded to massive; base grades.....	8	0
		(846	0)
162.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, abundant well rounded white quartz pebbles in basal 3 ft, few stylolites, crossbedded, thick-bedded to massive; base sharp.....	7	10
		(853	10)
163.	Shale, dark-gray, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded, fissile.....	0	9
		(854	7)
164.	Sandstone, light-gray, fine-grained, micaceous, contains 65 percent quartz, 5 percent discontinuous medium-gray siltstone laminae, scattered dark and light mineral grains, thin-bedded; base grades.....	4	0
		(858	7)

Unit Number	Description	Thickness (Depth) ft	in.
165.	Shale, medium-dark-gray, silty, contains 20 percent medium-light-gray siltstone and very fine grained sandstone laminae, evenly bedded, fissile; base grades abruptly.....	1	10
		(860	5)
166.	Sandstone, light-gray, fine-grained, micaceous, contains 55 percent quartz, 10 percent discontinuous medium-gray siltstone laminae, cross-laminated, thin-bedded; base grades.....	5	8
		(866	1)
167.	Sandstone, very light gray, fine-grained, contains 65 percent quartz, 5 percent dark-gray silty shale laminae, thin- to thick-bedded; base grades.....	3	8
		(869	9)
168.	Sandstone, medium-light-gray, very fine to fine-grained, contains 55 percent quartz, abundant dark and light mineral grains, thin- to thick-bedded.....	0	7
		(870	4)
169.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, silty, contains 50 percent quartz, 15 percent dark-gray silty shale laminae, scattered coal laminae, cross-laminated, thin-bedded; base sharp.....	1	6
		(871	10)
170.	Sandstone, medium-light-gray, fine- to medium-grained, contains 55 percent quartz, scattered dark and light mineral grains, thick-bedded; base grades.....	7	3
		(879	1)
171.	Sandstone, medium-light-gray, medium- to coarse-grained, sparsely micaceous, contains 60 percent quartz, few coal laminae 10 in. below top, scattered dark and light mineral grains, few green mineral grains, thick-bedded to massive; base grades.....	5	7
		(884	8)
172.	Sandstone, medium-light-gray, very fine to fine-grained, silty, finely micaceous, contains 60 percent quartz, few scattered dark-gray silty shale laminae, thin-bedded.....	2	11
		(887	7)
173.	Sandstone, light-gray, medium-grained, contains 60 percent quartz; scattered dark, light and green mineral grains; conglomeratic with abundant well rounded white quartz pebbles and granules up to 0.5 in. in diameter in basal 7 ft 8 in., scattered coal laminae and clasts, thick-bedded; base grades.....	11	10
		(899	5)

Unit Number	Description	Thickness (Depth) ft	in.
174.	Sandstone, very light gray, coarse-grained, contains 90 percent quartz, few scattered dark and green mineral grains, few coal laminae in basal 8 in., abundant well rounded white quartz pebbles mostly 0.25 in. in diameter; base grades	4	5
		(903	10)
175.	Sandstone, very light to light-gray, coarse-grained, contains 90 percent quartz, few scattered dark and green mineral grains, few coal and dark-gray shale clasts, abundant coal laminae and clasts 2 ft 6 in. below top; base grades	10	1
		(913	11)
176.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few scattered dark and green mineral grains, few coal laminae, thick-bedded to massive; base grades	4	8
		(918	7)
177.	Sandstone, light-gray, fine-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, thick-bedded to massive; base sharp	17	0
		(935	7)
178.	Coal, mostly bright attritus	0	0.25
		(935	7.25)
179.	Sandstone, medium-light-gray, fine-grained, contains 60 percent quartz; scattered siderite clasts, dark-gray shale clasts and quartz pebbles up to 0.5 in. in diameter; few coal laminae; base sharp and uneven	1	2.75
		(936	10)
180.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 55 percent quartz, 5 percent medium-gray siltstone laminae, scattered coal laminae in basal 2 ft, thin- to thick-bedded; base sharp	19	7
		(956	5)
181.	Shale, medium-dark- to dark-gray, evenly bedded, fissile; base sharp	0	3
		(956	8)
182.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 15 percent medium-gray siltstone laminae, 50 percent dark-gray shale laminae in basal 4 in., thin- to thick-bedded; base grades	0	11
		(957	7)
183.	Shale, medium-dark-gray, evenly bedded, fissile; base sharp and uneven	0	8
		(958	3)

Unit Number	Description	Thickness (Depth) ft	in.
184.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 5 percent discontinuous dark-gray silty shale laminae, thin-bedded; base sharp.....	0	2
		(958	5)
	Tongue of Norton Formation		
185.	Shale, medium-dark- to dark-gray, carbonaceous, evenly bedded, fissile; base grades.....	2	1
		(960	6)
186.	Shale, medium-dark- to dark-gray, contains 50 percent medium-gray siltstone laminae, evenly bedded, fissile; base sharp.....	6	10
		(967	4)
187.	Sandstone, light- to medium-light-gray, very fine to fine-grained, silty, micaceous, contains 45 percent quartz, cross-laminated, thin-bedded; base grades.....	0	6
		(967	10)
188.	Siltstone, medium-gray, contains 25 percent light-gray very fine grained sandstone laminae, cross-laminated, thin-bedded; base sharp and irregular.....	0	8
		(968	6)
189.	Shale, medium-dark-gray, silty, contains 20 percent light-gray siltstone laminae in top 5 in., evenly bedded; base sharp.....	1	11
		(970	5)
190.	Siltstone, medium-gray, very sandy in basal 0.5 in., thin-bedded; base sharp and uneven.....	0	2
		(970	7)
191.	Shale, medium-dark- to dark-gray, evenly bedded, fissile; base sharp.....	0	2.5
		(970	9.5)
	Lee Formation Bee Rock Sandstone Member		
192.	Sandstone, very light to light-gray, fine- to medium-grained, contains 90 percent quartz, few scattered dark mineral grains, 20 percent medium-dark-gray shale laminae from 5 ft 4 in. to 5 ft 8 in. below top, scattered well rounded white quartz pebbles up to 0.5 in. in diameter from 5 ft 11 in. to 14 ft 7 in. below top, few coal laminae and clasts from 38 ft 4 in. to 41 ft 2 in. below top, few stylolites, crossbedded, thick-bedded to massive; base grades.....	46	3.5
		(1017	1)
193.	Sandstone, very light gray, medium-to coarse-grained, contains 90 percent quartz, abundant well rounded white quartz pebbles in basal 4 ft 8 in., massive; base grades.....	6	2
		(1023	3)

Unit Number	Description	Thickness (Depth) ft	in.
194.	Conglomerate, white to very light gray, contains abundant well rounded white quartz pebbles and granules up to 1 in. in diameter, few well rounded pink quartz pebbles and dark-gray shale clasts, medium- to coarse-grained quartzose sandstone matrix, massive; base sharp.....	12	11
		(1036	2)
195.	Sandstone, light-gray, coarse-grained, micaceous, contains 65 percent quartz, scattered well rounded white quartz pebbles from 0.25 in. to 0.5 in. in diameter, abundant angular siderite clasts and well rounded white quartz pebbles in basal 1 ft, massive; base sharp and uneven.....	9	11
		(1046	1)
196.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few stylolites, massive.....	8	4
		(1054	5)
197.	Sandstone, white to very light gray, medium-grained, petroliferous 10 ft below top, contains 90 percent quartz, few scattered dark mineral grains, scattered well rounded white quartz pebbles in top 12 ft, few coal laminae and stylolites, massive; base grades..	27	0
		(1081	5)
198.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, few scattered dark mineral grains and stylolites, thick-bedded to massive; base sharp.....	7	6
		(1088	11)
	Lee Formation Hensley Member		
199.	Shale, dark-gray to black, carbonaceous, contains scattered siderite laminae and beds, evenly bedded, fissile; base grades....	12	3
		(1101	2)
200.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 15 percent medium- dark-gray siltstone laminae, thin-bedded; base grades.....	3	6
		(1104	8)
201.	Sandstone, light-gray, fine-grained, micaceous, contains 45 percent quartz, 5 percent discontinuous medium-gray siltstone laminae, thin-bedded; base grades.....	3	6
		(1108	2)
202.	Sandstone, light-gray, very fine grained, micaceous, contains 40 percent quartz, 30 percent dark-gray shale and siltstone laminae and beds up to 1 in. thick, thin-bedded; base grades.....	1	4
		(1109	6)
203.	Siltstone, medium- to medium-dark-gray, contains 25 percent light-gray very fine grained sandstone laminae, thin-bedded, fair fissility; base grades.....	1	3
		(1110	9)

Unit Number	Description	Thickness (Depth) ft	in.
204.	Shale, dark-gray, silty, evenly bedded; base grades.....	0	8
		(1111	5)
205.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	0	2
		(1111	7)
206.	Siltstone, medium-dark-gray, contains 10 percent light-gray very fine grained sandstone laminae, thin-bedded, poor fissility.....	1	4
		(1112	11)
207.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, thin- to thick-bedded; base sharp.....	1	0
		(1113	11)
208.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 20 percent light-gray siltstone laminae in top 6 in., 5 percent dark-gray silty shale laminae, thin-bedded; base grades.....	5	3
		(1119	2)
209.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded; base sharp.....	0	10
		(1120	0)
210.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, crossbedded, thin- to thick-bedded; base sharp.....	15	3
		(1135	3)
211.	Shale, medium-dark-gray, abundant plant fragments, evenly bedded.....	0	7
		(1135	10)
212.	Underclay, medium-dark-gray, carbonaceous, abundant rootlets; base sharp.....	0	8
		(1136	6)
213.	Sandstone, light-gray, fine- to medium-grained, contains 50 percent quartz, abundant angular dark-gray shale clasts; base sharp and uneven.....	0	4
		(1136	10)
214.	Shale, dark-gray, carbonaceous, poor fissility; base sharp.....	0	4
		(1137	2)

Unit Number	Description	Thickness (Depth) ft	in.
215.	Sandstone, light-gray, medium-grained, contains 50 percent quartz, few dark-gray shale clasts, contorted bedding; base sharp.....	0	10
		(1138	0)
216.	Coal, Jawbone coal bed (thickness - 2 ft 4 in.)		
	216a. Coal, mostly bright attritus.....	0	3
		(1138	3)
	216b. Pyrite.....	0	1
		(1138	4)
	216c. Coal, mostly bright attritus, few vitrain bands.....	1	10
		(1140	2)
217.	Underclay, medium-dark-gray, carbonaceous, abundant rootlets.....	2	7
		(1142	9)
218.	Coal, impure, abundant slickensided surfaces.....	1	4
		(1144	1)
219.	Underclay, medium-gray, abundant rootlets.....	2	1
		(1146	2)
220.	Coal, impure, contains scattered dark-gray shale laminae.....	0	4
		(1146	6)
221.	Underclay, dark-gray, silty, very carbonaceous, contains 10 percent coal laminae.....	1	6
		(1148	0)
222.	Sandstone, medium-light- to medium-dark-gray, carbonaceous, contains 50 percent quartz, few rootlets; base grades.....	0	10
		(1148	10)
223.	Underclay, medium-dark-gray, abundant rootlets, faintly bedded; base grades abruptly.....	1	3
		(1150	1)
224.	Sandstone, medium- to medium-dark-gray, medium-grained, micaceous, contains 50 percent quartz, abundant dark and light mineral grains, abundant angular medium-dark-gray shale clasts; base sharp and uneven.....	2	10
		(1152	11)
225.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark mineral grains, 10 percent medium-gray siltstone laminae in basal 3 ft, abundant coal laminae from 2 ft 6 in. to 5 ft below top; base grades abruptly.....	32	7
		(1185	6)

Unit Number	Description	Thickness (Depth) ft	in.
226.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, few green mineral grains, abundant angular medium-dark-gray shale clasts in top 8 ft, massive; base sharp.....	15	5
		(1200	11)
227.	Coal clast, thin to thick vitrain bands, bright attrital matrix.....	0	7
		(1201	6)
228.	Conglomerate, light-gray, contains abundant well rounded white quartz pebbles up to 0.5 in. in diameter, scattered siderite clasts up to 0.5 in. in diameter, medium-grained sandstone matrix.....	0	8
		(1202	2)
229.	Shale, medium-dark-gray, evenly bedded; base sharp.....	0	6
		(1202	8)
230.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, abundant well rounded white quartz granules and pebbles, scattered siderite and medium-dark-gray shale clasts; base sharp.....	0	4
		(1203	0)
231.	Shale, dark-gray, carbonaceous, contains scattered siderite nodules and beds, evenly bedded, fair fissility; base grades.....	36	9
		(1239	9)
232.	Shale, medium-dark- to dark-gray, carbonaceous, contains 10 percent light-gray very fine grained sandstone laminae, slightly burrowed, evenly bedded, fissile; base grades.....	24	0
		(1263	9)
233.	Shale, medium-dark- to dark-gray, carbonaceous, contains scattered siderite beds up to 1 in. thick, evenly bedded, fissile.....	26	6
		(1290	3)
234.	Shale, dark-gray to black, very carbonaceous, contains few coal and pyrite laminae in basal 10 in., few plant fragments evenly bedded, fissile; base sharp.....	5	7
		(1295	10)
235.	Coal, mostly bright attritus.....	0	0.5
		(1295	10.5)
236.	Underclay, medium- to medium-dark-gray, sandy in basal 5 in., few rootlets; base grades.....	0	8.5
		(1296	7)

Unit Number	Description	Thickness (Depth) ft	in.
237.	Sandstone, light- to medium-dark-gray, very fine to fine-grained, contains 50 percent quartz, 15 percent dark-gray shale and siltstone laminae, few rootlets in top 2 ft 6 in., thin-bedded.....	8	8
		(1305	3)
238.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 40 percent dark-gray silty shale beds up to 1 in. thick, thin-bedded; base grades abruptly.....	8	5
		(1313	8)
239.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent dark-gray shale laminae and beds, burrowed, flaser-bedded; base grades.....	2	5
		(1316	1)
240.	Shale, black, carbonaceous, evenly bedded, fissile.....	4	7
		(1320	8)
241.	Coal, Tiller coal bed, thin to thick vitrain bands, bright attrital matrix, 0.125 in. pyrite lens at 2.5 in. below top.....	1	1
		(1321	9)
242.	Siltstone, dark-gray to black, carbonaceous, faintly bedded; base grades.....	0	5
		(1322	2)
243.	Sandstone, medium- to medium-dark-gray, fine-grained, contains 40 percent quartz, few rootlets; base grades.....	0	11
		(1323	1)
244.	Siltstone, dark-gray, carbonaceous, few plant fragments, faintly bedded, poor fissility; base grades.....	0	10
		(1323	11)
245.	Sandstone, light- to medium-gray, fine-grained, carbonaceous in top 4 in., contains 40 percent quartz, few rootlets, poorly bedded; base grades.....	1	0
		(1324	11)
246.	Sandstone, very light to light-gray, medium-grained, micaceous, contains 65 percent quartz, few scattered dark and green mineral grains, scattered medium-dark-gray shale clasts in basal 2 in., thick-bedded to massive; base grades.....	32	8
		(1357	7)
247.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, crossbedded, thick-bedded to massive; base grades.....	8	0
		(1365	7)

Unit Number	Description	Thickness (Depth) ft	in.
248.	Sandstone, very light gray, medium-grained, contains 65 percent quartz; scattered dark, light, and green mineral grains; thick-bedded to massive; base grades.....	32	9
		(1398	4)
249.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz; scattered dark, light, and green mineral grains; scattered coal clasts 1 in. below top and in basal 1 ft 9 in., massive; base sharp and uneven.....	11	2
		(1409	6)
250.	Shale, dark-gray to black, carbonaceous, contains few scattered siderite beds and plant fragments, evenly bedded, fissile; base grades.....	38	5
		(1447	11)
251.	Shale, dark-gray to black, carbonaceous, silty, contains 20 percent light-gray siltstone and very fine grained sandstone laminae, few siderite beds up to 0.5 in. thick, few plant fragments, burrowed, evenly bedded, few contorted beds.....	16	0
		(1463	11)
252.	Coal, Lee coal bed, abundant thin vitrain bands, bright attrital matrix.....	2	3
		(1466	2)
253.	Underclay, dark-gray to black, silty, carbonaceous, abundant rootlets; base grades.....	2	8
		(1468	10)
254.	Shale, dark-gray, contains 15 percent light-gray siltstone and very fine grained sandstone laminae, few rootlets in top 4 in., few plant fragments, scattered siderite beds up to 1 in. thick, evenly bedded, fissile.....	7	2
		(1476	0)
255.	Coal, mostly dull attritus, 0.25 in. pyrite lense at base.....	0	1
		(1476	1)
256.	Underclay, medium-gray, few rootlets and root slicks; base grades.....	0	4
		(1476	5)
257.	Shale, medium-gray, silty, evenly bedded, poor fissility; base grades abruptly.....	1	2
		(1477	7)
	Lee Formation Middlesboro Member		
258.	Sandstone, medium-light- to medium-gray, very fine grained, micaceous, silty, contains 40 percent quartz, 20 percent medium-gray siltstone laminae, thin-bedded; base grades.....	4	10
		(1482	5)

Unit Number	Description	Thickness (Depth) ft	in.
259.	Shale, dark-gray, silty, evenly bedded, fair fissility; base grades abruptly	5	0
		(1487	5)
260.	Sandstone, medium-light-gray, fine-grained, very micaceous, silty, contains 40 percent quartz, thin-bedded; base grades	1	10
		(1489	3)
261.	Siltstone, medium-dark-gray, micaceous, fair fissility; base grades abruptly	0	5
		(1489	8)
262.	Sandstone, light- to medium-light-gray, fine-grained, micaceous, very silty in top 4 in., contains 50 percent quartz, thick-bedded; base sharp	1	7
		(1491	3)
263.	Shale, dark-gray to black, few plant fragments, evenly bedded, fissile; base grades	0	6
		(1491	9)
264.	Siltstone, medium-dark-gray, contains 10 percent light-gray very fine grained sandstone and dark-gray shale laminae, thin-bedded, fair fissility; base grades abruptly	2	8
		(1494	5)
265.	Sandstone, very light to light-gray, very fine to fine-grained, contains 60 percent quartz, abundant dark-gray carbonaceous shale laminae in basal 2 in., thin-bedded	1	2
		(1495	7)
266.	Siltstone, medium-dark-gray, micaceous, evenly bedded, fair fissility; base grades abruptly	2	11
		(1498	6)
267.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz; base grades	1	11
		(1500	5)
268.	Sandstone, light-gray, fine- to medium-grained, contains 65 percent quartz, 5 percent dark-gray siltstone laminae, few scattered dark mineral grains, thin- to thick-bedded; base sharp	7	4
		(1507	9)
269.	Shale, dark-gray to black, carbonaceous, evenly bedded, fissile; base grades abruptly	0	8
		(1508	5)
270.	Sandstone, light- to medium-light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, abundant dark mineral grains; base sharp	0	11
		(1509	4)

Unit Number	Description	Thickness (Depth) ft	in.
271.	Shale, dark-gray, silty, finely micaceous, evenly bedded, fair fissility; base grades abruptly.....	3	2
		(1512	6)
272.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, thin-bedded; base sharp.....	0	2
		(1512	8)
273.	Shale, dark-gray to black, evenly bedded, fair fissility; base sharp.....	0	6
		(1513	2)
274.	Sandstone, light-gray, medium-grained, contains 65 percent quartz, 5 percent dark-gray silty shale laminae, scattered dark and light mineral grains, thin- to thick-bedded; base sharp.....	9	8
		(1522	10)
275.	Shale, dark-gray, evenly bedded, fissile; base sharp.....	0	6
		(1523	4)
276.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, 20 percent dark-gray silty shale laminae in top 3 in. and from 6 ft to 7 ft below top, thin- to thick-bedded; base grades.....	8	6
		(1531	10)
277.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark mineral grains, abundant angular medium-dark-gray shale clasts in basal 3 ft 2 in., massive; base grades.....	13	8
		(1545	6)
278.	Sandstone, light-gray, fine- to medium-grained, contains 50 percent quartz, 10 percent medium-dark-gray shale laminae, thin- to thick-bedded; base grades.....	2	0
		(1547	6)
279.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, few scattered dark mineral grains, few small angular medium-dark-gray shale clasts from 9 ft to 10 ft below top, few well rounded white quartz granules and pebbles in basal 2 ft, 0.25 in. coal clast at base, few stylolites, crossbedded, massive; base grades.....	30	0
		(1577	6)
280.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, few widely scattered well rounded white quartz pebbles up to 0.5 in. in diameter in top 12 ft, few scattered dark mineral grains, few stylolites, massive; base sharp.....	22	11
		(1600	5)

Unit Number	Description	Thickness (Depth) ft	in.
281.	Sandstone, light-gray, fine-grained, micaceous, contains 60 percent quartz, scattered dark mineral grains and dark-gray carbonaceous shale laminae; base sharp.....	0	6
		(1600	11)
282.	Sandstone, light- to medium-light-gray, very fine grained, silty, contains 45 percent quartz, 25 percent dark-gray silty shale laminae and beds, slightly burrowed, thin-bedded; base sharp.....	1	5
		(1602	4)
283.	Shale, dark-gray to black, carbonaceous, evenly bedded, fissile; base grades.....	10	2
		(1612	6)
284.	Siltstone, medium-light- to medium-gray, micaceous, contains 25 percent light-gray very fine grained discontinuous sandstone lenses, burrowed, thin and irregularly bedded, fair fissility....	4	7
		(1617	1)
285.	Coal, Castle (?) coal bed (thickness-1 ft 3.5 in.)		
	285a. Coal, mostly bright attritus.....	0	4
		(1617	5)
	285b. Coal, impure, contains scattered dark-gray shale laminae.....	0	1.5
		(1617	6.5)
	285c. Shale, medium-dark-gray, poor fisility.....	0	4
		(1617	10.5)
	285d. Coal, impure, contains scattered dark-gray shale laminae.....	0	1
		(1617	11.5)
	285e. Coal, mostly bright attritus.....	0	0.5
		(1618	0)
	285f. Coal, impure, pyritic, mostly dull attritus.....	0	1.5
		(1618	1.5)
	285g. Coal, mostly bright attritus.....	0	3
		(1618	4.5)
286.	Shale, medium-gray, silty in basal 8 in., faintly bedded, fair to poor fissility; base grades.....	1	5.5
		(1619	10)

Unit Number	Description	Thickness (Depth) ft	in.
287.	Siltstone, medium-light- to medium-gray, contains 20 percent dark-gray shale laminae, thin-bedded, fair fissility; base grades	2	4
		(1622	2)
288.	Shale, medium-dark- to dark-gray, silty, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded; fair fissility	3	4
		(1625	6)
289.	Coal, mostly bright attritus	0	3
		(1625	9)
290.	Underclay, medium-gray, abundant rootlets; base grades	2	8
		(1628	5)
291.	Siltstone, medium-light- to medium-gray, contains 10 percent light-gray very fine grained sandstone laminae and lenses, thin and lenticularly bedded; fair fissility; base sharp	3	2
		(1631	7)
292.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, thin-bedded; base grades	3	9
		(1635	4)
293.	Shale, medium-dark- to dark-gray, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, few coal laminae, evenly bedded, fissile; base grades	0	9
		(1636	1)
294.	Sandstone, light-gray, fine- to medium-grained, very micaceous, contains 55 percent quartz, abundant dark mineral grains, thin- to thick-bedded; base sharp	6	6
		(1642	7)
295.	Sandstone, light- to medium-light-gray, very fine grained, micaceous, contains 60 percent quartz, 10 percent discontinuous medium-gray siltstone laminae, thin-bedded; base grades	1	11
		(1644	6)
296.	Siltstone, medium-light- to medium-gray, contains 30 percent light-gray very fine grained sandstone laminae, 10 percent dark-gray shale laminae, thin-bedded, fair fissility; base grades	1	1
		(1645	7)
297.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, 30 percent medium-gray siltstone laminae in top 8 in., thin- to thick-bedded; base grades	2	0
		(1647	7)

Unit Number	Description	Thickness (Depth) ft	in.
298.	Sandstone, light-gray, medium-grained, micaceous, contains 60 percent quartz, 10 percent feldspar, abundant dark mineral grains, few coal laminae and clasts in basal 3 in.; base sharp and very uneven.....	7	8
		(1655	3)
299.	Coal, dull to bright attritus, few vitrain bands, contains 30 percent light-gray very fine grained silty sandstone laminae, highly contorted bedding.....	0	2
		(1655	5)
300.	Coal, abundant vitrain bands, bright attrital mattrix.....	0	1
		(1655	6)
301.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, abundant dark mineral grains, scattered coal laminae and clasts, mostly contorted bedding; base grades.....	3	3
		(1658	9)
302.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, abundant dark mineral grains, scattered well rounded white quartz granules and pebbles up to 0.25 in. in diameter, abundant coal clasts and well rounded white quartz pebbles in basal 6 in.....	3	3
		(1662	0)

BOTTOM OF HOLE
TOTAL DEPTH 1,662 ft

GEOPHYSICAL LOG

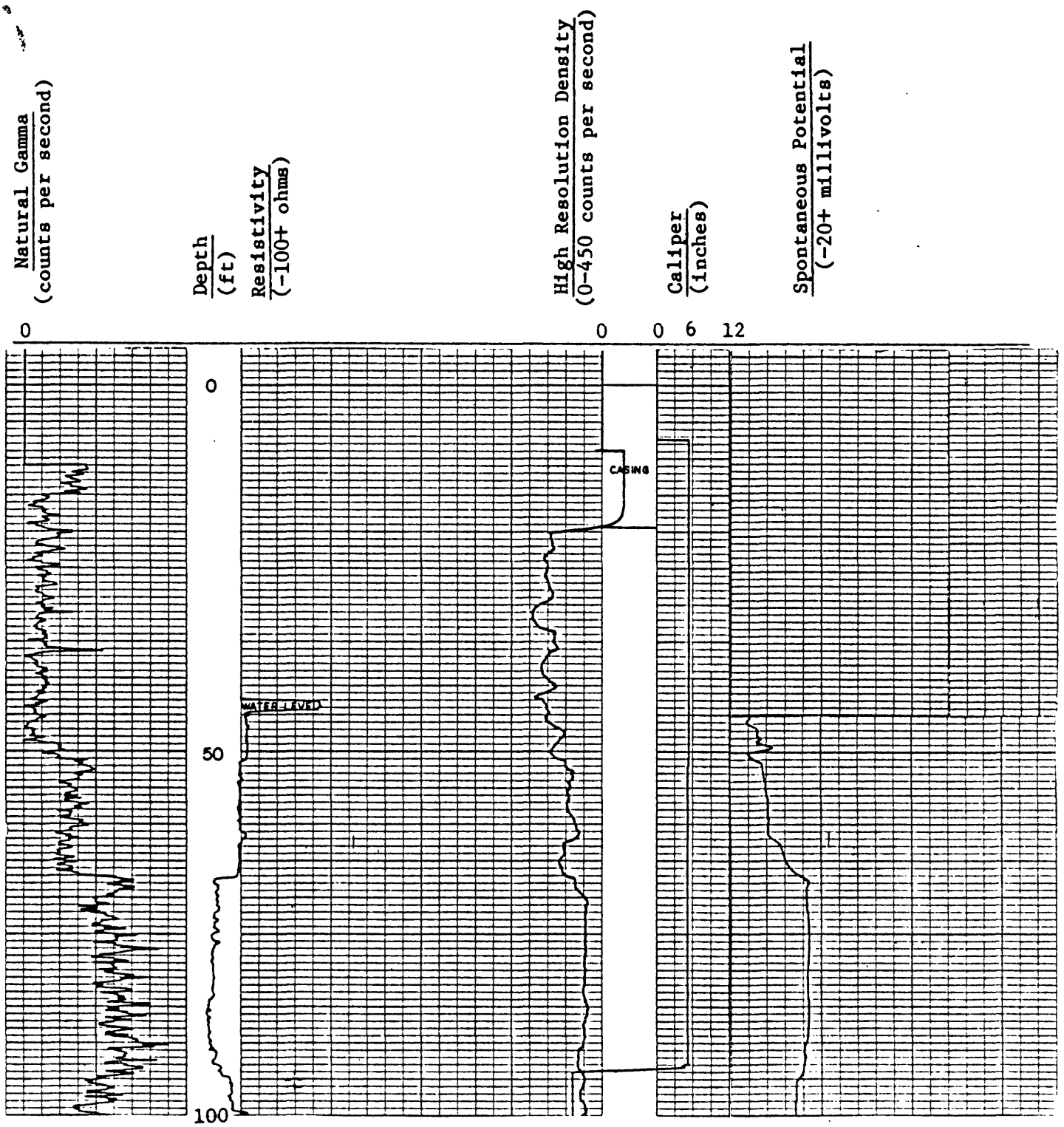
Corehole: SW-9 Date: 1/13/83 State: Virginia County: Lee

Quadrangle: Big Stone Gap, Va. Latitude: 36°51'13"N Longitude: 82°51'34"N

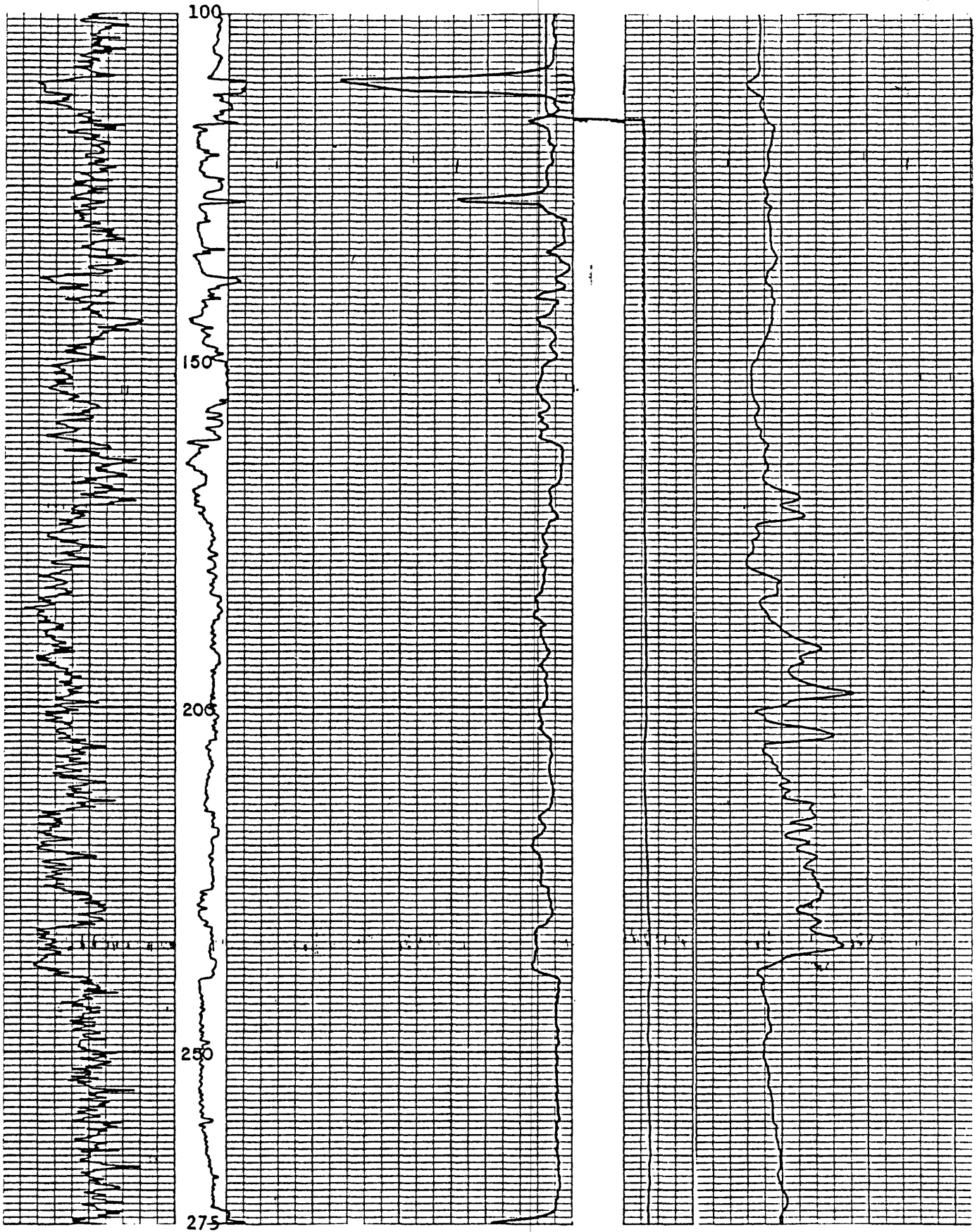
Altitude: 2,345 ft Logged Depth: 1,662 Drilled Depth: 1663 ft

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

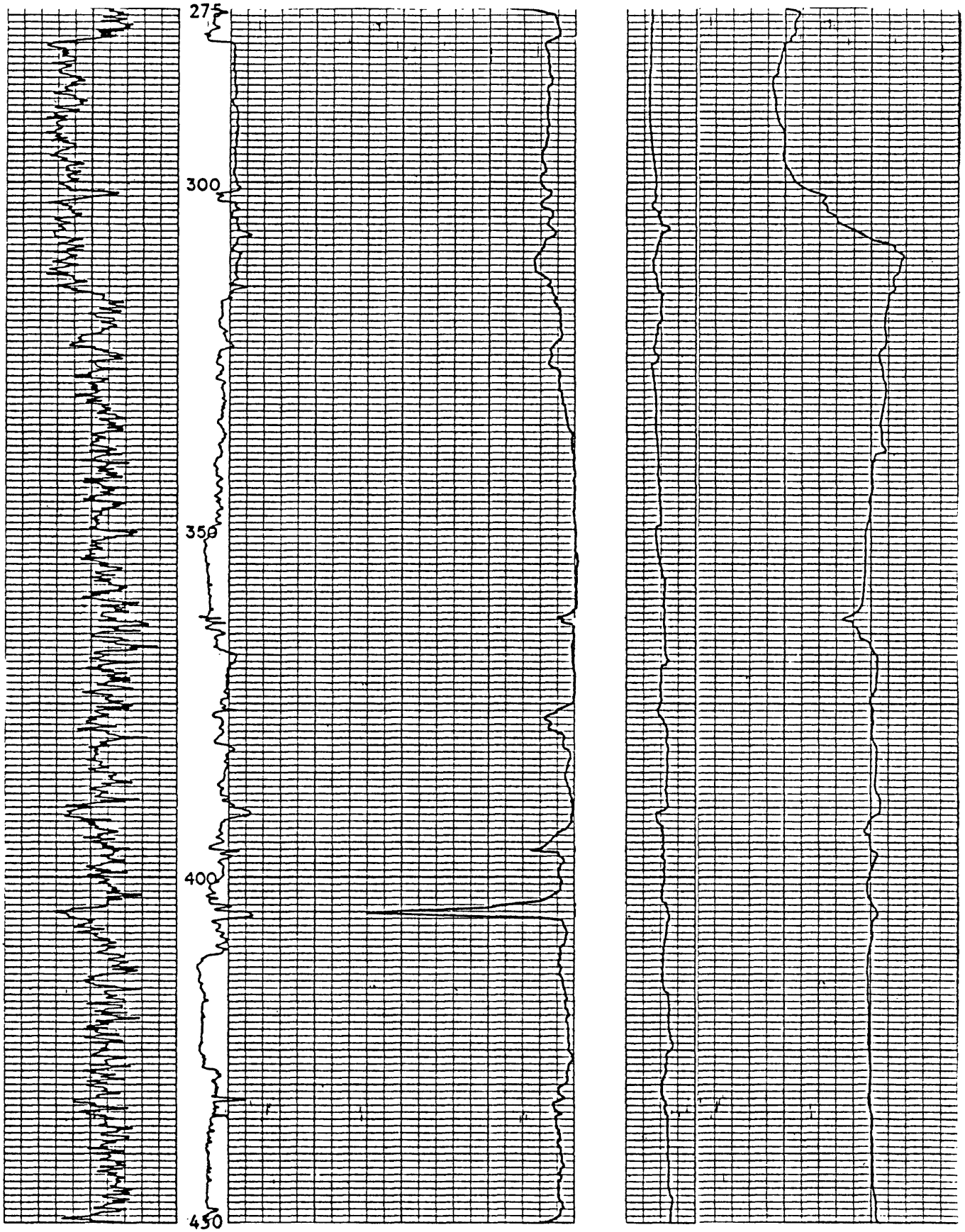
High Resolution Density Time Constant: 1



Corehole: SW-9 continued



Corehole: SW-9 continued



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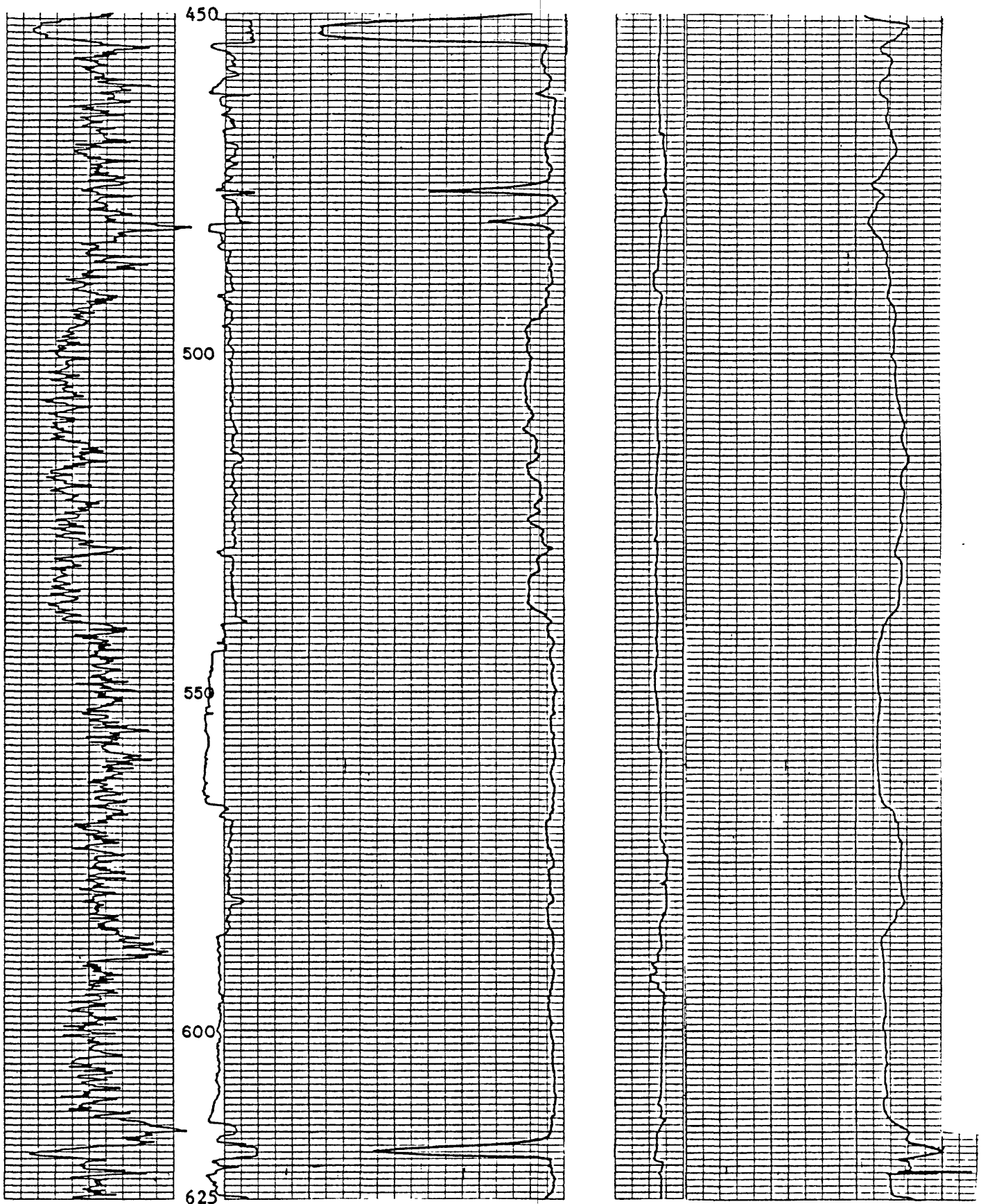

