

PCGK - Pressure Case Gamma

1 : 600 / 1 : 240

Company : Noble Energy									
Rig : H&P 321									
Well : Wells Ranch AE20-67-1HN									
Field : Wattenburg									
Country : USA									
API Number : 05-123-37561									
LOCATION					Other Services Directional Drilling				
Latitude : 40° 28' 33.92" North Longitude : 104° 21' 18.68" West UTM Easting = 3,318,474.730 ft UTM Northing = 1,418,335.800 ft									
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## WELL INFORMATION

<b>MWD Run Number</b>	100	200	300		
<b>Date run completed</b>	30-Sep-13	01-Oct-13	04-Oct-13		
<b>Rig Bit Number</b>	2	3	4		
<b>Bit Size (in)</b>	8.750	8.750	6.125		
<b>Tool Nominal OD (in)</b>	6.750	6.750	4.750		
<b>Log Start Depth (MD, ft)</b>	982.00	5,938.00	7,054.00		
<b>Log End Depth (MD, ft)</b>	5,938.00	7,054.00	10,976.00		
<b>Drill or Wipe</b>	Drill	Drill	Drill		
<b>Drill/Wipe Start Date and Time</b>	28-Sep-13 23:13	30-Sep-13 15:00	02-Jan-13 18:41		
<b>Drill/Wipe End Date and Time</b>	28-Sep-13 23:13	01-Oct-13 08:46	04-Jan-13 01:29		
<b>Min Inc (deg) @ Depth (MD, ft)</b>	0.15 @ 1,184.00	1.20 @ 5,942.00	85.29 @ 7,089.00		
<b>Max Inc (deg) @ Depth (MD, ft)</b>	16.01 @ 2,599.00	80.71 @ 6,999.00	92.49 @ 8,037.00		
<b>Bit TFA(in2) / Bit Type</b>	0.75 / N/A	0.86 / N/A	0.55 / PDC		
<b>Flow Rate (gpm)</b>	600.00	542.28	300.83		
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	N/A / N/A	N/A / N/A	N/A / N/A		
<b>Fluid Type</b>	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
<b>Density (ppg) / Viscosity (spqt)</b>	8.70 / 29.00	9.50 / 43.00	9.35 / 38.00		
<b>Filtrate CL (ppm)</b>	1,600.00	2,400.00	2,200.00		
<b>pH / Fluid Loss (mptm)</b>	12.10 / 61	10.50 / 8	9.90 / 10		
<b>PV (cP) / YP (lbf2)</b>	3 / 2.00	13 / 13.00	10 / 8.00		
<b>% Solids / % Sand</b>	2.50 / 1.00	6.40 / 0.20	6.00 / 0.15		
<b>% Oil / Oil:Water Ratio</b>	N/A / N/A	N/A / N/A	N/A / N/A		
<b>Rm @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A	N/A @ N/A		
<b>Rmf @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A	N/A @ N/A		
<b>Rmc @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A	N/A @ N/A		
<b>Min Tool Temp (deg F) / S</b>	111.75 / 20M	122.22 / 20M	212.10 / 20M		

Max Tool Temp (degF) / Source	141.70 / PCM	162.80 / PCM	213.40 / PCM		
Rm @ Max Tool Temp (degF)	N/A @ 141.70	N/A @ 162.80	N/A @ 213.40		
Lead MWD Engineer	Kyle Wass	Kyle Wass	Kyle Wass		
Customer Representative	Jim Turner	Jim Turner	Jim Turner		

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM	PCM		
Software Version	5.84	5.84	5.84		
Sub Serial Number	11342302	11342302	11744846		
Insert Serial Number	11620297	11620297	11620297		
Date and Time Initialized	28-Sep-13 17:47	01-Jan-70 00:00	01-Oct-13 22:21		
Date and Time Read	01-Jan-70 00:00	01-Oct-13 15:40	04-Oct-13 11:24		
ECMB SW Version	N/A	N/A	N/A		

### Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	57.00	55.00	64.00		
Software Version	6.21	6.21	6.21		
Sub Serial Number	11342302	11342302	11744846		
Sonde Serial Number	10859920	10859920	10859920		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	353.36	276.96	28.80		

### Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	50.53	48.55	67.12		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	11342302	11342302	11744846		
Insert/Sonde Serial Number	12037423	12037423	12037423		

## REMARKS

1. All depths are calibrated to driller's pipe tally and are true vertical depth from the Drill Floor.
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 "Brigham 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:  
 1:600 Log  
 PGRC (Gamma CG) and ROPA (Average Rate of Penetration)  
 Interval Resolution: 1.0 ft  
 Interval Distance: 3.0 ft  
  
 1:240 Log  
 PGRC (Gamma CG):  
 Interval Resolution: 0.5 ft  
 Interval Distance: 0.6 ft  
  
 ROPA (Average Rate Of Penetration):  
 Interval Resolution: 0.5 ft

Interval Distance: 1.2 ft

6. Insite Version V8.0.0

## WARRANTY

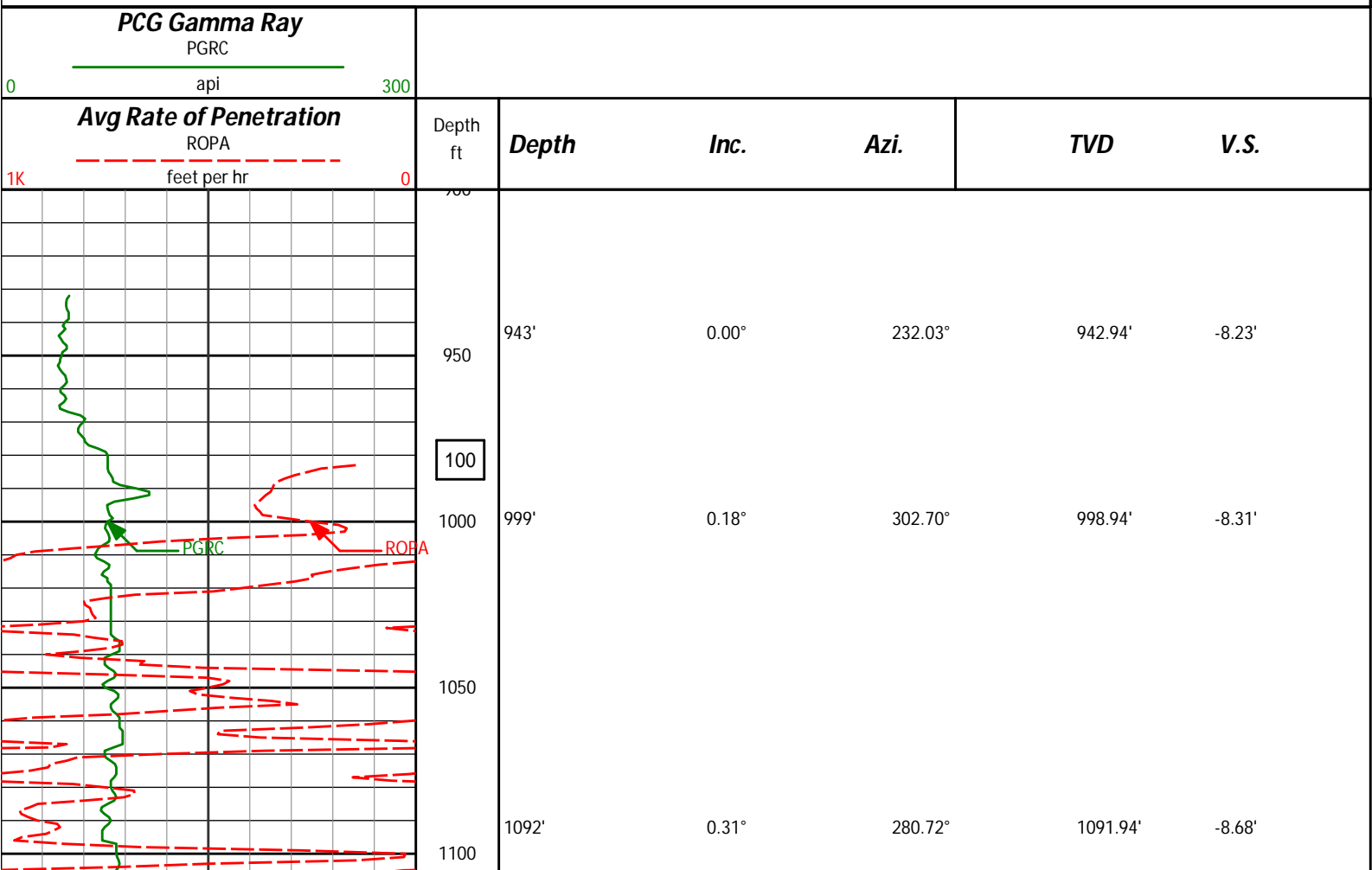
HALLIBURTON WILL USE ITS BEST EFFORTS TO FURNISH CUSTOMERS WITH ACCURATE INFORMATION AND INTERPRETATIONS THAT ARE PART OF, AND INCIDENT TO, THE SERVICES PROVIDED. HOWEVER, HALLIBURTON CANNOT AND DOES NOT WARRANT THE ACCURACY OR CORRECTNESS OF SUCH INFORMATION AND INTERPRETATIONS. UNDER NO CIRCUMSTANCES 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.

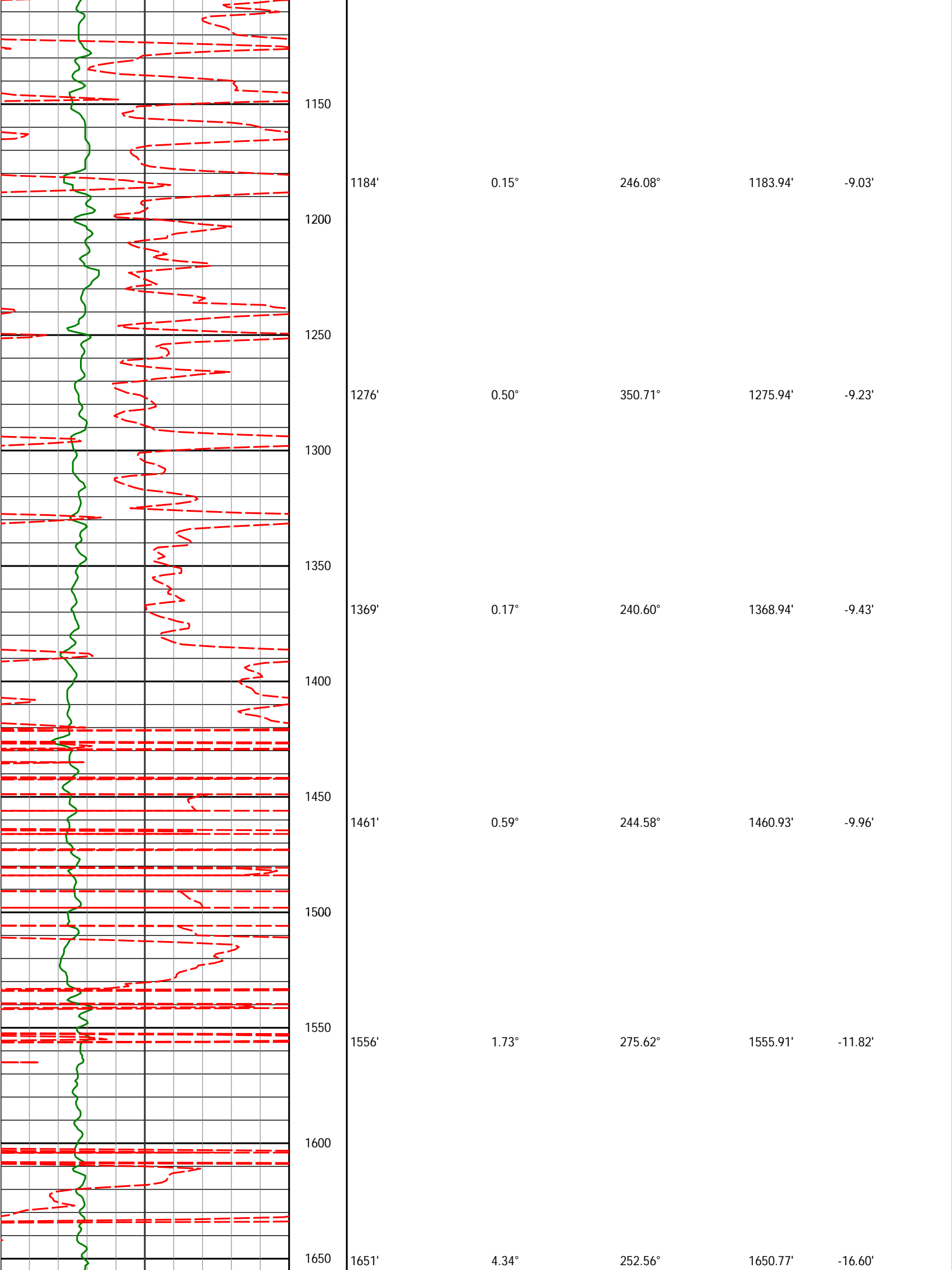
# HALLIBURTON

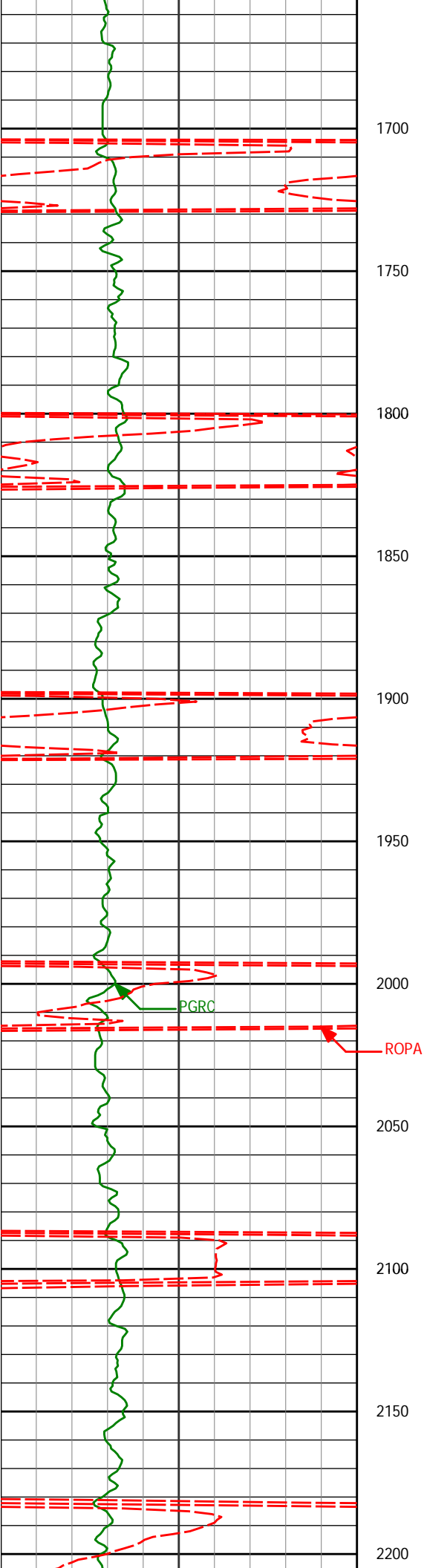
## Sperry Drilling Services

### MD Correlation Log 1:600

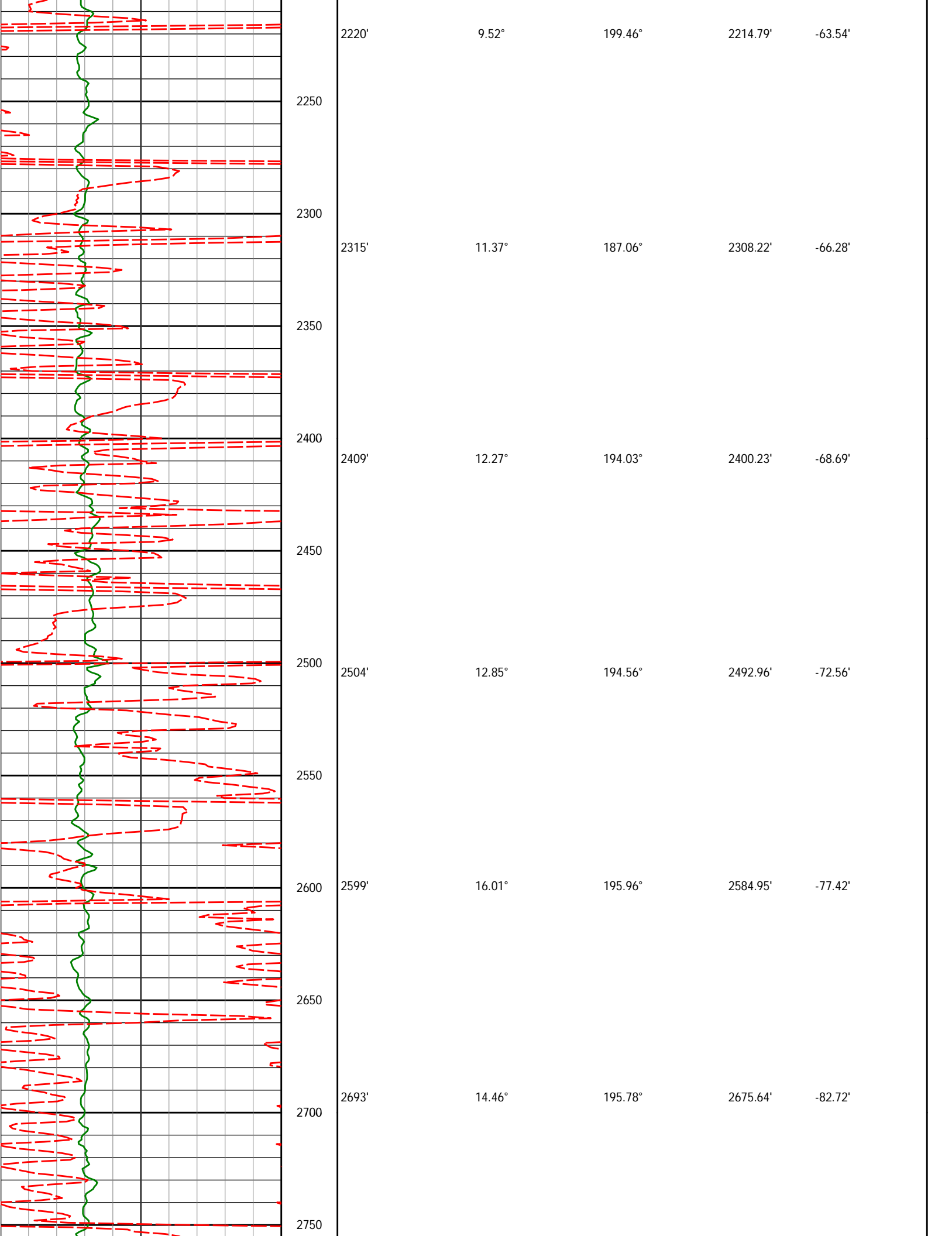
Noble Energy  
Wells Ranch AE20-67-1HN  
H&P 321  
Sec. 20-T6N-R62W

