

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Lithologic and geophysical logs of drill holes
BCR-4 and BCR-3 and coal analysis of a 1978 drill
hole BCR-1 in the southern part of the Wasatch
Plateau coalfield, Emery West, Flagstaff Peak, and
Acord Lakes Quadrangles, Sevier County, Utah

By

Joseph D. Sanchez

Open File Report 80-188

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This report is preliminary and has not
been edited or reviewed for conformity
with U.S. Geological Survey standards.

Lithologic and geophysical logs of drill holes BCR-4 and BCR-3 and coal analysis of a 1978 drill hole BCR-1 in the southern part of the Wasatch Plateau coalfield, Emery West, Flagstaff Peak, and Acord Lakes Quadrangles, Sevier County, Utah

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Two holes were drilled in the southern part of the Wasatch Plateau coalfield during a cooperative drilling program between the U.S. Geological Survey (U.S.G.S) and the Utah Geological and Mineral Survey (U.G.M.S.). Other holes drilled in the adjacent area will be described in a report by the U.G.M.S. at a later date.

The two holes, BCR-4 and BCR-3, have the following locations: BCR-4 is in T, 22 S., R. 4 E.; Section 2 and BCR-3 is in T. 21 S., R. 5 E., sec. 21. Both are in Sevier County, Utah (fig. 1).

BCR-4 was drilled to a total depth of 1,040 feet through the Blackhawk Formation (Upper Cretaceous) and into the Star Point Sandstone (Upper Cretaceous). Cores and cuttings were described (p. 8-13) and the hole was geophysically logged (p. 14-19). The cored coal beds were sampled along with their roof rock and floor rock; these samples will be submitted for testing and the results will be presented in a later report.

BCR-3 was drilled to a total depth of 963.4 feet. Cores and cuttings are described on pages 20-26. This hole was drilled through the Blackhawk Formation, but it did not bottom in the Star Point Sandstone owing to problems with the drilling equipment. A geophysical log of the hole was not run; however, this hole was placed 2,000 ft northwest of a rotary hole (W TP-2-EW) previously drilled and geophysically logged by the U.S.G.S. (Blanchard and others, 1977). The drill hole geophysical log for W TP-2-EW (p. 27-33) has

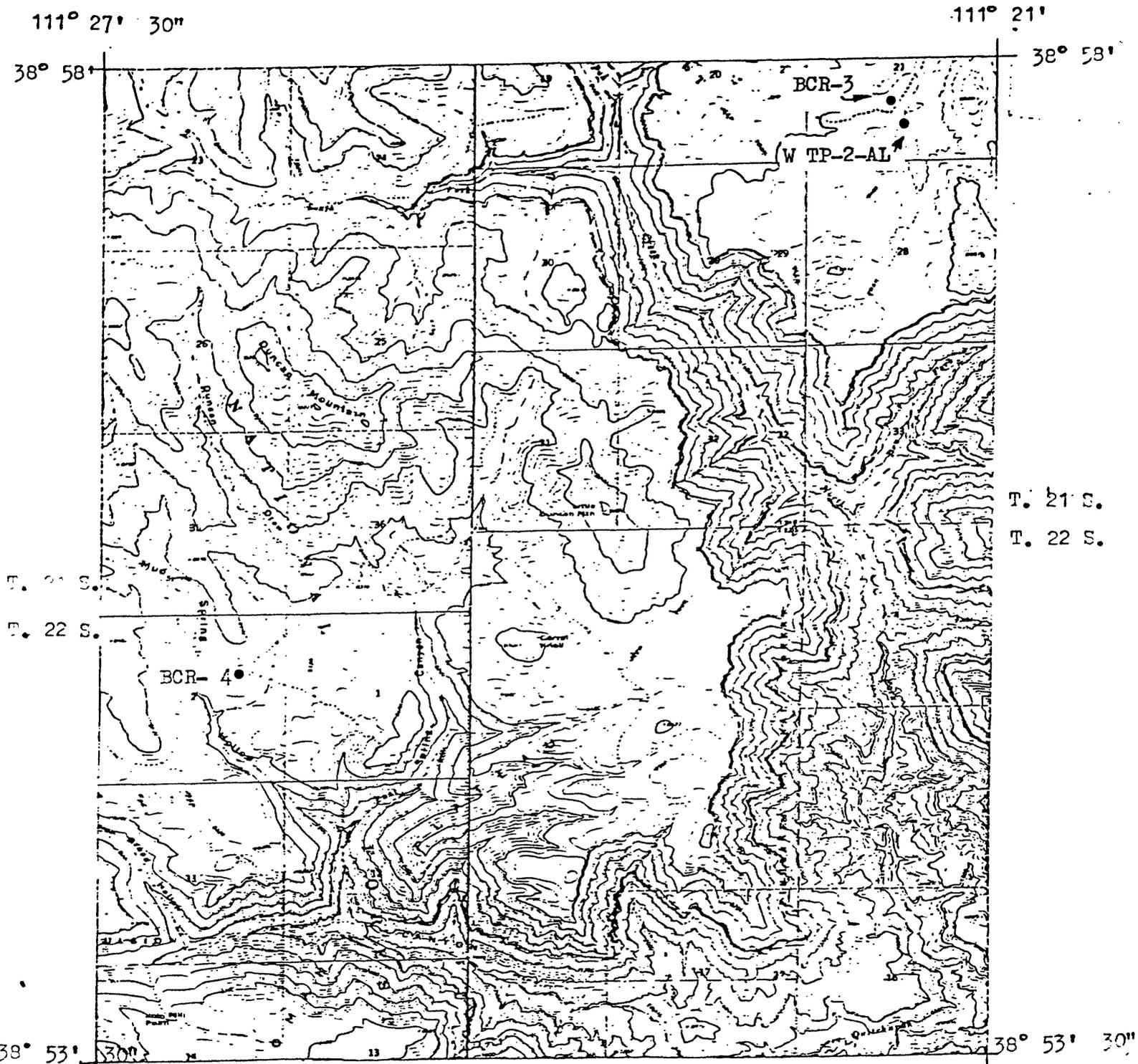
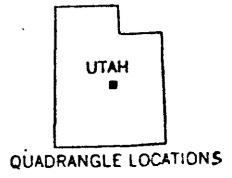
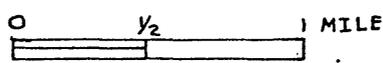


Figure 1. Location of drill holes BCR- 4 (Sec. 2, T. 22 S., R. 4 E.), BCR- 3 (Sec. 21, T. 21 S., R. 5 E.), W TP- 2-AL (Sec. 28, T. 21 S., R. 5 E.), (Base from U.S. Geological Survey Acord Lakes and Emery West quadrangles, Utah.)



been incorporated into this report and was used to help understand the location of coal beds in BCR-3. The coal beds cored in this drill hole were also sampled and will be submitted for testing; results will be published in a later report.

Cuttings descriptions generally are based on samples taken every 10 feet, although a few near-surface samples were collected at 5-foot intervals. These descriptions are very general. Core descriptions are based on the actual core sample.

All rock colors (i.e., cuttings and core) were described using the Geological Society of America (G.S.A.) Rock Color Chart. The G.S.A. Rock Color Chart was used to establish uniformity in the description of rock colors and to allow investigators of this report to relate the colors of the cuttings and cored rock to the G.S.A. rock color chart.

Coal Analysis

Table 1 shows results from analytical tests on coal core collected during the summer of 1978 (Sanchez and Kubatz, 1979) from drill hole BCR-1 (fig. 2), in sec. 32, T. 20 S., R. 6 E., Flagstaff Peak quadrangle, Utah. The results of geochemical analysis for BCR-1 will be presented in a later report.

Conversions to Metric Measures

<u>Symbol</u>	<u>When you know</u>	<u>Multiply by</u>	<u>To find</u>	<u>Symbol</u>
ft	feet	3.281	meters	m
in.	inches	2.54	centimeters	cm
F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius	C
Btu	British thermal units	1.055 x 10 ³	Joules	J

Table 1.—Proximate, ultimate, B.T.U., forms of sulfur, free swelling index, and ash deformation from drill hole BCR-1, T. 20 S., R. 6 E., Sec. 12, Flagstaff Peak Quadrangle, Emery County, Utah

All analysis except Btu and ash deformation are in percent. Forms of analysis: 1, as received; 2, moisture free; 3, moisture and ash free. All analysis by Dept. of Energy, Forrest E. Walker, Chemist-in-Charge

Sample number and footage	Form of analysis	Proximate analysis			Ultimate Analysis							Heating value			Forms of Sulfur			Free Swelling Index	ASH (degree faranheit)	
		Moisture	Volatlie matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Sulfur	Oxygen	Ash	Btu/lb	Sulfate	Pyrtie	Organic	Initial deformation	Softening temp.		Fluid temp.	
C-1 865.1- 872.6 ft	1	8.2	41.1	44.5	6.2	6.5	66.9	1.4	.6	18.5	6.2	.01	.40	.17	2,195 F.	2,345 F.	2,485 F.			
	2	N/A	44.7	48.6	6.7	6.5	66.9	1.4	.6	12.2	6.7	.01	.40	.17						
	3	N/A	47.9	52.1	N/A	6.5	78.1	1.6	.7	13.1	N/A	.01	.46	.20						
C-2 905.7- 907.7 ft	1	6.8	42.1	39.4	11.7	6.0	63.4	1.4	.8	16.7	11.7	.01	.32	.46	2,540 F.	2,650 F.	2,750 F.			
	2	N/A	45.1	42.3	12.6	5.6	68.0	1.5	.8	11.4	12.6	.01	.35	.49						
	3	N/A	51.6	48.4	N/A	6.4	77.9	1.7	1.0	13.1	N/A	.01	.40	.56						
C-3 941.5- 943.6 ft	1	8.4	36.8	42.2	12.6	5.7	61.8	1.2	.7	18.0	12.6	.01	.01	.01	2,430 F.	2,560 F.	2,690 F.			
	2	N/A	40.1	46.2	13.7	5.2	67.5	1.3	.7	11.5	13.7	.01	.36	.35						
	3	N/A	46.5	53.5	N/A	6.1	78.2	1.5	.8	13.3	N/A	.01	.36	.35						
C-4 943.6- 947.8 ft	1	8.5	41.5	44.7	5.3	5.9	68.2	1.3	.7	18.7	5.3	.01	.01	.01	1,980 F.	2,070 F.	2,180 F.			
	2	N/A	45.3	48.9	5.8	5.8	74.5	1.5	.7	12.2	5.8	.01	.30	.42						
	3	N/A	48.1	51.9	N/A	5.7	79.1	1.6	.8	12.9	N/A	.01	.32	.45						
C-5 951.3- 958.2 ft	1	8.4	39.5	42.8	9.3	5.8	64.8	1.2	1.6	17.3	9.3	.01	.01	.01	2,050 F.	2,170 F.	2,260 F.			
	2	N/A	43.1	46.8	10.1	5.3	70.8	1.3	1.7	10.7	10.1	.80	.87	.97						
	3	N/A	48.0	52.0	N/A	5.9	78.8	1.5	1.9	11.9	N/A	.79	.86	.96						