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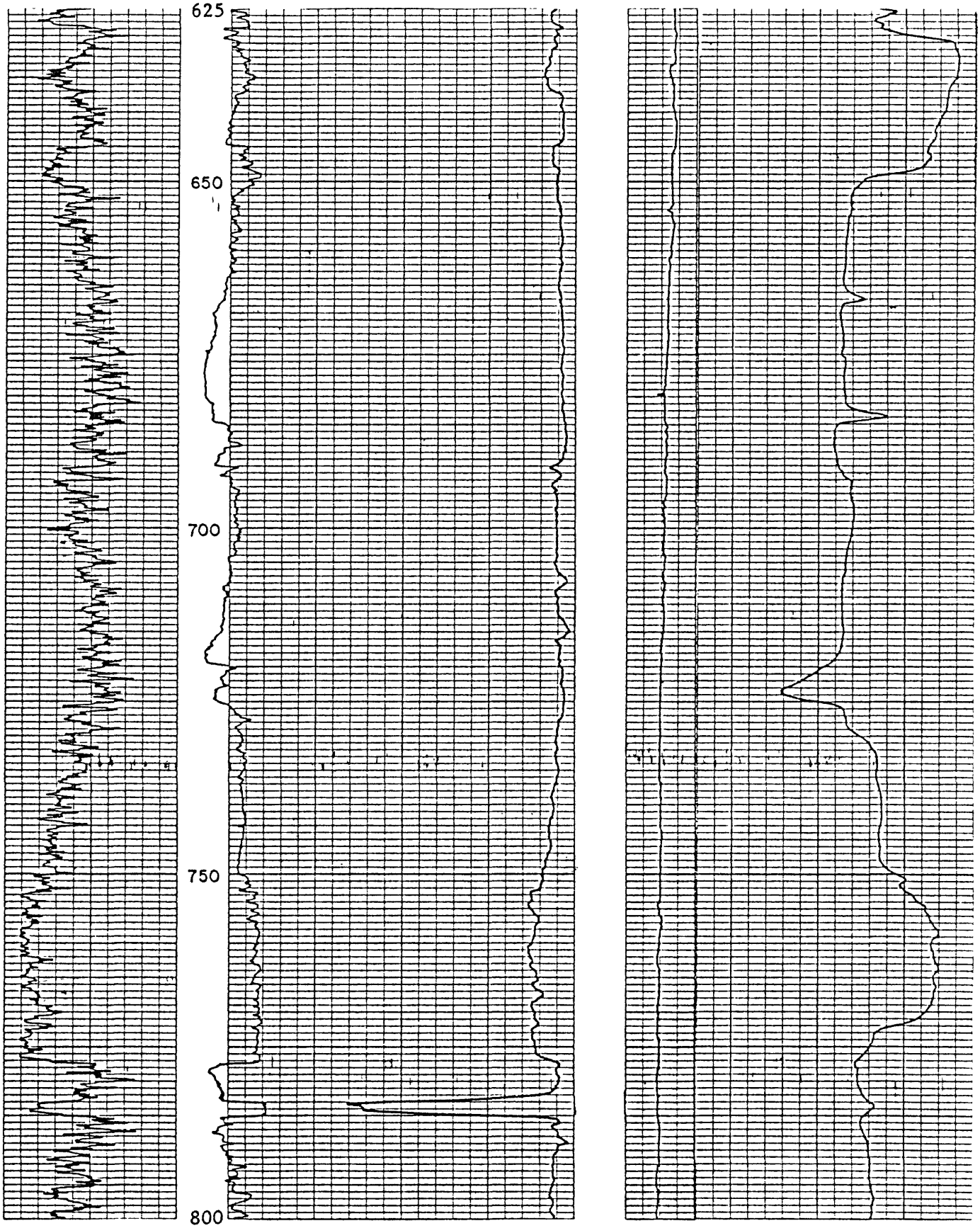

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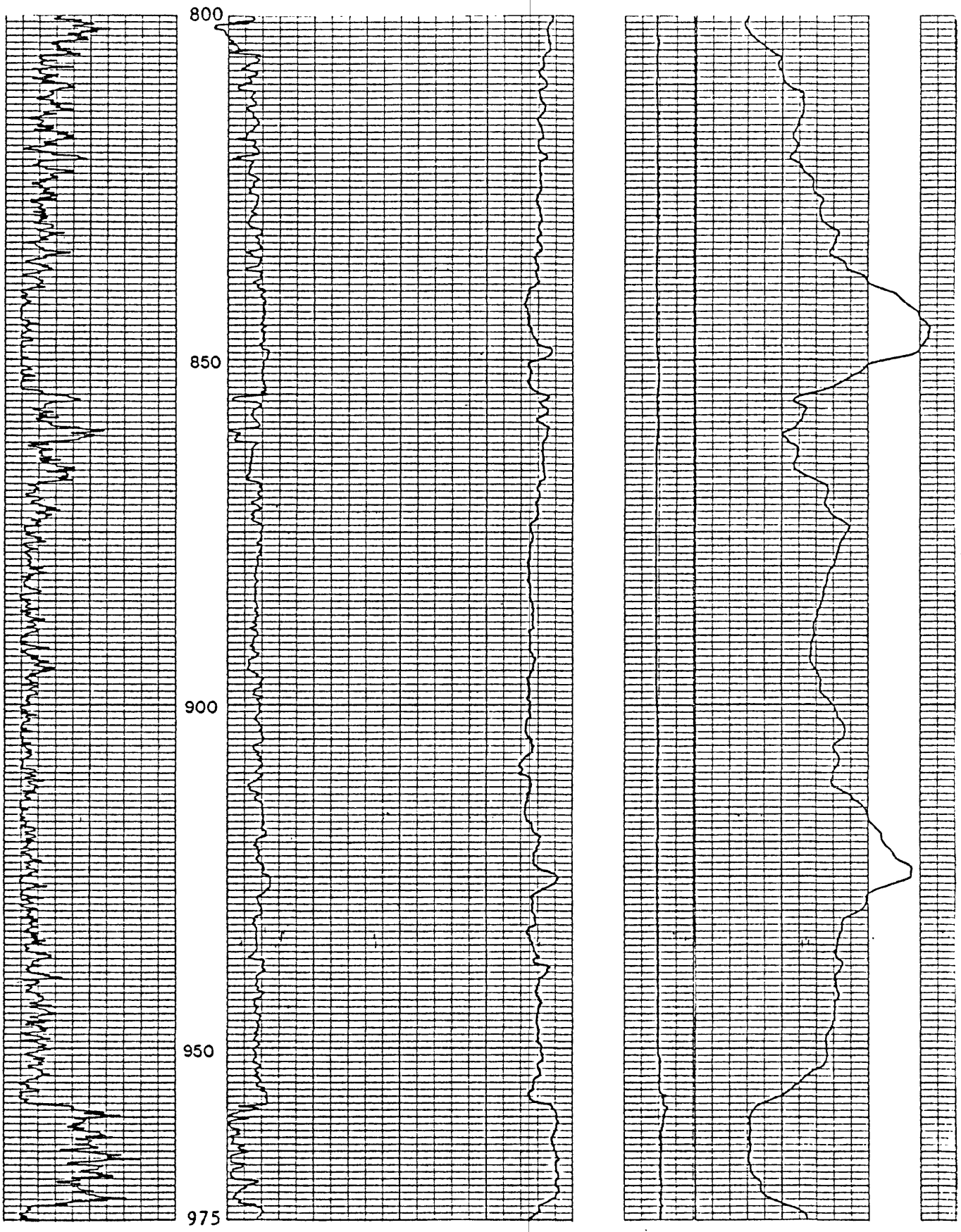

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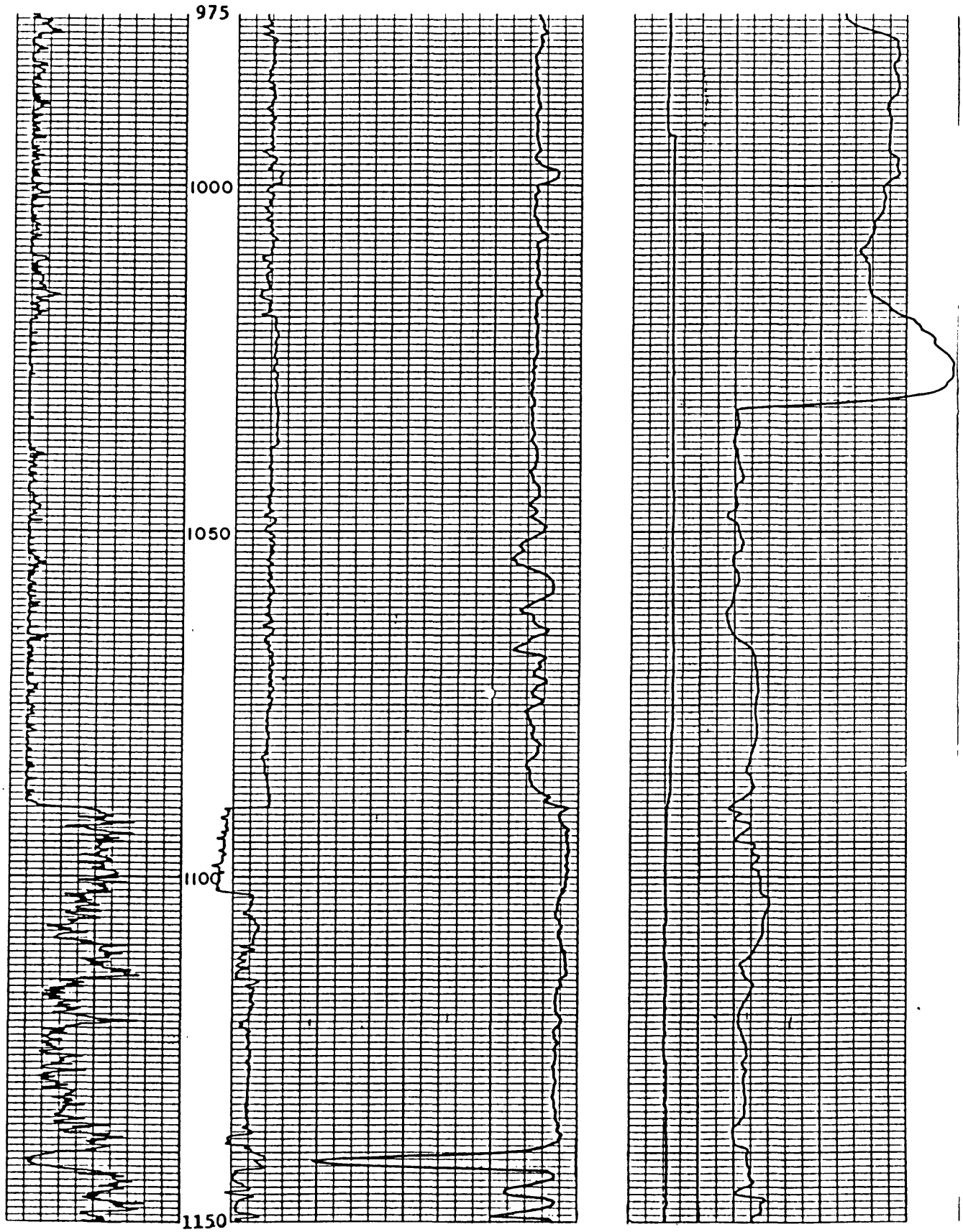

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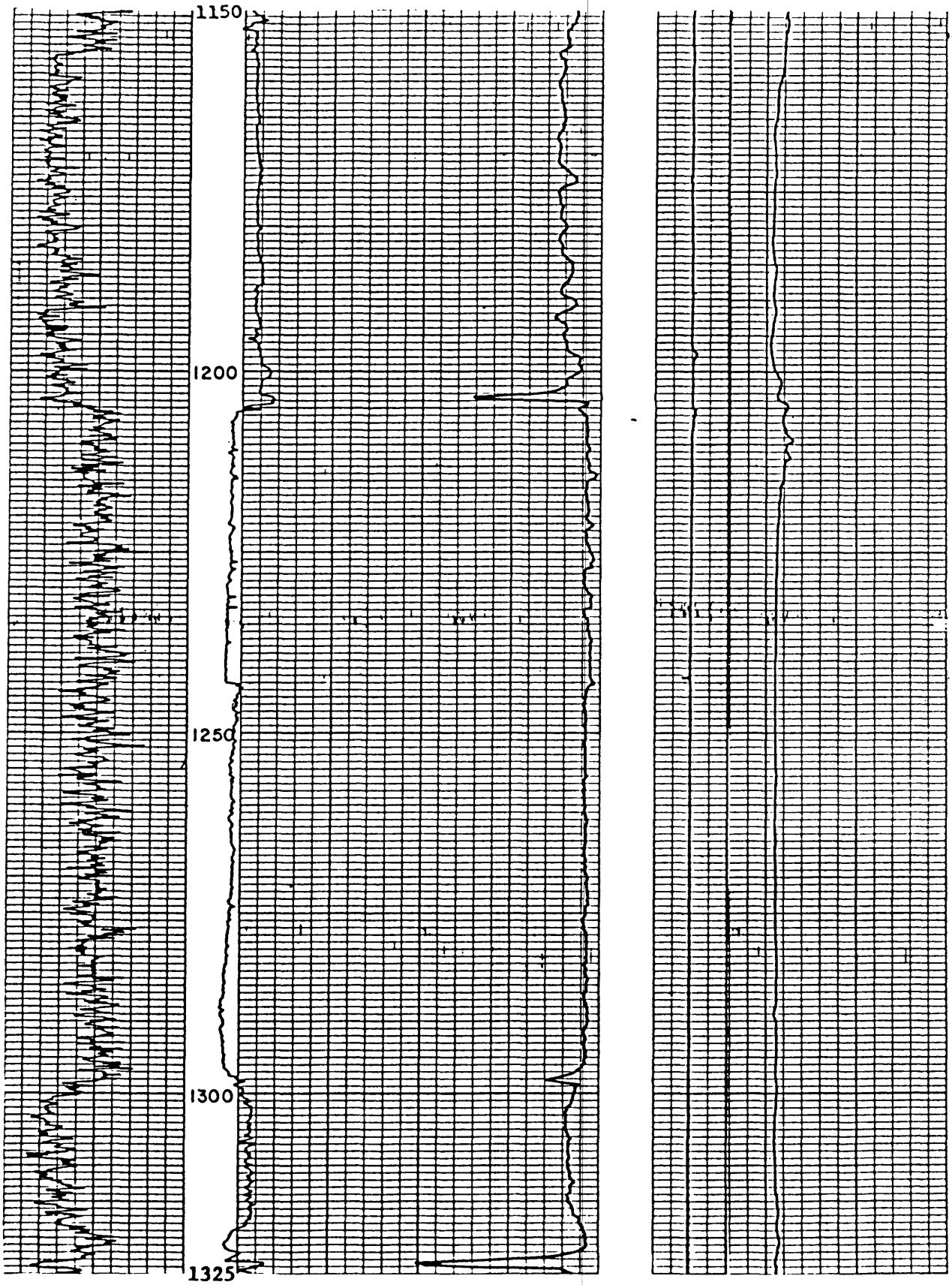

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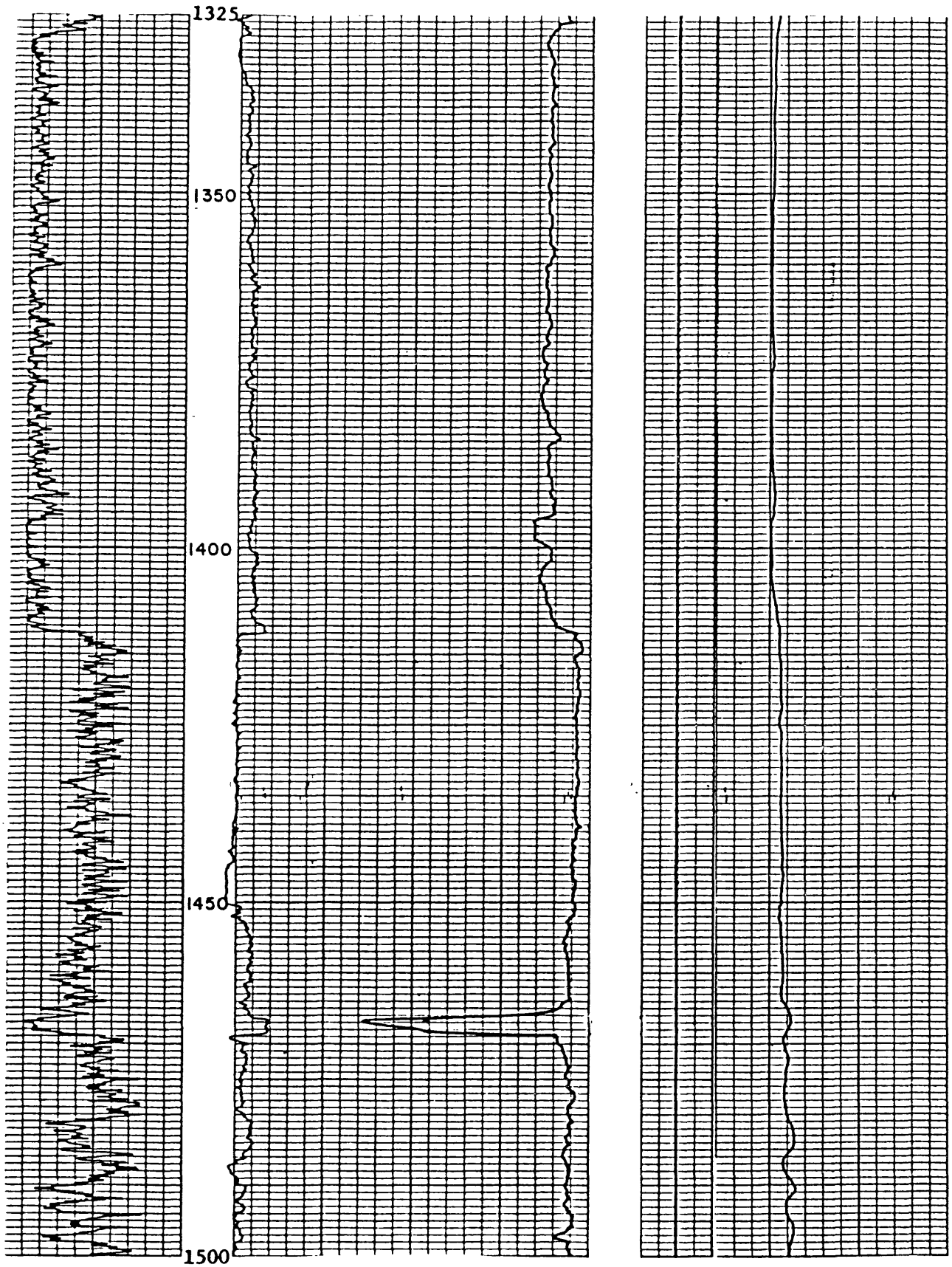

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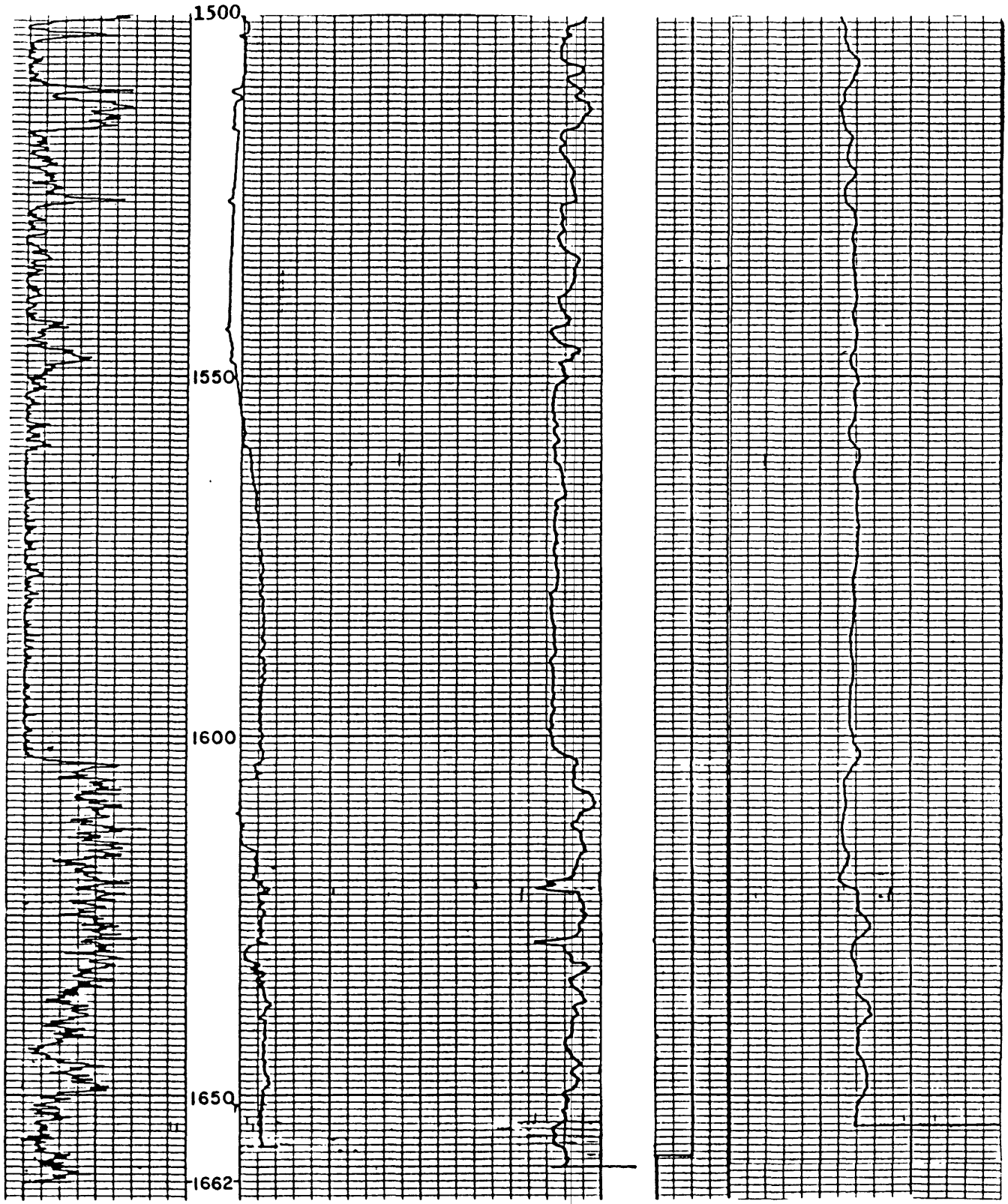
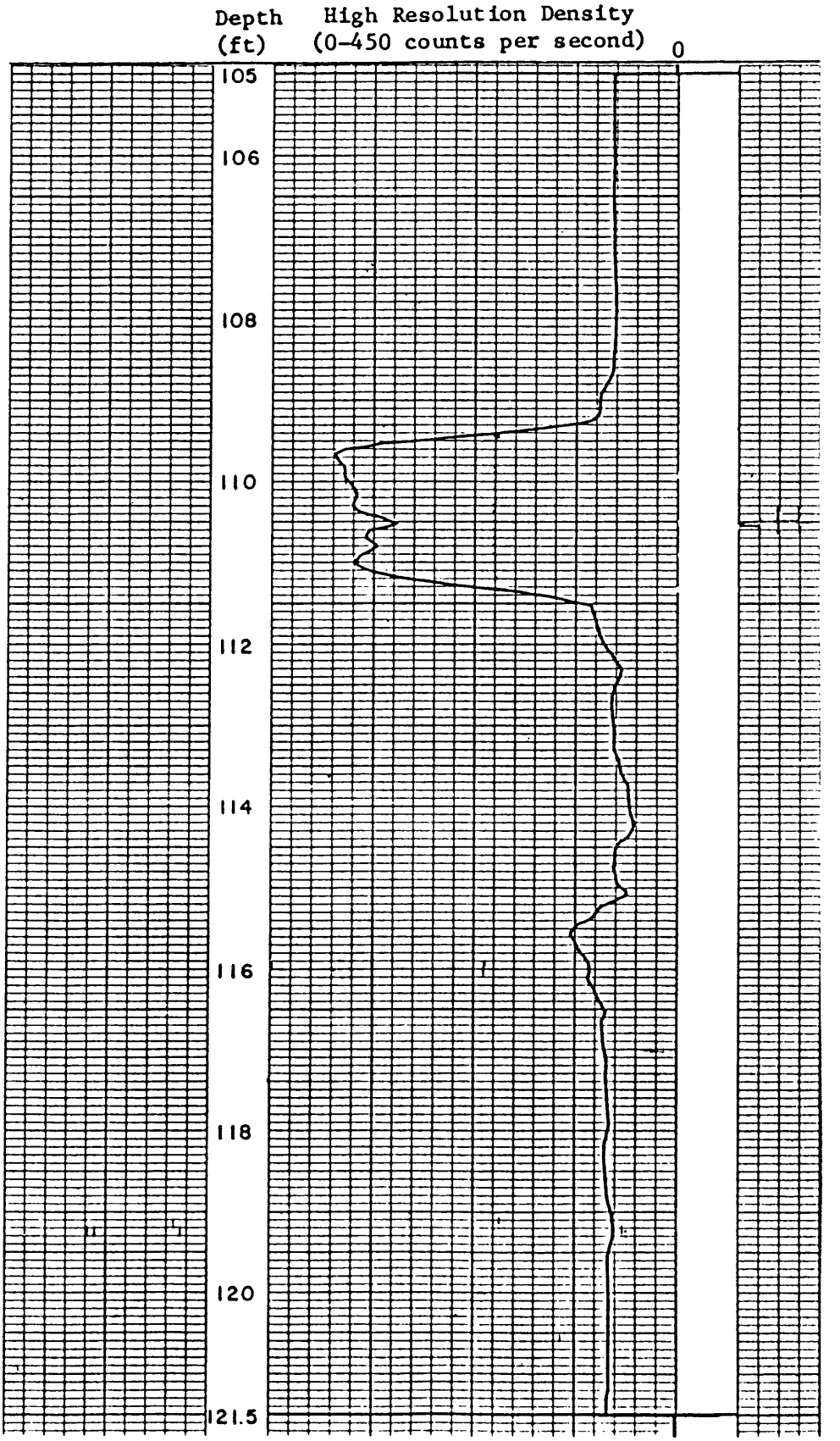


DETAIL LOG

Corehole: SW-9 Logging Speed: 10 ft/min Time Constant: 1



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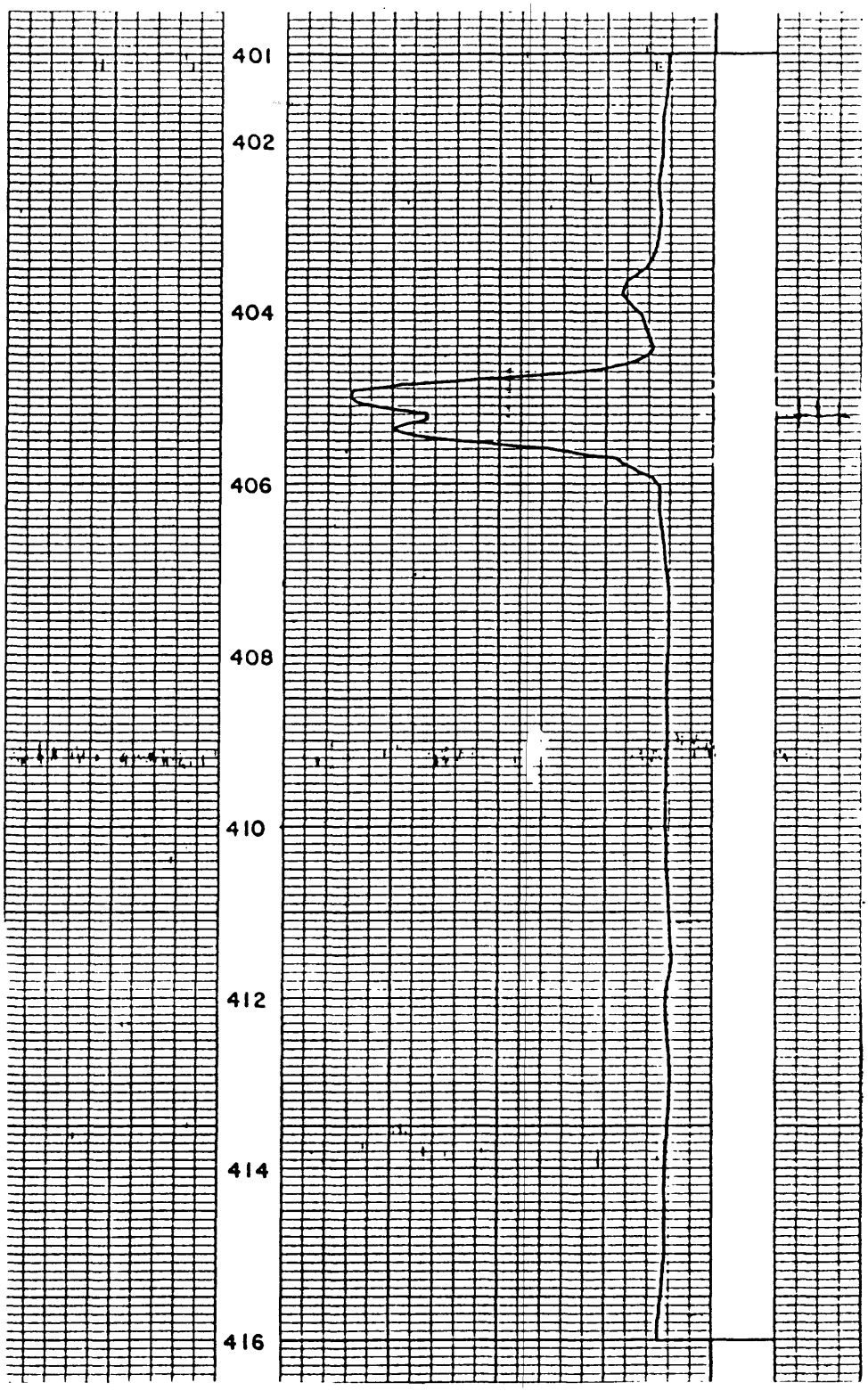

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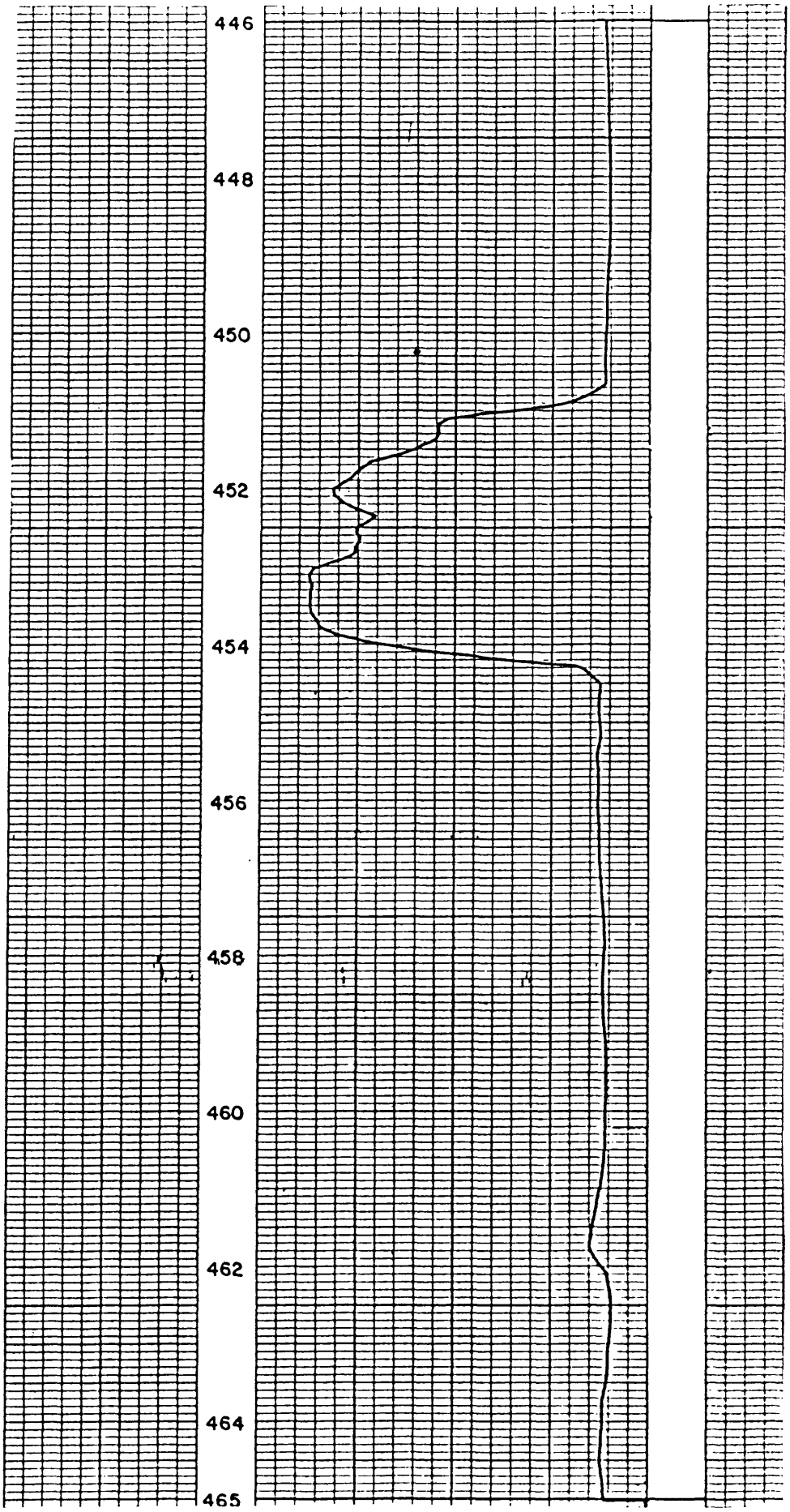

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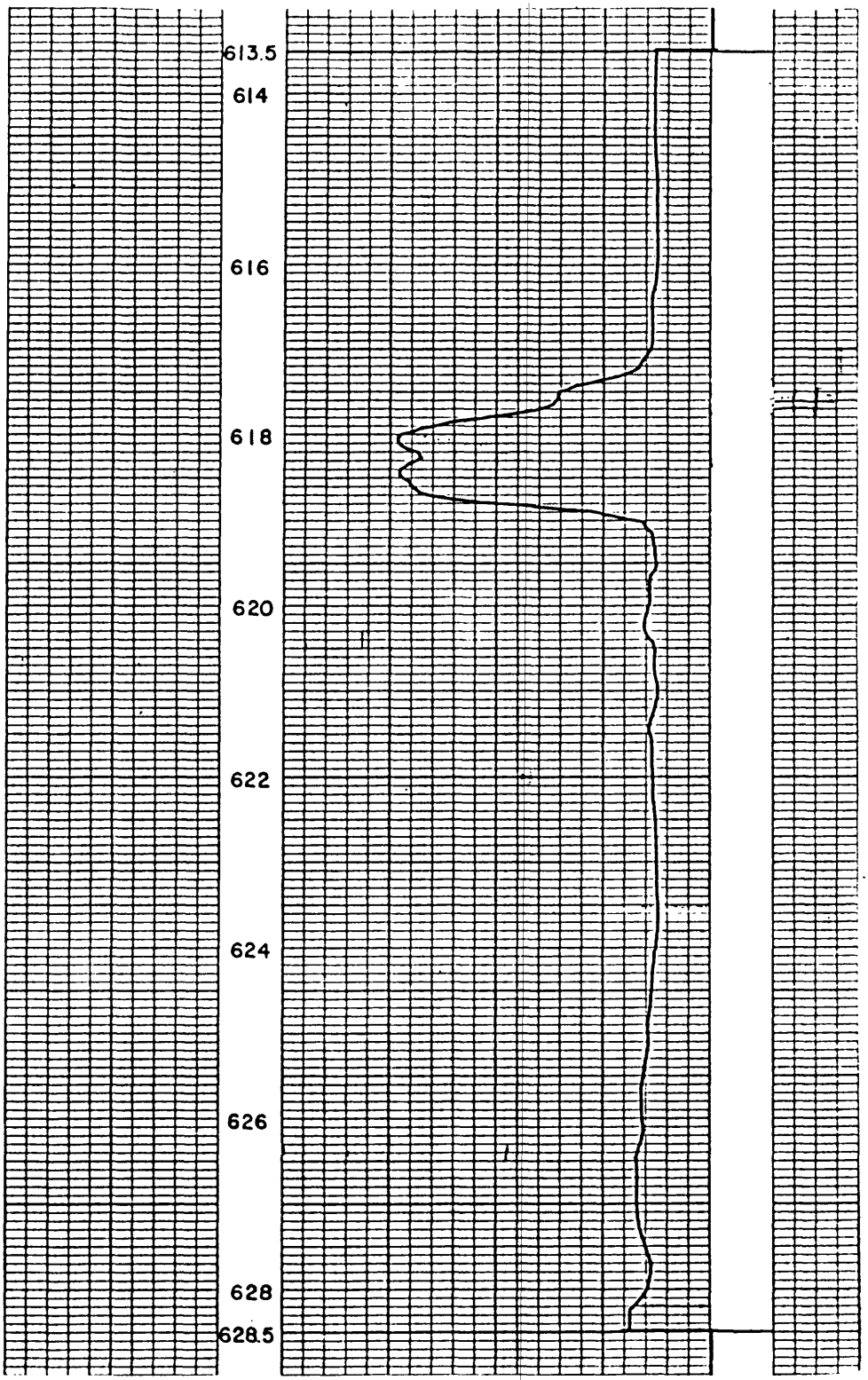

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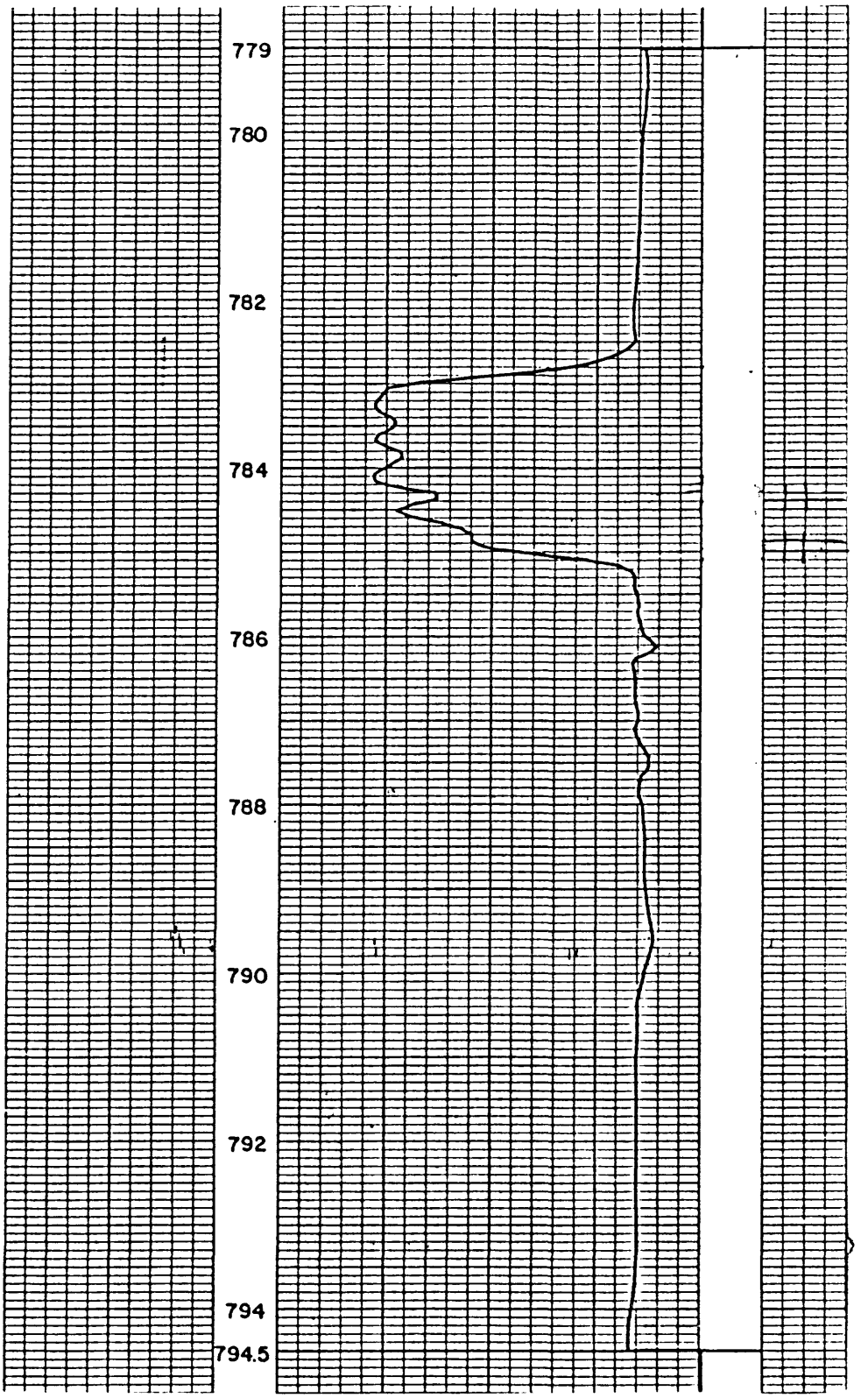

