

PCGK - Pressure Case Gamma



1 : 600 / 1 : 240

[illegible]

WELL INFORMATION

MWD Run Number	100				
Date run completed	28-Jun-15				
Rig Bit Number	2				
Bit Size (in)	8.750				
Tool Nominal OD (in)	6.890				
Log Start Depth (TVD, ft)	821.00				
Log End Depth (TVD, ft)	6,692.98				
Drill or Wipe	Drill				
Drill/Wipe Start Date and Time	27-Jun-15 04:31				
Drill/Wipe End Date and Time	28-Jun-15 14:15				
Min Inc (deg) @ Depth (TVD, ft)	0.13 @ 1,944.96				
Max Inc (deg) @ Depth (TVD, ft)	71.31 @ 6,675.37				
Bit TFA(in2) / Bit Type	0.98 / PDC				
Flow Rate (gpm)	589.88				
Max AV (fpm) / CV (fpm) @ MWD	N/A / N/A				
Fluid Type	Native/Spud Mud				
Density (ppg) / Viscosity (spqt)	9.75 / 35.00				
Filtrate CL (ppm)	1,700.00				
pH / Fluid Loss (mptm)	11.00 / 10				
PV (cP) / YP (lbf2)	7 / 6.00				
% Solids / % Sand	3.00 / 0.25				
% 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				
Min Temp (degF) / Max Temp (degF)	175.12 / 203.15				

Max Tool Temp (degF) / Source	175.40 / PCM				
Rm @ Max Tool Temp (degF)	N/A @ 175.40				
Lead MWD Engineer	Matt Busche				
Customer Representative	Jeremy Stolz				

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM				
Software Version	5.93				
Sub Serial Number	11404267				
Insert Serial Number	11680727				
Date and Time Initialized	26-Jun-15 15:07				
Date and Time Read	28-Jun-15 21:27				
ECMB SW Version	N/A				

Directional Sensor Information

Tool Type	PCDC				
Distance From Bit (ft)	56.00				
Software Version	6.33				
Sub Serial Number	11404267				
Sonde Serial Number	11478122				
Sensor ID Number	N/A				
Toolface Offset (deg)	157.90				

Gamma Ray Sensor Information

Tool Type	PCG				
Distance From Bit (ft)	48.95				
Recorded Sample Period (sec)	10				
Software Version	8.15				
Sub Serial Number	11404267				
Insert/Sonde Serial Number	11680921				

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: 0.5 ft
Interval Distance: 1.2 ft

6. Insite Version v8.1.10

WARRANTY

HALLIBURTON WILL USE ITS BEST EFFORTS TO FURNISH CUSTOMERS WITH ACCURATE INFORMATION AND INTERPRETATION 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.

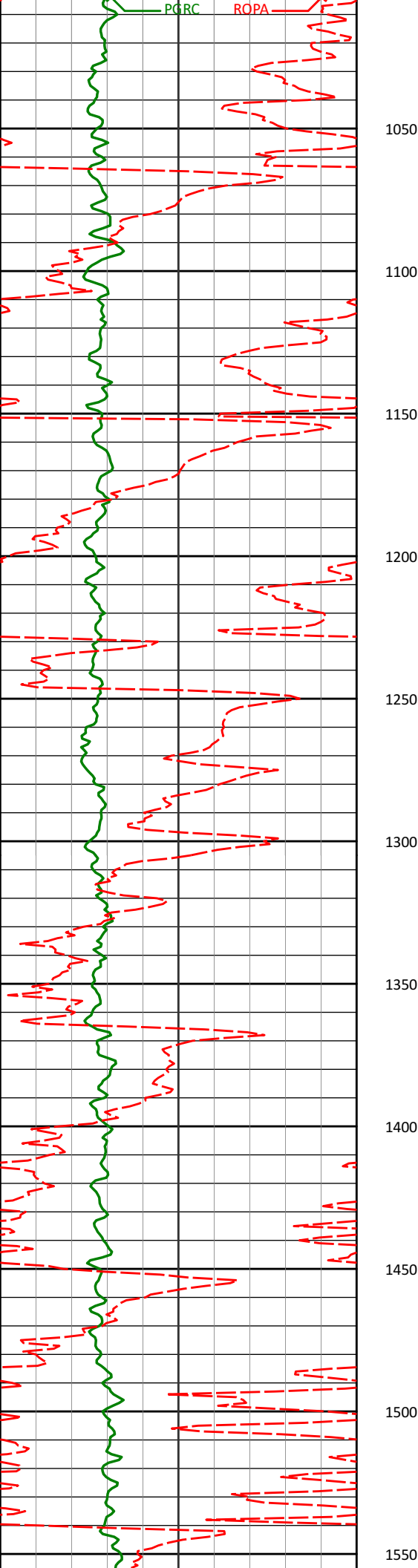
HALLIBURTON

Sperry Drilling Services

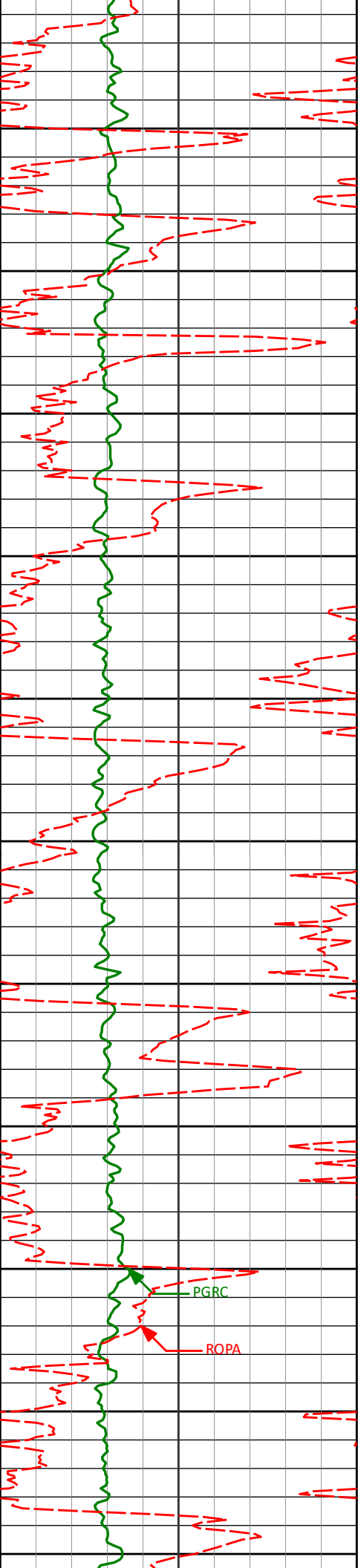
TVD Correlation Log 1:600

Noble Energy
Wells Ranch State A36-625
H&P 321
Sec. 31-T6N-R63W

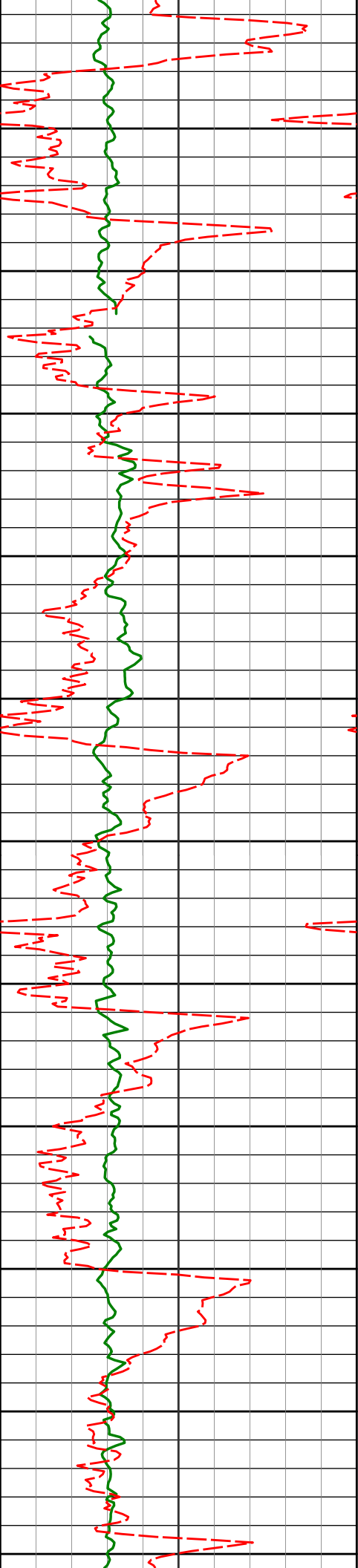




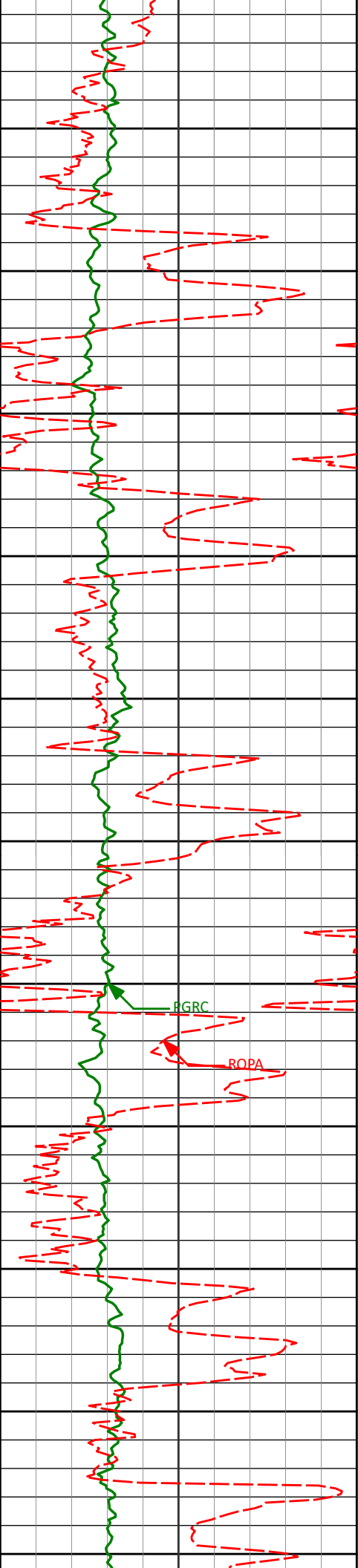
1011'	0.29°	51.49°	1010.99'	-2.00'
1103'	0.22°	1.45°	1102.99'	-2.21'
1208'	0.18°	313.41°	1207.99'	-2.12'
1300'	0.29°	269.55°	1299.99'	-1.79'
1392'	0.55°	269.52°	1391.99'	-1.12'
1485'	0.47°	267.03°	1484.99'	-0.29'



