

United States Department of the Interior  
Geological Survey

Coal Exploratory Drilling 1980  
Recluse and Sheridan 1/2° x 1° quadrangles,  
Campbell, Johnson and Sheridan Counties,  
Wyoming

by  
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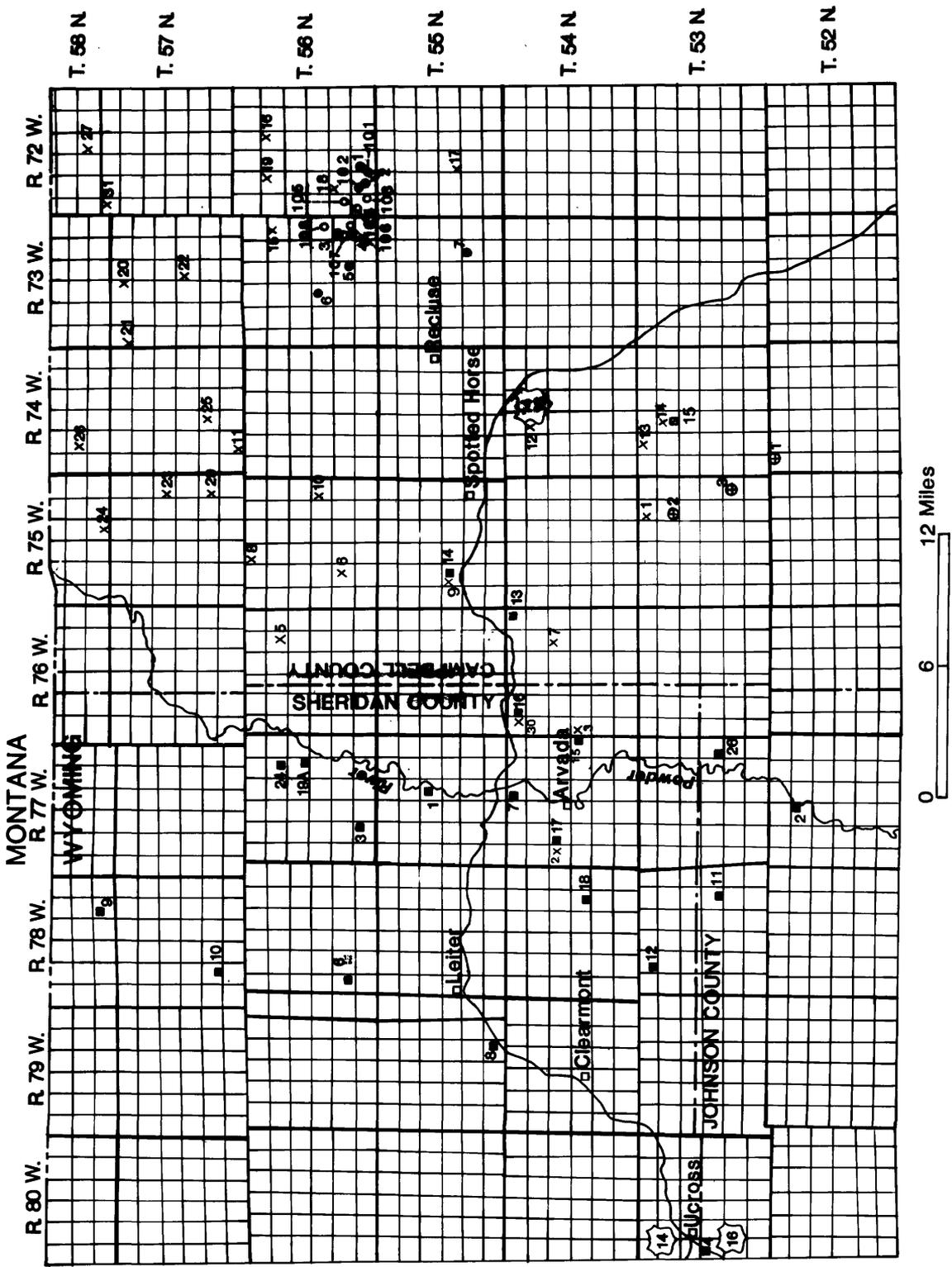
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## Introduction

In 1980, the U.S. Geological Survey drilled 20 holes in Campbell, Sheridan and Johnson Counties, Wyoming, as a continuation of the coal resource evaluation started in 1975. The total footage drilled in 1980 was 18241 feet of which 771 feet were cored. The location of this drilling is shown on Figure 1. A summary of 1980 drilling is presented on Table 1.

## General Information

- Location:** The area included in Figure 1 lies about midway from Buffalo on the west, Gillette to the southeast, and Sheridan to the northwest.
- Access:** The area is easily accessible from the west, east, and southeast via State Highway 14-16 (paved). A network of gravel roads, generally in good repair, are present throughout the area. These are maintained by the appropriate county road departments. A note of caution, however: the bridges within the county systems have a load limit, usually 10 tons (gross weight).
- Railroads:** A main line of the Burlington Northern railroad connecting Sheridan and Gillette bisects the area.
- Topography** The highlands of the area are dissected by the Powder River and its tributaries, forming a low to moderate relief.
- Climate:** The climate is typical northern temperate--hot, dry summers and severely cold winters. The average precipitation is 12 to 14 inches of moisture per year.



- USGS Drilling, 1975
- USBLM EMRIA Drilling, 1976
- ⊙ USGS Drilling, 1977
- × USGS Drilling, 1978
- USGS Drilling, 1979
- USGS Drilling, 1980

FIGURE 1 -- Drill hole locations 1975 through 1980, Campbell, Johnson, and Sheridan counties, Wyoming

Table 1.—Information summary: Locations, surface elevations, drilled and logged depths, and cored intervals of 1980 drill holes.

Hole No.	Location	Quadrangle	Surface Elev.(ft)	Depth Drilled(ft)	Depth Logged(ft)	Cored Intervals(ft)	Remarks
1	SE 1/4 NW 1/4 sec. 15, T. 55 N., R. 77 W.	Arvada NE	3610	800	800	----	
2	NW 1/4 NE 1/4 NE 1/4 sec. 9, T. 52 N., R. 77 W.	Lariat	3860	765	760	----	
3	NW 1/4 NE 1/4 sec. 32 T. 56 N., R. 77 W.	Fawn Draw	3717	555	550	130-150.0 335.0-372.0	
4	NW 1/4 NE 1/4 NW 1/4 sec. 19, T. 53 N., R. 80 W.	Ucross	4118	1000	265- 1000	----	
5	Not drilled						
6	NE 1/4 SE 1/4 sec. 30, T. 56 N., R. 78 W.	Gardner Gulch	3850	800	730	----	
7	NW 1/4 NW 1/4 sec. 3, T. 54 N., R. 77 W.	Arvada NE	3670	840	840	203.0-215.5 295.0-313.0 588.0-614.5	Sampled by TRW
8	NE 1/4 SE 1/4 NE 1/4 sec. 34, T. 55 N., R. 79 W.	Leiter	3890	900	900	----	
9	CNW 1/4 sec. 35, T. 58 N., R. 78 W.	Cabin Creek NW	4200	1000	1000	----	
10	SW 1/4 SW 1/4 SE 1/4 sec. 29, T. 57 N., R. 78 W.	Box Elder Draw	4190	1120	1120	----	
11	SW 1/4 SE 1/4 sec. 23, T. 53 N., R. 78 W.	Jewell Draw	4280	700	700	----	
12	CSW 1/4 sec. 5, T. 53 N., R. 78 W.	Arpan Butte	4360	800	770	----	
13	NE 1/4 NE 1/4 sec. 1, T. 54 N., R. 76 W.	Larey Draw	4180	1180	1019	----	
14	SW 1/4 NE 1/4 sec. 20, T. 55 N., R. 75 W.	Larey Draw	4120	960	955	290.0-339.2 680.0-749.8	Sampled by TRW
15	SE 1/4 NE 1/4 sec. 24, T. 54 N., R. 77 W.	Arvada NE	3800	1000	1000	270.0-367.6 675.0-777.3	
16	NW 1/4 SW 1/4 sec. 5, T. 54 N., R. 76 W.	Arvada NE	3830	1000	1000	59.0-76.0 264.0-316.6 588.0-638.0	Sampled by TRW
17	SE 1/4 NW 1/4 sec. 17, T. 54 N., R. 77 W.	Arvada	3790	1000	1000	406.0-431.3 699.0-734.1 779.0-801.9	
18	SW 1/4 SE 1/4 sec. 23, T. 54 N., R. 78 W.	Arvada	4340	840	840	----	
19A	SE 1/4 SE 1/4 sec. 14, T. 56 N., R. 77 W.	Cabin Creek SE	3700	210		185.0-210.0	No Geophysical log
24	NW 1/4 SW 1/4 sec. 11, T. 56 N., R. 77 W.	Cabin Creek SE	3625	900	900	87.0-109.7 219.0-250.9 691.0-733.8	
26	SW 1/4 SW 1/4 sec. 24, T. 53 N., R. 77 W.	Lariat	3770	820	820	----	

Land Ownership: The surface ownership is primarily private, while the coal ownership is primarily federal. The State of Wyoming generally owns both the surface and coal in sections 16 and 36 in each township.

Economy: The economy of the area is based on agriculture (winter wheat) and stock raising. A few small oil fields are present.

#### Drilling Operation

The drilling was done by El Dorado Exploration, Inc., of Broomfield, Colorado, under contract with the USGS. The drill was a truck mounted Porta-drill TK-1 with both air, air/water (foam) injection and fluid (mud) drilling capabilities.

A total of 17,470 feet was rotary drilled and 771 feet were cored. Of the 20 holes, 8 were twin core holes of pilot holes drilled previously.

The air, air mist, and air foam drilling was very effective where feasible. However, it could not be used throughout the project. At times heavy ground water and methane inflow, and unstable hole conditions required switching to mud drilling.

The major drilling problem encountered was caving in the upper portions of the hole preventing the logging of the complete hole. This occurred in holes 3, 4, 13 and 14.

The 15-foot core-drilling barrel used was of the split inner-tube type; it has a 4 5/8-inch outside diameter, and it cuts a 3-inch core. The Chris-drill coring bit used has tungsten face teeth.

Core recovery averaged about 84%, with major losses occurring in the soft, typically unconsolidated roof and floor rocks and interburden shales, mudstones and sandstones. These intervals tended to wash out completely

during coring, or the core diameter was reduced by the erosive action of the circulating medium until the core was too small for the core catcher to hold it.

The 3-inch core, as used in this project, is recommended for coal evaluations for several reasons:

1. Overall core recovery, especially in areas of difficult coring, is consistently better.
2. The core quality is consistently better, and there is less fracturing and breaking of the coal.
3. The larger coal and/or rock core is more representative of the in-situ condition.
4. The larger sample allows for more representative splits that may be required for multiple analyses, and concurrent petrographic studies or other determinations.

The split inner core barrel is also recommended for use in place of the solid inner barrel primarily because the core is not disturbed upon removal.

#### Lithologic logs

Composite drill cutting samples were taken for each 5 foot interval and were described and logged by the well site geologist. These logs are shown in Appendix A. The sample logging and core description handling, and packaging was per the guidelines outlined in Hobbs (1979).

Four of the core holes, 80AU 14, 15, 16 and 17, were twin holes offset to the pilot holes 78-9, 78-3, 78-30 and 78-2 drilled in 1978 (Correia, 1980). The twin holes were deepened about 200 feet below the total depth of the 1978 pilot holes.

## Geophysical logs

Geophysical logging of 18 holes was done by Digilog, Inc., Broomfield, Colorado, also under contract with the USGS. Holes 80AU 13 AND 14 were logged by Goodwell, Inc., Upton, Wyoming. The geophysical logs are presented in Appendix B at a reduced scale of about 1" = 40' for the full log and 1' = 20' for the re-runs through the coal intervals.

Natural gamma, high resolution density, caliper, and resistivity (below the fluid level) logs were obtained for each hole. The logging speed was a maximum of 15 fpm (feet per minute) at a scale of 1" = 10' (1 inch of log equals 10 feet of drill hole). Reruns were made through each coal interval, including about 20' each of the roof and floor rock, at a maximum logging speed of 5 fpm at a scale of 1" = 5'.

The density logs are the high resolution type utilizing Americium 241 for the gamma ray source. The depth of investigation of this type probe is shallow and therefore the density curve is not truly representative of the coal/rock apparent density. When interpreting the curve it should be used in conjunction with other curves. Interpretations of partings or possible high ash zones within coal beds should be substantiated by the natural gamma and the resistance curves.

## Acknowledgments

Acknowledgments with sincere appreciation are due the drilling and logging contractors, El Dorado, Inc. (Lloyd Nolan) and Digilog, Inc. (Dan Delaney), and the USGS personnel: R. N. Babcock, Connie Barnes, James D. Cathcart, George Correia, Margaret Stamm, B. H. Kent, Maureen McPhillips and Carol Molnia.

References cited

- Correia, G.A., 1980, Preliminary results of 1978 coal assessment drilling in Northern and Western Recluse Geologic Analysis Area, Northern Campbell County and Eastern Sheridan County, Wyoming: U.S. Geological Survey Open-File Report 80-80, 70 p.
- Hobbs, R. G., 1979, Guidelines for logging, describing and sampling cores and cuttings of coal and associated rocks at the drill site: U.S. Geological Survey Open-File report 79-1522, 23 p.

## Appendix A

### Lithologic logs

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 1 Geologist: Connie Barnes

Type log: Lithologic Elev.: 3610' Total depth: 800'

Location: SE 1/4 NW 1/4 Sec.: 15 T. 55 N. R. 77 W.

Nearest town: Arvada County: Sheridan State: Wyo. Quad.: Arvada NE

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-Drill TK-1 Date start: 8/4/80 Complete: 8/5/80

Non-core intervals and size hole: 0-800'; 5 1/8'

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-800'. Drill cuttings description.

## Log

From	To	Length	Description
(in feet)			
0	5	5	Soil, brown, clayey
5	36	31	Sandstone, brown to dark-gray, medium-grained, poorly sorted; subangular to subrounded
36	50	14	Sandstone, gray to gray-tan with dark-gray carbonaceous stringers, very fine grained, medium-sorted, subangular
50	57	7	Claystone, gray
57	65	8	Coal, black, silky
65	77	12	Claystone, brown to brown-gray with red-brown iron-oxide stringers
77	81	4	Coal, black, silky
81	116	35	Claystone, gray, interbedded with siltstone, light-gray, trace calcareous

Log Continuation:

Hole No.: 80 AU 1

Page 2 of 3

Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)			
116	131	15	Claystone, gray, interbedded with siltstone, light-gray
131	135	4	Claystone, light-gray to gray-mottled
135	153	18	Claystone, gray to tan-gray, trace silt and sand stringers
153	164	11	Claystone, gray-brown to dark-gray-brown
164	170	6	Claystone, dark-gray-brown with lignite stringers
170	173	3	Claystone, red-brown to dark-red-brown
173	229	56	Claystone, light-tan-gray to gray, silty
229	253	24	Claystone, dark-brown to very dark gray, carbonaceous
253	266	13	Sandstone, light-gray, very fine grained, trace green mineral crystals, well sorted, subangular, very argillaceous
266	271	5	Coal, black, dull
271	296	25	Claystone, gray with brown stringers, trace silt
296	309	13	Coal, black, dull to silky
309	311	2	Shale, dark-gray-brown, carbonaceous
311	316	5	Coal, black, dull to silky
316	323	7	Claystone, dark-brown-gray
323	328	5	Claystone, dark-gray-brown with lignite stringers
328	333	5	Shale, dark-gray-brown
333	353	20	Claystone, dark-brown-gray, trace sand and silt
353	361	8	Claystone, gray-brown, trace sand and silt
361	374	13	Shale, very dark-gray-brown with clay and sandstone partings
374	377	3	Coal, black, dull and silky
377	381	4	Shale, dark-gray-brown, carbonaceous

Log Continuation:

Hole No.: 80 AU 1Page 3 of 3Project: Arvada-Ucross 1980

## Log

From	To (in feet)	Length	Description
381	395	14	Coal, black, dull and silky
395	409	14	Claystone, dark-brown-gray, trace silt
409	413	4	Siltstone, gray, trace calcareous
413	449	36	Claystone, gray to gray-brown, silty
449	498	49	Siltstone, light-gray with dark-gray stringers
498	507	9	Coal, brown-black, bony and dull
507	540	33	Claystone, light-gray-brown to dark-gray-brown silt stringers
540	581	41	Claystone, light-green-gray, lignite and silt stringers
581	587	6	Sandstone, gray, very fine-grained
587	613	26	Claystone, gray, silty and carbonaceous
613	628	15	Shale, gray to very dark-gray, fissile to coarsely fissile, very carbonaceous
628	631	3	Coal, black, bright and bony
631	654	23	Shale, gray to very dark-gray, fissile to coarsely fissile, very carbonaceous
654	724	70	Sandstone, light-gray, very fine-grained, well sorted, subangular, very argillaceous with trace clay stringers, trace green mineral crystals
724	753	29	Shale, gray to tan-gray, coarsely fissile
753	760	7	Coal, black, dull, bony
760	800	40	Shale, brown-gray to very dark-brown-gray, fissile, with stringers of siltstone, light-gray, trace green mineral crystals

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 2 Geologist: M. Ellis

Type log: Lithologic Elev.: 3860' Total depth: 765'

Location: NW 1/4 NE 1/4 NE 1/4 Sec.: 9 T. 52 N. R. 77 W.

Nearest town: Arvada County: Sheridan State: Wyo. Quad.: Lariat

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 9/2/80 Complete: 9/2/80

Non-core intervals and size hole: 0-800'; 5 1/8"

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-760'. Drill cuttings description.

## Log

From	To (in feet)	Length	Description
0	5	5	Soil, red-brown; clinker, orange
5	20	15	Soil, tan-brown; clinker, orange
20	25	5	Soil, yellow-tan, sandy
25	54	29	Sandstone, yellow-tan, fine- to medium-grained
54	105	51	Interbedded sandstone, yellow-brown, fine to very coarse grained; shale, black, carbonaceous; and claystone, gray to gray-brown, trace gypsum and pyrite
105	108	3	Coal, black
108	205	97	Claystone, blue-gray to brown-gray, sandy; interbedded with sandstone, green-gray to gray, fine to very coarse grained
205	244	39	Sandstone, green-gray to gray, fine to very coarse grained

Log Continuation:

Hole No.: 80 AU 2Page 2 of 2Project: Arvada-Ucross 1980

## Log

From	To (in feet)	Length	Description
244	316	72	Interbedded claystone, gray to blue-gray; shale, gray to dark-brown, carbonaceous; siltstone, gray to green-gray
316	368	52	Sandstone, gray, very coarse grained
368	404	36	Claystone, gray
404	411	7	Coal, black, dull, bony, trace gypsum
411	462	51	Interbedded claystone, gray; sandstone, gray, very coarse grained; and siltstone, gray
462	538	76	Interbedded sandstone, gray-tan, medium-grained; claystone, gray; and shale, black
538	548	10	Shale, black
548	552	4	Coal
552	559	7	Shale, black
559	563	4	Coal
563	603	40	Interbedded sandstone, gray, coarse-grained; and claystone, tan-gray
603	613	10	Shale
613	640	27	Coal
640	695	55	Interbedded claystone, gray; and sandstone, gray, fine-grained
695	732	38	Shale, black, carbonaceous
732	740	8	Coal, bony
740	760	20	Sandstone, gray, fine- to medium-grained

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 3 Geologist: C. Molnia

Type log: Lithologic Elev.: 3717' Total depth: 555'

Location: NE 1/4 Sec.: 32 T. 56 N. R. 77 W.

Nearest town: Arvada County: Sheridan State: Wyo. Quad.: Fawn Draw

Drilled by: U.S. Geological Survey

Driller(s): Steve Grant

Drill: Porta-drill Date start: 8/1/80 Complete: 8/5/80

Non-core intervals and size hole: 0-130', 150-335', 372-555'; 5 1/8"

Cored intervals and size: 130-150'; 335-372'; 3"

Remarks: Pilot and core hole. Other logs include natural gamma, caliper density and resistivity by Digilog, Inc.; 0-550'. Drill cuttings and core description.

## Log

From	To	Length	Description
	(in feet)		
0	5	5	Silty alluvium, shell fragments
5	15	10	Siltstone, buff, coal stringers
15	25	10	Shale, gray, plant fragments, silty towards bottom
25	37	12	Sandstone, yellow-orange to buff-yellow, very fine grained
37	44	7	Siltstone, light-gray, calcareous
44	60	16	Sandstone, brown, fine-grained, gray shale at bottom
60	65	5	Coal, powdery
65	75	10	Shale, medium-gray, slightly silty
75	80	5	Coal
80	90	10	Siltstone, gray

Log Continuation:

Hole No.: 80 AU 3

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
90	135	45	Shale, light-gray, silty, calcareous stringer at 108 ft. See core description 130-150 ft
135	142	7	Coal
142	150	8	Shale, medium-gray, silty
150	183	33	Siltstone, light-gray, more clay and dark gray towards bottom
183	188	5	Coal (aquifer of 5 gallons per minute flow)
188	245	57	Siltstone, dark-gray, clayey at 200 ft, calcareous stringer at 207 ft, claystone stringer at 210 ft, calcareous stringers at 230 and 232 ft
245	275	30	Sandstone, light-gray to dark-gray, fine-grained, calcareous stringer at 265 ft, clay and silt partings common about 260-275 ft
275	333	58	Siltstone, dark-gray, dark shaley layer at 280 ft, calcareous stringer 295-297 ft, coal stringer at 320 ft, silty claystone at bottom
333	335	2	Coal
335	340	5	Siltstone, gray, slightly sandy (see core description 335-372 ft)
340	345	5	Coal
345	355	10	Claystone, dark-gray, sandy at 346 ft
355	368	13	Coal, hard, clean
368	435	67	Siltstone, gray, calcareous stringer at 403 ft
435	439	4	Sandstone, medium-gray, coal stringer at top, salt and pepper appearance (aquifer of 10 gallons per minute flow)

Log Continuation:

Hole No.: 80 AU 3

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Project: Arvada-Ucross 1980

Log

From	To (in feet)	Length	Description
439	455	16	Claystone, gray, calcareous stringer at 440 ft
455	480	25	Siltstone, gray, with sandstone and claystone, calcareous stringer at 479 ft
480	490	10	Coal, hard, clean, parting of shale at top
490	516	26	Shale, gray
516	530	14	Coal, hard, clean, parting at 517 ft
530	553	23	Shale, gray
553	555	2	Calcareous stringer siltstone, or siliceous sandstone, hard and indurated, bed was not drilled completely

CORE DESCRIPTION 130-150 ft

130	132.3	2.3	Sandstone
132.3	133.9	1.6	Clayey siltstone, dark-gray coal rootlets
133.9	134	0.1	Shale, dark-brown-gray
134	134.1	0.1	Siltstone, gray
134.1	136.6	2.5	Siltstone, gray-brown
136.6	142.6	6.0	Coal, bony, clay pockets at 137.0 ft, fractures at 137.5 and 138.5 ft; cleat fracture at 140.5-141.5 ft, fossil fragments at 140.5 and 141.2 ft
142.6	144	1.4	Lost
144	145.9	1.9	Coal, conchoidal fracture, no partings, no visible sulfur, some cleat structure
145.9	146.0	0.1	Shale, gray
146.0	150	4.0	Lost

Log Continuation:

Hole No.: 80 AU 3

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
CORE DESCRIPTION 335-372 ft			
335.0	336.1	1.1	Coal, hard, clean
336.1	336.4	0.3	Claystone, gray
336.4	336.9	0.5	Sandstone, gray, very fine grained
336.9	339	2.1	Lost--probably sandstone
339	339.8	0.8	Shale, dark-gray
339.8	344.8	5.0	Coal, cleated 343.9-344.7 ft, sand clasts present
344.8	345.4	0.6	Shale, gray, carbonaceous material, swelling clay
345.4	345.8	0.4	Sandstone, gray
345.8	346.4	0.6	Shale, gray
346.4	349	2.6	Lost
349	351.2	2.2	Lost
351.2	352.8	1.6	Siltstone, gray, laminated
352.8	353.9	1.1	Shale, gray, carbonaceous streaks
353.9	354.5	0.6	Shale, carbonaceous
354.5	356.5	2.0	Shale, gray, carbonaceous streaks, swelling
356.5	358.0	1.5	Coal, pyrite streak at 357.8 ft, resin at 357.5 ft
358.0	368.5	10.5	Coal, hard, clean, pyrite streaks at 358.8-358.4 ft, fracturing at 363.3-363.6 and 364.1-364.5 ft, pyrite streaks at 365.8 ft, cleated at bottom, pyrite streaks at 368.0-368.5 ft
368.5	369.6	1.1	Shale, carbonaceous
369.6	369.7	0.1	Coal

Log Continuation:

Hole No.: 80 AU 3

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
369.7	369.8	0.1	Shale, carbonaceous
369.8	370.1	0.3	Coal
370.1	370.3	0.2	Shale, gray with coal stringers
370.3	371.1	0.8	Coal with pyrite streaks
371.1	371.5	0.4	Shale, gray with coal stringers
371.5	372.0	0.5	Lost--probably shale

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 4 Geologist: M. Ellis

Type log: Lithologic Elev.: 4118' Total depth: 1000'

Location: NW 1/4 NE 1/4 NW 1/4 Sec.: 19 T. 53 N. R. 80 W.

Nearest town: Ucross County: Johnson State: Wyo. Quad.: Ucross

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 9/5/80 Complete: 9/6/80

Non-core intervals and size hole: 0-1000'; 5 1/8"

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 265-1000'. Drill cuttings description.

## Log

From	To	Length	Description
(in feet)			
0	10	10	Soil, red-brown, clayey
10	20	10	Soil, red-brown; and claystone, dark-brown-black
20	30	10	Claystone, yellow-brown; sandstone, tan, very coarse grained; and gravel
30	35	5	Claystone, very light yellow white and darker
35	40	5	Clinker and sandstone, tan, very fine grained
40	45	5	Claystone, tan-brown; clinker; and sandstone, tan, very coarse grained
45	50	5	Clinker; claystone, brown; sandstone, tan, medium to very coarse grained

Log Continuation:

Hole No.: 80 AU 4

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
50	60	10	Sandstone, gray, medium-grained
60	80	20	Claystone, gray to dark-gray
80	100	20	Claystone, medium-gray to blue-gray
100	110	10	Claystone, tan-gray to blue-gray
110	120	10	Claystone, blue-gray; and sandstone, gray to blue-gray, fine-grained
120	125	5	Claystone, blue-gray; and claystone, tan-orange
125	130	5	Claystone, blue-gray
130	135	5	Claystone, blue-gray to gray
135	140	5	Claystone, blue-gray, red-brown, dark-brown; and shale, carbonaceous
140	145	5	Claystone, blue-gray; and claystone, tan-gray
145	150	5	Sandstone, gray, fine-grained; claystone, gray; and siltstone, red-brown
150	160	10	Claystone, gray; sandstone, gray, fine-grained; and siltstone, red brown
160	165	5	Claystone, gray
165	170	5	Claystone, gray; shale, dark-brown, carbonaceous
170	215	45	Claystone, gray to gray-brown, silty; shale, gray to dark-brown; and sandstone, gray, fine-grained
215	250	35	Siltstone, brown-gray to gray
250	289	39	Claystone, brown-gray, carbonaceous

Log Continuation:

Hole No.: 80 AU 4

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
	(in feet)		
289	292	3	Coal
292	318	26	Interbedded claystone, brown to gray-brown; shale, dark-brown, carbonaceous; and sandstone, gray, fine-grained
318	328	10	Coal, dull, bony
328	435	107	Interbedded claystone, green-gray to brown-gray; siltstone, green-gray, clayey; and shale, brown
435	546	111	Interbedded claystone, gray to brown-gray; shale, dark-brown, carbonaceous, fissile
546	567	21	Coal
567	710	143	Claystone, gray to blue-gray
710	824	114	Interbedded claystone, blue-gray to brown-gray; sandstone, tan-orange, very coarse grained; and shale, brown
824	1000	176	Interbedded claystone, brown-gray to green-gray; coal, black; sandstone, tan to orange, very coarse grained

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 6 Geologist: M. Ellis

Type log: Lithologic Elev.: 3850' Total depth: 800'

Location: NE 1/4 SE 1/4 Sec.: 30 T. 56 N. R. 78 W.

Nearest town: Leiter County: Sheridan State: Wyo. Quad.: Gardner Gulch

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 9/10/80 Complete: 9/10/80

Non-core intervals and size hole: 0-800'; 5 1/8"

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-730'. Drill cuttings description.

## Log

From	To (in feet)	Length	Description
0	74	74	Soil, tan to light-brown
74	79	5	Coal
79	189	110	Interbedded claystone, tan-brown to gray; gravel; coal; sandstone; clinker; and shale, black, fissile
189	194	5	Coal
194	206	12	Shale, black, fissile
206	219	13	Coal
219	340	121	Sandstone with interbedded mudstone
340	349	9	Coal
349	374	25	Sandstone with interbedded mudstone

Log Continuation:

Hole No.: 80 AU 6

Page 2 of 2

Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
374	377	3	Coal
377	541	164	Sandstone with interbedded claystone, yellow-brown
541	547	6	Coal
547	570	23	Sandstone
570	578	8	Coal
578	636	58	Interbedded sandstone and siltstone
636	698	62	Claystone, yellow-brown
698	701	3	Coal
701	705	4	Sandstone, tan, coarse to very coarse grained; gravel; shale, black, carbonaceous, some coal
705	710	5	Gravel; coal; and sandstone, very coarse grained
710	720	10	Gravel and coal
720	725	5	Claystone, tan; gravel; and coal
725	735	10	Sandstone; claystone, yellow-brown; and coal
735	740	5	Sandstone, tan, medium to very coarse grained
740	800	60	Sandstone, tan, medium- to coarse-grained

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 7 Geologist: Connie Barnes

Type log: Lithologic Elev.: 3670' Total depth: 840'

Location: NW NW Sec.: 3 T. 54 N. R. 77 W.

Nearest town: Arvada County: Sheridan State: Wyo. Quad.: Arvada NE

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 7/31/80 Complete: 8/4/80

Non-core intervals and size hole: 0-203.0'; 215.5-295.0'; 313.0-588.0'; 614.0-840'

Cored intervals and size: 203.0-215.5'; 295.0-313.0'; 588.0-614.0'; 3"

Remarks: Pilot and core hole. Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-840'. Drill cuttings and core description.

## Log

From	To	Length	Description
(in feet)			
0	10	10	Soil, brown, clayey with shale fragments
10	22	12	Claystone, gray-tan to tan with gray stringers, trace iron-oxidation
22	32	10	Siltstone, tan, very argillaceous, uncemented, sandy
32	61	29	Interbedded claystone, gray-tan; siltstone, tan; sandstone, light-tan, very fine grained, very argillaceous, well-sorted, subrounded
61	63	2	Coal, black
63	81	18	Claystone, gray with dark-gray carbonaceous stringers

Log Continuation:

Hole No.: 80 AU 7

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)	(in feet)		
81	100	19	Interbedded claystone, tan-gray with iron-oxide staining; sandstone, gray, very fine grained, friable, well-sorted, subrounded to subangular, very argillaceous
100	203	103	Interbedded claystone, gray to dark-brown-gray, silty, with carbonaceous stringers; siltstone, gray, trace carbonaceous stringers and black mineral crystals, shaley, friable, trace calcareous

CORE DESCRIPTION

203	215.5	12.5	Coal, black, dull and silky-banded, blocky fracture, trace gas bubbles
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END CORE DESCRIPTION

215.5	225	9.5	Claystone, brown-gray with very dark brown gray stringers
225	227	2	Coal, black, dull
227	234	7	Shale, gray, fissile
234	237	3	Sandstone, gray, very fine grained, friable, trace calcareous
237	260	23	Interbedded claystone, gray; siltstone, light-gray to gray-mottled and streaked, friable, trace calcareous
260	275	15	Siltstone, light-gray to gray-mottled and streaked, very argillaceous, trace calcareous
275	283	8	Claystone, gray, trace calcareous
283	295	12	Siltstone, gray, very argillaceous, trace calcareous

Log Continuation:

Hole No.: 80 AU 7

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
CORE DESCRIPTION			
295	299	4	Shale, very dark brown gray with stringers of carbonaceous material
299	313	14	Coal, black, dull to dull and silky-banded, blocky to conchoidal fracture, trace of siltstone stringers, light brown, friable
END CORE DESCRIPTION			
313	317	4	Claystone, very dark brown gray with stringers of coal
317	384	67	Claystone, gray with trace dark-gray carbonaceous stringers, trace calcareous and silty stringers
384	387	3	Coal, black
387	417	30	Claystone, light-gray with gray stringers
417	434	17	Sandstone, gray, very fine grained, medium-sorted, subangular, well-cemented, trace of pyrite cement
434	441	7	Claystone, light-gray with gray stringers
441	448	7	Interbedded claystone and shale, carbonaceous
448	455	7	Sandstone, gray, shaley
455	475	20	Claystone, light-green-gray with dark-gray carbonaceous stringers to very dark gray, sandy
475	516	41	Sandstone, light-green-gray, very fine grained, friable, medium sorted, subangular, trace green mineral crystals, interbedded with claystone, very dark gray
516	520	4	Siltstone, green-gray to gray, 15 percent calcareous, 10 percent carbonaceous material

Log Continuation:

Hole No.: 80 AU 7

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
520	574	54	Sandstone, light-green-gray, very fine grained to fine-grained, friable, medium-sorted, subangular, trace green mineral crystals, very argillaceous; interbedded with claystone, very dark gray
574	588	14	Claystone, gray to dark-gray
CORE DESCRIPTION RUN 3			
588.0	601.0	13.0	Coal, black
601.0	602.5	1.5	Shale, very dark brown gray, carbonaceous
602.5	614.0	11.5	Coal, black, bony
END CORE DESCRIPTION			
614	674	60	Interbedded claystone, gray to very dark gray; siltstone, very light green gray; and shale, very dark gray, coarsely fissile to blocky
674	693	19	Coal, black with parting
693	711	18	Claystone, brown-gray with carbonaceous stringers
711	714	3	Sandstone, light-tan-gray, fine-grained, medium-sorted, subangular to subrounded, trace green mineral crystals, silicified, 5 percent calcareous
714	719	4	Claystone, light-gray to very dark gray mottled
719	737	18	Sandstone, light-tan-gray, carbonaceous
737	749	12	Coal, black
749	754	5	Shale, gray, silty

Log Continuation:

Hole No.: 80 AU 7

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
	(in feet)		
754	768	14	Siltstone, gray, trace pyrite cement in places
768	840	72	Interbedded claystone, gray to brown-gray-mottled; siltstone, gray; and carbonaceous material

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 8 Geologist: M. Ellis

Type log: Lithologic Elev.: 3890' Total depth: 900'

Location: NE 1/4 SE 1/4 NE 1/4 Sec.: 34 T. 55 N. R. 79 W.

Nearest town: Leiter County: Sheridan State: Wyo. Quad.: Leiter

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 9/11/80 Complete: 9/11/80

Non-core intervals and size hole: 0-900'; 5 1/8"

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-900'. Drill cuttings description.

## Log

From	To	Length	Description
(in feet)			
0	36	36	Soil; gravel, tan; and siltstone, tan to orange-tan
36	39	3	Shale, red-brown
39	44	5	Sandstone, gray-brown, fine to very fine-grained
44	48	4	Claystone, very dark brown gray, silty
48	54	6	Siltstone, gray
54	61	7	Siltstone, gray-brown
61	76	15	Shale, dark-brown-black, carbonaceous
76	125	49	Siltstone, gray to brown-gray; with interbedded claystone, brown-gray; and sandstone, brown-gray
125	155	30	Claystone, brown-gray, silty

Log Continuation:

Hole No.: 80 AU 8

Page 2 of 3

Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
155	181	26	Shale, black, fissile, carbonaceous; with interbedded coal, black; and claystone, brown to gray
181	198	17	Claystone, gray-brown, silty
198	276	78	Sandstone, tan to gray, very coarse grained
276	290	14	Claystone, gray; with interbedded sandstone, gray, very coarse grained; pyrite; and coal stringers
290	345	55	Claystone, blue-gray to green-gray; with interbedded siltstone, gray to green-gray; shale, dark-brown, carbonaceous; and coal stringers
345	360	15	Claystone, brown-gray; with interbedded shale, dark-brown, fissile, carbonaceous
360	385	25	Claystone, gray to brown-gray; with interbedded shale, dark-brown, carbonaceous; and siltstone, tan
385	435	50	Claystone, tan-gray to brown-gray; with interbedded siltstone, tan; and shale, dark-brown, carbonaceous
435	438	3	Coal
438	460	22	Claystone, brown-gray
460	481	21	Sandstone, gray, fine-grained to very fine grained
481	486	5	Claystone, gray-brown
486	494	8	Coal
494	582	88	Claystone, brown to dark-gray-brown; with interbedded silty sandstone, tan, very fine grained; and shale, gray-brown
582	587	5	Coal, black, shaley

Log Continuation:

Hole No.: 80 AU 8

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)	(in feet)		
587	654	67	Sandstone, gray, fine to very fine grained; with interbedded claystone, tan-gray to gray-brown; and shale, black, fissile, carbonaceous
654	668	14	Coal, black
668	738	70	Shale, black to brown-black, carbonaceous; with interbedded clay, dark-brown; and sandstone, light-gray, very fine to fine-grained
738	744	6	Coal
744	777	33	Shale, brown-black; with interbedded claystone, gray; and sandstone, gray, fine-grained
777	783	6	Coal
783	900	117	Claystone, gray to dark-brown and yellow-brown; with interbedded shale, dark-brown, fissile, carbonaceous; and sandstone, gray to orange, very coarse grained

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 9 Geologist: M. Ellis

Type log: Lithologic Elev.: 4200' Total depth: 1000'

Location: C NW 1/4 Sec.: 35 T. 58 N. R. 78 W.

Nearest town: Leiter County: Sheridan State: Wyo. Quad.: Cabin Creek NW

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 9/3/80 Complete: 9/8/80

Non-core intervals and size hole: 0-1000'; 5 1/8"

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-1000'. Drill cuttings description.

## Log

From	To	Length	Description
(in feet)			
0	5	5	Soil, yellow-brown
5	30	25	Claystone, red-brown and yellow-tan, silty
30	89	59	Claystone, blue-gray to black
89	92	3	Coal
92	94	2	Claystone, brown-gray
94	100	6	Coal
100	146	46	Claystone, blue to green-gray, silty; with interbedded sandstone, gray, fine-grained; trace shell fragments
146	233	87	Sandstone, gray to tan-gray, fine- to medium-grained, clayey
233	266	33	Claystone, gray to dark-brown-gray; with interbedded sandstone, gray, medium-grained; and coal

Log Continuation:

Hole No.: 80 AU 9

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
266	273	7	Coal
273	320	47	Sandstone, gray, coarse-grained; with interbedded claystone, gray, silty
320	323	3	Coal
323	380	57	Sandstone, gray, coarse-grained; with interbedded claystone, brown-gray, silty
380	386	6	Coal
386	565	179	Claystone, gray to tan-gray, silty; with interbedded sandstone, gray, coarse-grained; and siltstone, gray
565	589	24	Coal with shale partings
589	822	233	Claystone, brown-gray to blue-gray; interbedded with shale, dark-brown to black towards bottom
822	848	26	Coal with shale partings
848	1000	152	Claystone, brown-gray, blue-gray, yellow-gray, white-gray; with interbedded shale, dark-brown, fissile, carbonaceous

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 10 Geologist: M. Ellis

Type log: Lithologic Elev.: 4190' Total depth: 1120'

Location: SW 1/4 SW 1/4 SE 1/4 Sec.: 29 T. 57 N. R. 78 W.

Nearest town: Leiter County: Sheridan State: Wyo. Quad.: Box Elder Draw

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 9/8/80 Complete: 9/9/80

Non-core intervals and size hole: 0-1100'; 5 1/8"

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-1120'. Drill cuttings description.

## Log

From	To	Length	Description
(in feet)			
0	25	25	Soil, tan-brown, slightly clayey
25	40	15	Claystone, yellow-brown
40	50	10	Claystone, dark-gray
50	80	30	Claystone, yellow-brown, silty
80	163	83	Claystone, yellow-brown to tan-brown, silty and sandy
163	316	153	Claystone, brown-gray to blue-gray, silty; with interbedded sandstone, gray, very fine grained; claystone, blue-gray; and shale, brown
316	320	4	Coal

Log Continuation:

Hole No.: 80 AU 10

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
320	471	151	Claystone, dark-brown, dark-gray, blue-gray, yellow-brown; with interbedded shale, brown to black; sandstone, gray-brown, very coarse to very fine grained; and siltstone, gray
471	485	14	Coal with shale parting
485	493	8	Shale, dark-brown-gray
493	500	7	Coal
500	567	67	Sandstone, tan-gray; with interbedded claystone, tan-gray
567	574	7	Coal
574	631	57	Claystone, dark-brown; with interbedded shale, dark-brown, carbonaceous
631	635	4	Coal
635	768	133	Claystone, gray to brown-gray; with interbedded shale, dark-brown, carbonaceous; and sandstone, light-brown, very fine grained
768	776	8	Coal
776	915	139	Claystone, gray-brown to gray; with interbedded shale, dark-brown, fissile, carbonaceous; and siltstone, gray
915	922	7	Coal with shale parting
922	994	72	Shale, dark-brown, fissile, carbonaceous; with interbedded claystone, dark-brown to gray to green-gray
994	1004	10	Coal with shale parting
1004	1071	67	Shale, dark-brown to black, fissile, carbonaceous; with interbedded claystone, gray-brown to green-gray

Log Continuation:

Hole No.: 80 AU 10

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Project: Arvada-Ucross 1980

Log

From	To (in feet)	Length	Description
1071	1082	11	Coal
1082	3820	38	Claystone, brown, tan, and green-gray; interbedded with shale, dark-brown to black, fissile, carbonaceous

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 11 Geologist: M. Ellis

Type log: Lithologic Elev.: 4280' Total depth: 700'

Location: SW 1/4 SE 1/4 Sec.: 23 T. 53 N. R. 78 W.

