UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

GEOPHYSICAL AND LITHOLOGIC LOGS OF FOUR HOLES DRILLED IN THE BOOK CLIFFS COAL FIELD, SEGO CANYON QUADRANGLE, GRAND COUNTY, UTAH

By

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By Howard F. Albee

INTRODUCTION

Four holes, totaling 2,884 feet, were rotary drilled, and two of the holes were partially cored, in the Book Cliffs coal field, Utah, for the U.S. Geological Survey in October 1978. The drilling was done by Himes Drilling Company, Grand Junction, Colorado, under contract no. 14-08-0001-17342, awarded by the USGS. The geophysical logging was done by Strata Surveys, Steamboat Springs, Colorado. Permission to drill was granted by officials of the U.S. Bureau of Land Management, Moab, Utah.

The purpose of the drilling was to obtain information on the thickness, quality, and extent of coal beds and the lithology of the enclosing rocks in the Upper Cretaceous Blackhawk Formation. The overall goal of the project is to evaluate and classify the Federal lands in the public domain.

Drilling was done in the Sego Canyon quadrangle, Grand County, Utah, using truck-mounted rotary drilling and coring rigs. Drilling media were air and foam for the rotary drilling and mud for the coring. Coring was done only in the coal-bearing part of the Blackhawk Formation.

All drill holes were logged by geophysical methods which included resistivity, natural gamma, density, and caliper. The logs were run at a scale of 1 inch to 10 feet; but for this report they were reduced to 1 inch to 50 feet.

All measurements are in feet; to convert to meters, multiply by 0.3048.

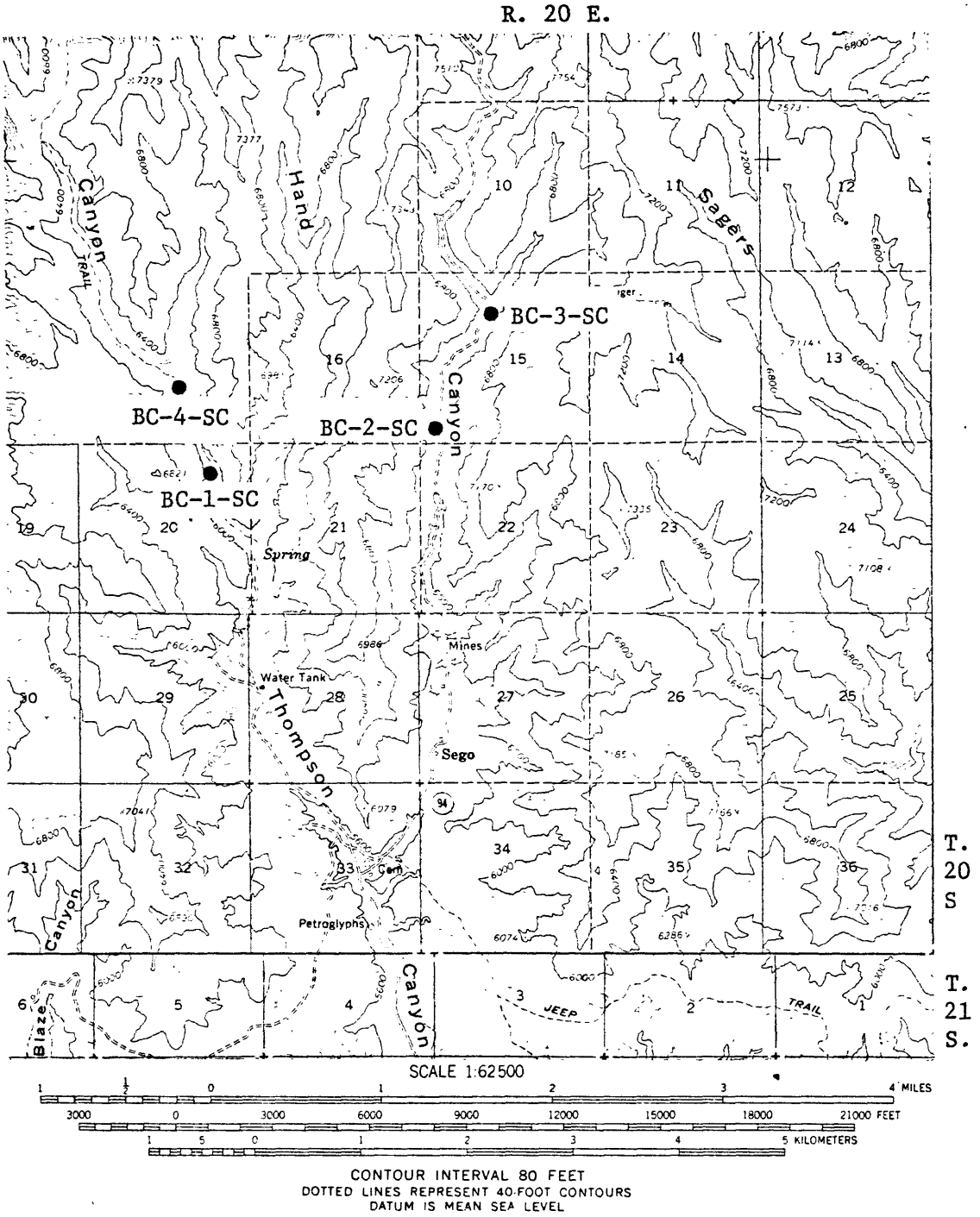


Figure 1.--Drill-hole locations in the Book Cliffs coal field, Sego Canyon quadrangle, Grand County, Utah.

