

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GEOPHYSICAL AND LITHOLOGIC LOGS OF 1977 COAL DRILLING IN THE
FORT UNION FORMATION, CARBON AND SWEETWATER COUNTIES, WYOMING

By

Robert D. Hettinger and Robert Brown

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

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INTRODUCTION

Twenty-eight coal test holes were drilled between July 12 and September 10, 1977, in Doty Mountain, Seaverson Reservoir, Fillmore Ranch, Riner, Bridger Pass, and Rawlins Peak quadrangles, Tps. 18, 19, 20, and 21, N., Rs. 88, 89, 90, and 91 W., Carbon and Sweetwater Counties, Wyoming. This drilling was for evaluation of depth, thickness, and lateral extent of federally owned coal in the Tertiary Fort Union Formation along the east flank of the Washakie Basin.

Drilling was done with truck-mounted rotary drilling rigs by Geck, Inc., of Rock Springs, Wyo., under U.S. Geological Survey Contract No. 14-08-0001-15795. Fluids used were air, water, air-water biodegradable foam, and mud. Drill-hole locations are shown on figures 1-7, and a summary of drill-hole locations and depths is given in table 1.

Geophysical logging by Century Geophysical Corp., Tulsa, Okla., included natural-gamma, gamma-gamma (density), and resistivity. All geophysical logs were produced with a single sonde. Geophysical logs were photographically reduced to a vertical scale of 1 in. to 50 ft and a horizontal scale of 1 in. to 5 in. as indicated near the top of each log. All measurements are in feet; to convert to meters, multiply by 0.3048.

The geophysical radiation source was lost at the bottom of hole FR-D1 and could not be recovered. This hole was cemented from bottom to top and reported to the proper authorities.

Lithologic interpretations are based on field examinations of drill cuttings collected at 5-ft intervals, corrected by a comparison with the geophysical logs.

Water levels as indicated on the resistivity logs have been artificially induced with drilling fluids and are not indicative of actual ground-water levels.

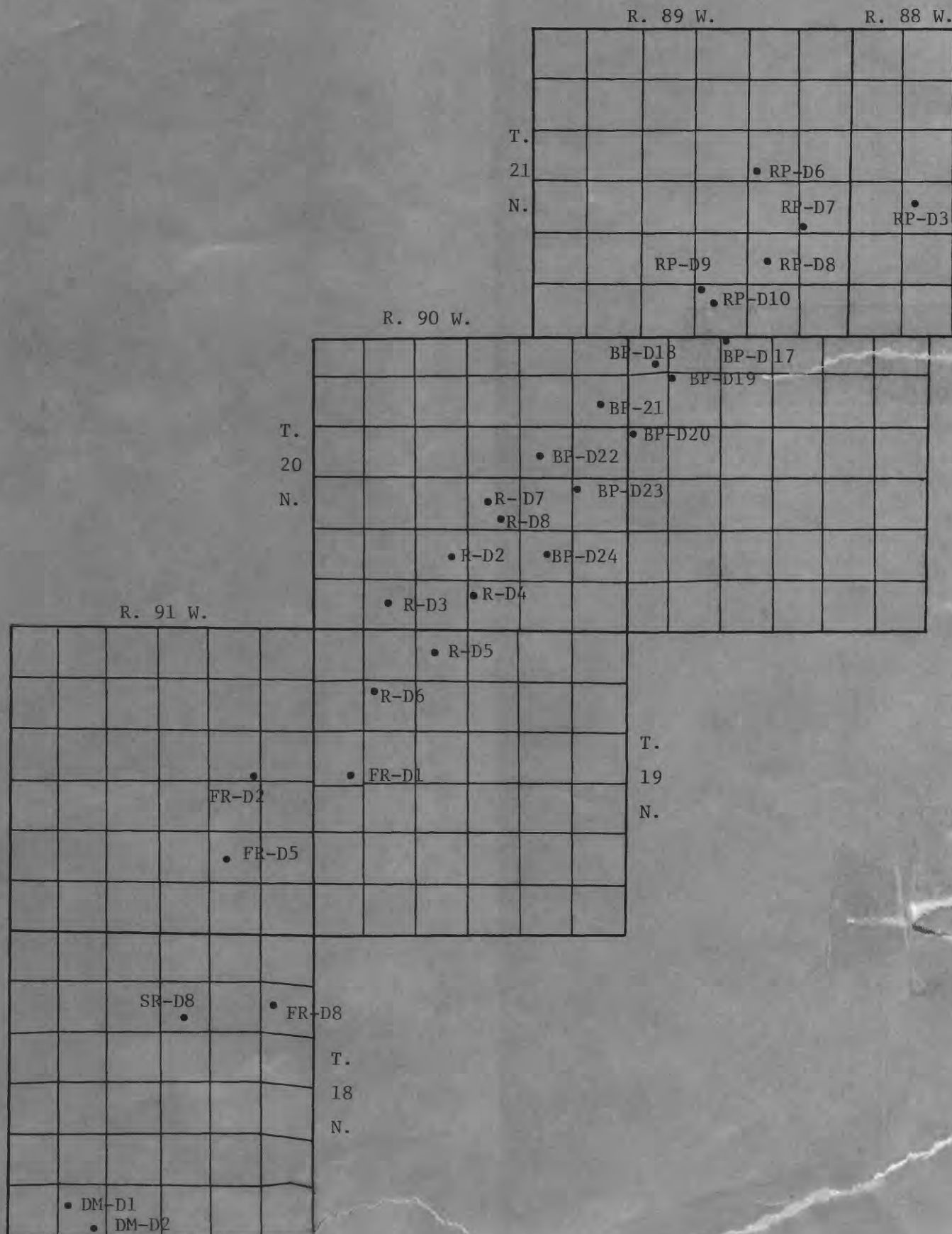
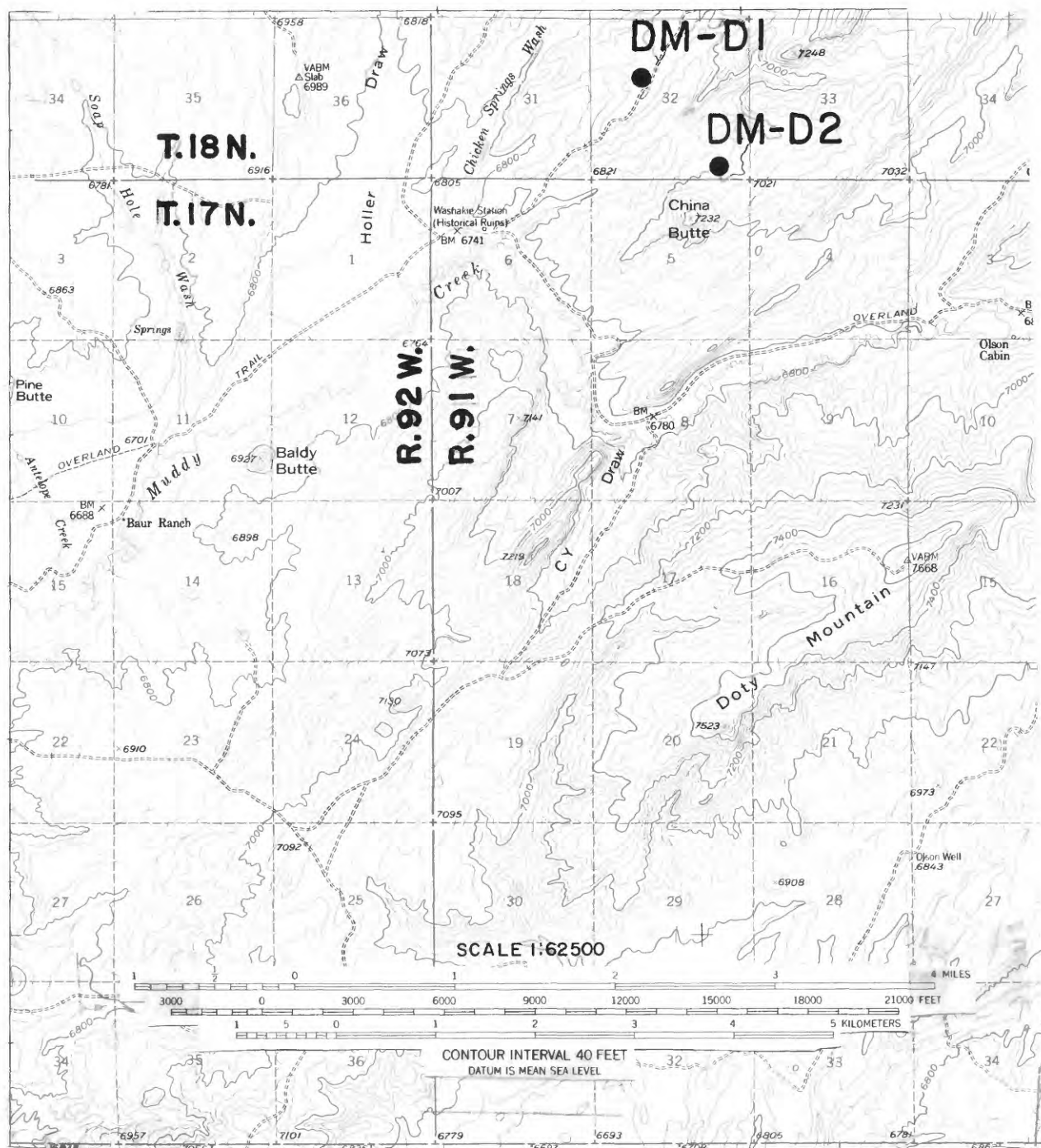


Figure 1.--Drill-hole locations in the Fort Union Formation, Rawlins-Little Snake River coal field, Wyoming.



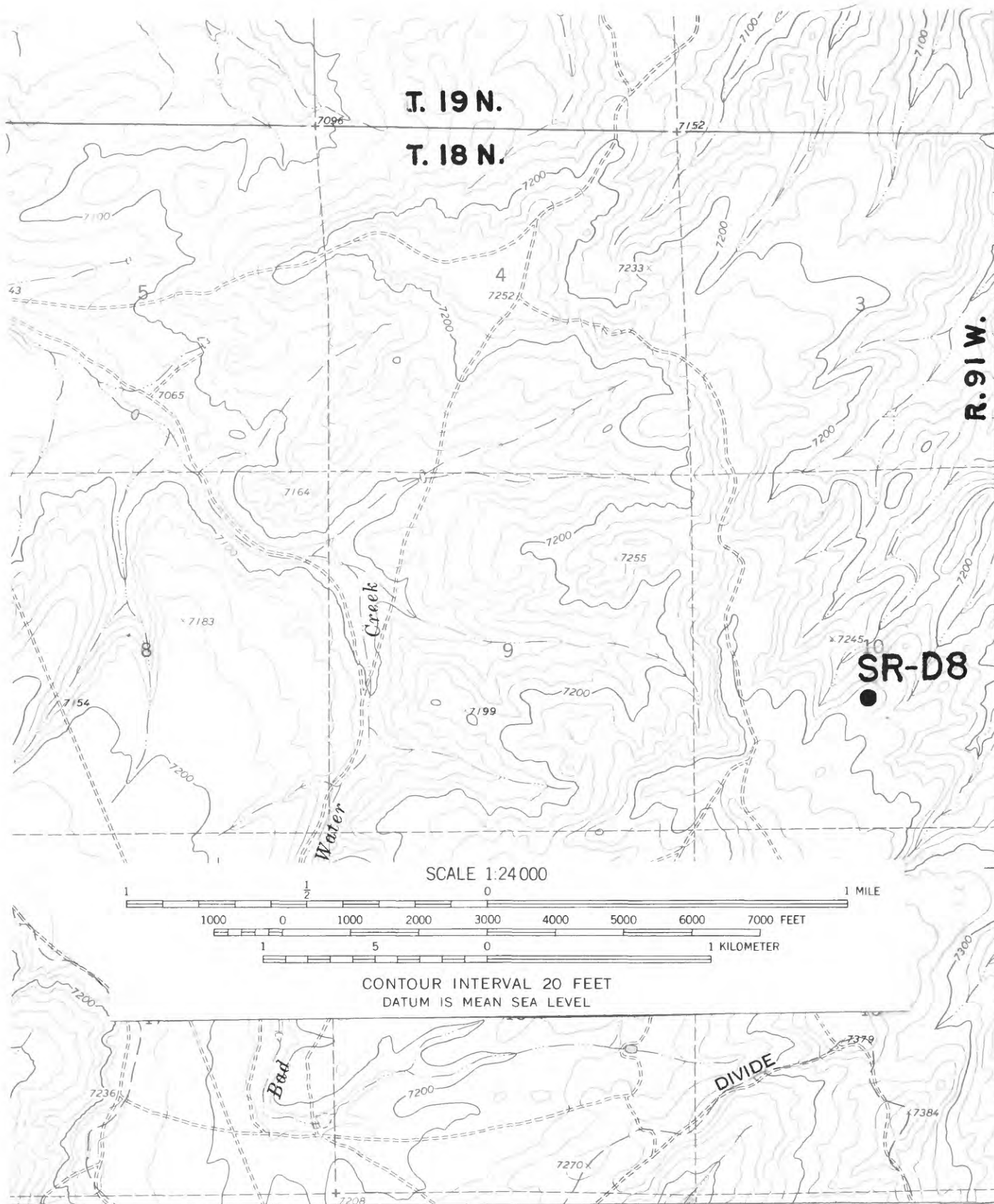


Figure 3.--Drill-hole location map, Seaverson Reservoir quadrangle, Wyoming.

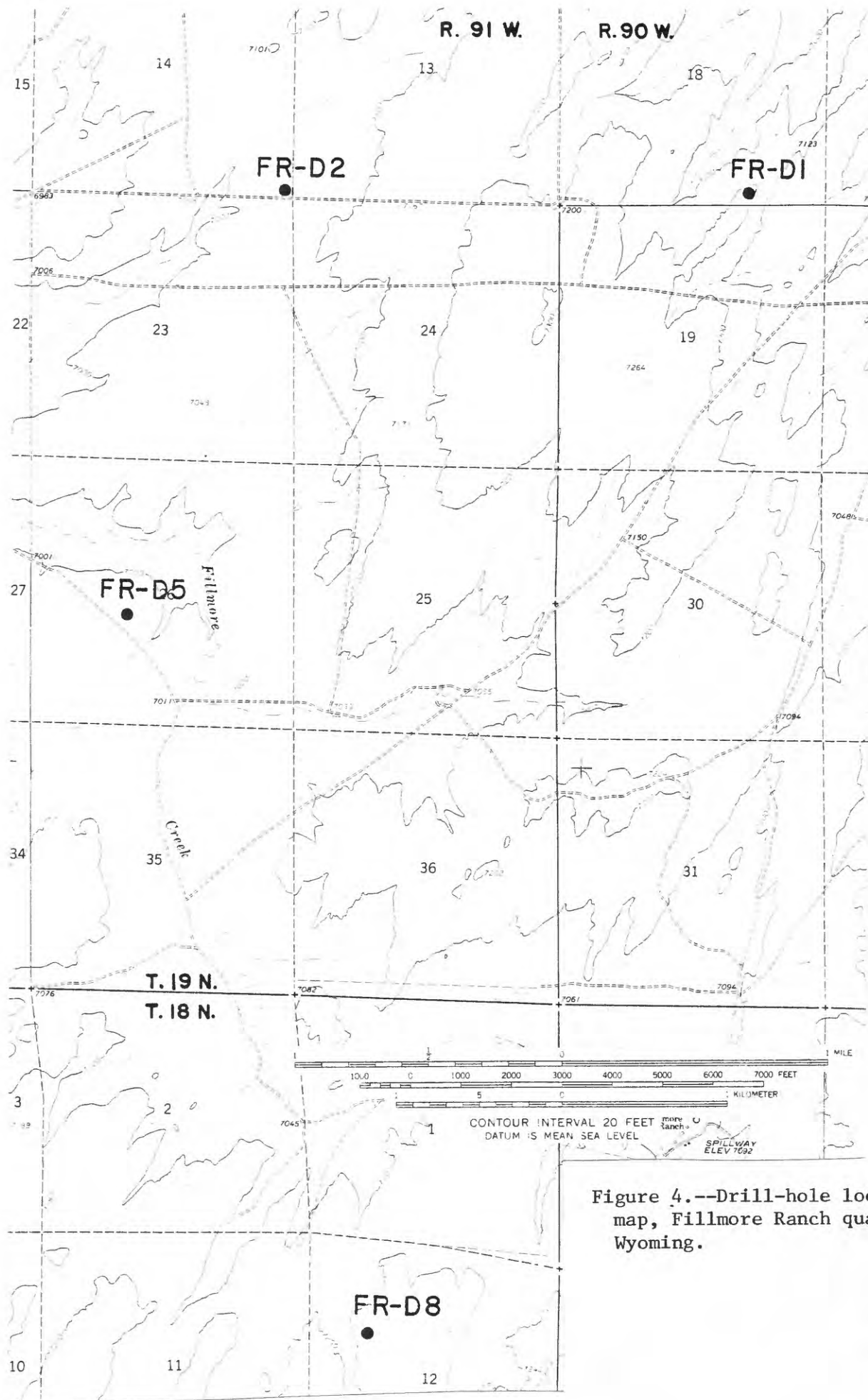


Figure 4.--Drill-hole location map, Fillmore Ranch quadrangle, Wyoming.

