

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLORATORY DRILLING IN THE McCALLUM COAL FIELD,
JACKSON COUNTY, COLORADO,
AUGUST-NOVEMBER 1977

By
Dawn Hill Madden

Open-File Report 77-888

1977

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

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EXPLORATORY DRILLING IN THE McCALLUM COAL FIELD, JACKSON COUNTY,
COLORADO, AUGUST-NOVEMBER 1977

By Dawn Hill Madden

INTRODUCTION

Jim Feighny and Son, Loveland, Colorado, rotary drilled 40 holes and cored the coal in 7 holes in the McCallum coal field, Jackson County, north-central Colorado (figs. 1-12, table 1). The drilling was done under Contract No. 14-08-0001-15798, awarded by the U.S. Geological Survey. Geophysical logging of the holes was done by Minerals Service Company, Grand Junction, Colorado. Savage Scientific, Craig, Colorado, logged one core hole (E-23). The purpose of the drilling was to obtain information about the depth, thickness, extent, and quality of the coal in the Coalmont Formation as part of the Survey's program to evaluate and classify federally owned coal resources. Most of the holes are located within areas nominated for coal leasing by industry.

U.S. Geological Survey personnel provided general supervision of the drilling, which included selecting the drill sites, determining depths to be drilled, and obtaining permission for access from the County and from private surface owners. Survey personnel also described the rocks in the cuttings at each site and compiled and analyzed the drill-hole data. One of the drill holes (G-16) was completed as an observation well. This well will be used to monitor water level and quality over a period of at least 3 years. Water level will be measured quarterly with a steel tape, and samples will be pumped yearly to be tested for major cations and anions and selected trace metals. Data obtained will be used to define the ground-water system and to aid in studies of the hydrologic impact of coal development. These data will be made available upon request from the U.S. Geological Survey, Water Resources Division, Colorado District Office, Lakewood, Colorado.

GEOPHYSICAL LOGS

Geophysical logs for each hole consist of natural gamma (G), spontaneous potential (SP), and resistivity (RES), which were measured with one probe, and density (DEN), which was measured with a separate probe. Where fluid level within the drill hole changed during logging, two fluid levels were recorded on the log. Only one fluid level, that measured by the natural-gamma spontaneous-potential resistivity probe, is listed in the log headings in this report. Geophysical logs were reduced to 20 percent of the original size, and the logging scales listed in the log headings have been changed accordingly. The geophysical logs are oriented so that higher gamma and resistivity and lower rock density readings are recorded to the right. The only exception to the above is the log for hole E-23 (see log on p. 66). The aquifer depth intervals and the quantity of waterflow (gal/min (GPM)) from drillers' logs are shown on the log headings.

LITHOLOGIC LOGS

Lithologic logs were made by adjusting descriptions of 5-foot cuttings intervals to correspond with the geophysical logs.

DRILL-HOLE DEPTHS, DIAMETERS, AND LOCATIONS

Depths of the drill holes range from 40 feet to 800 feet and the diameter of all holes is 4-3/4 inches. Locations and elevations are approximate.

CORE HOLES

Seven of the drill holes (J-2, J-6B, E-7, G-9, J-14, G-16, and E-23) were twin drilled for the purpose of coring the Sudduth coal bed. Core samples have been submitted to the U.S. Bureau of Mines for proximate and ultimate analyses, Btu/lb heating values, forms of sulfur present, and percent ash. The U.S. Geological Survey Analytical Laboratories

in Denver will do the analyses for major, minor, and trace elements.

Results of the analyses will be included in a future report.

COAL GEOLOGY

The major coal-bearing rocks are in the Coalmont Formation of Paleocene and Eocene age, which includes the Sudduth and Capron coal beds. Most of the drill holes were near the outcrop of the steeply dipping Sudduth coal bed, which occurs within 200 feet of the base of the Coalmont Formation and generally contains the thickest and highest quality coal in the area. The outcrop of the Sudduth bed curves around the southern two-thirds of the north-northwest-trending, doubly plunging north and south McCallum anticlines and occurs along the eastern side of the Johnny Moor syncline. Six of the drill holes were along the outcrop of the Capron coal zone (G-4, G-21, G-22, C-30, C-31, and C-32), which is approximately 1,700 feet above the base of the Coalmont Formation and consists of one to several thin, shaly coal beds within the persistent coal zone. The Capron outcrop is on the western flank of the north and south McCallum anticlines.

COAL THICKNESS

Drill-hole data indicate that the Sudduth coal bed is thickest (over 20 feet) along the outcrop in the following locations: T. 8 N., R. 78 W., secs. 2 and 11, and T. 9 N., R. 78 W., secs. 7, 8, 9, 15, 16, 18, 19, 20, 22, 23, 25, 26, 35, and 36.

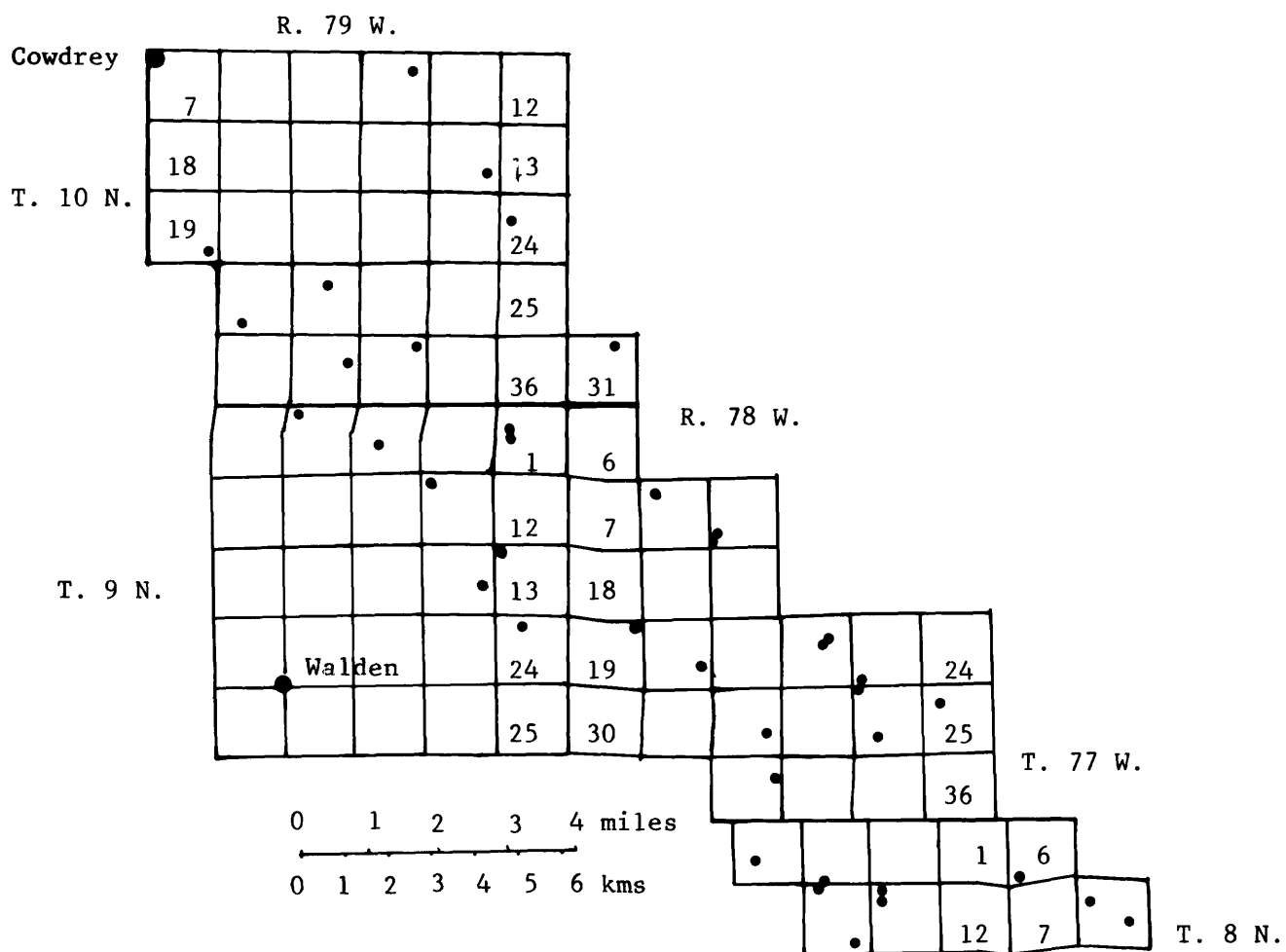


Figure 1.--Map showing drill-hole locations in the McCallum coal field, Jackson County, Colorado.

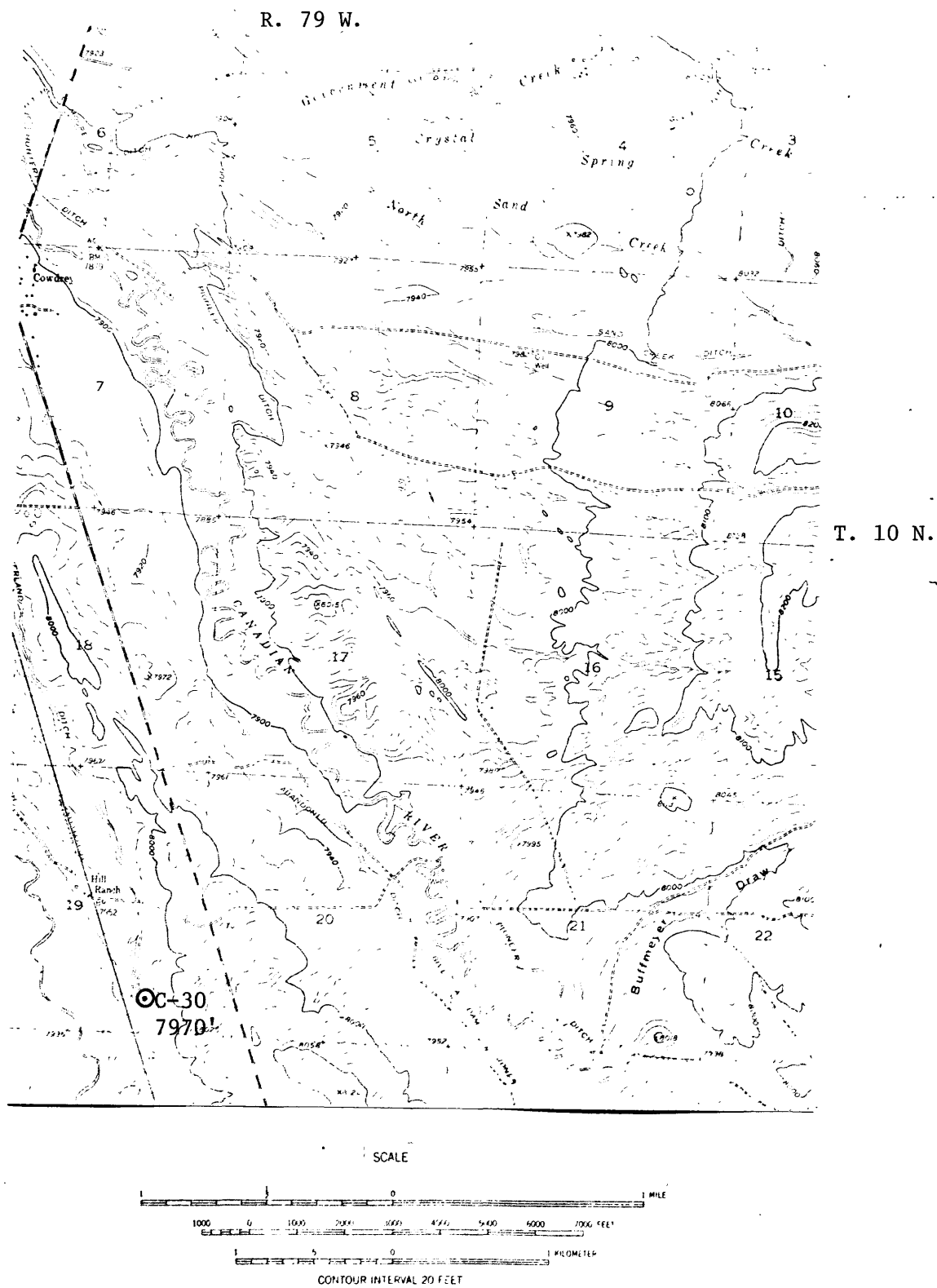


Figure 2. Locations of drill holes, NE $\frac{1}{4}$ of the Cowdrey quadrangle, Jackson County, Colorado.

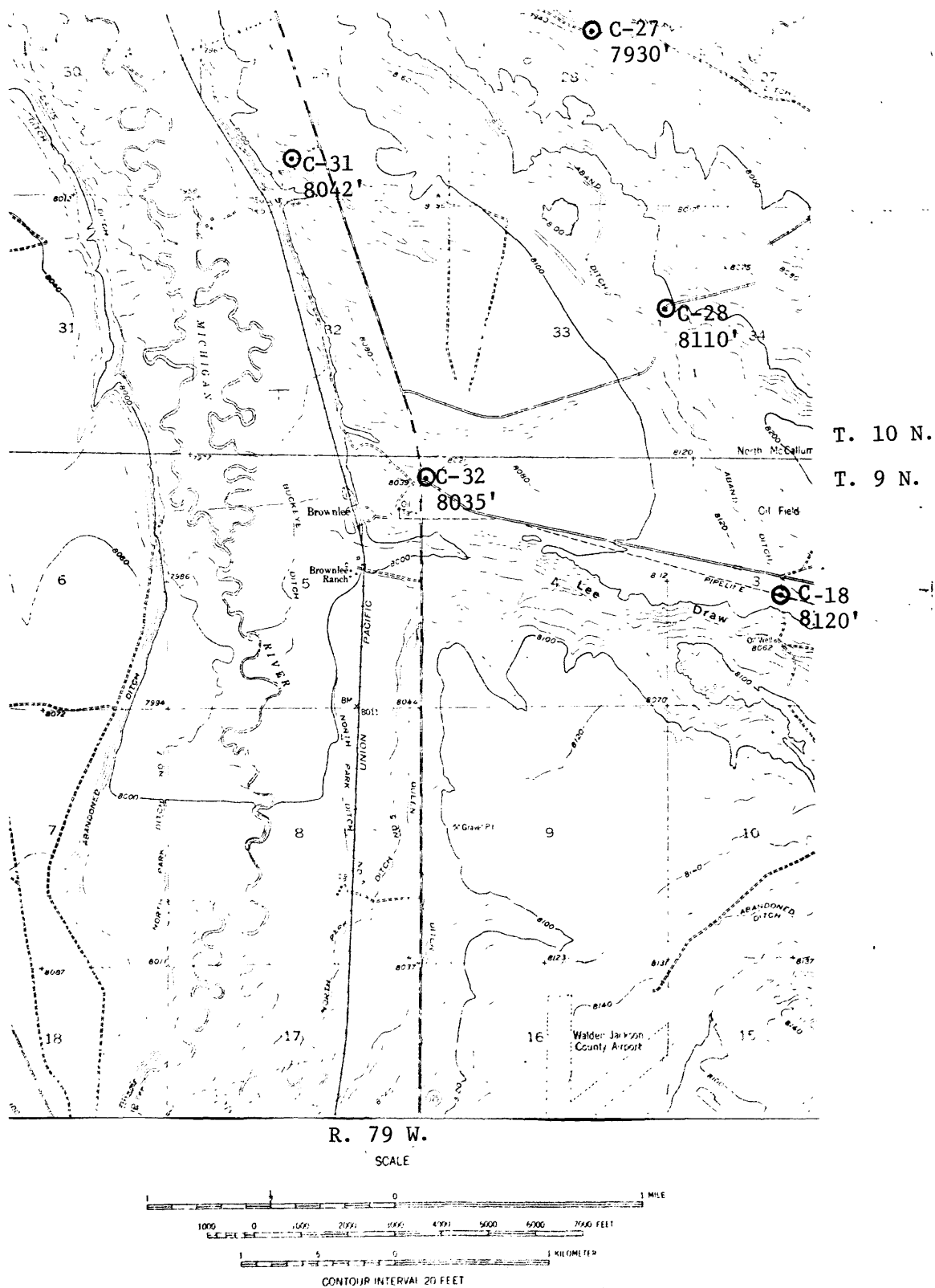
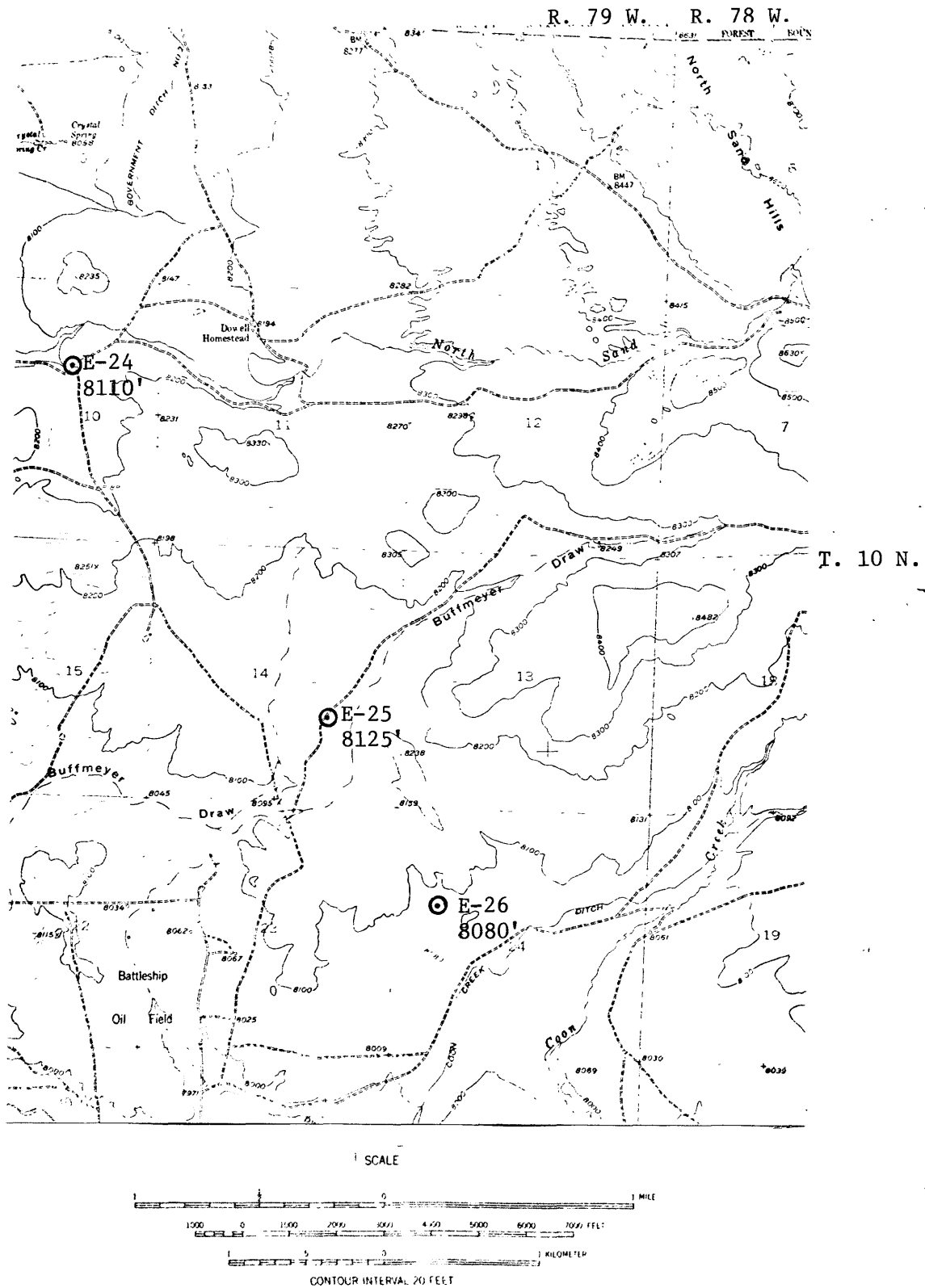


Figure 3. Locations of drill holes, SE¹/₄ of the Coudrey quadrangle, Jackson County, Colorado.



