

**D-C Pressure Case Directional**



1 : 240

[illegible]

## WELL INFORMATION

MWD Run Number	100				
Date run completed	17-Mar-13				
Rig Bit Number	0100				
Bit Size (in)	8.750				
Tool Nominal OD (in)	6.750				
Log Start Depth (TVD, ft)	1,083.97				
Log End Depth (TVD, ft)	7,189.43				
Drill or Wipe	Drill				
Drill/Wipe Start Date and Time	14-Mar-13 14:00				
Drill/Wipe End Date and Time	17-Mar-13 11:20				
Min Inc (deg) @ Depth (TVD, ft)	.10 @ 1,171.97				
Max Inc (deg) @ Depth (TVD, ft)	86.94 @ 7,189.18				
Bit TFA(in2) / Bit Type	.86 / PDC				
Flow Rate (gpm)	490.00				
Max AV (fpm) / CV (fpm) @ MWD	441.0 / N/A				
Fluid Type	Fresh Water Gel				
Density (ppg) / Viscosity (spqt)	9.70 / 38.50				
Filtrate CL (ppm)	1,700.00				
pH / Fluid Loss (mptm)	8.20 / 5				
PV (cP) / YP (lbf2)	14 / 11.00				
% Solids / % Sand	7.41 / .1				
% 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	177.84 / 350.0				

Max Tool Temp (degF) / Source	177.64 / PCM				
Rm @ Max Tool Temp (degF)	N/A @ 177.64				
Lead MWD Engineer	Ryan White				
Customer Representative	Travis Laurence				

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM				
Software Version	5.76				
Sub Serial Number	11331929				
Insert Serial Number	11680744				
Date and Time Initialized	12-Mar-13 14:59				
Date and Time Read	18-Mar-13 13:36				
ECMB SW Version	N/A				

### Directional Sensor Information

Tool Type	PCDC				
Distance From Bit (ft)	50.00				
Software Version	6.21				
Sub Serial Number	11331929				
Sonde Serial Number	11062125				
Sensor ID Number	N/A				
Toolface Offset (deg)	154.44				

### Gamma Ray Sensor Information

Tool Type	PCG				
Distance From Bit (ft)	52.69				
Recorded Sample Period (sec)	10				
Software Version	8.15				
Sub Serial Number	11331929				
Insert/Sonde Serial Number	11293276				

## 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

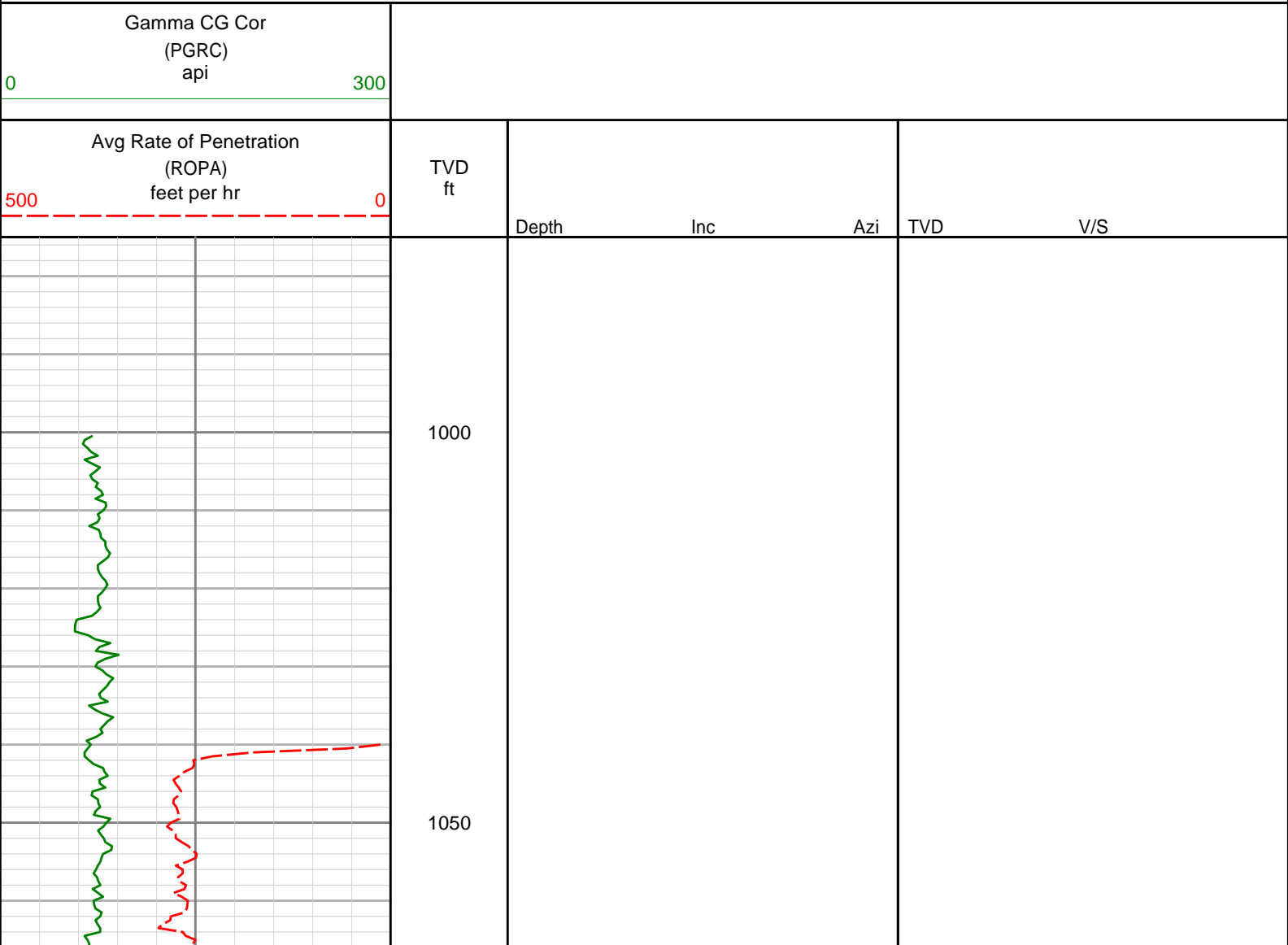
6. INSITE version 7.4.1

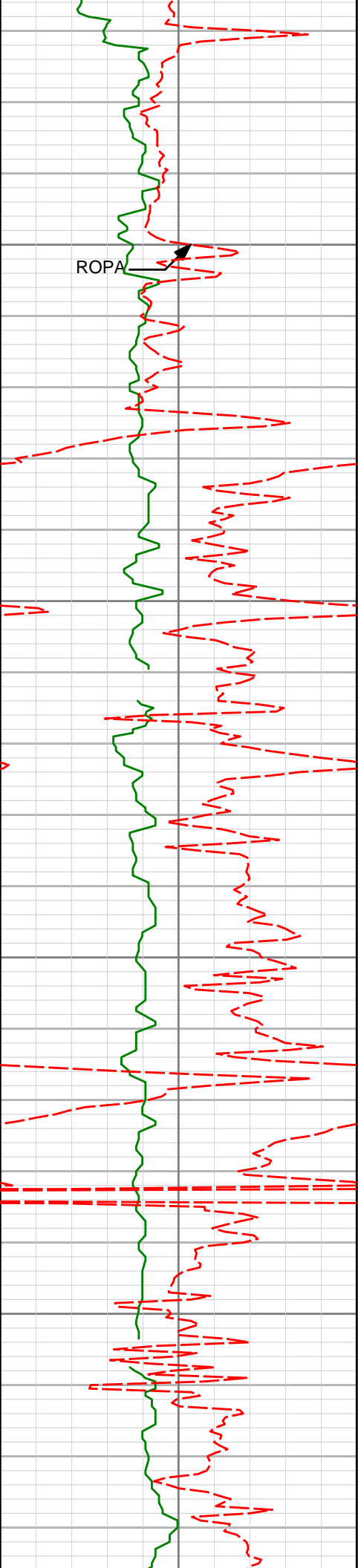
WARRANTY

HALLIBURTON WILL USE ITS BEST EFFORTS TO FURNISH CUSTOMERS WITH ACCURATE INFORMATION AND INTERPRETATIONS THAT ARE PART OF, AND INCIDENT TO, THE SERVICES PROVIDED. HOWEVER, HALLIBURTON CANNOT AND DOES NOT WARRANT THE ACCURACY OR CORRECTNESS OF SUCH INFORMATION AND INTERPRETATIONS. UNDER NO CIRCUMSTANCES SHOULD ANY SUCH INFORMATION OR INTERPRETATION BE RELIED UPON AS THE SOLE BASIS FOR ANY DRILLING, COMPLETION, PRODUCTION, OR FINANCIAL DECISION OR ANY PROCEDURE INVOLVING ANY RISK TO THE SAFETY OF ANY DRILLING VENTURE, DRILLING RIG OR ITS CREW OR ANY OTHER THIRD PARTY. THE CUSTOMER HAS FULL RESPONSIBILITY FOR ALL DRILLING, COMPLETION AND PRODUCTION OPERATION. HALLIBURTON MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO THE SERVICES RENDERED. IN NO EVENT WILL HALLIBURTON BE LIABLE FOR FAILURE TO OBTAIN ANY PARTICULAR RESULTS OR FOR ANY DAMAGES, INCLUDING, BUT NOT LIMITED TO, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, RESULTING FROM THE USE OF ANY INFORMATION OR INTERPRETATION PROVIDED BY HALLIBURTON.

