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UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



LITHOLOGIC AND GEOPHYSICAL LOGS AND COAL ANALYSES FROM TEST HOLES
DRILLED DURING 1977 IN CONVERSE AND CAMPBELL COUNTIES, WYOMING

By

Frank B. Kistner, Gregg A. Hollomon, and David G. Coppock

**UNIVERSITY OF UTAH
RESEARCH INSTITUTE
EARTH SCIENCE LAB.**

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This report has not been edited for conformity
with U.S. Geological Survey editorial standards
or stratigraphic nomenclature.

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CONVERSION TABLE

To convert ENGLISH UNITS	Multiply by	To obtain METRIC UNITS
Inches	2.54	Centimeters
Feet	0.3048	Meters
Btu/lb	2.324	Joule/kilogram
Fahrenheit	-32 and ÷ by 1.8	Celsius

LIST OF ABBREVIATIONS

amts - amounts	grnd - grained
appx - approximate	gry - gray
avg - average	L.S. - land surface
blk - black	lt - light
brn - brown	L.T.D. - logged total depth
brnish - brownish	m - medium
carb - carbonaceous	or - orange
conch - conchoidal	pos - possible
dk - dark	prtcls - particles
f - fine	sdv - sandy
frac - fracture	sh - shale
frag - fragment	sltst - siltstone
fragal - fragmental	ss - sandstone
G.L. - ground level	v - very
vf - very fine	
vit - vitreous	

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INTRODUCTION

Between August 11 and November 16, 1977, 28 coal test holes were drilled in Converse and Campbell Counties, Wyo. (fig. 1). This drilling was done as part of an ongoing U.S. Geological Survey (USGS) program to evaluate and classify mineral lands in the public domain. The overall purpose of the program is to gather data on the thickness, quality, extent, correlation, and recoverability of coal beds, and the thickness and lithologic characteristics of the associated rocks in the Tertiary Fort Union and Wasatch Formations of the Powder River Basin.

This report presents geophysical logs and lithologic descriptions, lagged or corrected in depth intervals to match the geophysical logs of each test hole, and analyses of coal samples obtained from three offset core holes. Similar information from 343 test holes and approximately 149 coal samples from 53 core tests in Campbell and Converse Counties, Wyo., was presented in earlier reports (U.S. Geological Survey and Montana Bureau of Mines and Geology, 1973, 1974, 1976a, 1976b, 1977, 1978; Kistner, 1977). Figure 1 shows the locations and test-hole numbers of all holes drilled during the 1977 field season.

Specific locations, following the system of land survey used by the U.S. Bureau of Land Management, appear on the individual log headings. The locations are indicated as distances, in feet, scaled from section lines as they appear on topographic quadrangle sheets. Elevations are approximate for all test holes except CD-77001 which was surveyed. Upon completion of drilling, test-hole CD-77001 was cased and converted to a water-observation well.

A conventional rotary drill was used with circulating water as the usual drilling fluid. Continuous 10-foot samples were collected except where circulation was difficult to maintain and then an air-mist drilling medium was used and no samples were collected. Samples were logged by a geologist in the field and then bagged and sent to the USGS storage facilities in Casper, Wyo. Field logs were completed for each test hole, and are also on file in Casper.

The geophysical logging procedure was to run the gamma ray probe followed by the resistance-spontaneous potential (SP) probe, unless there were problems with drill-hole stability. In these instances, the drill pipe was used to temporarily case the hole, and the gamma ray log was run through the drill pipe. Contract loggers geophysically logged the following test holes: CD-77018, CD-77024, CD-77027, and CD-77028. The logs were photographically reduced to 1 inch to 50 feet for convenience in reproducing this report and the originals are on file at the Casper office.

Eight core samples (table 1) were obtained from the following coal test holes: CD-77006, CD-77008, and CD-77017. A core hole was drilled adjacent to a logged test hole to obtain a sample of the coal interval (or intervals) indicated on the logs of the test hole. The core was measured, described, packaged, and sent for analysis to the USGS laboratory, Lakewood, Colo. The results of the analyses for these core samples are presented in tables 2-5 of this report. Analytical procedures used by the Survey are described in Swanson and Huffman (1976).

Discretion is urged in the use and interpretation of the coal analysis data. Although great care was exercised in obtaining and preserving the coal cores, changes in moisture content and some contamination from the drilling-fluid additives should be anticipated. Each core sample is approximately 2-1/8 in. in diameter and as much as 14.7 ft in length and the analysis of a sample this small may not be typical of the coal beds in the surrounding area.

ACKNOWLEDGMENTS

Fieldwork was carried out by the following USGS personnel: Frank B. Kistner, Linda G. Riglin, Edmund L. Fivas, geologists; Gregg A. Hollomon, technician; and Harry R. Cureton, driller. Lithologic detail was added to the field descriptions by Gregg A. Hollomon and David G. Coppock. Supervision and technical guidance were provided by Frank B. Kistner and Elmer M. Schell. Joseph R. Hatch, geologist, coordinated and compiled the various coal analyses.

REFERENCES

- Kistner, F. B., 1977, Preliminary report of coal drill-hole data in the southern Powder River Basin, Converse County, Wyoming: U.S. Geological Survey Open-File Report 77-774, 25 p.
- Swanson, V. E., and Huffman, Claude, Jr., 1976, Guidelines for sample collecting and analytical methods used in the U.S. Geological Survey for determining chemical composition of coal: U.S. Geological Survey Circular 735, 11 p.
- U.S. Geological Survey and Montana Bureau of Mines and Geology, 1973, Preliminary report of coal drill-hole data and chemical analyses of coal beds in Sheridan and Campbell Counties, Wyoming; and Big Horn County, Montana: U.S. Geological Survey open-file report, 57 p.
- _____ 1974, Preliminary report of coal drill-hole data and chemical analyses of coal beds in Campbell County, Wyoming: U.S. Geological Survey Open-File Report 74-97, 241 p., 1 fig., 3 tables.
- _____ 1976a, Preliminary report of coal drill-hole data and chemical analyses of coal beds in Campbell and Sheridan Counties, Wyoming; Custer, Prairie, and Garfield Counties, Montana; and Mercer County, North Dakota: U.S. Geological Survey Open-File Report 76-319, 377 p., 4 figs., 3 tables.
- _____ 1976b, Preliminary report of coal drill-hole data and chemical analyses of coal beds in Campbell, Converse, and Sheridan Counties, Wyoming; and Big Horn, Richland, and Dawson Counties, Montana: U.S. Geological Survey Open-File Report 76-450, 382 p., 4 figs.

U.S. Geological Survey and Montana Bureau of Mines and Geology, 1977, Preliminary report of 1976 drilling of coals in Campbell and Sheridan Counties, Wyoming; and Big Horn, Dawson, McCone, Richland, Roosevelt, Rosebud, Sheridan, and Wibaux Counties, Montana: U.S. Geological Survey Open-File Report 77-283, 403 p., 6 figs.

_____ 1978, Geophysical logs for Campbell and Converse Counties, Wyoming, chapter E of Preliminary report of 1977 coal drilling in eastern Montana and northeastern Wyoming: U.S. Geological Survey Open-File Report 77-721-E, 202 p.

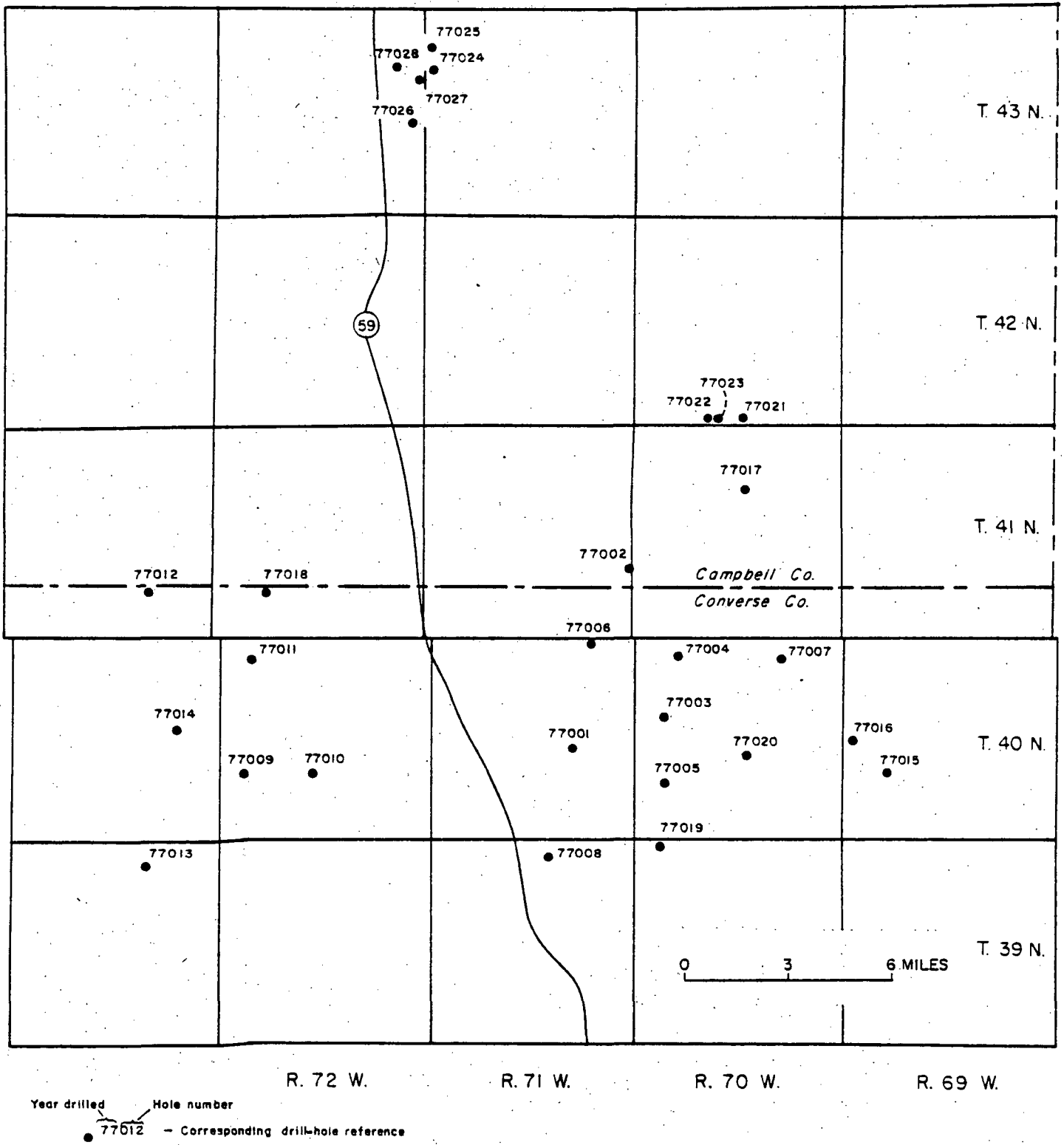


Figure 1.--Location of holes drilled during 1977 in Campbell and Converse Counties, Wyo.

Table 1.--Summary of information for eight coal samples from the Tertiary Fort Union Formation, Converse and Campbell Counties, Wyo.

Sample No.	Hole No.	Location			Depth interval (feet)	Coal bed Name	
		Sec.	T.N.	R.W.			
D196189	CD-77008	SW $\frac{1}{4}$ NW $\frac{1}{4}$	3	39	71	117.0-130.5	Wyodak W1
D196190	CD-77006	NE $\frac{1}{4}$ NE $\frac{1}{4}$	2	40	71	74.0- 85.5	Do.
D196191	-----	-----do-----	-----	-----	-----	87.0- 97.0	Do.
D196192	-----	-----do-----	-----	-----	-----	97.0-108.5	Do.
D196193	-----	-----do-----	-----	-----	-----	186.0-198.5	Wyodak W2
D196194	-----	-----do-----	-----	-----	-----	203.4-204.3	Do.
D196195	-----	-----do-----	-----	-----	-----	206.5-221.2	Do.
D197320	CD-77017	SW $\frac{1}{4}$ SW $\frac{1}{4}$	10	41	70	144.0-153.7	Wyodak

Table 2.--Coal analyses for eight coal samples from the Wyodak beds, Tongue River Member, Fort Union Formation, Converse and Campbell Counties, Wyoming.

[Analyses by U.S. Department of Energy, Coal Analysis Section, Pittsburgh, Pa., Forrest E. Walker, chemist in charge.
Type of analysis: A, as received; B, moisture free; and C, moisture and ash free. ---, no data]

Sample No.	Type of analysis	Proximate analysis (percent)				Ultimate analysis (percent)					Heating value (Btu/lb)	Air-dried loss (%)	Forms of sulfur (percent)			Free-swell- ing index	Ash-fusion temp. (°C)		
		Mois- ture	Volatile matter	Fixed carbon	Ash	Hydro- gen	Carbon	Nitro- gen	Oxy- gen	Sul- fur			Sulfate	Pyritic	Organic		Initial deforma- tion	Soft- ening	Fluid
D196189	A	25.1	31.3	36.2	7.4	6.4	49.3	1.0	35.5	0.4	8,430	6.9	0.01	0.07	0.33	0.0	1,165	1,180	1,200
	B	---	41.8	48.3	9.9	4.8	65.8	1.3	17.6	.5	11,260	---	.01	.09	.44				
	C	---	46.4	53.6	---	5.3	73.0	1.5	19.5	.6	12,490	---	.01	.10	.49				
D196190	A	25.4	31.4	38.3	4.9	6.4	51.0	.8	36.6	.4	8,630	10.3	.03	.04	.31	.0	1,215	1,230	1,250
	B	---	42.1	51.3	6.6	4.8	68.4	1.1	18.8	.5	11,570	---	.04	.05	.42				
	C	---	45.1	54.9	---	5.1	73.2	1.1	20.1	.6	12,380	---	.04	.06	.44				
D196191	A	24.5	32.7	38.6	4.2	6.4	52.4	.8	36.0	.2	8,980	7.0	.01	.02	.20	.0	1,245	1,265	1,280
	B	---	43.3	51.1	5.6	4.9	69.4	1.1	18.8	.3	11,890	---	.01	.03	.26				
	C	---	45.9	54.1	---	5.2	73.5	1.1	19.9	.3	12,590	---	.01	.03	.28				
D196192	A	24.8	31.2	37.4	6.6	6.3	50.5	.8	35.5	.2	8,550	9.1	.03	.04	.17	.0	1,190	1,215	1,245
	B	---	41.5	49.7	8.8	4.7	67.2	1.1	17.9	.3	11,370	---	.04	.05	.23				
	C	---	45.5	54.5	---	5.2	73.6	1.2	19.6	.3	12,470	---	.04	.06	.25				
D196193	A	26.7	28.8	39.3	5.2	6.2	50.5	.7	37.2	.2	8,510	11.9	.01	.01	.15	.0	1,210	1,225	1,245
	B	---	39.3	53.6	7.1	4.4	68.9	1.0	18.4	.3	11,610	---	.01	.01	.20				
	C	---	42.3	57.7	---	4.7	74.2	1.0	19.8	.3	12,490	---	.01	.01	.22				
D196194	A	26.8	29.0	37.5	6.7	6.3	48.8	.7	37.3	.2	8,270	12.2	<.01	<.01	.18	.0	1,215	1,230	1,250
	B	---	39.6	51.2	9.2	4.5	66.7	1.0	18.4	.3	11,300	---	<.01	<.01	.25				
	C	---	43.6	56.4	---	5.0	73.4	1.1	20.3	.3	12,440	---	<.01	<.01	.27				
D196195	A	25.7	30.6	39.0	4.7	6.3	52.0	.8	36.0	.2	8,800	9.8	.01	.01	.16	.0	1,100	1,115	1,130
	B	---	41.2	52.5	6.3	4.6	70.0	1.1	17.7	.3	11,840	---	.01	.01	.22				
	C	---	44.0	56.0	---	4.9	74.7	1.1	18.9	.3	12,640	---	.01	.01	.23				
D197320	A	29.8	30.4	34.7	5.1	6.8	47.5	.8	39.5	.3	8,190	15.0	.01	.04	.27	.0	1,210	1,225	1,245
	B	---	43.3	49.4	7.3	4.9	67.7	1.1	18.5	.5	11,670	---	.02	.06	.39				
	C	---	46.7	53.3	---	5.3	73.1	1.2	19.9	.5	12,580	---	.02	.07	.42				

Table 3.--Ash content and major- and minor-oxide and trace-element composition of eight coal samples from the Wyodak beds, Tongue River Member, Fort Union Formation, Converse and Campbell Counties, Wyoming.

[Analyses by U.S. Geological Survey laboratories, Denver, Colo. Analysts: J. H. Christie, J. W. Baker, A. J. Bartel, Candice Bliss, J. C. Hamilton, R. J. Knight, Cindy McFee, V. M. Merritt, H. T. Millard, Jr., H. G. Neiman, G. D. Shipley, J. A. Thomas, M. L. Tuttle, and J. W. Wahlberg. Coal ashed at 525°C. <, less than; --, not detected; N, not determined. Results of semiquantitative emission spectrographic analyses are based on their identity with geometric brackets whose boundaries are 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12, and so forth, and are reported arbitrarily as midpoints of these brackets, 1.0, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, respectively. The precision of a reported value is approximately plus-or-minus one bracket at 68-percent, or two brackets at 95-percent confidence level]

Sample No.	A. Percent ash, major- and minor-oxide, and trace-element compositions of ash (percent)											A. Percent ash, major- and minor-oxide, and trace-element compositions of ash (ppm)					
	Ash	SiO ₂	Al ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Fe ₂ O ₃	TiO ₂	P ₂ O ₅	SO ₃	Cu	Li	Mn	Pb	Zn	
D196189	9.1	36	11	18	2.76	2.60	0.50	5.2	0.90	2.0	12	80	26	950	35	170	
D196190	6.1	30	12	22	4.70	1.17	.50	5.5	.90	2.0	14	89	14	190	35	214	
D196191	5.1	24	11	24	6.40	.80	.30	4.3	1.4	<1.0	14	156	24	170	35	113	
D196192	8.5	44	17	14	4.20	.55	.90	3.0	1.4	2.0	8.8	136	29	115	35	418	
D196193	6.2	37	15	15	4.80	1.63	.40	2.9	1.4	2.0	8.0	125	28	40	40	470	
D196194	8.4	40	17	14	3.40	1.20	.30	2.5	1.7	8.5	3.8	61	16	34	90	65	
D196195	5.6	32	14	19	5.10	1.84	.20	3.6	1.3	4.0	8.2	96	24	80	50	495	
D197320	7.2	31	14	21	4.90	.27	.60	3.2	.96	3.0	12	91	14	110	45	196	
	B. Semiquantitative emission spectrographic analyses (ppm) for trace elements																
	B	Ba	Be	Ce	Ga	Ge	La	Mo	Nb	Nd	Ni	Sc	Sr	V	Y	Yb	Zr
D196189	500	3,000	--	--	30	--	70	7	--	--	30	15	2,000	100	50	5	150
D196190	700	3,000	3	--	30	--	70	7	--	--	50	15	2,000	100	50	5	150
D196191	1,000	3,000	--	--	30	--	--	--	20	N	30	15	1,500	100	20	2	150
D196192	700	5,000	3	--	70	--	70	7	30	--	100	30	2,000	200	30	3	200
D196193	500	5,000	7	--	50	--	70	10	30	--	150	20	2,000	150	50	5	200
D196194	300	10,000	20	500	300	70	300	7	30	300	70	70	5,000	300	200	15	150
D196195	500	7,000	3	--	30	--	100	7	30	--	70	15	3,000	100	50	5	300
D197320	1,500	3,000	3	--	30	--	--	50	--	--	30	15	1,500	100	30	2	150

Table 4.--Major, minor, and trace-element composition of eight coal samples from the Wyodak beds, Tongue River Member, Fort Union Formation, Converse and Campbell Counties, Wyoming.

[<, less than; --, not detected; N, not determined]

Sample No.	A. Values calculated from analysis of ash														B. Direct determinations on air-dried (32°C) coal (ppm)									
	(Percent)								(Ppm)															
	Si	Al	Ca	Mg	Na	K	Fe	Ti	Cu	Li	Mn	P	Pb	Zn	As	Co	Cr	F	Hg	Sb	Se	Th	U	
D196189	1.5	0.53	1.2	0.15	0.18	0.038	0.33	0.049	7.3	2.4	86	800	3.2	15	0.6	2.0	5.4	30	0.05	0.2	0.5	1.4	<0.2	
D196190	.85	.39	.96	.17	.053	.025	.23	.033	5.4	.9	12	530	2.1	13	.8	1.8	2.7	30	.09	.2	.6	.8	<.2	
D196191	.57	.30	.87	.20	.030	.013	.15	.043	8.0	1.2	8.7	<220	1.8	5.8	.3	.7	1.7	30	.05	.1	<.1	.6	<.2	
D196192	1.7	.76	.85	.21	.035	.064	.18	.071	12	2.5	9.8	740	3.0	36	.6	3.6	6.2	60	.06	.3	.5	1.9	.3	
D196193	1.1	.49	.66	.18	.075	.021	.13	.052	7.8	1.7	2.5	540	2.5	29	.7	3.1	2.8	40	.06	.1	.4	1.2	<.2	
D196194	1.6	.76	.84	.17	.075	.021	.15	.086	5.1	1.3	2.9	3,100	7.6	5.5	.5	5.3	12	105	.02	1.0	.2	1.4	.4	
D196195	.84	.41	.76	.17	.076	.009	.14	.044	5.4	1.3	4.5	980	2.8	28	.5	1.4	2.4	50	.04	.2	<.1	1.2	<.2	
D197320	1.04	.53	1.08	.21	.014	.036	.16	.041	6.5	1.0	7.9	940	3.0	14	.6	1.1	2.7	50	.05	<.1	2.9	1.9	1.0	
	C. Values calculated from analysis (ppm) of ash by emission spectrography																							
	B	Ba	Be	Ce	Ga	Ge	La	Mo	Nb	Nd	Ni	Sc	Sr	V	Y	Yb	Zr							
D196189	50	300	--	--	3	--	7	0.7	--	--	3	1.5	200	10	5	0.5	15							
D196190	50	200	0.2	--	2	--	5	.5	--	--	3	1	150	7	3	.3	10							
D196191	50	150	--	--	1.5	--	--	--	1	N	1.5	.7	70	5	1	.1	7							
D196192	70	500	.2	--	7	--	7	.7	2	--	10	2	150	15	2	.2	15							
D196193	30	300	.5	--	3	--	5	.7	2	--	10	1.5	150	10	3	.3	15							
D196194	20	1,000	1.5	50	20	7	20	.7	2	20	7	7	500	20	15	1.5	15							
D196195	30	500	.15	--	1.5	--	5	.5	1.5	--	5	1	150	5	3	.3	15							
D197320	100	200	.2	--	2	--	--	3	--	N	2	1	100	7	2	.15	10							

Table 5.--Elements looked for, but not detected, in coal samples from the Wyodak beds, Converse and Campbell Counties, Wyoming.

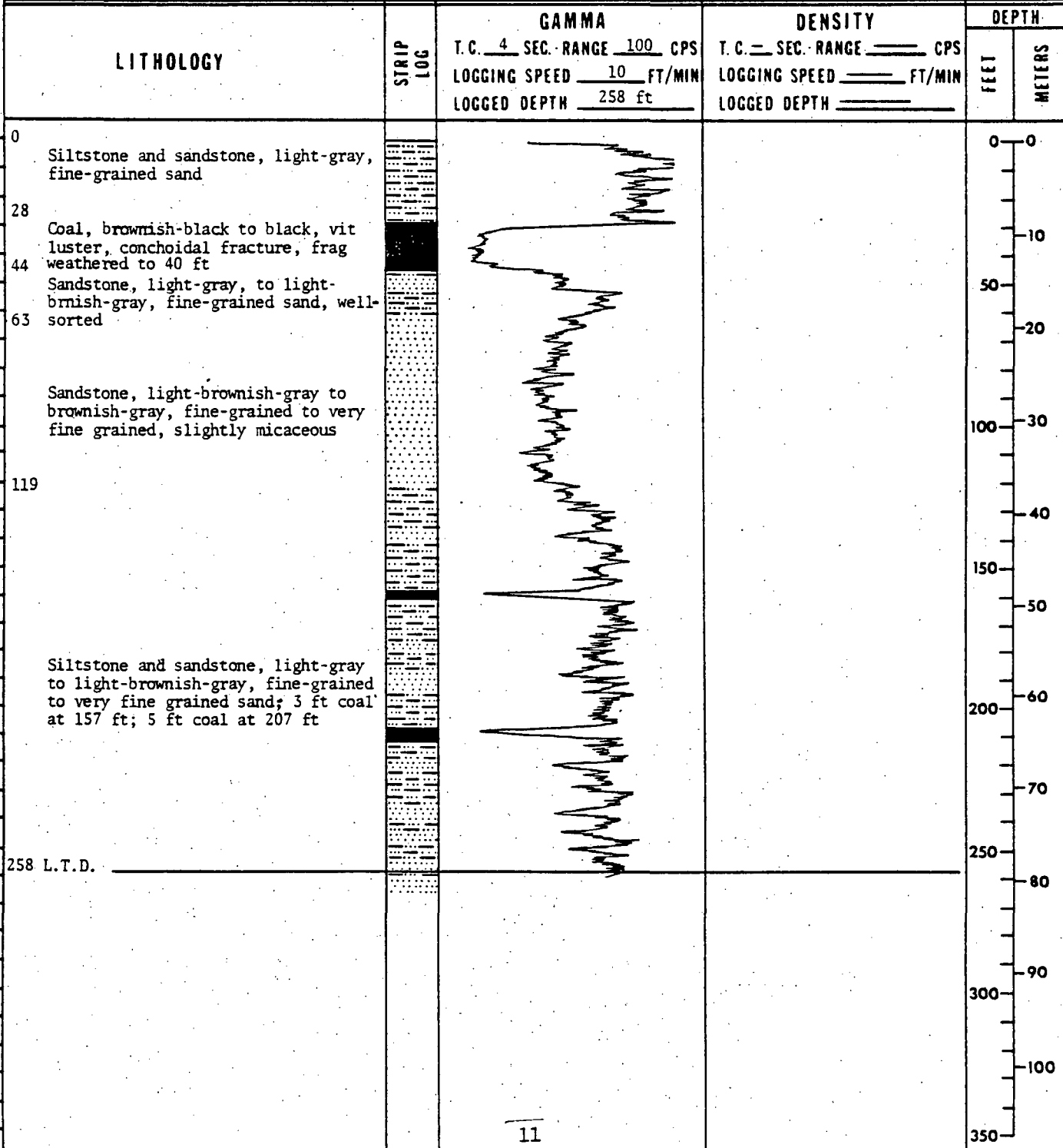
[Approximate lower detection limits in coal ash, as determined by the six-step spectrographic method of the U.S. Geological Survey, are included for all elements except Cd. The reported Cd lower detection limit is for the atomic absorption spectroscopic method]

Element	Lower limit of detection in coal ash (ppm)	Element	Lower limit of detection in coal ash (ppm)
Ag-----	1	Pd-----	5
Au-----	50	Pr-----	200
Bi-----	20	Pt-----	100
Cd-----	1	Re-----	100
Ce-----	500	Sm-----	200
Dy-----	100	Sn-----	20
Er-----	100	Ta-----	1,000
Eu-----	200	Tb-----	700
Gd-----	100	Te-----	5,000
Hf-----	200	Tl-----	100
Ho-----	50	Tm-----	50
In-----	20	W-----	200
Lu-----	70		

UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77001
SHEET 1 OF 2

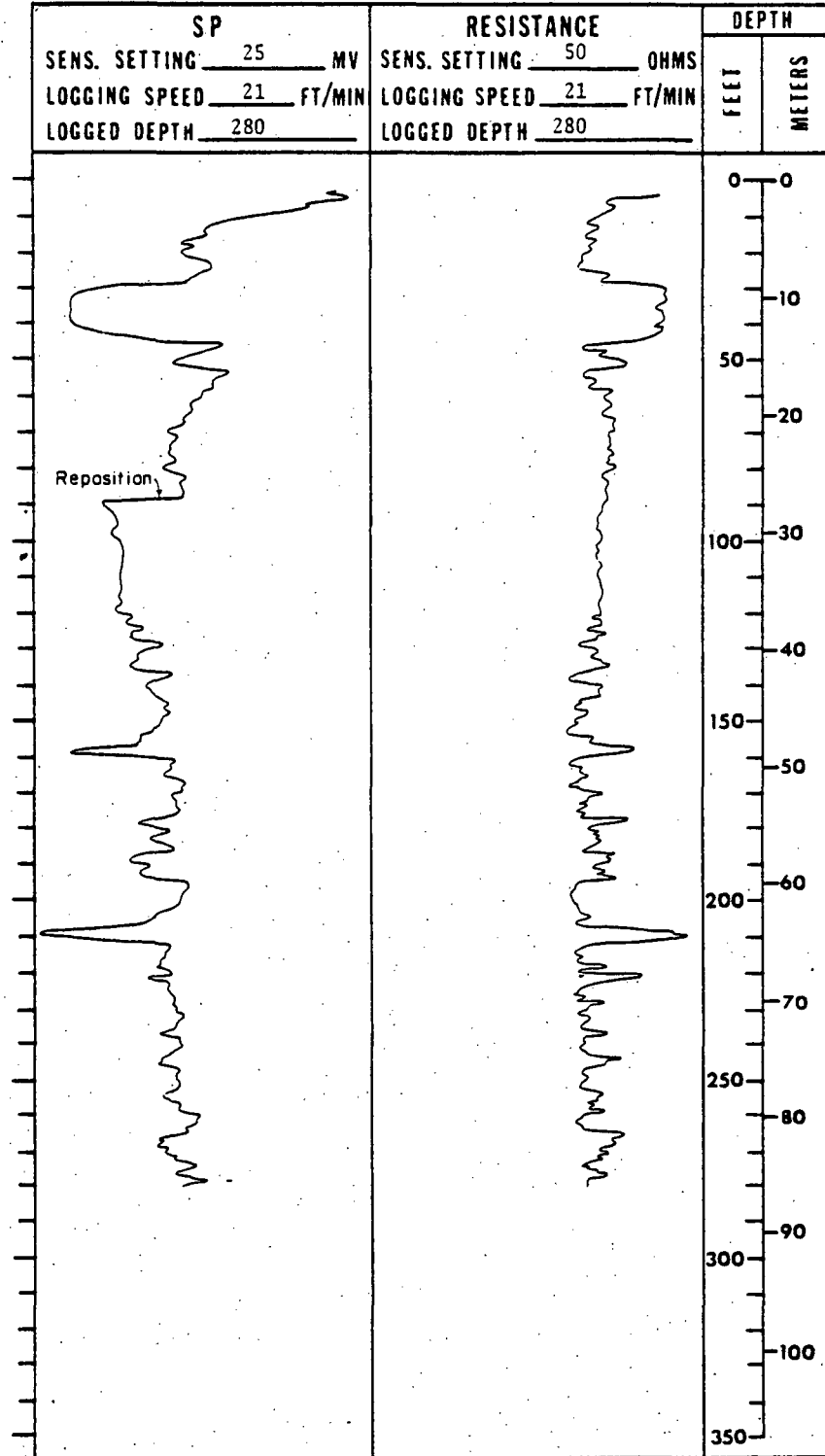
AREA <u>Southern Powder River Basin</u>		QUAD NAME <u>Berry Reservoir</u>	
DATE STARTED <u>8/16/77</u>	DATE COMP. <u>8/16/77</u>	COUNTY <u>Converse</u>	STATE <u>Wyoming</u>
LOCATION: SEC. <u>23 T. 40N R. 71W</u>		FOOTAGE LOC. <u>1600 FNL</u>	<u>550 FWL</u>
SIZE AND BIT TYPE: <u>4 3/4 Drag</u>		FOOTAGE ROTARY <u>280</u>	CORING <u>0</u>
DRILLING AGENCY: <u>U.S. Geological Survey</u>		DRILL TYPE: <u>Portadrill 524</u>	TOTAL DEPTH <u>280</u>
LITHOLOGY RECORDED BY <u>Hollomon, Coppock, Kistner</u>		GEOPHYSICAL LOGS RECORDED BY <u>F.B. Kistner & G.A. Hollomon</u>	
REMARKS: <u>2-inch observation well installed to 105 ft on 8/17/77</u>			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77001
SHEET 2 OF 2

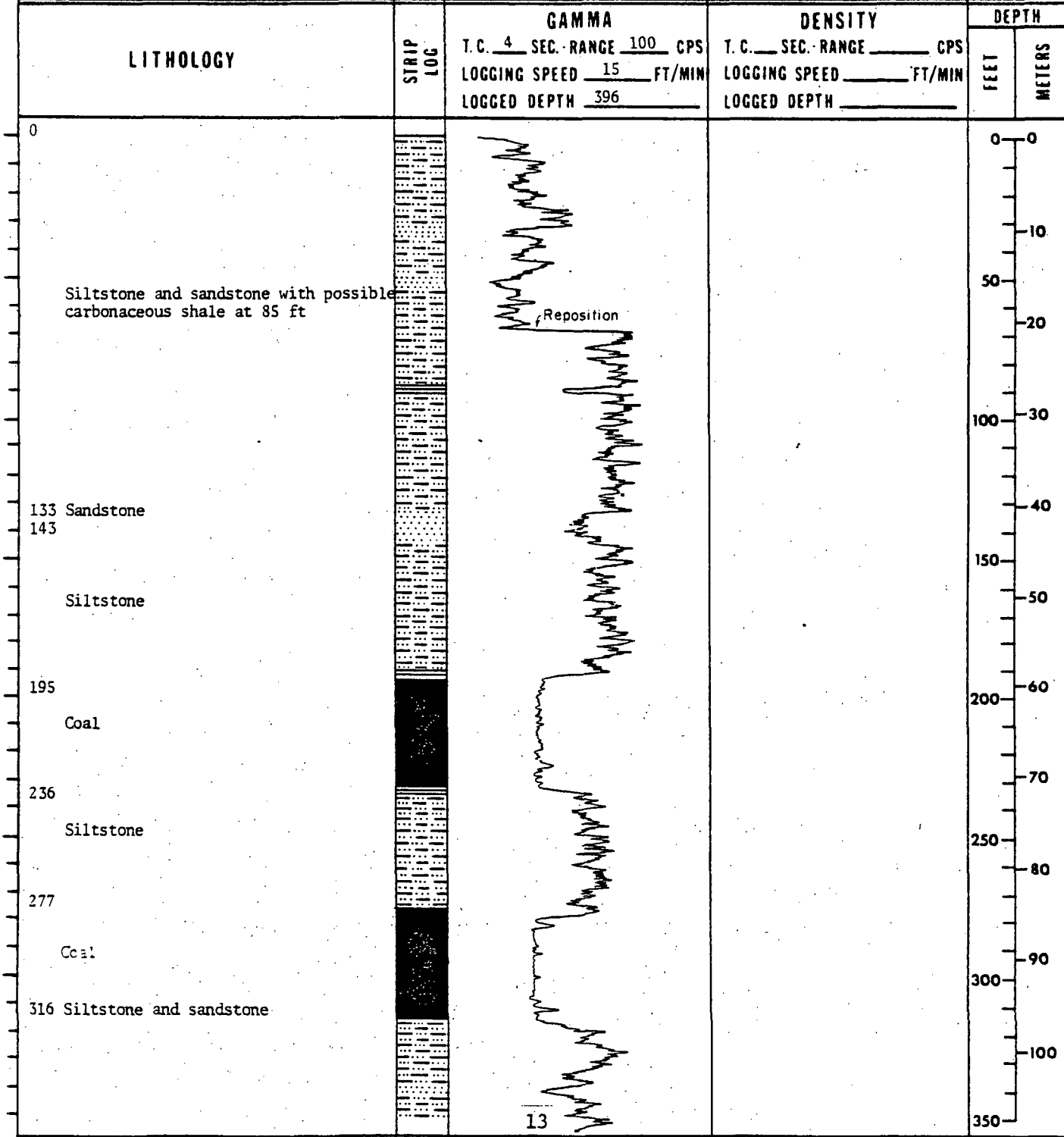
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77002
SHEET 1 OF 3



AREA Southern Powder River Basin		QUAD NAME Betty Reservoir NE	
DATE STARTED 8/31/77	DATE COMP. 8/31/77	COUNTY Campbell	STATE Wyoming
LOCATION: SEC. 25 T. 41N, R. 71W		FOOTAGE LOC. 1980 1980	FEL 1200
SIZE AND BIT TYPE: 4 3/4 Drag		GROUND ELEV 4730	
		TOTAL DEPTH 396	
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY Kistner, Hollomon, Riglin	
REMARKS:			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77002
SHEET 2 OF 3