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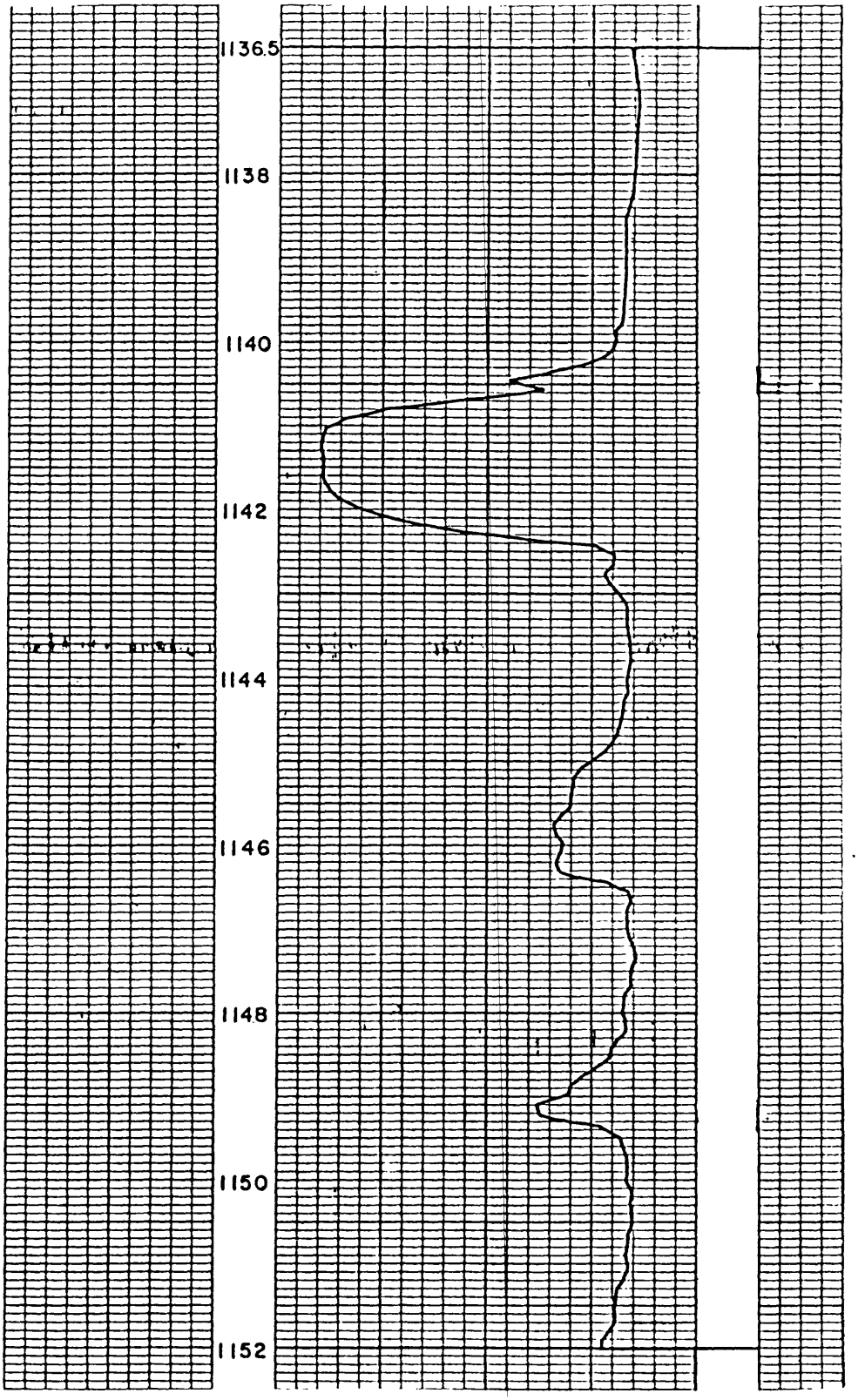

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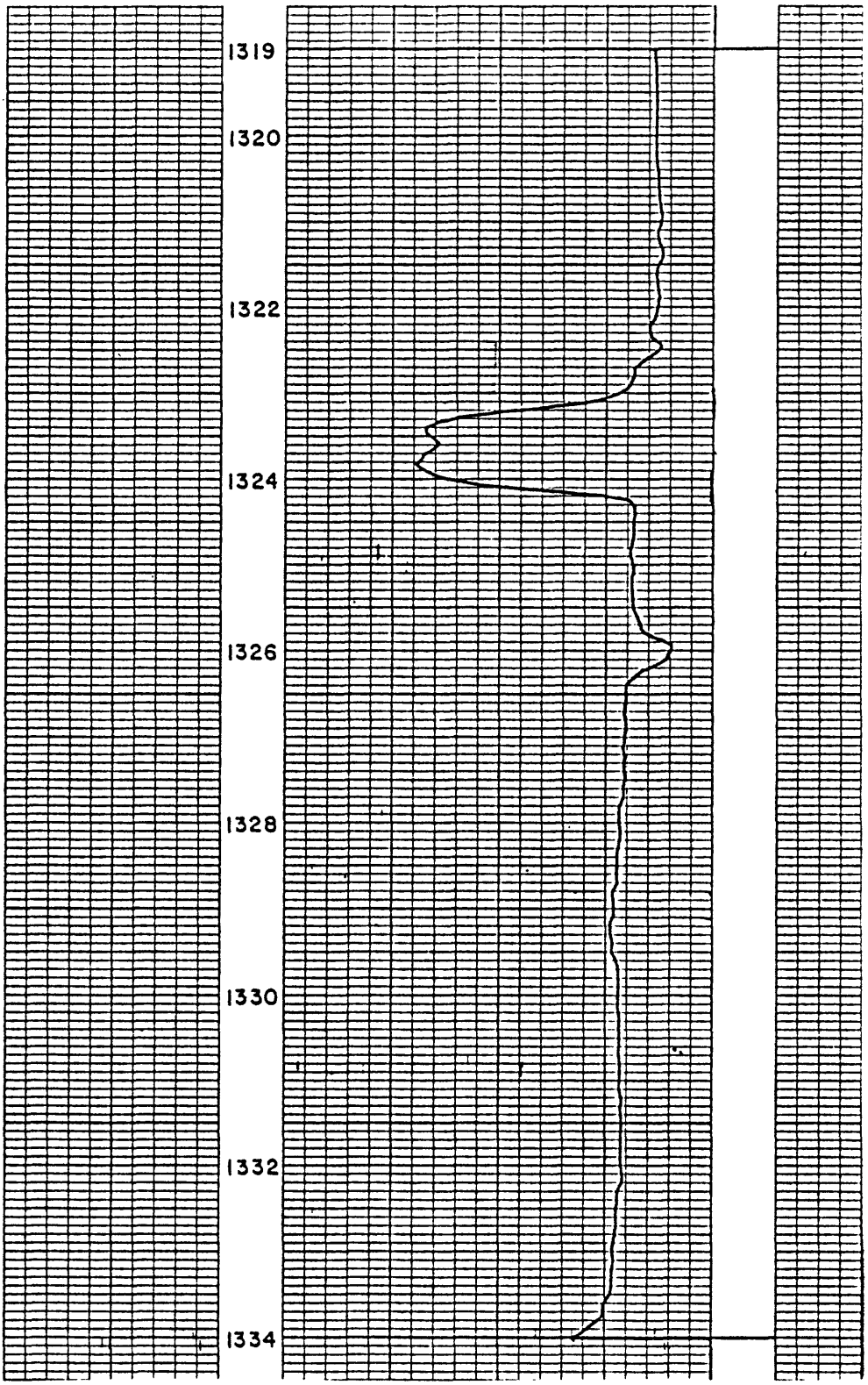
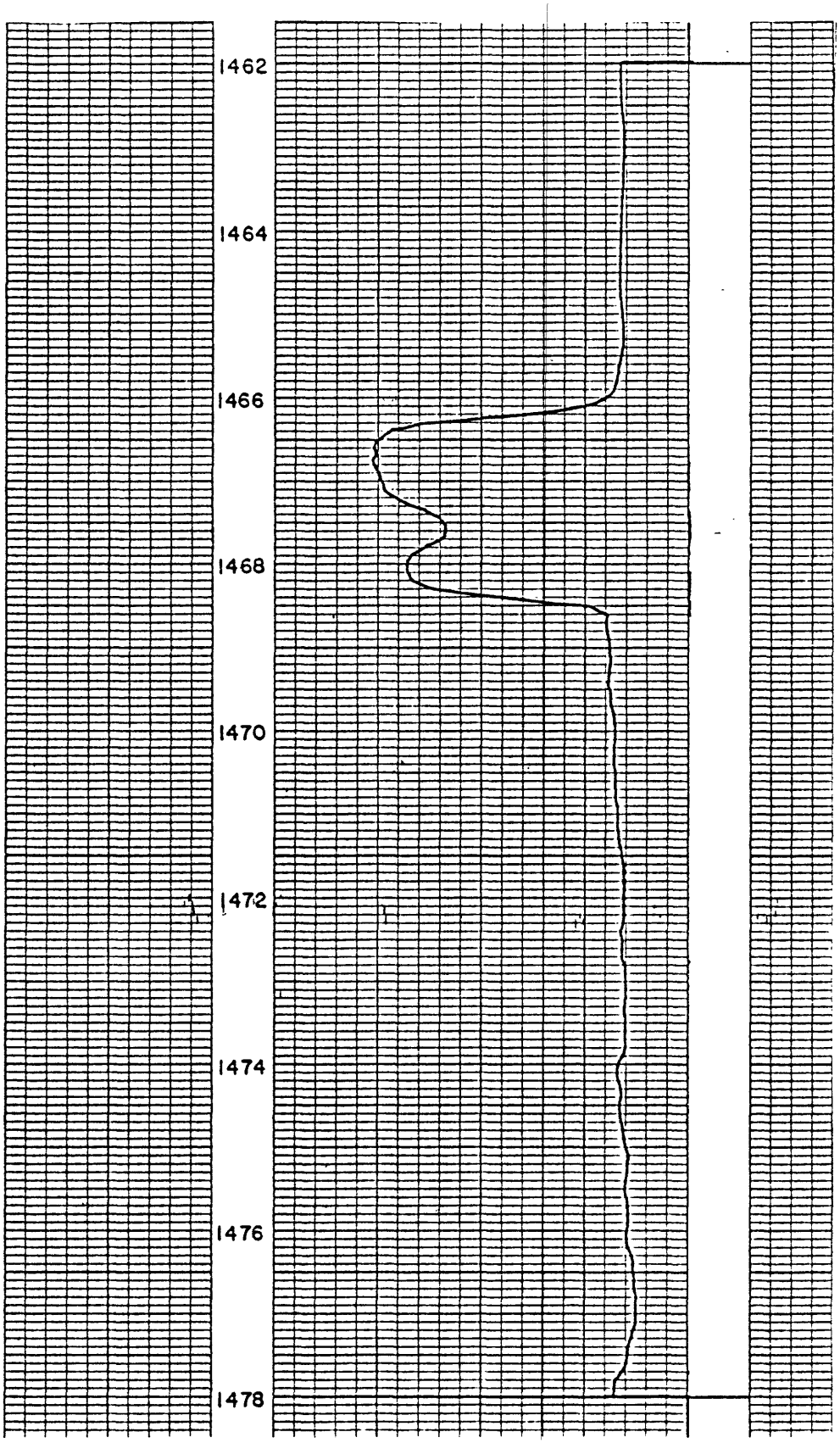


Corehole: SW-9 continued



Corehole SW-9A

Location: Lee County; Big Stone Gap, Va., 7.5 minute quadrangle; on Stone Mountain at Olinger Gap. Accessible by gravel road extending northward from State Route 621 at Olinger, Va.

Coordinates: Latitude 36°50'13"N Longitude 82°51'34"W

Altitude: 2,655 ft Drilled depth: 930 ft

Dip of strata: Decreases from 60° near surface to 50° at depth of 200 ft, 20° at depth of 300 ft, to about 10° from depth of 500 ft to bottom of corehole.

Date drilled: January 17, 1983 to February 3, 1983

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

Unit Number	Description	Thickness	(Depth)
	LOWER PENNSYLVANIAN SERIES Lee Formation		
1.	Surface material (no core recovered).....	110	0
		(110	0)
	Lee Formation Middlesboro Member		
2.	Sandstone, medium-light-gray, weathered brownish gray in part, fine- to medium-grained, micaceous, contains 55 percent quartz; scattered dark, light and green mineral grains; abundant coal clasts, thin- to thick-bedded; base sharp.....	50	8
		(160	8)
3.	Sandstone, light-gray, very fine to fine-grained, sparsely micaceous, contains 90 percent quartz, scattered dark mineral grains, thick-bedded to massive.....	5	2
		(165	10)
4.	Sandstone, medium-light-gray, fine- to course-grained, contains 60 percent quartz, scattered well rounded white quartz pebbles, medium-dark-gray shale and siderite clasts and scattered coal clasts in basal 3 in.....	8	9
		(174	7)
5.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 90 percent quartz, few dark-gray shale laminae, scattered dark mineral grains, few well rounded white quartz pebbles up to 0.25 in. in diameter in basal 3 ft, few stylolites.....	51	8
		(226	3)
6.	Conglomerate, medium-light-gray, contains well rounded white quartz pebbles up to 0.5 in. in diameter, few shale and siderite clasts, fine- to medium-grained quartzose sandstone matrix, massive; base sharp.....	3	6
		(229	9)

Unit Number	Description	Thickness (Depth) ft	in.
		(226	3)
7.	Sandstone, light-gray, very fine to fine-grained, contains 90 percent quartz, few scattered dark and light mineral grains, few stylolites, scattered well rounded white quartz pebbles in basal 3 ft 9 in.	81	9
		(311	6)
8.	Conglomerate, light-gray, contains well rounded white quartz pebbles up to 1 in. in diameter, fine- to medium-grained quartzose sandstone matrix, abundant siderite clasts up to 1.5 in. in diameter, and coal clasts in basal 5 in., few near vertical fractures in top 2 ft.	12	0
		(323	6)
9.	Sandstone, light-gray, very fine to fine-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles in top 1 ft 8 in., few dark-gray carbonaceous shale and coal laminae, scattered stylolites, thick-bedded to massive.	21	1
		(344	7)
10.	Coal, mostly bright attritus with few fusain bands, shattered.	0	6
		(345	1)
11.	Sandstone, medium-light-gray, very fine to fine-grained, contains 65 percent quartz, few dark-gray shale laminae, few coal clasts, abundant subrounded siderite clasts in basal 5 in., silty with few rootlets in top 2 ft; base sharp and angular.	6	6
		(351	7)
12.	Sandstone, medium-light- to medium-gray, very fine-grained, silty, contains 50 percent quartz, few medium-dark-gray shale laminae, cross-laminated, thin-bedded.	0	4
		(351	11)
13.	Shale, medium-gray, contains 40 percent light-brownish-gray siltstone laminae and 5 percent light-gray very fine-grained sandstone beds, bioturbated.	4	2
		(356	1)
14.	Shale, medium-dark- to dark-gray, very carbonaceous, silty, burrowed, evenly bedded, fair fissility.	0	3
		(356	4)
15.	Shale, medium-dark- to dark-gray, very carbonaceous, contains 25 percent medium-gray siltstone laminae and 20 percent medium-light-gray very fine-grained silty sandstone laminae and beds, burrowed.	6	10
		(363	2)
16.	Shale, medium-dark- to dark-gray, silty, very carbonaceous, few siderite beds, few plant fragments in basal 6 in., evenly bedded, fair fissility.	18	8
		(381	10)

Unit Number	Description	Thickness (Depth) ft	in.
17.	Coal, Little Raleigh (?) coal bed (thickness - 2 ft 7 in.)		
	17a. Coal, mostly dull attritus and thin vitrain bands; few fusain laminae in basal 7 in.	1 (383	5 3)
	17b. Impure coal and coal	1 (384	2 5)
18.	Underclay, medium-dark-gray, silty, very carbonaceous, abundant rootlets, faintly bedded; base sharp	3 (387	1 6)
19.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 50 percent quartz, 20 percent dark-gray shale laminae, few rootlets in top 1 ft, mostly thin-bedded, 4 in. thick contorted bed 4 ft below top, few dark-gray shale and siderite clasts at base; base grades	6 (393	3 9)
20.	Sandstone, light-gray, mottled brownish-gray in part, very fine-grained, contains 90 percent quartz, few siderite clasts, few small-scale faults; base sharp	2 (396	4 1)
21.	Coal, dull attritus	0 (396	4 5)
22.	Underclay, medium-gray, sandy from 1 ft 11 in. to 2 ft 3 in. below top, abundant rootlets, poorly bedded	5 (402	10 3)
23.	Siltstone, medium-gray, contains 10 percent dark-gray shale and light-gray very fine grained sandstone laminae, unevenly bedded; base sharp	1 (403	5 8)
24.	Sandstone, medium-light-gray, very fine grained, silty, contains 50 percent quartz, 30 percent dark-gray carbonaceous shale laminae, cross-laminated; base grades	1 (405	7 3)
25.	Shale, medium-dark-gray, contains 45 percent medium-gray, siltstone laminae, evenly bedded; base sharp	0 (405	4 7)
26.	Sandstone, light- to medium-light-gray, very fine grained, contains 50 percent quartz, few dark-gray shale laminae and lenses up to 0.5 in. thick	4 (410	8 3)

Unit Number	Description	Thickness (Depth) ft	in.
27.	Shale, medium- to medium-dark-gray, few siderite beds; base sharp.....	0	6
		(410	9)
28.	Sandstone, medium-light-gray, very fine grained, silty, contains 50 percent quartz, thin-bedded; base sharp.....	0	2.5
		(410	11.5)
29.	Shale, medium-dark-gray, slightly carbonaceous, fair fissility....	0	2.5
		(411	2)
30.	Sandstone, light-gray, fine-grained, contains 90 percent quartz, few dark and light mineral grains, few scattered dark-gray carbonaceous shale laminae, few well rounded white quartz pebbles up to 0.25 in. in diameter, conglomeratic with abundant well rounded white quartz pebbles up to 0.5 in. in diameter from 24 ft 5 in. to 36 ft 1 in. below top, abundant stylolites, massive; base grades.....	38	9
		(449	11)
31.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, scattered well rounded white quartz granules and pebbles up to 0.5 in. in diameter, 6 in. coal clast 5 ft 4 in. below top, abundant coal clasts in basal 6 in., massive; base sharp.....	8	4
		(458	3)
32.	Shale, medium-dark-gray, silty, contains abundant coal and siderite clasts and white quartz pebbles, very contorted bedding; base sharp.....	0	9
		(459	0)
33.	Sandstone, light-gray, very fine grained, contains 65 percent quartz, few dark-gray carbonaceous shale and coal laminae; base sharp.....	0	2
		(459	2)
34.	Conglomerate, white, contains abundant well rounded quartz pebbles up to 0.5 in. in diameter, medium- to coarse-grained quartzose sandstone matrix; base sharp.....	1	10
		(461	0)
35.	Shale, dark-gray, carbonaceous, contains 5 percent light-gray very fine grained silty sandstone laminae, few plant fragments, scattered siderite nodules and beds; base grades.....	0	10
		(461	10)
36.	Coal, impure, dull attritus.....	0	6
		(462	4)

Unit Number	Description	Thickness (Depth) ft	in.
37.	Sandstone, medium-gray, mottled brownish-gray, medium-grained, contains 65 percent quartz, few quartz granules; base sharp.....	0	3
		(462	7)
38.	Coal, Beckley coal bed (thickness - 2 ft 3.75 in.)		
	38a. Coal, thin to thick vitrain bands, dull to bright attrital matrix.....	0	1.25
		(462	8.25)
	38b. Coal, mostly bright attritus.....	0	4.5
		(463	0.75)
	38c. Coal, dull to bright attritus, slightly pyritic.....	1	0
		(464	0.75)
	38d. Coal, mostly bright attritus, few vitrain bands.....	0	10
		(464	10.75)
39.	Shale, dark-gray, carbonaceous, contains 10 percent coal laminae, few rootlets; base sharp.....	0	5.25
		(465	4)
40.	Sandstone, light-gray, very fine grained, silty, micaceous, contains 45 percent quartz, scattered rootlets in top 11 in., burrowed in basal 2 ft, irregularly bedded; base grades.....	6	3
		(471	7)
41.	Sandstone, light-gray, very fine grained, silty, contains 45 percent quartz, 45 percent dark-gray silty shale laminae, bioturbated; base grades.....	6	0
		(477	7)
42.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, 10 percent dark-gray shale laminae, thin irregularly bedded; base grades.....	3	7
		(481	2)
43.	Sandstone, light-gray, very fine to fine-grained, silty, micaceous, contains 65 percent quartz, 5 percent dark-gray carbonaceous shale laminae, few rootlets, thin- to thick-bedded; base grades abruptly.....	9	1
		(490	3)
44.	Sandstone, light-gray, very fine grained, contains 55 percent quartz, 20 percent dark-gray silty shale laminae, thin-bedded, partly flaser-bedded, few small-scale faults and contorted beds.....	3	2
		(493	5)
45.	Shale, dark-gray, silty, scattered siderite beds up to 0.5 in. thick, evenly bedded; base grades.....	5	6
		(498	11)

Unit Number	Description	Thickness (Depth) ft	in.
46.	Shale, dark-gray, slightly silty in top 20 ft, carbonaceous, contains 20 percent light-gray siltstone laminae from 12 ft to 16 ft 6 in. below top, scattered siderite beds up to 1 in. thick few plant fragments; base grades	40	8
		(539	7)
47.	Shale, dark-gray, carbonaceous, abundant siderite beds up to 0.5 in. thick, few slickensided surfaces, grades to black shale with abundant slickenslides in basal 5 ft; base grades	19	6
		(559	1)
48.	Coal, impure, very dull	0	1.5
		(559	2.5)
49.	Shale, black, very carbonaceous, contains 20 percent coal laminae	0	4.5
		(559	7)
50.	Underclay, medium-gray, abundant rootlets, and root slicks; base grades abruptly	1	5
		(561	0)
51.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent medium-dark-gray shale laminae in basal 1 ft, contorted bedding in top 10 in.; base sharp	1	10
		(562	10)
52.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine grained sandstone laminae, slightly burrowed, evenly bedded; base grades	2	1
		(564	11)
53.	Sandstone, light-gray, very fine grained, micaceous, contains 40 percent quartz, thin-bedded, contorted bedding in top 1.5 in.; base grades	0	4
		(565	3)
54.	Shale, medium-dark-gray, contains 10 percent light-gray siltstone and very fine grained sandstone laminae, few siderite beds, evenly bedded	1	5
		(566	8)
55.	Sandstone, light-gray, very fine grained, micaceous, contains 40 percent quartz, 10 percent medium-gray silty shale laminae, cross-laminated, thin-bedded	0	8
		(567	4)
56.	Shale, medium-dark-gray, silty, finely micaceous, evenly bedded, poor fissility; base grades abruptly	0	6
		(567	10)

Unit Number	Description	Thickness (Depth) ft	in.
57.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, cross-laminated, thin-bedded; base grades.....	1	1
		(568	11)
58.	Shale, medium-dark-gray, silty, evenly bedded; base grades.....	0	10
		(569	9)
59.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, 20 percent dark-gray shale laminae, thin-bedded; base grades.....	2	0
		(571	9)
60.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded; base grades...	1	0
		(572	9)
61.	Sandstone, light-gray, very fine grained, micaceous, contains 40 percent quartz, 10 percent medium-gray siltstone laminae, thin-bedded.....	1	10
		(574	7)
62.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine grained sandstone laminae, poor fissility; base grades abruptly.....	1	1
		(575	8)
63.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, calcite filled fractures from 7 in. to 12 in. below top, thin- to thick-bedded; base grades abruptly.....	1	10
		(577	6)
64.	Shale, medium-dark-gray, contains 20 percent light-gray fine-grained stone laminae and beds, evenly bedded, poor fissility; base sharp.....	1	3
		(578	9)
65.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, thin- to thick-bedded; base sharp and intertounging.....	0	11
		(579	8)
66.	Shale, medium-dark-gray, evenly bedded, fissile; base sharp.....	0	8
		(580	4)
67.	Sandstone, light-gray, very fine to fine-grained, contains 50 percent quartz, 15 percent medium-gray shale beds up to 2 in. thick; base sharp.....	1	11
		(582	3)
68.	Shale, medium-dark-gray, silty in top 2 ft, few plant fragments, evenly bedded, fair fissility; base grades abruptly.....	21	4
		(603	7)

Unit Number	Description	Thickness (Depth) ft	in.
69.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base grades	1	4
		(604	11)
70.	Shale, medium-dark-gray, silty, evenly bedded, fissile	0	9
		(605	8)
71.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine grained sandstone laminae and beds, few siderite beds up to 0.5 in. thick, evenly bedded	11	0
		(616	8)
72.	Shale, medium-dark to dark-gray, evenly bedded, fair fissility	6	0
		(622	8)
73.	Coal, Cove Creek coal bed (thickness - 2 ft 1 in.)		
73a.	Coal, mostly dull attritus, few thin to thick vitrain bands	1	11
		(624	7)
73b.	Coal, impure	0	2
		(624	9)
74.	Underclay, dark-gray, carbonaceous, abundant rootlets and root slicks; base grades	3	7
		(628	4)
75.	Shale, medium-gray, silty, poorly bedded; base grades abruptly	1	5
		(629	9)
76.	Sandstone, medium-light-gray, very fine grained, finely micaceous, contains 40 percent quartz; base sharp	0	4
		(630	1)
77.	Shale, medium-dark-gray, silty in top 6 in., evenly bedded, poor fissility; base sharp	1	2
		(631	3)
78.	Siltstone, medium-light- to medium-gray, contains 30 percent light-gray very fine grained sandstone laminae and beds, thin-bedded, fair fissility; base sharp	3	8
		(634	11)
79.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, few pyritic coal clasts and laminae, few small medium-dark-gray shale clasts in top 2 in., thin- to thick-bedded; base sharp	1	2
		(636	1)

Unit Number	Description	Thickness (Depth) ft	in.
80.	Shale, medium-dark-gray, contains 30 percent light-gray very fine grained sandstone laminae, evenly bedded; base sharp.....	0	3
		(636	4)
81.	Sandstone, white to very light gray, medium- to coarse-grained, very conglomeratic with abundant well rounded white quartz pebbles from 0.5 to 1 in. in diameter, contains 90 percent quartz, 10 percent medium-gray siltstone laminae in top 5 in., few dark and green mineral grains, few stylolites, thick-bedded to massive; base grades.....	15	9
		(652	1)
82.	Sandstone, very light gray, medium- to coarse-grianed, contains 90 percent quartz, few dark mineral grains, few scattered well rounded white quartz pebbles up to 0.5 in. in diameter, few stylolites, massive; base grades.....	34	4
		(686	5)
83.	Sandstone, very light gray, medium- to coarse-grained, very conglomeratic with well rounded white quartz pebbles from 0.25 in. to 0.5 in. in diameter, contains 90 percent quartz, few stylolites, massive; base grades.....	20	7
		(707	0)
84.	Coal, bright attritus, probably a large clast; base sharp and very irregular.....	1	0
		(708	0)
85.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, abundant angular coal clasts up to 1 in. in diameter in top 1 ft 2 in., scattered angular dark-gray shale clasts in basal 4 in., irregularly bedded; base grades.....	1	7
		(709	7)
86.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, 5 percent medium-gray siltstone laminae in basal 1 ft 7 in., well sorted, crossbedded, thick-bedded to massive.....	6	3
		(715	10)
87.	Shale, dark-gray, contains 30 percent light-gray very fine grained sandstone laminae and beds, abundant siderite nodules 7 in. above base, slightly burrowed, flaser-bedded, fissile; base grades.....	2	2
		(718	0)
88.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, scattered small dark-gray shale clasts from 1 ft 6 in. to 1 ft 10 in. below top, thin- to thick-bedded; base grades.....	6	1
		(724	1)

Unit Number	Description	Thickness (Depth) ft	in.
89.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, 30 percent dark-gray shale laminae, well sorted, burrowed, few small flow rolls, cross-laminated, flaser-bedded; base grades	6	1
		(730	2)
90.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, 10 percent medium-dark-gray shale laminae and beds up to 0.5 in. thick, thin-bedded; base grades	5	7
		(735	9)
91.	Sandstone, very light gray, very fine to fine-grained, contains 90 percent quartz, 40 percent dark-gray shale beds up to 1 in. thick, slightly burrowed, cross-laminated, thin- to lenticular-bedding; base grades	1	7
		(737	4)
92.	Sandstone, very light gray, very fine to fine-grained, contains 90 percent quartz, 5 percent medium-dark-gray shale laminae, cross-laminated, thin-bedded; base grades	2	11
		(740	3)
93.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, few carbonaceous siltstone laminae from 9 in. to 1 ft 1 in. above base, few styolites, crossbedded, thick-bedded to massive	3	10
		(744	1)
94.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 60 percent quartz, 5 percent carbonaceous siltstone laminae, thin-bedded; base grades	1	2
		(745	3)
95.	Sandstone, very light gray to white, fine-grained, contains 90 percent quartz, few scattered dark-gray carbonaceous siltstone laminae, few siderite clasts in top 1 ft 4 in., crossbedded, massive; base grades	33	1
		(778	4)
96.	Sandstone, very light gray to white, medium- to coarse-grained, contains 90 percent quartz, sparsely conglomeratic with well rounded white quartz pebbles mostly 0.5 in. in diameter, very conglomeratic with abundant well rounded white quartz pebbles, coal and siderite clasts from 10 ft to 14 ft below top, few coal and siderite clasts in basal 3 ft 4 in., scattered stylolites, massive; base sharp	53	10
		(832	2)

Unit Number	Description	Thickness (Depth) ft	in.
	Pocahontas Formation		
97.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine grained sandstone laminae and beds, few siderite beds, burrowed in basal 5 ft, evenly bedded, fair fissility; base grades	16	7
		(848	9)
98.	Sandstone, medium-light-gray, very fine to fine-grained, silty, finely micaceous, contains 40 percent quartz, 25 percent medium-dark-gray silty shale laminae, thin-bedded; base grades	2	2
		(850	11)
99.	Shale, medium-dark-gray, silty, contains 20 percent light-gray siltstone and very fine-grained sandstone laminae, evenly bedded; base grades	2	10
		(853	9)
100.	Sandstone, medium-light-gray, very fine to fine-grained, silty, finely micaceous, contains 40 percent quartz, thin-bedded; base grades abruptly	1	7
		(855	4)
101.	Shale, medium-dark-gray, silty, contains 25 percent light gray very fine grained sandstone laminae and beds up to 1.5 in. thick, evenly bedded; base grades	5	10
		(861	2)
102.	Siltstone, medium-gray, finely micaceous, faintly- to thin-bedded, poor fissility; base grades	1	1
		(862	3)
103.	Shale, medium-dark-gray, silty, contains 10 percent medium-gray siltstone laminae, evenly bedded; base grades	3	2
		(865	5)
104.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 10 percent medium-dark-gray silty shale laminae in basal 1 ft 6 in., few siderite clasts, thin- to thick-bedded; base grades	2	9
		(868	2)
105.	Shale, medium-dark-gray, abundant siderite nodules up to 1 in. in diameter, few pyrite nodules in basal 2 ft, evenly bedded, fair fissility; base sharp	6	3
		(874	5)
106.	Coal, mostly dull attritus, pyritic	0	7
		(875	0)

Unit Number	Description	Thickness (Depth) ft	in.
	UPPER MISSISSIPPIAN SERIES Bluestone Formation Red Member		
107.	Underclay, medium-greenish-gray, abundant rootlets; base grades...	1	11
		(876	11)
108.	Shale, dark-greenish-gray, silty in top 1 ft, very silty in basal 1 ft 6 in., abundant limestone nodules from 3 ft to 4 ft below top, few high-angle calcite-filled fractures, evenly bedded, fair fissility; base grades.....	6	0
		(882	11)
109.	Siltstone, dark-greenish-gray, faintly bedded, poor fissility; base grades.....	0	7
		(883	6)
110.	Shale, dark-greenish-gray, faintly bedded, poor fissility; base grades.....	1	6
		(885	0)
111.	Sandstone, light-greenish-gray, very fine grained, calcareous, contains 40 percent quartz, thin-bedded; base grades.....	1	1
		(886	1)
112.	Shale, medium-greenish-gray, silty, few limestone nodules, evenly bedded, fair to poor fissility; base grades.....	4	10
		(890	11)
113.	Sandstone, medium-light-greenish-gray, fine-grained, micaceous, calcareous, contains 40 percent quartz, thin-bedded; base grades..	2	11
		(893	10)
114.	Shale, medium-greenish-gray, silty, few limestone nodules; base grades.....	8	11
		(902	9)
115.	Shale, grayish-red, mottled greenish-gray, faintly bedded, poor fissility.....	2	9
		(905	6)
116.	Shale, greenish-gray, abundant limestone nodules up to 1 in. in diameter, poor fissility; base grades.....	3	6
		(909	0)
117.	Sandstone, light-greenish-gray, very fine grained, micaceous, silty, calcareous, contains 40 percent quartz, faintly bedded; base grades.....	4	9
		(913	9)
118.	Shale, greenish-gray, contains 20 percent light-greenish-gray siltstone laminae in basal 4 in., faintly bedded, poor fissility; base grades.....	2	5
		(916	2)

Unit Number	Description	Thickness (Depth) ft	in.
119.	Sandstone, light-greenish-gray, very fine grained, silty, finely micaceous, contains 40 percent quartz, thin-bedded; base grades	0	6
		(916	8)
120.	Shale, medium-dark-gray, silty, few plant fragments, poor fissility	1	5
		(918	1)
121.	Coal, dull attritus, impure, pyritic	0	7.5
		(918	8.5)
122.	Siltstone, brownish-gray, abundant rootlets, non-bedded; base grades	1	5.5
		(920	2)
123.	Siltstone, medium-gray, grades to greenish-gray 1 ft 6 in. below top, few rootlets in top 2 ft, poor fissility; base grades	7	5
		(927	7)
124.	Sandstone, medium-light-gray, very fine-grained, silty, sparsely micaceous, contains 40 percent quartz; base sharp	1	4
		(928	11)
125.	Shale, greenish-gray, mottled grayish-red, silty, faintly bedded, fair fissility	1	1
		(930	0)

BOTTOM OF HOLE
TOTAL DEPTH 930 ft

GEOPHYSICAL LOG

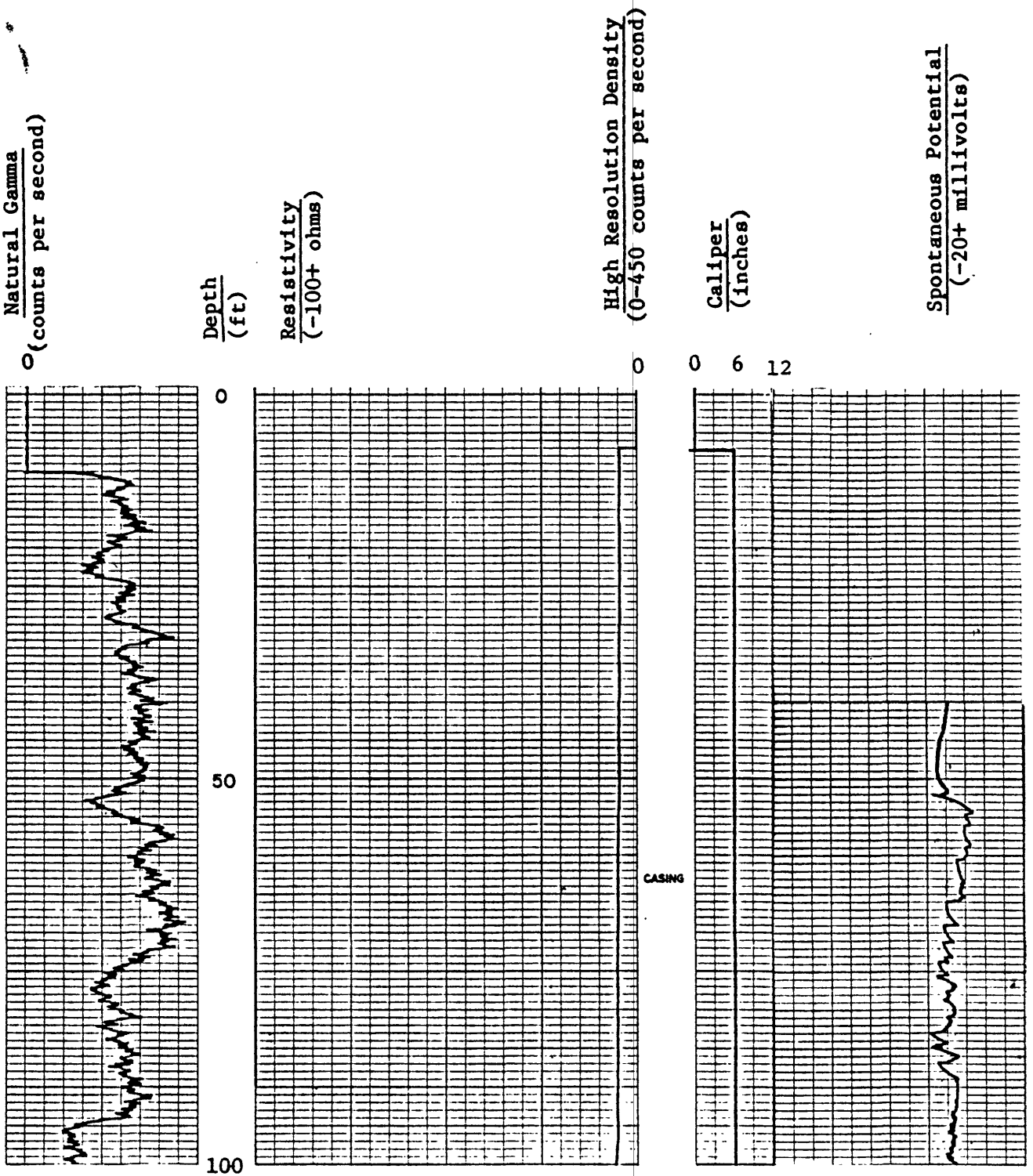
Corehole: SW-9A Date: 2/03/83 State: Virginia County: Lee

Quadrangle: Big Stone Gap, Va. Latitude: 36°50'13"N Longitude: 82°51'34"W

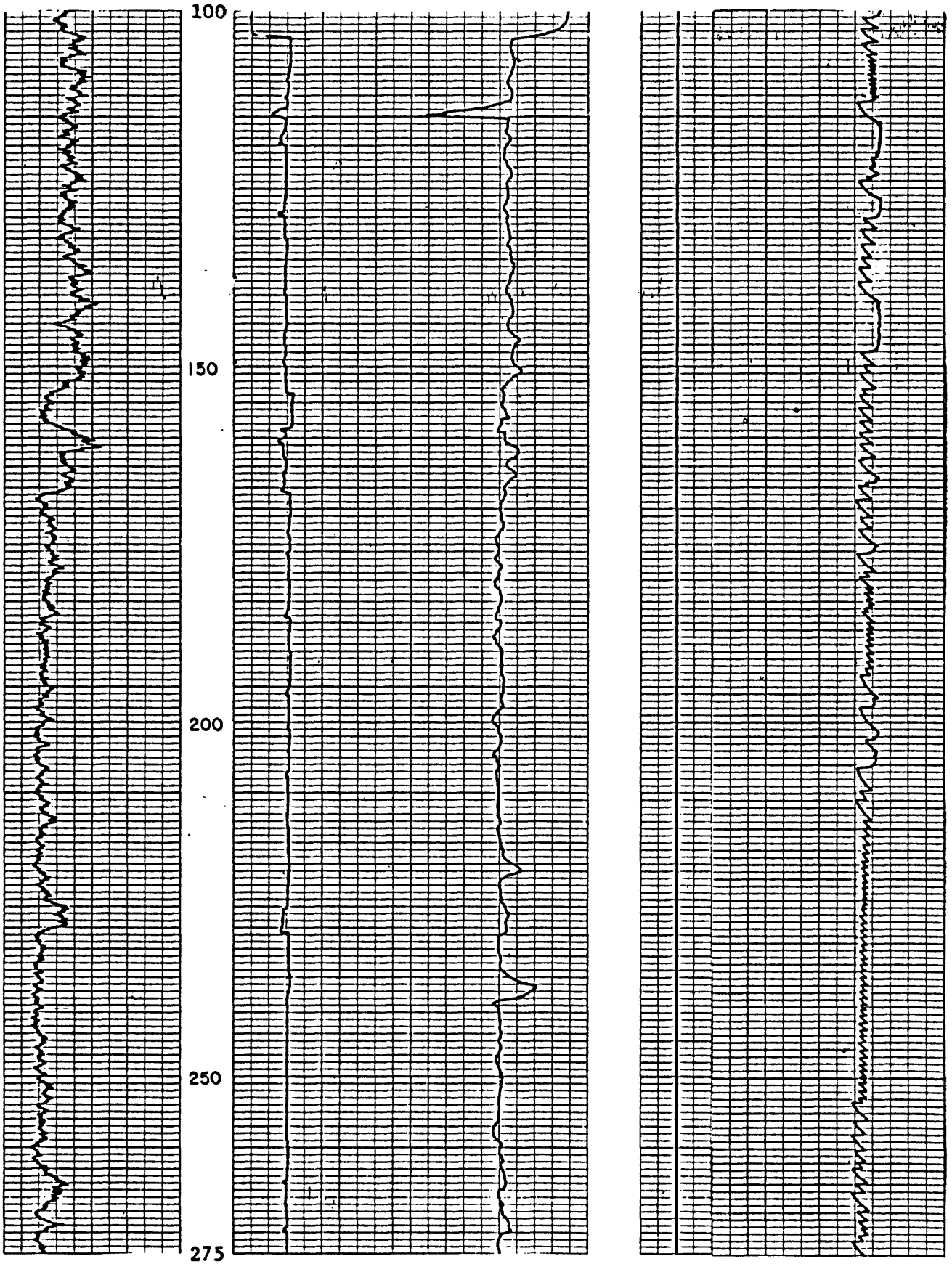
Altitude: 2,655 ft Logged Depth: 927 ft Drilled Depth: 930 ft