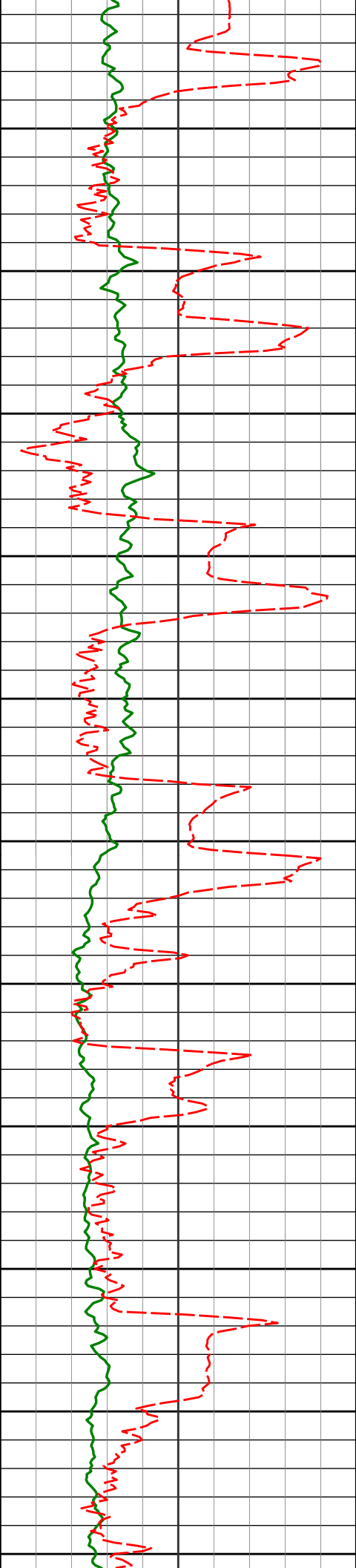
1576'	0.63°	283.17°	1575.98'	0.56'
1600				
1650				
1668'	0.65°	293.02°	1667.98'	1.51'
1700				
1750				
1761'	0.80°	286.40°	1760.97'	2.59'
1800				
1850				
1854'	0.63°	284.32°	1853.96'	3.68'
1900				
1945'	0.13°	5.86°	1944.96'	4.14'
2000				
2037'	0.41°	0.07°	2036.96'	4.09'
2050				
2100				



2129'	0.54°	210.44°	2128.96'	4.32'
2150				
2200				
2221'	0.56°	218.43°	2220.95'	4.87'
2250				
2300				
2313'	0.61°	204.09°	2312.95'	5.40'
2350				
2400				
2404'	0.62°	195.75°	2403.94'	5.80'
2450				
2500				
2497'	0.53°	202.69°	2496.94'	6.16'
2550				
2588'	0.47°	184.83°	2587.94'	6.41'
2600				
2650				

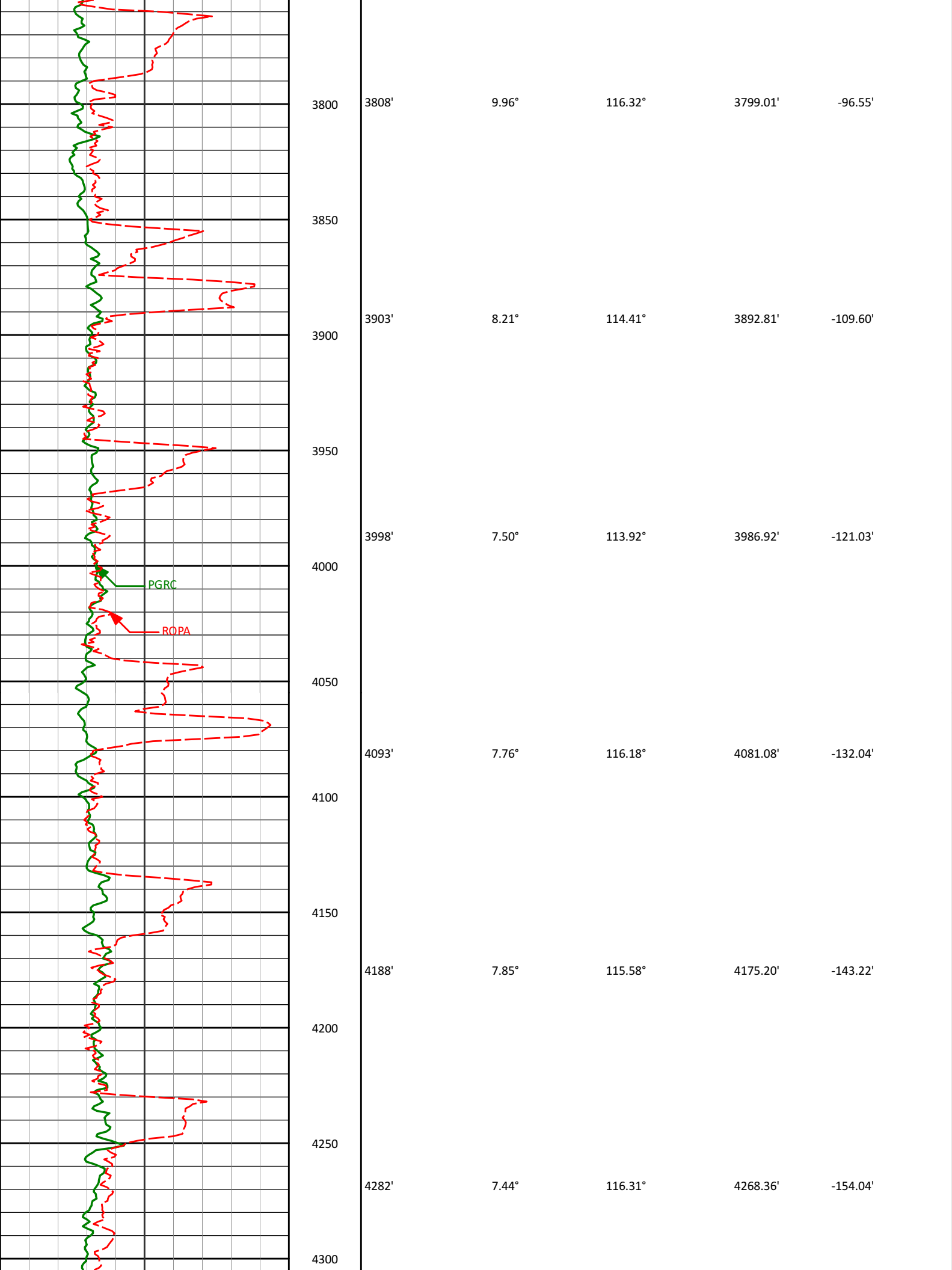


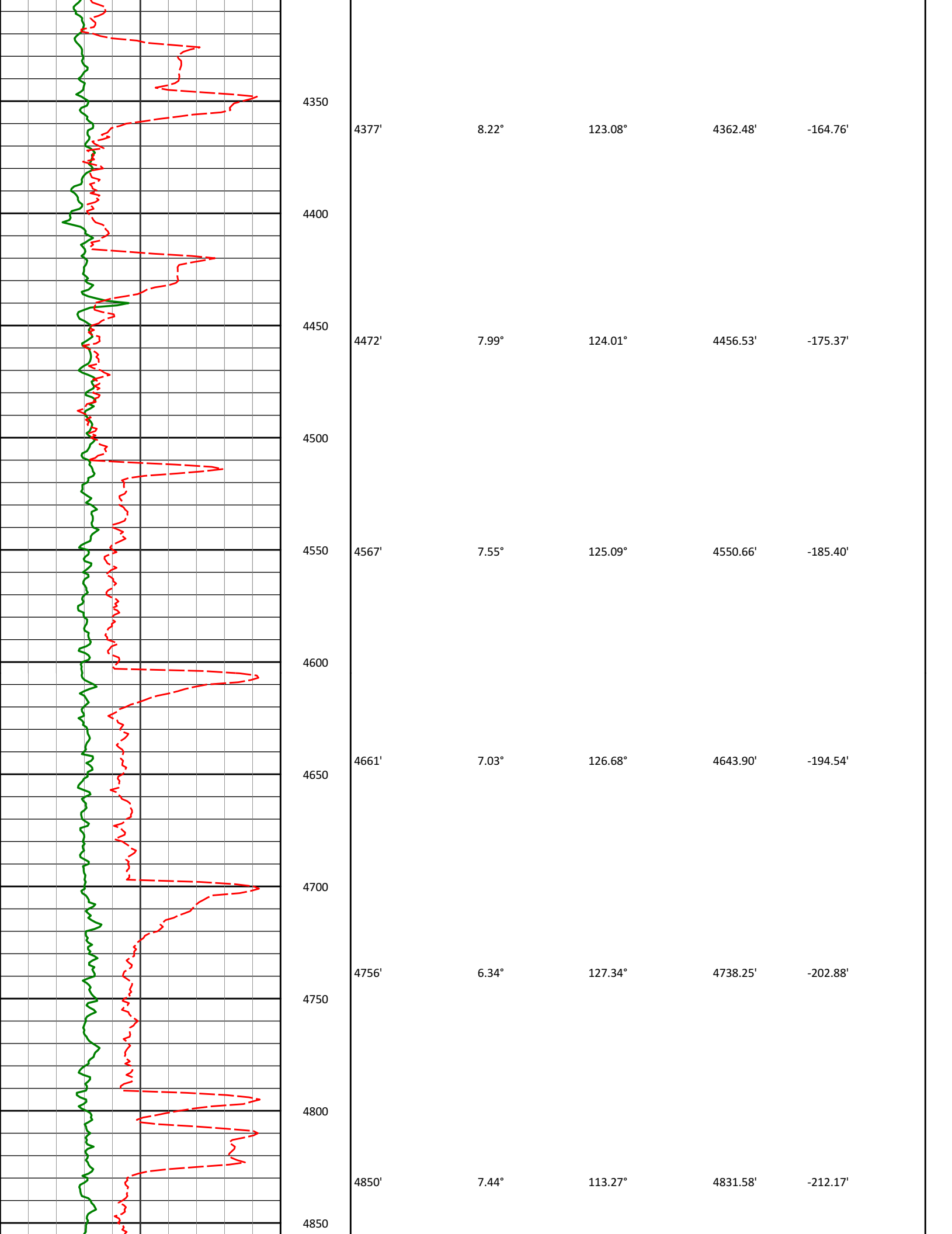
2680'	0.40°	187.30°	2679.93'	6.53'
2700				
2750				
2772'	1.75°	147.74°	2771.92'	5.93'
2800				
2850				
2863'	2.74°	130.36°	2862.84'	3.72'
2900				
2950				
2955'	3.95°	133.90°	2954.69'	0.03'
3000				
3050'	5.28°	135.67°	3049.38'	-4.98'
3100				
3145'	7.13°	123.66°	3143.82'	-12.46'
3150				
3200				

