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GEOLOGICAL SURVEY

COAL TEST DRILLING FOR THE SAN JUAN MINE EXTENSION, SAN JUAN COUNTY, NEW MEXICO

By

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INTRODUCTION

Between October 25 and December 16, 1977, the U.S. Geological Survey drilled test holes at 24 locations in T. 30 N., R. 15 W., N.M.P.M., in response to a request from the U.S. Bureau of Land Management that these lands be evaluated preparatory to competitive leasing under the Secretary of the Interior's short-term criteria (1977). The object of the drilling was to determine the depth, thickness, extent, and quality of the coal underlying T. 30 N., R. 15 W., in the San Juan basin, New Mexico. The holes were drilled under Government contract number 14-08-001-17162, awarded by the U.S. Geological Survey to Harlan Drilling Company of Farmington, New Mexico. Shumway Drilling Company of Moab, Utah, subcontracted by Harlan, did most of the drilling. The contractors drilled 24 holes and cored parts of five of them using truck-mounted rotary drilling rigs. Four of the holes were twinned for the purpose of coring the coal beds. In one drill hole the coal was cored as the hole was drilled without twinning the hole.

The drill holes are in the northwest part of the San Juan basin in the Upper Cretaceous Fruitland Formation outcrop, just east of the currently active Western Coal Company San Juan mine. The coal is in the lower 150 feet of the Fruitland Formation in two principal coal beds (table 1). The lower bed averages 15.3 feet in thickness, and in 13 locations a 2- to 3-foot-thick rider seam is present 3 to 11 feet above the main bed. All surface production in the nearby San Juan mine is currently coming from this lower

main bed. A thinner coal bed is located approximately 100 feet above the lower coal bed in the drilled area. This upper bed averages 6.3 feet in thickness. The Fruitland Formation and its contained coal beds dips from 1° to 3° northeastward in the drilled area.

DRILL-HOLE LOCATIONS

A triangulation survey was conducted to determine the exact location of the drill holes. Elevations were determined from two U.S. Geological Survey 7½-minute topographic quadrangle maps with contour intervals of 20 feet. (Three drill holes were surveyed by plane table to check their elevations and were found to be within 3 feet of the map interpolation.) All of the holes are in the Waterflow and Youngs Lake quadrangles, San Juan County, New Mexico (table 2). Figure 1, a composite map of the appropriate parts of these two quadrangles, shows the locations of all of the drill holes in this report. Each numbered drill hole is preceded by the letters "SJ" for San Juan. The first number after SJ is the number of the section where the hole is located and the second dashed number indicates the location of the hole in the section. The numbers increase from west to east and from north to south. For example, SJ 23-1 and SJ 23-4 are in section 23 in the NW and SE quarters, respectively.

DRILLING AND SAMPLING

Drilling fluids used were air, water, and air-water-biodegradable foam. Representative cuttings of the rock units penetrated were logged in the field at 10-foot intervals by U.S. Geological Survey geologists. Survey personnel supervised the drilling, selected the drill sites, determined the depths to be drilled, and obtained permission for access to the land from the U.S. Bureau of Land Management and private surface owners. The diameter of all drill holes is 4 inches, except for those intervals where the 3.25-inch core

barrel was used and the hole was not reamed. The coal beds generally become deeper from west to east and from south to north. The depths of the holes range from 406 ft to 845 ft and all were planned to penetrate the Pictured Cliffs Sandstone.

GEOPHYSICAL LOGS

Geophysical logs of the drill holes were run by USGS hydrologists, Albuquerque, New Mexico. Natural gamma, spontaneous-potential, resistivity, and high-resolution gamma-gamma density logs were run in drill holes at each location. Neutron logs were also run in drill-holes SJ 24-4 and SJ 25-1. No spontaneous-potential or resistivity logs were run for drill-hole SJ 25-2 because the hole collapsed after running the density and gamma logs. In this report, the geophysical logs are reduced to 20 percent of their original size. Each scale block on the reductions represents 1 square inch on the original logs.

CORING

Drill-hole SJ 26-3, drilled to a total depth of 407 feet, was cored from 303 feet to 406.6 feet, and then geophysically logged after the hole was completed. The other cored holes, SJ 13-2, SJ 25-2, SJ 14-1, and SJ 23-4, were twin drilled (table 3). Twin drilling was carried out as follows: First, a hole was drilled to the total depth and geophysical logs run. Next, a second hole was drilled about 30 feet from the first hole to a depth just above the upper coal bed and the bed was cored. Finally, the hole was drilled to just above the lower coal bed and that bed was cored. Coal bed depths were determined from the geophysical logs of the first drill hole. Cores were first roughly described in the field, and later more precisely in the office. The more detailed core descriptions and measurements follow the lithologic and geophysical logs of each core hole in this report. Core

samples of the coal beds have been submitted to the U.S. Geological Survey for proximate and ultimate analysis, heating value determination, and trace element analysis. A 1-foot coal sample from drill-hole SJ 23-4 (589-590 feet), collected for methane gas determination, was sent to the U.S. Bureau of Mines laboratory in Pittsburgh, Pa., for analysis; the partial results of this analysis are shown in table 4.

WATER-OBSERVATION WELLS

Three drill holes, SJ 13-2, SJ 23-4, and SJ 24-4, were completed as ground-water observation wells by Geological Survey hydrologists. These wells will be observed to determine water quality and ground-water levels. A 2-inch inside diameter polyvinyl chloride (PVC) plastic pipe, which is perforated with 1/4-inch holes opposite the zones to be observed, is used as casing. Core-hole SJ 23-4 was drilled 139 feet below the lowest Fruitland coal bed to monitor the water-producing capability of the underlying Pictured Cliffs Sandstone. In core-hole SJ 13-2, the casing is perforated opposite the lower coal, interburden, and upper coal, and in SJ 24-4, the water entering the hole above the coal beds (from the overburden) is being monitored. The three water-observation wells are denoted on figure 1 with the symbol "WOW" below the drill-hole number.

METHANE GAS STUDY

At the time of coring, several coal core samples were taken by a representative of the U.S. Bureau of Mines to observe and record the release of methane gas from the coal. The samples were subsequently sent to the U.S. Bureau of Mines laboratory in Pittsburgh, Pa., for further observation and study.

LITHOLOGIC LOGS

Lithologic descriptions of the drill-hole cuttings are based on records made in the field by the geologists. Sometimes the sample descriptions do not agree with the lithologies indicated by the geophysical logs. Where discrepancies exist, the geophysical log is more apt to be correct. The strip logs show only the coal intervals. Where there was disagreement between the lithologic and geophysical logs as to the location of a coal bed, the geophysical log was used to determine the location of the bed on the strip log.

REFERENCE

Secretary, U.S. Department of the Interior, 1977, Short-term competitive leasing: Federal Register, v. 42, no. 16, pt. 3525.3 (January 25, 1977).

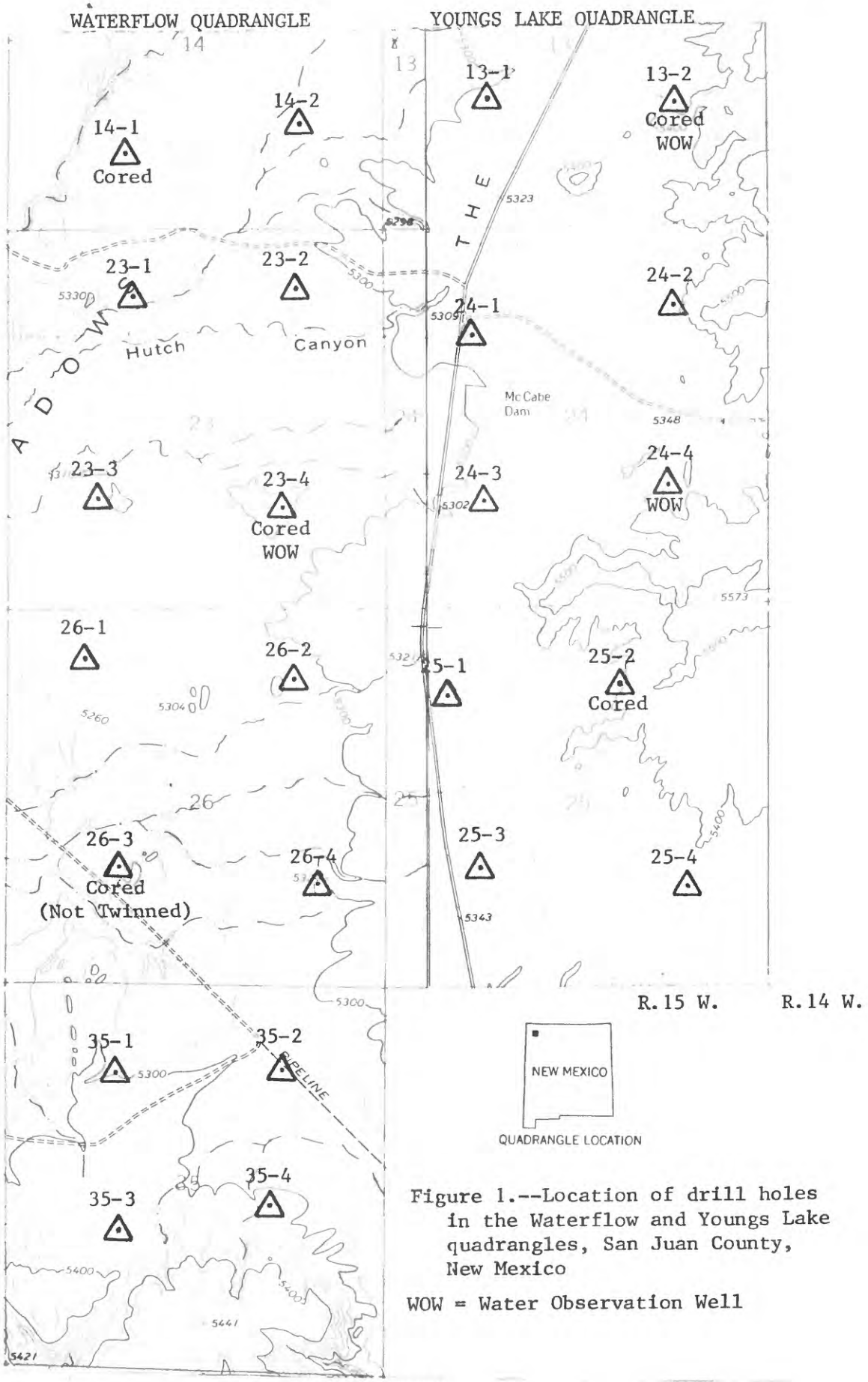


Figure 1.--Location of drill holes in the Waterflow and Youngs Lake quadrangles, San Juan County, New Mexico

WOW = Water Observation Well

Table 1.--Thicknesses and depths of the upper and lower coal beds in T. 30 N., R. 15 W., N.M.P.M., San Juan County, New Mexico

Drill-hole no.	Upper coal bed		Lower coal bed	
	Depth* (feet)	Thickness (feet)	Depth* (feet)	Thickness (feet)
SJ 13-1	479	5.0	606	12.0
SJ 13-2	590	3.0	720	9.0
			733	2.0
SJ 14-1	356	6.0	497	13.0
SJ 14-2	414	5.0	547	10.0
SJ 23-1	367	5.0	498	13.0
SJ 23-2	448	6.0	571	13.0
SJ 23-3	344	6.0	480	16.0
SJ 23-4	460	6.0	573	3.0
			586	15.0
SJ 24-1	537	6.0	648	2.0
			658	14.0
SJ 24-2	631	5.0	738	2.0
			750	13.0
SJ 24-3	538	7.0	647	2.0
			658	16.0
SJ 24-4	646	8.0	762	2.0
			768	1.0
			773	14.0
SJ 25-1	543	4.0	626	2.0
			660	13.0
SJ 25-2	648	7.0	739	3.0
	661	2.0	747	1.0
	665	2.0	750	11.0

*Depths are to the tops of the coal seams.

Table 1.--Thicknesses and depths of the upper and lower coal beds, T. 30 N., R. 15 W., N.M.P.M., San Juan County, New Mexico--continued

Drill-hole no.	Upper coal bed		Lower coal bed	
	Depth* (feet)	Thickness (feet)	Depth* (feet)	Thickness (feet)
SJ 25-3	521	6.0	616	4.0
			629	15.0
SJ 25-4	582	7.0	663	3.5
			680	16.0
SJ 26-1	317	7.0	436	15.0
SJ 26-2	430	6.0	511	2.0
			538	14.0
SJ 26-3	270	6.0	359	2.0
			376	15.0
SJ 26-4	384	7.0	465	3.0
			474	14.0
SJ 35-1	292	4.0	387	3.0
			392	17.0
SJ 35-2	330	7.0	423	22.0
SJ 35-3	325	6.0	417	23.0
SJ 35-4	349	7.0	436	23.0

*Depths are to the tops of the coal seams.

Table 2.--Summary of coal test drilling for the San Juan mine extension, San Juan County, New Mexico, from October 25 to December 16, 1977

[C, cored; WOW, waterwell. All measurements are in feet; to convert to meters, multiply by 0.3048]

Drill-hole No.	Location, T. 30 N., R. 15 W., N.M.P.M.	Surface elevation (feet)	Date completed	Total depth drilled (feet)	Total depth logged (feet)	Geography of location
		Youngs Lake quadrangle				
SJ 13-1	NE¼SW¼ sec. 13	5,305	11-12-77	668	668	Flood plain
SJ 13-2 (C, WOW)	NE¼SE¼ sec. 13	5,355	11-15-77	780	780	---Do-------
SJ 24-1	SW¼NW¼ sec. 24	5,310	11-18-77	703	703	---Do-------
SJ 24-2	NE¼NE¼ sec. 24	5,380	11-16-77	783	782	---Do-------
SJ 24-3	NW¼SW¼ sec. 24	5,308	11-19-77	680	680	Slope
SJ 24-4 (WOW)	NW¼SE¼ sec. 24	5,265	11-17-77	810	808	---Do-------
SJ 25-1	NW¼NW¼ sec. 25	5,338	11-30-77	845	823	Sand dune
SJ 25-2 (C)	NW¼NE¼ sec. 25	5,390	12-01-77	795	783	Slope
SJ 25-3	CN½SW¼ sec. 25	5,450	12-01-77	723	718	Sand dune
SJ 25-4	NE¼SE¼ sec. 25	5,375	11-29-77	743	737	Slope
		Waterflow quadrangle				
SJ 14-1 (C)	SE¼SW¼ sec. 14	5,278	11-09-77	643	545	Flood plain
SJ 14-2	NE¼SE¼ sec. 14	5,283	11-15-77	603	585	---Do-------
SJ 23-1	NE¼NW¼ sec. 23	5.250	11-05-77	604	603	---Do-------
SJ 23-2	NE¼NE¼ sec. 23	5,287	11-11-77	643	643	---Do-------
SJ 23-3	NE¼SW¼ sec. 23	5,282	11-04-77	542	518	Slope
SJ 23-4 (C, WOW)	NW¼SE¼ sec. 23	5,305	11-04-77	643	643	---Do-------
SJ 26-1	NW¼NW¼ sec. 26	5,265	11-02-77	503	499	Flood plain
SJ 26-2	NE¼NE¼ sec. 26	5,293	11-01-77	626	623	---Do-------
SJ 26-3 (C)	NE¼SW¼ sec. 26	5,260	10-31-77	410	407	Slope
SJ 26-4	NE¼SE¼ sec. 26	5,290	10-31-77	603	603	Grass flat
SJ 35-1	NE¼NW¼ sec. 35	5,295	10-27-77	443	440	Ridge
SJ 35-2	NW¼NE¼ sec. 35	5,285	10-26-77	463	443	Grass flat
SJ 35-3	NE¼SW¼ sec. 35	5,360	10-27-77	483	480	Graveled slope
SJ 35-4	NW¼SE¼ sec. 35	5,318	10-26-77	504	503	---Do--------

Table 3.--Summary of five core holes in the Waterflow and Youngs Lake quadrangles, San Juan County, New Mexico

Drill-hole No.	Interval cored* (feet)	Total core recovered (feet)	Percent of core recovered
	Waterflow quadrangle		
SJ 13-2	527.00-542.00	10.60	
	585.00-600.70	15.70	90
	710.00-737.50	27.50	
Drill-hole total----------		53.80	
SJ 25-2	643.00-673.00	8.90	
	736.00-761.00	19.90	52
Drill-hole total----------		28.80	
	Youngs Lake quadrangle		
SJ 14-1	353.00-366.00	13.00	
	488.00-517.40	29.40	94
Drill-hole total----------		42.40	
SJ 23-4	461.00-471.00	6.00	
	573.00-607.70	34.70	90
Drill-hole total----------		40.70	
SJ 26-3	303.00-406.60	103.60	100

*The intervals indicated are the depths below the surface.

Table 4.--Report of analysis on coal from the Fruitland Formation by the U. S. Bureau of Mines Methane Control and Ventilation Organization

Location: Sec. 23, T. 30 N., R. 15 W., NMPM, San Juan County, New Mexico
Hole number: SJ 23-4
Depth of core sample: 589.0 feet to 590.0 feet
Collector: Bernard M. Bench

	As received	Moisture free	Moisture and ash free
Proximate Analysis (in percent)			
Moisture	4.6	---	---
Volatile Matter	42.6	44.7	50.9
Fixed Carbon	41.1	43.1	49.1
Ash	11.7	12.2	---
Ultimate Analysis (in percent)			
Hydrogen	5.6	5.4	6.2
Carbon	66.2	69.4	79.0
Nitrogen	1.4	1.5	1.7
Sulfur	0.6	0.6	0.7
Oxygen	14.5	10.9	12.4
Ash	11.7	12.2	---
Heating Value Btu/lb	12,056	12,639	14,402

Ash

Initial deformation	2910°	Free swelling index
Softening temperature	2910°	1.0 (No change)
Fluid temperature	2910°	

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 13-1 Date Logged 11-12-77 Surface Elevation (ft) 5305

County & State San Juan County, N. M. Location NE¼SW¼ Sec. 13, T. 30 N., R. 15 W., NMPM

Map Youngs Lake, N. M. Drilled depth (ft) 668 Logged depth (ft) 737.50

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Richard Fulton,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

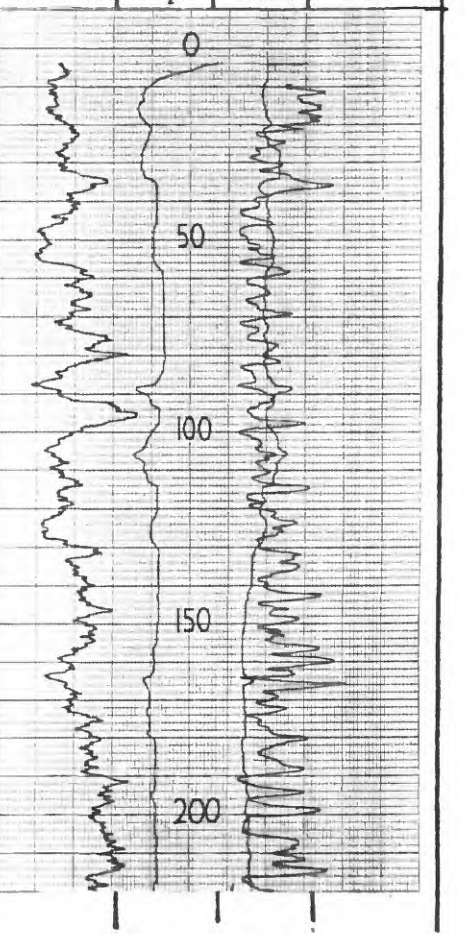
Spontaneous potential (sp): Scale 20 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

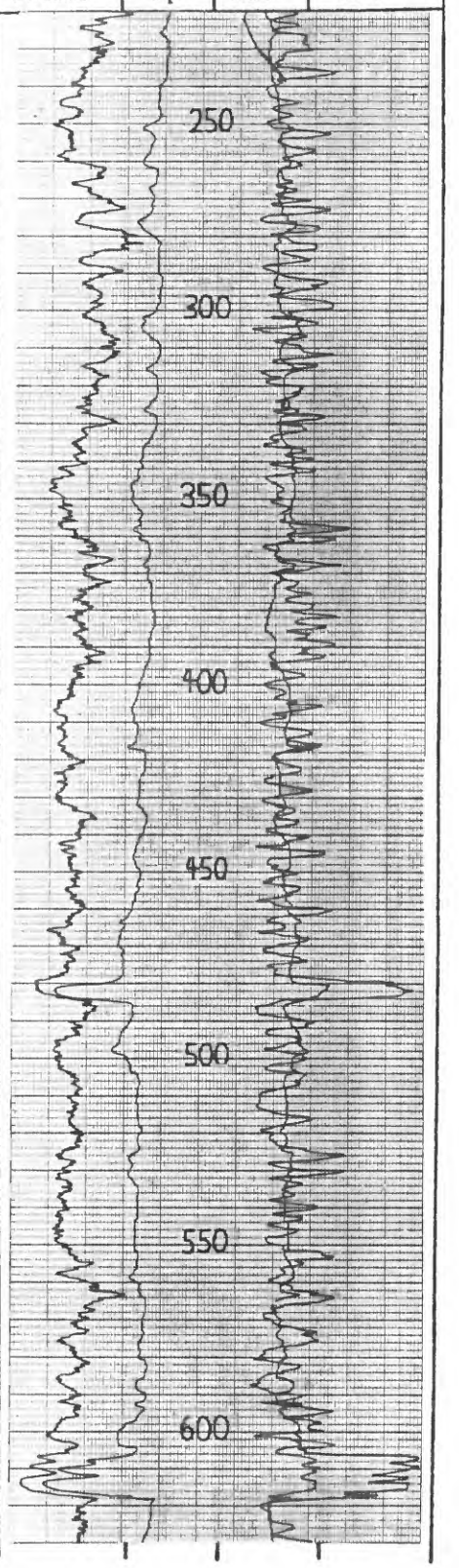
Gamma (G): Scale 20 cps/in. Logging speed 20 fpm

Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

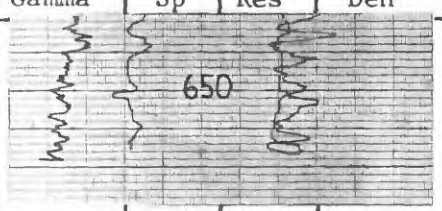
LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma / Sp / Res / Den
0-20 ft Sand, brown, very fine grained		0	0	
20-34 ft Siltstone, brown			10	
34-38 ft Shale, gray, silty				
38-57 ft Siltstone, light to dark-gray (increases downward), shaly		50		
57-82 ft Shale, dark-gray, silty			20	
82-92 ft Sandstone, dark-gray, very fine grained				
92-100 ft Shale, dark-gray		100	30	
100-129 ft Sandstone, dark-gray, very fine grained, shaly				
129-162 ft Shale, black to dark-gray, silty			40	
		150		
162-166 ft Siltstone, gray, hard			50	
166-205 ft Shale, dark-gray				
			60	
205-222 ft Shale, black, slightly silty		200		
			70	

Hole No. SJ 13-1 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma, Sp, Res, Den
222-227 ft Sandstone, gray, very fine grained 227-239 ft Shale, black 239-278 ft Sandstone, salt-and-pepper gray, very fine grained 278-301 ft Shale, very dark-gray 301-341 ft Shale, dark-gray, silty 341-351 ft Sandstone, gray, very fine grained, shaley 351-399 ft Shale, gray to black 399-434 ft Sandstone, salt-and-pepper gray, very fine grained, with gray shale 434-479 ft Sandstone, gray to dark-gray, very fine grained 479-484 ft Coal, black 484-491 ft Shale, black 491-606 ft Sandstone, dark-gray, very fine grained, hard, with black and gray shale 606-618 ft Coal, black 618-629 ft Shale, dark-gray, silty, hard		250 300 350 400 450 500 550 600	80 90 100 110 120 130 140 150 160 170 180 190	

Hole No. SJ 13-1 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma	Sp	Res	Den
629-668 ft Sandstone, salt-and-pepper gray, very fine to medium-grained		650	200				
			250				
		700	300				
			350				
		750	400				
			450				
		800	500				
			550				
		850	600				
		900	650				
		950	700				



LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 13-2 Date Logged 11-15-77 Surface Elevation (ft) 5355

County & State San Juan County, N. M. Location NE¼SE¼ Sec. 13, T. 30 N., R. 15 W., NMPM

Map Youngs Lake, N. M. Drilled depth (ft) 780 Logged depth (ft) 780 Cored depth (ft) 738

Cored: [x] Yes [ ] No Geologists: Richard Fulton, Laura Beach, Russell Jentgen

Drilling medium: [x] Air [ ] Water [x] Foam [ ] Mud [x] Water Observation Well

GEOPHYSICAL LOGS:

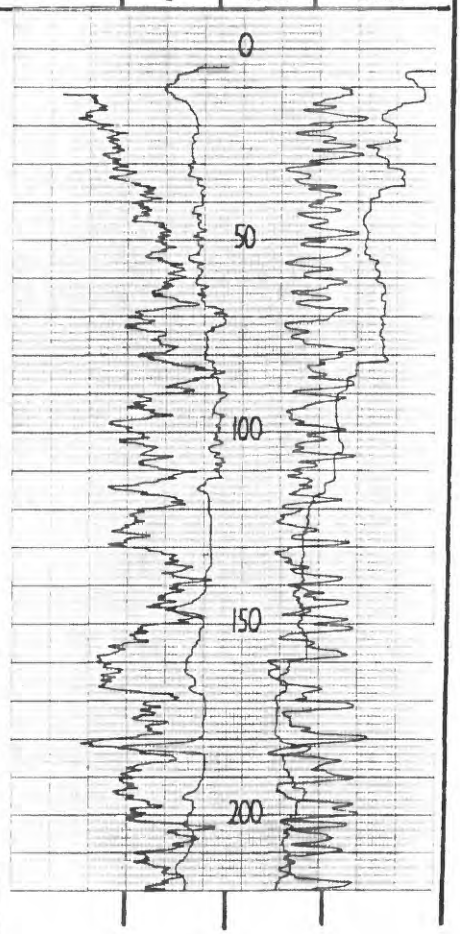
Spontaneous potential (Sp): Scale 20 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 200 ohms/in. Logging speed 20 fpm