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

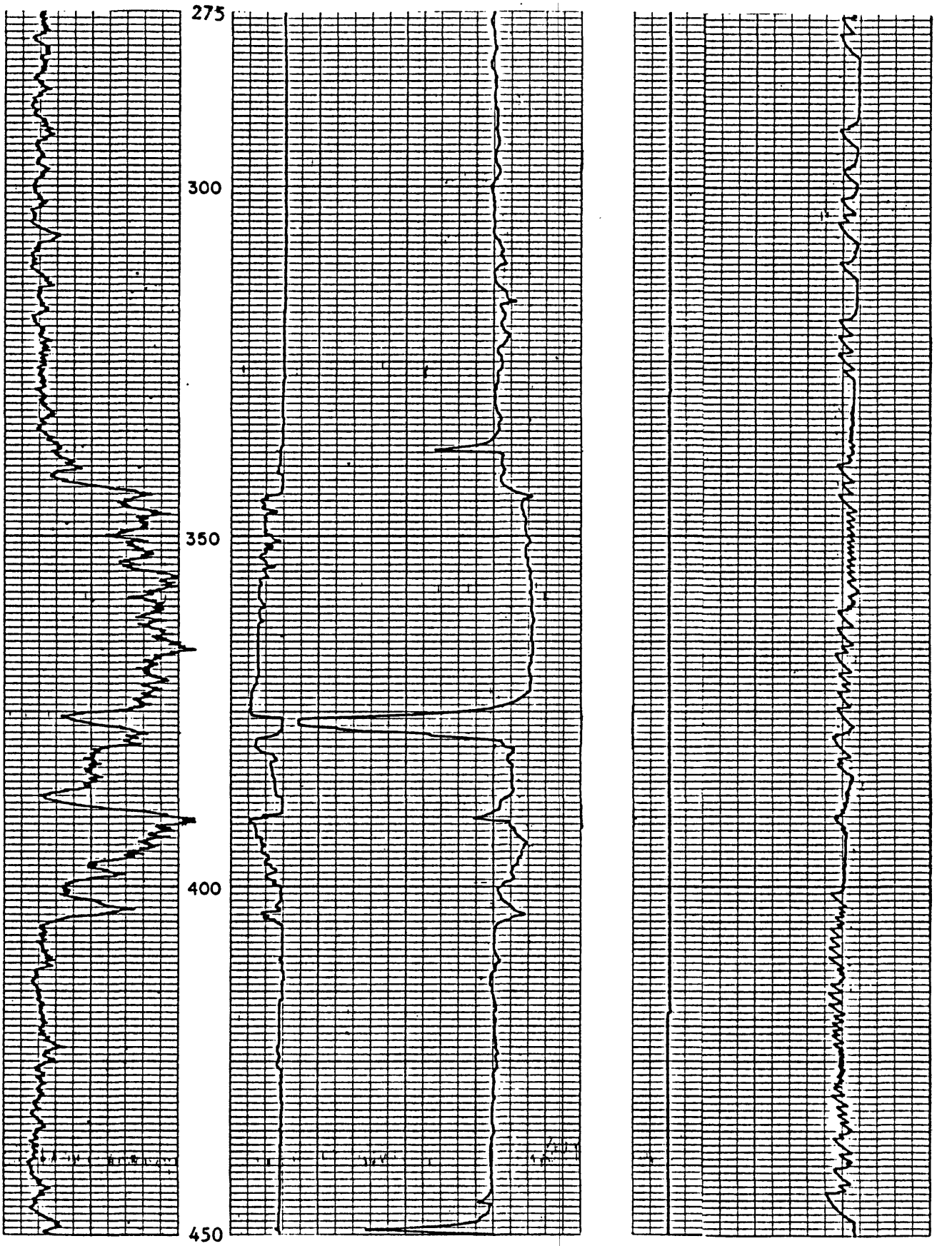
High Resolution Density Time Constant: 1



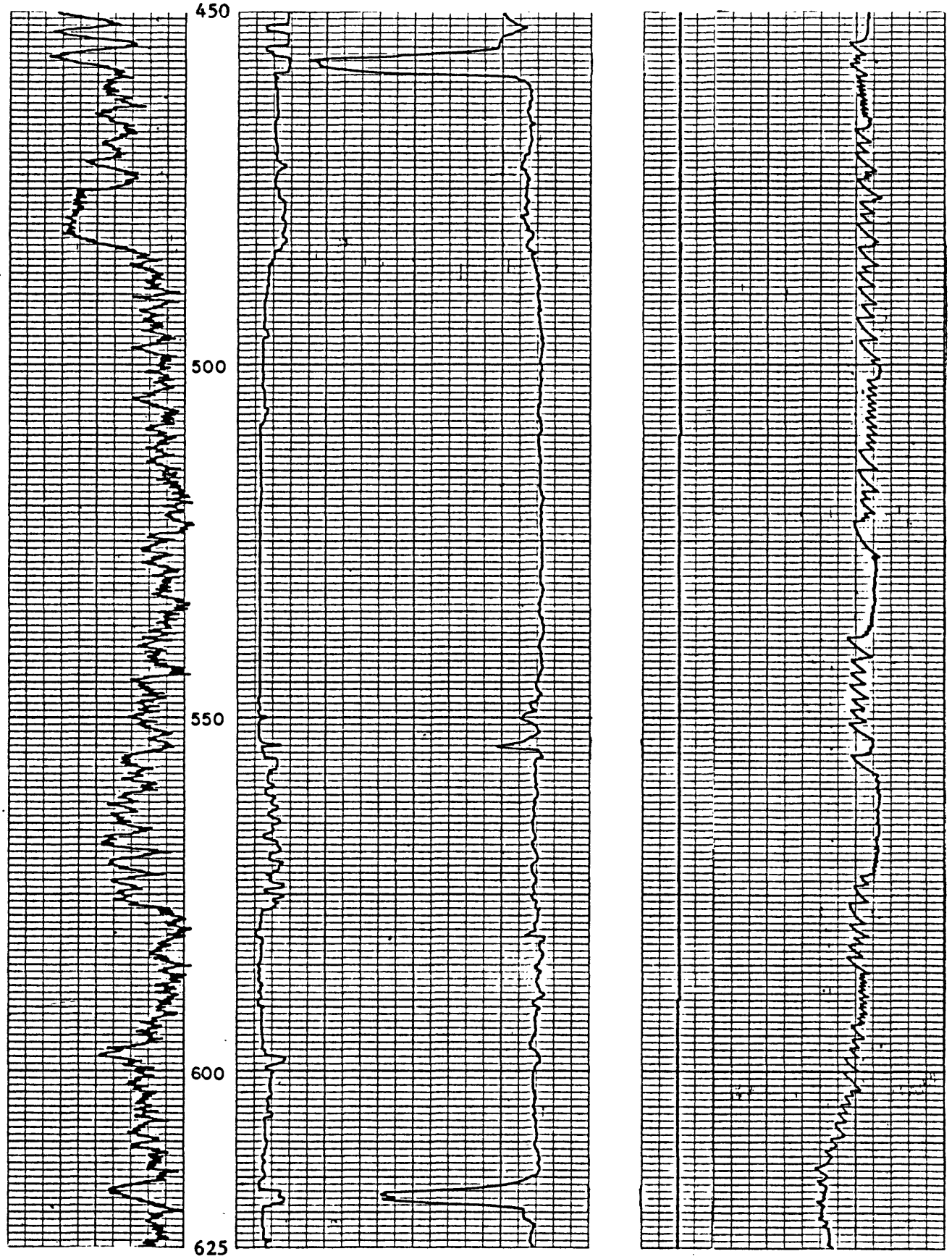
Corehole: SW-9A continued



Corehole: SW-9A continued



Corehole: SW-9A continued



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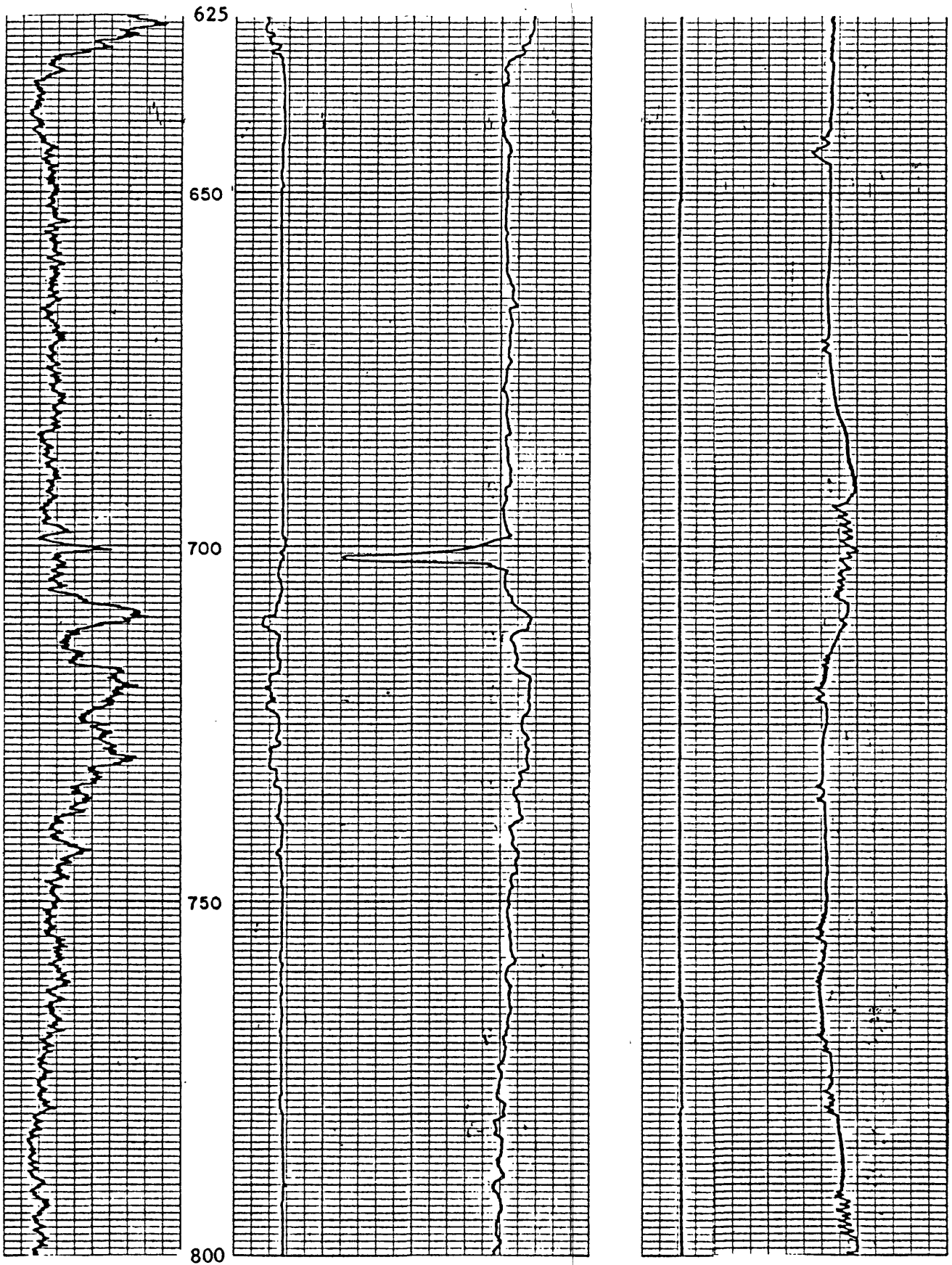
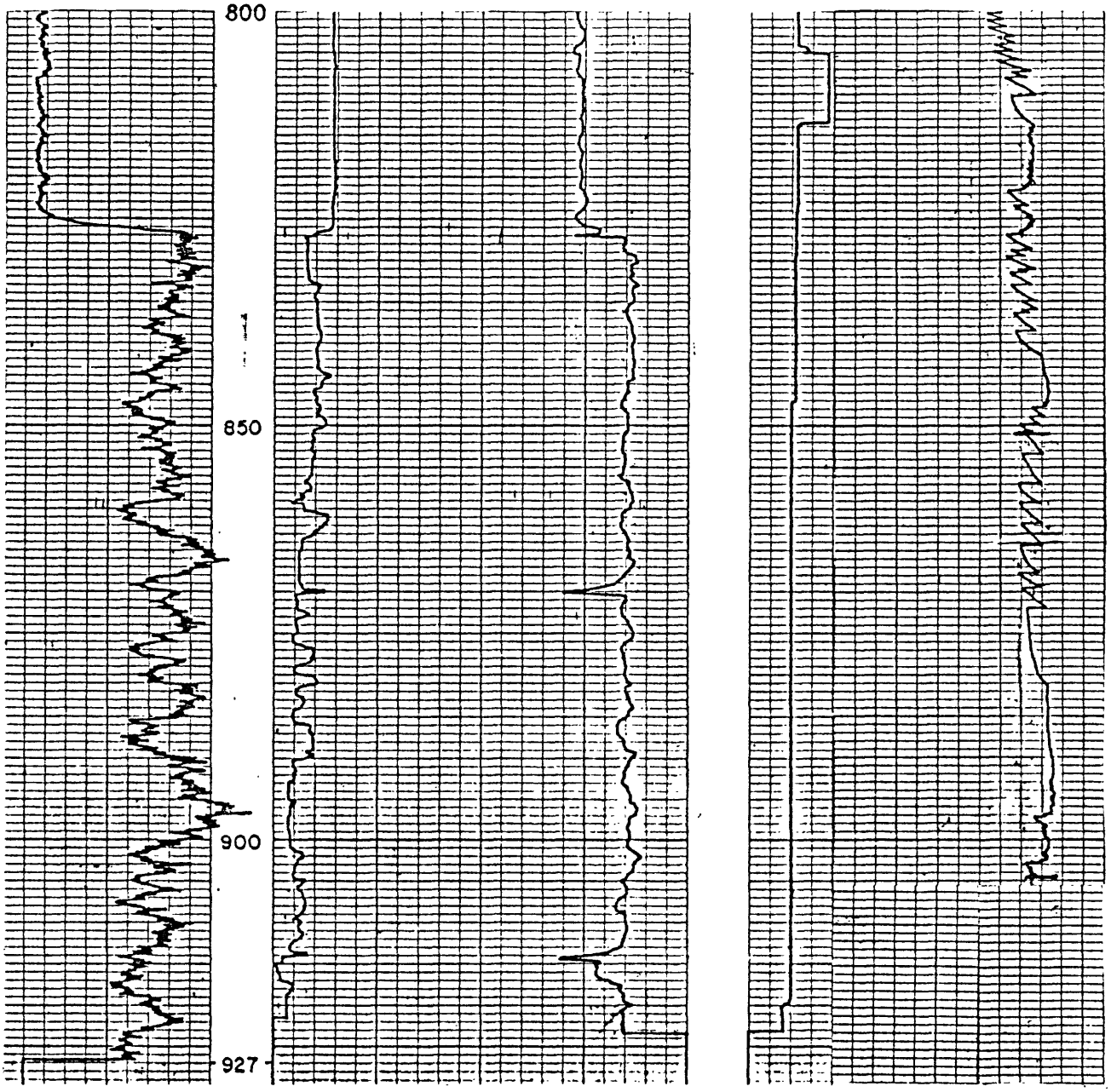
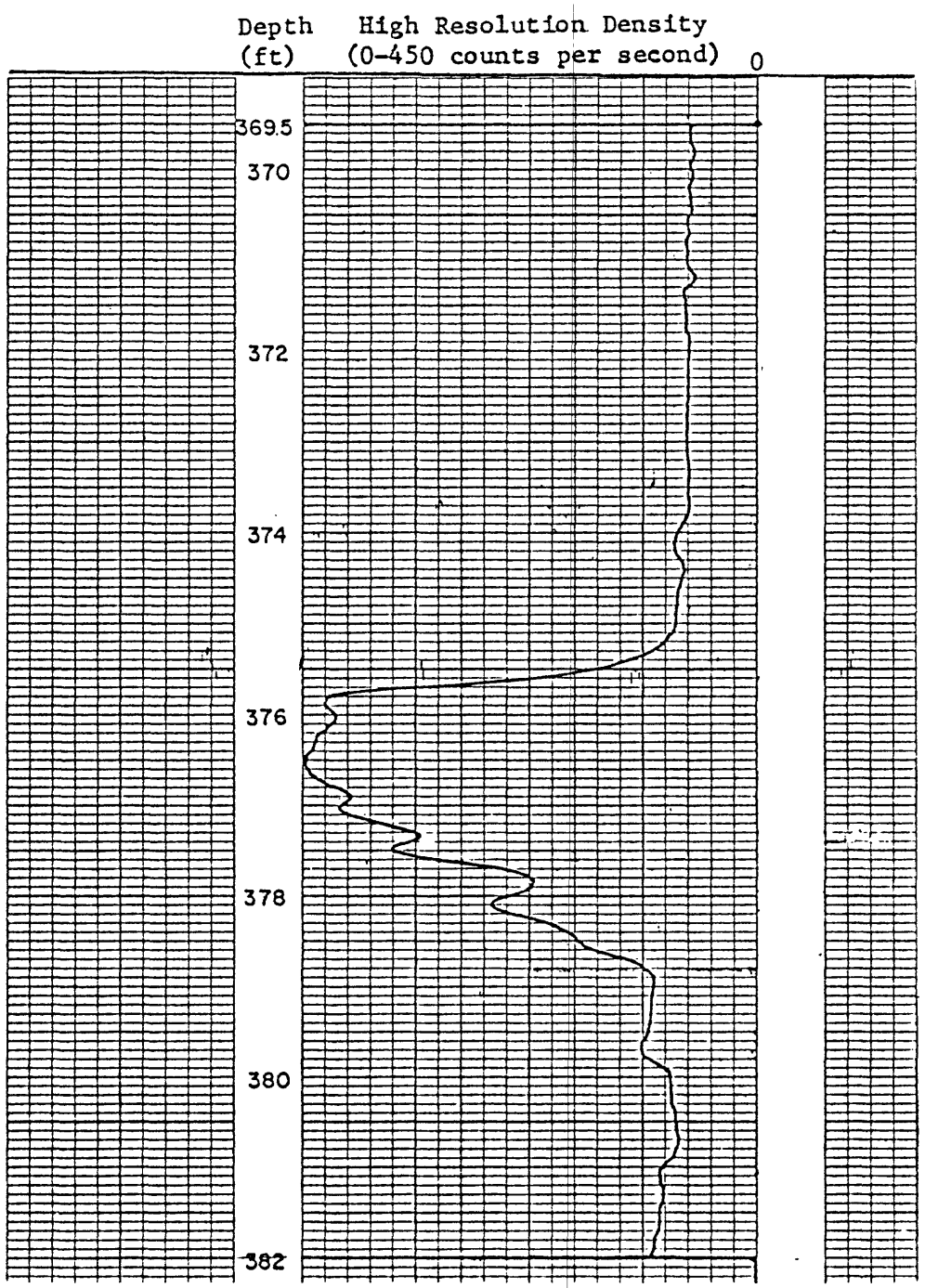


Corehole: SW-9A continued

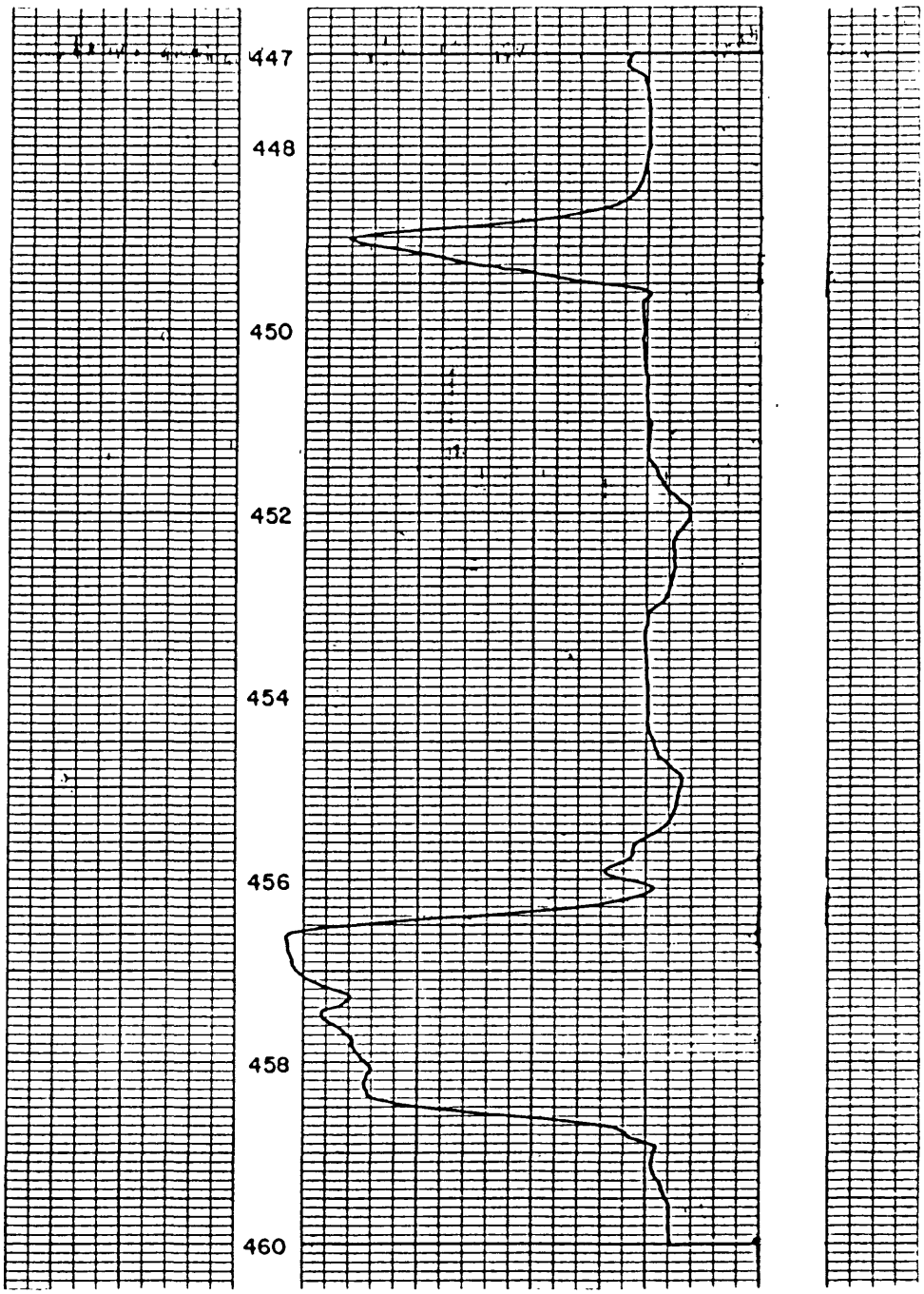


DETAIL LOG

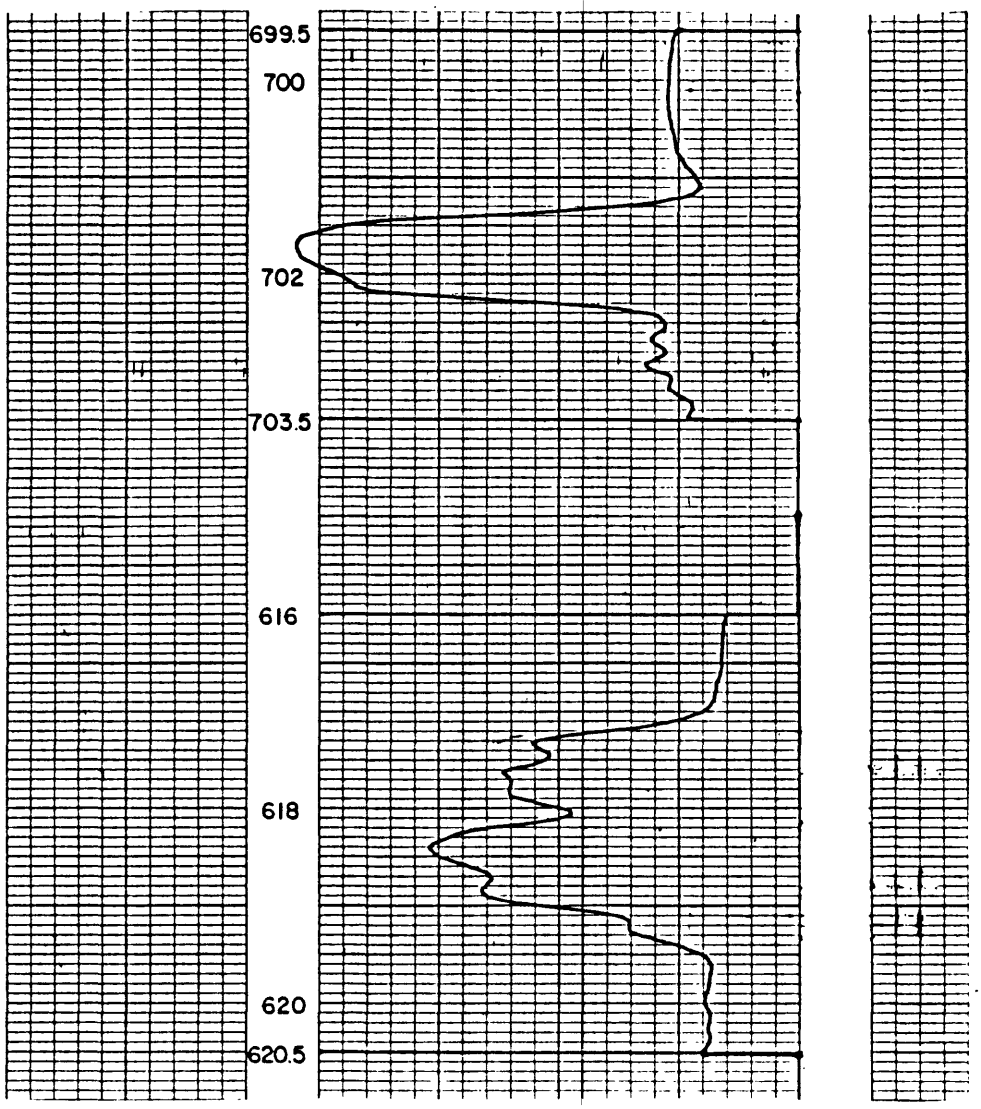
Corehole: SW-9A Logging Speed: 5 ft/min Time Constant: 1



Corehole: SW-9A continued



Corehole: SW-9A continued



Corehole SW-10

Location: Lee County; Keokee, Va.-Ky., 7.5 minute quadrangle; on Jordan Branch approximately 0.6 mi southeast of Rawhide. Accessible by unimproved road extending southward from State Route 624.

Coordinates: Latitude 36°50'57"N Longitude: 82°54'18"W

Altitude: 2,080 ft Drilled depth: 1,439 ft

Dip of strata: 10° to depth of about 400 ft, decreasing to 0° to 5° to base of corehole.

Date drilled: November 22, 1982 to January 24, 1983

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

Unit Number	Description	Thickness (Depth) ft	in.
	MIDDLE PENNSYLVANIAN SERIES Wise Formation		
1.	Soil and weathered rock (casing set - no core recovered).....	16	0
		(16	0)
2.	Sandstone, medium-gray, very fine to fine-grained, micaceous, silty, contains 40 percent quartz, abundant dark mineral grains, scattered medium-gray shale clasts, thin-bedded, few contorted beds; base sharp.....	5	10
		(21	10)
3.	Shale, medium- to medium-dark-gray, contains 20 percent light-gray very fine grained sandstone laminae, scattered siderite beds, evenly bedded, few contorted beds; base sharp.....	7	4
		(29	2)
4.	Siltstone, medium-dark-gray, contains 15 percent light-gray very fine grained sandstone laminae, few dark-gray shale laminae, few siderite nodules and beds; base grades.....	2	4
		(31	6)
5.	Shale, medium-dark-gray, contains 5 percent light-gray very fine grained slightly calcareous sandstone beds, abundant siderite nodules, evenly bedded, fissile; base sharp.....	3	1
		(34	7)
6.	Sandstone, medium-light-gray, very fine grained, slightly calcareous, silty, micaceous, contains 40 percent quartz, 30 percent medium-dark-gray shale laminae, scattered medium-dark-gray shale clasts, few siderite clasts, thin and evenly bedded; base sharp.....	2	4.5
		(36	11.5)

Unit Number	Description	Thickness (Depth) ft	in.
7.	Shale, medium-dark-gray, contains 10 percent light-gray very fine grained slightly calcareous sandstone laminae, few siderite beds near base; base grades	0	9.5
		(37	9)
8.	Siltstone, medium-dark-gray, argillaceous in top 6 in., fair fissility	1	8
		(39	5)
9.	Shale, medium-dark-gray, slightly silty in top 6 in., contains few light-gray very fine grained sandstone laminae, abundant siderite beds, evenly bedded, fissile; base sharp	16	2
		(55	7)
10.	Siltstone, medium- to medium-dark-gray, contains 30 percent light-gray very fine grained sandstone laminae and beds including a bed from 5 in. to 10 in. above base, few siderite clasts, thin and evenly bedded; base grades	5	2
		(60	9)
11.	Shale, medium-dark-gray, contains 10 percent medium-gray siltstone laminae, few siderite beds, evenly bedded, fissile; base grades	1	2
		(61	11)
12.	Siltstone, medium-gray, contains 10 percent light-gray very fine grained silty sandstone laminae, scattered siderite nodules and laminae, thin and evenly bedded; base grades abruptly	4	4
		(66	3)
13.	Sandstone, medium-light- to medium-gray, very fine grained, micaceous, silty, slightly calcareous, contains 40 percent quartz, few small-scale slump structures	2	6
		(68	9)
14.	Siltstone, medium-gray, contains few light-gray very fine grained sandstone and dark-gray shale laminae, abundant siderite nodules	2	0
		(70	9)
15.	Shale, medium- to medium-dark-gray, very carbonaceous from 7 ft 2 in. to 7 ft 3 in. below top, contains 15 percent light-gray very fine grained silty sandstone laminae and beds up to 0.75 in. thick, few coal laminae at 11 ft 10 in. below top, abundant siderite beds, few plant fragments, evenly bedded, fissile	26	3
		(97	0)
16.	Shale, dark-gray to black, very carbonaceous, abundant siderite nodules from 2 ft 5 in. to 2 ft 6 in. below top, few plant fragments, evenly bedded, fissile; base sharp	4	6
		(101	6)

Unit Number	Description	Thickness (Depth) ft	in.
17.	Coal, mostly bright attritus, scattered thin vitrain bands; impure in top 0.75 in.	0	7
		(102	1)
18.	Underclay, medium-gray, very plastic in top 2 ft 11 in., very silty in basal 5 in., abundant rootlets	3	4
		(105	5)
19.	Shale, medium-gray, contains few light-gray siltstone laminae from 1 ft to 1 ft 4 in. below top, few coal laminae from 2 ft to 2 ft 3 in. below top, few plant fragments, evenly bedded, fair fissility; base sharp	3	8
		(109	1)
20.	Siltstone, medium-gray, carbonaceous in top 4 in., sandy in basal 10 in., few plant fragments; base grades	1	4.5
		(110	5.5)
21.	Shale, medium-gray, silty, evenly bedded, poor fissility; base sharp	1	9.5
		(112	3)
22.	Sandstone, medium-light-gray, very fine grained, micaceous, contains 55 percent quartz, 10 percent dark-gray shale laminae, few coal clasts, thin-bedded; base sharp	2	6
		(114	9)
23.	Siltstone, medium-gray, sandy in basal 6 in., contains 10 percent dark-gray shale laminae, very irregularly bedded; base grades	1	11
		(116	8)
24.	Sandstone, light-gray, very fine grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, 10 percent discontinuous medium-gray siltstone laminae, 10 percent medium-dark-gray shale laminae, scattered coal laminae, few medium-gray shale clasts in basal 2 in., 0.5 in. coal clasts at 2 in. below top, crossbedded, thin-bedded; base sharp and irregular	17	4
		(134	0)
25.	Shale, medium-gray, contains few siderite nodules, unevenly bedded, fair to poor fissility	1	0
		(135	0)
26.	Shale, medium-dark-gray, silty, contains 5 percent medium-gray siltstone laminae, scattered siderite nodules, unevenly bedded, fair to poor fissility; base grades	6	6.5
		(141	6.5)
27.	Siltstone, medium-gray, thin and irregularly bedded, fair fissility; base grades	2	3.5
		(143	10)

Unit Number	Description	Thickness (Depth) ft	in.
28.	Shale, medium-dark-gray, silty in top 8 in., scattered siderite nodules, irregularly bedded, poor fissility.....	5	3.5
		(149	1.5)
29.	Coal, Clintwood coal bed (thickness -3 ft 4.5 in.)		
	29a. Coal, mostly bright attritus, scattered vitrain bands, slightly pyritic 3 in. above base.....	3	0.5
		(152	2)
	29b. Shale, dark-gray to black, carbonaceous.....	0	0.5
		(152	2.5)
	29c. Coal, dull to bright attritus, few thin vitrain bands.....	0	3.5
		(152	6)
30.	Underclay, medium-dark-gray, silty in basal 9.5 in., abundant rootlets; base grades.....	6	1
		(158	7)
31.	Siltstone, medium-gray, contains 30 percent medium-dark-gray shale laminae and beds, few siderite nodules; base grades.....	0	10
		(159	5)
32.	Sandstone, medium-light-gray, very fine grained, contains 65 percent quartz, 15 percent dark-gray shale laminae, scattered coal and medium-dark-gray shale clasts, few dark mineral grains, thin and unevenly bedded.....	1	4
		(160	9)
33.	Siltstone, light- to medium-gray, contains 10 percent light-gray very fine grained sandstone and dark-gray shale laminae and beds, few contorted beds, cross-laminated, thin and irregularly bedded.....	4	8
		(165	5)
34.	Shale, medium-gray, contains scattered medium-light-gray very fine grained sandstone lenses up to 1 in. thick, evenly bedded, fair fissility; base sharp.....	4	10
		(170	3)
35.	Coal, bright attritus, impure in basal 1.5 in.....	1	5
		(171	8)
36.	Underclay, medium-light-gray, abundant rootlets.....	0	9
		(172	5)
37.	Coal, mostly bright attritus.....	0	6
		(172	11)

Unit Number	Description	Thickness (Depth) ft	in.
38.	Underclay, medium- to medium-dark-gray, scattered rootlets.....	2	4
		(175	3)
39.	Shale, light- to medium-dark-gray, silty, few siderite nodules, few slickensided surfaces, few plant fragments, evenly bedded, fissile.....	0	9
		(176	0)
40.	Sandstone, medium-light-gray, very fine grained, contains 45 percent quartz; base sharp.....	0	5
		(176	5)
41.	Shale, medium- to medium-dark-gray, slickensided surfaces, evenly bedded, fissile; base grades.....	1	4
		(177	9)
42.	Shale, medium- to dark-gray, very carbonaceous, contains few coal laminae, evenly bedded, fair fissility; base sharp.....	0	10
		(178	7)
43.	Shale, medium-gray, few rootlets.....	0	1
		(178	8)
44.	Siltstone, medium-dark-gray, contains scattered medium-light-gray very fine grained sandstone laminae and beds, few scattered rootlets, thin and irregularly bedded; base grades.....	3	6
		(182	2)
45.	Sandstone, light-gray, fine-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, thick-bedded; base sharp.....	1	0
		(183	2)
46.	Shale, medium-gray, very plastic, few slickensided surfaces, evenly bedded, fissile; base grades.....	0	9
		(183	11)
47.	Siltstone, light- to medium-gray, contains scattered light-gray very fine grained sandstone laminae, few slickensided surfaces, evenly bedded; base grades.....	3	3
		(187	2)
48.	Sandstone, light-gray, fine-grained, micaceous, contains 40 percent quartz, 6 in. medium-gray siltstone bed with large plant impressions 5 in. below top, some small-scale slump structures, cross-laminated, thin- and ripple-bedded; base sharp...	1	11
		(189	1)
49.	Siltstone, medium- to dark-gray, slightly carbonaceous, contains 20 percent light-gray very fine grained sandstone laminae and beds, 5 percent dark-gray shale laminae, cross-laminated; base sharp.....	1	9
		(190	10)

Unit Number	Description	Thickness (Depth) ft	in.
50.	Sandstone, very light gray, medium- to coarse-grained, slightly micaceous, contains 50 percent quartz, few dark-gray shale laminae and beds in top 1 ft 8 in., scattered dark mineral grains, few coal laminae, thin- to thick-bedded; base sharp.....	18	8
		(209	6)
51.	Siltstone, medium-gray, sandy, few rootlets, non-bedded.....	0	6
		(210	0)
52.	Sandstone, light-gray, fine- to coarse-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark-gray shale laminae, few dark-gray shale clasts up to 1 in. thick 4 ft 5 in. above base, massive; base sharp.....	34	5
		(244	5)
53.	Shale, medium- to dark-gray, finely micaceous, silty in basal 2 ft 9 in., very carbonaceous in top 1 ft., few plant fragments, few slickensided surfaces, contorted bedding.....	3	10
		(248	3)
54.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, scattered coal laminae and beds up to 0.5 in. thick in upper 6 ft 7 in., few angular to subrounded medium-dark-gray shale and siderite clasts in basal 1 ft 8 in., massive; base sharp.....	11	3
		(259	6)
55.	Coal, Blair coal bed, dull to bright attritus, impure in top 5 in., 0.5 in. pyrite lens 6 in. below top; base sharp.....	1	0
		(260	6)
56.	Sandstone, light- to medium-light-gray, fine- to medium-grained, contains 40 percent quartz, 20 percent dark-gray shale laminae, few coal laminae 6 in. below top, few large siderite nodules 15 ft 5 in. above base, cross-laminated, ripple-bedded; base grades.....	24	11
		(285	5)
57.	Siltstone, medium-dark-gray, contains 20 percent light-gray fine-grained sandstone laminae and beds, cross-laminated, thin- and ripple-bedded, few contorted beds.....	12	11
		(298	4)
58.	Siltstone, medium-dark- to dark-gray, contains 30 percent medium-light-gray very fine grained sandstone laminae, abundant black carbonaceous shale laminae; base grades.....	3	10
		(302	2)
59.	Siltstone, dark-gray, contains 10 percent medium-light-gray fine-grained sandstone laminae and beds, 15 percent dark-gray carbonaceous shale laminae and beds.....	3	9
		(305	11)

Unit Number	Description	Thickness (Depth) ft	in.
60.	Shale, dark-gray to black, silty, carbonaceous, plastic in basal 1 ft, contains few siderite beds up to 0.5 in. thick, few medium-gray siltstone laminae in top 2 ft 6 in., few plant fragments; base sharp	5	0
		(310	11)
61.	Coal Dorchester coal bed (thickness- 4 ft)		
	61a. Coal, mostly bright attritus, few vitrain bands	2	0
		(312	11)
	61b. Coal, impure, scattered dark-gray shale laminae	0	1
		(313	0)
	61c. Coal, bright attritus, few vitrain bands	0	10
		(313	10)
	61d. Shale, medium-gray	0	3
		(314	1)
	61e. Coal, bright attritus	0	3
		(314	4)
	61f. Coal, impure, canneloid, contains few medium-gray shale laminae	0	2
		(314	6)
	61g. Coal, abundant thick vitrain bands, bright attrital matrix	0	5
		(315	11)
62.	Siltstone, medium-gray, sandy, micaceous, few rootlets	2	7
		(317	6)
	Gladeville(?) Sandstone		
63.	Sandstone, light- to medium-gray, fine- to medium-grained, silty, contains 45 percent quartz, ripple-bedded; base sharp	2	6
		(320	0)
64.	Siltstone, medium-gray, contains scattered dark-gray carbonaceous shale laminae	0	7
		(320	7)
65.	Sandstone, very light to light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, few dark mineral grains, scattered dark-gray carbonaceous silty shale laminae, thin- to thick-bedded	21	4
		(341	11)
66.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, scattered siderite clasts up to 1 in. in diameter, few coal laminae and clasts	1	3
		(343	2)

Unit Number	Description	Thickness (Depth) ft	in.
67.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, few coal laminae, scattered dark mineral grains, 2 in. thick dark-gray shale bed 6 in. above base..	4	7
		(347	9)
68.	Siltstone, dark-gray, carbonaceous, sandy, few plant fragments....	1	10
		(349	7)
69.	Siltstone, medium- to medium-dark-gray, contains 40 percent light-gray very fine grained sandstone laminae and beds, few dark-gray carbonaceous shale laminae, cross-laminated, thin- and ripple-bedded; base sharp and irregular.....	4	1
		(353	8)
70.	Sandstone, light- to medium-gray, very fine to fine-grained, contains 65 percent quartz, scattered dark-gray shale laminae, few dark-gray carbonaceous shale clasts up to 2 in. thick in basal 1 ft 4 in., thin- to thick-bedded; base sharp.....	3	7
		(357	3)
	Norton Formation		
71.	Siltstone, medium-dark-gray, contains 40 percent light-gray very fine grained sandstone beds, thin and ripple bedded, few contorted beds.....	0	10
		(358	1)
72.	Shale, medium-dark- to dark-gray, silty, carbonaceous, contains few medium-dark-gray siltstone laminae and beds, 10 percent medium-light-gray very fine grained sandstone laminae, few slickensided surfaces, cross-laminated, evenly bedded, fair fissility.....	2	5
		(360	6)
73.	Siltstone, medium-dark-gray, contains 20 percent medium-light gray fine-grained sandstone beds up to 2 in. thick, scattered slickensided surfaces, thin and evenly bedded; base grades.....	5	8
		(366	2)
74.	Siltstone, medium-gray, contains 45 percent dark-gray shale beds, few plant fragments, thin and evenly bedded; base sharp.....	8	7
		(374	9)
75.	Shale, dark-gray, very silty, carbonaceous at base, contains 10 percent light-gray fine-grained sandstone laminae and beds up to 0.5 in. thick, few coal laminae, evenly bedded; base grades.....	18	2
		(392	11)
76.	Sandstone, medium-light-gray, mottled brownish-gray in part, very fine grained, micaceous, contains 50 percent quartz, few dark-gray shale laminae, thin and irregularly bedded; base grades.....	3	7
		(396	6)

Unit Number	Description	Thickness (Depth) ft	in.
77.	Siltstone, medium- to medium-dark-gray, contains 15 percent light-gray very fine grained sandstone laminae, 20 percent dark-gray shale laminae, evenly bedded; base grades.....	4	5
		(400	11)
78.	Shale, medium- to dark-gray, very carbonaceous at base, plastic in part, contains few plant fragments, fissile; base grades.....	1	2
		(402	1)
79.	Coal, Norton coal bed (thickness- 2 ft 11.5 in.)		
	79a. Coal, bright attritus, few vitrain bands, some gypsum on cleats.....	1	4
		(403	5)
	79b. Coal, dull attritus, scattered fusain laminae.....	0	0.5
		(403	5.5)
	79c. Coal, bright attritus, scattered vitrain bands.....	1	7
		(405	0.5)
80.	Underclay, medium-dark-gray, carbonaceous, few rootlets and root slicks; base grades.....	0	11.5
		(406	0)
81.	Coal, impure.....	0	3
		(406	3)
82.	Underclay, medium-dark-gray, contains few coal laminae, scattered rootlets and root slicks.....	1	5
		(407	8)
83.	Siltstone, medium-gray, contains 20 percent light-gray very fine grained sandstone laminae and beds up to 2 in. thick, few plant fragments non-bedded; base grades.....	1	10
		(409	6)
84.	Shale, medium- to dark-gray, evenly bedded, fair fissility; base sharp.....	2	9
		(412	3)
85.	Coal, bright attritus, few slickensided surfaces.....	0	2
		(412	5)
86.	Underclay, medium- to dark-gray, scattered rootlets and root slicks; base sharp.....	0	5
		(412	10)
87.	Sandstone, medium-gray, very fine grained contains 50 percent quartz, thick-bedded; base sharp.....	1	5
		(414	3)