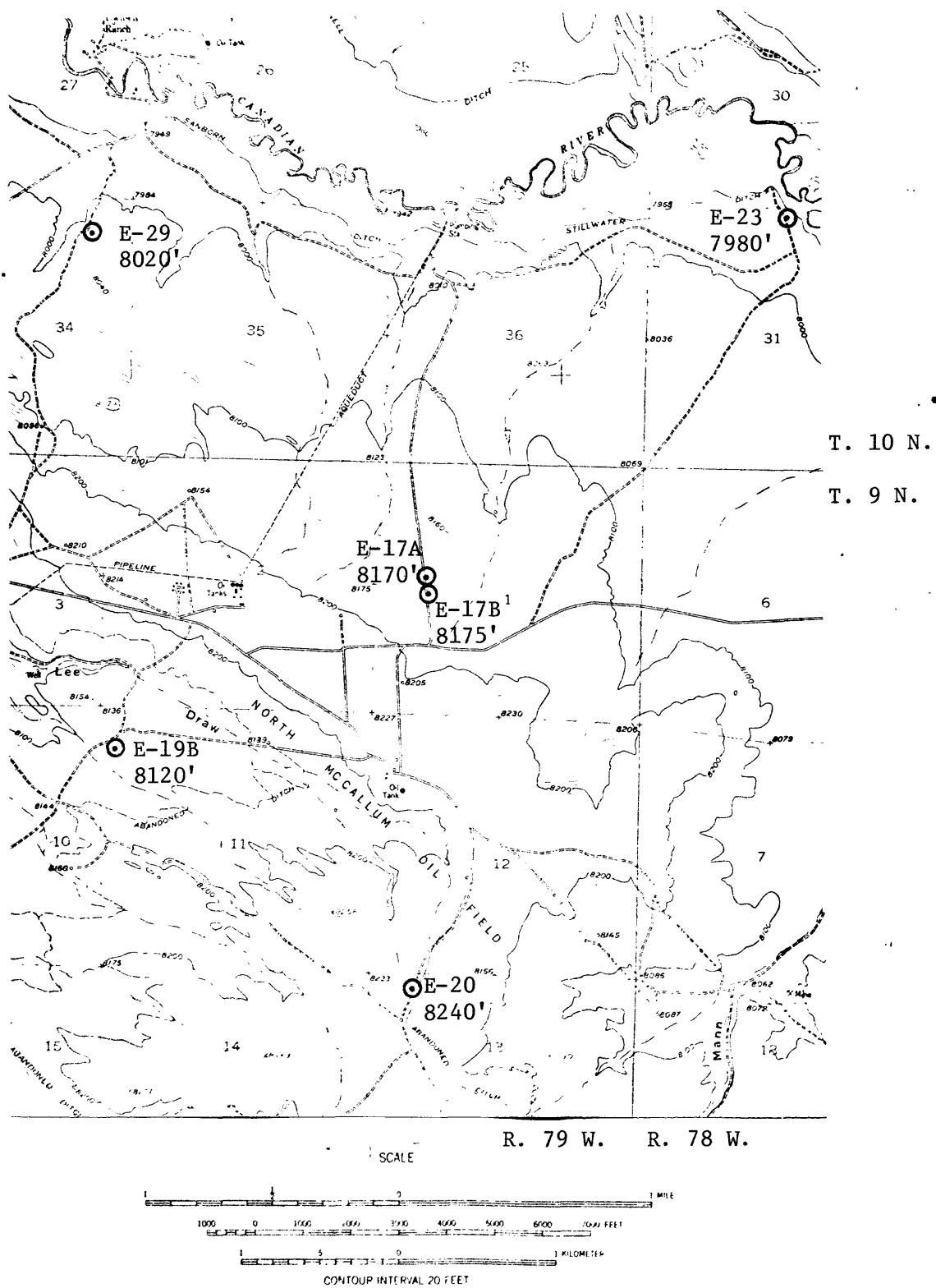


Figure 5. Locations of drill holes, SW $\frac{1}{4}$ of the Eagle Hill quadrangle, Jackson County, Colorado.

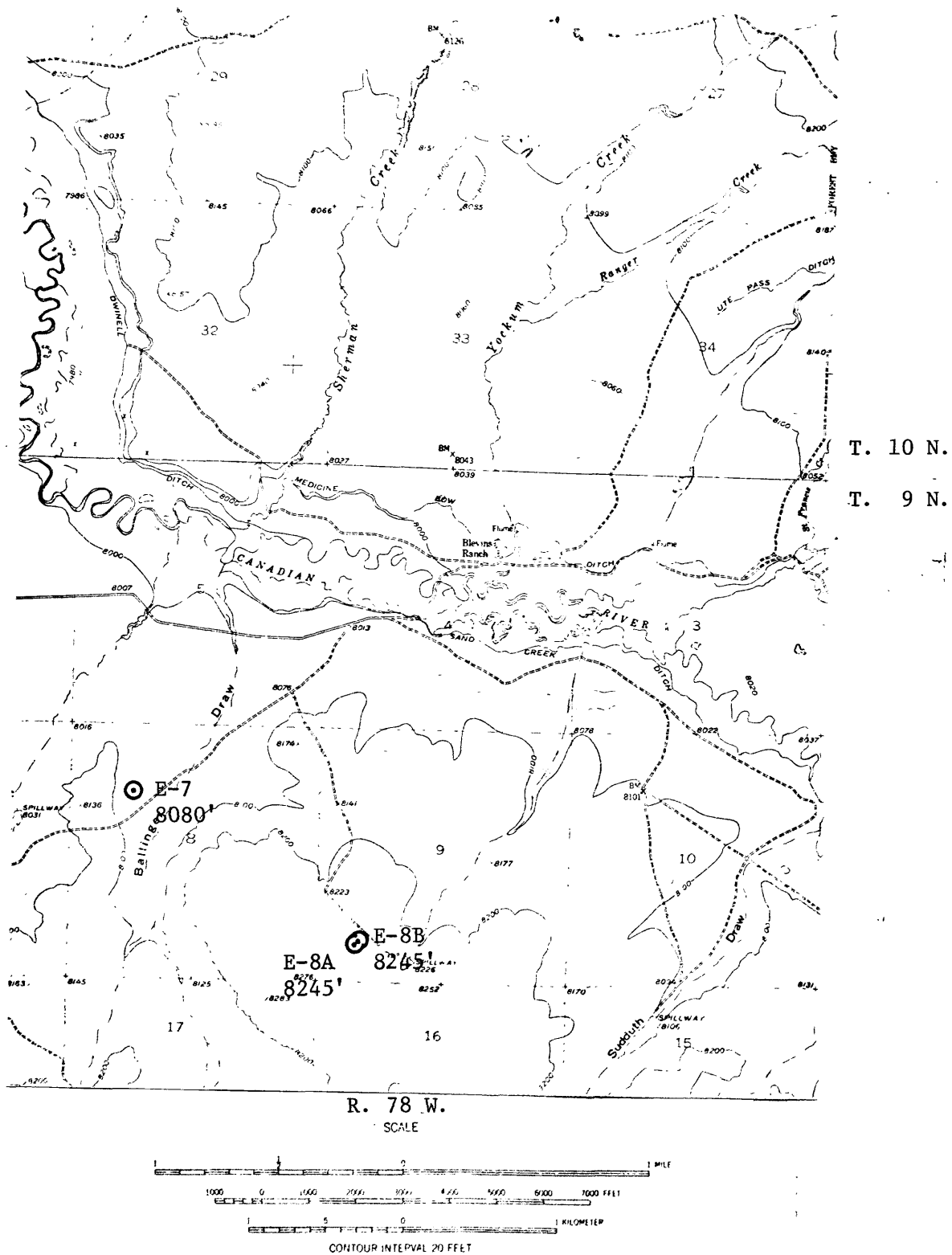


Figure 6. Locations of drill holes, SE $\frac{1}{4}$ of the Eagle Hill quadrangle, Jackson County, Colorado.

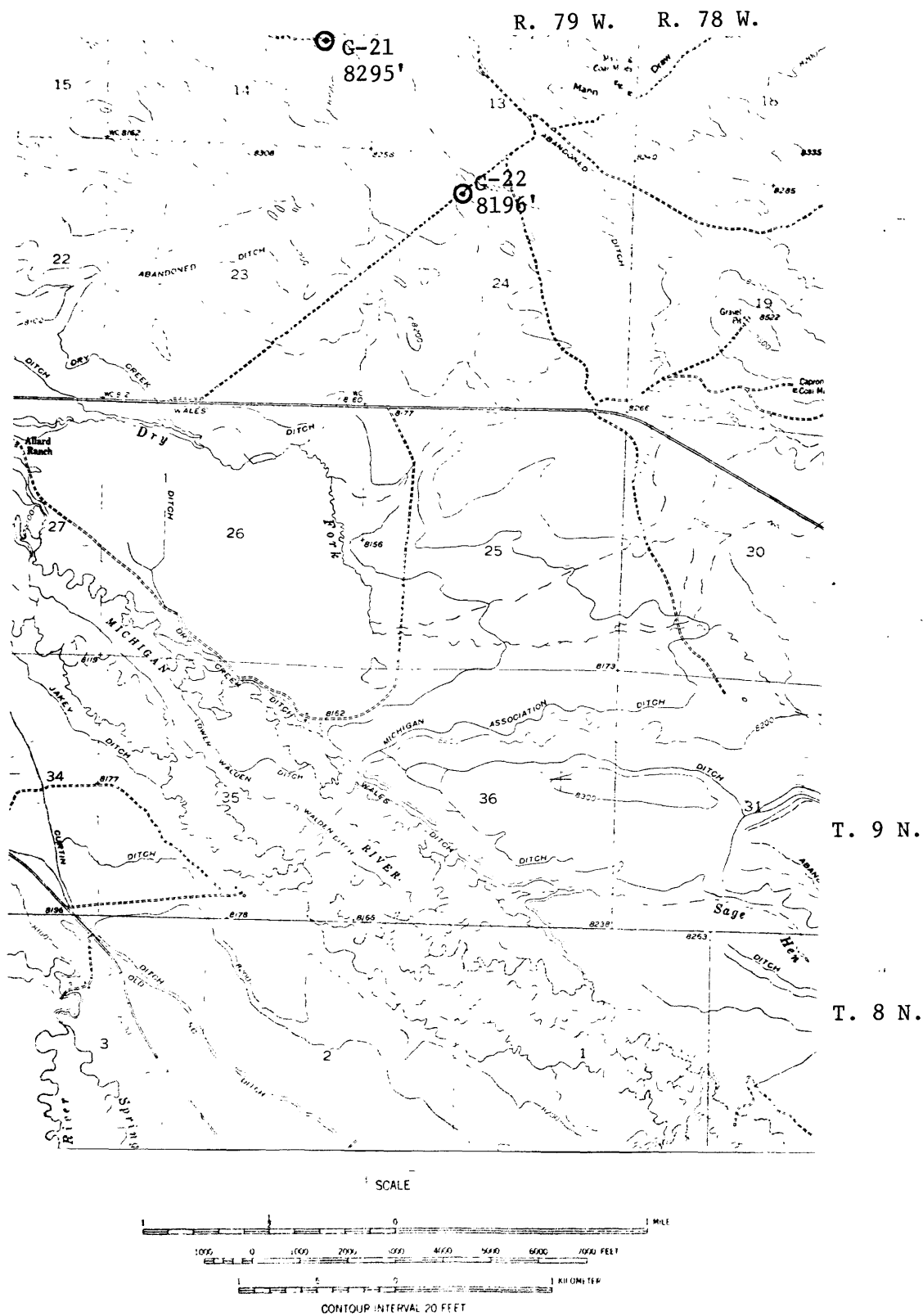


Figure 8. Locations of drill holes, NW $\frac{1}{4}$ of the Gould NW quadrangle, Jackson County, Colorado.

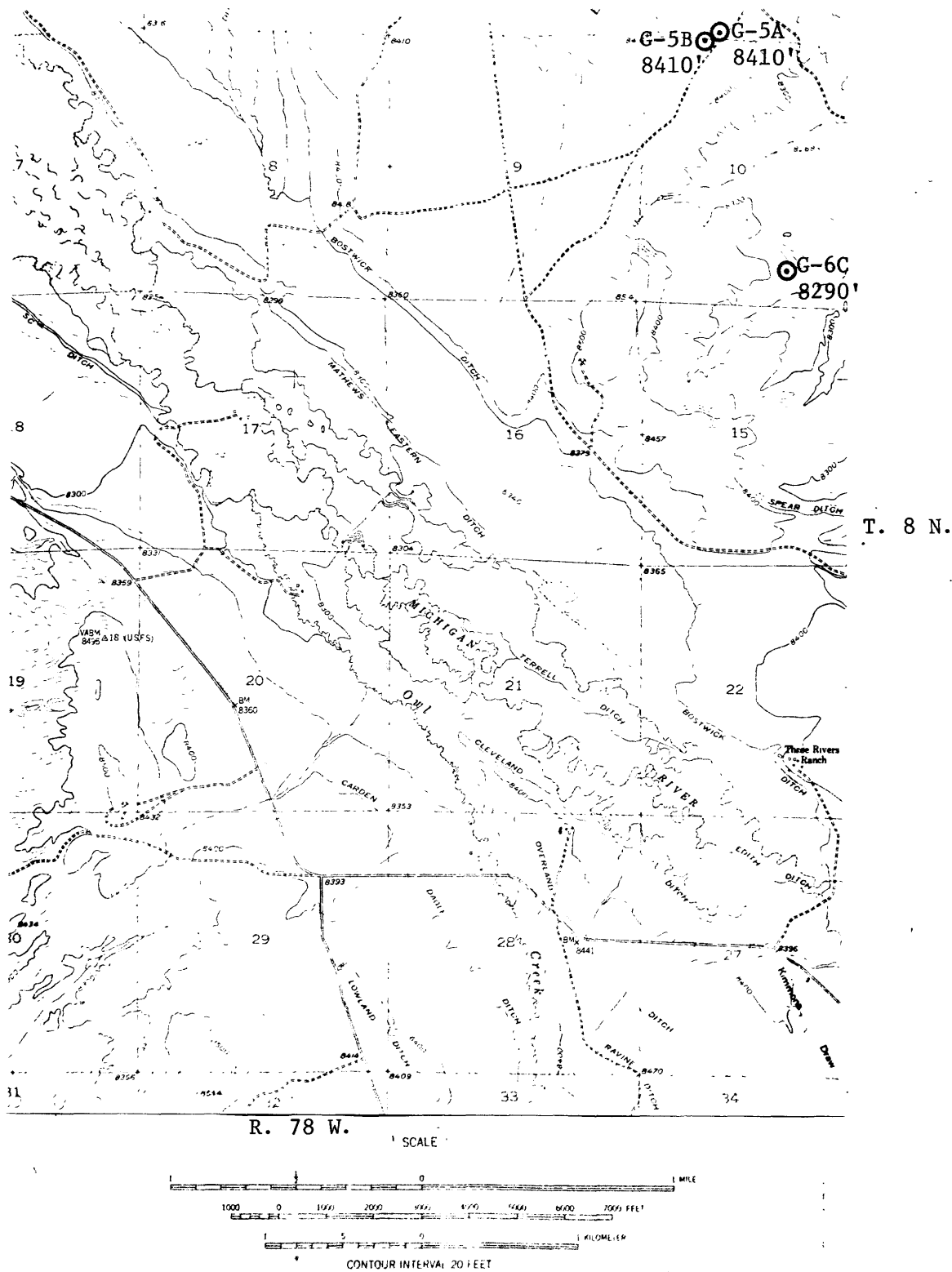


Figure 9. Locations of drill holes, SE $\frac{1}{4}$ of the Gould NW quadrangle, Jackson County, Colorado.

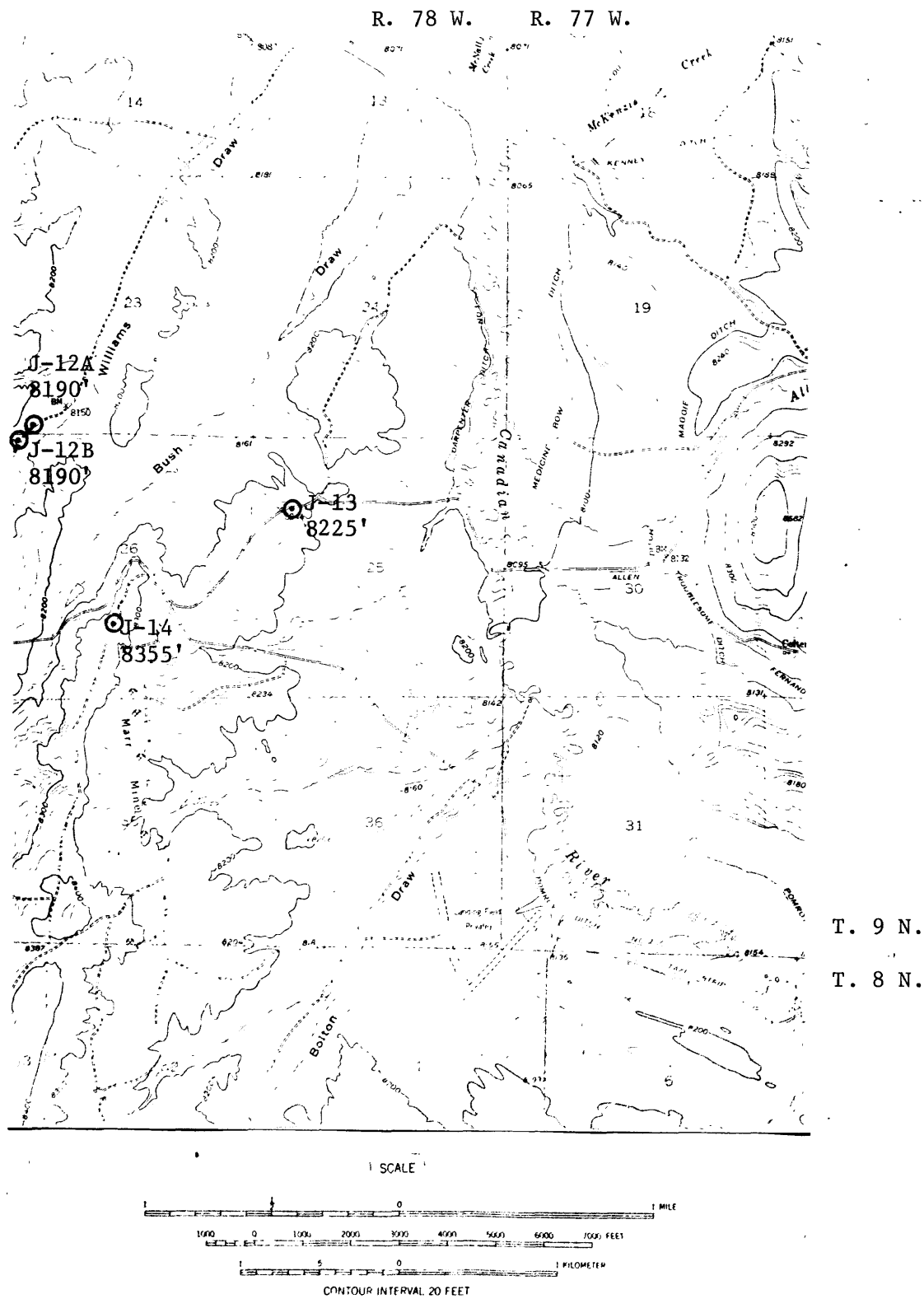


Figure 10. Locations of drill holes, NW $\frac{1}{4}$ of the Johnny Moore Mountain quadrangle, Jackson County, Colorado.

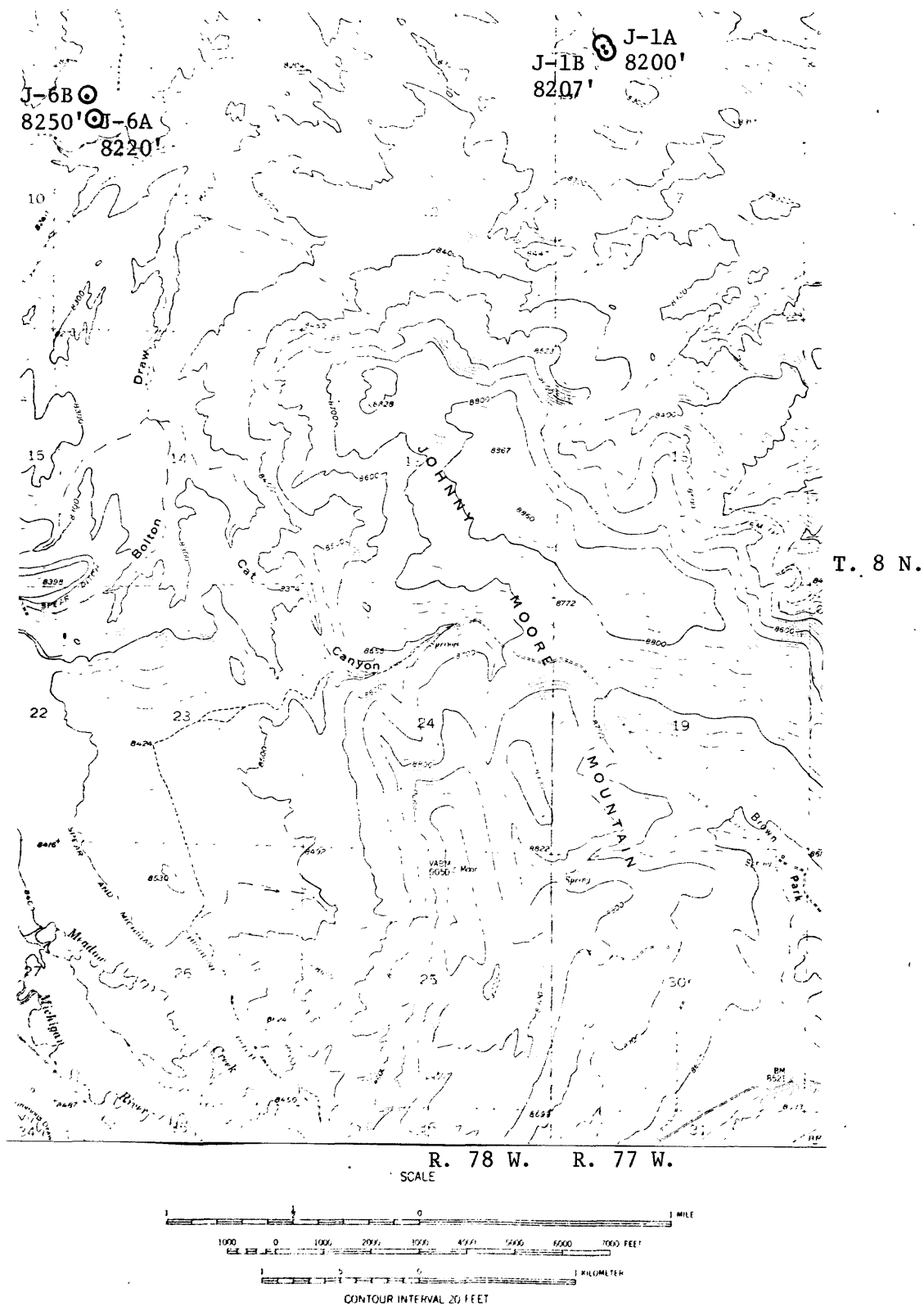


Figure 11. Locations of drill holes, SW $\frac{1}{4}$ of the Johnny Moore Mountain quadrangle, Jackson County, Colorado.