Nearest town: Arvada County: Sheridan State: Wyo. Quad.: Jewell Draw

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 8/30/80 Complete: 8/31/80

Non-core intervals and size hole: 0-700'; 5 1/8"

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-700'. Drill cuttings description.

## Log

From	To	Length	Description
(in feet)			
0	55	55	Soil, red-brown to tan-brown, silty and clayey, trace pebbles
55	79	24	Claystone, red-brown to tan-brown, silty, trace of clinker
79	140	61	Shale, black, carbonaceous; with interbedded siltstone, brown; sandstone, brown, very coarse grained, trace pyrite
140	143	3	Coal
143	151	8	Shale, black, fissile
151	159	8	Claystone, gray
159	184	25	Sandstone, gray, very coarse grained, trace pyrite
184	194	10	Shale, black, fissile
194	200	6	Sandstone, gray, very coarse grained
200	256	56	Claystone, blue-gray; with interbedded sandstone, gray

Log Continuation:

Hole No.: 80 AU 11

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
256	314	58	Siltstone, blue-gray to gray-brown; with interbedded claystone, gray to blue-gray
314	374	60	Claystone, gray to brown-gray; with interbedded shale, dark-gray to black, carbonaceous; and siltstone, gray to dark-gray
374	403	29	Claystone, gray to brown-gray; with interbedded siltstone, gray, clayey
403	406	3	Coal
406	420	14	Claystone, brown-gray; with interbedded shale, dark-brown, carbonaceous
420	450	30	Coal zone with shale, dark-brown to black partings and splits
450	507	57	Sandstone, gray
507	556	49	Claystone, gray to brown-gray; with interbedded siltstone, brown-gray
556	609	53	Sandstone, gray
609	614	5	Coal
614	631	17	Shale, black, carbonaceous
631	634	3	Coal
634	637	3	Claystone, yellow-gray
637	639	2	Coal
639	648	9	Claystone, yellow-gray, silty
648	657	9	Siltstone, gray
657	665	8	Claystone, yellow-gray
665	700	35	Siltstone, gray to yellow-brown, brown-gray, and blue-gray

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 12 Geologist: M. Ellis

Type log: Lithologic Elev.: 4360' Total depth: 800'

Location: SW 1/4 Sec.: 5 T. 53 N. R. 78 W.

Nearest town: Clearmont County: Sheridan State: Wyo. Quad.: Arpan Butte

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 8/28/80 Complete: 8/29/80

Non-core intervals and size hole: 0-800'; 5 1/8"

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-770'. Drill cuttings description.

## Log

From	To	Length	Description
	(in feet)		
0	28	28	Soil, tan-brown, clayey, silty
28	49	21	Claystone, yellow-brown to dark-brown
49	52	3	Shale, black, carbonaceous
52	78	26	Claystone, gray-brown
78	92	14	Coal, black, silky; with interbedded shale, dark-brown to black, carbonaceous partings and splits
92	114	22	Claystone, brown-gray to green-gray, silty; with interbedded shale, dark-brown to black, carbonaceous
114	208	94	Sandstone, gray to gray-brown, very fine to fine-grained; trace siltstone

Log Continuation:

Hole No.: 80 AU 12Page 2 of 2Project: Arvada-Ucross 1980

## Log

From	To (in feet)	Length	Description
208	306	98	Claystone, gray to brown-gray; with interbedded shale, gray-brown to dark-brown, carbonaceous; and sandstone, gray to gray-brown, fine-grained
306	335	29	Claystone, dark-gray-brown, silty
335	339	4	Coal
339	356	17	Claystone, dark-gray-brown
356	361	5	Coal
361	420	59	Claystone, gray to gray-brown, silty; with interbedded shale, gray-brown, carbonaceous
420	440	20	Siltstone, dark-brown to gray
440	500	60	Siltstone, dark-brown; with interbedded claystone, brown-gray; and sandstone, gray, fine-grained
500	503	3	Coal
503	599	96	Shale, dark-brown to black, carbonaceous; with interbedded sandstone, gray, very fine grained; claystone, gray-brown to green-gray, silty; and siltstone, tan-gray to brown-gray, sandy
599	614	15	Claystone, dark-brown to green-gray; and shale, gray
614	742	128	Claystone, tan-gray to green-gray; with interbedded siltstone, tan-gray, sandy
742	770	28	Sandstone, tan-gray, fine-grained; and siltstone, tan-gray, sandy
770	785	15	Siltstone, tan-gray, sandy
785	800	15	Sandstone, tan-gray, very fine to medium-grained

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 13 Geologist: M. McPhillips

Type log: Lithologic Elev.: 4180' Total depth: 1180'

Location: NE 1/4 NE 1/4 Sec.: 1 T. 54 N. R. 76 W.

Nearest town: Arvada County: Campbell State: Wyo. Quad.: Larey Draw

Drilled by: El Dorado Exploration Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 7/20/80 Complete: 7/22/80

Non-core intervals and size hole: 0-1180'; 5 1/8"

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Goodwell, Inc.; 0-1019'. Hole was bridged at 1019'. Drill cuttings description.

## Log

From	To	Length	Description
(in feet)			
0	5	5	Alluvium, yellow-orange, silty
5	10	5	Alluvium, pale-yellow-brown, silty, clayey
10	35	25	Alluvium, light-olive-gray, silty, clayey, some iron oxide stains
35	40	5	Alluvium, gray-orange, silty, leached
40	45	5	Alluvium, medium-yellow-brown, silty
45	55	10	Siltstone, light-gray to light-olive-gray, clayey
55	65	10	Sandstone, light-olive-gray, fine-grained, subrounded, iron oxide stains
65	75	10	Sandstone, very light gray, medium-grained, subrounded, weathered
75	80	5	Sandstone, gray-orange, fine- to coarse-grained, subrounded, weathered

Log Continuation:

Hole No.: 80 AU 13

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
80	85	5	Claystone, medium-gray
85	86	1	Coal, black, silky, hard
86	167	81	Claystone, medium-gray to dark-green-gray, some coal stringers
167	244	77	Claystone, medium-light-gray to medium-gray, silty, probably coaly or carbonaceous material; with shale, olive-gray, from 232 to 235 ft
244	247	3	Coal, black, dull to silky, bony to hard; with shale, olive-gray, parting
247	279	32	Claystone, medium-gray; interbedded with siltstone, light-gray
279	289	10	Siltstone, olive-gray; interbedded with shale, medium-gray
289	300	11	Siltstone, medium-gray
300	309	9	Siltstone, light-olive-gray
309	327	18	Siltstone, light-olive-gray; with interbedded claystone, light- to medium-gray
327	341	14	Sandstone, light-olive-gray, very fine grained
341	355	14	Claystone, medium-gray
355	369	14	Claystone, medium-gray to medium-dark-gray; interbedded with siltstone, medium-dark-gray; and shale, dark-gray
369	383	14	Claystone, medium-gray to medium-dark-gray; interbedded with siltstone, medium-dark-gray
383	390	7	Coal, black, with 1 ft parting in middle
390	404	14	Siltstone, medium-dark-gray

Log Continuation:

Hole No.: 80 AU 13Page 3 of 4Project: Arvada-Ucross 1980

## Log

From	To (in feet)	Length	Description
404	417	13	Claystone, medium-light-gray to medium-dark-gray, with siltstone, medium-dark-gray
417	443	26	Sandstone
443	454	11	Claystone, medium-gray
454	481	27	Sandstone
481	485	4	Coal, black
485	490	5	Claystone, medium-gray
490	510	20	Siltstone, medium-light-gray
510	520	10	Coal, black, dull soft
520	528	8	Shale, medium-dark-gray with coal stringers
528	549	21	Coal, black, shaley at bottom
549	581	32	Sandstone, light-olive-gray, very fine grained; interbedded with claystone, medium-gray, shaley at top, coaly at bottom
581	617	36	Claystone, medium-gray; interbedded with siltstone, light-olive- gray; and shale, medium-gray; and some siltstone, medium-light- gray, pyrite
617	623	6	Shale, medium-gray
623	627	4	Coal, black, dull, bony
627	631	4	Claystone, medium-gray
631	656	25	Claystone, medium-gray to green-gray; interbedded with sandstone, dark-yellow-orange, fine-grained; shale, light-olive-gray, silty; and sandstone, coarse-grained

Log Continuation:

Hole No.: 80 AU 13

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Project: Arvada-Ucross 1980

Log

From	To (in feet)	Length	Description
656	682	26	Claystone, green-gray to medium-gray; and shale, dark-gray, with some coal
682	732	50	Interbedded claystone, medium-light-gray to light-blue-gray to green-gray; siltstone, light-olive-gray, calcareous; coal, black, dull, bony, soft; and shale, medium-gray to medium-dark-gray, trace carbonaceous material
732	742	10	Sandstone
742	748	6	Claystone, medium-gray
748	763	15	Claystone, medium-gray to medium-blue-gray, with coal stringers
763	803	40	Coal, black, dull to silky, bony, soft
803	813	10	Shale, brown-black with coal, dull to silky, soft, some shale, medium-gray, trace carbonaceous material
813	830	17	Sandstone
830	872	42	Claystone, medium-light-gray to medium-blue-gray, with coal stringers
872	940	68	Sandstone
940	947	7	Shale, medium-dark-gray, and claystone, medium-gray
947	1019	72	Interbedded claystone, medium-light-gray to medium-blue-gray; siltstone, light-olive-gray to medium-gray to dark-green-gray; coal, black, dull to silky, bony, soft; and shale, medium-gray to medium-dark-gray with carbonaceous material
1019	1180	161	No geophysical log hole bridged, samples showed as 947-1019 ft. Poor sample returns 947-1180 ft

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 14 Geologist: M. McPhillips

Type log: Lithologic Elev.: 4120' Total depth: 955'

Location: SW 1/4 NE 1/4 Sec.: 20 T. 55 N. R. 75 W.

Nearest town: Spotted Horse County: Campbell State: Wyo. Quad.: Larey Draw

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 7/15/80 Complete: 7/20/80

Non-core intervals and size hole: 0-290'; 339.2-680.0'; 749.8-955.0'; 5 1/8"

Cored intervals and size: 290.0-339.2'; 680.0-749.8'; 3 1/8"

Remarks: Pilot and core hole. Other logs include natural gamma, caliper, density, and resistivity run by Goodwell, Inc.; 0-955'. Drill cuttings and core descriptions.

## Log

From	To	Length	Description
(in feet)			
0	14	14	Soil, tan, clayey, silty towards bottom
14	28	14	Sandstone, gray-tan, very fine grained, angular
28	45	17	Sandstone, tan, fine- to medium-grained, subangular, brown clay stringers
45	54	9	Sandstone, dark-tan to red-tan, fine-grained, subangular, some coarse sand
54	68	14	Siltstone, light-gray to light-brown
68	71	3	Sandstone, tan, very fine grained
71	108	37	Siltstone, light-brown, argillaceous around 90 ft, loosely cemented 101 to 106 ft
108	133	25	Claystone, gray

Log Continuation:

Hole No.: 80 AU 14

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Project: Arvada-Ucross 1980

Log

From	To (in feet)	Length	Description
133	162	29	Sandstone, gray, very fine grained, clayey
162	166	4	Coal, black, with parting
166	184	18	Sandstone, light-gray, very fine grained, clayey
184	200	16	Sandstone, poorly consolidated in places, clayey
200	205	5	Claystone, gray
205	208	3	Coal, black, soft, shiny
208	210	2	Claystone, gray, carbonaceous material
210	221	11	Sandstone, gray, very fine grained, some carbonaceous material
221	238	17	Shale, coarsely fissile to blocky, trace carbonaceous specks
238	243	5	Coal, black, dull, bony
243	261	18	Mudstone, dark-gray, abundant carbonaceous material
261	290	29	Claystone, gray, abundant plant remains

CORE DESCRIPTION

290	293.7	3.7	Sandstone, very light gray, carbonaceous and coal stringers, trace gypsum crystals, badly broken
293.7	294.6	0.9	Sandstone, light-gray, very fine grained, coal stringers at 294.2 and 293.9 ft
294.6	296.4	1.8	Shale, black, carbonaceous, slightly coaly, silty; interbedded with siltstone, gray, carbonaceous, gypsum crystals
296.4	297.0	0.6	Siltstone, gray, trace clay, slightly carbonaceous
297.0	297.4	0.4	Siltstone, dark-gray, carbonaceous, trace clay
297.4	298.8	1.4	Siltstone, gray
298.8	299.0	0.2	Shale, black, coaly, sandy

Log Continuation:

Hole No.: 80 AU 14

Page 3 of 7

Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
299.0	299.8	0.8	Shale, dark-olive-brown, carbonaceous, silty at top
299.8	303.5	3.7	Coal, black, hard, dull, cleat fracture from 301.0 to 301.8 ft
303.5	303.8	0.3	Claystone, dark-olive-gray
303.8	308.5	4.7	Coal, black, dull, hard, cleat and butt fracture from 305.4 to 307.9 ft, shaley at bottom
308.5	309.4	0.9	Shale, dark-gray, carbonaceous, clay streak at 309.3 ft
309.4	311.1	1.7	Coal, black, dull, hard, clay pockets near bottom, sharp basal contact
311.1	314.0	2.9	Claystone, light-olive-gray, silty, slightly carbonaceous at top
314.0	314.2	0.2	Claystone, light-brown
314.2	314.9	0.7	Shale, dark-gray, trace carbonaceous material
314.9	328.1	13.2	Coal, black, dull, bony from 315.5 to 315.9 ft, trace clay, cleat fractures from 315.9 to 318.9 ft, bony from 317.5 to 317.9 ft, cleat from 319.7 to 320.4 ft, bony from 320.8 to 321.0 ft
328.1	329.0	0.9	Coal, black, dull
329.0	334.3	5.3	Coal, black, dull with bright stringers, conchoidal fracture, broken, cleat fractures, clay stringers at 333.3 and 334.3 ft
334.3	339.2	4.9	Claystone, gray, with carbonaceous stringers
END CORE DESCRIPTION			
339.2	376	36.8	Shale, gray, trace to abundant plant remains
376	396	20	Siltstone, gray, trace plant remains
396	407	11	Claystone, gray
407	410	3	Coal, black, dull to silky, bony

Log Continuation:

Hole No.: 80 AU 14

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
410	414	4	Shale, light-gray, hard
414	421	7	Shale, dark-brown, carbonaceous
421	425	4	Coal, black, dull, bony, mica flakes
425	429	4	Shale, black, coaly, mica flakes
429	443	14	Sandstone, light-gray, very fine grained, carbonaceous
443	458	15	Shale, gray to dark-gray, abundant carbonaceous material near bottom
458	504	46	Sandstone, gray, very fine grained, shaley, trace carbonaceous material
504	565	61	Shale, light-gray to gray, silty; interbedded with siltstone, light- to medium-gray, trace to abundant carbonaceous material
565	594	29	Very poor sample--probably sandstone, silty, poorly consolidated
594	613	19	Siltstone, light-brown to light-brown-gray, abundant carbonaceous specks, trace carbonaceous plant remains; interbedded with shale, dark-gray, abundant carbonaceous material and plant remains
613	617	4	Sandstone, light-brown to light-brown-gray, very fine grained, rounded
617	624	7	Siltstone, light-brown to light-brown-gray, argillaceous, poorly cemented
624	680	56	Sandstone, light-brown to light-brown-gray, very fine grained, subangular to subrounded, poorly cemented; interbedded with siltstone

Log Continuation:

Hole No.: 80 AU 14Page 5 of 7Project: Arvada-Ucross 1980

## Log

From	To	Length	Description
(in feet)			
CORE DESCRIPTION			
680.0	680.3	0.3	Shale, dark-brown
680.3	680.4	0.1	Shale, gray-brown
680.4	680.8	0.4	Shale, gray-brown
680.8	681.7	0.9	Siltstone, gray, with carbonaceous stringers
681.7	682.0	0.3	Shale, black, very carbonaceous, clay stringers and nodules from 681.7 to 681.8 ft
682.0	682.5	0.5	Siltstone, gray, abundant carbonaceous material, clay from 682.0 to 682.2 ft
682.5	682.8	0.3	Claystone, gray, trace carbonaceous material and carbonaceous stringers
682.8	683.1	0.3	Coal, black, silky, shaley
683.1	685.6	2.5	Sandstone, gray, fine-grained, uncemented
685.6	686.0	0.4	Coal, black, silky, hard, clay stringer
686.0	686.3	0.3	Coal, black, dull with shiny streaks, hard
686.3	687.4	1.1	Coal, black, dull with shiny streaks, bony, fractured
687.4	687.6	0.2	Coal, black, dull with shiny streaks, clayey in spots, scattered resin pockets
687.6	688.0	0.4	Coal, black, dull, clayey, broken
688.0	701.0	13.0	Coal, black, dull, with bright bands, hard, conchoidal fracture slightly clayey in spots, small cleat fracture from 694.7 to 695.6 ft and 697.7 to 698.4 ft, bleeding gas

Log Continuation:

Hole No.: 80 AU 14

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
701.0	706.7	5.7	Coal, black, dull with bright bands to silky, conchoidal and blocky fracture
706.7	706.8	0.1	Coal, black, shiny, bony
706.8	712.3	5.5	Coal, black, dull with bright bands, scattered gypsum rosettes, conchoidal to blocky fracture
712.3	712.4	0.1	Coal, black, dull to bright bony
712.4	716.0	3.6	Coal, black, dull with bright bands, scattered gypsum rosettes, conchoidal to blocky fracture
716.0	716.8	0.8	Coal, black, silky with dull bands, friable, scattered gypsum rosettes
716.8	718.2	1.4	Coal, black, flakey, scattered gypsum rosettes
718.2	722.9	4.7	Coal, black, silky with dull bands scattered gypsum rosettes, blocky fracture
722.9	723.3	0.4	Shale, dark-gray to brown, interbedded with coaly stems and branches
723.3	729.0	5.7	Coal, black, silky with dull bands, blocky fracture
729.0	731.0	2.0	Coal, black, silky with dull bands, blocky fracture
731.0	732.2	1.2	Coal, black, hard, silky banded, abundant plant remains, blocky fracture, gas bubbles, resin at 731.7 ft
732.2	737.5	5.3	Coal, black, hard, dull and silky bands, abundant plant remains, resin at 733.5 ft
737.5	739.4	1.9	Coal, black, silky, conchoidal fracture
739.4	742.0	2.6	Lost from bottom of core barrel

Log Continuation:

Hole No.: 80 AU 14

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
742.0	744.0	2.0	Coal, black, dull with silky bands, hard, scattered gypsum rosettes and crystals, trace gas bubbles
744.0	747.7	3.7	Coal, black, hard, silky with dull bands, blocky fracture, scattered gypsum rosettes and crystals, trace gas bubbles
747.7	749.8	2.1	Coal, black, dull with silky bands, blocky fracture, friable, fibrous mineral crystals, scattered gypsum rosettes, trace gas bubbles
END CORE DESCRIPTION			
749.8	760	10.2	Coal, gray-black, bony
760	777	17	Very poor samples--sandstone, poorly cemented
777	805	28	Siltstone, gray, carbonaceous material; with interbedded claystone, gray; and shale, dark-gray
805	856	51	Very poor samples--sandstone, fine-grained
856	869	13	Coal, black
869	886	17	Siltstone, gray, with carbonaceous material and pyrite crystals, trace iron oxide
886	955	69	Siltstone, light to medium-gray; with interbedded claystone, light-gray to dark-gray; and some sandstone, medium-brown, very fine grained; coaly stringer at 939 ft

## U.S. Geological Survey

Project: Arvada-Ucross 1980Hole No.: 80 AU 15 Geologist: M. McPhillipsType log: Lithologic Elev.: 3800' Total depth: 1000'Location: SE 1/4 NE 1/4 Sec.: 24 T. 54 N. R. 77 W.Nearest town: Arvada County: Sheridan State: Wyo. Quad.: Arvada NEDrilled by: El Dorado Exploration, Inc.Driller(s): Ed PotterDrill: Porta-drill TK-1 Date start: 8/13/80 Complete: 8/18/80Non-core intervals and size hole: 0-270'; 339.6-675.0'; 777.3-1000'; 5 1/8"Cored intervals and size: 270.0-339.6'; 675.0-777.3'; 3 1/8"Remarks: Pilot and core hole. Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-1000'. Drill cuttings and core description.

## Log

From	To	Length	Description
(in feet)			
0	15	15	Alluvium, clay, green-brown, gypsiferous, slightly silty with iron staining
15	18	3	Shale, light-olive-gray, gypsiferous, silty
18	24	6	Sandstone, light-yellow-gray, very fine grained
24	41	17	Claystone, medium-yellow-gray with iron stains, gypsiferous
41	47	6	Shale, carbonaceous
47	52	5	Claystone, medium-blue-gray, silty, gypsiferous
52	62	10	Shale, medium to dark-gray
62	70	8	Sandstone, light-blue-gray, very fine grained, quartz angular to subangular
70	75	5	Shale, medium-brown-gray

Log Continuation:

Hole No.: 80 AU 15

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Project: Arvada-Ucross 1980

Log

From	To (in feet)	Length	Description
75	101	26	Siltstone, medium-blue-gray
101	110	9	Sandstone, light- to medium-gray, very fine grained, abundant pyrite and calcareous
110	120	10	Shale, medium-brown-gray, sandy
120	132	12	Coal, dark-brown, dull, bony; interbedded with carbonaceous shale
132	166	34	Interbedded shale, medium-gray, carbonaceous; siltstone, medium- to dark-brown, silty, carbonaceous; and sandstone, medium-gray, fine-grained, quartz subrounded
166	173	7	Shale, medium-brown-gray, trace carbonaceous
173	192	19	Claystone, medium-gray with carbonaceous streaks
192	206	14	Siltstone, medium-brown-gray, sandy
206	209	3	Coal, bony
209	214	5	Shale, brown-black, carbonaceous, sandy
214	270	56	Siltstone, light- to medium-gray, sandy

CORE DESCRIPTION

270.0	270.5	0.5	Shale, brown-black, carbonaceous
270.5	271.6	1.1	Coal, black, dull, abundant pyrite
271.6	273.7	2.1	Claystone, medium-grained with thin carbonaceous streaks, silty at base
273.7	274.5	0.8	Siltstone, medium-gray with numerous pockets of siltstone, light-olive-green
274.5	274.7	0.2	Claystone, medium-gray, carbonaceous with abundant pyrite balls 1/2" to 1" diameter

Log Continuation:

Hole No.: 80 AU 15

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
274.7	277.4	2.7	Siltstone, light- to medium-gray, some carbonaceous streaks; interbedded with sandstone, olive-gray, fine-grained to very fine grained
277.4	299.0	21.6	Shale, brown-black, carbonaceous
299.0	299.2	0.2	Shale, black, carbonaceous; interbedded with siltstone, medium-gray
299.2	299.5	0.3	Shale, black, carbonaceous
299.5	300.0	0.5	Coal, black, dull with silky bands, some bony streaks
300.0	306.9	6.9	Coal, black, silky with dull bands, bony at top, hard, trace resin
306.9	307.1	0.2	Shale, dark-olive-gray, carbonaceous, coal stringers
307.1	309.2	2.1	Coal, black, silky with dull bands, bony at top, hard, trace resin
309.2	309.4	0.2	Coal, brown-black, bony
309.4	314.0	4.6	Coal, black, bony with silky streaks
314.0	316.6	0.6	Siltstone, medium-light-gray to medium-gray with coal streak
314.6	316.4	1.8	Siltstone, light- to medium-gray, sandy, trace carbonaceous material
316.4	317.1	0.7	Shale, medium-gray, silty at top, coaly stringers, pyrite streaks, carbonaceous, shale at base
317.1	319.9	2.8	Sandstone, light-olive-gray, fine-grained; interbedded with shale, medium-gray
319.9	320.5	0.6	Sandstone, medium-gray, very fine grained, carbonaceous, clayey

Log Continuation:

Hole No.: 80 AU 15

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
320.5	328.4	7.9	Shale, medium-gray, silty; interbedded with sandstone, medium-light-gray, very fine grained with coal stringers at 324.3 ft; calcareous mottles at 323.6 ft; with shale, olive-gray, carbonaceous stringers at bottom
328.4	329.1	0.7	Shale, brown-black, carbonaceous
329.1	330.0	0.9	Coal, black, dull with silky bands, shaley
330.0	331.0	1.0	Coal, black, dull, bony with resin
331.0	331.8	0.8	Siltstone, medium-gray, clayey at bottom, coal stringer at 331.7 ft
331.8	333.7	1.9	Shale, medium-dark-gray, carbonaceous with coal stringers
333.7	334.6	0.9	Claystone, olive-gray, silty
334.6	339.9	5.3	Siltstone, medium-gray to olive-gray, clayey, carbonaceous; interbedded with sandstone, medium-gray to olive-gray, very fine to fine-grained
339.9	346.6	6.7	Siltstone, medium-gray, clayey; interbedded with shale, brown-black, carbonaceous
346.6	346.8	0.2	Coal, black, bony, sandy
346.8	357.6	10.8	Coal, black, silky with dull bands, sandy streak near top, trace resin
357.6	364.0	6.4	Coal, black, silky with dull bands, trace resin
364.0	364.4	0.4	Shale, dark-gray to brown-black, carbonaceous with some coal stringers

Log Continuation:

Hole No.: 80 AU 15

Page 5 of 8

Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
364.4	367.0	2.6	Siltstone, medium-gray, slightly carbonaceous; interbedded with shale, medium-gray; and sandstone, medium-gray, very fine grained
367.0	367.6	0.6	Shale, medium-gray, carbonaceous
END OF CORE DESCRIPTION			
367.6	503	135.4	Interbedded claystone, gray to dark-gray, rare carbonaceous; siltstone, medium-gray, slightly carbonaceous; and sandstone, medium-light-gray, very fine to fine-grained, very argillaceous
503	505	2	Coal, black, bony
505	555	50	Shale, brown-black, carbonaceous
555	675	120	Interbedded shale, brown-black, carbonaceous; siltstone, medium-gray to brown-gray, sandy, rare pyrite cement; claystone, medium-gray to brown-gray; and sandstone, light-gray, very fine grained
CORE DESCRIPTION			
675.0	676.0	1.0	Siltstone, medium-light-gray to light-gray; interbedded with sandstone, medium-light-gray to light-gray, very fine grained
676.0	676.1	0.1	Sandstone, medium-gray, fine-grained, pyritic
676.1	676.3	0.2	Shale, medium-dark-gray, silty
676.3	676.5	0.2	Siltstone, light-olive-gray, hard
676.5	677.8	1.3	Siltstone, medium-gray to medium-dark-gray; interbedded with sandstone, medium-light-gray, very fine grained
677.8	677.9	0.1	Sandstone, medium-gray, very fine grained, pyritic

Log Continuation:

Hole No.: 80 AU 15

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
677.9	678.8	0.9	Shale, medium-gray; interbedded with siltstone, medium-gray, with a hard stringer at 678.6 ft
678.8	679.8	1.0	Shale, medium-dark-gray
679.8	688.0	8.2	Shale, brown-black, carbonaceous
688.0	690.4	2.4	Shale, brown-black, carbonaceous, sandy streaks bottom 0.1 ft
690.4	694.9	4.5	Sandstone, medium-light-gray to medium-gray, very fine grained, thin coaly stringers throughout; interbedded with siltstone, brown-gray
694.9	695.2	0.3	Shale, brown-gray, carbonaceous
695.2	700.0	4.8	Shale, brown-black, carbonaceous
700.0	701.9	1.9	Coal, black, dull, bony
701.9	703.5	1.6	Shale, brown-gray, carbonaceous
703.5	703.8	0.3	Coal, black, bony, dull with silky bands, abundant thin pyrite streaks
703.8	706.1	2.3	Coal, black, silky with dull bands, some bony, some gypsum, some resin
706.1	719.7	13.6	Coal, black, silky with dull bands, scattered gypsum rosettes, shiny patches at 709.7 and 715.1 ft, bony at 712.5 ft
719.7	732.3	12.6	Coal, black, silky with dull bands, abundant scattered gypsum rosettes
732.3	745.8	13.5	Coal, black, silky with dull bands, scattered gypsum rosettes, slightly bony at top in dull bands

Log Continuation:

Hole No.: 80 AU 15

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)	(in feet)		
745.8	747.8	2.0	Coal, black, dull with silky bands, some resin, trace gypsum rosettes
747.8	750.9	3.1	Shale, brown-black, carbonaceous, thin coal stringers, scattered pyrite nodules
750.9	752.1	1.2	Coal, black, dull with shiny streaks to silky, some resin, bony, shaley in places, some pyrite nodules, very bony from 751 ft to bottom
752.1	762.3	10.2	Shale, brown-black to brown-gray, carbonaceous, coaly stringers and thin streaks throughout
762.3	764.3	2.0	Shale, medium-gray, trace carbonaceous material, thin coaly stringers
764.3	765.6	1.3	Siltstone, medium-light-gray to medium-gray, some coal stringers
765.6	765.9	0.3	Sandstone, medium-gray, fine-grained, subrounded, abundant quartz, trace carbonaceous streaks
765.9	766.1	0.2	Siltstone, medium-light-gray, sandy, clayey, rare carbonaceous material
766.1	768.9	2.8	Sandstone, medium-gray, fine-grained, subrounded, abundant quartz
768.9	771.3	2.4	Siltstone, medium-gray, sandy, rare thinly laminated carbonaceous stringers
771.3	773.8	2.5	Siltstone, medium-light-gray to medium-gray, sandy, carbonaceous material in places, trace clay stringers
773.8	777.3	3.5	Siltstone, medium-light-gray to medium-gray, sandy, some carbonaceous stringers and material, some cross bedding

Log Continuation:

Hole No.: 80 AU 15

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)			
END CORE DESCRIPTION			
777.3	812	34.7	Shale, medium-dark-gray to brown-black, carbonaceous
812	817	5	Sandstone
817	857	40	Interbedded shale, brown-black to black; siltstone, gray to light-olive-gray; and claystone, medium-gray to very light gray
856	859	3	Coal, black, dull, bony
859	897	38	Siltstone, medium-gray to medium-light-gray; with interbedded claystone, medium-gray to dark-gray; shale, dark-gray to brown-black, carbonaceous; and sandstone, medium-gray to medium-light-gray, fine-grained, quartz abundant, subrounded
897	918	21	Shale, brown-gray to brown-black, carbonaceous; with interbedded claystone, medium-light-gray
918	1000	82	Shale, gray to black, carbonaceous; with interbedded claystone, medium-gray, silty

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 16 Geologist: Connie Barnes

Type log: Lithologic Elev.: 3830' Total depth: 1000'

Location: C NW 1/4 SW 1/4 Sec.: 5 T. 54 N. R. 76 W.

Nearest town: Arvada County: Sheridan State: Wyo. Quad.: Arvada NE

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 7/29/80 Complete: 7/31/80

Non-core intervals and size hole: 0-59'; 76.0-264.0'; 316.6-588.0'; 638-1000'; 5 1/8"

Cored intervals and size: 585-640'; 3"

Remarks: Other logs run include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-1000'. Drill cuttings and core description.

## Log

From	To	Length	Description
(in feet)			
0	13	13	Soil, brown with fragments of yellow-tan shale
13	38	25	Sandstone, tan-gray, very fine grained, uncemented, well sorted, well rounded, silty
38	41	3	Claystone, gray, carbonaceous
41	44	3	Sandstone, tan-gray, very fine grained, uncemented, well sorted, well rounded, silty
44	49	5	Claystone, gray, carbonaceous
49	59	10	Claystone, gray, sandy

## CORE DESCRIPTION

59.0	62.0	3.0	Sandstone, gray, fine-grained, pyrite nodules--0.5-2 cm diameter
62.0	63.8	1.8	Claystone, dark-gray to green-gray, sand concretions

Log Continuation:

Hole No.: 80 AU 16

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
63.8	76.0	12.2	Coal, black, dull with rare silky bands, abundant gypsum stringers, bony, conchoidal to blocky fracture, rare disseminated pyrite
END CORE DESCRIPTION			
76	78	2	Shale, dark-brown-gray
78	91	13	Claystone, gray, abundant carbonaceous specks
91	95	4	Coquina
95	132	37	Sandstone, gray, very fine grained, uncemented, well sorted, well rounded
132	136	4	Claystone, gray, trace calcareous, abundant carbonaceous specks
136	144	8	Sandstone, gray, very fine grained, uncemented, well sorted, well rounded
144	149	5	Claystone, gray, trace calcareous, abundant carbonaceous specks, sandy
149	157	8	Sandstone, gray, very fine grained, uncemented, well sorted, well rounded
157	162	5	Claystone, gray to brown-gray with brown stringers, trace calcareous
162	166	4	Coal, black
166	200	34	Claystone, light-gray with gray stringers, trace calcareous, abundant carbonaceous specks

Log Continuation:

Hole No.: 80 AU 16

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
200	242	42	Claystone, gray to brown-gray, trace carbonaceous specks, sandy with sand stringers
242	247	5	Claystone, brown-gray with light-gray bands, shale stringers
247	264	17	Claystone, gray to white
CORE DESCRIPTION			
264.0	264.8	0.8	Shale, black, very carbonaceous
264.8	270.1	5.3	Coal, black, dull and silky-banded, conchoidal to blocky fracture
270.1	270.8	0.7	Claystone, gray-brown
270.8	275.0	4.2	Coal, black, dull and silky-banded, yellow-green amber nodules
275.0	276.6	1.6	Shale, black, very carbonaceous
276.6	279.0	2.4	Claystone, gray with bands of coal
279.0	283.0	4.0	Coal, black, silky, blocky and conchoidal fracture, dull bands, trace amber
283.0	295.2	12.2	Claystone, gray with stringers of coal and abundant carbonaceous material
295.2	295.4	0.2	Claystone, brown-gray, interbedded with coal
295.4	298.8	3.4	Claystone, gray with abundant carbonaceous stringers
298.8	302.0	3.2	Coal, black, silky and dull-banded, blocky to conchoidal fracture
302.0	312.3	10.3	Coal, black, silky and dull-banded, blocky fracture, trace pyrite
312.3	313.3	1.0	Coal, black, bony

Log Continuation:

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)			
313.3	314.5	1.2	Coal, black, dull and silky banded, conchoidal and blocky fracture, trace pyrite
314.5	315.6	1.1	Shale, dark-brown-gray, fissile, abundant carbonaceous plant remnants
315.6	316.6	1.0	Coal, black, bony, very shaley with shale stringers
END CORE DESCRIPTION			
316	336	20	Claystone, gray, abundant carbonaceous specks
336	339	3	Siltstone, gray, slightly salt and pepper, trace calcareous
339	342	3	Claystone, gray, trace carbonaceous material
342	345	3	Siltstone, gray, slightly salt and pepper, trace calcareous
345	420	75	Sandstone, tan-gray, very fine grained, uncemented, well sorted, well rounded, silty
420	425	5	Claystone, very dark gray
425	428	3	Coal, black
428	501	73	Interbedded claystone, gray; and siltstone, brown, trace calcareous
501	559	58	Interbedded siltstone, gray, trace pyrite cement; and claystone, gray
559	588	29	Siltstone, gray; interbedded with claystone, brown, and carbonaceous stringers
CORE DESCRIPTION			
588.0	589.6	1.6	Claystone, brown, trace carbonaceous plant remnants

Log Continuation:

Hole No.: 80 AU 16Page 5 of 6Project: Arvada-Ucross 1980

## Log

From	To	Length	Description
	(in feet)		
589.6	592.5	2.9	Shale, dark-brown-gray, fissile to coarsely fissile, abundant carbonaceous material
592.5	592.8	0.3	Siltstone, brown-gray, poorly cemented
592.8	596.0	3.2	Coal, black, silky and dull-banded, shaley at bottom
596.0	598.0	2.0	Shale, dark-brown-gray, fissile, abundant carbonaceous material
598.0	615.0	17.0	Coal, black, silky and dull-banded disseminated pyrite stringers, blocky fracture, bleeding gas, trace gypsum
615.0	622.3	7.3	Coal, black, silky, conchoidal to blocky fracture, trace scattered gypsum, bleeding gas
622.3	630.0	7.7	Coal, black, silky and dull-banded, bony, blocky fracture, bleeding gas
630.0	634.2	4.2	Coal, black, silky with dull bands, trace clay filling plant imprints, bony, rare gypsum, very finely disseminated pyrite bleeding gas
634.2	635.5	1.3	Coal, black, silky, banded, conchoidal fracture, very finely disseminated pyrite
635.5	638.0	2.5	Coal, black, silky and dull-banded, blocky fracture, very finely disseminated pyrite
END CORE DESCRIPTION			
638.0	682	44	Shale, dark-brown-gray, fissile, very brittle, abundant carbonaceous material
682	717	35	Siltstone, gray, rare calcite, trace carbonaceous specks
717	734	17	Claystone, gray

Log Continuation:

Hole No.: 80 AU 16

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
734	766	32	Sandstone, gray, very fine grained, well sorted, well rounded
766	776	10	Shale, gray, coarsely fissile
776	800	24	Sandstone, gray, very fine grained, well sorted, well rounded
800	822	22	Shale, gray, coarsely fissile
822	918	96	Interbedded shale, brown-gray to very dark gray, fissile, trace pyrite stringers and disseminated pyrite, trace carbonaceous plant remnants; claystone, gray, trace carbonaceous specks; siltstone, gray, trace carbonaceous specks
918	924	6	Coal, black
924	952	28	Shale, black, blocky
952	959	7	Coal, black, silky, blocky to conchoidal fracture
959	1000	41	Claystone, gray

## U.S. Geological Survey

Project: Arvada-Ucross 1980Hole No.: 80 AU 17 Geologist: C. Barnes, M. EllisType log: Lithologic Elev.: 3790' Total depth: 1000'Location: SE 1/4 NW 1/4 Sec.: 17 T. 54 N. R. 77 W.Nearest town: Arvada County: Sheridan State: Wyo. Quad.: ArvadaDrilled by: El Dorado Exploration, Inc.Driller(s): Ed PotterDrill: Porta-drill TK-1 Date start: 8/25/80 Complete: 8/27/80Non-core intervals and size hole: 0-406'; 431.3-699.0'; 734.1-779.0'; 801.9-1000'Cored intervals and size: 406.0-431.3'; 699.0-734.1'; 779.0-801.9'; 802-1000'; 3 1/8"Remarks: Pilot and core hole. Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-1000'. Sample cuttings were lost from 425 to 625'.Drill cuttings and core descriptions.

## Log

From	To	Length	Description
(in feet)			
0	13	13	Soil, brown
13	15	2	Shale, yellow-brown, blocky, trace silty, iron stained
15	18	3	Claystone, yellow-brown to gray-brown
18	30	12	Sandstone, tan, very fine grained, medium-sorted, subangular to subrounded, friable
30	35	5	Sandstone, dark-brown, very fine grained, medium-sorted, angular, siderite nodules in sample
35	40	5	Sandstone, dark-brown to yellow-brown, very fine grained
40	57.5	17.5	Claystone, gray to gray-green, trace gypsum
57.5	100	42.5	Sandstone, green-gray, very fine grained, clayey; interbedded with claystone, green-gray

Log Continuation:

Hole No.: 80 AU 17Page 2 of 5Project: Arvada-Ucross 1980

## Log

From	To	Length	Description
(in feet)			
100	117.5	17.5	Claystone, gray
117.5	129.5	12	Sandstone, gray, very fine grained
129.5	133.5	4	Shale, dark-brown to brown-black, carbonaceous
133.5	145	11.5	Coal, black, dull to bright
145	148	3	Shale, dark-brown to brown-black, carbonaceous
148	189	41	Claystone, gray to gray-brown with stringer of sandstone, gray, very fine grained, clayey
189	192	3	Coal
192	261	69	Sandstone, gray to dark-gray, very fine to fine-grained, pyrite cement, trace gypsum crystals
261	310	49	Sandstone, gray, fine-grained
310	323	13	Coal
323	403	80	Interbedded sandstone, tan to gray-brown, very fine to fine-grained, silty; shale, brown to black; claystone, gray; and siltstone, gray
403	406	6	Claystone, gray
CORE DESCRIPTION			
406.6	406.4	0.4	Claystone, light-gray, trace of coal stringers
406.4	408.0	1.6	Claystone, dark-gray-brown
408.0	408.45	0.45	Coal, black, silky bands, blocky fracture
408.45	408.75	0.30	Coal with sandstone stringers, gray
408.75	409.80	1.05	Coal, black, silky with dull bands

Log Continuation:

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)	(in feet)		
409.80	417.1	7.3	Coal, black, silky and dull banded with bony layers and bands, blocky fracture, trace amber at bottom
417.1	418.8	1.7	Sandstone, gray with dark-gray carbonaceous stringers and bands, very fine grained
418.8	421.3	2.5	Coal, black, dull and silky banded, blocky fracture, pyrite crystals at bottom
421.3	423.0	1.7	Coal, black, blocky
423.0	431.3	8.3	Sandstone, gray, very fine to fine-grained, very argillaceous, with carbonaceous stringers
END CORE DESCRIPTION			
431.3	625.0	193.7	Samples lost
625	650	25	Sandstone, brown, fine-grained, well-rounded, well-sorted, friable
650	699	49	Sandstone, tan-gray to brown, medium-grained, medium-sorted, subrounded to rounded, friable, trace green mineral crystals
CORE DESCRIPTION			
699.0	700.3	1.2	Claystone, gray, abundant carbonaceous plant remnants and stringers
700.3	701.5	1.2	Claystone, dark-brown-gray, abundant carbonaceous stringers
701.5	702.2	0.7	Coal, black, dull, blocky fracture, bony
702.2	714.1	11.9	Coal, black, silky-banded, blocky and conchoidal fracture, bony, trace pyrite stringers and nodules, badly broken and fractured at bottom 1.5 ft

Log Continuation:

Hole No.: 80 AU 17

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)	(in feet)		
714.1	714.7	0.6	Coal, black, silky, blocky to conchoidal fracture
714.7	717.7	3.0	Claystone, gray to dark-brown-gray with brown to black carbonaceous stringers and bands, trace coal stringers
717.7	718.3	0.6	Sandstone, brown-gray, very fine grained, well sorted, well rounded
718.3	719.35	1.05	Claystone, dark-brown-gray
719.35	724.10	4.75	Coal, black, silky-banded, conchoidal to blocky fracture
724.10	729.10	5.0	Lost coal from bottom of barrel
729.1	729.6	0.5	Shale, black with coal stringers
729.6	730.0	0.4	Claystone, dark-brown to black with carbonaceous shale stringers
730	734.1	4.1	Sandstone, gray, very fine grained, clayey, coal stringers
END CORE DESCRIPTION			
734.1	779.0	44.9	Interbedded claystone, gray to dark-gray; and shale, brown-gray to dark-brown-gray; abundant carbonaceous material
CORE DESCRIPTION			
779.0	781.2	2.2	Claystone, gray to dark-gray, abundant carbonaceous plant remains and coal stringers
781.2	784.2	3.0	Coal, black, dull- and silky-banded, blocky fracture, bony
784.2	784.5	0.3	Shale, black, carbonaceous
784.5	787.5	3.0	Coal, black, dull- and silky-banded, blocky fracture
787.5	788.05	0.55	Coal, black, silky with mineral and pyrite crystals, blocky fracture
788.05	789.40	1.35	Coal, black, silky- and dull-banded, blocky fracture

Log Continuation:

Hole No.: 80 AU 17

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Project: Arvada-Ucross 1980

Log

From	To	Length	Description
(in feet)			
789.40	791.1	1.7	Coal, black, dull, blocky fracture, badly broken
791.1	792.8	1.7	Coal (lost)
792.8	794.6	1.8	Coal, black, blocky, silky
794.6	797.7	3.1	Coal, dark-brown
797.7	801.9	4.2	Sandstone, gray to brown-gray, very fine grained, some carbonaceous stringers, slightly clayey
END CORE DESCRIPTION			
801.9	816	14.1	Interbedded claystone, dark-gray-brown; and shale, black, carbonaceous
816	818	2	Coal, bony
818	855	37	Interbedded claystone, dark-gray-brown; and shale, gray to black, carbonaceous
855	867	12	Coal, with shale parting
867	1000	133	Interbedded claystone, gray-brown; shale, black, carbonaceous; and siltstone, gray

## U.S. Geological Survey

Project: Arvada-Ucross 1980Hole No.: 80 AU 18 Geologist: C. Barnes, M. EllisType log: Lithologic Elev.: 4340' Total depth: 840'Location: SW 1/4 SE 1/4 Sec.: 23 T. 54 N. R. 78 W.Nearest town: Arvada County: Sheridan State: Wyo. Quad.: ArvadaDrilled by: El Dorado Exploration, Inc.Driller(s): Ed PotterDrill: Porta-drill TK-1 Date start: 8/27/80 Complete: 8/28/80Non-core intervals and size hole: 0-840'; 5 1/8"Cored intervals and size: NoneRemarks: Other logs include natural gamma, caliper, density, and resistivity run byDigilog, Inc.; 0-840'. Drill cuttings description.