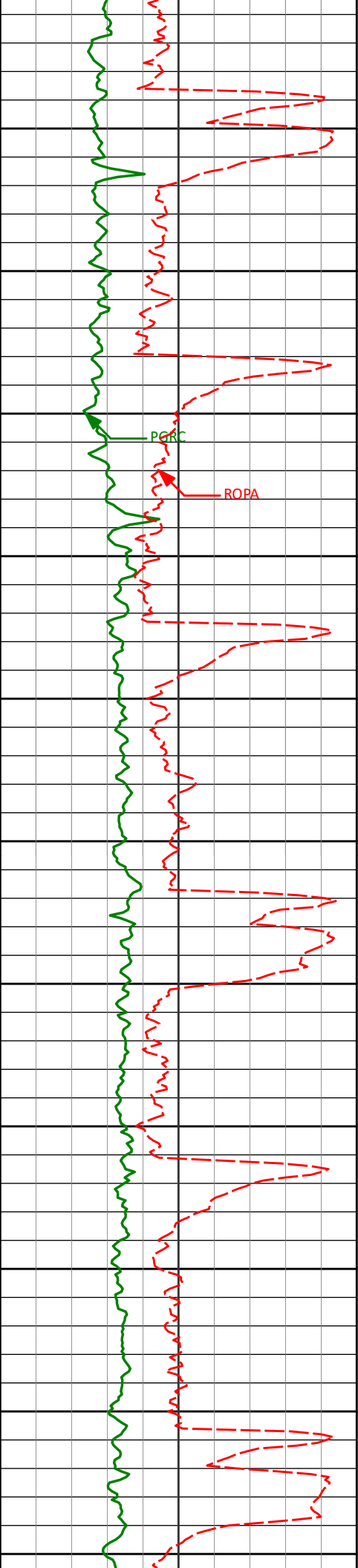


3250
3300
3350
3400
3450
3500
3550
3600
3650
3700
3750

3240'	7.65°	118.61°	3238.03'	-22.45'
3334'	8.27°	119.25°	3331.13'	-33.36'
3429'	8.52°	124.62°	3425.11'	-44.56'
3524'	9.06°	119.76°	3518.99'	-56.26'
3619'	9.51°	117.86°	3612.75'	-69.13'
3713'	9.80°	117.15°	3705.42'	-82.56'







4900

4945'

8.08°

115.78°

4925.71'

-223.42'

4950

5000

5039'

7.80°

115.38°

5018.81'

-234.70'

5050

5100

5134'

6.97°

115.25°

5113.02'

-245.34'

5150

5200

5228'

8.32°

114.90°

5206.18'

-256.26'

5250

5300

5323'

7.35°

111.31°

5300.29'

-267.76'

5350

5400

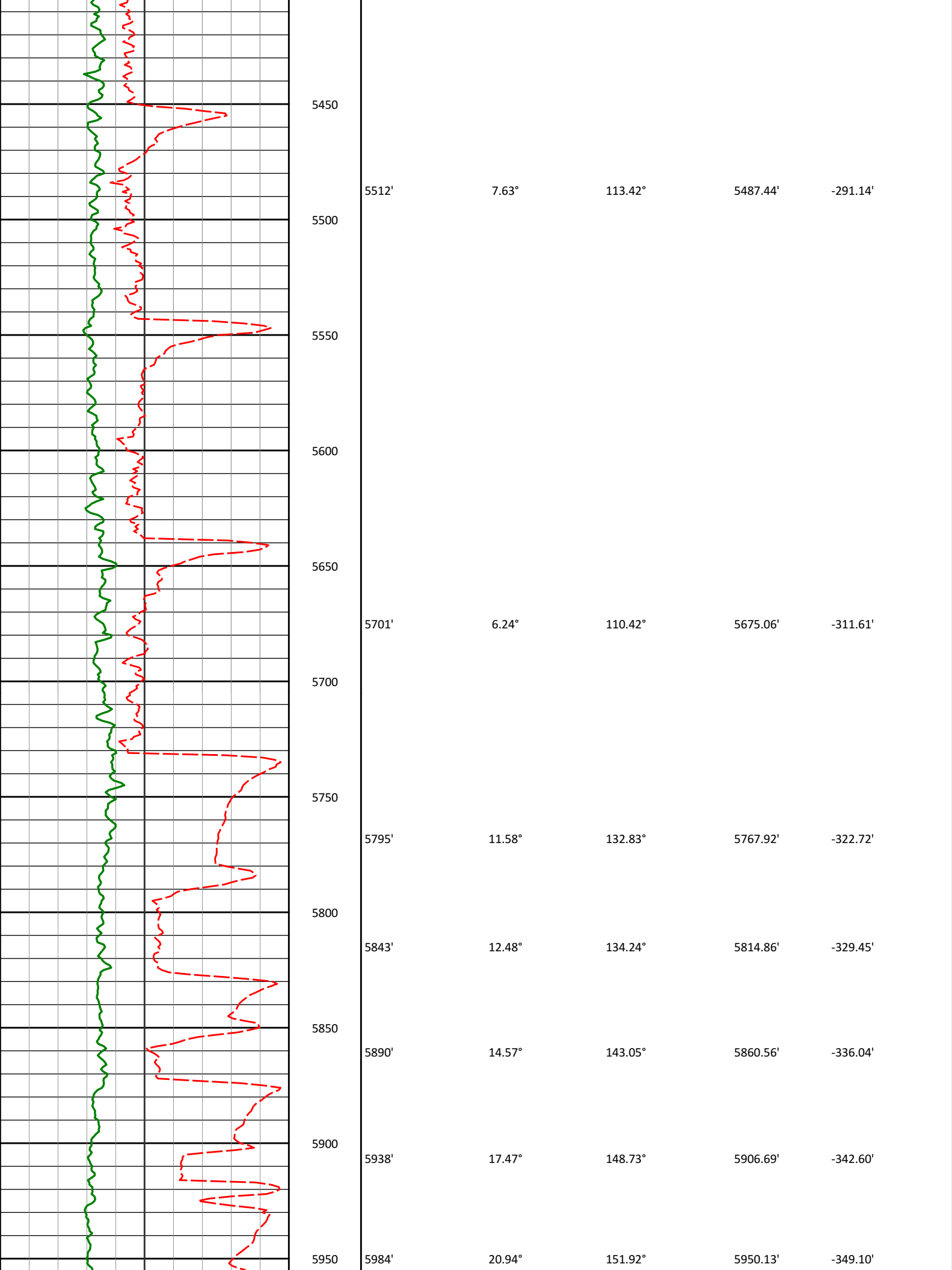
5417'

