

DC - Pressure Case Directional
PCGK - Pressure Case Gamma



1 : 600 / 1 : 240

[illegible]

WELL INFORMATION

MWD Run Number	100	200			
Date run completed	17-Oct-13	19-Oct-13			
Rig Bit Number	2	3			
Bit Size (in)	8.750	8.750			
Tool Nominal OD (in)	6.870	6.870			
Log Start Depth (TVD, ft)	982.90	5,881.18			
Log End Depth (TVD, ft)	5,881.18	6,653.72			
Drill or Wipe	Drill	Drill			
Drill/Wipe Start Date and Time	15-Oct-13 19:39	17-Oct-13 23:19			
Drill/Wipe End Date and Time	17-Oct-13 13:20	18-Oct-13 19:15			
Min Inc (deg) @ Depth (TVD, ft)	0.20 @ 5,421.25	2.01 @ 5,894.18			
Max Inc (deg) @ Depth (TVD, ft)	13.79 @ 2,776.00	82.94 @ 6,648.57			
Bit TFA(in2) / Bit Type	0.78 / PDC	1.24 / PDC			
Flow Rate (gpm)	587.30	559.68			
Max AV (fpm) / CV (fpm) @ MWD	N/A / N/A	N/A / N/A			
Fluid Type	Fresh Water Gel	Fresh Water Gel			
Density (ppg) / Viscosity (spqt)	9.50 / 48.00	10.30 / 37.00			
Filtrate CL (ppm)	1,900.00	1,850.00			
pH / Fluid Loss (mptm)	9.60 / 10	9.70 / 9			
PV (cP) / YP (lbf2)	13 / 11.00	12 / 8.00			
% Solids / % Sand	8.00 / 0.15	9.50 / 0.10			
% Oil / Oil:Water Ratio	N/A / N/A	N/A / N/A			
Rm @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Rmf @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Rmc @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Min Tool Temp (deg F) @ 150 ft	144.70 / BOM	151.00 / BOM			

Max Tool Temp (degF) / Source	141.70 / PCM	154.30 / PCM			
Rm @ Max Tool Temp (degF)	N/A @ 141.70	N/A @ 154.30			
Lead MWD Engineer	Kyle Wass	Kyle Wass			
Customer Representative	Stetson Nielsen	Stetson Nielsen			

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM	PCM			
Software Version	5.84	5.84			
Sub Serial Number	11341336	11341336			
Insert Serial Number	11620297	11620297			
Date and Time Initialized	15-Oct-13 21:16	01-Jan-70 00:00			
Date and Time Read	19-Oct-13 01:38	19-Oct-13 01:44			
ECMB SW Version	N/A	N/A			

Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	57.00	54.00			
Software Version	6.21	6.21			
Sub Serial Number	11341336	11341336			
Sonde Serial Number	10859920	10859920			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	189.59	356.27			

Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	50.53	47.74			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	11341336	11341336			
Insert/Sonde Serial Number	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 Resolution: 1.2 ft

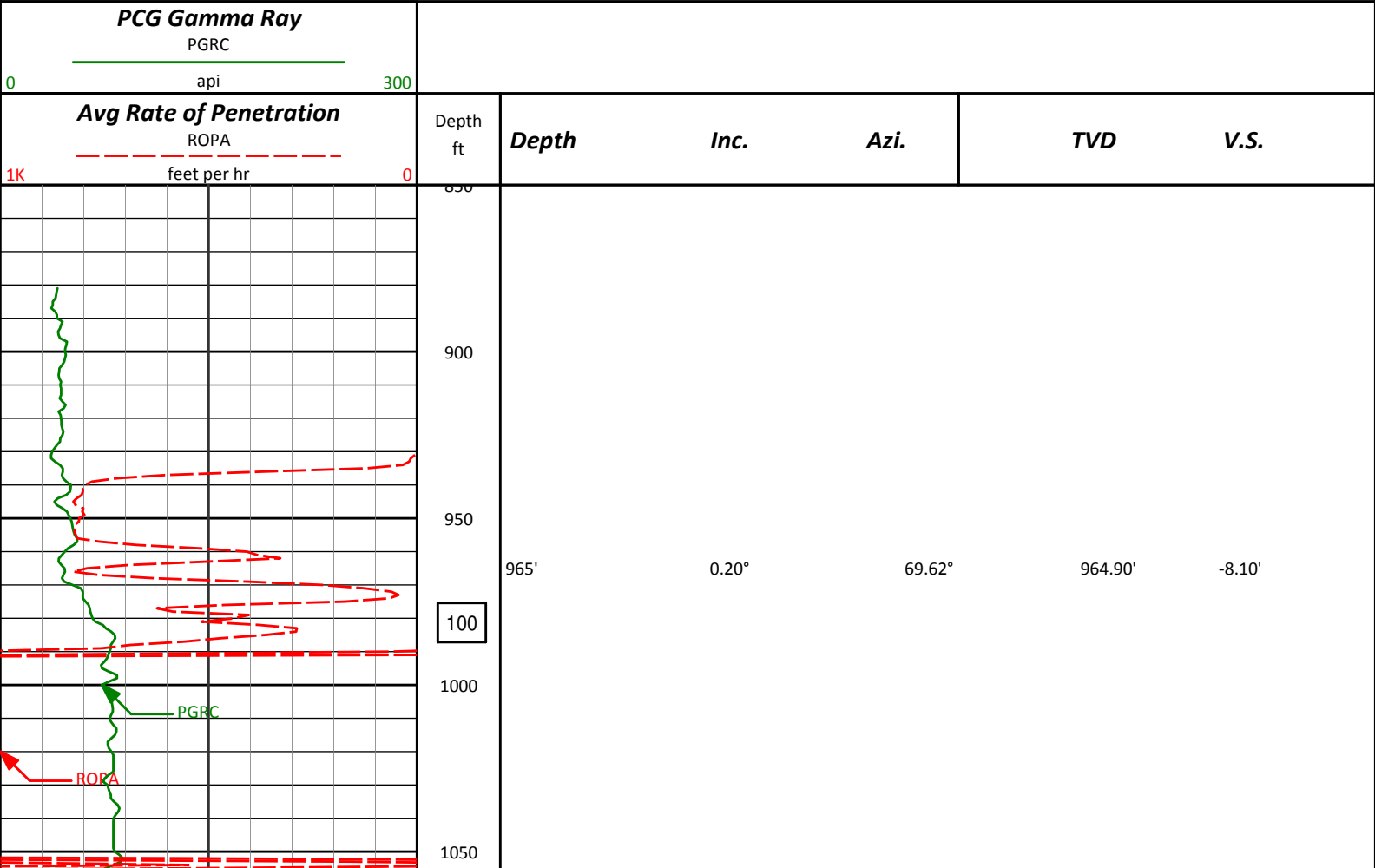
6. Insite Version v8.0.0

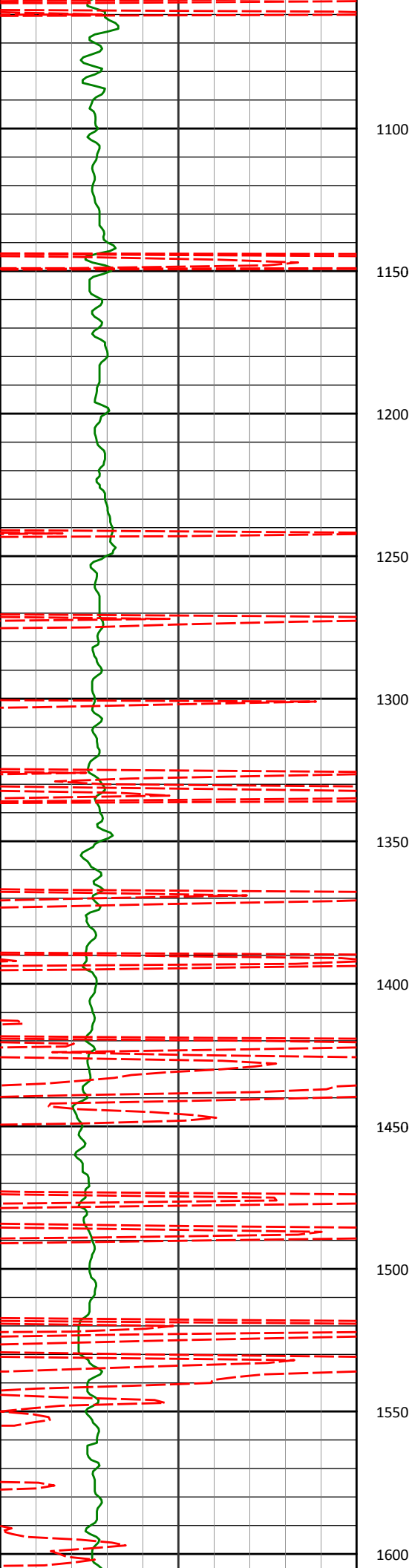
WARRANTY

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.

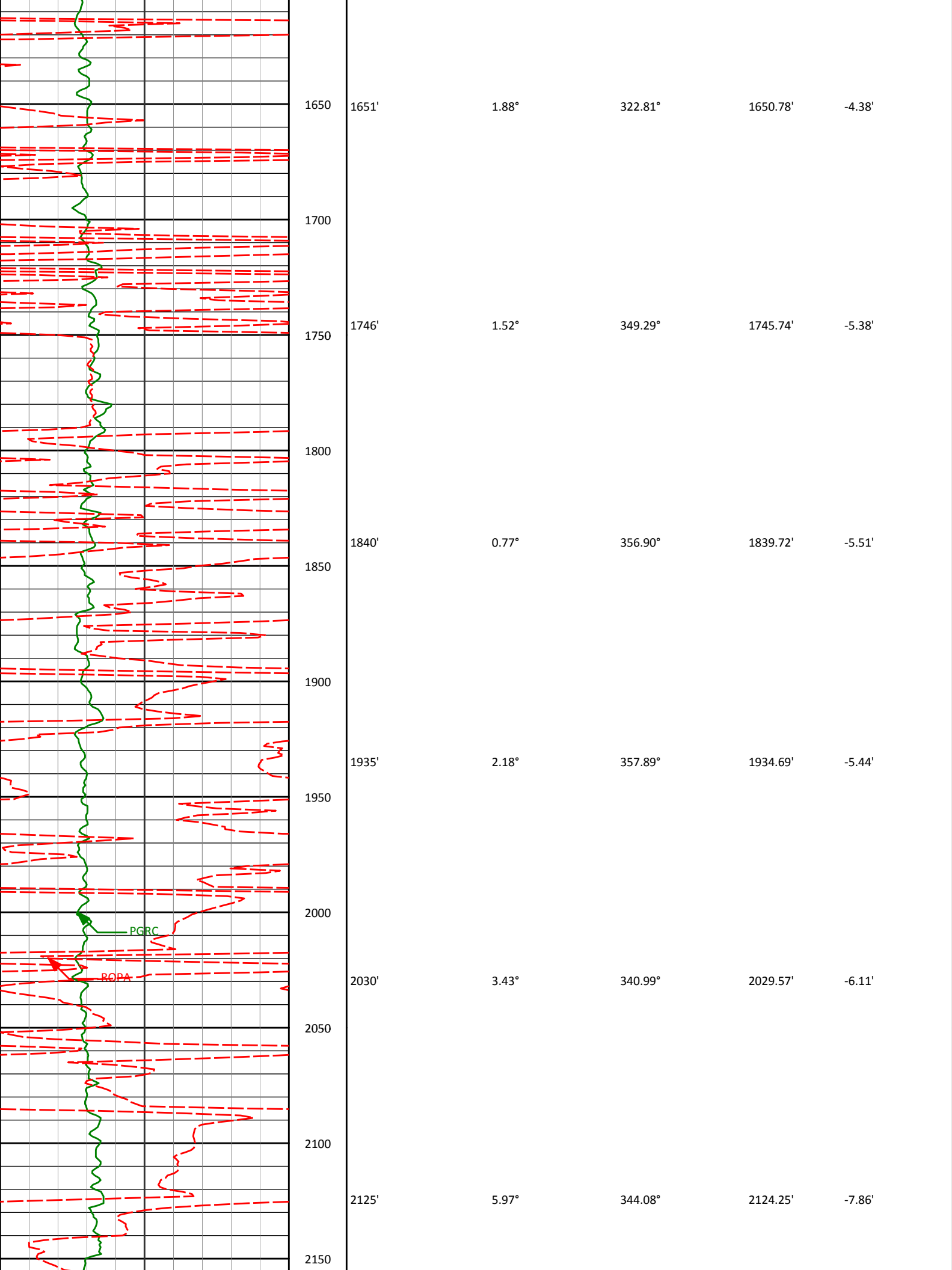
HALLIBURTON
Sperry Drilling Services
TVD Correlation Log 1:600

