

THE GEOLOGICAL SURVEY OF WYOMING
Gary B. Glass, State Geologist



RESULTS OF COAL DRILLING PROJECTS IN THE WIND RIVER COAL FIELD, WYOMING

compiled by

Robert W. Gregory, Richard W. Jones, and Gary B. Glass
Prepared in cooperation with the U.S. Bureau of Land Management



Report of Investigations No. 46
1991

Laramie, Wyoming

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Front cover: Sandstone beds in the lower coal-bearing member of the Mesaverde Formation on the eastern flank of Alkali Butte anticline, Wind River Basin, Wyoming. Dark areas in foreground are coal slack piles; wood structure in middle right of slide was part of the now-abandoned Bell mine. The Signor coal bed at this mine (section 25, T 34N, R 95W) is about 14 feet thick. (Photograph by Suzanne C. Luhr, 1985.)

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Introduction

In November, 1986, the Geological Survey of Wyoming and the U.S. Department of the Interior, Bureau of Land Management (BLM), entered into Cooperative Agreement No. WY-910-CA7-01. This agreement provides that geologic information collected with public funds or in response to a Federal mandate may be released to the public through the Geological Survey of Wyoming. Federal funds were made available through a grant to the Geological Survey of Wyoming to publish reports on coal exploration projects conducted for the Worland District office (Bighorn Basin) and the Rawlins District office (Wind River and Hanna basins) of the BLM. This report presents drill hole data and coal analyses from two BLM-sponsored projects in the Wind River Coal Field, Wyoming. Drilling in the Bighorn Coal Field was already published as Geological Survey of Wyoming Report of Investigations No. 43 (Taucher and others, 1990).

Because the Geological Survey of Wyoming did not generate any of the subject data, the compilers cannot warrant their accuracy, particularly with regard to the analytical data. Although none of the coal analyses were reported correctly, there was enough information to allow corrections on all but one of the analyses. That analysis was omitted from the report.

Descriptions and use of trade names and/or commercial products in this report do not constitute their endorsement by the State of Wyoming, the Geological Survey of Wyoming, or the U.S. Department of the Interior, Bureau of Land Management. These names and products are mentioned strictly for descriptive purposes.

Geographic and geologic setting

The 15 drill holes described in this report are located in two areas in the central part of the Wind River Coal Field, (Jones, 1990) Fremont County, Wyoming (Figure 1). This coal field is part of the larger Wind River structural and topographic basin. Boundaries of the Wind River Coal Field are defined by the extent of the stratigraphically lowest major coal-bearing formation in the area, the Mesaverde Formation (Groff and Jones, 1986). A general summary of coal occurrences and development in this coal field is given in Glass and Roberts (1978).

Drilling in the Alkali Butte area, which is approximately 15 miles southeast of Riverton, Wyoming (Figure 1), targeted coals in the Upper Cretaceous Mesaverde Formation. Ten holes were drilled in this area in July and August, 1983 (Figure 2). Coal beds from 3.5 to 7.0 feet thick were penetrated in six of these holes; only traces or no coal were encountered in the other four holes. Descriptions and logs of all these holes are found in Appendix A (Database sequence numbers 58000-58009).

Three of the rotary-drilled holes (AB-83-01, AB-83-02, and AB-83-08) were twinned so that coal cores could be recovered and analyzed. These core holes are designated AB-83-01-C, AB-83-02-C, and AB-83-08-C (Figure 2). One coal from each core hole was analyzed (Table 1). In the case of core hole AB-83-08-C, the coal was analyzed as two separate benches (an upper 1-foot bench and a lower 4-foot bench). While data from the BLM's District office included a separate analysis of a

composited sample of these two benches, that analysis was not included in Table 1 because the as-received moisture content was only half that of the separate bench analyses as well as the other analyses and is probably in error. A calculated weighted average of the two separate bench analyses was included in Table 1.

The analyses included in Table 1 all show as-received moisture contents greater than 28 percent, which is somewhat higher than might be expected for coals of this age. A review of some other published coal analyses from the Mesaverde Formation in this area suggests that relatively shallow coals (under less than 400 feet of cover) generally exhibit as-received moisture contents between 20.2 and 31.4 percent (Glass and Roberts, 1978; Warlow and others, 1987). These same references show that the analyses of more deeply buried Mesaverde coals (under greater than 580 feet of cover) have as-received moisture contents between 14.9 and 20.1 percent. These observed variations in moisture content may be a function of increased coalification with depth or of weathering or oxidation of the shallower coals. Only a systematic study of these higher moisture coals will resolve this dilemma, i.e. a comparative study of chemical and petrographic analyses is needed. In addition, it was assumed that the reported values for the coal analyses included in this report were correct on an as-received basis. These comments are provided as a caution to users of this data.

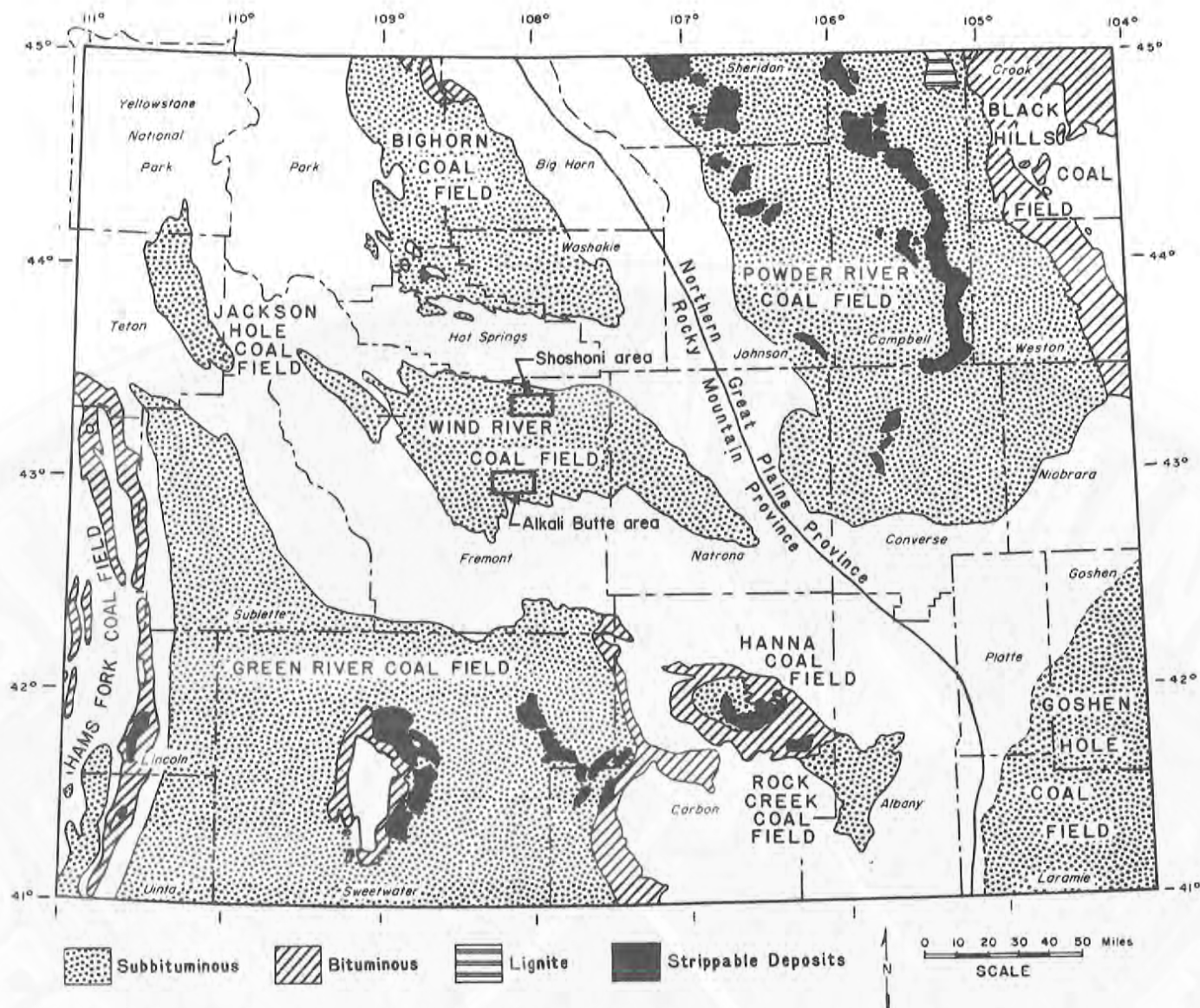


Figure 1. Index map showing Wyoming coal fields and the drilled areas that are described in this report (modified from Jones, 1990).

When moist, mineral-matter-free heat values are calculated for the analyzed coals in the Alkali Butte area (Table 1), they indicate an apparent rank of subbituminous C (ASTM, 1987). If the coals are indeed weathered, the observed apparent rank is incorrect. For comparison, the apparent rank of other Mesaverde coals in this area of the Wind River Coal Field, when calculated from published analyses, are subbituminous C to high volatile C bituminous.

The second area of study, approximately 6 miles east of Shoshoni, Wyoming (Figures 1 and 3), targeted coals in the Eocene Wind River Formation. The

five drill holes described in this report intersected only traces of coal (Database Sequence Numbers 58010-58014 in Appendix A). Although Glass and Roberts (1978) reported that published information on coals in the Wind River Formation indicated the coals were only a few inches thick, more recent work by Thaden (1978, 1979, 1980a, 1980b, and 1980c) described lenticular coal beds up to approximately 20 feet thick and traceable for fractions of miles up to tens of miles in areas to the north and northeast of the Shoshoni study area. None of the thin coals in the Shoshoni area drill holes were collected or analyzed.

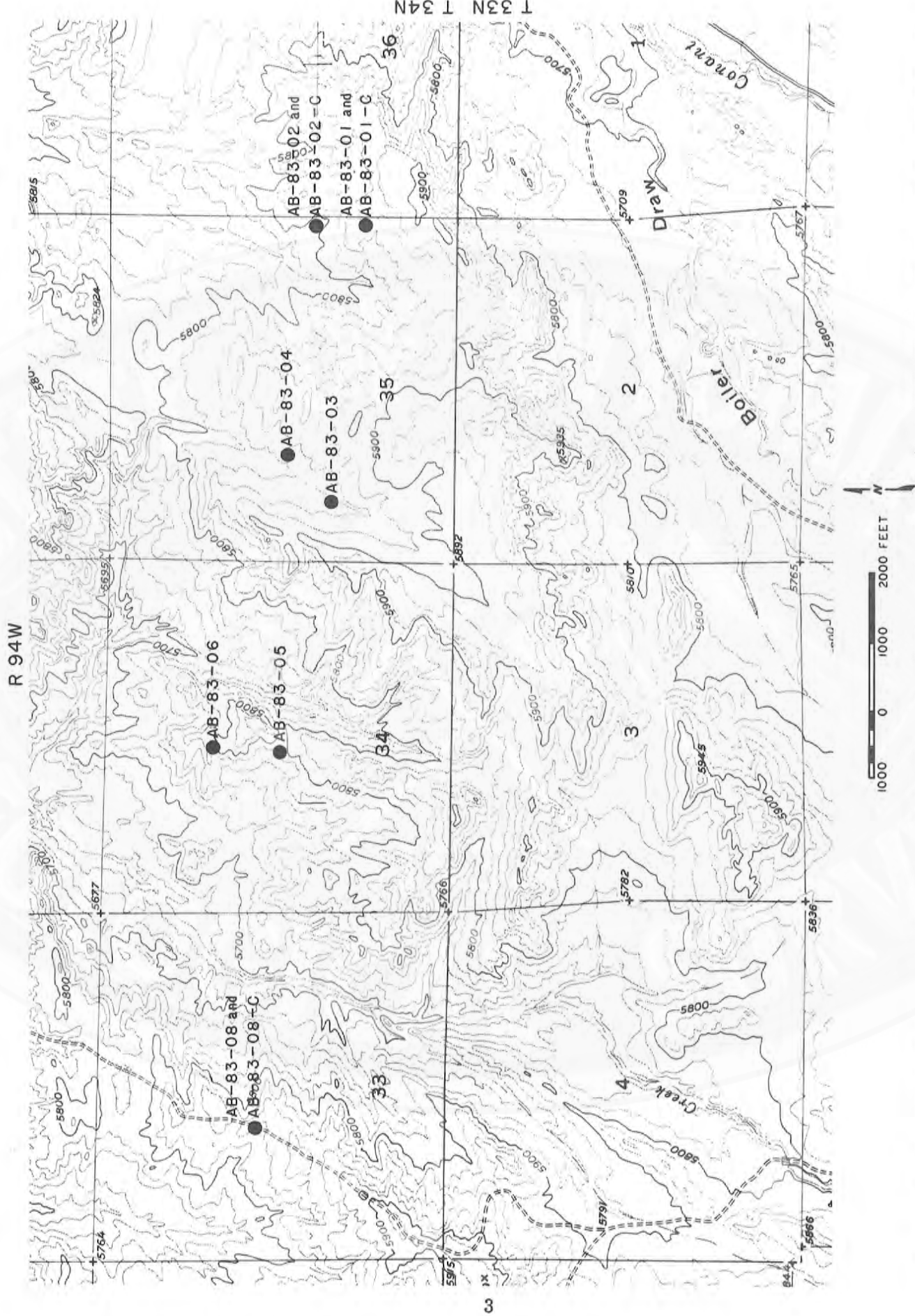


Figure 2. Base map of Alkali Butte area showing locations of holes drilled by the U.S. Bureau of Land Management in 1983. (Database Sequence Numbers 58000 through 58009.)

