UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Results of 1988 Coal Exploratory Drilling in the Fruitland Formation, Western Part of the Southern Ute Indian Reservation, La Plata County, Colorado

[Lithologic descriptions, preliminary correlations, and proximate analyses of coal samples]

By

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Open-file Report 89-487

Prepared in cooperation with Southern Ute Tribe

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INTRODUCTION

There is a potential for development of coal resources in the Upper Cretaceous Fruitland Formation for about 20 miles along a 1- to 3-mile-wide strip on the western side of the Southern Ute Indian Reservation, La Plata County, Colorado. This area is referred to in a previous report (J.W. Shomaker and S.C. Feldman, unpub. data, 1978) as the Picnic Flats area. Most recent estimates of strippable coal resources in the Picnic Flats area is about 288 million short tons under less than 200 feet of overburden (J.W. Shomaker and S.C. Feldman, unpub. data, 1978). Because of renewed interest in the coals in this area, a cooperative project between the U.S. Geological Survey and the Southern Ute Tribe was initiated with the main objective of gathering new data to supplement previous investigations.

During the months of June, August, September, and October of 1988, the U.S. Geological Survey drilled a total of 23 rotary and 10 core holes in the southern half of the Picnic Flats area, which is a 1-mile-wide strip near the outcrop of the Fruitland Formation in the Pinkerton Mesa 7.5' quadrangle (fig. 1). The purpose of the drilling was to provide the Southern Ute Tribe with information on the occurrence and areal distribution of coal deposits, the stratigraphic correlations, and the quality of the coal in the Fruitland Formation. Figures 1 and 2 show the general locations of the drilled area and more specific locations of the drill holes, respectively. The data gathered from the drilling program will supplement data from the many holes drilled in this same area by Peabody Coal Company in 1963 and by Sunedco in 1977.

GEOLOGIC SETTING

The study area is located on the northwestern edge of the San Juan basin. The dip of the strata ranges from 5° in the southern part of the study area to as much as 26° in the northernmost part.

All the coal beds encountered in the drill holes occur in the Fruitland Formation of Late Cretaceous age. The stratigraphic sequence of the Fruitland Formation and related rocks is described below and is shown on figure 3. Descriptions of the Kirtland Shale and the Pictured Cliffs Sandstone are modified from Barnes and others (1954). For the purpose of this report, the base of the Fruitland Formation is arbitrarily defined by the base of the lowest coal.

Kirtland Shale

Upper shale member

Shale and unconsolidated sandstone in varying proportions. Shale is olive to medium gray, sandy, and silty. The sandstone is pale olive to grayish orange and is fine to medium grained

Farmington Sandstone Member

Interbedded sandstone, shale, and sandy, silty shale. Sandstone beds are fine to medium grained, massive bedded, and pale olive, dusky yellow, and grayish orange in color. Shale and sandy shale is similar to shale of upper and lower members and form slopes. Member is about 350 feet thick

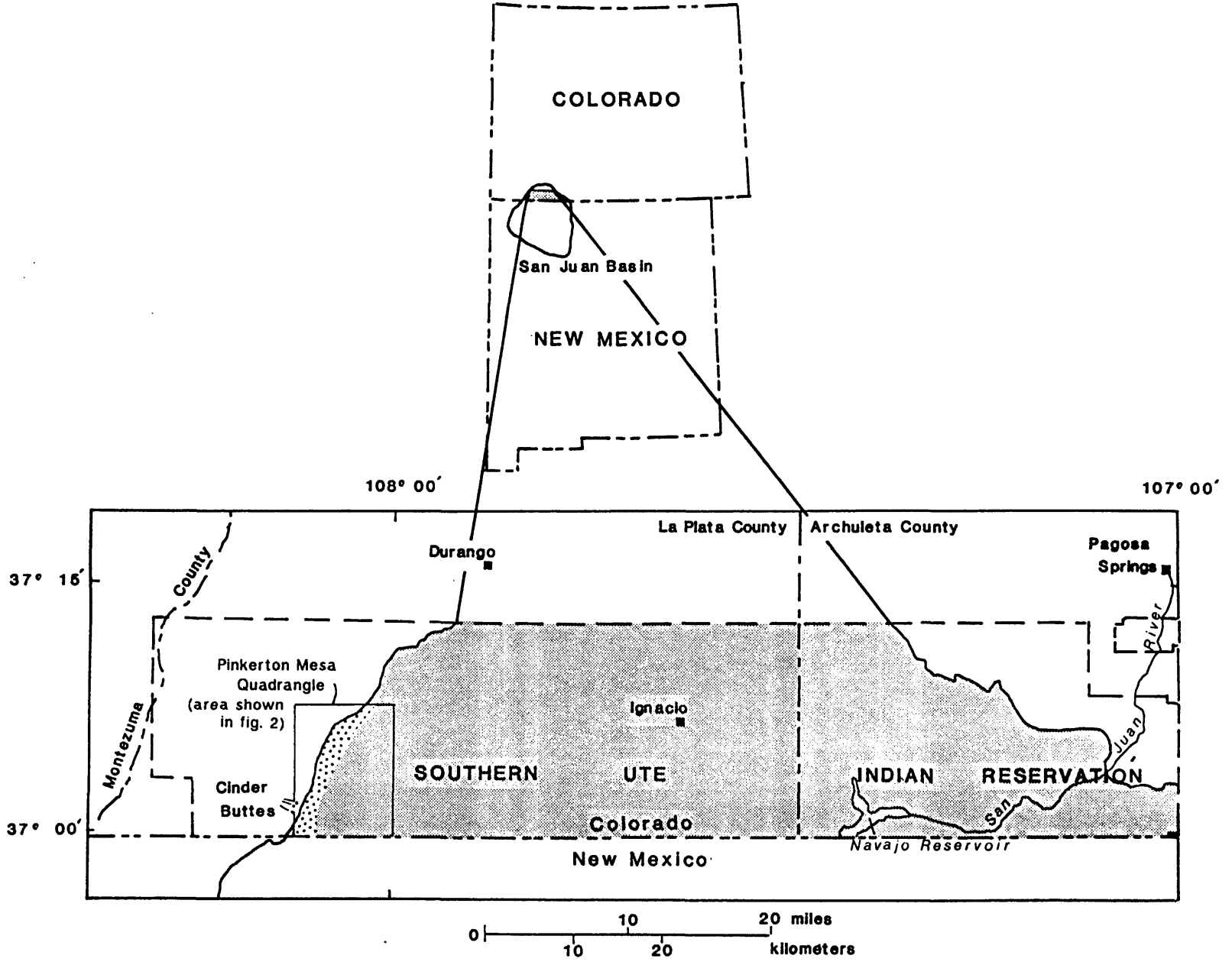


Figure 1.--Index map of the Southern Ute Indian Reservation showing general location of exploratory drilling (stippled) within the Pinkerton Mesa quadrangle. Area underlain by coal-bearing Fruitland Formation is shaded.

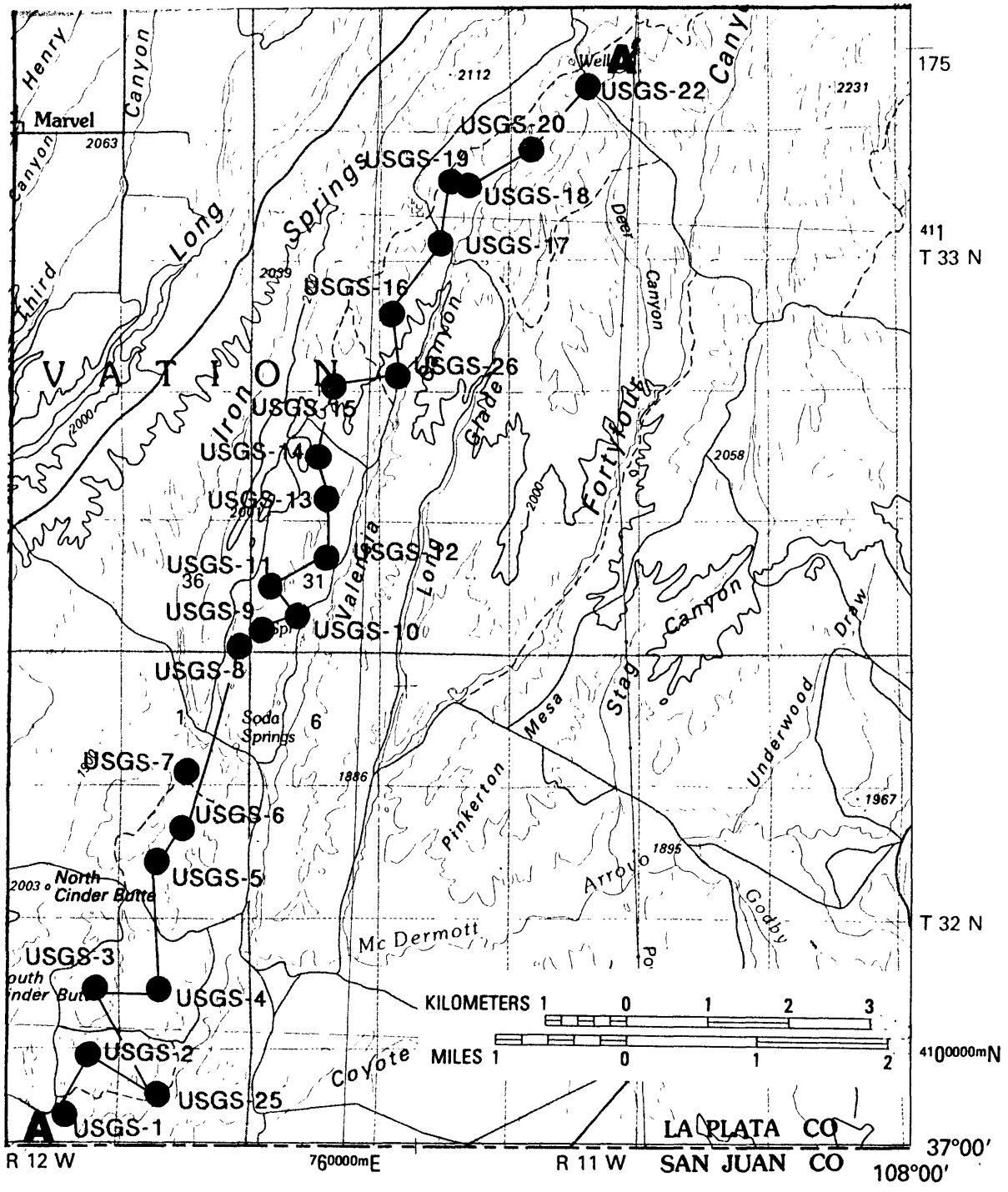


Figure 2.--Index map showing locations of holes drilled in 1988 and line of section A-A'. Base from Cortez 30 x 60-minute quadrangle (1982).

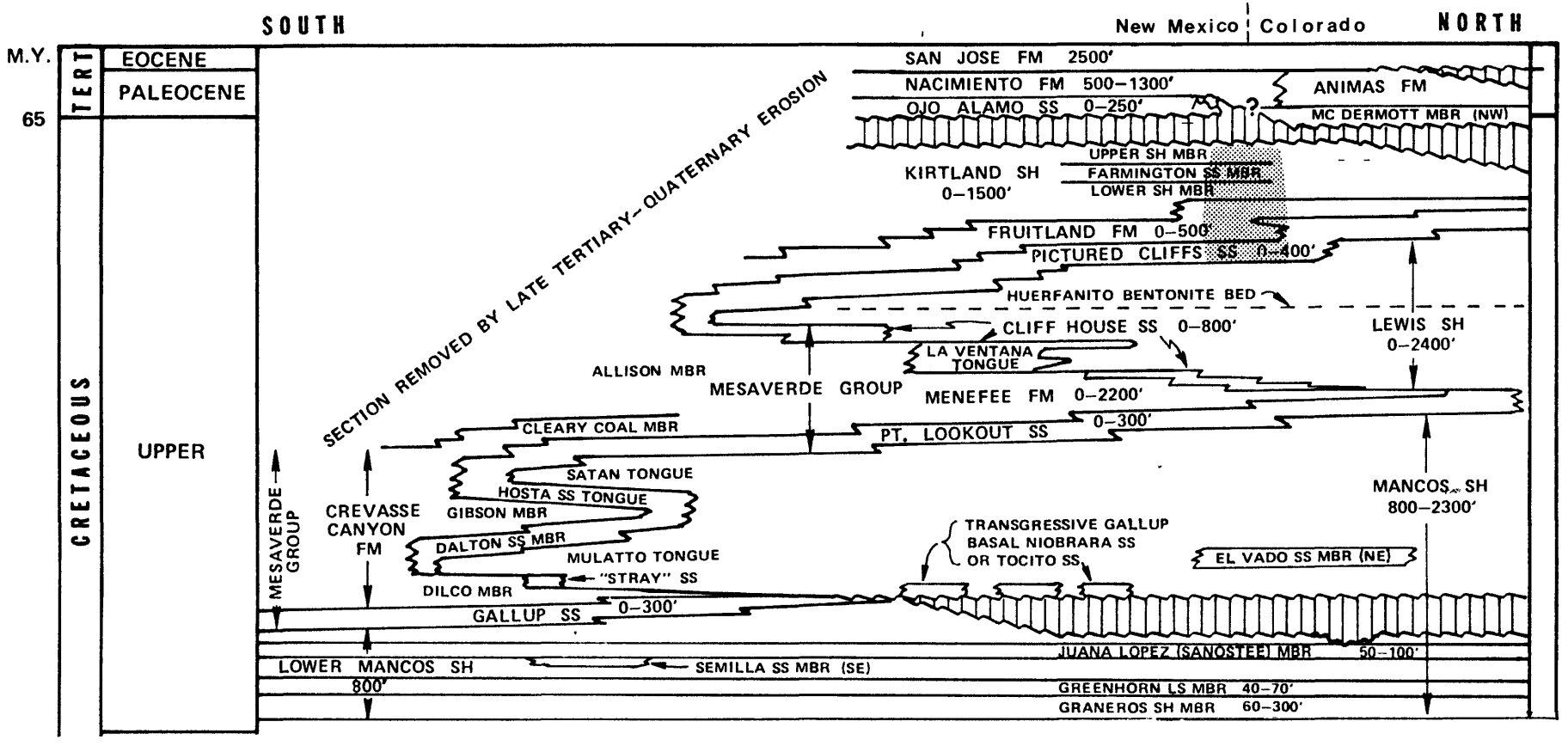


Figure 3.--Chart showing stratigraphy of Upper Cretaceous and Tertiary rocks of the San Juan basin. Formations discussed in text are shaded. From Molenaar, 1977.

	Lower shale member Sandy and silty shale beds and a few thin lenses of sandstone. Shale is olive to medium gray. Sandstones are olive gray and fine grained. Member is 325 feet thick in the northern part of the Pinkerton Mesa quadrangle
Fruitland Formation	Interbedded sandstone, siltstone, claystone, and coal. Sandstone beds are light to medium gray and are very fine to medium grained, cross and horizontal laminated. Some sandstone beds are well cemented and form low ridges. Interbedded claystone and siltstone beds are medium to dark gray, often carbonaceous and form slopes. Coal is present throughout the formation, but the thickest, most persistent beds occur in the lower 150 feet. Formation averages about 510 feet thick
Pictured Cliffs Sandstone	Lower part consists of alternating thin beds of yellowish- to light-gray sandstone and light- to dark-gray siltstone and shale. Upper part is massive, very fine to medium-grained sandstone, which resists erosion and forms the prominent hogback through the Pinkerton Mesa quadrangle. Thickness of formation decreases from 285 feet near Colorado-New Mexico state line to 215 feet in the northern part of the quadrangle

The thicker coals of the Fruitland Formation have burned back from the outcrop in much of the study area. The resulting heat has baked and fused the overlying rocks into a brittle, resistant red rock called clinker. The clinker beds are a prominent feature, especially in the southwestern part of the Pinkerton Mesa quadrangle where they form the Cinder Buttes (fig. 1).

Individual coal beds present in the drill holes are lenticular and cannot be correlated between drill holes; however, the zones in which coal beds occur can be correlated. Lithologies within the coal zones include bright coal, bony coal, and numerous partings of shale, claystone, and siltstone. Plate 1 shows preliminary correlations of the principal coal zones found in drilling (see fig. 2 for location of line of section). The coal zone names (A coal zone and D coal zone) are from J.W. Shomaker and S.C. Feldman (unpub. data, 1978) and are based on results of a coal exploratory drilling program in 1977. The A and D coal zones correlate with the #1 bed and #2 bed, respectively, which are coals currently mined at the La Plata mine less than 1 mile south of the Colorado-New Mexico state line. Plate 1 shows that the A coal zone is persistent throughout the study area, but that it thins northward. The D coal zone is also laterally continuous, but splits to the north. Also, the D coal zone contains thicker and more numerous partings than are found in the A zone. Based on the signatures of the geophysical logs, preliminary correlation lines are drawn between some of the coal zones stratigraphically above the D zone. The Local 1 and Local 2 coal zones are named specifically for this report because they could not be correlated with coal beds in previous reports.

LOGS OF THE DRILL HOLES

Appendix 1 contains the data gathered during the drilling project. Figures 4 through 9 of appendix 1 show specific locations of the drill holes. Of the holes drilled, only one hole (USGS-7) was abandoned before completion because of lost circulation. Upon completion of the rotary hole at 10 of the localities, the rig was moved about 20 ft and a second hole was drilled to obtain core samples of the coal for quality analyses. A suite of geophysical logs was run in each hole to determine the thickness and depth of the coal beds. The geophysical logs consist of gamma, density, caliper, and electrical resistivity logs. The resistivity log was recorded only in the water-filled part of each hole. In a few of the holes, more than one logging company logged the hole. The geophysical logs that best represent the data from the hole are shown in appendix 1. Data on each drill hole is reported in table 1.

Samples of the rock penetrated during drilling of the rotary holes were collected and described at 5-foot intervals. Lithologic logs were made by adjusting the cuttings descriptions to correspond to the geophysical logs. Thicknesses of the described intervals were not adjusted according to dip of the strata. Strip logs of the lithologic logs were computer generated to graphically show the lithologies encountered in the drill holes; the strip logs accompany the geophysical logs in appendix 1. A detailed description was prepared for the cored intervals and these intervals are graphically represented following the detailed description of core; description and strip logs of the cored interval are presented in appendix 1.

SAMPLE ANALYSES

To date, no ASTM (American Society for Testing and Materials) standard practice exists for collecting coal samples from core; therefore, cored intervals were sampled according to the standard practice for collecting channel samples of coal from a mine (ASTM, 1988a, D4596-86, p. 383). In accordance with this standard, roof and floor rock and mineral partings more than 3/8-inch thick were excluded from the sample. A total of 155 coal samples were submitted for proximate analyses, which include the determination of ash, sulfur, moisture, volatile matter, and fixed carbon content, and gross calorific value (Btu). Time did not allow for a synthesis of all the analytical data, but a brief look at the data on the coal intervals (excluding partings greater than 3/8-inch thick) indicates that the apparent rank, on an as-received basis, in the Fruitland Formation in this area is high-volatile B bituminous coal. Apparent rank was determined using the Parr Formula for moist, mineral-matter-free Btu according to ASTM (1988b, D388-88, p. 184) standards.

In February 1989, at the request of the Bureau of Indian Affairs personnel, Lakewood, Colorado, 71 samples of roof and floor rock and the partings were submitted for the same analyses as the coal samples. With this additional data, the values from the rock analyses could be calculated back into the values for the previously analyzed coal beds, thereby giving an in-place apparent rank and grade of the coal. This recalculated data would then be compatible with core data gathered by Sunedco in 1977; samples submitted for analyses during that project included partings with the coal.

Table 1.--Data on coal-exploratory holes drilled in 1988 in the Pinkerton Mesa 7 1/2-minute quadrangle, western part of the Southern Ute Indian Reservation

[Leaders (---) indicate no data. Holes logged by: BPB, British Plaster Board; SWS, Southwest Surveys; USGS, U.S. Geological Survey]

Hole number	Location			Approx. elevation	Date		Total depth (ft)				Cored interval (ft)	Logged by	
	Sec.	T.N.	R.W.		Started	Completed	Rotary hole		Core hole			Rotary hole	Core hole
							Drilled	Logged	Drilled	Logged			
USGS-1	23	32	12	6,105	6/22	6/23	274	245	234	234	181.0-226.0	BPB&USGS	BPB
USGS-2	23	32	12	6,242	6/24	6/25	275	270	135	135	61-119.4	BPB&USGS	USGS
USGS-3	14	32	12	6,330	6/25	6/26	255	250	215	210	54.0-99.0 157.5-187.5	USGS	USGS
USGS-4	13	32	12	6,120	9/2	9/2	335	333	---	---	---	SWS	---
USGS-5	12	32	12	6,379	6/27	6/28	285	283	275	273	95-131 210-255	BPB	USGS& BPB
USGS-6	12	32	12	6,345	6/29	8/31	275	275	160	160	90-149.2	BPB	SWS
USGS-7	1	32	12	6,420	9/1	9/1	186	183	---	---	---	SWS	---
USGS-8	36	33	12	6,436	9/12	9/15	235	233	150	148	75.5-129	SWS	SWS
USGS-9	31	33	11	6,404	9/15	9/16	315	313	---	---	---	SWS	---
USGS-10	31	33	11	6,260	6/13	6/21	497	475	475	475	190-205 337-397 416-459.5	USGS	BPB
USGS-11	31	33	11	6,442	9/16	9/17	255	253	136	135	71-136.8	SWS	SWS
USGS-12	31	33	11	6,320	9/4	9/5	515	513	---	---	---	SWS	---
USGS-13	30	33	11	6,400	9/5	9/6	385	382	---	---	---	SWS	---
USGS-14	30	33	11	6,550	9/17	9/19	275	273	265	264	46.5-57.5 161-264.7	SWS	SWS
USGS-15	19	33	11	6,590	9/20	9/20	315	313	---	---	---	SWS	---
USGS-16	20	33	11	6,690	10/13	10/14	395	393	---	---	---	SWS	---
USGS-17	17	33	11	6,700	9/29	10/2	515	513	530	529	226-270.5 340-354.6 473-501.6	SWS	SWS
USGS-18	17	33	11	6,850	10/4	10/5	375	374	---	---	---	SWS	---
USGS-19	17	33	11	6,820	10/3	10/3	155	154	---	---	---	SWS	---
USGS-20	16	33	11	6,860	9/20	9/28	555	551	---	---	---	SWS	---
USGS-22	9	33	11	6,880	9/28	9/29	435	434	---	---	---	SWS	---
USGS-25	24	32	12	6,010	10/19	10/20	555	552	---	---	---	SWS	---
USGS-26	20	33	11	6,470	10/14	10/15	650	647	---	---	---	SWS	---

Results of all of the analyses are shown in appendix 2. The sample numbers correspond to intervals shown on the strip log of the cored interval (appendix 1).

ACKNOWLEDGMENTS

Geophysical logs were run by the U.S. Geological Survey; British Plasterboard of Grand Junction, Colorado; and Southwest Surveys of Farmington, New Mexico. Data collected from the drilling project were entered into the U.S. Geological Survey National Coal Resources Data System (NCRDS). Personnel of the Energy Resources Office, Southern Ute Tribe, provided support before and during the drilling. Particularly helpful were Robert Santistevan, Oil and Gas Field Coordinator, and Brad Boyce, Manager of Exploration and Production. U.S. Geological Survey personnel who helped significantly to expedite the work include Art Clark, Bill Betterton, and Rob Zech.

CONVERSION TO METRIC UNITS

This report uses the U.S. Customary System for units of measurement. The factors used for converting to the metric system are tabulated below:

To convert	To	Multiply by
feet	meters	0.3048
miles	kilometers	1.609
inches	centimeters	2.54
Btu/lb	kcal/kg	0.556

REFERENCES CITED

American Society for Testing and Materials, 1988a, Standard practice for collection of channel samples of coal in the mine (ASTM designation D-4596-86): Annual book of ASTM standards, v. 05.05, p. 383-384.

_____1988b, Standard specification for classification of coals by rank (ASTM designation D-388-88): Annual Book of ASTM standards, v. 05.05, p. 182-185.

Barnes, Harley, Baltz, E.H., Jr., and Hayes, P.T., 1954, Geology and fuel resources of the Red Mesa area, La Plata and Montezuma Counties, Colorado: U.S. Geological Survey Oil and Gas Investigations Map OM-149, scale 1:62,500.

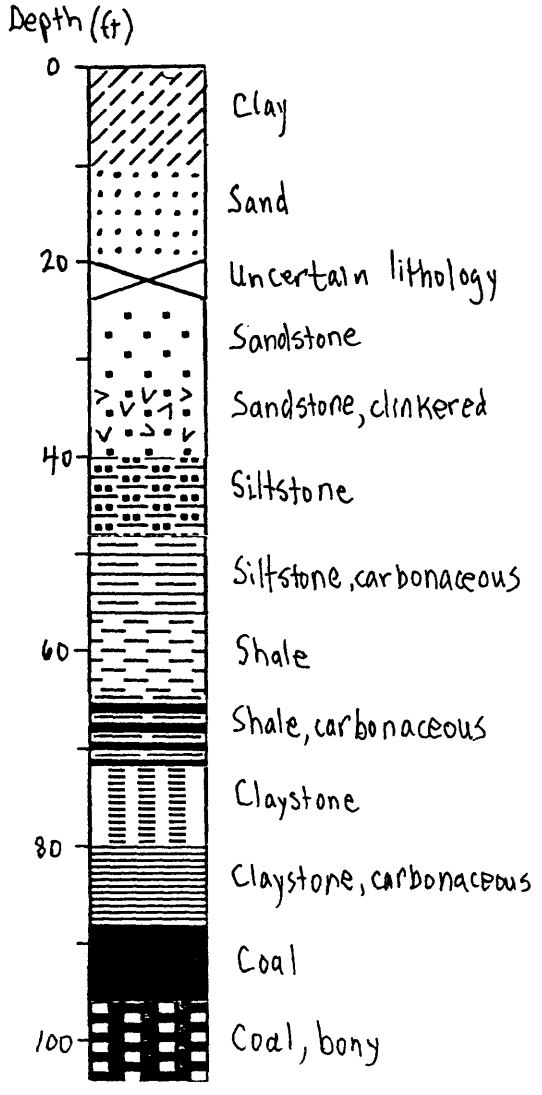
Molenaar, C.M., 1977, Stratigraphy and depositional history of upper Cretaceous rocks of the San Juan Basin area, New Mexico and Colorado, with a note on economic resources: New Mexico Geological Society Guidebook, 28th Field Conference, San Juan Basin III, 307 p.

APPENDIX 1

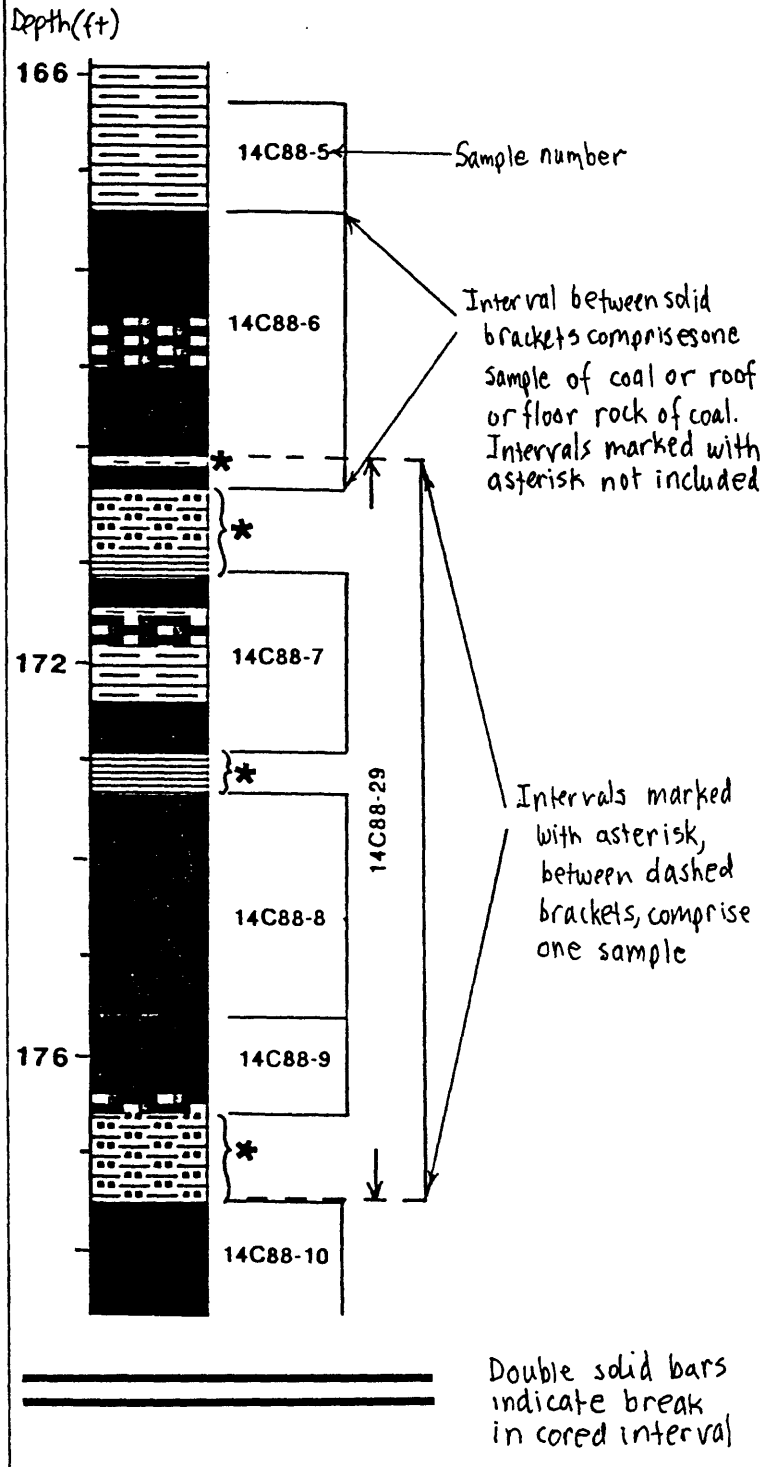
Lithologic descriptions, core descriptions, strip logs, geophysical logs, and location maps of holes USGS-1 through USGS-20, USGS-22, USGS-25, and USGS-26. An explanation of the symbols used in the strip logs is included. Locations of drill holes, as shown on the heading for each lithologic description, are in Colorado State Plane coordinates, south zone.

Explanation of symbols used in strip logs

Strip log accompanying geophysical logs



Strip log of cored interval



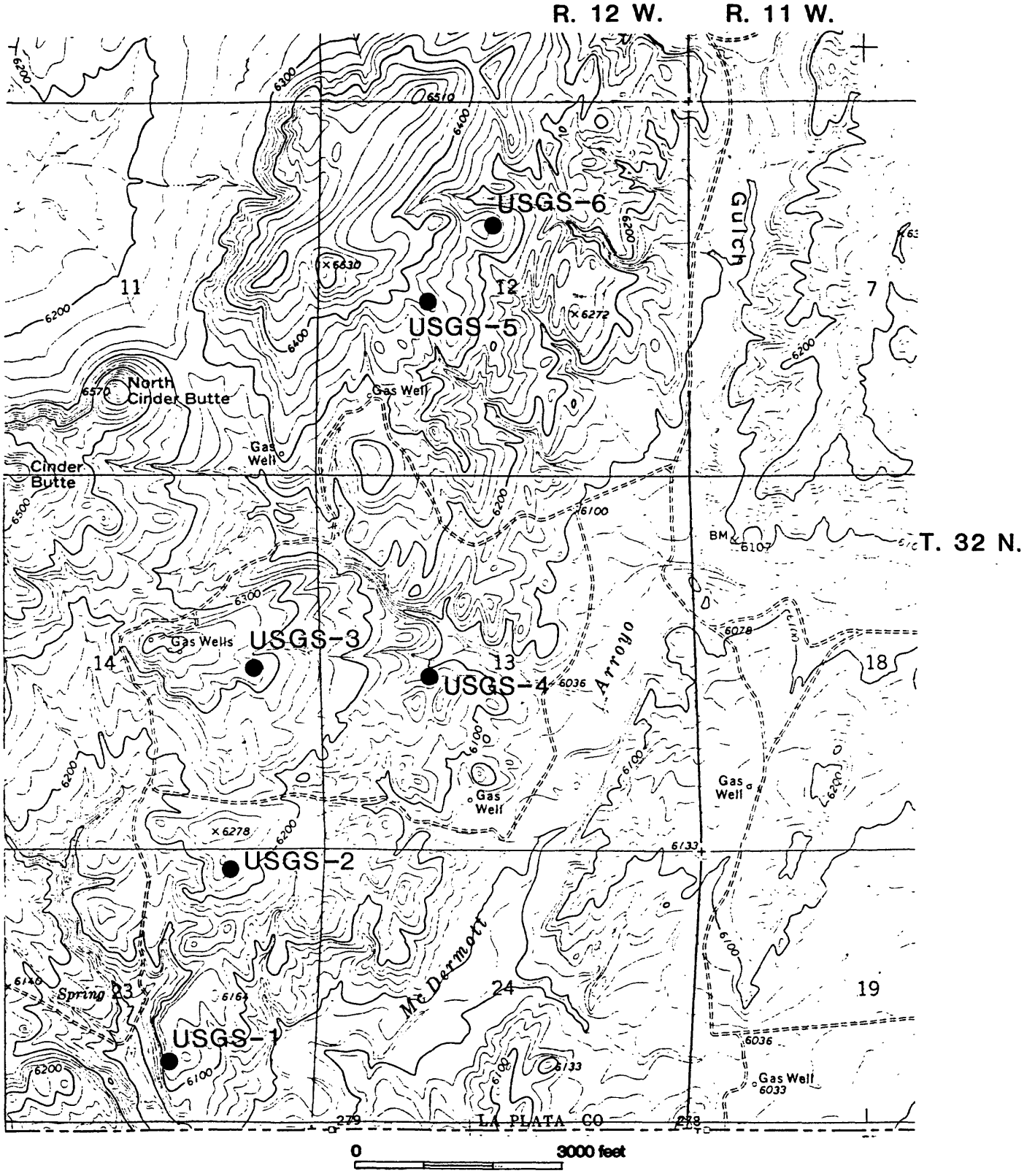


Figure 4.--Map showing locations of holes USGS-1 through USGS-6. Base from Pinkerton Mesa 7 1/2-minute quadrangle (1968).

Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 1

Hole USGS-1 Elevation 6,105 feet Total depth 274 feet

Location 1235819 E., 132988 N. Sec. 23, T. 32 N., R. 12 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Jeff Eman Core hole size 5 5/8 inches

Date started 6/22/88 Date completed 6/23/88 Geologist L. Roberts

Remarks: Fractured zone from 25 to 32 ft in rotary hole. Lost circulation from 25 to 55 ft and from 220 to 240 ft. Lost circulation at 85 ft in core hole. Drilled with heavy foam. Cored interval, 181 to 226 ft.

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Sand
11	5	16	Siltstone, light-brown
24	16	40	Sandstone, fine-grained, light-brown
8	40	48	No cuttings
3	48	51	Coal; uncertain; driller's call
33	51	84	Siltstone, slightly sandy, light-gray; hard iron-concretion lenses
11	84	95	Sandstone, very fine grained, silty, light-gray
6	95	101	Siltstone, gray; interbedded with shale
4	101	105	Coal; uncertain; driller's call
7	105	112	Shale, gray
8	112	120	Sandstone, very fine grained, gray; interbedded with siltstone
11	120	131	Shale, gray to dark-gray
4	131	135	Shale, dark-gray; interbedded with siltstone
14	135	149	Siltstone, dark-gray; thin brown shale lenses
6	149	155	Shale, dark-gray
7	155	162	Siltstone, gray
17	162	179	Sandstone, fine-grained, light- to medium-gray
2	179	181	Sandstone, medium-grained, light-gray
Start generalized core description (detailed description follows geophysical logs)			
3	181	184	Siltstone, shale, and claystone
28	184	212	Coal
2	212	214	Shale, carbonaceous
1	214	215	Coal
3	215	218	Shale, claystone, and siltstone
3	218	221	Coal
5	221	226	Sandstone
End core description			
14	226	240	Sandstone; uncertain lithology
34	240	274	Sandstone, fine-grained, light-gray

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-1** County **La Plata** State **Colorado**

Location Sec. **23** T. **32** N. R. **12** W.

Elevation **6,105** Drilled depth **274** Logged depth **245**

Drilling medium **air and foam** Date logged **6/23/88**

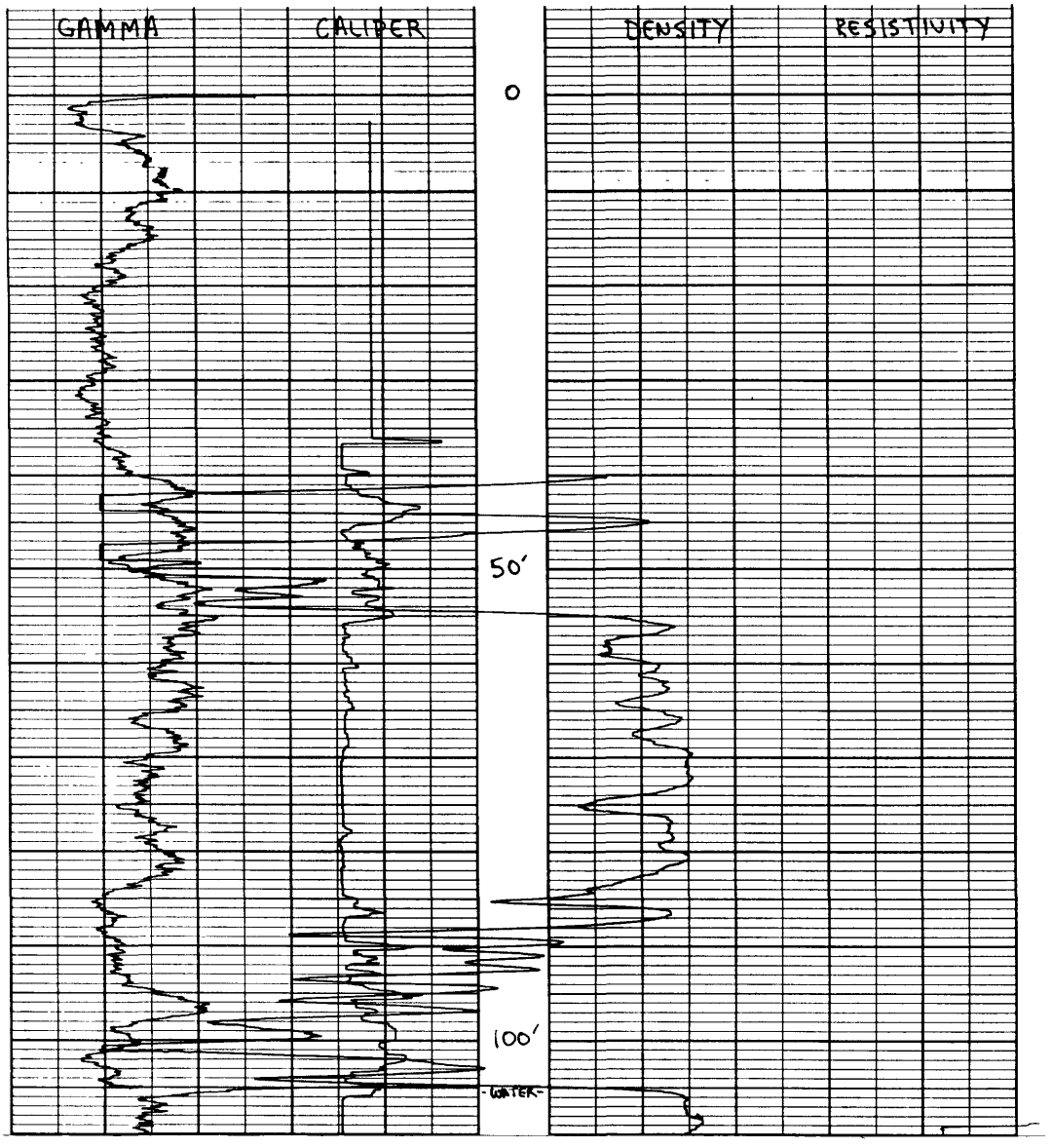
Geophysical logs:

Gamma ray (G)
Density (DEN)
High resolution density (HRD)
Caliper (CAL)
Resistance (RES)

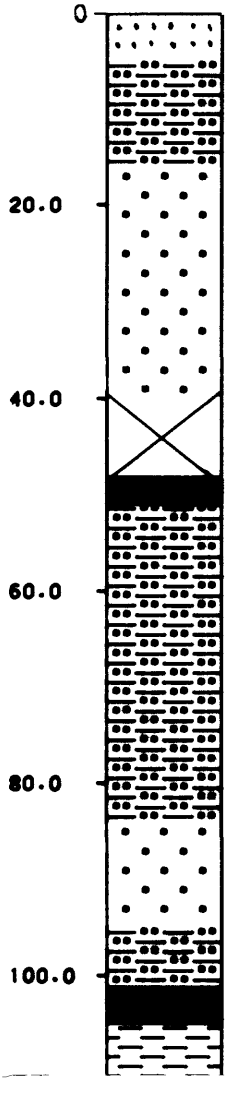
Logging speed **15** fpm
Vertical scale **1 in. = 20 ft.**

Remarks: **Cored interval, 181 to 226 ft**

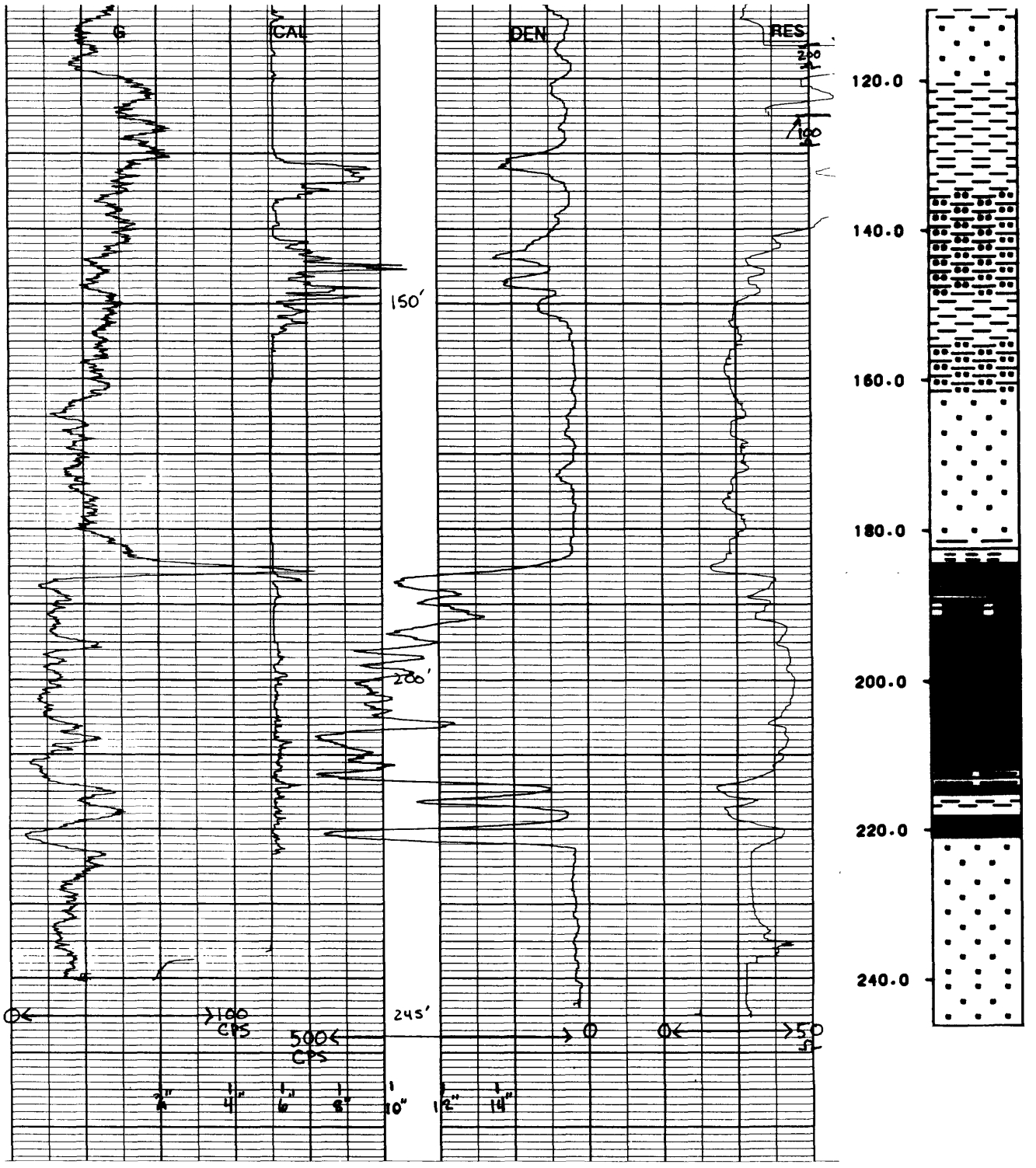
GEOPHYSICAL LOGS



STRIP LOG



Hole No. USGS-1 continued



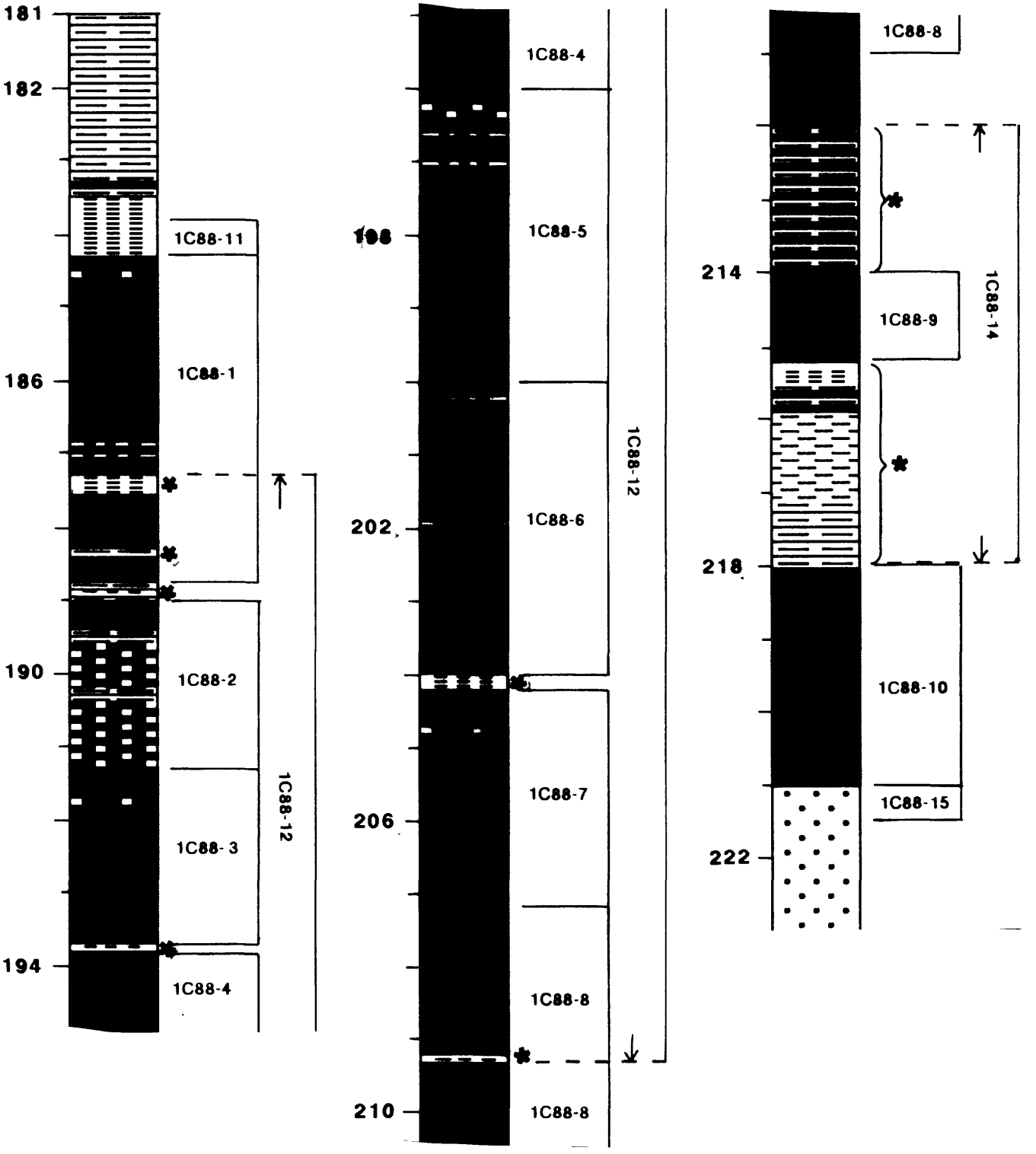
Depth interval (feet) Thickness	From	To	Detailed Core Description
2.20	181.00	183.20	Siltstone, carbonaceous, dark-gray, 45° fracture
0.30	183.20	183.50	Shale, carbonaceous, dark-gray; gradational base
0.80	183.50	184.30	Claystone, light-gray; ash; bentonite?
0.20	184.30	184.50	Coal, bright; good cleats
0.10	184.50	184.60	Coal, bony
2.25	184.60	186.85	Coal, bright; good cleats
0.05	186.85	186.90	Claystone; ash
0.10	186.90	187.00	Coal, bright; good cleats
0.05	187.00	187.05	Claystone; ash
0.25	187.05	187.30	Coal, bright; good cleats
0.25	187.30	187.55	Claystone; ash
0.75	187.55	188.30	Coal, bright; good cleats
0.10	188.30	188.40	Shale, carbonaceous, black
0.30	188.40	188.70	Coal, bright; good cleats
0.10	188.70	188.80	Shale, carbonaceous, dark-brown, silty
0.10	188.80	188.90	Claystone, light-gray; ash
0.10	188.90	189.00	Shale, carbonaceous, dark-gray, silty
0.40	189.00	189.40	Coal, bright; good cleats
0.20	189.40	189.60	Shale, carbonaceous, black
0.60	189.60	190.20	Coal, bony; very thin scattered ash partings
0.20	190.20	190.40	Shale, carbonaceous, black
0.90	190.40	191.30	Coal, bony, very thin scattered ash partings
0.40	191.30	191.70	Coal, bright; good cleats
0.10	191.70	191.80	Coal, bony
1.90	191.80	193.70	Coal, bright; good cleats
0.10	193.70	193.80	Claystone, gray; ash
2.20	193.80	196.00	Coal, bright; high-angle fracture; good cleats
0.20	196.00	196.20	Coal, bright; good cleats
0.20	196.20	196.40	Coal, bony; scattered mud clasts
0.20	196.40	196.60	Coal, bright; good cleats
0.05	196.60	196.65	Claystone; ash
0.35	196.65	197.00	Coal, bright; scattered resin; good cleats
0.05	197.00	197.05	Claystone; ash
3.15	197.05	200.20	Coal, bright; scattered resin; good cleats
0.05	200.20	200.25	Claystone; ash
1.65	200.25	201.90	Coal, bright; good cleats; scattered resin; pyrite at 201 ft
0.05	201.90	201.95	Claystone; ash
2.05	201.95	204.00	Coal, bright; good cleats
0.20	204.00	204.20	Claystone, brown to gray, silty, carbonaceous; ash; sharp contacts
0.50	204.20	204.70	Coal, bright; good cleats
0.10	204.70	204.80	Coal, bony, clayey
4.40	204.80	209.20	Coal, bright; good cleats; vertical and 45° fractures
0.10	209.20	209.30	Claystone, gray; ash

Depth interval (feet) Thickness	From	To	Detailed Core Description
1.70	209.30	211.00	Coal, bright; good cleats; vertical fractures
0.30	211.00	211.30	Coal, bright; good cleats
0.70	211.30	212.00	Coal and carbonaceous shale, interbedded
2.00	212.00	214.00	Shale, carbonaceous, clayey, dark-gray; thin coal stringers
1.20	214.00	215.20	Coal, bright; good cleats; vertical fractures
0.10	215.20	215.30	Shale, carbonaceous, dark-brown
0.20	215.30	215.50	Claystone, light-gray; ash; sharp basal contact
0.40	215.50	215.90	Shale, carbonaceous, dark-gray; coaly stringers at base
1.20	215.90	217.10	Shale, silty, gray
0.90	217.10	218.00	Siltstone, carbonaceous, rippled, burrowed; sharp basal contact
3.00	218.00	221.00	Coal, bright; cleats; vertical and 45° fractures
0.40	221.00	221.40	Sandstone, medium-grained, carbonaceous, dark-brown; carbonaceous fragments
4.60	221.40	226.00	Sandstone, medium-grained, gray, well-sorted, well-cemented

U.S. Geological Survey

Hole No. **USGS-1** Page 1 of 1

Detailed strip log showing cored interval, location of sampled intervals, and sample numbers
Vertical scale: 1 inch = 2 feet



Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 2

Hole USGS-2 Elevation 6,242 feet Total depth 275 feet

Location 1236770 E., 135657 N. Sec. 23, T. 32 N., R. 12 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Jeff Eman Core hole size 5 5/8 inches

Date started 6/24/88 Date completed 6/25/88 Geologist L. Roberts

Remarks: Rotary hole was dry; filled with water in order to log. Core hole depth = 135 ft.

Depth interval (feet) Thickness	From	To	Lithologic Description
9	0	9	Sandstone, very fine grained, light-gray, well-sorted
4	9	13	Siltstone, brown to gray
6	13	19	Siltstone, sandy, gray; interbedded with shale
6	19	25	Sandstone, very fine grained, medium-gray; interbedded with siltstone
5	25	30	Siltstone, sandy, very light brown
7	30	37	Sandstone, very fine grained, silty, light-gray; interbedded with siltstone
3	37	40	Shale, carbonaceous
4	40	44	Sandstone, very fine grained, silty, light-brown
4	44	48	Shale, carbonaceous, gray to dark-gray
13	48	61	Siltstone, light- to medium-gray
Start core description			
6	61	67	Shale
21	67	88	Coal; includes partings
9	88	97	Shale, siltstone, and sandstone, interbedded
4	97	101	Coal; includes partings
2	101	103	Shale, carbonaceous
11	103	114	Coal; includes partings
5	114	119	Shale and siltstone, interbedded
End core description			
12	119	131	Claystone, gray
4	131	135	Siltstone, medium-gray
15	135	150	Sandstone, very fine grained, light-gray; interbedded with siltstone; hard
2	150	152	Claystone
3	152	155	Siltstone, dark-gray
20	155	175	Sandstone, fine-grained, unconsolidated
30	175	205	Sandstone, very fine grained, silty, gray to dark-gray; some siltstone lenses

Depth interval (feet) Thickness	From	To	Lithologic Description
4	205	209	Siltstone
2	209	211	Claystone; ash; bentonite?
21	211	232	Coal
2	232	234	Claystone
3	234	237	Coal
1	237	238	Claystone
1	238	239	Coal
2	239	241	Claystone
1	241	242	Coal
2	242	244	Claystone
3	244	247	Coal
3	247	250	Shale, carbonaceous, brown
25	250	275	Sandstone, medium-grained, gray, clean, well-sorted; scattered black minerals

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-2** County **La Plata** State **Colorado**

Location Sec. **23** T. **32** N. R. **12** W.

Elevation **6,242** Drilled depth **275** Logged depth **270**

Drilling medium **air** Date logged **6/25/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale **1 in. = 20 ft.**

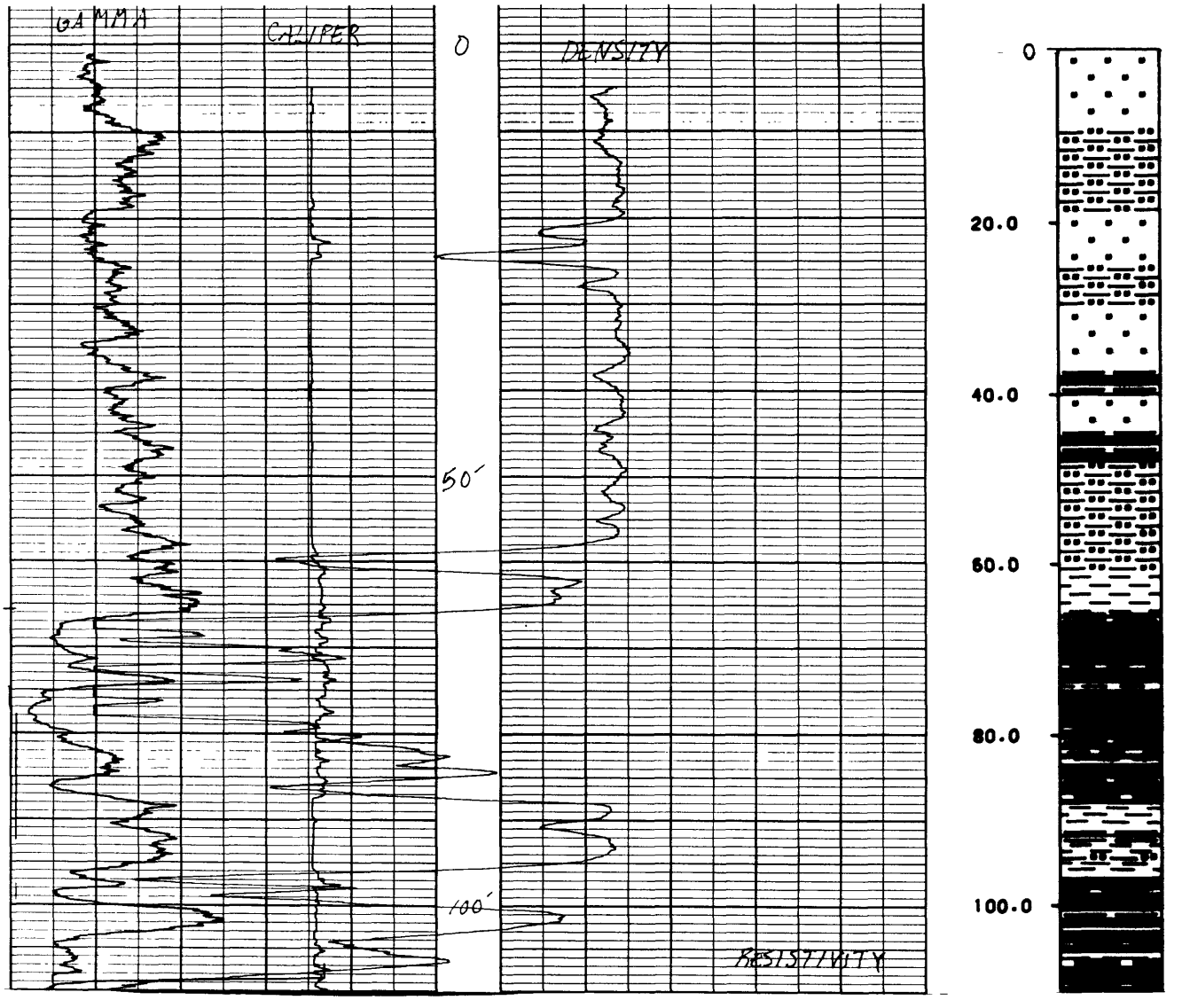
High resolution density (HRD)

Caliper (CAL)

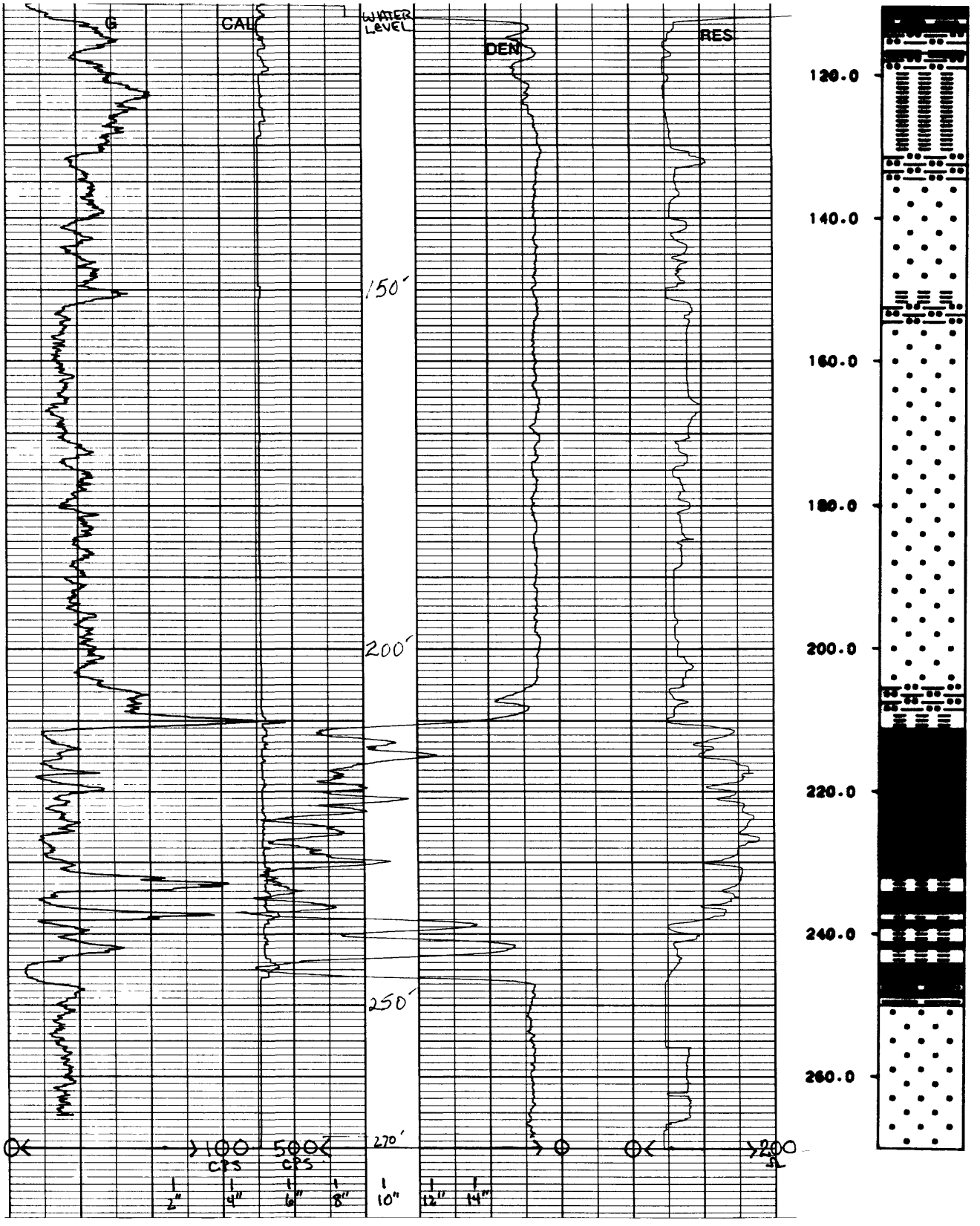
Resistance (RES)

Remarks: **Cored interval, 61 to 119 ft**

GEOPHYSICAL LOGS STRIP LOG



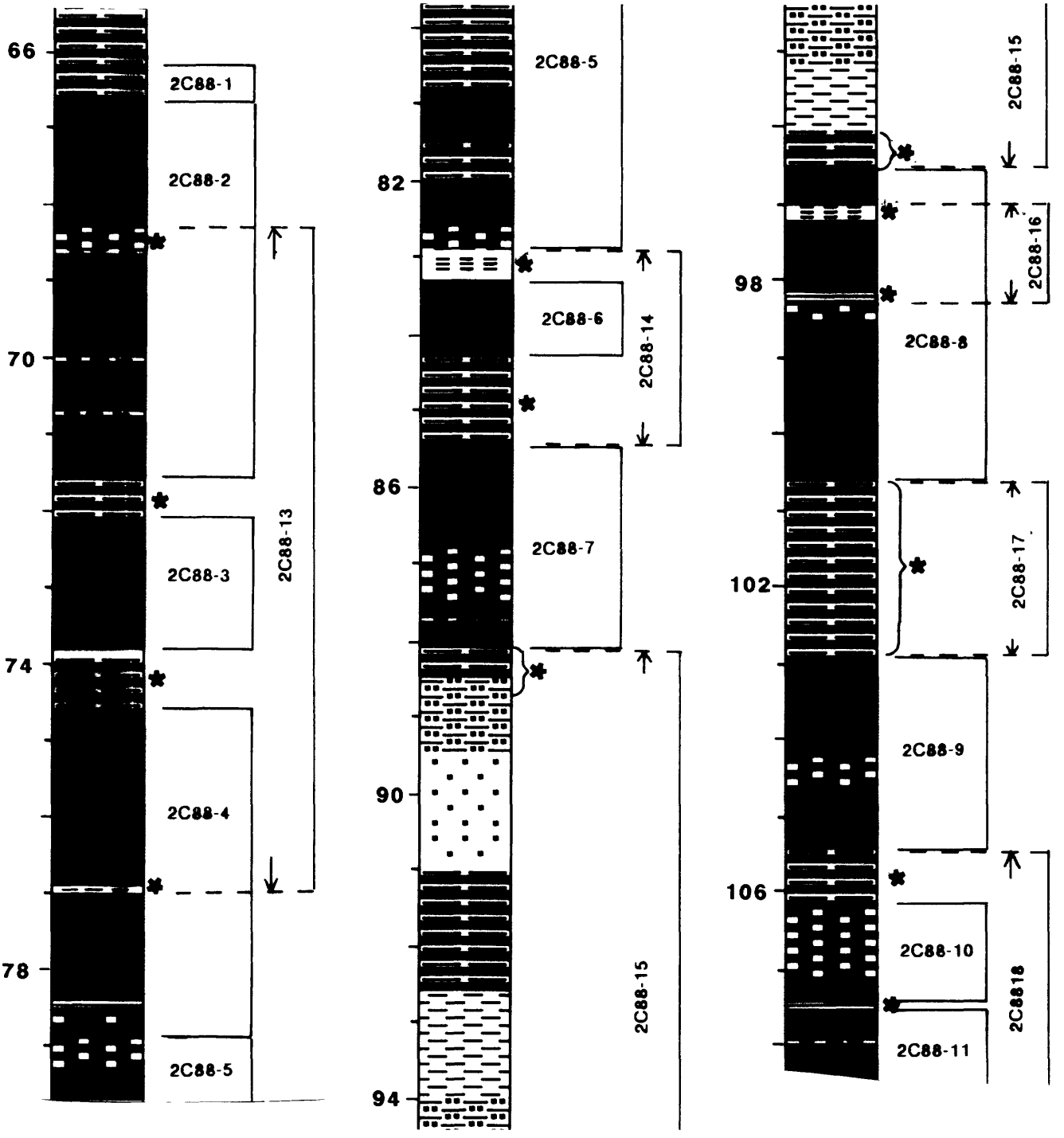
Hole No. **USGS-2** continued

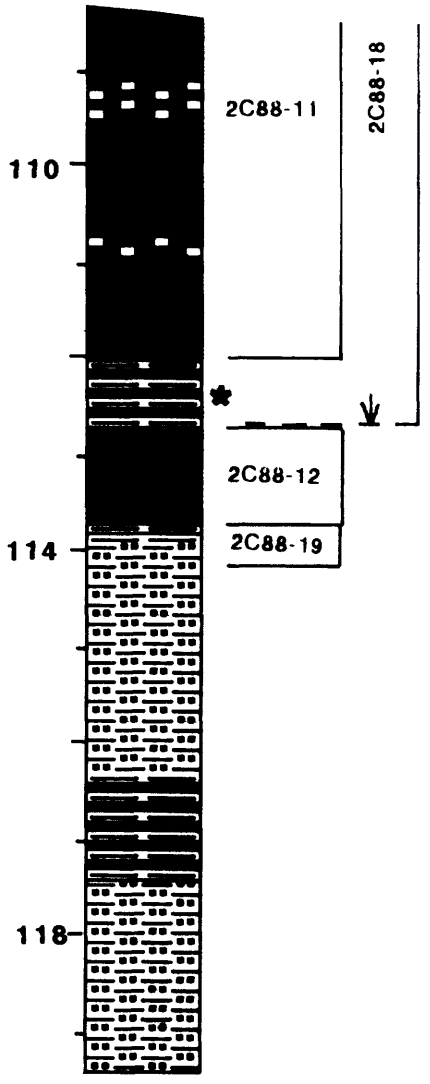


U.S. Geological Survey

Hole No. **USGS-2**

Detailed strip log showing cored interval, location of sampled intervals, and sample numbers
Vertical scale: 1 inch = 2 feet




2C88-11
2C88-18
110
2C88-12
2C88-19
114
118

Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 2

Hole USGS-3 Elevation 6,330 feet Total depth 255 feet

Location 1237139 E., 138414 N. Sec. 14 , T. 32 N. , R. 12 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Jeff Eman Core hole size 5 5/8 inches

Date started 6/25/88 Date completed 6/26/88 Geologist L. Roberts

Remarks: Lost circulation between 65 and 77 ft in rotary hole. Drilled with foam. In core hole, upper coal was highly weathered causing loss of core.

Depth interval (feet) Thickness	From	To	Lithologic Description
30	0	30	Sandstone, very fine grained, light-gray
10	30	40	Sandstone, medium-grained, light-gray
8	40	48	Sandstone, fine-grained, light-gray
6	48	54	Shale, carbonaceous, dark-gray
Start generalized core description (detailed description follows geophysical logs)			
16	54	70	Shale and siltstone, interbedded
2	70	72	Coal
4	72	76	Shale, claystone, and siltstone, interbedded
5	76	81	Coal
3	81	84	Siltstone
12	84	96	Coal
3	96	99	Shale
End core description			
6	99	105	Shale, carbonaceous, dark-gray
15	105	120	Siltstone, sandy, medium-gray; interbedded with very fine grained sandstone
10	120	130	Sandstone, very fine grained, gray
5	130	135	Sandstone, fine-grained, gray
5	135	140	Sandstone, medium-grained, gray
17.5	140	157.5	Siltstone, medium-gray; interbedded with gray shale
Start core description			
4.5	157.5	162	Shale, siltstone, sandstone, and claystone, interbedded
25	162	187	Coal; includes partings
0.5	187	187.5	Siltstone
End core description			

Depth interval (feet) Thickness	From	To	Lithologic Description
4.5	187.5	192	Shale, gray; interbedded with siltstone
3	192	195	Sandstone, very fine grained, light-gray
11	195	206	Siltstone; interbedded with very fine grained sandstone
4	206	210	Sandstone, very fine grained
3	210	213	Siltstone, dark-gray; interbedded with shale
9	213	222	Sandstone, very fine grained, light-gray
2	222	224	Siltstone
8	224	232	Sandstone, medium-grained, light-gray, clean, well-sorted
8	232	240	Siltstone, medium- to dark-gray
15	240	255	Sandstone, medium-grained, light-gray

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-3** County **La Plata** State **Colorado**

Location Sec. **14** T. **32** N. R. **12** W.

