

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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

By
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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.

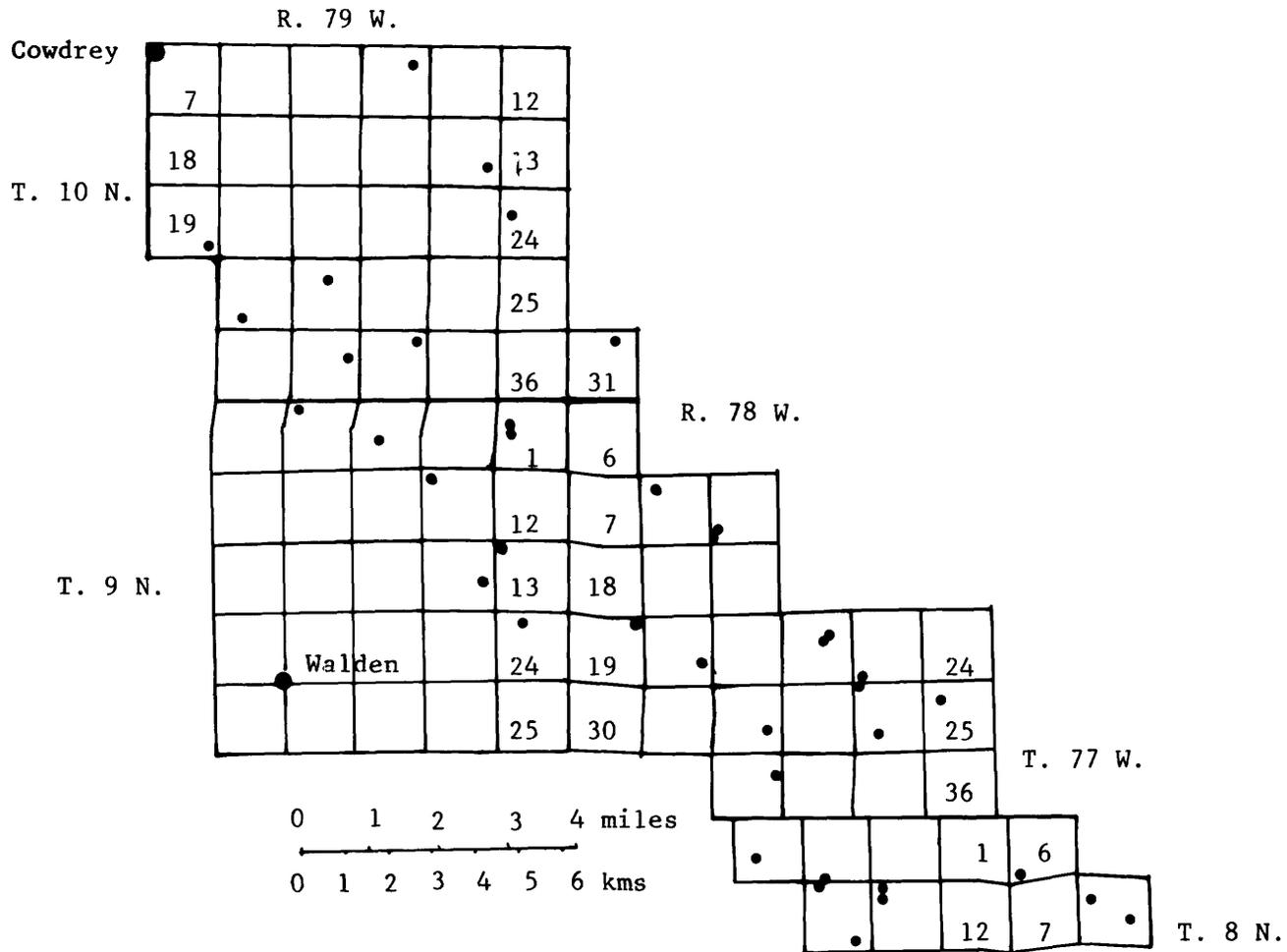
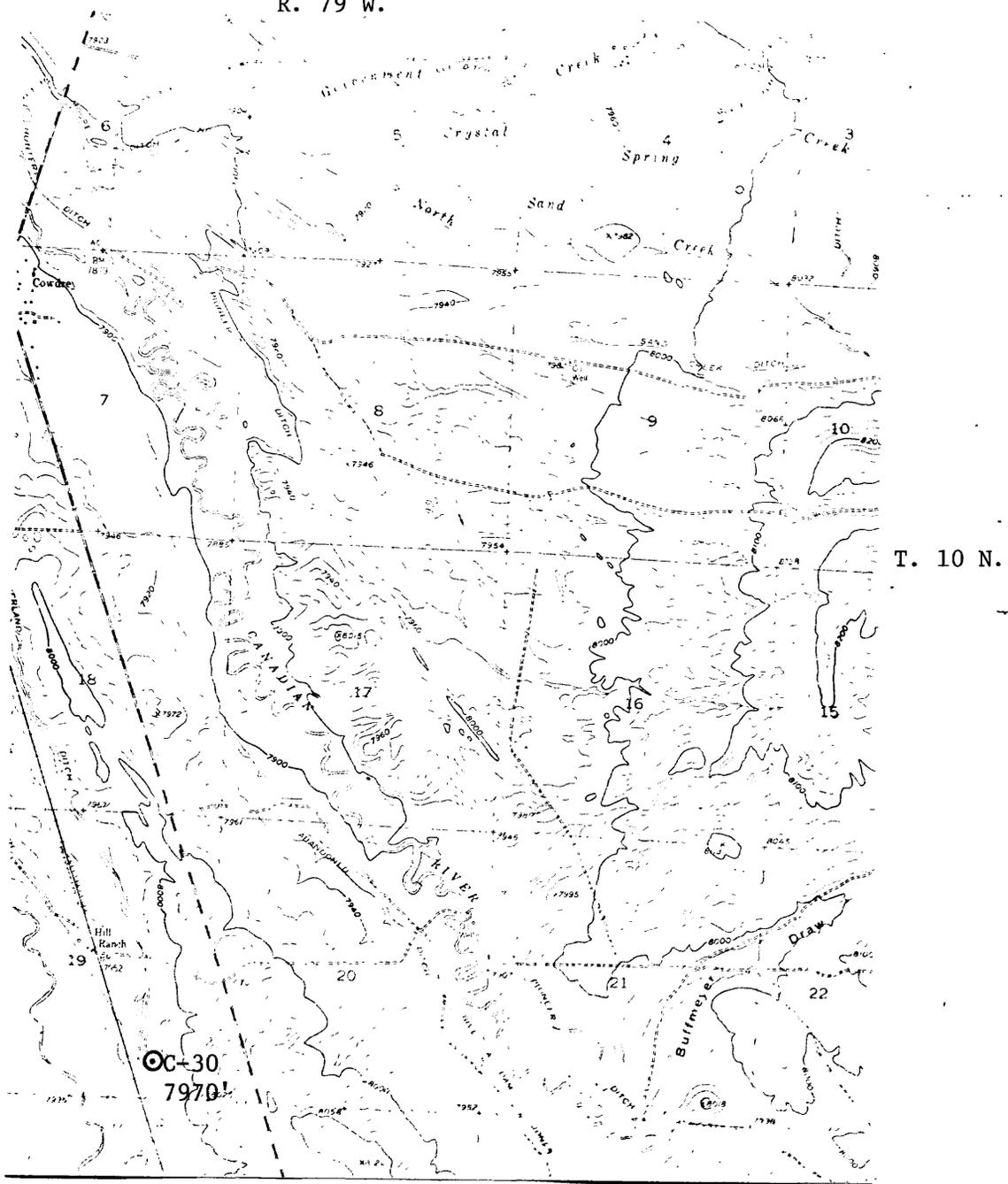


Figure 1.--Map showing drill-hole locations in the McCallum coal field, Jackson County, Colorado.

R. 79 W.



T. 10 N.

SCALE

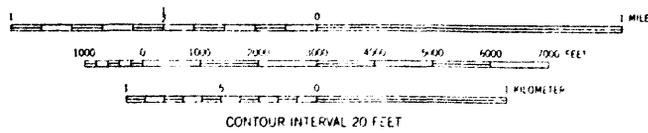


Figure 2. Locations of drill holes, NE¹/₄ of the Cowdrey quadrangle, Jackson County, Colorado.

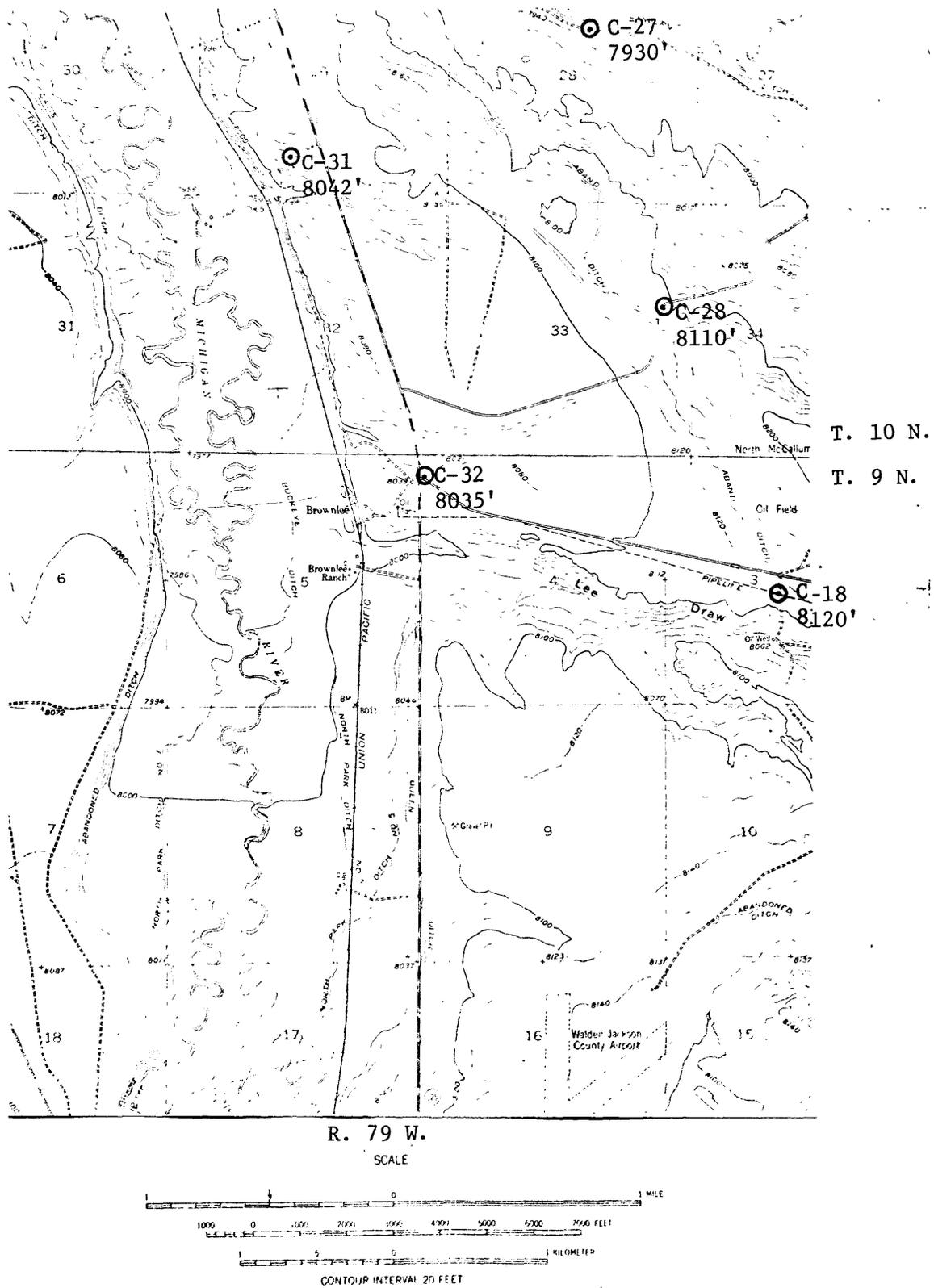


Figure 3. Locations of drill holes, SE¹/₄ of the Cowdrey quadrangle, Jackson County, Colorado.

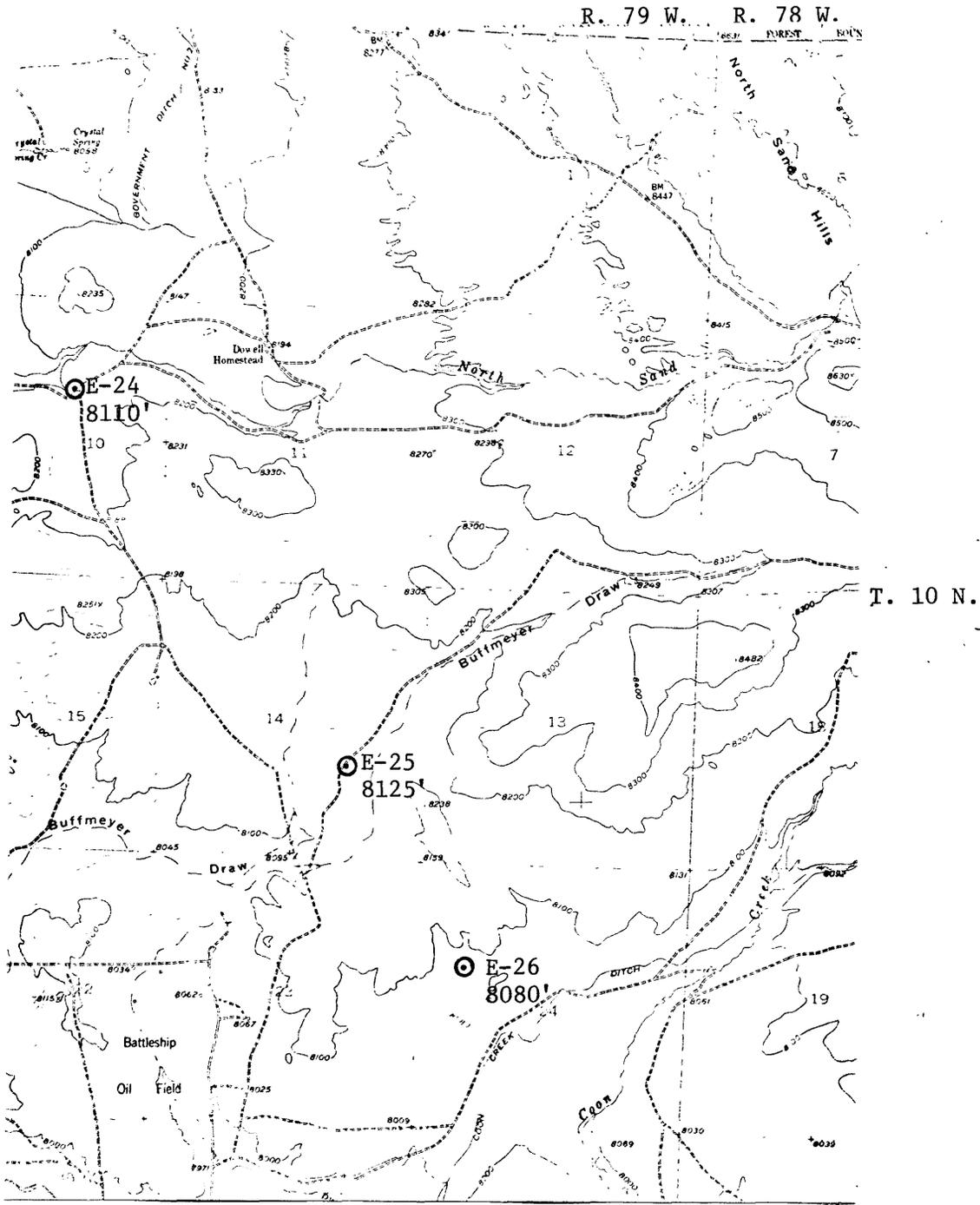


Figure 4. Locations of drill holes, NW $\frac{1}{4}$ of the Eagle Hill quadrangle, Jackson County, Colorado.