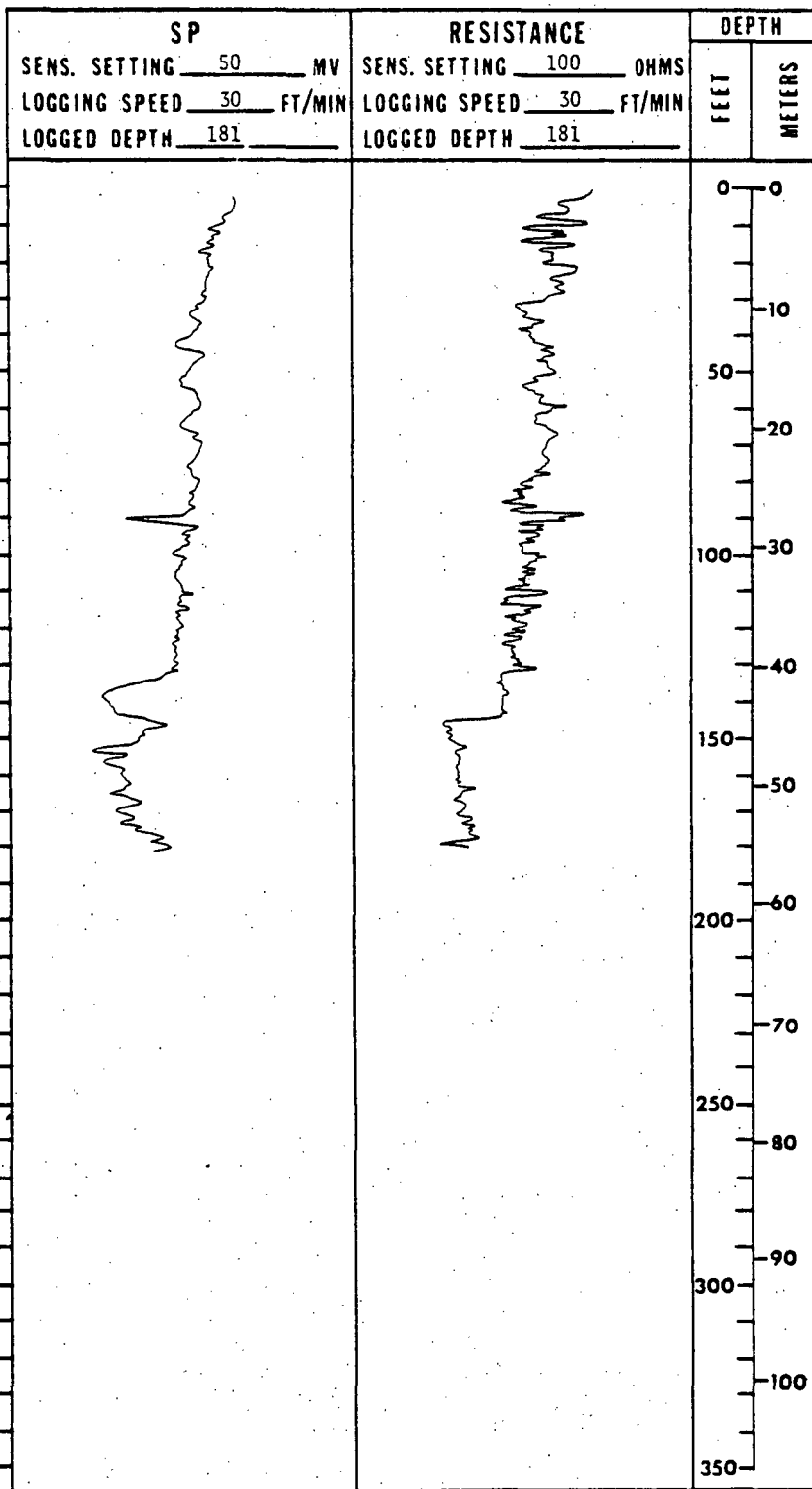
REMARKS:

LITHOLOGY	STRIP LOG	GAMMA	DENSITY	DEPTH	
		T.C. <u>4</u> SEC. RANGE <u>100</u> CPS LOGGING SPEED <u>15</u> FT/MIN LOGGED DEPTH <u>396</u>	T.C. _____ SEC. RANGE _____ CPS LOGGING SPEED _____ FT/MIN LOGGED DEPTH _____	FEET	METERS
Siltstone and sandstone 396 L.T.D.				350 110 120 400 130 450 140 500 150 550 160 600 170 650 180 700 190 750 200 210 220	

UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77002
SHEET 3 OF 3

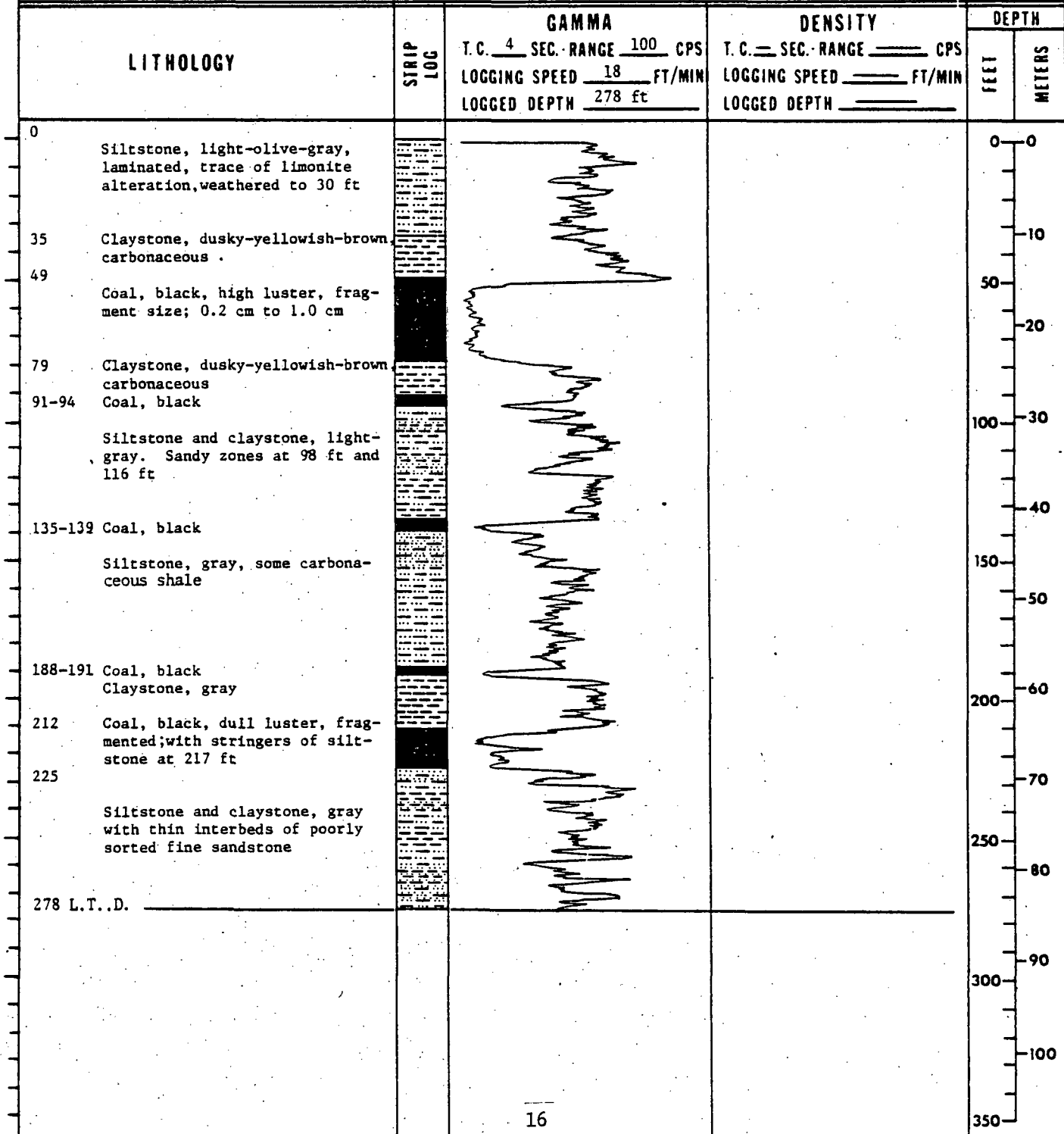
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77003
SHEET 1 OF 2

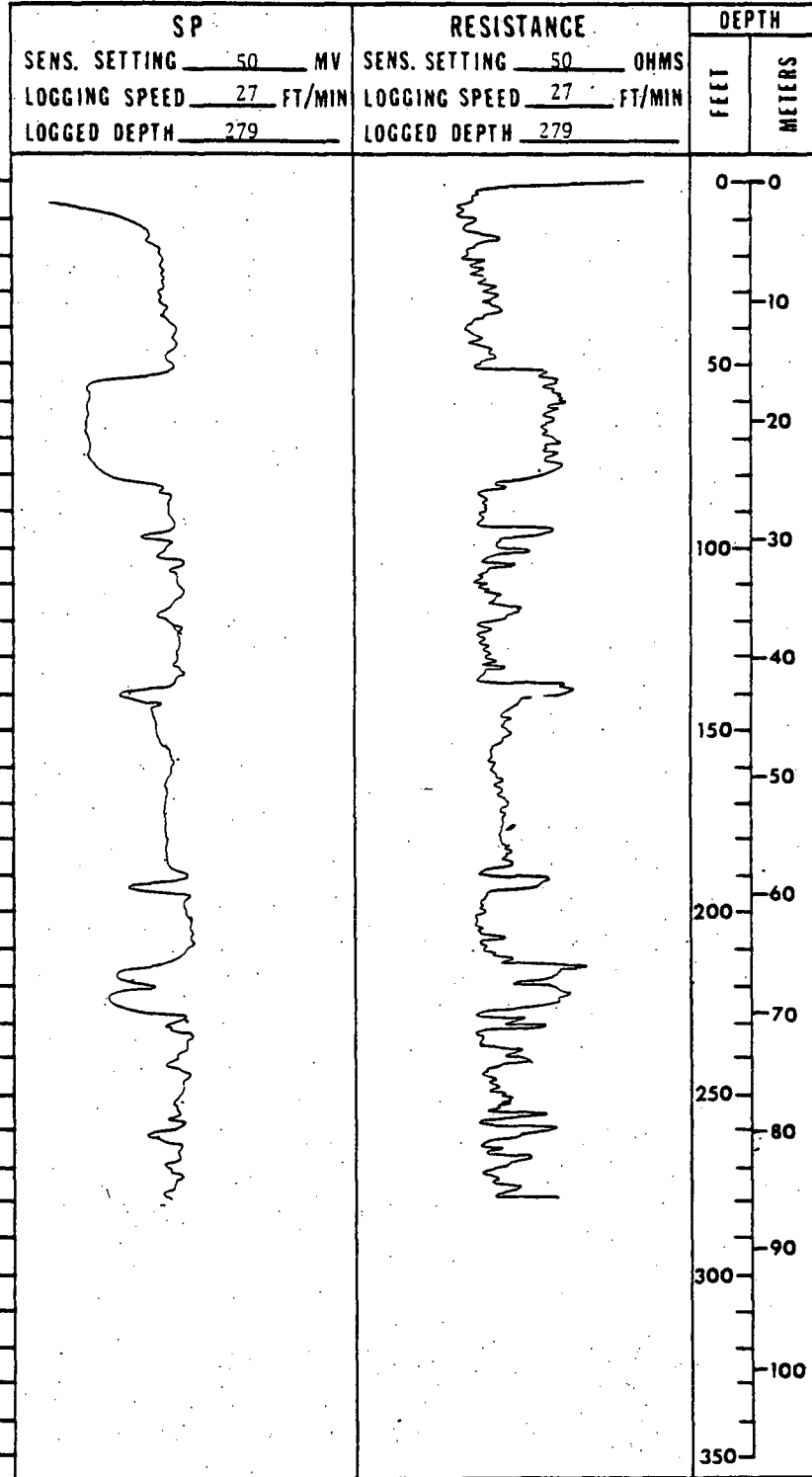
AREA Southern Powder River Basin		QUAD NAME Betty Reservoir	
DATE STARTED 9/1/77	DATE COMP. 9/1/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 18 T. 40N, R. 70W, FOOTAGE LOC.		1450	50
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE ROTARY 280 CORING 0	GROUND ELEV 4845 TOTAL DEPTH 280
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY G.A. Hollomon	
REMARKS:			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77003
SHEET 2 OF 2

REMARKS:

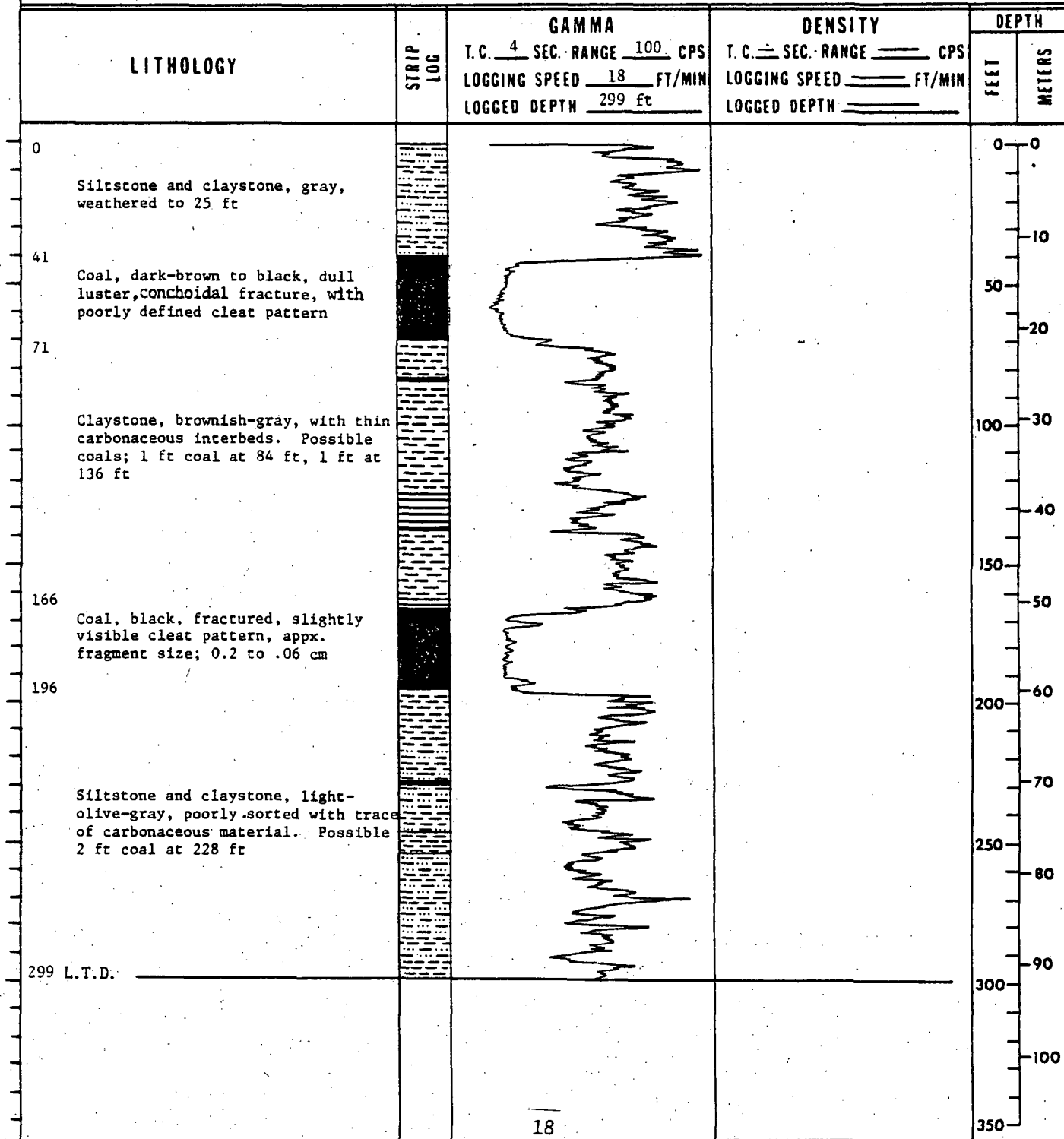


UNITED STATES GEOLOGICAL SURVEY

HOLE NO C27004
SHEET 1 OF 2

AREA Southern Powder River Basin		QUAD NAME Betty Reservoir	
DATE STARTED 9/2/77	DATE COMP. 9/3/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 5 T. 40N R. 70W		FOOTAGE LOC. 1250 XXX FSL 500 XXX FWL	GROUND ELEV 4730
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE ROTARY 300 CORING 0	TOTAL DEPTH 300
DRILLING AGENCY: US Geological Survey		DRILL TYPE: Portadrill 524	DEPTH TO WATER 40 ft
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY L. Riglin	

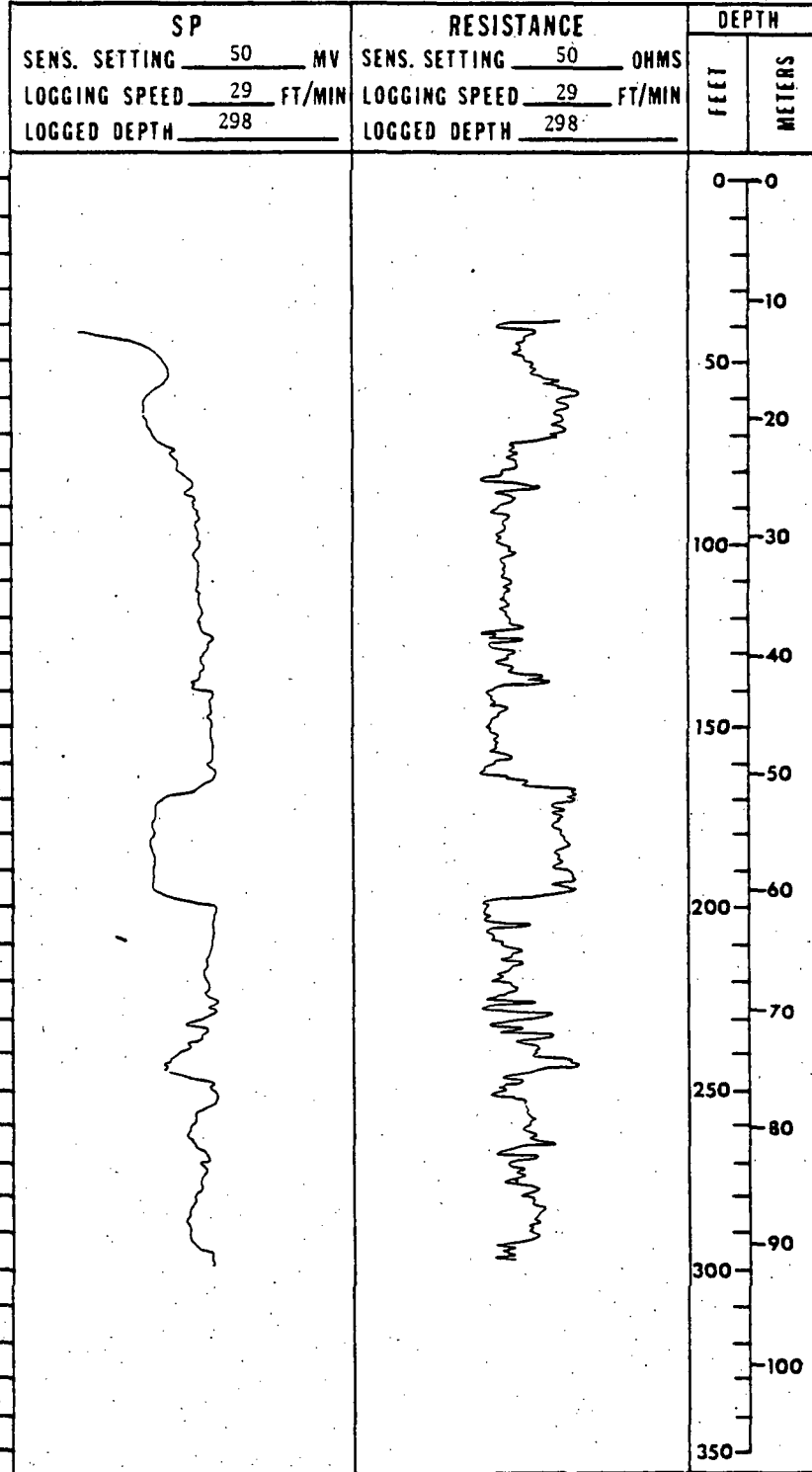
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77004
SHEET 2 OF 2

REMARKS

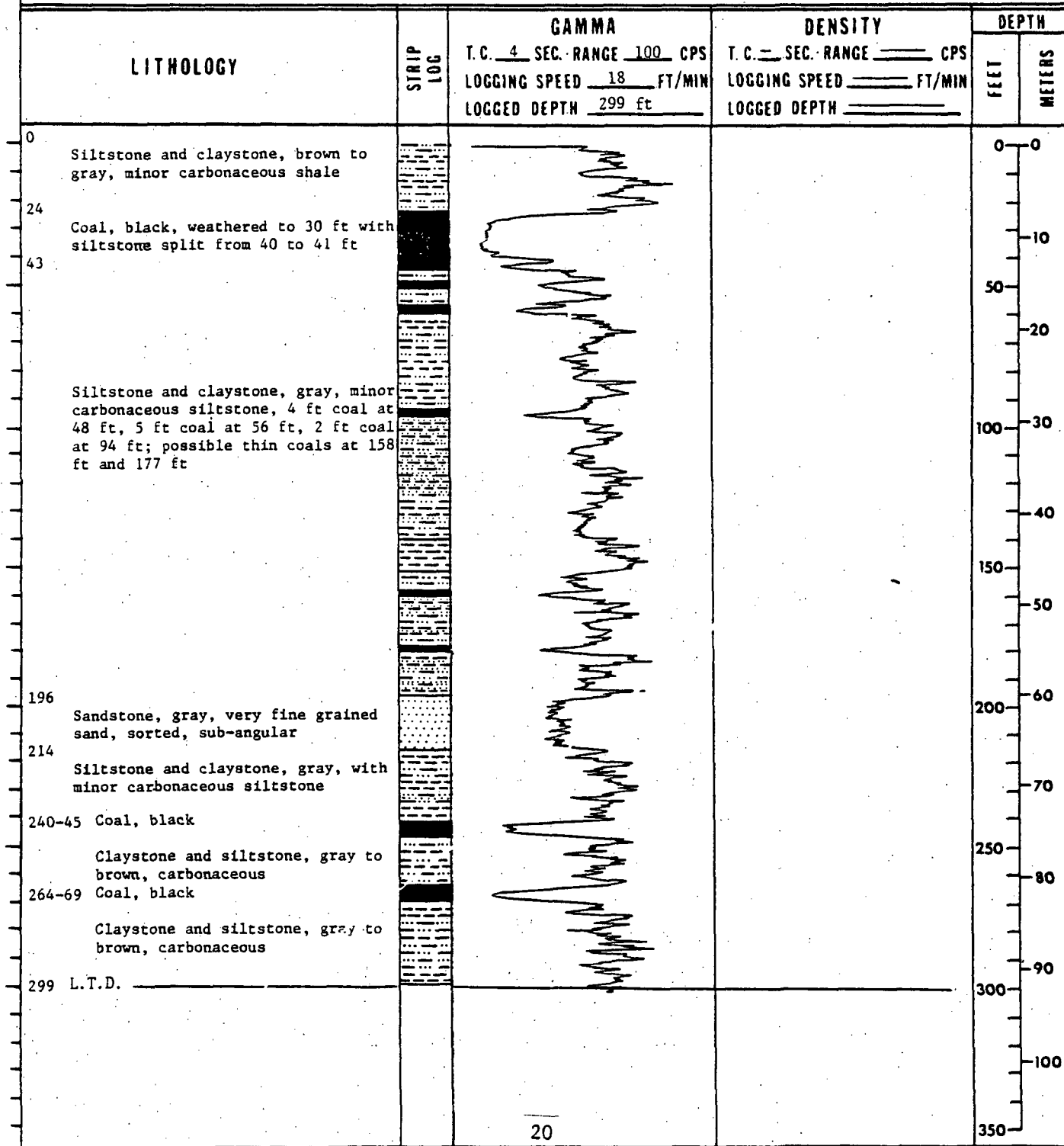


UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77005
SHEET 1 OF 2

AREA Southern Powder River Basin		QUAD NAME Betty Reservoir	
DATE STARTED 9/4/77	DATE COMP. 9/4/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 30 T. 40N, R. 70W		FOOTAGE LOC. 2600	FNL 300 FEL
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE ROTARY 300 CORING 0	GROUND ELEV 4925
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	TOTAL DEPTH 300
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY G. A. Hollomon	

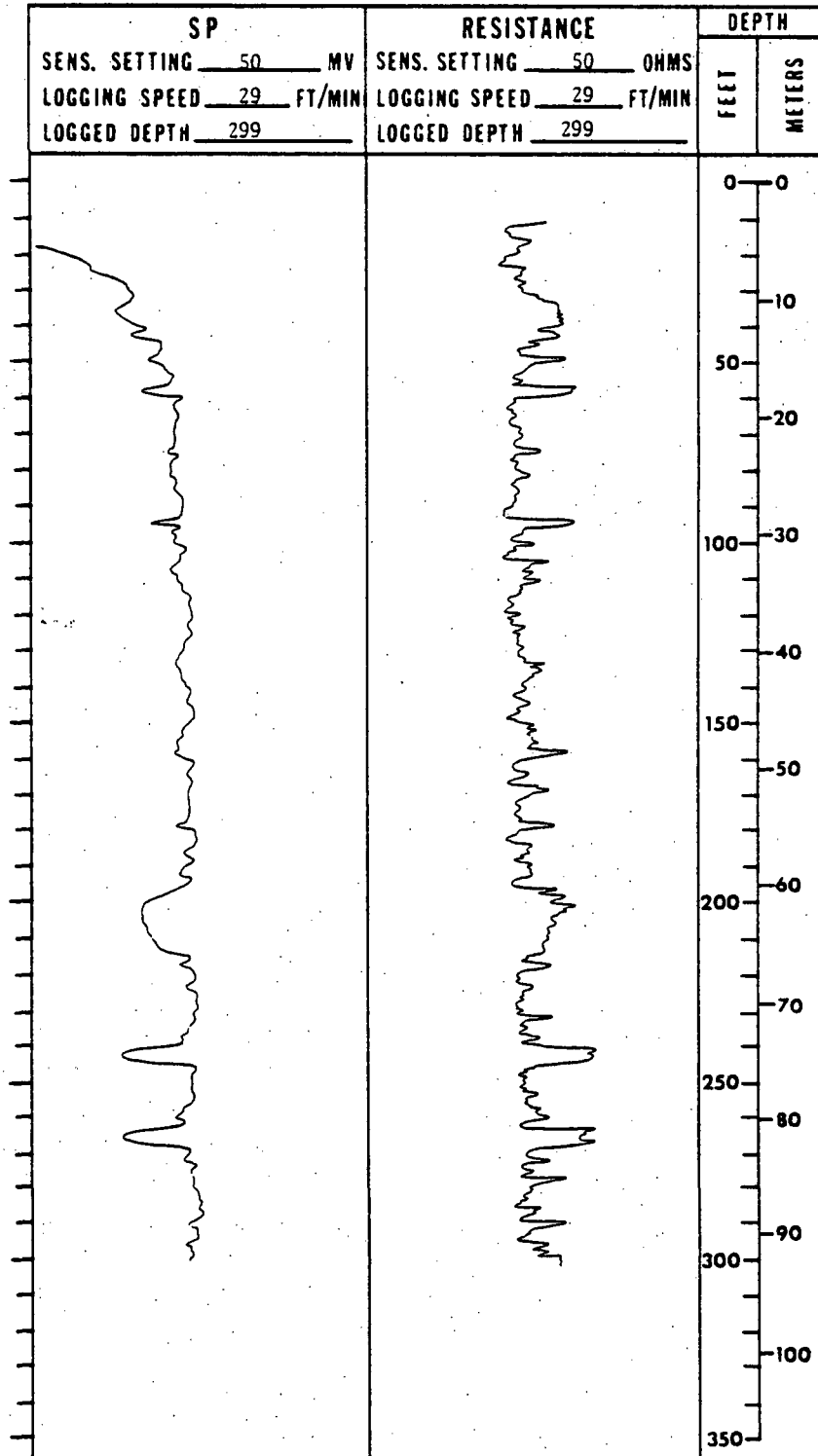
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77005
SHEET 2 OF 2

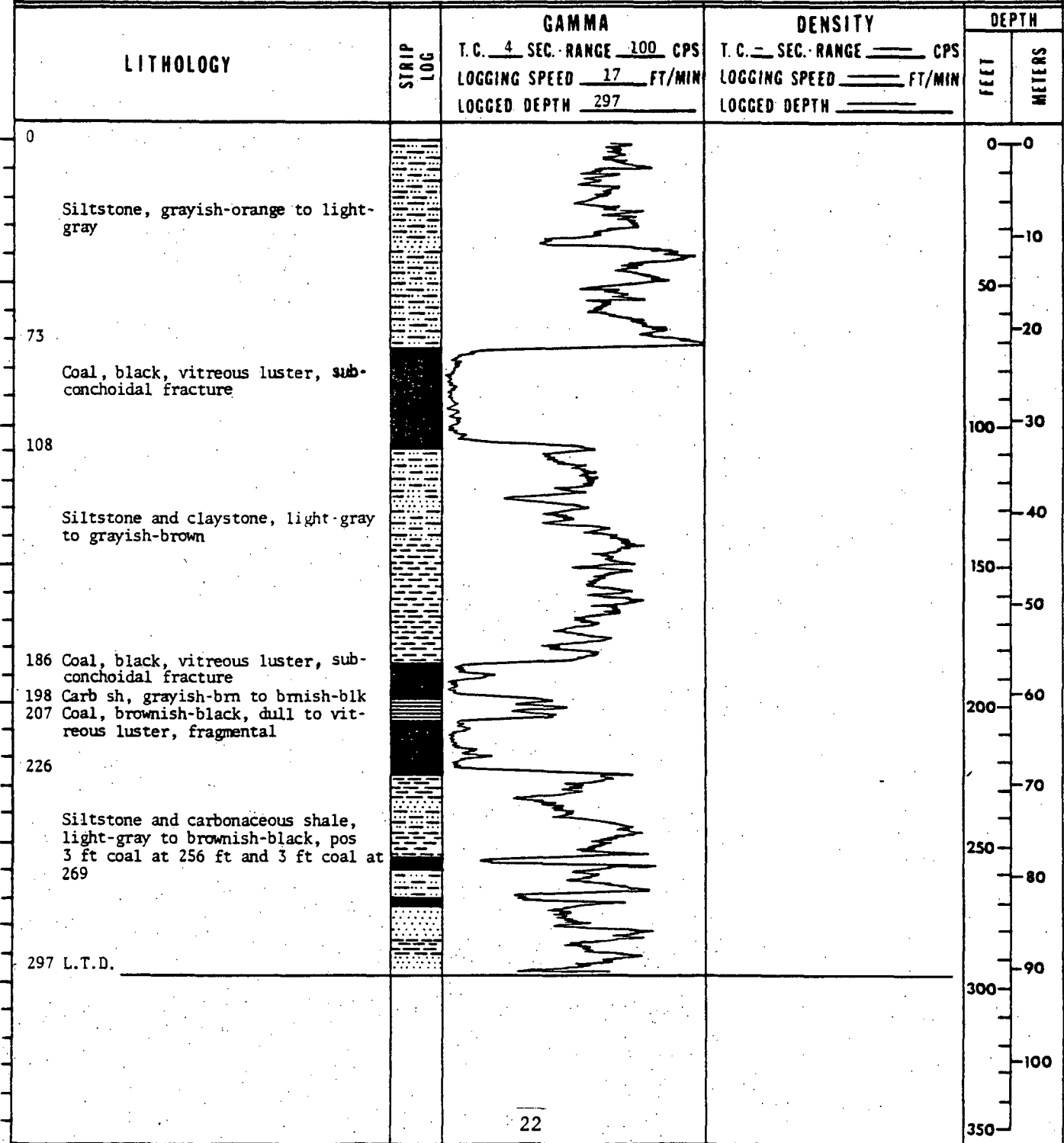
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77006
SHEET 1 OF 2

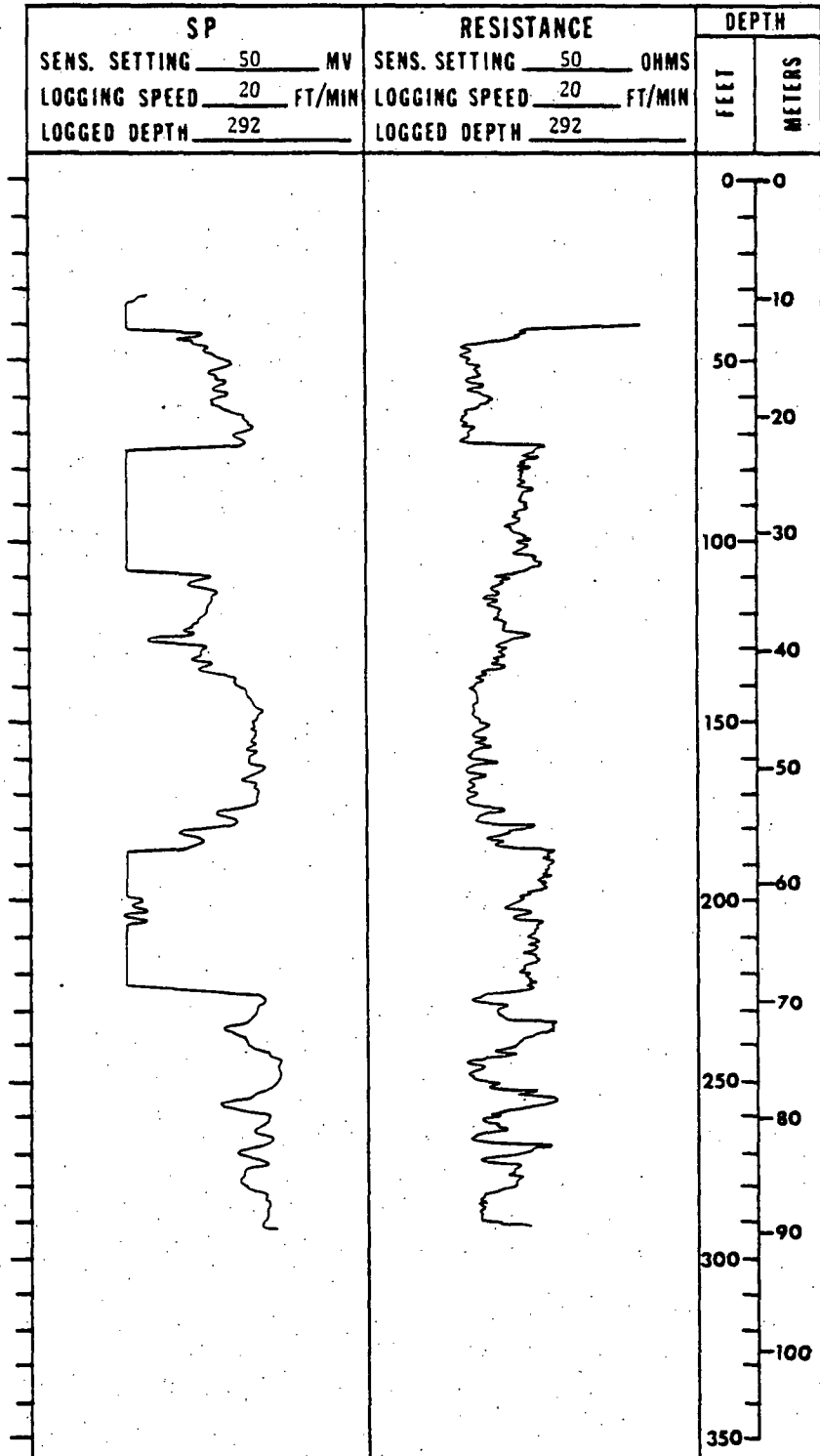
AREA Southern Powder River Basin		QUAD NAME Betty Reservoir	
DATE STARTED 9/5/77	DATE COMP. 9/5/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 2 T. 40N, R. 71W		FOOTAGE LOC. 1000	FML ### 950 FEL ###
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE	GROUND ELEV 4650
		ROTARY 223	CORING 77
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	TOTAL DEPTH 300
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		DEPTH TO WATER 41 ft	
GEOPHYSICAL LOGS RECORDED BY L. Riglin			
REMARKS:			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77006
SHEET 2 OF 2

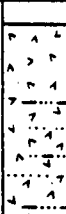
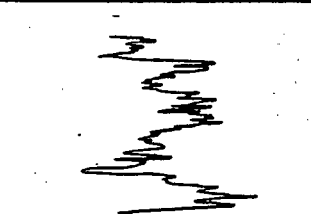

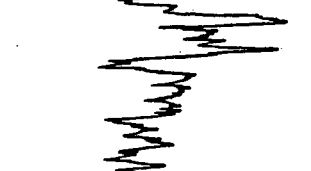
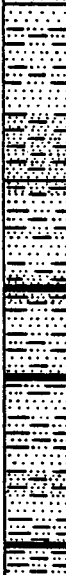



REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO **CD77007**
SHEET 1 OF 2