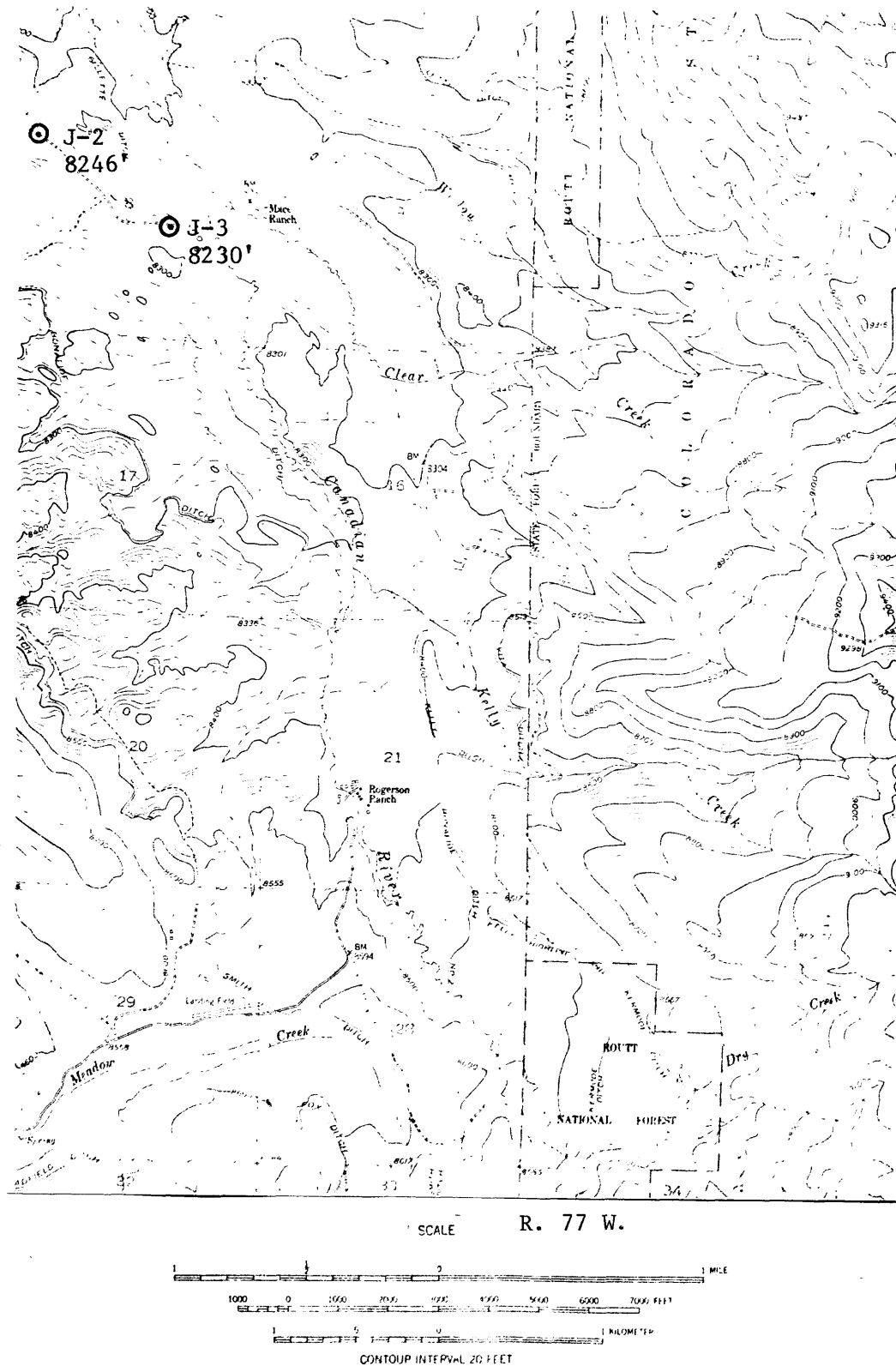


Figure 12. Locations of drill holes, SE $\frac{1}{4}$ of the Johnny Moore Mountain quadrangle, Jackson County, Colorado.

Table 1.--Locations of drill holes in the McCallum coal field, Jackson County, Colorado (listed by township and range)

[Measurements are in feet; to convert to meters, multiply by 0.3048]

<u>Hole no.</u>	<u>Location</u>	<u>Elevation (approx.)</u>	<u>Total depth drilled</u>	<u>Total depth logged</u>
T. 8 N., R. 77 W.,				
J1A	sec. 6, SW $\frac{1}{4}$ SW $\frac{1}{4}$	8,200	40	40
J1B	sec. 6, SW $\frac{1}{4}$ SW $\frac{1}{4}$	8,207	118	118
J2	sec. 8, SW $\frac{1}{4}$ NW $\frac{1}{4}$	8,246	97	97
J3	sec. 8, NW $\frac{1}{4}$ SE $\frac{1}{4}$	8,230	220	220
T. 8 N., R. 78 W.,				
G5A	sec. 3, SE $\frac{1}{4}$ SW $\frac{1}{4}$	8,410	300	300
G4	sec. 4, NE $\frac{1}{4}$ SW $\frac{1}{4}$	8,390	292	292
G5B	sec. 10, NE $\frac{1}{4}$ NW $\frac{1}{4}$	8,410	161	161
G6C	sec. 10, SW $\frac{1}{4}$ SE $\frac{1}{4}$	8,290	320	320
J6B	sec. 11, NW $\frac{1}{4}$ NW $\frac{1}{4}$	8,250	79	79
J6A	sec. 11, NW $\frac{1}{4}$ NW $\frac{1}{4}$	8,220	200	200
T. 9 N., R. 78 W.,				
E7	sec. 8, CNW $\frac{1}{4}$	8,080	280	226
E8A	sec. 9, SW $\frac{1}{4}$ SW $\frac{1}{4}$	8,245	200	200
E8B	sec. 9, SW $\frac{1}{4}$ SW $\frac{1}{4}$	8,245	300	300
G9	sec. 19, NE $\frac{1}{4}$ NE $\frac{1}{4}$	8,215	160	160
G10	sec. 20, NE $\frac{1}{4}$ SE $\frac{1}{4}$	8,310	120	120
G11A	sec. 22, SW $\frac{1}{4}$ NE $\frac{1}{4}$	8,290	200	200
G11B	sec. 22, SW $\frac{1}{4}$ NE $\frac{1}{4}$	8,290	125	125
G12A	sec. 23, SW $\frac{1}{4}$ SW $\frac{1}{4}$	8,190	139	139
J13	sec. 25, SW $\frac{1}{4}$ NW $\frac{1}{4}$	8,225	140	140
J12B	sec. 26, NW $\frac{1}{4}$ NW $\frac{1}{4}$	8,190	392	392
J14	sec. 26, NE $\frac{1}{4}$ SW $\frac{1}{4}$	8,355	200	200
G15	sec. 28, NW $\frac{1}{4}$ SE $\frac{1}{4}$	8,400	140	140
G16	sec. 33, SE $\frac{1}{4}$ NE $\frac{1}{4}$	8,365	200	200

Table 1.--Locations of drill holes in the McCallum coal field, Jackson County, Colorado (listed by township and range) - continued

<u>Hole no.</u>	<u>Location</u>	<u>Elevation (approx.)</u>	<u>Total depth drilled</u>	<u>Total depth logged</u>
T. 9 N., R. 79 W.,				
E17A	sec. 1, SW $\frac{1}{4}$ NW $\frac{1}{4}$	8,170	461	461
E17B	sec. 1, SW $\frac{1}{4}$ NW $\frac{1}{4}$	8,175	400	399
C18	sec. 3, NE $\frac{1}{4}$ SW $\frac{1}{4}$	8,120	341	341
C32	sec. 5, NE $\frac{1}{4}$ NE $\frac{1}{4}$	8,035	200	200
E19	sec. 11, NW $\frac{1}{4}$ NW $\frac{1}{4}$	8,120	322	322
E20	sec. 13, NW $\frac{1}{4}$ NW $\frac{1}{4}$	8,240	496	496
G21	sec. 14, NE $\frac{1}{4}$ SE $\frac{1}{4}$	8,295	140	140
G22	sec. 24, NE $\frac{1}{4}$ NW $\frac{1}{4}$	8,196	261	261
T. 10 N., R. 78 W.,				
E23	sec. 31, NW $\frac{1}{4}$ NE $\frac{1}{4}$	7,980	306	306
T. 10 N., R. 79 W.,				
E24	sec. 10, SW $\frac{1}{4}$ NE $\frac{1}{4}$	8,110	800	800
E25	sec. 14, SW $\frac{1}{4}$ SE $\frac{1}{4}$	8,125	600	550
C30	sec. 19, SE $\frac{1}{4}$ SE $\frac{1}{4}$	7,970	300	298
E26	sec. 24, SW $\frac{1}{4}$ NW $\frac{1}{4}$	8,080	700	647
C27	sec. 28, SW $\frac{1}{4}$ NE $\frac{1}{4}$	7,930	320	320
C31	sec. 29, SE $\frac{1}{4}$ SW $\frac{1}{4}$	8,042	80	79
C28	sec. 33, SE $\frac{1}{4}$ NE $\frac{1}{4}$	8,110	200	200
E29	sec. 34, NE $\frac{1}{4}$ NE $\frac{1}{4}$	8,020	100	100

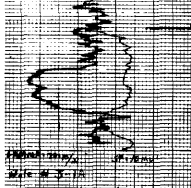
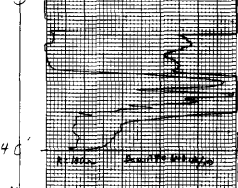
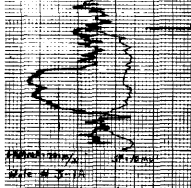
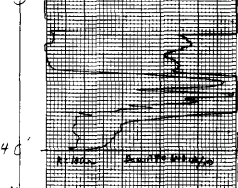
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. J1A Map Johnny Moore Mountain Date logged 8-23-77 Elevation (ft) 8,200
Location: T. 8 N., R. 77 W., sec. 6 : 800 FS L 1000 FW L Cored: ☐ Yes ☒ No
Drilled depth 40 Logged depth 40 Drilling medium Air Fluid level 9

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 26° SW.

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0-20 Mudstone, brown						0	0
20-32 Coal							
32-42 Mudstone, brownish-gray and brown						10	
						50	
						20	
						100	30
						40	
						150	
						50	
						200	60
						70	
						250	
						80	
						300	90

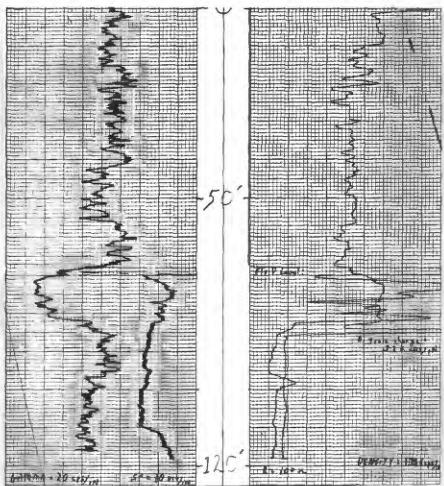
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. J1B Map Johnny Moore Mtn. Date logged 8-23-77 Elevation (ft) 8,207
Location: T. 8 N., R. 77 W., sec. 6 : 650 F SL 1050 F WL Cored: ☐ Yes ☒ No
Drilled depth 118 Logged depth 118 Drilling medium air Fluid level 68

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 6.4 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 26° SW.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-38	Mudstone, medium-gray						0	0
38-49	Shale, carbonaceous and coaly; and gray mudstone						10	
49-68	Sandstone, light-gray, medium-grained, poorly consolidated, with biotite						50	
68-83	Coal						20	
83-109	Mudstone, reddish-brown and olive-black, some silty; minor pinkish-gray siltstone						100	30
109-120	Sandstone, light-olive-gray, fine-grained						40	
							150	
							50	
							200	60
							70	
							250	80
							90	
							300	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. J2 Map Johnny Moore Mountain Date logged 8-23-77 Elevation (ft) 8246
Location: T. 8 N., R. 77 W., sec. 8 : 1500 FNL 800 FWL Cored: ☐ Yes ☒ No
Drilled depth 97 Logged depth 97 Drilling medium Air Fluid level 16
Geophysical logs:

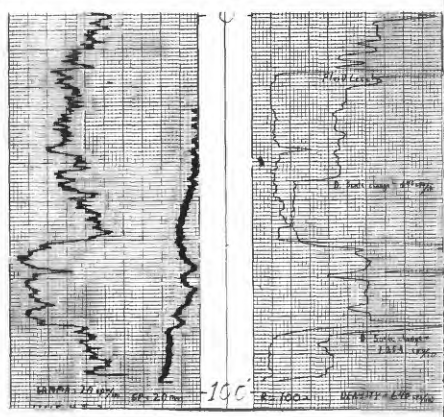
Spontaneous potential (SP): Scale 100 mv/in Logging speed 20 fpm

Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm

Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm

Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: Dip of strata is approximately 27° SW. Twin drilled, coal cored in second hole.

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0-15 Mudstone, olive-gray						0	0
15-20 Siltstone, light-gray							
20-53 Sandstone, light-gray, fine- to medium-grained, with biotite						10	
53-60 Mudstone, medium-dark-gray						50	
60-84 Coal, with parting						20	
84-97 Mudstone, medium-gray and dark-yellowish-brown						100	30
						40	
						150	
						50	
						200	60
						70	
						250	80
						90	
						300	

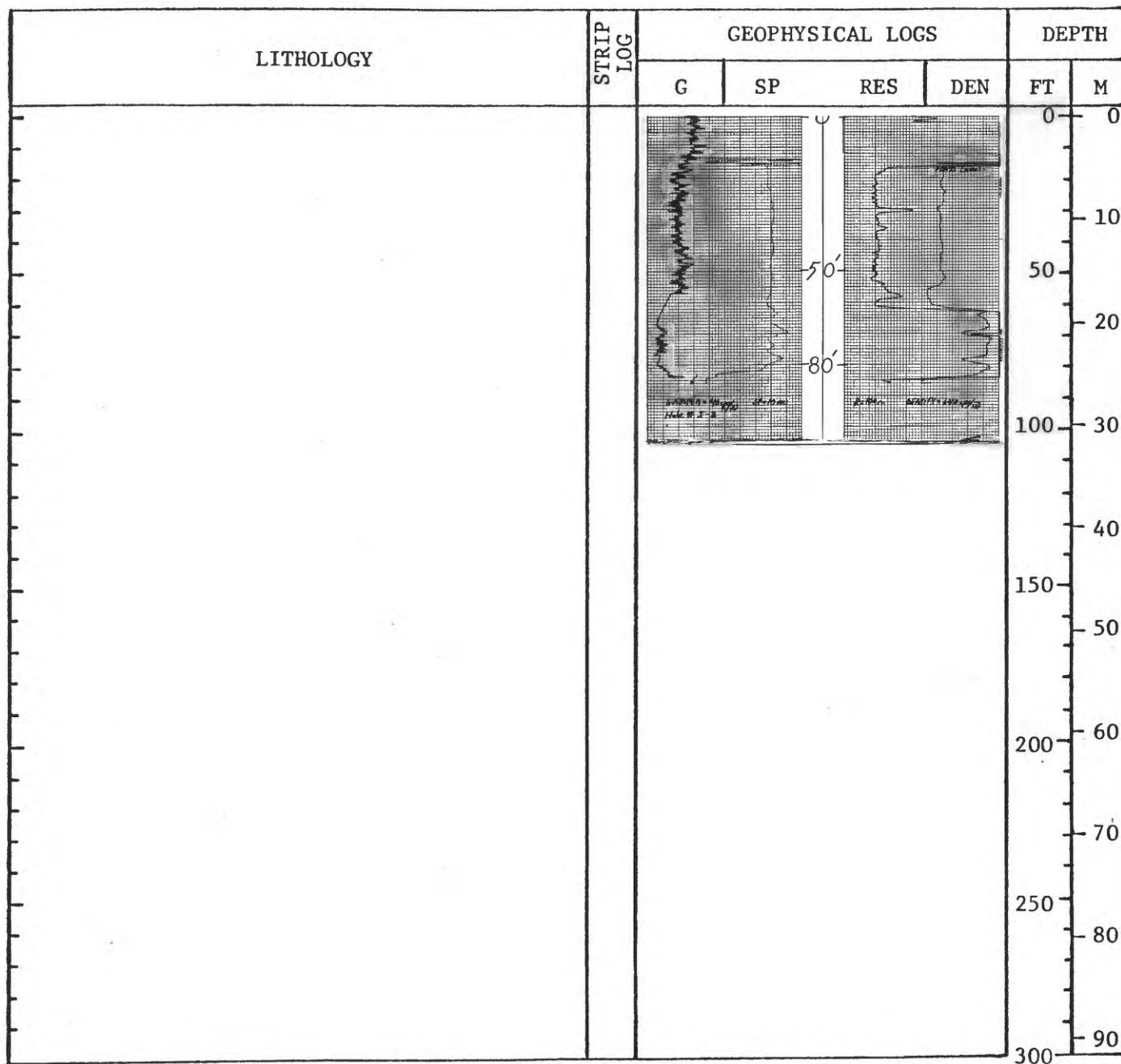
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. J2 Map Johnny Moore Mtn Date logged 9/30/77 Elevation (ft) 8246
Location: T. 8 N., R. 77 W., sec. 8 : 1500 FNL 800 FW L Cored: ☒ Yes ☐ No
Drilled depth 88 Logged depth 86 Drilling medium mud Fluid level 16'

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 27° SW. Cored interval: 55'-87'




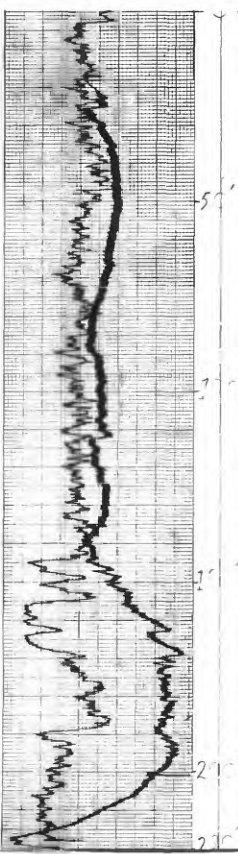
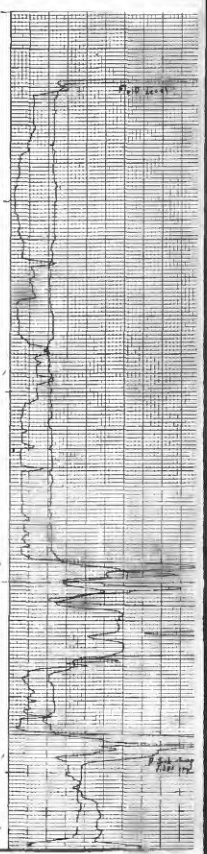
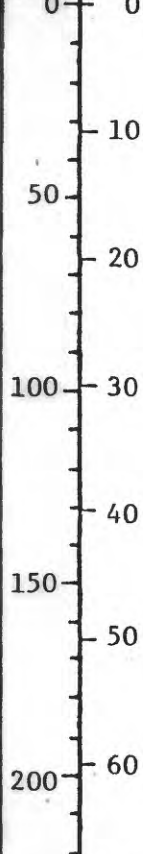












U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. J3 Map Johnny Moore Mountain Date logged 8-23-77 Elevation (ft) 8242
Location: T. 8 N., R. 77 W., sec. 8 : 2150 FS L 1850 FE L Cored: ☐ Yes ☒ No
Drilled depth 220 Logged depth 220 Drilling medium Air Fluid level 18

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata approximately 52° SW.