Elevation **6,330** Drilled depth **255** Logged depth **250**

Drilling medium **air and foam** Date logged **6/26/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale **1 in. = 20 ft.**

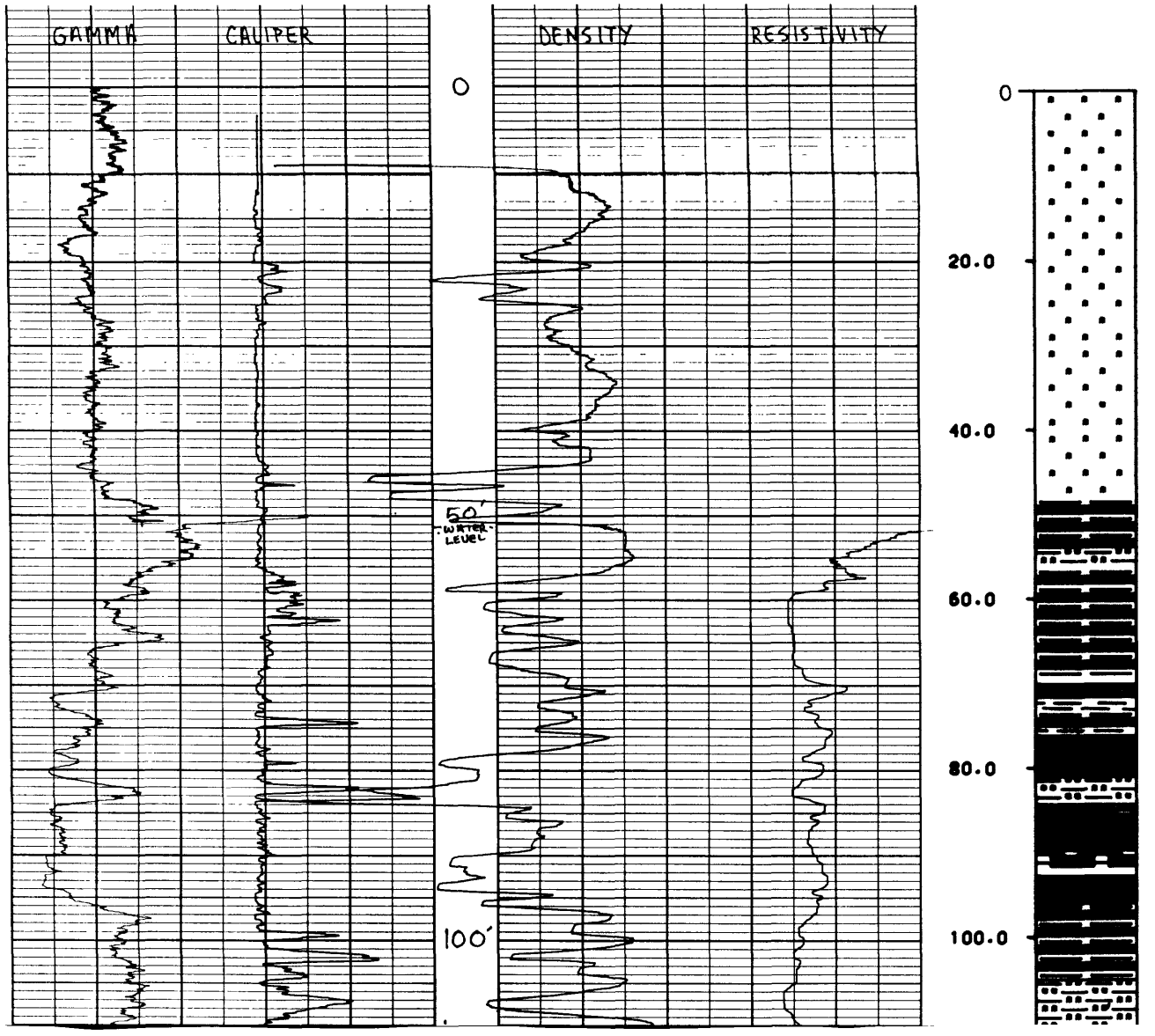
High resolution density (HRD)

Caliper (CAL)

Resistance (RES)

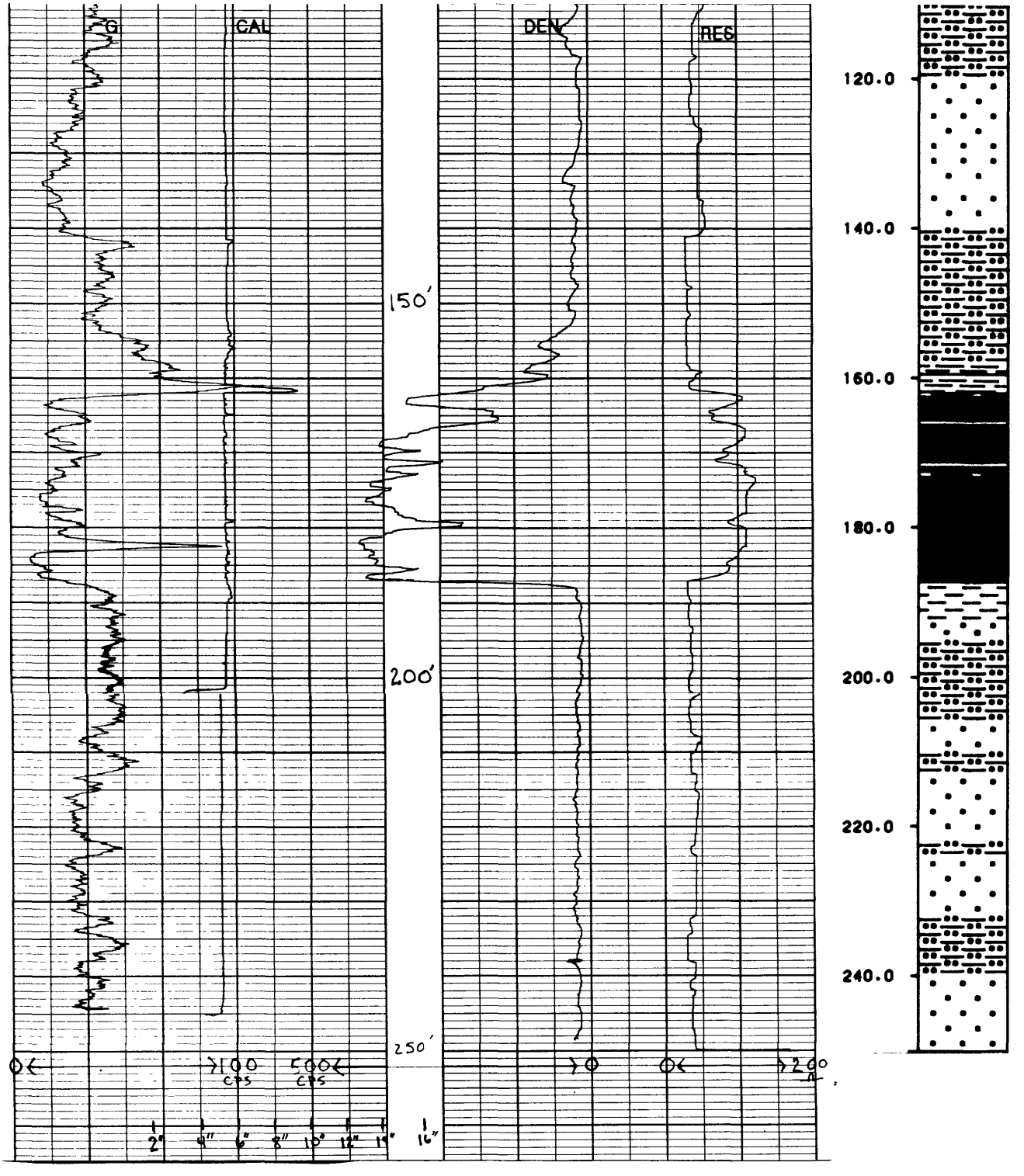
Remarks: **Cored intervals, 54 to 99 ft and 157.5 to187.5 ft**

GEOPHYSICAL LOGS STRIP LOG



U.S. Geological Survey

Hole No. **USGS-3** continued



Hole No. USGS-2 Page 1 of 2

Depth interval (feet) Thickness	From	To	Detailed Core Description
4.50	61.00	65.50	Shale, silty, medium-gray; 45° fracture
1.20	65.50	66.70	Shale, carbonaceous, dark-gray to black; coaly at base; 45° fracture
1.60	66.70	68.30	Coal, bright; good cleats
0.30	68.30	68.60	Coal, bony
0.05	68.60	68.65	Claystone, gray; ash
1.35	68.65	70.00	Coal, bright; good cleats
0.05	70.00	70.05	Claystone, brown; ash
0.65	70.05	70.70	Coal, bright; good cleats
0.05	70.70	70.75	Claystone, brown; ash
0.85	70.75	71.70	Coal, bright; good cleats
0.50	71.70	72.20	Shale, coaly, black; coal bands
1.70	72.20	73.90	Coal, bright; good cleats; scattered resin; vertical and 45° fracture
0.10	73.90	74.00	Claystone; ash
0.70	74.00	74.70	Shale, coaly, carbonaceous, dark-gray to black; interbedded carbonaceous and coaly shale
2.30	74.70	77.00	Coal, bright; good cleats; scattered resin; vertical fracture
0.10	77.00	77.10	Claystone; ash; carbonaceous at top and bottom
1.40	77.10	78.50	Coal, bright; good cleats
0.10	78.50	78.60	Shale, carbonaceous, coaly, dark-brown to black
0.10	78.60	78.70	Coal, bright
0.10	78.70	78.80	Coal, bony
0.20	78.80	79.00	Coal, bright
0.40	79.00	79.40	Coal, bony
0.40	79.40	79.80	Coal, bright; scattered pyrite
1.20	79.80	81.00	Shale, coaly, carbonaceous, black; thin coal bands
0.60	81.00	81.60	Coal, bright; good cleats; vertical fracture
0.60	81.60	82.20	Shale, carbonaceous, black; scattered resin; thin coal bands
0.50	82.20	82.70	Coal, bright
0.30	82.70	83.00	Coal, bony
0.10	83.00	83.10	Shale, coaly, black
0.20	83.10	83.30	Claystone; ash
0.10	83.30	83.40	Shale, coaly, black
1.00	83.40	84.40	Coal; interbedded with bony coal
1.20	84.40	85.60	Shale, carbonaceous, dark-brown; scattered resin; thin coal bands
1.30	85.60	86.90	Coal, bright; good cleats; vertical fracture; pyrite at 85.8 ft
0.70	86.90	87.60	Coal, bony; vertical fracture
0.20	87.60	87.80	Coal, bright
0.05	87.80	87.85	Claystone, light-gray; sharp basal contact; ash
0.35	87.85	88.20	Coal, bright; good cleats
0.40	88.20	88.60	Shale, carbonaceous, dark-brown; thin coal bands
1.00	88.60	89.60	Siltstone, gray; carbonaceous fragments

Depth interval (feet) Thickness	From	To	Detailed Core Description
1.00	89.60	90.60	Sandstone, very fine grained, very light gray; burrowed or rooted at top
0.50	90.60	91.10	Sandstone; lost core; probable sandstone
1.60	91.10	92.70	Shale, carbonaceous, dark-brown; thin coal bands; 45° fracture
1.40	92.70	94.10	Shale, slightly carbonaceous, gray; 45° fracture
1.20	94.10	95.30	Siltstone, shaley, gray
0.80	95.30	96.10	Shale, silty, gray; carbonaceous fragments
0.60	96.10	96.70	Shale, carbonaceous, dark-gray
0.40	96.70	97.10	Coal, bright; good cleats; vertical fracture
0.20	97.10	97.30	Claystone, carbonaceous, rippled; ash
0.90	97.30	98.20	Coal, bright; good cleats; vertical fracture
0.20	98.20	98.40	Claystone, carbonaceous, brown-gray; ash
0.20	98.40	98.60	Coal, bony
2.10	98.60	100.70	Coal, bright; good cleats; scattered resin; dirty at 99 and 99.9 ft
2.30	100.70	103.00	Shale, carbonaceous, dark-brown; coaly at top
1.30	103.00	104.30	Coal, bright; scattered resin; good cleats
0.40	104.30	104.70	Coal, bony
0.80	104.70	105.50	Coal, bright; scattered resin; good cleats
0.80	105.50	106.30	Shale, carbonaceous, dark-brown, pyritic
0.90	106.30	107.20	Coal, bony; scattered resin
0.30	107.20	107.50	Coal, bright; good cleats
0.10	107.50	107.60	Shale, carbonaceous; thin ash in middle
0.40	107.60	108.00	Coal, bright; good cleats
0.05	108.00	108.05	Claystone; ash
1.15	108.05	109.20	Coal, bright; good cleats
0.40	109.20	109.60	Coal, bony; scattered resin; vertical fracture
1.20	109.60	110.80	Coal, bright; scattered resin; good cleats
0.20	110.80	111.00	Coal, bony; scattered resin
1.10	111.00	112.10	Coal, bright; scattered resin; vertical fracture; good cleats; bony at 111.3 ft
0.70	112.10	112.80	Shale, carbonaceous; interbedded with coal; scattered resin; silty at base
1.00	112.80	113.80	Coal, bright; good cleats; vertical fracture
0.20	113.80	114.00	Shale, carbonaceous, dark-brown
2.40	114.00	116.40	Siltstone, clayey, dark- to light-gray, thin-bedded; 45° fracture; pyrite at top; burrowed
1.10	116.40	117.50	Shale, carbonaceous, thin coal bands; pyrite at 116.7 ft
2.00	117.50	119.50	Siltstone, shaley, light-gray

Depth interval (feet) Thickness	From	To	Detailed Core Description
Start core description			
2.30	54.00	56.30	Siltstone, slightly carbonaceous, brown-red, highly fractured, oxidized
2.10	56.30	58.40	Shale, carbonaceous, dark-brown, highly oxidized; coaly at base
10.60	58.40	69.00	Shale, carbonaceous; lost core; uncertain lithology; interbedded with siltstone
0.90	69.00	69.90	Shale, carbonaceous, red-brown, highly oxidized
0.90	69.90	70.80	Coal, highly oxidized; limonite?
0.20	70.80	71.00	Shale, carbonaceous, black, oxidized; thin coal bands
0.60	71.00	71.60	Coal, oxidized; vertical fracture
1.00	71.60	72.60	Shale, carbonaceous, dark-brown to gray, highly oxidized; silty at base
0.20	72.60	72.80	Claystone, silty, pinkish-gray; ash
0.10	72.80	72.90	Shale, carbonaceous, black, oxidized
0.10	72.90	73.00	Claystone, pinkish-gray, oxidized; ash
0.20	73.00	73.20	Shale, coaly, carbonaceous, black, oxidized; very thin coal bands
2.30	73.20	75.50	Shale, carbonaceous, dark-brown to black, oxidized; very thin coal bands at base
0.10	75.50	75.60	Siltstone, carbonaceous, oxidized
0.40	75.60	76.00	Shale, coaly, carbonaceous, black, oxidized
5.00	76.00	81.00	Coal; lost core; uncertain lithology
3.00	81.00	84.00	Siltstone; lost core; uncertain lithology
0.10	84.00	84.10	Shale, carbonaceous, coaly, black
0.20	84.10	84.30	Coal, oxidized; cleats
0.30	84.30	84.60	Shale, carbonaceous, black, oxidized; coal bands
0.50	84.60	85.10	Coal, oxidized; high-angle fracture
0.20	85.10	85.30	Shale, carbonaceous, coaly, black
0.40	85.30	85.70	Coal, oxidized, fractured
0.20	85.70	85.90	Shale, coaly, black
1.80	85.90	87.70	Coal, oxidized, fractured
0.20	87.70	87.90	Siltstone
1.80	87.90	89.70	Coal, oxidized; cleats; 45° fracture
0.20	89.70	89.90	Siltstone, carbonaceous
0.30	89.90	90.20	Shale, carbonaceous, black
0.70	90.20	90.90	Coal, bony; vertical fracture
0.10	90.90	91.00	Claystone, silty, gray; sharp contacts; ash
0.10	91.00	91.10	Coal
0.10	91.10	91.20	Claystone, silty, gray; ash
0.40	91.20	91.60	Coal, bony; vertical fracture
0.40	91.60	92.00	Claystone, brownish-gray, oxidized; silty at base; ash
0.60	92.00	92.60	Siltstone, carbonaceous, dark-gray; coaly lenses; thin ash at 92.3 ft
3.40	92.60	96.00	Coal; lost core; uncertain lithology
9.00	96.00	99.00	Shale; lost core; uncertain lithology
End core description			

Depth interval (feet) Thickness	From	To	Detailed Core Description
Start core description			
0.40	157.50	157.90	Siltstone, carbonaceous, shaley, medium-gray
0.50	157.90	158.40	Shale, silty, carbonaceous; coal lenses
0.10	158.40	158.50	Sandstone, silty, gray
0.50	158.50	159.00	Shale, carbonaceous, black; coal lenses
0.10	159.00	159.10	Shale, carbonaceous, light-gray
0.20	159.10	159.30	Shale, carbonaceous
0.20	159.30	159.50	Coal, bright; good cleats
0.30	159.50	159.80	Shale, carbonaceous, black; coal lenses
1.00	159.80	160.80	Siltstone, light- to dark-gray; carbonaceous and coaly at base
0.20	160.80	161.00	Shale, carbonaceous, dark-gray; thin coal bands
0.80	161.00	161.80	Claystone, light-gray; ash; bentonite?; sharp basal contact
0.50	161.80	162.30	Coal, bony; scattered resin
1.80	162.30	164.10	Coal, bright
0.20	164.10	164.30	Coal, bony
0.50	164.30	164.80	Coal, bright; good cleats
0.10	164.80	164.90	Siltstone, clayey to sandy, brown
0.40	164.90	165.30	Coal, bright
0.10	165.30	165.40	Coal, bony
0.20	165.40	165.60	Coal, bright
0.50	165.60	166.10	Shale, carbonaceous, black
0.20	166.10	166.30	Coal, bright; good cleats
0.05	166.30	166.35	Claystone; ash
0.35	166.35	166.70	Coal, bright
0.05	166.70	166.75	Claystone
0.05	166.75	166.80	Coal, bright
0.10	166.80	166.90	Claystone, carbonaceous; ash
3.10	166.90	170.00	Coal, bright; good cleats; high-angle fracture
0.10	170.00	170.10	Claystone, silty, gray; ash
0.30	170.10	170.40	Coal, bright
0.05	170.40	170.45	Claystone; ash
0.95	170.45	171.40	Coal, bright; good cleats; high-angle fracture
0.40	171.40	171.80	Shale, carbonaceous, dark-gray to black; bony coal at base
0.70	171.80	172.50	Coal, bright; good cleats; vertical fracture
0.60	172.50	173.10	Coal, bony; scattered resin
2.80	173.10	175.90	Coal, bright; good cleats; high-angle fracture; scattered resin
0.10	175.90	176.00	Siltstone, slightly carbonaceous, gray, clayey; ash?
1.50	176.00	177.50	Coal, bright; cleats; high-angle fracture; scattered resin
0.10	177.50	177.60	Coal, bony
1.80	177.60	179.40	Coal, bright; good cleats
0.20	179.40	179.60	Claystone, light-gray; sharp contact; carbonaceous bands; ash

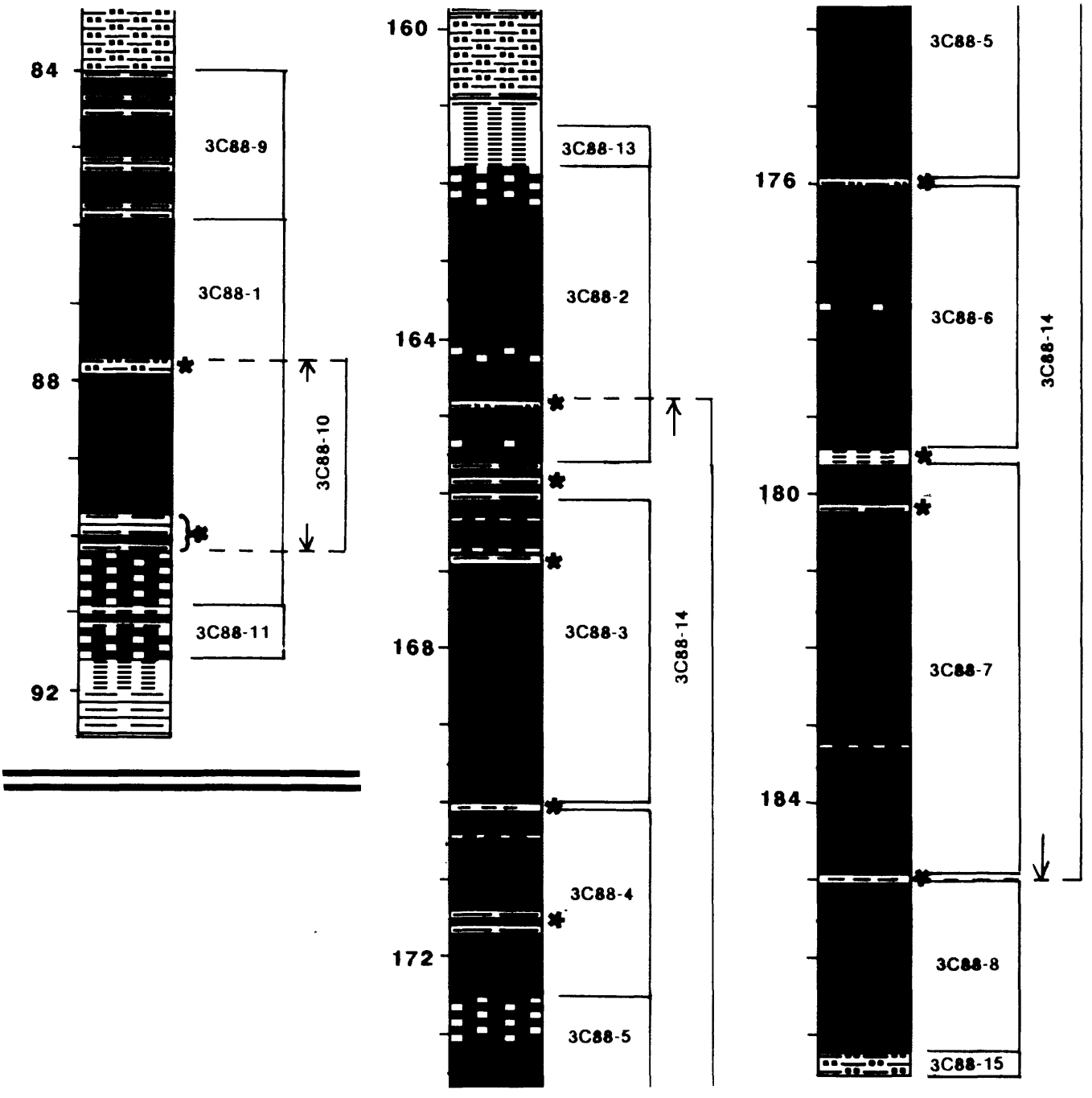
Depth interval (feet) Thickness	From	To	Detailed Core Description
0.50	179.60	180.10	Coal, bright; vertical fracture
0.10	180.10	180.20	Shale, carbonaceous, black
3.00	180.20	183.20	Coal, bright; vertical and high-angle fractures
0.05	183.20	183.25	Claystone; ash
1.65	183.25	184.90	Coal, bright; vertical and high-angle fractures
0.10	184.90	185.00	Claystone, silty, gray; ash
2.20	185.00	187.20	Coal, bright; good cleats; interval was sampled for desorption of methane
0.30	187.20	187.50	Siltstone, light-gray; carbonaceous fragments

End core description

U.S. Geological Survey

Hole No. **USGS-3**

Detailed strip log showing cored interval, location of sampled intervals, and sample numbers
Vertical scale: 1 inch = 2 feet



Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 2

Hole USGS-4 Elevation 6,120 feet Total depth 335 feet

Location 1239648 E., 138272 N. Sec. 13 , T. 32 N ., R. 12 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 9/2/88 Date completed 9/2/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Siltstone, fine-grained, carbonaceous, dark-gray
7	5	12	Siltstone, fine-grained, carbonaceous, coaly, dark-gray; coal stringers
11	12	23	Claystone, carbonaceous, dark-brown; thin bentonite near base
16	23	39	Siltstone, fine-grained, carbonaceous, gray
3	39	42	Claystone, carbonaceous, dark-gray; thin carbonaceous laminae
13	42	55	Siltstone, gray
6	55	61	Siltstone, carbonaceous, dark-gray
14	61	75	Sandstone, very fine grained, light-gray; thin carbonaceous laminae
1	75	76	Coal
15	76	91	Siltstone, very fine grained, slightly carbonaceous, gray; interbedded with claystone
2	91	93	Sandstone, very fine grained, gray
23	93	116	Siltstone; grades up to claystone
6	116	122	Siltstone, carbonaceous, dark-gray; interbedded with claystone
22	122	144	Coal; thin partings throughout
5	144	149	Siltstone, carbonaceous, medium-gray, coaly
19	149	168	Coal; thin partings throughout
14	168	182	Siltstone, carbonaceous, dark-gray; interbedded with claystone
6	182	188	Siltstone, medium-gray; grades up to claystone
14	188	202	Sandstone, very fine grained, light-gray; mostly quartz; not well sorted
10	202	212	Sandstone, fine-grained, light-gray; mostly quartz; not well sorted
23	212	235	Siltstone, carbonaceous, medium-gray; interbedded with claystone
2	235	237	Claystone, light-gray; ash; bentonite
14	237	251	Siltstone, carbonaceous, medium-gray; interbedded with sandstone
7	251	258	Claystone, silty, carbonaceous, dark-gray
25.5	258	283.5	Coal; upper 3 ft bony; includes partings

Depth interval (feet) Thickness	From	To	Lithologic Description
1.5	283.5	285	Siltstone
1.5	285	286.5	Coal
15.5	286.5	302	Siltstone, carbonaceous, dark-gray
3	302	305	Coal
30	305	335	Sandstone, fine-grained, light-gray; mainly quartz; well sorted; clean

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. USGS-4 County La Plata State Colorado

Location Sec. 13 T. 32 N. R. 12 W.

Elevation 6,120 Drilled depth 335 Logged depth 333

Drilling medium air Date logged 9/2/88

Geophysical logs:

Gamma ray (G) Logging speed 15 fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

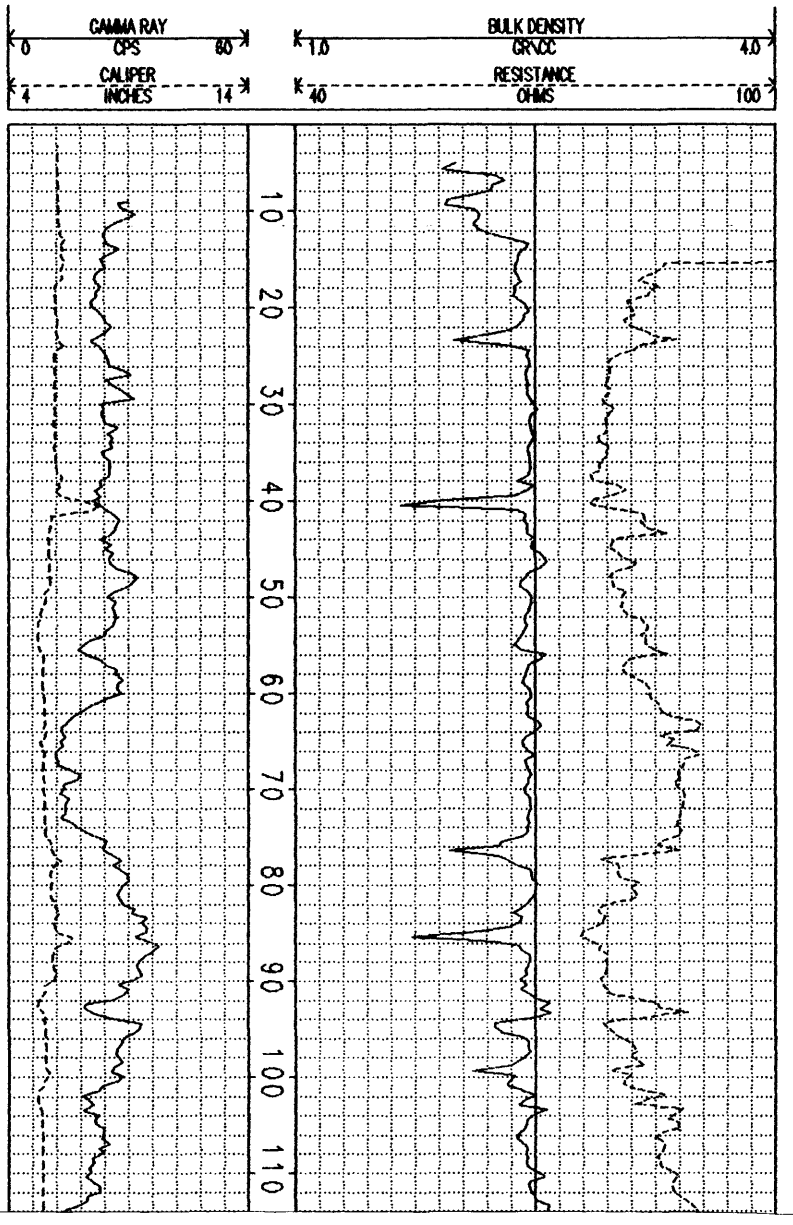
High resolution density (HRD)

Caliper (CAL)

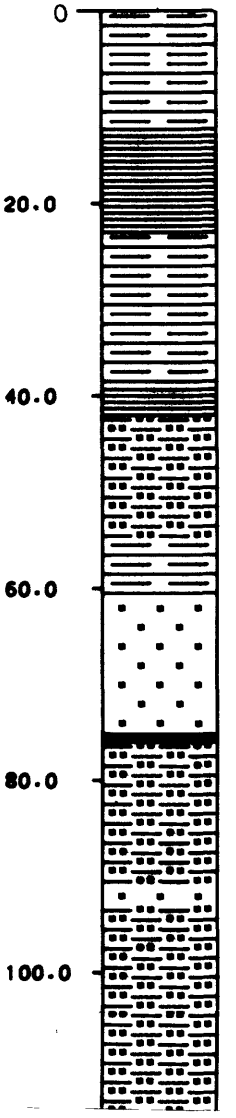
Resistance (RES)

Remarks:

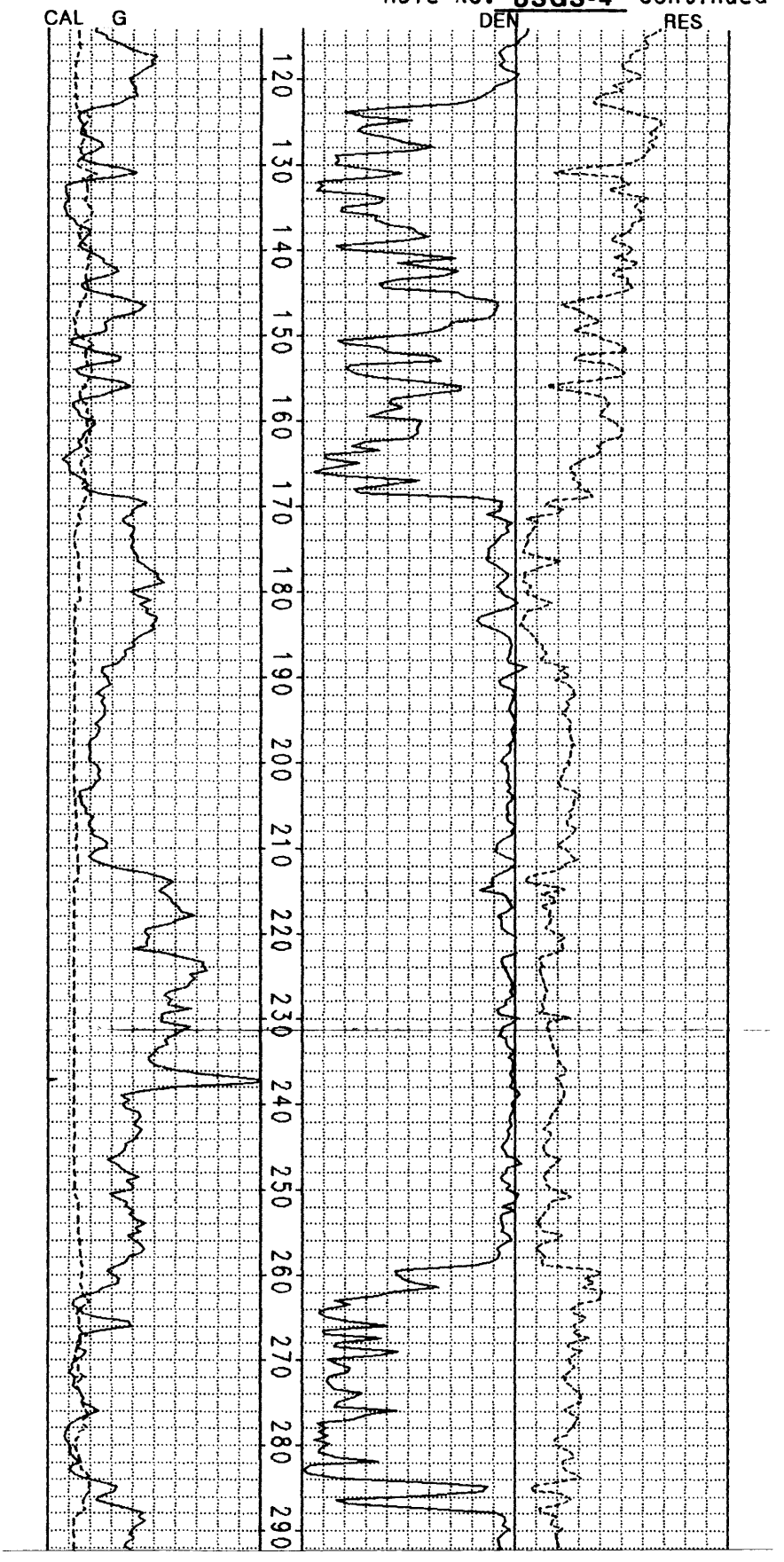
GEOPHYSICAL LOGS

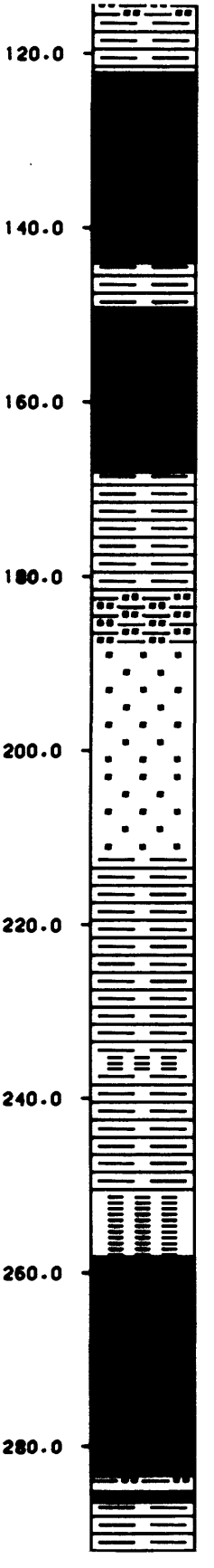


STRIP LOG

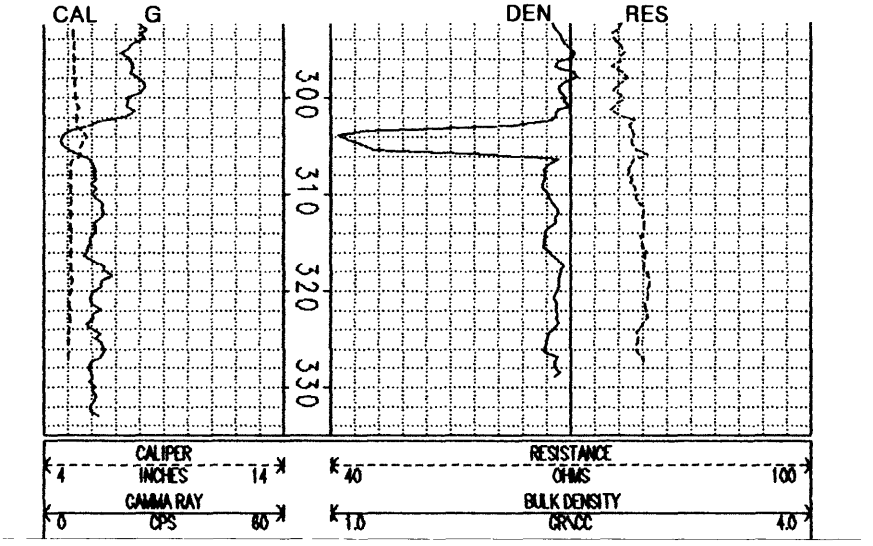


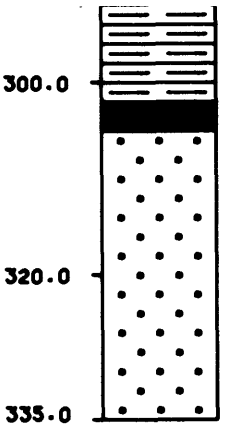
Hole No. USGS-4 continued





Hole No. **USGS-4** continued





Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 2

Hole USGS-5 Elevation 6,379 feet Total depth 285 feet

Location 1239795 E., 143549 N. Sec. 12, T. 32 N., R. 12 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Jeff Eman Core hole size 5 5/8 inches

Date started 6/27/88 Date completed 6/28/88 Geologist L. Roberts

Remarks: Lost circulation in rotary hole from 85 ft to bottom. Lost circulation in core hole at 15 ft.

Depth interval (feet) Thickness	From	To	Lithologic Description
10	0	10	Sandstone, very fine grained, light-brown, well-cemented
5	10	15	Siltstone, slightly sandy, light-gray
2	15	17	Siltstone, brown
8	17	25	Siltstone, gray
9	25	34	Siltstone, medium-gray
3	34	37	Shale, carbonaceous, dark-gray
5	37	42	Siltstone, carbonaceous, dark-gray
17	42	59	Sandstone, fine-grained, brown; interbedded with siltstone
3	59	62	Shale, carbonaceous, brown
5	62	67	Sandstone, very fine grained
4	67	71	Siltstone; interbedded with sandstone
9	71	80	Sandstone, very fine grained; interbedded with claystone
15	80	95	Claystone; no cuttings below 85 ft; uncertain lithology
Start core description			
5	95	100	Shale, claystone, siltstone, and coal, interbedded, highly oxidized
5	100	105	Coal, oxidized
12	105	117	Siltstone, claystone, shale, and thin coal, interbedded
12	117	129	Coal; includes partings
2	129	131	Shale
End core description			
12	131	143	Siltstone; no cuttings; uncertain lithology to 210 ft
7	143	150	Shale
8	150	158	Siltstone
7	158	165	Shale
2	165	167	Siltstone; fines upward to shale
43	167	210	Sandstone, fine-grained

Depth interval (feet) Thickness	From	To	Lithologic Description
Start core description			
9	210	219	Sandstone and siltstone, interbedded
26	219	245	Coal; includes partings
3	245	248	Shale, carbonaceous
7	248	255	Sandstone and siltstone, interbedded
End core description			
2	255	257	Sandstone, very fine grained; no cuttings to bottom of hole
2	257	259	Siltstone
26	259	285	Sandstone, fine-grained

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-5** County **La Plata** State **Colorado**

Location Sec. **12** T. **32** N. R. **12** W.

Elevation **6,379** Drilled depth **285** Logged depth **273**

Drilling medium **air and foam** Date logged **6/28/88**

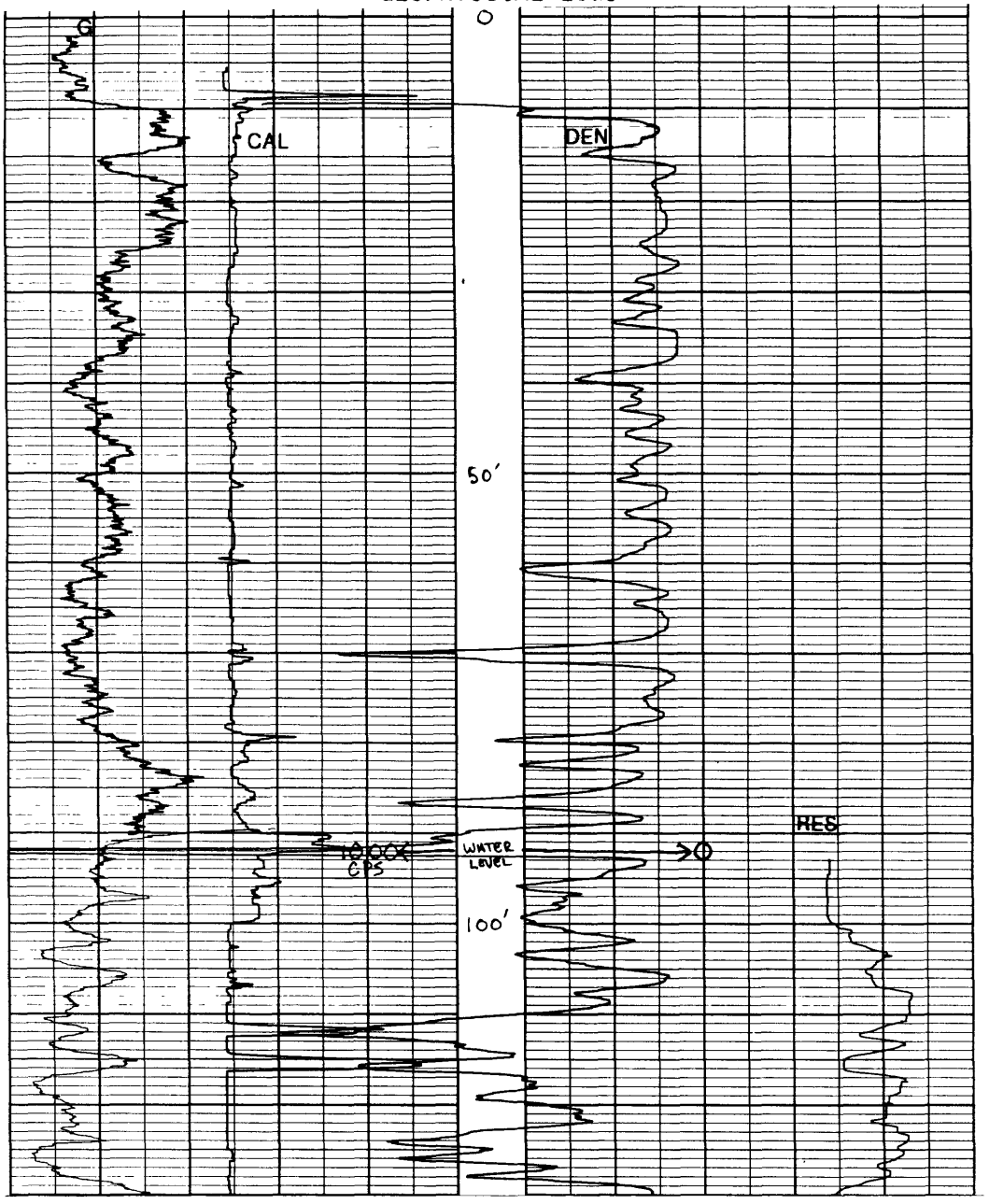
Geophysical logs:

Gamma ray (G)
Density (DEN)
High resolution density (HRD)
Caliper (CAL)
Resistance (RES)

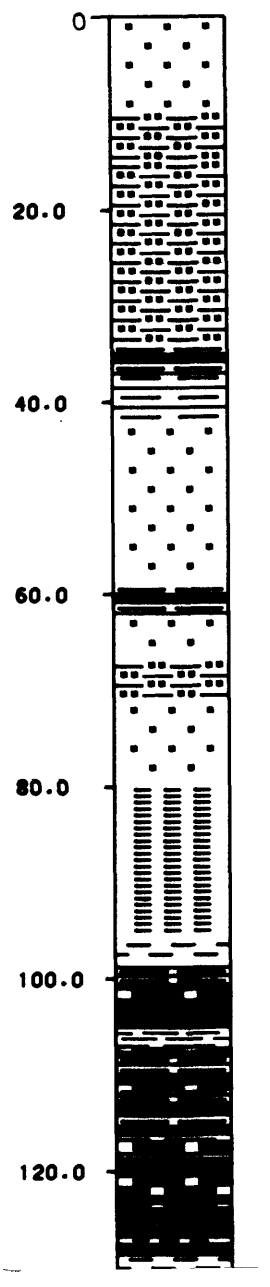
Logging speed **15** fpm
Vertical scale 1 in. = 20 ft.

Remarks: **Cored intervals, 95 to 131 ft and 210 to 255 ft**

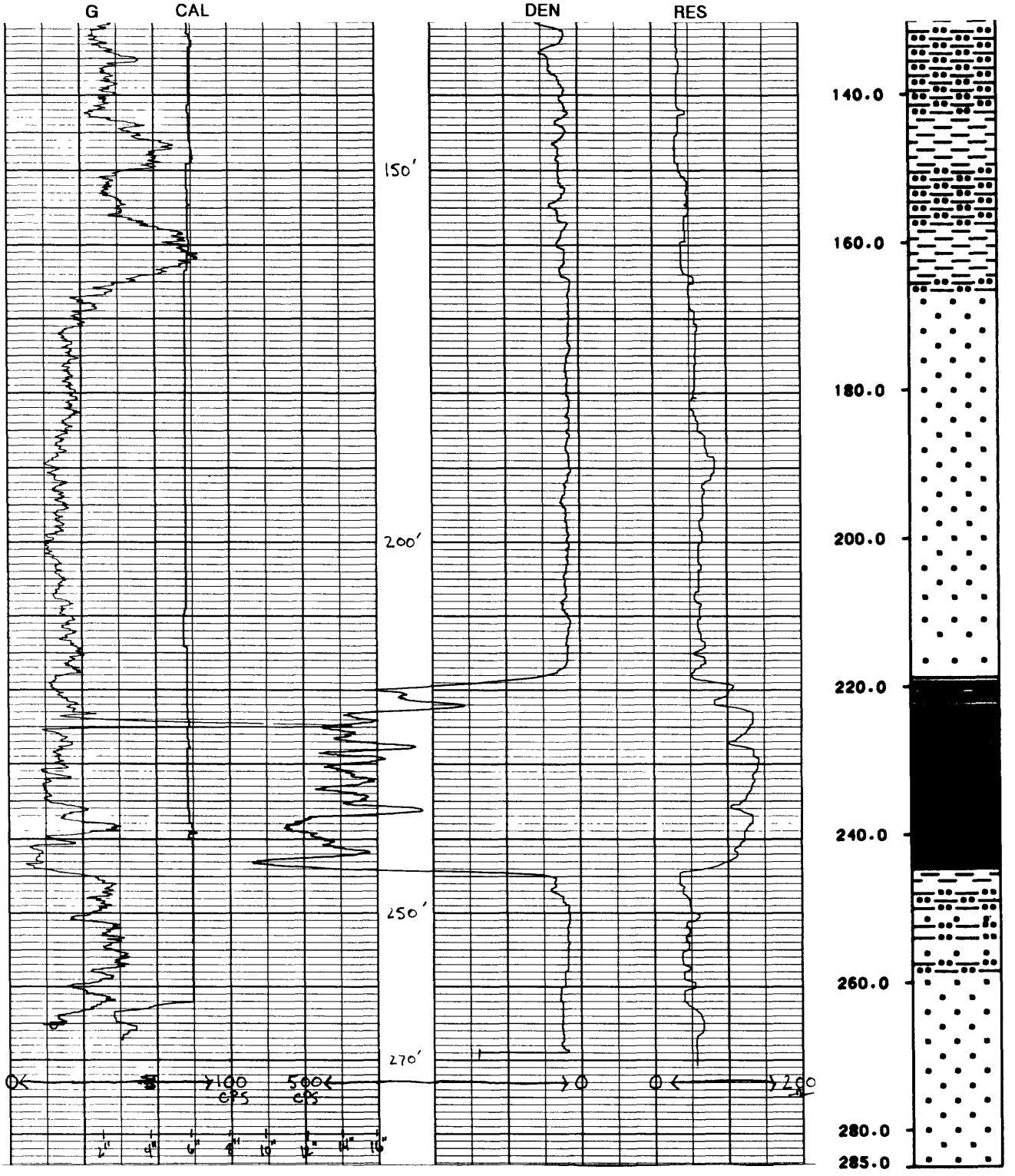
GEOPHYSICAL LOGS



STRIP LOG



Hole No. **USGS-5** continued



Depth interval (feet) Thickness	From	To	Detailed Core Description
Start core description			
1.00	95.00	96.00	Claystone, carbonaceous, grayish-red
2.00	96.00	98.00	Shale, clayey, carbonaceous, dark-gray, highly oxidized
0.60	98.00	98.60	Shale, coaly, carbonaceous, black
0.30	98.60	98.90	Coal, highly oxidized, soft
1.50	98.90	100.40	Shale, carbonaceous, coaly; possibly oxidized coal
0.60	100.40	101.00	Coal, oxidized
1.00	101.00	102.00	Coal, bony, fractured
3.00	102.00	105.00	Coal, lost core; uncertain lithology
0.40	105.00	105.40	Shale, silty, carbonaceous, medium-gray
0.20	105.40	105.60	Claystone, light-gray
0.60	105.60	106.20	Siltstone, clayey, gray
0.80	106.20	107.00	Claystone, pinkish-gray; ash; sharp lower contact
0.30	107.00	107.30	Coal, bony
0.10	107.30	107.40	Shale, clayey, carbonaceous, dark-brown
0.60	107.40	108.00	Coal; good cleats; vertical fracture
1.70	108.00	109.70	Shale, carbonaceous, black; thin coal bands
1.10	109.70	110.80	Coal, bright; good cleats
0.60	110.80	111.40	Coal, bony
1.30	111.40	112.70	Shale, carbonaceous, black
1.40	112.70	114.10	Coal, bright; good cleats
0.20	114.10	114.30	Coal, bony
2.40	114.30	116.70	Shale, carbonaceous, dark-brown to black; clay clasts; oxidized stringers
1.19	116.70	117.89	Coal, bony; vitrain bands; scattered resin
0.06	117.89	117.95	Claystone, gray; ash
0.35	117.95	118.30	Coal, bright; good cleats
0.15	118.30	118.45	Shale, coaly, carbonaceous, black
0.05	118.45	118.50	Claystone, gray; ash
1.00	118.50	119.50	Coal, bright; cleats
0.20	119.50	119.70	Shale, carbonaceous, black; scattered resin
0.70	119.70	120.40	Coal, bright; cleats
0.05	120.40	120.45	Claystone, gray; ash
1.85	120.45	122.30	Coal, bony; scattered resin; cleats at the top; high-angle fracture
0.10	122.30	122.40	Shale, coaly, carbonaceous, black
0.10	122.40	122.50	Coal
0.20	122.50	122.70	Shale, carbonaceous, gray; claystone; ash at top and bottom
0.70	122.70	123.40	Coal, bright; cleats; high-angle fracture
0.15	123.40	123.55	Coal, bony
0.05	123.55	123.60	Claystone; ash
0.10	123.60	123.70	Coal, bony
1.60	123.70	125.30	Coal, bright; cleats; high-angle fracture
0.30	125.30	125.60	Shale, coaly, carbonaceous; thin ash in middle
1.20	125.60	126.80	Coal, bright; cleats; vertical fracture

Depth interval (feet) Thickness	From	To	Detailed Core Description
0.60	126.80	127.40	Shale, carbonaceous; coaly bands; ash at base; scattered resin
0.40	127.40	127.80	Coal, bright
0.05	127.80	127.85	Claystone; ash
0.85	127.85	128.70	Coal, bright; cleats; fractured
1.80	128.70	130.50	Shale, silty, carbonaceous, dark-brown; coal bands
0.50	130.50	131.00	Shale, silty, medium-gray
End core description			
Start core description			
4.80	210.00	214.80	Sandstone, very fine grained, gray, rippled; muddy lenses
0.70	214.80	215.50	Siltstone, shaley, dark-gray
2.70	215.50	218.20	Sandstone, very fine grained, silty, gray; carbonaceous on bedding planes
0.40	218.20	218.60	Shale, carbonaceous, silty, dark-gray; thin coal stringers
0.30	218.60	218.90	Coal; cleats; muddy stringers
0.30	218.90	219.20	Shale, coaly, carbonaceous, dark-gray
0.80	219.20	220.00	Coal, bright; cleats; 45° fracture
0.20	220.00	220.20	Coal, bony
0.05	220.20	220.25	Claystone; ash
0.45	220.25	220.70	Coal, bony
0.80	220.70	221.50	Coal, bright; cleats
0.30	221.50	221.80	Shale, coaly, carbonaceous
0.20	221.80	222.00	Coal; thin carbonaceous lenses in middle
0.40	222.00	222.40	Shale, carbonaceous; thin ash near top; pyritic
0.50	222.40	222.90	Coal, bright; cleats
0.05	222.90	222.95	Claystone; ash
2.05	222.95	225.00	Coal, bright; cleats; vertical fracture
2.40	225.00	227.40	Coal, bright; cleats
0.30	227.40	227.70	Shale, coaly, carbonaceous, black; bony coal at base
1.30	227.70	229.00	Coal, bright; cleats
0.20	229.00	229.20	Coal, bony
0.10	229.20	229.30	Coal, bright
0.05	229.30	229.35	Coal, bony
0.10	229.35	229.45	Coal, bright
0.15	229.45	229.60	Coal, bony
0.20	229.60	229.80	Coal, bright
1.80	229.80	231.60	Coal, bright; interval sampled for desorption of methane
0.50	231.60	232.10	Coal, bright; claystone; thin ash at top
0.10	232.10	232.20	Claystone; ash
2.60	232.20	234.80	Coal, bright; cleats; high-angle and vertical fractures
0.10	234.80	234.90	Coal, bony
1.10	234.90	236.00	Coal, bright
0.20	236.00	236.20	Claystone, carbonaceous, gray; ash

Depth interval (feet) Thickness	From	To	Detailed Core Description
3.80	236.20	240.00	Coal, bright; scattered resin; thin ash at top; vertical fracture
1.80	240.00	241.80	Coal, bright; cleats; vertical and high-angle fractures
0.10	241.80	241.90	Claystone, carbonaceous, gray; ash
2.80	241.90	244.70	Coal, bright; cleats; scattered resin
0.30	244.70	245.00	Shale, carbonaceous, dark-brown
1.70	245.00	246.70	Shale, silty, clayey, gray
0.80	246.70	247.50	Shale, carbonaceous, dark-brown; coaly bands
2.90	247.50	250.40	Siltstone, gray; carbonaceous fragments
1.50	250.40	251.90	Sandstone, very fine grained, rippled; carbonaceous on bedding planes
1.20	251.90	253.10	Siltstone, shaley, gray
0.40	253.10	253.50	Sandstone, very fine grained, rippled; carbonaceous on bedding planes
1.10	253.50	254.60	Siltstone, gray
0.40	254.60	255.00	Sandstone, very fine grained, gray

End core description

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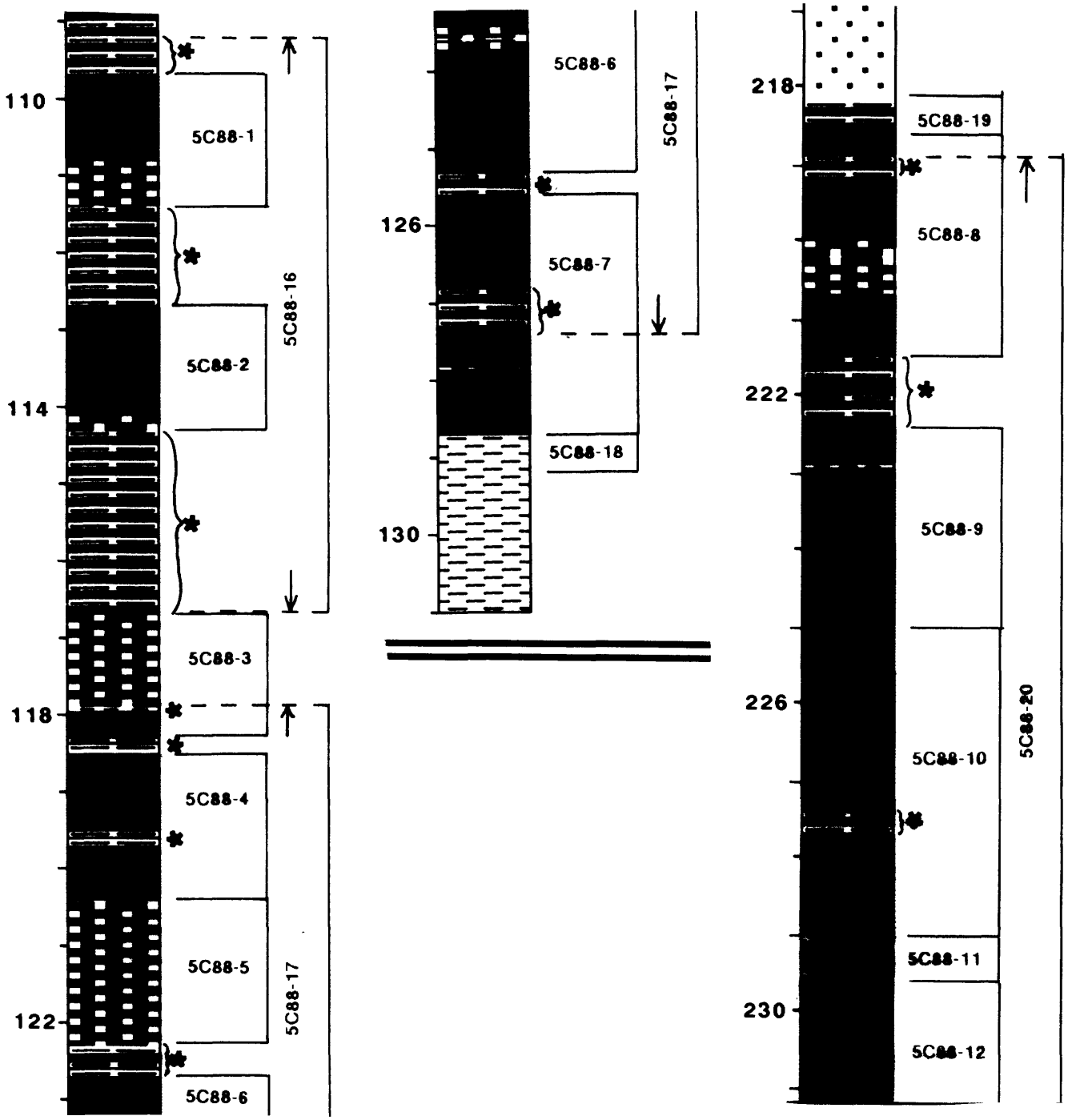
Hole No. **USGS-5**

Detailed strip log showing cored interval, location of sampled intervals, and sample numbers
Vertical scale: 1 inch = 2 feet



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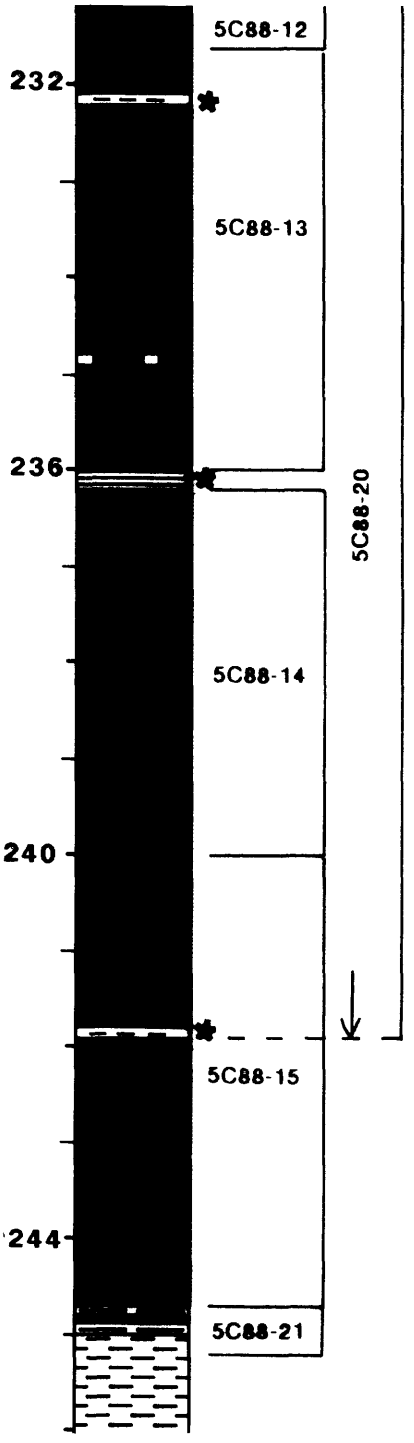
Hole No. USGS-5 continued



Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 2

Hole USGS-6 Elevation 6,345 feet Total depth 275 feet

Location 1240643 E., 144618 N. Sec. 12, T. 32 N., R. 12 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Jeff Eman Core hole size 5 5/8 inches

Date started 6/29/88 Date completed 8/31/88 Geologist L. Roberts

Remarks: Encountered water at about 75 ft in both rotary and core hole. Water flowed at a rate of approximately 5 gallons per minute.

Depth interval (feet) Thickness	From	To	Lithologic Description
28	0	28	Sandstone, fine-grained, light-brown
7	28	35	Siltstone, sandy, light-brown; interbedded with sandstone
2	35	37	Claystone
10	37	47	Siltstone, gray
2	47	49	Shale, carbonaceous, dark-gray
18	49	67	Siltstone, gray; interbedded with sandstone
3	67	70	Sandstone, gray
4	70	74	Siltstone, gray; interbedded with shale; carbonaceous fragments
1	74	75	Sandstone
5.5	75	80.5	Siltstone, gray-brown; interbedded with gray shale
1.5	80.5	82	Coal
4	82	86	Sandstone
3	86	89	Siltstone, carbonaceous, dark-gray to black
1	89	90	Sandstone, fine-grained
Start generalized core description (detailed description follows geophysical logs)			
3	90	93	Sandstone and siltstone, interbedded
19	93	112	Coal; includes partings
4	112	116	Siltstone, carbonaceous
2	116	118	Coal
1	118	119	Siltstone
2	119	121	Coal
3	121	124	Claystone and siltstone
13	124	137	Coal; includes partings
12.2	137	149.2	Siltstone, claystone, and thin coal, interbedded
End core description			

Depth interval (feet) Thickness	From	To	Lithologic Description
8.8	149.2	158	Siltstone; interbedded with claystone
4	158	162	Shale, gray
7	162	169	Siltstone, dark-gray
3	169	172	Shale, gray
32	172	204	Siltstone, gray; interbedded with gray shale
11	204	215	Sandstone, very fine grained, light-gray
5	215	220	Siltstone, carbonaceous, dark-gray; carbonaceous shale at base
7	220	227	Coal; includes bright and bony coal and partings
2	227	229	Shale, carbonaceous; uncertain lithology
7	229	236	Coal
1	236	237	Shale; uncertain lithology
8	237	245	Coal
6	245	251	Shale, carbonaceous, dark-brown
8	251	259	Siltstone, medium-gray; interbedded with shale
16	259	275	Sandstone, medium-grained, light-gray

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Southern Ute Indian Reservation

Hole No. **USGS-6** County **La Plata** State **Colorado**

Location Sec. **12** T. **32** N. R. **12** W.

Elevation **6,345** Drilled depth **275** Logged depth **275**

Drilling medium **air** Date logged **8/31/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

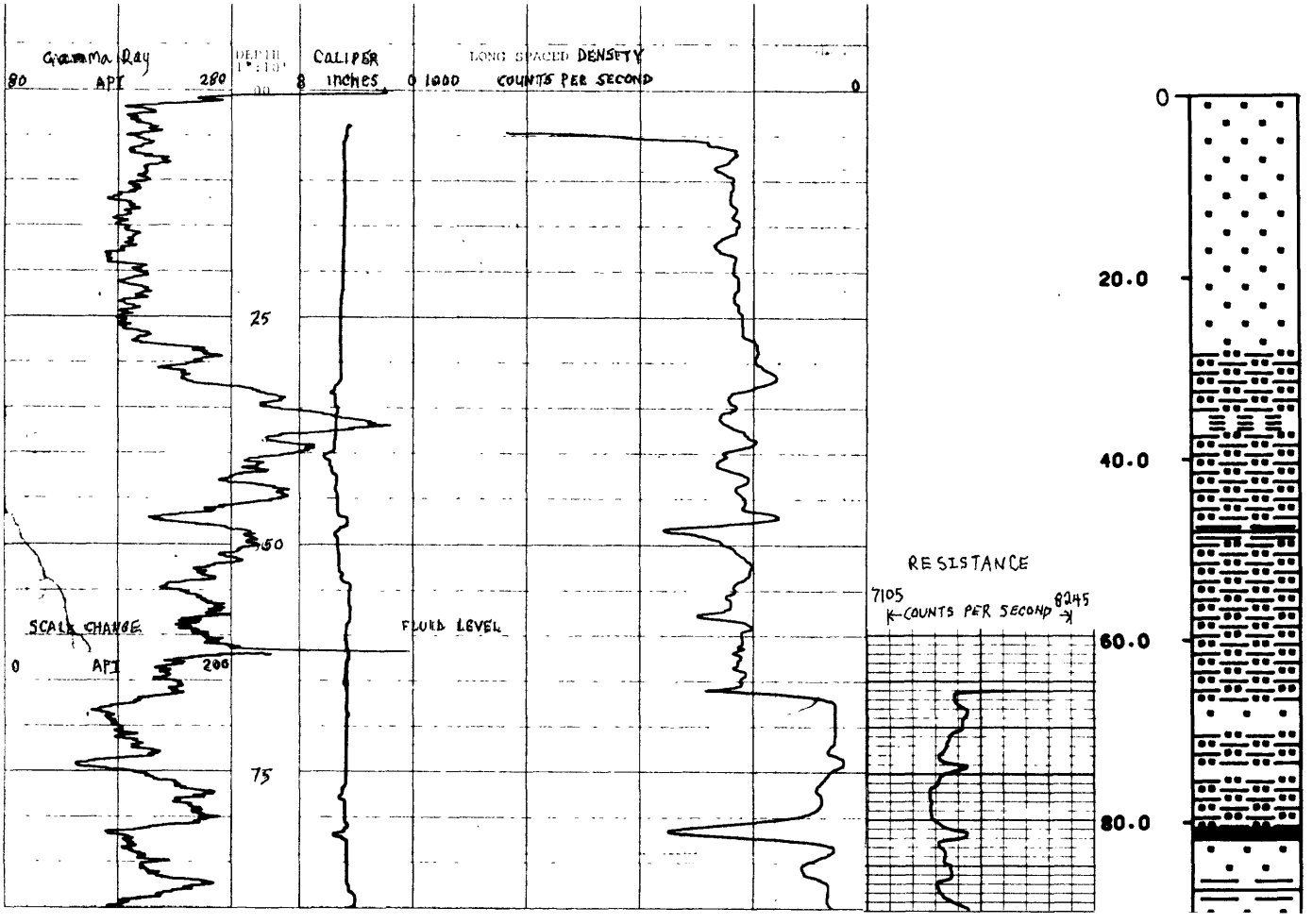
High resolution density (HRD)

Caliper (CAL)

Resistance (RES)

Remarks: **Cored interval, 90 to 149.2 ft**

GEOPHYSICAL LOGS STRIP LOG



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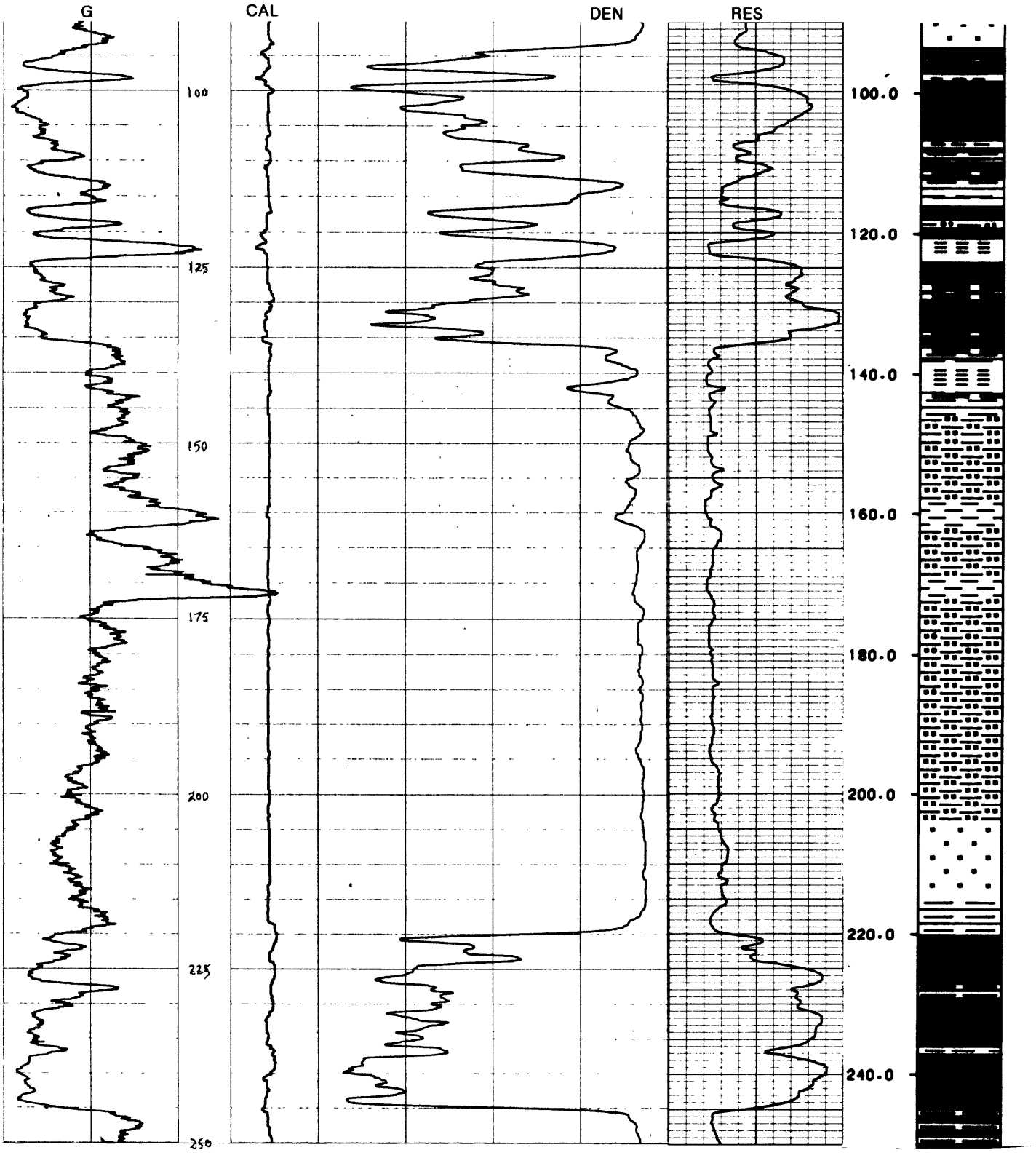
Hole No. **USGS-6** continued



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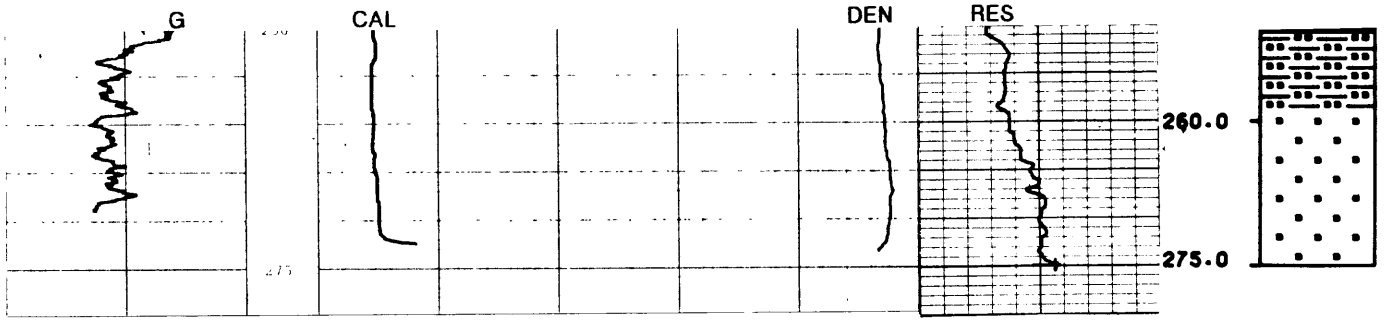
Hole No. **USGS-6** continued



Depth interval (feet) Thickness	From	To	Detailed Core Description
Start core description			
2.40	90.00	92.40	Sandstone, fine-grained, rippled
0.90	92.40	93.30	Siltstone, carbonaceous
0.30	93.30	93.60	Coal, bright; good cleats
0.02	93.60	93.62	Claystone; ash
0.58	93.62	94.20	Coal, bright
0.10	94.20	94.30	Siltstone; possible tonstein
0.60	94.30	94.90	Coal, bright; cleats
0.40	94.90	95.30	Coal, bony
1.90	95.30	97.20	Coal, bright; cleats
0.05	97.20	97.25	Siltstone, coaly
0.10	97.25	97.35	Claystone; ash
0.75	97.35	98.10	Siltstone, fine-grained, carbonaceous
3.00	98.10	101.10	Coal, bright; scattered resin
3.90	101.10	105.00	Coal, bright; good cleats; scattered resin
1.70	105.00	106.70	Coal, bright; cleats
0.90	106.70	107.60	Siltstone, carbonaceous, coaly; coal stringers at base
0.60	107.60	108.20	Coal, bright; scattered resin
1.40	108.20	109.60	Siltstone, carbonaceous; coal stringers
0.80	109.60	110.40	Coal; very thin ash at 109.9 ft
0.20	110.40	110.60	Siltstone, carbonaceous
0.30	110.60	110.90	Coal, bright
0.60	110.90	111.50	Coal, bony
0.30	111.50	111.80	Coal, bright
0.10	111.80	111.90	Claystone; ash
0.20	111.90	112.10	Coal, bright
0.10	112.10	112.20	Claystone; ash
1.70	112.20	113.90	Siltstone, carbonaceous
0.30	113.90	114.20	Siltstone, coaly, carbonaceous
0.40	114.20	114.60	Siltstone, carbonaceous
0.30	114.60	114.90	Coal, bony
0.95	114.90	115.85	Siltstone, carbonaceous; coaly at base
0.75	115.85	116.60	Coal, bright; cleats
0.10	116.60	116.70	Coal, bony
1.30	116.70	118.00	Coal, bright; good cleats
1.00	118.00	119.00	Siltstone, coaly, carbonaceous; coal stringers
1.70	119.00	120.70	Coal, bright; cleats
0.20	120.70	120.90	Siltstone, carbonaceous
2.00	120.90	122.90	Claystone; ash; bentonite
1.00	122.90	123.90	Siltstone, fine-grained, carbonaceous; coaly at base
3.10	123.90	127.00	Coal, bright; good cleats
0.03	127.00	127.03	Claystone, carbonaceous; ash
1.37	127.03	128.40	Coal, bony
0.05	128.40	128.45	Claystone; ash
0.80	128.45	129.25	Coal, bony; very thin ash at 128.8 and 129.1 ft
0.05	129.25	129.30	Claystone; ash

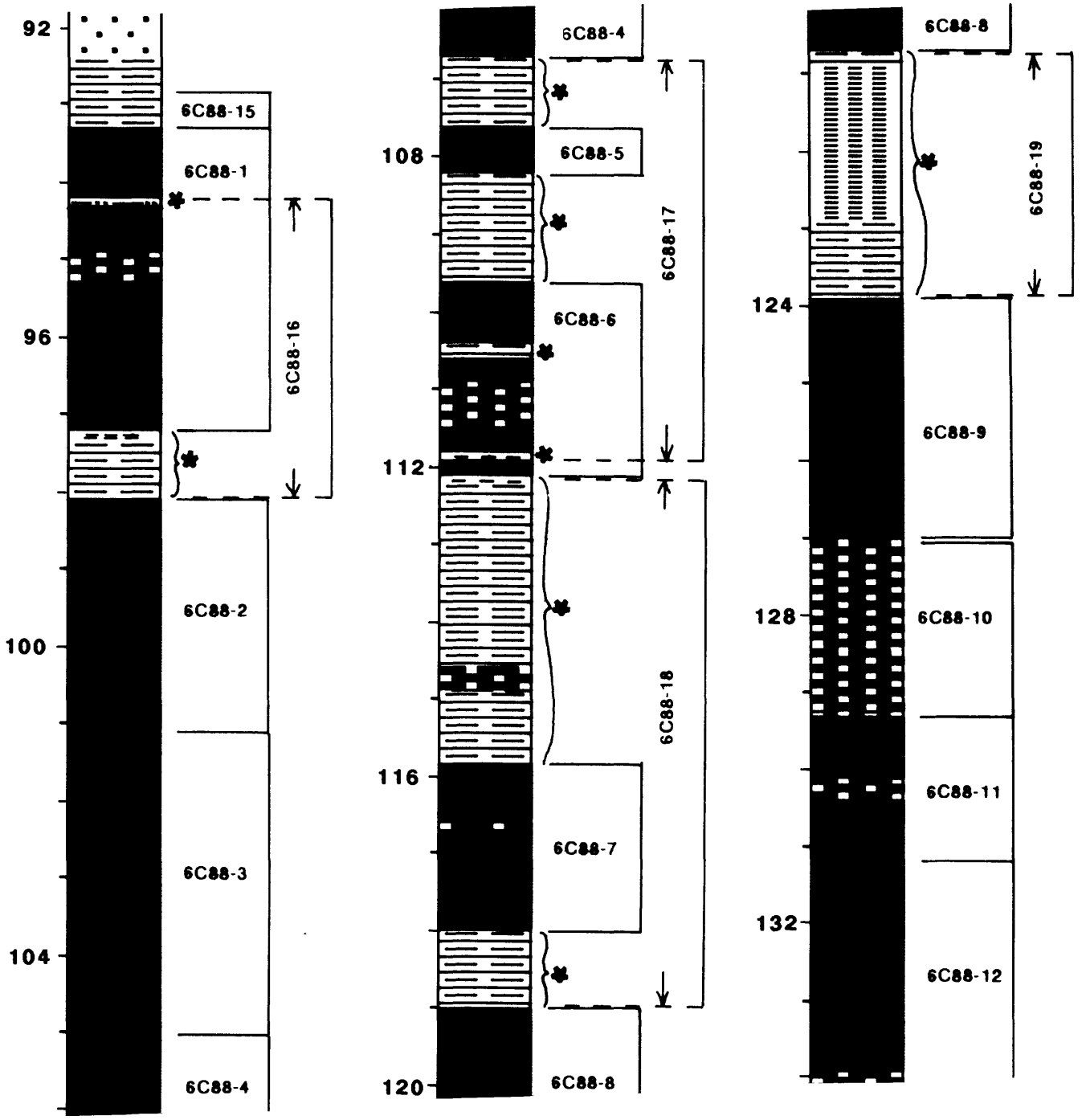
Depth interval (feet) Thickness	From	To	Detailed Core Description
0.80	129.30	130.10	Coal, bright
0.30	130.10	130.40	Coal, bony
0.80	130.40	131.20	Coal, bright
2.70	131.20	133.90	Coal, bright; scattered resin; vertical fracture
0.50	133.90	134.40	Coal, bony; very thin ash at 134.2 ft
0.60	134.40	135.00	Coal; lost core; uncertain lithology
0.20	135.00	135.20	Coal, bony
0.90	135.20	136.10	Coal, bright; cleats
0.80	136.10	136.90	Coal, bony
1.20	136.90	138.10	Siltstone, carbonaceous
0.10	138.10	138.20	Coal, bony
0.90	138.20	139.10	Siltstone, clayey, carbonaceous
2.90	139.10	142.00	Claystone
0.60	142.00	142.60	Siltstone, carbonaceous
0.60	142.60	143.20	Coal, bony
2.80	143.20	146.00	Siltstone, carbonaceous; coal stringers
2.90	146.00	148.90	Siltstone
0.30	148.90	149.20	Sandstone, very fine grained

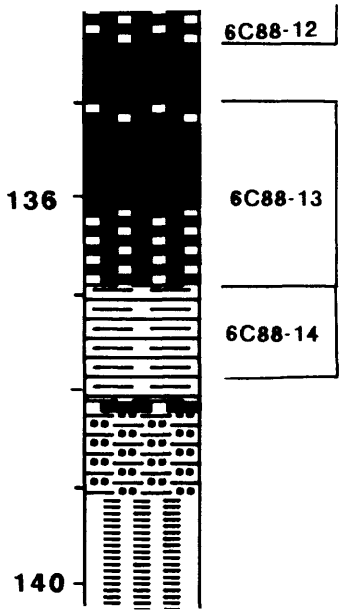
End core description

U.S. Geological Survey

Hole No. **USGS-6**

Detailed strip log showing cored interval, location of sampled intervals, and sample numbers
Vertical scale: 1 inch = 2 feet

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6C88-13
6C88-14
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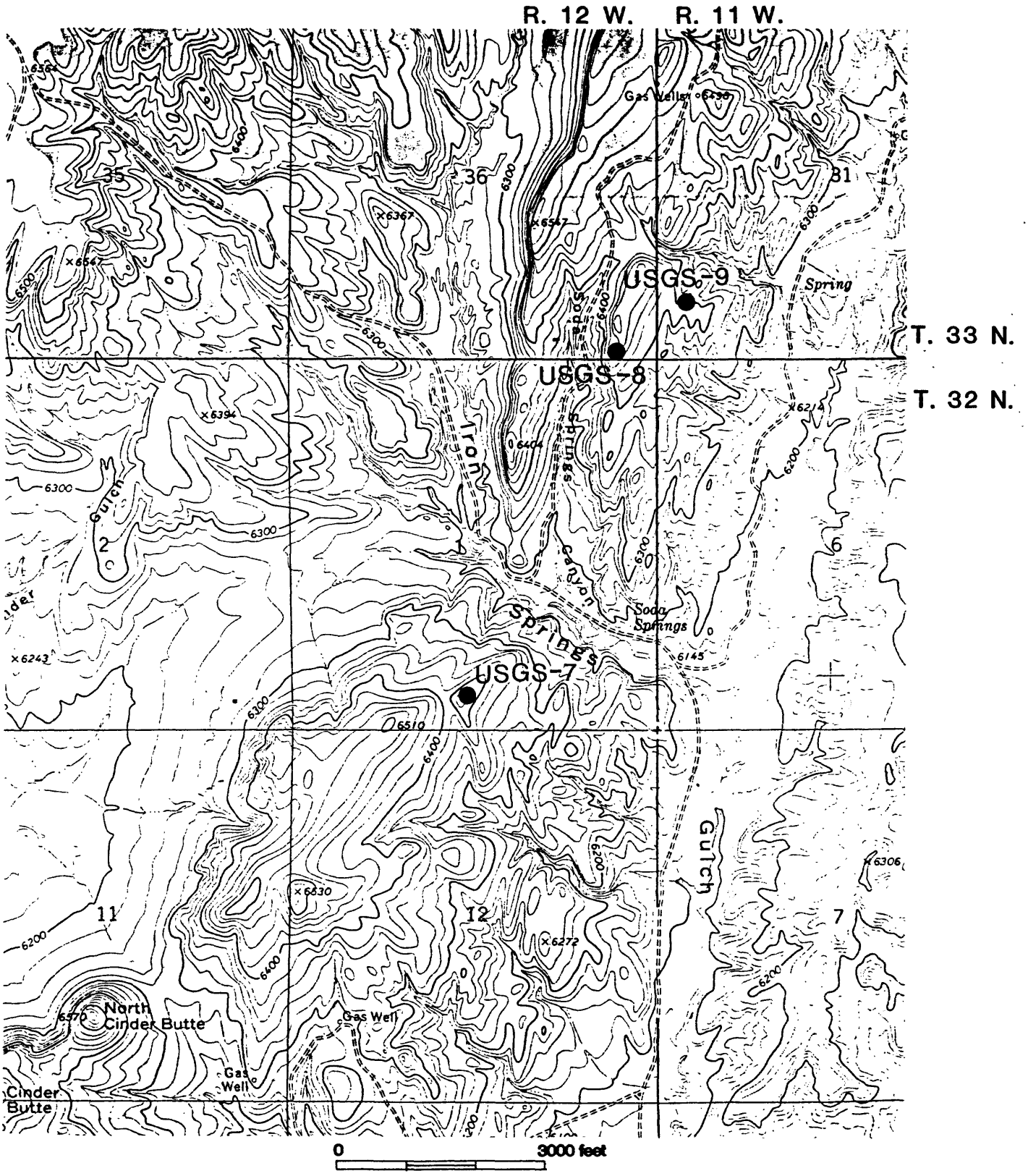


Figure 5.--Map showing locations of holes USGS-7 through USGS-9. Base from Pinkerton Mesa 7 1/2-minute quadrangle (1968).

Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 1

Hole USGS-7 Elevation 6,420 feet Total depth 186 feet

Location 1240763 E., 146837 N. Sec. 1, T. 32 N., R. 12 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 9/1/88 Date completed 9/1/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
10	0	10	Sandstone, very fine grained to fine-grained, well-sorted, oxidized
5	10	15	Sandstone, very fine grained, silty, unconsolidated
5	15	20	Claystone, slightly carbonaceous; interbedded with siltstone
7	20	27	Siltstone; scattered carbonaceous fragments
17	27	44	Sandstone, fine-grained to very fine grained; carbonaceous on bedding planes
6	44	50	Sandstone, red, clinkered, oxidized
7	50	57	Siltstone, slightly carbonaceous, well-cemented
4	57	61	Claystone
12	61	73	Siltstone, fine-grained, slightly carbonaceous; thin lenses of very fine grained sandstone
2	73	75	Claystone
25	75	100	Siltstone, carbonaceous; interbedded with sandstone
5	100	105	Sandstone, fine-grained; interbedded with siltstone
35	105	140	Sandstone, fine- to medium-grained; not well sorted
5	140	145	Claystone; grades downward into silt
25	145	170	Siltstone; interbedded with sandstone; well cemented
7	170	177	Sandstone, very fine grained, well-sorted
9	177	186	Siltstone; encountered void at 181 ft

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-7** County La Plata State Colorado

Location Sec. 1 T. 32 N. R. 12 W.

Elevation **6,420** Drilled depth **186** Logged depth **183**

Drilling medium **air and heavy foam** Date logged **9/1/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

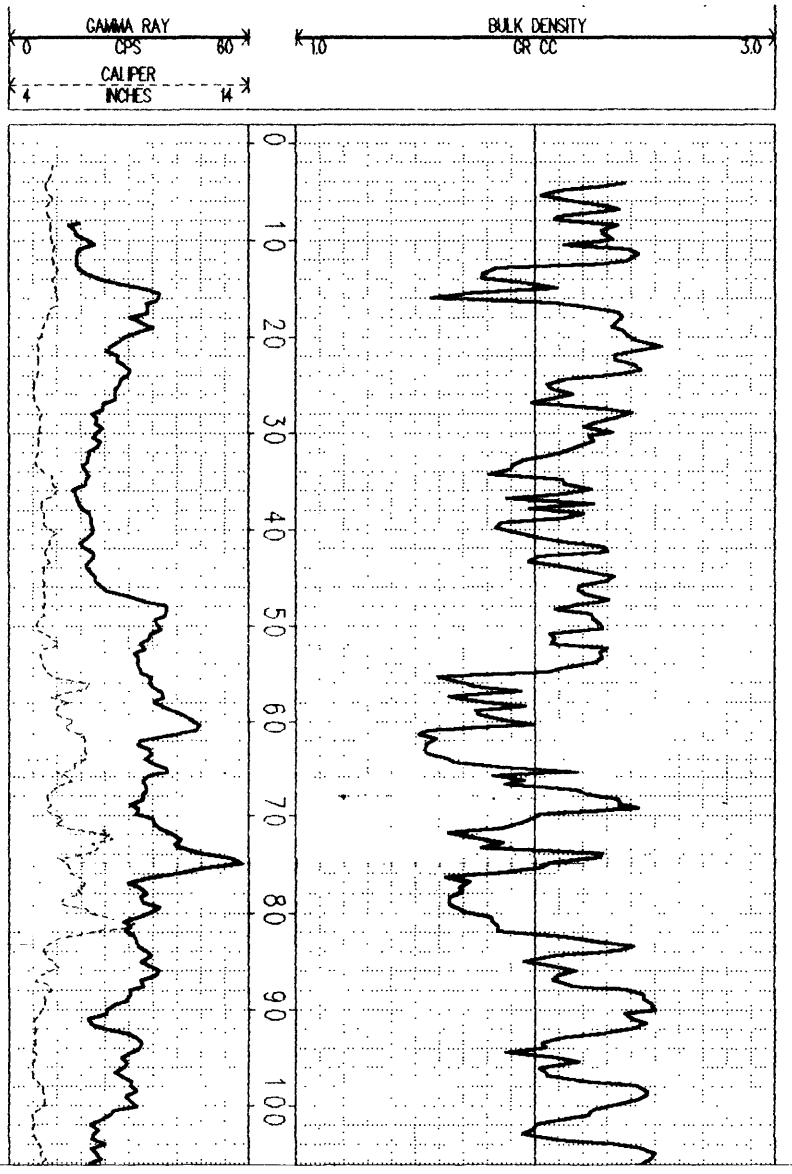
High resolution density (HRD)

Caliper (CAL)

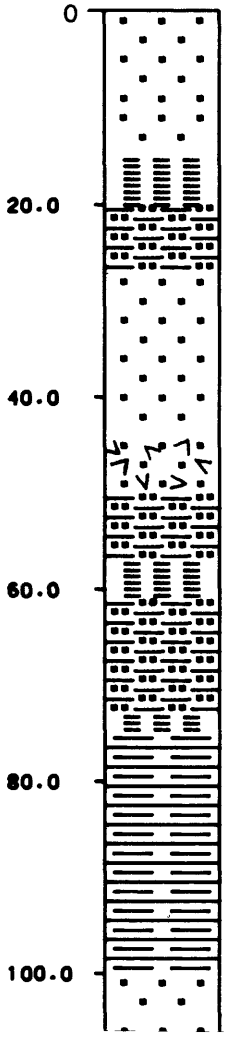
Resistance (RES)

Remarks: **Encountered void at 181 ft; abondoned hole**

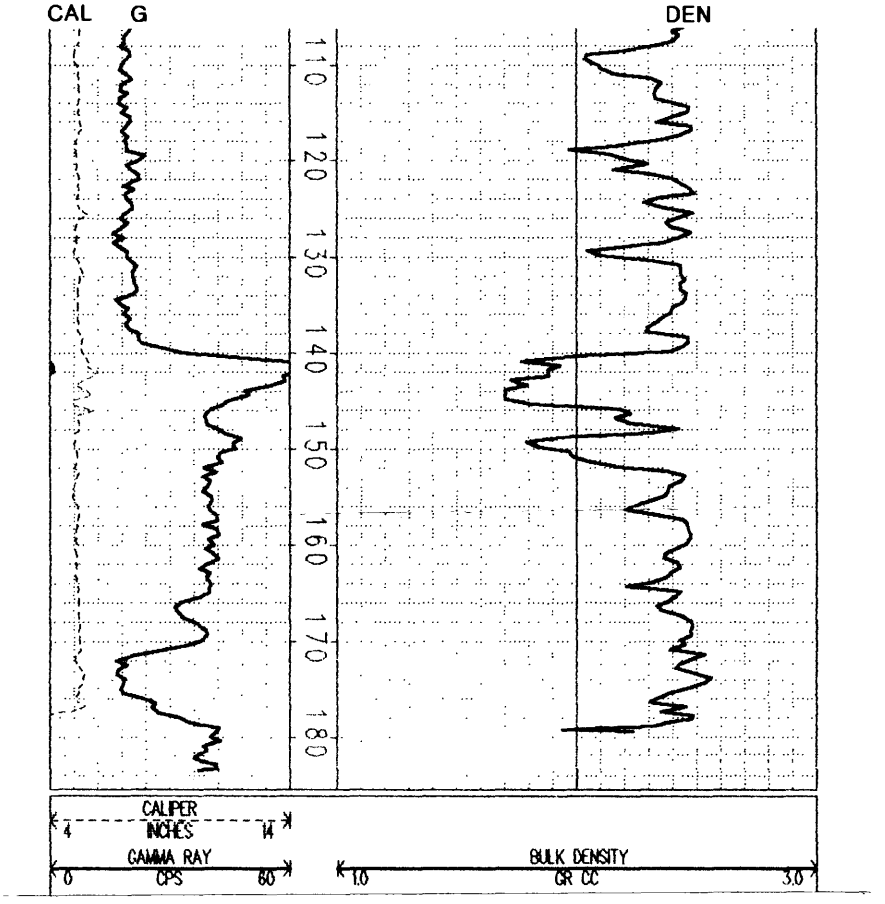
GEOPHYSICAL LOGS

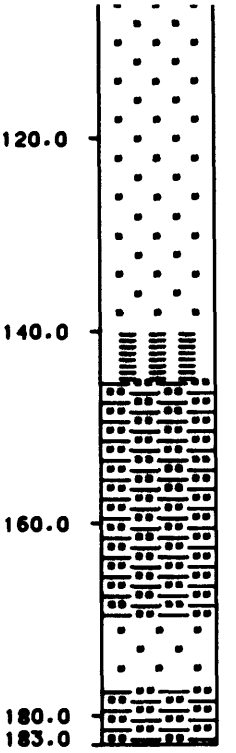


STRIP LOG



Hole No. **USGS-7** continued





Sample and Core Log U.S. GEOLOGICAL SURVEY

Hole USGS-8 Elevation 6,436 feet Total depth 235 feet

Location 1243151 E., 151870 N. Sec. 36 , T. 33 N ., R. 12 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by U.S.G.S. Driller Steve Grant Core hole size 5 5/8 inches

Date started 9/12/88 Date completed 9/15/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Claystone, brownish-gray
2	5	7	Siltstone, light-brown
8	7	15	Claystone, carbonaceous, dark-brown to black
5	15	20	Siltstone, carbonaceous, dark-brown to black, slightly coaly
14	20	34	Siltstone, slightly sandy, medium-gray
6	34	40	Sandstone, very fine grained, medium-gray, slightly calcareous
15	40	55	Sandstone, very fine grained, medium-gray; interbedded with sandy siltstone; scattered plant fragments
13	55	68	Sandstone, very fine grained, medium-gray, well-cemented
3	68	71	Siltstone, medium-gray; scattered plant fragments
2	71	73	Sandstone, very fine grained, medium-gray
2.5	73	75.5	Siltstone, medium-gray
Start core description			
3.5	75.5	79	Siltstone and sandstone
12	79	91	Coal
4	91	95	Siltstone, coaly
11	95	106	Coal; includes partings
3	106	109	Claystone and siltstone, carbonaceous
12	109	121	Coal; includes partings
2	121	123	Siltstone
1	123	124	Coal
1	124	125	Siltstone and claystone
3	125	128	Coal
1	128	129	Siltstone, carbonaceous
End core description			

Depth interval (feet) Thickness	From	To	Lithologic Description
17	129	146	Siltstone, medium-gray; thin claystone lenses at base
19	146	165	Sandstone, very fine grained, gray; mostly quartz; interbedded siltstone lenses; scattered carbonaceous fragments
6	165	171	Siltstone, dark-gray
2	171	173	Claystone, medium-gray
3	173	176	Sandstone
4	176	180	Siltstone, carbonaceous, dark-brown to black
3	180	183	Claystone; bentonite?; uncertain lithology
3	183	186	Coal
2	186	188	Sandstone, very fine grained; mostly quartz; thin lenses of fine-grained sandstone
9	188	197	Siltstone, medium-gray
8	197	205	Sandstone, medium-grained, gray, clean, well-sorted
7	205	212	Sandstone, fine-grained
4	212	216	Sandstone, medium-grained
19	216	235	Sandstone, medium-grained, clean, well-sorted; interbedded sandstone and siltstone

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-8** County **La Plata** State **Colorado**

Location Sec. **36** T. **33** N. R. **12** W.

Elevation **6,436** Drilled depth **235** Logged depth **233**

Drilling medium **air** Date logged **9/15/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale **1 in. = 20 ft.**

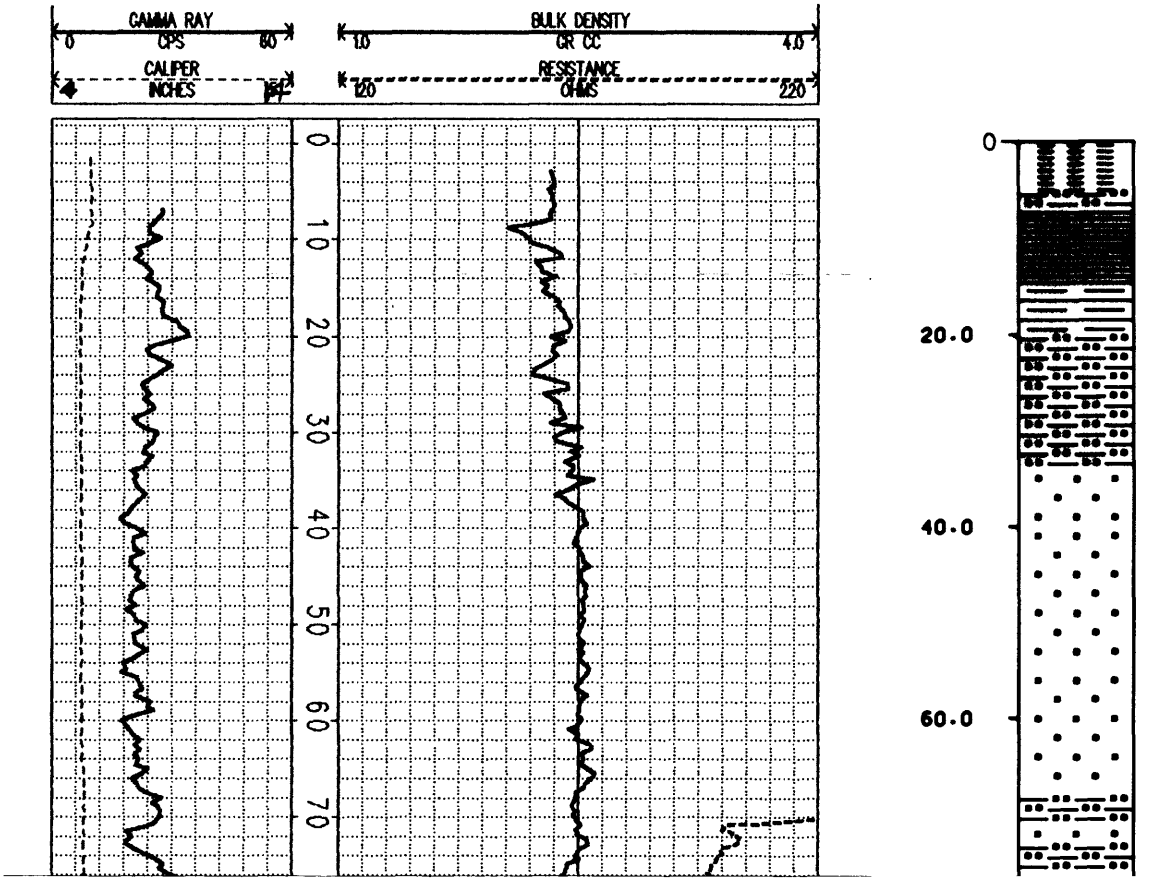
High resolution density (HRD)

Caliper (CAL)

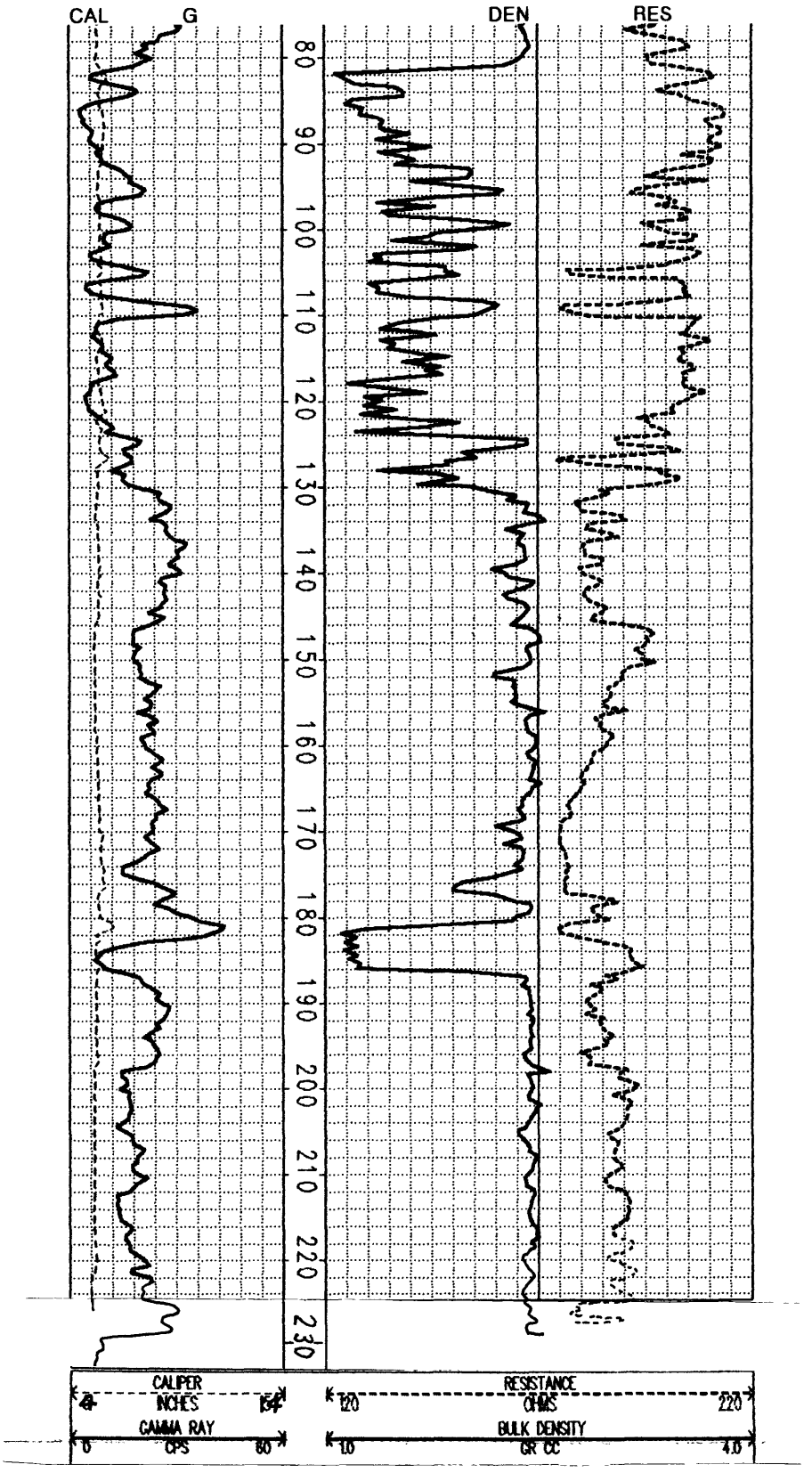
Resistance (RES)

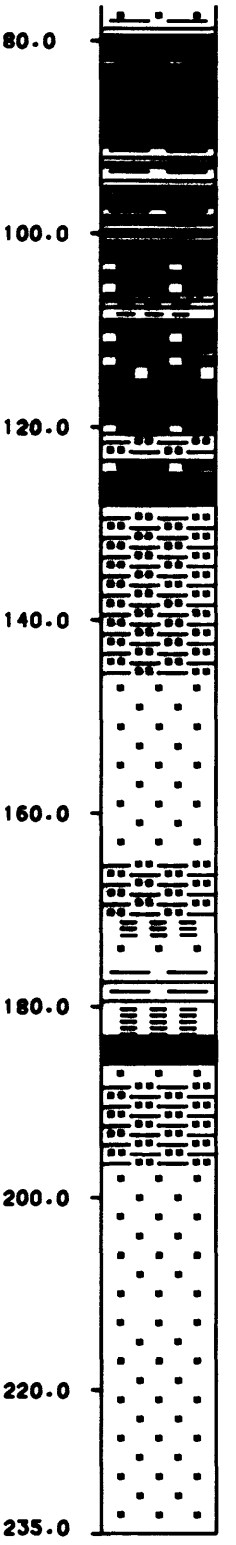
Remarks: **Cored interval, 75.5 to 129.0 ft**

GEOPHYSICAL LOGS STRIP LOG



Hole No. **USGS-8** continued





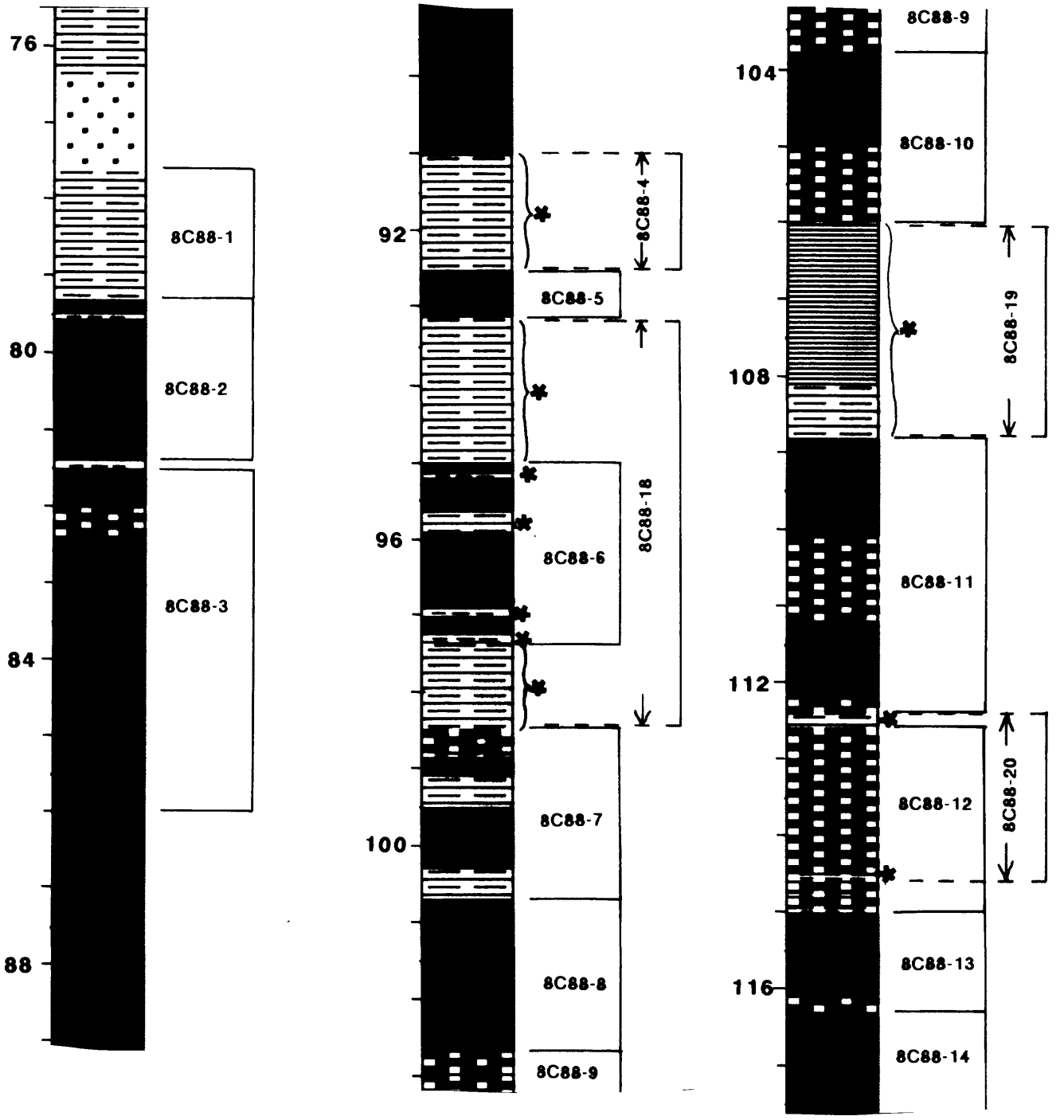
Depth interval (feet) Thickness	From	To	Detailed Core Description
Start core description			
0.90	75.50	76.40	Siltstone, carbonaceous, medium-gray; pyritic; plant fragments
1.20	76.40	77.60	Sandstone, very fine grained, gray, rippled
1.60	77.60	79.20	Siltstone, coaly, medium-gray; pyrite on fractures
0.10	79.20	79.30	Siltstone, carbonaceous, dark-gray
0.20	79.30	79.50	Coal
0.05	79.50	79.55	Claystone; ash
1.85	79.55	81.40	Coal, bright; good cleats; high angle fracture
0.10	81.40	81.50	Claystone; ash
0.50	81.50	82.00	Coal, bright; good cleats
0.40	82.00	82.40	Coal, bony; very thin ash parting near top
3.60	82.40	86.00	Coal, bright; scattered resin; good cleats; fractured
5.00	86.00	91.00	Coal; lost core; uncertain lithology
1.50	91.00	92.50	Siltstone, coaly, carbonaceous; scattered resin; coal stringers
0.60	92.50	93.10	Coal, bright; good cleats
1.90	93.10	95.00	Siltstone, coaly, carbonaceous; scattered resin; coal stringers
0.15	95.00	95.15	Coal, bright; good cleats
0.05	95.15	95.20	Claystone, carbonaceous; ash
0.45	95.20	95.65	Coal, bright; cleats
0.25	95.65	95.90	Siltstone, coaly, carbonaceous, black
1.00	95.90	96.90	Coal, bright; cleats
0.10	96.90	97.00	Claystone; ash
0.25	97.00	97.25	Coal, bright
0.10	97.25	97.35	Claystone; ash
0.05	97.35	97.40	Coal, bony
1.10	97.40	98.50	Siltstone, carbonaceous, dark-gray
0.30	98.50	98.80	Coal, bony
0.05	98.80	98.85	Claystone, carbonaceous; ash
0.25	98.85	99.10	Coal, bright
0.40	99.10	99.50	Siltstone, coaly, black
0.80	99.50	100.30	Coal, bright, slightly bony; good cleats
0.40	100.30	100.70	Siltstone, coaly, carbonaceous; coal stringers
2.00	100.70	102.70	Coal, bright; good cleats
0.30	102.70	103.00	Coal, bony; abundant pyrite
0.80	103.00	103.80	Coal, bony
1.20	103.80	105.00	Coal, bright; good cleats
1.00	105.00	106.00	Coal, bony; scattered clay lenses
2.10	106.00	108.10	Claystone, carbonaceous, silty, dark-brown
0.70	108.10	108.80	Siltstone, carbonaceous, coaly; coal stringers
1.30	108.80	110.10	Coal, bright; good cleats
1.10	110.10	111.20	Coal, bony
1.00	111.20	112.20	Coal, bright; very thin ash layers at 111.8 and 112.2 ft
0.20	112.20	112.40	Coal, bony

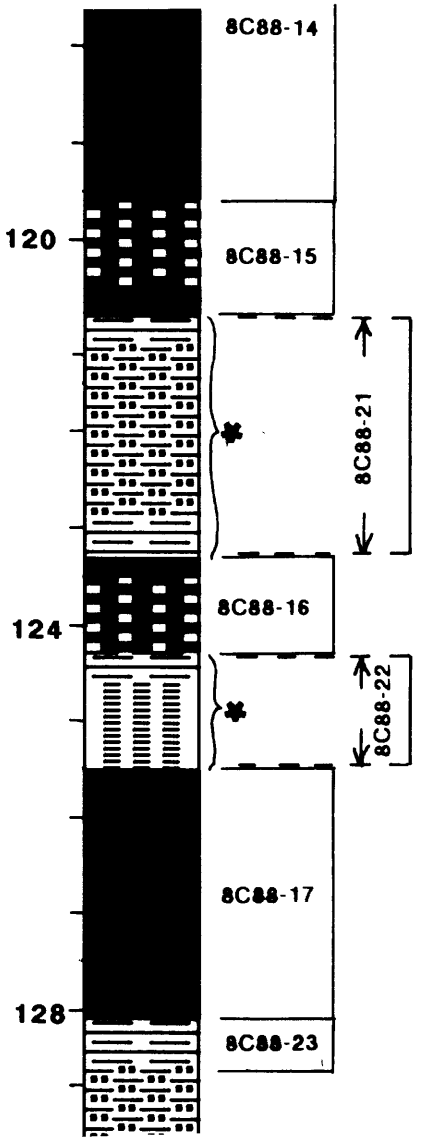
Depth interval (feet) Thickness	From	To	Detailed Core Description
0.20	112.40	112.60	Siltstone, carbonaceous; ash?
1.90	112.60	114.50	Coal, bony; scattered resin
0.10	114.50	114.60	Claystone; ash
0.15	114.60	114.75	Coal, bony
0.05	114.75	114.80	Claystone; ash
0.15	114.80	114.95	Coal, bony
0.05	114.95	115.00	Claystone; ash
1.10	115.00	116.10	Coal, bright
0.20	116.10	116.30	Coal, bony; abundant pyrite
3.30	116.30	119.60	Coal, bright; thin ash at 118.2 ft; high-angle fracture
0.90	119.60	120.50	Coal, bony; scattered resin
0.30	120.50	120.80	Coal, bright; cleats
0.30	120.80	121.10	Siltstone, carbonaceous, gray
1.80	121.10	122.90	Siltstone, gray
0.40	122.90	123.30	Siltstone, carbonaceous, gray
0.20	123.30	123.50	Coal, bright
0.80	123.50	124.30	Coal, bony
0.30	124.30	124.60	Siltstone, coaly, carbonaceous
0.90	124.60	125.50	Claystone; ash; bentonite
0.90	125.50	126.40	Coal, bright; good cleats; high-angle fracture
1.30	126.40	127.70	Coal; interbedded coal, carbonaceous siltstone, and bony coal
0.40	127.70	128.10	Coal, bright; cleats
0.50	128.10	128.60	Siltstone, carbonaceous, coaly
0.40	128.60	129.00	Siltstone, slightly carbonaceous
End core description			

U.S. Geological Survey

Hole No. **USGS-8**

Detailed strip log showing cored interval, location of sampled intervals, and sample numbers
Vertical scale: 1 inch = 2 feet

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8C88-22
8C88-17
128
8C88-23

Sample and Core Log U.S. GEOLOGICAL SURVEY

Hole USGS-9 Elevation 6,404 feet Total depth 315 feet

Location 1244127 E., 152316 N. Sec. 31 , T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 9/15/88 Date completed 9/16/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Sandstone, very fine grained, silty, light-gray to brown; plant fragments
4	5	9	Claystone, medium-gray; interbedded with siltstone
1	9	10	Sandstone, fine-grained, light-gray, well-cemented
5	10	15	Sandstone, very fine grained, light-gray, iron-stained
5	15	20	Siltstone, light-brown; interbedded with sandstone
8	20	28	Sandstone, very fine grained, light-brown, oxidized
2	28	30	Claystone, carbonaceous, medium-gray to dark-brown
6	30	36	Claystone, carbonaceous, medium- to light-gray; plant fragments; grades downward to siltstone
4	36	40	Siltstone, light-gray
6	40	46	Claystone, medium-gray
15	46	61	Siltstone; fining downward to claystone; carbonaceous stringers
3	61	64	Siltstone, medium-gray
4	64	68	Claystone, light-gray; ash; bentonite
4	68	72	Siltstone, carbonaceous, dark-brown; coal stringers
5	72	77	Siltstone, medium-gray; plant fragments
5	77	82	Claystone, carbonaceous, dark-brown; resin
2	82	84	Siltstone, sandy, medium-gray
28	84	112	Sandstone, very fine grained to fine-grained, medium-gray; siltstone lenses; thinly laminated; plant fragments
4	112	116	Claystone, carbonaceous, medium-gray
1.5	116	117.5	Coal
2.5	117.5	120	Claystone, carbonaceous, medium-gray
1.5	120	121.5	Coal
2	121.5	123.5	Claystone, carbonaceous, medium-gray
2.5	123.5	126	Coal
6	126	132	Siltstone, medium-gray; some plant fragments
28	132	160	Siltstone, carbonaceous, medium-gray to dark-gray; interbedded with very fine grained sandstone
35	160	195	Sandstone, very fine grained, medium-gray; interbedded with siltstone
9	195	204	Coal; includes partings
2	204	206	Claystone, light-gray; ash; bentonite

Depth interval (feet) Thickness	From	To	Lithologic Description
11	206	217	Coal; includes partings
13	217	230	Claystone, carbonaceous, medium-gray
3	230	233	Sandstone
16	233	249	Siltstone, slightly carbonaceous, medium-gray
5	249	254	Claystone, medium-gray
2	254	256	Siltstone, carbonaceous, black
3	256	259	Claystone, white; ash; bentonite
9	259	268	Coal; includes partings
2	268	270	Siltstone, carbonaceous
7.5	270	277.5	Coal; includes partings
1.5	277.5	279	Siltstone, carbonaceous
8	279	287	Coal; includes partings
6	287	293	Siltstone, medium-gray; interbedded with sandstone
11	293	304	Sandstone, very fine grained to fine-grained, light-gray, clean, well-sorted, laminated; some carbonaceous material
11	304	315	Sandstone, fine-grained, light-gray, clean, well-sorted

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. USGS-9 County La Plata State Colorado

Location Sec. 31 T. 33 N. R. 11 W.

Elevation 6,404 Drilled depth 315 Logged depth 313

Drilling medium air Date logged 9/16/88

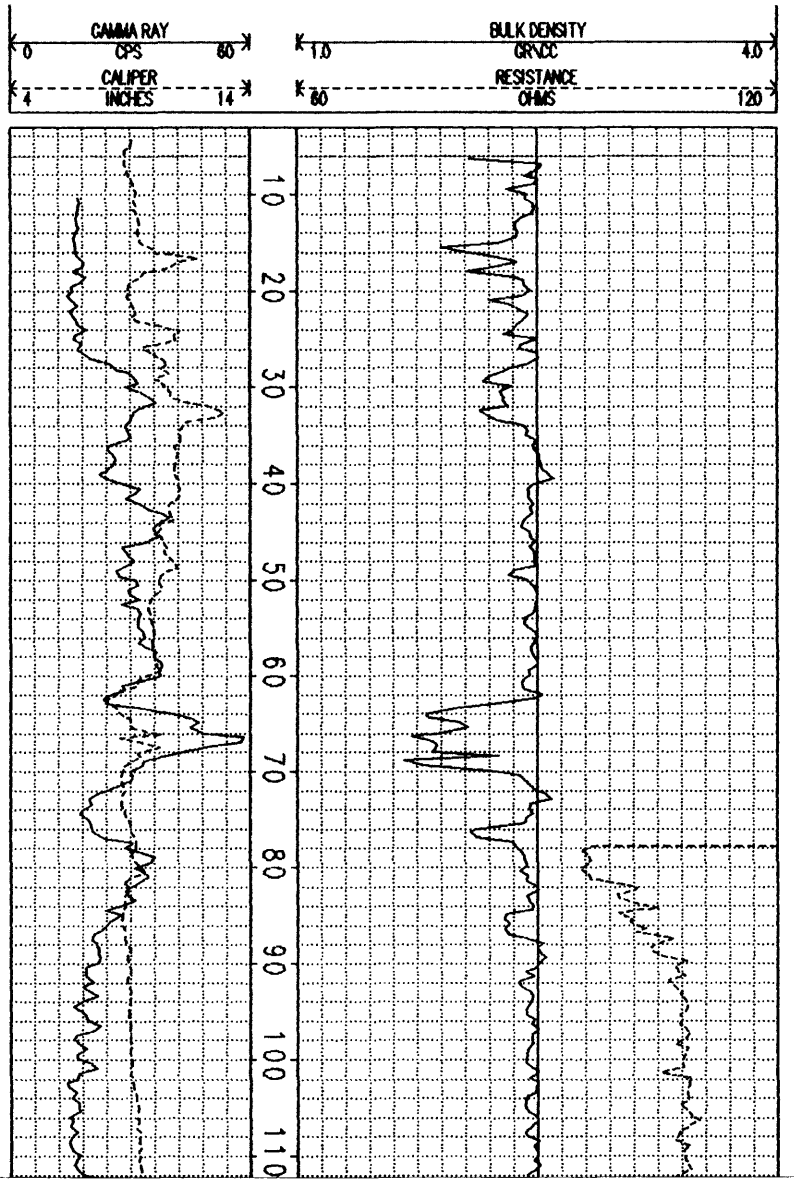
Geophysical logs:

Gamma ray (G)
Density (DEN)
High resolution density (HRD)
Caliper (CAL)
Resistance (RES)

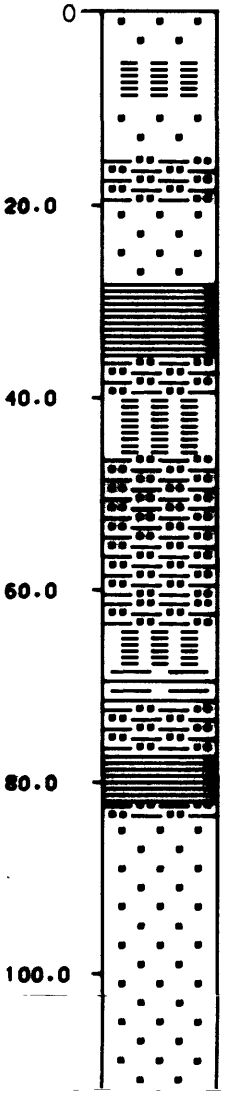
Logging speed 15 fpm
Vertical scale 1 in. = 20 ft.

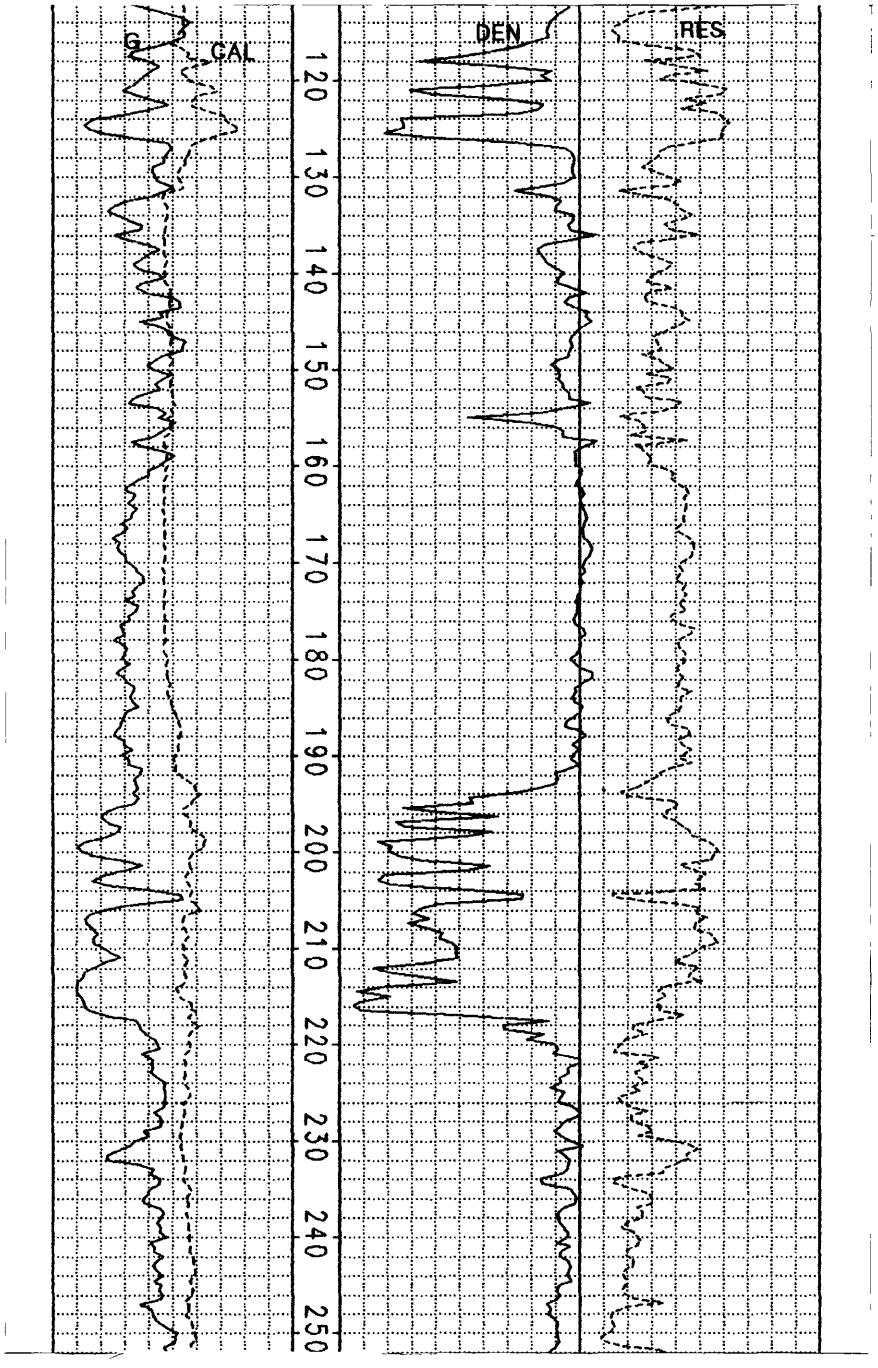
Remarks:

GEOPHYSICAL LOGS



STRIP LOG

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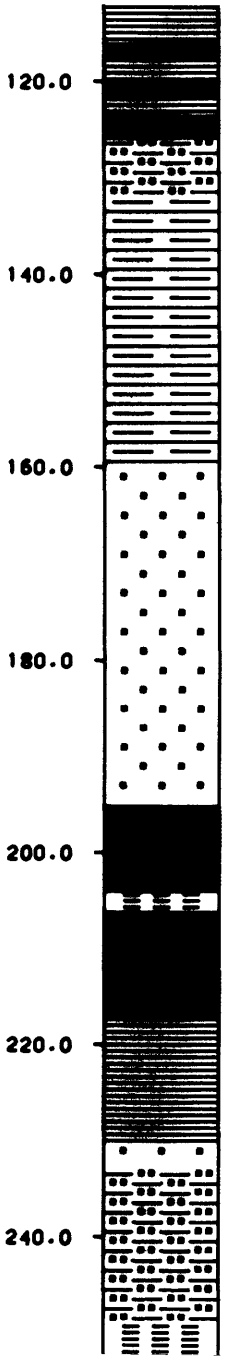
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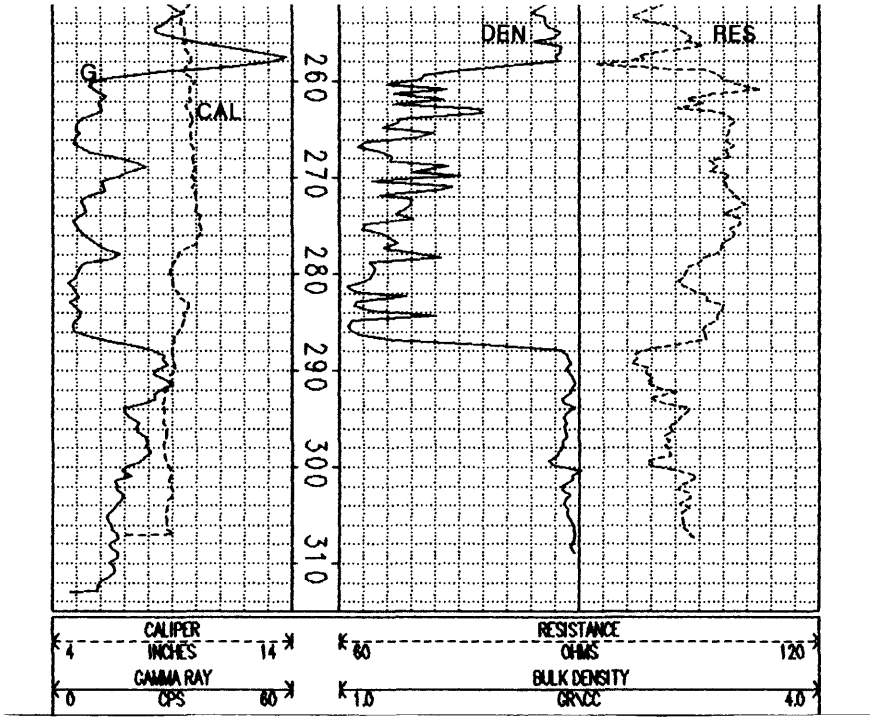
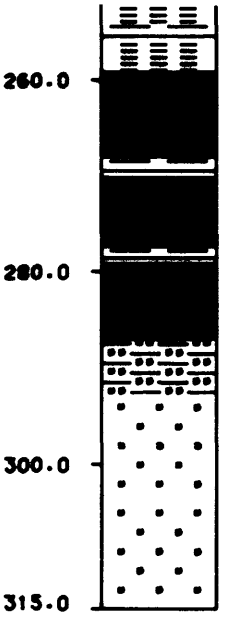
220.0
240.0

Hole No. **USGS-9** continued





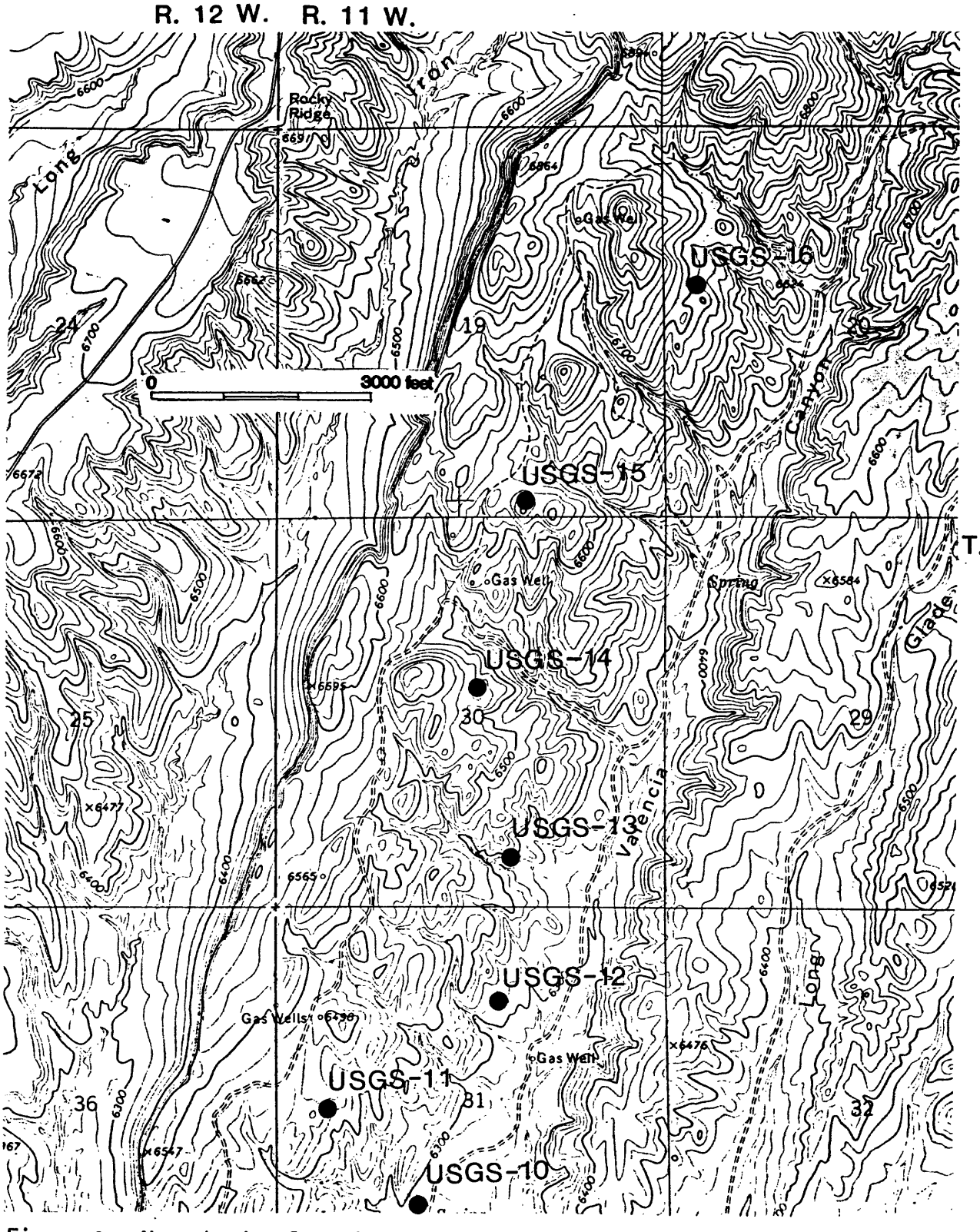


Figure 6.--Map showing locations of holes USGS-10 through USGS-16. Base from Pinkerton Mesa 7 1/2-minute quadrangle (1968).

Sample and Core Log U.S. GEOLOGICAL SURVEY

Hole USGS-10 Elevation 6,260 feet Total depth 497 feet

Location 1245604 E., 152931 N. Sec. 31, T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Jeff Eman Core hole size 5 5/8 inches

Date started 6/13/88 Date completed 6/21/88 Geologist L. Roberts

Remarks: Drilled both holes with mud. Encountered artesian water at 95 ft and methane gas from coal bed at about 340 ft. Gas bubbled from cuttings in mud pit and from core. Estimated flow of water from both holes at 5 gal/min.

Depth interval (feet) Thickness	From	To	Lithologic Description
10	0	10	Sand, silty, brown
10	10	20	Siltstone, gray
2	20	22	Claystone
11	22	33	Shale, silty, light-gray; interbedded with siltstone; carbonaceous lenses
4	33	37	Sandstone
10	37	47	Siltstone, light-gray
4	47	51	Shale, medium-gray
5	51	56	Sandstone, medium-gray
16	56	72	Siltstone, dark-gray
4	72	76	Shale
10	76	86	Siltstone
1	86	87	Coal
6	87	93	Shale, carbonaceous, dark-gray
2	93	95	Siltstone, shaley, dark-gray
2	95	97	Sandstone
7	97	104	Siltstone, carbonaceous, dark-gray; coal chips
3	104	107	Sandstone
10	107	117	Shale, medium-gray; interbedded with siltstone
5	117	122	Siltstone
1	122	123	Coal; uncertain lithology
10	123	133	Siltstone
5	133	138	Sandstone
9	138	147	Siltstone
6	147	153	Sandstone; interbedded with siltstone
37	153	190	Siltstone; interbedded with sandstone; carbonaceous at base
Start core description			
2	190	192	Coal; includes partings
6.5	192	198.5	Shale and siltstone, carbonaceous
0.5	198.5	199	Coal
2	199	201	Shale
1	201	202	Coal
3	202	205	Siltstone
End core description			

Depth interval (feet) Thickness	From	To	Lithologic Description
3	205	208	Siltstone
1	208	209	Coal; uncertain lithology
8	209	217	Siltstone
9	217	226	Sandstone
8	226	234	Siltstone
1	234	235	Coal
6	235	241	Siltstone
5	241	246	Coal; probably interbedded with carbonaceous shale
7	246	253	Siltstone
3	253	256	Sandstone
34	256	290	Siltstone
34	290	324	Sandstone, fine-grained
6	324	330	Sandstone, very fine grained
4	330	334	Sandstone, fine-grained
3	334	337	Sandstone, very fine grained
Start core description			
6	337	343	Sandstone, siltstone, and shale, interbedded
14.5	343	357.5	Coal; includes partings
2	357.5	359.5	Shale, carbonaceous
2.5	359.5	362	Coal; includes partings
2.5	362	364.5	Shale, carbonaceous
6.5	364.5	371	Coal; includes partings
3	371	374	Siltstone and shale
14	374	388	Coal; includes partings
3	388	391	Siltstone and coal
3	391	394	Coal
3	394	397	Shale, carbonaceous
End core description			
4	397	401	Siltstone
11	401	412	Shale, interbedded with siltstone
2	412	414	Siltstone
2	414	416	Shale, interbedded with siltstone
Start core description			
10	416	426	Shale, claystone, and siltstone, interbedded
14	426	445	Coal; includes partings
1.5	445	446.5	Shale
12.5	446.5	459	Coal; includes partings
0.5	459	459.5	Shale, carbonaceous
End core description			
8.5	459.5	468	Siltstone, gray
12	468	480	Sandstone, fine-grained, light-gray, well-cemented
17	480	497	Sandstone, medium-grained

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-10** County **La Plata** State **Colorado**

Location Sec. **31** T. **33** N. R. **11** W.

Elevation **6,260** Drilled depth **497** Logged depth **475**

Drilling medium **mud** Date logged **6/21/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale **1 in. = 20 ft.**

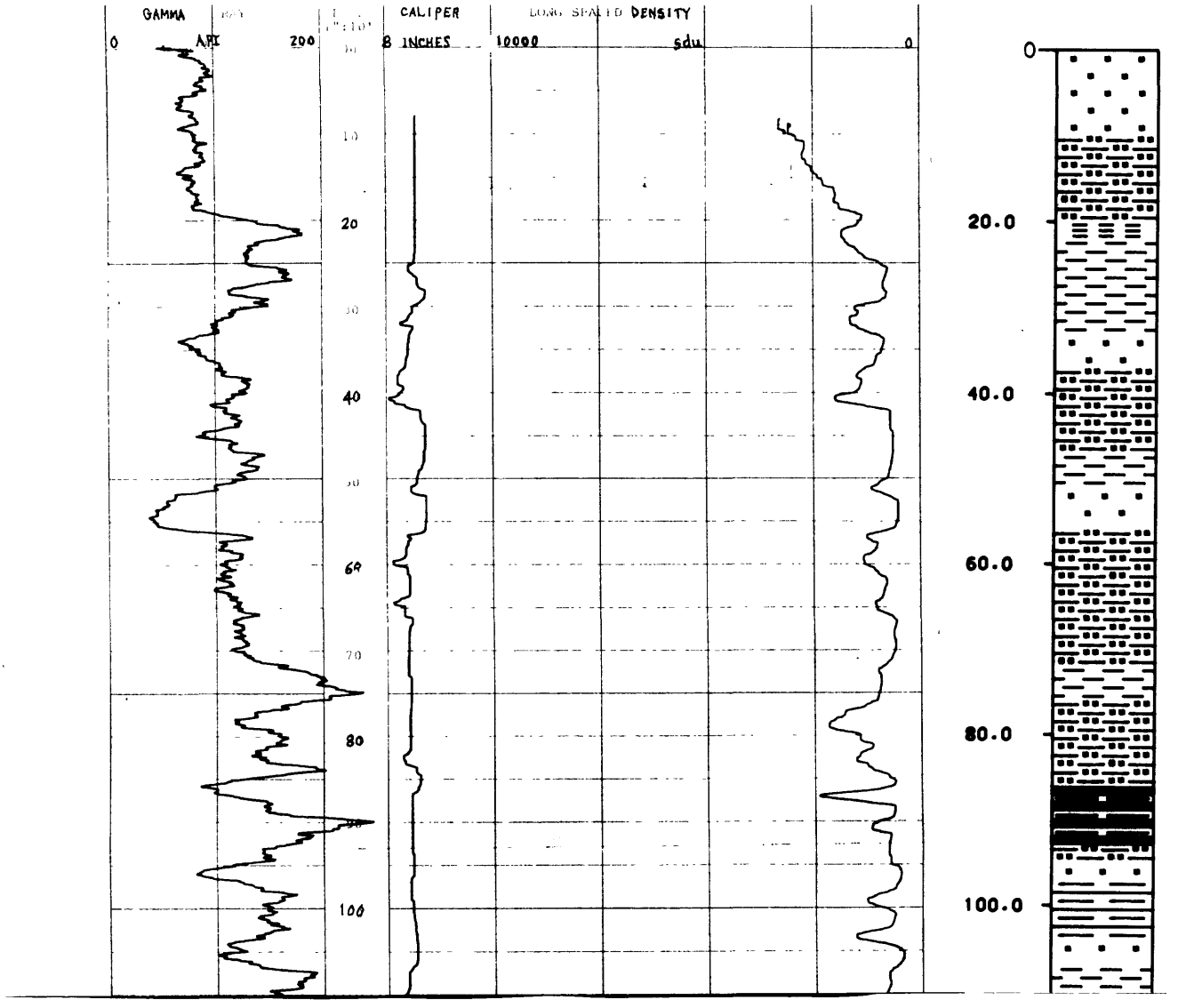
High resolution density (HRD)

Caliper (CAL)

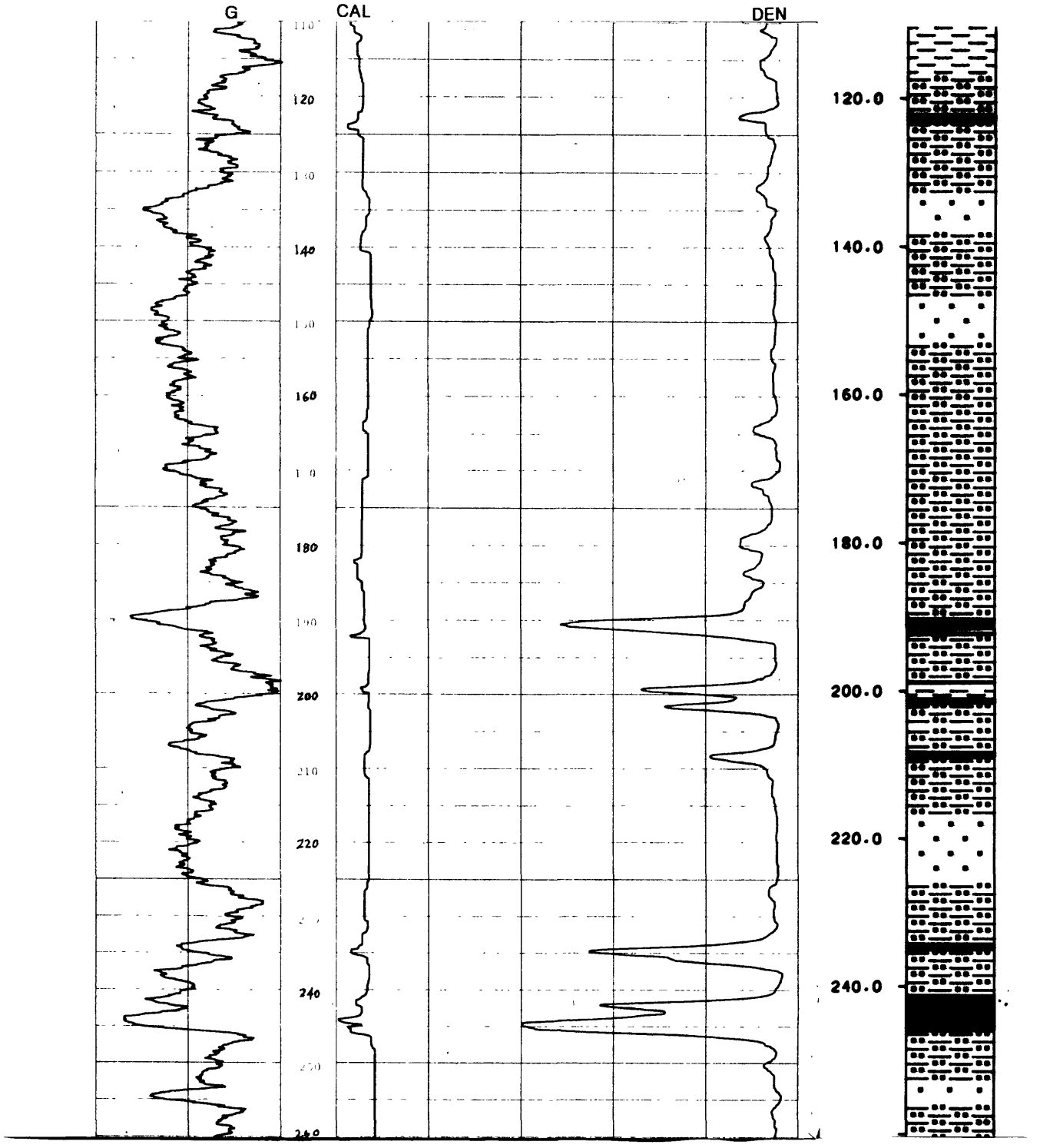
Resistance (RES)

Remarks: **Cored intervals, 190 to 205 ft, 337 to 397 ft, and 416 to 459.5 ft**

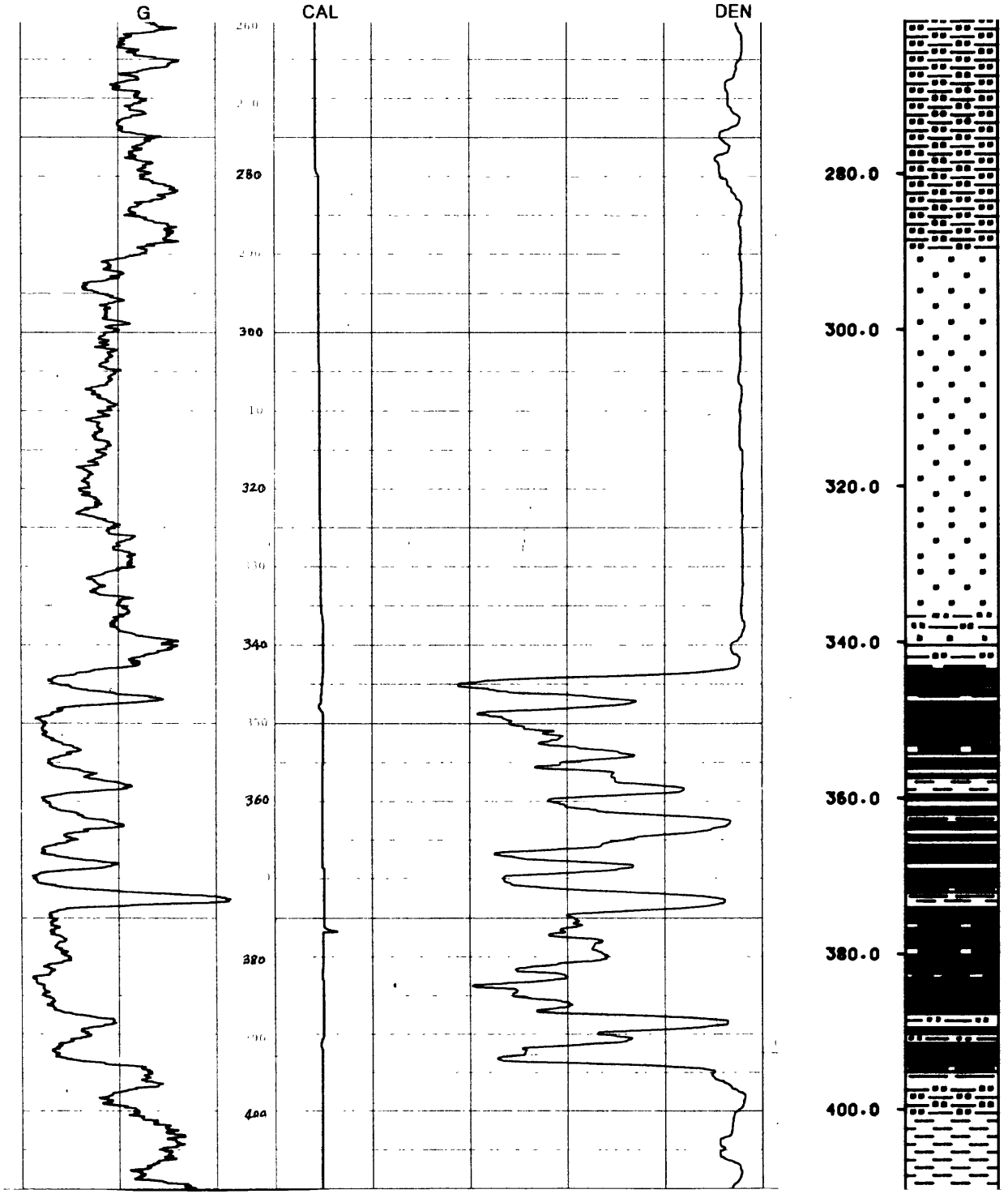
GEOPHYSICAL LOGS STRIP LOG



Hole No. **USGS-10** continued

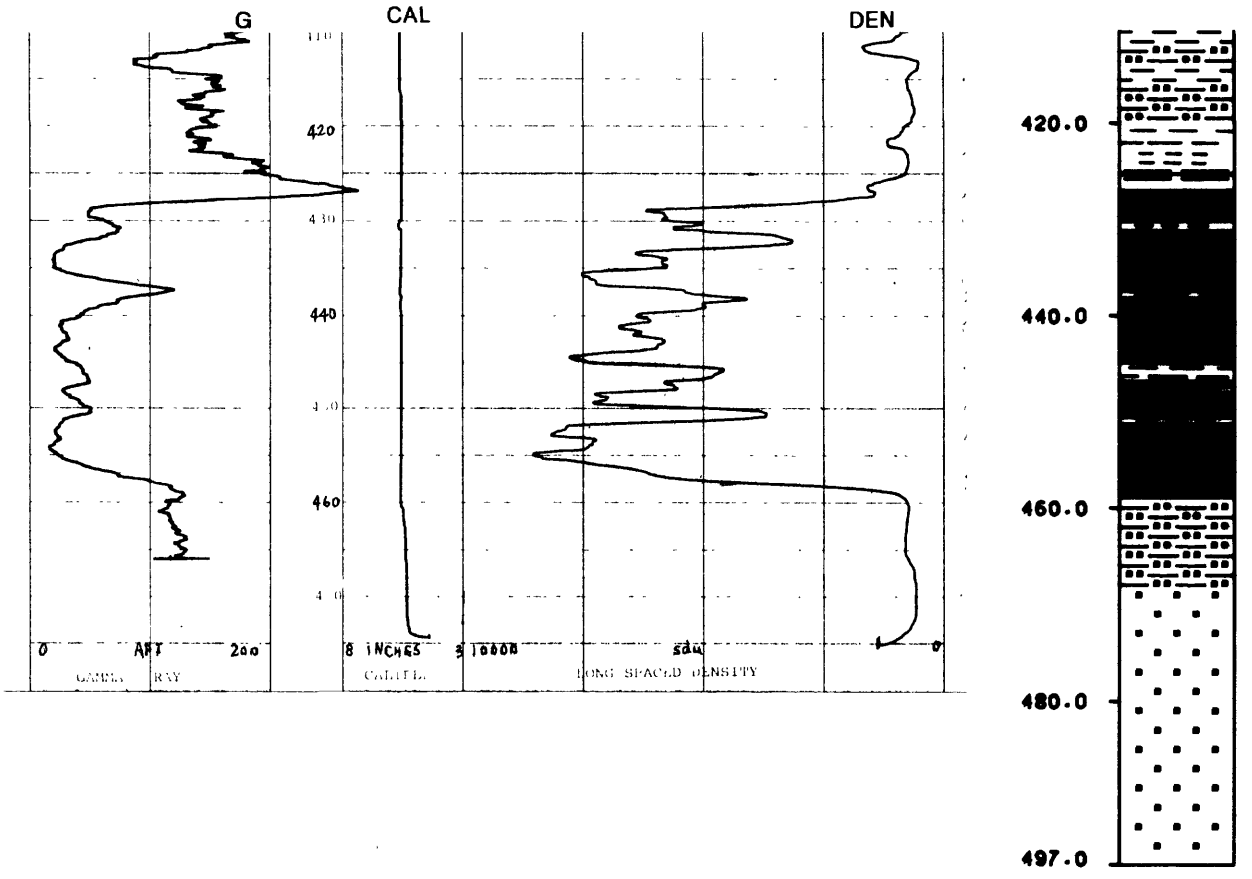


Hole No. **USGS-10** continued



U.S. Geological Survey

Hole No. **USGS-10** continued



Depth interval (feet) Thickness	From	To	Detailed Core Description
Start core description			
0.70	190.00	190.70	Coal; fusain
0.20	190.70	190.90	Coal, bony
0.30	190.90	191.20	Coal, bright
0.10	191.20	191.30	Shale, coaly
0.10	191.30	191.40	Coal, bright
0.50	191.40	191.90	Shale, coaly; thin coal bands
0.40	191.90	192.30	Coal, shaley
0.10	192.30	192.40	Shale, carbonaceous, gray
0.10	192.40	192.50	Shale, coaly
6.00	192.50	198.50	Siltstone, slightly carbonaceous, gray
0.50	198.50	199.00	Coal, bright
0.20	199.00	199.20	Claystone, pinkish-gray; ash
0.50	199.20	199.70	Shale, coaly
1.10	199.70	200.80	Shale, slightly carbonaceous, brownish-gray
0.80	200.80	201.60	Coal; very thin ash at 201.2 ft
3.40	201.60	205.00	Siltstone, gray; plant fragments
End core description			
Start core description			
1.10	337.00	338.10	Sandstone, very fine grained, gray
1.00	338.10	339.10	Siltstone, dark-gray; plant fragments
0.20	339.10	339.30	Siltstone, carbonaceous, very dark gray
0.30	339.30	339.60	Siltstone, dark-gray
0.60	339.60	340.20	Shale, coaly, carbonaceous; thin coal bands
0.20	340.20	340.40	Coal, bright
1.00	340.40	341.40	Shale, carbonaceous, dark-gray to black; thin coal bands
1.10	341.40	342.50	Siltstone, sandy, gray
0.30	342.50	342.80	Shale, silty, carbonaceous, very dark gray
0.30	342.80	343.10	Siltstone, carbonaceous, sandy, dark-gray
0.20	343.10	343.30	Coal, bony
1.80	343.30	345.10	Coal, bright; scattered resin
0.30	345.10	345.40	Shale
0.40	345.40	345.80	Coal, bright
0.10	345.80	345.90	Shale, carbonaceous
0.70	345.90	346.60	Coal, bright
0.10	346.60	346.70	Siltstone, clayey; possible ash
0.40	346.70	347.10	Coal, bony
0.40	347.10	347.50	Shale, carbonaceous, coaly, black; very thin ash at base
2.60	347.50	350.10	Coal, bright
0.05	350.10	350.15	Coal, bony
0.75	350.15	350.90	Coal, bright
0.03	350.90	350.93	Shale, carbonaceous
1.07	350.93	352.00	Coal, bright
0.20	352.00	352.20	Shale, silty, carbonaceous, black, coaly

Depth interval (feet) Thickness	From	To	Detailed Core Description
0.50	352.20	352.70	Coal, bright; cleats
0.20	352.70	352.90	Coal, bony; with some bright bands
0.30	352.90	353.20	Coal, bright; cleats
0.90	353.20	354.10	Coal, bony; thin bright bands; resin
0.20	354.10	354.30	Coal, bright; good cleats
0.50	354.30	354.80	Shale, carbonaceous, black
1.50	354.80	356.30	Coal, bright; vertical fracture; scattered resin; cleats
0.50	356.30	356.80	Shale, carbonaceous
0.70	356.80	357.50	Coal, bright; cleats; scattered resin
1.90	357.50	359.40	Shale, silty, carbonaceous, very dark gray; thin coal bands
0.40	359.40	359.80	Coal, bright
0.05	359.80	359.85	Siltstone, carbonaceous
0.55	359.85	360.40	Coal, bright; cleats; vertical fracture
0.60	360.40	361.00	Shale, carbonaceous, coaly
0.80	361.00	361.80	Coal, bright; cleats
0.10	361.80	361.90	Claystone; ash
0.20	361.90	362.10	Coal, bright
0.10	362.10	362.20	Siltstone, rippled, carbonaceous; mud on bedding planes
2.40	362.20	364.60	Shale, carbonaceous; silty at top; thin ash at 363.7 ft
0.80	364.60	365.40	Coal, bright; cleats
0.50	365.40	365.90	Shale, coaly, carbonaceous, black
1.10	365.90	367.00	Coal, bright; cleats; vertical fracture
0.90	367.00	367.90	Coal, bright
0.20	367.90	368.10	Coal, bony
0.30	368.10	368.40	Coal, bright; 45° fracture
0.60	368.40	369.00	Shale, carbonaceous, dark-brown
2.40	369.00	371.40	Coal, bright; vertical fracture
1.40	371.40	372.80	Shale, coaly, carbonaceous; coal bands
0.80	372.80	373.60	Siltstone, medium- to light-gray; rippled top 0.3 ft; thin ash at 373.2 ft
0.30	373.60	373.90	Shale, coaly, carbonaceous; resin at top
0.90	373.90	374.80	Coal, bright; resin at bottom; cleats
0.05	374.80	374.85	Claystone, medium-gray; ash
0.65	374.85	375.50	Coal, bright
0.10	375.50	375.60	Claystone, medium-gray; ash
0.40	375.60	376.00	Coal, bright; cleats; vertical fracture
0.60	376.00	376.60	Coal, bony; bright bands; resin
0.80	376.60	377.40	Coal, bright; cleats; vertical fracture
0.10	377.40	377.50	Claystone, silty, dark-gray; ash
0.30	377.50	377.80	Coal, bright; cleats
0.20	377.80	378.00	Coal, bony; very thin ash at base
0.20	378.00	378.20	Coal, bright
0.10	378.20	378.30	Shale, coaly, carbonaceous; thin ash at base

Depth interval (feet) Thickness	From	To	Detailed Core Description
0.90	378.30	379.20	Coal, bright; very thin ash at 378.6 ft
0.80	379.20	380.00	Coal, bony; bright bands at base
0.80	380.00	380.80	Coal, bright
0.30	380.80	381.10	Shale, carbonaceous; interbedded claystone; ash
0.90	381.10	382.00	Coal, bright; cleats; vertical fracture
0.20	382.00	382.20	Coal, bright; scattered resin
0.05	382.20	382.25	Claystone, carbonaceous, dark-brown; ash
0.25	382.25	382.50	Coal, bright
0.50	382.50	383.00	Shale, carbonaceous, dark-brown to black
1.80	383.00	384.80	Coal, bright; horizontal and vertical fracture; gas bubbling from core
0.20	384.80	385.00	Siltstone, carbonaceous, dark-gray
1.20	385.00	386.20	Coal, bright; cleats; vertical fracture
0.30	386.20	386.50	Siltstone, carbonaceous, dark-gray
1.30	386.50	387.80	Coal, bright; cleats; vertical fracture; resin; gas bubbling from core
0.50	387.80	388.30	Shale, coaly, carbonaceous, dark-brown to black
1.00	388.30	389.30	Siltstone, carbonaceous, dark-gray; sharp basal contact
0.70	389.30	390.00	Coal, bright
0.05	390.00	390.05	Claystone; ash
0.35	390.05	390.40	Coal, bright; cleats; gas bubbling from core
0.90	390.40	391.30	Shale, carbonaceous, coaly, dark-brown to black
3.00	391.30	394.30	Coal, bright; good cleats; horizontal and vertical fractures
1.70	394.30	396.00	Shale, carbonaceous, dark-gray; thin coal bands
1.00	396.00	397.00	Shale; lost core; uncertain lithology
End core description			
Start core description			
3.60	416.00	419.60	Siltstone, clayey, carbonaceous, medium- to dark-gray; thin coal bands
1.00	419.60	420.60	Shale, silty, carbonaceous, dark-gray; plant fragments
0.80	420.60	421.40	Shale, coaly, carbonaceous, black; thin coal bands
0.60	421.40	422.00	Claystone, greenish-gray; ash
0.80	422.00	422.80	Siltstone, carbonaceous, dark-gray; plant fragments
0.60	422.80	423.40	Claystone
0.40	423.40	423.80	Siltstone, carbonaceous
0.60	423.80	424.40	Shale, carbonaceous, dark-brown to black, pyritic
0.30	424.40	424.70	Shale, coaly, carbonaceous; thin coal bands
1.20	424.70	425.90	Shale, coaly
0.90	425.90	426.80	Shale, silty, carbonaceous, dark-gray
2.60	426.80	429.40	Coal, bright; scattered resin; cleats; vertical fracture
0.20	429.40	429.60	Claystone, light-brownish-gray, pyritic; ash
0.70	429.60	430.30	Coal, bright; good cleats