N/A = not applicable

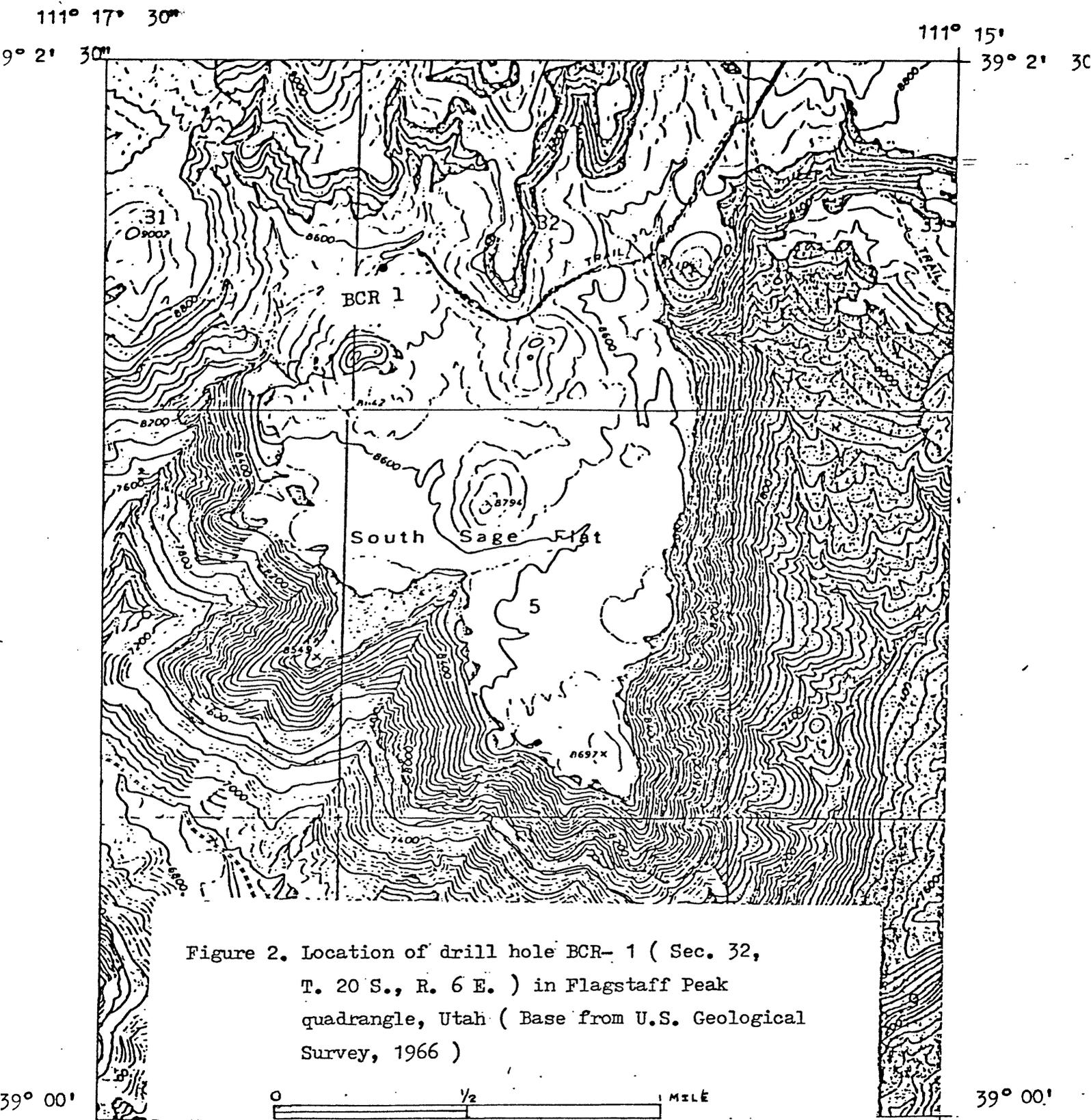
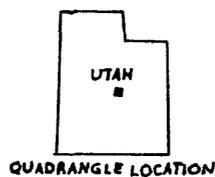
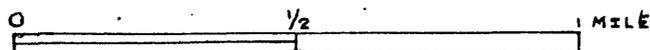


Figure 2. Location of drill hole BCR- 1 (Sec. 32, T. 20 S., R. 6 E.) in Flagstaff Peak quadrangle, Utah (Base from U.S. Geological Survey, 1966)



QUADRANGLE LOCATION

Acknowledgements

Thanks go to Archie Smith and Al Young, Utah Geological and Mineral Survey, for their cooperation and assistance during the drilling of these two drill holes.

Thanks also to Bob Wilson, Geologist for Manti-La Sal National Forest and Darrel Hintze, Minerals Specialist for Fishlake National Forest for their invaluable help during the drilling of these holes.

References

- Blanchard, L. F., Ellis, E. G., and Roberts, J. V., 1977, Lithologic and geophysical logs of holes drilled in the Wasatch Plateau known recoverable coal resource area, Carbon, Emery, and Sevier Counties, Utah: U.S. Geol. Survey Open-File Report 77-133, 32 pages.
- Sanchez, J. D., and Kubatz, M. P., 1979, Lithologic and geophysical log of drill hole BCR-1, sec. 32, T. 20 S., R. 6 E., Emery County, Utah: U.S. Geol. Survey Open-File Report 79-241, 30 pages.

U.S. Geological Survey

Project Area Southern part Wasatch Plateau Coal Field
 Hole No. BCR-4 Geologist J. D. Sanchez
 Type log cuttings and core Elev. 8290 Total depth 1040 ft
 Location 1900 ft. F.N.L., 1300 ft. F.E.L. Sec. 2 T. 22 S. R. 4 E.
 Nearest town Salina County Sevier State Utah Quad. Acord Lakes
 Drilled by: Ironclad Drilling Inc.
 Driller(s): Oscar Dell; helpers, Jerry Swasey and Jim Trusty
 Drill: Falling (Holemaster) 1500 Date start 6/26/79 Complete 7/4/79
 Non-core intervals and size: 5 5/8 inch hole from 0-830 ft., and 963.1 ft.,
to 1,040 ft.
 Cored intervals and size hole: 830 ft. to 963.1 ft., 3 inch core
 Remarks: Drilled into top of Star Point Sandstone (Ksp).

LOG

From	To	Length (feet)	Description (cuttings)
0	5	5	Soil, brownish-gray (5 YR 4/1)
5	10	5	Sandstone, yellowish-gray (5 Y 7/2), very fine- to medium-grained
10	20	10	Sandstone, yellowish-gray (5 Y 7/2), very fine- to medium-grained
20	30	10	Shale, dark-gray (N3), cave-in material
30	40	10	Sandstone, yellowish-gray (5 Y 8/1), fine- to medium-grained
40	50	10	Sandstone, yellowish-gray (5 Y 8/1), fine- to medium-grained
50	60	10	Sandstone, very light-gray (N8), fine- to medium-grained
60	70	10	Sandstone, yellowish-gray (5 Y 8/1), fine- to medium-grained
70	80	10	Sandstone, yellowish-gray (5 Y 8/1), very fine- to fine-grained
80	90	10	Sandstone, yellowish-gray (5 Y 8/1), very fine- to fine-grained
90	100	10	Sandstone, yellowish-gray (5 Y 8/1), very fine- to fine-grained
100	110	10	Sandstone, yellowish-gray (5 Y 8/1), very fine- to fine-grained
110	120	10	Sandstone, yellowish-gray (5 Y 8/1), very fine- to fine-grained
120	130	10	No sample
130	140	10	No sample
140	150	10	Siltstone, light brownish-gray (5 YR 6/1), calcareous
150	160	10	Shale, dark-gray (N3), silty
160	170	10	Sandstone, medium light-gray (N6) to light-gray (N7), very fine grained; some siltstone, medium gray (N5), calcareous
170	180	10	Shale, dark-gray (3)

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LOG

From	To	Length (feet)	Description (cuttings)
180	190	10	Sandstone, very light-gray (8), very fine- to fine-grained
190	200	10	Shale, black (N1), silty
200	210	10	Sandstone, light-gray (N7), very fine- to fine-grained, some siltstone, medium-gray (N5), calcareous
210	220	10	Sandstone, yellowish-gray (5 Y 7/2), very fine- to fine-grained, calcareous
220	230	10	Sandstone, dusky-yellow (5 Y 6/4), very fine- to fine-grained; some shale, dark-gray (N3), carbonaceous, calcareous
230	240	10	Shale, black (N1), carbonaceous
240	250	10	Sandstone, dusky-yellow (5 Y 6/4), very fine- to fine-grained; some siltstone, medium-gray (N5), calcareous
250	260	10	Sandstone, yellowish-gray (5 Y 8/1), very fine-grained, calcareous
260	270	10	Siltstone, light brownish-gray (5 YR 6/1), calcareous
270	280	10	Sandstone, yellowish-gray (5 Y 7/2), fine- to very fine-grained, calcareous
280	290	10	Sandstone, light-gray (7), very fine-grained, calcareous
290	300	10	Siltstone, medium-dark-gray (N4), calcareous
300	310	10	Shale, dark-gray (N3), silty
310	320	10	Sandstone, medium-gray (N5), very fine-grained, shaly
320	330	10	Shale, medium-dark-gray (N4), silty
330	340	10	Sandstone, dusky-yellow (5 Y 6/4), very fine-grained, calcareous
340	620	280	No samples
620	630	10	Sandstone, light-gray (7)
630	640	10	Siltstone, light-gray (N7), calcareous
640	650	10	Siltstone, light olive-gray (5 Y 6/1), calcareous
650	660	10	Siltstone, dark-gray (3), calcareous
660	670	10	Siltstone, light-gray (N7), calcareous
670	680	10	Siltstone, medium-dark-gray, (4), calcareous
680	690	10	Siltstone, medium-dark-gray (4), sandy, calcareous
690	700	10	Siltstone, medium-dark gray (4), sandy, calcareous
700	710	10	Siltstone, medium-gray (N5), calcareous, some sandstone, grayish-orange-pink (5 YR 7/2), fine-grained, calcareous
710	720	10	Siltstone, medium-dark-gray (4), calcareous
720	730	10	Sandstone, light-gray (7), very fine-grained, calcareous
730	740	10	Sandstone, light-gray (N) to grayish-orange-pink (5 YR 7/2) very fine- to fine-grained, calcareous
740	750	10	Sandstone, medium-light-gray (N6), very fine-grained, calcareous
750	760	10	Siltstone, medium-dark-gray (N4), calcareous; some sandstone, light-olive-gray (5 Y 5/2), calcareous
760	770	10	Siltstone, medium-gray (5), calcareous
770	780	10	Shale, black (N1), some siltstone, light-gray (N7), calcareous
780	790	10	Siltstone, medium-light-gray (N6), calcareous, some sandstone, yellowish-gray (5 Y 7/2), calcareous