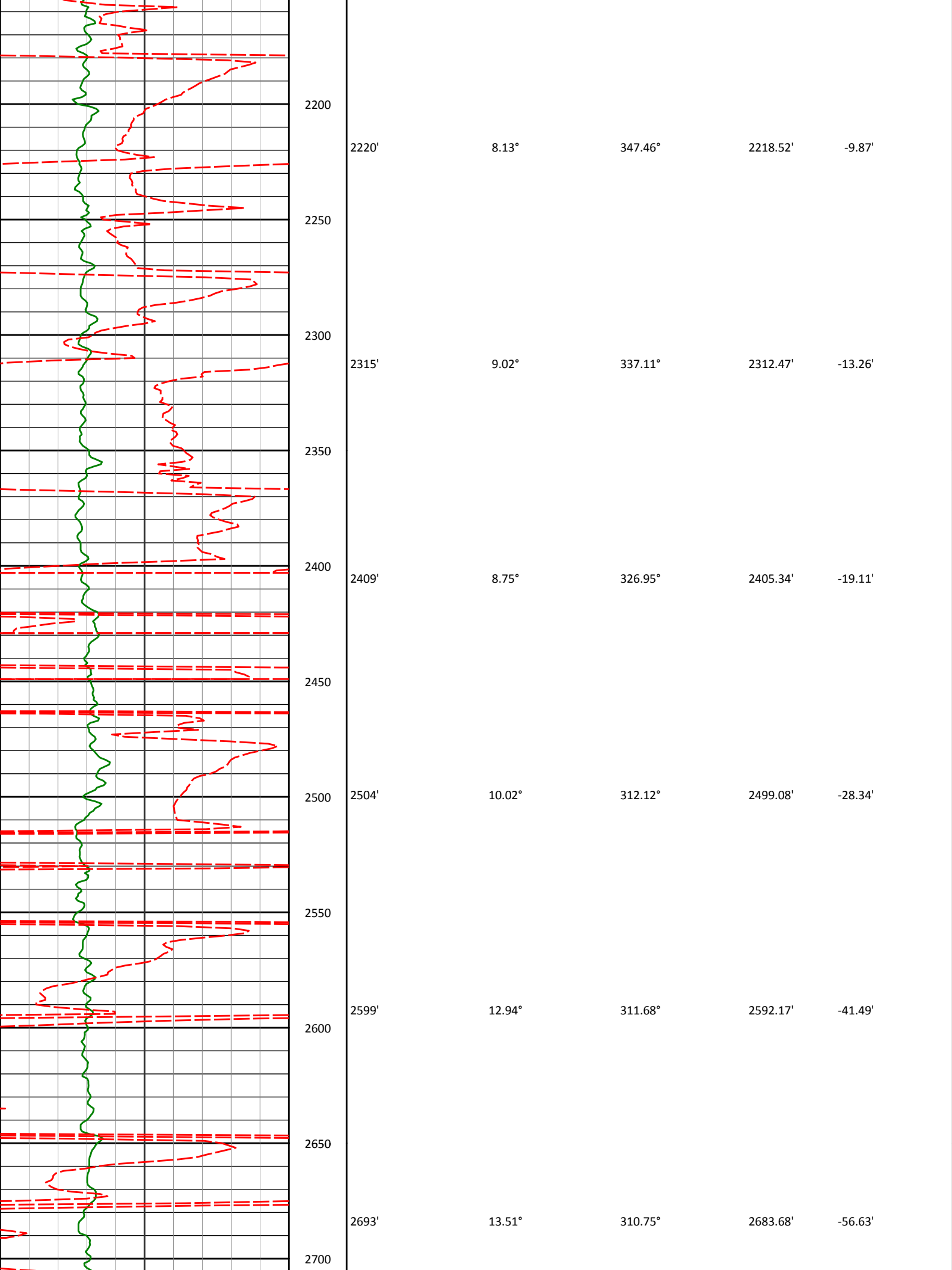
Noble Energy
Wells Ranch AE20-68-1HN
H&P 321
Sec. 20-T6N-R62W