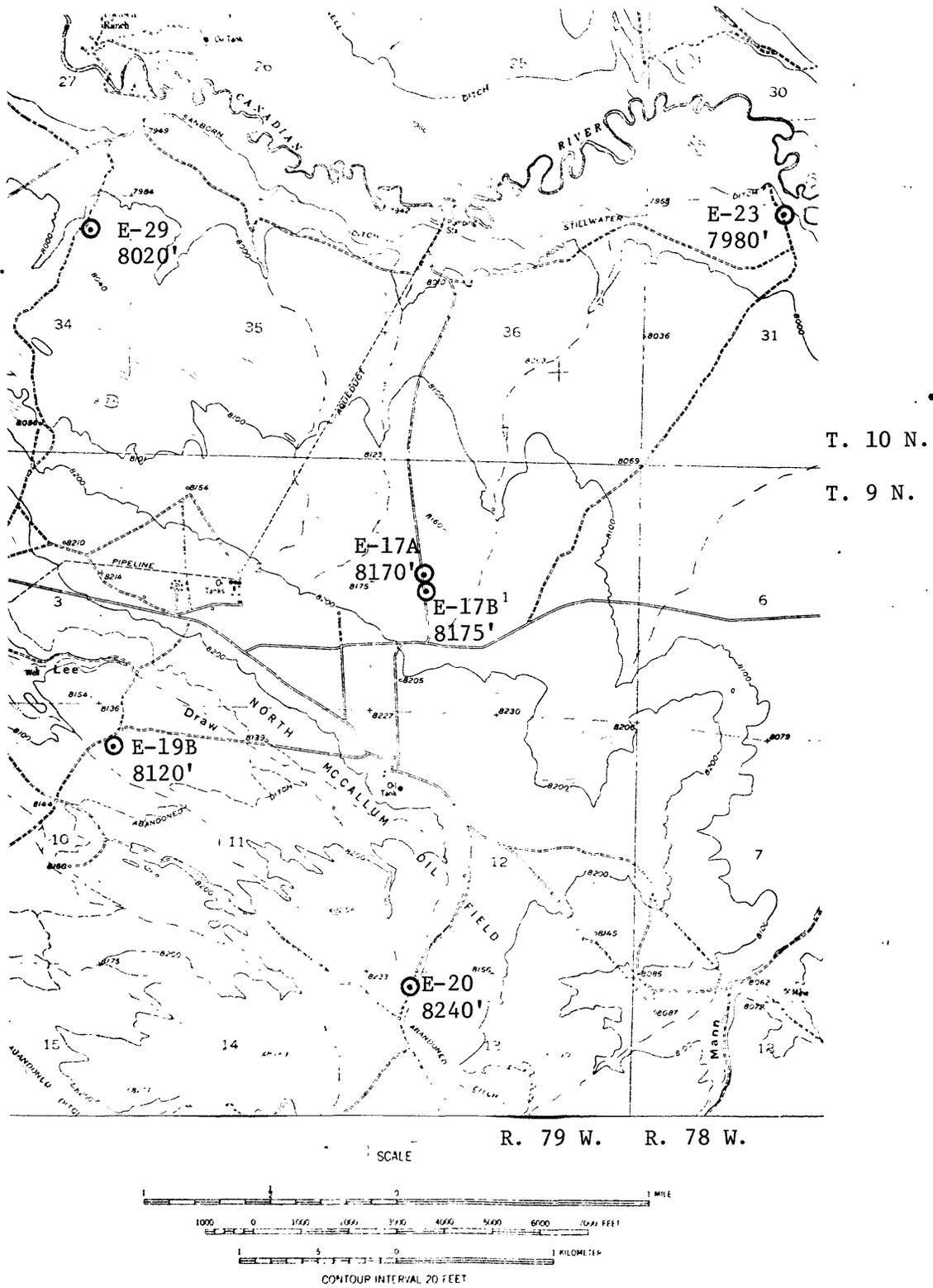


Figure 5. Locations of drill holes, SW $\frac{1}{4}$ of the Eagle Hill quadrangle, Jackson County, Colorado. •

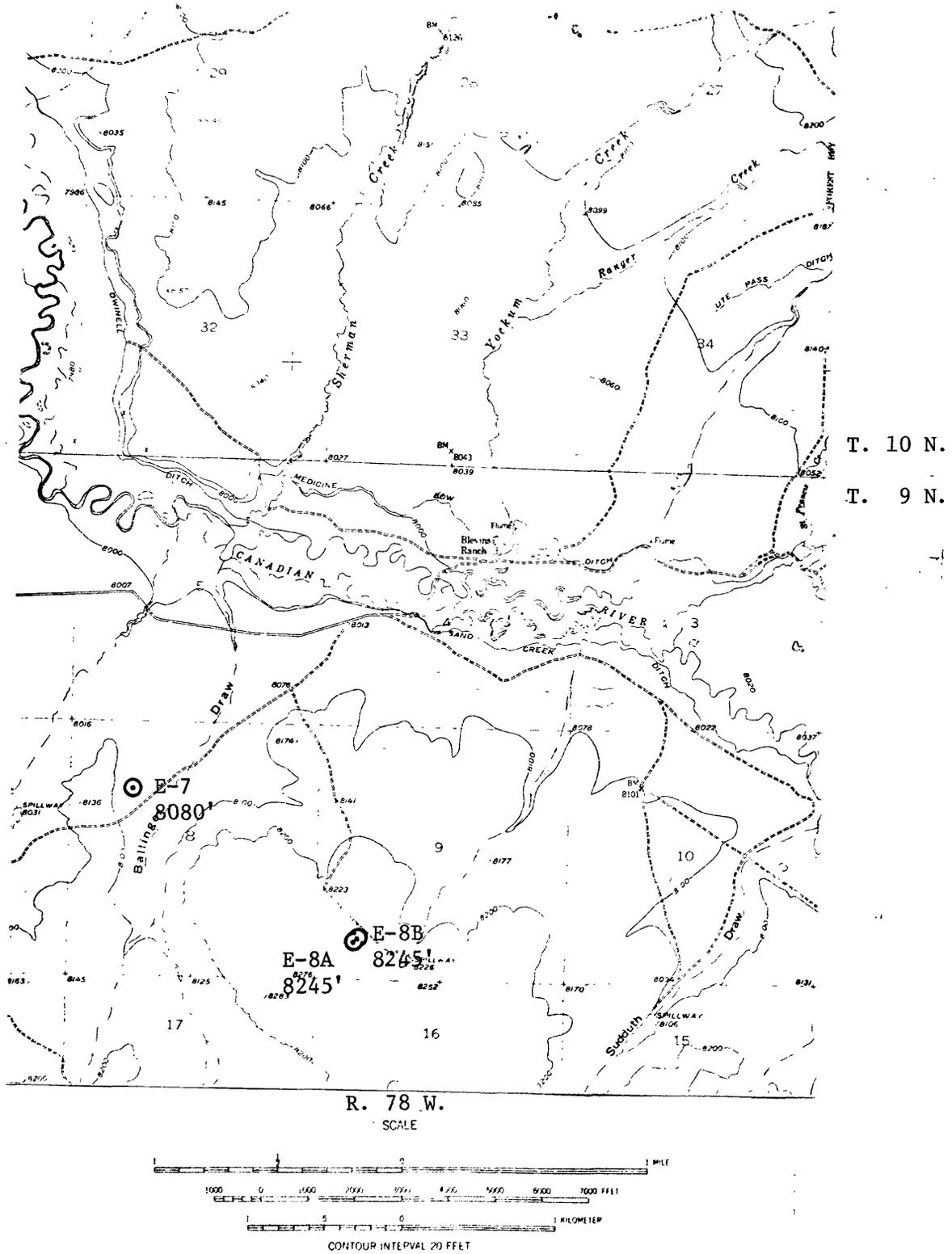
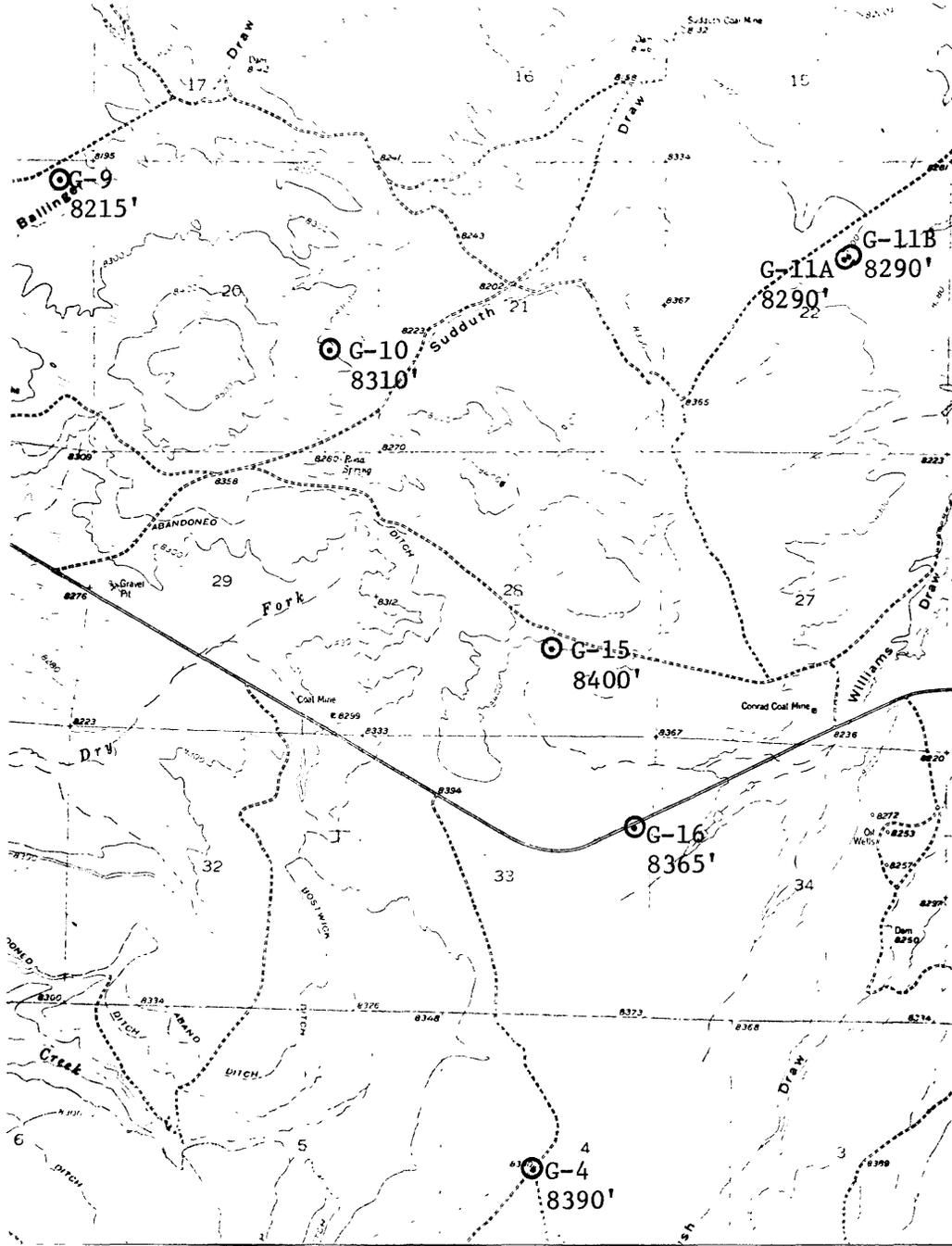


Figure 6. Locations of drill holes, SE $\frac{1}{4}$ of the Eagle Hill quadrangle, Jackson County, Colorado.

R. 78 W.



T. 9 N.
T. 8 N.

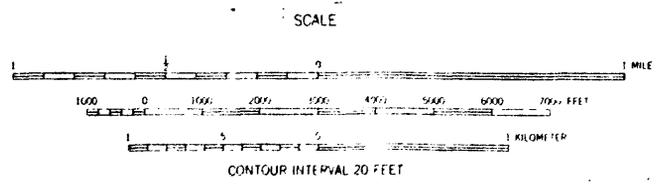


Figure 7. Locations of drill holes, NE $\frac{1}{4}$ of the Gould NW quadrangle, Jackson County, Colorado.

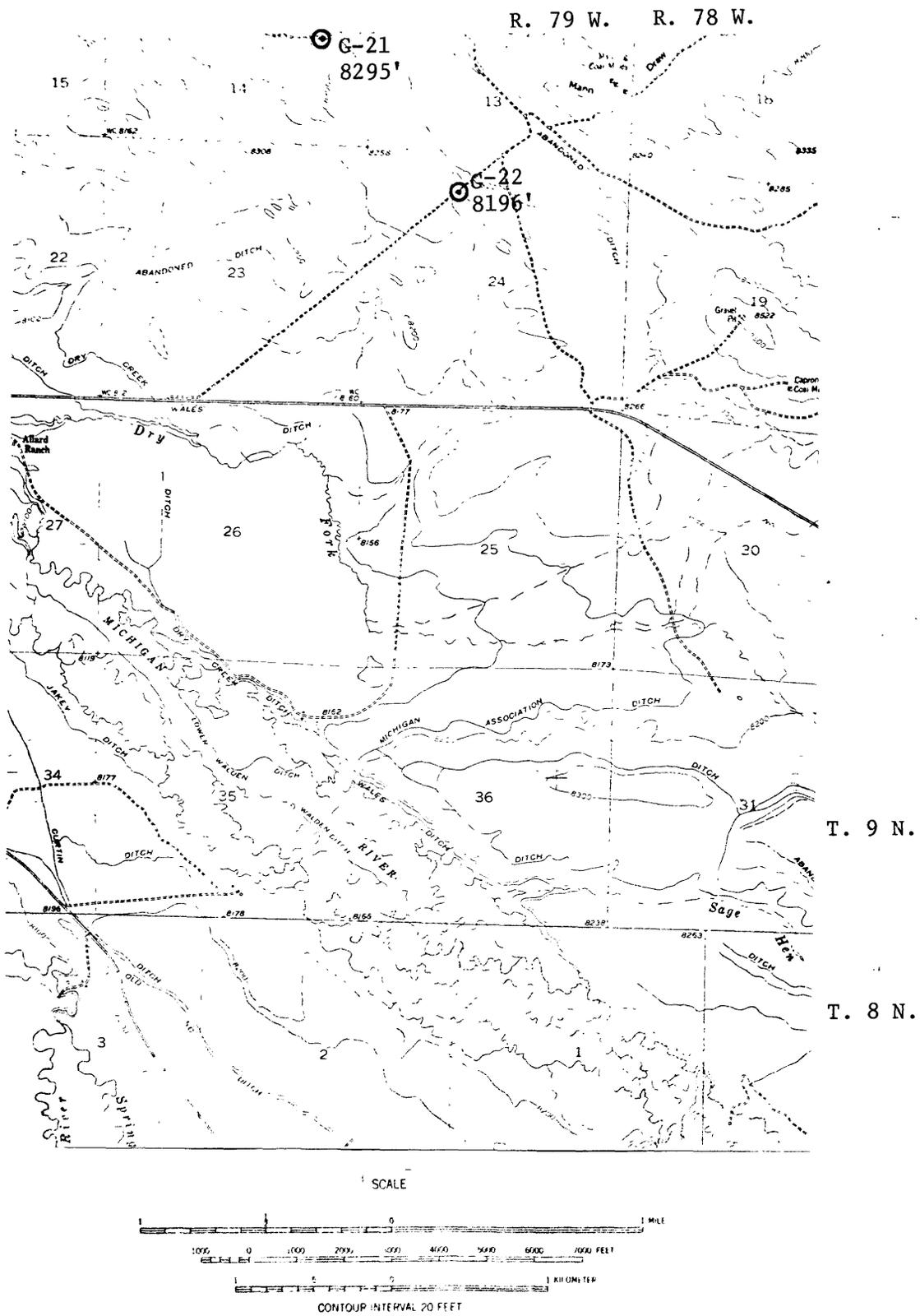


Figure 8. Locations of drill holes, NW $\frac{1}{4}$ of the Gould NW quadrangle, Jackson County, Colorado.