Unit Number	Description	Thickness (Depth) ft	in.
88.	Shale, medium-gray, silty at base, plastic; base sharp and irregular	2	3
		(416	6)
89.	Sandstone, light- to medium-gray, fine-grained, silty, contains 50 percent quartz, thick-bedded; base grades	1	0
		(417	6)
90.	Siltstone, medium-gray, sandy at base, contains few medium-gray shale laminae and beds; base sharp	3	0
		(420	6)
91.	Shale, dark-gray, scattered slickensided surfaces, few plant fragments, poor fissility; base grades	2	2
		(422	8)
92.	Siltstone, medium-gray, scattered plant fragments, thick-bedded; base grades	5	2
		(427	10)
93.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 65 percent quartz, abundant dark and light mineral grains, scattered discontinuous dark-gray shale laminae, few contorted coal clasts 11 ft 6 in. above base, thin- to thick-bedded; base sharp	32	7
		(460	5)
94.	Coal, Unnamed coal bed, bright attritus, abundant vitrain bands, 0.5 in. fusain band 3 in. above base	1	4
		(461	9)
95.	Underclay, medium-gray, few scattered rootlets; base grades	0	7
		(462	4)
96.	Siltstone, medium-gray, contains 25 percent dark-gray shale laminae, 10 percent light-gray very fine grained sandstone beds, few plant fragments, burrowed, thin-bedded; base sharp	5	10
		(468	2)
97.	Sandstone, light-gray, very fine grained, contains 65 percent quartz, scattered dark-gray shale and siltstone laminae, few siderite nodules, thin- to thick-bedded; base grades	45	0
		(513	2)
98.	Shale, dark-gray, contains 40 percent medium- to medium-dark-gray siltstone laminae and beds, 10 percent light-gray very fine grained sandstone laminae and beds up to 3 in. thick, few coal laminae, evenly bedded	42	7
		(555	9)

Unit Number	Description	Thickness (Depth) ft	in.
99.	Shale, medium- dark-to dark-gray, very carbonaceous, contains scattered siderite beds in basal 4 in., few plant fragments, evenly bedded.....	1	4
		(557	1)
100.	Underclay, medium-gray, silty; base grades.....	1	7
		(558	8)
101.	Shale, medium- to medium-dark-gray, contains few light-gray siltstone and very fine grained sandstone laminae in basal 6 in., evenly bedded.....	1	8
		(560	4)
102.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 45 percent quartz, thin-bedded.....	0	4
		(560	8)
103.	Shale, medium- to medium-dark-gray, silty, contains few light-gray very fine grained sandstone laminae; base sharp.....	0	5
		(561	1)
104.	Sandstone, medium-light-gray, very fine grained, silty, contains 50 percent quartz, scattered dark and light mineral grains, 5 percent medium-gray siltstone and shale laminae and beds, few coal laminae 4 ft 8 in. above base; base sharp.....	15	7
		(576	8)
105.	Shale, medium- to medium-dark-gray, silty, contains 5 percent medium-light-gray siltstone and fine-grained sandstone laminae, abundant plant fragments, evenly bedded, fair fissility; base grades.....	23	4
		(600	0)
106.	Shale, medium-dark- to dark-gray, slightly calcareous in basal 9 in., contains few siderite beds up to 0.5 in. thick, evenly bedded, fair fissility; base grades.....	4	11
		(604	11)
107.	Siltstone, medium-gray, micaceous, slightly calcareous, few plant fragments, thin-bedded, poor fissility; base grades.....	1	11
		(606	10)
108.	Shale, medium- to medium-dark-gray, slightly silty in basal 1 ft 3 in., contains scattered siderite beds up to 0.5 in. thick; base sharp.....	7	6.5
		(614	4.5)
109.	Shale, medium-gray, silty, evenly bedded; base grades abruptly....	0	7.5
		(615	0)

Unit Number	Description	Thickness (Depth) ft	in.
110.	Shale, medium- to medium-dark-gray, contains scattered siderite beds up to 1 in. in diameter, evenly bedded, fair fissility; base grades.....	4	0
		(619	0)
111.	Shale, dark-gray to black, very carbonaceous, contains few plant fragments, poor fissility; base grades.....	0	6.5
		(619	6.5)
112.	Underclay, medium-gray, mottled brownish-gray, very silty in top 3 in., abundant rootlets, poor fissility; base grades.....	2	0
		(621	6.5)
113.	Siltstone, medium- to medium-dark-gray, finely micaceous, slightly sandy in basal 6 in.; base grades abruptly.....	2	3.5
		(623	10)
114.	Sandstone, medium-light-gray, very fine grained, silty, micaceous, contains 40 percent quartz, 10 percent medium-gray siltstone laminae, cross-laminated, thin-bedded; base sharp.....	2	10
		(626	8)
115.	Siltstone, medium- to medium-dark-gray, contains 5 percent light-gray very fine grained silty sandstone laminae, thin-bedded, fair fissility; base grades abruptly.....	0	7
		(627	3)
116.	Sandstone, medium- light-gray, fine-grained, micaceous, contains 45 percent quartz, abundant dark mineral grains; 5 percent dark-gray siltstone laminae, increasing to 50 percent 1 ft 2 in. above base; cross-laminated, thin-bedded; base sharp.....	3	11
		(631	2)
117.	Shale, dark-gray, slightly silty, finely micaceous, fair fissility; base sharp.....	0	2
		(631	4)
118.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 50 percent quartz, abundant dark mineral grains, thin-bedded; base sharp.....	0	2.5
		(631	6.5)
119.	Siltstone, medium-dark-gray, contains 20 percent medium-light-gray very fine grained sandstone laminae, thin-bedded; base grades abruptly.....	0	3.5
		(631	10)
120.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 60 percent quartz, scattered dark mineral grains; 5 percent dark-gray siltstone laminae, increasing to 20 percent from 2 ft to 2 ft 3 in. below top and in basal 4 in.; thin- to thick-bedded.....	5	10
		(637	8)

Unit Number	Description	Thickness (Depth) ft	in.
121.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz; few medium-gray siltstone laminae, increasing to 10 percent in basal 3 ft 5 in.; scattered feldspar and dark mineral grains, abundant coal laminae and clasts in basal 3 ft 5 in., thick-bedded; base sharp.....	22	9
		(660	5)
122.	Shale, medium-dark- to dark-gray, contains 5 percent light-gray very fine grained sandstone laminae, scattered siderite beds, evenly bedded, fair fissility.....	6	8
		(667	1)
123.	Coal, Splash Dam (?) coal bed (thickness- 1 ft 7 in.)		
	123a. Coal, canneloid, impure.....	1	4.5
		(668	5.5)
	123b. Coal, impure, few thin vitrain bands.....	0	2.5
		(668	8)
124.	Underclay, medium-gray, contains few coal laminae, abundant rootlets; base grades.....	0	10
		(669	6)
125.	Siltstone, medium-gray, micaceous, contains 5 percent light-gray very fine grained sandstone laminae and beds in top 4 in., thin-bedded, poor fissility; base grades.....	2	1
		(671	7)
126.	Shale, medium-gray, silty in basal 5 in., contains 10 percent light-gray very fine grained sandstone laminae and beds up to 1.5 in. thick, few coal laminae from 9 in. to 1 ft below top, 5 percent medium-gray siltstone laminae, evenly bedded, fair fissility.....	8	5
		(680	0)
127.	Sandstone, light- to medium-light-gray, very fine grained, slightly micaceous, contains 50 percent quartz, 40 percent dark-gray shale laminae and beds, cross-laminated, thin and lenticularly bedded; base grades.....	3	2
		(683	2)
128.	Shale, medium-dark-gray, contains 5 percent medium-light-gray very fine grained sandstone laminae, evenly bedded, fair fissility; base grades.....	0	6
		(683	8)
129.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 20 percent dark-gray shale laminae, cross-laminated, thin-bedded; base grades.....	0	5
		(684	1)

Unit Number	Description	Thickness (Depth) ft	in.
130.	Shale, dark-gray to black, very carbonaceous, very silty in basal 6 in., contains 0.5 in. canneloid shale bed 1 ft. 11 in. below top, few pyritized plant stems 4 ft 6 in. below top, few rootlets, evenly bedded, fair fissility; base grades.....	12	8
		(696	9)
131.	Sandstone, medium- to medium-dark-gray, very fine to fine-grained, silty, micaceous, contains 50 percent quartz, 25 percent dark-gray siltstone and shale laminae and beds, burrowed, thin-bedded; base grades.....	8	3
		(705	0)
132.	Siltstone, medium-dark-gray, micaceous, carbonaceous, contains 15 percent light-gray very fine grained sandstone laminae, slightly burrowed, thin- to thick-bedded; base grades.....	7	4
		(712	4)
133.	Shale, dark-gray, carbonaceous, slightly silty, contains 5 percent medium-dark-gray siltstone and light-gray very fine grained sandstone laminae, evenly bedded, fair fissility.....	7	10
		(720	2)
134.	Shale, black, very carbonaceous, contains few siderite beds up to 1 in. thick, evenly bedded, fissile.....	9	2
		(729	4)
135.	Coal, Upper Banner coal bed, bright attritus, few thin vitrain bands.....	2	9
		(732	1)
136.	Underclay, medium-dark-gray, carbonaceous in top 6 in., few rootlets; base grades.....	1	6
		(733	7)
137.	Sandstone, light-gray, very fine- to fine-grained, micaceous, contains 45 percent quartz, 40 percent medium-dark-gray silty shale laminae, cross-laminated, thin-bedded; base sharp.....	1	5
		(735	0)
138.	Shale, medium-gray, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded; base sharp.....	0	7
		(735	7)
139.	Sandstone, light- to medium-light-gray, very fine grained, contains 40 percent quartz, few rootlets, thin and unevenly bedded; base grades.....	0	7
		(736	2)
140.	Shale, medium-gray, silty, contains 20 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded; base grades.....	2	4
		(738	6)

Unit Number	Description	Thickness (Depth) ft	in.
141.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, 5 percent medium-gray siltstone and shale laminae, thin-bedded; base grades	0	4
		(738	10)
142.	Shale, medium-gray, silty, contains 25 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded; base grades abruptly	0	9
		(739	7)
143.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, 10 percent medium-gray shale and siltstone laminae, few coal laminae, thin-bedded; base sharp	0	10
		(740	5)
144.	Shale, medium-gray, contains few light-gray siltstone laminae in basal 2 in., evenly bedded, fair fissility; base grades	0	8
		(741	1)
145.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, 10 percent discontinuous medium-gray siltstone laminae; base sharp	0	5
		(741	6)
146.	Shale, medium-dark-gray, silty in top 6 in., contains few siderite beds, evenly bedded; base grades	3	0
		(744	6)
147.	Coal, impure, canneloid	0	10
		(745	4)
148.	Shale, medium-gray, contains 10 percent light-gray very fine grained sandstone laminae, few siderite beds, evenly bedded; base grades abruptly	1	1
		(746	5)
149.	Sandstone, light- to medium-light-gray, very fine grained, contains 45 percent quartz, thin-bedded; base grades abruptly	0	5
		(746	10)
150.	Shale, medium-gray, contains 30 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded; base sharp	0	11
		(747	9)
151.	Sandstone, light-gray, very fine grained, micaceous, silty, contains 40 percent quartz, 15 percent medium-gray siltstone laminae, cross-laminated, thin-bedded	6	2
		(753	11)

Unit Number	Description	Thickness (Depth) ft	in.
152.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, 5 percent medium-gray siltstone laminae, thin-bedded; base sharp.....	0	6
		(754	5)
153.	Shale, medium-dark-gray, evenly bedded, fissile.....	0	0.25
		(754	5.25)
154.	Coal, bright attritus.....	0	1.25
		(754	6.5)
155.	Underclay, medium-gray, contains abundant rootlets, few root slicks; base grades.....	0	11.5
		(755	6)
156.	Siltstone, medium-gray, micaceous, sandy, faintly bedded; base sharp.....	0	10
		(756	4)
157.	Sandstone, light- to medium-light-gray, very fine grained, micaceous, contains 45 percent quartz, 25 percent medium-gray siltstone laminae; base grades.....	2	4
		(758	8)
158.	Shale, medium-dark-gray, silty, evenly bedded, fair fissility; base grades.....	0	3
		(758	11)
159.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 45 percent quartz; base sharp.....	1	4
		(760	3)
160.	Shale, medium-dark-gray, contains few siderite beds, evenly bedded, fair fissility; base grades.....	1	11
		(762	2)
161.	Shale, dark-gray to black, very carbonaceous, contains few siderite beds, evenly bedded, fair fissility.....	0	10
		(763	0)
162.	Coal, impure, contains scattered dark-gray shale laminae.....	0	1
		(763	1)
163.	Coal, bright attritus, few thin vitrain bands.....	0	1.5
		(763	2.5)
164.	Underclay, medium-dark-gray, slightly carbonaceous, contains few coal laminae in top 2 in., few rootlets; base sharp.....	3	0
		(766	2.5)
165.	Sandstone, light-gray, fine-grained, micaceous, contains 60 percent quartz, thin-bedded; base sharp.....	0	7.5
		(766	10)

Unit Number	Description	Thickness (Depth) ft	in.
166.	Siltstone, medium-gray, finely micaceous, faintly bedded, poor fissility	0	5
		(767	3)
167.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, thin-bedded	1	7
		(768	10)
168.	Siltstone, medium-gray, micaceous, faintly bedded, poor fissility; base sharp	0	3
		(769	1)
169.	Sandstone, light-gray, very fine to fine-grained, contains 45 percent quartz, 15 percent medium-gray siltstone laminae, cross-laminated, thin-bedded; base grades	2	2
		(771	3)
170.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz, few plant fragments; base sharp	1	1
		(772	4)
171.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 10 percent medium-gray siltstone laminae; base grades	1	6
		(773	10)
172.	Siltstone, medium-gray, thin-bedded, poor fissility; base sharp	0	2.5
		(774	0.5)
173.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 45 percent quartz, 20 percent dark-gray silty shale laminae, small scale slump structures from 1 ft 3 in. to 1 ft 9 in. below top, cross-laminated, thin-bedded; base sharp	2	4.5
		(776	5)
174.	Siltstone, medium-dark-gray, micaceous, contains 10 percent light-gray very fine grained sandstone beds, thin-bedded; base sharp	1	4
		(777	9)
175.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, abundant dark and light mineral grains, thick-bedded; base sharp and uneven	2	9
		(780	6)
176.	Siltstone, medium-gray, micaceous, contains 5 percent medium-light-gray very fine grained sandstone laminae, thin-bedded; base sharp	0	9
		(781	3)

Unit Number	Description	Thickness (Depth) ft	in.
177.	Sandstone, light-gray, medium-grained, micaceous, contains 60 percent quartz, abundant dark and light mineral grains, scattered medium-gray shale clasts from 2 in. to 3 in. below top, thick-bedded to massive; base grades.....	7	2
		(788	5)
178.	Sandstone, light-gray, medium- to coarse-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark and green mineral grains.....	7	5
		(795	10)
179.	Shale, medium-gray, silty; base sharp.....	0	0.5
		(795	10.5)
180.	Sandstone, light-gray, coarse-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark and green mineral grains, few small medium-dark-gray shale clasts from 1 ft 8 in. to 2 ft 3 in. below top, abundant coal laminae from 2 ft 3 in. to 2 ft 4 in. and 4 ft 9 in. to 5 ft below top and in top 4 in.; abundant siderite, dark-gray shale, and coal clasts in basal 8 in.; thick-bedded to massive; base grades.....	14	0
		(809	10.5)
181.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, 10 percent feldspar, scattered dark mineral grains, massive; base grades abruptly.....	2	1
		(811	11.5)
182.	Sandstone, light-gray, fine-grained, micaceous, contains 60 percent quartz, abundant dark and light mineral grains; base grades.....	2	9.5
		(814	9)
183.	Sandstone, light-gray, medium-grained, micaceous, contains 60 percent quartz, abundant dark and light mineral grains, scattered coal laminae in basal 4 ft; base sharp.....	8	4
		(823	1)
184.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, 10 percent dark-gray carbonaceous siltstone laminae, thin and evenly bedded; base grades abruptly...	2	0
		(825	1)
185.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, abundant dark and light mineral grains, thick-bedded to massive; base sharp and irregular.	3	2
		(828	3)
186.	Shale, dark-gray, carbonaceous, evenly bedded, fair fissility; base grades.....	40	11
		(869	2)

Unit Number	Description	Thickness (Depth) ft	in.
187.	Shale, medium-dark-gray, contains few siderite beds, evenly bedded, fair fissility base grades.....	4	2
		(873	4)
188.	Shale, black, carbonaceous, fair fissility.....	0	3
		(873	7)
189.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent dark-gray shale laminae, cross-laminated, thin-bedded; base grades.....	0	8
		(874	3)
190.	Shale, medium-dark-gray, silty, contains 20 percent light-gray very fine grained sandstone laminae, evenly bedded; base grades abruptly.....	0	8
		(874	11)
191.	Sandstone, medium-light-gray, very fine grained, contains 40 percent quartz, 30 percent medium-dark-gray shale laminae, evenly bedded; base sharp.....	2	3
		(877	2)
192.	Shale, medium-dark-gray, contains 10 percent light-gray very fine grained sandstone beds up to 2 in. thick, few plant fragments, evenly bedded, fair fissility.....	8	1
		(885	3)
193.	Coal, Lower Banner coal bed, bright attritus.....	1	2.5
		(886	5.5)
194.	Underclay, medium-gray, carbonaceous in top 1 in., abundant rootlets; base grades.....	1	0
		(887	5.5)
195.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent medium-dark-gray shale laminae, thin-bedded; base grades.....	0	4.5
		(887	10)
196.	Siltstone, medium-dark-gray, contains few light-gray very fine grained sandstone beds, thin-bedded, poor fissility; base sharp...	0	4
		(888	2)
197.	Sandstone, medium-light-gray, very fine to medium-grained micaceous, contains 45 percent quartz, abundant dark and light mineral grains, 15 percent medium-dark-gray shale laminae; base sharp.....	2	4
		(890	6)
198.	Sandstone, medium-light-gray, medium-grained, micaceous, contains 50 percent quartz, thick-bedded; base sharp.....	2	3
		(892	9)

Unit Number	Description	Thickness (Depth) ft	in.
199.	Shale, dark-gray to black, carbonaceous, evenly bedded, fair fissility	0	8
		(893	5)
200.	Shale, medium-gray, slightly silty, carbonaceous in basal 0.5 in., evenly bedded, fair fissility	1	0
		(894	5)
201.	Siltstone, medium-light-gray, mottled brownish-gray, few rootlets, faintly bedded; base grades abruptly	0	2
		(894	7)
202.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, abundant dark and light mineral grains, thin- to thick-bedded; base sharp and irregular	2	9
		(897	4)
203.	Sandstone, medium-gray, very fine to fine-grained, micaceous, contains 45 percent quartz; base sharp and uneven	0	7
		(897	11)
204.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, abundant dark and light mineral grains, few small-scale slump structures in top 7 in., few medium-dark-gray shale clasts at base, thick-bedded to massive; base sharp and uneven	8	5
		(906	4)
205.	Sandstone, medium-light-gray, fine- to medium-grained, contains 50 percent quartz, thin- to thick-bedded; base grades	0	8
		(907	0)
206.	Sandstone, medium-light-gray, medium-grained, micaceous, contains 65 percent quartz, abundant dark and light mineral grains, scattered coal laminae from 1 ft 6 in. to 1 ft 8 in. below top, thick-bedded to massive; base grades	38	8
		(945	8)
207.	Sandstone, medium-light-gray, medium-grained, contains 65 percent quartz, 20 percent coal laminae and beds up to 0.25 in. thick, thin-bedded; base sharp	0	2
		(945	10)
208.	Siltstone, medium-gray, micaceous, contains 10 percent medium-light-gray fine-grained sandstone laminae, thin-bedded; base sharp	0	4
		(946	2)
209.	Sandstone, medium-light-gray, medium- to coarse-grained, contains 65 percent quartz, scattered angular medium-gray shale clasts, few siderite and coal clasts; base grades abruptly	1	4
		(947	6)

Unit Number	Description	Thickness (Depth) ft	in.
210.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 30 percent medium-dark-gray siltstone laminae, thin and evenly bedded.....	1	8
		(949	2)
211.	Sandstone, light- to medium-light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, scattered siderite clasts in basal 6 ft, abundant angular medium-dark-gray shale clasts in basal 2 ft, thick-bedded to massive; base grades.....	12	5
		(961	7)
212.	Sandstone, medium-light-gray, fine- to medium-grained, contains 60 percent quartz, 5 percent medium-dark-gray shale laminae, thin- to thick-bedded; base grades.....	10	0
		(971	7)
213.	Sandstone, medium-light-gray, petroliferous and mottled brownish-gray, fine- to medium-grained, contains 50 percent quartz, thin-bedded; base sharp.....	0	5
		(972	0)
214.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 50 percent quartz, few dark mineral grains, 5 percent medium-gray siltstone laminae, 0.25 in. siderite clast 10 in. below top, thin-bedded; base grades.....	16	9
		(988	9)
215.	Sandstone, medium-light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, scattered dark mineral grains, few medium-gray siltstone laminae, abundant medium-gray shale clasts from 7 in. to 10 in. below top, thin- to thick-bedded; base grades.....	5	1
		(993	10)
216.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, scattered dark and light mineral grains, crossbedded, massive; base sharp.....	1	11
		(995	9)
217.	Sandstone, medium-lgiht-gray, very fine- to fine-grained, contains 40 percent quartz, 30 percent dark-gray shale and siltstone laminae, thin-bedded.....	0	7
		(996	4)
218.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 60 percent quartz, scattered dark and light mineral grains, massive; base sharp.....	5	3
		(1001	7)
219.	Shale, black, silty, very carbonaceous, poor fissility; base sharp.....	0	6
		(1002	1)

Unit Number	Description	Thickness (Depth) ft	in.
220.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, abundant medium-dark-gray shale clasts in top 9 in. and from 2 ft 6 in. to 3 ft 2 in. below top, thick-bedded to massive; base sharp.....	4	11
		(1007	0)
221.	Siltstone, medium-dark- to dark-gray, micaceous, contains 30 percent light-gray very fine grained sandstone laminae and beds, cross-laminated, thin and evenly bedded; base grades.....	3	3
		(1010	3)
222.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 60 percent quartz, scattered dark mineral grains; 25 percent dark-gray siltstone laminae in top 7 in., decreasing to 10 percent in basal 5 ft; thin- to thick-bedded; base grades...	9	11
		(1020	2)
223.	Sandstone, light-gray, fine-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, abundant angular siderite and medium-dark-gray shale clasts from 2 ft 6 in. to 3 ft 6 in., 7 ft to 13 ft 6 in., 18 ft 6 in. to 20 ft and 21 ft 6 in. to 26 ft 6 in. below top and in basal 1 ft 8 in.; base sharp..	32	0
		(1052	2)
224.	Shale, medium-dark-gray, contains 30 percent light-gray very fine grained sandstone laminae, evenly bedded, fissile; base grades abruptly.....	1	5
		(1053	7)
225.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, 5 percent dark-gray siltstone laminae, thin- to thick-bedded; base sharp.....	12	3
		(1065	10)
226.	Coal, Kennedy coal bed, bright attritus, pyrite and gypsum on cleats, 0.75 in. pyrite lens 2.5 in. below top.....	1	6
		(1067	4)
	LOWER PENNSYLVANIAN SERIES Norton Formation (cont.)		
227.	Sandstone, medium-light-gray, very fine to fine-grained, contains 60 percent quartz, abundant rootlets; base sharp.....	0	4
		(1067	8)
228.	Underclay, medium-dark-gray, silty in basal 2 ft 6 in., contains 0.5 in. medium-light-gray fine-grained sandstone lens 2 ft 9 in. below top, scattered rootlets; base sharp.....	4	6
		(1072	2)

Unit Number	Description	Thickness (Depth) ft	in.
229.	Sandstone, light-gray, very fine grained, contains 60 percent quartz, 20 percent medium-gray siltstone laminae, thin-bedded; base sharp.....	0	2.5
		(1072	4.5)
230.	Siltstone, medium-dark-gray, micaceous, contains 30 percent light-gray very fine grained sandstone laminae in basal 1 ft 2 in., thin- to poorly bedded, poor fissility; base grades.....	2	8.5
		(1075	1)
231.	Sandstone, light-gray, fine-grained, very micaceous, contains 60 percent quartz, scattered dark mineral grains, scattered medium-dark-gray shale clasts from 3 ft to 4 ft below top, thin- to thick-bedded, few contorted beds in top 1 ft; base grades.....	5	0
		(1080	1)
232.	Sandstone, light-gray, fine-grained, micaceous, contains 65 percent quartz, scattered dark-gray carbonaceous shale laminae from 2 ft 6 in. to 4 ft 8 in. below top, few dark mineral grains, thin- to thick-bedded; base sharp.....	7	5
		(1087	6)
233.	Shale, medium-dark-gray, silty in top 3 in., evenly bedded, fissile; base grades abruptly.....	0	7
		(1088	1)
234.	Shale, black, carbonaceous, fair fissility.....	0	8
		(1088	9)
235.	Underclay, medium-gray, silty in basal 8 in., few rootlets.....	1	1
		(1089	10)
236.	Shale, medium-dark-gray, silty, contains 25 percent light-gray very fine grained sandstone laminae and beds, few plant fragments, evenly bedded, fair fissility.....	13	0
		(1102	10)
	Lee Formation Naese Sandstone Member		
237.	Sandstone, very light to light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, scattered dark and light mineral grains, 10 percent medium-gray discontinuous siltstone laminae, thin- to thick-bedded; base grades.....	17	8
		(1120	6)
238.	Sandstone, very light to light-gray, medium-grained, micaceous, contains 65 percent quartz, scattered feldspar and dark mineral grains, massive; base grades.....	3	10
		(1124	4)

Unit Number	Description	Thickness (Depth) ft	in.
239.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, few scattered dark and green mineral grains, few stylolites, few coalified plant fragments, massive; base grades.....	21	2
		(1145	6)
240.	Sandstone, very light to light-gray, medium- to coarse-grained, contains 90 percent quartz, few scattered dark and green mineral grains, scattered well rounded white quartz pebbles becoming abundant in basal 8 in., few stylolites, crossbedded, massive; base grades.....	63	7
		(1209	1)
241.	Sandstone, very light gray, medium-grained, micaceous, contains 90 percent quartz, 5 percent dark-gray carbonaceous siltstone laminae, crossbedded; base sharp.....	1	4
		(1210	5)
242.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered dark and light mineral grains, massive; base sharp.....	3	4
		(1213	9)
	Tongue of Norton Formation		
243.	Shale, dark-gray to black, very carbonaceous, sandy in top 0.5 in., evenly bedded; fair fissility; base grades.....	0	10
		(1214	7)
244.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 40 percent quartz, 30 percent dark-gray shale laminae, thin-bedded; base grades.....	0	4
		(1214	11)
245.	Shale, dark-gray to black, very carbonaceous, silty in basal 2 ft 2 in., evenly bedded, fair fissility; base grades.....	3	6
		(1218	5)
246.	Sandstone, light-gray, fine-grained, contains 60 percent quartz, 20 percent dark-gray shale laminae and beds up to 7 in. thick, thick-bedded; base sharp.....	10	7
		(1229	0)
247.	Sandstone, light-gray, medium-grained, micaceous, contains 65 percent quartz, scattered dark and light mineral grains, thick-bedded; base sharp.....	2	0
		(1231	0)
248.	Shale, dark-gray, silty, evenly bedded, fair fissility.....	0	1
		(1231	1)
	Lee Formation Bee Rock Sandstone Member		

Unit Number	Description	Thickness (Depth) ft	in.
249.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles up to 0.25 in. in diameter, 5 percent dark-gray siltstone laminae, few coal clasts at 16 ft 3 in., 22 ft and 28 ft 8 in. below top, few stylolites, crossbedded, thick-bedded to massive; base sharp	43	6
		(1274	7)
250.	Shale, medium-gray, very silty contains 5 percent medium-light gray siltstone laminae, evenly bedded, fair fissility; base sharp	2	4
		(1276	11)
251.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, 5 percent dark-gray carbonaceous shale laminae, scattered stylolites, crossbedded, massive; base grades	9	6
		(1286	5)
252.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, abundant well rounded white quartz pebbles and granules, 1 in. coal clast 2 ft 8 in. below top, few stylolites massive; base grades	30	3
		(1316	8)
253.	Sandstone, very light gray, very fine to medium-grained, contains 90 percent quartz, few well rounded white quartz pebbles, cross-bedded, massive; base grades	13	0
		(1329	8)
254.	Sandstone, very light gray, very coarse grained, contains 90 percent quartz, scattered white quartz pebbles and granules up to 0.5 in. in diameter, massive; base grades	6	0
		(1335	8)
255.	Sandstone, very light gray, very fine to fine-grained, contains 90 percent quartz, few dark-gray carbonaceous shale laminae, thin-bedded; base sharp	3	3
		(1338	11)
256.	Sandstone, very light to light-gray, medium-grained, contains 90 percent quartz, few coal and dark-gray shale clasts up to 1.5 in. thick, conglomeratic with abundant white quartz pebbles, massive; base grades	23	10
		(1362	9)
257.	Sandstone, light-gray, fine- to medium-grained, sparsely micaceous, contains 65 percent quartz, few dark-gray carbonaceous shale laminae, scattered feldspar and dark mineral grains, thick-bedded; base sharp	23	0
		(1385	9)

Unit Number	Description	Thickness (Depth) ft	in.
	Lee Formation **Hensley Member**		
258.	Shale, medium-dark- to dark-gray, contains scattered siderite beds up to 1 in. thick, few coal laminae in basal 2 in., scattered slickensided surfaces, fair fissility; base grades.....	13 (1398	0 9)
259.	Coal, Jawbone coal bed (thickness- 1 ft 9.75 in.)		
259a.	Coal, mostly bright attritus.....	0 (1398	0.75 9.75)
259b.	Shale, medium-gray, contains few discontinuous pyrite laminae.....	0 (1398	0.25 10)
259c.	Coal, bright attritus, scattered thin to thick vitrain bands.....	0 (1399	6 4)
259d.	Shale, medium-gray.....	0 (1399	0.75 4.75)
259e.	Coal, bright attritus, abundant thick vitrain bands, thin medium-gray shale lens 0.5 in. below top.....	1 (1400	2 6.75)
260.	Underclay, medium-gray, very silty in basal 1 ft, abundant rootlets; base grades.....	3 (1404	5.25 0)
261.	Siltstone, medium-gray, finely micaceous, few rootlets in top 2 ft, poorly bedded, non-fissile; base grades abruptly.....	5 (1409	7 7)
262.	Sandstone, medium-light-gray, very fine- to fine-grained, silty, contains 45 percent quartz, thin-bedded; base grades.....	4 (1414	10 5)
263.	Sandstone, light-gray, fine-grained, micaceous, contains 50 percent quartz, few medium-dark-gray shale clasts in top 2 in., 10 percent medium-gray siltstone laminae, thin-bedded; base grades.....	6 (1421	10 3)
264.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 50 percent quartz, abundant dark mineral grains, 10 percent medium-gray siltstone laminae from 2 ft to 3 ft 4 in. below top, thin- to thick-bedded; base sharp.....	5 (1426	5 8)

Unit Number	Description	Thickness (Depth) ft	in.
265.	Shale, medium-dark-gray, very silty, evenly bedded, poor fissility; base grades.....	0	2
		(1426	10)
266.	Sandstone, medium-light-gray, very fine grained, silty, contains 40 percent quartz; base grades.....	0	6
		(1427	4)
267.	Sandstone, light-gray, fine- to medium-grained, micaceous, contains 55 percent quartz, abundant dark mineral grains, few angular medium-dark-gray shale clasts and coal laminae in basal 11 in.....	11	8
		(1439	0)

BOTTOM OF HOLE
TOTAL DEPTH 1,439 ft

GEOPHYSICAL LOG

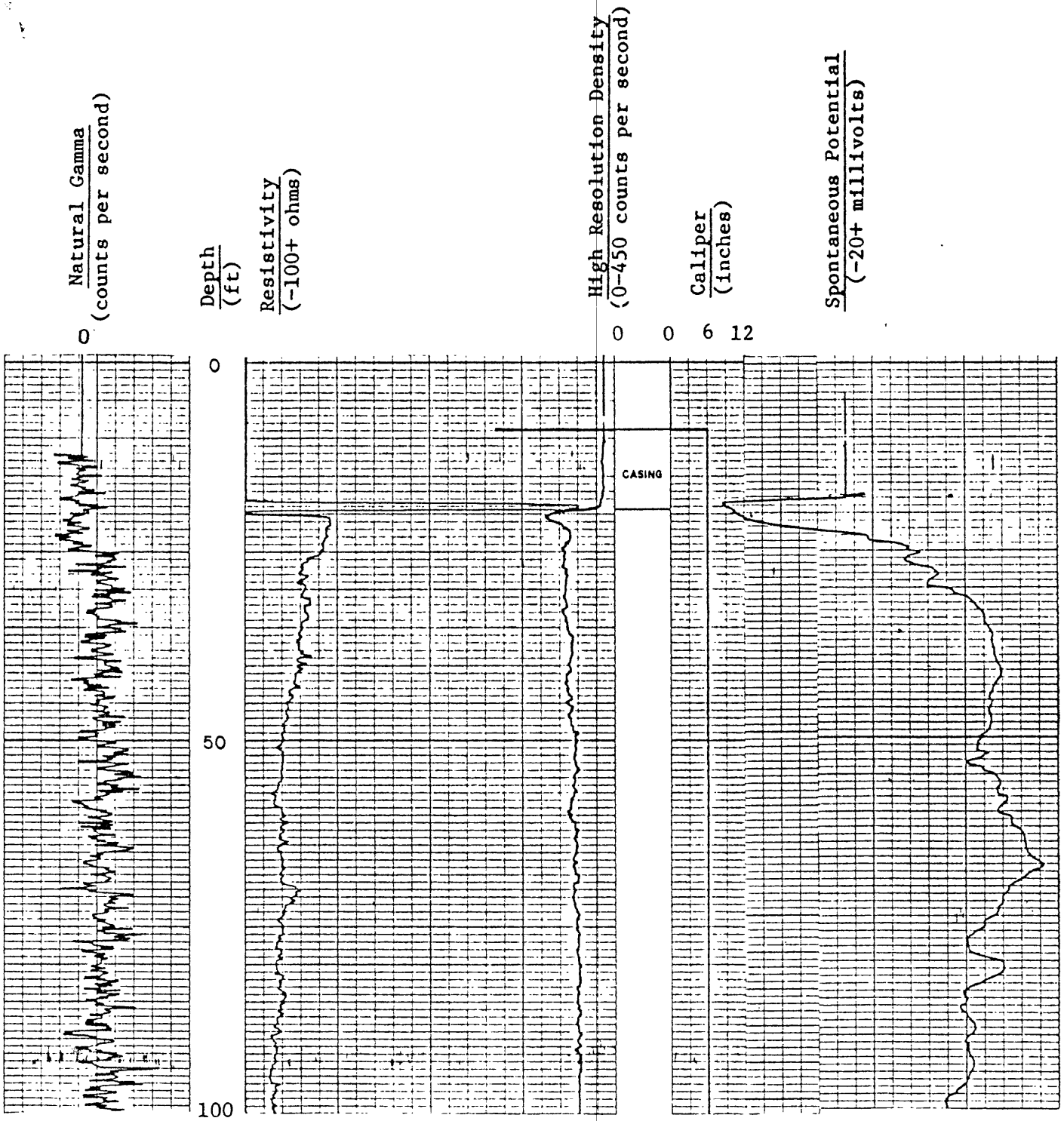
Corehole: SW-10 Date: 1/24/83 State: Virginia County: Lee

Quadrangle: Keokee, Va.-Ky. Latitude: 36°50'57"N Longitude: 82°54'18"

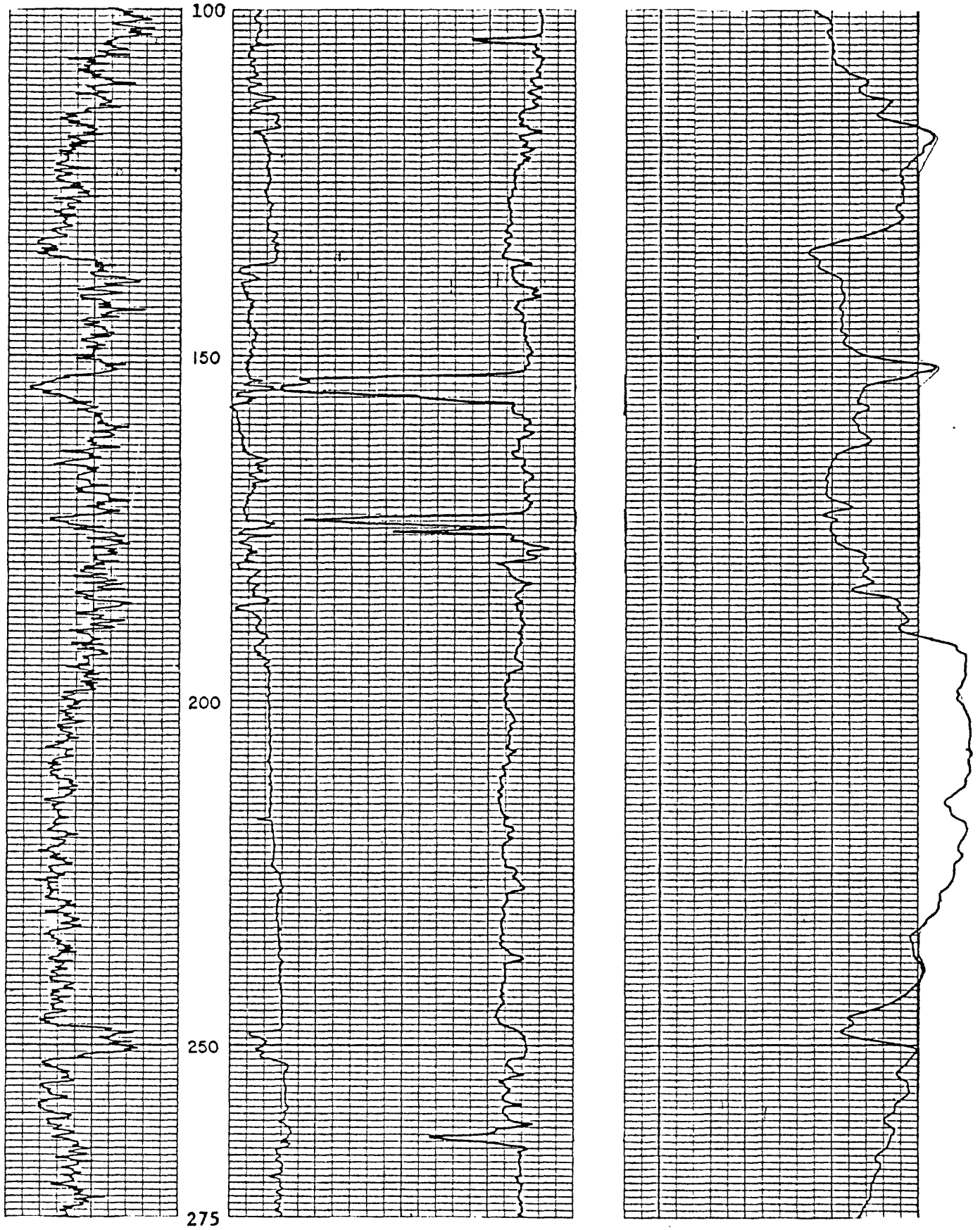
Altitude: 2,080 ft Logged Depth: 1,439 ft Drilled Depth: 1,439 ft