HALLIBURTON

1:240 TVD Detail Log





ROPA

1100

1150

1200

1250

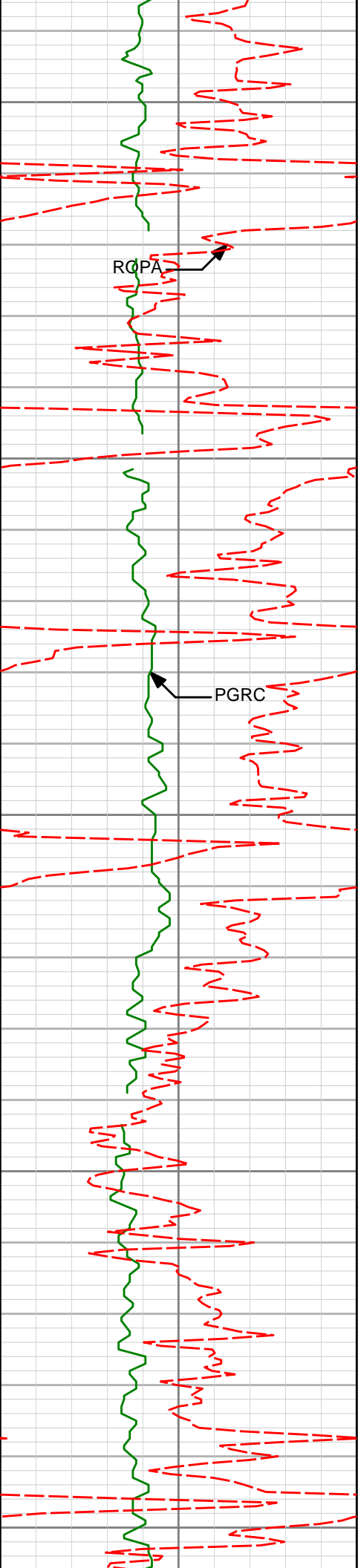
1172'

0.10°

301.06°

1171.97'

-7.63'



1300

1350

1400

1450

1500

1295'

0.25°

303.21°

1294.97'

-7.83'

1356'

0.86°

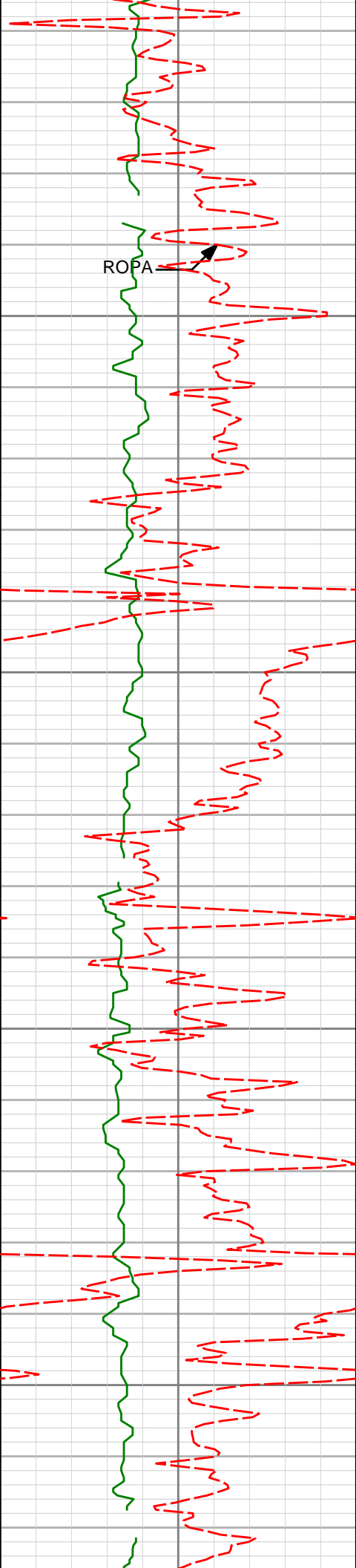
129.19°

1355.97'

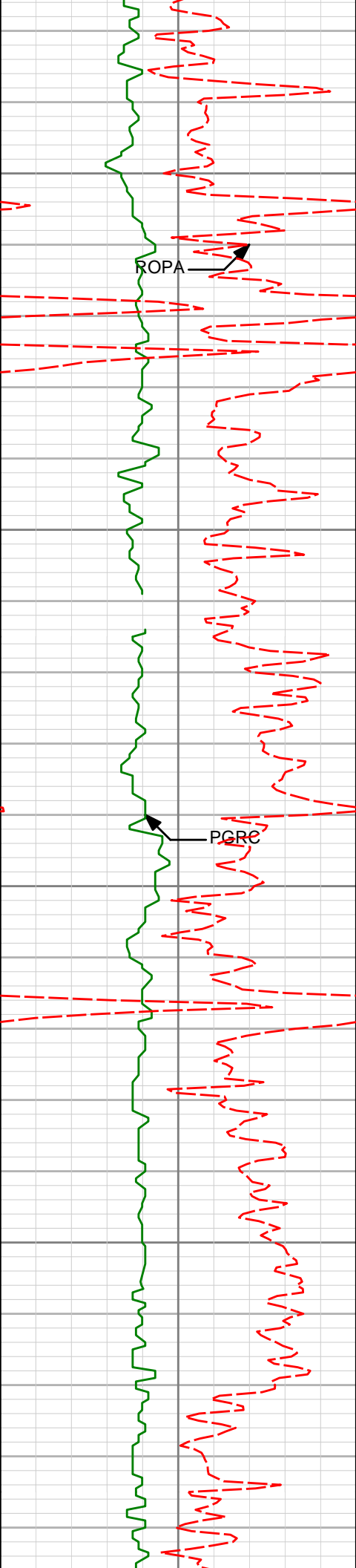
-7.61'

RQPA

PGRC



1540'	1.49°	128.16°	1539.93'	-5.22'
1550				
1600				
1650				
1700				
1724'	1.34°	125.48°	1723.87'	-2.44'



1750

1800

1850

1900

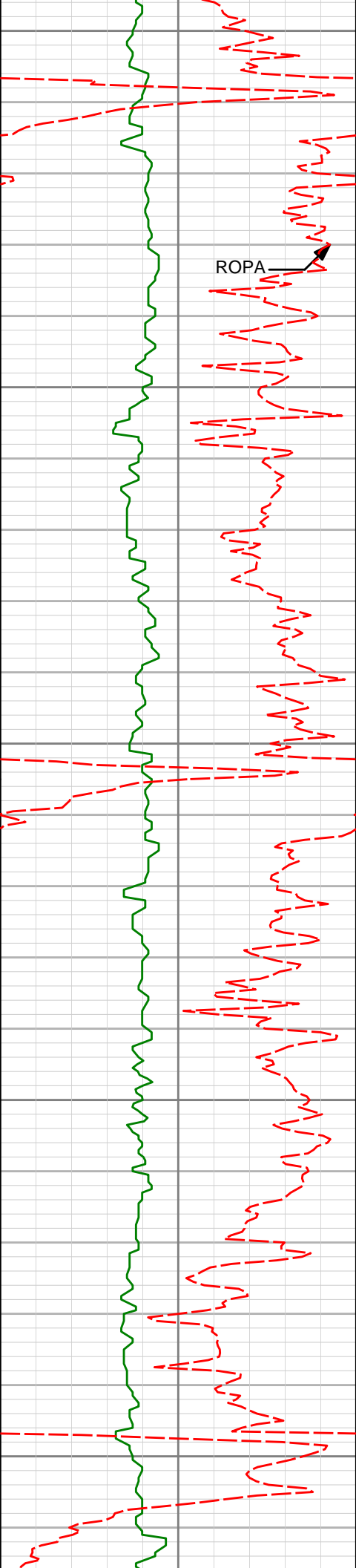
1908'

1.11°

125.43°

1907.83'

-0.10'



1950

2000

2050

2100

2150

2002'

0.98°

108.20°

2001.81'

0.70'

2097'

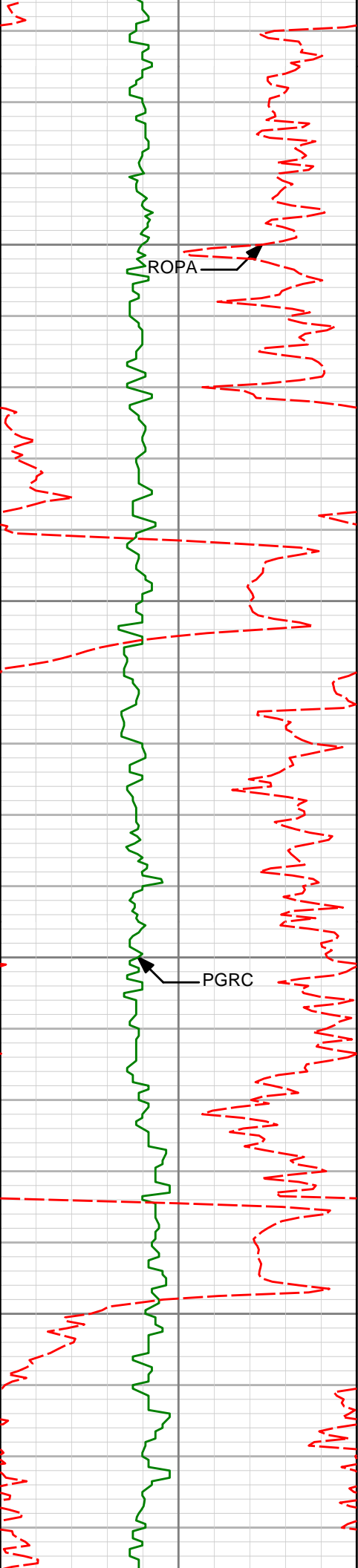
1.18°

91.16°

2096.80'