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LOG

From	To	Length (feet)	Description <u>cuttings</u>
790	800	10	Siltstone, medium-light-gray (N6), calcareous, some sandstone, yellowish-gray (5 Y 7/2)
800	810	10	Siltstone, light-gray (7) to medium-dark-gray (4), calcareous, coal chips, black (N1), calcareous
810	820	10	Sandstone, light-gray (7), very fine-grained; siltstone, black (N1), calcareous; coal chips, black (N1), calcareous
820	830	10	Sandstone, light-olive-gray (5 Y 6/1), very fine- to fine-grained; siltstone, medium-light-gray (N6), fossiliferous leaf impressions; calcareous, coal chips, black (N1)

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LOG

From	To	Length (feet)	Description (core)
Note: Run number 1, from 830.0 ft to 840.2 ft; 10.2 ft received			
830.0	831.1	1.1	Siltstone, interlaminated, very light-gray (N8) to medium-gray (N5), very calcareous
831.1	832.2	1.1	Siltstone, medium-light-gray (6), extensively bioturbated, very calcareous
832.2	836.3	4.1	Sandstone, medium-gray (N5), carbonaceous in part, slightly calcareous
836.3	836.8	.5	Claystone, dark-gray (3)
836.8	840.2	3.4	Siltstone, very light-gray (N8), interlaminated with shale, medium-dark-gray (N4); flow casts throughout, burrowed upper .3, calcareous
Note: Run number 2, from 840.2 ft to 851.7 ft; 11.5 ft received			
840.2	842.4	2.2	Claystone, medium-gray (N5)
842.4	843.3	.9	Claystone, grayish-black (N2)
843.3	845.0	1.7	Siltstone, light-gray (N7), burrowed in upper .4, root casts throughout
845.0	845.9	.9	Claystone, grayish-black (N2)
845.9	851.7	5.8	Siltstone, light-gray (N7) to medium-gray (N5)
Note: Run number 3, from 851.7 ft to 861.0 ft; 9.3 ft received			
851.7	853.7	2.0	Siltstone, medium-light-gray (N6), carbonaceous streaks throughout
853.7	854.7	1.0	Siltstone, medium-dark-gray (4), carbonaceous
854.7	861.0	6.3	Siltstone, very light-gray (N8) to medium-light-gray (N6); fracture (vertical) at 854.7-855.7. Oxidized in upper part. Small amount of burrowing in lower .4

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LOG

From	To	Length (feet)	Description (core)
Note: Run number 4, from 861.0 ft to 874.5 ft; 13.5 ft received			
861.0	863.5	2.5	Claystone, light-gray (7), some coaly streaks, burrowing in lower part interlaminated with some siltstone, black (N1)
863.5	863.8	.3	Claystone, dark-gray (N3), slightly carbonaceous
863.8	864.4	.6	Claystone, medium-gray (5)
864.4	866.4	2.0	Claystone, light-gray (7), burrowing in lower part
866.4	866.5	0.1	Claystone, black (N1), very carbonaceous, pyrite throughout
866.5	871.3	4.8	Siltstone, very light-gray (N8), very calcareous, coaly streaks throughout, burrowing at 867.8-868.2
871.3	872.7	1.4	Claystone, medium-gray (N5) to grayish black (N2), very carbonaceous throughout, amber inclusions at base
872.7	873.1	.4	Siltstone, light-gray (N7), rooted at top
873.1	873.7	.6	Claystone, medium-gray (N5), very silty, burrowed at top (.1), slightly calcareous
873.7	874.5	.8	Claystone, black (N1), carbonaceous with inclusions of amber, calcareous
Note: Run number 5, from 874.5 to 892.0; 17.5 ft received			
874.5	887.5	13.0	Coal, black (N1)
887.5	888.9	1.4	Claystone, medium-dark-gray (4) to grayish-black (N2), rooted very carbonaceous
888.9	890.0	1.1	Siltstone, light-gray (N7), rooted
890.0	892.0	2.0	Core loss
Note: Run number 6, from 892.0 ft to 907.2 ft; 15.2 ft received			
892.0	895.3	3.3	Siltstone, very light-gray (N8), interlaminated with shale, medium-dark-gray (N4), slight calcareous. Pyrite inclusion at top, rooted at top, slightly carbonaceous throughout flow casts (892.2 to 895.3)
895.3	899.2	3.9	Sandstone, medium-light-gray (N6), carbonaceous streaks throughout, vertical fracturing 896.3-899.7
899.2	900.9	1.7	Claystone, light-gray (N7), silty in part interlaminated with flow casts medium-gray (N5), burrowed in part, calcareous
900.9	902.4	1.5	Claystone, medium-gray (N5), pelecypods
902.4	903.1	.7	Coal, black (N1), boney, burrowed
903.1	906.0	2.9	Siltstone, very light-gray (N8), rooted at top, burrowed at 905.1-905.4, carbonaceous streaks throughout, burrowed at 906.3-906.8.
906.0	907.2	1.2	Coal, black (N1), amber throughout, small clayey parting at base

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Project: Wasatch Plateau Coal Field

LOG

From	To	Length (feet)	Description (core)
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Note: Run number 7, from 907.2 ft. to 921.9 ft.; 14.7 ft. received

907.2	912.7	5.5	Coal, black (N1), amber throughout, pyrite in some parts
912.7	913.1	.4	Shale, black (N1), carbonaceous
913.1	916.4	3.3	Siltstone; medium light-gray (N6), slightly carbonaceous
916.4	916.7	.3	Siltstone, medium-light-gray (N6), burrowed float casts
916.7	921.9	5.2	Siltstone, light-gray (7), interlaminated with shale, dark

Note: Run number 8, from 921.9 ft to 937.8 ft; 15.9 ft received

921.9	923.7	1.8	Siltstone, very light-gray (N8) to light-gray (N7), some interlaminated clasts medium-dark-gray (N4) in upper .3, cross-bedding at 922.7-923.4, clay clasts in lower .2, calcareous
923.7	924.4	.7	Siltstone, dark-gray (N3) to light-gray (N7), heavily bioturbated, calcareous
924.4	925.0	.6	Siltstone, medium-light-gray (N6), some shaly streaks, calcareous
925.0	928.2	3.2	Siltstone, light-gray (N7), abundant clay, medium-dark-gray (N4), and siltstone clasts
928.2	931.8	3.6	Sandstone, medium-light-gray (N6), very fine-grained, well rounded, some convoluted structures in upper part, burrow holes are filled with pyrite; sandstone is coarsening downward to a medium-grained sandstone
931.8	931.9	.1	Shale, grayish black (N2), heavily burrowed
931.9	937.8	5.9	Sandstone, very light-gray (N8), fine- to medium-grained upper 4 ft, well-rounded to subrounded, coarsening downward to a medium-grained sandstone, burrows filled with pyrite throughout, some carbonaceous streaks in bottom .5 ft; cross-bedding 933.9-935.9

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LOG

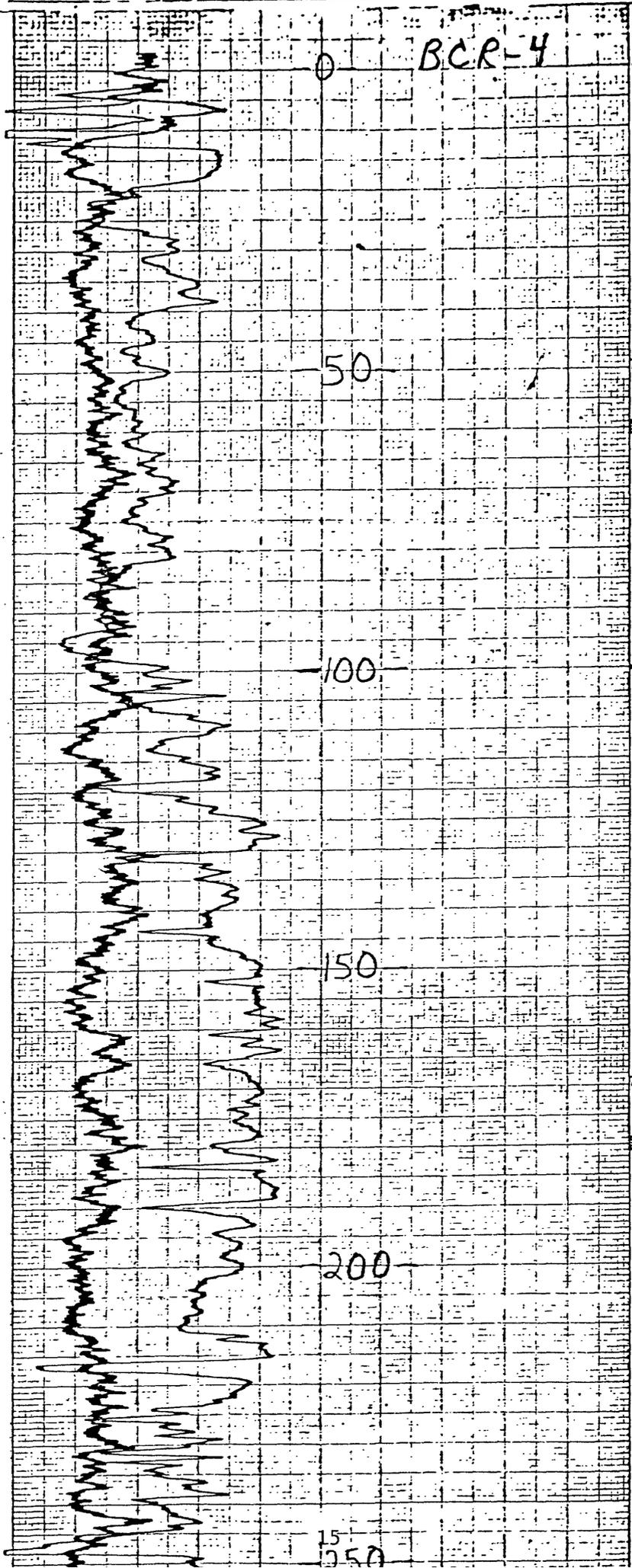
From	To	Length (feet)	Description (core)
Note: Run number 9, from 937.8 ft to 952.4 ft; 14.6 ft received			
937.8	938.2	.4	Claystone, grayish-black (2), abundant pelecypods
938.2	941.5	3.3	Siltstone, medium-light-gray (6) to very light-gray (8), heavy bioturbation throughout section, calcareous
941.5	941.8	.3	Sandstone, medium-light-gray (4), fine-grained, abundant pelecypods, calcareous, carbonaceous
941.8	950.1	8.3	Sandstone, medium-light-gray (N6), fine- to medium-grained, heavy bioturbation
950.1	952.4	2.3	Sandstone, fine grained, very light-gray (N8), calcareous, very fine-grained, well-rounded grains, poorly-sorted
Note: Run number 10, from 952.4 ft to 963.1 ft; 10.7 feet received			
952.4	953.7	1.3	Sandstone, very light-gray gray (N8), fine-grained, slightly carbonaceous
953.7	960.7	7.0	Sandstone, fine-grained, light-gray (N7), upper 4 ft, medium-light-gray (N4) lower part heavily bioturbated
960.7	962.3	1.6	Sandstone, fine grained, medium-dark-gray (N4), some burrowing
962.3	963.1	.8	Siltstone, light-gray (N7), calcareous
Note: 963.1 to 1,040 ft. (cuttings)			
963.1	970.0	6.9	Siltstone, light-gray (N7), coal chips, black (N1)
970.0	980.0	10	Shale, black (N1)
980.0	990.0	10	Shale, black (N1), coal chips, black (N1)
990.0	1000.0	10	Siltstone, medium-dark-gray (N4), calcareous, coal chips black (N1)
1000.0	1010.0	10	Siltstone, medium-dark-gray (N5)
1010.0	1040.0	30	No sample

