

**D-C Pressure Case Directional**  
**PCG-K Pressure Case Gamma**



1 : 240

[illegible]

## WELL INFORMATION

MWD Run Number	100				
Date run completed	17-Apr-13				
Rig Bit Number	100				
Bit Size (in)	8.750				
Tool Nominal OD (in)	6.750				
Log Start Depth (TVD, ft)	1,078.98				
Log End Depth (TVD, ft)	7,359.00				
Drill or Wipe	Drill				
Drill/Wipe Start Date and Time	14-Apr-13 01:45				
Drill/Wipe End Date and Time	17-Apr-13 06:50				
Min Inc (deg) @ Depth (TVD, ft)	.36 @ 5,961.65				
Max Inc (deg) @ Depth (TVD, ft)	85.27 @ 7,357.98				
Bit TFA(in2) / Bit Type	.86 / PDC				
Flow Rate (gpm)	552.78				
Max AV (fpm) / CV (fpm) @ MWD	400.0 / 400.0				
Fluid Type	Fresh Water Gel				
Density (ppg) / Viscosity (spqt)	9.60 / 50.00				
Filtrate CL (ppm)	1,400.00				
pH / Fluid Loss (mptm)	9.00 / 4				
PV (cP) / YP (lbf2)	19 / 19.00				
% Solids / % Sand	8.42 / .50				
% Oil / Oil:Water Ratio	N/A / N/A				
Rm @ Measured Temp (degF)	N/A @ N/A				
Rmf @ Measured Temp (degF)	N/A @ N/A				
Rmc @ Measured Temp (degF)	N/A @ N/A				
Max Tool Temp (in) Temp (degF)	127.27 / 204.4				

Max Tool Temp (degF) / Source	167.97 / PCM				
Rm @ Max Tool Temp (degF)	N/A @ 167.97				
Lead MWD Engineer	Ryan White				
Customer Representative	Stan Walters				

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM				
Software Version	5.76				
Sub Serial Number	11404300				
Insert Serial Number	11680766				
Date and Time Initialized	13-Apr-13 17:37				
Date and Time Read	17-Apr-13 13:07				
ECMB SW Version	N/A				

### Directional Sensor Information

Tool Type	PCDC				
Distance From Bit (ft)	50.00				
Software Version	6.21				
Sub Serial Number	11404300				
Sonde Serial Number	11297574				
Sensor ID Number	N/A				
Toolface Offset (deg)	302.59				

### Gamma Ray Sensor Information

Tool Type	PCG				
Distance From Bit (ft)	53.35				
Recorded Sample Period (sec)	10				
Software Version	8.15				
Sub Serial Number	11404300				
Insert/Sonde Serial Number	11681021				

## REMARKS

1. All depths are true vertical bit depths, referenced to the driller's pipe tally and are measured from the drill floor, unless otherwise specified.
2. No depth corrections have been made for pipe stretch or compression.
3. Critical annular velocities are calculated using the "Power Law" model for water based fluids and the "Bingham Plastic" model for oil and synthetic based fluids.
4. All data presented is recorded data unless otherwise specified
5. The following smoothing parameters have been applied to the data:
 

PGRC (Corrected Gamma Ray):  
     Interval Resolution: 0.5 ft  
     Interval Distance: 0.6 ft  
     Gap Fill: 3.0 ft


ROPA (Average Rate of Penetration):  
     Interval Resolution: 0.5 ft  
     Interval Distance: 1.2 ft  
     Gap Fill : 3.0 ft
6. INSITE version 7.4.1

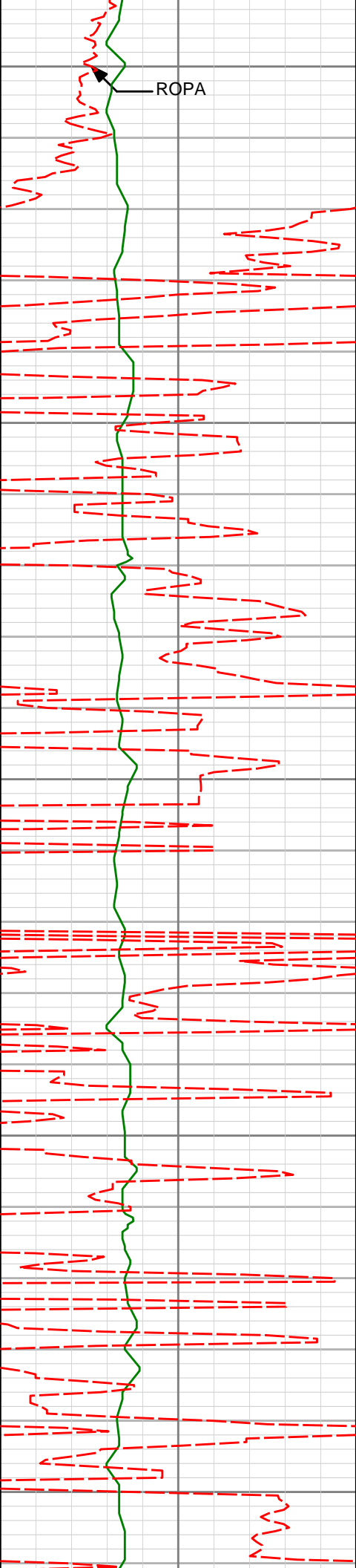
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1:240 TVD Detail Log

Gamma Ray CG (PGRC) api					
0	300				
Avg Rate of Penetration (ROPA) feet per hr		TVD ft			
500	0	Depth	Inc	Azi	TVD
					V/S
		1000			
		1050			



ROPA

1100

1150

1200

1250

1300

1171'

0.49°

349.75°

1170.97'

-7.06'

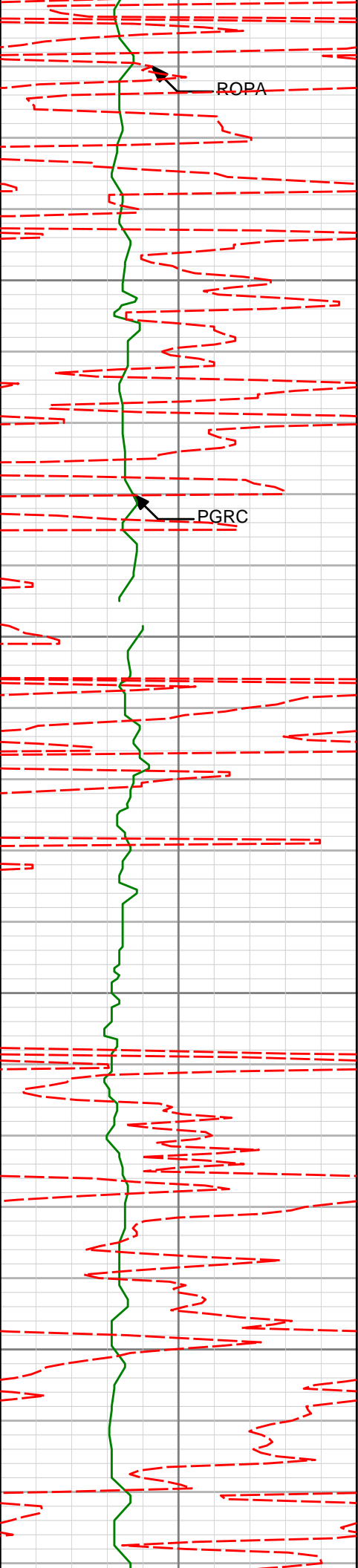
1263'

0.41°

351.13°

1262.97'

-7.76'



1350

1355'

0.62°

39.85°

1354.97'

-8.47'

1400

1450

1447'

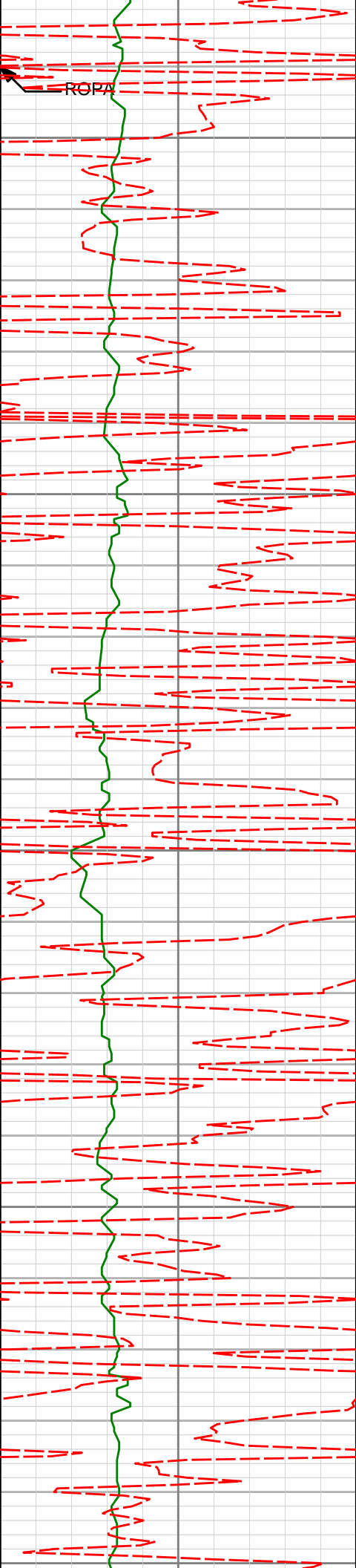
0.85°

23.21°

1446.96'