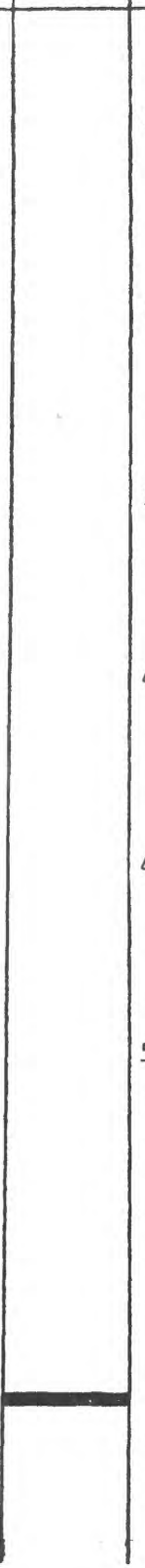
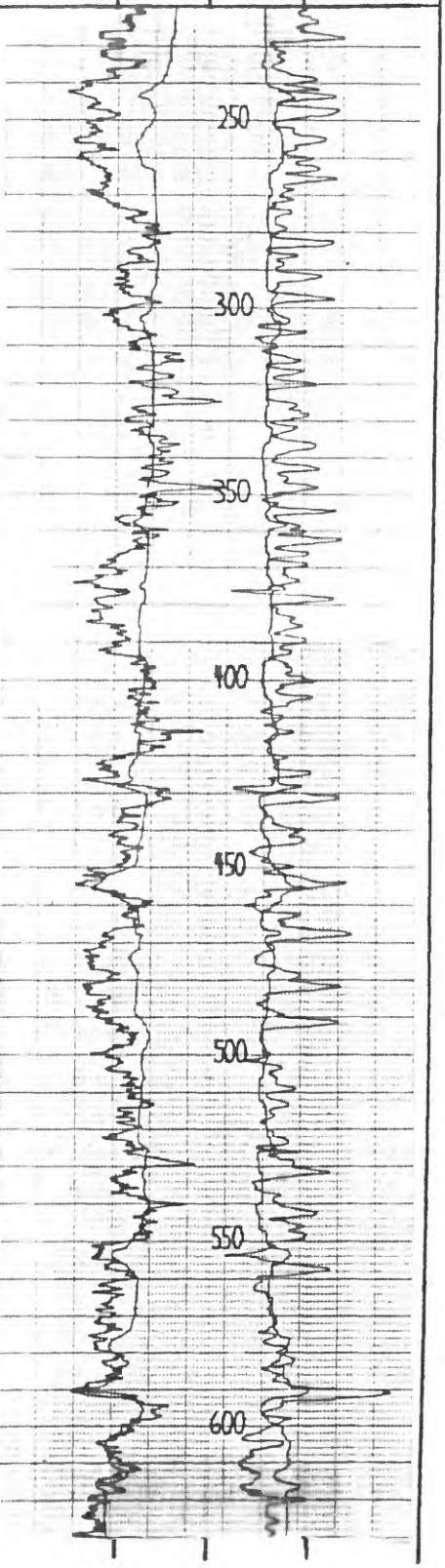
Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale Logging speed 20 fpm

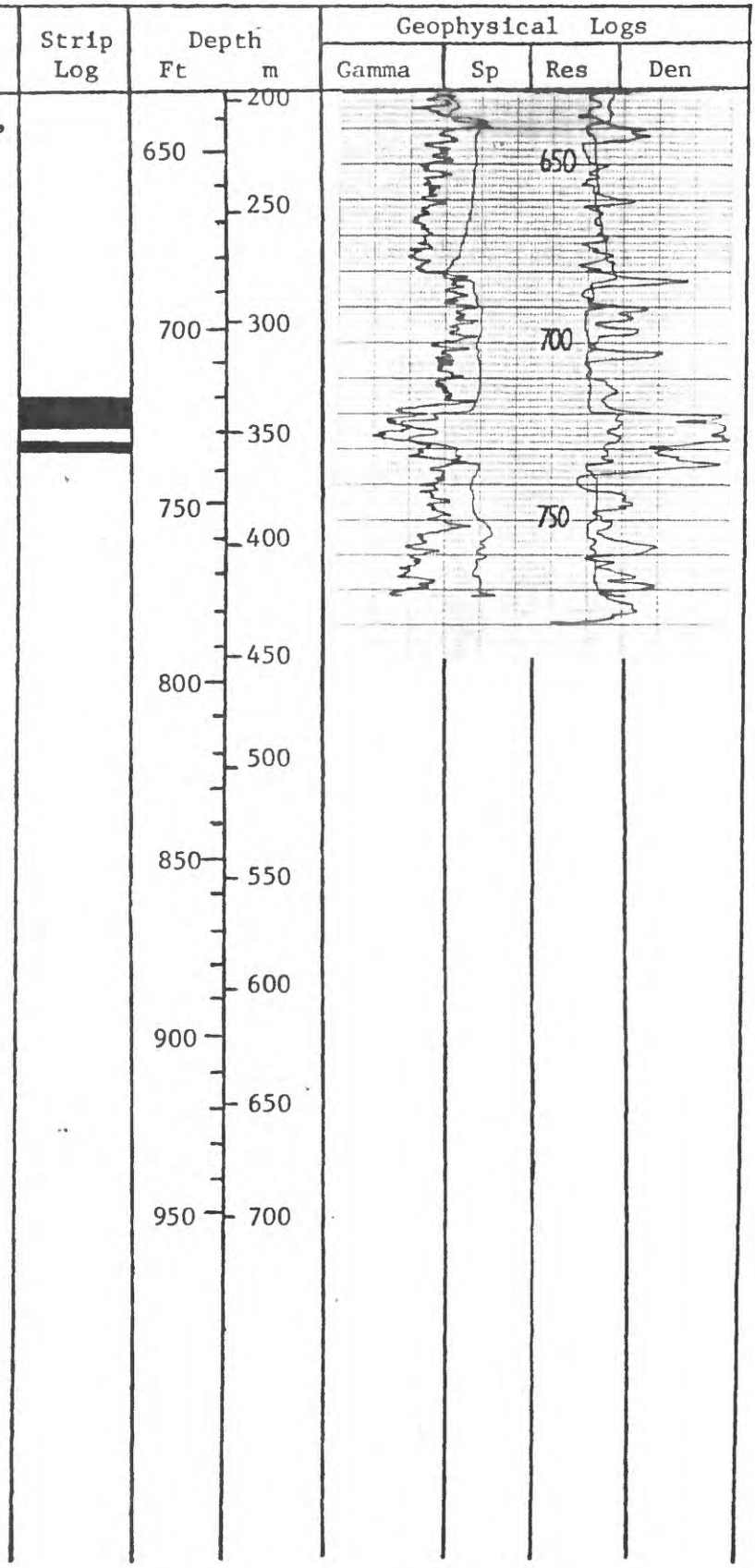
LITHOLOGY	Strip Log	Depth ft	Depth m	Geophysical Logs
0-8 ft Sand, brown 8-19 ft Sandstone, reddish-brown, very fine grained 19-23 ft Siltstone, brown, very very fine grained 23-83 ft Siltstone, gray to dark-gray, very very fine grained 83-116 ft Siltstone, dark-gray, shaly 116-169 ft Shale, dark-gray, silty 169-179 ft Shale, dark-gray to black, carbonaceous 179-183 ft Sandstone, salt-and-pepper gray, fine grained 183-203 ft Shale, dark-gray to black 203-213 ft Shale, black 213-223 ft Shale, dark-gray, slightly silty		0 50 100 150 200	0 10 20 30 40 50 60 70	Gamma Sp Res Den 

Hole No. SJ 13-2 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma / Sp / Res / Den
223-243 ft Shale, black, carbonaceous 243-253 ft Shale, dark-gray 253-263 ft Sandstone, gray, fine-grained 263-273 ft Shale, black, slightly silty 273-296 ft Shale, dark-gray 296-298 ft Coal, shaly 298-313 ft Shale, dark-gray 313-333 ft Shale, dark-gray to black 333-343 ft Shale, black 343-375 ft Shale, dark-gray 375-376 ft Coal, shaly 376-383 ft Shale, dark-gray 383-393 ft Shale, dark-gray, silty 393-403 ft Shale, dark-gray to green 403-423 ft Shale, dark-gray, slightly silty 423-433 ft Shale, dark-gray to green 433-451 ft Shale, dark-gray, silty 451-467 ft Sandstone, salt-and-pepper gray, very fine-grained 467-468 ft Coal, sandy 468-475 ft Sandstone, salt-and-pepper gray, very fine grained 475-490 ft Shale, dark-gray 490-503 ft Sandstone, gray, very fine grained 503-513 ft Shale, gray, slightly silty 513-533 ft Shale, gray to black 533-552 ft Shale, dark-gray to black, carbonaceous 552-590 ft Sandstone, gray, very fine grained 590-593 ft Coal 593-602 ft Shale, gray to black, carbonaceous, silty 602-636 ft Sandstone, salt-and-pepper gray, fine-grained 636-640 ft Shale, black, carbonaceous		250 300 350 400 450 500 550 600	80 90 100 110 120 130 140 150 160 170 180 190	

Hole No. SJ 13-2 (continued)

LITHOLOGY	
640-705 ft	Sandstone, light to dark-gray, very fine grained
705-720 ft	Sandstone, salt-and-pepper gray, very fine grained
720-729 ft	Coal
729-733 ft	Shale, black, coaly
733-735 ft	Coal
735-755 ft	Shale, dark-gray, silty
755-780 ft	Sandstone, gray, very fine grained, shaly



Description of core from SJ 13-2

December 12, 1977 to December 16, 1977

Total Depth of Core (T.D.): 737.50 feet
Total Length of Coring: 53.80 feet out of 58.20 feet attempted
Total Length of Lower Coal Seam in Core: 13.47 feet

Lithologic description	Feet From	Feet To
Coring 1 Depth - 527.00 feet to 542.00 feet		
Missing interval	527.00	531.40
Shale, dark-gray	531.40	537.30
Shale, black, carbonaceous; coal fragments	537.30	538.60
Shale, black, carbonaceous; 3.50-in. fossilized oyster shell	538.60	539.00
Shale, dark-gray; scattered coal fragments	539.00	539.90
Shale, black, carbonaceous; coal fragments	539.90	540.80
Shale, dark-gray; scattered coal fragments	540.80	542.00
Length of Core = 10.60 feet		
Length of Coal in Core = 0.00 feet		
Coring 2 Depth - 585.00 feet to 600.70 feet		
Shale, black, carbonaceous; coal fragments	585.00	585.40
Shale, gray, silty; coal fragments	585.40	586.10
Shale, dark-gray, carbonaceous; coal fragments	586.10	586.60
Shale, black, carbonaceous, earthy, friable	586.60	587.50
Shale, dark-gray, earthy, friable; coal fragments	587.50	588.30
Shale, black, carbonaceous, earthy; coal fragments, interbedded with brown silty shale	588.30	589.50
Shale, dark-gray; coal fragments, interbedded with brown silty shale	589.50	590.20
Shale, gray, silty; coal fragments	590.20	593.20

Description of core from SJ 13-2 -- continued

Lithologic description	Feet From	Feet To
Siltstone, gray, shaly, fossiliferous; coal fragments	593.20	593.90
Sandstone, gray, very fine grained, fossiliferous; scattered coal fragments; fig leaf imprint (Ficus sp.) at 594.30	593.90	594.80
Shale, gray	594.80	595.70
Shale, light-brown	595.70	596.00
Shale, gray, silty	596.00	596.40
Sandstone, light-gray, very fine grained, with a wispy bedded appearance and scattered coal fragments	596.40	598.00
Sandstone, light-gray, very fine grained, silty, with a wispy bedded appearance and scattered coal fragments	598.00	600.70

Length of Core = 15.70 feet

Length of Coal in Core = 0.00 feet

Coring 3 Depth - 710.00 feet to 724.40 feet

Shale, gray, silty; coal fragments	710.00	711.30
Coal, black, shiny, resinous; good cleat and conchoidal fracture	711.30	716.10
Shale, brown; coal fragments	716.10	716.25
Coal, black, shiny, resinous; good cleat and conchoidal fracture	716.25	720.30
Coal, black to brown, dull, with shiny black coal (vitrain) streaks, resinous; good cleat and conchoidal fracture	720.30	723.10
Shale, light-brown; coal fragments	723.10	723.38
Coal, black, dull, with shiny black coal (vitrain) streaks, resinous; good cleat and conchoidal fracture	723.38	724.40

Length of Core = 14.40 feet

Length of Coal in Core = 12.67 feet

Description of core from SJ 13-2 -- Continued

Lithologic description	Feet From	Feet To
Coring 4 Depth - 724.40 to 737.50 feet		
Shale, black, carbonaceous, 0.02 to 0.12 in.; coal streaks	724.40	725.30
Coal, black, dull, with shiny black coal (vitrain) streaks resinous; good cleat and conchoidal fracture	725.30	726.10
Shale, gray; coal fragments	726.10	729.00
Shale, gray, silty, scattered coal fragments	729.00	730.30
Sandstone, light-gray, very fine grained; coal fragments, interbedded with dark-gray, very fine grained, shaly sandstone and siltstone	730.30	737.50

Length of Core = 13.10 feet

Length of Coal in Core = 0.80 feet

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 14-1 Date Logged 11-09-77 Surface Elevation (ft) 5278

County & State San Juan County, N. M. Location SE¼SW¼ Sec. 14, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 643 Logged depth (ft) 545

Cored depth (ft) 517.40 Cored: [x] Yes [ ] No Geologists: Dennis Umshler, Laura Beach

Drilling medium: [x] Air [ ] Water [x] Foam [ ] Mud

GEOPHYSICAL LOGS:

Spontaneous potential (sp): Scale 200 MV/in. Logging speed 20 fpm

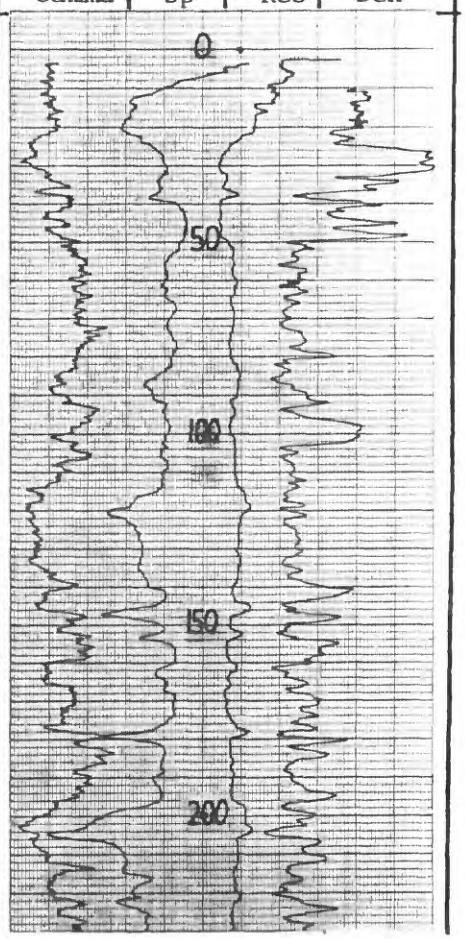
Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 20 cps/in. Logging speed 20 fpm

Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

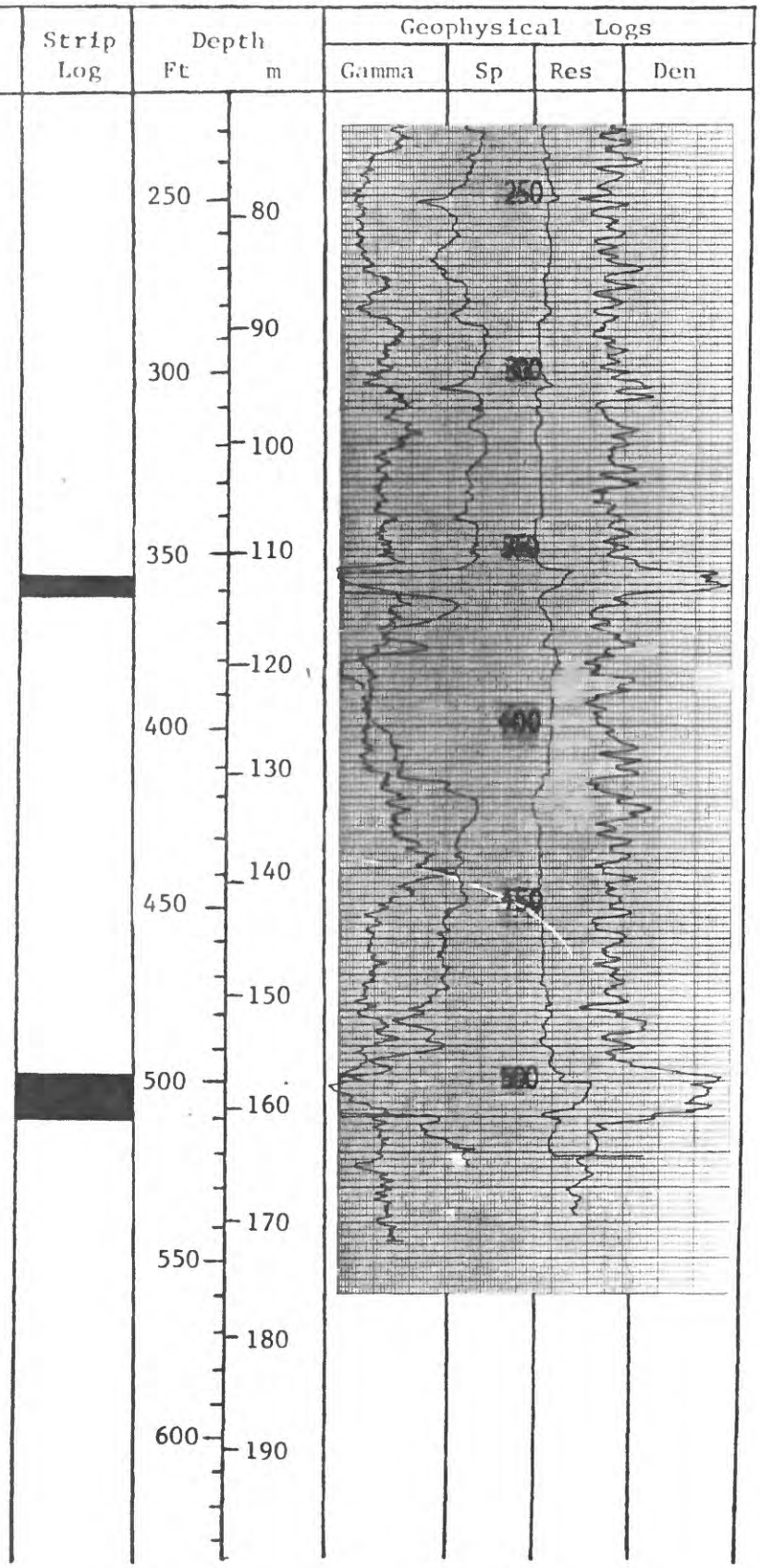
Neutron (Neu): Scale Logging speed fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
0-23 ft Alluvium, light-brown, medium grained		0	0	Gamma Sp Res Den
23-52 ft Sandstone, light-brownish-yellow, very fine grained			10	
52-71 ft Shale, gray, silty		50	20	
71-75 ft Sandstone, gray, very fine grained				
75-85 ft Shale, gray				
85-101 ft Sandstone, gray, very fine grained, shaly		100	30	
101-117 ft Shale, gray				
117-141 ft Sandstone, gray, very fine grained			40	
141-153 ft Shale, black, carbonaceous				
153-183 ft Shale, gray to dark-gray, silty		150	50	
183-197 ft Shale, gray, silty			60	
197-213 ft Sandstone, gray, very fine grained		200		
213-223 ft Siltstone, gray			70	



Hole No. SJ 14-1 (continued)

LITHOLOGY	
223-274 ft	Sandstone, gray, very fine grained
274-283 ft	Shale, gray
283-288 ft	Sandstone, gray, very fine grained
288-336 ft	Shale, gray, silty
336-356 ft	Sandstone, gray, very fine grained
356-361 ft	Coal
361-371 ft	Shale, black, carbonaceous; coal fragments
371-420 ft	Siltstone, gray, shaly, and gray, very fine grained shaly sandstone
420-428 ft	Shale, dark-gray, coal fragments
428-481 ft	Sandstone, gray, very fine grained
481-493 ft	Shale, dark-gray to brown, carbonaceous; coal fragments
493-495 ft	Shale, black, carbonaceous
495-509 ft	Coal
509-553 ft	Shale, brownish-black, carbonaceous; coal fragments
553-563 ft	Shale, dark-gray
563-623 ft	Sandstone, salt-and-pepper gray, very fine grained



Description of Core From SJ 14-1

December 8, 1977 to December 12, 1977

Total Depth of Core (T.D.): 517.40 feet
Total Length of Coring: 42.40 feet out of 45.00 feet attempted
Total Length of Upper Coal Seam in Core: 1.40 feet
Total Length of Lower Coal Seam in Core: 9.50 feet

Lithologic description	Feet From	Feet To
Coring 1 Depth - 353.00 feet to 366.00 feet		
Coal, black, shiny, resinous; good cleat and conchoidal fracture	353.00	354.15
Coal, black, dull, shaly	354.15	354.40
Shale, gray, coal fragments	354.40	356.20
Siltstone, gray, shaly; scattered coal fragments	356.20	356.55
Sandstone, gray, very fine grained, shaly; scattered coal fragments, coal streaks 0.02-in. to 0.08-in.	356.55	357.80
Shale, dark-gray, scattered coal fragments	357.80	358.20
Shale, black, carbonaceous, 0.04-in. to 0.08-in. coal streaks	358.20	358.65
Shale, gray, with interbedded brown, clayey shale	358.65	359.34
Shale, dark-gray, scattered black carbonaceous shale fragments	359.34	360.60
Shale, gray, clayey	360.60	361.50
Shale, gray, dark-gray, carbonaceous shale fragments	361.50	352.80
Shale, gray, silty, dark-gray carbonaceous shale fragments	362.80	364.30
Sandstone, gray, very fine grained, shaly; dark-gray carbonaceous shale fragments	364.30	366.00

Length of Core = 13.00 feet

Length of Coal in Core = 1.40 feet

Description of core from SJ 14-1 -- continued

Lithologic description	Feet From	Feet To
Coring 2 Depth - 488.00 feet to 503.50 feet		
Shale, gray; interbedded with light-brown shale	488.00	488.46
Shale, dark-gray; interbedded with light-gray, very fine grained sandstone	488.46	489.37
Shale, dark-gray, banded	489.37	491.90
Sandstone, gray, fine- to medium-grained; carbonaceous shale fragments	491.90	492.50
Shale, dark-gray; coal fragments	492.50	494.55
Shale, black, carbonaceous; coal fragments	494.55	495.38
Coal, black, dull, with 0.04-to 0.12-in. shiny coal (vitrain) bands, resinous, shaly	495.38	496.00
Coal, black, shiny, resinous; good cleat and conchoidal fracture	496.00	496.30
Coal, black, dull, with shiny coal (vitrain) bands, resinous, shaly	496.30	496.80
Coal, dull, with shiny coal (vitrain) bands, resinous; good cleat and conchoidal fracture	496.80	497.90
Sandstone, light-brown, very fine grained; coal fragments; 0.02- to 0.04-in. coal partings	497.90	497.95
Coal, dull, with shiny coal (vitrain) bands, resinous; good cleat and conchoidal fracture	497.95	498.50
Sandstone, light-brown, very fine grained; coal fragments; 0.04-in. coal bands	498.50	498.55
Coal, black, dull, with shiny coal (vitrain) bands, resinous; good cleat and conchoidal fracture	498.55	502.15
Sandstone, light-brown, very fine grained; coal fragments; 0.04-in. coal bands	502.15	502.17

Description of core from SJ 14-1 -- continued

Lithologic description	Feet From	Feet To
Coal, black, dull, with shiny coal (vitrain) bands, resinous; good cleat and conchoidal fracture	502.17	502.25
Sandstone, light-brown, very fine grained; coal fragments; 0.04-in. coal bands	502.25	502.26
Coal, black, dull, with shiny coal (vitrain) bands, resinous; good cleat and conchoidal fracture	502.26	502.58
Sandstone, light-brown, very fine grained; coal fragments; 0.04-in. coal bands	502.58	502.65
Coal, black, dull, with shiny coal (vitrain) bands, resinous; good cleat and conchoidal fracture	502.65	502.74
Sandstone, light-brown, very fine grained; coal fragments; 0.04-in. coal bands	502.74	502.76
Coal, black, dull, with shiny coal (vitrain) bands, resinous; good cleat and conchoidal fracture	502.76	503.50

Length of Core = 15.50 feet

Length of Coal in Core = 7.90 feet

Coring 3 Depth - 503.50 feet to 517.40 feet

Lithologic description	Feet From	Feet To
Coal, black, dull, with shiny coal (vitrain) bands, resinous, friable	503.50	504.20
Shale, brown; dull black coal fragments and streaks	504.20	504.80
Coal, black, dull, with shiny coal (vitrain) bands, resinous	504.80	505.50
Shale, brownish-black, carbonaceous; 0.04 to 0.08-in. shiny black coal (vitrain) bands	505.50	506.80
Shale, gray; black carbonaceous shale fragments	506.80	507.20
Sandstone, light-gray, very fine grained, shaly	507.20	507.50

Description of Core From SJ 14-1 -- Continued

Lithologic description	Feet From	Feet To
Shale, gray; interbedded with light-gray, very fine grained sandstone with coal fragments	507.50	509.00
Siltstone, gray	509.00	509.20
Sandstone, gray, very fine grained; interbedded with black carbonaceous shale less than 0.04 in. thick	509.20	509.50
Sandstone, light-gray, very fine grained, shaly	509.50	509.72
Shale, dark-gray; interbedded with very fine grained light-gray sandstone	509.72	512.70
Shale, gray	512.70	513.10
Shale, gray; interbedded with light-gray siltstone	513.10	514.60
Shale, gray; carbonaceous shale fragments	514.60	517.40

Length of Core = 13.90 feet

Length of Coal in Core = 1.60 feet

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 14-2 Date Logged 11-15-77 Surface Elevation (ft) 5283

County & State San Juan County, N. M. Location NE¼SE¼ Sec. 14, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 603 Logged depth (ft) 585

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Richard Fulton,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

Spontaneous potential (sp): Scale 200 MV/in. Logging speed 20 fpm

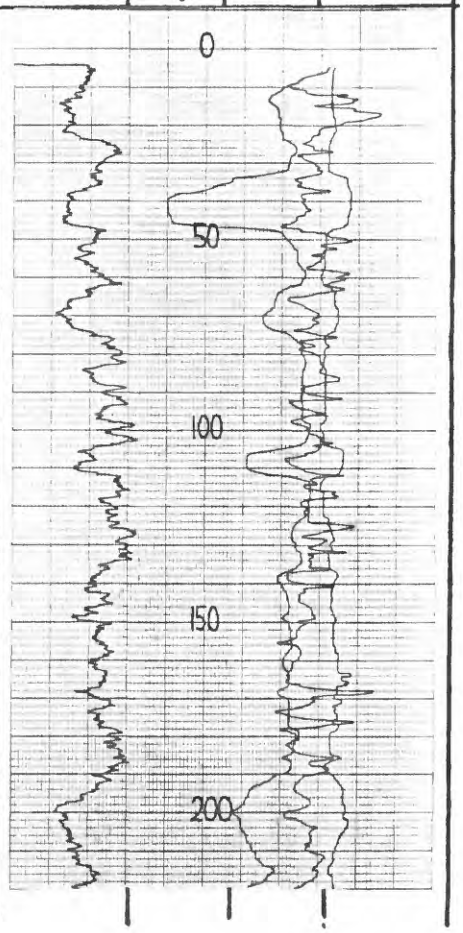
Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