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0-3 Gravel						0	0
3-21 Soil, sandy, grayish-orange							
21-37 Sandstone, very light gray to medium-light-gray, medium- to coarse-grained						10	
37-65 Mudstone, medium-gray						50	
65-75 Sandstone, white and very light gray; fine- to coarse-grained						20	
75-86 Mudstone, medium-gray							
86-103 Sandstone, very light gray, coarse-grained						100	30
103-145 Mudstone, gray and brownish-black; some silty, interbedded, white, fine-grained sandstone						40	
145-170 Coal; partings of brownish-black mudstone						150	50
170-190 Mudstone, brownish-gray and brownish-black							
190-195 Coal							
195-220 Sandstone, white, fine-grained, well-consolidated						200	60
						70	
						250	80
						90	
						300	

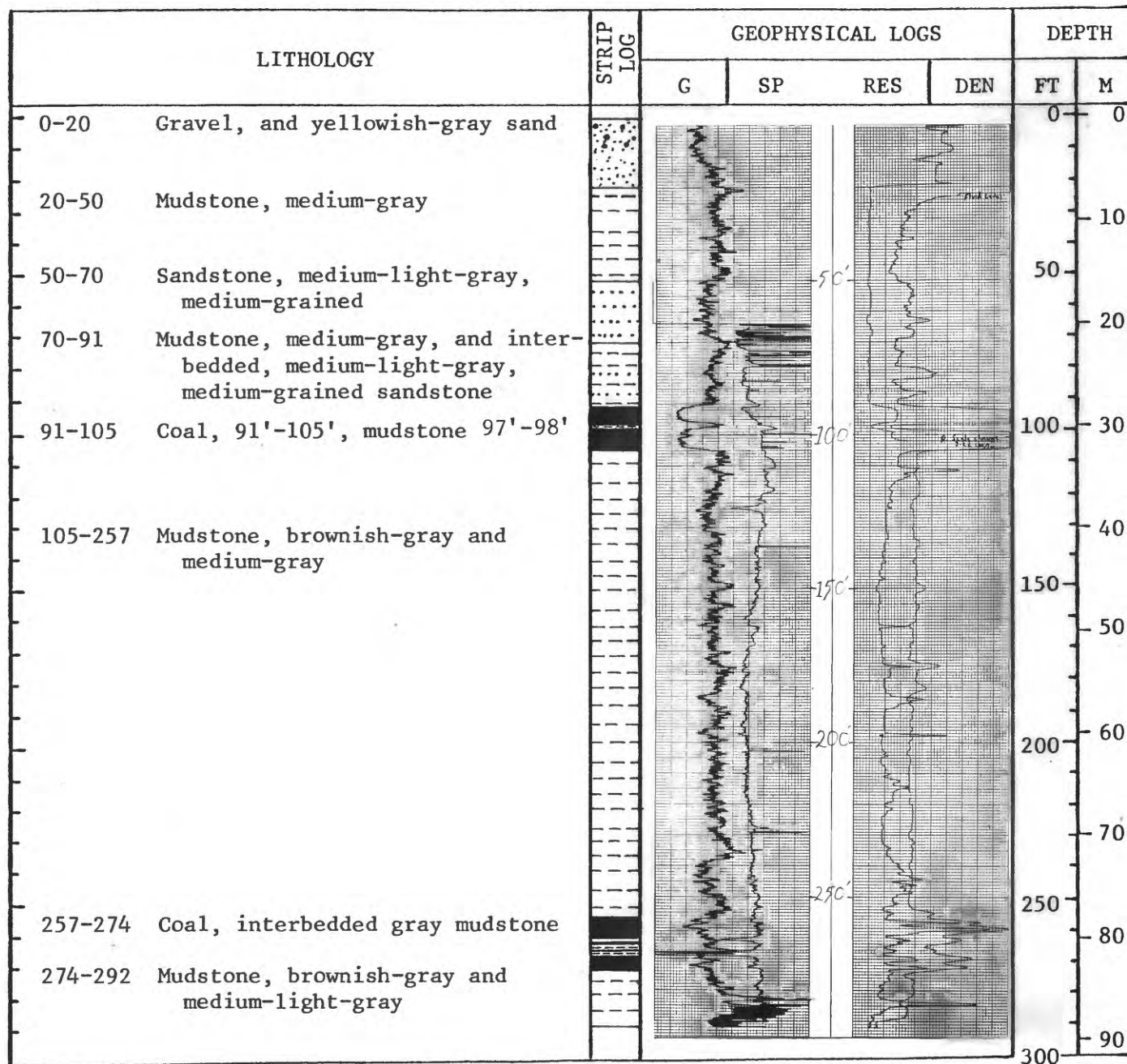
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G4 Map Gould NW Date logged 8-25-77 Elevation (ft) 8390
Location: T. 8 N., R. 78 W., sec. 4 : 2000 FS L 1700FW L Cored: ☐ Yes ☒ No
Drilled depth 292 Logged depth 292 Drilling medium Air Fluid level 0

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 mv/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: _____



U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G5A Map Gould NW Date logged 8-23-77 Elevation (ft) 8410
Location: T. 8 N., R. 78 W., sec. 3 : 100 FS L 1500 FWL Cored: ☐ Yes ☒ No
Drilled depth 300 Logged depth 300 Drilling medium Air Fluid level 78

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-18	Soil, sandy, pale-yellowish-brown, and gravel						0	0
18-30	Mudstone, light-gray							
30-41	Sandstone, very pale orange, very fine grained						10	
41-58	Sandstone, grayish-orange, coarse- to fine-grained						50	20
58-70	Siltstone, very light gray						20	
70-125	Mudstone, medium-light-gray						100	30
125-200	Sandstone, medium-light-gray, fine-grained, well-consolidated; interbedded medium-light-gray mudstone						40	
							150	50
							200	60
200-300	Sandstone, light-gray, fine-grained, well-sorted, poorly consolidated							
							70	
							250	80
							300	90


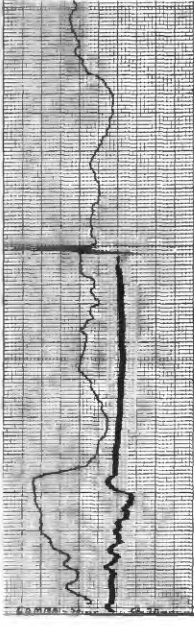
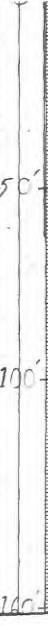

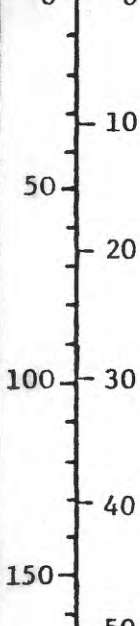




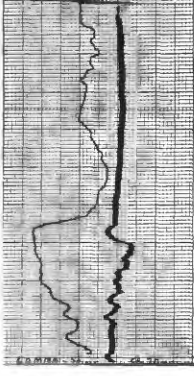

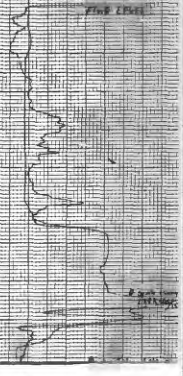
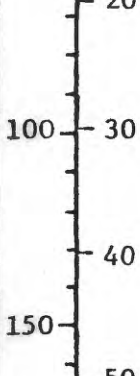


U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G5B Map Gould NW Date logged 8-24-77 Elevation (ft) 8410
Location: T. 8 N., R. 78 W., sec. 10 : 0 FN L 1200 FWL Cored: ☐ Yes ☒ No
Drilled depth 161 Logged depth 161 Drilling medium air Fluid level 168

Geophysical logs:

Spontaneous potential (SP): Scale 100 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 32° SW.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-11	Gravel						0	0
11-31	Sandstone, yellowish-orange and yellowish-gray, medium- to fine-grained						10	
31-38	Mudstone, medium-gray						50	
38-47	Sandstone, yellowish-gray, fine-grained						20	
47-125	Mudstone, medium-gray						100	30
							40	
125-152	Coal						150	
152-161	Mudstone, brownish-gray						50	
							200	60
							70	
							250	80
							90	
							300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. J6A Map Johnny Moore Mountain Date logged 8-24-77 Elevation (ft) 8220
Location: T. 8 N., R. 78 W., sec. 11 : 1050 FNL 850 FWL Cored: ☐ Yes ☒ No
Drilled depth 200 Logged depth 200 Drilling medium Air Fluid level 80

Geophysical logs:

Spontaneous potential (SP): Scale 100 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-19	Siltstone, grayish-orange and brownish-gray						0	0
19-90	Mudstone, medium-light-gray						10	
							50	
							20	
90-93	Coal							
93-96	Sandstone, light-gray, medium-grained, poorly consolidated						100	30
96-165	Mudstone, medium-gray						40	
							150	
165-178	Sandstone, light-gray, medium-grained, poorly consolidated						50	
178-200	Mudstone, medium-gray						60	
							200	
							70	
							80	
							90	
							300	




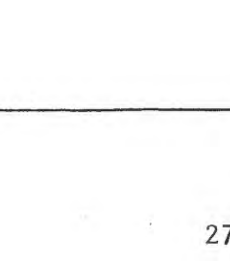
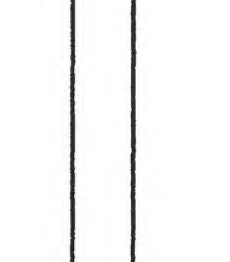
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. J6B Map Johnny Moore Mountain Date logged 8-25-77 Elevation (ft) 8250
Location: T. 8 N., R. 78 W., sec. 11 : 600 FNL 700 FWL Cored: ☐ Yes ☒ No
Drilled depth 79 Logged depth 79 Drilling medium Air Fluid level 65

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 16 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 36° SE. Twin drilled, coal cored in second hole.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-12	Soil, sandy, yellowish-gray						0	0
12-19	Sandstone, white, medium-grained, poorly consolidated						10	
19-45	Mudstone, light-gray						50	
45-72	Coal						20	
72-79	Mudstone, brownish-gray and gray						30	
							40	
							50	
							60	
							70	
							80	
							90	

McCALLUM AREA

Geophysical logs:

Remarks: Dip of strata is approximately 36° SE.

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
		<p>The image shows a geophysical log strip with four tracks: G (Gamma Ray), SP (Spontaneous Potential), RES (Resistivity), and DEN (Density). The depth scale on the right ranges from 0 to 300 feet. The G track shows a curve that starts at approximately 150 at 0 feet, drops to about 100 at 10 feet, and then fluctuates between 100 and 150 down to 300 feet. The SP track shows a curve that starts at approximately 100 at 0 feet, drops to about 50 at 10 feet, and then fluctuates between 50 and 100 down to 300 feet. The RES track shows a curve that starts at approximately 100 at 0 feet, drops to about 50 at 10 feet, and then fluctuates between 50 and 100 down to 300 feet. The DEN track shows a curve that starts at approximately 1.5 at 0 feet, drops to about 1.2 at 10 feet, and then fluctuates between 1.2 and 1.5 down to 300 feet. There are also some handwritten notes on the strip, including 'A. 1000' and '1000'.</p>				0	0
						10	
						50	
						70	
						100	30
							40
						150	
							50
							60
						200	
							70
						250	
							80
							90
						300	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G6C Map Gould NW Date logged 8-25-77 Elevation (ft) 8290
Location: T. 8 N., R. 78 W., sec. 10 : 700 FS L 3100FW L Cored: ☐ Yes ☒ No
Drilled depth 320 Logged depth 320 Drilling medium air Fluid level 53

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 16 Kcps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0-225 Mudstone, brownish-gray, and medium-gray; sandstone, white, fine-grained, at 52'-53' and at 95'-97'						0	0
						10	
						20	
						30	
						40	
						50	
						60	
						70	
						80	
						90	
225-250 Sandstone, light-gray, coarse-grained						100	30
						110	
						120	
						130	
						140	
						150	
						160	
						170	
						180	
						190	
250-269 Mudstone, medium-gray						200	60
						210	
						220	
						230	
						240	
						250	
						260	
						270	
						280	
						290	
269-277 Coal						250	75
						260	
						270	
						280	
						290	
						300	
						310	
						320	
						330	
						340	
277-300 Sandstone, light-gray, coarse-grained						300	90
						310	
						320	
						330	
						340	
						350	
						360	
						370	
						380	
						390	

Hole No. G6C (continued)

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U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E7 Map Eagle Hill Date logged 9-7-77 Elevation (ft) 8080
Location: T. 9 N., R. 78 W., sec. 8 : 1400 FN L 1325 FW L Cored: ☐ Yes ☒ No
Drilled depth 280 Logged depth 226 Drilling medium Air Fluid level 33

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 58° NE. Twin drilled, coal cored
in second hole.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-5	Soil, pale-yellowish-brown						0	0
5-18	Siltstone, grayish-orange							
18-36	Mudstone, medium-gray							
36-69	Sandstone, white, medium-grained to very fine pebble gravel, subangular						10	
69-77	Mudstone, medium-light-gray						20	
77-84	Sandstone, white, very coarse grained to very fine pebble gravel, subangular						30	
84-97	Mudstone, medium-light-gray						40	
97-109	Siltstone, white						50	
109-114	Mudstone, light-gray						60	
114-149	Siltstone, white						70	
149-166	Sandstone, white, medium-grained to very fine pebble gravel, subangular						80	
166-180	Mudstone, light-gray						90	
180-221	Coal; mudstone parting at 211'-213'						100	
221-226	Mudstone, very light gray						110	
							120	
							130	
							140	
							150	
							160	
							170	
							180	
							190	
							200	
							210	
							220	
							230	
							240	
							250	
							260	
							270	
							280	

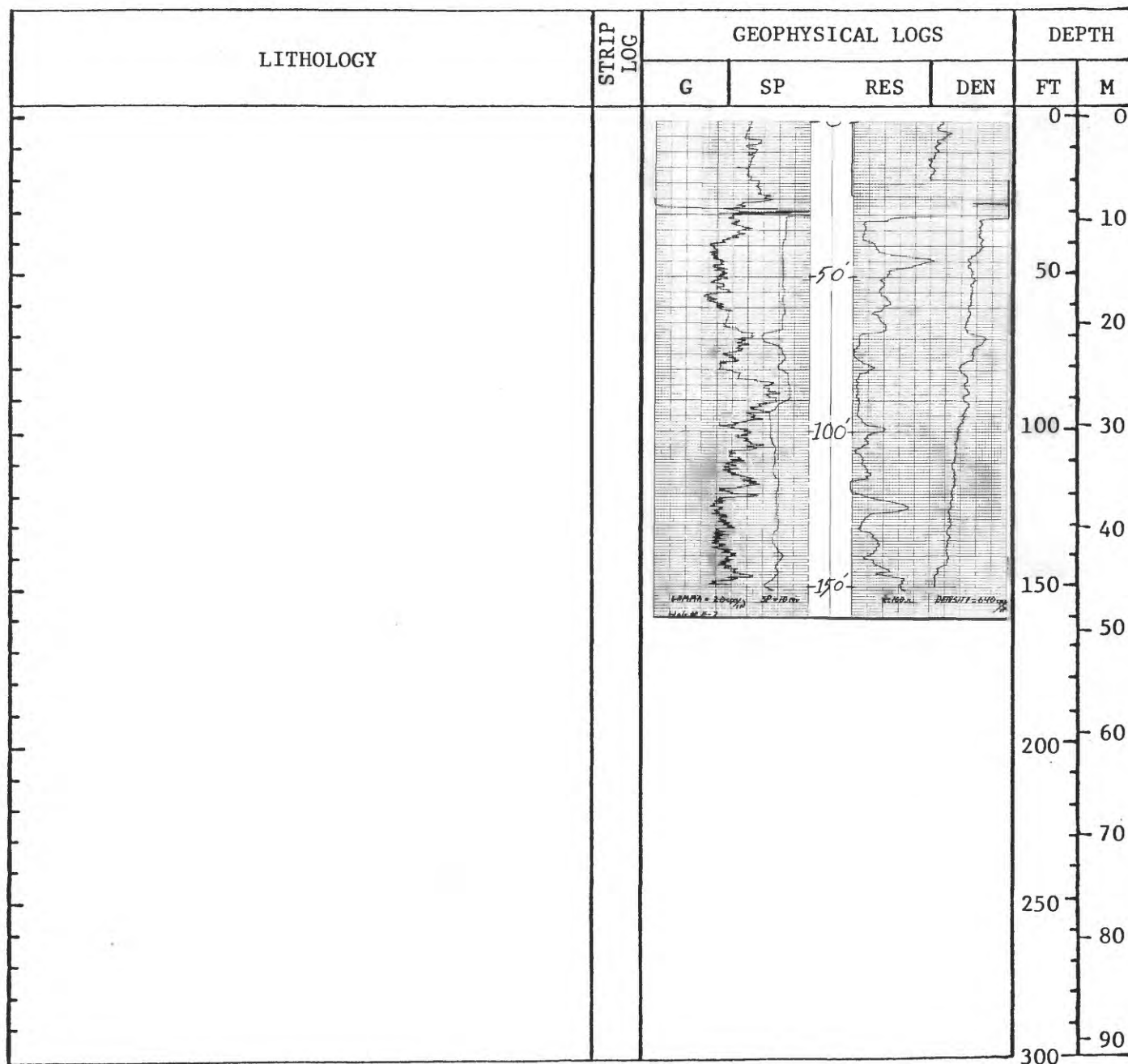
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E7 Map Eagle Hill Date logged 10/12/77 Elevation (ft) 8080
Location: T. 9 N., R. 78 W., sec. 8 : 1400 FNL 1325 FWL Cored: ☒ Yes ☐ No
Drilled depth 180' Logged depth 151' Drilling medium mud Fluid level 30'

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 58° SE. Cored interval: 170'-180',
core hole drilled a second time.



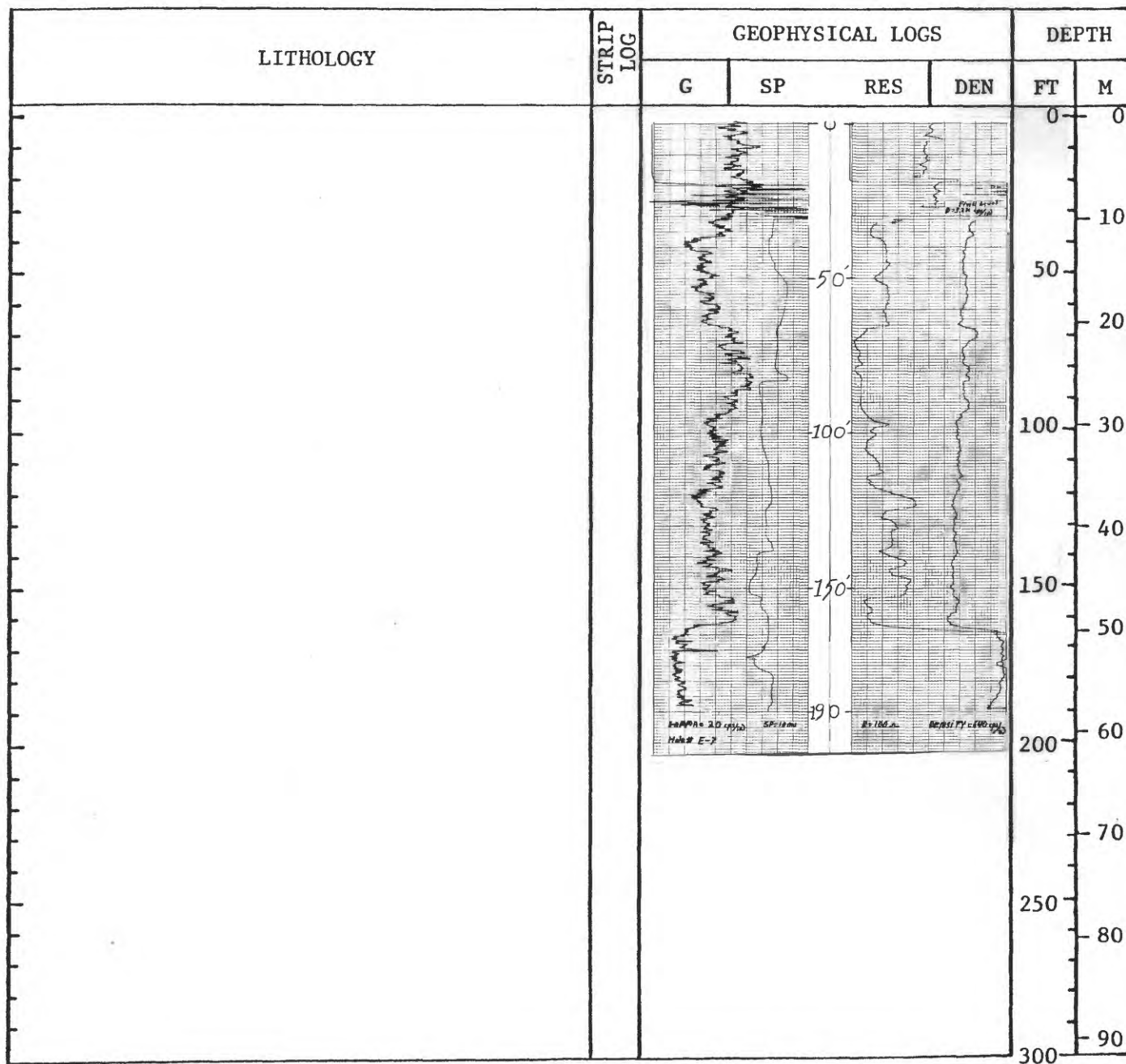
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E7 Map Eagle Hill Date logged 10/11/77 Elevation (ft) 8080
Location: T. 9 N., R. 78 W., sec. 8 : 1400 FNL 1325 FW L Cored: ☒ Yes ☐ No
Drilled depth 213' Logged depth 190' Drilling medium mud Fluid level 31'

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 58° NE. Cored interval: 160'-213'

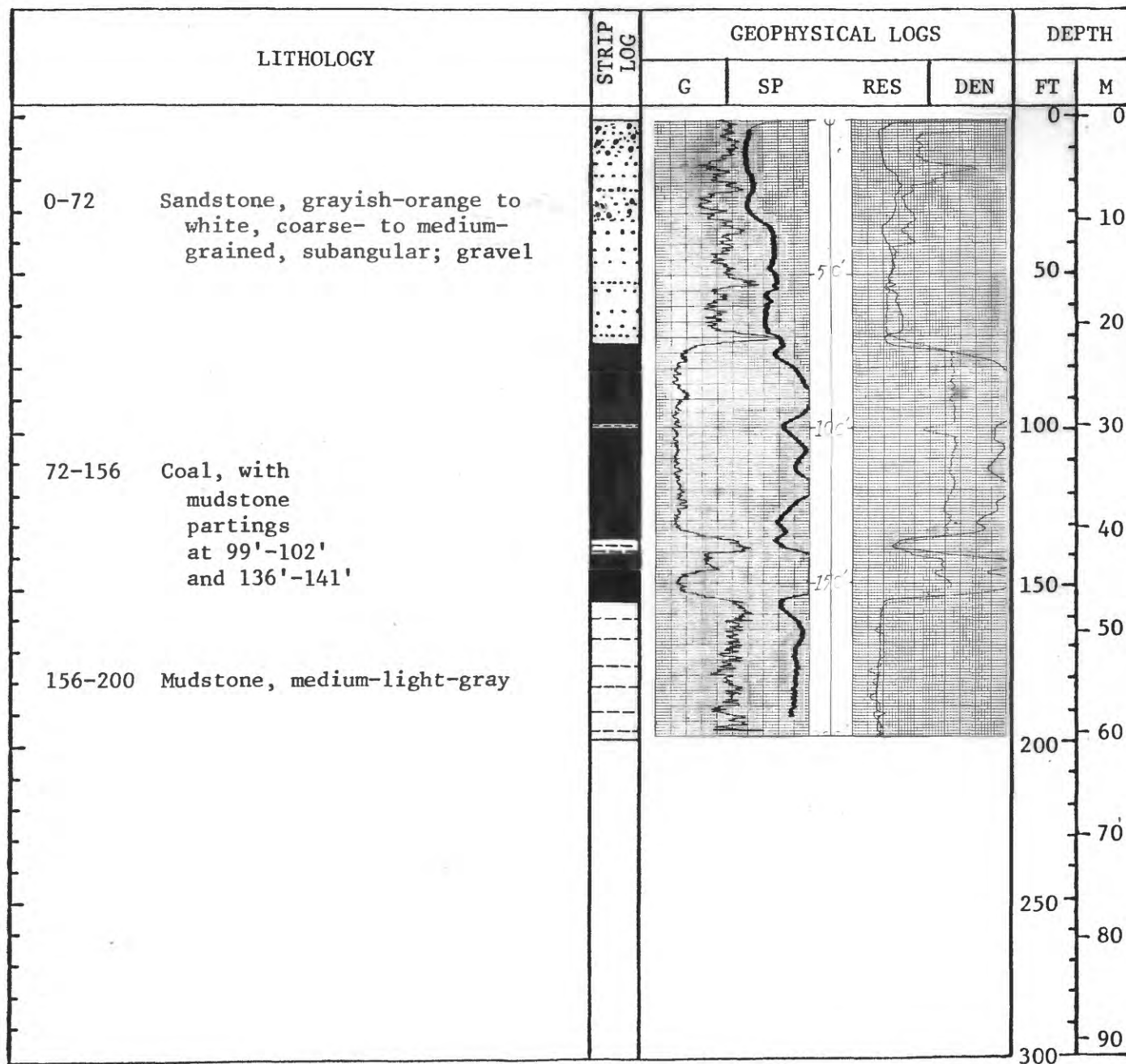


U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E8A Map Eagle Hill Date logged 9-7-77 Elevation (ft) 8245
 Location: T. 9 N., R. 78 W., sec. 9 : 750 FSL 800 FWL Cored: ☐ Yes ☒ No
 Drilled depth 200 Logged depth 200 Drilling medium Mud Fluid level 1
 Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
 Resistivity (RES): Scale 1000 ohms/in Logging speed 20 fpm
 Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
 Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
 Remarks: Dip of strata approximately 36° NE.