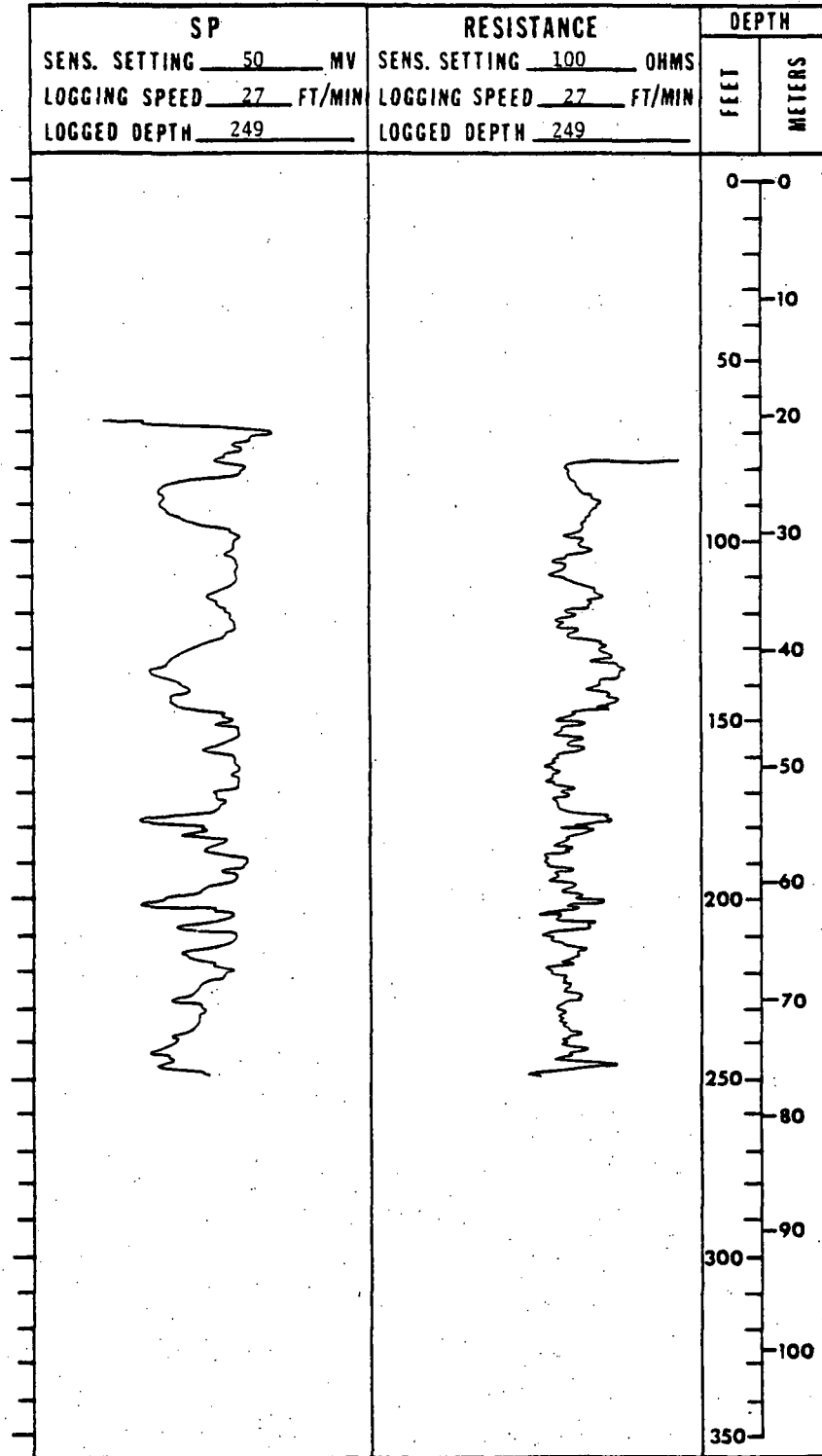
AREA Southern Powder River Basin		QUAD NAME Coal Bank Draw	
DATE STARTED 9/6/77	DATE COMP. 9/7/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 2 T. 40N, R. 70W, FOOTAGE LOC.		650 FSL 450 FWL	GROUND ELEV 4825
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE	
		ROTARY 260	CORING 0
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	DEPTH TO WATER 78 ft
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY L.D. Riglin	
REMARKS: Lost circulation at 120 ft			

LITHOLOGY	STRIP LOG	GAMMA	DENSITY	DEPTH	
		T.C. <u>4</u> SEC. RANGE <u>100</u> CPS LOGGING SPEED <u>17</u> FT/MIN LOGGED DEPTH <u>255</u>	T.C. <u> </u> SEC. RANGE <u> </u> CPS LOGGING SPEED <u> </u> FT/MIN LOGGED DEPTH <u> </u>	FEET	METERS
<p>0</p> <p>Clinker, red to light-grays and blues, fine sandstone to siltstone, poorly sorted, sub-angular to angular prtcls, traces of chert and ash. Weathered to 30 ft</p>				0	0
<p>97</p> <p>Sandstone and siltstone, light-gray, siltstones with traces of carbonaceous material at 104 ft and 120 ft</p>				100	30
<p>146</p> <p>Sandstone and siltstone with possible coals at these intervals, 2 ft at 176 ft, 2 ft at 199 ft and 1 ft at 246 ft</p>				200	60
<p>247</p> <p>255 L.T.D.</p>				250	75

UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77007
SHEET 2 OF 2

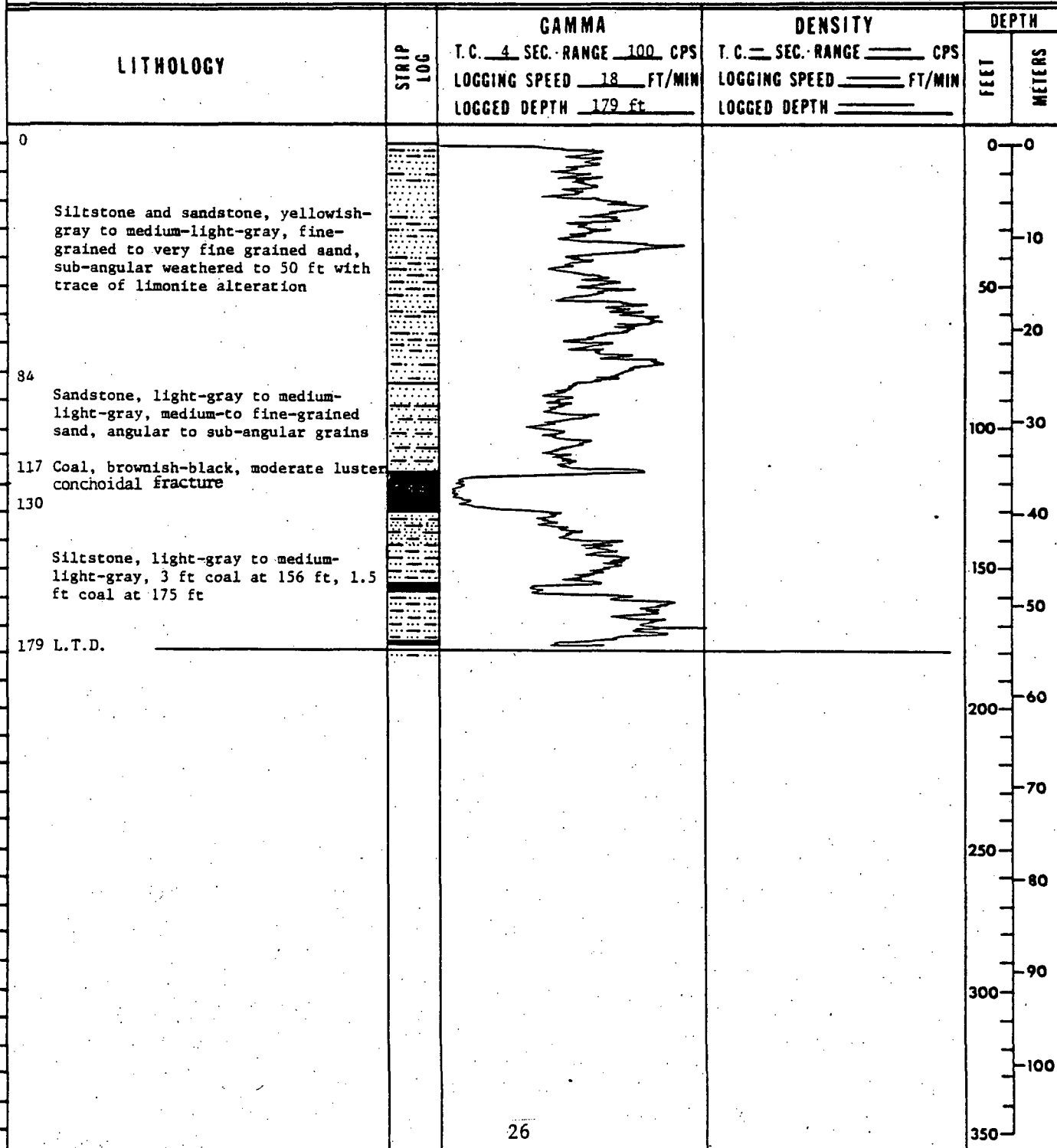
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77008
SHEET 1 OF 2

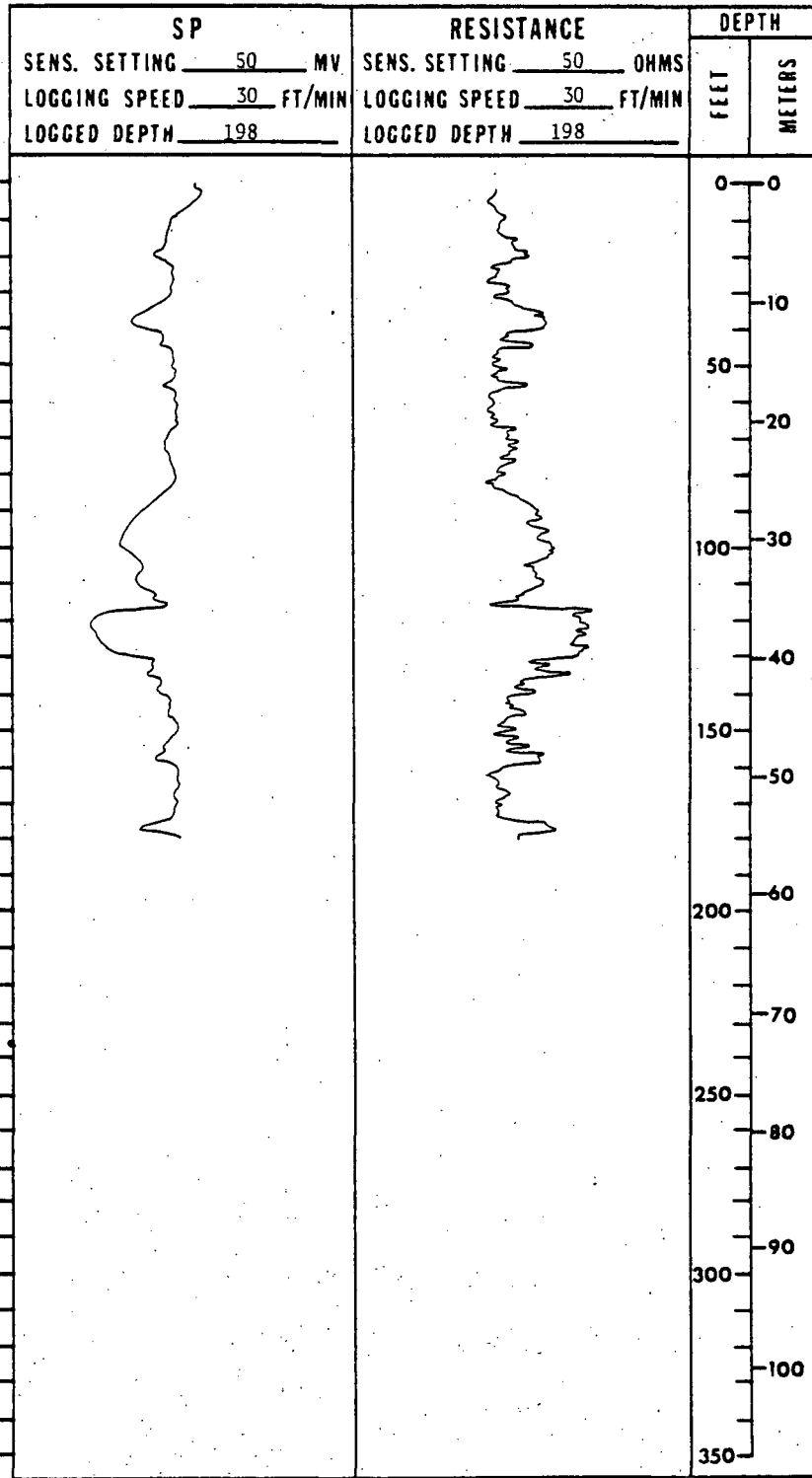
AREA Southern Powder River Basin		QUAD NAME Betty Reservoir	
DATE STARTED 9/8/77	DATE COMP. 9/8/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 3 T. 59N, R. 71W		FOOTAGE LOC. 2350	GROUND ELEV 4965
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE ROTARY 164	FOOTAGE CORING 16
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	DEPTH TO WATER LS
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY L. Riglin	
REMARKS:			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77008
SHEET 2 OF 2

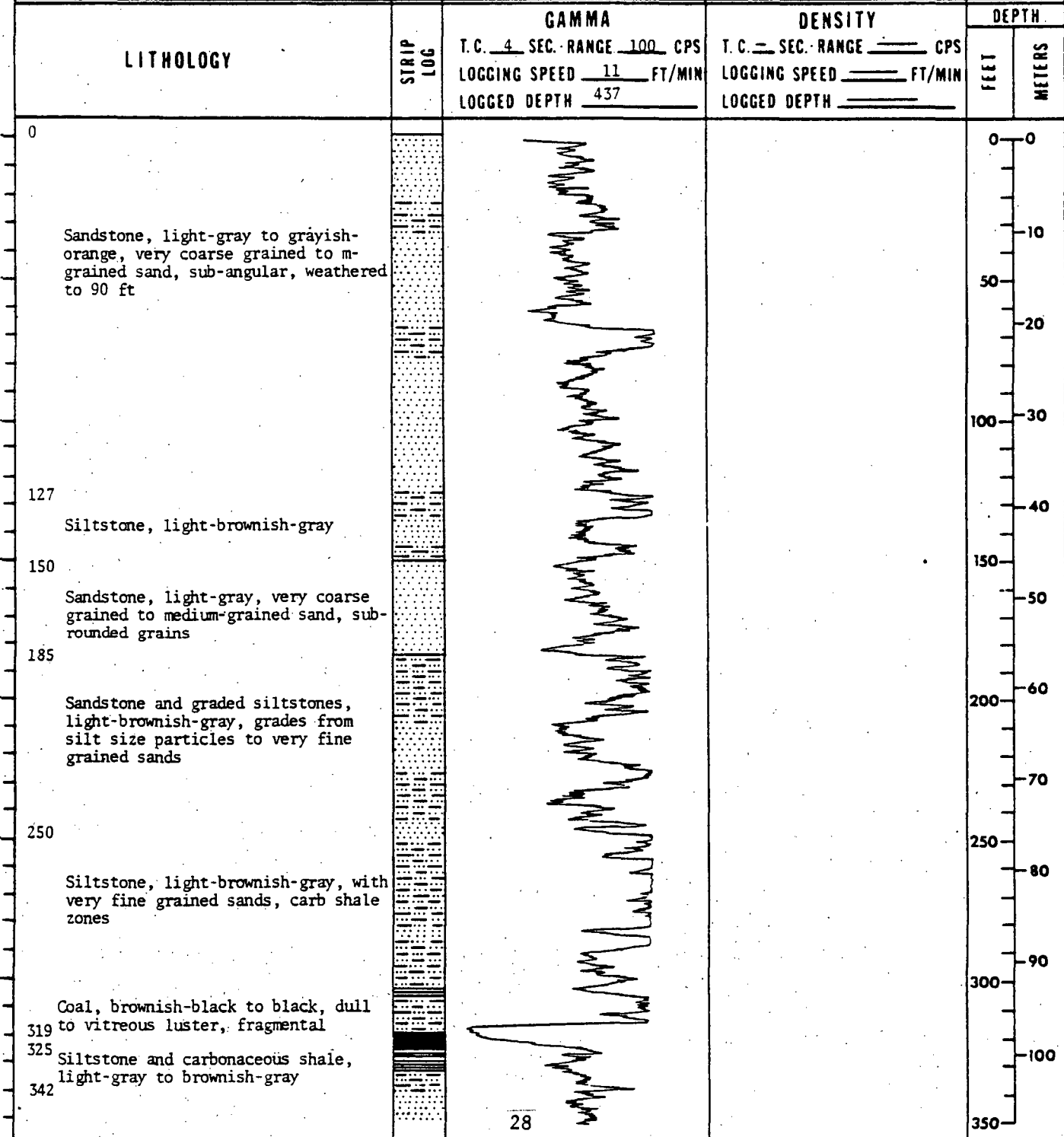
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77009
SHEET 1 OF 4


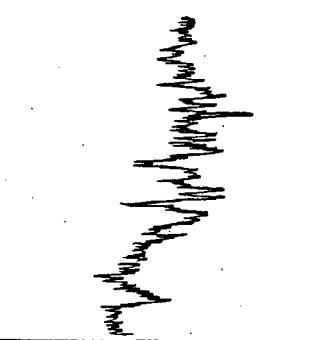
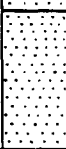
AREA <u>Southern Powder River Basin</u>		QUAD NAME <u>Coal Draw</u>	
DATE STARTED <u>9/18/77</u>	DATE COMP. <u>9/18/77</u>	COUNTY <u>Converse</u>	STATE <u>Wyoming</u>
LOCATION: SEC. <u>30</u> T. <u>40N</u> , R. <u>72W</u>		FOOTAGE LOC. <u>900</u>	FNL <u>2350</u> FEL <u>5010</u>
SIZE AND BIT TYPE: <u>4 3/4 Drag</u>		FOOTAGE ROTARY <u>440</u> CORING <u>0</u>	TOTAL DEPTH <u>440</u>
DRILLING AGENCY: <u>U.S. Geological Survey</u>		DRILL TYPE: <u>Portadrill 524</u>	DEPTH TO WATER <u>92ft</u>
LITHOLOGY RECORDED BY <u>Hollomon, Coppock, Riglin</u>		GEOPHYSICAL LOGS RECORDED BY <u>L. Riglin</u>	
REMARKS:			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77009
SHEET 2 OF 4

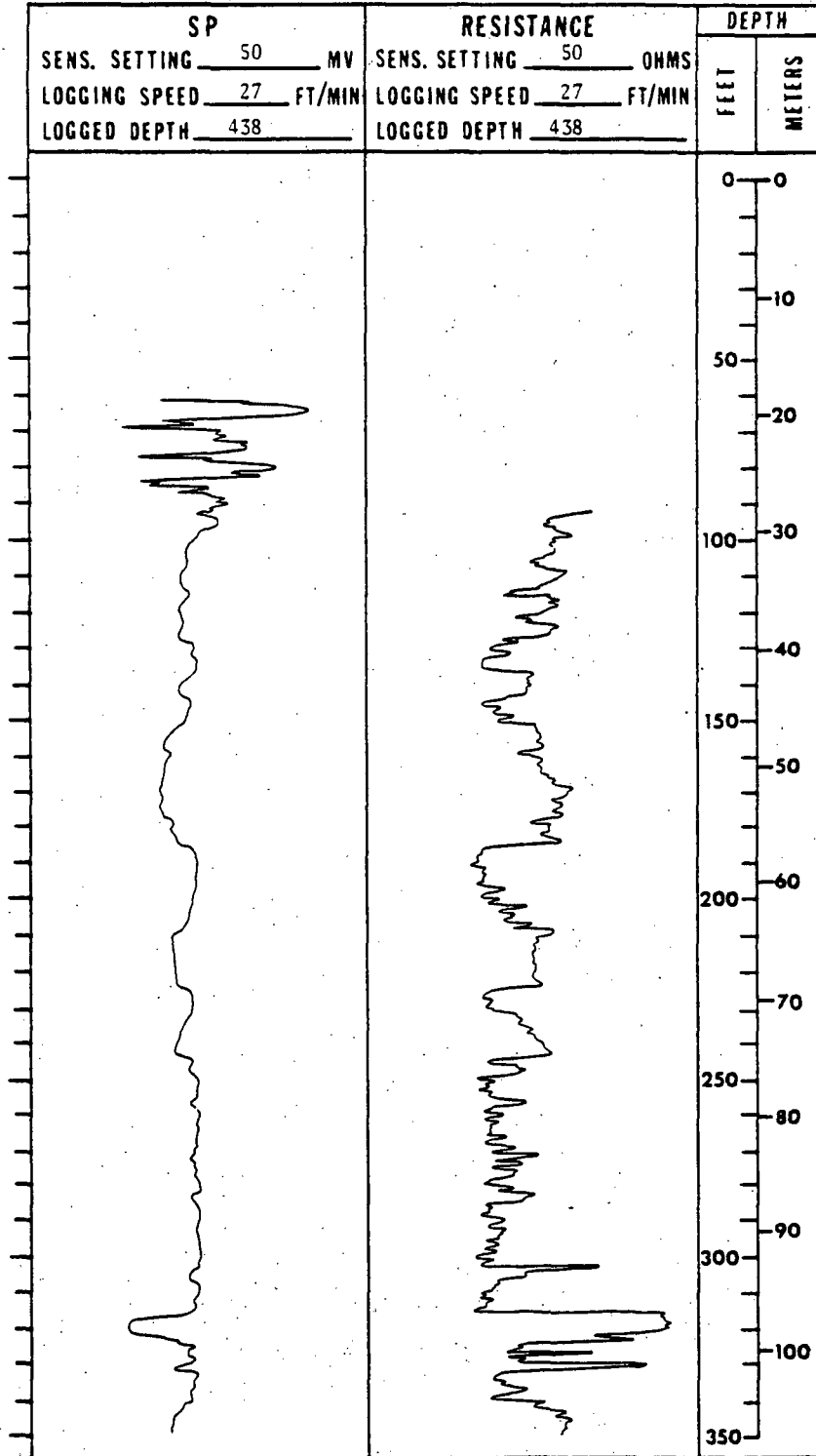
REMARKS:

LITHOLOGY	STRIP LOG	GAMMA	DENSITY	DEPTH	
		T.C. <u>4</u> SEC. RANGE <u>100</u> CPS LOGGING SPEED <u>11</u> FT/MIN LOGGED DEPTH <u>437</u>	T.C. <u> </u> SEC. RANGE <u> </u> CPS LOGGING SPEED <u> </u> FT/MIN LOGGED DEPTH <u> </u>	FEET	METERS
<p>401 Sandstone, medium-light-gray to light-brownish-gray, very coarse grained to fine-grained sand, sub-rounded grains</p>				<p>350</p> <p>110</p> <p>400</p> <p>120</p> <p>437</p> <p>130</p>	
<p>437 L.T.D. Sandstone, medium-light-gray, fine-grained to very fine grained sand</p>				<p>450</p> <p>140</p> <p>500</p> <p>150</p> <p>550</p> <p>160</p> <p>600</p> <p>170</p> <p>650</p> <p>180</p> <p>700</p> <p>190</p> <p>750</p> <p>200</p> <p>210</p> <p>220</p>	

UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77009
SHEET 3 OF 4

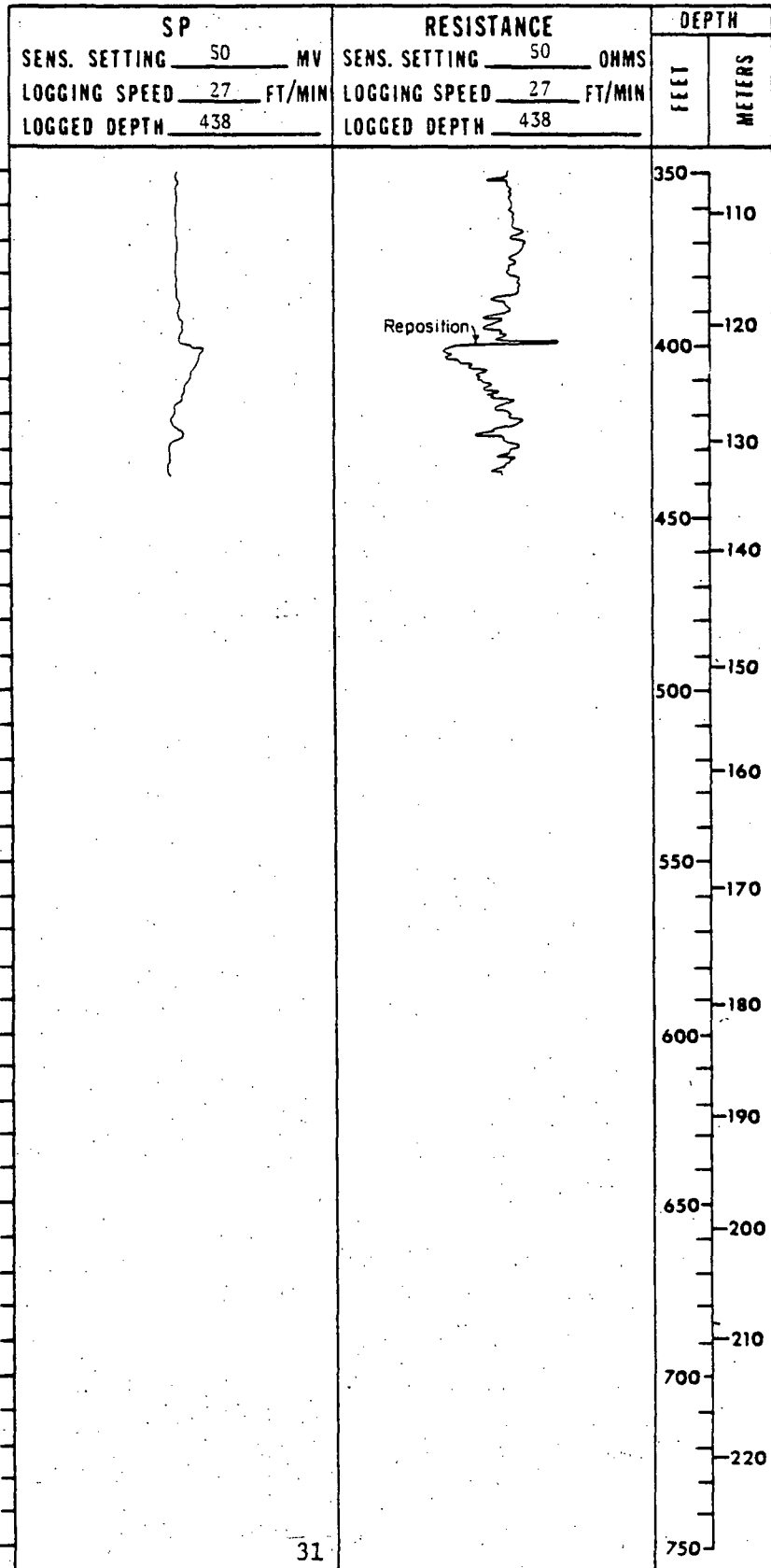
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77009
SHEET 4 OF 4

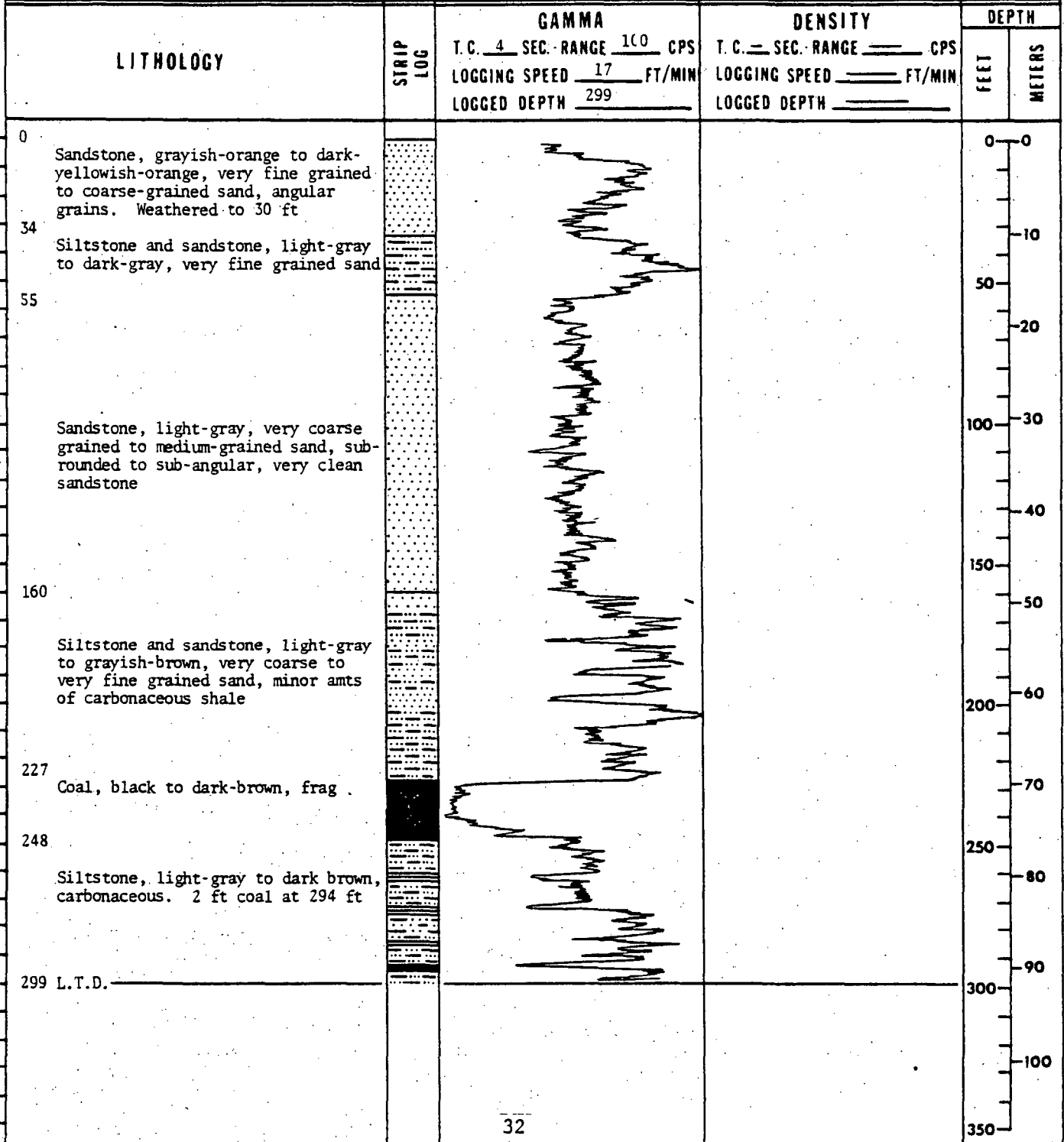
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77010
SHEET 1 OF 2

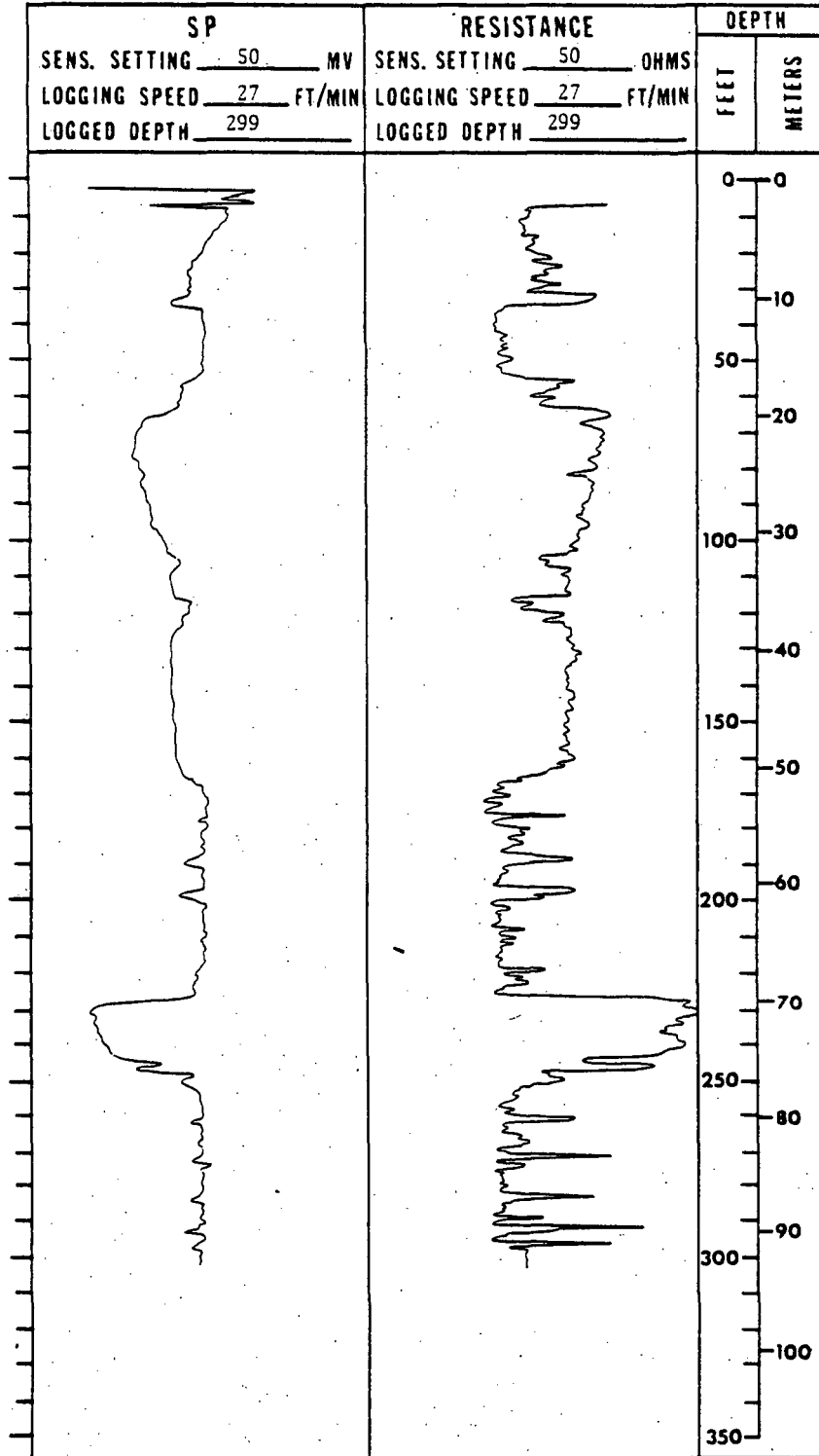
AREA <u>Southern Powder River Basin</u>		QUAD NAME <u>Coal Draw</u>	
DATE STARTED <u>9/19/77</u>	DATE COMP. <u>9/19/77</u>	COUNTY <u>Converse</u>	STATE <u>Wyoming</u>
LOCATION: SEC. <u>28</u> T. <u>40N</u> , R. <u>72W</u> , FOOTAGE LOC. <u>1500</u> FNL <u>1000</u> FEL		GROUND ELEV. <u>4825</u>	
SIZE AND BIT TYPE: <u>4 3/4 Drag</u>		FOOTAGE ROTARY <u>300</u> CORING <u>0</u>	
DRILLING AGENCY: <u>U.S. Geological Survey</u>		DRILL TYPE: <u>Portadrill 524</u>	
LITHOLOGY RECORDED BY: <u>Hollomon, Coppock, Riglin</u>		GEOPHYSICAL LOGS RECORDED BY: <u>L. Riglin</u>	
REMARKS:			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77010
SHEET 2 OF 2

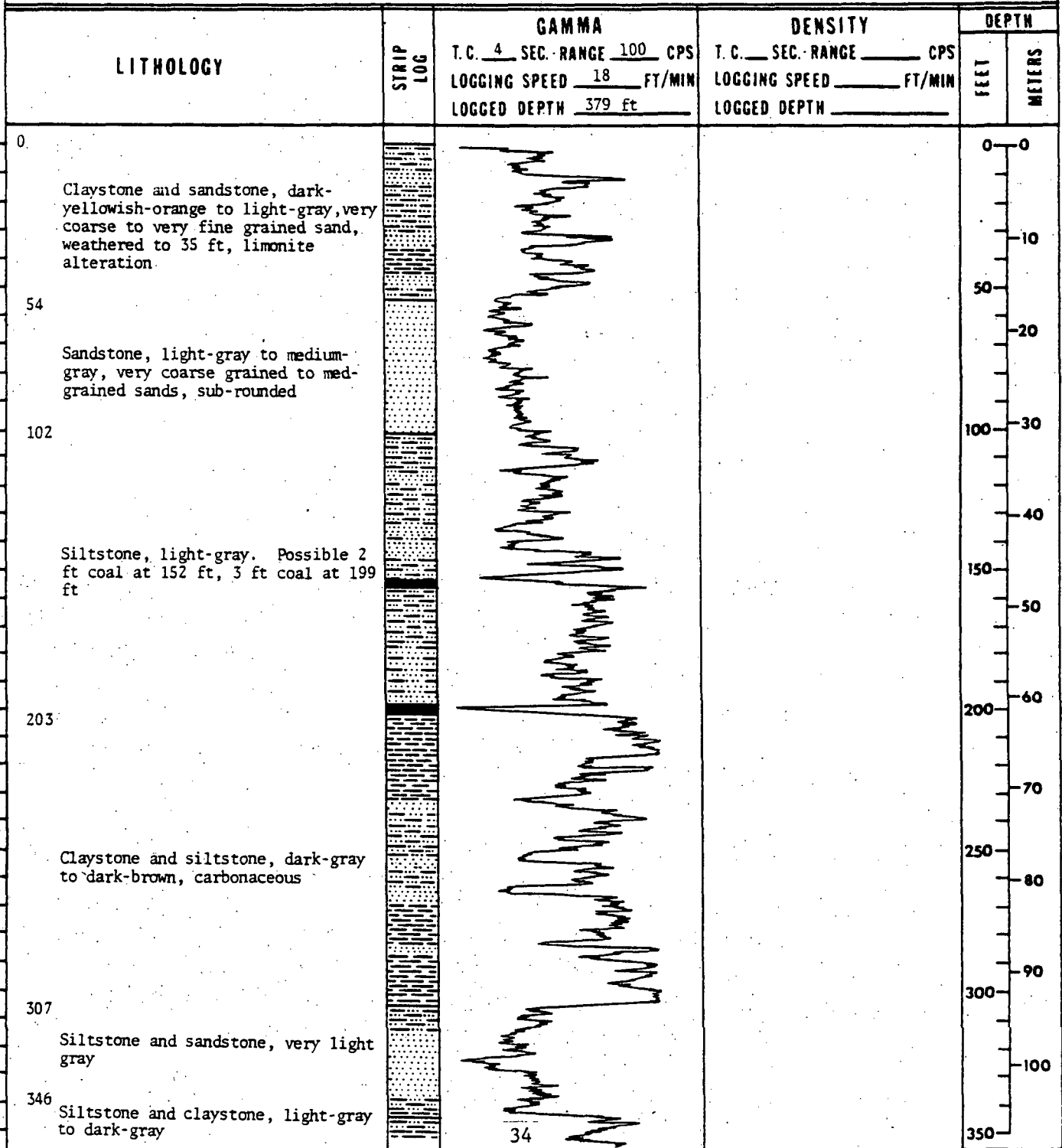
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77011
SHEET 1 OF 4