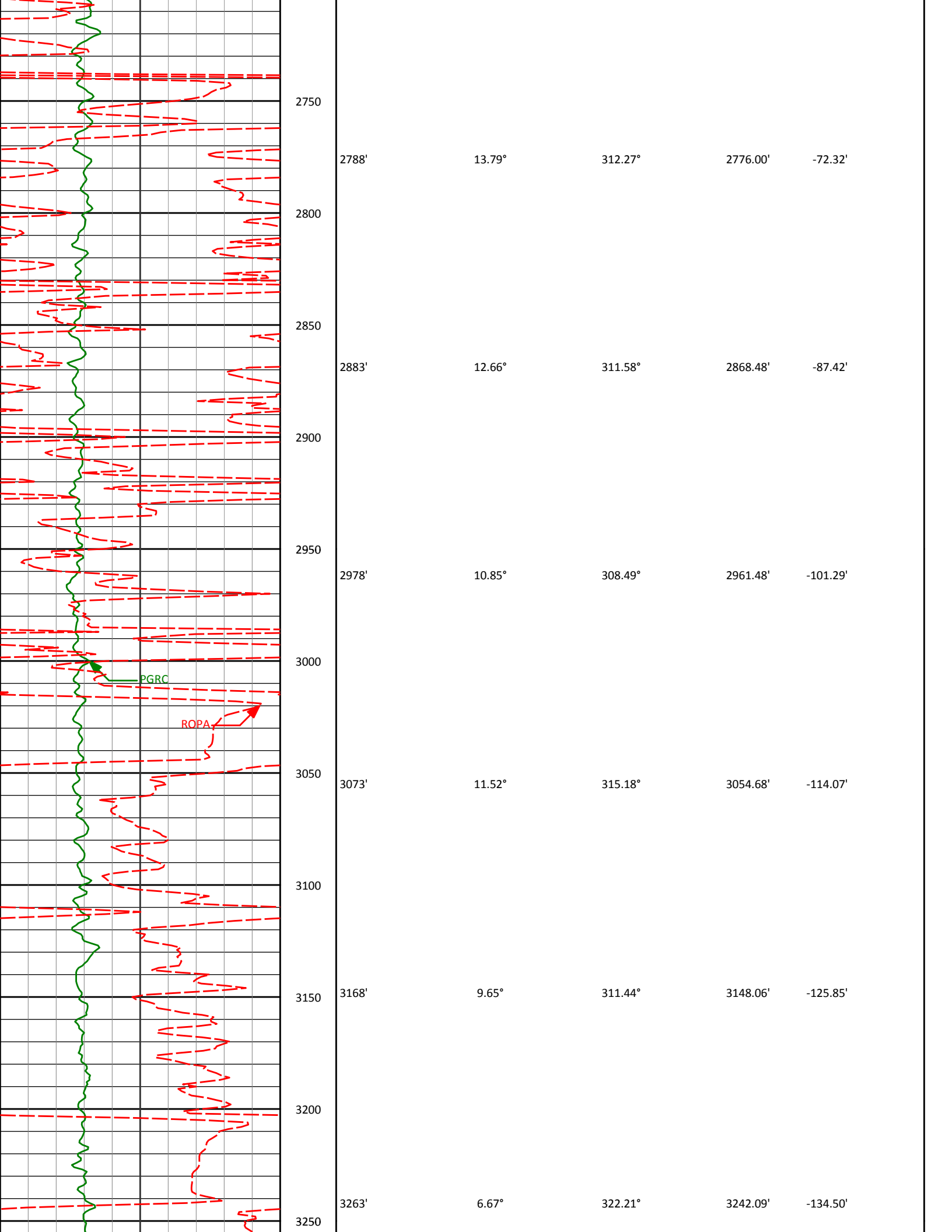


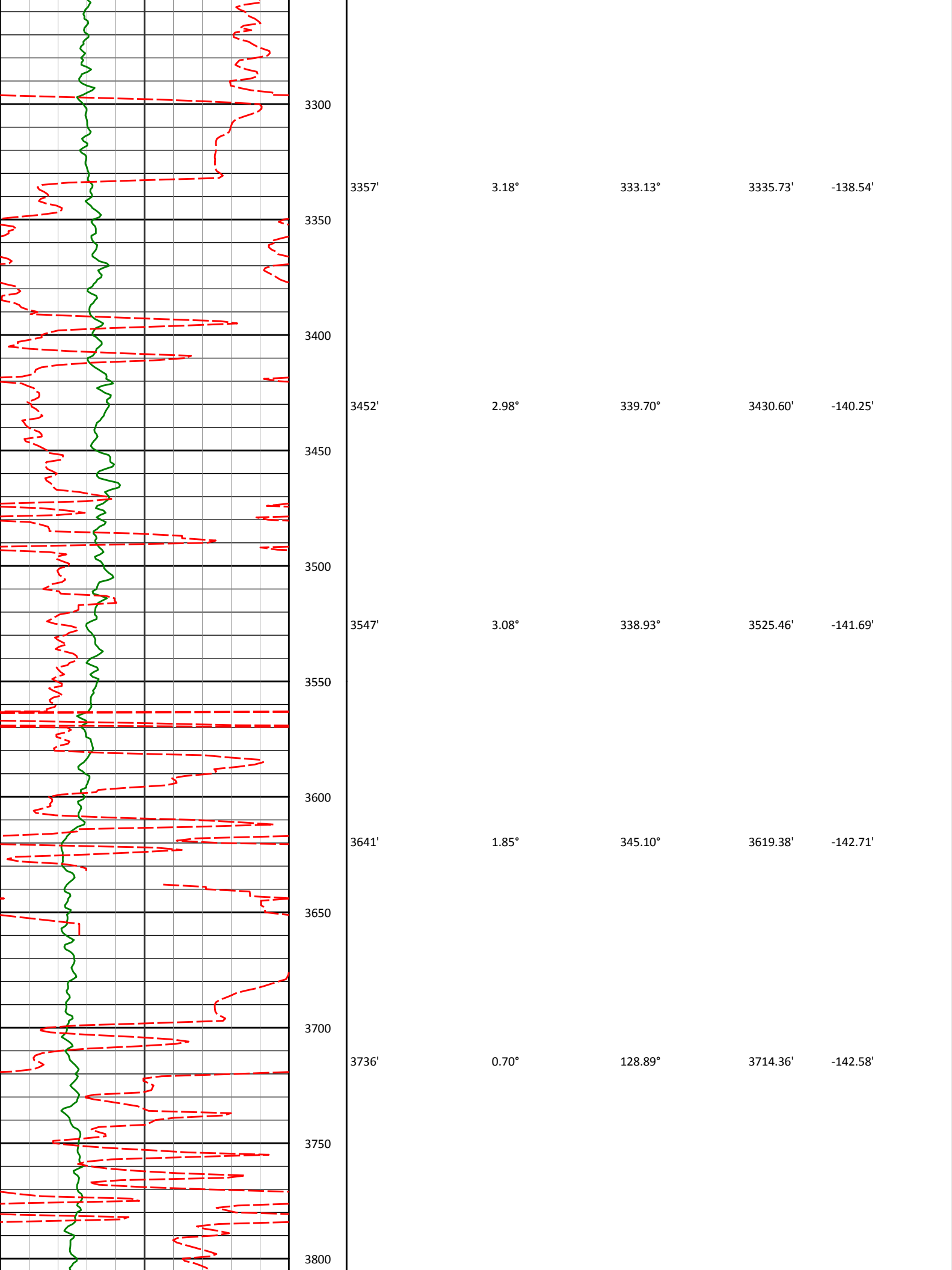


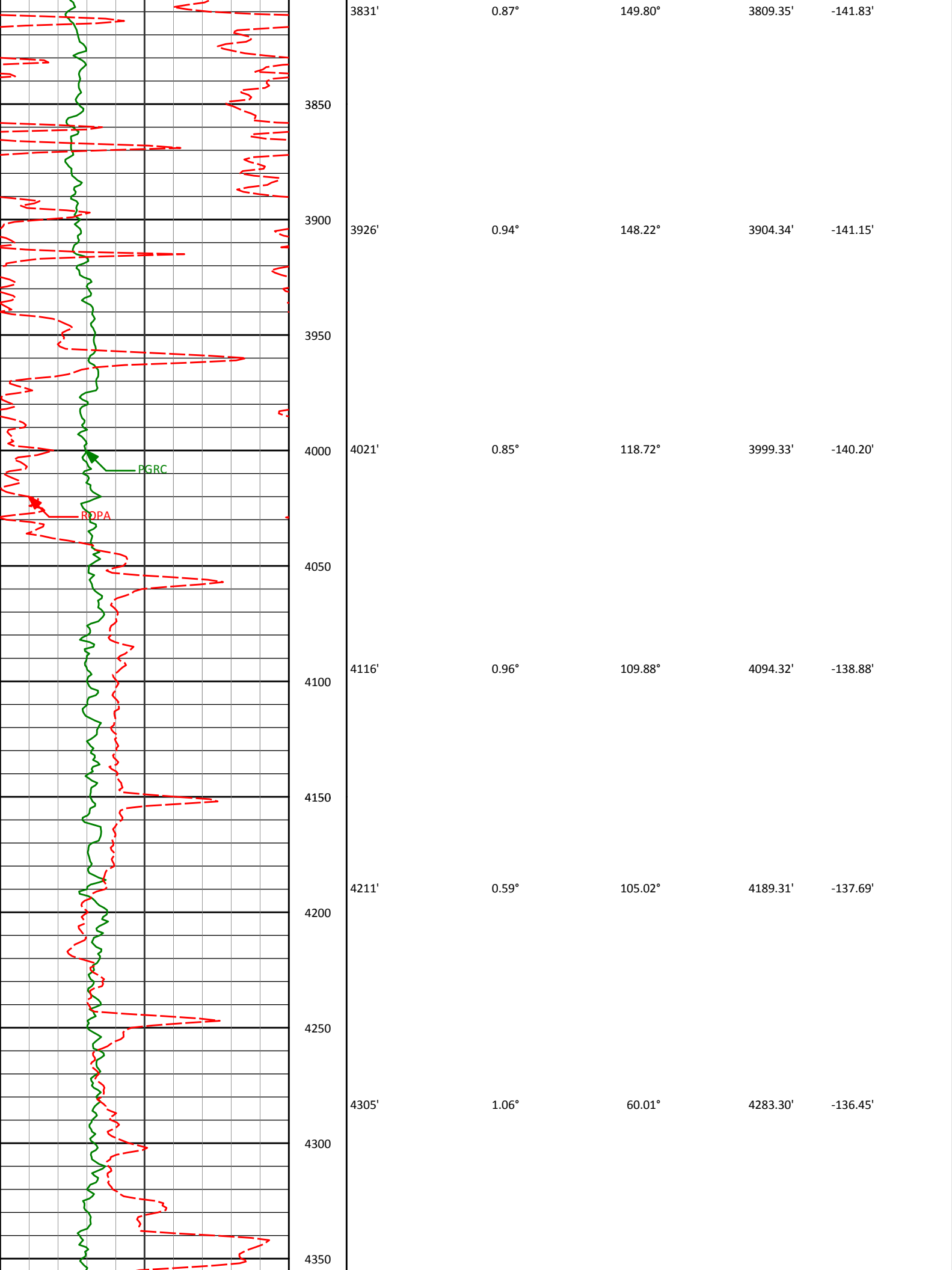
1092'	0.97°	107.34°	1091.89'	-6.88'
1184'	0.87°	106.27°	1183.88'	-5.50'
1276'	0.98°	98.01°	1275.86'	-4.08'
1369'	1.05°	101.02°	1368.85'	-2.48'
1461'	0.91°	335.82°	1460.84'	-1.91'
1556'	1.49°	322.81°	1555.82'	-2.85'