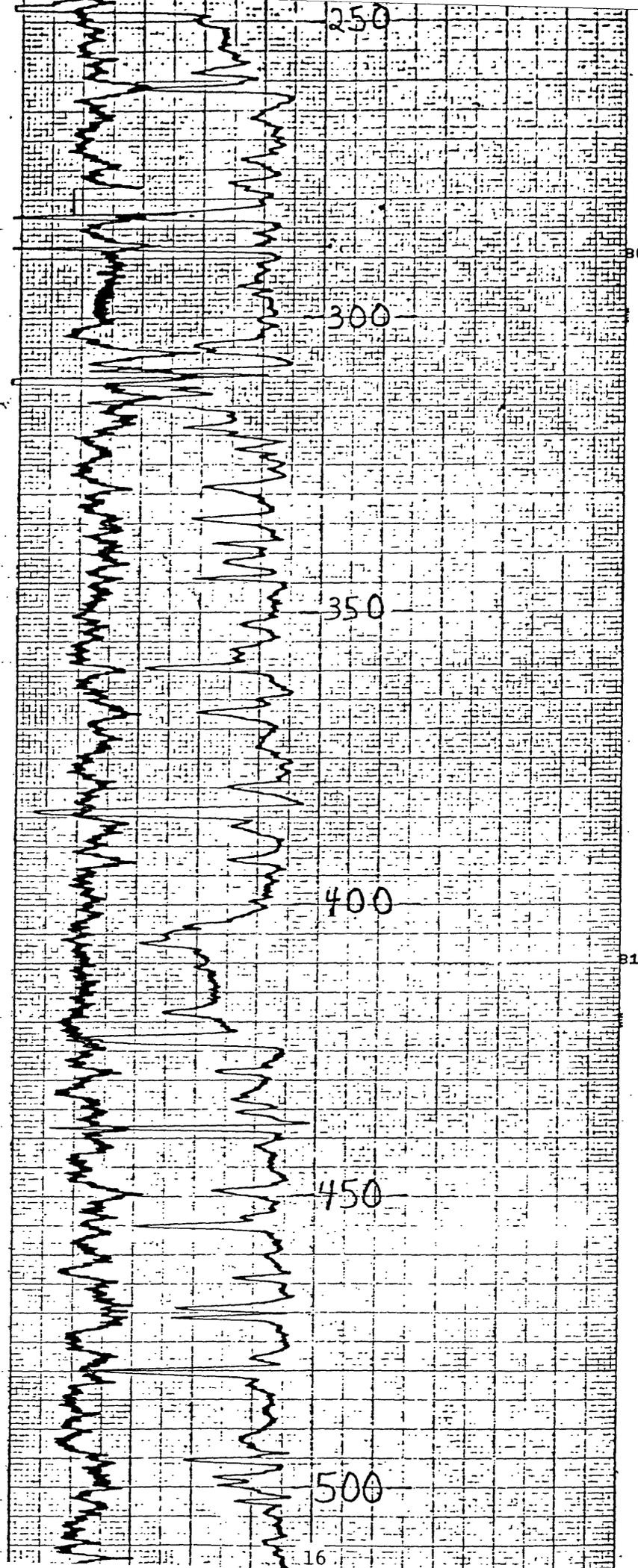
Grand Total for core footage: 830 to 963.1 ft., 133.1 ft. received

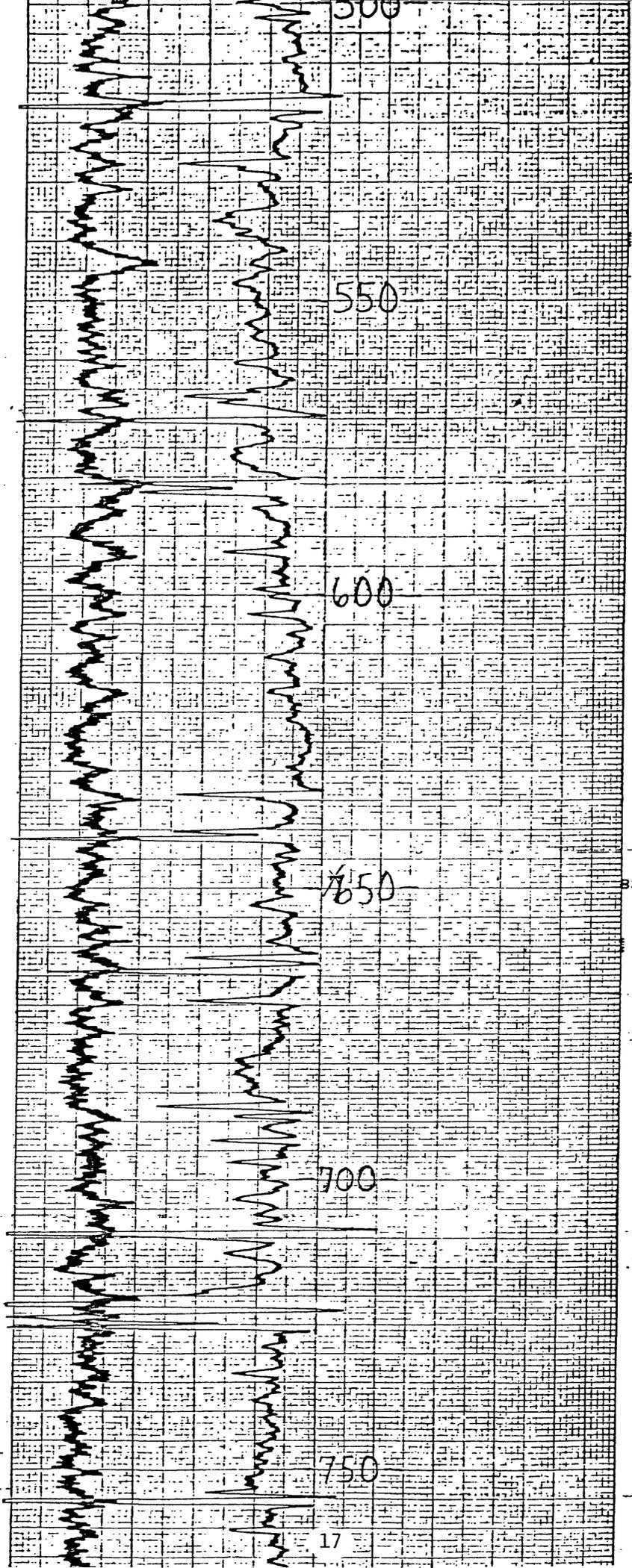
U.S. GEOLOGICAL SURVEY
DRILL-HOLE GEOPHYSICAL LOG

Project Southern Part Wasatch Plateau Coal Field
Hole No. BCR-4 Quadrangle Acord Lakes
Elevation 8,290 ft. Bottom logged interval 1,036
Type fluid in hole H₂O, Foam
Location: T. 22 S., R. 4 E., Sec. 2, 1,650 ft. FNL 1,400 ft. FEL
Logged by: Century Geophysical Corp. Recorded by: D. Ellison
Witnessed by: J. D. Sanchez Date 7/3/79 Drill depth 1,040 ft.
Logging speed 20 ft/min
Geophysical logs: Gamma, Gamma-Gamma Density