Geologic age	Group and formation		Member	Character	Thickness (feet)
Tertiary (?).	Tuscher formation.			Light-colored sandstones with minor interbedded shales. No fossils.	130(?) to 600.
Unconformity (?)					
Upper Cretaceous.	Mesaverde group[1]	Price River formation	Farrer non-coal-bearing member.	Somber-colored sandstones with greenish-tinged gray shales. Fresh-water fossils. Recognized in the upper part of the second escarpment of the Book Cliffs east of the Green River.	410 to 1,095 (average 690).
			Neslen coal-bearing member.	Series of relatively light-colored alternating sandstones and shales in about equal proportions. On the whole a rather heterogeneous unit of brackish- to fresh-water origin, but sandstones were recognized at three definite horizons, and these are here named "Bluecastle sandstone bed", "Thompson Canyon sandstone bed", and "Sulphur Canyon sandstone bed." Carries coal in the Palisade, Ballard, Chesterfield, and Carbonera (?) coal zones, as well as in minor amounts in other unnamed and lenticular beds. Not recognized northwest of the Beckwith Plateau as a distinct unit.	250 to 410 (average 350).
			Sego sandstone member.	Dominantly sandstone; buff-weathering in the main, massive and cliff-forming to thin-bedded and shaly. Makes one to four cliffs; this variation is due to the presence of local irregular shaly zones. Carries a marine fauna of Lewis age. Not recognized northwest of the Beckwith Plateau.	110 to 210.

Figure 2.--Description of rocks in the Thompson area of the Book Cliffs coal field, Grand County, Utah. (From Fisher, 1936, p. 9.)

REFERENCES

Fisher, J. D., 1936, The Book Cliffs coal field in Emery and Grand Counties, Utah: U.S. Geological Survey Bulletin 852, 104 p.

Fisher, J. D., Erdmann, C. E., and Reeside, J. B., Jr., 1960, Cretaceous and Tertiary Formations of the Book Cliffs, Carbon, Emery, and Grand Counties, Utah, and Garfield and Mesa Counties, Colorado: U.S. Geological Survey Professional Paper 332, 80 p.

Table 1.--Summary of information for four holes drilled in the Book Cliffs coal field, Sego Canyon quadrangle, Grand County, Utah

[FEL, from east line; FWL, from west line; FNL, from north line; FSL, from south line]

Drill-hole No.	Location	Rotary drilled depth (ft)	Cored interval (ft)	Depth logged (ft)	Total depth (ft)
BC-1-SC	T. 20 S., R. 20 E., sec. 20 1,250 FEL, 700 FNL	575	---	572	575
BC-2-SC	T. 20 S., R. 20 E., sec. 15 500 FWL, 600 FSL	665	---	657	665
BC-3-SC	T. 20 S., R. 20 E., sec. 15 1,300 FNL, 2,200 FWL	702	702-1,002	1,002	1,002
BC-4-SC	T. 20 S., R. 20 E., sec. 17 1,850 FSL, 2,200 FEL	440.3	440.3-642	642	642

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, GRAND COUNTY, UTAH

Hole No. BC-1-SC Quadrangle Sego Canyon Elevation 6,000 ft

Location: T. 20 S., R. 20 E., sec. 20, 1,250 FEL 700 FNL

Rotary-drilled depth 575 ft Cored interval -- Logged depth 572 ft Total depth 575 ft

Drilling medium Foam and water

Geophysical logs:

Caliper (Cal) - Logging speed: 40 ft/min Others: 20 ft/min

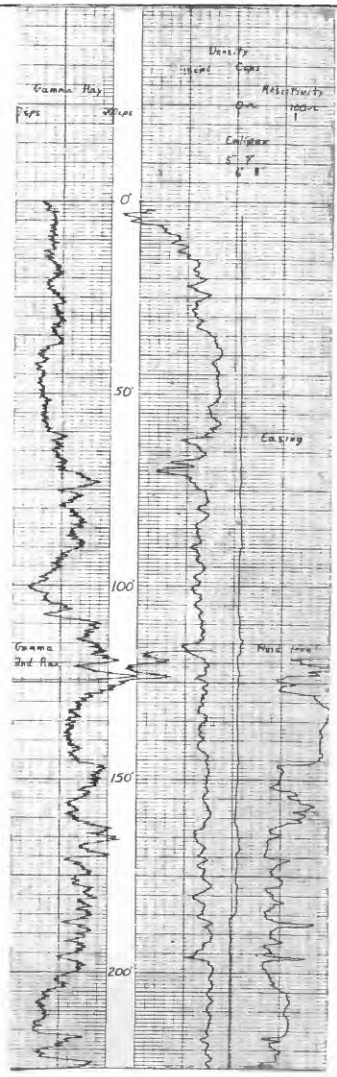
Resistivity (Res): Scale: 100 Ω/6 log div.

Gamma (Gam): T.C. 1 sec. Scale: 20 cps/log div.

Density (Den): T.C. 1 sec. Scale: 200 cps/log div.

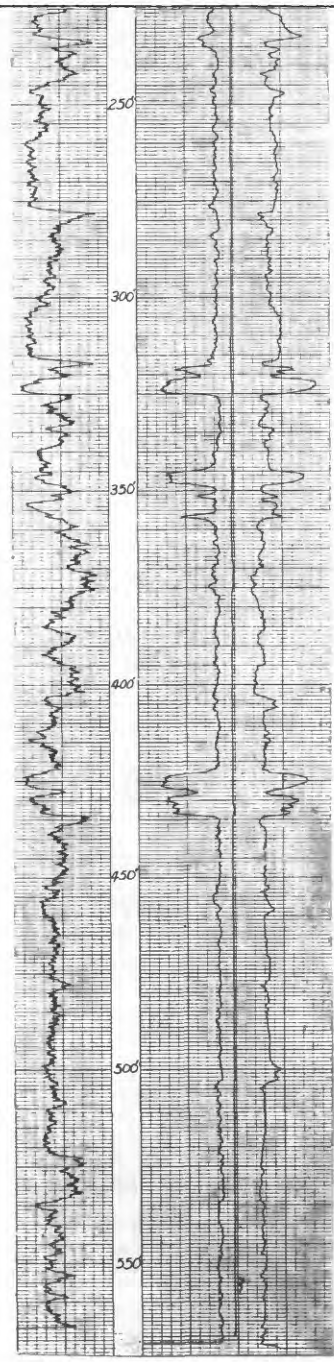
Remarks:

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS Gam Den Cal Res
0- 35	Alluvium		
35- 50	Sandstone, brown, medium-grained		
50- 70	Sandstone, gray, medium-grained		
70- 80	Sandstone, gray, medium-grained; some carbonaceous streaks and shale partings		
80- 98	Sandstone, gray, fine-grained		
98-100	Sandstone, brown, fine-grained		
100-120	Sandstone, gray, medium-grained; carbonaceous streaks		
120-145	Sandstone, gray, medium- to fine-grained, clean		
145-165	Sandstone, gray, fine-grained, hard		
165-180	Sandstone, fine-grained; shale, gray		
180-185	Sandstone, fine- to medium-grained		
185-190	Sandstone, fine-grained		
190-200	Sandstone, fine-grained; shale and carbonaceous shale		
200-215	Sandstone, medium-grained, clean		
215-220	Sandstone, medium-grained; carbonaceous mudstone and some coaly material		
220-225	Mudstone; carbonaceous shale and some coal		



Drill-hole no. BC-1-SC (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS
225-230	Siltstone, gray; carbonaceous shale and coal streaks		Gam Den Cal Res
230-235	Siltstone, gray; medium-grained sandstone; carbonaceous shale		
235-245	Sandstone, fine-grained; gray siltstone; some carbonaceous streaks		
245-250	Sandstone, light-gray, medium-grained		
250-270	Sandstone, light-gray, medium-grained; dark-grayish-brown, fine-grained sandstone		
270-285	Sandstone, medium-grained		
285-305	Sandstone, dark-gray, medium-grained, platy		
305-315	Sandstone, light-gray, medium-grained; minor carbonaceous material		
315-320	Shale, carbonaceous; some coal		
320-325	Coal. Chesterfield bed		
325-335	Sandstone, dark-grayish-brown, fine-grained		
335-340	Sandstone, gray to dark-gray, very fine grained; siltstone		
340-343	Sandstone, medium-grained		
343-347	Coal; carbonaceous shale. Ballard bed		
347-350	Sandstone, brownish-gray, fine-grained		
350-355	Sandstone, brownish-gray, fine-grained		
355-360	Sandstone, white, medium-grained; coal and carbonaceous shale		
360-370	Sandstone, brown and gray, fine- to very fine-grained		
370-394	Sandstone, brownish-gray, very fine grained; shale; some coal		
394-397	Sandstone, white, medium-grained, soft		



Drill-hole no. BC-1-SC (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS			
			Gam	Den	Cal	Res
397-413	Sandstone, brownish-gray, fine- to very fine-grained; minor carbonaceous material					
413-435	Sandstone, white, medium-grained; gray, fine-grained, thinly bedded sandstone					
435-440	Coal; carbonaceous shale. Palisade bed					
440-445	Sandstone, brown, fine-grained, thinly bedded					
445-455	Sandstone, medium-grained, thinly bedded; some brown carbonaceous stringers					
455-465	Sandstone, brown, fine-grained; white, medium-grained sandstone					
465-530	Sandstone, white, medium-grained, clean					
530-565	Sandstone, gray and brown, fine- to very fine-grained, thinly bedded					
565-575	Sandstone, white, medium-grained; some carbonaceous siltstone to carbonaceous mudstone					
	Total depth: 575 ft					

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, GRAND COUNTY, UTAH

Hole No. BC-2-SC Quadrangle Sego Canyon Elevation 6,080 ft

Location: T. 20 S., R. 20 E., sec. 15, 550 FWL 600 FSL

Rotary-drilled depth 665 ft Cored interval -- Logged depth 657 ft Total depth 665 ft

Drilling medium Foam and Water

Geophysical logs:

Caliper (Cal) - Logging speed: 40 ft/min Others: 20 ft/min

Resistivity (Res): Scale: 10 Ω/log div.

Gamma (Gam): T.C. 2 sec. Scale: 33 cps/log div.

Density (Den): T.C. 2 sec. Scale: 333 cps/log div.

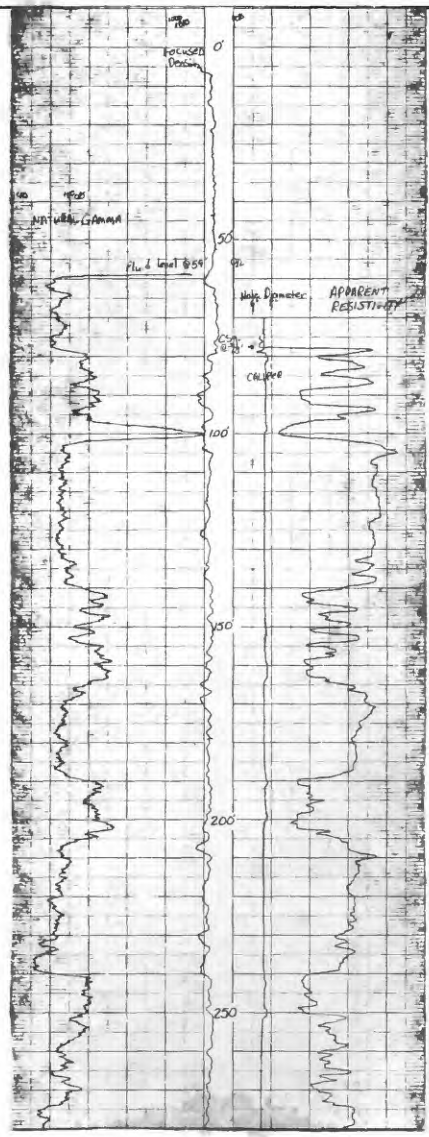
Remarks:

LITHOLOGY	
0- 78	Alluvium
78- 80	Sandstone, fine-grained
80- 85	Sandstone, medium-grained; carbonaceous siltstone and mudstone
85-130	Sandstone, medium-grained, salt-and-pepper appearance
130-145	Sandstone, gray, fine-grained
145-150	Siltstone, black, carbonaceous
150-175	Sandstone, gray, fine-grained; white, medium-grained sandstone
175-190	Sandstone, medium-grained, salt-and-pepper appearance
190-205	Siltstone, dark-gray
205-245	Sandstone, medium-grained; fine-grained sandstone
245-260	Siltstone, dark-gray
260-290	Sandstone, medium- to medium-fine-grained; some fine-grained sandstone
290-315	Sandstone, medium-grained; interbedded, gray, fine-grained sandstone
315-340	Sandstone, light-gray to white, medium-grained
340-350	Siltstone, gray

STRIP LOG

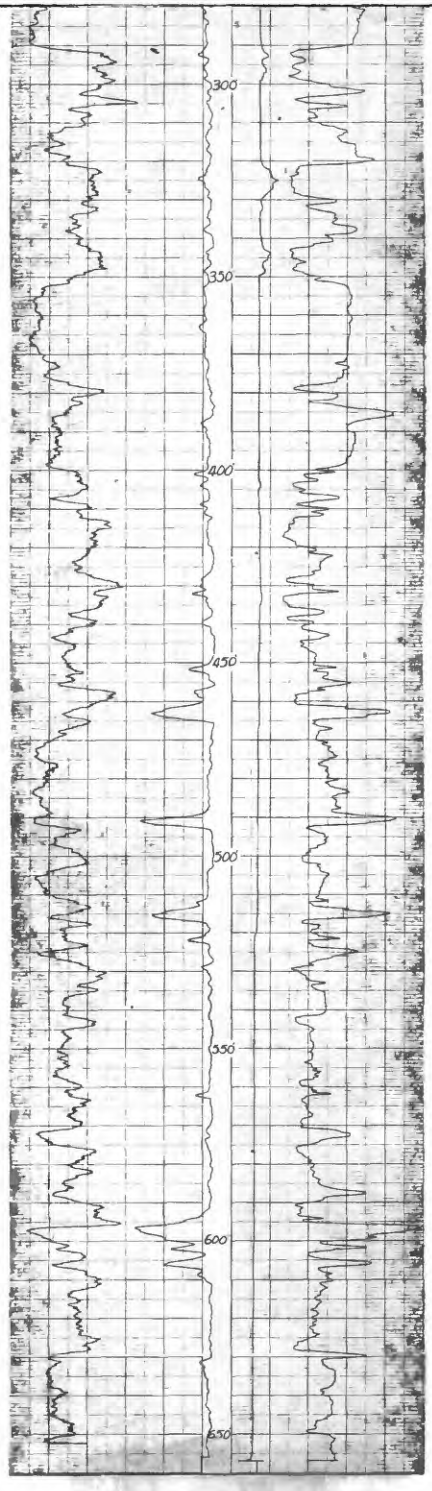
GEOPHYSICAL LOGS

Gam Den Cal Res



Drill-hole no. BC-2-SC (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS
350–355	Sandstone, white, medium-grained, with carbonaceous stringers		Gam Den Cal Res
355–370	Sandstone, medium-grained		
370–385	Sandstone, gray, fine-grained		
385–395	Sandstone, light-gray, medium-grained		
395–400	Sandstone, medium- to medium-coarse-grained		
400–420	Mudstone, carbonaceous; carbonaceous shale; coal stringers		
420–425	Mudstone, carbonaceous; carbonaceous shale; some medium-grained sandstone		
425–435	Mudstone, carbonaceous; coal stringers		
435–440	Mudstone, carbonaceous; medium-grained sandstone		
440–445	Siltstone, dark-gray; light-gray, medium-grained sandstone		
445–450	Siltstone, gray		
450–470	Mudstone, carbonaceous; interbedded coal at 455 ft		
470–485	Sandstone, medium-grained		
485–490	Sandstone, white, clean, with carbonaceous stringers		
490–495	Coal. Chesterfield bed		
495–505	Mudstone, carbonaceous; carbonaceous shale; medium-grained sandstone		
505–510	Sandstone, gray, medium-grained		
510–515	Coal. Ballard bed		
515–525	Shale, carbonaceous; carbonaceous mudstone; coal split		
525–540	Shale, carbonaceous; carbonaceous mudstone; thinly bedded, fine-grained sandstone		
540–545	Sandstone, medium-grained		
545–555	Sandstone, gray, medium-grained		



Drill-hole no. BC-2-SC (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS			
			Gam	Den	Cal	Res
555-560	Sandstone, light-gray, medium-grained					
560-580	Sandstone, fine-grained, carbonaceous; carbonaceous mudstone					
580-600	Sandstone, medium-grained; interbedded, fine-grained, carbonaceous sandstone					
600-610	Coal; coal and carbonaceous shale in lower 5 ft. Palisade bed					
610-615	Shale, carbonaceous; carbonaceous mudstone					
615-630	Sandstone, medium-grained; fine-grained sandstone					
630-665	Sandstone, white, medium-grained					
	Total depth: 665 ft					

