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UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

GEOPHYSICAL AND LITHOLOGIC LOGS OF NINE  
TEST HOLES DRILLED DURING 1978  
IN HARDING COUNTY, SOUTH DAKOTA

UNIVERSITY OF UTAH  
RESEARCH INSTITUTE  
EARTH SCIENCE LAB.

By

Frank B. Kistner

Open-File Report 80-852

1980

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 (in)	2.54	Centimeters (cm)
Feet (ft)	0.3048	Meters (m)

Abbreviations

brn	-	brown
carb	-	carbonaceous
lt	-	light
LTD	-	Logged Total Depth
NR	-	No Record
ss	-	sandstone
w/	-	with

GEOPHYSICAL AND LITHOLOGIC LOGS OF NINE TEST HOLES  
DRILLED DURING 1978 IN HARDING COUNTY, SOUTH DAKOTA

By Frank B. Kistner

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INTRODUCTION

Between October 25 and November 1, 1978, nine coal test holes were drilled and geophysically logged near Ludlow, in Harding County, South Dakota (fig. 1). Drilling was conducted by personnel (and drilling equipment) of the U.S. Geological Survey (USGS) as part of an ongoing USGS program to evaluate and classify mineral lands in the public domain. The purpose of the program is to gather data on the thickness, extent, correlation, quality, and recoverability of coal beds, and the thickness and lithologic characteristics of the associated rocks in the Tertiary Tongue River and Ludlow-Cannonball Members of the Fort Union Formation in the Williston Basin.

The occurrence of lignite in northwestern South Dakota has been discussed by several writers (Winchester and others, 1916; Searight, 1930; Baker, 1952). Discovery of uranium associated with these lignites has drawn the attention of numerous investigators to this area since the mid-1950's (Curtiss, 1955; Denson and others, 1959; Pipiringos and others, 1965; Dane, 1978). Several authors (Hares, 1928; Kepferle and Culbertson, 1955; Rehbein, 1977) have discussed the general geology, stratigraphy, and depositional environments of the thicker lignite deposits in North Dakota. These discussions apply in a general way to the coal geology of northwestern South Dakota.

Although considerable uranium exploration drilling has been conducted in the Ludlow area, there has been no previous coal drilling to the writer's knowledge. This report presents geophysical logs and field lithologic descriptions lagged (or corrected in depth intervals) to match the geophysical logs. Test holes CD-78001 through CD-78071, inclusive, and test hole CD-78081 were drilled in Wyoming and their logs were presented in a report by Kistner and others (1980). Table 1 lists the locations and test-hole numbers of all holes drilled in Harding County, South Dakota, during the 1978 field season.

Specific drill-site 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 expressed as distances, in feet, scaled from section lines as they appear on topographic quadrangle sheets. Elevations are approximate for all test holes.

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. Where circulation could not be maintained 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, Wyoming. Field logs were completed for each test hole and are on file in Casper.

The usual geophysical logging procedure was to run a multiconductor probe equipped with gamma-ray, resistance, and spontaneous potential detectors. Where problems existed with drill-hole instability, the drill pipe was used to temporarily case the hole, and a gamma-ray casing collar locator log was run through the drill pipe. The logs were photographically reduced to a vertical scale of 1 inch to 50 feet for convenience in reproducing this report, and the originals are on file at the Casper office.

The identification of lignites from geophysical logs is discussed at length by Kaiser (1974, p. 32), Kaiser and others (1978, p. 67-68), and Rehbein (1977, p. 3-4). Gamma-ray logs were found to be generally the most useful, followed in order of usefulness by density, neutron, acoustic (sonic), and electrical logs. Induction logs, used alone, were found to be the least reliable for the identification of lignite beds, especially near the outcrop. This experience is supported by the logs presented in this report. The single-point resistance log often does not respond to lignites. It is thought that the water quality and content of the lignites in relation to their enclosing rocks dictates this lack of electrical response.

#### ACKNOWLEDGEMENTS

Fieldwork was carried out by the following USGS personnel: Frank B. Kistner, geologist; Gregg A. Hollomon, technician; Harry R. Cureton, driller. Supervision and technical guidance were provided by Frank B. Kistner and Robert C. Lewis.

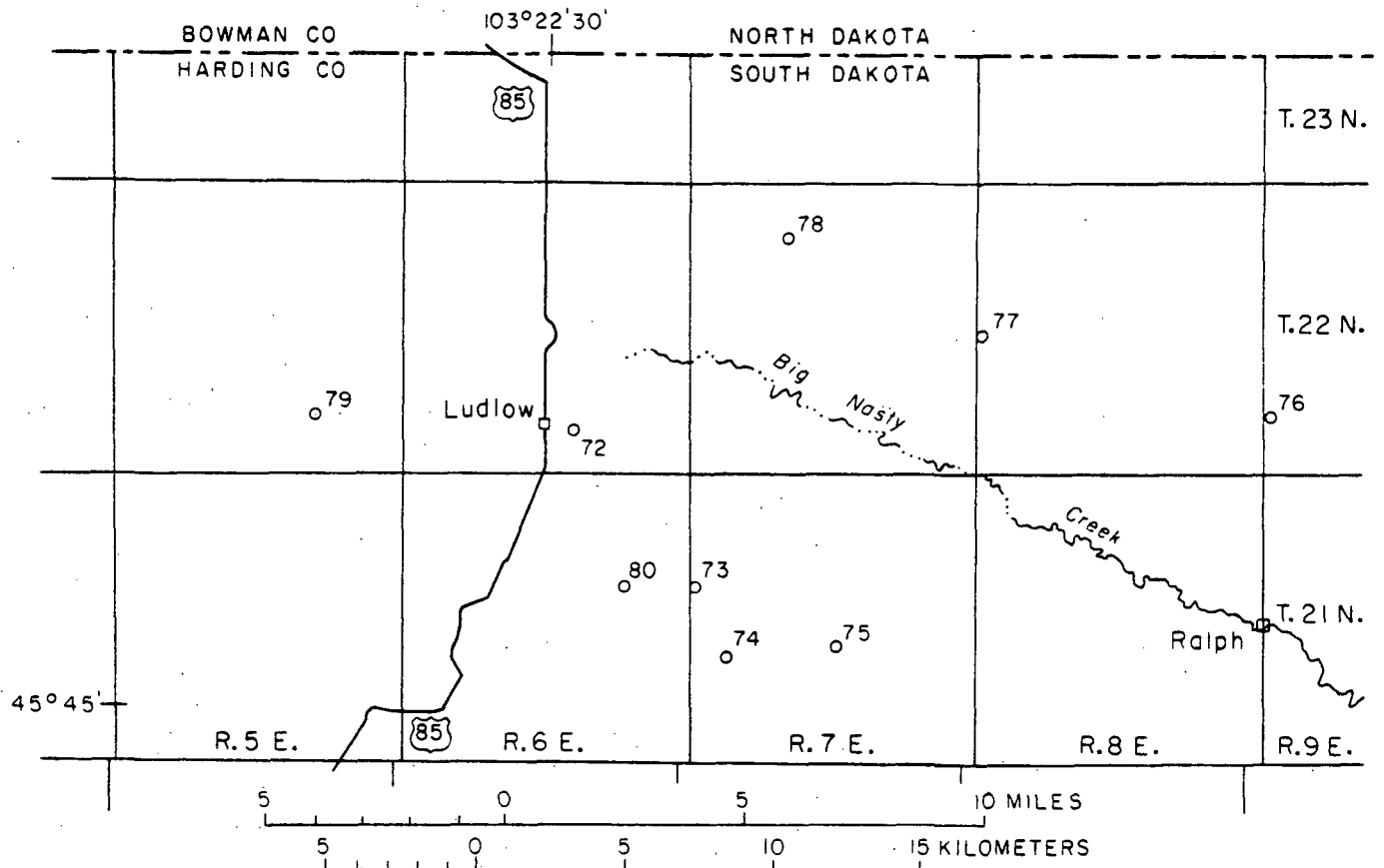


Figure 1. - Coal test holes drilled during 1978 in Harding County, South Dakota, (Hole numbers in Table 1 are preceded by CD-780\_\_.)