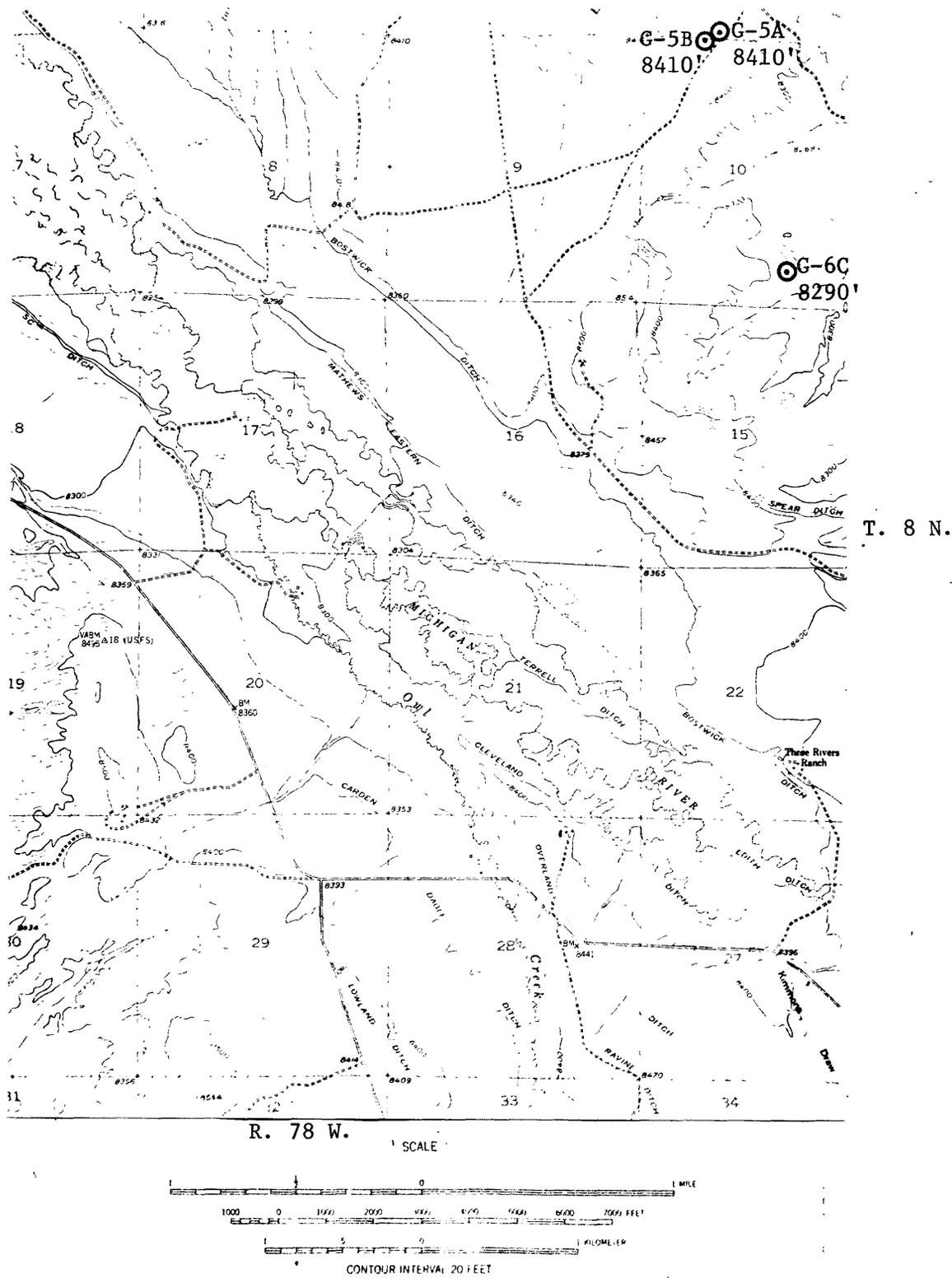


Figure 9. Locations of drill holes, SE $\frac{1}{4}$ of the Gould NW quadrangle, Jackson County, Colorado.

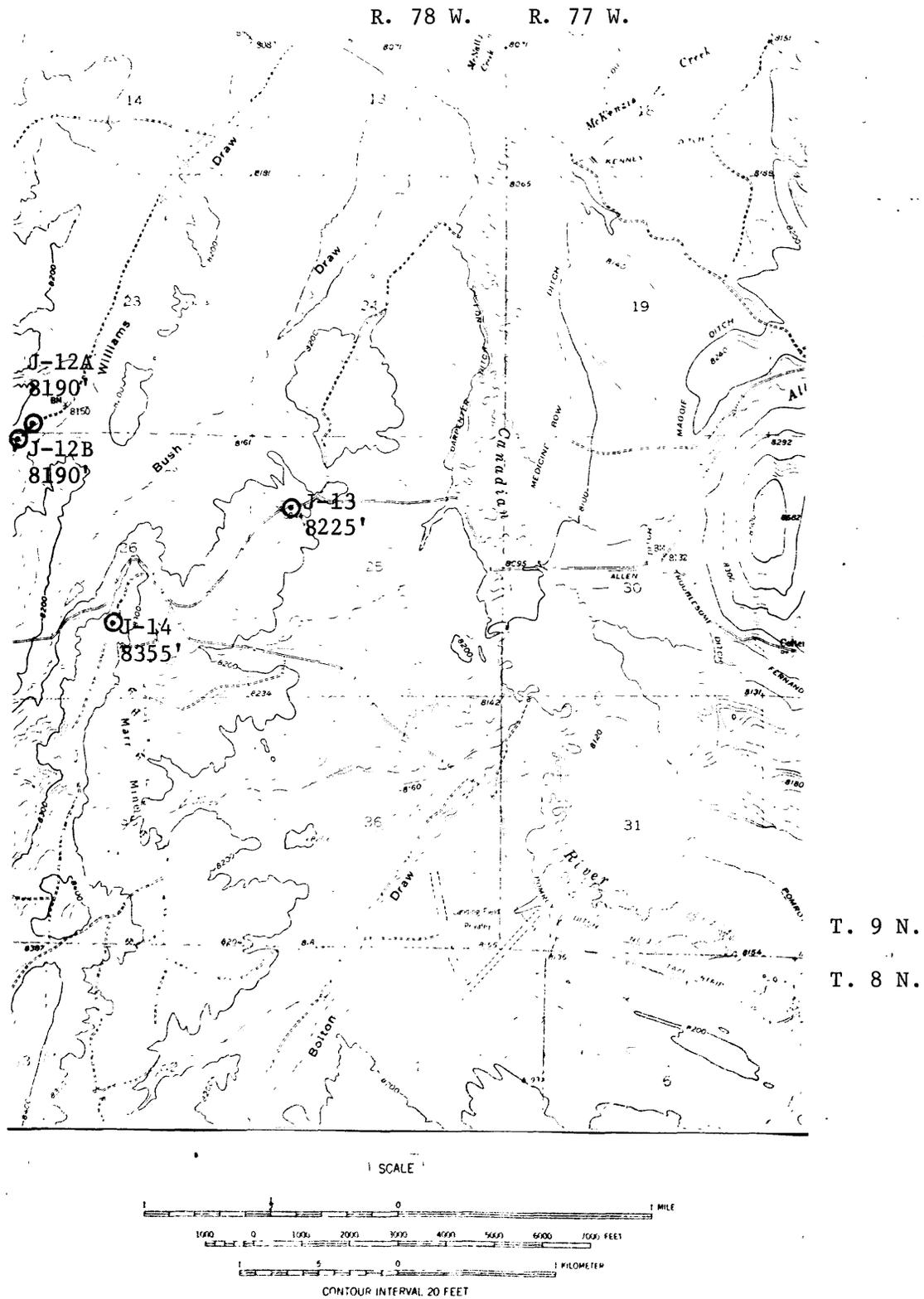


Figure 10. Locations of drill holes, NW $\frac{1}{4}$ of the Johnny Moore Mountain quadrangle, Jackson County, Colorado.

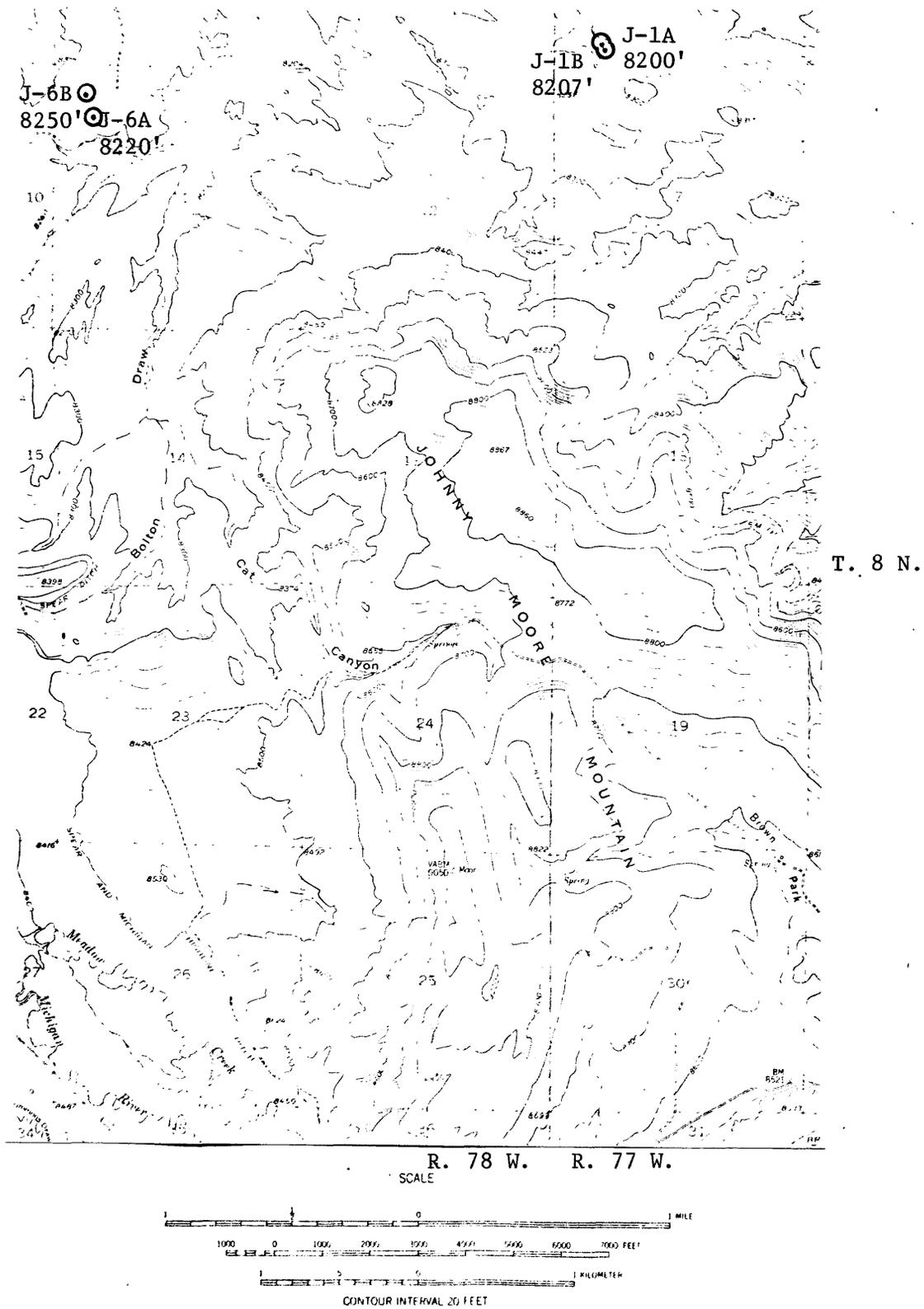
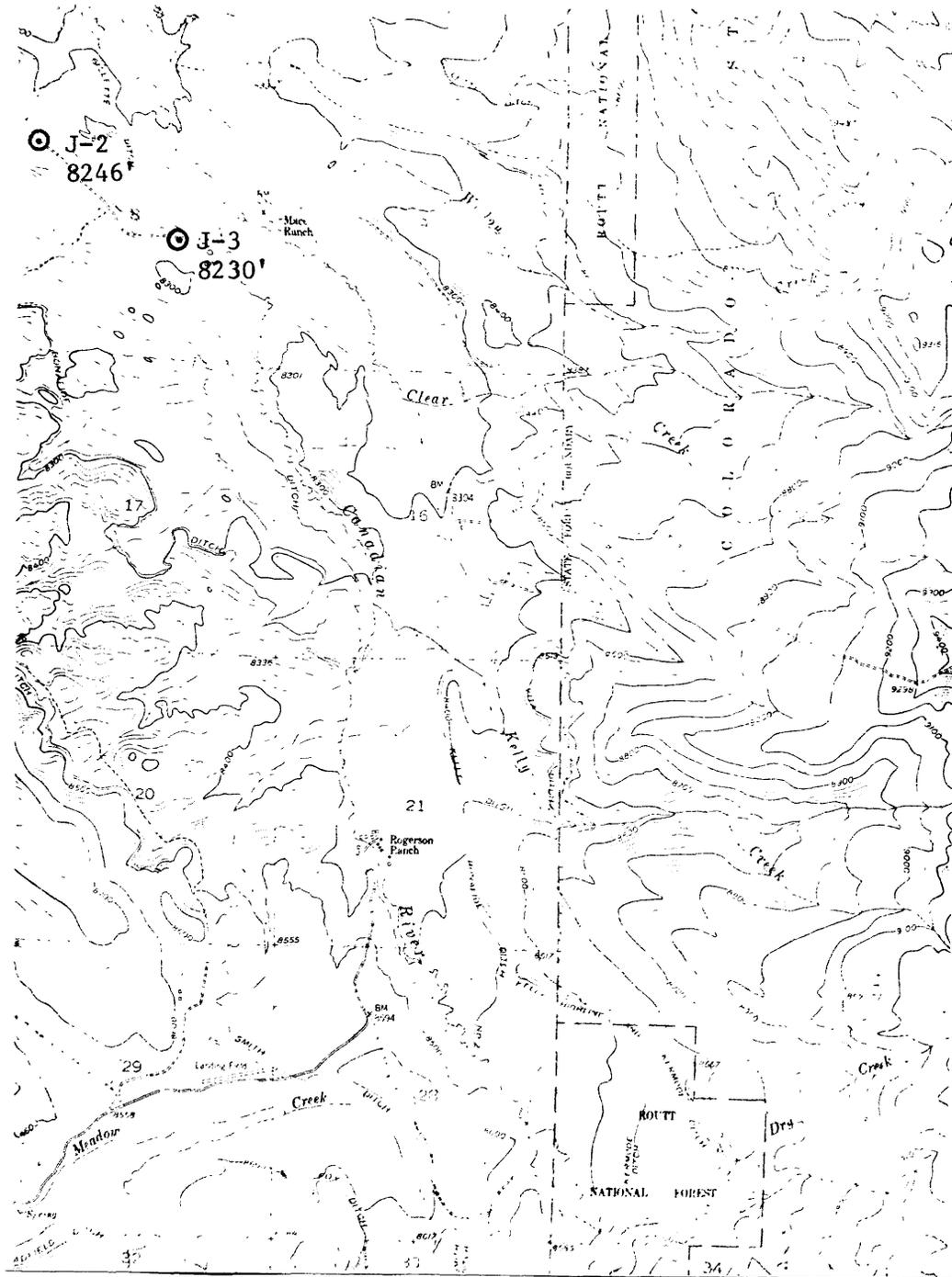


Figure 11. Locations of drill holes, SW $\frac{1}{4}$ of the Johnny Moore Mountain quadrangle, Jackson County, Colorado.



T. 8 N.

SCALE R. 77 W.

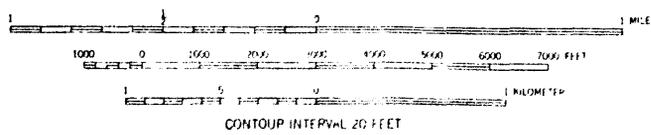


Figure 12. Locations of drill holes, SE $\frac{1}{4}$ of the Johnny Moore Mountain quadrangle, Jackson County, Colorado.