Table 1. Proximate and ultimate analyses and heat values for four Mesaverde Formation coal samples from the Alkali Butte area.

Drill hole number Sampled interval (feet) Sample thickness (feet)		Proximate analysis (percent)				Ultimate analysis (percent)						Heat value	
		Moisture	Volatile matter	Fixed carbon	Ash	Carbon	Hydrogen	Oxygen	Nitrogen	Sulfur	Chlorine	Btu/pound¹	
AB-83-01-C 121.7-128.0 6.3	28.40	32.80	33.27	5.53	48.89	6.71	36.59	1.00	1.25	0.03	8,490	1	
		45.81	46.47	7.72	58.28	4.93	15.88	1.40	1.75	0.04	11,860	2	
		49.64	50.36		73.99	5.34	17.21	1.52	1.90	0.04	12,850	3	
												9,030	4
AB-83-02-C 268.7-274.9 6.2	29.46	32.04	33.18	5.32	48.92	6.75	36.51	1.08	1.39	0.03	8,480	1	
		45.42	47.04	7.54	59.35	4.90	14.67	1.53	1.97	0.04	12,020	2	
		49.12	50.88		75.01	5.30	15.87	1.65	2.13	0.04	13,000	3	
												9,000	4
AB-83-08-C 214.3-215.3 1.0	33.19	28.31	33.61	4.89	46.23	6.68	40.44	0.84	0.87	0.05	7,950	1	
		42.37	50.31	7.32	69.20	4.44	16.41	1.26	1.30	0.07	11,900	2	
		45.72	54.28		74.66	4.79	17.71	1.36	1.40	0.08	12,840	3	
												8,390	4
AB-83-08-C 215.3-219.3 4.0	32.09	28.29	33.65	5.97	46.20	6.68	39.39	1.07	0.62	0.07	7,780	1	
		41.65	49.56	8.79	68.03	4.55	16.04	1.58	0.91	0.10	11,460	2	
		45.66	54.34		74.59	4.99	17.58	1.73	1.00	0.11	12,560	3	
												8,320	4
AB-83-08-C³ 214.3-219.3 5.0	32.30	28.29	33.64	5.77	46.20	6.68	39.58	1.03	0.67	0.07	7,810	1	
		41.79	49.69	8.52	68.24	4.54	16.09	1.52	0.99	0.10	11,540	2	
		45.68	54.32		74.60	4.96	17.59	1.66	1.08	0.11	12,620	3	
												8,330	4

¹ Figures are rounded to the nearest 10 Btu.

² Analyses reported on: (1) as-received basis, (2) dry basis, (3) dry, ash-free basis, and (4) moist, mineral-matter-free basis.

³ Derived from a calculated weighted average of the two analyzed samples from this core.

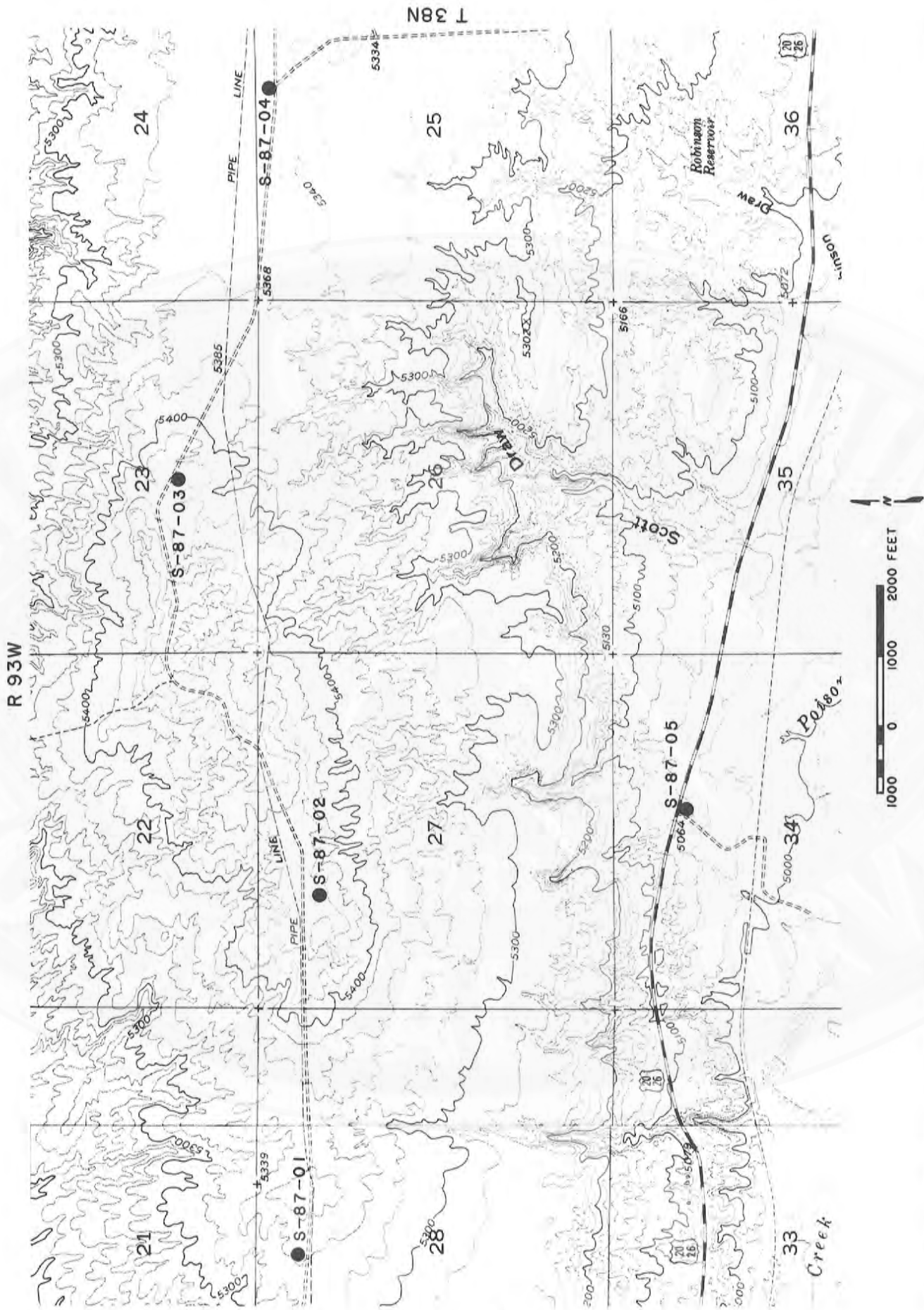


Figure 3. Base map of Shoshoni area showing locations of holes drilled by the U.S. Bureau of Land Management in 1987. (Database Sequence Numbers 58010 through 58014.)

Acquisition and presentation of data

The BLM Rawlins District Office provided the Geological Survey of Wyoming with files containing lithologic descriptions of drill cuttings, geophysical logs, location information, and results of chemical analyses performed on coals from cored holes. Twelve holes described in this report were drilled by the BLM with a Portadrill rig. Drill cuttings were described in 5-foot intervals in the field. Core holes were drilled immediately adjacent to three of the holes in the Alkali Butte area. The core holes were drilled to the core point with conventional rotary tools and then cored with a diamond core bit. Only the cored interval was described by the geologist on site. Gamma-ray, density, and resistivity logs were run for all 15 holes using a Logmaster logging unit.

Location information was taken primarily from geophysical log headings. The log data presented here is primarily as it exists in BLM files; only the format was changed for consistency. Lithologic descriptions

were condensed and depths were adjusted slightly to correlate with units indicated on geophysical logs. Discussions of the coal analyses are included in the earlier section titled, Geographic and geologic setting.

The 15 drill holes discussed in this report are each represented by a single summarized data page and one to two pages of geophysical logs and lithologic descriptions of drill cuttings (**Appendix A**). Each geophysical log page includes a heading that lists the drill hole number, the log types and recording parameters, log traces, strip log with lithologic descriptions, and depth scale. Recording parameters given as units per inch are based on the original log scale rather than the reduced scale presented in this report. In **Appendix A**, the drill hole descriptions are arranged by their Database Sequence Numbers, starting with the lowest number (58000 through 58014). There is an index to the drill hole descriptions in **Appendix A**.

References cited

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- Thaden, R.E., 1979, Geologic map of the Lysite Quadrangle, showing chromolithofacies and coal beds in the Wind River Formation, Fremont County, Wyoming: U.S. Geological Survey Geologic Quadrangle Map GQ-1511, scale 1:24,000.
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- Thaden, R.E., 1980c, Geologic map of the Picard Ranch Quadrangle, showing chromolithofacies and coal

beds in the Wind River Formation, Fremont County, Wyoming: U.S. Geological Survey Geologic Quadrangle Map GQ-1539, scale 1:24,000.

Warlow, R.C., Bragg, L.J., Windolph, J.F., Jr., Hickling, N.L., Oman, J.K., Kerr, P.T., and Baker, J.W.,

1987, Chemical analysis and evaluation of 40 samples from Upper Cretaceous coal beds from the Wind River Basin, Wyoming: U.S. Geological Survey Open File Report 86-187, 42 p.



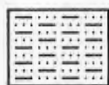
INDEX TO LITHOLOGIC SYMBOLS



CLAY and CLAYSTONE



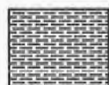
SAND and SANDSTONE



SILTSTONE



SHALE



CARBONACEOUS SHALE



COAL

DATABASE SEQUENCE NUMBER: 58000

DRILL HOLE NUMBER: AB-83-01

STATE: Wyoming

COUNTY: Fremont

SECTION: 35

TOWNSHIP: 34 N

RANGE: 94 W

FOOTAGE LOCATION: 1400' fsl 100' fel

GROUND ELEVATION: 5860'

QUADRANGLE: Blue Gulch (7.5 min.)