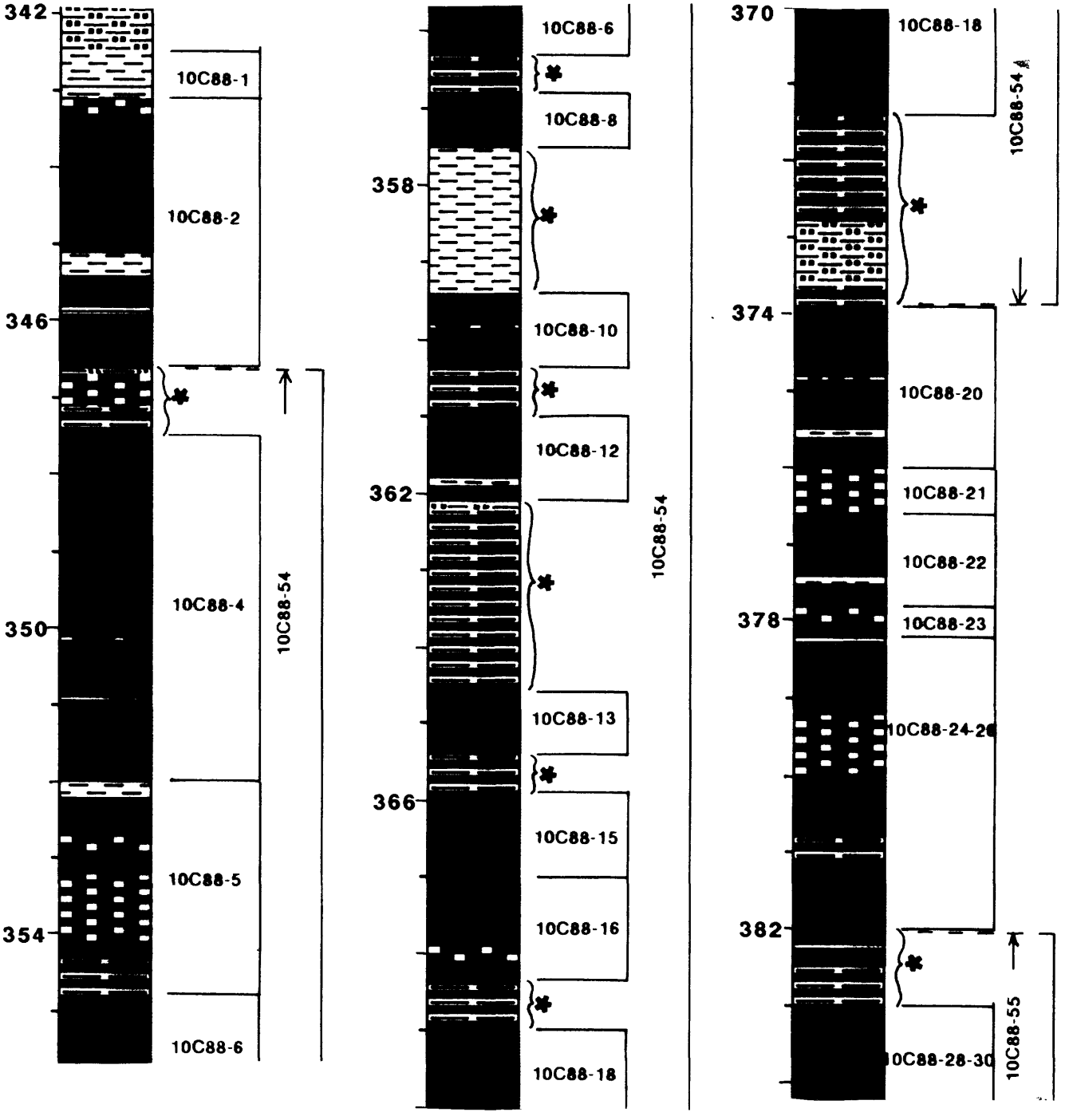
Depth interval (feet) Thickness	From	To	Detailed Core Description
0.70	430.30	431.00	Siltstone, gray; coaly at top
5.50	431.00	436.50	Coal, bright; cleats; thin ash at 432.3 and 433.1 ft
0.20	436.50	436.70	Claystone, gray; sharp basal contact; ash
0.70	436.70	437.40	Coal, bright; cleats; gas bubbling from core
0.60	437.40	438.00	Coal, bony
0.90	438.00	438.90	Coal, bright
0.20	438.90	439.10	Siltstone, carbonaceous, dark-gray
2.90	439.10	442.00	Coal, bright; scattered resin; cleats; vertical fracture
0.10	442.00	442.10	Siltstone, carbonaceous, gray; ash?
2.90	442.10	445.00	Coal, bright; cleats; vertical fracture; thin ash at 444.4 ft
1.00	445.00	446.00	Shale; lost core; uncertain lithology
0.60	446.00	446.60	Shale, coaly, carbonaceous, black
0.90	446.60	447.50	Coal, bright; cleats; vertical fracture
0.20	447.50	447.70	Coal, bony
0.10	447.70	447.80	Claystone, sharp basal contact; ash
2.80	447.80	450.60	Coal, bright; vertical fracture; scattered pyrite
0.50	450.60	451.10	Shale, carbonaceous, dark-gray; scattered coal bands
2.90	451.10	454.00	Coal, bright; cleats; pyrite in bottom 0.1 ft
2.00	454.00	456.00	Coal, bright; interval sampled for desorption of methane
1.00	456.00	457.00	Coal, bright; good cleats; vertical fracture
0.20	457.00	457.20	Shale, carbonaceous, black
1.30	457.20	458.50	Coal, bright; scattered resin; vertical fracture
0.20	458.50	458.70	Claystone, light-gray; ash
0.30	458.70	459.00	Coal, bright; bony at bottom
0.50	459.00	459.50	Shale, coaly, carbonaceous, dark-gray

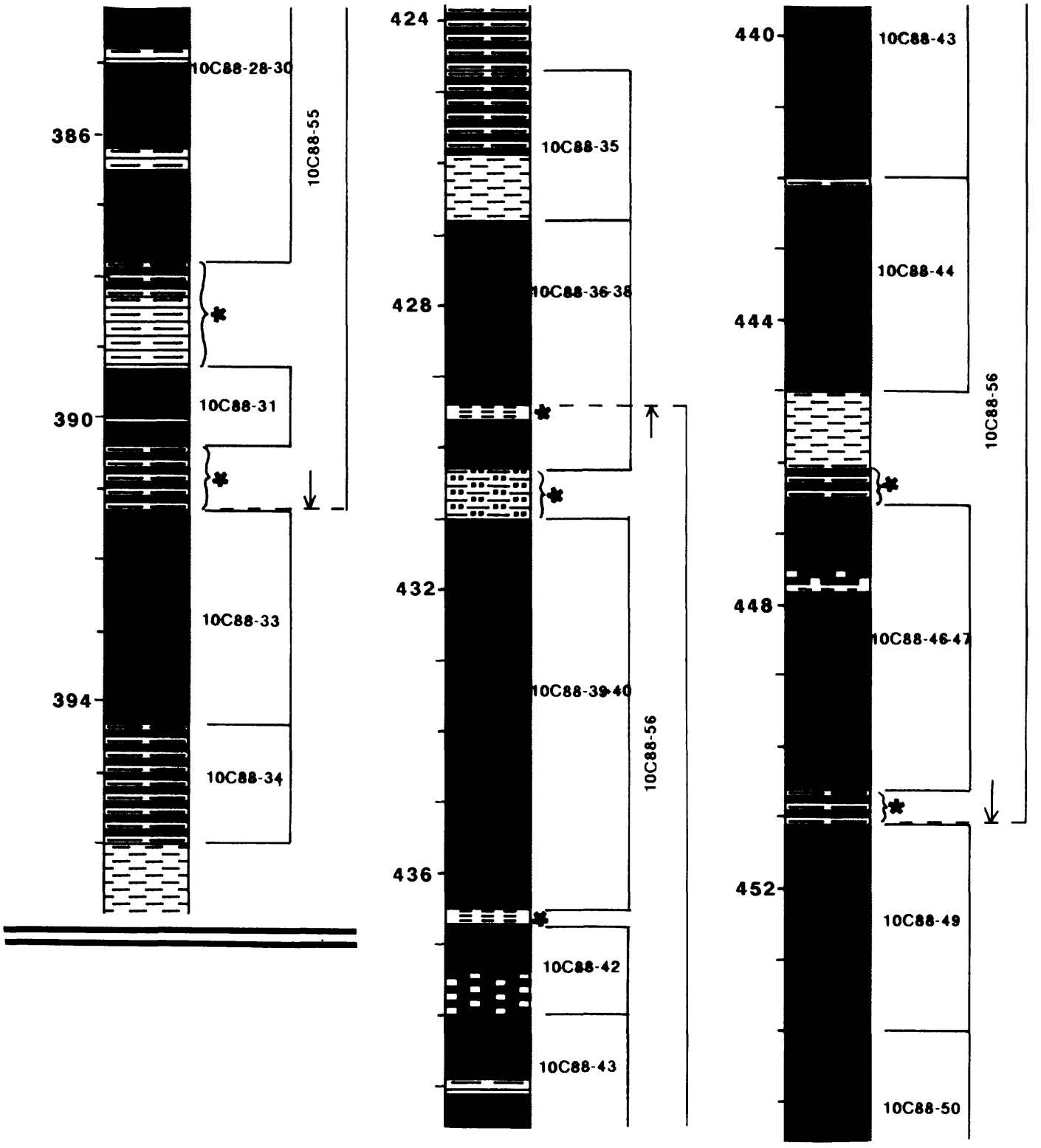
End core description

U.S. Geological Survey

Hole No. **USGS-10**

Detailed strip log showing cored interval, location of sampled intervals, and sample numbers
Vertical scale: 1 inch = 2 feet

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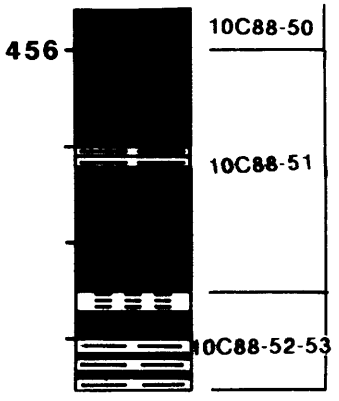
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10C88-52-53

Sample and Core Log U.S. GEOLOGICAL SURVEY

Hole USGS-11 Elevation 6,442 feet Total depth 255 feet

Location 1244378 E., 154021 N. Sec. 31, T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size 5 5/8 inches

Date started 9/16/88 Date completed 9/17/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Claystone, medium-brown; scattered plant fragments
8	5	13	Claystone, carbonaceous, dark-brown to gray
2	13	15	Coal
4	15	19	Claystone, carbonaceous, dark-brown; bentonite layer
1	19	20	Coal
2	20	22	Claystone, carbonaceous
3	22	25	Coal
5	25	30	Siltstone, coaly, carbonaceous, medium- to dark-gray
3	30	33	Sandstone, very fine grained, medium-gray; scattered plant fragments
10	33	43	Siltstone, medium-dark-gray; thin carbonaceous lenses
2	43	45	Sandstone, very fine grained, gray
4	45	49	Siltstone, medium-gray; thin carbonaceous lenses
2	49	51	Claystone
20	51	71	Siltstone, medium-gray; thin carbonaceous lenses
Start generalized core description (detailed description follows geophysical logs)			
7	71	78	Siltstone, carbonaceous
13	78	91	Coal; includes partings
2	91	93	Siltstone, carbonaceous
3	93	96	Coal
1.5	96	97.5	Claystone
7.5	97.5	105	Coal; includes partings
3	105	108	Claystone, carbonaceous
18.5	108	126.5	Coal; includes partings
10.3	126.5	136.8	Sandstone and siltstone
End core description			
33.2	136.8	170	Sandstone, fine-grained, light-gray; interbedded with very fine grained sandstone
19	170	189	Siltstone, carbonaceous, medium- to dark-gray; grades down to claystone; scattered plant fragments

Depth interval (feet) Thickness	From	To	Lithologic Description
2	189	191	Claystone, bentonite
9	191	200	Coal, bright
2.5	200	202.5	Claystone, coaly, carbonaceous; interbedded with bright and bony coal
6.5	202.5	209	Coal, bright
2	209	211	Claystone, coaly, carbonaceous; interbedded with bright and bony coal
8	211	219	Coal, bright
9	219	228	Siltstone, carbonaceous, medium-gray; scattered plant fragments
9	228	237	Sandstone, very fine grained, light-gray, laminated; thin siltstone lenses
10	237	247	Sandstone, fine-grained
6	247	255	Sandstone, medium-grained, light-gray; includes siltstone laminae

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-11** County **La Plata** State **Colorado**

Location Sec. **31** T. **33** N. R. **11** W.

Elevation **6,442** Drilled depth **255** Logged depth **253**

Drilling medium **air** Date logged **9/17/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale **1 in. = 20 ft.**

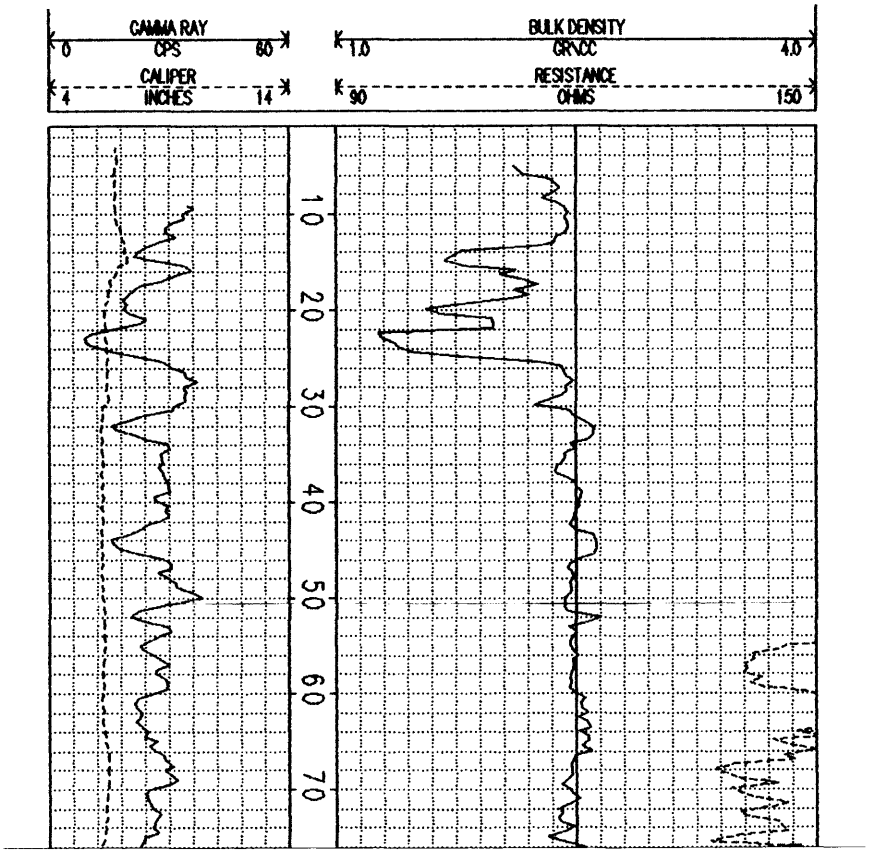
High resolution density (HRD)

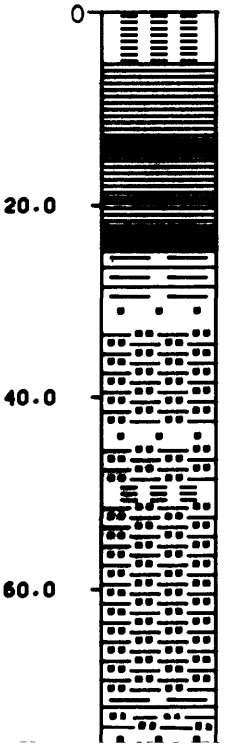
Caliper (CAL)

Resistance (RES)

Remarks: **Cored interval, 71 to 136.8 ft**

GEOPHYSICAL LOGS STRIP LOG





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Depth interval (feet) Thickness	From	To	Detailed Core Description
Start core description			
0.20	71.00	71.20	Siltstone, carbonaceous, dark-gray; scattered coal fragments
1.40	71.20	72.60	Siltstone, carbonaceous, dark-gray; plant fossils
0.30	72.60	72.90	Siltstone, coaly, carbonaceous, dark-gray; coal stringers
0.80	72.90	73.70	Siltstone, carbonaceous, medium-gray
0.05	73.70	73.75	Claystone; ash
0.55	73.75	74.30	Siltstone, carbonaceous, dark-gray; coal stringers; 45° fracture
0.30	74.30	74.60	Siltstone, medium-gray
1.30	74.60	75.90	Sandstone, very fine grained, light-gray; fractures filled with calcite
2.10	75.90	78.00	Siltstone, sandy, medium-gray; scattered plant fragments
0.20	78.00	78.20	Siltstone, carbonaceous; coaly at base
1.95	78.20	80.15	Coal, bright; cleats
0.10	80.15	80.25	Claystone, carbonaceous; ash
0.35	80.25	80.60	Coal, bright; cleats
0.20	80.60	80.80	Siltstone, carbonaceous, black; thin coal bands
0.20	80.80	81.00	Claystone, carbonaceous; ash
0.80	81.00	81.80	Coal, bony
2.60	81.80	84.40	Coal, bright; cleats; thin ash at 83.0 ft
0.50	84.40	84.90	Siltstone, coaly, black
1.30	84.90	86.20	Coal, bright; good cleats; scattered resin
0.50	86.20	86.70	Coal, bony
1.00	86.70	87.70	Siltstone, coaly, black
0.60	87.70	88.30	Coal, bright; cleats
0.50	88.30	88.80	Siltstone, coaly, black
0.70	88.80	89.50	Coal, bright; cleats
0.80	89.50	90.30	Siltstone, carbonaceous; thin coal bands
1.00	90.30	91.30	Coal, bright; cleats
1.90	91.30	93.20	Siltstone, carbonaceous, coaly, black
1.00	93.20	94.20	Coal; lost core
0.60	94.20	94.80	Coal, bright; thin ash at 94.4 ft
0.40	94.80	95.20	Coal, bony; possibly siltstone, carbonaceous
0.60	95.20	95.80	Coal, bright, thin; ash at 95.7 ft
0.20	95.80	96.00	Siltstone, carbonaceous, coaly, dark-brown
1.30	96.00	97.30	Claystone, very light gray; ash; hard
0.10	97.30	97.40	Siltstone, coaly, dark-brown
0.10	97.40	97.50	Claystone, very light gray; ash
0.40	97.50	97.90	Coal, bright; cleats; scattered resin
0.10	97.90	98.00	Claystone, ash
0.20	98.00	98.20	Coal, bony
0.70	98.20	98.90	Siltstone, carbonaceous; thin ash at 98.3 and 98.4 ft

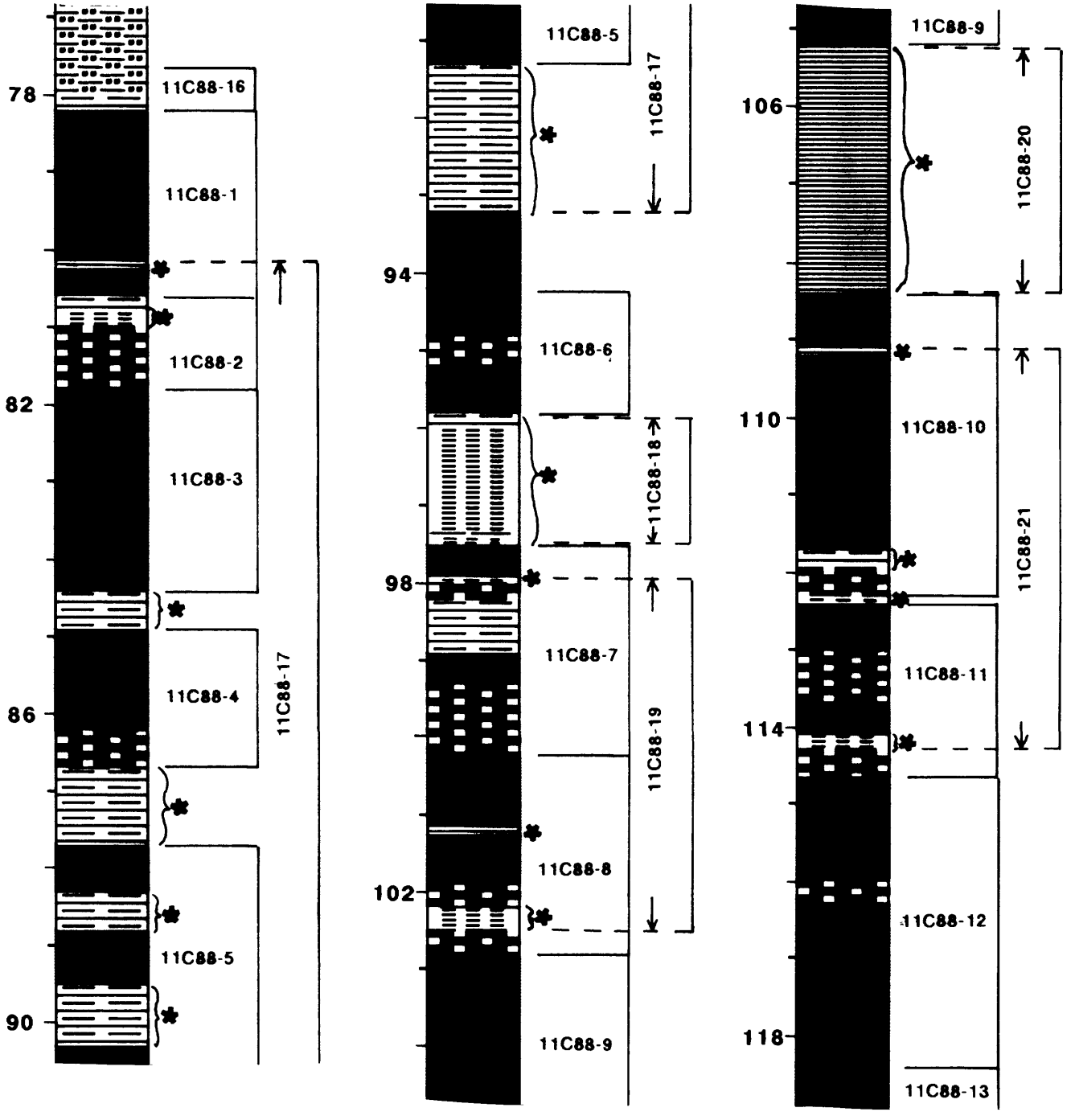
Depth interval (feet) Thickness	From	To	Detailed Core Description
0.40	98.90	99.30	Coal, bright
0.90	99.30	100.20	Coal, bony
0.95	100.20	101.15	Coal, bright
0.10	101.15	101.25	Claystone, carbonaceous; ash
0.65	101.25	101.90	Coal, bright
0.30	101.90	102.20	Coal, bony
0.30	102.20	102.50	Claystone; ash; bentonite?
0.30	102.50	102.80	Coal, bony
2.40	102.80	105.20	Coal, bright; cleats
3.20	105.20	108.40	Claystone, carbonaceous, dark-brown; scattered resin
0.70	108.40	109.10	Coal, bright
0.10	109.10	109.20	Claystone, carbonaceous, light-gray; ash
2.50	109.20	111.70	Coal, bright; high-angle fracture; scattered resin; ash at 111 and 111.6 ft
0.20	111.70	111.90	Siltstone, carbonaceous, black
0.05	111.90	111.95	Claystone, light-gray; ash
0.35	111.95	112.30	Coal, bony
0.10	112.30	112.40	Claystone, light-gray; ash
0.60	112.40	113.00	Coal, bright; cleats
0.70	113.00	113.70	Coal, bony
0.40	113.70	114.10	Coal, bright; cleats
0.20	114.10	114.30	Claystone, light-gray; ash
0.35	114.30	114.65	Coal, bony; thin ash beds
1.35	114.65	116.00	Coal, bright
0.30	116.00	116.30	Coal, bony
5.20	116.30	121.50	Coal, bright; scattered resin; high-angle fracture
0.30	121.50	121.80	Coal, bony
4.20	121.80	126.00	Coal, bright; high-angle fracture
0.30	126.00	126.30	Coal, bony
0.10	126.30	126.40	Coal, bright
0.20	126.40	126.60	Siltstone, carbonaceous, dark-gray
3.40	126.60	130.00	Siltstone, carbonaceous, medium-gray; grading down to very fine grained sandstone
2.40	130.00	132.40	Sandstone, very fine grained, carbonaceous, light-gray, convolute- and ripple-bedded; carbonaceous on bedding
0.50	132.40	132.90	Siltstone, carbonaceous, convolute-bedded, laminated
3.90	132.90	136.80	Sandstone, fine-grained, light-gray, clean, well-sorted; carbonaceous lens at 134 and 136.8 ft

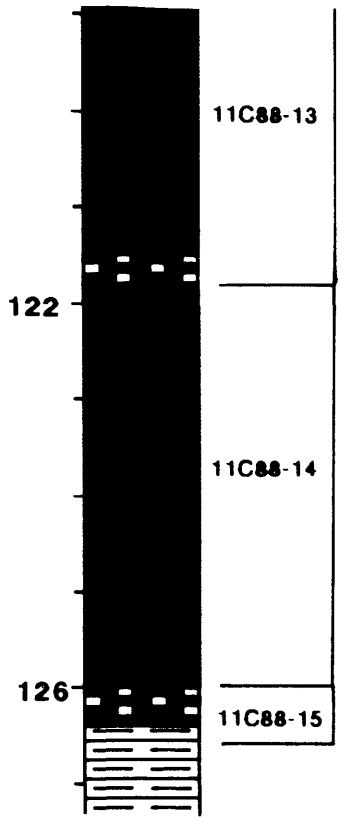
End core description

U.S. Geological Survey

Hole No. **USGS-11**

Detailed strip log showing cored interval, location of sampled intervals, and sample numbers
Vertical scale: 1 inch = 2 feet

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Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 2

Hole USGS-12 Elevation 6,320 feet Total depth 515 feet

Location 1246633 E., 155307 N. Sec. 31 , T. 33 N ., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 9/4/88 Date completed 9/5/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Claystone, slightly carbonaceous, brown
5	5	10	Siltstone, gray; scattered plant fragments
5	10	15	Siltstone, fine-grained, carbonaceous, brown
5	15	20	Siltstone, slightly sandy, gray-brown
15	20	35	Sandstone, very fine grained, light-gray, clean, well-sorted
5	35	40	Sandstone, fine-grained, clean, well-sorted; carbonaceous fragments; calcareous
9	40	49	Siltstone, fine-grained, clayey, gray; grades upward into claystone
4	49	53	Sandstone, very fine grained, clean, well-sorted, slightly calcareous
14	53	67	Siltstone, carbonaceous, dark-gray to black; thin lenses of claystone
7	67	74	Siltstone, sandy, gray
6	74	80	Siltstone, slightly carbonaceous, medium-gray; plant fragments
10	80	90	Siltstone, gray; carbonaceous fragments
4	90	94	Siltstone, carbonaceous, dark-brown, coaly; coal stringers
4	94	98	Siltstone, carbonaceous, medium-gray
3	98	101	Sandstone, very fine grained
19	101	120	Siltstone, medium-gray; scattered plant fragments; grades downward to sandstone
3	120	123	Sandstone, fine-grained, light-gray; mainly quartz
4	123	127	Sandstone, very fine grained, light-gray; mainly quartz
13	127	140	Sandstone, fine-grained, light-gray; mainly quartz
9	140	149	Claystone, carbonaceous, silty; interbedded with siltstone
7	149	156	Sandstone, very fine grained, slightly carbonaceous, gray
27	156	183	Siltstone, carbonaceous, gray; interbedded with claystone
3	183	186	Sandstone

Depth interval (feet) Thickness	From	To	Lithologic Description
19	186	205	Siltstone, carbonaceous, dark-brown; some plant and coal fragments
3	205	208	Coal
5	208	213	Claystone, carbonaceous, coaly
3	213	216	Siltstone, medium-gray; scattered plant fragments
1	216	217	Coal
16	217	233	Siltstone, medium-gray; brown at base
10	233	243	Sandstone, very fine grained, gray
6.5	243	249.5	Siltstone, carbonaceous, dark-brown
1.5	249.5	251	Coal
9.5	251	260.5	Siltstone, carbonaceous, dark-gray
4	260.5	264.5	Coal; includes partings
57	264.5	321.5	Siltstone, carbonaceous, dark-gray; interbedded with sandstone
1.5	321.5	323	Coal
1.5	323	324.5	Siltstone, carbonaceous
20.5	324.5	345	Coal; includes partings
2.5	345	347.5	Claystone; bentonite (?)
14.5	347.5	362	Coal; includes partings
13	362	375	Siltstone, carbonaceous, medium-gray, very fine grained; sandstone stringers
16	375	391	Sandstone, very fine grained, gray; interbedded with siltstone; some carbonaceous material along bedding
50	391	441	Siltstone, gray; interbedded with sandstone; scattered carbonaceous fragments
1	441	442	Claystone, light-gray; ash; bentonite
28.5	442	470.5	Coal; includes partings
1.5	470.5	472	Claystone
1	472	473	Coal
3	473	476	Claystone
15	476	491	Siltstone, slightly carbonaceous, gray to brown; scattered plant fragments
7	491	498	Sandstone, very fine grained to fine-grained, gray, thinly laminated; mostly quartz; carbonaceous along bedding planes
4	498	502	Siltstone, gray
13	502	515	Sandstone, fine-grained, light- to medium-gray; interbedded with siltstone

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. USGS-12 County La Plata State Colorado

Location Sec. 31 T. 33 N. R. 11 W.

Elevation 6,320 Drilled depth 515 Logged depth 513

Drilling medium air Date logged 9/5/88

Geophysical logs:

Gamma ray (G) Logging speed 15 fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

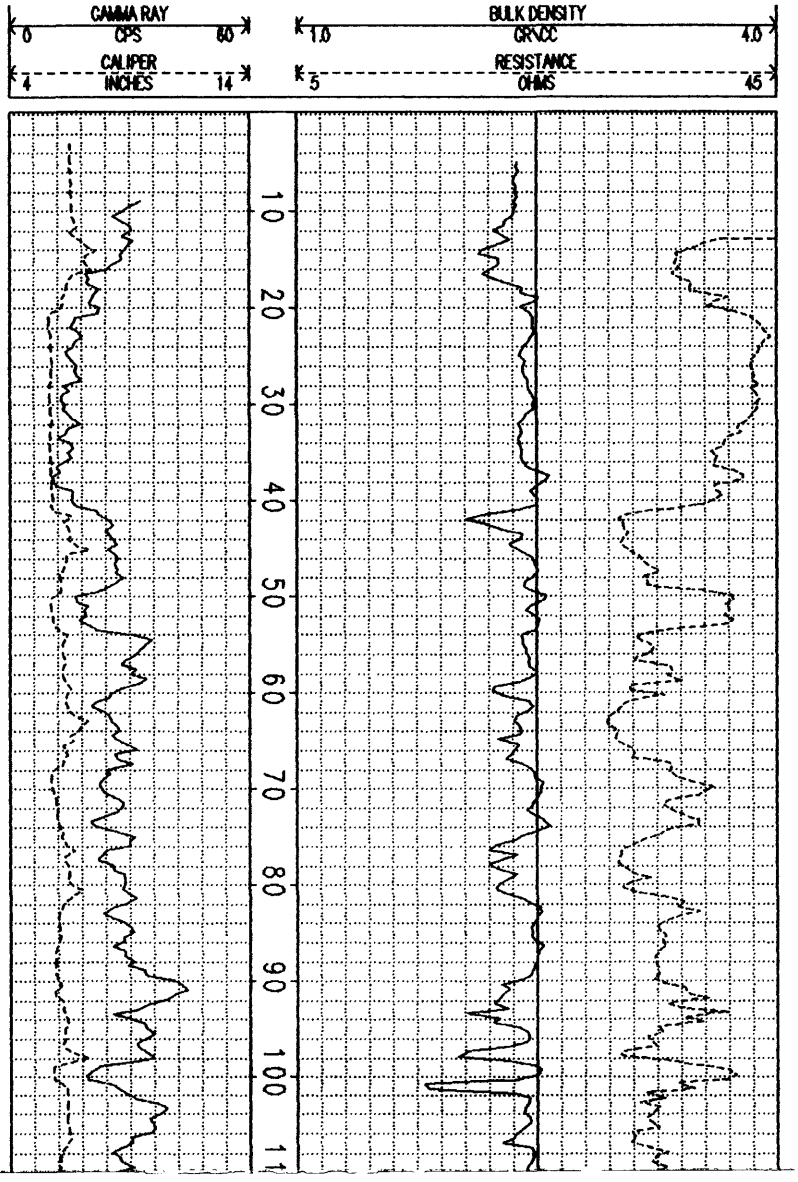
High resolution density (HRD)

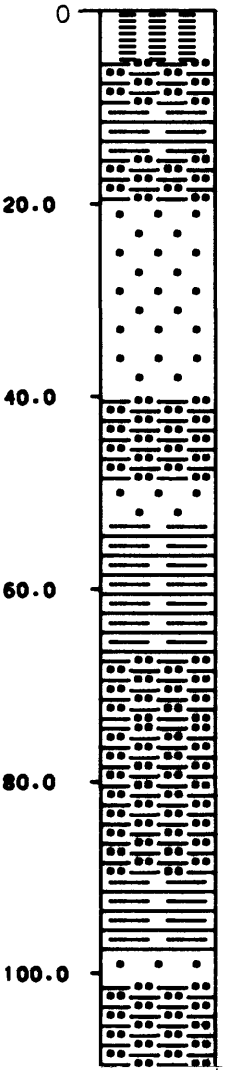
Caliper (CAL)

Resistance (RES)

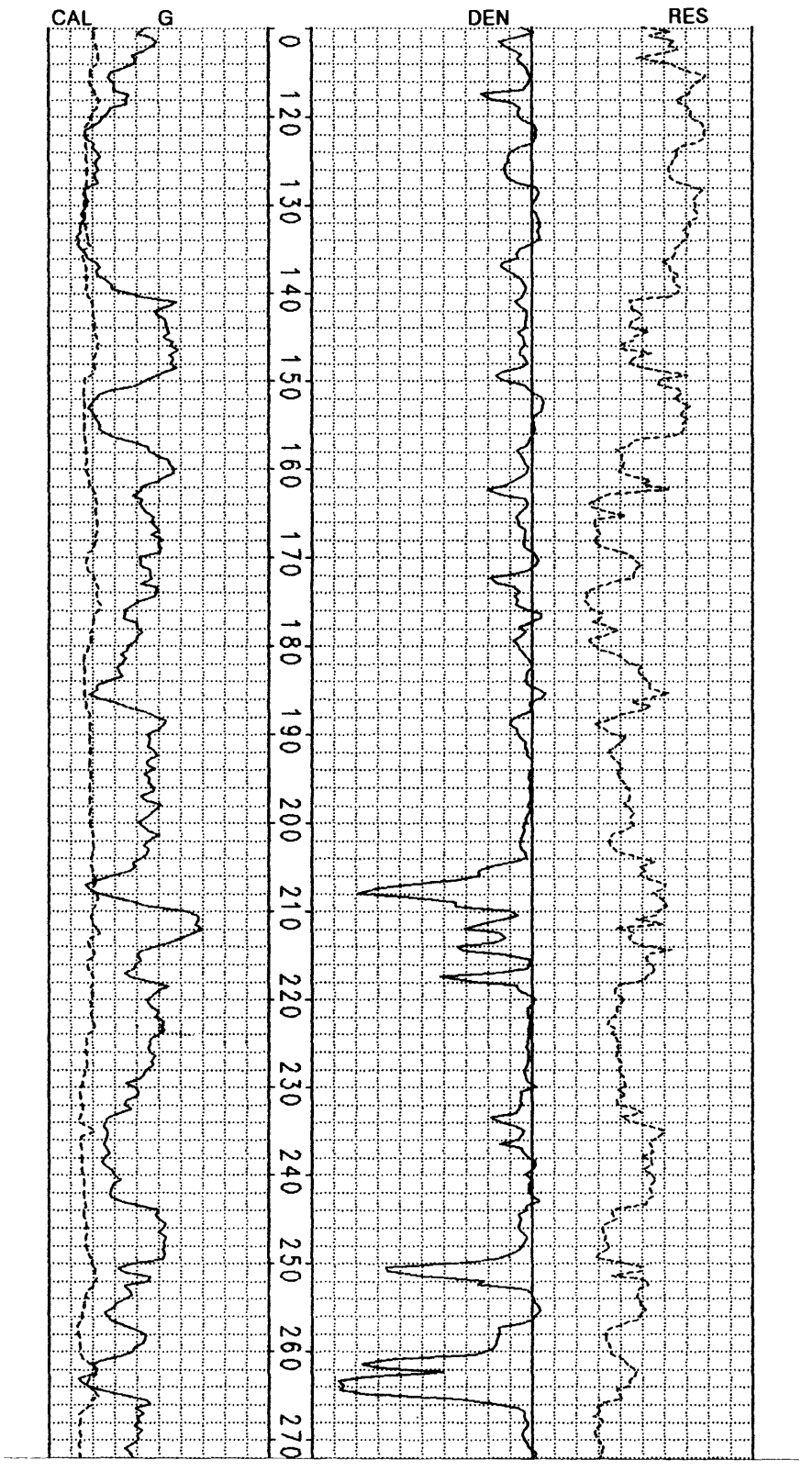
Remarks:

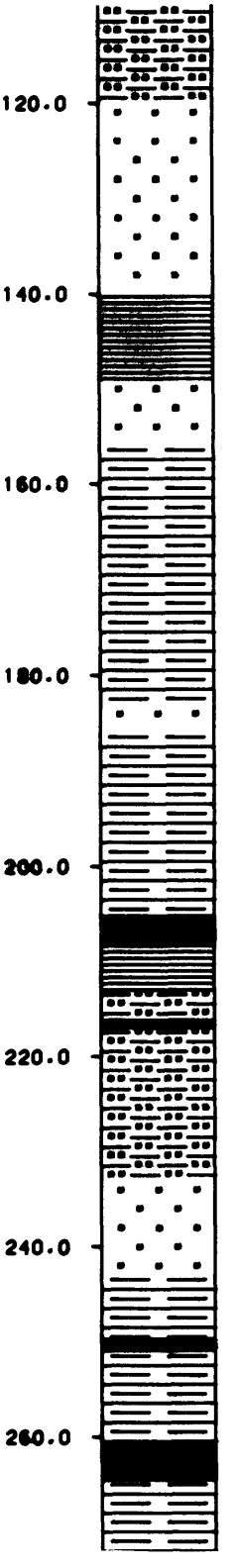
GEOPHYSICAL LOGS STRIP LOG





Hole No. **USGS-12** continued





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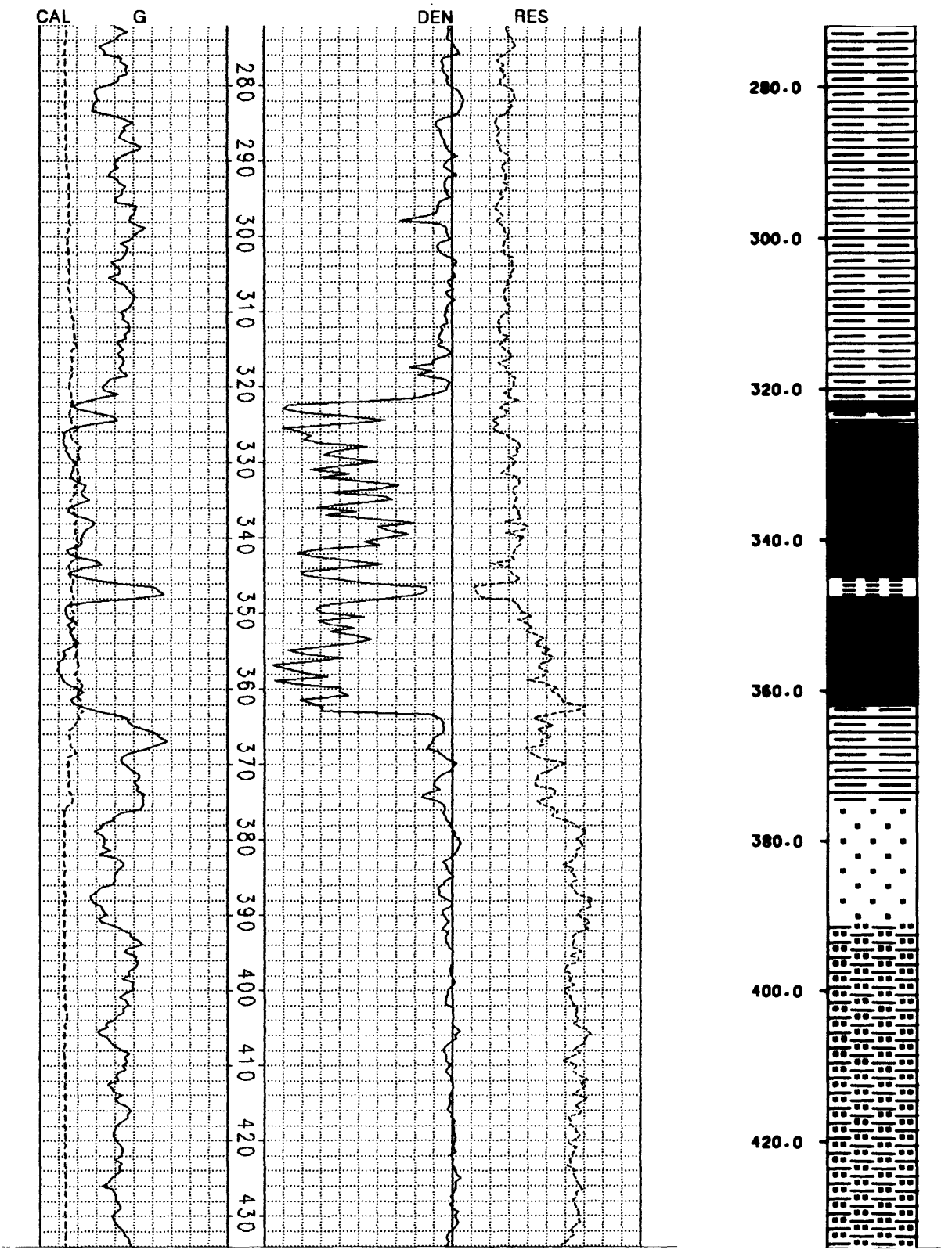

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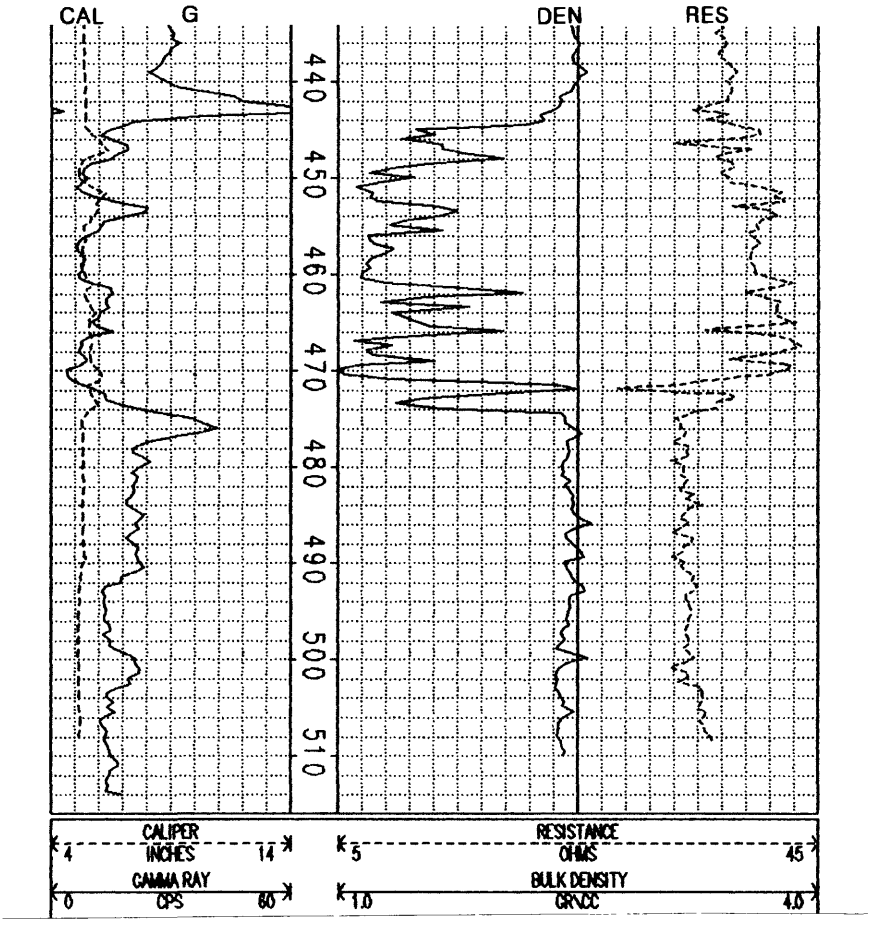
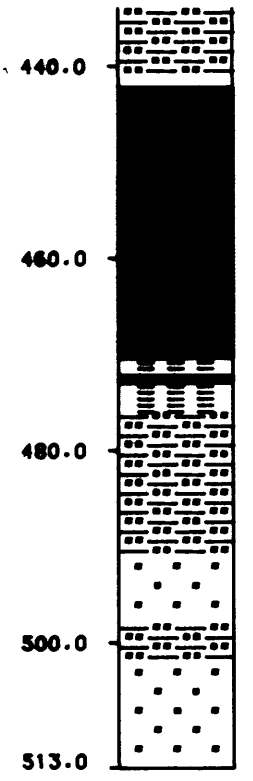




Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 3

Hole USGS-13 Elevation 6,400 feet Total depth 385 feet

Location 1246952 E., 157337 N. Sec. 30 , T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 9/5/88 Date completed 9/6/88 Geologist L. Roberts

Remarks: Encountered artesian water at 75 ft; also encountered methane gas

Depth interval (feet) Thickness	From	To	Lithologic Description
13	0	13	Siltstone, brown to gray, rooted; scattered carbonaceous fragments
4	13	17	Claystone, gray
4	17	21	Siltstone, carbonaceous, coaly, dark-brown
6	21	27	Silt, fine-grained, slightly carbonaceous, medium-gray
1	27	28	Coal
6	28	34	Silt, slightly carbonaceous; plant fragments
11	34	45	Siltstone, sandy, medium-gray; carbonaceous fragments along bedding planes
8	45	53	Sandstone, very fine grained; interbedded with siltstone; scattered carbonaceous fragments
1	53	54	Coal
5	54	59	Sandstone, very fine grained
10.5	59	69.5	Siltstone, carbonaceous, medium-gray
1	69.5	70.5	Coal
15.5	70.5	86	Sandstone, very fine grained to fine-grained, gray; scattered carbonaceous fragments
7	86	93	Siltstone, carbonaceous, medium-gray; grades upward into sandstone
1	93	94	Coal
6	94	100	Siltstone, carbonaceous, medium-gray, thin; very fine grained sandstone and claystone lenses
2	100	102	Siltstone, carbonaceous, coaly, black
17	102	119	Siltstone, fine-grained, medium-gray; carbonaceous fragments
2	119	121	Sandstone, very fine grained; interbedded with siltstone
6	121	127	Coal; includes partings; bony at top
1.5	127	128.5	Siltstone, carbonaceous
1	128.5	129.5	Coal
2	129.5	131.5	Siltstone, carbonaceous
2.5	131.5	134	Coal; includes partings
17	134	151	Siltstone, fine-grained, carbonaceous, medium- to dark-gray
2.5	151	153.5	Coal; includes partings
1	153.5	154.5	Siltstone, carbonaceous

Depth interval (feet) Thickness	From	To	Lithologic Description
0.5	154.5	155	Coal
2	155	157	Siltstone, carbonaceous; thin, very fine grained sandstone lenses
5	157	162	Sandstone, very fine grained; scattered carbonaceous fragments
8	162	170	Siltstone, medium-gray
2	170	172	Coal
1	172	173	Siltstone, carbonaceous
3	173	176	Coal
2	176	178	Siltstone, medium-gray
2	178	180	Sandstone, very fine grained, well-sorted; mostly quartz
2	180	182	Siltstone, medium-gray
4	182	186	Sandstone, very fine grained, well-sorted; mostly quartz
14	186	200	Siltstone, carbonaceous, dark-gray to brown
3	200	203	Sandstone, very fine grained, clean, well-sorted; carbonaceous lenses
9	203	212	Siltstone, fine-grained, carbonaceous, medium- to dark-gray; plant fragments
9	212	221	Sandstone, carbonaceous; interbedded with siltstone; plant fragments
1.5	221	222.5	Coal
1.5	222.5	224	Siltstone, carbonaceous
8	224	232	Coal; includes partings
24	232	256	Siltstone, carbonaceous; few claystone lenses; plant fragments
5	256	261	Sandstone, very fine grained, gray; mostly quartz; carbonaceous fragments
3	261	264	Siltstone
1	264	265	Coal
1.5	265	266.5	Siltstone, carbonaceous
2.5	266.5	269	Coal; includes partings
4	269	273	Claystone, carbonaceous; bentonite; coaly lenses
6.5	273	279.5	Coal; includes partings
1.5	279.5	281	Claystone, light-gray; ash; bentonite
19	281	300	Coal; includes partings
11.5	300	311.5	Siltstone, carbonaceous, coaly, medium-gray
1	311.5	312.5	Coal
9.5	312.5	322	Siltstone, medium-gray; carbonaceous fragments
2	322	324	Claystone, light-gray; ash; bentonite
3	324	327	Coal; includes partings
2	327	329	Siltstone, carbonaceous
13	329	342	Coal; includes partings
2	342	344	Siltstone, carbonaceous
1	344	345	Coal

Depth interval (feet) Thickness	From	To	Lithologic Description
3	345	348	Siltstone, carbonaceous
7	348	355	Coal; includes partings
30	355	385	Sandstone, very fine grained, light-gray; mostly quartz; thin siltstone lenses

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-13** County La Plata State Colorado

Location Sec. **30** T. **33** N. R. **11** W.

Elevation **6,400** Drilled depth **385** Logged depth **382**

Drilling medium **air** Date logged **9/6/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

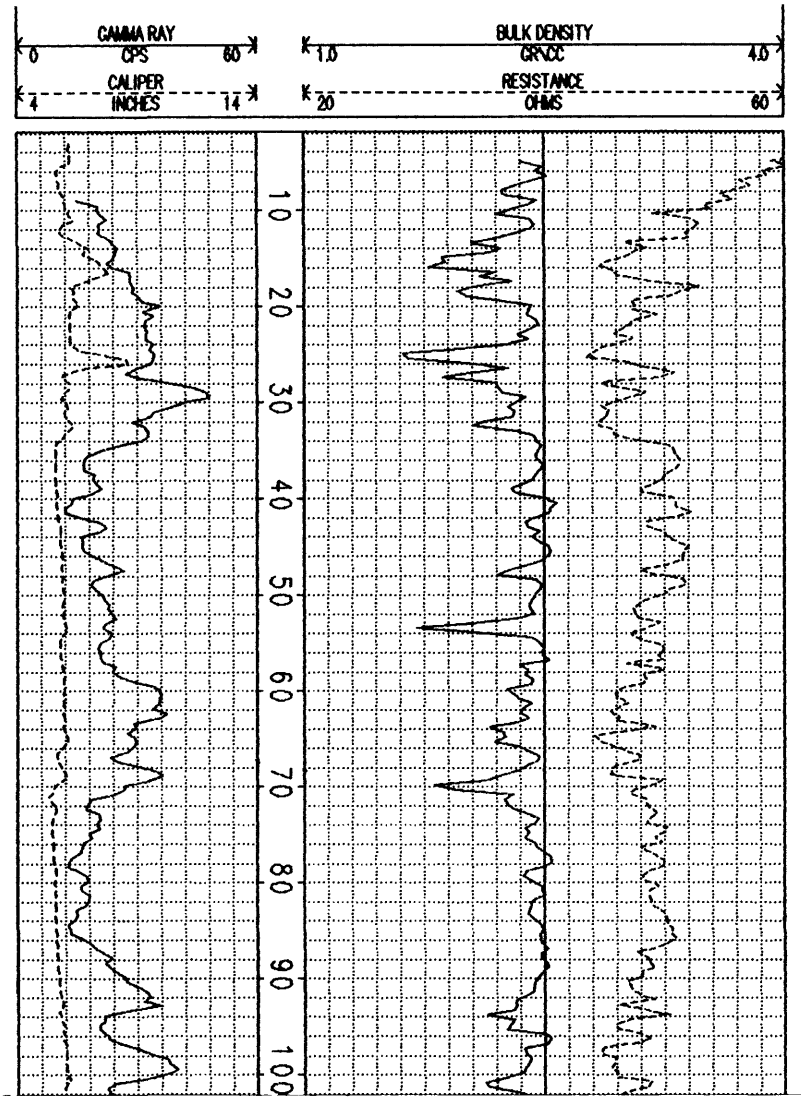
High resolution density (HRD)

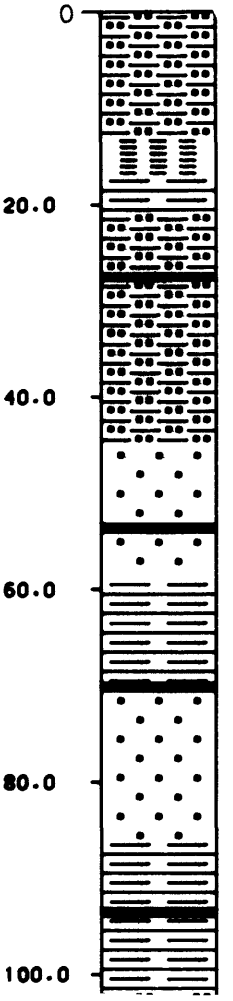
Caliper (CAL)

Resistance (RES)

Remarks:

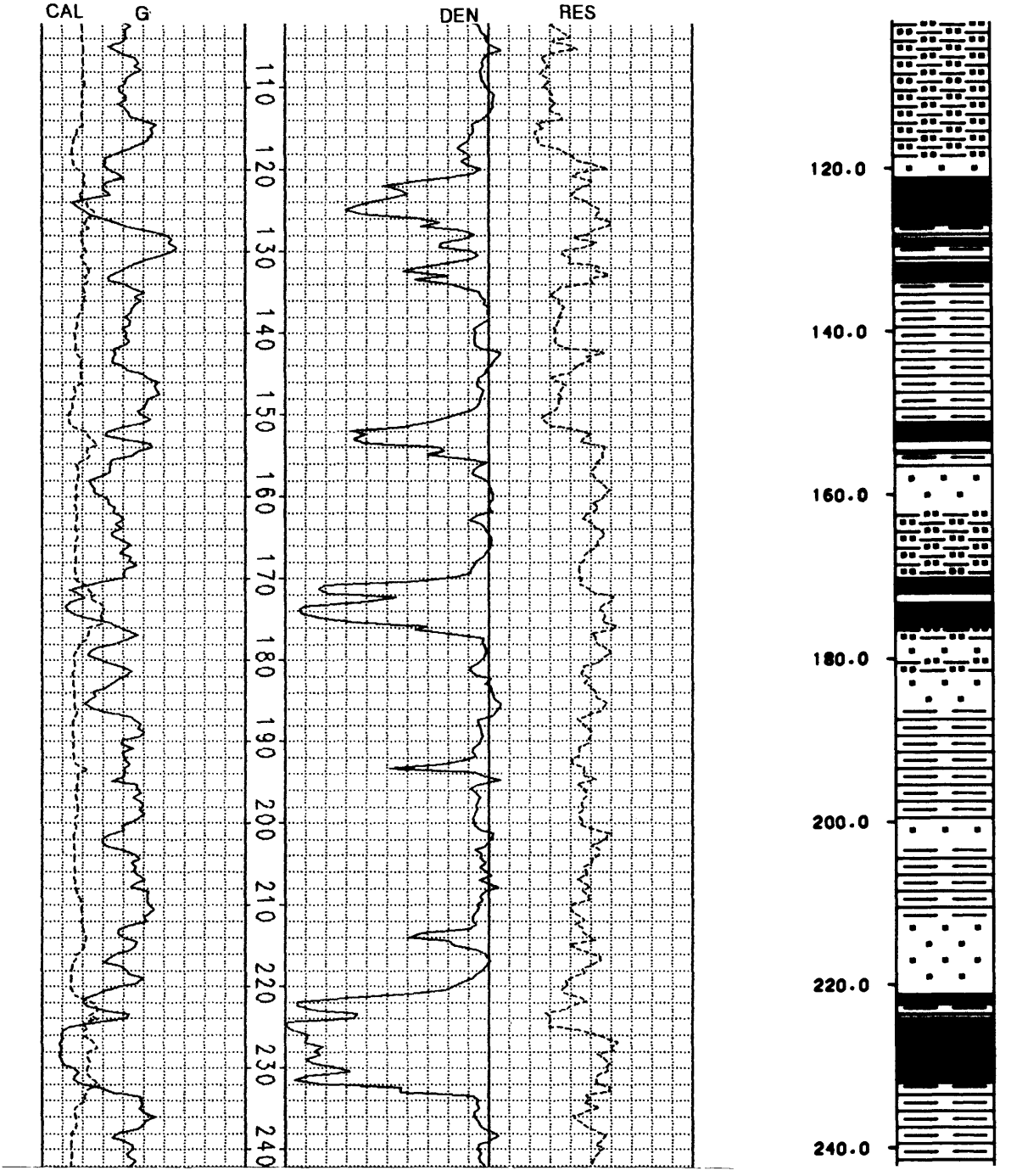
GEOPHYSICAL LOGS STRIP LOG





U.S. Geological Survey

Hole No. USGS-13 continued



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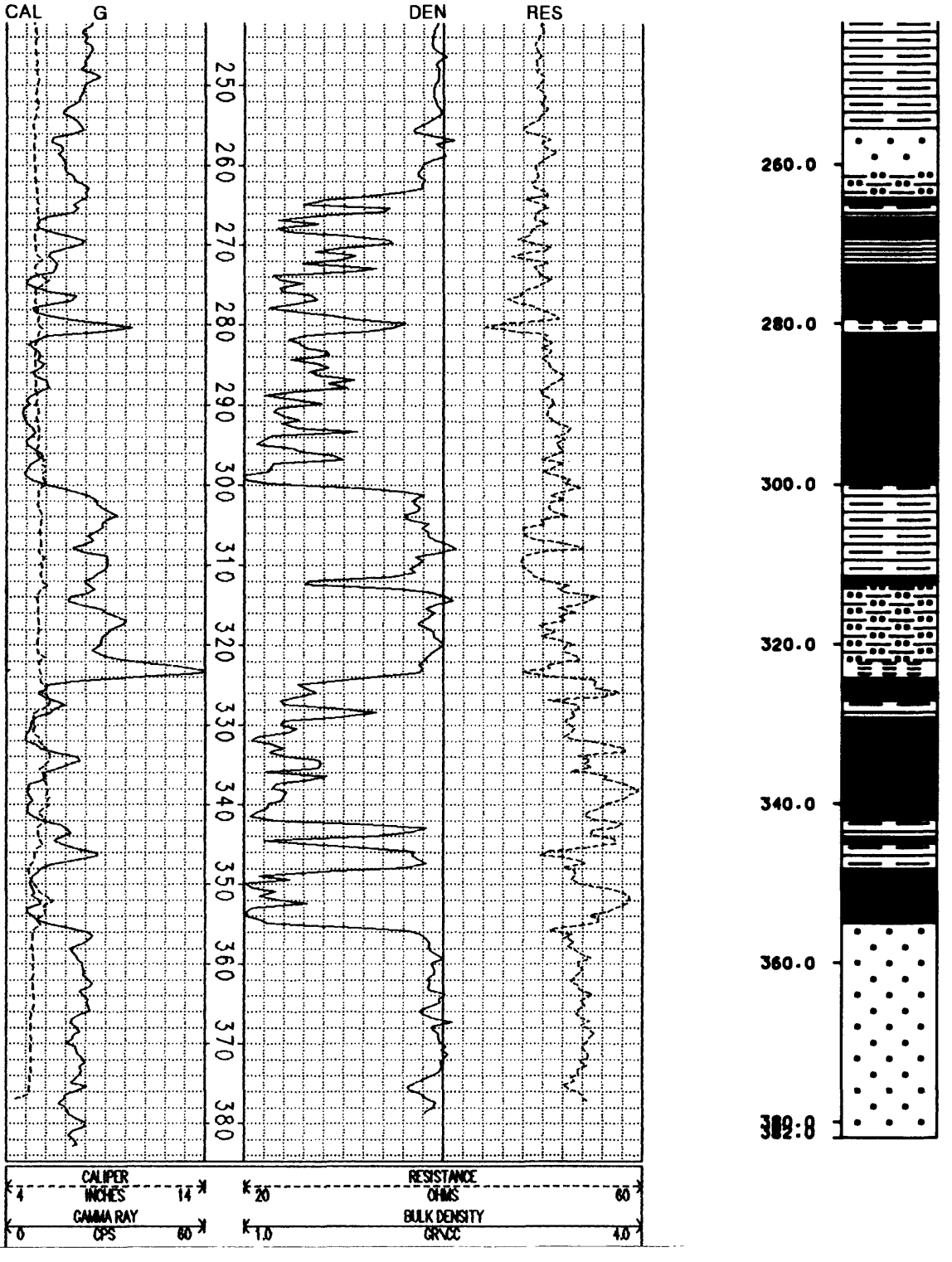


Sample and Core Log U.S. GEOLOGICAL SURVEY

Hole USGS-14 Elevation 6,550 feet Total depth 273 feet

Location 1246604 E., 159569 N. Sec. 30 , T. 33 N. , R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller S. Grant Core hole size 5 5/8 inches

Date started 9/17/88 Date completed 9/19/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Claystone, carbonaceous, dark-brown; coal stringers
2	5	7	Siltstone, medium-gray
3	7	10	Siltstone, carbonaceous, medium- to dark-brown
4	10	14	Siltstone, medium-gray; interbedded with claystone
1	14	15	Claystone, light-brown to gray
5	15	20	Coal, bright
3	20	23	Claystone, medium-gray
10	23	33	Siltstone, medium-gray; scattered lenses of very fine grained sandstone
2	33	35	Sandstone, very fine grained
6	35	41	Siltstone; interbedded with very fine grained sandstone
1	41	42	Claystone, coaly, carbonaceous
4.5	42	46.5	Siltstone, carbonaceous, medium-gray; interbedded with claystone
Start core description			
1.5	46.5	48	Siltstone
8.5	48	56.5	Coal; includes partings
.5	56.5	57	Claystone and siltstone
End core description			
0.5	57	57.50	Siltstone, sandy, light-gray; scattered plant fragments
9.5	57.5	67	Claystone, medium-gray
5	67	72	Siltstone, carbonaceous, medium-gray; interbedded with claystone
3	72	75	Sandstone, very fine grained
5	75	80	Siltstone, carbonaceous, sandy, medium-gray
6	80	86	Sandstone, very fine grained, carbonaceous, light-gray
7	86	93	Siltstone, carbonaceous dark-gray; lenses of very fine grained sandstone

Depth interval (feet) Thickness	From	To	Lithologic Description
11	93	104	Sandstone, very fine grained, light-gray; interbedded with dark-gray siltstone
5	104	109	Siltstone; interbedded with very fine grained sandstone
13	109	122	Sandstone, fine-grained, light-gray; interbedded with very fine grained sandstone
3	122	125	Siltstone, medium-gray
5	125	130	Sandstone, very fine grained, light-gray
22	130	152	Sandstone, fine-grained, light-gray; rippled laminae in top 5 ft; interbedded with very fine grained sandstone
5	152	157	Sandstone, very fine grained, light-gray
4	157	161	Sandstone, fine-grained, light-gray
Start core description			
6.5	161	167.5	Siltstone, carbonaceous; interbedded with coal
12.5	167.5	180	Coal; includes partings
2	180	182	Claystone, carbonaceous
21.5	182	203.5	Coal; includes partings
12.5	203.5	216	Siltstone and claystone
1	216	217	Coal
4.5	217	221.5	Siltstone and claystone
19.5	221.5	241	Coal; includes partings
2	241	243	Siltstone, carbonaceous
9.5	243	252.5	Coal; includes partings
12.2	252.5	264.7	Sandstone; interbedded with siltstone
End core description			
8.3	264.7	273	Sandstone, fine-grained, light-gray; scattered plant fragments; scattered siltstone laminae

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-14** County La Plata State Colorado

Location Sec. **30** T. **33** N. R. **11** W.

Elevation **6,550** Drilled depth **275** Logged depth **273**

Drilling medium **air** Date logged **9/19/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

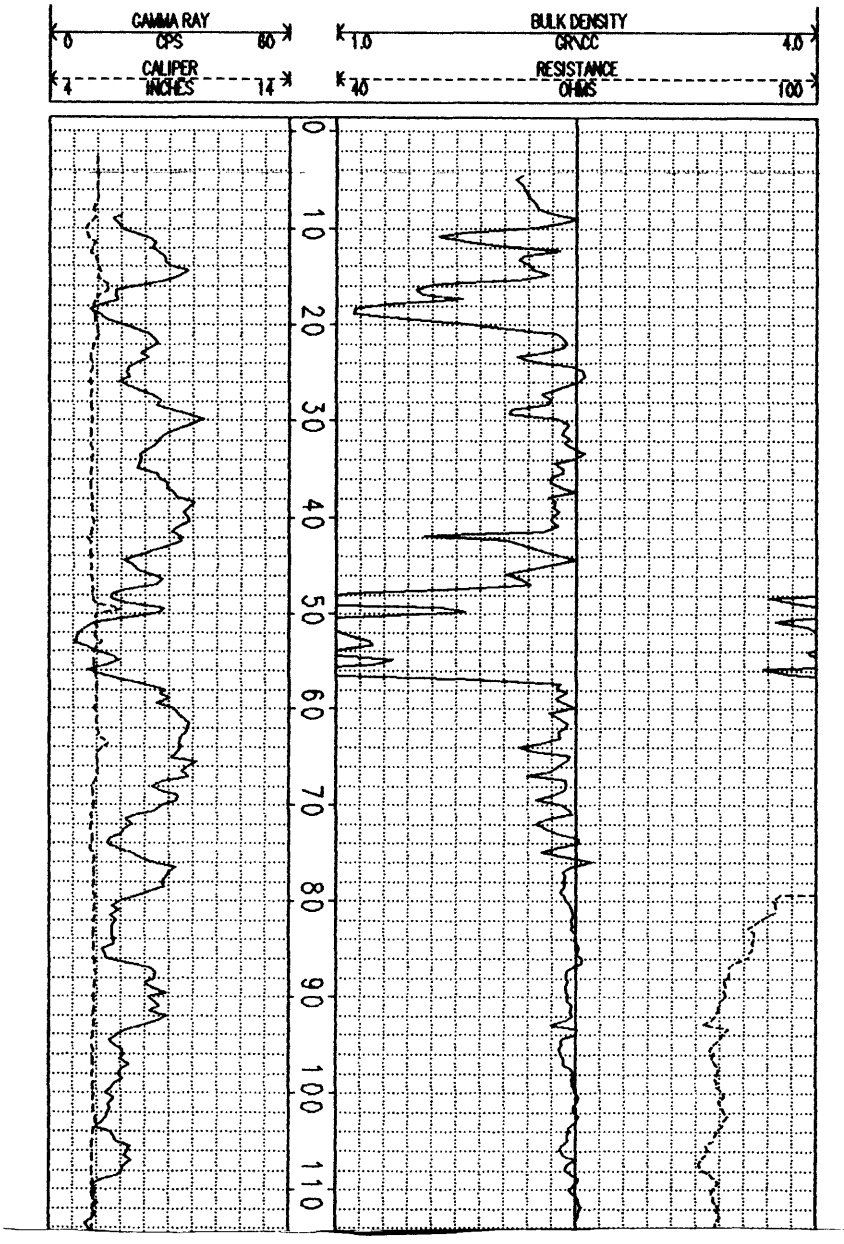
High resolution density (HRD)

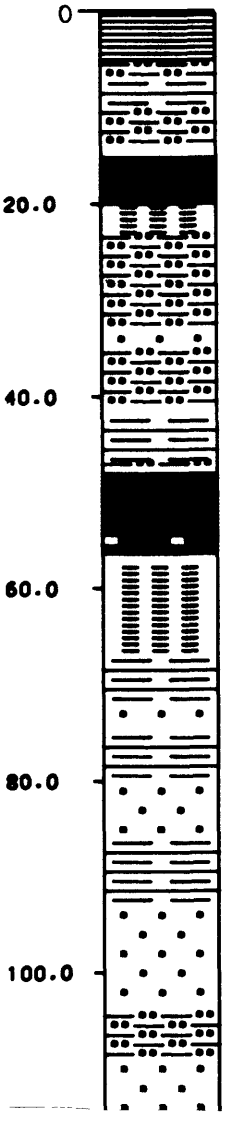
Caliper (CAL)

Resistance (RES)

Remarks: **Cored intervals, 46.5 to 57.5 ft and 161 to 264.7 ft**

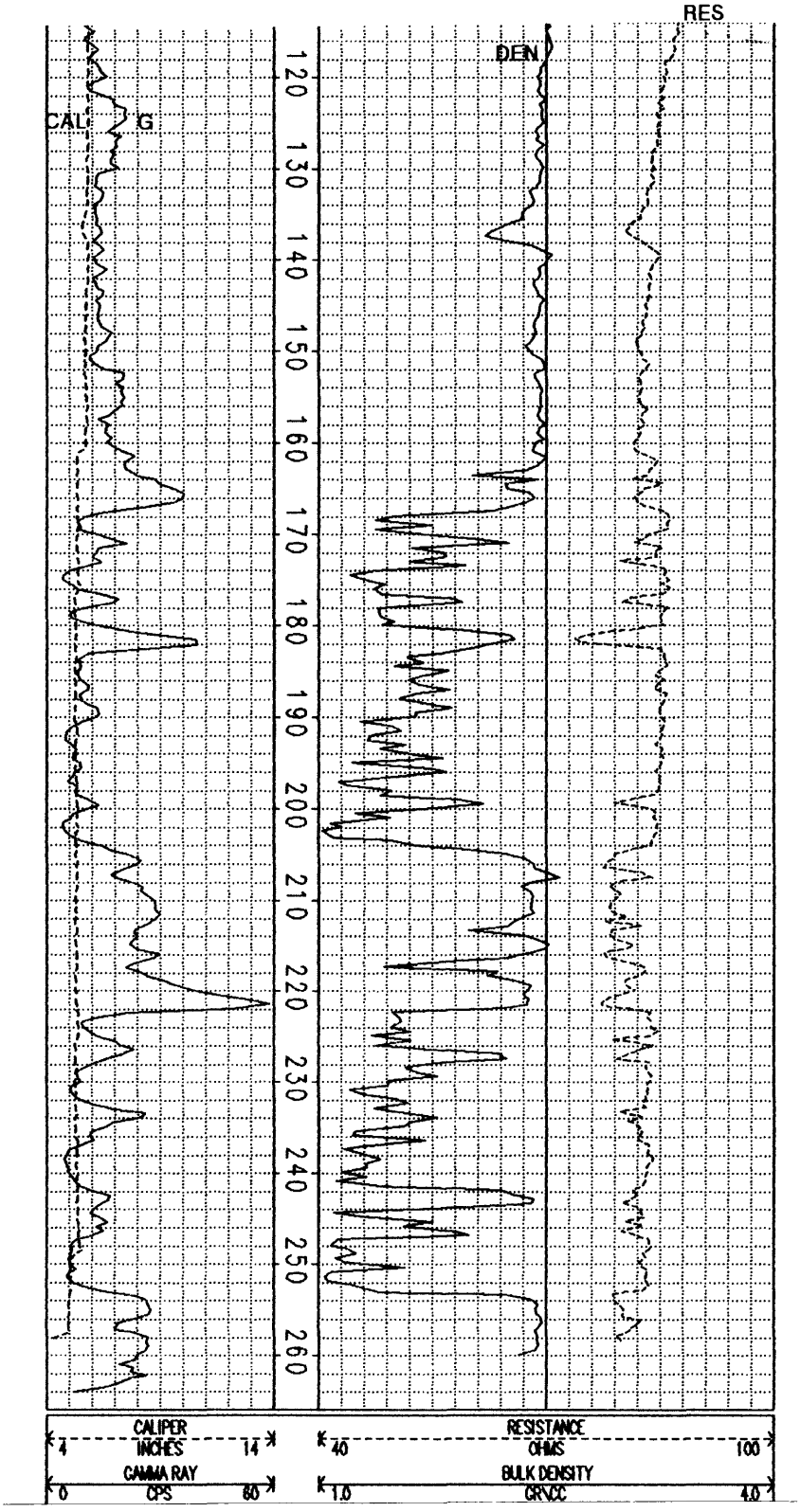
GEOPHYSICAL LOGS STRIP LOG

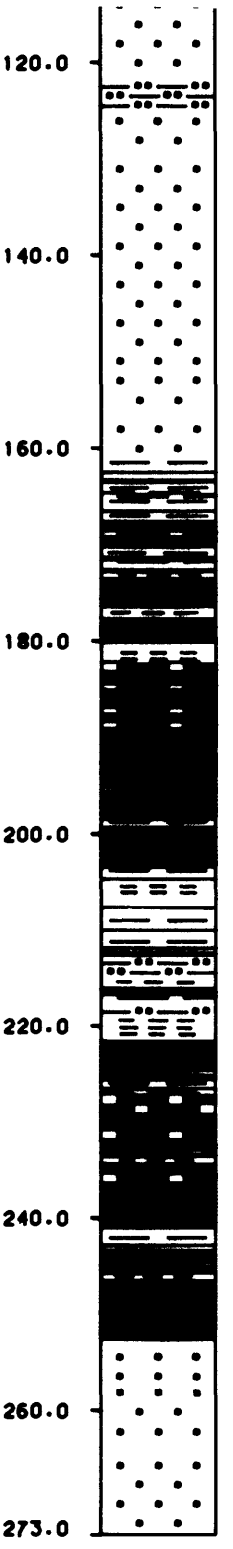




U.S. Geological Survey

Hole No. **USGS-14** continued





Depth interval (feet) Thickness	From	To	Detailed Core Description
Start core description			
1.30	46.50	47.80	Siltstone, medium-gray, pyritic; 45° fracture
1.70	47.80	49.50	Coal, bright; cleats
0.05	49.50	49.55	Claystone; ash
0.10	49.55	49.65	Coal, bright; cleats; scattered resin
0.05	49.65	49.70	Claystone, dark-gray; bentonite
4.70	49.70	54.40	Coal, bright; scattered resin; 45° fracture; ash at 52.5 ft
0.90	54.40	55.30	Coal, bony; scattered resin
0.10	55.30	55.40	Claystone, carbonaceous, light-brown; ash
1.10	55.40	56.50	Coal, bright; good cleats; highly fractured
0.20	56.50	56.70	Siltstone, carbonaceous, dark-gray
0.30	56.70	57.00	Claystone, slightly carbonaceous, light-gray
End core description			
Start core description			
2.10	161.00	163.10	Siltstone, carbonaceous, coaly, medium-gray; lower 0.2 ft rippled
0.55	163.10	163.65	Coal, bright; good cleats
0.95	163.65	164.60	Siltstone, coaly, carbonaceous, dark-gray
0.40	164.60	165.00	Coal, bony
2.40	165.00	167.40	Siltstone, carbonaceous, dark-brown; scattered resin; thin coal bands
1.10	167.40	168.50	Coal, bright; good cleats; very thin ash at 167.8 ft
0.50	168.50	169.00	Coal, bony
0.90	169.00	169.90	Coal, bright; cleats
0.10	169.90	170.00	Claystone, light-gray; ash
0.25	170.00	170.25	Coal, bright
0.05	170.25	170.30	Claystone; ash
0.60	170.30	170.90	Siltstone, clayey, carbonaceous, dark-brown
0.25	170.90	171.15	Claystone, carbonaceous, medium-gray, coaly; ash
0.30	171.15	171.45	Coal, bright; good cleats
0.10	171.45	171.55	Siltstone, coaly, carbonaceous, dark-brown
0.30	171.55	171.85	Coal, bony
0.05	171.85	171.90	Claystone, dark-brown; ash
0.50	171.90	172.40	Siltstone, carbonaceous, coaly, dark-brown
0.50	172.40	172.90	Coal, bright; good cleats
0.20	172.90	173.10	Claystone, carbonaceous, black
0.25	173.10	173.35	Claystone, carbonaceous; ash
2.25	173.35	175.60	Coal, bright; cleats
0.80	175.60	176.40	Coal, bright; cleats; gas bubbling from core
0.20	176.40	176.60	Coal, bony
0.90	176.60	177.50	Siltstone, clayey, carbonaceous, dark-brown
2.70	177.50	180.20	Coal, bright; cleats; scattered resin; high-angle fracture
0.70	180.20	180.90	Claystone, carbonaceous, dark-brown