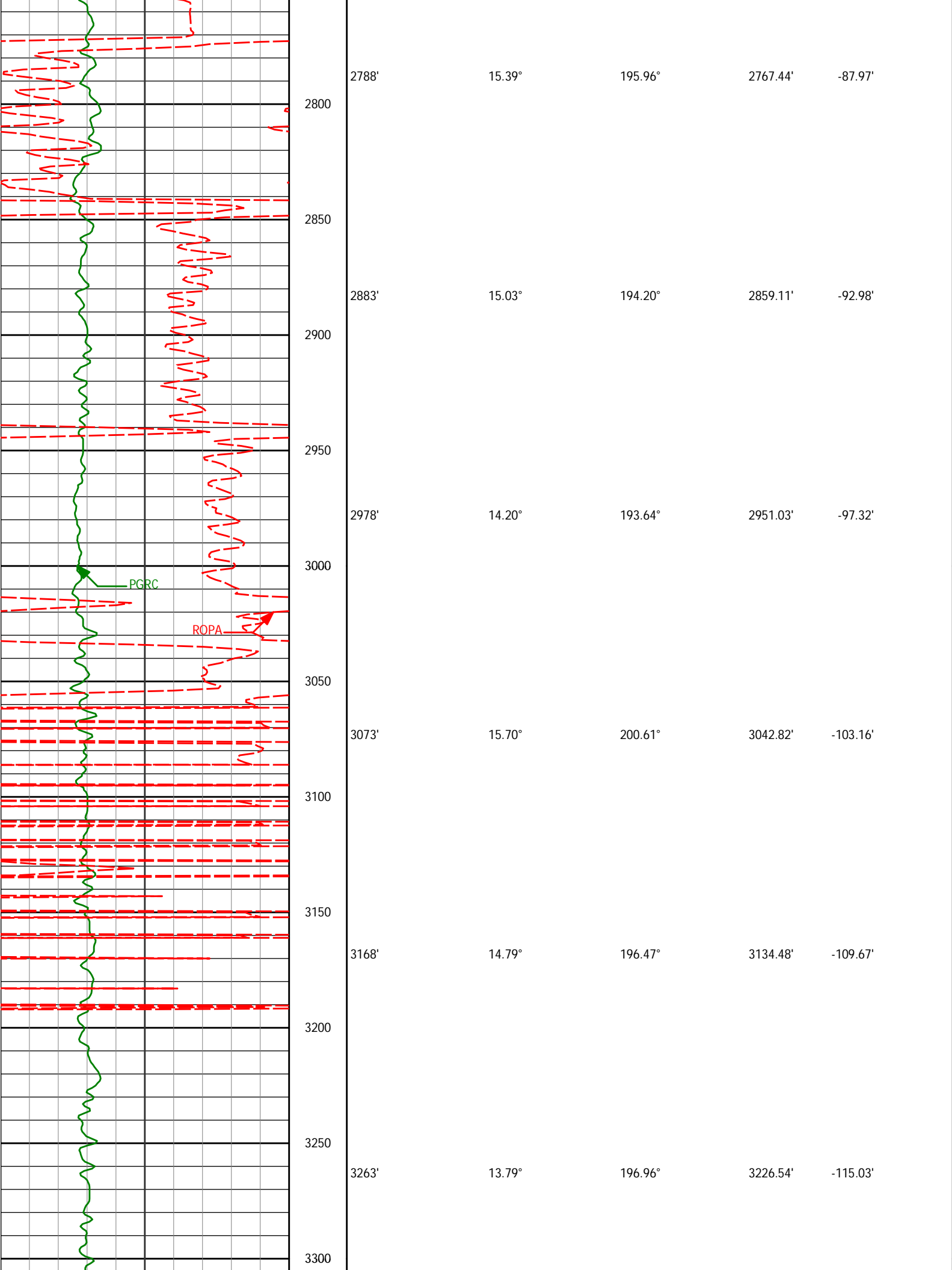


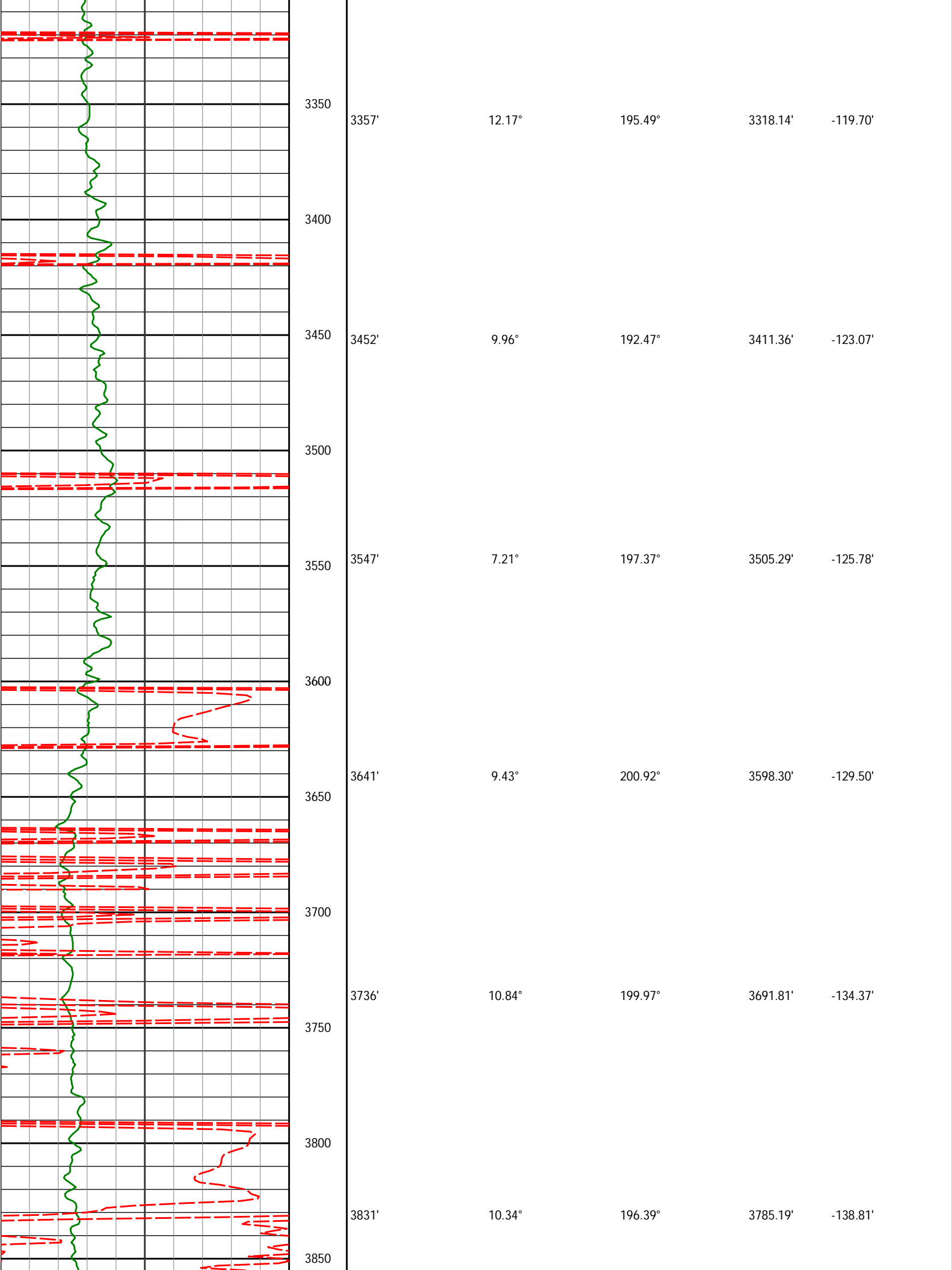


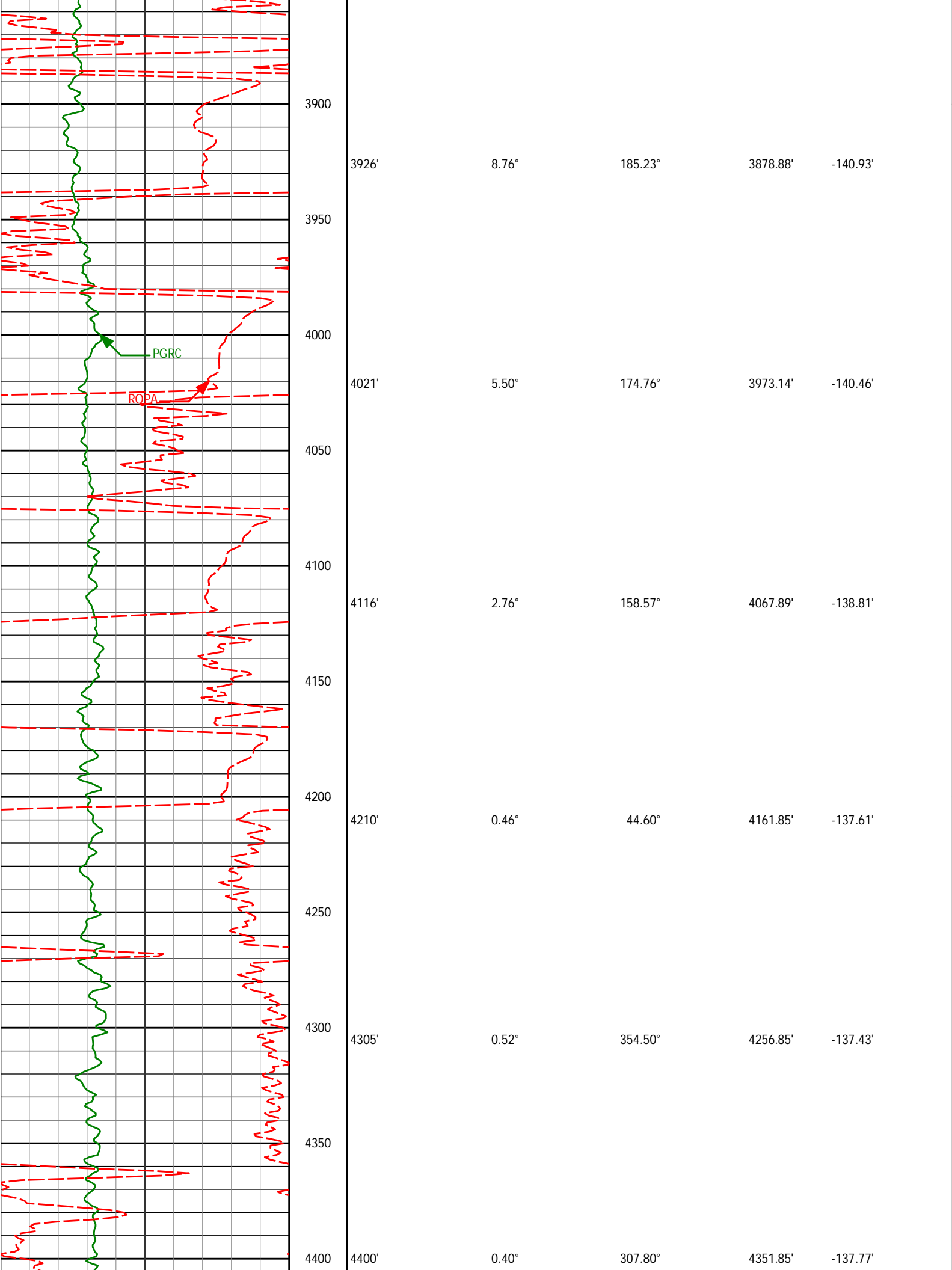


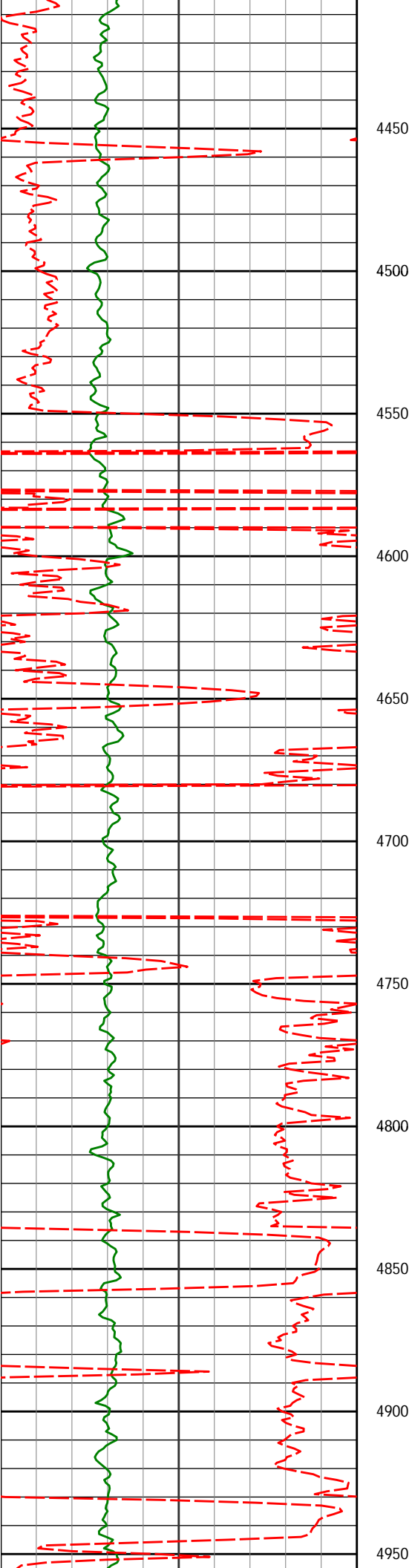
1700				
1750	1746'	5.03°	238.36°	1745.46'
1800				
1850	1840'	6.55°	233.58°	1838.98'
1900				
1950	1935'	8.03°	231.63°	1933.21'
2000				
2030'		9.60°	223.20°	2027.09'
2050				
2100				
2125'		8.34°	211.07°	2120.93'
2150				
2200				



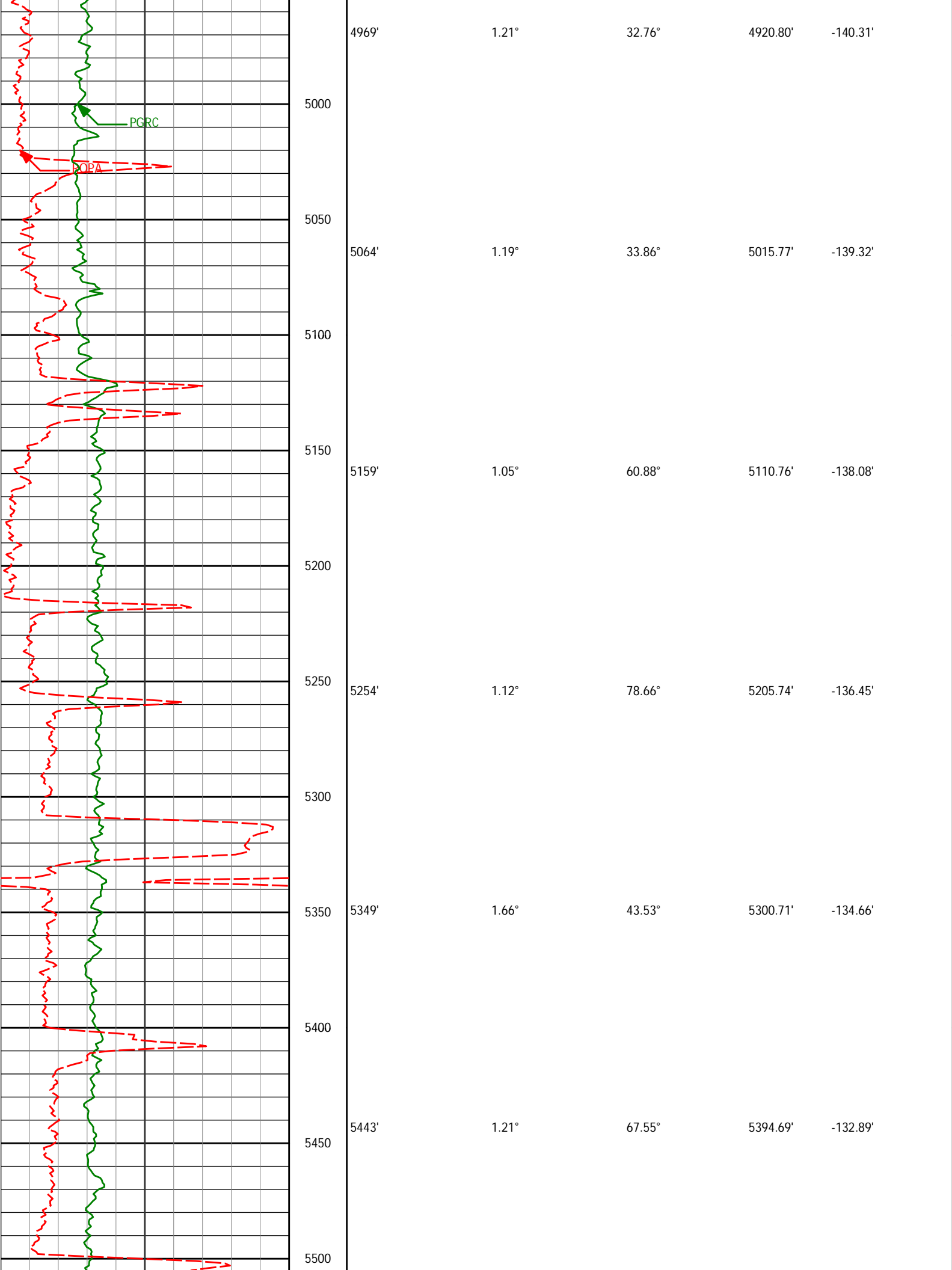


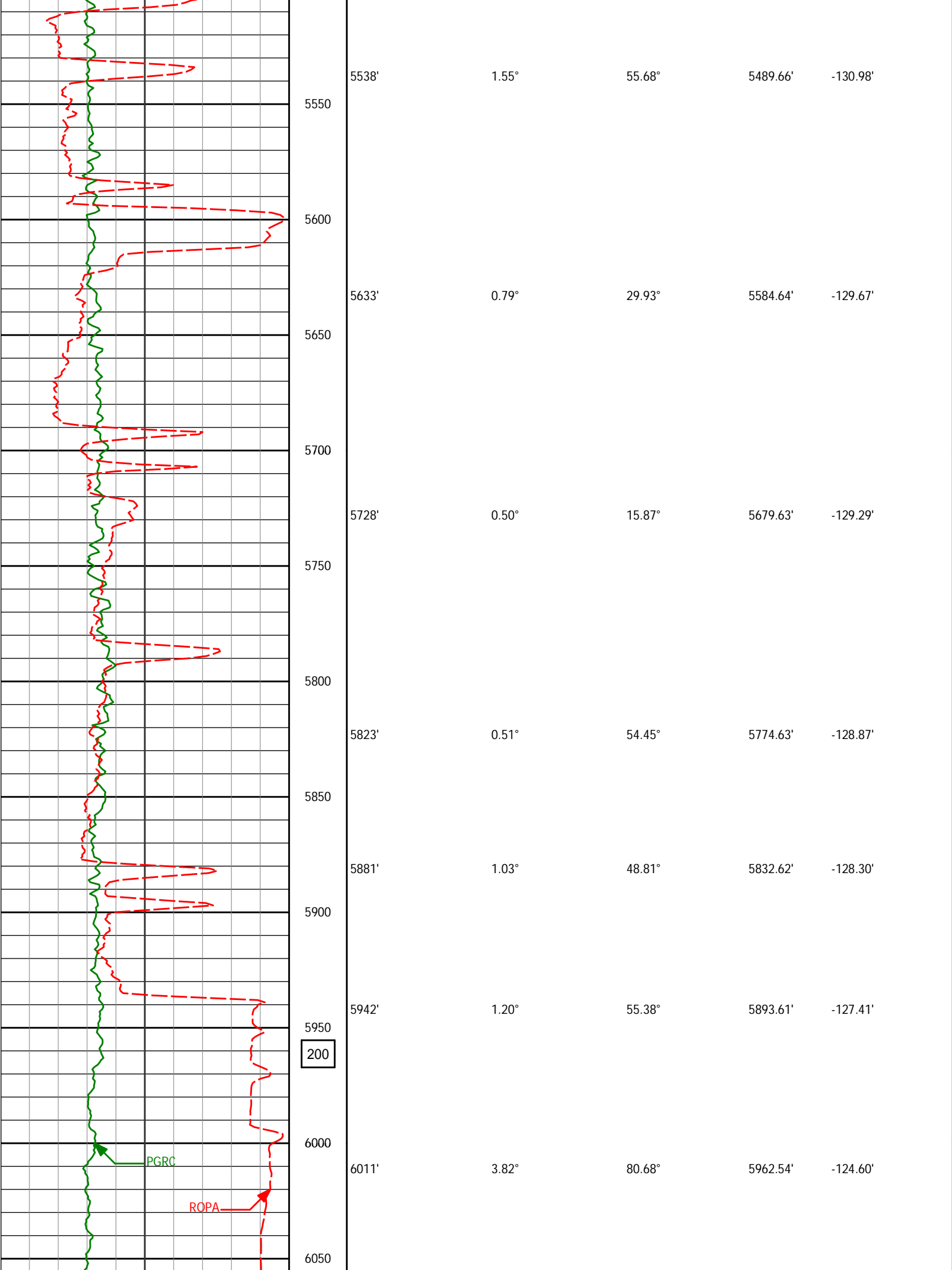


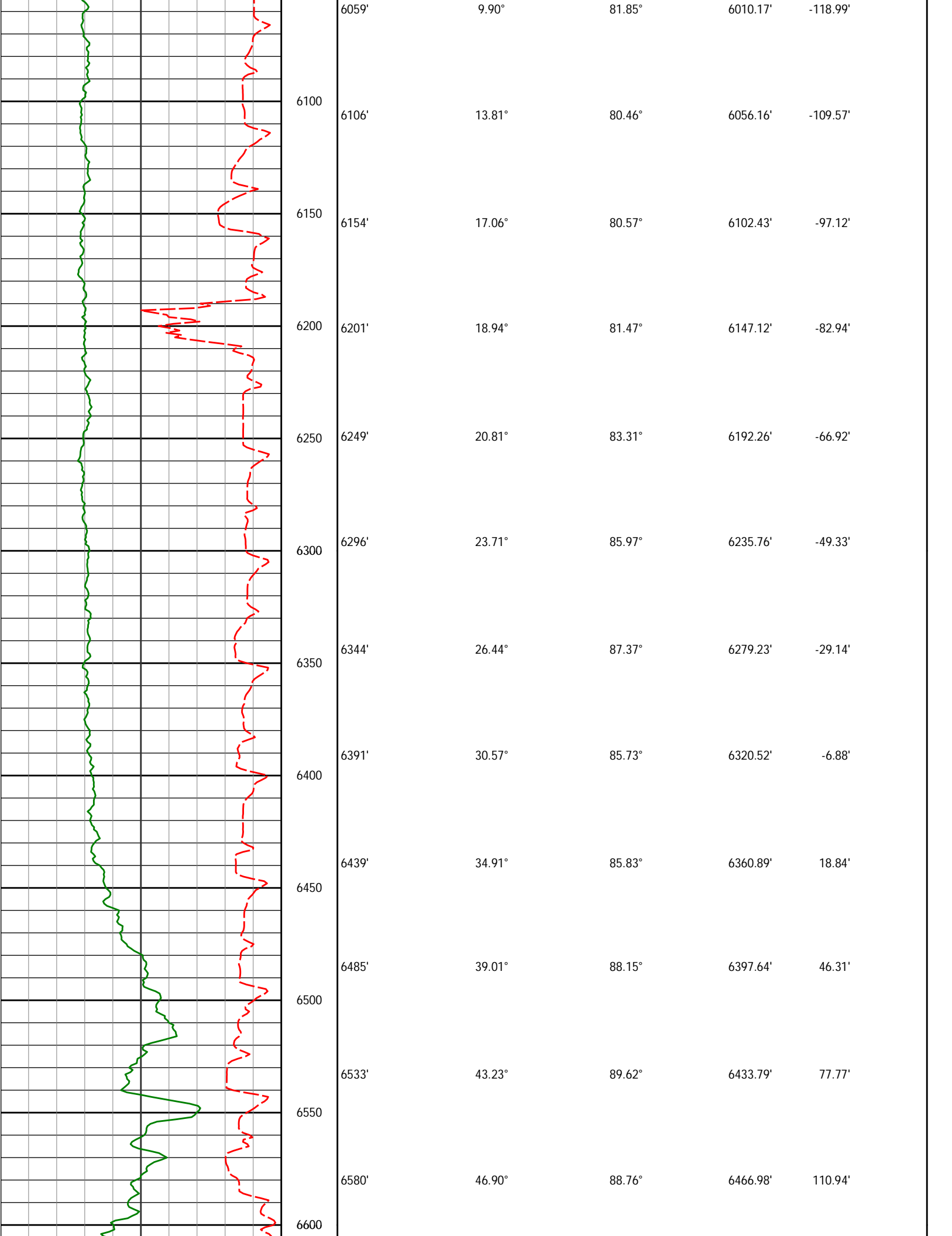


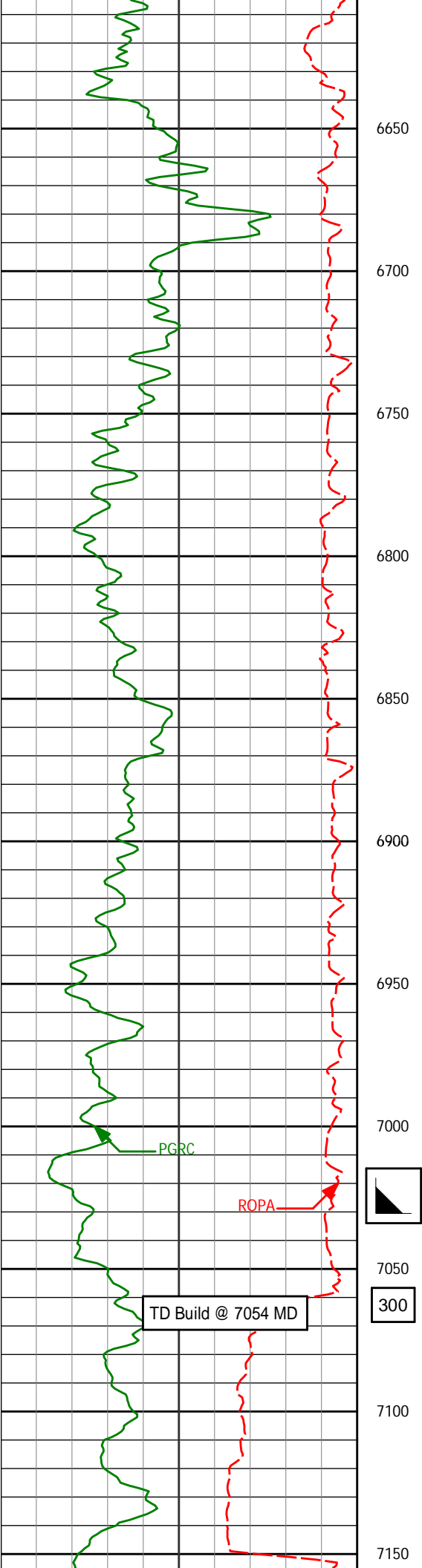


4495'	0.52°	297.08°	4446.84'	-138.44'
4590'	0.99°	329.31°	4541.83'	-139.30'
4685'	0.89°	244.97°	4636.83'	-140.40'
4780'	1.10°	208.65°	4731.81'	-141.44'
4874'	0.62°	100.49°	4825.81'	-141.31'