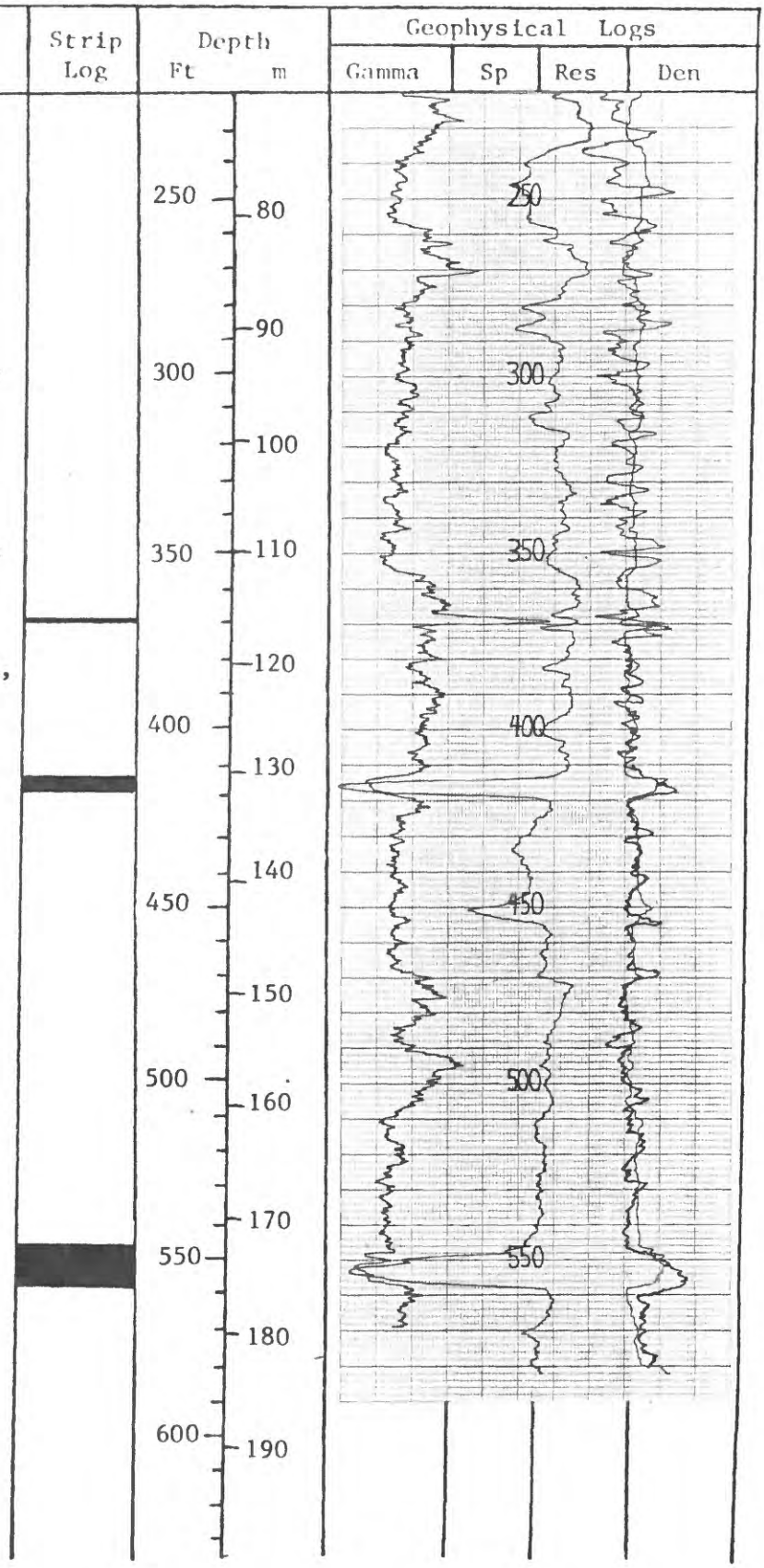
Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
0-23 ft Silt, light-brown, unconsolidated, very very fine grained		0	0	Gamma Sp Res Den
23-33 ft Siltstone, brown, very very fine grained			10	
33-73 ft Siltstone, gray to dark-gray, very very fine grained		50	20	
73-103 ft Siltstone, dark-gray, slightly shaly, very very fine grained		100	30	
103-113 ft Siltstone, dark-gray, very very fine grained			40	
113-133 ft Siltstone, very dark-gray, very very fine grained		150	50	
133-163 ft Siltstone, dark-gray, slightly shaly, very very fine grained			60	
163-173 ft Siltstone, dark-gray to black, very fine grained		200		
173-190 ft Siltstone, dark-gray, very fine grained			70	
190-213 ft Shale, black				
213-243 ft Siltstone, dark-gray, very very fine grained, shaly				



Hole No. SJ 14-2 (continued)

LITHOLOGY	
243-263 ft	Siltstone, gray, very very fine grained
263-279 ft	Siltstone, gray, very very fine grained, shaly
279-288 ft	Shale, black
288-303 ft	Siltstone, gray, very very fine grained
303-353 ft	Sandstone, gray, shaly, very fine grained
353-368 ft	Shale, light-gray, bentonitic
368-370 ft	Coal
370-388 ft	Shale, brown, carbonaceous
388-414 ft	Shale, light-gray, bentonitic, sandy
414-419 ft	Coal
419-432 ft	Shale, gray, silty
432-472 ft	Sandstone, salt-and-pepper gray, fine-grained
472-493 ft	Shale, dark-gray
493-509 ft	Shale, dark-gray, sandy
509-547 ft	Sandstone, dark-gray, very fine grained
547-558 ft	Coal
558-573 ft	Sandstone, dark-gray, very fine grained
573-603 ft	Sandstone, salt-and-pepper gray, fine-grained



LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 23-1 Date Logged 11-05-77 Surface Elevation (ft) 5250

County & State San Juan County, N. M. Location NE¼NW¼ Sec. 23, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 604 Logged depth (ft) 603

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Dennis Umshler,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

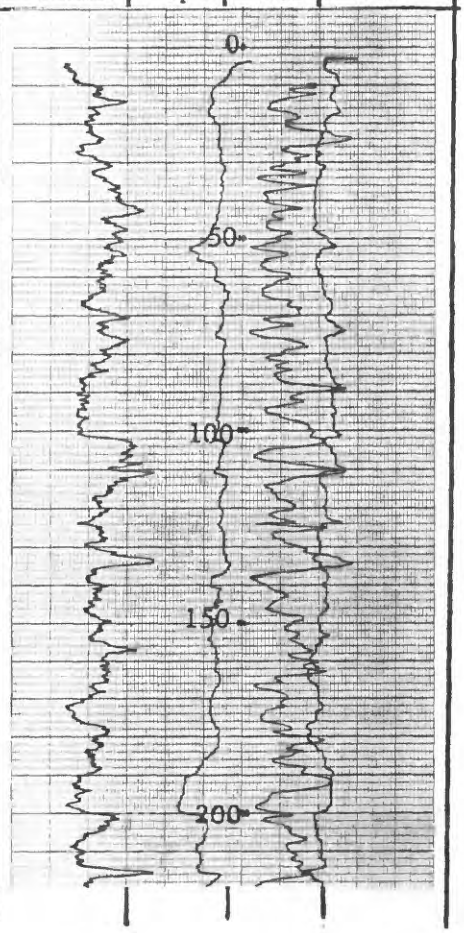
Spontaneous potential (sp): Scale 200 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma / Sp / Res / Den
0-13 ft Shale, light-brown, silty 13-23 ft Shale, black, silty, carbonaceous 23-33 ft Shale, light-brown, silty 33-45 ft Shale, gray, silty 45-49 ft Shale, black, carbonaceous 49-55 ft Sandstone, gray, very fine grained, silty 55-83 ft Shale, gray, silty 83-113 ft Sandstone, gray, very fine grained, silty 113-133 ft Shale, dark-gray, silty 133-136 ft Shale, black, carbonaceous 136-256 ft Shale, dark-gray, silty		0 50 100 150 200	0 10 20 30 40 50 60 70	

Hole No. SJ 23-1 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
256-293 ft Sandstone, gray, very fine grained		250	80	Gamma Sp Res Den
293-312 ft Shale, dark-gray, silty			90	
		300		
312-313 ft Coal			100	
313-318 ft Shale, dark-gray				
318-351 ft Sandstone, gray, very fine grained				
351-367 ft Shale, dark-gray, silty		350	110	
367-372 ft Coal				
372-383 ft Shale, gray, silty				
383-403 ft Shale, gray, silty, clayey			120	
403-432 ft Sandstone, gray, very fine grained; coal fragments		400	130	
432-449 ft Shale, dark-gray, silty, with black shale partings			140	
449-499 ft Shale, gray, silty		450		
			150	
499-510 ft Coal, black, shaly				
510-557 ft Shale, gray to dark-gray, silty		500	160	
			170	
557-603 ft Sandstone, salt-and-pepper gray, very fine grained		550		
			180	
		600	190	

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 23-2 Date Logged 11-11-77 Surface Elevation (ft) 5287

County & State San Juan County, N. M. Location NE¼NE¼ Sec. 23, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 643 Logged depth (ft) 643

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Dennis Umshler,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

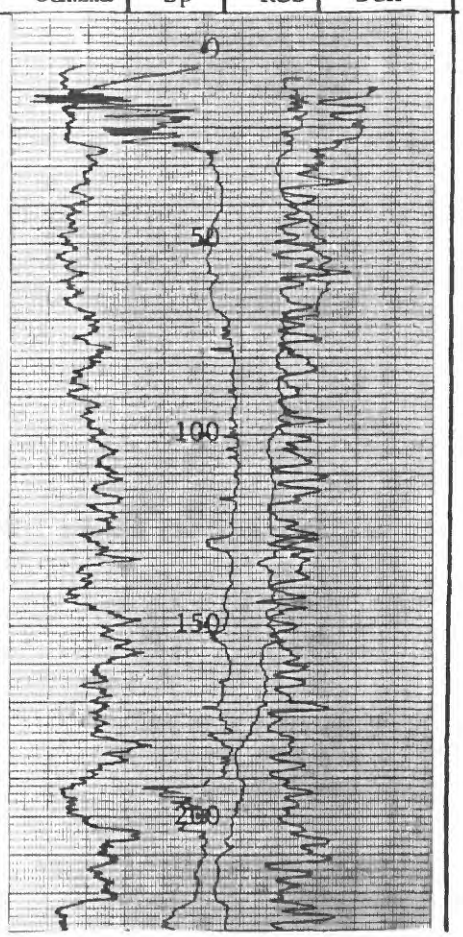
Spontaneous potential (sp): Scale 200 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 20 cps/in. Logging speed 20 fpm

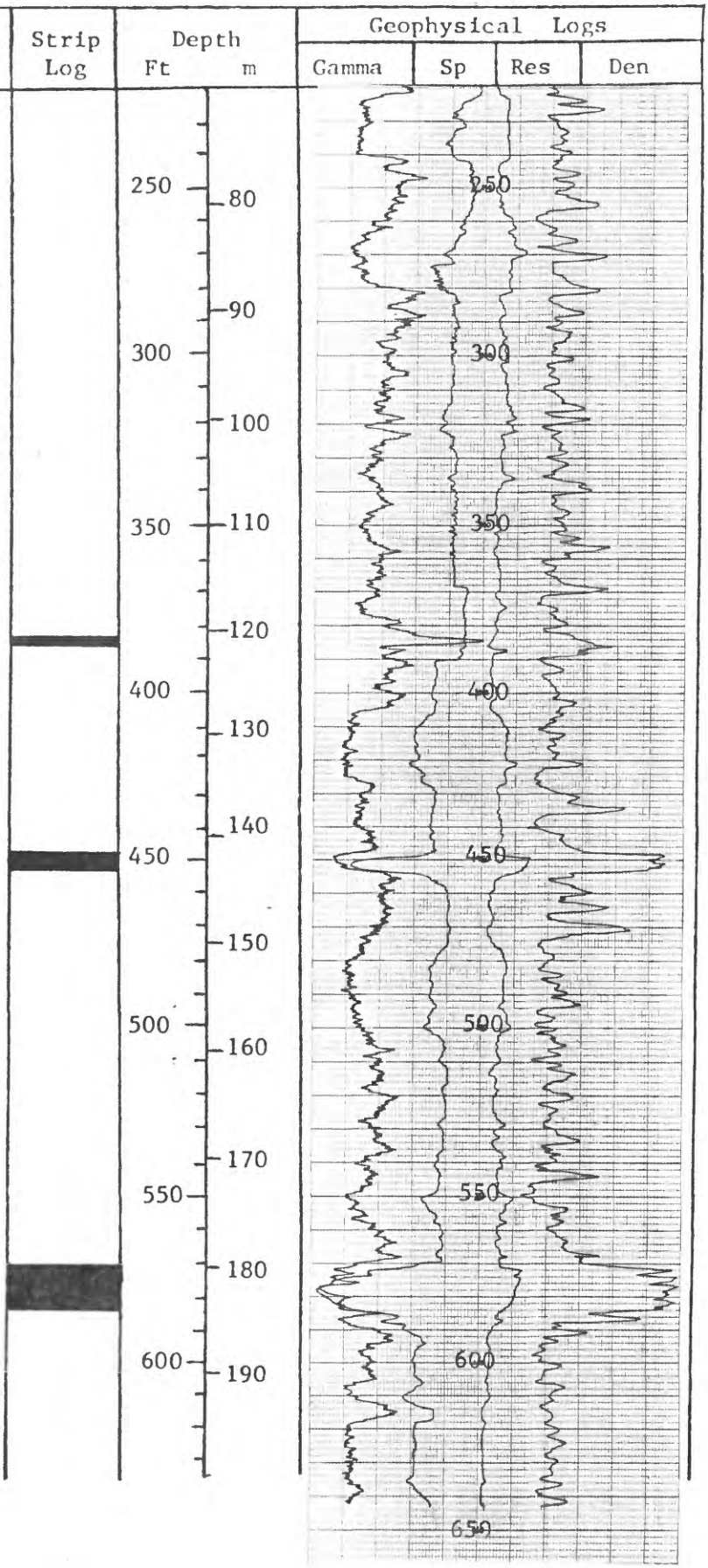
Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma, Sp, Res, Den
0-28 ft Sand, yellowish-brown, fine- to medium-grained, clayey		0	0	
28-43 ft Shale, yellowish-brown, sandy			10	
43-73 ft Sandstone, salt-and-pepper gray, fine-grained, shaly		50	20	
73-113 ft Shale, dark-gray, silty		100	30	
113-133 ft Shale, gray, silty, sandstone partings			40	
133-138 ft Shale, dark-brown, carbonaceous, sandy		150	50	
138-191 ft Shale, dark-gray, silty			60	
191-204 ft Sandstone, gray, very fine grained		200		
204-223 ft Shale, gray, silty			70	

Hole No. SJ 23-2 (continued)

LITHOLOGY	
223-233 ft	Siltstone, dark-gray, shaly
233-248 ft	Sandstone, salt-and-pepper gray, shaly
248-263 ft	Shale, dark-gray, silty
263-283 ft	Sandstone, salt-and-pepper gray, very fine grained
283-313 ft	Shale, dark-gray
313-323 ft	Shale, gray
323-333 ft	Shale, dark-brown, silty
333-363 ft	Shale, bluish-gray, silty
363-374 ft	Shale, dark-gray, silty
374-378 ft	Sandstone, gray, very fine grained
378-384 ft	Shale, gray, silty
384-386 ft	Coal, shaly
386-413 ft	Shale, gray to bluish-gray, silty
413-428 ft	Sandstone, white, fine-grained, shaly
428-448 ft	Shale, dark-gray, silty
448-454 ft	Coal
454-475 ft	Shale, dark-gray, silty
475-493 ft	Sandstone, light-gray, fine-grained, shaly
493-503 ft	Sandstone, salt-and-pepper gray, very fine grained, shaly
503-543 ft	Shale, dark-gray, silty, with black sandstone partings
543-553 ft	Sandstone, salt-and-pepper gray, very fine grained
553-571 ft	Shale, gray, sandy
571-583 ft	Coal
583-613 ft	Sandstone, light-gray, fine-grained, shaly
613-643 ft	Sandstone, salt-and-pepper gray, very fine grained, shaly



LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 23-3 Date Logged 11-04-77 Surface Elevation (ft) 5282

County & State San Juan County, N. M. Location NE¼SW¼ Sec. 23, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 542 Logged depth (ft) 518

Cored depth (ft) _____ Cored: [ ] Yes [x] No Geologists: Dennis Umshler

Drilling medium: [x] Air [ ] Water [x] Foam [ ] Mud Russell Jentgen

GEOPHYSICAL LOGS:

Spontaneous potential (sp): Scale 400 MV/in. Logging speed 20 fpm

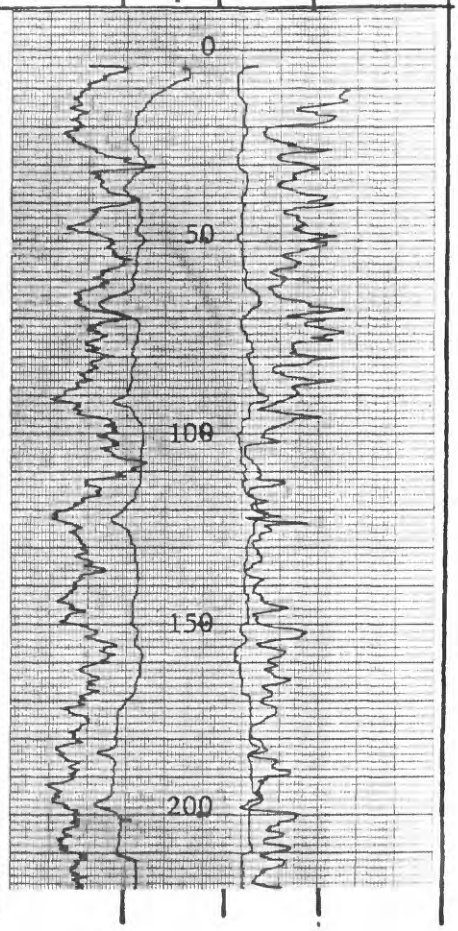
Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

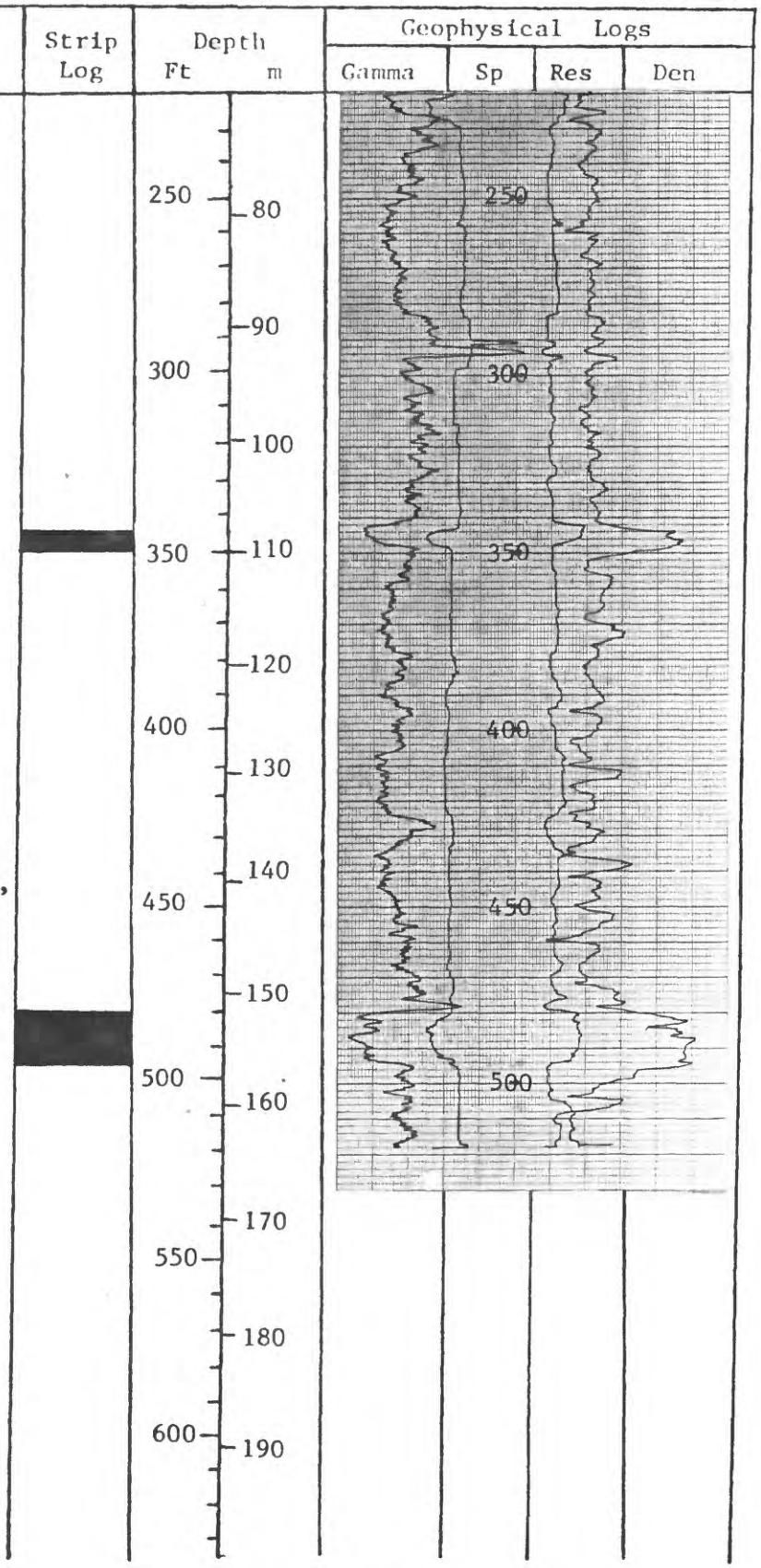
Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma / Sp / Res / Den
0-22 ft Shale, dark-brown to gray, silty,		0	0	
22-29 ft Sandstone, gray, very fine grained, shaly			10	
29-42 ft Shale, black, silty		50		
42-52 ft Sandstone, light-gray, very fine grained			20	
52-64 ft Shale, dark-gray, silty				
64-69 ft Sandstone, gray, very fine grained			30	
69-82 ft Shale, dark-gray, carbonaceous		100		
82-97 ft Shale, light-gray, silty			40	
97-112 ft Shale, dark-brown to black; coal fragments				
112-124 ft Sandstone, light-gray, very fine grained			50	
124-127 ft Shale, light-gray, silty; coal fragments		150		
127-132 ft Sandstone, gray, very fine grained			60	
132-142 ft Siltstone, gray, shaly				
142-158 ft Sandstone, gray, silty, very fine grained		200		
158-162 ft Shale, gray, silty			70	
162-202 ft Sandstone, salt-and-pepper gray, shaly				
202-211 ft Shale, brown, silty				
211-222 ft Shale, dark-gray, silty				



Hole No. SJ 23-3 (continued)

LITHOLOGY	
222-232 ft	Shale, dark-brown, silty, carbonaceous
232-237 ft	Shale, gray to dark-gray, carbonaceous, coal fragments
237-262 ft	Shale, gray, sandy
262-275 ft	Shale, gray, sandy
275-290 ft	Sandstone, gray, very fine grained, shaly
290-297 ft	Shale, dark-gray, bentonitic
297-302 ft	Shale, brown, sandy, carbonaceous
302-312 ft	Shale, dark-gray, sandy
312-322 ft	Shale, dark-brown, carbonaceous; coal fragments
322-344 ft	Sandstone, gray, very fine grained
344-349 ft	Coal
349-352 ft	Shale, dark-gray
352-362 ft	Sandstone, light-gray, very fine grained
362-374 ft	Sandstone, light-gray, very fine grained, with coal fragments
374-423 ft	Sandstone, light-gray, very fine grained, silty
423-433 ft	Shale, dark-gray, sandy
433-442 ft	Sandstone, light-gray to brown, very fine grained, siderite cement
442-452 ft	Shale, gray
452-480 ft	Sandstone, salt-and-pepper gray, very fine grained, siderite cement
480-496 ft	Coal
496-502 ft	Shale, gray
502-542 ft	Sandstone, light-gray, fine grained, shaly



LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 23-4 Date Logged 11-04-77 Surface Elevation (ft) 5305

County & State San Juan County, N. M. Location NW¼SE¼ Sec. 23, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 643 Logged depth (ft) 643 Cored depth (ft) 607.70

Cored: [x] Yes [ ] No Geologists: Dennis Umshler, Laura Beach, Russell Jentgen

Drilling medium: [x] Air [ ] Water [x] Foam [ ] Mud [x] Water Observation Well

GEOPHYSICAL LOGS:

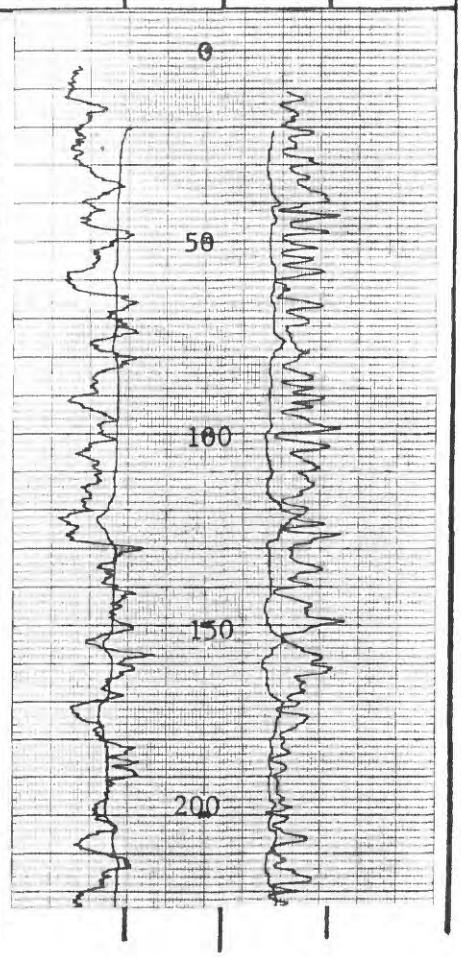
Spontaneous potential (Sp): Scale 400 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