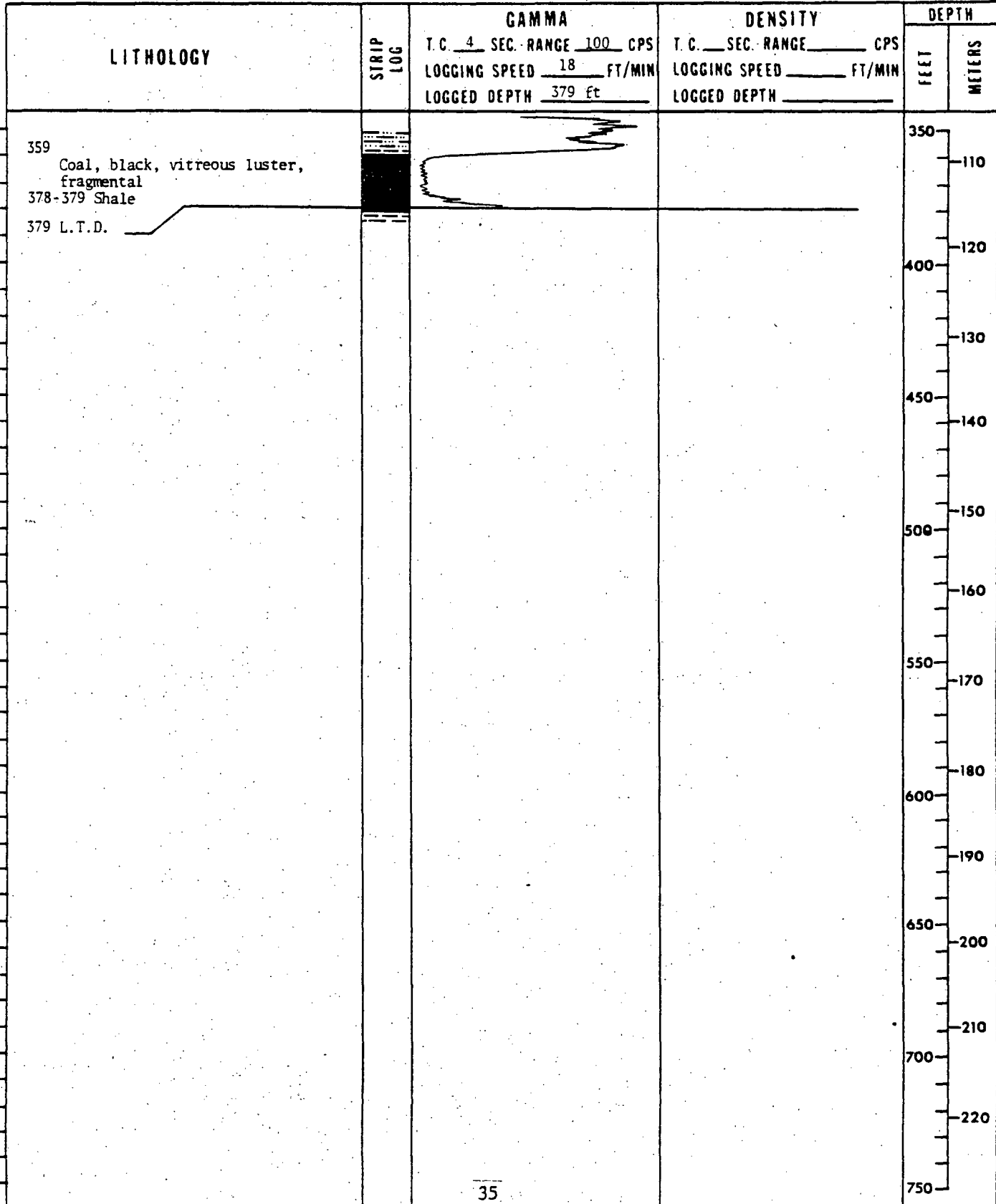
AREA Southern Powder River Basin		QUAD NAME Coal Draw	
DATE STARTED 9/20/77	DATE COMP. 9/20/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 6 T. 40N, R. 72W, FOOTAGE LOC. 700		FSL 450	FEL FSL GROUND ELEV 4890
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE	
		ROTARY 380	CORING 0
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	TOTAL DEPTH 380
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY L. Riglin	
REMARKS:			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77011
SHEET 2 OF 4

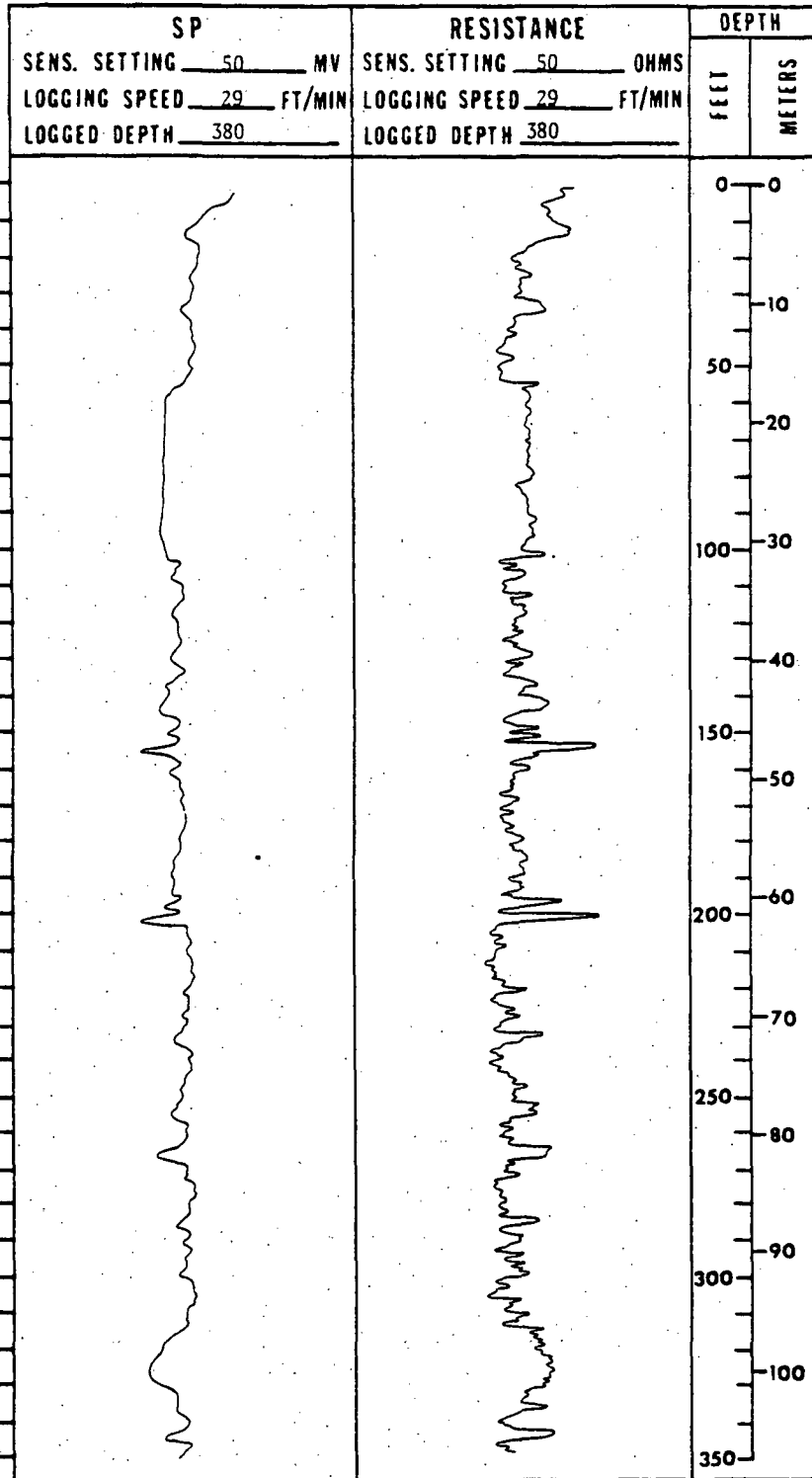
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77011
SHEET 3 OF 4

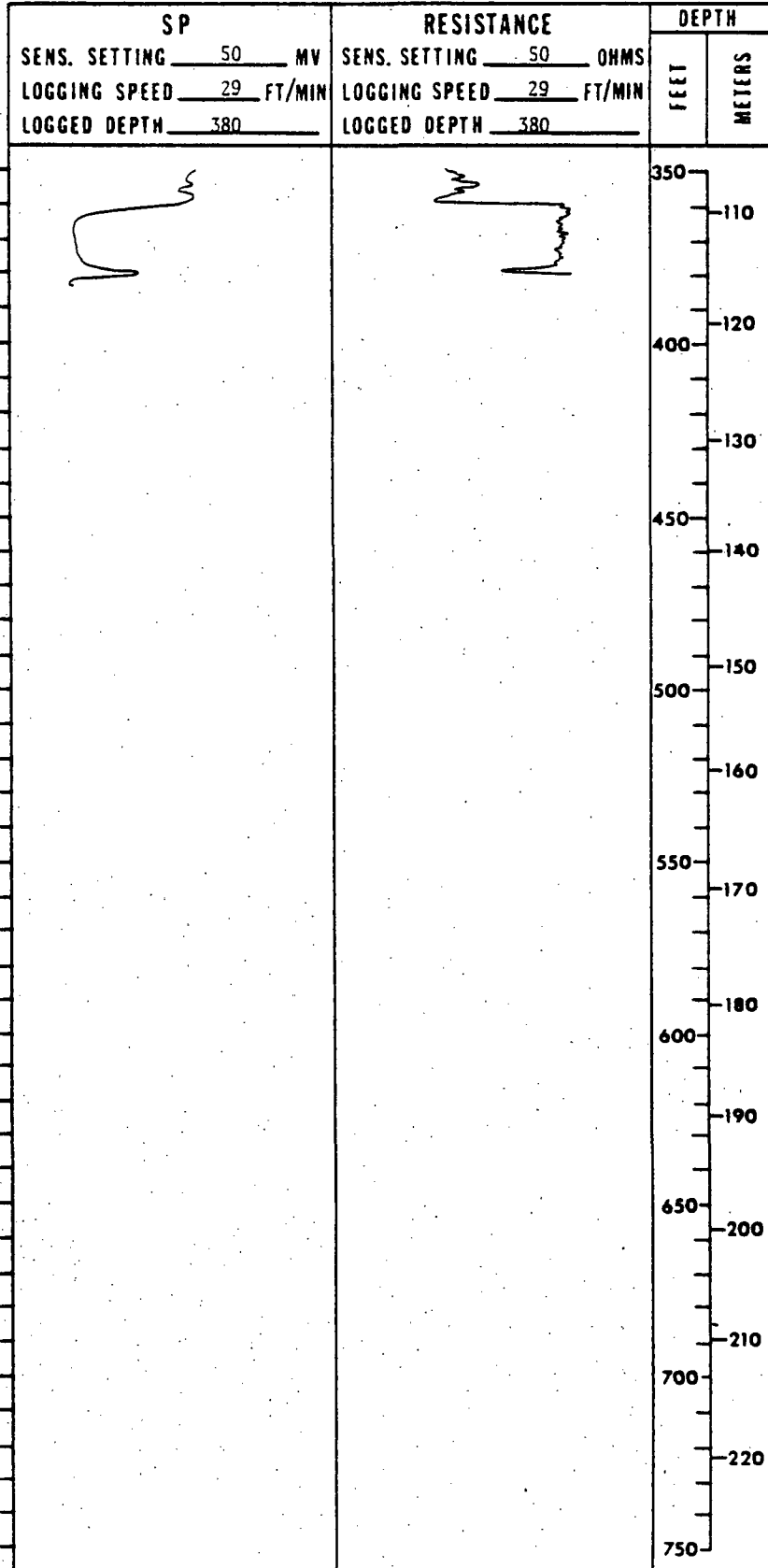
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77011
SHEET 4 OF 4

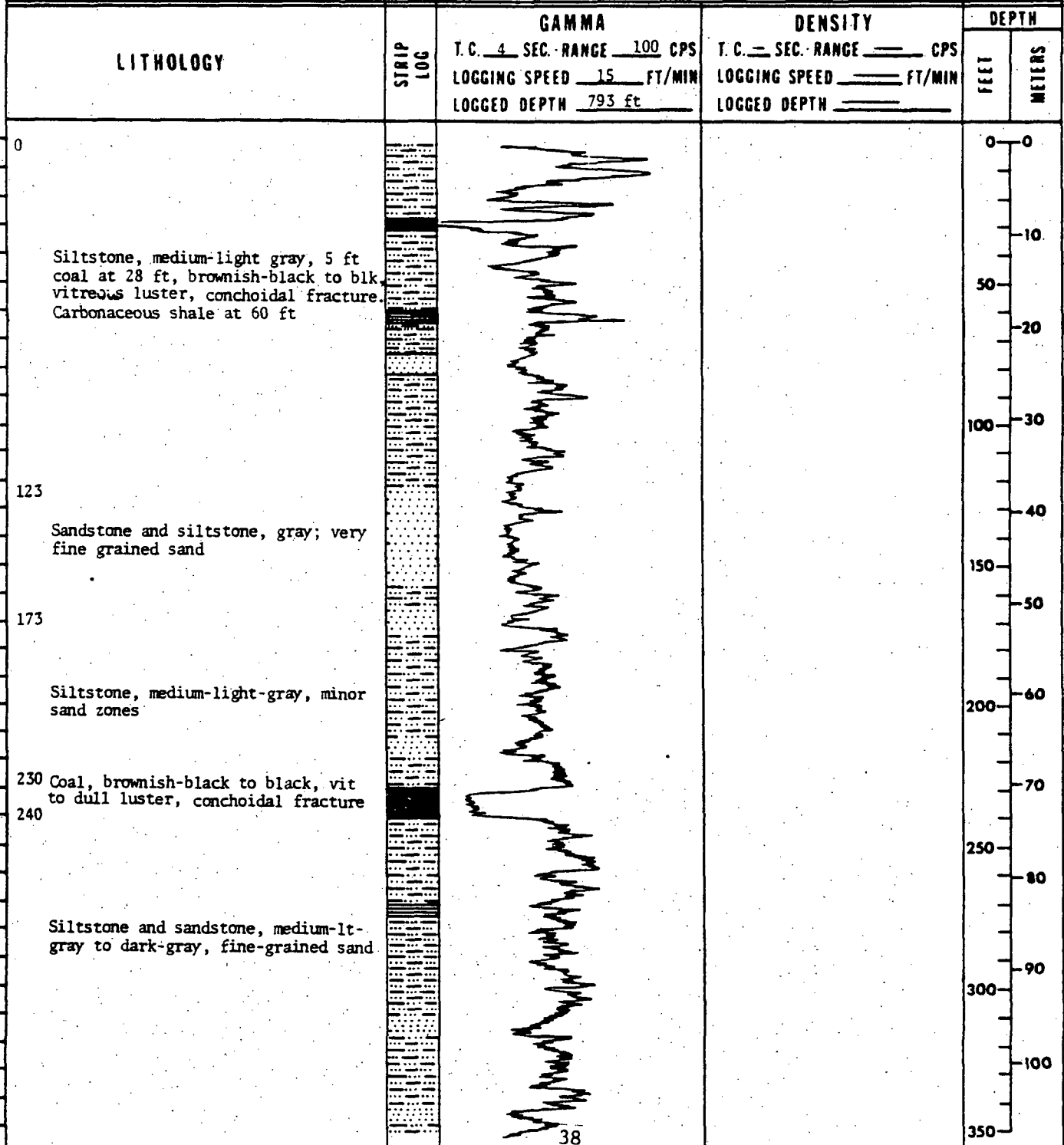
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77012
SHEET 1 OF 5



AREA Southern Powder River Basin		QUAD NAME Coal Draw	
DATE STARTED 9/21/77	DATE COMP. 9/27/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 26 T. 41N, R. 73W		FOOTAGE LOC. 1800 FSL 200 FWL	GROUND ELEV 4910 ft
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE ROTARY 820 CORING 0	TOTAL DEPTH 820
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	DEPTH TO WATER 5 ft
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin.		GEOPHYSICAL LOGS RECORDED BY G. Hollomon	
REMARKS: Drilled and logged footage composite of drill holes CDNE-2 and CDNE-2A (40 ft + 780 ft) Composite log logged through drill rods below 30 ft.			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77012
SHEET 3 OF 5

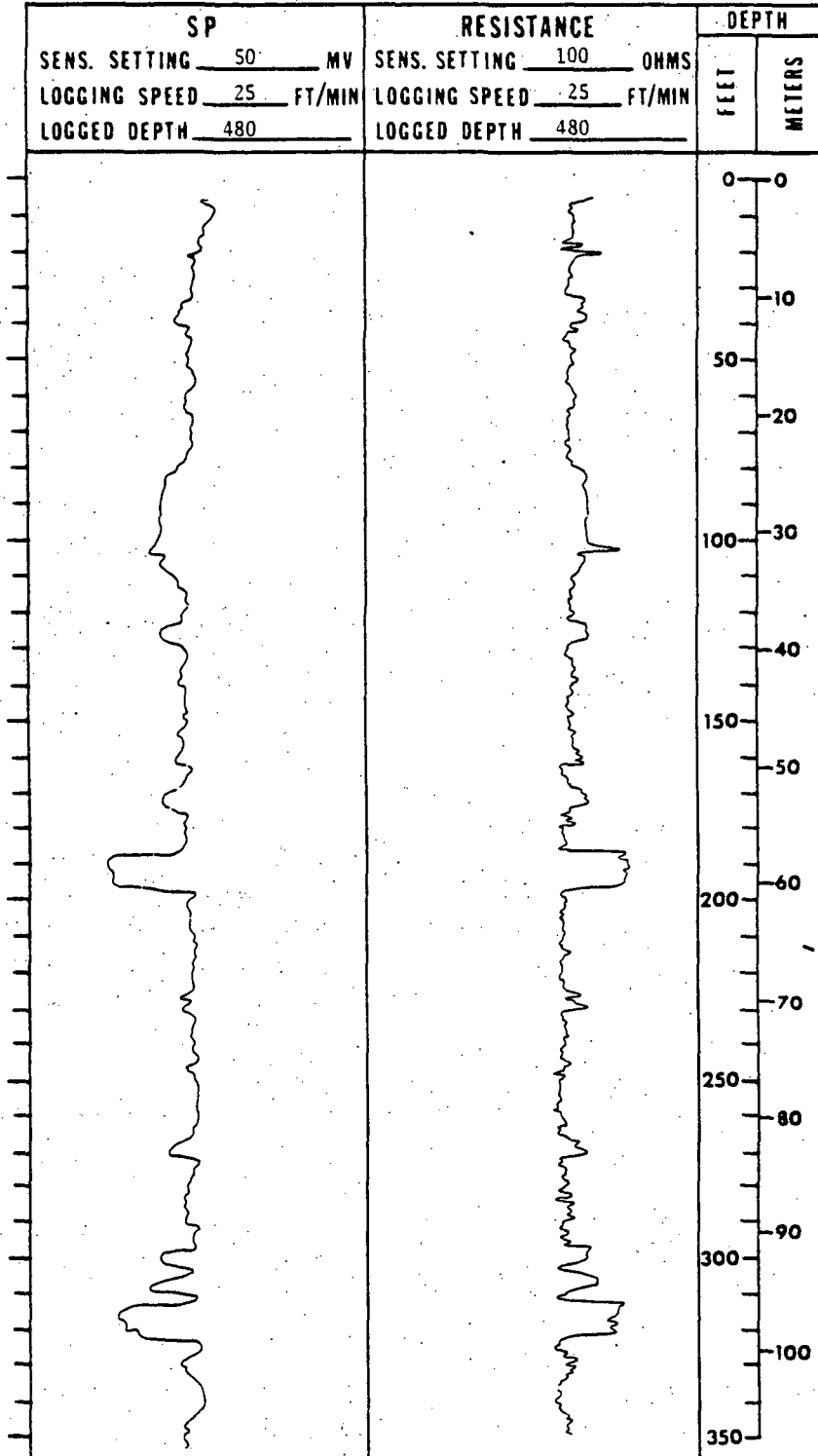
REMARKS:

LITHOLOGY	STRIP LOG	GAMMA	DENSITY	DEPTH	
		T. C. <u>4</u> SEC. RANGE <u>100</u> CPS LOGGING SPEED <u>15</u> FT/MIN LOGGED DEPTH <u>793</u> ft	T. C. <u> </u> SEC. RANGE <u> </u> CPS LOGGING SPEED <u> </u> FT/MIN LOGGED DEPTH <u> </u>	FEET	METERS
<p>Siltstone, light-brownish-gray to brownish-gray. 3 ft coal at 775 ft.</p> <p>775</p> <p>793 L.T.D.</p>				<p>750</p> <p>230</p> <p>240</p> <p>800</p> <p>250</p> <p>850</p> <p>260</p> <p>270</p> <p>900</p> <p>280</p> <p>950</p> <p>290</p> <p>300</p> <p>1000</p> <p>310</p> <p>1050</p> <p>320</p> <p>330</p> <p>1100</p> <p>340</p> <p>1150</p> <p>350</p>	<p>230</p> <p>240</p> <p>250</p> <p>260</p> <p>270</p> <p>280</p> <p>290</p> <p>300</p> <p>310</p> <p>320</p> <p>330</p> <p>340</p> <p>350</p>

UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77012
SHEET 4 OF 5

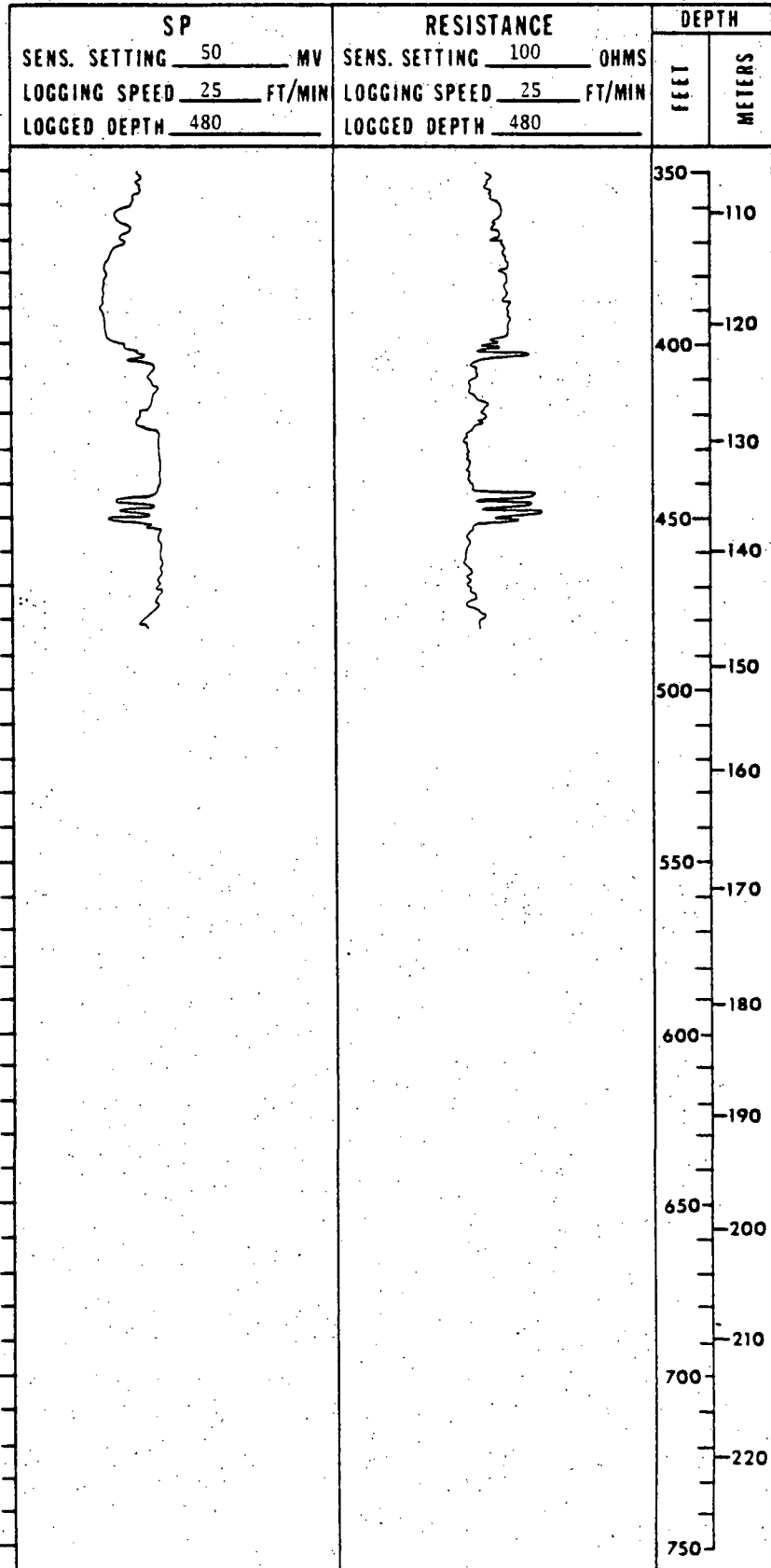
REMARKS: Log recorded 30 ft. shallow



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. 077012
SHEET 5 OF 5

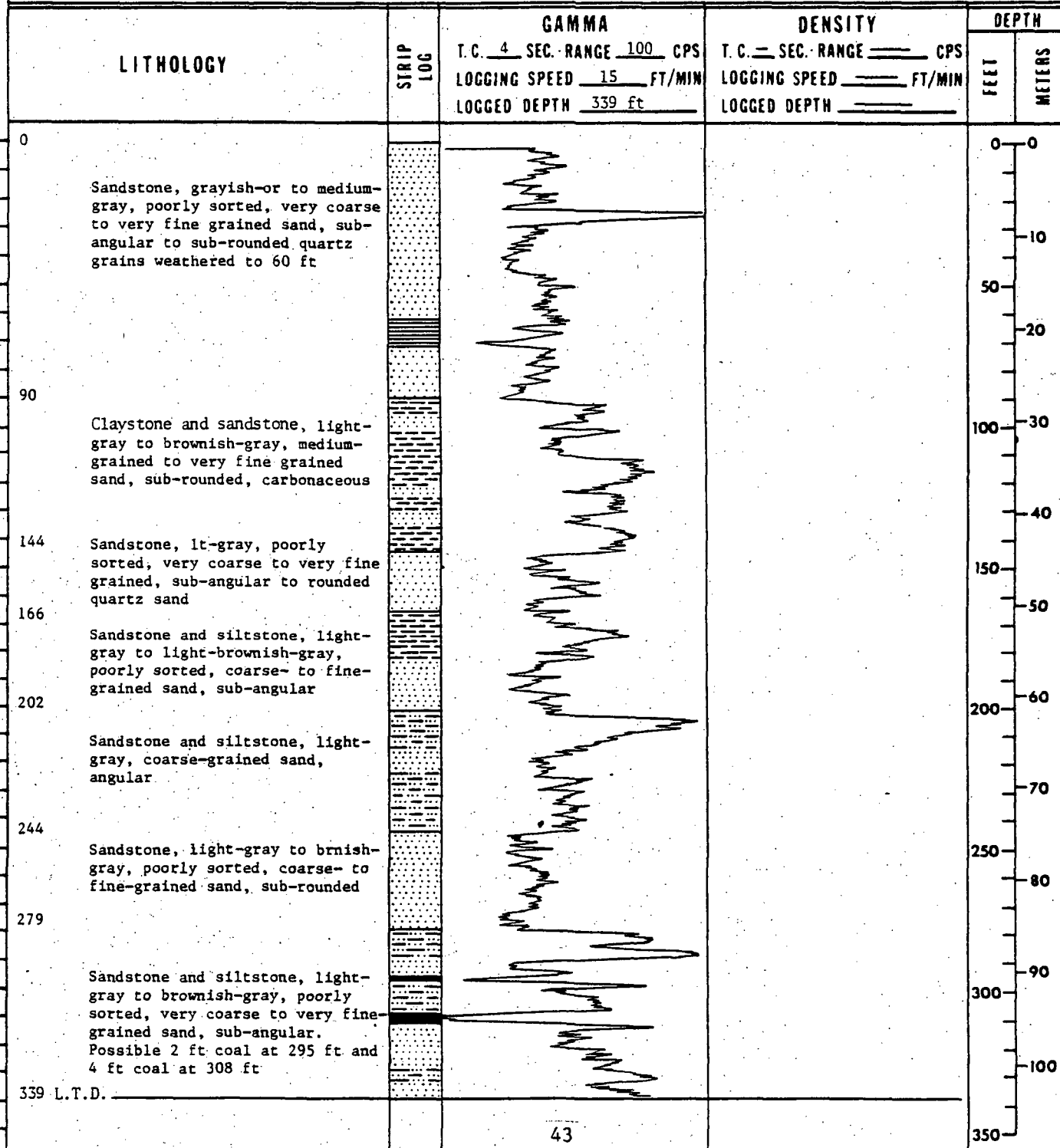
REMARKS: Log recorded 30 ft. shallow



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77013
SHEET 1 OF 2

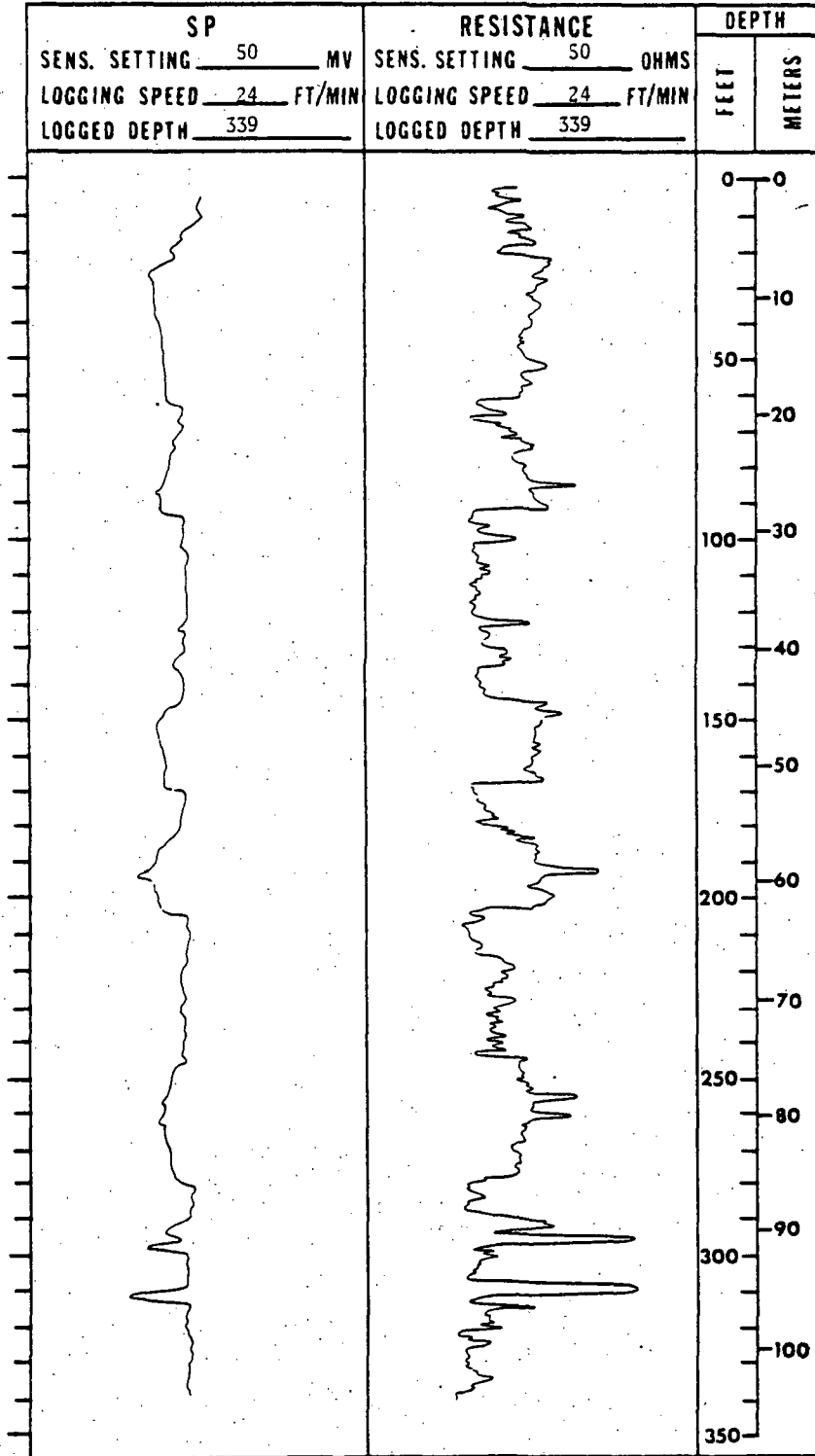
AREA Southern Powder River Basin		QUAD NAME Coal Draw (15 Minute)	
DATE STARTED 9/29/77	DATE COMP. 9/29/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 3 T. 39N, R. 73W		FOOTAGE LOC. 1900 FSL 400 FEL 0	GROUND ELEV 4920
SIZE AND BIT TYPE: 4 3/4 inch Drag		FOOTAGE ROTARY 340 CORING 0	TOTAL DEPTH 340 ft
DRILLING AGENCY: USGS - CD - NRMA		DRILL TYPE: Portadrill 524	DEPTH TO WATER 1.4 ft
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY L.D. Riglin	
REMARKS:			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77013
SHEET 2 OF 2

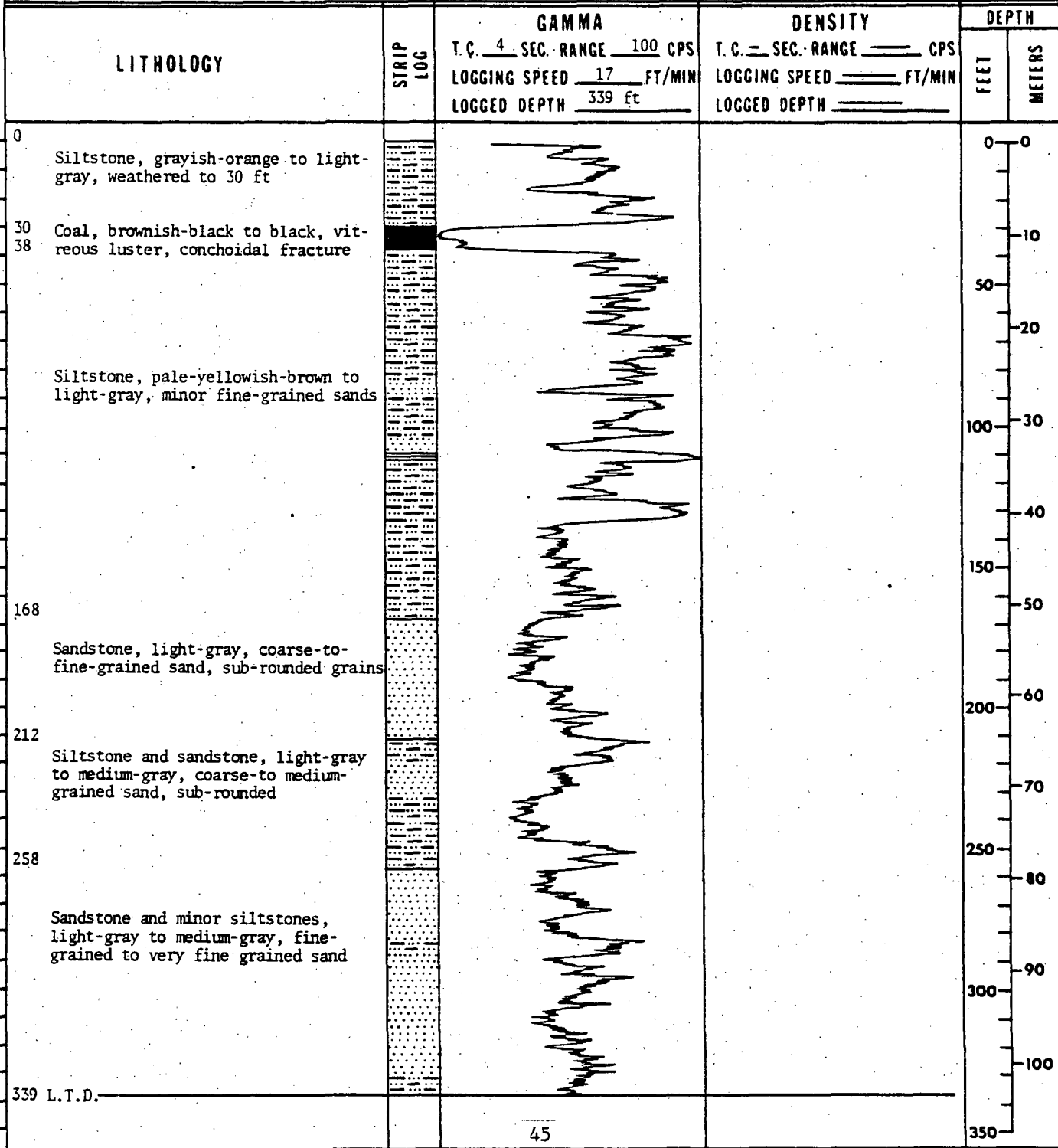
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD 77014
SHEET 1 OF 2