BCR-4







750

SHEET

84

800

850

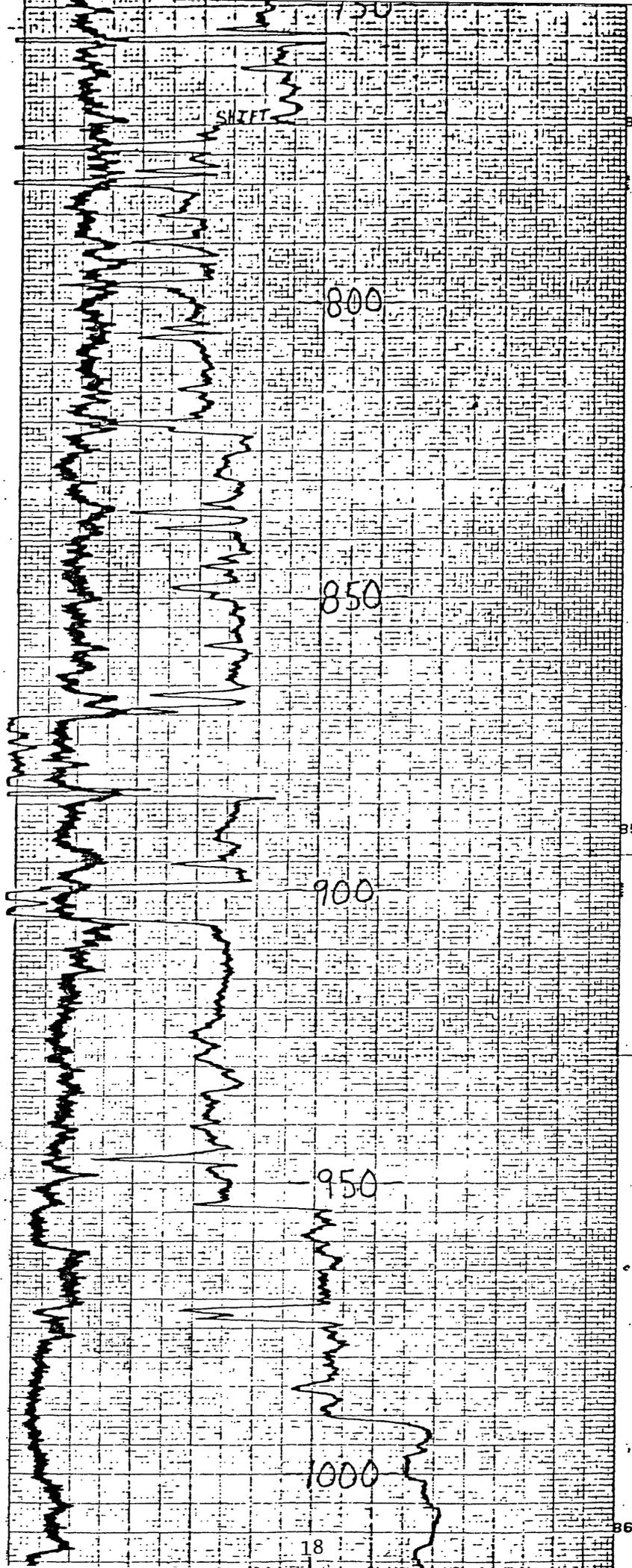
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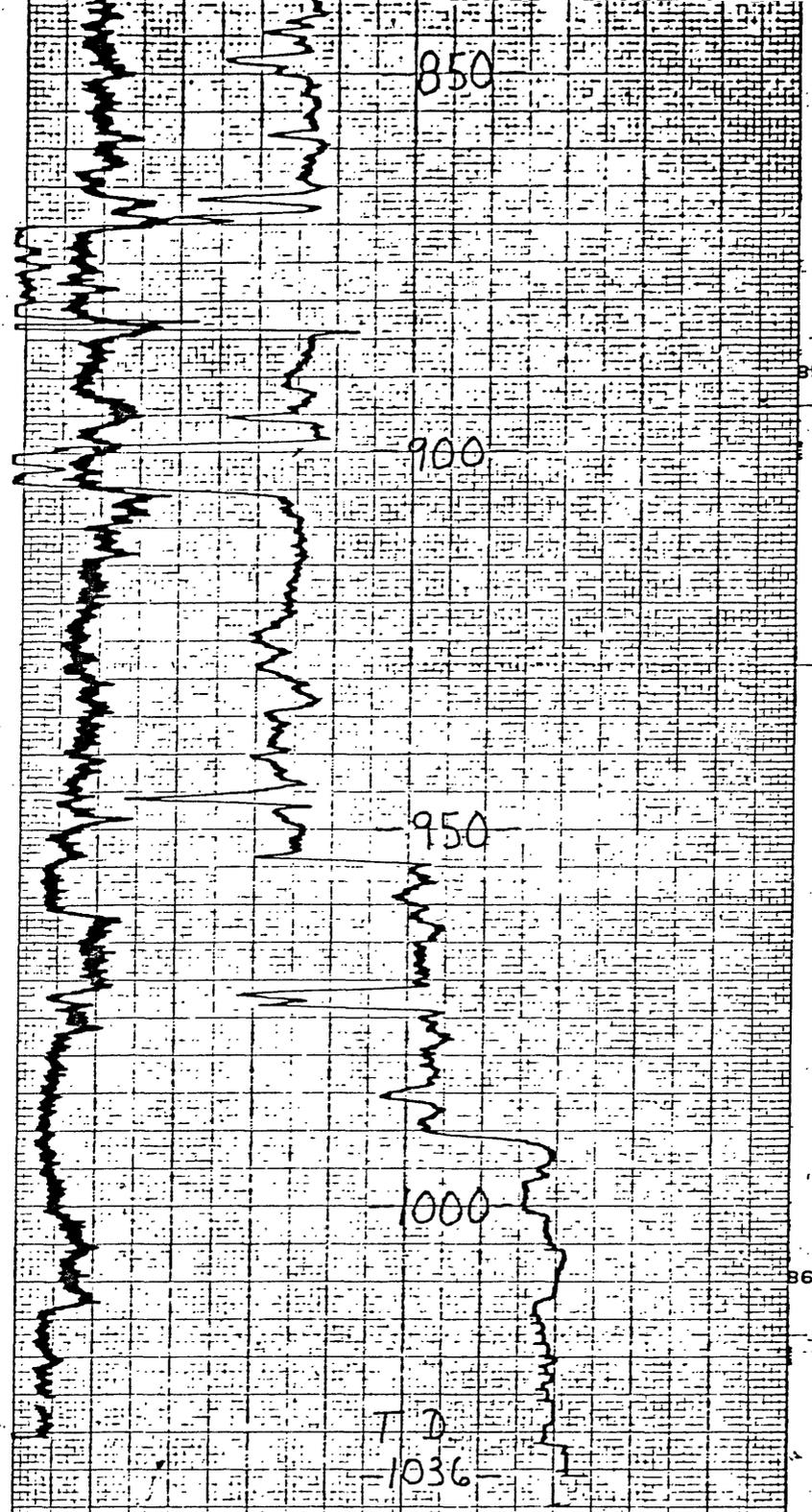
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950

1000

86





GAMMA
50 CPS/IN
20' / MIN
T.C. 1

DENSITY
5 K CPS/IN
20' / MIN
T.C. 0.5

BCR-4

U.S. Geological Survey

Project area Southern part Wasatch Plateau Coal Field
 Hole No. BCR-3 Geologist J. D. Sanchez
 Type log Drill cuttings and core Elev. 8440 Total depth 963.4 ft
 Location 1,650 ft F.S.L., 2,800 ft F.E.L. Sec. 21 T. 21 S. R. 5 E.
 Nearest town Salina County Sevier State Utah Quad. Emery West
 Drilled by: Ironclad Drilling
 Driller(s) Oscar Dell; helpers Jerry Swasey, Jim Trusty
 Drill: Falling (Holemaster) 1500 Date start 7/10/79 Complete 7/18/79
 Non-core intervals and size: 5 5/8 inch hole from 0-850 ft
 Cored intervals and size hole: 850 to 963.4 ft. 3 inch core
 Remarks: Total depth of 963.4 ft. in Blackhawk Formation

LOG

From	To	Length (feet)	Description (cuttings)
0	5	5	Soil, pale-yellowish-brown, (10 YR 6/2) sandstone, light-gray (7), very fine-grained, calcareous
5	10	5	Sandstone, grayish-orange-pink (10 R 8/2), very fine-grained
10	15	5	Sandstone, grayish-orange-pink (10 R 8/2), very fine-grained
15	20	5	Sandstone, grayish-orange-pink (10 R 8/2), very fine-grained
20	30	10	Sandstone, pale-pink (8 RP 8/2), very fine-grained
30	40	10	Sandstone, pale-pink (S RP 8/2) and grayish orange-pink (10 R 8/2), very fine-grained
40	50	10	Sandstone, grayish orange-pink (10 R 8/2), fine-grained, subrounded
50	60	10	Sandstone, grayish orange-pink (10 R 8/2), fine-grained, subrounded
60	70	10	Sandstone, grayish-orange-pink (10 R 8/2), fine-grained, subrounded
70	80	10	Sandstone, grayish-orange-pink (10 R 8/2), fine-grained, subrounded
80	90	10	Sandstone, moderate-orange-pink (5 YR 8/4), medium-grained, subrounded
90	100	10	Sandstone, grayish-pink (5 R 8/2), fine-grained, subrounded to subangular
100	110	10	Sandstone, grayish-pink (5 R 8/2), fine-grained, subrounded to subangular
110	120	10	Sandstone, grayish-pink (5 R 8/2), fine-grained, subrounded to subangular
120	130	10	Sandstone, white (N9) and grayish-pink (5 R 8/2), coarse-grained, subrounded

Hole No.: BCR-3Project: Wasatch Plateau Coal Field

LOG

From	To	Length (feet)	Description (cuttings)
130	140	10	Sandstone, grayish-pink (5 R 8/2), medium-grained, subangular to subrounded
140	150	10	No sample. Fracture?
150	160	10	No sample. Fracture?
160	170	10	Sandstone, pale-yellowish-orange (10 YR 8/6), fine-grained, angular to subangular
170	180	10	Sandstone, pale-yellowish-orange (10 YR 8/6), fine-grained, angular to subangular
180	190	10	No sample. Fracture?
190	200	10	Shale, medium-dark-gray (N4), sandstone, very pale-orange (10 YR 8/2), fine-grained, subrounded, mildly calcareous
200	210	10	Siltstone, very light-gray (8) and dark-gray (3), calcareous
210	220	10	Sandstone, very light-gray (8), very fine-grained, calcareous
220	230	10	Sandstone, very light-gray (8), very fine-grained, calcareous
230	240	10	Siltstone, medium-light-gray (6), calcareous
240	250	10	Siltstone, medium-light-gray (6), calcareous
250	260	10	Siltstone, medium-light-gray (6), calcareous
260	270	10	Siltstone, medium-dark-gray (N4) to very light-gray (N8), calcareous
270	280	10	Siltstone, medium-dark-gray (N4) to very light-gray (N8), calcareous
280	290	10	Siltstone, medium-dark-gray (N4) to very light-gray (N8), calcareous, sandstone, very light-gray (N8), very fine-grained, calcareous
290	300	10	Siltstone, medium-dark-gray (N4) to very light-gray (N8), calcareous
300	310	10	Siltstone, medium-dark-gray (N4) to very light-gray (N8), calcareous
310	320	10	Siltstone, medium-light-gray (N6), calcareous, shale, grayish black (N2), carbonaceous, calcareous
320	330	10	Sandstone, very light-gray (N6), very fine-grained, calcareous, siltstone, medium-gray (5), calcareous
330	340	10	Sandstone, very light-gray (N6), very fine-grained, calcareous
340	350	10	Sandstone, very light-gray (N6), very fine-grained, calcareous
350	360	10	Sandstone, very light-gray (N6), very fine-grained, calcareous
360	370	10	Sandstone, very light-gray (N6), very fine-grained, calcareous
370	380	10	Sandstone, very light-gray (N6), very fine-grained, calcareous
380	390	10	Siltstone, very light-gray (N8) to medium-gray (N5), sandstone, very light-gray (N6), very fine-grained, calcareous