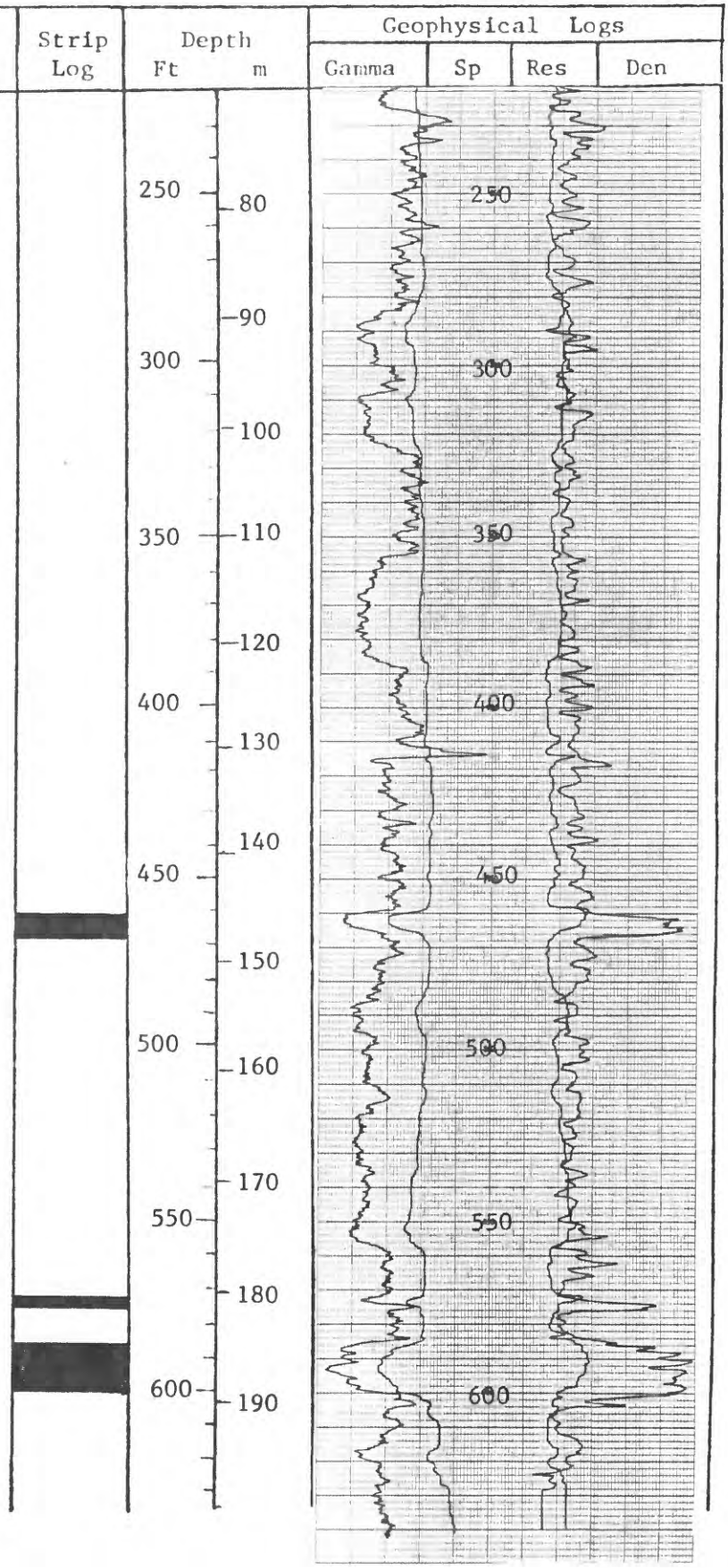
Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale Logging speed fpm

LITHOLOGY	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Sp / Res / Den
0-23 ft Sandstone, yellow, very fine grained		0	0	
23-43 ft Shale, yellowish-gray, silty			10	
43-63 ft Sandstone, yellowish-gray, very fine grained, shaly		50	20	
63-73 ft Shale, gray, silty				
73-93 ft Shale, gray				
93-103 ft Shale, dark-gray				
103-115 ft Shale, black		100	30	
115-120 ft Shale, gray, silty				
120-129 ft Sandstone, gray, very fine grained			40	
129-143 ft Shale, dark-gray				
143-152 ft Shale, gray, silty		150		
152-163 ft Sandstone, gray, very fine grained			50	
163-170 ft Shale, gray				
170-179 ft Sandstone, gray, very fine grained			60	
179-195 ft Shale, gray, silty		200		
195-210 ft Sandstone, gray, very fine grained, with biotite banding				
210-219 ft Shale, gray			70	
219-225 ft Sandstone, gray, very fine grained, with biotite banding				

Hole No. SJ 23-4 (continued)

LITHOLOGY	
225-243 ft	Shale, black; abundant biotite
243-253 ft	Shale, dark-gray
253-270 ft	Shale, black, carbonaceous
270-285 ft	Shale, gray
285-303 ft	Sandstone, gray, very fine grained
303-323 ft	Sandstone, salt-and-pepper gray, very fine grained
323-333 ft	Shale, black, carbonaceous
333-355 ft	Shale, gray
355-363 ft	Sandstone, salt-and-pepper gray, very fine grained
363-373 ft	Sandstone, salt-and-pepper gray; coal fragments
373-386 ft	Sandstone, salt-and-pepper gray, very fine grained
386-412 ft	Shale, gray to dark-gray
412-415 ft	Clay, gray, bentonitic
415-440 ft	Shale, dark-gray
440-461 ft	Shale, black, carbonaceous
461-468 ft	Coal, dark-gray to black, silty
468-486 ft	Shale, gray; coal fragments
486-503 ft	Sandstone, salt-and-pepper gray, very fine grained
503-523 ft	Shale, gray
523-557 ft	Sandstone, salt-and-pepper gray, very fine grained
557-573 ft	Shale, gray
573-576 ft	Coal
576-586 ft	Shale, dark-gray, carbonaceous; coal fragments
586-601 ft	Coal
601-614 ft	Shale, gray to dark-gray to brown; coal fragments
614-643 ft	Sandstone, salt-and-pepper gray, very fine grained



Description of core from SJ 23-4

December 6, 1977 to December 8, 1977

Total Depth of Core (T.D.): 607.70 feet
Total Length of Coring: 40.70 feet out of 44.70 feet attempted
Total Length of Upper Coal Seam: 3.66 feet
Total Length of Lower Coal Seam: 14.39 feet

Lithologic description	Feet From	Feet To
Coring 1 Depth - 461.00 feet to 471.00 feet		
Missing interval	461.00	465.00
Coal, black, dull, silty	465.00	465.45
Coal, black, shiny, resinous; good cleat and conchoidal fracture	465.45	466.55
Sandstone, light-brown, very fine grained; 0.02-in. to 0.12-in. wide coal streaks	466.55	466.64
Coal, black, shiny, resinous; good cleat and conchoidal fracture	466.64	467.00
Coal, black, shiny, resinous; good cleat and conchoidal fracture; sample taken for methane gas analysis	467.00	468.35
Coal, black, dull, resinous, conchoidal fracture	468.35	468.50
Coal, brownish-black, silty, dull with 0.04-in. shiny coal (vitrain) streaks	468.50	468.80
Shale, gray; coal fragments	468.80	471.00

Length of Core = 6.00 feet

Length of Coal in Core = 3.66 feet

Description of core from SJ 23-4 -- continued

Lithologic description	Feet From	Feet To
Coring 2 Depth-573.00 feet to 583.00 feet		
Shale, gray, silty	573.00	580.60
Shale, dark-gray, carbonaceous, scattered 0.04-in. coal fragments	580.60	581.00
Coal, brownish-black, dull, shaly, soft	581.00	582.00
Shale, dark-gray; 0.02-in. to 0.04-in. coal fragments	582.00	582.50
Shale, gray, silty	582.50	583.00
Length of Core = 10.00 feet		
Length of Coal in Core approximately 1.00 foot		
Coring 3 Depth-583.00 feet to 590.80 feet		
Coal, black, dull, resinous	583.00	583.90
Coal, black, shiny, resinous; good cleat and conchoidal fracture	583.90	586.80
Sandstone, light-brown, very fine grained, coaly; 0.02-in. to 0.12-in. coal partings	586.80	587.00
Coal, black, shiny, resinous; good cleat and conchoidal fracture	587.00	587.05
Sandstone, light-brown, very fine grained, coaly; 0.02-in. to 0.12-in. coal partings	587.05	587.10
Coal, black, shiny, resinous; scattered coatings of pyrite; good cleat and conchoidal fracture	587.10	587.25
Sandstone, light-brown, very fine grained; scattered coal fragments	587.25	587.45
Coal, black, shiny, resinous; good cleat and conchoidal fracture	587.45	589.00

Description of core from SJ 23-4 -- continued

Lithologic description	Feet From	Feet To
Coal, black, shiny, resinous; good cleat and conchoidal fracture; sample taken for methane gas analysis	589.00	590.00
Coal, black, shiny, resinous; good cleat and conchoidal fracture	590.00	590.70
Sandstone, light-brown, very fine grained; scattered 0.02-in. to 0.12-in. coal partings and fragments	590.70	590.76
Coal, black, shiny, resinous; good cleat and conchoidal fracture	590.76	590.80

Length of Core = 7.80 feet

Length of Coal in Core = 7.29 feet

Coring 4 Depth-590.80 feet to 596.00 feet

Coal, black, shiny, resinous; good cleat and conchoidal fracture	590.80	591.80
Coal, black, shiny, resinous, good cleat and conchoidal fracture	591.80	592.00
Sandstone, gray, very fine grained, coaly; coal fragments; 0.02-in. to 0.06-in. coal partings	592.00	592.18
Coal, black, shiny, resinous; good cleat and conchoidal fracture	592.18	592.62
Sandstone, light-brown, very fine grained, coaly; 0.02-in. to 0.06-in. coal partings	592.62	592.64
Coal, black, shiny, resinous; good cleat and conchoidal fracture	592.64	594.90
Shale, brown, silty; scattered coal fragments	594.90	595.05
Coal, black, shiny, resinous; good cleat and conchoidal fracture	595.05	596.00

Length of Core = 5.20 feet

Length of Coal in Core = 4.85 feet

Description of core from SJ 23-4 -- continued

Lithologic description	Feet From	Feet To
Coring 5 Depth-596.00 feet to 607.70 feet		
Coal, black, shiny, resinous; occasional coatings of gypsum; good cleat and conchoidal fracture	596.00	596.50
Coal, black, dull, clayey, friable	596.50	596.80
Shale, black, carbonaceous; 0.02-in. to 0.04-in. coal partings, with interbedded light-gray sandstone	596.80	599.00
Coal, black, dull, clayey, friable, with interbedded brown and black carbonaceous shale	599.00	599.30
Coal, black, shiny, resinous; good cleat and conchoidal fracture	599.30	599.45
Shale, black, clayey, carbonaceous; coal fragments, 0.02-in. to 0.04-in. coal streaks	599.45	600.00
Shale, gray, clayey; coal fragments	600.00	600.10
Sandstone, light-gray, very fine grained, shaly; coal fragments; 0.02-in. to 0.04-in. vertical coal partings . .	600.10	604.03
Siltstone, gray, shaly; scattered coal fragments	604.03	604.60
Shale, gray; scattered coal fragments, with interbedded light-gray sandstone	604.60	607.70

Length of Core = 11.70 feet

Length of Coal in Core = 1.25 feet

Hole was drilled to 740 feet and completed as a water observation well

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 24-1 Date Logged 11-18-77 Surface Elevation (ft) 5310

County & State San Juan County, N. M. Location SW¼NW¼ Sec. 24, T. 30 N., R. 15 W., NMPM

Map Youngs Lake, N. M. Drilled depth (ft) 703 Logged depth (ft) 703

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Ray Noble,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

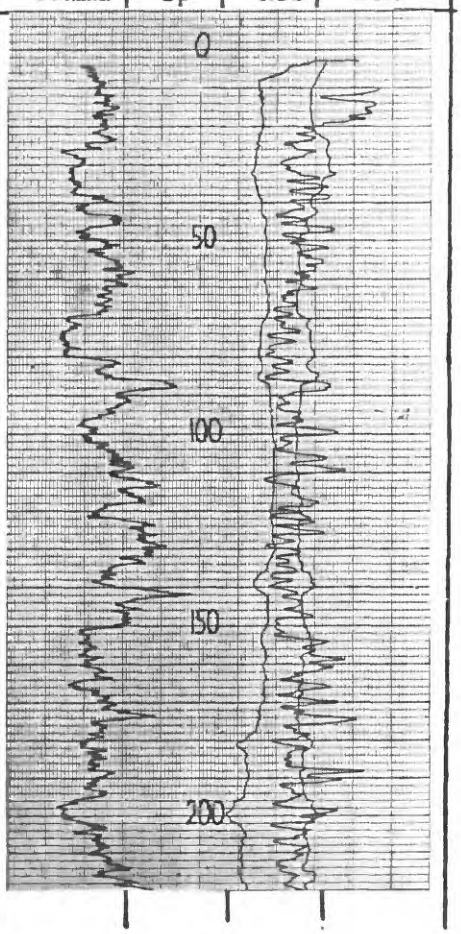
Spontaneous potential (sp): Scale 200 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

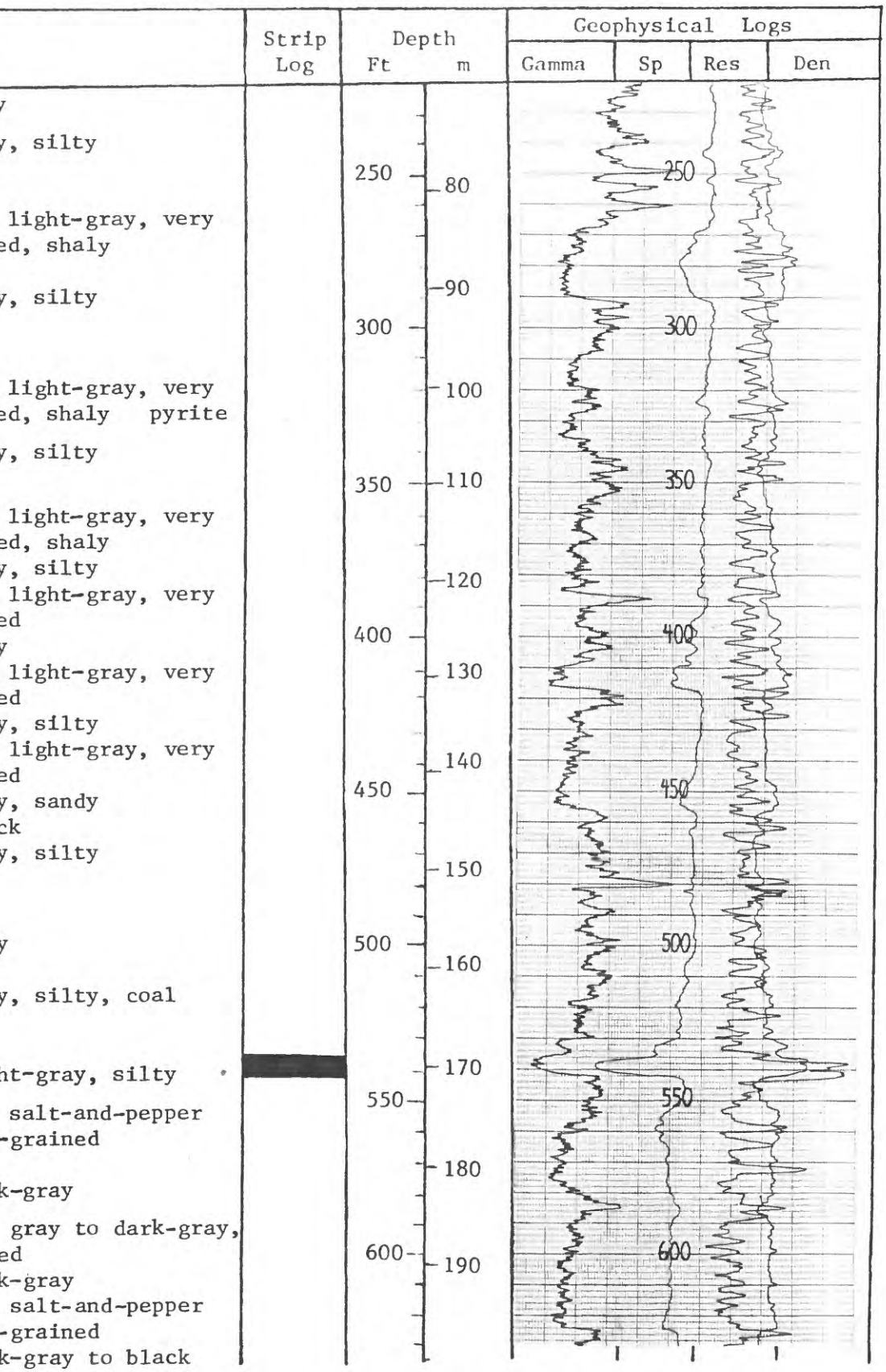
Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
0-13 ft Sandstone, buff, very fine grained, clayey 13-23 ft Shale, gray, silty; limonite 23-43 ft Sandstone, light-gray, fine grained, shaly 43-69 ft Shale, gray, silty 69-81 ft Sandstone, light-gray, very fine grained, shaly 81-130 ft Shale, silty, gray 130-137 ft Shale, black, silty 137-142 ft Sandstone, gray, fine-grained, shaly 142-179 ft Shale, gray to black, silty 179-183 ft Sandstone, gray, very fine grained, silty 183-197 ft Shale, gray to black, carbonaceous 197-203 ft Sandstone, gray, very fine grained, shaly 203-213 ft Shale, gray 213-223 ft Sandstone, gray, very fine grained, shaly		0 50 100 150 200	0 10 20 30 40 50 60 70	Gamma Sp Res Den 

Hole No. SJ 24-1 (continued)

LITHOLOGY	Strip Log
223-243 ft Shale, gray	
243-269 ft Shale, gray, silty	
269-293 ft Sandstone, light-gray, very fine grained, shaly	
293-323 ft Shale, gray, silty	
323-341 ft Sandstone, light-gray, very fine grained, shaly pyrite	
341-363 ft Shale, gray, silty	
363-373 ft Sandstone, light-gray, very fine grained, shaly	
373-384 ft Shale, gray, silty	
384-387 ft Sandstone, light-gray, very fine grained	
387-394 ft Shale, gray	
394-417 ft Sandstone, light-gray, very fine grained	
417-447 ft Shale, gray, silty	
447-456 ft Sandstone, light-gray, very fine grained	
456-477 ft Shale, gray, sandy	
477-483 ft Shale, black	
483-503 ft Shale, gray, silty	
503-523 ft Shale, gray	
523-537 ft Shale, gray, silty, coal fragments	
537-543 ft Coal	
543-554 ft Shale, light-gray, silty	
554-583 ft Sandstone, salt-and-pepper gray, fine-grained	
583-593 ft Shale, dark-gray	
593-603 ft Sandstone, gray to dark-gray, fine-grained	
603-620 ft Shale, dark-gray	
620-625 ft Sandstone, salt-and-pepper gray, fine-grained	
625-633 ft Shale, dark-gray to black	



Hole No. SJ 24-1 (continued)

LITHOLOGY		Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma / Sp / Res / Den
633-643 ft	Shale, dark-gray to black; coal fragments		650	200	
643-658 ft	Shale, dark-gray, carbonaceous; coal fragments			250	
658-671 ft	Coal		700	300	
671-677 ft	Siltstone, gray, and gray shale			350	
677-690 ft	Sandstone, salt-and-pepper gray, fine-grained to very fine grained		750	400	
690-703 ft	Sandstone, gray, fine-grained to very fine grained			450	
			800	500	
			850	550	
				600	
			900	650	
			950	700	

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 24-2 Date Logged 11-16-77 Surface Elevation (ft) 5380

County & State San Juan County, N. M. Location NE¼NE¼ Sec. 24, T. 30 N., R. 15 W., NMPM

Map Youngs Lake, N. M. Drilled depth (ft) 783 Logged depth (ft) 782

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologist Richard Fulton

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud

GEOPHYSICAL LOGS:

Spontaneous potential (sp): Scale 200 MV/in. Logging speed 20 fpm

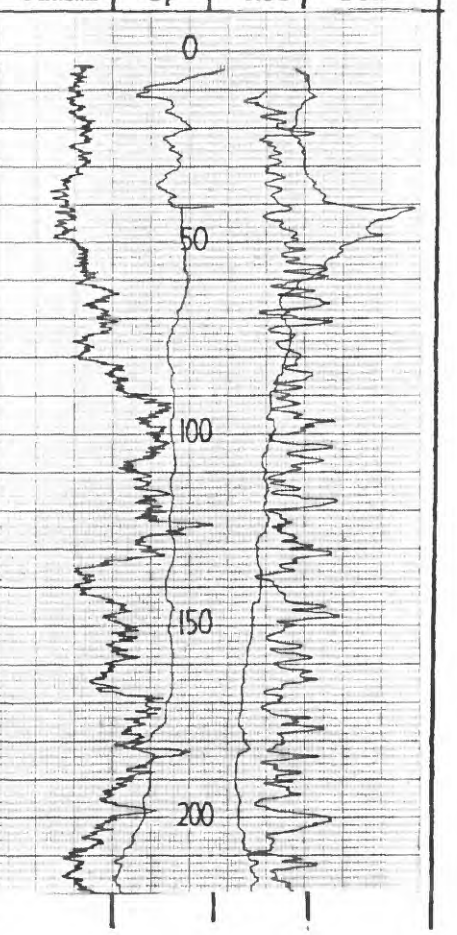
Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

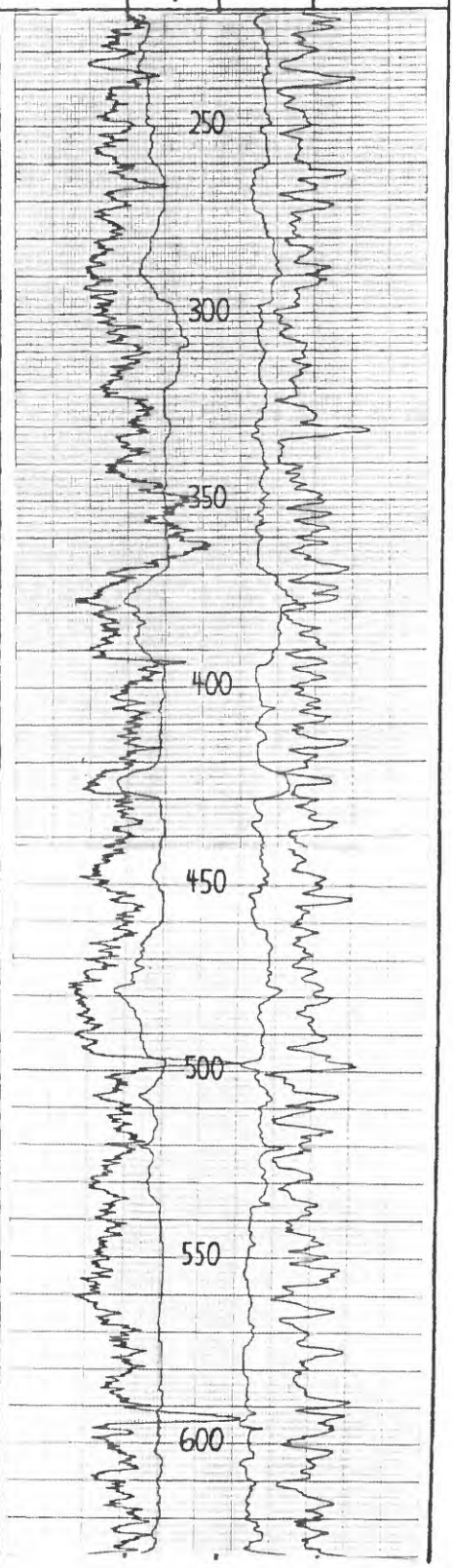
Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma, Sp, Res, Den
0-23 ft Sand, brown, with gray siltstone fragments		0	0	
23-41 ft Sandstone, gray, very fine grained			10	
41-53 ft Sandstone, gray, very fine grained, wet		50		
53-93 ft Siltstone, dark-gray, shaly			20	
93-133 ft Shale, dark-gray, slightly silty		100	30	
133-143 ft Sandstone, salt-and-pepper gray, very fine grained			40	
143-163 ft Siltstone, dark-gray, very very fine grained		150		
163-203 ft Shale, dark-gray			50	
203-223 ft Sandstone, gray, fine-grained		200	60	
			70	

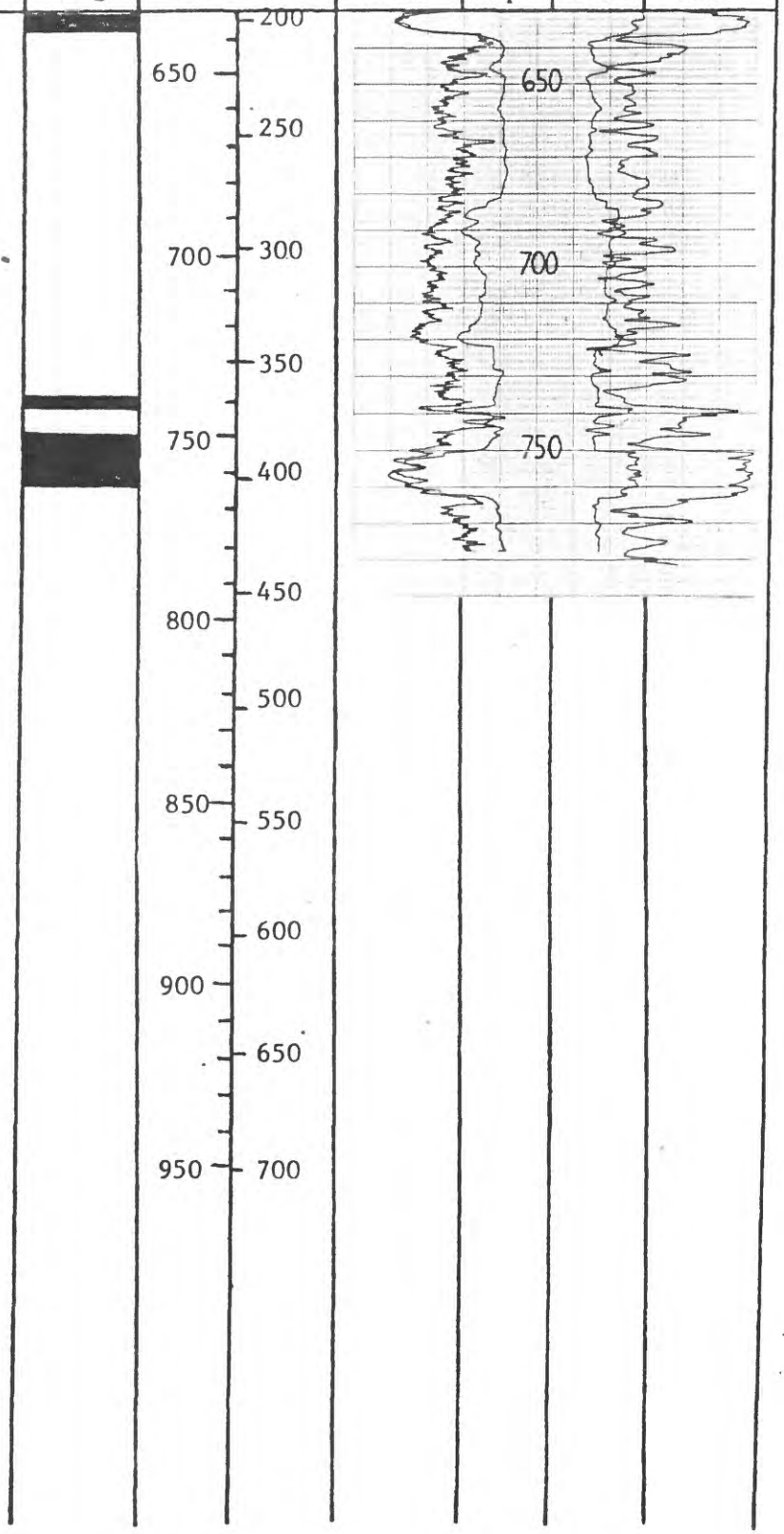


Hole No. SJ 24-2 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma / Sp / Res / Den
223-243 ft Sandstone, gray, very fine grained				
243-260 ft Shale, gray to dark-gray				
260-273 ft Shale, black, silty		250	80	
273-298 ft Sandstone, gray, very fine grained				
298-305 ft Shale, dark-gray			90	
305-313 ft Shale, dark-gray to black, carbonaceous		300		
313-330 ft Shale, dark-gray to black, silty			100	
330-333 ft Shale, black, carbonaceous				
333-343 ft Shale, dark-gray				
343-353 ft Shale, dark-gray to black				
353-363 ft Shale, black		350	110	
363-370 ft Shale, dark-gray to black				
370-383 ft Sandstone, gray, very fine grained				
383-393 ft Sandstone, gray, carbonaceous, very fine grained			120	
393-404 ft Siltstone, dark-gray, very very fine grained, slightly shaly		400		
404-423 ft Shale, black			130	
423-430 ft Shale, black, carbonaceous, and gray, very fine grained sandstone				
430-443 ft Shale, dark-gray to black			140	
443-453 ft Shale, black, carbonaceous		450		
453-463 ft Siltstone, dark-gray, shaly				
463-495 ft Sandstone, gray, fine grained, shaly			150	
495-503 ft Shale, black		500		
503-523 ft Shale, dark-gray to black			160	
523-533 ft Sandstone, gray, very fine grained				
533-537 ft Coal			170	
537-543 ft Shale, dark-gray		550		
543-553 ft Sandstone, gray, very fine grained			180	
553-573 ft Shale, dark-gray				
573-593 ft Shale, dark-gray to black		600	190	
595-630 ft Shale, dark-gray				