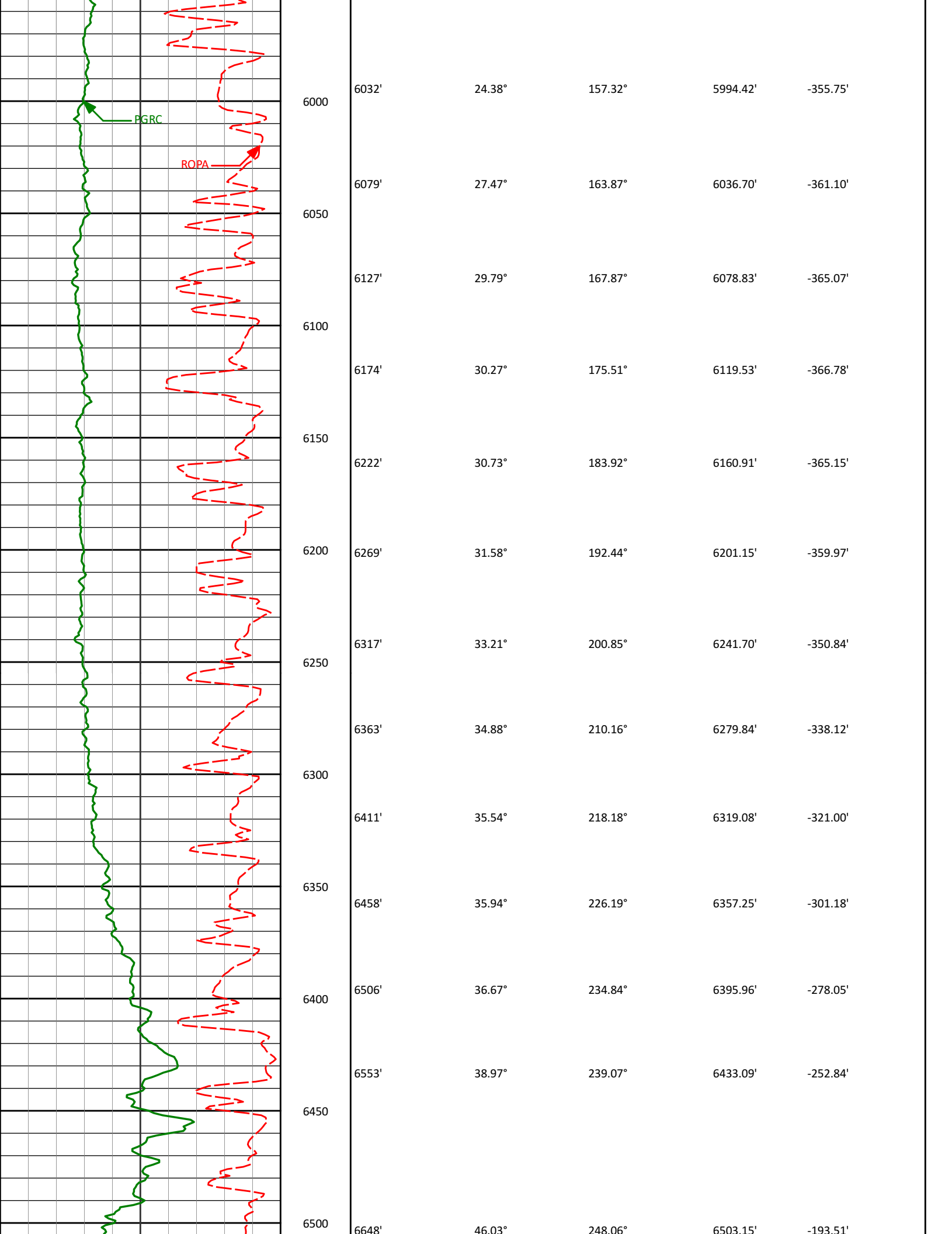
8.54°

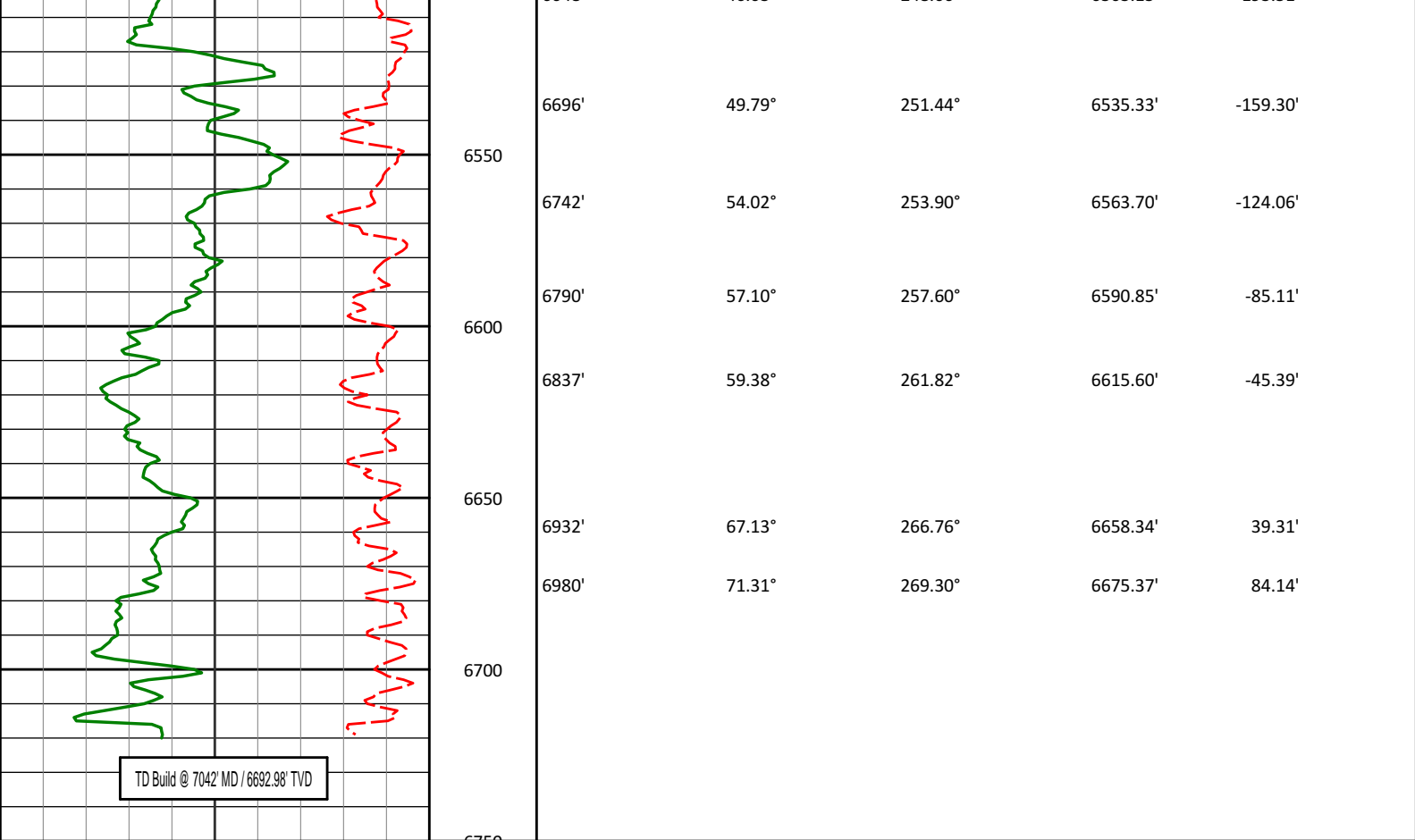
114.21°

5393.39'

-279.34'







<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

TVD Detail Log 1:240

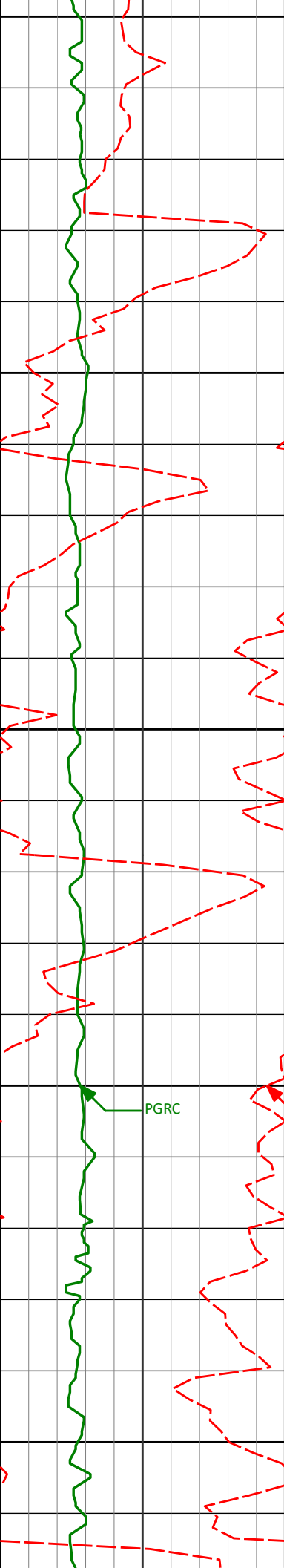
Noble Energy

Wells Ranch State A36-625

H&P 321

Sec. 31-T6N-R63W

<div><div>PCG Gamma Ray</div><div>PGRC</div><div>api</div></div>							
<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>Run 100</div></div>							



850

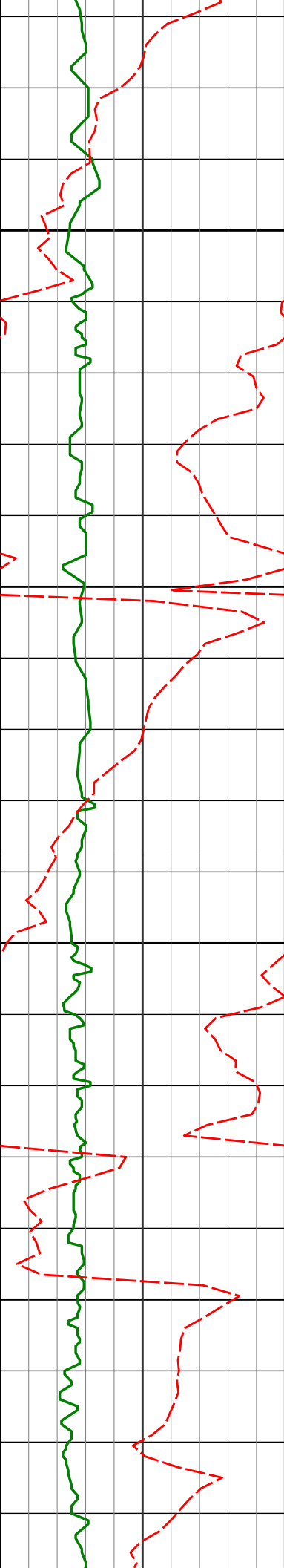
900

950

1000

1050

857'	0.26°	41.28°	857.00'	-1.38'
919'	0.34°	41.55°	919.00'	-1.62'
1011'	0.29°	51.49°	1010.99'	-2.00'



1100

1150

1200

1250

1103'

0.22°

1.45°

1102.99'

-2.21'

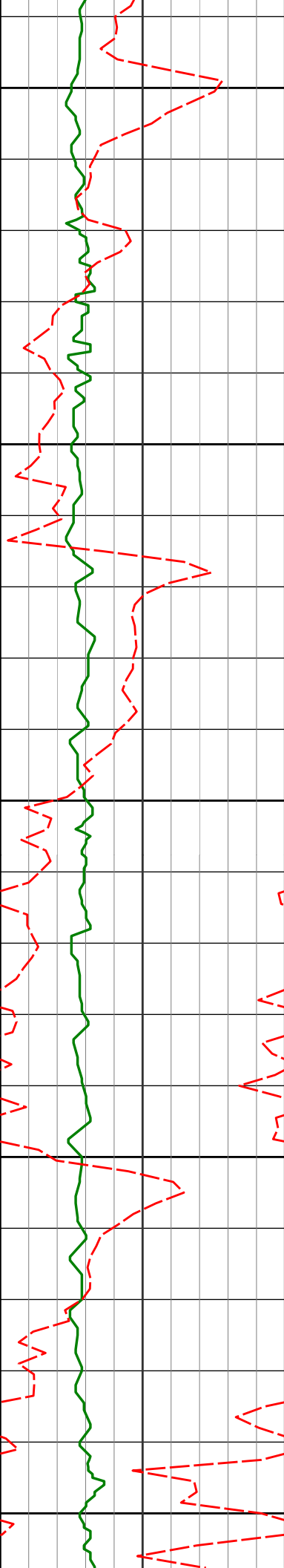
1208'

0.18°

313.41°

1207.99'

-2.12'



1300

1350

1400

1450

1500

1300'

1392'

1485'

0.29°

0.55°

0.47°

269.55°

269.52°

267.03°

1299.99'

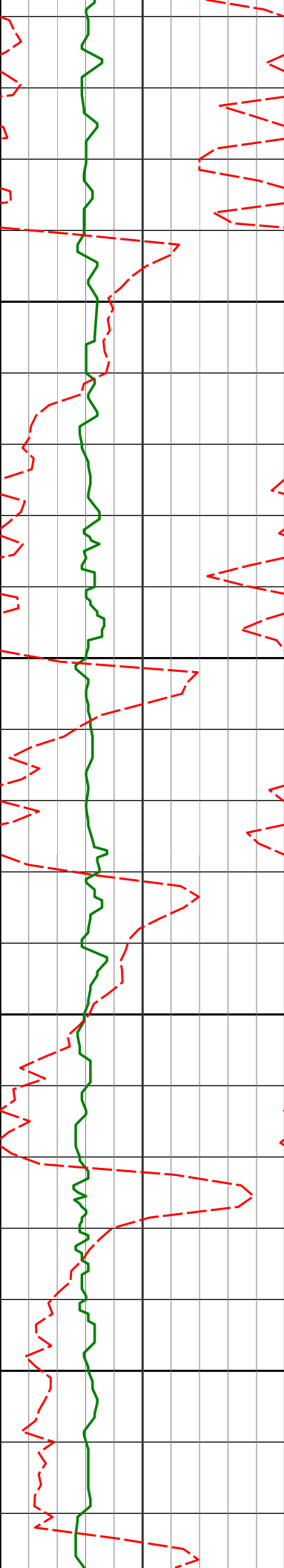
1391.99'

1484.99'

-1.79'

-1.12'

-0.29'



1550

1576'

0.63°

283.17°

1575.98'

0.56'

1600

1650

1668'

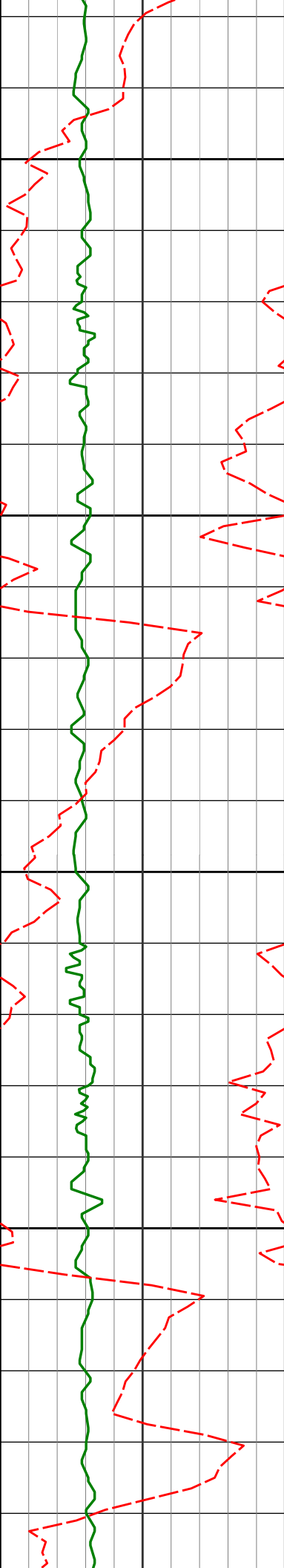
0.65°

293.02°

1667.98'

1.51'

1700



1750

1761'