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, GRAND COUNTY, UTAH

Hole No. BC-3-SC Quadrangle Sego Canyon Elevation 6,300 ft

Location: T. 20 S., R. 20 E., sec. 15, 2,200 FWL 1,300 FNL

Rotary-drilled depth 702 ft Cored interval 702-1,002' Logged depth 1,002' Total depth 1,002'

Drilling medium Air, foam, and mud

Geophysical logs:

Caliper (Cal) - Logging speed: - ft/min Others: 20 ft/min

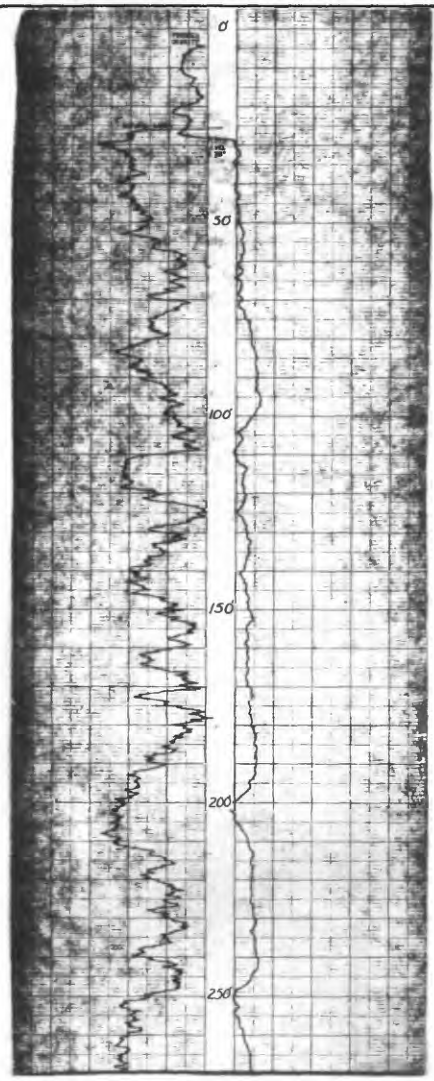
Resistivity (Res): Scale: not shown on log

Gamma (Gam): T.C. 2 sec. Scale: 25 cps/log div.

Density (Den): T.C. 2 sec. Scale: 250 cps/log div.

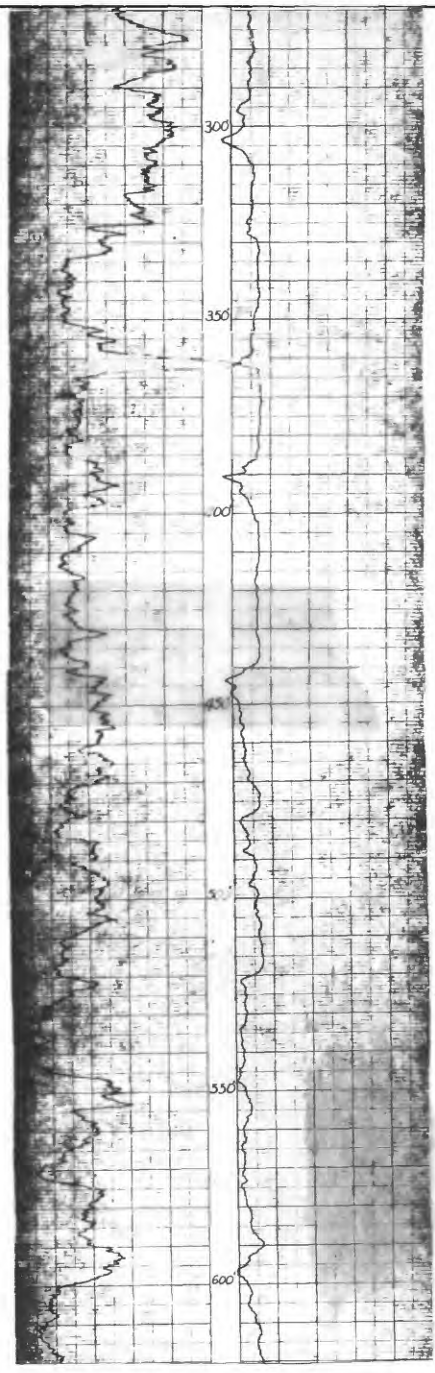
Remarks: Caliper log not run

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS
			Gam Den Cal Res
0- 60	Alluvium - Surface casing		
60- 65	Siltstone, light-greenish-gray		
65- 75	Shale, dark-gray		
75-100	Siltstone, light-greenish-gray		
100-110	Sandstone, medium-gray, fine-grained; abundant black grains		
110-115	Shale, dark-gray		
115-120	Sandstone as above (110-115)		
120-140	Shale, dark-greenish-gray		
140-210	Shale, medium-gray; dark-gray at 160 and 185 ft		
210-225	Shale, dark-gray		
225-235	Shale and sandstone, interbedded		
235-270	Shale, medium-gray		
270-290	Sandstone and shale, interbedded		
290-300	Shale, dark-gray		
300-335	Sandstone, dark-gray; minor siltstone		
335-350	Sandstone, dark-gray		
350-425	Siltstone, light-gray; interbedded dark-gray shale		



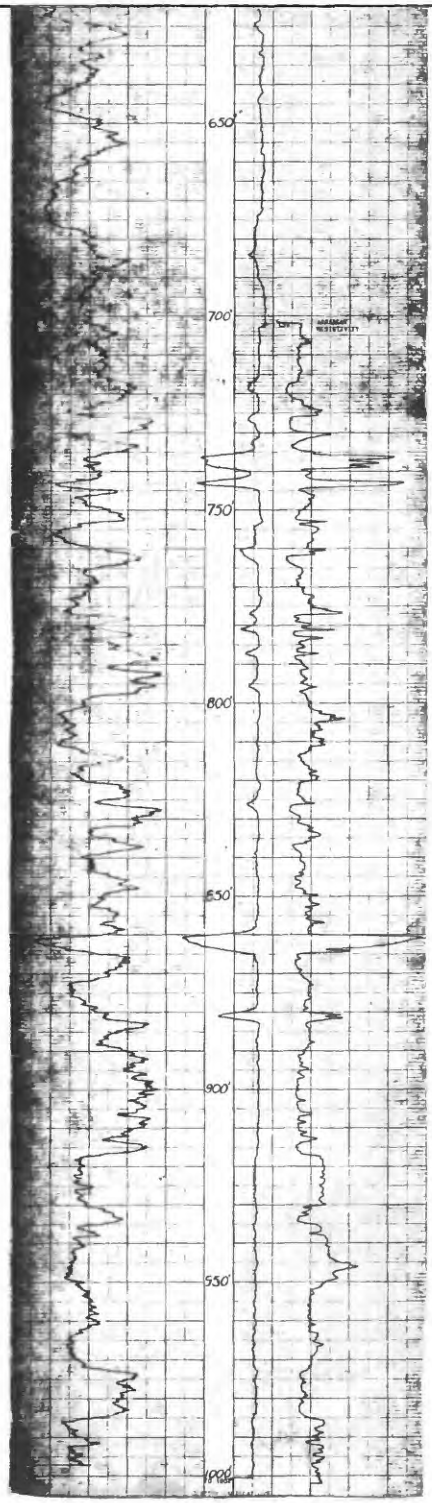
Drill-hole no. BC-3-SC (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS
			Gam Den Cal Res
425-430	Shale, black, carbonaceous		
430-440	Sandstone and black shale, interbedded		
440-470	Shale, black		
470-485	Sandstone, dark-gray		
485-505	Shale, medium-gray to black		
505-520	Sandstone, dark-gray		
520-525	Shale, medium-gray; some carbonaceous material		
525-545	Sandstone, light-gray, fine-grained; interbedded gray shale with carbonaceous shale at 545 ft		
545-565	Sandstone, light-gray, fine-grained, with abundant black grains; interbedded medium-gray shale		
565-570	Sandstone, medium-light-gray, poorly sorted, fine- to coarse-grained; grains of pink quartz and black chert		
570-600	Shale, medium-gray		
600-620	Sandstone, light-gray, fine-grained; contains black grains		
620-660	Shale, dark-gray to black		
660-680	Sandstone, light-gray, fine-grained; contains black grains		
680-690	Shale, carbonaceous; some coal		
690-702	Sandstone, medium- to light-gray, fine-grained; interbedded siltstone and medium-gray shale		
	Core point - 702 ft		



Drill-hole no. BC-3-SC (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS
		Gam Den Cal Res
702.0- 735.3 Shale and sandstone. 65% carbonaceous shale and 35% light-gray, very fine grained sandstone		
735.3-744.0 Upper unnamed coal zone Coal at 735.3-738.8 ft and 742.0-743.4 ft. Remainder of interval is black carbonaceous shale, occasionally coaly		
744-0-753.0 Sandstone and shale. Laminated (varvelike) 40% carbonaceous shale and 60% light-brown, fine-grained, sandstone		
753.0-759.0 Sandstone, brown, fine-grained, mottled, carbonaceous		
759.0-769.3 Shale, black, carbonaceous, with resin spots; coal partings		
769.3-776.3 Shale and sandstone. 70% carbonaceous shale with thin laminations of very fine grained sandstone		
776.3-785.0 Shale, sandstone, and coal. 50% black carbonaceous shale and 50% very fine grained silty sandstone and siltstone with thin black shale partings. 0.5-ft coal seam at 780.0 ft		
785.0-809.0 Shale, black, carbonaceous, with some resin spots and occasional coal partings less than 1/2 in. thick		
809.0-821.5 Sandstone and shale. 60% light-gray and brown sandstone with hairline and thin laminations (less than 1/4") of black and brown shale		
821.5-831.0 Shale, black, carbonaceous, with thin coal partings. Woody material on fractured surfaces		



Drill-hole no. BC-3-SC (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS			
			Gam	Den	Cal	Res
831.0-838.0	Sandstone, light-gray, very fine grained, with thin carbonaceous stringers					
838.0-859.5	Shale, sandstone, and siltstone. 50% black shale; 50% light- to medium-gray sandstone with minor siltstone. Shale and sandstone have rhythmic laminations of shale. Some distinct sandstone beds less than 0.5 ft thick					
859.5-863.8	Coal. Chesterfield bed. Coal sample at 859.5-862.8; bony coal at 862.8-863.8					
863.8-871.1	Shale, black, carbonaceous, with very fine grained sandy stringers near bottom					
871.1-890.0	Shale, sandstone, and coal. Rhythmic, thin (less than 1/4 in.) laminations of carbonaceous shale and very fine grained, light-gray sandstone. Laminations in upper 5 ft and lower 7 ft are highly contorted. Ballard? bed. 879.5-881.6: Upper 0.5 ft, vitrous black coal grading upward into thinbedded shale; 0.4 ft bony coal; 0.3 ft coal; 0.9 ft coaly black shale					
890.0-916.4	Shale and sandstone. 85% black, carbonaceous shale, with irregularly distributed thin, light-gray to white, wavy laminations of very fine grained sandstone. Woody material on fractured surfaces					
916.4-929.6	Sandstone, medium-gray, fine-grained, salt-and-pepper appearance; quartzose sandstone with hairline carbonaceous streaks					

Drill-hole no. BC-3-SC (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS			
		Gam	Den	Cal	Res
929.6-934.3 Sandstone, siltstone, and shale. Banded interval of 50% black and light-brown carbonaceous shale; 40% light-gray, very fine grained sandstone; 10% light-gray siltstone					
934.3-974.4 Sandstone, medium-gray, fine-grained, quartzose, with irregular salt-and-pepper appearance; mottled with carbonaceous blebs below 951 ft. White sandstone interval at 942.5-943.9					
974.4-984.0 Shale, siltstone, and sandstone. Banded interval of dark-gray to black shale (50%); medium-gray siltstone (30%); and light-gray, very fine grained sandstone (20%)					
984.0-1,002.0 Sandstone and shale. 80% light-gray, fine-grained, quartzose sandstone, with discrete, thin (1/32"-1/2") stringers of brown and black shale (20%)					
Total depth: 1,002.0 ft					

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, GRAND COUNTY, UTAH

Hole No. BC-4-SC Quadrangle Sego Canyon Elevation 6,080 ft

Location: T. 20 S., R. 20 E., sec. 17, 2,200 FEL 1,850 FSL

Rotary-drilled depth 440.3 ft Cored interval 440.3-642' Logged depth 642 ft Total depth 642 ft

Drilling medium Air, foam, and mud

Geophysical logs:

Caliper (Cal) - Logging speed: - ft/min Others: 20 ft/min

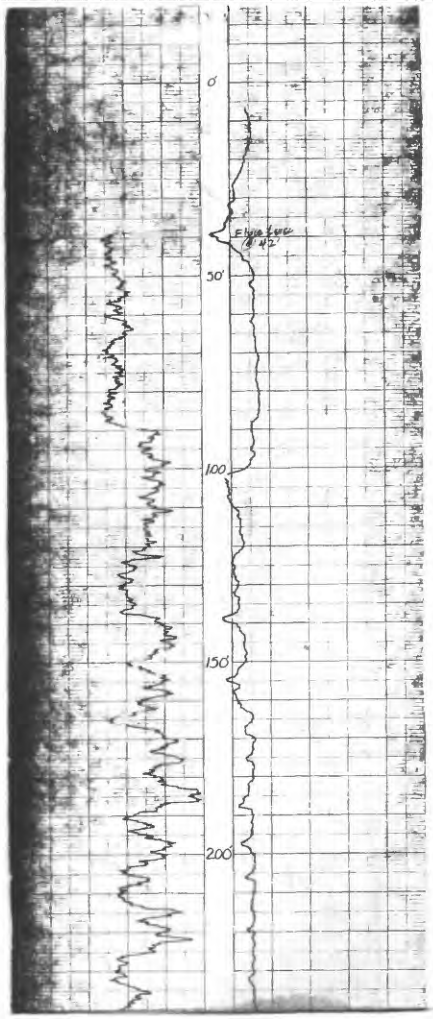
Resistivity (Res): Scale: Not shown on log

Gamma (Gam): T.C. 2 sec. Scale: 25 cps/log div.

Density (Den): T.C. 2 sec. Scale: 250 cps/log div.

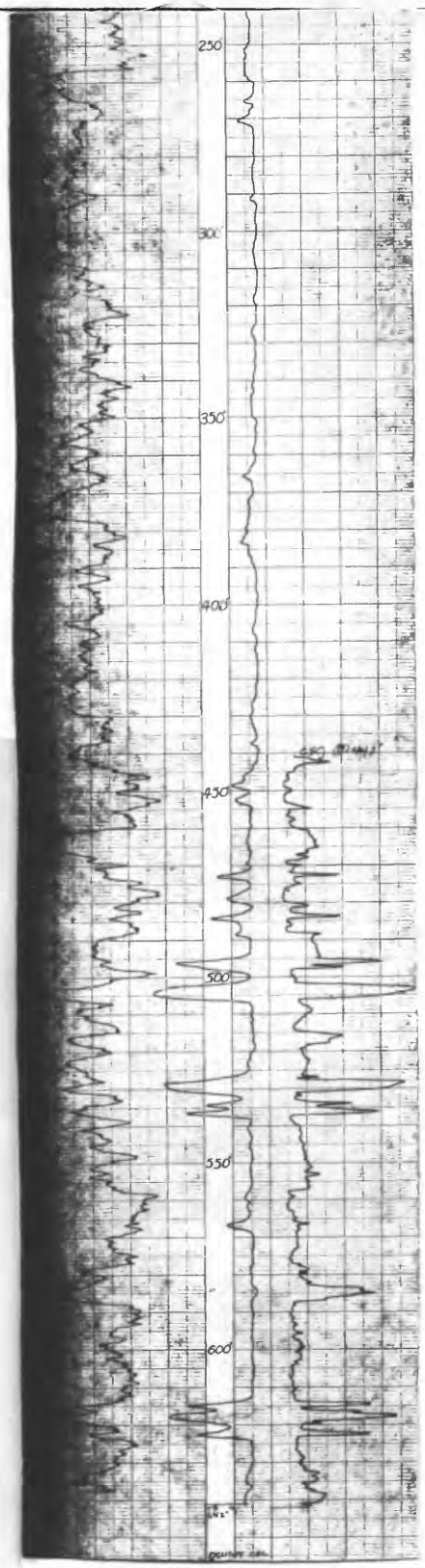
Remarks: Caliper log not run

LITHOLOGY			STRIP LOG	GEOPHYSICAL LOGS
				Gam Den Cal Res
0	- 85	Alluvium		
85	-105	Sandstone, gray, medium-grained		
105	-115	Sandstone, dark-gray, fine- to medium-grained		
115	-145	Sandstone, light-gray, medium-grained; contains black specks		
145	-190	Sandstone, gray, fine-grained, hard, thinly bedded		
190	-205	Sandstone, fine-grained, carbonaceous; fine-grained sandstone		
205	-215	Sandstone, fine-grained		
215	-270	Sandstone, fine-grained; thinly bedded fine-grained sandstone		
270	-275	Sandstone, medium-grained		
275	-285	Sandstone, medium-grained; carbonaceous mudstone		
285	-305	Sandstone, medium-grained, fairly clean		
305	-320	Sandstone, light-gray, fine-grained		
320	-370	Sandstone, light- and dark-gray, fine- to medium-grained		
370	-380	Mudstone, carbonaceous; medium-grained sandstone		



Drill-hole no. BC-4-SC (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS
			Gam Den Cal Res
380 -385	Mudstone, carbonaceous; medium-grained; coal stringers		
385 -400	Shale, carbonaceous; carbonaceous mudstone		
400 -405	Sandstone, white, medium-grained		
405 -440.3	Sandstone to siltstone. Sandstone is dark gray and fine grained		
	Core point at 440.3		
440.3-458.4	Sandstone, siltstone and shale. Thin bedded interval of brown claystone and gray shale in upper 2 ft underlain by sandy shale with streaks of coaly material. Lower 3 ft is gray very fine grained sandstone and siltstone		
458.4-467.7	Sandstone, brown, fine-grained; carbonaceous streaks and minor black shale laminations in lower 4 ft		
467.7-479.9	Shale; dominently carbonaceous with less than 5% fine-grained, gray sandstone beds, each less than 0.4 ft in thickness. 0.3-ft coal seam at 471.7 ft. Woody material on fractured surfaces. Zone of solution? 0.4-ft cavities at 471.0 ft, partially sealed by coarsely crystalline calcite		
479.9-482.3	Sandstone and shale. 50% gray, very fine grained sandstone and 50% dark-gray shale or mudstone		
482.3-486.5	Shale and coal. Black, coaly, carbonaceous shale. 0.4-ft coal seam at 482.5. Dominantly carbonaceous shale interval at 467.7-486.5 ft		



Drill-hole no. BC-4-SC (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS			
			Gam	Den	Cal	Res
486.5-494.2	Sandstone, uniformly gray, fine-grained; few hairline carbonaceous stringers in upper 2 ft					
494.2-501.1	Shale and coal. Resinous coal, bony coal, and coaly shale at 494.2-498.0 ft, underlain by carbonaceous shale to 501.1 ft					
501.1-505.3	Coal. Chesterfield bed. Lustrous, attrital coal with 1/8-in. vitrain bands; resin spot and trace of pyrite. Coal sample - 501.1-504.1; Gas sample - 504.1-505.3					
505.3-513.8	Shale, sandstone, and siltstone. About equal amounts of each as thin (1/32-1/2 in.) wavy laminations (varvelike). Lower 2 ft - continuous gray shale or mudstone					
513.8-517.3	Sandstone, gray, fine-grained. (Thompson Sandstone?)					
517.3-525.9	Sandstone, siltstone, and shale. Thin (less than 3/8 in.) regular laminations of brown claystone, gray sandstone, siltstone, and black shale in upper 2 ft. Grades downward into very disturbed sandstone, siltstone, and shale, with no regular bedding. Some recognizable fragments of pre-existing laminations					
525.9-536.0	Coal and shale. Ballard bed. Interbedded coal, bony coal, and black shale as follows: 0.2 ft of coal; 0.7 ft of bony coal; 3.1 ft of coal (sample); 1.9 ft coaly shale; 0.6 ft of coal; 1.4 ft of laminated siltstone, shale, and coaly shale; 1.5 ft of coal and bony coal; 0.2 ft of gray shale or mudstone. About 0.5 ft of core lost					

Drill-hole no. BC-4-SC (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS			
			Gam	Den	Cal	Res
536.0-557.0	Sandstone and shale. 50% thin (1/2 in. or less) wavy laminations of very fine grained sandstone, siltstone and black shale, with 50% interbedded bands of carbonaceous shale or very fine grained gray sandstone ranging from 0.4 to 1.2 ft in thickness					
557.0-576.2	Shale, black, carbonaceous; occasionally coaly. 0.2-ft coal seam at 565.5. Less than 5% very fine grained sandstone seams					
576.2-586.3	Sandstone, light-gray to white, very fine grained (50%); black shale (50%). Thinly (1 in. or less) laminated stringers and interfingering sandstone and shale					
586.3-593.7	Shale, black, carbonaceous, sandy, with few contorted sandy bands in less than 15% of interval					
593.7-603.4	Shale and sandstone. Thinly laminated interval of 60% black sandy shale and 40% light-gray, very fine grained sandstone and siltstone. Laminations (1/2 in. thick or less) are even and moderately contorted					
603.4-613.0	Shale and sandstone. 90% black shale, with thin stringers of siltstone and brown claystone; occasional coaly partings less than 1/4 in. thick					
613.0-622.0	Coal and bony coal. Palisade bed. 1.2 ft bony coal; 1.0 ft coaly shale; 2.4 ft coal (sample); 0.6 ft coaly shale; 0.3 ft bony coal; 2.5 ft coaly shale; 0.8 ft bony coal. 0.2 ft of core lost					

Drill-hole no. BC-4-SC (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS			
			Gam	Den	Cal	Res
	Coal sample 615.35-617.75: 1/3 bony coal and 2/3 coal. Coal contains pyrite and calcite on cleats; resinous; vitrain bands as much as 1/4 in. Gas sample 616.8-617.75: pure coal. Methane bubbles on wet surfaces					
622.0-631.3	Shale and sandstone. 80% carbonaceous shale with 20% light-gray, very fine grained sandstone and siltstone laminations primarily below 626.0 ft					
631.3-642.0	Sandstone, light-gray, fine-grained (85%), with about 15% thin laminations and stringers of carbonaceous shale.					
	Total depth: 642 ft					