Hole No. SJ 24-2 (continued)

LITHOLOGY		Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma / Sp / Res / Den
630-636 ft	Coal				
636-663 ft	Sandstone, dark-gray, very fine grained				
663-673 ft	Shale, dark-gray				
673-723 ft	Sandstone, salt-and-pepper gray, fine- to very fine-grained				
723-739 ft	Shale, gray, carbonaceous				
739-750 ft	Coal, shaly				
750-763 ft	Coal				
763-769 ft	Shale, black				
769-783 ft	Sandstone, gray to dark-gray, very fine grained; methane gas near bottom				



LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 24-3 Date Logged 11-19-77 Surface Elevation (ft) 5308

County & State San Juan County, N. M. Location NW¼SW¼ Sec. 24, T. 30 N., R. 15 W., NMPM

Map Youngs Lake, N. M. Drilled depth (ft) 680 Logged depth (ft) 680

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologist Ray Noble,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

Spontaneous potential (sp): Scale 200 MV/in. Logging speed 20 fpm

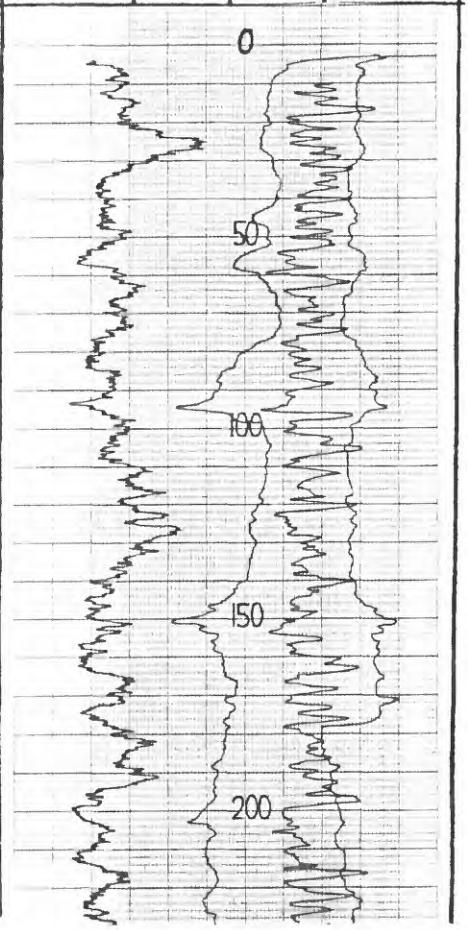
Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
0-14 ft Sand 14-77 ft Shale, gray to dark-gray, silty		0	0	Gamma Sp Res Den
			10	
		50		
			20	
77-98 ft Sandstone, light-gray, very fine grained, shaly				
98-125 ft Shale, gray, silty		100	30	
			40	
125-130 ft Sandstone, light-gray, shaly 130-140 ft Shale, dark-gray, silty 140-164 ft Sandstone, light-gray, very fine grained, shaly				
164-174 ft Shale, gray		150		
174-178 ft Sandstone, light-gray, very fine grained			50	
178-187 ft Shale, black, silty				
187-197 ft Sandstone, light-gray, very fine grained, shaly			60	
197-198 ft Coal, shaly		200		
198-236 ft Sandstone, light-gray, very fine grained			70	



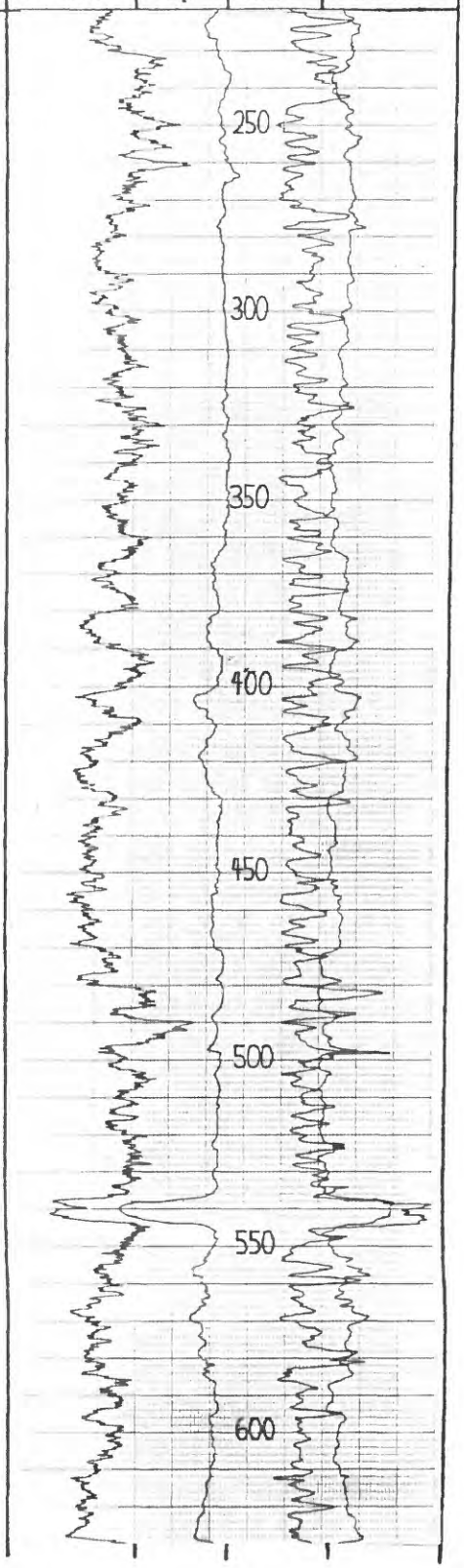
Hole No. SJ 24-3 (continued)

LITHOLOGY	
236–254 ft	Shale, black, silty
254–262 ft	Shale, gray
262–265 ft	Shale, gray, carbonaceous
265–278 ft	Sandstone, light-gray, very fine grained
278–284 ft	Shale, gray
284–294 ft	Sandstone, light-gray, very fine grained; coal fragments
294–304 ft	Sandstone, light-gray, very fine grained
304–314 ft	Shale, gray, silty, carbonaceous
314–324 ft	Shale, gray, silty
324–374 ft	Shale, dark-gray, silty
374–381 ft	Shale, black
381–391 ft	Sandstone, light-gray, very fine grained, carbonaceous
391–405 ft	Shale, black, carbonaceous, coal fragments
405–454 ft	Sandstone, light-gray, very fine grained, silty
454–471 ft	Sandstone, light-gray, very fine grained, shaly
471–477 ft	Shale, gray, silty
477–484 ft	Sandstone, light-gray, shaly very fine grained
484–495 ft	Shale, gray, silty
495–524 ft	Shale, gray, silty, coaly
524–538 ft	Shale, gray, silty
538–545 ft	Coal
545–554 ft	Shale, black, silty
554–566 ft	Shale, gray
566–574 ft	Sandstone, light- to dark-gray, very fine grained, carbonaceous
574–604 ft	Shale, gray, silty, and salt-and-pepper gray, very fine grained sandstone
604–614 ft	Shale, gray, silty
614–619 ft	Sandstone, salt-and-pepper gray, very fine grained
619–621 ft	Limestone, brown
621–647 ft	Sandstone, salt-and-pepper

Strip Log

Depth

Ft	m
250	80
300	90
	100
350	110
	120
400	130
	140
450	150
	160
500	170
550	180
	190
600	



Hole No. SJ 24-3 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma	Sp	Res	Den
gray, very fine grained, and gray silty shale			200				
647-649 ft Coal		650					
649-659 ft Sandstone, salt-and-pepper gray, very fine grained, and gray shale			250				
659-676 ft Coal							
676-680 ft Sandstone, salt-and-pepper gray, very fine grained, hard		700	300				
			350				
		750	400				
			450				
		800					
			500				
		850					
			550				
			600				
		900					
			650				
		950					
			700				

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 24-4 Date Logged 11-17-77 Surface Elevation (ft) 5265

County & State San Juan County, N. M. Location NW¼SE¼, Sec. 24, T. 30 N., R. 15 W., NMPM

Map Youngs Lake, N. M. Drilled depth (ft) 810 Logged depth (ft) 808 Cored depth (ft) ____

Cored: ☐ Yes ☒ No Geologists: Richard Fulton, Russell Jentgen

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud ☒ Water Observation Well

GEOPHYSICAL LOGS:

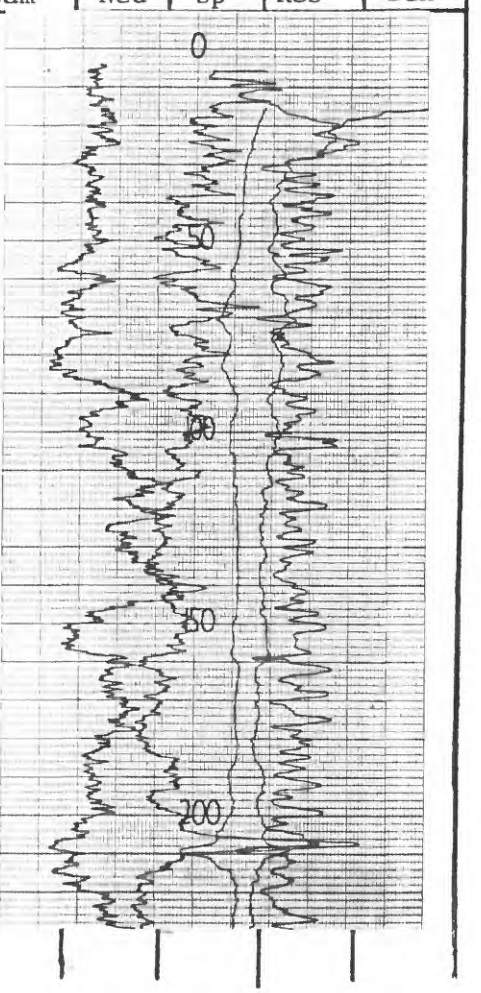
Spontaneous potential (Sp): Scale 200 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale 100 cps/in. Logging speed 20 fpm

LITHOLOGY	Strip Log	Depth ft	Depth m	Geophysical Logs
0-13 ft Silt, brown, loose, very fine grained		0	0	
13-33 ft Siltstone, brown, very very fine grained			10	
33-43 ft Sandstone, gray, very fine grained		50		
43-81 ft Shale, gray, silty			20	
81-90 ft Sandstone, gray, very fine grained				
90-113 ft Shale, dark-gray		100	30	
113-123 ft Siltstone, gray, very very fine grained				
123-143 ft Shale, dark-gray, silty			40	
143-153 ft Siltstone, gray, shaly		150		
153-163 ft Sandstone, gray, fine-grained carbonaceous			50	
163-188 ft Shale, gray to dark-gray				
188-206 ft Sandstone, gray, very fine grained			60	
206 Water level		200		
206-214 ft Sandstone, brown, medium grained			70	
214-233 ft Shale, dark-gray				

Hole No. SJ 24-4 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
233-253 ft Sandstone, salt-and-pepper gray, fine-grained				Neu Gam Sp Res Den
253-279 ft Sandstone, gray, very fine grained		250	80	
279-343 ft Shale, dark-gray			90	
		300	100	
343-363 ft Shale, dark-gray to black, silty				
		350	110	
363-373 ft Shale, dark-gray				
373-375 ft Sandstone, gray, very fine grained			120	
375-393 ft Shale, dark-gray				
393-403 ft Sandstone, gray, very fine grained		400		
			130	
403-413 ft Siltstone, brown, very very fine grained				
413-423 ft Shale, black, silty			140	
423-433 ft Shale, dark-gray, coaly fragments				
433-455 ft Shale, dark-gray, carbonaceous		450		
			150	
455-465 ft Sandstone, salt-and-pepper gray, very fine grained				
465-473 ft Shale, black, carbonaceous				
473-513 ft Sandstone, salt-and-pepper gray, carbonaceous		500	160	
513-518 ft Shale, dark-gray				
518-520 ft Sandstone, gray, very fine grained, hard				
520-563 ft Shale, black, carbonaceous			170	
		550		
563-593 ft Shale, dark-gray			180	
593-605 ft Shale, gray, silty				
605-623 ft Shale, dark-gray to black, coaly		600	190	
623-633 ft Sandstone, gray, very fine grained, shaly, coaly				
633-638 ft Shale, black, carbonaceous				

Hole No. SJ 24-4 (continued)

LITHOLOGY		Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma, Sp, Res, Den
638–646 ft	Coal, very shaly, and black carbonaceous shale		650	200	
646–653 ft	Coal			250	
653–663 ft	Coal, very shaly, and black carbonaceous shale		700	300	
663–673 ft	Sandstone, gray, very fine grained			350	
673–703 ft	Sandstone, salt-and-pepper gray, very fine grained, with black carbonaceous shale		750	400	
703–713 ft	Shale, dark-gray, silty				
713–753 ft	Sandstone, light-gray, very fine grained, carbonaceous laminations			450	
753–762 ft	Shale, dark-gray, carbonaceous		800		
762–787 ft	Coal			500	
787–793 ft	Shale, gray, carbonaceous				
793–803 ft	Shale, gray		850	550	
803–810 ft	Sandstone, gray, very fine grained				
				600	
			900		
				650	
			950	700	

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 25-1 Date Logged 11-30-77 Surface Elevation (ft) 5338

County & State San Juan County, N. M. Location NW¼NW¼ Sec. 25, T. 30 N., R. 15 W., NMPM

Map Youngs Lake, N. M. Drilled depth (ft) 845 Logged depth (ft) 823

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Ray Noble, Laura Beach,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

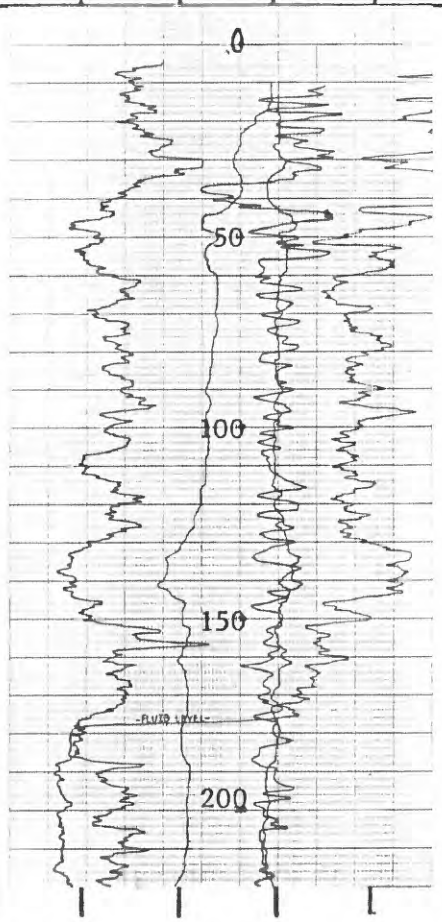
Spontaneous potential (Sp): Scale 200 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

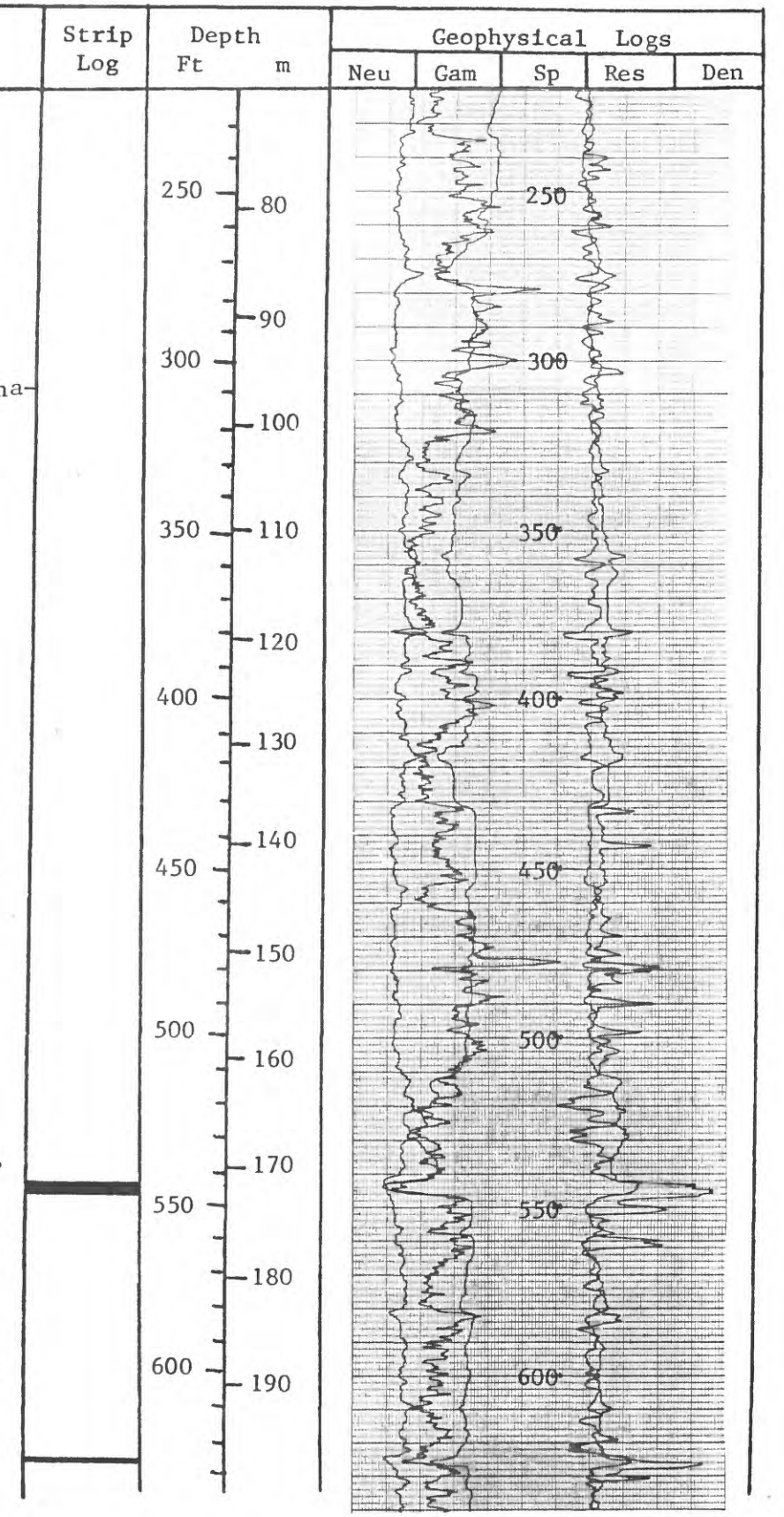
Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale 300 cps/in. Logging speed 20 fpm

LITHOLOGY	Strip Log	Depth	Geophysical Logs
0-44 ft Shale, grayish-green		0	
44-124 ft Shale, gray, silty		50	
124-145 ft Sandstone, salt-and-pepper gray, very fine grained, clayey to shaly		100	
145-148 ft Shale, gray, silty			
148-151 ft Sandstone, gray, very fine grained, shaly			
151-164 ft Shale, gray to dark-gray, silty		150	
164-174 ft Sandstone, gray, very fine grained, shaly			
174-177 ft Sandstone, salt-and-pepper gray, shaly, very fine grained			
177 ft Fluid level		200	
177-184 ft Sandstone, salt-and-pepper gray, shaly, very fine grained			
184-212 ft No sample			
212-233 ft Sandstone, gray, very fine grained			

Hole No. SJ 25-1 (continued)

LITHOLOGY	Strip Log
233-242 ft Shale, gray	
242-287 ft No sample	
287-302 ft Shale, dark-gray, silty	
302-320 ft Shale, black, coaly	
320-347 ft Shale, black, coaly, carbonaceous, with gray silty shale	
347-370 ft Sandstone, salt-and-pepper gray, very fine grained	
370-377 ft Siltstone, gray	
377-407 ft Sandstone, black, fine grained	
407-414 ft Shale, gray, silty	
414-435 ft Sandstone, gray, fine grained, hard	
435-452 ft Shale, grayish-black	
452-493 ft Sandstone, salt-and-pepper gray, fine-grained	
493-542 ft Shale, gray to dark-gray	
542-550 ft Shale, black, carbonaceous, coaly	
550-572 ft Shale, gray	
572-595 ft Sandstone, salt-and-pepper gray, very fine grained	
595-612 ft Shale, gray, sandy	
612-625 ft Sandstone, salt-and-pepper gray, and dark-gray sandy shale	
625-632 ft Shale, black, carbonaceous	
632-644 ft Shale, gray	
644-659 ft Shale, black, carbonaceous	



Hole No. SJ 25-1 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
659–672 ft Coal		650	200	Neu Gam Sp Res Den
672–705 ft Sandstone, salt-and-pepper gray, fine-grained, and gray shale			210	
705–733 ft Sandstone, salt-and-pepper gray, and green shale		700	220	
733–748 ft Shale, green			230	
748–814 ft Sandstone, salt-and-pepper gray; gray shale, and green shale		750	240	
			250	
		800		
814–845 ft Shale, green			260	
		850	270	
			280	
		900		
			290	
		950	300	
			310	

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 25-2 Date Logged 12-01-77 Surface Elevation (ft) 5390

County & State San Juan County, N. M. Location NW¼NE¼ Sec. 25, T. 30 N., R. 15 W., NMPM

Map Youngs Lake, N. M. Drilled depth (ft) 795 Logged depth (ft) 783

Cored depth (ft) 761 Cored: [x] Yes [ ] No Geologists: Jim Pettengill, Laura Beach,

Drilling medium: [x] Air [ ] Water [x] Foam [ ] Mud Russell Jentgen

GEOPHYSICAL LOGS:

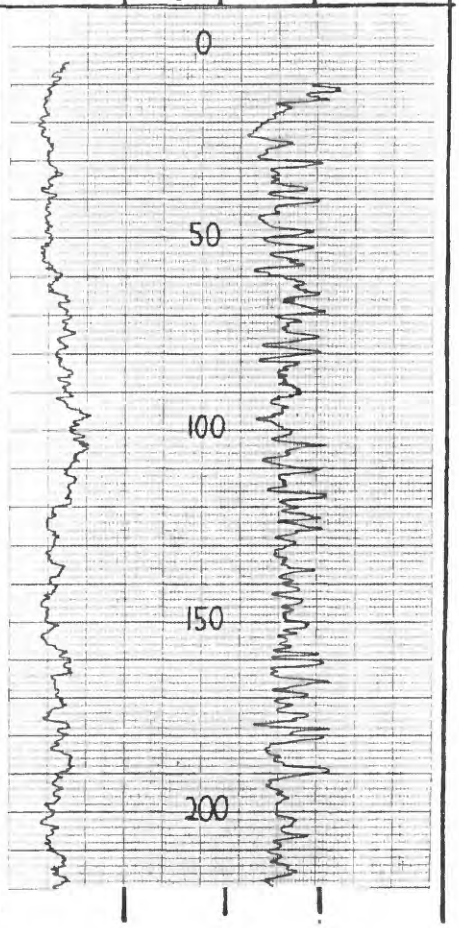
Spontaneous potential (sp): Scale - Logging speed - fpm