AREA: Alkali Butte

INDEX MAP: Figure 2

COMMENCED DRILLING: 7-30-83

COMPLETED DRILLING: 7-30-83

DRILL HOLE DEPTH: Driller - 240' Logger - 241'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton

LOGGING TOOL: Logmaster

LOGGED BY: BLM, R. Howell

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: B. Pitman

ELEVATION AT TOP OF COAL: 5738.5' (E-Log)

THICKNESS OF COAL: 6.5'

FORMATION: Mesaverde

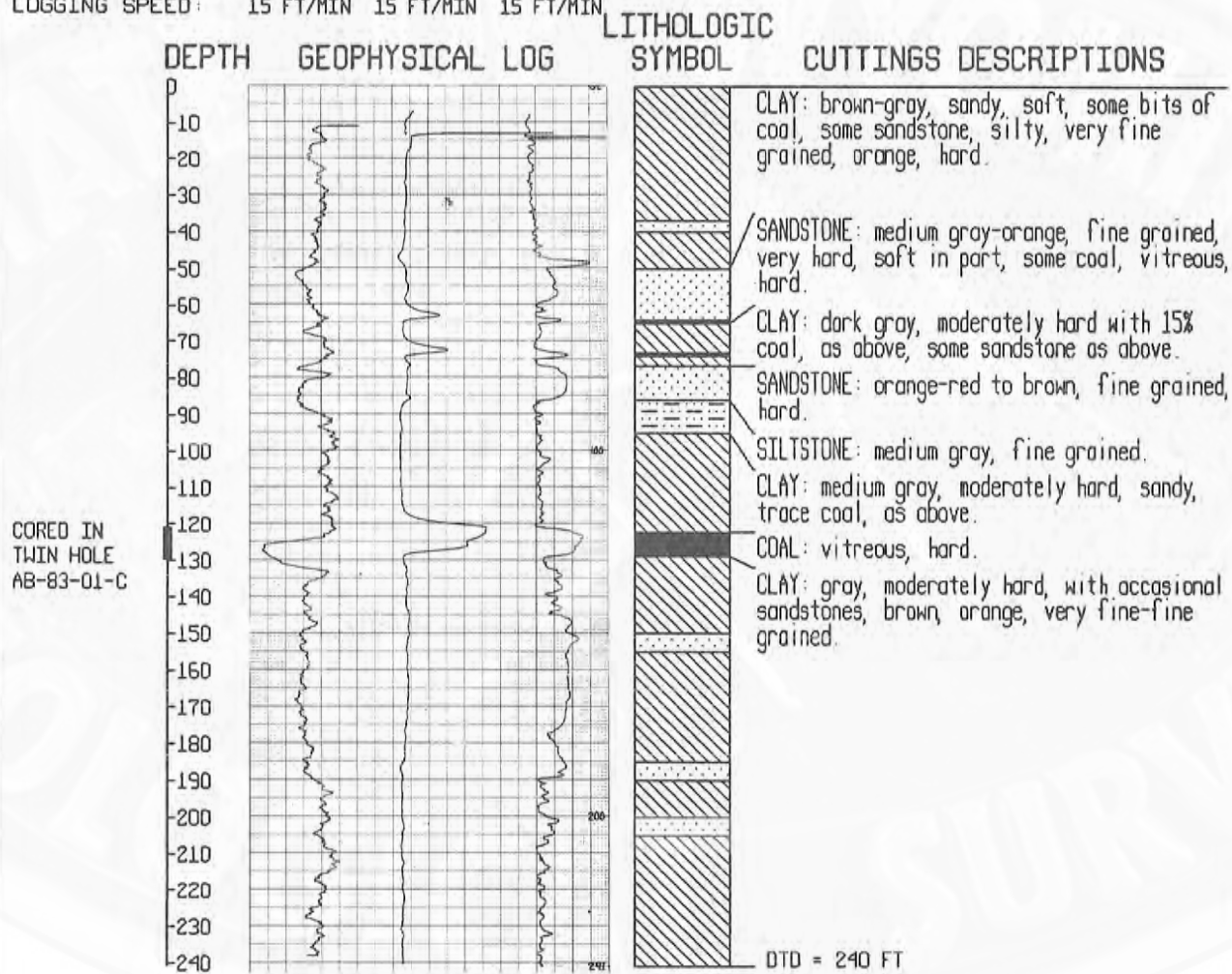
AGE: Upper Cretaceous

INTERVAL(s) CORED: See AB-83-01-C

LOG TRACES

AB-83-01

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	241'	241'	241'
SCALE:	50 CPS/IN	50 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN



CORED IN
TWIN HOLE
AB-83-01-C

DATABASE SEQUENCE NUMBER: 58001

DRILL HOLE NUMBER: AB-83-01-C

STATE: Wyoming

COUNTY: Fremont

SECTION: 35

TOWNSHIP: 34 N

RANGE: 94 W

FOOTAGE LOCATION: 1400' fsl 100' fel

GROUND ELEVATION: 5860'

QUADRANGLE: Blue Gulch (7.5 min.)

AREA: Alkali Butte

INDEX MAP: Figure 2

COMMENCED DRILLING: 7-30-83

COMPLETED DRILLING: 7-30-83

DRILL HOLE DEPTH: Driller - 129' Logger - 129'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton

LOGGING TOOL: Logmaster

LOGGED BY: R. Howell

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: 5739' (E-Log)

THICKNESS OF COAL: 6.5'

FORMATION: Mesaverde

AGE: Upper Cretaceous

INTERVAL(s) CORED: 121.75' - 129.75'

INTERVAL(s) ANALYZED: 121.75' - 128.0'

DATE SAMPLED: 7-30-83

DATE ANALYZED: 10-20-83

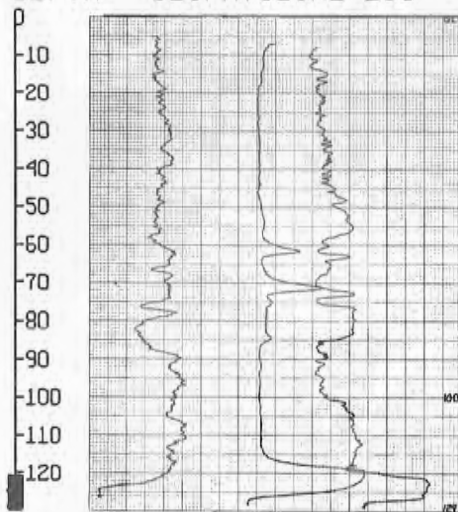
LAB NUMBER (s): F535-83 (Gabriel Laboratories)

LOG TRACES

AB-83-01-C

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	129'	129'	129'
SCALE:	50 CPS/IN	50 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN

DEPTH GEOPHYSICAL LOG



LITHOLOGIC

SYMBOL

CUTTINGS DESCRIPTIONS

NO SAMPLES FOR 0-122 FEET - SEE AB-83-01

COAL: (121.75 - 128.25) vitreous, hard, with interbedded sandstone stringers.

CARBONACEOUS SHALE: (128.5 - 129.75) brown-gray, interbedded with very thin vitrain coal stringer and light brown-orange sandstone stringers, fine grained.

DTD = 129 FT

DATABASE SEQUENCE NUMBER: 58002

DRILL HOLE NUMBER: AB-83-02

STATE: Wyoming

COUNTY: Fremont

SECTION: 35

TOWNSHIP: 34 N

RANGE: 94 W

FOOTAGE LOCATION: 2150' fsl 100' fel

GROUND ELEVATION: 5795'

QUADRANGLE: Campbell Ridge (7.5 min.)

AREA: Alkali Butte

INDEX MAP: Figure 2

COMMENCED DRILLING: 7-31-83

COMPLETED DRILLING: 7-31-83

DRILL HOLE DEPTH: Driller - 320' Logger - 322'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton

LOGGING TOOL: Logmaster

LOGGED BY: R. Howell

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: 5526.5' (E-Log)

THICKNESS OF COAL: 7'

FORMATION: Mesaverde

AGE: Upper Cretaceous

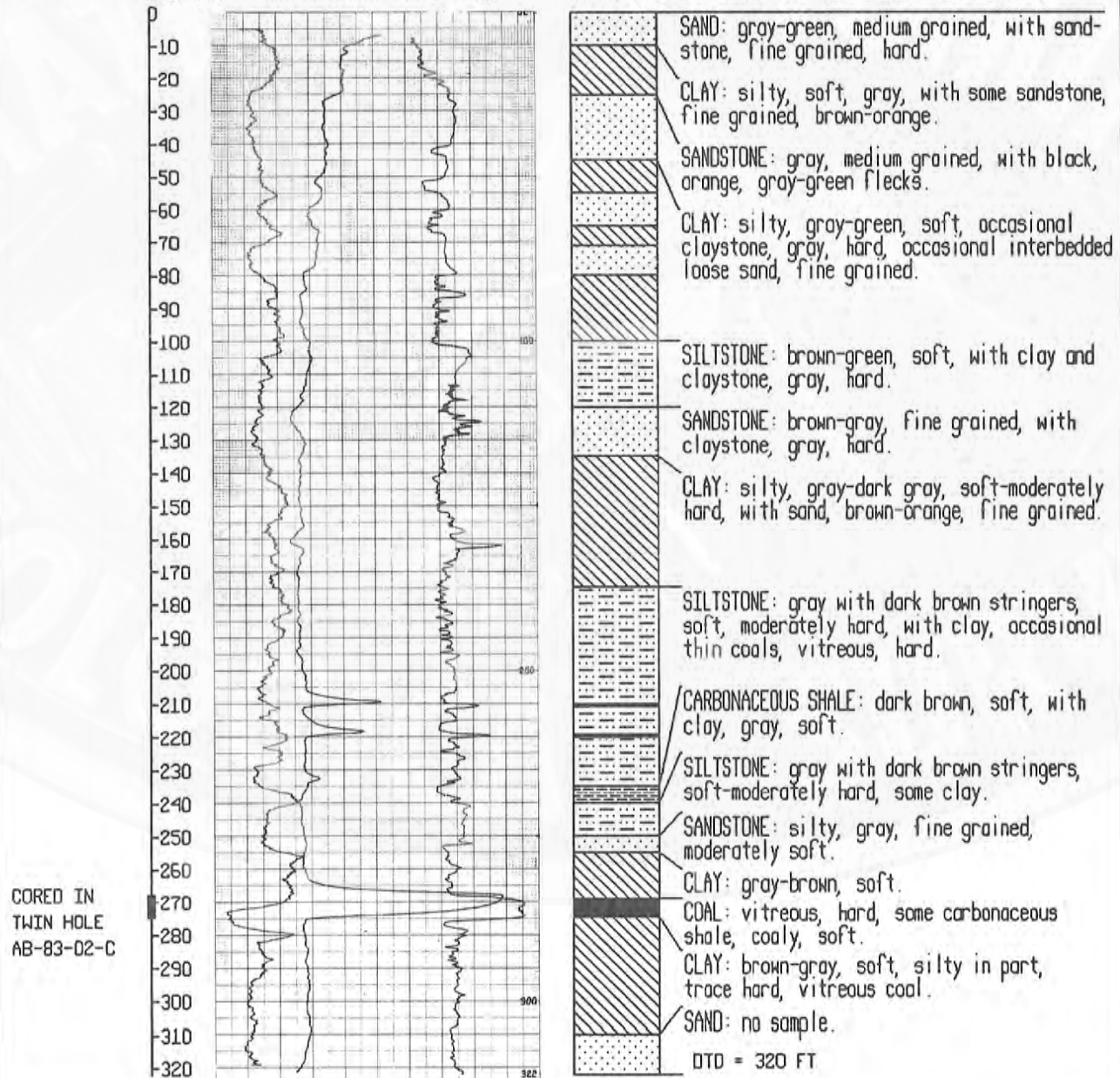
INTERVAL(s) CORED: See AB-83-02-C

LOG TRACES

AB-83-02

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	322'	322'	322'
SCALE:	50 CPS/IN	20 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN

LITHOLOGIC SYMBOL CUTTINGS DESCRIPTIONS



DATABASE SEQUENCE NUMBER: 58003

DRILL HOLE NUMBER: AB-83-02-C

STATE: Wyoming

COUNTY: Fremont

SECTION: 35

TOWNSHIP: 34 N

RANGE: 94 W

FOOTAGE LOCATION: 2150' fsl 100' fel

GROUND ELEVATION: 5795'

QUADRANGLE: Campbell Ridge (7.5 min.)

AREA: Alkali Butte

INDEX MAP: Figure 2

COMMENCED DRILLING: 7-31-83

COMPLETED DRILLING: 8-1-83

DRILL HOLE DEPTH: Driller - 278' Logger - 278'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton

LOGGING TOOL: Logmaster

LOGGED BY: R. Howell

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: 5526' (E-Log)

THICKNESS OF COAL: 7'

FORMATION: Mesaverde

AGE: Upper Cretaceous

INTERVAL(s) CORED: 268.15' - 276.25'

INTERVAL(s) ANALYZED: 268.75' - 274.9'

DATE SAMPLED: 8-1-83

DATE ANALYZED: 10-20-83

LAB NUMBER (s): F523-83 (Gabriel Laboratories)

LOG TRACES

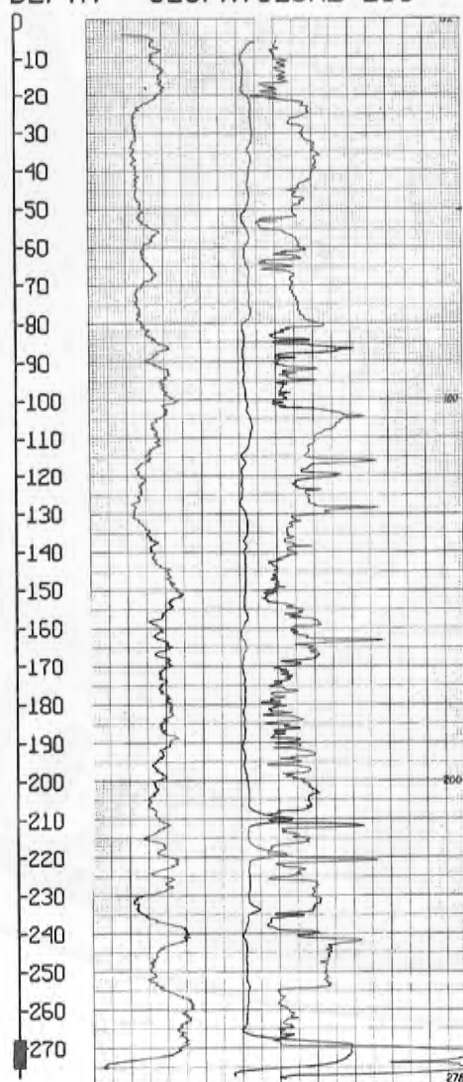
AB-83-02-C

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	278'	278'	278'
SCALE:	50 CPS/IN	50 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN

DEPTH GEOPHYSICAL LOG

LITHOLOGIC
SYMBOL

CUTTINGS DESCRIPTIONS



NO SAMPLES FOR 0-268 FEET - SEE AB-83-02

COAL: (268.15 - 274.9) vitreous, hard,
scattered yellow mineralizations near top,
occasional thin carbonaceous shale stringers,
dark brown, hard.