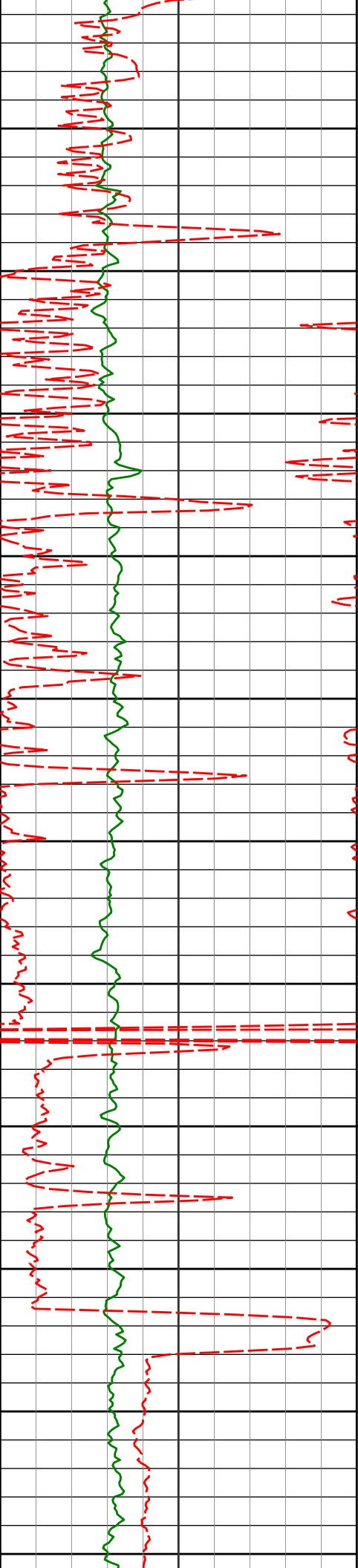




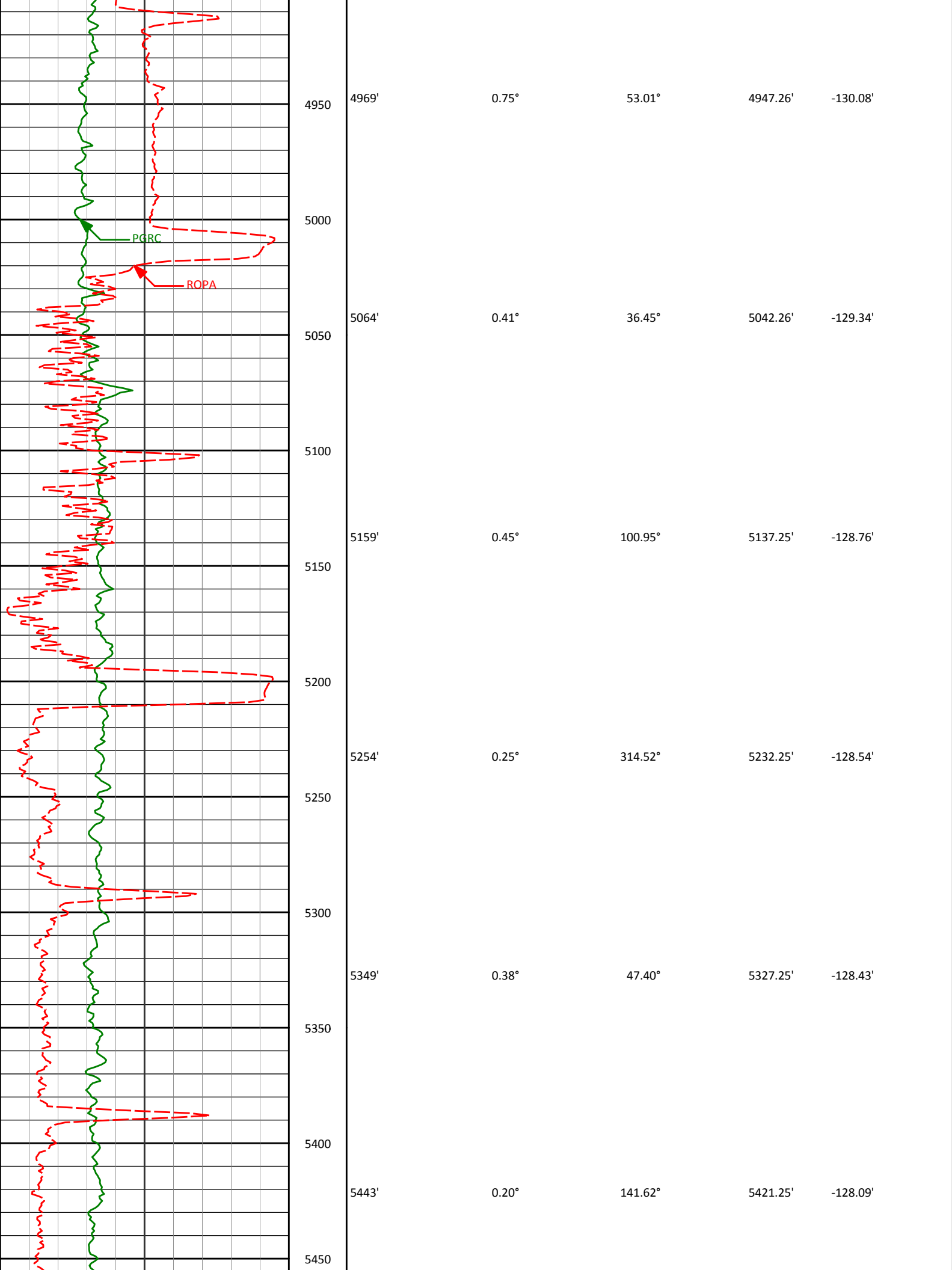


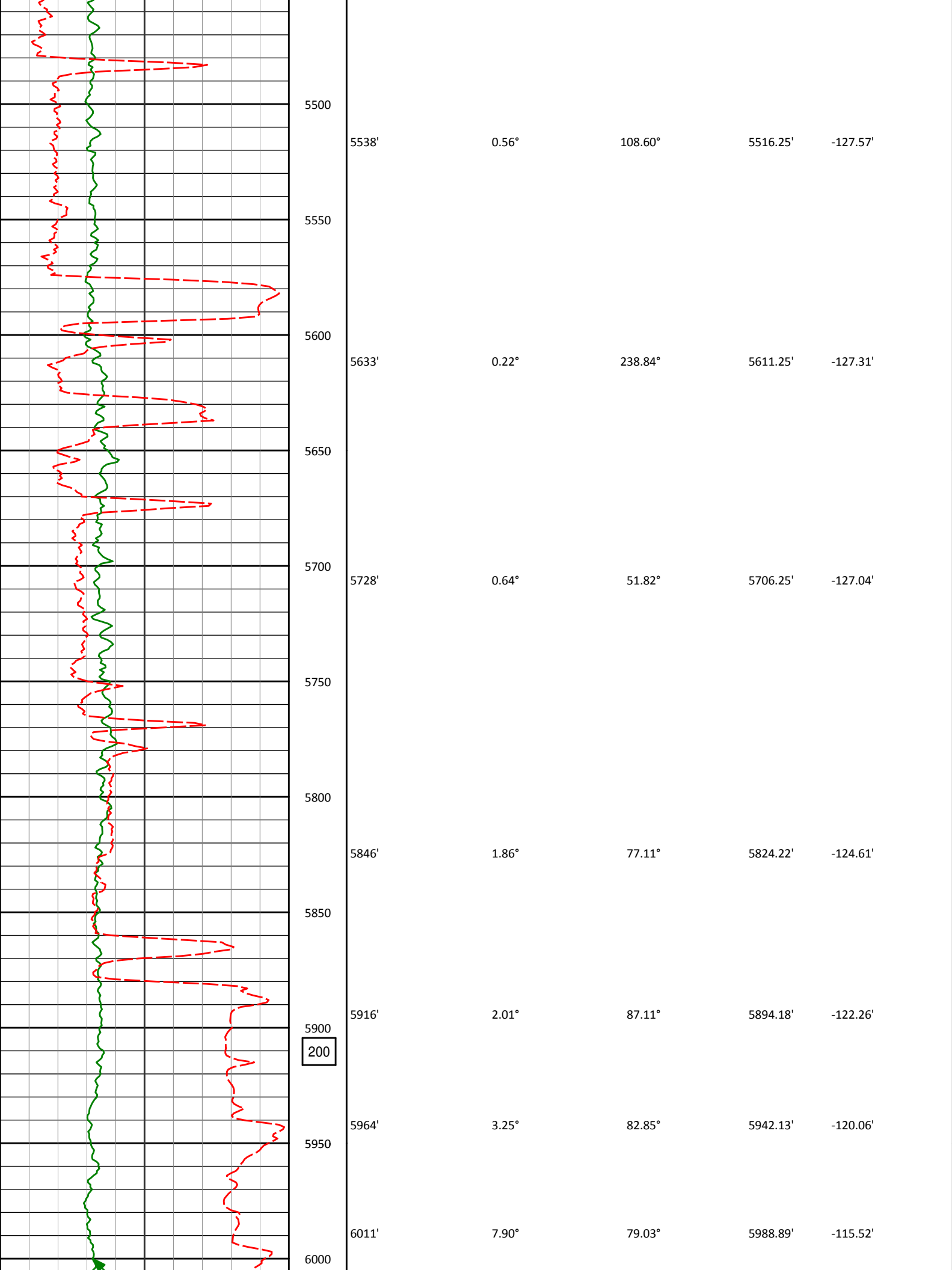


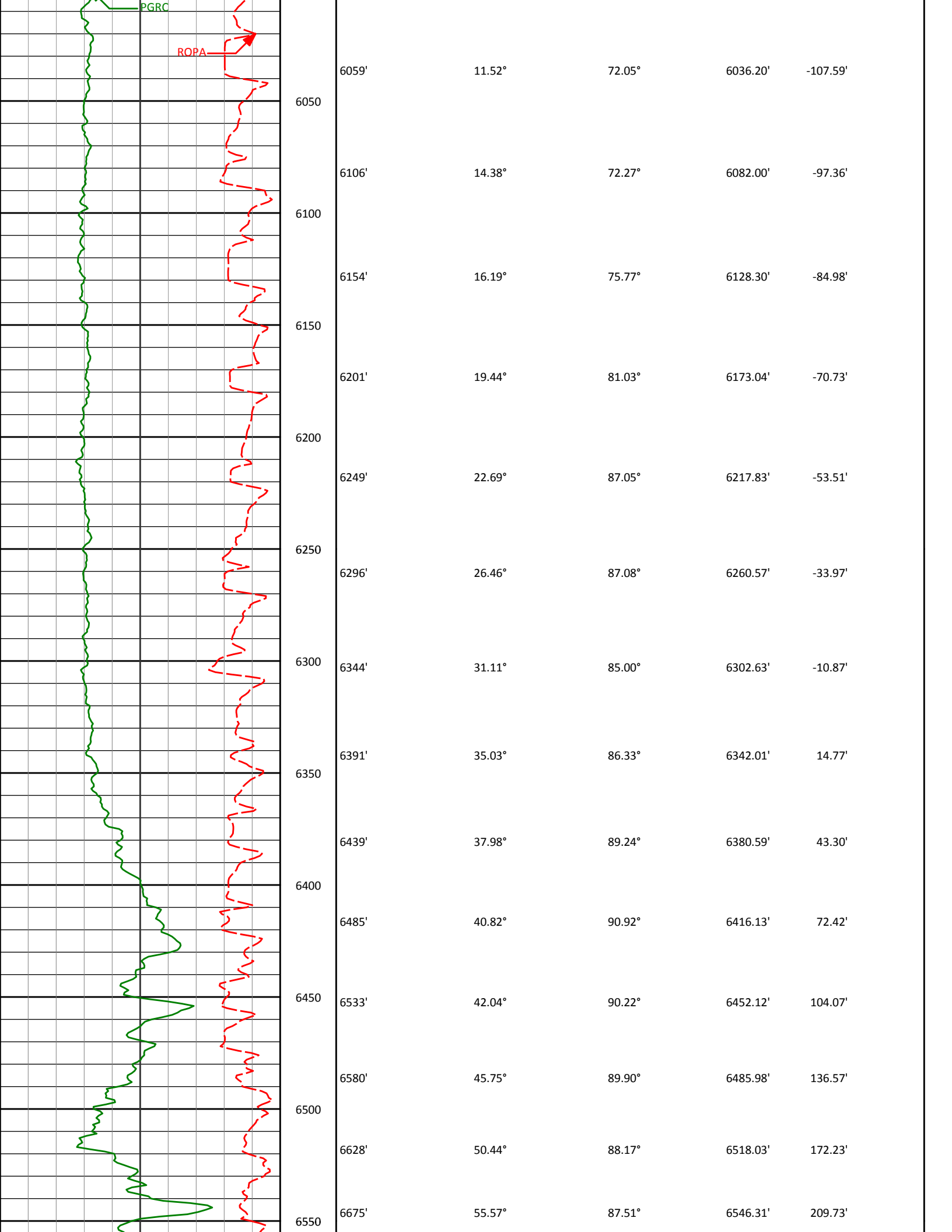


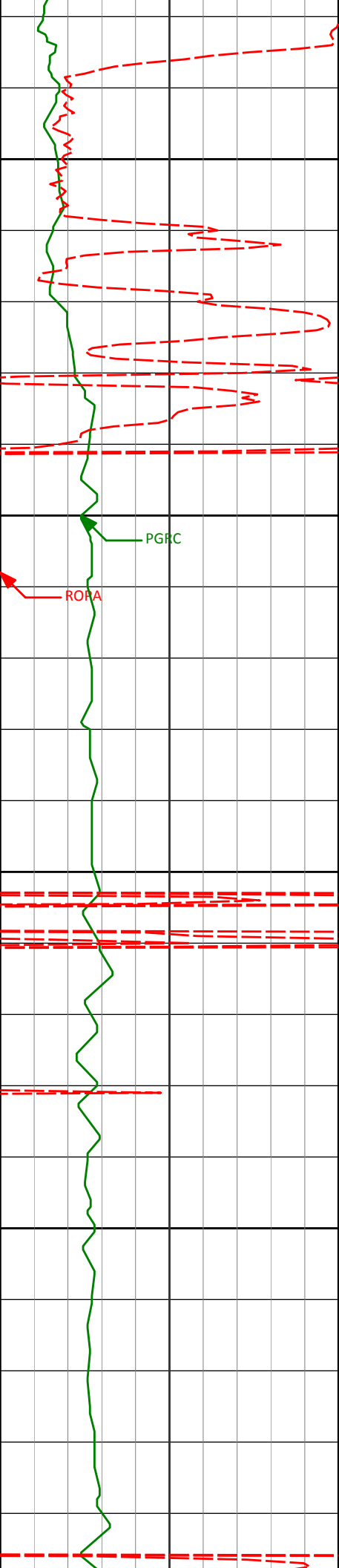


4400	4400'	0.22°	65.00°	4378.29'	-135.49'
4450					
4500	4495'	0.53°	112.71°	4473.29'	-134.93'
4550					
4600	4590'	0.63°	100.41°	4568.29'	-134.04'
4650					
4700	4685'	0.63°	85.53°	4663.28'	-133.01'
4750					
4800	4780'	0.84°	78.28°	4758.27'	-131.79'
4850					
4900	4874'	0.55°	30.15°	4852.27'	-130.85'









950

100

1000

1050

1100

PGRC

ROPA

965'

0.20°

69.62°

964.90'

-8.10'

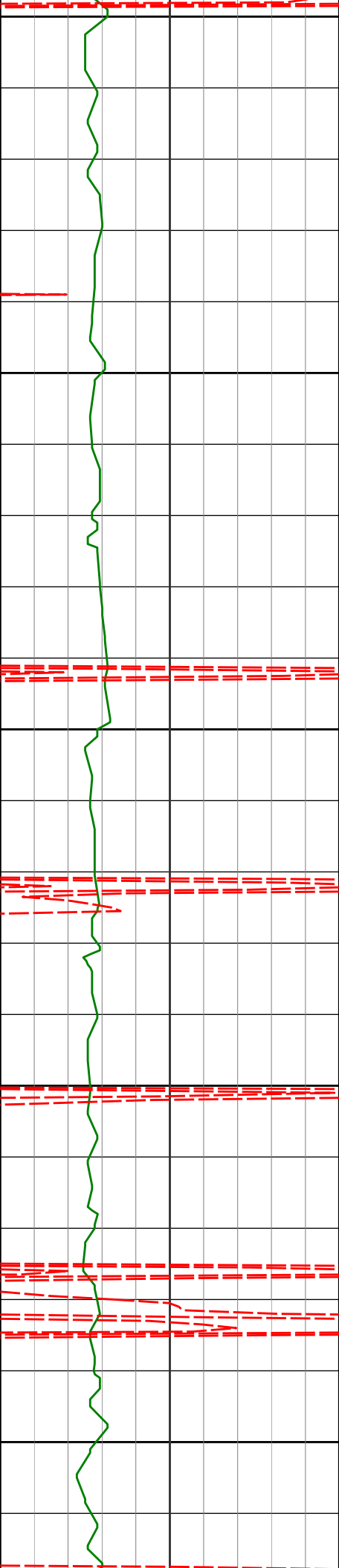
1092'

0.97°

107.34°

1091.89'

-6.88'



1150

1184'

0.87°

106.27°

1183.88'

-5.50'

1200

1250

1276'

0.98°

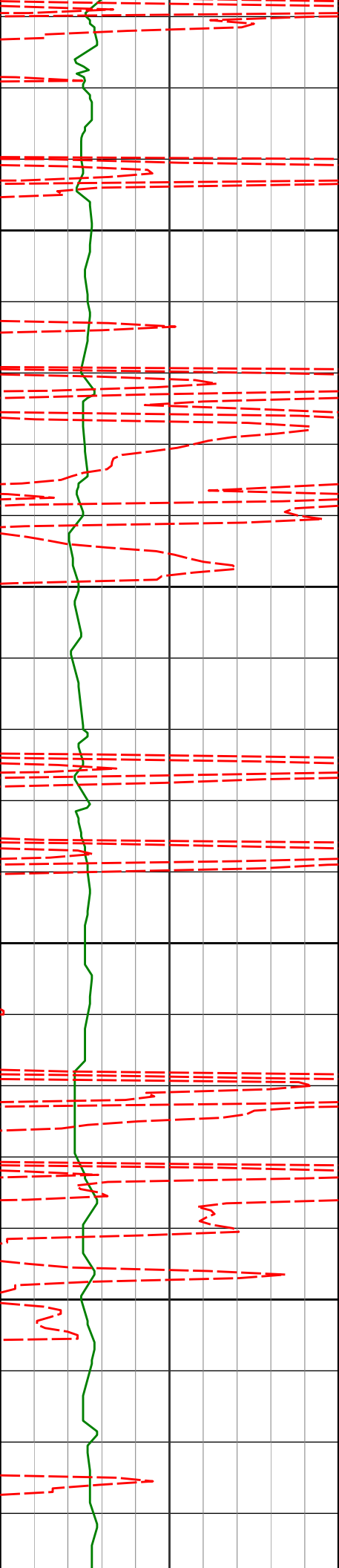
98.01°

1275.86'

-4.08'

1300

1350



1369'

1400

1450

1461'

1500

1550

1556'

1.05°

0.91°

1.49°

101.02°

335.82°

322.81°

1368.85'

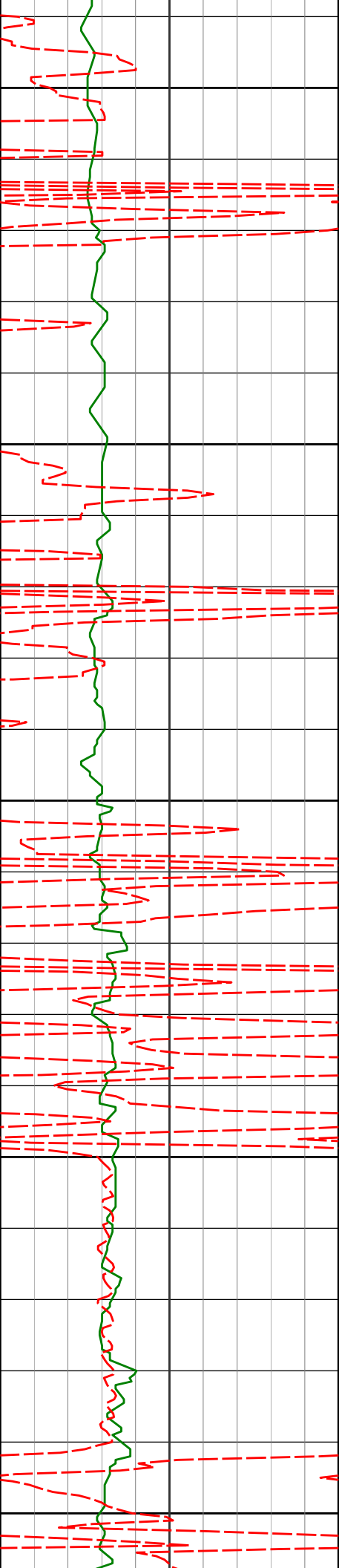
1460.84'

1555.82'