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					10	10	
32-42 Mudstone, brownish-gray and brown					50	50	
		20	20				
		100	30				
		40	40				
		150	50				
		200	60				
		70	70				
		250	80				
		90	90				
		300	90				

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

McCALLUM AREA

Hole No. J1B Map Johnny Moor 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	90				

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						10	
20-53 Sandstone, light-gray, fine- to medium-grained, with biotite						50	
53-60 Mudstone, medium-dark-gray						20	
60-84 Coal, with parting						100	30
84-97 Mudstone, medium-gray and dark-yellowish-brown		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. 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'

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. J3 Map Johnny Moor & 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						50	
190-195 Coal							
195-220 Sandstone, white, fine-grained, well-consolidated						200	60
						70	
						250	80
						300	90

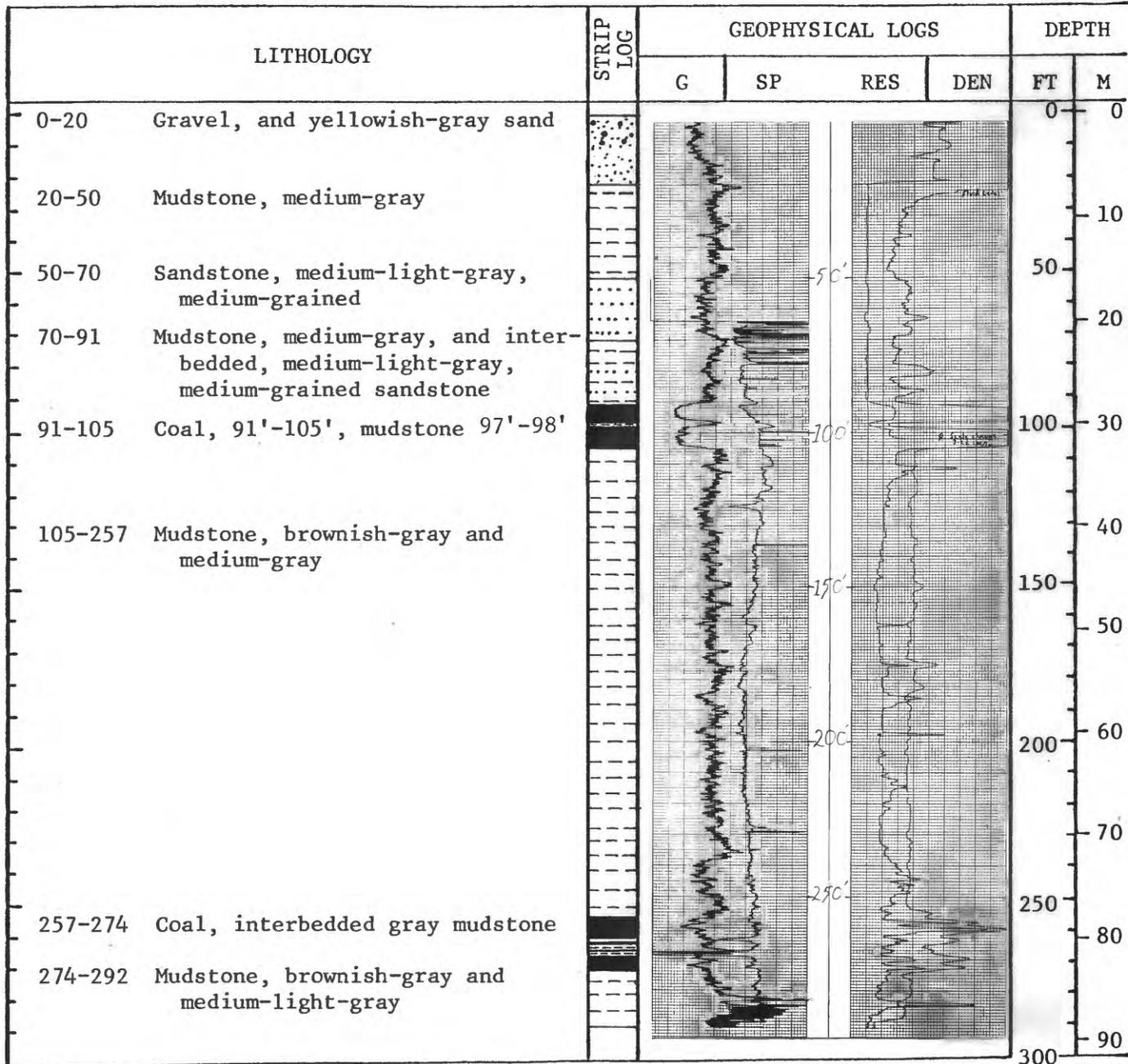
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

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

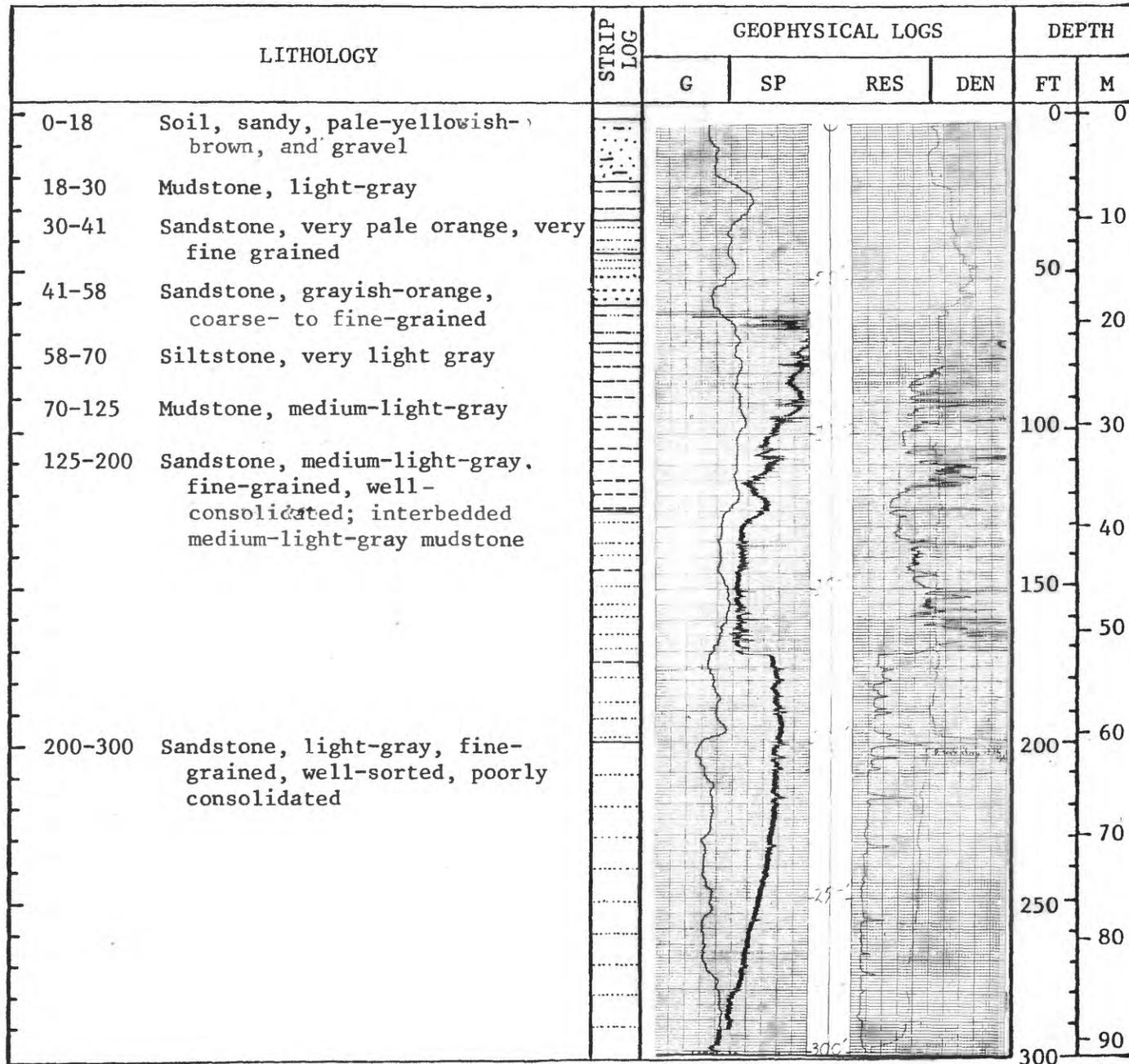
McCALLUM AREA

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: _____



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
125-152 Coal						40	
152-161 Mudstone, brownish-gray						150	50
						50	
						200	60
						70	
						250	80
						80	
						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					
			200					
178-200	Mudstone, medium-gray		60					
			70					
			250					
			80					
			300					
			90					

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						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. J6B Map Johnny Moore Mtn Date logged 9/27/77 Elevation (ft) 8,250'
 Location: T. 8 N., R. 78 W., sec. 11 : 600' FNL 700' FWL Cored: Yes No
 Drilled depth 70' Logged depth 70' Drilling medium mud Fluid level 26'

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 36° SE.

Cored interval: 35'-72'

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

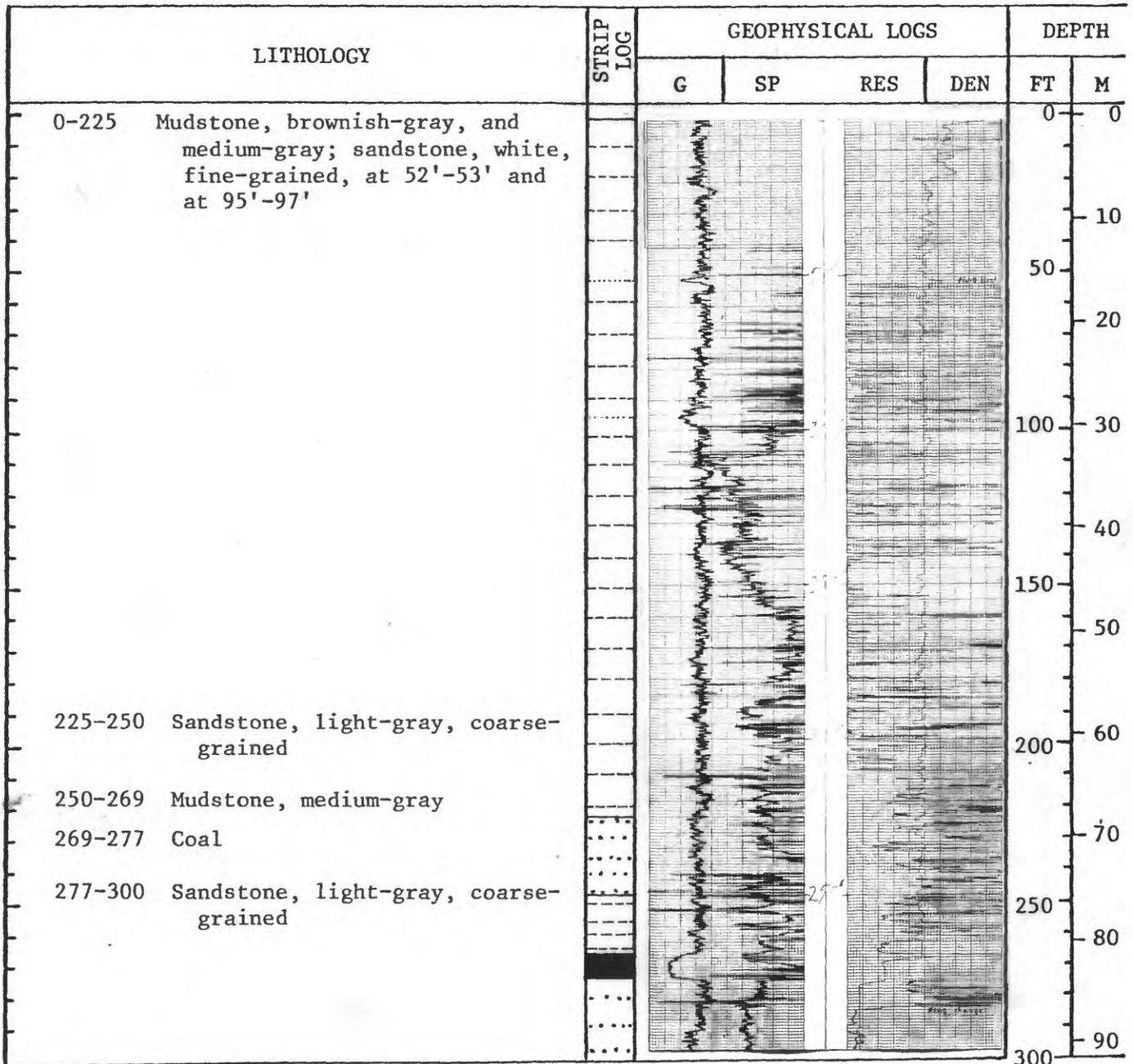
McCALLUM AREA

Hole No. 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:

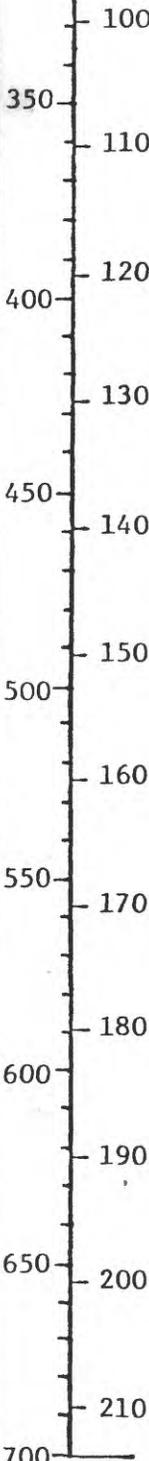
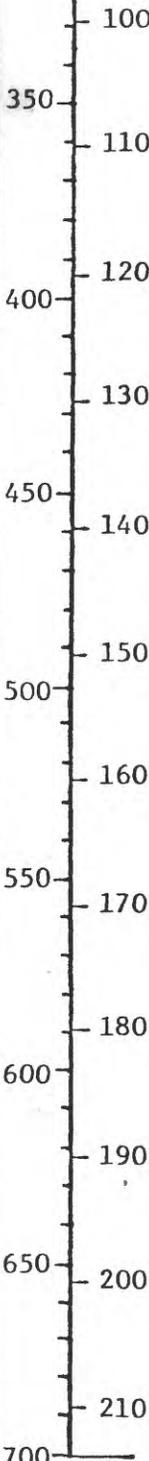
Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
 Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
 Gamma (G): T.C. 4 Scale 200 cps/in Logging speed 20 fpm
 Density (DEN): T.C. 4 Scale 16 Kcps/in Logging speed 20 fpm

Remarks: _____



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

Hole No. G6C (continued)

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
300-320 Sandstone, light-gray, coarse-grained							

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	

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 FW L 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.