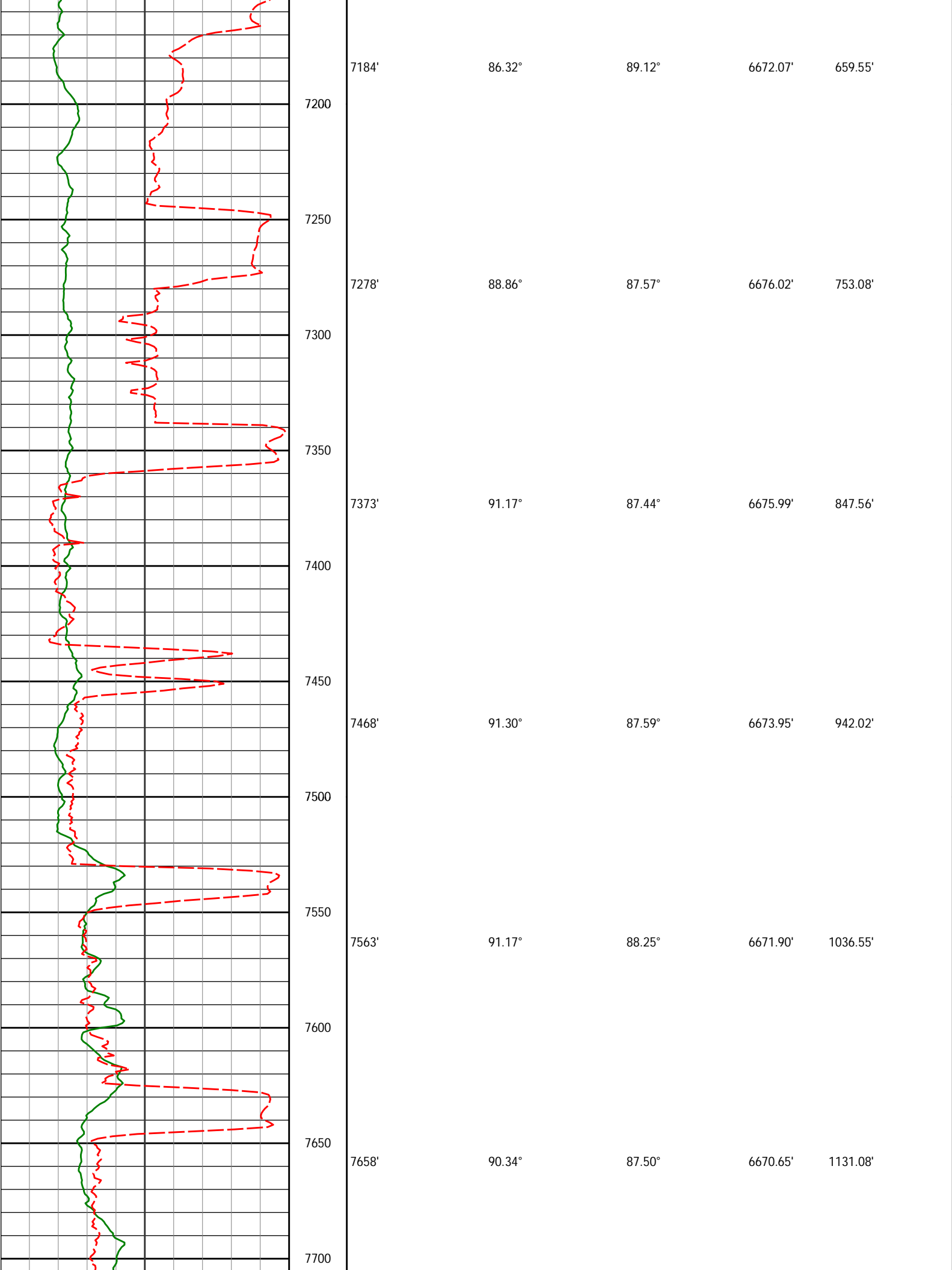
6628'	49.40°	87.29°	6499.00'	146.53'
6650				
6675'	51.92°	86.71°	6528.80'	182.64'
6700				
6723'	56.20°	85.32°	6556.96'	221.16'
6750				
6770'	60.81°	86.16°	6581.51'	260.86'
6800				
6818'	65.75°	86.54°	6603.09'	303.39'
6850				
6865'	70.14°	87.98°	6620.74'	346.68'
6900				
6913'	74.12°	90.00°	6635.46'	392.21'
6950				
6959'	77.68°	90.18°	6646.67'	436.74'
7000	80.71°	89.73°	6654.16'	475.95'
7050				
7089'	85.29°	89.56°	6665.13'	565.06'
7100				
7150				

