

DC - Pressure Case Directional  
PCGK - Pressure Case Gamma



**1 : 600 / 1 : 240**

[illegible]

## WELL INFORMATION

<b>MWD Run Number</b>	100	200			
<b>Date run completed</b>	20-Apr-14	21-Apr-14			
<b>Rig Bit Number</b>	2	3			
<b>Bit Size (in)</b>	8.750	8.750			
<b>Tool Nominal OD (in)</b>	6.880	6.750			
<b>Log Start Depth (TVD, ft)</b>	637.99	5,811.05			
<b>Log End Depth (TVD, ft)</b>	5,811.05	6,504.42			
<b>Drill or Wipe</b>	Drill	Drill			
<b>Drill/Wipe Start Date and Time</b>	19-Apr-14 02:34	20-Apr-14 05:19			
<b>Drill/Wipe End Date and Time</b>	19-Apr-14 20:37	20-Apr-14 18:17			
<b>Min Inc (deg) @ Depth (TVD, ft)</b>	0.07 @ 1,925.93	1.26 @ 5,817.04			
<b>Max Inc (deg) @ Depth (TVD, ft)</b>	18.08 @ 3,801.95	85.62 @ 6,503.27			
<b>Bit TFA(in2) / Bit Type</b>	1.05 / PDC	1.74 / PDC			
<b>Flow Rate (gpm)</b>	598.06	600.00			
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	N/A / N/A	N/A / N/A			
<b>Fluid Type</b>	Native/Spud Mud	Native/Spud Mud			
<b>Density (ppg) / Viscosity (spqt)</b>	8.90 / 32.00	10.50 / 40.00			
<b>Filtrate CL (ppm)</b>	1,200.00	2,400.00			
<b>pH / Fluid Loss (mptm)</b>	10.00 / 19	9.50 / 8			
<b>PV (cP) / YP (lbf2)</b>	4 / 4.00	14 / 11.00			
<b>% Solids / % Sand</b>	3.60 / 0.20	10.20 / 0.20			
<b>% Oil / Oil:Water Ratio</b>	N/A / N/A	N/A / N/A			
<b>Rm @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A			
<b>Rmf @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A			
<b>Rmc @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A			
<b>Min Tool Temp (deg F) @ Depth (ft)</b>	144.75 @ 6,504.42	150.00 @ 6,504.42			

Max Tool Temp (degF) / Source	141.70 / PCM	158.60 / PCM			
Rm @ Max Tool Temp (degF)	N/A @ 141.70	N/A @ 158.60			
Lead MWD Engineer	Kyle Wass	Kyle Wass			
Customer Representative	Jim Turner	Jim Turner			

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM			
Software Version	5.84	5.84			
Sub Serial Number	11404294	11404294			
Insert Serial Number	11400991	11400991			
Date and Time Initialized	18-Apr-14 01:27	18-Apr-14 01:27			
Date and Time Read	21-Apr-14 01:15	21-Apr-14 01:18			
ECMB SW Version	N/A	N/A			

### Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	56.00	54.00			
Software Version	6.21	6.21			
Sub Serial Number	11404294	11404294			
Sonde Serial Number	11833237	11833237			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	191.43	38.82			

### Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	49.16	47.18			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	11404294	11404294			
Insert/Sonde Serial Number	11293318	11293318			

## 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 v8.0.10

## WARRANTY

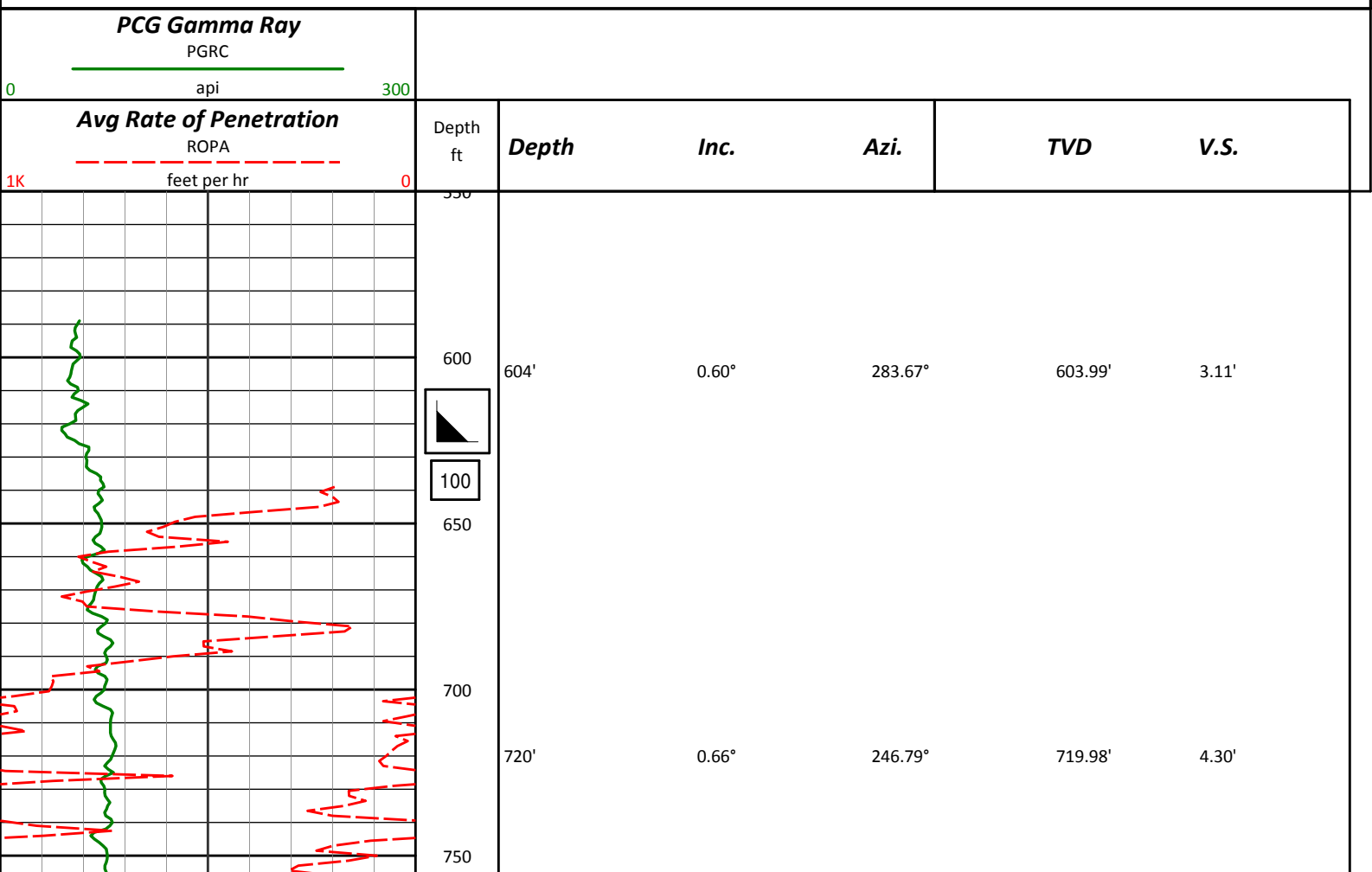
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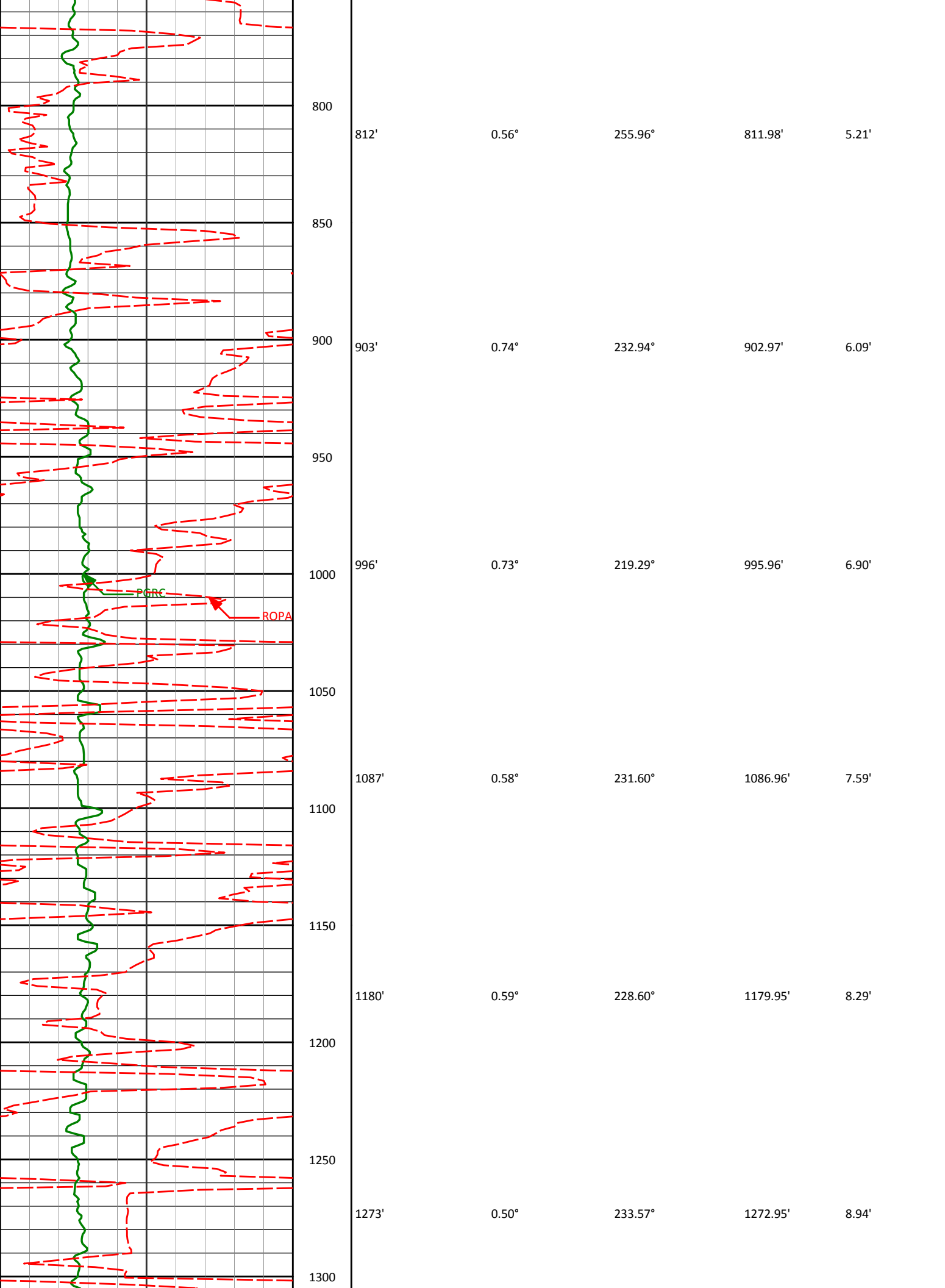
# HALLIBURTON

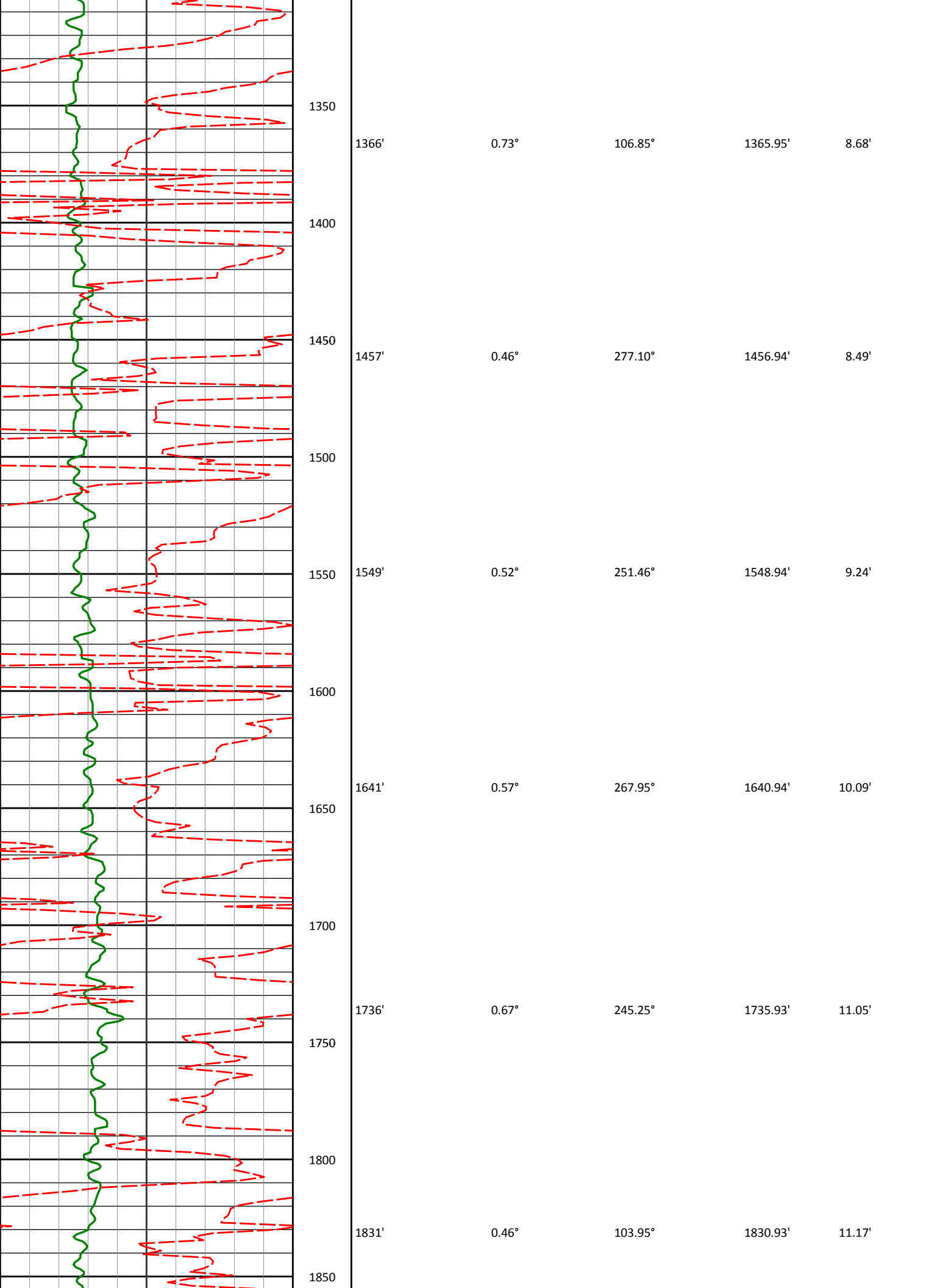
## Sperry Drilling Services

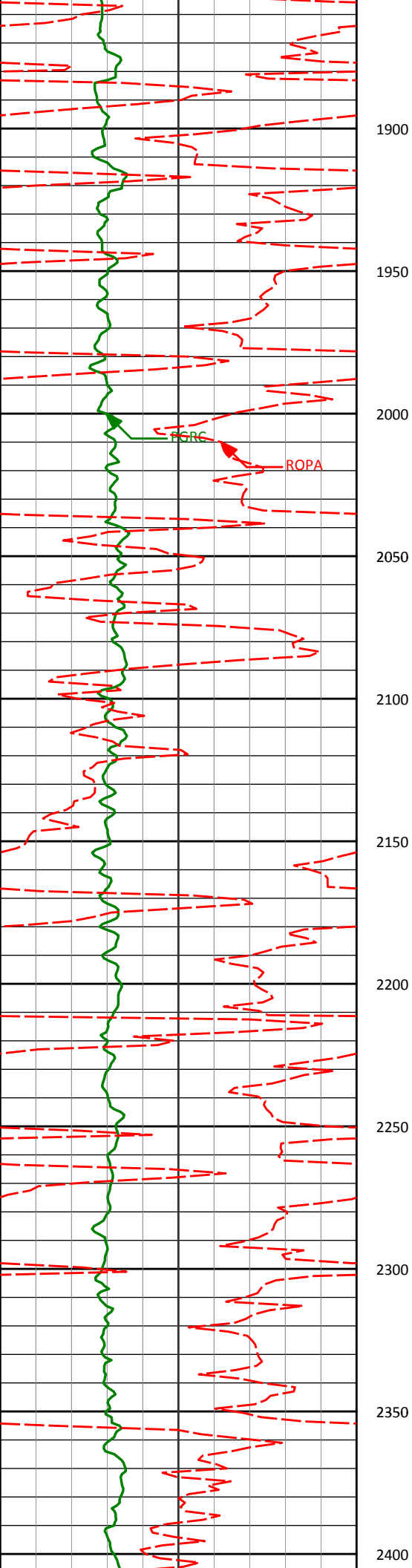
### TVD Correlation Log 1:600

Noble Energy  
Wells Ranch AE30-65-1AHNB  
H&P 321  
Sec. 29-T6N-R62W

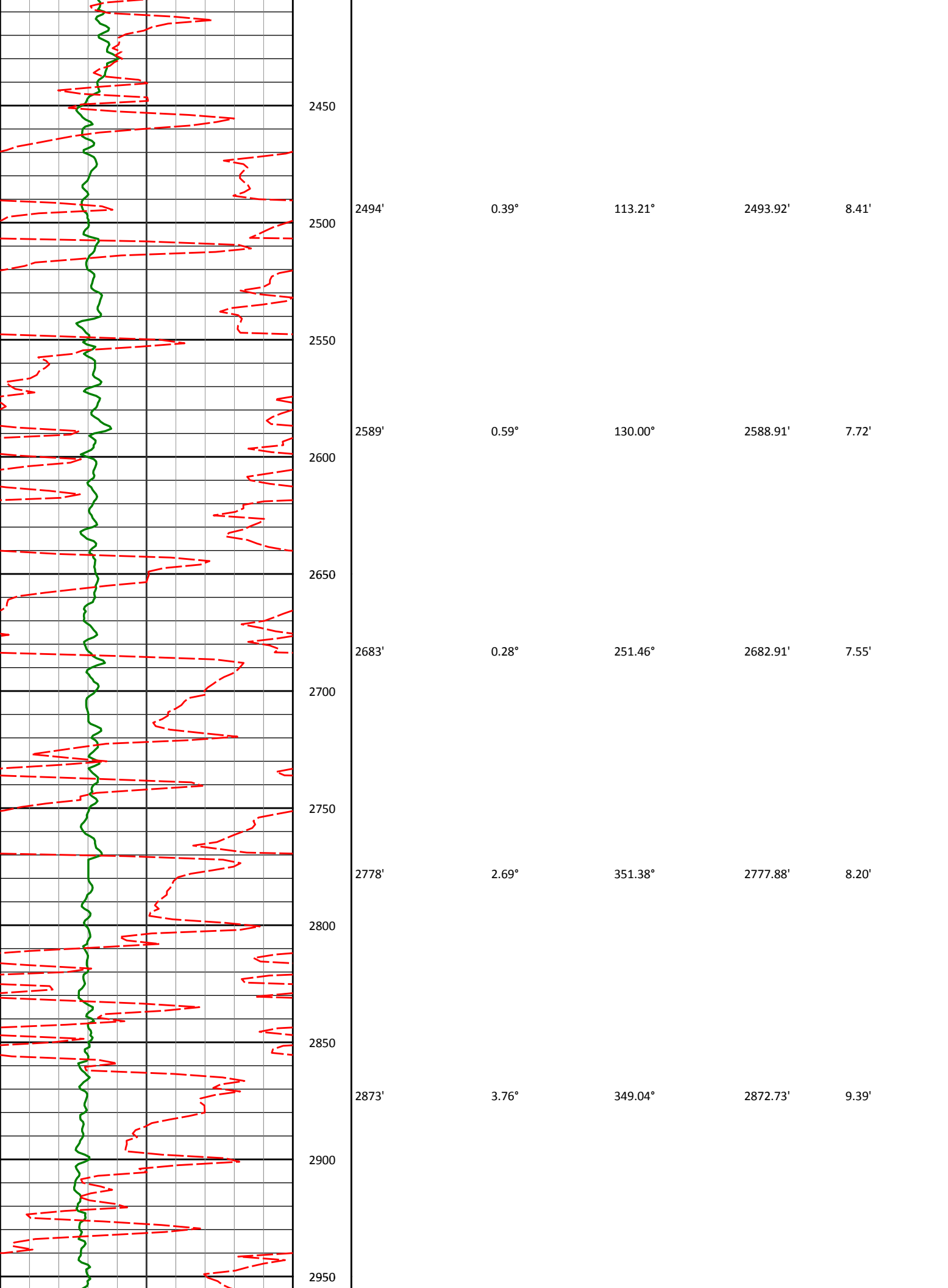


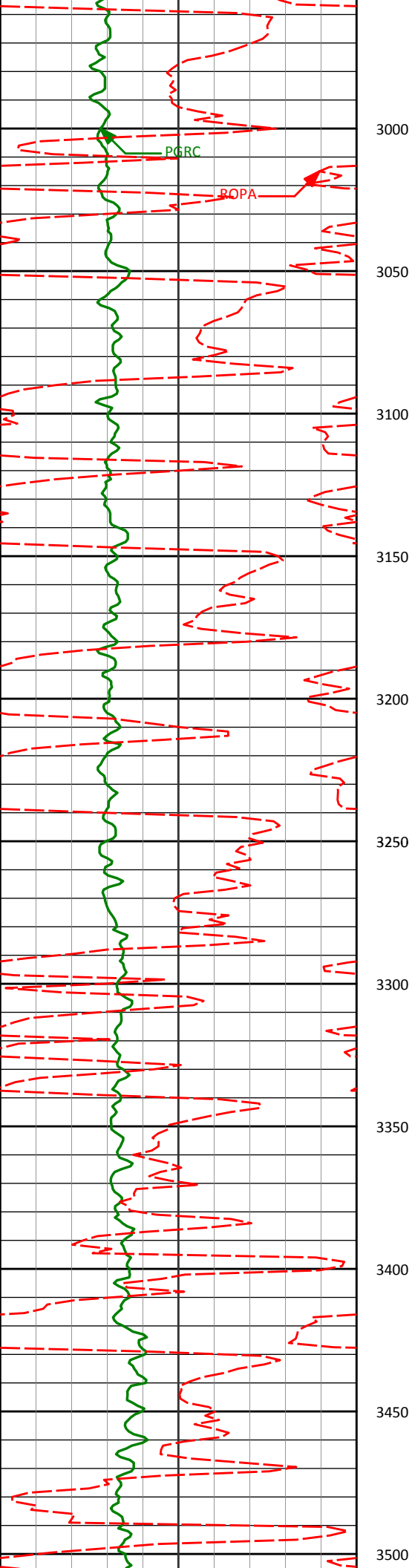






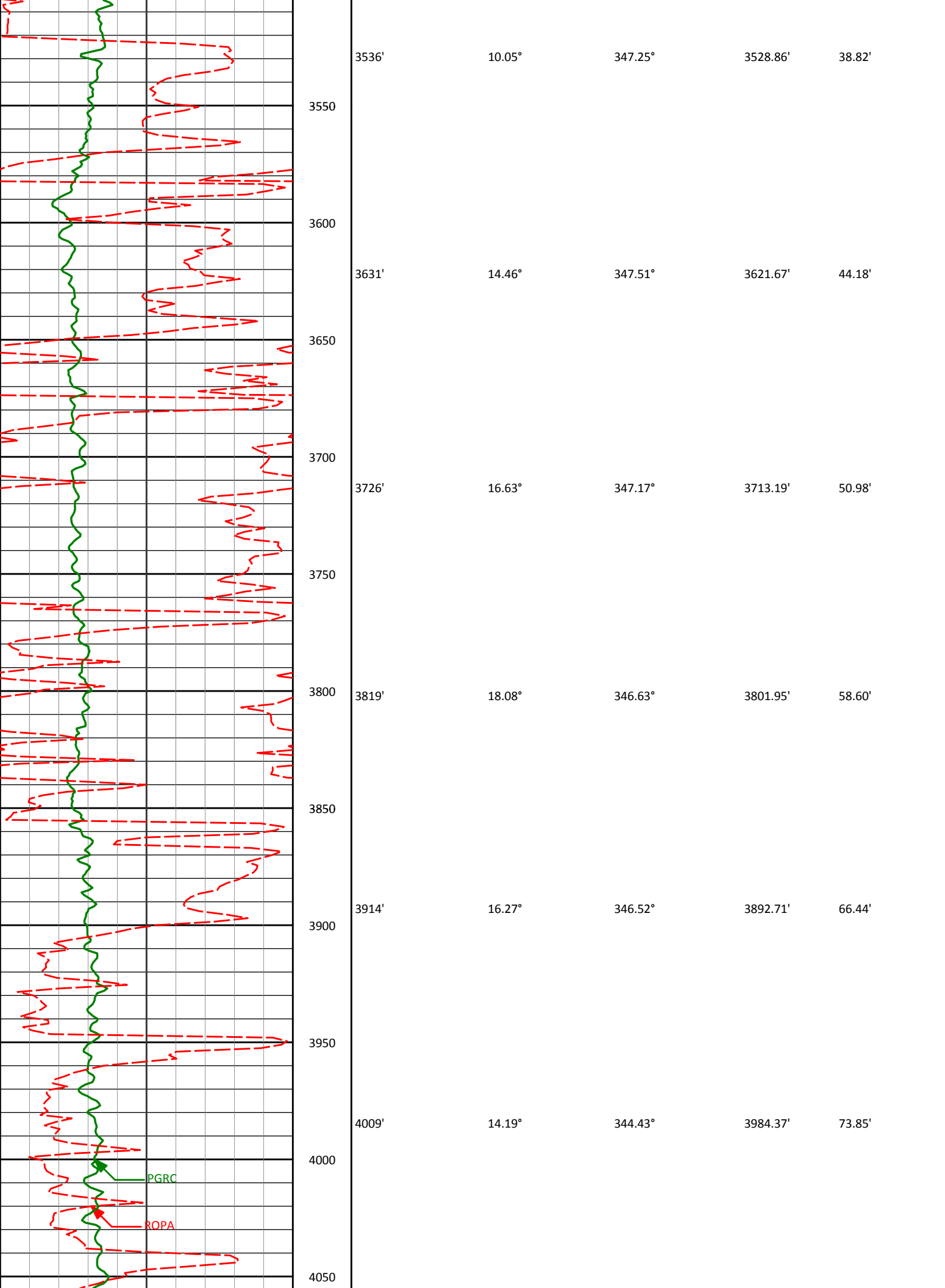
1900				
1926'	0.07°	355.94°	1925.93'	10.80'
1950				
2000				
2020'	0.29°	300.73°	2019.93'	11.02'
2050				
2100				
2115'	0.63°	67.22°	2114.93'	10.76'
2150				
2200				
2210'	0.41°	65.37°	2209.92'	9.99'
2250				
2300				
2350				
2400				
2399'	0.30°	67.99°	2398.92'	8.94'

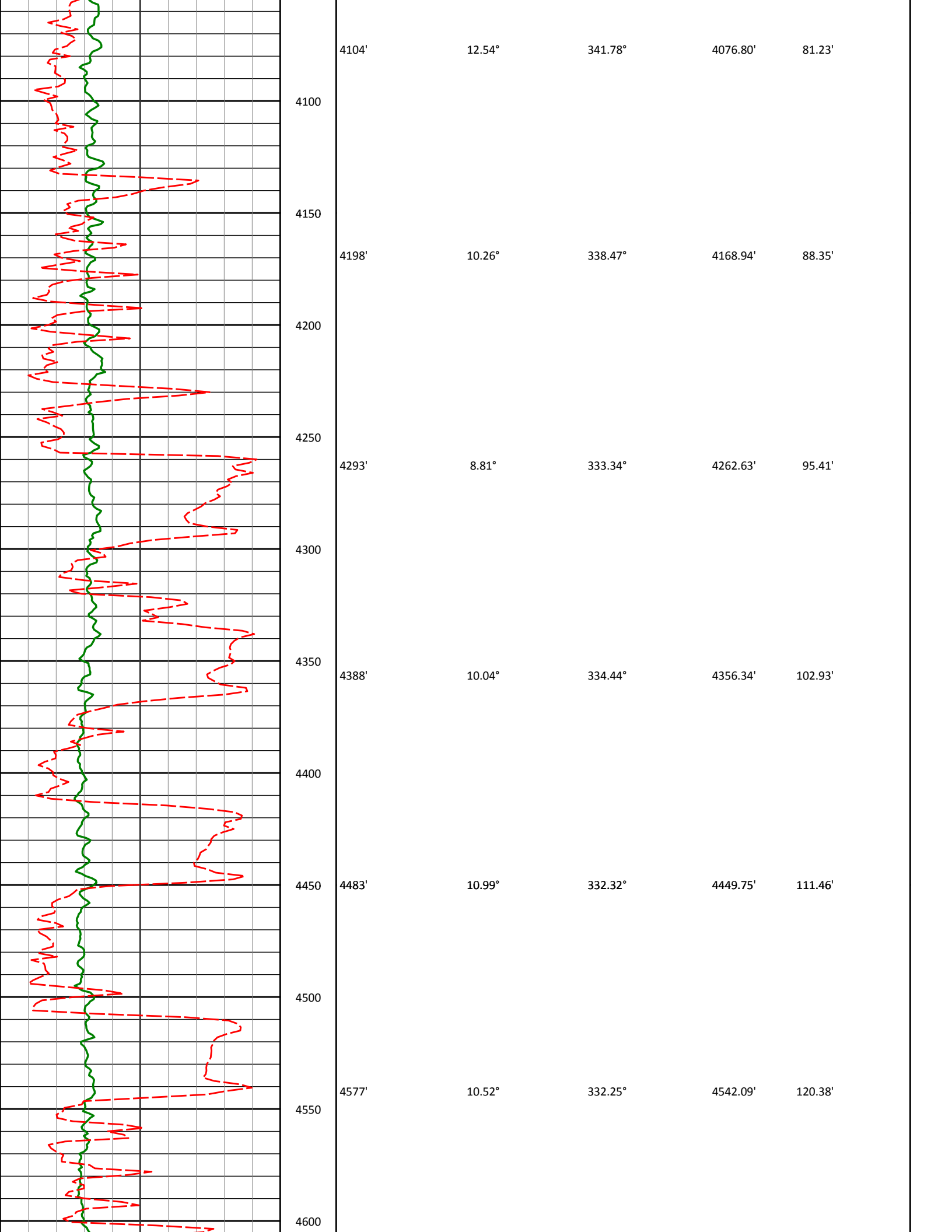


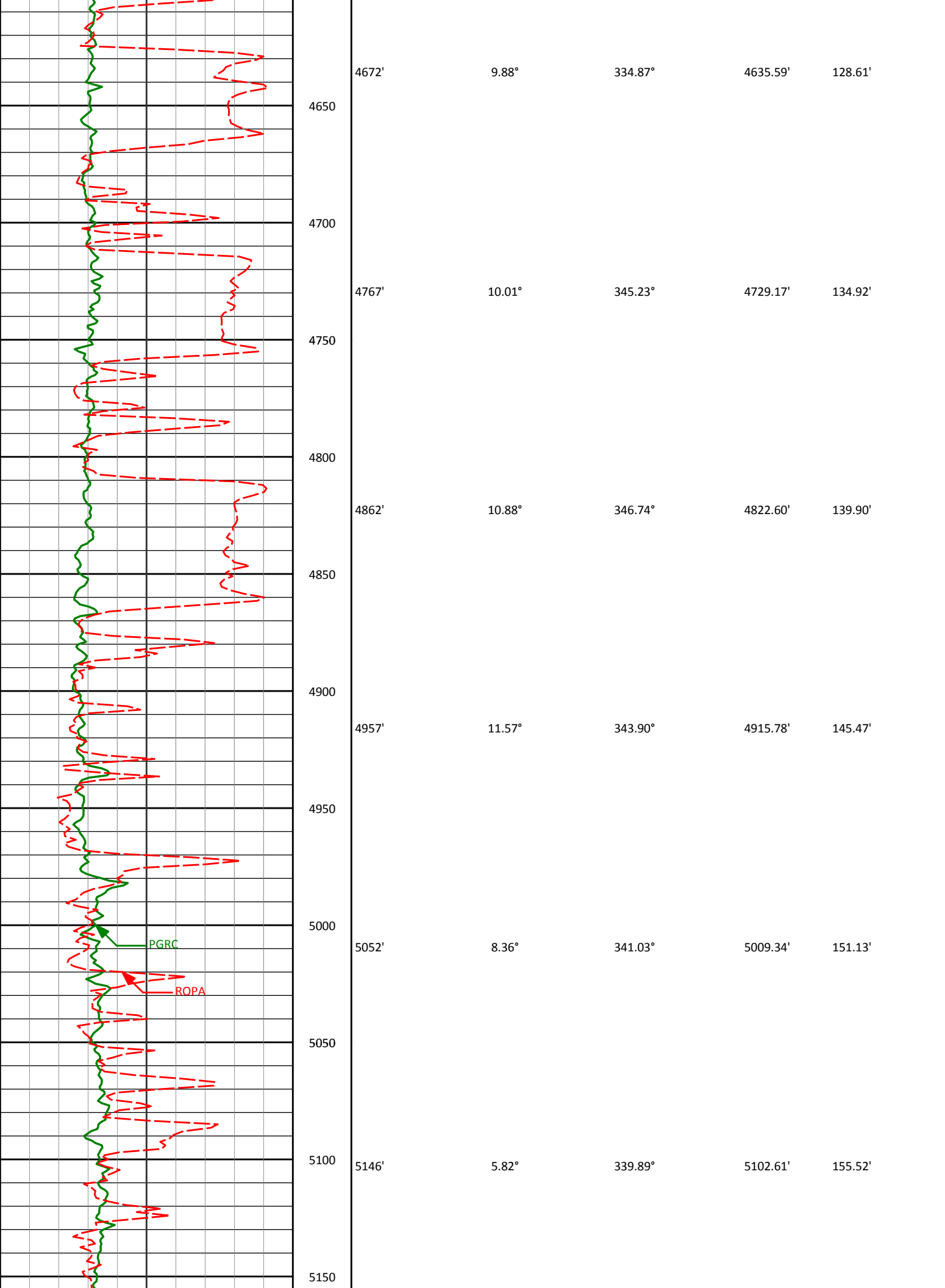


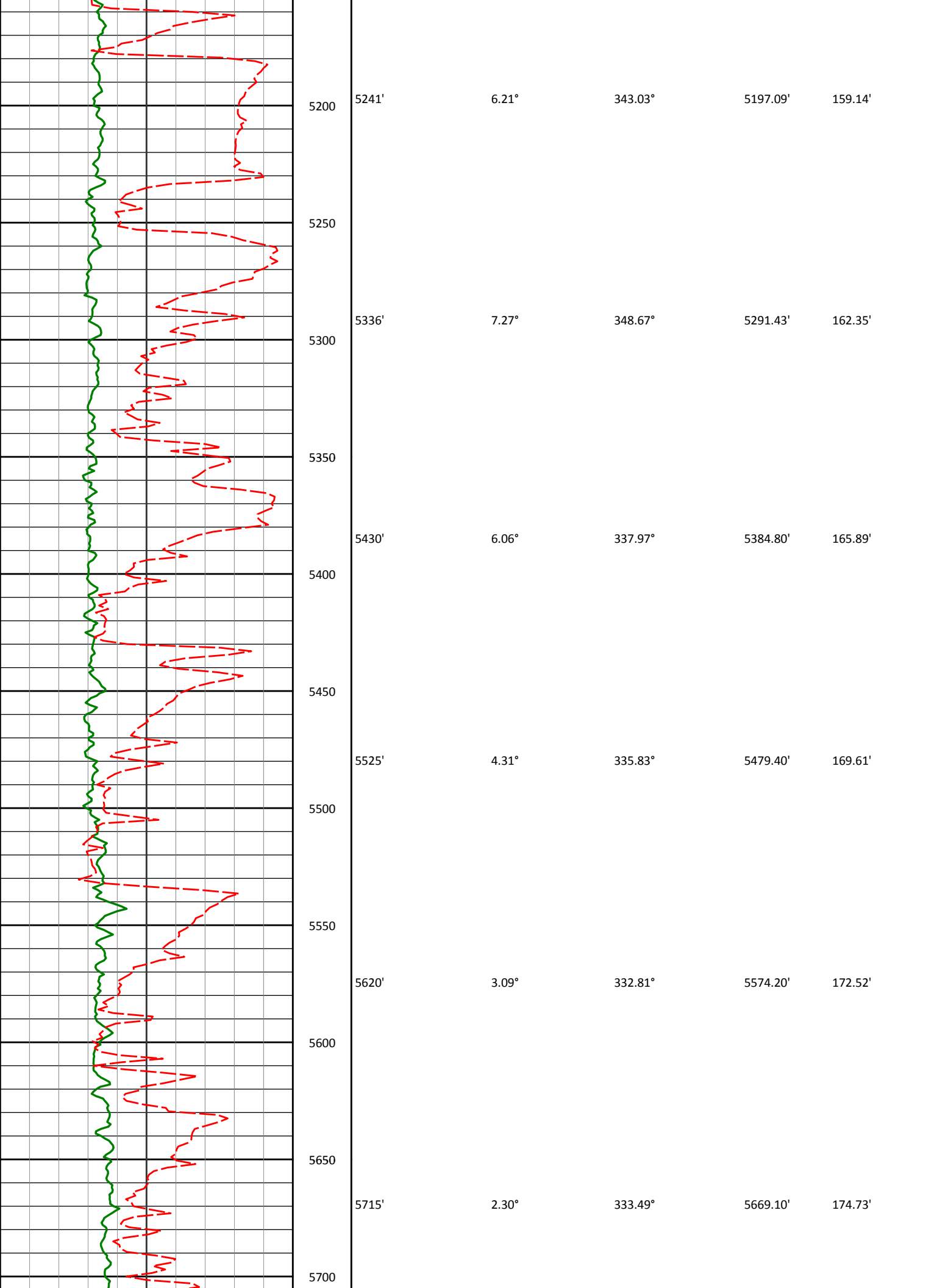
2968'	6.05°	334.65°	2967.37'	12.49'
3000				
3062'	8.20°	331.12°	3060.64'	18.36'
3100				
3157'	8.19°	342.12°	3154.68'	24.31'
3200				
3252'	8.76°	349.31°	3248.64'	28.39'
3300				
3347'	8.88°	350.54°	3342.52'	31.64'
3400				
3441'	9.78°	350.53°	3435.28'	34.88'
3450				
3500				

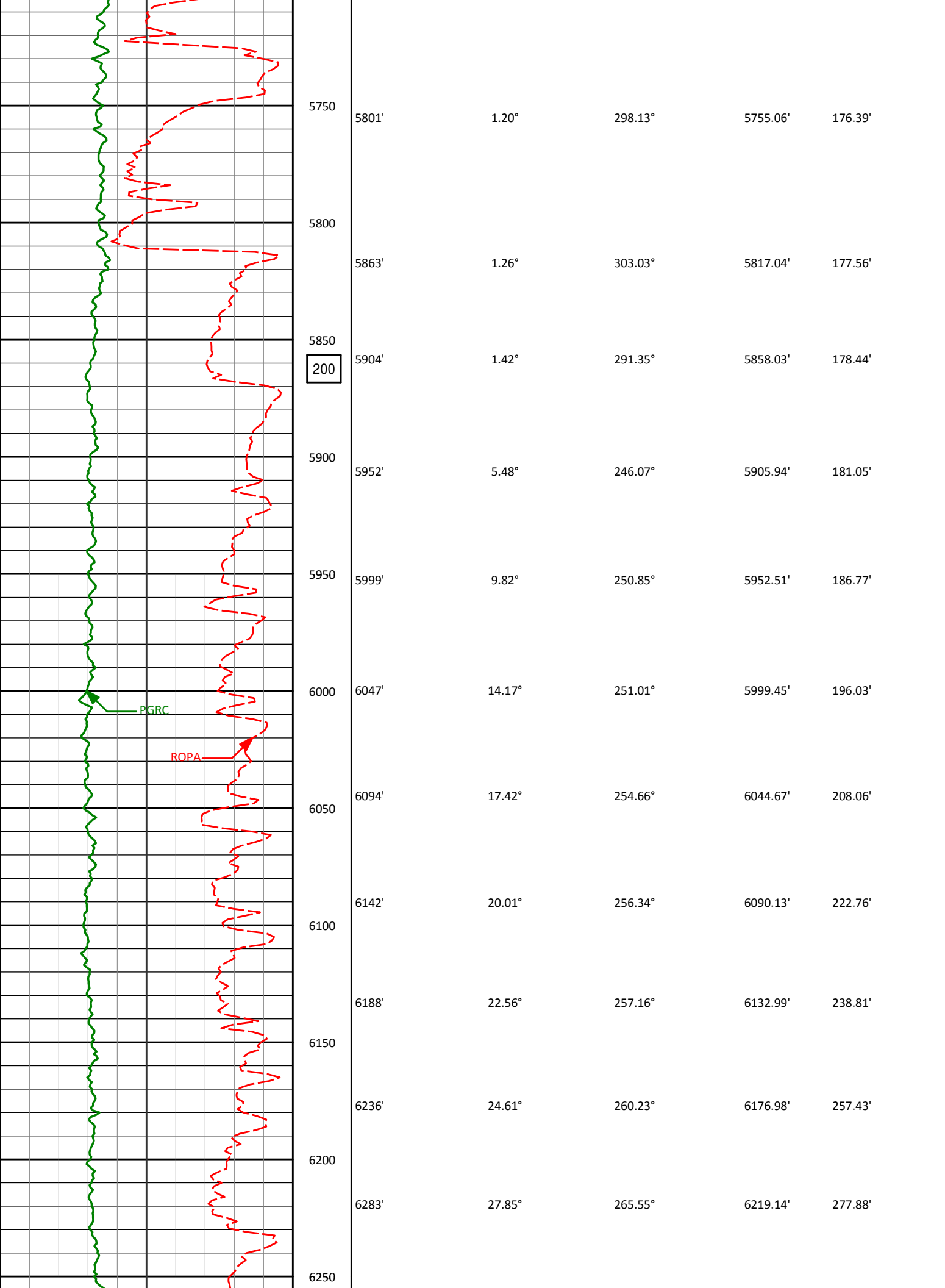


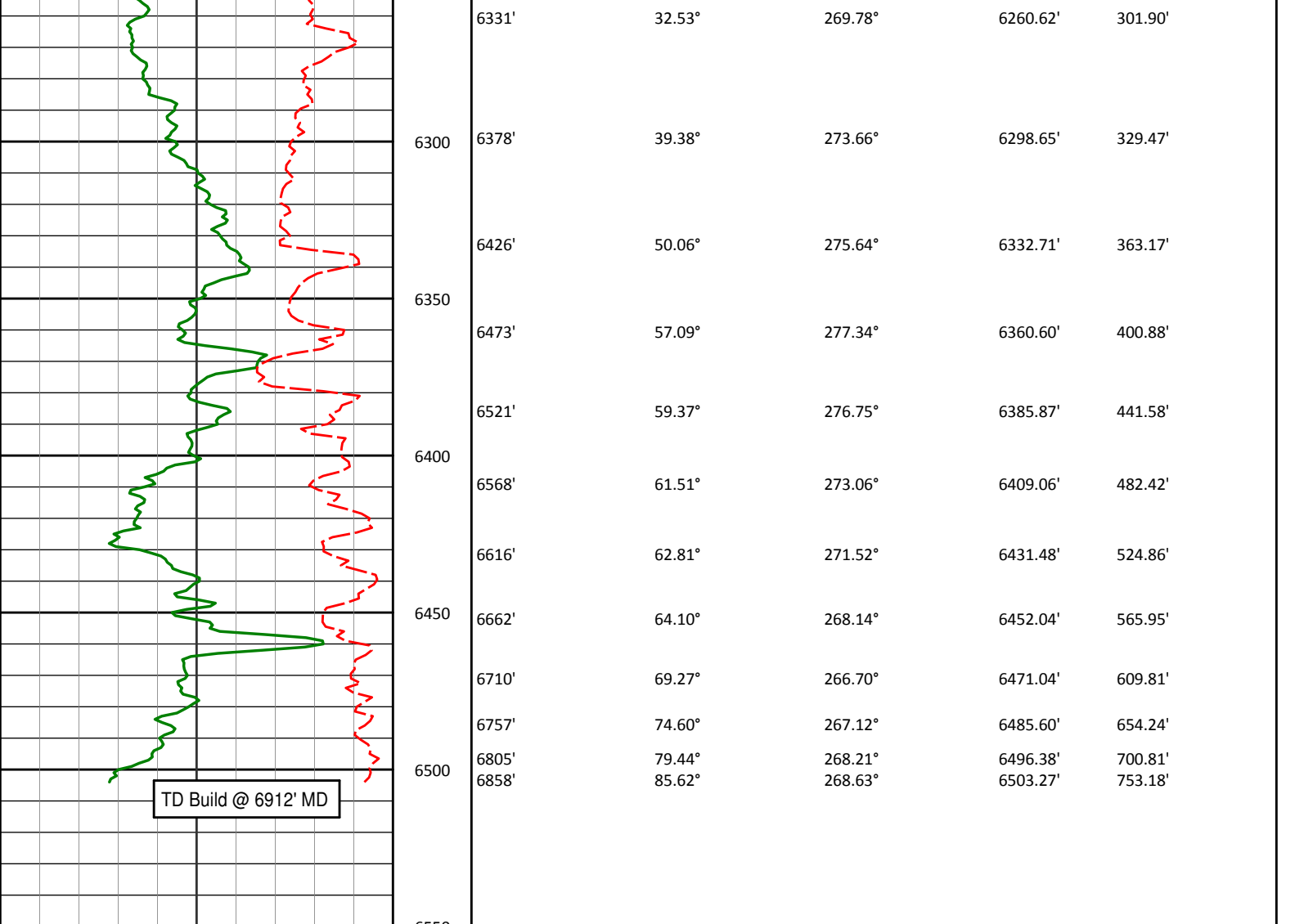




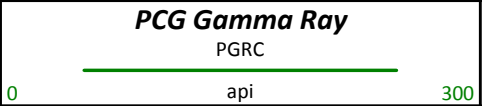








<b>Avg Rate of Penetration</b> ROPA feet per hr		Depth ft	<b>Depth</b>	<b>Inc.</b>	<b>Azi.</b>	<b>TVD</b>	<b>V.S.</b>
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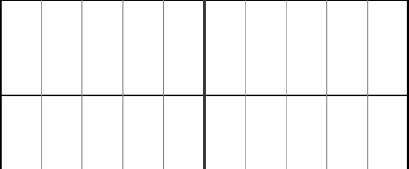
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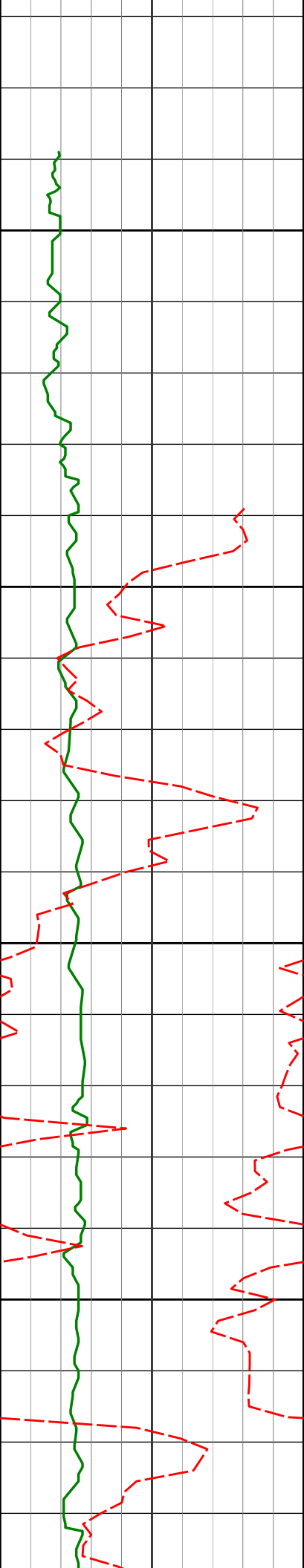
## Sperry Drilling Services

### TVD Detail Log 1:240

Noble Energy  
Ranch AE30-65-1AHNB  
H&P 321  
Sec. 29-T6N-R62W

<b>PCG Gamma Ray</b> PGRC api		Depth ft	<b>Depth</b>	<b>Inc.</b>	<b>Azi.</b>	<b>TVD</b>	<b>V.S.</b>
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600

604'

0.60°

283.67°

603.99'

3.11'

650

670

700

720'

0.66°

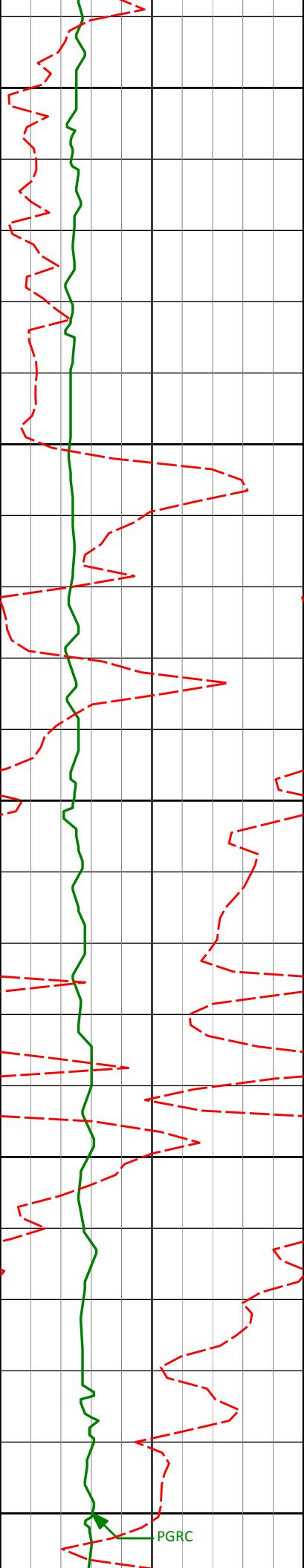
246.79°

719.98'

4.30'

750





800

812'

0.56°

255.96°

811.98'

5.21'

850

900

903'

0.74°

232.94°

902.97'

6.09'

950

1000

996'

0.73°

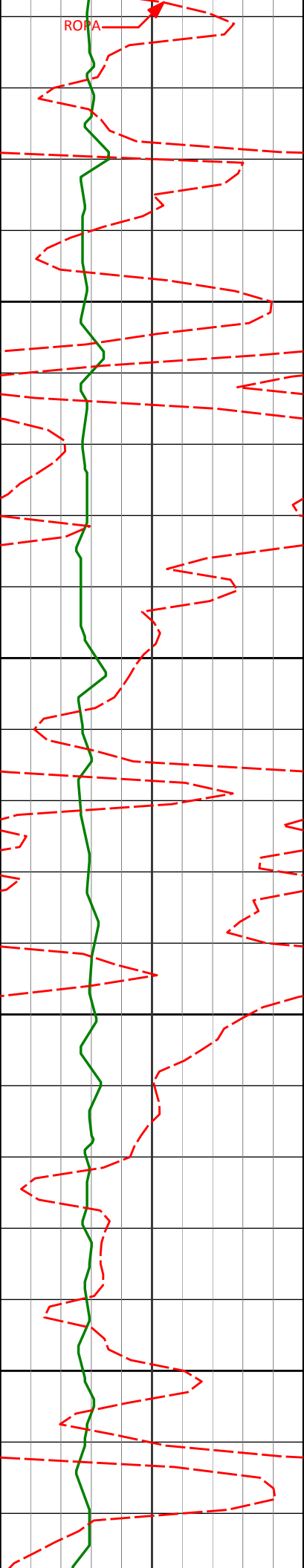
219.29°

995.96'

6.90'

PGRC





1050

1087'

0.58°

231.60°

1086.96'

7.59'

1100

1150

1180'

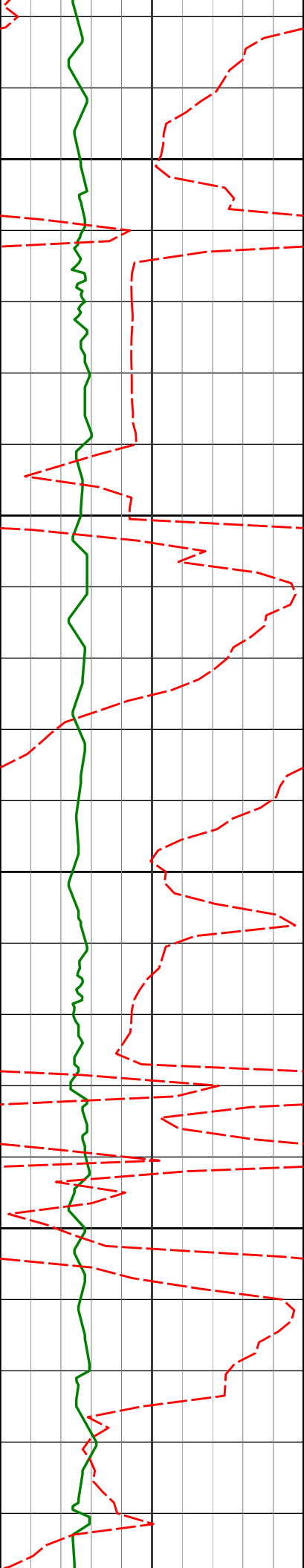
0.59°

228.60°

1179.95'

8.29'

1200



1250

1273'

0.50°

233.57°

1272.95'

8.94'

1300

1350

1366'

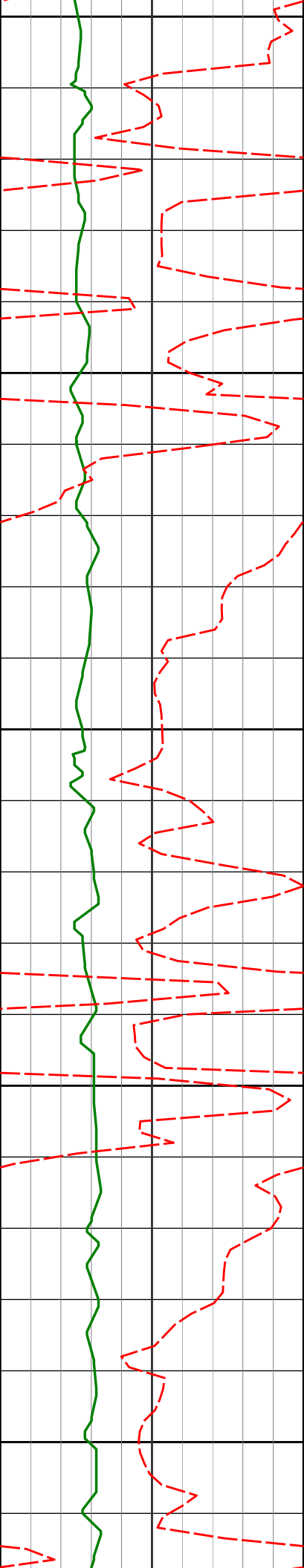
0.73°

106.85°

1365.95'

8.68'

1400



1450

1457'

0.46°

277.10°

1456.94'

8.49'

1500

1550

1549'

0.52°

251.46°

1548.94'

9.24'

1600

1650

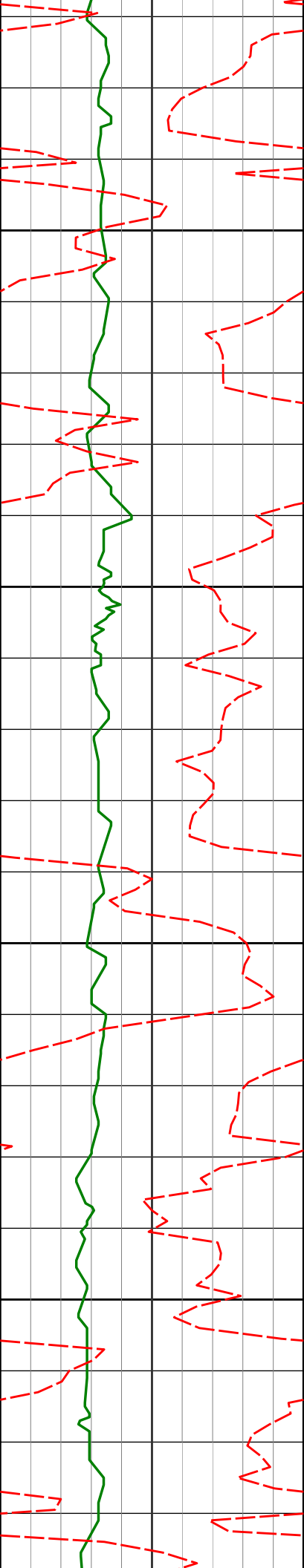
1641'

0.57°

267.95°

1640.94'

10.09'



1700

1750

1800

1850

1736'

0.67°

245.25°

1735.93'

11.05'

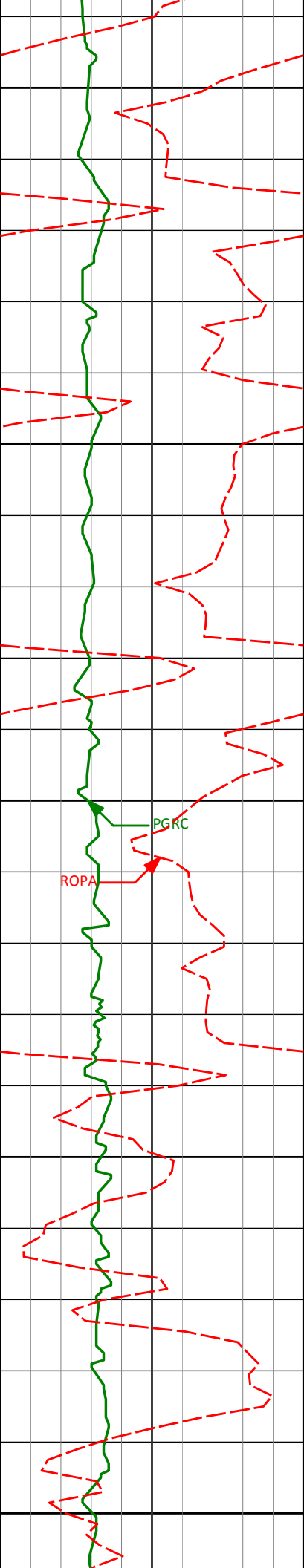
1831'

0.46°

103.95°

1830.93'

11.17'



1900

1926'

0.07°

355.94°

1925.93'

10.80'

1950

2000

PGRC

ROPA

2020'

0.29°

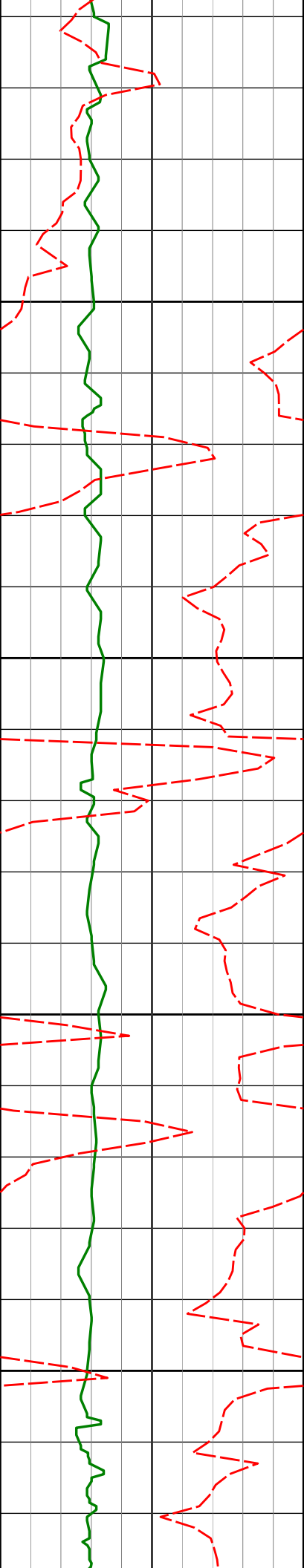
300.73°

2019.93'

11.02'

2050

2100



2150

2200

2250

2300

2115'

0.63°

67.22°

2114.93'

10.76'

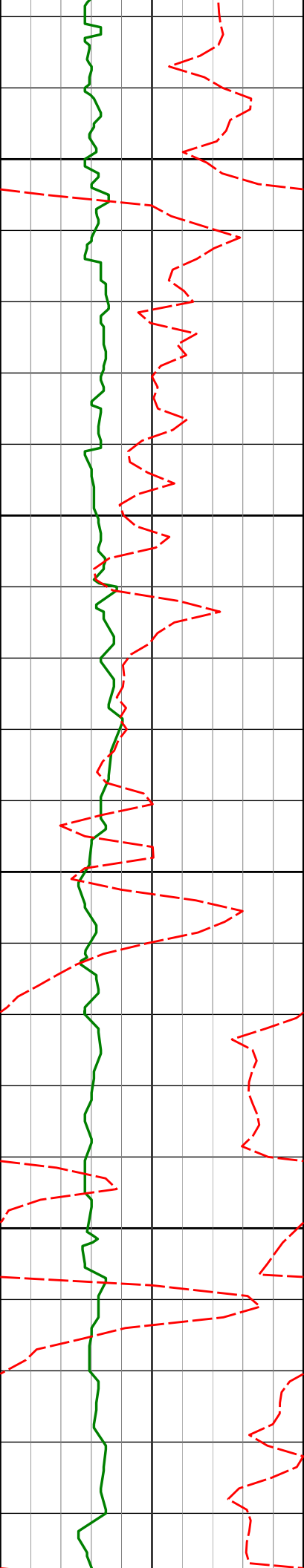
2210'

0.41°

65.37°

2209.92'

9.99'



2350

2400

2450

2500

2399'

0.30°

67.99°

2398.92'

8.94'

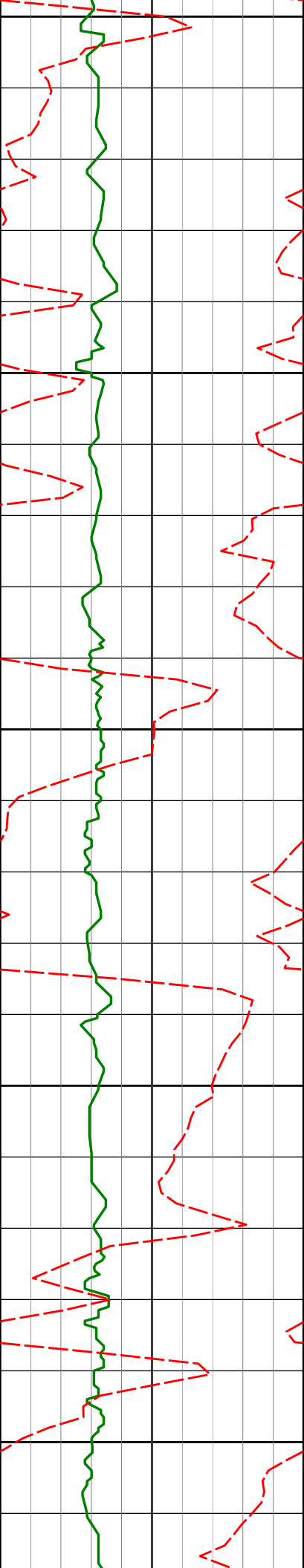
2494'

0.39°

113.21°

2493.92'

8.41'



2550

2589'

0.59°

130.00°

2588.91'

7.72'

2600

2650

2683'

0.28°

251.46°

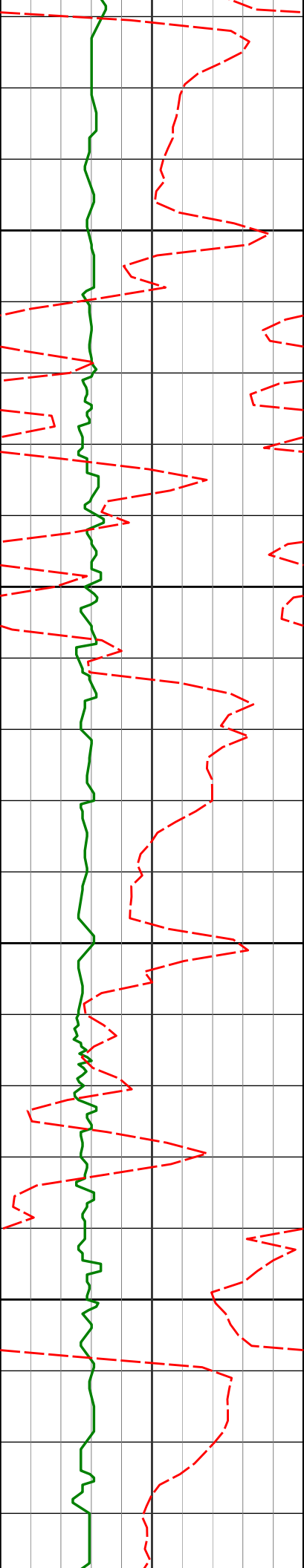
2682.91'

7.55'

2700

2750





2800

2850

2900

2950

2778'

2.69°

351.38°

2777.88'

8.20'

2873'

3.76°

349.04°

2872.73'

9.39'

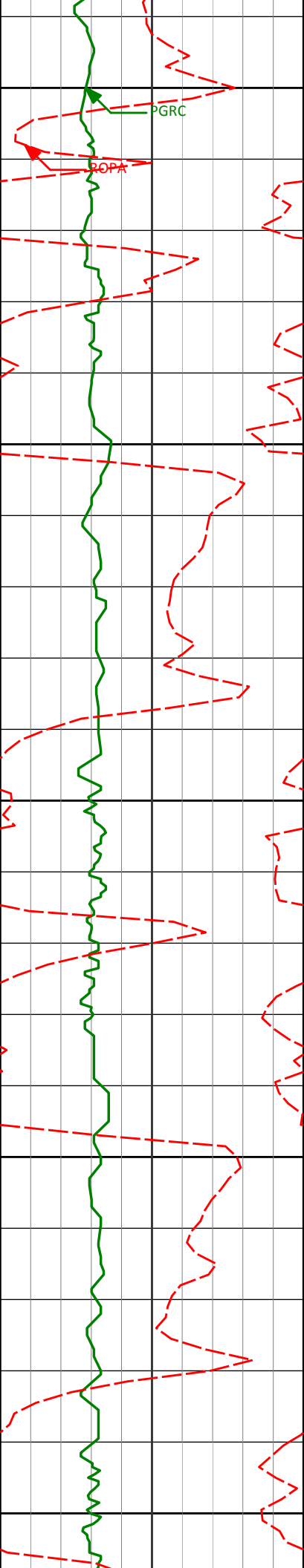
2968'

6.05°

334.65°

2967.37'

12.49'



3000

3050

3100

3150

3200

3062'

8.20°

331.12°

3060.64'

18.36'

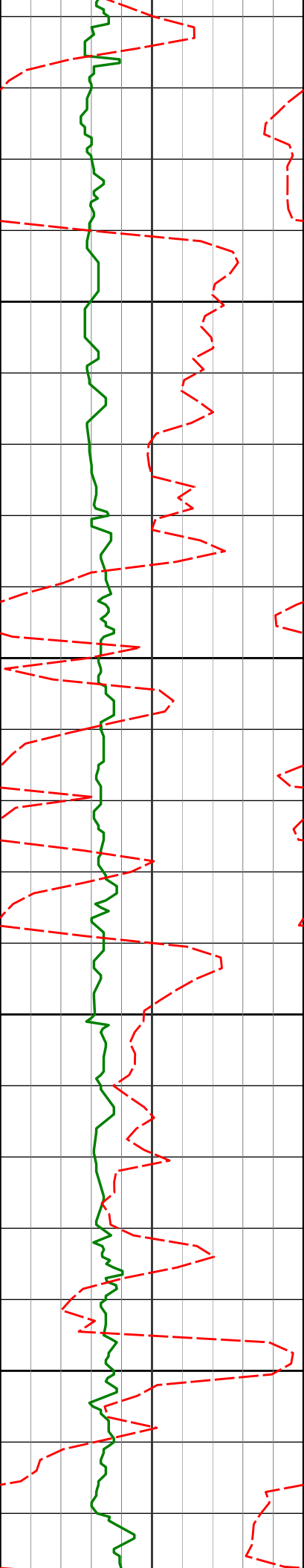
3157'

8.19°

342.12°

3154.68'

24.31'



3250

3300

3350

3400

3252'

3347'

8.76°

8.88°

349.31°

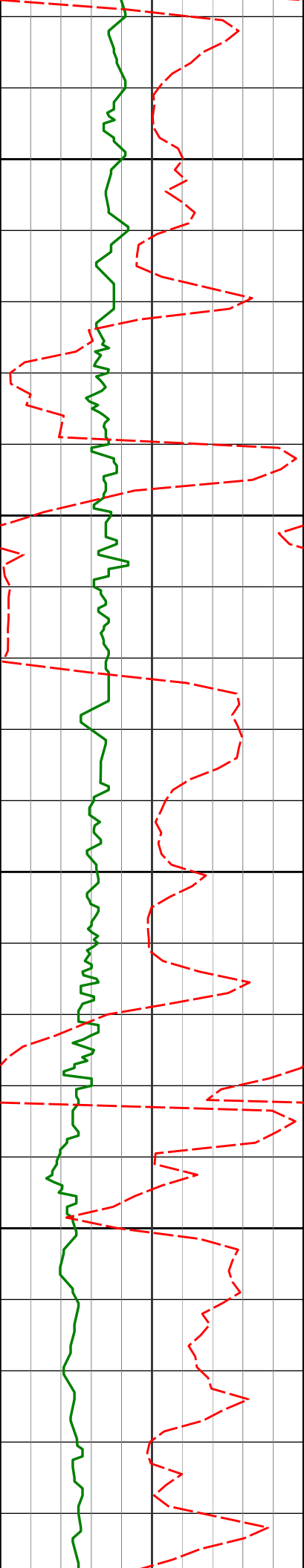
350.54°

3248.64'

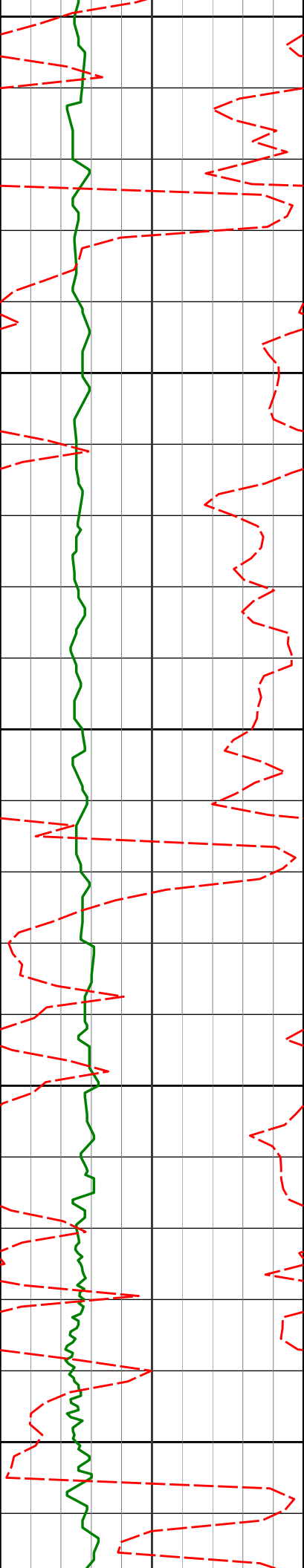
3342.52'

28.39'

31.64'



3441'	9.78°	350.53°	3435.28'	34.88'
3450				
3500				
3536'	10.05°	347.25°	3528.86'	38.82'
3550				
3600				
3631'	14.46°	347.51°	3621.67'	44.18'



3650

3700

3750

3800

3850

3726'

16.63°

347.17°

3713.19'

50.98'

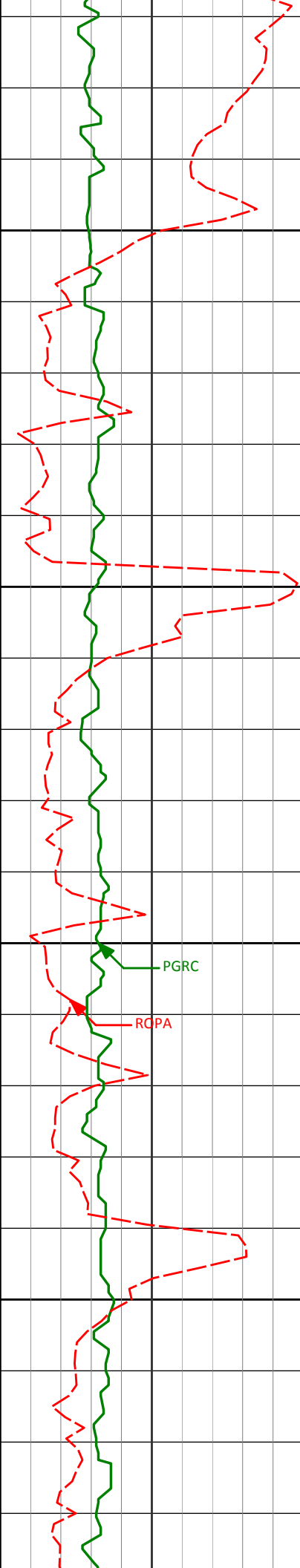
3819'

18.08°

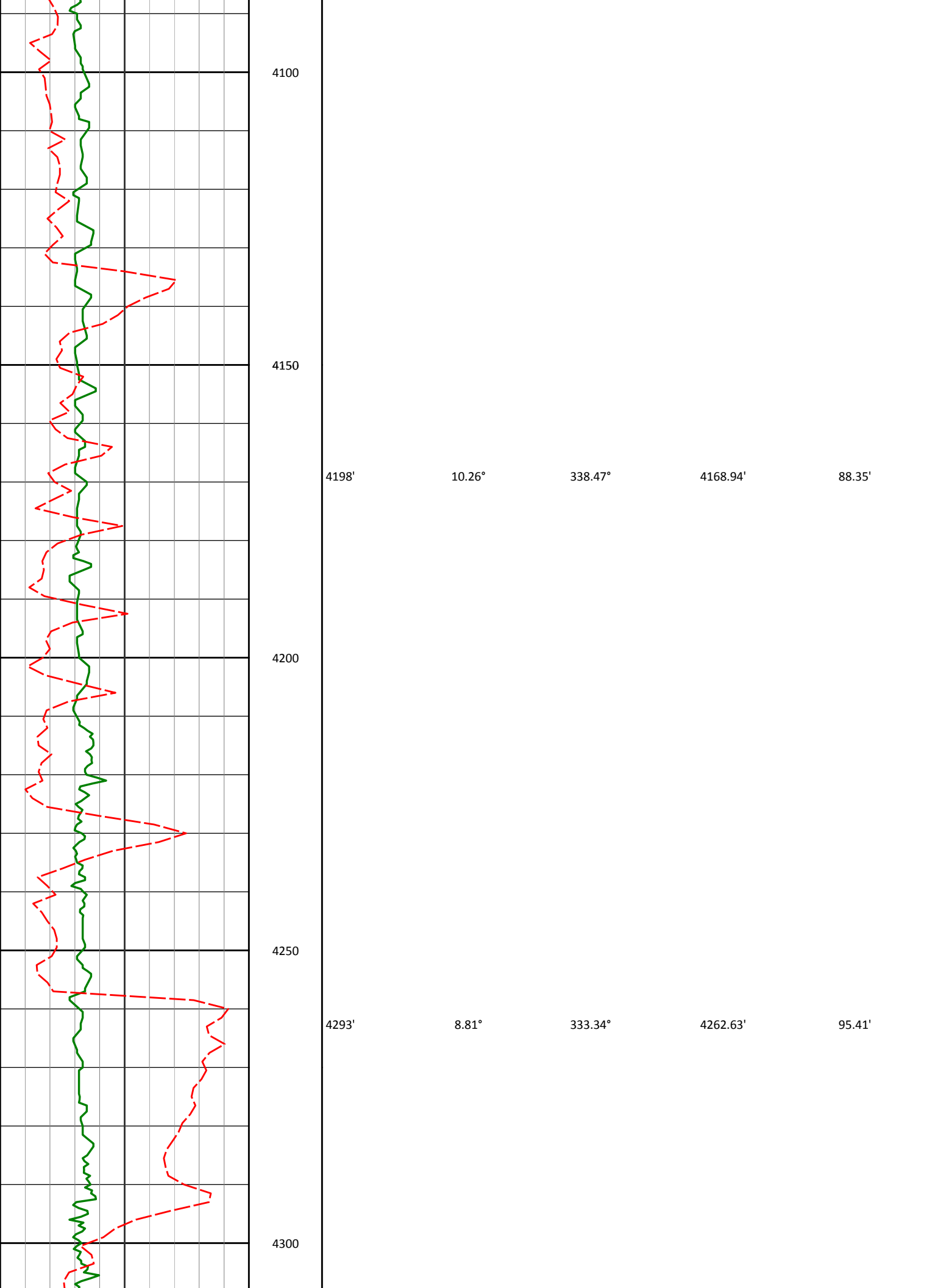
346.63°

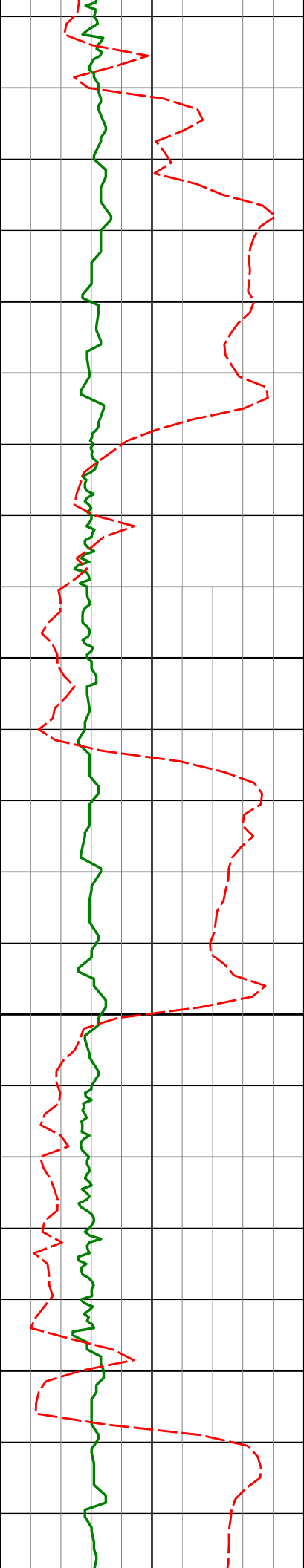
3801.95'

58.60'



3914'	16.27°	346.52°	3892.71'	66.44'
3900				
3950				
4009'	14.19°	344.43°	3984.37'	73.85'
4000				
4050				
4104'	12.54°	341.78°	4076.80'	81.23'





4350

4388'

10.04°

334.44°

4356.34'

102.93'

4400

4450

4483'

10.99°

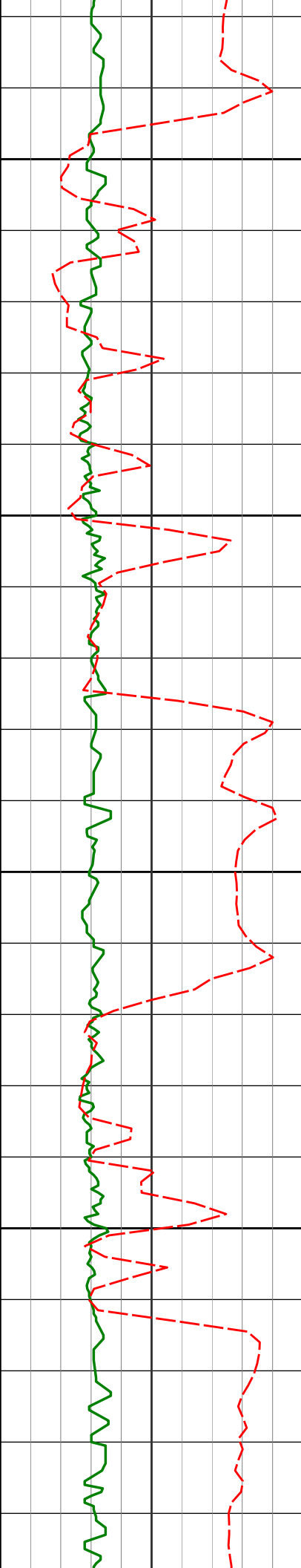
332.32°

4449.75'

111.46'

4500





4550

4600

4650

4700

4577'

10.52°

332.25°

4542.09'

120.38'

4672'

9.88°

334.87°

4635.59'

128.61'

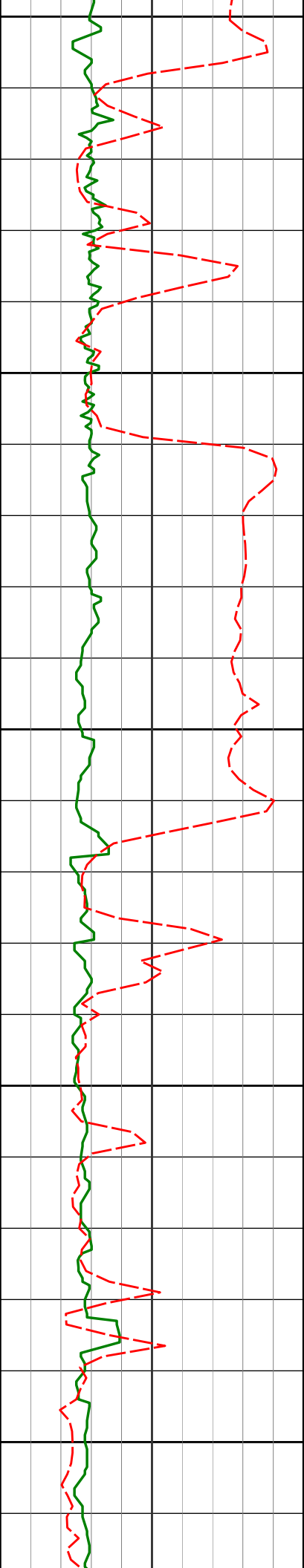
4767'

10.01°

345.23°

4729.17'

134.92'



4750

4800

4850

4900

4950

4862'

10.88°

346.74°

4822.60'

139.90'

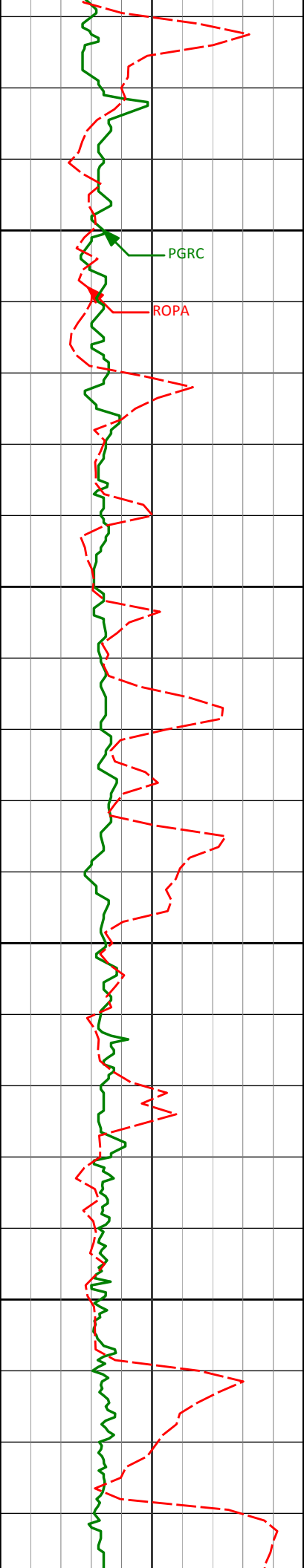
4957'

11.57°

343.90°

4915.78'

145.47'



5000

PGRC

ROPA

5050

5100

5150

5052'

8.36°

341.03°

5009.34'

151.13'

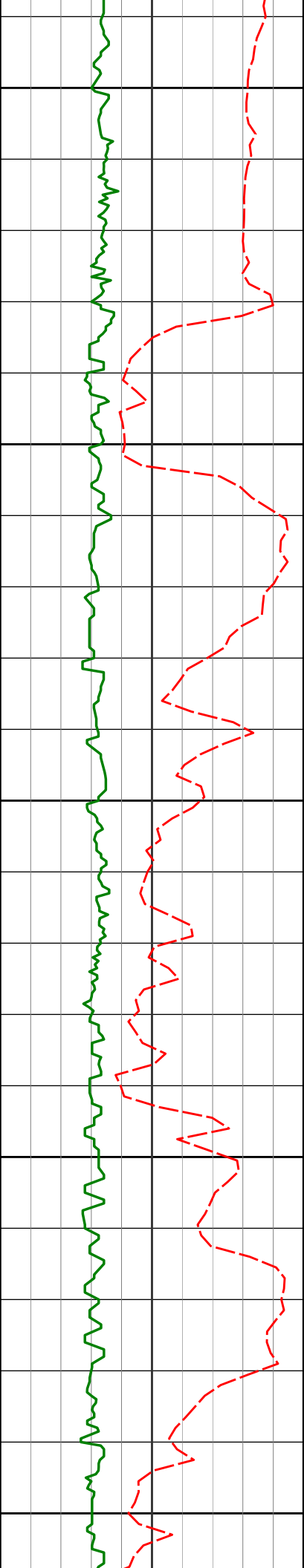
5146'

5.82°

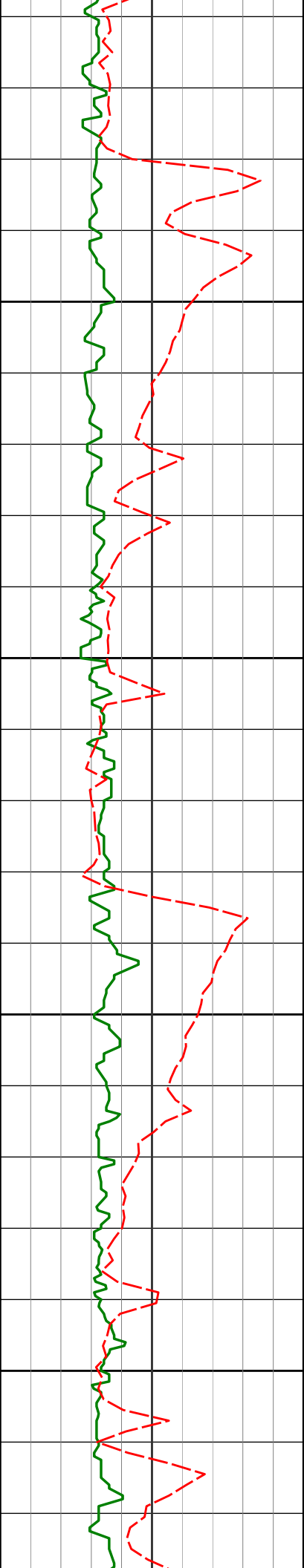
339.89°

5102.61'

155.52'