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

High Resolution Density Time Constant: 1



Corehole: SW-10 continued



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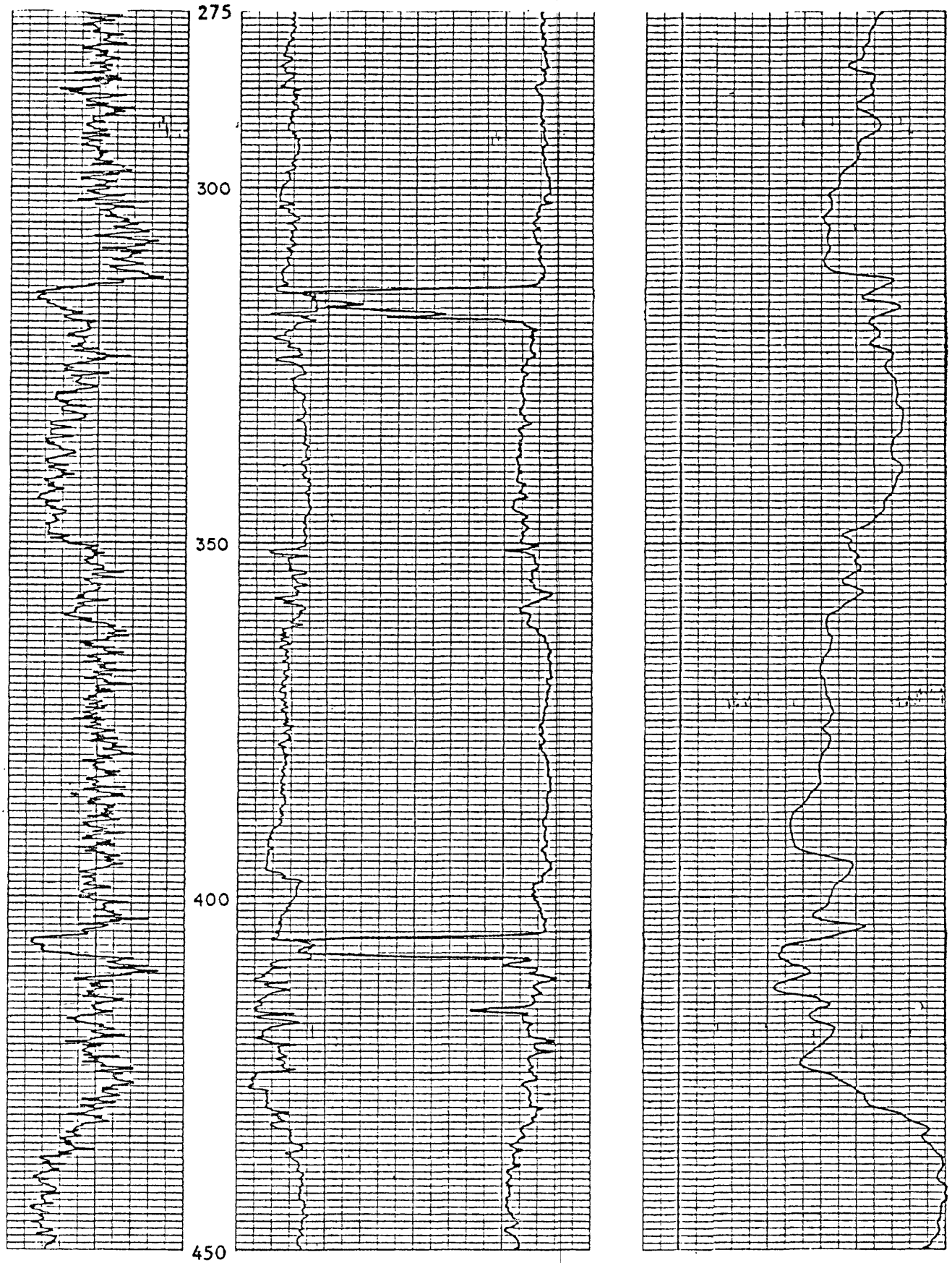
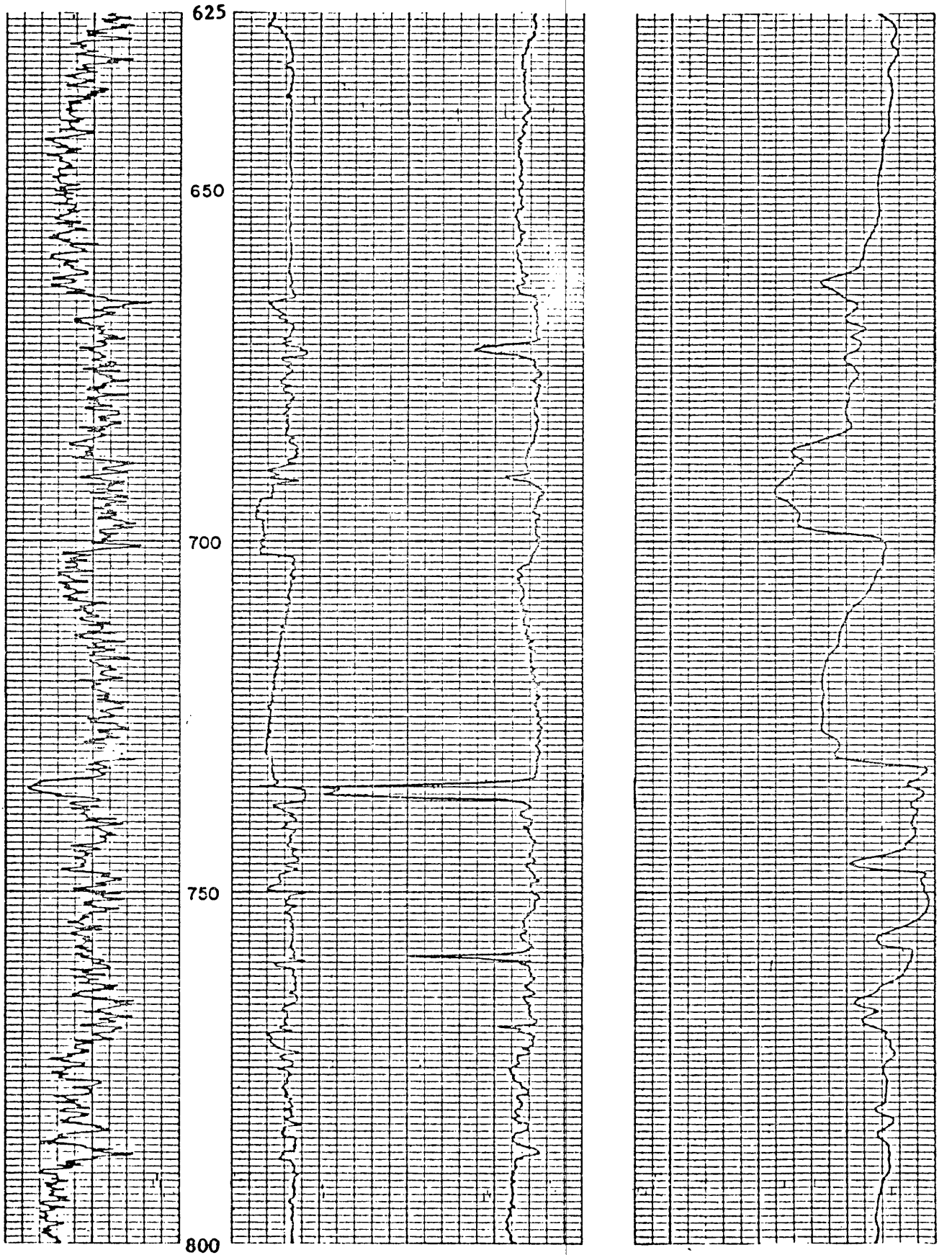


Corehole: SW-10 continued

Corehole: SW-10 continued



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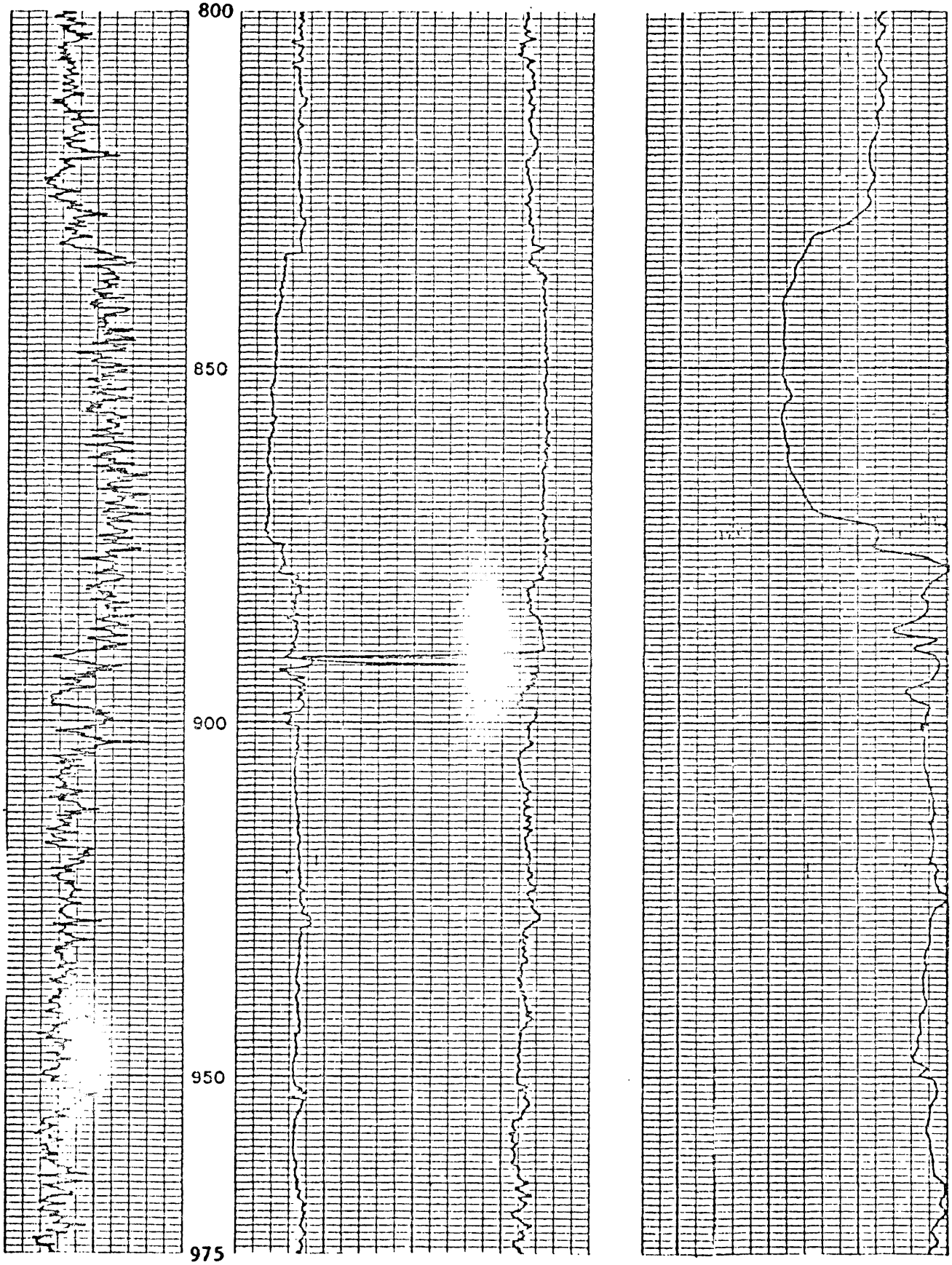

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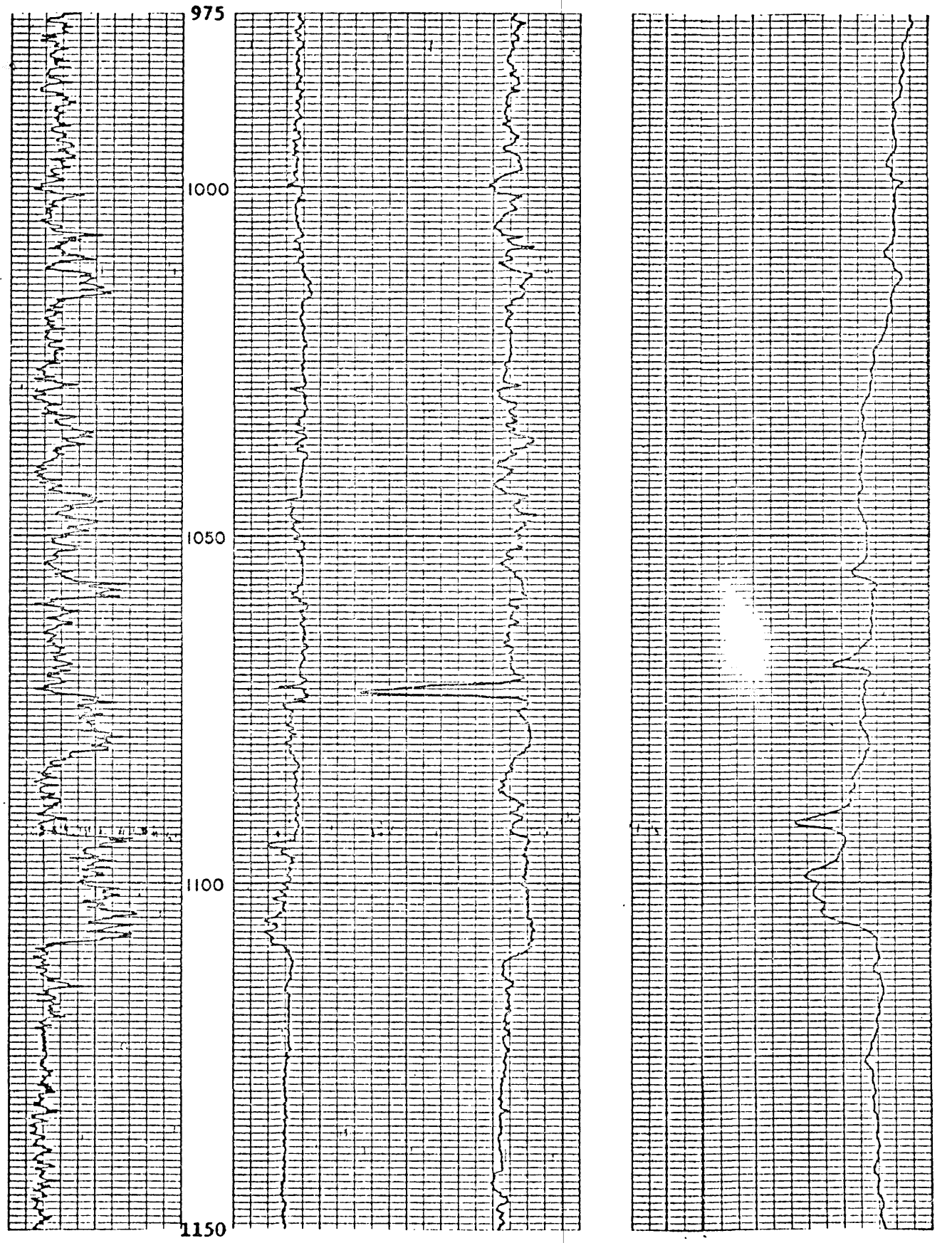
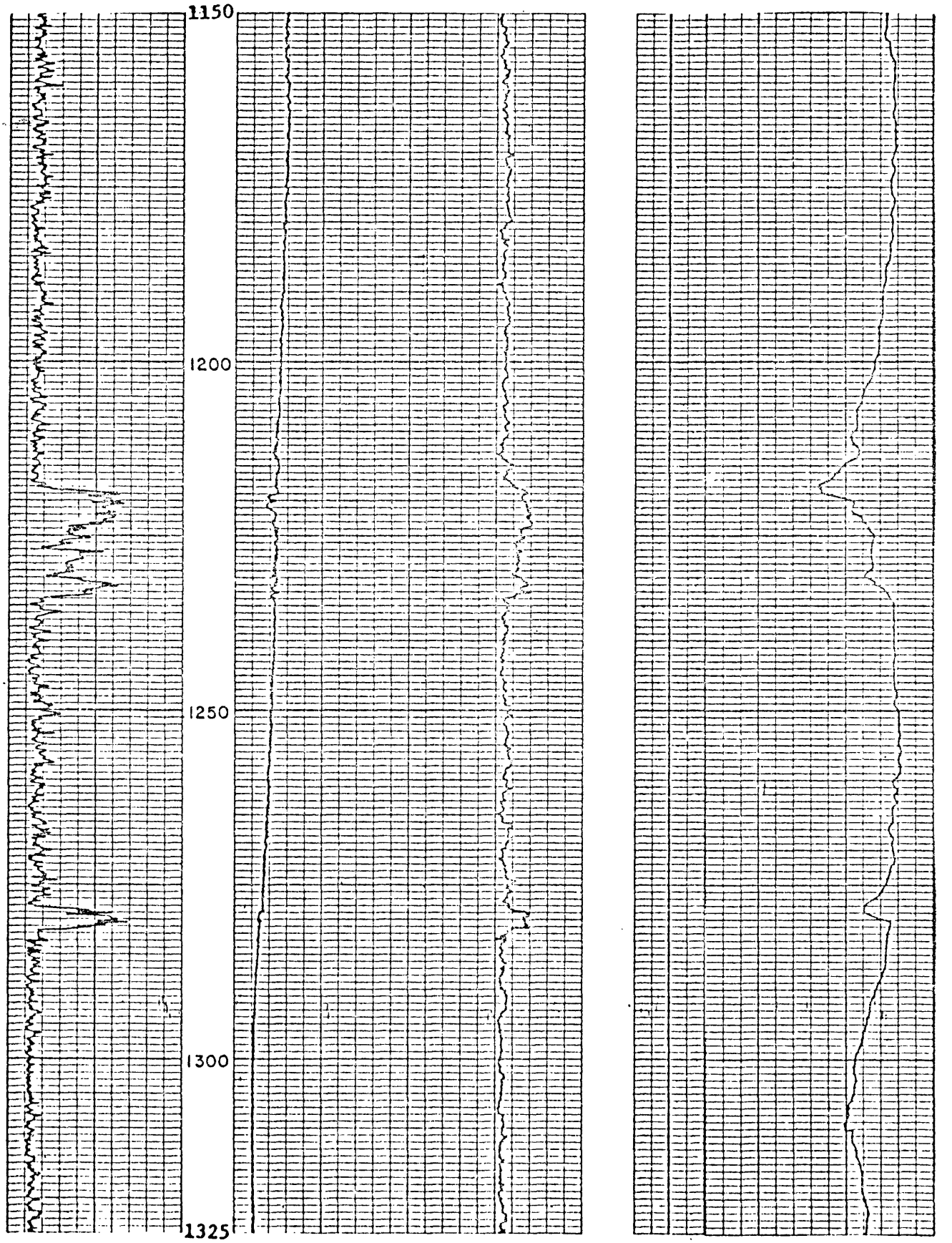
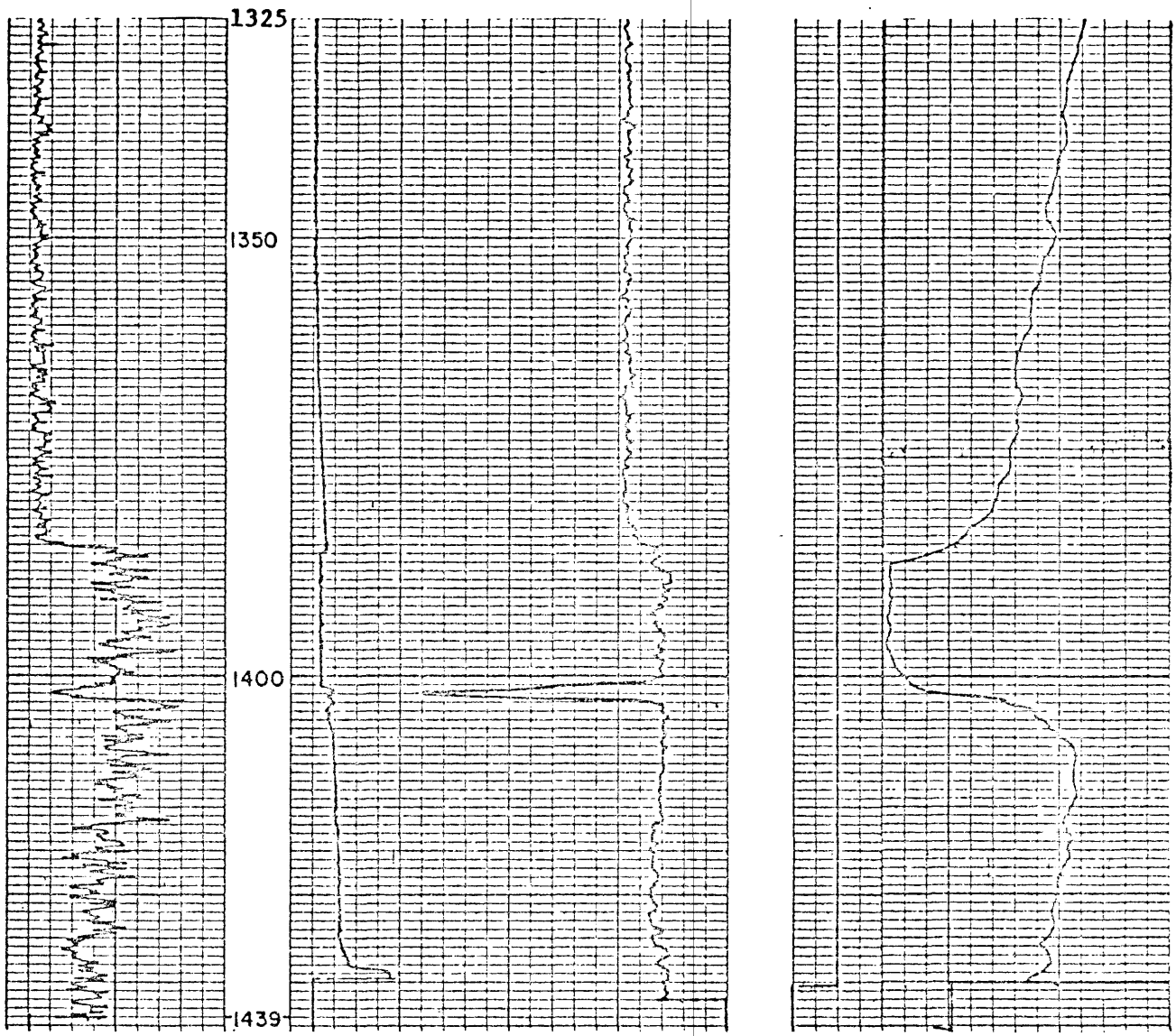


Corehole: SW-10 continued

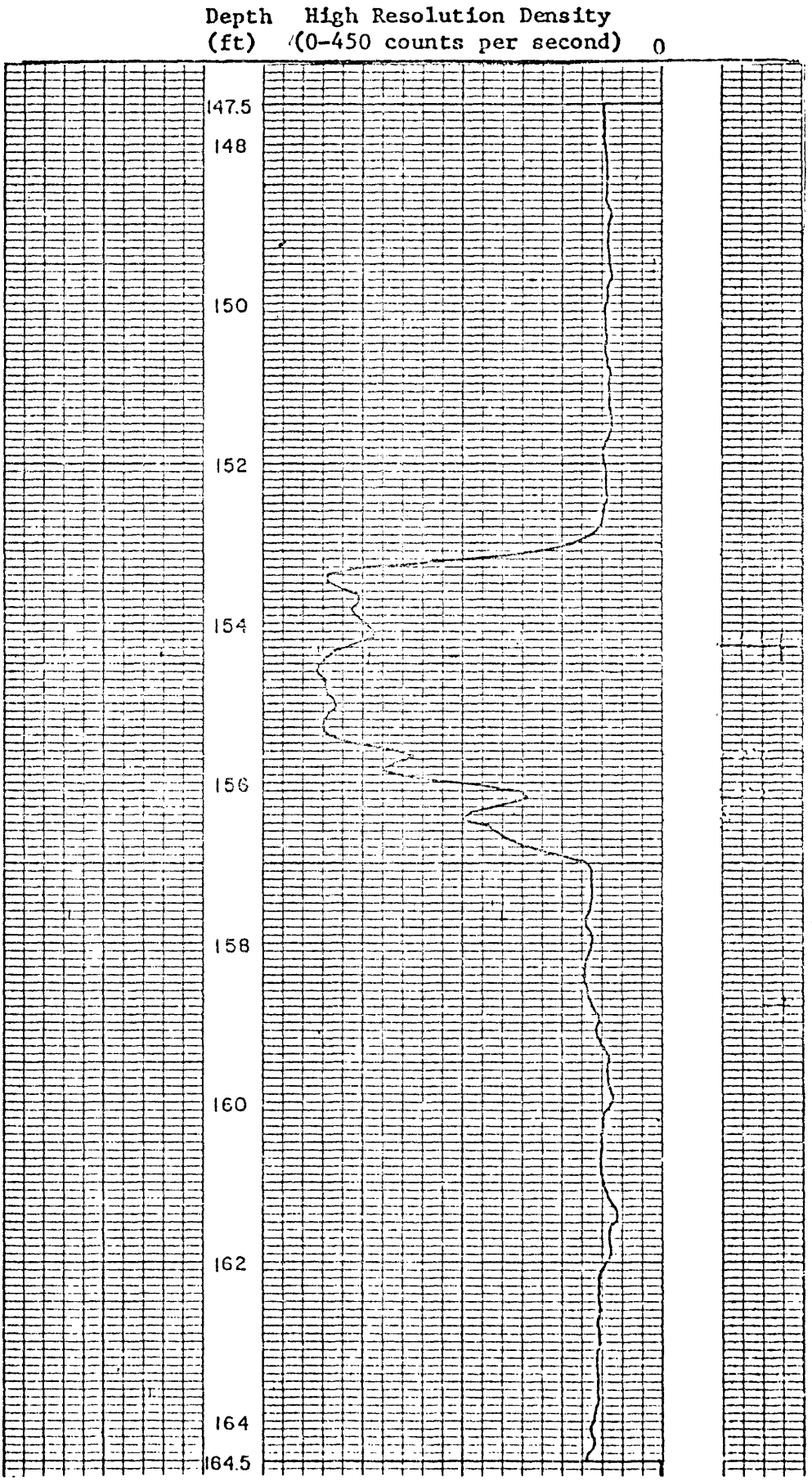


Corehole: SW-10 continued

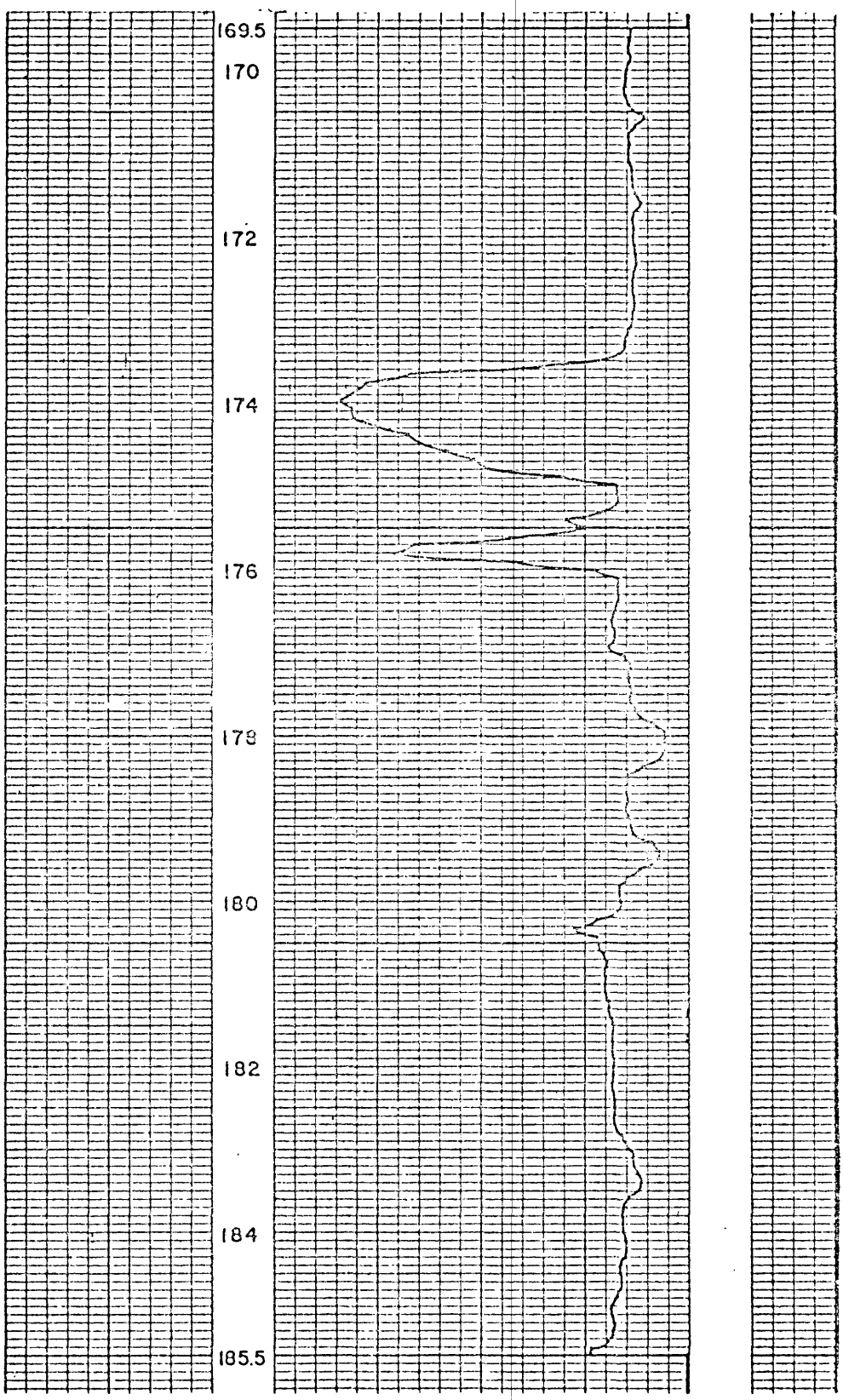


DETAIL LOG

Corehole: SW-10 Logging Speed: 5 ft/min Time Constant: 1



Corehole: SW-10 continued



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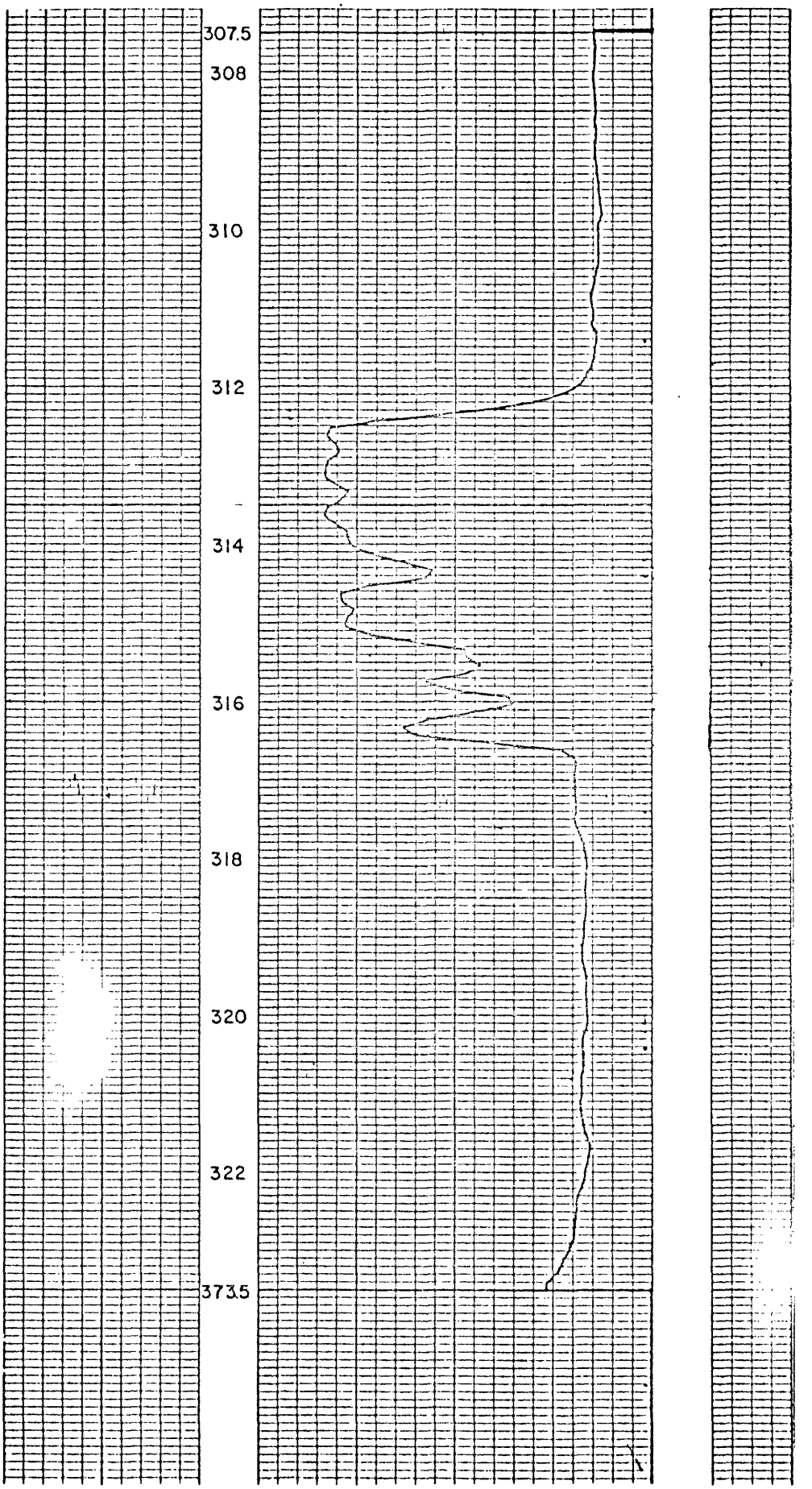
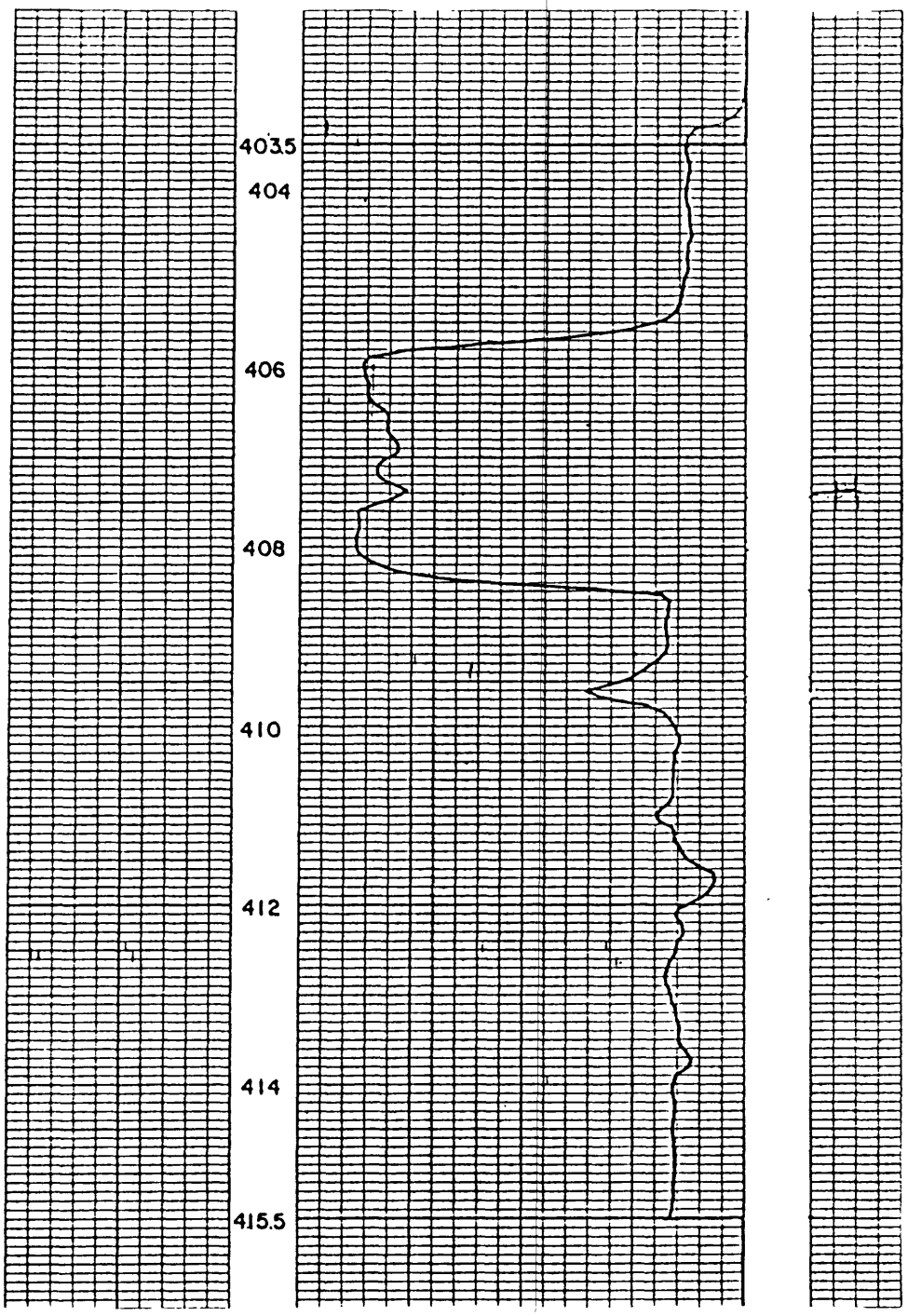


Corehole: SW-10 continued



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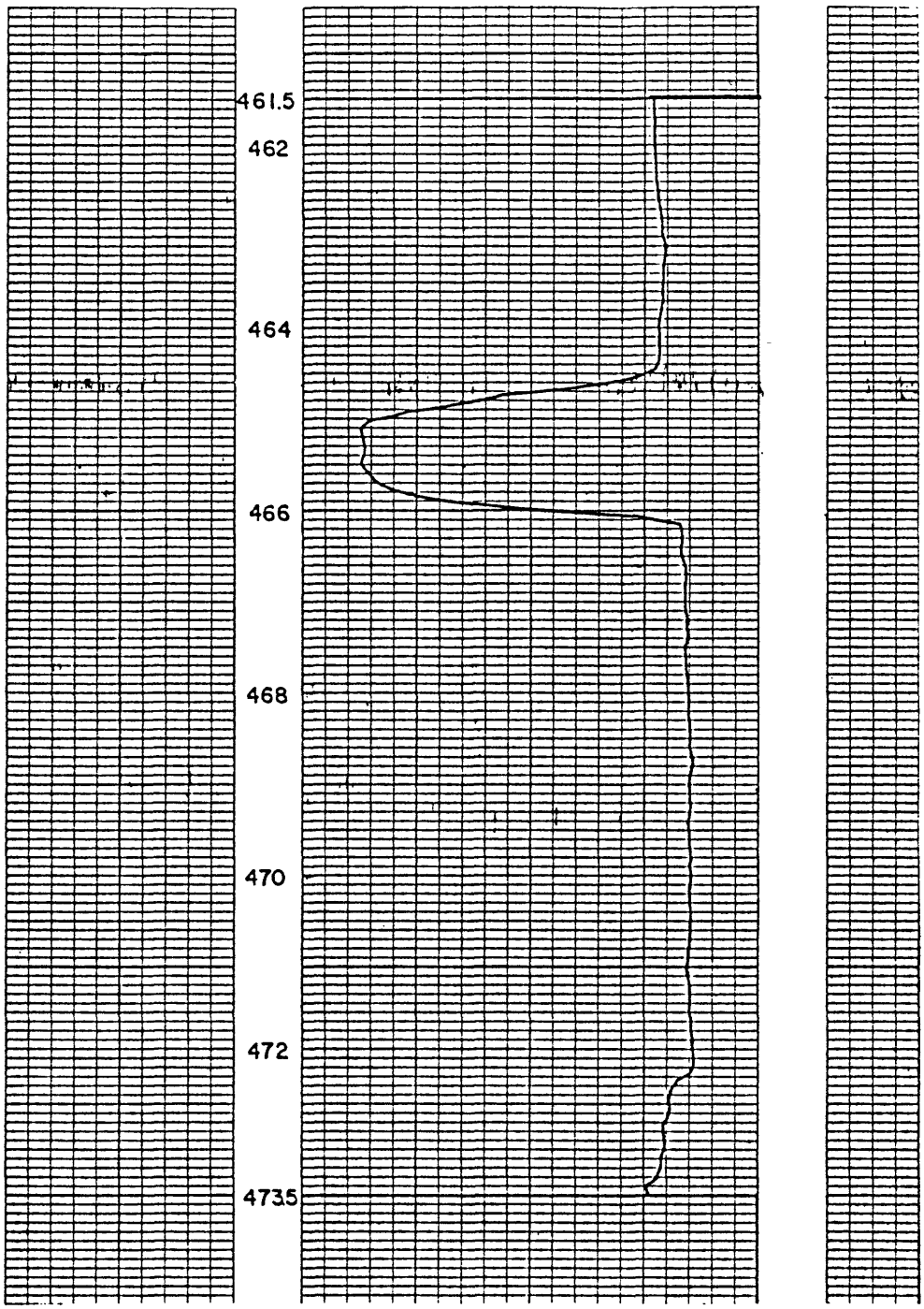