Resistivity (Res): Scale - Logging speed - fpm

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

Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale Logging speed fpm

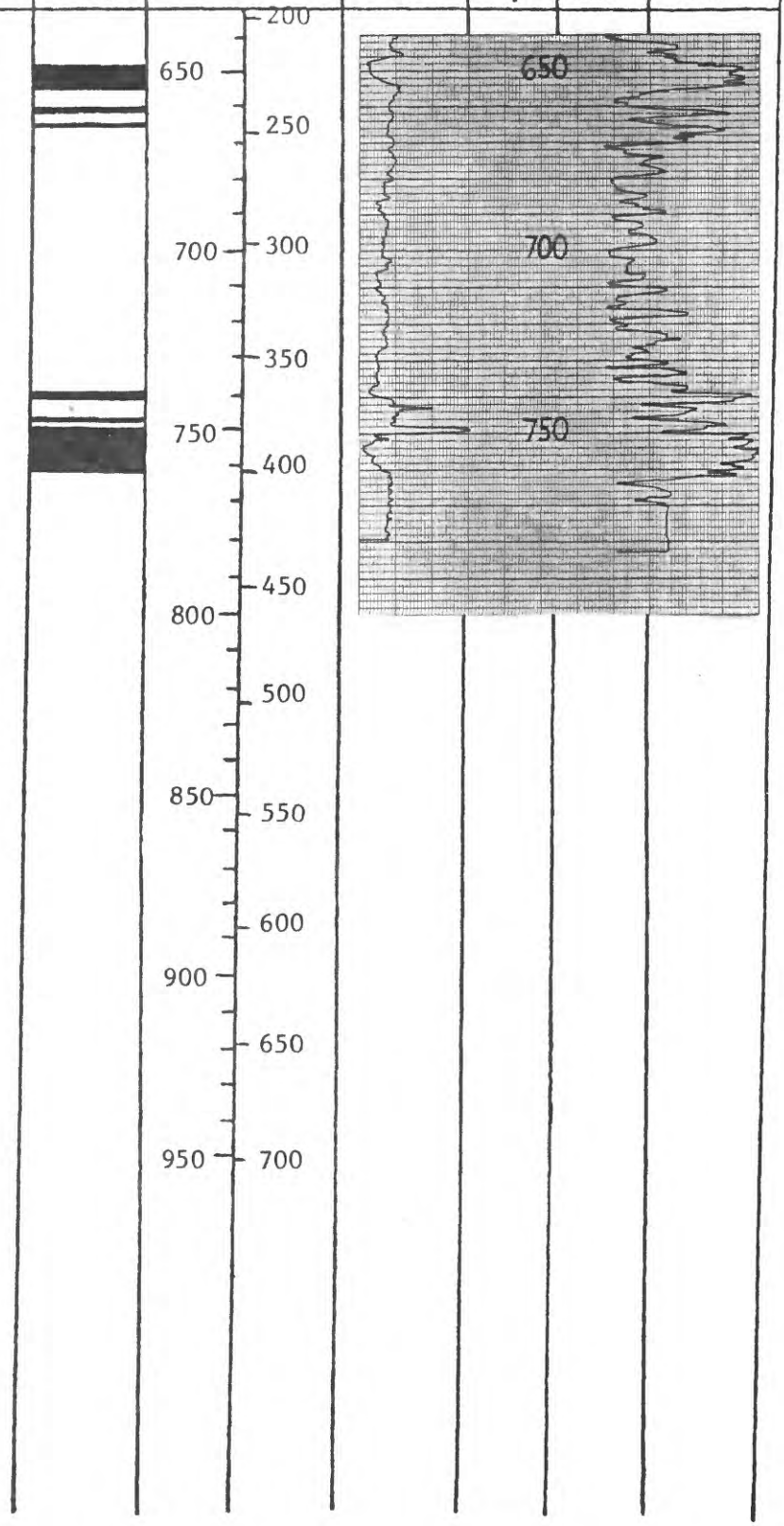
LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma, Sp, Res, Den
0-13 ft Shale, gray to green 13-33 ft Shale, yellow, sandy, gray shale, and yellow, very fine grained sandstone 33-43 ft Shale, gray 43-53 ft Shale, gray, sandy 53-63 ft Sandstone, gray, very fine grained, and gray shale 63-113 ft Shale, gray to green 113-133 ft Sandstone, gray, very fine grained 133-143 ft Shale, gray 143-153 ft Sandstone, gray, very fine grained, with abundant biotite 153-163 ft Shale, dark-gray, sandy 163-183 ft Shale, gray, silty 183-193 ft Shale, black 193-225 ft Shale, gray, silty		0 50 100 150 200	0 10 20 30 40 50 60 70	

Hole No. SJ 25-2 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
225-233 ft Shale, green				Gamma Sp Res Den
233-243 ft Shale, dark-gray				
243-253 ft Sandstone, light-gray, very fine grained, shaly		250	80	
253-263 ft Shale, gray, silty				
263-283 ft Shale, black, carbonaceous				
283-303 ft Shale, dark-gray			90	
303-309 ft Shale, gray				
309-310 ft Coal				
310-343 ft Shale, dark-gray, carbonaceous		300	100	
343-353 ft Shale, gray				
353-390 ft Sandstone, gray, very fine grained		350	110	
390-403 ft Shale, gray, sandy			120	
403-413 ft Sandstone, gray, very fine grained		400	130	
413-433 ft Shale, black, carbonaceous, coaly				
433-463 ft Sandstone, gray, very fine grained			140	
463-473 ft Shale, gray, sandy		450		
473-483 ft Sandstone, gray, very fine grained, shaly			150	
483-493 ft Shale, gray				
493-503 ft Shale, dark-gray, sandy				
503-513 ft Shale, black		500	160	
513-533 ft Shale, gray, sandy				
533-543 ft Sandstone, gray, shaly				
543-573 ft Shale, gray, silty		550	170	
573-595 ft Shale, dark-gray, silty			180	
595-643 ft Shale, black, coaly		600	190	

Hole No. SJ 25-2 (continued)

LITHOLOGY	
643-655 ft	Coal
655-673 ft	Shale, black, coaly
673-723 ft	Shale, gray, silty
723-733 ft	Sandstone, gray, very fine grained
733-739 ft	Shale, black, carbonaceous coal stringers
739-753 ft	Coal, shaly
753-763 ft	Coal
763-783 ft	Shale, gray
783-787 ft	Sandstone, salt-and-pepper gray, very fine grained
787-793 ft	Shale, gray, and green shale
793-795 ft	Sandstone, salt-and-pepper gray, very fine grained



Description of core from SJ 25-2

December 2, 1977 to December 5, 1977

Total Depth of Core (T.D.): 761.00 feet
Total Length of Coring: 28.80 feet out of 55.00 feet attempted
Total Length of Upper Coal Seam in Core: 6.30 feet
Total Length of Lower Coal Seam in Core: 12.64 feet

Lithologic description	Feet From	Feet To
Coring 1 Depth - 643.00 feet to 658.00 feet		
Coal, black, shiny, resinous, amorphous; good cleat and conchoidal fracture; sample taken for methane gas analysis	643.00	644.50
Coal, black, shiny, resinous, amorphous; good cleat and conchoidal fracture	644.50	646.00
Sandstone, gray, very fine grained; coal fragments; 0.08-in. to 0.16-in. wide coal streaks	646.00	646.50
Coal, black, shiny, resinous; good cleat and conchoidal fracture	646.50	646.85
Shale, black, carbonaceous; coal fragments	646.85	647.00
Coal, black, shiny, resinous; good cleat and conchoidal fracture	647.00	647.90
Sandstone, light-gray, very fine grained; coal fragments	647.90	647.95
Coal, black, shiny, resinous; good cleat and conchoidal fracture	647.95	649.35
Coal, brownish-black, dull, resinous, shaly, friable	649.35	649.55
Shale, dark-gray; coal fragments; 0.04-in. to 0.39-in. coal streaks	649.55	650.10
Shale, light-gray; coal fragments	650.10	651.90
Missing interval	651.90	658.00

Length of Core = 8.90 feet

Length of Coal in Core = 6.30 feet

Description of core from SJ 25-2 -- continued

Lithologic description	Feet From	Feet To
Coring 2 Depth - 658.00 feet to 673.00 feet		
Missing interval	658.00	673.00
Length of core = 0.00 feet		
Length of Coal in Core = 0.00 feet		
Coring 3 Depth - 736.00 feet to 751.00 feet		
Shale, gray, coal fragments	736.00	736.60
Shale, gray, clayey; 0.02-in. to 0.04-in. coal partings	736.60	737.40
Coal, black, dull, shaly, soft; 0.02-in. to 0.04-in. shiny coal (vitrain) lenticles	737.40	737.55
Coal, black, shiny, resinous; good cleat and conchoidal fracture	737.55	737.75
Shale, black, carbonaceous; coal fragments	737.75	738.15
Coal, black; dull matrix with shiny coal (vitrain) bands; sample taken for methane gas analysis	738.15	739.15
Coal, black; dull matrix with 0.04-in. to 0.08-in. wide shiny (vitrain) bands	739.15	739.30
Shale, gray; pyrite traces; coal fragments	739.30	740.70
Coal, black, shiny, resinous; good cleat and conchoidal fracture	740.70	741.15
Coal, black, dull matrix with 0.02-in. to 0.04-in. shiny coal (vitrain) bands	741.15	741.60
Sandstone, light-brown, very fine grained; coal fragments, 0.04-in. wide vitrain bands	741.60	741.65
Coal, black; dull matrix with 0.02-in. to 0.12-in. shiny coal (vitrain) bands; resinous, good cleat and conchoidal fracture	741.65	741.88
Shale, black, sandy, carbonaceous; 0.04-in. wide coal streaks	741.88	742.00

Description of core from SJ 25-2 -- continued

Lithologic description	Feet From	Feet To
Coal, black shiny, resinous; good cleat and conchoidal fracture	742.00	744.10
Sandstone, light-brown, very fine grained; coal fragments; 0.004-in. to 0.04-in. coal streaks and swirls	744.10	744.14
Coal, black, shiny, resinous; good cleat and conchoidal fracture	744.14	744.40
Sandstone, light-brown, very fine grained; coal fragments; 0.004-in. to 0.08-in. wide coal streaks	744.40	744.50
Coal, black, shiny, resinous; good cleat and conchoidal fracture	744.50	744.78
Sandstone, light-brown, very fine grained; coal fragments, 0.02-in. to 0.04-in. wide coal streaks	744.78	744.83
Coal, black, shiny, resinous; good cleat and conchoidal fracture	744.83	745.90
Missing interval	745.90	751.00

Length of Core = 9.90 feet

Length of Coal in Core = 6.74 feet

Coring 4 Depth - 751.00 feet to 761.00 feet

Lithologic description	Feet From	Feet To
Coal, black, shiny, resinous; good cleat and conchoidal fracture	751.00	751.90
Sandstone, yellow, very fine grained, limonitic; 0.04 in. coal streaks	751.90	751.95
Coal, black, shiny, resinous; good cleat and conchoidal fracture	751.95	753.90
Shale, brown; coal fragments	753.90	754.00
Coal, black, shiny, resinous; good cleat and conchoidal fracture; sample taken for methane gas analysis	754.00	755.00

Description of core from SJ 25-2 -- continued

Lithologic description	Feet From	Feet To
Coal, black, shiny, resinous; good cleat and conchoidal fracture	755.00	757.05
Shale, gray, carbonaceous, fossiliferous; scattered coatings of pyrite; coal fragments; 0.02-in. to 0.12-in. wide coal streaks	757.05	761.00

Length of Core = 10.00 feet

Length of Coal in Core = 5.90 feet

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 25-3 Date Logged 11-30-77 12-01-77 Surface Elevation (ft) 5450

County & State San Juan County, N. M. Location CN½SW¼ Sec. 25, T. 30 N., R. 15 W., NMPM

Map Youngs Lake, N. M. Drilled depth (ft) 723 Logged depth (ft) 718

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Jim Pettengill

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud _____

GEOPHYSICAL LOGS:

Spontaneous potential (sp): Scale 200 MV/in. Logging speed 20 fpm

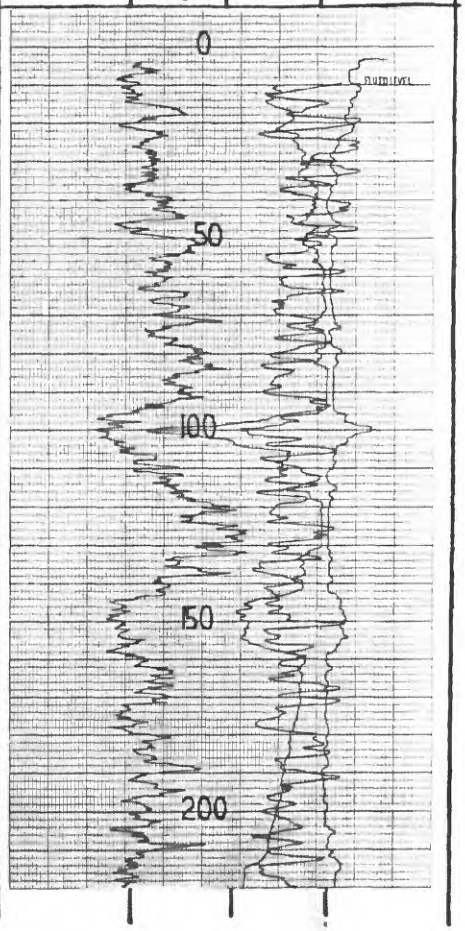
Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

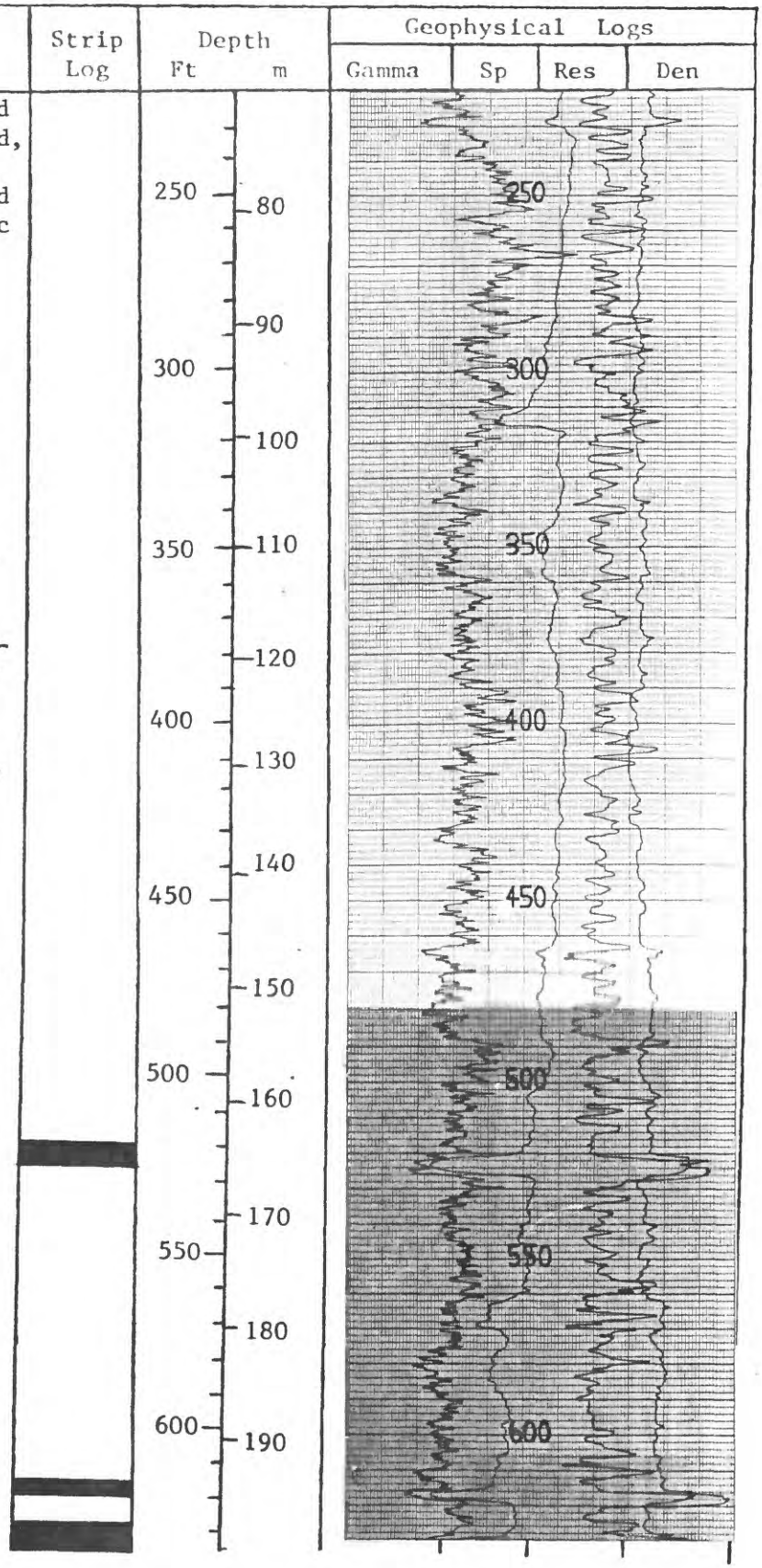
Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
0-35 ft Sand, yellow, fine-grained		0	0	Gamma Sp Res Den
35-65 ft No samples			10	
65-95 ft Shale, gray		50	20	
95-103 ft Sandstone, light-gray, very fine grained		100	30	
103-115 ft Shale, dark-gray, silty and light-gray shale			40	
115-125 ft Shale, dark-gray, sandy				
125-143 ft Shale, dark-gray, bentonitic				
143-165 ft Sandstone, light-gray, silty		150	50	
165-185 ft Shale, dark-gray to black				
185-195 ft Shale, gray			60	
195-205 ft Shale, dark-gray		200		
205-208 ft Sandstone, gray, fine-grained				
208-215 ft Shale, gray, silty, bentonitic				
215-225 ft Sandstone, gray, fine-grained, silty			70	



Hole No. SJ 25-3 (continued)

LITHOLOGY	
225–229 ft	Sandstone, brown, fine-grained
229–231 ft	Sandstone, brown, fine-grained, very hard
231–235 ft	Sandstone, brown, fine-grained
235–245 ft	Shale, gray, silty, bentonitic
245–255 ft	Shale, black to dark-gray
255–265 ft	Shale, gray, sandy
265–275 ft	Shale, blackish-brown
275–295 ft	Shale, brown, carbonaceous
295–330 ft	Shale, blackish-brown, carbonaceous
330–345 ft	Sandstone, gray, medium-to fine-grained, with gray silty shale
345–359 ft	Sandstone, gray, medium-to fine-grained, with gray shale, quartz splinters, and petrified wood fragments
359–385 ft	Sandstone, light-gray, medium-to fine-grained, and dark-gray shale
385–395 ft	Sandstone, light-gray, fine-grained, with quartz splinters, and dark-gray shale
395–415 ft	Shale, dark-gray to black, silty; scattered gray sandstone fragments
415–435 ft	Sandstone, fine-grained, light-gray, with black shale
435–485 ft	Shale, dark-gray, silty, with gray, fine-grained sandstone
485–488 ft	Sandstone, light-gray, fine-grained
488–489 ft	Coal
489–495 ft	Sandstone, light-gray, fine-grained
495–505 ft	Shale, dark-gray, and light-gray, fine-grained sandstone
505–520 ft	Shale, dark-gray, and light-gray, fine-grained sandstone; scattered coal fragments
520–527 ft	Coal
527–545 ft	Sandstone, light-gray, fine-grained; scattered coal fragments
545–615 ft	Shale, dark-gray, light-gray, fine-grained sandstone, and scattered coal fragments
615–620 ft	Coal, shaly
620–630 ft	Shale, dark-gray, coaly



Hole No. SJ 25-3 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma	Sp	Res	Den
630-642 ft Coal; sulfur gas at 635 ft 642-660 ft Shale, dark-gray 660-670 ft Sandstone, light-gray, fine-grained 670-685 ft Shale, black 685-723 ft Sandstone, salt-and-pepper gray, very fine grained		650 700 750 800 850 900 950	200 250 300 350 400 450 500 550 600 650 700				

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 25-4 Date Logged 11-29-77 Surface Elevation (ft) 5375

County & State San Juan County, N. M. Location NE¼SE¼ Sec. 25, T. 30 N., R. 15 W., NMPM

Map Youngs Lake, N. M. Drilled depth (ft) 743 Logged depth (ft) 737

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Jim Pettengill,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

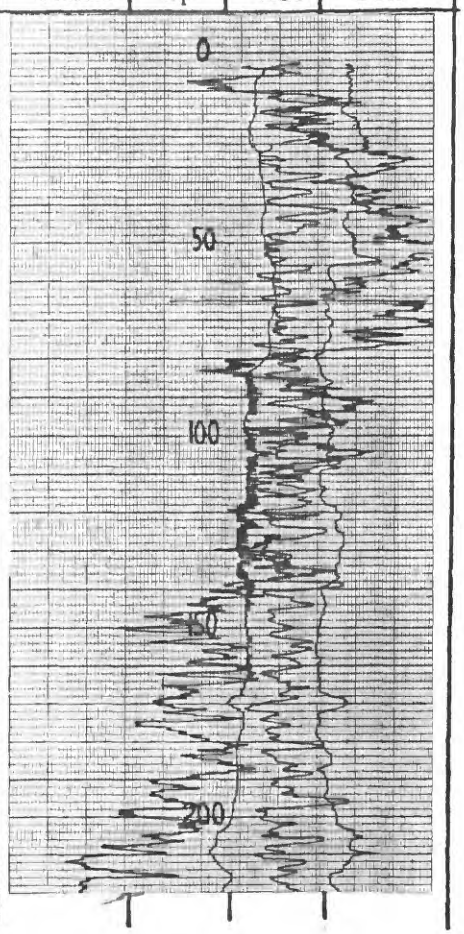
Spontaneous potential (sp): Scale 200 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

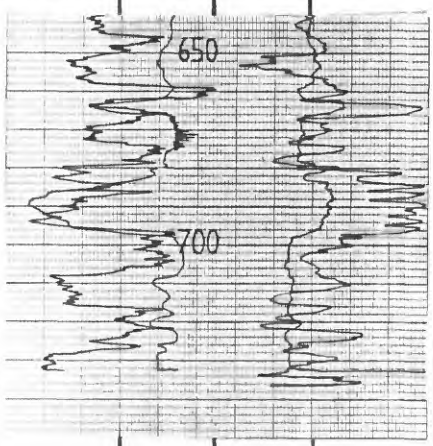
LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
0-14 ft Sandstone, yellow, fine-grained 14-34 ft Sandstone, yellowish-gray, very fine grained with yellowish-gray silty shale 34-44 ft Shale, black, silty 44-115 ft Shale, gray to dark-gray, silty 115-145 ft Sandstone, gray, very fine grained, shaly 145-168 ft Shale, gray, sandy 168-173 ft Shale, black, carbonaceous 173-194 ft Shale, dark-gray, silty 194-204 ft Shale, gray, silty 204-215 ft Sandstone, gray, very fine grained 215-234 ft Siltstone, gray		0 50 100 150 200	0 10 20 30 40 50 60 70	Gamma Sp Res Den 

Hole No. SJ 25-4 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
234-252 ft Shale, gray, silty				Gamma Sp Res Den
252-270 ft Shale, gray, bentonitic		250	80	
270-290 ft Shale, gray				
290-304 ft Sandstone, gray, silty			90	
304-327 ft Shale, gray, silty, bentonitic		300		
327-334 ft Sandstone, gray, silty			100	
334-344 ft Shale, gray, silty				
344-358 ft Siltstone, gray; petrified wood fragments				
358-374 ft Sandstone, gray, fine-grained		350	110	
374-390 ft Siltstone, gray				
390-404 ft Shale, dark-brown to dark-gray			120	
404-424 ft Shale, dark-gray, silty		400		
424-435 ft Shale, dark-brown			130	
435-442 ft Shale, dark-brown, silty, bentonitic				
442-474 ft Shale, gray, silty		450	140	
474-494 ft Shale, gray, silty, coal fragments			150	
494-514 ft Shale, dark-gray				
514-580 ft Shale, gray; dark-gray coaly shale, and shaly coal		500	160	
			170	
		550		
580-589 ft Coal			180	
589-597 ft Shale, gray, silty, coaly				
597-602 ft Coal, shaly		600	190	
602-610 ft Shale, black, silty, carbonaceous, coaly, with scattered coal fragments				
610-640 ft Shale, black, carbonaceous, and gray silty shale with scattered coal fragments				

Hole No. SJ 25-4 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma	Sp	Res	Den
640-662 ft Shale, black, carbonaceous			200				
		650					
662-666 ft Coal, shaly							
666-681 ft Shale, black, carbonaceous			250				
681-697 ft Coal							
697-706 ft Shale, black, carbonaceous			300				
706-715 ft Shaly, black, carbonaceous, coaly; coal fragments		700					
715-724 ft Sandstone, salt-and-pepper gray, very fine grained, coal fragments			350				
724-734 ft Sandstone, salt-and-pepper gray, very fine grained, and black shale			400				
734-743 ft Sandstone, salt-and-pepper gray, very fine grained		750					
			450				
		800					
			500				
		850					
			550				
			600				
		900					
			650				
		950					
			700				



LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 26-1 Date Logged 11-02-77 Surface Elevation (ft) 5265

County & State San Juan County, N. M. Location NW¼NW¼ Sec. 26, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 503 Logged depth (ft) 499

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Laura Beach,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

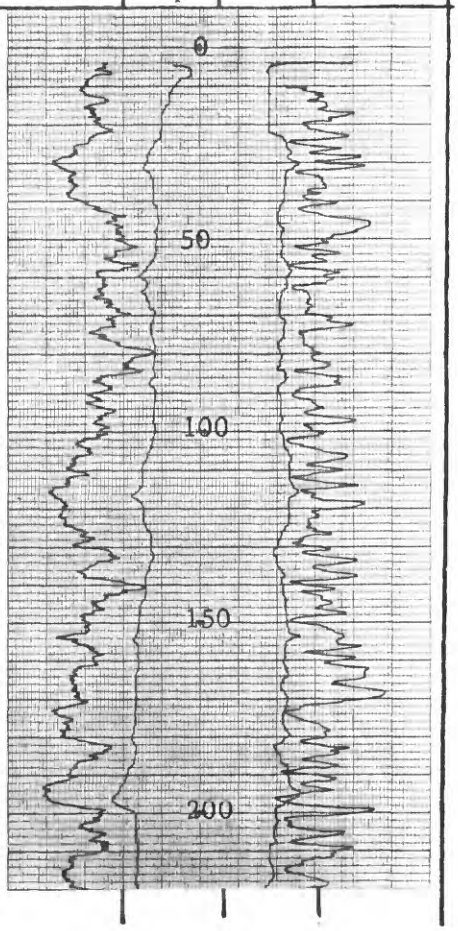
Spontaneous potential (sp): Scale 400 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma / Sp / Res / Den
0-17 ft Shale, brown, limonitic coating; gypsum		0	0	
17-27 ft Shale, light-gray, silty				
27-37 ft Sandstone, light-gray, very fine grained, shaly			10	
37-47 ft Shale, black				
47-67 ft Shale, dark-gray, silty		50		
67-71 ft Shale, gray to brown, carbonaceous			20	
71-72 ft Coal, shaly				
72-87 ft Shale, gray to black, silty				
87-97 ft Shale, dark-brown to gray, silty, carbonaceous		100	30	
97-107 ft Siltstone, gray				
107-115 ft Sandstone, light-gray, very fine grained, silty			40	
115-118 ft Shale, dark-brown, carbonaceous				
118-147 ft Shale, gray to black, silty		150		
147-157 ft Shale, light-gray, silty			50	
157-167 ft Shale, light-gray, sandy, hard, with wavy organic laminae				
167-177 ft Shale, dark-gray, sandy, carbonaceous			60	
177-198 ft Sandstone, gray, very fine grained, shaly		200		
198-207 ft Shale, gray, sandy				
207-214 ft Shale, light-gray, silty			70	
214-219 ft Sandstone, light-gray, very fine grained, shaly				

Hole No. SJ 26-1 (continued)

LITHOLOGY		Strip Log	Depth Ft	Depth m	Geophysical Logs
219-237 ft	Shale, gray to grayish-brown, silty, carbonaceous; scattered coal fragments				Gamma Sp Res Den
237-244 ft	Sandstone, grayish-brown, very fine grained		250	80	
244-249 ft	Shale, black, carbonaceous, scattered coal fragments				
249-257 ft	Shale, gray, sandy			90	
257-279 ft	Siltstone, light-gray, shaly		300		
279-285 ft	Shale, grayish-brown, carbonaceous, coaly				
285-316 ft	Shale, gray, carbonaceous, silty			100	
316-326 ft	Coal				
326-339 ft	Shale, grayish-brown, carbonaceous		350	110	
339-361 ft	Sandstone, light-gray, very fine grained, shaly				
361-377 ft	Shale, gray, sandy and light-gray, very fine grained sandstone			120	
377-405 ft	Sandstone, salt-and-pepper gray, very fine grained		400		
405-417 ft	Shale, gray, sandy, soft			130	
417-427 ft	Shale, gray, carbonaceous				
427-435 ft	Shale, brownish-black, carbonaceous, coaly, coal fragments			140	
435-451 ft	Coal		450		
451-459 ft	Shale, gray, carbonaceous			150	
459-463 ft	Sandstone, light-gray, very fine grained				
463-503 ft	Sandstone, salt-and-pepper gray, very fine grained		500	160	
				170	
			550		
				180	
			600		
				190	