CLAYSTONE: (274.9 - 276.25) dark brown-gray,
hard, with sandstone interbed near base,
light gray, fine grained, hard.

DTD = 278 FT

DATABASE SEQUENCE NUMBER: 58004

DRILL HOLE NUMBER: AB-83-03

STATE: Wyoming

COUNTY: Fremont

SECTION: 35

TOWNSHIP: 34 N

RANGE: 94 W

FOOTAGE LOCATION: 1800' fsl 900' fwl

GROUND ELEVATION: 5855'

QUADRANGLE: Blue Gulch (7.5 min.)

AREA: Alkali Butte

INDEX MAP: Figure 2

COMMENCED DRILLING: 8-1-83

COMPLETED DRILLING: 8-2-83

DRILL HOLE DEPTH: Driller - 380' Logger - 383'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton

LOGGING TOOL: Logmaster

LOGGED BY: R. Howell

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: ---

THICKNESS OF COAL: ---

FORMATION: Mesaverde

AGE: Upper Cretaceous

LOG TRACES

GAMMA RAY	DENSITY	RESIS- TIVITY
--------------	---------	------------------

AB-83-03

LOGGED DEPTH:

SCALE: 50 CPS/IN 50 CPS/IN 20 OHM/IN

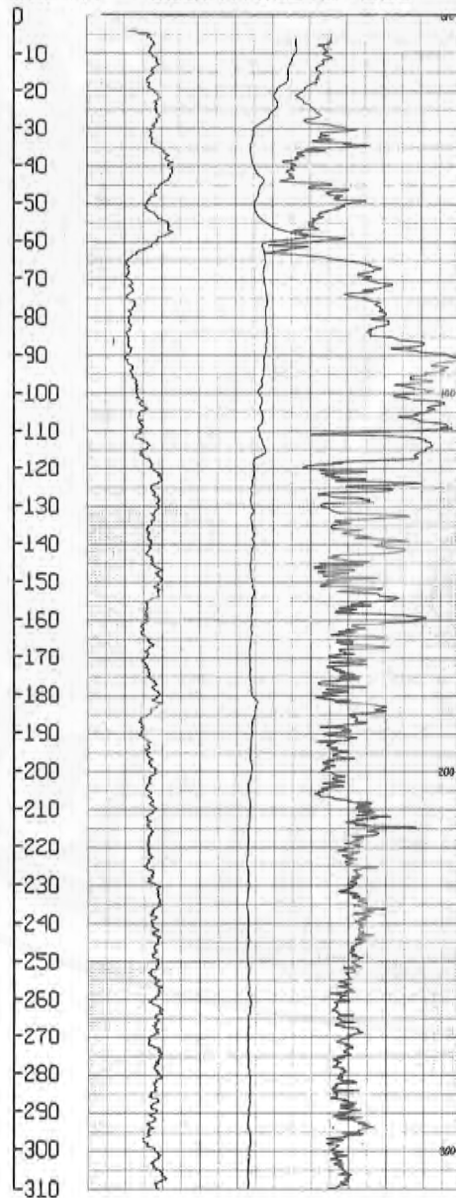
TIME CONSTANT: 4 SEC 2 SEC

DEFLECTION: RIGHT LEFT RIGHT

SOURCE STRENGTH: 125 mCi

LOGGING SPEED: 15 FT/MIN 15 FT/MIN 15 FT/MIN

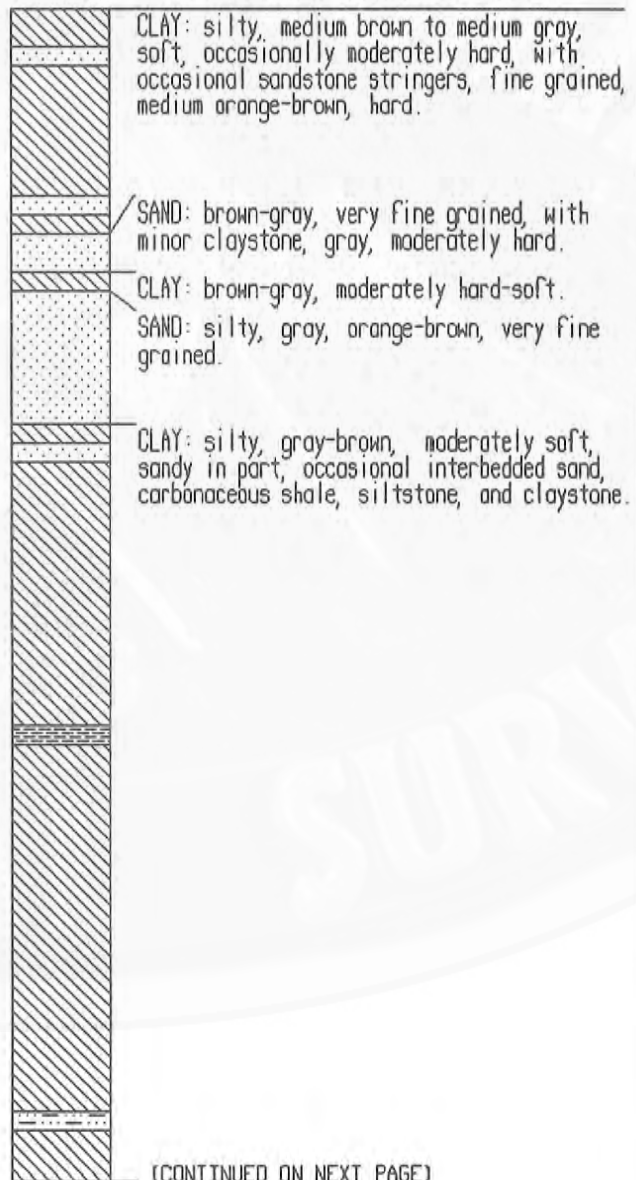
DEPTH GEOPHYSICAL LOG



LITHOLOGIC

SYMBOL

CUTTINGS DESCRIPTIONS

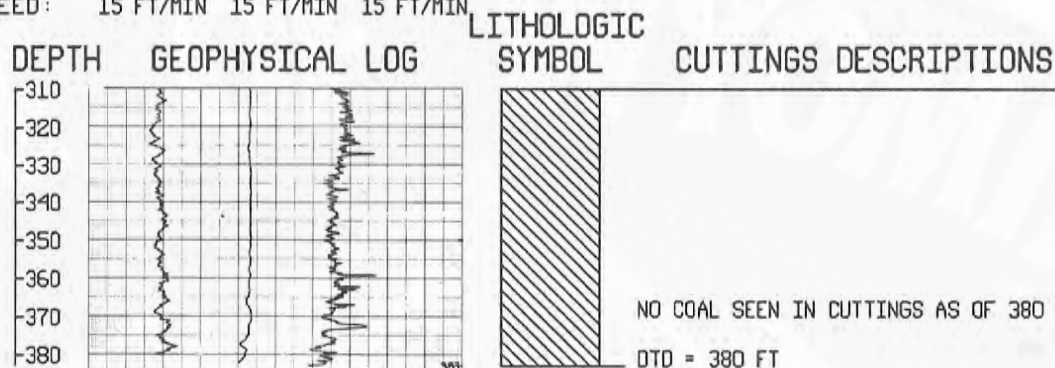


(CONTINUED ON NEXT PAGE)

LOG TRACES

AB-83-03

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	383'	383'	383'
SCALE:	50 CPS/IN	50 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN



DATABASE SEQUENCE NUMBER: 58005

DRILL HOLE NUMBER: AB-83-04

STATE: Wyoming

COUNTY: Fremont

SECTION: 35

TOWNSHIP: 34 N

RANGE: 94 W

FOOTAGE LOCATION: 2600' fnl 1600' fwl

GROUND ELEVATION: 5850'

QUADRANGLE: Campbell Ridge (7.5 min.)

AREA: Alkali Butte

INDEX MAP: Figure 2

COMMENCED DRILLING: 8-2-83

COMPLETED DRILLING: 8-2-83

DRILL HOLE DEPTH: Driller - 400' Logger - 406'

DEPTH TO WATER: 65'

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton

LOGGING TOOL: Logmaster

LOGGED BY: R. Howell

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: 5571' (E-log)

THICKNESS OF COAL: 3.5'

FORMATION: Mesaverde

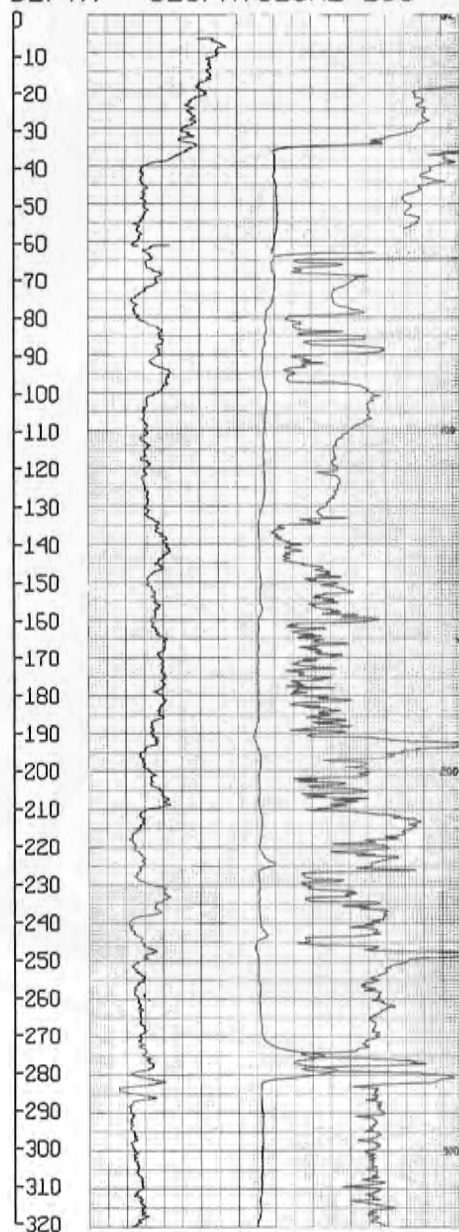
AGE: Upper Cretaceous

LOG TRACES

AB-83-04

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	406'	406'	406'
SCALE:	50 CPS/IN	50 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN

DEPTH GEOPHYSICAL LOG



LITHOLOGIC

SYMBOL

CUTTINGS DESCRIPTIONS

	SAND: medium brown, medium-very fine grained, with clay and claystone, medium gray, hard.
	CLAY: gray, soft, with claystone, moderately hard.
	SILTSTONE: sandy, light-medium gray, very soft, with clay, medium gray, soft.
	CLAY: gray, occasionally brown, soft-very soft, with claystone, gray, moderately hard.
	SANDSTONE: light-medium gray, fine grained, hard, with clay, medium gray-brown, moderately soft.
	CLAY: gray, sandy, silty, shaly in part, soft, with some sandstone, as above.
	CARBONACEOUS SHALE: dark brown, moderately soft, with traces of coal, vitreous, hard.
	CLAY: gray-brown, moderately soft, trace of carbonaceous shale, dark brown-black.
	SANDSTONE: gray, fine grained, hard.
	CLAY: silty, medium gray-brown, soft.
	CARBONACEOUS SHALE: dark brown, moderately hard with some coal, vitreous, hard, traces of silty sand, red-brown, fine grained.
	SILTSTONE: shaly, gray, moderately soft.