-2.48'

-1.91'

-2.85'



1600

1650

1700

1750

1800

1651'

1.88°

322.81°

1650.78'

-4.38'

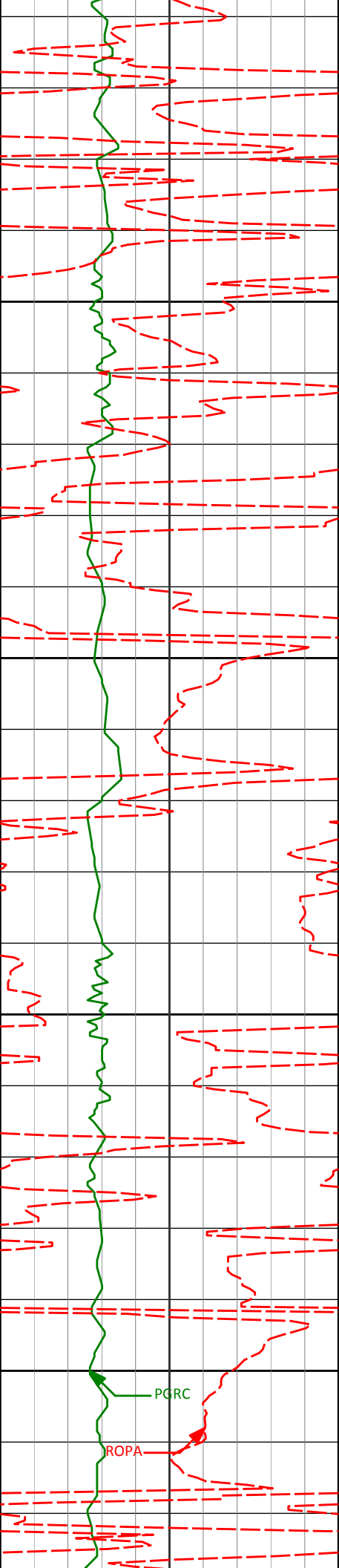
1746'

1.52°

349.29°

1745.74'

-5.38'



1840'

0.77°

356.90°

1839.72'

-5.51'

1850

1900

1935'

2.18°

357.89°

1934.69'

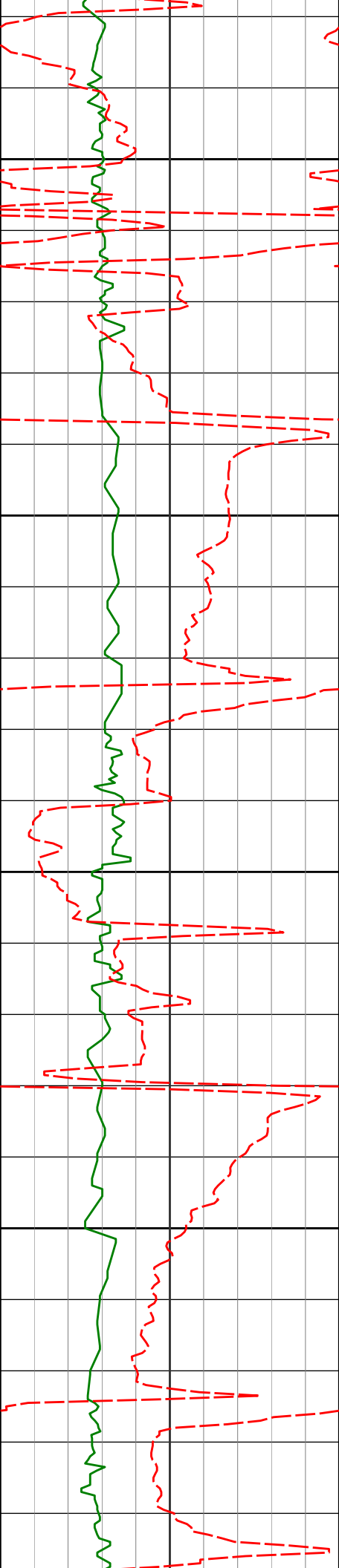
-5.44'

1950

2000

PGRC

ROPA



2030'

3.43°

340.99°

2029.57'

-6.11'

2050

2100

2125'

5.97°

344.08°

2124.25'

-7.86'

2150

2200

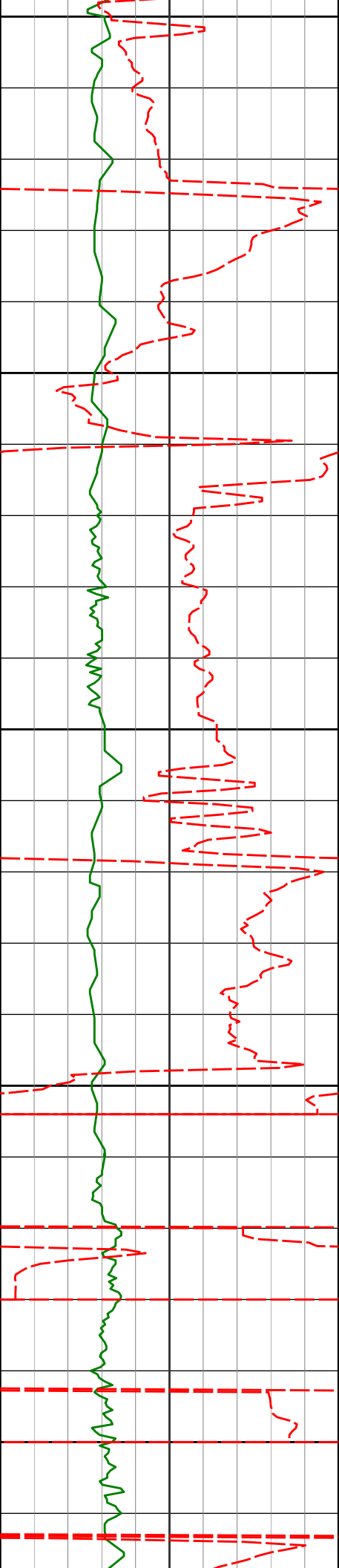
2220'

8.13°

347.46°

2218.52'

-9.87'



2250

2300

2350

2400

2450

2315'

9.02°

337.11°

2312.47'

-13.26'

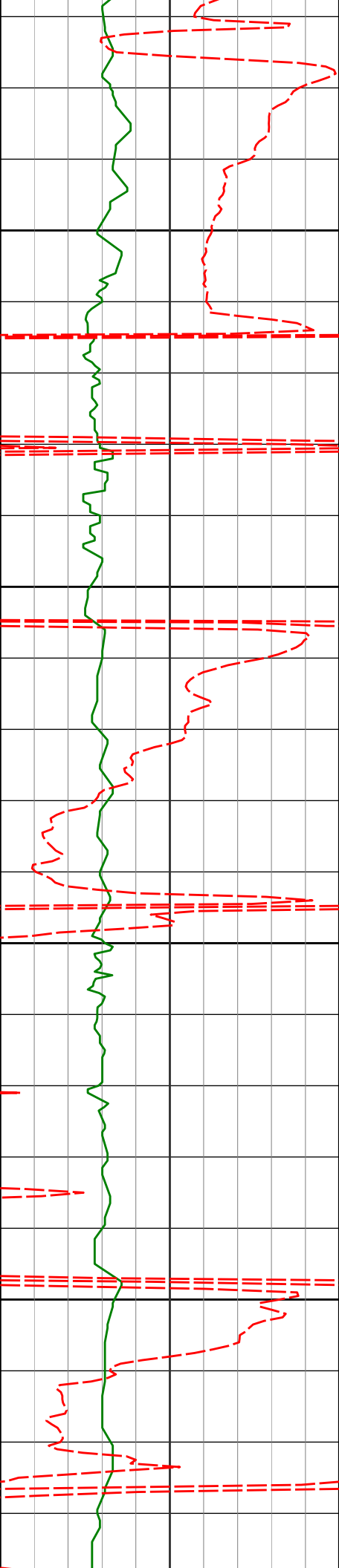
2409'

8.75°

326.95°

2405.34'

-19.11'



2500

2550

2600

2650

2504'

2599'

2693'

10.02°

12.94°

13.51°

312.12°

311.68°

310.75°

2499.08'

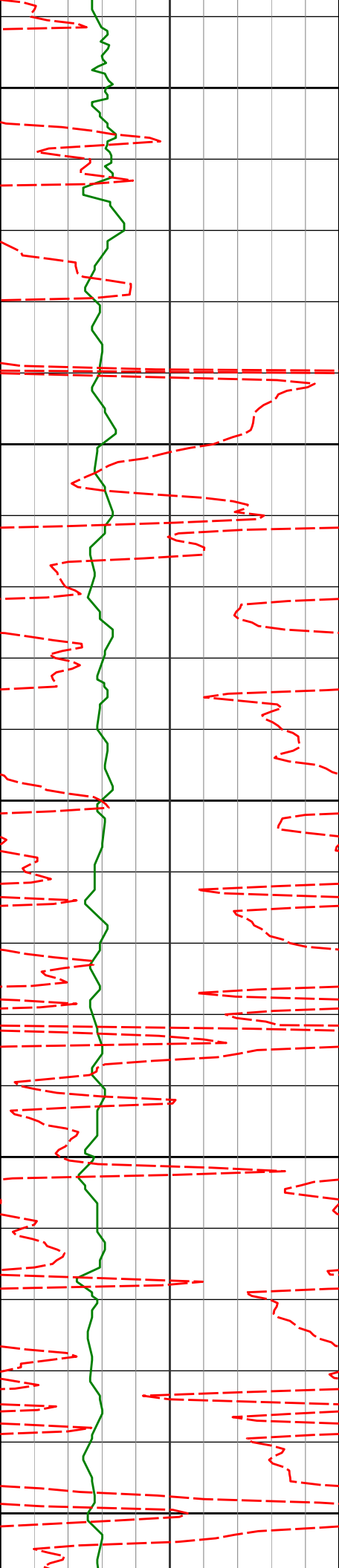
2592.17'

2683.68'

-28.34'

-41.49'

-56.63'



2700

2750

2800

2850

2900

2788'

13.79°

312.27°

2776.00'

-72.32'

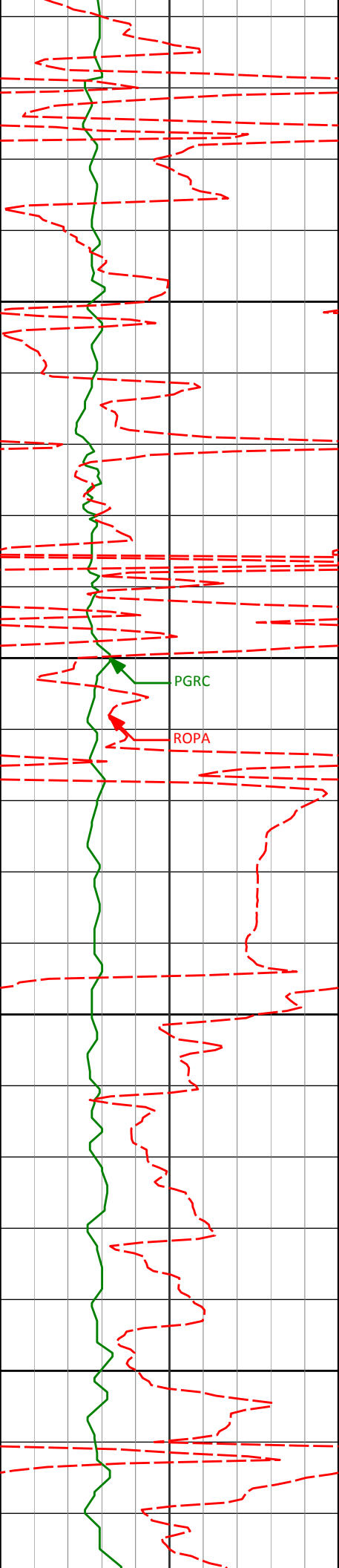
2883'

12.66°

311.58°

2868.48'

-87.42'



2950

2978'

10.85°

308.49°

2961.48'

-101.29'

3000

PGRC

ROPA

3050

3073'