-9.48'

1500



1550

1600

1650

1700

1750

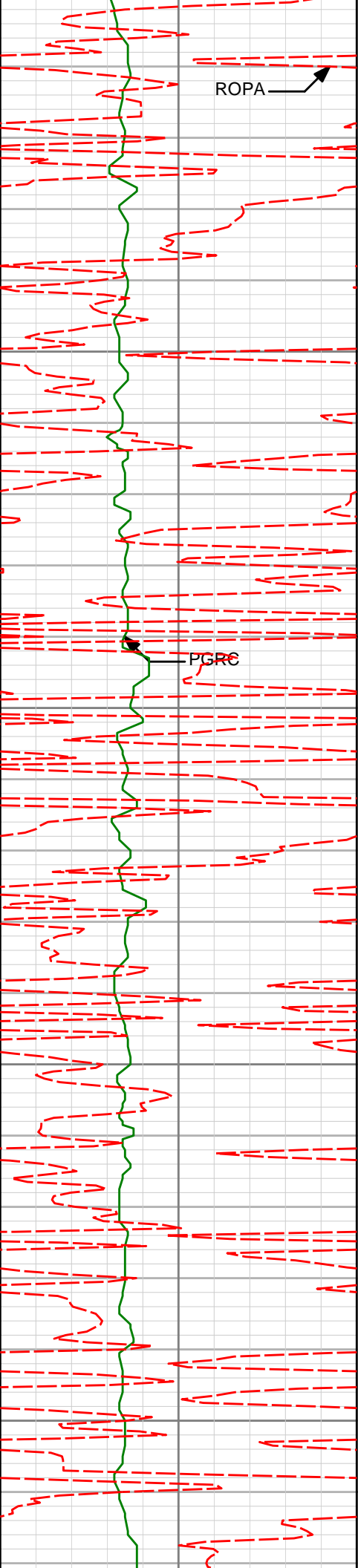
1631'

1.05°

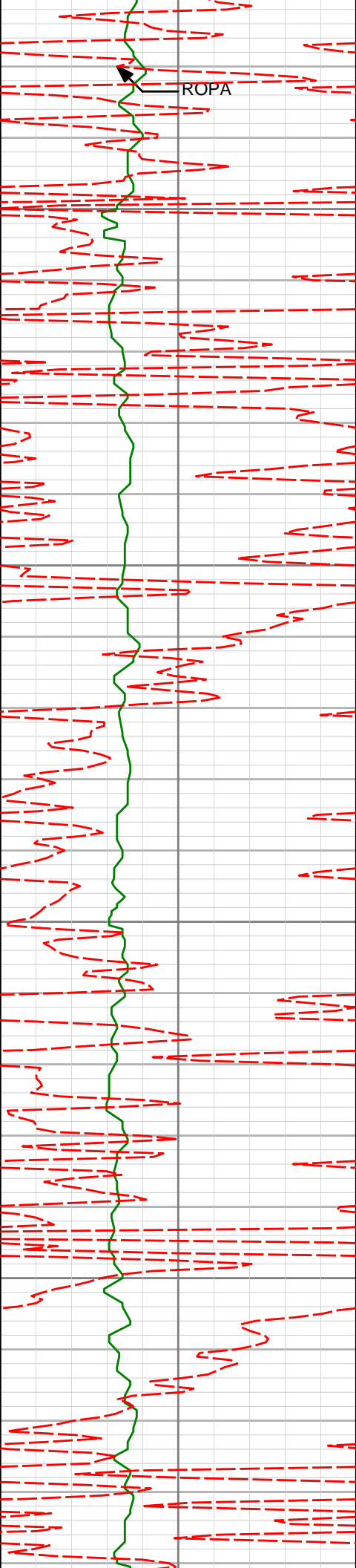
10.51°

1630.93'

-12.41'



1750					
1800					
1814'	1.59°	355.77°	1813.89'	-16.60'	
1850					
1900					
1950					



2000

2050

2100

2150

2004'

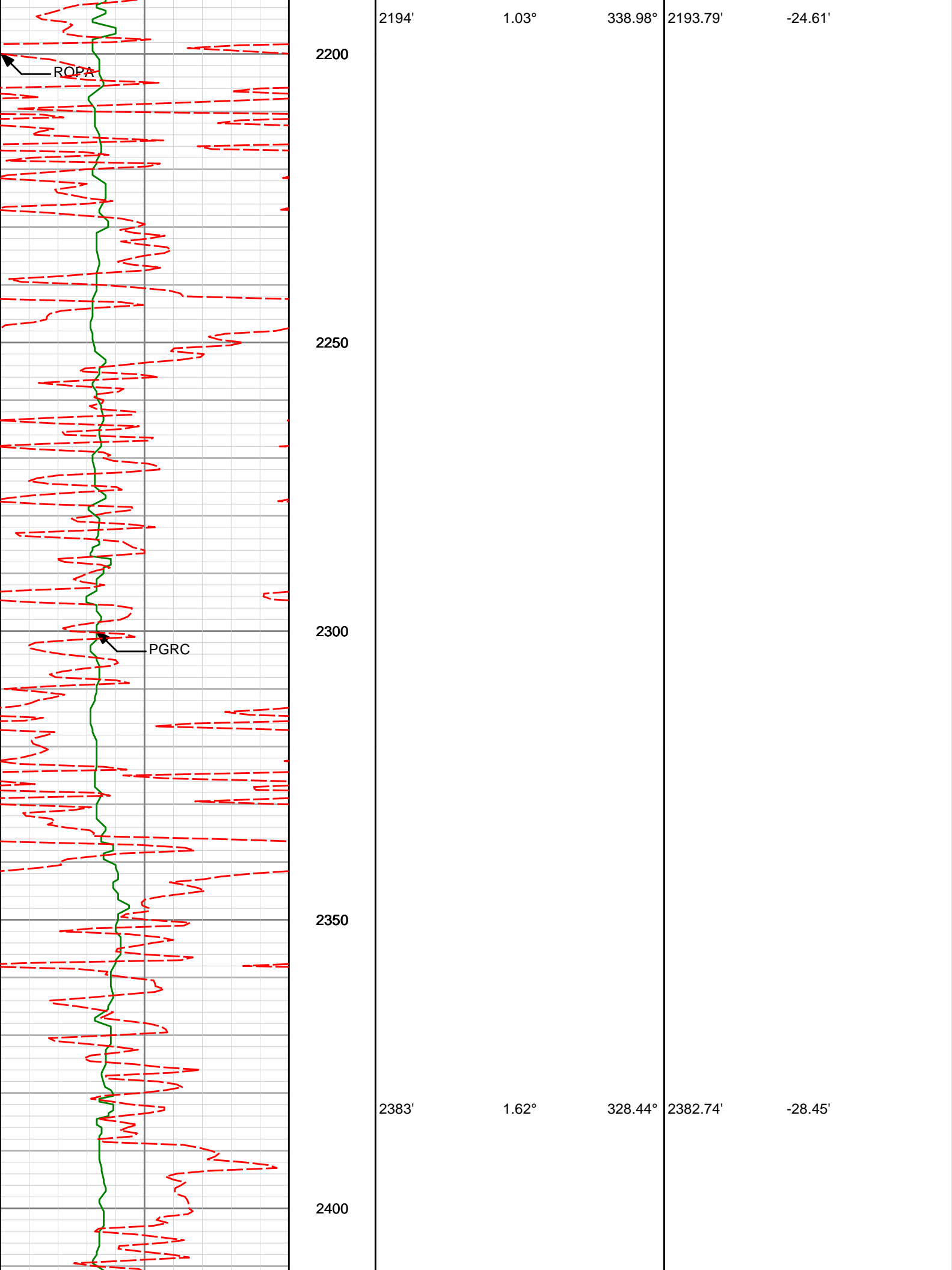
1.20°

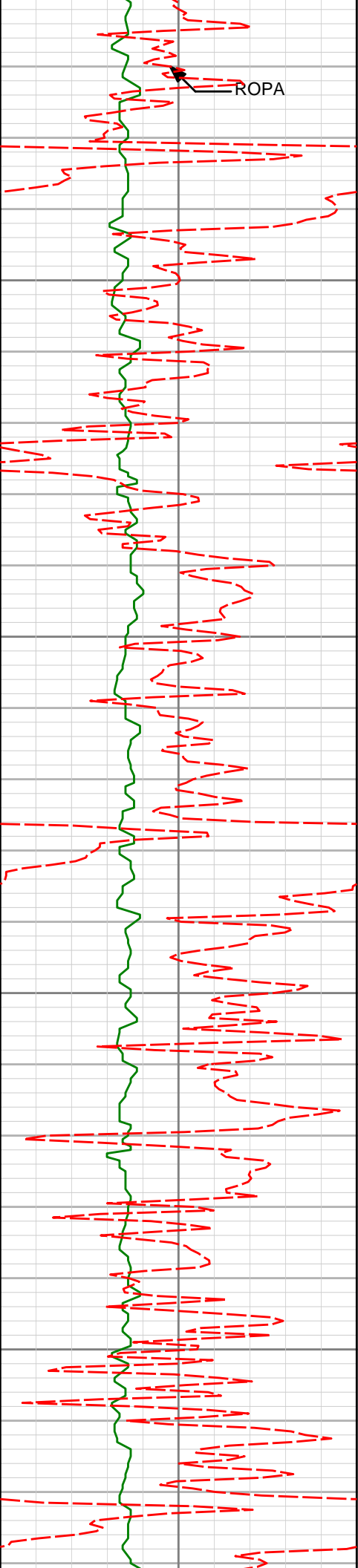
343.14°

2003.83'