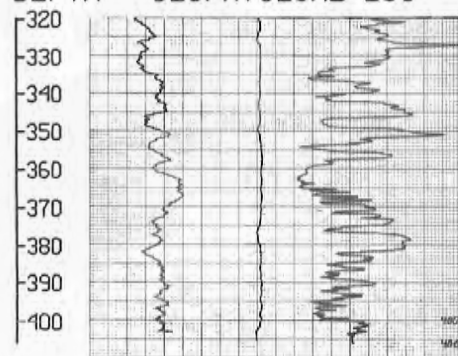
(CONTINUED ON NEXT PAGE)

LOG TRACES

AB-83-04

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	406'	406'	406'
SCALE:	50 CPS/IN	50 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN

DEPTH GEOPHYSICAL LOG LITHOLOGIC SYMBOL CUTTINGS DESCRIPTIONS



CLAY: gray-dark brown, silty in part,
moderately soft.

DTD = 400 FT

DATABASE SEQUENCE NUMBER: 58006

DRILL HOLE NUMBER: AB-83-05

STATE: Wyoming

COUNTY: Fremont

SECTION: 34

TOWNSHIP: 34 N

RANGE: 94 W

FOOTAGE LOCATION: 2600' fnl 2400' fwl

GROUND ELEVATION: 5780'

QUADRANGLE: Campbell Ridge (7.5 min.)

AREA: Alkali Butte

INDEX MAP: Figure 2

COMMENCED DRILLING: 8-3-83

COMPLETED DRILLING: 8-3-83

DRILL HOLE DEPTH: Driller - 300' Logger - 303'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton

LOGGING TOOL: Logmaster

LOGGED BY: R. Howell

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: —

THICKNESS OF COAL: (Trace)

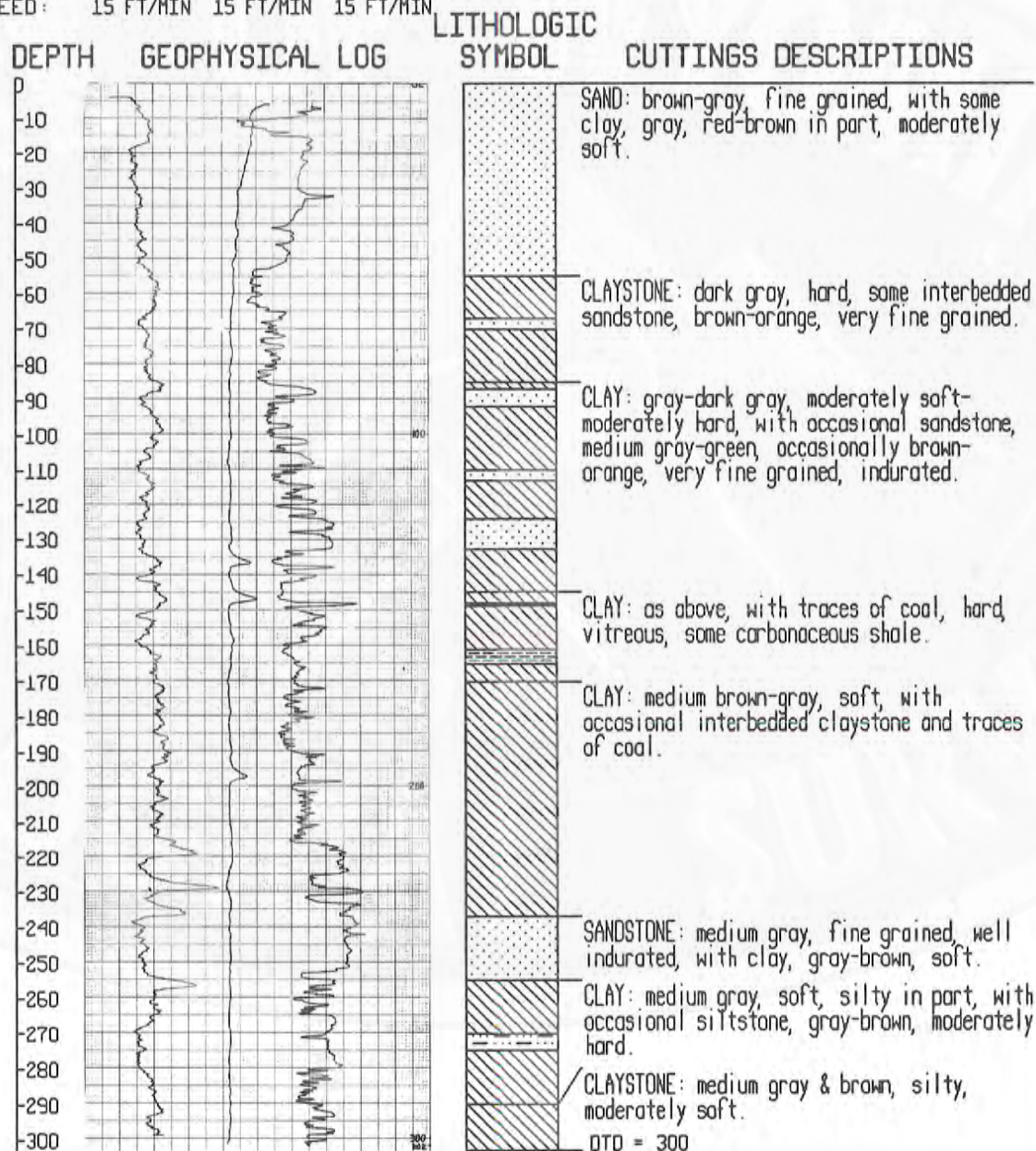
FORMATION: Mesaverde

AGE: Upper Cretaceous

LOG TRACES

AB-83-05

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	303'	303'	303'
SCALE:	50 CPS/IN	50 CPS/IN	50 CPS/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN



DATABASE SEQUENCE NUMBER: 58007

DRILL HOLE NUMBER: AB-83-06

STATE: Wyoming

COUNTY: Fremont

SECTION: 34

TOWNSHIP: 34 N

RANGE: 94 W

FOOTAGE LOCATION: 1600' fnl 2500' fwl

GROUND ELEVATION: 5790'

QUADRANGLE: Campbell Ridge (7.5 min.)

AREA: Alkali Butte

INDEX MAP: Figure 2

COMMENCED DRILLING: 8-3-83

COMPLETED DRILLING: 8-4-83

DRILL HOLE DEPTH: Driller - 480' Logger - 484'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton

LOGGING TOOL: Logmaster

LOGGED BY: R. Howell

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: —

THICKNESS OF COAL: (Trace)

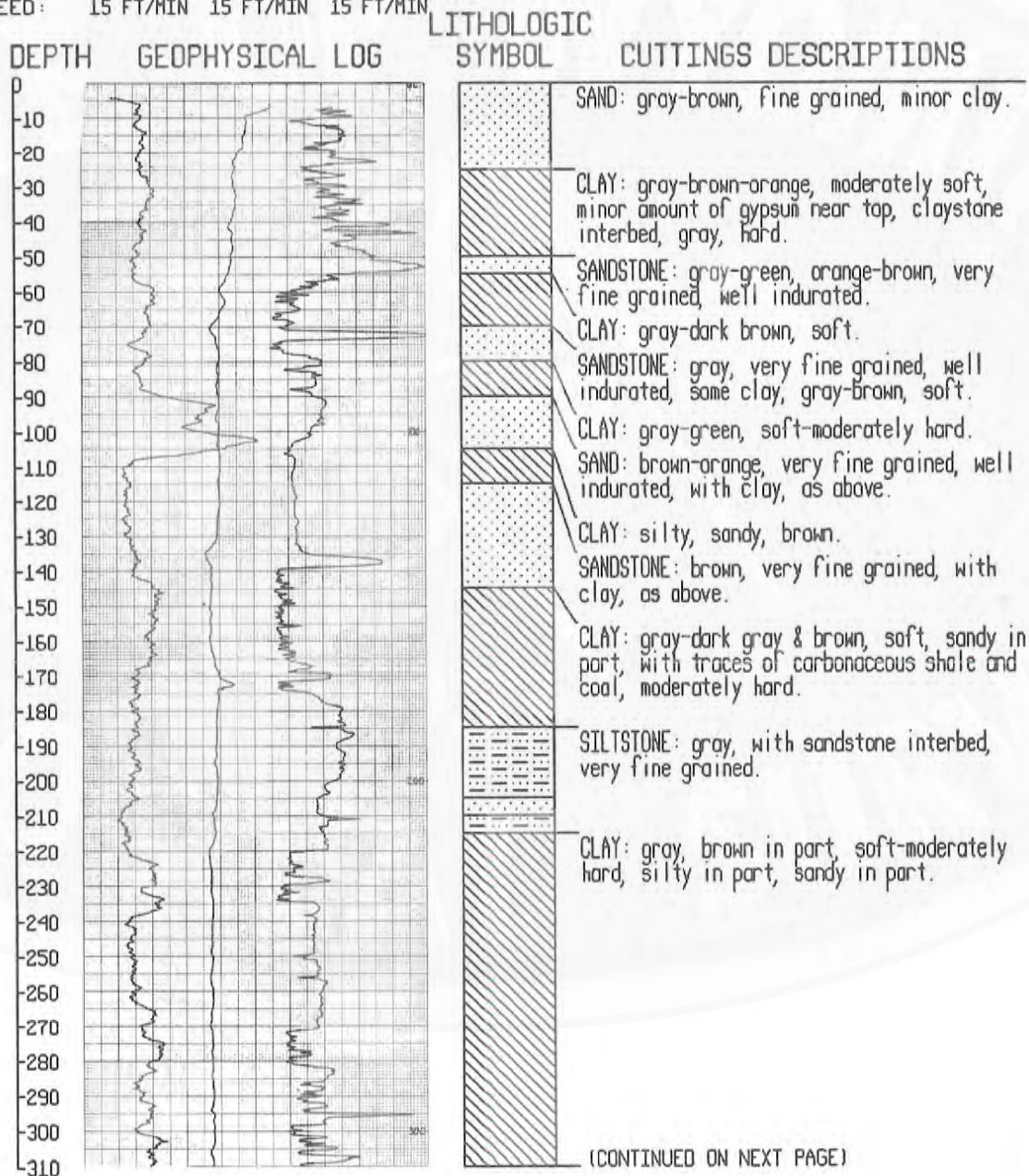
FORMATION: Mesaverde

AGE: Upper Cretaceous

LOG TRACES

AB-83-06

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	484'	484'	484'
SCALE:	50 CPS/IN	50 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN

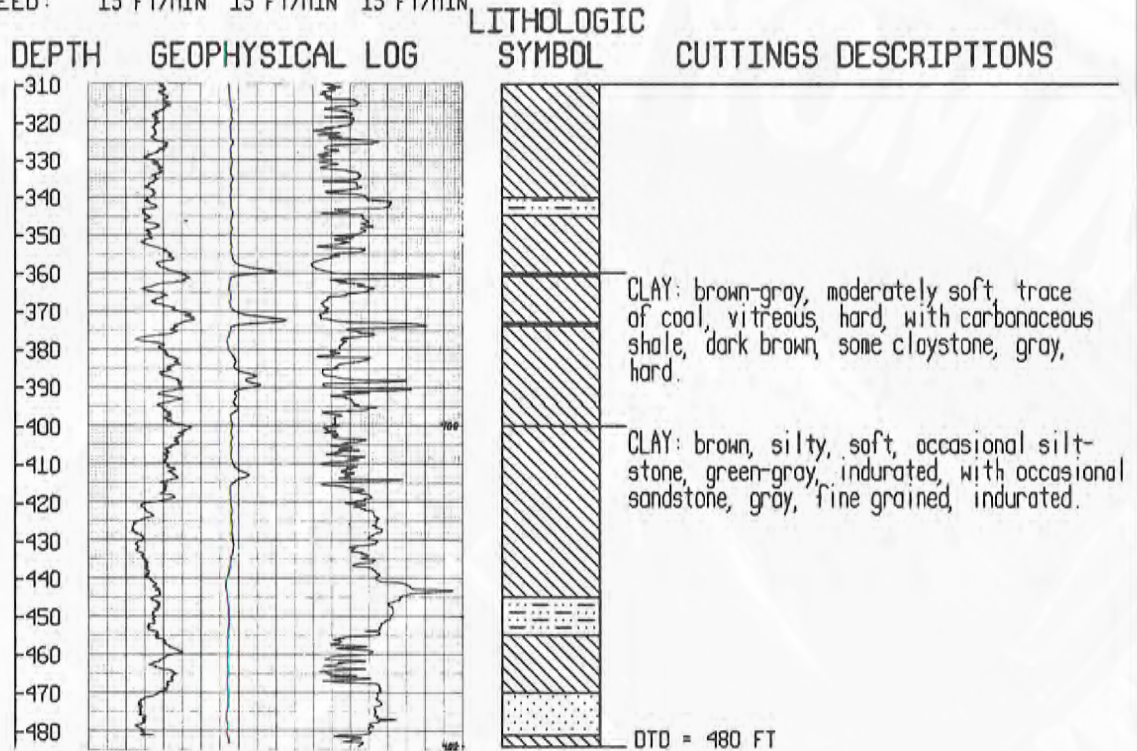


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LOG TRACES

AB-83-06

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	484'	484'	484'
SCALE:	50 CPS/IN	50 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN



DATABASE SEQUENCE NUMBER: 58008

DRILL HOLE NUMBER: AB-83-08

STATE: Wyoming

COUNTY: Fremont

SECTION: 33

TOWNSHIP: 34 N

RANGE: 94 W

FOOTAGE LOCATION: 2300' fnl 2000' fwl

GROUND ELEVATION: 5835'

QUADRANGLE: Campbell Ridge (7.5 min.)