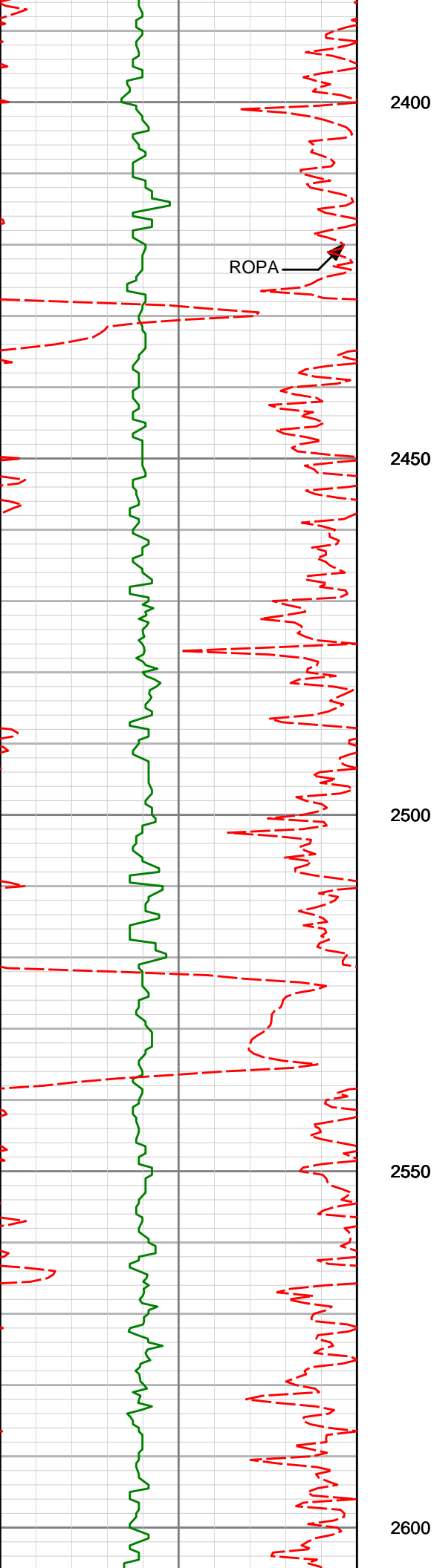
1.01'





ROPA

PGRC



2475'

4.56°

102.41°

2474.14'

8.11'

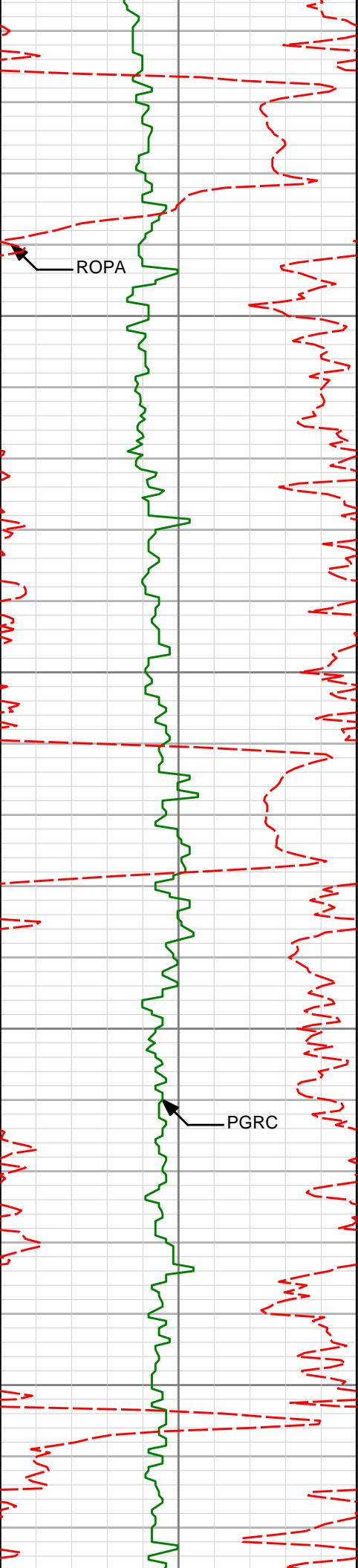
2570'

5.67°

93.14°

2568.76'

9.32'



2650

2664'

7.05°

91.38°

2662.18'

9.89'

2700

2750

2759'

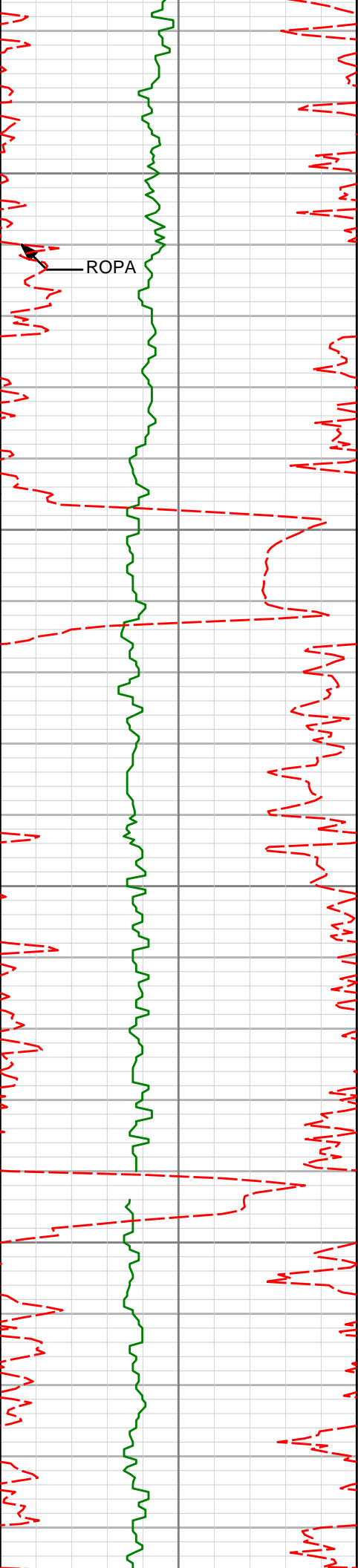
8.88°

83.28°

2756.26'

9.39'

2800



2850	2854'	7.88°	81.17°	2850.25'	7.76'
------	-------	-------	--------	----------	-------

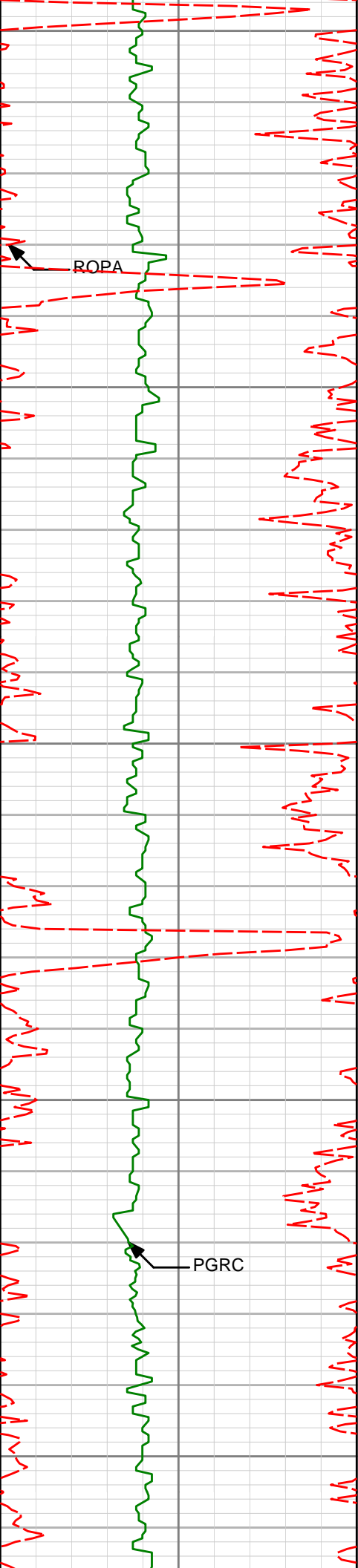
2900

2949'	9.44°	81.34°	2944.16'	5.83'
-------	-------	--------	----------	-------

2950

3000

3043'	8.79°	78.86°	3036.97'	3.53'
-------	-------	--------	----------	-------



3050

3100

3150

3200

3250

ROPA

PGRC

3138'

8.18°

74.47°

3130.93'

0.55'

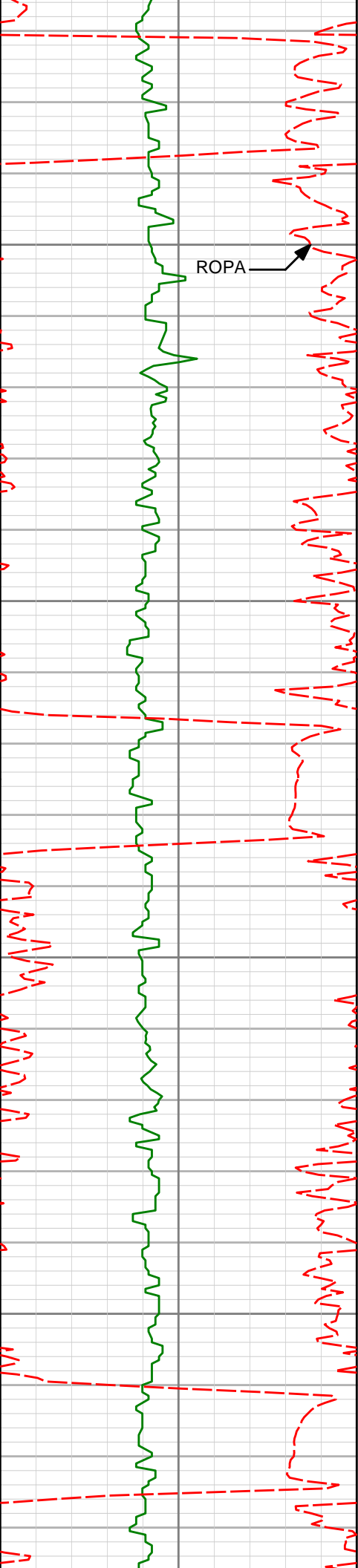
3233'