Table 1.--Summary of information for nine coal test holes in Harding County, South Dakota

Test-hole Number	Location				Depth (feet)	
	T.N.	R.E.	Sec.	1/4	Drilled	Logged
CD-78072	22	6	34	NE	400	390
CD-78073	21	7	18	NW	200	200
CD-78074	21	7	19	SE	500	490
CD-78075	21	7	22	SW	300	300
CD-78076	22	9	30	SW	540	530
CD-78077	22	8	19	NW	500	490
CD-78078	22	7	9	NW	420	417
CD-78079	22	5	26	SW	620	610
CD-78080	21	6	14	NE	200	190

#### REFERENCES CITED

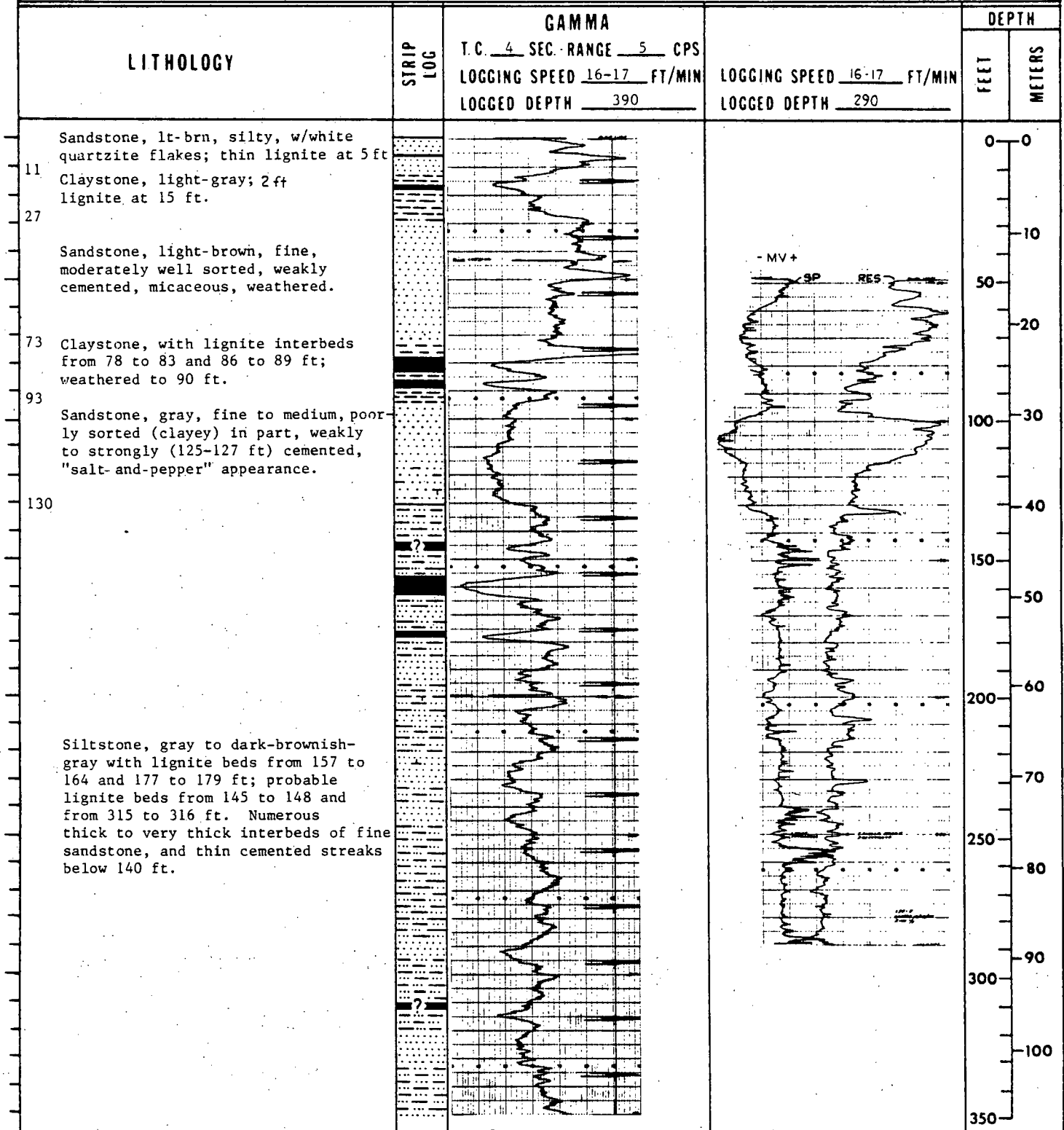
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# UNITED STATES GEOLOGICAL SURVEY

HOLE NO. CD-78072  
SHEET 1 OF 2

AREA Southern Williston Basin		QUAD NAME Ludlow SE	
DATE STARTED 10-25-1978	DATE COMP. 10-26-1978	COUNTY Harding	STATE South Dakota
LOCATION: SEC. 34 T. 22 N., R. 6 E.		FOOTAGE LOC. 890	FNL 1650 FEL GROUND ELEV 3090
SIZE AND BIT TYPE: 5-in. wing		FOOTAGE ROTARY 400 CORING 0	
DRILLING AGENCY: USGS/CD/NRMA		DRILL TYPE: Portadrill 524	DEPTH TO WATER NR
LITHOLOGY RECORDED BY F. B. Kistner		GEOPHYSICAL LOGS RECORDED BY G. A. Hollomon	

**REMARKS:**  
Gamma ray logged through drill pipe  
"Noisy" SP curve  
SP = 20 MV  
RES = 10 OHMS

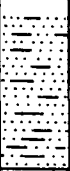
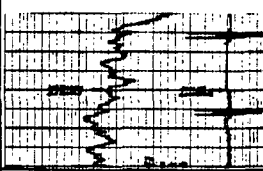




# UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD-78072  
SHEET 2 OF 2

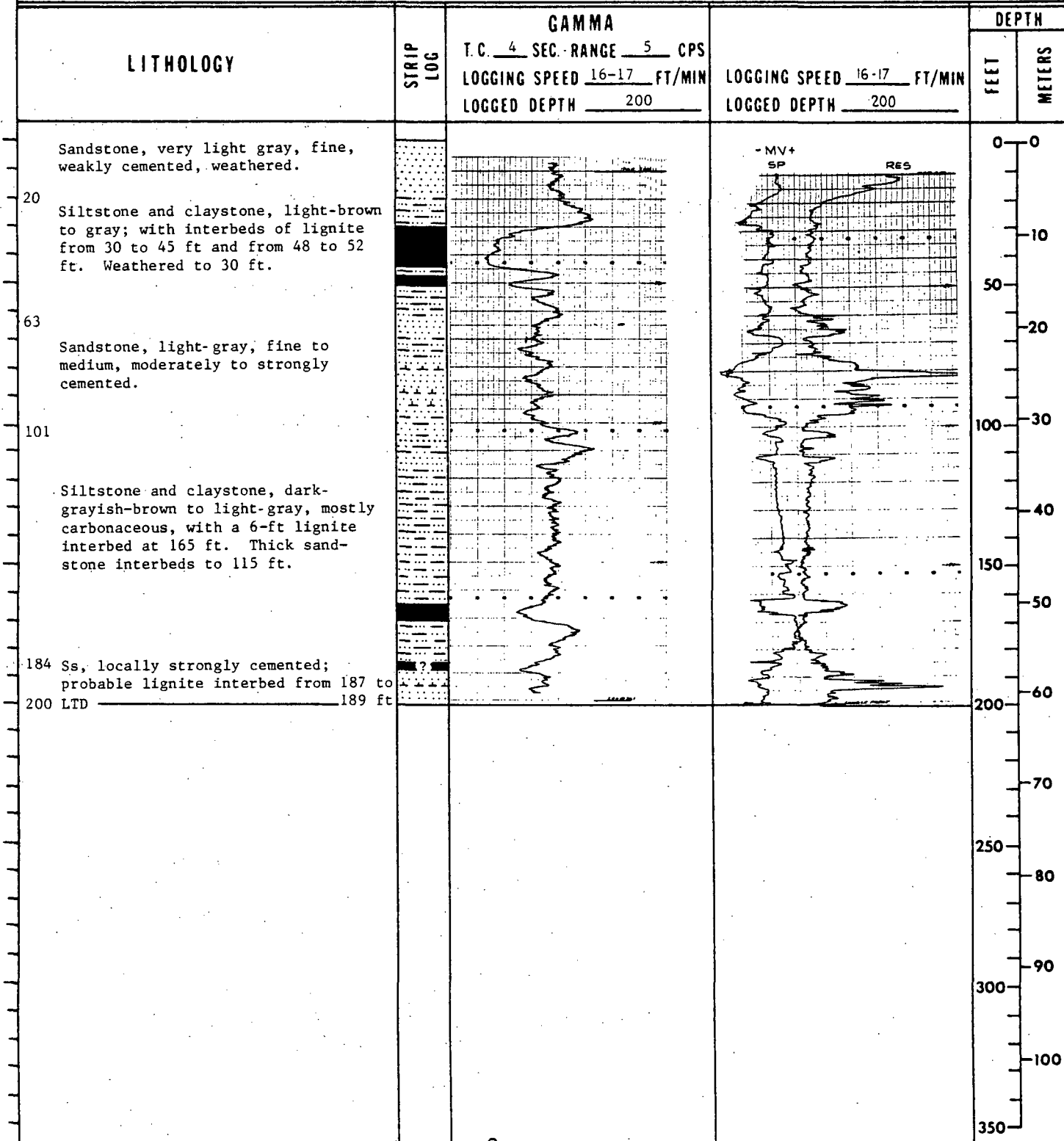
REMARKS:

LITHOLOGY	STRIP LOG	GAMMA		DEPTH	
		T.C. <u>4</u> SEC. RANGE <u>5</u> CPS	LOGGING SPEED <u>16-17</u> FT/MIN	LOGGING SPEED _____ FT/MIN	LOGGED DEPTH _____
Siltstone, gray-to dark-brownish-gray, with numerous thick to very thick interbeds of fine sandstone.  390 LTD					350 110 120 400 130 450 140 500 150 160 550 170 180 600 190 650 200 700 210 750 220

# UNITED STATES GEOLOGICAL SURVEY

HOLE NOCD-78073  
SHEET 1 OF 1

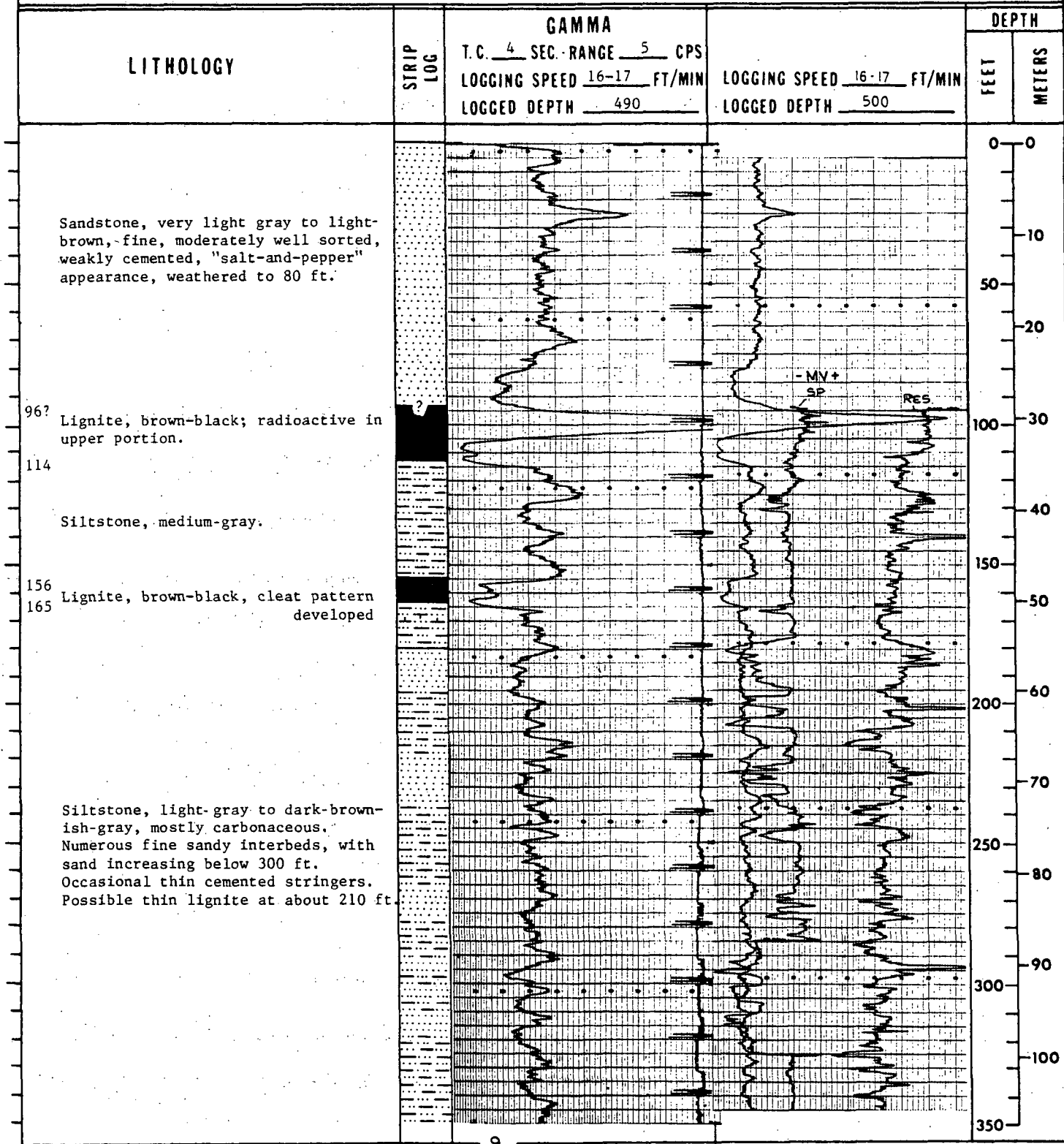
<b>AREA</b> Southern Williston Basin		<b>QUAD NAME</b> Ludlow SE	
<b>DATE STARTED</b> 10-26-1978	<b>DATE COMP.</b> 10-26-1978	<b>COUNTY</b> Harding	<b>STATE</b> South Dakota
<b>LOCATION: SEC.</b> 18 T. 21 N., R. 7 E., <b>FOOTAGE LOC.</b> 1950		<b>FNL</b> 50	<b>GROUND ELEV</b> 3090
<b>SIZE AND BIT TYPE:</b> 5-in. wing		<b>FOOTAGE</b>	
		<b>ROTARY</b> 200	<b>CORING</b> 0
<b>DRILLING AGENCY:</b> USGS/CD/NRMA		<b>DRILL TYPE:</b> Portadrill 524	<b>DEPTH TO WATER</b> NR
<b>LITHOLOGY RECORDED BY</b> F. B. Kistner		<b>GEOPHYSICAL LOGS RECORDED BY</b> G. A. Hollomon	
<b>REMARKS:</b> SP = 20 MV RES = 10 OHMS			



# UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD-78074  
SHEET 1 OF 2

AREA Southern Williston Basin		QUAD NAME Ludlow SE	
DATE STARTED 10-27-1978	DATE COMP. 10-27-1978	COUNTY Harding	STATE South Dakota
LOCATION: SEC. 19 T. 21 N., R. 7 E., FOOTAGE LOC. 700		XENX FSL 50	FEL XENX GROUND ELEV 3090
SIZE AND BIT TYPE: 5-in. wing		FOOTAGE	
		ROTARY 500	CORING 0
DRILLING AGENCY: USGS/CD/NRMA	DRILL TYPE: Portadrill 524		DEPTH TO WATER 95
LITHOLOGY RECORDED BY F. B. Kistner		GEOPHYSICAL LOGS RECORDED BY G. A. Hollomon	
REMARKS: Gamma ray logged through drill pipe SP=10 MV RES=10 OHMS			

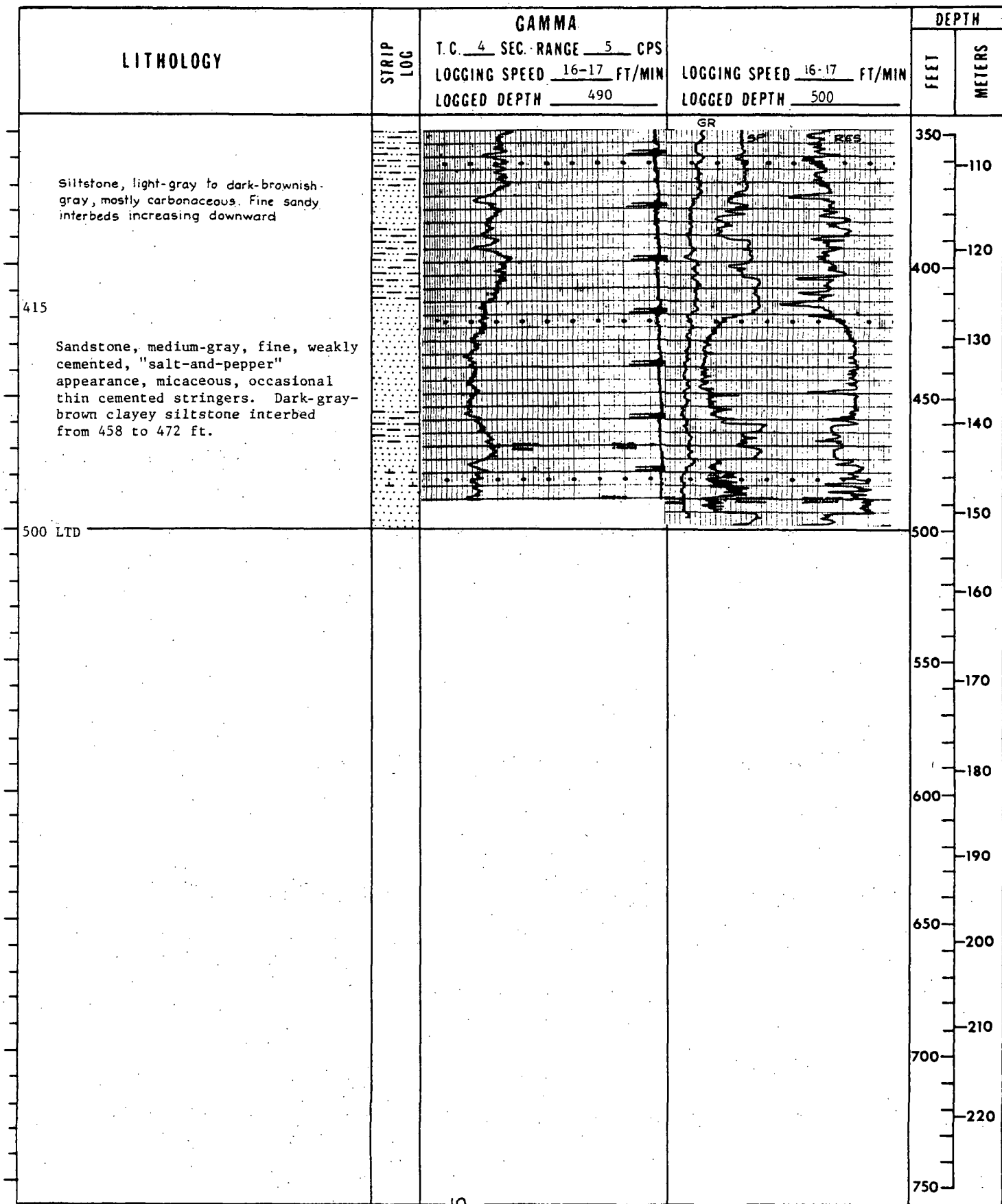


# UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD-78074  
SHEET 2 OF 2

**REMARKS:**

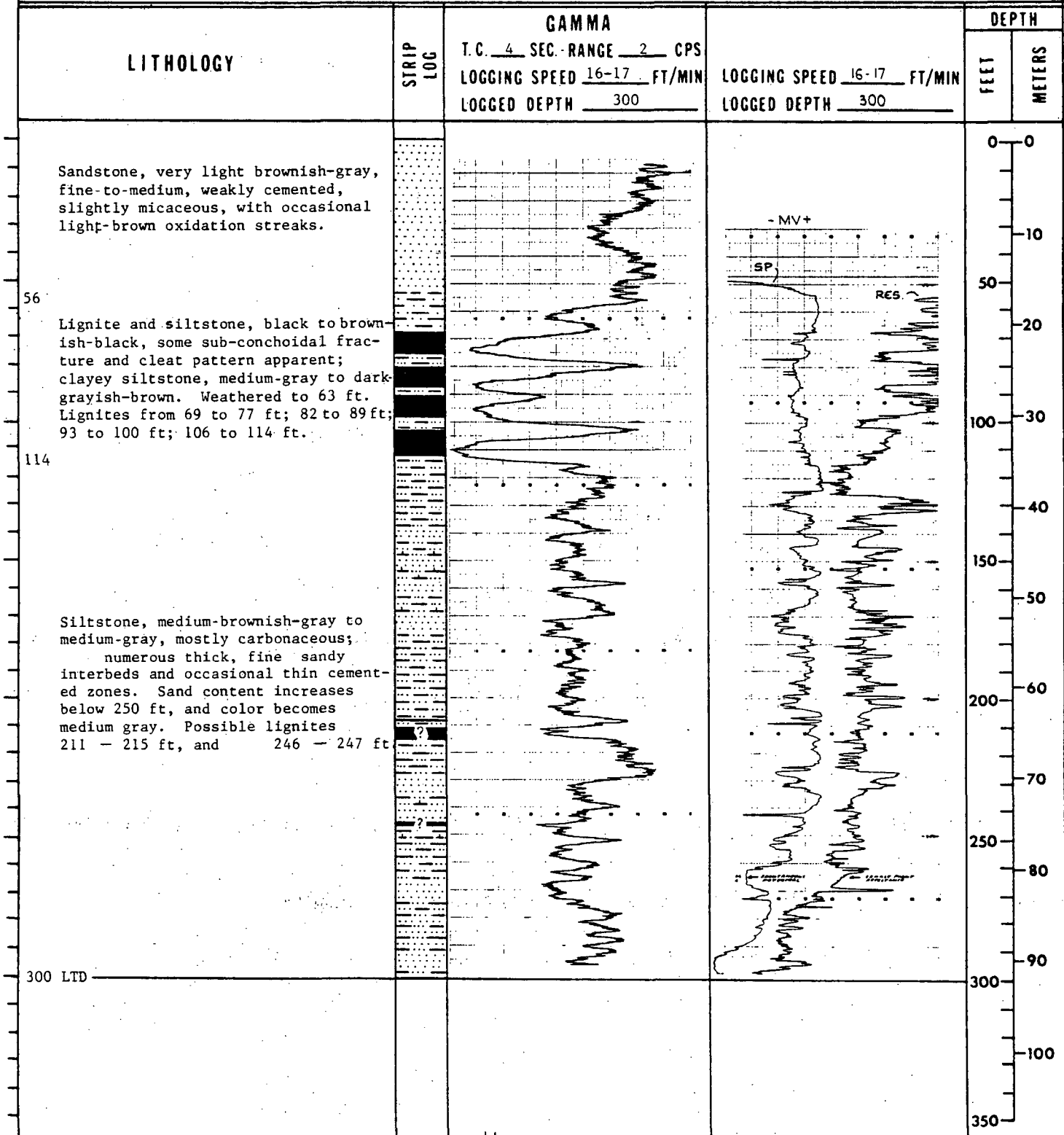
SP = 10 MV  
RES = 10 OHMS



# UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD-78075  
SHEET 1 OF 1

AREA Southern Williston Basin		QUAD NAME Ralph SW			
DATE STARTED 10-28-1978	DATE COMP. 10-28-1978	COUNTY Harding	STATE South Dakota		
LOCATION: SEC. 22 T. 21 N., R. 7 E.		FOOTAGE LOC. 2150	XFWL FSL 1100	XFWL FWL	GROUND ELEV 3035
SIZE AND BIT TYPE: 5-in. wing		FOOTAGE ROTARY 300 CORING 0		TOTAL DEPTH 300	
DRILLING AGENCY: USGS/CD/NRMA		DRILL TYPE: Portadrill 524		DEPTH TO WATER 70	
LITHOLOGY RECORDED BY F. B. Kistner		GEOPHYSICAL LOGS RECORDED BY G. A. Hollomon			
REMARKS: SP = 20 MV RES = 10 OHMS					