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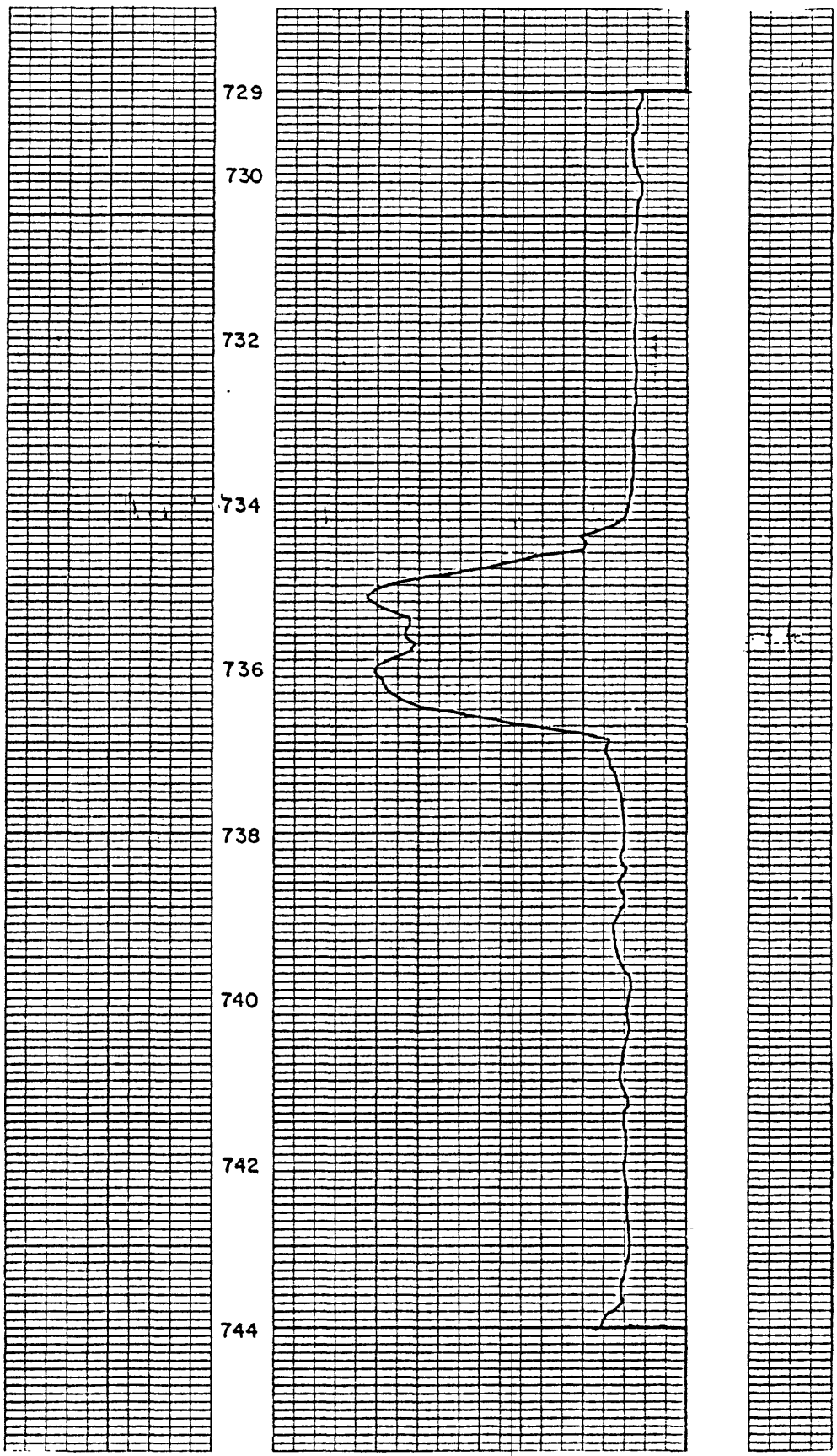

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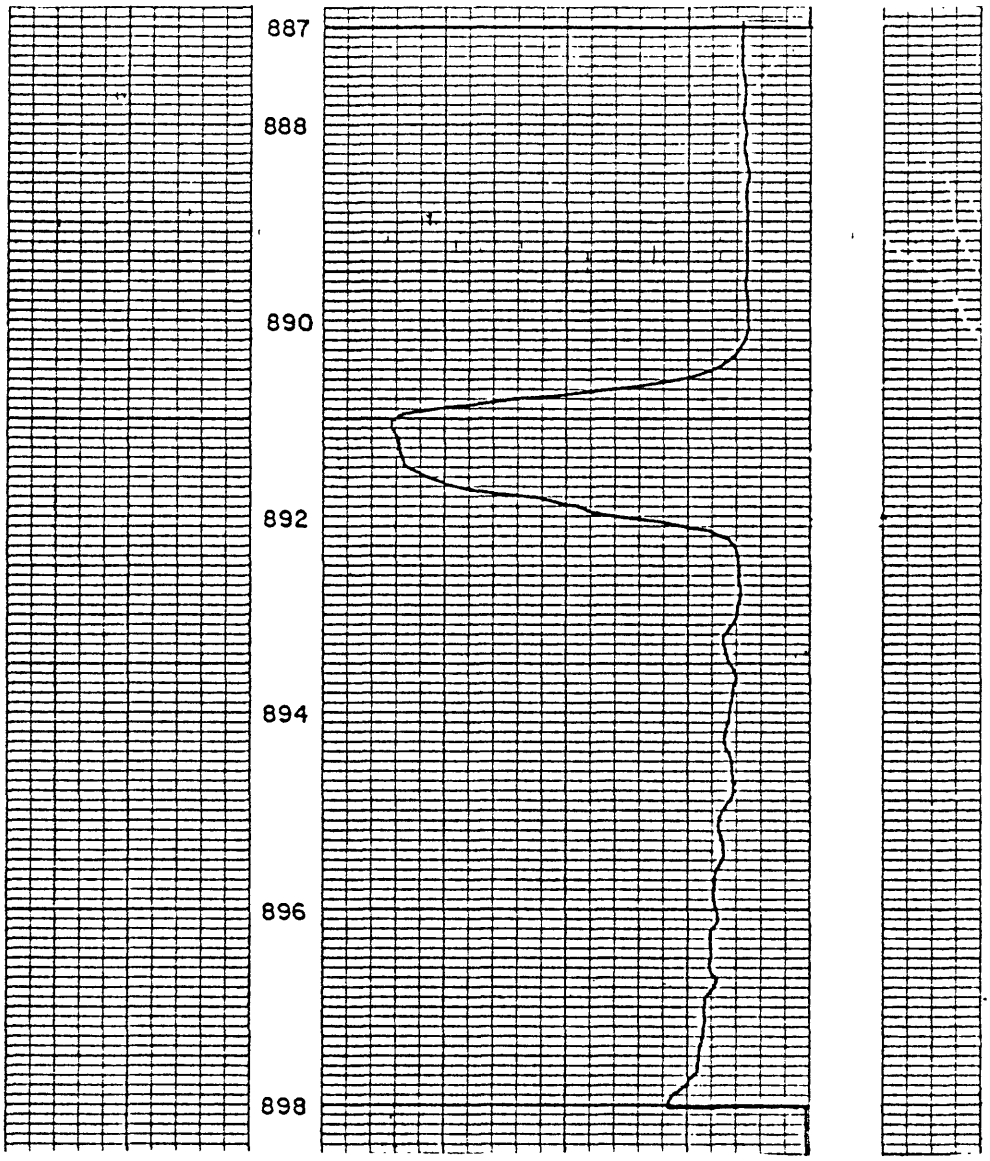

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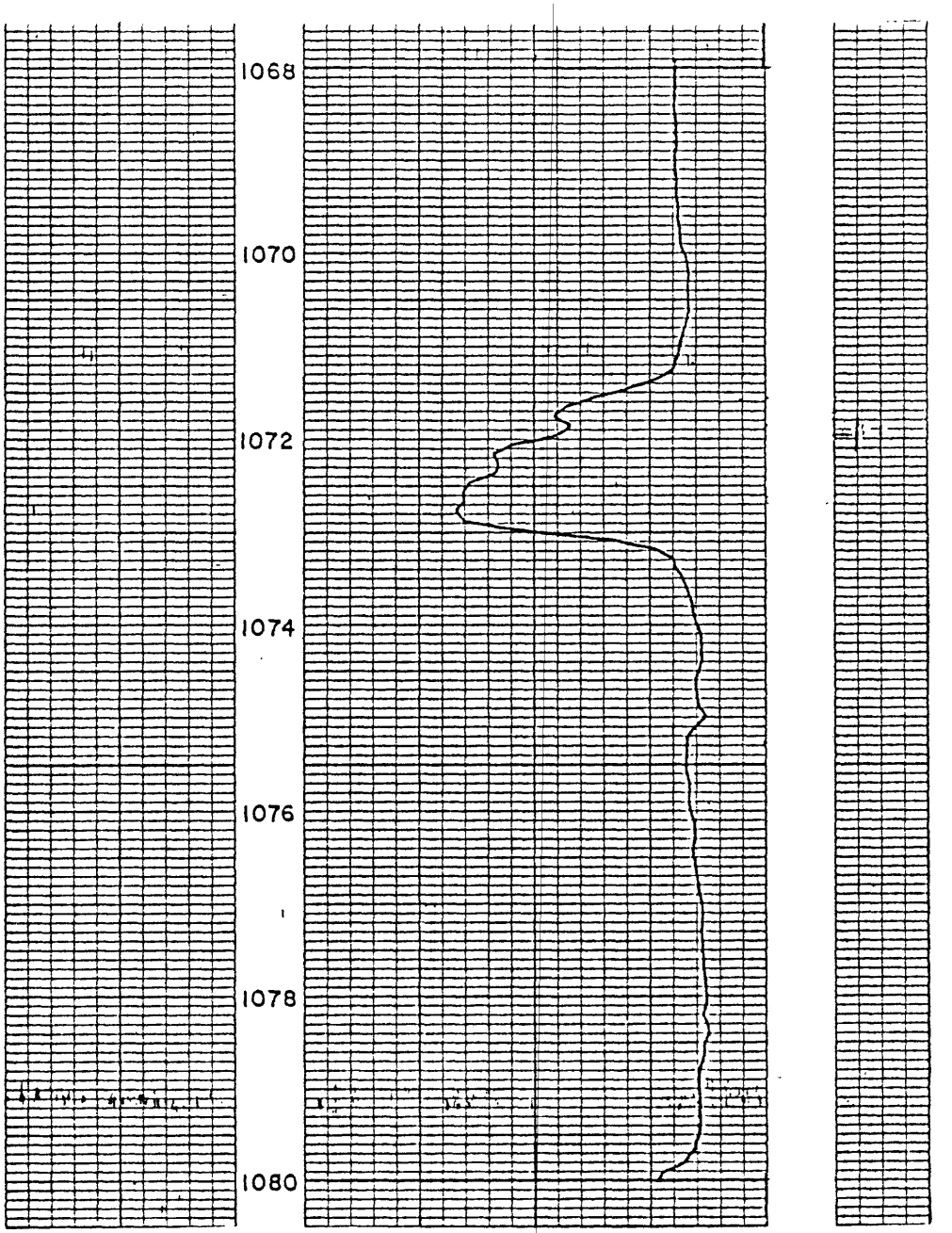
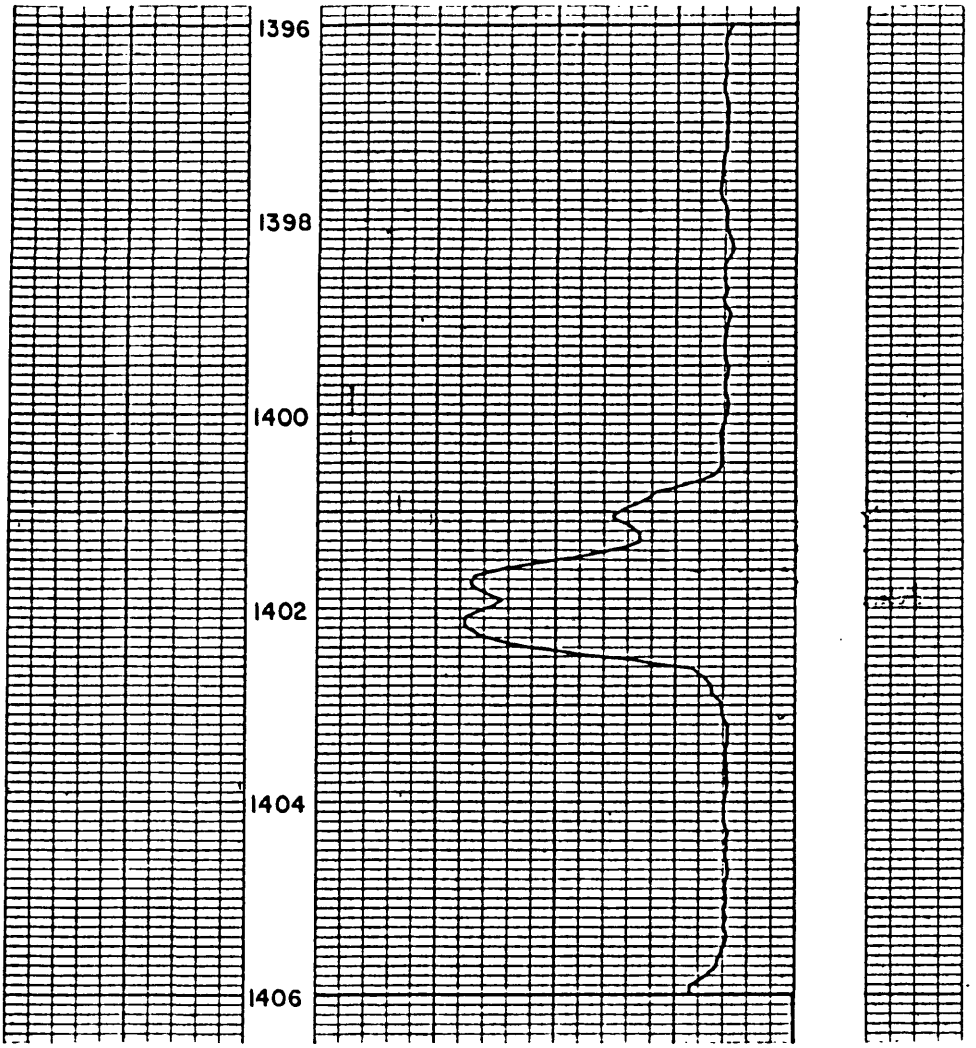


Corehole: SW-10 continued



Corehole SW-11

Location: Lee County; Keokee, Va.-Ky., 7.5 minute quadrangle; on Payne Branch approximately 0.5 mi southeast of Sigma, Va. Accessible by unimproved road which extends southward from State Route 625.

Coordinates: Latitude 36°49'23"N Longitude: 82°56'04"W

Altitude: 2,220 ft Drilled depth: 1,160 ft

Dip of strata: Mostly 15° from surface to depth of 800 ft decreasing to 10° at base of corehole.

Date drilled: November 30, 1982 to January 11, 1983

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

Unit Number	Description	Thickness (Depth) ft	in.
	LOWER PENNSYLVANIAN SERIES Lee Formation Hensley Member		
1.	Soil and weathered rock (casing set- no core recovered).....	15	0
		(15	0)
2.	Sandstone, light-gray, weathered brownish-gray in top 3 in., fine-grained, contains 60 percent quartz, few discontinuous medium-gray siltstone laminae, thin-bedded; base sharp.....	0	10
		(15	10)
3.	Shale, medium-gray, weathered brownish-gray, silty, evenly bedded; base sharp.....	0	4
		(16	2)
4.	Sandstone, light-gray, weathered brownish-gray in top 3 ft and from 6 ft 2 in. to 6 ft 8 in. below top, fine-grained, contains 60 percent quartz, few discontinuous medium-gray siltstone laminae, thin-bedded; base grades.....	6	10
		(23	0)
5.	Sandstone, very light gray, weathered brownish-gray from 3 ft 2 in. to 3 ft 8 in. below top, fine- to medium-grained, contains 90 percent quartz, 5 percent discontinuous medium-gray siltstone laminae, few coal laminae from 2 in. to 5 in. above base, thin- to thick-bedded; base grades.....	8	7
		(31	7)
6.	Sandstone, very light gray, weathered brownish-gray from 4 ft 8 in. to 11 ft 7 in. below top, fine- to medium-grained, contains 90 percent quartz, abundant coal laminae from 2 ft 9 in. to 3 ft 1 in. and 4 ft 4 in. to 4 ft 9 in. below top, crossbedded, thick-bedded to massive; base grades.....	25	4
		(56	11)

Unit Number	Description	Thickness (Depth) ft	in.
7.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, few scattered dark mineral grains abundant coal laminae from 1 ft 5 in. to 1 ft 6 in. below top, crossbedded, thick-bedded to massive; base sharp.....	3	10
		(60	9)
8.	Shale, medium-gray, micaceous, silty, evenly bedded, fair fissility base sharp;.....	0	7
		(61	4)
9.	Sandstone, light-gray, fine-grained, micaceous, contains 65 percent quartz, few coal and discontinuous medium-gray siltstone laminae, thin-bedded; base grades abruptly.....	1	4
		(62	8)
10.	Sandstone, very light gray, weathered brownish-gray in basal 1 in., contains 65 percent quartz, scattered dark mineral grains, abundant coal laminae in top 1 ft, thick-bedded; base sharp.....	3	3
		(65	11)
11.	Shale, medium-gray, evenly bedded, fair fissility; base sharp.....	0	1
		(66	0)
12.	Sandstone, very light gray, weathered brownish-gray, fine- to medium-grained, contains 65 percent quartz, thick-bedded; base grades.....	3	11
		(69	11)
13.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, few coal laminae, thin-bedded; base grades.....	2	6
		(72	5)
14.	Sandstone, very light gray, fine- to medium-grained, contains 65 percent quartz, abundant medium-dark-gray shale clasts up to 0.5 in. in diameter in basal 3 ft 3 in., thick-bedded to massive; base grades.....	6	9
		(79	2)
15.	Sandstone, very light gray, weathered brownish-gray from 1 ft 10 in. to 7 ft 6 in. below top, medium-grained, contains 90 percent quartz, few scattered dark mineral grains, abundant coal laminae in basal 3 ft, crossbedded, massive; base grades.....	15	5
		(94	7)
16.	Sandstone, white to very light gray, fine- to medium-grained, contains 90 percent quartz, few scattered medium-gray siltstone laminae, abundant coal laminae from 5 ft 5 in. to 7 ft 2 in. below top, crossbedded, massive; base grades.....	19	9
		(114	4)

Unit Number	Description	Thickness (Depth) ft	in.
17.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, few scattered dark mineral grains, scattered coal laminae from 8 ft to 13 ft below top, few well rounded quartz granules and small dark-gray shale clasts in basal 1 ft, crossbedded, massive; base grades.....	17	8
		(132	0)
18.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, few scattered dark mineral grains, few coal laminae and dark-gray shale clasts in basal 4 in., few stylolites, massive; base sharp.....	4	3
		(136	3)
19.	Sandstone, light-gray, fine- to medium-grained, contains 65 percent quartz, few small medium-dark-gray shale clasts in top 2 in., thick-bedded to massive; base grades.....	1	7
		(137	10)
20.	Sandstone, white to very light gray, fine- to medium-grained, contains 90 percent quartz, few scattered dark mineral grains, 1 in. coal clast 3 ft 8 in. below top, few dark-gray micaceous shale laminae, thick-bedded to massive; base sharp.....	8	9
		(146	7)
21.	Sandstone, light-gray, medium-grained, contains 65 percent quartz, abundant contorted and pyritic coal clasts up to 1 in. in diameter, massive; base sharp.....	3	6
		(150	1)
22.	Shale, medium-dark-gray, contains 10 percent discontinuous light-gray very fine grained sandstone laminae, few siderite beds up to 0.25 in. thick at 8 in. below top, evenly bedded; base grades.....	1	6
		(151	7)
23.	Shale, medium-dark-gray, contains 15 percent light-gray fine-grained sandstone laminae and beds, evenly bedded, few bioturbated beds, fair fissility; base sharp.....	1	1
		(152	8)
24.	Sandstone, light-gray, fine- to medium-grained, contains 65 percent quartz, abundant contorted coal clasts, thick-bedded; base sharp.....	1	2
		(153	10)
25.	Shale, medium-dark-gray, contains few siderite beds, evenly bedded, fair fissility; base grades.....	7	9
		(161	7)
26.	Shale, dark-gray to black, carbonaceous, evenly bedded, fair fissility.....	0	3
		(161	10)

Unit Number	Description	Thickness (Depth) ft	in.
27.	Shale, medium-dark-gray, contains 10 percent light-gray very fine grained sandstone laminae in basal 17 ft 8 in., scattered siderite bands in basal 12 ft 5 in., slightly burrowed, evenly bedded.....	19	5
		(181	3)
28.	Coal, Lee coal bed, dull to bright attritus, few thick vitrain bands.....	1	10.5
		(183	1.5)
29.	Underclay, medium-dark-gray, silty, carbonaceous in top 1 in., abundant rootlets; base sharp.....	3	3.5
		(186	5)
	Lee Formation Middlesboro Member		
30.	Sandstone, light-gray, fine- to medium-grained, contains 65 percent quartz, 10 percent medium gray siltstone laminae, few rootlets in top 2 in., thin-bedded; base grades.....	2	4
		(188	9)
31.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, few scattered coal laminae, crossbedded, thick-bedded to massive, few contorted beds in top 2 ft; base grades.....	45	7
		(234	4)
32.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, few scattered well rounded white quartz pebbles up to 0.5 in. in diameter in top 10 ft, few scattered coal laminae and stylolites, massive; base grades.....	51	6
		(285	10)
33.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded quartz pebbles up to 0.5 in. in diameter, 1 in. coal clast 13 ft below top, massive; base grades.....	19	2
		(305	0)
34.	Sandstone, white to very light gray, medium-grained, contains 90 percent quartz, few scattered quartz granules and dark mineral grains, abundant well rounded white quartz pebbles up to 0.5 in. in diameter, scattered coal clasts in basal 7 ft 8 in., scattered siderite clasts from 1 ft 6 in. to 3 ft 4 in. above base, few stylolites, massive; base sharp.....	35	8
		(340	8)
35.	Shale, dark-gray to black, carbonaceous, sandy in basal 2 ft 6 in., few siderite beds and nodules up to 2 in. thick, evenly bedded, very fissile; base grades.....	10	9
		(351	5)

Unit Number	Description	Thickness (Depth) ft	in.
36.	Shale, medium-dark- to dark-gray, carbonaceous, sandy in top 6 in., contains 15 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded, burrowed; base grades...	6	5
		(357	10)
37.	Shale, medium-dark- to dark-gray, very carbonaceous at base, contains few siderite beds, few plant fragments, evenly bedded; base sharp.....	3	0
		(360	10)
38.	Underclay, medium-gray, very silty, abundant rootlets and root slicks; base sharp.....	5	7
		(366	5)
39.	Sandstone, medium-light- to medium-gray, very fine to fine-grained, sparsely micaceous, contains 50 percent quartz, abundant small siderite clasts, thick-bedded; base sharp and uneven.....	2	1
		(368	6)
40.	Underclay, medium- to medium-dark-gray, contains few coal fragments, abundant rootlets and root slicks; base grades.....	1	5
		(369	11)
41.	Sandstone, medium-light-gray, very fine to fine-grained, silty, contains 45 percent quartz, scattered medium-dark-gray shale clasts up to 2 in. in diameter; base sharp and uneven.....	1	1
		(371	0)
42.	Shale, medium- to medium-dark-gray, few plant fragments, evenly bedded, fair fissility; base sharp and uneven.....	0	11
		(371	11)
43.	Sandstone, medium-light-gray, fine-grained, silty, contains 45 percent quartz, few medium-dark-gray shale clasts; base sharp.....	0	3
		(372	2)
44.	Shale, medium- to medium-dark-gray, contains 5 percent light-gray siltstone and very fine grained sandstone laminae, few siderite beds, evenly bedded; base sharp and uneven.....	2	6
		(374	8)
45.	Sandstone, medium-light-gray, very fine to fine-grained, finely micaceous, contains 45 percent quartz, 5 percent dark-gray shale and siltstone laminae, cross-laminated, thin- to thick-bedded; base sharp and uneven.....	3	1
		(377	9)
46.	Shale, medium-dark-gray, silty, slightly carbonaceous, evenly bedded; base sharp.....	0	1.5
		(377	10.5)

Unit Number	Description	Thickness (Depth) ft	in.
47.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 65 percent quartz, 15 percent dark-gray shale laminae and beds up to 0.25 in. thick; base sharp.....	2	2.5
		(380	1)
48.	Shale, medium-dark- to dark-gray, carbonaceous, silty, evenly bedded, fair fissility; base sharp and uneven.....	0	3
		(380	4)
49.	Sandstone, light- to medium-light-gray, very fine grained, contains 65 percent quartz, 5 percent dark-gray shale laminae and beds up to 1 in. thick, few small dark-gray shale clasts at base; base sharp.....	1	5
		(381	9)
50.	Shale, medium-dark-gray, contains 10 percent medium-light-gray siltstone laminae, few coal laminae at base, evenly bedded; base sharp.....	0	3.5
		(382	0.5)
51.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, 20 percent dark-gray shale laminae and beds, thin-bedded; base grades.....	0	5.5
		(382	6)
52.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine grained sandstone laminae, evenly bedded.....	1	0.5
		(383	6.5)
53.	Shale, medium-dark-gray, slightly carbonaceous, contains few scattered siderite beds up to 0.75 in. thick, evenly bedded, very fissle; base sharp.....	3	0
		(386	6.5)
54.	Coal, Sewell (?) coal bed, mostly bright attritus, few pyritic fusain laminae, impure in basal 1 in.....	0	8
		(387	2.5)
55.	Underclay, medium-gray, silty, contains few light-gray very fine grained sandstone laminae from 4 in. to 2 in. above base, abundant rootlets.....	2	0
		(389	2.5)
56.	Sandstone, medium-light-gray, very fine grained, silty, contains 45 percent quartz, 5 percent dark-gray shale laminae, few rootlets in top 1 ft 7 in., thin-bedded; base grades.....	2	10
		(392	0.5)
57.	Shale, medium- to medium-dark-gray, evenly bedded, fair fissility; base sharp.....	0	2.5
		(392	3)

Unit Number	Description	Thickness (Depth) ft	in.
58.	Sandstone, medium-light-gray, very fine grained, silty, contains 50 percent quartz, 5 percent dark-gray shale laminae, thin-bedded.	2	0
		(394	3)
59.	Sandstone, medium-gray, very fine grained, silty, contains 45 percent quartz, 40 percent dark-gray shale laminae, thin-bedded...	0	8
		(394	11)
60.	Sandstone, medium-light-gray, fine-grained, contains 45 percent quartz, 20 percent dark-gray carbonaceous shale laminae, thin-bedded.....	2	11
		(397	10)
61.	Shale, medium-gray, sandy at base, evenly bedded; base grades.....	0	9
		(398	7)
62.	Sandstone, medium-light-gray, very fine to fine-grained, contains 65 percent quartz, scattered coal and dark-gray carbonaceous shale laminae, thin- to thick-bedded; base sharp.....	0	11
		(399	6)
63.	Shale, medium- to medium-dark-gray, carbonaceous, contains 40 percent light-gray siltstone and very fine grained sandstone laminae, few coal laminae, evenly bedded; base sharp.....	0	7
		(400	1)
64.	Sandstone, medium-light-gray, very fine to fine-grained, contains 45 percent quartz, 20 percent dark-gray shale laminae in top 1 ft 2 in., cross-laminated, thin-bedded.....	2	8
		(402	9)
65.	Siltstone, medium-gray, argillaceous, contains few light-gray very fine grained sandstone and dark-gray carbonaceous shale laminae, thin-bedded.....	2	8
		(405	5)
66.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 65 percent quartz, thick-bedded.....	0	7
		(406	0)
67.	Shale, medium- to medium-dark-gray, very silty, contains 45 percent light-gray siltstone and very fine grained sandstone laminae, evenly bedded.....	0	8
		(406	8)
68.	Sandstone, light- to medium-light-gray, fine-grained, contains 50 percent quartz, 30 percent dark-gray shale laminae and beds, scattered dark and light mineral grains, thin- to thick-bedded; base sharp.....	9	0
		(415	8)

Unit Number	Description	Thickness (Depth) ft	in.
69.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, few scattered dark mineral grains and dark-gray shale laminae, crossbedded, thick-bedded to massive; base grades	32	4
		(448	0)
70.	Sandstone, white to very light-gray, fine- to medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles, coal clasts and laminae, conglomeratic with abundant well rounded quartz pebbles from 14 ft to 15 ft 6 in. and 35 ft 10 in. to 38 ft 3 in. below top, abundant siderite clasts from 22 ft 3 in. to 25 ft below top, thick-bedded to massive	52	0
		(500	0)
71.	Sandstone, medium-light-gray, fine-grained, contains 65 percent quartz, few well rounded white quartz pebbles, abundant coal laminae and clasts, thin- to thick-bedded, base grades	10	0
		(510	0)
72.	Sandstone, white to very light gray, fine- to medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles up to 0.5 in. in diameter, few dark-gray siltstone laminae, few stylolites, crossbedded, thick-bedded to massive; base grades	15	0
		(525	0)
73.	Sandstone, white to very light gray, medium-grained, contains 90 percent quartz, few scattered dark mineral grains, few scattered well rounded white quartz pebbles, few stylolites, well sorted, thick-bedded to massive; base grades	9	10
		(534	10)
74.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles up to 1 in. in diameter, crossbedded, massive; base grades	15	7
		(550	5)
75.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, conglomeratic with abundant well rounded white quartz pebbles up to 1 in. in diameter, crossbedded, massive; base grades	10	11
		(561	4)
76.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, few scattered dark mineral grains, few scattered well rounded white quartz pebbles in basal 3 ft, scattered stylolites, massive; base grades	10	7
		(571	11)
77.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, very conglomeratic with abundant well rounded white quartz pebbles up to 1 in. in diameter, few stylolites, massive; base grades	17	11
		(589	10)

Unit Number	Description	Thickness (Depth) ft	in.
78.	Sandstone, white, fine- to medium-grained, contains 90 percent quartz, very few dark mineral grains, few well rounded quartz pebbles and granules in basal 1 ft, few stylolites, well sorted, crossbedded, massive; base sharp.....	13	9
		(603	7)
79.	Coal, Little Raleigh coal bed, dull to bright attritus, pyritic, contains 30 percent light-gray fine-grained sandstone beds from 0.25 in. to 3 in. thick; base sharp.....	2	4
		(605	11)
80.	Underclay, medium-dark-gray, abundant rootlets; base sharp.....	4	0
		(609	11)
81.	Sandstone, very light gray, fine-grained, contains 65 percent quartz, thin-bedded.....	0	6
		(610	5)
82.	Underclay, medium-dark-gray, abundant rootlets.....	0	1
		(610	6)
83.	Sandstone, medium-light-gray, fine-grained, micaceous, contains 50 percent quartz, thin-bedded; base sharp.....	0	7
		(611	1)
84.	Shale, black, carbonaceous, few rootlets, poorly bedded, poor fissility.....	0	5
		(611	6)
85.	Underclay, medium-gray, few rootlets; base grades.....	1	4
		(612	10)
86.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 10 percent medium-gray siltstone laminae, thin-bedded; base sharp.....	0	11
		(613	9)
87.	Shale, dark-gray, silty, evenly bedded; base sharp.....	0	6
		(614	3)
88.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, few medium-gray siltstone laminae; base sharp.....	1	4
		(615	7)
89.	Shale, medium-dark- to dark-gray, contains 10 percent light-gray very fine grained sandstone laminae and beds, evenly bedded, fair fissility; base grades abruptly.....	1	8
		(617	3)
90.	Sandstone, light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	0	2
		(617	5)

Unit Number	Description	Thickness (Depth) ft	in.
91.	Shale, medium-dark-gray, black and carbonaceous in basal 4 in., contains 20 percent light-gray siltstone and very fine grained sandstone laminae in top 1 ft 4 in., few siderite beds, evenly bedded, fair fissility; base sharp.....	2	6
		(619	11)
92.	Sandstone, medium-light-gray, very fine to fine-grained, contains 40 percent quartz, 1 in. siderite bed 1 ft 2 in. below top, abundant medium-dark-gray shale clasts from 1 ft to 2 ft below top, thin- to thick-bedded; base sharp.....	3	11
		(623	10)
93.	Shale, dark-gray, carbonaceous, contorted bedding; base sharp.....	0	2
		(624	0)
94.	Sandstone, medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, few scattered siderite and dark-gray shale clasts; base sharp.....	0	7
		(624	7)
95.	Shale, medium-dark-gray, contorted bedding; base sharp.....	0	1
		(624	8)
96.	Sandstone, medium-light-gray, very fine to fine-grained, contains 50 percent quartz, abundant angular medium-dark-gray shale clasts.	1	8
		(626	4)
97.	Sandstone, very light to light-gray, fine-grained, sparsely micaceous, contains 65 percent quartz, scattered discontinuous medium-gray siltstone laminae, thick-bedded; base grades abruptly.	3	8
		(630	0)
98.	Sandstone, very light to light-gray, very fine to medium-grained, micaceous, contains 65 percent quartz, scattered dark mineral grains, few medium-gray siltstone laminae, thick-bedded to massive; base sharp.....	10	1
		(640	1)
99.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, scattered medium-gray siltstone laminae, few scattered dark mineral grains, thick-bedded to massive; base grades.....	17	8
		(657	9)
100.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, few scattered dark mineral grains, scattered well rounded white quartz pebbles in basal 47 ft 4 in., 0.25 in. coal clast 2 ft below top, scattered stylolites, thick-bedded to massive; base grades.....	51	11
		(709	8)
101.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, few scattered well rounded white quartz pebbles and granules in basal 2 ft, few styolites, massive; base grades.....	7	8
		(717	4)

Unit Number	Description	Thickness (Depth) ft	in.
102.	Sandstone, white to very light gray, coarse-grained, contains 90 percent quartz, very conglomeratic with abundant well rounded white quartz pebbles mostly 0.5 in. in diameter, massive; base grades abruptly	5	4
		(722	8)
103.	Sandstone, white to very light gray, medium- to coarse-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles mostly 0.5 in. in diameter, scattered stylolites, massive; base grades	28	3
		(750	11)
104.	Sandstone, white, medium-grained, contains 90 percent quartz, few stylolites, thick-bedded to massive; base sharp	21	7
		(772	6)
105.	Sandstone, light-gray, fine-grained, contains 60 percent quartz, 5 percent discontinuous medium-gray siltstone laminae, thin-bedded; base grades	5	2
		(777	8)
106.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, 25 percent medium-dark-gray siltstone laminae; base grades	3	7
		(781	3)
107.	Shale, medium-dark-gray, silty, contains 15 percent light-gray very fine grained sandstone laminae, evenly bedded, fair fissility; base grades	4	5
		(785	8)
108.	Shale, medium-dark-gray, slightly silty in top 1 ft 6 in., scattered siderite beds, evenly bedded, fissile; base grades	16	5
		(802	1)
109.	Shale, dark-gray, carbonaceous, contains few coal laminae	0	9
		(802	10)
110.	Coal, mostly bright attritus	0	2
		(803	0)
111.	Shale, black, very carbonaceous, very fissile	0	3
		(803	3)
112.	Coal, mostly bright attritus	0	1
		(803	4)
113.	Shale, dark-gray, carbonaceous	0	1
		(803	5)
114.	Shale, medium-gray, contains few plant fragments, fair fissility; base grades	1	0
		(804	5)

Unit Number	Description	Thickness (Depth) ft	in.
115.	Shale, medium-gray, contains 20 percent light-gray very fine grained sandstone laminae, evenly bedded, fair fissility; base sharp.....	1	2
		(805	7)
116.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 20 percent dark-gray shale laminae in basal 1 ft, thin-bedded; base grades.....	3	11
		(809	6)
117.	Shale, medium-dark-gray, micaceous, contains 40 percent light-gray very fine grained sandstone laminae, evenly bedded; base sharp....	1	11
		(811	5)
118.	Sandstone, light-gray, very fine grained, micaceous, contains 40 percent quartz, 20 percent medium-gray siltstone laminae; base grades.....	0	6
		(811	11)
119.	Shale, medium-dark-gray, silty, micaceous, contains 40 percent light-gray very fine grained sandstone laminae, evenly bedded.....	2	4
		(814	3)
120.	Sandstone, light-gray, very fine grained, contains 40 percent quartz, 20 percent medium-gray shale laminae, thin-bedded.....	2	1
		(816	4)
121.	Shale, medium-dark-gray, burrowed in top 6 in., evenly bedded, fair fissility; base grades.....	3	0
		(819	4)
122.	Shale, dark-gray, carbonaceous, contains few coal laminae, fair fissility.....	0	7
		(819	11)
123.	Coal, mostly bright attritus, few thin vitrain bands.....	0	1
		(820	0)
124.	Underclay, medium-gray, abundant rootlets; base grades abruptly...	4	2
		(824	2)
125.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 50 percent quartz, thin- to thick-bedded; base grades abruptly.....	9	6
		(833	8)
126.	Shale, medium-gray, silty, contains few plant fragments, few coal laminae at base, poor fissility; base sharp.....	0	6
		(834	2)

Unit Number	Description	Thickness (Depth) ft	in.
127.	Siltstone, medium-gray, micaceous, faintly bedded; base sharp.....	0	9
		(834	11)
128.	Sandstone, light- to medium-light-gray, very fine to fine-grained, contains 40 percent quartz, thin-bedded; base sharp.....	2	11
		(837	10)
129.	Shale, medium-gray, silty, poor fissility; base sharp.....	0	2.5
		(838	0.5)
130.	Sandstone, light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz; 1 in. medium-dark-gray shale beds at 9 in., 2 ft 1 in. and 3 ft 3 in. below top; thin-bedded; base sharp.....	2	6
		(840	6.5)
131.	Shale, medium-dark-gray, silty, contains 10 percent light-gray very fine grained sandstone laminae and beds, slightly burrowed, evenly bedded, poor fissility; base grades.....	1	6
		(842	0.5)
132.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 30 percent dark-gray shale laminae and beds, thin-bedded.....	6	3
		(848	3.5)
133.	Sandstone, very light gray, medium-grained, contains 65 percent quartz, massive; base sharp.....	2	2.5
		(850	6)
134.	Shale, medium-dark-gray, silty, contains 50 percent light-gray very fine grained sandstone laminae in top 6 in., few plant fragments, evenly bedded, fair fissility; base grades.....	5	0
		(855	6)
135.	Shale, dark-gray, carbonaceous, contains 20 percent coal laminae..	0	4
		(855	10)
136.	Shale, medium-gray, evenly bedded, fair fissility.....	0	3
		(856	1)
137.	Shale, black, carbonaceous, contains 10 percent coal laminae, scattered pyrite nodules up to 1 in. in diameter.....	0	8
		(856	9)
138.	Coal, impure, contains 25 percent dark-gray shale laminae.....	0	7
		(857	4)
139.	Shale, black, carbonaceous, contains 20 percent coal laminae, fair fissility.....	0	11
		(858	3)

Unit Number	Description	Thickness (Depth) ft	in.
140.	Underclay, medium-gray, abundant rootlets; base grades.....	3	1
		(861	4)
141.	Sandstone, light- to medium-light-gray, very fine to fine-grained, micaceous, contains 40 percent quartz, 45 percent medium-dark-gray siltstone and shale beds from 5 in. to 9 in. and 2 ft 6 in. to 3 ft below top; base grades.....	3	8
		(865	0)
142.	Sandstone, light-gray, medium-grained, micaceous, contains 60 percent quartz, scattered dark mineral grains, scattered medium-dark-gray shale clasts in top 6 ft 4 in., crossbedded, thick-bedded to massive, contorted bedding from 10 in. to 11 in. below top; base grades.....	12	7
		(877	7)
143.	Sandstone, very light gray, fine- to medium-grained, contains 90 percent quartz, scattered well rounded white quartz pebbles in basal 38 ft 9 in., massive; base sharp.....	50	7
		(928	2)
144.	Shale, medium-dark-gray, few slickenslided surfaces, evenly bedded, fair fissility; base grades abruptly.....	1	9
		(929	11)
145.	Sandstone, white to very light gray, medium-grained, contains 90 percent quartz, few scattered well rounded white quartz pebbles, few dark mineral grains, few stylolites, abundant coal laminae, thick-bedded to massive; base sharp.....	27	3
		(957	2)
146.	Coal, few thin vitrain bands, dull to bright attrital matrix.....	0	6
		(957	8)
147.	Coal, impure, contains 20 percent dark-gray shale laminae.....	0	3.5
		(957	11.5)
148.	Underclay, medium-gray, abundant rootlets; base grades.....	1	10.5
		(959	10)
149.	Shale, medium-gray, slightly silty, few rootlets, evenly bedded, poor fissility; base grades.....	1	6
		(961	4)
150.	Siltstone, medium-gray, contains 20 percent light-gray very fine grained sandstone laminae in top 6 in., thin and evenly bedded; base grades.....	1	7
		(962	11)
151.	Shale, medium-dark-gray, slightly silty, contains few plant fragments, evenly bedded, fair fissility; base sharp.....	4	10
		(967	9)

Unit Number	Description	Thickness (Depth) ft	in.
152.	Siltstone, medium-gray, sideritic in top 2 in., contains 10 percent light-gray very fine grained sandstone laminae, few plant fragments; base grades.....	2	0
		(969	9)
153.	Shale, medium- to medium-dark-gray, silty in basal 5 in., abundant plant fragments, few siderite nodules 1 ft 4 in. above base, evenly bedded, poor fissility; base grades.....	3	3
		(973	0)
154.	Sandstone, medium-light-gray, very fine grained, micaceous, contains 55 percent quartz, abundant dark mineral grains, thin-bedded; base grades.....	0	4
		(973	4)
155.	Siltstone, medium-gray, finely micaceous, contains 10 percent light-gray very fine grained sandstone laminae, thin-bedded; base grades.....	1	4
		(974	8)
156.	Sandstone, medium-light-gray, very fine grained, micaceous, contains 55 percent quartz, 25 percent dark-gray silty shale beds containing few plant fragments, thin- to thick-bedded; base sharp.....	2	9
		(977	5)
157.	Shale, medium- to medium-dark-gray, contains 10 percent medium-light-gray siltstone laminae in top 2 in., evenly bedded, fair fissility; base grades abruptly.....	10	4
		(987	9)
158.	Shale, medium-dark-gray, slightly silty, contains 15 percent light-gray siltstone and very fine grained sandstone laminae and beds up to 1.5 in. thick, scattered plant fragments, evenly bedded, fair to poor fissility; base grades.....	6	1
		(993	10)
159.	Shale, medium-dark-gray, silty, contains 20 percent medium-light gray siltstone laminae from 1 ft 9 in. to 4 ft below top, abundant plant fragments and pinnules, evenly bedded; base grades.	8	4
		(1002	2)
160.	Shale, dark-gray to black, carbonaceous, contains 5 percent coal laminae, abundant plant fragments, evenly bedded, grades to impure coal in basal 2 in.....	1	0
		(1003	2)
161.	Coal, Little Fire Creek coal bed (thickness- 4 ft 0.5 in.)		
	161a. Coal, thin to thick vitrain bands, bright attrital matrix.....	3	1.5
		(1006	3.5)