7.48°

71.46°

3225.05'

-3.01'



ROPA

3300

3350

3400

3450

3327'

6.06°

74.64°

3318.39'

-6.10'

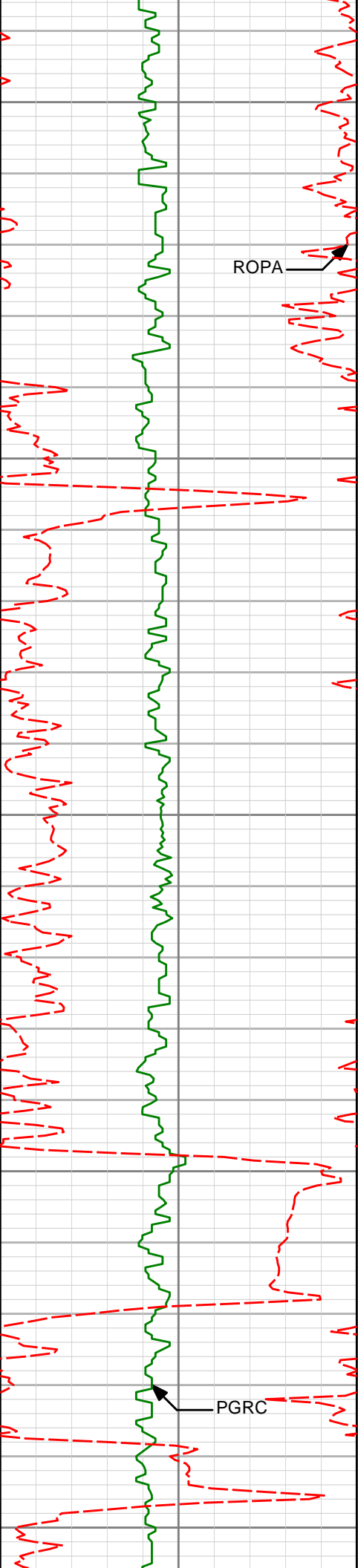
3422'

7.09°

86.40°

3412.77'

-7.61'



3500

3517'

7.21°

98.46°

3507.04'

-6.90'

ROPA

3550

3600

3611'

6.63°

92.66°

3600.35'

-5.59'

3650

PGRC

3706'

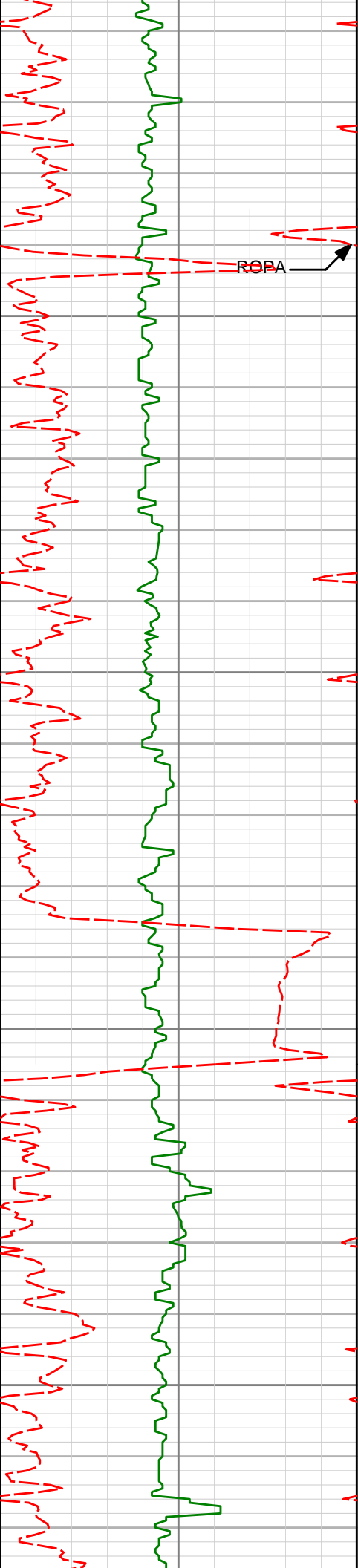
8.30°

97.77°

3694.54'

-4.20'

3700



3750

3801'

7.69°

92.60°

3788.62'

-2.76'

3800

3850

3896'

9.24°

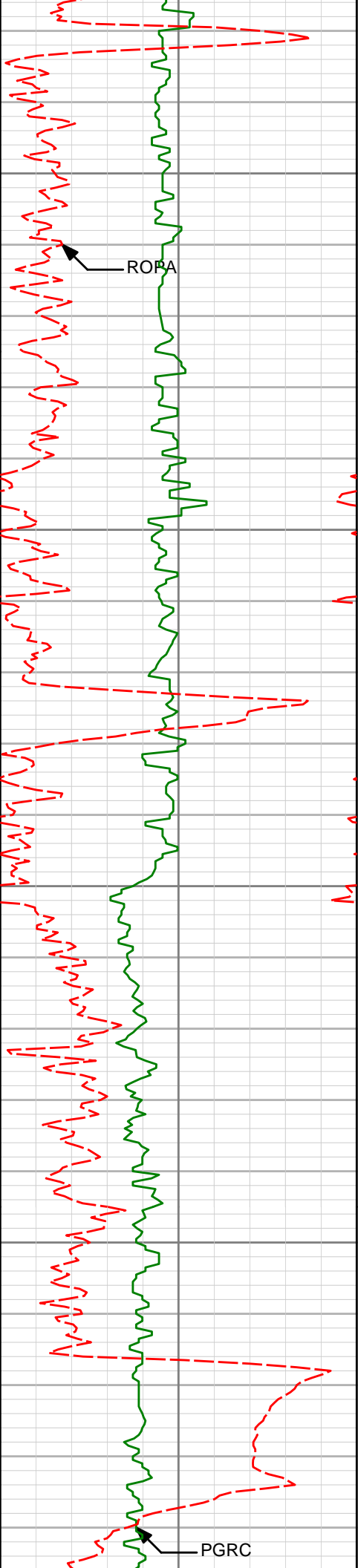
88.19°

3882.58'

-2.48'

3900





3950

3990'

8.41°

81.05°

3975.47'

-3.54'

4000

4050

4085'

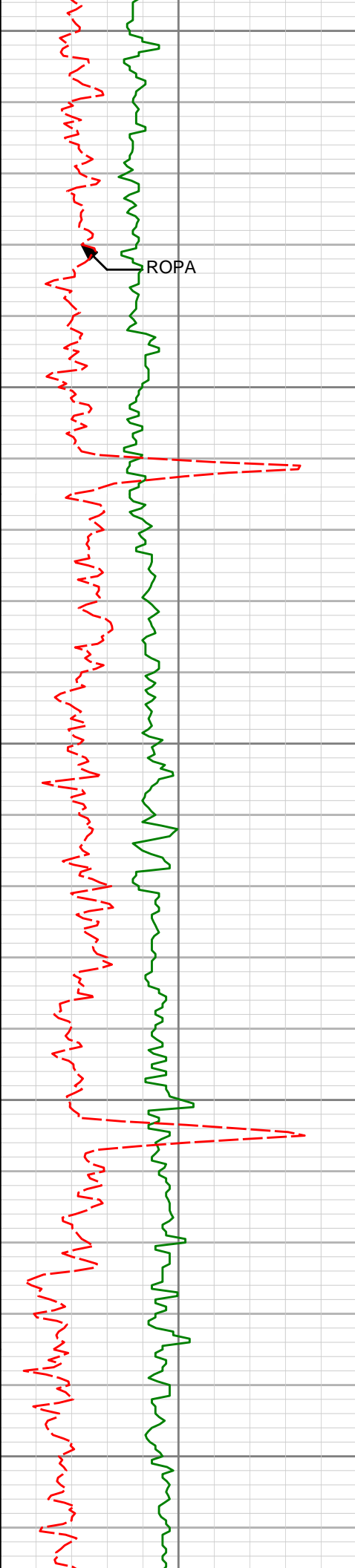
7.96°

78.36°

4069.50'

-5.72'

4100



4150

4179'

9.62°

92.49°

4162.41'

-6.45'

4200

4250

4274'

10.11°

91.05°

4256.01'

-5.68'

4300

4350

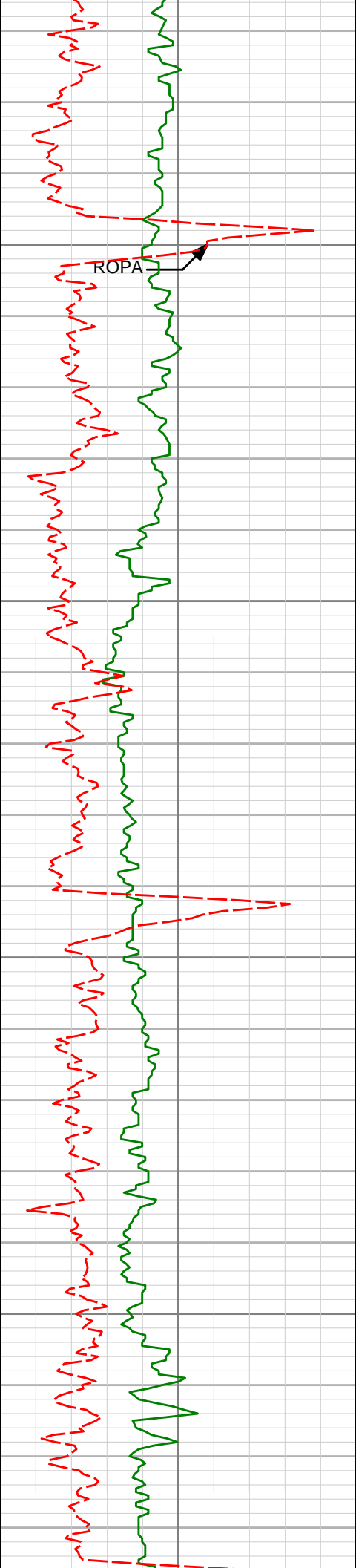
4369'