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

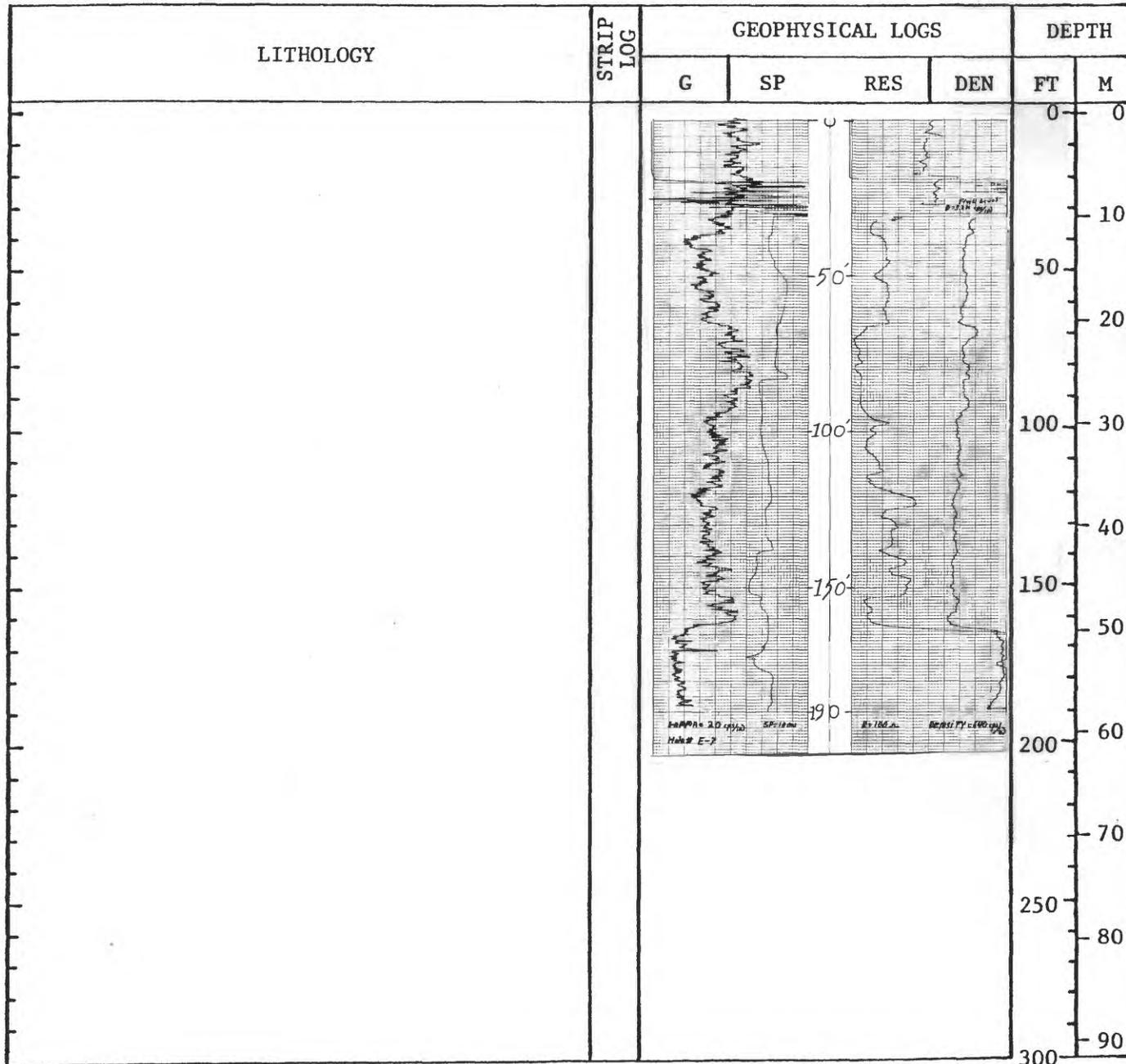
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

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'



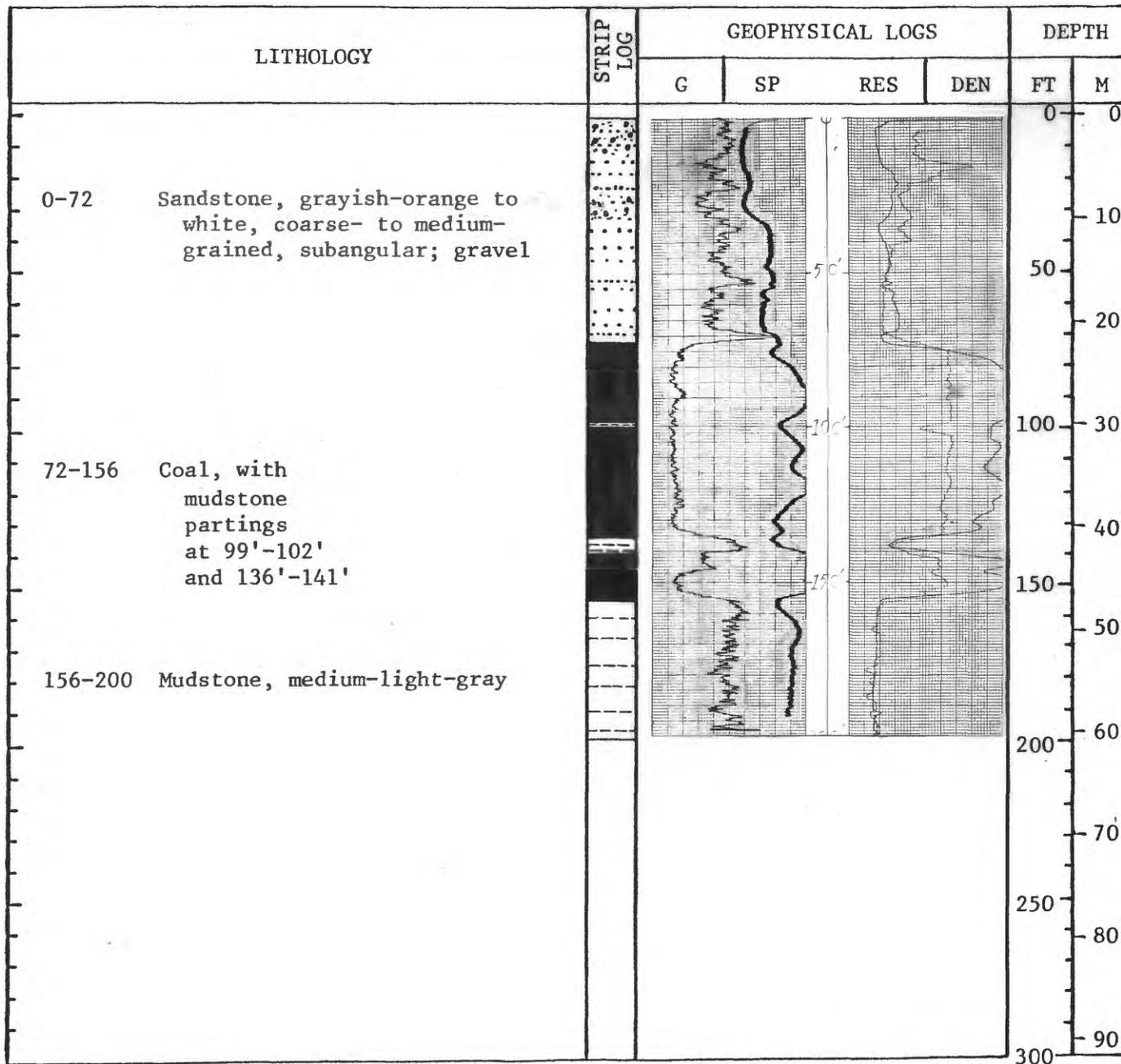
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

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	
							20	
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					
			70					
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
								80	
								300	90

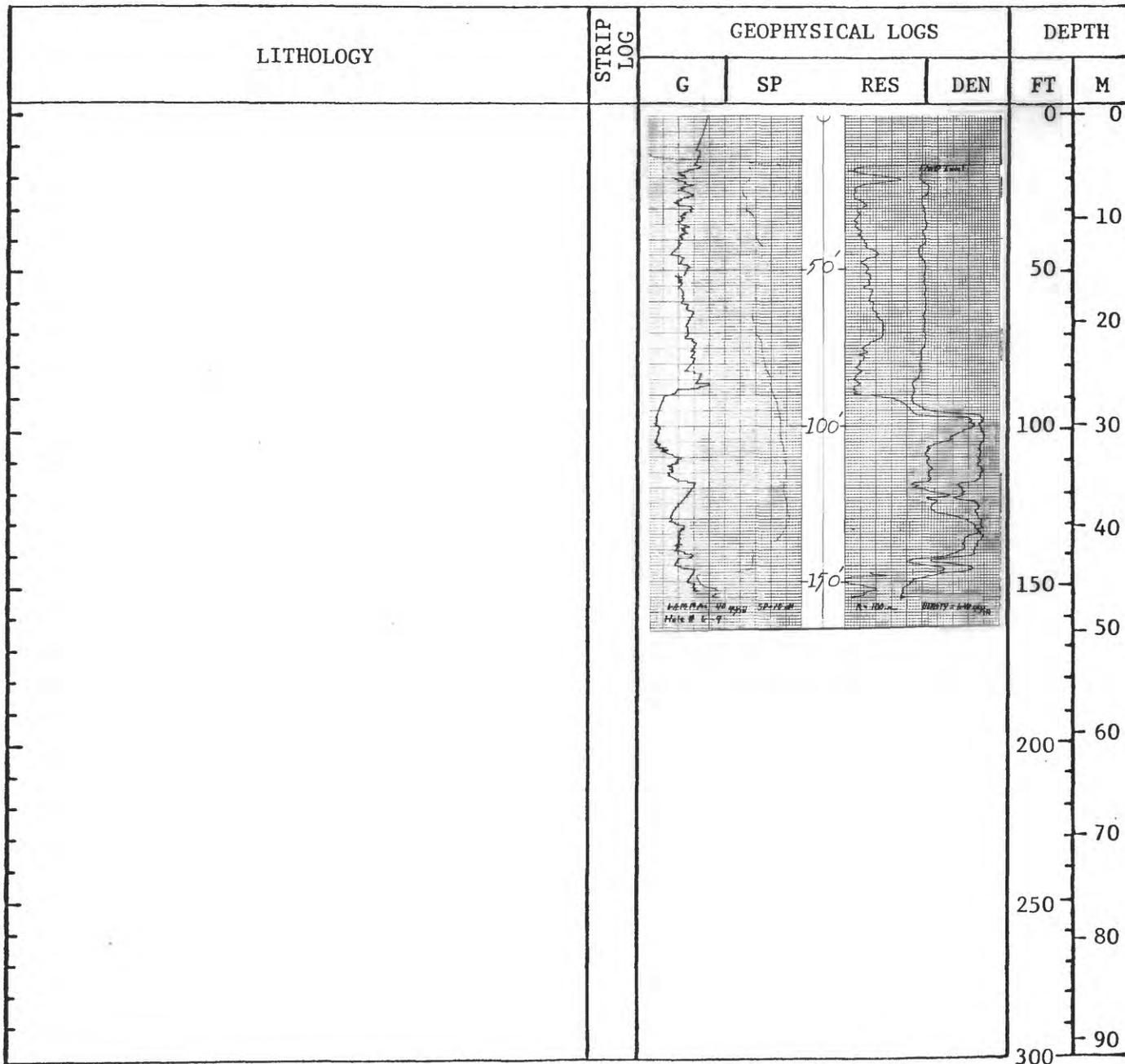
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

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'



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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
55-60 Mudstone, light-gray						50	
60-98 Coal						20	
98-120 Sandstone, light-gray, well-consolidated. Fines upward from medium- to fine-grained						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. G11A Map Gould NW Date logged 8-26-77 Elevation (ft) 8,290
 Location: T. 9 N., R. 78 W., sec. 22 : 1775 FN L 1950FE 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						50	
61-88 Sandstone, light-gray, coarse-grained to very coarse grained, and gravel						20	
88-117 Mudstone, light-gray; interbedded very light gray siltstone						100	30
117-175 Sandstone, very light gray, very coarse grained to medium-grained						40	
175-200 Mudstone, medium-light-gray; interbedded, light-gray siltstone						150	50
						200	60
						70	
						250	80
						300	90

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	
						20	
						50	
						100	30
						150	
						200	60
						250	
						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	[Strip Log]					0	0
5-19 Shale, brown	[Strip Log]					10	
	[Strip Log]					20	
19-112 Shale, dark-gray; coal traces	[Strip Log]					30	
112-118 Shale, coaly	[Strip Log]					40	
118-139 Shale, dark-gray	[Strip Log]	50					
	[Strip Log]	60					
	[Strip Log]	70					
	[Strip Log]	80					
	[Strip Log]	90					
	[Strip Log]	100					
	[Strip Log]	110					
	[Strip Log]	120					
	[Strip Log]	130					
	[Strip Log]	140					
	[Strip Log]	150					
	[Strip Log]	160					
	[Strip Log]	170					
	[Strip Log]	180					
	[Strip Log]	190					
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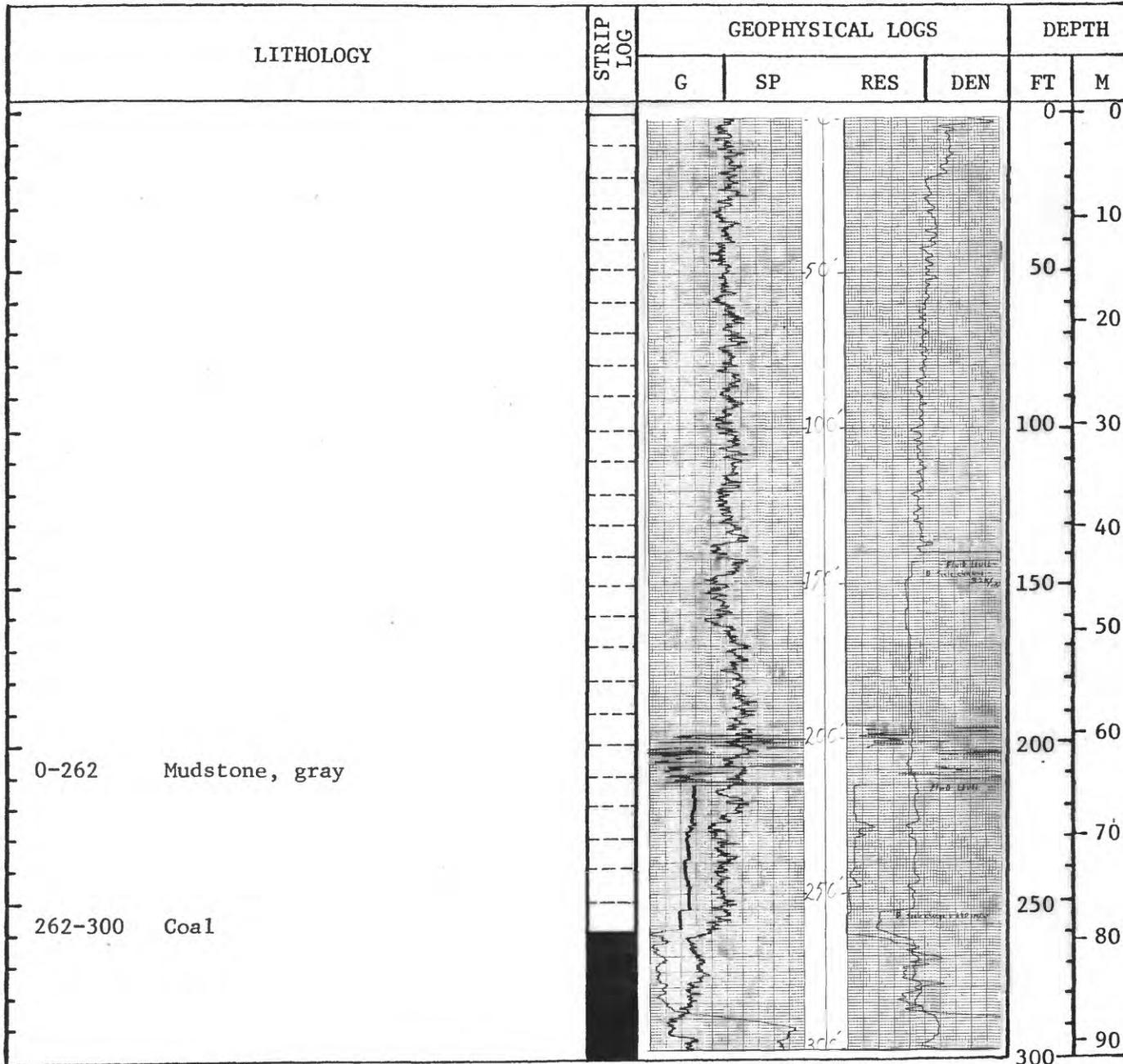
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

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.