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 26-2 Date Logged 11-01-77 Surface Elevation (ft) 5293

County & State San Juan County, N. M. Location NE¼NE¼ Sec. 26, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 626 Logged depth (ft) 623

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Wayne Lambert, Russell Jentgen

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud

GEOPHYSICAL LOGS:

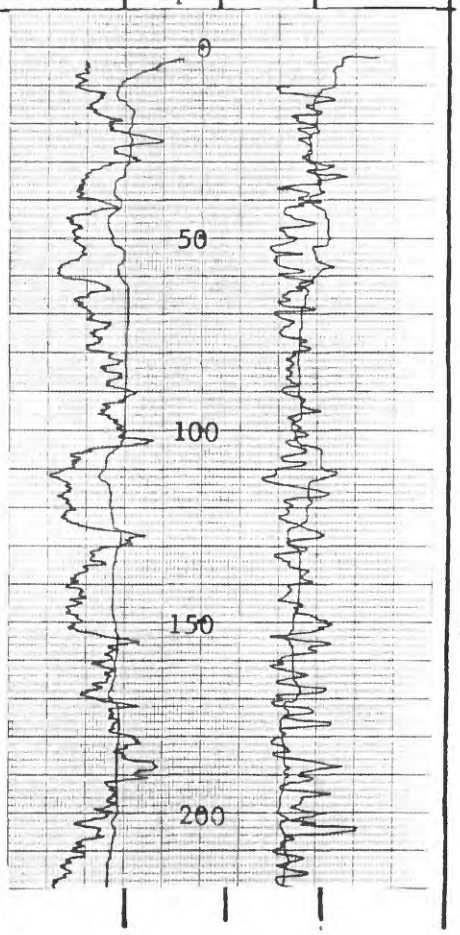
Spontaneous potential (sp): Scale 400 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma / Sp / Res / Den
0-13 ft Sandstone, fine-grained, white, clayey 13-33 ft Shale, brown, sandy 33-43 ft Shale, light-gray, sandy, hard 43-53 ft Sandstone, light-gray, very fine grained, shaly 53-105 ft Shale, gray, silty 105-126 ft Sandstone, light-gray, very fine grained, shaly 126-153 ft Sandstone, gray, fine-grained 153-160 ft Shale, brown, carbonaceous; brown coal fragments 160-180 ft Shale, gray, silty 180-193 ft Shale, brown, carbonaceous; brown coal fragments 193-207 ft Shale, gray, very silty 207-223 ft Sandstone, light-gray, fine-to medium-grained, silty		0 50 100 150 200	0 10 20 30 40 50 60 70	

Hole No. SJ 26-2 (continued)

LITHOLOGY		Strip Log	Depth Ft	Depth m	Geophysical Logs
223-229 ft	Shale, brown, carbonaceous, coaly				Gamma Sp Res Den
229-233 ft	Shale, gray, silty to sandy				
233-243 ft	Sandstone, light-gray, very fine grained, silty		250	80	250
243-293 ft	Siltstone, light-gray to gray, shaly				
293-305 ft	Sandstone, light-gray, very fine grained, silty			90	
305-323 ft	Shale, gray, silty, soft		300		300
323-333 ft	Shale, dark-gray, carbonaceous, silty			100	
333-353 ft	Shale, gray, silty				
353-368 ft	Shale, dark-gray, silty		350	110	350
368-373 ft	Shale, brown, carbonaceous; coal fragments				
373-393 ft	Shale, dark-gray, silty, and dark-gray siltstone			120	
393-413 ft	Sandstone, light-gray, very fine grained, silty		400		400
413-428 ft	Shale, brown, carbonaceous, coaly, coal fragments			130	
428-436 ft	Coal				
436-443 ft	Shale, black, carbonaceous, and coal			140	
443-463 ft	Shale, dark-gray		450		450
463-473 ft	Shale, gray, silty				
473-510 ft	Sandstone, light-gray, fine- to medium-grained, shaly			150	
510-514 ft	Shale, gray, sandy, and coal				
514-538 ft	Shale, gray, sandy		500	160	500
538-553 ft	Coal				
				170	
553-583 ft	Shale, gray, sandy		550		550
				180	
583-623 ft	Sandstone, light-gray, fine-grained, shaly		600	190	600

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 26-3 Date Logged 10-31-77 Surface Elevation (ft) 5260

County & State San Juan County, N. M. Location NE¼SW¼ Sec. 26, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 410 Logged depth (ft) 407

Cored depth (ft) 406.6 Cored: [x] Yes [ ] No Geologists: Wayne Lambert,

Drilling medium: [x] Air [ ] Water [x] Foam [ ] Mud Russell Jentgen

GEOPHYSICAL LOGS:

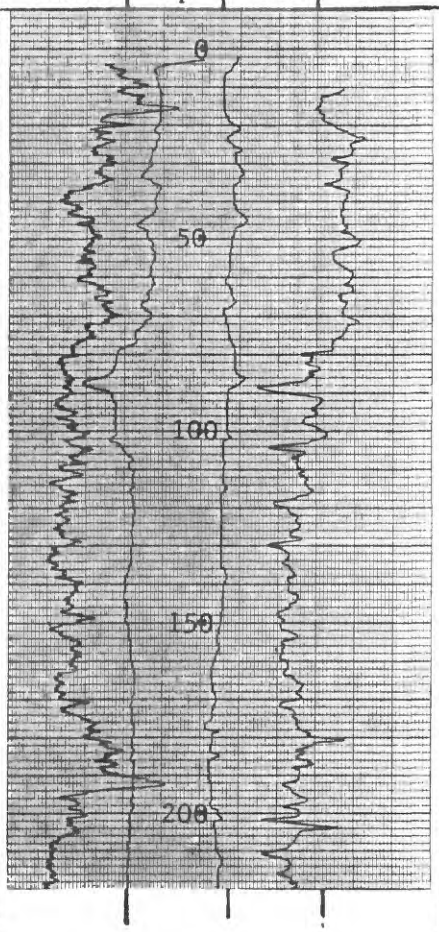
Spontaneous potential (sp): Scale 400 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

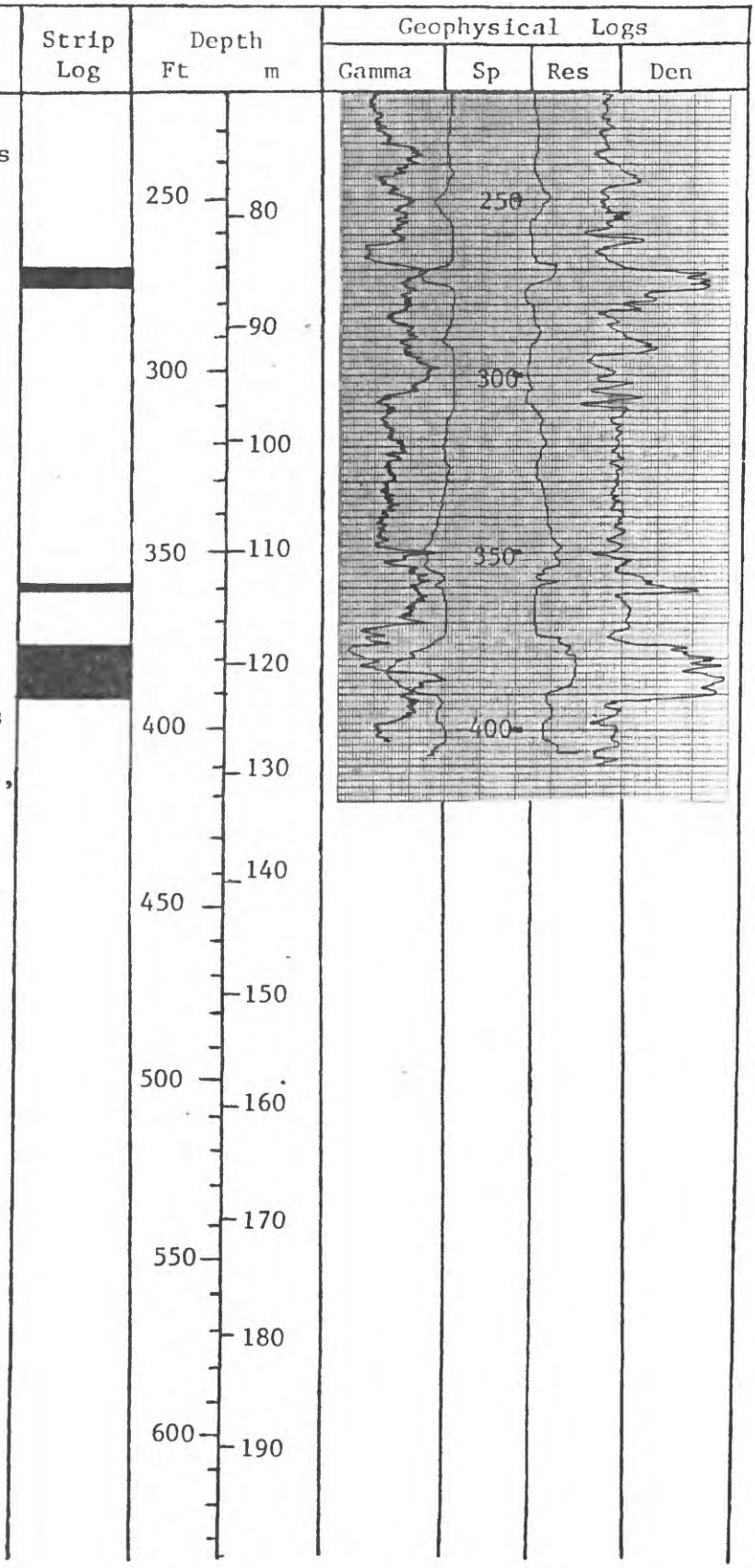
Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale Logging speed fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
0-20 ft Shale, grayish-green, silty 20-21 ft Coal 21-33 ft Shale, brownish-black, carbonaceous; coal fragments 33-43 ft Shale, black, carbonaceous; coal fragments 43-53 ft Sandstone, light-gray, very fine grained, clayey 53-83 ft Shale, dark-gray, and dark-brown carbonaceous shale 83-103 ft Sandstone, light-gray, very fine to fine-grained, soft 103-113 ft Sandstone, light-gray, very fine to fine-grained, with interbedded dark-gray silty shale 113-123 ft Shale, light-gray, silty 123-146 ft Siltstone, light-gray, shaly 146-150 ft Shale, brown to black, carbonaceous 150-163 ft Siltstone, light-gray, with some dark-gray shale and light-gray, very fine grained sandstone 163-167 ft Shale, dark-gray, silty 167-168 ft Shale, dark-brown carbonaceous 168-180 ft Siltstone, light-gray 180-181 ft Coal		0 50 100 150 200	0 10 20 30 40 50 60 70	Gamma Sp Res Den 

Hole No. SJ 26-3 (continued)

LITHOLOGY	
181–183 ft	Siltstone, light-gray
183–191 ft	Shale, dark-brown, carbonaceous
191–193 ft	Coal
193–203 ft	Shale, gray, silty, and dark-brown carbonaceous shale
203–204 ft	Coal
204–213 ft	Shale, gray
213–233 ft	Shale, light- to dark-gray, silty
233–244 ft	Sandstone, light-gray, very fine grained
244–251 ft	Shale, brown to black, carbonaceous
251–254 ft	Sandstone, gray, very fine grained, hard
254–261 ft	Shale, gray to brown, silty
261–263 ft	Shale, black, carbonaceous, coaly
263–270 ft	Shale, gray to brown, silty
270–276 ft	Coal
276–283 ft	Shale, dark-brown, carbonaceous
283–290 ft	Shale, dark-gray, silty
290–294 ft	Shale, dark-brown, carbonaceous, coaly
294–305 ft	Shale, gray, silty, very fossiliferous
305–309 ft	Shale, light-gray to dark-gray, silty, carbonaceous
309–319 ft	Sandstone, light-gray, very fine to fine-grained, clayey, carbonaceous, with coal streaks less than 0.04 in. wide
319–333 ft	Sandstone, gray, fine-to medium-grained, interbedded with gray laminated shale
333–353 ft	Sandstone, light-gray, fine-to medium-grained, carbonaceous
353–359 ft	Shale, gray to dark-gray, silty, carbonaceous, coaly
359–361 ft	Coal
361–376 ft	Shale, gray to dark-gray, silty, carbonaceous
376–391 ft	Coal, and shaly coal
391–400 ft	Shale, light to dark-gray, silty, carbonaceous
400–407 ft	Sandstone, light-gray, fine-grained, fossiliferous



Description of core from SJ-26-3

October 31, 1977

Total Depth of Core (T.D.): 406.60 feet
Total Length of Coring: 103.60 feet out of 103.60 feet attempted
Total Length of Lower Coal Seam in Core: 13.05

Lithologic description	Feet From	Feet To
Coring 1 Depth - 303.00 feet to 316.60 feet		
Shale, gray, silty, with carbonized plant fragments	303.00	305.00
Shale, gray to dark-gray, silty, carbonaceous	305.00	307.40
Shale, gray to light-gray, silty, carbonaceous	307.40	308.50
Sandstone, light-gray, very fine to medium-grained, carbonaceous, with coal fragment laminae and carbonaceous clay	308.50	316.60
Length of Core: 13.60 feet		
Length of Coal in Core: 0.00		
Coring 2 Depth - 316.60 feet to 331.70 feet		
Sandstone, light-gray, very fine to medium-grained, carbonaceous, with coal laminae and carbonaceous clay	316.60	322.20
Sandstone, light-gray to gray, fine-grained, carbonaceous, interbedded with gray silty carbonaceous shale	322.20	323.70
Sandstone, light-gray, very fine to fine-grained, interbedded with gray carbonaceous clay and coal laminae	323.70	326.40
Shale, gray, silty, carbonaceous	326.40	326.80
Sandstone, light-gray, fine-grained, clayey, with gray carbonaceous shale clasts and coal laminae	326.80	331.70
Length of Core: 15.10 feet		
Length of Coal in Core: 0.00 feet		

Description of core from SJ 26-3 -- continued

Lithologic description	Feet From	Feet To
Coring 3 Depth - 331.70 feet to 345.30 feet		
Sandstone, light-gray, fine-grained, clayey, with gray carbonaceous shale clasts and coal laminae	331.70	334.90
Sandstone, light-gray, fine-to medium-grained, carbonaceous, with occasional gray carbonaceous shale clasts and coal laminae	334.90	345.30
Length of Core: 13.60 feet		
Length of Coal in Core: 0.00 feet		
Coring 4 Depth - 345.30 feet to 360.80 feet		
Sandstone, light-gray, fine-to medium-grained, carbonaceous, with occasional gray carbonaceous shale clasts and coal laminae	345.30	353.10
Shale, gray to dark-gray, silty, carbonaceous	353.10	353.80
Coal, black, shaly	353.80	354.00
Shale, dark-gray, silty, coaly	354.00	354.30
Shale, light- to dark-gray, silty, carbonaceous, with coal fragments	354.30	356.00
Coal, black, shaly	356.00	356.30
Coal, black	356.30	357.30
Shale, dark-gray, silty, coaly	357.30	357.70
Shale, gray to dark-gray, silty, carbonaceous	357.70	360.80
Length of Core: 15.50 feet		
Length of Coal in Core: 1.50 feet		
Coring 5 Depth - 360.80 feet to 375.90 feet		
Shale, gray to dark-gray, silty, carbonaceous	360.80	371.90
Shale, black, silty, with black coaly shale	371.90	375.00
Coal, black	375.00	375.90
Length of Core: 15.10 feet		
Length of Coal in Core: 0.90 feet		

Description of core from SJ 26-3 -- continued

Lithologic description	Feet From	Feet To
Coring 6 Depth - 375.90 feet to 391.00 feet		
Coal, black	375.90	376.60
Shale, light-gray to black, silty, carbonaceous	376.60	376.90
Coal, black	376.90	379.00
Shale, light- to dark-gray, silty, carbonaceous	379.00	379.30
Coal, black, shaly	379.30	380.00
Coal, black	380.00	383.90
Sandstone, light-gray, very fine grained, with coal laminae	383.90	384.00
Coal, black	384.00	384.35
Sandstone, light-gray, very fine grained, with coal laminae	384.35	384.40
Coal, black	384.40	387.30
Shale, dark-gray to black, silty, carbonaceous, with coal fragments	387.30	390.00
Shale, light-gray to gray, silty, carbonaceous	390.00	391.00
Length of Core: 15.05 feet		
Length of Coal in Core: 10.65 feet		
Coring 7 Depth - 391.00 feet to 406.60 feet		
Shale, light-gray to gray, silty, carbonaceous	391.00	391.50
Shale, dark-gray, sandy, carbonaceous, laminated, and light-gray, fine-grained shaly laminated sandstone	391.50	395.40
Shale, dark-gray, sandy, carbonaceous, laminated	395.40	400.70
Sandstone, light-gray, fine-grained, with gray shale; coal and plant fragments, unidentified bone at 404.30	400.70	406.60
Length of Core: 15.60 feet		
Length of Coal in Core: 0.00 feet		

LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 26-4 Date Logged 10-31-77 Surface Elevation (ft) 5290

County & State San Juan County, N. M. Location NE¼SE¼ Sec. 26, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 603 Logged depth (ft) 603

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Wayne Lambert,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

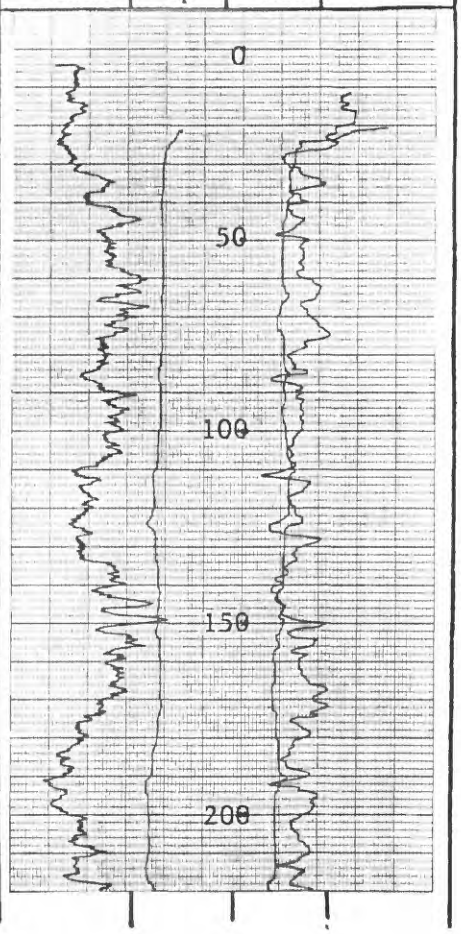
Spontaneous potential (sp): Scale 400 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

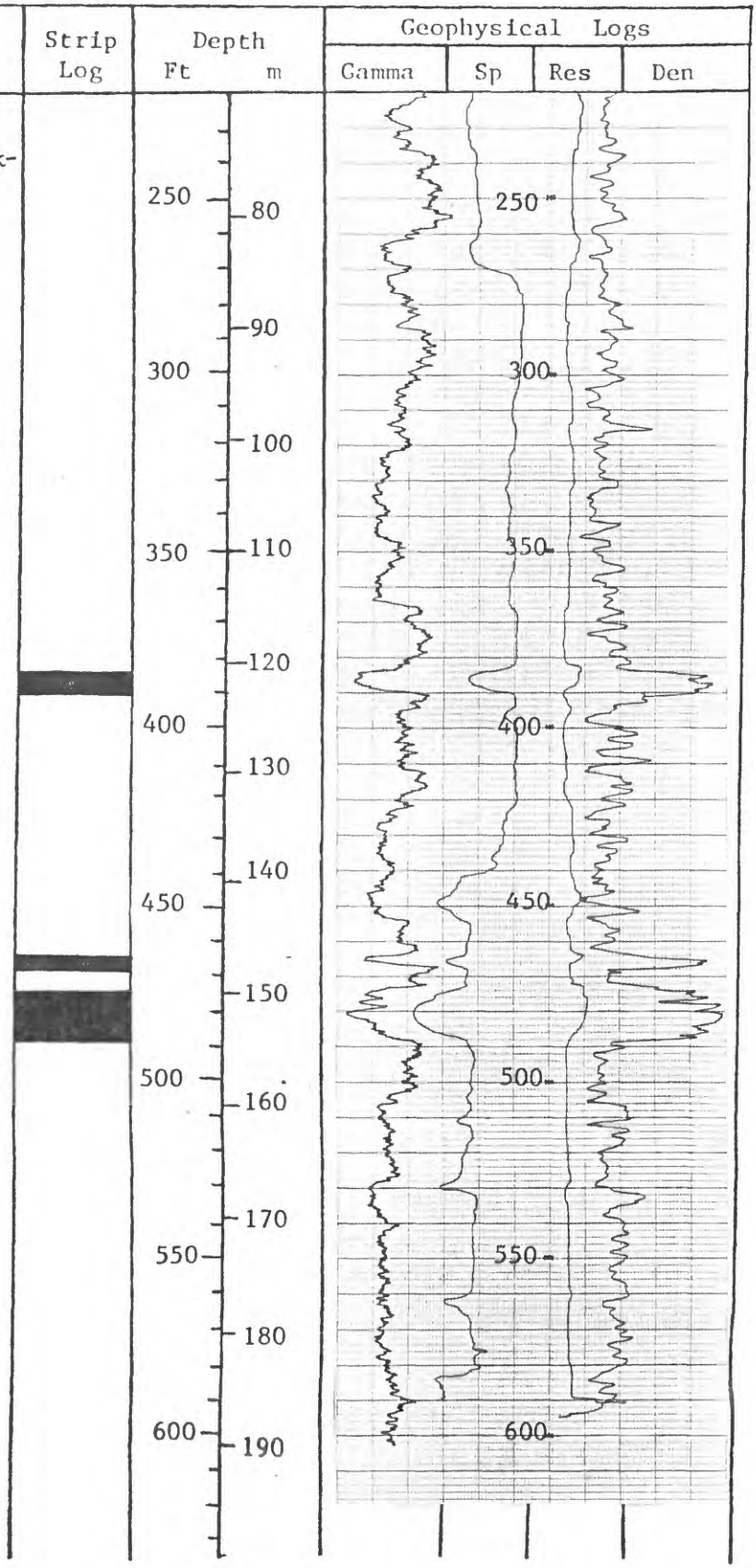
Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma, Sp, Res, Den
0-13 ft Sandstone, yellow, fine grained, shaly 13-43 ft Shale, gray to dark-brown, silty 43-63 ft Shale, dark-gray 63-83 ft Shale, dark-gray, silty, soft 83-93 ft Sandstone, light-gray, very fine grained; black carbonaceous shale, and blackish-brown coaly shale 93-111 ft Shale, gray 111-115 ft Sandstone, gray, very fine grained 115-123 ft Shale, gray, silty 123-133 ft Sandstone, gray, very fine grained, clayey 133-148 ft Shale, gray 148-163 ft Shale, dark-brown, carbonaceous, and black coaly shale 163-183 ft Shale, dark-grayish-brown to gray 183-200 ft Sandstone, light-gray, very fine grained, hard 200-204 ft Shale, dark-gray 204-223 ft Sandstone, greenish-gray, very fine to fine-grained, clayey		0 50 100 150 200	0 10 20 30 40 50 60 70	

Hole No. SJ 26-4 (continued)

LITHOLOGY	
223-238 ft	Sandstone, gray, very fine to fine-grained, clayey, and dark-brown carbonaceous shale
238-239 ft	Coal, shaly
239-253 ft	Shale, gray to dark-gray
253-272 ft	Sandstone, gray, very fine grained, clayey
272-283 ft	Shale, gray, silty
283-288 ft	Shale, dark-gray
288-289 ft	Coal, shaly
289-303 ft	Shale, gray to brownish-gray, silty
303-313 ft	Sandstone, light-gray, very fine grained, silty
313-314 ft	Coal
314-323 ft	Shale, dark-gray, and light-gray, very fine grained sandstone
323-343 ft	Sandstone, light-gray, very fine grained, clayey
343-350 ft	Shale, gray, silty, and light-gray, very fine grained sandstone
350-351 ft	Coal, and dark-brown carbonaceous shale
351-373 ft	Siltstone, light-gray, sandy
373-384 ft	Shale, dark-brownish-gray, coal fragments
384-391 ft	Coal
391-408 ft	Shale, dark-brownish-gray
408-413 ft	Shale, dark-gray, silty, bentonitic
413-433 ft	Shale, gray, silty
433-453 ft	Shale, gray, carbonaceous, soft
453-465 ft	Shale, dark-gray, and dark-gray to black coaly shale
465-467 ft	Coal
467-474 ft	Shale, gray
474-488 ft	Coal
488-513 ft	Shale, gray
513-603 ft	Sandstone, light-gray, very fine to fine-grained, clayey



LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 35-1 Date Logged 10-27-77 Surface Elevation (ft) 5295

County & State San Juan County, N. M. Location NE¼NW¼ Sec. 35, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 443 Logged depth (ft) 440

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Wayne Lambert,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

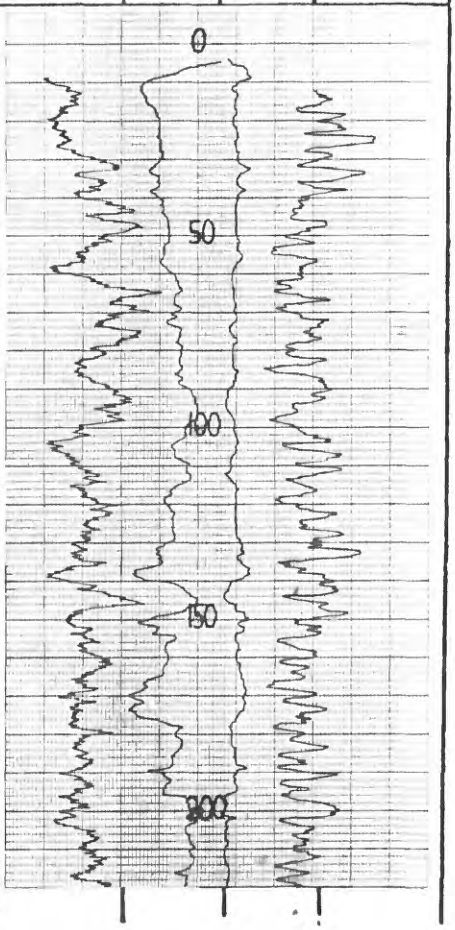
Spontaneous potential (sp): Scale 400 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 20 cps/in. Logging speed 20 fpm