Hole No.: BCR-3Project: Wasatch Plateau Coal Field

LOG

From	To	Length (feet)	Description (cuttings)
390	400	10	Siltstone, very light-gray (8) to medium-dark-gray (4), calcareous
400	410	10	Siltstone, light-gray (7), calcareous
410	420	10	Siltstone, light-gray (7), calcareous
420	430	10	Siltstone, very light-gray (N8) to medium-gray (5), calcareous
430	440	10	Siltstone, very light-gray (N8) to medium-gray (5), calcareous
440	450	10	Siltstone, very light-gray (N8) to medium-gray (5), calcareous, sandstone, white (9), fine-grained, subrounded, mildly calcareous
450	460	10	Siltstone, very light-gray (N8) to medium-gray (5), calcareous, sandstone, white (9), fine-grained, subrounded, mildly calcareous
460	470	10	Siltstone, very light-gray (N8) to medium-dark-gray (4), calcareous
470	480	10	Shale, dark-gray (N3), coal chip
480	490	10	Siltstone, light-gray (7), calcareous
490	500	10	Siltstone, light-gray (7), calcareous
500	510	10	Siltstone, medium-gray (5), calcareous
510	520	10	Siltstone, medium-light-gray (6), calcareous
520	530	10	Shale, black (N1), carbonaceous, some shale chips, dark-gray (3)
530	540	10	Siltstone, very light-gray (N8)
540	550	10	Siltstone, medium-gray (5)
550	560	10	Siltstone, medium-gray (5)
560	570	10	Shale, grayish-black (N2)
570	580	10	✓ Siltstone, medium-light-gray (6)
580	590	10	Siltstone, medium-gray (4)
590	600	10	Siltstone, medium-gray (N5), some sandstone chips, grayish yellow (5 Y 8/4), very fine to fine-grained
600	610	10	Siltstone, medium-light-gray (N6)
610	620	10	Shale, brownish gray (5 YR 4/1), calcareous, some sandstone, light brownish gray (5 YR 6/1), very fine to fine-grained
620	630	10	Shale, medium-dark-gray (N4), some sandstone, light-gray (7), fine-grained
630	640	10	Shale, black (N1), some sandstone, light-gray, (7), fine grained
640	650	10	Shale, dark-gray (N3)
650	660	10	Shale, medium-dark-gray (N4), some sandstone, medium-light gray (N6)
660	670	10	Siltstone, medium-gray (N5), calcareous
670	680	10	Shale, black (N1)
680	690	10	Shale, medium-dark-gray (N5)
690	700	10	Shale, dark-gray (N3)
700	710	10	Shale, medium-dark-gray (N4)
710	720	10	Shale, medium-gray (N5)

Hole No.: BCR -3

Project: Wasatch Plateau Coal Field

LOG

From	To	Length (feet)	Description
720	730	10	Shale, medium-gray (N5)
730	740	10	No sample
740	750	10	Shale, medium-dark-gray (N4), silty, some sandstone, yellowish-gray (5 Y 7/2) very fine- to medium-grained
750	760	10	Shale, medium-dark-gray (N4)
760	770	10	No sample
770	780	10	Shale, medium-dark-gray (4)
780	790	10	Shale, medium-dark-gray (N4), silty
790	800	10	Siltstone, grayish-black (N2)
800	810	10	Siltstone, grayish-black (N2)
810	820	10	Siltstone, medium-dark-gray (4)
820	830	10	Siltstone, medium-gray (N5)
830	840	10	Siltstone, medium-dark-gray (4)
840	850	10	Siltstone, medium-gray (5)

Hole No.: BCR-3

Project: Wasatch Plateau Coal Field

LOG

From	To	Length (feet)	Description (core)
Note: Run number 1, from 850 ft to 865.1 ft; 15.1 ft received			
850.0	851.2	1.2	Coal, black (N1), amber throughout, pyrite in part
851.2	854.0	2.8	Sandstone, light-gray (N7), fine-grained, rooted upper 1.4 ft, calcareous
854.0	857.0	3.0	Siltstone, very light-gray (8), burrow calcareous
857.0	858.0	1.0	Claystone, medium-dark-gray (N4), carbonaceous, calcareous, silty
858.0	859.9	1.9	Siltstone, very light-gray (8), calcareous
859.9	862.9	3.0	Sandstone, very fine-grained, white (N9), ripple marks at top
862.9	865.1	2.2	Siltstone, very light-gray (N8), bioturbated throughout
Note: Run number 2, from 865.1 ft to 869.9 ft; 4.8 ft received			
865.1	867.8	2.7	Siltstone, very light-gray (8), with claystone medium-gray (5) streaks throughout, calcareous bioturbated
867.8	869.9	2.1	Sandstone, light-gray (7), fine-grained, calcareous ripple marks, some carbonaceous streaks
Note: Run number 3, from 869.9 ft to 884.1 ft; 14.2 ft received			
869.9	872.8	2.9	Claystone, light-gray (7), small coal lens upper .2 ft, calcareous, silty throughout
872.8	873.7	.9	Sandstone, medium-light-gray (6), very fine-grained, burrowing calcareous
873.7	874.1	.4	Claystone, dark-gray (N3), coal streaks throughout, calcareous
874.1	878.4	4.3	Siltstone, light-gray (N7), abundant carbonaceous streaks throughout, calcareous fossiliferous
878.4	880.4	2.0	Claystone, dark-gray (N3), carbonaceous throughout
880.4	884.1	3.7	Siltstone, very light-gray (8), clay streaks
Note: Run number 4 from 884.1 ft to 898.3 ft; 14.2 ft received			
884.1	884.5	.4	Claystone, dark-gray (3), burrowing throughout
884.5	885.1	.6	Sandstone, very light-gray (N8), very fine-grained
885.1	886.3	1.2	Siltstone, medium-light-gray (6), silty clay streaks
886.4	888.7	2.4	Siltstone, light-gray (N7)
888.7	891.3	2.6	Siltstone, medium-light-gray, carbonaceous, calcareous clay streaks
891.3	891.8	.5	Claystone, medium-dark-gray (N4), .1 siltstone, light-gray (7) in lower part
891.8	892.8	1.0	Siltstone, light-gray (7), calcareous
892.8	893.5	.7	Siltstone, very light-gray (N8), interbedded with claystone, dark-gray (N3), calcareous
893.5	894.0	.5	Coal, (N1) coal, pyrite throughout, amber throughout
894.0	898.3	4.3	Sandstone, medium-light-gray (6), rooted in upper 3.0

Hole No.: BCR-3

Project: Wasatch Plateau Coal Field

LOG

From	To	Length (feet)	Description (core)
Note: Run number 5 from 898.3 ft to 910.6 ft; 12.3 ft received			
898.3	899.9	1.6	Siltstone, medium-light-gray (6) some carbonaceous streaks, calcareous
899.9	901.1	1.2	Coal, black (N1)
901.1	905.1	4.0	Siltstone, light-gray (N7), slump structure at 903.1
905.1	905.5	.4	Shale, black (N1), carbonaceous
905.5	906.4	.9	Siltstone, medium-light-gray (6), carbonaceous, some pyrite
906.4	906.7	.3	Shale, dark-gray (N3), carbonaceous silty
906.7	907.6	.9	Siltstone, grayish-black (N2), carbonaceous calcareous
907.6	908.9	1.3	Siltstone, light-gray (7), carbonaceous, calcareous silty throughout
908.8	910.6	1.7	Siltstone, light-gray (N7), bioturbation throughout, some ripple marks at base
Note: Run number 6, from 910.6 ft to 919.9 ft; 9.3 ft received			
910.6	913.4	2.8	Siltstone, medium-light-gray, calcareous, carbonaceous throughout, plant fossils throughout, .1 shale, dark-gray (3) at 909.7, bioturbated lower .8 ft
913.4	913.7	.3	Shale, gray black (N2), coal streaks throughout, amber
913.7	914.7	1.0	Siltstone, light-gray (N7), rooted in upper .3 ft, calcareous transition with lower unit, slump structure at base
914.7	915.6	.9	Sandstone, light-gray (7), fine-grained, carbonaceous, calcareous
915.6	916.7	1.1	Siltstone, medium-light-gray (5), calcareous, carbonaceous, preserved vertical .3 ft plant fragments at base
916.7	917.8	1.1	Shale, grayish-black (N2), amber throughout, pyrite throughout and coaly vitram throughout
917.8	919.9	2.1	Siltstone, medium-light-gray (N6), rooted upper foot, ripple marks at base, calcareous, vertical fracture in total unit
Note: Run number 7, from 919.9 ft to 935.4 ft; 15.5 ft			
919.9	924.9	5.0	Siltstone, light-gray (N7), convoluted bedding throughout, ripple marks at base
924.9	926.5	1.6	Sandstone, medium-light-gray, calcareous, carbonaceous throughout, transition with upper unit
926.5	926.7	.2	Coal, black (N1), amber throughout
926.7	927.4	.7	Siltstone, medium-gray (5), calcareous, carbonaceous
927.4	927.7	.3	Shale, dark-gray (3), flaky
927.7	931.3	3.6	Siltstone, light-gray (N7), carbonaceous, convoluted bedding in lower part
931.3	931.5	.2	Shale, medium-dark-gray (N4)
931.5	935.4	3.9	Coal, black (N1) amber throughout, aragonite in part

Hole No.: BCR-3

Project: Wasatch Plateau Coal Field

LOG

From	To	Length (feet)	Description (core)
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Note: Run number 8, from 935.4 ft to 948.2 ft; 12.8 ft