AREA: Alkali Butte

INDEX MAP: Figure 2

COMMENCED DRILLING: 8-10-83

COMPLETED DRILLING: 8-10-83

DRILL HOLE DEPTH: Driller - 400' Logger - 403'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton

LOGGING TOOL: Logmaster

LOGGED BY: R. Howell

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: 5621' (E-log)

THICKNESS OF COAL: 5.0'

FORMATION: Mesaverde

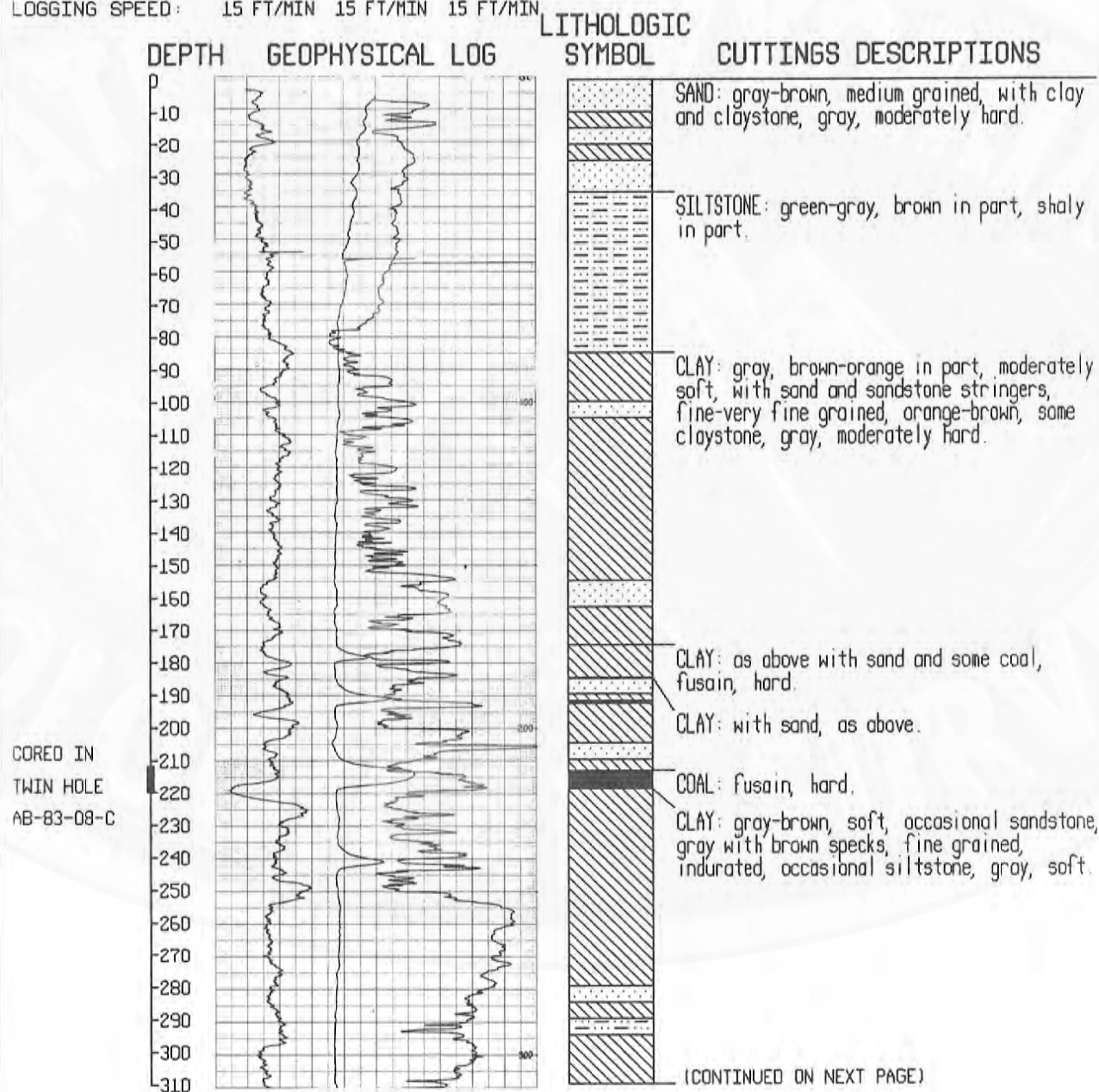
AGE: Upper Cretaceous

INTERVAL(s) CORED: See AB-83-08-C

LOG TRACES

AB-83-08

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	403'	403'	403'
SCALE:	50 CPS/IN	50 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN

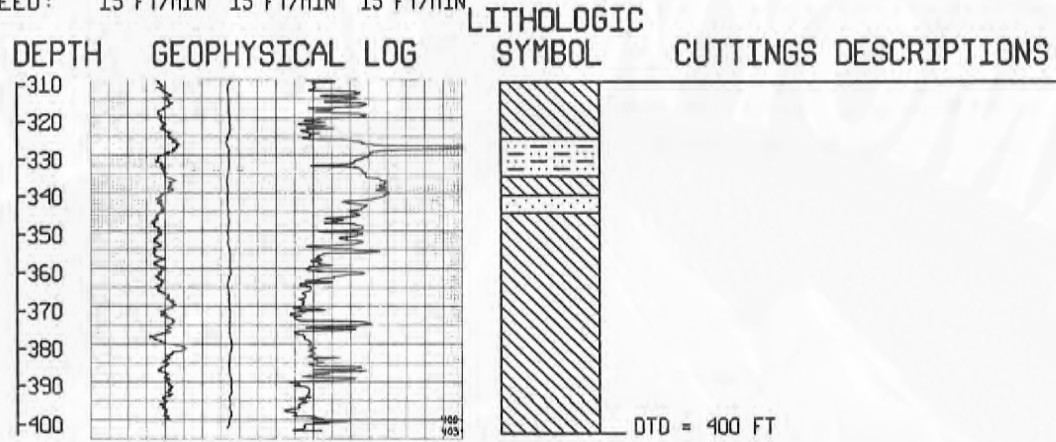


CORED IN
TWIN HOLE
AB-83-08-C

LOG TRACES

AB-83-08

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	403'	403'	403'
SCALE:	50 CPS/IN	50 CPS/IN	50 CPS/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN



DATABASE SEQUENCE NUMBER: 58009

DRILL HOLE NUMBER: AB-83-08-C

STATE: Wyoming

COUNTY: Fremont

SECTION: 33

TOWNSHIP: 34 N

RANGE: 94 W

FOOTAGE LOCATION: 2300' fnl 2000' fwl

GROUND ELEVATION: 5835'

QUADRANGLE: Campbell Ridge (7.5 min.)

AREA: Alkali Butte

INDEX MAP: Figure 2

COMMENCED DRILLING: 8-10-83

COMPLETED DRILLING: 8-11-83

DRILL HOLE DEPTH: Driller - 220' Logger - 216'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton

LOGGING TOOL: Logmaster

LOGGED BY: R. Howell

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: 5620.7' (E-log)

THICKNESS OF COAL: 5.0'

FORMATION: Mesaverde

AGE: Upper Cretaceous

INTERVAL(s) CORED: 212.3' - 219.7'

INTERVAL(s) ANALYZED: 214.3' - 219.3'

DATE SAMPLED: 8-10-83

DATE ANALYZED: 10-20-83

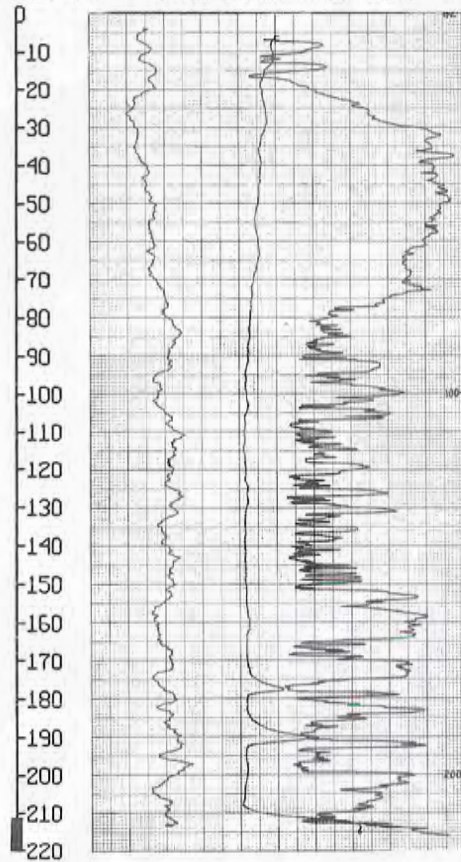
LAB NUMBER (s): F520-83, F521-83

LOG TRACES

AB-83-08-C

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	216'	216'	216'
SCALE:	50 CPS/IN	50 CPS/IN	20 OHM/IN
TIME CONSTANT:	4 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	15 FT/MIN	15 FT/MIN	15 FT/MIN

LITHOLOGIC SYMBOL CUTTINGS DESCRIPTIONS



NO SAMPLES FOR 0-212 FEET - SEE AB-83-08

SHALE: (212.4 - 213.2) brown, hard, inter-bedded with sandstone, gray, fine-very fine grained.

CARBONACEOUS SHALE: (213.2 - 215.3) dark brown, hard, with coal stringers, fusain, hard.

COAL: (214.3 - 219.3) fusain, hard, with minor carbonaceous shale, as above.