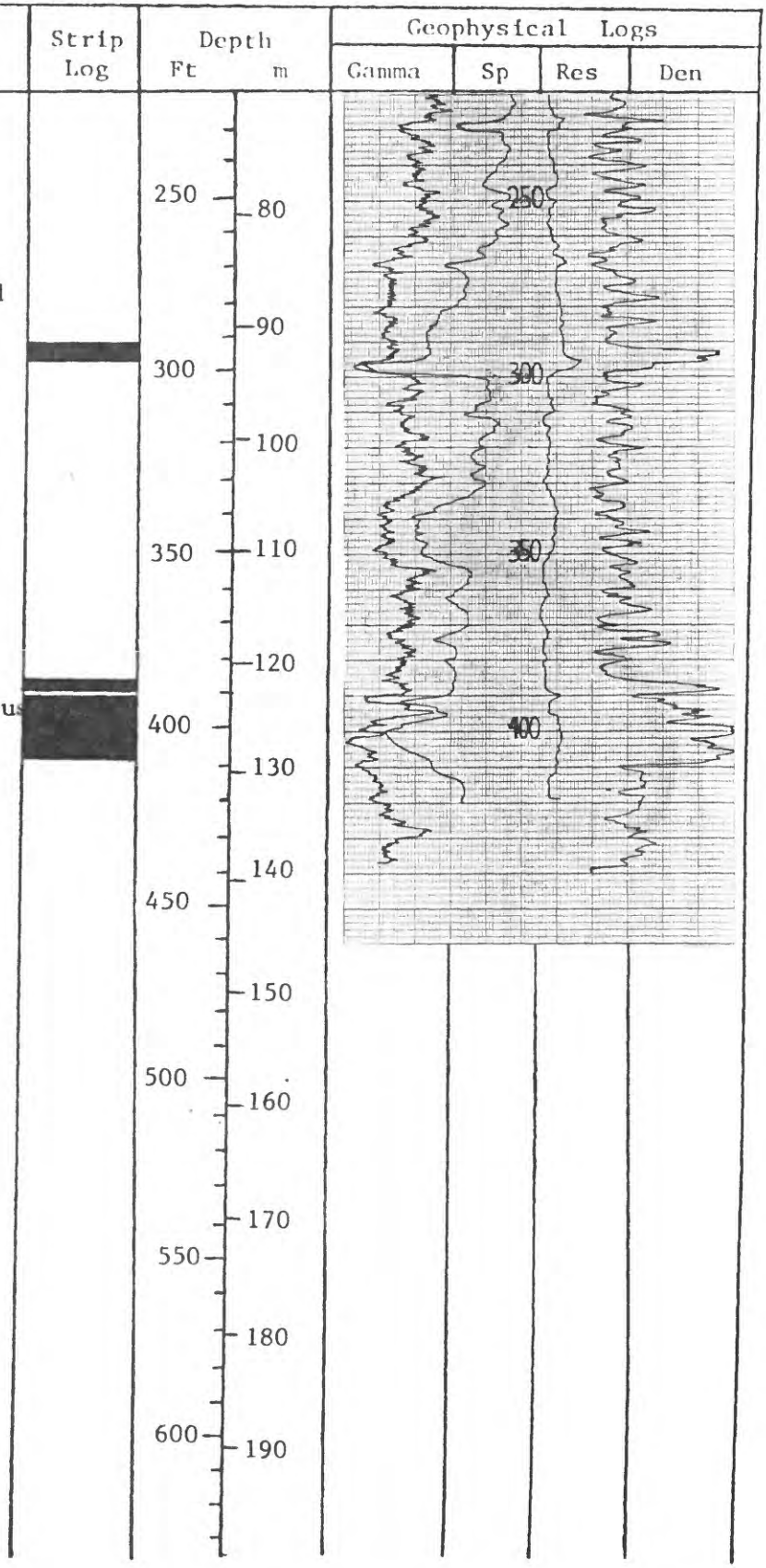
Density (Den): Scale 2000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
0-1 ft Sand, yellow, fine-grained 1-13 ft Sandstone, yellow, very fine to fine grained, clayey, soft 13-23 ft Shale, yellow, silty 23-63 ft Shale, dark-gray to brown 63-73 ft Shale, dark-gray, with thin layers (less than 1 ft) black carbonaceous shale and shaly coal 73-113 ft Shale, grayish-brown, carbonaceous 113-133 ft Shale, dark-gray to brownish-gray 133-137 ft Shale, dark-gray, and dark-gray siltstone 137-139 ft Coal, shaly and brown carbonaceous shale 139-150 ft Shale, dark-brown, carbonaceous, and dark-gray shale 150-151 ft Coal 151-163 ft Shale, dark-gray 163-173 ft Shale, dark-gray, silty, with pyrite 173-189 ft Shale, dark-gray 189-194 ft Sandstone, dark-gray, very fine grained 194-197 ft Shale, dark-gray 197-198 ft Coal		0 50 100 150 200	0 10 20 30 40 50 60 70	Gamma Sp Res Den 

Hole No. SJ 35-1 (continued)

LITHOLOGY	
198–213 ft	Shale, dark-gray, and dark-brown carbonaceous shale
213–223 ft	Shale, gray to light-gray, silty
223–228 ft	Shale, gray
228–229 ft	Coal
229–233 ft	Sandstone, gray, fine-grained
233–243 ft	Shale, black, soft
243–259 ft	Shale, dark-gray, silty
259–263 ft	Shale, dark-brown, carbonaceous
263–283 ft	Shale, gray to light-gray, sandy
283–292 ft	Sandstone, light-gray, fine grained
292–298 ft	Coal
298–301 ft	Shale, dark-brown, carbonaceous
301–310 ft	Shale, light-gray, silty
310–311 ft	Coal
311–318 ft	Shale, dark-brown, carbonaceous
318–323 ft	Shale, light-brown, silty, very hard
323–343 ft	Shale, light-gray, silty
343–353 ft	Siltstone, light-gray, shaly
353–385 ft	Shale, gray, silty
385–409 ft	Coal
409–443 ft	Sandstone, salt-and-pepper gray, medium-grained; shale



LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 35-2 Date Logged 10-26-77 Surface Elevation (ft) 5285

County & State San Juan County, N. M. Location NW¼NE¼ Sec. 35, T. 30 N., R. 15 W., NMPI

Map Waterflow, N. M. Drilled depth (ft) 463 Logged depth (ft) 443

Cored depth (ft)_____ Cored: ☐ Yes ☒ No Geologists: Wayne Lambert,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

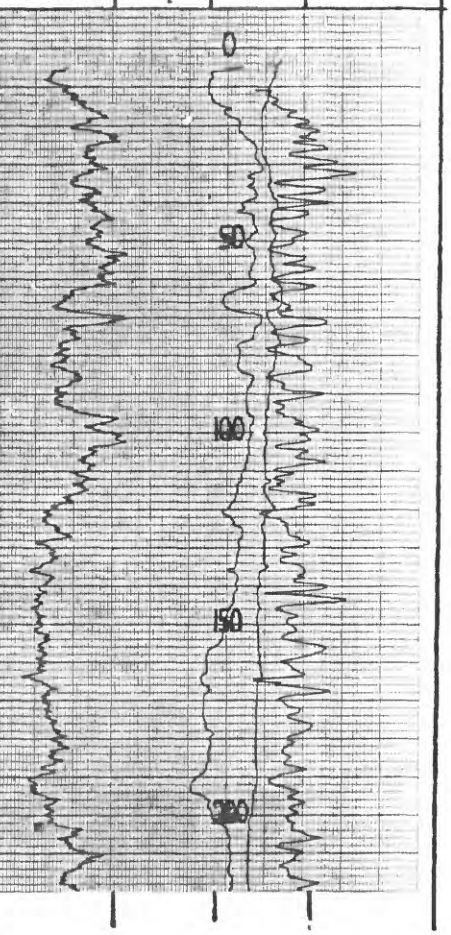
Spontaneous potential (sp): Scale 200 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

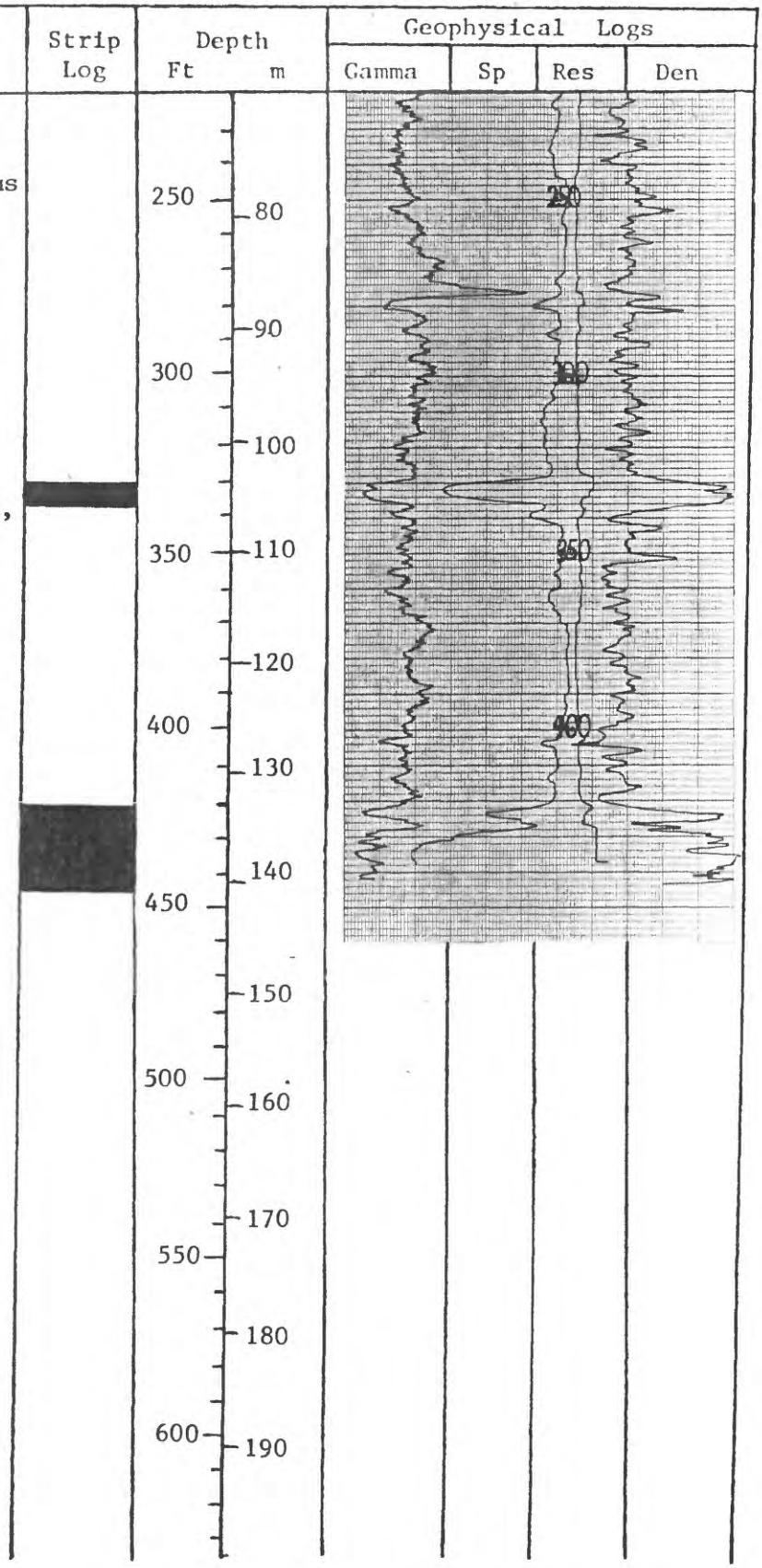
Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
0-13 ft Shale, tan, sandy, with pebbles 13-23 ft Shale, dark-gray, sandy 23-33 ft Shale, light-brown with yellow stains, sandy 33-43 ft Sandstone, bluish-gray, very fine grained, clayey 43-63 ft Shale, dark-gray, silty 63-83 ft Sandstone, light-gray, very fine grained 83-90 ft Shale, gray, silty to sandy 90-103 ft Shale, dark-gray, silty, carbonaceous 103-124 ft Shale, gray to light-gray 124-143 ft Sandstone, light-gray, very fine grained, shaly, brittle 143-153 ft Sandstone, light-gray, very fine grained 153-173 ft Sandstone, light-gray, fine- to medium-grained, shaly, brittle 173-183 ft Shale, gray, silty 183-203 ft Sandstone, light-gray, very fine grained, shaly 203-221 ft Shale, light-gray to gray, silty		0 50 100 150 200	0 10 20 30 40 50 60 70	Gamma Sp Res Den 

Hole No. SJ 35-2 (continued)

LITHOLOGY	
221-243 ft	Sandstone, gray, very fine grained, shaly, brittle
243-251 ft	Shale, dark-brown, carbonaceous
251-252 ft	Coal
252-278 ft	Shale, gray to brownish-gray, silty
278-280 ft	Coal, shaly, and gray shale
280-303 ft	Shale, brownish-gray, silty
303-313 ft	Shale, dark-gray, silty
313-330 ft	Shale, dark-gray, with thin (less than 1.0 ft) coal partings
330-337 ft	Coal
337-343 ft	Shale, black to brownish-black, carbonaceous, coaly, with coal fragments
343-350 ft	Sandstone, dark-gray, very fine grained, shaly
350-353 ft	Shale, black, carbonaceous, coaly, with coal fragments
353-369 ft	Sandstone, gray, very fine grained
369-403 ft	Shale, dark-gray, silty to sandy near bottom
403-422 ft	Sandstone, light-gray, very fine grained, shaly
422-444 ft	Coal
444-463 ft	Sandstone, white, medium-grained, shaly



LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 35-3 Date Logged 10-27-77 Surface Elevation (ft) 5360

County & State San Juan County, N. M. Location NE¼SW¼ Sec. 35, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 483 Logged depth (ft) 480

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Wayne Lambert,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

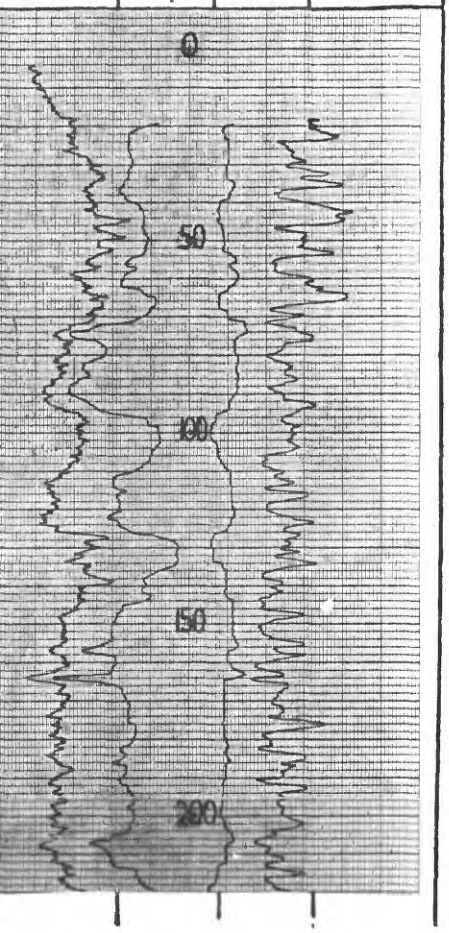
Spontaneous potential (sp): Scale 400 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

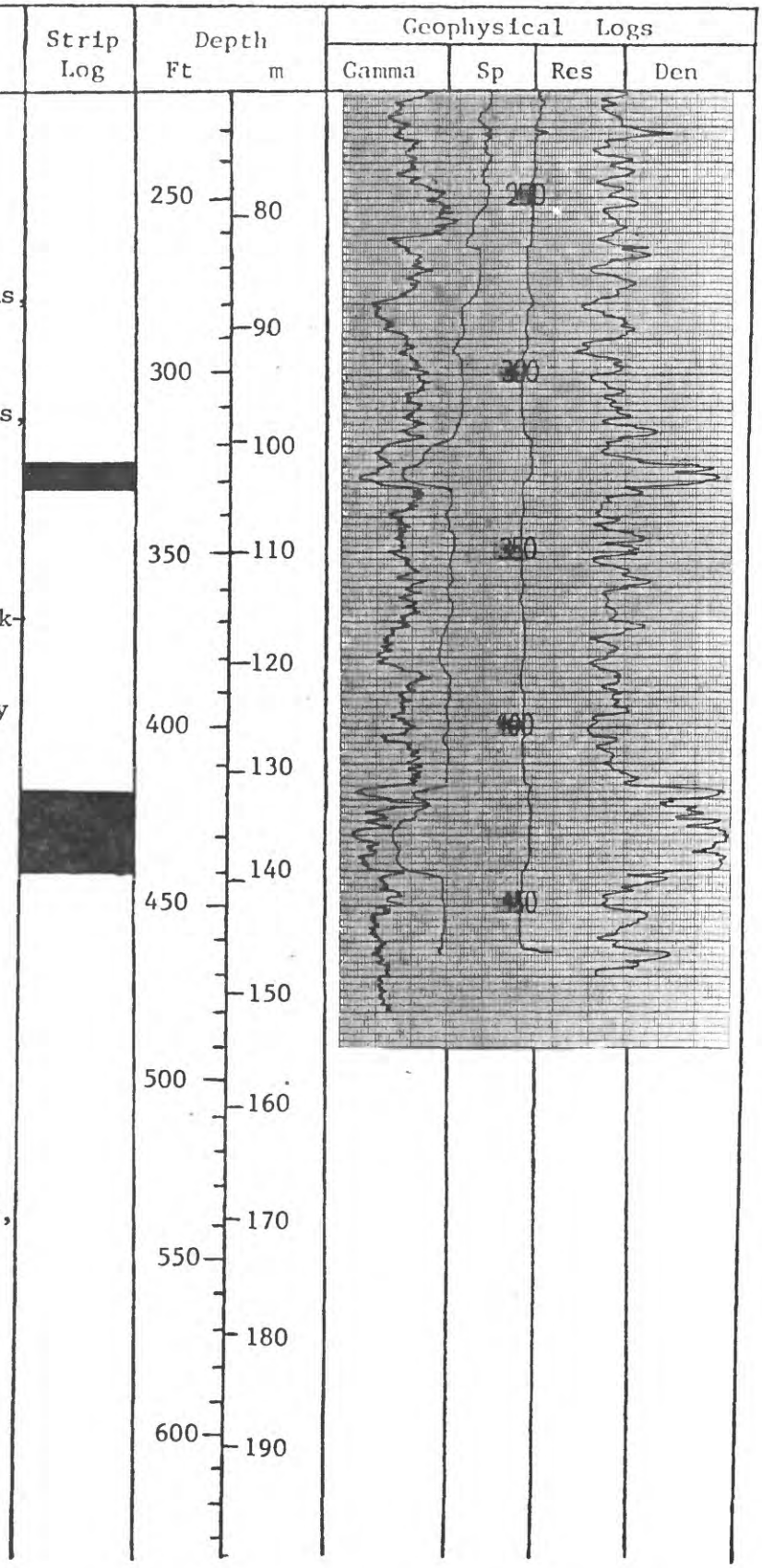
Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs: Gamma, Sp, Res, Den
0-15 ft Sand, pale-orange, fine-to medium-grained 15-23 ft Clay, gray to yellow-green 23-33 ft Sand, light-yellowish-green, very fine grained 33-53 ft Shale, grayish-brown to dark-gray, with limonitic stains 53-63 ft Shale, dark-gray to black 63-83 ft Shale, dark-gray, and gray, very fine grained sandstone 83-94 ft Sandstone, gray, very fine to fine-grained 94-103 ft Shale, gray to dark-gray, and gray, very fine to fine-grained sandstone 103-111 ft Shale, dark-gray 111-128 ft Sandstone, gray, very fine grained, shaly 128-133 ft Shale, gray 133-143 ft Shale, gray to dark-gray, interbedded with black carbonaceous coaly shale 143-153 ft Shale, gray to dark-gray, silty 153-162 ft Sandstone, light-gray, very fine grained, shaly 162-164 ft Shale, black, carbonaceous, coaly 164-197 ft Sandstone, light-gray, very fine grained, shaly		0 50 100 150 200	0 10 20 30 40 50 60 70	

Hole No. SJ 35-3 (continued)

LITHOLOGY	
197–203 ft	Shale, gray
203–217 ft	Sandstone, light-gray, very fine grained, shaly
217–223 ft	Shale, brownish-gray, silty
223–230 ft	Sandstone, light-gray, very fine grained, shaly
230–232 ft	Shale, dark-brown, carbonaceous, and coal
232–259 ft	Shale, gray to grayish-brown, silty
259–260 ft	Shale, dark-brown, carbonaceous, and coal
260–273 ft	Shale, dark-brownish-gray
273–287 ft	Shale, gray to brown
287–290 ft	Sandstone, gray, very fine to fine-grained
290–303 ft	Shale, dark-gray, with thin (less than 2 ft) layers of dark-brown carbonaceous shale
303–313 ft	Shale, dark-gray
313–324 ft	Shale, dark-gray and light-gray very fine grained sandstone, with coal fragments
324–332 ft	Coal, with thin (less than 0.04 in.) layers of light-gray very fine grained sandstone and gray siltstone
332–343 ft	Shale, gray to brownish-gray
343–363 ft	Shale, dark-gray
363–393 ft	Shale, gray to dark-gray, interbedded with light-gray very fine grained sandstone
393–403 ft	Siltstone, gray and light-gray very fine grained sandstone
403–417 ft	Shale, gray, with brownish-red siderite
417–440 ft	Coal
440–483 ft	Sandstone, salt-and-pepper gray, fine-to medium-grained, clayey, with coal fragments



LITHOLOGIC AND GEOPHYSICAL LOGS

Location Number SJ 35-4 Date Logged 10-26-77 Surface Elevation (ft) 5318

County & State San Juan County, N. M. Location NW¼SE¼ Sec. 35, T. 30 N., R. 15 W., NMPM

Map Waterflow, N. M. Drilled depth (ft) 504 Logged depth (ft) 503

Cored depth (ft) _____ Cored: ☐ Yes ☒ No Geologists: Wayne Lambert,

Drilling medium: ☒ Air ☐ Water ☒ Foam ☐ Mud Russell Jentgen

GEOPHYSICAL LOGS:

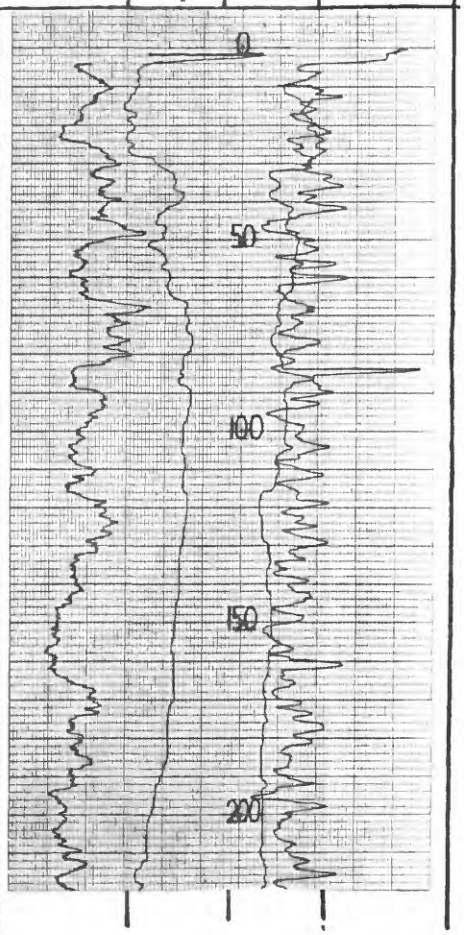
Spontaneous potential (sp): Scale 400 MV/in. Logging speed 20 fpm

Resistivity (Res): Scale 20 ohms/in. Logging speed 20 fpm

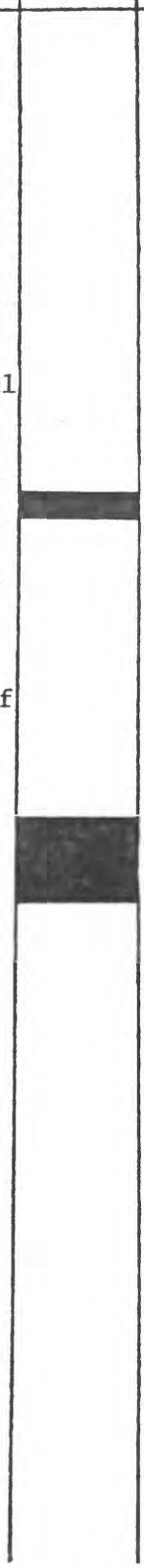
Gamma (G): Scale 40 cps/in. Logging speed 20 fpm

Density (Den): Scale 4000 cps/in. Logging speed 20 fpm

Neutron (Neu): Scale _____ Logging speed _____ fpm

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
0-24 ft Shale, yellowish-brown, silty, soft 24-30 ft Sandstone, white, very fine grained, shaly 30-50 ft Shale, dark-brown to light-gray, silty, soft 50-64 ft Sandstone, white, fine-grained, shaly 64-74 ft Shale, light-gray with dark-gray streaks, sandy 74-85 ft Shale, light-gray, sandy, with thin layers (less than 1 ft) of carbonaceous dark-brown shale 85-94 ft Sandstone, white, fine-grained, shal 94-104 ft Shale, light-gray, silty 104-124 ft Sandstone, light-gray, fine- to medium-grained 124-164 ft Shale, light- to dark-gray, silty 164-174 ft Shale, light-gray, very sandy 174-226 ft Shale, light-gray, silty, soft		0 50 100 150 200	0 10 20 30 40 50 60 70	Gamma Sp Res Den 

Hole No. SJ 35-4 (continued)

LITHOLOGY	Strip Log	Depth Ft	Depth m	Geophysical Logs
226-234 ft Shale, light-gray, and dark-brown shale 234-244 ft Shale, light-gray, silty 244-252 ft Shale, dark-gray 252-262 ft Shale, black, carbonaceous, with thin (less than 2 ft) layers of coal 262-274 ft Shale, dark-gray 274-281 ft Shale, dark-gray, carbonaceous 281-284 ft Coal, and shaly coal 284-294 ft Shale, dark-gray, with thin (less than 2 ft) layers of coal 294-304 ft Shale, gray to dark-gray 304-323 ft Sandstone, light-gray, fine-grained, shaly, and gray shale 323-341 ft Sandstone, gray, very fine grained, shaly 341-349 ft Shale, gray, carbonaceous, with coal fragments 349-356 ft Coal 356-425 ft Shale, dark-gray, silty, with thin (less than 1 ft) layers of gray, very fine grained sandstone 425-434 ft Shale, dark-gray, and black, coaly shale 434-459 ft Coal 459-462 ft Shale, dark-gray 462-484 ft Sandstone, gray, fine-to medium-grained 484-504 ft Sandstone, gray, fine-to medium-grained, with yellow iron sulfide coating		250 300 350 400 450 500 550 600	80 90 100 110 120 130 140 150 160 170 180 190	Gamma Sp Res Den