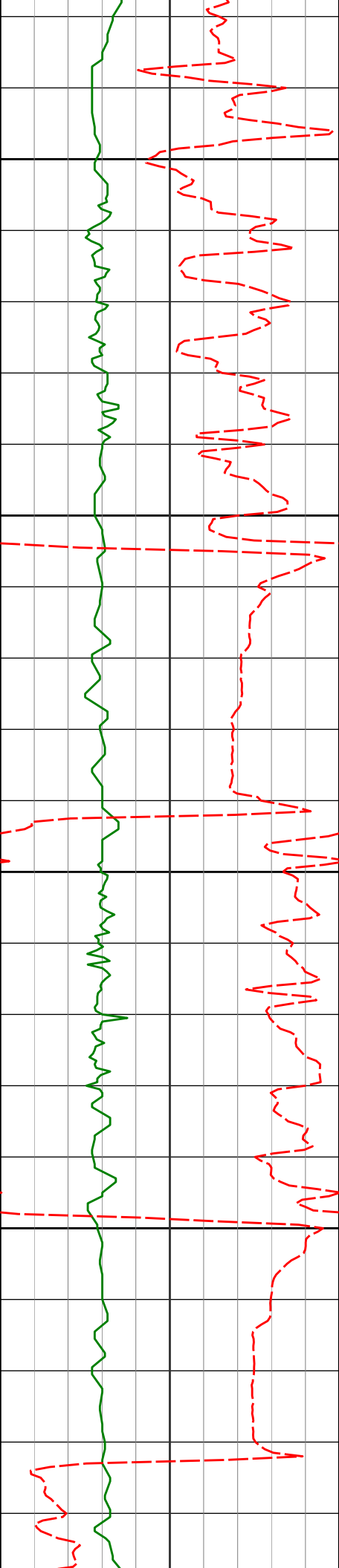
11.52°

315.18°

3054.68'

-114.07'

3100



3150

3200

3250

3300

3168'

9.65°

311.44°

3148.06'

-125.85'

3263'

6.67°

322.21°

3242.09'

-134.50'

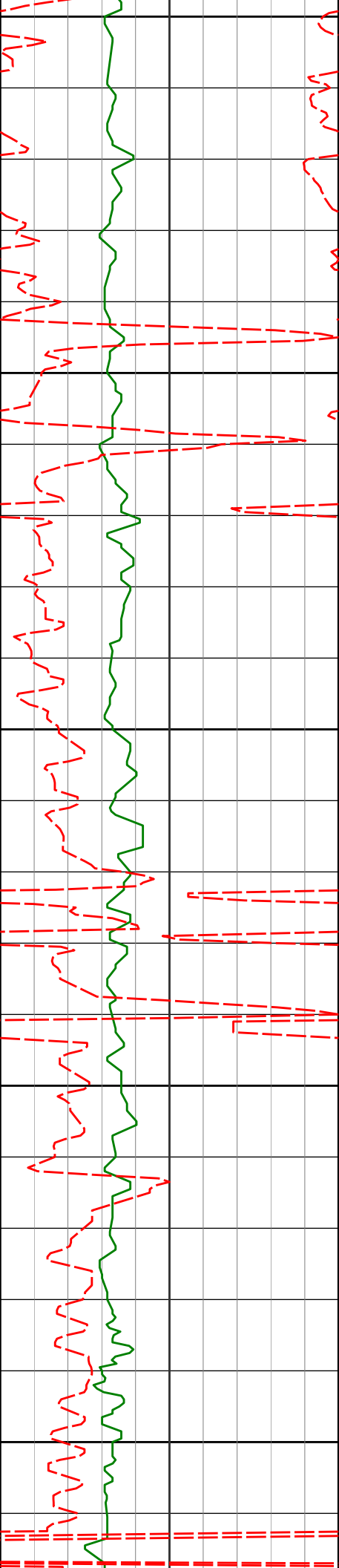
3357'

3.18°

333.13°

3335.73'

-138.54'



3350

3400

3450

3500

3550

3452'

2.98°

339.70°

3430.60'

-140.25'

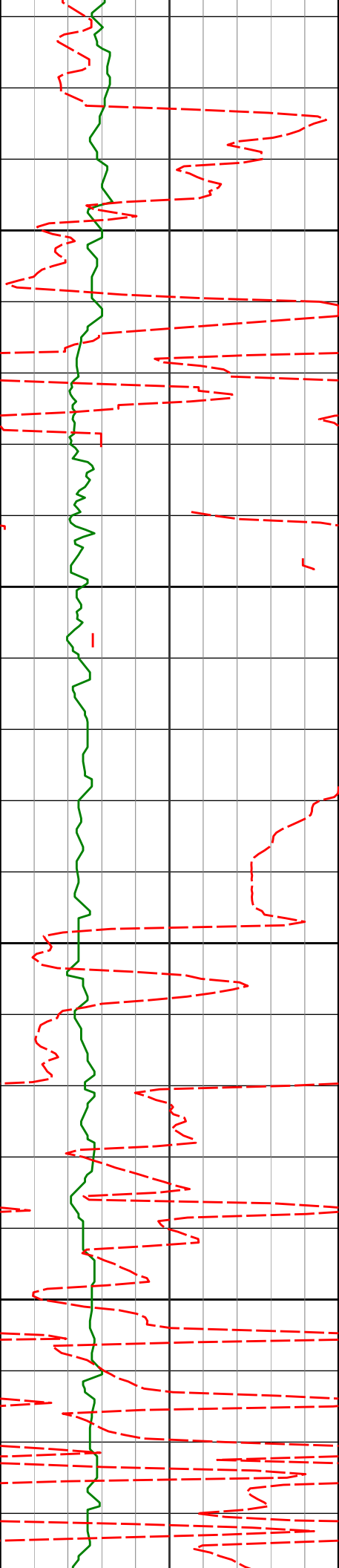
3547'

3.08°

338.93°

3525.46'

-141.69'



3600

3641'

1.85°

345.10°

3619.38'

-142.71'

3650

3700

3736'

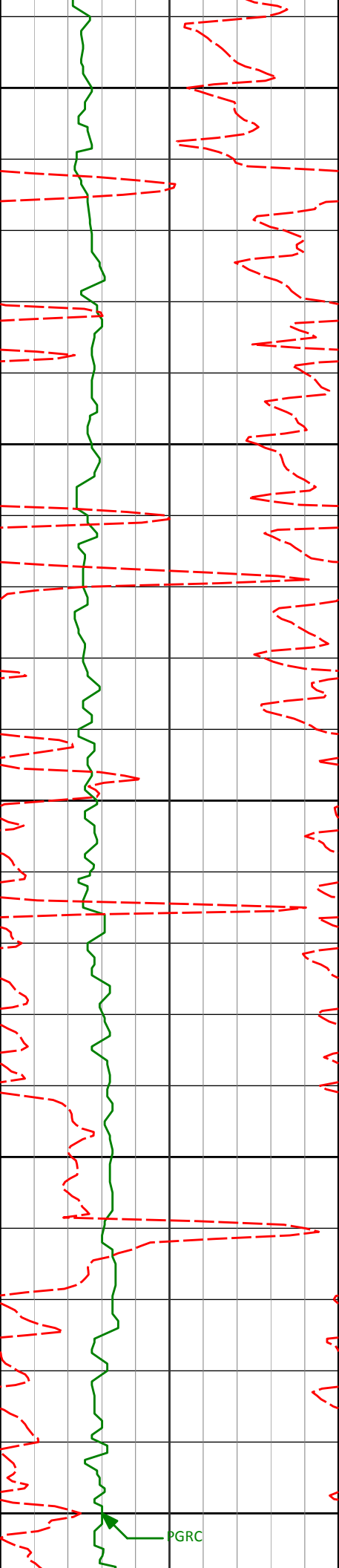
0.70°

128.89°

3714.36'

-142.58'

3750



3800

3831'

0.87°

149.80°

3809.35'

-141.83'

3850

3900

3926'

0.94°

148.22°

3904.34'

-141.15'

3950

4000

4021'

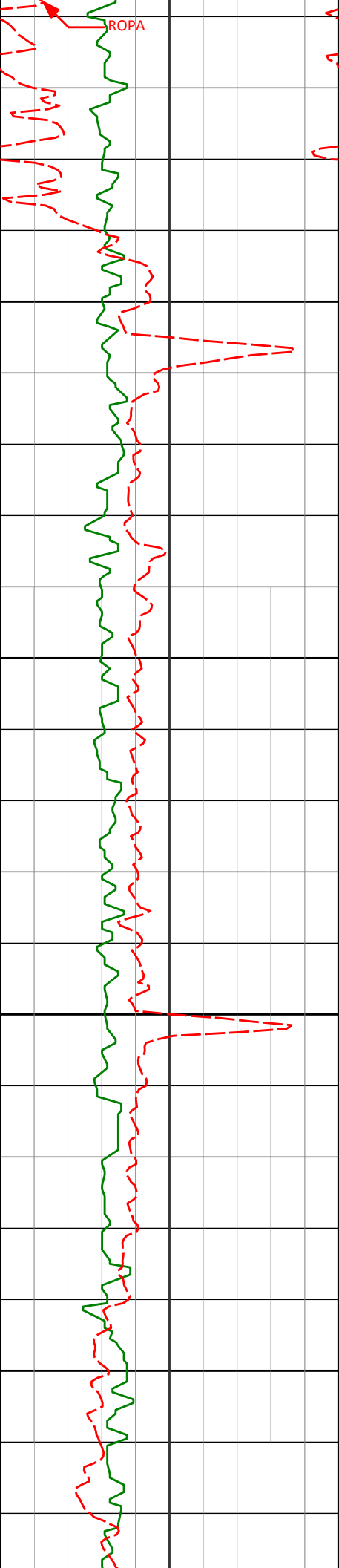
0.85°

118.72°

3999.33'

-140.20'

PGRC



4050

4100

4150

4200

4116'

0.96°

109.88°

4094.32'

-138.88'

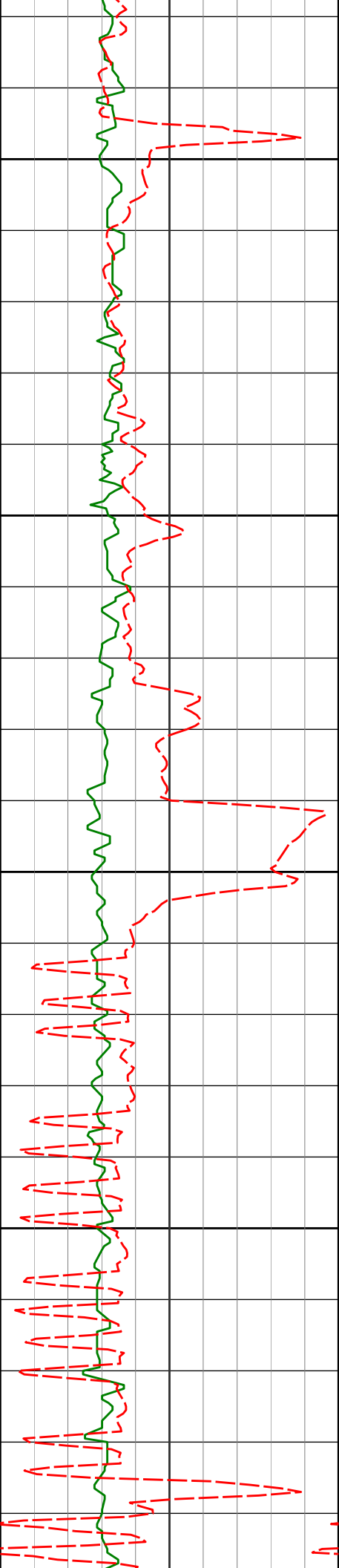
4211'

0.59°

105.02°

4189.31'

-137.69'



4250

4305'

1.06°

60.01°

4283.30'

-136.45'

4300

4350

4400'

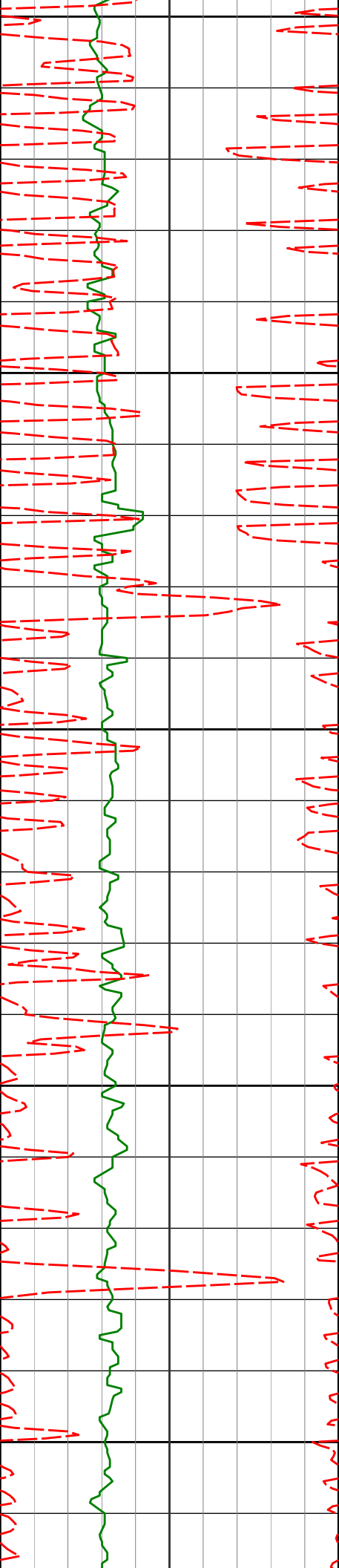
0.22°

65.00°

4378.29'