935.4	942.1	6.7	Coal, black (N1)
942.1	948.2	6.1	Siltstone, medium-gray (N5)

Note: Run number 9, from 948.2 ft to 963.4 ft; 15.2 ft

948.2	962.1	13.9	Sandstone, reddish-gray (N5), medium- to coarse-grained, well-rounded grains
962.1	963.4	1.3	Coal, black (N1)

GRAND TOTAL for core footage From 850.0 ft to 963.4; 113.4 ft received

U.S. GEOLOGICAL SURVEY
DRILL-HOLE GEOPHYSICAL LOG

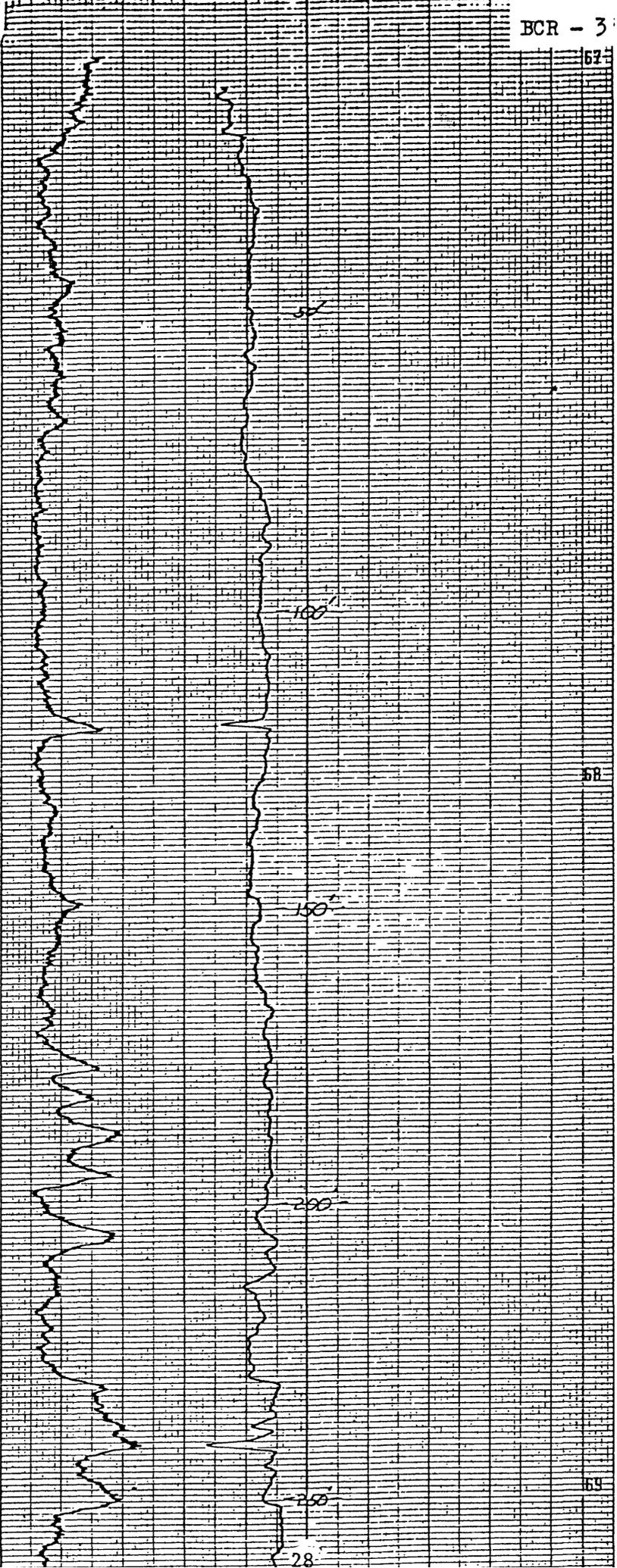
Project Southern Part Wasatch Plateau Coal Field; Utah
Hole No. W-TP-2-EW Quadrangle Emery West
Elevation 8,475 ft Bottom logged interval 1193 ft
Type fluid in hole H₂O and mud
Location 21 S., R. 5 E., Sec. 28, 150 ft FNL 3,250 ft FWL
Logged by: Century Geophysical Corp. Recorded by: Hollander
Witnessed by: L. Blanchard Date _____ Drill depth 1,193 ft
Logging speed 20 ft/min
Geophysical logs: Density, Gamma, Spontaneous Potential, Resistivity

BCR - 3

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CENTURY GEOPHYSICAL CORP. TULSA, OKLAHOMA, U.S.A. CHART W5110



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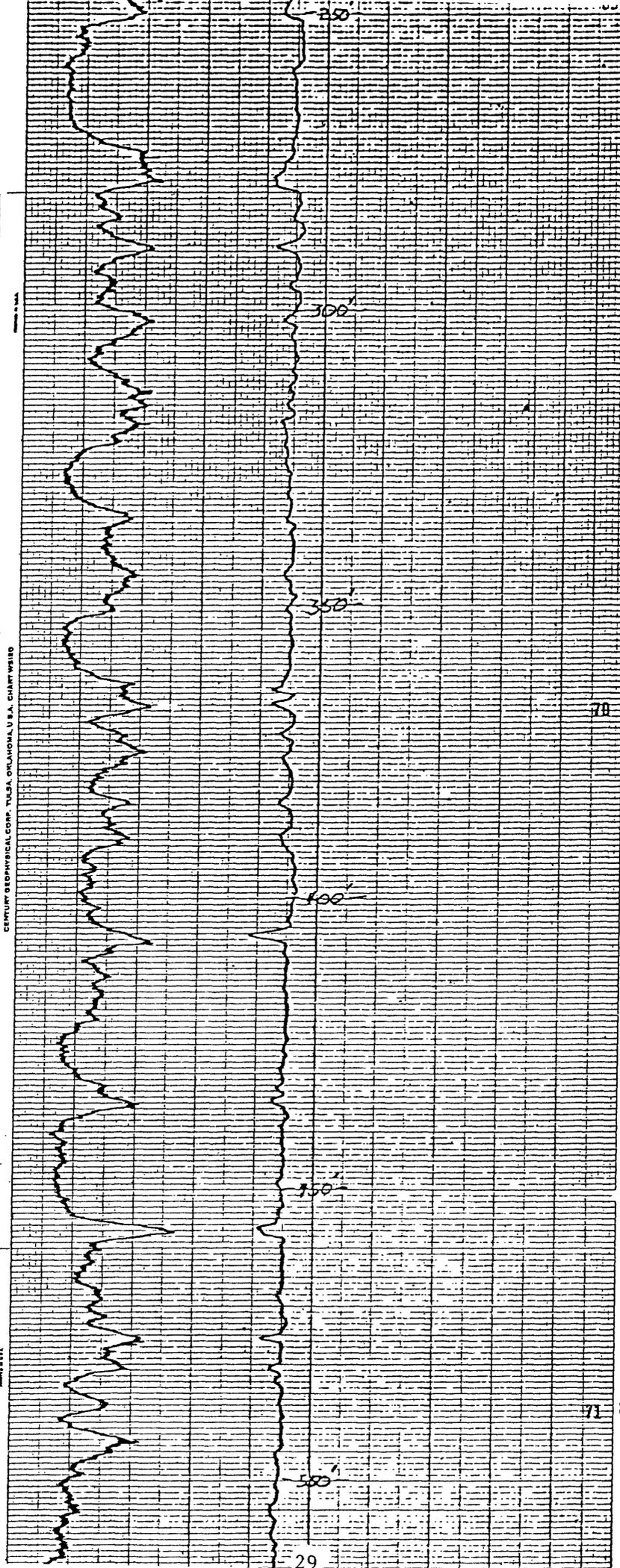
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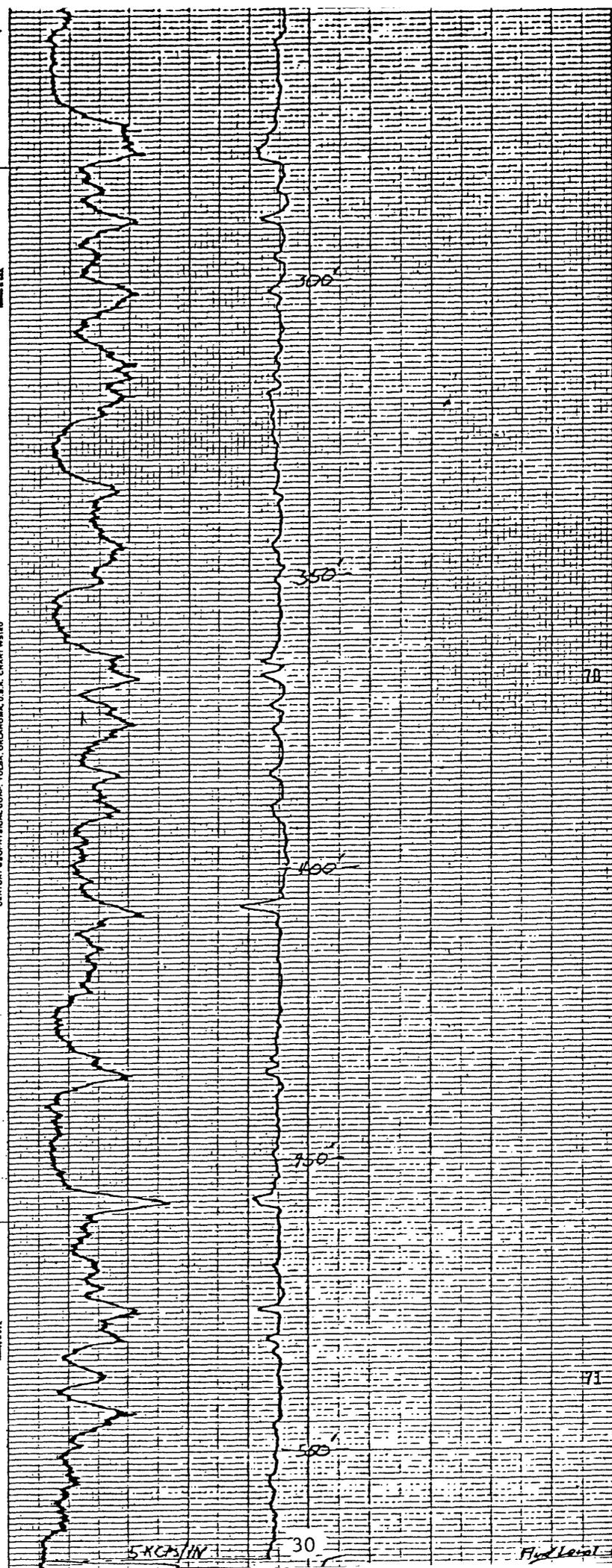
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CENTURY GEOPHYSICAL CORP. TULSA, OKLAHOMA, U.S.A. CHART W510