-21.12'







2450

2500

2550

2600

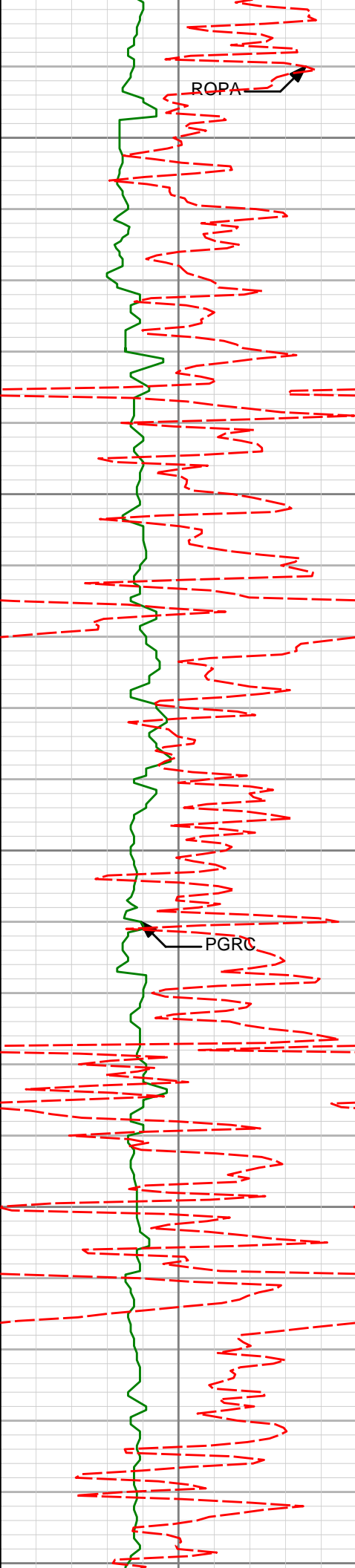
2573'

1.84°

283.54°

2572.66'

-31.39'



2650

2700

2750

2800

2850

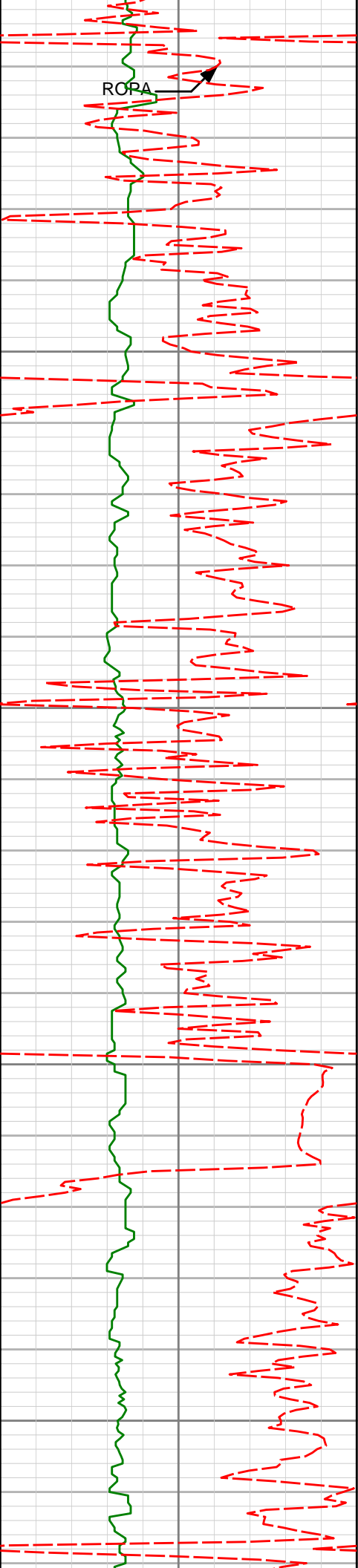
2763'

1.50°

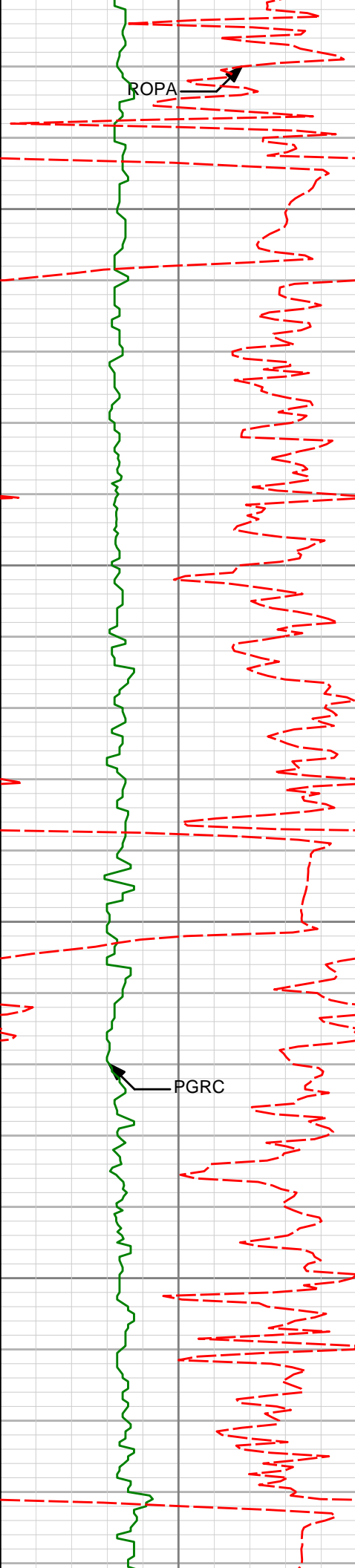
251.66°

2762.59'

-31.26'



2850					
2900					
2950	2952'	2.20°	242.91°	2951.49'	-28.76'
3000					
3050	3047'	3.18°	269.61°	3046.39'	-27.86'



3100

3150

3200

3250

3142'

4.34°

280.69°

3141.18'

-28.43'

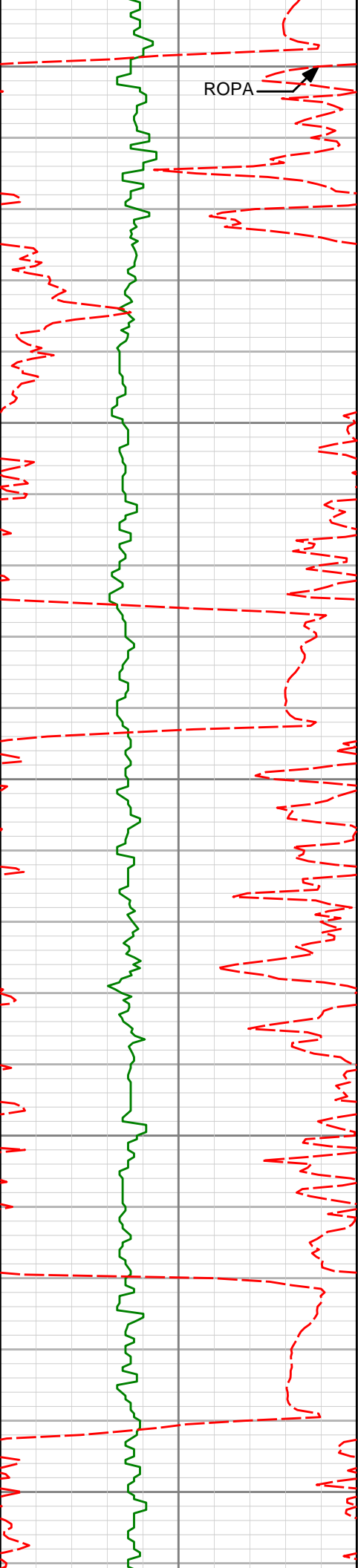
3237'

4.77°

285.49°

3235.88'

-30.06'



3300

3332'

6.30°

301.18°

3330.44'

-33.72'

3350

3400

3427'