Depth interval (feet) Thickness	From	To	Detailed Core Description
1.30	180.90	182.20	Claystone, light-gray; ash; bentonite?
0.80	182.20	183.00	Coal, bony; scattered resin
1.40	183.00	184.40	Coal, bright; cleats; very thin ash at 183.2 and 183.8 ft
0.50	184.40	184.90	Coal, bony
1.50	184.90	186.40	Coal, bright; cleats; high-angle fracture; scattered resin
0.10	186.40	186.50	Claystone, coaly, carbonaceous, dark-brown to black
0.25	186.50	186.75	Coal, bright; cleats
0.10	186.75	186.85	Claystone, light-gray; ash
0.55	186.85	187.40	Coal, bony
0.90	187.40	188.30	Coal, bright
0.60	188.30	188.90	Coal, bony
0.40	188.90	189.30	Coal, bright; cleats
0.05	189.30	189.35	Claystone, medium- to light-gray; ash
1.25	189.35	190.60	Coal, bright; scattered resin; cleats; thin ash at 189.75 ft
0.60	190.60	191.20	Coal, bright; cleats; scattered resin; pyrite
0.20	191.20	191.40	Coal, bony
2.40	191.40	193.80	Coal, bright; scattered resin; thin ash at 193.3 ft; gas bubbling from core
0.35	193.80	194.15	Coal, bony
0.85	194.15	195.00	Coal, bright; cleats; scattered resin
0.40	195.00	195.40	Coal, bony
3.00	195.40	198.40	Coal, bright; cleats; scattered resin; thin ash at 195.7 ft; gas bubbling from core
1.20	198.40	199.60	Siltstone, carbonaceous, black; thin coal bands
0.80	199.60	200.40	Coal, bright; cleats; vertical fracture
0.20	200.40	200.60	Coal, bony
2.80	200.60	203.40	Coal, bright; cleats; scattered resin; high-angle fracture
1.70	203.40	205.10	Siltstone, carbonaceous, dark-gray; abundant thin coal bands
1.05	205.10	206.15	Claystone, silty, carbonaceous, dark-gray
1.05	206.15	207.20	Sandstone, very fine grained, medium-gray; coal fragments
0.10	207.20	207.30	Siltstone, coaly, dark-brown
0.70	207.30	208.00	Siltstone, medium-gray; very thin coal bands
0.50	208.00	208.50	Siltstone, carbonaceous, medium-gray
2.40	208.50	210.90	Siltstone, carbonaceous; coal lens at 209.5 ft; very fine grained sandstone lens at 209.9 ft
1.30	210.90	212.20	Siltstone, carbonaceous, coaly, dark-gray; very fine grained sandstone lens at 212.1 ft
0.50	212.20	212.70	Coal, bright; cleats; scattered resin
0.05	212.70	212.75	Siltstone, carbonaceous, dark-gray
0.05	212.75	212.80	Siltstone; pyrite
0.20	212.80	213.00	Siltstone, carbonaceous, dark-gray; thin coal bands

Depth interval (feet) Thickness	From	To	Detailed Core Description
2.30	213.00	215.30	Siltstone, medium-gray; scattered coal fragments
0.60	215.30	215.90	Siltstone, carbonaceous, medium-gray; more carbonaceous toward base
0.20	215.90	216.10	Coal, bright; cleats; scattered resin
0.10	216.10	216.20	Claystone, light-brown; ash
0.50	216.20	216.70	Coal, bright; cleats
0.50	216.70	217.20	Coal, bony
0.90	217.20	218.10	Siltstone, carbonaceous, dark-gray; thin coal bands
1.10	218.10	219.20	Siltstone, medium-gray; scattered coal fragments
1.00	219.20	220.20	Siltstone, carbonaceous; pyrite at 219.3 ft; very fine grained sandstone lens at 219.9 ft
0.45	220.20	220.65	Siltstone, carbonaceous, medium-gray
0.75	220.65	221.40	Claystone, light-gray; bentonite
0.70	221.40	222.10	Coal, bright; cleats
0.10	222.10	222.20	Coal, bony
2.55	222.20	224.75	Coal, bright; very thin ash at 222.7, 223.6, 223.8, and 224.6 ft; scattered resin
0.20	224.75	224.95	Claystone, light-gray; ash
0.75	224.95	225.70	Coal, bright; cleats
1.10	225.70	226.80	Siltstone, carbonaceous, dark-gray; coal bands; grades to bony coal at base
0.15	226.80	226.95	Claystone, light-gray
0.10	226.95	227.05	Siltstone, coaly, carbonaceous, black; thin light-brown ash at base
1.95	227.05	229.00	Coal, bony; ash at 227.2, 227.75, 228, and 228.15 ft
1.80	229.00	230.80	Coal, bright; cleats; scattered resin
0.90	230.80	231.70	Coal, bony
1.20	231.70	232.90	Coal, bright; cleats; scattered resin
0.05	232.90	232.95	Claystone, carbonaceous, dark-brown
0.20	232.95	233.15	Claystone, light-gray; ash
0.05	233.15	233.20	Claystone, carbonaceous, dark-brown
0.50	233.20	233.70	Coal, bright; cleats
0.50	233.70	234.20	Siltstone, coaly, carbonaceous, dark-brown; thin coal bands
0.50	234.20	234.70	Coal, bright; cleats; scattered resin; high-angle fracture
0.60	234.70	235.30	Coal; lost core
0.90	235.30	236.20	Coal, bony; ash at 235.75 and 235.9 ft
4.80	236.20	241.00	Coal, bright; scattered resin; ash at 238.8 ft
0.70	241.00	241.70	Siltstone, carbonaceous, dark-brown; thin coal bands
1.50	241.70	243.20	Siltstone, carbonaceous, dark-brown
1.50	243.20	244.70	Coal, bright; scattered resin
0.10	244.70	244.80	Claystone, coaly, carbonaceous, black
0.10	244.80	244.90	Claystone, light-gray; ash
0.90	244.90	245.80	Coal, bright; cleats; scattered resin; thin ash at 245.5 ft

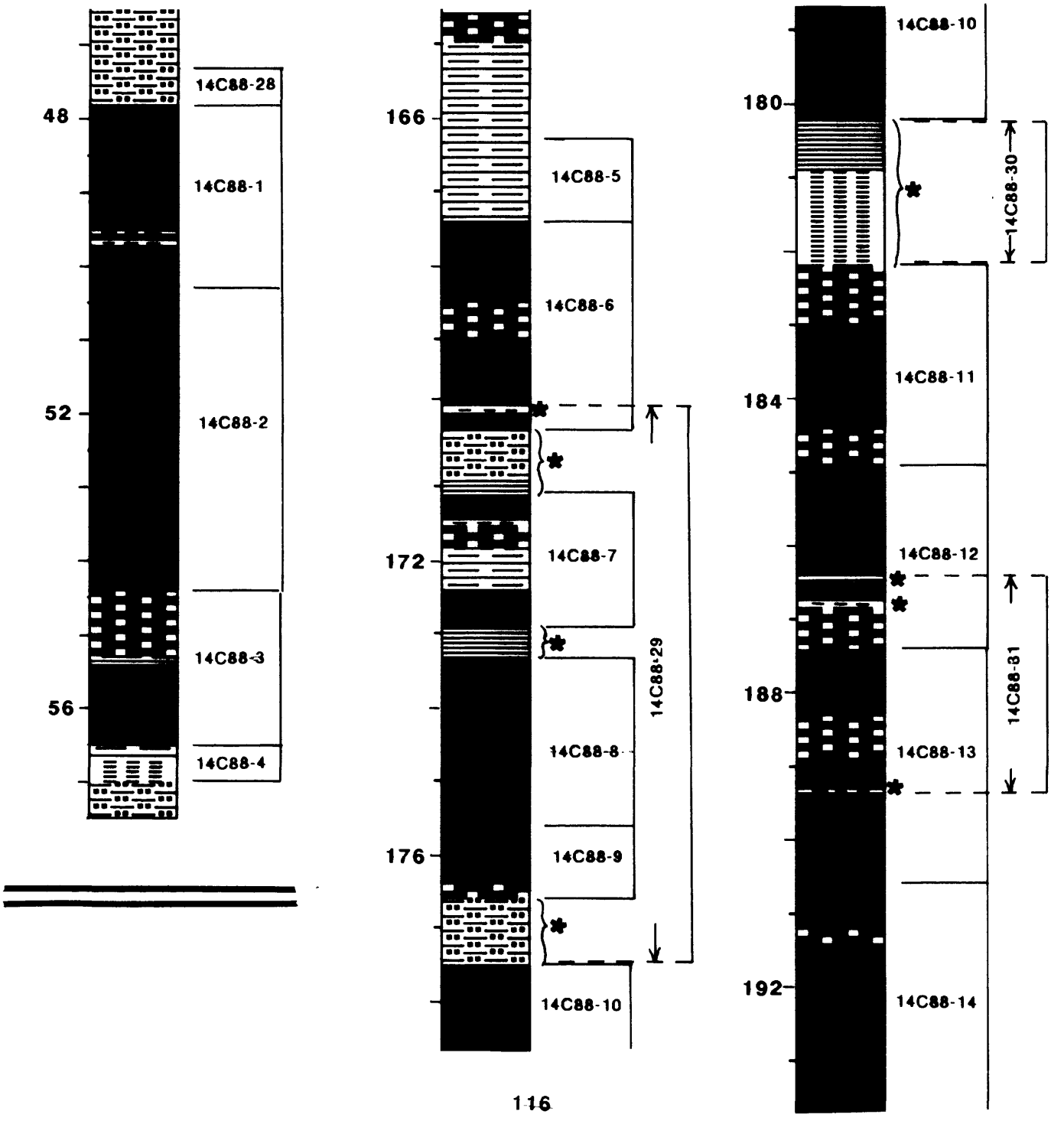
Depth interval (feet) Thickness	From	To	Detailed Core Description
0.55	245.80	246.35	Siltstone, clayey, carbonaceous, dark-brown to gray; scattered pyrite; coal bands
3.35	246.35	249.70	Coal, bright; cleats; scattered resin; high-angle fracture
0.05	249.70	249.75	Claystone, medium-gray; ash
0.25	249.75	250.00	Coal, bright; cleats
2.00	250.00	252.00	Coal, bright; cleats; vertical fracture; interval sampled for desorption of methane
0.60	252.00	252.60	Coal, bright
0.20	252.60	252.80	Siltstone, clayey, carbonaceous, dark-brown
0.60	252.80	253.40	Siltstone, medium-gray; scattered coal fragments
2.00	253.40	255.40	Sandstone, very fine grained, medium-gray
1.70	255.40	257.10	Sandstone, very fine grained, light-gray
4.10	257.10	261.20	Sandstone, very fine grained, medium-gray; scattered carbonaceous zones
1.30	261.20	262.50	Sandstone, very fine grained, light- to medium-gray; carbonaceous material along bedding planes; laminated
1.00	262.50	263.50	Sandstone, very fine grained, light-gray
0.15	263.50	263.65	Siltstone, medium-gray
0.05	263.65	263.70	Sandstone, very fine grained, light-gray; rippled
0.20	263.70	263.90	Siltstone, medium-gray
0.40	263.90	264.30	Sandstone, very fine grained, light-gray; rippled
0.10	264.30	264.40	Sandstone, very fine grained; horizontal laminae of siltstone
0.10	264.40	264.50	Siltstone, medium-gray
0.20	264.50	264.70	Sandstone, very fine grained, light-gray; carbonaceous on bedding planes

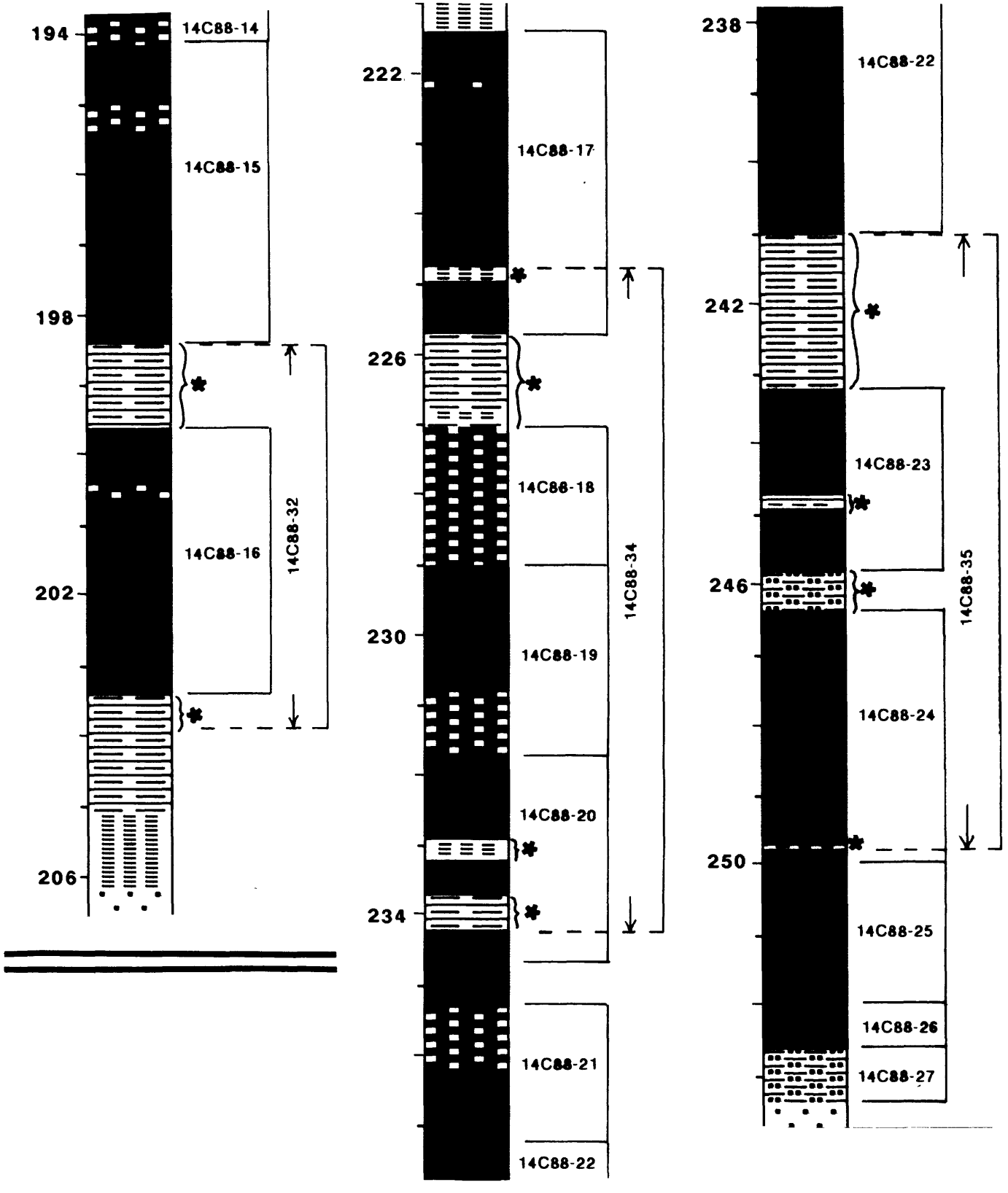
End core description

U.S. Geological Survey

Hole No. **USGS-14**

Detailed strip log showing cored interval, location of sampled intervals, and sample numbers
Vertical scale: 1 inch = 2 feet

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198
202
206
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14C88-16
14C88-32
222
226
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234
14C88-17
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14C88-19
14C88-20
14C88-21
14C88-22
14C88-34
238
242
246
250
14C88-22
14C88-23
14C88-24
14C88-25
14C88-26
14C88-27
14C88-35

Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 2

Hole USGS-15 Elevation 6,590 feet Total depth 315 feet

Location 1247461 E., 162059 N. Sec. 19, T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 9/20/88 Date completed 9/20/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
17	0	17	Sandstone, very fine grained, light-brown; interbedded with siltstone; oxidized
1.5	17	18.5	Claystone, coaly, carbonaceous, dark-gray to black
3.5	18.5	22	Coal, bright
4	22	26	Claystone, carbonaceous, dark-gray
4	26	30	Sandstone, very fine grained, medium-gray
2	30	32	Siltstone, carbonaceous, coaly, dark-gray to black
6	32	38	Claystone, carbonaceous, medium-gray
5	38	43	Siltstone, medium-gray; interbedded with very fine grained sandstone
1	43	44	Claystone, carbonaceous
2	44	46	Siltstone, medium-gray
2	46	48	Sandstone, very fine grained, light-gray
4	48	52	Siltstone, light-brown
1	52	53	Coal
1	53	54	Claystone, carbonaceous, dark-brown
7	54	61	Siltstone, medium-gray; scattered carbonaceous lenses; interbedded with very fine grained sandstone
1.5	61	62.5	Coal
1	62.5	63.5	Siltstone, carbonaceous, dark-brown
6.5	63.5	70	Coal
5	70	75	Siltstone, carbonaceous; scattered pyrite
3	75	78	Claystone, carbonaceous
4	78	82	Siltstone, carbonaceous, dark-gray
4	82	86	Sandstone, very fine grained, medium-gray; siltstone lenses
8	86	94	Claystone, carbonaceous, dark-gray to black; coaly at top 1 ft
4	94	98	Siltstone, carbonaceous, medium-gray
15	98	113	Sandstone, very fine grained, medium-gray
7	113	120	Sandstone, fine-grained, light-gray
6	120	126	Sandstone, very fine grained, light-gray
5	126	131	Sandstone, fine-grained, light-gray
2	131	133	Coal

Depth interval (feet) Thickness	From	To	Lithologic Description
1.5	133	134.5	Siltstone, carbonaceous
5.5	134.5	140	Coal, bony
1	140	141	Siltstone, carbonaceous
2	141	143	Coal
1	143	144	Claystone, carbonaceous
17	144	161	Coal, bony; includes partings
1.5	161	162.5	Siltstone, carbonaceous
1	162.5	163.5	Coal
2	163.5	165.5	Claystone, carbonaceous; bentonite?
3	165.5	168.5	Coal
2.5	168.5	171	Claystone
1	171	172	Coal, bony
20	172	192	Siltstone, medium-gray; interbedded with light-gray, very fine grained sandstone
10	192	202	Sandstone, very fine grained, light- to medium-gray
3	202	205	Sandstone, fine-grained, light-gray
5	205	210	Sandstone, very fine grained, light-gray
5	210	215	Siltstone, medium-gray
14	215	229	Sandstone, fine-grained, light-gray
24	229	253	Sandstone, very fine grained, light-gray; interbedded with fine-grained sandstone and siltstone
2	253	255	Sandstone, fine-grained, light-gray
7	255	262	Siltstone, carbonaceous, medium-gray; interbedded with very fine grained sandstone
1	262	263	Claystone; bentonite?
1.5	263	264.5	Siltstone, carbonaceous, dark-gray to black
3.5	264.5	268	Coal
2.5	268	270.5	Siltstone, coaly, carbonaceous, dark-gray to black
1	270.5	271.5	Coal
0.5	271.5	272	Claystone; bentonite?
7	272	279	Coal
1	279	280	Claystone
1	280	281	Coal
12	281	293	Sandstone, very fine grained, light-gray; lenses of medium-gray siltstone
4	293	297	Sandstone, fine-grained, light-gray
18	297	315	Sandstone, fine-grained, light-gray; interbedded with very fine grained sandstone and siltstone; carbonaceous laminae

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-15** County **La Plata** State **Colorado**

Location Sec. **19** T. **33** N. R. **11** W.

Elevation **6,590** Drilled depth **315** Logged depth **313**

Drilling medium **air** Date logged **9/20/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale **1 in. = 20 ft.**

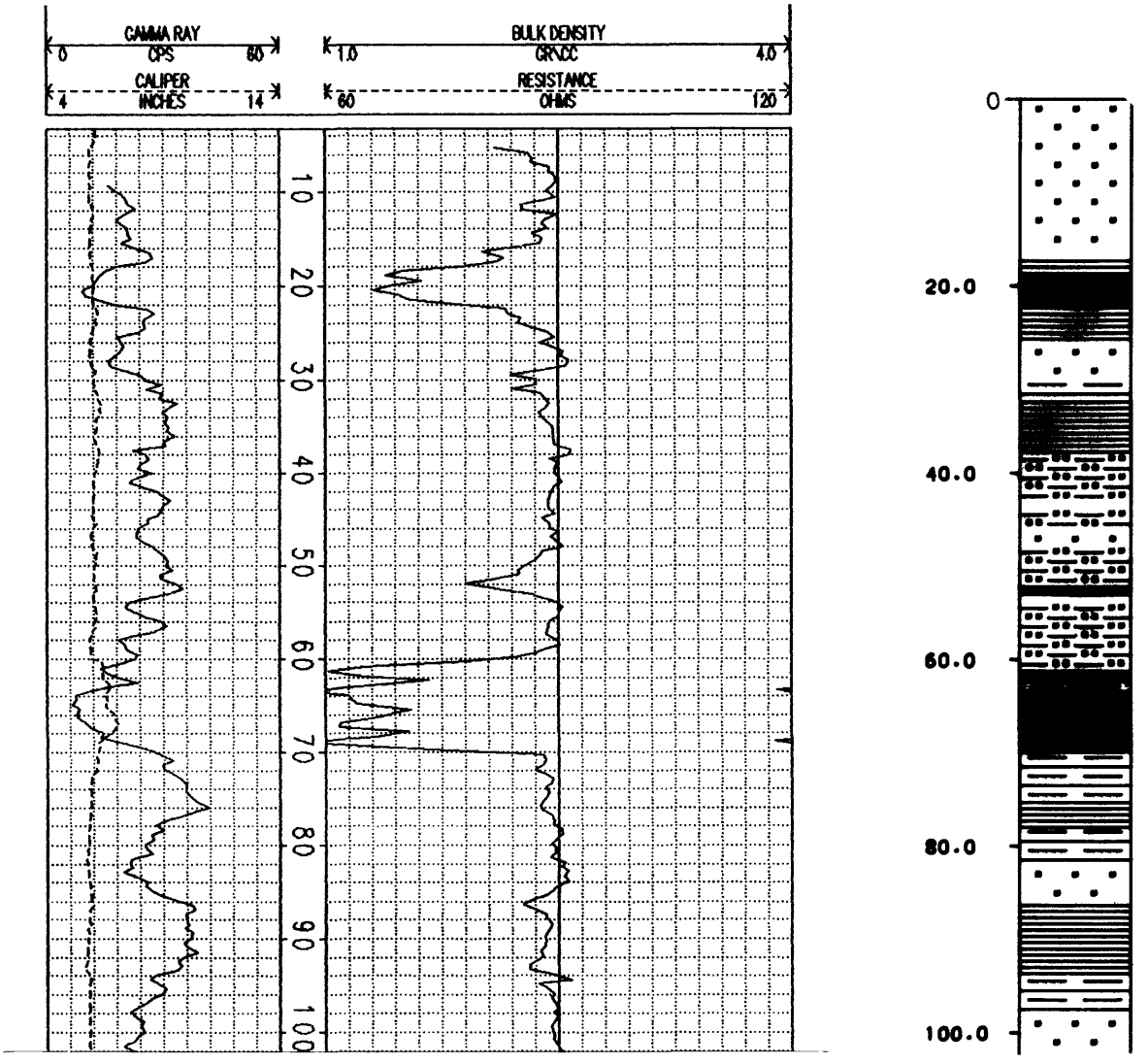
High resolution density (HRD)

Caliper (CAL)

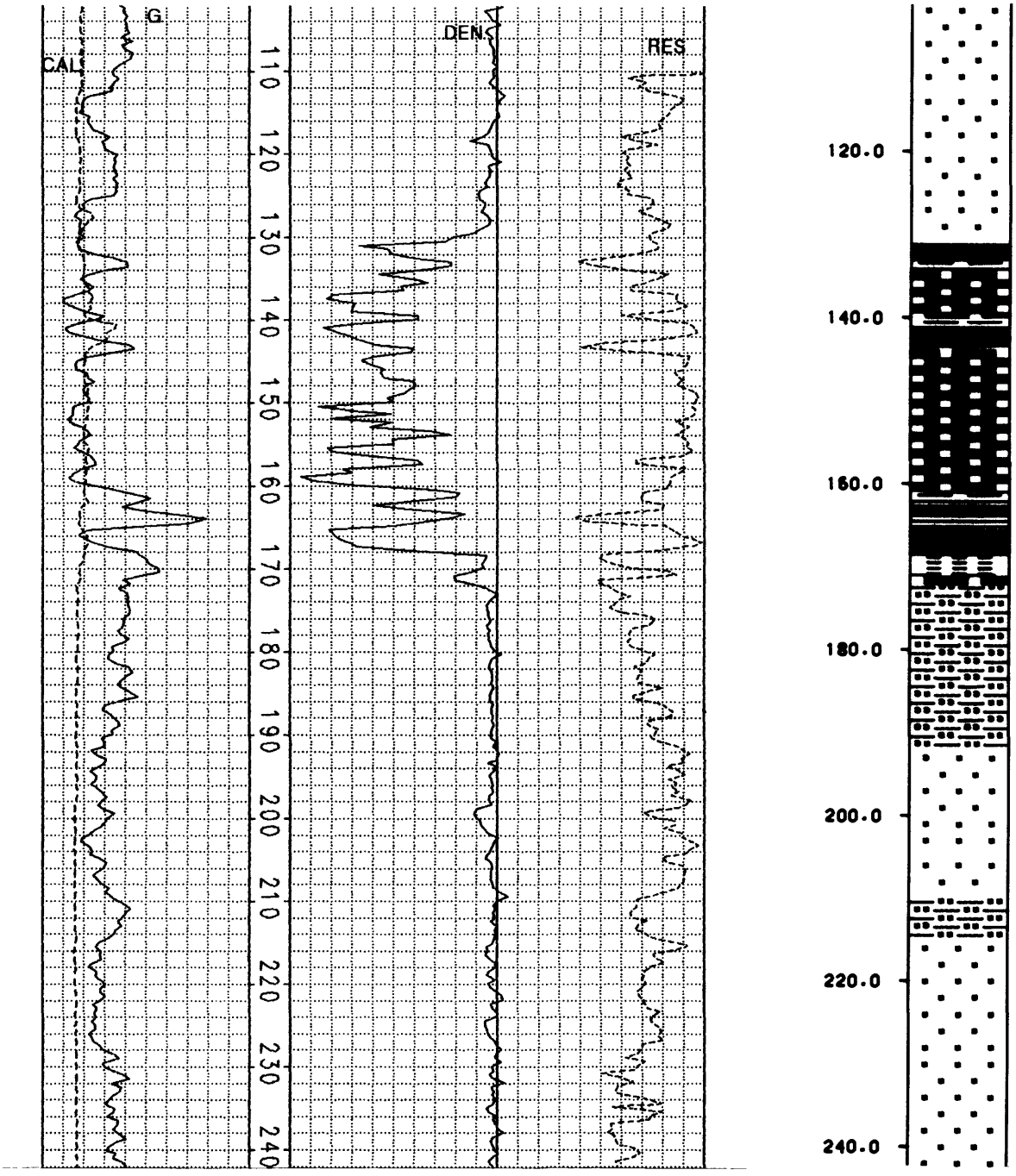
Resistance (RES)

Remarks:

GEOPHYSICAL LOGS STRIP LOG



Hole No. **USGS-15** continued



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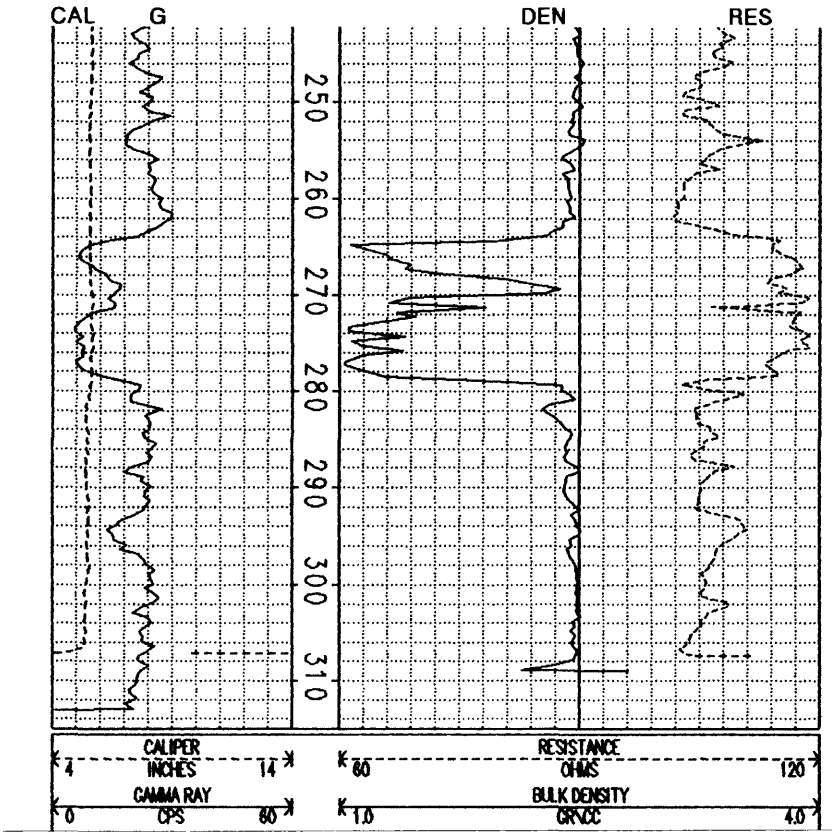
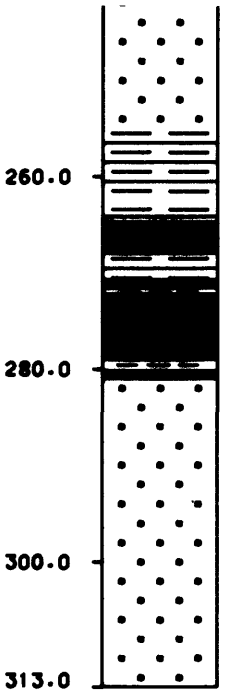




Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 3

Hole USGS-16 Elevation 6,690 feet Total depth 395 feet

Location 1249643 E., 164985 N. Sec. 20 , T. 33 N. , R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 10/13/88 Date completed 10/14/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
10	0	10	Sandstone, very fine grained, light-brown to gray, well-sorted, oxidized
1	10	11	Sandstone, very fine grained, red-brown, oxidized
4	11	15	Claystone, slightly carbonaceous, light-gray; scattered plant fragments
0.5	15	15.5	Claystone, carbonaceous, coaly, black
1.5	15.5	17	Claystone, carbonaceous, dark-gray
3	17	20	Siltstone, brown
2	20	22	Claystone, light-gray
0.5	22	22.5	Claystone, carbonaceous, coaly, black
2.5	22.5	25	Claystone, light-gray
4	25	29	Siltstone, light-gray, well-cemented
5.5	29	34.5	Claystone, light-gray; carbonaceous fragments
2	34.5	36.5	Claystone, carbonaceous, coaly, dark-brown to black
1	36.5	37.5	Coal
5.5	37.5	43	Claystone, carbonaceous
2	43	45	Coal
1	45	46	Claystone, carbonaceous
1.5	46	47.5	Coal
8	47.5	55.5	Claystone, slightly carbonaceous, light- to medium-gray; scattered plant fragments
1	55.5	56.5	Coal, bony
5.5	56.5	62	Claystone, carbonaceous, dark-brown
3	62	65	Claystone, medium-gray; thin siltstone lenses
9	65	74	Sandstone, very fine grained, light-gray, clean, well-sorted; carbonaceous laminae
14	74	88	Sandstone, fine-grained, light-gray, clean, well-sorted
3	88	91	Sandstone, very fine grained, medium-gray; carbonaceous laminae
3	91	94	Sandstone, fine-grained to very fine grained, medium-gray; grades downward into siltstone
4.5	94	98.5	Siltstone, medium-gray
1.5	98.5	100	Coal, bony
4	100	104	Claystone, carbonaceous, dark-brown

Depth interval (feet) Thickness	From	To	Lithologic Description
1	104	105	Coal, bony
6	105	111	Claystone, carbonaceous, medium-gray
7	111	118	Sandstone, very fine grained, medium-gray; interbedded with claystone; scattered carbonaceous fragments
7.5	118	125.5	Claystone, medium-gray; interbedded with siltstone; some very fine grained sandstone lenses
2	125.5	127.5	Coal
0.5	127.5	128	Siltstone, carbonaceous
2.5	128	130.5	Coal
2.5	130.5	133	Siltstone, medium-gray
6	133	139	Sandstone, very fine grained, medium-gray
16.5	139	155.5	Siltstone, medium- to dark-gray; interbedded with very fine grained sandstone
1	155.5	156.5	Claystone, carbonaceous, coaly, black
6.5	156.5	163	Siltstone, carbonaceous, dark-gray to brown
2.5	163	165.5	Sandstone
4.5	165.5	170	Siltstone, carbonaceous, dark-gray to brown
2.5	170	172.5	Sandstone
4	172.5	176.5	Siltstone, carbonaceous
1.5	176.5	178	Coal
1	178	179	Claystone; ash; bentonite
8	179	187	Coal; includes partings
9.5	187	196.5	Claystone, carbonaceous, dark-brown to gray, coaly
2.5	196.5	199	Coal; includes partings
1	199	200	Claystone; ash; bentonite
5	200	205	Coal; includes partings
1.5	205	206.5	Claystone, carbonaceous
3	206.5	209.5	Coal
1	209.5	210.5	Claystone; ash; bentonite
3.5	210.5	214	Coal
7	214	221	Siltstone, medium-gray
1	221	222	Coal, bony
.9	222	231	Sandstone, very fine grained, carbonaceous, medium-gray; interbedded with black carbonaceous siltstone
14	231	245	Siltstone, sandy, medium-gray
2.5	245	247.5	Siltstone, carbonaceous, dark-gray
8	247.5	255.5	Coal, bony; includes partings
1	255.5	256.5	Claystone, light-gray; ash; bentonite
6.5	256.5	263	Coal; includes partings
1	263	264	Claystone; ash; bentonite
4	264	268	Coal; includes partings
5	268	273	Sandstone, very fine grained, light-gray, clean, well-sorted
16	273	289	Sandstone, fine-grained to very fine grained, light-gray, clean, well-sorted

Depth interval (feet) Thickness	From	To	Lithologic Description
17	289	306	Siltstone, carbonaceous, dark-brown; coaly stringers
32	306	338	Sandstone, very fine grained, silty, medium-gray; plant fragments; carbonaceous laminae
4	338	342	Siltstone, medium- to dark-gray
2	342	344	Coal
1	344	345	Siltstone, carbonaceous, dark-brown
4.5	345	349.5	Coal; includes partings
2.5	349.5	352	Siltstone, carbonaceous
8.5	352	360.5	Coal; includes partings
18.5	360.5	379	Sandstone, very fine grained to fine-grained, light-gray, clean, well-sorted; some carbonaceous laminae
16	379	395	Sandstone, fine-grained, light-gray, clean, well-sorted; siltstone laminae

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. USGS-16 County La Plata State Colorado

Location Sec. 20 T. 33 N. R. 11 W.

Elevation 6,690 Drilled depth 395 Logged depth 393

Drilling medium air Date logged 10/14/88

Geophysical logs:

Gamma ray (G) Logging speed 15 fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

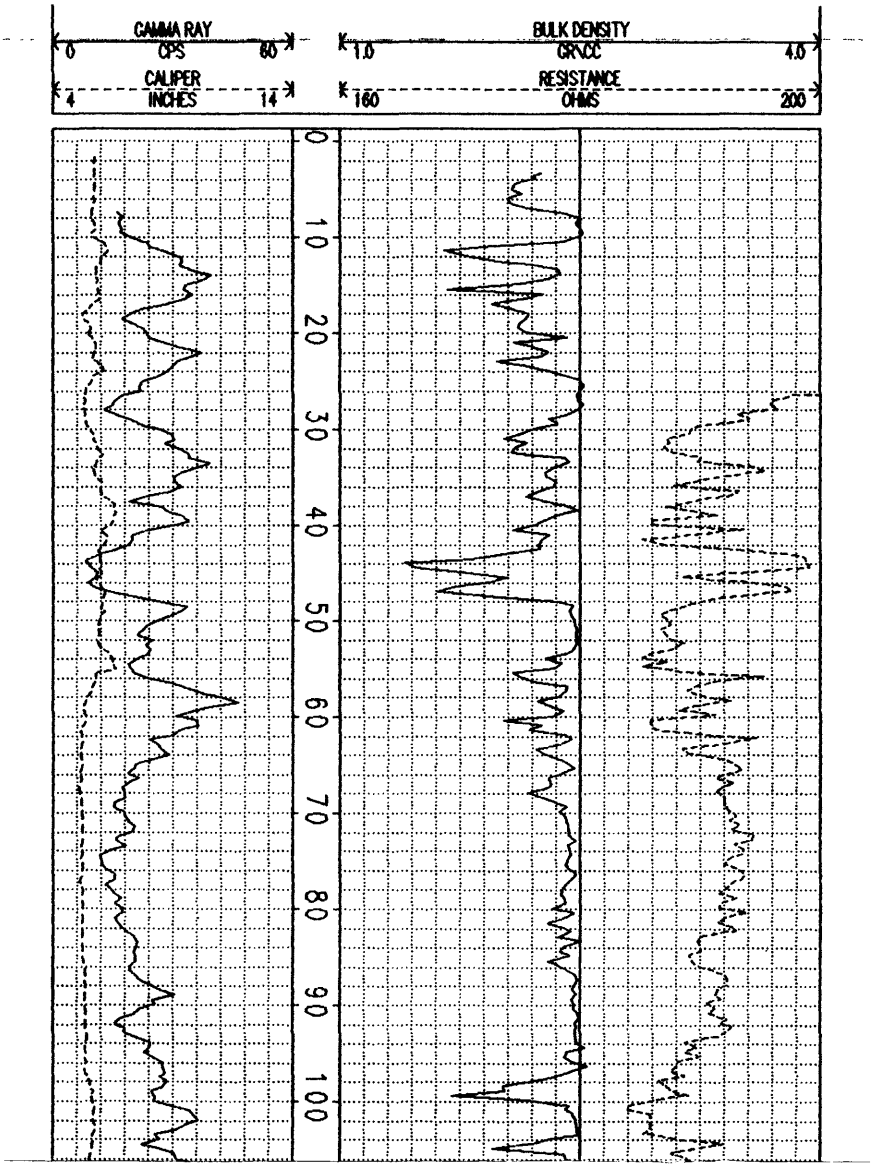
High resolution density (HRD)

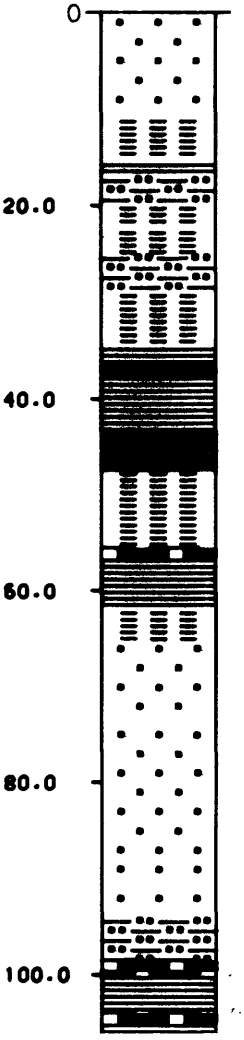
Caliper (CAL)

Resistance (RES)

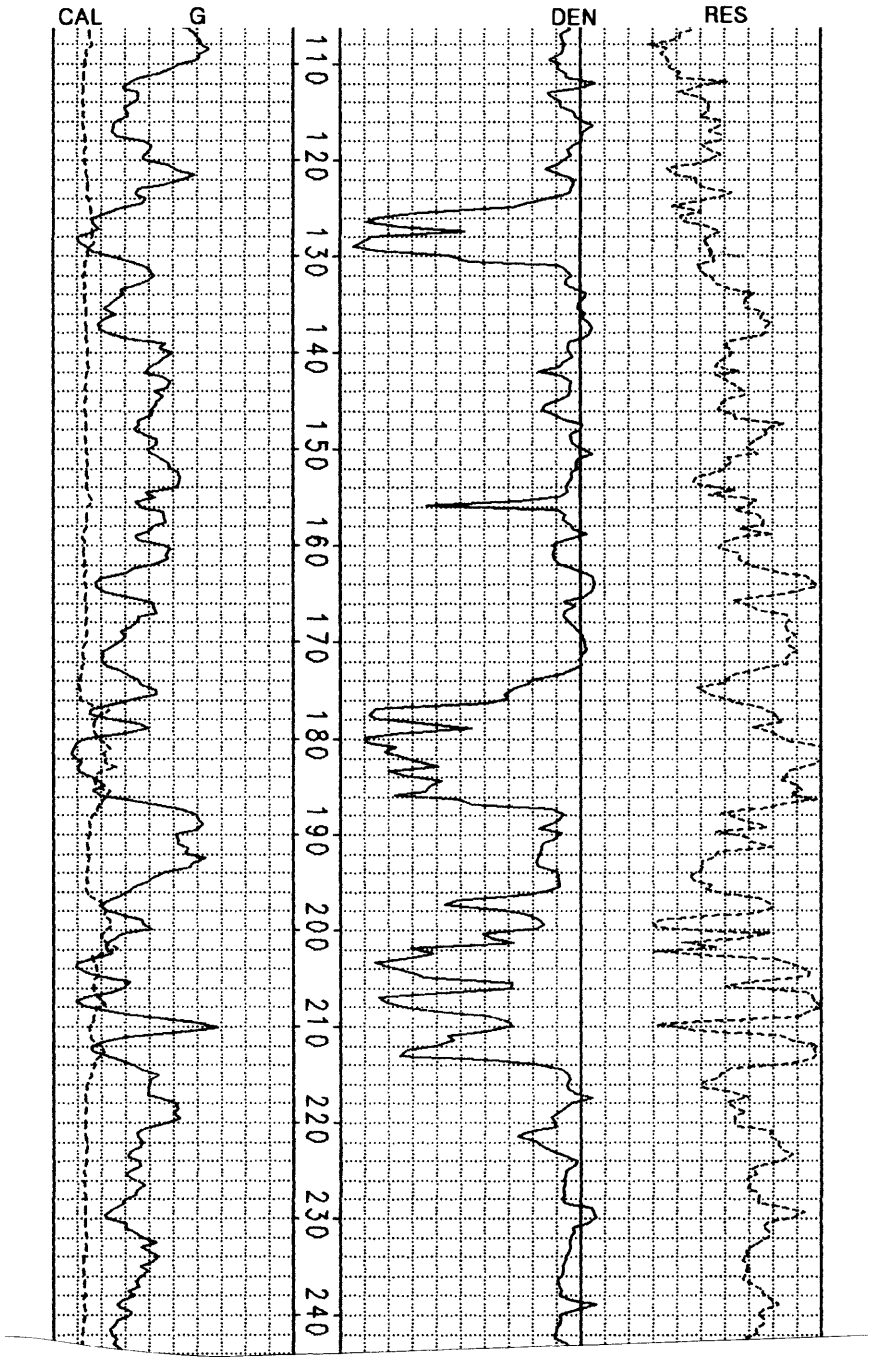
Remarks:

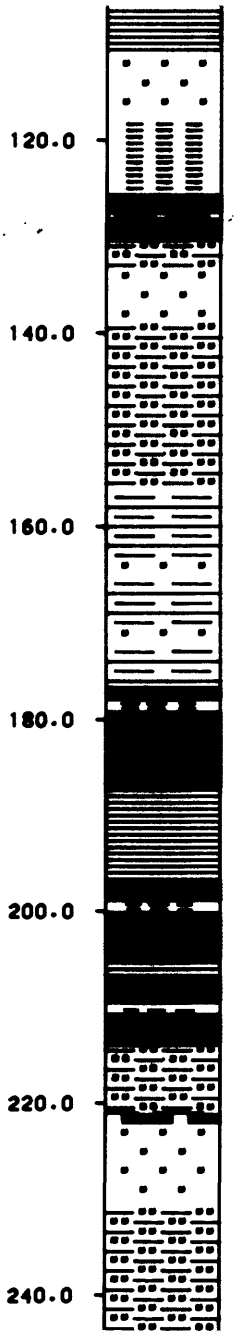
GEOPHYSICAL LOGS STRIP LOG



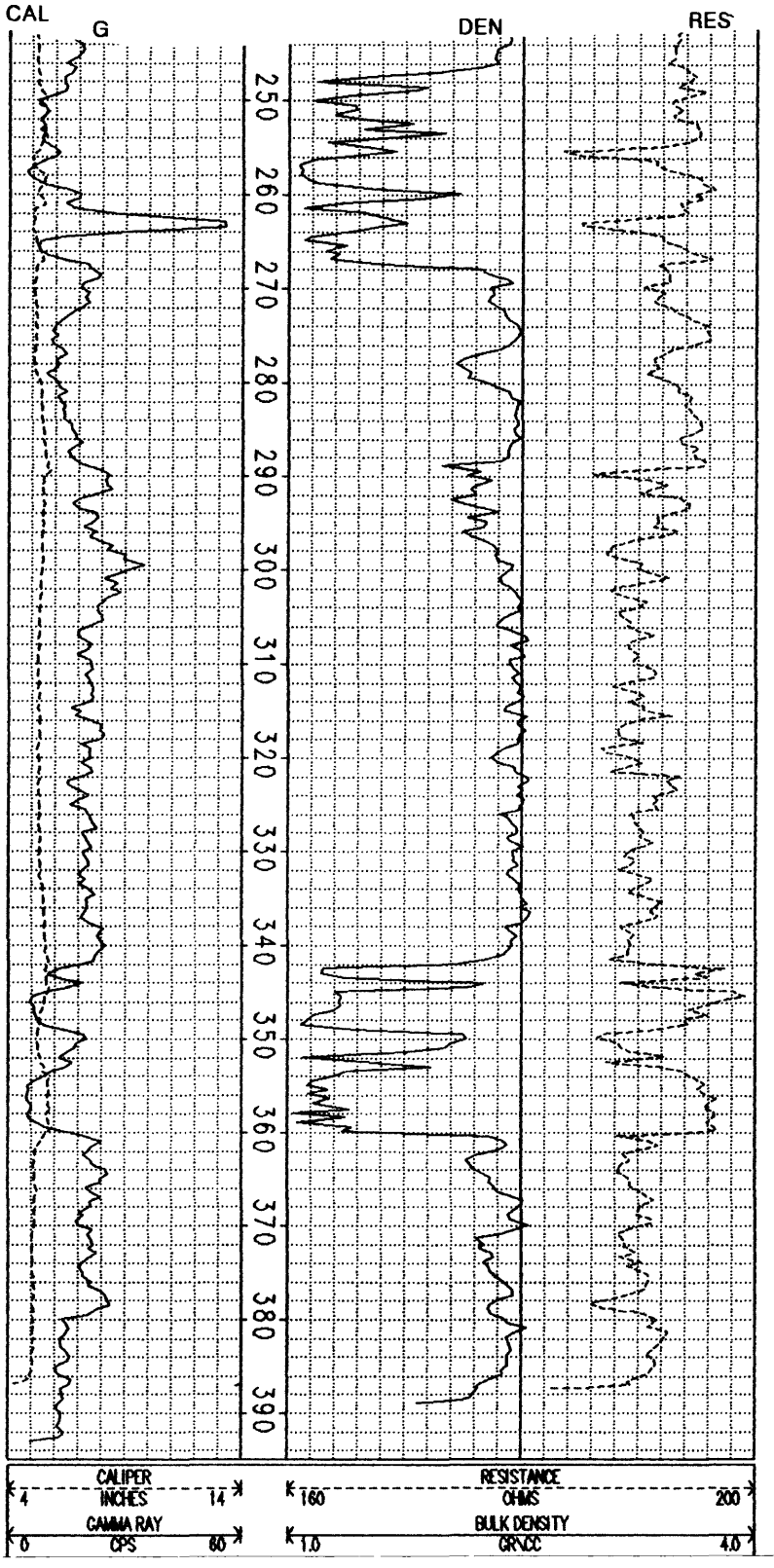


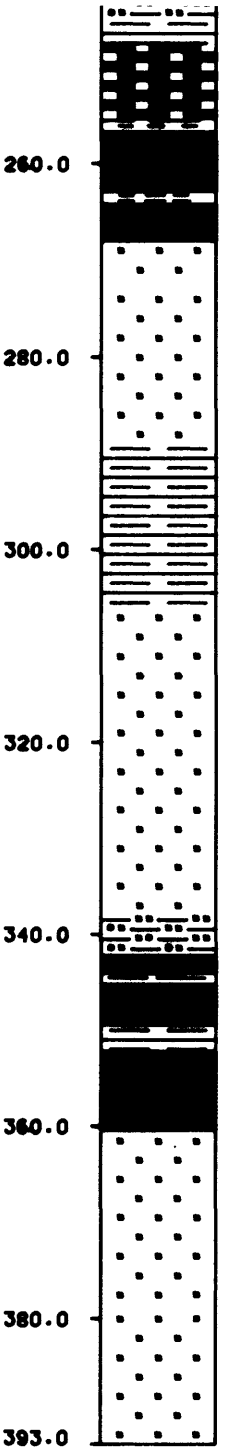
Hole No. **USGS-16** continued





Hole No. **USGS-16** continued





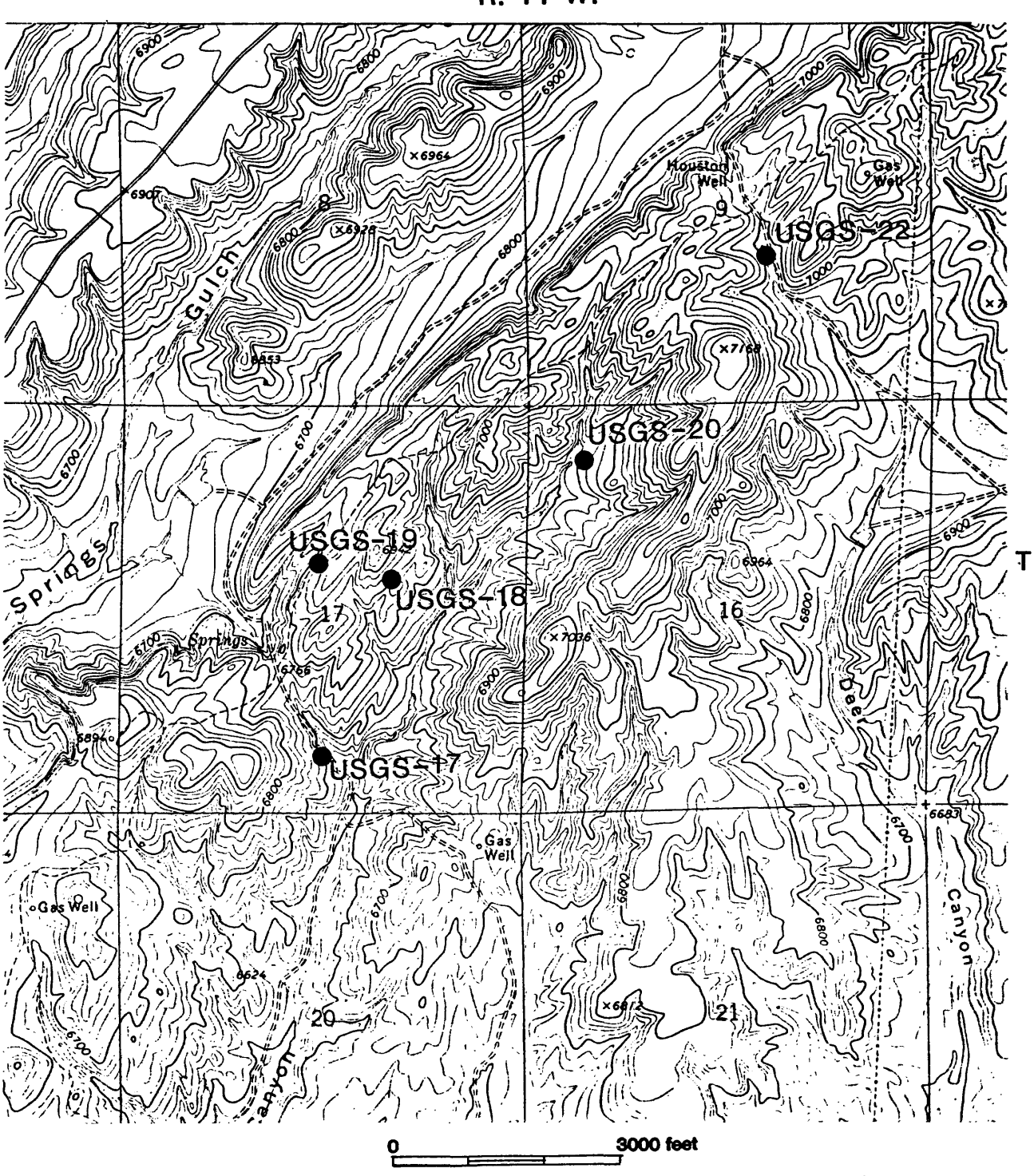


Figure 7.--Map showing locations of holes USGS-17 through USGS-20 and USGS-22. Base from Pinkerton Mesa 7 1/2-minute quadrangle (1968).

Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 3

Hole USGS-17 Elevation 6,700 feet Total depth 529 feet

Location 1251992 E., 167616 N. Sec. 17, T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size 5 5/8 inches

Date started 9/29/88 Date completed 10/2/88 Geologist L. Roberts

Remarks: Encountered artesian water in both holes at about 130 ft. Water flowed from holes at approximate rate of 10 gal/min. Encountered methane gas in both holes.

Depth interval (feet) Thickness	From	To	Lithologic Description
3	0	3	Claystone, light-brown to gray, oxidized
5	3	8	Siltstone, carbonaceous, medium-gray to brown
3	8	11	Siltstone, medium-gray; interbedded with very fine grained sandstone; coal lenses; oxidized
1	11	12	Coal, oxidized
3	12	15	Siltstone, light-gray; carbonaceous stringers
6	15	21	Sandstone, very fine grained
8	21	29	Claystone, medium- to light-gray; interbedded with siltstone; carbonaceous lenses
5	29	34	Sandstone, very fine grained, medium-gray
4.5	34	38.5	Siltstone, medium-gray
1	38.5	39.5	Coal, bony, oxidized
7.5	39.5	47	Siltstone, medium-gray; interbedded with very fine grained sandstone
1	47	48	Coal, bony
4	48	52	Claystone, medium-gray
1	52	53	Coal
1	53	54	Claystone, medium-gray
1	54	55	Coal
4	55	59	Claystone, medium-gray
1	59	60	Coal
1.5	60	61.5	Claystone, medium-gray
0.5	61.5	62	Coal
7	62	69	Siltstone, medium-gray
4	69	73	Claystone, coaly, carbonaceous, dark-brown to black
6	73	79	Siltstone, medium-gray
2	79	81	Claystone, medium-gray
5	81	86	Sandstone, very fine grained, medium-gray; interbedded with coaly siltstone lenses
5	86	91	Sandstone, fine-grained, medium-gray
6	91	97	Sandstone, very fine grained, medium-gray
13	97	110	Claystone, medium-gray; interbedded with siltstone; carbonaceous lenses
2	110	112	Sandstone, very fine grained, medium-gray
2	112	114	Siltstone
1	114	115	Coal

Depth interval (feet) Thickness	From	To	Lithologic Description
12	115	127	Siltstone, carbonaceous, medium- to dark-gray; interbedded with claystone and bony coal
1.5	127	128.5	Coal
1	128.5	129.5	Claystone, carbonaceous, black
1	129.5	130.5	Coal
16.5	130.5	147	Siltstone, coaly, carbonaceous, dark-gray; interbedded with carbonaceous claystone
5	147	152	Sandstone, very fine grained; interbedded with siltstone
14	152	166	Sandstone, fine-grained, light-gray; interbedded with very fine grained sandstone and siltstone
4.5	166	170.5	Siltstone, coaly, carbonaceous, dark-brown
1	170.5	171.5	Coal
2.5	171.5	174	Siltstone
9	174	183	Sandstone, fine-grained, light-gray; grades downward to very fine grained sandstone
5	183	188	Siltstone, medium-gray
3	188	191	Claystone, light-gray; bentonite?
4	191	195	Siltstone, medium-gray
5	195	200	Coal
3	200	203	Siltstone, medium-gray, laminated
5	203	208	Sandstone, very fine grained, light-gray, laminated
18	208	226	Siltstone, medium-gray; interbedded with very fine grained sandstone
Start generalized core description (detailed description follows geophysical logs)			
7	226	233	Sandstone and carbonaceous siltstone
8.5	233	241.5	Coal; includes partings
4.5	241.5	246	Siltstone and claystone, carbonaceous
2	246	248	Coal
11.5	248	259.5	Claystone; interbedded with carbonaceous siltstone and coal
11	259.5	270.5	Sandstone, very fine grained; siltstone
End core description			
32.50	270.5	303	Sandstone, fine-grained, light-gray; interbedded with very fine grained sandstone and siltstone
1	303	304	Claystone
18	304	322	Sandstone, fine-grained, light-gray
8	322	330	Sandstone, very fine grained, light-gray
6	330	336	Sandstone, fine-grained, light-gray
4	336	340	Sandstone, very fine grained

Depth interval (feet) Thickness	From	To	Lithologic Description
Start core description			
2.5	340	342.5	Siltstone, carbonaceous; 1-ft-thick coal in middle
5	342.5	347.5	Coal; includes partings
1.5	347.5	349	Claystone, carbonaceous
3	349	352	Coal
2.6	352	354.6	Claystone
End core description			
20.4	354.6	375	Sandstone, very fine grained, light- to medium-gray; interbedded with very fine grained sandstone and siltstone; fines upward
11	375	386	Sandstone, fine-grained; interbedded with very fine grained sandstone and siltstone
3	386	389	Siltstone, medium-gray
84	389	473	Sandstone, fine-grained, light-gray; scattered siltstone lenses
Start core description			
9	473	482	Sandstone, fine-grained
1.5	482	483.5	Coal
3.5	483.5	487	Claystone, carbonaceous
1	487	488	Coal
1	488	489	Claystone
7	489	496	Coal; includes partings
5.6	496	501.6	Sandstone and siltstone
End core description			
3.4	501.6	505	Sandstone, fine-grained, light-gray
2	505	507	Claystone, medium-gray
9	507	516	Sandstone, very fine grained, light-gray; interbedded with fine-grained sandstone and siltstone lenses
13	516	529	Sandstone, fine-grained, light-gray; interbedded with very fine grained sandstone

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-17** County **La Plata** State **Colorado**

Location Sec. **17** T. **33** N. R. **11** W.

Elevation **6,700** Drilled depth **530** Logged depth **529**

Drilling medium **air** Date logged **10/2/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale **1 in. = 20 ft.**

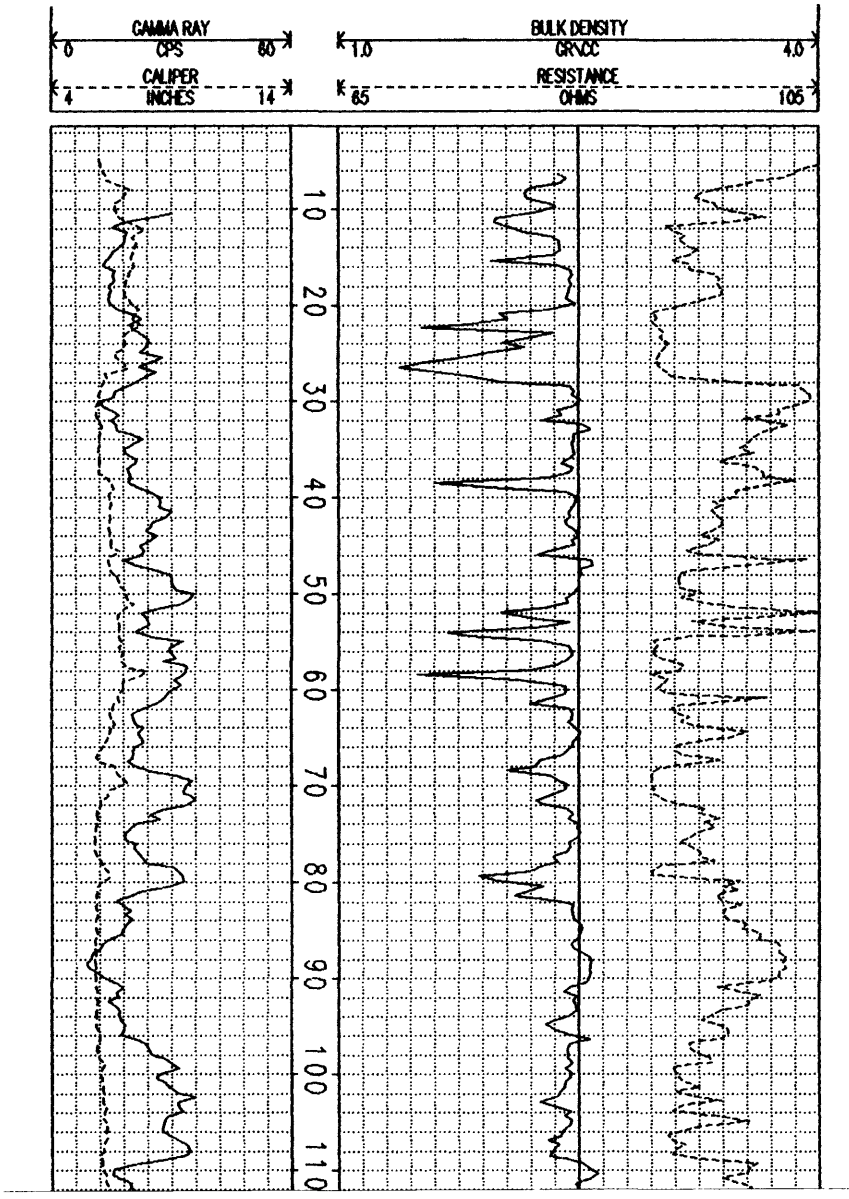
High resolution density (HRD)

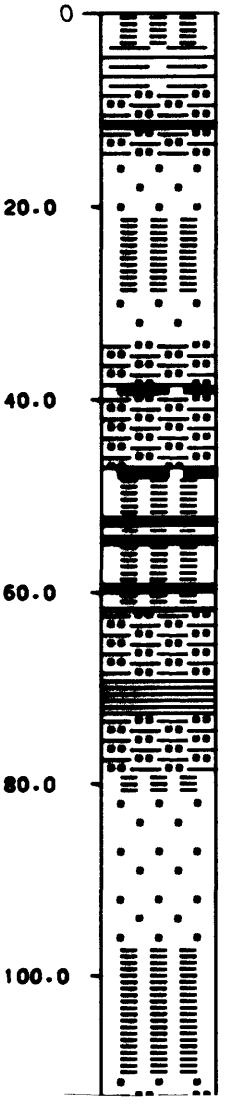
Caliper (CAL)

Resistance (RES)

Remarks: **Cored intervals, 226 to 270.5 ft, 340 to 354.6 ft, and 473 to 501.6 ft**

GEOPHYSICAL LOGS STRIP LOG





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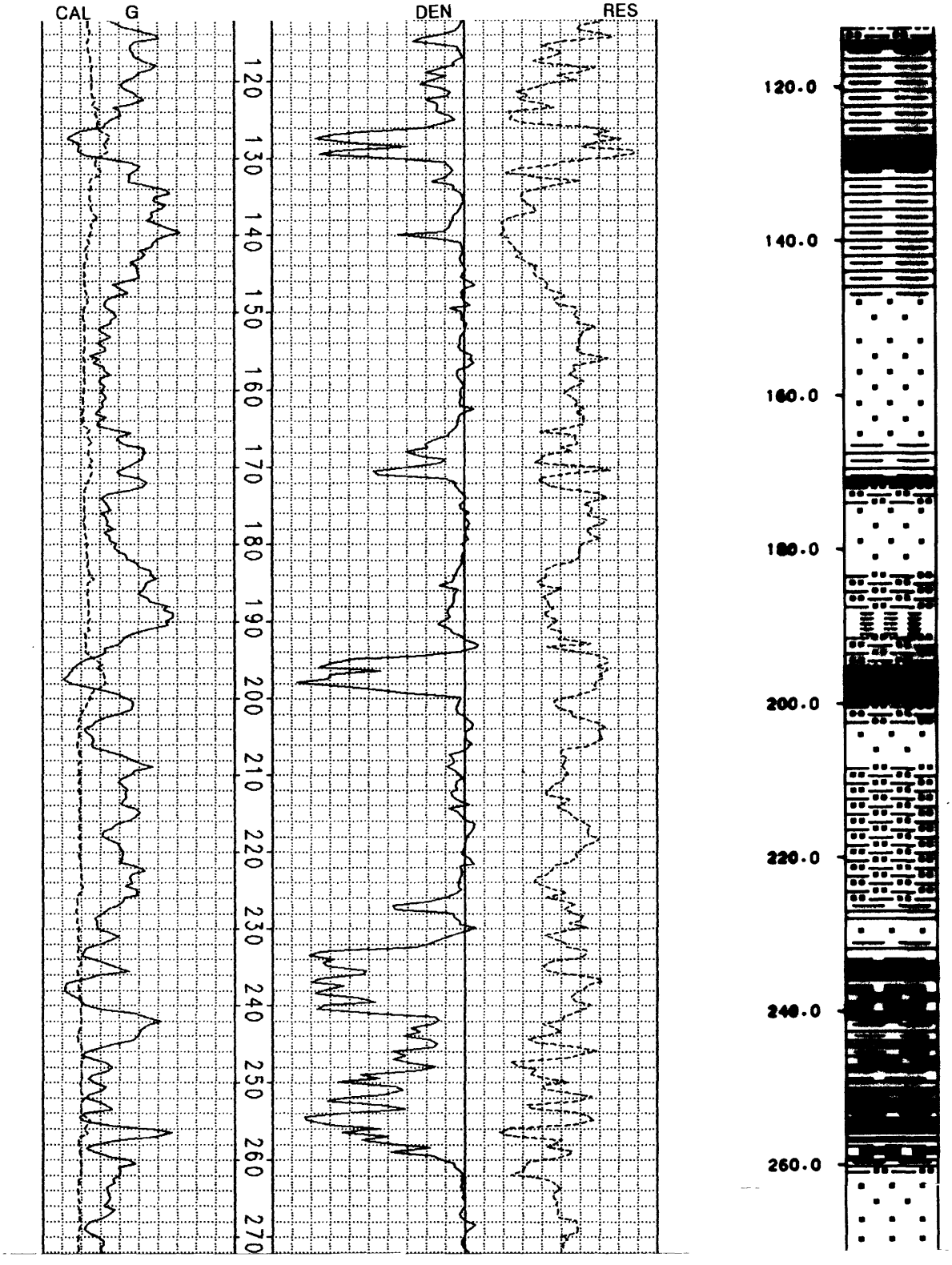

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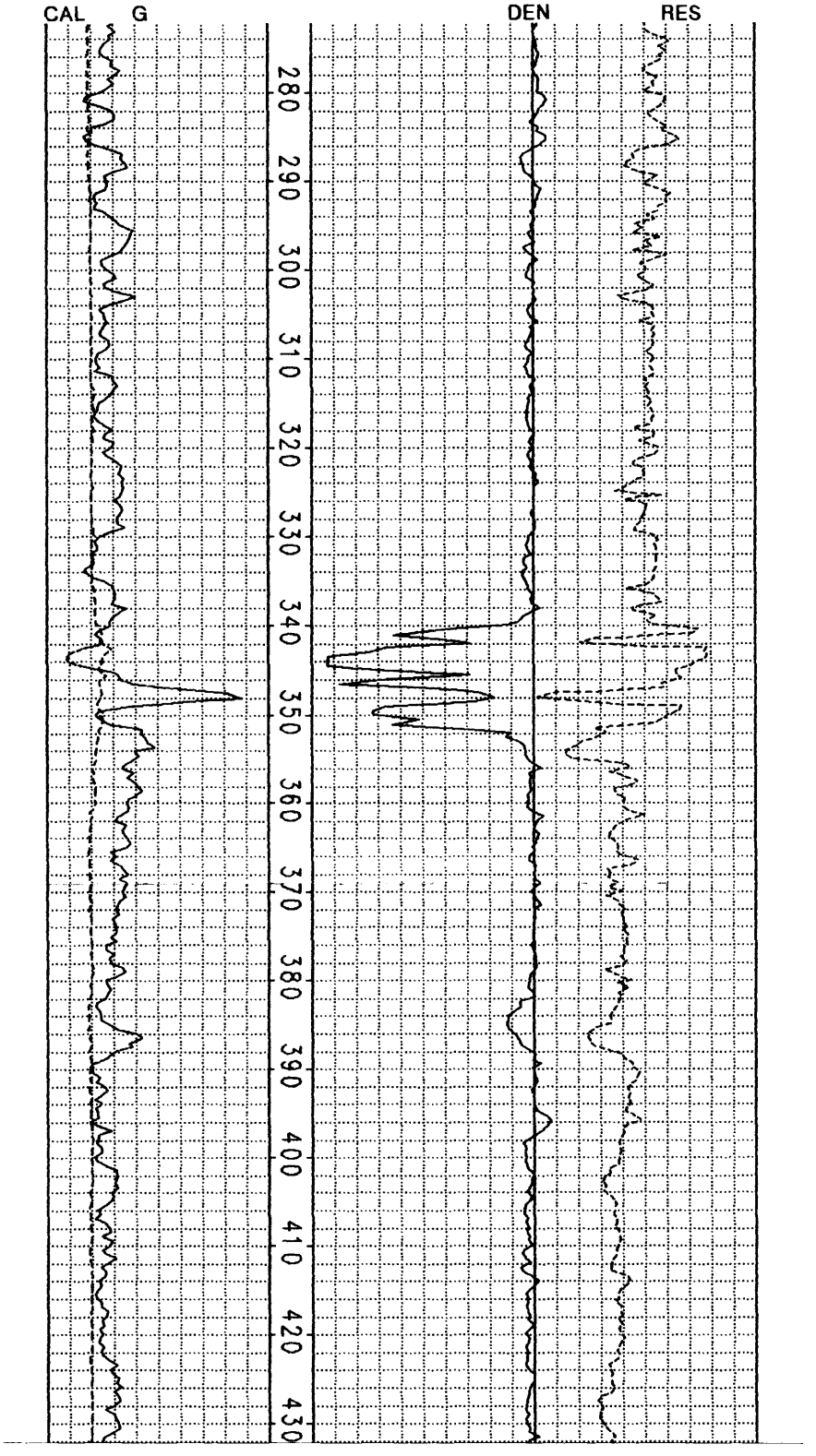

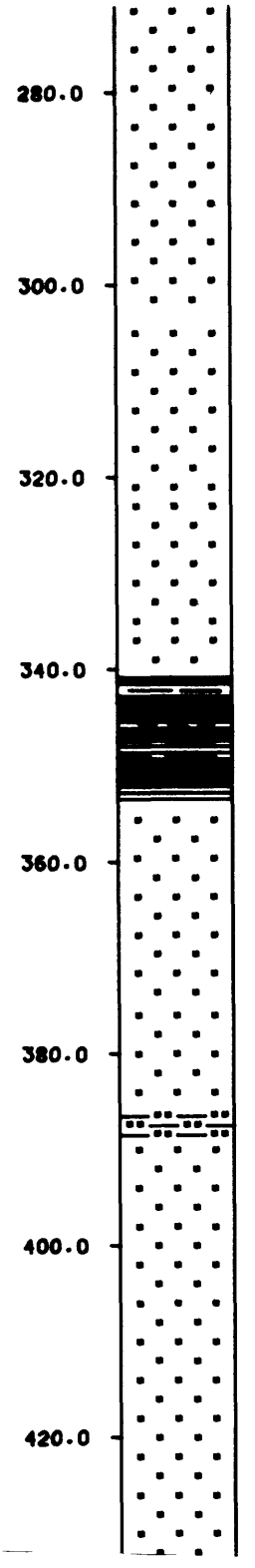

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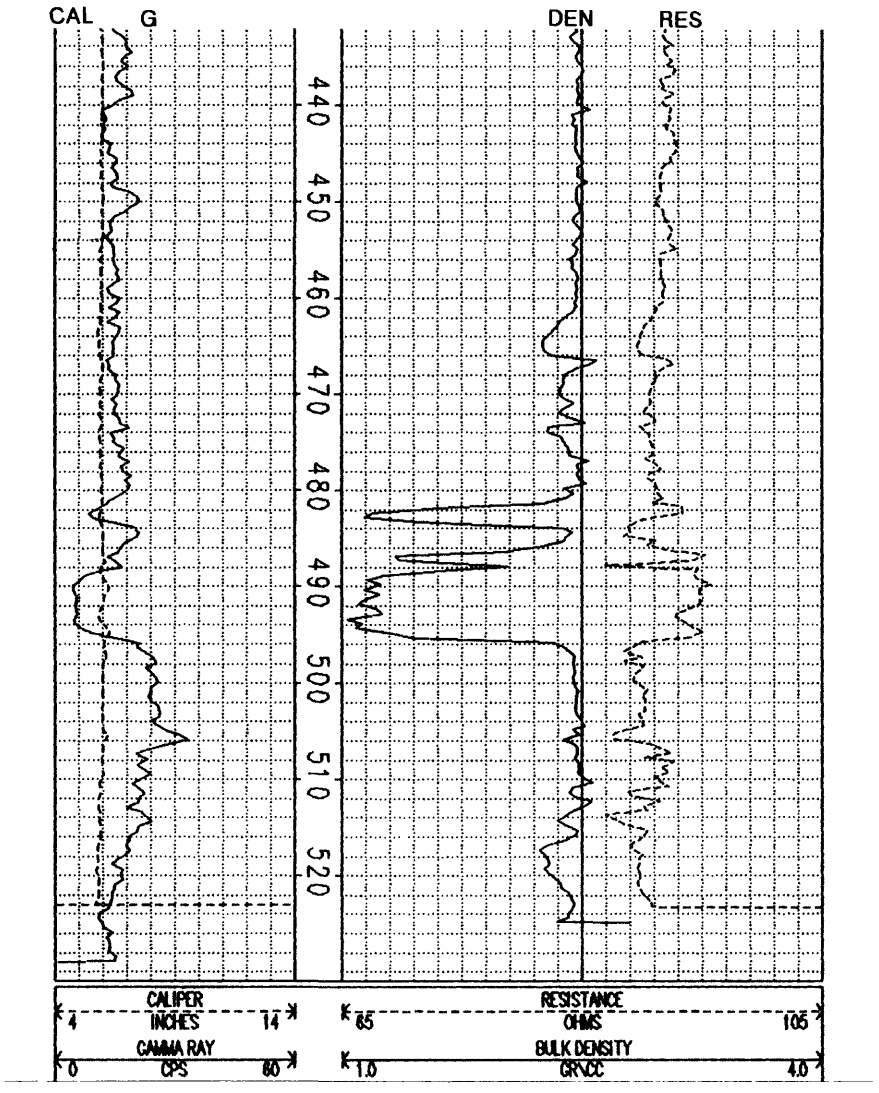
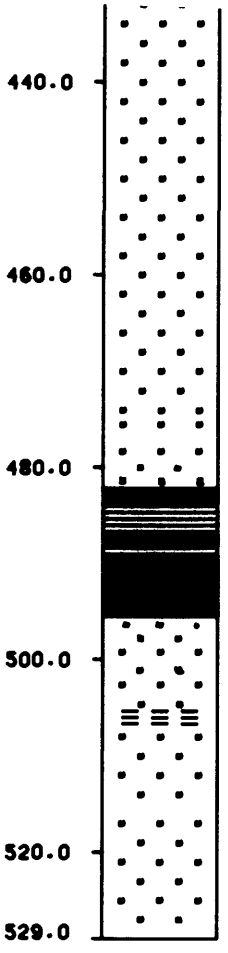




Depth interval (feet) Thickness	From	To	Detailed Core Description
Start core description			
1.40	226.00	227.40	Siltstone, carbonaceous, dark-brown
0.40	227.40	227.80	Siltstone, coaly, carbonaceous; coal bands
0.30	227.80	228.10	Coal, bright; good cleats
0.45	228.10	228.55	Siltstone, carbonaceous, dark-brown; coaly in top 0.1 ft
2.25	228.55	230.80	Sandstone, very fine grained, light-gray, laminated; carbonaceous for 0.1 ft at 230 ft
1.50	230.80	232.30	Siltstone, carbonaceous, medium-gray
0.30	232.30	232.60	Siltstone, carbonaceous, coaly, dark-brown
0.70	232.60	233.30	Claystone, carbonaceous, dark-brown
0.10	233.30	233.40	Coal, bony
1.20	233.40	234.60	Coal, bright; scattered resin
0.10	234.60	234.70	Claystone, light-brown; ash
1.20	234.70	235.90	Coal, bright; cleats; thin ash at 235.0 and 235.4 ft
0.90	235.90	236.80	Siltstone, coaly, carbonaceous, very dark brown; coal stringers
2.90	236.80	239.70	Coal, bony; scattered resin; thin ash at 237.1 ft
0.30	239.70	240.00	Siltstone, coaly, carbonaceous, dark-brown; thin ash at top
1.00	240.00	241.00	Coal, bright; cleats
0.40	241.00	241.40	Coal, bony
1.70	241.40	243.10	Siltstone, coaly, carbonaceous, dark-brown; 0.1 ft coal at 241.8 ft
0.10	243.10	243.20	Claystone, carbonaceous, brown
0.10	243.20	243.30	Claystone, light-brown; ash
0.80	243.30	244.10	Siltstone, coaly; interbedded with bony coal
0.80	244.10	244.90	Siltstone, coaly, dark-brown; coal stringers; scattered resin; high-angle fracture
1.00	244.90	245.90	Siltstone, carbonaceous, medium-gray; very fine grained sandstone clasts at 245.2 ft
1.30	245.90	247.20	Coal, bony; scattered resin
0.10	247.20	247.30	Claystone, light-gray
0.05	247.30	247.35	Coal, bony
0.05	247.35	247.40	Claystone, brown
0.30	247.40	247.70	Coal, bony
0.05	247.70	247.75	Siltstone, carbonaceous, dark-brown
0.05	247.75	247.80	Claystone; ash
0.10	247.80	247.90	Coal, bony
0.95	247.90	248.85	Claystone, light-gray; ash; 45° fracture
0.10	248.85	248.95	Coal, bony
0.05	248.95	249.00	Claystone, light-gray; ash
0.20	249.00	249.20	Coal, bright; cleats
0.70	249.20	249.90	Claystone, carbonaceous, dark-brown
0.80	249.90	250.70	Coal, bright; cleats
1.10	250.70	251.80	Siltstone, coaly, carbonaceous, dark-brown; scattered resin; gas bubbling from core