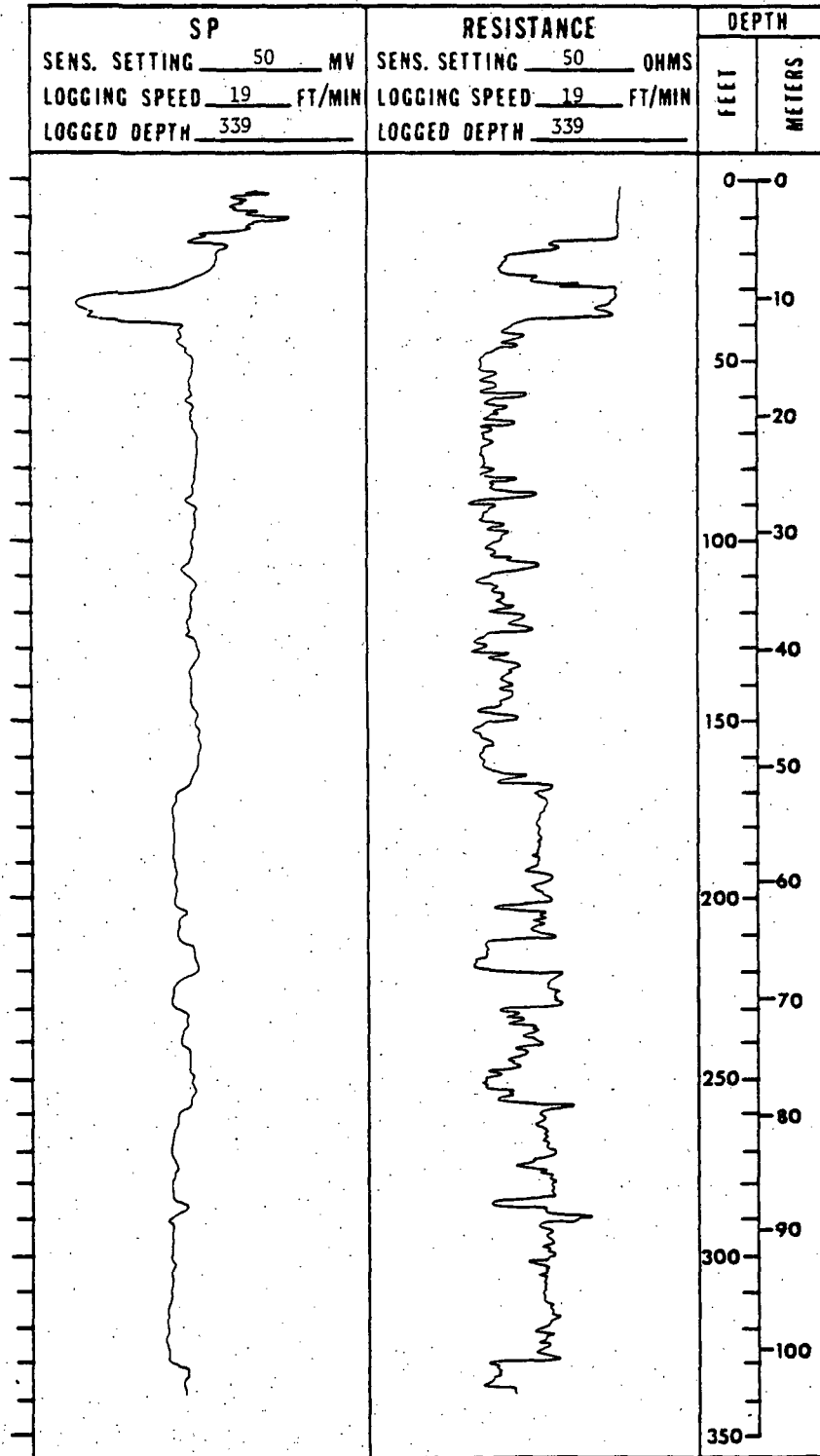
AREA Southern Powder River Basin		QUAD NAME Coal Draw	
DATE STARTED 9/30/77	DATE COMP. 9/30/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 14 T. 40N, R. 73W		FOOTAGE LOC. 925 FSL 150 FWL	GROUND ELEV 4910
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE	TOTAL DEPTH 340
		ROTARY 340 CORING 0	DEPTH TO WATER 16 ft
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY L. Riglin	
REMARKS:			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77014
SHEET 2 OF 2

REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77015
SHEET 1 OF 2

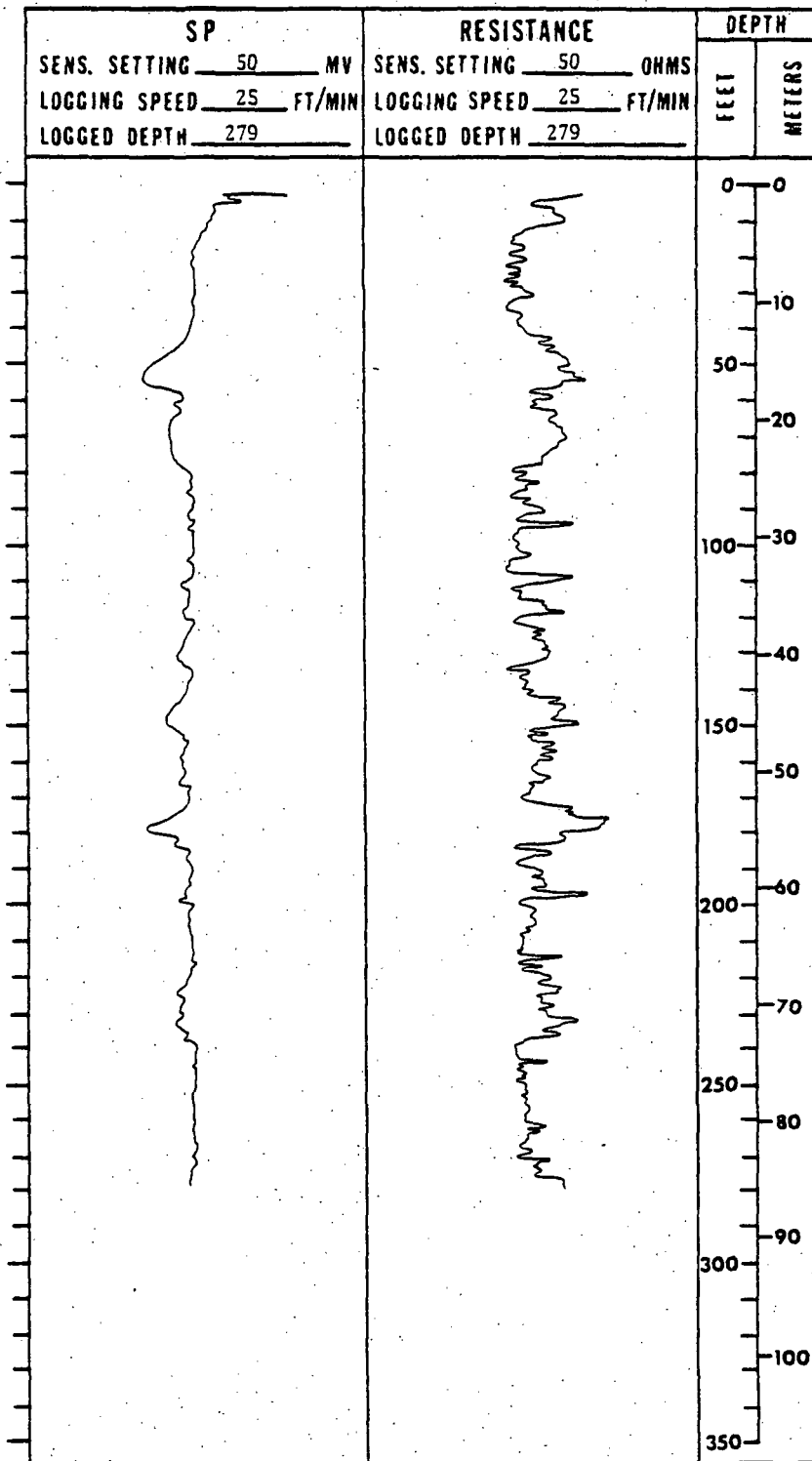
AREA Southern Powder River Basin		QUAD NAME Coal Bank Draw 7 1/2	
DATE STARTED 10/3/77	DATE COMP. 10/3/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 29 T. 40N R. 69W		FOOTAGE LOC. 300	GROUND ELEV. 4640e
SIZE AND BIT TYPE: 4 3/4 inch Drag		FOOTAGE ROTARY 280 CORING 0	TOTAL DEPTH 280
DRILLING AGENCY: U.S.G.S. / CD/NRMA		DRILL TYPE: Portadrill 524	DEPTH TO WATER 3.5
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY L.D. Riglin	
REMARKS:			

LITHOLOGY	STRIP LOG	GAMMA	DENSITY	DEPTH	
		T.C. 4 SEC. RANGE 100 CPS LOGGING SPEED 17 FT/MIN LOGGED DEPTH 277	T.C. — SEC. RANGE — CPS LOGGING SPEED — FT/MIN LOGGED DEPTH —	FEET	METERS
0 Siltstone and sandstone, pinkish-gray to light-brownish-gray, fine-grained sand, carbonaceous shale, weathered to 25 ft 46 Sandstone, pinkish-gray to light-brownish-gray, medium-to fine-grained sand, sub-rounded 79 Siltstone, sandy to claystone, pinkish-gray to brownish-gray, carbonaceous shale 176-80 Coal, brownish-black Siltstone and claystone, pinkish-gray to brownish-gray, carbonaceous shale 238 Siltstone and claystone, light-gray to brownish-gray, carbonaceous shale 277 L.T.D.				0 10 50 20 100 30 40 150 50 200 60 70 250 80 300 90 100 350	0 10 50 20 100 30 40 150 50 200 60 70 250 80 300 90 100 350

UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77015
SHEET 2 OF 2

REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77016
SHEET 1 OF 4

AREA Southern Powder River Basin		QUAD NAME Coal Bank Draw 7½'	
DATE STARTED 10/3/77	DATE COMP. 10/4/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 19 T. 40N, R. 69W		FOOTAGE LOC.	
		FNL 100	KKK 150 FWL
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE	
		ROTARY 600	CORING 0
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	
LITHOLOGY RECORDED BY Hollomon, Coppock, Riglin		GEOPHYSICAL LOGS RECORDED BY L.D. Riglin	


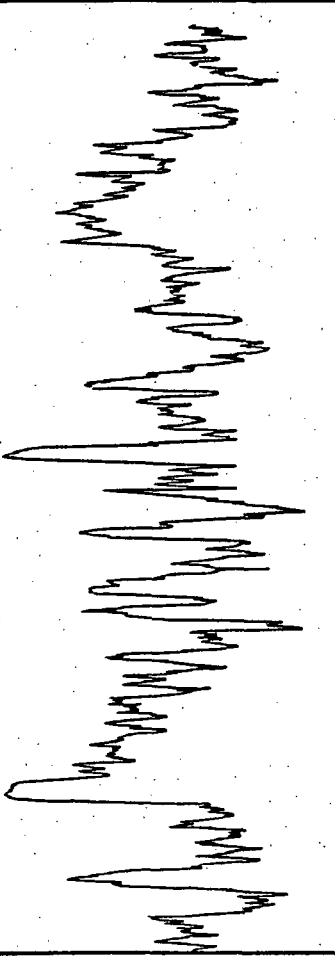

REMARKS:

LITHOLOGY	STRIP LOG	GAMMA	DENSITY	DEPTH	
		T.C. 4 SEC. RANGE 100 CPS LOGGING SPEED 15 FT/MIN LOGGED DEPTH 600 ft	T.C. SEC. RANGE CPS LOGGING SPEED FT/MIN LOGGED DEPTH	FEET	METERS
0 Sandstone, yellowish-brown, very fine grained to very coarse grained sand, sub-angular, poorly sorted, weathered to 25 ft 25 Siltstone and sandstone, light-gray to brownish-gray, very fine grained sand, trace of carbonaceous shale. Possible 2 ft coal at 56 ft 150 Sandstone, lt-gray to medium-gray, very fine grained to medium-grained sand, sub-angular particles 190 Siltstone, light-gray to light-brownish-gray 232 Sandstone, light-gray to medium-gray, very fine grained sand 268 Siltstone, medium-gray to brownish-gray, carbonaceous; claystone near top 290 Sandstone, light-gray to light-brownish-gray, very fine grained sand, fining upward 316 Siltstone, light-gray to medium-gray, carbonaceous				0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350	0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72 75 78 81 84 87 90 93 96 99 102 105 108 111 114 117 120 123 126 129 132 135 138 141 144 147 150 153 156 159 162 165 168 171 174 177 180 183 186 189 192 195 198 201 204 207 210 213 216 219 222 225 228 231 234 237 240 243 246 249 252 255 258 261 264 267 270 273 276 279 282 285 288 291 294 297 300 303 306 309 312 315 318 321 324 327 330 333 336 339 342 345 348 351

UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77016
SHEET 2 OF 4

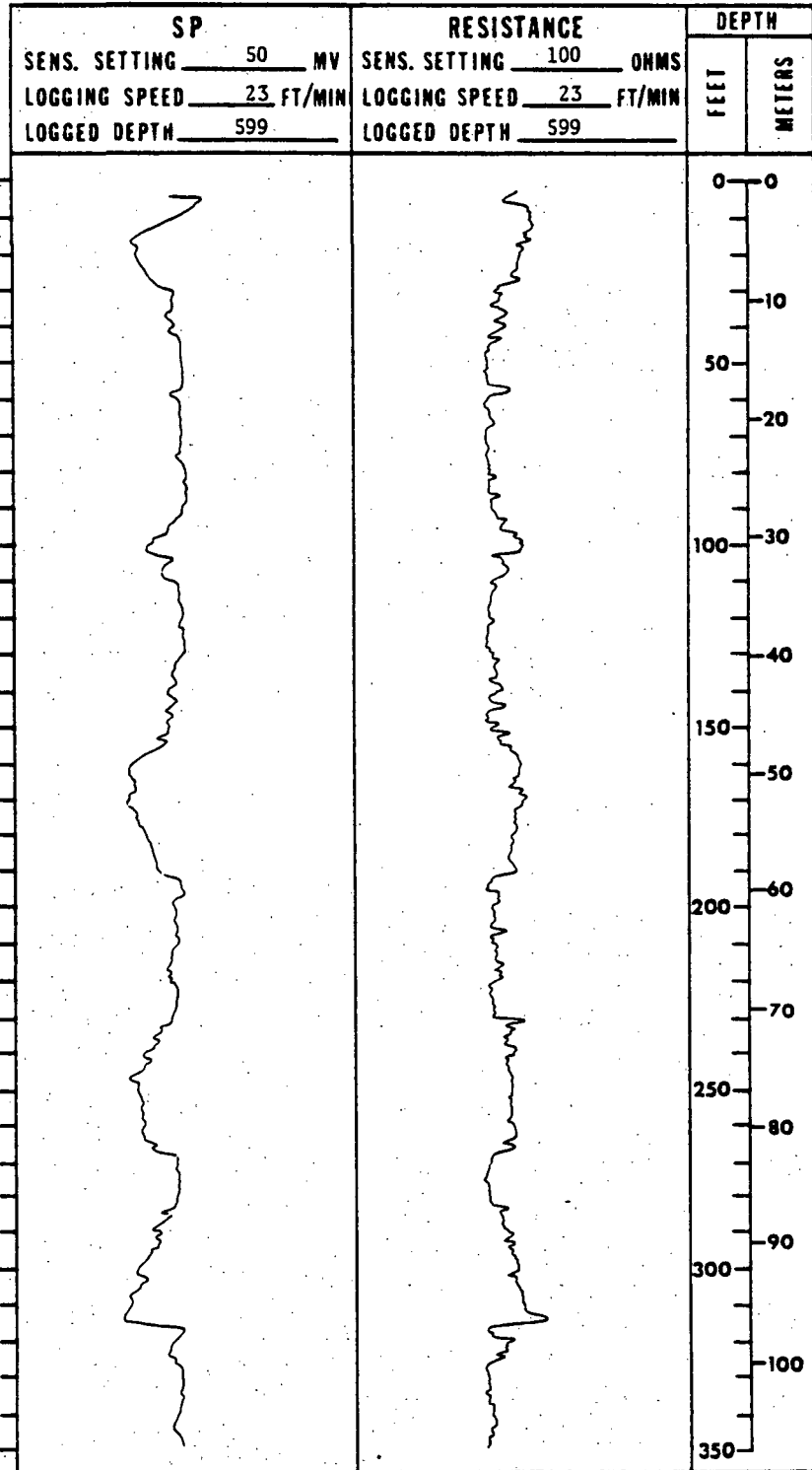
REMARKS:

LITHOLOGY	STRIP LOG	GAMMA	DENSITY	DEPTH	
		T.C. <u>4</u> SEC. RANGE <u>100</u> CPS LOGGING SPEED <u>15</u> FT/MIN LOGGED DEPTH <u>600</u> ft	T.C. _____ SEC. RANGE _____ CPS LOGGING SPEED _____ FT/MIN LOGGED DEPTH _____	FEET	METERS
<p>380 Siltstone, medium-gray to brownish-gray</p> <p>408</p> <p>Siltstone and claystone, light-gray to brownish-black, minor carbonaceous shales. Possible coals: 4 ft coal at 444 ft, 5 ft coal at 462 ft, 2 ft coal at 472 ft, 3 ft coal at 485 ft, 5 ft coal at 498 ft, 4 ft coal at 505 ft, 2 ft coal at 519 ft</p> <p>552 Coal, black</p> <p>559 Siltstone and claystone, very light gray to brownish-gray, carbonaceous</p> <p>577 Coal, black</p> <p>582 Siltstone, gray to dark gray</p> <p>600 L.T.D.</p>				<p>350</p> <p>110</p> <p>120</p> <p>400</p> <p>130</p> <p>450</p> <p>140</p> <p>500</p> <p>150</p> <p>160</p> <p>550</p> <p>170</p> <p>180</p> <p>600</p> <p>190</p> <p>650</p> <p>200</p> <p>700</p> <p>210</p> <p>750</p> <p>220</p>	<p>350</p> <p>110</p> <p>120</p> <p>400</p> <p>130</p> <p>450</p> <p>140</p> <p>500</p> <p>150</p> <p>160</p> <p>550</p> <p>170</p> <p>180</p> <p>600</p> <p>190</p> <p>650</p> <p>200</p> <p>700</p> <p>210</p> <p>750</p> <p>220</p>

UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77016
SHEET 3 OF 4

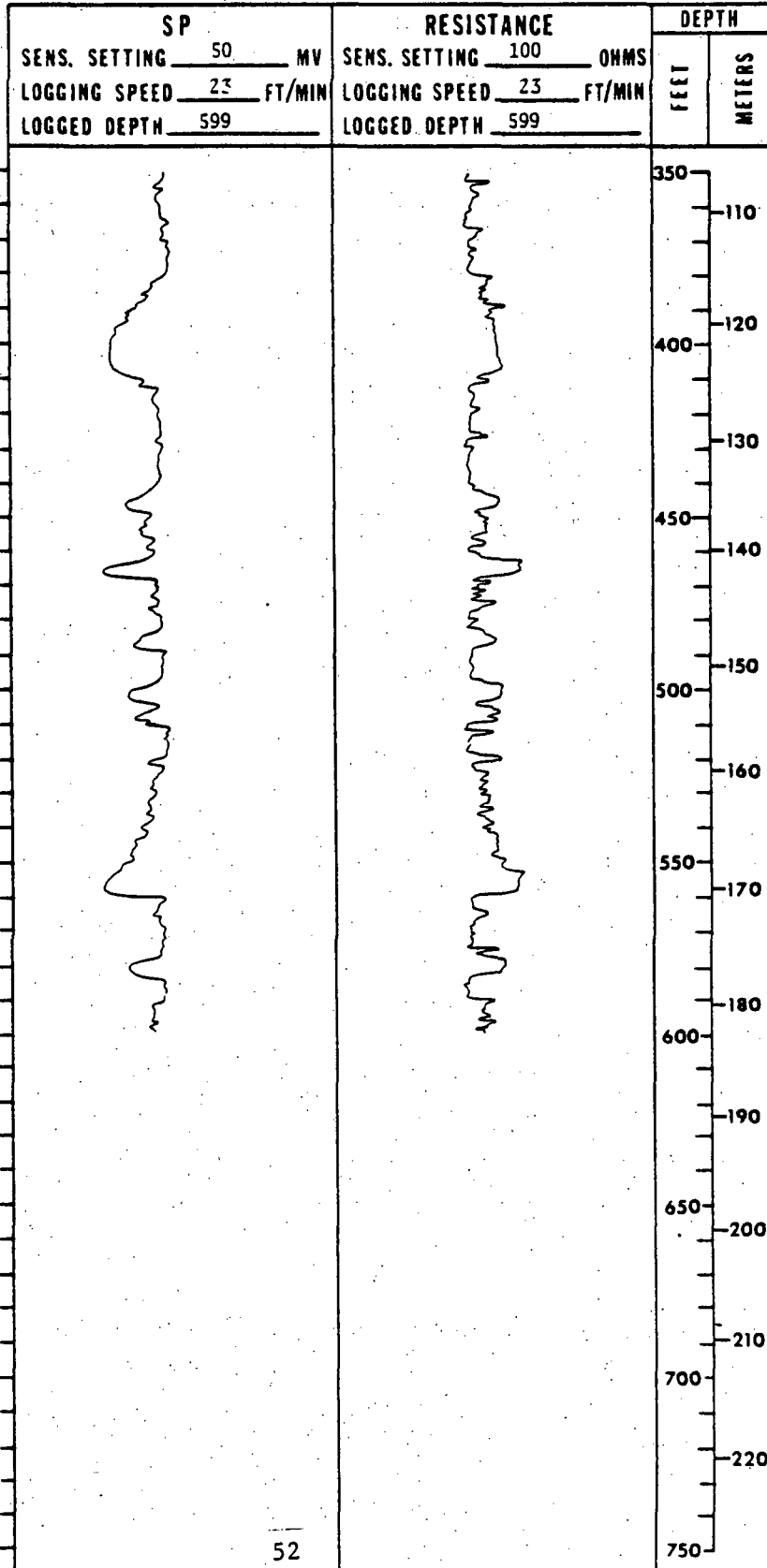
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77016
SHEET 4 OF 4

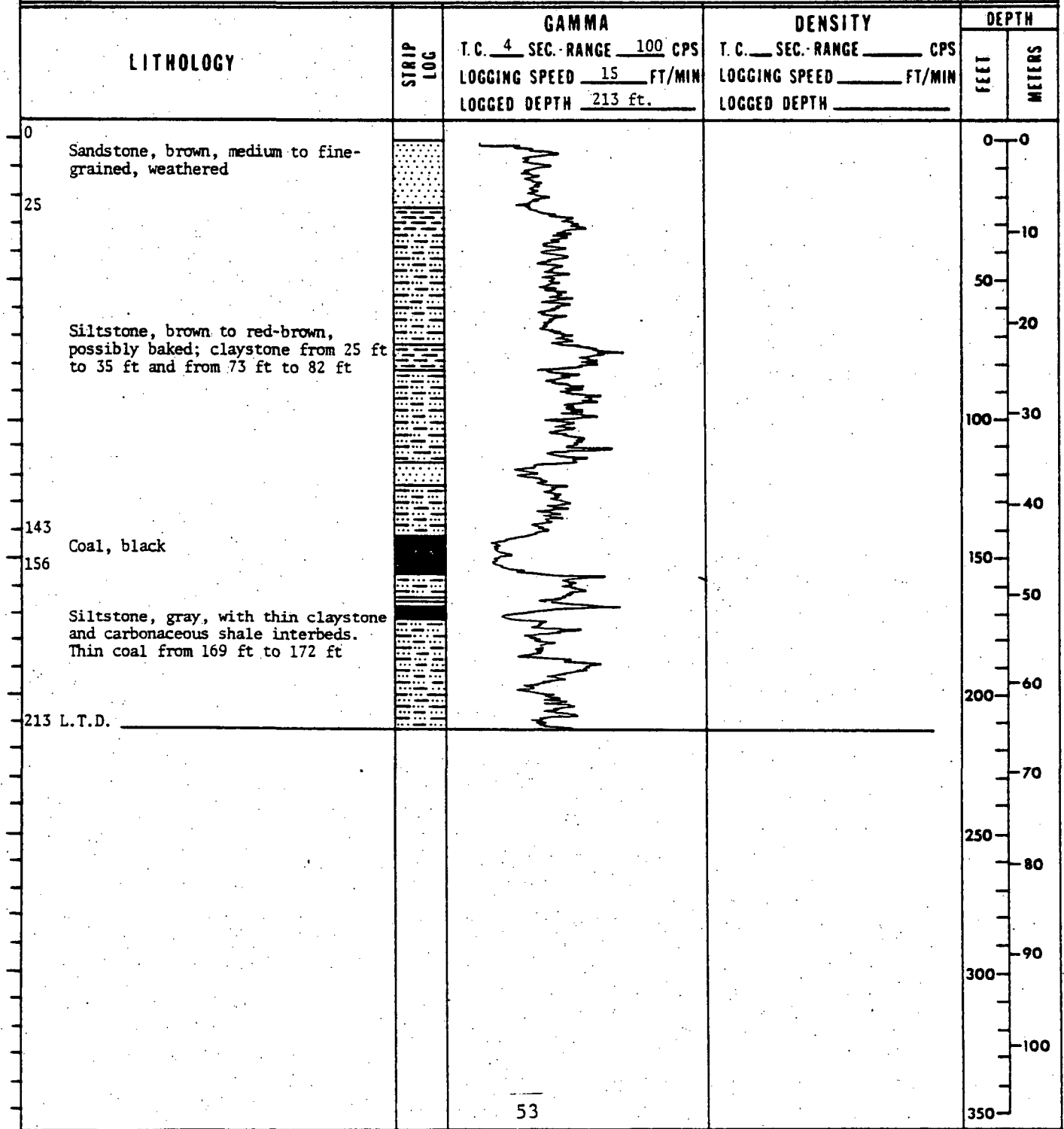
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO **CD77017**
SHEET 1 OF 1

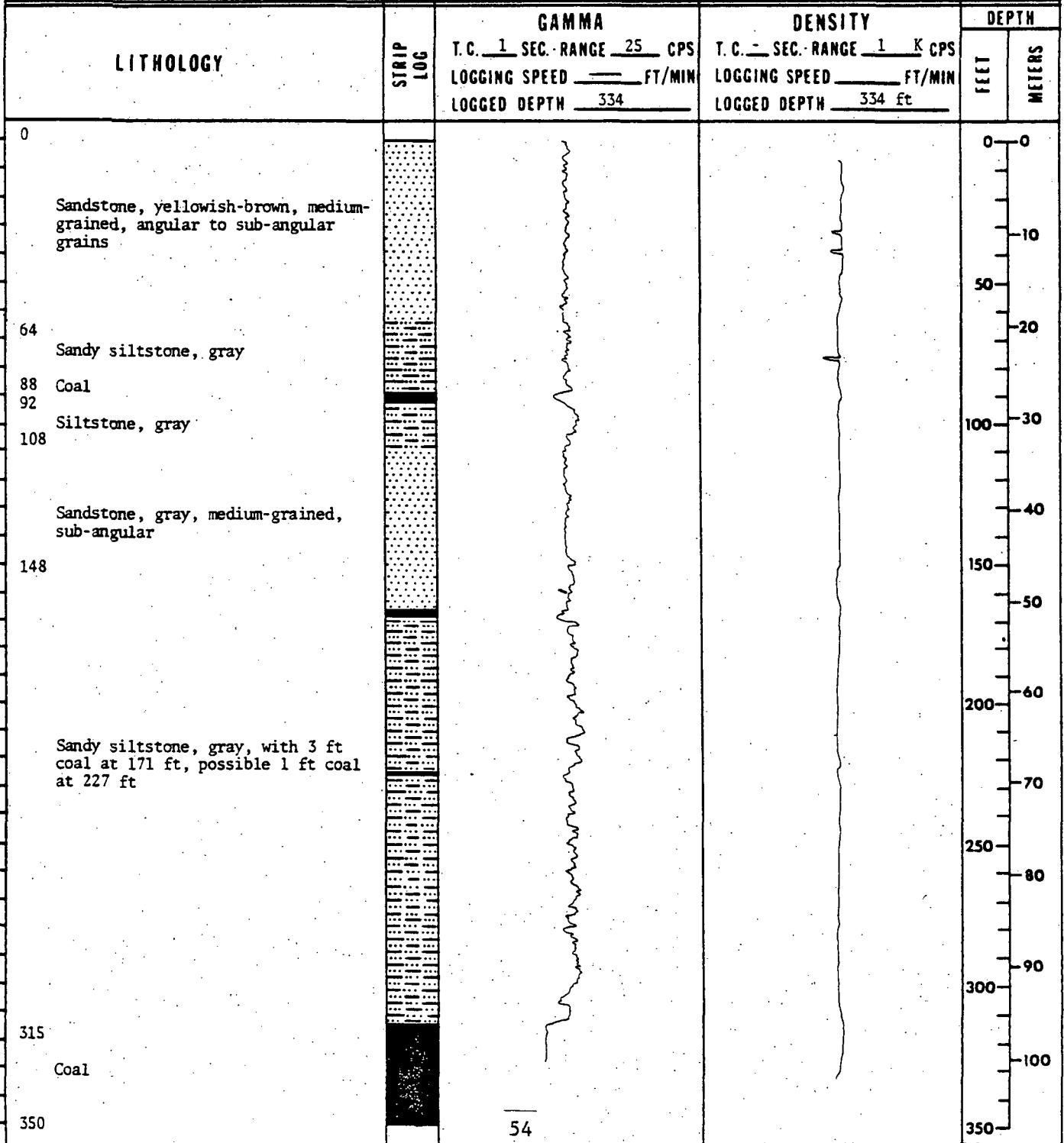
AREA Southern Powder River Basin		QUAD. NAME Teckla	
DATE STARTED 10/12/77	DATE COMP. 10/16/77	COUNTY Campbell	STATE Wyoming
LOCATION: SEC. 10 T. 41N, R. 70 W, FOOTAGE LOC.		1000 FWL ^{FSL}	950 FWL ^{FSL}
SIZE AND BIT TYPE: NX Diamond 4 3/4 Drag		FOOTAGE	
		ROTARY 80	CORING 140
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	GROUND ELEV 4725 ft
LITHOLOGY RECORDED BY Hollomon, Coppock, Fivas		GEOPHYSICAL LOGS RECORDED BY G. Hollomon	
REMARKS: Cored interval from 21 ft to 161 ft. Lost circulation @ 130 ft			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77018
SHEET 1 OF 3

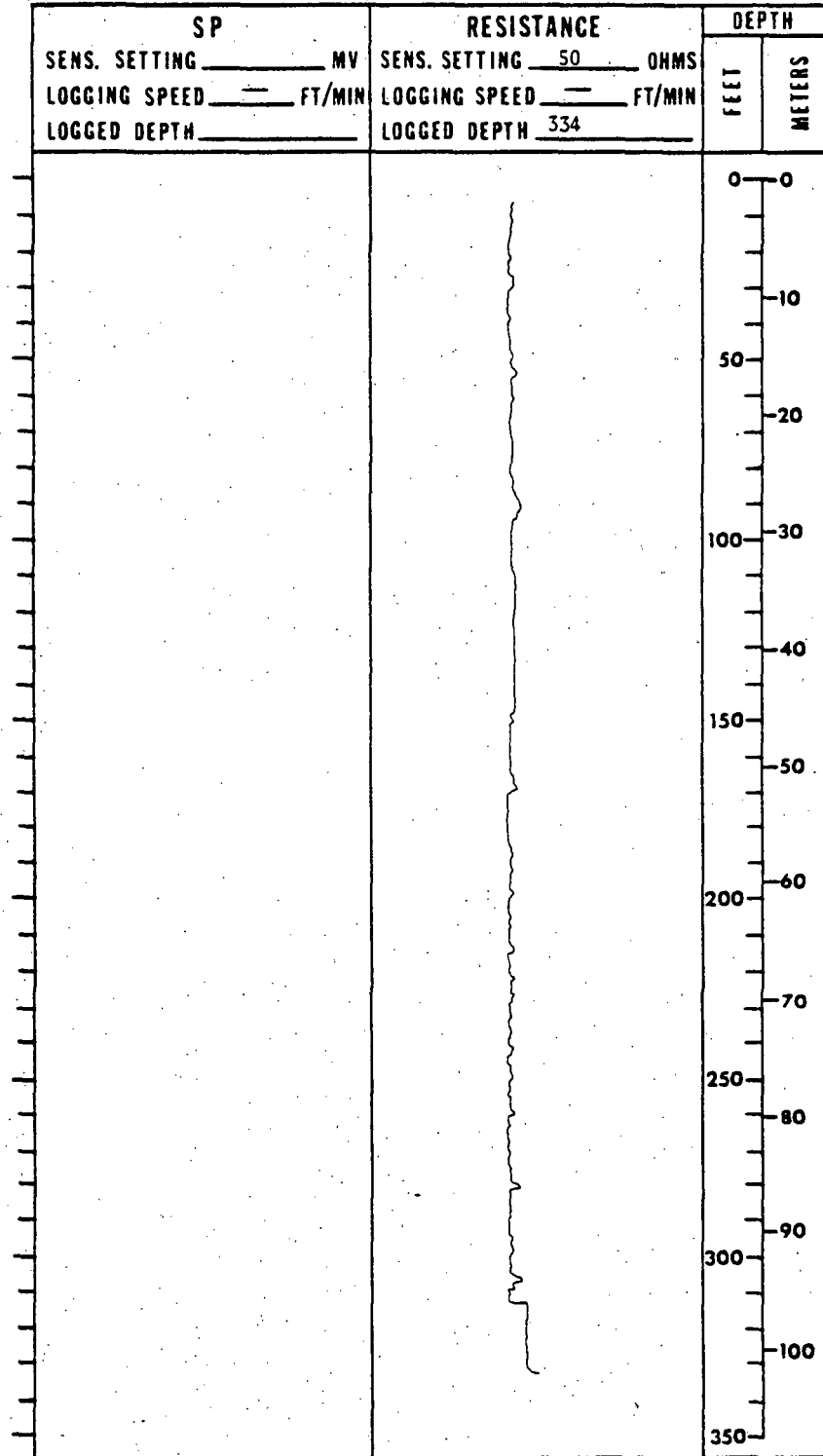
AREA Southern Powder River Basin		QUAD NAME Coal Draw	
DATE STARTED 10/18/77	DATE COMP. 10/18/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 29 T. 41N, R. 72W		FOOTAGE LOC. 1700 FT FSL 2100 FEL #	GROUND ELEV 4765
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE ROTARY 640 CORING 0	TOTAL DEPTH 640
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	
LITHOLOGY RECORDED BY Ed Fivas		GEOPHYSICAL LOGS RECORDED BY Rocky Mountain Logging	
REMARKS: Not logged below 334 ft. Lithology based on unlagged samples only.			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. 077018
SHEET 3 OF 3