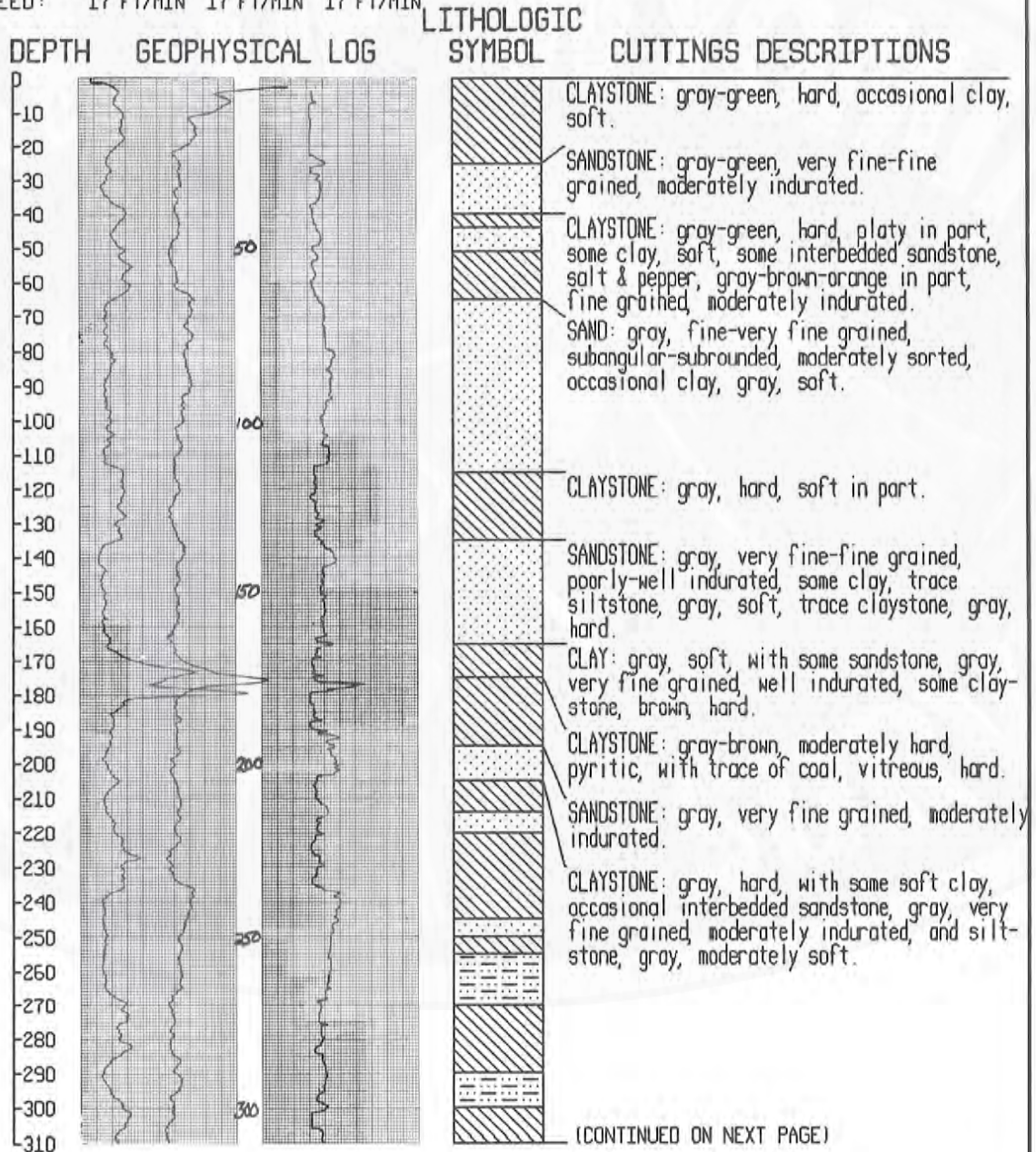
DTD = 220

DATABASE SEQUENCE NUMBER: 58010
DRILL HOLE NUMBER: S-87-01
STATE: Wyoming
COUNTY: Fremont
SECTION: 28
TOWNSHIP: 38 N
RANGE: 93 W
FOOTAGE LOCATION: 680' fnl 2270' fwl
GROUND ELEVATION: 5365'
QUADRANGLE: Shoshoni (7.5 min.)
AREA: Shoshoni
INDEX MAP: Figure 3
COMMENCED DRILLING: 6-23-87
COMPLETED DRILLING: 6-24-87
DRILL HOLE DEPTH: Driller - 340' Logger - 344'
DEPTH TO WATER: Surface
DRILL TYPE: Portadrill
BIT SIZE: 4.75"
DRILLING FLUID: Water, mud
DRILLER: BLM, H. Cureton, B. Gates
LOGGING TOOL: Logmaster
LOGGED BY: F. Rakow
LOGS RUN: Gamma-Ray, Density, Resistivity
LITHOLOGY RECORDED BY: BLM, B. Pitman
ELEVATION AT TOP OF COAL: ---
THICKNESS OF COAL: (Trace)
FORMATION: Wind River
AGE: Eocene

LOG TRACES

S-87-01

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	338'	343'	344'
SCALE:	100 CPS/IN	50 CPS/IN	50 OHM/IN
TIME CONSTANT:	1 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	17 FT/MIN	17 FT/MIN	17 FT/MIN



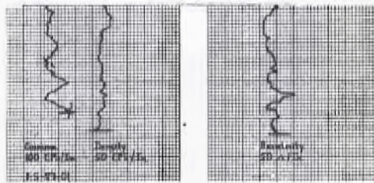
LOG TRACES

S-87-01

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	338'	343'	344'
SCALE:	100 CPS/IN	50 CPS/IN	50 OHM/IN
TIME CONSTANT:	1 SEC	2 SEC	
DEFLECTION:			
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	17 FT/MIN	17 FT/MIN	17 FT/MIN

DEPTH GEOPHYSICAL LOG

310
320
330
340



LITHOLOGIC SYMBOL

CUTTINGS DESCRIPTIONS



OTO = 340 FT

DATABASE SEQUENCE NUMBER: 58011

DRILL HOLE NUMBER: S-87-02

STATE: Wyoming

COUNTY: Fremont

SECTION: 27

TOWNSHIP: 38 N

RANGE: 93 W

FOOTAGE LOCATION: 900' fnl 1700' fwl

GROUND ELEVATION: 5445'

QUADRANGLE: Ocla Draw (7.5 min.)

AREA: Shoshoni

INDEX MAP: Figure 3

COMMENCED DRILLING: 6-24-87

COMPLETED DRILLING: 6-25-87

DRILL HOLE DEPTH: Driller - 440' Logger - 445'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton, B. Gates

LOGGING TOOL: Logmaster

LOGGED BY: F. Rakow

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: —

THICKNESS OF COAL: (Trace)

FORMATION: Wind River

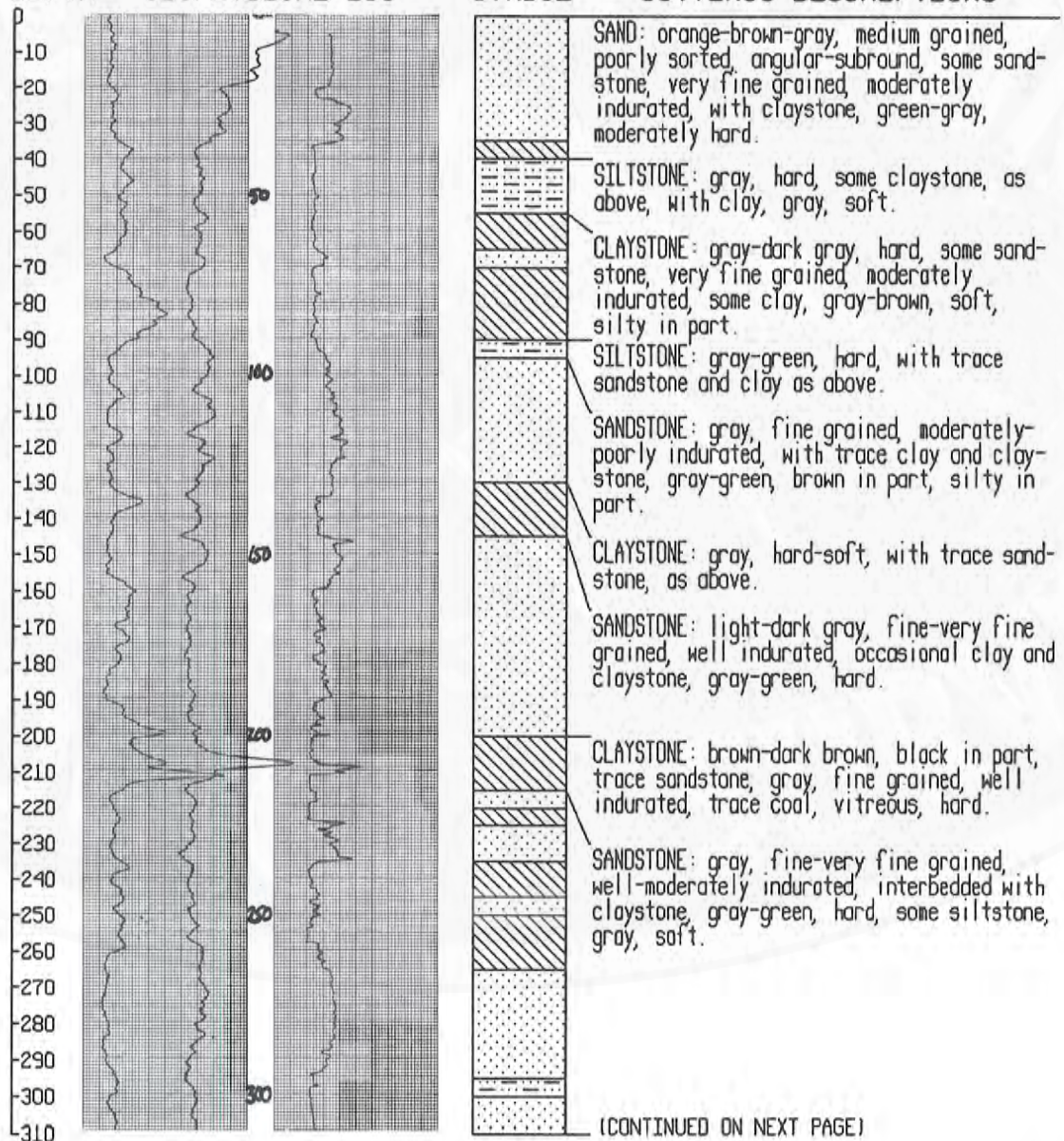
AGE: Eocene

LOG TRACES

S-87-02

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	439'	444'	445'
SCALE:	100 CPS/IN	50 CPS/IN	50 OHM/IN
TIME CONSTANT:	1 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	18 FT/MIN	18 FT/MIN	18 FT/MIN

DEPTH	GEOPHYSICAL LOG	LITHOLOGIC SYMBOL	CUTTINGS DESCRIPTIONS
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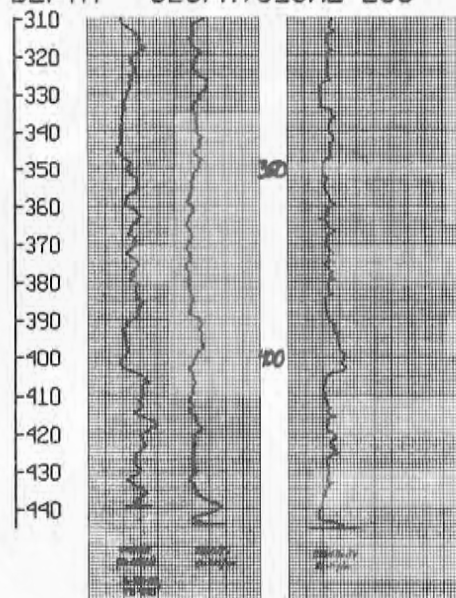
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LOG TRACES

S-87-02

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	439'	444'	445'
SCALE:	100 CPS/IN	50 CPS/IN	50 OHM/IN
TIME CONSTANT:	1 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	18 FT/MIN	18 FT/MIN	18 FT/MIN

DEPTH GEOPHYSICAL LOG

LITHOLOGIC
SYMBOL

CUTTINGS DESCRIPTIONS



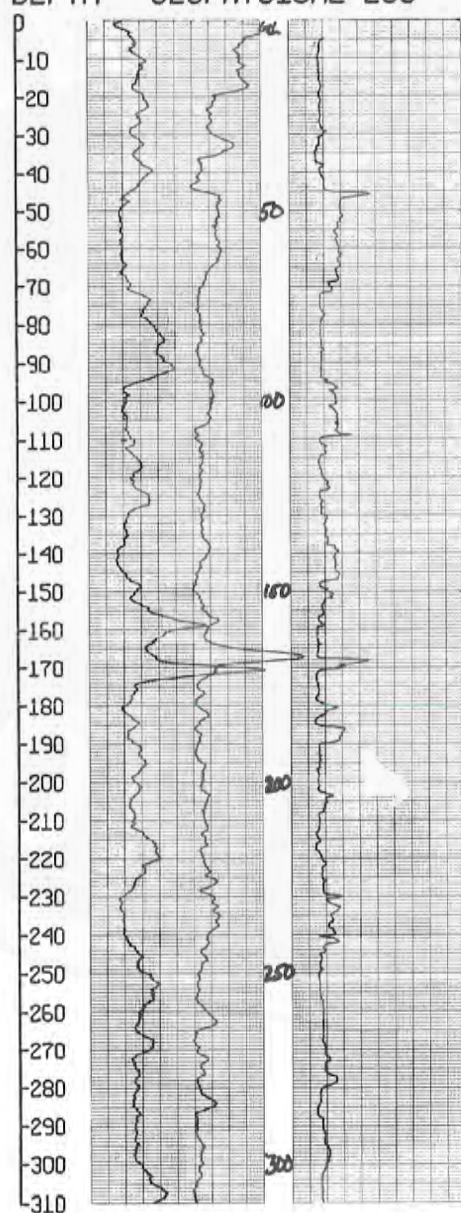
DATABASE SEQUENCE NUMBER: 58012
DRILL HOLE NUMBER: S-87-03
STATE: Wyoming
COUNTY: Fremont
SECTION: 23
TOWNSHIP: 38 N
RANGE: 93 W
FOOTAGE LOCATION: 1130' fsl 2630' fel
GROUND ELEVATION: 5430'
QUADRANGLE: Ocla Draw (7.5 min.)
AREA: Shoshoni
INDEX MAP: Figure 3
COMMENCED DRILLING: 6-25-87
COMPLETED DRILLING: 6-26-87
DRILL HOLE DEPTH: Driller - 340' Logger - 345'
DEPTH TO WATER: Surface
DRILL TYPE: Portadrill
BIT SIZE: 4.75"
DRILLING FLUID: Mud
DRILLER: BLM, H. Cureton, B. Gates
LOGGING TOOL: Logmaster
LOGGED BY: J. McKay, F. Rakow
LOGS RUN: Gamma-Ray, Density, Resistivity
LITHOLOGY RECORDED BY: BLM, B. Pitman
ELEVATION AT TOP OF COAL: —
THICKNESS OF COAL: (Trace)
FORMATION: Wind River
AGE: Eocene