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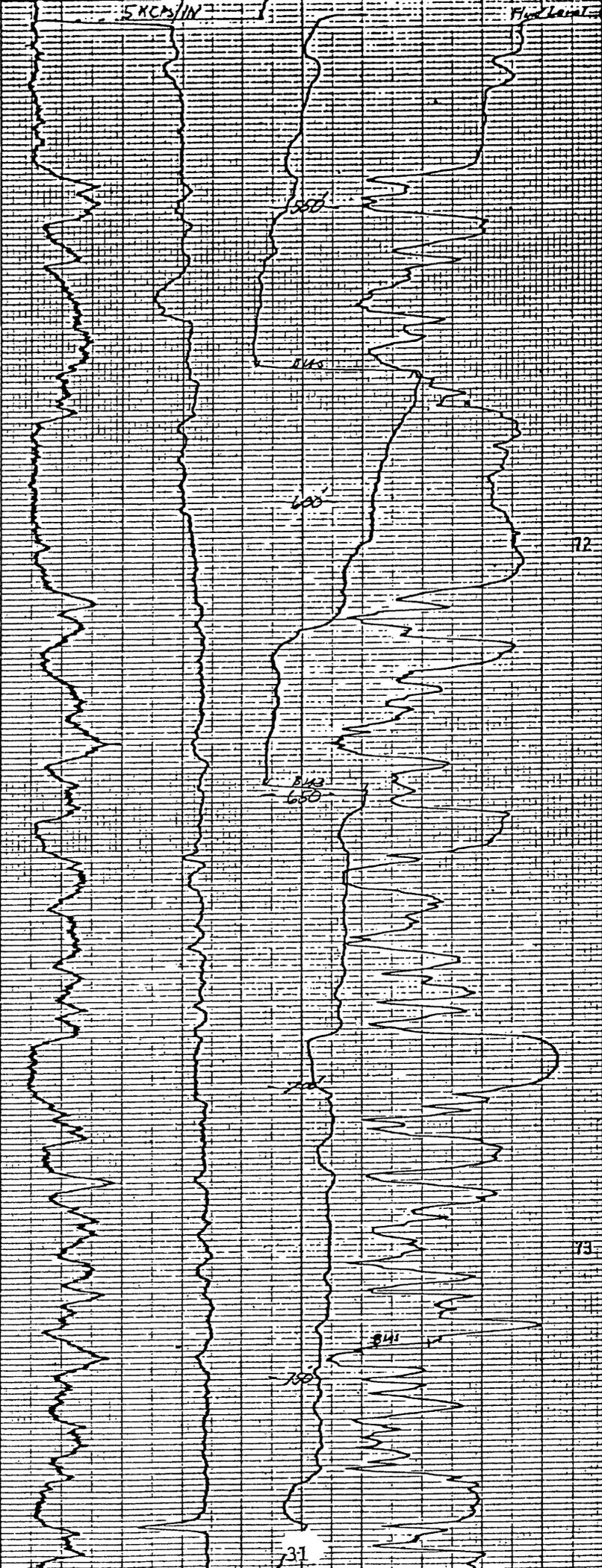
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5 CM/IN

Flux Level



500

600

650

700

750

72

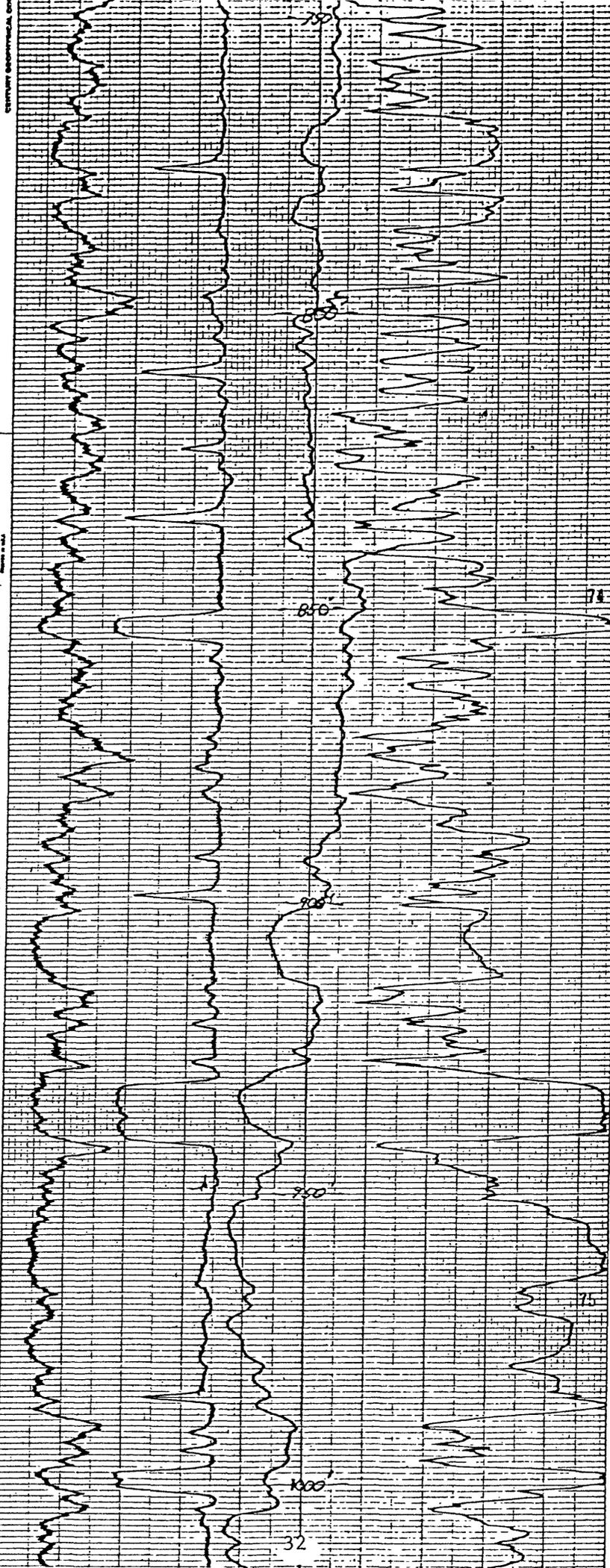
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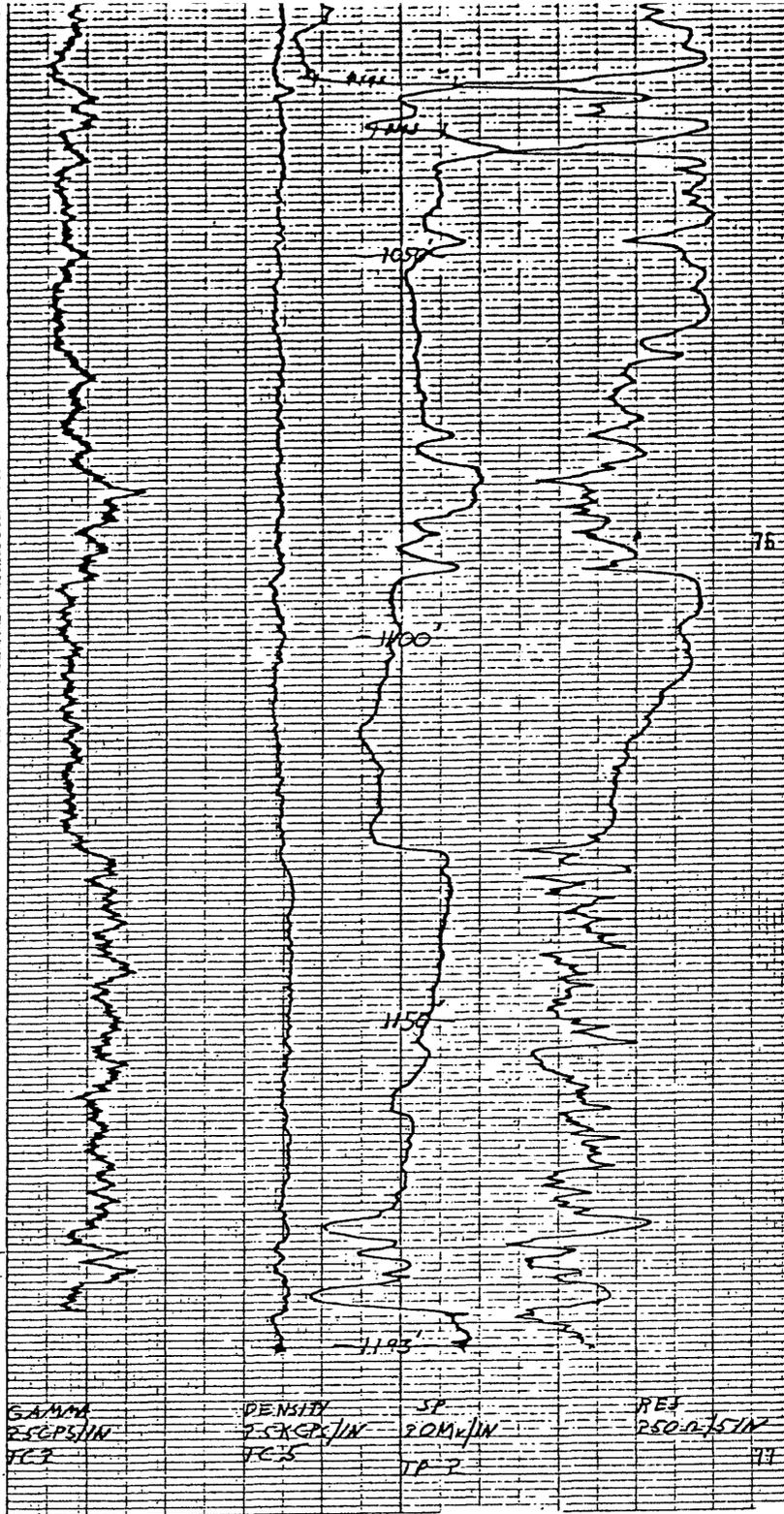
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GAMMA
RAYS/IN
GAPI

DENSITY
GAPI/IN
DENS

SP
GAPI/IN
SP

RES
GAPI/IN
RES