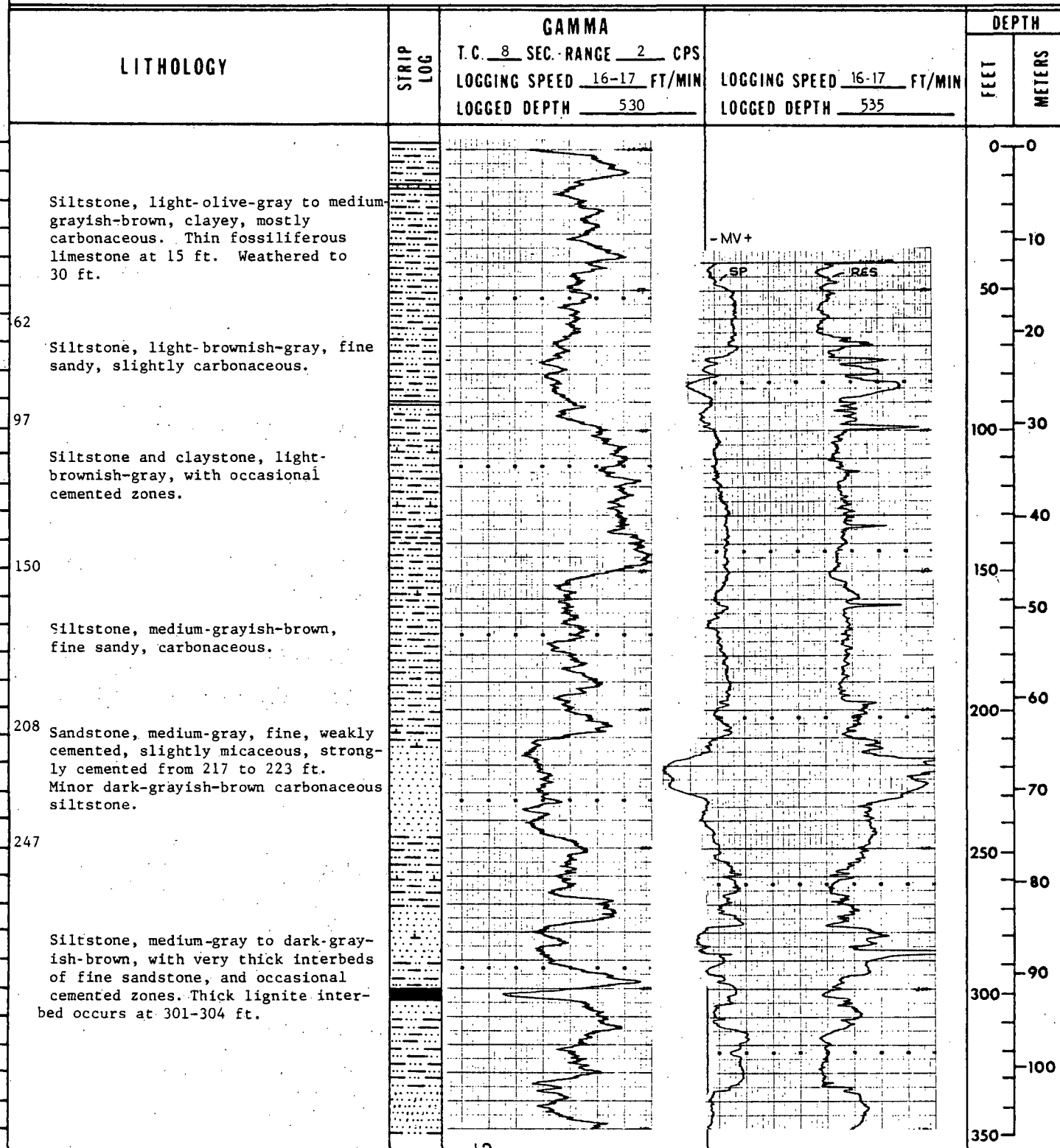


# UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD-78076  
SHEET 1 OF 2

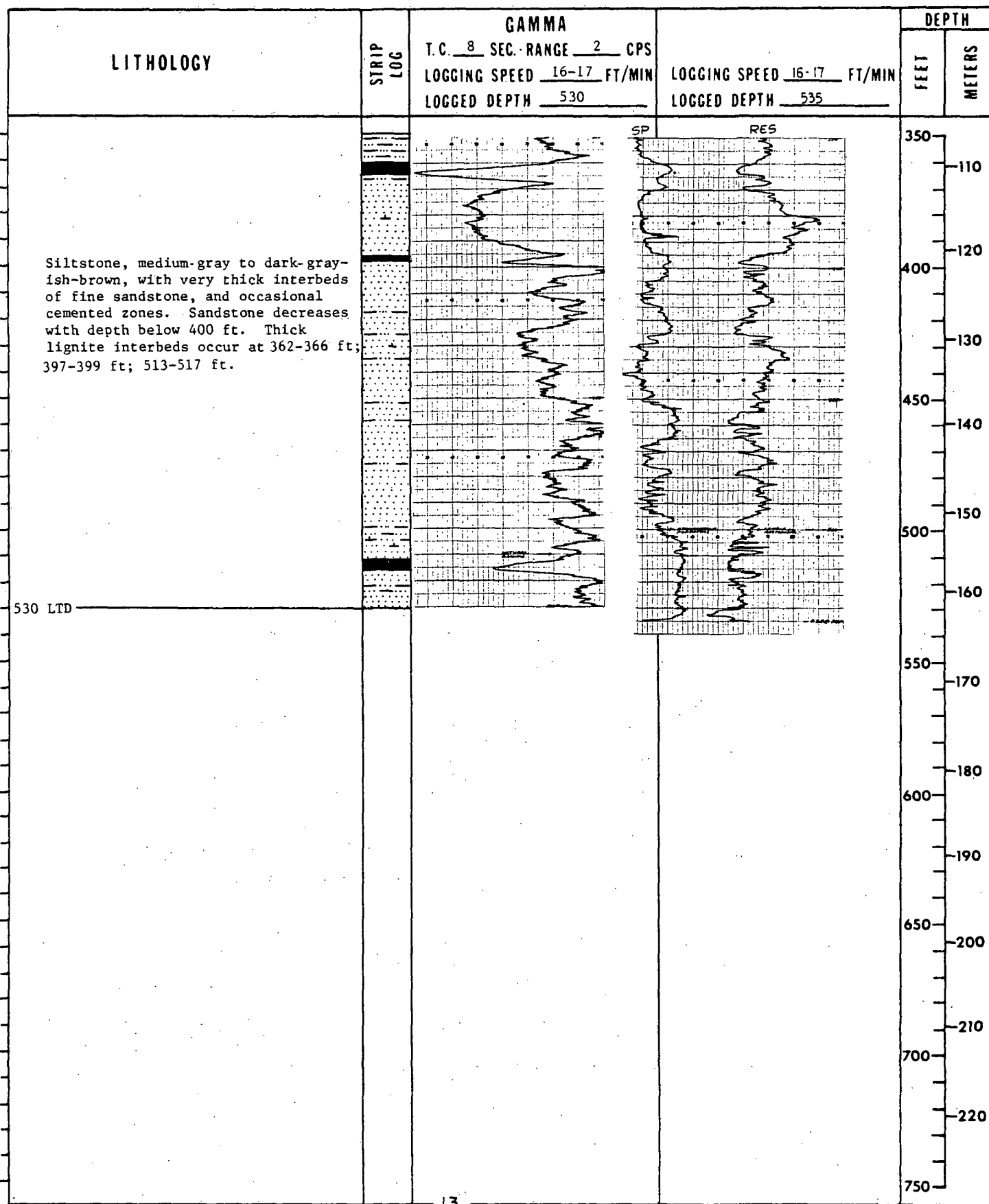
AREA Southern Williston Basin		QUAD NAME Ralph	
DATE STARTED 10-28-1978	DATE COMP. 10-29-1978	COUNTY Harding	STATE South Dakota
LOCATION: SEC. 30 T. 22 N., R. 9 E., FOOTAGE LOC. 500		EMMx FSL 100	GROUND ELEV 3030
SIZE AND BIT TYPE: 5-in. wing		FOOTAGE	
		ROTARY 540	CORING 0
DRILLING AGENCY: USGS/CD/NRMA	DRILL TYPE: Portadrill 524		DEPTH TO WATER NR
LITHOLOGY RECORDED BY F. B. Kistner		GEOPHYSICAL LOGS RECORDED BY G. A. Hollomon	

REMARKS: Gamma ray logged through drill pipe  
 SP = 10 MV  
 RES = 5 OHMS



REMARKS:

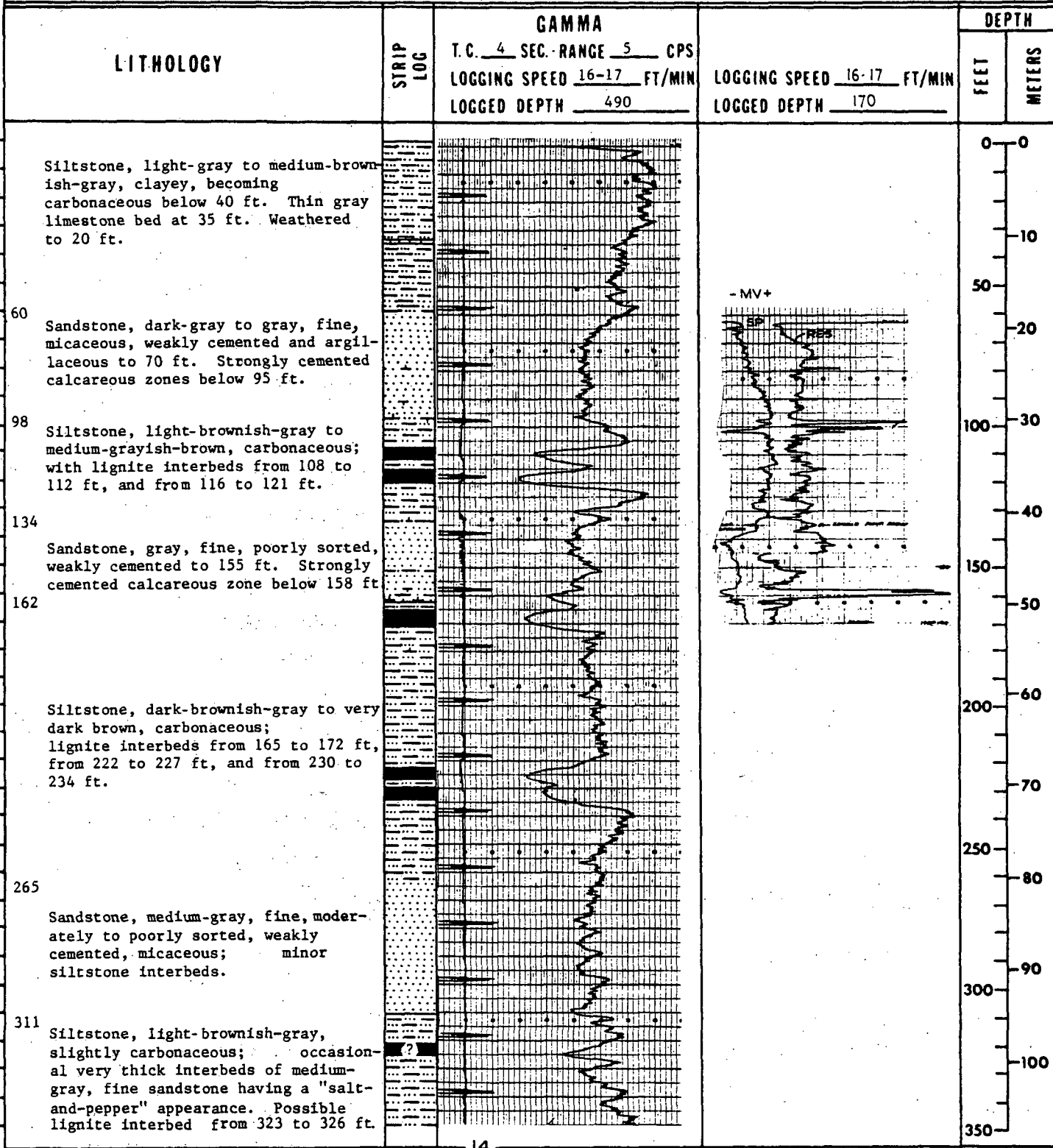
SP = 10 MV  
RES = 5 OHMS



# UNITED STATES GEOLOGICAL SURVEY

HOLE NOCD-78077  
SHEET 1 OF 2

AREA Southern Williston Basin		QUAD NAME Ralph SW	
DATE STARTED 10-29-1978	DATE COMP. 10-30-1978	COUNTY Harding	STATE South Dakota
LOCATION: SEC. 19 T. 22 N., R. 8 E., FOOTAGE LOC. 50		FNL 100 <del>SSL</del>	GROUND ELEV 2950
SIZE AND BIT TYPE: 5-in. wing		FOOTAGE ROTARY 500 CORING 0	
DRILLING AGENCY: USGS/CD/NRMA	DRILL TYPE: Portadrill 524		TOTAL DEPTH 500 DEPTH TO WATER 38
LITHOLOGY RECORDED BY F. B. Kistner		GEOPHYSICAL LOGS RECORDED BY G. A. Hollomon	
REMARKS: Gamma ray logged through drill pipe SP = 20 MV RES = 10 OHMS ELECTRIC LOG SPLICE AT 145 FT.			

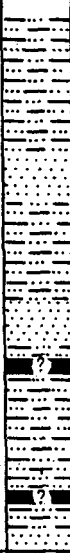
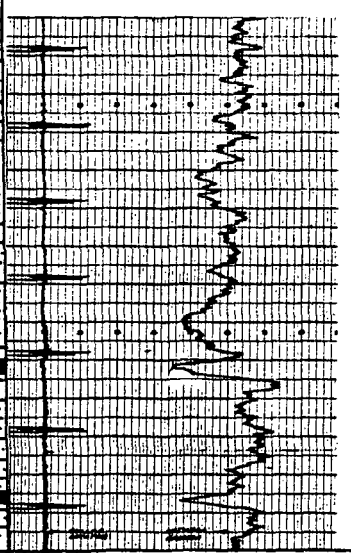




# UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD-78077  
SHEET 2 OF 2

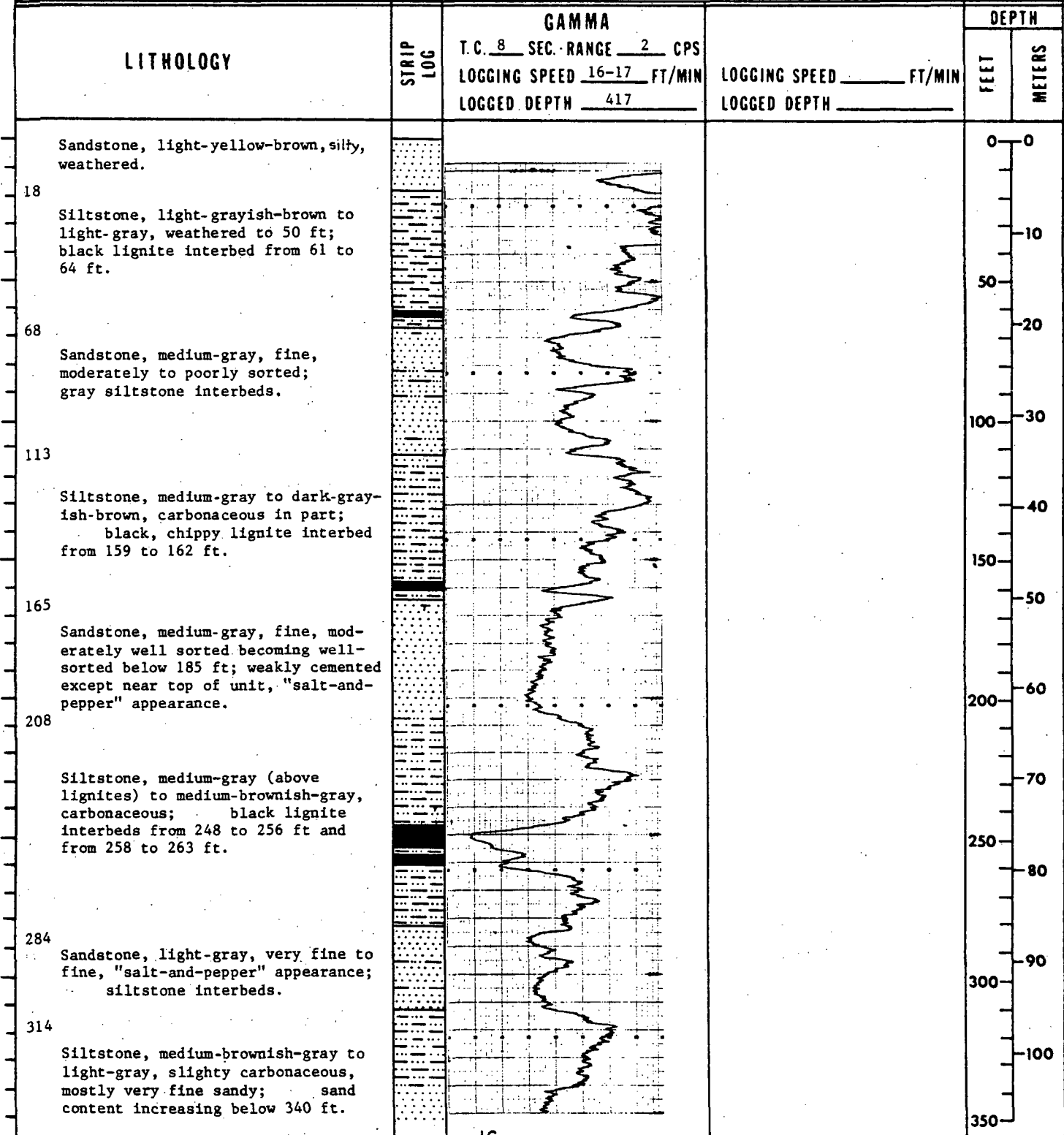
REMARKS:

LITHOLOGY	STRIP LOG	GAMMA		LOGGING SPEED _____ FT/MIN		DEPTH	
		T.C. <u>4</u> SEC. RANGE <u>5</u> CPS	LOGGED DEPTH <u>490</u>	LOGGING SPEED _____ FT/MIN	LOGGED DEPTH _____	FEET	METERS
<p>Siltstone, light-brownish-gray, slightly carbonaceous; occasional very thick interbeds of medium-gray, fine sandstone having a "salt-and-pepper" appearance.</p> <p>Possible lignite interbeds at 441-444 ft, and 476-478 ft.</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>550</p> <p>170</p> <p>600</p> <p>180</p> <p>650</p> <p>200</p> <p>700</p> <p>210</p> <p>750</p> <p>220</p>	
<p>490 LTD</p>							

# UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD-78078  
SHEET 1 OF 2


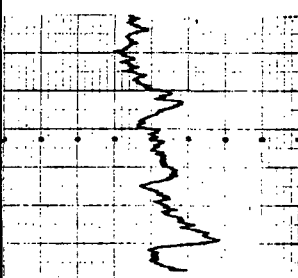
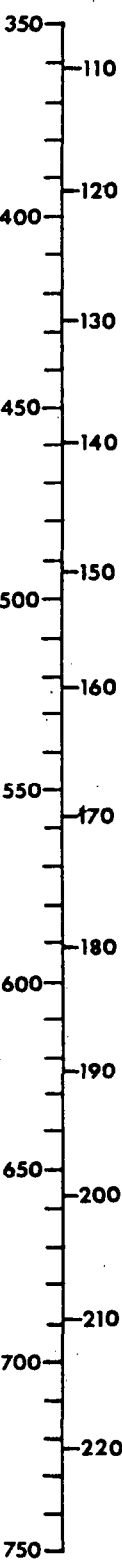
AREA Southern Williston Basin		QUAD NAME Tepee Buttes	
DATE STARTED 10-30-1978	DATE COMP. 10-30-1978	COUNTY Harding	STATE South Dakota
LOCATION: SEC. 9 T. 22 N., R. 7 E.		FOOTAGE LOC. 45	FNL 55 <del>XXX</del> FWL
SIZE AND BIT TYPE: 5-in. wing		FOOTAGE ROTARY 420 CORING 0	
DRILLING AGENCY: USGS/CD/NRMA		DRILL TYPE: Portadrill 524	GROUND ELEV 3020 TOTAL DEPTH 420 DEPTH TO WATER NR
LITHOLOGY RECORDED BY F. B. Kistner		GEOPHYSICAL LOGS RECORDED BY G. A. Hollomon	
REMARKS:			



# UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD-78078  
SHEET 2 OF 2

REMARKS:

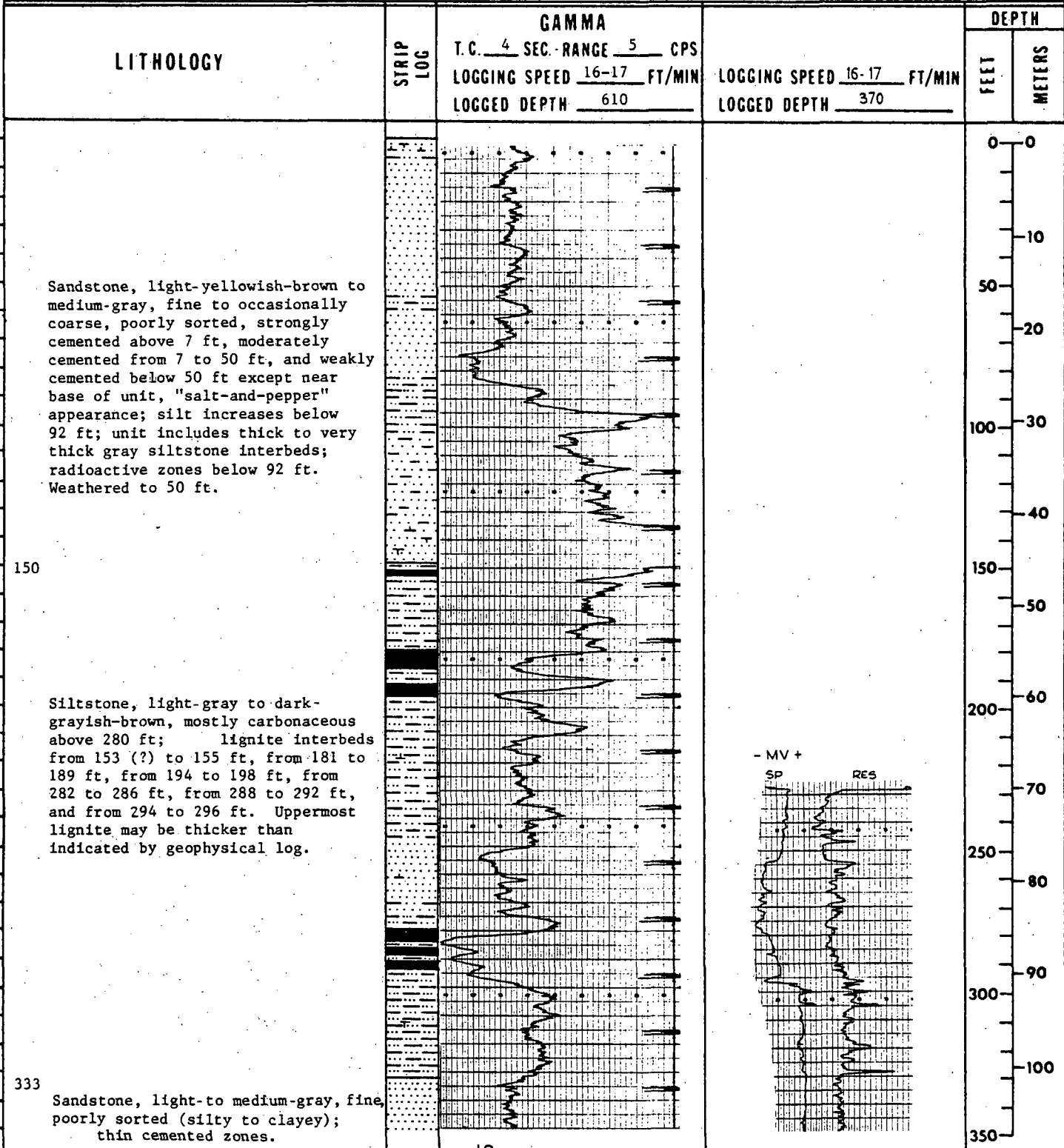
LITHOLOGY	STRIP LOG	GAMMA		DEPTH	
		T.C. <u>8</u>	SEC. RANGE <u>2</u> CPS	LOGGING SPEED <u>16-17</u> FT/MIN	LOGGING SPEED _____ FT/MIN
Siltstone, medium-brownish-gray to light-gray, slightly carbonaceous, mostly very fine sandy; sand content increasing below 340 ft.			LOGGED DEPTH <u>417</u>	LOGGED DEPTH _____	
417 LTD					

# UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD-78079  
SHEET 1 OF 2

<b>AREA</b> Southern Williston Basin		<b>QUAD NAME</b> Ludlow	
<b>DATE STARTED</b> 10-31-1978	<b>DATE COMP.</b> 11-1-1978	<b>COUNTY</b> Harding	<b>STATE</b> South Dakota
<b>LOCATION: SEC.</b> 26 T. 22 N., R. 5 E., <b>FOOTAGE LOC.</b> 600		<b>XXX FSL</b> 500	<b>XXX FWL</b> <b>GROUND ELEV</b> 3300
<b>SIZE AND BIT TYPE:</b> 4-3/4 in. Tricone; 5-in. wing		<b>FOOTAGE</b>	
		<b>ROTARY</b> 620	<b>CORING</b> 0
<b>DRILLING AGENCY:</b> USGS/CD/NRMA		<b>DRILL TYPE:</b> Portadrill 524	<b>DEPTH TO WATER</b> NR
<b>LITHOLOGY RECORDED BY</b> F. B. Kistner		<b>GEOPHYSICAL LOGS RECORDED BY</b> G. A. Hollomon	

**REMARKS:** Gamma ray logged through drill pipe. Collared at top of E-Sandstone (Pipiringos, etal, 1965), Tongue River Member, Fort Union Formation.  
SP-20 MV RES = 10 OHMS





# UNITED STATES GEOLOGICAL SURVEY

HOLE NO CD-78080  
SHEET 1 OF 1

AREA Southern Williston Basin		QUAD NAME Ludlow SE	
DATE STARTED 11-1-1978	DATE COMP. 11-1-1978	COUNTY Harding	STATE South Dakota
LOCATION: SEC. 14 T. 21 N., R. 6 E., FOOTAGE LOC. 2590		FNL 2500	FEL 3110
SIZE AND BIT TYPE: 5-in. wing		FOOTAGE	
		ROTARY 200	CORING 0
DRILLING AGENCY: USGS/CD/NRMA	DRILL TYPE: Portadrill 524		DEPTH TO WATER NR
LITHOLOGY RECORDED BY F. B. Kistner		GEOPHYSICAL LOGS RECORDED BY G. A. Hollomon	

REMARKS:  
Gamma ray logged through drill pipe  
SP = 20 MV  
RES = 10 OHMS