## Log

From	To	Length	Description
	(in feet)		
0	21	21	Soil, light-tan to red-brown; trace clinker and coal
21	67	46	Claystone, gray to green-gray; trace clinker and coal; siltstone, tan-gray; and shale, dark-brown partings
67	76	9	Coal with parting of shale, dark-brown-gray to black, carbonaceous
76	90	14	Interbedded claystone, tan-gray to dark-gray; shale, dark-gray
90	96	6	Coal, bony
96	182	86	Interbedded claystone, tan-gray to dark-brown-gray; shale, dark-brown-gray; siltstone, tan-gray; and lignite stringers
182	185	3	Coal

Log Continuation:

Hole No.: 80 AU 18Page 2 of 2Project: Arvada-Ucross 1980

## Log

From	To	Length	Description
(in feet)			
185	280	95	Interbedded shale, gray to dark-gray-brown, fissile, carbonaceous; claystone, gray to tan-gray, silty; and siltstone, gray to tan-gray
280	288	8	Coal, bony; and shale, dark-brown to black, carbonaceous
288	344	56	Claystone, tan-gray, silty with siltstone stringers, gray with pyrite cement
344	350	7	Shale, dark-brown to black, carbonaceous, fissile, trace coal stringers and pyrite
350	364	14	Claystone, tan-gray, silty, trace pyrite
364	378	14	Shale, black, very carbonaceous, fissile
378	386	8	Coal
386	430	44	Shale, black, fissile, carbonaceous; and claystone, gray to dark-tan-gray, silty
430	435	5	Coal
435	471	36	Siltstone, gray
471	483	12	Shale, black
483	723	240	Claystone, gray to brown-gray to green-gray, silty and sandy; trace stringers of sandstone, gray to light-brown; and shale, dark-gray, fissile, carbonaceous
723	736	13	Coal, black, silky
736	840	104	Claystone, gray to green-gray, trace sandy; with interbedded shale, black, fissile, carbonaceous; and sandstone, green-gray, very fine to fine-grained

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 19A Geologist: M. McPhillips

Type log: Lithologic Elev.: 3700' Total depth: 210'

Location: SE 1/4 SE 1/4 Sec.: 14 T. 56 N. R. 77 W.

Nearest town: Arvada County: Sheridan State: Wyo. Quad.: Cabin Creek SE

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 8/12/80 Complete: 8/12/80

Non-core intervals and size hole: 0-185'; 5 1/8"

Cored intervals and size: 185-210'; 3 1/8"

Remarks: Hole was an offset to R-1 pilot and R-1 core--R. Flores Special Project, USGS, 1981, core description

## Log

From	To	Length	Description
(in feet)			
185.0	185.9	0.9	Claystone, medium-dark-gray with trace of carbonaceous material
185.9	186.2	0.3	Shale, dark-gray, carbonaceous
186.2	196.0	9.8	Coal, black, dull with silky bands; thin pyritic lamination at 186.2 ft; gypsum at 186.3 ft
196.0	198.3	2.3	Coal, black, dull with silky bands; bony at 196.7 ft, shaley at bottom
198.3	198.8	0.5	Claystone, olive-gray to dark-gray, carbonaceous
198.8	199.0	0.2	Shale, brown-black, carbonaceous
199.0	201.1	2.1	Coal, black dull with silky bands; bony at bottom

Log Continuation:

Hole No.: 80 AU 19A

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)			
201.1	201.6	0.5	Claystone, olive-gray, trace carbonaceous material; shaley at bottom
201.6	202.7	1.1	Shale, brown-black to black, carbonaceous; interbedded with coal stringers
202.7	204.5	1.8	Siltstone, medium-light-gray to medium-gray, some carbonaceous material; interbedded with sandstone, medium-light-gray, very fine grained at 204.2-204.3 ft
204.5	205.5	1.0	Claystone, medium-gray, slightly silty
205.5	207.1	1.6	Shale, brown-black, carbonaceous; interbedded with claystone, medium-gray at 206.3-206.5 ft
207.1	210.0	2.9	Shale, brown-black to black, carbonaceous with coal stringers

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 24 Geologist: M. McPhillips, T. Moore

Type log: Lithologic Elev.: 3625' Total depth: 900'

Location: NW 1/4 SW 1/4 Sec.: 11 T. 56 N. R. 77 W.

Nearest town: Arvada County: Sheridan State: Wyo. Quad.: Cabin Creek SE

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 8/5/80 Complete: 8/12/80

Non-core intervals and size hole: 0-87.0'; 109.7-219.0'; 250.9'; 691.0-900'; 5 1/8"

Cored intervals and size: 87.0-109.7'; 219.0-250.9'; 691.0-733.8'; 3"

Remarks: Pilot and core hole. Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-900'. Drill cuttings and core description.

## Log

From	To	Length	Description
(in feet)			
0	7	7	Soil, brown, clayey
7	87	80	Interbedded sandstone, gray-brown to tan-gray, medium- to coarse-grained, medium-sorted, subrounded, friable; shale, very dark brown gray to yellow-brown, coarsely fissile to blocky, trace gypsum crystals; claystone, gray to very dark brown gray with carbonaceous plant remnants and streaks

## CORE DESCRIPTION

87.0	91.5	4.5	Coal, black, dull to silky, trace gypsum and pyrite nodules
91.5	93.3	1.8	Claystone, gray, abundant carbonaceous material, coal stringer at 91.7 ft
93.3	94.0	0.7	Shale, black, carbonaceous

Log Continuation:

Hole No.: 80 AU 24

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)	(in feet)		
94.0	94.2	0.2	Coal, black, dull to silky
94.2	95.3	1.1	Coal, black, dull, very bony, abundant pyrite streaks and nodules
95.3	102.3	7.0	Coal, black, silky; bony with pyrite nodules at 95.2 ft; gypsum at 98.3-99.4 ft; pyrite lens and resin at 101.5 ft
102.3	102.5	0.2	Coal, black, hard, silky
102.5	102.6	0.1	Coal, black, bony with clay lens
102.6	104.8	2.2	Coal, black, silky, hard; clay lens at 103.5 ft; gypsum at 104.2 ft; shale, dark-brown, carbonaceous at 104.8 ft
104.8	105.1	0.3	Sandstone, tan, very fine grained, abundant carbonaceous material and coal stringers
105.1	107.9	2.8	Claystone, olive-gray, abundant carbonaceous material
107.9	109.6	1.7	Coal, black, dull to silky; clay lens at 108.9 and 109.5 ft
109.6	109.7	0.1	Shale, black, carbonaceous
END CORE DESCRIPTION			•
109.7	219.0	109.3	Interbedded claystone, tan-gray to dark-brown-gray; shale, very dark brown gray, fissile; and siltstone, light-gray-tan
CORE DESCRIPTION			
219.0	221.5	2.5	Claystone, dark-gray, slightly carbonaceous; coal streak at 221.1 ft
221.5	226.0	4.5	Coal, black, dull to silky, bony at top; clay lens at 226.1-226.3 ft; clay stringers at 226.9 ft
226.0	228.0	2.0	Claystone, dark-gray, abundant carbonaceous plant remains
228.0	228.3	0.3	Claystone, gray, trace sandy and carbonaceous

Log Continuation:

Hole No.: 80 AU 24

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)			
228.3	234.5	6.2	Coal, black, silky, friable, trace scattered gypsum
234.5	242.5	8.0	Coal, black; bony at 236.6 ft; clay at 237.0 ft; bony at 240.5 ft; bony with scattered pyrite streaks at 239.8 ft; gypsum and clay lens at 240.5 ft; bony at 240.8 ft; clay at 241.2 ft
242.5	242.8	0.3	Shale, black, carbonaceous, trace resin
242.8	243.3	0.5	Coal, black, dull and silky bands
243.3	248.8	5.5	Claystone, dark-gray, banded, abundant plant remains and coal stringers
248.8	249.0	0.2	Siltstone, light-olive-gray, calcareous
249.0	249.1	0.1	Claystone, light-gray to gray-banded with coal stringers
249.1	249.3	0.2	Siltstone, light-olive-gray, calcareous
249.3	250.9	1.6	Claystone, gray, abundant plant remains
END CORE DESCRIPTION			
250.9	258	7.1	Claystone, very light gray to gray, silty
258	262	4	Shale, black, fissile, carbonaceous
262	269	7	Claystone, very light gray, silty
269	287		Interbedded claystone, dark-gray; and shale, very dark brown gray to very dark gray
287	303	16	Claystone, gray
303	448	145	Siltstone, very light gray to gray-tan, trace carbonaceous specks, trace calcareous, silicified, and claystone stringers towards bottom

Log Continuation:

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Project: Arvada-Ucross 1980

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Log

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From	To (in feet)	Length	Description
448	455	7	Siltstone, light gray with black carbonaceous stringers, silicified
455	458	3.0	Claystone, light-gray to gray, trace calcareous
458	467	9	Siltstone, light-gray with black carbonaceous stringers, silicified, clay stringer
467	479	12	Claystone, light-gray to dark-gray mottled, trace calcareous and silty
479	482	3	Siltstone, light-gray with black carbonaceous stringers, silicified
482	558	76	Interbedded claystone, gray, silty; siltstone, gray, trace carbonaceous specks, silicified; and shale, very dark gray, fissile, very carbonaceous
558	564	6	Coal, black, bright to silky, bony
564	568	4	Claystone, gray
568	574	6	Coal, black, bright to silky, bony
574	616	42	Interbedded claystone, gray; siltstone, tan-gray, silicified; shale, very dark brown gray
616	652	36	Interbedded claystone, gray; siltstone, tan-gray, silicified
652	668	16	Interbedded claystone, gray; shale, very dark brown gray
668	691	23	Siltstone, gray, very argillaceous

Log Continuation:

Hole No.: 80 AU 24Page 5 of 6Project: Arvada-Ucross 1980

## Log

From	To	Length	Description
(in feet)			
CORE DESCRIPTION			
691.0	691.8	0.8	Sandstone, gray, fine-grained to very fine grained, quartz subrounded, silty, carbonaceous
691.8	693.4	1.6	Sandstone, medium-gray, medium-grained, quartz subrounded, thin carbonaceous streaks
693.4	694.0	0.6	Claystone, medium-gray, sandy; interbedded with sandstone, medium-gray, fine- to medium-grained, thin carbonaceous streaks
694.0	695.6	1.6	Sandstone, medium-gray, fine- to medium-grained, quartz subrounded, quartz 90 percent, thin carbonaceous streaks, uncemented
695.6	696.2	0.6	Sandstone, medium-gray with medium-dark-gray bands, very fine grained, clayey, carbonaceous streaks; interbedded with claystone, medium-gray
696.2	698.5	2.3	Sandstone, medium-light-gray, very fine grained, silty, slightly carbonaceous
698.5	701.5	3.0	Shale, medium-gray to 699.1 ft, dark-gray-black from 699.1 to 699.8 ft
701.5	706.4	4.9	Coal, black; bony at top; dull to 700.9 ft, silky with dull bands to 704.7 ft
706.4	721.4	15.0	Coal, black, dull; resin at 707.0 ft; scattered gypsum at 708.6 ft, gypsum rosette at 711.1 and 713.1 ft; resin at 713.2 ft; bony at 712.4 ft; bony at 715.4 ft, silky with dull bands from 716.6 to 718.1 ft; resin at 718.0 ft

Log Continuation:

Hole No.: 80 AU 24

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Project: Arvada-Ucross 1980

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Log

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From	To	Length	Description
(in feet)			
721.4	730.4	9.0	Coal, black, dull to silky; gypsum at 719.3 ft; bony at 721.1, 721.6, and 723.9 ft; resin at 725.5 ft; shaley near bottom
730.4	732.4	2.0	Shale, brown-black to gray-black, carbonaceous, abundant pyrite stringers, some gypsum; resin from 729.8 to 729.9 ft; coaly at bottom
732.4	733.8	1.4	Shale, medium-dark-gray to olive-gray, clayey, carbonaceous, pyrite stringers
END CORE DESCRIPTION			
733.8	735.1	1.3	Siltstone, medium-dark-gray, carbonaceous, thin coaly stringers; with very fine grained sandstone stringer at 732.2-732.3 ft
735.1	735.6	0.5	Sandstone, medium-light-gray, fine-grained, clayey, some carbonaceous material
735.6	739.0	3.4	Siltstone, light-tan-gray
739.0	742.0	3.0	Shale, dark-gray to dark-brown-gray, fissile to coarsely fissile, abundant carbonaceous plant remains
742.0	755.0	13.0	Siltstone, light-tan-gray
755.0	900.0	145.0	Interbedded siltstone, very light gray to gray friable; claystone, gray; claystone, gray to dark-gray; shale, dark-gray, fissile; and shale, dark-gray-brown, fissile

## U.S. Geological Survey

Project: Arvada-Ucross 1980

Hole No.: 80 AU 26 Geologist: M. McPhillips

Type log: Lithologic Elev.: 3770' Total depth: 820'

Location: SW 1/4 SW 1/4 Sec.: 24 T. 53 N. R. 77 W.

Nearest town: Arvada County: Johnson State: Wyo. Quad.: Lariat

Drilled by: El Dorado Exploration, Inc.

Driller(s): Ed Potter

Drill: Porta-drill TK-1 Date start: 8/19/80 Complete: 8/20/80

Non-core intervals and size hole: 0-820'; 5 1/8"

Cored intervals and size: None

Remarks: Other logs include natural gamma, caliper, density, and resistivity run by Digilog, Inc.; 0-820'. Samples end at 725'. Drill cuttings description.

## Log

From	To	Length	Description
(in feet)			
0	38	38	Soil, yellow-brown to dark-yellow-brown with iron stains
38	65	27	Claystone, medium-gray to medium-dark-gray
65	74	9	Shale, carbonaceous
74	118	44	Interbedded claystone, medium-gray to medium-dark-gray; shale, medium-dark-gray to dark-gray; and trace stringers of siltstone, light-gray
118	121	3	Shale, carbonaceous
121	177	56	Interbedded claystone, medium-gray to medium-dark-gray; shale, medium-dark-gray to dark-gray; and trace stringers of siltstone and sandstone, gray

Log Continuation:

Hole No.: 80 AU 26Page 2 of 3Project: Arvada-Ucross 1980

## Log

From	To	Length	Description
(in feet)			
176	200	24	Claystone, medium-gray to dark-gray; and siltstone, medium-gray, pyritic
200	213	13	Coal, black, silky, bony
213	261	48	Interbedded claystone, gray, trace carbonaceous material; and siltstone, gray
261	290	29	Interbedded shale, dark-gray, carbonaceous; and sandstone, medium-light-gray, fine-grained, abundant quartz, subangular
290	324	34	Claystone, medium-blue-gray to dark-gray
324	347	23	Coal
347	400	53	Siltstone, medium-light-gray
400	406	6	Coal, bony
406	421	15	Claystone, medium-gray, carbonaceous
421	437	16	Coal, black, silky, bony
437	445	8	Claystone, medium-gray, carbonaceous
445	452	7	Sandstone, medium-light-gray, very fine grained, trace iron oxide stains
452	461	9	Claystone, medium-gray, carbonaceous
461	468	7	Coal, black, bony, silky
468	542	74	Siltstone, gray; claystone, gray; and trace sandstone, dark-yellow-orange, very fine grained, iron oxide stains
542	600	58	Sandstone, medium-gray, fine-grained; and siltstone, medium-gray, carbonaceous, trace pyrite cement
600	611	11	Coal, black, dull, bony

Log Continuation:

Hole No.: 80 AU 26

Page 3 of 3

Project: Arvada-Ucross 1980

Log

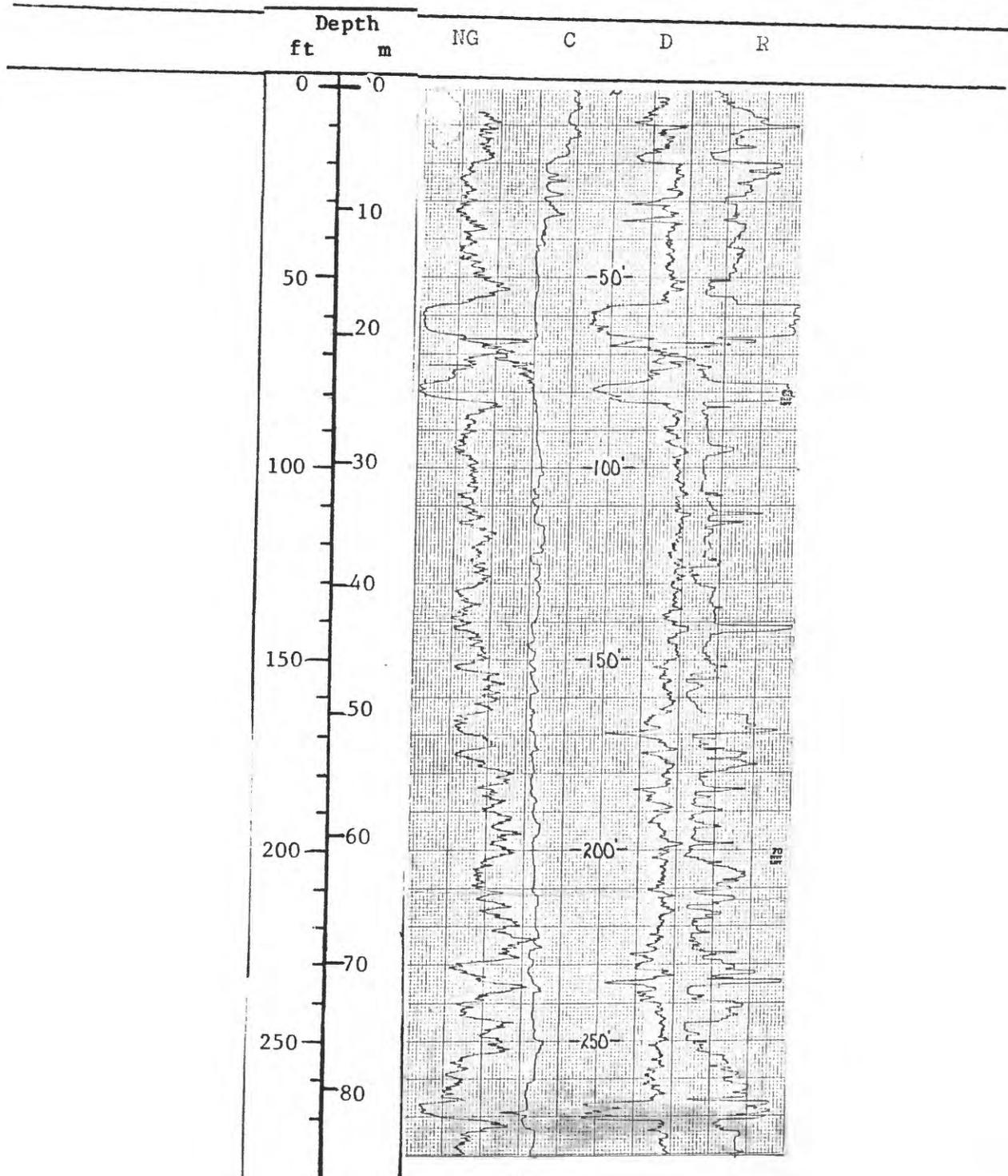
From	To	Length	Description
(in feet)			
611	618	7	Claystone, medium-gray
618	621	3	Coal, black, dull
621	631	10	Claystone, medium-gray
631	653	22	Sandstone, gray
652	724	72	Sandstone, gray; claystone, medium-gray; and siltstone, medium-light-gray
724	769	45	Coal
769	820	51	Samples lost, no returns

Appendix B

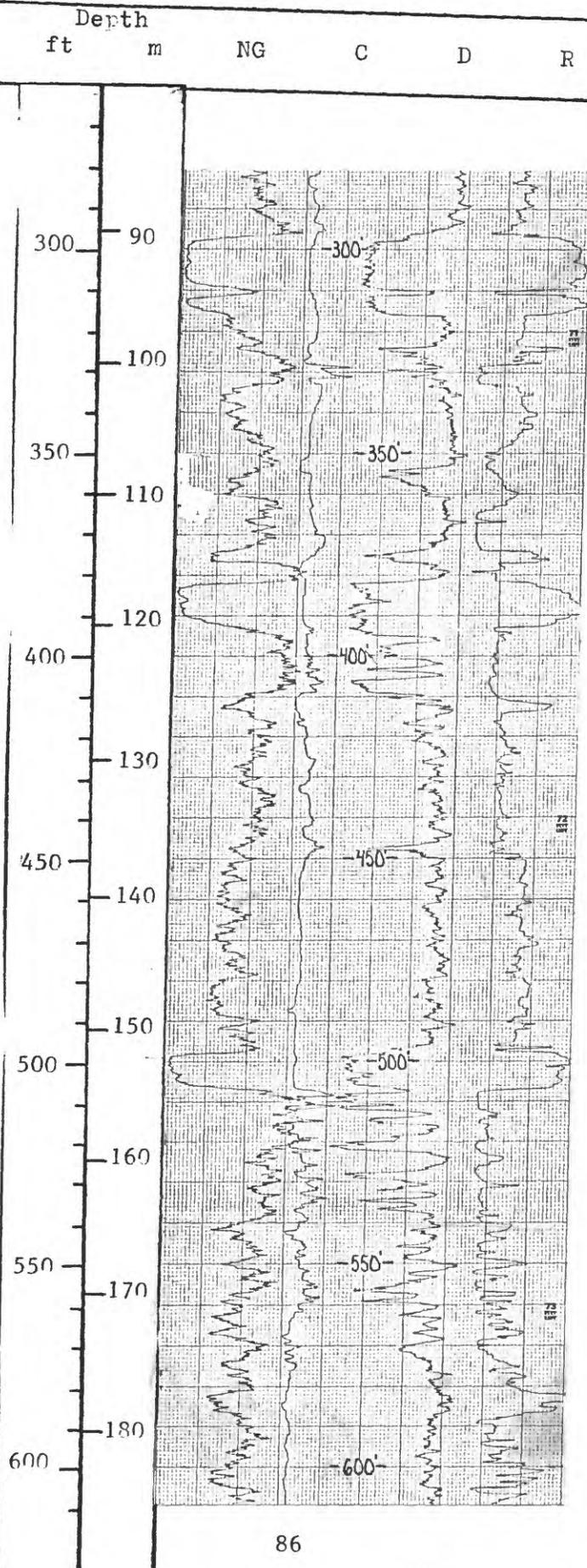
Geophysical Logs

U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80AU1 Date logged 8/5/80 Surface elevation 3610'  
 Location Se1/4NW1/4 sec. 15, T. 55 N., R. 77 W. County Sheridan  
 Drilled depth 800' Logged depth 800' Fluid level ----  
 Remarks drilled with mud

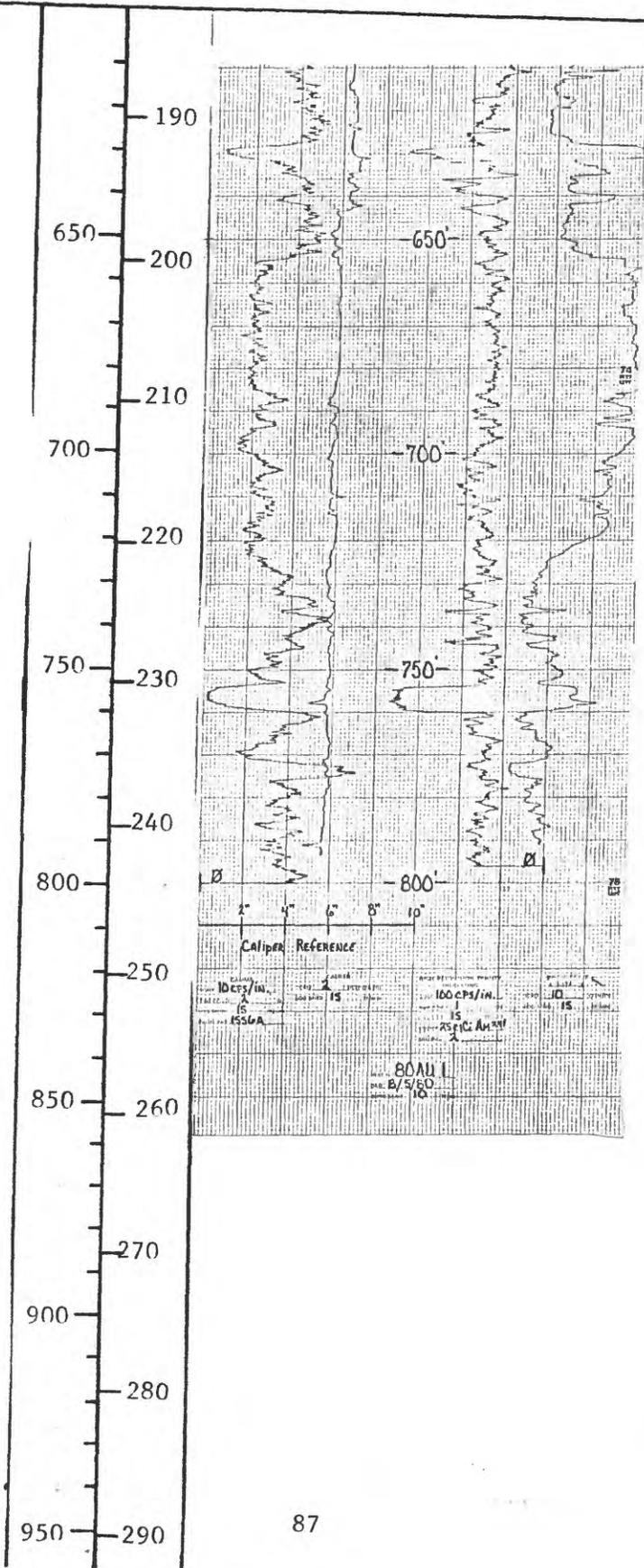


Hole no. 80AU1 (continued)



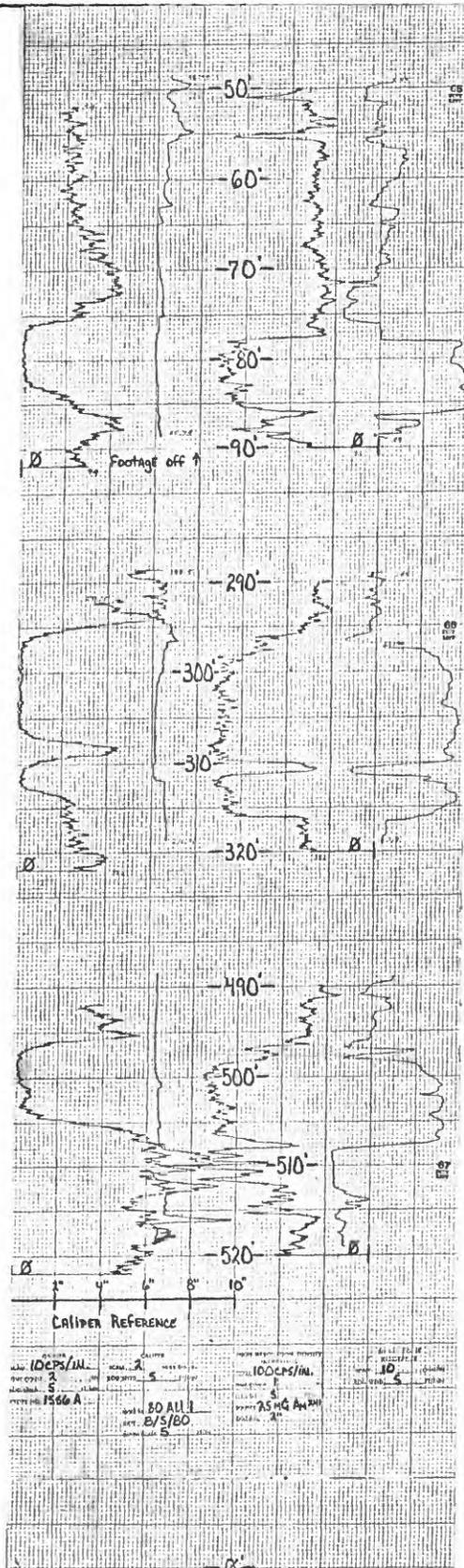
Hole no. 80AU1 (continued)

Depth  
ft m NG C D R



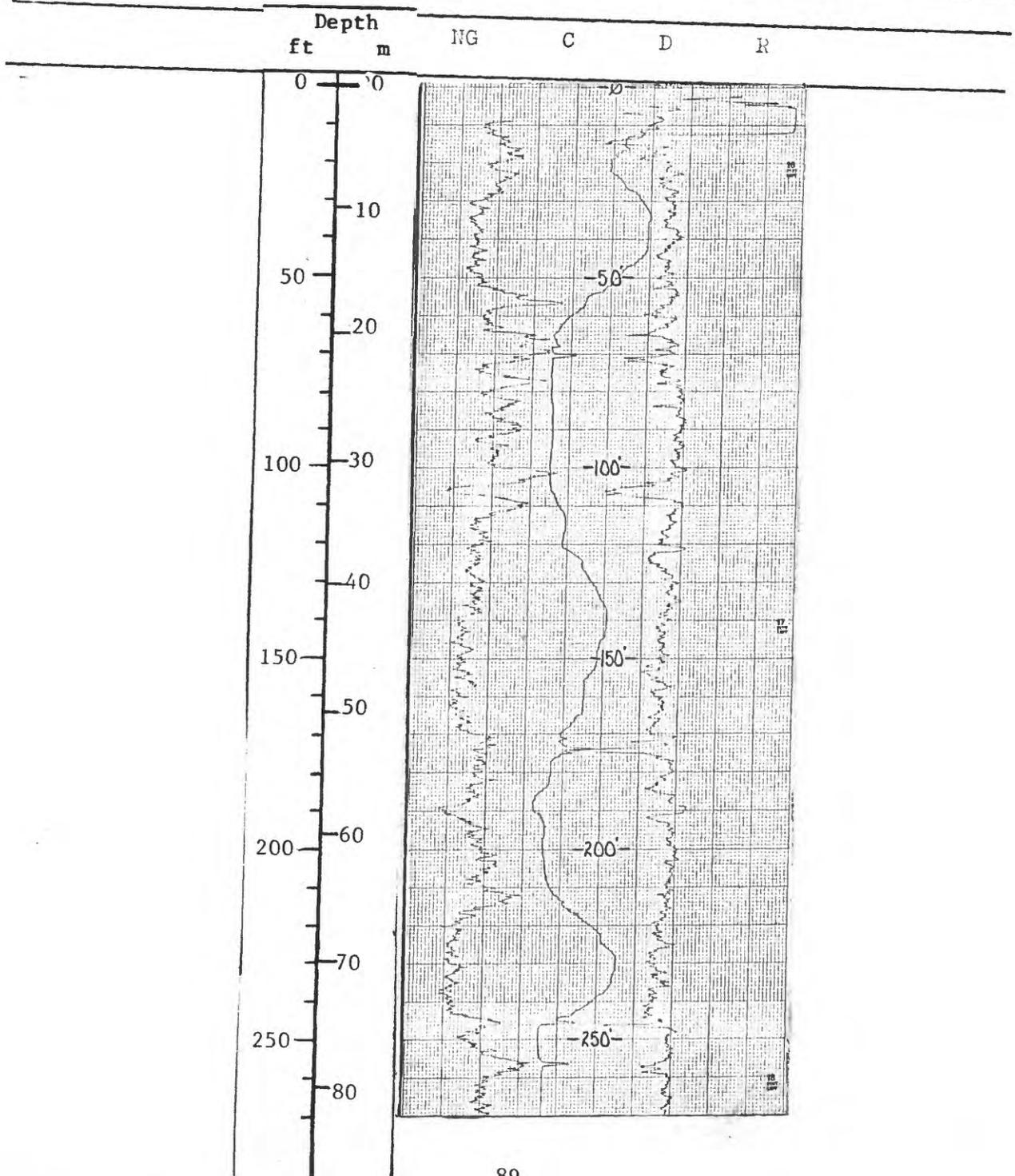
Hole no. 80 AU1 (reruns)

NG C D R

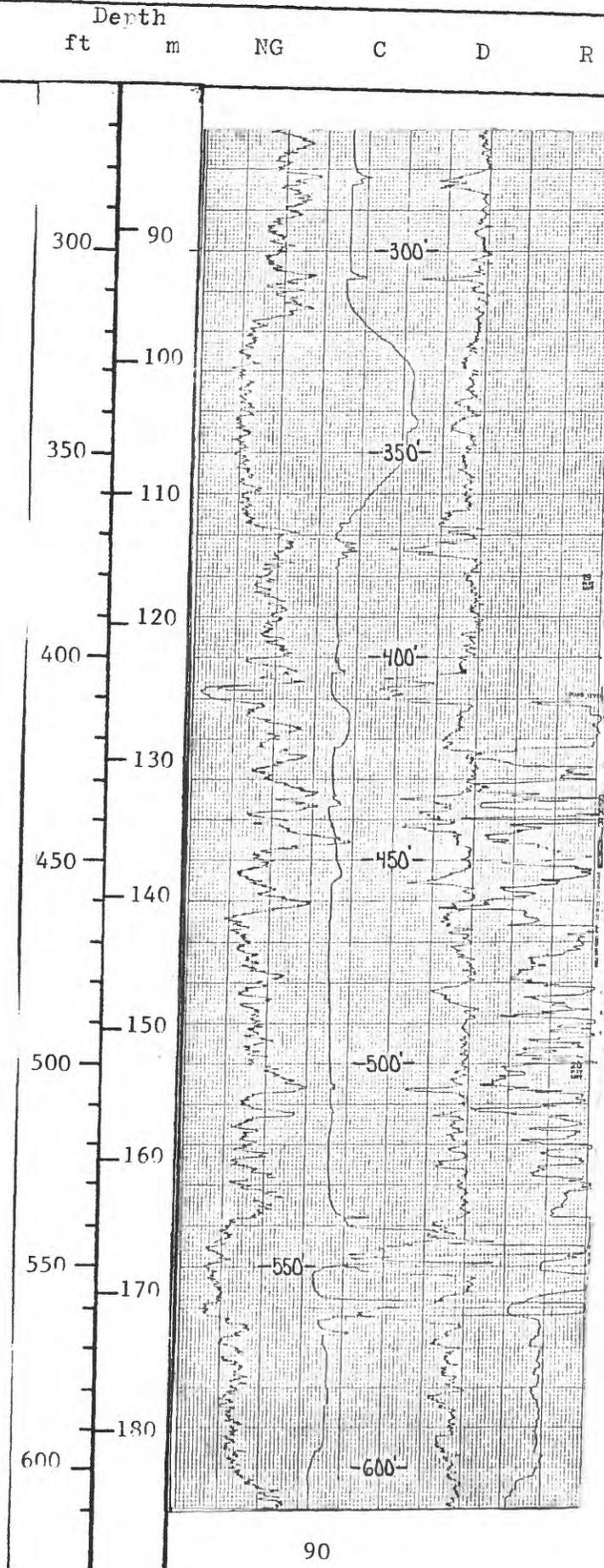


U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80 AU2 Date logged 9/2/80 Surface elevation 3860'  
 Location NW<sup>1</sup>/<sub>4</sub> NE<sup>1</sup>/<sub>4</sub> NE<sup>1</sup>/<sub>4</sub> sec. 9, T. 52 N., R. 77 W. County Johnson  
 Drilled depth 765' Logged depth 760' Fluid level 411'  
 Remarks drilled with air/foam

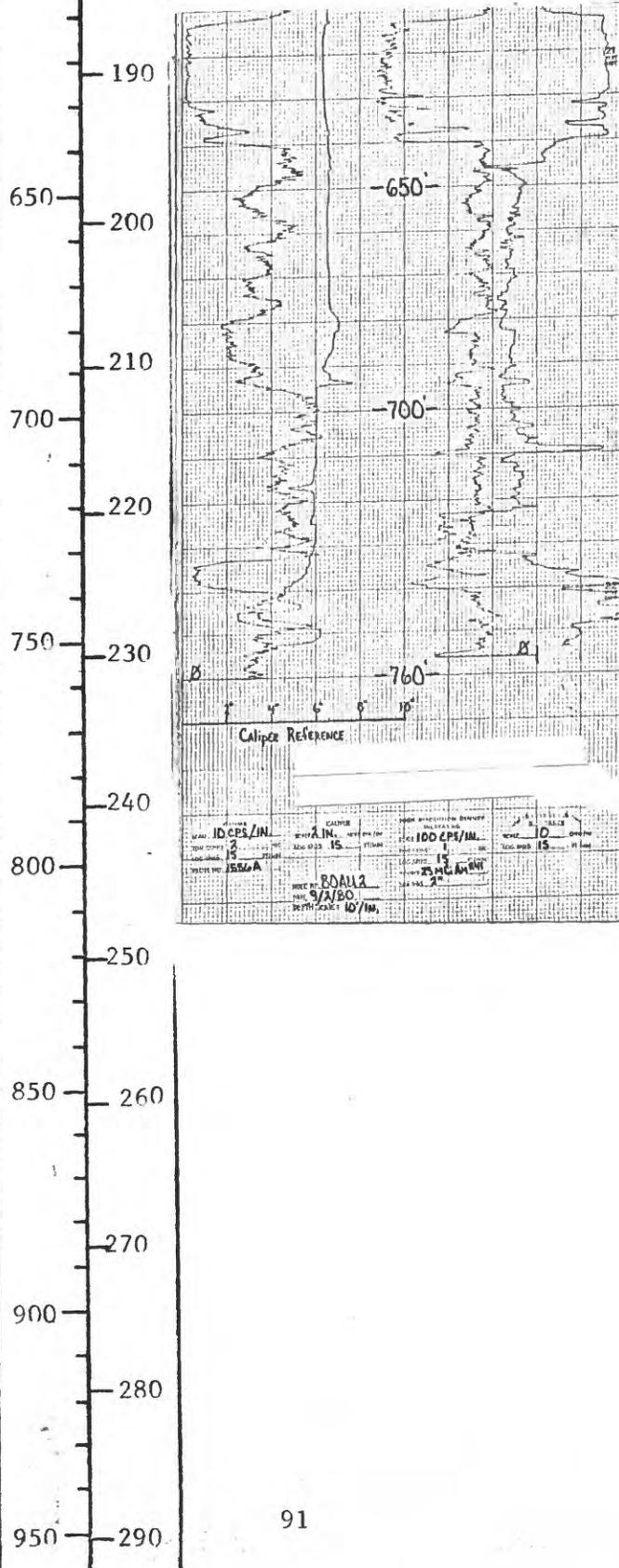


Hole no. 80 AU2 (continued)