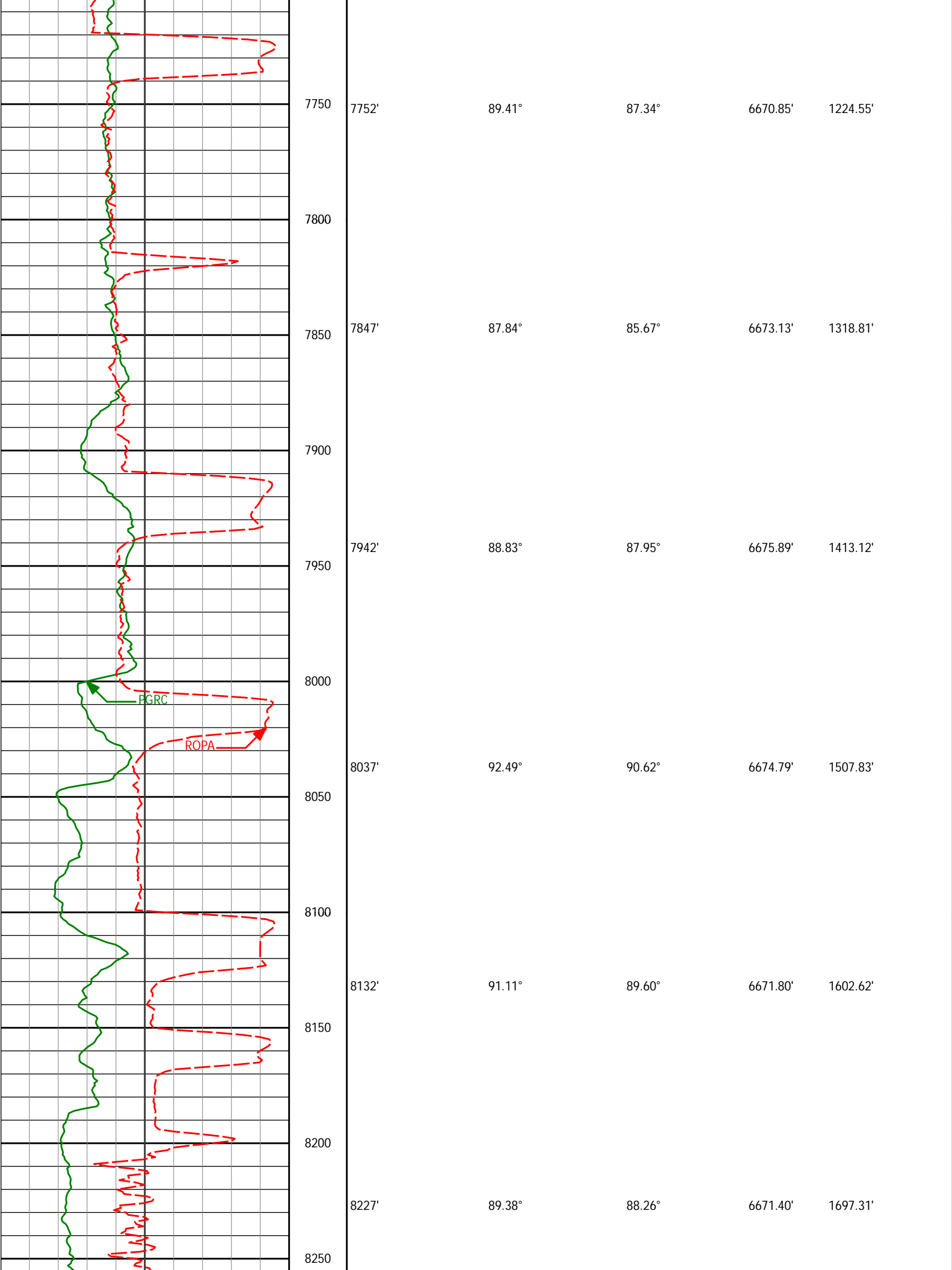
PGRC

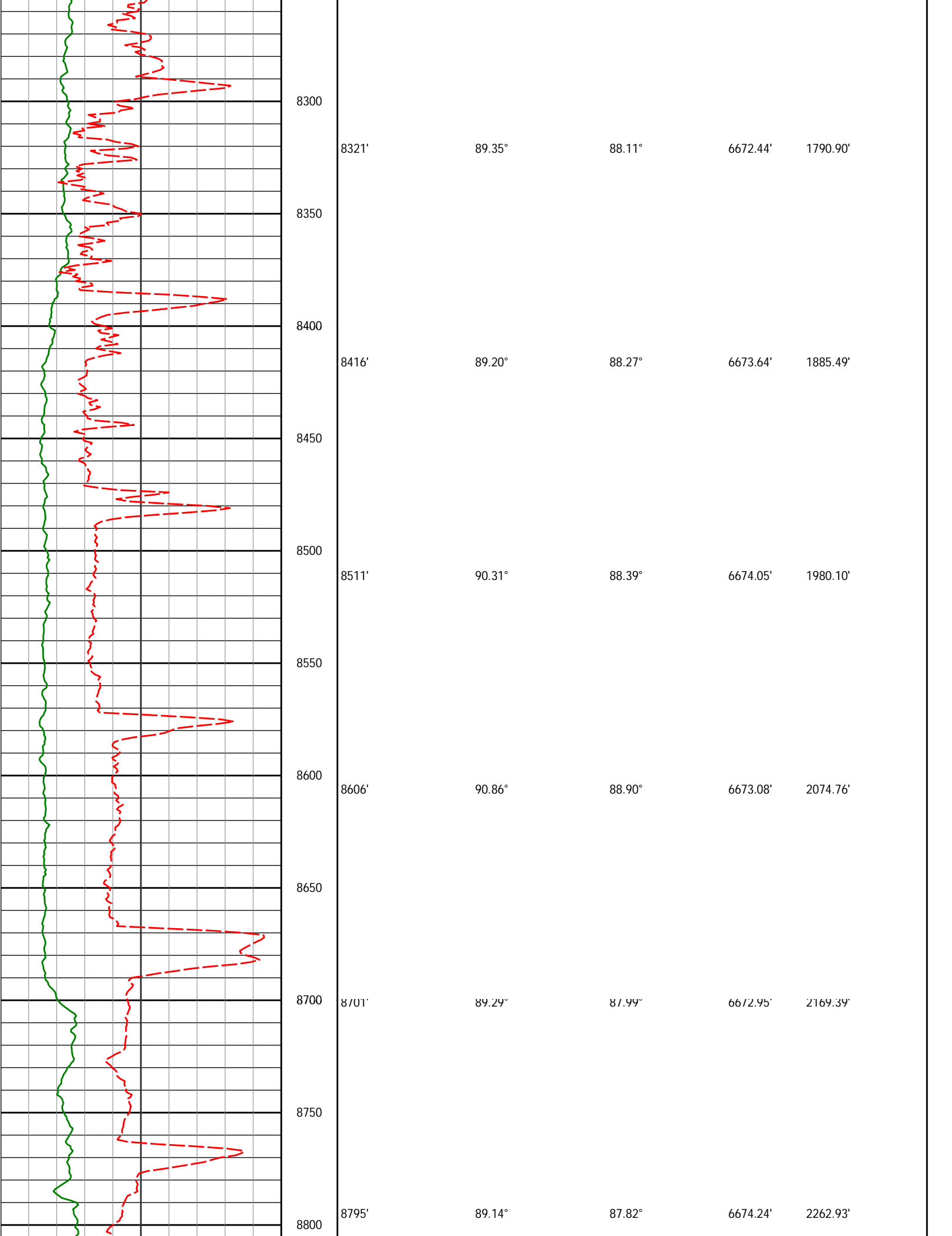
ROPA

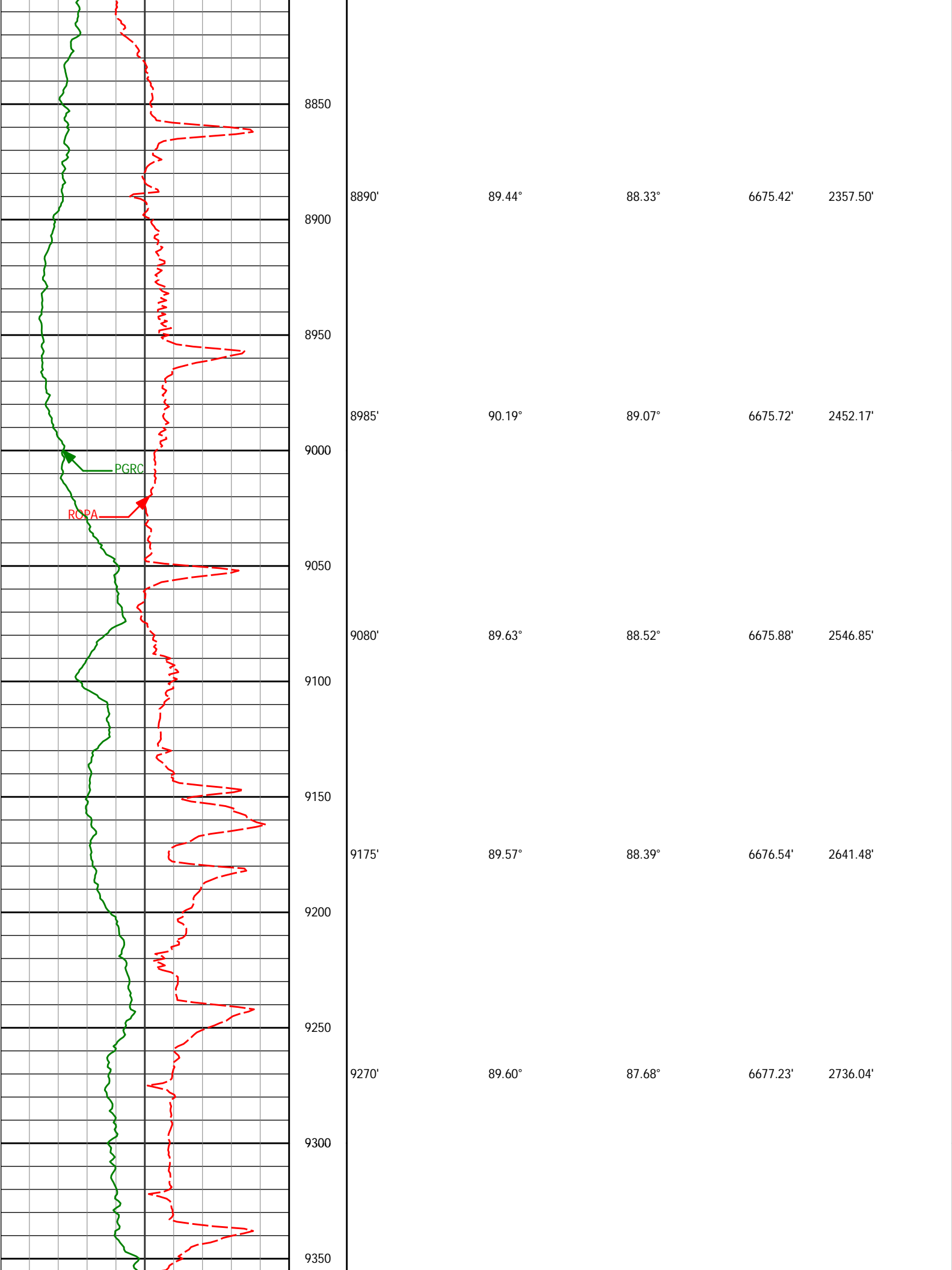
TD Build @ 7054 MD

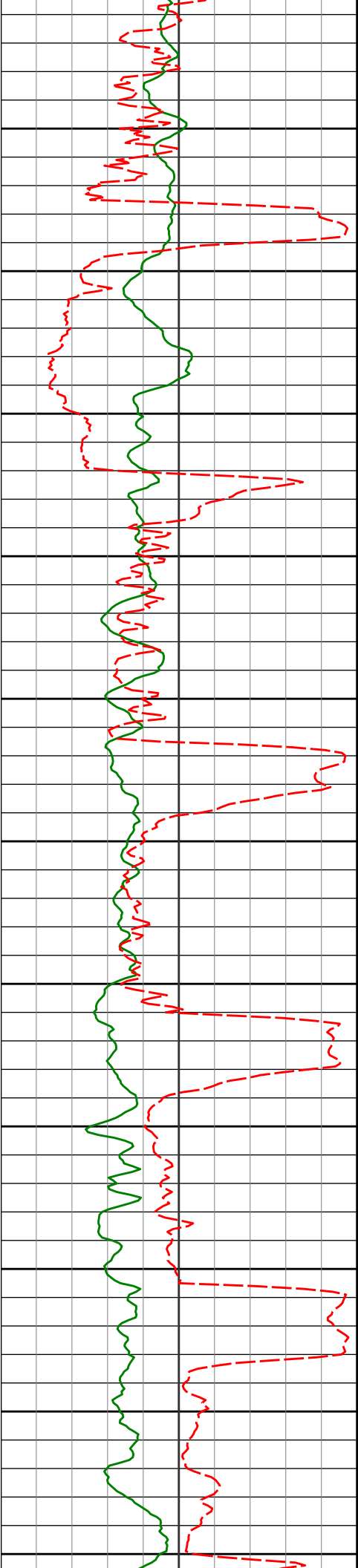
300



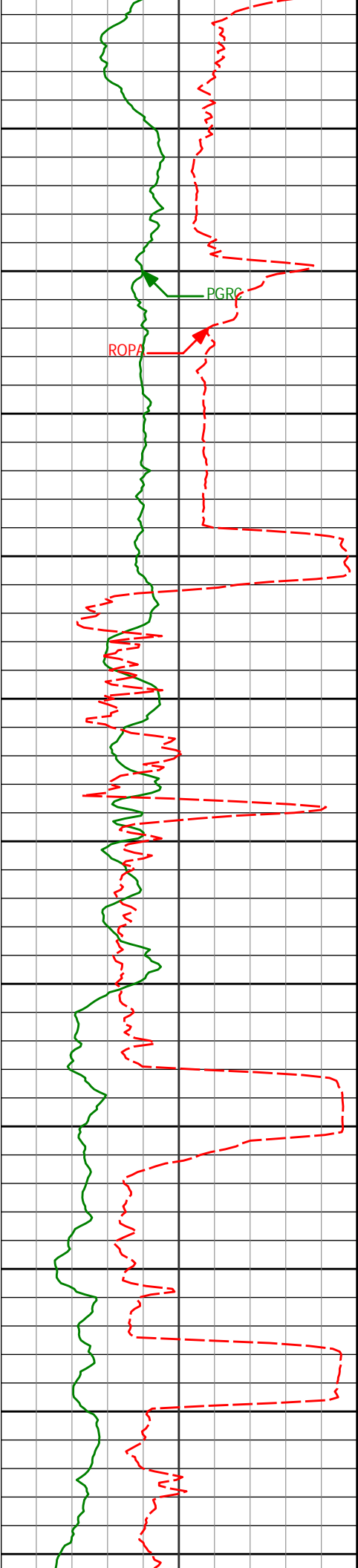




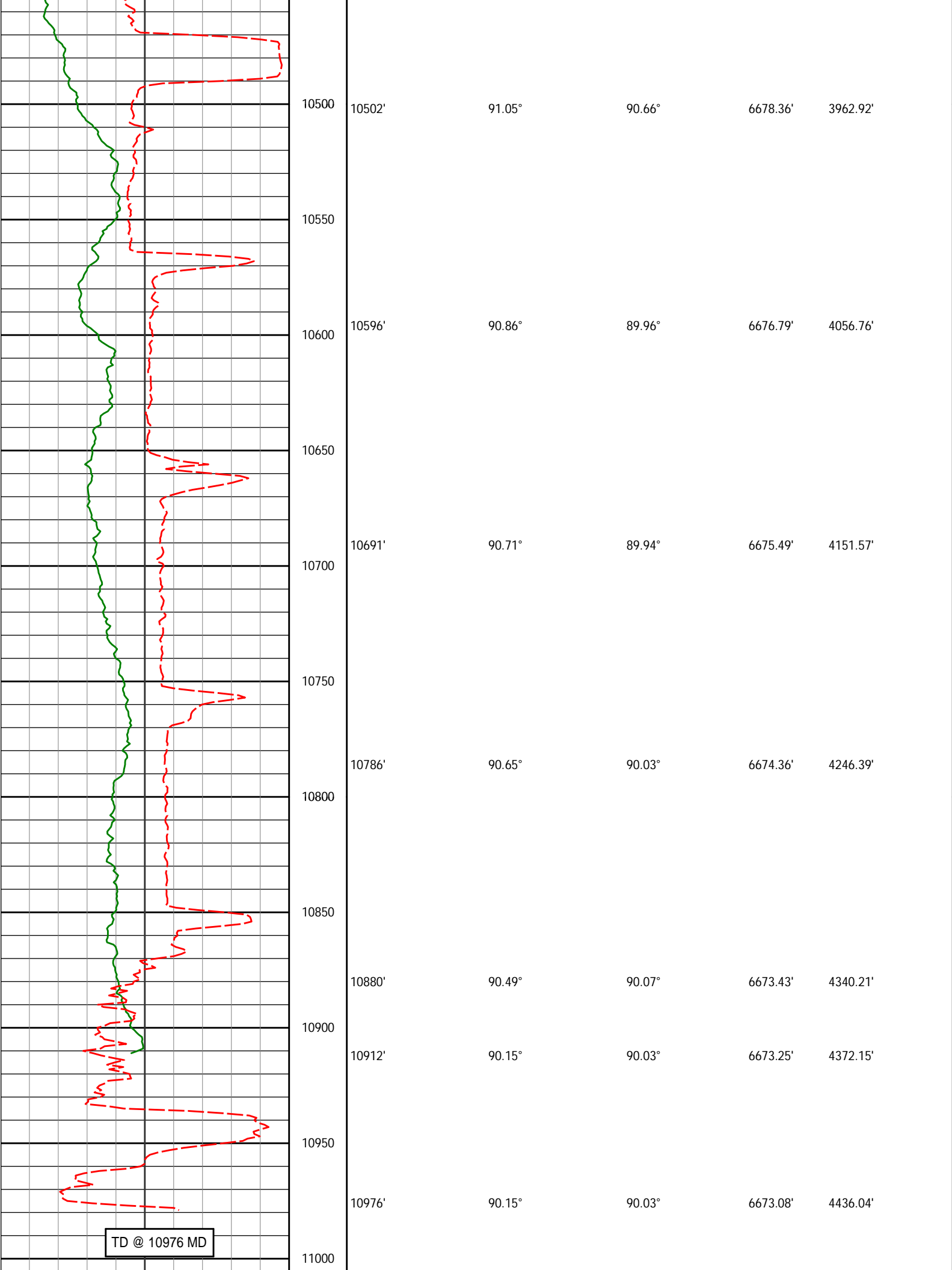


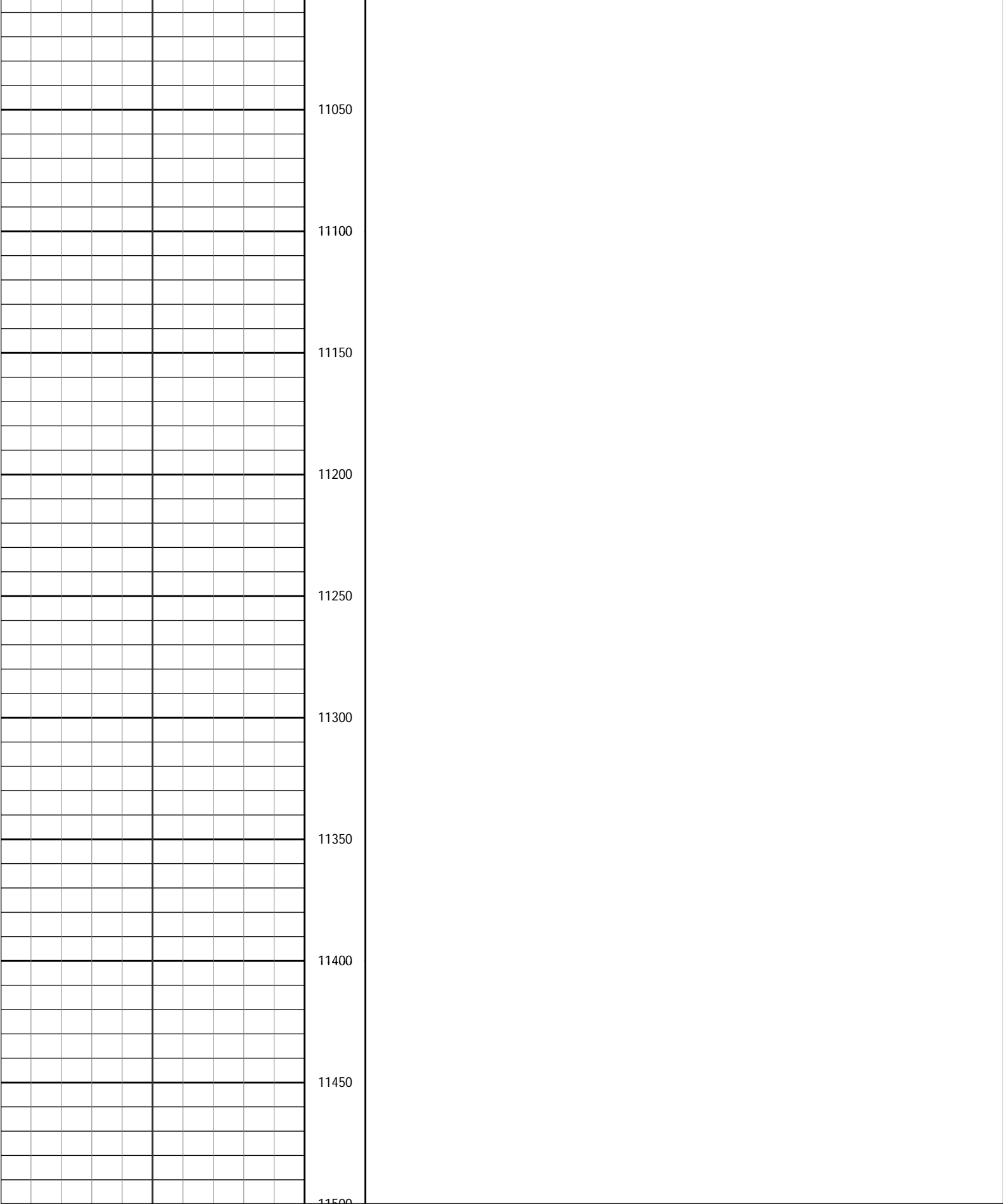


9364'	89.29°	87.08°	6678.14'	2829.51'
9400				
9450				
9459'	90.25°	87.61°	6678.53'	2923.96'
9500				
9550				
9554'	89.11°	87.88°	6679.06'	3018.48'
9600				
9649'	89.60°	88.31°	6680.13'	3113.05'
9700				
9744'	89.48°	89.65°	6680.90'	3207.75'
9750				
9800				
9838'	91.60°	89.68°	6680.02'	3301.53'
9850				
9900				



9933'	91.64°	89.44°	6677.33'	3396.27'
9950				
10000				
10028'	92.03°	88.93°	6674.29'	3490.95'
10050				
10100				
10123'	89.20°	87.20°	6673.27'	3585.51'
10150				
10200				
10217'	88.34°	87.04°	6675.29'	3678.91'
10250				
10300				
10312'	88.98°	88.42°	6677.52'	3773.40'
10350				
10400				
10407'	89.48°	89.53°	6678.79'	3868.09'
10450				

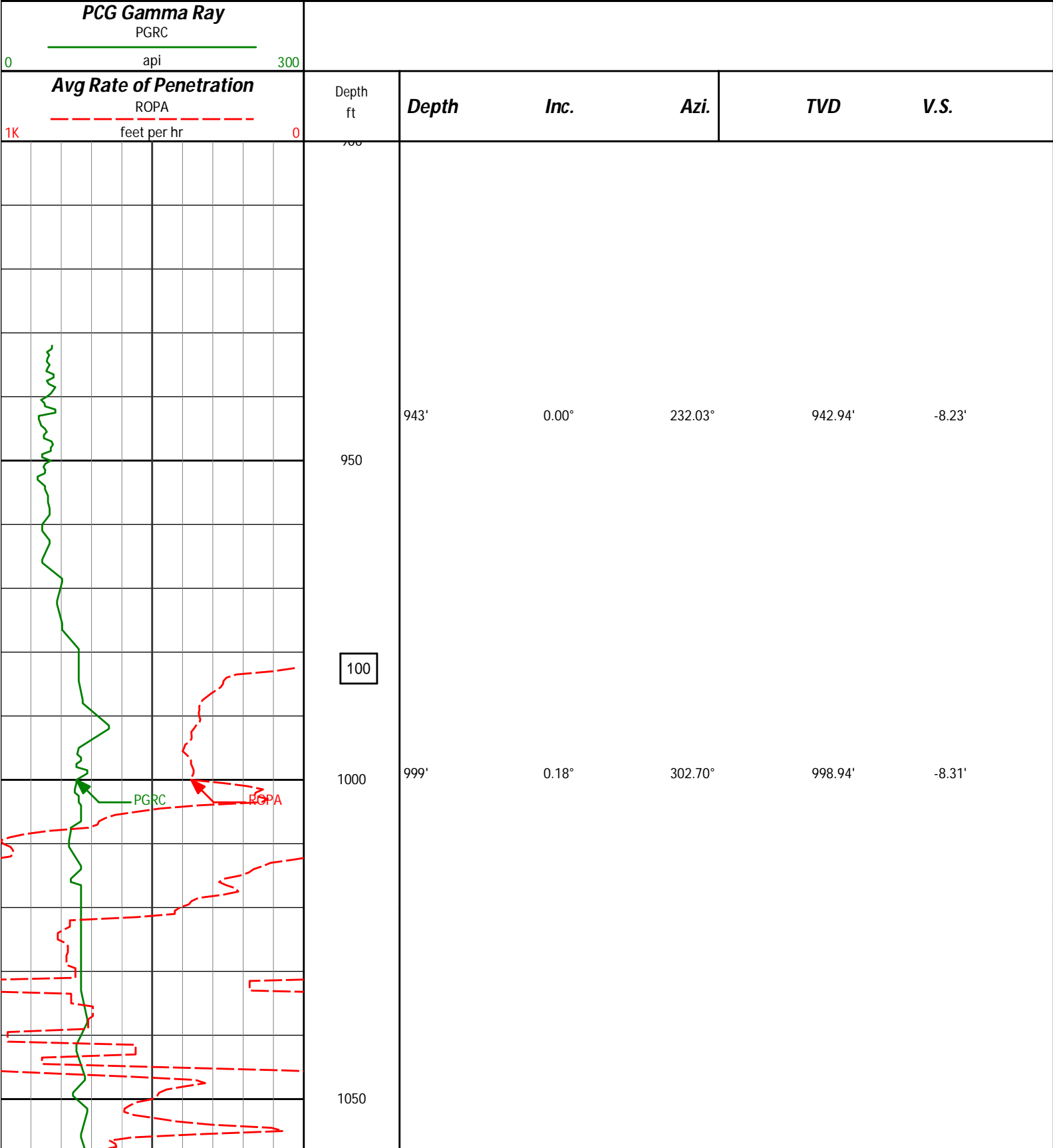


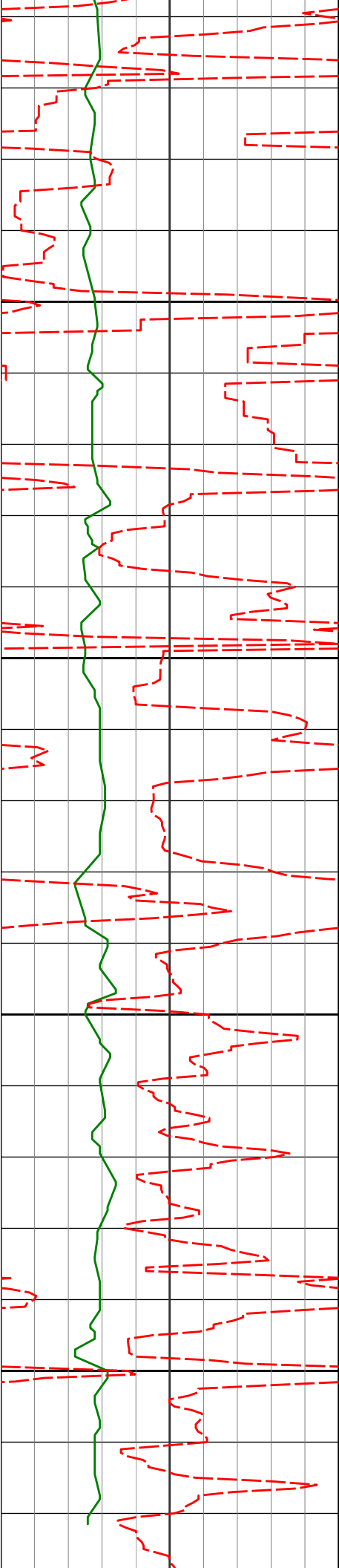


<div><div>Avg Rate of Penetration</div><div>ROPA</div><div>feet per hr</div></div>		Depth ft	Depth	Inc.	Azi.	TVD	V.S.
<div><div>PCG Gamma Ray</div><div>PGRC</div><div>api</div></div>							

**HALLIBURTON**  
**Sperry Drilling Services**  
**MD Detail Log 1:240**

Noble Energy  
Wells Ranch AE20-67-1HN  
H&P 321  
Sec. 20-T6N-R62W





1092'	0.31°	280.72°	1091.94'	-8.68'
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1100

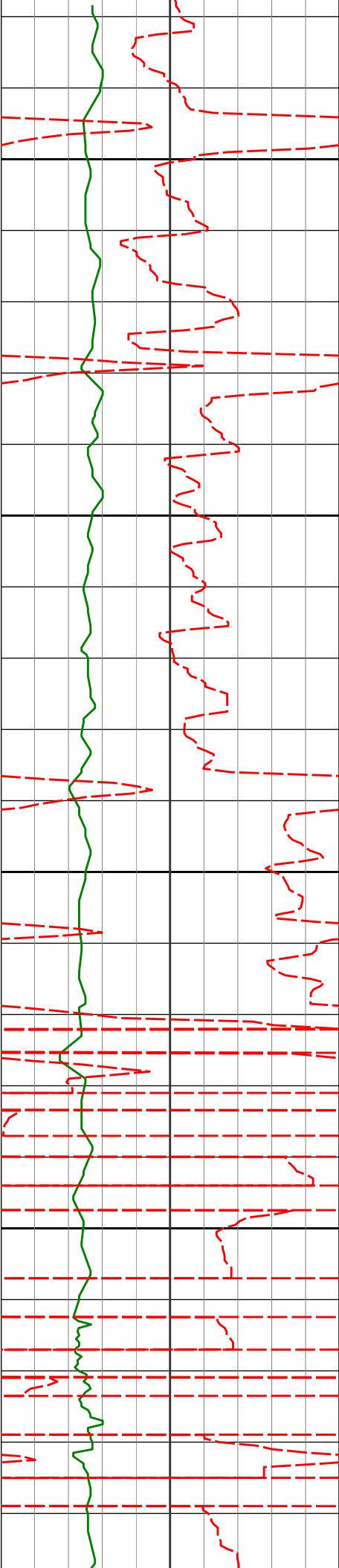
1150

1184'	0.15°	246.08°	1183.94'	-9.03'
-------	-------	---------	----------	--------

1200

1250

1276'	0.50°	350.71°	1275.94'	-9.23'
-------	-------	---------	----------	--------



1300

1350

1400

1450

1369'

0.17°

240.60°

1368.94'

-9.43'

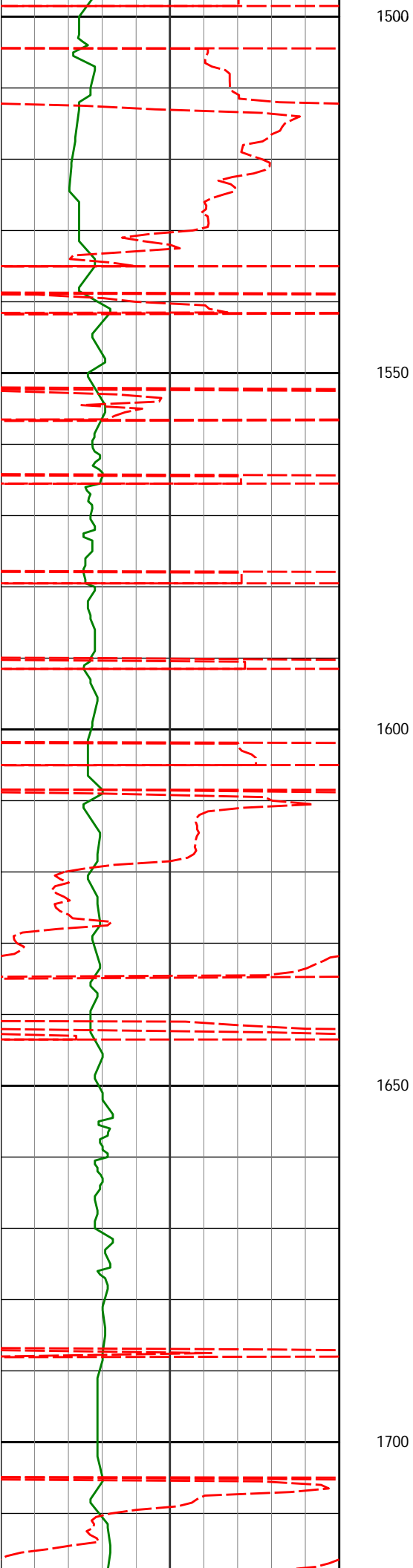
1461'

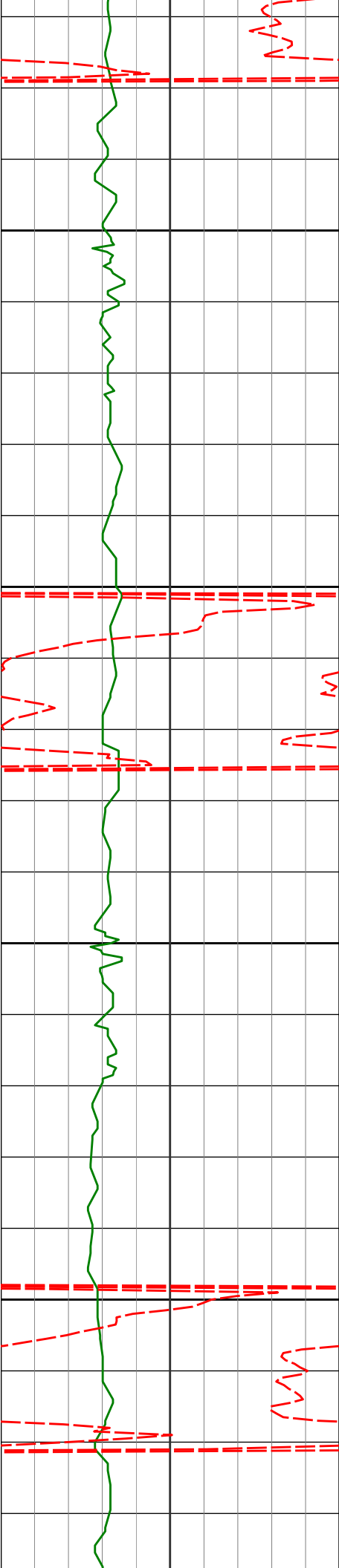
0.59°

244.58°

1460.93'

-9.96'





1750

1800

1850

1900

1746'

5.03°

238.36°

1745.46'

-23.36'

1840'

6.55°

233.58°

1838.98'

-30.84'

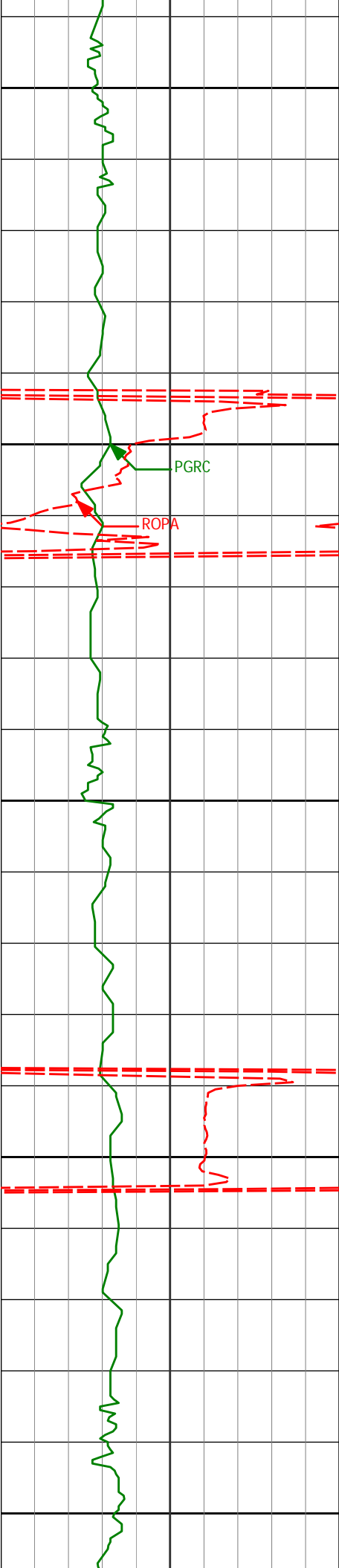
1935'