U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E8B Map Eagle Hill Date logged 9-8-77 Elevation (ft) 8245
Location: T. 9 N., R. 78 W., sec. 9 : 800 FSL 850 FWL Cored: ☐ Yes ☒ No
Drilled depth 300 Logged depth 300 Drilling medium Mud Fluid level 1

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 1,000 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 76° NE.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-20	Sandstone, yellowish-brown, medium-grained to very coarse grained, poorly consolidated, some gravel						0	0
20-38	Mudstone, yellowish-gray						10	
38-73	Sandstone, pinkish-gray, medium-to coarse-grained, subangular, interbedded mudstone, medium-light-gray						50	
73-113	Mudstone, light-gray						100	30
113-147	Siltstone, white						40	
147-167	Sandstone, white, very coarse grained to gravel						150	
167-180	Mudstone, medium-gray						50	
180-246	Coal, 180'-246' with parting of mudstone, gray and brownish-black, at 225'						200	60
246-250	Mudstone, medium-gray						250	
250-279	Coal, with parting of mudstone, medium-gray, at 260' (and at 270'?)						80	
279-300	Mudstone, brownish-gray and very light gray						90	
							300	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G9 Map Gould NW Date logged 8-26-77 Elevation (ft) 8,215
Location: T. 9 N., R. 78 W., sec. 19 : 325 FNL 600 FEL Cored: ☐ Yes ☒ No
Drilled depth 160 Logged depth 160 Drilling medium air Fluid level 21

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 16 cps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 29° SW.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-3	Sand, dark-yellowish-orange, medium-grained						0	0
3-18	Mudstone, light-gray and brownish-black						10	
18-76	Sandstone, light-gray, coarse-grained, poorly consolidated, some is medium- to fine-grained, well-consolidated						50	
76-89	Mudstone, light-gray						20	
89-140	Coal						100	30
140-144	Mudstone, brownish-black						40	
144-160	Sandstone, light-gray, medium- to fine-grained, well-consolidated, and light-gray mudstone						150	
							50	
							200	60
							70	
							250	80
							90	
							300	

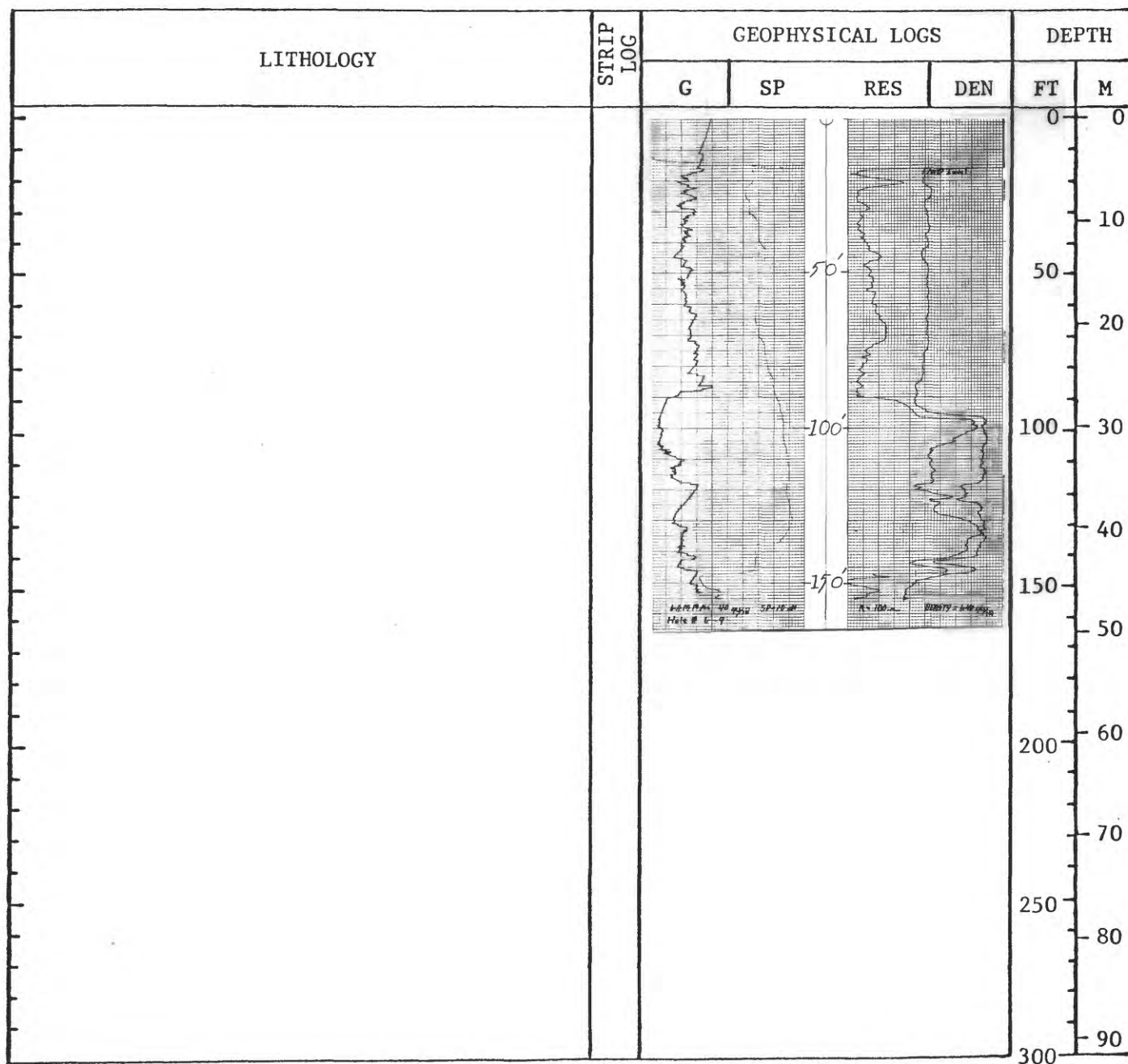
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G9 Map Gould NW Date logged 10/5/77 Elevation (ft) 8,215'
Location: T. 9 N., R. 78 W., sec. 19 : 325 FNL 600 FEL Cored: ☒ Yes ☐ No
Drilled depth 155' Logged depth 155' Drilling medium mud Fluid level 16'

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 29° SW. Cored interval: 85'-156'



U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G10 Map Gould NW Date logged 8-26-77 Elevation (ft) 8310
Location: T. 9 N., R. 78 W., sec. 20 : 1850 FS L 900 FE L Cored: ☐ Yes ☒ No
Drilled depth 120 Logged depth 120 Drilling medium air Fluid level 48

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 32 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 25° SW.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-55	Sandstone, grayish-orange, poorly consolidated. Fines upward from very coarse-grained (to 40'), to medium- to fine-grained (above 40')						0	0
							10	
55-60	Mudstone, light-gray						50	
							20	
60-98	Coal						100	30
98-120	Sandstone, light-gray, well-consolidated. Fines upward from medium- to fine-grained						120	36
							40	
							150	
							50	
							200	60
							70	
							250	80
							90	
							300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G11A Map Could NW Date logged 8-26-77 Elevation (ft) 8,290
Location: T. 9 N., R. 78 W., sec. 22 : 1775 FN L 1950 FE L Cored: ☐ Yes ☒ No
Drilled depth 200 Logged depth 200 Drilling medium Air Fluid level 50

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 6.4 Kcps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-46	Sand, grayish-orange to very light-gray, coarse-grained to very coarse grained, and gravel						0	0
46-61	Mudstone						10	
61-88	Sandstone, light-gray, coarse-grained to very coarse grained, and gravel						20	
88-117	Mudstone, light-gray; interbedded very light gray siltstone						30	
							40	
117-175	Sandstone, very light gray, very coarse grained to medium-grained						50	
175-200	Mudstone, medium-light-gray; interbedded, light-gray siltstone		60					
			70					
			80					
			90					
			100					
			110					
			120					
			130					
			140					
			150					
			160					
			170					
			180					
			190					
			200					

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

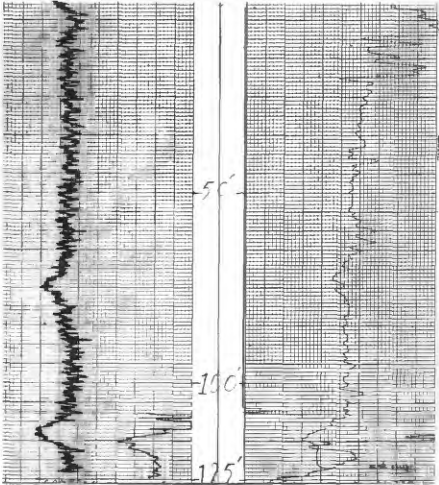
McCALLUM AREA

Hole No. G11B Map Gould NW Date logged 8-26-76 Elevation (ft) 8,290
Location: T. 9 N., R. 78 W., sec. 22 : 1725 F^N L 1875 F^E L Cored: ☐ Yes ☒ No
Drilled depth 125 Logged depth 125 Drilling medium air Fluid level 115

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 1,000 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 16 Kcps/in Logging speed 20 fpm

Remarks: No lithology log.

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
						0	0
						10	
						50	
						20	
						100	30
						40	
						150	
						50	
						200	60
						70	
						250	80
						90	
						300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

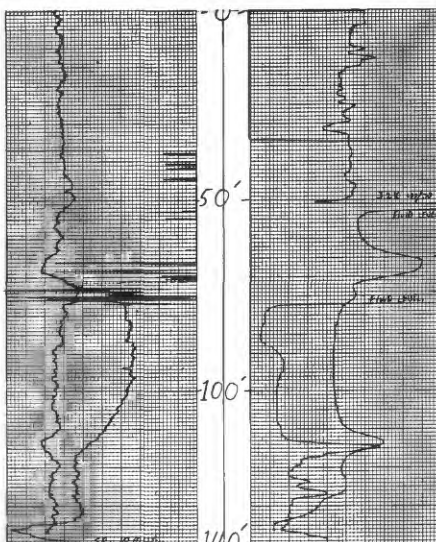
McCALLUM AREA

Hole No. J12A Map Johnny MooreMtn Date logged 8-22-77 Elevation (ft) 8,190
Location: T. 9 N., R. 78 W., sec. 23 : 200 F SL 4575' F EL Cored: ☐ Yes ☒ No
Drilled depth 139 Logged depth 139 Drilling medium air Fluid level 77

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 50 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 cps/in Logging speed 20 fpm

Remarks: _____

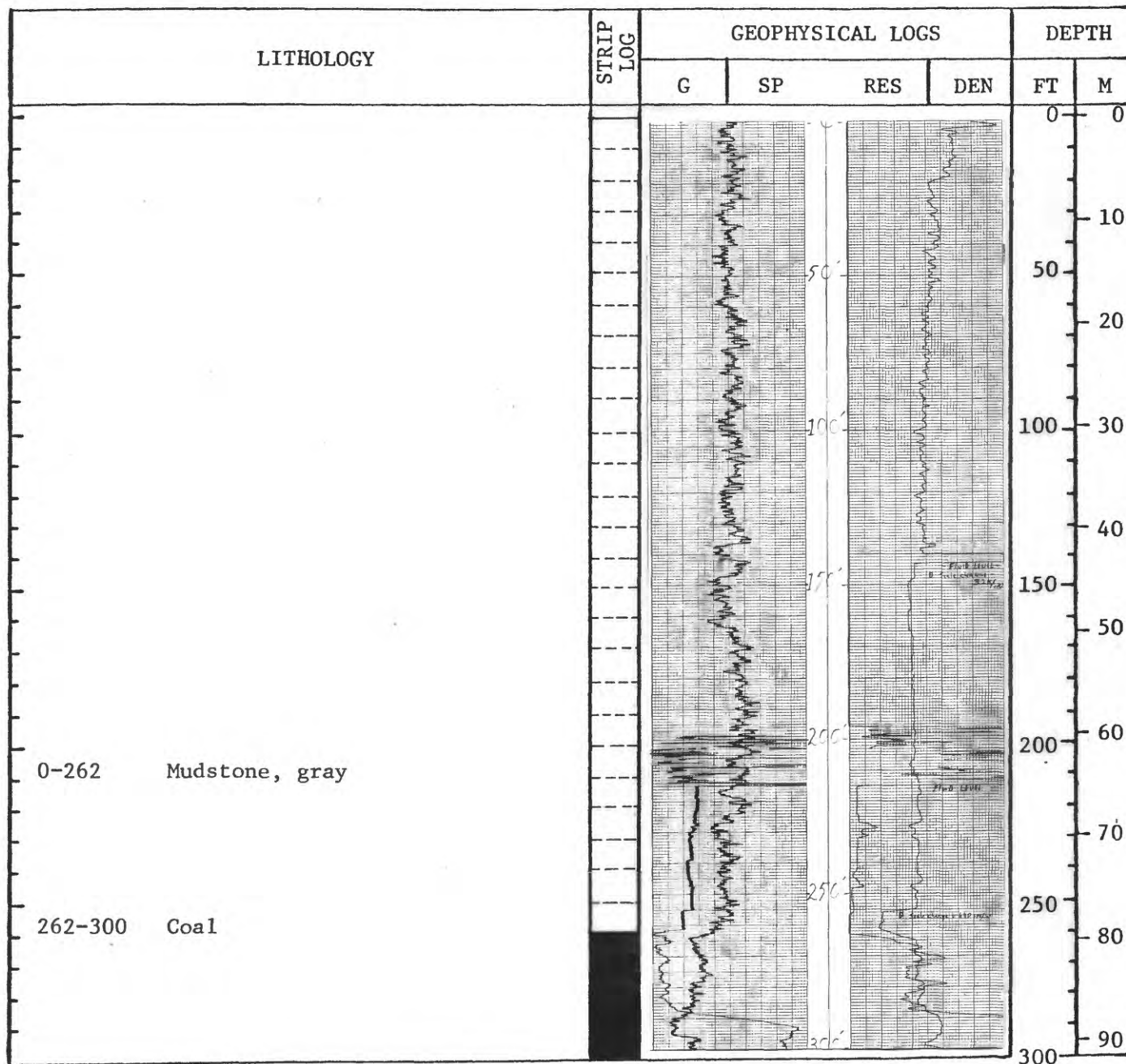
LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-5	Soil						0	0
5-19	Shale, brown						10	
							50	
							20	
19-112	Shale, dark-gray; coal traces						100	30
112-118	Shale, coaly						40	
118-139	Shale, dark-gray						150	50
							200	60
							250	80
							300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA


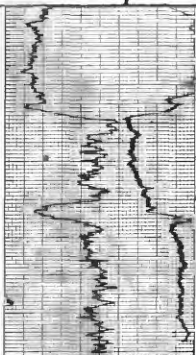
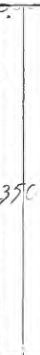
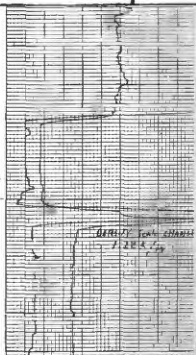
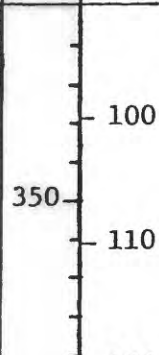







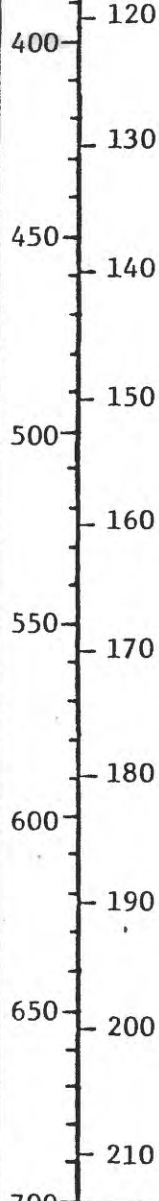
Hole No. J12B Map Johnny Moor Mtn Date logged 8-22-77 Elevation (ft) 8,190
Location: T. 9 N., R. 78 W., sec. 26 : 100 FNL 4900 FEL Cored: ☐ Yes ☒ No
Drilled depth 392 Logged depth 392 Drilling medium air Fluid level 215
Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 100 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 72° NE.



U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. J12B (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
300-329 Coal						100	
						350	
						110	
						120	
329-392 Mudstone						400	
						120	
						130	
						450	
						140	
						150	
						500	
						160	
						550	
						170	
						180	
						600	
						190	
						650	
						200	
						210	
						700	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. J13 Map Johnny Moore Mountain Date logged 8-23-77 Elevation (ft) 8220
Location: T. 9 N., R. 78 W., sec. 25 : 1425 FNL 850 FWL Cored: ☐ Yes ☒ No
Drilled depth 140 Logged depth 140 Drilling medium Air Fluid level 122
Geophysical logs:

Spontaneous potential (SP): Scale 25 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 30° W.

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0-61 Mudstone, dusky-yellowish-brown, brownish-black and gray; some silty mudstone						0	0
						10	
						50	
61-121 Coal, with parting of gray mudstone at 66'-73'						20	
						100	30
121-140 Mudstone, silty, gray, and minor interbedded black shale						40	
						150	
						50	
						200	60
						70	
						250	80
						90	
						300	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. J14 Map Johnny Moor Mtn Date logged 8-22-77 Elevation (ft) 8,355
Location: T. 9 N., R. 78 W., sec. 26 : 1525 F SL 2775 FEL Cored: ☐ Yes ☒ No
Drilled depth 200 Logged depth 200 Drilling medium air Fluid level 170

Geophysical logs:

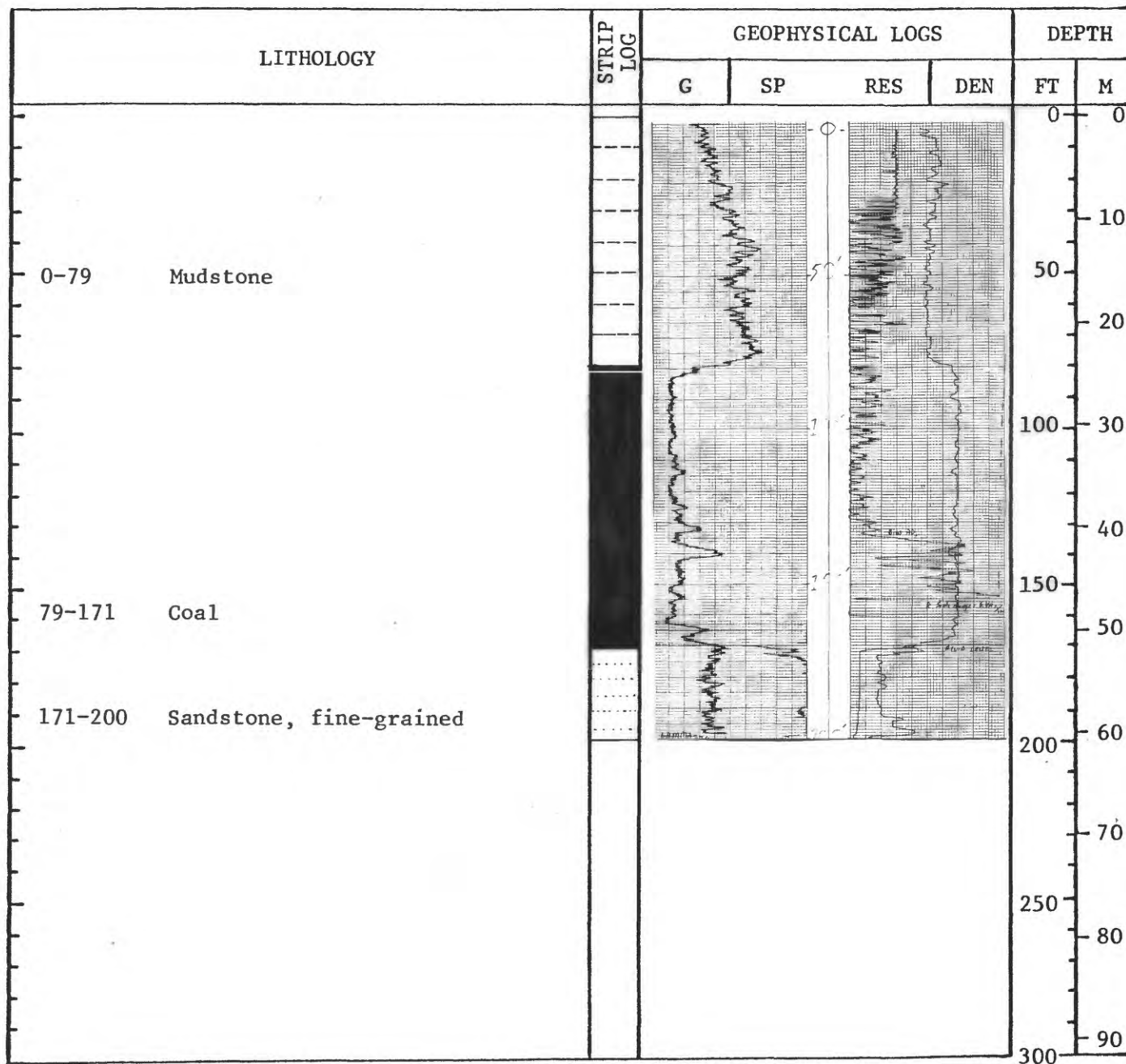
Spontaneous potential (SP): Scale 25 mv/in Logging speed 20 fpm

Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm

Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm

Density (DEN): T.C. 4 Scale 16 Kcps/in Logging speed 20 fpm

Remarks: Dip of strata is approximately 59° ENE. Twin drilled, coal cored in second hole.