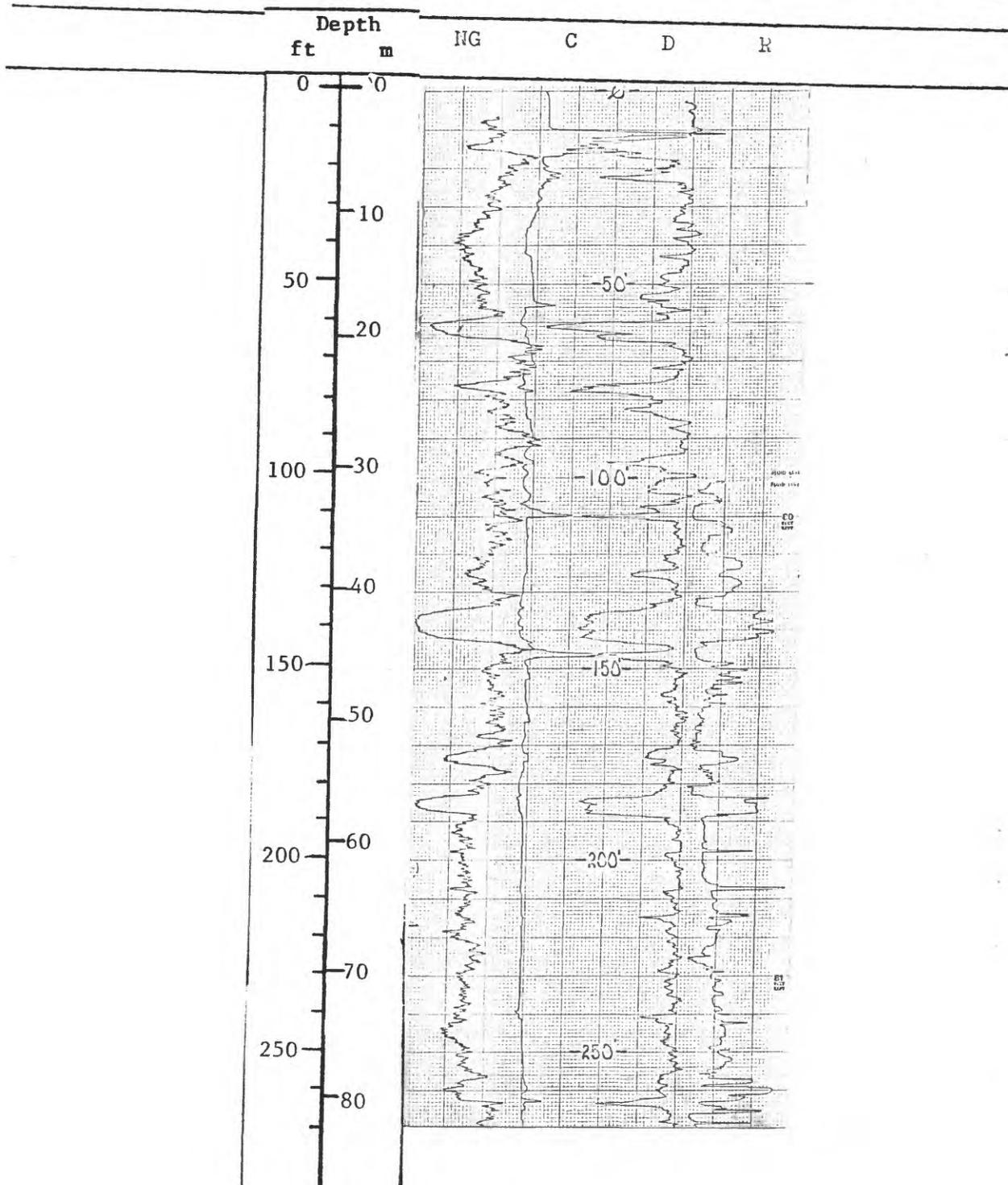
Hole no. 80 AU2 (continued)

Depth  
ft m NG C D R

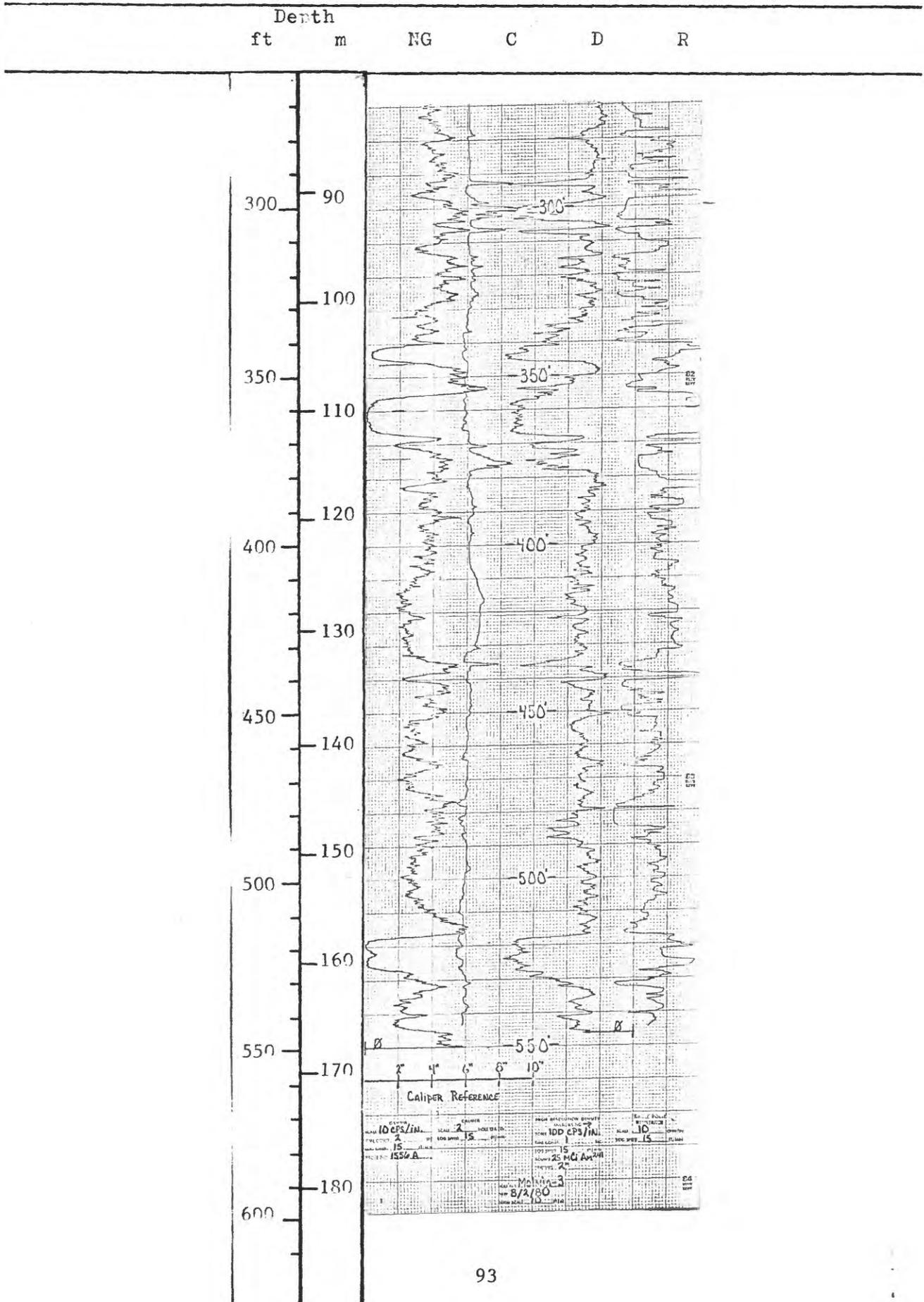


U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80 AU3 Date logged 8/2/80 Surface elevation 3717'  
 Location NW1/4NE1/4sec. 32, T. 56 N., R. 77 W. County Sheridan  
 Drilled depth 555' Logged depth 550' Fluid level 100'  
 Remarks drilled with air

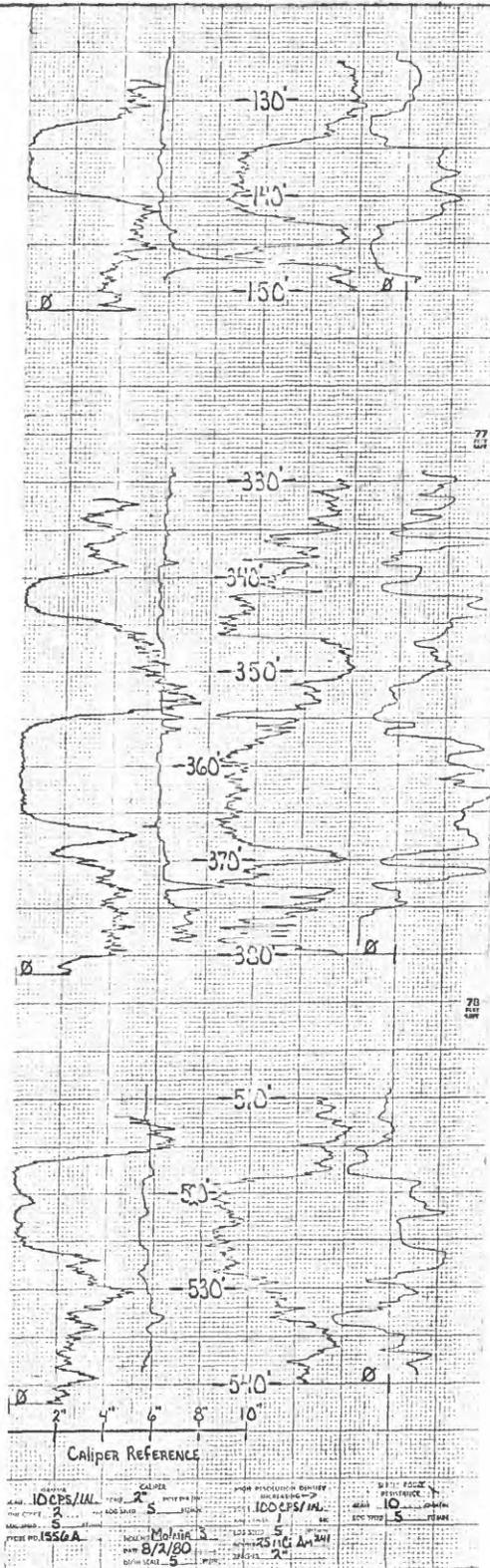


Hole no. 80 AU3 (continued)



Hole no. 80 AU3 (reruns)

NG C D R



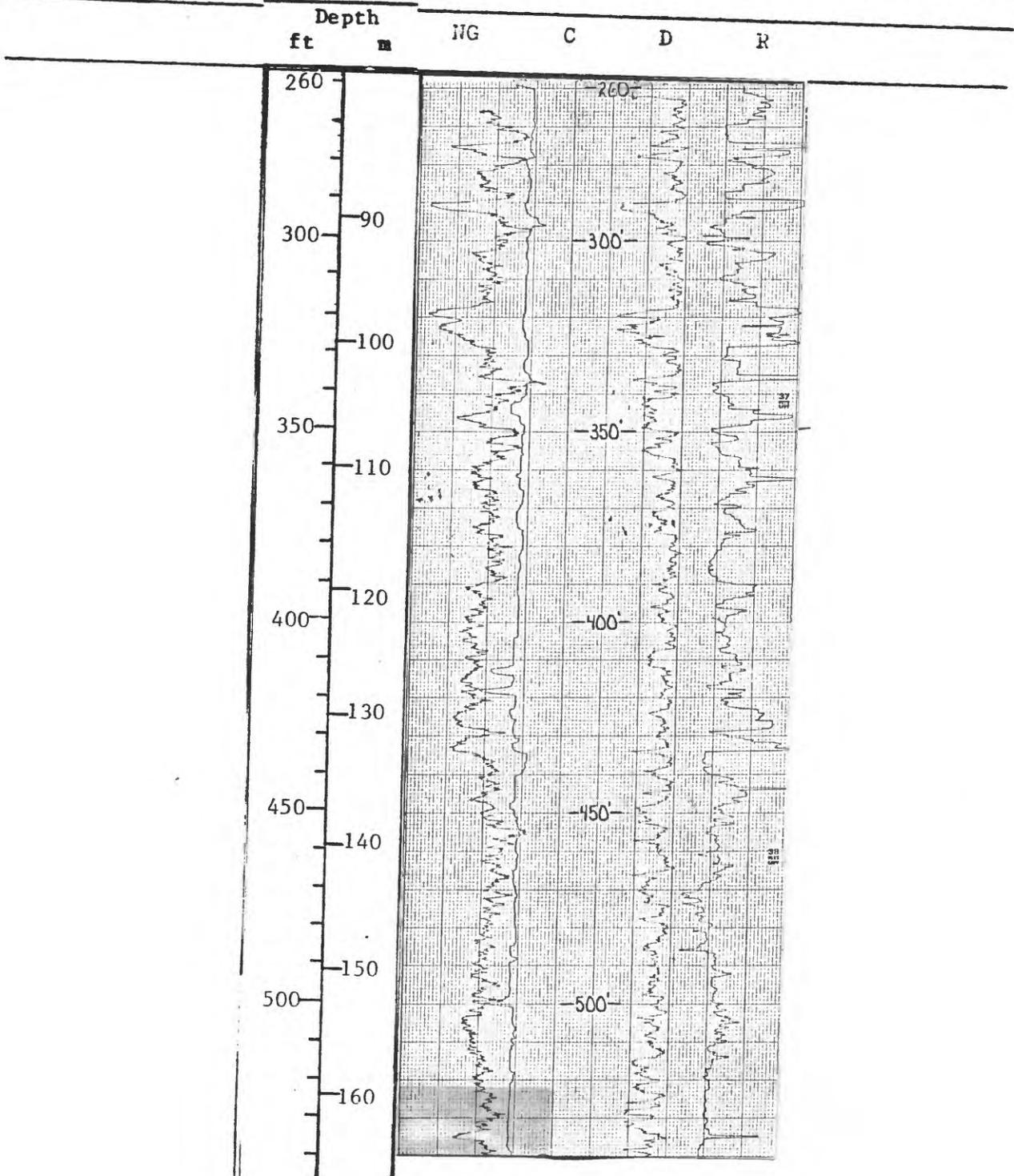
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80 AU4 Date logged 9/12/80 Surface elevation 4118'

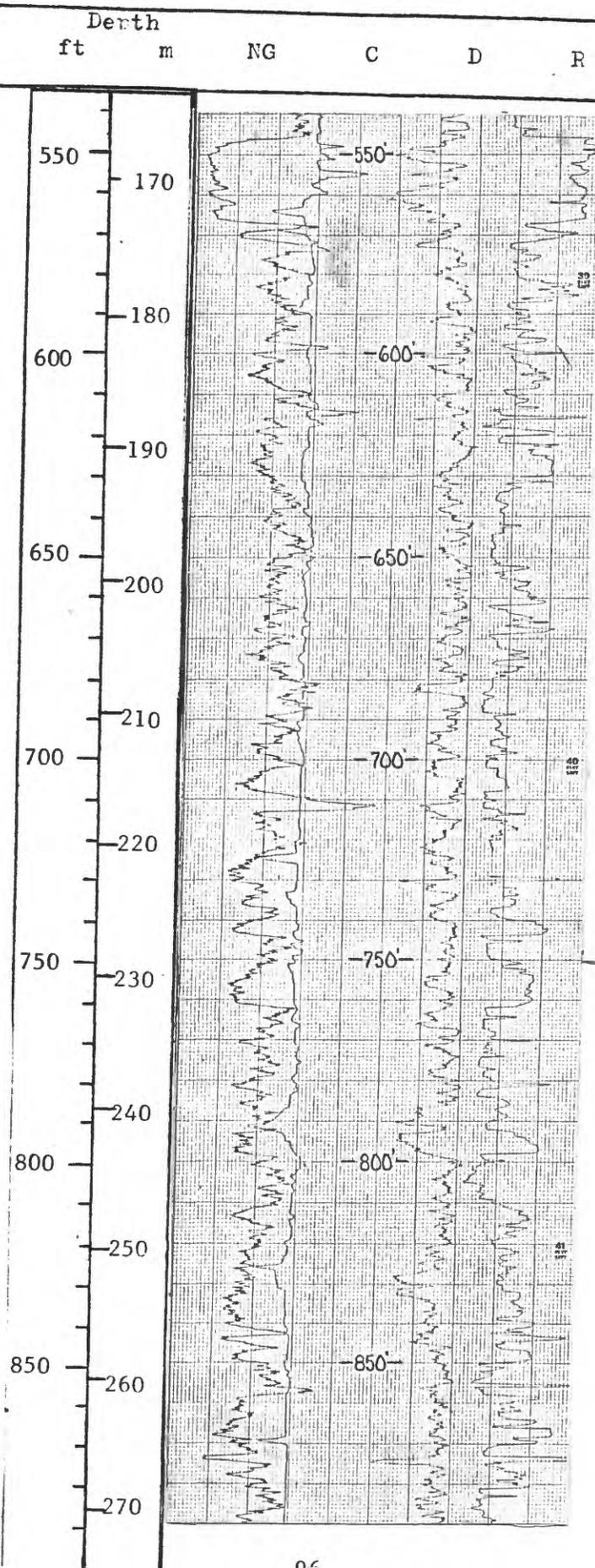
Location NW<sup>1</sup>/<sub>4</sub>NE<sup>1</sup>/<sub>4</sub>NW<sup>1</sup>/<sub>4</sub> sec. 19, T. 53 N., R. 80 W. County Johnson

Drilled depth 1000' Logged depth 265'-1000' Fluid level ----

Remarks drilled with air foam; hole logged 265-1000' only-adverse hole conditions.

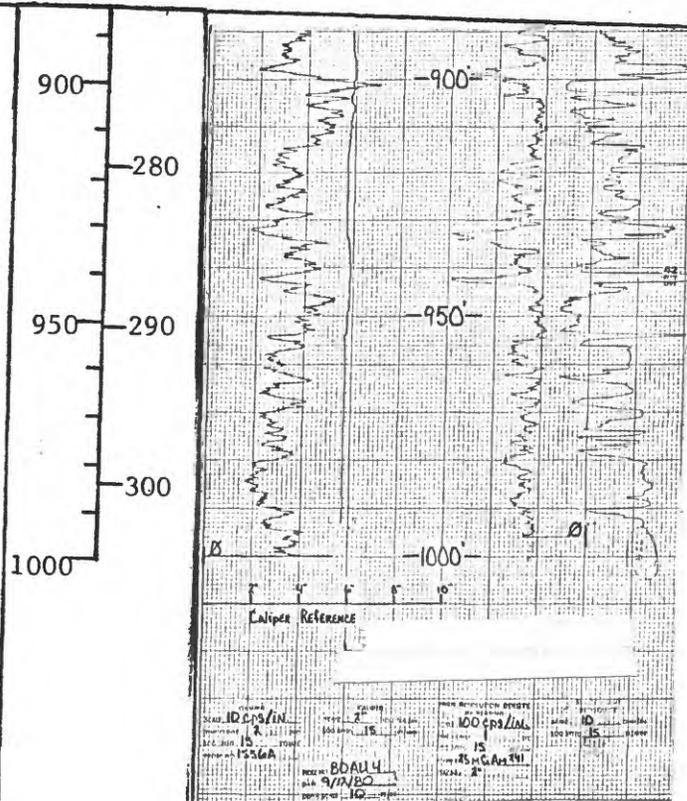


Hole no. 80 AU4 (continued)



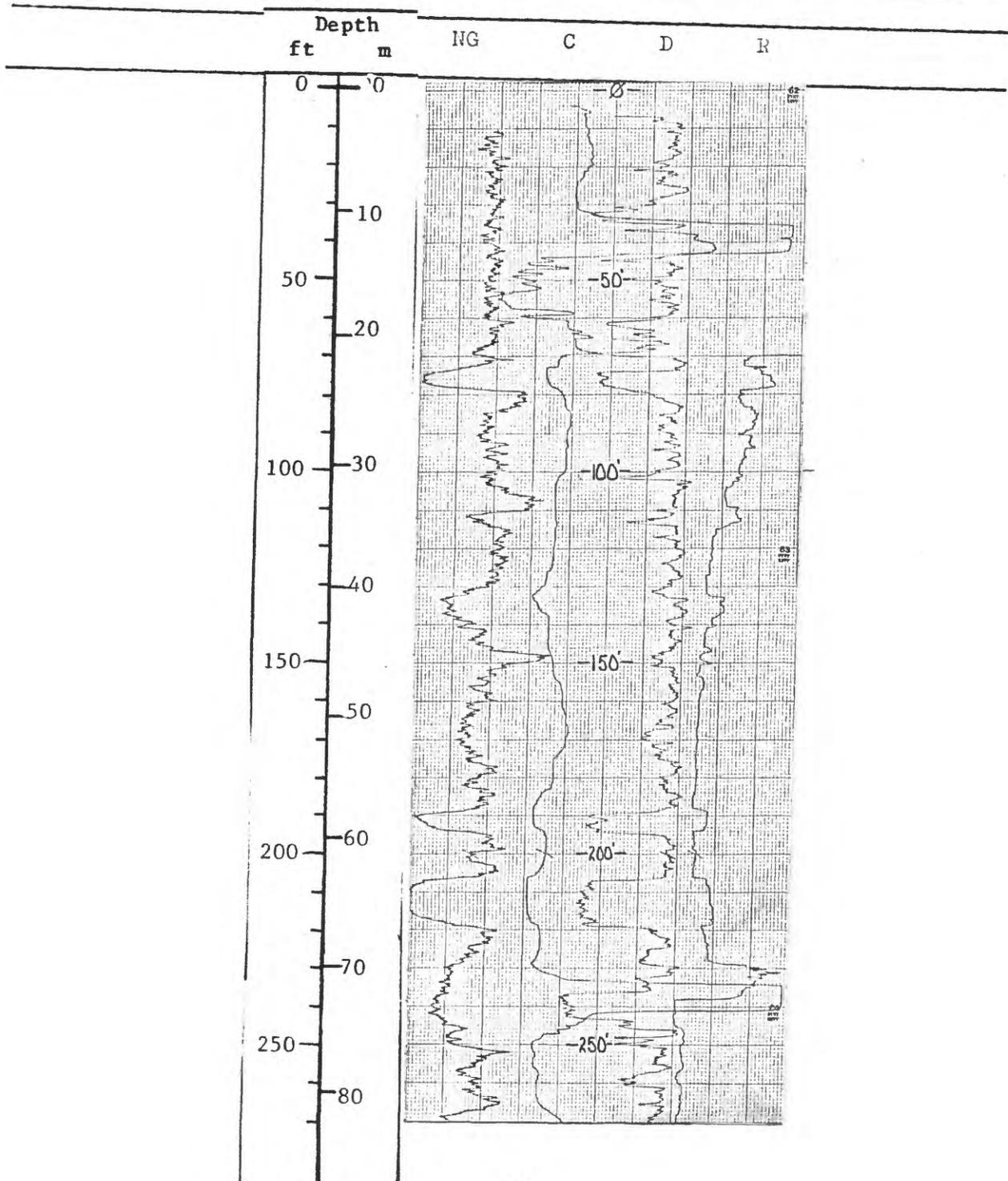
Hole no. 80 AU4 (continued)

Depth  
ft m NG C D R

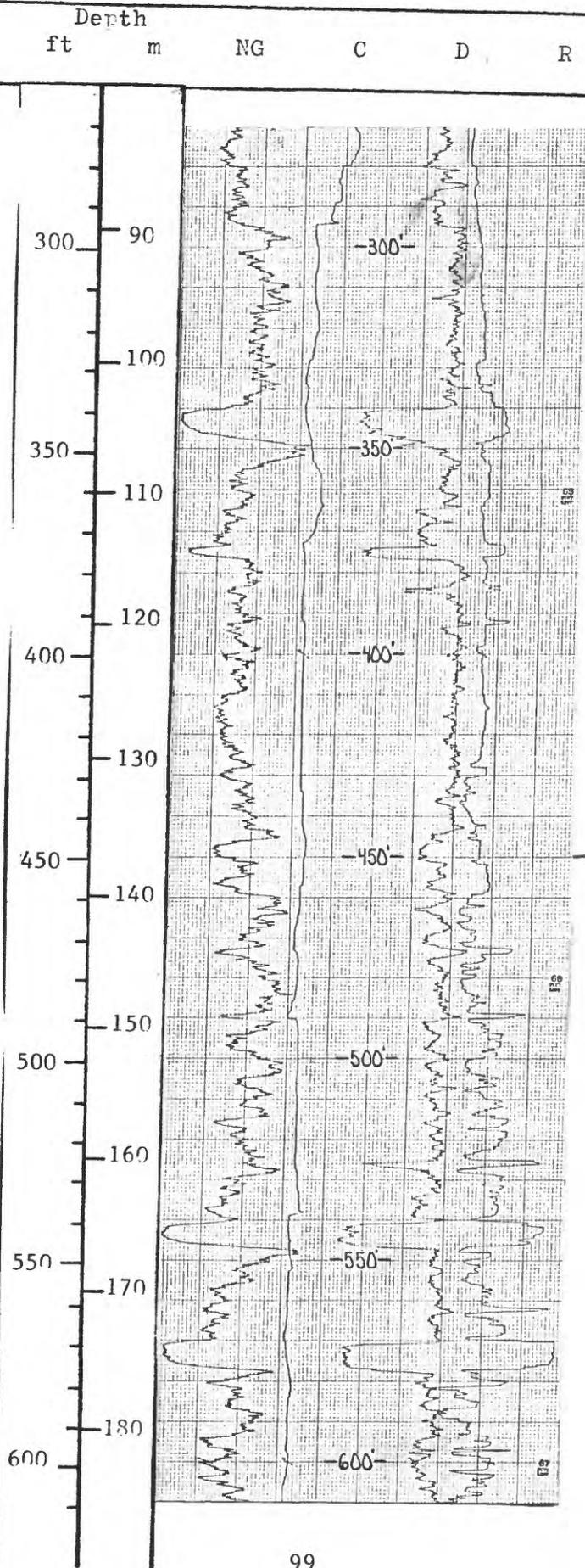


U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80 AU6 Date logged 9/10/80 Surface elevation 3850'  
 Location NE1/4SE1/4sec. 30, T. 56 N., R. 78 W. County Sheridan  
 Drilled depth 800' Logged depth 730' Fluid level 70'  
 Remarks drilled with air foam

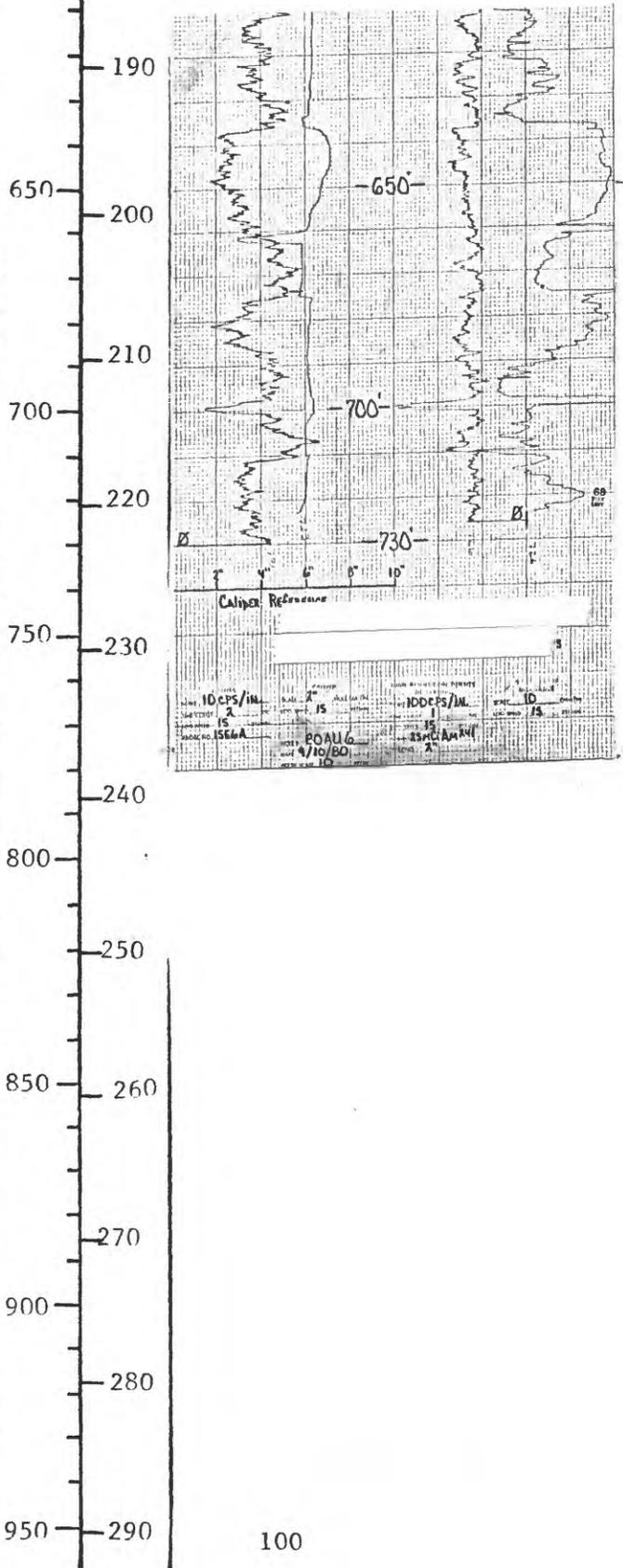


Hole no. 80 AU6 (continued)



Hole no. 80 AU6 (continued)

Depth  
ft m NG C D R



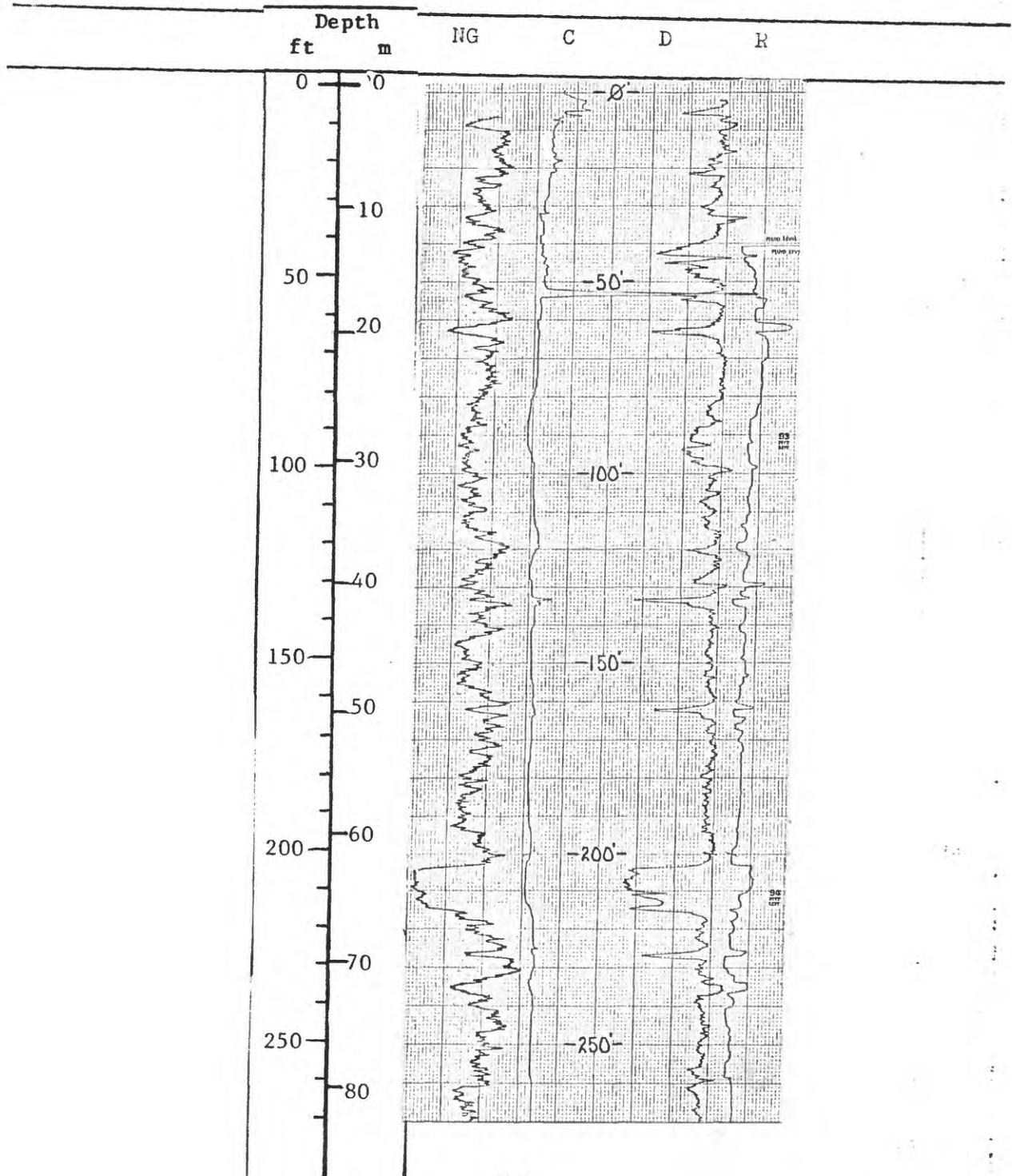
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80 AU7 Date logged 8/1/80 Surface elevation 3670'

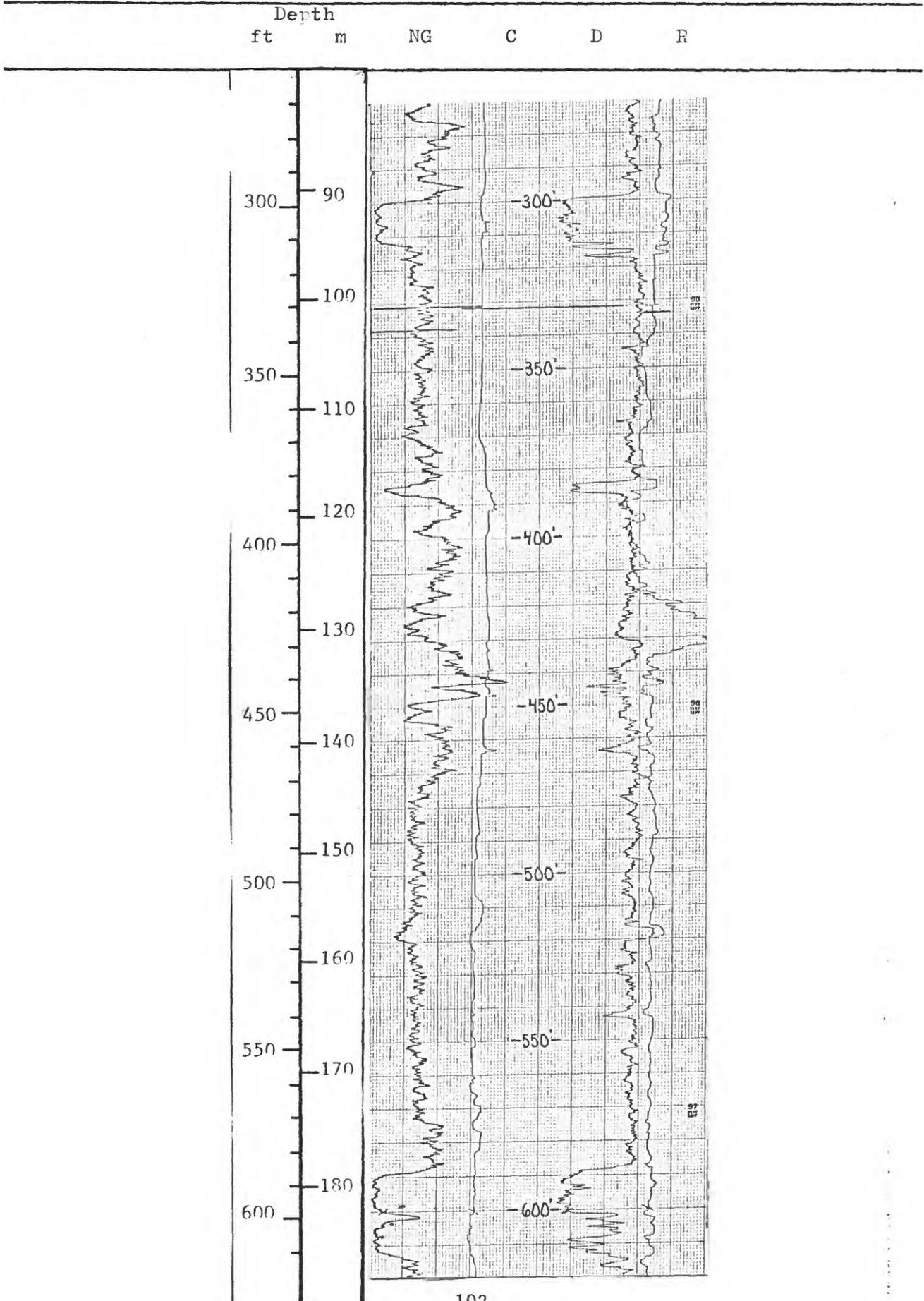
Location NW¼ NW¼ sec. 3, T. 54 N., R. 77 W. County Sheridan

Drilled depth 840' Logged depth 840' Fluid level ----

Remarks drilled with mud

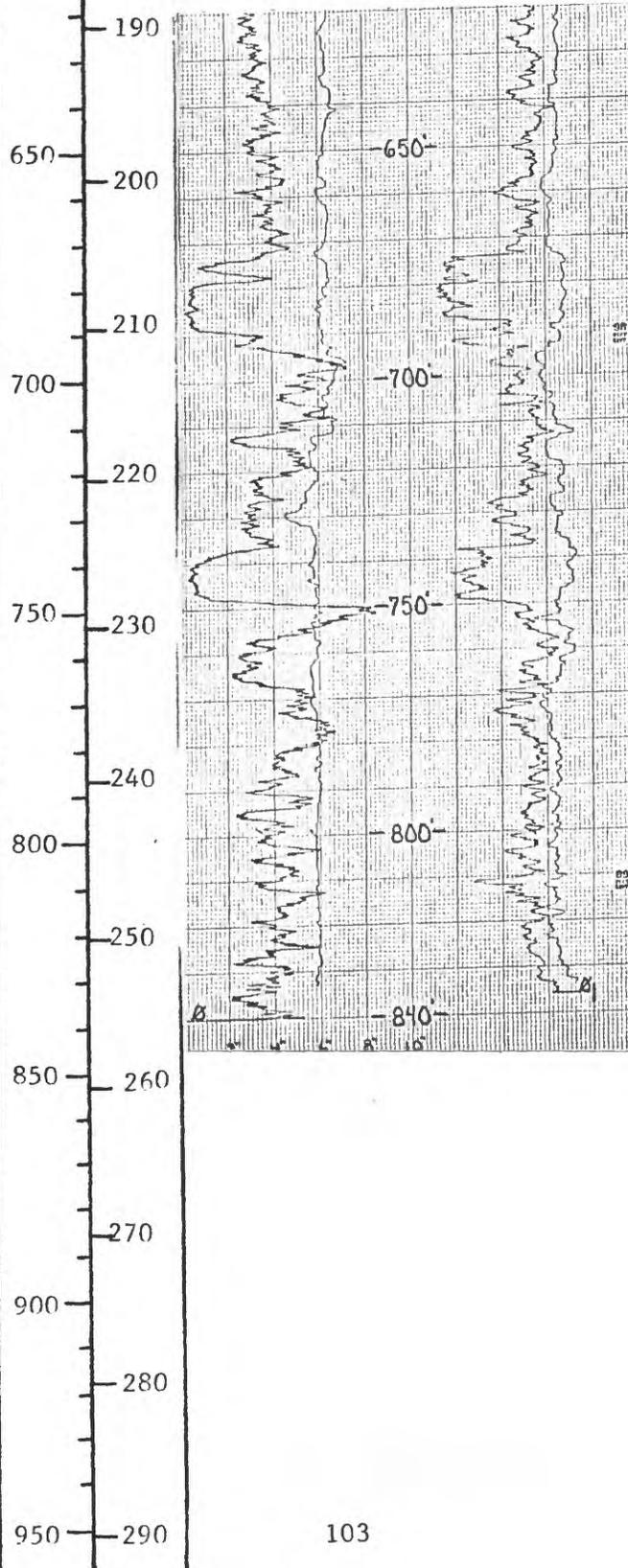


Hole no. 80-AU7 (continued)



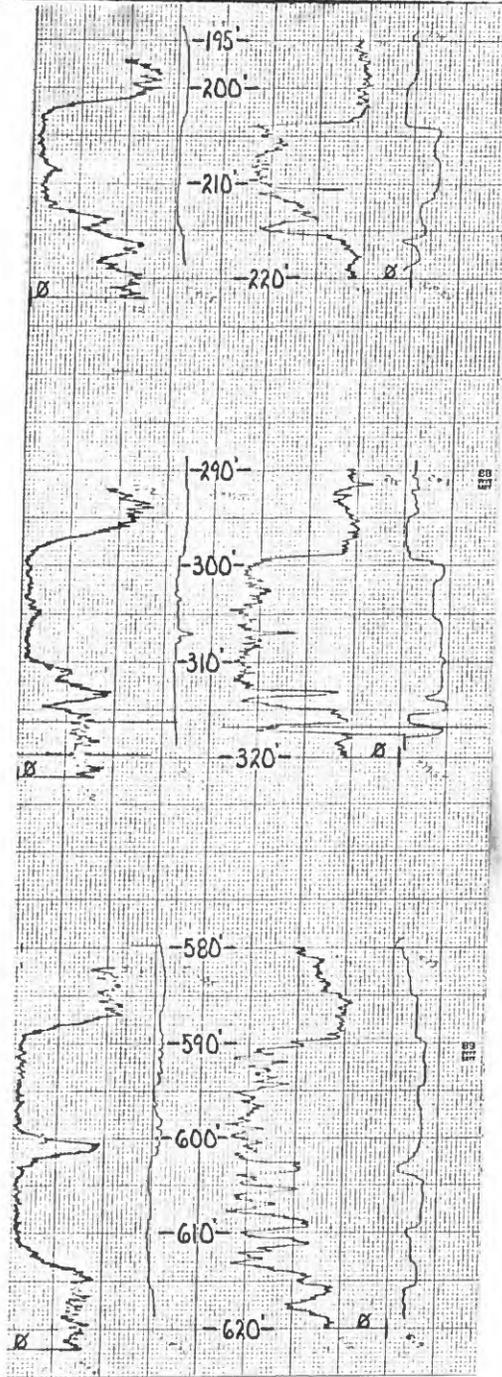
Hole no. 80-AU7 (continued)