0.80°

286.40°

1760.97'

2.59'

1800

1850

1854'

0.63°

284.32°

1853.96'

3.68'

1900

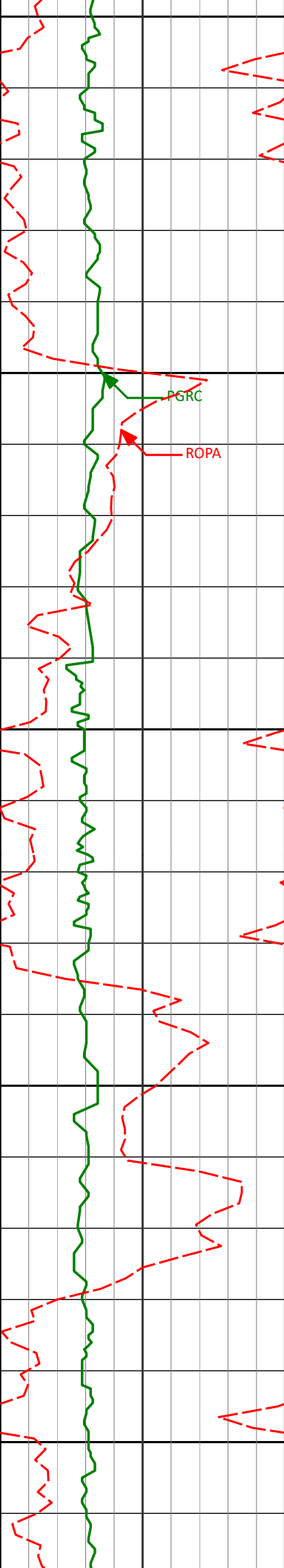
1945'

0.13°

5.86°

1944.96'

4.14'



1950

2000

2050

2100

2150

2037'

0.41°

0.07°

2036.96'

4.09'

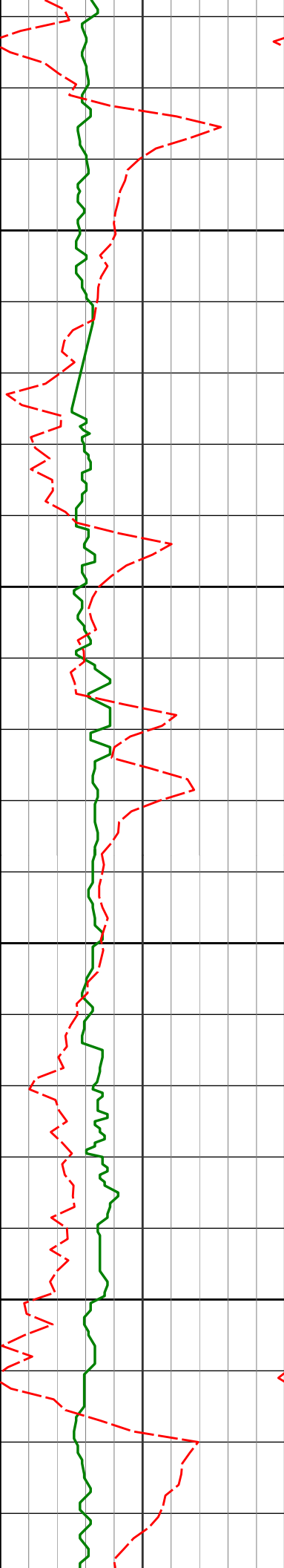
2129'

0.54°

210.44°

2128.96'

4.32'



2200

2250

2300

2350

2221'

0.56°

218.43°

2220.95'

4.87'

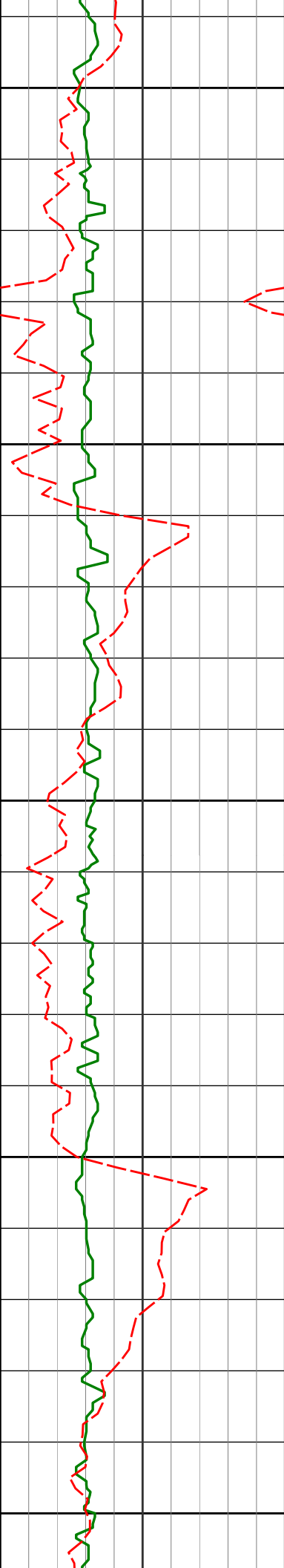
2313'

0.61°

204.09°

2312.95'

5.40'



2400

2404'

0.62°

195.75°

2403.94'

5.80'

2450

2500

2497'

0.53°

202.69°

2496.94'

6.16'

2550

2588'

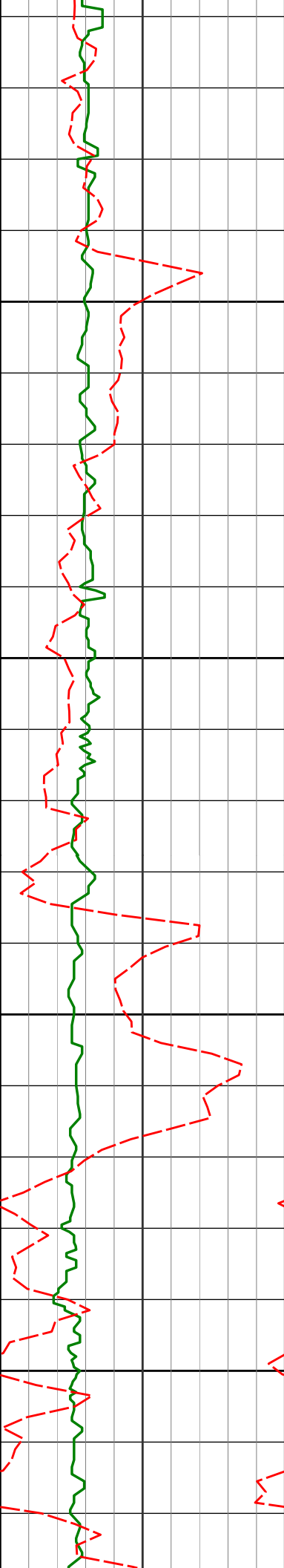
0.47°

184.83°

2587.94'

6.41'

2600



2650

2700

2750

2800

2680'

0.40°

187.30°

2679.93'

6.53'

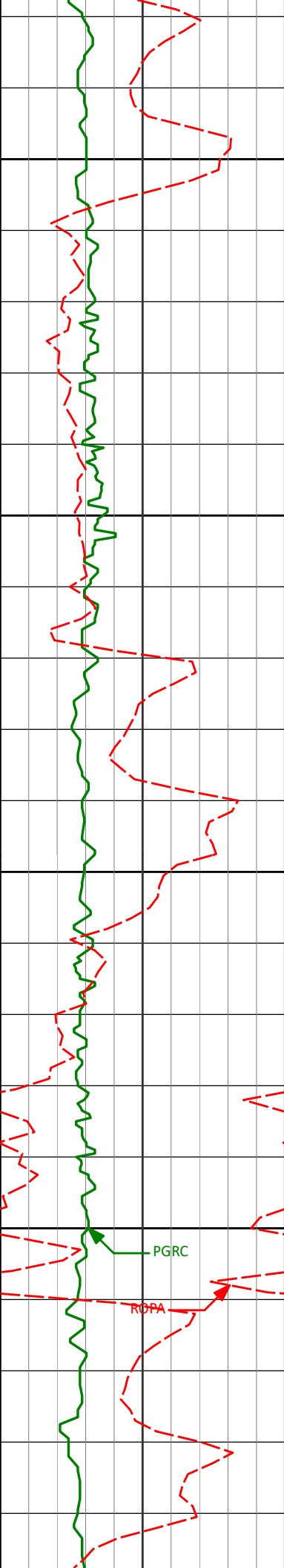
2772'

1.75°

147.74°

2771.92'

5.93'



2850

2900

2950

3000

2863'

2.74°

130.36°

2862.84'

3.72'

2955'

3.95°

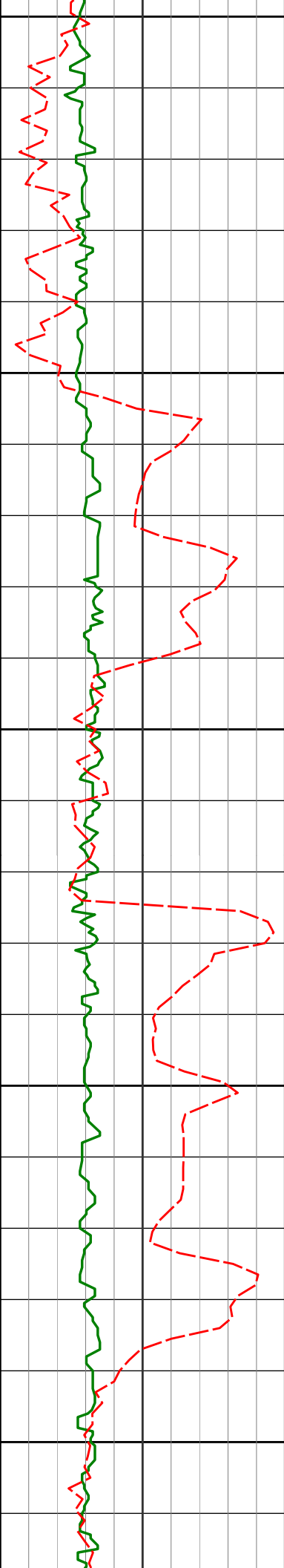
133.90°

2954.69'

0.03'

PGRC

ROPA



3050

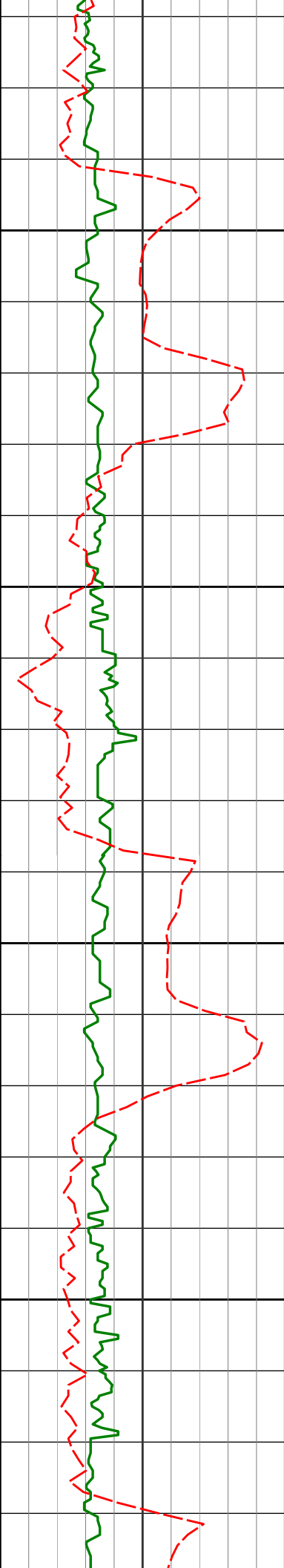
3100

3150

3200

3250

3050'	5.28°	135.67°	3049.38'	-4.98'
3145'	7.13°	123.66°	3143.82'	-12.46'
3240'	7.65°	118.61°	3238.03'	-22.45'