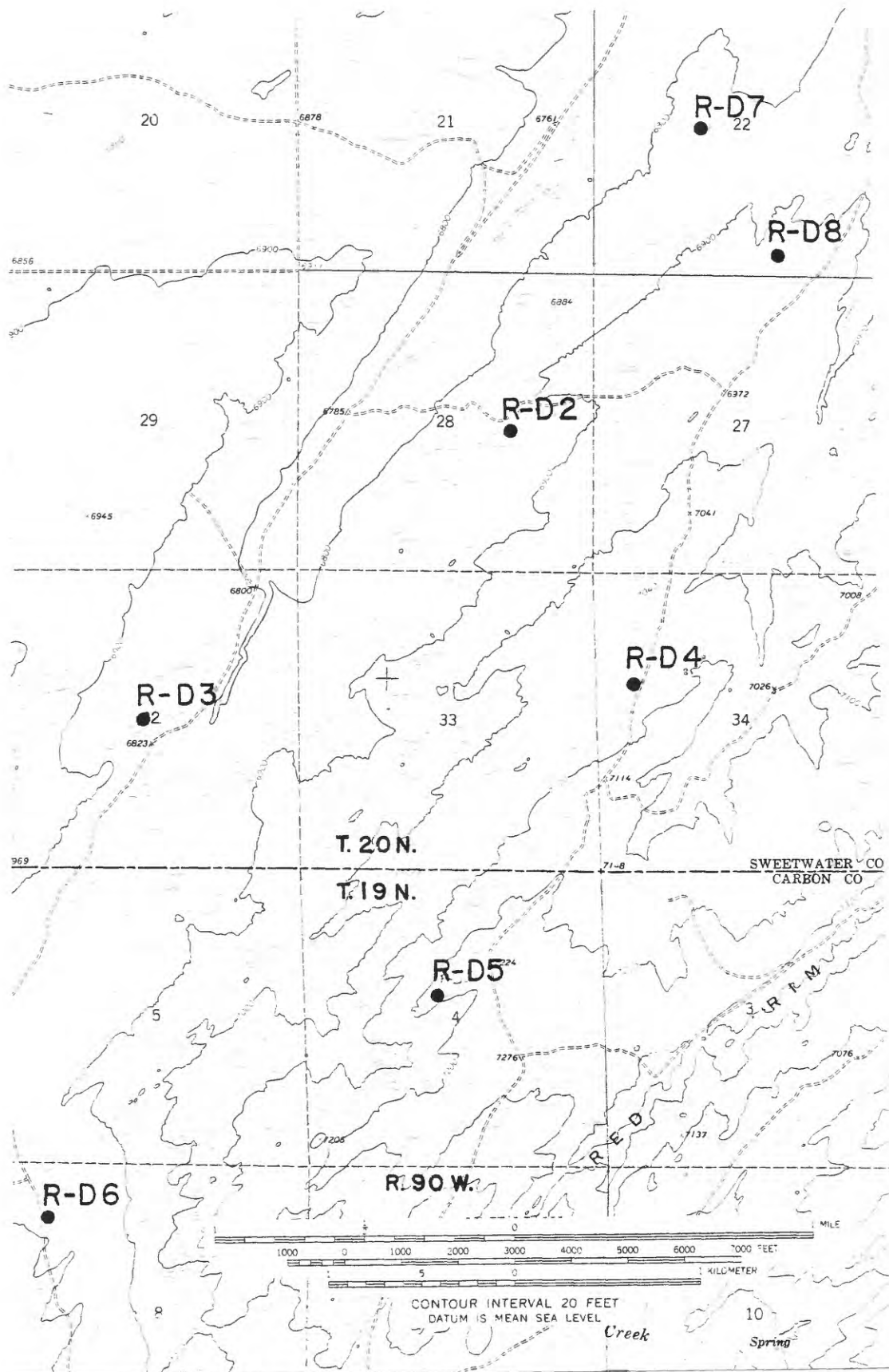


Figure 5.--Drill-hole location map, Riner quadrangle, Wyoming.

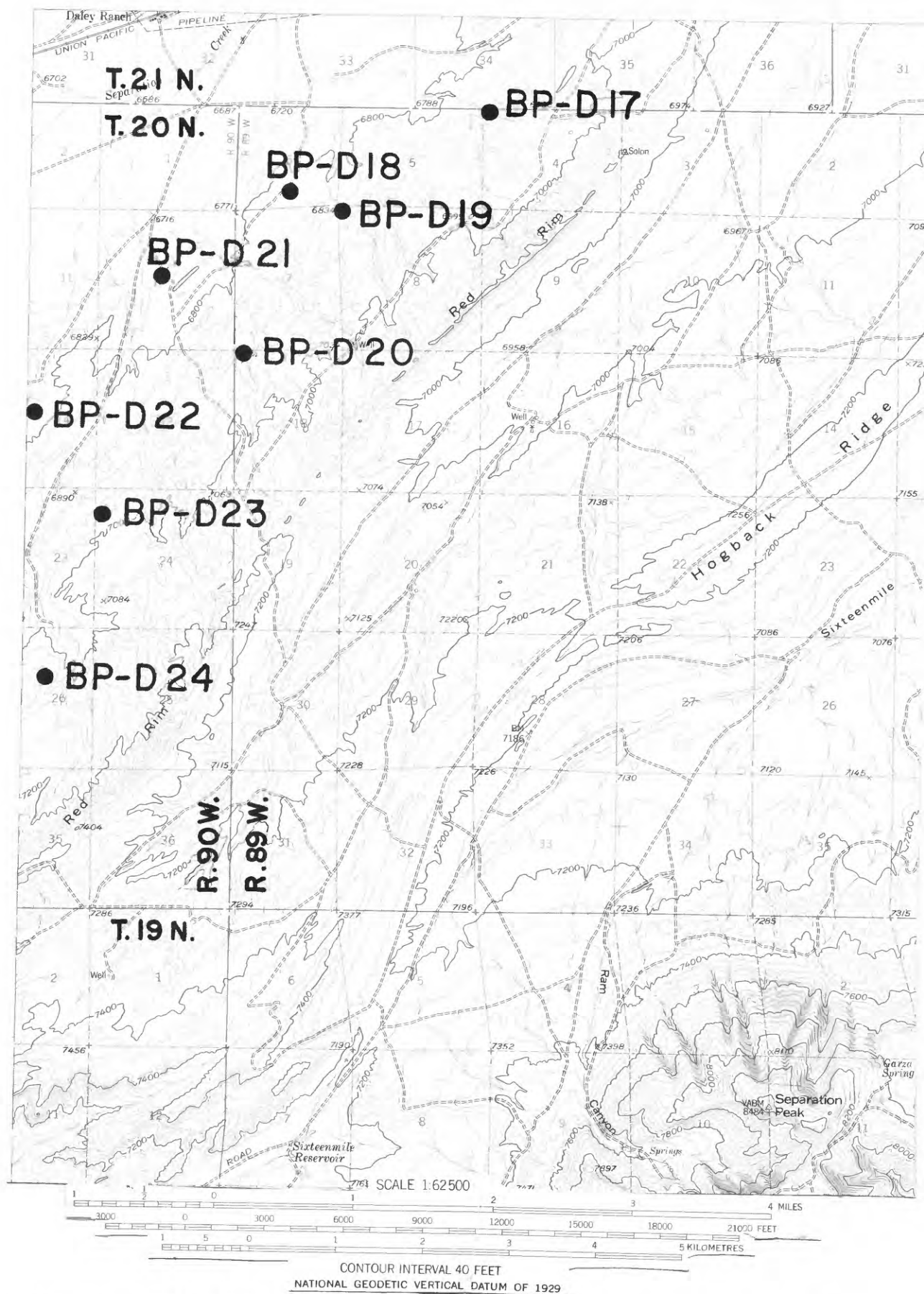


Figure 6.--Drill-hole location map, Bridger Pass quadrangle, Wyoming.

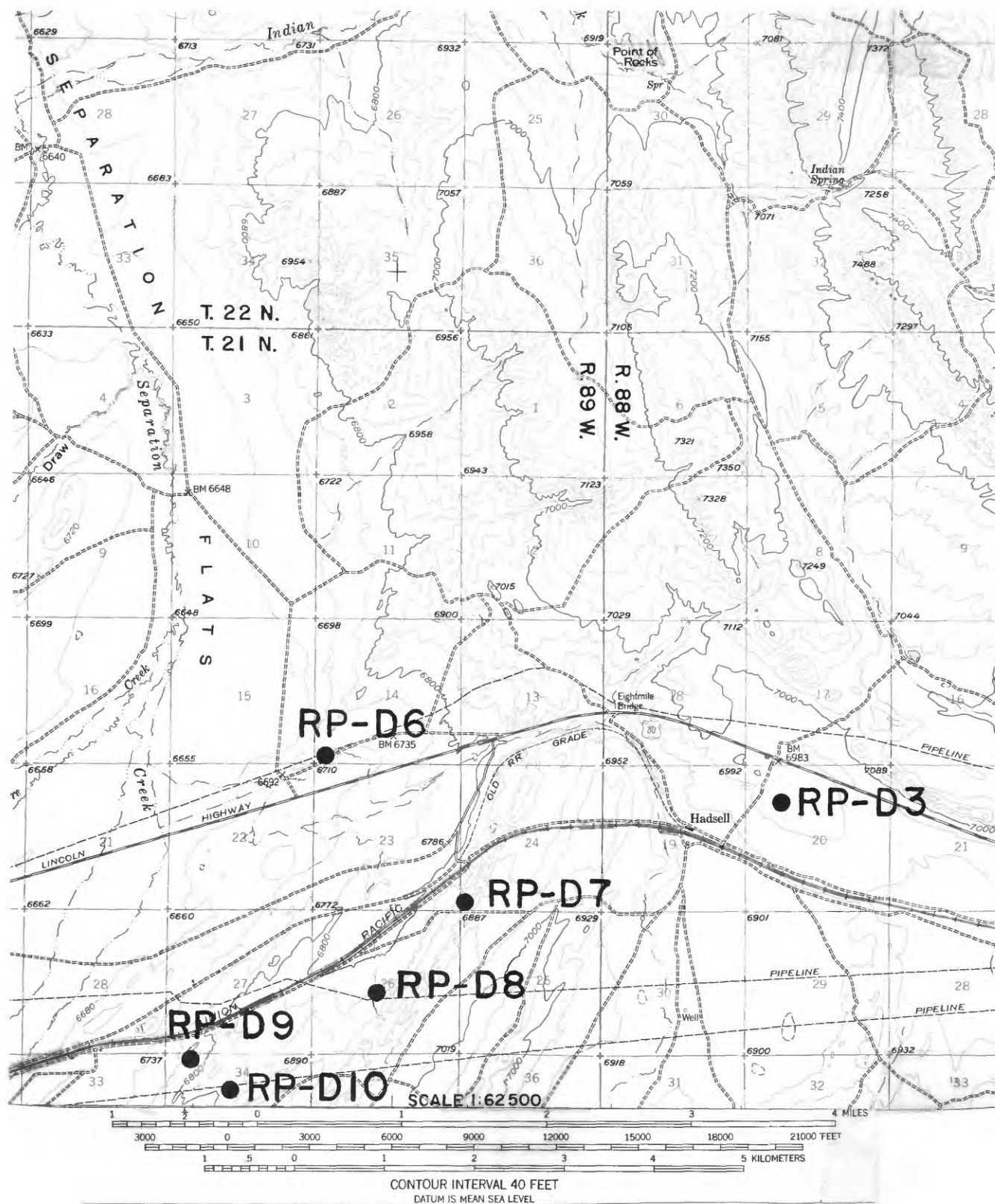


Figure 7.--Drill-hole location map, Rawlins Peak quadrangle, Wyoming.

Table 1.--Summary of information for 28 drill holes in the Rawlins-Little Snake River coal field, Carbon and Sweetwater Counties, Wyoming

Drill-hole No.	Location	Drilled depth (feet)	Logged depth (feet)
Doty Mountain quadrangle			
DM-D1	NW $\frac{1}{4}$ sec. 32, T. 18 N., R. 91 W.	745	745
DM-D2	SE $\frac{1}{4}$ sec. 32, T. 18 N., R. 91 W.	700	697
Seaverson Reservoir quadrangle			
SR-D8	SW $\frac{1}{4}$ sec. 10, T. 18 N., R. 91 W.	520	495
Fillmore Ranch quadrangle			
FR-D1	SE $\frac{1}{4}$ sec. 18, T. 19 N., R. 90 W.	420	390
FR-D2	SE $\frac{1}{4}$ sec. 14, T. 19 N., R. 91 W.	680	670
FR-D5	SW $\frac{1}{4}$ sec. 26, T. 19 N., R. 91 W.	1,200	1,195
FR-D8	NW $\frac{1}{4}$ sec. 12, T. 18 N., R. 91 W.	240	230
Riner quadrangle			
R-D2	SE $\frac{1}{4}$ sec. 28, T. 20 N., R. 90 W.	340	335
R-D3	C sec. 32, T. 20 N., R. 90 W.	1,200	1,198
R-D4	NW $\frac{1}{4}$ sec. 34, T. 20 N., R. 90 W.	320	318
R-D5	NW $\frac{1}{4}$ sec. 4, T. 19 N., R. 90 W.	200	191
R-D6	NW $\frac{1}{4}$ sec. 8, T. 19 N., R. 90 W.	340	336
R-D7	SW $\frac{1}{4}$ sec. 22, T. 20 N., R. 90 W.	480	472
R-D8	SE $\frac{1}{4}$ sec. 22, T. 20 N., R. 90 W.	520	519
Bridger Pass quadrangle			
BP-D17	NW $\frac{1}{4}$ sec. 4, T. 20 N., R. 89 W.	420	417
BP-D18	SE $\frac{1}{4}$ sec. 6, T. 20 N., R. 89 W.	480	475
BP-D19	NW $\frac{1}{4}$ sec. 8, T. 20 N., R. 89 W.	220	218
BP-D20	NW $\frac{1}{4}$ sec. 18, T. 20 N., R. 89 W.	220	218
BP-D21	C sec. 12, T. 20 N., R. 90 W.	1,200	1,200
BP-D22	NE $\frac{1}{4}$ sec. 14, T. 20 N., R. 90 W.	400	397
BP-D23	NW $\frac{1}{4}$ sec. 24, T. 20 N., R. 90 W.	417	417
BP-D24	NE $\frac{1}{4}$ sec. 26, T. 20 N., R. 90 W.	470	466
Rawlins Peak quadrangle			
RP-D3	NW $\frac{1}{4}$ sec. 20, T. 21 N., R. 88 W.	460	459
RP-D6	SW $\frac{1}{4}$ sec. 14, T. 21 N., R. 89 W.	1,200	1,200
RP-D7	SW $\frac{1}{4}$ sec. 24, T. 21 N., R. 89 W.	300	280
RP-D8	SW $\frac{1}{4}$ sec. 26, T. 21 N., R. 89 W.	500	496
RP-D9	NW $\frac{1}{4}$ sec. 34, T. 21 N., R. 89 W.	700	699
RP-D10	NW $\frac{1}{4}$ sec. 34, T. 21 N., R. 89 W.	700	700

DRILL-HOLE LOGS

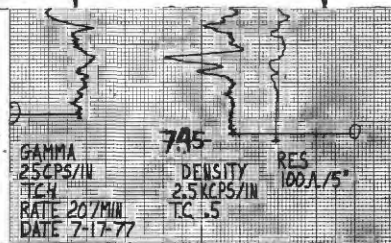
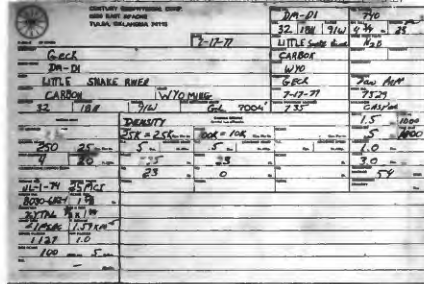
Hole no. DM-D1 Date logged 7-17-77 Surface elevation (ft) 7004
 Loc.: State Wyo. Cty. Carbon T. 18 N. R. 91 W. Sec. 32 ; 2000 FNL, 1750 FW L
 Drilled depth (ft) 740 Logged depth (ft) 745
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 4 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-15	Sandstone, light-gray, fine-grained, quartz grains, calcareous; trace of pyrite					0	0
15-27	Siltstone, light-gray, slightly sandy					10	
27-72	Sandstone, light-gray, fine-grained; occasionally silty					50	
72-80	Siltstone, light-gray, slightly sandy					20	
80-86	Carbonaceous shale, dark-grayish-black, silty						
86-141.5	Siltstone, gray, slightly sandy					100	30
141.5-149.7	Coal						
149.7-151	Carbonaceous shale						
151-170	Coal					40	
170-174	Carbonaceous shale, brown, silty					150	
174-226	Sandstone, light-gray, fine-grained, silty					50	
226-248.6	Siltstone and carbonaceous shale, interbedded. Siltstone is gray and clayey. Carbonaceous shale is brown and coaly					200	60
248.6-250.8	Coal						
250.8-331	Sandstone, gray, very fine grained to fine-grained, silty to very silty, slightly calcareous					70	
331-335	Claystone, dark-gray					250	
335-361	Siltstone, dark-gray, clayey					80	
361-365.5	Carbonaceous shale, dark-brown						
365.5-370.5	Coal						
370.5-372	Carbonaceous shale					300	90

LITHOLOGY		Strip log	Geophysical Logs.			Depth	
			Gamma	Density	Res.	ft.	m.
372-375	Coal						
375-445	Sandstone, gray, fine- to medium-grained, calcareous						
445-466	Claystone, gray to dark-gray, very silty						
466-469.5	Coal					350	
469.5-471	Carbonaceous shale						110
471-472.5	Coal						
472.5-479	Carbonaceous shale						
479-482	Coal						120
482-483	Claystone						
483-496	Siltstone, gray, sandy					400	
496-509	Claystone, gray, silty						
509-576	Sandstone, gray, very fine grained, very silty						130
576-583	Shale						
583-714	Sandstone, gray, very fine grained, very silty. Minor shale beds					450	
714-735	Siltstone and shale, interbedded						140
							150
						500	
							160
							170
						550	
							180
							190
						600	
							200
							210
						650	
						700	

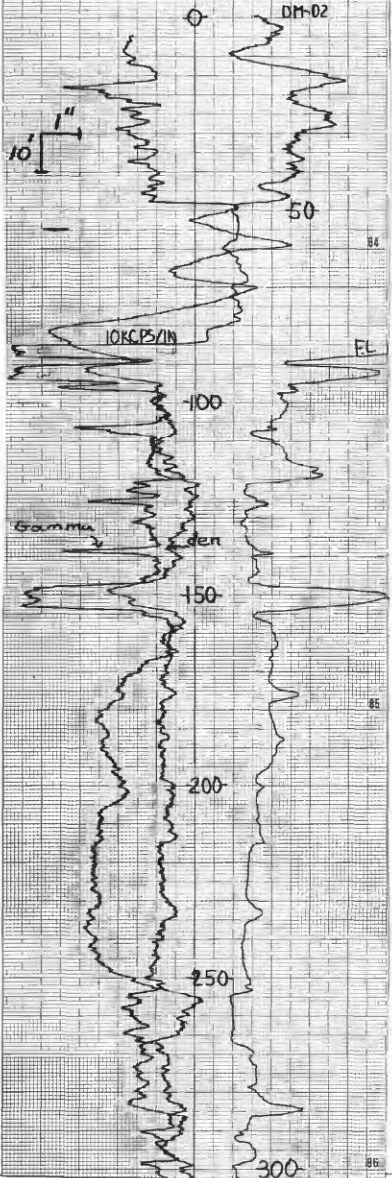
Hole No. DM-D1 (continued)


LITHOLOGY	Strip log	Geophysical Logs.			Depth	
		Gamma	Density	Res.	ft.	m.
					220	
					750	230
						