9.66°

86.96°

4349.60'

-5.68'



4400

4463'

8.06°

81.95°

4442.47'

-6.77'

4450

4500

4558'

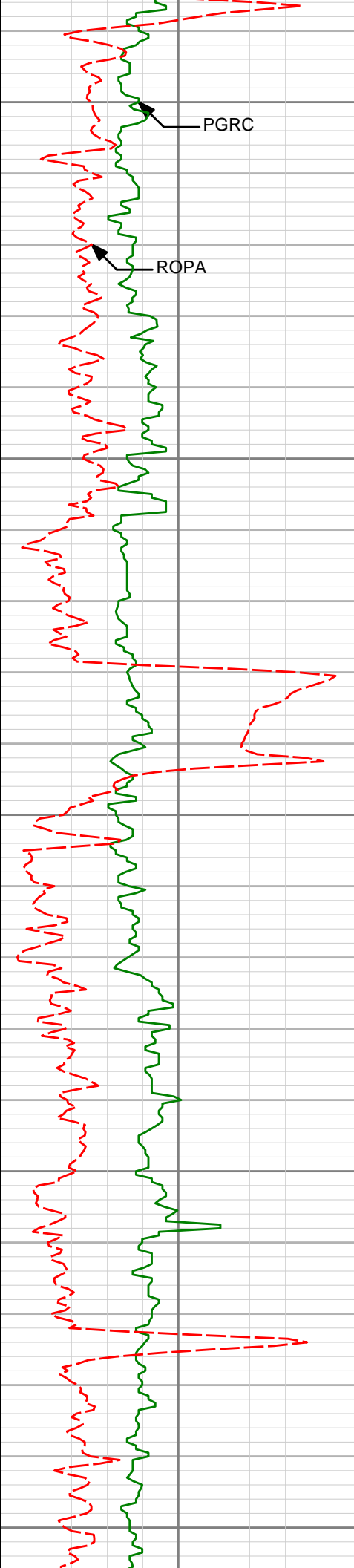
8.54°

77.36°

4536.48'

-9.02'

4550



4600

PGRC

ROPA

4650

4700

4750

4800

4652'

7.84°

74.00°

4629.52'

-12.09'

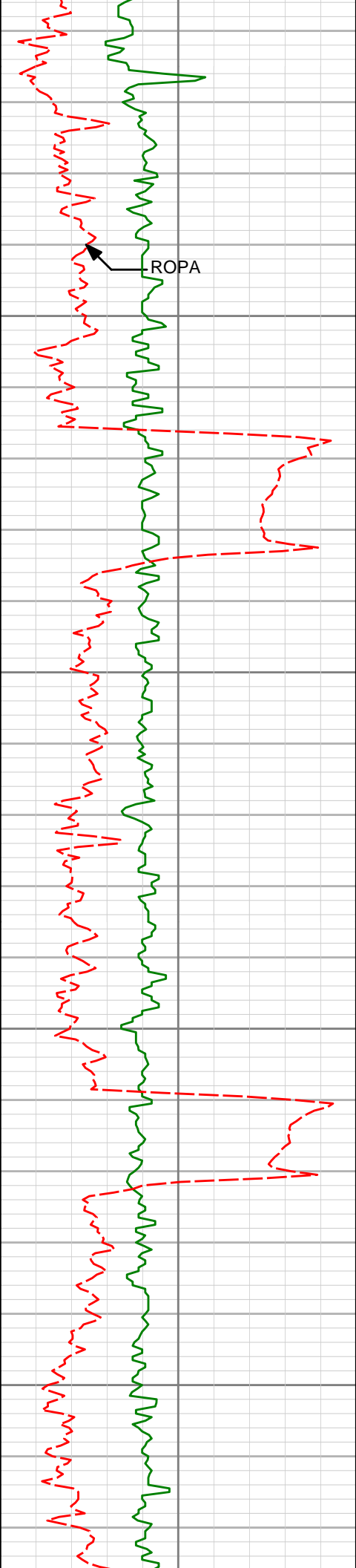
4747'

8.87°

78.29°

4723.51'

-15.14'



4850

4900

4950

5000

4842'

9.11°

78.04°

4817.35'

-17.94'

4936'

9.31°

88.57°

4910.14'

-19.42'

5031'

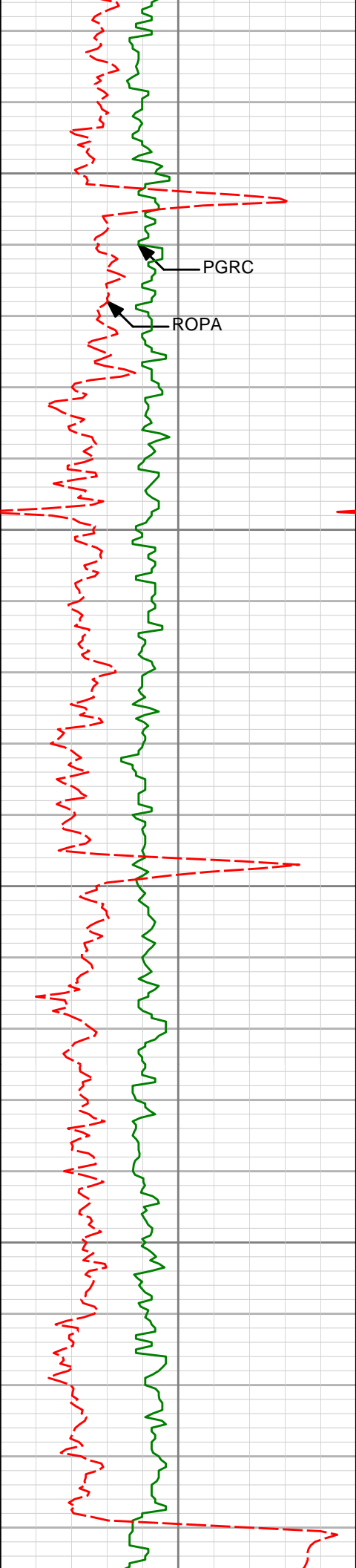
9.48°

92.13°

5003.87'

-19.05'

ROPA



5050

5100

5150

5200

5125'

8.27°

89.94°

5096.74'

-18.53'

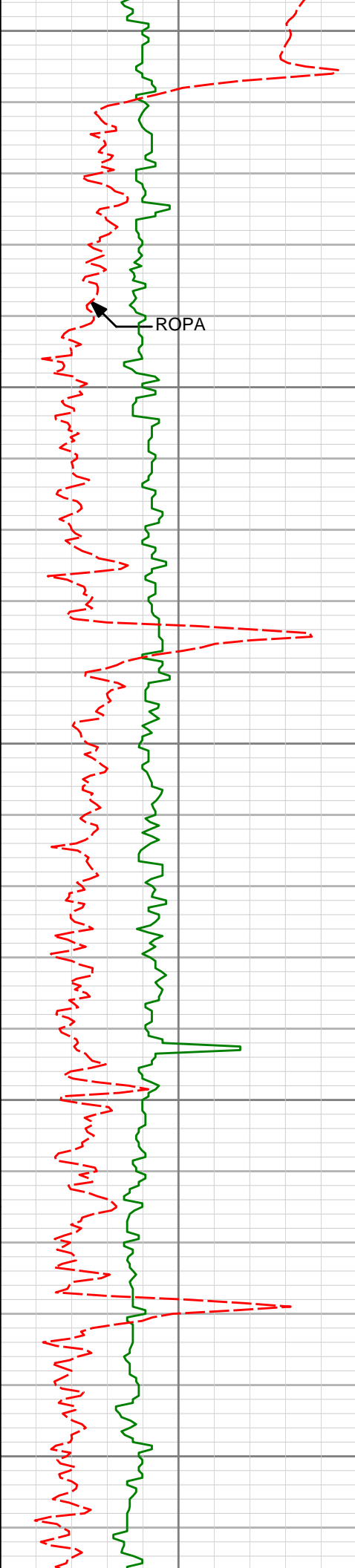
5220'

7.15°

84.69°

5190.88'

-18.87'



5250

5314'

6.85°

102.65°

5284.19'

-17.99'

5300

5350

5409'

6.48°

97.85°

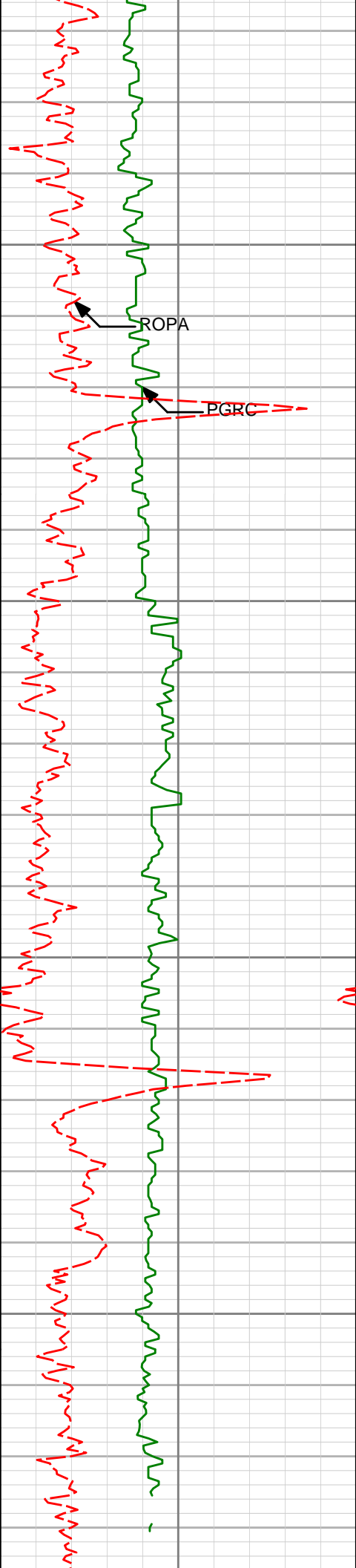
5378.55'