8.03°

231.63°

1933.21'

-39.93'



1950

2000

2050

2100

2150

2030'

9.60°

223.20°

2027.09'

-49.93'

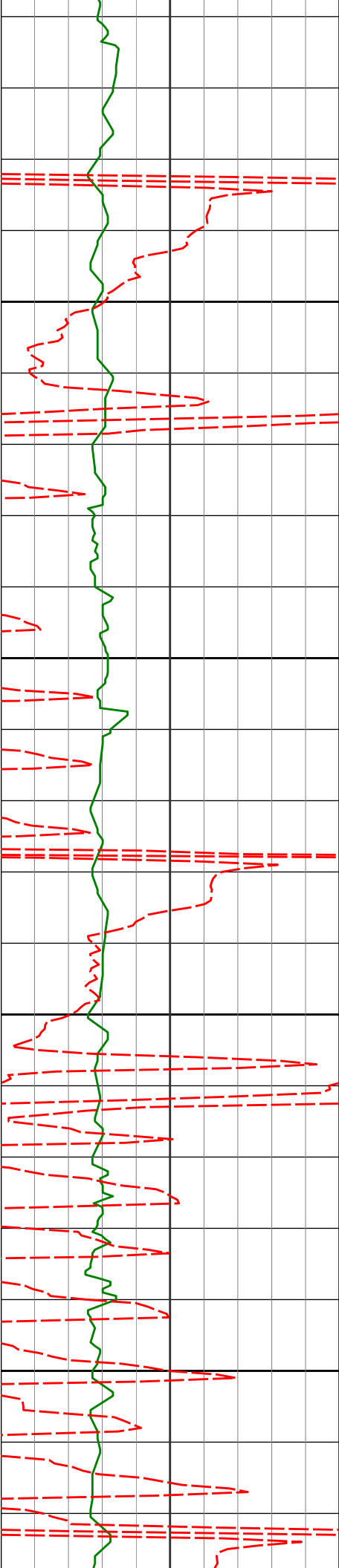
2125'

8.34°

211.07°

2120.93'

-58.18'



2200

2220'

9.52°

199.46°

2214.79'

-63.54'

2250

2300

2315'

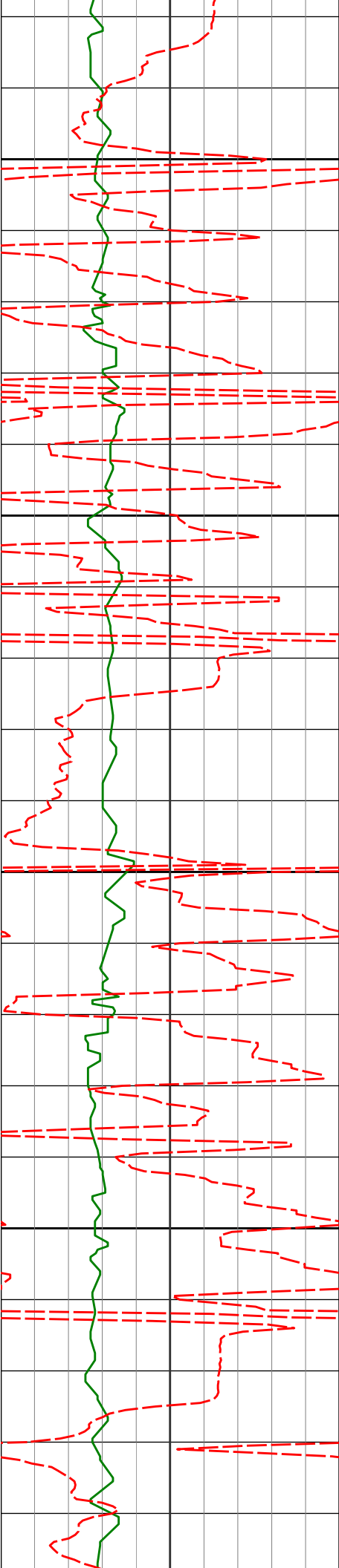
11.37°

187.06°

2308.22'

-66.28'

2350



2400

2409'

12.27°

194.03°

2400.23'

-68.69'

2450

2500

2504'

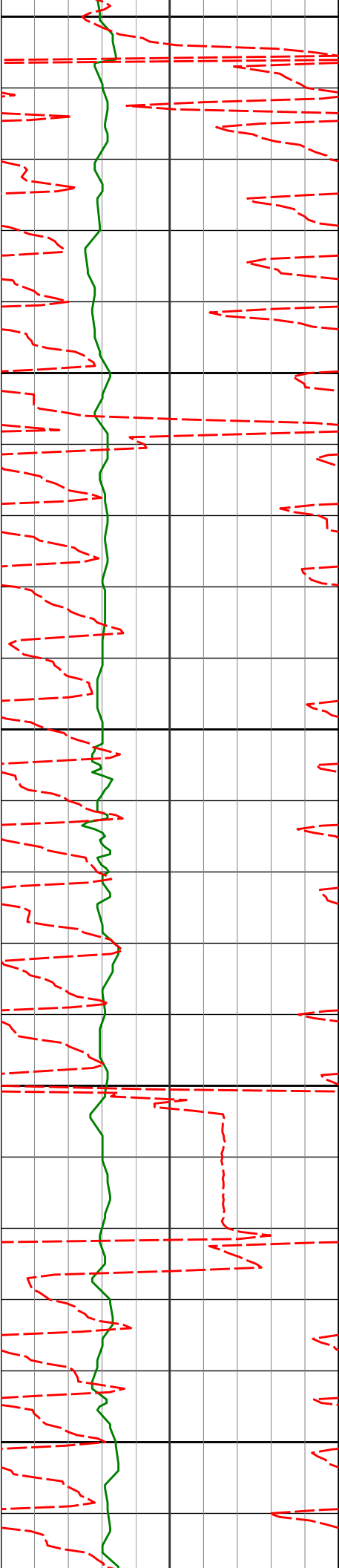
12.85°

194.56°

2492.96'

-72.56'

2550



2600

2650

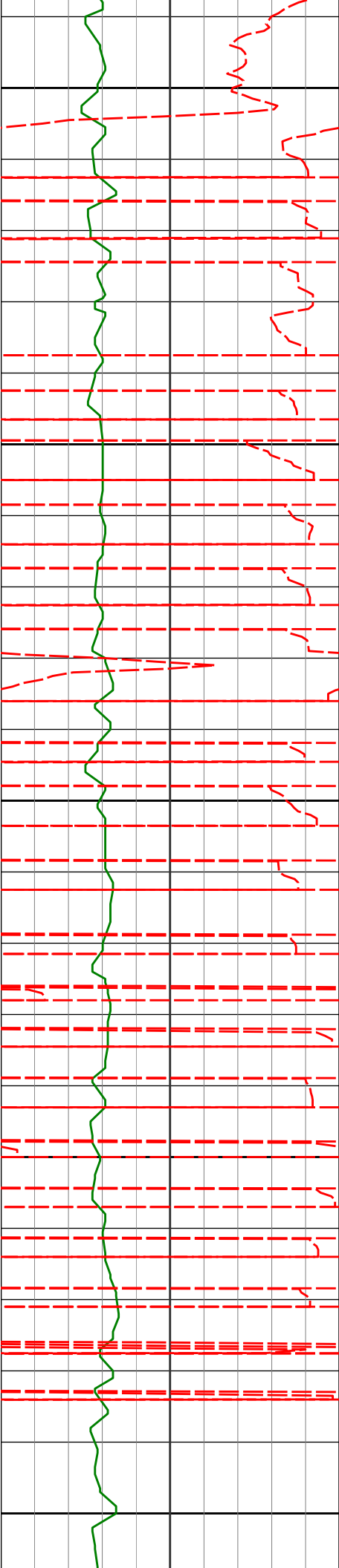
2700

2750

2800

2599'	16.01°	195.96°	2584.95'	-77.42'
2693'	14.46°	195.78°	2675.64'	-82.72'
2788'	15.39°	195.96°	2767.44'	-87.97'





3050

3073'

15.70°

200.61°

3042.82'

-103.16'

3100

3150

3168'

14.79°

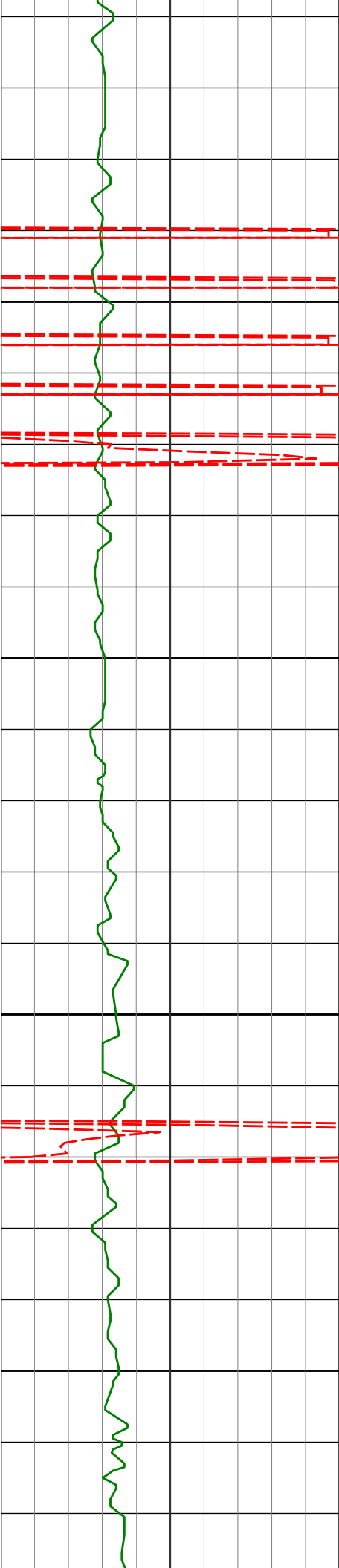
196.47°

3134.48'

-109.67'

3200

3250



3263'

13.79°

196.96°

3226.54'

-115.03'

3300

3350

3357'

12.17°

195.49°

3318.14'

-119.70'

3400

3450

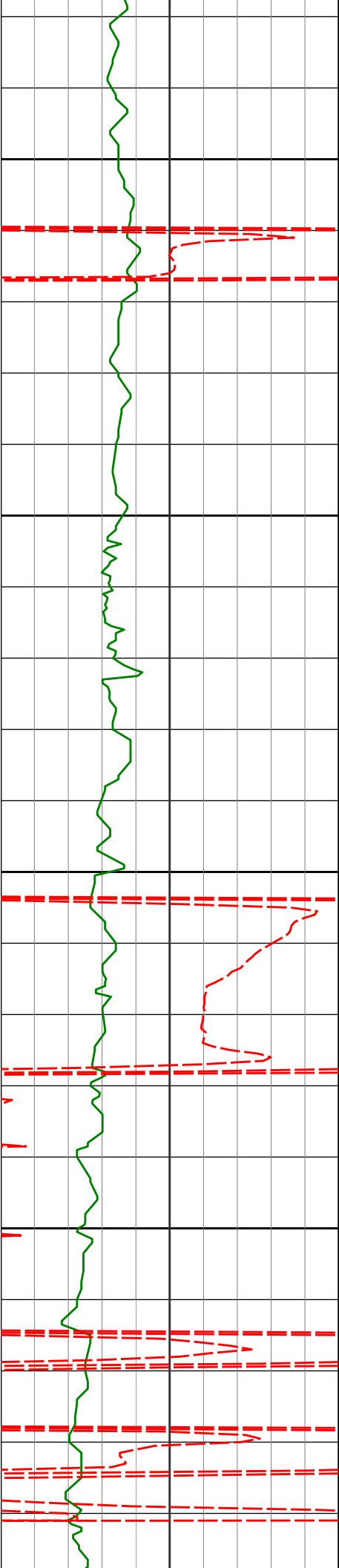
3452'

9.96°

192.47°

3411.36'

-123.07'



3500

3550

3600

3650

3547'

7.21°

197.37°

3505.29'

-125.78'

3641'

9.43°

200.92°

3598.30'

-129.50'



3700

3736'

10.84°

199.97°

3691.81'

-134.37'

3750

3800

3831'

10.34°

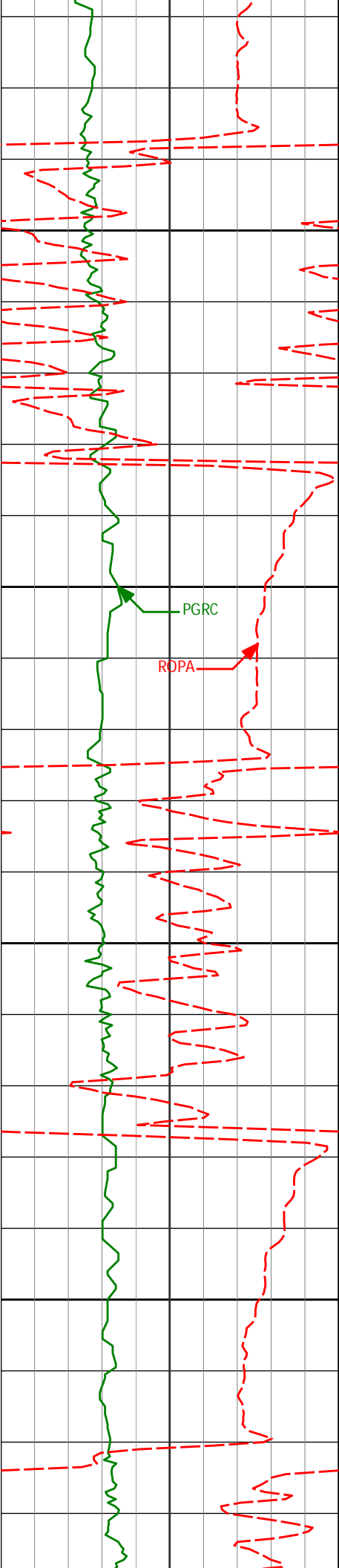
196.39°

3785.19'

-138.81'

3850

3900



3950

4000

4050

4100

3926'

8.76°

185.23°

3878.88'

-140.93'

4021'

5.50°

174.76°

3973.14'

-140.46'

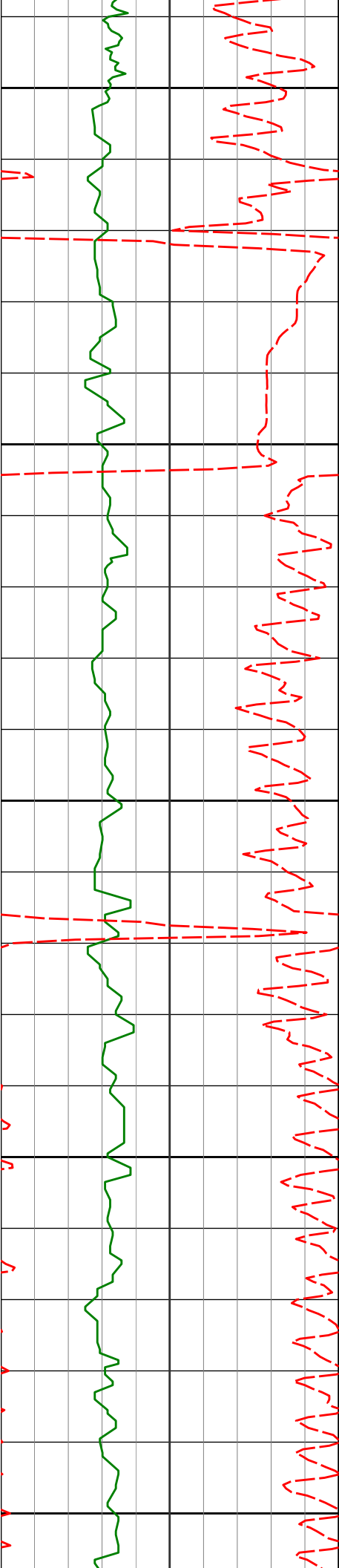
4116'

2.76°

158.57°

4067.89'

-138.81'



4150

4200

4250

4300

4350

4210'

0.46°

44.60°

4161.85'

-137.61'

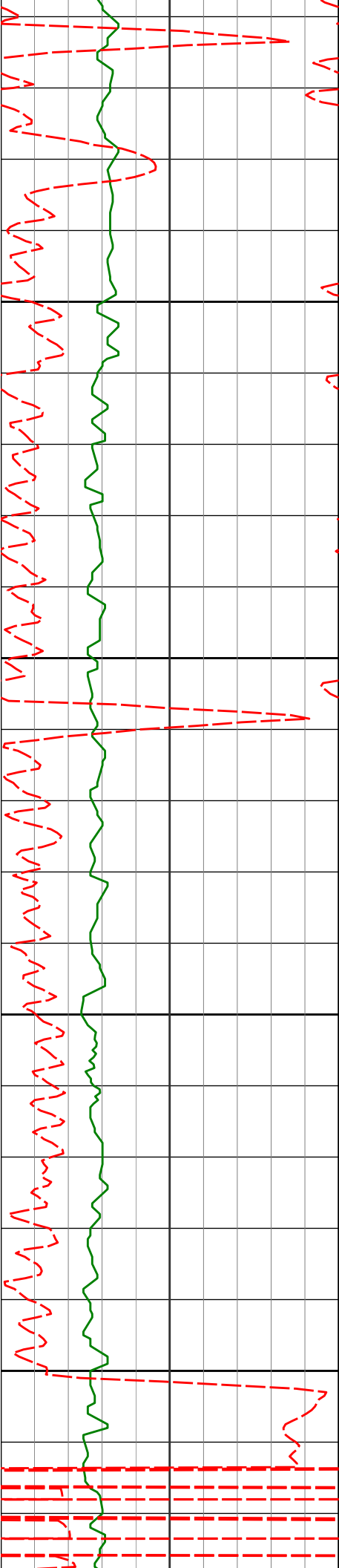
4305'

0.52°

354.50°

4256.85'

-137.43'



4400

4400'

0.40°

307.80°

4351.85'

-137.77'

4450

4500

4495'

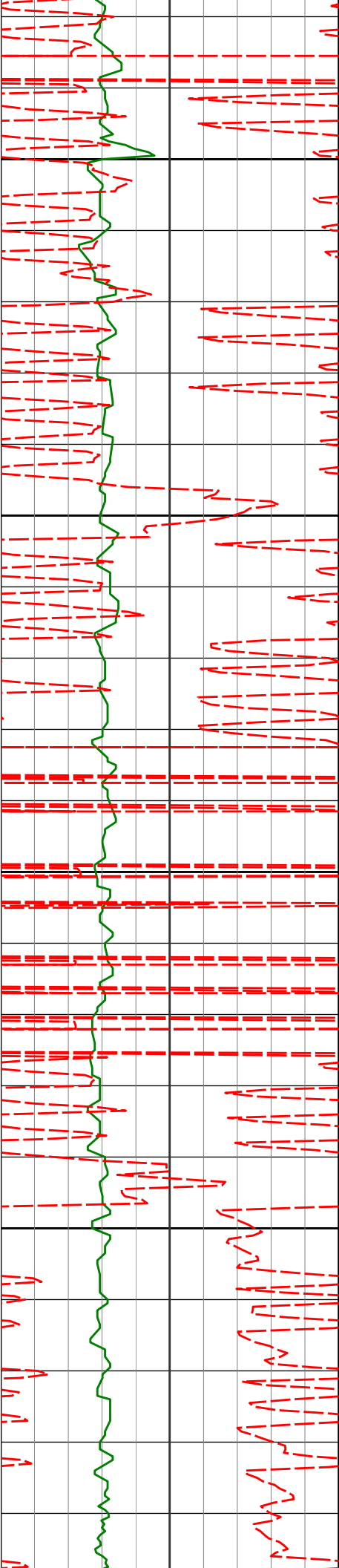
0.52°

297.08°

4446.84'

-138.44'

4550



4590'

0.99°

329.31°

4541.83'

-139.30'

4600

4650

4685'

0.89°

244.97°

4636.83'

-140.40'

4700

4750

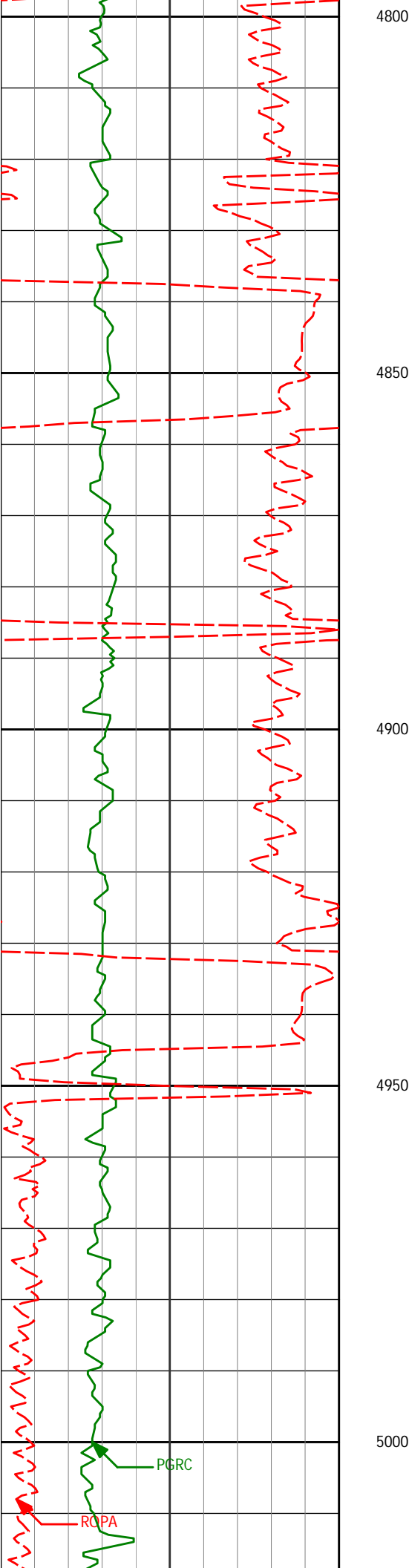
4780'