3300

3350

3400

3450

3334'

8.27°

119.25°

3331.13'

-33.36'

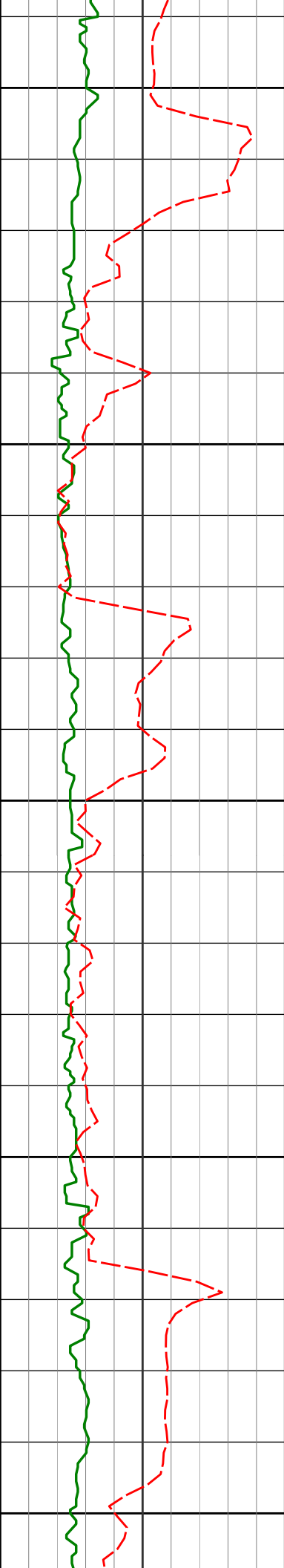
3429'

8.52°

124.62°

3425.11'

-44.56'



3500

3524'

9.06°

119.76°

3518.99'

-56.26'

3550

3600

3619'

9.51°

117.86°

3612.75'

-69.13'

3650

3700

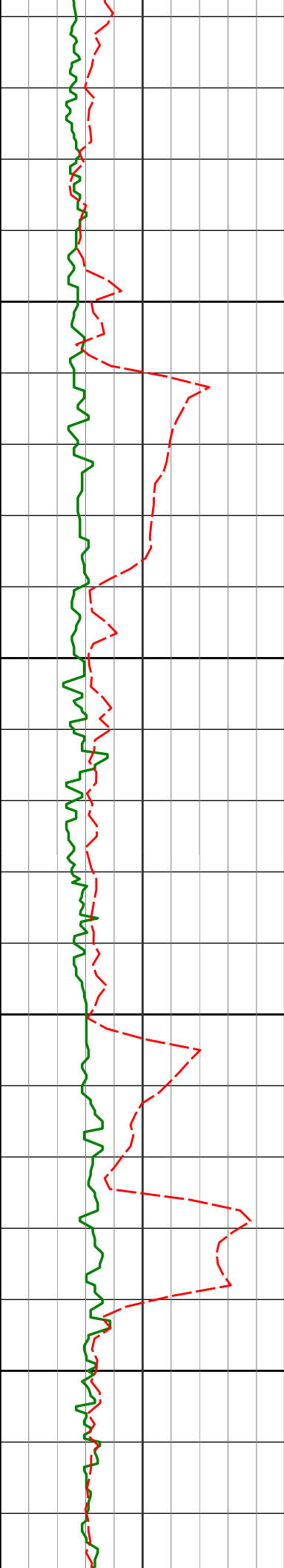
3713'

9.80°

117.15°

3705.42'

-82.56'



3750

3800

3850

3900

3808'

9.96°

116.32°

3799.01'

-96.55'

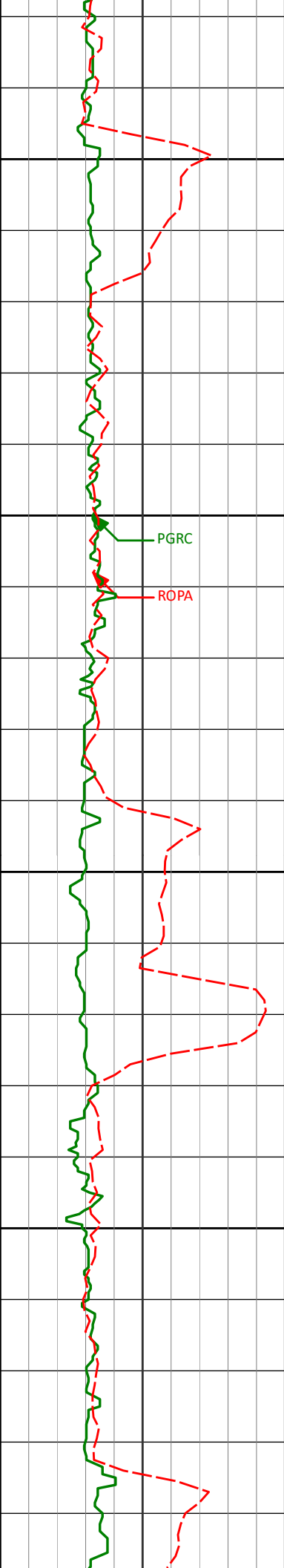
3903'

8.21°

114.41°

3892.81'

-109.60'



3950

3998'

7.50°

113.92°

3986.92'

-121.03'

4000

PGRC

ROPA

4050

4093'

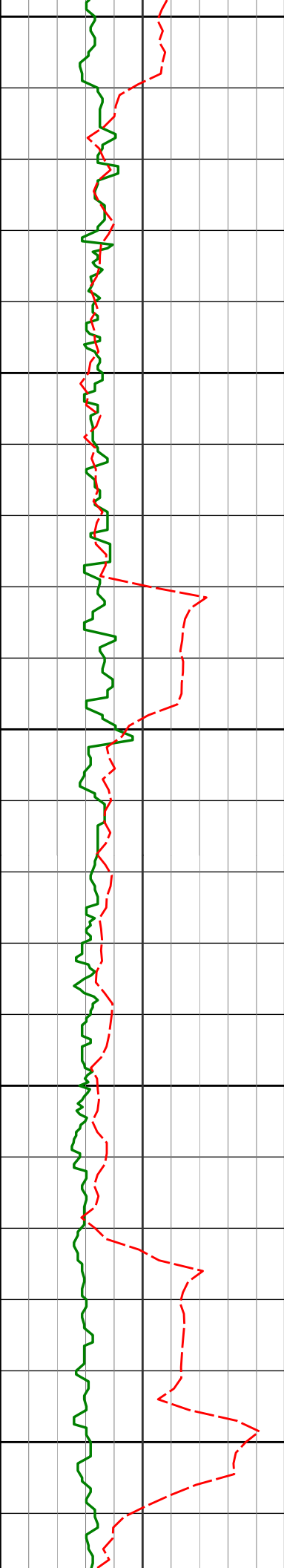
7.76°

116.18°

4081.08'

-132.04'

4100



4150

4188'

4200

4250

4282'

4300

4350

4377'

4188'

7.85°

115.58°

4175.20'

-143.22'

4282'

7.44°

116.31°

4268.36'

-154.04'

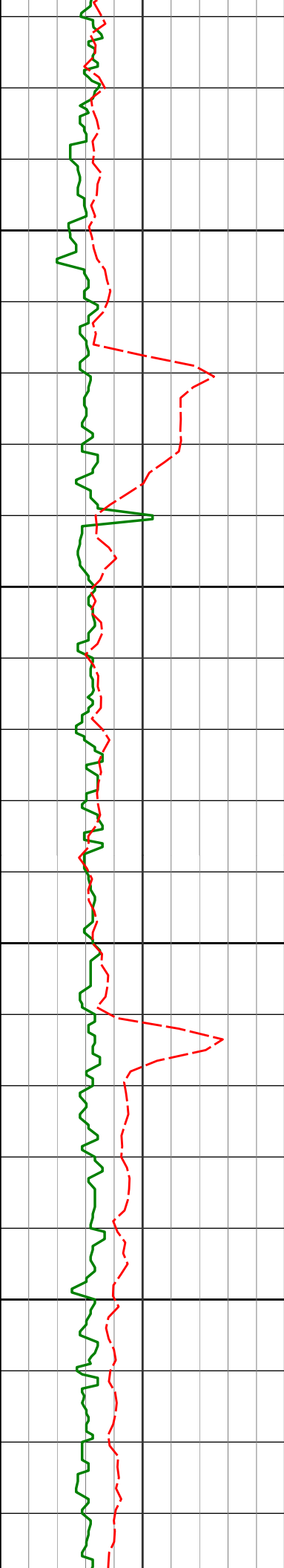
4377'

8.22°

123.08°

4362.48'

-164.76'



4400

4450

4500

4550

4472'

7.99°

124.01°

4456.53'

-175.37'

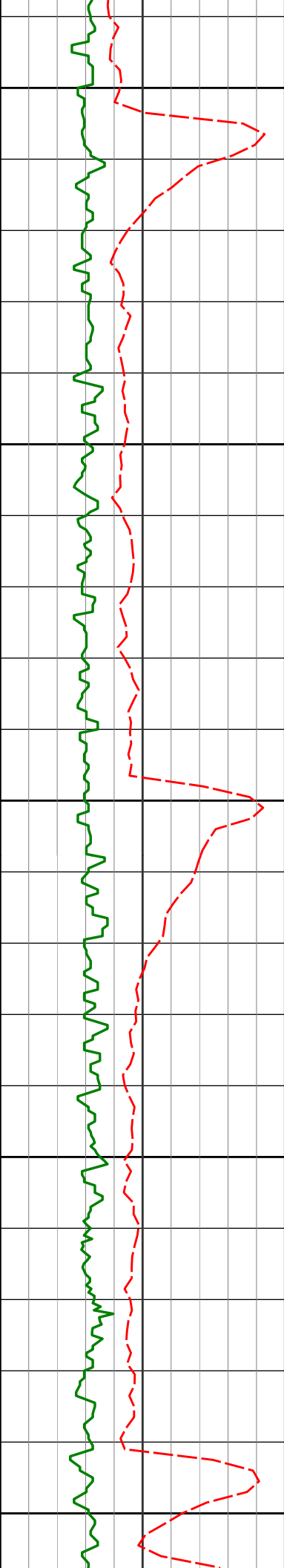
4567'