Depth  
ft      m      NG      C      D      R



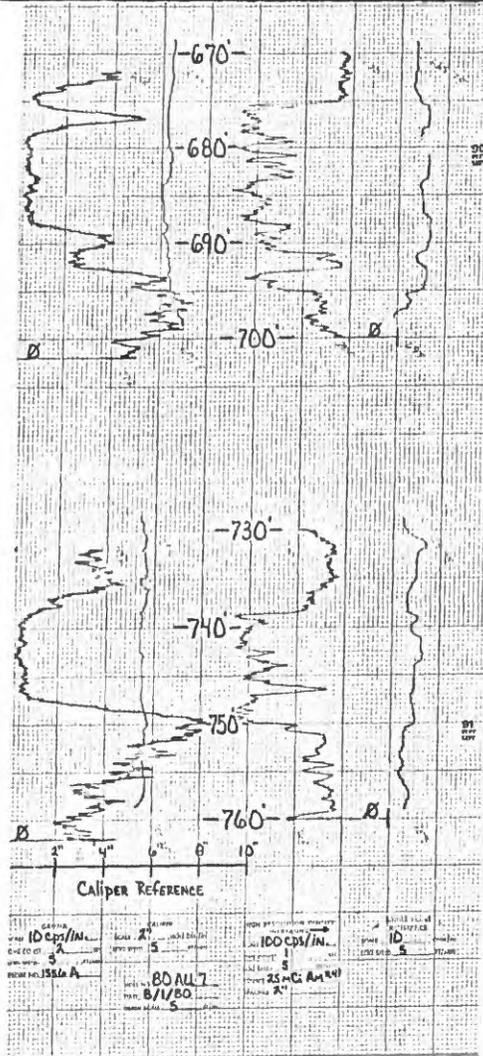
hole no. 80-AU7 (reruns)

NG C D R



Hole no. 80-AU7 (reruns)

NG C D R



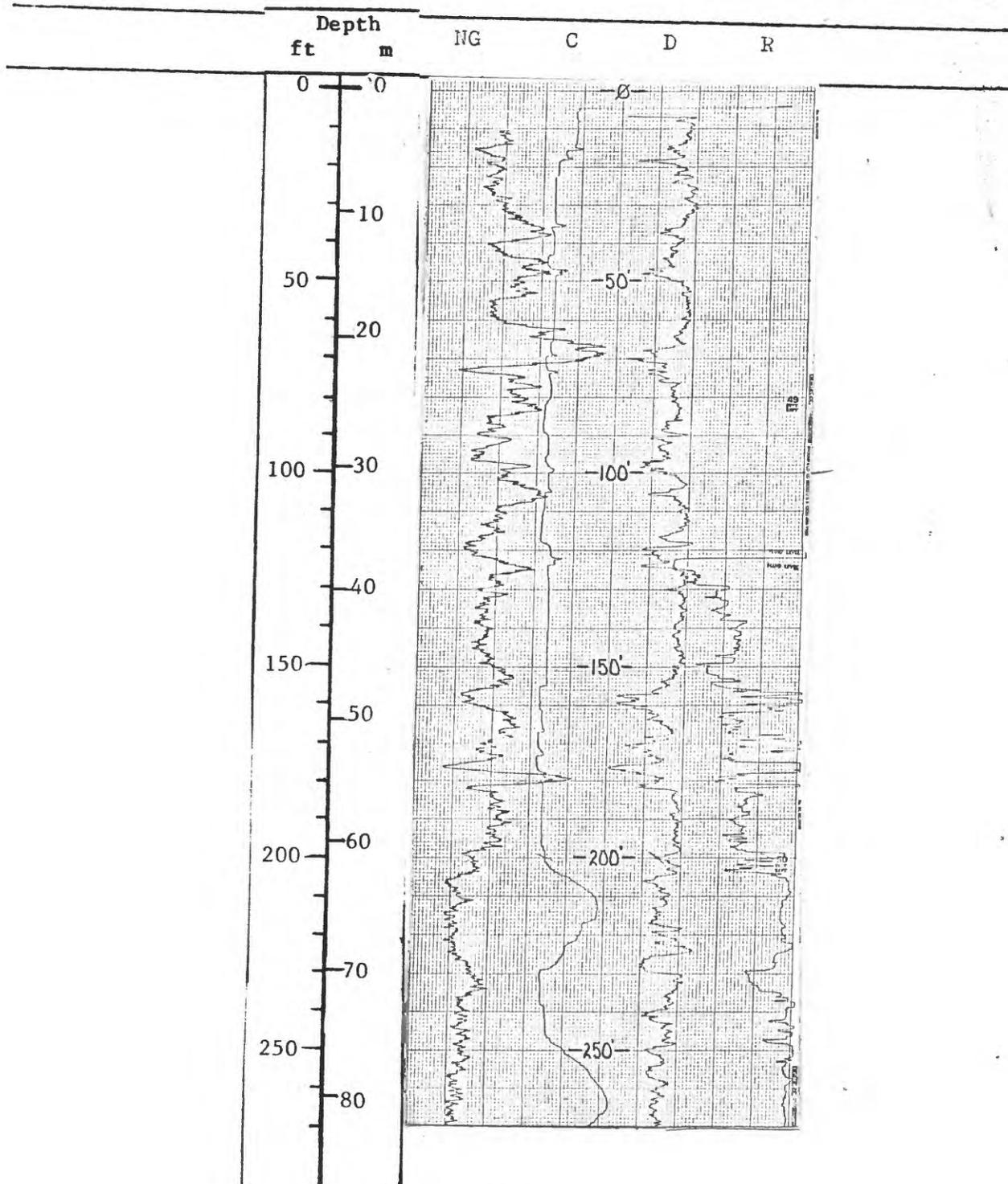
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU8 Date logged 9/11/80 Surface elevation 3890'

Location NE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 34, T. 55 N., R. 79 W. County Sheridan

Drilled depth 900' Logged depth 900' Fluid level 122'

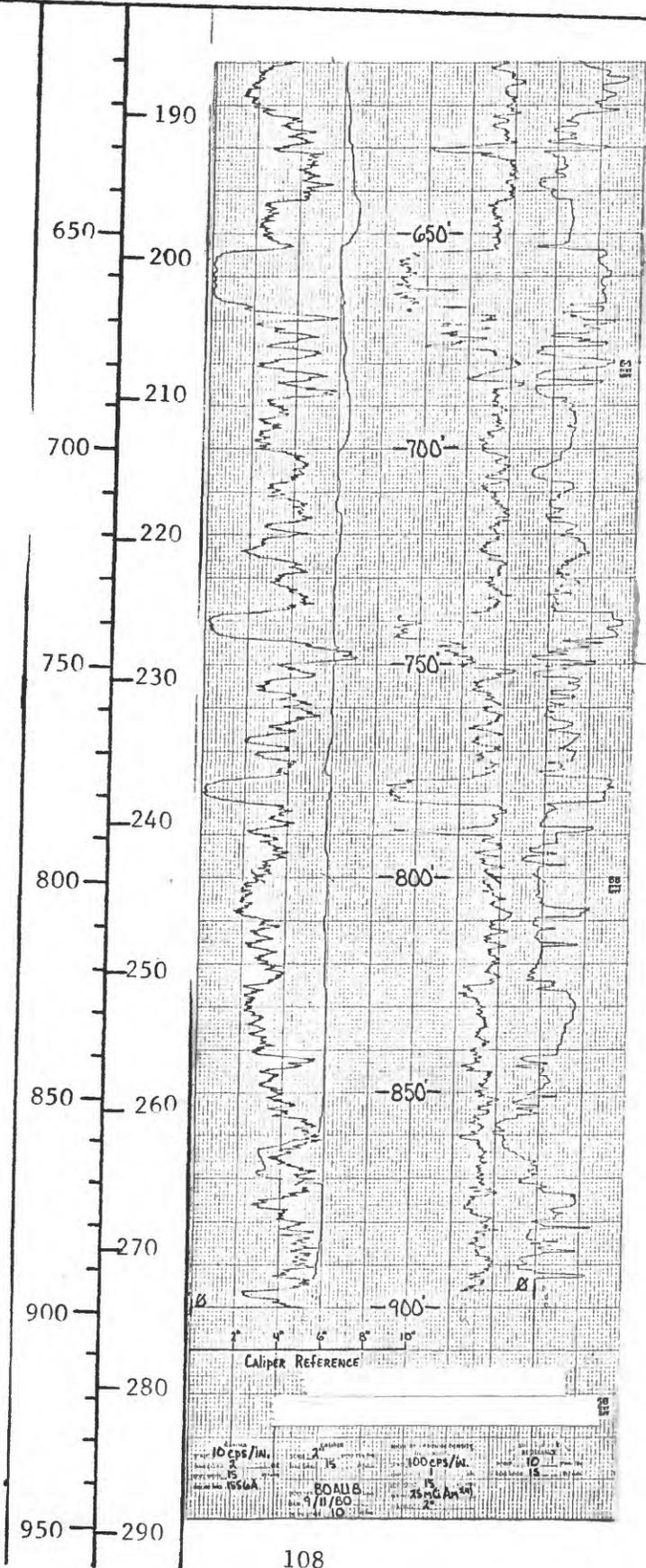
Remarks drilled with air/foam





Hole no. 80-AU8 (continued)

Depth  
ft m NG C D R



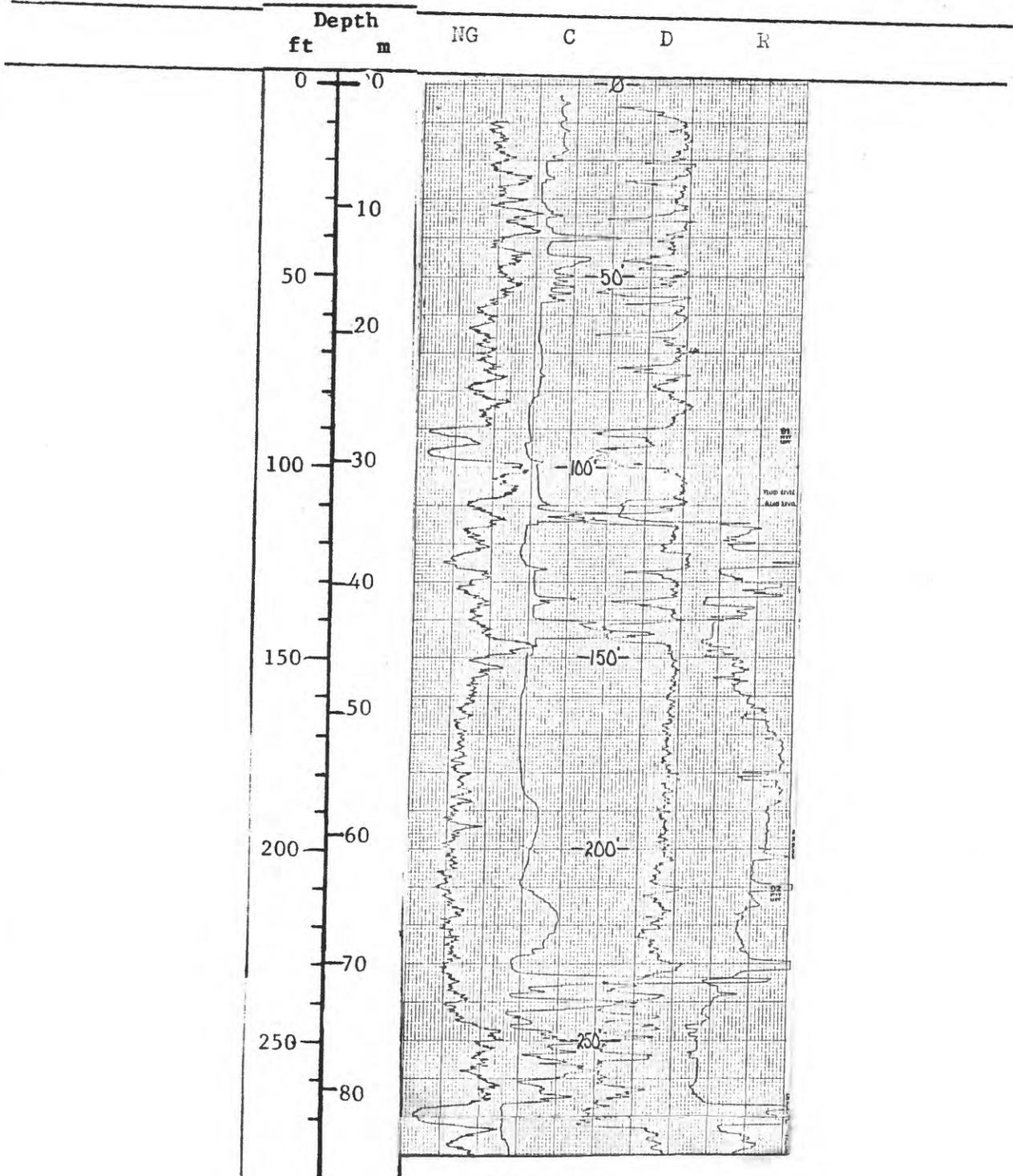
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU9 Date logged 9/8/80 Surface elevation 4200'

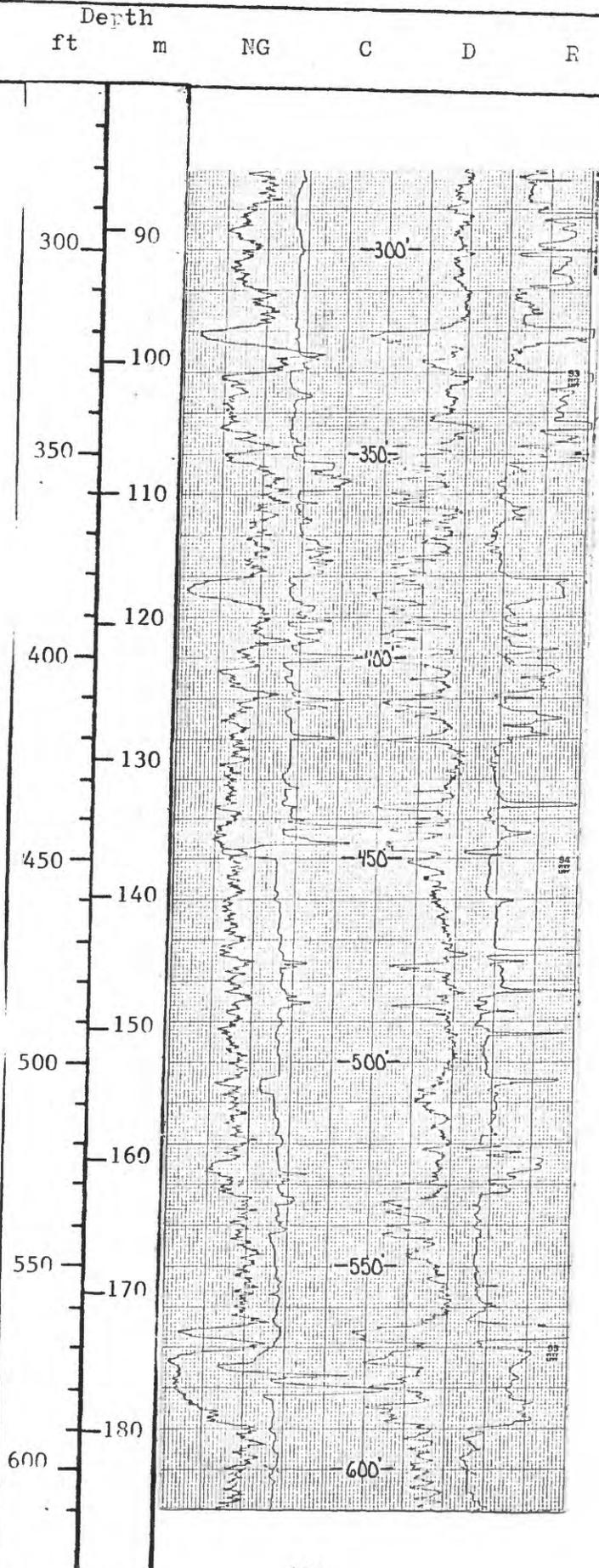
Location Ctr, NW<sup>1</sup>/<sub>4</sub> sec. 35, T. 58 N., R. 78 W. County Sheridan

Drilled depth 1000' Logged depth 1000' Fluid level 108'

Remarks drilled with air/foam

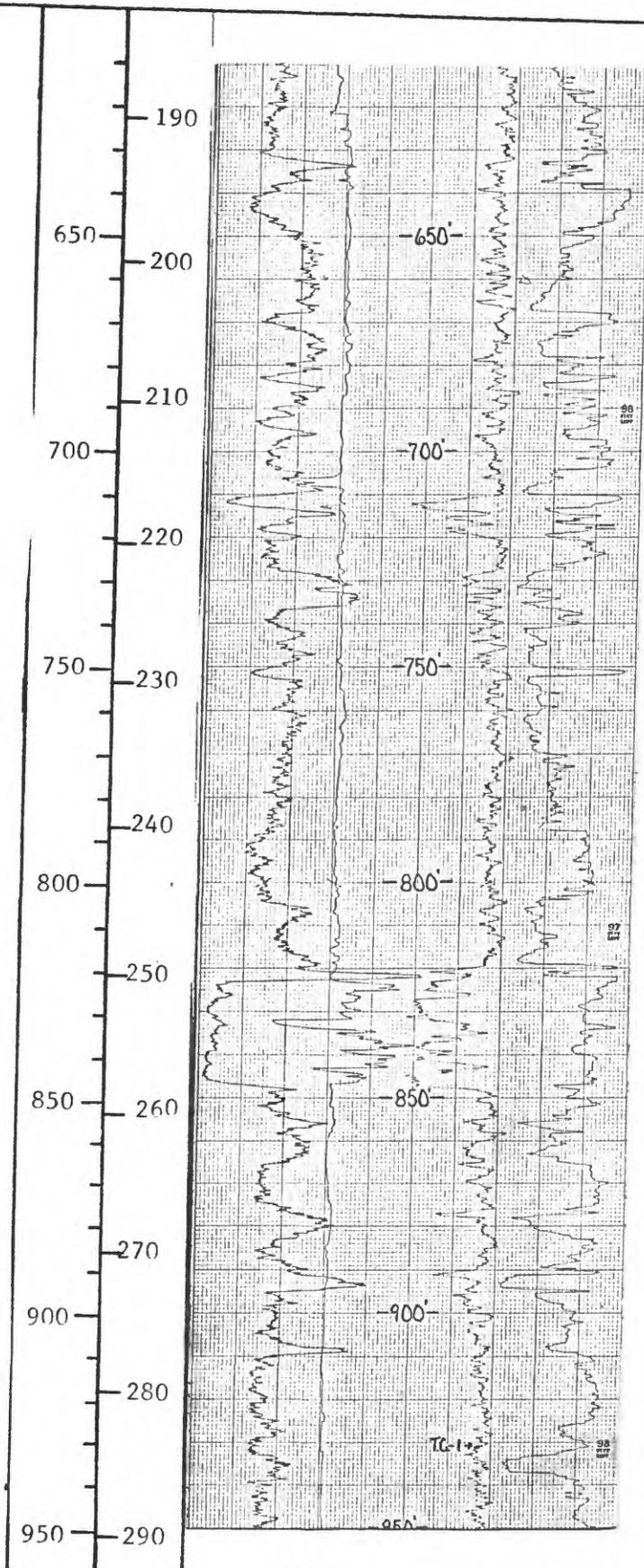


Hole no. 80-AU9 (continued)

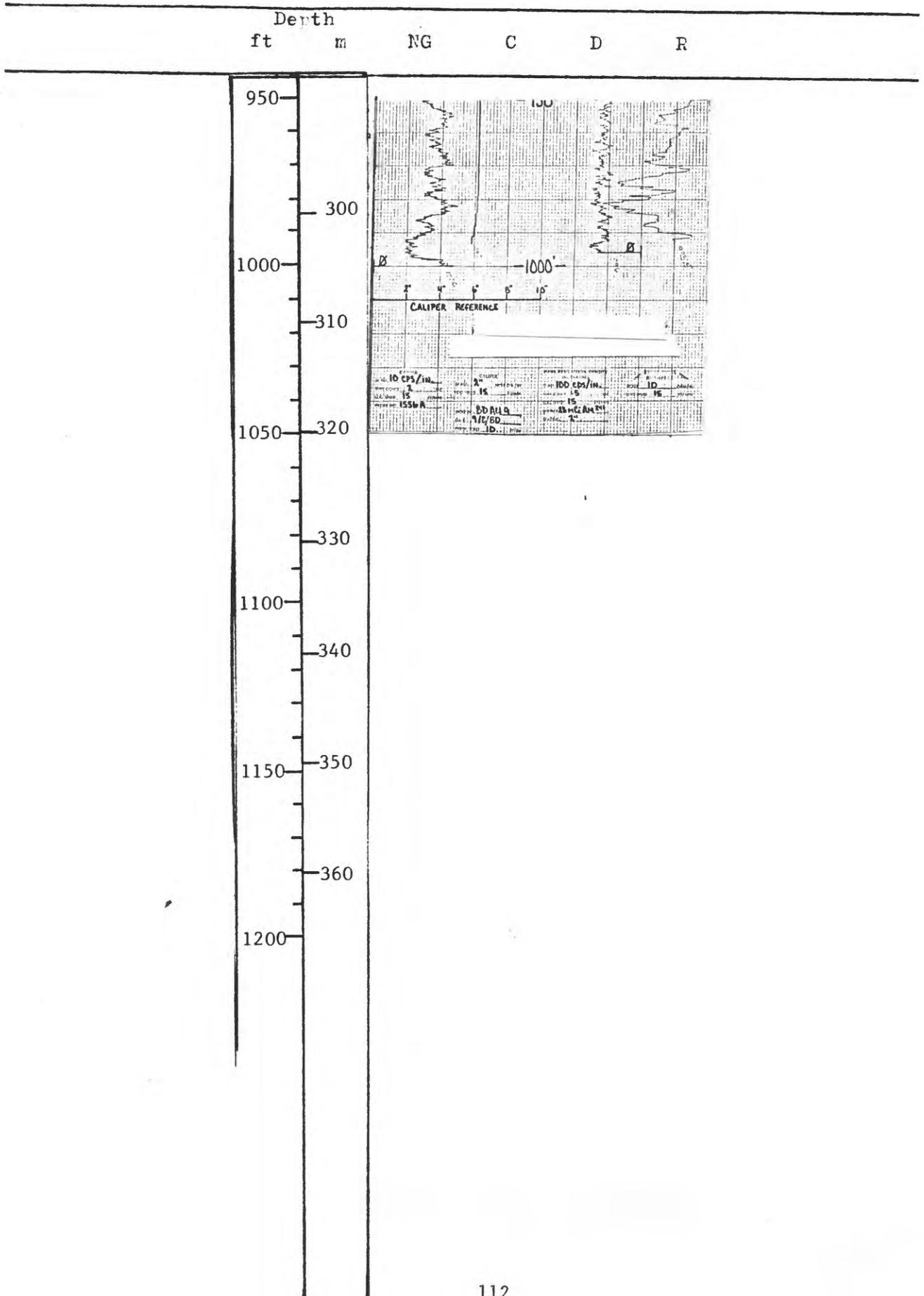


Hole no. 80-AU9 (continued)

Depth  
ft m NG C D R



Hole no. 80-AU9 (continued)



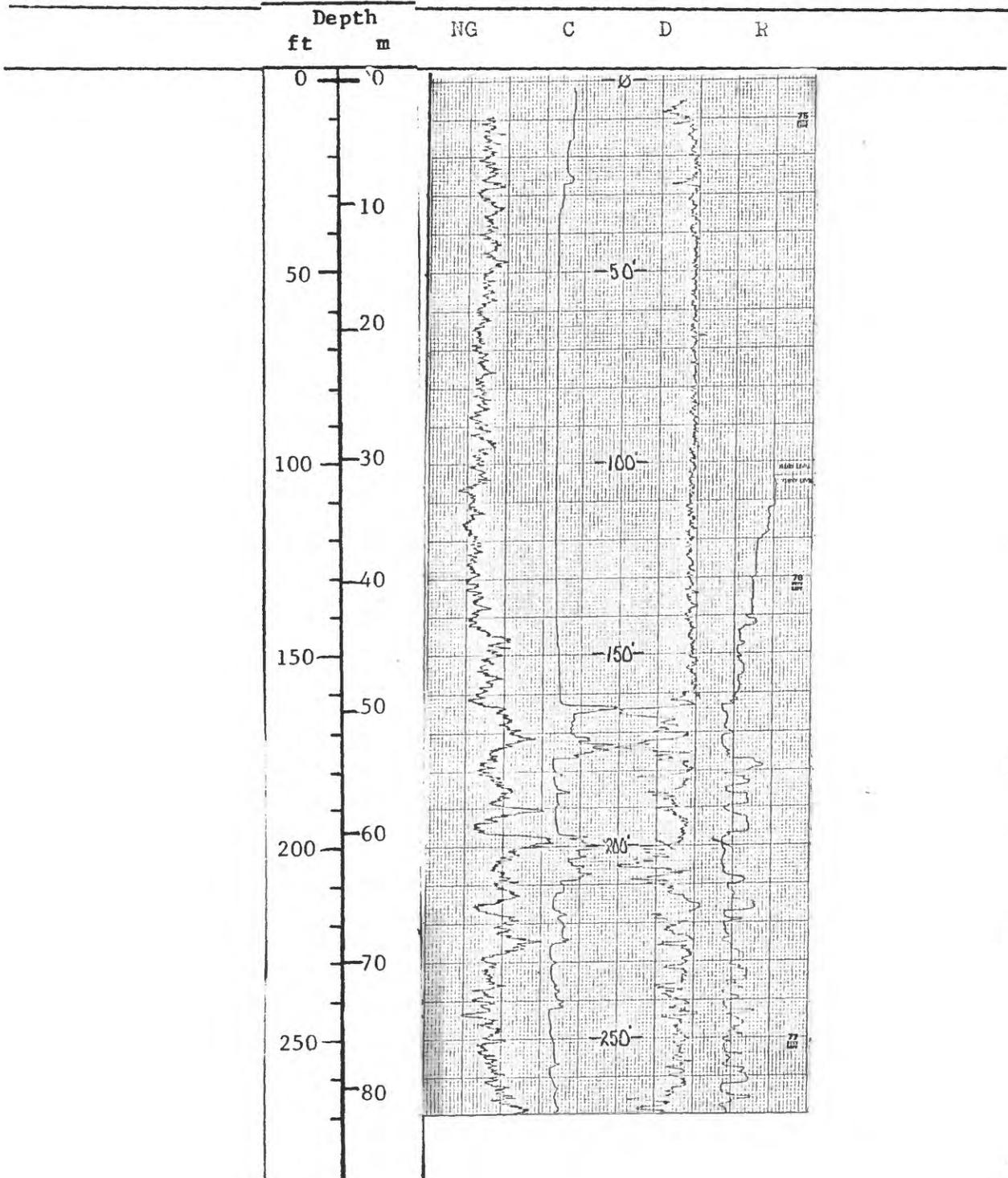
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU10 Date logged 9/9/80 Surface elevation 4190'

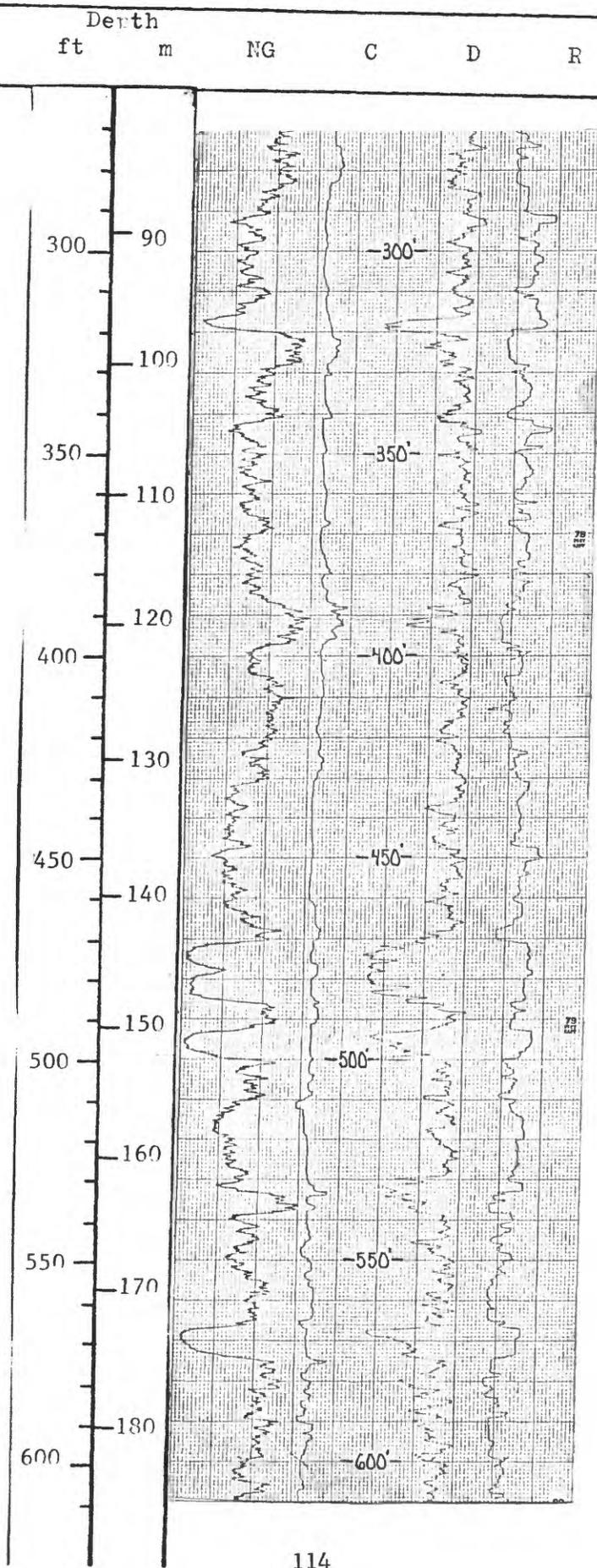
Location SW¼SW¼SE¼ sec. 29, T. 57 N., R. 78 W. County Sheridan

Drilled depth 1120' Logged depth 1120' Fluid level 103.5'

Remarks drilled with air/foam

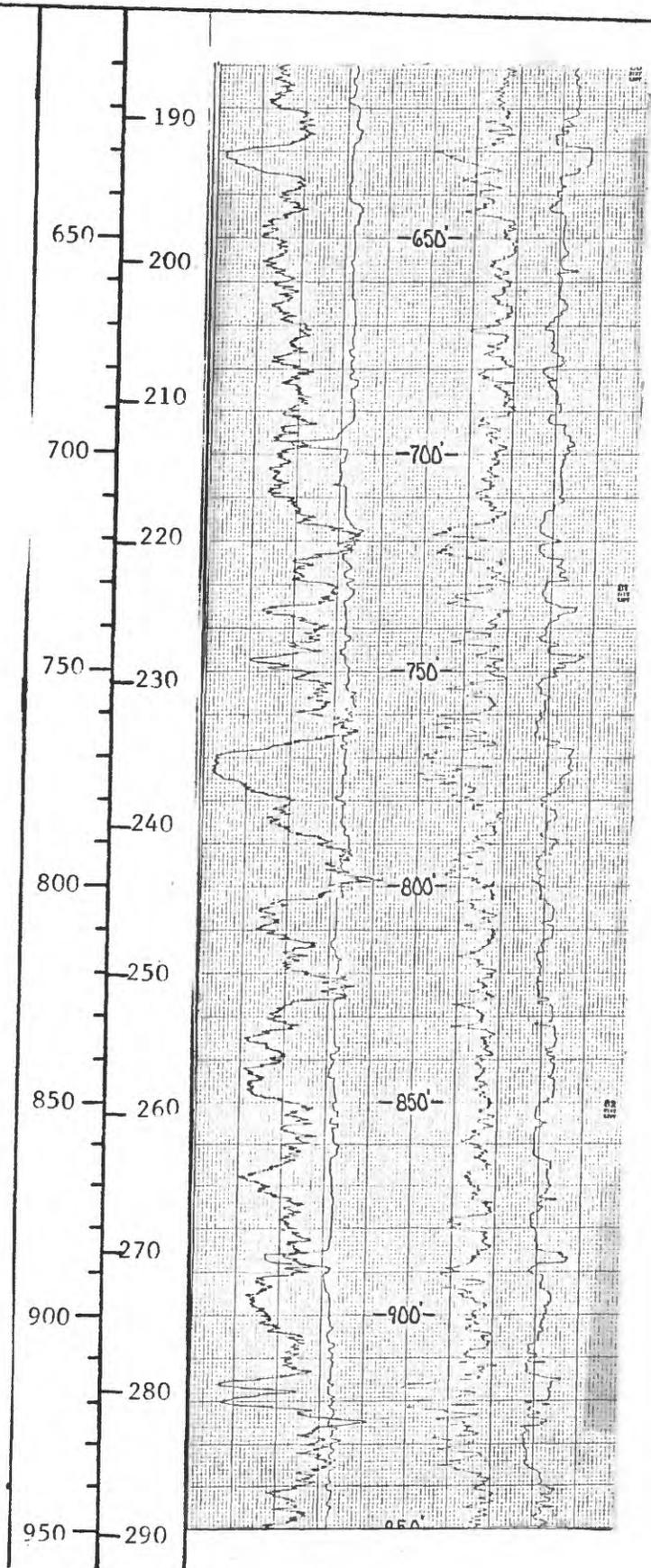


Hole no. 80-AU10 (continued)

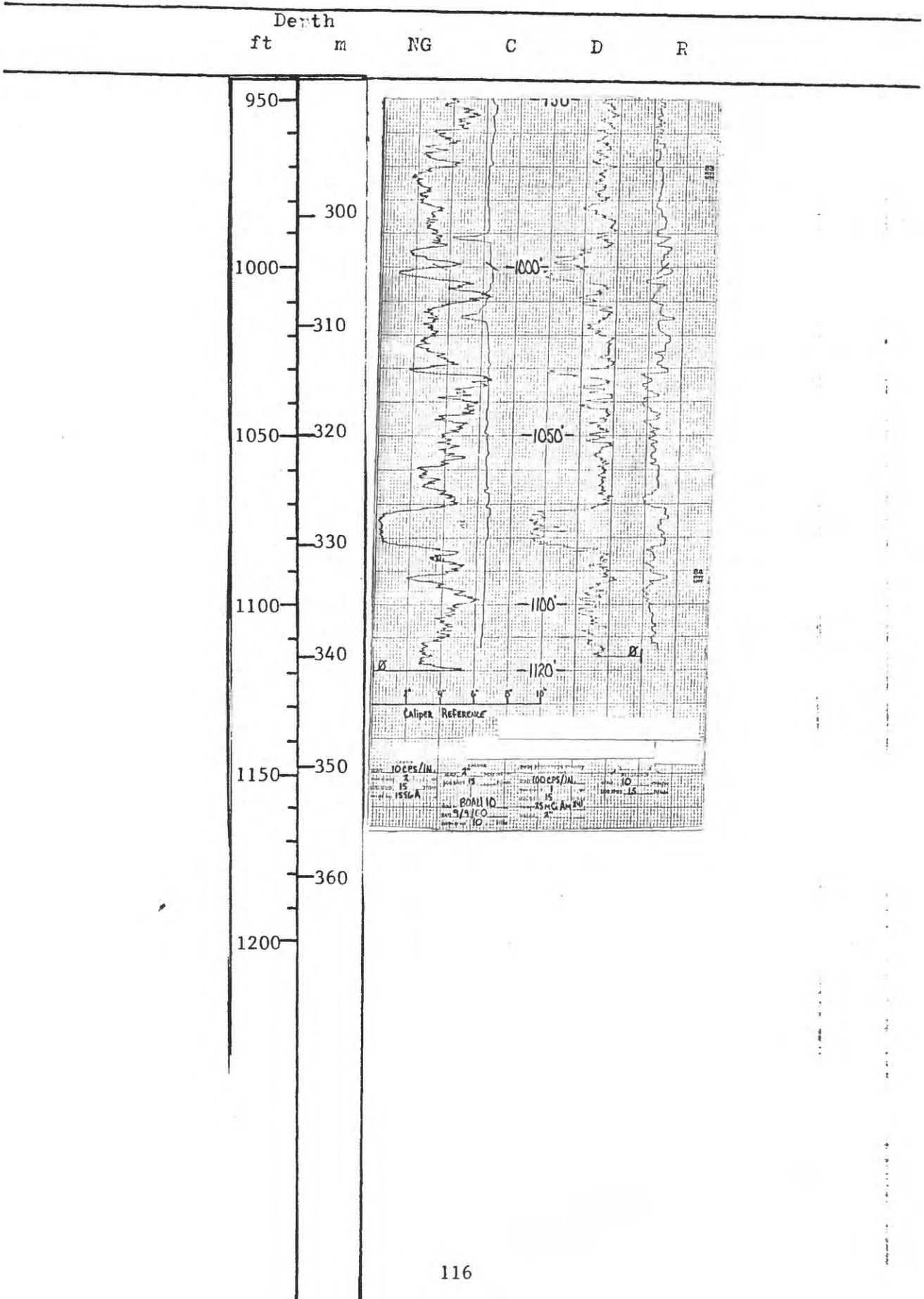


Hole no. 80-AU10 (continued)

Depth  
ft m NG C D R



Hole no. 80-AU10 (continued)



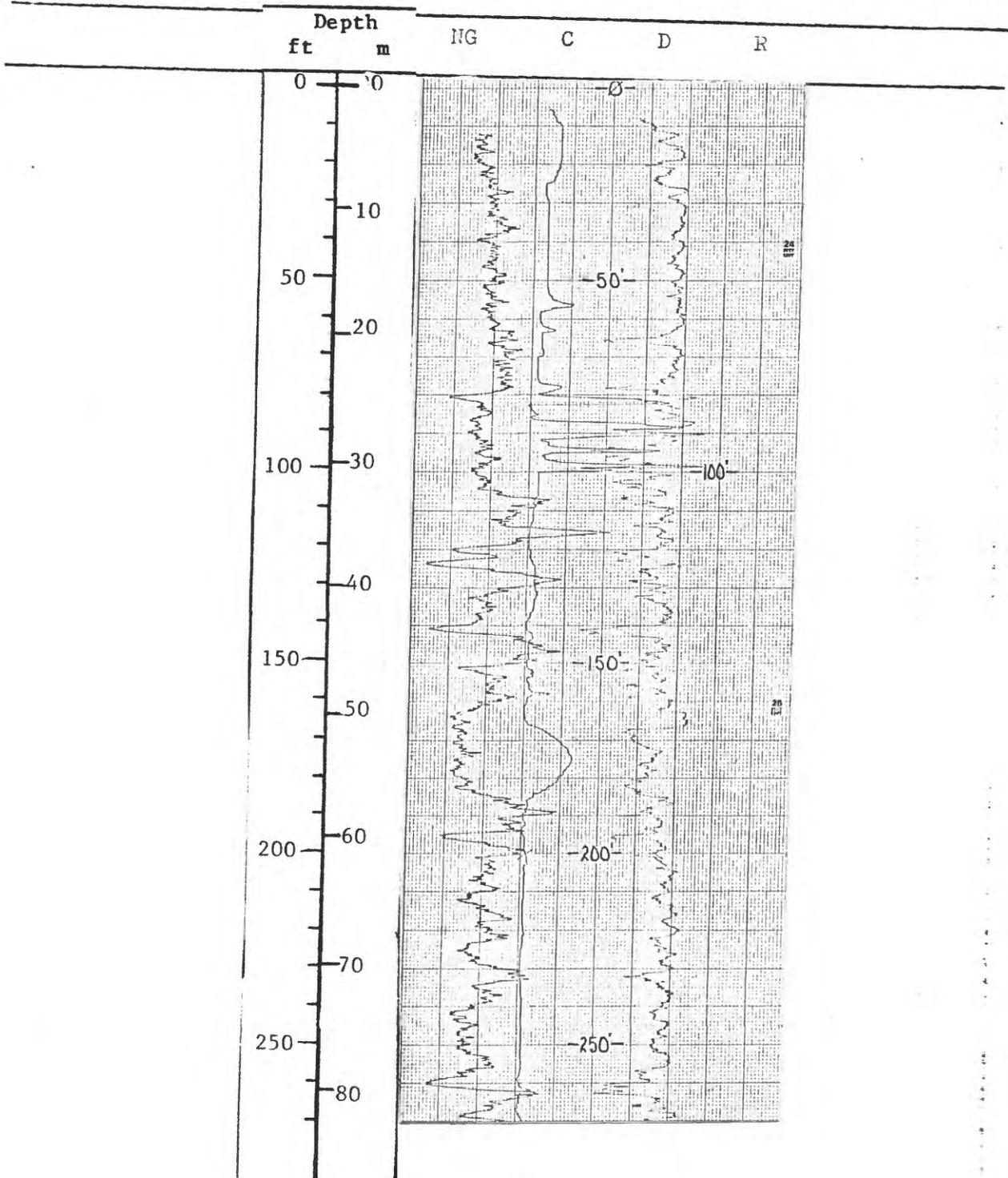
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU11 Date logged 8/31/80 Surface elevation 4280'