1.10°

208.65°

4731.81'

-141.44'



4874'

0.62°

100.49°

4825.81'

-141.31'

5000

PGRC

ROPA

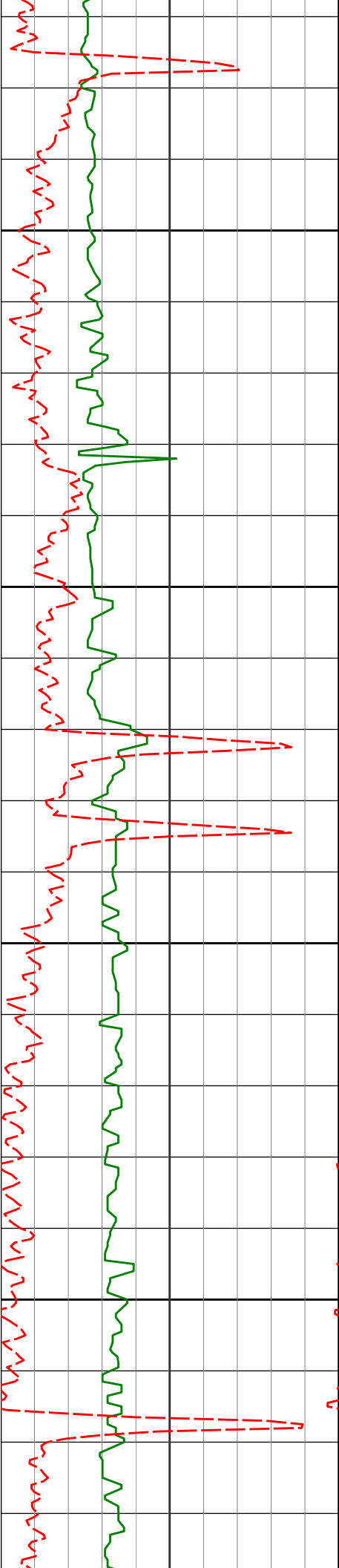
4969'

1.21°

32.76°

4920.80'

-140.31'



5050

5064'

1.19°

33.86°

5015.77'

-139.32'

5100

5150

5159'

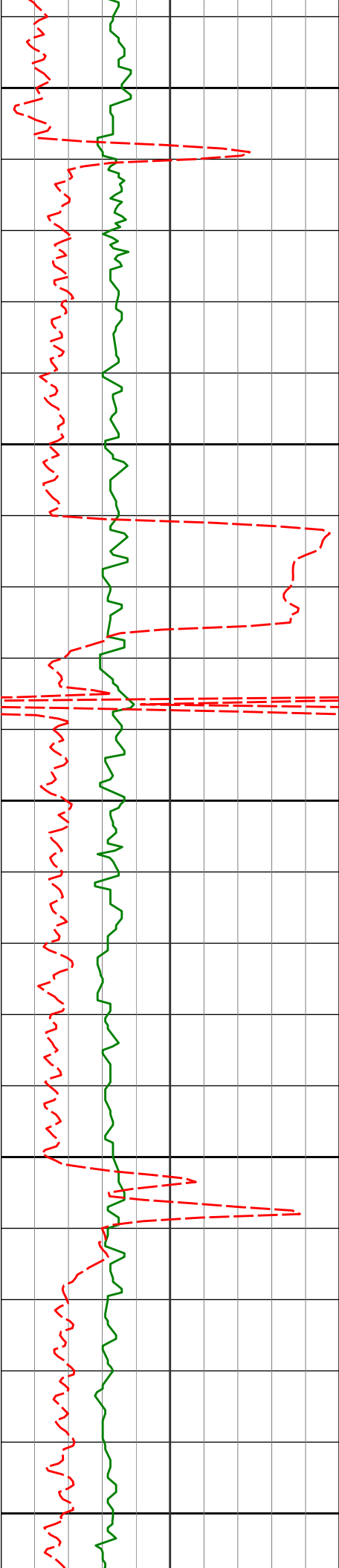
1.05°

60.88°

5110.76'

-138.08'

5200



5250

5254'

1.12°

78.66°

5205.74'

-136.45'

5300

5350

5349'

1.66°

43.53°

5300.71'

-134.66'

5400

5450

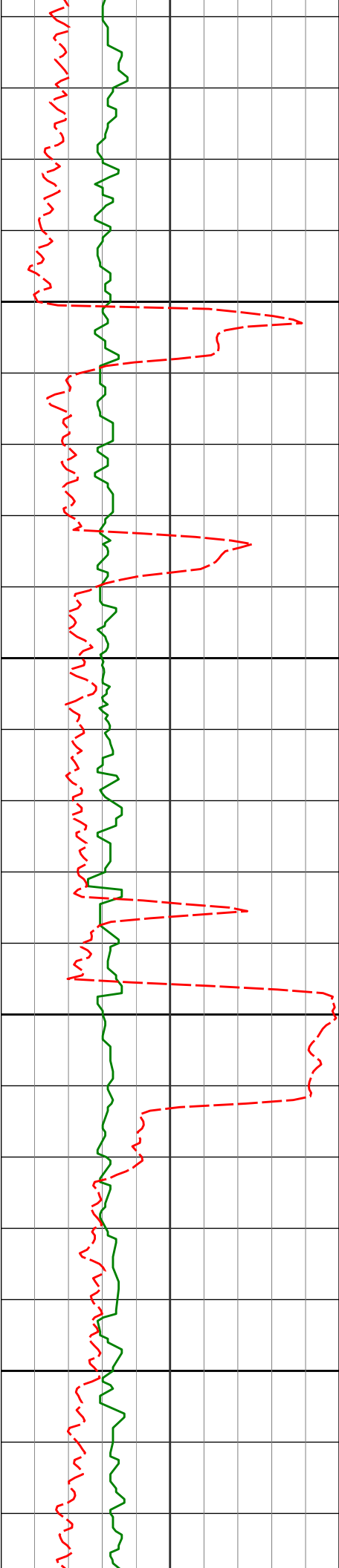
5443'

1.21°

67.55°

5394.69'

-132.89'



5500

5538'

1.55°

55.68°

5489.66'

-130.98'

5550

5600

5633'

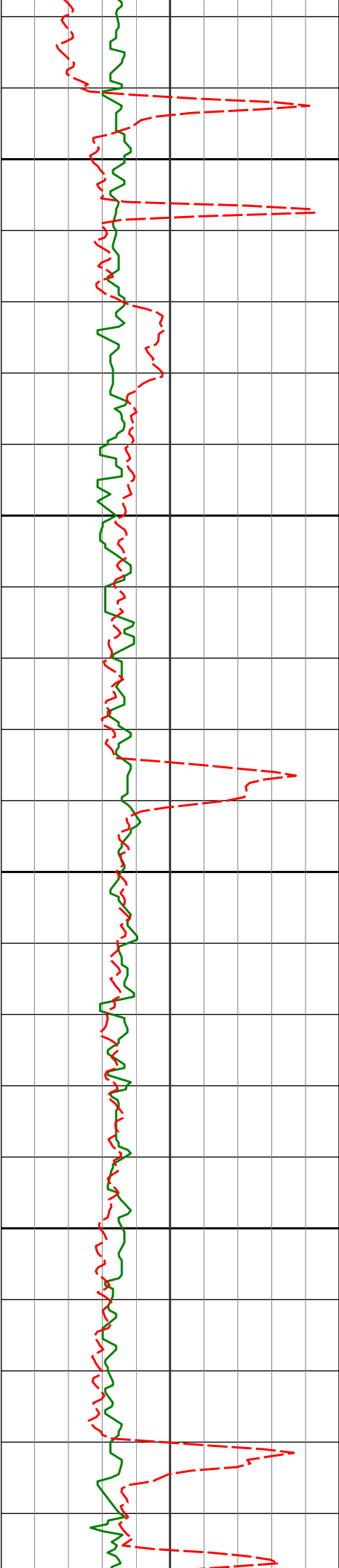
0.79°

29.93°

5584.64'

-129.67'

5650



5700

5728'

0.50°

15.87°

5679.63'

-129.29'

5750

5800

5823'

0.51°

54.45°

5774.63'

-128.87'

5850

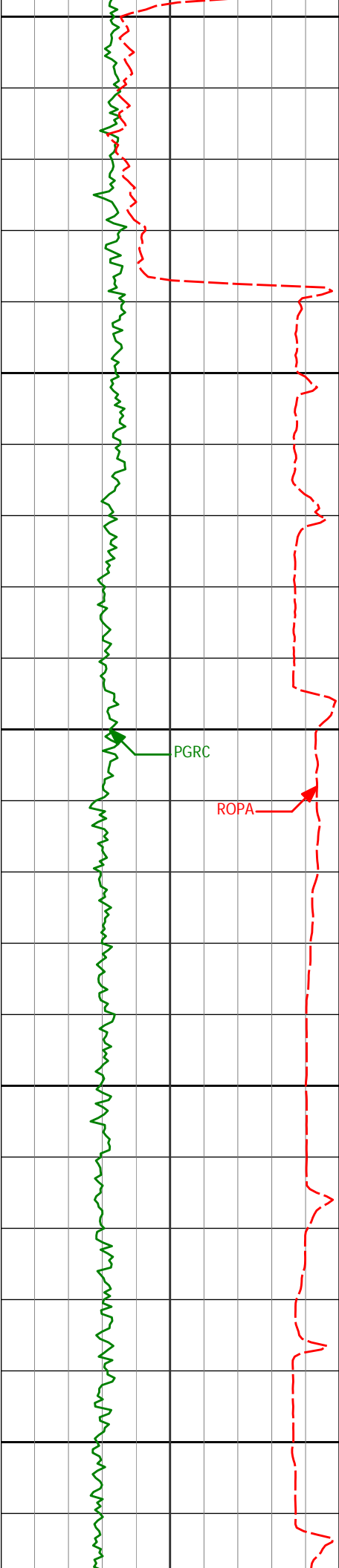
5881'

1.03°

48.81°

5832.62'

-128.30'



5900

5942'

1.20°

55.38°

5893.61'

-127.41'

5950

200

6000

PGRC

ROPA

6011'

3.82°

80.68°

5962.54'

-124.60'

6050

6059'

9.90°

81.85°

6010.17'

-118.99'

6100

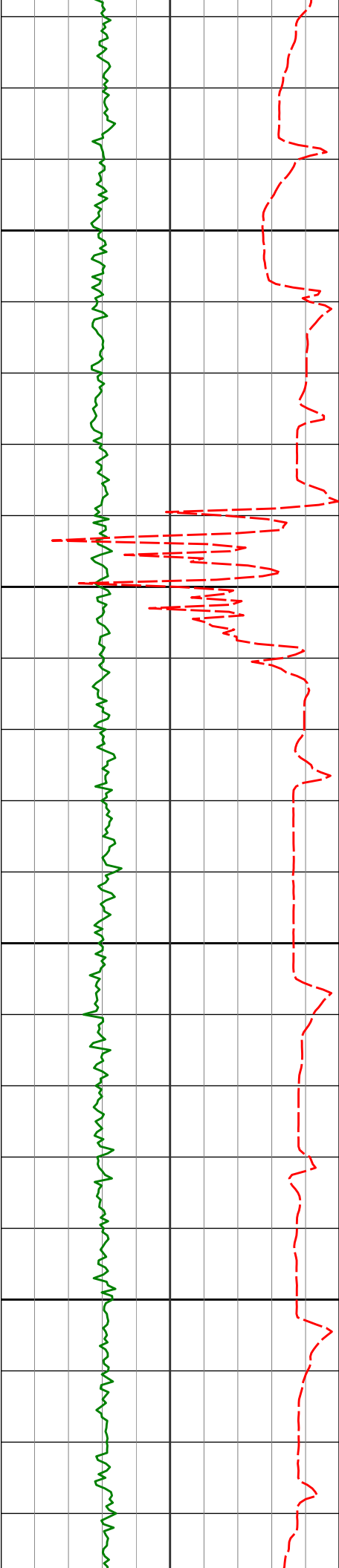
6106'

13.81°

80.46°

6056.16'

-109.57'



6150

6154'

17.06°

80.57°

6102.43'

-97.12'

6200

6201'

18.94°

81.47°

6147.12'

-82.94'

6250

6249'

20.81°

83.31°

6192.26'

-66.92'

6300

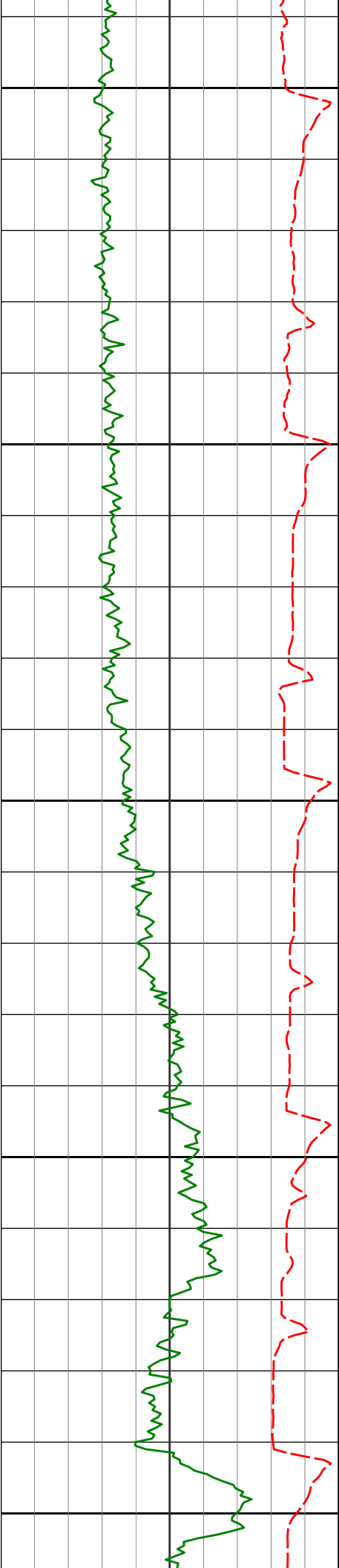
6296'

23.71°

85.97°

6235.76'

-49.33'



6350

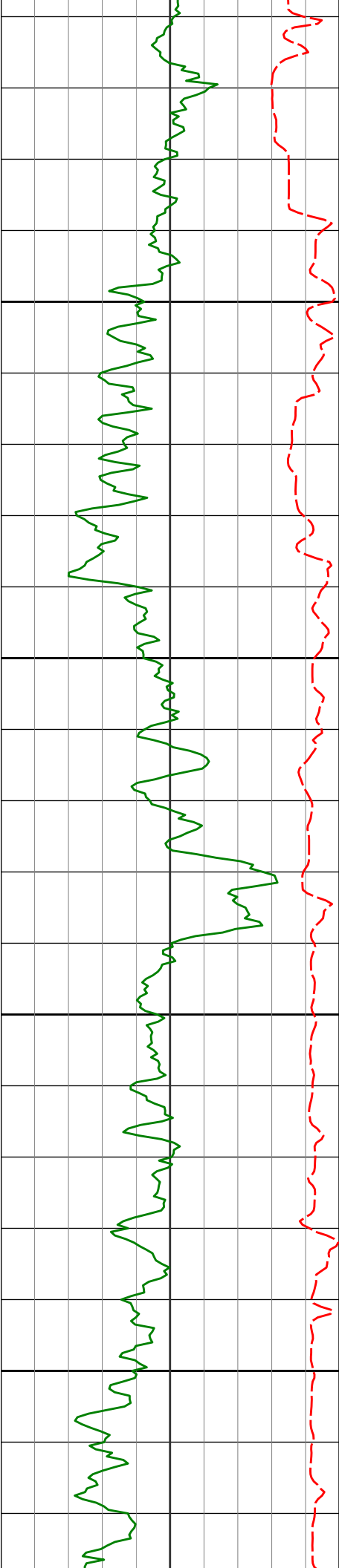
6400

6450

6500

6550

6344'	26.44°	87.37°	6279.23'	-29.14'
6391'	30.57°	85.73°	6320.52'	-6.88'
6439'	34.91°	85.83°	6360.89'	18.84'
6485'	39.01°	88.15°	6397.64'	46.31'
6533'	43.23°	89.62°	6433.79'	77.77'



6600

6650

6700

6750

6580'

46.90°

88.76°

6466.98'

110.94'

6628'

49.40°

87.29°

6499.00'

146.53'

6675'

51.92°

86.71°

6528.80'

182.64'

6723'

56.20°

85.32°

6556.96'

221.16'

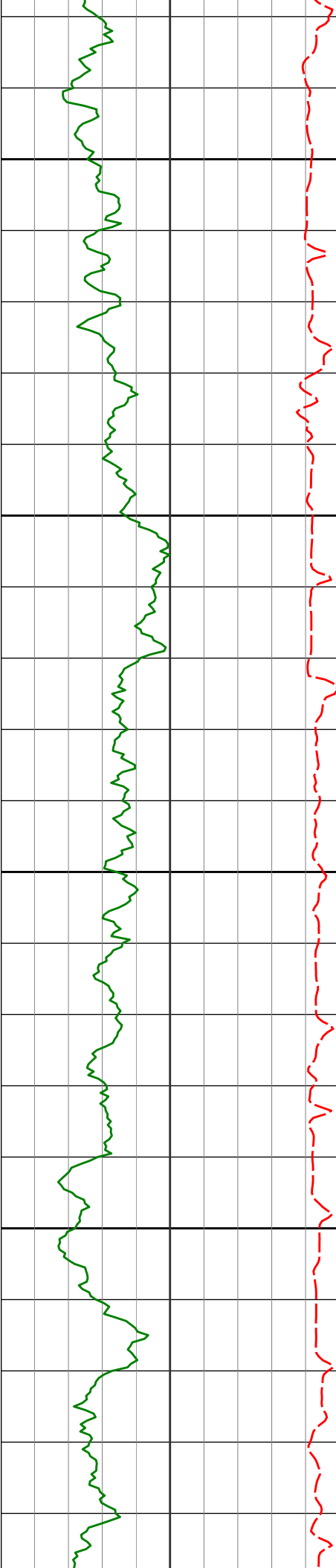
6770'

60.81°

86.16°

6581.51'

260.86'



6800

6818'

65.75°

86.54°

6603.09'

303.39'

6850

6865'

70.14°

87.98°

6620.74'

346.68'

6900

6913'

74.12°

90.00°

6635.46'

392.21'

6950

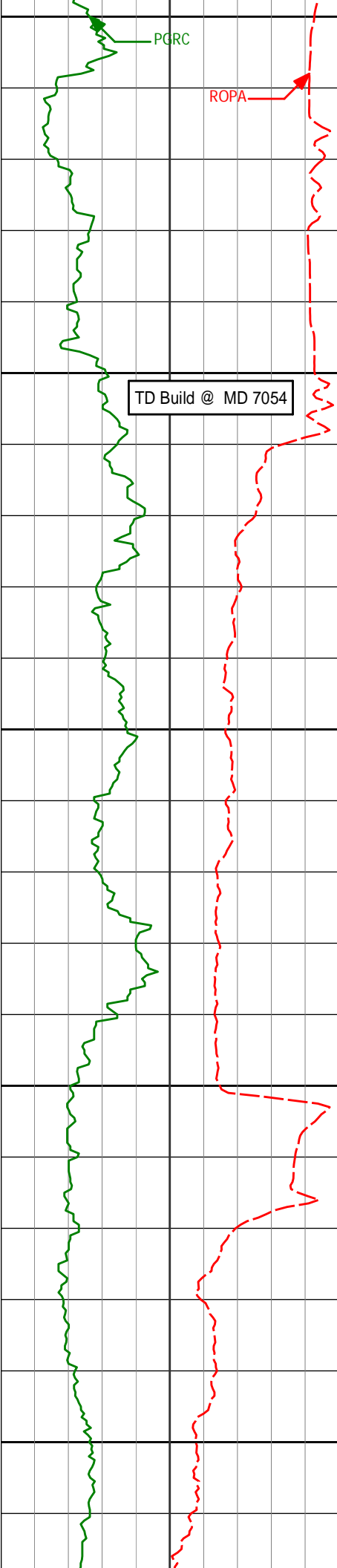
6959'

77.68°

90.18°

6646.67'

436.74'



7000

7050

7100

7150

7200

6999'

7089'

7184'

80.71°

85.29°

86.32°

89.73°

89.56°

89.12°

6654.16'

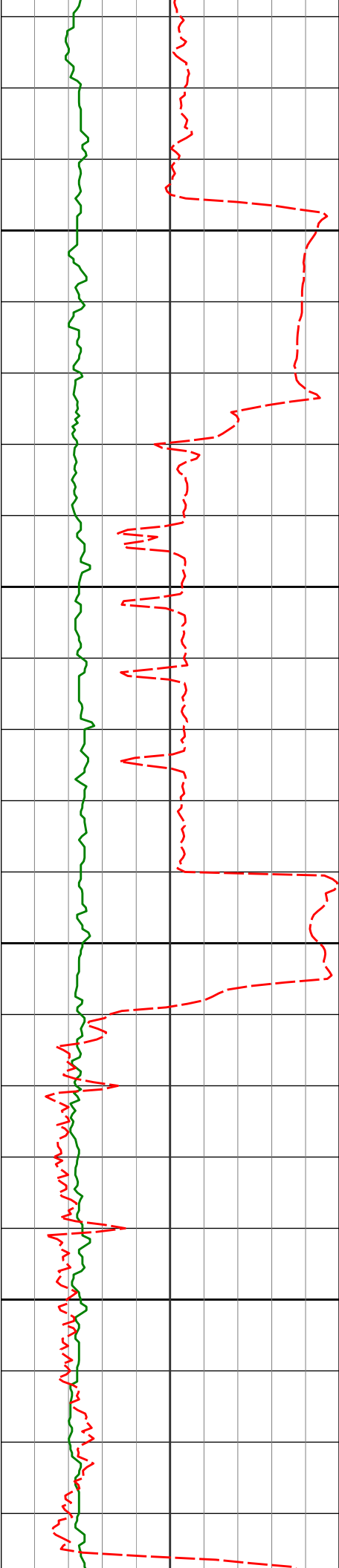
6665.13'

6672.07'

475.95'

565.06'

659.55'



7250

7278'

88.86°

87.57°

6676.02'

753.08'

7300

7350

7373'

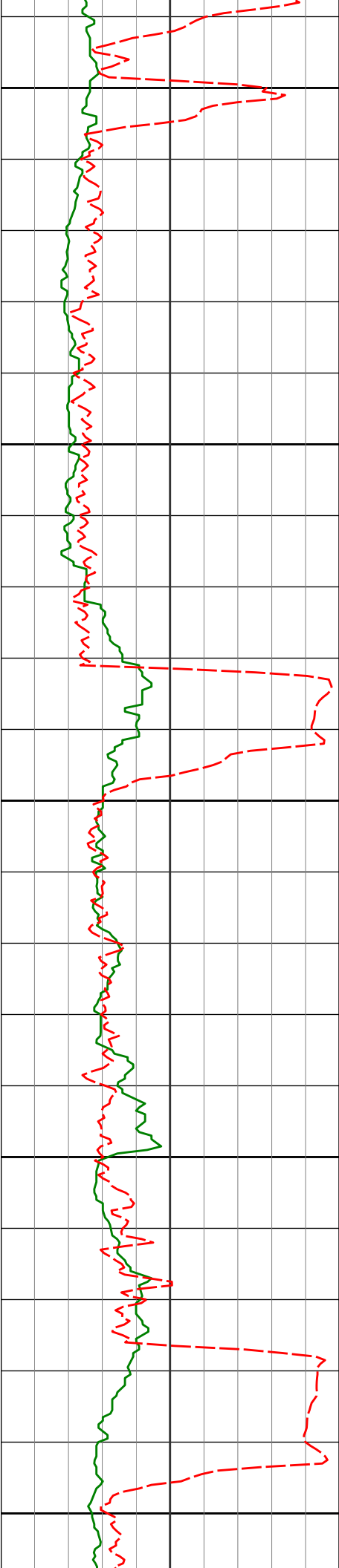
91.17°

87.44°

6675.99'

847.56'

7400



7450

7468'

91.30°

87.59°

6673.95'

942.02'

7500

7550

7563'

91.17°

88.25°

6671.90'

1036.55'

7600

7650

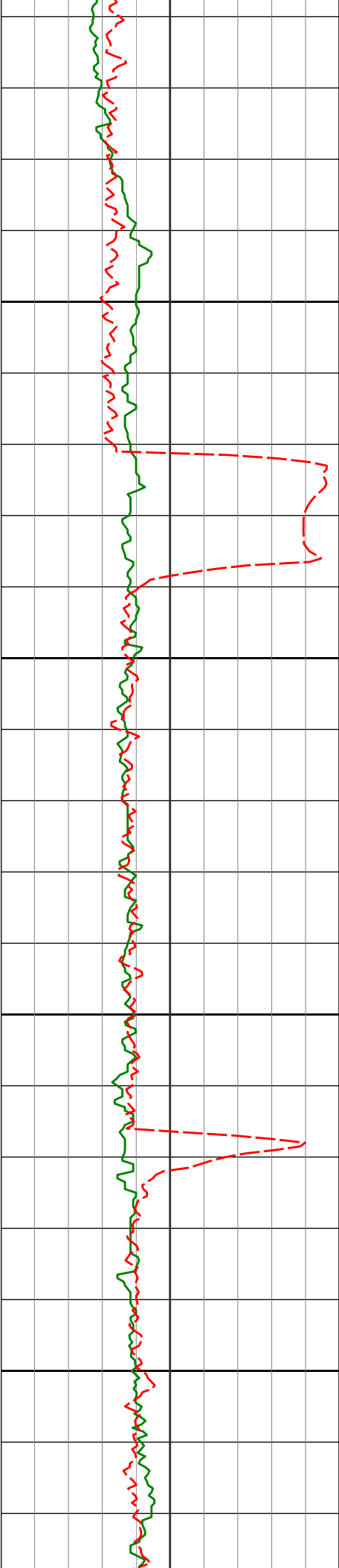
7450'

90.34°

87.50°

6670.45'

1131.00'



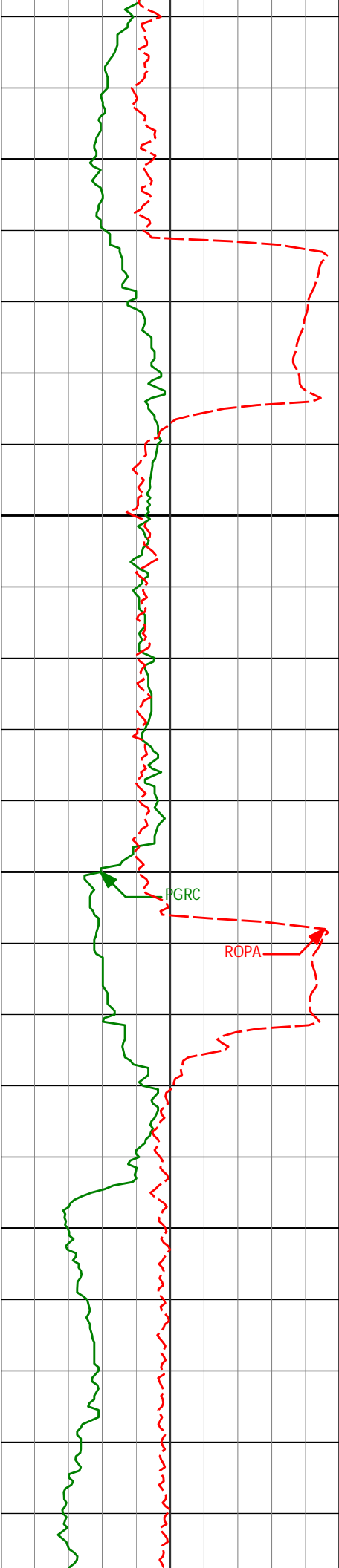
7700

7750

7800

7850

7658	90.34	87.50	6670.65	1131.08
7752'	89.41°	87.34°	6670.85'	1224.55'
7847'	87.84°	85.67°	6673.13'	1318.81'



7900

7950

8000

8050

7942'

88.83°

87.95°

6675.89'

1413.12'

PGRC

ROPA

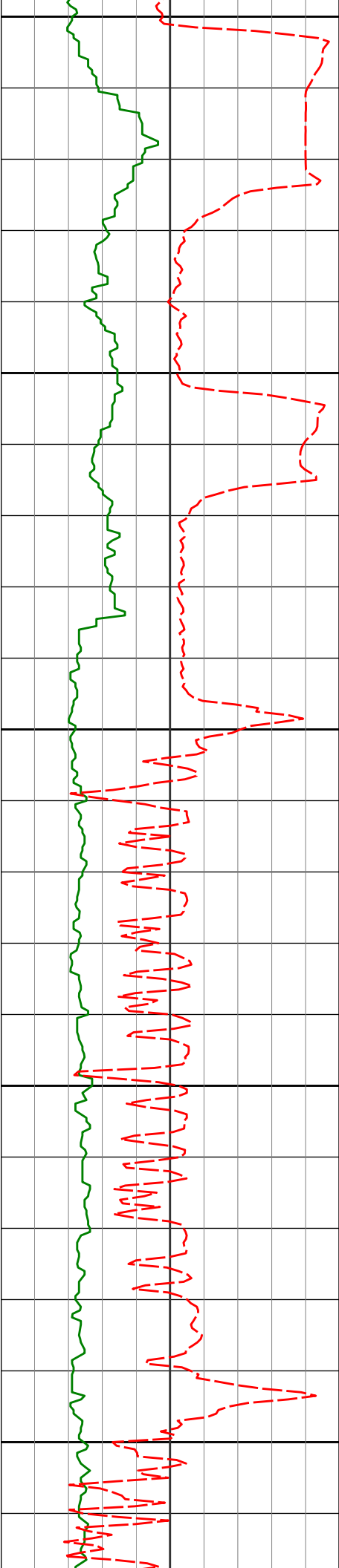
8037'

92.49°

90.62°

6674.79'

1507.83'



8100

8132'

91.11°

89.60°

6671.80'

1602.62'

8150

8200

8227'

89.38°

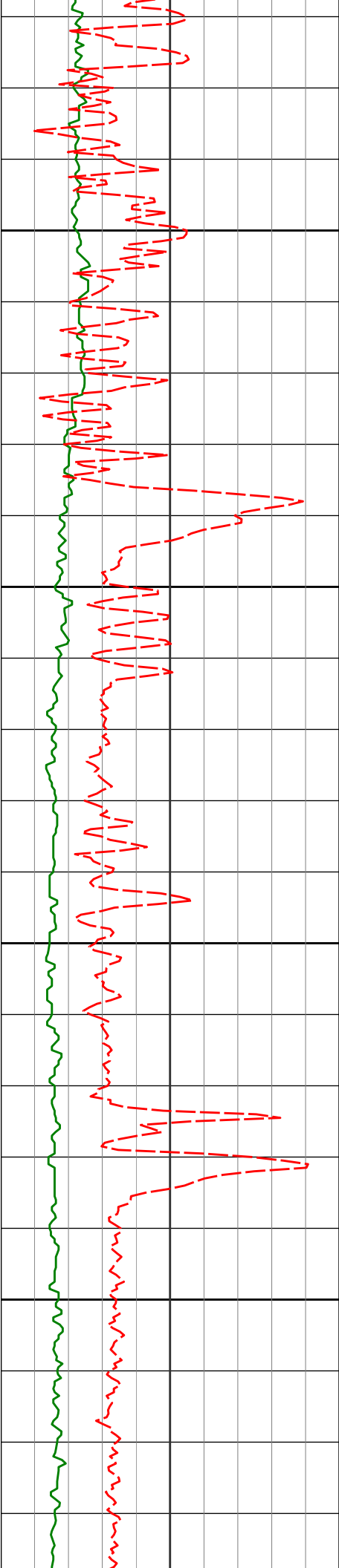
88.26°

6671.40'

1697.31'

8250

8300



8321'

89.35°

88.11°

6672.44'

1790.90'

8350

8400

8416'

89.20°

88.27°

6673.64'

1885.49'

8450

8500

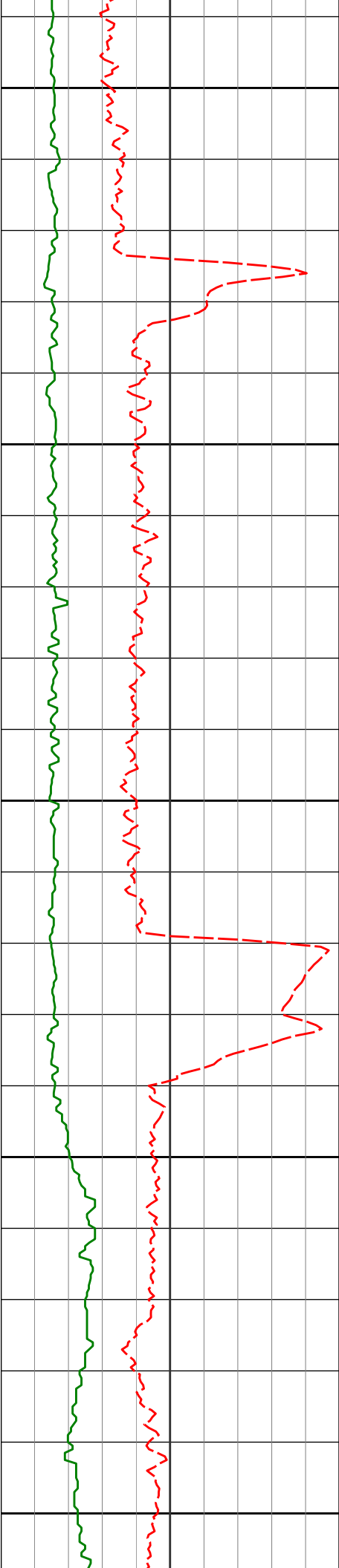
8511'

90.31°

88.39°

6674.05'

1980.10'



8550

8600

8650

8700

8750

8606'

90.86°

88.90°

6673.08'

2074.76'

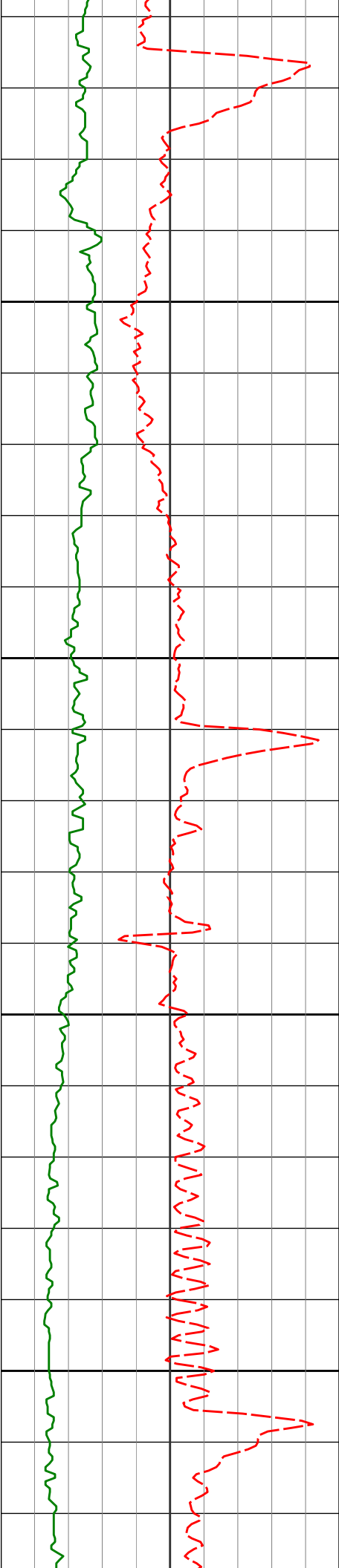
8701'

89.29°

87.99°

6672.95'

2169.39'



8800

8850

8900

8950

8795'

89.14°

87.82°

6674.24'

2262.93'

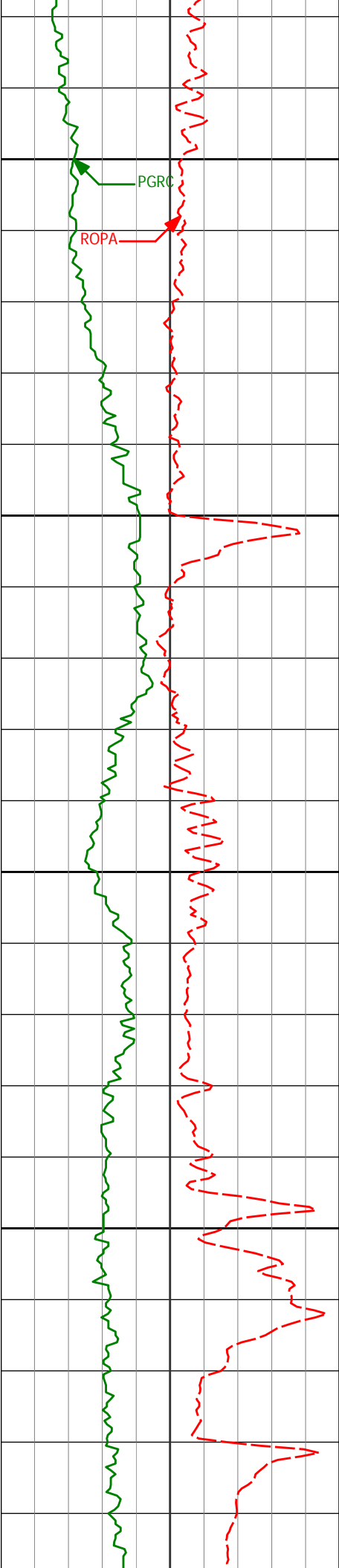
8890'

89.44°

88.33°

6675.42'

2357.50'



8985'

90.19°

89.07°

6675.72'

2452.17'

9000

PGR0

ROPA

9050

9080'

89.63°

88.52°

6675.88'

2546.85'

9100

9150

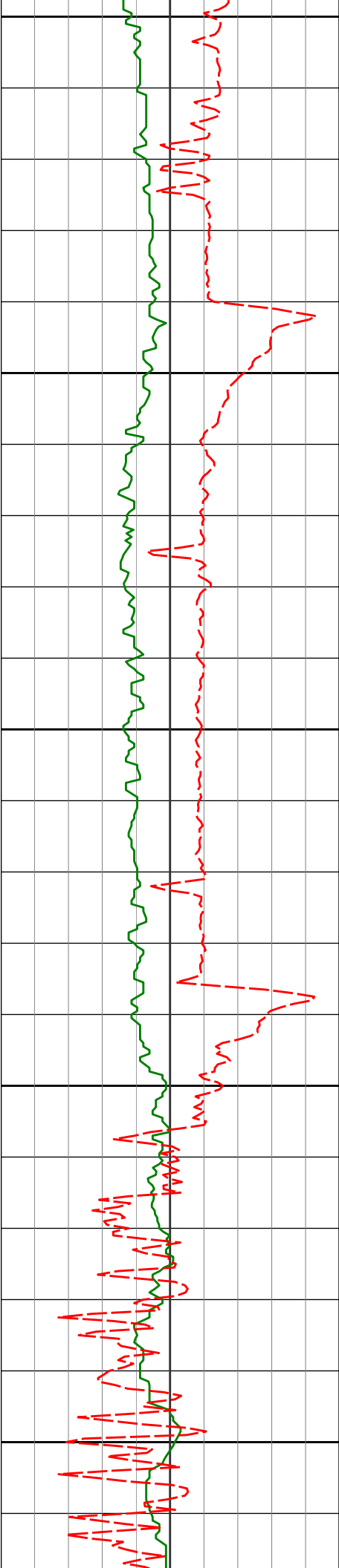
9175'

89.57°

88.39°

6676.54'

2641.48'



9200

9250

9300

9350

9400

9270'

89.60°

87.68°

6677.23'

2736.04'

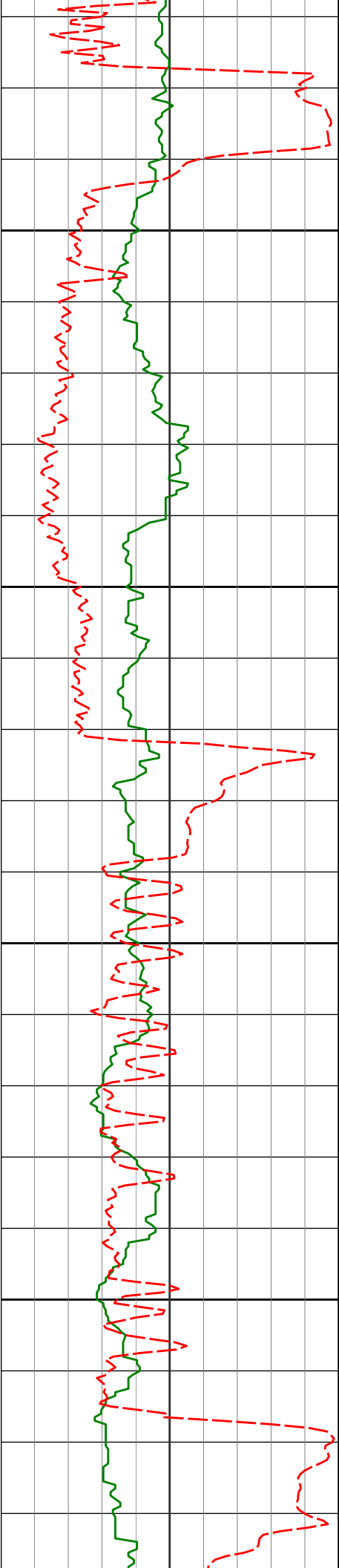
9364'

89.29°

87.08°

6678.14'

2829.51'



9450

9459'

90.25°

87.61°

6678.53'

2923.96'

9500

9550

9554'

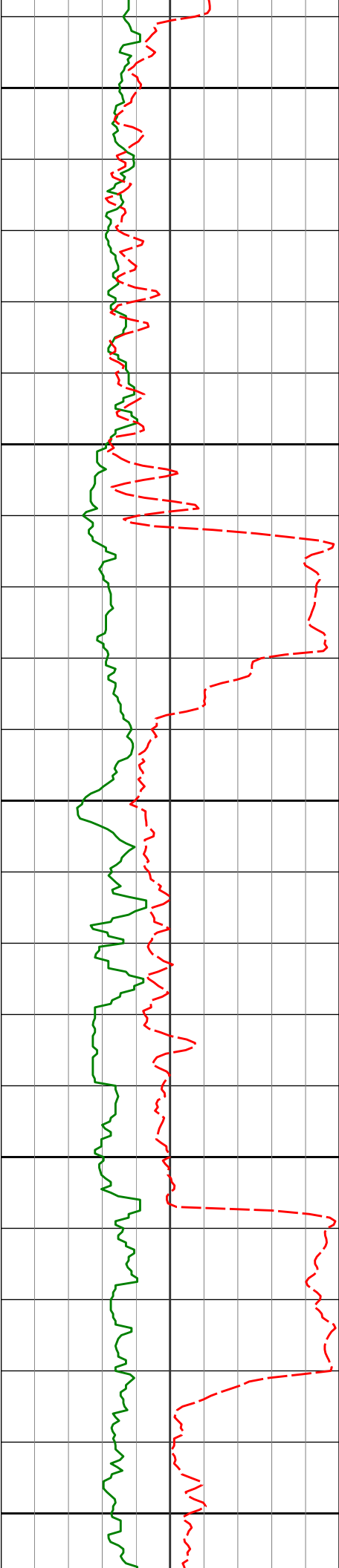
89.11°

87.88°

6679.06'

3018.48'

9600



9650

9700

9750

9800

9850

9649'

9744'

9838'

89.60°

89.48°

91.60°

88.31°

89.65°

89.68°

6680.13'