Unit Number	Description	Thickness (Depth) ft	in.
161b.	Shale, black, carbonaceous.....	0	0.5
		(1006	4)
161c.	Coal, thin vitrain bands, dull to bright attrital matrix....	0	10.5
		(1007	2.5)
162.	Underclay, medium-gray, sandy from 1 ft 11 in. to 2 ft 3 in. below top and in basal 5 in., abundant rootlets; base grades.....	4	3.5
		(1011	6)
163.	Siltstone, medium-gray, contains 10 percent light-gray very fine grained sandstone laminae and beds, thin- to thick- bedded; base sharp.....	1	9
		(1013	3)
164.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, 25 percent medium-gray siltstone beds in basal 8 in., thin- to thick-bedded.....	1	0
		(1014	3)
165.	Shale, medium-gray, silty, scattered plant fragments and siderite beds, evenly bedded, fair fissility; base grades.....	1	2
		(1015	5)
166.	Silstone, medium-gray, finely micaceous, contains 10 percent light-gray very fine grained sandstone laminae, thin-bedded; base sharp.....	1	7
		(1017	0)
167.	Sandstone, white to very light gray, medium-grained, contains 90 percent quartz, very conglomeratic with abundant well rounded white quartz pebbles, scattered quartz granules, few stylolites, massive; base sharp and uneven.....	19	8
		(1036	8)
168.	Conglomerate, very light gray, contains abundant well rounded white quartz pebbles up to 1.25 in. in diameter, medium- to coarse-grained quartzose sandstone matrix, massive.....	6	5
		(1043	1)
169.	Sandstone, very light gray, medium- to coarse-grained, contains 90 percent quartz, few scattered quartz pebbles up to 0.75 in. in diameter, few scattered dark mineral grains, few coal laminae, scattered stylolites, massive; base grades.....	16	5
		(1059	6)
170.	Conglomerate, very light gray, contains abundant well rounded white to dark-gray quartz pebbles, medium-grained quartzose sandstone matrix, massive; base grades.....	10	8
		(1070	2)

Unit Number	Description	Thickness (Depth)	
171.	Sandstone, very light gray, medium-grained, contains 90 percent quartz, abundant angular shale clasts up to 8 in. thick in basal 8 ft 7 in., scattered well rounded white quartz pebbles, and siderite clasts up to 1.5 in. in diameter, massive; base sharp and uneven	11	7
		(1081	9)
172.	Sandstone, very light gray, fine-grained, contains 90 percent quartz, few stylolites, thick-bedded; base grades	2	11
		(1084	8)
173.	Sandstone, light-brownish-gray, yellowish-gray in basal 4 in., very fine to fine-grained, calcareous, contains 90 percent quartz.	3	3
		(1087	11)
174.	Sandstone, light-gray, very fine to fine-grained, contains 65 percent quartz, 5 percent medium-dark-gray shale laminae; abundant angular dark-gray shale, coal and siderite clasts; abundant well rounded white quartz pebbles up to 0.5 in. in diameter in basal 1 ft, thin-bedded; base sharp	3	9
		(1091	8)
175.	Sandstone, light-gray, fine-grained, contains 50 percent quartz, 10 percent dark-gray shale laminae and beds, few scattered siderite clasts up to 0.25 in. in diamter, thin-bedded	8	7
		(1100	3)
176.	Sandstone, light-gray, fine-grained, contains 65 percent quartz, 5 percent dark-gray shale laminae and beds up to 1.5 in. thick, few scattered siderite clasts, mostly thick-bedded; base grades	6	11
		(1107	2)
177.	Sandstone, very light to light-gray, fine-grained, contains 90 percent quartz, 5 percent dark-gray shale laminae; few siderite clasts, quartz pebbles, and quartz granules from 2 ft 4 in. to 3 ft below top; mostly thick-bedded; base grades	5	6
		(1112	8)
178.	Sandstone, white to very light gray, medium-grained, contains 90 percent quartz, few well rounded white quartz pebbles from 5 ft to 5 ft 5 in. below top; abundant well rounded white quartz pebbles, siderite, coal, and dark-gray shale clasts up to 1 in. in diameter in basal 1 ft; crossbedded, massive; base sharp	11	9
		(1124	5)
	Pocahontas Formation		
179.	Siltstone, medium- to medium-dark-gray, micaceous, thin-bedded; base sharp	0	4
		(1124	9)

Unit Number	Description	Thickness (Depth) ft	in.
180.	Shale, medium-gray, evenly bedded, fair fissility; base sharp.....	1	2
		(1125	11)
181.	Sandstone, light-gray, very fine grained, silty, contains 45 percent quartz, 20 percent medium-dark-gray shale lamainae, cross-laminated, thin and lenticularly bedded; base grades.....	3	6
		(1129	5)
182.	Siltstone, medium-gray, contains well preserved plant pinnules and fragments; base sharp.....	0	3
		(1129	8)
183.	Shale, medium-gray, silty in top 4 in., contains well preserved plant pinnules and fragments, evenly bedded; base sharp.....	1	10
		(1131	6)
184.	Shale, black, carbonaceous, contains 30 percent coal laminae.....	0	1
		(1131	7)
185.	Coal, Pocahontas No. 1 coal bed, thin to thick vitrain bands, bright attrital matrix, few pyrite nodules.....	1	0
		(1132	7)
186.	Underclay, medium- to medium-dark-gray, slightly silty, very carbonaceous in top 2 in., abundant rootlets; base grades.....	2	0
		(1134	7)
187.	Siltstone, medium-gray, sandy in basal 1 ft, thin- to thick-bedded, poor fissility; base grades.....	2	10
		(1137	5)
188.	Shale, medium-dark-gray, silty, contains few plant fragments, fair fissility; base grades.....	1	0
		(1138	5)
189.	Siltstone, medium- to medium-dark-gray, contains few plant fragments; base grades abruptly.....	0	8
		(1139	1)
190.	Sandstone, medium-light-gray, very fine to fine-grained, very silty, contains 40 percent quartz, thin-bedded.....	0	11
		(1140	0)
191.	Shale, medium-gray, silty, contains abundant siderite nodules in basal 4 in., poor fissility.....	0	8
		(1140	8)
192.	Siltstone, medium- to medium-dark-gray, contains 10 percent light-gray very fine grained sandstone laminae, few siderite nodules in top 2 in.....	1	9
		(1142	5)

Unit Number	Description	Thickness (Depth) ft	in.
193.	Sandstone, light-gray, medium-grained, contains 65 percent quartz, scattered dark mineral grains, abundant angular greenish-gray shale clasts from 1 ft 2 in. to 2 ft 2 in. below top, abundant siderite and greenish-gray shale clasts in basal 4 ft 6 in., 3 in. medium-gray siltstone clast 1 ft 6 in. above base..	7	4
		(1149	9)
	UPPER MISSISSIPPIAN SERIES Bluestone Formation Red Member		
194.	Shale, greenish-gray, silty from 2 ft 2 in. to 3 ft 3 in. and 6 ft to 7 ft below top, abundant limestone nodules from 3 ft 3 in. to 6 ft below top, evenly bedded, poor fissility; base grades.....	7	6
		(1157	3)
195.	Sandstone, light-greenish-gray, very fine grained, micaceous, silty, calcareous, contains 40 percent quartz, cross-laminated, thin-bedded; base grades abruptly.....	0	9
		(1158	0)
196.	Shale, greenish-gray, silty, evenly bedded, fair fissility; base sharp.....	0	5
		(1158	5)
197.	Sandstone, light-greenish-gray, very fine grained, very silty, micaceous, contains 45 percent quartz, cross-laminated, thin and unevenly bedded.....	1	7
		(1160	0)
	BOTTOM OF HOLE TOTAL DEPTH 1,160 ft		

GEOPHYSICAL LOG

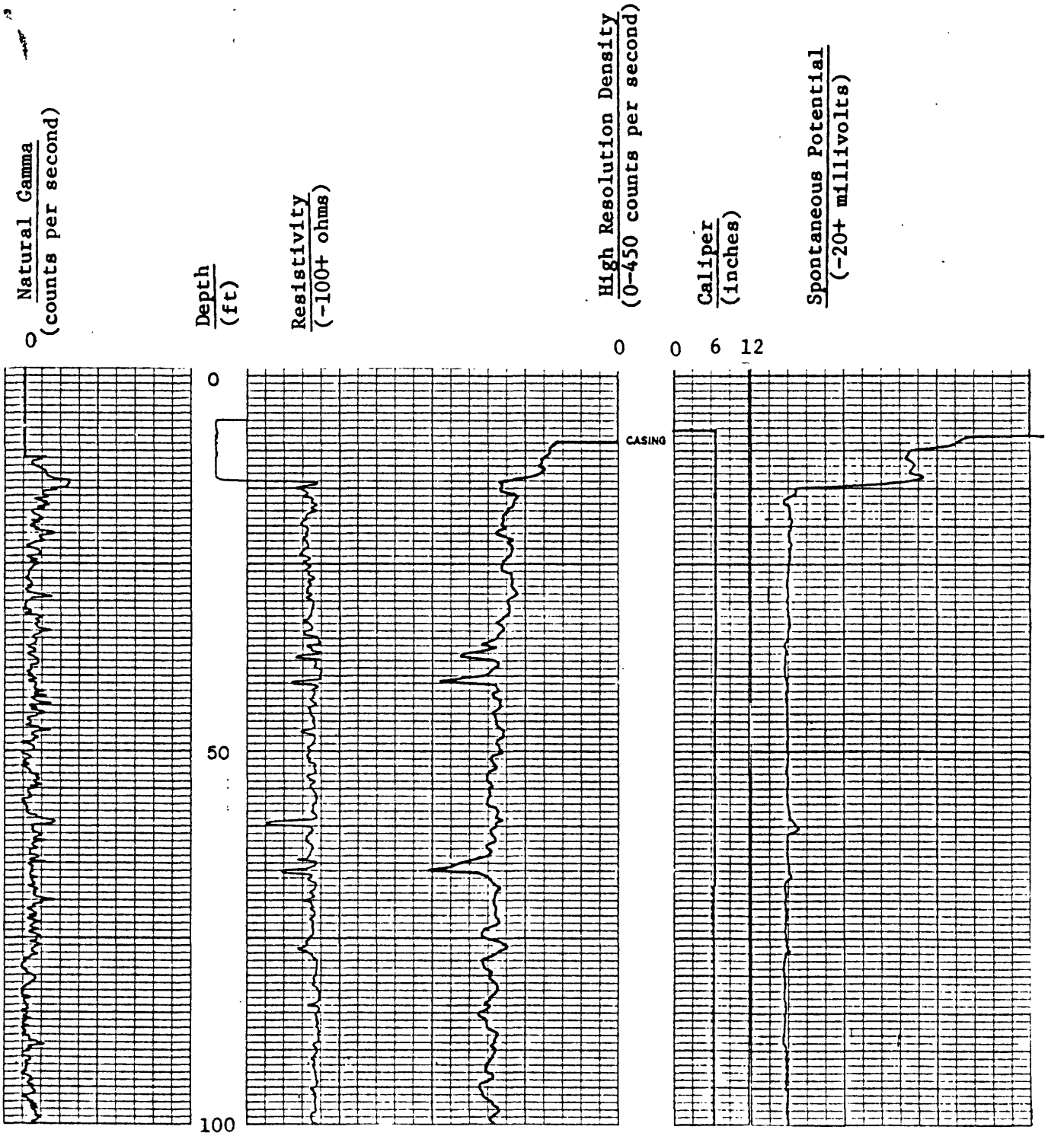
Corehole: SW-11 Date: 1/11/83 State: Virginia County: Lee

Quadrangle: Keokee, Va.-Ky. Latitude: 36°49'23"N Longitude: 82°56'04"W

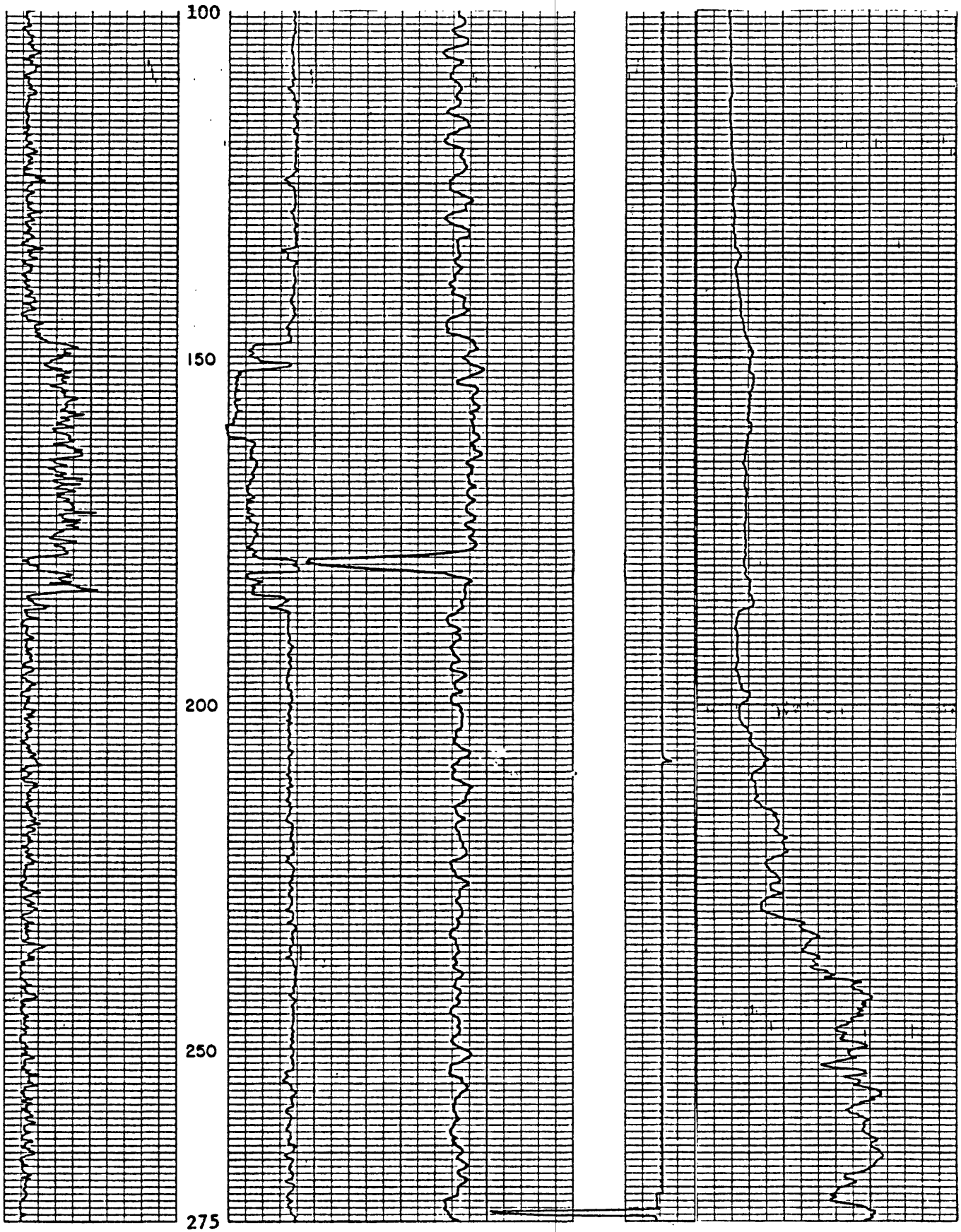
Altitude: 2,220 ft Logged Depth: 1,158 ft Drilled Depth: 1,160 ft

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

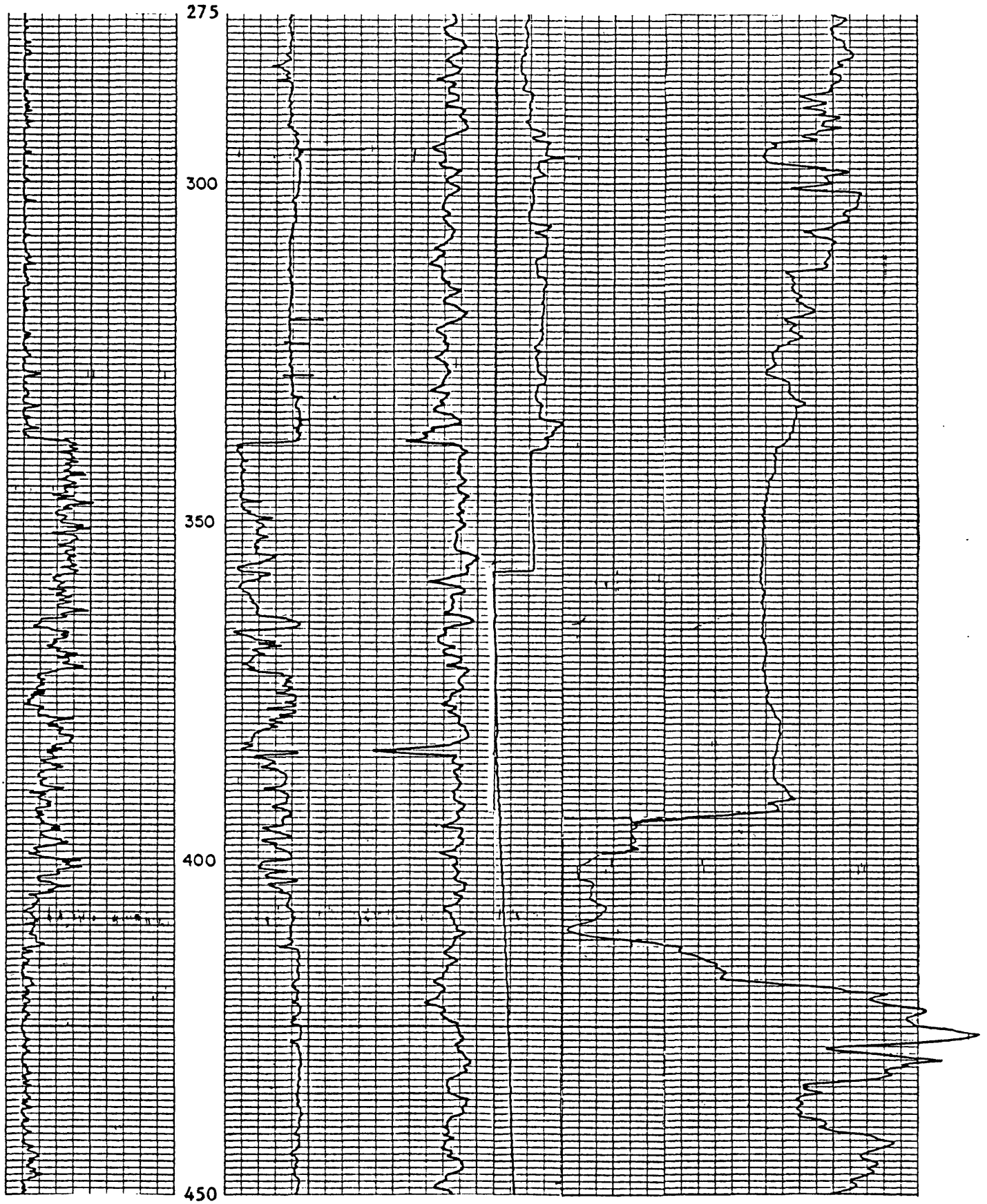
High Resolution Density Time Constant: 1



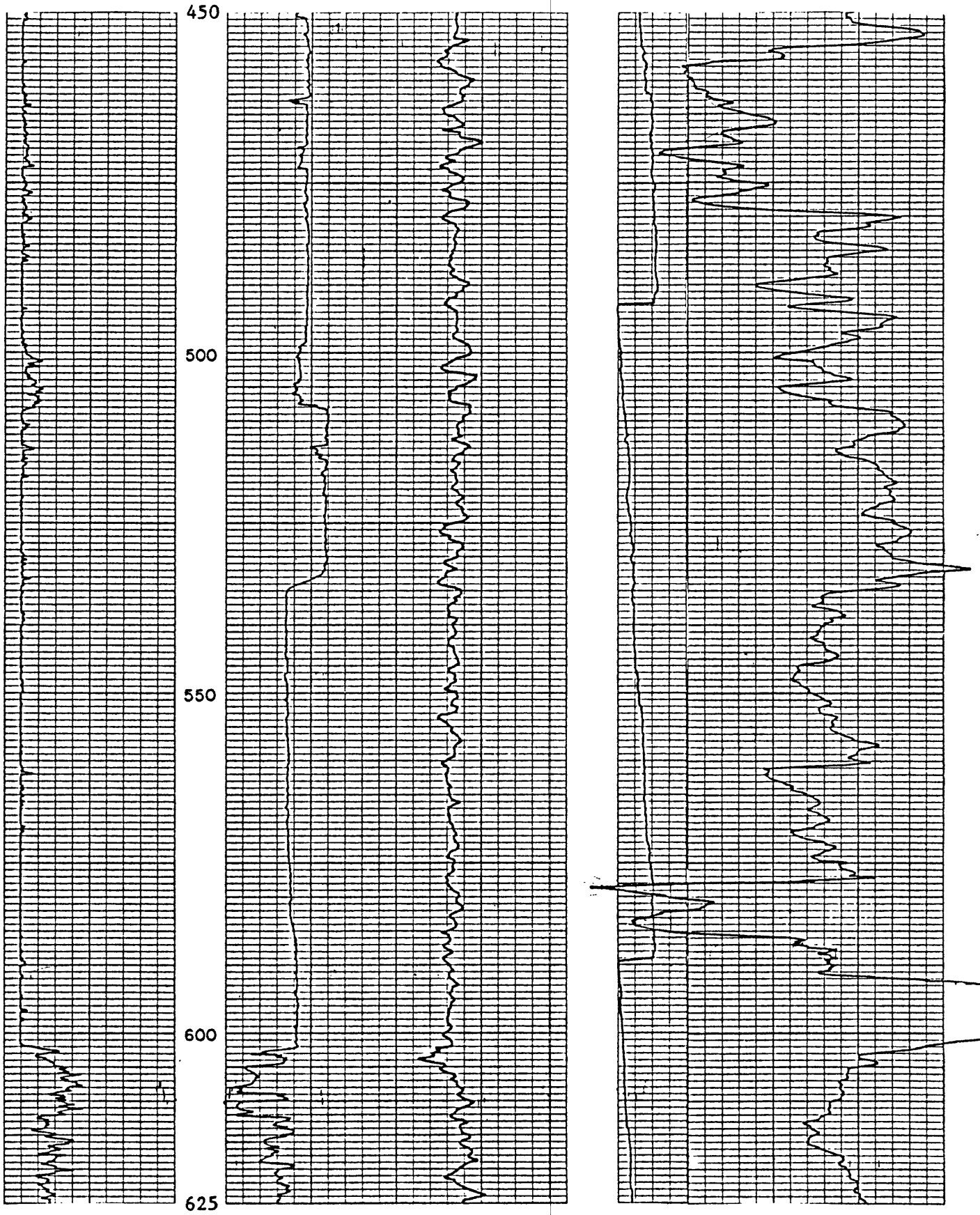
Corehole: SW-11 continued



Corehole: SW-11 continued



Corehole: SW-11 continued



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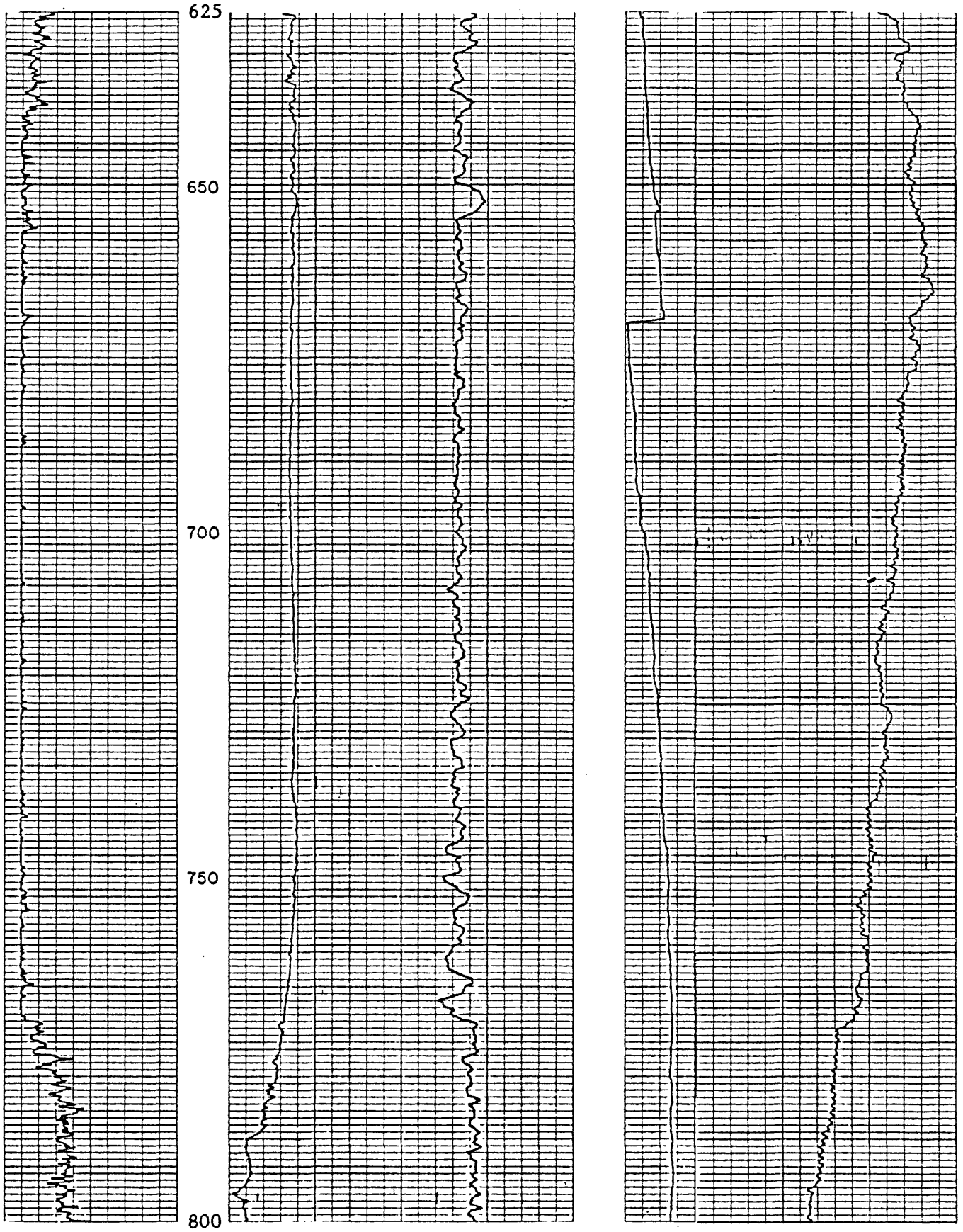

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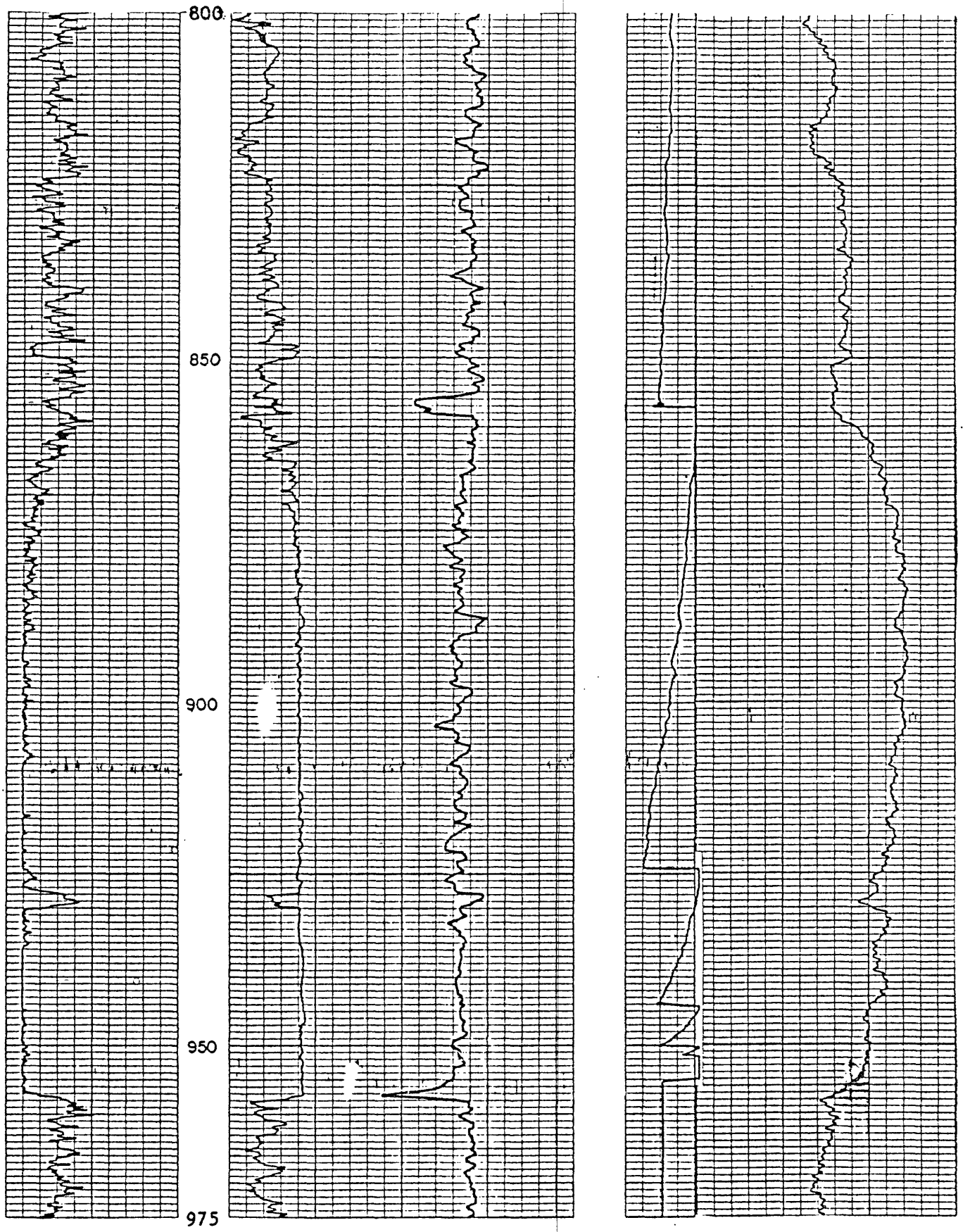
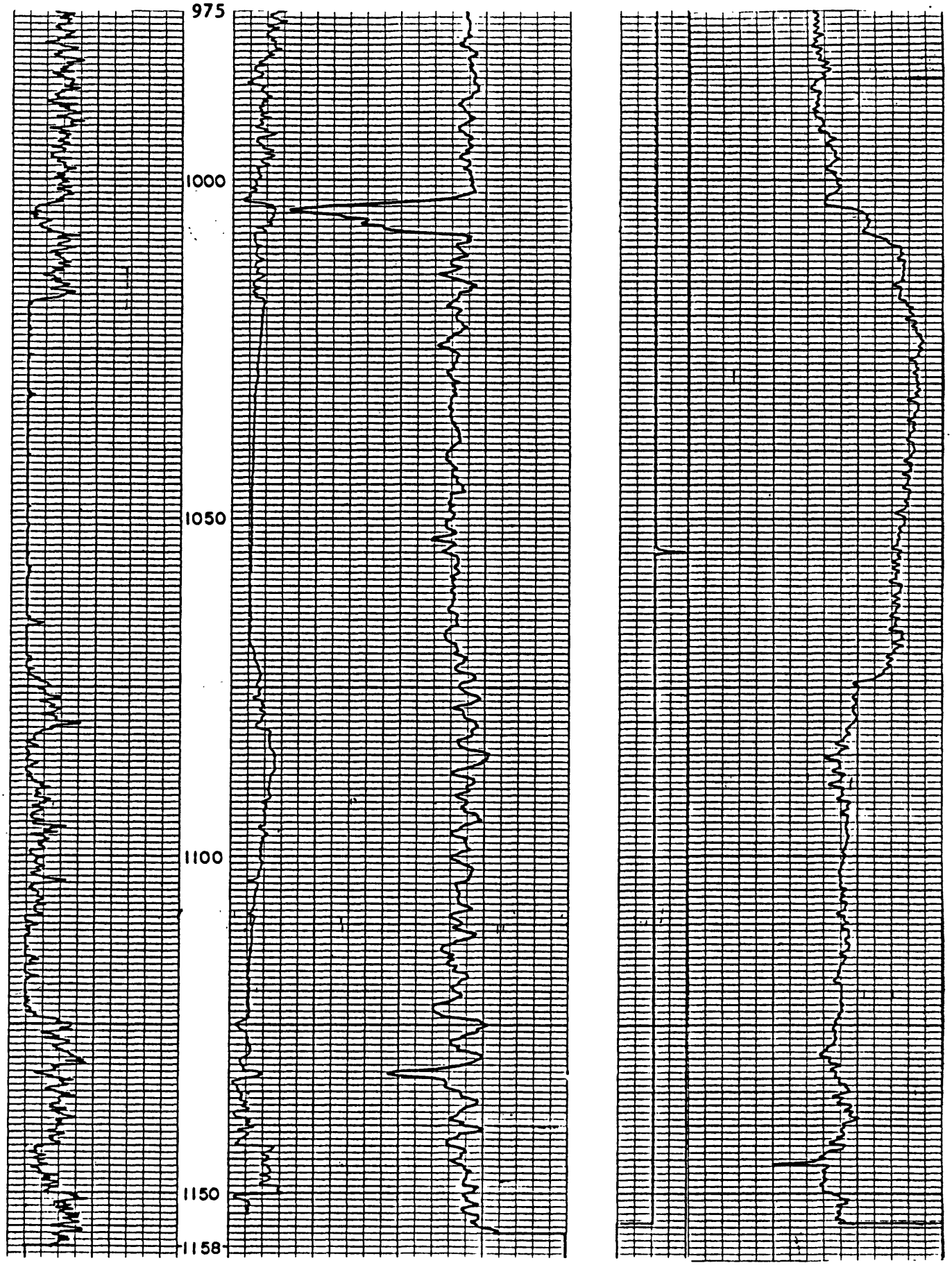
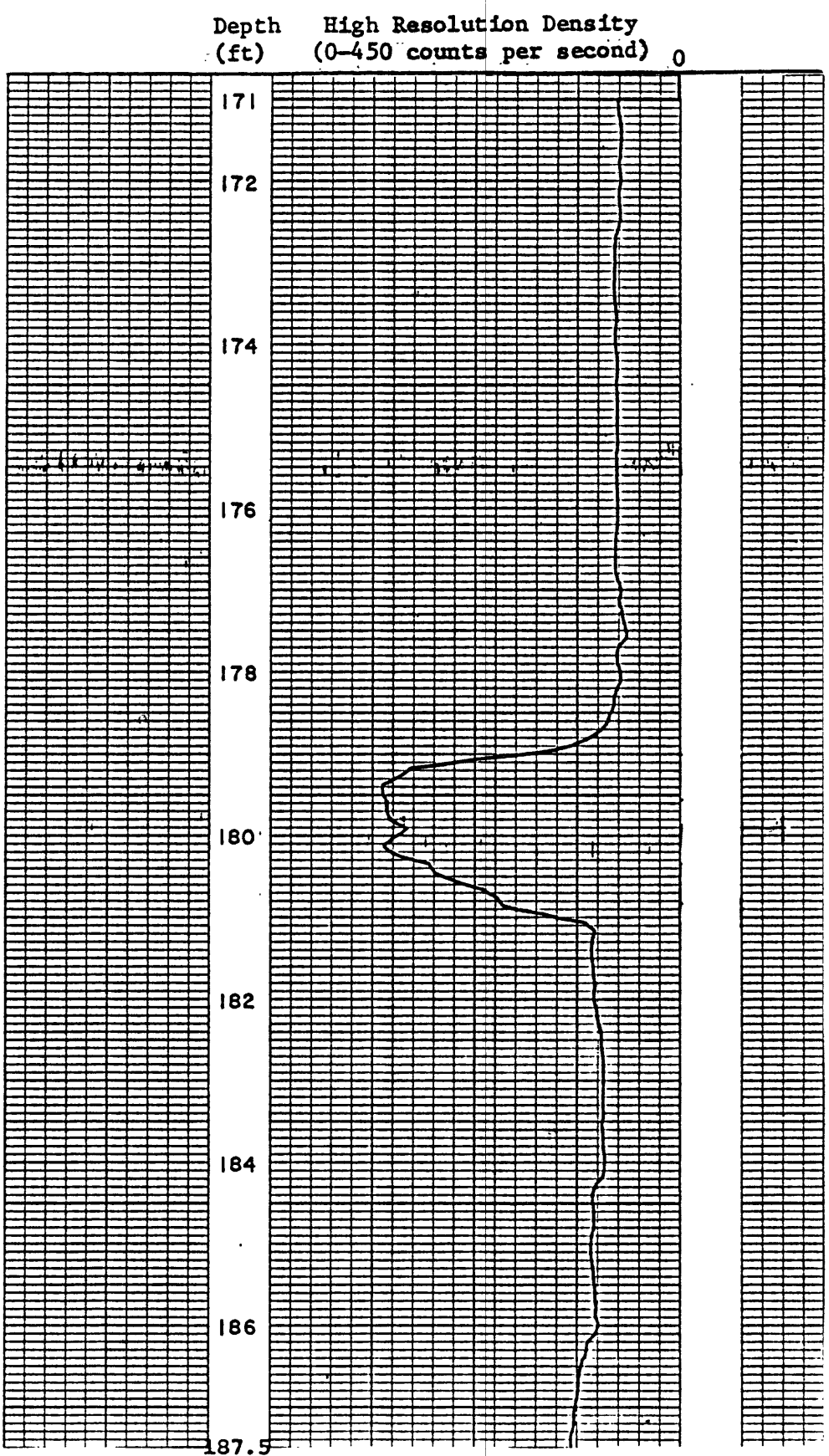


Corehole: SW-11 continued

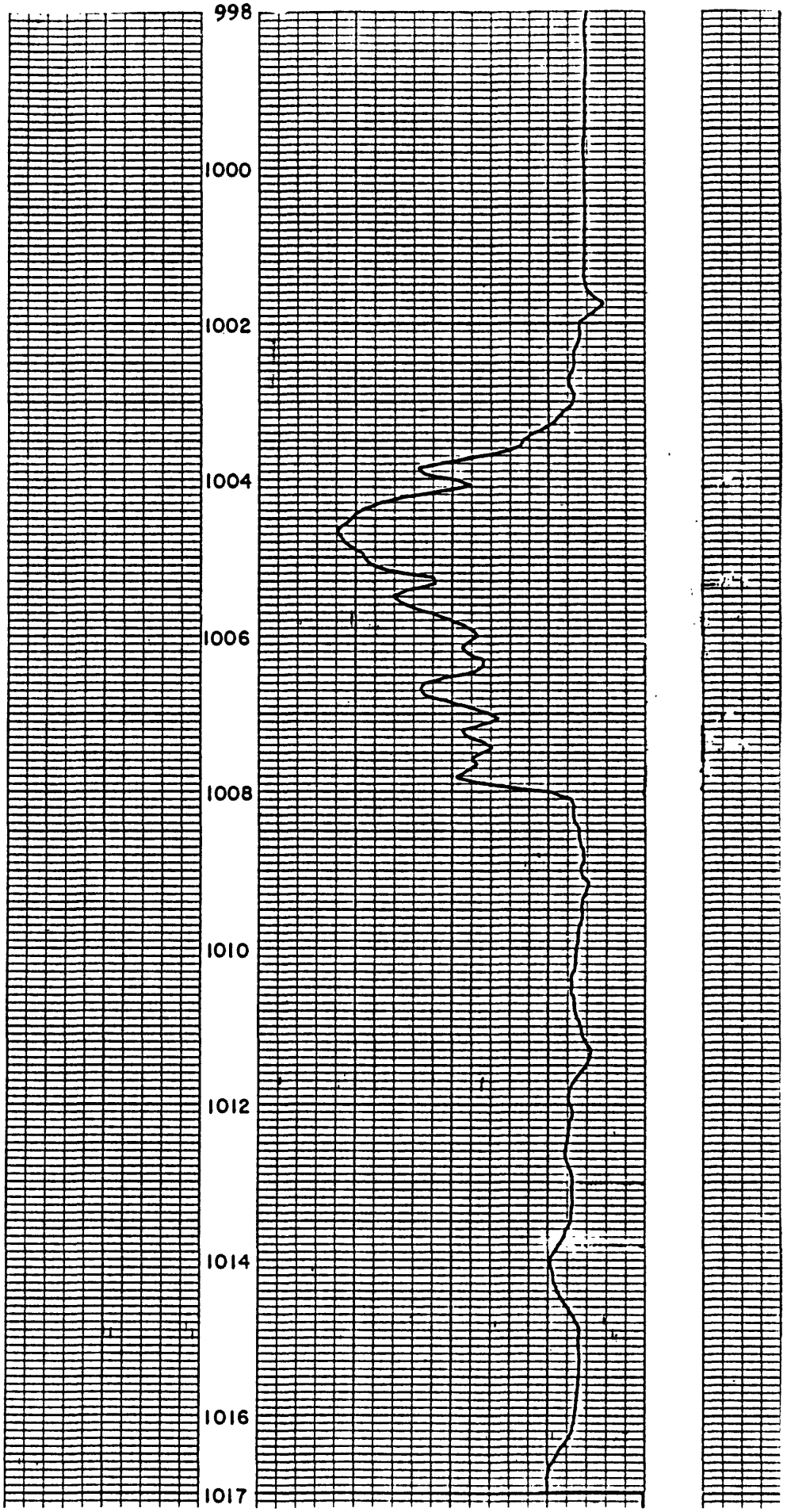


DETAIL LOG

Corehole: SW-11 Logging Speed: 5 ft/min Time Constant: 1



Corehole: SW-11 continued



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