6.58°

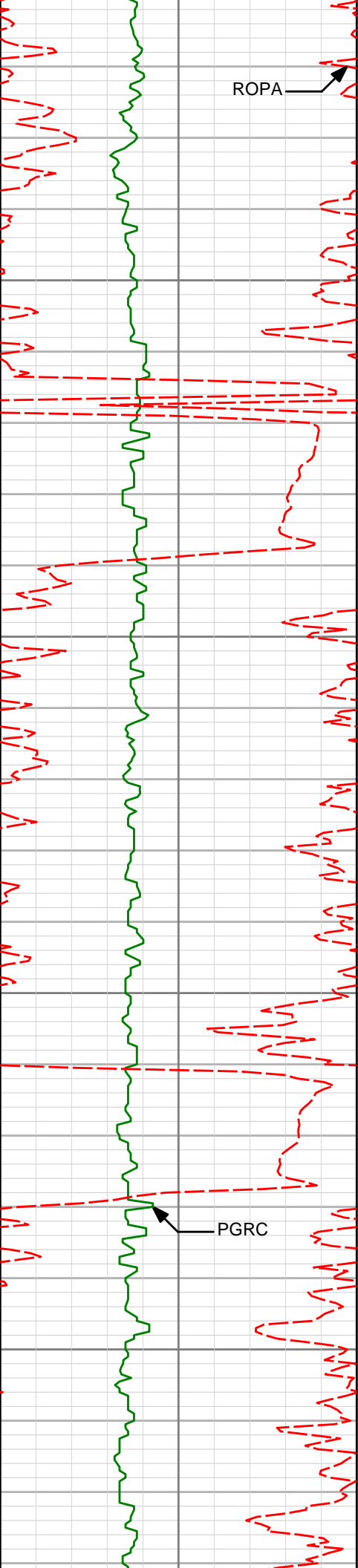
308.24°

3424.84'

-39.68'

3450

3500



3550

3600

3650

3700

3522'

7.81°

315.52°

3519.09'

-47.54'

3617'

9.43°

313.65°

3613.02'

-57.39'

3711'

9.62°

312.80°

3705.72'

-67.90'



ROPA

3750

3800

3850

3900

3950

3806'

8.21°

306.79°

3799.58'

-77.22'

3901'

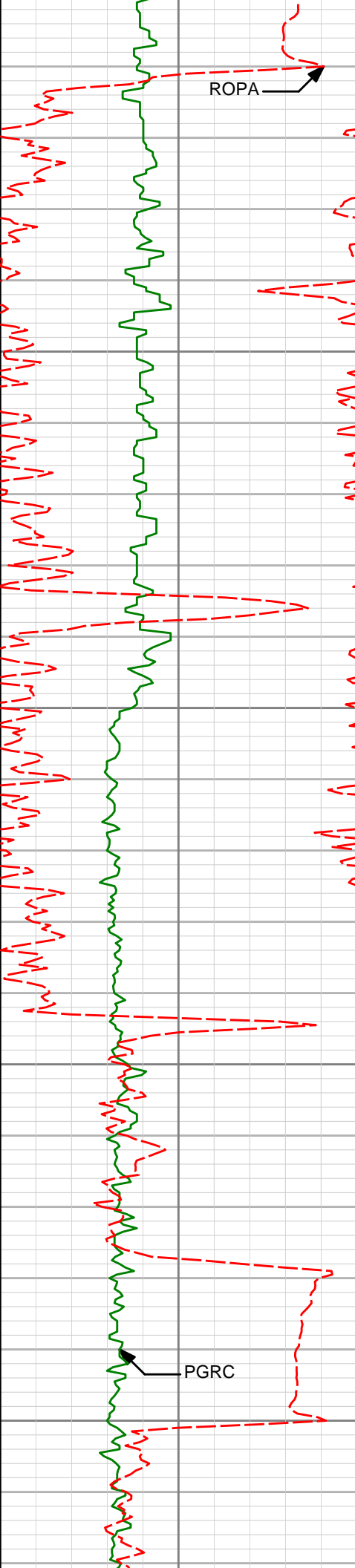
9.74°

311.36°

3893.41'

-86.45'





3996'

4000

4050

4091'

4100

4150

3996'

10.60°

307.65°

3986.92'

-96.93'

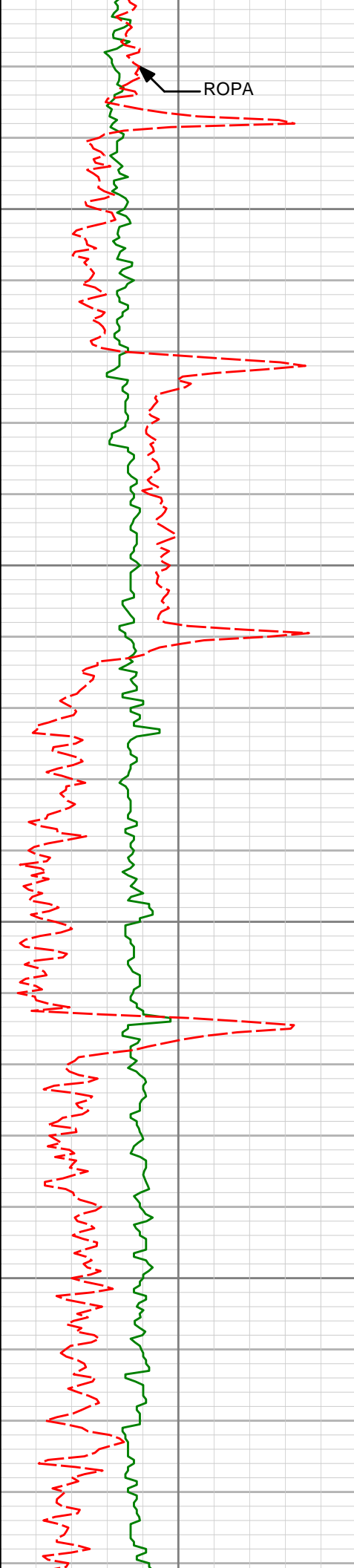
4091'

9.57°

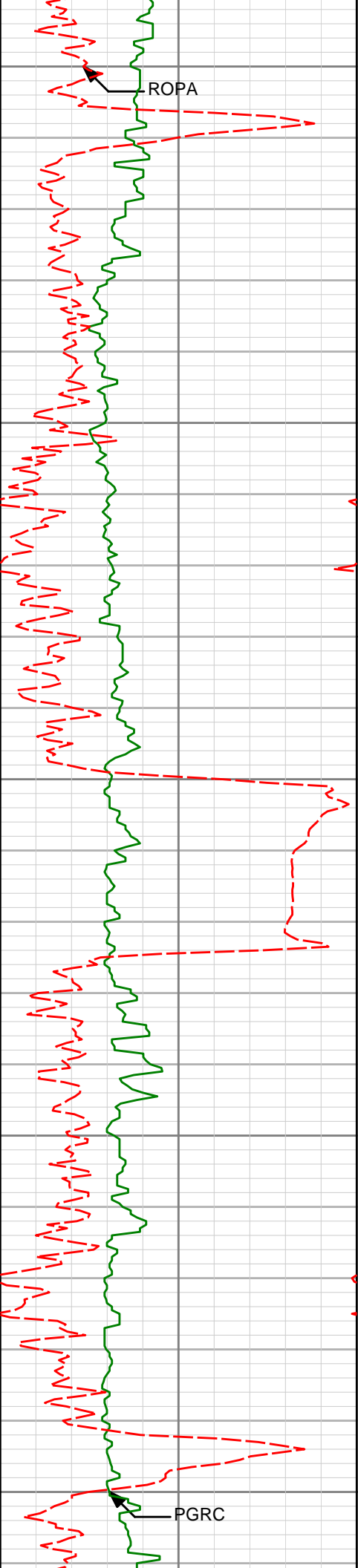
304.54°

4080.45'

-106.58'



	4186'	11.83°	305.38°	4173.79'	-116.52'
4200					
4250					
4281'	4281'	11.10°	304.05°	4266.90'	-127.09'
4300					
4350					
4375'	4375'	9.93°	304.38°	4359.32'	-136.56'



4400

ROPA

4450

4470'

9.17°

300.07°

4453.00'

-144.82'

4500

4550

4565'

10.88°

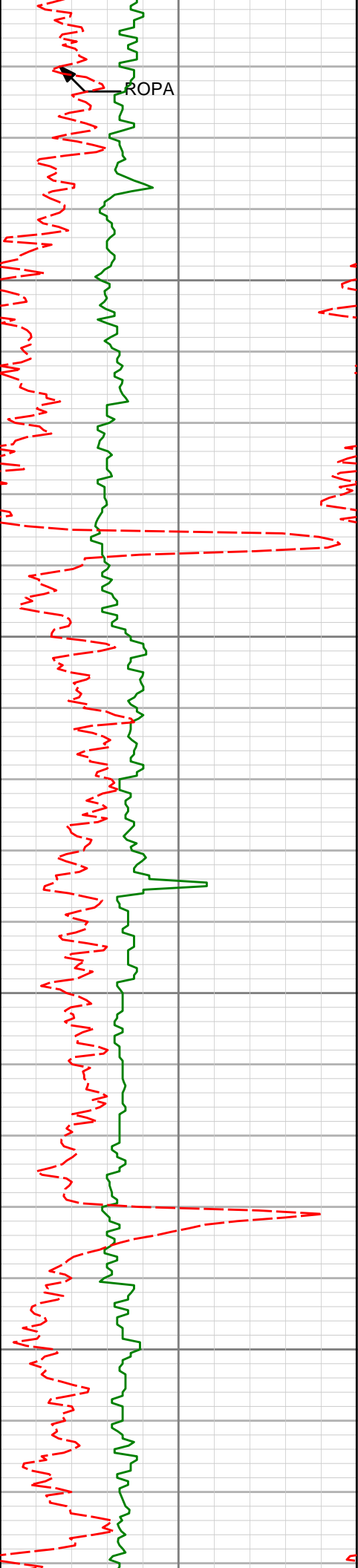
303.92°

4546.55'