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 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	[Strip Log]				100		
					350		
329-392 Mudstone					110		
					120		
					400		
					130		
					450		
					140		
					500		
					150		
					160		
					550		
					170		
					180		
					600		
					190		
					650		
					200		
					210		
					700		

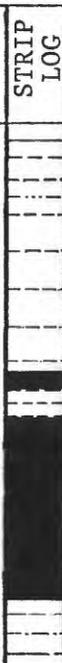
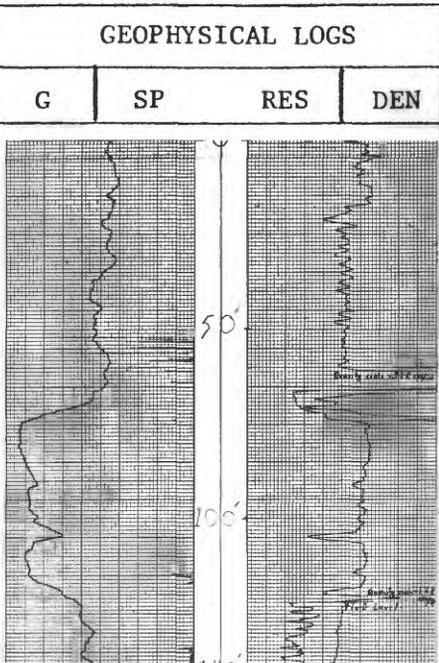
U.S. GEOLOGICAL SURVEY
 DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

McCALLUM AREA

Hole No. 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
61-121 Coal, with parting of gray mudstone at 66'-73'						10	
121-140 Mudstone, silty, gray, and minor interbedded black shale						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

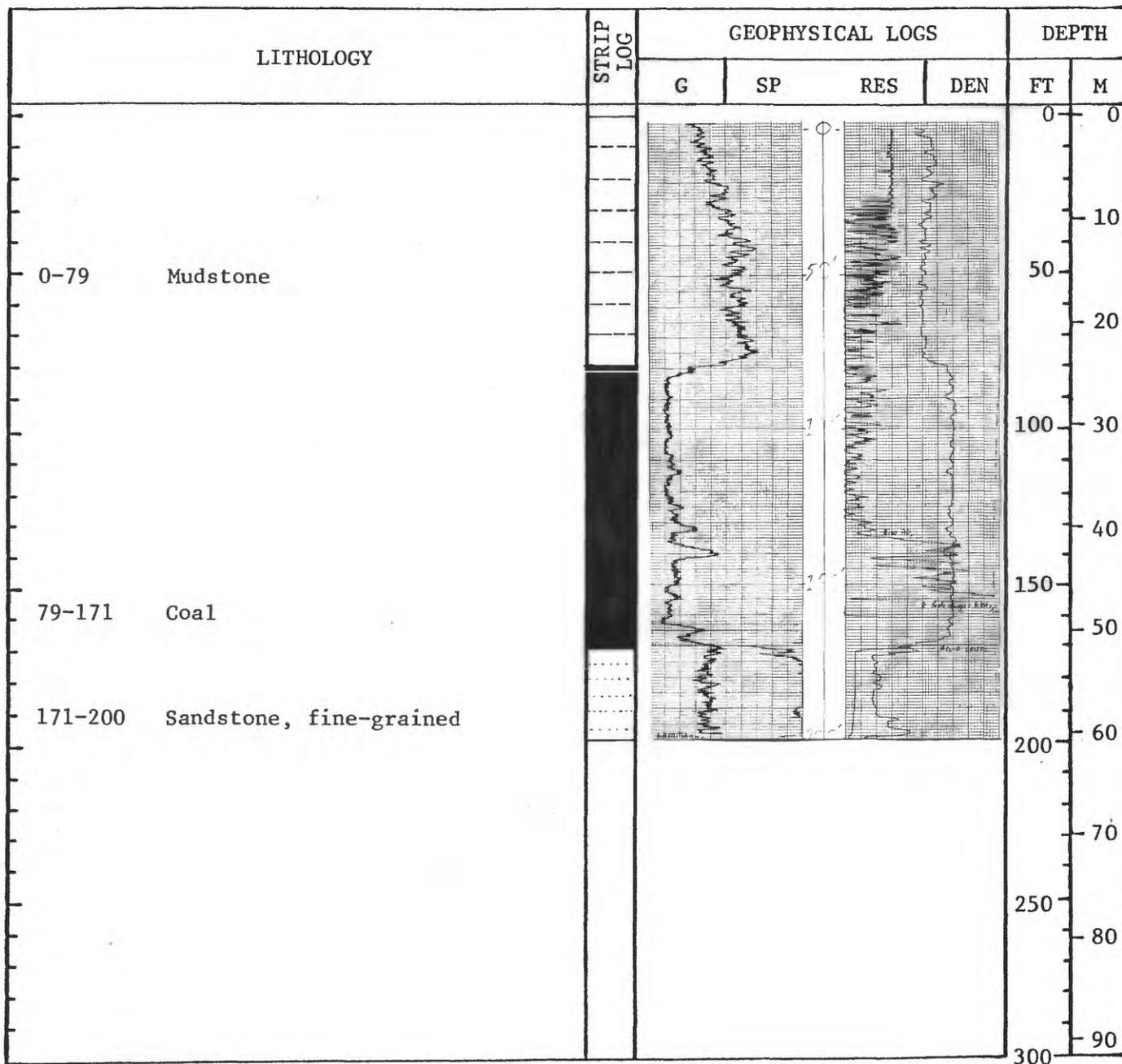
McCALLUM AREA

Hole No. J14 Map Johnny Mooræ 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.



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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' F SL 2,775' F 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'

LITHOLOGY	STRIP LOG	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
		<div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 10px;">0</div> <div style="margin-bottom: 10px;">10</div> <div style="margin-bottom: 10px;">50</div> <div style="margin-bottom: 10px;">20</div> <div style="margin-bottom: 10px;">100</div> <div style="margin-bottom: 10px;">30</div> <div style="margin-bottom: 10px;">40</div> <div style="margin-bottom: 10px;">150</div> <div style="margin-bottom: 10px;">50</div> <div style="margin-bottom: 10px;">200</div> <div style="margin-bottom: 10px;">60</div> <div style="margin-bottom: 10px;">70</div> <div style="margin-bottom: 10px;">250</div> <div style="margin-bottom: 10px;">80</div> <div style="margin-bottom: 10px;">300</div> <div style="margin-bottom: 10px;">90</div> </div>					

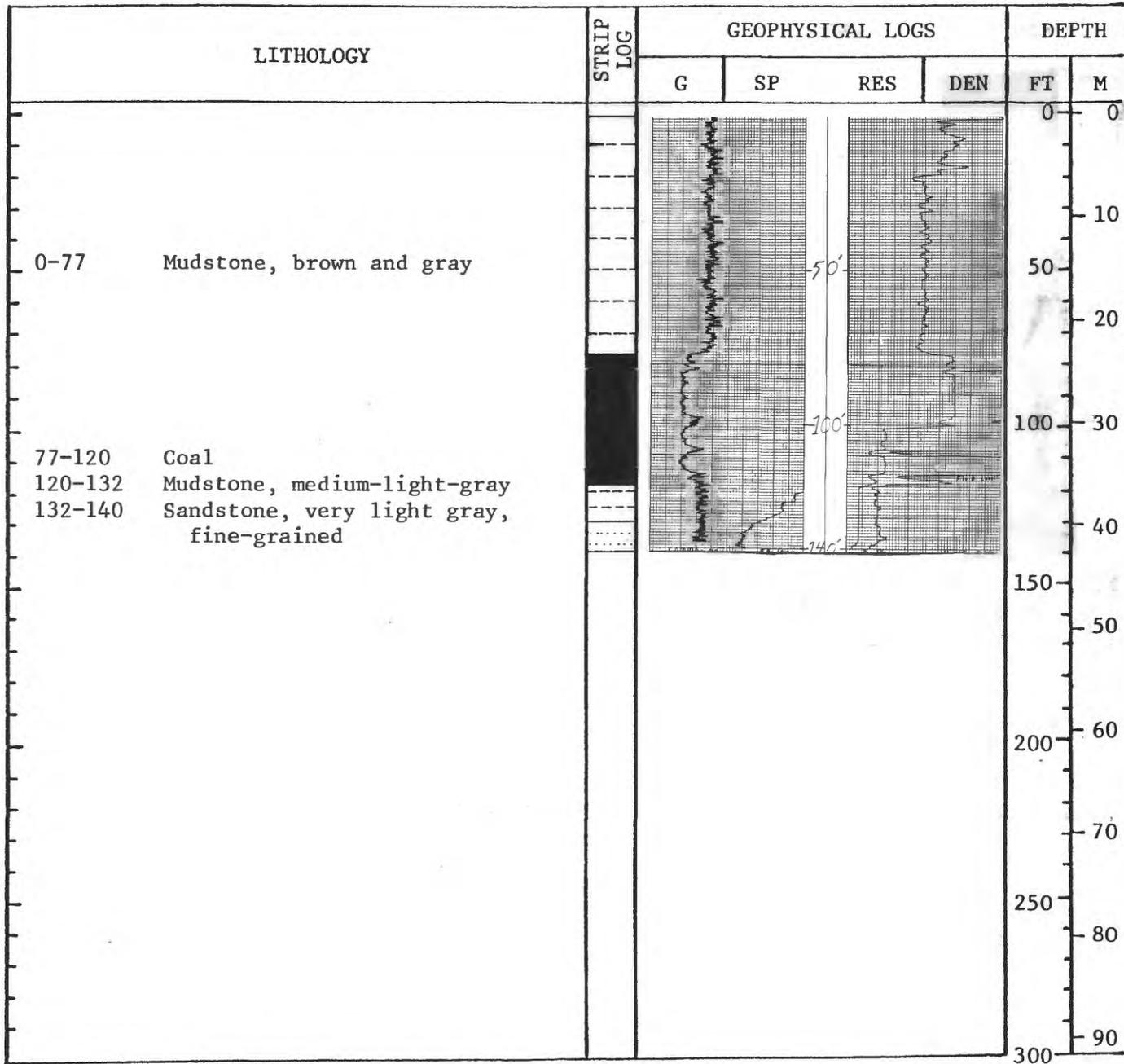
U.S. GEOLOGICAL SURVEY
 DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

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.



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

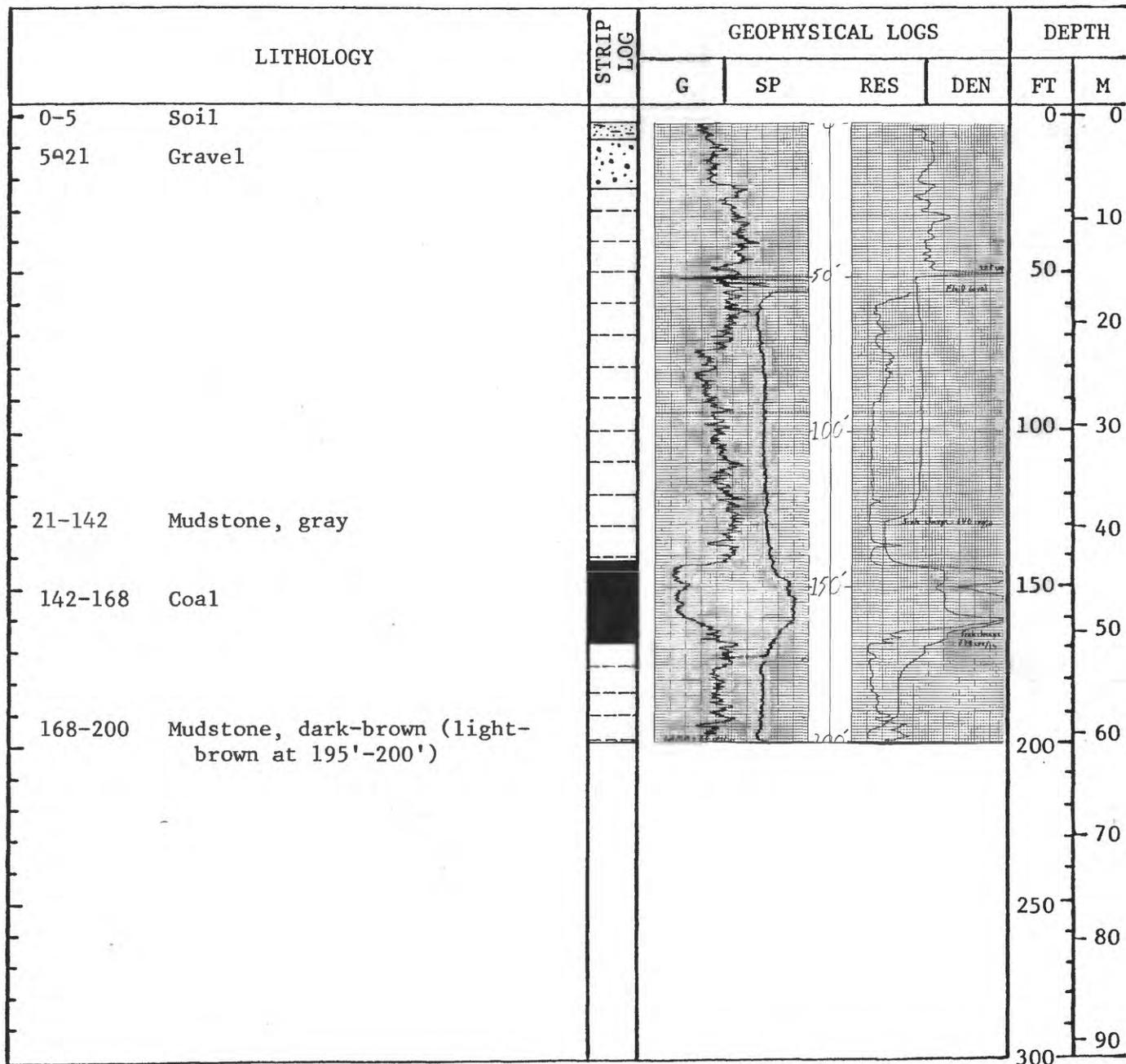
McCALLUM AREA

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.



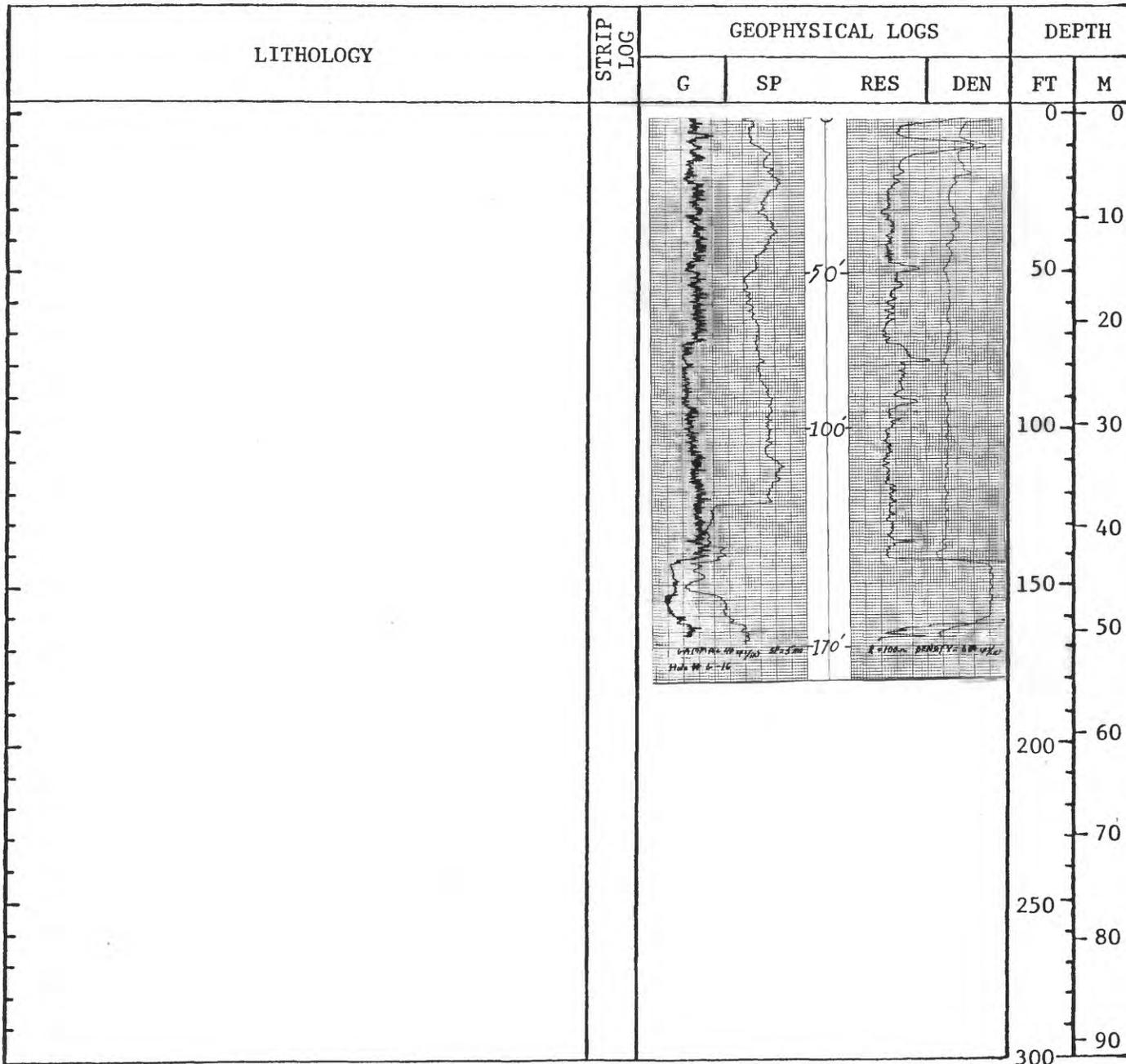
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