LOG TRACES

S-87-03

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	339'	344'	345'
SCALE:	100 CPS/IN	50 CPS/IN	50 OHM/IN
TIME CONSTANT:	1 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	18 FT/MIN	18 FT/MIN	18 FT/MIN

DEPTH GEOPHYSICAL LOG



LITHOLOGIC

SYMBOL

CUTTINGS DESCRIPTIONS

	CLAYSTONE: gray-green, moderately hard, interbedded with sandstone, yellow-gray, very fine grained, moderately indurated, some clay, gray, soft.
	SILTSTONE: gray-dark gray, hard, trace claystone, gray-green, hard.
	SANDSTONE: gray, fine-very fine grained, subangular-subround, well sorted, becoming poorly sorted toward base, well-moderately indurated, with minor claystone, gray, moderately hard.
	CLAYSTONE: gray-dark gray, hard, with trace sandstone gray, very fine grained, well indurated.
	SANDSTONE: gray, very fine-fine grained, moderately well indurated, interbedded with gray siltstone, poorly indurated, and claystone, gray, hard.
	CLAYSTONE: gray-brown, black in part, hard, pyritic in part, with a trace of coal, vitreous, hard.
	SANDSTONE: gray-dark gray, fine-very fine grained, well-moderately indurated, interbedded with siltstone, gray, hard, and claystone, gray-green, hard.
	SILTSTONE: gray, hard, interbedded with claystone, gray-green, hard, and sandstone, gray, very fine grained, well-moderately indurated, some clay, gray, soft.

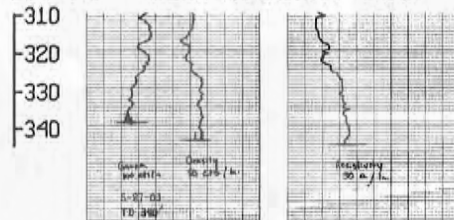
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LOG TRACES

S-87-03

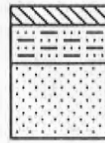
	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	339'	344'	345'
SCALE:	100 CPS/IN	50 CPS/IN	50 OHM/IN
TIME CONSTANT:	1 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	18 FT/MIN	18 FT/MIN	18 FT/MIN

DEPTH GEOPHYSICAL LOG



LITHOLOGIC SYMBOL

CUTTINGS DESCRIPTIONS



SANDSTONE: gray, fine-medium grained, well indurated, poorly indurated in part.

DTD = 340 FT

DATABASE SEQUENCE NUMBER: 58013

DRILL HOLE NUMBER: S-87-04

STATE: Wyoming

COUNTY: Fremont

SECTION: 25

TOWNSHIP: 38 N

RANGE: 93 W

FOOTAGE LOCATION: 250' fnl 2050' fel

GROUND ELEVATION: 5345'

QUADRANGLE: Ocla Draw (7.5 min.)

AREA: Shoshoni

INDEX MAP: Figure 3

COMMENCED DRILLING: 6-26-87

COMPLETED DRILLING: 6-27-87

DRILL HOLE DEPTH: Driller - 300' Logger - 304'

DEPTH TO WATER: Surface

DRILL TYPE: Portadrill

BIT SIZE: 4.75"

DRILLING FLUID: Mud

DRILLER: BLM, H. Cureton, B. Gates

LOGGING TOOL: Logmaster

LOGGED BY: B. Gates

LOGS RUN: Gamma-Ray, Density, Resistivity

LITHOLOGY RECORDED BY: BLM, B. Pitman

ELEVATION AT TOP OF COAL: ---

THICKNESS OF COAL: (Trace)

FORMATION: Wind River

AGE: Eocene

LOG TRACES

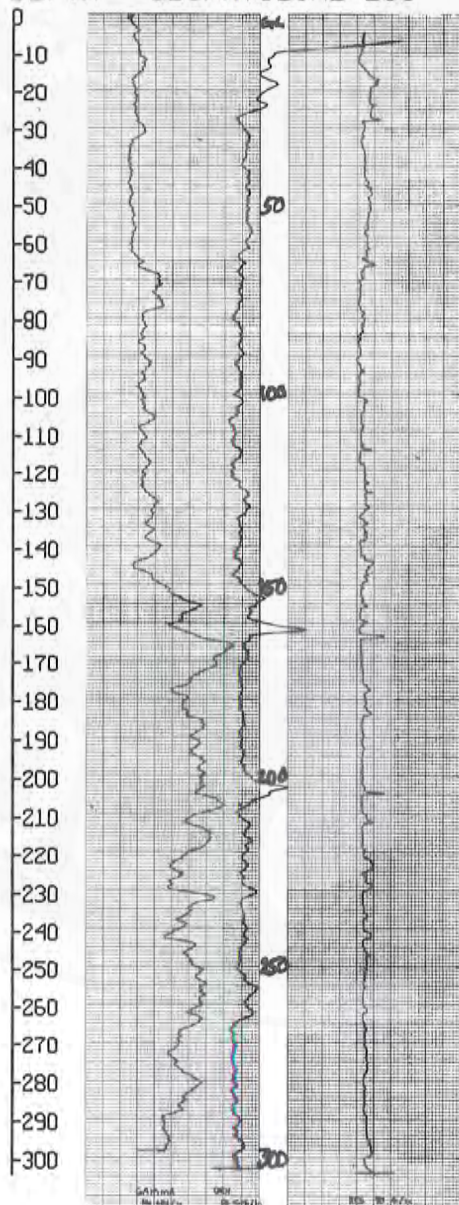
S-87-04

	GAMMA RAY	DENSITY	RESIS- TIVITY
LOGGED DEPTH:	298'	303'	304'
SCALE:	100 CPS/IN	50 CPS/IN	50 OHM/IN
TIME CONSTANT:	1 SEC	2 SEC	
DEFLECTION:	RIGHT	LEFT	RIGHT
SOURCE STRENGTH:		125 mCi	
LOGGING SPEED:	18 FT/MIN	18 FT/MIN	18 FT/MIN

DEPTH GEOPHYSICAL LOG

LITHOLOGIC SYMBOL

CUTTINGS DESCRIPTIONS



	CLAY: yellow-brown-gray, moderately hard, becoming claystone.
	SANDSTONE: gray, fine grained, salt & pepper in part, moderately indurated, with siltstone, gray, moderately hard.
	CLAYSTONE: gray-black, occasional orange weathered surfaces, hard, trace coal, hard, vitreous, fusain in part, sandstone interbed, gray, very fine grained, moderately indurated.
	SANDSTONE: gray, medium-fine grained, sub-angular-subround, moderately-well sorted, well indurated in part, some claystone, gray, hard, and siltstone, green-gray hard.
	SANDSTONE: gray, very fine-fine grained, moderately indurated to unconsolidated, subangular-subround, moderately well sorted.
	SILTSTONE: gray, hard, with some clay, gray, soft.
	SANDSTONE: gray, fine-very fine grained, poorly-well indurated, with clay, gray, soft.
	CLAYSTONE: gray-green, hard, grades to siltstone, gray, hard, and sandstone, gray, green-gray, very fine grained, moderately-well indurated, some clay, gray, soft.
	SANDSTONE: gray, fine-very fine grained, well-poorly indurated, some clay, gray, soft.
	CLAYSTONE: gray, moderately hard, with some sandstone, gray, very fine grained, moderately indurated, and siltstone, as above, with clay, gray, soft.
	SANDSTONE: gray, orange in part, fine-very fine grained, moderately-poorly indurated, with some siltstone, green-gray, hard, minor clay, blue-green-gray, hard-soft.

DTD = 300 FT

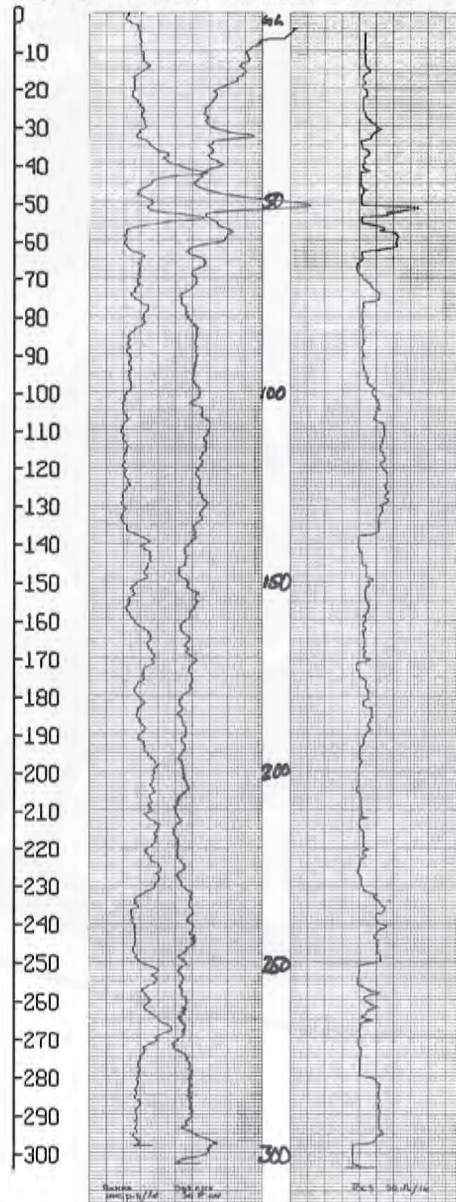
DATABASE SEQUENCE NUMBER: 58014
DRILL HOLE NUMBER: S-87-05
STATE: Wyoming
COUNTY: Fremont
SECTION: 34
TOWNSHIP: 38 N
RANGE: 93 W
FOOTAGE LOCATION: 1070' fnl 2310' fel
GROUND ELEVATION: 5063'
QUADRANGLE: Ocla Draw (7.5 min.)
AREA: Shoshoni
INDEX MAP: Figure 3
COMMENCED DRILLING: 6-27-87
COMPLETED DRILLING: 6-28-87
DRILL HOLE DEPTH: Driller - 300' Logger - 304'
DEPTH TO WATER: 11'
DRILL TYPE: Portadrill
BIT SIZE: 4.75"
DRILLING FLUID: Mud
DRILLER: BLM, H. Cureton, B. Gates
LOGGING TOOL: Logmaster
LOGGED BY: B. Gates
LOGS RUN: Gamma-Ray, Density, Resistivity
LITHOLOGY RECORDED BY: BLM, B. Pitman
ELEVATION AT TOP OF COAL: —
THICKNESS OF COAL: (Trace)
FORMATION: Wind River
AGE: Eocene

LOG TRACES

S-87-05

LOGGED DEPTH: 298' 303' 304'
 SCALE: 100 CPS/IN 50 CPS/IN 50 OHM/IN
 TIME CONSTANT: 1 SEC 2 SEC
 DEFLECTION: RIGHT LEFT RIGHT
 SOURCE STRENGTH: 125 mCi
 LOGGING SPEED: 17 FT/MIN 17 FT/MIN 17 FT/MIN

DEPTH GEOPHYSICAL LOG



LITHOLOGIC SYMBOL

CUTTINGS DESCRIPTIONS