DRILL-HOLE LOGS

Hole no. DM-D2 Date logged 7-16-77 Surface elevation (ft) 6966
 Loc.: State Wyo. Cty. Carbon T. 18N., R. 91W., Sec. 32; 450 F SL, 1050 F EL
 Drilled depth (ft) 700 Logged depth (ft) 697
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 10 ohms/in Logging speed 20 fpm
 Gamma: T.C. 8 Scale 10 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

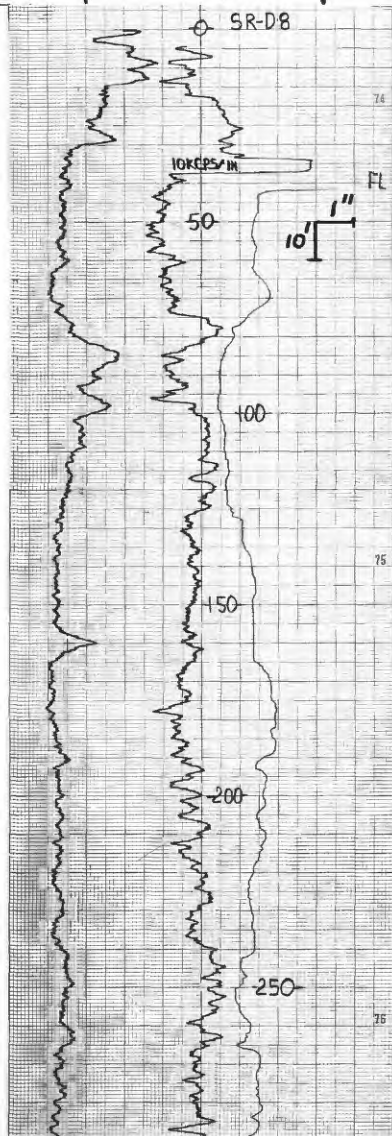
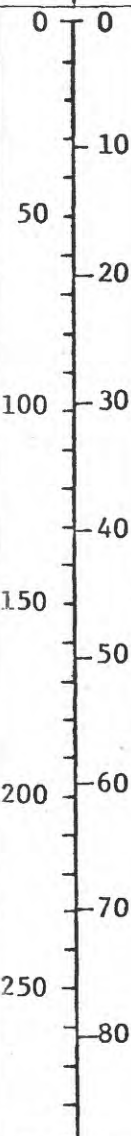
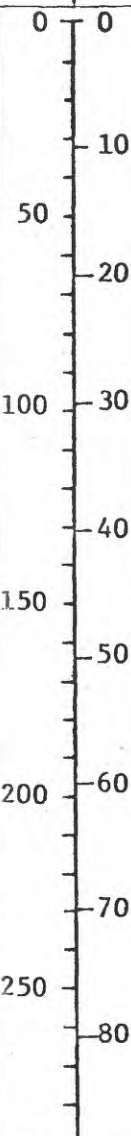
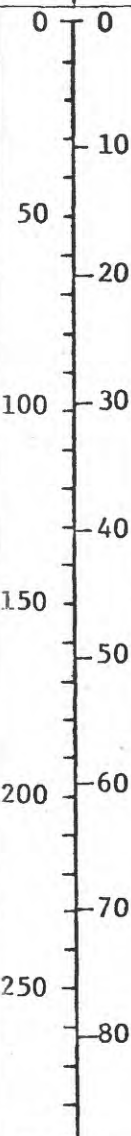
LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
0-15 Soil, medium-gray to medium-brown, sandy, silty, and clayey					0	0
15-20 Sandstone, medium-brown, silty, fine-grained					10	
20-45 Claystone, medium-gray					50	
45-80 Siltstone and sandstone, interbedded. Siltstone is medium gray and shaly. Sandstone is medium gray, fine grained, and silty					20	
80-82 Carbonaceous shale, black, coaly					100	30
82-88.4 Coal						
88.4-90.5 Carbonaceous shale					40	
90.5-94.3 Coal						
94.3-97 Carbonaceous shale, medium-gray, coaly					150	
97-120 Sandstone, medium-gray, fine-grained, silty					50	
120-148 Siltstone, medium-gray; shaly within the lower 5 feet of the unit						
148-153.5 Coal					200	60
153.5-156 Claystone						
156-171 Siltstone, medium-gray, shaly. Minor medium-gray, fine-grained, silty sandstone					70	
171-254 Sandstone, medium-gray, fine-grained, silty. Minor medium-gray siltstone					250	
254-326 Siltstone and claystone, interbedded. Siltstone is gray and clayey. Claystone is gray and shaly. Minor thinly interbedded sandstone					80	
					300	90

		Century Supermarket Corporation Denver, Colo.		PM-22 32 1/2" WxW L300 cont. Rine CASHW WFO Gend 7-14-77 587		240 320 150 177	
7-16-77		GECK PM-22 LITZ SEASE RING Cnt. FOLD #2 CASHW WFO 7-14-77 587		40 150 163		177	
32 1/2" WxW 62 69.56		DENSITY 25K - 25K 5 677 87		20K = 16K 5 0		40 150 163	
697 100 9		10 20 50		100 200 500		1000 2000 5000	
11-1-77 802-641-74 3/27 87.79 1/23 50		250 500 1000 2000 5000		10000 20000 50000		100000 200000 500000	

DRILL-HOLE LOGS

Hole no. SR-D8 Date logged 7-16-77 Surface elevation (ft) 7,285
 Loc.: State Wyo. Cty. Carbon T. 18N., R. 91W., Sec. 10; 1950 FSL, 2600 FWL
 Drilled depth (ft) 520 Logged depth (ft) 495
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 4 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

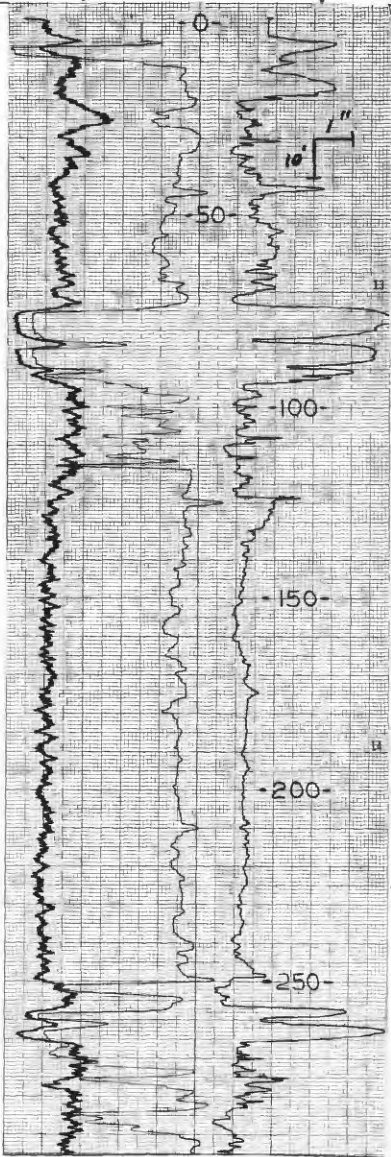
LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
0-80 Sandstone, yellow-brown, fine- to medium-grained, slightly iron stained friable, well-sorted. Minor greenish-gray claystone and medium-gray to black shale stringers					0	0
80-127 Shale, medium- to dark-gray, silty, and sandy. Minor fine-grained sandstone stringers. Minor shaly, gray, and sandy claystone					50	10
127-241 Sandstone, yellow-brown, fine-grained. Minor medium- gray shale stringers					100	30
241-266 Shale, medium- to dark-gray. Minor blue-gray, very fine grained sandstone.					150	40
266-289 Sandstone, light-gray, fine- grained, well-sorted. Minor medium-gray shale.					200	50
289-358.6 Shale and sandstone, inter- bedded. Shale is bluish gray to medium gray. Sand- stone is medium gray and fine grained					250	60
358.6-362 Coal					260	70
362-429.5 Shale and sandstone, inter- bedded. Shale is medium gray. Sandstone is yellow brown to medium gray and very fine grained. Minor carbonaceous shale and coal					270	80

LITHOLOGY		Strip Log	Geophysical Logs.			Depth		
			Gamma	Density	Res.	ft.	m.	
429.5-431.2	Coal					300	90	
431.2-432.3	Carbonaceous shale							
432.3-456	Coal							
456-457	Carbonaceous shale							
457-457.5	Coal							
457.5-495	Shale, yellow-brown to medium-gray; sandy in the lower 5 feet							

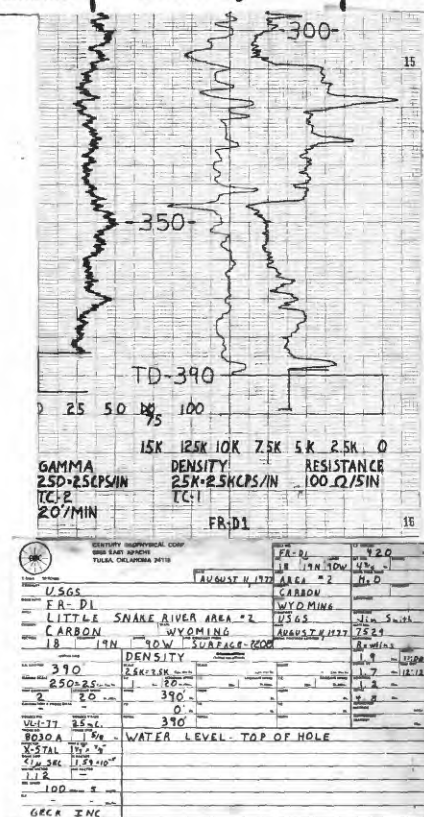
DRILL-HOLE LOGS

Hole no. FR-D1 Date logged 8-11-77 Surface elevation (ft) 7208
 Loc.: State Wyo. Cty. Carbon T. 19N., R. 90W., Sec. 18; 250 FSL, 1500 FEL
 Drilled depth (ft) 420 Logged depth (ft) 390
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 1 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
0-4.5 Sandstone, brown, fine-grained, silty, shaly					0	0
4.5-7.5 Coal						
7.5-12 Siltstone, light-gray, brown, shaly, sandy					10	
12-20 Sandstone, light-brown, very fine grained, silty					50	
20-22.2 Carbonaceous shale, brown-gray to dark-brown					20	
22.2-23 Coal?						
23-25 Carbonaceous shale, brown-gray to dark-brown					100	30
25-26.8 Coal?						
26.8-70 Sandstone, light-gray to light-brown, fine-grained, silty, minor shaly lenses and calcareous lenses					40	
70-74 Carbonaceous shale, black					150	
74-82 Coal						
82-83.2 Carbonaceous shale, black					50	
83.2-89.2 Coal						
89.2-89.8 Carbonaceous shale					200	60
89.8-93.6 Coal; two carbonaceous shale partings in lower half (0.2 to 0.4 feet thick)						
93.6-95 Carbonaceous shale, black					70	
95-98 Sandstone, light-gray, fine-grained, silty					250	80
98-99.5 Claystone, gray, silty						
99.5-100.7 Coal						
100.7-101.5 Claystone, gray, silty						
101.5-102.1 Coal						
102.1-103 Claystone, gray, silty						
103-103.8 Coal						
103.8-107.5 Claystone, gray, silty						
107.5-108.5 Coal						
108.5-109.2 Claystone, gray, silty						

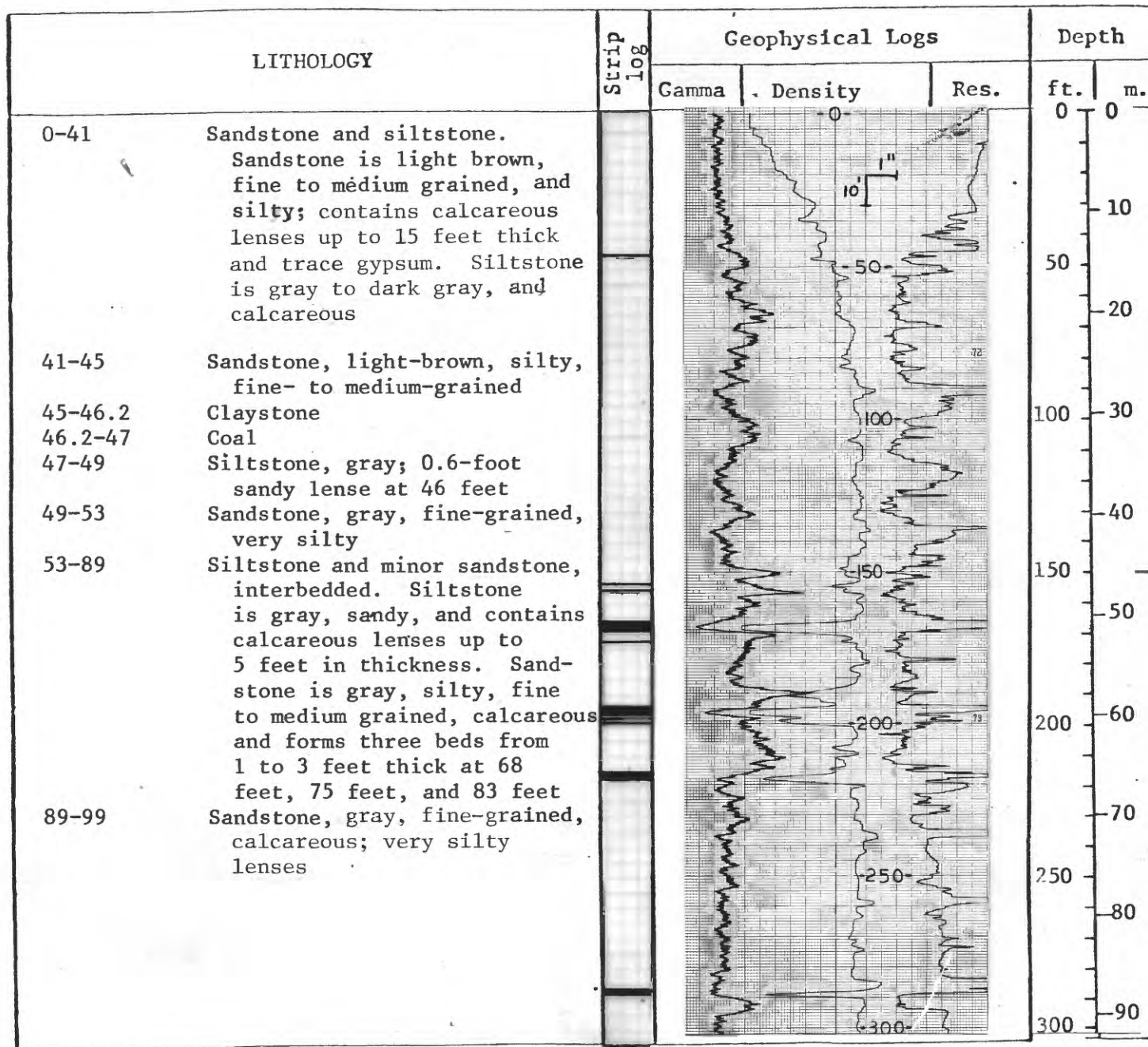
LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
109.2-109.5 Coal					300	
109.5-112.6 Claystone, gray, silty						
112.6-113.4 Coal						
113.4-123 Claystone, gray, silty					100	
123 -249 Sandstone, gray, fine-grained to very fine grained, silty					350	
249-256.5 Claystone, gray, silty						
256.5-259.2 Coal					110	
259.2-261.2 Carbonaceous shale, black						
261.2-265.3 Coal and baked rock						
265.3-271.2 Claystone, gray, silty, slightly sandy					120	
271.2-271.8 Coal?					400	
271.8-275 Claystone, gray, silty, slightly sandy, and baked rock						
275-276.2 Coal						
276.2-281.2 Coal and carbonaceous shale, thinly interbedded						
281.2-290 Siltstone, gray						
290-309 Claystone, gray, silty						
309-313 Siltstone, gray, very sandy, slightly clayey						
313-320 Sandstone, gray, fine-grained, silty						
320-327 Siltstone, gray, sandy, clayey; slightly calcareous lenses						
327-329 Sandstone, gray, fine-grained, silty						
329-344 Siltstone, gray, sandy, clayey; slightly calcareous lenses						
344-350 Claystone, gray, silty; slightly calcareous lenses						
350-362 Siltstone, gray, slightly calcareous, sandy						
362-390 Sandstone, gray, fine-grained, silty, slightly calcareous						



DRILL-HOLE LOGS

Hole no. FR-D2 Date logged 8-16-77 Surface elevation (ft) 7035
 Loc.: State Wyo. Cty. Carbon T. 19N., R. 91W., Sec. 14 ; 200 FSL, 100 FEL
 Drilled depth (ft) 680 Logged depth (ft) 670
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 1 Scale 2.5k cps/in Logging speed 20 fpm



LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
99-114	Siltstone and minor sandstone, interbedded. Siltstone is gray. Sandstone is fine to medium grained, silty, gray, and forms two lenses up to 1 foot thick at 102 and 106 feet. Minor thin coal beds				100	
114-123	Sandstone, gray, fine-grained; silty lenses, minor calcareous lenses				350	
123-135	Siltstone and minor sandstone; interbedded. Siltstone is gray with minor calcareous lenses up to 5 feet thick. Sandstone is gray, fine grained, very silty				400	
135-141	Sandstone, gray, calcareous, fine-grained, silty				450	
141-145	Siltstone, gray, calcareous				140	
145-148	Sandstone, gray, calcareous, fine-grained, silty				150	
148-151	Claystone, gray, silty				500	
151-152.4	Sandstone, gray, fine-grained, very silty				550	
152.4-153.6	Carbonaceous shale, black				160	
153.6-154.6	Coal				170	
154.6-155.6	Carbonaceous shale, black				180	
155.6-156	Coal				190	
156 -158	Carbonaceous shale, black, slightly coaly				600	
158-161	Siltstone, gray to dark-gray, slightly calcareous; sandy stringers of 1 foot or less				650	
161-166	Carbonaceous shale, black, coaly stringers				200	
166-169	Coal; carbonaceous shale stringer of less than half a foot at 167.4 feet					
169 -172	Carbonaceous shale, black, coaly					
172-172.5	Coal					
172.5-173	Carbonaceous shale, black					

10K 15K 20K 25K 30K 35K 40K 45K 50K 55K 60K 65K 70K 75K 80K 85K 90K 95K 100K
 GAMMA DENSITY RES
 25 CPS/IN 25K+25KPS/IN 100 Ω/5IN
 TC-2 TC-1 FR-D2
 20 FT/MIN R-16-77

got
strip

LITHOLOGY	Strip log	Geophysical Logs.			Depth	
		Gamma	Density	Res.	ft.	m.
498.2-499.2 Coal						
499.2-501 Carbonaceous shale, black						
501-520 Siltstone, gray, calcareous; minor sandy stringers. Minor carbonaceous shale						
520-521 Carbonaceous shale, black						
521-522.5 Coal						
522.5-526 Carbonaceous shale, black, silty						
526-537 Sandstone, fine-grained, silty, calcareous						
537-573 Siltstone and minor sandstone, interbedded. Siltstone is gray and calcareous. Sand- stone is fine grained, silty and calcareous. Minor gray claystone						
573-574.5 Carbonaceous shale, black						
574.5-581 Coal						
581-581.6 Carbonaceous shale, black						
581.6-582.7 Coal						
582.7-584.2 Carbonaceous shale, black						
584.2-670 Sandstone, gray, fine-grained; minor calcareous stringers. Very silty in the upper and lower thirds of the unit						

DRILL-HOLE LOGS

Hole no. FR-D5 Date logged 9-11-77 Surface elevation (ft) 7010
 Loc.: State Wyo. Cty. Carbon T. 19N., R. 91W., Sec. 26; 2100 FSL, 1900 FWL
 Drilled depth (ft) 1200 Logged depth (ft) 1195
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

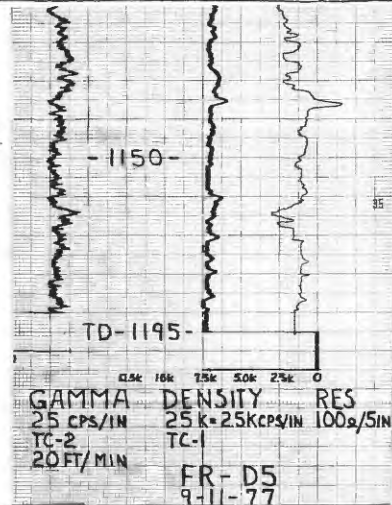
Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 1 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
0-149.8 Sandstone, claystone, and siltstone, interbedded. Sandstone is gray to brown, fine to medium grained, silty, occasionally iron stained, and contains minor calcareous stringers. Claystone is light to dark gray, calcareous, and silty. Siltstone is light to dark gray and calcareous					0	0
149.8-152.8 Coal					10	
152.8-163 Claystone, dark-gray, carbonaceous					50	
163-164 Coal					20	
164-167.8 Claystone, dark-gray, carbonaceous					100	30
167.8-170.5 Coal					40	
170.5-171.6 Claystone, dark-gray to black, carbonaceous and very shaly					150	
171.6-172.4 Coal					50	
172.4-175 Carbonaceous shale					200	60
175-289.7 Sandstone, medium- to dark-gray, fine- to medium-grained, silty, occasionally iron-stained; minor calcareous stringers. Minor gray calcareous siltstone					70	
289.7-293 Coal					250	
293-311.6 Sandstone, medium- to dark-gray, fine- to medium-grained, silty; with minor calcareous stringers. Minor gray calcareous siltstone					80	
311.6-316.2 Coal						

LITHOLOGY		Strip log	Geophysical Logs.			Depth	
			Gamma	Density	Res.	ft.	m.
316.2-320	Carbonaceous shale			- 300 -		300	
320-335.2	Sandstone, gray, fine- to medium-grained, silty; with minor calcareous stringers						100
335.2-336.5	Coal						
336.5-390	Siltstone, medium- to dark-gray, clayey, slightly sandy. Minor gray silty claystone			- 350 -		350	110
390-396	Coal						
396-397.3	Siltstone, gray, clayey						
397.3-399	Coal						
399-409	Claystone and siltstone, interbedded			- 400 -		400	120
409-444	Sandstone, gray, fine-grained						
444-475	Siltstone, gray, sandy. Minor carbonaceous shale						130
475-477.5	Coal						
477.5-480	Carbonaceous shale			- 450 -		450	140
480-515.7	Sandstone, gray, fine-grained, calcareous, very silty						
515.7-516.5	Coal						
516.5-516.8	Carbonaceous shale						
516.8-522.4	Coal						
522.4-523	Carbonaceous shale			- 500 -		500	150
523-523.7	Coal						
523.7-560	Siltstone and claystone, interbedded						160
560-732	Sandstone, gray, fine-grained, calcareous; very silty from 620 to 685 feet			- 550 -		550	170
732-734	Siltstone, medium- to dark-gray and very sandy						
734-735.2	Coal						
735.2-738	Siltstone, medium- to dark-gray, very sandy						180
738-756	Sandstone, medium- to dark-gray, fine-grained, calcareous, very silty			- 600 -		600	
756-757.6	Coal						190
757.6-768	Siltstone, medium- to dark-gray, very sandy, and slightly calcareous			- 650 -		650	200
768-849	Sandstone, medium- to dark-gray, fine-grained, very silty; with calcareous stringers						
849-850.2	Coal			- 700 -		700	210

LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
850.2-859.5 Sandstone, medium- to dark-gray, fine-grained, very silty					220	
859.5-860.8 Coal						
860.8-864 Claystone						
864-874 Sandstone, medium- to dark-gray, fine-grained, very silty			-750-		750	230
874-875 Coal						
875-875.4 Siltstone, medium- to dark-gray					240	
875.4-875.8 Coal			-800-	32	800	
875.8-879.3 Carbonaceous shale						
879.3-882.3 Coal					250	
882.3-883 Claystone, dark-gray						
883-884 Coal						
884-885 Claystone, dark-gray, silty			-850-		850	260
885-885.5 Coal						
885.5-886 Claystone, dark-gray, silty						
886-886.5 Coal						
886.5-900 Siltstone and shale, interbedded. Siltstone is medium gray and sandy. Shale is dark gray and silty			-900-		900	270
900-932.6 Sandstone and siltstone. Sandstone is medium gray and very fine to fine grained. Siltstone is gray and sandy. Minor gray silty shale			-950-	33	950	280
932.6-933.8 Coal						
933.8-957 Siltstone, medium-gray, sandy					300	
957-978 Sandstone, medium-gray, very fine grained to fine-grained, silty. Minor gray claystone			-1000-		1000	310
978-979.5 Coal						
979.5-1005.4 Sandstone, medium-gray, fine-grained, calcareous, very silty. Minor medium- to dark-gray, calcareous and clayey siltstone and shale			-1050-	34	1050	320
1005.4-1007.4 Coal			-1100-		1100	330

Hole No. FR-D5 (continued)

LITHOLOGY	Strip Log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
1007.4-1038 Sandstone and siltstone. Sandstone is gray and fine grained. Siltstone is gray and sandy. Minor claystone and clayey siltstone					340	
1038-1054.2 Coal					1150	350
1054.2-1056 Siltstone, dark-gray, calcareous, very clayey						
1056-1057.2 Coal						360
1057.2-1195 Sandstone and siltstone, inter- bedded. Sandstone is medium gray, calcareous, fine grained and very silty. Siltstone is medium to dark gray, calcareous, and very clayey					1200	

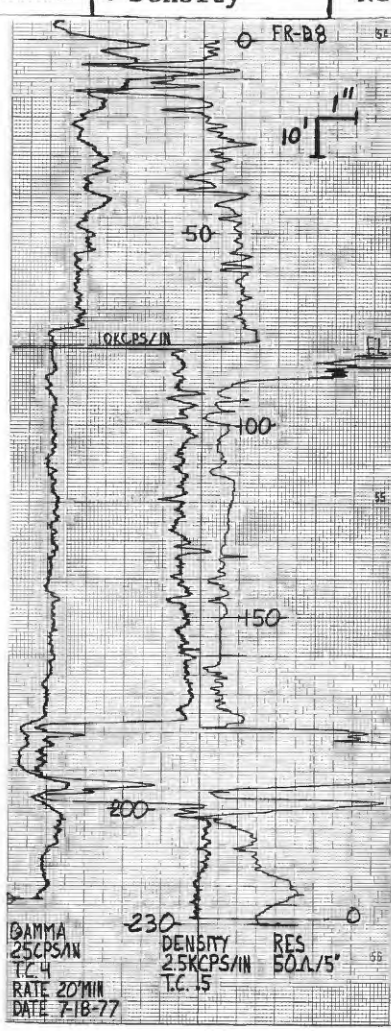
U.S.G.S - GECK
 FR - D5
 LITTLE SNAKE RIVER - AREA #2
 CARBON WYOMING
 26 19 N 91 W Ground Level 1195
 1195
 250 25
 2 20
 1195
 0
 1195
 8030 19
 No. 1 x 1/2 1/2 x 1/4
 6-1/2 sec 1.5 x 10
 1.12
 100 5

FR-D5 1200
 26 19 N 91 W
 LITTLE SNAKE RIVER
 CARBON
 WYOMING
 U.S.G.S - GECK
 9-11-77
 7528
 Rawlins
 20 - 1530
 6.5 - 1100
 1.5
 100
 WATER LEVEL - 24 FT.

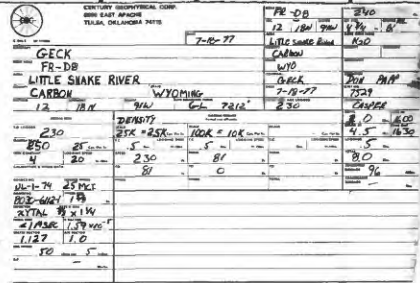
DRILL-HOLE LOGS

Hole no. FR-D8 Date logged 7-18-77 Surface elevation (ft) 7,225
 Loc.: State Wyo. Cty. Carbon T. 18N., R. 91W., Sec. 12; 1850 FNL, 1,150 FWL
 Drilled depth (ft) 240 Logged depth (ft) 230
 Drilling fluid: ☒ Air ☐ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 10 ohms/in Logging speed 20 ipm
 Gamma: T.C. 4 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-91	Sandstone, brown, fine- to medium-grained, silty; minor gray lense at 20 feet, minor white lense at 75 feet		 <p>FR-D8</p> <p>10' 1''</p> <p>50</p> <p>100</p> <p>150</p> <p>200</p> <p>230</p> <p>GAMMA 25CPS/IN T.C. 4</p> <p>DENSITY 2.5K CPS/IN T.C. 0.5</p> <p>RES 50 OHM/IN</p> <p>RATE 20' MIN</p> <p>DATE 7-18-77</p>			0	0
91-100	Siltstone and sandstone, interbedded, gray. Siltstone is shaly. Sandstone is fine to medium grained and silty					10	
100-140	Sandstone, brown, fine- to medium-grained, silty. Minor brown siltstone					20	
140-178.6	Sandstone and siltstone, interbedded. Sandstone is fine to medium grained, silty. Siltstone is slightly sandy					30	
178.6-178.8	Carbonaceous shale, black, coaly					40	
178.8-180.5	Coal					50	
180.5-181	Carbonaceous shale, black, coaly					60	
181-181.8	Coal, shaly					70	
181.8-182.2	Carbonaceous shale, black, coaly						
182.2-194.8	Coal						
194.8-197.2	Carbonaceous shale, black, coaly						
197.2-200.5	Coal						
200.5-202.4	Carbonaceous shale, black, coaly						
202.4-205	Siltstone and carbonaceous shale, interbedded. Siltstone is gray and slightly sandy. Carbonaceous shale is silty and gray to black						

Hole No. FR-D8 (continued)

LITHOLOGY	SERIAL LOG	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
205-230 Sandstone, gray, fine- to medium-grained, silty						

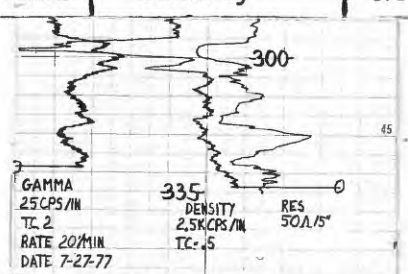
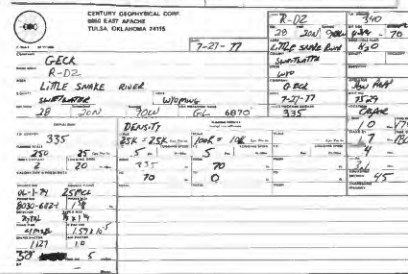
DRILL-HOLE LOGS

Hole no. R-D2 Date logged 7-27-77 Surface elevation (ft) 6870
 Loc.: State Wyo. Cty. Sweet-water T. 20N., R. 90W., Sec. 28; 2450 FSL, 1450 FEL
 Drilled depth (ft) 340 Logged depth (ft) 335
 Drilling fluid: ☒ Air ☐ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 10 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5 cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-57	Sandstone, tan, very fine grained to fine-grained, with minor brown iron-staining. Minor brown shale					0	0
57-61	Shale, light-blue-gray						10
61-73.8	Coal						
73.8-74.8	Carbonaceous shale					50	
74.8-78.7	Coal						20
78.7-106.8	Shale, light-gray, slightly sandy						
106.8-109.2	Carbonaceous shale, medium-brownish-gray						30
109.2-113	Coal					100	
113-118.4	Shale, medium- to dark-gray						
118.4-119.5	Coal						40
119.5-127	Claystone						
127-160	Sandstone and shale, interbedded. Sandstone is medium gray and very fine grained. Shale is medium gray and slightly sandy					150	
160-162.2	Coal						50
162.2-169	Shale, medium-gray. Minor medium-gray very fine grained sandstone					200	
169-296.3	Sandstone and shale, interbedded. Sandstone is medium gray and very fine grained. Shale is medium gray with minor medium-brown to black carbonaceous lenses						60
296.3-335	Shale, medium-gray, with minor medium-brown carbonaceous lenses. Minor medium-gray and very fine grained sandstone					250	
							70
							80

Hole No. R-D2 (continued)

LITHOLOGY	Strip Log	Geophysical Logs			Depth ft.
		Gamma	Density	Res.	
					300
					

DRILL-HOLE LOGS

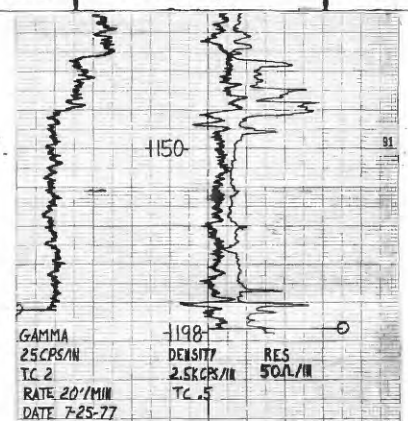
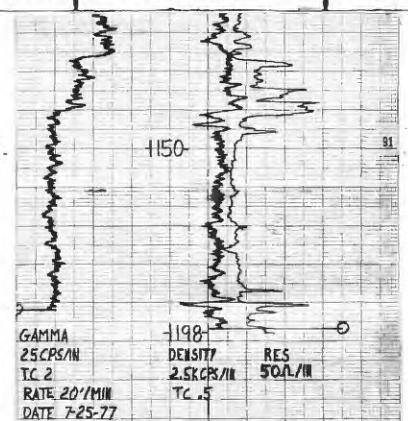
Hole no. R-D3 Date logged 7-25-77 Surface elevation (ft) 6860
 Loc.: State Wyo. Cty. Sweet- T. 20N., R. 90W., Sec. 32 ; 2550 FSL, 2450 FW L
 Drilled depth (ft) 1200 Logged depth (ft) 1198
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 50 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
0-5 Soil, brownish-yellow, sandy to clayey					0	0
5-55 Sandstone, tan to orange-brown, very fine grained to fine-grained, well-sorted					10	
55-181 Sandstone, gray, fine-grained, carbonaceous. Minor gray siltstone, and carbonaceous shale					50	
181-185 Carbonaceous shale, brownish-black, silty					20	
185-190.5 Coal					100	30
190.5-192 Carbonaceous shale, grayish-brown, silty					40	
192-195 Siltstone, gray, carbonaceous					150	
195-197 Carbonaceous shale, brown, silty					50	
197-202 Coal					200	60
202-217 Siltstone and shale, gray, carbonaceous					70	
217-221 Coal					250	
221-227 Shale, grayish-brown, carbonaceous, silty					80	
227-230 Sandstone, orange, fine-grained, silty					90	
230-238 Shale, gray, silty. Minor thinly interbedded siltstone						
238-259 Siltstone, gray, carbonaceous, shaly. Minor orange, medium-grained sandstone						
259-265 Carbonaceous shale, grayish-brown						
265-270.1 Coal						
270.1-273 Siltstone, gray, sandy						

	LITHOLOGY	Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
273-278	Carbonaceous shale, brown, silty						
278-278.6	Coal						100
278.6-279.6	Carbonaceous shale						
279.6-280	Coal						
280-294	Sandstone, siltstone, and shale, thinly interbedded. Sandstone is gray, fine grained, silty. Siltstone is gray and carbonaceous. Shale is brown and carbonaceous			350		350	110
294-295	Coal						
295-298	Shale, gray, carbonaceous, silty			400		400	120
298-298.5	Coal						130
298.5-306	Shale, brownish-gray, silty, carbonaceous			450		450	
306-334	Sandstone, siltstone, and shale, interbedded. Sandstone is gray and very fine grained. Siltstone is gray and sandy to shaly. Shale is gray and silty to clayey			500		500	140
334-350	Siltstone, gray, sandy						150
350-410	Sandstone, gray, very fine grained						160
410-419	Shale						
419-430	Siltstone and sandstone, thinly interbedded			550		550	170
430-436	Shale, gray, silty						
436-443	Sandstone, gray, fine-grained						
443-448	Siltstone and shale						
448-456	Sandstone and shale, thinly interbedded			600		600	180
456-464	Sandstone, light-gray, fine-grained						
464-466	Carbonaceous shale						190
466-471.4	Coal						
471.4-483	Claystone, gray, silty						
483-490	Siltstone and shale, thinly interbedded			650		650	200
490-506	Sandstone, gray, fine-grained						
506-519	Shale and siltstone. Shale is gray and silty. Siltstone is gray and shaly to sandy						210
519-608	Sandstone, gray to greenish-gray, fine-grained			700		700	

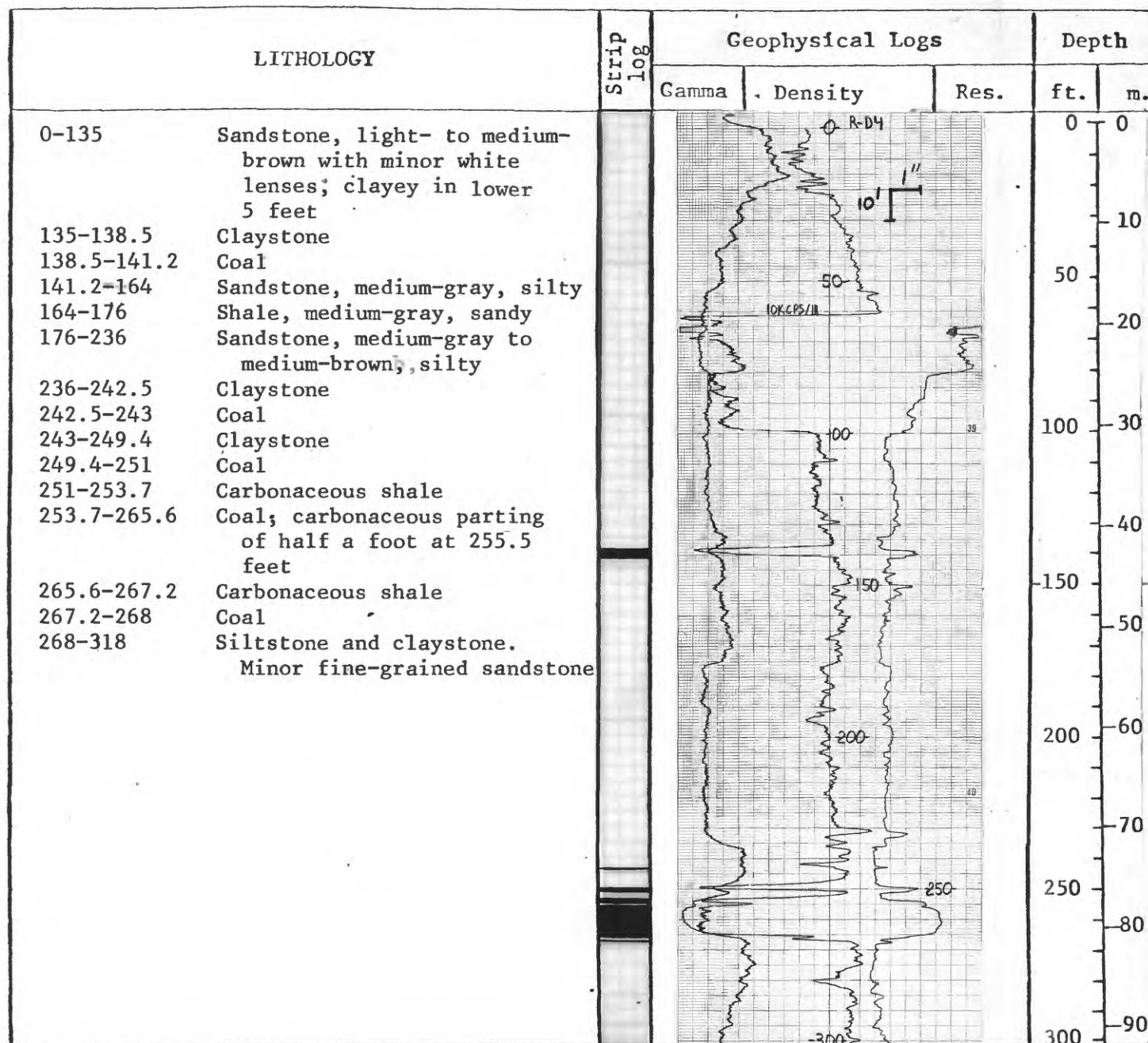
	LITHOLOGY	Strip log	Geophysical Logs.			Depth	
			Gamma	Density	Res.	ft.	m.
608-615	Shale, gray, silty						
615-618	Sandstone, gray, fine-grained, silty					220	
618-622	Coal						
622-625	Shale						
625-629	Sandstone					750	230
629-635	Shale						
635-640	Sandstone						
640-660	Sandstone, siltstone, and shale, thinly interbedded					240	
660-661	Coal						
661-663.5	Carbonaceous shale					800	
663.5-666	Coal						
666-673.5	Carbonaceous shale, grayish-brown					250	
673.5-674.5	Coal						
674.5-676	Carbonaceous shale						
676-679.8	Coal					850	260
679.8-697	Sandstone, siltstone, and shale, thinly interbedded						
697-709	Sandstone						
709-711	Siltstone					270	
711-712.2	Coal						
712.2-741	Shale, siltstone, and sandstone, thinly interbedded					900	
741-749	Shale, gray, clayey					280	
749-760.8	Shale and sandstone, interbedded						
760.8-762	Coal						
762-762.5	Carbonaceous shale					950	290
762.5-769.6	Coal						
769.6-770.5	Carbonaceous shale						
770.5-771	Coal						
771-773	Carbonaceous shale					300	
773-775.8	Coal with 0.5-foot parting						
775.8-785	Carbonaceous shale, brownish-black, coaly					1000	
785-873	Sandstone					310	
873-921	Shale and siltstone. Shale is grayish-black, carbonaceous and gradational into siltstone. Siltstone is gray					1050	320
921-958	Siltstone and sandstone, interbedded. Siltstone is gray and sandy to clayey. Sandstone is fine grained and thinly interbedded					330	
958-960	Shale					1100	

LITHOLOGY	Strip log	Geophysical Logs			Depth ft.
		Gamma	Density	Res.	
960-970 Sandstone					1150
970-976 Sandstone and shale					35
976-986 Sandstone					36
986-992.5 Carbonaceous shale					1200
992.5-997 Coal					
997-1016.8 Siltstone and shale, interbedded. Siltstone is gray and shaly to sandy. Shale is brownish gray and carbonaceous					
1016.8-1020.8 Coal					
1020.8-1050 Sandstone, siltstone, and shale, thinly interbedded					
1050-1052 Coal					
1052-1053 Carbonaceous shale					
1053-1061 Coal					
1061-1064 Carbonaceous shale					
1064-1065 Coal					
1065-1067.5 Carbonaceous shale					
1067.5-1070.5 Coal					
1070.5-1140 Shale, gray to brown, carbonaceous, silty. Minor thinly interbedded sandstone and siltstone					
1140-1198 Sandstone, light-gray, very fine grained					

DRILL-HOLE LOGS

Hole no. R-D4 Date logged 7-19-77 Surface elevation (ft) 7055
 Loc.: State Wyo. Cty. Sweet- water T. 20N., R. 90W., Sec. 34; 2000 FNL, 700 FW L
 Drilled depth (ft) 320 Logged depth (ft) 318
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 50 ohms/in Logging speed 20 fpm
 Gamma: T.C. 4 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm



Hole No. R-D4 (continued)

[illegible]

DRILL-HOLE LOGS

Hole no. R-D5 Date logged 7-21-77 Surface elevation (ft) 7224
 Loc.: State Wyo. Cty. Carbon T. 19N., R. 90W., Sec. 4; 2250 FNL, 2350 FW L
 Drilled depth (ft) 200 Logged depth (ft) 191
 Drilling fluid: ☒ Air ☐ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 10 ohms/in Logging speed 20 fpm
 Gamma: T.C. 4 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-5	Shale and sandstone, interbedded. Shale is medium gray. Sandstone is tan and fine grained					0	0
5-63	Sandstone, tanish-gray, fine-grained, well-sorted, slightly iron-stained					10	
63-73.2	Coal; with a carbonaceous parting of half a foot at 64 feet					20	
73.2-74.6	Carbonaceous shale					30	
74.6-79	Claystone and siltstone, interbedded					40	
79-108	Shale, medium-gray, slightly silty					50	
108-191	Sandstone, medium-gray, very fine grained to fine-grained, well-sorted. Minor medium-gray shale		150	60			
			GAMMA 25 CPS/IN TC 4 RATE 20/FPM DATE 7-21-77 DENSITY 2.5 CPS/IN TC 5 RES 50 OHM/IN			200	60
			<div>GEOPHYSICAL LOG SUMMARY</div> <div>HOLE NO. R-D5</div> <div>DATE 7-21-77</div> <div>SURFACE ELEVATION 7224</div> <div>STATE WYO. COUNTY CARBON T. 19N. R. 90W. SEC. 4</div> <div>DRILLED DEPTH 200 FT. LOGGED DEPTH 191 FT.</div> <div>DRILLING FLUID AIR</div> <div>LOGGING SPEED 20 FPM</div> <div>GAMMA SCALE 25 CPS/IN TC 4</div> <div>DENSITY SCALE 2.5 CPS/IN TC 5</div> <div>RESISTIVITY SCALE 50 OHM/IN</div> <div>LOGGING SPEED 20 FPM</div> <div>TOTAL DEPTH 191 FT.</div> <div>TOTAL LOG 191 FT.</div> <div>TOTAL LOG 191 FT.</div> <div>TOTAL LOG 191 FT.</div>				

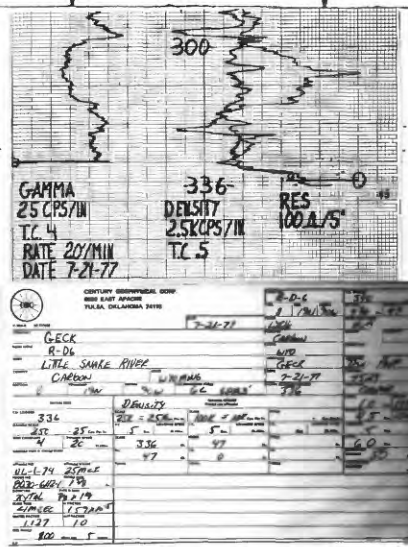
DRILL-HOLE LOGS

Hole no. R-D6 Date logged 7-21-77 Surface elevation (ft) 6883
 Loc.: State Wyo. Cty. Carbon T. 19N., R. 90W., Sec. 8; 1000 FNL, 650 FW L
 Drilled depth (ft) 340 Logged depth (ft) 336
 Drilling fluid: ☒ Air ☐ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 4 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-10	Sandstone, medium-brown to gray. Minor siltstone					0	0
10-38	Shale, medium-brown to gray, silty, slightly sandy. Minor sandstone					10	
38-40	Coal					50	
40-45	Carbonaceous shale, black					20	
45-48	Coal					30	
48-81	Shale, medium-gray to black, silty. Minor coaly lenses, minor clayey lenses					100	
81-268.5	Sandstone, medium-gray. Minor medium-gray siltstone					40	
268.5-270.6	Coal					150	
270.6-295	Siltstone, medium-gray and sandy					50	
295-300	Claystone, silty and sandy					60	
300-315	Sandstone, medium-gray and silty. Minor medium-gray siltstone					70	
315-336	Siltstone, medium-gray, sandy. Minor medium-gray silty sandstone					80	
						90	
						300	

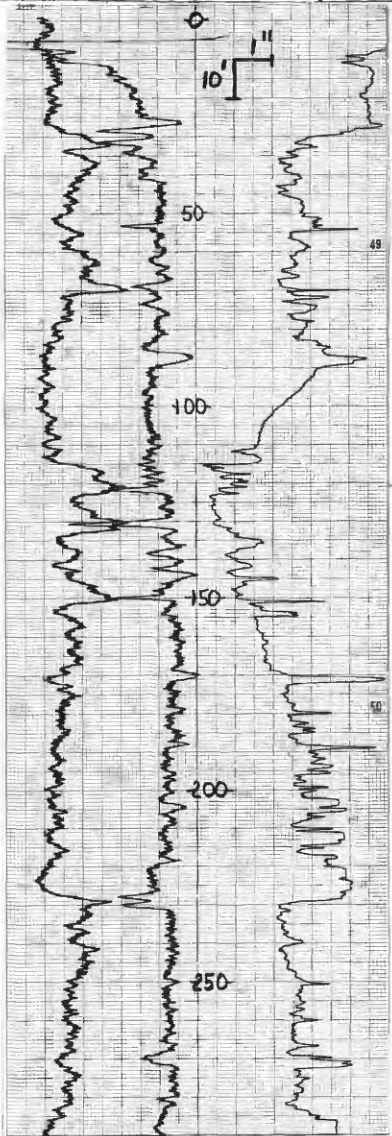
Hole No. R-D6 (continued)

LITHOLOGY	Strip Log	Geophysical Logs			Depth ft.
		Gamma	Density	Res.	
					300 100 350

DRILL-HOLE LOGS

Hole no. R-D7 Date logged 8-2-77 Surface elevation (ft) 6,815
 Loc.: State Wyo. Cty. water T. 20N., R. 90W., Sec. 22; 2600 FSL, 1900 FWL
 Drilled depth (ft) 480 Logged depth (ft) 472
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☐ Mud
 Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-28	Sandstone, light- to medium-brown, fine-grained, silty and calcareous					0	0
28-29	Coal						
29-34.5	Carbonaceous shale						10
34.5-35	Coal						
35-40	Claystone, medium-gray, silty; thin calcareous stringers					50	
40-54	Siltstone, medium-gray, slightly clayey; calcareous stringers. Minor medium gray, calcareous, silty, very fine grained to fine-grained sandstone						20
54-54.5	Coal						
54.5-71	Siltstone, medium- to dark-gray, slightly clayey, calcareous						30
71-115	Sandstone, medium-gray, calcareous, silty						40
115-123	Carbonaceous shale and coal, interbedded. Carbonaceous shale is dark gray and forms beds as much as 1.5 feet thick. Coal forms beds ranging from 0.5 to 1.5 feet						50
123-152	Siltstone, medium- to dark-gray, slightly sandy, calcareous. Minor medium-gray, very fine grained to fine-grained sandstone						60
152-229	Sandstone and siltstone, interbedded. Sandstone is gray and very fine grained to fine grained. Siltstone is gray						70
							80
							90
							300

42

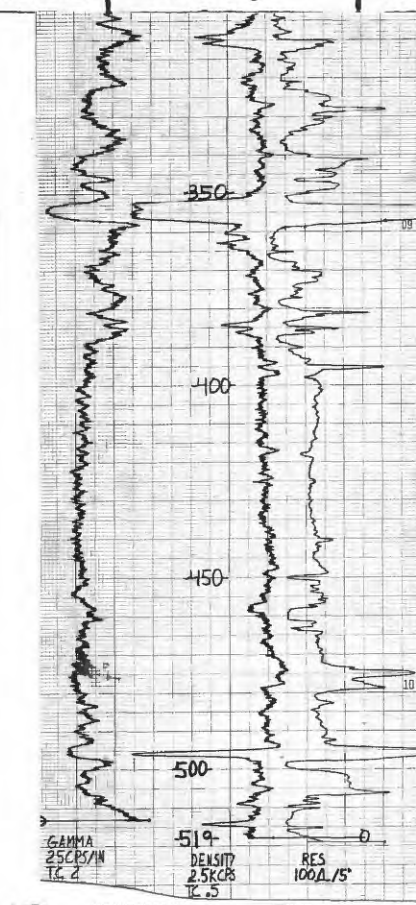
DRILL-HOLE LOGS

Hole no. RD-8 Date logged 7-24-77 Surface elevation (ft) 6940
 Loc.: State Wyo. ^{Sweet-} water Cty. T. 20N., R. 90W., Sec. 22; 350 FSL, 1950 FE L
 Drilled depth (ft) 520 Logged depth (ft) 519
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-54	Sandstone, light-yellow-brown, fine-grained, well-sorted. Minor gray-brown shale					0	0
54-60	Shale, gray to brown, sandy					10	
60-66	Sandstone, tan, fine-grained, silty and shaly					50	
66-85	Shale and sandstone, thinly interbedded. Shale is gray. Sandstone is tan, fine grained, and silty					20	
85-97.2	Coal					100	30
97.2-100	Carbonaceous shale, grayish-black						
100-104	Coal					40	
104-132	Shale and siltstone. Shale is gray and silty. Siltstone is gray and sandy. Minor fine-grained gray sandstone					150	
132-135.5	Coal					50	
135.5-144	Shale, bluish-gray, silty						
144-144.5	Coal					60	
144.5-155	Shale, bluish-gray, silty					200	
155-177.5	Sandstone, siltstone, and shale, interbedded. Sandstone is gray, fine grained, and silty. Siltstone is gray. Shale is blue gray and silty					70	
177.5-178.2	Coal					250	
178.2-184	Shale, blue-gray, silty					80	
184-233	Sandstone, gray, very fine grained					300	90

	LITHOLOGY	Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
233-250	Shale, gray to black, carbonaceous. Minor very fine grained gray sandstone						100
250-277	Siltstone, gray, sandy. Minor dark-gray silty shale						
277-353	Shale, siltstone, and sandstone, interbedded. Shale is gray to black and carbonaceous. Siltstone is gray and shaly to sandy. Sandstone is gray and fine grained					350	110
353-358	Coal						
358-359	Carbonaceous shale, blackish-brown						
359-388	Shale and siltstone, interbedded. Shale is gray to brown and carbonaceous. Siltstone is gray and clayey. Minor coal at 385-385.4 and 386-386.6 feet					400	120
388-458	Sandstone, gray, very fine grained. Minor gray silty shale					450	140
458-461	Shale, gray, silty						
461-493	Sandstone and shale, interbedded. Sandstone is gray and very fine grained. Shale is gray and very silty					500	150
493-494	Carbonaceous shale, brownish-black						
494-497	Coal						
497-500	Carbonaceous shale, brownish-black						
500-519	Shale, gray to black, silty and sandy						



CENTURY GEOPHYSICAL, DENVER
800 EAST AVENUE
DENVER, COLORADO 80202

7-24-77

WELL: RD-8
SITE: LITTLE SHALE RIVER
LOG: 25 CPS/IN TC 2
DENSITY: 2.5 KCPS TC 5
RESISTIVITY: 100A/5'

LOG NO. 100

DATE: 7-24-77

LOGGERS: J. H. H. & S. H. H.

TIME: 10:00 AM

WELL NO. RD-8

LOG NO. 100

DATE: 7-24-77

LOGGERS: J. H. H. & S. H. H.

TIME: 10:00 AM

WELL NO. RD-8

LOG NO. 100

DATE: 7-24-77

LOGGERS: J. H. H. & S. H. H.

TIME: 10:00 AM

DRILL-HOLE LOGS

Hole no. BP-D17 Date logged 8-1-77 Surface elevation (ft) 6,850
 Loc.: State Wyo. Cty. Carbon T. 20N., R. 89W., Sec. 4 ; 100 FNL, 400 FWL
 Drilled depth (ft) 420 Logged depth (ft) 417
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-10	Sandstone, medium-brown to light-gray, very fine grained to fine-grained, very silty					10	
10-21.2	Claystone, dark-brown to black; shaly in the upper 5 feet					50	
21.2-22.5	Coal					20	
22.5-48	Claystone and carbonaceous shale, interbedded. Claystone is dark brown. Carbonaceous shale is dark brown to black and very clayey					100	30
48-68	Sandstone, light- to medium-gray, fine- to medium-grained, silty; calcareous stringer between 55 and 60 feet					150	
68 -69.5	Siltstone, medium-gray, slightly sandy					50	
69.5-70.2	Coal						
70.2-70.6	Siltstone, medium-gray						
70.6-75	Coal					200	60
75-89.6	Claystone and siltstone, interbedded. Claystone is medium to dark gray and silty. Siltstone is medium to dark gray and slightly clayey					70	
89.6-92	Coal					250	
92-92.4	Shale, medium- to dark-gray					80	
92.4-93.1	Coal						
93.1-102	Shale, medium- to dark-gray, clayey					300	90

801
Scrip

Hole No. BP-D17 (continued)

LITHOLOGY		Strip 108	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
394-408	Claystone, medium- to dark-gray, silty						
408-417	Sandstone, medium-gray, fine-grained, silty						

DRILL-HOLE LOGS

Hole no. BP-D18 Date logged 7-31-77 Surface elevation (ft) 6,805
 Loc.: State Wyo. Cty. Carbon T. 20N., R. 89W., Sec. 6 ; 650 FSL, 1600 FEL
 Drilled depth (ft) 480 Logged depth (ft) 475
 Drilling fluid: ☒ Air ☐ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-26	Sandstone, light-brown to medium-gray, fine- to medium-grained; minor calcareous stringers, silty in the lower 15 feet					0	0
26-28.3	Claystone, medium-brown and shaly					10	
28.3-29.2	Coal					20	
29.2-34	Claystone, gray, silty					30	
34-50	Siltstone, light-gray, sandy, calcareous					40	
50-59	Claystone					50	
59-75.6	Siltstone, light-gray, sandy					60	
75.6-77	Carbonaceous shale, black, silty					70	
77-85.7	Coal; 0.5-foot parting at 82.5 feet					80	
85.7-109	Siltstone and sandstone, interbedded. Siltstone is medium to dark gray, clayey, and contains calcareous stringers. Sandstone is medium gray, calcareous, fine grained, and very silty					90	
109-112.3	Shale					100	
112.3-114.4	Coal, carbonaceous partings of about half a foot or less at 112.9 and 113.5 feet					110	
114.4-124.7	Sandstone, medium-gray, silty, fine-grained, calcareous					120	
124.7-133	Claystone, medium-gray, very silty					130	

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Hole No. BP-D18 (continued)

LITHOLOGY		Strip Log	Geophysical Logs.			Depth	
			Gamma	Density	Res.	ft.	m.
310.6-432	Siltstone and sandstone, interbedded. Siltstone is gray and sandy. Sandstone is light gray and very fine to fine grained						
432-440	Coal						
440-480	Siltstone, medium- to dark-gray; contains calcareous lenses, very sandy. Minor gray, fine-grained sandstone						

DRILL-HOLE LOGS

Hole no. BP-D19 Date logged 7-28-77 Surface elevation (ft) 6840
 Loc.: State Wyo. Cty. Carbon T. 20N, R. 89W, Sec. 8; 300 FNL, 300 FWL
 Drilled depth (ft) 220 Logged depth (ft) 218
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 10 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

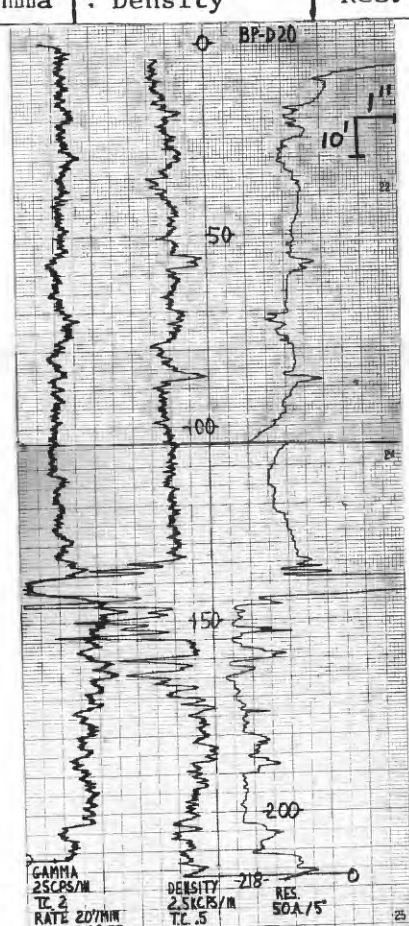
LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
0-5 Coal and carbonaceous shale, thinly interbedded. Coal is dark brown to black and very shaly. Carbonaceous shale is black					0	0
5-25 Sandstone, light-brown to gray, very fine grained to fine-grained, calcareous, silty					10	
25-29 Carbonaceous shale, black					20	
29-29.5 Coal, shaly; trace of sulfur staining					30	
29.5-30.2 Carbonaceous shale, black					40	
30.2-31.8 Coal					50	
31.8-32.6 Carbonaceous shale, black					60	
32.6-36.1 Coal; carbonaceous parting of less than half a foot at 33.2 feet					70	
36.1-50 Claystone and siltstone, interbedded. Claystone is dark brown, very silty and shaly. Siltstone is medium gray, very shaly, and slightly clayey					80	
50-100.5 Sandstone, medium-gray, very fine grained to medium-grained, silty					90	
100.5-114.5 Siltstone, medium-gray, shaly					100	
114.5-176.7 Sandstone, medium-gray, very fine grained to fine-grained, very silty					110	
176.7-178 Carbonaceous shale, black					120	
178-181.6 Coal					130	
181.6-182.2 Carbonaceous shale, black					140	
182.2-183 Coal					150	
					160	
					170	
					180	
					190	
					200	
					210	
					220	

LITHOLOGY		Strip Log	Geophysical Logs.			Depth	
			Gamma	Density	Res.	ft.	m.
183-189.3	Claystone, dark-gray, very shaly						
189.3-190.6	Coal, shaly						
190.6-194	Siltstone, dark-gray, slightly carbonaceous						
194-195	Coal						
195-200	Claystone, medium- to dark-gray, slightly silty						
200-205	Siltstone, medium- to dark-gray, slightly clayey						
205-220	Sandstone, medium-gray, fine-grained, silty						

DRILL-HOLE LOGS

Hole no. BP-D20 Date logged 7-29-77 Surface elevation (ft) 6872
 Loc.: State Wyo. Cty. Carbon T. 20N, R. 89W, Sec. 18; 200 FNL, 400 FWL
 Drilled depth (ft) 220 Logged depth (ft) 218
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 10 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
0-35 Sandstone and siltstone, interbedded. Sandstone is tan to pale yellowish brown and very fine grained to fine grained with minor calcareous lenses. Siltstone is grayish orange to medium dark gray and calcareous					0	0
					10	
					20	
					30	
					40	
					50	
					60	
					70	
					80	
					90	
35-135 Sandstone, light- to medium-gray and grayish-orange, very fine grained to medium-grained with calcareous lenses					100	30
135-136 Carbonaceous shale					110	
136-136.4 Coal					120	
136.4-137.3 Carbonaceous shale					130	
137.3-138 Coal					140	
138-138.7 Carbonaceous shale					150	
138.7-144 Coal					160	
144-145.2 Carbonaceous shale, medium-dark-gray					170	
145.2-146 Coal					180	
146-152 Siltstone					190	
152-153.4 Coal; carbonaceous parting of less than half a foot at 152.5 feet					200	60
153.4-158.5 Shale, dark-gray and coaly					210	
158.5-160.4 Coal; carbonaceous parting of less than half a foot at 159.3 feet					220	70

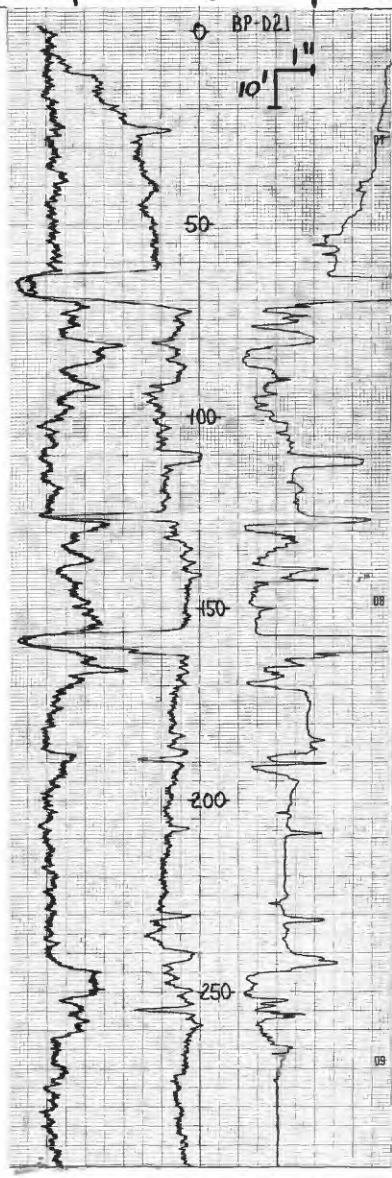
Hole No. BP-D20 (continued)

LITHOLOGY		Scrip Log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
160.4-203	Shale, medium- to dark-gray; coaly in the upper 5 feet, sandy in the lower 5 feet						
203-218	Sandstone and siltstone, interbedded. Sandstone is medium gray and very fine grained. Siltstone is carbonaceous						

DRILL-HOLE LOGS

Hole no. BP-D21 Date logged 7-29-77 Surface elevation (ft) 6762
 Loc.: State Wyo. Cty. Carbon T. 20N., R. 90W., Sec. 12 ; 2500 FNL, 2400 FWL
 Drilled depth (ft) 1200 Logged depth (ft) 1200
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-64	Sandstone, yellow-brown to medium-gray, fine-grained, well-sorted, friable, slightly silty; clayey within the lower 5 feet					0	0
64-70.3	Coal					10	
70.3-73	Carbonaceous shale. Minor medium-gray claystone					50	
73-101	Claystone and siltstone, interbedded					20	
101-126.2	Sandstone, medium-gray, very fine grained to fine-grained, occasionally coarse grained, silty, friable					100	30
126.2-128	Coal					40	
128-130	Carbonaceous shale					150	
130-137	Siltstone, dark-brown. Minor carbonaceous shale					50	
137-139	Carbonaceous shale and claystone, interbedded					200	60
139-143	Sandstone, medium-brown. Minor claystone and carbonaceous shale					70	
143-157.2	Claystone and carbonaceous shale, interbedded					250	80
157.2-161.6	Coal					90	
161.6-162.1	Carbonaceous shale						
162.1-163	Coal						
163-169	Carbonaceous shale and coal, interbedded						
169-170.3	Carbonaceous shale						
170.3-188	Sandstone, medium-gray, fine-grained. Minor claystone and carbonaceous shale						
188-190	Carbonaceous shale						
190-190.8	Coal					300	90

LITHOLOGY		Strip log	Geophysical Logs.			Depth	
			Gamma	Density	Res.	ft.	m.
190.8-192.5	Carbonaceous shale					300	
192.5-245	Sandstone, medium-gray, fine-grained, silty						
245-262	Shale, medium-gray, silty Minor thinly bedded sandstone					100	
262-379	Sandstone, medium-gray, fine-grained, silty. Minor medium-gray siltstone					350	
379-406.2	Sandstone and siltstone. Sandstone is medium gray and very fine to fine grained. Siltstone is medium gray and sandy					400	
406.2-411.9	Coal						
411.9-413.6	Claystone					130	
413.6-414.6	Coal						
414.6-493.	Sandstone, siltstone, and claystone, interbedded					450	
493-548.3	Sandstone					140	
548.3-549.6	Coal						
549.6-560.1	Claystone, medium-gray						
560.1-561.1	Coal					150	
561.1-561.8	Claystone, medium-gray						
561.8-564.3	Coal					500	
564.3-565.3	Claystone, medium-gray						
565.3-586	Sandstone and claystone, interbedded					160	
586-587	Carbonaceous shale						
587-593	Coal					550	
593-594.2	Claystone, medium-gray						
594.2-595	Coal					170	
595-596.9	Claystone, medium-gray						
596.9-598.2	Coal						
598.2-630.6	Siltstone, sandstone, and claystone, interbedded					180	
630.6-631.4	Coal					600	
631.4-632	Carbonaceous						
632-635.9	Coal					190	
635.9-636.4	Carbonaceous shale						
636.4-637	Coal					650	
637-665	Claystone, sandstone, and carbonaceous shale, interbedded. Claystone is medium gray to dark brown					200	
						210	
						700	

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
665-783	Sandstone and siltstone, interbedded. Sandstone is very fine grained, medium gray, and very silty. Siltstone is medium gray, and very clayey within the lower 47 feet of the unit					220	
783-785.4	Claystone, medium-gray					750	230
785.4-792.4	Coal					240	
792.4-804	Claystone, medium-gray. Minor coal at 802 and 803 feet					800	
804-813.5	Siltstone, medium-gray					250	
813.5-847.4	Claystone, medium-gray, silty						
847.4-850.3	Coal					850	260
850.3-860	Claystone						
860-874	Sandstone and minor siltstone					270	
874-878	Siltstone						
878-879.8	Coal					900	280
879.8-906	Claystone and siltstone, interbedded. Claystone is medium gray and shaly						
906-1079.5	Sandstone and siltstone, interbedded. Sandstone is medium gray, very fine grained, and very silty. Siltstone is medium gray and clayey					950	290
1079.5-1084.1	Coal					300	
1084.1-1085.5	Siltstone, medium-gray, shaly						
1085.5-1086	Coal					1000	310
1086-1089	Claystone, medium-gray, shaly						
1089-1089.7	Coal					1050	320
1089.7-1095	Siltstone, medium-gray, shaly						
1095-1095.8	Coal					1100	330
1095.8-1100.4	Siltstone, medium-gray, shaly. Minor coal						
1100.4-1101.2	Coal						
1101.2-1140	Siltstone, medium-gray, shaly						
1140-1200	Sandstone, medium-gray, very fine grained. Minor medium-gray shaly siltstone						

Hole No. BP-D21 (continued)

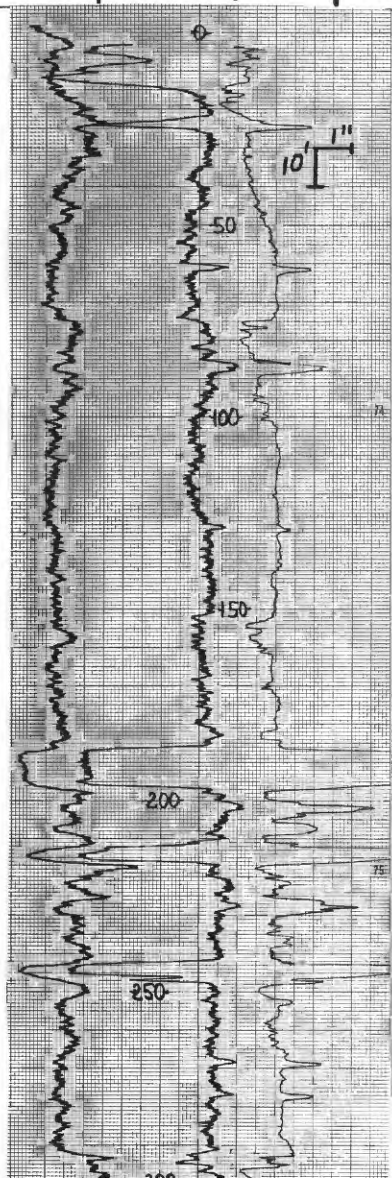
LITHOLOGY	SERIAL 801 LITH	Geophysical Logs			Depth																								
		Gamma	Density	Res.	ft.																								
					340 350 360 1200																								
		<table border="1"> <tr> <td colspan="2">GAMMA</td> <td colspan="2">DENSITY</td> <td colspan="2">RES.</td> </tr> <tr> <td colspan="2">25 CPS/IN</td> <td colspan="2">2.5 GKPS/IN</td> <td colspan="2">100 A/15'</td> </tr> <tr> <td colspan="2">TC 2</td> <td colspan="2">TC 3</td> <td colspan="2">TC 4</td> </tr> <tr> <td colspan="2">RATE 20.2 MIN</td> <td colspan="2">DATE 7-29-77</td> <td colspan="2"></td> </tr> </table>			GAMMA		DENSITY		RES.		25 CPS/IN		2.5 GKPS/IN		100 A/15'		TC 2		TC 3		TC 4		RATE 20.2 MIN		DATE 7-29-77				
GAMMA		DENSITY		RES.																									
25 CPS/IN		2.5 GKPS/IN		100 A/15'																									
TC 2		TC 3		TC 4																									
RATE 20.2 MIN		DATE 7-29-77																											

DRILL-HOLE LOGS

Hole no. BP-D22 Date logged 7-30-77 Surface elevation (ft) 6,780
 Loc.: State Wyo. Cty. Carbon T. 20N, R. 90W, Sec. 14; 2500 FN L, 2300 FEL
 Drilled depth (ft) 400 Logged depth (ft) 397
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud

Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-24	Sandstone, medium-brown to light-gray, very fine grained to fine grained, very silty; slightly clayey in the upper 5 feet, and calcareous in the lower 5 feet					0	0
24-25.5	Coal						10
25.5-34	Siltstone, light-gray, slightly sandy					50	20
34-75	Sandstone, light-gray, fine-grained, silty; calcareous in the lower 10 feet					100	30
75-95	Siltstone, medium-gray, sandy, calcareous. Minor light-gray, fine-grained, very silty sandstone					150	40
95-186.6	Sandstone, medium-gray, very fine to medium-grained, silty, and calcareous. Minor medium-gray sandy siltstone within the lower half of the unit					200	60
186.6-197	Coal					250	70
197-212.2	Siltstone, claystone, and sandstone, thinly interbedded. Siltstone is medium gray and calcareous. Claystone is gray and silty. Sandstone is gray and silty					300	80
212.2-216.7	Coal						90
216.7-220	Claystone, dark-gray, carbonaceous						

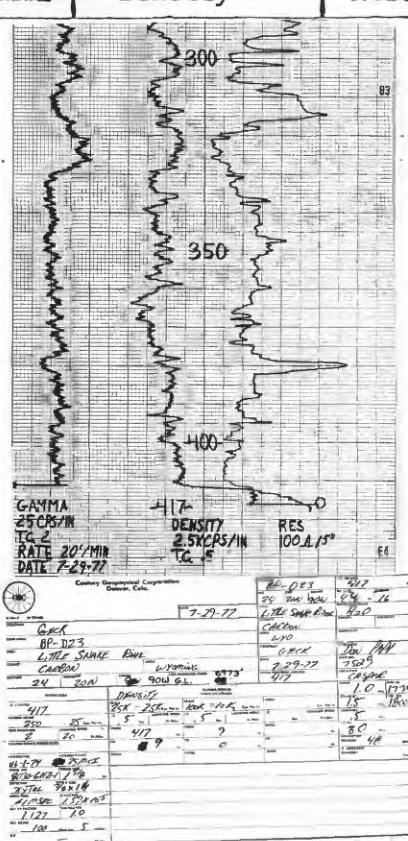
60

DRILL-HOLE LOGS

Hole no. BP-D23 Date logged 7-29-77 Surface elevation (ft) 6973
 Loc.: State Wyo. Cty. Carbon T. 20N., R. 90W., Sec. 24 ; 1000 FN L, 300 FW L
 Drilled depth (ft) 417 Logged depth (ft) 417
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
0-27 Sandstone, light-brown, fine- to medium-grained, silty. Minor calcareous stringers					0	0
27-28 Claystone, medium- to dark- gray, slightly carbonaceous					10	
28-29.8 Coal					50	
29.8-43 Sandstone, light-brown, very fine grained, very silty; calcareous in the lower 5 feet					20	
43-46.3 Claystone, medium- to dark- gray and slightly silty					100	30
46.3-47.8 Coal					40	
47.8-56.5 Claystone and siltstone, interbedded. Claystone is medium to dark gray and slightly silty. Silt- stone is medium gray and slightly clayey					150	
56.5-58 Coal					50	
58-59.5 Claystone, medium-gray, slightly silty					200	60
59.5-60 Coal					70	
60-78 Claystone, medium-gray, slightly silty					250	80
78-78.6 Coal					300	90
78.6-79.2 Carbonaceous shale, black						
79.2-88 Claystone, medium-gray, slightly silty						
88-90 Sandstone, medium-gray, very fine grained, slightly silty, and calcareous						

LITHOLOGY	Strip Log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
90-142 Claystone and siltstone, interbedded. Claystone is medium to dark gray, slightly silty and shaly. Siltstone is medium to dark gray and slightly clayey					100	
142-149.2 Sandstone, medium-gray, fine-grained, silty, calcareous					350	110
149.2-153 Carbonaceous shale, black, slightly coaly. Minor medium-gray shaly siltstone						
153-157.5 Coal					400	120
157.5-158 Carbonaceous shale, black						
158-158.8 Coal						
158.8-159.5 Carbonaceous shale, black					130	
159.5-160 Coal						
160-160.4 Carbonaceous shale, black						
160.4-162.6 Coal					450	
162.6-171 Carbonaceous shale, black, silty						
171-176.3 Siltstone, medium-gray, slightly sandy						
176.3-177.3 Carbonaceous shale, black and coaly						
177.3-180 Coal, shaly; carbonaceous partings of less than half a foot at 177.9 feet, 178.5 feet, and 179.5 feet						
180-180.7 Carbonaceous shale, black, coaly						
180.7-183.3 Coal; carbonaceous parting of less than half a foot at 182.5 feet						
183.3-189.8 Carbonaceous shale, black, coaly. Minor medium- to dark-gray claystone						
189.8-194 Coal						
194-194.8 Carbonaceous shale						
194.8-197 Coal						
197-198 Carbonaceous shale, black, coaly						
198-198.8 Coal						
198.8-210.4 Claystone, dark-gray, silty						
210.4-211 Coal						

LITHOLOGY	SERIAL LOG	Geophysical Logs.			Depth	
		Gamma	Density	Res.	ft.	m.
211-247.8 Siltstone and sandstone, interbedded. Siltstone is medium gray, slightly clayey, and sandy. Sandstone is medium gray, very fine grained, and very silty						
247.8-251.5 Coal						
251.5-254 Siltstone, medium-gray, slightly clayey						
254-254.6 Coal						
254.6-259 Carbonaceous shale and siltstone. Carbonaceous shale is blackish brown. Siltstone is medium gray and slightly clayey						
259-271 Sandstone and siltstone, interbedded. Sandstone is gray and fine grained. Siltstone is medium gray and slightly clayey						
271-272 Coal						
272-272.4 Carbonaceous shale, black						
272.4-273.5 Coal						
273.5-274 Carbonaceous shale, black						
274-274.8 Coal						
274.8-275.2 Carbonaceous shale, black						
275.2-275.6 Coal						
275.6-276 Carbonaceous shale, black, slightly coaly						
276-276.4 Coal, shaly						
276.4-278 Carbonaceous shale, black, slightly coaly						
278-294 Sandstone, medium-gray, very fine grained to fine-grained, silty; minor calcareous stringers. Minor medium-gray siltstone						
294-307 Sandstone and shale, interbedded						
307-319 Sandstone, gray, fine-grained, silty						
319-336 Claystone, gray, silty						
336-417 Sandstone, medium-gray, very fine grained to medium-grained, silty; minor calcareous stringers. Minor medium- to dark-gray, silty claystone						

DRILL-HOLE LOGS

Hole no. BP-D24 Date logged 7-27-77 Surface elevation (ft) 7,090
 Loc.: State Wyo. Cty. Carbon T. 20N., R. 90W., Sec. 26; 1800 FN L, 1700 FE L
 Drilled depth (ft) 470 Logged depth (ft) 466
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 0.5 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-107	Sandstone, yellow-brown, fine- to medium-grained; calcareous lenses; minor iron staining					0	0
107-137	Carbonaceous shale, dark-gray to black, silty					10	
137-191	Sandstone, light-gray, medium-grained, calcareous					50	
191-193	Carbonaceous shale, dark-gray to black					20	
193-193.6	Coal					100	30
193.6-194.5	Carbonaceous shale						
194.5-195.5	Coal						
195.5-199	Carbonaceous shale, dark-gray to black					40	
199-201	Coal						
201-204	Carbonaceous shale					150	
204-204.7	Coal					50	
204.7-205.4	Carbonaceous shale						
205.4-208.3	Coal						
208.3-269.6	Shale, blue-gray to gray. Minor sandstone					200	60
269.6-273.7	Coal						
273.7-281	Carbonaceous shale, black, coaly					70	
281-337	Sandstone, medium-gray, very fine grained, silty						
337-339	Coal					250	80
339-452	Siltstone, sandstone, and carbonaceous shale, interbedded						
452-455.9	Coal					300	90
455.9-466	Sandstone, medium-gray. Minor medium-gray siltstone						

Hole No.

BP-D24

(continued)



got
strip

Geophysical Logs.

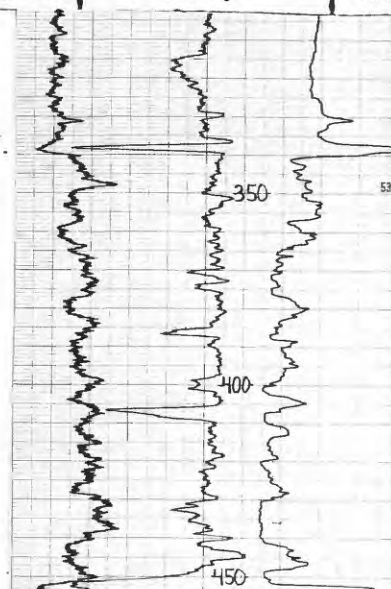
Depth

Gamma

Density

Res.

ft.



GAMMA 466-
25 CPS/IN
TC 2
RATE 20"/MIN
DATE 7-27-77

DENSITY
2.5 CPS/IN
TC .5

RES
100A/15"

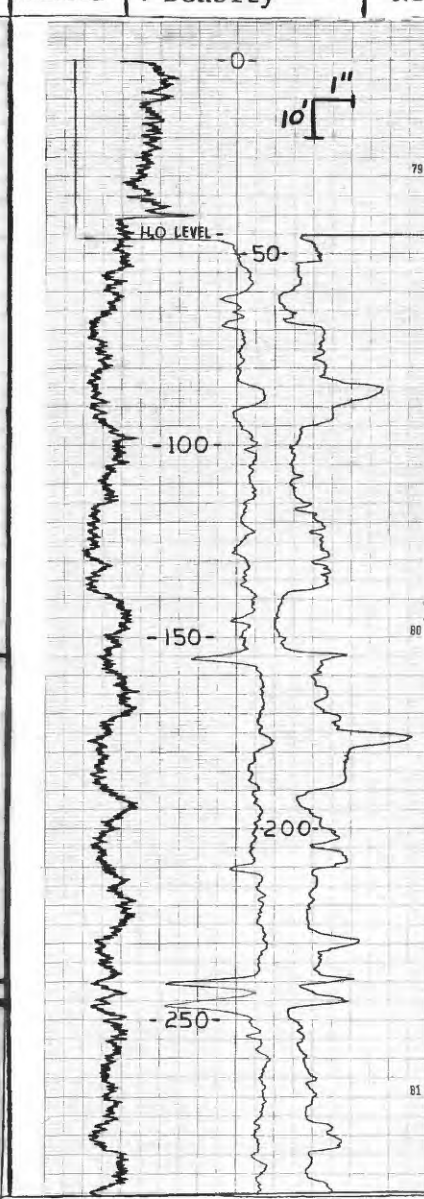
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DRILL-HOLE LOGS

Hole no. RP-D3 Date logged 9-2-77 Surface elevation (ft) 6997
 Loc.: State Wyo. Cty. Carbon T. 21N., R. 88W., Sec. 20; 1,300 FNL, 1400 FW L
 Drilled depth (ft) 460 Logged depth (ft) 459
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 1 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-138	Sandstone and siltstone. Sandstone is medium brown to medium gray, very fine to medium grained, very silty and calcareous. Siltstone is dark brown to medium gray, sandy, and calcareous					0	0
138-154	Siltstone and claystone, interbedded. Siltstone is medium to dark gray and calcareous. Claystone is dark gray, silty, and calcareous					50	10
154-155	Coal					100	20
155-170	Siltstone, light- to dark-gray					150	30
170-190	Sandstone, light- to medium-gray, fine- to medium-grained					200	40
190-239	Sandstone and siltstone, interbedded. Sandstone is gray and fine to medium grained. Siltstone is gray and sandy					250	50
239-240	Coal					300	60
240-244	Shale					350	70
244-246	Coal					400	80
246-364	Siltstone and sandstone, interbedded. Siltstone is gray. Sandstone is gray and fine to medium grained					450	90
364-366	Shale						
366-377	Coal						

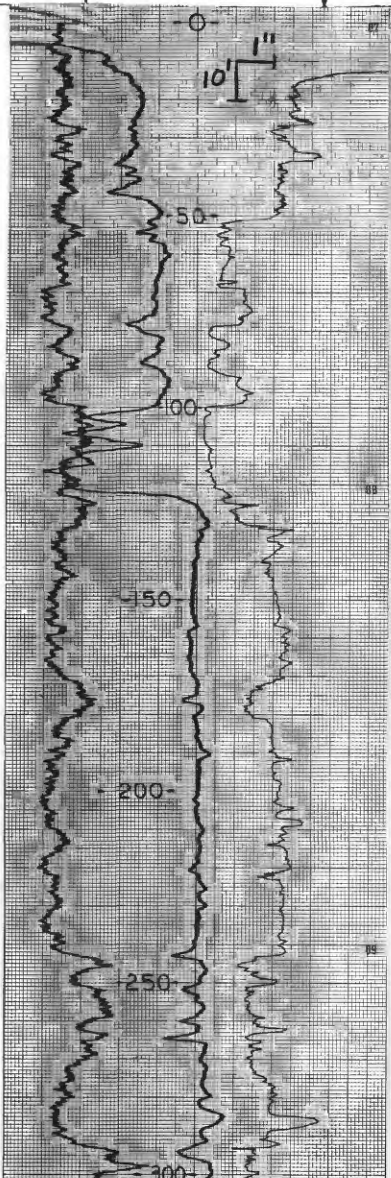
LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
377-382.5	Carbonaceous shale, dark-brown to black, very silty					
382.5-393	Siltstone, light-gray					100
393-397	Coal					
397-402.3	Carbonaceous shale, dark-brown to black				350	
402.3-459	Siltstone and sandstone, interbedded. Siltstone is medium gray. Sandstone is medium gray, calcareous, fine grained, and silty				110	
					120	
					130	
					140	

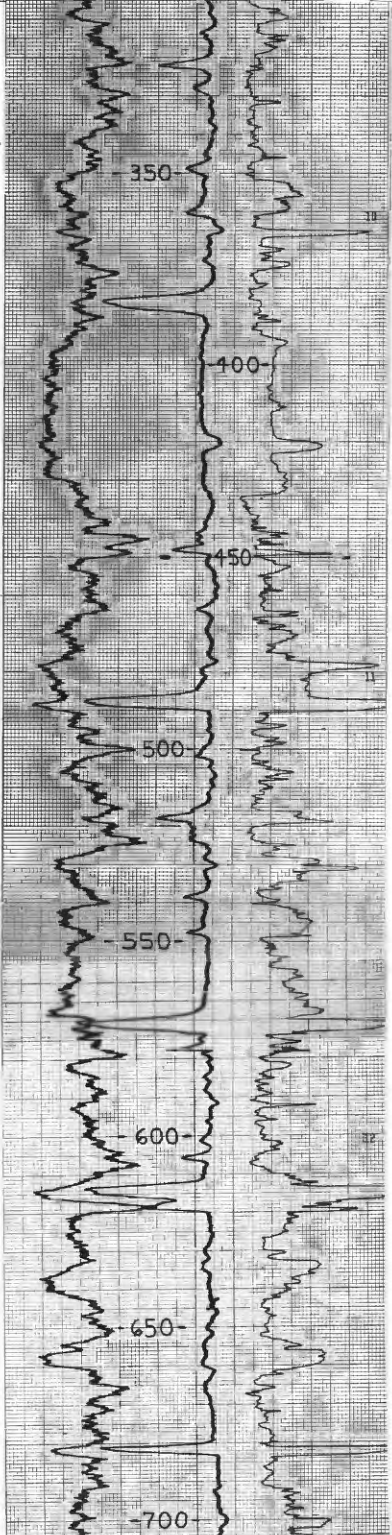
TD-459
 0.5K 10K 15K 50K 25K 0
 GAMMA 25 CPS/IN TC-2 20 FT/MIN
 DENSITY 25K-25K CPS/IN TC-1
 RES 100Ω/5IN
 RP-D3
 9-2-77
 83
 U.S.G.S. - GECK
 RP-D3
 LITTLE SNAKE RIVER - AREA #2
 CARBON WYOMING
 20 21 N 89 W Ground 4997
 DENSITY 459 25K-25K 1 20 459 0
 250 25 2 20 459 0
 VL-1-77 25mCi
 R030A 1 1/2
 No. 1 1/2 1 1/2
 0-1 sec 1 1/2 1 1/2
 100 5
 WATER LEVEL - 46 FT

DRILL-HOLE LOGS

Hole no. RP-D6 Date logged 9-4-77 Surface elevation (ft) 6,720
 Loc.: State Wyo. Cty. Carbon T. 21N., R. 89W., Sec. 14 ; 300 FSL, 500 FWL
 Drilled depth (ft) 1200 Logged depth (ft) 1200
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 2 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
0-51 Sandstone, light-brown to light-gray, very fine grained, well-sorted. Minor light-gray claystone and siltstone					0	0
51-99.5 Sandstone, siltstone, and claystone, interbedded. Sandstone is light to medium gray and very fine grained. Siltstone and claystone are light gray.					10	
99.5-131.5 Claystone, medium-gray, silty. Minor medium-gray siltstone					50	
131.5-171 Sandstone and siltstone, interbedded. Sandstone is fine grained, dark gray, and slightly carbonaceous. Siltstone is dark gray					20	
171-181 Claystone and siltstone, interbedded. Claystone and siltstone are medium gray.					100	30
181-243 Sandstone and siltstone, interbedded. Sandstone is dark gray, very fine grained, and slightly carbonaceous. Siltstone is light brown. Minor medium-gray claystone					150	50
					200	60
					250	80
					300	90

LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
243-393					100	
Claystone, siltstone, and sandstone, interbedded. Claystone is light brown to medium gray with minor dark-gray to black carbonaceous stringers. Siltstone is gray. Sandstone is light to medium gray and fine grained					350	
393-434					110	
Sandstone and siltstone, interbedded. Sandstone is light gray and very fine grained. Siltstone is medium gray, clayey and carbonaceous. Minor medium-gray claystone					400	
434-448.2					130	
Claystone and siltstone, interbedded. Minor medium-gray very fine grained sandstone					450	
448.2-449.3					140	
Coal					150	
449.3-487					500	
Siltstone and claystone, interbedded. Minor sandstone					160	
487-490					170	
Coal					550	
490-570.3					180	
Siltstone, sandstone, and claystone, interbedded					600	
570.3-573					190	
Coal					650	
573-613.5					200	
Siltstone and claystone, interbedded. Minor carbonaceous shale					700	
613.5-617.6						
Coal						
617.6-618						
Carbonaceous shale						
618-618.5						
Coal						
618.5-619						
Carbonaceous shale						
619-620						
Coal						
620-681.2						
Siltstone, sandstone, and claystone, interbedded						
681.2-683						
Coal						
683-709.2						
Siltstone and claystone, interbedded						
709.2-711.8						
Coal						
711.8-743						
Siltstone, sandstone, and claystone, interbedded. Minor coal						
743-745						
Coal						
745-789						
Siltstone, sandstone, and claystone, interbedded						

LITHOLOGY		Strip log	Geophysical Logs.			Depth	
			Gamma	Density	Res.	ft.	m.
789-848	Siltstone, gray and very sandy						
848-867	Siltstone and claystone, interbedded					220	
867-872.2	Coal						
872.2-873.3	Carbonaceous shale					750	230
873.3-875	Coal						
875-916	Claystone and siltstone, interbedded						
916-948	Sandstone, gray, silty					240	
948-970	Siltstone, sandstone, and claystone, interbedded					800	
970-971	Coal						
971-1030.5	Sandstone					250	
1030.5-1033.4	Carbonaceous shale						
1033.4-1037	Coal with 1.5 feet of shale partings						
1037-1048	Claystone, gray					850	260
1048-1050.5	Coal with 0.5-foot parting						
1050.5-1087.5	Claystone and siltstone, interbedded						
1087.5-1088.5	Coal					270	
1088.5-1092	Carbonaceous shale						
1092-1200	Sandstone, gray, silty					900	
						280	
						950	290
						300	
						1000	
						310	
						1050	320
						330	
						1100	

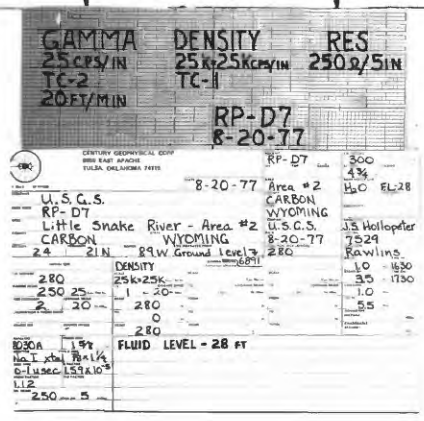
LITHOLOGY	SERIAL 801	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m
					1150	350
		<p>12.5 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000 4100 4200 4300 4400 4500 4600 4700 4800 4900 5000 5100 5200 5300 5400 5500 5600 5700 5800 5900 6000 6100 6200 6300 6400 6500 6600 6700 6800 6900 7000 7100 7200 7300 7400 7500 7600 7700 7800 7900 8000 8100 8200 8300 8400 8500 8600 8700 8800 8900 9000 9100 9200 9300 9400 9500 9600 9700 9800 9900 10000</p>			1200	370
		<p>GAMMA DENSITY RES 25 CPS/IN 25K-25KCPH/M 100g/5M TC-2 TC-2 20 FT/MIN RP-D6 9-4-77</p>				
		<p>U.S.G.S. - GECK 9-4-77 RP-D6 LITTLE SNAKE RIVER-AREA 2 CARBON WYOMING 14 21N 21 W Ground LEVEL 1200</p>				
		<p>DENSITY 1200 25K-25K 250 25 2-20 2 20 1200 G 1200 VL-1-77 25mG 100 1 1 1 100 1 1 1 100 1 1 1 100 1 1 1</p>				
		<p>WATER LEVEL - 4 FT</p>				

DRILL-HOLE LOGS

Hole no. RP-D7 Date logged 8-20-77 Surface elevation (ft) 6891
 Loc.: State Wyo. Cty. Carbon T. 21N., R. 89W., Sec. 24; 400 FSL, 200 FWL
 Drilled depth (ft) 300 Logged depth (ft) 280
 Drilling fluid: ☒ Air ☐ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 50 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 1 Scale 2.5k cps/in Logging speed 20 fpm

	LITHOLOGY	Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-15	Siltstone and sandstone, interbedded. Siltstone is brownish-gray to reddish-brown and slightly sandy. Sandstone is light brown, very fine grained, and very silty					0	0
15-41	Sandstone, light- to medium-brownish-gray, very fine grained to fine-grained, and very silty					10	
41-41.8	Carbonaceous shale, black, and silty					20	
41.8-43.1	Coal, shaly					30	
43.1-44	Carbonaceous shale, black, and silty					40	
44-56.3	Siltstone, shaly, and slightly sandy					50	
56.3-57.4	Carbonaceous shale, dark-gray to black, and slightly coaly					60	
57.4-59.2	Coal					70	
59.2-78.1	Siltstone, medium-gray; shaly in the upper 5 feet					80	
78.1-79.2	Coal					90	
79.2-98.8	Siltstone, medium-gray, shaly; slightly sandy in the lower 5 feet					100	
98.8-99.7	Coal					110	
99.7-100.2	Carbonaceous shale, black					120	
100.2-100.4	Coal					130	
100.4-100.8	Carbonaceous shale, black					140	
100.8-109.8	Coal					150	
109.8-126.8	Siltstone, medium- to dark-gray, slightly clayey. Minor medium-gray, fine-grained, silty sandstone					160	
						170	
						180	
						190	
						200	
						210	
						220	
						230	
						240	
						250	
						260	
						270	
						280	
						290	
						300	

LITHOLOGY	Strip 108	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
126.8-129.9	Coal; carbonaceous parting of less than half a foot at 129.4 feet					
129.9-132.5	Shale, medium- to dark-gray, silty					
132.5-152	Siltstone, gray, sandy					
152-199	Sandstone, light- to medium-gray, very fine grained to medium-grained, very silty					
199-207	Siltstone, medium- to dark-gray, clayey					
207-208.5	Shale					
208.5-209	Coal					
209-210.6	Shale					
210.6-218	Coal					
218-228.6	Siltstone, medium- to dark-gray. Minor medium-gray, fine-grained, and silty sandstone					
228.6-229.8	Coal					
229.8-232	Siltstone, medium- to dark-gray					
232-233.8	Coal					
233.8-245	Siltstone, medium- to dark-gray. Minor medium-gray, fine-grained, silty sandstone and carbonaceous shale					
245-248.5	Coal					
248.5-252	Claystone, medium- to dark-gray					
252-259	Sandstone, medium-gray, fine-grained, very silty					
259-263	Claystone, medium-gray, slightly shaly					
263-263.6	Coal					
263.6-265.4	Claystone, medium-gray, slightly shaly					
265.4-280	Sandstone and siltstone, interbedded. Sandstone is medium gray, very fine to fine grained, and very silty. Siltstone is medium gray and sandy					

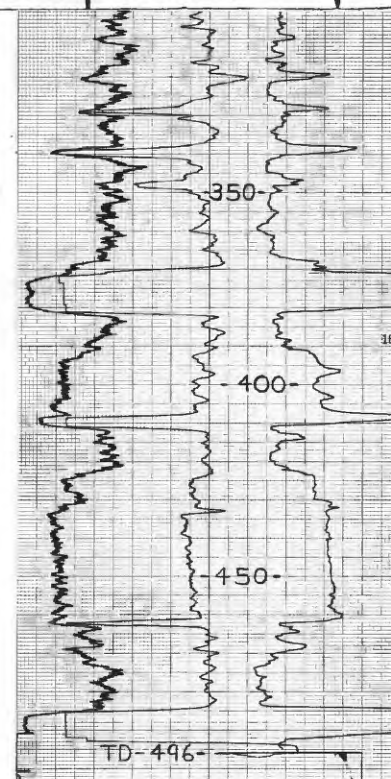
DRILL-HOLE LOGS

Hole no. RP-D8 Date logged 8-27-77 Surface elevation (ft) 6840
 Loc.: State Wyo. Cty. Carbon T. 21N., R. 89W., Sec. 26; 2300 FSL, 2500 FWL
 Drilled depth (ft) 500 Logged depth (ft) 496
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 1 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY		Strip log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-137	Sandstone, light-brown to medium-gray, very fine grained to fine-grained, well-sorted. Minor medium-gray claystone					0	0
137-183.6	Sandstone and claystone, interbedded. Sandstone is medium gray, very fine grained, and well sorted. Claystone is medium gray to black and contains carbonaceous and silty lenses. Minor coal from 162 to 163 feet					10	3
183.6-184.6	Coal					50	15
184.6-185.2	Carbonaceous shale					20	6
185.2-186.1	Coal					100	30
186.1-186.7	Carbonaceous shale					150	45
186.7-188.6	Coal					50	15
188.6-213	Claystone, medium-gray to black, carbonaceous, silty					200	60
213-223	Sandstone, medium-gray, very fine grained. Minor dark-gray carbonaceous shale					70	21
223-261	Siltstone and claystone, interbedded. Siltstone is medium to dark gray. Claystone is medium gray. Minor sandstone					250	76
261-261.8	Carbonaceous shale					80	24
261.8-268	Coal					90	27
268-271	Carbonaceous shale					300	91
271-284	Coal						
284-285	Carbonaceous shale						
285-295.5	Coal						
295.5-296.8	Carbonaceous shale						

LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m
296.8-297.5 Coal						
297.5-327.5 Claystone and siltstone, interbedded. Claystone is medium gray and slightly carbonaceous. Siltstone is medium gray. Minor sandstone about 2 feet thick at 319 feet					100	
327.5-328.7 Coal					350	
328.7-329.5 Carbonaceous shale					110	
329.5-330 Coal					120	
330-337.6 Claystone					400	
337.6-340 Coal						
340-346.5 Claystone					130	
346.5-348 Coal; carbonaceous parting of half a foot at 347.2 feet					450	
384-370.8 Claystone					140	
370.8-380.5 Coal						
380.5-391 Claystone, silty					150	
391-407.3 Sandstone						
407.3-410 Coal						
410-422 Claystone, silty						
422-462 Sandstone						
462-484 Siltstone and claystone, interbedded						
484-491.5 Coal						
491.5-496 Siltstone and claystone, interbedded						



TD-496

GAMMA 25 CPS/IN
TC-2
20 FT/MIN

DENSITY 25K+25Kcps/IN
TC-1
RP-D8
8-27-77

RES 100 Ohm-in

U.S.G.S. GECK
RP-D8
LITTLE SNAKE RIVER #2
CARBON
26 1/2 IN

WYOMING
8-27-77
7529
Hollister
Sawling

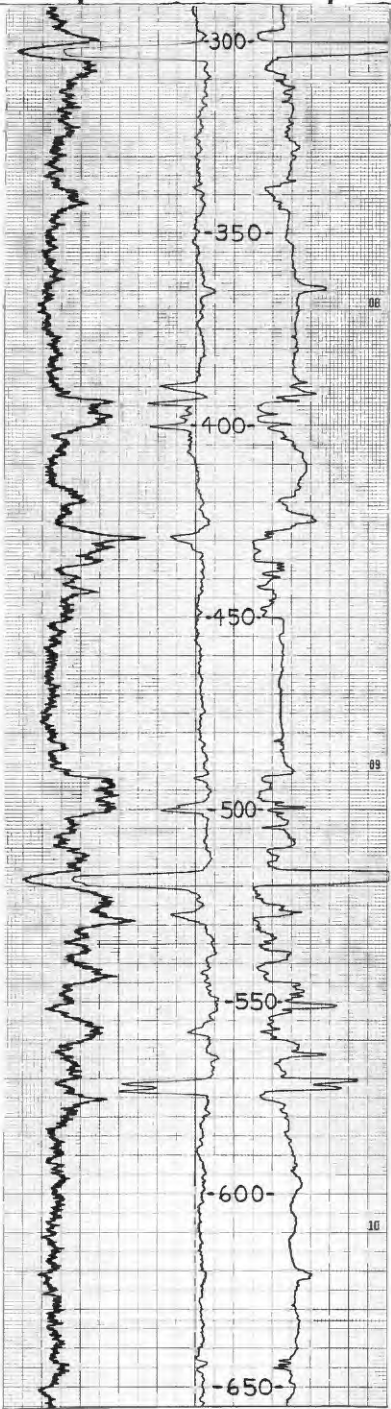
WATER LEVEL 24 FT.

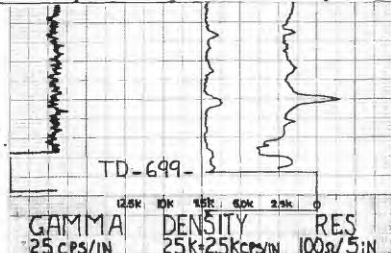
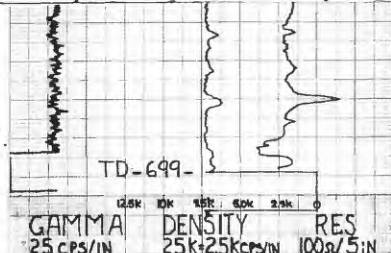
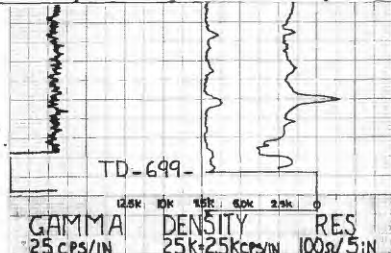
DRILL-HOLE LOGS

Hole no. RP-D9 Date logged 8-29-77 Surface elevation (ft) 6751
 Loc.: State Wyo. Cty. Carbon T. 21N., R. 89W., Sec. 34; 100 FNL, 900 FWL
 Drilled depth (ft) 700 Logged depth (ft) 699
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☒ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 1 Scale 2.5k cps/in Logging speed 20 fpm

	LITHOLOGY	Strip Log	Geophysical Logs			Depth	
			Gamma	Density	Res.	ft.	m.
0-68.7	Sandstone, light- to medium-brown, very fine grained to fine-grained, silty; minor calcareous stringers					0	0
68.7-73	Coal					10	
73-75	Carbonaceous shale, dark-brown to black, coaly, slightly silty					50	
75-87	Sandstone and siltstone. Sandstone is light gray, very fine grained, very silty, and calcareous. Siltstone is gray and sandy					20	
87-98.6	Carbonaceous shale, dark-brown, slightly sandy and silty					100	30
98.6-107	Sandstone, light-gray, very fine grained, very silty, slightly calcareous					40	
107-123	Siltstone and carbonaceous shale, interbedded. Siltstone is light gray and sandy. Carbonaceous shale is medium brown, silty, and sandy. Minor light-gray, very fine grained, very silty, and slightly calcareous sandstone					150	50
123-127.2	Coal; carbonaceous parting of less than half a foot at 126.6 feet					200	60
127.2-137.6	Claystone and siltstone. Siltstone is medium gray and slightly sandy					70	
137.6-138.1	Carbonaceous shale, black and slightly coaly					250	80
						90	
						300	90

	LITHOLOGY	Strip log	Geophysical Logs.			Depth	
			Gamma	Density	Res.	ft.	m.
138.1-140.4	Coal, shaly					300	
140.4-255	Siltstone, light- to dark-gray; minor calcareous stringers. Minor light-gray, very fine grained, calcareous, and very silty sandstone						100
255-297.3	Sandstone, light-gray, very fine grained, very silty; minor calcareous stringers. Minor light-gray, slightly sandy, and calcareous siltstone					350	110
297.3-300	Claystone						120
300-304	Coal					400	
304-308.2	Claystone						130
308.2-324	Siltstone, light- to medium-gray, sandy						140
324-337	Sandstone, medium-gray, very fine grained, very silty					450	
337-344	Siltstone, medium-gray, clayey						150
344-392.4	Sandstone, medium-gray, very fine grained, very silty					500	
392.4-401.4	Carbonaceous shale and coal, interbedded. Carbonaceous shale is dark gray and silty. Coal is thinly bedded						160
401.4-427	Sandstone, medium- to dark-gray, very fine grained, very silty, calcareous. Minor medium- to dark-gray, slightly sandy, calcareous siltstone					550	
427-450	Siltstone and claystone, interbedded						180
450-491	Sandstone, medium-gray, very fine grained, very silty. Minor dark-gray siltstone					600	
491-498	Siltstone and claystone, interbedded						190
498-498.4	Coal					650	
498.4-499	Carbonaceous shale						200
499-500	Coal						

LITHOLOGY	801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
500-515.8	Sandstone and siltstone, interbedded. Sandstone is medium gray, very fine grained, calcareous, and very silty. Siltstone is medium to dark gray and calcareous. Minor claystone				210	
515.8-519.6	Coal, shaly, and silty				700	
519.6-570	Siltstone and sandstone, interbedded. Siltstone is dark gray. Sandstone is dark gray, fine grained, and silty					
570-571.2	Coal					
571.2-572	Carbonaceous shale					
572-573	Coal					
573-576	Claystone, dark-gray					
576-700	Sandstone, light-gray, very fine grained, very silty; calcareous in the lower 110 feet. Minor dark-gray and calcareous siltstone					

DRILL-HOLE LOGS

Hole no. RP-D10 Date logged 8-31-77 Surface elevation (ft) 6820
 Loc.: State Wyo. Cty. Carbon T. 21N., R. 89W., Sec. 34; 1350 FNL, 2300 FWL
 Drilled depth (ft) 700 Logged depth (ft) 700
 Drilling fluid: ☒ Air ☒ Water ☐ Foam ☐ Mud
Geophysical logs:

Resistivity: Scale 20 ohms/in Logging speed 20 fpm
 Gamma: T.C. 2 Scale 25 cps/in Logging speed 20 fpm
 Gamma dens.: T.C. 1 Scale 2.5k cps/in Logging speed 20 fpm

LITHOLOGY	Strip Log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
0-66.2 Sandstone, light-brown to medium-gray, fine-grained, calcareous, very silty. Minor medium-gray shaly siltstone					0	0
66.2-67.1 Coal, very shaly					10	
67.1-67.7 Carbonaceous shale					50	
67.7-68.8 Coal					20	
68.8-73.2 Carbonaceous shale, black, slightly coaly					100	30
73.2-73.9 Coal					40	
73.9-75.2 Carbonaceous shale, black, slightly coaly					150	50
75.2-96.5 Sandstone, medium- to dark-gray, fine-grained, silty. Minor siltstone					200	60
96.5-104.3 Shale and coal, interbedded					70	
104.3-113 Sandstone, medium-gray, fine- to medium-grained, very silty, calcareous. Minor medium-gray siltstone					250	80
113-128.6 Siltstone and claystone, interbedded. Siltstone is medium gray. Claystone is medium gray and very silty					300	90
128.6-139 Sandstone, medium-gray, fine- to medium-grained						
139-162 Siltstone, claystone, and coal, interbedded. Siltstone is medium to dark gray and clayey. Claystone is medium gray and very silty. Coal is less than 1 foot thick with thin carbonaceous partings						

LITHOLOGY	Strip log	Geophysical Logs			Depth	
		Gamma	Density	Res.	ft.	m.
162-180.6 Sandstone, medium-gray, fine-grained, very silty, calcareous. Minor medium-gray slightly clayey siltstone						100
180.6-183.3 Coal					350	
183.3-184 Carbonaceous shale, black						110
184-185.5 Coal						
185.5-189.8 Siltstone, dark-gray, clayey						
189.8-190.2 Coal						
190.2-194 Carbonaceous shale						120
194-213 Siltstone, medium- to dark-gray, sandy. Minor thin coal beds					400	
213-214.2 Coal						130
214.2-223.3 Siltstone, medium- to dark-gray						
223.3-224.3 Coal					450	
224.3-225.4 Carbonaceous shale, black, slightly coaly						140
225.4-226.4 Coal						
226.4-235 Siltstone, medium- to dark-gray						150
235-286 Sandstone, gray, fine-grained					500	
286-295 Siltstone, coal, and carbonaceous shale, interbedded						
295-456 Sandstone and siltstone, interbedded. Sandstone is medium gray, very silty, and very fine grained. Siltstone is medium gray and calcareous					550	160
456-472 Siltstone, medium-gray, clayey, slightly calcareous						170
472-505 Sandstone and siltstone, interbedded						180
505-516.2 Siltstone, medium-gray, slightly calcareous					600	
516.2-517.8 Coal						190
517.8-521.2 Carbonaceous shale and medium-gray siltstone. Minor coal						
521.2-523 Coal					650	200
523-530 Siltstone, medium-gray, slightly calcareous						
530-533 Sandstone, medium-gray, shaly, very fine grained, very silty						