-135.49'

4400



4450

4495'

0.53°

112.71°

4473.29'

-134.93'

4500

4550

4590'

0.63°

100.41°

4568.29'

-134.04'

4600

4650

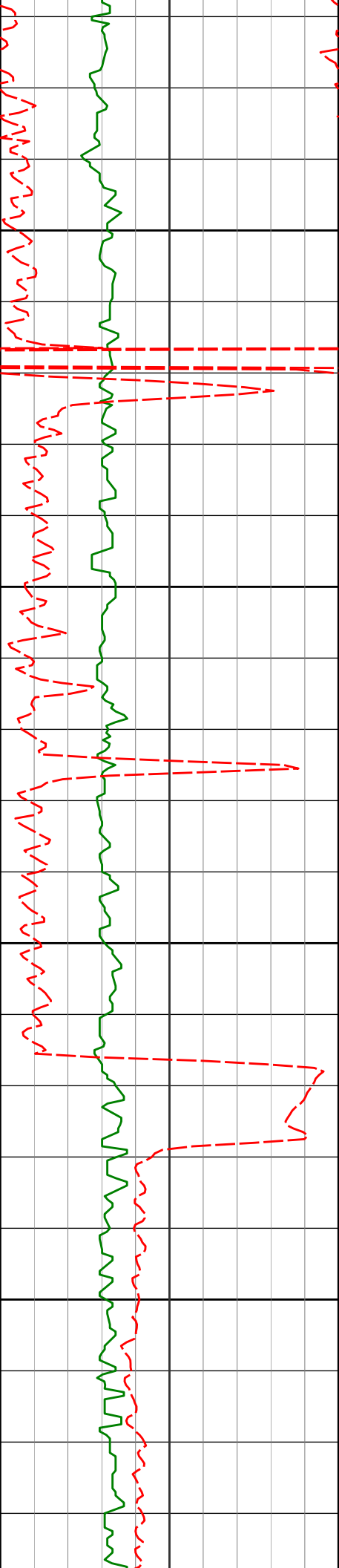
4685'

0.63°

85.53°

4663.28'

-133.01'



4700

4750

4800

4850

4780'

0.84°

78.28°

4758.27'

-131.79'

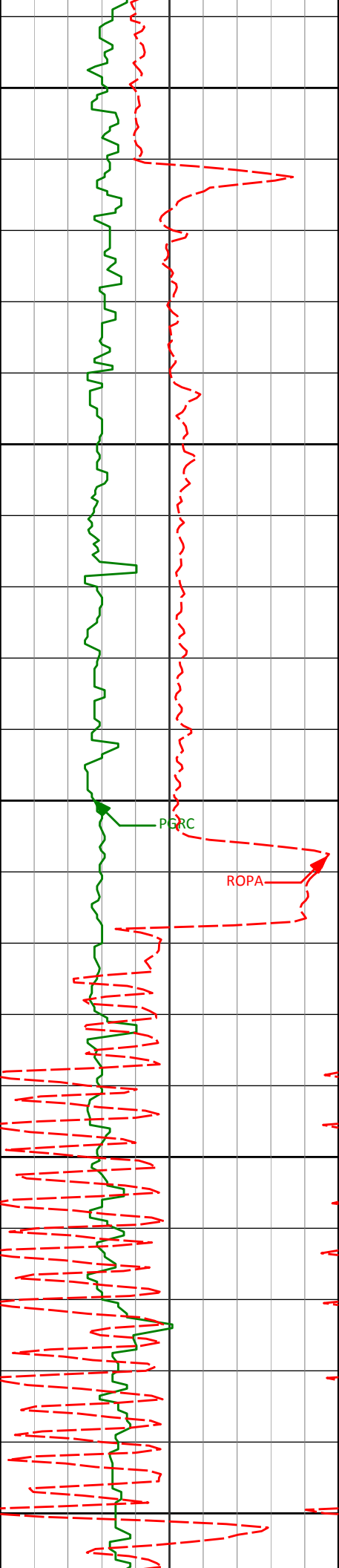
4874'

0.55°

30.15°

4852.27'

-130.85'



4900

4950

5000

5050

5100

4969'

0.75°

53.01°

4947.26'

-130.08'

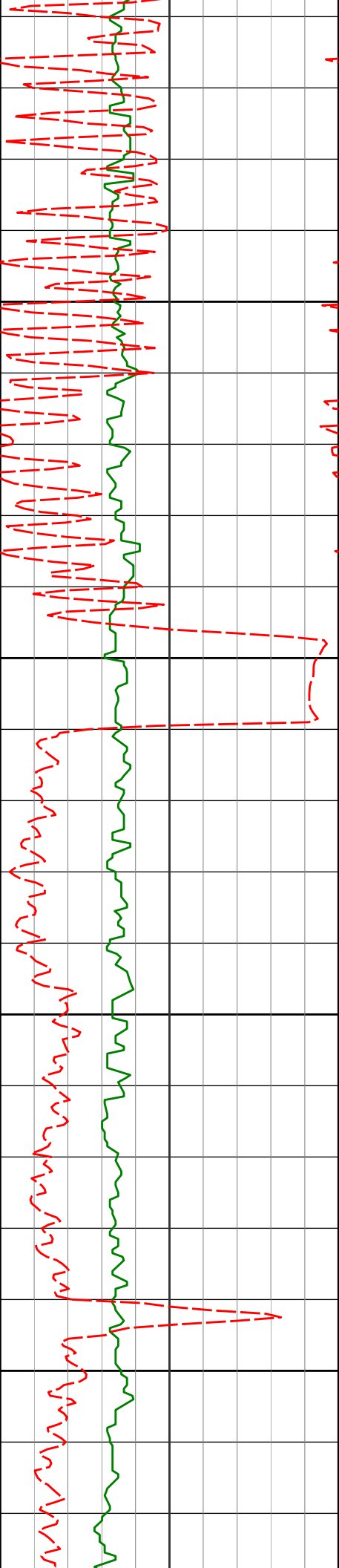
5064'

0.41°

36.45°

5042.26'

-129.34'



5159'

0.45°

100.95°

5137.25'

-128.76'

5150

5200

5254'

0.25°

314.52°

5232.25'

-128.54'

5250

5300

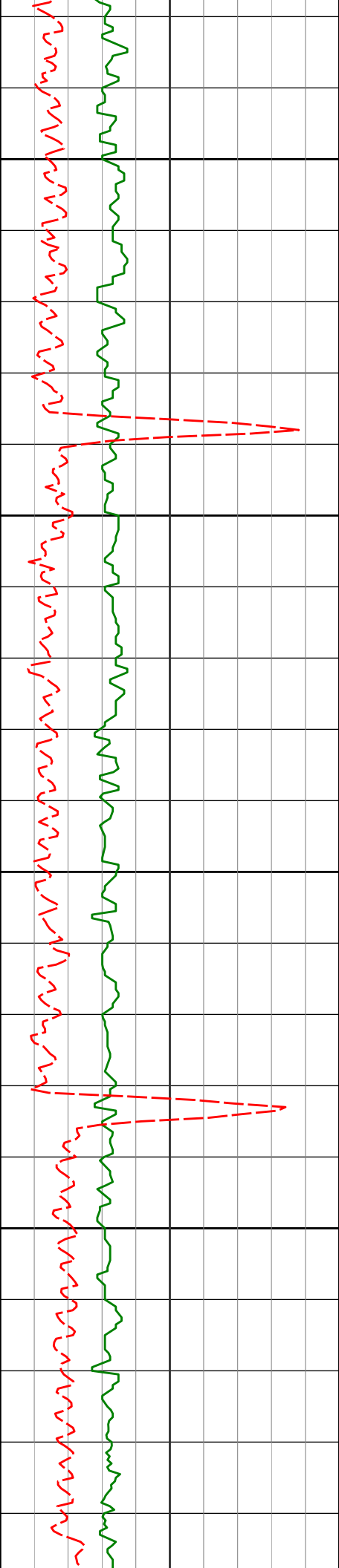
5349'

0.38°

47.40°

5327.25'

-128.43'



5350

5400

5450

5500

5443'

0.20°

141.62°

5421.25'

-128.09'

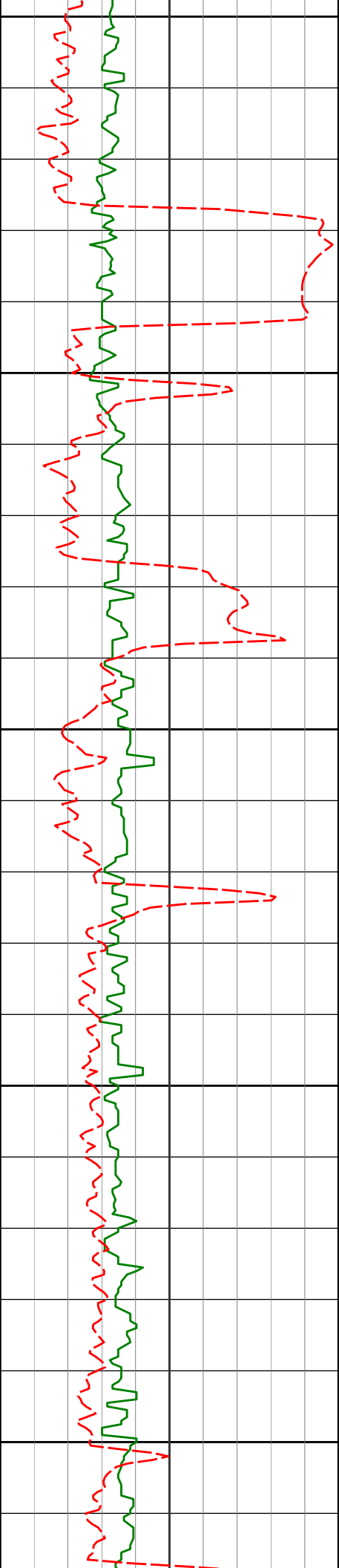
5538'

0.56°

108.60°

5516.25'

-127.57'



5550

5600

5650

5700

5750

5633'

0.22°

238.84°

5611.25'

-127.31'

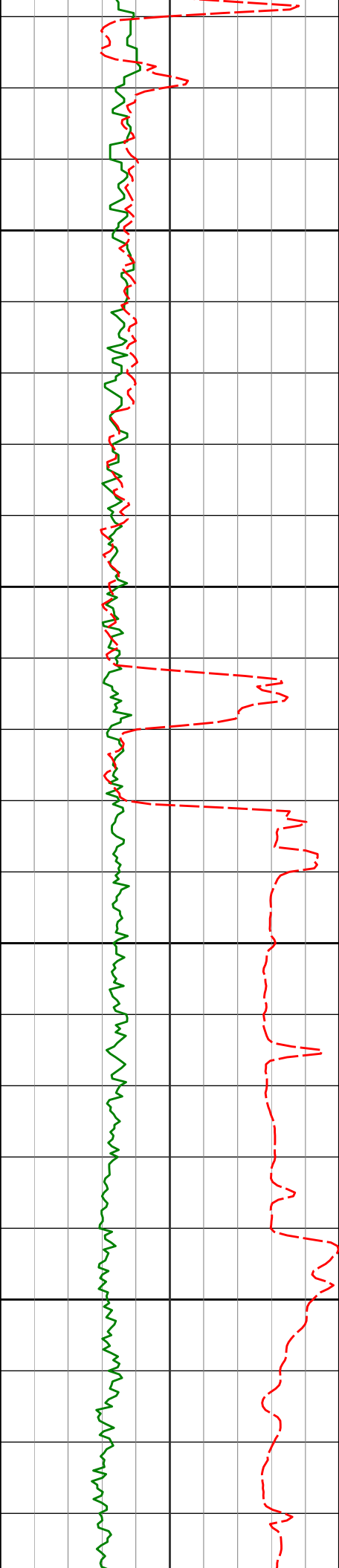
5728'