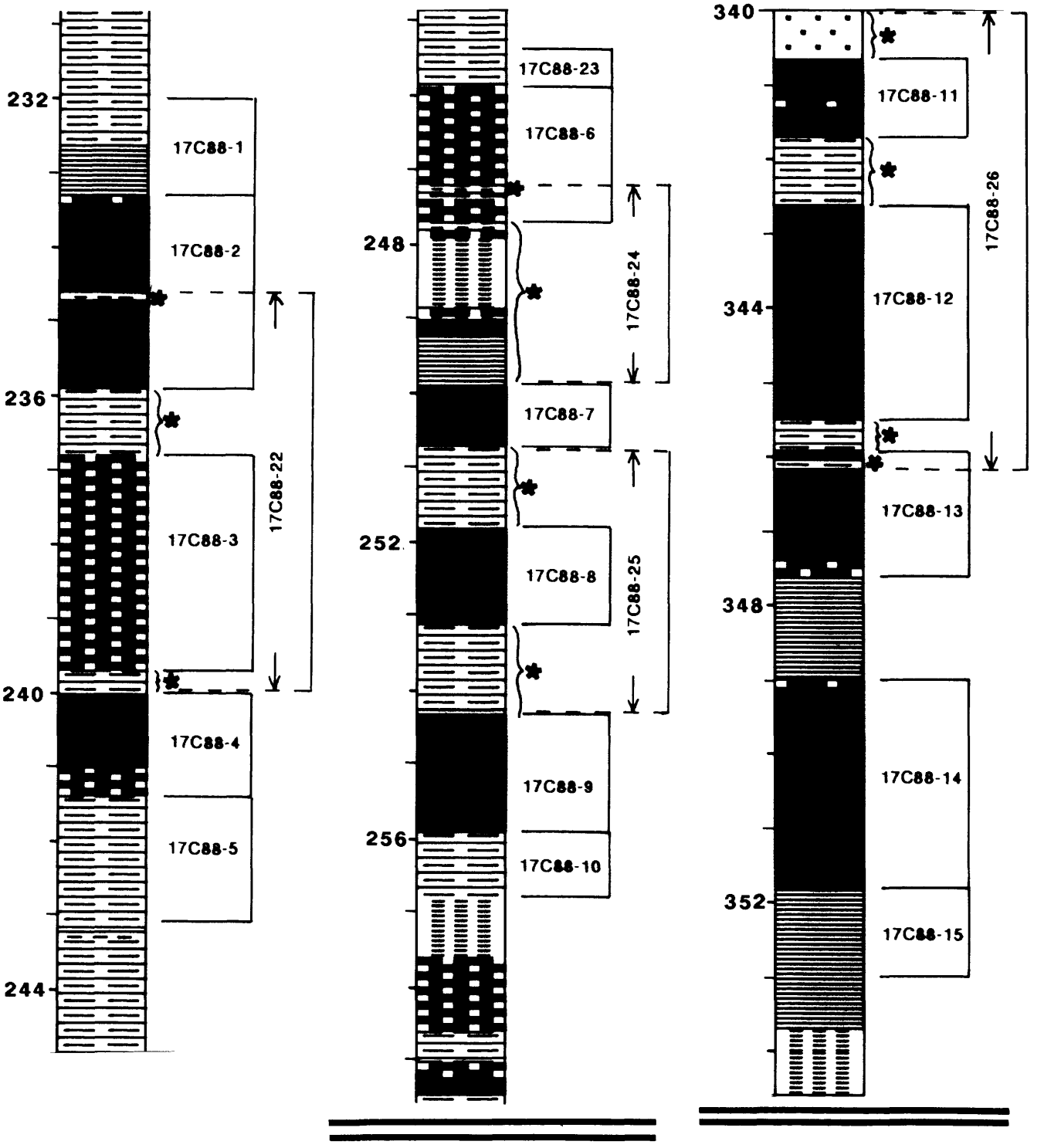
Depth interval (feet) Thickness	From	To	Detailed Core Description
1.30	251.80	253.10	Coal, bright; scattered resin; cleats; thin ash at 252.3 ft
1.20	253.10	254.30	Siltstone, carbonaceous, coaly; scattered resin; coal bands; gas bubbling from core
1.60	254.30	255.90	Coal, bright; cleats; scattered resin; fractured
0.90	255.90	256.80	Siltstone, carbonaceous, coaly, black; coal stringers
0.80	256.80	257.60	Claystone, light-gray; bentonite?, 45° fracture at base
1.00	257.60	258.60	Coal, bony
0.40	258.60	259.00	Siltstone, carbonaceous, dark-brown
0.20	259.00	259.20	Coal, bony; scattered resin
0.25	259.20	259.45	Coal, bright; cleats
1.05	259.45	260.50	Siltstone, carbonaceous, dark-brown; coal stringers; scattered resin; gas bubbling from core
1.20	260.50	261.70	Siltstone, medium-gray; plant fragments
4.30	261.70	266.00	Sandstone, very fine grained, medium-gray
2.50	266.00	268.50	Sandstone, very fine grained, medium-gray to brown; coal stringers at 268.7 ft; scattered carbonaceous fragments
2.00	268.50	270.50	Sandstone, very fine grained, light- to medium-gray, rippled, burrowed
End core description			
Start core description			
0.55	340.00	340.55	Sandstone, fine-grained, light-gray; large mud clasts; pyrite
0.10	340.55	340.65	Siltstone, carbonaceous, coaly, black
0.55	340.65	341.20	Coal, bright; cleats
0.10	341.20	341.30	Coal, bony
0.40	341.30	341.70	Coal, bright; cleats; high-angle fracture
0.90	341.70	342.60	Siltstone, carbonaceous, dark-brown; scattered resin; small clay clasts at 342.2 ft
2.90	342.60	345.50	Coal, bright; pyrite at 344 ft; high-angle fracture; cleats
0.20	345.50	345.70	Siltstone, coaly, dark-brown
0.10	345.70	345.80	Sandstone, fine-grained, light-gray, rippled
0.10	345.80	345.90	Siltstone, carbonaceous, coaly, dark-brown; scattered resin
0.15	345.90	346.05	Coal, bright; cleats; thin pyrite bands at 345.95 ft
0.05	346.05	346.10	Claystone, carbonaceous, brown; ash
0.05	346.10	346.15	Siltstone, coaly, carbonaceous, black
1.25	346.15	347.40	Coal, bright; scattered resin; ash at 346.35 ft; pyrite at 346.2 ft
0.20	347.40	347.60	Coal, bony
1.40	347.60	349.00	Claystone, carbonaceous, dark-brown; scattered resin; thin coal bands
0.10	349.00	349.10	Coal, bony

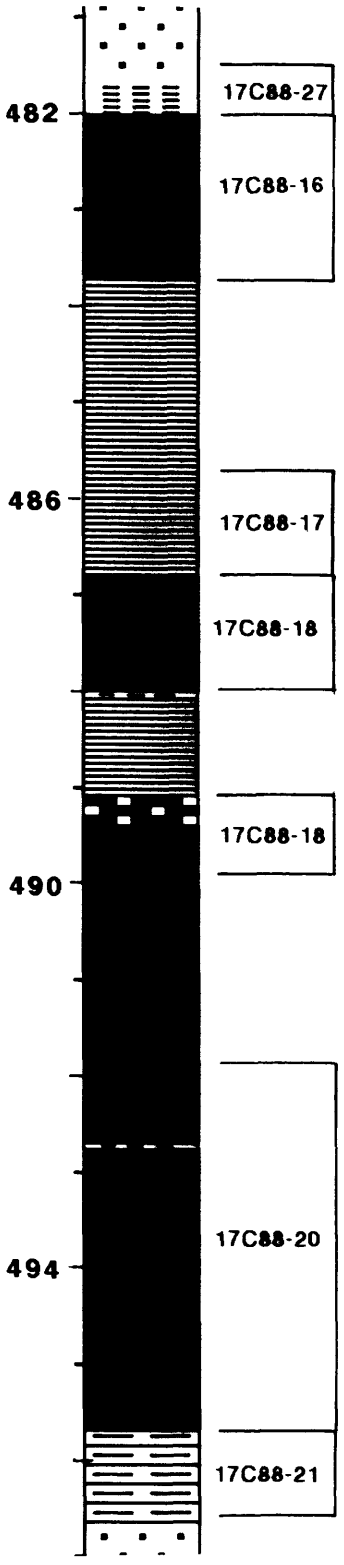
Depth interval (feet) Thickness	From	To	Detailed Core Description
2.70	349.10	351.80	Coal, bright; ash at 349.8, 350.8, 350.9, and 351.55 ft; resin
1.90	351.80	353.70	Claystone, carbonaceous, coaly, dark-brown; scattered pyrite; silty toward base
0.30	353.70	354.00	Claystone, slightly carbonaceous, burrowed, rooted
0.60	354.00	354.60	Claystone, silty, light-gray
End core description			
Start core description			
1.50	473.00	474.50	Sandstone, fine-grained, light-gray, rippled; large carbonaceous siltstone clasts
2.50	474.50	477.00	Sandstone, fine-grained, scattered carbonaceous laminations
0.30	477.00	477.30	Sandstone, very fine grained, brown-gray, rippled; coaly lens at 477.2 ft
1.30	477.30	478.60	Sandstone, fine-grained, rippled; abundant medium-gray siltstone clasts
0.80	478.60	479.40	Siltstone, brown-gray, rippled; lenses of very fine grained sandstone
0.30	479.40	479.70	Sandstone, fine-grained, light-gray; siltstone clasts and coal stringers at base
0.20	479.70	479.90	Claystone, medium-gray; undulating basal contact
0.70	479.90	480.60	Sandstone, fine-grained, light-gray; small scattered siltstone clasts at base
0.20	480.60	480.80	Sandstone, fine-grained; interlaminated with claystone; shell hash
0.90	480.80	481.70	Sandstone, fine-grained; rippled top; claystone clasts; coarser grained downward
0.30	481.70	482.00	Claystone, dark-gray; laminae of very fine grained sandstone
1.70	482.00	483.70	Coal, bright; high-angle fracture at top; scattered resin
3.10	483.70	486.80	Claystone, carbonaceous, dark-brown; scattered resin; gas bubbling from core
1.20	486.80	488.00	Coal, bright; pyrite nodule at top
0.05	488.00	488.05	Claystone; ash
1.05	488.05	489.10	Claystone, carbonaceous, black
0.30	489.10	489.40	Coal, bony; scattered resin
3.30	489.40	492.70	Coal, bright; scattered resin; gas bubbling from core; interval sampled for desorption of methane
0.05	492.70	492.75	Claystone; ash
2.95	492.75	495.70	Coal, bright; high-angle fracture
1.00	495.70	496.70	Siltstone, carbonaceous, dark-brown; coal bands; grades down to very fine grained sandstone
1.00	496.70	497.70	Sandstone, very fine grained, medium-gray, rooted
0.50	497.70	498.20	Siltstone, sandy, medium-gray, rooted
2.80	498.20	501.00	Sandstone, very fine grained, light- to medium-gray, rippled, burrowed
0.60	501.00	501.60	Sandstone, fine-grained, light-gray, burrowed
End core description			

U.S. Geological Survey

Hole No. **USGS-17**

Detailed strip log showing cored interval, location of sampled intervals, and sample numbers
Vertical scale: 1 inch = 2 feet




482
486
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494
17C88-27
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17C88-18
17C88-18
17C88-20
17C88-21

Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 2

Hole USGS-18 Elevation 6,850 feet Total depth 375 feet

Location 1252903 E., 169995 N. Sec. 17, T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 10/4/88 Date completed 10/5/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Claystone, carbonaceous, dark-brown, coaly
8	5	13	Claystone, slightly carbonaceous, medium-gray; plant fragments; rooted
7.5	13	20.5	Sandstone, very fine grained, light-gray, clean, well-sorted; interbedded with siltstone
2	20.5	22.5	Siltstone, medium-gray; scattered plant fragments
5.5	22.5	28	Sandstone, very fine grained, light-gray
4	28	32	Siltstone, medium-gray; scattered plant fragments
2.5	32	34.5	Coal, dirty; includes partings
1.5	34.5	36	Claystone, carbonaceous, dark-brown
1	36	37	Coal, dirty
3	37	40	Claystone, slightly carbonaceous, medium-gray
13.5	40	53.5	Sandstone, very fine grained, light-gray, clean, well-sorted; scattered carbonaceous fragments
4.5	53.5	58	Claystone, carbonaceous, dark-brown; coaly stringers
10	58	68	Sandstone, very fine grained, slightly carbonaceous, medium-gray; interbedded with siltstone
1	68	69	Siltstone, carbonaceous, dark-brown
4	69	73	Coal; includes partings
5.5	73	78.5	Claystone, carbonaceous, dark-brown; coaly at top
3	78.5	81.5	Siltstone, medium-gray; scattered carbonaceous fragments
1.5	81.5	83	Claystone, carbonaceous, dark-brown
3.5	83	86.5	Siltstone, medium-gray
6	86.5	92.5	Siltstone, slightly carbonaceous, gray-brown
5.5	92.5	98	Siltstone, grades upward to very fine grained sandstone
5.5	98	103.5	Claystone, carbonaceous, dark-gray
1.5	103.5	105	Coal
8	105	113	Siltstone, carbonaceous, dark-gray
1	113	114	Coal
1.5	114	115.5	Siltstone, carbonaceous
6.5	115.5	122	Coal; includes partings
6.5	122	128.5	Claystone, carbonaceous, dark-brown
1	128.5	129.5	Coal

Depth interval (feet) Thickness	From	To	Lithologic Description
0.5	129.5	130	Claystone, light-gray; ash; bentonite
3	130	133	Claystone, carbonaceous, coaly, dark-brown
6.5	133	139.5	Coal; includes partings
1	139.5	140.5	Claystone, ash, light-gray; bentonite
1.5	140.5	142	Coal
4.5	142	146.5	Claystone, carbonaceous, dark-gray; silty at top
10.5	146.5	157	Siltstone, carbonaceous, dark-gray; plant fragments
3.5	157	160.5	Sandstone, very fine grained
3	160.5	163.5	Siltstone, carbonaceous, dark-gray; plant fragments; grades downward into sandstone
10.5	163.5	174	Sandstone, fine-grained, medium-gray, well-sorted, well-cemented
4	174	178	Siltstone, medium-gray
5	178	183	Sandstone, very fine grained; siltstone lenses; carbonaceous laminae
3	183	186	Claystone
40.5	186	226.5	Siltstone, medium-gray
1	226.5	227.5	Coal
0.5	227.5	228	Claystone, light-gray; ash; bentonite
3	228	231	Coal; includes partings
1	231	232	Claystone
1.5	232	233.5	Coal
1.5	233.5	235	Claystone, light-gray; ash; bentonite
3.5	235	238.5	Coal; includes partings
8.5	238.5	247	Claystone, medium-gray; interbedded with siltstone
8	247	255	Sandstone, very fine grained, light-gray, clean, well-sorted; thin carbonaceous laminae
26	255	281	Sandstone, fine-grained, light-gray, clean, well-sorted; coaly lenses at top
8	281	289	Siltstone, carbonaceous, dark-gray
33	289	322	Siltstone, light- to medium-gray; interbedded with very fine grained sandstone; plant fragments
1.5	322	323.5	Coal
0.5	323.5	324	Claystone; ash; bentonite
7	324	331	Coal; includes partings
2	331	333	Siltstone, carbonaceous
2.5	333	335.5	Coal; includes partings
3	335.5	338.5	Siltstone, carbonaceous, black, coaly
4.5	338.5	343	Coal; includes partings
2.5	343	345.5	Siltstone, carbonaceous, dark-gray
1.5	345.5	347	Coal
7.5	347	354.5	Siltstone, dark-gray
7.5	354.5	362	Sandstone, very fine grained, light-gray, clean, well-sorted
13	362	375	Sandstone, fine-grained, light-gray, clean, well-sorted

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-18** County La Plata State Colorado

Location Sec. **17** T. **33** N. R. **11** W.

Elevation **6,850** Drilled depth **375** Logged depth **374**

Drilling medium **air** Date logged **10/5/88**

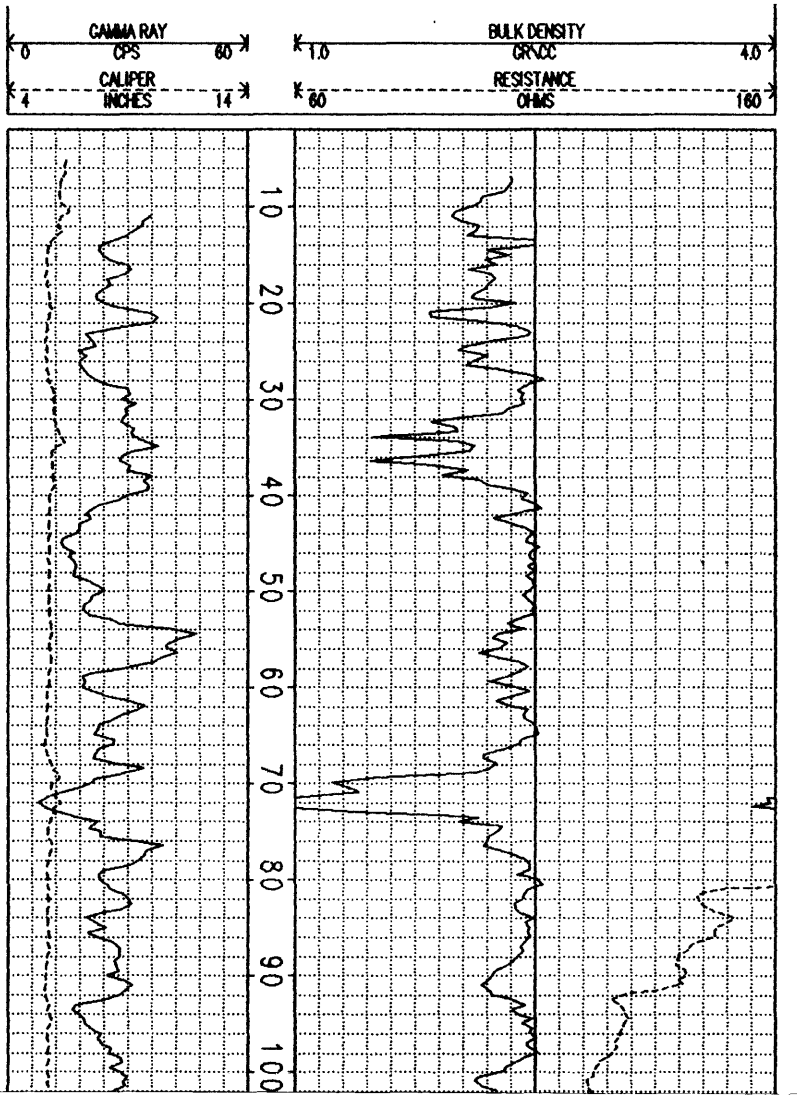
Geophysical logs:

Gamma ray (G)
Density (DEN)
High resolution density (HRD)
Caliper (CAL)
Resistance (RES)

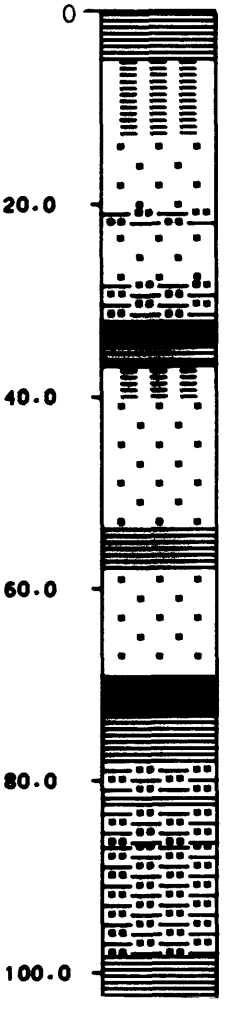
Logging speed **15** fpm
Vertical scale 1 in. = 20 ft.

Remarks:

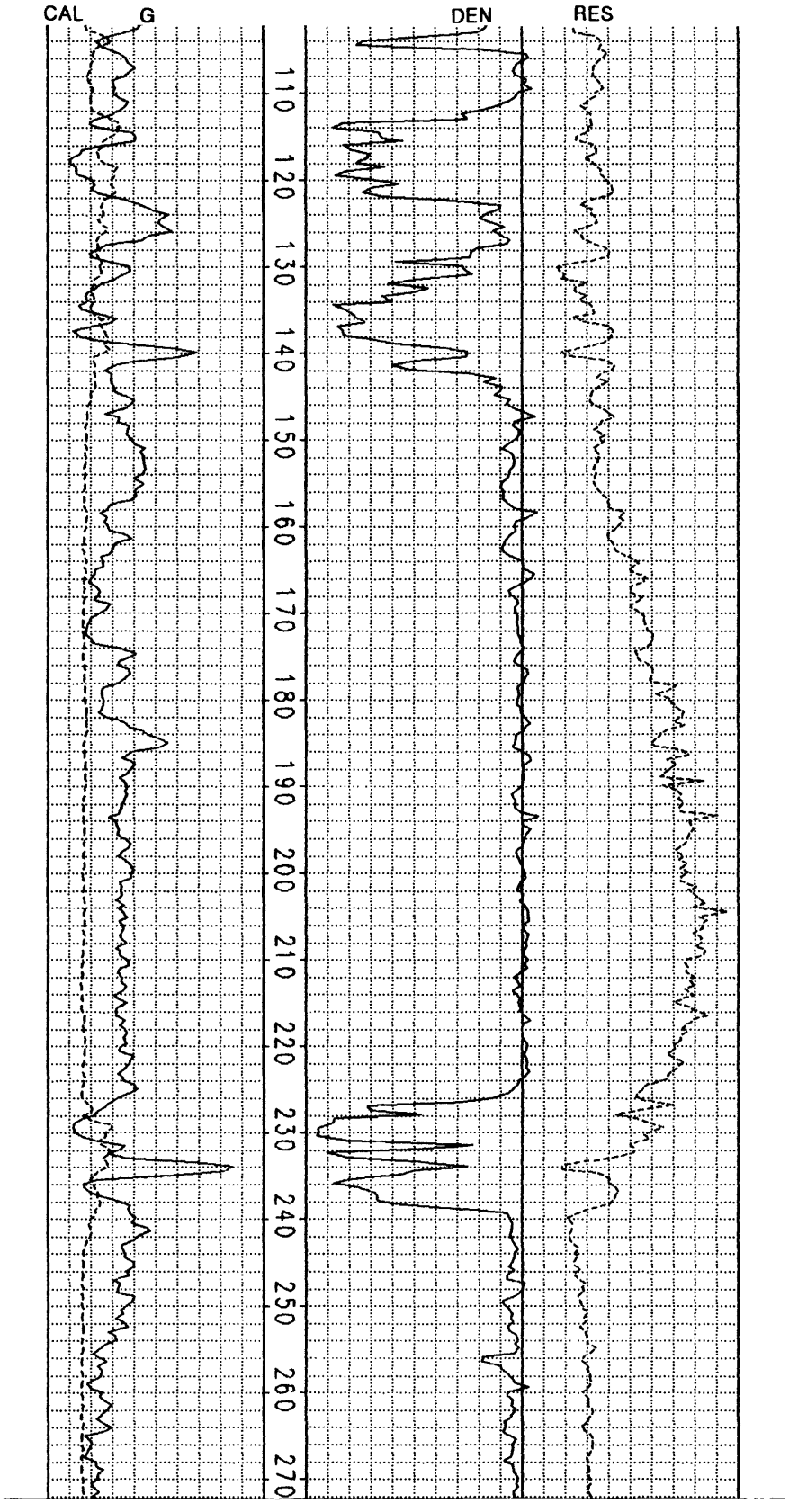
GEOPHYSICAL LOGS

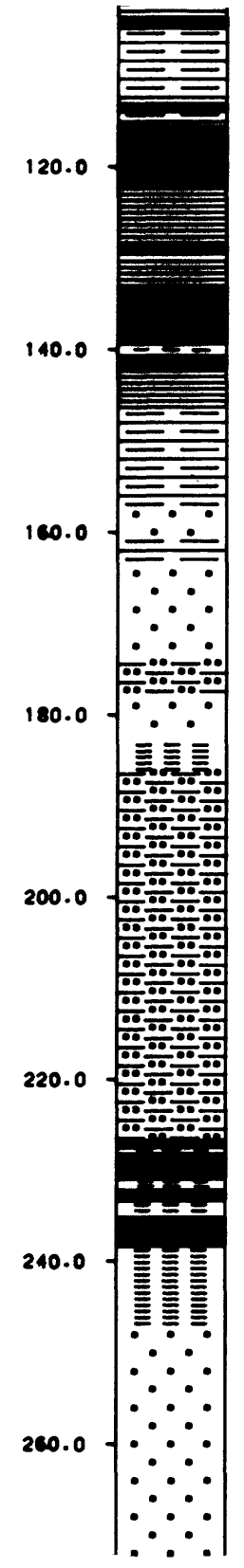


STRIP LOG

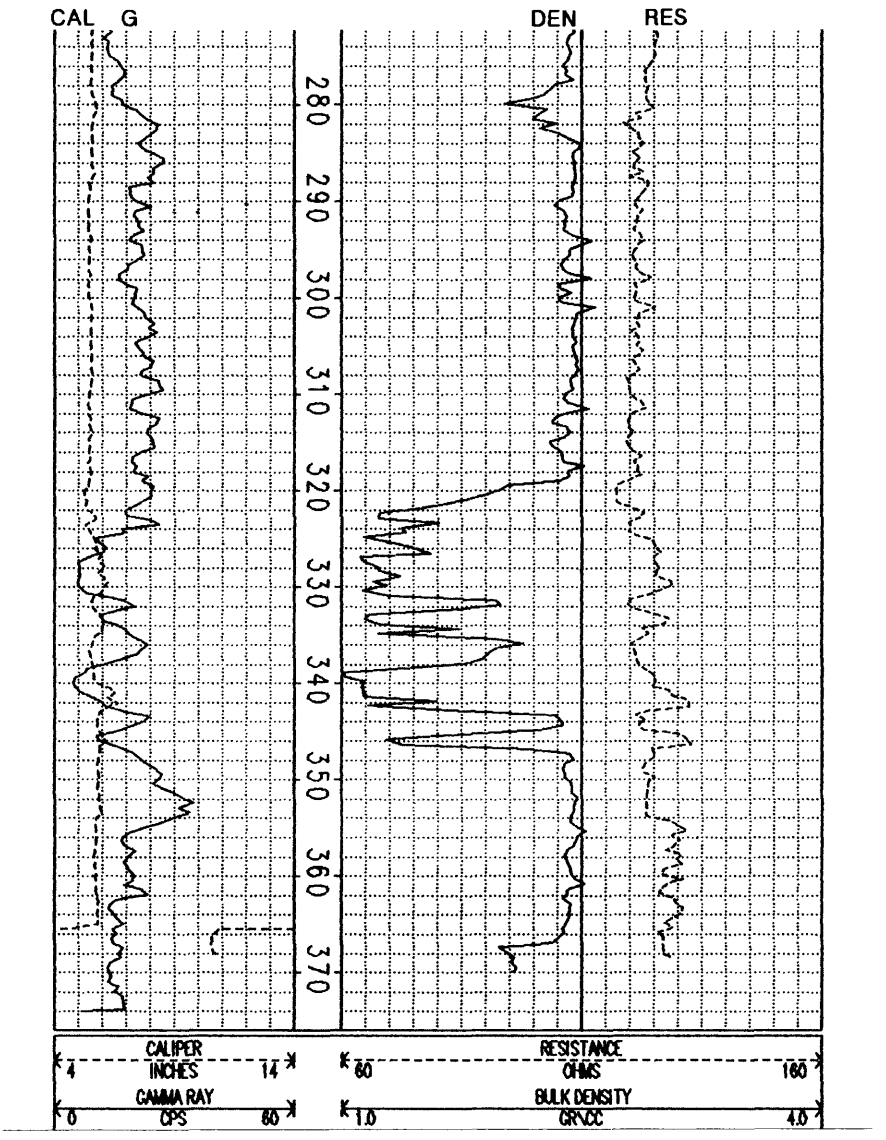


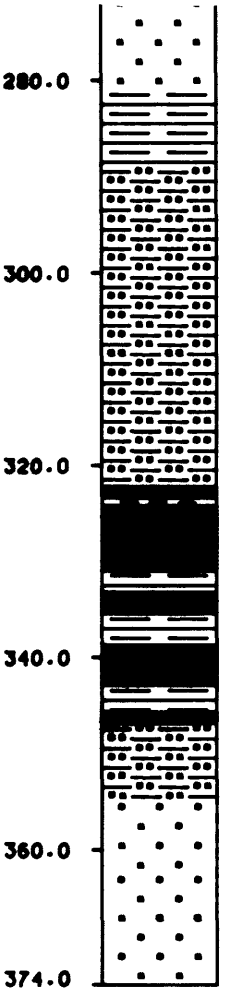
Hole No. **USGS-18** continued





Hole No. **USGS-18** continued





Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 1

Hole USGS-19 Elevation 6,820 feet Total depth 155 feet

Location 1252123 E., 170271 N. Sec. 17, T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 10/3/88 Date completed 10/3/88 Geologist L. Roberts

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Claystone, carbonaceous, dark-brown to gray; interbedded with siltstone; minor coal; and scattered, very fine grained sandstone
4	5	9	Sandstone, fine-grained, orange-gray, well-sorted, iron-stained
6	9	15	Sandstone, fine-grained, light-gray, clean, well-sorted
10	15	25	Claystone, medium-gray, scattered carbonaceous lenses
16	25	41	Sandstone, very fine grained, light-gray; thin carbonaceous siltstone lenses; ripple laminated
6	41	47	Siltstone
24	47	71	Sandstone, fine-grained, light-gray; thin carbonaceous siltstone lenses
3	71	74	Siltstone, carbonaceous, coaly, dark-brown
7	74	81	Coal; includes partings
2	81	83	Claystone, carbonaceous, dark-brown
2	83	85	Coal
0.5	85	85.5	Claystone; ash; bentonite
0.5	85.5	86	Coal
4	86	90	Siltstone, slightly sandy, medium-gray, hard
5	90	95	Coal; includes partings
3	95	98	Claystone, carbonaceous, dark- to medium-brown
1.5	98	99.5	Coal
9.5	99.5	109	Claystone, carbonaceous, dark-gray
6	109	115	Sandstone, medium-grained, light-gray, clean, well-sorted
10	115	125	Sandstone, fine-grained, light-gray; interbedded with dark-gray siltstone; siltstone clasts
5	125	130	Sandstone, fine-grained, ripple-laminated; carbonaceous along bedding; medium-brown siltstone lenses
5	130	135	Sandstone, fine-grained to medium-grained, light-gray, well-sorted
20	135	155	Sandstone, fine-grained to medium-grained, light-gray; siltstone clasts; interbedded siltstone lenses

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-19** County **La Plata** State **Colorado**

Location Sec. **17** T. **33** N. R. **11** W.

Elevation **6,820** Drilled depth **155** Logged depth **154**

Drilling medium **air** Date logged **10/3/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

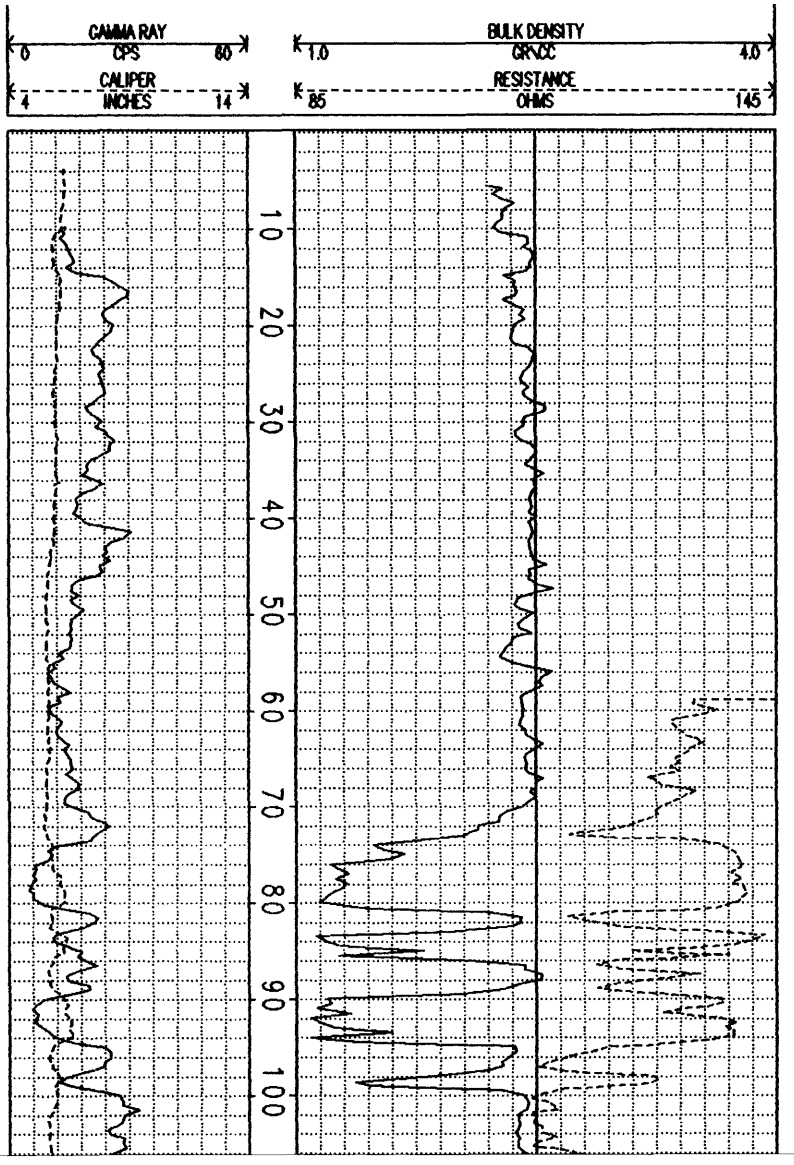
High resolution density (HRD)

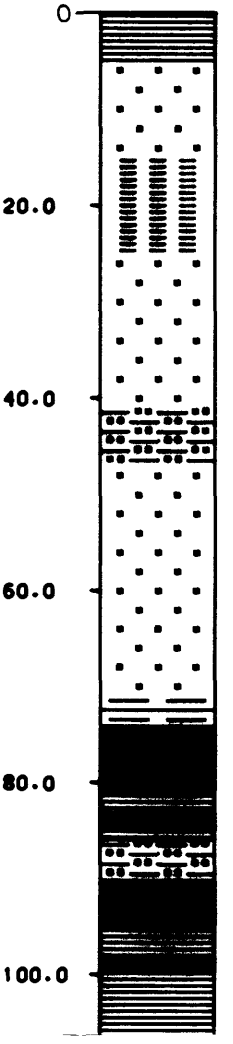
Caliper (CAL)

Resistance (RES)

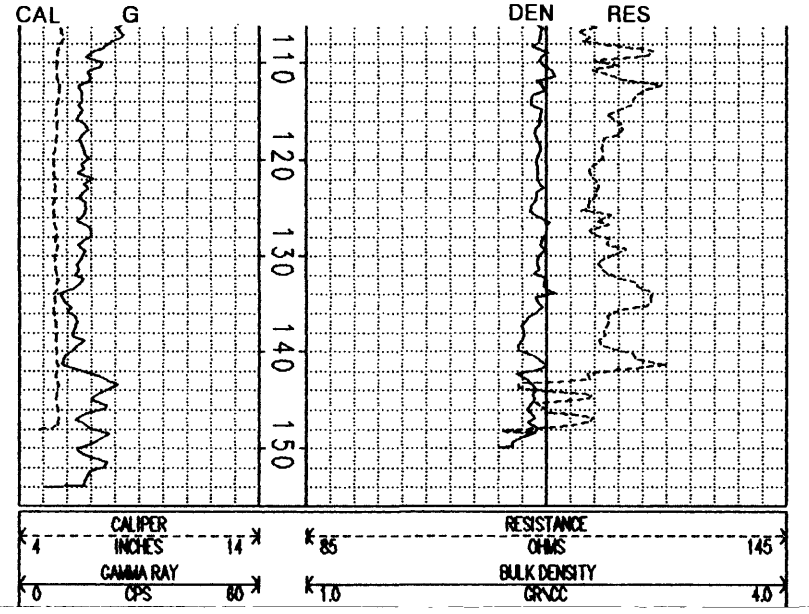
Remarks:

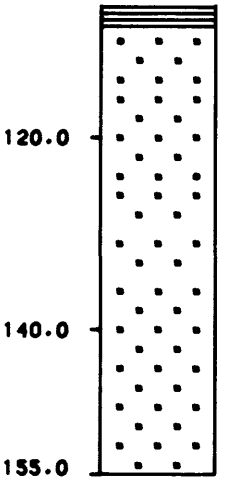
GEOPHYSICAL LOGS STRIP LOG





Hole No. **USGS-19** continued





Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 3

Hole USGS-20 Elevation 6,860 feet Total depth 555 feet

Location 1255391 E., 171347 N. Sec. 16, T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 9/20/88 Date completed 9/28/88 Geologist W. Betterton

Remarks: Encountered artesian water at about 230 ft; encountered methane above 230 ft.

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Sandstone, medium-grained, light-brown, oxidized
5	5	10	Sandstone, fine- to medium-grained, light-brown, oxidized
12	10	22	Claystone, carbonaceous, dark-brown to gray; plant fragments; coal fragments
7	22	29	Siltstone, medium-gray; clayey at top
5	29	34	Siltstone, medium-gray; coaly lense
21	34	55	Claystone, medium- to light-gray; interbedded with siltstone; plant fragments; coaly lenses
4	55	59	Siltstone, medium-gray
11	59	70	Sandstone, very fine grained, medium-gray; grades upward to siltstone
1.5	70	71.5	Claystone, carbonaceous, dark-brown to black; plant fragments; coaly
1	71.5	72.5	Coal
4.5	72.5	77	Siltstone, medium-gray; interbedded with very fine grained sandstone
6	77	83	Siltstone, medium- to dark-gray
2	83	85	Sandstone, very fine grained
4	85	89	Siltstone, medium-gray
2	89	91	Coal
3	91	94	Claystone, carbonaceous; plant fragments
3	94	97	Siltstone, carbonaceous, dark-gray
2	97	99	Sandstone, very fine grained
7	99	106	Siltstone, carbonaceous, medium- to dark-gray
16	106	122	Sandstone, very fine grained, medium- to light-gray
1	122	123	Siltstone, medium-gray
3	123	126	Sandstone, very fine grained, medium-gray; grades down to siltstone
9	126	135	Claystone, carbonaceous, dark-gray to black; coaly stringers; plant fragments; silty at top
10	135	145	Siltstone, medium-gray; coaly lenses
7	145	152	Sandstone, very fine grained, medium-gray
17	152	169	Sandstone, fine-grained, light-gray; some carbonaceous material on laminae surfaces
1.5	169	170.5	Siltstone, carbonaceous, medium- to dark-gray

Depth interval (feet) Thickness	From	To	Lithologic Description
0.5	170.5	171	Coal
0.5	171	171.5	Claystone, light-gray; ash; bentonite
2	171.5	173.5	Coal
9	173.5	182.5	Siltstone, carbonaceous, medium- to dark-gray
2	182.5	184.5	Claystone
6.5	184.5	191	Sandstone, very fine grained, medium- to light-gray; siltstone lenses
4	191	195	Coal, bony; includes partings
10	195	205	Siltstone, medium-gray to black; coaly at top
4	205	209	Sandstone, very fine grained, light-gray
8	209	217	Siltstone, medium-gray; some carbonaceous material on laminae
2.5	217	219.5	Sandstone, very fine grained, light-gray
15.5	219.5	235	Siltstone, medium- to light-gray; carbonaceous lenses
1	235	236	Coal
1	236	237	Siltstone
1.5	237	238.5	Coal
1.5	238.5	240	Siltstone, carbonaceous, coaly
12	240	252	Siltstone, medium-gray
4	252	256	Sandstone, very fine grained, medium- to light-gray; grades upward to siltstone
5	256	261	Siltstone, carbonaceous, medium-gray; grades upward to very fine grained sandstone; clayey
1	261	262	Coal
2	262	264	Sandstone, very fine grained
5.5	264	269.5	Siltstone, medium- to light-gray
2	269.5	271.5	Coal
1.5	271.5	273	Siltstone, carbonaceous
6.5	273	279.5	Coal; includes partings
5	279.5	284.5	Siltstone, carbonaceous, coaly
1.5	284.5	286	Coal
1.5	286	287.5	Siltstone, carbonaceous
1.5	287.5	289	Coal
1.5	289	290.5	Siltstone, carbonaceous
2	290.5	292.5	Coal
1	292.5	293.5	Claystone, light-gray; ash; bentonite
2	293.5	295.5	Coal
1.5	295.5	297	Claystone, carbonaceous
1.5	297	298.5	Coal, bony
24.5	298.5	323	Siltstone, medium-gray; interbedded with very fine grained sandstone
4	323	327	Sandstone, fine-grained, light-gray; very fine grained sandstone lenses
13	327	340	Siltstone, medium-gray; grades upward to very fine grained sandstone

Depth interval (feet) Thickness	From	To	Lithologic Description
10	340	350	Sandstone, very fine grained, medium-gray; interbedded with siltstone; laminated
31	350	381	Sandstone, fine-grained, light-gray
3	381	384	Siltstone, carbonaceous, medium-gray
7	384	391	Sandstone, very fine grained, carbonaceous, medium-brown to gray
8.5	391	399.5	Siltstone, carbonaceous, dark-brown to gray, coaly; plant fragments; grades upward to very fine grained sandstone
1.5	399.5	401	Coal
0.5	401	401.5	Siltstone, carbonaceous
3.5	401.5	405	Coal
1	405	406	Siltstone, carbonaceous
1.5	406	407.5	Coal
0.5	407.5	408	Claystone; ash; bentonite
2	408	410	Claystone, carbonaceous
4	410	414	Coal
2	414	416	Siltstone
2	416	418	Sandstone, very fine grained, medium-gray
16	418	434	Siltstone, carbonaceous, medium- to dark-gray; interbedded with claystone
3	434	437	Sandstone, very fine grained
5	437	442	Siltstone, carbonaceous, medium-gray
31	442	473	Sandstone, very fine grained, medium- to light-gray; thin siltstone lenses; carbonaceous along laminae
1	473	474	Coal
7	474	481	Siltstone, carbonaceous, medium- to dark-gray; interbedded with claystone
1	481	482	Coal
2	482	484	Siltstone, carbonaceous
6.5	484	490.5	Coal; includes partings
1.5	490.5	492	Siltstone, carbonaceous
8	492	500	Coal; includes partings
2	500	502	Siltstone, carbonaceous
3	502	505	Sandstone, very fine grained
1	505	506	Coal
2	506	508	Siltstone, carbonaceous
1	508	509	Coal, bony
1.5	509	510.5	Siltstone, carbonaceous, coaly
1.5	510.5	512	Sandstone, very fine grained, medium-gray
11	512	523	Siltstone, sandy, medium-gray; interbedded with very fine grained sandstone
16	523	539	Sandstone, fine-grained, light-gray; interlaminated with siltstone
4	539	543	Siltstone, sandy
12	543	555	Sandstone, fine-grained, light-gray

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-20** County **La Plata** State **Colorado**

Location Sec. **16** T. **33** N. R. **11** W.

Elevation **6,860** Drilled depth **555** Logged depth **551**

Drilling medium **air** Date logged **9/28/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

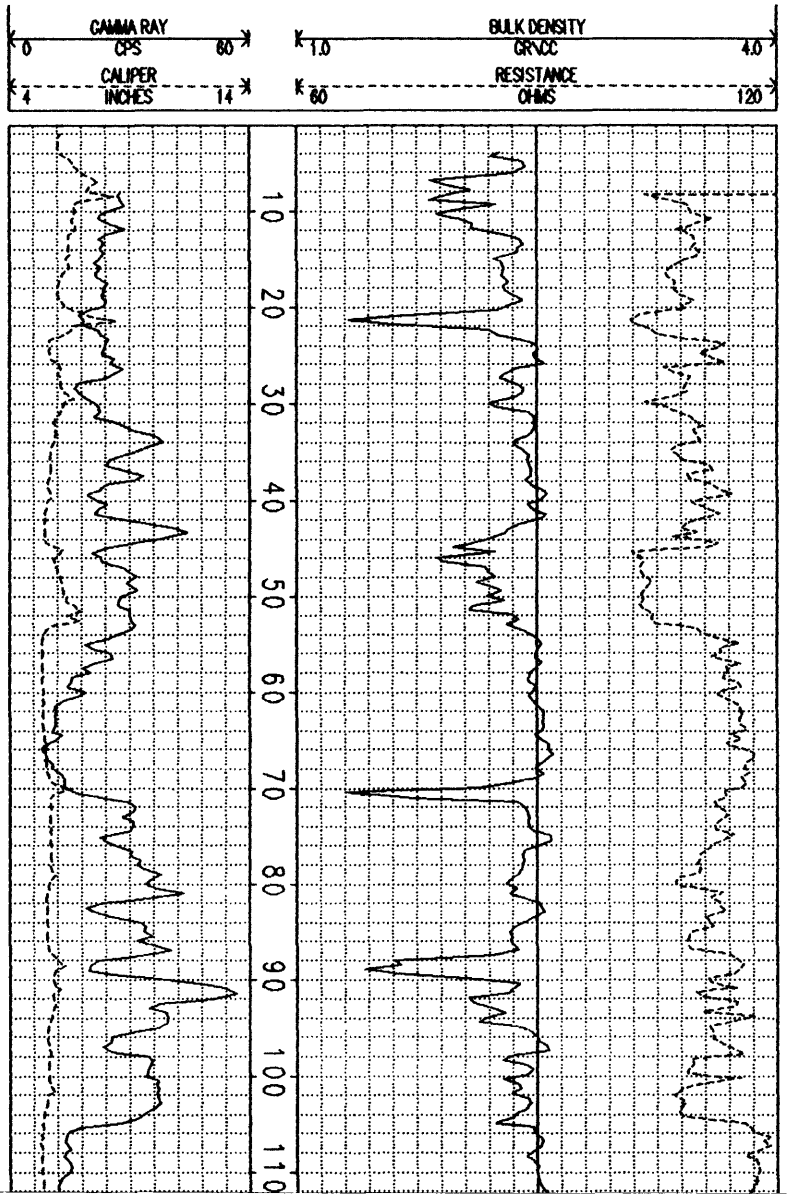
High resolution density (HRD)

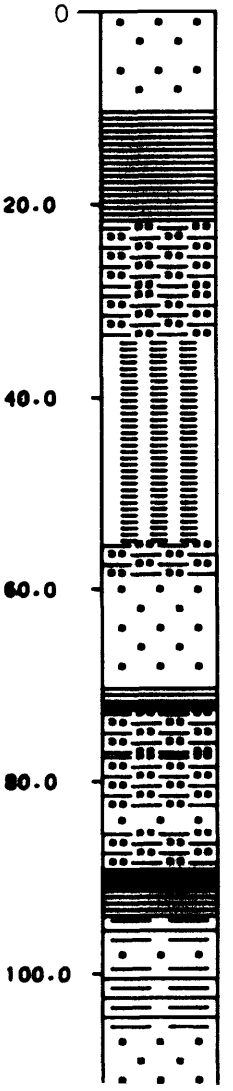
Caliper (CAL)

Resistance (RES)

Remarks:

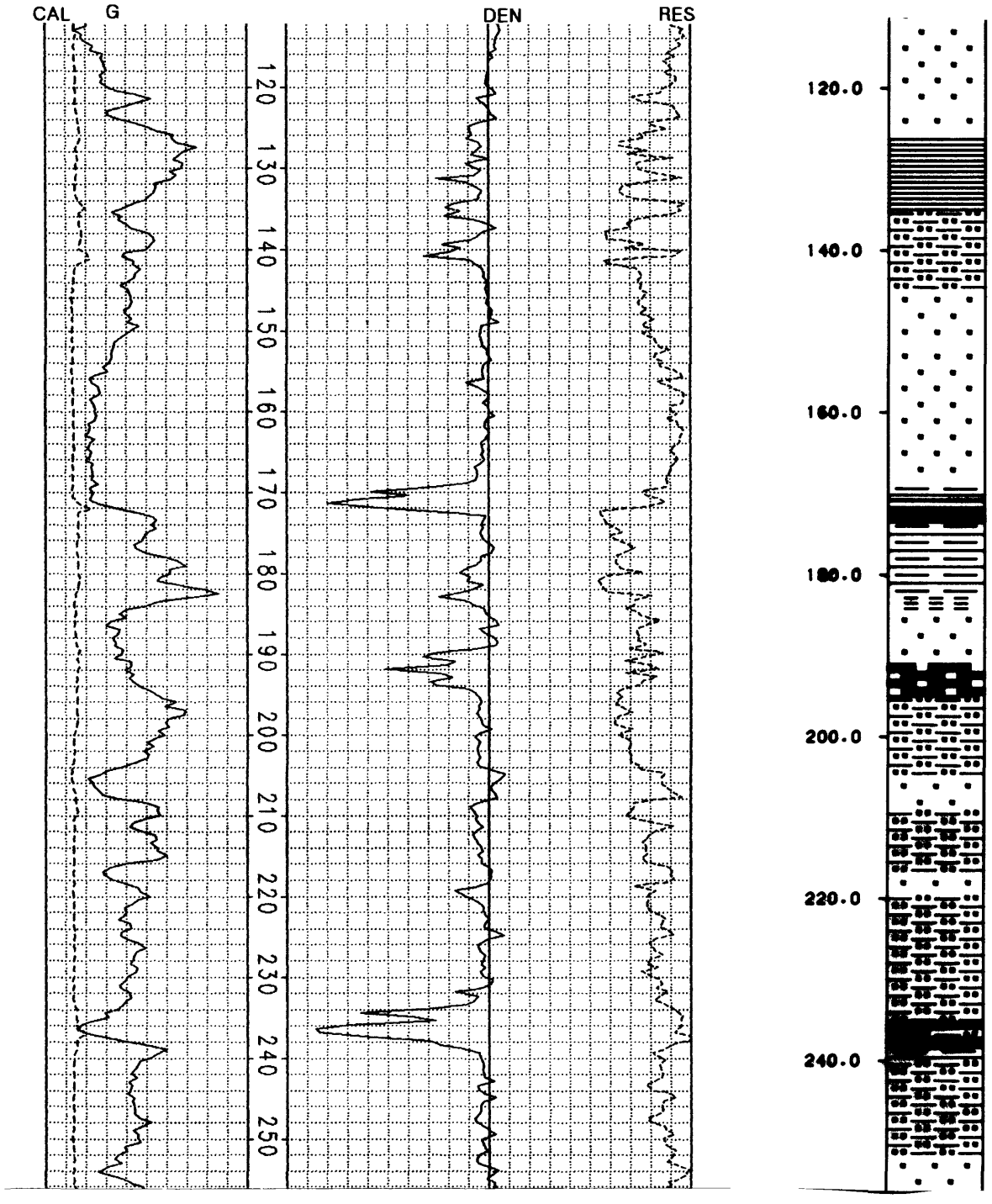
GEOPHYSICAL LOGS STRIP LOG





U.S. Geological Survey

Hole No. **USGS-20** continued



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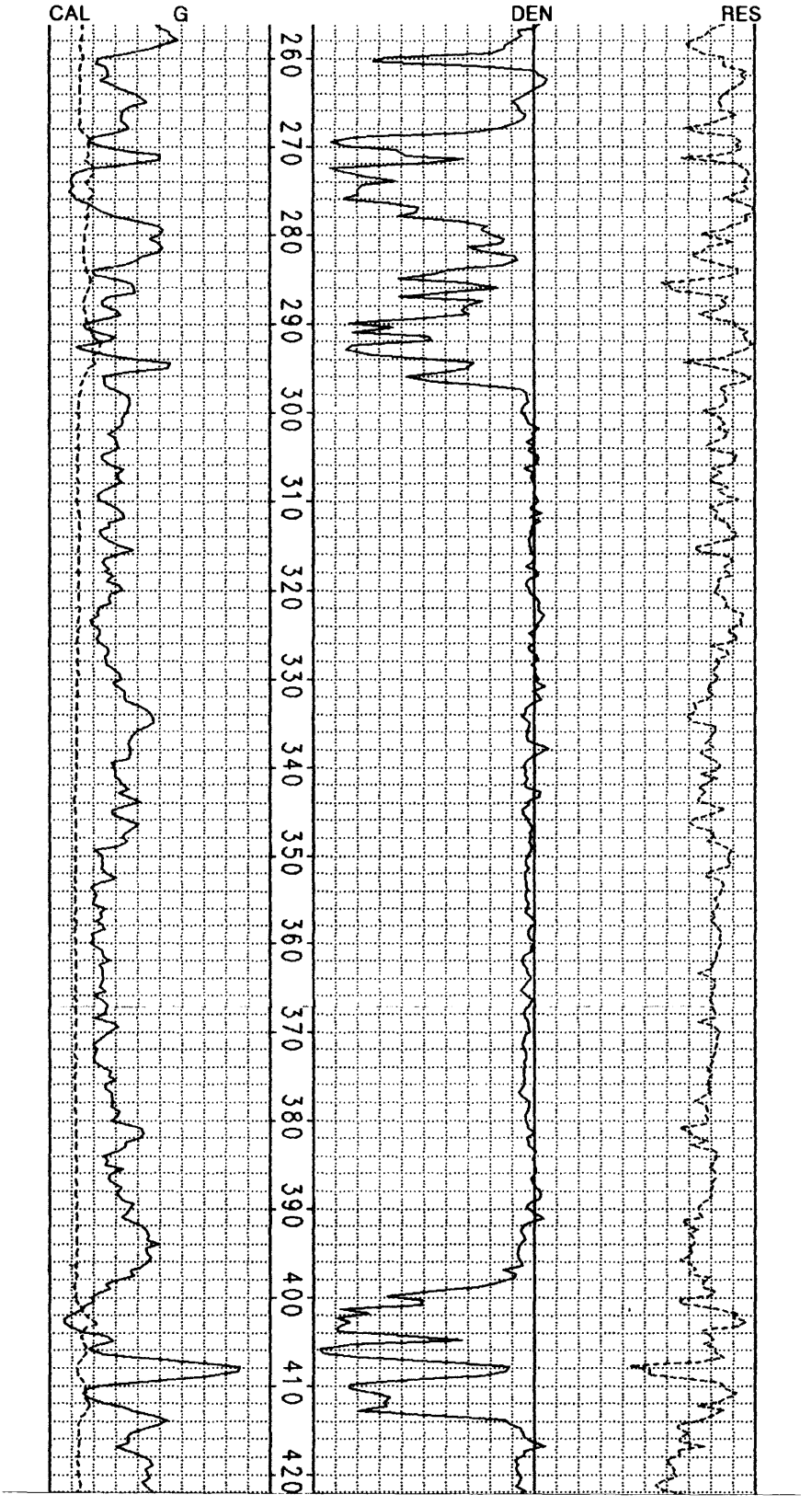
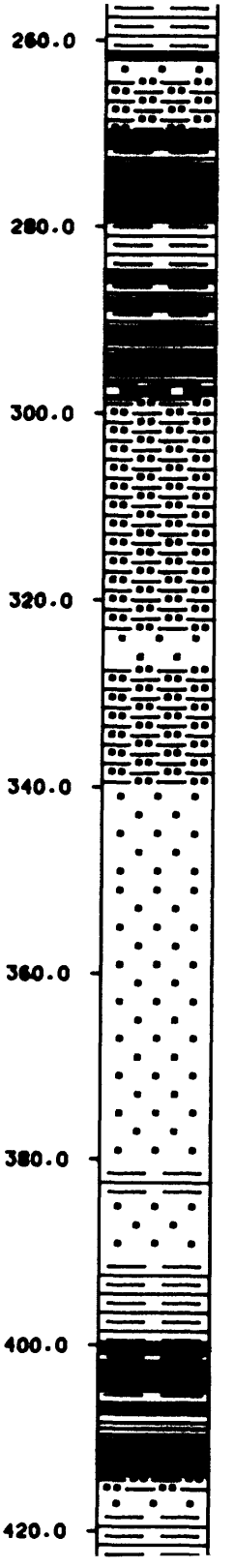
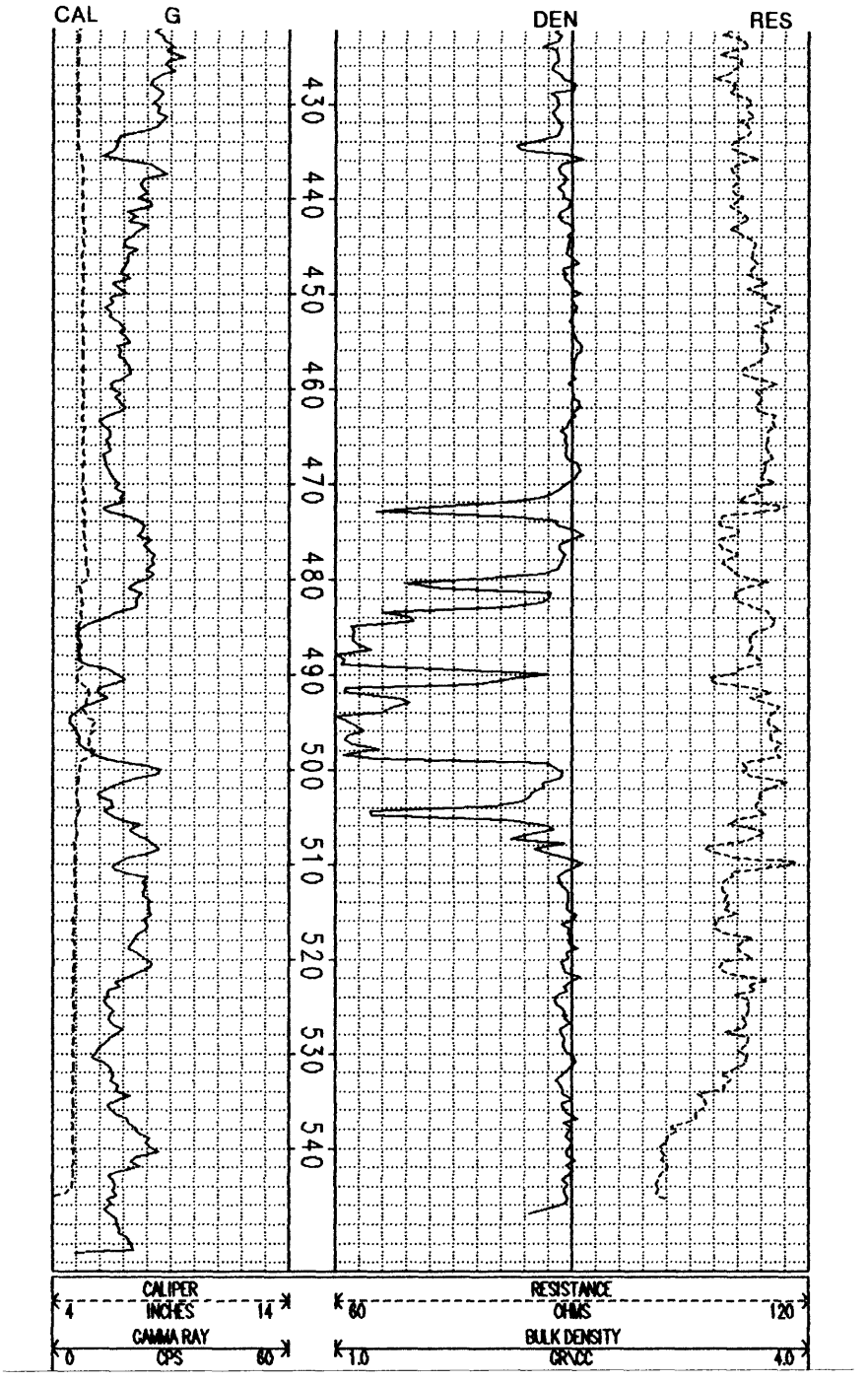
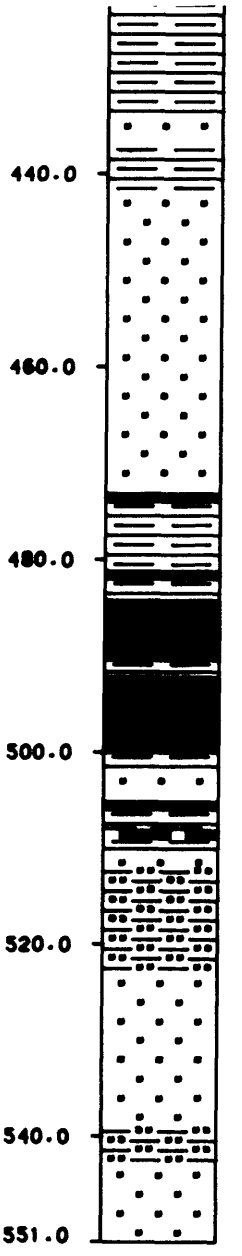




Hole No. **USGS-20** continued





Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 2

Hole USGS-22 Elevation 6,880 feet Total depth 435 feet

Location 1257963 E., 173681 N. Sec. 9, T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 9/28/88 Date completed 9/29/88 Geologist W. Betterton

Remarks:

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Siltstone, coaly, carbonaceous, dark-brown, highly oxidized
5	5	10	Siltstone, coaly, carbonaceous, highly oxidized; interbedded with coal
5	10	15	Claystone, carbonaceous, oxidized; thin coal stringers
1	15	16	Sandstone, fine-grained, oxidized
13	16	29	Sandstone, very fine grained, medium-gray; scattered siltstone lenses; carbonaceous laminae
21	29	50	Siltstone, clayey, medium-gray to brown; interbedded with carbonaceous claystone and thin coal lenses
0.5	50	50.5	Coal, bony
6	50.5	56.5	Claystone
2.5	56.5	59	Coal
1	59	60	Siltstone, carbonaceous
1.5	60	61.5	Coal
3.5	61.5	65	Claystone, carbonaceous, silty, black
11	65	76	Sandstone, very fine grained, laminated; interbedded with siltstone
8	76	84	Sandstone, fine-grained, light-gray; fines downward to siltstone
25	84	109	Claystone, carbonaceous; interbedded with carbonaceous siltstone and thin bony coal
3	109	112	Siltstone, sandy, light-brown
10	112	122	Claystone, slightly carbonaceous, medium-gray; interbedded with siltstone
4	122	126	Siltstone, medium-gray; thin coal stringer at base
6	126	132	Claystone, silty, medium-gray; carbonaceous lenses
2	132	134	Coal
4	134	138	Claystone, coaly, carbonaceous; interbedded with bony coal
6	138	144	Siltstone, medium-gray
6	144	150	Sandstone, very fine grained, medium-gray
5	150	155	Siltstone, medium-gray; scattered pyrite
3.5	155	158.5	Claystone, medium-gray
11.5	158.5	170	Coal; includes several thin partings

Depth interval (feet) Thickness	From	To	Lithologic Description
5	170	175	Claystone, coaly, carbonaceous, dark-gray to black
1.5	175	176.5	Coal, bony
4.5	176.5	181	Claystone, carbonaceous, dark-brown to black
5	181	186	Coal; includes partings
2	186	188	Claystone, light-gray; bentonite
3.5	188	191.5	Coal; bony toward base
3.5	191.5	195	Claystone, carbonaceous, dark-brown
10	195	205	Siltstone, clayey, dark-gray
54	205	259	Sandstone, very fine grained, light-gray; interbedded with fine-grained sandstone and sandy siltstone
7	259	266	Sandstone, fine-grained, light-gray
3.5	266	269.5	Siltstone, carbonaceous, medium-gray
5	269.5	274.5	Coal
1	274.5	275.5	Claystone; bentonite
5	275.5	280.5	Coal
27.5	280.5	308	Siltstone, medium-gray; interbedded with very fine grained and fine-grained sandstone; scattered carbonaceous lenses
37	308	345	Sandstone, fine-grained, light-gray; interbedded with medium-grained and very fine grained sandstone and siltstone
19.5	345	364.5	Siltstone, medium-gray; interbedded with very fine grained sandstone
2	364.5	366.5	Coal
4	366.5	370.5	Siltstone, carbonaceous, coaly, dark-gray; 0.5 ft of coal in middle
1.5	370.5	372	Coal
2	372	374	Siltstone, coaly, carbonaceous, dark-brown
8	374	382	Coal, bright; scattered resin
2	382	384	Siltstone, coaly, carbonaceous, dark-gray to brown
2.5	384	386.5	Sandstone, very fine grained, medium-gray
1	386.5	387.5	Coal
17.5	387.5	405	Siltstone, medium-gray; laminated with very fine grained sandstone
16	405	421	Sandstone, fine-grained, light-gray; interbedded with very fine grained sandstone and siltstone
14	421	435	Sandstone, medium- to fine-grained, light-gray; thin siltstone lenses

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-22** County La Plata State Colorado

Location Sec. **9** T. **33** N. R. **11** W.

Elevation **6,880** Drilled depth **435** Logged depth **434**

Drilling medium **air** Date logged **9/29/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

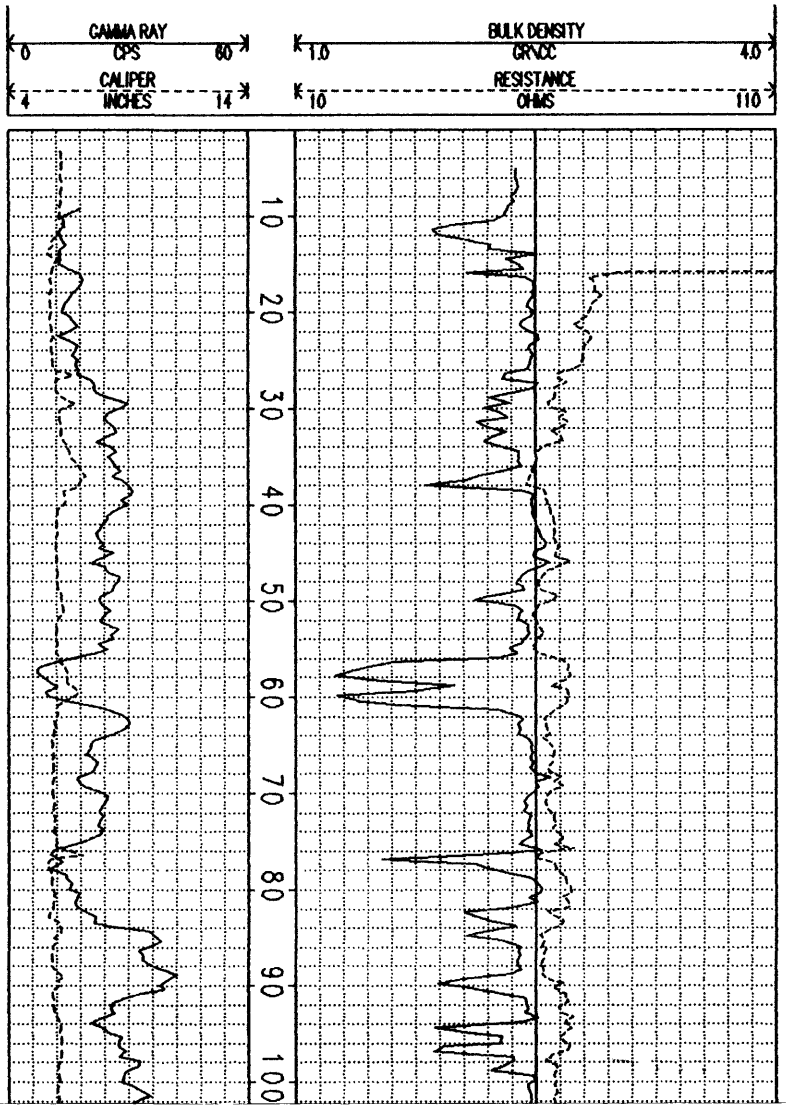
High resolution density (HRD)

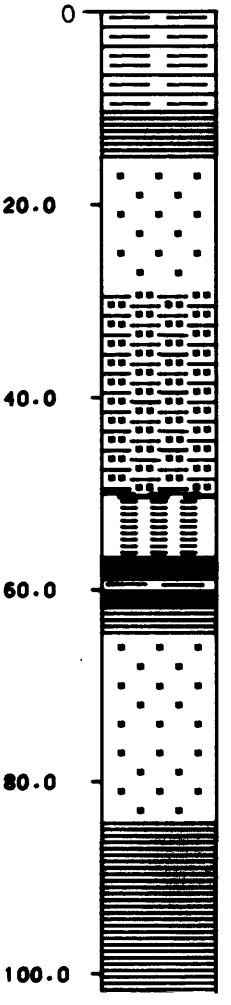
Caliper (CAL)

Resistance (RES)

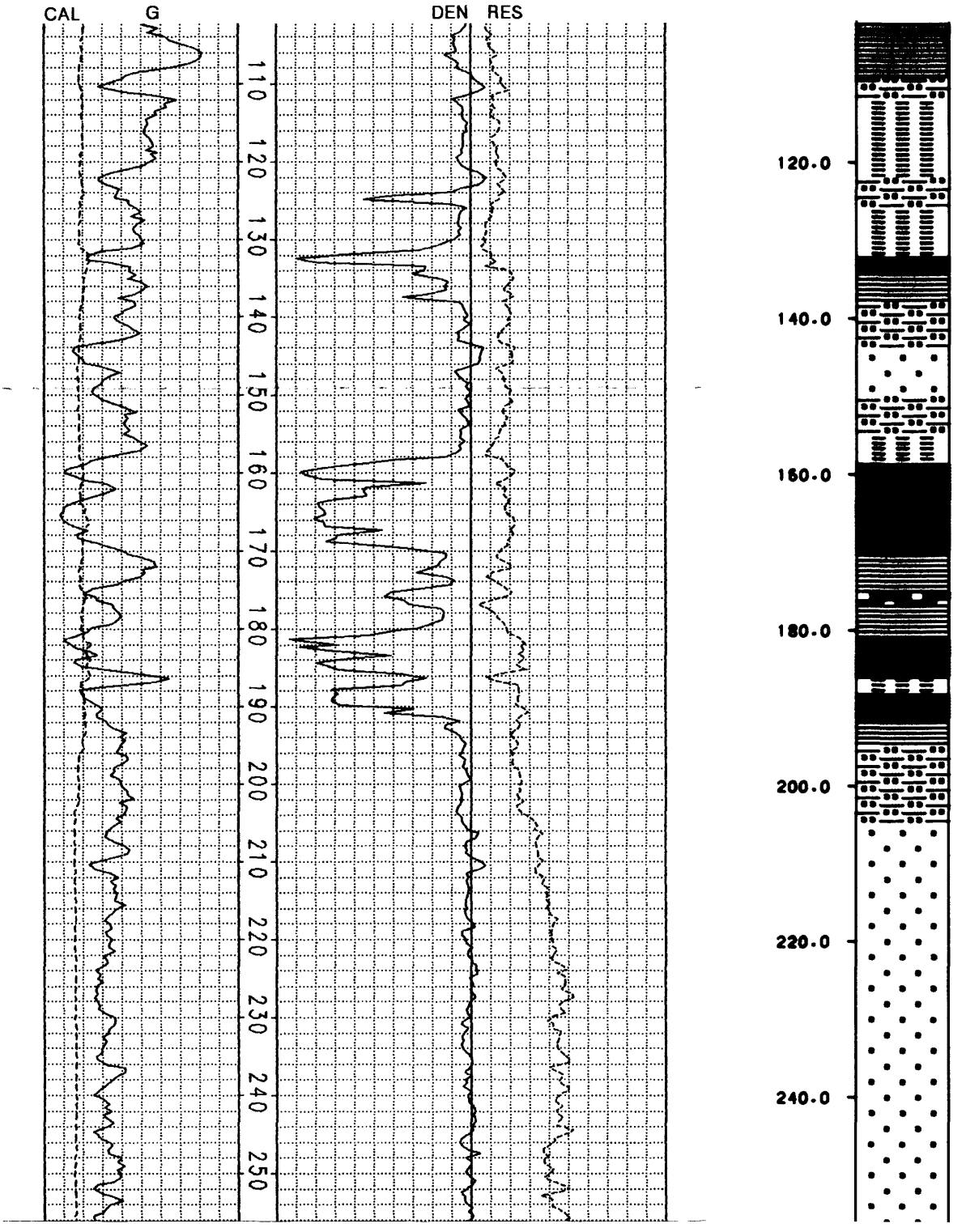
Remarks:

GEOPHYSICAL LOGS STRIP LOG





Hole No. **USGS-22** continued



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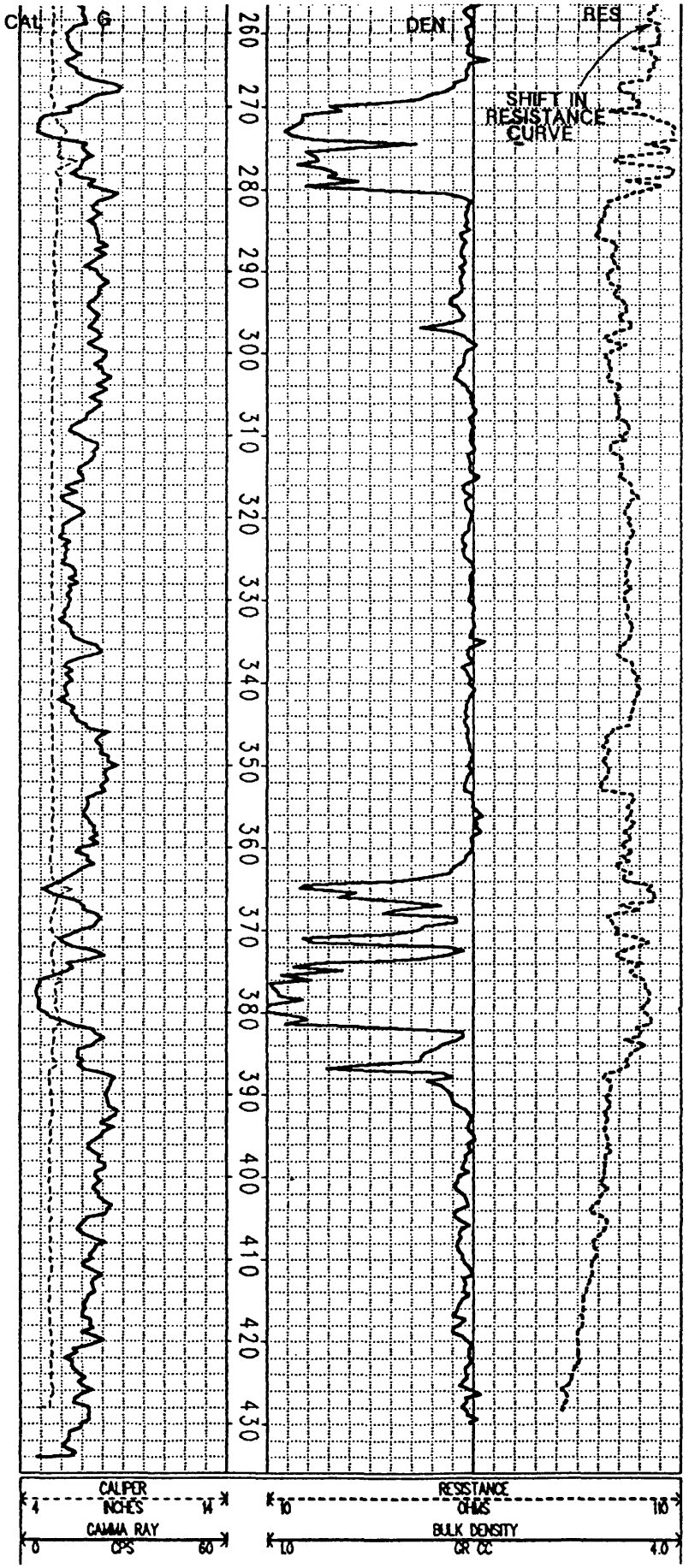
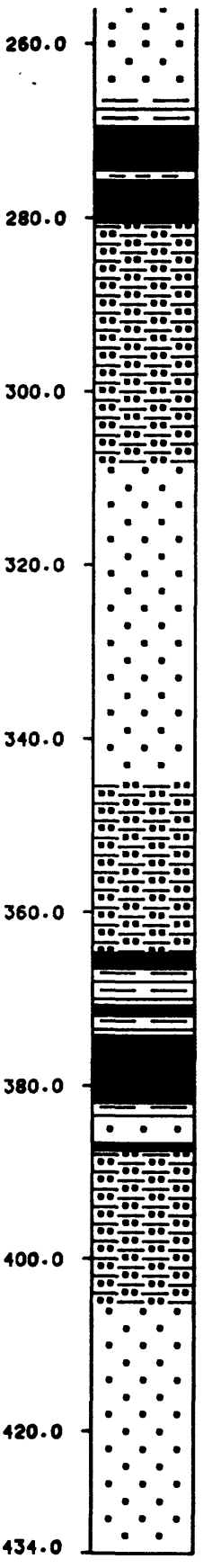




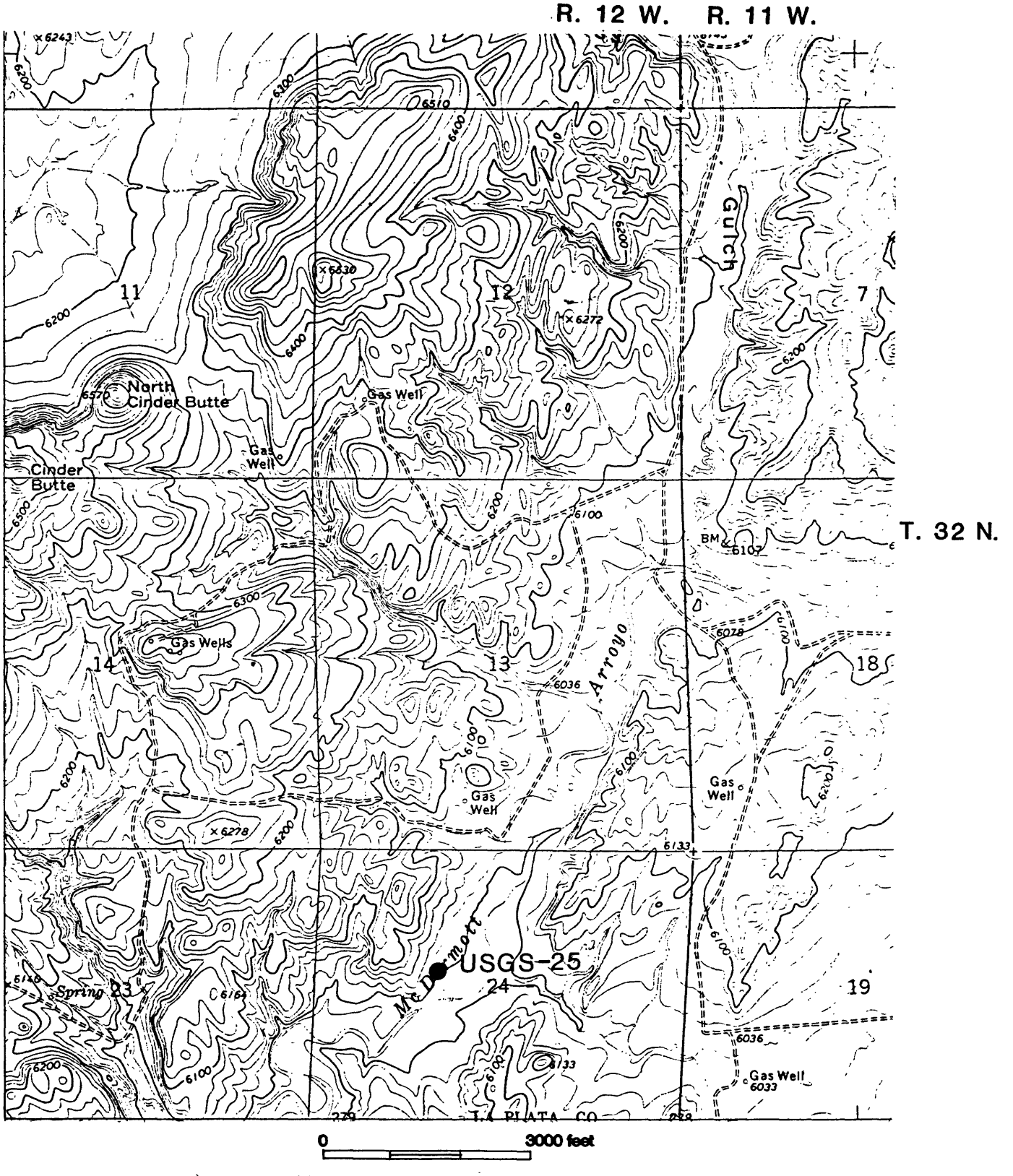


Figure 8.--Map showing location of hole USGS-25. Base from Pinkerton Mesa 7 1/2-minute quadrangle (1968).

Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 2

Hole USGS-25 Elevation 6,010 feet Total depth 555 feet

Location 1239679 E., 134155 N. Sec. 24, T. 32 N., R. 12 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 10/19/88 Date completed 10/20/88 Geologist L. Roberts

Remarks: Encountered artesian water at about 30 ft; methane gas above 280 ft; minor amount of oil in coal at about 375 ft.

Depth interval (feet) Thickness	From	To	Lithologic Description
10	0	10	Clay, sandy, medium-brown; some fine-grained sandstone lenses
8	10	18	Sand, fine- to medium-grained, clayey, brown
3	18	21	Claystone, oxidized
1	21	22	Coal, bony
4	22	26	Sandstone, very fine grained, carbonaceous, dark-gray
8	26	34	Claystone, medium-gray
2	34	36	Siltstone, greenish-gray
27	36	63	Claystone, medium- to dark-gray; interbedded with siltstone; carbonaceous lenses
4	63	67	Sandstone, very fine grained, medium-gray
4	67	71	Sandstone, fine-grained, light-gray, clean, well-sorted
3	71	74	Claystone
10	74	84	Siltstone, light-gray; some claystone and fine-grained sandstone lenses; carbonaceous lenses
5	84	89	Claystone
6	89	95	Sandstone, very fine grained, medium-gray
12	95	107	Siltstone, slightly carbonaceous, medium-gray; interbedded with claystone; plant fragments
14	107	121	Sandstone, fine-grained, light-gray, clean, well-sorted
23	121	144	Siltstone, carbonaceous, medium- to dark-gray; interbedded with claystone; plant fragments; scattered pyrite
6	144	150	Claystone
12	150	162	Siltstone, medium-gray; coal fragments
27	162	189	Sandstone, fine-grained, light-gray, clean, well-sorted; coarsens to medium-grained sandstone at base
3	189	192	Siltstone, medium-gray; coal fragments
2	192	194	Sandstone, very fine grained, medium-gray, clean
6	194	200	Siltstone, carbonaceous; coal fragments
3	200	203	Claystone, carbonaceous, dark-gray; grades upward to siltstone
5	203	208	Siltstone, medium-gray, pyritic

Depth interval (feet) Thickness	From	To	Lithologic Description
33	208	241	Siltstone, medium-gray; some claystone and very fine grained sandstone lenses; carbonaceous material
5	241	246	Sandstone, fine-grained, medium-gray, clean, well-sorted
7	246	253	Siltstone, medium- to light-gray; interbedded with very fine grained sandstone; some carbonaceous material
18	253	271	Sandstone, very fine grained to fine-grained, light-gray, clean, well-sorted
3	271	274	Siltstone, medium-gray
70	274	344	Sandstone, fine-grained, light-gray; interbedded with very fine grained sandstone; clean; well-sorted
7.5	344	351.5	Coal; includes partings
1	351.5	352.5	Claystone; ash; bentonite
4.5	352.5	357	Coal; includes partings
6	357	363	Coal, bony; silty at base
2.5	363	365.5	Coal
5	365.5	370.5	Siltstone, carbonaceous, coaly, very dark gray
4	370.5	374.5	Coal; includes partings
2	374.5	376.5	Siltstone, carbonaceous
2	376.5	378.5	Coal, oily
3	378.5	381.5	Siltstone, carbonaceous
5	381.5	386.5	Coal; includes partings
5.5	386.5	392	Sandstone, very fine grained, medium-gray, clean, well-sorted
53	392	445	Sandstone, fine-grained, medium- to light-gray; interbedded with very fine grained sandstone; some siltstone lenses
45	445	490	Siltstone, carbonaceous, medium- to dark-gray; interbedded with very fine grained sandstone; plant fragments
1	490	491	Claystone, light-gray; ash; bentonite
8	491	499	Coal; includes partings
1	499	500	Siltstone, carbonaceous
9	500	509	Coal; includes partings
1	509	510	Claystone; ash; bentonite
10	510	520	Coal; includes partings
6	520	526	Sandstone, very fine grained, light-gray, clean, well-sorted
2.5	526	528.5	Coal
26.5	528.5	555	Sandstone, fine- to medium-grained, clean, well-sorted; some carbonaceous claystone lenses

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-25** County La Plata State Colorado

Location Sec. **24** T. **32** N. R. **12** W.

Elevation **6,010** Drilled depth **555** Logged depth **552**

Drilling medium **air** Date logged **10/20/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

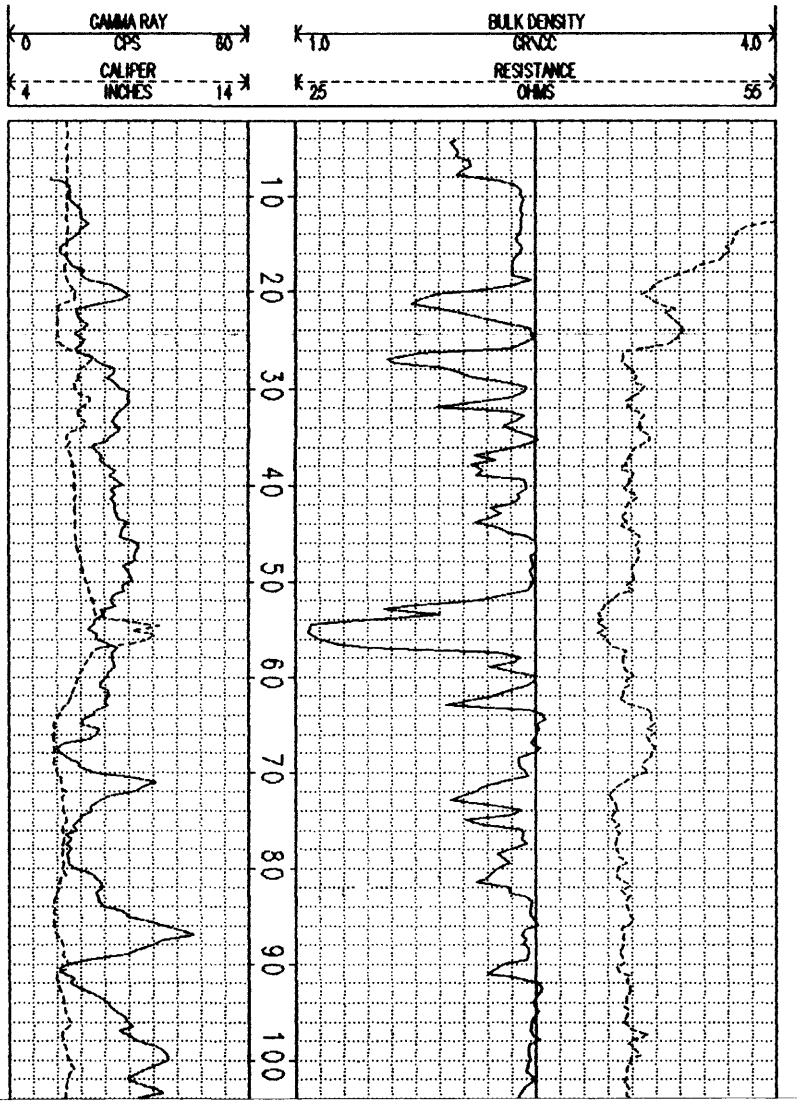
High resolution density (HRD)

Caliper (CAL)

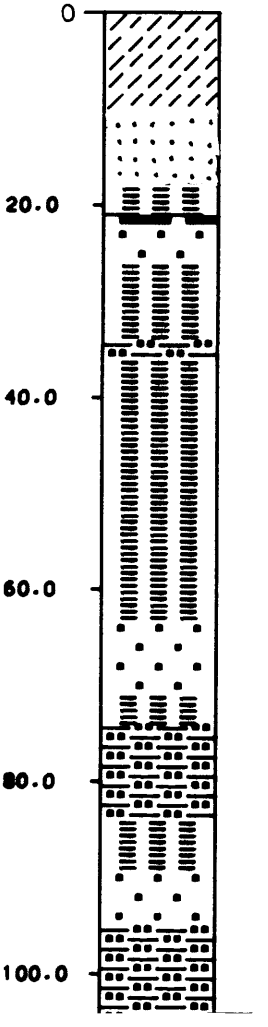
Resistance (RES)

Remarks:

GEOPHYSICAL LOGS

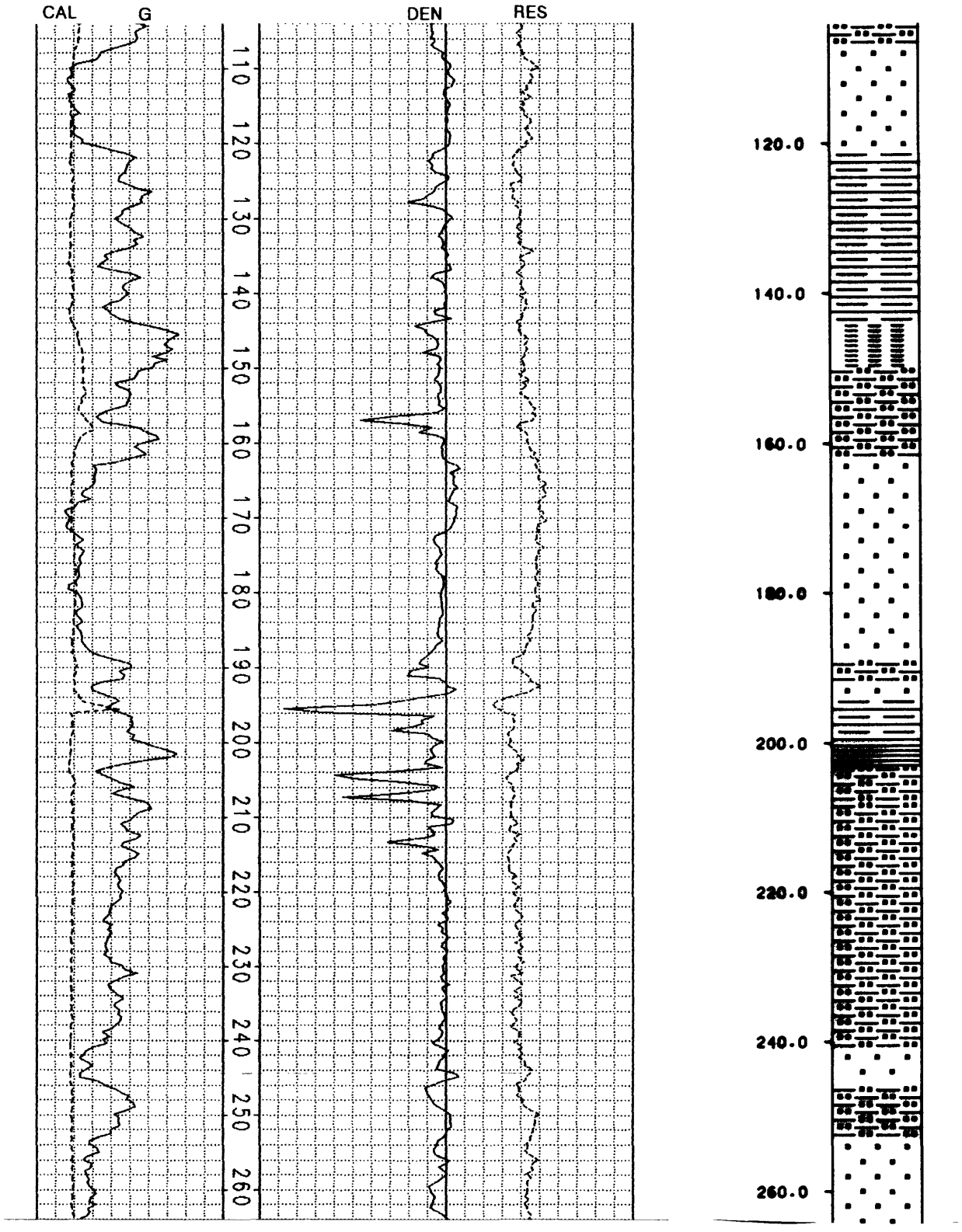


STRIP LOG



U.S. Geological Survey

Hole No. **USGS-25** continued



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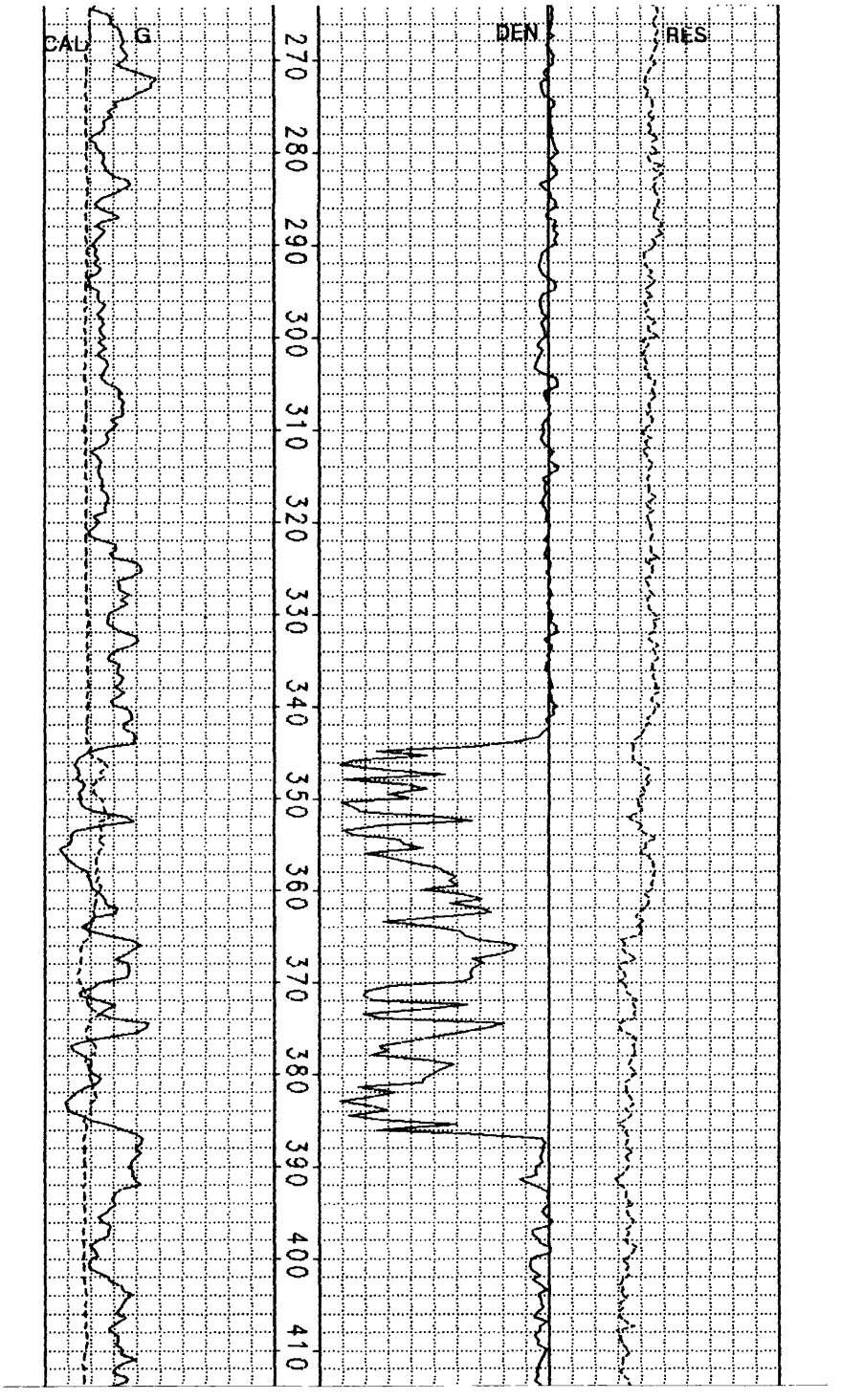

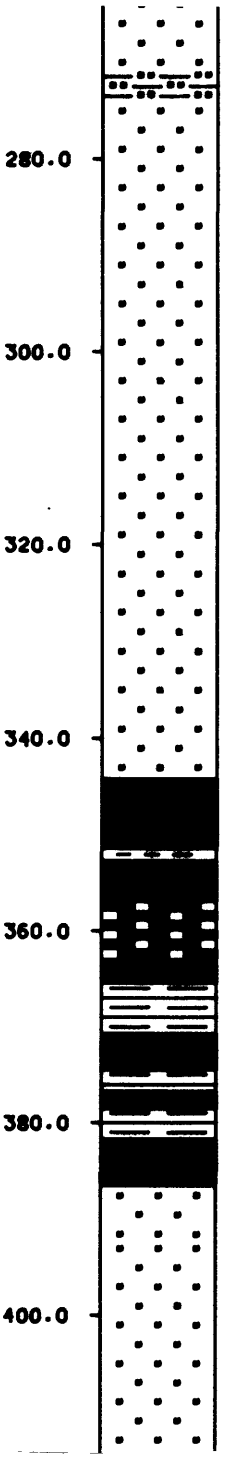

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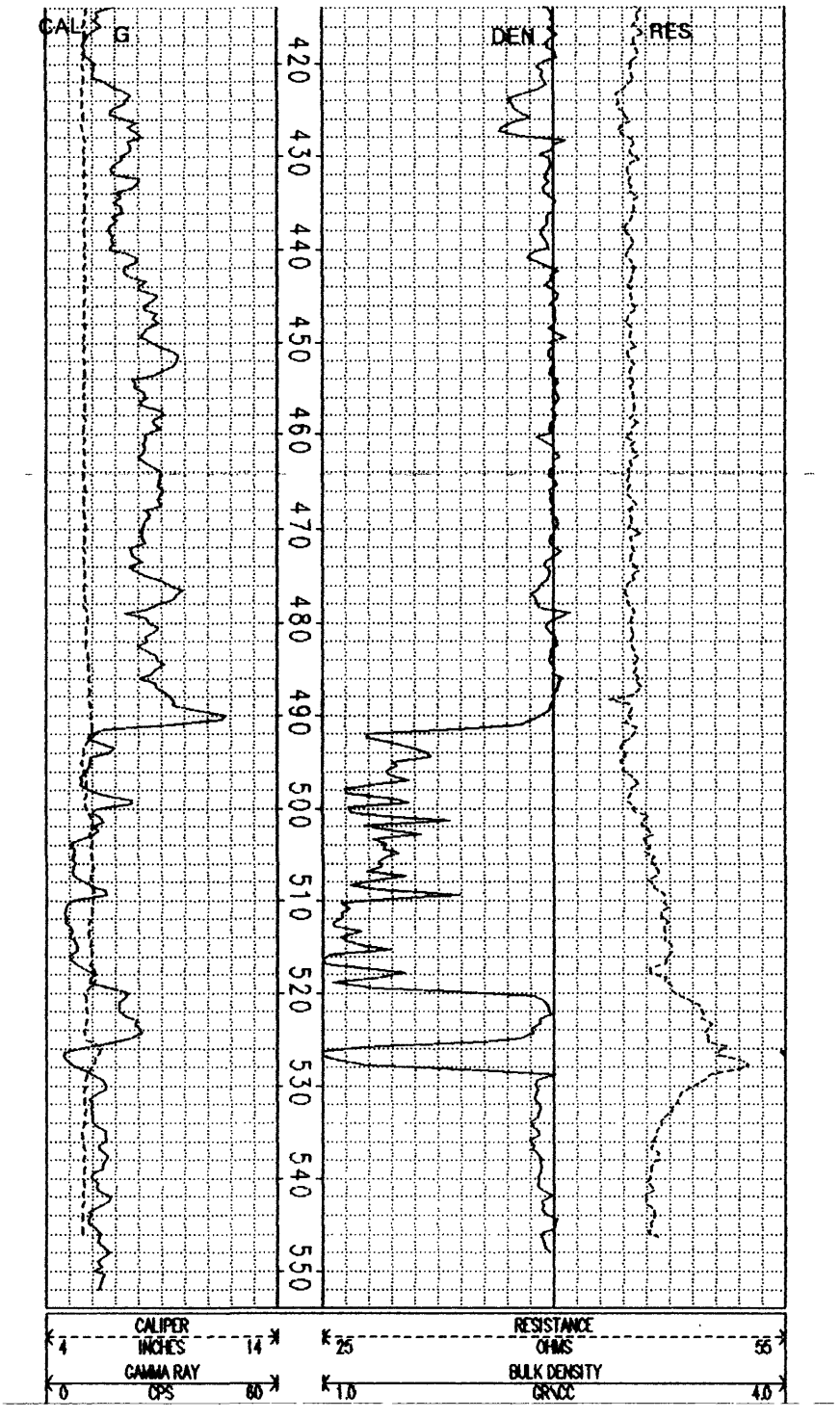
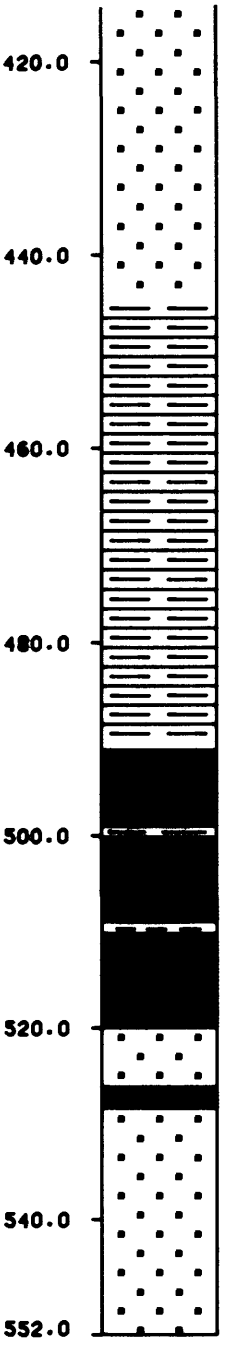




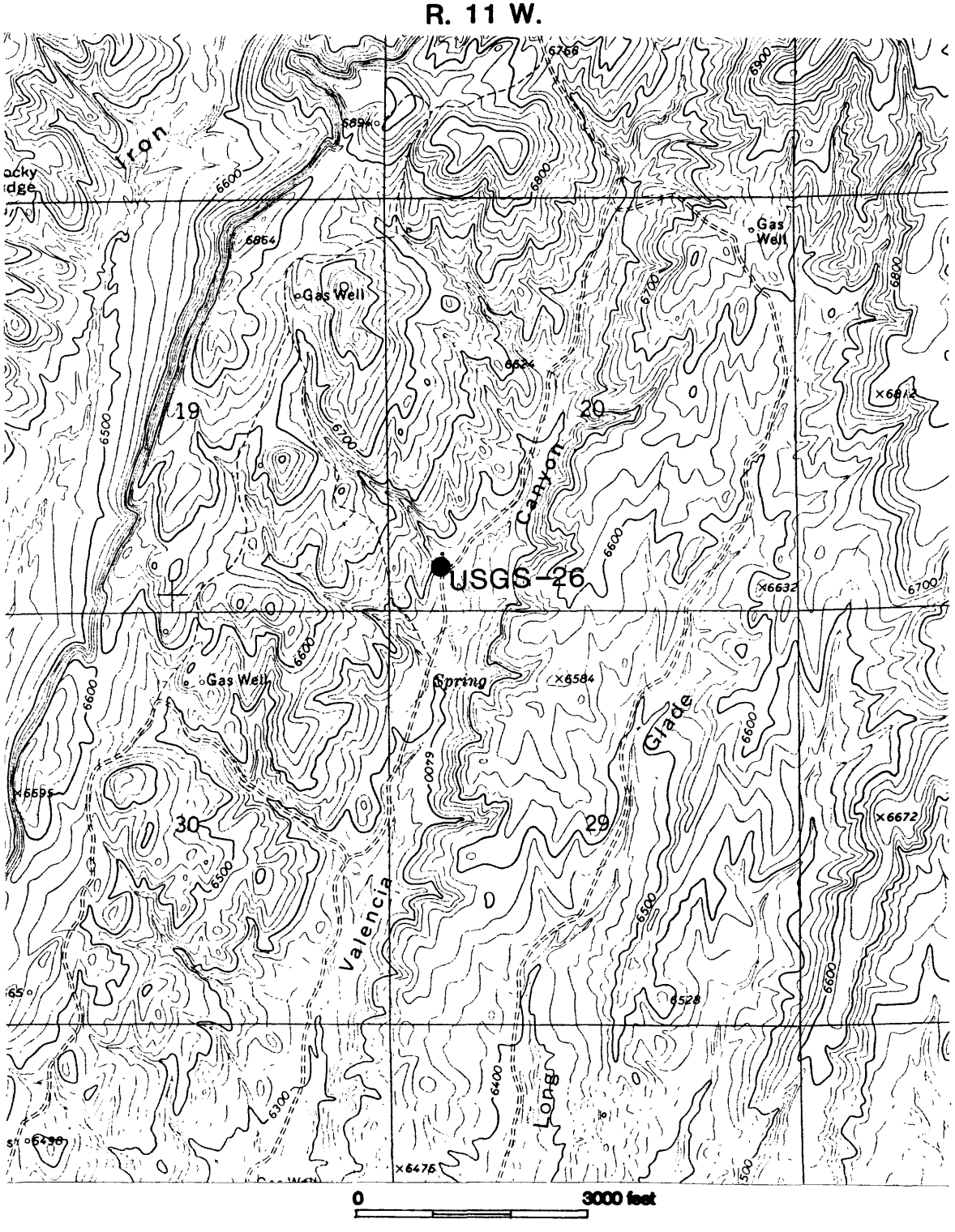


Figure 9.--Map showing location of hole USGS-26. Base from Pinkerton Mesa 7 1/2-minute quadrangle (1968).

Sample and Core Log U.S. GEOLOGICAL SURVEY Page 1 of 3

Hole USGS-26 Elevation 6,470 feet Total depth 650 feet

Location 1249893 E., 162392 N. Sec. 20, T. 33 N., R. 11 W.

County La Plata State Colorado Rotary hole size 5 1/8 inches

Drilled by USGS Driller Steve Grant Core hole size --- inches

Date started 10/14/88 Date completed 10/15/88 Geologist L. Roberts

Remarks: Artesian water at 30 ft; yellowish-green oily substance from hole at 172 ft; then black oil at about 202 ft (minor amounts); methane

Depth interval (feet) Thickness	From	To	Lithologic Description
5	0	5	Sand, fine-grained, silty, light-brown
2	5	7	Sandstone, very fine grained, light-gray
3	7	10	Claystone, light-gray
5	10	15	Claystone, carbonaceous, medium-brown; plant fragments
8	15	23	Claystone, gray
4	23	27	Claystone, coaly, carbonaceous, dark-gray to black
4	27	31	Siltstone, light-gray
21	31	52	Siltstone, medium-gray; interbedded with light-gray claystone and very fine grained sandstone
5	52	57	Claystone, medium-gray
58	57	115	Siltstone; interbedded with claystone and carbonaceous claystone
3	115	118	Claystone, light-gray
2	118	120	Siltstone, carbonaceous, dark-gray
11	120	131	Claystone, light-gray; interbedded with medium-gray siltstone
7	131	138	Siltstone, medium-gray
2	138	140	Claystone
4	140	144	Sandstone, very fine grained, medium-gray; scattered siltstone lenses
15	144	159	Sandstone, fine-grained; grades downward to very fine grained sandstone
1.5	159	160.5	Coal
8.5	160.5	169	Sandstone, very fine grained, medium-gray, clean, well-sorted
3	169	172	Sandstone, fine-grained; oily film on water; odor of gasoline
7	172	179	Sandstone, very fine grained, medium-gray; siltstone lenses
1	179	180	Coal
4	180	184	Siltstone, dark-gray; carbonaceous at top; grades downward to fine-grained sandstone
16	184	200	Sandstone, fine-grained, light-gray; interbedded with siltstone and very fine grained sandstone

Depth interval (feet) Thickness	From	To	Lithologic Description
25	200	225	Sandstone, medium- to fine-grained, well-sorted, oily; odor of gasoline
13	225	238	Siltstone, carbonaceous, dark-gray; coal stringers
2	238	240	Coal
1	240	241	Siltstone, carbonaceous
2	241	243	Coal
1	243	244	Siltstone, carbonaceous
0.5	244	244.5	Coal
15.5	244.5	260	Siltstone, carbonaceous; interbedded with light-gray claystone
1	260	261	Coal
4.5	261	265.5	Siltstone, carbonaceous, dark-gray
1.5	265.5	267	Coal
6	267	273	Siltstone, slightly carbonaceous, medium-gray
5	273	278	Sandstone, very fine grained, light-gray
4.5	278	282.5	Coal; 0.5 ft parting in middle
5.5	282.5	288	Sandstone, very fine grained, carbonaceous, medium-gray
6	288	294	Siltstone, slightly sandy, medium-gray
6	294	300	Sandstone, very fine grained, carbonaceous, medium-gray; includes lenses of bony coal
8.5	300	308.5	Coal
16.5	308.5	325	Siltstone, carbonaceous; grades downward to very fine grained sandstone
48	325	373	Sandstone, fine-grained, medium-gray; interbedded with medium-gray siltstone
9	373	382	Sandstone, fine-grained, light-gray; interbedded with very fine grained sandstone and siltstone
5.5	382	387.5	Coal, bony; includes partings
1.5	387.5	389	Siltstone, carbonaceous, dark-brown
11	389	400	Coal, bony; includes partings
1	400	401	Claystone, light-gray; bentonite?
3.5	401	404.5	Coal
1.5	404.5	406	Siltstone, carbonaceous
1	406	407	Coal
2.5	407	409.5	Claystone, light-gray; bentonite
3.5	409.5	413	Coal
3.5	413	416.5	Siltstone, carbonaceous, dark-brown
1	416.5	417.5	Coal
24.5	417.5	442	Siltstone, carbonaceous; interbedded with carbonaceous claystone
1	442	443	Sandstone, fine-grained, light-gray
3	443	446	Siltstone, dark-brown
55	446	501	Sandstone, fine-grained, light-gray, well-sorted; interbedded with very fine grained sandstone; carbonaceous laminae
2	501	503	Siltstone

Depth interval (feet) Thickness	From	To	Lithologic Description
4	503	507	Coal
4	507	511	Siltstone, carbonaceous, dark-brown
8	511	519	Coal; includes very thin partings
9	519	528	Siltstone; interbedded with light-gray, very fine grained sandstone
42	528	570	Sandstone, fine-grained, light-gray, well-sorted; carbonaceous fragments; scattered clay clasts
7	570	577	Sandstone, very fine grained; grades downward to siltstone
4	577	581	Sandstone, fine-grained, light-gray
4	581	585	Siltstone, medium-gray
2	585	587	Sandstone, fine-grained, light-gray
5	587	592	Siltstone, medium-gray
5	592	597	Sandstone, fine-grained, light-gray
5	597	602	Siltstone, medium-gray
3	602	605	Sandstone, fine-grained, light-gray
45	605	650	Sandstone, very fine grained, light-gray; interbedded with fine-grained sandstone and siltstone

U.S. Geological Survey
Southern Ute Indian Reservation

Hole No. **USGS-26** County **La Plata** State **Colorado**

Location Sec. **20** T. **33** N. R. **11** W.

Elevation **6,470** Drilled depth **650** Logged depth **647**

Drilling medium **air** Date logged **10/15/88**

Geophysical logs:

Gamma ray (G) Logging speed **15** fpm

Density (DEN) Vertical scale 1 in. = 20 ft.

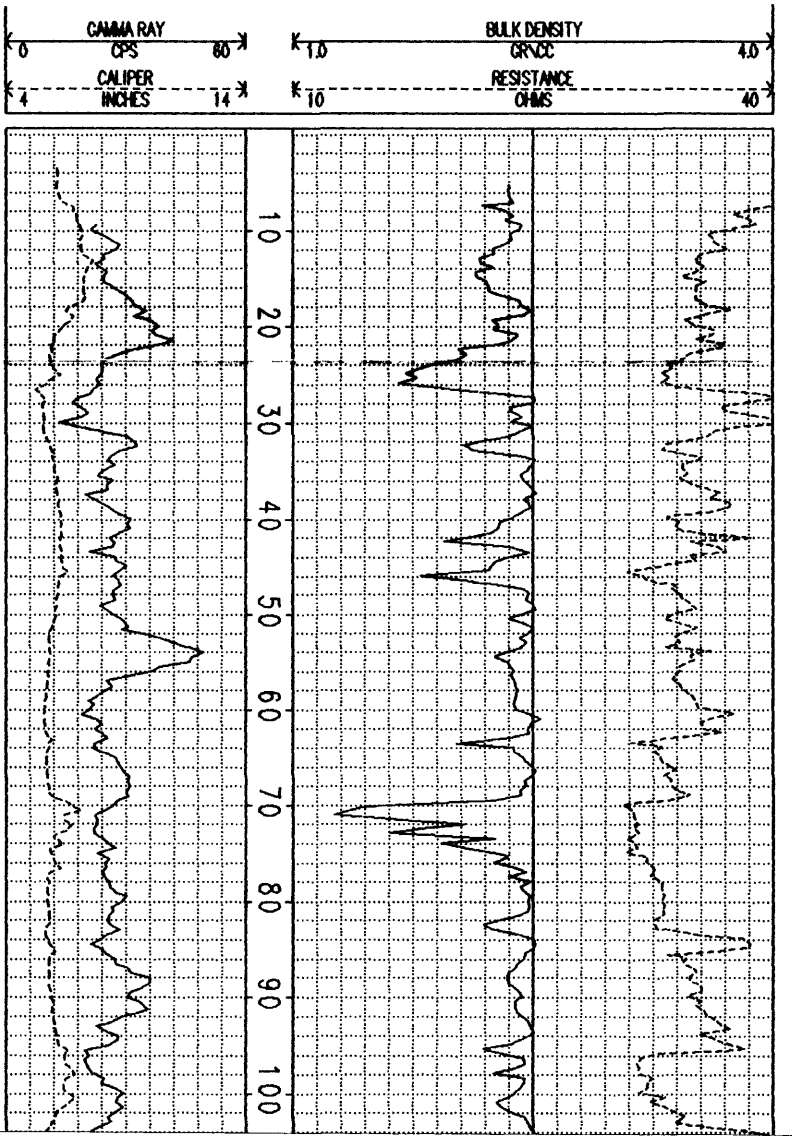
High resolution density (HRD)

Caliper (CAL)

Resistance (RES)

Remarks:

GEOPHYSICAL LOGS



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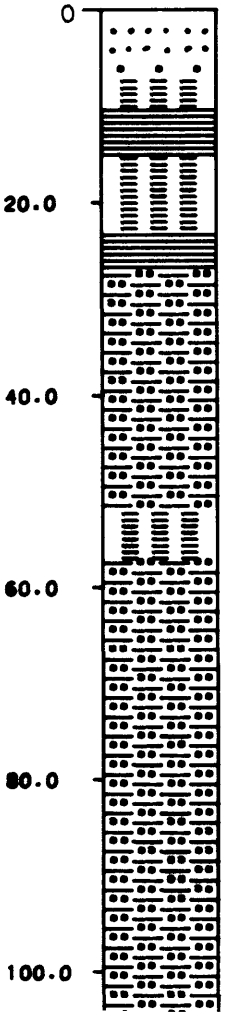

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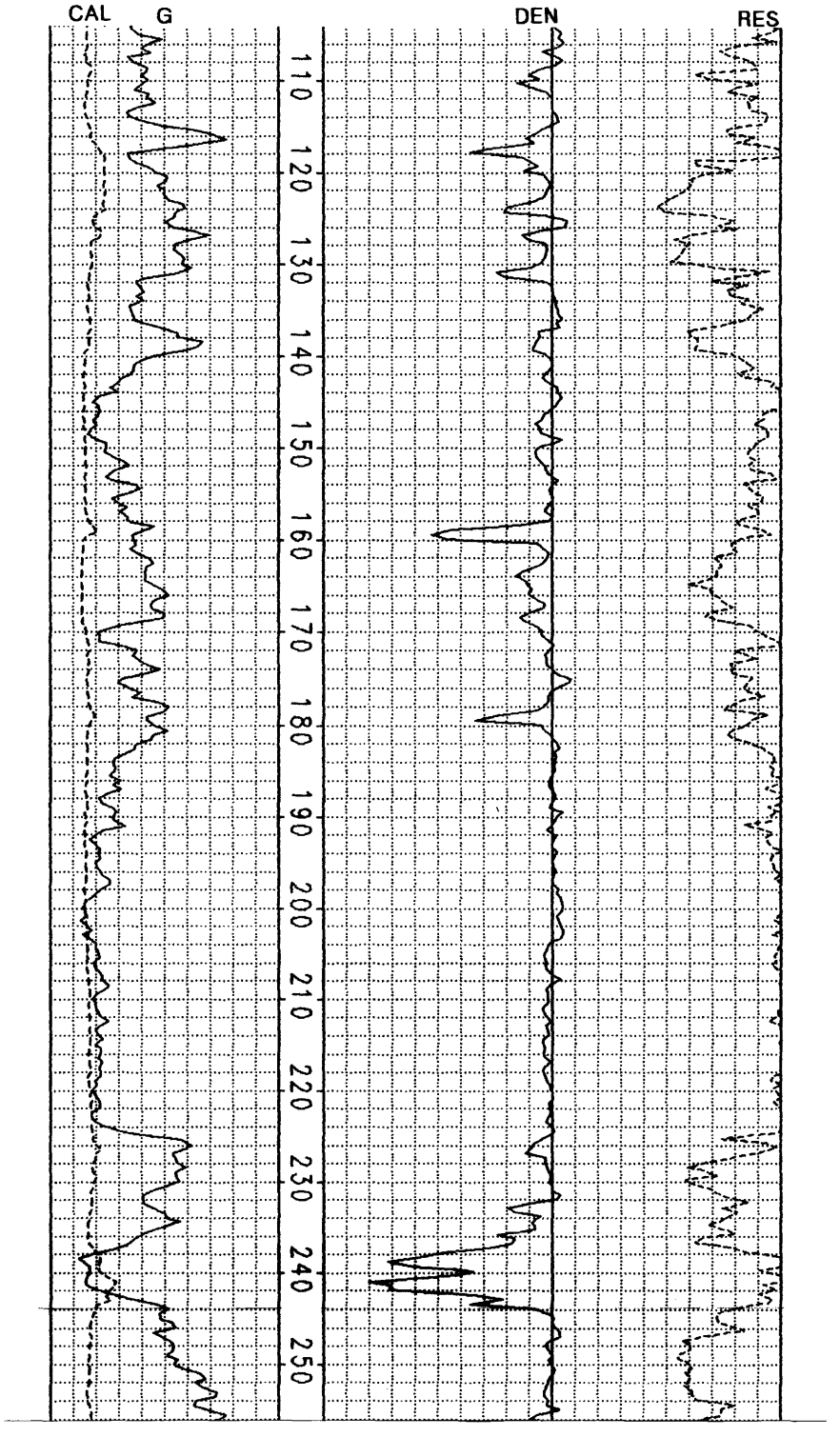

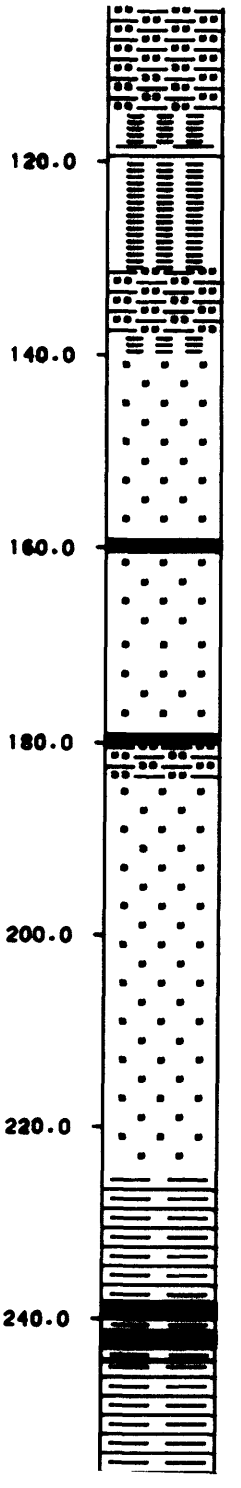

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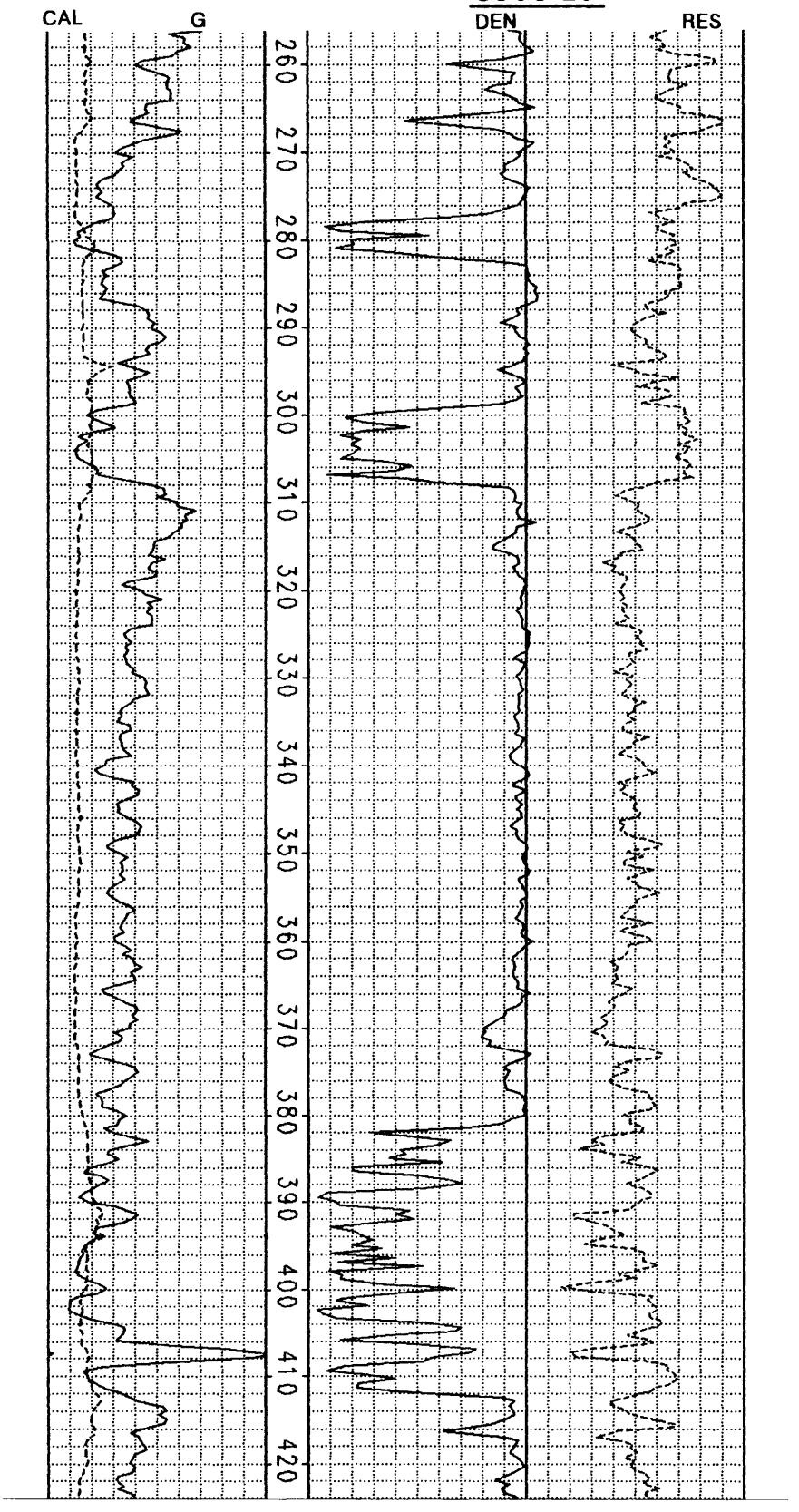

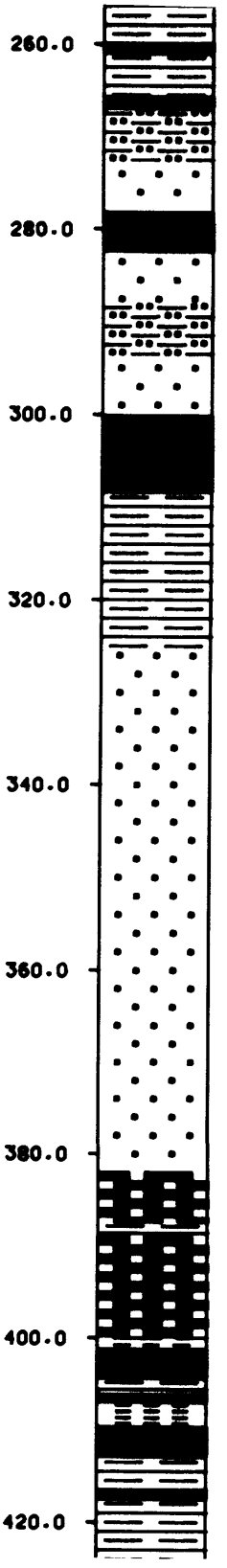

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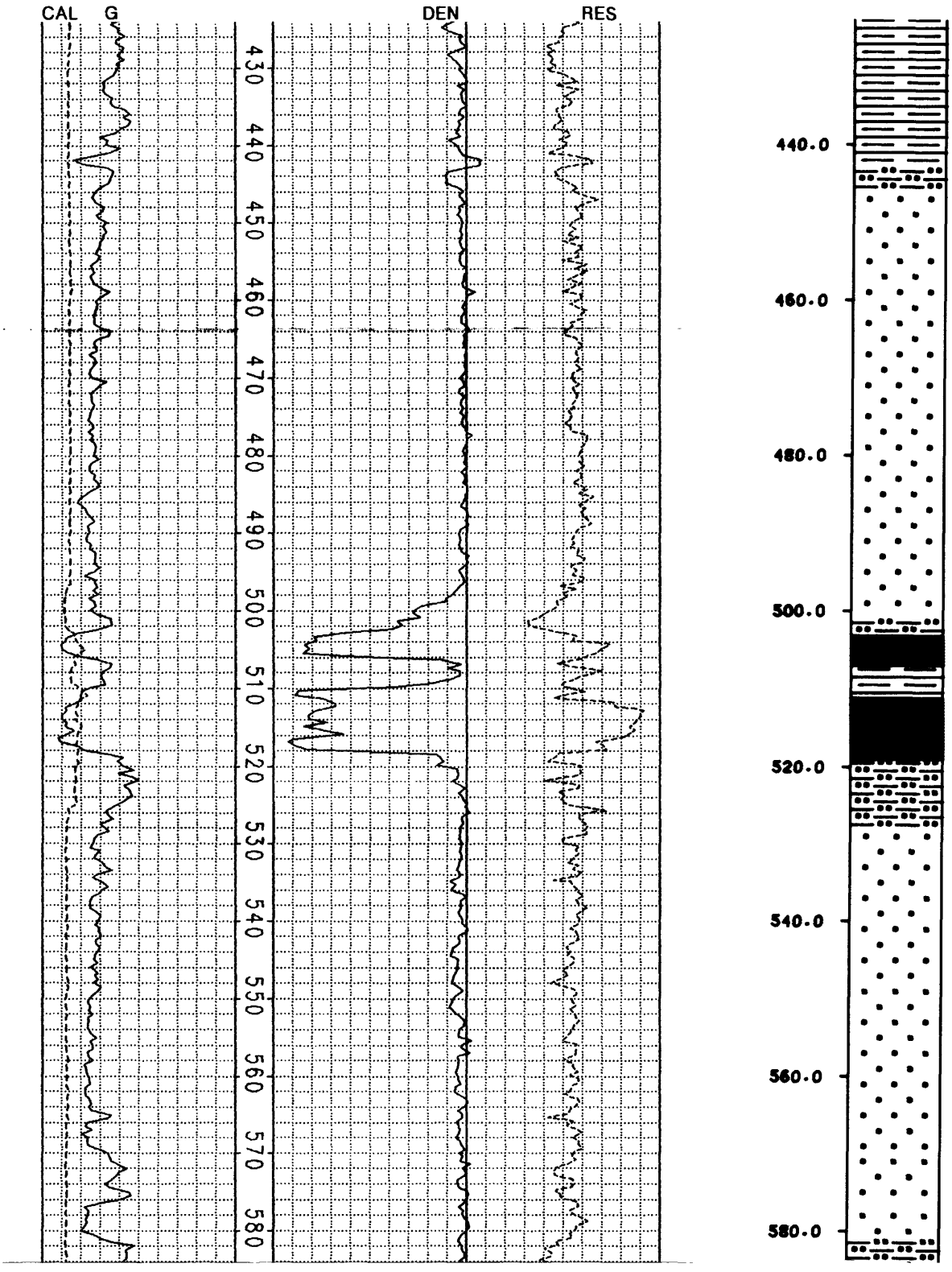

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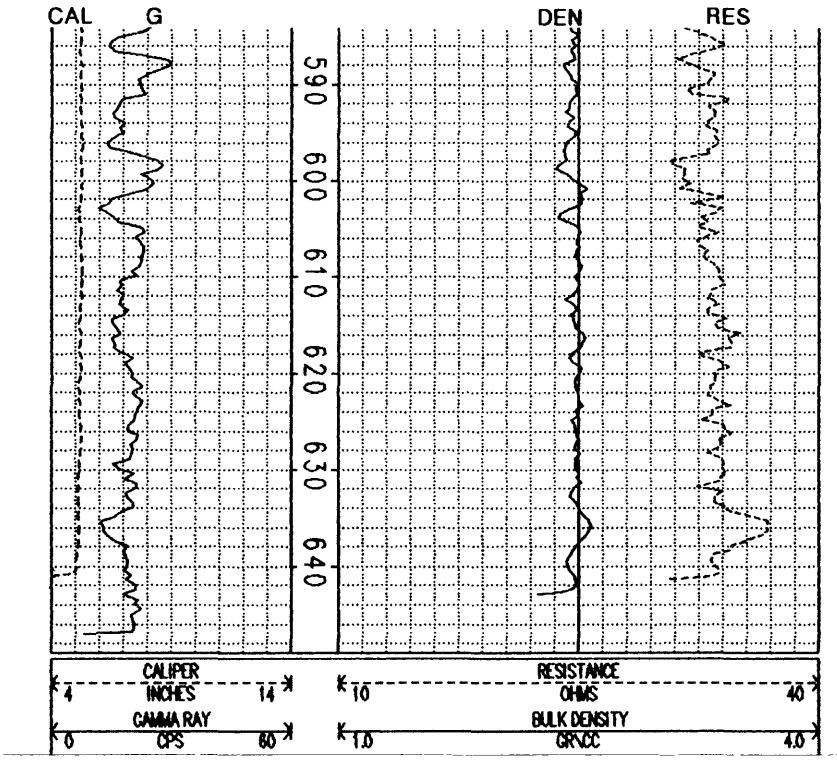

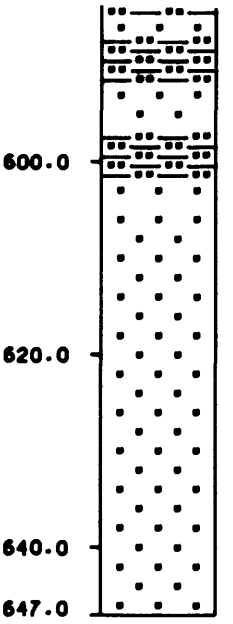

APPENDIX 2

Results of proximate analyses of coal, partings, and roof and floor rock. Refer to appendix 1 for graphic display showing stratigraphic position of each sampled interval. Depth intervals and thickness are in feet. The following abbreviations are used: E.M. - equilibrium moisture; M&A - moisture and ash; lbs SUL/MM BTU - pounds of sulfur per million Btu.

SAMPLE NO.: IC88-1
DEPTH: 184.3 - 188.7
BED NAME: A
THICKNESS: 4.4
REMARKS: .25' parting @ 187.3' and .1' parting @ 188.3 excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.23	6.59		
% Ash	25.62	25.25	27.04	
% Volatile	32.56	32.10	34.36	47.09
% Fixed Carbon	36.59	36.06	38.60	52.91
Btu	9955	9812	10504	14397
% Sulfur	.91	.90	.96	

SAMPLE NO.: IC88-2
DEPTH: 189.0 - 191.3
BED NAME: A
THICKNESS: 2.3
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.75	6.93		
% Ash	44.17	43.62	46.87	
% Volatile	24.88	24.57	26.40	49.68
% Fixed Carbon	25.20	24.88	26.73	50.32
Btu	6949	6861	7373	13877
% Sulfur	.50	.49	.53	

SAMPLE NO.: IC88-3
DEPTH: 191.3 - 193.7
BED NAME: A
THICKNESS: 2.4
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.19	6.78		
% Ash	19.75	19.42	20.84	
% Volatile	32.88	32.33	34.68	43.81
% Fixed Carbon	42.18	41.47	44.48	56.19
Btu	10908	10725	11506	14535
% Sulfur	.52	.51	.55	

SAMPLE NO.: IC88-4
DEPTH: 193.8 - 196.0
BED NAME: A
THICKNESS: 2.2
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.79	9.02		
% Ash	9.79	9.45	10.39	
% Volatile	37.55	36.26	39.86	44.48
% Fixed Carbon	46.87	45.27	49.75	55.52
Btu	12434	12007	13198	14728
% Sulfur	.75	.73	.80	

SAMPLE NO.: IC88-5
DEPTH: 196.0 - 200.0
BED NAME: A
THICKNESS: 4.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.15	5.30		
% Ash	17.69	17.48	18.46	
% Volatile	36.86	36.41	38.45	47.15
% Fixed Carbon	41.30	40.81	43.09	52.85
Btu	11458	11320	11954	14660
% Sulfur	.59	.58	.62	

SAMPLE NO.: IC88-6
DEPTH: 200.0 - 204.0
BED NAME: A
THICKNESS: 4.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.18	5.82		
% Ash	14.90	14.64	15.55	
% Volatile	38.24	37.58	39.91	47.25
% Fixed Carbon	42.68	41.96	44.54	52.75
Btu	11857	11653	12374	14653
% Sulfur	.77	.76	.81	

SAMPLE NO.: IC88-7
DEPTH: 204.2 - 207.2
BED NAME: A
THICKNESS: 3.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.17	6.11		
% Ash	13.24	13.11	13.97	
% Volatile	37.11	36.74	39.13	45.48
% Fixed Carbon	44.48	44.04	46.90	54.52
Btu	11981	11862	12635	14686
% Sulfur	.49	.48	.51	

SAMPLE NO.: IC88-8
DEPTH: 207.2 - 211.0
BED NAME: A
THICKNESS: 3.8
REMARKS: 0.1' parting @ 209.2' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.25	7.21		
% Ash	9.30	9.11	9.81	
% Volatile	36.15	35.40	38.16	42.31
% Fixed Carbon	49.30	48.28	52.03	57.69
Btu	12510	12251	13203	14640
% Sulfur	.67	.66	.71	

SAMPLE NO.: IC88-9
DEPTH: 214.0 - 215.2
BED NAME: A
THICKNESS: 1.2
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.21	8.34		
% Ash	12.79	12.37	13.50	
% Volatile	37.01	35.78	39.04	45.13
% Fixed Carbon	44.99	43.51	47.46	54.87
Btu	12021	11623	12682	14661
% Sulfur	1.04	1.01	1.10	

SAMPLE NO.: IC88-10
DEPTH: 218.0 - 221.0
BED NAME: A
THICKNESS: 3.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.17	5.38		
% Ash	10.85	10.71	11.32	
% Volatile	40.20	39.69	41.95	47.30
% Fixed Carbon	44.78	44.22	46.73	52.70
Btu	12572	12413	13119	14793
% Sulfur	.66	.65	.69	

SAMPLE NO.: IC88-11
DEPTH: 183.8 - 184.3
BED NAME: A
THICKNESS: 0.5
REMARKS: Roof rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		7.37		
% Ash		85.35	92.14	
% Volatile		7.23	7.81	99.35
% Fixed Carbon		0.05	0.05	0.65
Btu		0	0	0
% Sulfur		0.41	0.44	5.62

SAMPLE NO.: IC88-12
DEPTH: 187.3-187.5; 188.3-188.4; 188.7-189.0; 193.7-193.8; 204.0-204.2; 209.2-209.3
BED NAME: A
THICKNESS: 1.05
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		7.70		
% Ash		74.06	80.24	
% Volatile		13.67	14.81	74.95
% Fixed Carbon		4.57	4.95	25.05
Btu		749	811	4106
% Sulfur		2.32	2.51	12.71

SAMPLE NO.: IC88-14
DEPTH: 212.0-214.0; 215.2-218.0
BED NAME: A
THICKNESS: 4.8
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		3.10		
% Ash		84.97	87.68	
% Volatile		11.44	11.81	95.89
% Fixed Carbon		0.49	0.51	4.11
Btu		638	658	5345
% Sulfur		0.49	0.51	4.11

SAMPLE NO.: IC88-15
DEPTH: 221.0-221.5
BED NAME: A
THICKNESS: 0.5
REMARKS: Floor rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		0.90		
% Ash		79.77	80.49	
% Volatile		19.27	19.45	99.69
% Fixed Carbon		0.06	0.06	0.31
Btu		999	1009	5170
% Sulfur		0.11	0.11	0.57

SAMPLE NO.: 2C88-1
DEPTH: 66.2 - 66.7
BED NAME: D
THICKNESS: 0.5
REMARKS: Roof rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		7.91		
% Ash		60.72	65.93	
% Volatile		18.00	19.54	57.35
% Fixed Carbon		13.37	14.53	42.65
Btu		3877	4210	12358
% Sulfur		1.36	1.48	

SAMPLE NO.: 2C88-2
DEPTH: 66.7 - 71.6
BED NAME: D
THICKNESS: 4.9
REMARKS: .35' parting @ 68.6' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.56	7.32		
% Ash	17.67	17.34	18.71	
% Volatile	36.61	35.93	38.77	47.69
% Fixed Carbon	40.16	39.41	42.52	52.31
Btu	11000	10795	11648	14329
% Sulfur	.78	.76	.82	

SAMPLE NO.: 2C88-3
DEPTH: 72.1 - 73.8
BED NAME: D
THICKNESS: 1.7
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.31	7.47		
% Ash	10.21	9.97	10.78	
% Volatile	39.25	38.35	41.45	46.45
% Fixed Carbon	45.23	44.21	47.77	53.55
Btu	12274	11993	12962	14529
% Sulfur	.68	.67	.72	

SAMPLE NO.: 2C88-4
DEPTH: 74.6 - 78.9
BED NAME: D
THICKNESS: 4.3
REMARKS: 0.1' parting @ 76.9' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.55	7.51		
% Ash	15.29	14.97	16.19	
% Volatile	36.72	35.95	38.88	46.39
% Fixed Carbon	42.44	41.57	44.93	53.61
Btu	11460	11222	12134	14478
% Sulfur	.70	.69	.74	

SAMPLE NO.: 2C88-5
DEPTH: 78.9 - 82.9
BED NAME: D
THICKNESS: 4.0
REMARKS: 1.2' coaly shale @ 79.7' and 0.6' carbonaceous shale @ 81.5' included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	7.11	10.32		
% Ash	36.00	34.75	38.76	
% Volatile	28.12	27.14	30.27	49.42
% Fixed Carbon	28.77	27.79	30.97	50.58
Btu	7981	7705	8592	14030
% Sulfur	.88	.85	.95	

SAMPLE NO.: 2C88-6
DEPTH: 83.3 - 84.3
BED NAME: D
THICKNESS: 1.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.78	6.90		
% Ash	25.17	24.87	26.71	
% Volatile	33.10	32.70	35.13	47.93
% Fixed Carbon	35.95	35.53	38.16	52.07
Btu	9888	9769	10494	14319
% Sulfur	1.67	1.65	1.77	

SAMPLE NO.: 2C88-7
DEPTH: 85.5 - 88.1
BED NAME: D
THICKNESS: 2.6
REMARKS: 0.05' parting @ 87.7' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.32	7.79		
% Ash	25.02	24.62	26.70	
% Volatile	31.42	30.92	33.54	45.75
% Fixed Carbon	37.24	36.67	39.76	54.25
Btu	9729	9576	10386	14169
% Sulfur	1.73	1.71	1.85	

SAMPLE NO.: 2C88-8
DEPTH: 96.6 - 100.6
BED NAME: D
THICKNESS: 4.0
REMARKS: 0.2' partings @ 97.0' and 98.1' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.03	7.06		
% Ash	19.54	19.32	20.79	
% Volatile	32.99	32.62	35.10	44.31
% Fixed Carbon	41.44	41.00	44.11	55.69
Btu	10677	10560	11362	14344
% Sulfur	.56	.56	.60	

SAMPLE NO.: 2C88-9
DEPTH: 102.9 - 105.4
BED NAME: D
THICKNESS: 2.5
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.78	6.16		
% Ash	25.40	25.03	26.68	
% Volatile	34.36	33.86	36.09	49.22
% Fixed Carbon	35.46	34.95	37.23	50.78
Btu	10043	9898	10548	14386
% Sulfur	.61	.60	.64	

SAMPLE NO.: 2C88-10
DEPTH: 106.2 - 107.4
BED NAME: D
THICKNESS: 1.2
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.23	5.02		
% Ash	33.42	33.14	34.89	
% Volatile	29.90	29.65	31.22	47.94
% Fixed Carbon	32.45	32.19	33.89	52.06
Btu	8796	8723	9184	14105
% Sulfur	.65	.64	.68	

SAMPLE NO.: 2C88-11
DEPTH: 107.5 - 112.0
BED NAME: D
THICKNESS: 4.5
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.94	6.68		
% Ash	19.93	19.57	20.97	
% Volatile	34.89	34.25	36.70	46.43
% Fixed Carbon	40.24	39.50	42.33	53.57
Btu	10746	10548	11304	14304
% Sulfur	.73	.72	.77	

SAMPLE NO.: 2C88-12
DEPTH: 112.7 - 113.7
BED NAME: D
THICKNESS: 1.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.39	7.02		
% Ash	12.53	12.31	13.24	
% Volatile	36.99	36.35	39.10	45.06
% Fixed Carbon	45.09	44.32	47.66	54.94
Btu	11899	11693	12577	14497
% Sulfur	1.25	1.22	1.32	

SAMPLE NO.: 2C88-13
DEPTH: 68.3-68.65; 71.6-72.1; 73.8-74.6; 76.9-77.0
BED NAME: D
THICKNESS: 1.75
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		7.80		
% Ash		57.55	62.42	
% Volatile		18.04	19.57	52.07
% Fixed Carbon		16.61	18.01	47.93
Btu		3530	3829	10188
% Sulfur		3.07	3.33	8.85

lbs SUL/MM BTU = 8.70

SAMPLE NO.: 2C88-14
DEPTH: 82.9-83.3; 84.3-85.5
BED NAME: D
THICKNESS: 1.6
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.62		
% Ash		60.66	63.60	
% Volatile		17.68	18.54	50.93
% Fixed Carbon		17.04	17.86	49.07
Btu		4241	4446	12216
% Sulfur		1.44	1.51	4.16

lbs SUL/MM BTU = 3.40

SAMPLE NO.: 2C88-15
DEPTH: 88.1-88.6; 96.0-96.6
BED NAME: D
THICKNESS: 1.1
REMARKS: Floor rock of upper part of D bed and roof rock of lower part of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.20		
% Ash		65.00	67.85	
% Volatile		16.20	16.91	52.59
% Fixed Carbon		14.60	15.24	47.41
Btu		3512	3666	11403
% Sulfur		0.81	0.85	2.64

lbs SUL/MM BTU = 2.31

SAMPLE NO.: 2C88-16
DEPTH: 97.0-97.2; 98.1-98.3
BED NAME: D
THICKNESS: 0.4
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		12.74		
% Ash		72.39	82.95	
% Volatile		11.36	13.02	76.38
% Fixed Carbon		3.51	4.03	23.62
Btu		504	577	3386
% Sulfur		0.21	0.24	1.39

lbs SUL/MM BTU = 4.17

SAMPLE NO.: 2C88-17
DEPTH: 100.6-102.9
BED NAME: D
THICKNESS: 2.3
REMARKS: Parting

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		7.73		
% Ash		72.01	78.04	
% Volatile		12.10	13.12	59.75
% Fixed Carbon		8.16	8.84	40.25
Btu		1747	1893	8622
% Sulfur		0.28	0.31	1.39

lbs SUL/MM BTU = 1.60

SAMPLE NO.: 2C88-18
DEPTH: 105.4-106.2; 107.4-107.5; 112.0-112.7
BED NAME: D
THICKNESS: 1.6
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		3.19		
% Ash		56.15	58.00	
% Volatile		20.97	21.66	51.58
% Fixed Carbon		19.69	20.34	48.42
Btu		4934	5097	12136
% Sulfur		1.37	1.42	3.37

lbs SUL/MM BTU = 2.78

SAMPLE NO.: 2C88-19
DEPTH: 113.7 - 114.2
BED NAME: D
THICKNESS: 0.5
REMARKS: Floor rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		2.69		
% Ash		86.50	88.89	
% Volatile		7.02	7.21	64.94
% Fixed Carbon		3.79	3.90	35.06
Btu		695	714	6430
% Sulfur		1.48	1.52	13.66

lbs SUL/MM BTU = 21.29

SAMPLE NO.: 3C88-1
DEPTH: 85.9-90.9
BED NAME: D
THICKNESS: 5.0
REMARKS: 0.2' parting @ 87.7 and 0.5' parting @ 89.7 excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	9.76	9.42		
% Ash	16.33	16.39	18.09	
% Volatile	34.89	35.02	38.66	47.19
% Fixed Carbon	39.02	39.17	43.25	52.81
Btu	8980	9014	9951	12149
% Sulfur	1.02	1.02	1.13	

SAMPLE NO.: 3C88-2
DEPTH: 161.8 - 165.6
BED NAME: A
THICKNESS: 3.8
REMARKS: 0.1' parting @ 164.8' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.31	6.35		
% Ash	29.13	28.81	30.77	
% Volatile	31.64	31.29	33.42	48.27
% Fixed Carbon	33.92	33.55	35.81	51.73
Btu	9398	9294	9925	14337
% Sulfur	1.53	1.52	1.62	

SAMPLE NO.: 3C88-3
DEPTH: 166.1 - 170.0
BED NAME: A
THICKNESS: 3.9
REMARKS: 0.1' parting @ 166.8' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.91	6.08		
% Ash	22.16	21.88	23.30	
% Volatile	33.72	33.30	35.46	46.23
% Fixed Carbon	39.21	38.74	41.24	53.77
Btu	10624	10492	11172	14566
% Sulfur	.61	.60	.64	

SAMPLE NO.: 3C88-4
DEPTH: 170.1 - 172.5
BED NAME: A
THICKNESS: 2.4
REMARKS: 0.4' parting @ 171.4' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.47	11.84		
% Ash	11.47	10.81	12.26	
% Volatile	37.49	35.33	40.08	45.68
% Fixed Carbon	44.57	42.02	47.66	54.32
Btu	11981	11292	12809	14599
% Sulfur	.55	.52	.59	

SAMPLE NO.: 3C88-5
DEPTH: 172.5 - 175.9
BED NAME: A
THICKNESS: 3.4
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.44	5.96		
% Ash	19.37	19.06	20.27	
% Volatile	36.75	36.17	38.46	48.23
% Fixed Carbon	39.44	38.81	41.27	51.77
Btu	11136	10958	11654	14616
% Sulfur	.61	.60	.64	

SAMPLE NO.: 3C88-6
DEPTH: 176.0 - 179.4
BED NAME: A
THICKNESS: 3.4
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.58	6.03		
% Ash	16.92	16.67	17.73	
% Volatile	39.03	38.43	40.90	49.72
% Fixed Carbon	39.47	38.87	41.37	50.28
Btu	11450	11276	11999	14586
% Sulfur	0.56	0.55	0.59	0.72

lbs SUL/MM BTU = 0.49

SAMPLE NO.: 3C88-7
DEPTH: 179.6-184.9
BED NAME: A
THICKNESS: 5.3
REMARKS: 0.1' parting @ 180.1' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.72	7.21		
% Ash	11.24	11.07	11.93	
% Volatile	36.90	36.31	39.14	44.44
% Fixed Carbon	46.14	45.41	48.93	55.56
Btu	12136	11944	12872	14616
% Sulfur	.56	.55	.60	

SAMPLE NO.: 3C88-8
DEPTH: 185.0-187.2
BED NAME: A
THICKNESS: 2.2
REMARKS: Sample desorbed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.17	6.53		
% Ash	6.91	6.81	7.28	
% Volatile	39.73	39.16	41.90	45.19
% Fixed Carbon	48.19	47.50	50.82	54.81
Btu	13015	12828	13724	14802
% Sulfur	0.53	0.52	0.56	0.60

lbs SUL/MM BTU = 0.41

SAMPLE NO.: 3C88-9
DEPTH: 84.0-85.9
BED NAME: D
THICKNESS: 1.9
REMARKS: Interbedded coaly shale and coal

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		5.67		
% Ash		47.73	50.59	
% Volatile		24.62	26.10	52.82
% Fixed Carbon		21.98	23.31	47.18
Btu		4005	4245	8593
% Sulfur		0.47	0.50	1.01

lbs SUL/MM BTU = 1.17

SAMPLE NO.: 3C88-10
DEPTH: 87.7-87.9 and 89.7-90.2
BED NAME: D
THICKNESS: 0.7
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		5.49		
% Ash		69.40	73.43	
% Volatile		15.30	16.19	60.93
% Fixed Carbon		9.81	10.38	39.07
Btu		1659	1756	6608
% Sulfur		0.34	0.36	1.34

lbs SUL/MM BTU = 2.05

SAMPLE NO.: 3C88-11
DEPTH: 90.9-91.6
BED NAME: D
THICKNESS: 0.7
REMARKS: Interbedded claystone and bony coal

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		2.99		
% Ash		60.24	62.10	
% Volatile		17.09	17.61	46.48
% Fixed Carbon		19.68	20.29	53.52
Btu		4555	4695	12388
% Sulfur		1.01	1.04	2.73

lbs SUL/MM BTU = 2.22

SAMPLE NO.: 3C88-13
DEPTH: 161.3-161.8
BED NAME: A
THICKNESS: 0.5
REMARKS: Roof rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		5.08		
% Ash		88.11	92.83	
% Volatile		6.68	7.04	98.13
% Fixed Carbon		0.13	0.13	1.87
Btu		0	0	0
% Sulfur		0.63	0.66	9.20

SAMPLE NO.: 3C88-14
DEPTH: 164.8 - 185.0
BED NAME: A
THICKNESS: 1.7
REMARKS: Partings only in this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.57		
% Ash		73.27	76.78	
% Volatile		14.41	15.10	65.00
% Fixed Carbon		7.75	8.12	35.00
Btu		1584	1660	7148
% Sulfur		0.74	0.77	3.33
		lbs SUL/MM BTU =		4.67

SAMPLE NO.: 3C88-15
DEPTH: 187.2 - 187.5
BED NAME: A
THICKNESS: 0.3
REMARKS: Floor rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		1.65		
% Ash		91.88	93.42	
% Volatile		5.54	5.63	85.58
% Fixed Carbon		0.93	0.95	14.42
Btu		74	76	1150
% Sulfur		0.43	0.43	6.60
		lbs SUL/MM BTU =		58.11

SAMPLE NO.: 5C88-1
DEPTH: 109.7 - 111.4
BED NAME: D
THICKNESS: 1.7
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	8.95	8.73		
% Ash	16.83	16.87	18.49	
% Volatile	33.19	33.27	36.46	44.73
% Fixed Carbon	41.03	41.13	45.05	55.27
Btu	9300	9323	10215	12532
% Sulfur	.55	.55	.60	

SAMPLE NO.: 5C88-2
DEPTH: 112.7 - 114.3
BED NAME: D
THICKNESS: 1.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	9.15	9.64		
% Ash	16.82	16.73	18.52	
% Volatile	31.16	30.99	34.30	42.09
% Fixed Carbon	42.87	42.64	47.18	57.91
Btu	9482	9430	10437	12809
% Sulfur	.49	.49	.54	

SAMPLE NO.: 5C88-3
DEPTH: 116.7 - 118.3
BED NAME: D
THICKNESS: 1.6
REMARKS: .06' parting @ 118' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	8.00	9.12		
% Ash	29.21	28.86	31.76	
% Volatile	30.69	30.32	33.36	48.88
% Fixed Carbon	32.10	31.70	34.88	51.12
Btu	8296	8194	9017	13214
% Sulfur	.46	.45	.50	

SAMPLE NO.: 5C88-4
DEPTH: 118.5 - 120.4
BED NAME: D
THICKNESS: 1.9
REMARKS: 0.2' parting @ 119.5' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.28	6.98		
% Ash	23.56	23.14	24.88	
% Volatile	32.79	32.20	34.62	46.08
% Fixed Carbon	38.37	37.68	40.50	53.92
Btu	10293	10108	10867	14467
% Sulfur	.58	.57	.61	

SAMPLE NO.: 5C88-5
DEPTH: 120.4 - 122.3
BED NAME: D
THICKNESS: 1.9
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.76	6.59		
% Ash	46.62	45.72	48.95	
% Volatile	29.14	28.58	30.60	59.93
% Fixed Carbon	19.48	19.11	20.45	40.07
Btu	6628	6501	6960	13632
% Sulfur	0.53	0.52	0.56	1.10

lbs SUL/MM BTU = 0.80

SAMPLE NO.: 5C88-6
DEPTH: 122.7 - 125.3
BED NAME: D
THICKNESS: 2.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.09	7.45		
% Ash	18.32	18.05	19.50	
% Volatile	35.54	35.02	37.85	47.01
% Fixed Carbon	40.05	39.48	42.65	52.99
Btu	10862	10704	11566	14368
% Sulfur	.57	.56	.61	