7.55°

125.09°

4550.66'

-185.40'



4600

4661'

7.03°

126.68°

4643.90'

-194.54'

4650

4700

4756'

6.34°

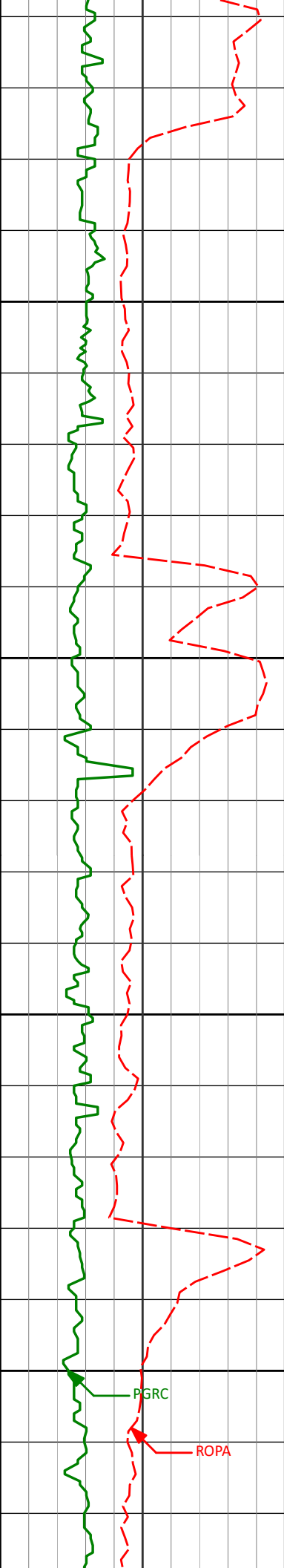
127.34°

4738.25'

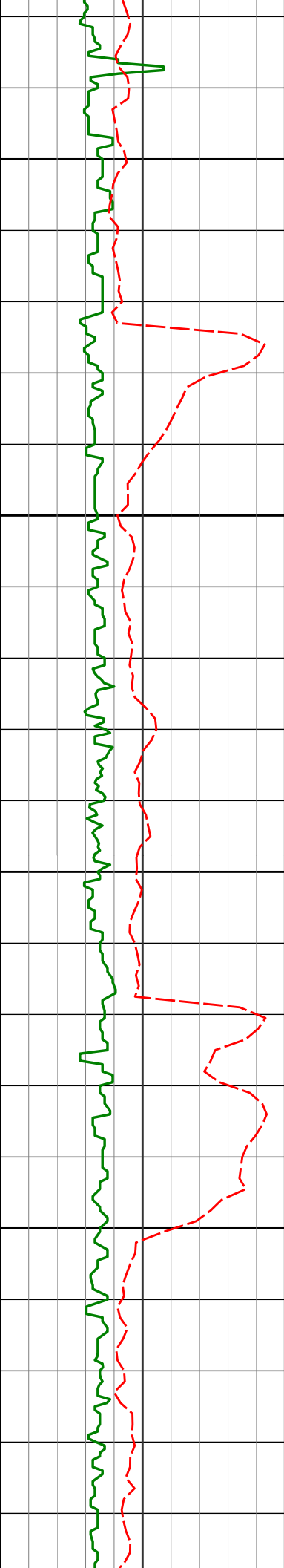
-202.88'

4750

4800



4850'	7.44°	113.27°	4831.58'	-212.17'
4850				
4900				
4945'	8.08°	115.78°	4925.71'	-223.42'
4950				
5000				
5039'	7.80°	115.38°	5018.81'	-234.70'



5050

5100

5150

5200

5134'

6.97°

115.25°

5113.02'

-245.34'

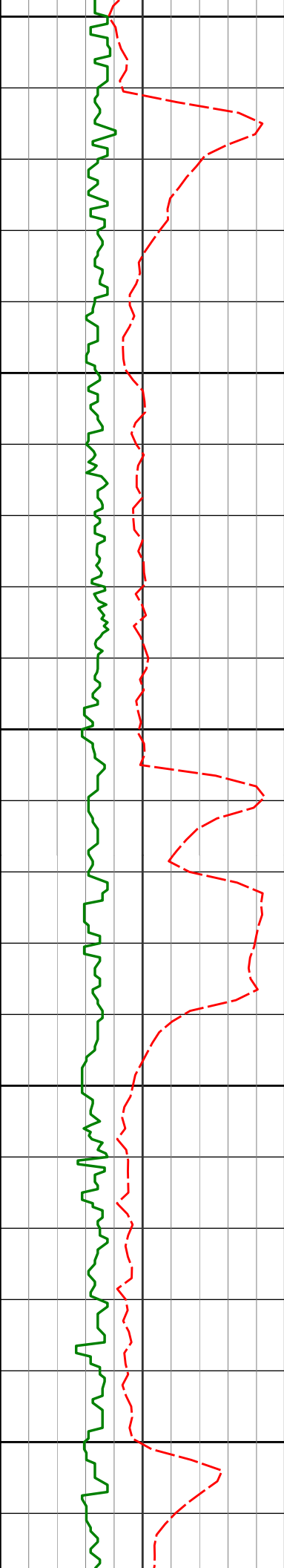
5228'

8.32°

114.90°

5206.18'

-256.26'



5250

5300

5350

5400

5450

5323'

7.35°

111.31°

5300.29'

-267.76'

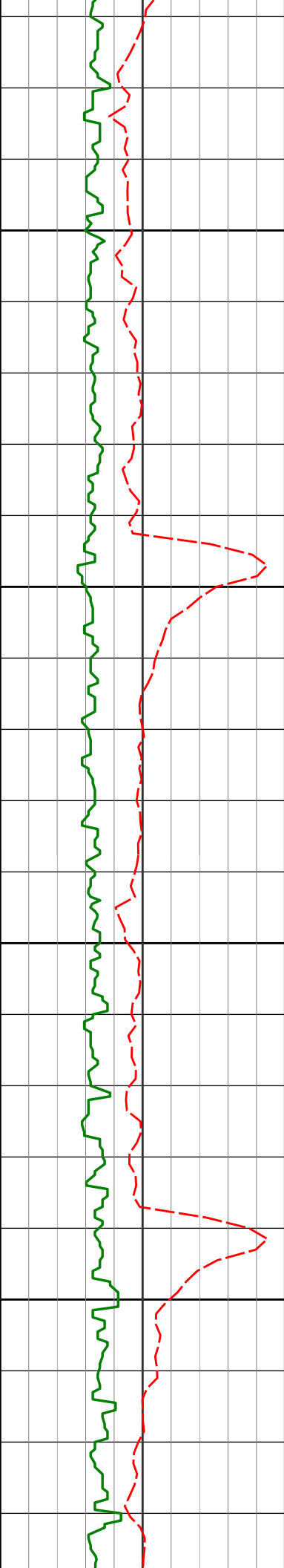
5417'

8.54°

114.21°

5393.39'

-279.34'



5512'

7.63°

113.42°

5487.44'

-291.14'

5500

5550

5600

5650

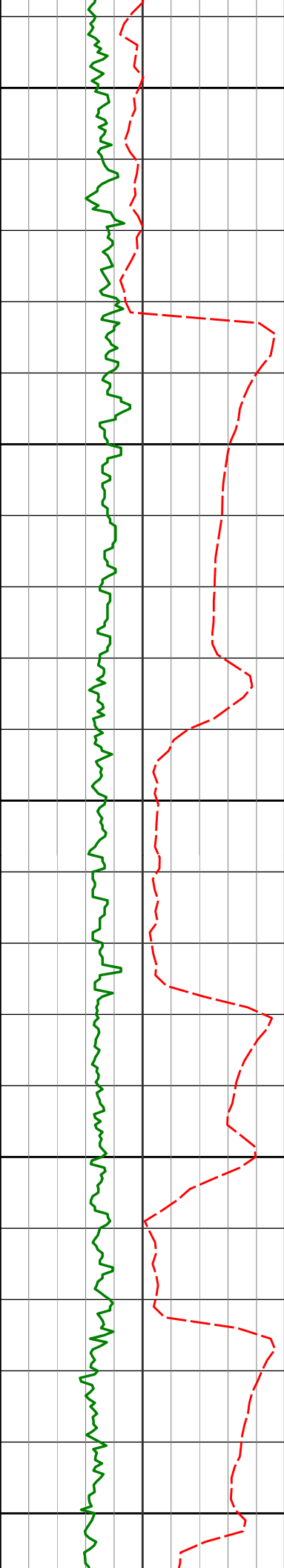
5701'

6.24°

110.42°

5675.06'

-311.61'



5700

5750

5800

5850

5900

5795'

11.58°

132.83°

5767.92'

-322.72'

5843'

12.48°

134.24°

5814.86'

-329.45'

5890'

14.57°

143.05°

5860.56'

-336.04'

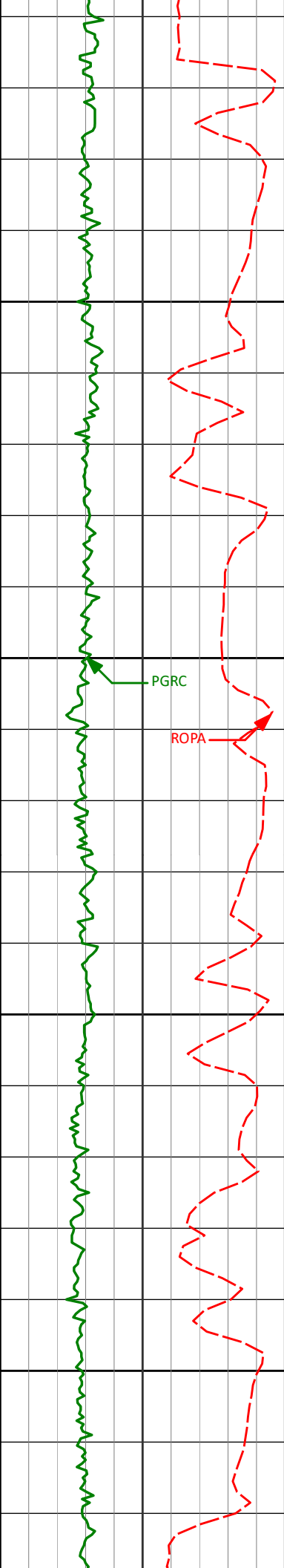
5938'

17.47°

148.73°

5906.69'

-342.60'



5950

5984'

20.94°

151.92°

5950.13'

-349.10'

6032'

24.38°

157.32°

5994.42'

-355.75'

6000

PGRC

ROPA

6079'

27.47°

163.87°

6036.70'

-361.10'

6050

6127'

29.79°

167.87°

6078.83'

-365.07'