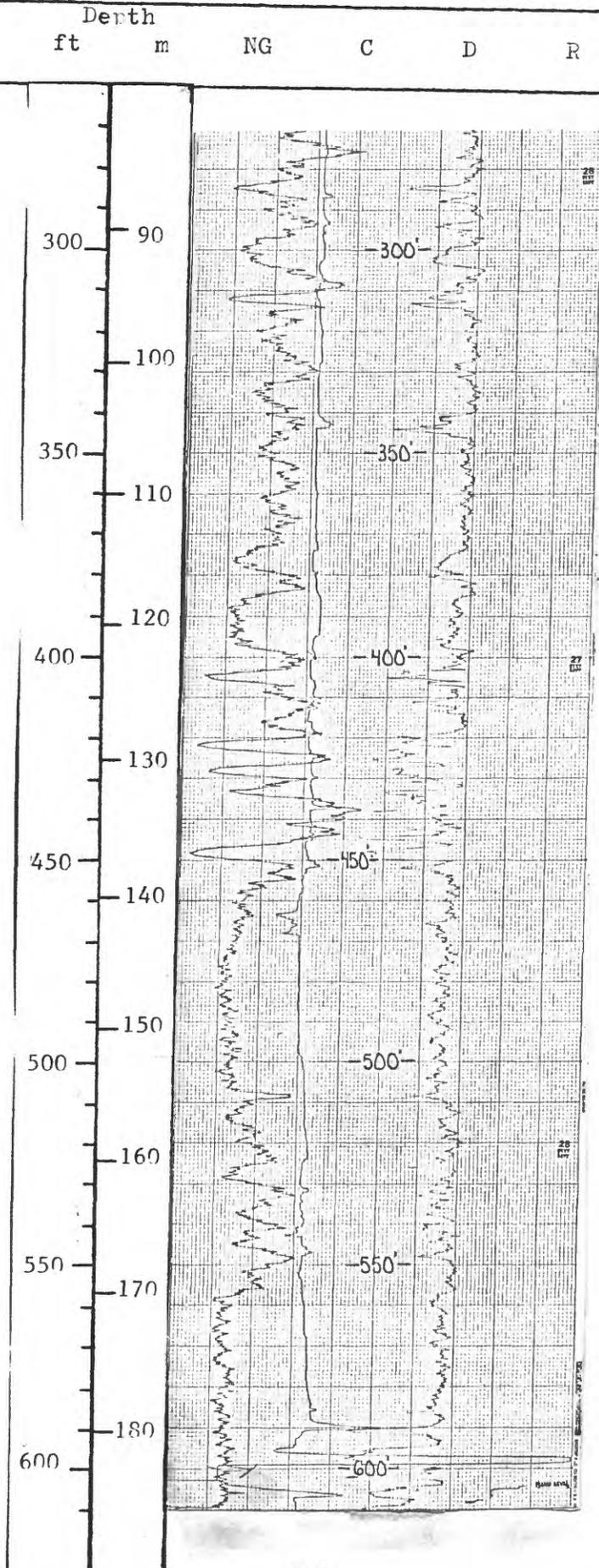
Location SW $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 23, T. 53 N., R. 78 W. County Johnson

Drilled depth 700' Logged depth 700' Fluid level 604'

Remarks drilled with air/foam

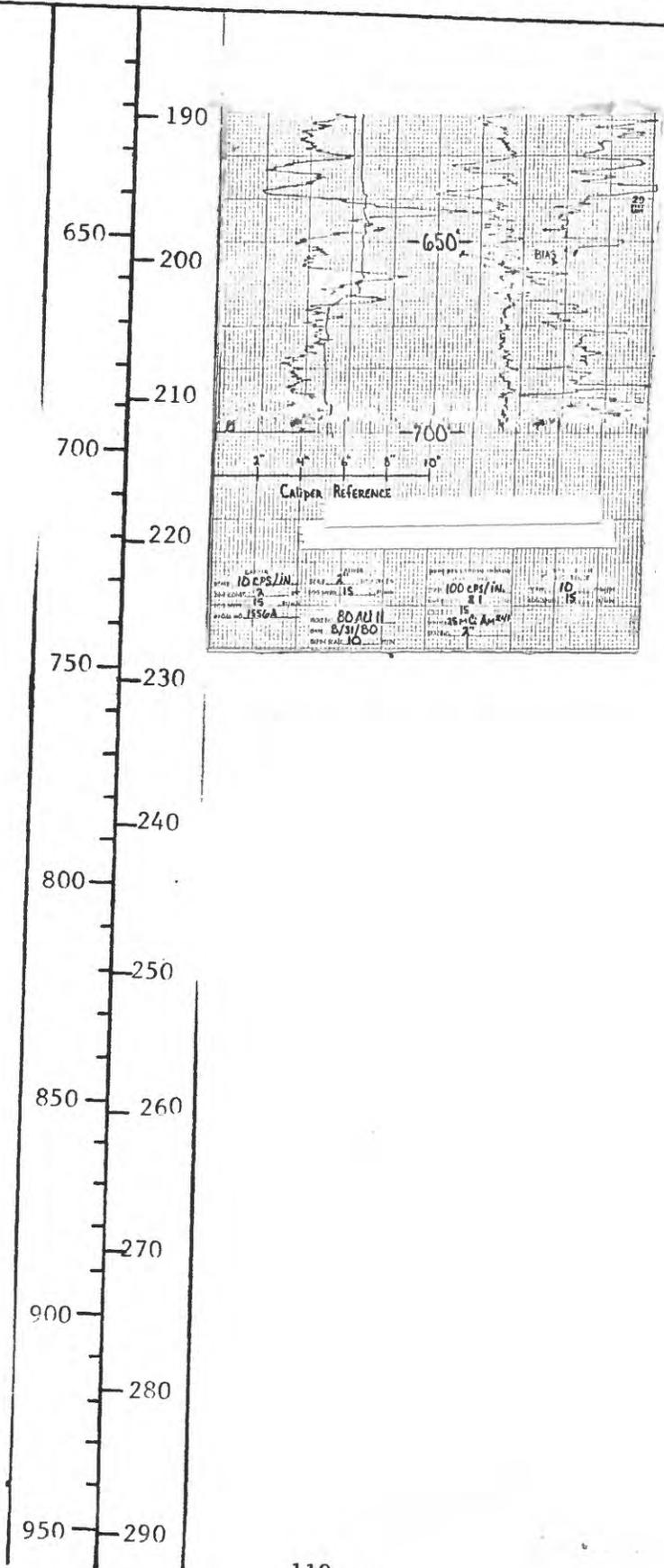


Hole no. 80-AU11 (continued)



Hole no. 80-AU11 (continued)

Depth  
ft      m      NG      C      D      R



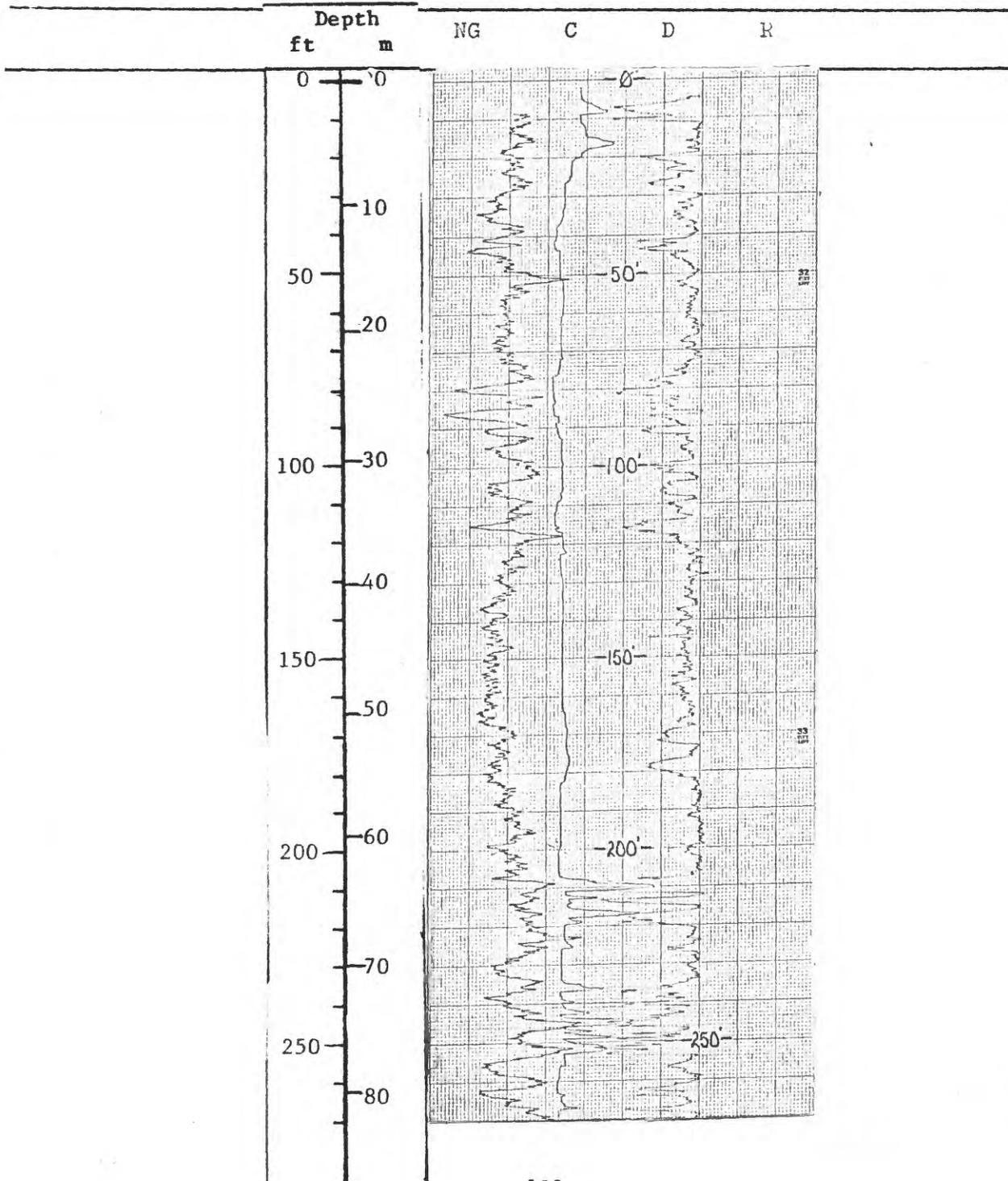
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU12 Date logged 8/30/80 Surface elevation 4360'

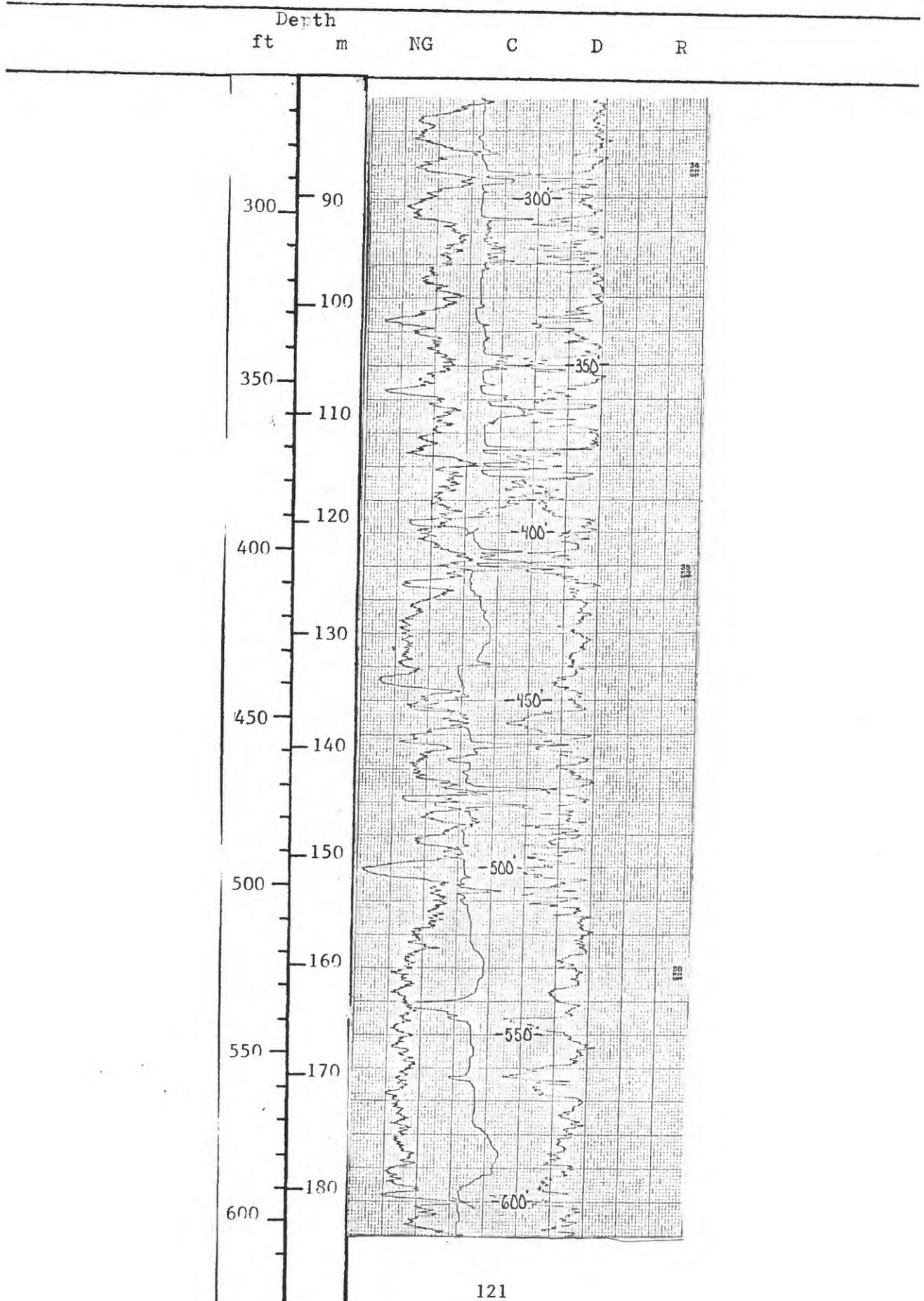
Location SW $\frac{1}{4}$  sec. 5, T. 53 N., R. 78 W. County Johnson

Drilled depth 800' Logged depth 770' Fluid level 673.5'

Remarks drilled with air/foam

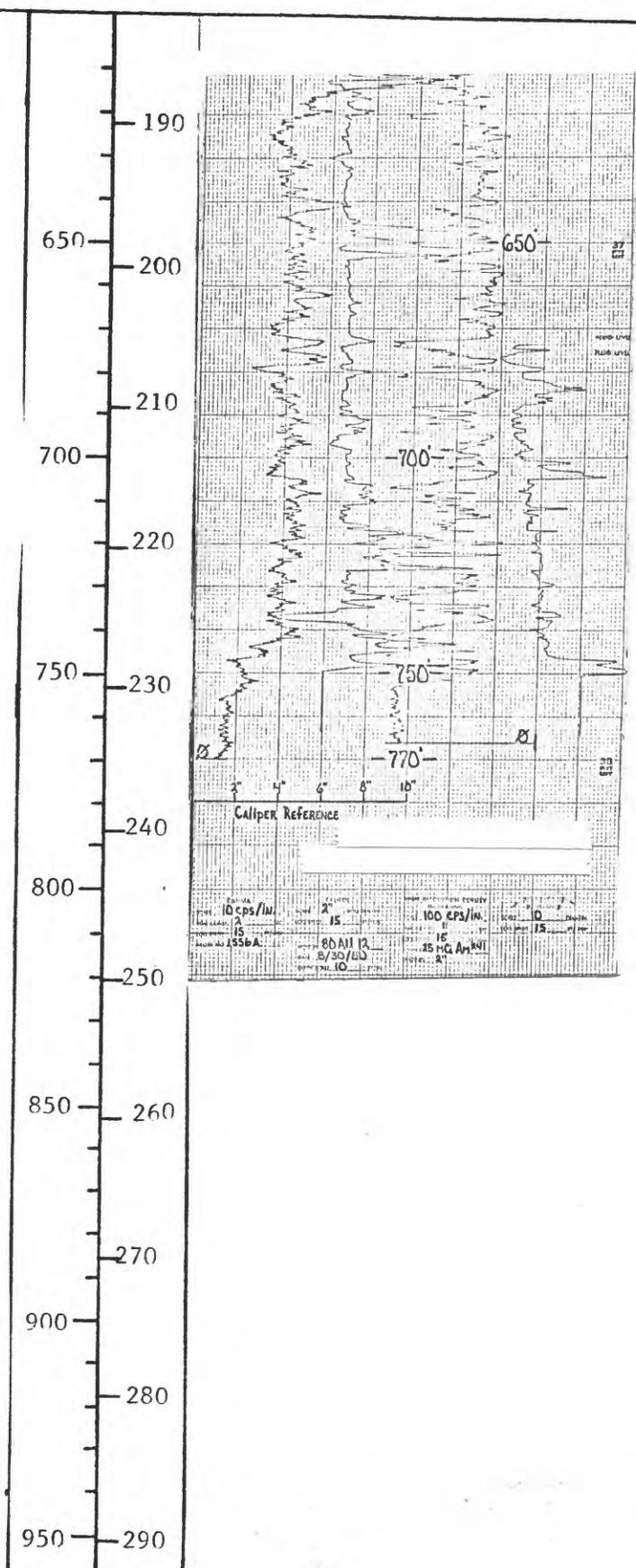


Hole no. 80-AU12 (continued)



Hole no. 80-AU12(continued)

Depth  
ft m NG C D R



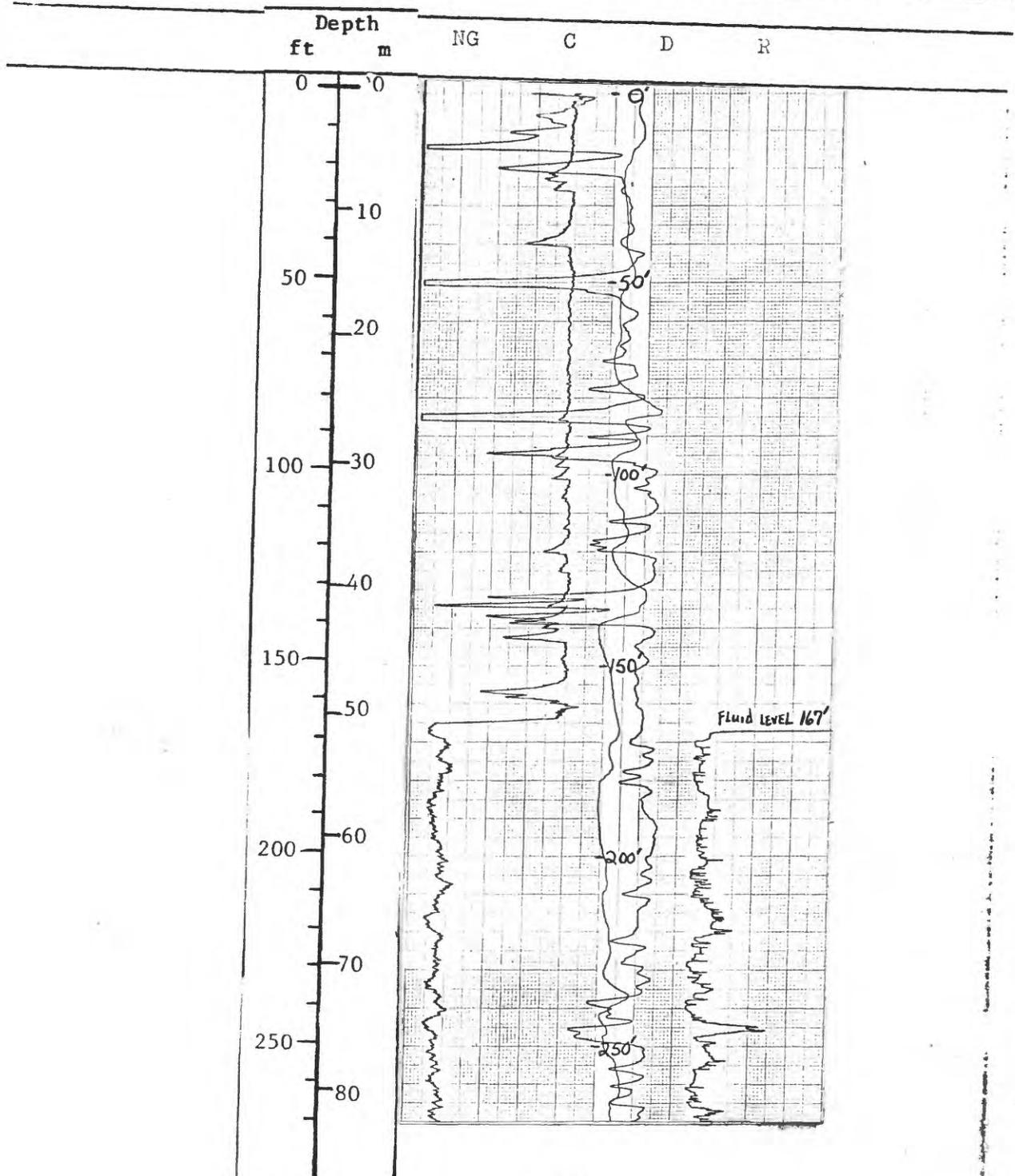
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU13 Date logged 7/22/80 Surface elevation 4180'

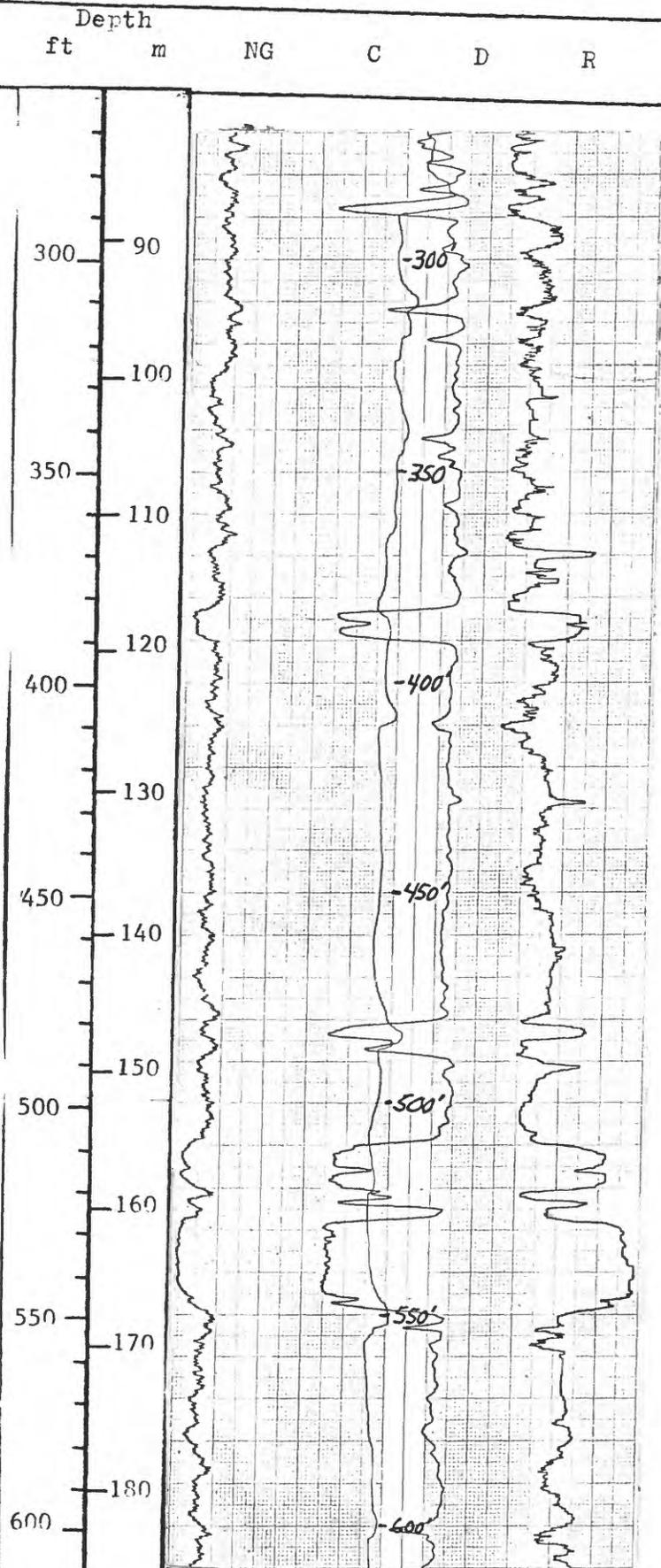
Location NE<sup>1</sup>/<sub>4</sub>NE<sup>1</sup>/<sub>4</sub> sec. 1, T. 54 N., R. 76 W. County Campbell

Drilled depth 1180' Logged depth 1019' Fluid level 167'

Remarks drilled with mud; NG scale-20 cps/in., T.C.-3; D T.C.-3.

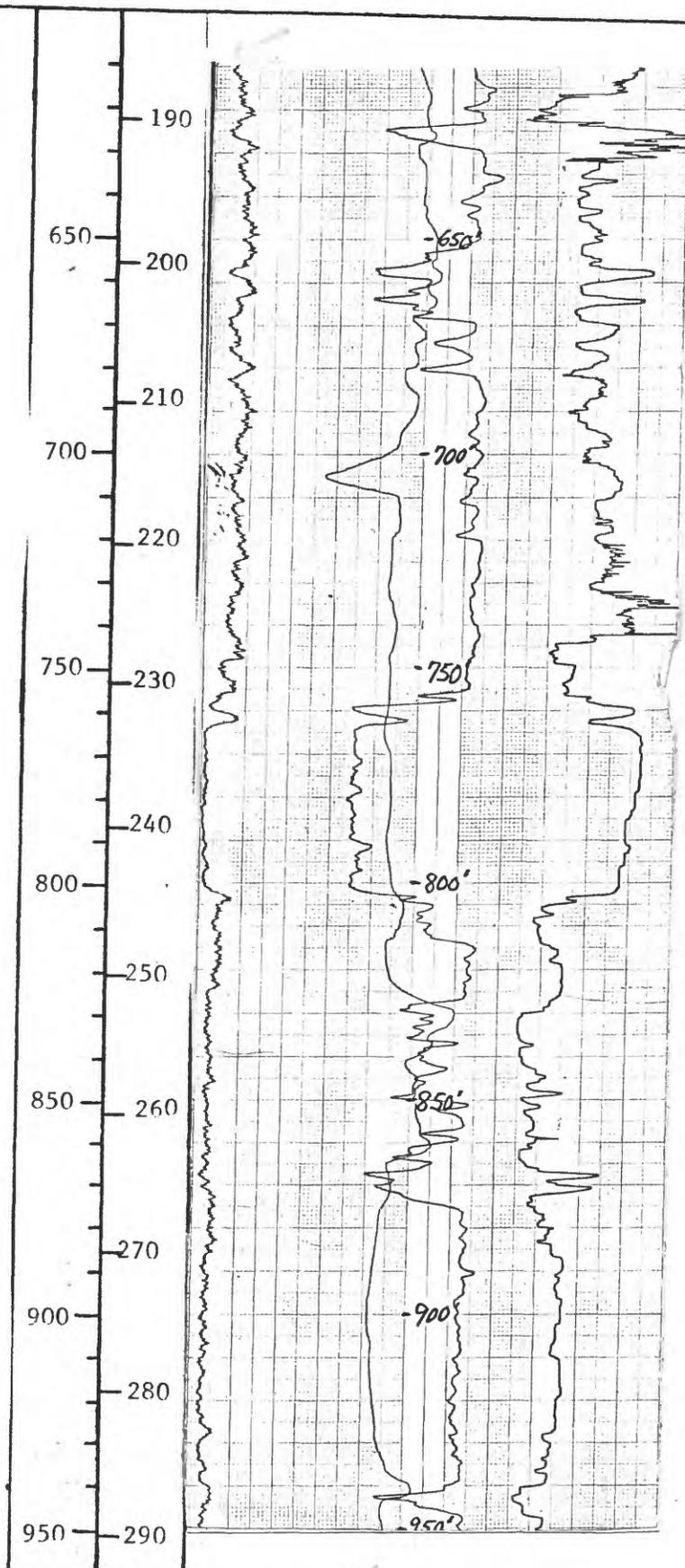


Hole no. 80-AU13 (continued)

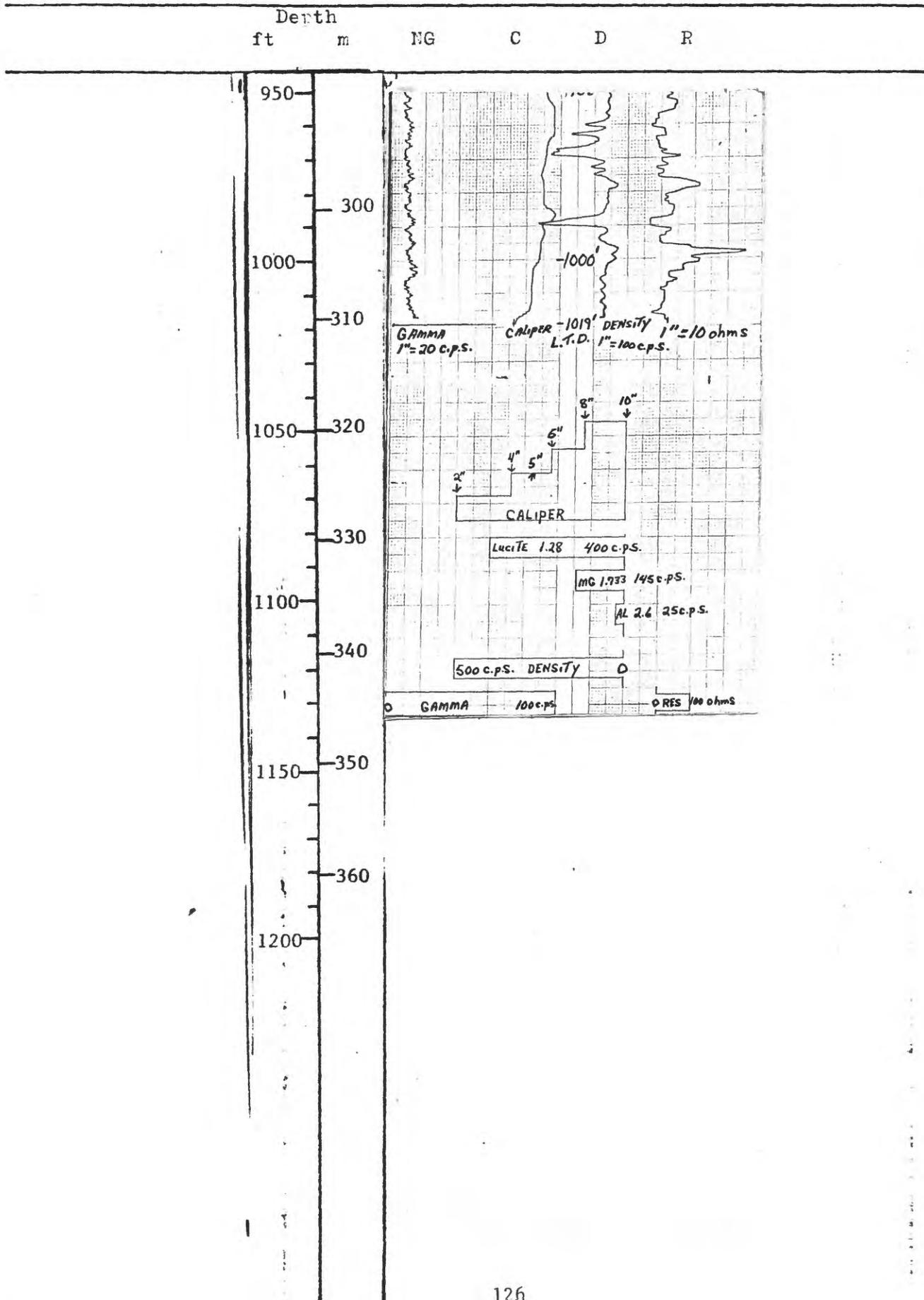


Hole no. 80-AU13 (continued)

Depth  
ft m NG C D R

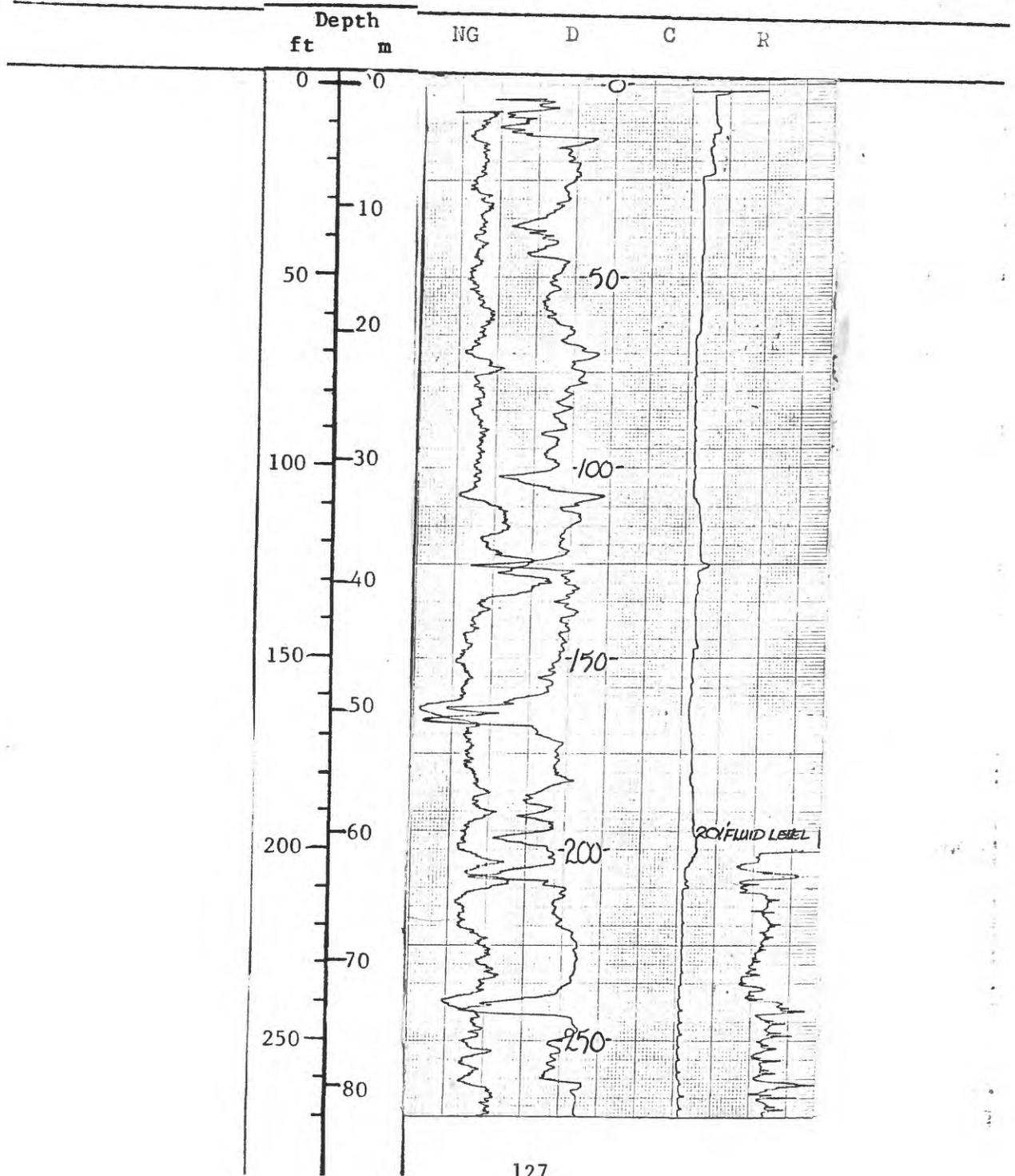


Hole no. 80-AU13 (continued)

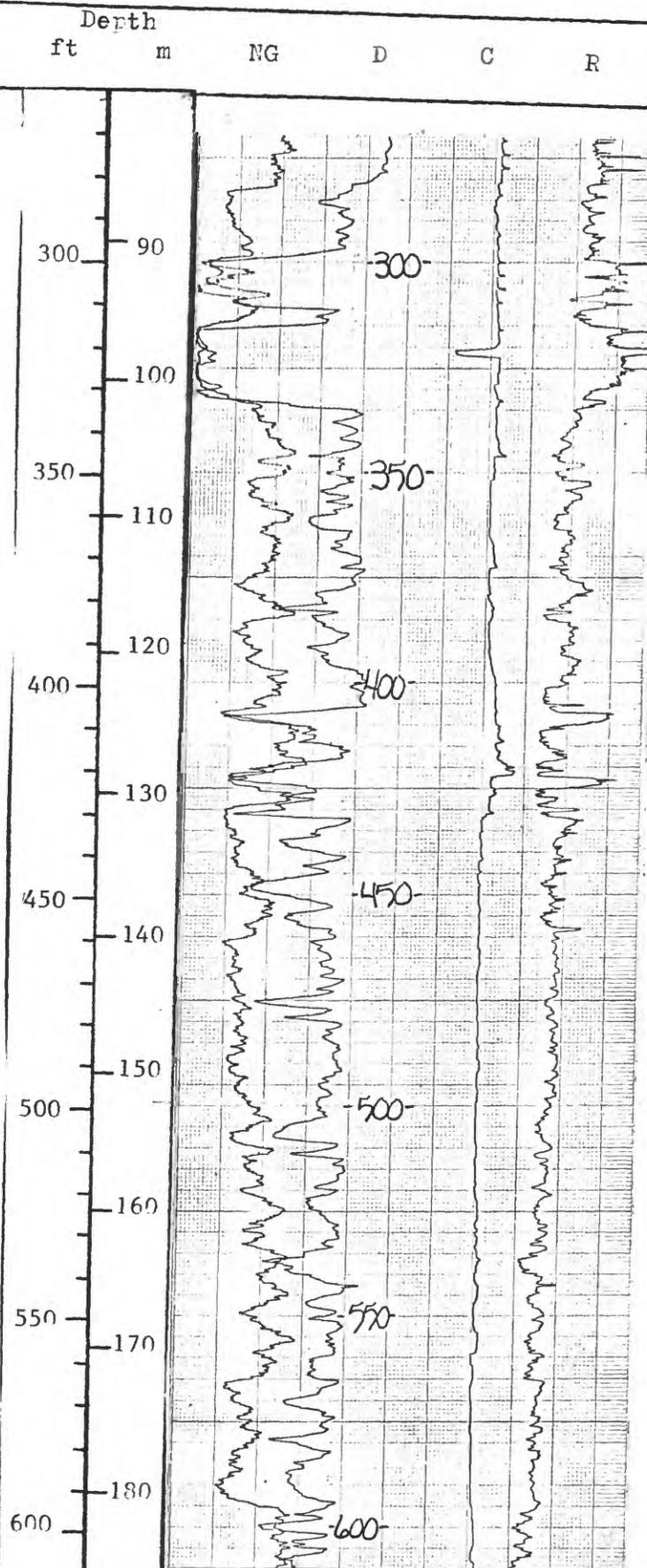


U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU14 Date logged 7/20/80 Surface elevation 4120'  
 Location SW 1/4 NE 1/4 sec. 20, T. 55 N., R. 75 W. County Campbell  
 Drilled depth 960' Logged depth 955' Fluid level 201'  
 Remarks drilled with air/foam; NG scale 50 cps/in. T.C. 3

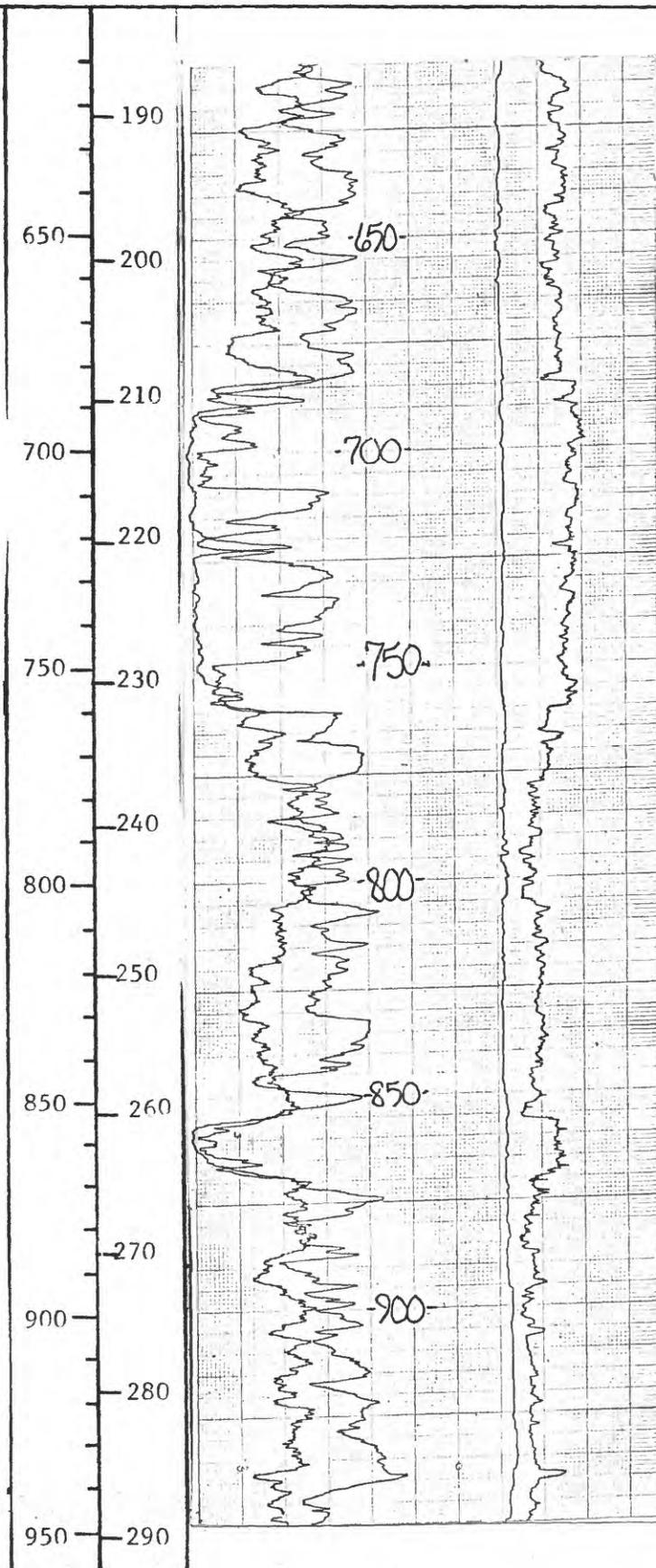


Hole no. 80-AU14 (continued)