-15.83'

5400

5450

ROPA



5503'

6.75°

94.09°

5471.93'

-14.53'

5500

ROPA

PGRC

5550

5598'

6.45°

91.97°

5566.30'

-13.77'

5600

5650

5693'

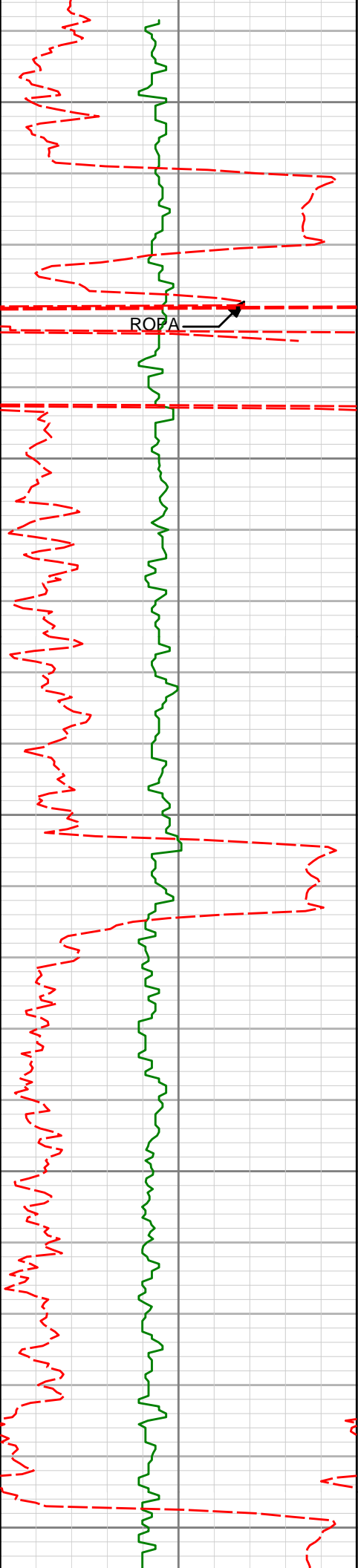
5.97°

88.42°

5660.74'

-13.55'





5700

5750

5800

5850

5900

5787'

4.17°

91.43°

5754.37'

-13.46'

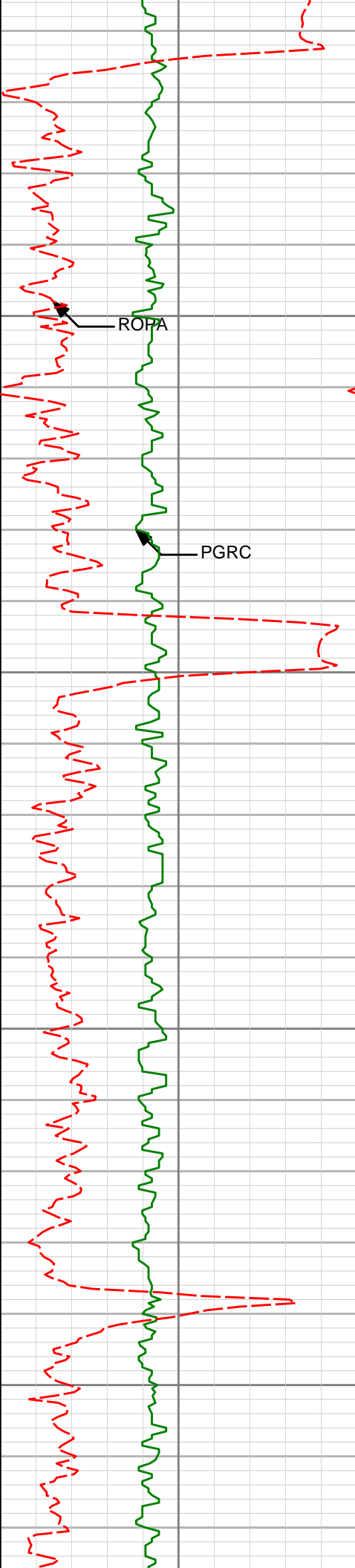
5882'

3.41°

100.90°

5849.16'

-12.73'



5950

6000

6050

6100

5976'

1.56°

98.10°

5943.07'

-11.95'

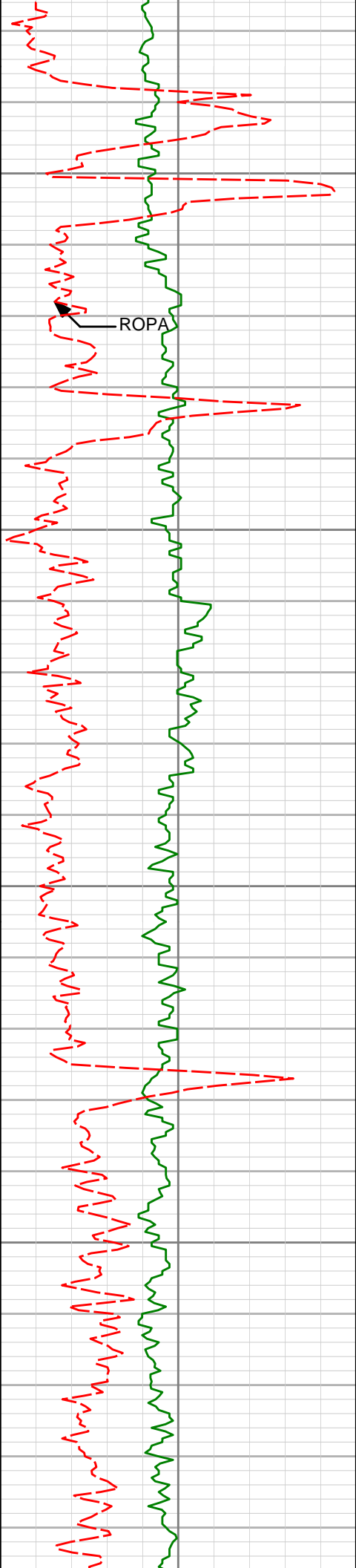
6071'

0.87°

75.02°

6038.05'

-11.92'



6150

6200

6250

6300

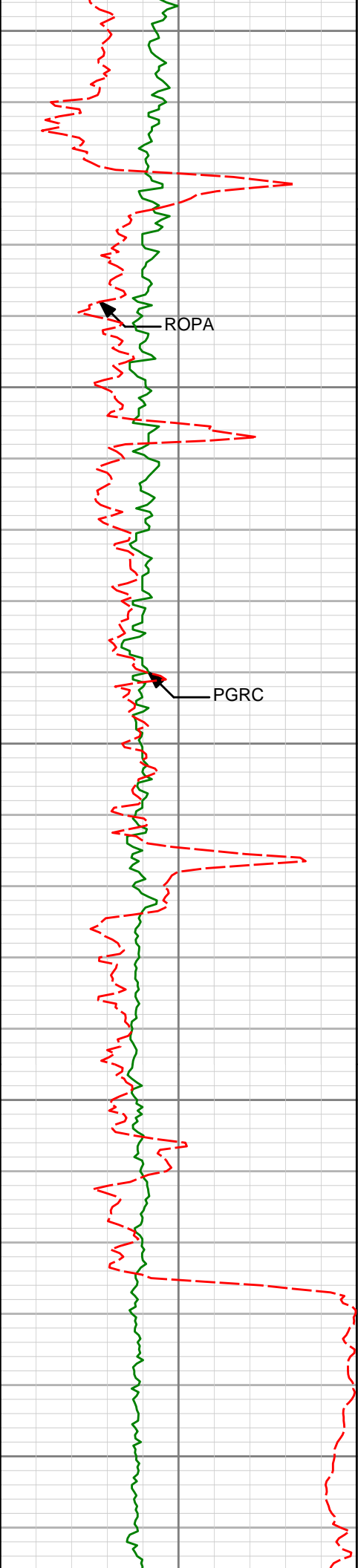
6260'

0.62°

84.44°

6227.03'

-12.35'



6350

6400

6450

6500

6550

6449'

0.54°

80.64°

6416.02'

-12.56'

6513'

0.50°

112.02°

6480.02'

-12.50'

6544'

0.47°

129.15°

6511.02'

-12.36'