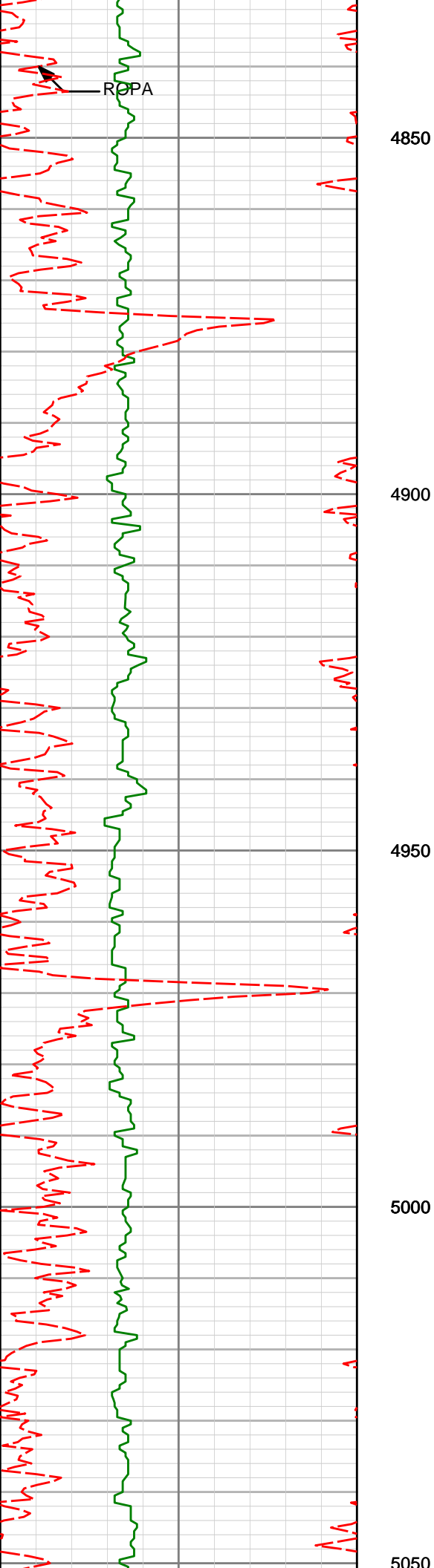
-153.44'

4600

PGRC



4660'	10.06°	302.53°	4639.97'	-162.73'
4650				
4700				
4755'	9.18°	304.03°	4733.63'	-171.27'
4750				
4800				



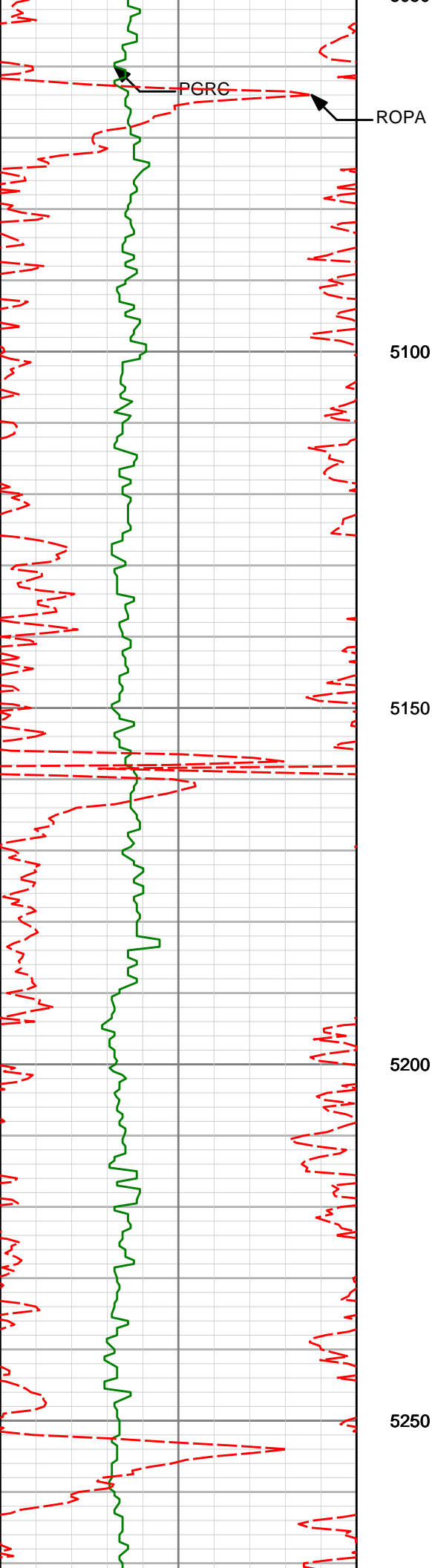
4945'

7.42°

304.99°

4921.63'

-186.50'



5134'

5.21°

316.75°

5109.48'

-199.56'

5100

5150

5200

5229'

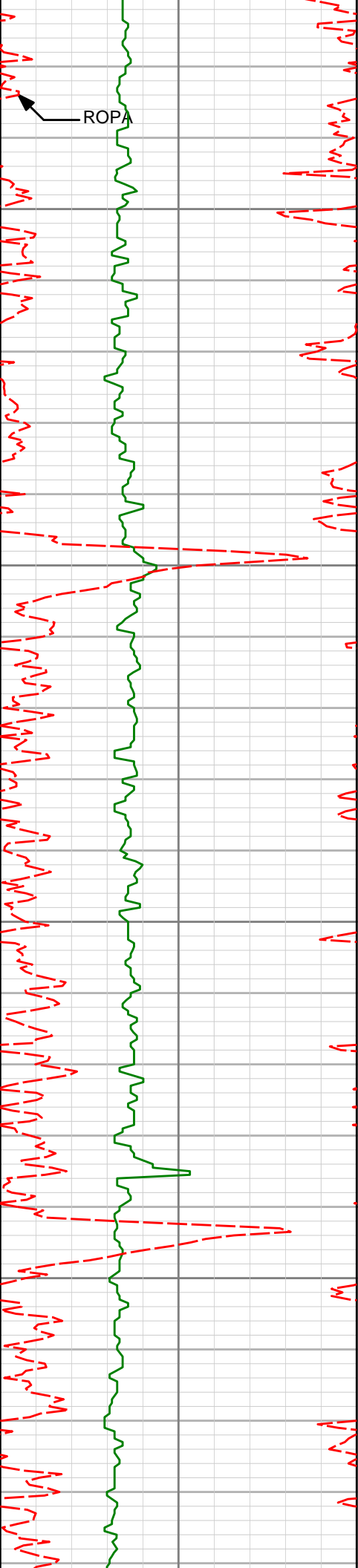
4.44°

313.55°

5204.15'

-205.17'

5250



5300

5324'

3.46°

310.65°

5298.92'

-209.51'

5350

5400

5419'

2.06°

315.49°

5393.81'

-212.55'

5450

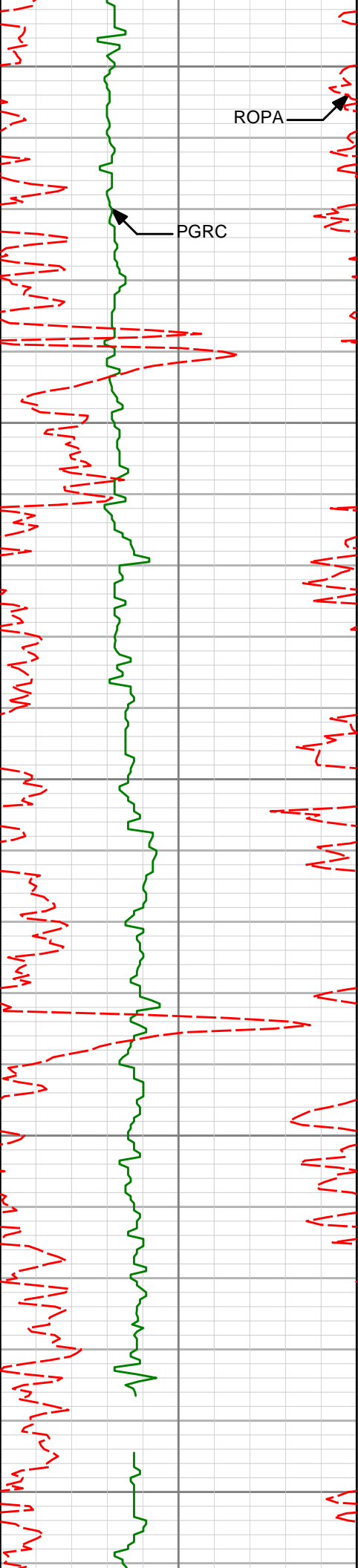
5514'

2.20°

307.66°

5488.74'

-214.84'



5500

ROPA

PGRC

5550

5608'

1.54°

297.36°

5582.69'

-216.49'

5600

5650

5703'