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

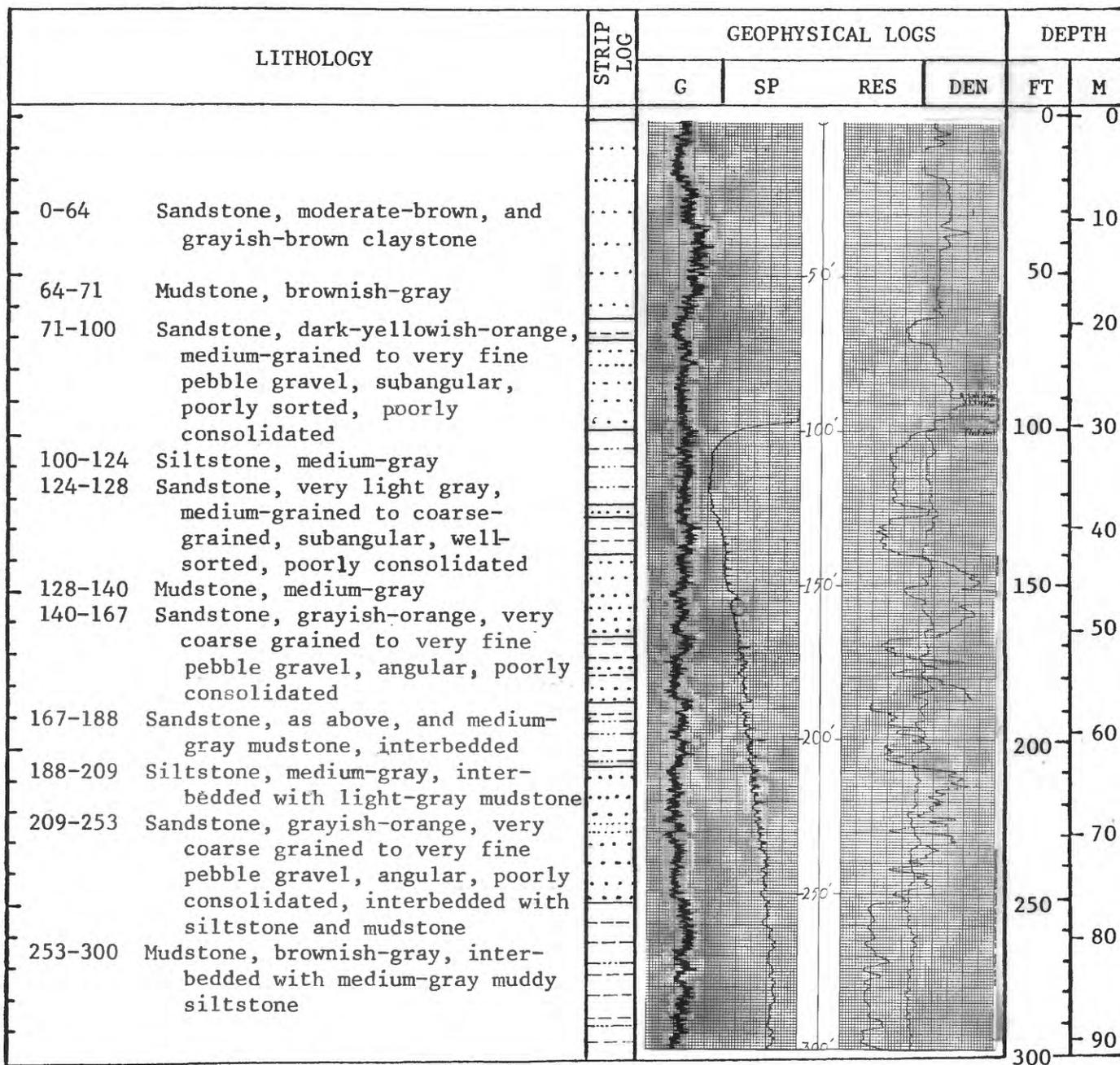
McCALLUM AREA

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: _____



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						400	
431-461 Sandstone, very light gray, coarse-grained, angular, poorly consolidated; interbedded mudstone						120	
		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 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						200	60
						70	
204-268 Sandstone, white, medium-grained to very fine pebble gravel, subangular, poorly consolidated						250	
						80	
268-300 Mudstone, light-gray						90	
						300	90

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, subangular, poorly consolidated						350	
359-372	Mudstone, medium-dark-gray and brownish-black							
372-380	Sandstone, light-gray, medium- to fine-grained, poorly consolidated						400	
380-400	Mudstone, light-gray							
							450	
							140	
							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. 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	
						50	
						20	
23-133 Mudstone, light-brown, grayish-orange, light-olive-gray, and moderate-yellowish-brown						100	30
						40	
133-150 Sandstone, very light gray, coarse-grained to very coarse grained, subrounded, poorly consolidated						150	
						50	
150-204 Mudstone, brownish-gray and light-gray						200	60
						70	
204-268 Sandstone, white, medium-grained to very fine pebble gravel, subangular, poorly consolidated						250	
						80	
268-300 Mudstone, light-gray						300	90

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, subangular, poorly consolidated			350			350	
359-372 Mudstone, medium-dark-gray and brownish-black						110	
372-380 Sandstone, light-gray, medium- to fine-grained, poorly consolidated			380			400	
380-400 Mudstone, light-gray						130	
						450	
					140		
					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 FwL Cored: Yes No
 Drilled depth 341 Logged depth 341 Drilling medium Air Fluid level 48

Geophysical logs:

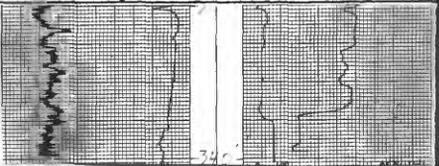
Spontaneous potential (SP): Scale 250 mv/in Logging speed 20 fpm
 Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
 Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
 Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

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	20
59-102	Mudstone, silty, medium-light-gray and light-gray						100	30
102-108	Sandstone, very light gray, fine-grained, rounded							
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	50
159-172	Sandstone, light-gray, very coarse grained to very fine pebble gravel, angular, poorly consolidated						200	60
172-180	Mudstone, light-gray							
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						250	80
240-300	Mudstone						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	
						140	
						150	
						500	
						160	
						170	
						180	
						600	
						190	
						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:

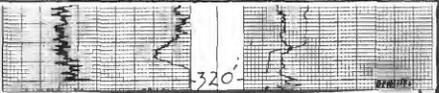
Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
 Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
 Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
 Density (DEN): T.C. 4 Scale 3.2 Kcps/in Logging speed 20 fpm

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						30	
53-67	Sandstone, very light gray, very coarse grained, poorly consolidated						50	
67-83	Mudstone, light-gray						60	
83-92	Sandstone, white, fine- to medium-grained						70	
92-300	Siltstone, medium-light-gray and white, fine-grained, well-sorted, well-consolidated, with biotite						80	
							90	
							300	

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						300	91.4
						350	106.7
						400	121.9
						450	137.2
						500	152.4
						550	167.6
						600	182.9
						650	198.1
						700	213.4

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	0
0-55	Sandstone, dark-yellowish-orange to light-brownish-gray, very coarse to medium-grained, sub-angular, poorly consolidated						10	
55-63	Mudstone, light-gray and brownish-black					50		
63-85	Coal, with parting of brownish-black mudstone at 77'-81'					20		
85-108	Mudstone, light-gray					100	30	
108-126	Sandstone, light-gray, very coarse grained, poorly consolidated; some gravel							
126-132	Mudstone, gray; coal, 132'-133'					40		
132-142	Sandstone, light-gray, coarse-grained							
142-204	Mudstone, light-gray and light-gray, coarse-grained, poorly consolidated sandstone, 165'-170', 186-189', and 200'-204'					150		
204-212	Mudstone, brownish-gray, and coal at 205' and 210' -212'					200	60	
212-224	Sandstone, light-brownish-gray, medium-grained, poorly consolidated					70		
224-235	Mudstone, light-gray and brownish-gray					250		
235-276	Sandstone, very light gray, medium- to fine-grained, sub-rounded, well-sorted, and light-gray, very coarse grained poorly consolidated sandstone					80		
276-300	Mudstone, medium-light-gray and brownish-black					300	90	

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
<p>300-413 Mudstone, medium-light-gray and brownish-black</p> <p>413-430 Sandstone, very light gray, fine-grained to very coarse grained</p> <p>430-496 Mudstone, gray, some silty, and very light gray, fine- to medium-grained sandstone at 445'-448'</p>						<p>100</p> <p>350</p> <p>110</p> <p>120</p> <p>400</p> <p>130</p> <p>450</p> <p>140</p> <p>150</p> <p>500</p> <p>160</p> <p>550</p> <p>170</p> <p>180</p> <p>600</p> <p>190</p> <p>650</p> <p>200</p> <p>210</p> <p>700</p>	<p>100</p> <p>350</p> <p>110</p> <p>120</p> <p>400</p> <p>130</p> <p>450</p> <p>140</p> <p>150</p> <p>500</p> <p>160</p> <p>550</p> <p>170</p> <p>180</p> <p>600</p> <p>190</p> <p>650</p> <p>200</p> <p>210</p> <p>700</p>

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	
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	
							70	
							250	
		80						
		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							
14-58	Mudstone, gray and brownish-black						10	
58-76	Coal; brownish-black mudstone; carbonaceous shale						50	
76-97	Mudstone, brownish-black and medium-gray						20	
97-104	Coal and brownish-black mudstone							
104-109	Mudstone, brownish-black and light-gray						100	30
109-111	Coal							
111-134	Mudstone, brownish-black and light-gray						40	
134-142	Coal, 134'-136' and 140'-142'; brownish-black mudstone						150	
142-187	Mudstone, light-gray and brownish-gray						50	
187-194	Sandstone, very light gray, fine- to medium-grained, well-rounded, well-sorted						200	60
194-200	Mudstone, light-gray							
200-261	Sandstone, very light gray, fine- to medium-grained, well-rounded, well-sorted, interbedded with light-gray mudstone						70	
							250	80
							300	90

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

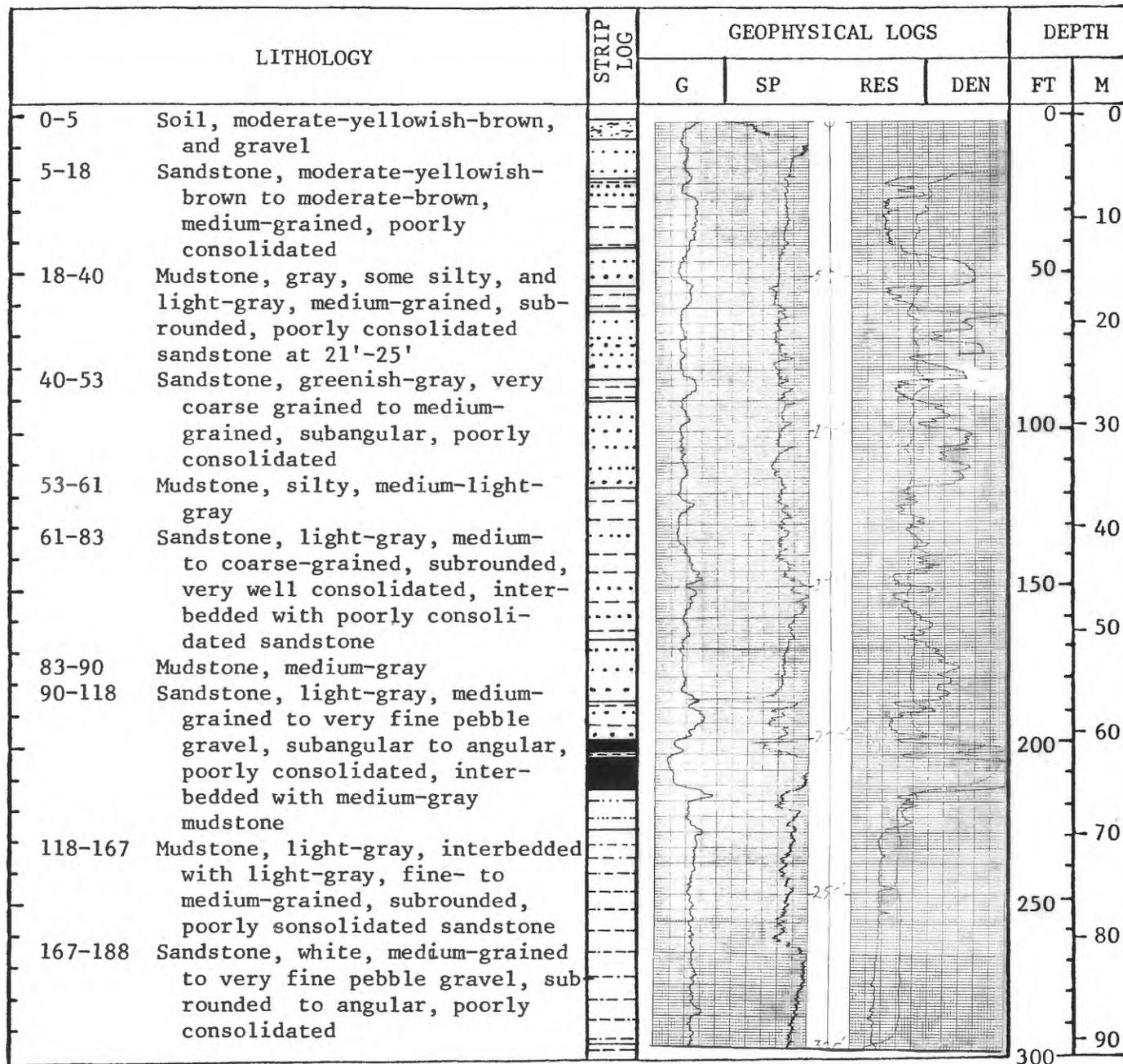
McCALLUM AREA

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 FE L 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'.



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		[REDACTED]					
200-216 Coal; medium-gray mudstone at 203-205'						350	
216-229 Siltstone, white							110
229-298 Mudstone, silty, medium-gray							
298-306 Mudstone, brownish-gray							
						400	120
							130
						450	140
							150
						500	160
							170
						550	180
							190
						600	200
							210
						650	700

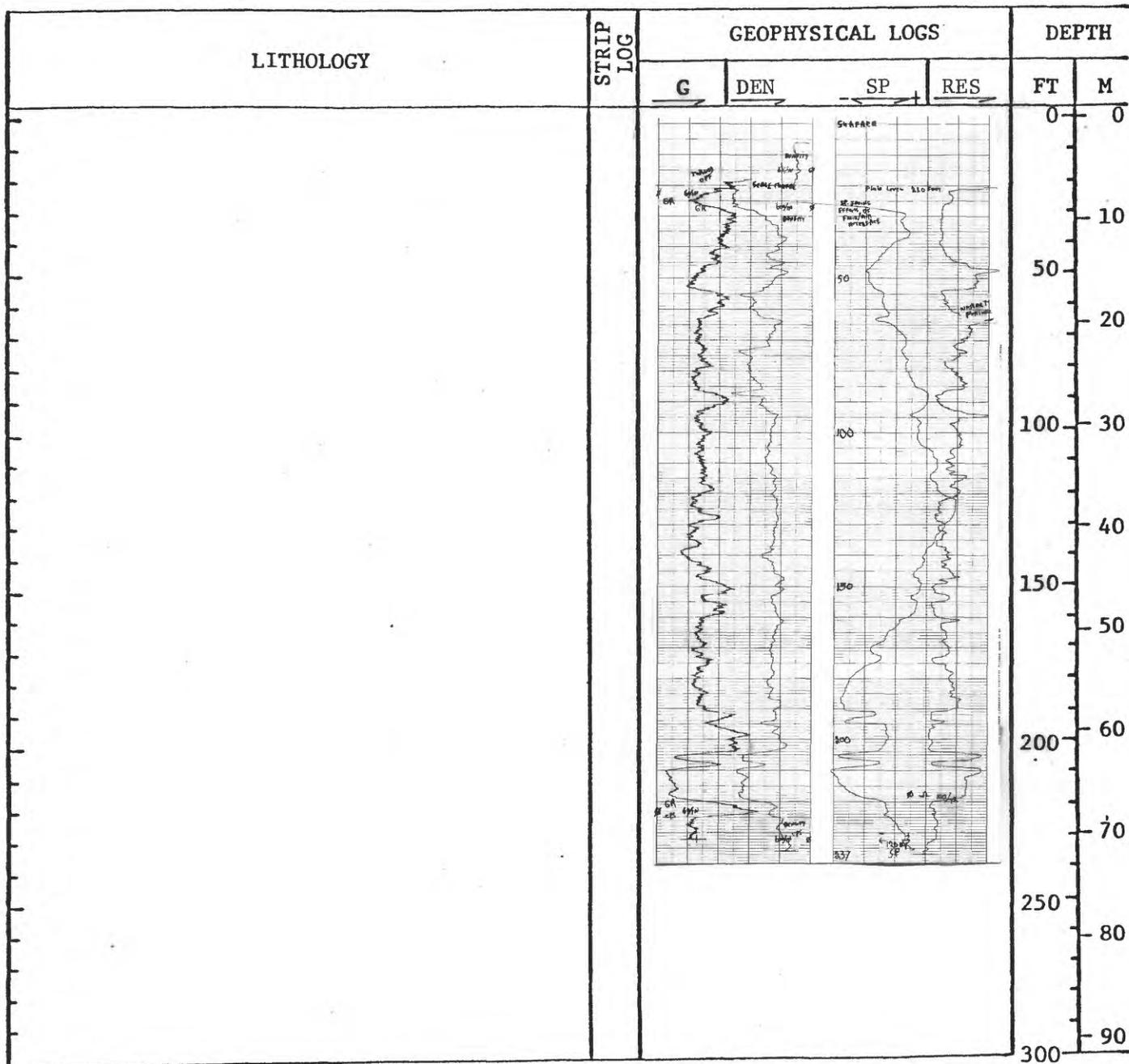
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