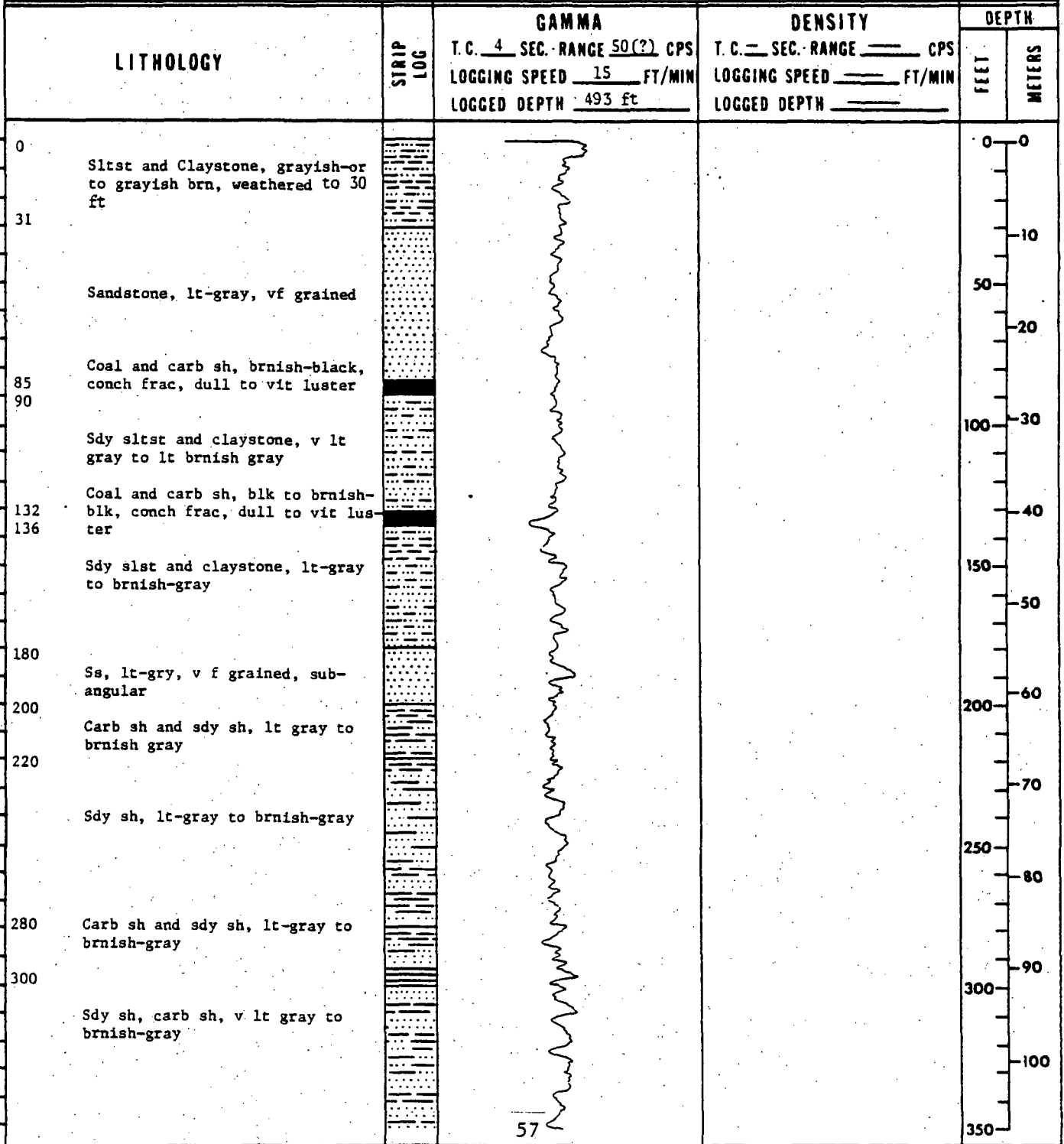
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77019
SHEET 1 OF 4

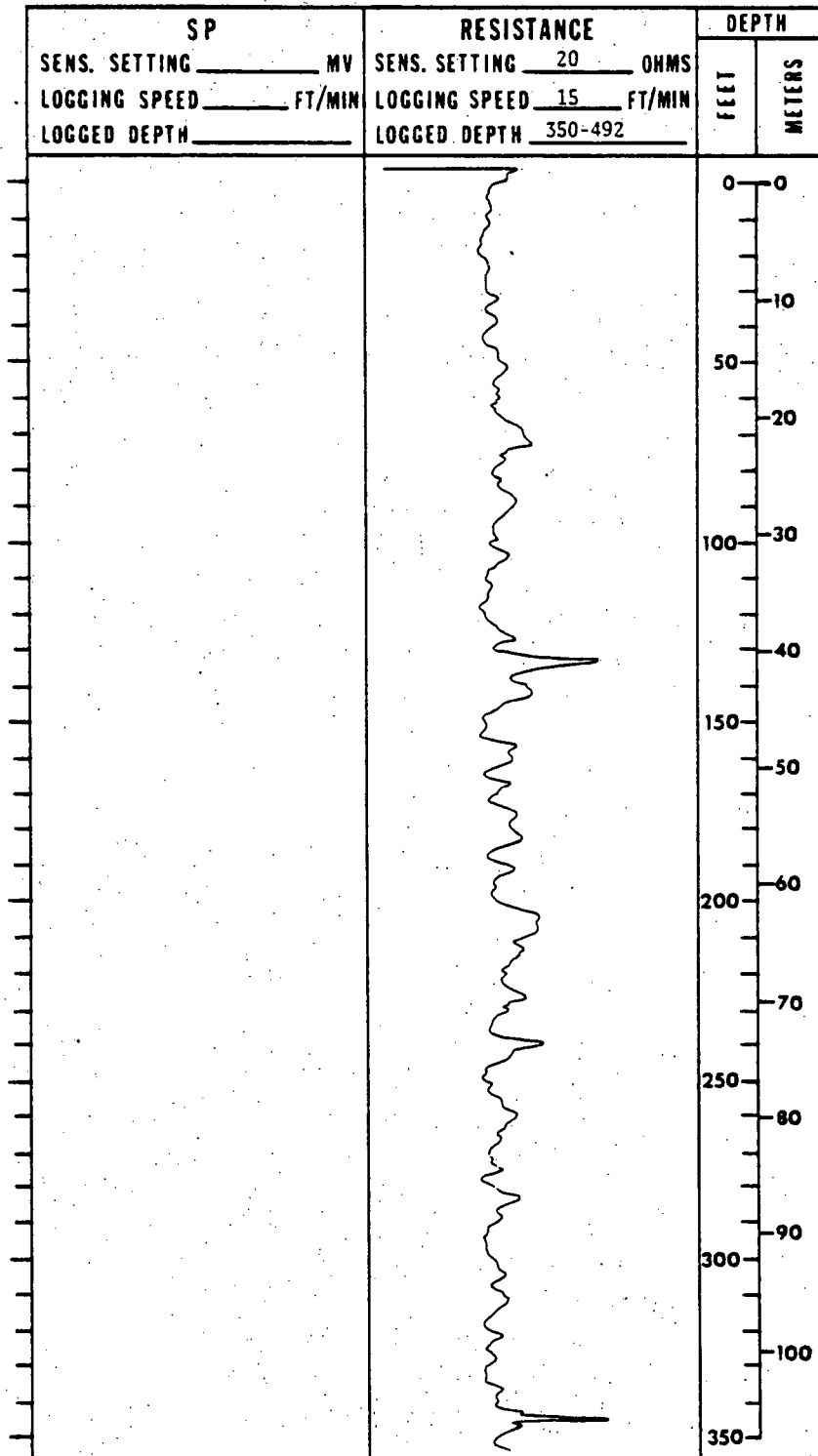
AREA Southern Powder River Basin		QUAD NAME Betty Reservoir	
DATE STARTED 10/19/77	DATE COMP. 10/19/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 6 T. 39N R. 70W		FOOTAGE LOC. 950	GROUND ELEV 4840
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE ROTARY 500 CORING 0	TOTAL DEPTH 500
DRILLING AGENCY: USGS - CD - NRMA		DRILL TYPE: Pore-drill 524	DEPTH TO WATER Land Surface
LITHOLOGY RECORDED BY Hollomon, Coppock, Fivas		GEOPHYSICAL LOGS RECORDED BY F.B. Kistner	
REMARKS: Geophysical logs poor. Lithology from field logs and samples.			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77019
SHEET 3 OF 4

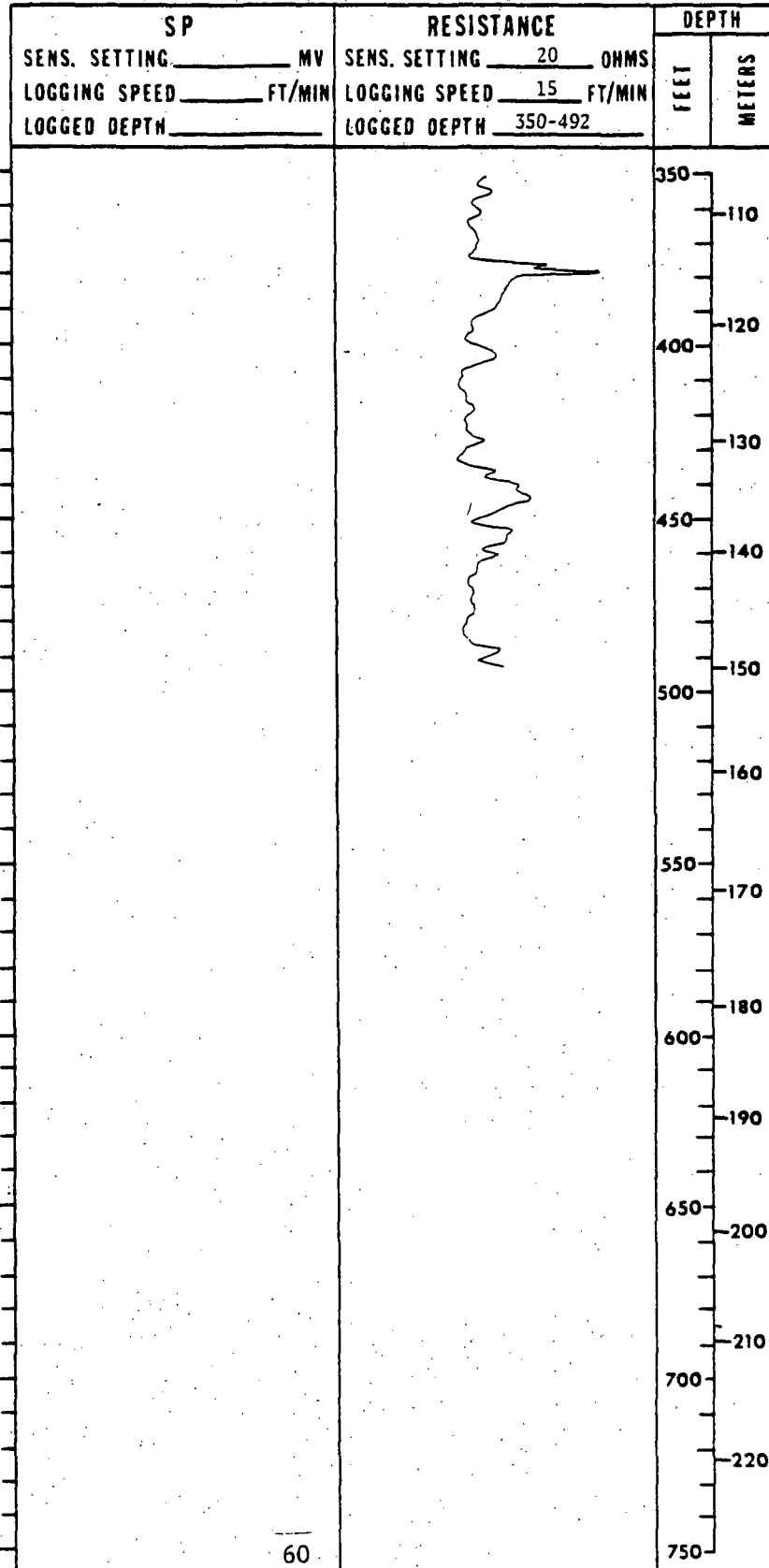
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77019
SHEET 4 OF 4


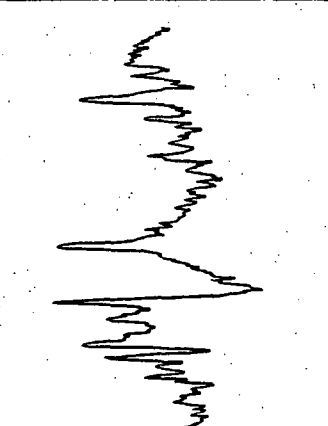

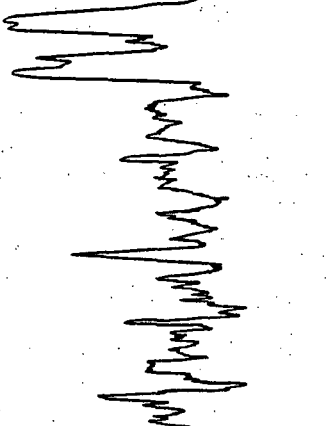
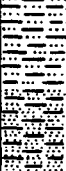



REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77020
SHEET 1 OF 2

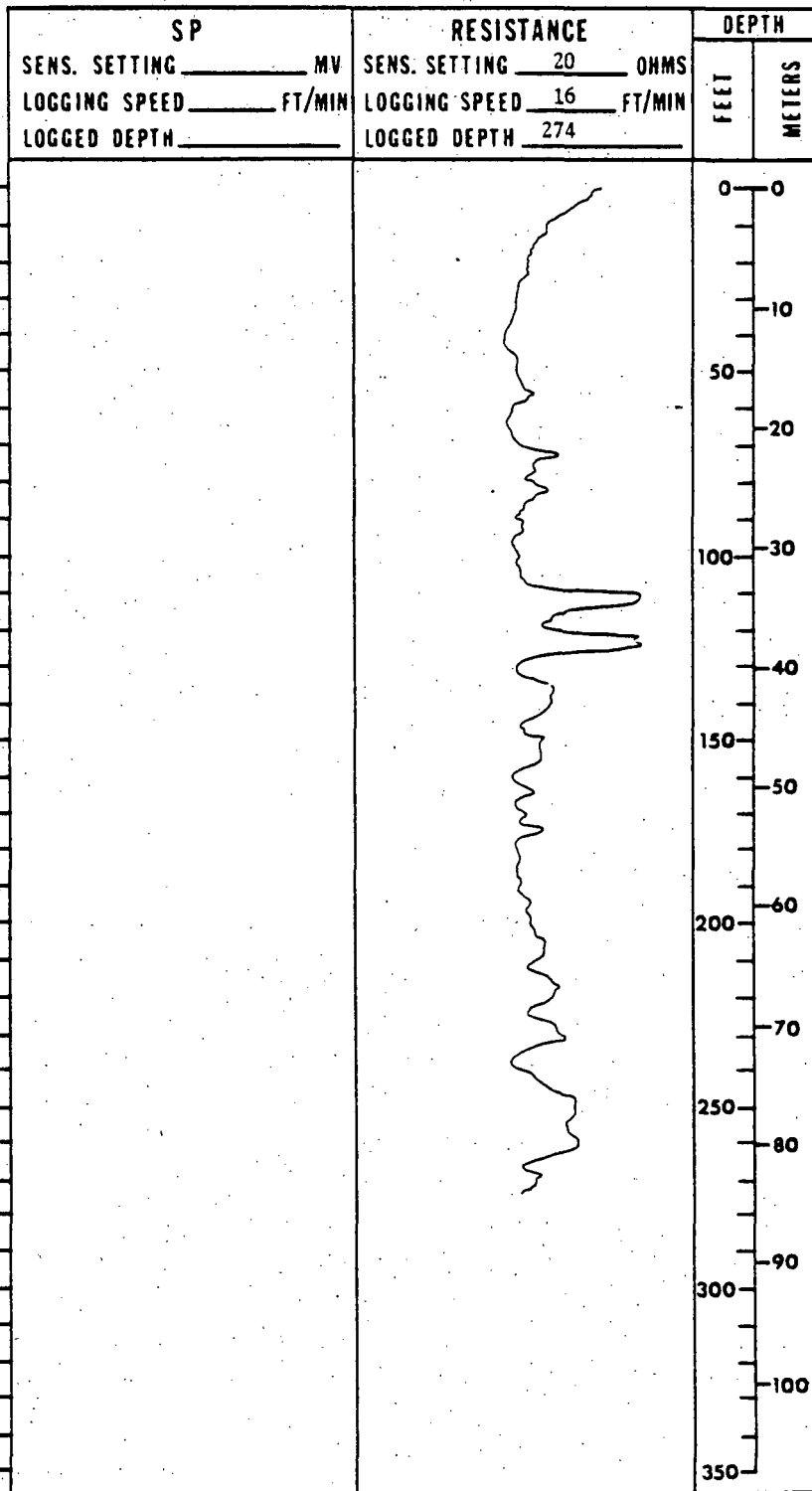
AREA Southern Powder River Basin		QUAD NAME Betty Reservoir	
DATE STARTED 10/20/77	DATE COMP 10/20/77	COUNTY Converse	STATE Wyoming
LOCATION: SEC. 22 T. 40N R. 70W		FOOTAGE LOC. 2250	GROUND ELEV 4870
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE	TOTAL DEPTH 280
		ROTARY 280	CORING 0
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	DEPTH TO WATER IS
LITHOLOGY RECORDED BY Hollomon, Coppock, Fivas		GEOPHYSICAL LOGS RECORDED BY F.B. Kistner	
REMARKS: Ground level at base of burn			

LITHOLOGY	STRIP LOG	GAMMA	DENSITY	DEPTH	
		T.C. 4 SEC. RANGE 10(?) CPS LOGGING SPEED 18 FT/MIN LOGGED DEPTH 275	T.C. SEC. RANGE CPS LOGGING SPEED FT/MIN LOGGED DEPTH	FEET	METERS
<p>0 Siltstone, dk-gy to dk-yellowish brown, sandy, very fine, sub-angular sand, minor amounts of black shale. Possible 2 ft coal at 19 ft and 1.5 ft coal at 59 ft</p>				0	0
<p>73 Claystone and sdy siltst, m-lt-gray, approx. 20% carb sh, thin coal at 74 ft</p>				20	7.3
<p>111 Coal, dk-brn to black, dull luster, avg frag size of 0.4 cm; with dark gray siltstone parting from 117-122 ft</p>				30	11.1
<p>Siltstone, dark-gray, with less than 5 percent fine-grained sand, minor amounts of carbonaceous shale. Possible 3 ft coal at 176 ft</p>				35	12.8
<p>275 L.T.D.</p>				100	30.5

UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77020
SHEET 2 OF 2

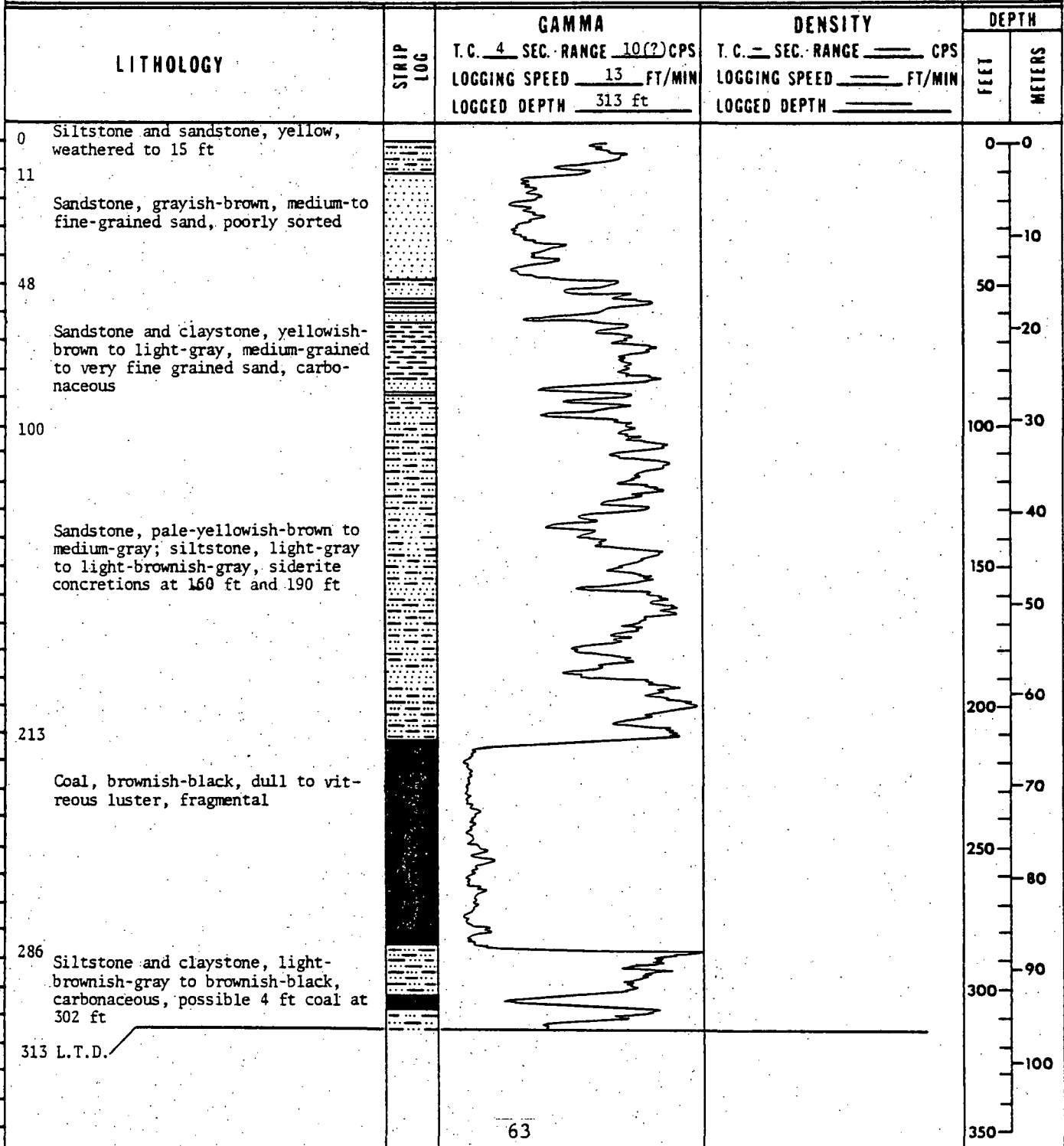
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77021
SHEET 1 OF 2

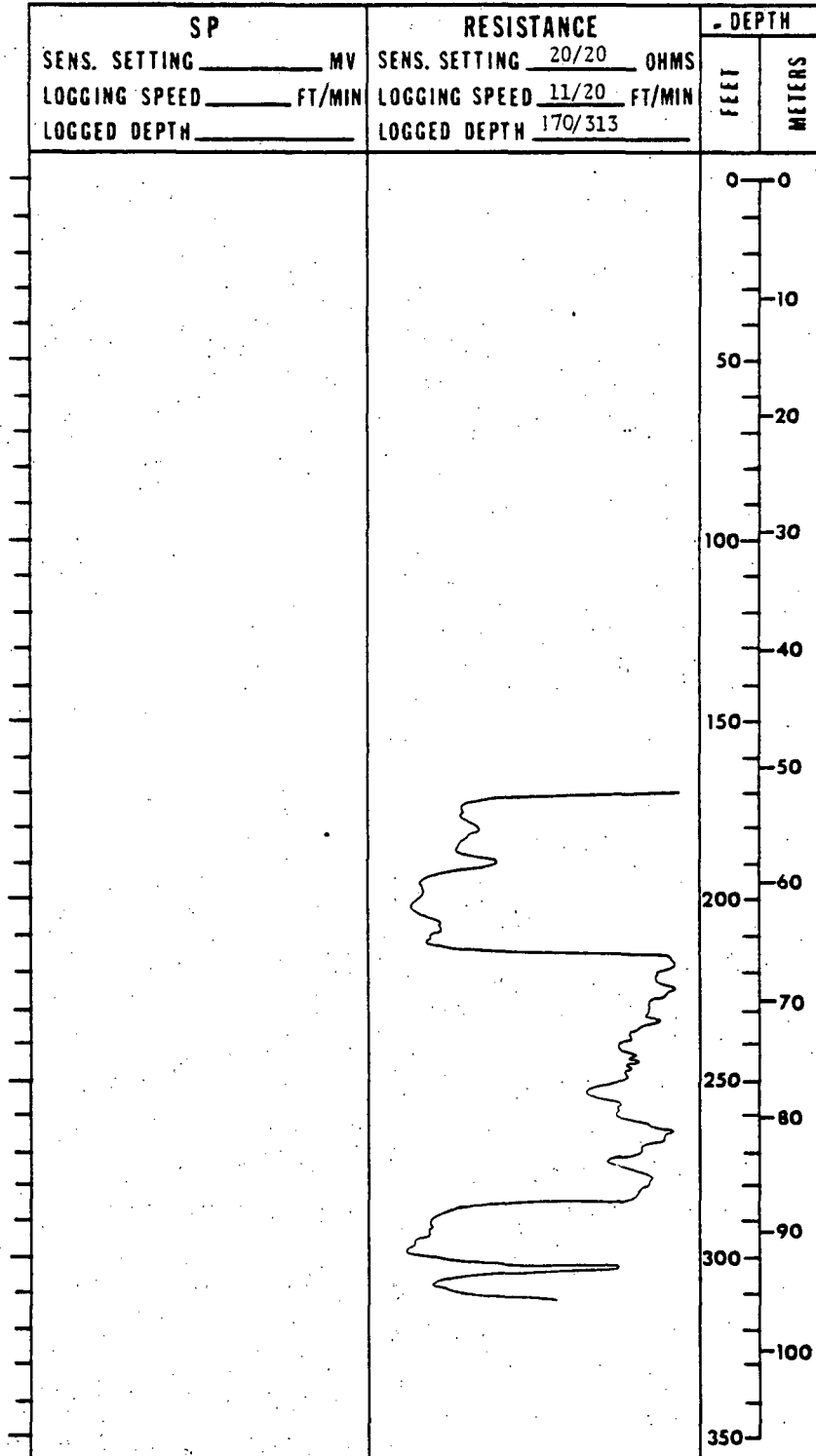
AREA Southern Powder River Basin		QUAD NAME Teckla	
DATE STARTED 10/29/77	DATE COMP. 10/29/77	COUNTY Campbell	STATE Wyoming
LOCATION: SEC. 34 T. 42N R. 70W		FOOTAGE LOC. 26 ## FSL 50 ## FWL	GROUND ELEV 4850
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE ROTARY 318	TOTAL DEPTH 318
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	DEPTH TO WATER 169'
LITHOLOGY RECORDED BY Hollomon, Coppock, Fivas		GEOPHYSICAL LOGS RECORDED BY G. Hollomon	
REMARKS: USFS SEAM 9A			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77021
SHEET 2 OF 2

REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77022
SHEET 1 OF 2

AREA Southern Powder River Basin		QUAD NAME Teckla	
DATE STARTED 10/30/77	DATE COMP. 10/30/77	COUNTY Campbell	STATE Wyoming
LOCATION: SEC. 33 T. 42N, R. 70W		FOOTAGE LOC. 27 FSL 37 FWL	GROUND ELEV 4805
SIZE AND BIT TYPE: 4 3/4 Drag.		ROTARY 360	CORING 0
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	DEPTH TO WATER LS
LITHOLOGY RECORDED BY Hollomon, Coppock, Fivas		GEOPHYSICAL LOGS RECORDED BY G. Hollomon	

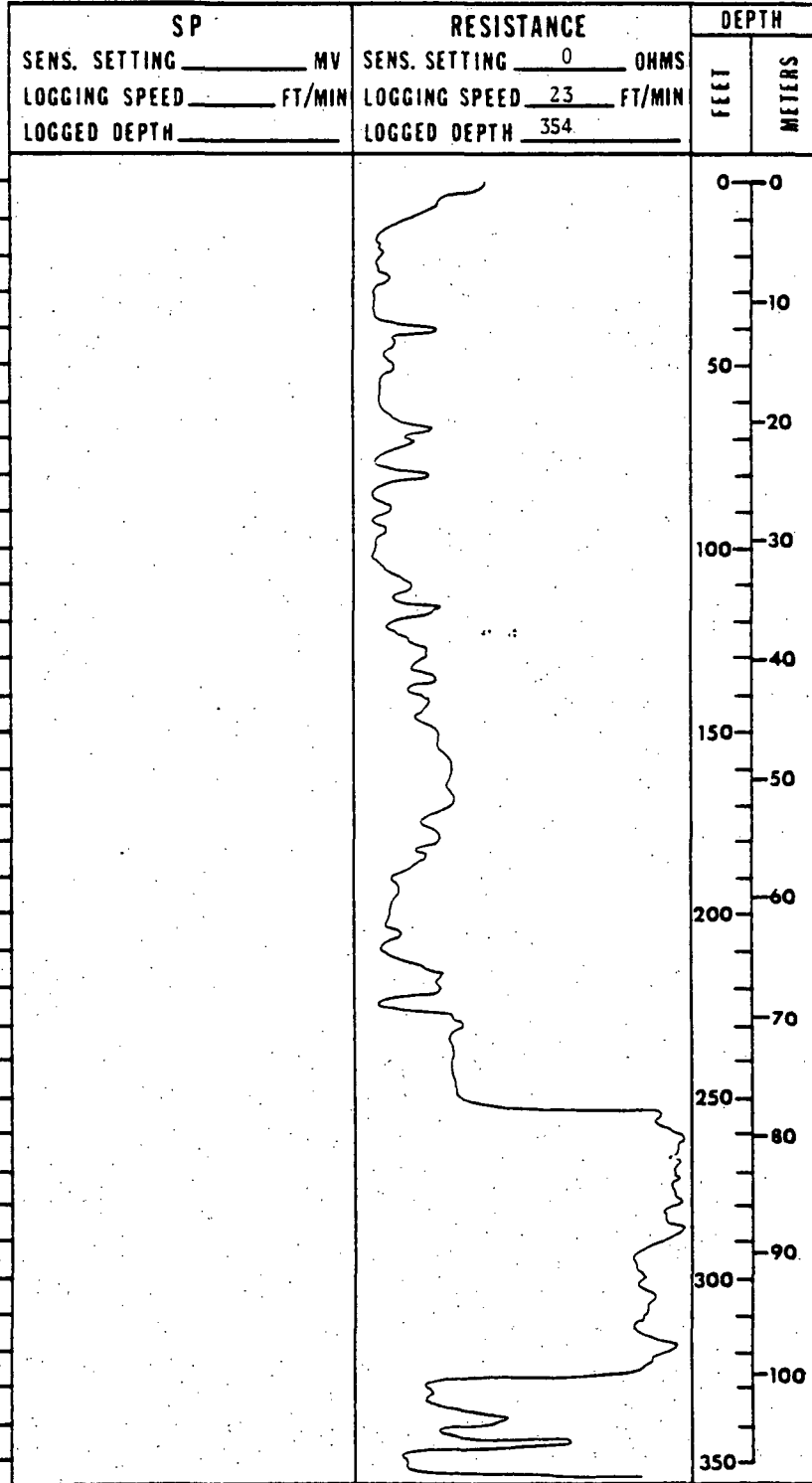
REMARKS:
Technically poor gamma log due to recorder drive malfunction.
Lithology from samples lagged to resistance log, USFS SEAM 11A;

LITHOLOGY	STRIP LOG	GAMMA		DENSITY		DEPTH	
		T.C. _____	SEC. RANGE _____	CPS _____	T.C. _____	SEC. RANGE _____	CPS _____
<p>0</p> <p>Sandstone, moderate-yellowish-brown to light-brownish-gray, weathered to 34 ft; siltstone and claystone, light-gray to brownish-black, medium-grained to very fine grained sand, sub-angular to sub-rounded grains, carbonaceous zones</p> <p>259</p> <p>Coal, dark-brown to black, dull to vitreous luster, fragmental</p> <p>327</p> <p>Siltstone and sandstone, medium-light-gray to brownish-black, fine-grained sand, carbonaceous</p> <p>353</p> <p>L.T.D.</p>		65				<p>0</p> <p>10</p> <p>50</p> <p>20</p> <p>100</p> <p>30</p> <p>40</p> <p>150</p> <p>50</p> <p>200</p> <p>60</p> <p>70</p> <p>250</p> <p>80</p> <p>300</p> <p>90</p> <p>100</p> <p>350</p>	

UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77022
SHEET 2 OF 2

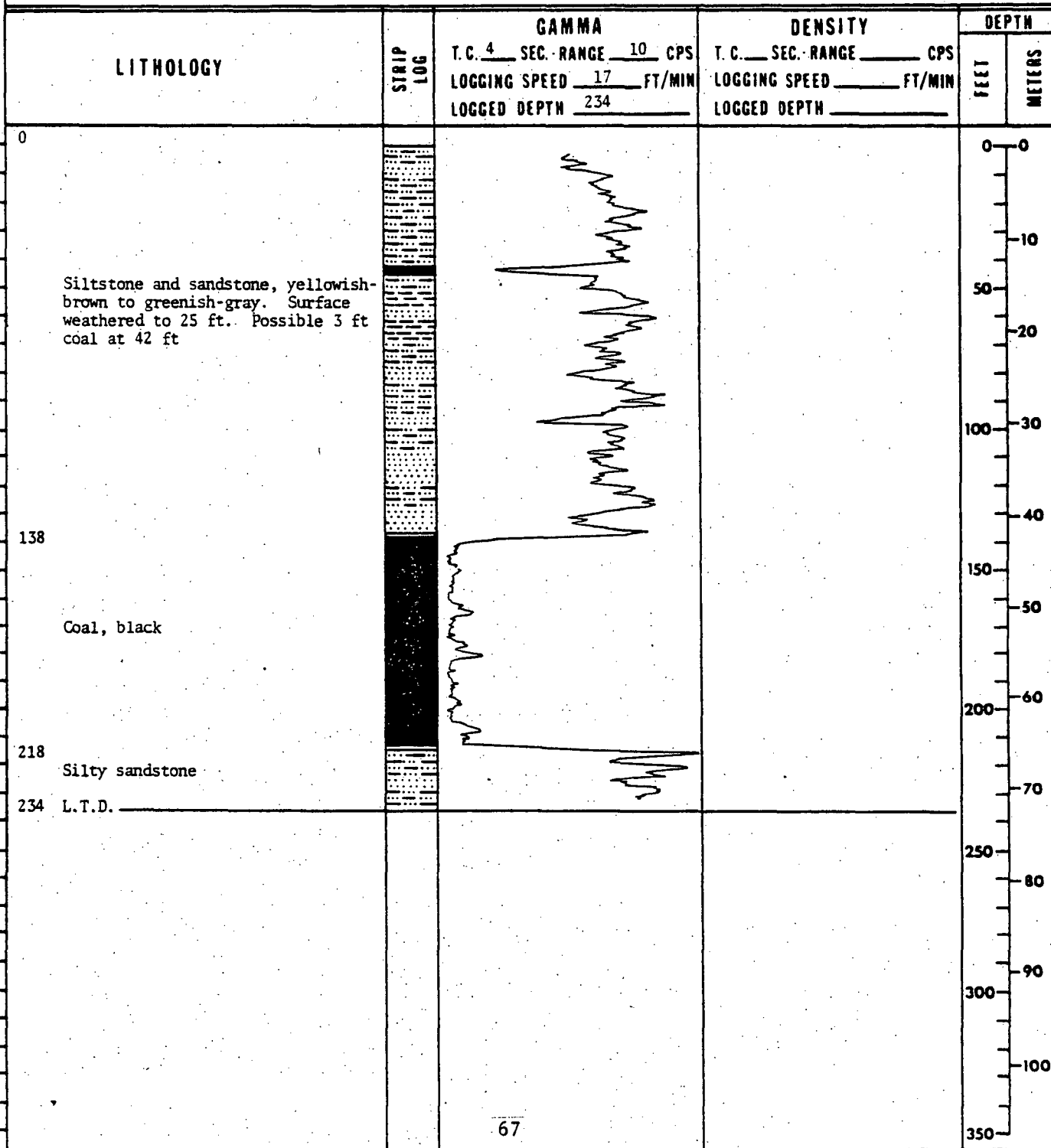
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO **CD77023**
SHEET 1 OF 2

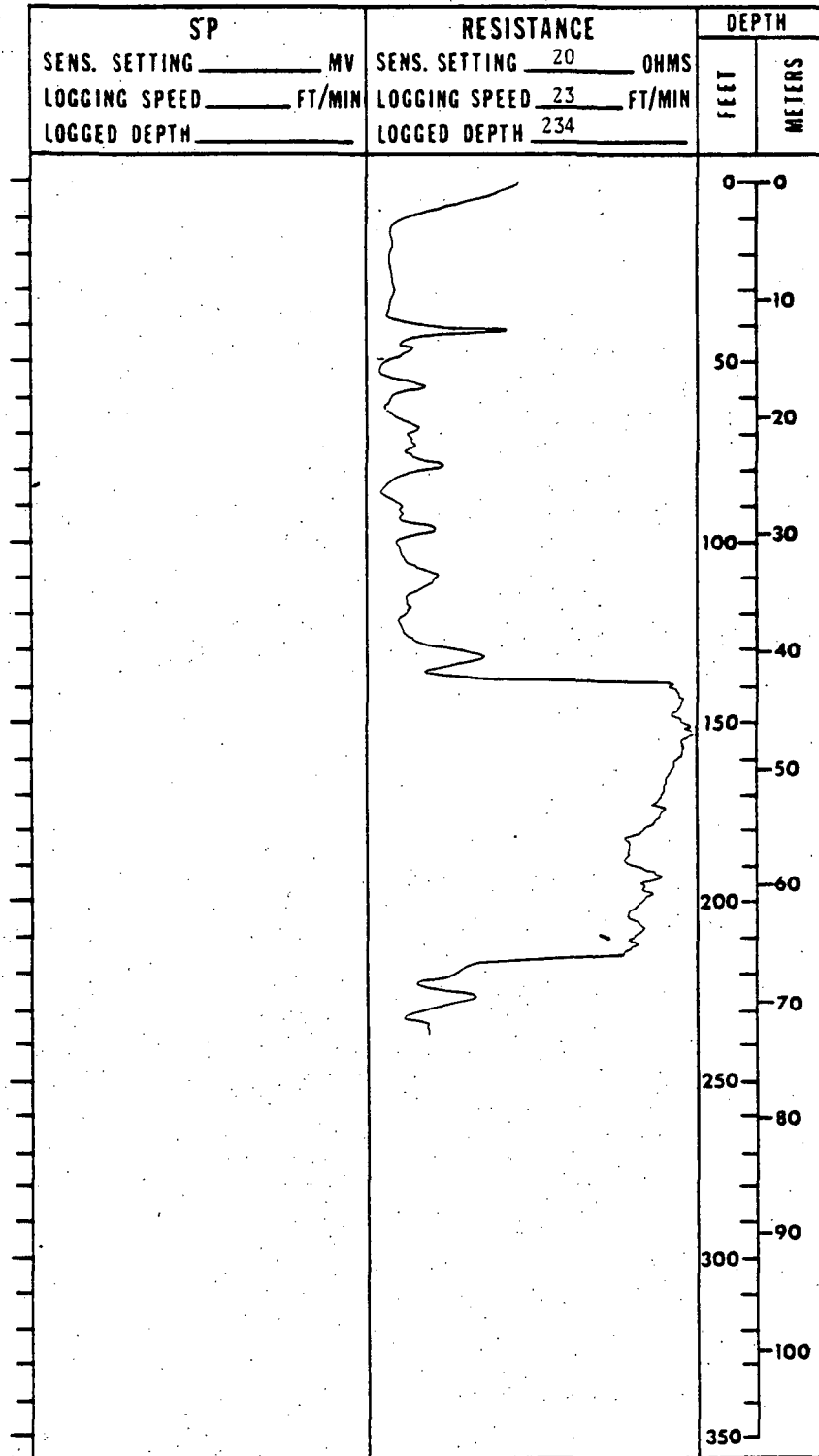
AREA Southern Powder River Basin		QUAD NAME Teckla	
DATE STARTED 10/31/77	DATE COMP. 10/31/77	COUNTY Campbell	STATE Wyoming
LOCATION: SEC. 33 T. 42N , R. 70W , FOOTAGE LOC. 200		FWL 2000 FWL	GROUND ELEV 4740
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE ROTARY 240 CORING 0	
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	
LITHOLOGY RECORDED BY Hollomon, Coppock, Eivas		GEOPHYSICAL LOGS RECORDED BY G. A. Hollomon	
REMARKS: USFS SEAM 3N			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77023
SHEET 2 OF 2