1.04°

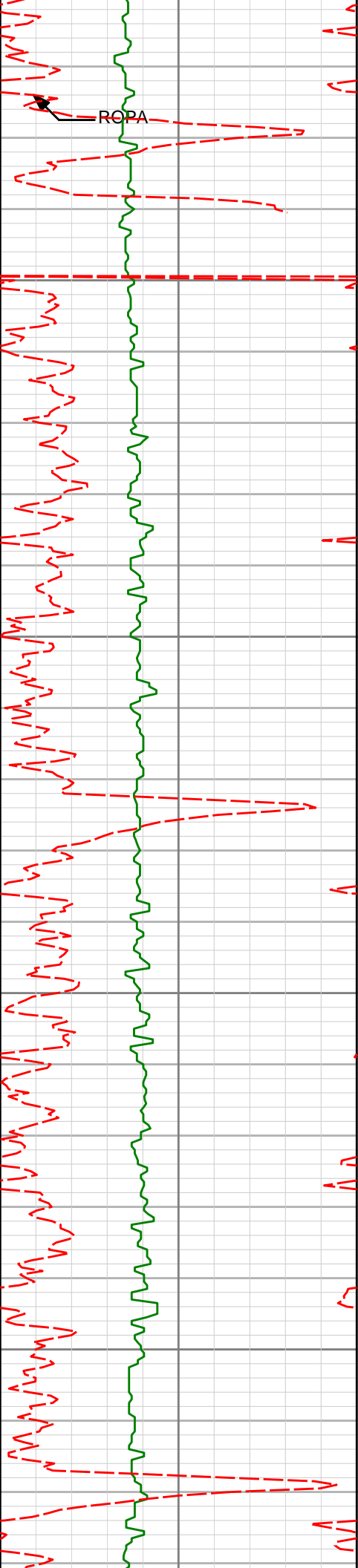
295.85°

5677.67'

-217.44'

5700





5750

5800

5850

5893'

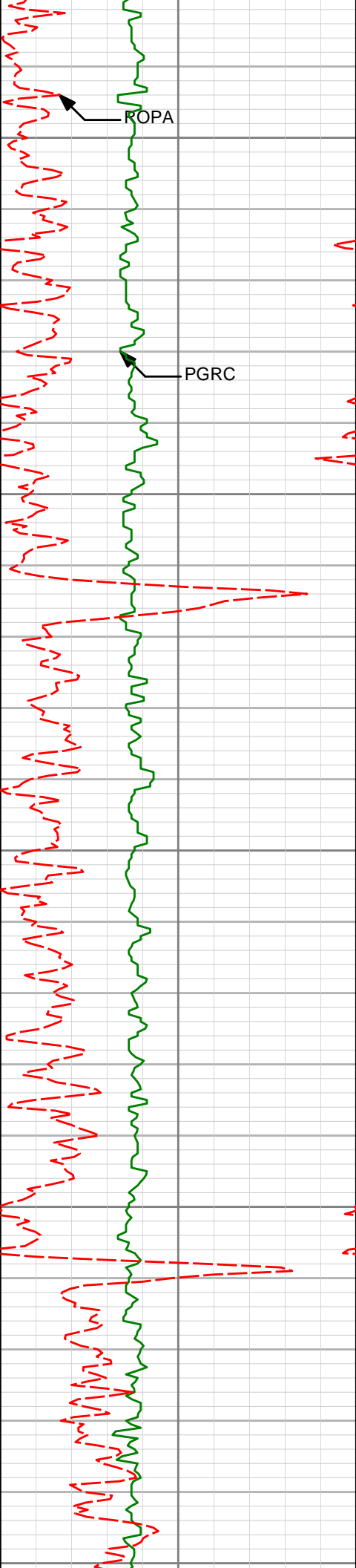
0.51°

265.88°

5867.65'

-218.10'

5900



5950

5987'

0.36°

174.23°

5961.65'

-217.77'

6000

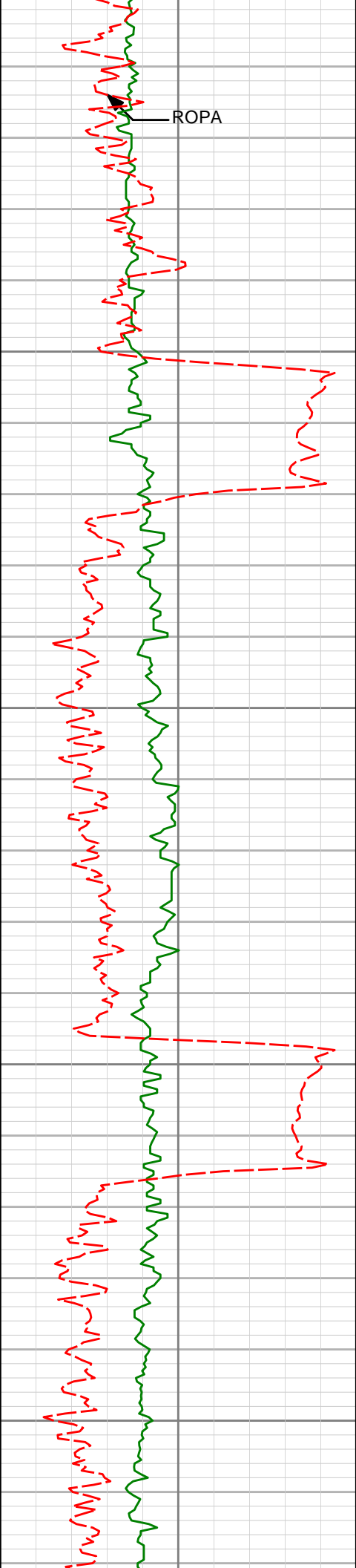
6050

6100

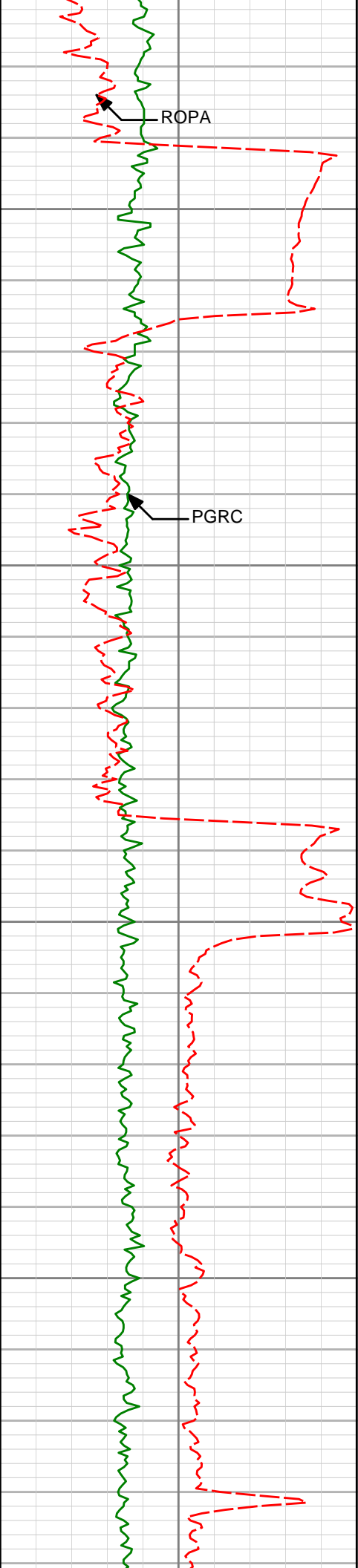
6150

ROPA

PGRC



	6177'	4.10°	95.26°	6151.48'	-216.64'
6200					
6250	6272'	3.23°	104.29°	6246.29'	-215.74'
6300					
6350	6367'	2.86°	105.56°	6341.15'	-214.51'



6400

6450

6500

6550

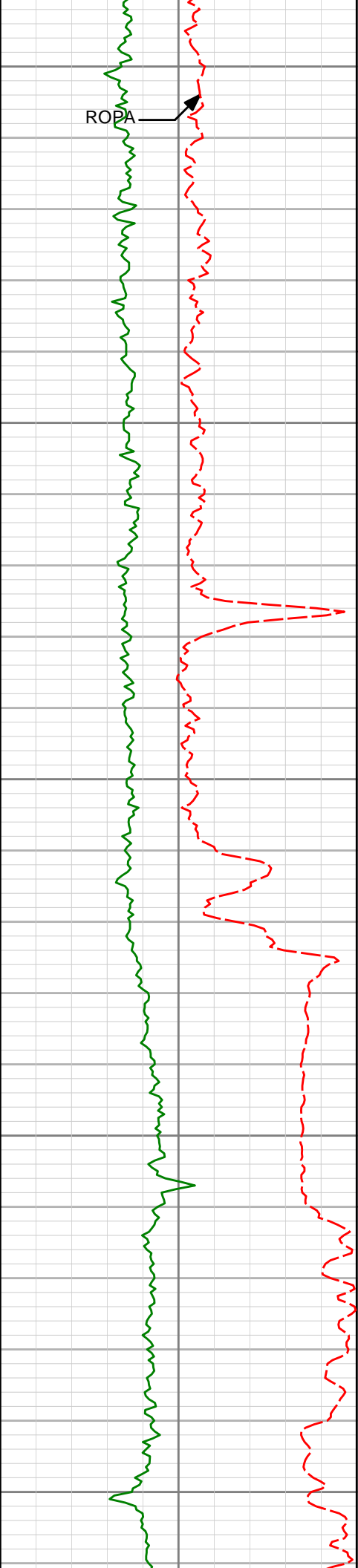
6556'

0.68°

196.82°

6530.07'

-212.21'



6600

ROPA

6650

6700

6750

6800

6651'