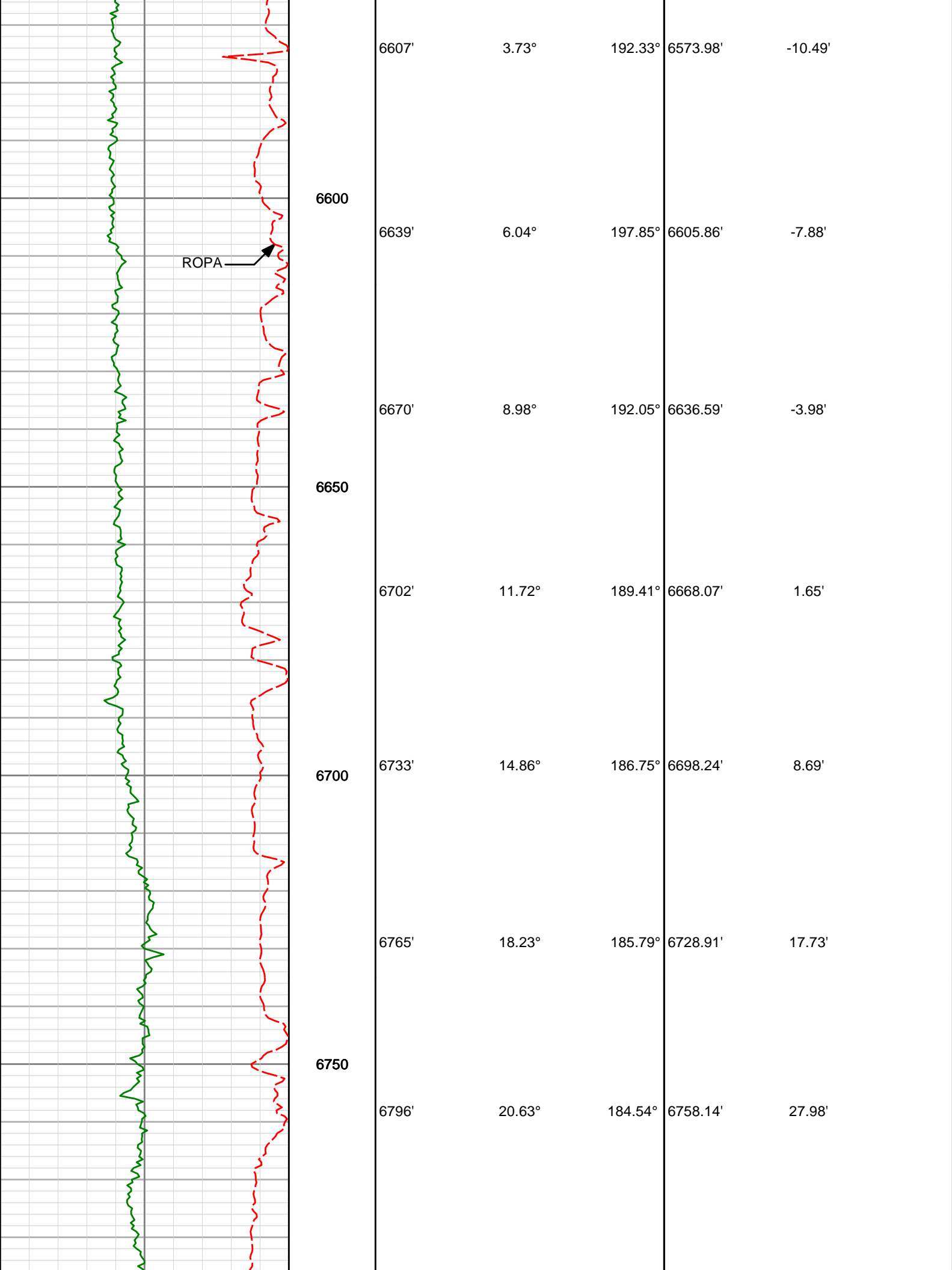
6576'

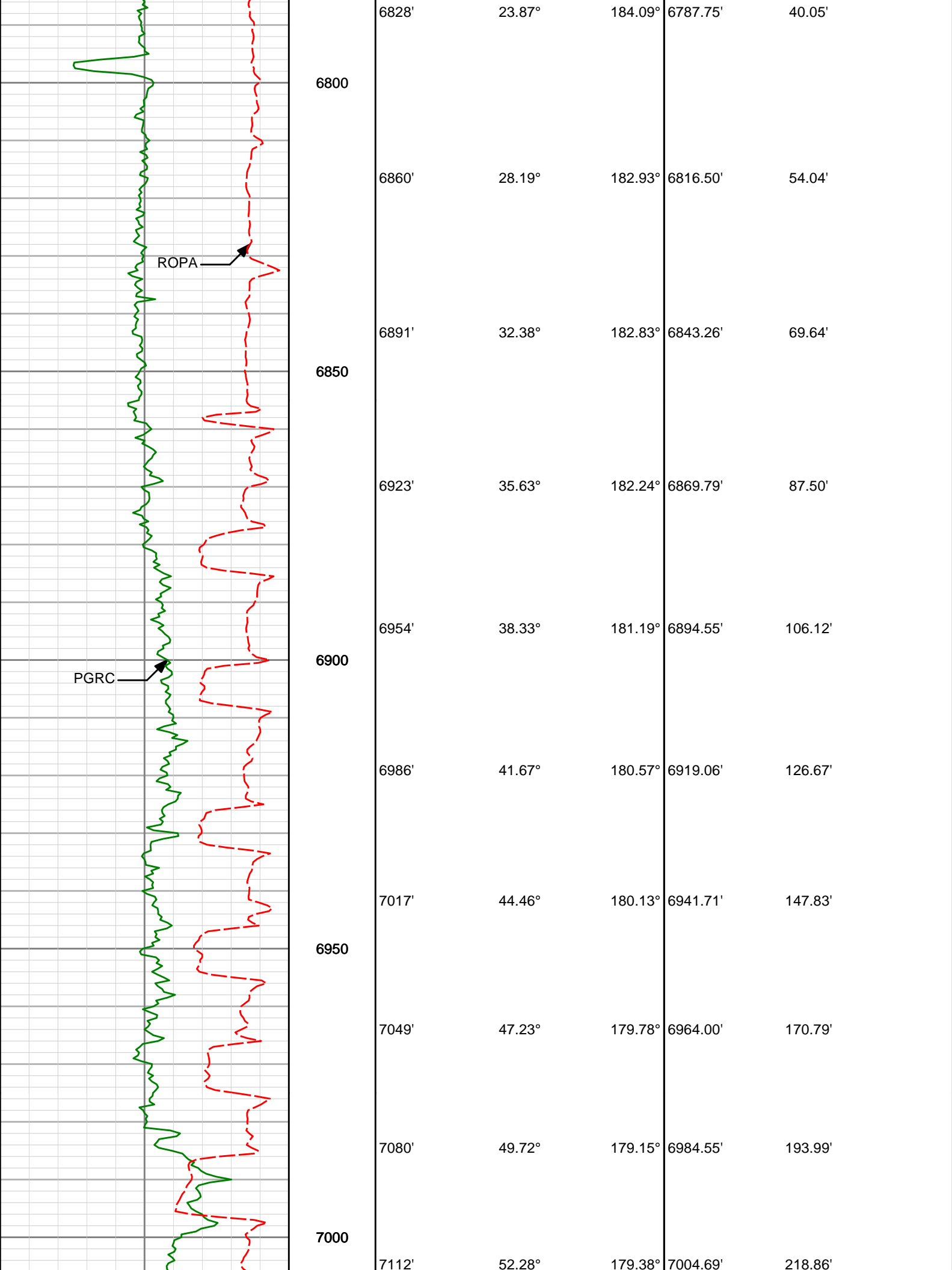
1.49°

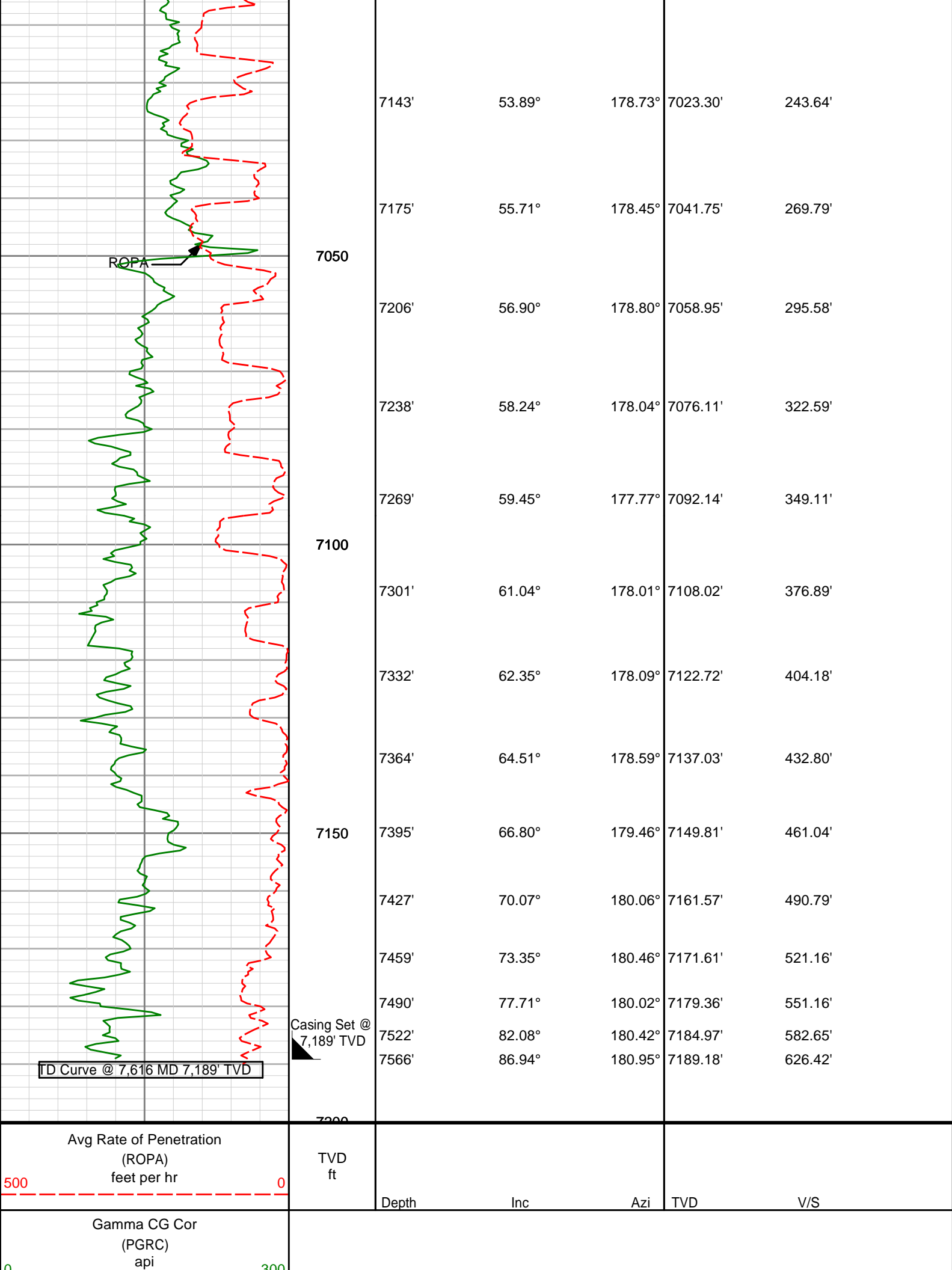
189.57°

6543.01'