REMARKS:

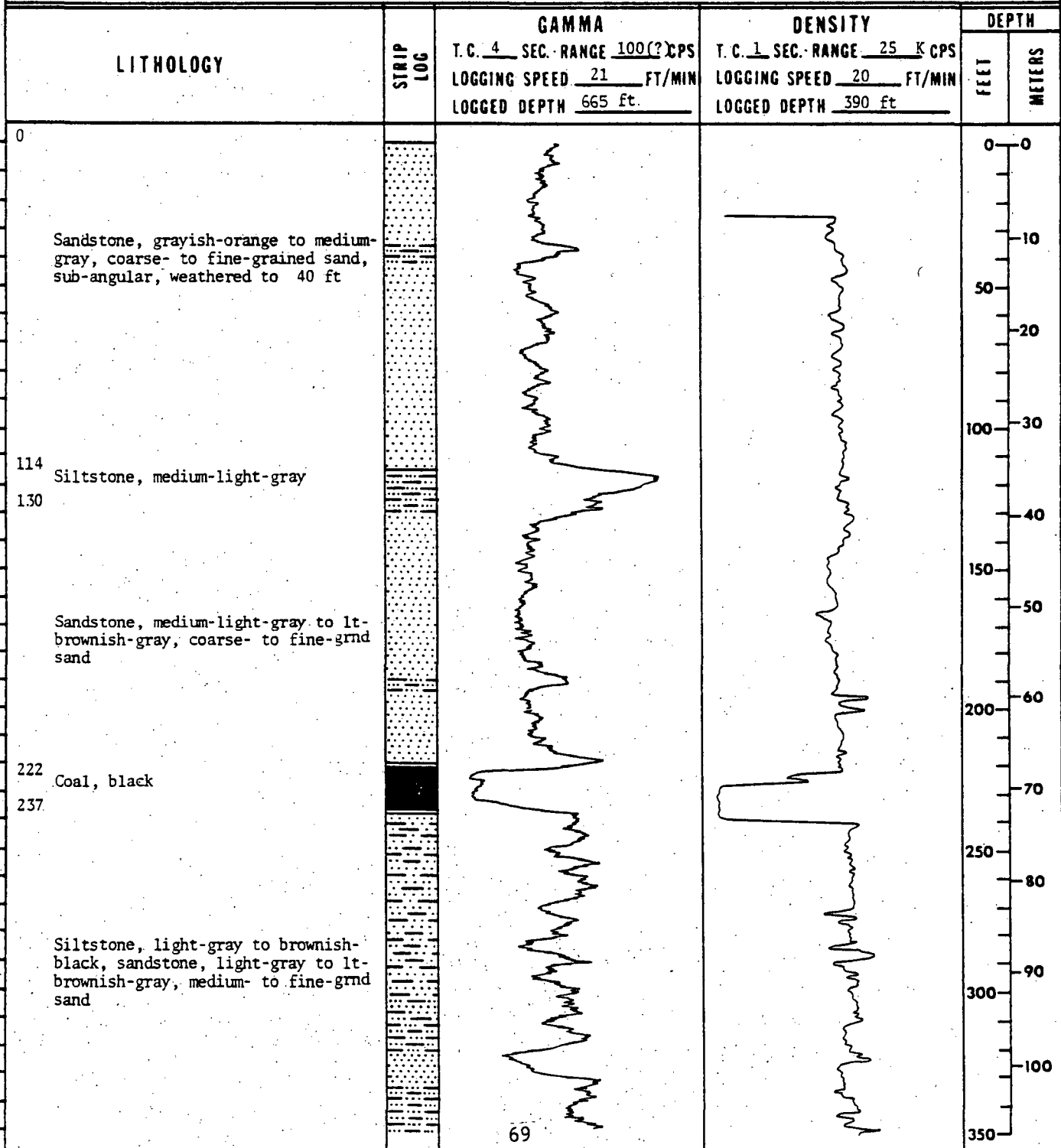


UNITED STATES GEOLOGICAL SURVEY

HOLE NO 77024
SHEET 1 OF 4

AREA Southern Powder River Basin		QUAD NAME Little Thunder Reservoir	
DATE STARTED 11/2/77	DATE COMP. 11/2/77	COUNTY Campbell	STATE Wyoming
LOCATION: SEC. 7 T. 43N, R. 71W		FOOTAGE LOC. 100	GROUND ELEV 4850
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE ROTARY 700	CORING 0
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	DEPTH TO WATER 25 ft
LITHOLOGY RECORDED BY Hollomon, Coppock, Fivas		GEOPHYSICAL LOGS RECORDED BY G.A. Hollomon	

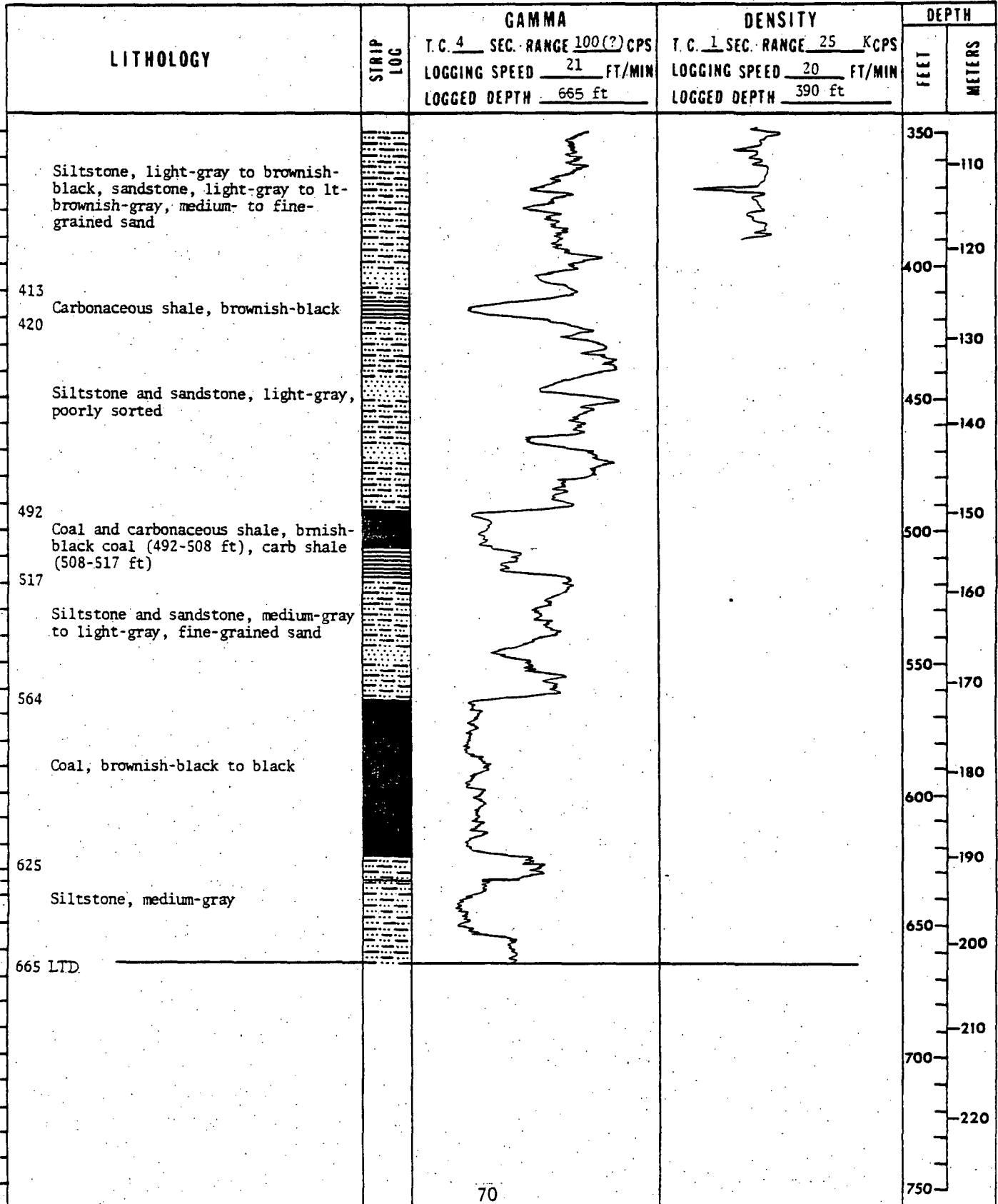
REMARKS: Gamma logged through drill rods.



UNITED STATES GEOLOGICAL SURVEY

HOLE NO 77024
SHEET 2 OF 4

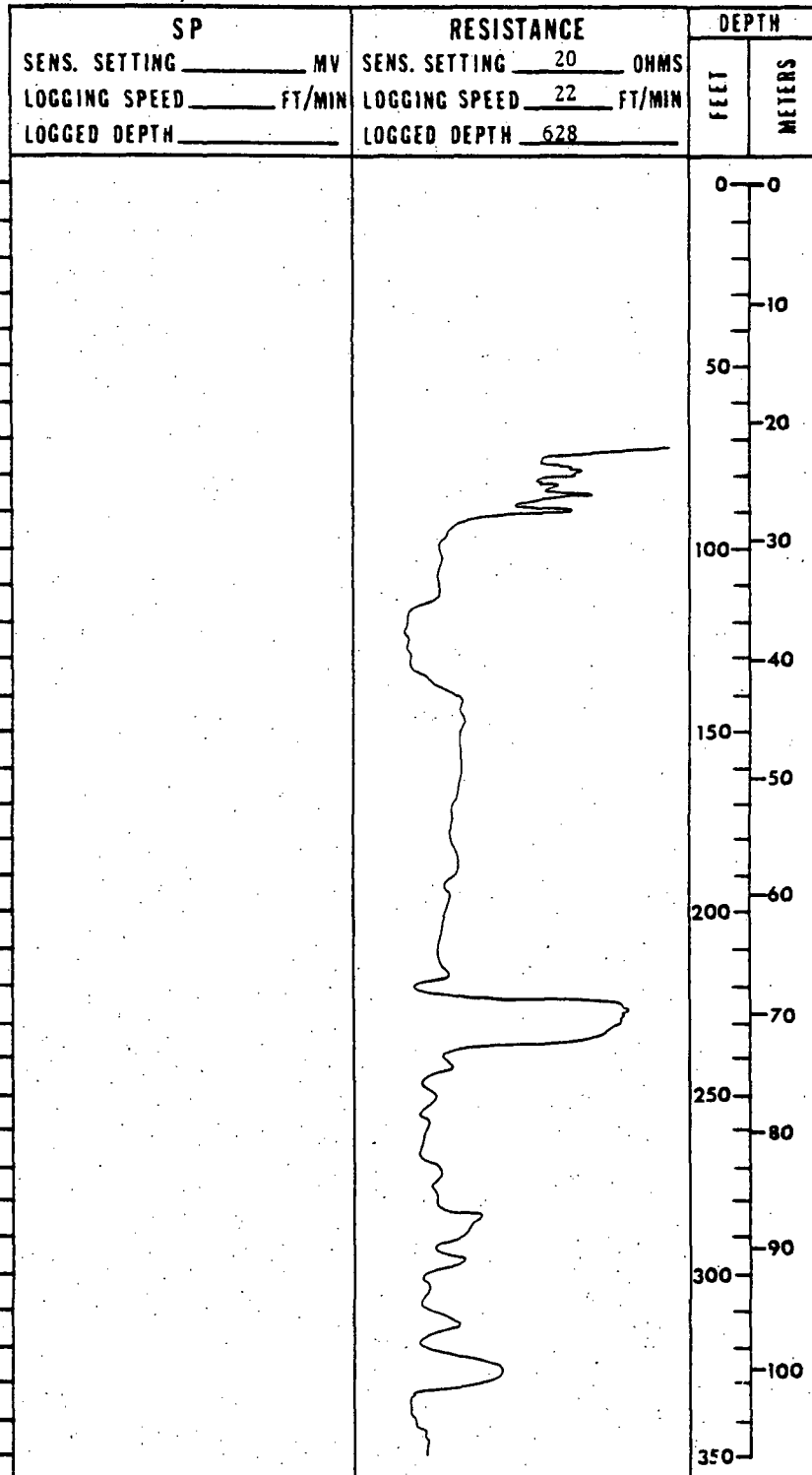
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. 77024
SHEET 3 OF 4

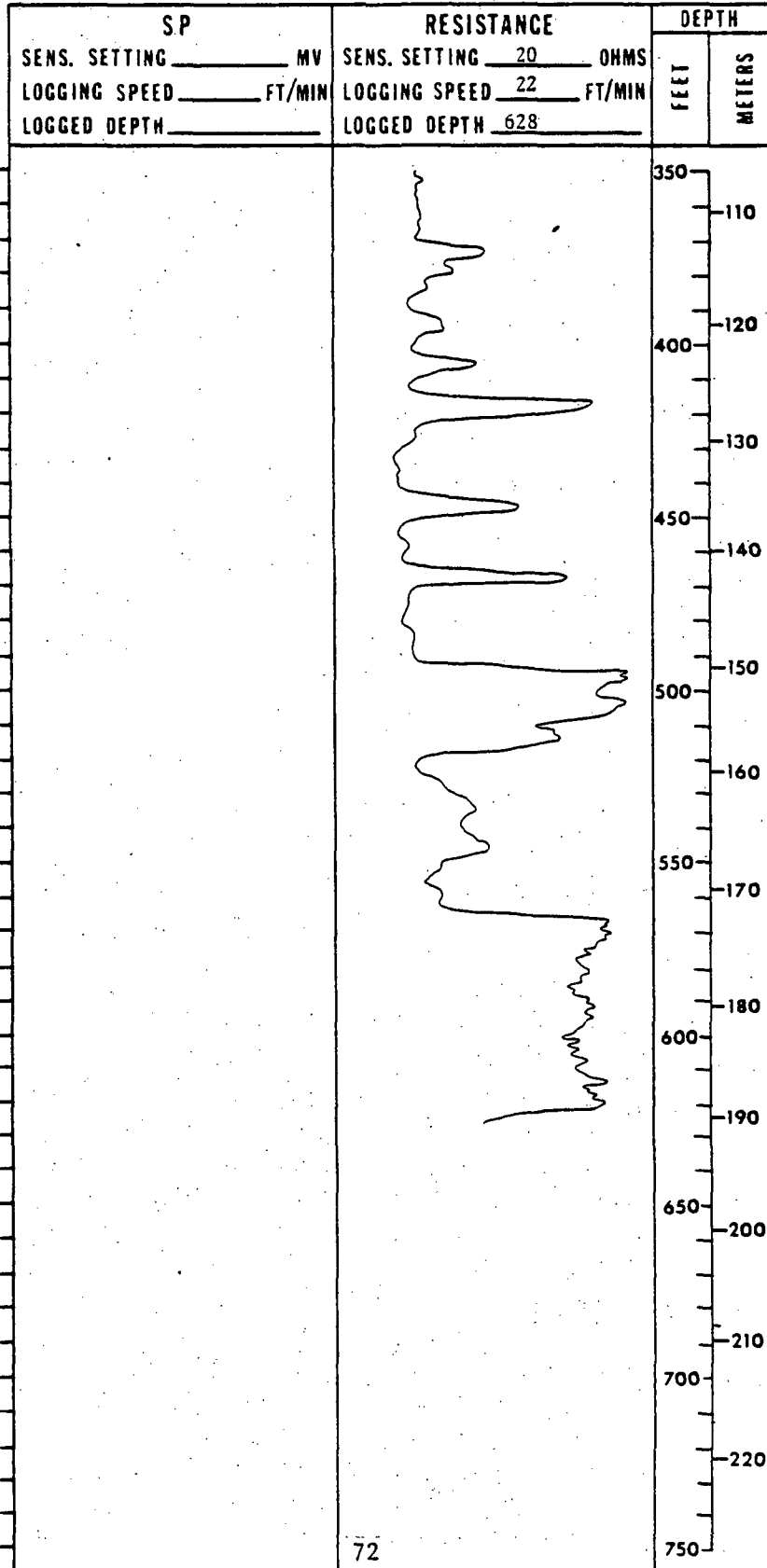
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. 77024
SHEET 4 OF 4

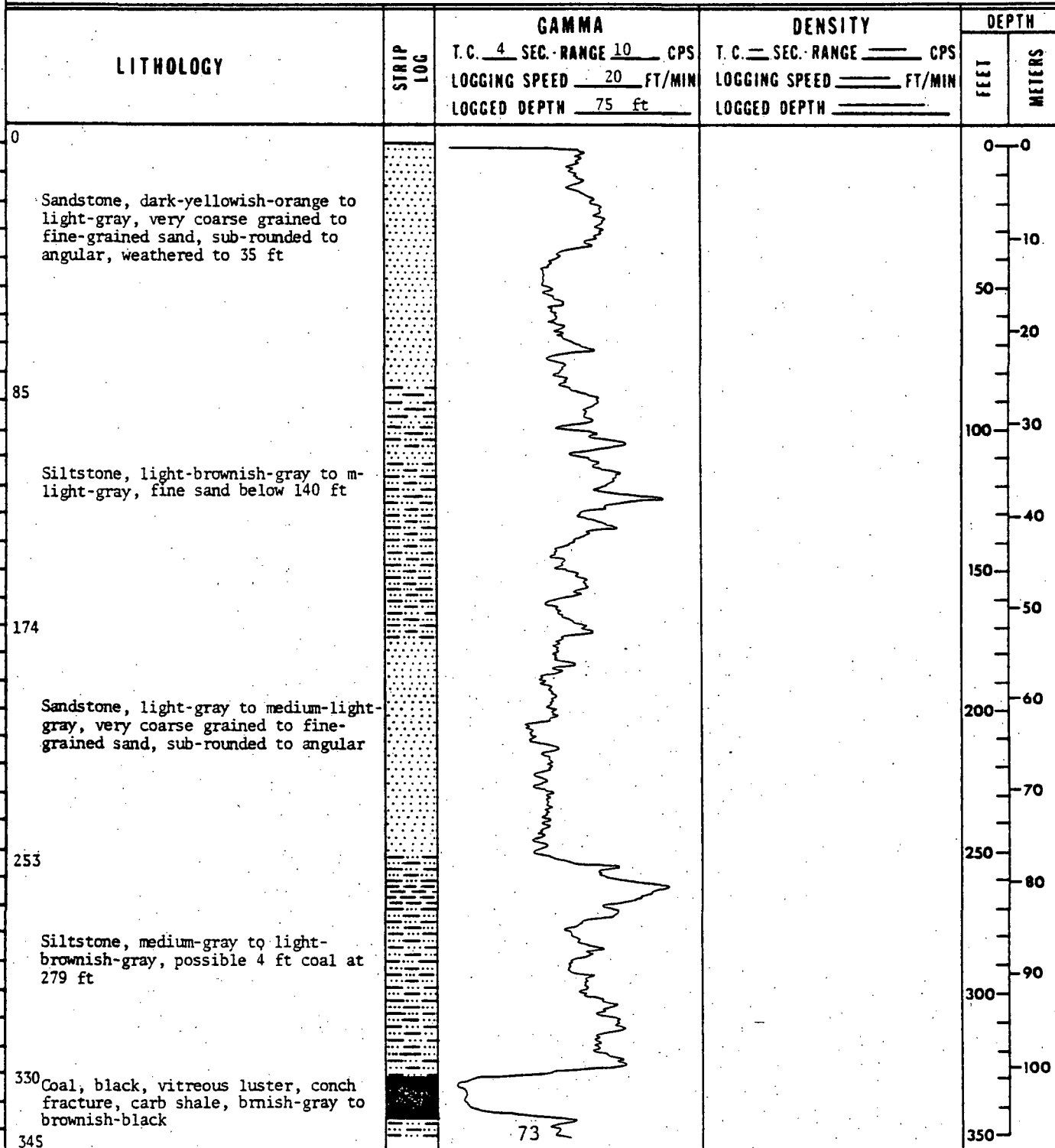
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO **CD77025**
SHEET **1** OF **4**

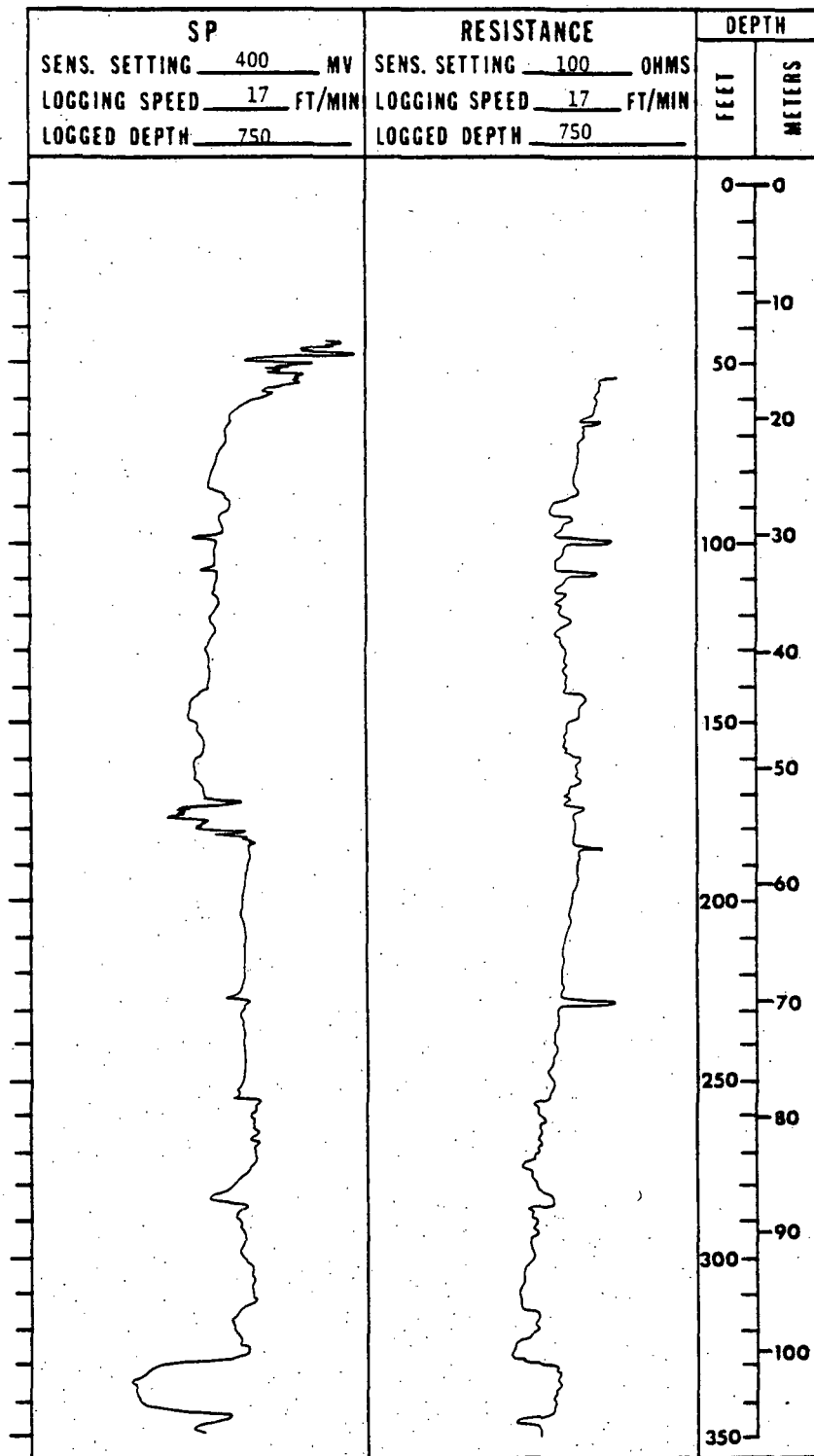
AREA Southern Powder River Basin		QUAD NAME Little Thunder Reservoir	
DATE STARTED 11/11/77	DATE COMP. 11/11/77	COUNTY Campbell	STATE Wyoming
LOCATION: SEC. 7 T. 43N , R. 71W , FOOTAGE LOC.		100 FWL	100 FWL
SIZE AND BIT TYPE: 4 3/4 Ken-claw		FOOTAGE	
		ROTARY 800	CORING 0
DRILLING AGENCY: U.S. Geological Survey		DRILL TYPE: Portadrill 524	DEPTH TO WATER 27 ft
LITHOLOGY RECORDED BY Hollomon, Coppock, Kistner		GEOPHYSICAL LOGS RECORDED BY F.B. Kistner	
REMARKS:			



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. 077025
SHEET 3 OF 4

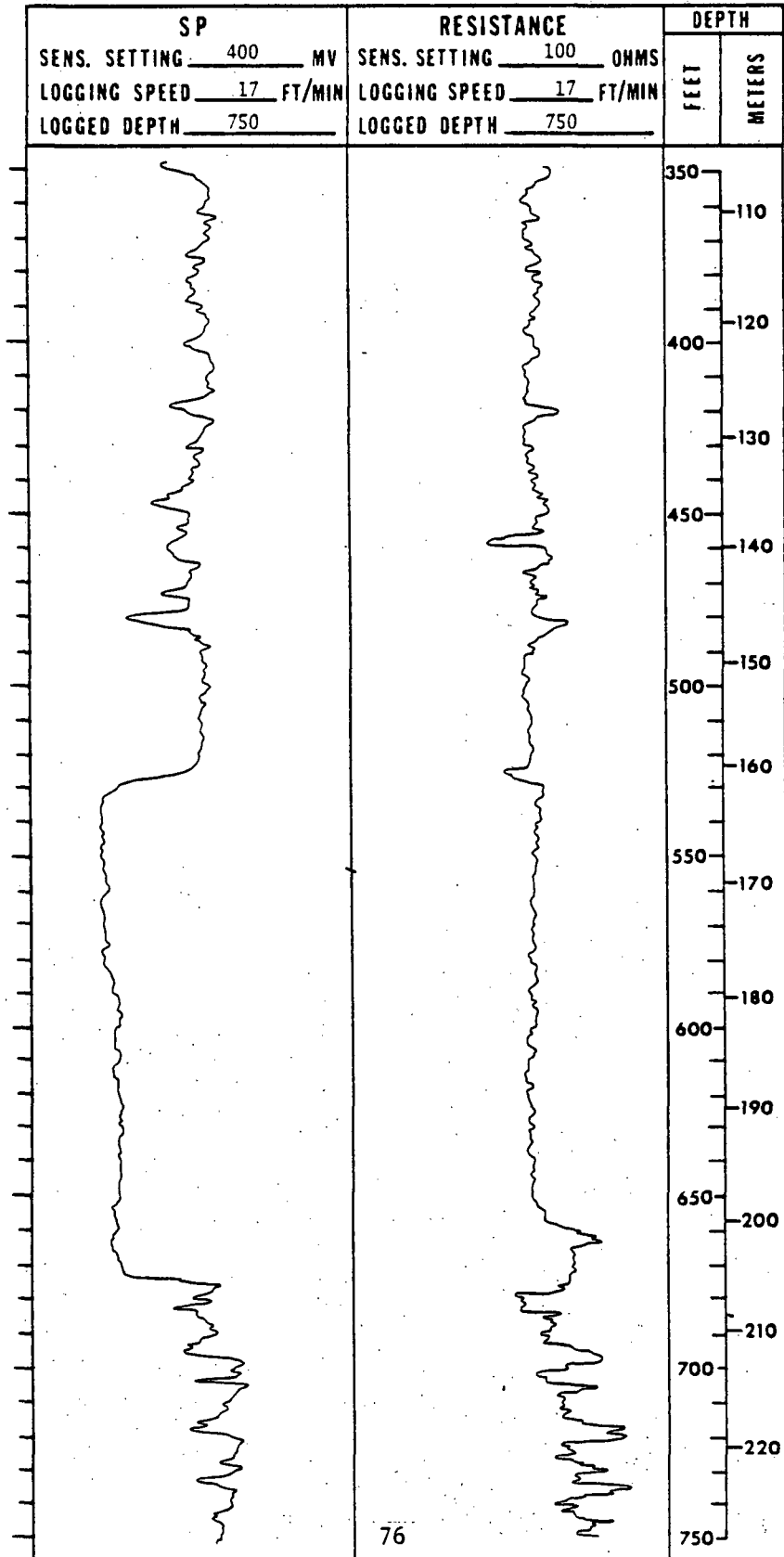
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77025
SHEET 4 OF 4

REMARKS:

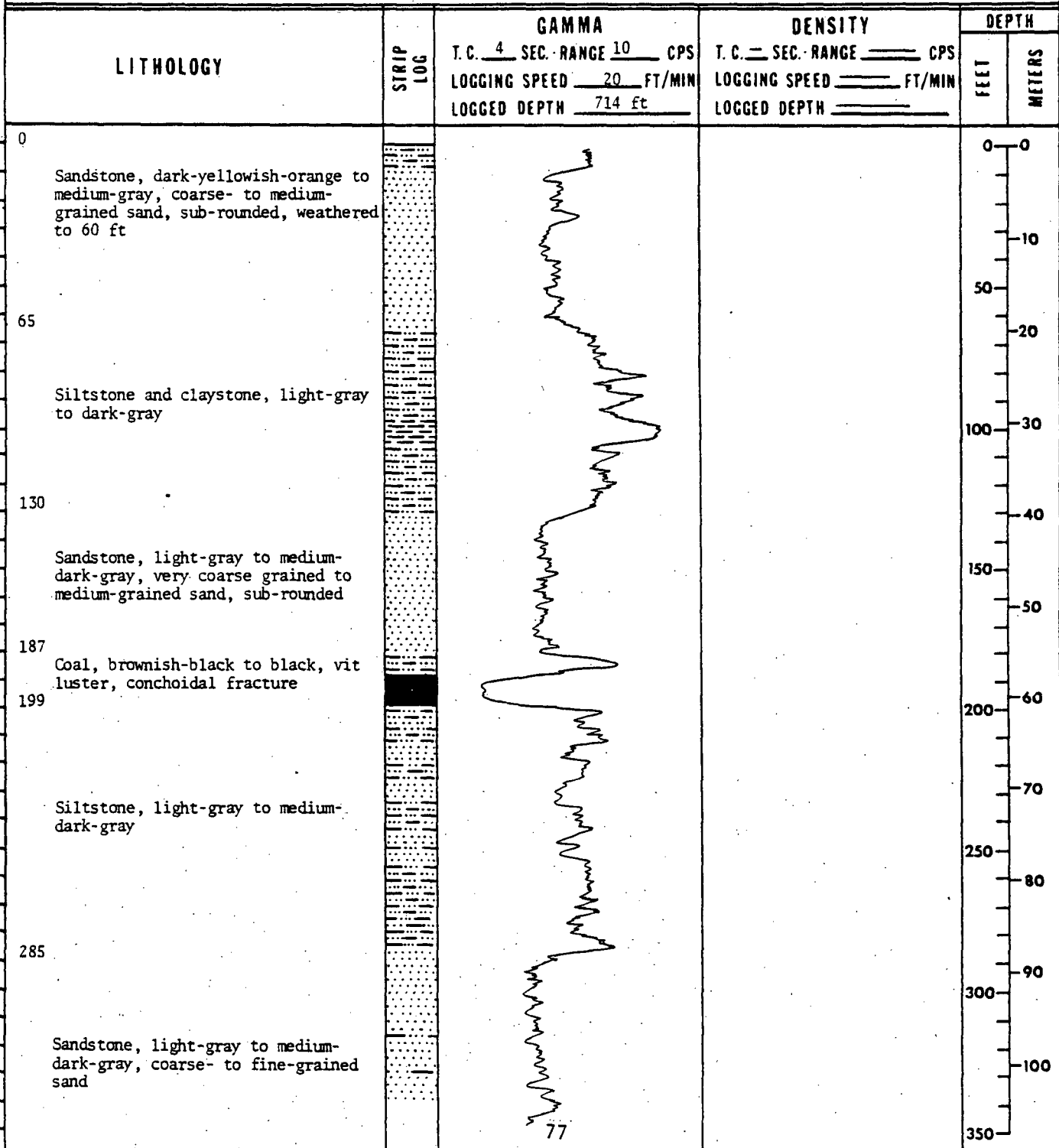


UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD77026
SHEET 1 OF 4

AREA <u>Southern Powder River Basin</u>		QUAD NAME <u>Little Thunder Reservoir</u>	
DATE STARTED <u>11/13/77</u>	DATE COMP. <u>11/13/77</u>	COUNTY <u>Campbell</u>	STATE <u>Wyoming</u>
LOCATION: SEC. <u>24</u> T. <u>43N</u> R. <u>72W</u>		FOOTAGE LOC. <u>2550</u>	FNL <u>2550</u> FEL <u>2550</u>
SIZE AND BIT TYPE: <u>4 3/4 Drag</u>		FOOTAGE: ROTARY <u>725</u> CORING <u>0</u>	
DRILLING AGENCY: <u>U. S. Geological Survey</u>		DRILL TYPE: <u>Portadrill 524</u>	
LITHOLOGY RECORDED BY <u>Hollomon, Coppock, Fivas</u>		GEOPHYSICAL LOGS RECORDED BY <u>F.B. Kistner</u>	

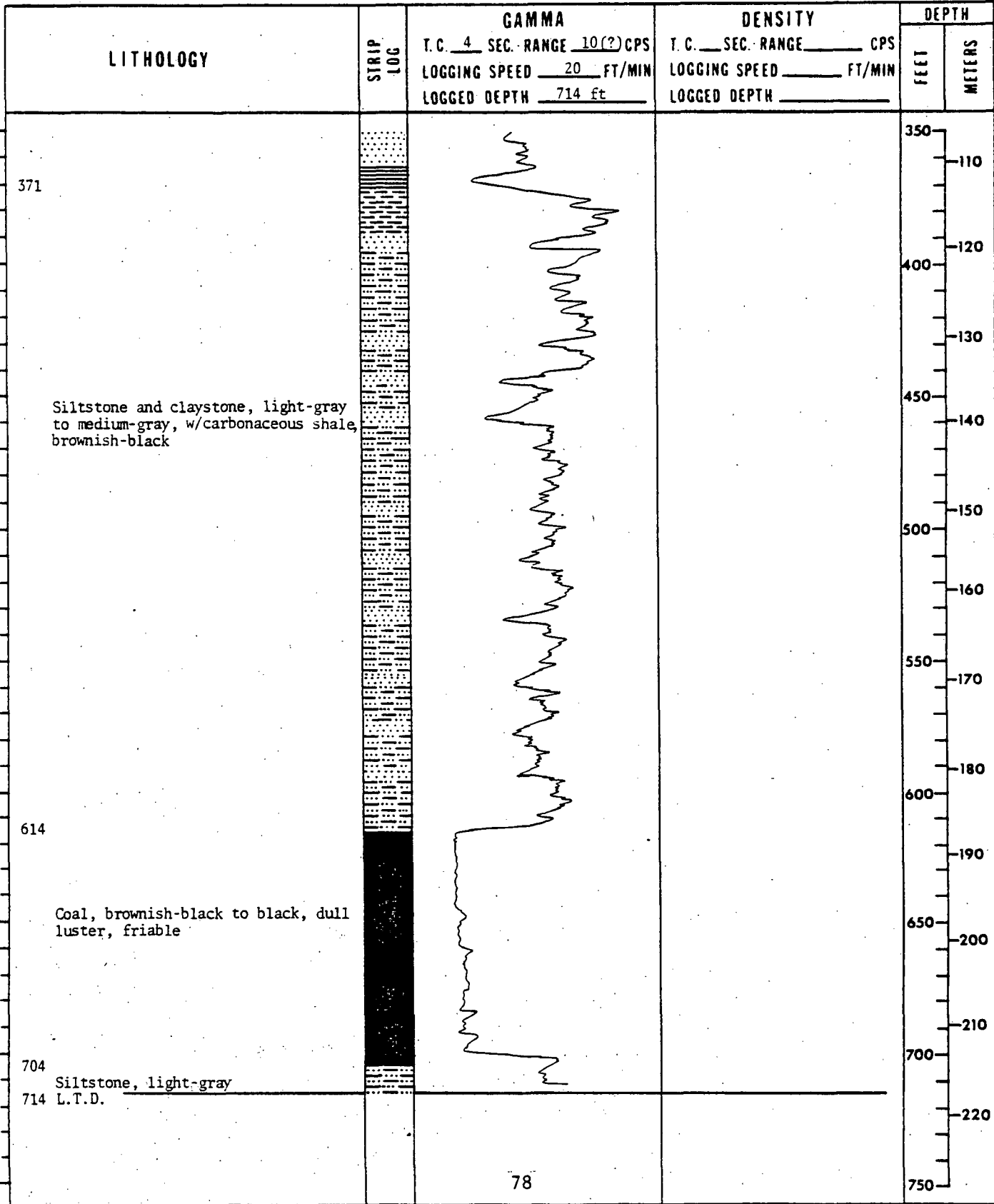
REMARKS: Gamma logged through drill rods.