0.64°

51.82°

5706.25'

-127.04'



5800

5846'

1.86°

77.11°

5824.22'

-124.61'

5850

5916'

2.01°

87.11°

5894.18'

-122.26'

5900

200

5964'

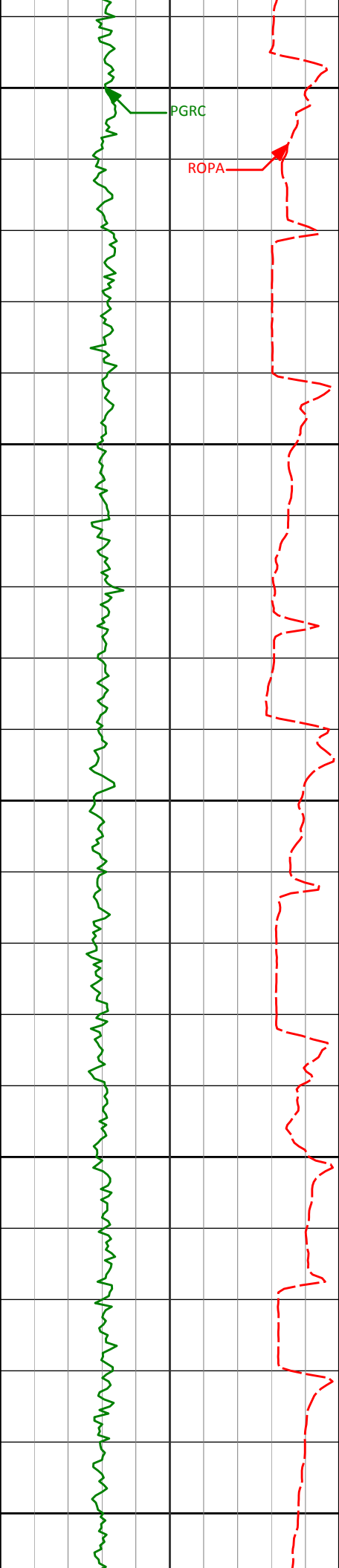
3.25°

82.85°

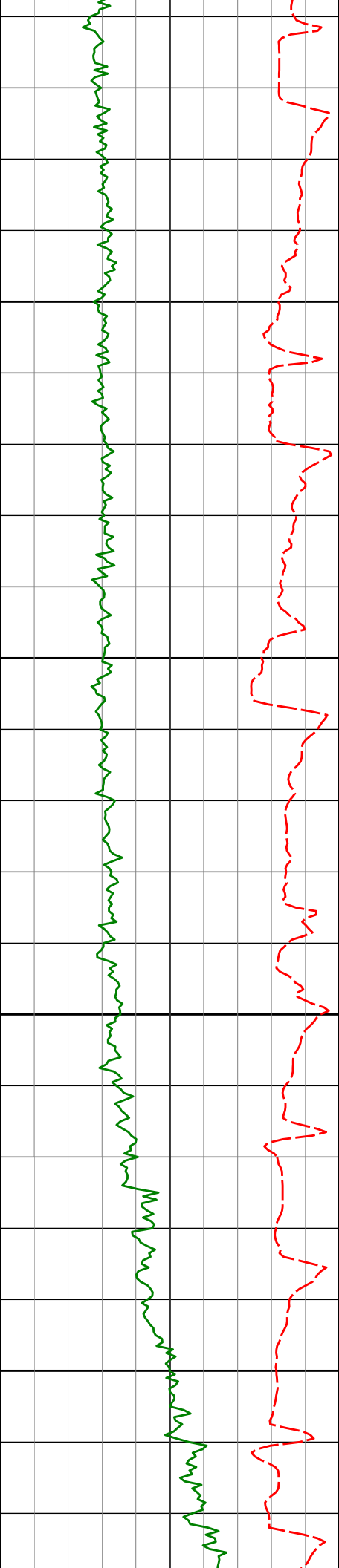
5942.13'

-120.06'

5950



6011'	7.90°	79.03°	5988.89'	-115.52'
6000				
6059'	11.52°	72.05°	6036.20'	-107.59'
6050				
6106'	14.38°	72.27°	6082.00'	-97.36'
6100				
6154'	16.19°	75.77°	6128.30'	-84.98'
6150				
6201'	19.44°	81.03°	6173.04'	-70.73'
6200				



6249'

22.69°

87.05°

6217.83'

-53.51'

6250

6296'

26.46°

87.08°

6260.57'

-33.97'

6300

6344'

31.11°

85.00°

6302.63'

-10.87'

6350

6391'

35.03°

86.33°

6342.01'

14.77'

6400

6439'

37.98°

89.24°

6380.59'

43.30'

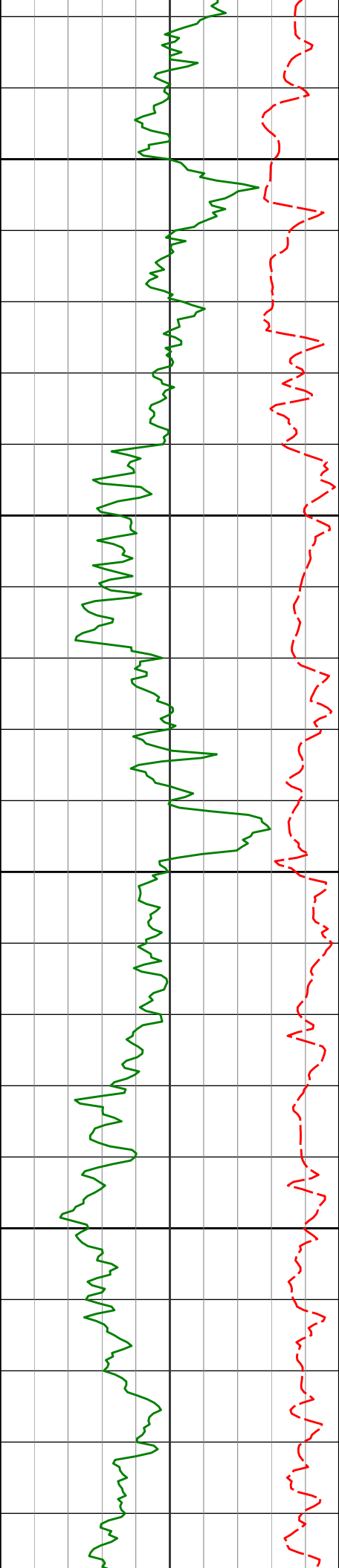
6485'

40.82°

90.92°

6416.13'

72.42'



6450

6533'

42.04°

90.22°

6452.12'

104.07'

6580'

45.75°

89.90°

6485.98'

136.57'

6500

6628'

50.44°

88.17°

6518.03'

172.23'

6675'

55.57°

87.51°

6546.31'

209.73'

6550

6723'

61.49°

87.90°

6571.35'

250.64'

6770'

66.76°

88.66°

6591.85'

292.88'

6600

6818'

68.91°

90.28°

6609.96'

337.24'

6865'

73.91°

91.32°

6624.94'

381.62'

6913'

78.15°

92.06°

6636.52'

427.95'

6959'

81.30°

91.33°

6644.73'

472.98'

3547.00	3.08	338.93	3525.46	179.41 N	154.74 W	-141.69	0.12
3641.00	1.85	345.10	3619.38	183.24 N	156.04 W	-142.71	1.33
3736.00	0.70	128.89	3714.36	184.36 N	155.99 W	-142.58	2.59
3831.00	0.87	149.80	3809.35	183.37 N	155.17 W	-141.83	0.35
3926.00	0.94	148.22	3904.34	182.08 N	154.40 W	-141.15	0.08
4021.00	0.85	118.72	3999.33	181.08 N	153.37 W	-140.20	0.49
4116.00	0.96	109.88	4094.32	180.48 N	152.01 W	-138.88	0.19
4211.00	0.59	105.02	4189.31	180.08 N	150.79 W	-137.69	0.40
4305.00	1.06	60.01	4283.30	180.39 N	149.57 W	-136.45	0.82
4400.00	0.22	65.00	4378.29	180.91 N	148.64 W	-135.49	0.89
4495.00	0.53	112.71	4473.29	180.82 N	148.07 W	-134.93	0.43
4590.00	0.63	100.41	4568.29	180.56 N	147.16 W	-134.04	0.17
4685.00	0.63	85.53	4663.28	180.50 N	146.12 W	-133.01	0.17
4780.00	0.84	78.28	4758.27	180.69 N	144.91 W	-131.79	0.24
4874.00	0.55	30.15	4852.27	181.21 N	144.01 W	-130.85	0.67
4969.00	0.75	53.01	4947.26	181.98 N	143.29 W	-130.08	0.34
5064.00	0.41	36.45	5042.26	182.62 N	142.59 W	-129.34	0.40
5159.00	0.45	100.95	5137.25	182.82 N	142.03 W	-128.76	0.48
5254.00	0.25	314.52	5232.25	182.89 N	141.81 W	-128.54	0.71
5349.00	0.38	47.40	5327.25	183.25 N	141.72 W	-128.43	0.49
5443.00	0.20	141.62	5421.25	183.34 N	141.39 W	-128.09	0.47
5538.00	0.56	108.60	5516.25	183.06 N	140.86 W	-127.57	0.43
5633.00	0.22	238.84	5611.25	182.82 N	140.58 W	-127.31	0.76
5728.00	0.64	51.82	5706.25	183.05 N	140.32 W	-127.04	0.90
5846.00	1.86	77.11	5824.22	183.88 N	137.94 W	-124.61	1.11
5916.00	2.01	87.11	5894.18	184.20 N	135.61 W	-122.26	0.53
5964.00	3.25	82.85	5942.13	184.41 N	133.42 W	-120.06	2.62
6011.00	7.90	79.03	5988.89	185.19 N	128.92 W	-115.52	9.92
6059.00	11.52	72.05	6036.20	187.30 N	121.12 W	-107.59	7.91
6106.00	14.38	72.27	6082.00	190.52 N	111.09 W	-97.36	6.10
6154.00	16.19	75.77	6128.30	193.98 N	98.93 W	-84.98	4.23
6201.00	19.44	81.03	6173.04	196.81 N	84.84 W	-70.73	7.72
6249.00	22.69	87.05	6217.83	198.53 N	67.70 W	-53.51	8.12
6296.00	26.46	87.08	6260.57	199.53 N	48.18 W	-33.97	8.01
6344.00	31.11	85.00	6302.63	201.16 N	25.14 W	-10.87	9.91
6391.00	35.03	86.33	6342.01	203.08 N	0.43 E	14.77	8.49
6439.00	37.98	89.24	6380.59	204.16 N	28.95 E	43.30	7.12
6485.00	40.82	90.92	6416.13	204.11 N	58.14 E	72.42	6.60
6533.00	42.04	90.22	6452.12	203.79 N	89.90 E	104.07	2.73
6580.00	45.75	89.90	6485.98	203.76 N	122.48 E	136.57	7.90
6628.00	50.44	88.17	6518.03	204.38 N	158.19 E	172.23	10.13
6675.00	55.57	87.51	6546.31	205.81 N	195.69 E	209.73	10.99
6723.00	61.49	87.90	6571.35	207.44 N	236.58 E	250.64	12.35
6770.00	66.76	88.66	6591.85	208.70 N	278.83 E	292.88	11.31
6818.00	68.91	90.28	6609.96	209.11 N	323.28 E	337.24	5.45
6865.00	73.91	91.32	6624.94	208.48 N	367.81 E	381.62	10.84
6913.00	78.15	92.06	6636.52	207.10 N	414.36 E	427.95	8.96
6959.00	81.30	91.33	6644.73	205.76 N	459.59 E	472.98	7.02
6987.00	82.94	90.14	6648.57	205.41 N	487.33 E	500.62	7.21

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 85.95 DEGREES (GRID)
A TOTAL CORRECTION OF 7.62 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.
HORIZONTAL DISPLACEMENT(CLOSURE) AT 6987.00 FEET
IS 528.85 FEET ALONG 67.14 DEGREES (GRID)**

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

Depth 350 Inc 1.20 Azi 217.02

Depth 720 Inc 1.00 Azi 217.42

Depth 965 Inc 0.20 Azi 69.62

Tied in @ Surface

Magnetic direction of 7.623 has been added to AZI for grid direction correction.