0.90°

216.47°

6625.06'

-211.07'

6745'

1.62°

184.13°

6719.04'

-209.15'

6777'

4.92°

180.84°

6750.98'

-207.33'

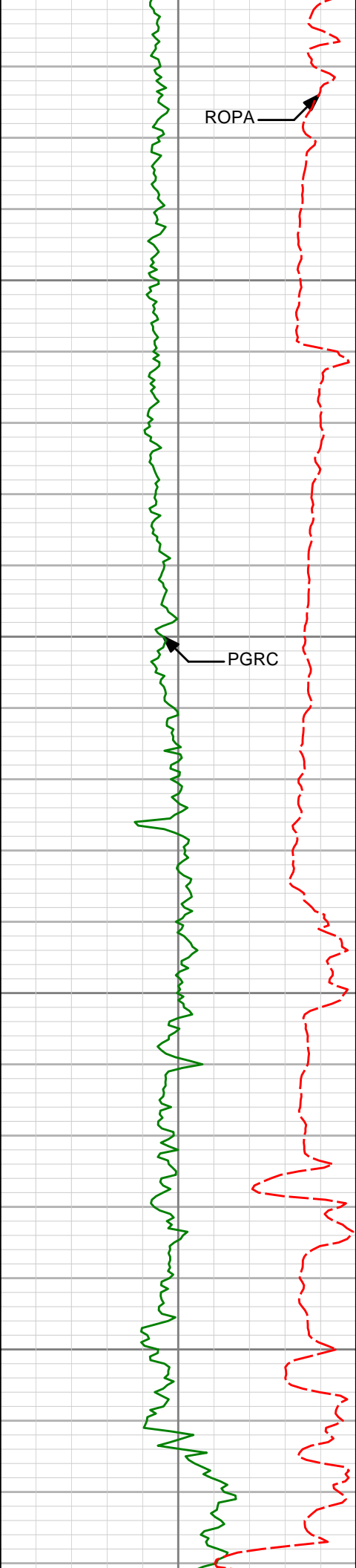
6808'

6.75°

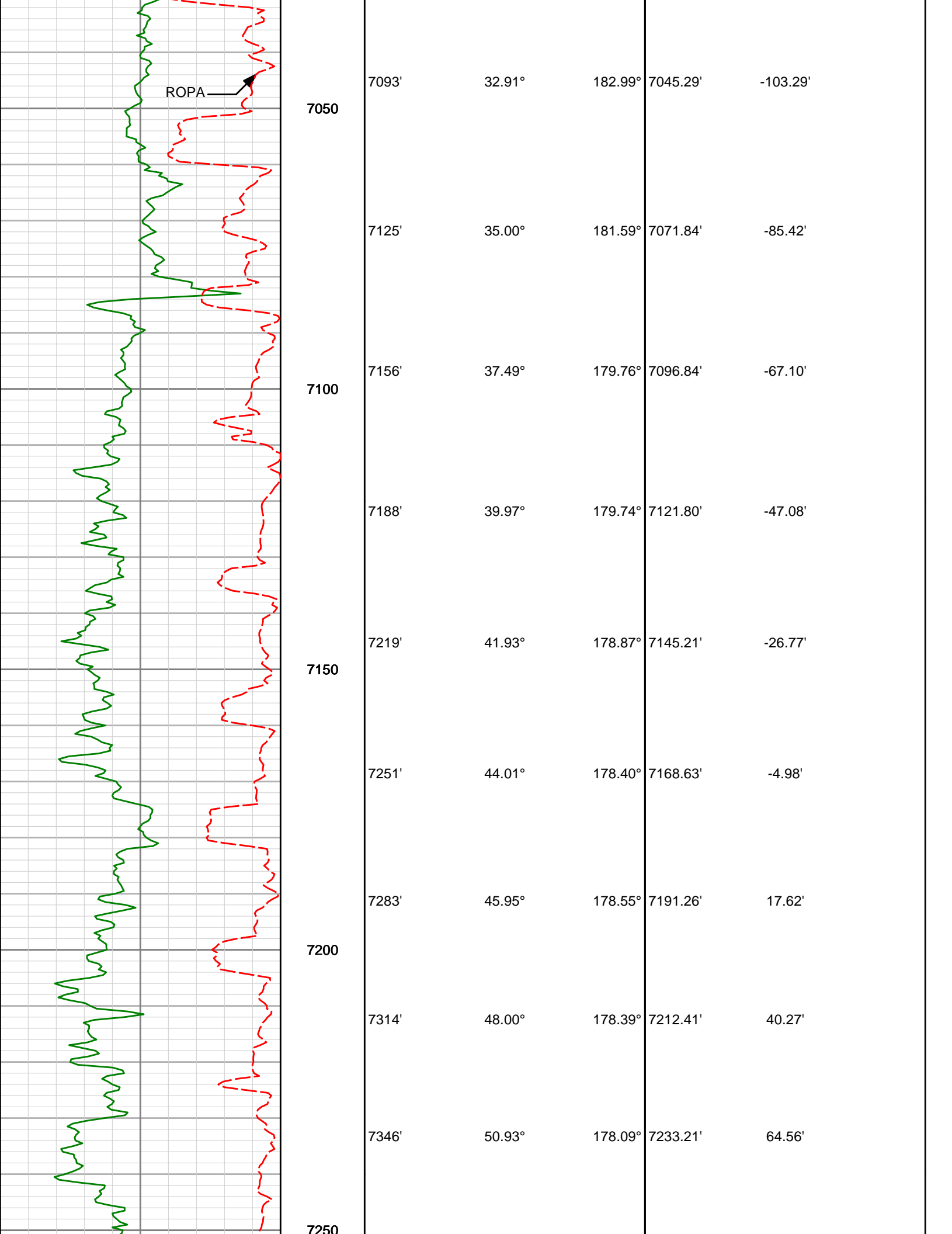
179.47°

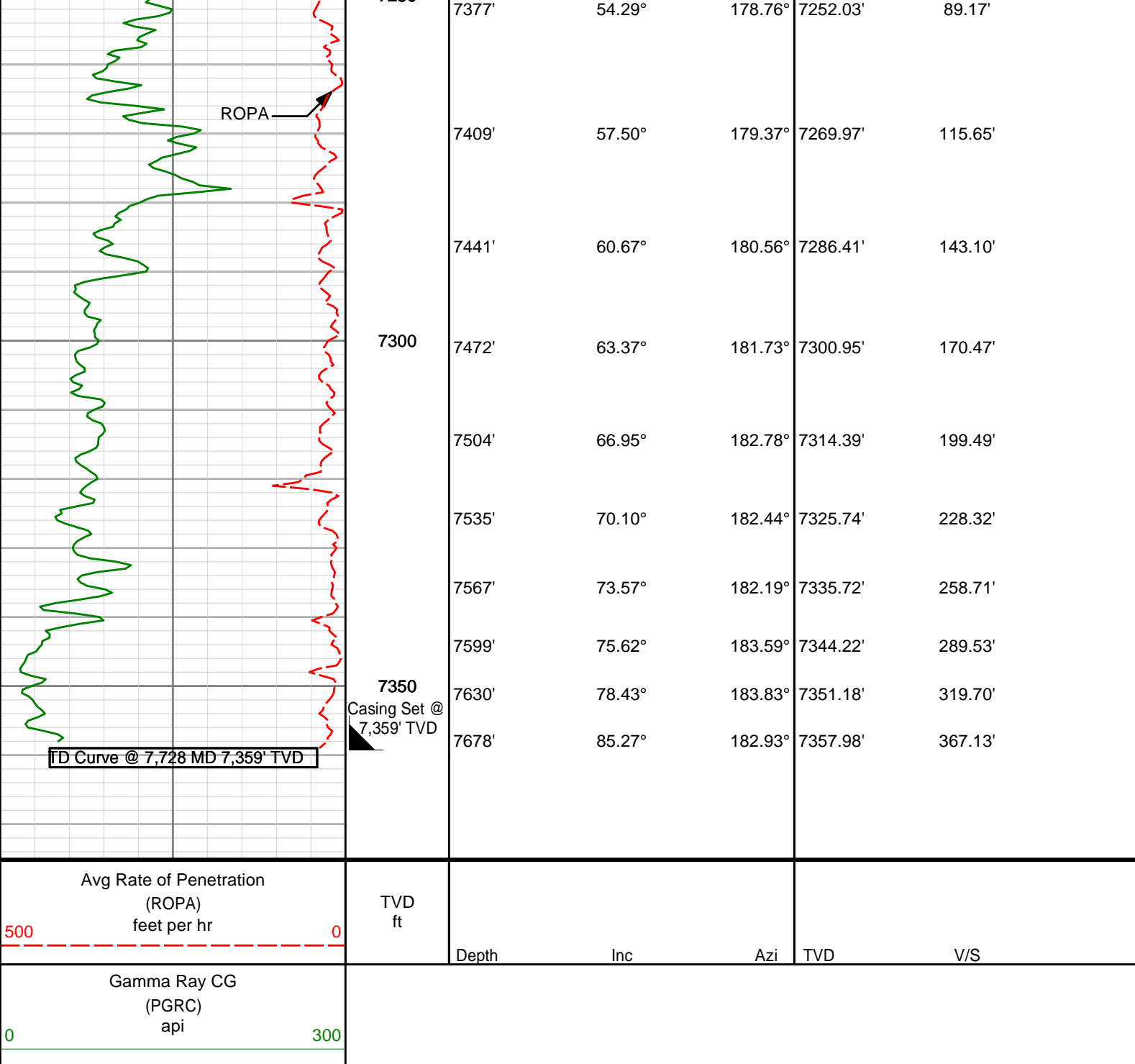
6781.82'

-204.18'



6850	6840'	9.21°	179.34°	6813.51'	-199.73'
	6872'	12.81°	180.20°	6844.92'	-193.63'
6900	6903'	16.64°	179.14°	6874.89'	-185.75'
	6935'	20.03°	180.40°	6905.26'	-175.69'
6950	6966'	23.61°	181.36°	6934.04'	-164.17'
	6998'	26.58°	182.75°	6963.01'	-150.60'
7000	7030'	29.20°	183.42°	6991.30'	-135.65'
	7061'	30.90°	185.77°	7018.13'	-120.16'





**HALLIBURTON**

## DIRECTIONAL SURVEY REPORT

Anadarko Petroleum Corp.