SAMPLE NO.: 5C88-7
DEPTH: 125.6 - 128.7
BED NAME: D
THICKNESS: 3.1
REMARKS: 0.6' parting @ 126.8' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.16	8.73		
% Ash	12.69	12.34	13.52	
% Volatile	37.92	36.88	40.41	46.72
% Fixed Carbon	43.23	42.05	46.07	53.28
Btu	11817	11492	12593	14561
% Sulfur	.88	.85	.94	

SAMPLE NO.: 5C88-8
DEPTH: 218.6 - 221.5
BED NAME: A
THICKNESS: 2.9
REMARKS: 0.3' parting @ 218.9' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.33	6.57		
% Ash	22.74	22.44	24.02	
% Volatile	34.85	34.39	36.81	48.44
% Fixed Carbon	37.08	36.60	39.17	51.56
Btu	10361	10225	10945	14405
% Sulfur	.96	.95	1.02	

SAMPLE NO.: 5C88-9
DEPTH: 222.4 - 225.0
BED NAME: A
THICKNESS: 2.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.94	6.92		
% Ash	18.67	18.28	19.64	
% Volatile	34.78	34.06	36.59	45.53
% Fixed Carbon	41.61	40.74	43.77	54.47
Btu	11069	10838	11644	14489
% Sulfur	.62	.60	.65	

SAMPLE NO.: 5C88-10
DEPTH: 225.0 - 229.0
BED NAME: A
THICKNESS: 4.0
REMARKS: 0.3' parting @ 227.4' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.05	5.80		
% Ash	15.59	15.47	16.42	
% Volatile	34.38	34.11	36.21	43.32
% Fixed Carbon	44.98	44.62	47.37	56.68
Btu	11612	11519	12230	14632
% Sulfur	.49	.48	.51	

SAMPLE NO.: 5C88-11
DEPTH: 229.0 - 229.8
BED NAME: A
THICKNESS: 0.8
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.43	5.04		
% Ash	26.67	26.50	27.90	
% Volatile	35.55	35.32	37.20	51.59
% Fixed Carbon	33.35	33.14	34.90	48.41
Btu	9889	9826	10348	14352
% Sulfur	.55	.55	.57	

SAMPLE NO.: 5C88-12
DEPTH: 229.8 - 231.6
BED NAME: A
THICKNESS: 1.8
REMARKS: Sample desorbed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.41	5.23		
% Ash	15.57	15.43	16.28	
% Volatile	37.26	36.94	38.98	46.56
% Fixed Carbon	42.76	42.40	44.74	53.44
Btu	11752	11651	12294	14686
% Sulfur	0.56	0.55	0.58	0.70

lbs SUL/MM BTU = 0.47

SAMPLE NO.: 5C88-13
DEPTH: 231.6 - 236.0
BED NAME: A
THICKNESS: 4.4
REMARKS: 0.1' parting @ 232.1' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.04	6.07		
% Ash	15.68	15.51	16.51	
% Volatile	36.23	35.84	38.15	45.69
% Fixed Carbon	43.05	42.58	45.34	54.31
Btu	11628	11502	12245	14666
% Sulfur	.60	.60	.64	

SAMPLE NO.: 5C88-14
DEPTH: 236.2 - 240.0
BED NAME: A
THICKNESS: 3.8
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.82	7.78		
% Ash	10.29	10.07	10.92	
% Volatile	40.67	39.82	43.18	48.48
% Fixed Carbon	43.22	42.33	45.90	51.52
Btu	12336	12080	13099	14705
% Sulfur	0.80	0.78	0.85	0.95

lbs SUL/MM BTU = 0.65

SAMPLE NO.: 5C88-15
DEPTH: 240.0 - 244.7
BED NAME: A
THICKNESS: 4.7
REMARKS: 0.1' parting @ 241.8' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.16	6.48		
% Ash	9.77	9.63	10.30	
% Volatile	38.26	37.73	40.35	44.98
% Fixed Carbon	46.81	46.16	49.35	55.02
Btu	12545	12369	13227	14746
% Sulfur	.55	.54	.58	

SAMPLE NO.: 5C88-16
DEPTH: 109.2 - 109.7; 111.4 - 112.7; 114.3 - 116.7
BED NAME: D
THICKNESS: 4.2
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		7.12		
% Ash		64.20	69.12	
% Volatile		16.93	18.22	59.02
% Fixed Carbon		11.75	12.66	40.98
Btu		2673	2878	9321
% Sulfur		0.30	0.32	1.05

lbs SUL/MM BTU = 1.12

SAMPLE NO.: 5C88-17
DEPTH: 117.9 - 127.4
BED NAME: D
THICKNESS: 1.75
REMARKS: Partings only, from this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		2.92		
% Ash		63.56	65.47	
% Volatile		17.60	18.13	52.51
% Fixed Carbon		15.92	16.40	47.49
Btu		3781	3895	11280
% Sulfur		1.42	1.46	4.23

lbs SUL/MM BTU = 3.76

SAMPLE NO.: 5C88-18
DEPTH: 128.7 - 129.2
BED NAME: D
THICKNESS: 0.5
REMARKS: Floor rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		3.01		
% Ash		63.40	65.37	
% Volatile		15.08	15.55	44.90
% Fixed Carbon		18.51	19.08	55.10
Btu		4486	4626	13357
% Sulfur		1.26	1.30	3.76

lbs SUL/MM BTU = 2.81

SAMPLE NO.: 5C88-19
DEPTH: 218.1-218.6
BED NAME: A
THICKNESS: 0.5'
REMARKS: Roof rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		2.60		
% Ash		82.84	85.05	
% Volatile		11.27	11.57	77.43
% Fixed Carbon		3.29	3.38	22.57
Btu		1103	1132	7574
% Sulfur		1.05	1.08	7.23

lbs SUL/MM BTU = 9.52

SAMPLE NO.: 5C88-20
DEPTH: 218.9-241.9
BED NAME: A
THICKNESS: 1.9
REMARKS: Partings only, from this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.72		
% Ash		66.90	70.22	
% Volatile		18.48	19.39	65.12
% Fixed Carbon		9.90	10.39	34.88
Btu		2494	2618	8790
% Sulfur		1.58	1.66	5.56

lbs SUL/MM BTU = 6.34

SAMPLE NO.: 5C88-21
DEPTH: 244.7-245.2
BED NAME: A
THICKNESS: 0.5
REMARKS: Floor rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		2.88		
% Ash		83.73	86.22	
% Volatile		9.19	9.46	68.63
% Fixed Carbon		4.20	4.32	31.37
Btu		876	902	6546
% Sulfur		0.61	0.63	4.57

lbs SUL/MM BTU = 6.96

SAMPLE NO.: 6C88-1
DEPTH: 93.3-97.2
BED NAME: D
THICKNESS: 3.9
REMARKS: 0.1' parting @ 94.2 excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.93	6.13		
% Ash	19.87	19.62	20.90	
% Volatile	34.96	34.52	36.78	46.50
% Fixed Carbon	40.24	39.73	42.32	53.50
Btu	10842	10705	11404	14418
% Sulfur	0.67	0.66	0.71	0.89

lbs SUL/MM BTU = 0.62

SAMPLE NO.: 6C88-2
DEPTH: 98.1-101.1
BED NAME: D
THICKNESS: 3.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.13	6.39		
% Ash	15.92	15.71	16.79	
% Volatile	36.30	35.82	38.26	45.98
% Fixed Carbon	42.65	42.08	44.95	54.02
Btu	11471	11319	12092	14531
% Sulfur	0.53	0.53	0.56	0.68

lbs SUL/MM BTU = 0.47

SAMPLE NO.: 6C88-3
DEPTH: 101.1-105.0
BED NAME: D
THICKNESS: 3.9
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.12	7.37		
% Ash	21.67	21.38	23.08	
% Volatile	33.57	33.12	35.76	46.49
% Fixed Carbon	38.64	38.13	41.16	53.51
Btu	10411	10272	11089	14417
% Sulfur	0.74	0.73	0.79	1.03

lbs SUL/MM BTU = 0.71

SAMPLE NO.: 6C88-4
DEPTH: 105.0-106.7
BED NAME: D
THICKNESS: 1.7
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.77	7.38		
% Ash	22.37	22.22	23.99	
% Volatile	31.92	31.71	34.23	45.04
% Fixed Carbon	38.94	38.69	41.78	54.96
Btu	10138	10072	10874	14307
% Sulfur	0.64	0.64	0.69	0.91

lbs SUL/MM BTU = 0.64

SAMPLE NO.: 6C88-5
DEPTH: 107.6-108.2
BED NAME: D
THICKNESS: 0.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.63	8.72		
% Ash	19.94	19.49	21.36	
% Volatile	33.19	32.45	35.55	45.20
% Fixed Carbon	40.24	39.34	43.09	54.80
Btu	10675	10436	11433	14537
% Sulfur	0.85	0.83	0.91	1.16

lbs SUL/MM BTU = 0.80

SAMPLE NO.: 6C88-6
DEPTH: 109.6-112.1
BED NAME: D
THICKNESS: 2.5
REMARKS: 0.2' parting @ 110.4' and 0.1' parting @ 111.8' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.48	8.58		
% Ash	27.08	26.48	28.96	
% Volatile	31.33	30.62	33.50	47.15
% Fixed Carbon	35.11	34.32	37.54	52.85
Btu	9516	9302	10175	14324
% Sulfur	0.64	0.63	0.69	0.97

lbs SUL/MM BTU = 0.68

SAMPLE NO.: 6C88-7
DEPTH: 115.85 - 118.0
BED NAME: D
THICKNESS: 2.15
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.15	7.91		
% Ash	18.78	18.42	20.01	
% Volatile	34.11	33.47	36.35	45.44
% Fixed Carbon	40.96	40.20	43.64	54.56
Btu	10871	10668	11584	14481
% Sulfur	0.65	0.63	0.69	0.86

lbs SUL/MM BTU = 0.59

SAMPLE NO.: 6C88-8
DEPTH: 119.0 - 120.7
BED NAME: D
THICKNESS: 1.7
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.85	7.38		
% Ash	32.26	31.74	34.27	
% Volatile	28.48	28.02	30.25	46.02
% Fixed Carbon	33.41	32.86	35.48	53.98
Btu	8928	8783	9483	14426
% Sulfur	0.51	0.50	0.54	0.82

lbs SUL/MM BTU = 0.57

SAMPLE NO.: 6C88-9
DEPTH: 123.9 - 127.0
BED NAME: D
THICKNESS: 3.1
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.17	7.42		
% Ash	29.71	29.00	31.33	
% Volatile	30.91	30.17	32.59	47.46
% Fixed Carbon	34.21	33.41	36.08	52.54
Btu	9468	9244	9985	14540
% Sulfur	0.57	0.55	0.60	0.87

lbs SUL/MM BTU = 0.59

SAMPLE NO.: 6C88-10
DEPTH: 127.03 - 129.3
BED NAME: D
THICKNESS: 2.27
REMARKS: include thin ash partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.43	6.09		
% Ash	42.72	42.42	45.17	
% Volatile	26.85	26.67	28.40	51.79
% Fixed Carbon	25.00	24.82	26.43	48.21
Btu	7186	7136	7599	13859
% Sulfur	0.57	0.56	0.60	1.10

lbs SUL/MM BTU = 0.78

SAMPLE NO.: 6C88-11
DEPTH: 129.3 - 131.2
BED NAME: D
THICKNESS: 1.9
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.16	8.03		
% Ash	22.43	21.98	23.90	
% Volatile	31.62	30.99	33.69	44.28
% Fixed Carbon	39.79	39.00	42.41	55.72
Btu	10309	10103	10985	14436
% Sulfur	0.57	0.55	0.60	0.79

lbs SUL/MM BTU = 0.54

SAMPLE NO.: 6C88-12
DEPTH: 131.2 - 134.4
BED NAME: D
THICKNESS: 3.2
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.23	6.33		
% Ash	21.33	21.08	22.50	
% Volatile	33.46	33.07	35.31	45.56
% Fixed Carbon	39.98	39.52	42.19	54.44
Btu	10593	10470	11178	14423
% Sulfur	1.23	1.21	1.29	1.67

lbs SUL/MM BTU = 1.16

SAMPLE NO.: 6C88-13
DEPTH: 135.0-136.9
BED NAME: D
THICKNESS: 1.9
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.50	6.35		
% Ash	35.12	34.80	37.16	
% Volatile	27.78	27.53	29.40	46.78
% Fixed Carbon	31.60	31.32	33.44	53.22
Btu	8512	8435	9007	14334
% Sulfur	2.34	2.32	2.48	3.95

lbs SUL/MM BTU = 2.75

SAMPLE NO.: 6C88-14
DEPTH: 136.9-137.9
BED NAME: D
THICKNESS: 1.0
REMARKS: Floor rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		11.11		
% Ash		76.11	85.62	
% Volatile		10.02	11.27	78.39
% Fixed Carbon		2.76	3.11	21.61
Btu		885	996	6926
% Sulfur		0.81	0.91	6.35

lbs SUL/MM BTU = 9.15

SAMPLE NO.: 6C88-15
DEPTH: 92.8-93.3
BED NAME: D
THICKNESS: 0.5
REMARKS: Roof rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		1.78		
% Ash		88.32	89.92	
% Volatile		8.93	9.10	90.21
% Fixed Carbon		0.97	0.98	9.79
Btu		514	523	5185
% Sulfur		0.78	0.80	7.89

lbs SUL/MM BTU = 15.18

SAMPLE NO.: 6C88-16
DEPTH: 94.2-94.3; 97.2-98.1
BED NAME: D
THICKNESS: 1.0,
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		13.93		
% Ash		68.49	79.57	
% Volatile		11.37	13.20	64.64
% Fixed Carbon		6.21	7.23	35.36
Btu		1197	1390	6807
% Sulfur		0.69	0.81	3.94

lbs SUL/MM BTU = 5.76

SAMPLE NO.: 6C88-17
DEPTH: 106.7-107.6; 108.2-109.6; 110.4-110.6; 111.8-111.9
BED NAME: D
THICKNESS: 2.6
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		6.44		
% Ash		57.79	61.77	
% Volatile		19.30	20.63	53.97
% Fixed Carbon		16.47	17.60	46.03
Btu		4337	4636	12127
% Sulfur		1.19	1.28	3.34

lbs SUL/MM BTU = 2.74

SAMPLE NO.: 6C88-18
DEPTH: 112.1-115.85; 118.0-119.0
BED NAME: D
THICKNESS: 4.75
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		6.00		
% Ash		67.16	71.45	
% Volatile		16.24	17.28	60.52
% Fixed Carbon		10.60	11.27	39.48
Btu		2728	2903	10166
% Sulfur		0.40	0.42	1.48

lbs SUL/MM BTU = 1.47

SAMPLE NO.: 6C88-19
DEPTH: 120.7-123.9
BED NAME: D
THICKNESS: 3.2
REMARKS: Parting

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		10.72		
% Ash		79.99	89.60	
% Volatile		9.11	10.20	98.08
% Fixed Carbon		0.18	0.20	1.92
Btu		7	8	81
% Sulfur		0.01	0.01	0.10

lbs SUL/MM BTU = 14.29

SAMPLE NO.: 8C88-1
DEPTH: 77.6 - 79.3
BED NAME: D
THICKNESS: 1.7
REMARKS: Roof rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.00	6.11		
% Ash	87.60	85.67	91.25	
% Volatile	8.29	8.10	8.63	98.62
% Fixed Carbon	0.11	0.12	0.12	1.38
Btu	48	47	50	577
% Sulfur	0.40	0.39	0.41	4.73

lbs SUL/MM BTU = 82.98

SAMPLE NO.: 8C88-2
DEPTH: 79.3 - 81.4
BED NAME: D
THICKNESS: 2.1
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.22	6.62		
% Ash	11.47	11.30	12.10	
% Volatile	37.85	37.29	39.94	45.43
% Fixed Carbon	45.46	44.79	47.96	54.57
Btu	12185	12005	12856	14625
% Sulfur	0.77	0.76	0.81	0.92

lbs SUL/MM BTU = 0.63

SAMPLE NO.: 8C88-3
DEPTH: 81.5 - 86.0
BED NAME: D
THICKNESS: 4.5
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.45	7.71		
% Ash	19.47	19.01	20.60	
% Volatile	35.10	34.26	37.13	46.76
% Fixed Carbon	39.98	39.02	42.27	53.24
Btu	10830	10571	11455	14426
% Sulfur	0.77	0.75	0.82	1.03

lbs SUL/MM BTU = 0.71

SAMPLE NO.: 8C88-4
DEPTH: 91.0 - 92.5
BED NAME: D
THICKNESS: 1.5
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.57	8.79		
% Ash	49.54	48.36	53.02	
% Volatile	22.73	22.19	24.32	51.78
% Fixed Carbon	21.16	20.66	22.66	48.22
Btu	5875	5736	6288	13386
% Sulfur	1.29	1.26	1.38	2.95

lbs SUL/MM BTU = 2.20

SAMPLE NO.: 8C88-5
DEPTH: 92.5 - 93.1
BED NAME: D
THICKNESS: 0.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.31	8.16		
% Ash	16.35	16.03	17.46	
% Volatile	35.26	34.56	37.64	45.59
% Fixed Carbon	42.08	41.25	44.90	54.41
Btu	10983	10767	11723	14202
% Sulfur	0.86	0.84	0.92	1.11

lbs SUL/MM BTU = 0.78

SAMPLE NO.: 8C88-6
DEPTH: 95.0 - 97.4
BED NAME: D
THICKNESS: 2.4
REMARKS: partings excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.62	7.20		
% Ash	19.30	18.98	20.45	
% Volatile	33.73	33.17	35.74	44.93
% Fixed Carbon	41.35	40.65	43.81	55.07
Btu	10942	10759	11593	14574
% Sulfur	0.84	0.83	0.89	1.12

lbs SUL/MM BTU = 0.77

SAMPLE NO.: 8C88-7
DEPTH: 98.5 - 100.7
BED NAME: D
THICKNESS: 2.2
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.85	9.73		
% Ash	42.72	41.40	45.87	
% Volatile	25.36	24.58	27.23	50.30
% Fixed Carbon	25.07	24.29	26.90	49.70
Btu	7050	6832	7568	13981
% Sulfur	0.55	0.53	0.59	1.09

lbs SUL/MM BTU = 0.78

SAMPLE NO.: 8C88-8
DEPTH: 100.7 - 102.7
BED NAME: D
THICKNESS: 2.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.86	7.79		
% Ash	14.55	14.25	15.46	
% Volatile	34.75	34.04	36.91	43.66
% Fixed Carbon	44.84	43.92	47.63	56.34
Btu	11571	11334	12292	14539
% Sulfur	0.60	0.58	0.63	0.75

lbs SUL/MM BTU = 0.51

SAMPLE NO.: 8C88-9
DEPTH: 102.7 - 103.8
BED NAME: D
THICKNESS: 1.1
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.14	6.11		
% Ash	29.01	28.72	30.59	
% Volatile	30.85	30.53	32.52	46.85
% Fixed Carbon	35.00	34.64	36.89	53.15
Btu	9532	9434	10048	14476
% Sulfur	0.56	0.56	0.59	0.86

lbs SUL/MM BTU = 0.59

SAMPLE NO.: 8C88-10
DEPTH: 103.8 - 106.0
BED NAME: D
THICKNESS: 2.2
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.03	7.93		
% Ash	29.69	28.78	31.26	
% Volatile	28.99	28.10	30.52	44.40
% Fixed Carbon	36.29	35.19	38.22	55.60
Btu	9384	9097	9881	14374
% Sulfur	1.06	1.02	1.11	1.62

lbs SUL/MM BTU = 1.12

SAMPLE NO.: 8C88-11
DEPTH: 108.8 - 112.4
BED NAME: D
THICKNESS: 3.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.64	6.98		
% Ash	30.43	29.69	31.92	
% Volatile	31.12	30.35	32.63	47.93
% Fixed Carbon	33.81	32.98	35.45	52.07
Btu	9332	9103	9786	14373
% Sulfur	0.56	0.55	0.59	0.87

lbs SUL/MM BTU = 0.60

SAMPLE NO.: 8C88-12
DEPTH: 112.6 - 115.0
BED NAME: D
THICKNESS: 2.4
REMARKS: 0.1' parting @ 114.5' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.38	5.93		
% Ash	38.18	37.56	39.93	
% Volatile	29.03	28.56	30.36	50.53
% Fixed Carbon	28.41	27.95	29.71	49.47
Btu	8011	7881	8378	13947
% Sulfur	0.63	0.62	0.66	1.10

lbs SUL/MM BTU = 0.79

SAMPLE NO.: 8C88-13
DEPTH: 115.0 - 116.3
BED NAME: D
THICKNESS: 1.3
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.61	10.47		
% Ash	12.52	11.87	13.26	
% Volatile	35.94	34.09	38.07	43.89
% Fixed Carbon	45.93	43.57	48.67	56.11
Btu	12013	11394	12727	14672
% Sulfur	0.69	0.66	0.73	0.85

lbs SUL/MM BTU = 0.58

SAMPLE NO.: 8C88-14
DEPTH: 116.3 - 119.6
BED NAME: D
THICKNESS: 3.3
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.76	5.92		
% Ash	15.97	15.77	16.77	
% Volatile	35.14	34.72	36.90	44.33
% Fixed Carbon	44.13	43.59	46.33	55.67
Btu	11523	11383	12099	14536
% Sulfur	0.86	0.85	0.90	1.08

lbs SUL/MM BTU = 0.75

SAMPLE NO.: 8C88-15
DEPTH: 119.6 - 120.8
BED NAME: D
THICKNESS: 1.2
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.30	4.94		
% Ash	49.86	49.53	52.10	
% Volatile	25.47	25.30	26.62	55.56
% Fixed Carbon	20.37	20.23	21.28	44.44
Btu	5959	5919	6226	12999
% Sulfur	0.62	0.62	0.65	1.36

lbs SUL/MM BTU = 1.05

SAMPLE NO.: 8C88-16
DEPTH: 123.3 - 124.3
BED NAME: D
THICKNESS: 1.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.10	6.39		
% Ash	28.27	27.89	29.79	
% Volatile	31.76	31.32	33.46	47.66
% Fixed Carbon	34.87	34.40	36.75	52.34
Btu	9504	9375	10015	14265
% Sulfur	2.14	2.11	2.26	3.22

lbs SUL/MM BTU = 2.25

SAMPLE NO.: 8C88-17
DEPTH: 125.5 - 128.1
BED NAME: D
THICKNESS: 2.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.84	7.61		
% Ash	28.69	28.15	30.47	
% Volatile	29.47	28.92	31.30	45.01
% Fixed Carbon	36.00	35.32	38.23	54.99
Btu	9358	9182	9938	14293
% Sulfur	1.23	1.21	1.31	1.88

lbs SUL/MM BTU = 1.32

SAMPLE NO.: 8C88-18
DEPTH: 93.1 - 98.5
BED NAME: D
THICKNESS: 3.5
REMARKS: Partings only, from this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.25		
% Ash		70.09	73.20	
% Volatile		17.31	18.08	67.45
% Fixed Carbon		8.35	8.72	32.55
Btu		2241	2340	8733
% Sulfur		0.67	0.70	2.62

lbs SUL/MM BTU = 2.99

SAMPLE NO.: 8C88-19
DEPTH: 106.0 - 108.8
BED NAME: D
THICKNESS: 2.8
REMARKS: Parting

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		7.98		
% Ash		76.09	82.69	
% Volatile		12.44	13.52	78.07
% Fixed Carbon		3.49	3.79	21.93
Btu		1069	1162	6711
% Sulfur		0.24	0.26	1.51

lbs SUL/MM BTU = 2.25

SAMPLE NO.: 8C88-20
DEPTH: 112.4 - 112.6; 114.5 - 114.6
BED NAME: D
THICKNESS: 0.3
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		3.96		
% Ash		70.45	73.36	
% Volatile		16.20	16.86	63.30
% Fixed Carbon		9.39	9.78	36.70
Btu		2333	2429	9117
% Sulfur		0.42	0.44	1.64

lbs SUL/MM BTU = 1.80

SAMPLE NO.: 8C88-21
DEPTH: 120.8 - 123.3
BED NAME: D
THICKNESS: 2.5
REMARKS: Parting

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		3.76		
% Ash		87.55	90.97	
% Volatile		7.61	7.91	87.58
% Fixed Carbon		1.08	1.12	12.42
Btu		506	525	5817
% Sulfur		1.12	1.16	12.86

lbs SUL/MM BTU = 22.13

SAMPLE NO.: 8C88-22
DEPTH: 124.3-125.5
BED NAME: D
THICKNESS: 1.2
REMARKS: Parting

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		11.98		
% Ash		70.91	80.57	
% Volatile		12.57	14.29	73.51
% Fixed Carbon		4.54	5.14	26.49
Btu		882	1002	5157
% Sulfur		0.96	1.09	5.59

lbs SUL/MM BTU = 10.88

SAMPLE NO.: 8C88-23
DEPTH: 128.1 - 128.6
BED NAME: D
THICKNESS: 0.5
REMARKS: Floor rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		3.10		
% Ash		78.17	80.68	
% Volatile		13.31	13.74	71.10
% Fixed Carbon		5.42	5.58	28.90
Btu		1711	1765	9136
% Sulfur		0.95	0.98	5.08

lbs SUL/MM BTU = 5.55

SAMPLE NO.: 10C88-1
DEPTH: 342.5 – 343.1
BED NAME: D
THICKNESS: 0.6
REMARKS: Roof rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.00		
% Ash		84.93	88.47	
% Volatile		9.83	10.24	88.80
% Fixed Carbon		1.24	1.29	11.20
Btu		615	640	5556
% Sulfur		0.90	0.94	8.14

lbs SUL/MM BTU = 14.63

SAMPLE NO.: 10C88-2
DEPTH: 343.1 – 346.6
BED NAME: D
THICKNESS: 3.5
REMARKS: includes partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.74	5.31		
% Ash	17.85	17.56	18.55	
% Volatile	36.29	35.70	37.70	46.28
% Fixed Carbon	42.12	41.43	43.75	53.72
Btu	11442	11255	11886	14592
% Sulfur	1.16	1.14	1.20	1.47

lbs SUL/MM BTU = 1.01

SAMPLE NO.: 10C88-4
DEPTH: 347.5 – 352.0
BED NAME: D
THICKNESS: 4.5
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.18	3.90		
% Ash	17.05	16.92	17.61	
% Volatile	35.92	35.65	37.10	45.02
% Fixed Carbon	43.85	43.53	45.29	54.98
Btu	11764	11677	12151	14748
% Sulfur	.57	.56	.59	

SAMPLE NO.: 10C88-5
DEPTH: 352.0 – 354.8
BED NAME: D
THICKNESS: 2.8
REMARKS: 0.2' parting @ 352.0' and 0.5' parting @ 354.3' included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.57	5.12		
% Ash	37.82	37.60	39.63	
% Volatile	28.01	27.85	29.36	48.63
% Fixed Carbon	29.60	29.43	31.01	51.37
Btu	8133	8086	8523	14118
% Sulfur	.60	.60	.63	

SAMPLE NO.: 10C88-6
DEPTH: 354.8 – 356.3
BED NAME: D
THICKNESS: 1.5
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.90		
% Ash		17.91	18.83	
% Volatile		33.05	34.76	42.82
% Fixed Carbon		44.14	46.41	57.18
Btu		11424	12012	14800
% Sulfur		0.63	0.66	0.81

lbs SUL/MM BTU = 0.55

SAMPLE NO.: 10C88-8
DEPTH: 356.8 – 357.5
BED NAME: D
THICKNESS: 0.7
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.05	6.06		
% Ash	16.98	16.62	17.69	
% Volatile	39.99	39.16	41.68	50.64
% Fixed Carbon	38.98	38.16	40.63	49.36
Btu	11602	11359	12092	14691
% Sulfur	0.70	0.69	0.73	0.89

lbs SUL/MM BTU = 0.61

SAMPLE NO.: 10C88-10
DEPTH: 359.4 - 360.4
BED NAME: D
THICKNESS: 1.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.39	5.31		
% Ash	14.36	14.22	15.02	
% Volatile	40.62	40.23	42.48	49.99
% Fixed Carbon	40.63	40.24	42.50	50.01
Btu	11843	11729	12386	14576
% Sulfur	0.63	0.63	0.66	0.78

lbs SUL/MM BTU = 0.54

SAMPLE NO.: 10C88-12
DEPTH: 361.0 - 362.1
BED NAME: D
THICKNESS: 1.1
REMARKS: 0.1' parting @ 361.8' included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		5.81		
% Ash		25.84	27.43	
% Volatile		33.22	35.27	48.60
% Fixed Carbon		35.13	37.30	51.40
Btu		9818	10423	14364
% Sulfur		0.52	0.55	0.76

lbs SUL/MM BTU = 0.53

SAMPLE NO.: 10C88-13
DEPTH: 364.6 - 365.4
BED NAME: D
THICKNESS: 0.8
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.94	5.75		
% Ash	23.47	23.03	24.44	
% Volatile	37.17	36.47	38.69	51.21
% Fixed Carbon	35.42	34.75	36.87	48.79
Btu	10711	10509	11151	14757
% Sulfur	0.68	0.67	0.71	0.94

lbs SUL/MM BTU = 0.64

SAMPLE NO.: 10C88-15
DEPTH: 365.9 - 367.0
BED NAME: D
THICKNESS: 1.1
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.85	8.25		
% Ash	14.05	13.54	14.76	
% Volatile	37.80	36.45	39.73	46.61
% Fixed Carbon	43.30	41.76	45.51	53.39
Btu	11971	11543	12581	14760
% Sulfur	0.57	0.55	0.60	0.71

lbs SUL/MM BTU = 0.48

SAMPLE NO.: 10C88-16
DEPTH: 367.0 - 368.4
BED NAME: D
THICKNESS: 1.4
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.02	5.65		
% Ash	22.97	22.58	23.94	
% Volatile	35.64	35.03	37.13	48.81
% Fixed Carbon	37.37	36.74	38.93	51.19
Btu	10643	10462	11089	14578
% Sulfur	0.54	0.53	0.56	0.73

lbs SUL/MM BTU = 0.51

SAMPLE NO.: 10C88-18
DEPTH: 369.0 - 371.4
BED NAME: D
THICKNESS: 2.4
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.65	4.89		
% Ash	14.24	14.21	14.94	
% Volatile	34.79	34.70	36.49	42.89
% Fixed Carbon	46.32	46.20	48.57	57.11
Btu	12020	11990	12607	14821
% Sulfur	.47	.47	.49	

SAMPLE NO.: 10C88-20
DEPTH: 373.9 - 376.0
BED NAME: D
THICKNESS: 2.1
REMARKS: 0.1' parting @ 375.5' included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.60	4.76		
% Ash	26.73	26.41	27.73	
% Volatile	32.76	32.36	33.98	47.01
% Fixed Carbon	36.91	36.47	38.29	52.99
Btu	10128	10005	10506	14537
% Sulfur	.52	.52	.54	

SAMPLE NO.: 10C88-21
DEPTH: 376.0 - 376.6
BED NAME: D
THICKNESS: 0.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.40		
% Ash		37.47	39.19	
% Volatile		26.70	27.93	45.92
% Fixed Carbon		31.43	32.88	54.08
Btu		8270	8651	14227
% Sulfur		0.49	0.51	0.84

lbs SUL/MM BTU = 0.59

SAMPLE NO.: 10C88-22
DEPTH: 376.6 - 377.8
BED NAME: D
THICKNESS: 1.2
REMARKS: includes 0.1' parting @ 377.4'

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.73	4.85		
% Ash	20.03	19.80	20.81	
% Volatile	40.07	39.61	41.63	52.56
% Fixed Carbon	36.17	35.74	37.56	47.44
Btu	11152	11023	11584	14628
% Sulfur	0.72	0.71	0.75	0.95

lbs SUL/MM BTU = 0.64

SAMPLE NO.: 10C88-23
DEPTH: 377.8 - 378.3
BED NAME: D
THICKNESS: 0.5
REMARKS: include 0.1' parting @ 378.2'

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		5.38		
% Ash		48.69	51.46	
% Volatile		23.93	25.29	52.09
% Fixed Carbon		22.00	23.25	47.91
Btu		6352	6713	13828
% Sulfur		0.39	0.42	0.86

lbs SUL/MM BTU = 0.61

SAMPLE NO.: 10C88-24-26
DEPTH: 378.3 - 382.0
BED NAME: D
THICKNESS: 3.7
REMARKS: includes 0.3' parting @ 380.8'

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.86	5.29		
% Ash	29.77	29.33	30.97	
% Volatile	34.08	33.57	35.45	51.35
% Fixed Carbon	32.29	31.81	33.58	48.65
Btu	9643	9500	10031	14530
% Sulfur	0.55	0.54	0.57	0.83

lbs SUL/MM BTU = 0.57

SAMPLE NO.: 10C88-28-30
DEPTH: 383.0 - 387.8
BED NAME: D
THICKNESS: 4.8
REMARKS: 0.2' parting @ 384.8' and 0.3' parting @ 386.2 excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.00	5.60		
% Ash	18.44	18.13	19.21	
% Volatile	37.75	37.12	39.32	48.67
% Fixed Carbon	39.81	39.15	41.47	51.33
Btu	11347	11158	11820	14631
% Sulfur	0.67	0.66	0.70	0.87

lbs SUL/MM BTU = 0.59

SAMPLE NO.: 10C88-31
DEPTH: 389.3 - 390.4
BED NAME: D
THICKNESS: 1.1
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.13	5.57		
% Ash	18.18	17.91	18.97	
% Volatile	33.92	33.41	35.38	43.66
% Fixed Carbon	43.77	43.11	45.65	56.34
Btu	11335	11164	11823	14591
% Sulfur	1.26	1.25	1.32	

SAMPLE NO.: 10C88-33
DEPTH: 391.3 - 394.3
BED NAME: D
THICKNESS: 3.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.93	6.28		
% Ash	16.01	15.62	16.67	
% Volatile	35.54	34.67	37.00	44.40
% Fixed Carbon	44.52	43.43	46.33	55.60
Btu	11755	11467	12236	14684
% Sulfur	1.00	.98	1.04	

SAMPLE NO.: 10C88-34
DEPTH: 394.3 - 396.0
BED NAME: D
THICKNESS: 1.7
REMARKS: Floor rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		7.50		
% Ash		74.31	80.34	
% Volatile		11.38	12.30	62.54
% Fixed Carbon		6.81	7.36	37.46
Btu		1639	1772	9010
% Sulfur		0.75	0.82	4.15

lbs SUL/MM BTU = 4.58

SAMPLE NO.: 10C88-35
DEPTH: 424.7 - 426.8
BED NAME: A
THICKNESS: 2.1
REMARKS: Roof rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		8.16		
% Ash		65.44	71.25	
% Volatile		16.16	17.59	61.19
% Fixed Carbon		10.24	11.16	38.81
Btu		2708	2948	10255
% Sulfur		2.68	2.92	10.15

lbs SUL/MM BTU = 9.90

SAMPLE NO.: 10C88-36-38
DEPTH: 426.8 - 430.3
BED NAME: A
THICKNESS: 3.5
REMARKS: 0.2' parting @ 429.4' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.01	4.25		
% Ash	19.09	18.85	19.69	
% Volatile	34.90	34.46	35.99	44.81
% Fixed Carbon	43.00	42.44	44.32	55.19
Btu	11459	11312	11815	14712
% Sulfur	.83	.82	.86	

SAMPLE NO.: 10C88-39+40
DEPTH: 431.0 - 436.5
BED NAME: A
THICKNESS: 5.5
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.10	4.60		
% Ash	17.92	17.65	18.50	
% Volatile	34.16	33.63	35.25	43.25
% Fixed Carbon	44.82	44.12	46.25	56.75
Btu	11776	11593	12152	14910
% Sulfur	0.62	0.61	0.64	0.79

lbs SUL/MM BTU = 0.53

SAMPLE NO.: 10C88-42
DEPTH: 436.7-438.0
BED NAME: A
THICKNESS: 1.3
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.00	3.41		
% Ash	33.24	33.10	34.27	
% Volatile	34.35	34.21	35.41	53.88
% Fixed Carbon	29.41	29.28	30.32	46.12
Btu	9134	9095	9417	14326
% Sulfur	0.43	0.43	0.45	0.68

lbs SUL/MM BTU = 0.47

SAMPLE NO.: 10C88-43
DEPTH: 438.0 - 442.0
BED NAME: A
THICKNESS: 4.0
REMARKS: 0.2' parting @ 438.9' included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.10	3.55		
% Ash	17.63	17.55	18.20	
% Volatile	38.36	38.18	39.58	48.39
% Fixed Carbon	40.91	40.72	42.22	51.61
Btu	11744	11689	12119	14816
% Sulfur	0.57	0.57	0.59	0.72

lbs SUL/MM BTU = 0.49

SAMPLE NO.: 10C88-44
DEPTH: 442.0 - 445.0
BED NAME: A
THICKNESS: 3.0
REMARKS: 0.1' parting @ 442.0' included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.06	4.52		
% Ash	16.29	16.05	16.81	
% Volatile	35.67	35.13	36.79	44.23
% Fixed Carbon	44.98	44.30	46.40	55.77
Btu	11919	11739	12295	14779
% Sulfur	0.98	0.97	1.01	1.22

lbs SUL/MM BTU = 0.83

SAMPLE NO.: 10C88-46-47
DEPTH: 446.6-450.6
BED NAME: A
THICKNESS: 4.0
REMARKS: 0.1' parting @ 447.7' included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	2.75	3.74		
% Ash	14.68	14.53	15.10	
% Volatile	36.72	36.34	37.76	44.47
% Fixed Carbon	45.85	45.39	47.14	55.53
Btu	12262	12137	12609	14852
% Sulfur	.54	.53	.55	

SAMPLE NO.: 10C88-49
DEPTH: 451.1 - 454.0
BED NAME: A
THICKNESS: 2.9
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	2.63	3.29		
% Ash	10.59	10.52	10.88	
% Volatile	42.61	42.32	43.76	49.10
% Fixed Carbon	44.17	43.87	45.36	50.90
Btu	12979	12891	13330	14957
% Sulfur	0.63	0.63	0.65	0.73

lbs SUL/MM BTU = 0.49

SAMPLE NO.: 10C88-50
DEPTH: 454.0 - 456.0
BED NAME: A
THICKNESS: 2.0
REMARKS: Sample desorbed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	2.75	3.81		
% Ash	4.85	4.80	4.99	
% Volatile	42.62	42.16	43.83	46.13
% Fixed Carbon	49.78	49.23	51.18	53.87
Btu	13870	13719	14262	15012
% Sulfur	0.70	0.70	0.72	0.76

lbs SUL/MM BTU = 0.51

SAMPLE NO.: 10C88-51
DEPTH: 456.0-458.5
BED NAME: A
THICKNESS: 2.5
REMARKS: 0.2' parting @ 457' included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	2.87	3.88		
% Ash	15.74	15.58	16.21	
% Volatile	40.58	40.16	41.78	49.86
% Fixed Carbon	40.81	40.38	42.01	50.14
Btu	12092	11967	12450	14858
% Sulfur	0.70	0.69	0.72	0.86

lbs SUL/MM BTU = 0.58

SAMPLE NO.: 10C88-52-53
DEPTH: 458.5-459.5
BED NAME: A
THICKNESS: 1.0
REMARKS: Floor rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		9.04		
% Ash		62.27	68.46	
% Volatile		15.36	16.88	53.51
% Fixed Carbon		13.33	14.66	46.49
Btu		3398	3736	11844
% Sulfur		1.29	1.41	

SAMPLE NO.: 10C88-54
DEPTH: 346.6-373.9
BED NAME: D
THICKNESS: 10.1
REMARKS: Partings only, from this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.45		
% Ash		63.34	66.29	
% Volatile		17.87	18.70	55.48
% Fixed Carbon		14.34	15.01	44.52
Btu		3837	4016	11913
% Sulfur		0.37	0.39	1.15

lbs SUL/MM BTU = 0.96

SAMPLE NO.: 10C88-55
DEPTH: 382.0-383.0; 387.8-389.3; 390.4-391.3
BED NAME: D
THICKNESS: 3.4
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.37		
% Ash		63.61	66.51	
% Volatile		17.39	18.18	54.31
% Fixed Carbon		14.63	15.31	45.69
Btu		4017	4200	12544
% Sulfur		0.68	0.71	2.12

lbs SUL/MM BTU = 1.69

SAMPLE NO.: 10C88-56
DEPTH: 429.4-451.1
BED NAME: A
THICKNESS: 4.5
REMARKS: Partings only, from this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		5.09		
% Ash		64.34	67.79	
% Volatile		16.63	17.52	54.39
% Fixed Carbon		13.94	14.69	45.61
Btu		3537	3727	11571
% Sulfur		1.65	1.74	5.40

lbs SUL/MM BTU = 4.66

SAMPLE NO.: 11C88-1
DEPTH: 78.2 - 80.6
BED NAME: D
THICKNESS: 2.4
REMARKS: 0.1' parting @ 80.1' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.00	6.70		
% Ash	13.62	13.38	14.34	
% Volatile	38.02	37.34	40.02	46.72
% Fixed Carbon	43.36	42.58	45.64	53.28
Btu	11909	11696	12536	14634
% Sulfur	0.61	0.60	0.65	0.75

lbs SUL/MM BTU = 0.51

SAMPLE NO.: 11C88-2
DEPTH: 80.6 - 81.8
BED NAME: D
THICKNESS: 1.2
REMARKS: 0.2' parting @ 80.8' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	7.16	8.57		
% Ash	32.12	31.64	34.60	
% Volatile	28.39	27.96	30.58	46.76
% Fixed Carbon	32.33	31.83	34.82	53.24
Btu	8495	8366	9150	13991
% Sulfur	1.06	1.05	1.15	1.75

lbs SUL/MM BTU = 1.26

SAMPLE NO.: 11C88-3
DEPTH: 81.8 - 84.4
BED NAME: D
THICKNESS: 2.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.41	6.32		
% Ash	14.31	14.17	15.13	
% Volatile	34.05	33.72	36.00	42.41
% Fixed Carbon	46.23	45.79	48.87	57.59
Btu	11820	11707	12496	14723
% Sulfur	0.59	0.58	0.62	0.74

lbs SUL/MM BTU = 0.50

SAMPLE NO.: 11C88-4
DEPTH: 84.9 - 86.7
BED NAME: D
THICKNESS: 1.8
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.96	6.57		
% Ash	21.52	21.38	22.88	
% Volatile	34.03	33.81	36.19	46.93
% Fixed Carbon	38.49	38.24	40.93	53.07
Btu	10501	10433	11166	14480
% Sulfur	0.70	0.70	0.74	0.97

lbs SUL/MM BTU = 0.67

SAMPLE NO.: 11C88-5
DEPTH: 87.7 - 91.3
BED NAME: D
THICKNESS: 3.6
REMARKS: 0.5' parting @ 88.3' and 0.8' parting @ 89.5' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.28	8.03		
% Ash	12.77	12.54	13.63	
% Volatile	35.22	34.56	37.58	43.51
% Fixed Carbon	45.73	44.87	48.79	56.49
Btu	11908	11685	12706	14711
% Sulfur	0.91	0.90	0.98	1.13

lbs SUL/MM BTU = 0.77

SAMPLE NO.: 11C88-6
DEPTH: 94.2 - 95.8
BED NAME: D
THICKNESS: 1.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.99	7.08		
% Ash	37.54	37.11	39.94	
% Volatile	27.51	27.19	29.26	48.72
% Fixed Carbon	28.96	28.62	30.80	51.28
Btu	7933	7841	8438	14049
% Sulfur	0.72	0.71	0.76	1.27

lbs SUL/MM BTU = 0.91

SAMPLE NO.: 11C88-7
DEPTH: 97.5 - 100.2
BED NAME: D
THICKNESS: 2.7
REMARKS: 0.1' parting @ 97.9' excluded; 0.7' parting @ 98.2' included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.04	7.14		
% Ash	47.24	46.69	50.28	
% Volatile	24.59	24.30	26.17	52.63
% Fixed Carbon	22.13	21.87	23.55	47.37
Btu	6450	6375	6865	13807
% Sulfur	0.47	0.47	0.51	1.02

lbs SUL/MM BTU = 0.74

SAMPLE NO.: 11C88-8
DEPTH: 100.2 - 102.8
BED NAME: D
THICKNESS: 2.6
REMARKS: 0.1' parting @ 101.2' and 0.3' parting @ 102.2' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.98	7.30		
% Ash	29.69	29.27	31.58	
% Volatile	28.55	28.14	30.36	44.37
% Fixed Carbon	35.78	35.29	38.06	55.63
Btu	9192	9063	9776	14288
% Sulfur	0.69	0.68	0.73	1.07

lbs SUL/MM BTU = 0.75

SAMPLE NO.: 11C88-9
DEPTH: 102.8 - 105.2
BED NAME: D
THICKNESS: 2.4
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.88	6.71		
% Ash	17.43	17.27	18.51	
% Volatile	33.19	32.90	35.27	43.28
% Fixed Carbon	43.50	43.12	46.22	56.72
Btu	11209	11110	11909	14615
% Sulfur	0.57	0.56	0.60	0.74

lbs SUL/MM BTU = 0.50

SAMPLE NO.: 11C88-10
DEPTH: 108.4 - 112.3
BED NAME: D
THICKNESS: 3.9
REMARKS: 0.1' parting @ 109.1' and 0.25' parting @ 111.7' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.06	6.22		
% Ash	31.13	30.75	32.79	
% Volatile	29.66	29.30	31.24	46.48
% Fixed Carbon	34.15	33.73	35.97	53.52
Btu	9228	9115	9720	14461
% Sulfur	0.67	0.66	0.70	1.05

lbs SUL/MM BTU = 0.72

SAMPLE NO.: 11C88-11
DEPTH: 112.4 - 114.65
BED NAME: D
THICKNESS: 2.25
REMARKS: 0.2' parting @ 114.1' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.02	6.11		
% Ash	38.73	38.28	40.77	
% Volatile	28.75	28.42	30.27	51.10
% Fixed Carbon	27.50	27.19	28.96	48.90
Btu	7889	7799	8306	14025
% Sulfur	0.70	0.69	0.74	1.24

lbs SUL/MM BTU = 0.88

SAMPLE NO.: 11C88-12
DEPTH: 114.65 - 118.4
BED NAME: D
THICKNESS: 3.75
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.10	6.19		
% Ash	18.37	18.16	19.36	
% Volatile	34.99	34.58	36.87	45.72
% Fixed Carbon	41.54	41.07	43.77	54.28
Btu	11158	11030	11758	14581
% Sulfur	0.98	0.97	1.03	1.28

lbs SUL/MM BTU = 0.88

SAMPLE NO.: 11C88-13
DEPTH: 118.4 - 121.8
BED NAME: D
THICKNESS: 3.4
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.25	6.28		
% Ash	20.47	20.25	21.61	
% Volatile	33.40	33.03	35.25	44.96
% Fixed Carbon	40.88	40.44	43.14	55.04
Btu	10709	10593	11303	14418
% Sulfur	0.92	0.91	0.97	1.24

lbs SUL/MM BTU = 0.86

SAMPLE NO.: 11C88-14
DEPTH: 121.8 - 126.0
BED NAME: D
THICKNESS: 4.2
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.44	6.30		
% Ash	24.57	24.34	25.98	
% Volatile	33.07	32.77	34.97	47.25
% Fixed Carbon	36.92	36.59	39.05	52.75
Btu	10004	9913	10579	14293
% Sulfur	1.18	1.17	1.25	1.69

lbs SUL/MM BTU = 1.18

SAMPLE NO.: 11C88-15
DEPTH: 126.0 - 126.6
BED NAME: D
THICKNESS: 0.6
REMARKS: Floor rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		10.20		
% Ash		57.94	64.52	
% Volatile		16.35	18.21	51.32
% Fixed Carbon		15.51	17.27	48.68
Btu		4146	4616	13010
% Sulfur		0.49	0.55	1.55

lbs SUL/MM BTU = 1.18

SAMPLE NO.: 11C88-16
DEPTH: 77.7 - 78.2
BED NAME: D
THICKNESS: 0.5
REMARKS: Roof rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		1.73		
% Ash		91.49	93.11	
% Volatile		5.38	5.47	79.36
% Fixed Carbon		1.40	1.42	20.64
Btu		283	288	4173
% Sulfur		0.67	0.69	9.96

lbs SUL/MM BTU = 23.67

SAMPLE NO.: 11C88-17
DEPTH: 80.15 - 93.2
BED NAME: D
THICKNESS: 5.0
REMARKS: Partings only, from this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		8.54		
% Ash		53.18	58.14	
% Volatile		19.07	20.85	49.80
% Fixed Carbon		19.21	21.01	50.20
Btu		4895	5352	12785
% Sulfur		0.91	0.99	2.37

lbs SUL/MM BTU = 1.86

SAMPLE NO.: 11C88-18
DEPTH: 95.8 - 97.5
BED NAME: D
THICKNESS: 1.7
REMARKS: Parting

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		2.67		
% Ash		79.52	81.70	
% Volatile		16.79	17.25	94.25
% Fixed Carbon		1.02	1.05	5.75
Btu		239	246	1344
% Sulfur		0.10	0.10	0.55

lbs SUL/MM BTU = 4.18

SAMPLE NO.: IIC88-19
DEPTH: 97.9-98.0; 101.15-101.25; 102.2-102.5
BED NAME: D
THICKNESS: 0.5
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		17.06		
% Ash		68.35	82.41	
% Volatile		12.45	15.02	85.39
% Fixed Carbon		2.14	2.57	14.61
Btu		617	743	4228
% Sulfur		1.92	2.32	13.17

lbs SUL/MM BTU = 31.12

SAMPLE NO.: IIC88-20
DEPTH: 105.2-108.4
BED NAME: D
THICKNESS: 3.2
REMARKS: Parting

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		8.64		
% Ash		71.60	78.37	
% Volatile		12.52	13.71	63.36
% Fixed Carbon		7.24	7.92	36.64
Btu		1767	1934	8941
% Sulfur		0.36	0.40	1.85

lbs SUL/MM BTU = 2.04

SAMPLE NO.: IIC88-21
DEPTH: 109.1-109.2; 111.7-111.95; 112.3-112.4; 114.1-114.3
BED NAME: D
THICKNESS: 0.65
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.19		
% Ash		76.78	80.14	
% Volatile		13.39	13.98	70.38
% Fixed Carbon		5.64	5.88	29.62
Btu		1093	1141	5744
% Sulfur		0.61	0.63	3.18

lbs SUL/MM BTU = 5.58

SAMPLE NO.: 14C88-1
DEPTH: 47.8-50.3
BED NAME:
THICKNESS: 2.5
REMARKS: 0.05' partings @ 49.5' and 49.65' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.46	7.38		
% Ash	22.63	22.17	23.94	
% Volatile	34.56	33.86	36.56	48.07
% Fixed Carbon	37.35	36.59	39.50	51.93
Btu	10321	10111	10917	14352
% Sulfur	0.64	0.63	0.68	0.89

lbs SUL/MM BTU = 0.62

SAMPLE NO.: 14C88-2
DEPTH: 50.3-54.4
BED NAME:
THICKNESS: 4.1
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.09	7.15		
% Ash	13.88	13.58	14.63	
% Volatile	37.88	37.05	39.91	46.75
% Fixed Carbon	43.15	42.22	45.46	53.25
Btu	11820	11563	12453	14587
% Sulfur	0.86	0.85	0.91	1.07

lbs SUL/MM BTU = 0.74

SAMPLE NO.: 14C88-3
DEPTH: 54.4-56.5
BED NAME:
THICKNESS: 2.1
REMARKS: 0.1' parting @ 55.3' included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.05	10.15		
% Ash	32.49	31.07	34.58	
% Volatile	29.96	28.65	31.89	48.74
% Fixed Carbon	31.50	30.13	33.53	51.26
Btu	8585	8210	9138	13967
% Sulfur	0.55	0.52	0.58	0.89

lbs SUL/MM BTU = 0.63

SAMPLE NO.: 14C88-4
DEPTH: 56.5-57.0
BED NAME:
THICKNESS: 0.5
REMARKS: Floor rock

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		6.30		
% Ash		86.58	92.40	
% Volatile		6.53	6.97	91.74
% Fixed Carbon		0.59	0.63	8.26
Btu		366	391	5140
% Sulfur		0.18	0.19	2.53

lbs SUL/MM BTU = 4.92

SAMPLE NO.: 14C88-5
DEPTH: 166.3-167.4
BED NAME: D
THICKNESS: 1.1
REMARKS: Roof rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		6.63		
% Ash		70.06	75.04	
% Volatile		14.92	15.98	64.02
% Fixed Carbon		8.39	8.98	35.98
Btu		2684	2875	11516
% Sulfur		1.20	1.28	5.13

lbs SUL/MM BTU = 4.47

SAMPLE NO.: 14C88-6
DEPTH: 167.4-170.25
BED NAME: D
THICKNESS: 2.85
REMARKS: 0.1' parting @ 169.9' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.15	6.28		
% Ash	21.94	21.67	23.13	
% Volatile	33.19	32.79	34.99	45.52
% Fixed Carbon	39.72	39.26	41.88	54.48
Btu	10552	10427	11125	14472
% Sulfur	1.14	1.13	1.20	1.56

lbs SUL/MM BTU = 1.08

SAMPLE NO.: 14C88-7
DEPTH: 171.15 - 172.9
BED NAME: D
THICKNESS: 1.75
REMARKS: Partings included

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.02	7.50		
% Ash	33.31	32.78	35.44	
% Volatile	29.11	28.65	30.97	47.98
% Fixed Carbon	31.56	31.07	33.59	52.02
Btu	8718	8581	9276	14369
% Sulfur	0.54	0.53	0.57	0.89

lbs SUL/MM BTU = 0.62

SAMPLE NO.: 14C88-8
DEPTH: 173.35 - 175.6
BED NAME: D
THICKNESS: 2.25
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	6.23	7.17		
% Ash	17.98	17.80	19.17	
% Volatile	32.64	32.31	34.81	43.06
% Fixed Carbon	43.15	42.72	46.02	56.94
Btu	10894	10784	11617	14373
% Sulfur	0.54	0.54	0.58	0.72

lbs SUL/MM BTU = 0.50

SAMPLE NO.: 14C88-9
DEPTH: 175.6 - 176.6
BED NAME: D
THICKNESS: 1.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.05	6.44		
% Ash	26.85	26.46	28.28	
% Volatile	30.28	29.84	31.89	44.47
% Fixed Carbon	37.82	37.26	39.83	55.53
Btu	9909	9764	10436	14551
% Sulfur	0.45	0.45	0.48	0.67

lbs SUL/MM BTU = 0.46

SAMPLE NO.: 14C88-10
DEPTH: 177.5 - 180.2
BED NAME: D
THICKNESS: 2.7
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.55	6.56		
% Ash	16.06	15.89	17.00	
% Volatile	35.23	34.86	37.30	44.94
% Fixed Carbon	43.16	42.69	45.70	55.06
Btu	11491	11368	12166	14658
% Sulfur	0.52	0.52	0.55	0.66

lbs SUL/MM BTU = 0.46

SAMPLE NO.: 14C88-11
DEPTH: 182.2 - 184.9
BED NAME: D
THICKNESS: 2.7
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.51	5.92		
% Ash	39.59	39.00	41.46	
% Volatile	27.15	26.75	28.43	48.57
% Fixed Carbon	28.75	28.33	30.11	51.43
Btu	7950	7832	8325	14220
% Sulfur	0.54	0.53	0.56	0.96

lbs SUL/MM BTU = 0.68

SAMPLE NO.: 14C88-12
DEPTH: 184.9 - 187.4
BED NAME: D
THICKNESS: 2.5
REMARKS: 0.1' parting @ 186.4' and 186.75' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.75	6.00		
% Ash	26.39	26.04	27.70	
% Volatile	33.63	33.19	35.31	48.84
% Fixed Carbon	35.23	34.77	36.99	51.16
Btu	10003	9872	10502	14525
% Sulfur	0.70	0.69	0.73	1.02

lbs SUL/MM BTU = 0.70

SAMPLE NO.: 14CBB-13
DEPTH: 187.4 - 190.6
BED NAME: D
THICKNESS: 3.2
REMARKS: 0.05' parting @ 189.3' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.58	5.71		
% Ash	28.88	28.54	30.27	
% Volatile	30.50	30.14	31.97	45.84
% Fixed Carbon	36.04	35.61	37.76	54.16
Btu	9532	9419	9990	14326
% Sulfur	0.64	0.63	0.67	0.96

lbs SUL/MM BTU = 0.67

SAMPLE NO.: 14CBB-14
DEPTH: 190.6 - 194.15
BED NAME: D
THICKNESS: 3.55
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.70	5.35		
% Ash	27.30	27.12	28.65	
% Volatile	30.38	30.17	31.87	44.67
% Fixed Carbon	37.62	37.36	39.48	55.33
Btu	9811	9744	10295	14429
% Sulfur	1.07	1.06	1.12	1.57

lbs SUL/MM BTU = 1.09

SAMPLE NO.: 14CBB-15
DEPTH: 194.15 - 198.4
BED NAME: D
THICKNESS: 4.25
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.07	6.42		
% Ash	19.81	19.53	20.87	
% Volatile	32.51	32.05	34.24	43.27
% Fixed Carbon	42.61	42.00	44.89	56.73
Btu	10978	10822	11565	14615
% Sulfur	0.81	0.79	0.85	1.07

lbs SUL/MM BTU = 0.73

SAMPLE NO.: 14CBB-16
DEPTH: 199.6 - 203.4
BED NAME: D
THICKNESS: 3.8
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.43	6.57		
% Ash	13.30	13.14	14.06	
% Volatile	36.00	35.56	38.06	44.29
% Fixed Carbon	45.27	44.73	47.88	55.71
Btu	11927	11783	12612	14675
% Sulfur	0.70	0.69	0.74	0.86

lbs SUL/MM BTU = 0.59

SAMPLE NO.: 14CBB-17
DEPTH: 221.4 - 225.7
BED NAME: A
THICKNESS: 4.3
REMARKS: 0.2' parting @ 224.7' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.34	5.87		
% Ash	18.68	18.57	19.73	
% Volatile	35.05	34.86	37.03	46.14
% Fixed Carbon	40.93	40.70	43.24	53.86
Btu	11087	11025	11713	14592
% Sulfur	0.90	0.89	0.95	1.18

lbs SUL/MM BTU = 0.81

SAMPLE NO.: 14CBB-18
DEPTH: 227.05 - 229.0
BED NAME: A
THICKNESS: 1.95
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.96	5.78		
% Ash	28.74	28.49	30.24	
% Volatile	29.60	29.34	31.14	44.64
% Fixed Carbon	36.70	36.39	38.62	55.36
Btu	9522	9440	10019	14362
% Sulfur	1.04	1.03	1.10	1.57

lbs SUL/MM BTU = 1.09

SAMPLE NO.: 14CBB-19
DEPTH: 229.0-231.7
BED NAME: A
THICKNESS: 2.7
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.45	5.55		
% Ash	20.91	20.67	21.88	
% Volatile	32.30	31.93	33.81	43.28
% Fixed Carbon	42.34	41.85	44.31	56.72
Btu	10968	10841	11478	14694
% Sulfur	0.75	0.74	0.79	1.01

lbs SUL/MM BTU = 0.68

SAMPLE NO.: 14CBB-20
DEPTH: 231.7-234.7
BED NAME: A
THICKNESS: 3.0
REMARKS: 0.3' parting @ 232.9' and 0.5' parting @ 233.7' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.03	5.36		
% Ash	14.31	14.11	14.91	
% Volatile	38.39	37.85	40.00	47.01
% Fixed Carbon	43.27	42.68	45.09	52.99
Btu	12087	11920	12595	14803
% Sulfur	0.61	0.60	0.63	0.74

lbs SUL/MM BTU = 0.50

SAMPLE NO.: 14CBB-21
DEPTH: 235.3-237.3
BED NAME: A
THICKNESS: 2.0
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.90	6.72		
% Ash	20.41	20.24	21.69	
% Volatile	32.43	32.15	34.47	44.02
% Fixed Carbon	41.26	40.89	43.84	55.98
Btu	10867	10773	11549	14748
% Sulfur	0.84	0.83	0.89	1.14

lbs SUL/MM BTU = 0.77

SAMPLE NO.: 14CBB-22
DEPTH: 237.3-241.0
BED NAME: A
THICKNESS: 3.7
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.10	5.76		
% Ash	12.54	12.45	13.21	
% Volatile	35.82	35.57	37.75	43.49
% Fixed Carbon	46.54	46.22	49.04	56.51
Btu	12198	12113	12853	14809
% Sulfur	0.61	0.61	0.64	0.74

lbs SUL/MM BTU = 0.50

SAMPLE NO.: 14CBB-23
DEPTH: 243.2-245.8
BED NAME: A
THICKNESS: 2.6
REMARKS: 0.2' parting @ 244.7' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.61	6.24		
% Ash	16.93	16.65	17.75	
% Volatile	34.26	33.67	35.91	43.67
% Fixed Carbon	44.20	43.44	46.34	56.33
Btu	11505	11308	12061	14664
% Sulfur	0.70	0.69	0.73	0.89

lbs SUL/MM BTU = 0.61

SAMPLE NO.: 14CBB-24
DEPTH: 246.35-250.0
BED NAME: A
THICKNESS: 3.65
REMARKS: 0.05' parting @ 249.7' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.81	6.66		
% Ash	11.97	11.74	12.58	
% Volatile	34.56	33.89	36.30	41.53
% Fixed Carbon	48.66	47.71	51.12	58.47
Btu	12282	12044	12903	14759
% Sulfur	0.57	0.56	0.60	0.69

lbs SUL/MM BTU = 0.46

SAMPLE NO.: 14C88-25
DEPTH: 250.0 - 252.0
BED NAME: A
THICKNESS: 2.0
REMARKS: Sample desorbed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.96	5.36		
% Ash	8.19	8.16	8.62	
% Volatile	41.95	41.78	44.14	48.31
% Fixed Carbon	44.90	44.70	47.24	51.69
Btu	12805	12751	13474	14745
% Sulfur	0.53	0.52	0.55	0.61

lbs SUL/MM BTU = 0.41

SAMPLE NO.: 14C88-26
DEPTH: 252.0 - 252.6
BED NAME: A
THICKNESS: 0.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.14	5.67		
% Ash	9.05	8.90	9.44	
% Volatile	39.73	39.10	41.45	45.77
% Fixed Carbon	47.08	46.33	49.11	54.23
Btu	12865	12660	13421	14820
% Sulfur	0.60	0.59	0.62	0.69

lbs SUL/MM BTU = 0.47

SAMPLE NO.: 14C88-27
DEPTH: 252.6 - 253.4
BED NAME: A
THICKNESS: 0.8
REMARKS: Floor rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		6.35		
% Ash		81.12	86.62	
% Volatile		9.86	10.53	78.70
% Fixed Carbon		2.67	2.85	21.30
Btu		1019	1088	8135
% Sulfur		0.28	0.30	2.27

lbs SUL/MM BTU = 2.75

SAMPLE NO.: 14C88-28
DEPTH: 47.3 - 47.8
BED NAME:
THICKNESS: 0.5
REMARKS: Roof rock

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		2.16		
% Ash		89.65	91.63	
% Volatile		7.17	7.33	87.56
% Fixed Carbon		1.02	1.04	12.44
Btu		127	129	1546
% Sulfur		0.42	0.42	5.07

lbs SUL/MM BTU = 33.07

SAMPLE NO.: 14C88-29
DEPTH: 169.9-177.5
BED NAME: D
THICKNESS: 2.35
REMARKS: Partings only, from this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		9.86		
% Ash		67.35	74.72	
% Volatile		12.38	13.73	54.31
% Fixed Carbon		10.41	11.55	45.69
Btu		2362	2620	10364
% Sulfur		0.62	0.69	2.74

lbs SUL/MM BTU = 2.62

SAMPLE NO.: 14C88-30
DEPTH: 180.2 - 182.2
BED NAME: D
THICKNESS: 2.0
REMARKS: Parting

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		7.65		
% Ash		78.75	85.28	
% Volatile		10.04	10.87	73.83
% Fixed Carbon		3.56	3.85	26.17
Btu		838	907	6160
% Sulfur		0.26	0.28	1.91

lbs SUL/MM BTU = 3.10

SAMPLE NO.: 14C88-31
DEPTH: 186.4-186.5; 186.75-186.85; 189.3-189.35
BED NAME: D
THICKNESS: 0.25
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.06		
% Ash		70.49	73.47	
% Volatile		16.70	17.41	65.62
% Fixed Carbon		8.75	9.12	34.38
Btu		2184	2277	8581
% Sulfur		0.41	0.43	1.61

lbs SUL/MM BTU = 1.88

SAMPLE NO.: 14C88-32
DEPTH: 198.4-199.6; 203.4-203.9
BED NAME: D
THICKNESS: 1.7
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		8.51		
% Ash		50.08	54.74	
% Volatile		20.02	21.88	48.34
% Fixed Carbon		21.39	23.38	51.66
Btu		5437	5942	13128
% Sulfur		0.74	0.80	1.78

lbs SUL/MM BTU = 1.36

SAMPLE NO.: 14C88-34
DEPTH: 224.75-234.2
BED NAME: A
THICKNESS: 2.35
REMARKS: Partings only, from this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		8.36		
% Ash		60.10	65.58	
% Volatile		16.28	17.76	51.61
% Fixed Carbon		15.26	16.66	48.39
Btu		3671	4006	11639
% Sulfur		3.21	3.51	10.19

lbs SUL/MM BTU = 8.74

SAMPLE NO.: 14C88-35
DEPTH: 241.0-249.75
BED NAME: A
THICKNESS: 3.0
REMARKS: Partings only, from this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		3.38		
% Ash		73.43	76.00	
% Volatile		15.12	15.65	65.19
% Fixed Carbon		8.07	8.35	34.81
Btu		2599	2690	11205
% Sulfur		1.32	1.37	5.69

lbs SUL/MM BTU = 5.08

SAMPLE NO.: 17C88-1
DEPTH: 232.0 - 233.3
BED NAME:
THICKNESS: 1.3
REMARKS: Roof rock

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		6.00		
% Ash		69.09	73.50	
% Volatile		15.75	16.76	63.25
% Fixed Carbon		9.16	9.74	36.75
Btu		2573	2737	10328
% Sulfur		1.92	2.04	7.69

lbs SUL/MM BTU = 7.46

SAMPLE NO.: 17C88-2
DEPTH: 233.3-235.9
BED NAME:
THICKNESS: 2.6
REMARKS: 0.1' parting @ 234.6' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.87	5.75		
% Ash	19.27	19.09	20.26	
% Volatile	35.82	35.49	37.65	47.22
% Fixed Carbon	40.04	39.67	42.09	52.78
Btu	11042	10940	11607	14555
% Sulfur	0.63	0.63	0.66	0.83

lbs SUL/MM BTU = 0.58

SAMPLE NO.: 17C88-3
DEPTH: 236.8-239.7
BED NAME:
THICKNESS: 2.9
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.89	6.88		
% Ash	16.33	15.99	17.17	
% Volatile	34.54	33.81	36.31	43.84
% Fixed Carbon	44.24	43.32	46.52	56.16
Btu	11616	11373	12213	14744
% Sulfur	0.61	0.59	0.64	0.77

lbs SUL/MM BTU = 0.52

SAMPLE NO.: 17C88-4
DEPTH: 240.0-241.4
BED NAME:
THICKNESS: 1.4
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.66	7.02		
% Ash	21.32	21.02	22.60	
% Volatile	33.24	32.76	35.23	45.52
% Fixed Carbon	39.78	39.20	42.17	54.48
Btu	10568	10415	11202	14473
% Sulfur	0.61	0.60	0.64	0.83

lbs SUL/MM BTU = 0.58

SAMPLE NO.: 17C88-5
DEPTH: 241.4-243.1
BED NAME:
THICKNESS: 1.7
REMARKS: Floor rock

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		8.63		
% Ash		64.59	70.69	
% Volatile		15.42	16.88	57.58
% Fixed Carbon		11.36	12.43	42.42
Btu		3177	3477	11862
% Sulfur		1.32	1.44	4.93

lbs SUL/MM BTU = 4.15

SAMPLE NO.: 17C88-6
DEPTH: 245.9-247.7
BED NAME:
THICKNESS: 1.8
REMARKS: 0.2' parting @ 247.2' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.67	5.45		
% Ash	36.97	37.06	39.20	
% Volatile	28.28	28.35	29.98	49.30
% Fixed Carbon	29.08	29.14	30.82	50.70
Btu	8077	8095	8562	14081
% Sulfur	1.17	1.17	1.24	2.04

lbs SUL/MM BTU = 1.45

SAMPLE NO.: 17C88-7
DEPTH: 249.9-250.7
BED NAME:
THICKNESS: 0.8
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		6.05		
% Ash		22.24	23.67	
% Volatile		30.78	32.76	42.92
% Fixed Carbon		40.93	43.57	57.08
Btu		10499	11175	14641
% Sulfur		0.75	0.80	1.04

lbs SUL/MM BTU = 0.71

SAMPLE NO.: 17C88-8
DEPTH: 251.8-253.1
BED NAME:
THICKNESS: 1.3
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		6.05		
% Ash		19.98	21.27	
% Volatile		31.38	33.40	42.42
% Fixed Carbon		42.59	45.33	57.58
Btu		10827	11524	14637
% Sulfur		0.72	0.77	0.97

lbs SUL/MM BTU = 0.67

SAMPLE NO.: 17C88-9
DEPTH: 254.3-255.9
BED NAME:
THICKNESS: 1.6
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.23	6.20		
% Ash	14.15	14.01	14.93	
% Volatile	35.58	35.22	37.54	44.13
% Fixed Carbon	45.04	44.57	47.53	55.87
Btu	11997	11875	12660	14882
% Sulfur	0.65	0.64	0.68	0.80

lbs SUL/MM BTU = 0.54

SAMPLE NO.: 17C88-10
DEPTH: 255.9-256.8
BED NAME:
THICKNESS: 0.9
REMARKS: Floor rock

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		11.70		
% Ash		53.00	60.02	
% Volatile		20.60	23.33	58.35
% Fixed Carbon		14.70	16.65	41.65
Btu		4537	5138	12851
% Sulfur		1.44	1.63	4.06

lbs SUL/MM BTU = 3.17

SAMPLE NO.: 17C88-11
DEPTH: 340.65-341.7
BED NAME: D
THICKNESS: 1.05
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.27	6.09		
% Ash	17.66	17.51	18.64	
% Volatile	35.11	34.81	37.07	45.56
% Fixed Carbon	41.96	41.59	44.29	54.44
Btu	11337	11239	11968	14710
% Sulfur	0.91	0.90	0.96	1.18

lbs SUL/MM BTU = 0.80

SAMPLE NO.: 17C88-12
DEPTH: 342.6-345.5
BED NAME:
THICKNESS: 2.9
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.90	5.66		
% Ash	11.83	11.73	12.44	
% Volatile	36.47	36.17	38.34	43.79
% Fixed Carbon	46.80	46.44	49.22	56.21
Btu	12299	12201	12933	14770
% Sulfur	0.77	0.76	0.80	0.92

lbs SUL/MM BTU = 0.62

SAMPLE NO.: 17C88-13
DEPTH: 345.9-347.6
BED NAME: D
THICKNESS: 1.7
REMARKS: 0.1' parting @ 346.05 excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.24	5.48		
% Ash	16.24	16.03	16.96	
% Volatile	36.02	35.55	37.61	45.29
% Fixed Carbon	43.50	42.94	45.43	54.71
Btu	11666	11515	12182	14670
% Sulfur	2.46	2.43	2.57	3.10

lbs SUL/MM BTU = 2.11

SAMPLE NO.: 17C88-14
DEPTH: 349.0-351.8
BED NAME: D
THICKNESS: 2.8
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	5.24	5.60		
% Ash	19.64	19.57	20.73	
% Volatile	33.60	33.47	35.45	44.72
% Fixed Carbon	41.52	41.36	43.82	55.28
Btu	10938	10896	11543	14561
% Sulfur	0.98	0.98	1.04	1.31

lbs SUL/MM BTU = 0.90

SAMPLE NO.: 17C88-15
DEPTH: 351.8-353.0
BED NAME: D
THICKNESS: 1.2
REMARKS: Floor rock of D bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		8.46		
% Ash		66.52	72.67	
% Volatile		16.58	18.12	66.29
% Fixed Carbon		8.44	9.21	33.71
Btu		2608	2850	10427
% Sulfur		0.97	1.06	3.90

lbs SUL/MM BTU = 3.72

SAMPLE NO.: 17C88-16
DEPTH: 482.0-483.7
BED NAME: A
THICKNESS: 1.7
REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	4.92	5.86		
% Ash	10.14	10.04	10.66	
% Volatile	38.26	37.88	40.24	45.04
% Fixed Carbon	46.68	46.22	49.10	54.96
Btu	12652	12527	13307	14895
% Sulfur	0.59	0.58	0.62	0.69

lbs SUL/MM BTU = 0.46

SAMPLE NO.: 17C88-17
DEPTH: 485.7-486.8
BED NAME: A
THICKNESS: 1.1
REMARKS: Roof rock

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		8.19		
% Ash		61.35	66.82	
% Volatile		17.30	18.84	56.78
% Fixed Carbon		13.16	14.34	43.22
Btu		3797	4136	12464
% Sulfur		0.77	0.84	2.54

lbs SUL/MM BTU = 2.03

SAMPLE NO.: 17C88-18
DEPTH: 486.8-489.9
BED NAME: A
THICKNESS: 3.1
REMARKS: 1.1' parting @ 488.0' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.87	4.65		
% Ash	14.96	14.84	15.57	
% Volatile	35.06	34.78	36.48	43.20
% Fixed Carbon	46.11	45.73	47.95	56.80
Btu	12066	11968	12551	14865
% Sulfur	0.60	0.59	0.62	0.73

lbs SUL/MM BTU = 0.49

SAMPLE NO.: 17C88-20
DEPTH: 491.9-495.7
BED NAME: A
THICKNESS: 3.8
REMARKS: 0.05' parting @ 492.7' excluded

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	3.56	4.84		
% Ash	9.25	9.13	9.59	
% Volatile	36.21	35.73	37.55	41.53
% Fixed Carbon	50.98	50.30	52.86	58.47
Btu	13022	12849	13503	14935
% Sulfur	0.46	0.45	0.48	0.53

lbs SUL/MM BTU = 0.35

SAMPLE NO.: 17C88-21
DEPTH: 495.7-496.6
BED NAME: A
THICKNESS: 0.9
REMARKS: Floor rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		9.03		
% Ash		73.99	81.34	
% Volatile		12.33	13.55	72.61
% Fixed Carbon		4.65	5.11	27.39
Btu		1459	1604	8595
% Sulfur		0.16	0.17	0.93

lbs SUL/MM BTU = 1.10

SAMPLE NO.: 17C88-22
DEPTH: 234.6-234.7; 235.9-236.8; 239.7-240.0
BED NAME:
THICKNESS: 1.3
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		7.39		
% Ash		54.04	58.36	
% Volatile		18.96	20.48	49.17
% Fixed Carbon		19.61	21.16	50.83
Btu		4824	5209	12508
% Sulfur		0.22	0.24	0.58

lbs SUL/MM BTU = 0.46

SAMPLE NO.: 17C88-23
DEPTH: 245.4-245.9
BED NAME:
THICKNESS: 0.5
REMARKS: Roof rock

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		4.70		
% Ash		86.44	90.70	
% Volatile		6.15	6.46	69.44
% Fixed Carbon		2.71	2.84	30.56
Btu		573	601	6462
% Sulfur		0.77	0.80	8.65

lbs SUL/MM BTU = 13.44

SAMPLE NO.: 17C88-24
DEPTH: 247.2-247.4; 247.7-249.9
BED NAME:
THICKNESS: 2.4
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		5.29		
% Ash		75.33	79.53	
% Volatile		13.39	14.14	69.06
% Fixed Carbon		5.99	6.33	30.94
Btu		1570	1658	8099
% Sulfur		0.21	0.23	1.11

lbs SUL/MM BTU = 1.34

SAMPLE NO.: 17C88-25
DEPTH: 250.7-251.8; 253.1-254.3
BED NAME:
THICKNESS: 2.3
REMARKS: Partings

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		10.60		
% Ash		57.74	64.58	
% Volatile		14.52	16.24	45.85
% Fixed Carbon		17.14	19.18	54.15
Btu		3767	4213	11897
% Sulfur		0.65	0.72	2.04

lbs SUL/MM BTU = 1.73

SAMPLE NO.: 17C88-26
DEPTH: 340.0 - 346.15
BED NAME: D
THICKNESS: 2.05
REMARKS: Partings only, from this interval

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		6.75		
% Ash		75.17	80.61	
% Volatile		11.91	12.77	65.84
% Fixed Carbon		6.17	6.62	34.16
Btu		1585	1700	8766
% Sulfur		0.50	0.53	2.75
		lbs SUL/MM BTU =		3.15

SAMPLE NO.: 17C88-27
DEPTH: 481.5 - 482.0
BED NAME: A
THICKNESS: 0.5
REMARKS: Roof rock of A bed

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture		1.93		
% Ash		94.84	96.71	
% Volatile		3.17	3.23	98.17
% Fixed Carbon		0.06	0.06	1.83
Btu		0	0	0
% Sulfur		0.04	0.04	1.22