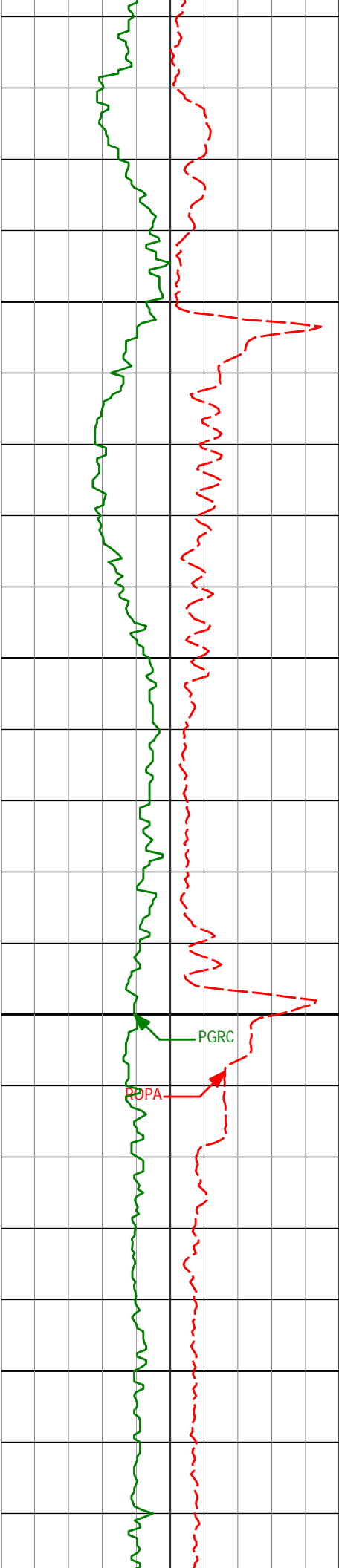
6680.90'

6680.02'

3113.05'

3207.75'

3301.53'



9900

9933'

91.64°

89.44°

6677.33'

3396.27'

9950

10000

PGRC

POPA

10028'

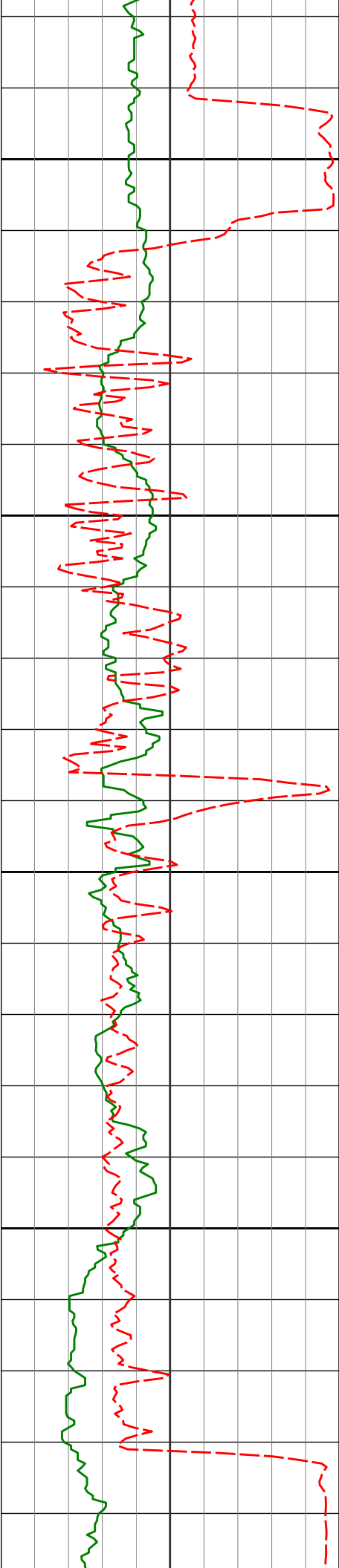
92.03°

88.93°

6674.29'

3490.95'

10050



10100

10123'

89.20°

87.20°

6673.27'

3585.51'

10150

10200

10217'

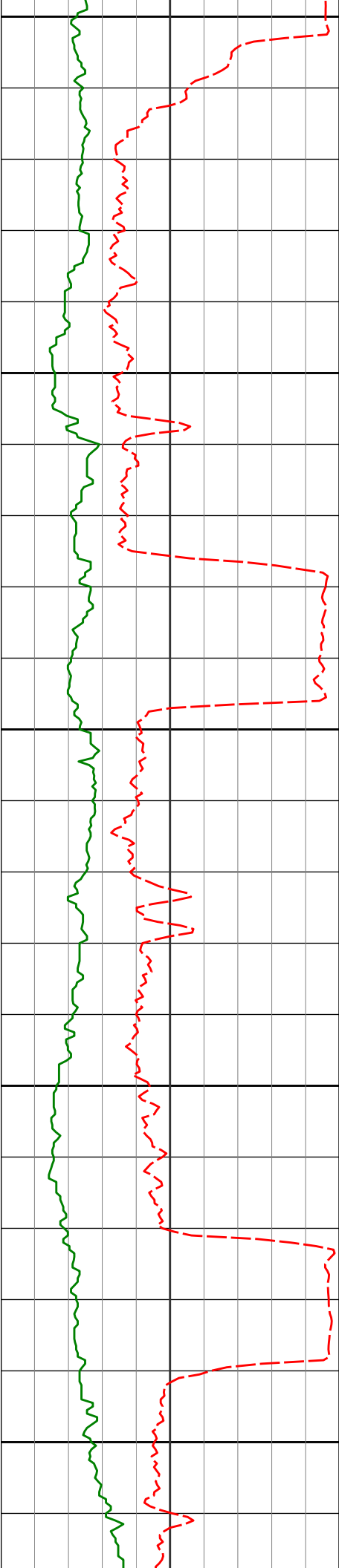
88.34°

87.04°

6675.29'

3678.91'

10250



10300

10312'

88.98°

88.42°

6677.52'

3773.40'

10350

10400

10407'

89.48°

89.53°

6678.79'

3868.09'

10450

10500

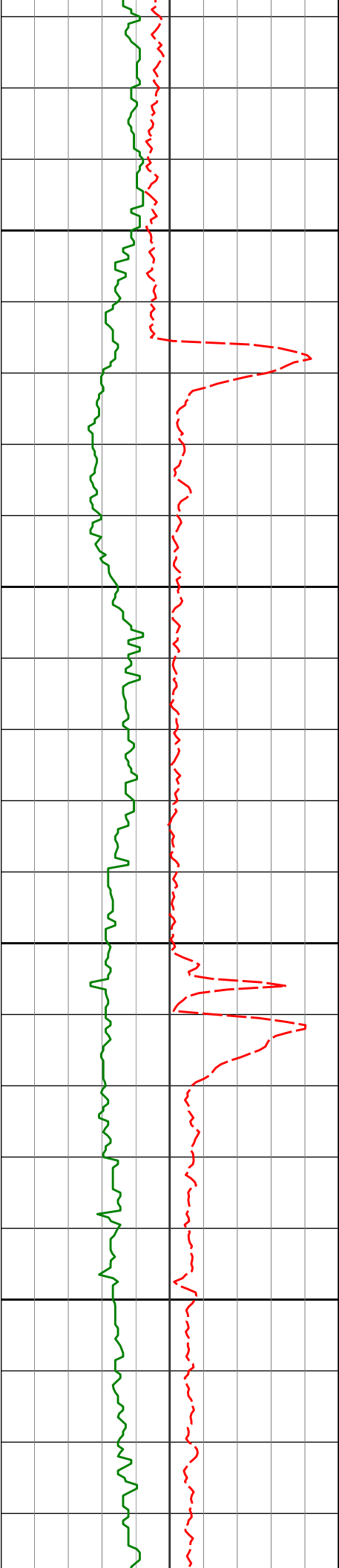
10502'

91.05°

90.66°

6678.36'

3962.92'



10550

10600

10650

10700

10596'

90.86°

89.96°

6676.79'

4056.76'

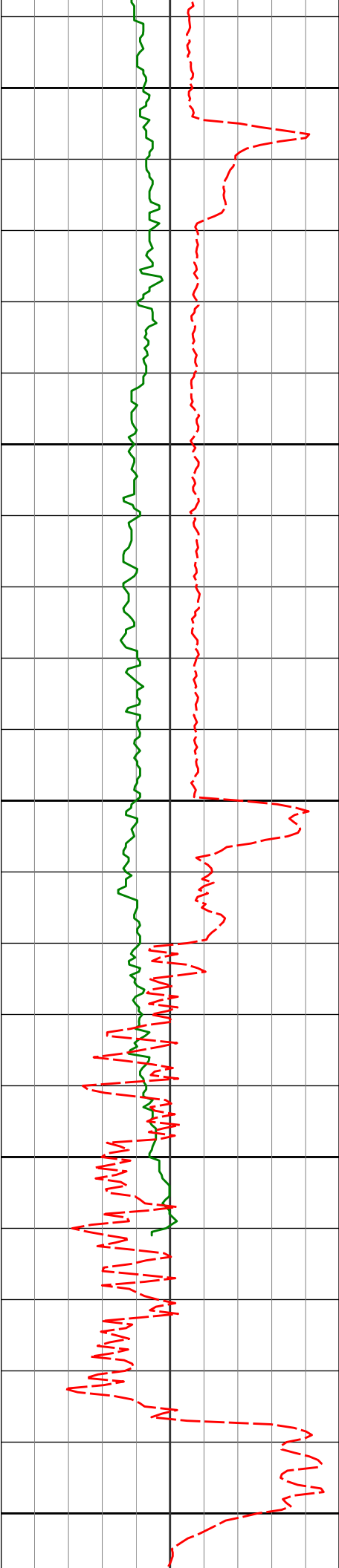
10691'

90.71°

89.94°

6675.49'

4151.57'



10750

10786'

90.65°

90.03°

6674.36'

4246.39'

10800

10850

10880'

90.49°

90.07°

6673.43'

4340.21'

10900

10912'

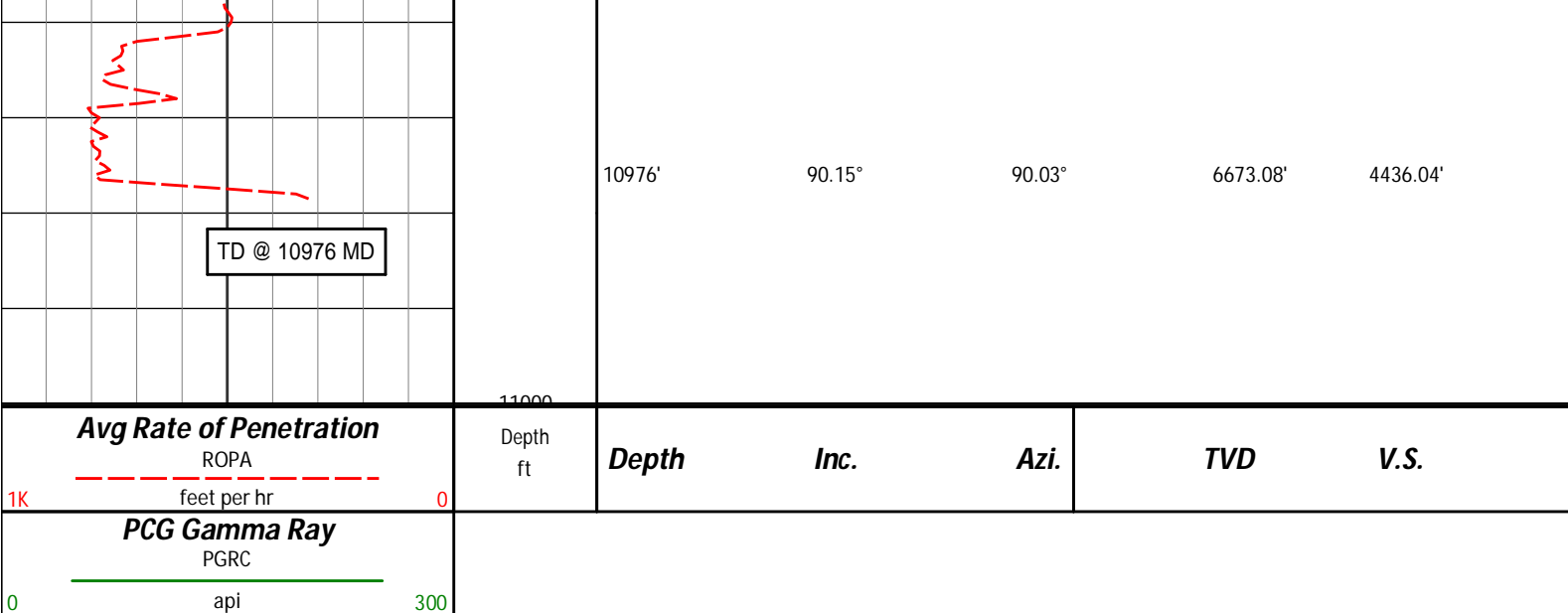
90.15°

90.03°

6673.25'

4372.15'

10950

**HALLIBURTON**

## DIRECTIONAL SURVEY REPORT

**Noble Energy  
Wells Ranch AE20-67-1HN  
Wattensburg  
Weld Colorado  
USA  
CA-XX-0900775403**

Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
333.00	1.20	244.43	332.98	1.51 S	3.15 W	-3.05	0.36
609.00	0.40	283.83	608.95	2.52 S	6.69 W	-6.52	0.34
823.00	0.60	217.23	822.94	3.24 S	8.09 W	-7.88	0.27
943.00	0.00	232.03	942.94	3.74 S	8.47 W	-8.23	0.50
999.00	0.18	302.70	998.94	3.69 S	8.55 W	-8.31	0.32
1092.00	0.31	280.72	1091.94	3.56 S	8.91 W	-8.68	0.17
1184.00	0.15	246.08	1183.94	3.57 S	9.27 W	-9.03	0.22
1276.00	0.50	350.71	1275.94	3.22 S	9.44 W	-9.23	0.61
1369.00	0.17	240.60	1368.94	2.88 S	9.63 W	-9.43	0.62
1461.00	0.59	244.58	1460.93	3.15 S	10.17 W	-9.96	0.46
1556.00	1.73	275.62	1555.91	3.22 S	12.03 W	-11.82	1.32
1651.00	4.34	252.56	1650.77	4.16 S	16.89 W	-16.60	2.98
1746.00	5.03	238.36	1745.46	7.42 S	23.86 W	-23.36	1.42
1840.00	6.55	233.58	1838.98	12.76 S	31.68 W	-30.84	1.69
1935.00	8.03	231.63	1933.21	20.10 S	41.23 W	-39.93	1.58
2030.00	9.60	223.20	2027.09	29.98 S	51.85 W	-49.93	2.13
2125.00	8.34	211.07	2120.93	41.66 S	60.83 W	-58.18	2.38
2220.00	9.52	199.46	2214.79	54.97 S	67.01 W	-63.54	2.26
2315.00	11.37	187.06	2308.22	71.68 S	70.78 W	-66.28	3.06
2409.00	12.27	194.03	2400.23	90.57 S	74.34 W	-68.69	1.79
2504.00	12.85	194.56	2492.96	110.58 S	79.44 W	-72.56	0.62
2599.00	16.01	195.96	2584.95	133.41 S	85.70 W	-77.42	3.35
2693.00	14.46	195.78	2675.64	157.17 S	92.46 W	-82.72	1.65
2788.00	15.39	195.96	2767.44	180.71 S	99.15 W	-87.97	0.98
2883.00	15.03	194.20	2859.11	204.77 S	105.64 W	-92.98	0.61
2978.00	14.20	193.64	2951.03	228.04 S	111.41 W	-97.32	0.89
3073.00	15.70	200.61	3042.82	251.40 S	118.69 W	-103.16	2.46
3168.00	14.79	196.47	3134.48	275.06 S	126.65 W	-109.67	1.50
3263.00	13.79	196.96	3226.54	297.51 S	133.39 W	-115.03	1.06
3357.00	12.17	195.49	3318.14	317.78 S	139.30 W	-119.70	1.76
3452.00	9.96	192.47	3411.36	335.46 S	143.75 W	-123.07	2.40
3547.00	7.21	197.37	3505.29	349.18 S	147.31 W	-125.78	2.99

3641.00	9.43	200.92	3598.30	362.00 S	151.82 W	-129.50	2.42
3736.00	10.84	199.97	3691.81	377.67 S	157.65 W	-134.37	1.50
3831.00	10.34	196.39	3785.19	394.25 S	163.11 W	-138.81	0.87
3926.00	8.76	185.23	3878.88	409.63 S	166.18 W	-140.93	2.56
4021.00	5.50	174.76	3973.14	421.37 S	166.42 W	-140.46	3.68
4116.00	2.76	158.57	4067.89	428.03 S	165.17 W	-138.81	3.11
4210.00	0.46	44.60	4161.85	429.86 S	164.08 W	-137.61	3.16
4305.00	0.52	354.50	4256.85	429.16 S	163.86 W	-137.43	0.44
4400.00	0.40	307.80	4351.85	428.53 S	164.16 W	-137.77	0.40
4495.00	0.52	297.08	4446.84	428.13 S	164.81 W	-138.44	0.16
4590.00	0.99	329.31	4541.83	427.23 S	165.61 W	-139.30	0.64
4685.00	0.89	244.97	4636.83	426.83 S	166.69 W	-140.40	1.33
4780.00	1.10	208.65	4731.81	427.94 S	167.80 W	-141.44	0.68
4874.00	0.62	100.49	4825.81	428.83 S	167.73 W	-141.31	1.51
4969.00	1.21	32.76	4920.80	428.08 S	166.67 W	-140.31	1.19
5064.00	1.19	33.86	5015.77	426.41 S	165.58 W	-139.32	0.03
5159.00	1.05	60.88	5110.76	425.17 S	164.27 W	-138.08	0.57
5254.00	1.12	78.66	5205.74	424.56 S	162.60 W	-136.45	0.36
5349.00	1.66	43.53	5300.71	423.38 S	160.73 W	-134.66	1.04
5443.00	1.21	67.55	5394.69	422.01 S	158.88 W	-132.89	0.79
5538.00	1.55	55.68	5489.66	420.90 S	156.89 W	-130.98	0.47
5633.00	0.79	29.93	5584.64	419.61 S	155.50 W	-129.67	0.95
5728.00	0.50	15.87	5679.63	418.65 S	155.06 W	-129.29	0.35
5823.00	0.51	54.45	5774.63	418.00 S	154.60 W	-128.87	0.35
5881.00	1.03	48.81	5832.62	417.51 S	154.00 W	-128.30	0.91
5942.00	1.20	55.38	5893.61	416.78 S	153.06 W	-127.41	0.34
6011.00	3.82	80.68	5962.54	416.00 S	150.20 W	-124.60	4.03
6059.00	9.90	81.85	6010.17	415.16 S	144.53 W	-118.99	12.68
6106.00	13.81	80.46	6056.16	413.65 S	135.00 W	-109.57	8.34
6154.00	17.06	80.57	6102.43	411.55 S	122.40 W	-97.12	6.76
6201.00	18.94	81.47	6147.12	409.29 S	108.05 W	-82.94	4.05
6249.00	20.81	83.31	6192.26	407.14 S	91.88 W	-66.92	4.10
6296.00	23.71	85.97	6235.76	405.50 S	74.16 W	-49.33	6.53
6344.00	26.44	87.37	6279.23	404.34 S	53.85 W	-29.14	5.82
6391.00	30.57	85.73	6320.52	402.96 S	31.47 W	-6.88	8.95
6439.00	34.91	85.83	6360.89	401.06 S	5.58 W	18.84	9.04
6485.00	39.01	88.15	6397.64	399.63 S	22.03 E	46.31	9.41
6533.00	43.23	89.62	6433.79	399.03 S	53.58 E	77.77	9.01
6580.00	46.90	88.76	6466.98	398.56 S	86.84 E	110.94	7.92
6628.00	49.40	87.29	6499.00	397.32 S	122.57 E	146.53	5.70
6675.00	51.92	86.71	6528.80	395.41 S	158.87 E	182.64	5.44
6723.00	56.20	85.32	6556.96	392.70 S	197.62 E	221.16	9.21
6770.00	60.81	86.16	6581.51	389.73 S	237.58 E	260.86	9.93
6818.00	65.75	86.54	6603.09	387.00 S	280.35 E	303.39	10.32
6865.00	70.14	87.98	6620.74	384.93 S	323.85 E	346.68	9.77
6913.00	74.12	90.00	6635.46	384.13 S	369.51 E	392.21	9.20
6959.00	77.68	90.18	6646.67	384.19 S	414.12 E	436.74	7.74
6999.00	80.71	89.73	6654.16	384.16 S	453.41 E	475.95	7.66
7089.00	85.29	89.56	6665.13	383.60 S	542.71 E	565.06	5.09
7184.00	86.32	89.12	6672.07	382.51 S	637.45 E	659.55	1.18
7278.00	88.86	87.57	6676.02	379.80 S	731.32 E	753.08	3.16
7373.00	91.17	87.44	6675.99	375.66 S	826.22 E	847.56	2.44
7468.00	91.30	87.59	6673.95	371.54 S	921.11 E	942.02	0.21
7563.00	91.17	88.25	6671.90	368.09 S	1016.02 E	1036.55	0.71
7658.00	90.34	87.50	6670.65	364.57 S	1110.95 E	1131.08	1.18
7752.00	89.41	87.34	6670.85	360.34 S	1204.85 E	1224.55	1.00
7847.00	87.84	85.67	6673.13	354.55 S	1299.64 E	1318.81	2.41
7942.00	88.83	87.95	6675.89	349.26 S	1394.45 E	1413.12	2.61

**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 93.49 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.63 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 7942.00 FEET**

IS 1437.52 FEET ALONG 104.06 DEGREES (GRID)

First four survey's are from 3rd party source (Muilti Shot EMS) and provided by CO-man on location before drilling.

Depth 333 Inc 1.20 Azi 244.43

Depth 609 Inc 0.40 Azi 283.83

Depth 823 Inc 0.60 Azi 217.23

Depth 943 Inc 0.00 Azi 232.03

Tied in @ Surface

Magnetitic direction of 7.631 has been added to AZI for grid direction correction.

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