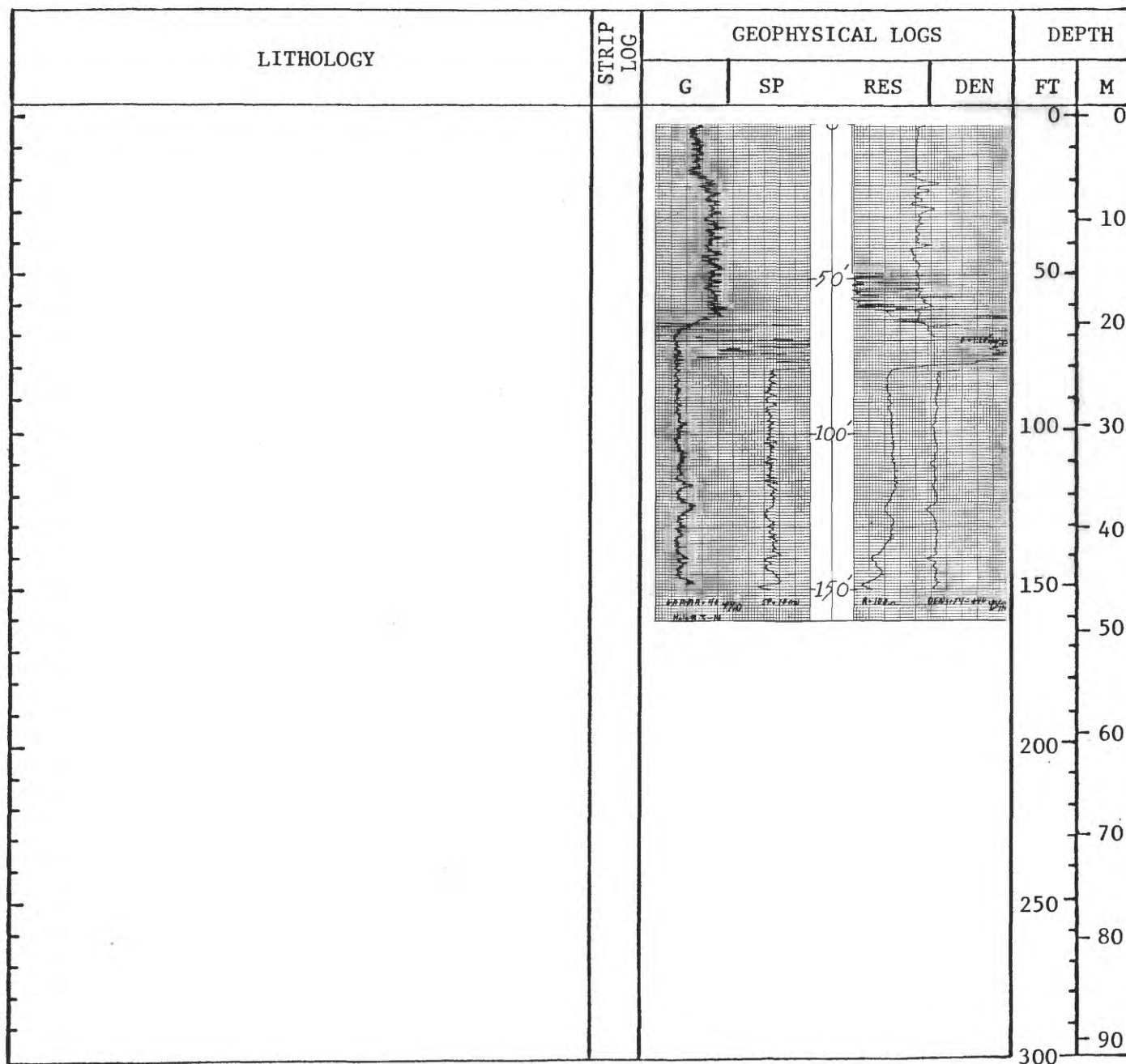
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. J14 Map Johnny Moore Mtn Date logged 9/30/77 Elevation (ft) 8,355'
Location: T. 9 N., R. 78 W., sec. 26 : 1,525' S 2,775' E L Cored: ☒ Yes ☐ No
Drilled depth 150' Logged depth 150' Drilling medium mud Fluid level 65'

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 59° ENE. Cored interval: 70'-154'



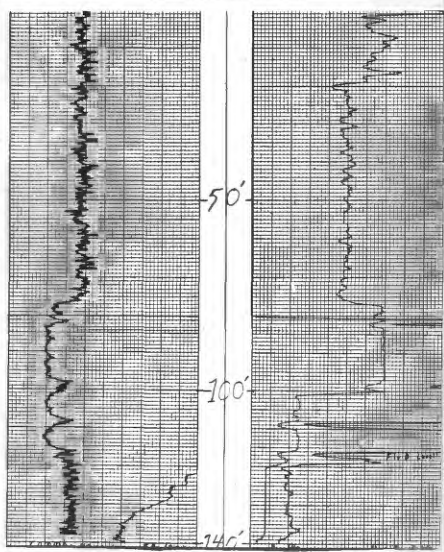
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G15 Map Gould NW Date logged 8-25-77 Elevation (ft) 8,400
Location: T. 9 N., R. 78 W., sec. 28 : 1600 FSL 1975 FEL Cored: ☐ Yes ☒ No
Drilled depth 140 Logged depth 140 Drilling medium air Fluid level 116

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 16 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 21° SW.

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0-77 Mudstone, brown and gray						0	0
						10	
						50	
						20	
77-120 Coal						100	30
120-132 Mudstone, medium-light-gray							
132-140 Sandstone, very light gray, fine-grained						40	
						150	
						50	
						200	60
						70	
						250	80
						90	
						300	

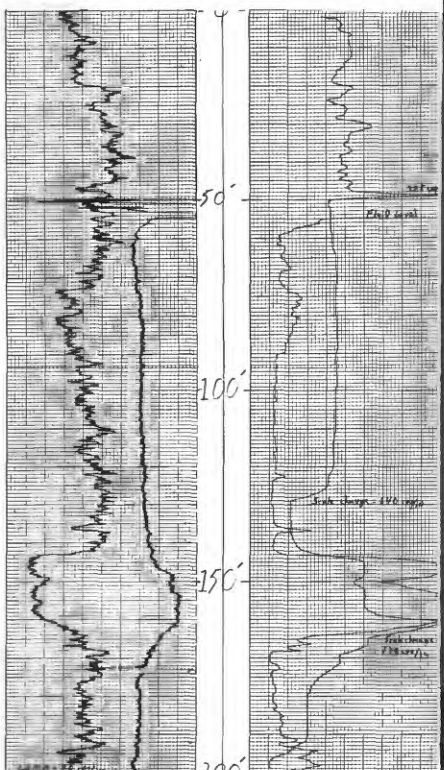
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G16 Map Gould NW Date logged 8-22-77 Elevation (ft) 8,365
Location: T. 9 N., R. 78 W., sec. 33 : 1625 FNL 325 FEL Cored: ☐ Yes ☒ No
Drilled depth 200 Logged depth 200 Drilling medium air Fluid level 55

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 100 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 36° WSW. Twin drilled, coal cored in
second hole.

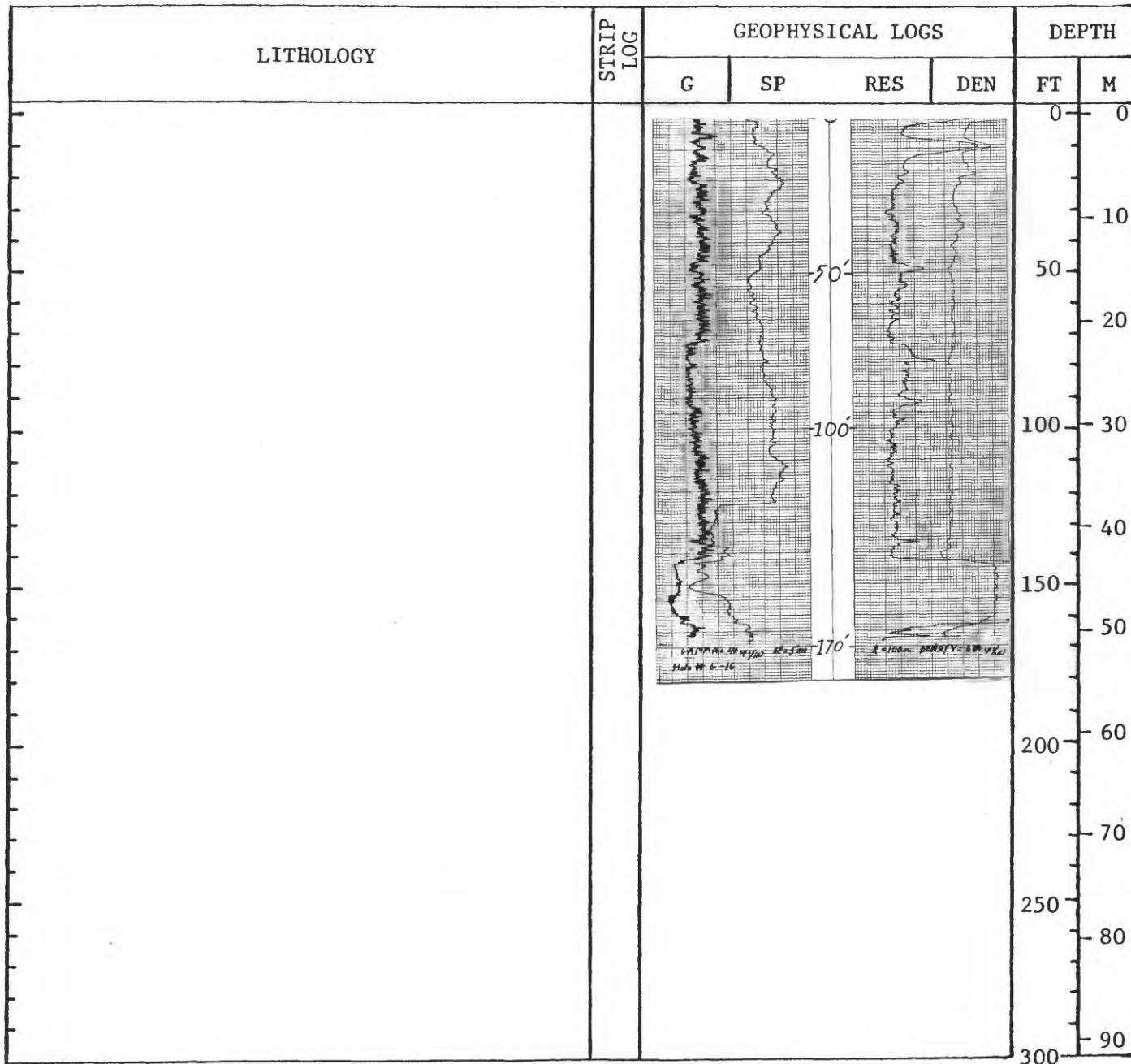
LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-5	Soil						0	0
5-21	Gravel						10	
							20	
							30	
							40	
21-142	Mudstone, gray						50	
							60	
							70	
							80	
							90	
142-168	Coal						100	30
							110	
							120	
							130	
							140	
							150	45
							160	
							170	
							180	
							190	
168-200	Mudstone, dark-brown (light-brown at 195'-200')						200	60
							210	
							220	
							230	
							240	
							250	75
							260	
							270	
							280	
							290	
							300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G16 Map Gould NW Date logged 9/26/77 Elevation (ft) 8,365'
Location: T. 9 N., R. 78 W., sec. 33 : 1,625' FNL 325' FEL Cored: ☒ Yes ☐ No
Drilled depth 170' Logged depth 168' Drilling medium mud Fluid level 0'
Geophysical logs:

Spontaneous potential (SP): Scale 25 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 36° WSW. Cored interval: 140'-170'



U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E17A Map Eagle Hill Date logged 8-31-77 Elevation (ft) 8170
Location: T. 9 N., R. 79 W., sec. 1 : 2325 FNL 1050 FWL Cored: ☐ Yes ☒ No
Drilled depth 461 Logged depth 461 Drilling medium Air Fluid level 99

Geophysical logs:

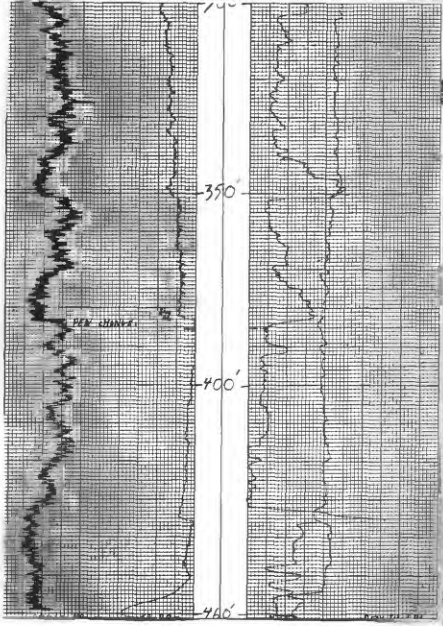
Spontaneous potential (SP): Scale 100 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-64	Sandstone, moderate-brown, and grayish-brown claystone						0	0
64-71	Mudstone, brownish-gray						10	
71-100	Sandstone, dark-yellowish-orange, medium-grained to very fine pebble gravel, subangular, poorly sorted, poorly consolidated						50	
100-124	Siltstone, medium-gray						20	
124-128	Sandstone, very light gray, medium-grained to coarse-grained, subangular, well-sorted, poorly consolidated						100	30
128-140	Mudstone, medium-gray						40	
140-167	Sandstone, grayish-orange, very coarse grained to very fine pebble gravel, angular, poorly consolidated						150	
167-188	Sandstone, as above, and medium-gray mudstone, interbedded						50	
188-209	Siltstone, medium-gray, interbedded with light-gray mudstone						200	60
209-253	Sandstone, grayish-orange, very coarse grained to very fine pebble gravel, angular, poorly consolidated, interbedded with siltstone and mudstone						70	
253-300	Mudstone, brownish-gray, interbedded with medium-gray muddy siltstone						250	80
							300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. E17A (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
300-341	Mudstone and muddy siltstone							
341-351	Sandstone, very light gray, coarse-grained, angular, poorly consolidated						100	
351-375	Mudstone, brownish-gray						350	
375-385	Sandstone, very light gray, coarse-grained, angular, poorly consolidated						110	
385-433	Mudstone, medium-light-gray						120	
431-461	Sandstone, very light gray, coarse-grained, angular, poorly consolidated; interbedded mudstone						400	
							130	
							140	
							150	
							160	
							170	
							180	
							190	
							200	
							210	
							700	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E17B Map Eagle Hill Date logged 9-6-77 Elevation (ft) 8175
Location: T. 9 N., R. 79 W., sec. 1 : 2475 FS L 1125 FW L Cored: ☐ Yes ☒ No
Drilled depth 400 Logged depth 399 Drilling medium air Fluid level 154

Geophysical logs:

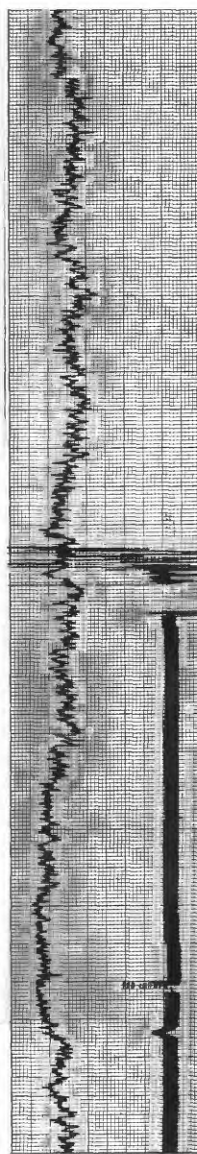
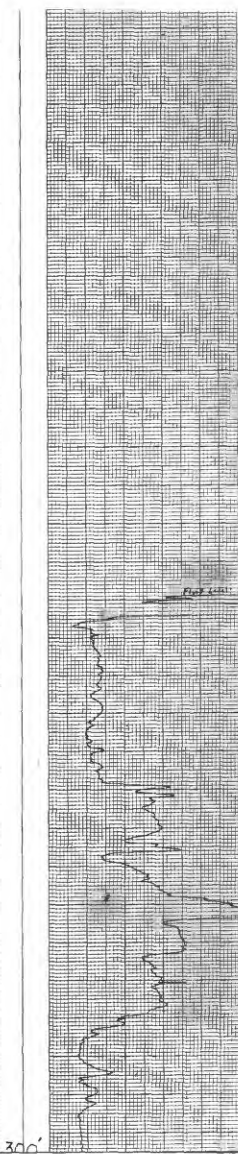
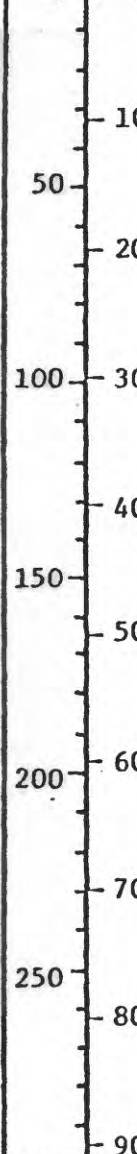
Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm

Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm

Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm

Density (DEN): T.C. _____ Scale _____ Logging speed _____ fpm

Remarks: Density log run on separate sheet. Water (8 GPM) between 130' and 135'.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-23	Siltstone, grayish-orange						0	0
							10	
							50	
							20	
23-133	Mudstone, light-brown, grayish-orange, light-olive-gray, and moderate-yellowish-brown						100	30
133-150	Sandstone, very light gray, coarse-grained to very coarse grained, subrounded, poorly consolidated							40
				150	50			
150-204	Mudstone, brownish-gray and light-gray			60				
				200				
				70				
204-268	Sandstone, white, medium-grained to very fine pebble gravel, subangular, poorly consolidated			250	80			
268-300	Mudstone, light-gray			90				
				300	300			

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. E17B (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
300-307	As above							
307-312	Coal							
312-338	Mudstone, brownish-gray							100
338-340	Coal							
340-356	Mudstone, light-gray							
356-359	Sandstone, very light gray, very coarse grained, subangu- lar, poorly consolidated						350	
								110
359-372	Mudstone, medium-dark-gray and brownish-black							
372-380	Sandstone, light-gray, medium- to fine-grained, poorly consolidated						400	120
380-400	Mudstone, light-gray							
								130
								140
								150
								160
								170
								180
								190
								200
								210
								700

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E17B Map Eagle Hill Date logged 9-6-77 Elevation (ft) 8175
Location: T. 9 N., R. 79 W., sec. 1 : 2475 FSL 1125 FWL Cored: ☐ Yes ☒ No
Drilled depth 400 Logged depth 376 Drilling medium Air Fluid level 154
Geophysical logs:

Spontaneous potential (SP): Scale _____ Logging speed _____ fpm

Resistivity (RES): Scale _____ Logging speed _____ fpm

Gamma (G): T.C. _____ Scale _____ Logging speed _____ fpm

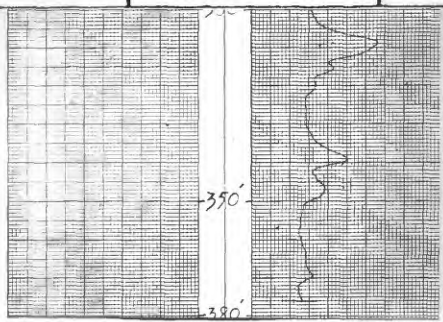
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: Gamma, SP, resistivity and strip logs on a sheet separate from the density
log. Water (8 GPM) between 130' and 135'.