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77026
SHEET 2 OF 4

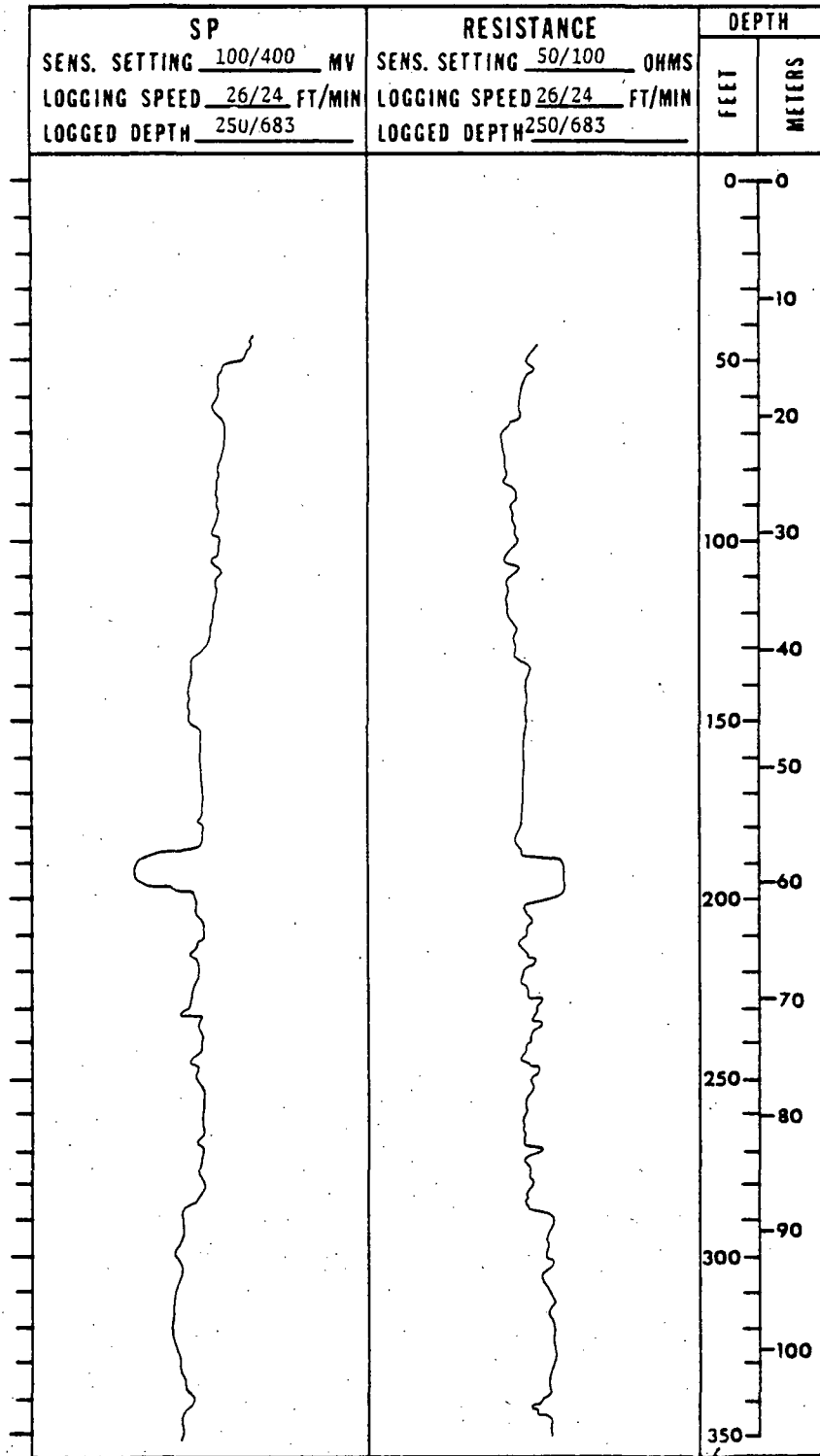
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77026
SHEET 3 OF 4

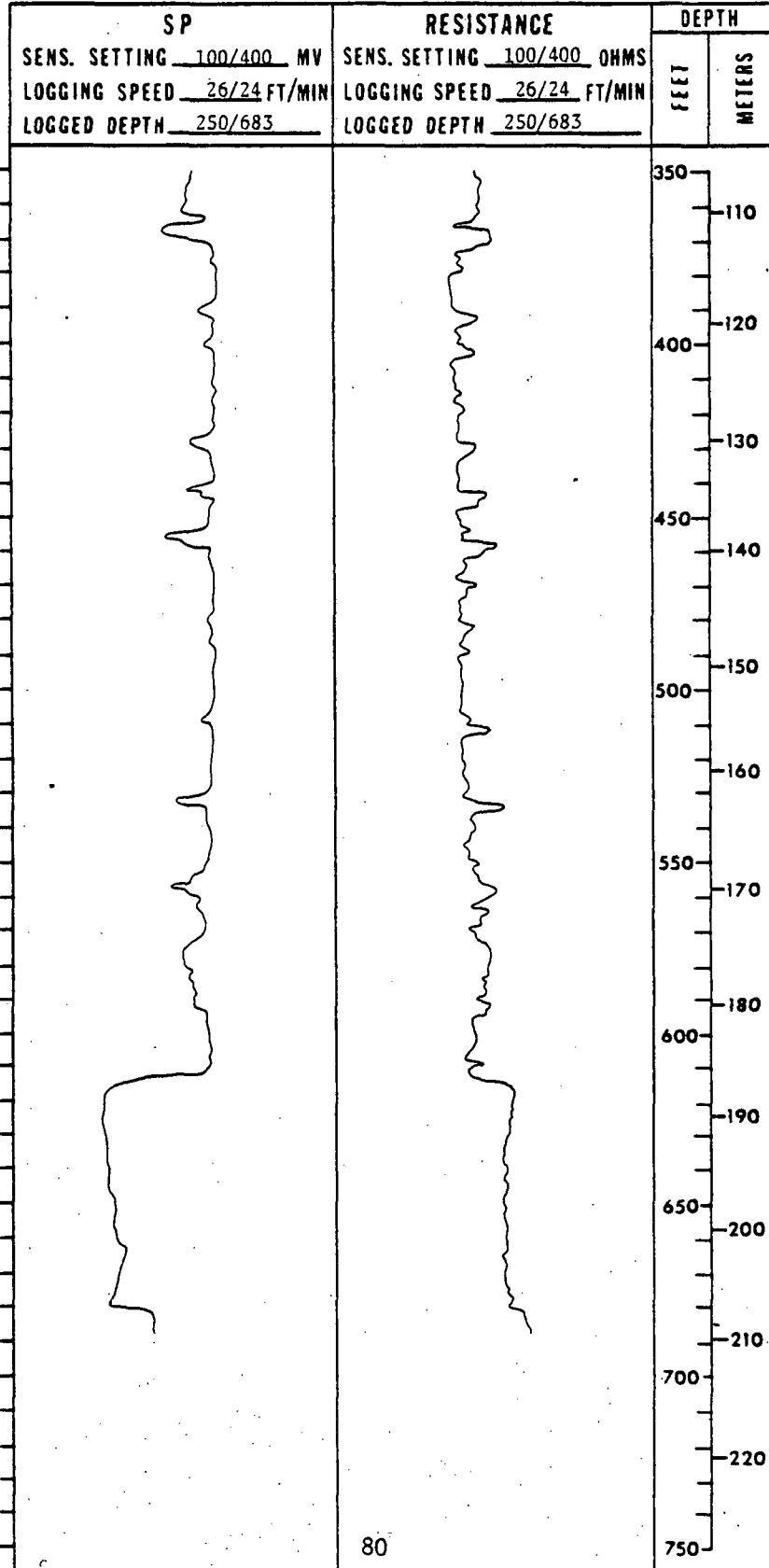
REMARKS: Log is composite of two runs



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77026
SHEET 4 OF 4

REMARKS: Log is composite of two runs



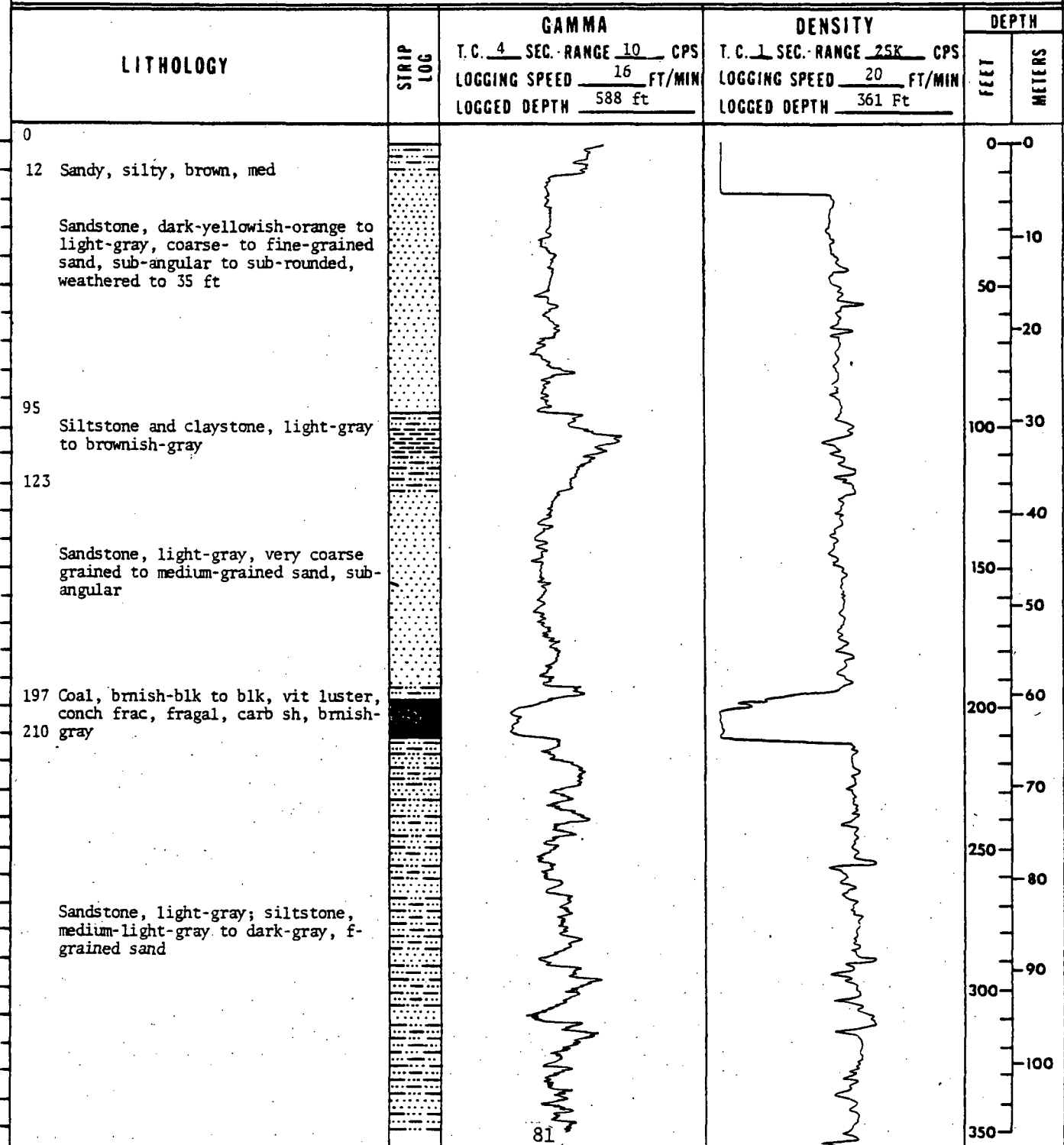
UNITED STATES GEOLOGICAL SURVEY

HOLE NO **CD77027**
SHEET 1 OF 4

AREA Southern Powder River Basin		QUAD NAME Little Thunder Reservoir	
DATE STARTED 11/14/77	DATE COMP. 11/14/77	COUNTY Campbell	STATE Wyoming
LOCATION: SEC. 13 T. 43N R. 72W		FOOTAGE LOC. 600 ###	GROUND ELEV 4835
SIZE AND BIT TYPE: 4 3/4 Drag		FOOTAGE	
		ROTARY 600	CORING 0
DRILLING AGENCY: U. S. Geological Survey		DRILL TYPE: Portadrill 524	TOTAL DEPTH 600
LITHOLOGY RECORDED BY Hollomon, Coppock, Fivas		GEOPHYSICAL LOGS RECORDED BY F.B. Kistner	

REMARKS:

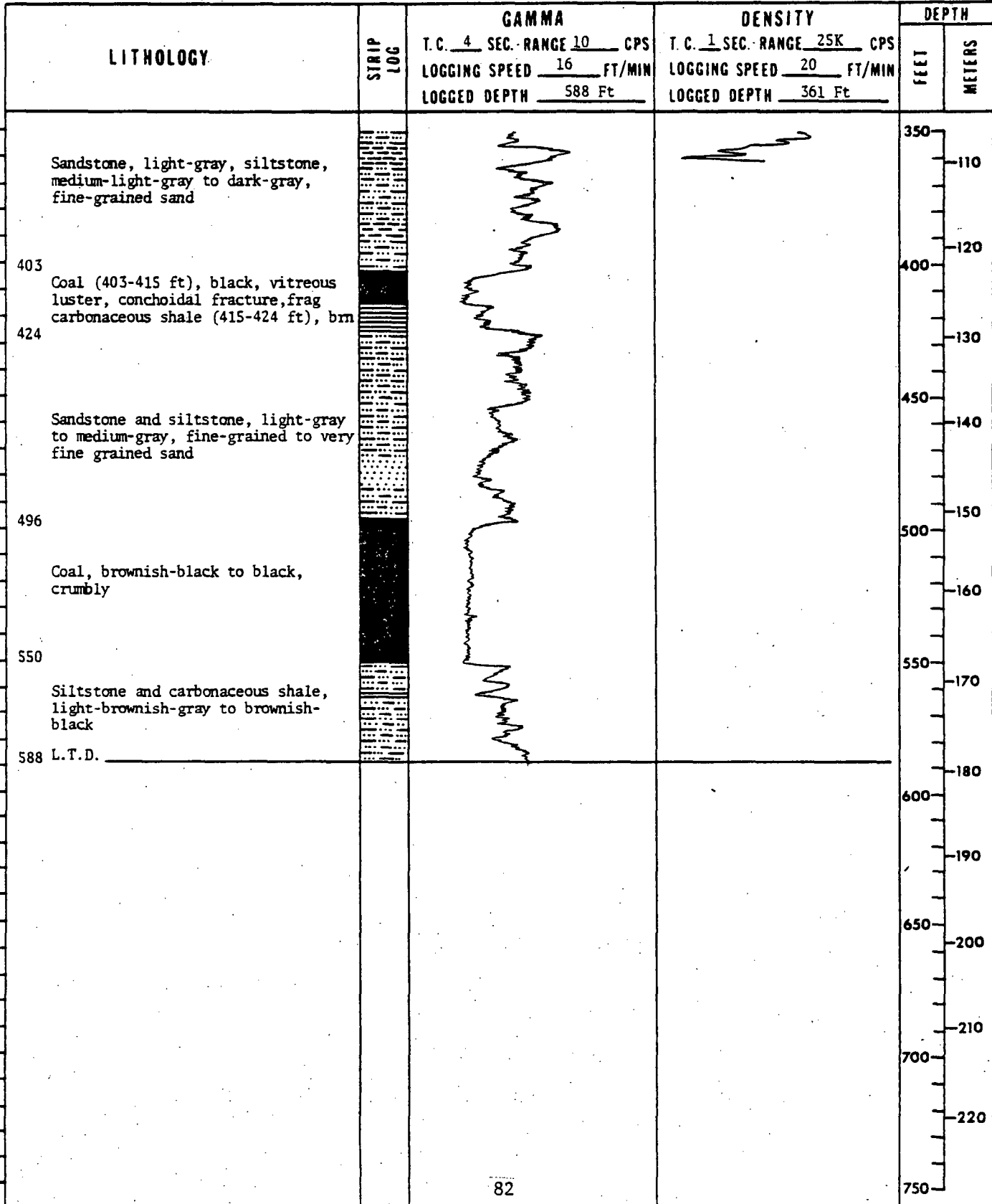
Gamma logged thru drill rods



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. 077027
SHEET 2 OF 4

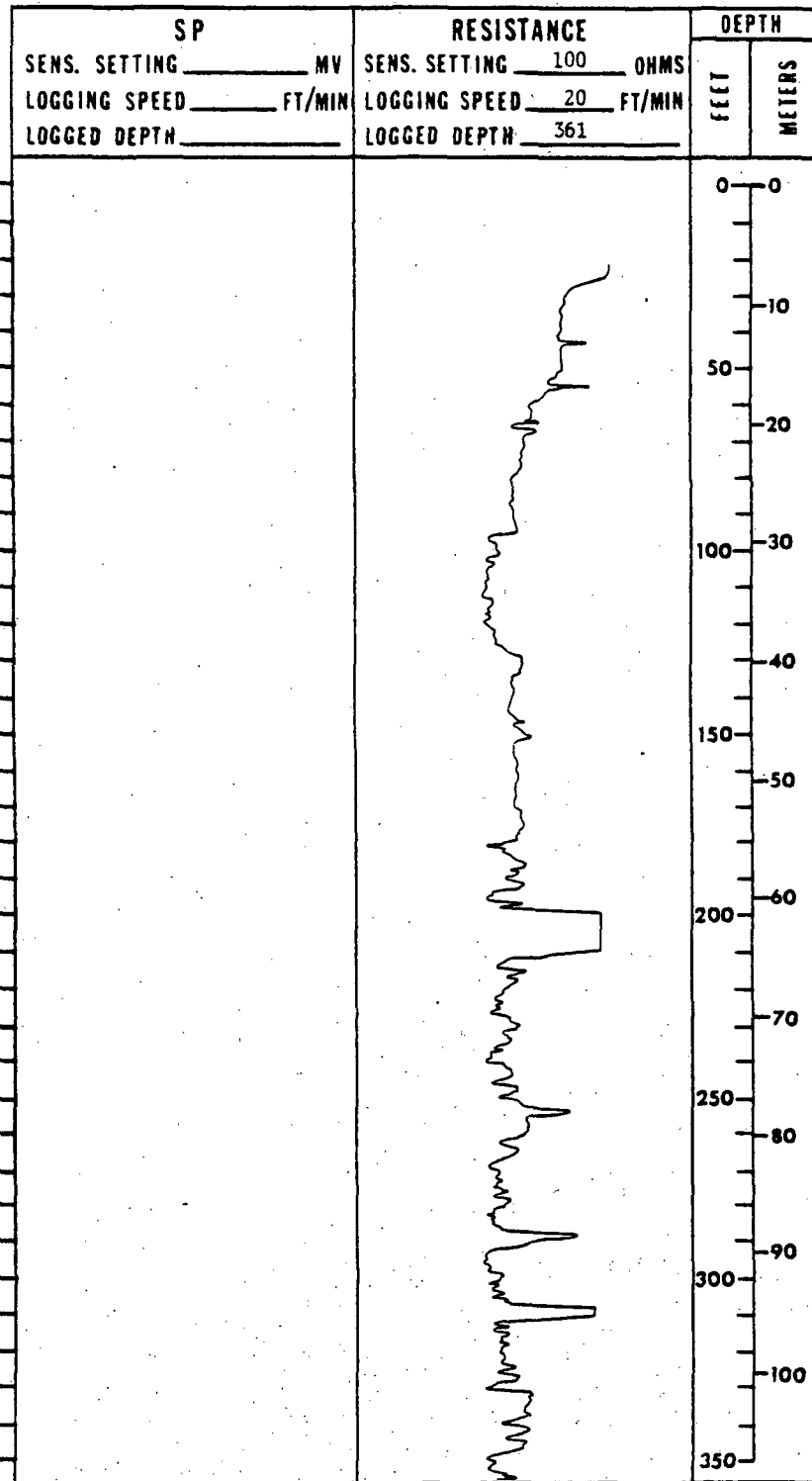
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77027
SHEET 3 OF 4

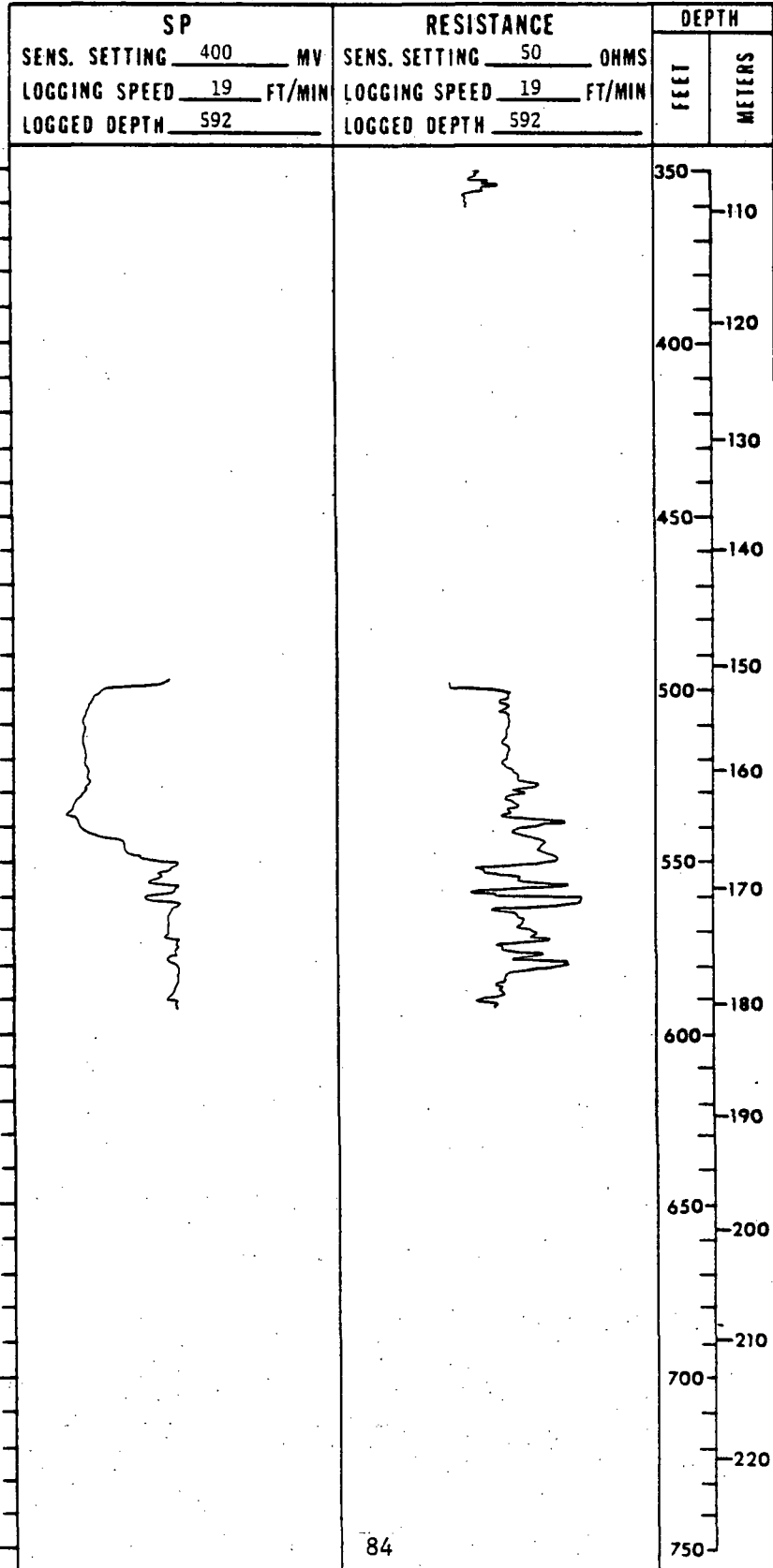
REMARKS:



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HOLE NO. CD77027
SHEET 4 OF 4

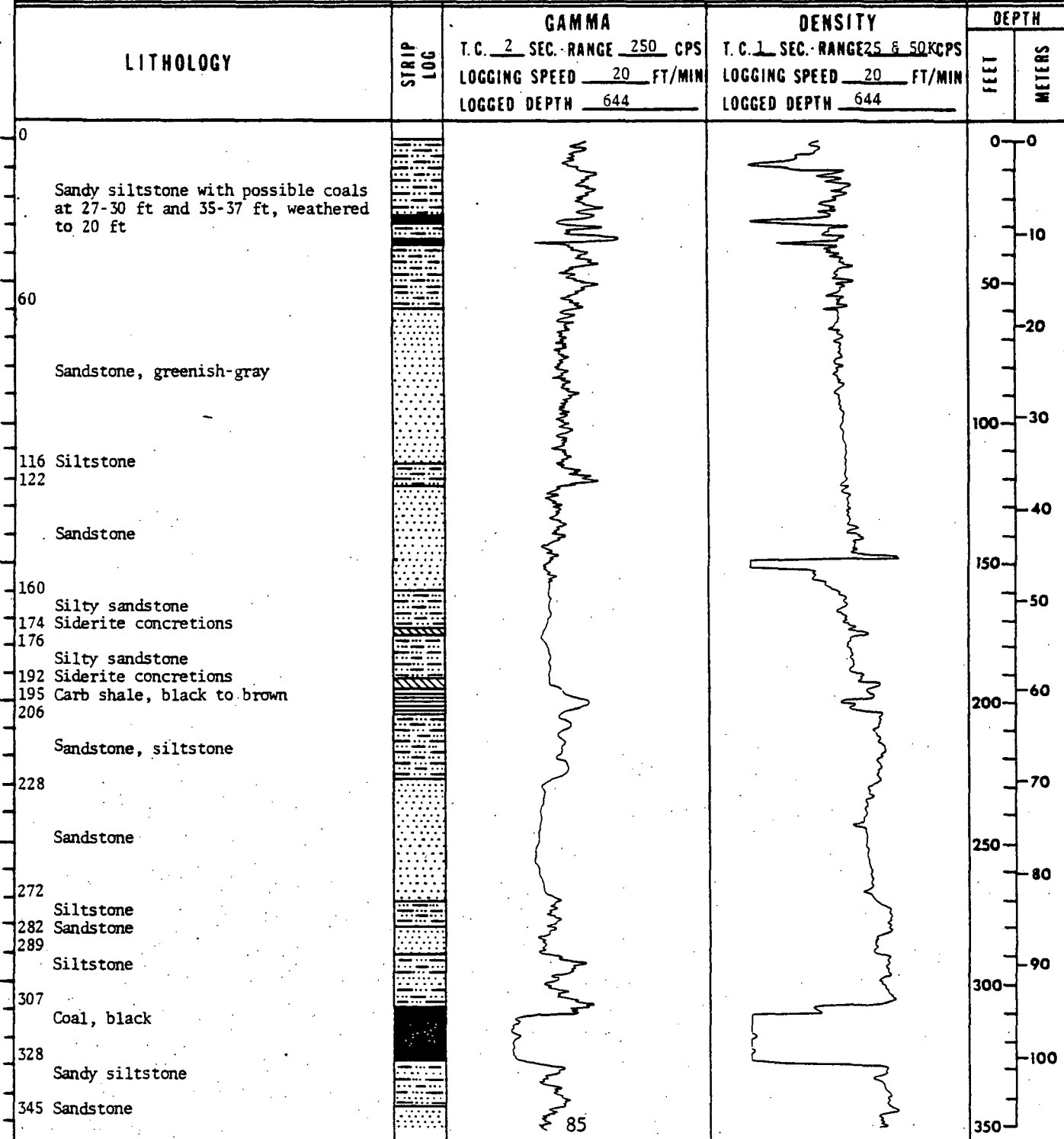
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO **CD77028**
SHEET 1 OF 4

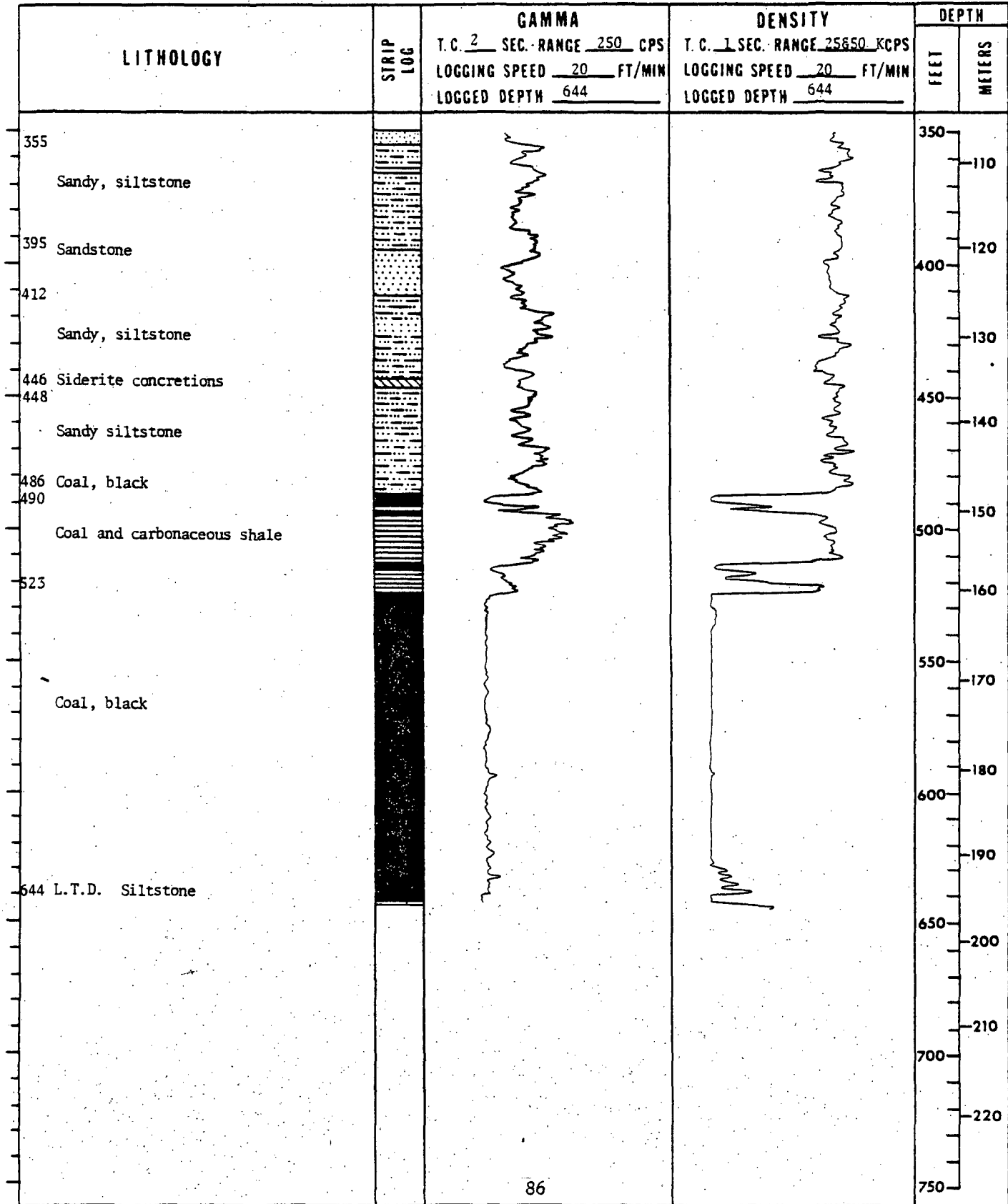
AREA Southern Powder River Basin		QUAD NAME Little Thunder Reservoir	
DATE STARTED 11/15/77	DATE COMP. 11/16/77	COUNTY Campbell	STATE Wyoming
LOCATION: SEC. 12 T. 43N., R. 72W., FOOTAGE LOC.		1300 FT FSL	1400 FT FWL
SIZE AND BIT TYPE: 4 3/4 Ken-claw & drag		FOOTAGE	
		ROTARY 670	CORING 0
DRILLING AGENCY: U.S.G.S.		DRILL TYPE: Portadrill 524	DEPTH TO WATER 148 ft
LITHOLOGY RECORDED BY Fivas		GEOPHYSICAL LOGS RECORDED BY Century Geophysical	
REMARKS: Density log scale changed from 25 to 50 KCPS @ 148 ft Lost circulation @ 557 ft			



UNITED STATES GEOLOGICAL SURVEY

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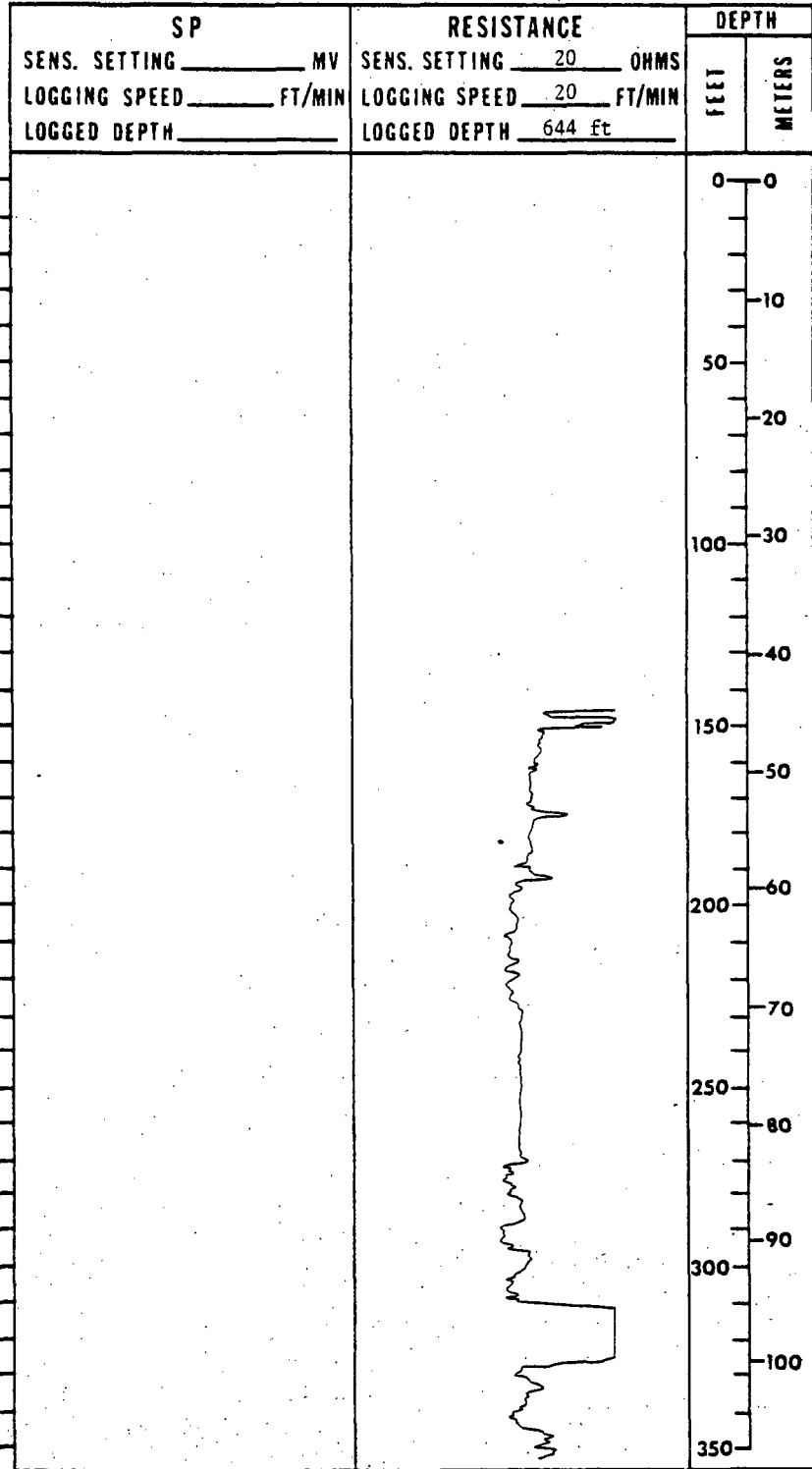
REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77028
SHEET 3 OF 4

REMARKS:



UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD77028
SHEET 4 OF 4

REMARKS:

