Geologic and Geochemical Results of 1978 Coal Exploratory Drilling in the Upper Cretaceous Frontier Formation, at six sites in Lincoln and Uinta Counties, Wyoming

by

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Open File Report 80-1244

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Geologic and Geochemical results of 1978 Coal Exploratory Drilling in the Upper Cretaceous Frontier Formation, at six sites in Lincoln and Uinta Counties, Wyoming

Introduction

In 1978 the U.S. Geological Survey had test holes drilled at six locations in the Elkol, Cumberland Gap, and Bridger quadrangles, Lincoln and Uinta counties, Wyoming as part of the Coal Exploratory program. The purpose of the drilling was to check the continuity and correlation of coal beds traced in surface mapping, and to obtain coal samples for modern chemical analyses. Geologic maps of the quadrangles have been produced by M'Gonigle (1979) and by Schroeder and Lunceford (1979a,1979b).

Drilling was done by the Hugh M. Harris Drilling Co., Poway, California, under the supervision of U.S. Geological Survey personnel. Rotary holes were drilled at each site with truck mounted rigs; these holes were logged with geophysical probes by Strata Surveys of Steamboat Springs, Colorado, immediately upon completion. The logs were then examined and representative coal-bearing sections selected for coring. Subsequently, each site was reoccupied by the drill rig and these intervals cored in a second rotary drill hole.

Mud was the primary drilling fluid used, although air and air-water biogradable foam were initially used on two holes. Geophysical logs included gamma ray, gamma gamma (density), resistivity, and caliper. The geophysical logs were photographically reduced to a scale of 1 inch equals 50 feet; the final copies in this report are close to that scale.

Lithologic logs are based on field examinations of drill-hole cuttings collected at 5-foot intervals and on field description of cored intervals. Lithologic interpretations in this report are adjusted to geophysical logs, and thicknesses of units are given as logged; they have not been corrected for the dip of bedding.

REFERENCES

M'Gonigle, J. W., 1979, Preliminary geologic map of the Elkol quadrangle, Lincoln County, southwestern Wyoming: U.S. Geological Survey open-file report 79-1150.

Schroeder, M. L., and Lunceford, R. A., 1979a, Preliminary geologic map and coal sections of the west half of the Bridger quadrangle, Uinta county, Wyoming: U.S. Geological Survey open-file report 79-1632.

_____,1979b, Preliminary geologic map and coal sections of the Cumberland Gap quadrangle, Lincoln and Uinta counties, Wyoming: U.S. Geological Survey open-file report 79-1633.

Table 1.--Summary of information on drilling at six sites, Lincoln and Uinta counties, Wyoming

Drill hole	Location	Quadrangle	Depth (feet) Drilled	Logged	Cored
E-1	SW 1/4 SW 1/4 sec. 4 T. 19 N., R. 116 W.	Elkol	665	665	139.6-146.2 235.0-244.9 309.5-318.6 367.4-377.6
E-2	SE 1/4 NW 1/4 sec. 4 T. 19 N., R. 116 W.	Elkol	780	779	141.0-151.0
CG-1	NW 1/4 NE 1/4 sec. 12 T. 18 N., R. 117 W.	Cumberland Gap	460	459	241.2-250.5 294.0-303.9
CG-2	SW 1/4 SW 1/4 sec. 18 T. 18 N., R. 116 W.	Cumberland Gap	700	697	633.2-646.0
CG-3	SE 1/4 SW 1/4 sec. 18 T. 18 N., R. 116 W.	Cumberland Gap	980	979	75.0- 79.6 200.0-205.1 223.0-232.5 333.0-340.2 365.0 373.4 570.5-579.9
B-1	SW 1/4 SW 1/4 sec. 2 T. 17 N., R. 117 W.	Bridger	560	560	301.6-314.6 336.0-361.0

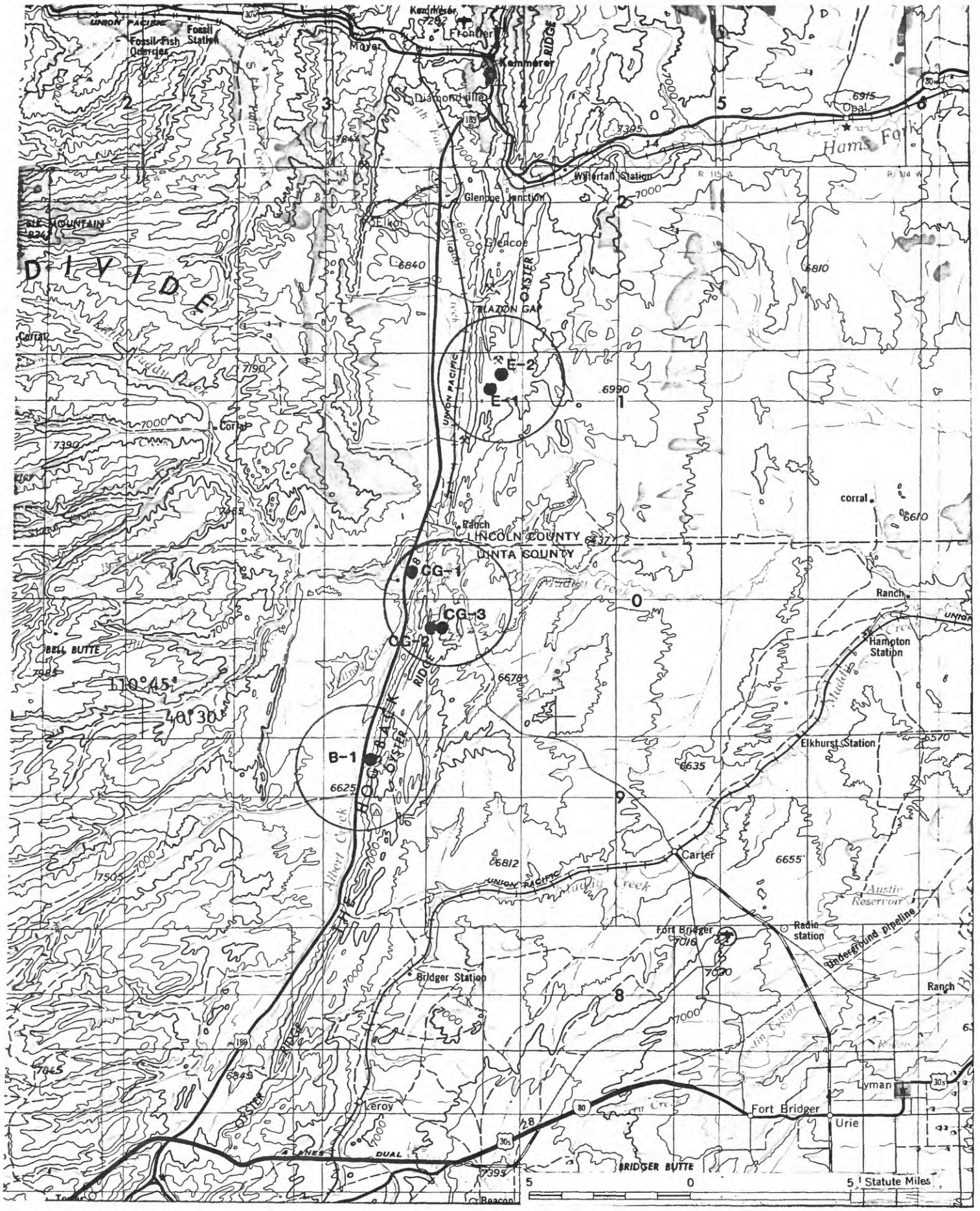


Figure 1.--Map showing general location of drill holes, Lincoln and Uinta Counties, Wyoming

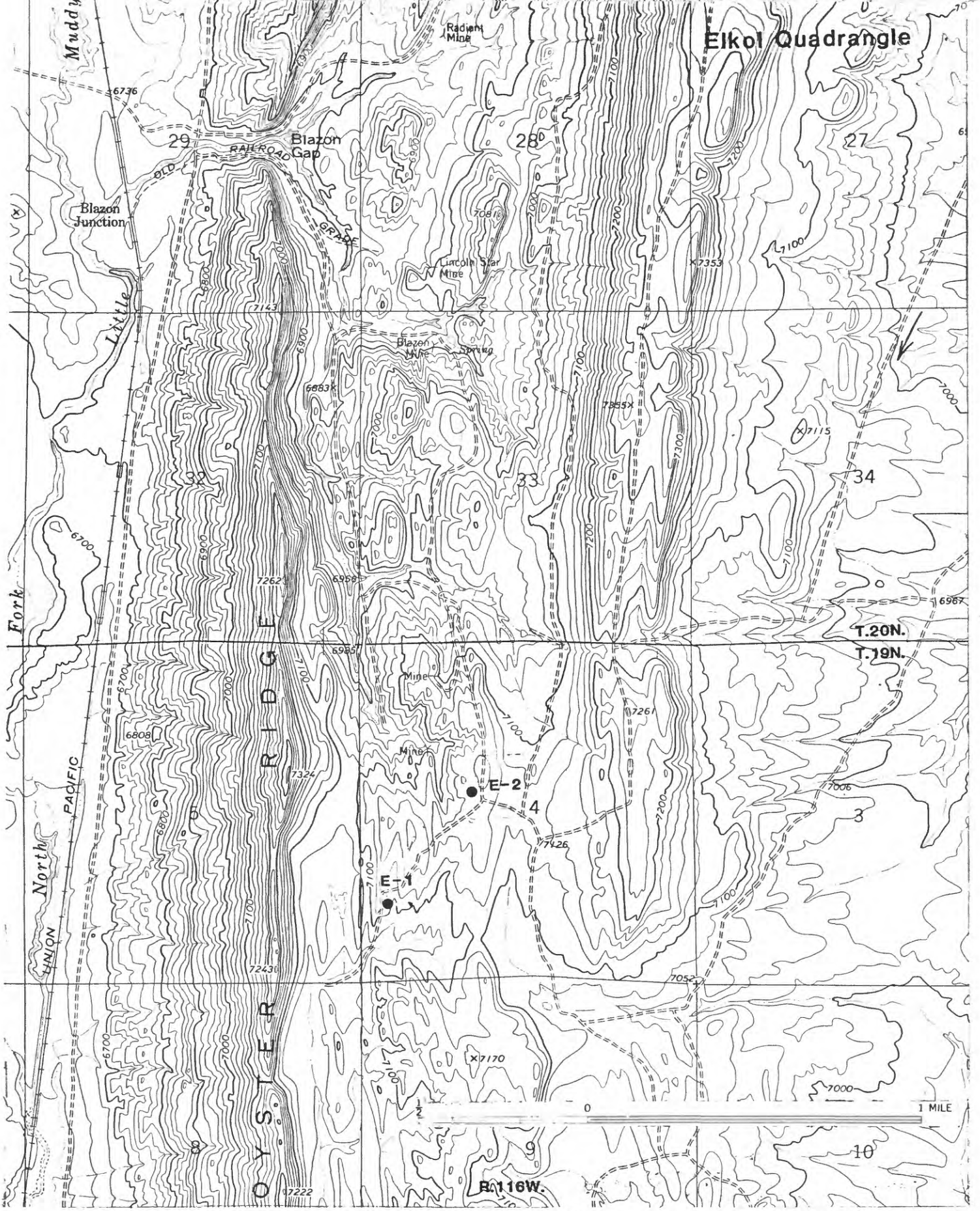


Figure 2.--Map showing location of drill holes in the Elkol quadrangle, Lincoln County, Wyoming

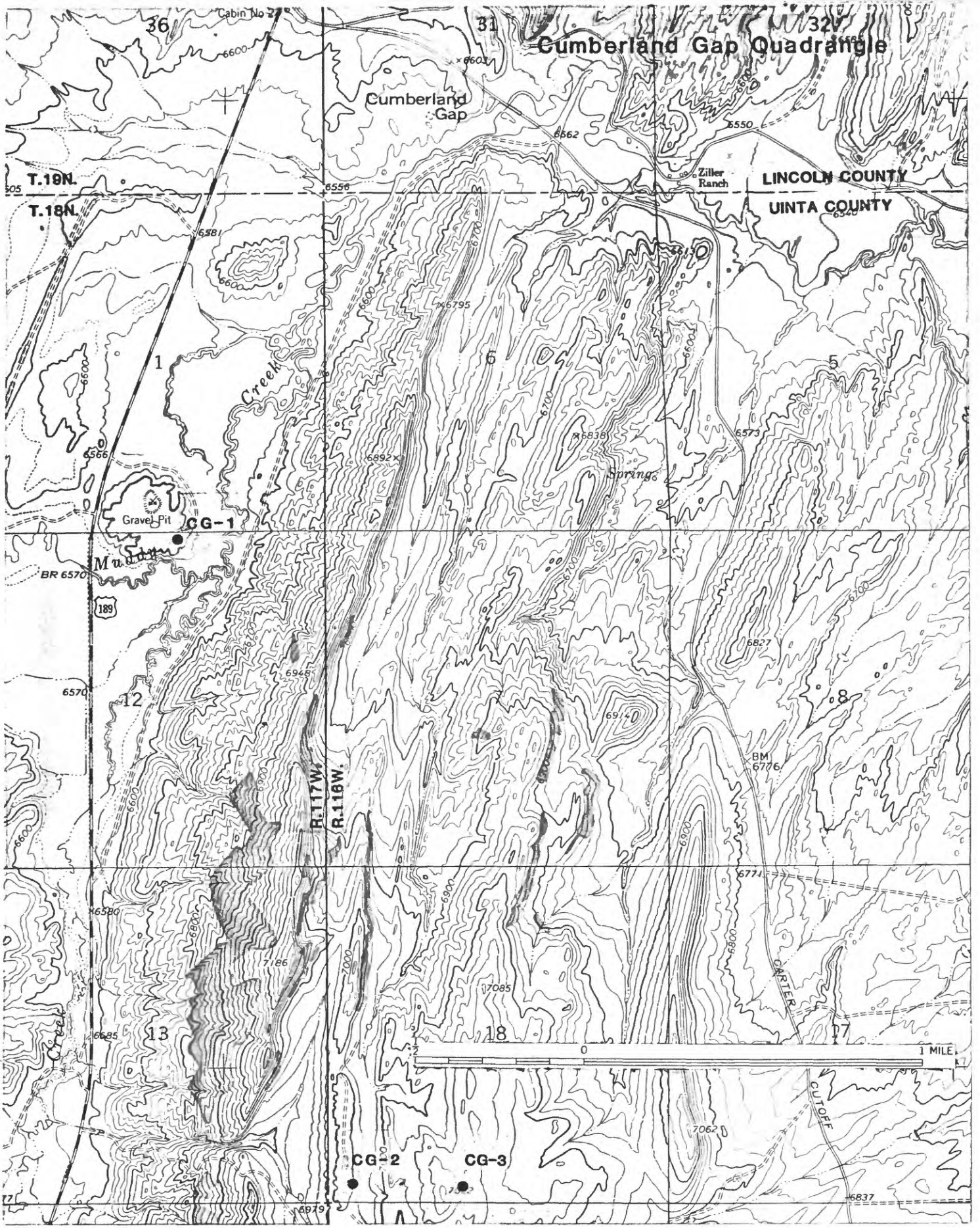


Figure 3.--Map showing location of drill holes in the Cumberland Gap quadrangle, Lincoln and Uinta Counties, Wyoming

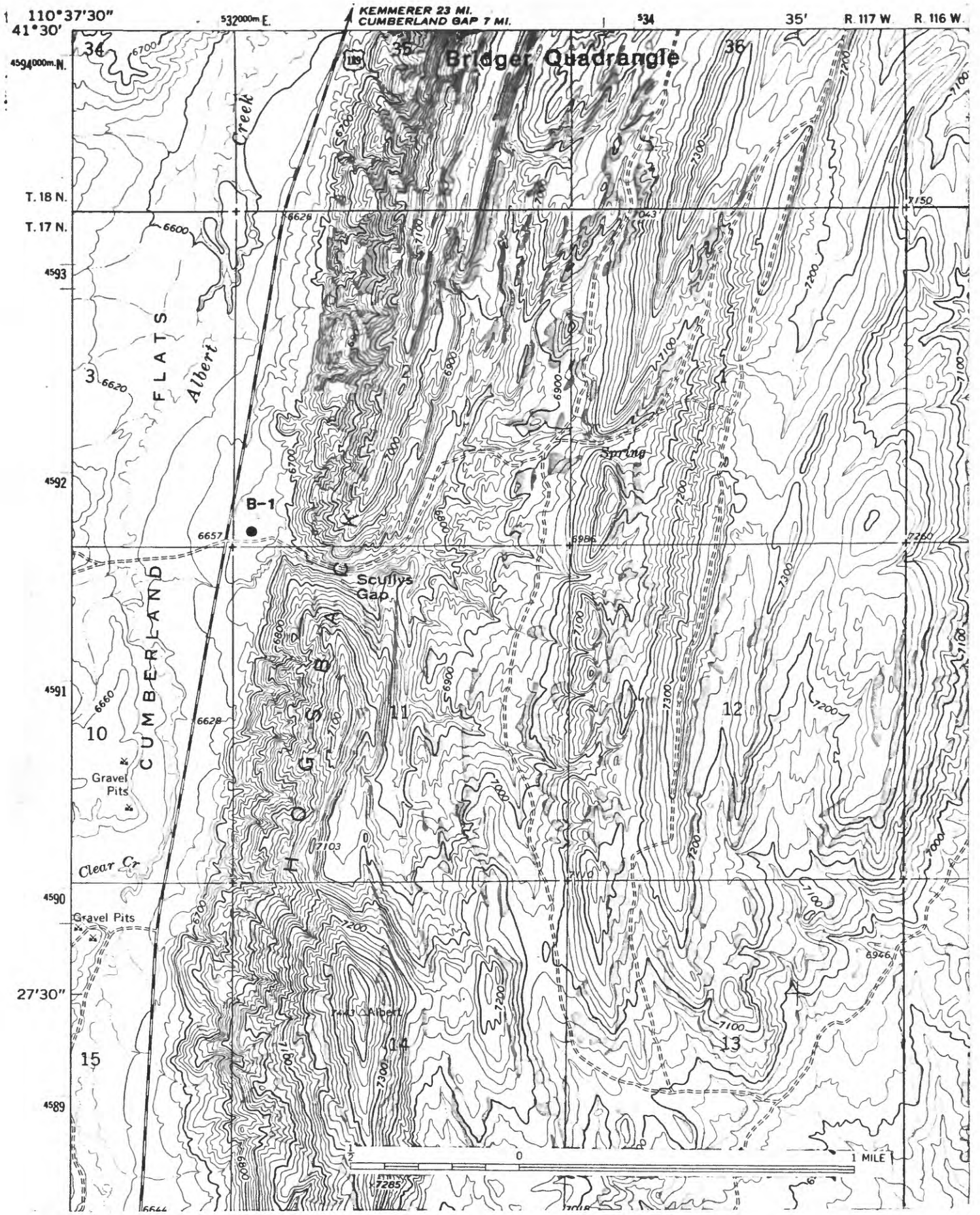


Figure 4.--Map showing location of drill hole in the Bridger quadrangle, Uinta County, Wyoming

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER E-1 DATE LOGGED 8/28/78 SURFACE ELEVATION(ft) 7125

LOCATION: SW 1/4 SW 1/4 Sec. 4 T. 19 N. R. 116 W. Quad. Elkol

COUNTY Lincoln STATE Wyoming TOTAL DEPTH(ft) 665

CORED; YES X NO ____ INTERVAL(s) 139.6-146.2; 235-244.9; 309.5-318.6; 367.4-377.6

DRILLING MEDIUM; AIR ____ FOAM ____ MUD X WATER OBSERVATION WELL ____

GEOPHYSICAL LOGS;

Natural Gamma ;	Scale 20 cps/log div.	Logging Speed 20 fpm
Gamma Gamma Density;	Scale 200 cps/log div.	Logging Speed 20 fpm
Resistivity ;	Scale 8.33 ohms/log div.	Logging Speed 20 fpm
Caliper ;	Scale ----	Logging Speed -- fpm

BEDDING ATTITUDE; Strike North Dip 22° W.

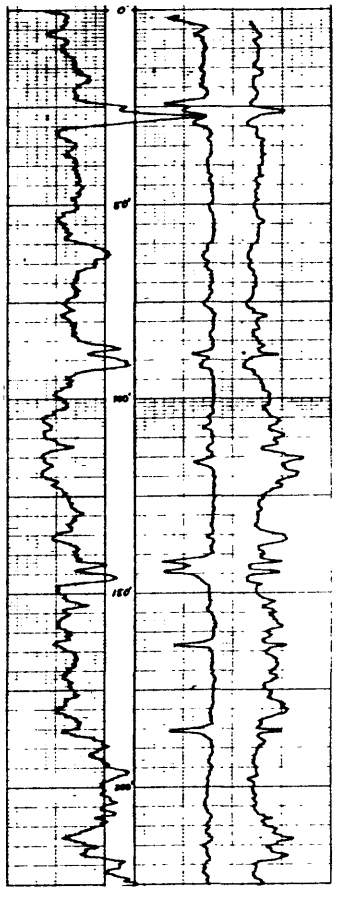
Interval (feet)	Lithology
0- 15	Soil; medium-brownish-gray shale; tan to gray fine-grained sandstone, some carbonaceous shale
15- 25	Clay, light-gray to yellow-brown; gray shale; some carbonaceous shale and trace of coal
25- 30	Clay, medium-gray (after tuff)
30- 40	Claystone, light-gray
40- 60	Shale, medium-light-gray, silty
60- 65	Claystone (after tuff), slightly brownish-gray
65- 85	Shale, medium-gray, slightly silty, and medium-light-gray claystone (some after tuff)
85- 90	Coal and gray shale
90- 95	Shale, carbonaceous and gray shale
95-100	Shale, medium-gray, slightly silty; some claystone (after tuff?) and fine-grained sandstone

Strip Log

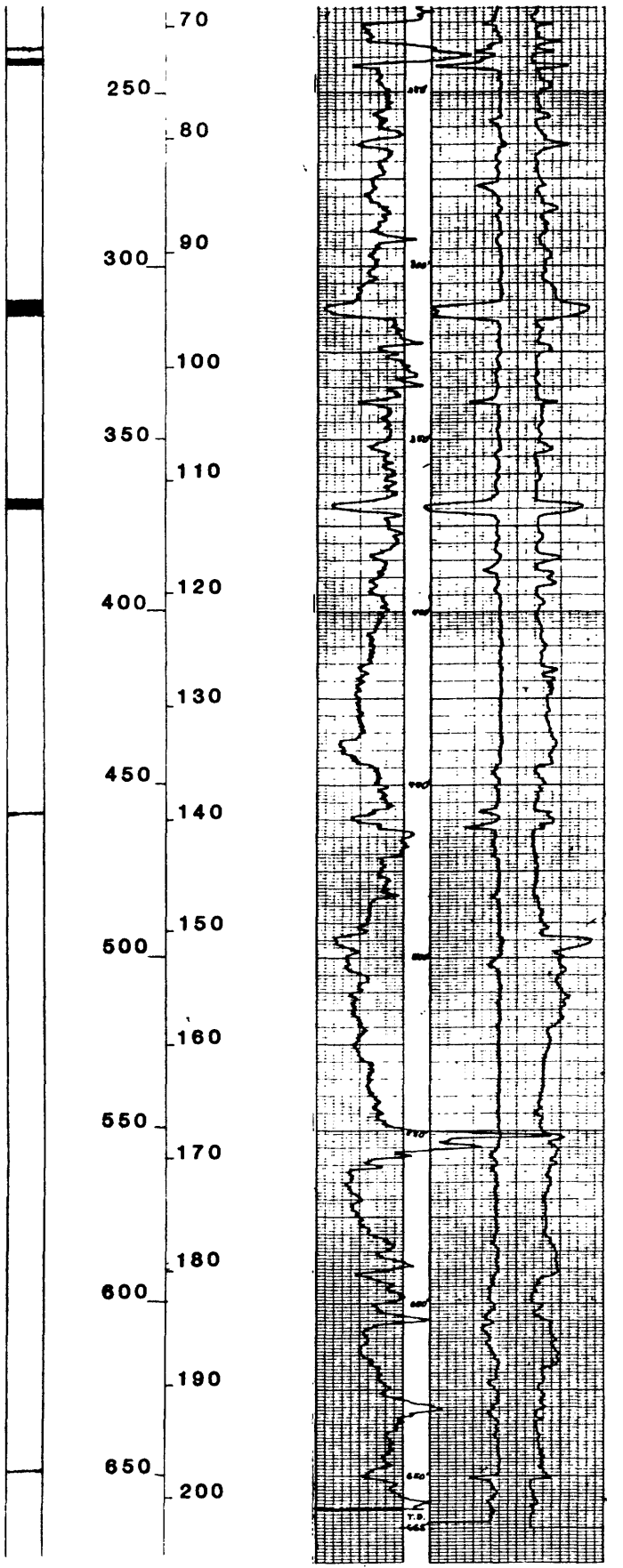
Depth

ft	m
	10
50	20
100	30
	40
150	50
200	60

Geophysical Logs



Interval (feet)	Lithology
100-125	Sandstone, light- to medium-gray, very fine grained to fine-grained, some carbonaceous; some light-brownish-gray, silty-sandy claystone; minor light-yellow-gray tuff
125-140	Shale, medium-dark to light-brownish-gray, and some medium-gray, fine-grained sandstone
140-150	Coal; shale, medium-light to olive-brownish-gray, carbonaceous; clayey light-gray tuff; some very fine grained medium-gray sandstone
150-165	Sandstone, medium-gray, very fine to fine-grained, and medium-brownish-gray siltstone
165-185	Siltstone; medium-brownish-gray; some shale and very fine grained sandstone
185-190	Coal and siltstone as above
190-210	Shale, medium-dark-brownish-gray, silty, and slightly brownish medium-gray claystone
210-215	Sandstone, very light gray, fine-grained, very "clean"; some sandy gray claystone
215-230	Tuff, light-gray, clayey; light-brown siltstone; some grayish-brown carbonaceous shale
230-235	Sandstone, light-gray, very fine grained



Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
235-245	Coal (two thin beds); shale, medium-light-gray to medium-dark-brownish-gray, locally carbonaceous; tuff, light gray; some siltstone and very fine-grained sandstone						
245-295	Shale and siltstone, light-to dark-brownish-gray; some fine-grained sandstone; some light-gray, clayey tuff						
295-310	Sandstone, medium-gray, very fine to fine-grained; some dark-gray shale and some claystone (after tuff)						
310-320	Coal; sandstone, light-gray, fine- to medium-grained, and brownish-gray shale						
320-335	Shale, medium-dark-brownish-gray and grayish-brown claystone						
335-340	Sandstone, light-brown, very fine-grained; trace of coal; some light-gray clayey tuff						
340-365	Siltstone and shale, gray to brownish-gray; light gray, very fine to fine-grained sandstone, and medium-light-gray claystone (after tuff)						
365-380	Coal; shale, light-gray to dark-brown, locally carbonaceous						
380-400	Sandstone, light-gray, very fine to fine-grained; medium-dark-brownish-gray shale (some carbonaceous); light-gray claystone						
400-455	Sandstone, light-gray, fine-grained, and siltstone; some gray to medium-dark-brown shale and white clayey sandy tuff						

Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
455-470	Shale, medium-dark-brownish-gray; carbonaceous shale, and coal						
470-490	Shale, medium-gray, silty, and siltstone; light-gray sandy clayey tuff; light-gray fine-grained sandstone						
490-550	Sandstone, light-gray, fine- to medium-grained; some light-tan claystone and gray siltstone						
550-560	Claystone, light-brown and orange-tan (after tuff), and sandstone, siltstone as above						
560-580	Sandstone, light-gray, fine-grained, some clayey (tuffaceous)						
580-605	Shale, light-tan and light-gray; sandstone, light-gray, fine-grained; brownish-gray siltstone; some carbonaceous shale; tuff, light-gray (at 594 and 605 feet)						
605-625	Sandstone, light-gray, fine-grained; siltstone, dark-gray, some shale						
625-645	Shale, light-brown; tuff, light-tan, clayey; siltstone, dark-brownish-gray; some sandstone						
645-655	Coal trace; shale and siltstone, medium-dark-brownish-gray						
655-665	Shale, light-tan and light-gray; some light-tan-gray tuff, and light-gray clayey tuffaceous) sandstone						

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER E-2 DATE LOGGED 8/22/78 SURFACE ELEVATION(ft) 7155

LOCATION: SE 1/4 NW 1/4 Sec. 4 T. 19 N. R. 116 W. Quad. Elkol

COUNTY Lincoln STATE Wyoming TOTAL DEPTH(ft) 780

CORED; YES X NO INTERVAL(s) 141.0-151.0

DRILLING MEDIUM; AIR FOAM MUD X WATER OBSERVATION WELL

GEOPHYSICAL LOGS;

Natural Gamma ;	Scale 20 cps/log div.	Logging Speed 15 fpm
Gamma Gamma Density;	Scale 125 cps/log div.	Logging Speed 15 fpm
Resistivity ;	Scale 8.33 cps/log div.	Logging Speed 15 fpm
Caliper ;	Scale 1 in./log div.	Logging Speed 15 fpm

BEDDING ATTITUDE; Strike North Dip 22° W.

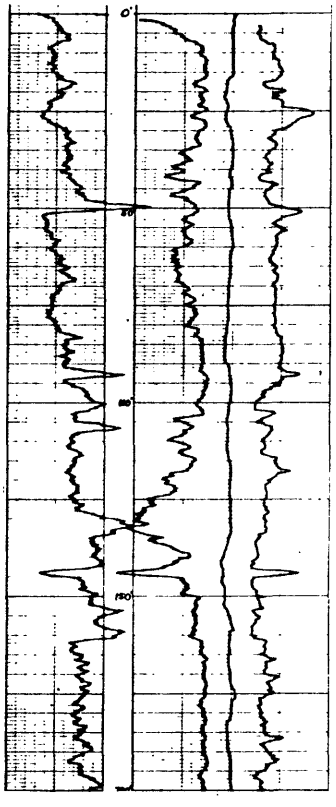
Interval (feet)	Lithology
0- 10	Alluvium; sandstone, tan and medium-gray, fine- to very fine grained; some brownish-medium-gray carbonaceous shale
10- 20	Sandstone, gray, fine- to very fine grained; brown carbonaceous shale
20- 30	Sandstone, gray, fine- to very fine grained, contains dark minerals and some medium-green grains; some brown carbonaceous shale
30- 50	Sandstone, brown, silty, carbonaceous; grades downward into gray carbonaceous shale. Some claystone (after tuff) at 50 feet
50- 90	Sandstone, light-gray, fine- to medium-grained, locally clayey (probably originally tuffaceous); contains dark mineral grains

Strip Log

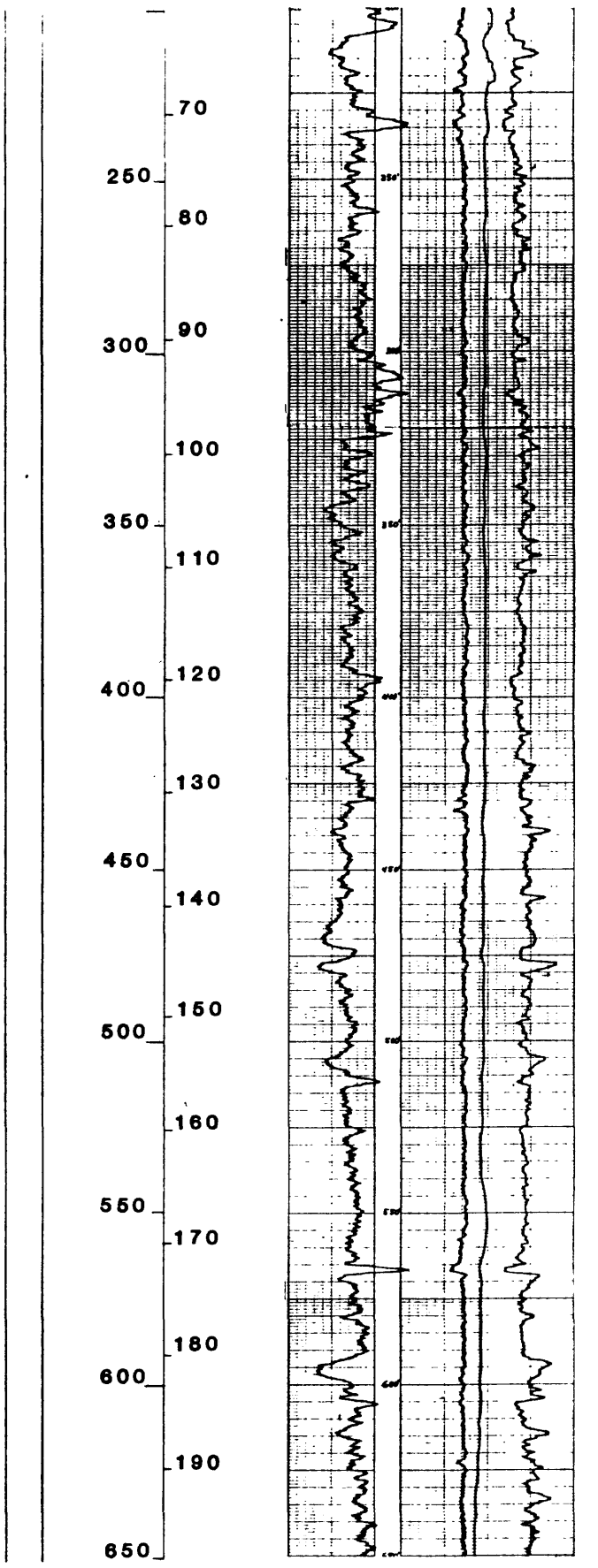
Depth

ft	m
	10
50	20
100	30
	40
150	50
200	60

Geophysical Logs

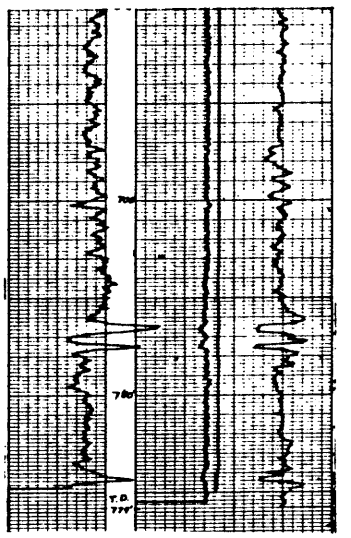


Interval (feet)	Strip Lithology	Depth Log	Geophysical Logs ft	m	Gamma	Den	Res
90-110	Sandstone as above; medium-dark-gray slightly silty shale, and some very light gray clay (after tuff)						
110-125	Shale, medium-gray, silty, becomes medium-brownish-gray lower part of interval						
125-143	Shale, brownish-medium-gray, very carbonaceous; some boney coal						
143-145	Coal, with some shaly partings						
145-150	Shale, carbonaceous, grades downward into medium-dark-brown shale, light-gray shale, and light-gray, very fine grained sandstone						
150-160	Sandstone, tan, and porcelanite, light-brownish-gray, very fine grained to aphanitic; some sandy claystone (after tuff), and some medium-dark-gray shale						
160-195	Mostly sandstone, medium-gray, very fine to fine-grained, with thin interbeds of light-gray claystone (after tuff), minor porcelanite						
195-210	Shale, medium-gray to dark medium-gray, slightly carbonaceous; large amount of medium-light-gray clay (after tuff)						
210-230	Sandstone, tan, fine-grained; light-brown shale; medium-light-gray clay. Amount of clay increases with depth						
230-235	Mostly clay, light-gray; probably after tuff						



Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
235-275	Clay, light-gray, brownish-medium-gray shale, and brown to gray, fine-grained sandstone						
275-300	Clay, medium-light-gray, sandy, and medium-brownish-gray shale; some brownish fine-grained sandstone						
300-325	Tuff, light-gray, clayey and soft; shale, light brownish-gray; minor sandstone						
325-360	Tuff as above, sandy, some carbonaceous. Sandstone, gray, very fine to fine-grained, tuffaceous; some medium-brownish-gray shale and siltstone						
360-390	Siltstone and shale, brownish-gray to medium-gray; sandstone, gray, very fine grained, some carbonaceous						
390-400	Shale, medium-dark-brownish-gray, and light-gray clay (after tuff) and tuffaceous sandstone						
400-415	Shale, slightly brownish-dark-gray and slightly carbonaceous silty shale						
415-430	Shale and siltstone, medium-gray, some very fine grained gray sandstone, some clay (after tuff)						
430-460	Siltstone and shale as above; increase in amount of medium-gray to brownish-gray very fine grained sandstone						
460-480	Sandstone, medium-gray, fine- to medium-grained; some clayey (tuffaceous?) around 475 feet. Some dark-gray siltstone and shale						
480-490	Siltstone and shale, dark-gray and sandstone, gray, fine-grained						

Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
490-505	Shale, dark-gray and some brown, carbonaceous shale; some siltstone and sandstone as above						
505-515	Sandstone, medium-gray, very fine grained; some medium-dark-brownish-gray shale and carbonaceous shale, and some clayey (tuffaceous) fine- to medium-grained sandstone						
515-565	Sandstone, medium-gray, very fine to fine-grained; and siltstone. Increased amount of siltstone and dark-brownish-gray shale below 535 feet						
565-570	Clay, (after tuff), very light-gray, sandy; some dark-brownish-gray shale						
570-590	Shale, dark-brownish-gray; some very fine-grained sandstone and shale; rare pieces of porcelanite						
590-600	Sandstone, medium-gray, very fine to fine-grained; medium-dark-gray siltstone		650	200			
600-640	Sandstone, light- to medium-gray, fine-grained, some dark-gray shale and siltstone, amount increases toward base of interval			210			
640-700	Interbedded shale, medium dark-gray; siltstone, dark-brownish-gray and sandstone, medium-light-gray, very fine to fine-grained		700				
640-700	Interbedded shale, medium-dark-gray; siltstone, dark-brownish-gray to medium-gray; and sandstone, medium-gray, very fine to fine-grained; some carbonaceous shale and sandstone			220			
			750	230			
				240			
			800				



Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
700-705	Sandstone, light-gray, fine-grained, clayey (after tuff); medium-dark and light-gray shale						
705-730	Shale and siltstone, medium-dark-gray; some very fine grained gray sandstone; some porcelanite fragments						
730-740	Same as above plus clayey tuff						
740-780	Shale, medium- to dark-brownish-gray; sandstone, gray, very fine grained, locally clayey (tuffaceous); medium-dark-gray siltstones; some porcelanite fragments below 760 feet						

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER CG-1 DATE LOGGED 8/5/78 SURFACE ELEVATION(ft) 6610

LOCATION: NW 1/4 NE 1/4 Sec. 12 T. 18 N. R. 117 W. Quad. Cumberland Gap

COUNTY Uinta STATE Wyoming TOTAL DEPTH(ft) 460

CORED; YES X NO INTERVAL(s) 241.2-250.5; 294.0-303.9

DRILLING MEDIUM; AIR FOAM MUD X WATER OBSERVATION WELL

GEOPHYSICAL LOGS;

Natural Gamma ;	Scale 15 cps/log div.	Logging Speed 15 fpm
Gamma Gamma Density;	Scale 125 cps/log div.	Logging Speed 15 fpm
Resistivity ;	Scale 10 ohms/log div.	Logging Speed 15 fpm
Caliper ;	Scale 1 in./log div.	Logging Speed 40 fpm

BEDDING ATTITUDE; Strike N. 27° E. Dip 24° W.

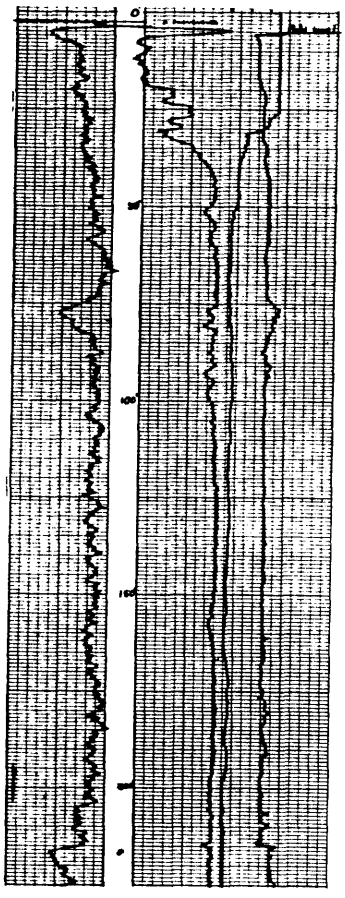
Interval (feet)	Lithology
0- 45	Sand and gravel (alluvium); gravel, granule-to cobble-sized, of quartzite, chert, and sandstone
45- 55	Shale, dark-gray
55- 60	Sandstone, dark-gray, very fine grained and dark-gray sandy-silty shale
60- 75	Shale, dark-gray, silty
75- 85	Sandstone, gray, very fine grained, and some gray silty shale
85-205	Shale, gray, silty and very fine grained sandstone, some carbonaceous shale between 100-115 feet, 150-155 feet and 175-180 feet. Some pyrite in shale between 100-115 feet
205-225	Sandstone, medium-gray, very fine grained, and medium-dark-gray silty shale. A few carbonaceous sandstone fragments from 220-225 feet

Strip Log

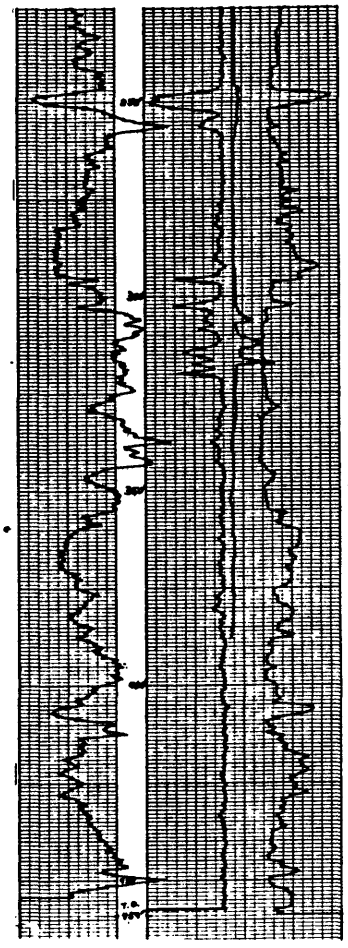
Depth

ft	m
	10
50	
	20
100	30
	40
150	
	50
200	60

Geophysical Logs



Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma Den Res
225-247.5	Sandstone, gray, fine- to medium grained; medium-dark-gray siltstone and shale; a few coal fragments		250	70 80	
247.5-252	Coal				
252-260	Sandstone, gray, fine- to medium-grained, some carbonaceous; gray siltstone		300	90 100	
260-280	Sandstone, gray, very fine to fine-grained, some dark-gray shale and siltstone				
280-295	Sandstone, medium-gray, fine-grained and light-gray, medium-grained		350	110	
295-296.5	Coal with light-gray fine- to medium-grained sandstone stringer				
296.5-310	Shale, brownish-gray to light-gray, locally carbonaceous with coaly stringers		400	120	
310-325	Siltstone, gray; shale, dark-gray; medium-gray fine- to medium-grained sandstone; some large coal fragments in cuttings			130	
325-335	Sandstone, medium-gray, fine- to medium-grained, and greenish-gray siltstone		450	140	
335-345	Siltstone, gray, and dark-gray silty shale		500	150	
345-350	Sandstone, gray, fine- to medium-grained; dark-gray shale and siltstone				
350-355	Shale, dark-gray, some fine- to medium-grained sandstone; scattered shell fragments				
355-360	Same as above with increasing amount of very fine to fine-grained sandstone				



Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
360-370	Sandstone, light- to medium-gray; some shell fragments						
370-390	Sandstone, light-gray and tan, fine- to medium-grained; dark-gray shale						
390-400	Shale, dark- to medium-gray						
400-410	Sandstone, gray, fine- to medium-grained, some carbonaceous; some shell fragments						
410-415	Shale, dark-gray, and gray fine- to medium-grained sandstone						
415-440	Sandstone, gray, very fine to fine-grained; some medium-dark-gray shale; some shell fragments; some fine- to medium-grained reddish sandstone from 420-425 feet						
440-445	Shale, dark- to medium-gray						
445-460	Shale, greenish-gray; light-gray very fine to medium-grained sandstone; gray siltstone						

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER CG-2 DATE LOGGED 8/8/78 SURFACE ELEVATION(ft) 7010

LOCATION: SW 1/4 SW 1/4 Sec. 18 T. 18 N. R. 116 W. Quad. Cumberland Gap

COUNTY Uinta STATE Wyoming TOTAL DEPTH(ft) 700

CORED; YES X NO INTERVAL(s) 633.2-646.0

DRILLING MEDIUM; AIR FOAM MUD X WATER OBSERVATION WELL

GEOPHYSICAL LOGS;

Natural Gamma ;	Scale 20 cps/log div.	Logging Speed 15 fpm
Gamma Gamma Density;	Scale 125 cps/log div.	Logging Speed 15 fpm
Resistivity ;	Scale 20 ohms/log div.	Logging Speed 15 fpm
Caliper ;	Scale 2 in./log div.	Logging Speed 30 fpm

BEDDING ATTITUDE; Strike N. 5° E. Dip 19°-20° W.

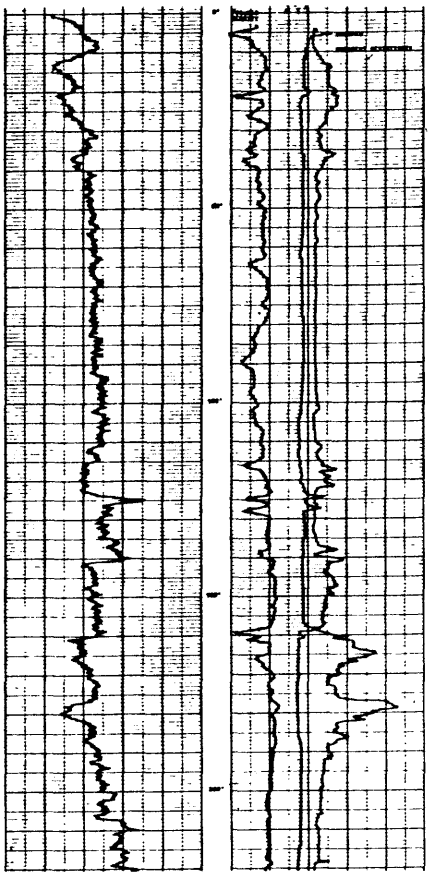
Interval (feet)	Lithology
0- 10	Soil; sandstone, tan to gray, medium- and fine-grained
10- 40	Sandstone, tan and brown, fine- to medium-grained. Sandstones clean, mostly quartz grains; some feldspar grains
40-115	Shale, dark-gray, slightly silty
115-120	Shale as above, plus some grayish-brown shale and light-gray sandy clay
120-135	Shale, dark-gray, and white bentonitic clay (after tuff)
135-160	Shale, dark-gray, locally silty; some white clay (after tuff)
160-165	Shale, dark-gray; medium-gray fine-grained sandstone; some coal chips
165-185	Sandstone, medium-light-gray, fine- to very fine grained; some dark-gray and light-brownish-gray shale chips

Strip Log

Depth

ft	m
	10
50	20
100	30
	40
150	50
200	60

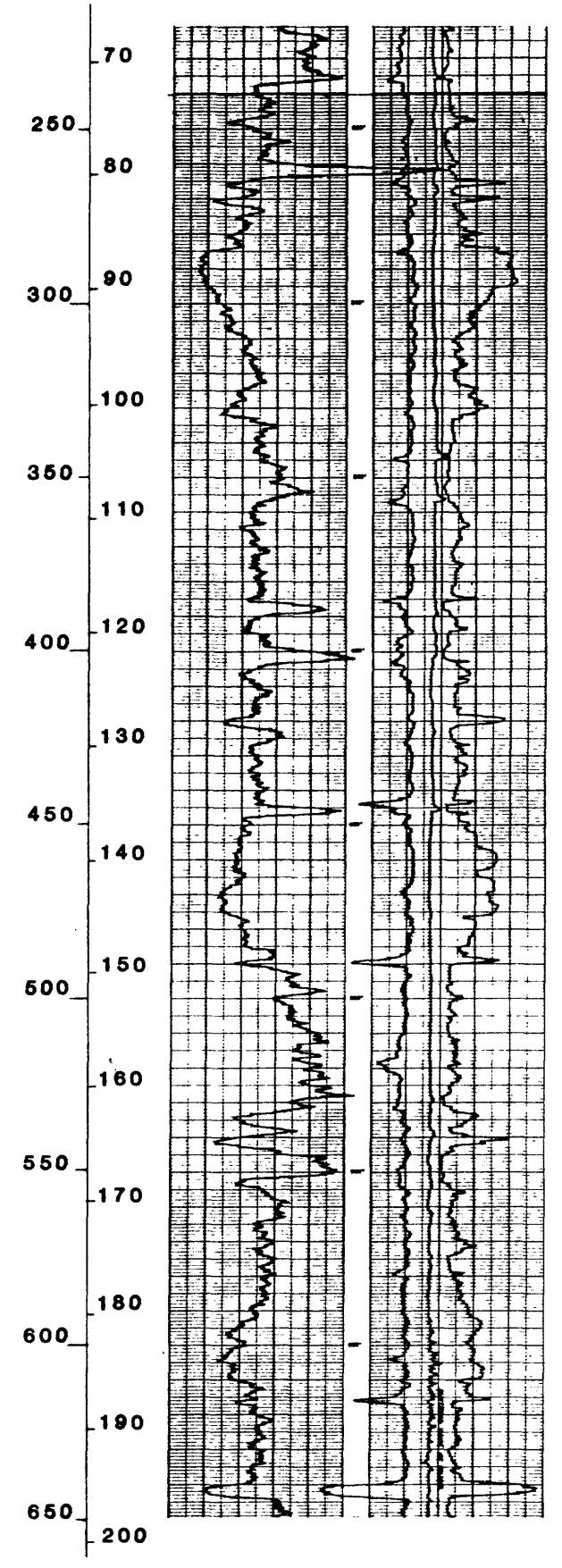
Geophysical Logs



Interval (feet)	Strip Lithology
185-190	Same, with increasing amount of dark-gray shale
190-215	Mostly dark-gray shale; around 210 ft, some very light-gray clay after volcanic ash; contains biotite flakes
215-223	Very dark-gray and light-brownish-gray shales; light-colored shales increase toward base
223-235	Largely light-gray clay/volcanic ash, contains dark minerals; some shale as above; some light-gray very fine grained sandstone
235-260	Some light-gray clay as above; mostly dark-gray shale and dark-gray bentonitic clay
260-265	Claystone, white (after tuff); some fine-grained sandstone
265-285	Claystone, medium-gray and grayish-brown; some medium-gray siltstone; some dark-gray carbonaceous siltstone and a few coal fragments
285-310	Sandstone, medium-light-gray, very fine grained; dark- to medium-gray siltstone. Some claystone
310-323	Same, plus increased amount of gray bentonitic clay
323-335	Sandstone, medium-gray to light-gray, very fine grained; some carbonaceous
335-345	Siltstone, medium-dark-gray, some dark-gray shale
345-360	Claystone, gray; some dark-gray and medium-gray shale
360-385	Shale, as above; a few rare coal fragments
385-390	Clay, gray (after tuff?), some dark-gray shale and rare coal

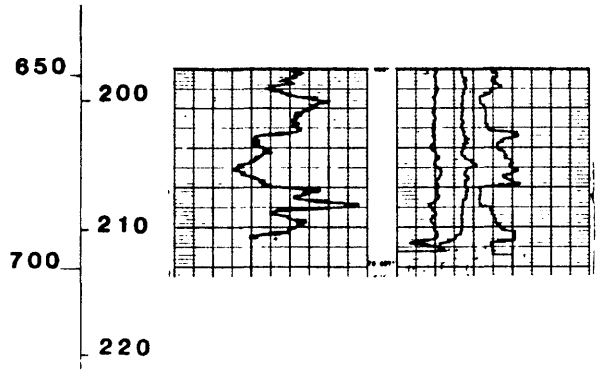
Depth Log

Geophysical Logs



Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
390-400	Dark-gray shale and gray claystone, some fine-grained sandstone						
400-405	Clay (after tuff), light-brownish-gray; and gray shale. A few coal fragments						
405-410	Sandstone, gray, fine-grained, some shale and light-gray clay fragments						
410-418	Mostly shale, medium-dark-gray						
418-425	Sandstone, gray, fine-grained; some dark-gray shale and minor carbonaceous shale						
425-442	Shale, very dark-gray to medium-dark-gray, some siltstone, gray, and carbonaceous shale						
442-450	Clay, very light-gray (after tuff), a few coal chips, some dark-gray shale and minor siltstone						
450-485	Sandstone, light- to medium-gray, fine- to medium-grained; minor gray shale and siltstone						
485-488	Shale, gray, and carbonaceous sandstone						
488-491	Coal						
491-530	Shale, dark-gray and medium-gray, siltstone, and light-gray fine- to medium-grained sandstone						
530-545	Mostly sandstone, light-gray to yellowish-gray, some medium-dark-gray shale and siltstone						
545-550	Mostly medium-dark-gray shale						
550-555	Sandstone, light-gray, very fine grained						
555-565	Mostly medium dark-gray shale and siltstone, some sandstone as above						

Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
565-590	Interbedded sandstone, gray and tan, fine- to medium-grained, and shale and siltstone, dark-to medium-gray						
590-610	Sandstone, gray and tan, fine- to medium-grained, minor amount white clayey sandstone (originally tuffaceous sandstone?), and minor amounts dark-gray shale and carbonaceous shale						
610-639.6	Roughly subequal amounts of sandstone, light-gray, very fine to fine-grained; shale, medium-dark-gray, and siltstone, dark-gray. Some white claystone and tuffaceous (clayey) sandstone. Thin coal bed at 615 ft						
639.6-644	Coal						
644-666	Shale, gray and dark-gray, some silty; some sandstone, gray, fine-grained (e.g. at 655 ft); some white sandy clay (after tuffaceous sandstone?)						
666-680	Sandstone, gray, very fine to fine-grained, some medium-gray shale and white claystone; a few shell fragments (pelecypod)						
680-700	Interbedded shale, medium and dark-gray, and sandstone, gray, fine-grained. Some fine-grained white clayey sandstone (as at 685 ft); originally tuffaceous sandstone? Some coal fragments; perhaps a thin coal bed at 694 ft						



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER CG-3 DATE LOGGED 8/20/78 SURFACE ELEVATION(ft) 7050

LOCATION: SE 1/4 SW 1/4 Sec. 18 T. 18 N. R. 116 W. Quad. Cumberland Gap

COUNTY Uinta STATE Wyoming TOTAL DEPTH(ft) 980

CORED; YES X NO INTERVAL(s) 75.0-79.6; 200.0-205.1; 223.0-232.5; 333.0-340.2; 365.0-373.4; 570.5-579.9

DRILLING MEDIUM; AIR FOAM MUD X WATER OBSERVATION WELL

GEOPHYSICAL LOGS;

Natural Gamma ;	Scale 20 cps/log div.	Logging Speed 20	fpm
Gamma Gamma Density;	Scale 125 cps/log div.	Logging Speed 20	fpm
Resistivity ;	Scale 10 ohms/log div.	Logging Speed 20	fpm
Caliper ;	Scale 1 in./log div.	Logging Speed 40	fpm

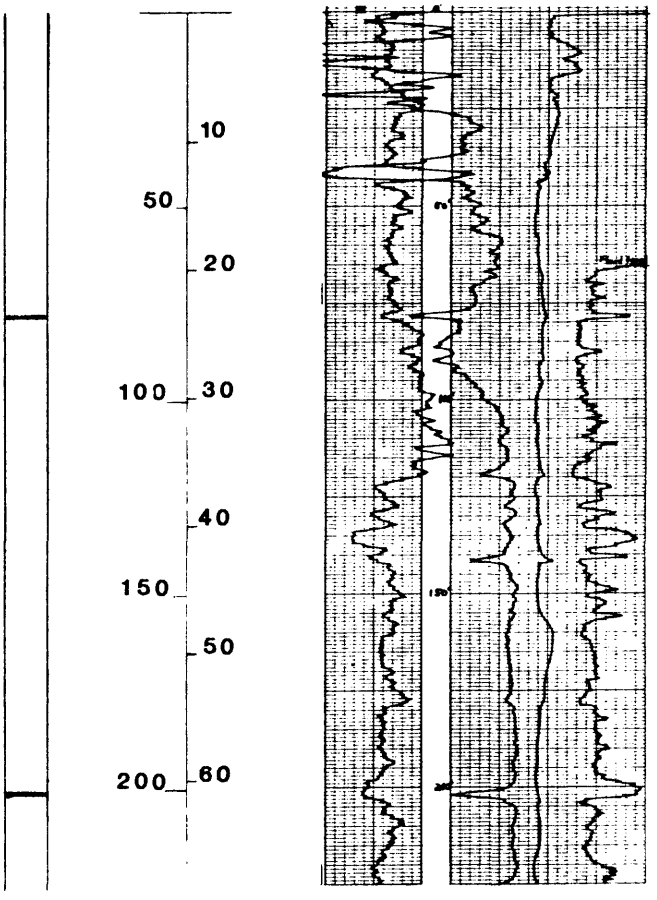
BEDDING ATTITUDE; Strike North Dip 17°-18° W.

Interval (feet)	Lithology
0- 10	Alluvium, plus some dark-gray claystone and fine- to medium-grained tan sandstone
10- 30	Shale (claystone), dark-gray, and sandstone, tan, fine-grained
30- 40	Mostly claystone as above
40- 50	Claystone, medium-gray, carbonaceous; sandstone, medium-gray, very fine grained; a few coal fragments
50- 60	Mostly sandstone as above
60- 75	Shale, medium-gray, silty, some carbonaceous; some medium-gray very fine grained sandstone
75- 80	Shale, medium-gray and brown; some sandstone as above. Core shows 1.4 ft of coal
80- 95	Shale, medium-gray and greenish-gray, some silty; siltstone, medium-gray

Strip Log

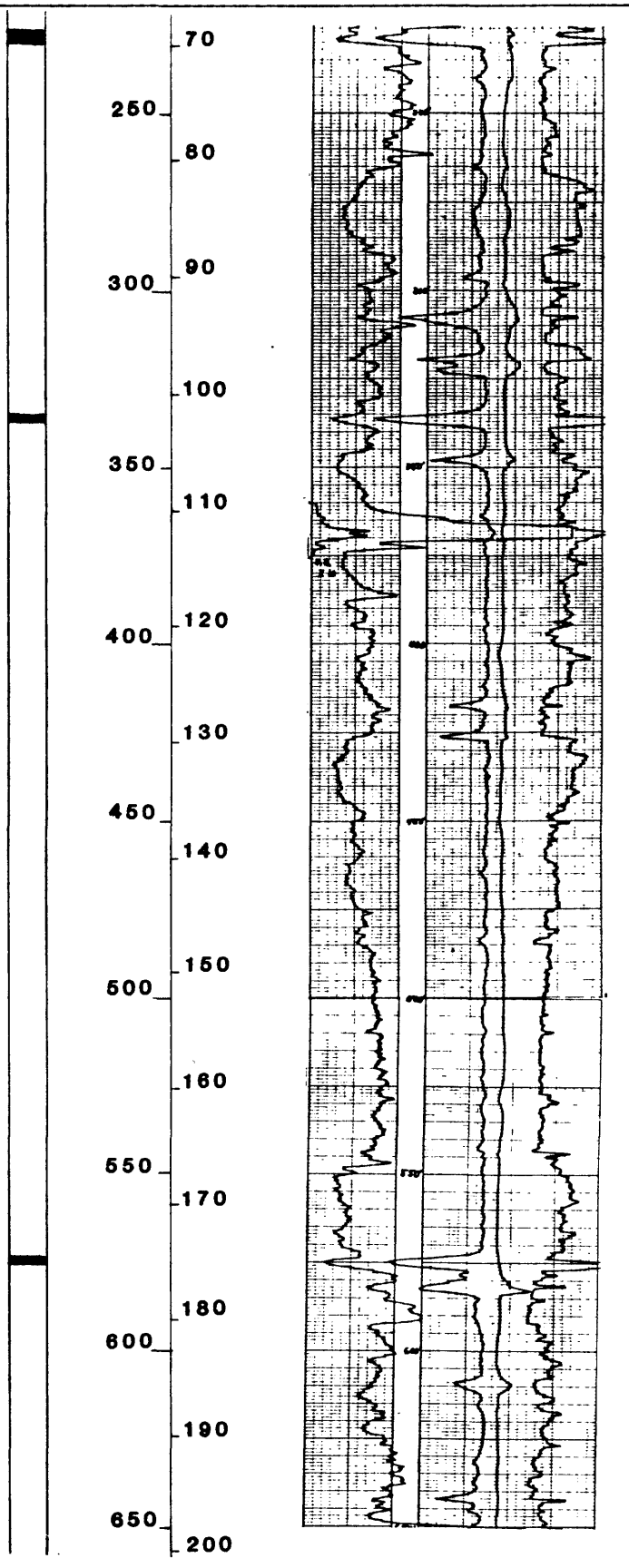
Depth ft m

Geophysical Logs: Gamma Den Res



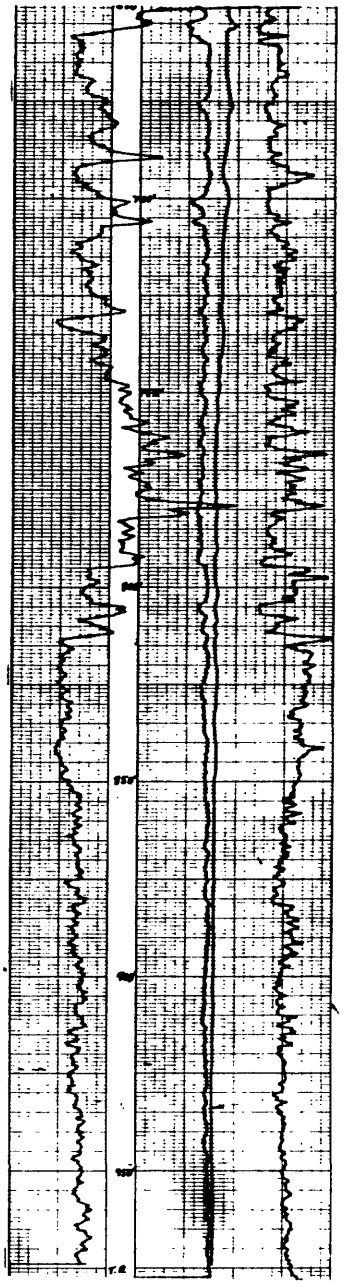
Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
95-120	Shale and siltstone as above; some white, fine-grained sandstone, and pink, very fine grained sandstone; very light-gray clay (after tuff) at about 110-115 feet						
120-145	Sandstone, gray and very light-gray, fine-grained; siltstone and shale, medium-gray to greenish-gray; some white clay (after tuff), minor brown carbonaceous shale						
145-165	Shale, medium-gray, silty; gray bentonite clay; some very fine grained gray sandstone						
165-190	Sandstone, light-gray, fine- to medium-grained, locally clayey (originally probably tuffaceous); some medium-gray shale						
190-195	Sandstone and shale as above, plus sandy gray claystone (bentonitic)						
195-200	Mostly sandstone, medium-gray, very fine-grained, and gray siltstone						
200-205	Coal, 1.4 ft thick in core; shale, medium-gray to medium-brown; some medium-light-gray, very fine grained sandstone						
205-225	Sandstone, gray, fine-grained; some medium-gray shale and siltstone; minor light-gray clay (after tuff) at about 209 ft. Percentage of sandstone increases toward base of interval						
225-235	Coal, 4.3 ft thick in core; overlain by 3 ft of sandstone, light-gray, very fine to fine-grained; underlain by carbonaceous shale and light-gray shale						

Interval (feet)	Lithology
235-260	Shale, brownish-gray; light-gray sandy clay (after tuff); some fine-grained gray sandstone
260-265	Tuff, sandy, and light-gray clay; minor carbonaceous shale
265-290	Sandstone, light-gray, fine- to medium-grained, with a fairly high percentage of dark minerals; some light-gray siltstone and light-gray to white sandy clay (after tuff); minor brownish-gray shale and carbonaceous shale
290-295	Tuff, white, clayey and sandy; some sandstone and siltstone as above
295-330	Mostly sandstone, light-gray, fine-grained, some with a high percentage of dark minerals; siltstone and shale, dark-medium-gray; some clay, white to gray, sandy; minor carbonaceous shale
330-340	Coal, 2.5 ft thick in core; overlain by light-gray, fine-grained sandstone which grades downward into siltstone and carbonaceous shale. Underlain by thin carbonaceous shale layer, then light-gray shale
340-365	Sandstone, light-gray, very fine- to fine-grained, some with dark minerals, chert, and rock fragments; siltstone and silty shale, medium-gray; some white sandy clay (after tuff)



Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
365-375	Sandstone, light-gray with some darker bands, fine- to medium-grained, tuffaceous; sandstone, medium-light-gray and dark, slightly brownish gray, very fine to medium grained, tuffaceous. Thinly bedded to laminated; relatively radioactive						
375-385	Sandstone, light and medium-gray, fine-grained						
385-390	Sandstone, light-gray, fine-grained, clayey (originally tuffaceous sandstone?)						
390-425	Sandstone, as above, plus dark-brownish-gray siltstone. Some sandy white clay and clayey sandstone below 410 ft; considerable dark-brownish-gray shale below 415 ft						
425-490	Sandstone, light-gray, some clayey (after tuff); some dark-gray shale and siltstone. Some carbonaceous shale between 425-430 ft						
490-545	Shale, dark-gray to brownish, silty; minor gray, fine-grained sandstone						
545-570	Shale as above, but mainly light-gray, very fine to fine-grained sandstone. Rare tan carbonaceous shale between 545-550 ft						
570-580	Coal, 3 ft thick in core; overlain by carbonaceous sandstone; underlain by carbonaceous shale and clayey tuff						

Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma Den Res
580-595	Carbonaceous shale; medium-gray shale; some white sandy claystone (after tuff); minor fine-grained sandstone		650	200	
595-625	Shale, medium-gray, dark-gray, and brown; light-gray, very fine to fine-grained sandstone; rare white claystone (after tuff)		700	210	
625-645	Shale and siltstone, medium-gray and medium-dark-gray; minor light-gray fine-grained sandstone		750	220	
645-660	Same constituents; increase in amount of sandstone, plus some claystone (after tuff)		800	230	
660-670	Sandstone, gray, fine-grained, and gray siltstone		850	240	
670-690	Shale, medium-gray, some dark-gray; gray very fine to fine-grained sandstone and siltstone. Some sandstone, clayey, (originally tuffaceous?), as at 690 ft		900	250	
690-700'	Sandstone, very fine to fine-grained; some medium-gray shale		950	260	
700-710	Shale, medium-gray and medium-dark-brownish-gray; some white clayey sandstone (originally tuffaceous)		1000	270	
710-745	Sandstone, light-gray, very fine to fine-grained; shale, some siltstone, medium-gray to medium-dark-brownish-gray; some light-gray claystone (after tuff)			280	
				290	
				300	



Interval (feet)	Strip Lithology	Depth Log	Geophysical Logs ft	m	Gamma	Den	Res
745-795	Apparently interbedded sandstone, gray, very fine to fine-grained, and shale, light and medium-gray. Below 775 ft encounter small platy fragments of porcellanite. High gamma log readings probably from tuffaceous sandstones and the porcellanites in the sequence						
795-815	Shale and siltstone, dark-brownish-gray; porcellanite; some white claystone (after tuff)						
815-850	Shale, medium-gray and dark-gray; tan sandy siltstone and shale; some very fine to fine-grained gray sandstone						
850-980	Interbedded shale, medium- and dark-gray; brownish siltstone; some white claystone and minor gray and tan fine-grained sandstone						

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER B-1 DATE LOGGED 8/3/78 SURFACE ELEVATION(ft) 6670

LOCATION: SW 1/4 SW 1/4 Sec. 2 T. 17 N. R. 117 W. Quad. Bridger

COUNTY Uinta STATE Wyoming TOTAL DEPTH(ft) 560

CORED; YES X NO INTERVAL(s) 301.6-314.6; 336.0-361.0

DRILLING MEDIUM; AIR FOAM MUD WATER OBSERVATION WELL

GEOPHYSICAL LOGS;

Natural Gamma ; Scale 20 cps/log div. Logging Speed 15 fpm

Gamma Gamma Density; Scale 125 cps/log div. Logging Speed 15 fpm

Resistivity ; Scale 12.5 ohms/log div. Logging Speed 15 fpm

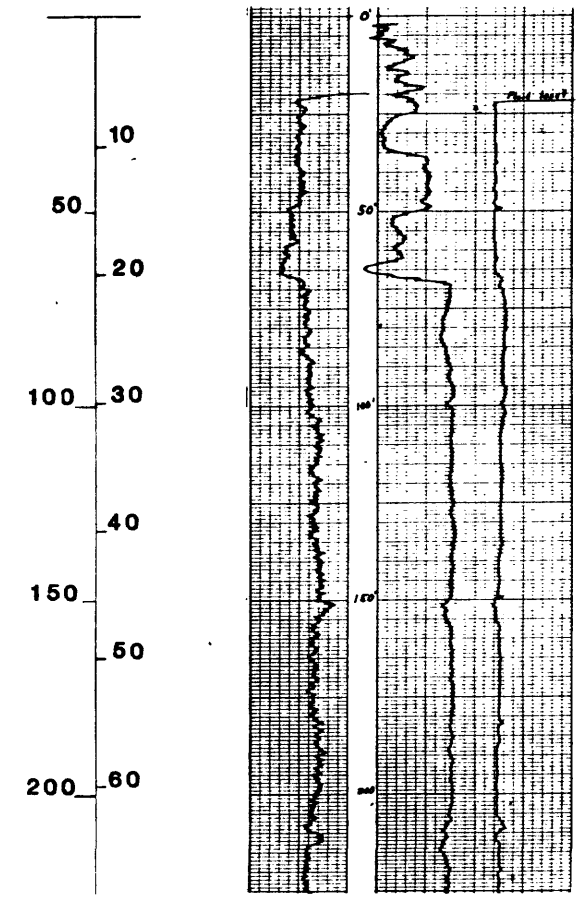
Caliper ; Scale ---- Logging Speed -- fpm

BEDDING ATTITUDE; Strike N. 15° E. Dip 35°-36° W.

Interval (feet)	Strip Lithology
0- 60	Shale, dark gray
60- 80	Sandstone, medium-gray, fine-grained, and dark-gray shale
80- 85	Shale, dark-gray, silty
85-100	Shale, dark-gray, and fine-grained sandstone
100-105	Shale, dark-gray
105-130	Shale, dark-gray and some fine-grained medium-gray sandstone
130-140	Shale, dark-gray, slightly silty, hard
140-215	Shale, dark-gray, slightly silty, hard
215-225	Shale as above; some fine-grained sandstone; some shell fragments
225-230	Sandstone, fine- to medium-grained and dark-gray shale
230-240	Shale, dark-gray; silty shale; some sandstone grains
240-260	Sandstone, medium-gray, fine- to medium-grained, and dark gray shale

Depth Log

Geophysical Logs



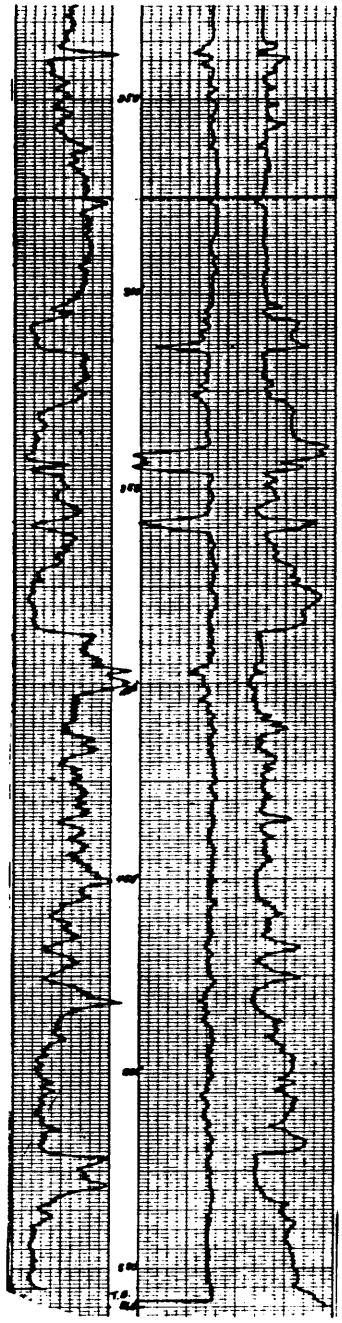
Interval (feet)	Lithology
260-300	Shale, dark-gray, sandy and silty, and fine- to medium-grained, gray, carbonaceous sandstone
300-315	Coal; sandstone, light-gray, fine-grained; medium-dark-brownish-gray shale; some oyster shell fragments
315-340	Sandstone, gray, fine-grained; some silty dark-gray shale and carbonaceous sandstone
340-360	Coal; sandstone, light-gray, fine- to medium-grained, carbonaceous; siltstone, medium-dark-gray, sandy; and shale, medium-dark-grayish-brown, silty
360-370	Shale, dark-gray; siltstone, medium-dark-gray; minor sandstone
370-385	Sandstone, light-gray; siltstone, dark-gray
385-395	Shale and siltstone, dark-gray; some sandstone
395-405	Shale, dark-gray, silty; minor coal fragments
405-455	Shale, medium-gray and dark-gray carbonaceous; siltstone, dark-gray, some carbonaceous, minor light-gray sandstone
455-480	Sandstone, light-gray, fine-grained, some carbonaceous; some medium-dark-gray shale; some silty shale
480-485	Shale, medium-dark-gray
485-520	Sandstone, gray and light-greenish-gray, very fine to medium-grained; some shell material; minor shale

Strip Log

Depth

ft	m
	70
250	80
300	90
	100
350	110
400	120
	130
450	140
	150
500	160
550	170
	180
600	

Geophysical Logs



Interval (feet)	Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Den	Res
520-530	Shale, dark-gray; some medium-gray, fine-grained sandstone						
530-560	Sandstone, gray and tan, fine- to medium-grained, locally carbonaceous, some gray shale						

LITHOLOGIC DESCRIPTIONS OF CORE SAMPLES

Description of Core From Drill Hole E-1

Drilled July 30, 1978 to July 31, 1978
Total depth of hole (T.D.) = 665 feet
Cored interval no. 1: 139.6 to 146.2 feet
Bedding Attitude: strike North dip 22° W

Lithologic Description

	Thickness (feet)	Depth (feet)
Shale, medium-light to olive-brown-gray, slightly carbonaceous, silty	1.1	139.55
Shale, carbonaceous	0.1	
Shale, carbonaceous, medium-light to olive-brown-gray, slightly carbonaceous, silty	0.15	
Shale, carbonaceous	0.1	
Shale, broken along more carbonaceous layers	0.25	
Coaly parting	0.05	
Shale, carbonaceous, grading at base into coal	0.2	
Coal, grading at base into carbonaceous shale	0.8	
Shale, carbonaceous, with patchy light-gray shale partings	0.4	
Volcanic tuff, light-gray, medium-grained; sandy. 0.05′ layer at top very clayey, cream-colored	1.1	
Shale, carbonaceous, with coaly stringers; grades downward into gray shale	1.4	
Shale, slightly brownish light gray, with carbonaceous stringers (after rootlets?)	0.3	
Volcanic tuff, light-gray, clayey, with crushed gray shale partings	0.25	

Cored interval no. 1: 139.6 to 146.2 feet--continued

Lithologic Description

	Thickness (feet)	Depth (feet)
Shale, light-gray, with scattered carbonaceous blebs (rootlets?) and a clayey tuff parting 0.2 feet from top----------	0.4	
Total	6.60	146.15 = 146.2

Cored interval no. 2: 235.0 to 244.9 feet

Lithologic Description

Sandstone, light-gray, very fine grained to fine-grained---------	1.37	235.0
Shale, medium-light-gray, sandy, with darker shale layers--------	0.2	
Shale, medium-dark-gray, slightly carbonaceous------------------	0.5	
Shale, dark-brown, carbonaceous (crumbled zone)-----------------	0.3	
Shale, medium-dark-brownish-gray, mottled with lighter gray patches. Lower part crumbled----------	1.0	
Coal; upper part crumbled. Grades downward into shale----------	0.6	
Shale, carbonaceous. Grades downward into lighter gray shale----	0.15	
Shale, light-brown-gray, with carbonaceous stringers; grades downward into tuff----------	0.55	
Tuff, light-gray to light-brownish-gray. Upper 0.6 feet graded--	1.8	
Coal----------	1.6	
Shale, carbonaceous. Grades downward into clayey tuff----------	0.1	
Tuff, clayey----------	0.2	
Siltstone, light-gray, shaly; contains fragments of sandstone in lower part----------	0.9	
Sandstone, very fine grained----------	0.65	
Total	9.92	244.92 = 244.9

Cored interval no. 3: 309.5 to 318.6 feet

Lithologic Description

	Thickness (feet)	Depth (feet)
Sandstone, light-gray, fine- to medium-grained. Shale chips at 0.9′ and 1.5′ from top	1.55	309.5
Coal, crushed top and bottom. (Some dirt included when driller "roded up" at this point)	2.3	
Coal, slightly boney	1.0	
Shale, carbonaceous	0.2	
Coal, slightly boney (?)	0.7	
Shale, medium-brownish-gray, soft, slightly crumbled	0.2	
Shale, medium-brownish-gray, hard, slighjtly carbonaceous	0.1	
Shale, light- to medium-gray, slightly brownish, hard. Very fine grained sandstone and siltstone layers at 1.7 and 1.9 feet from top	3.05	
Total	9.10	318.6

Cored interval no. 4: 367.4 to 377.6 feet

Lithologic Description

Shale, medium-dark-brown, sandy-silty	0.3	367.4
Shale, carbonaceous	0.3	
Coal	3.8	
Shale, dark-brown, carbonaceous	0.45	
Shale, medium-light-gray, medium-dark-brown shale in swirly layers	0.8	
Shale, medium-light-gray, scattered darker shale patches and blobs (burrows?)	4.55	
Total	10.20	377.6

Description of Core From Drill Hole E-2

Drilled July 29, 1978
Total depth of hole (T.D.) = 780 feet
Cored interval: 141.0 feet to 151.0 feet
Bedding attitude: strike North dip 22° W.

Lithologic Description

	Thickness (feet)	Depth (feet)
Shale, carbonaceous	0.6	141.0
Shale, carbonaceous at top to medium-gray at base	0.4	
Volcanic tuff, light tan	0.3	
Shale, medium-brown	0.15	
Shale, carbonaceous, and boney coal	0.55	
Coal, locally shaley	1.7	
Shale, carbonaceous	.7	
break; removed core from barrel; resumed coring	?	
Shale, carbonaceous	1.7	
Crumbled carbonaceous shale zone	0.1±	
Shale, medium dark brown, slightly carbonaceous	0.4	
Transition zone to medium-light-gray shale	0.25	
Shale, medium-light-gray, with dark shale clasts	0.6	
Sandstone, light-gray, very fine grained	2.0	
Sandstone, light-gray, very fine grained, with crossbedding and patches of dark shaly material	0.55	
Total	10.00	151.00

Description of Core From Drill Hole CG-1

Drilled September 6 to September 7, 1978
Total depth of hole (T.D.) = 460 feet
Cored interval no. 1: 241.2 to 250.5 feet
Bedding Attitude: strike N. 27° E. dip 24° W.

Lithologic Description

	Thickness (feet)	Depth (feet)
Shale, medium-dark-gray, silty, interlayered with sandstone, light-gray, very fine to fine-grained. Layers range from 0.02 to 0.3 feet, average about 0.2 feet. Some sandstone layers are crossbedded, with laminae abutting steeply against the shale layers, and some show graded bedding. Pyrite common on fracture surfaces----------	6.5	241.2
Coal, fractured----------	1.5	
Gap, pebble lodged in core barrel----------	0.65±	
Coal, crushed and ground----------	0.6	
	9.25	250.45 = 250.5
Estimated additional coal in bed (not retrieved)----------	1.65	

Cored interval no. 2: 294.0 feet to 303.9 feet

Lithologic Description

	Thickness (feet)	Depth (feet)
Sandstone, light-gray, fine- to medium-grained, laminated-------	1.0	294.0
Coal stringer----------	0.12	
Sandstone, with coal fragments----------	0.43	
Coal----------	0.93	
Shale, light-brownish-gray with light-gray, irregular shale patches, carbonaceous, top 0.1 feet----------	1.23	
Sandstone, light-gray, very fine grained, some pyrite on fracture surfaces----------	0.86	
Shale, medium-light-gray, with brownish-gray layers and blebs; rare carbonaceous blebs (rootlets ?)----------	2.86	
Shale, medium-brown-gray, with lighter gray layers, locally carbonaceous with coaly streaks----------	1.4	
Shale, medium-brown; carbonaceous, with 0.2 feet boney coal at top and coaly layers below----------	1.05	
Total	9.88	303.88 = 303.9

LITHOLOGIC DESCRIPTIONS OF CORE SAMPLES

Description of Core From Drill Hole CG-2

Drilled September 4 to September 5, 1978
Total depth of hole (T.D.) = 700 feet
Cored interval: 633.2 feet to 646.0 feet
Bedding Attitude: strike N. 5 E. dip 19°-20° W.

Lithologic Description

	Thickness (feet)	Depth (feet)
Shale, medium-dark-gray, with silty bands and layers; some soft sediment breccia bands----------	1.45	633.2
Sandstone, light-gray, very fine grained----------	0.25	
Shale----------	0.2	
Sandstone and siltstone, very fine grained----------	0.8	
Shale, medium-dark-gray, and siltstone----------	0.47	
Sandstone, very fine to fine-grained----------	0.8	
Shale, medium-dark, slightly brownish-gray, some siltstone layers----------	2.44	
Coal, very shattered----------	3.65	
Coal, fractured----------	0.75	
Shale, medium-dark-brown-gray, mottled with light-gray patches; becomes medium-gray lower 0.7 feet----------	2.00	
	12.81	646.01 = 646.0

Description of Core From Drill Hole CG-3

Drilled July 31, 1978 to September 2, 1978
Total depth of hole (T.D.) = 980 feet
Cored interval no. 1: 75.0 to 79.6 feet
Bedding Attitude: strike North dip 17°-18° W

Lithologic Description

	Thickness (feet)	Depth (feet)
Shale, medium-gray	0.1	75.0
Sandstone, medium-light-gray, very fine grained. Base grades downward into shale	1.5	
Shale, medium-dark-brownish gray; lower part very shattered	1.1	
Coal	1.4	
Shale, medium-brown	0.5	
Total	4.6	79.6

Cored Interval No. 2: 200.0 feet to 205.1 feet

Lithologic Description

	Thickness (feet)	Depth (feet)
Sandstone, light-gray, fine- to medium-grained, "dirty" (contains feldspar grains, chert and rock fragments), and has carbonaceous and coaly streaks. Coaly streaks at 0.1, 0.3, 0.5, 0.65, and 1.0 feet from top	1.35	200.0
Coal, crumbly	1.3	
Shale, medium-light-gray, silty. Some carbonaceous streaks and minor pyrite in top 0.5 feet	2.4	
Total	5.05	205.05 = 205.1

Cored interval no. 3: 223.0 to 232.5 feet

Lithologic Description

	Thickness (feet)	Depth (feet)
Sandstone, light-gray, very fine to fine-grained, "dirty", (contains feldspar grains, chert, and rock fragments); shows banding with layers slightly richer in dark minerals, and a few carbonaceous filaments. Shale layer at 2.86 feet from top, and shale chips at bottom----------	3.27	223.0
Coal, broken, sticky (stuck to core barrel)----------	1.9	
Coal----------	0.65	
Coal, boney (shaly?)----------	0.2	
Coal----------	1.55	
Shale, carbonaceous; coaly streak at 0.44 feet from top. Grades into gray shale at base----------	0.5	
Shale, medium-light-gray, with scattered carbonaceous blebs (rootlets?)----------	1.45	
Total	9.52	232.52 = 232.5

Cored interval no. 4: 333.0 to 340.2 feet

Lithologic Description

	Thickness (feet)	Depth (feet)
Sandstone, light-gray, fine-grained, grades downward to very fine grained; mottled and banded, carbonaceous	2.15	333.0
Siltstone, interlaminated with very fine grained sandstone, medium-gray, carbonaceous	0.68	
Shale, medium-dark-brown, carbonaceous, mixed with boney coal-	0.32	
Coal, very shattered	2.45	
Shale, dark medium brown, carbonaceous, with thin coaly partings	0.6	
Shale, medium-light-gray with scattered carbonaceous fragments and blebs; becomes silty in lower part	1.0	
Total	7.2	340.2

Cored interval no. 5: 365.0 feet to 373.4 feet

Lithologic Description

	Thickness (feet)	Depth (feet)
Sandstone, light-gray, fine- to medium-grained, contains minor chert, rock fragments, mica flakes, weathered feldspar and some tuff (?) grains. Some pyrite along fractures	1.05	365.0
Sandstone as above, but contains darker bands and layers	1.65	
Sandstone, medium-light-gray and dark, slightly brownish gray, very fine to medium-grained, mostly fine-grained, tuffaceous. Thinly-bedded to laminated. Contains pyrite, chalcopyrite (?), mainly in interval 1.3 to 1.7 feet from top. Gave high reading on gamma ray log (about 1400 counts per second)	4.4	
Sandstone, light-gray, with some darker bands, medium- to fine-grained, tuffaceous	1.25	
Total	8.35	373.4

Cored interval no. 6: 570.5 to 579.9 feet

Lithologic Description

	Thickness (feet)	Depth (feet)
Sandstone, light-gray, carbonaceus layers	3.12	570.5
Coal, boney	0.4	
Coal	2.05	
Coal, boney	0.4	
Tuffaceous shale break	0.1	
Shale, brown, carbonaceous. Grades downward into gray shale	0.75	
Shale, gray, with carbonaceous bands and layers	0.82	
Shale, carbonaceous	0.1	
Tuff, shaly, carbonaceous	0.15	
Tuff	0.1	
Tuff, shaly, carbonaceous	0.1	
Shale, carbonaceous	0.2	
Tuff, shaly and carbonaceous, top and bottom	0.25	
Shale, carbonaceous	0.83	
Total	9.37	579.87 = 579.9

LITHOLOGIC DESCRIPTIONS OF CORE SAMPLES

Description of Core From Drill Hole B-1

Drilled September 7 to September 8, 1978
Total depth of hole (T.D.) = 560 feet
Cored interval no. 1: 301.6 to 314.6 feet
Bedding Attitude: strike N. 15 E. dip 35°-36° W

Lithologic Description

	Thickness (feet)	Depth (feet)
Sandstone, light-gray, fine-grained, shows crossbedding---------	3.25	301.6
Shale, medium-dark-gray-brown, with very fine grained sandstone layers----------	1.3	
Sandstone, light-gray, fine-grained, with thin shale layers-----	0.43	
Shale, medium-dark-brownish-gray; pyrite in fractures----------	0.9	
Sandstone, light-gray, fine-grained, as above----------	5.4	
Coal, shattered, contains pyrite----------	1.25	
Shale, carbonaceous with coaly stringers----------	0.5	
	13.03	314.63 = 314.6

Cored interval no. 2: 336.0 to 361.0 feet

Lithologic Description

	Thickness (feet)	Depth (feet)
Sandstone, light-gray, fine- to medium-grained, with a few carbonaceous layers	3.2	336.0
Sandstone, light-gray, fine- to medium-grained, carbonaceous. Coarser grained upper 0.2 feet, finer grained toward base; shows a gradational contact with underlying coal	0.9	
Coal, top 0.1 feet sandy, badly fractured at base, contains some pyrite. Thickness somewhat approximate	2.85	
Tonstein, sandy	0.1	
Tonstein	0.7	
Coal, somewhat shattered	1.7	
Shale, medium-dark-grayish-brown, sandy-silty	0.2	
Siltstone, dark-medium-gray, sandy, some shale	0.75	
Siltstone, as above, with irregular layers and blebs of fine-grained light-gray sandstone. Sandstone patches particularly prominent at 0.9-1.6 feet from top and also below 3.7 feet from top	6.3	
Sandstone, light-gray, fine-grained, interbedded with medium-dark-grayish-brown siltstone. Toward base sandstone decreases in amount, and occurs in irregular layers and blebs in the siltstone	2.4	
Shale, medium-dark-grayish-brown, silty	2.97	
Coal; upper 0.25 feet contains sandstone and siltstone lenses. An incomplete sample; core stopped in coal, and electric log shows approximately 3 feet of coal in this bed	2.9	
Total	24.97	360.97 = 361.0

Table 2. Proximate and ultimate analyses, heat content, forms-of-sulfur, and ash fusion temperature determinations for 12 coal samples from the Frontier Formation, Lincoln and Uinta Counties, Wyoming

[All analyses except heat content, and ash fusion temperatures, in percent. For each sample number, the analyses are reported three ways: first, as received; second, moisture free; and third, moisture and ash free. All analyses by Coal Analysis Section, U.S. Department of Energy, Pittsburg, Pa. To convert degrees fahrenheit to centigrade, subtract 32° and multiply by 5/9; to convert BTU/lb to Kcal/kg, multiply by 5/9. Leaders (---) indicate no data. All samples are from the Frontier Formation of Cretaceous age. Samples from drill hole B-1 are from the Kemmerer coal zone and the rest are from the Spring Valley coal zone; none of the beds have formal names. See figures 1- 4 for locations and table 1 for data on drill holes]

	Depth interval	Proximate analysis			Ultimate Analysis						Heat content		Forms of sulfur			Ash fusion temperature F°		
Drill hole & sample	in feet (meters)	Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur	Btu/lb	Air dried loss	Sulfate	Pyritic	Organic	Initial deform.	Soften.	Fluid
E-1	241.5-243.1	5.7	37.7	48.0	8.6	5.6	69.5	1.5	14.6	.3	12327	2.3	.01	.02	.32	2380	2510	2630
B	(73.6- 74.1)	---	40.0	50.9	9.1	5.3	73.7	1.6	10.0	.4	13079	---	.01	.02	.34			
		---	44.0	56.0	---	5.8	81.1	1.7	11.0	.4	14386	---	.01	.03	.38			
E-1	311.1-315.2	6.7	34.5	42.7	16.1	5.4	62.1	1.2	14.8	.4	11032	3.5	.01	.06	.37	2310	2440	2580
C	(94.8- 96.1)	---	37.0	45.7	17.3	5.0	66.5	1.3	9.4	.5	11824	---	.01	.06	.40			
		---	44.8	55.2	---	6.1	80.4	1.5	11.4	.6	14297	---	.01	.08	.48			
E-1	368.0-371.8	7.2	36.1	48.0	8.7	5.7	68.0	1.2	16.0	.5	12014	4.0	.01	.04	.44	2330	2430	2530
D	(112.2-113.3)	---	38.9	51.8	9.3	5.3	73.3	1.3	10.3	.5	12945	---	.01	.04	.48			
		---	42.9	57.1	---	5.8	80.8	1.4	11.4	.6	14276	---	.01	.05	.52			
E-2	143.4-144.7	5.9	31.4	38.3	24.4	4.6	55.8	1.2	13.5	.6	9866	2.4	.01	.05	.52	2590	2680	2790
B	(43.7- 44.1)	---	33.4	40.7	25.9	4.2	59.3	1.3	8.8	.6	10479	---	.01	.05	.56			
		---	45.1	54.9	---	5.6	80.0	1.7	11.9	.8	14146	---	.01	.07	.75			
CG-2	639.6-644.0	6.0	33.4	43.4	17.2	5.5	61.6	1.2	14.0	.4	10951	2.8	.0	.03	.38	2460	2580	2700
A	(194.9-196.3)	---	35.5	46.2	18.3	5.1	65.6	1.3	9.2	.4	11647	---	.0	.03	.41			
		---	43.5	56.5	---	6.3	80.3	1.6	11.3	.5	14263	---	.01	.04	.50			
CG-3	77.7-79.0	6.8	31.9	42.7	18.6	5.0	59.6	1.2	15.1	.5	10306	3.3	.01	.15	.38	2390	2480	2570
A	(23.7-24.1)	---	34.2	45.8	20.0	4.5	63.9	1.3	9.8	.6	11052	---	.01	.17	.41			
		---	42.7	57.3	---	5.7	79.9	1.6	12.2	.7	13813	---	.01	.21	.51			
CG-3	227.9-230.3	5.3	36.0	44.7	14.0	5.4	64.9	1.3	13.9	.5	11511	2.2	.0	.06	.42	2390	2480	2580
D	(69.5- 70.2)	---	38.0	47.2	14.8	5.1	68.5	1.4	9.7	.5	12149	---	.0	.06	.44			
		---	44.6	55.4	---	6.0	80.4	1.6	11.4	.6	14260	---	.0	.07	.52			
CG-3	336.2-338.7	5.8	36.1	47.1	11.0	5.5	66.7	1.3	15.0	.6	11862	2.7	.01	.12	.51	2450	2540	2630
E	(102.5-103.2)	---	38.3	50.0	11.7	5.1	70.8	1.3	10.4	.7	12591	---	.01	.12	.54			
		---	43.3	56.7	---	5.8	80.1	1.5	11.8	.8	14256	---	.01	.14	.61			
CG-3	573.9-576.0	5.2	31.1	40.7	23.0	4.9	57.9	1.2	12.3	.7	10370	2.0	.01	.16	.55	2740	2800	2800
F	(174.9-175.6)	---	32.8	42.9	24.3	4.6	61.0	1.2	8.1	.8	10934	---	.01	.17	.58			
		---	43.3	56.7	---	6.1	80.6	1.6	10.7	1.0	14436	---	.01	.22	.77			
B-1	340.1-343.0	6.6	35.5	47.1	10.8	5.5	64.6	1.3	16.2	1.5	11512	2.5	.01	.35	1.14	2200	2370	2450
B	(103.7-104.5)	---	38.0	50.4	11.6	5.1	69.2	1.4	11.0	1.6	12331	---	.01	.38	1.23			
		---	43.0	57.0	---	5.8	78.3	1.6	12.5	1.8	13952	---	.01	.43	1.39			
B-1	343.8-345.5	7.0	37.1	48.7	7.2	5.6	67.4	1.4	17.6	.8	12048	3.0	.01	.16	.60	1960	2050	2160
C	(104.8-105.3)	---	39.9	52.4	7.7	5.2	72.5	1.5	12.3	.8	12955	---	.01	.18	.65			
		---	43.3	56.7	---	5.6	78.6	1.6	13.3	.9	14043	---	.01	.19	.70			
B-1	357.7-360.6	5.6	35.5	44.3	14.6	5.4	62.4	1.2	15.5	1.0	11292	1.9	.01	.23	.74	2490	2570	2650
D	(109. -109.9)	---	37.6	47.0	15.4	5.1	66.1	1.2	11.2	1.0	11965	---	.01	.24	.79			
		---	44.4	55.6	---	6.0	78.1	1.5	13.2	1.2	14147	---	.01	.28	.93			