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0-23 Siltstone, grayish-orange						0	0
						10	
						20	
						30	
23-133 Mudstone, light-brown, grayish-orange, light-olive-gray, and moderate-yellowish-brown						40	
						50	
						60	
133-150 Sandstone, very light gray, coarse-grained to very coarse grained, subrounded, poorly consolidated						70	
						80	
						90	
150-204 Mudstone, brownish-gray and light-gray						100	
						110	
						120	
						130	
204-268 Sandstone, white, medium-grained to very fine pebble gravel, subangular, poorly consolidated						140	
						150	
						160	
						170	
268-300 Mudstone, light-gray						180	
						190	
						200	
						210	
						220	
						230	
						240	
						250	
						260	
						270	
						280	
						290	
						300	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. E17B (continued)

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
300-307	As above							
307-312	Coal							
312-338	Mudstone, brownish-gray							
338-340	Coal							100
340-356	Mudstone, light-gray							
356-359	Sandstone, very light gray, very coarse grained, subangular, poorly consolidated						350	
359-372	Mudstone, medium-dark-gray and brownish-black							110
372-380	Sandstone, light-gray, medium-to fine-grained, poorly consolidated						400	120
380-400	Mudstone, light-gray							
								130
								140
							450	
								150
							500	
								160
								170
							550	
								180
							600	
								190
							650	200
								210
							700	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. C18 Map Cowdrey Date logged 8-30-77 Elevation (ft) 8120
Location: T. 9 N., R. 79 W., sec. 3 : 2350 Fs L 2400 F_{WL} Cored: ☐ Yes ☒ No
Drilled depth 341 Logged depth 341 Drilling medium Air Fluid level 48

Geophysical logs:

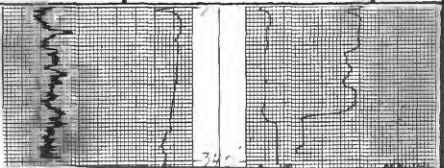
Spontaneous potential (SP): Scale 250 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-20	Siltstone, yellowish-gray and moderate-yellowish-brown; white mudstone						0	0
20-55	Mudstone, grayish-brown and medium-gray						10	
55-59	Sandstone, very light gray, medium-grained to very fine pebble gravel, subrounded, poorly sorted, poorly consolidated						50	
59-102	Mudstone, silty, medium-light-gray and light-gray						20	
102-108	Sandstone, very light gray, fine-grained, rounded						100	30
108-155	Mudstone, brownish-gray, coal, 113'-115' interbedded medium-light-gray, silty mudstone						40	
155-159	Sandstone, very light gray, fine-grained, rounded, well-consolidated						150	
159-172	Sandstone, light-gray, very coarse grained to very fine pebble gravel, angular, poorly consolidated						50	
172-180	Mudstone, light-gray						200	60
180-240	Sandstone, very light gray, fine-grained, rounded, well-consolidated, interbedded with light-gray, very coarse grained to fine pebble gravel, angular, poorly consolidated sandstone						70	
							250	80
240-300	Mudstone						90	
							300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. C18 (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
300-340 Mudstone							
						100	
						350	
						110	
						120	
						400	
						130	
						450	
						140	
						150	
						500	
						160	
						550	
						170	
						180	
						600	
						190	
						650	
						200	
						210	
						700	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E19 Map Eagle Hill Date logged 8-30-77 Elevation (ft) 8125
Location: T. 9 N., R. 79 W., sec. 10 : 900 FN L 275 FW L Cored: ☐ Yes ☒ No
Drilled depth 322 Logged depth 322 Drilling medium Air Fluid level 30

Geophysical logs:


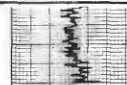
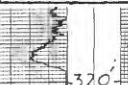
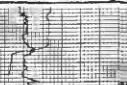

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-16	Sandstone, moderate-orange-pink, medium-grained, subrounded, well-sorted, well-consolidated; some gravel						0	0
16-30	Mudstone, very light gray and silty, some light-olive-gray and not silty						10	
30-34	Sandstone, very light gray, medium-grained, poorly consolidated						20	
34-40	Siltstone, white							
40-53	Mudstone, light-gray						100	30
53-67	Sandstone, very light gray, very coarse grained, poorly consolidated							
67-83	Mudstone, light-gray						40	
83-92	Sandstone, white, fine- to medium-grained						150	50
							200	60
							250	80
92-300	Siltstone, medium-light-gray and white, fine-grained, well-sorted, well-consolidated, with biotite						300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. E-19 (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
300-322 Siltstone, medium-light-gray and white, fine-grained, well-sorted, well-consolidated, with biotite							
							100
						350	
							110
							120
						400	
							130
							140
						450	
							150
							160
						500	
							170
							180
						600	
							190
							200
						650	
							210
							700

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E20 Map Eagle Hill Date logged 8-29-77 Elevation (ft) 8240
Location: T. 9 N., R. 79 W., sec. 13 : 300 FN L 900 FW L Cored: ☐ Yes ☒ No
Drilled depth 496 Logged depth 496 Drilling medium Air Fluid level 30

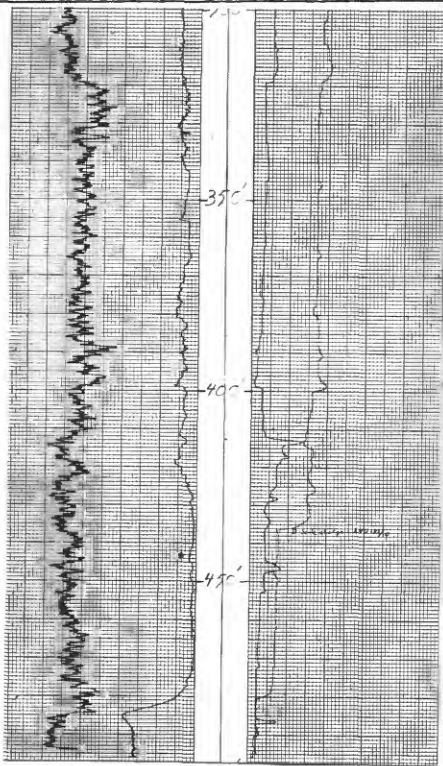
Geophysical logs:

Spontaneous potential (SP): Scale 100 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 1,000 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 6.4Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 40° SW.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-55	Sandstone, dark-yellowish-orange to light-brownish-gray, very coarse to medium-grained, sub-angular, poorly consolidated						0	0
55-63	Mudstone, light-gray and brownish-black						10	
63-85	Coal, with parting of brownish-black mudstone at 77'-81'						20	
85-108	Mudstone, light-gray						30	
108-126	Sandstone, light-gray, very coarse grained, poorly consolidated; some gravel						40	
126-132	Mudstone, gray; coal, 132'-133'						50	
132-142	Sandstone, light-gray, coarse-grained						60	
142-204	Mudstone, light-gray and light-gray, coarse-grained, poorly consolidated sandstone, 165'-170', 186-189', and 200'-204'						70	
204-212	Mudstone, brownish-gray, and coal at 205' and 210' -212'						80	
212-224	Sandstone, light-brownish-gray, medium-grained, poorly consolidated						90	
224-235	Mudstone, light-gray and brownish-gray						100	
235-276	Sandstone, very light gray, medium- to fine-grained, sub-rounded, well-sorted, and light-gray, very coarse grained poorly consolidated sandstone						110	
276-300	Mudstone, medium-light-gray and brownish-black						120	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. E20 (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
						100	
						350	110
300-413 Mudstone, medium-light-gray and brownish-black						400	120
413-430 Sandstone, very light gray, fine-grained to very coarse grained						450	130
							140
430-496 Mudstone, gray, some silty, and very light gray, fine- to medium-grained sandstone at 445'-448'						500	150
							160
						550	170
							180
						600	190
						650	200
							210
						700	

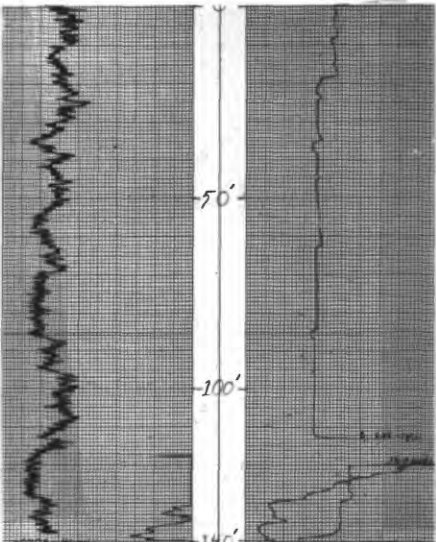
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G21 Map Gould NW Date logged 8-29-77 Elevation (ft) 8295
Location: T. 9 N., R. 79 W., sec. 14 : 2175 FSL 975 FEL Cored: ☐ Yes ☒ No
Drilled depth 140 Logged depth 140 Drilling medium air Fluid level 120

Geophysical logs:

Spontaneous potential (SP): Scale 25 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: _____

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-33	Mudstone, gray						0	0
33-38	Sandstone, very light gray, coarse-grained to very coarse grained, subangular, poorly consolidated							10
38-54	Mudstone, light-gray and dark-yellowish-orange						50	
54-62	Sandstone, grayish-orange, fine-grained, well sorted, and yellowish-gray siltstone							20
62-69	Mudstone, dark-yellowish-orange							
69-87	Sandstone, grayish-orange, coarse-grained to very coarse grained, subangular, poorly consolidated						100	30
87-120	Mudstone, gray							40
120-123	Sandstone, white, very coarse grained to very fine pebble gravel, subangular						150	
123-140	Mudstone, light-gray, silty							50
							200	60
								70
							250	80
								90
							300	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. G22 Map Gould NW Date logged 8-29-77 Elevation (ft) 8196
Location: T. 9 N., R. 79 W., sec. 24 : 825 FNL 1950 FWL Cored: ☐ Yes ☒ No
Drilled depth 261 Logged depth 261 Drilling medium Air Fluid level 19
Geophysical logs:

Spontaneous potential (SP): Scale 100 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 250 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata 25-30° W.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-11	Mudstone, shaly, brownish-gray						0	0
11-14	Coal							
							10	
14-58	Mudstone, gray and brownish-black						50	
58-76	Coal; brownish-black mudstone; carbonaceous shale						20	
76-97	Mudstone, brownish-black and medium-gray							
97-104	Coal and brownish-black mudstone						100	30
104-109	Mudstone, brownish-black and light-gray							
109-111	Coal						40	
111-134	Mudstone, brownish-black and light-gray							
134-142	Coal, 134'-136' and 140'-142'; brownish-black mudstone						150	50
142-187	Mudstone, light-gray and brownish-gray						60	
187-194	Sandstone, very light gray, fine- to medium-grained, well-rounded, well-sorted						200	60
194-200	Mudstone, light-gray						70	
200-261	Sandstone, very light gray, fine- to medium-grained, well-rounded, well-sorted, interbedded with light-gray mudstone						250	80
							80	
							90	
							300	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E23 Map Eagle Hill Date logged 9-6-77 Elevation (ft) 7980
Location: T. 10 N., R. 78 W., sec. 31 : 200 FNL 2400 FEL Cored: ☐ Yes ☒ No
Drilled depth 306 Logged depth 306 Drilling medium air Fluid level 18
Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Dip of strata is approximately 25° W. Twin drilled, coal cored
in second hole. Water (2 GPM) between 42' and 48'.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-5	Soil, moderate-yellowish-brown, and gravel						0	0
5-18	Sandstone, moderate-yellowish-brown to moderate-brown, medium-grained, poorly consolidated						10	
18-40	Mudstone, gray, some silty, and light-gray, medium-grained, subrounded, poorly consolidated sandstone at 21'-25'						50	
40-53	Sandstone, greenish-gray, very coarse grained to medium-grained, subangular, poorly consolidated						20	
53-61	Mudstone, silty, medium-light-gray						100	30
61-83	Sandstone, light-gray, medium-to coarse-grained, subrounded, very well consolidated, interbedded with poorly consolidated sandstone						40	
83-90	Mudstone, medium-gray						150	
90-118	Sandstone, light-gray, medium-grained to very fine pebble gravel, subangular to angular, poorly consolidated, interbedded with medium-gray mudstone						50	
118-167	Mudstone, light-gray, interbedded with light-gray, fine- to medium-grained, subrounded, poorly consolidated sandstone						200	60
167-188	Sandstone, white, medium-grained to very fine pebble gravel, subrounded to angular, poorly consolidated						70	
							250	80
							300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. E23 (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
188-200 Mudstone, medium-gray; interbedded, white, very coarse grained to very fine pebble gravel, angular, poorly consolidated sandstone							100
200-216 Coal; medium-gray mudstone at 203-205'						350	110
216-229 Siltstone, white							120
229-298 Mudstone, silty, medium-gray						400	130
298-306 Mudstone, brownish-gray						450	140
						500	150
						550	160
						600	170
						650	180
							190
							200
							210
						700	

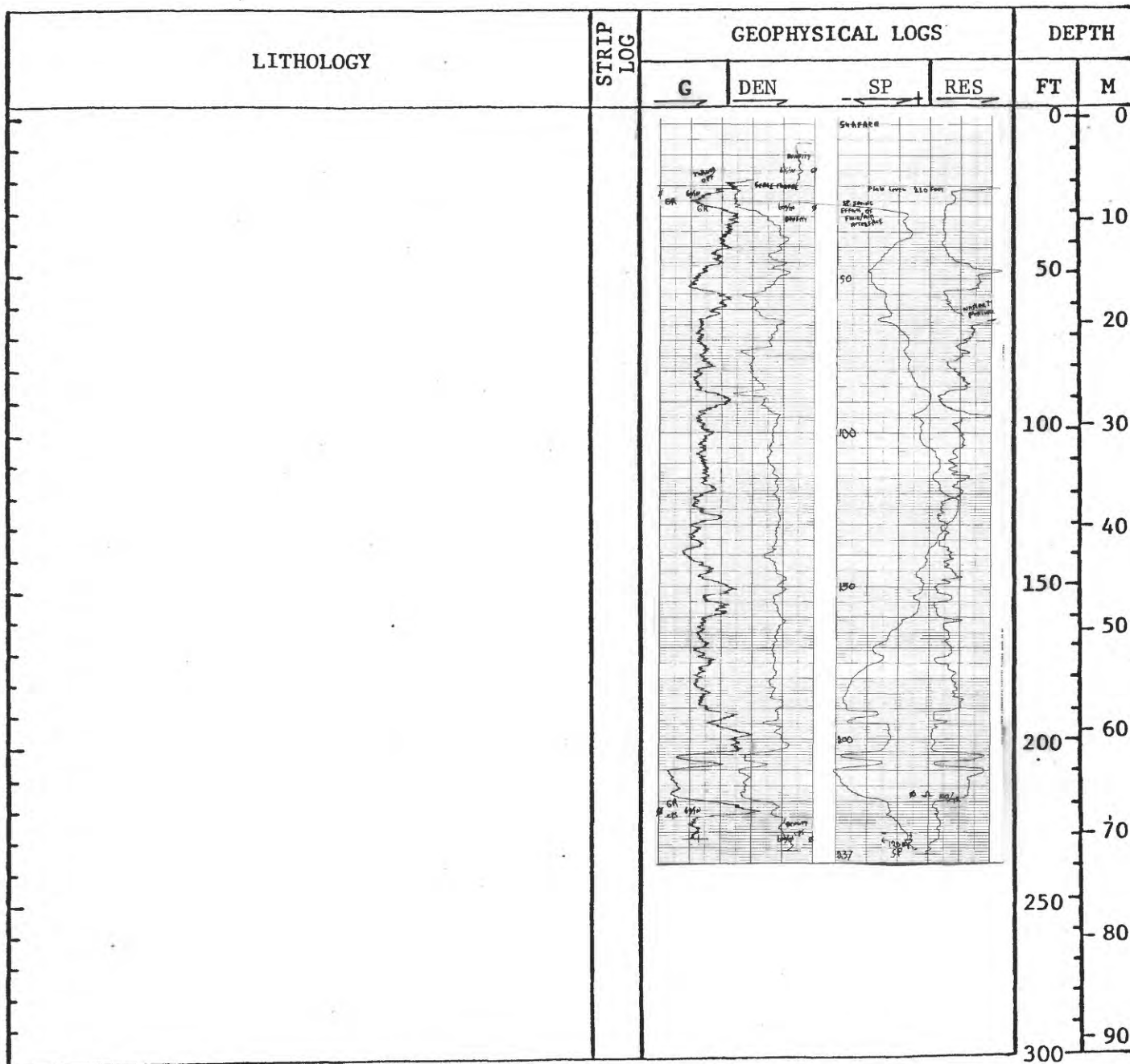
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E-23 Map Eagle Hill Date logged 11-6-77 Elevation (ft) 7,980
Location: T. 10 N., R. 78 W., sec. 31 : 200 FN L 2400 FEL Cored: ☒ Yes ☐ No
Drilled depth 237 Logged depth 237 Drilling medium water Fluid level 21

Geophysical logs:

Spontaneous potential (SP): Scale 600 mv/in Logging speed 25 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 25 fpm
Gamma (G): T.C. 1 Scale 300 cps/in Logging speed 25 fpm
Density (DEN): T.C. 1 Scale 3 Kcps/in Logging speed 25 fpm
Remarks: Cored interval 185'-227'.



U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E24 Map Eagle Hill Date logged 9/15/77 Elevation (ft) 8,110
Location: T. 10 N., R. 79 W., sec. 10 : 1,750 F NL 1,825 F EL Cored: ☐ Yes ☒ No
Drilled depth 800' Logged depth 800' Drilling medium mud Fluid level 24'

Geophysical logs:

Spontaneous potential (SP): Scale 25 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 8 cps/in Logging speed 20 fpm
Remarks: Water (5 GPM) between 25' and 40'.

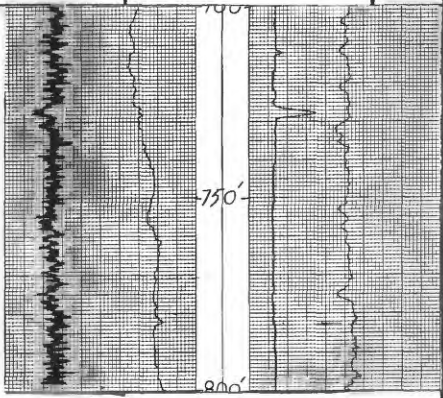
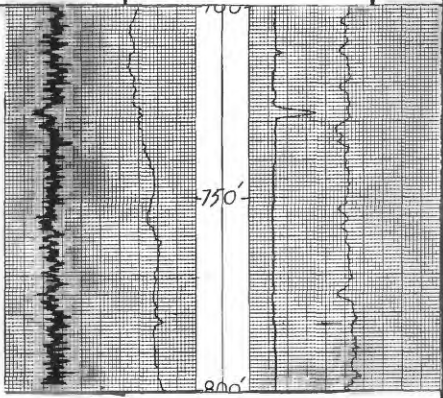
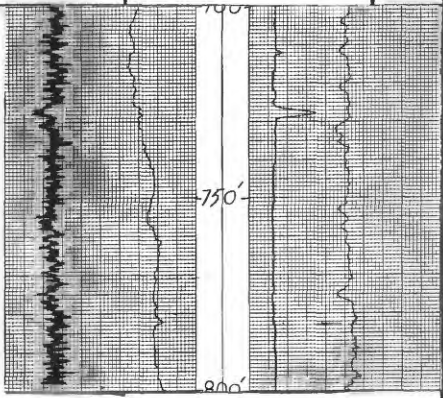
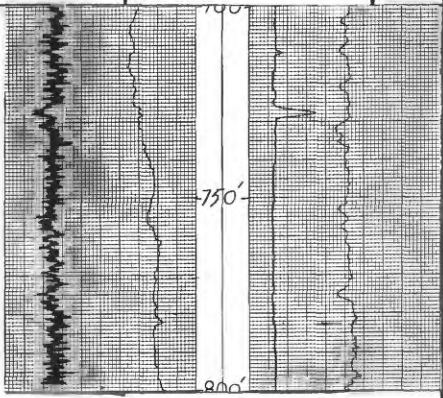
LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0- 24 - Sand, grayish-orange, medium-grained						0	0
24- 29 - Silty mudstone, medium-light-gray; medium-gray mudstone						10	
29- 34 - Sandstone, light-gray, medium-grained to very fine pebble gravel						50	
34- 52 - Mudstone, medium-gray						20	
52-108 - Sandstone, light-gray, medium-grained to very fine pebble gravel, poorly consolidated; interbedded medium-gray mudstone and sandstone, very light-gray, medium-grained, well-consolidated, with biotite						100	30
108-146 - Mudstone, greenish-gray; interbedded, greenish-gray siltstone						40	
146-169 - Siltstone, greenish-gray; interbedded sandstone, light-gray, medium-grained to very fine pebble gravel, poorly consolidated						150	50
169-172 - Mudstone, yellowish-brown							
172-188 - Sandstone, light-gray, medium-grained to very fine pebble gravel, poorly consolidated						200	60
188-192 - Mudstone, greenish-gray							
192-213 - Sandstone, light-gray, medium-grained to very fine pebble gravel, poorly consolidated						70	
213-300 - Mudstone, greenish-gray and light-gray						250	80
						300	90

Hole No. E24 (continued)

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U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. E24 (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
700-800 - Mudstone and siltstone, as above						220	
						230	
						240	
						250	
						260	
						270	
						280	
						290	
						300	
						310	
						320	
						330	
						340	
						350	
						360	
						370	
						380	
						390	
						400	
						410	
						420	
						430	
						440	
						450	
						460	
						470	
						480	
						490	
						500	
						510	
						520	
						530	
						540	
						550	
						560	
						570	
						580	
						590	
						600	
						610	
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						770	
						780	
						790	
						800	
						810	
						820	
						830	
						840	
						850	
						860	
						870	
						880	
						890	
						900	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E25 Map Eagle Hill Date logged 9/11/77 Elevation (ft) 8,125
Location: T. 10 N., R. 79 W., sec. 14 : 1,800FS L1,550 FEL Cored: ☐ Yes ☒ No
Drilled depth 600' Logged depth 550' Drilling medium mud Fluid level 11'

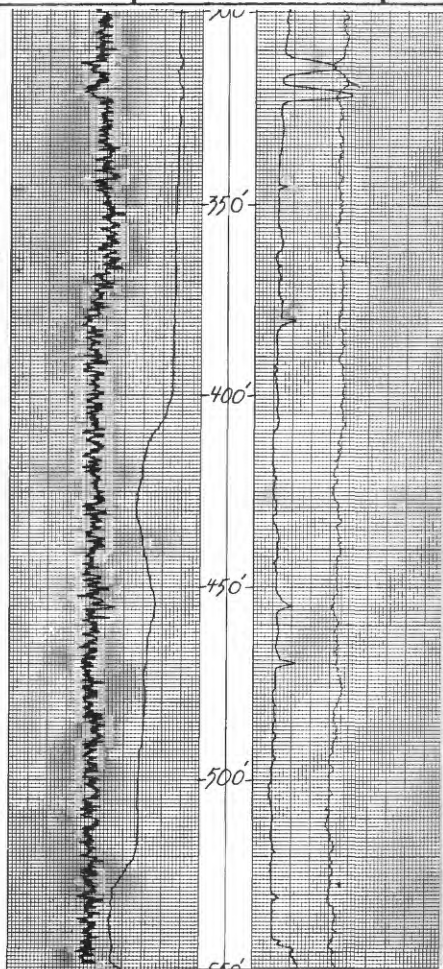
Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 8 cps/in Logging speed 20 fpm
Remarks: Water (5 GPM) between 530' and 550'.