6100

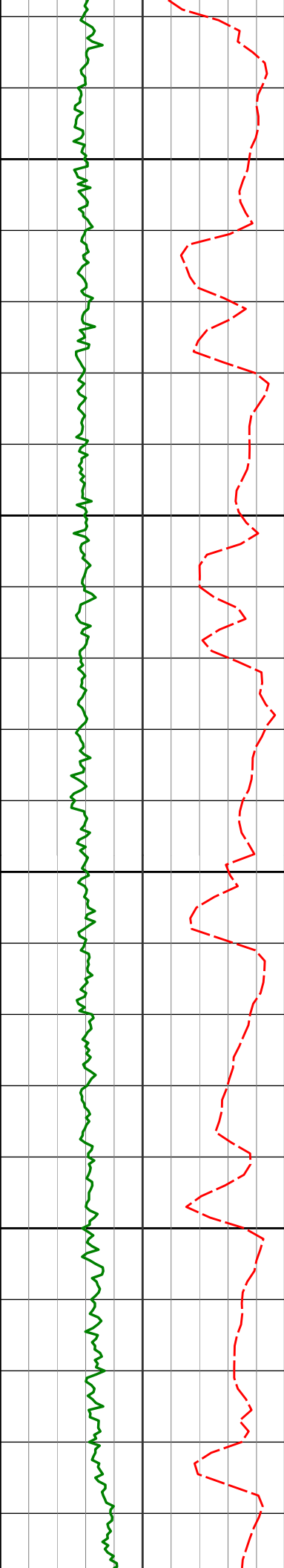
6174'

30.27°

175.51°

6119.53'

-366.78'



6150

6222'

30.73°

183.92°

6160.91'

-365.15'

6200

6269'

31.58°

192.44°

6201.15'

-359.97'

6250

6317'

33.21°

200.85°

6241.70'

-350.84'

6300

6363'

34.88°

210.16°

6279.84'

-338.12'

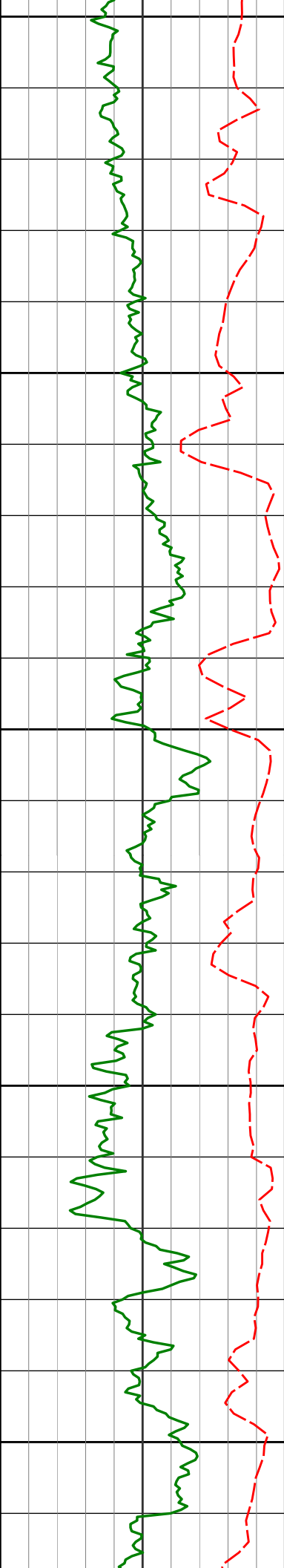
6411'

35.54°

218.18°

6319.08'

-321.00'



6350
6400
6450
6500
6550

6458'	35.94°	226.19°	6357.25'	-301.18'
6506'	36.67°	234.84°	6395.96'	-278.05'
6553'	38.97°	239.07°	6433.09'	-252.84'
6648'	46.03°	248.06°	6503.15'	-193.51'
6696'	49.79°	251.44°	6535.33'	-159.30'
6742'	54.02°	253.90°	6563.70'	-124.06'

<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>
0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
857.00	0.26	41.28	857.00	1.46 N	1.28 E	-1.38	0.03
919.00	0.34	41.55	919.00	1.70 N	1.50 E	-1.62	0.13
1011.00	0.29	51.49	1010.99	2.05 N	1.86 E	-2.00	0.08
1103.00	0.22	1.45	1102.99	2.38 N	2.05 E	-2.21	0.24
1208.00	0.18	313.41	1207.99	2.69 N	1.93 E	-2.12	0.16
1300.00	0.29	269.55	1299.99	2.79 N	1.60 E	-1.79	0.22
1392.00	0.55	269.52	1391.99	2.78 N	0.92 E	-1.12	0.28
1485.00	0.47	267.03	1484.99	2.76 N	0.09 E	-0.29	0.09
1576.00	0.63	283.17	1575.98	2.85 N	0.77 W	0.56	0.24
1668.00	0.65	293.02	1667.98	3.17 N	1.74 W	1.51	0.12
1761.00	0.80	286.40	1760.97	3.56 N	2.85 W	2.59	0.18
1854.00	0.63	284.32	1853.96	3.87 N	3.97 W	3.68	0.18
1945.00	0.13	5.86	1944.96	4.10 N	4.44 W	4.14	0.69
2037.00	0.41	0.07	2036.96	4.53 N	4.43 W	4.09	0.31
2129.00	0.54	210.44	2128.96	4.49 N	4.65 W	4.32	1.00
2221.00	0.56	218.43	2220.95	3.76 N	5.15 W	4.87	0.09
2313.00	0.61	204.09	2312.95	2.96 N	5.63 W	5.40	0.17
2404.00	0.62	195.75	2403.94	2.05 N	5.96 W	5.80	0.10
2497.00	0.53	202.69	2496.94	1.16 N	6.26 W	6.16	0.12
2588.00	0.47	184.83	2587.94	0.40 N	6.45 W	6.41	0.18
2680.00	0.40	187.30	2679.93	0.29 S	6.53 W	6.53	0.08
2772.00	1.75	147.74	2771.92	1.80 S	5.82 W	5.93	1.59
2863.00	2.74	130.36	2862.84	4.38 S	3.42 W	3.72	1.31
2955.00	3.95	133.90	2954.69	8.00 S	0.54 E	0.03	1.33
3050.00	5.28	135.67	3049.38	13.40 S	5.95 E	-4.98	1.41
3145.00	7.13	123.66	3143.82	19.79 S	13.92 E	-12.46	2.37
3240.00	7.65	118.61	3238.03	26.09 S	24.37 E	-22.45	0.88
3334.00	8.27	119.25	3331.13	32.39 S	35.77 E	-33.36	0.67
3429.00	8.52	124.62	3425.11	39.72 S	47.52 E	-44.56	0.87
3524.00	9.06	119.76	3518.99	47.44 S	59.80 E	-56.26	0.97
3619.00	9.51	117.86	3612.75	54.82 S	73.23 E	-69.13	0.57
3713.00	9.80	117.15	3705.42	62.10 S	87.22 E	-82.56	0.33
3808.00	9.96	116.32	3799.01	69.43 S	101.78 E	-96.55	0.23
3903.00	8.21	114.41	3892.81	75.87 S	115.32 E	-109.60	1.87
3998.00	7.50	113.92	3986.92	81.19 S	127.16 E	-121.03	0.75
4093.00	7.76	116.18	4081.08	86.53 S	138.59 E	-132.04	0.42
4188.00	7.85	115.58	4175.20	92.17 S	150.19 E	-143.22	0.13
4282.00	7.44	116.31	4268.36	97.63 S	161.44 E	-154.04	0.45
4377.00	8.22	123.08	4362.48	104.07 S	172.64 E	-164.76	1.27
4472.00	7.99	124.01	4456.53	111.47 S	183.81 E	-175.37	0.28
4567.00	7.55	125.09	4550.66	118.75 S	194.39 E	-185.40	0.49
4661.00	7.03	126.68	4643.90	125.73 S	204.05 E	-194.54	0.59
4756.00	6.34	127.34	4738.25	132.39 S	212.89 E	-202.88	0.73
4850.00	7.44	113.27	4831.58	137.94 S	222.60 E	-212.17	2.13
4945.00	8.08	115.78	4925.71	143.28 S	234.27 E	-223.42	0.76
5039.00	7.80	115.38	5018.81	148.88 S	245.98 E	-234.70	0.30
5134.00	6.97	115.25	5113.02	154.10 S	257.02 E	-245.34	0.87
5228.00	8.32	114.90	5206.18	159.40 S	268.34 E	-256.26	1.44
5323.00	7.35	111.31	5300.29	164.50 S	280.24 E	-267.76	1.14
5417.00	8.54	114.21	5393.39	169.55 S	292.21 E	-279.34	1.34
5512.00	7.63	113.42	5487.44	174.95 S	304.43 E	-291.14	0.96
5701.00	6.24	110.42	5675.06	183.52 S	325.57 E	-311.61	0.76
5795.00	11.58	132.83	5767.92	191.73 S	337.29 E	-322.72	6.67
5843.00	12.48	134.24	5814.86	198.62 S	344.54 E	-329.45	1.97
5890.00	14.57	143.05	5860.56	206.89 S	351.73 E	-336.04	6.23
5938.00	17.47	148.73	5906.69	217.88 S	359.10 E	-342.60	6.86
5984.00	20.94	151.92	5950.13	231.03 S	366.56 E	-349.10	7.88
6032.00	24.38	157.32	5994.42	247.75 S	374.42 E	-355.75	8.37
6079.00	27.47	163.87	6036.70	267.12 S	381.17 E	-361.10	8.95

<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>
6127.00	29.79	167.87	6078.83	289.42 S	386.75 E	-365.07	6.27
6174.00	30.27	175.51	6119.53	312.65 S	390.14 E	-366.78	8.19
6222.00	30.73	183.92	6160.91	336.96 S	390.25 E	-365.15	8.94
6269.00	31.58	192.44	6201.15	360.97 S	386.77 E	-359.97	9.54
6317.00	33.21	200.85	6241.70	385.54 S	379.38 E	-350.84	9.97
6363.00	34.88	210.16	6279.84	408.70 S	368.28 E	-338.12	11.89
6411.00	35.54	218.18	6319.08	431.55 S	352.75 E	-321.00	9.73
6458.00	35.94	226.19	6357.25	451.85 S	334.35 E	-301.18	9.99
6506.00	36.67	234.84	6395.96	469.86 S	312.45 E	-278.05	10.77
6553.00	38.97	239.07	6433.09	485.55 S	288.29 E	-252.84	7.37
6648.00	46.03	248.06	6503.15	513.74 S	230.83 E	-193.51	9.79
6696.00	49.79	251.44	6535.33	526.03 S	197.41 E	-159.30	9.41
6742.00	54.02	253.90	6563.70	536.79 S	162.86 E	-124.06	10.11
6790.00	57.10	257.60	6590.85	546.51 S	124.50 E	-85.11	9.03
6837.00	59.38	261.82	6615.60	553.62 S	85.20 E	-45.39	9.04
6932.00	67.13	266.76	6658.34	561.93 S	0.87 E	39.31	9.38
6980.00	71.31	269.30	6675.37	563.46 S	43.97 W	84.14	10.01

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 265.90 DEGREES (GRID)
A TOTAL CORRECTION OF 7.49 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.
HORIZONTAL DISPLACEMENT(CLOSURE) AT 6980.00 FEET
IS 565.17 FEET ALONG 184.46 DEGREES (GRID)

Tied in @ Surface
Final survey projected to Bit.