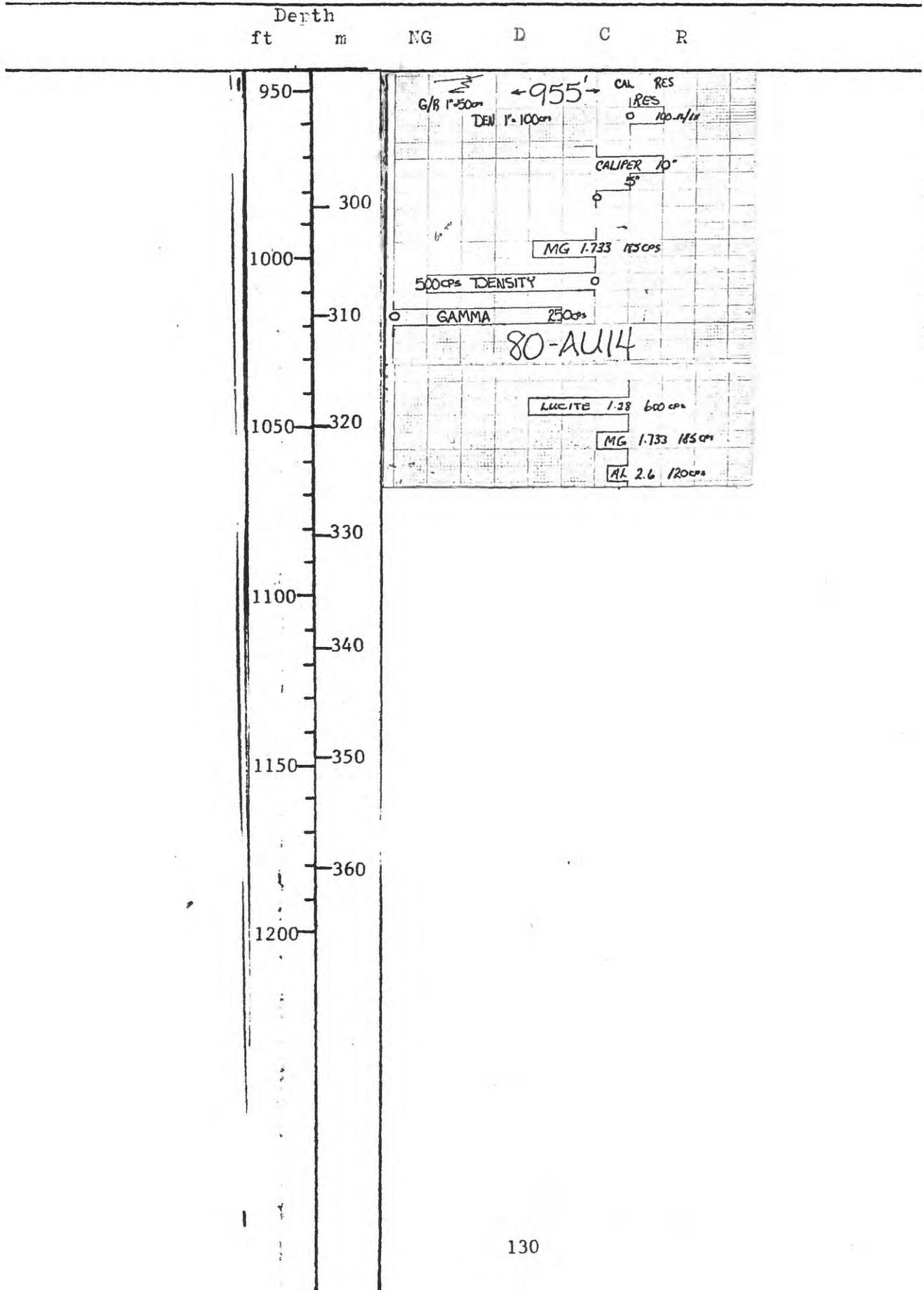


Hole no. 80-AU14 (continued)

Depth  
ft m NG D C R



Hole no. 80-AU14 (continued)



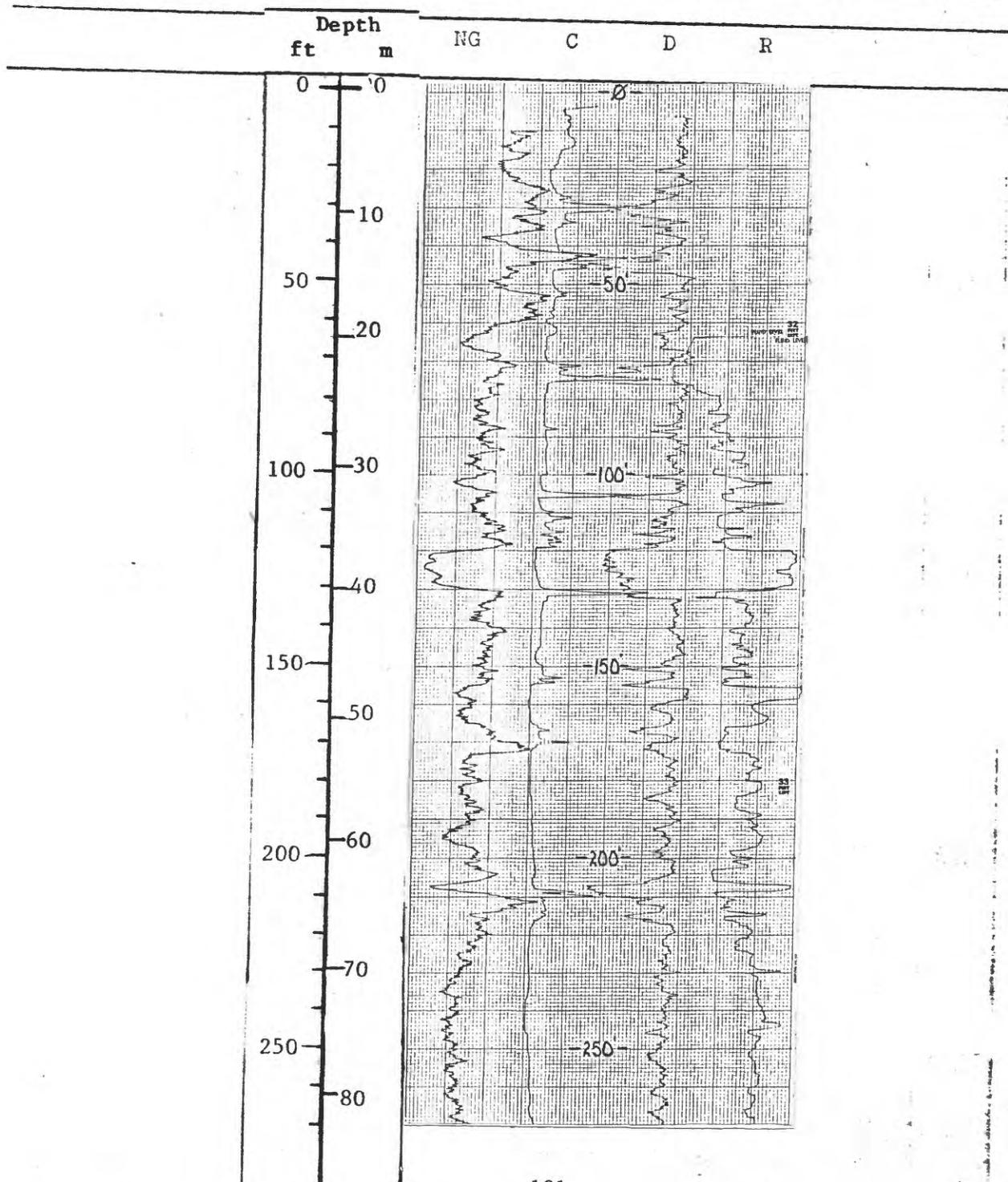
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU15 Date logged 8/18/80 Surface elevation 3800'

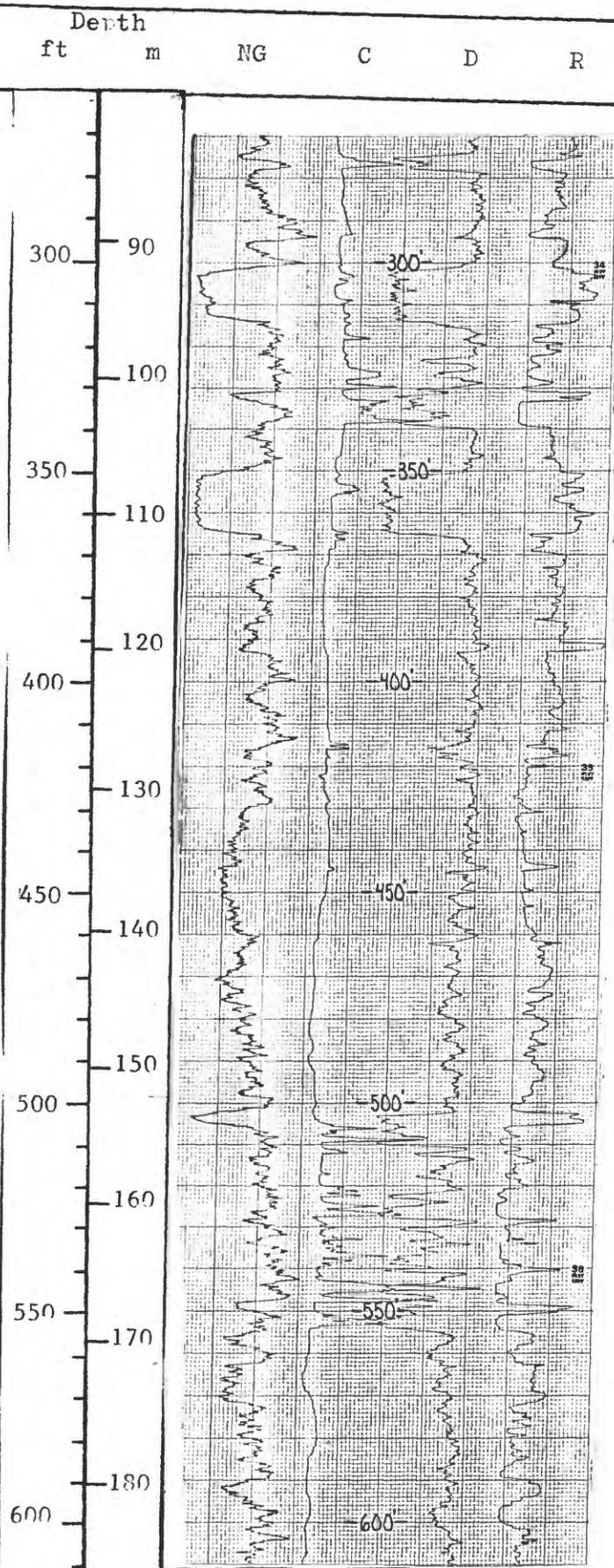
Location SE $\frac{1}{4}$  NE $\frac{1}{4}$  sec. 24, T. 54 N., R. 77 W. County Sheridan

Drilled depth 1000' Logged depth 1000' Fluid level 63.5'

Remarks drilled with air/foam/mud

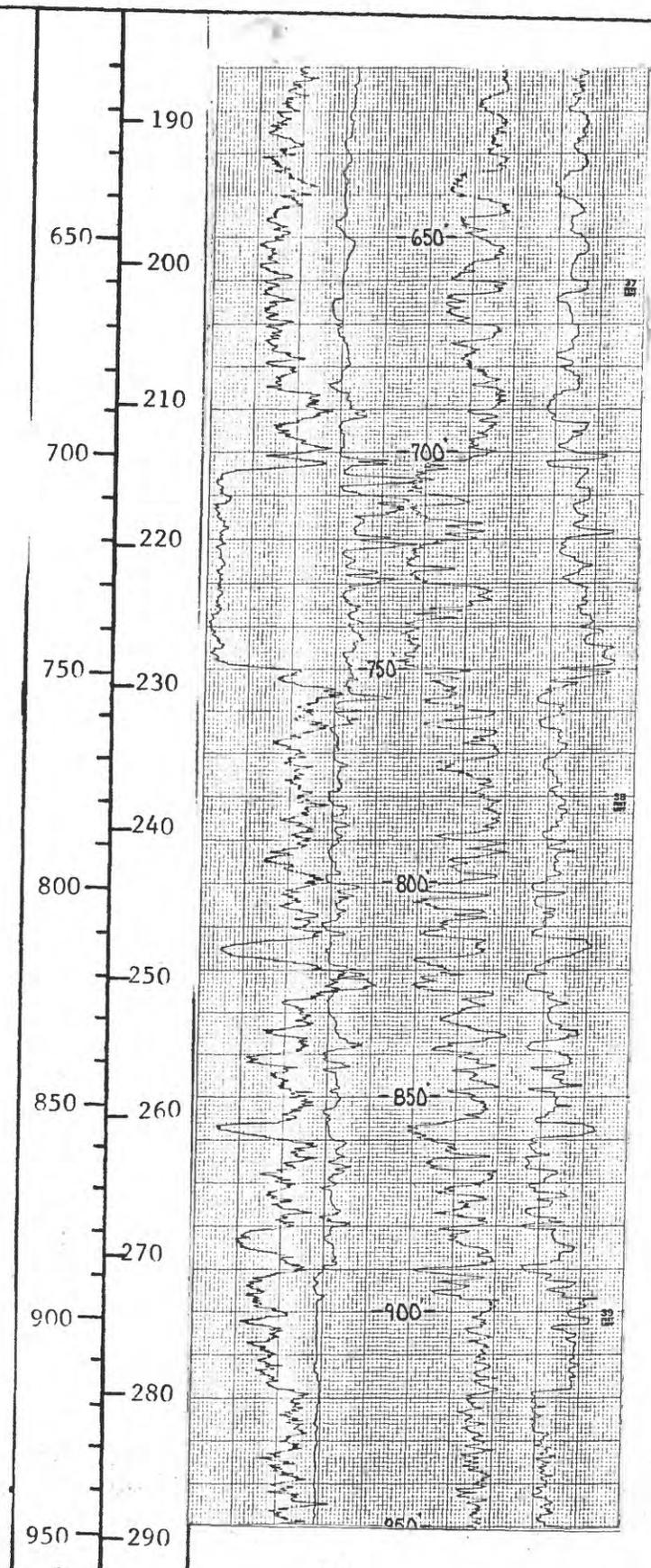


Hole no. 80-AU15 (continued)

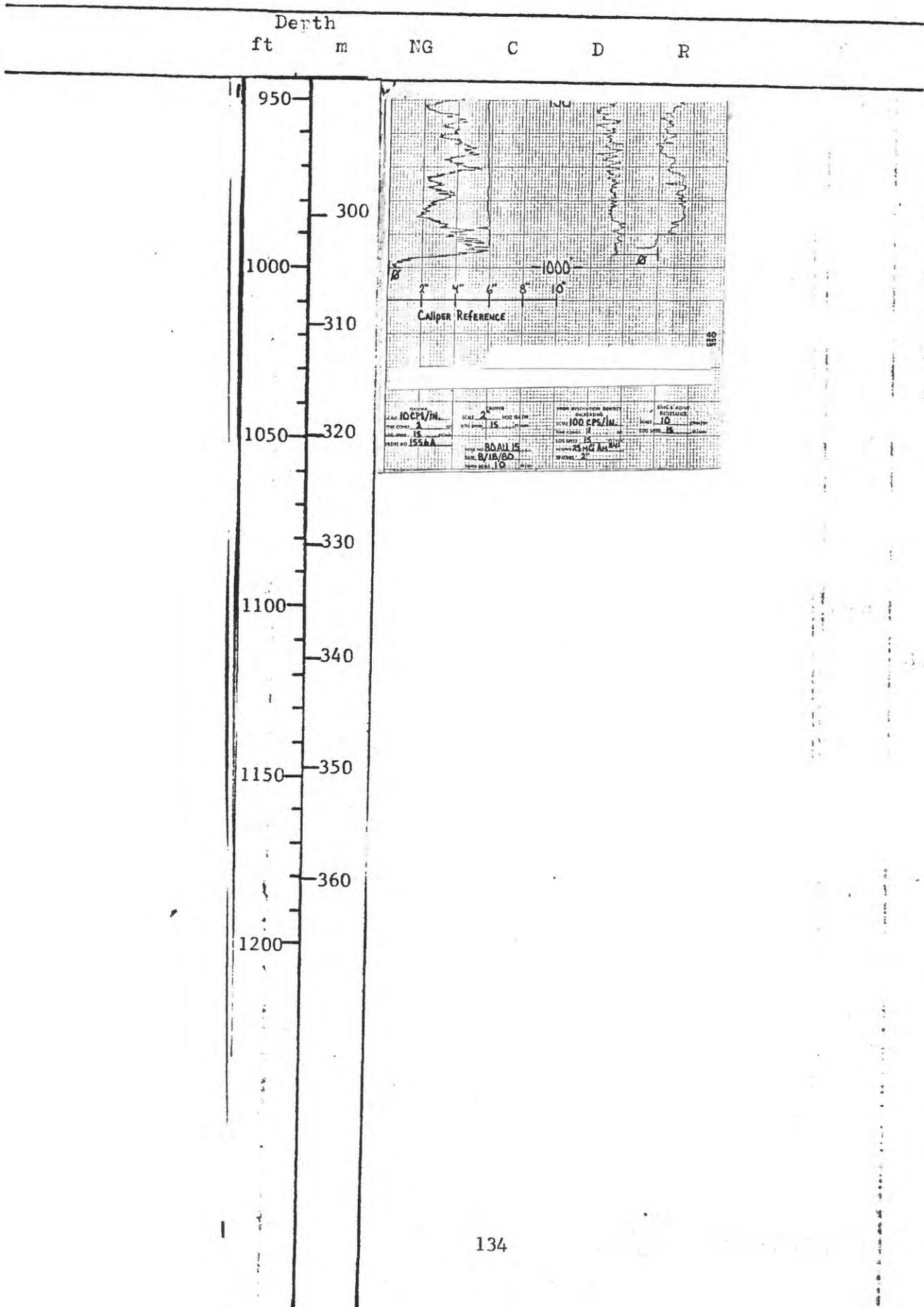


Hole no. 80-AU15 (continued)

Depth  
ft m NG C D R

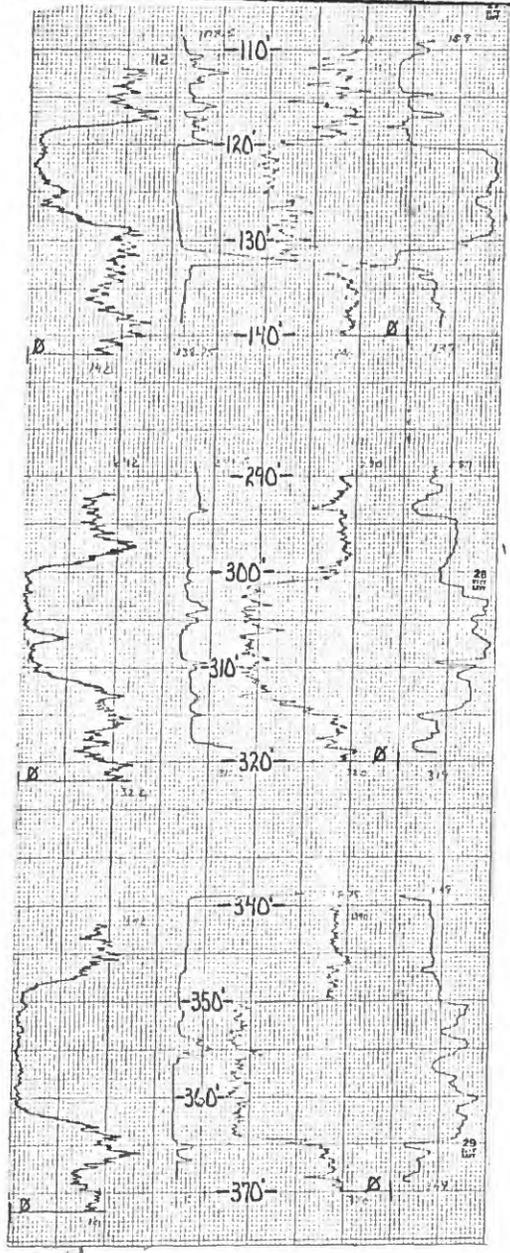


Hole no. 80-AU15 (continued)



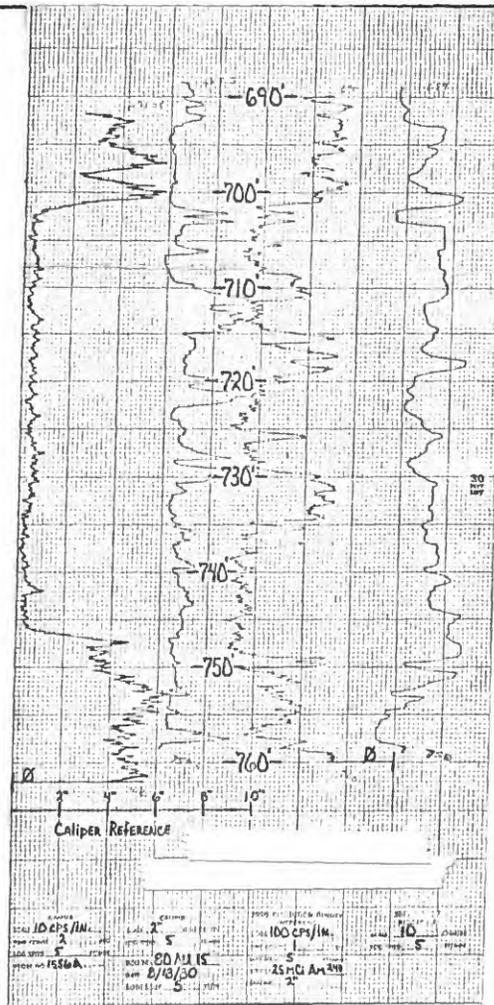
Hole no. 80-AU15 (reruns)

NG C D R



Hole no. 80-AU15 (reruns)

NG C D R



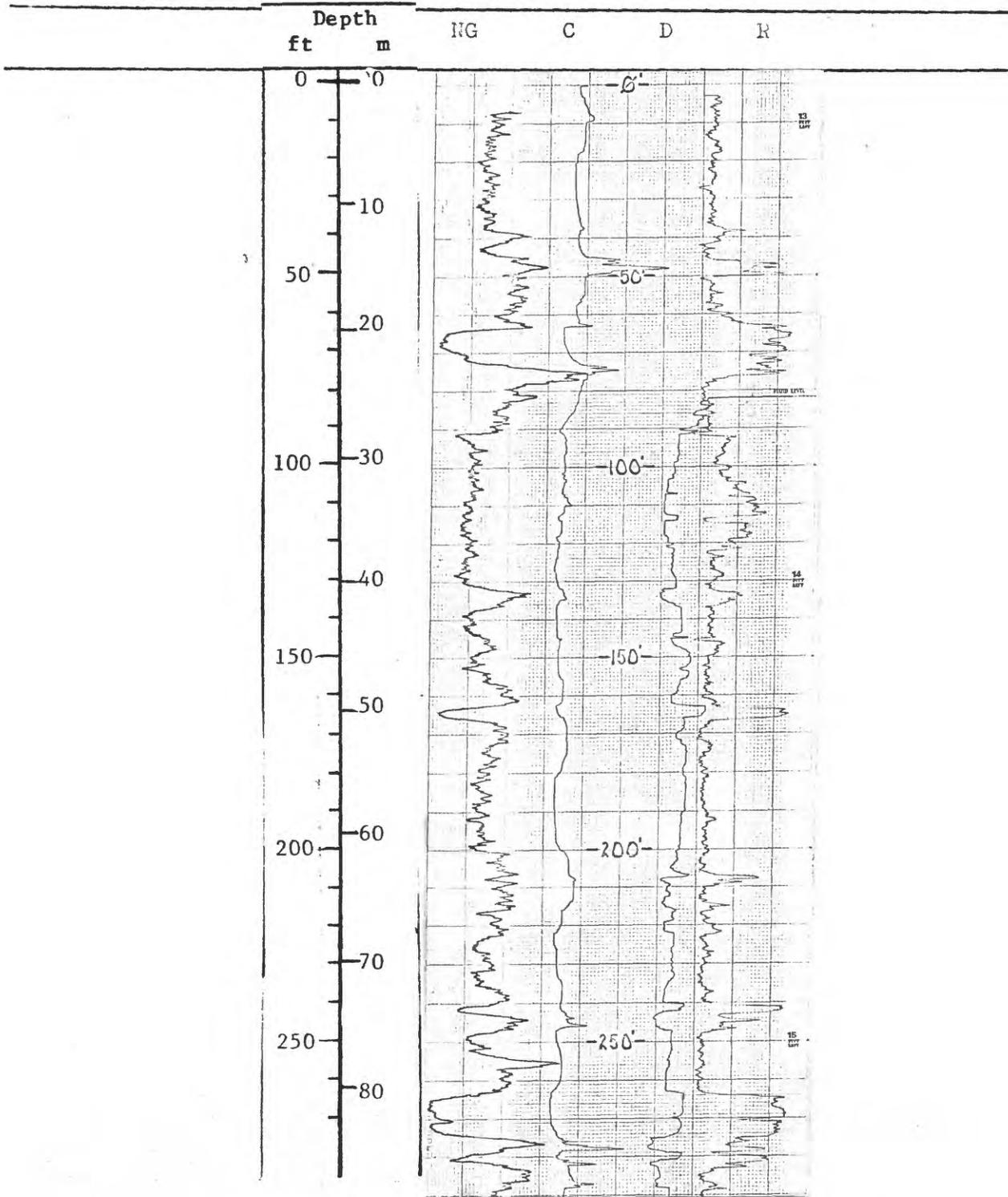
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU16 Date logged 7/31/80 Surface elevation 3830'

Location NW¼ SW¼ sec. 5, T. 54 N., R. 76 W. County Sheridan

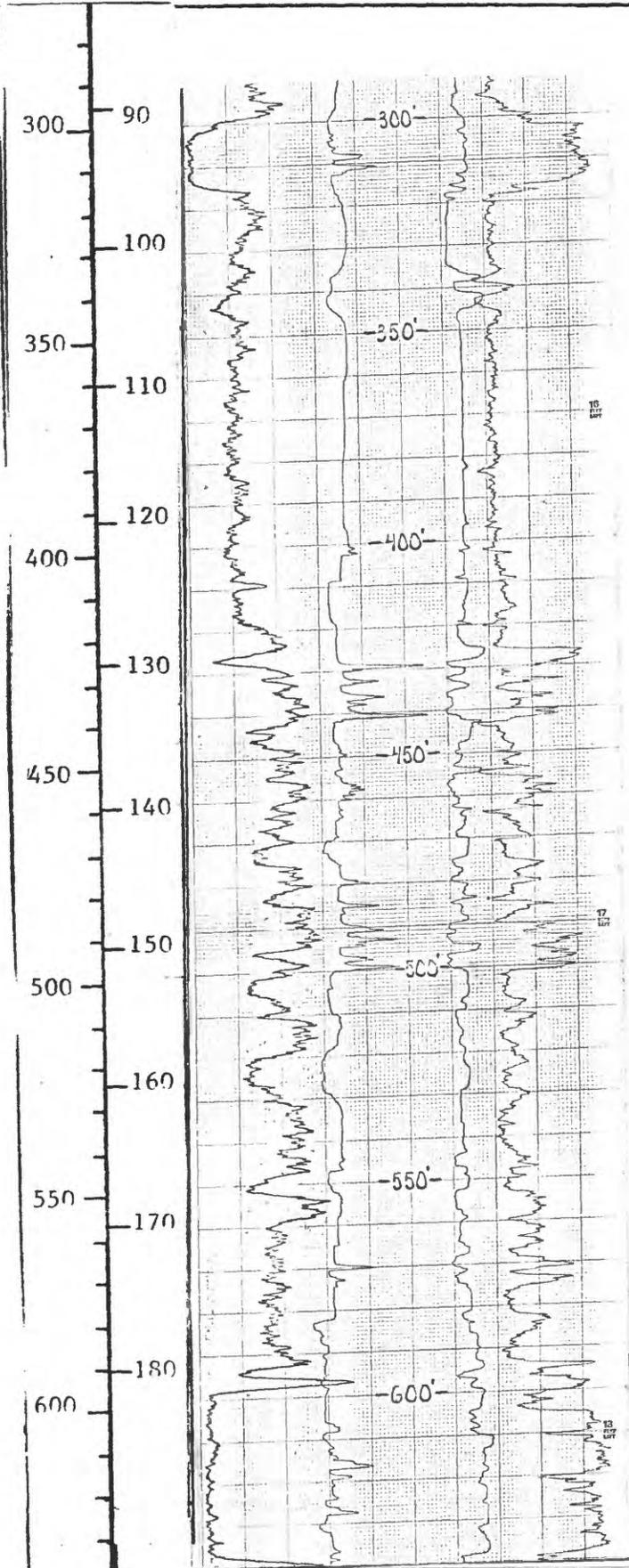
Drilled depth 1000' Logged depth 1000' Fluid level 82'

Remarks drilled with mud



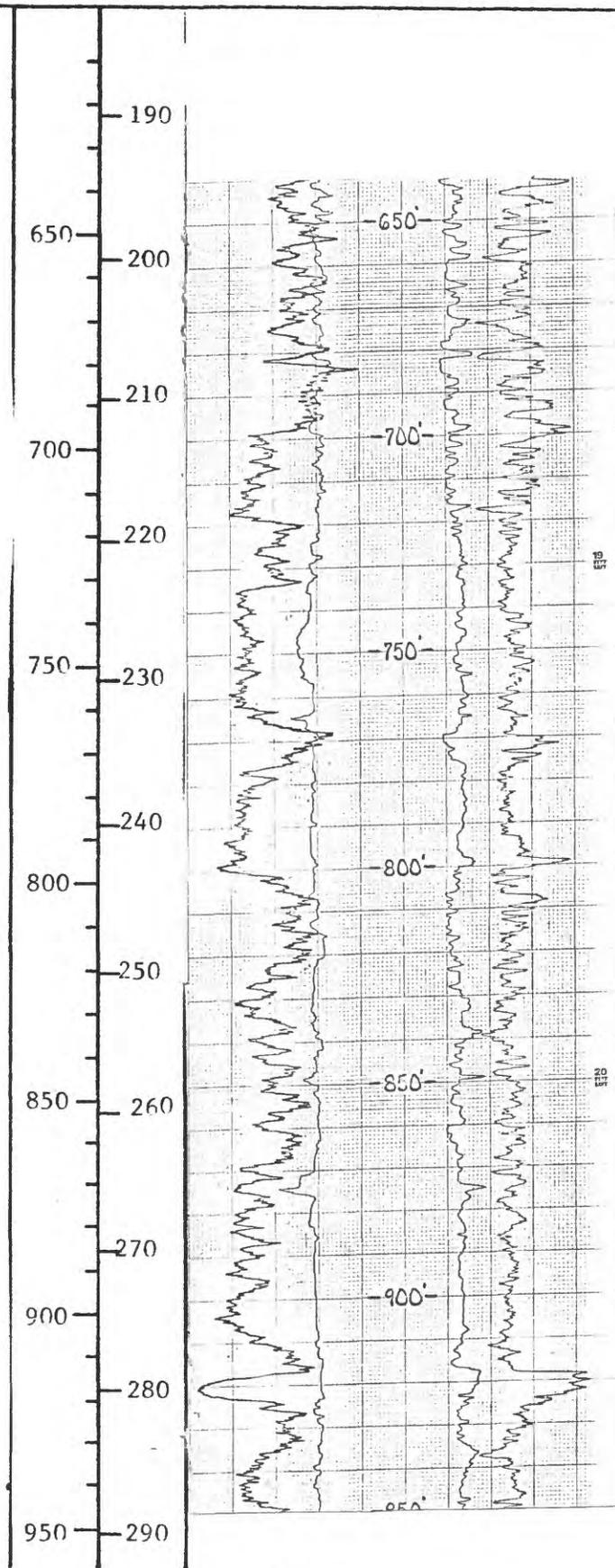
Hole no. 80-AU16 (continued)

Depth  
ft m NG C D R



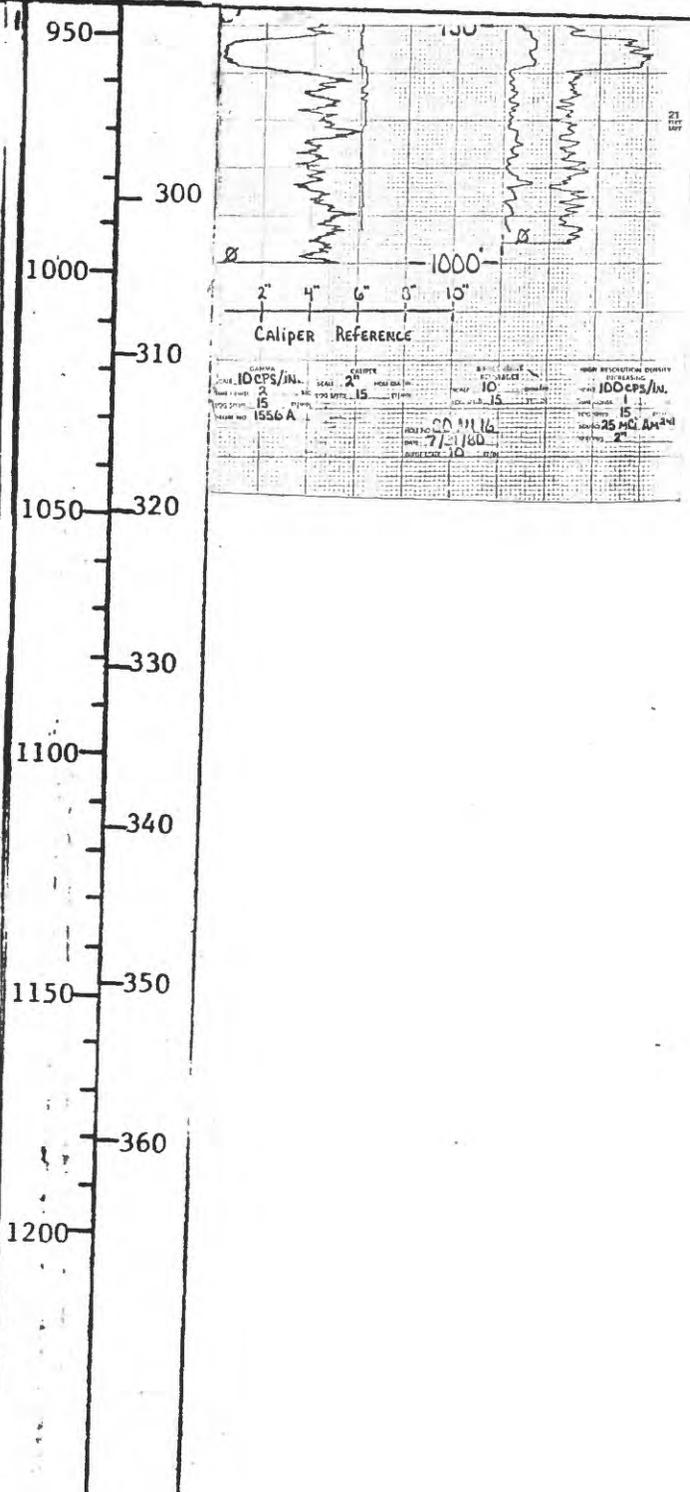
Hole no. 80-AU16 (continued)

Depth  
ft m NG C D R



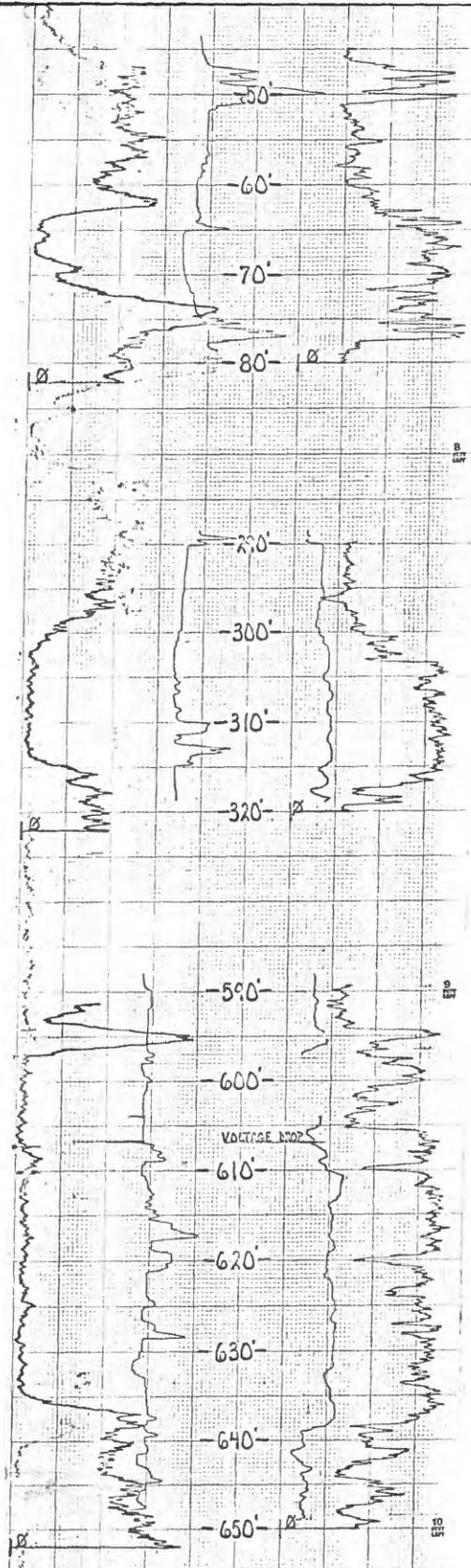
Hole no. 80-AU16 (continued)

Depth  
ft m NG C D R



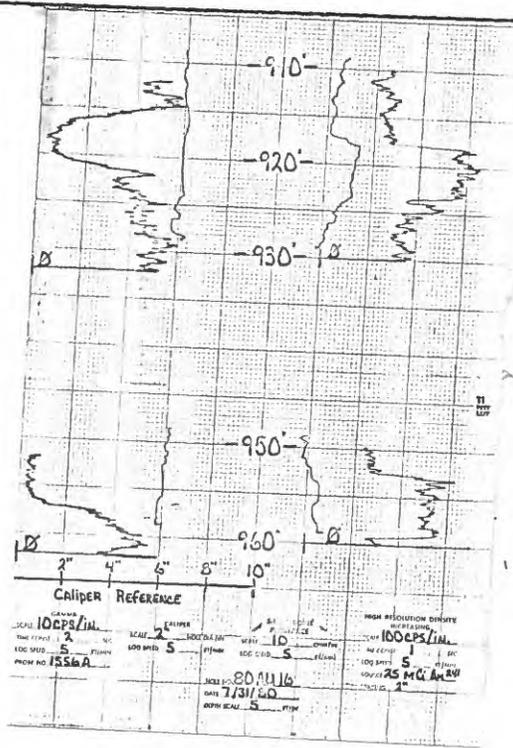
Hole no. 80-AU16 (reruns)

NG C D R



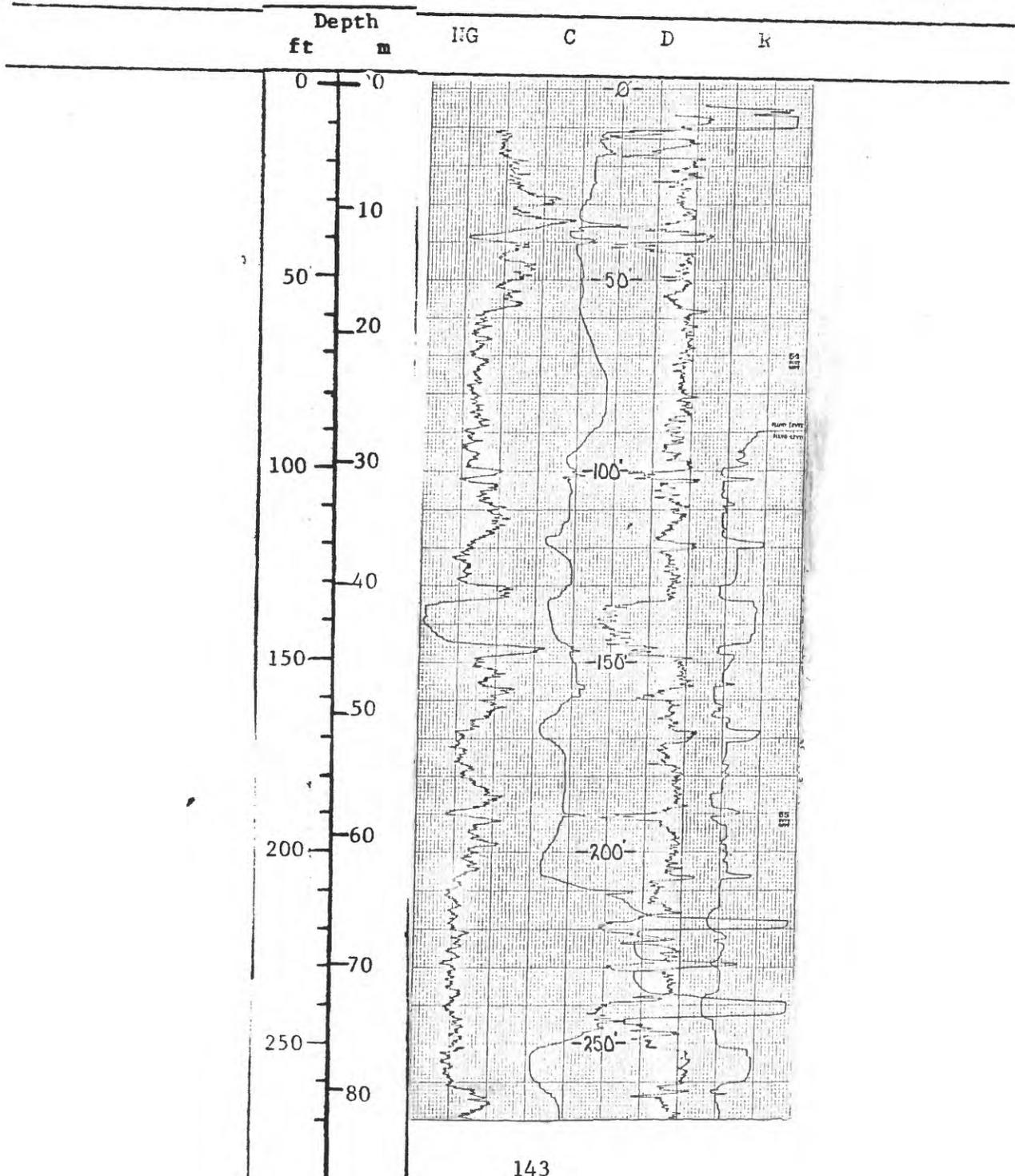
Hole no. 80-AU16 (reruns)