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0- 63 - Sand, pale-yellowish-brown, coarse- to medium-grained, sub-rounded; interbedded medium-gray mudstone						0	0
						10	
						50	
63- 91 - Mudstone, medium-gray; interbedded silty mudstone, pale-brown and dark-grayish green						20	
91-105 - Sandstone, white, very coarse grained to coarse-grained, sub-angular, poorly consolidated						100	30
105-121 - Mudstone, pale-brown						40	
121-131 - Sandstone, white, very coarse grained to coarse-grained, sub-angular, poorly consolidated						150	50
131-138 - Mudstone, pale-brown						200	60
138-147 - Sandstone, white, very coarse grained to coarse-grained, sub-angular, poorly consolidated						250	70
147-185 - Mudstone, pale-brown						300	90
185-209 - Sandstone, light-gray, medium-grained, subrounded, well-consolidated, with biotite, interbedded mudstone, light-gray and pale-brown							
209-300 - Silty mudstone, medium-light-gray							

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. E25 (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
300-312 - Silty mudstone, medium-light-gray							
312-323 - Sandstone, light-gray, medium-grained, subrounded, well-consolidated, with biotite; silty mudstone, medium-light-gray, 316'-319'						100	
						350	
						110	
323-543 - Silty mudstone, medium-light-gray; interbedded sandstone, very light-gray, fine- to medium-grained, poorly consolidated						120	
						400	
						130	
						140	
						150	
						500	
						160	
543-550 - Sandstone, very light-gray, fine- to medium-grained, poorly consolidated						550	
						170	
						180	
						600	
						190	
						650	
						200	
						210	
						700	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. E26 Map Eagle Hill Date logged 9-9-77 Elevation (ft) 8080
Location: T. 10 N., R. 79 W., sec. 24 : 2,000F NL 900 FWL Cored: ☐ Yes ☒ No
Drilled depth 700 Logged depth 647 Drilling medium air Fluid level 24

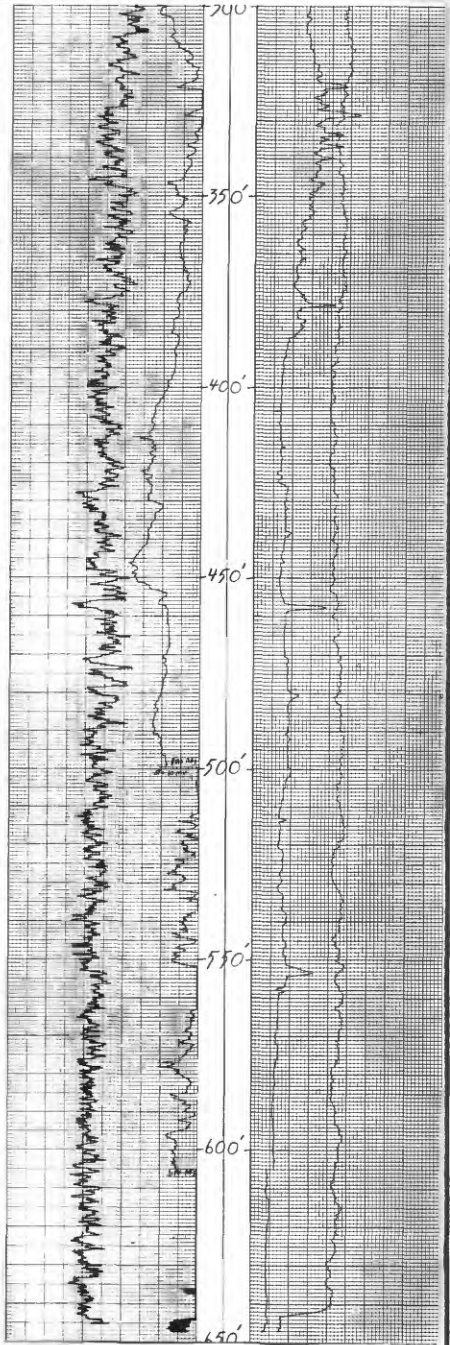
Geophysical logs:

Spontaneous potential (SP): Scale 25 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm
Remarks: Water (5 GPM) between 90' and 130'.

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-16	Sandstone, very pale orange to moderate-yellowish-brown, fine-grained to very coarse grained, subrounded to subangular						0	0
							10	
							50	
							20	
16-88	Mudstone, light-gray and silty							
88-107	Sandstone, white, medium-grained, to very fine pebble gravel, subangular to angular						100	30
107-117	Mudstone, medium-light-gray							
117-126	Sandstone, white, medium- to coarse-grained, subangular						40	
126-139	Mudstone, medium-light-gray							
139-147	Sandstone, white, coarse-grained to very fine pebble gravel, subangular to angular						150	50
147-169	Mudstone, medium-light-gray and brownish-gray							
169-185	Sandstone, white, coarse-grained to very fine pebble gravel, subangular to angular						200	60
185-200	Mudstone, light-gray and medium-dark-gray							
200-216	Sandstone, white, fine-grained, subrounded						70	
216-244	Mudstone, light-gray and medium-dark-gray						250	80
244-264	Sandstone, white, fine- to medium-grained, subrounded							
264-300	Mudstone, medium-light-gray						300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. E26 (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
300-320 As above						100	
						350	110
320-551 Mudstone, medium-light-gray; minor interbedded very light gray siltstone, and grayish- green silty mudstone						400	120
							130
						450	140
							150
						500	160
551-554 Sandstone, light-gray, medium- to coarse-grained, subrounded						550	170
							180
						600	190
554-700 Mudstone, light-gray; inter- bedded grayish-green silty mudstone							200
						650	210
							210
						700	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. C27 Map Cowdrey Date logged 9/16/77 Elevation (ft) 7930
Location: T. 10 N., R. 79 W., sec. 28 : 1750 F NL 2300 F EL Cored: ☐ Yes ☒ No
Drilled depth 320' Logged depth 320' Drilling medium air Fluid level 18'

Geophysical logs:



Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 8 cps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0- 4 - Soil, light-brown						0	0
4- 98 - Mudstone, medium-dark-gray and brownish-black; coal traces						10	
						50	
						20	
98-100 - Sandstone, white, fine-grained, well-sorted, well-consolidated						100	30
100-140 - Mudstone, light-gray, brownish-gray and brownish-black						40	
140-145 - Coal, and brownish-black mudstone						150	
145-200 - Mudstone, light-gray and brownish-black						50	
200-206 - Sandstone, very light gray, very coarse grained to medium-grained, subangular, poorly consolidated						200	60
206-269 - Mudstone, light-gray and brownish-gray						70	
269-279 - Sandstone, very light gray, coarse-grained to very coarse grained, subangular, poorly consolidated						250	
279-293 - Silty mudstone, brownish-gray						80	
293-300 - Sandstone, white, fine-grained, subrounded, well-sorted, well-consolidated, and interbedded very light gray, coarse-grained to very coarse grained, subangular, poorly consolidated sandstone						300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

Hole No. C27 (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
300-308 - As above							
308-311 - Mudstone, brownish-gray with coaly matter							
311-320 - Sandstone, very light gray, coarse-grained to very coarse grained, subangular, poorly consolidated						100	
						350	
						110	
						120	
						400	
						130	
						450	
						140	
						150	
						500	
						160	
						550	
						170	
						180	
						600	
						190	
						650	
						200	
						210	
						700	

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

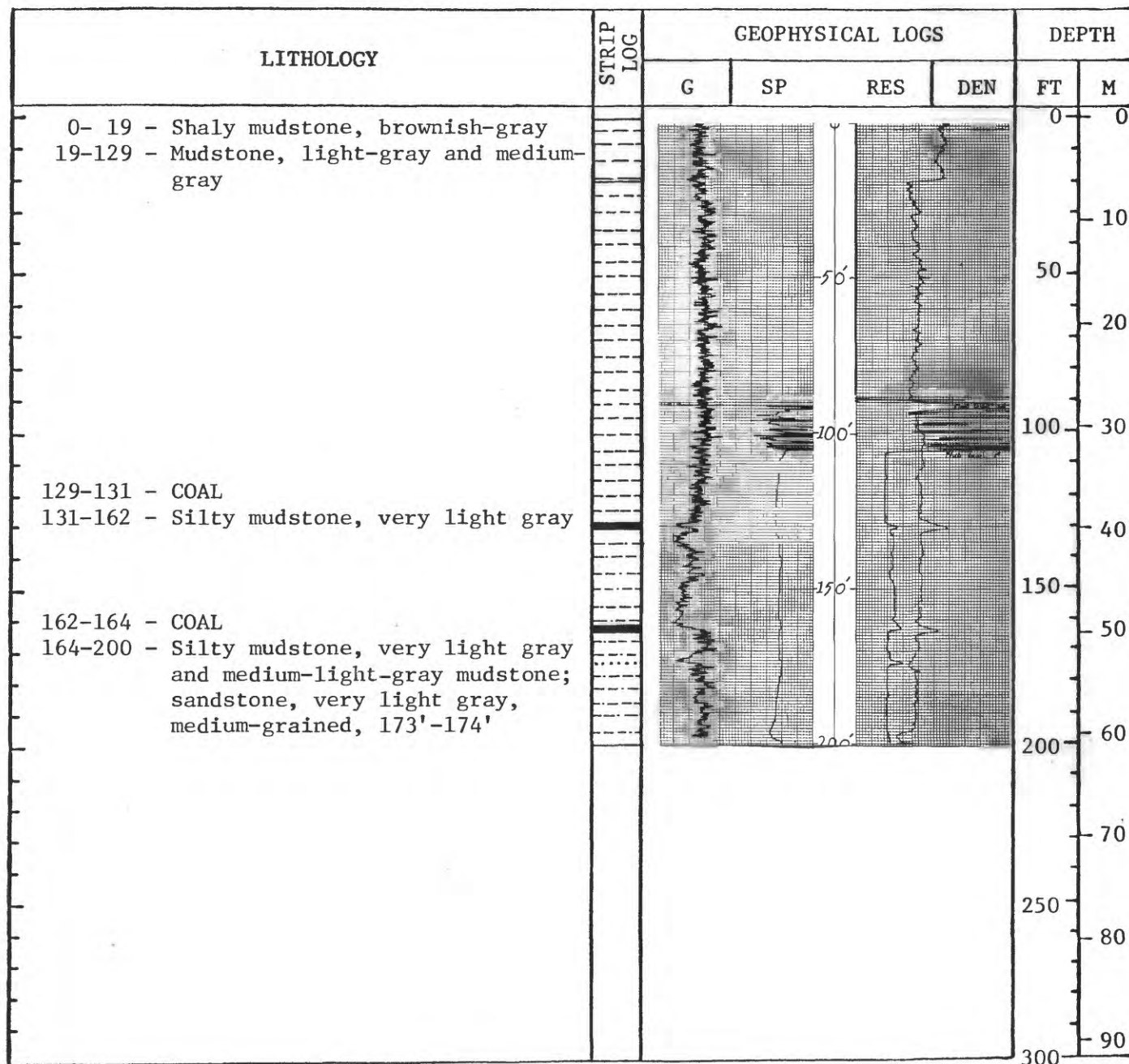
McCALLUM AREA

Hole No. C28 Map Cowdrey Date logged 9/16/77 Elevation (ft) 8110
Location: T. 10 N., R. 79 W., sec. 33 : 2150 FNL 650 FE L Cored: ☐ Yes ☒ No
Drilled depth 200' Logged depth 200' Drilling medium air Fluid level 106'

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 8 cps/in Logging speed 20 fpm

Remarks: _____



U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

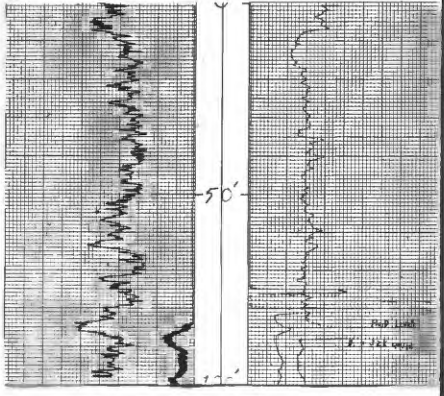
McCALLUM AREA

Hole No. E29 Map Eagle Hill Date logged 9-8-77 Elevation (ft) 8020
Location: T. 10 N., R. 79 W., sec. 34 : 700 F NL 875 F EL Cored: ☐ Yes ☒ No
Drilled depth 100 Logged depth 100 Drilling medium air Fluid level 82

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: Poor cuttings samples.

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
						0	0
						10	
						50	
0-84 Mudstone, light-brown and light-gray						20	
84-88 Coal						100	30
88-100 Mudstone, light-gray						40	
						150	50
						200	60
						70	
						250	80
						90	
						300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. C30 Map Cowdrey Date logged 9/16/77 Elevation (ft) 7,970'
Location: T. 10 N., R. 79 W., sec. 19 : 700 F SL 1,100 F EL Cored: ☐ Yes ☒ No
Drilled depth 300' Logged depth 298' Drilling medium air Fluid level 21'

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 500 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0- 24 - Sand, light-brown to yellowish-gray, medium-grained, and gravel						0	0
24- 33 - Mudstone, light-gray							
33- 38 - Sandstone, white, very coarse grained to very fine pebble gravel, subangular to angular, poorly consolidated						10	
38- 42 - Mudstone, medium-dark-gray						50	
42- 47 - Sandstone, medium-gray, fine-grained, well-sorted, rounded, well-consolidated, with biotite						20	
47- 53 - Mudstone, medium-dark-gray							
53- 62 - Sandstone, medium-gray, fine-grained, rounded, well-sorted, well-consolidated, with biotite						100	30
62- 66 - Mudstone, medium-dark-gray							
66- 69 - Sandstone (see 53'-62')						40	
69- 74 - Mudstone, medium-dark-gray							
74- 84 - Sandstone (see 33'-38')						150	
84- 89 - Mudstone, medium-dark-gray						50	
89-104 - Sandstone, white, very coarse grained, subangular, poorly consolidated							
104-161 - Mudstone, medium-dark-gray; interbedded sandstone (see 89'-104')						200	60
161-164 - COAL							
164-205 - Mudstone, medium-dark-gray; sandstone, medium-gray, fine- to very coarse grained, subangular to angular, poorly consolidated						70	
205-211 - Mudstone, medium-dark-gray							
211-214 - COAL						250	80
214-298 - Mudstone and sandstone (see 164'-205')							
						300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

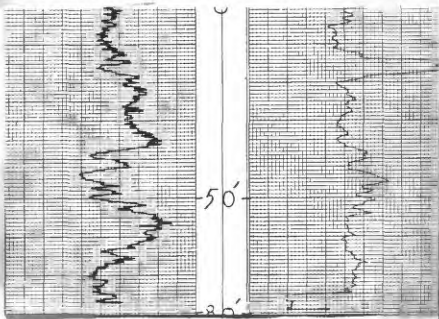
McCALLUM AREA

Hole No. C31 Map Cowdrey Date logged 9/16/77 Elevation (ft) 8042
Location: T. 10 N., R. 79 W., sec. 29 : 850 FSL 1950 FWL Cored: ☐ Yes ☒ No
Drilled depth 80' Logged depth 79' Drilling medium air Fluid level ---

Geophysical logs:

Spontaneous potential (SP): Scale 0 Logging speed 20 fpm
Resistivity (RES): Scale 0 Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
0- 12 - Sandy soil, yellowish-orange and yellowish-gray, medium-grained sandstone						0	0
12- 19 - Shaly mudstone, reddish-black						10	
19- 37 - Mudstone, pale-yellowish-brown and brownish-gray						50	
37- 55 - COAL, with partings						20	
55- 61 - Mudstone, light-gray						100	30
61- 65 - Sandstone, white, very coarse grained to very fine pebble gravel, subangular, poorly consolidated						40	
65- 80 - Sandstone, white, fine-grained, well-sorted, well-consolidated, and light-gray mudstone at 65'-67'						150	50
						200	60
						250	80
						300	90

U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

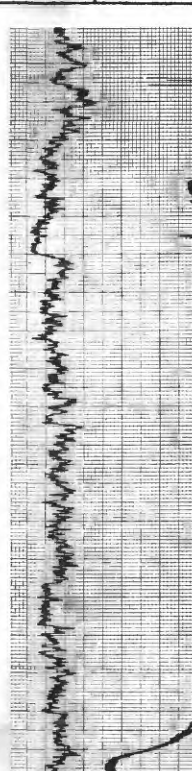
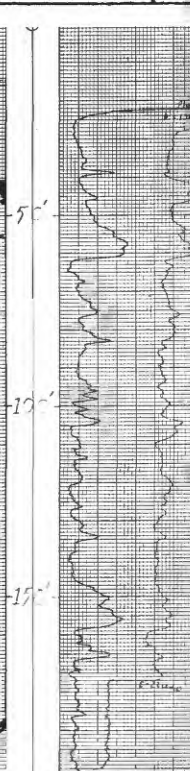
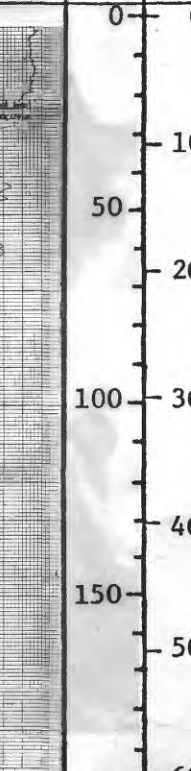

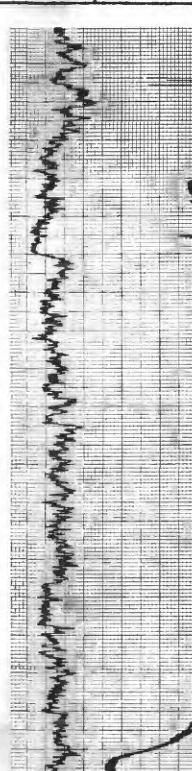
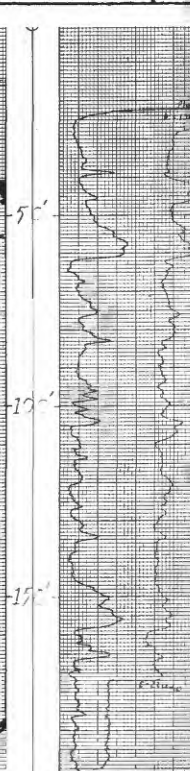
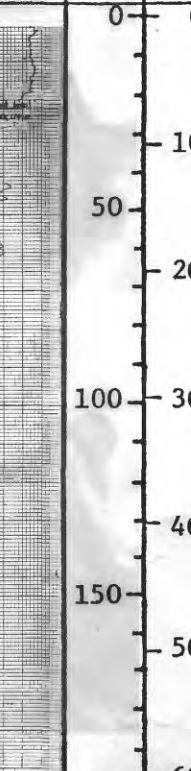

McCALLUM AREA

Hole No. C32 Map Cowdrey Date logged 9-8-77 Elevation (ft) 8035
Location: T. 9 N., R. 79 W., sec. 5 : 475 F_NL 300 F_EL Cored: ☐ Yes ☒ No
Drilled depth 200 Logged depth 200 Drilling medium air Fluid level 22

Geophysical logs:

Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

Remarks: _____

LITHOLOGY		STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
			G	SP	RES	DEN	FT	M
0-21	Mudstone, silty, grayish-orange						0	0
21-24	Coal, weathered and powdery							
24-51	Mudstone, light-gray; inter-bedded, very light gray, fine-grained sandstone							
51-61	Sandstone, white, very coarse grained to very fine pebble gravel, subangular							
							50	
							20	
							100	30
							40	
61-146	Mudstone, light-gray; inter-bedded, very light gray, fine-grained sandstone						150	50
146-158	Sandstone, very light gray, fine-grained						50	
158-162	Mudstone, light-gray							
162-166	Sandstone, white, very coarse grained							
166-200	Mudstone, silty, greenish-gray and light-gray						200	60
							70	
							250	80
							300	90