-11.87'









# HALLIBURTON

## DIRECTIONAL SURVEY REPORT

Anadarko Petroleum Corp.  
Crowder 38N-19HZ  
Wattenburg  
Weld Colorado  
USA  
CA-XX-0900118961

<i>Measured Depth (feet)</i>	<i>Inclination (degrees)</i>	<i>Direction (degrees)</i>	<i>Vertical Depth (feet)</i>	<i>Latitude (feet)</i>	<i>Departure (feet)</i>	<i>Vertical Section (feet)</i>	<i>Dogleg (deg/100ft)</i>
1004.00	0.48	10.72	1003.97	6.85 N	0.89 W	-6.86	TIE-IN
1172.00	0.10	301.06	1171.97	7.61 N	0.88 W	-7.63	0.27
1295.00	0.25	303.21	1294.97	7.81 N	1.19 W	-7.83	0.12
1356.00	0.86	129.19	1355.97	7.60 N	0.95 W	-7.61	1.80
1540.00	1.49	128.16	1539.93	5.25 N	1.99 E	-5.22	0.34
1724.00	1.34	125.48	1723.87	2.53 N	5.62 E	-2.44	0.09
1908.00	1.11	125.43	1907.83	0.25 N	8.82 E	-0.10	0.12
2002.00	0.98	108.20	2001.81	0.53 S	10.33 E	0.70	0.36
2097.00	1.18	91.16	2096.80	0.80 S	12.08 E	1.01	0.39
2191.00	1.50	121.82	2190.77	1.47 S	14.09 E	1.71	0.82
2286.00	3.38	123.96	2285.68	3.69 S	17.47 E	3.99	1.98
2380.00	4.71	101.34	2379.45	6.00 S	23.56 E	6.40	2.19
2475.00	4.56	102.41	2474.14	7.58 S	31.08 E	8.11	0.19
2570.00	5.67	93.14	2568.76	8.65 S	39.45 E	9.32	1.45
2664.00	7.05	91.38	2662.18	9.04 S	49.85 E	9.89	1.49
2759.00	8.88	83.28	2756.26	8.33 S	62.96 E	9.39	2.26
2854.00	7.88	81.17	2850.25	6.47 S	76.68 E	7.76	1.11
2949.00	9.44	81.34	2944.16	4.29 S	90.82 E	5.83	1.65
3043.00	8.79	78.86	3036.97	1.75 S	105.49 E	3.53	0.81
3138.00	8.18	74.47	3130.93	1.47 N	119.13 E	0.55	0.94
3233.00	7.48	71.46	3225.05	5.24 N	131.50 E	-3.01	0.85
3327.00	6.06	74.64	3318.39	8.50 N	142.09 E	-6.10	1.56
3422.00	7.09	86.40	3412.77	10.20 N	152.77 E	-7.61	1.78
3517.00	7.21	98.46	3507.04	9.69 N	164.52 E	-6.90	1.58
3611.00	6.63	92.66	3600.35	8.57 N	175.78 E	-5.59	0.97
3706.00	8.30	97.77	3694.54	7.38 N	188.06 E	-4.20	1.89
3801.00	7.69	92.60	3788.62	6.17 N	201.20 E	-2.76	0.99
3896.00	9.24	88.19	3882.58	6.12 N	215.18 E	-2.48	1.77
3990.00	8.41	81.05	3975.47	7.43 N	229.52 E	-3.54	1.46
4085.00	7.96	78.36	4069.50	9.84 N	242.82 E	-5.72	0.63
4179.00	9.62	92.49	4162.41	10.81 N	257.04 E	-6.45	2.89
4274.00	10.11	91.05	4256.01	10.31 N	273.30 E	-5.68	0.58
4369.00	9.66	86.96	4349.60	10.58 N	289.59 E	-5.68	0.88
4463.00	8.06	81.95	4442.47	11.92 N	303.98 E	-6.77	1.89
4558.00	8.54	77.36	4536.48	14.40 N	317.46 E	-9.02	0.86
4652.00	7.84	74.00	4629.52	17.69 N	330.43 E	-12.09	0.90
4747.00	8.87	78.29	4723.51	20.96 N	343.83 E	-15.14	1.27
4842.00	9.11	78.04	4817.35	24.01 N	358.36 E	-17.94	0.25
4936.00	9.31	88.57	4910.14	25.74 N	373.24 E	-19.42	1.80
5031.00	9.48	92.13	5003.87	25.64 N	388.74 E	-19.05	0.64
5125.00	8.27	89.94	5096.74	25.36 N	403.23 E	-18.53	1.33
5220.00	7.15	84.69	5190.88	25.91 N	415.95 E	-18.87	1.39
5314.00	6.85	102.65	5284.19	25.23 N	427.24 E	-17.99	2.34
5409.00	6.48	97.85	5378.55	23.25 N	438.08 E	-15.83	0.70
5503.00	6.75	94.09	5471.93	22.14 N	448.84 E	-14.53	0.54
5598.00	6.45	91.97	5566.30	21.56 N	459.74 E	-13.77	0.41
5693.00	5.97	88.42	5660.74	21.51 N	470.01 E	-13.55	0.65
5787.00	4.17	91.43	5754.37	21.56 N	478.31 E	-13.46	1.94
5882.00	3.41	100.90	5849.16	20.94 N	484.54 E	-12.73	1.03
5976.00	1.56	98.10	5943.07	20.23 N	488.56 E	-11.95	1.97
6071.00	0.87	75.02	6038.05	20.23 N	490.54 E	-11.92	0.88
6260.00	0.62	84.44	6227.03	20.70 N	492.94 E	-12.35	0.15



6449.00	0.54	80.64	6416.02	20.94 N	494.84 E	-12.56	0.05
6513.00	0.50	112.02	6480.02	20.89 N	495.39 E	-12.50	0.44
6544.00	0.47	129.15	6511.02	20.76 N	495.62 E	-12.36	0.48
6576.00	1.49	189.57	6543.01	20.26 N	495.65 E	-11.87	4.13
6607.00	3.73	192.33	6573.98	18.88 N	495.37 E	-10.49	7.25
6639.00	6.04	197.85	6605.86	16.26 N	494.63 E	-7.88	7.36
6670.00	8.98	192.05	6636.59	12.34 N	493.62 E	-3.98	9.77
6702.00	11.72	189.41	6668.07	6.69 N	492.57 E	1.65	8.69
6733.00	14.86	186.75	6698.24	0.37 S	491.59 E	8.69	10.32
6765.00	18.23	185.79	6728.91	9.43 S	490.60 E	17.73	10.58
6796.00	20.63	184.54	6758.14	19.70 S	489.68 E	27.98	7.83
6828.00	23.87	184.09	6787.75	31.78 S	488.77 E	40.05	10.14
6860.00	28.19	182.93	6816.50	45.79 S	487.92 E	54.04	13.60
6891.00	32.38	182.83	6843.26	61.40 S	487.14 E	69.64	13.53
6923.00	35.63	182.24	6869.79	79.27 S	486.35 E	87.50	10.20
6954.00	38.33	181.19	6894.55	97.91 S	485.80 E	106.12	8.95
6986.00	41.67	180.57	6919.06	118.47 S	485.48 E	126.67	10.51
7017.00	44.46	180.13	6941.71	139.64 S	485.36 E	147.83	9.07
7049.00	47.23	179.78	6964.00	162.59 S	485.38 E	170.79	8.67
7080.00	49.72	179.15	6984.55	185.80 S	485.60 E	193.99	8.18
7112.00	52.28	179.38	7004.69	210.66 S	485.91 E	218.86	8.03
7143.00	53.89	178.73	7023.30	235.44 S	486.32 E	243.64	5.46
7175.00	55.71	178.45	7041.75	261.58 S	486.96 E	269.79	5.73
7206.00	56.90	178.80	7058.95	287.37 S	487.58 E	295.58	3.93
7238.00	58.24	178.04	7076.11	314.37 S	488.33 E	322.59	4.66
7269.00	59.45	177.77	7092.14	340.88 S	489.30 E	349.11	3.97
7301.00	61.04	178.01	7108.02	368.64 S	490.32 E	376.89	5.02
7332.00	62.35	178.09	7122.72	395.92 S	491.25 E	404.18	4.23
7364.00	64.51	178.59	7137.03	424.53 S	492.08 E	432.80	6.89
7395.00	66.80	179.46	7149.81	452.76 S	492.56 E	461.04	7.80
7427.00	70.07	180.06	7161.57	482.52 S	492.68 E	490.79	10.37
7459.00	73.35	180.46	7171.61	512.90 S	492.54 E	521.16	10.31
7490.00	77.71	180.02	7179.36	542.90 S	492.41 E	551.16	14.15
7522.00	82.08	180.42	7184.97	574.40 S	492.29 E	582.65	13.71
7566.00	86.94	180.95	7189.18	618.18 S	491.77 E	626.42	11.11

**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 179.03 DEGREES (TRUE)  
A TOTAL CORRECTION OF 8.63 DEG FROM MAGNETIC NORTH TO TRUE NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 7566.00 FEET  
IS 789.93 FEET ALONG 141.50 DEGREES (TRUE)**