NG C D R

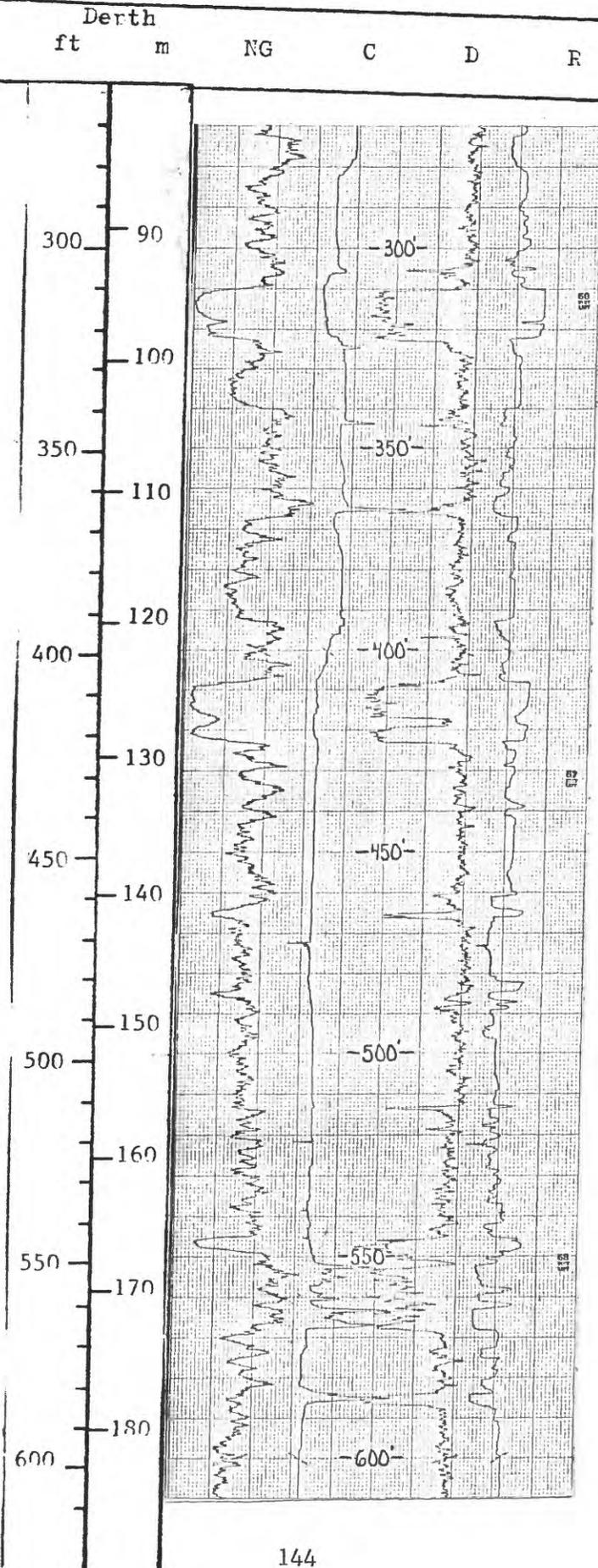


U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU17 Date logged 8/27/80 Surface elevation 3790'  
 Location SE¼ NW¼ sec. 17, T. 54 N., R. 77 W. County Sheridan  
 Drilled depth 1000' Logged depth 1000' Fluid level 89.5'  
 Remarks drilled with air/foam

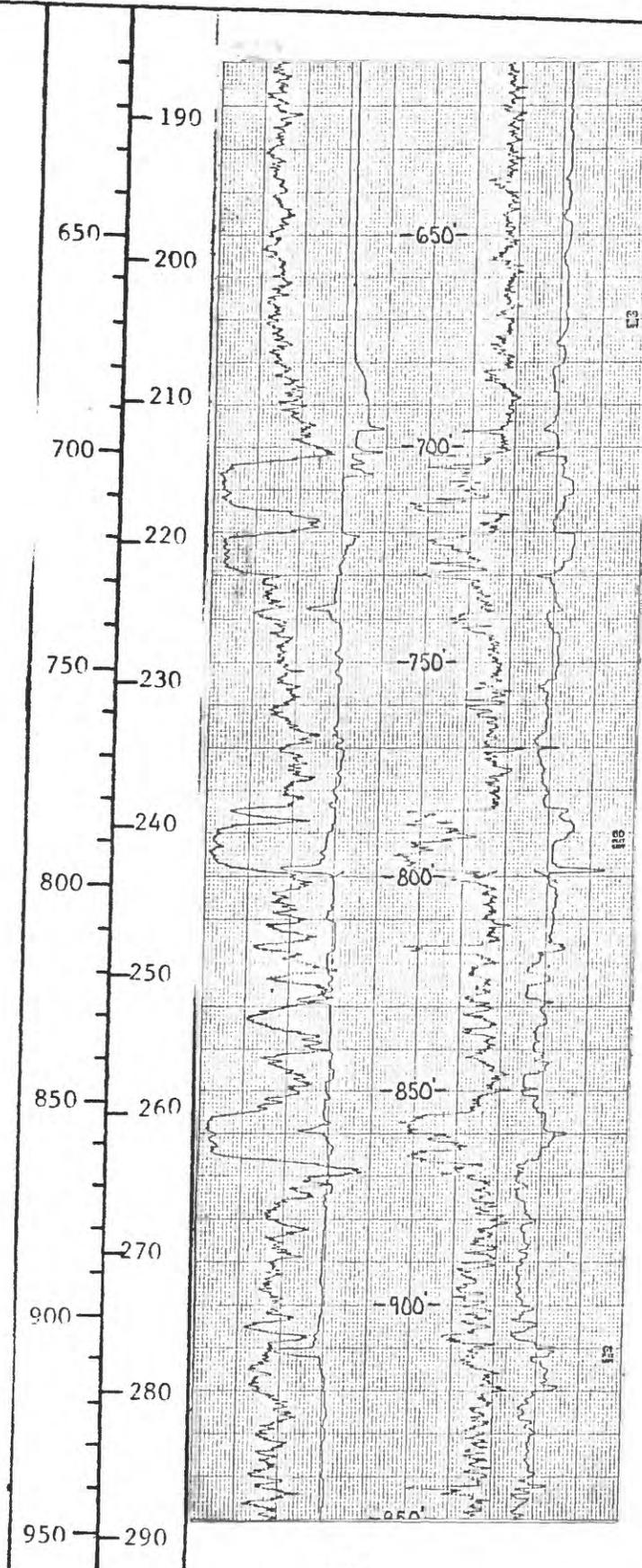


Hole no. 80-AU17 (continued)



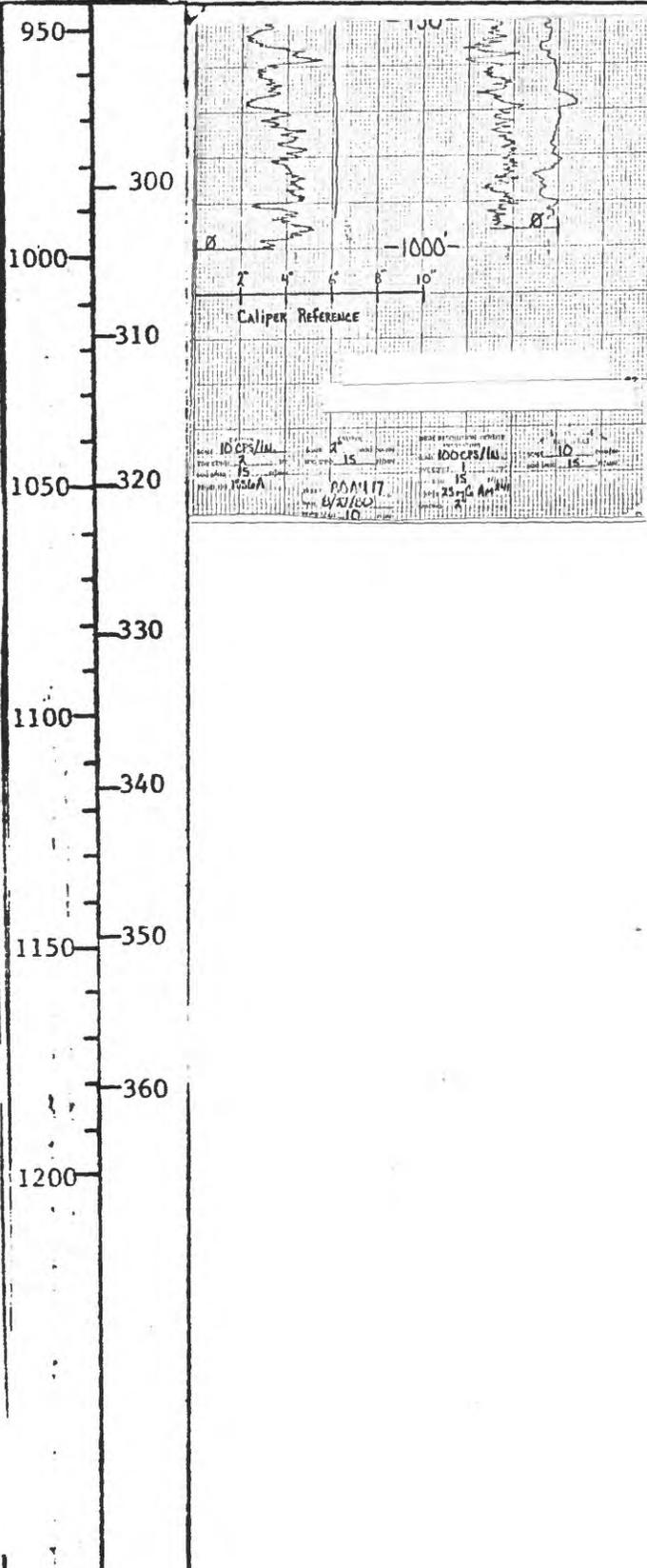
Hole no. 80-AU17 (continued)

Depth  
ft m NG C D R



Hole no. 80-AU17 (continued)

Depth  
ft m NG C D R



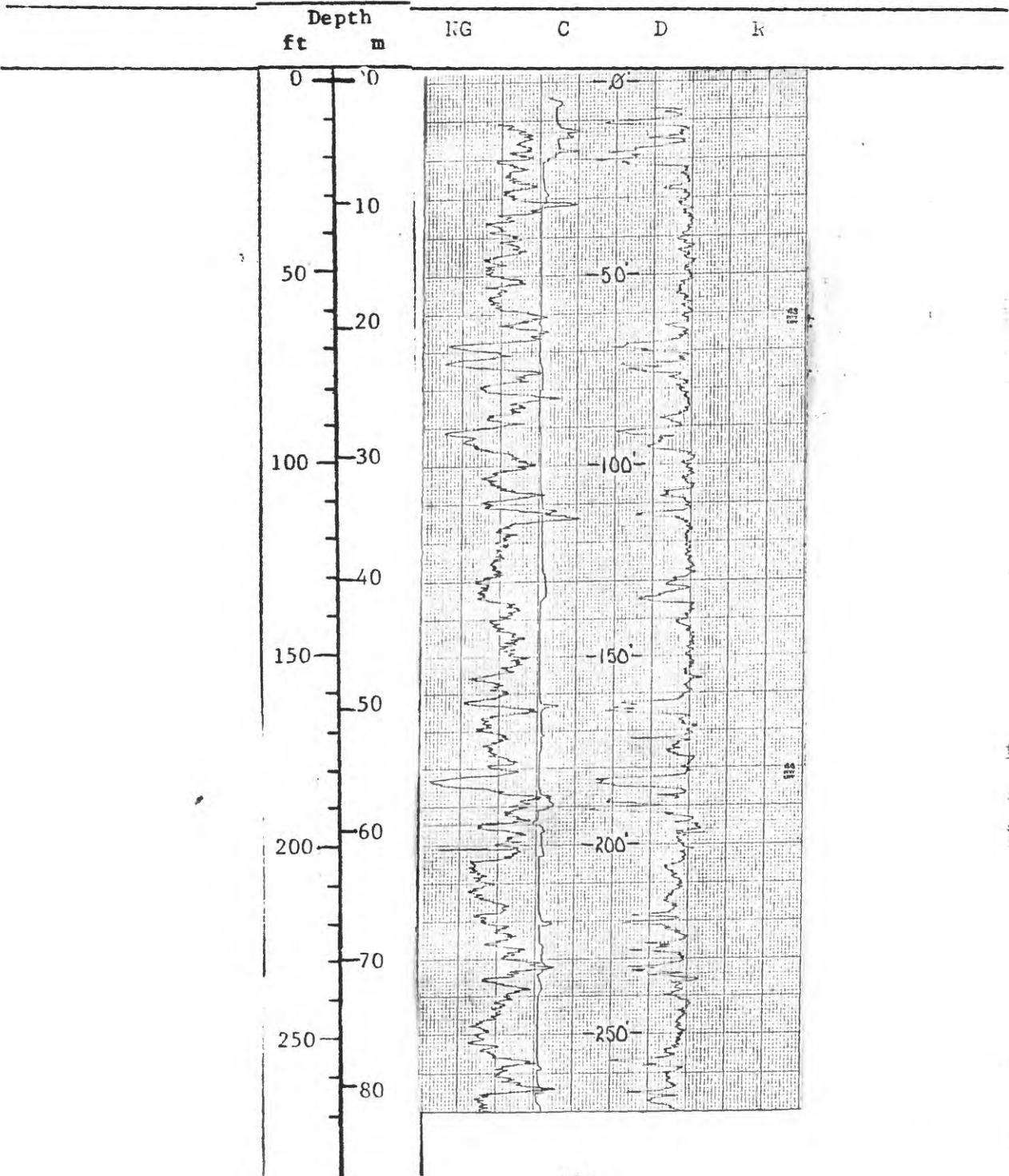
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU18 Date logged 8/28/80 Surface elevation 4340'

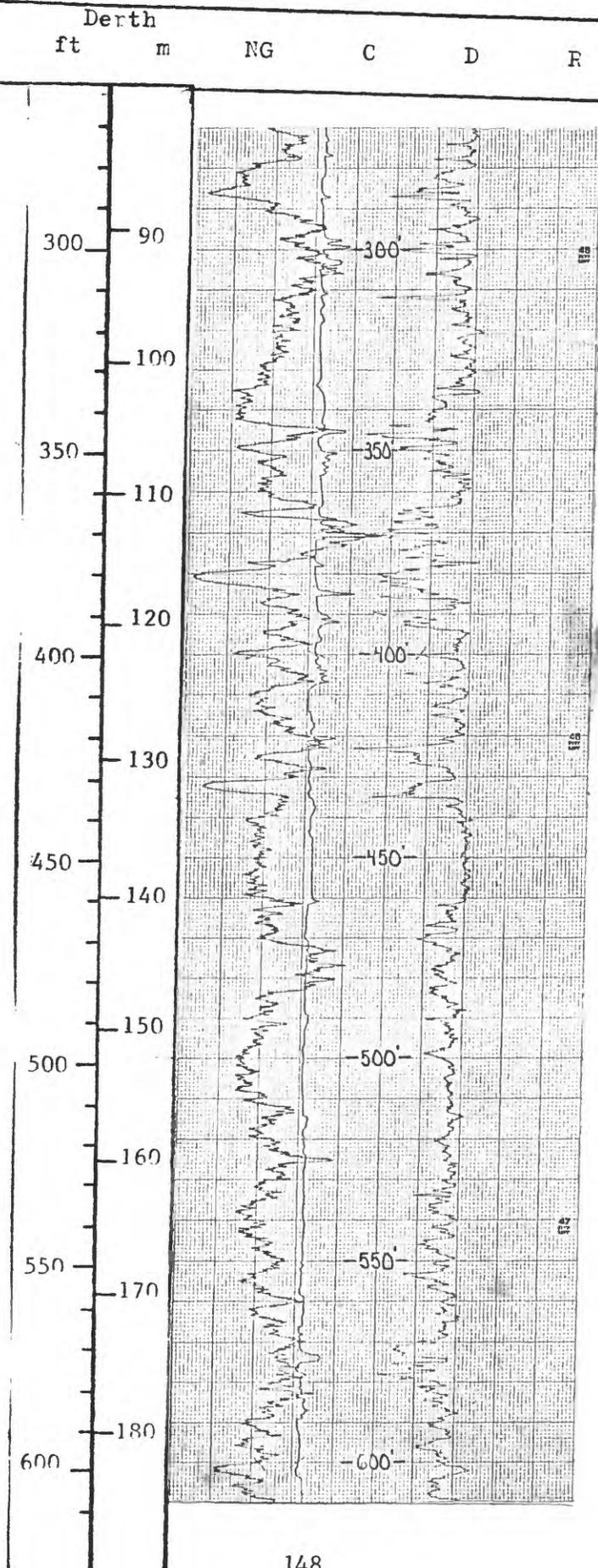
Location SW<sup>1</sup>/<sub>4</sub> SE<sup>1</sup>/<sub>4</sub> sec. 23, T. 54 N., R. 78 W. County Sheridan

Drilled depth 840' Logged depth 840' Fluid level 752'

Remarks drilled with air/foam

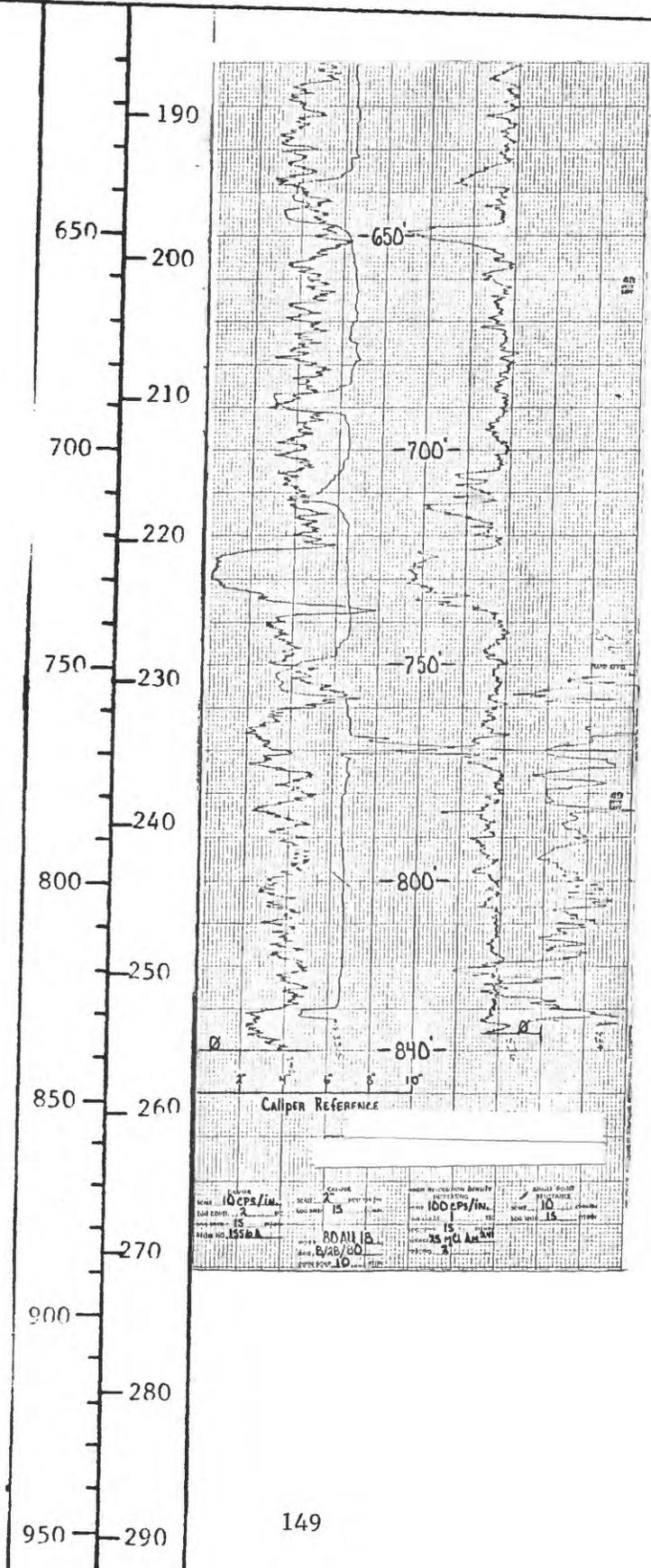


Hole no. 80-AU18 (continued)



Hole no. 80-AU18 (continued)

Depth  
ft m NG C D R



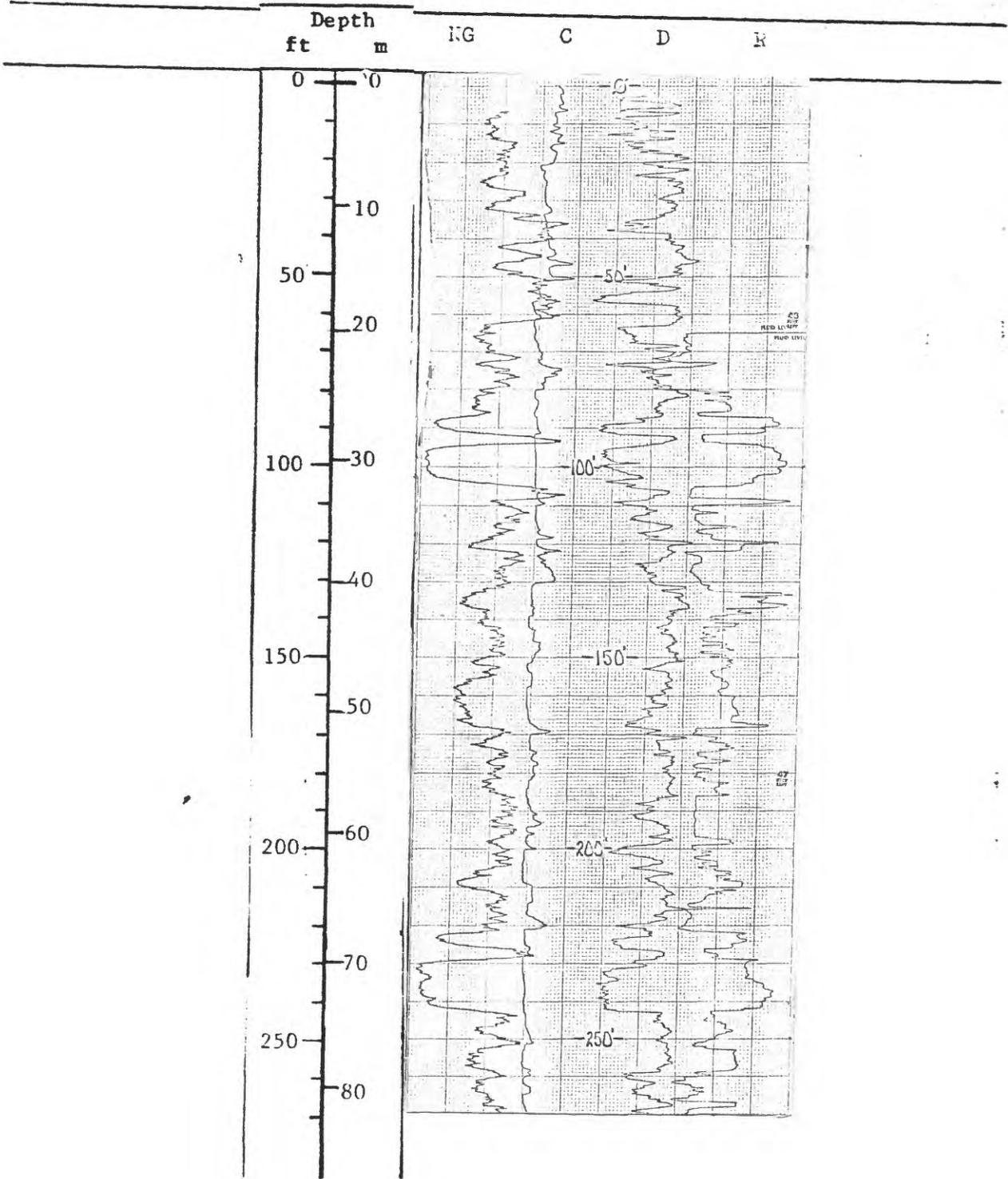
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU24 Date logged 8/6/80 Surface elevation 3625'

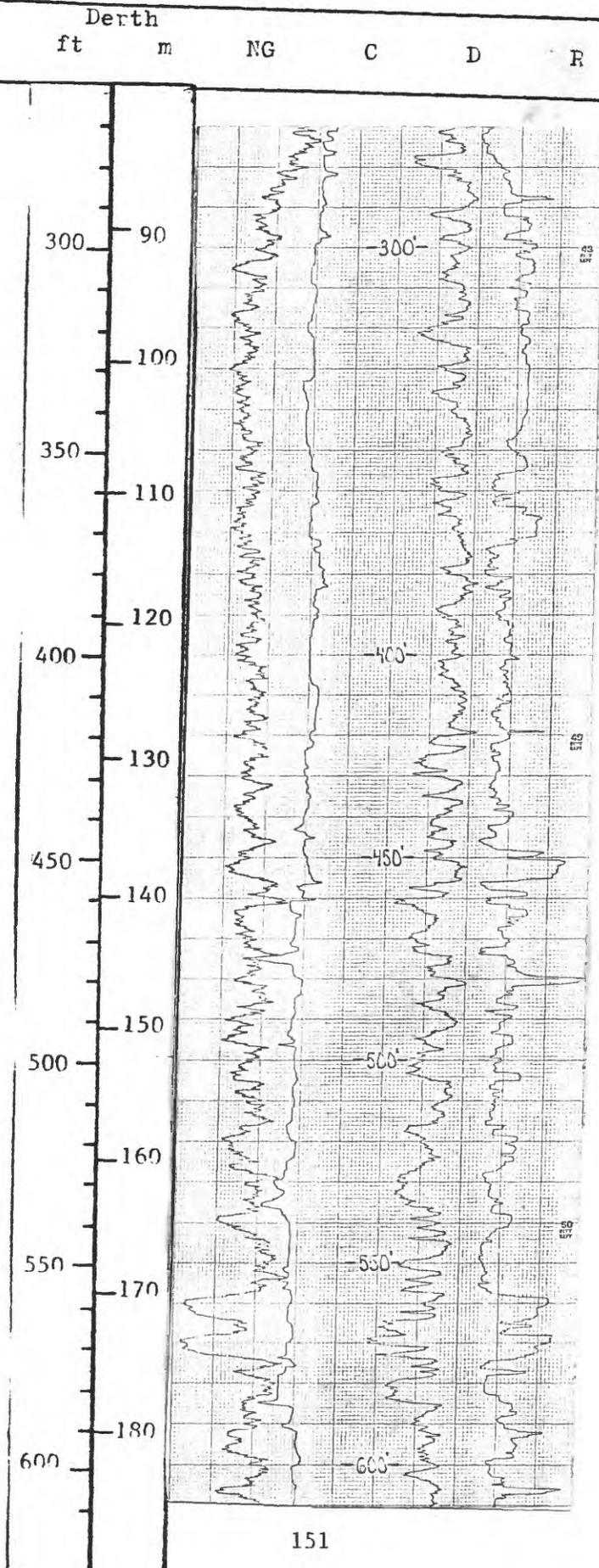
Location NW¼ SW¼ sec. 11, T. 56 N., R. 77 W. County Sheridan

Drilled depth 900' Logged depth 900' Fluid level 65'

Remarks drilled with mud

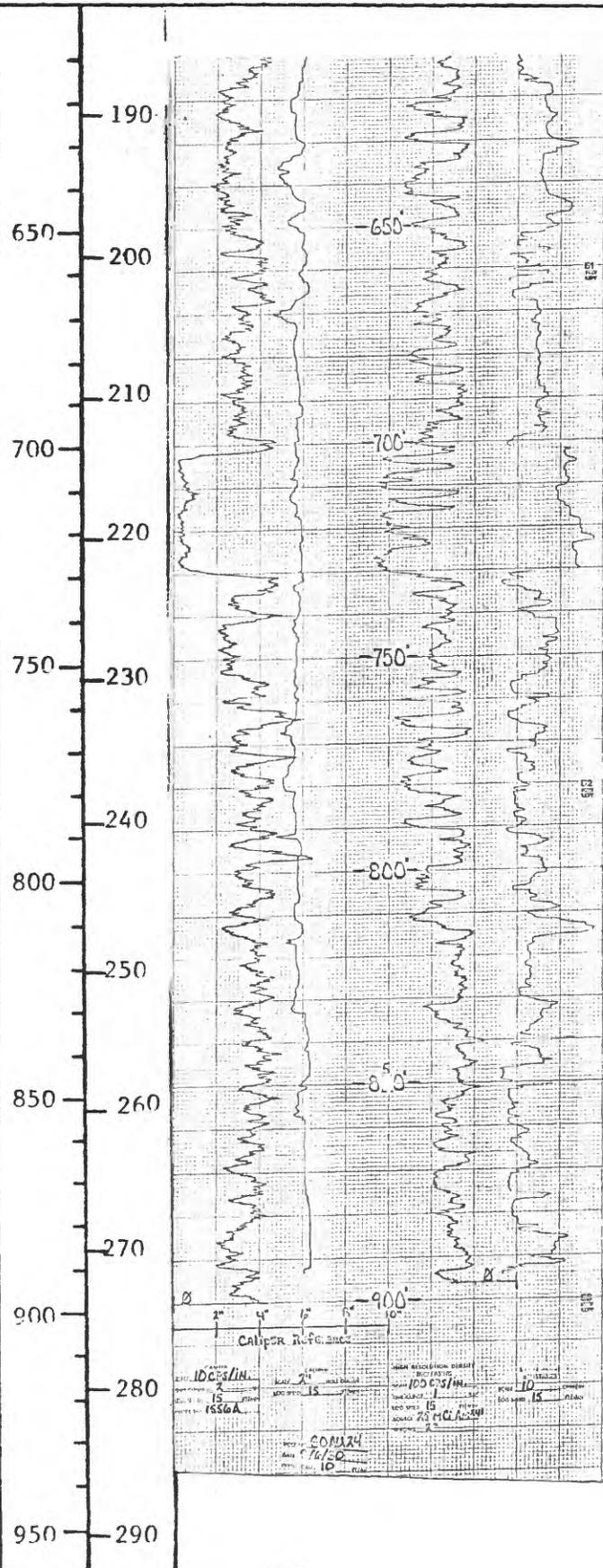


Hole no. 80-AU24 (continued)



Hole no. 80-AU24 (continued)

Depth  
ft m NG C D R





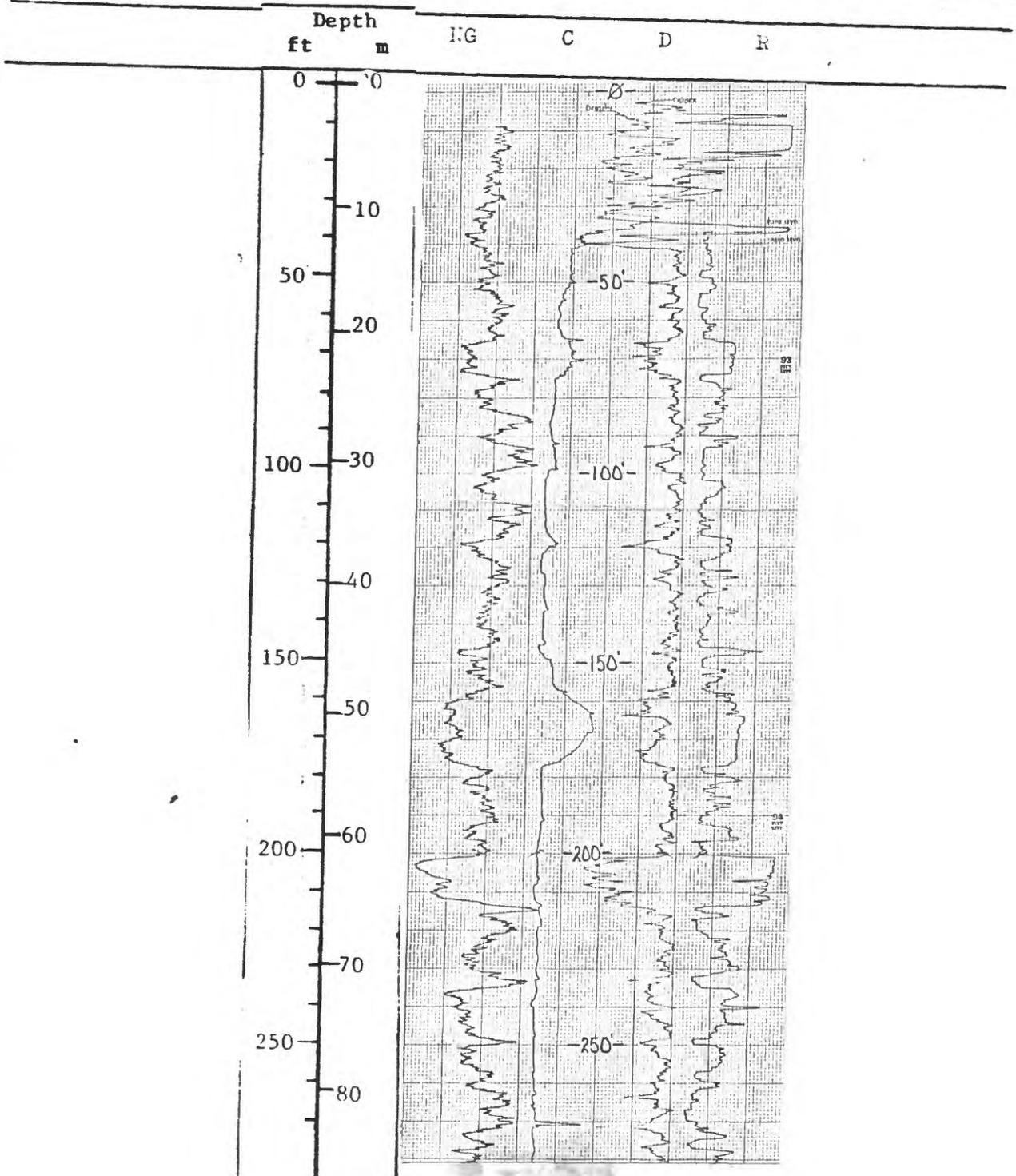
U.S. Geological Survey  
 Geophysical log, 1980 Drilling  
 Arvada-Ucross Area, Wyoming

Hole no. 80-AU26 Date logged 8/19/80 Surface elevation 3770'

Location SW $\frac{1}{4}$  SW $\frac{1}{4}$  sec. 24, T. 53 N., R. 77 W. County Sheridan

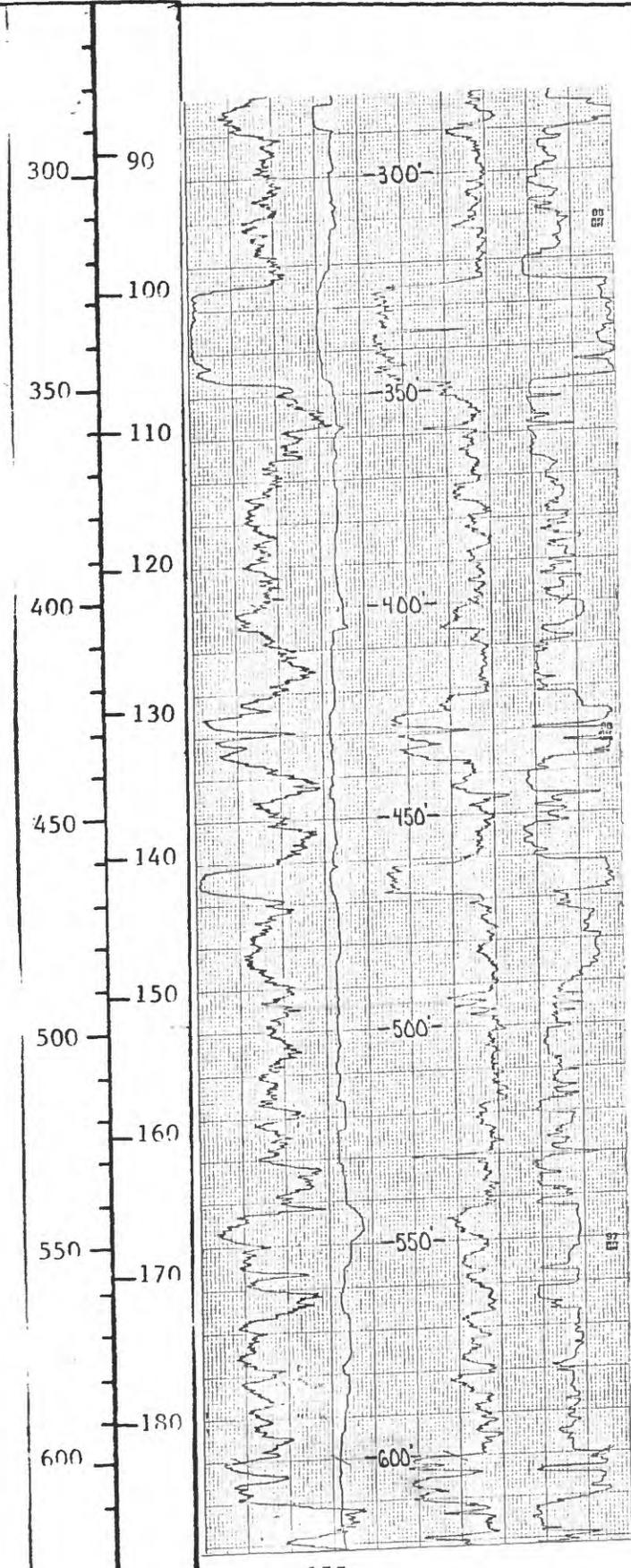
Drilled depth 820' Logged depth 820' Fluid level 37'

Remarks drilled with mud



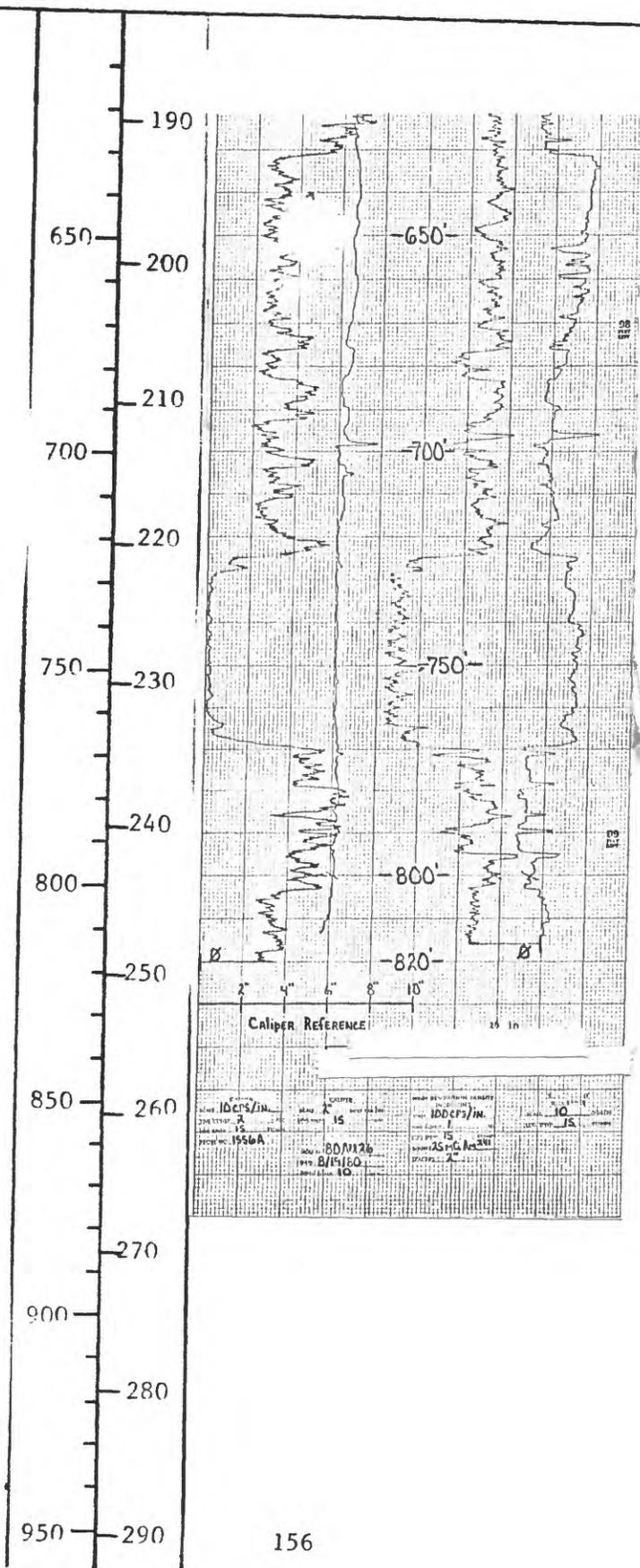
Hole no. 80-AU26 (continued)

Depth  
ft      m      NG      C      D      R



Hole no. 80-AU26 (continued)

Depth  
ft m NG C D R



Hole no. 80-AU26 (reruns)

NG C D R