Crowder 15C-18HZ

Wattensburg

Weld Colorado

USA

CA-XX-0900217530

Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
975.00	0.50	34.87	974.98	5.51 N	1.76 E	-5.53	TIE-IN
1171.00	0.49	349.75	1170.97	7.03 N	2.10 E	-7.06	0.19
1263.00	0.41	351.13	1262.97	7.74 N	1.98 E	-7.76	0.09
1355.00	0.62	39.85	1354.97	8.44 N	2.25 E	-8.47	0.50



1447.00	0.85	23.21	1446.96	9.45 N	2.83 E	-9.48	0.34
1631.00	1.05	10.51	1630.93	12.36 N	3.68 E	-12.41	0.16
1814.00	1.59	355.77	1813.89	16.55 N	3.80 E	-16.60	0.35
2004.00	1.20	343.14	2003.83	21.09 N	3.03 E	-21.12	0.26
2194.00	1.03	338.98	2193.79	24.59 N	1.83 E	-24.61	0.10
2383.00	1.62	328.44	2382.74	28.45 N	0.17 W	-28.45	0.33
2573.00	1.84	283.54	2572.66	31.45 N	4.53 W	-31.39	0.70
2763.00	1.50	251.66	2762.59	31.38 N	9.86 W	-31.26	0.51
2952.00	2.20	242.91	2951.49	28.95 N	15.44 W	-28.76	0.40
3047.00	3.18	269.61	3046.39	28.10 N	19.70 W	-27.86	1.65
3142.00	4.34	280.69	3141.18	28.75 N	25.87 W	-28.43	1.43
3237.00	4.77	285.49	3235.88	30.47 N	33.21 W	-30.06	0.60
3332.00	6.30	301.18	3330.44	34.22 N	41.47 W	-33.72	2.26
3427.00	6.58	308.24	3424.84	40.29 N	50.21 W	-39.68	0.88
3522.00	7.81	315.52	3519.09	48.26 N	59.00 W	-47.54	1.61
3617.00	9.43	313.65	3613.02	58.24 N	69.16 W	-57.39	1.73
3711.00	9.62	312.80	3705.72	68.89 N	80.49 W	-67.90	0.25
3806.00	8.21	306.79	3799.58	78.34 N	91.74 W	-77.22	1.77
3901.00	9.74	311.36	3893.41	87.72 N	103.21 W	-86.45	1.77
3996.00	10.60	307.65	3986.92	98.36 N	116.15 W	-96.93	1.14
4091.00	9.57	304.54	4080.45	108.17 N	129.57 W	-106.58	1.22
4186.00	11.83	305.38	4173.79	118.29 N	144.02 W	-116.52	2.39
4281.00	11.10	304.05	4266.90	129.05 N	159.54 W	-127.09	0.82
4375.00	9.93	304.38	4359.32	138.70 N	173.73 W	-136.56	1.25
4470.00	9.17	300.07	4453.00	147.12 N	187.04 W	-144.82	1.10
4565.00	10.88	303.92	4546.55	155.91 N	201.03 W	-153.44	1.94
4660.00	10.06	302.53	4639.97	165.38 N	215.47 W	-162.73	0.90
4755.00	9.18	304.03	4733.63	174.08 N	228.74 W	-171.27	0.97
4945.00	7.42	304.99	4921.63	189.59 N	251.34 W	-186.50	0.93
5134.00	5.21	316.75	5109.48	202.84 N	267.22 W	-199.56	1.35
5229.00	4.44	313.55	5204.15	208.51 N	272.84 W	-205.17	0.86
5324.00	3.46	310.65	5298.92	212.91 N	277.68 W	-209.51	1.05
5419.00	2.06	315.49	5393.81	216.00 N	281.05 W	-212.55	1.50
5514.00	2.20	307.66	5488.74	218.32 N	283.68 W	-214.84	0.34
5608.00	1.54	297.36	5582.69	220.01 N	286.24 W	-216.49	0.78
5703.00	1.04	295.85	5677.67	220.97 N	288.15 W	-217.44	0.53
5893.00	0.51	265.88	5867.65	221.67 N	290.55 W	-218.10	0.35
5987.00	0.36	174.23	5961.65	221.35 N	290.93 W	-217.77	0.67
6177.00	4.10	95.26	6151.48	220.13 N	284.10 W	-216.64	2.13
6272.00	3.23	104.29	6246.29	219.16 N	278.12 W	-215.74	1.10
6367.00	2.86	105.56	6341.15	217.86 N	273.25 W	-214.51	0.39
6556.00	0.68	196.82	6530.07	215.52 N	269.03 W	-212.21	1.56
6651.00	0.90	216.47	6625.06	214.38 N	269.64 W	-211.07	0.36
6745.00	1.62	184.13	6719.04	212.46 N	270.17 W	-209.15	1.05
6777.00	4.92	180.84	6750.98	210.64 N	270.22 W	-207.33	10.33
6808.00	6.75	179.47	6781.82	207.49 N	270.23 W	-204.18	5.93
6840.00	9.21	179.34	6813.51	203.05 N	270.18 W	-199.73	7.69
6872.00	12.81	180.20	6844.92	196.94 N	270.16 W	-193.63	11.27
6903.00	16.64	179.14	6874.89	189.06 N	270.11 W	-185.75	12.39
6935.00	20.03	180.40	6905.26	179.00 N	270.08 W	-175.69	10.65
6966.00	23.61	181.36	6934.04	167.48 N	270.26 W	-164.17	11.62
6998.00	26.58	182.75	6963.01	153.92 N	270.76 W	-150.60	9.45
7030.00	29.20	183.42	6991.30	138.98 N	271.57 W	-135.65	8.26
7061.00	30.90	185.77	7018.13	123.50 N	272.82 W	-120.16	6.67
7093.00	32.91	182.99	7045.29	106.64 N	274.10 W	-103.29	7.76
7125.00	35.00	181.59	7071.84	88.79 N	274.81 W	-85.42	6.98
7156.00	37.49	179.76	7096.84	70.46 N	275.02 W	-67.10	8.75
7188.00	39.97	179.74	7121.80	50.45 N	274.93 W	-47.08	7.77
7219.00	41.93	178.87	7145.21	30.13 N	274.68 W	-26.77	6.56
7251.00	44.01	178.40	7168.63	8.33 N	274.16 W	-4.98	6.58
7283.00	45.95	178.55	7191.26	14.28 S	273.56 W	17.62	6.09
7314.00	48.00	178.39	7212.41	36.94 S	272.96 W	40.27	6.60
7346.00	50.93	178.09	7233.21	61.24 S	272.21 W	64.56	9.19
7377.00	54.29	178.76	7252.03	85.86 S	271.53 W	89.17	10.99
7409.00	57.50	179.37	7269.97	112.34 S	271.10 W	115.65	10.14
7441.00	60.67	180.56	7286.41	139.79 S	271.09 W	143.10	10.43
7472.00	63.37	181.73	7300.95	167.16 S	271.64 W	170.47	9.32
7504.00	66.95	182.78	7314.39	196.17 S	272.79 W	199.49	11.57
7535.00	70.10	182.44	7325.74	224.99 S	274.10 W	228.32	10.23
7567.00	73.57	182.19	7335.72	255.36 S	275.32 W	258.71	10.84
7599.00	75.62	183.59	7344.22	286.17 S	276.88 W	289.53	7.67

7630.00	78.43	183.83	7351.18	316.31 S	278.84 W	319.70	9.10
7678.00	85.27	182.93	7357.98	363.72 S	281.64 W	367.13	14.37

CALCULATION BASED ON MINIMUM CURVATURE METHOD

SURVEY COORDINATES RELATIVE TO WELL SYSTEM REFERENCE POINT  
TVD VALUES GIVEN RELATIVE TO DRILLING MEASUREMENT POINT

VERTICAL SECTION RELATIVE TO WELL HEAD  
VERTICAL SECTION IS COMPUTED ALONG A DIRECTION OF 180.70 DEGREES (TRUE)  
A TOTAL CORRECTION OF 8.62 DEG FROM MAGNETIC NORTH TO TRUE NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 7678.00 FEET  
IS 460.01 FEET ALONG 217.75 DEGREES (TRUE)

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