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'

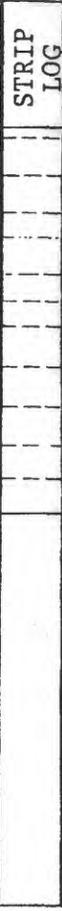
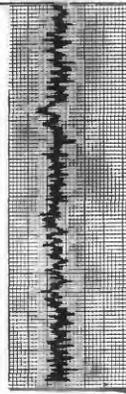
Geophysical logs:

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

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						700 750 800	220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870 880 890 900

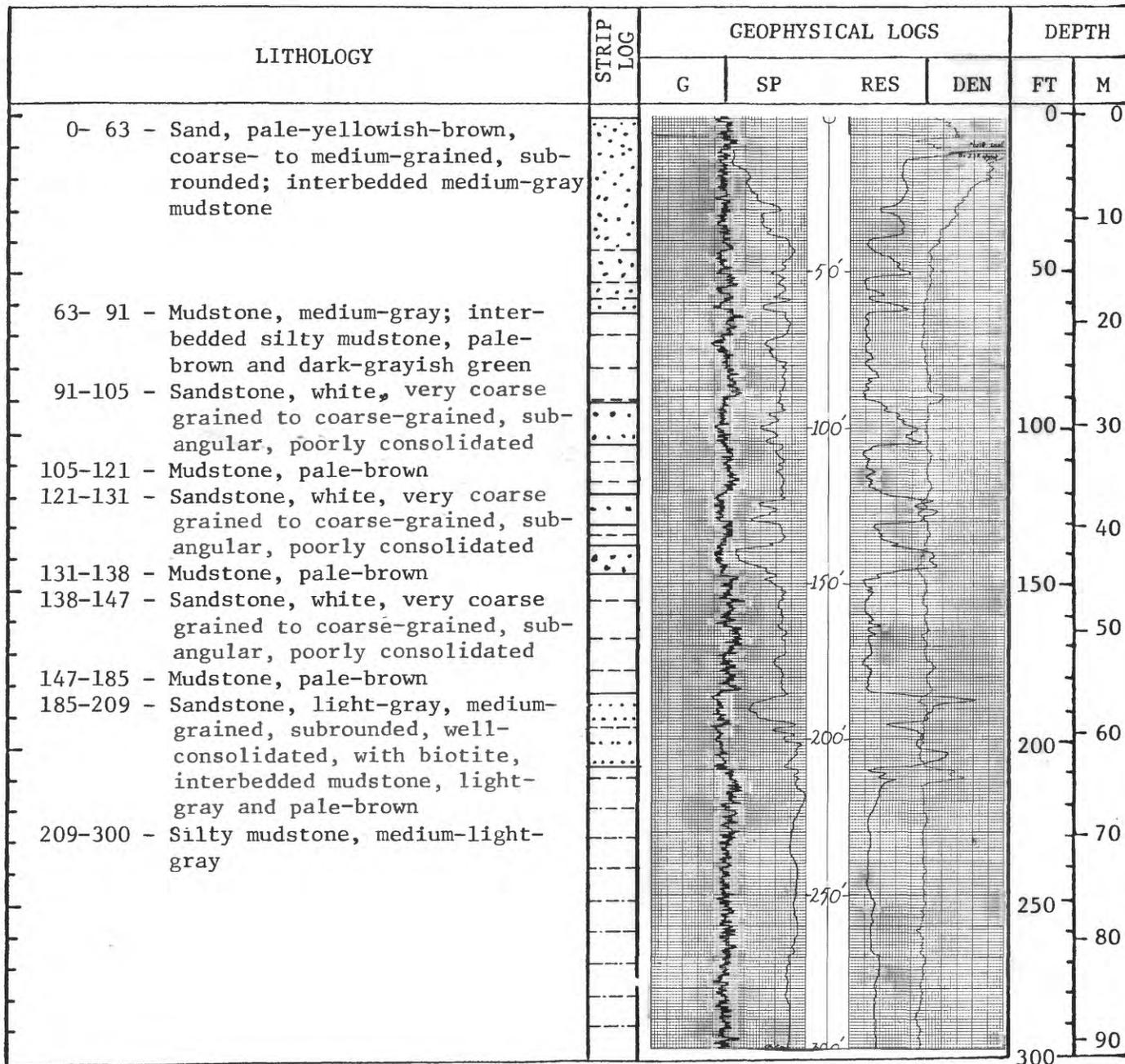
U.S. GEOLOGICAL SURVEY
DRILL-HOLE LOG, JACKSON COUNTY, COLORADO

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 : 1,800F S L1,550 F E L 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'.



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	[Symbol]					100	
312-323 - Sandstone, light-gray, medium-grained, subrounded, well-consolidated, with biotite; silty mudstone, medium-light-gray, 316'-319'	[Symbol]					350	110
323-543 - Silty mudstone, medium-light-gray; interbedded sandstone, very light-gray, fine- to medium-grained, poorly consolidated	[Symbol]					400	120
	[Symbol]					450	130
	[Symbol]					500	140
	[Symbol]					550	150
	[Symbol]					600	160
	[Symbol]					650	170
543-550 - Sandstone, very light-gray, fine- to medium-grained, poorly consolidated	[Symbol]					700	180
	[Symbol]					750	190
	[Symbol]	800	200				
	[Symbol]	850	210				
	[Symbol]	900	210				

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						50	
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						50	
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						80	
264-300	Mudstone, medium-light-gray		90					
			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
						450	140
						500	150
551-554 Sandstone, light-gray, medium- to coarse-grained, subrounded		550	170				
		600	180				
554-700 Mudstone, light-gray; interbedded grayish-green silty mudstone		650	200				
			210				
			700				

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

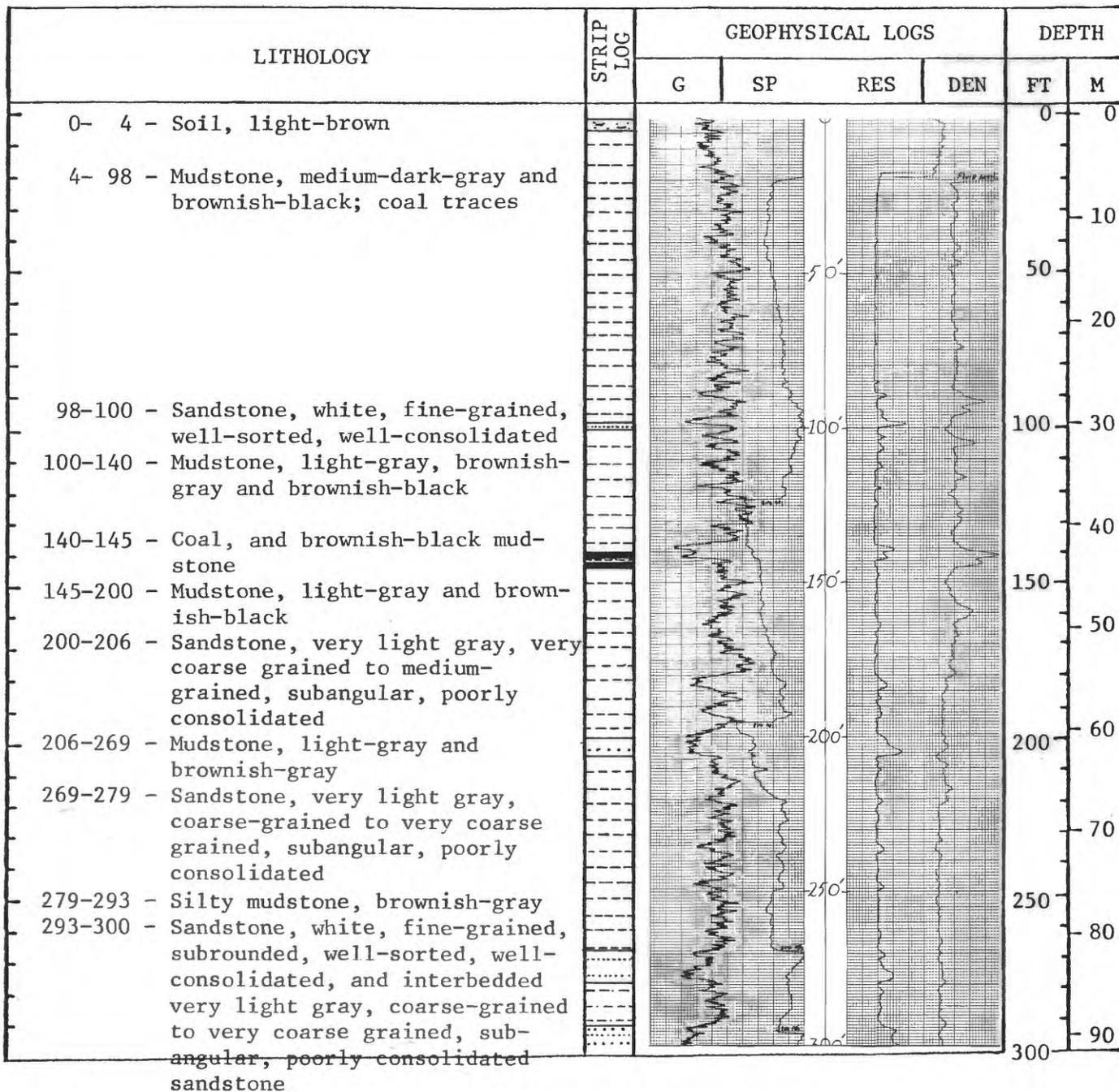
McCALLUM AREA

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:

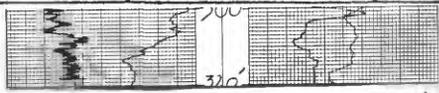
Spontaneous potential (SP): Scale 50 mv/in Logging speed 20 fpm
 Resistivity (RES): Scale 500 ohms/in Logging speed 20 fpm
 Gamma (G): T.C. 4 Scale 100 cps/in Logging speed 20 fpm
 Density (DEN): T.C. 4 Scale 8 cps/in Logging speed 20 fpm

Remarks: _____



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						100 350 400 450 500 550 600 650 700	100 110 120 130 140 150 160 170 180 190 200 210

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	
0-84 Mudstone, light-brown and light-gray		20				50	
84-88 Coal						100	30
88-100 Mudstone, light-gray						150	
						200	60
						250	80
						300	90

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

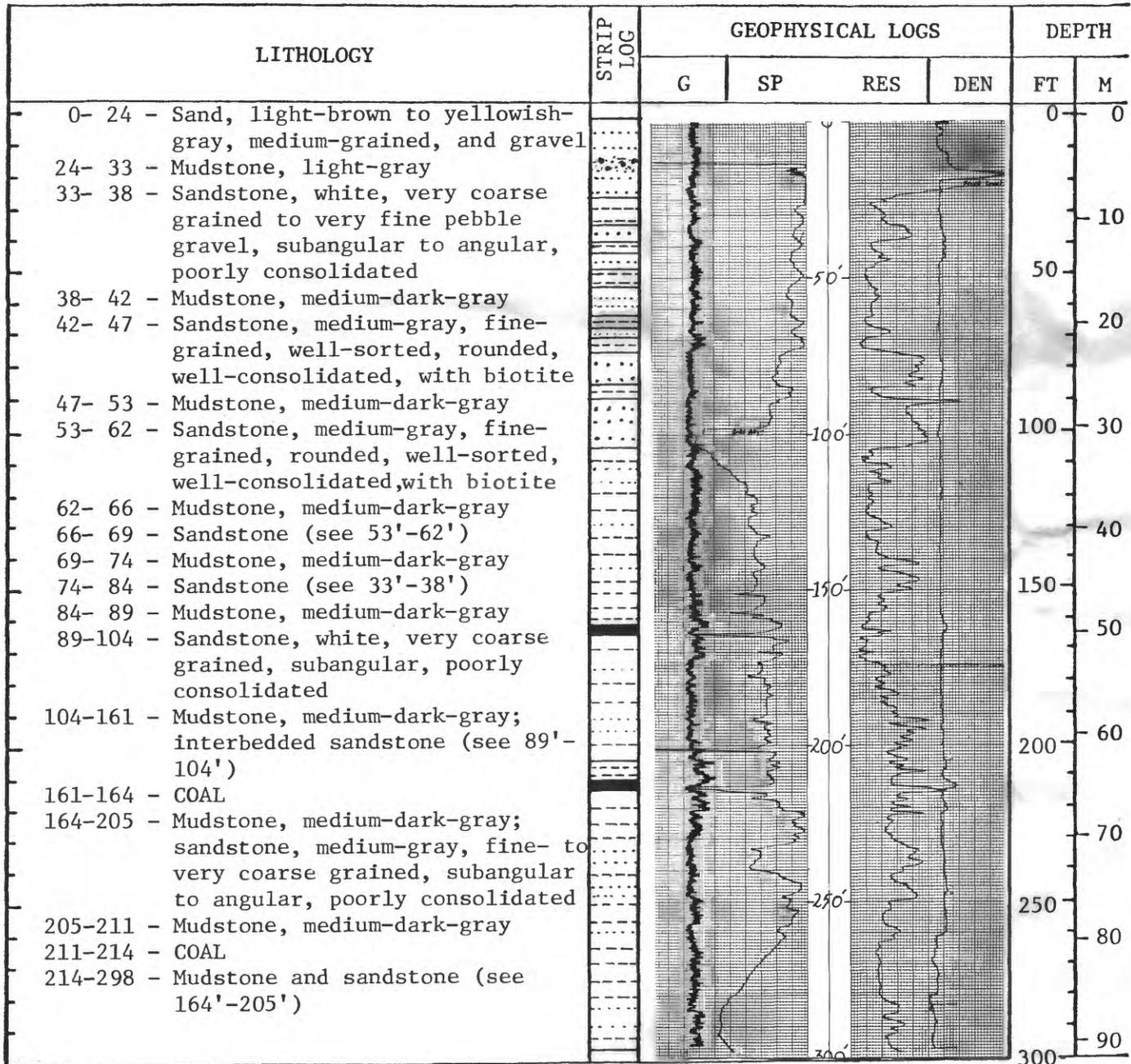
McCALLUM AREA

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: _____



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 LOC	GEOPHYSICAL LOGS				DEPTH	
		G	SP	RES	DEN	FT	M
						0	0
0- 12 - Sandy soil, yellowish-orange and yellowish-gray, medium-grained sandstone	1					0	0
12- 19 - Shaly mudstone, reddish-black	2					10	
19- 37 - Mudstone, pale-yellowish-brown and brownish-gray	3					50	
37- 55 - COAL, with partings	4					20	
55- 61 - Mudstone, light-gray	5					60	
61- 65 - Sandstone, white, very coarse grained to very fine pebble gravel, subangular, poorly consolidated	6	70					
65- 80 - Sandstone, white, fine-grained, well-sorted, well-consolidated, and light-gray mudstone at 65'-67'	7	80					
		90					
		300					

