FC USGS OFR 30-852

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 Otab Research institute Farth Science Lab.

Ву

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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	nformation for nine coal te unty	est holes in
· · · · · · · · · · · · · · · · · · ·	Conversion Table	- 4
lo convert English units	Multiply by	To obtain metric units
Inches (in)	2.54	Centimeters (cm)
Feet (ft)	0.3048	Meters (m)
•	Abbreviations	

		0 1 0 1111
carb	-	carbonaceous
1t	-	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

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. Is 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.

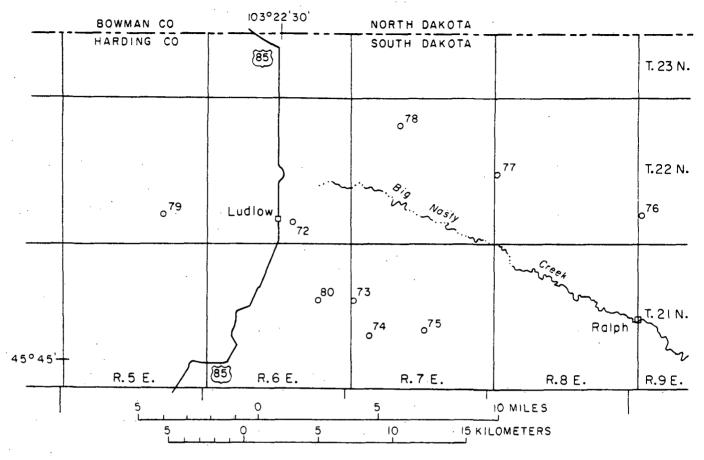


Figure 1. - Coal test holes drilled during 1978 in Harding County, South Dakota, (Hole numbers in Table 1 are preceded by CD-780__.)

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

Test-hole		Locati	Lon		Depth (feet)
Number	 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

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AREA QUAD NAME Southern Williston Basin Ludlow SE DATE STARTED 10-25-1978 DATE COMP. 10-26-1978 COUNTY STATE South Dakota Harding GROUND ELEV FEL LOCATION: SEC. 34 T. 22 N., R. 6 E. FOOTAGE LOC. 890 1650 3090 FOOTAGE TOTAL SIZE AND BIT TYPE: 5-in. wing 400 ROTARY 0 DEPTH CORING DEPTH TO USGS/CD/NRMA NR DRILLING AGENCY: DRILL TYPE: Portadrill 524 WATER 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 DEPTH GAMMA STR 1P LOG T. C. 4 SEC. - RANGE 5 CPS LITHOLOGY LOGGING SPEED 16-17 FT/MIN LOGGING SPEED 16-17 FT/MIN LOGGED DEPTH _ 390 LOGGED DEPTH __290 Sandstone, lt-brn, silty, w/white -0 quartzite flakes; thin lignite at 5ft Claystone, light-gray; 2ft lignite at 15 ft. -10 Sandstone, light-brown, fine, moderately well sorted, weakly 50 cemented, micaceous, weathered. 20 73 Claystone, with lignite interbeds from 78 to 83 and 86 to 89 ft; weathered to 90 ft. 93 Sandstone, gray, fine to medium, poor--30 100 ly sorted (clayey) in part, weakly to strongly (125-127 ft) cemented, "salt- and-pepper" appearance. 130 40 150--50 -60 200-Siltstone, gray to dark-brownishgray with lignite beds from 157 to 164 and 177 to 179 ft; probable lignite beds from 145 to 148 and 70 from 315 to 316 ft. Numerous thick to very thick interbeds of fine 250 sandstone, and thin cemented streaks below 140 ft. 80 90 300-100 350

		GAMMA	DEPTH
LITHOLOGY	STR IP LOG	TO 4 CEC. DANCE 5 CDC	FEET
Siltstone, gray-to dark-brownish-gray, with numerous thick to very thick interbeds of fine sandstone.			350-
		4	-12 13
		4	450— ——14 ——
		5	500-15
			550-
			500-
			650-
			700

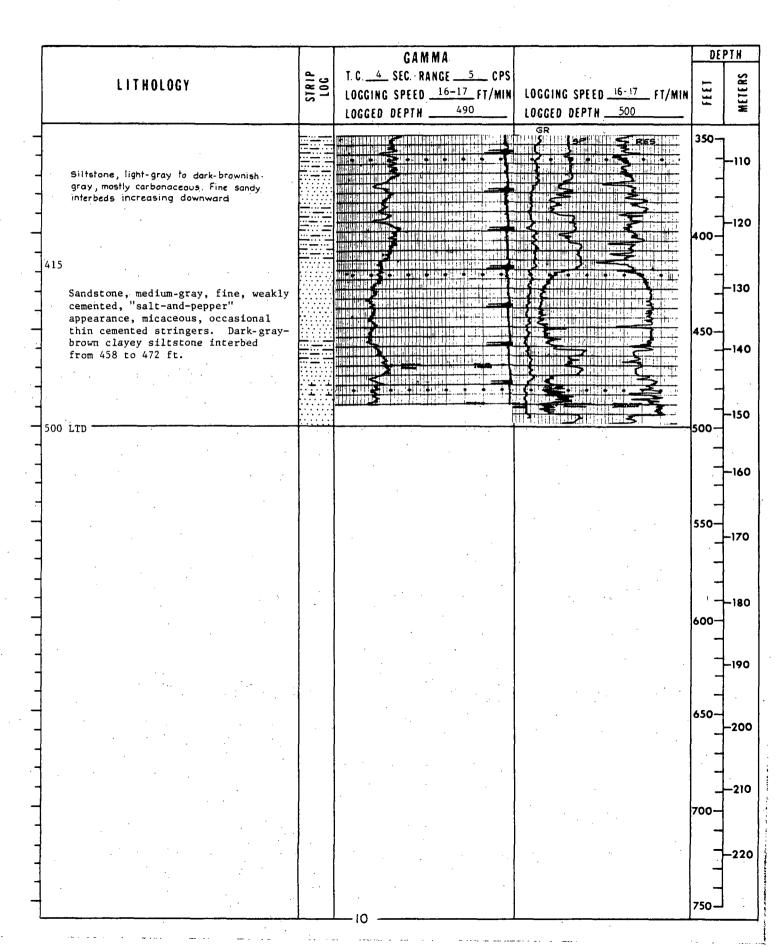
UNITED STATES GEOLOGICAL SURVEY

HOLE NOCD-78073 SHEET 1 OF 1

		· · · · · · · · · · · · · · · · · · ·				
AREA Southern Williston Basin		QUAD NAM	Ludlow	SE		
DATE STARTED 10-26-1978 DATE	COMP	10-26-1978	COUNTY	Harding	STATE South	Dakota
LOCATION: SEC. 18 T. 21 N., R. 7 E.	. , FOOTA	AGE LOC. 1950	FNL XEXSAL	50 XB61	GROUND ELEV	3090
SIZE AND BIT TYPE: 5-in, wing		ROTA	F00	TAGE CORING O	TOTAL	200
DRILLING AGENCY: USGS/CD/NRMA			YPE: Portad		DEPTH TO	NR
			CAL LOGS REC	· · · · · · · · · · · · · · · · · · ·	. Hollomon	
REMARKS: SP 20 MV RES = 10 OHMS	er	T GEOTHISI	CAL LUGS REC	ORDED OF G. A	. HOIIOMON	
		G A M M T. C. <u>4</u> SEC RAN	1			DEPTH
LITHOLOGY	STR	LOGGED DEPTH _	6-17_FT/MIN	LOGGING SPEED. LOGGED DEPTH_	· · · · · · · · · · · · · · · · · · ·	FEET
Sandstone, very light gray, fine, weakly cemented, weathered.			1) or 1 Williams	- MV+ 5P	RES	°Ţ°
Siltstone and claystone, light-brown to gray; with interbeds of lignite	n ====================================					-10
from 30 to 45 ft and from 48 to 52 ft. Weathered to 30 ft.				7 2		50-
3 Sandstone, light-gray, fine to			- 1			-20
medium, moderately to strongly cemented.	777					
01				36		10030
Siltstone and claystone, dark- grayish-brown to light-gray, mostly carbonaceous, with a 6-ft lignite		Ž				
interbed at 165 ft. Thick sand- stone interbeds to 115 ft.		Ş		3	• • • •	150
						-50
84 Ss, locally strongly cemented; probable lignite interbed from 187 00 LTD189	to <u></u>		tenes.	3		2006
			. <u>.</u>	• • •	•	
						7°
				·		250 —
						-
						300-
			. •			-
		_				350

AREA QUAD NAME Ludlow SE Southern Williston Basin COUNTY DATE STARTED 10-27-1978 DATE COMP. 10-27-1978 Harding STATE South Dakota GROUND ELEV FEL LOCATION: SEC. 19 T. 21 N., R. 7 E. FOOTAGE LOC. 3090 700 FOOTAGE TOTAL SIZE AND BIT TYPE: 5-in. wing ROTARY 500 500 CORING DEPTH DEPTH TO USGS/CD/NRMA Portadrill 524 DRILLING AGENCY: DRILL TYPE: WATER LITHOLOGY RECORDED BY F. B. Kistner GEOPHYSICAL LOGS RECORDED BY G. A. Hollomon REMARKS: Gamma ray logged through drill pipe SPEID MY RESEID OHMS DEPTH GAMMA STR 1P LOG T. C. 4 SEC. RANGE 5 CPS LITHOLOGY LOGGING SPEED 16-17 FT/MIN LOGGING SPEED 16-17 FT/MIN LOCGED DEPTH __ 490 LOGGED DEPTH _ 0-0 Sandstone, very light gray to light--10 brown, fine, moderately well sorted, weakly cemented, "salt-and-pepper" appearance, weathered to 80 ft. 50--20 Lignite, brown-black; radioactive in 100upper portion. 114 40 Siltstone, medium-gray. 150-165 Lignite, brown-black, cleat pattern -50 developed 200 -70 Siltstone, light-gray to dark-brownish-gray, mostly carbonaceous. 250 Numerous fine sandy interbeds, with sand increasing below 300 ft. 80 Occasional thin cemented stringers. Possible thin lignite at about 210 ft .90 300 100

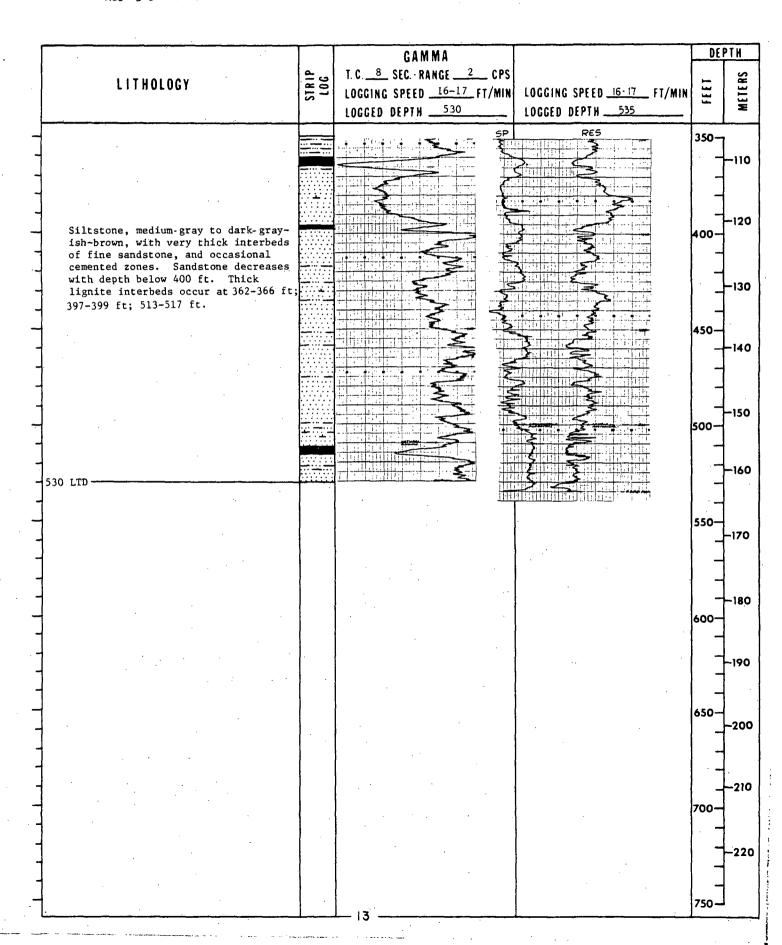
SP=10 MV RES=10 OHMS



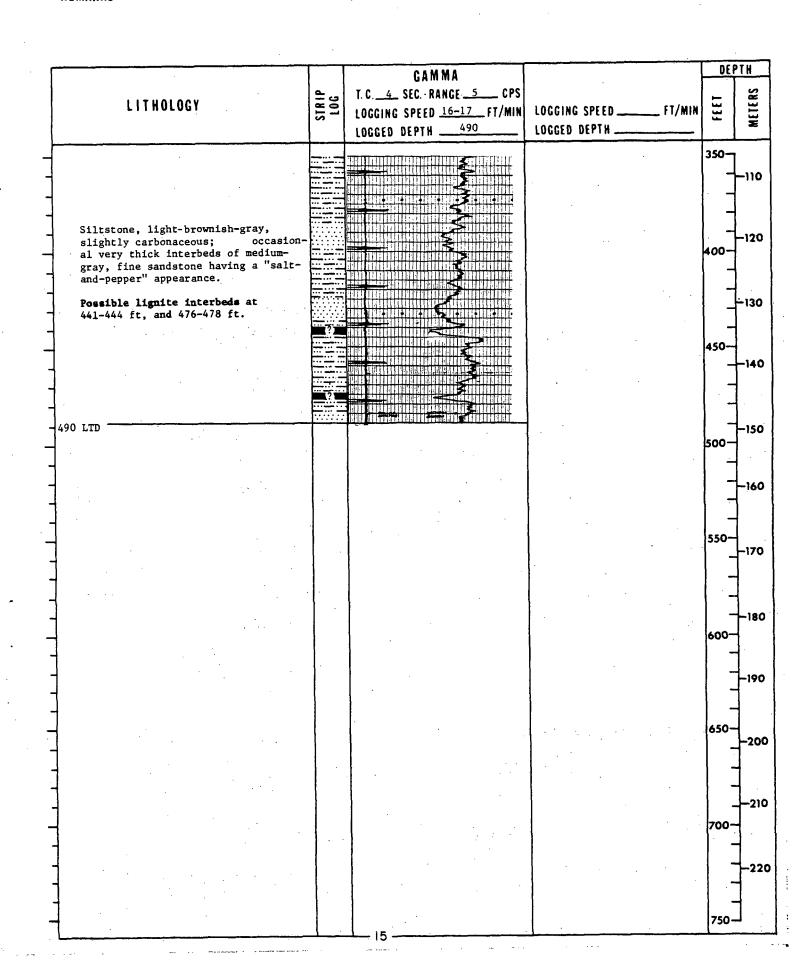
							<u> </u>	SHEE	T 1 OF 1
AREA	Southern Williston	Basin		QU	AD NAME	Ralph SW	1		
DATE STAR	TED 10-28-1978	DATE C	OMP.	10-28-1	978 CO	UNTY	Harding	STATE South	Dakota
LOCATION:	SEC. 22 T. 21 N.,	R. 7 E.	. F001	AGE LO	C . 2150	JAKAX 121	1100 XIX	EL GROUND 31	035
	BIT TYPE: 5-in. wi		,		L	FOC	TAGE	TOTAL	200
DRILLING					DRILL TYPE	300	CORING 0	DEPTH TO	300 70
							· · · · · · · · · · · · · · · · · · ·	A Wallenson	70
REMARKS:		Kistner			GEOPHYSICAL	LOGS KEC	OKDED BY G.	A. Hollomon	
VE MAKKS.	SP = 20 MV RES = 10 OHMS								
			· 						
					GAMMA				DEPTH
	ITHOLOGY	4.	STR IP 106		_ SEC. RANGE _ G SPEED <u>16-17</u>		IACCING COS	D <u>16-17</u> FT/MIN	1334
	•		S		OEPTH30		LOGGED DEPT	•	= :
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Co= 4-+-		h_a===		.1: 1 1	1 1 1 1 1		,		▎⁰ु
fine-to-m	e, very light brownis nedium, weakly cement	ed,				3			7
	micaceous, with occa						- MV+		7
TTRUE DEC	own oxidation streaks	••			* * * *	<u> </u>		• • •	<u> </u>
						*	5P,		
6			===	11 1	\$			RE5.	50-
Lignite a	and siltstone, black	to brown-				** *			-2
	c, some sub-conchoida cleat pattern appare				4 . ; . ; . ;	:	3		1
clayey si	iltstone, medium-gray	to dark				ما بلاد المنظم			
grayish-l Lignires	rown. Weathered to from 69 to 77 ft; 82	63 ft. 2 to 89 ft:		<	2	1.4, 1	• • •		J
	ft; 106 to 114 ft.						3	-	100-3
14					~	,:- : :	3		
					3			1	
							3		1 +4
				+	5	r			<u>,,,</u>
					-	•		-	150-
						•		3	- - 5
	e, medium-brownish-gr ray, mostly carbonace				3	2.	E		
nume	erous thick, fine sa	andy			\$		3		
	s and occasional thir . Sand content incre				\$		3		-6
below 250) ft, and color becom	nes			~	*.		= -	200-
	ray. Possible lignit 15 ft, and 246	es — 247 ft	?		-	•	·	4	1
						5]_,
					E				1′
***			? =	· . • •	-	• • •	3	\$	7
				· · ··			5		250
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	ar ver				- 3	:	7		7.
					\geq		<u> </u>		
00 LTD				· · · · · · · · · · · · · · · · · · ·			-		-9
						-			300
		•		٠					
	<i>,</i> '				· ·				<u> </u>
				•					7
•	•		<u> </u>						7
			, I				1		1350-

AREA Southern Williston Basin		QUAD NAMI	Ralph				\Box
DATE STARTED 10-28-1978 DATE (OMP. 10	0-29-1978	COUNTY	Harding ST	ATE South I	akota	
LOCATION: SEC. 30 T. 22 N., R. 9 E.	, FOOTA	IGE LOC. 50	00 EM ix FSL	100 XIKIKL FWL	GROUND ELEV	030	
SIZE AND BIT TYPE: 5-in, wing		ROTA	F00 RY 540	TAGE CORING O	TOTAL DEPTH	540	
DRILLING AGENCY: USGS/CD/NRMA		DRILL T	YPE: Portad	rill 524	DEPTH TO WATER	NR	
LITHOLOGY RECORDED BY F. B. Kistne	r	GEOPHYSI	CAL LOGS REC	ORDED BY G. A.	Hollomon		
REMARKS: Gamma ray logged through SP 10 MV RES = 5 OHMS	drill pip	pe			, , , , , , , , , , , , , , , , , , , ,		
		GAMM	A			DEPTH	
LITHOLOGY	STR LO	T.C. <u>8</u> SEC. RAN Logging Speed _1 Logged Depth _	.6-17_FT/MIN	LOGGING SPEED 16 LOGGED DEPTH		FEET	MEILRS
4			الخساء			0—0	
			>			-	
Siltstone, light-olive-gray to medium grayish-brown, clayey, mostly			<u> </u>			4	
carbonaceous. Thin fossiliferous limestone at 15 ft. Weathered to			S	- MV + Hadden (1801) 1996 (1801)			,
30 ft.				ŞP SP S R	£S	50-	1
162		1 1 3	• • • • • • • • • • • • • • • • • • • •				
Siltstone, light-brownish-gray, fine		\$				- -20	,
sandy, slightly carbonaceous.						4	
197				3			
7			*	}		10030	,
Siltstone and claystone, light- brownish-gray, with occasional		71.	2	<u>} </u>		7	
cemented zones.			\$],,	
			3	************		- 40	١
150			3	`{ 		150	
4		***		(50	
Siltstone, medium-grayish-brown,		1 3				-	'
fine sandy, carbonaceous.		- 5		}		-	
				3		60	ا ه
208 Sandstone, medium-gray, fine, weakly				3	3	200-	
cemented, slightly micaceous, strong-					≥		
ly cemented from 217 to 223 ft. Minor dark-grayish-brown carbonaceous						70	,
siltstone.	-		}		{	4	
247					<i></i>	250-	
1		3		3 8	•	80	0
			3	3 3		4	
Siltstone, medium-gray to dark-gray-			<u> </u>		3	1	
ish-brown, with very thick interbeds of fine sandstone, and occasional					5	-90	5
cemented zones. Thick lignite inter- bed occurs at 301-304 ft.				3		300	
4			> 				·
4						-10	0
4	-				>	4	
4	-	13		र हा समित्र का स्वर्ध के प्रमुख	<i>P</i> " "":	350	

SP = 10 MV RES = 5 OHMS



	AREA Southern Williston Bas:		QUAD NAMI	Ralph SW	 		
ł						TATE Court D	als at a
ł	 		0-30-1978	FAL	KEEK	GROUND 2	
}	LOCATION: SEC. 19 T. 22 N., R. 8	E. , PUUTAG		XEXS1.	100 FWL	TOTAL 2	950
}	SIZE AND BIT TYPE: 5-in. wing	·	ROTA	RY 500	CORING O	DEPTH TO	500
-	DRILLING AGENCY: USGS/CD/NRMA		DRILL T		drill 524	WATER	38
-	LITHOLOGY RECORDED BY F. B. K1:	tner	GEOPHYSI	CAL LOGS REC	ORDED BY G. A.	Hollomon	
	REMARKS: Gamma ray logged of SP= 20 MV RES= 10 OHMS ELECTRIC LOG SPLICE	-	pipe				
ſ	•		GAMM	A			DEPTH
	LITHOLOGY	15 0 LO	C4_SEC.·RANG DGGING SPEED 16 DGGED DEPTH	5-17FT/MIN	LOGGING SPEED _ LOGGED DEPTH _	•	FEET
	Siltstone, light-gray to medium-buish-gray, clayey, becoming carbonaceous below 40 ft. Thin gray to medium-buish-gray to 20 ft. Weathered to 20 ft.	ay ====================================					0 0 0
1	60		%44 #4 #4 #4 # #4 #4 #4 #4 #4 #4 #4 #4 #4		- MV+	HH	50-
1	Sandstone, dark-gray to gray, fine micaceous, weakly cemented and ar laceous to 70 ft. Strongly cemented calcareous zones below 95 ft.	3 11- 					-20 - -
 	Siltstone, light-brownish-gray to medium-grayish-brown, carbonaceou with lignite interbeds from 108 to 112 ft, and from 116 to 121 ft.						10030 -
	134 Sandstone, gray, fine, poorly sor						-40
_ _ _	weakly cemented to 155 ft. Stron cemented calcareous zone below 15 162						150-
 							20060
1 1	Siltstone, dark-brownish-gray to dark brown, carbonaceous; lignite interbeds from 165 to 172 from 222 to 227 ft, and from 230 234 ft.	ft,					
- - -	265						250 — 80
1	Sandstone, medium-gray, fine, mode ately to poorly sorted, weakly cemented, micaceous; minor	r-					-
444	siltstone interbeds. 311 Siltstone, light-brownish-gray,						30090
-1-1-1	slightly carbonaceous; occas al very thick interbeds of medium gray, fine sandstone having a "sa and-pepper" appearance. Possible lignite interbed from 323 to 326	16-					350

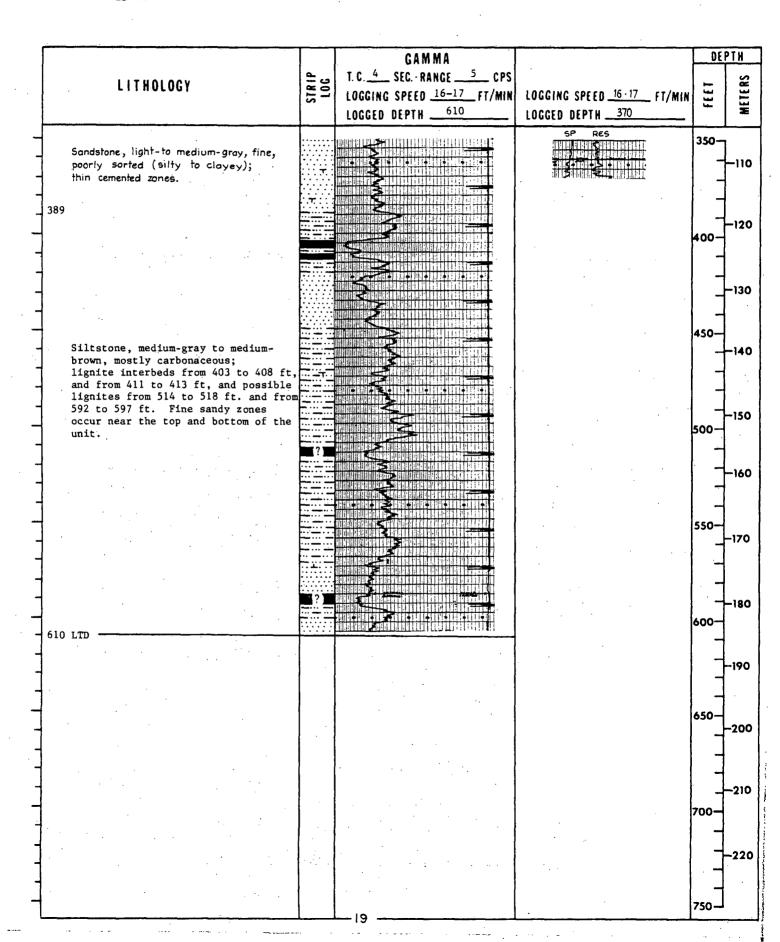


AREA Southern Williston Basin		QUAD NAM	E Tepee E	luttes			
DATE STARTED 10-30-1978 DATE	COMP.	10-30-1978	COUNTY	Harding	STATE South	Dakota	
LOCATION: SEC. 9 T. 22 N., R. 7 E.	, F00T	TAGE LOC.	45 FNL	55 XEXEX 55 FWL	ELEV 3	020	
SIZE AND BIT TYPE: 5-in. wing		RO		TAGE CORING O	TOTAL DEPTH	420	
DRILLING AGENCY: USGS/CD/NRMA		DRILL	TYPE: Port	adrill 524	DEPTH TO WATER	NR	
LITHOLOGY RECORDED BY F. B. Kistner		GEOPHYS	ICAL LOGS REC	ORDED BY G.	A. Hollomon		
REMARKS:							
		GAMI	ИА			DEF	HT
LITHOLOGY	STR 1P LOG	T. C. 8 SEC RAI		1000100 00000			ERS
	S	LOGGING SPEED _ LOGGED DEPTH _	i i	LOGGING SPEED	FT/MIN	FEET	METERS
		todato oti i ii z					
Sandstone, light-yellow-brown, silly, weathered.							-°
18						4	1
Siltstone, light-grayish-brown to light-gray, weathered to 50 ft;							-10
black lignite interbed from 61 to 64 ft.			- }				
						50-	
68			> _			4	-20
Sandstone, medium-gray, fine, moderately to poorly sorted;			-3			-	
gray siltstone interbeds.		7	-			-	20
			>			100-	-30
113			3	,			
Siltstone, medium-gray to dark-gray- ish-brown, carbonaceous in part;						-	-40
black, chippy lignite interbed from 159 to 162 ft.			>			-	
110m 137 to 102 ft.		<	>			150-	
165	- · · · · · · ·	5	> <u> </u>				-50
Sandstone, medium-gray, fine, mod- erately well sorted becoming well-		* ***********************************				\dashv	
sorted below 185 ft; weakly cemented except near top of unit, "salt-and-						-	-60
pepper" appearance.						200-	
Siltstone, medium-gray (above					•		-70
lignites) to medium-brownish-gray, carbonaceous; black lignite						-	
interbeds from 248 to 256 ft and from 258 to 263 ft.					٠.	250-	
		→					-80
			>				
284 Sandstone, light-gray, very fine to					•	-	-90
fine, "salt-and-pepper" appearance; siltstone interbeds.						300-	
314						-	, ,
Siltstone, medium-brownish-gray to							-100
light-gray, slighty carbonaceous, mostly very fine sandy; sand							
content increasing below 340 ft.						350	

		G A M M A		DEP	TH
LITHOLOGY	STR 1P LOG	T.C. 8 SEC. RANGE 2 CPS LOGGING SPEED 16-17 FT/MIN LOGGED DEPTH 417		_	METERS
Siltstone, medium-brownish-gray to light-gray, slightly carbonaceous, mostly very fine sandy; sand content increasing below 340 ft.				350	110
417 LTD				400-	-120
				450-	-130 -140
			·	500	-150
				550-	-160 -170
				600-	-18C
				650-	1 9 0
				-	-200 -210
				700- - -	-22(

AREA Southern Williston Basin		011	AD NAM	Ludlow		2465	T 1 0	1 2
DATE STARTED 10-31-1978 DATE C	OMD.	11-1-1		COUNTY	Harding	STATE South	Delegate	-
					12/21	CROUND		·
			C . 60		500 FWL	TOTAL 3	300	
SIZE AND BIT TYPE: 4-3/4 in Tricone	; 5-in.w	ring	ROTA	RY 620	CORING O	DEPTH	620	<u></u>
DRILLING AGENCY: USGS/CD/NRMA			DRILL 1	YPE: Por	tadrill 524	DEPTH TO WATER	NR	
LITHOLOGY RECORDED BY F. B. Kistn	er		GEOPHYSI	CAL LOGS REC	ORDED BY G. A.	. Hollomon		·
REMARKS: Gamma ray logged through d Tongue River Member, Fort	rill pip	e. Co	ollared at	top of E-Sa	ndstone (Pipiri	ngos, etal, 19	65),	
SP-20 MV RES = 10 0HM5								
		/	GAMM				DEI	TH
LITHOLOGY	احتا			GE <u> </u>	LOGGING SPEED	16-17 ET/MIN	FEET	METERS
			DEPTH		LOGGED DEPTH.		15	. WE
	1.7.12		.	· · · · · · · · · · · · · · · · · · ·			0-	-0
-			>				-	
1	[:::::: <u>#</u>						-	
1							-	-10
<u>]</u>			Z					
Sandstone, light-yellowish-brown to medium-gray, fine to occasionally							50-	
coarse, poorly sorted, strongly cemented above 7 ft, moderately	<u>†</u>				·		▎▗▏	-20
cemented from 7 to 50 ft, and weakly cemented below 50 ft except near		**						
base of unit, "salt-and-pepper"			1211				-	
appearance; silt increases below 92 ft; unit includes thick to very						•	100-	-30
thick gray siltstone interbeds; radioactive zones below 92 ft.							-	
Weathered to 50 ft.	- <u>-</u> #	•		* • • • •	٠.	•	l T	
]					·	•	\vdash]	40
150					•		150-	
4				3		•	-	-50
1							-	
1								
Siltstone, light-gray to dark-						•	200-	-60
grayish-brown, mostly carbonaceous above 280 ft; lignite interbeds							200	,
from 153 (?) to 155 ft, from 181 to					- MV +	DE&		
189 ft, from 194 to 198 ft, from 282 to 286 ft, from 288 to 292 ft,			3		5P	RES	-	-70
and from 294 to 296 ft. Uppermost lignite may be thicker than		+++++++	*	.			-	
indicated by geophysical log.							250 —	
		i i i			3			- 80
					{			
1								00
							300-	-90
A Company of the Comp							-	
1			<u> }} </u>				-	-100
333 Sandstone, light-to medium-gray, fine,							-	-100
poorly sorted (silty to clayey);								
thin cemented zones.		- 18				1	350-	

SP = 20 MV RES = 10 0HM5



AREA QUAD NAME Southern Williston Basin Ludlow SE DATE STARTED 11-1-1978 DATE COMP. 11-1-1978 COUNTY STATE South Dakota Harding GROUND 2500 LOCATION: SEC. 14 T. 21 N., R. 6 E. FOOTAGE LOC. 2590 3110 ELEV TOTAL SIZE AND BIT TYPE: 5-in. wing 200 ROTARY 200 CORING DEPTH DEPTH TO DRILLING AGENCY: USGS/CD/NRMA DRILL TYPE: Portadrill 524 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 DEPTH GAMMA T. C. 4 SEC. RANGE 5 CPS LITHOLOGY LOGGING SPEED 16-17 FT/MIN LOGGING SPEED 16-17 _FT/MIN LOGGED DEPTH _ LOGGED DEPTH . 10 Siltstone, light-gray to grayishbrown, mostly carbonaceous; lignite interbeds from 32 to 34 ft, -20 from 35 to 43 ft, from 104 to 113 ft, from 119 to 124 ft, from 178 to possible lignite 180 ft; - MV+ interbed from 132 to 136 ft. Very thick fine sandy zones occur throughout the unit. Weathered to 50 ft. 100 40 150--50 190 Sandstone Siltstone, medium-grayish-brown, carb -60 200 250 90 300 100 20