5200	5241'	6.21°	343.03°	5197.09'	159.14'
5250					
5300	5336'	7.27°	348.67°	5291.43'	162.35'
5350					
5400	5430'	6.06°	337.97°	5384.80'	165.89'



5450

5525'

4.31°

335.83°

5479.40'

169.61'

5500

5550

5620'

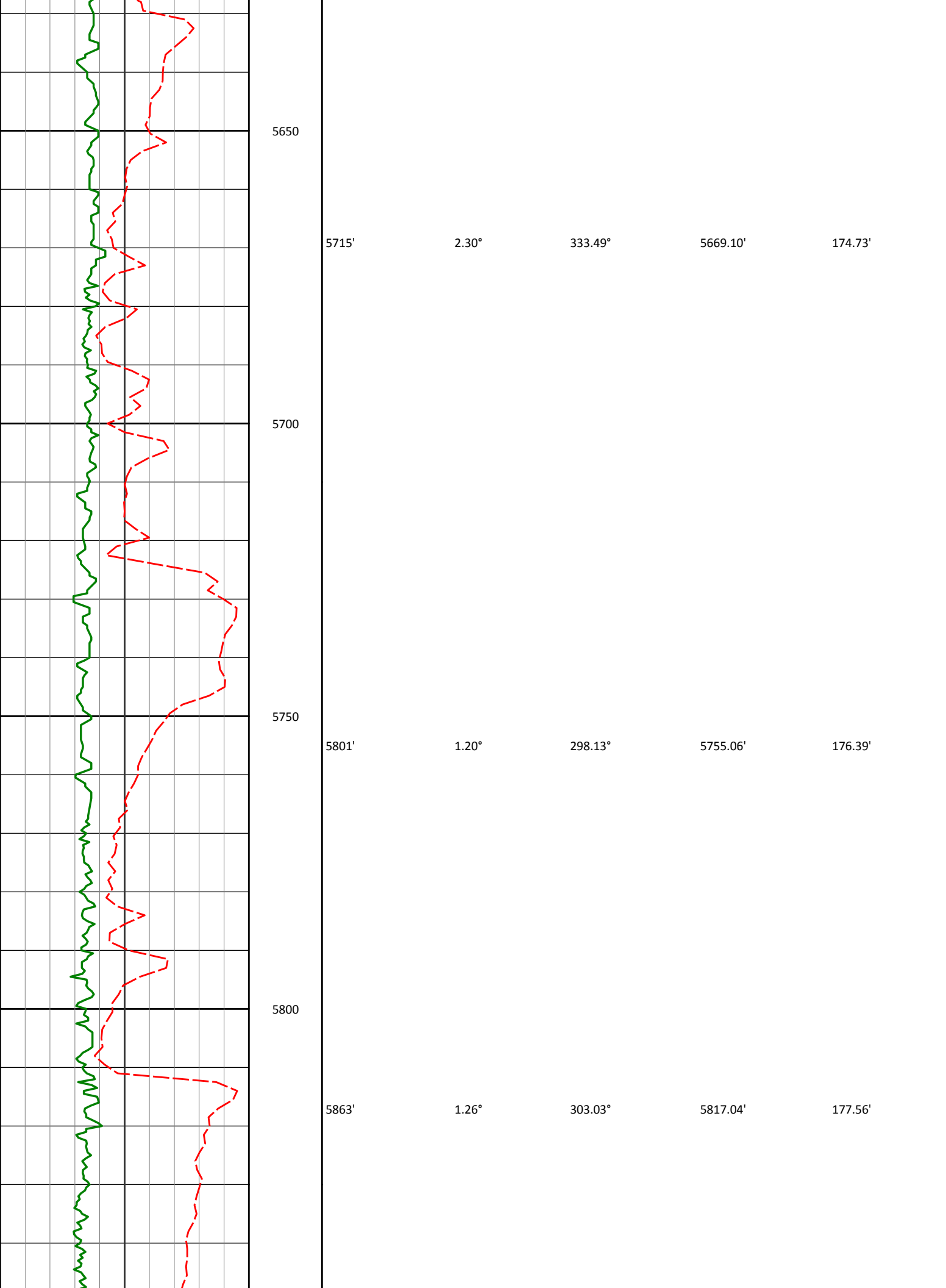
3.09°

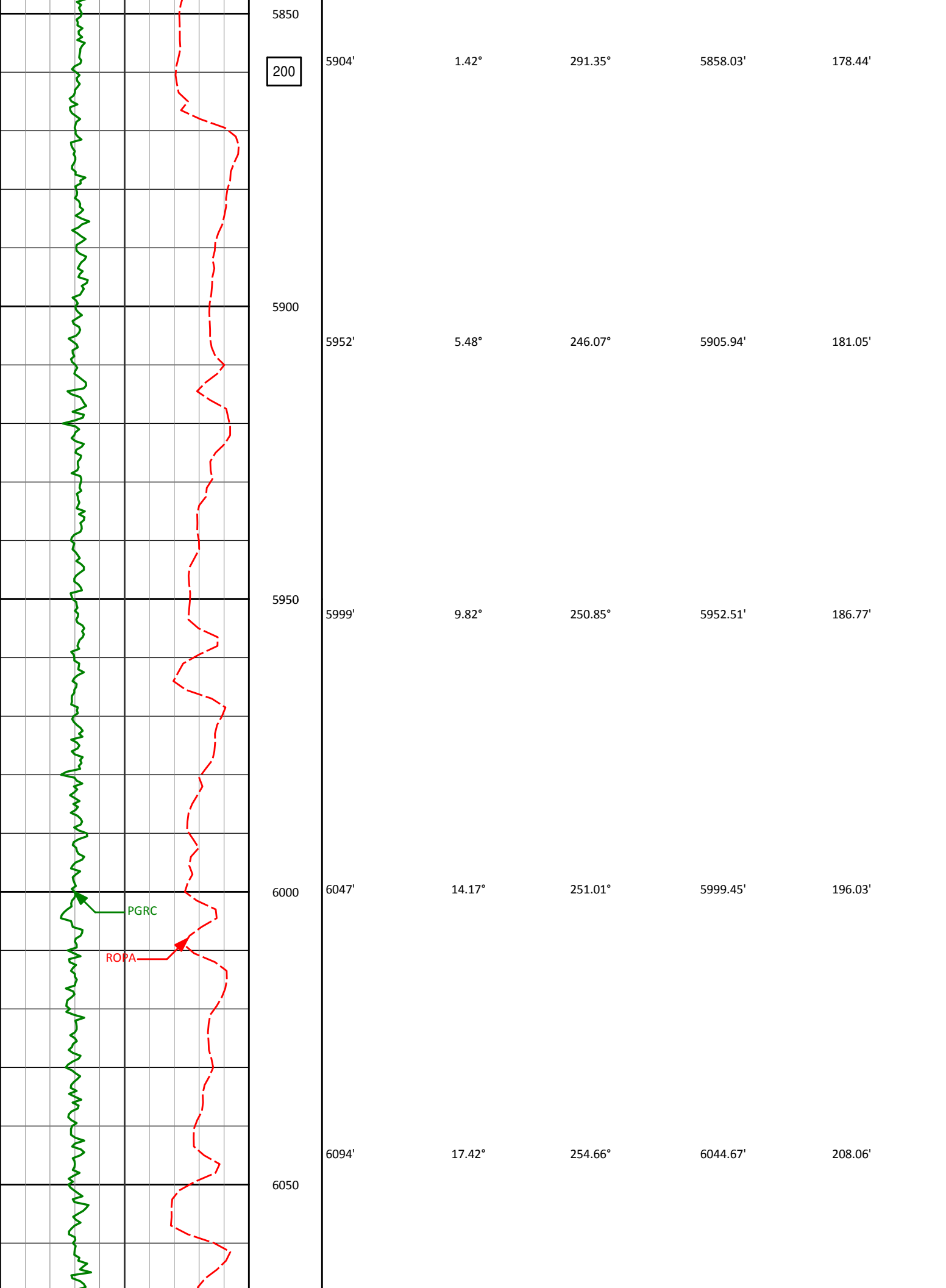
332.81°

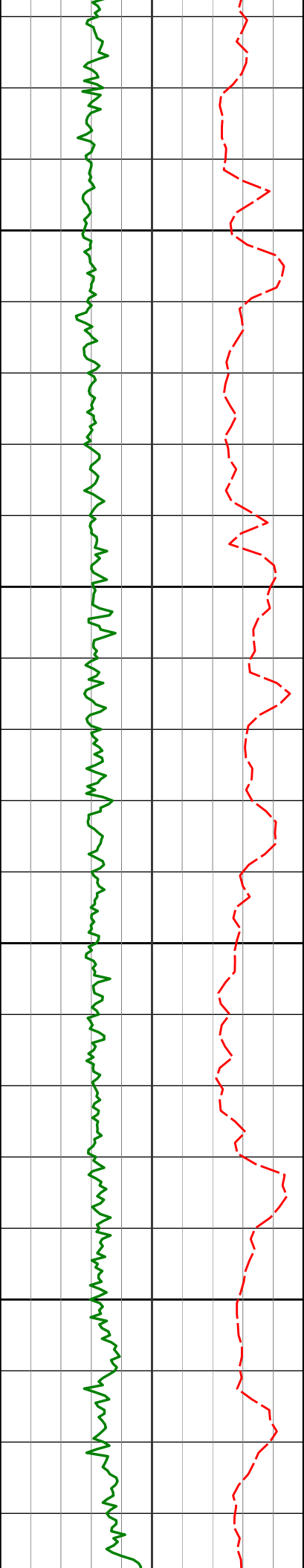
5574.20'

172.52'

5600

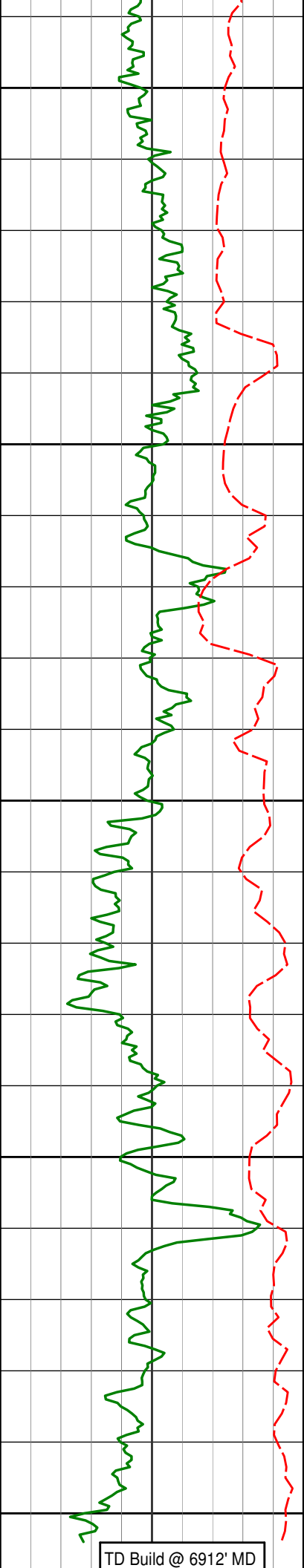






6100	6142'	20.01°	256.34°	6090.13'	222.76'
6150	6188'	22.56°	257.16°	6132.99'	238.81'
6200	6236'	24.61°	260.23°	6176.98'	257.43'
6250	6283'	27.85°	265.55°	6219.14'	277.88'
	6331'	32.53°	269.78°	6260.62'	301.90'





6300	6378'	39.38°	273.66°	6298.65'	329.47'
	6426'	50.06°	275.64°	6332.71'	363.17'
6350					
	6473'	57.09°	277.34°	6360.60'	400.88'
	6521'	59.37°	276.75°	6385.87'	441.58'
6400					
	6568'	61.51°	273.06°	6409.06'	482.42'
	6616'	62.81°	271.52°	6431.48'	524.86'
6450	6662'	64.10°	268.14°	6452.04'	565.95'
	6710'	69.27°	266.70°	6471.04'	609.81'
	6757'	74.60°	267.12°	6485.60'	654.24'
	6805'	79.44°	268.21°	6496.38'	700.81'
6500					
	6858'	85.62°	268.63°	6503.27'	753.18'

TD Build @ 6912' MD

[illegible]**HALLIBURTON**

## DIRECTIONAL SURVEY REPORT

**Noble Energy**  
**Wells Ranch AE30-65-1AHNB**  
**Wattenburg**  
**Weld Colorado**  
**USA**  
**CA-XX-0901176457**

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
604.00	0.60	283.67	603.99	0.75 N	3.07 W	3.11	0.10
720.00	0.66	246.79	719.98	0.63 N	4.28 W	4.30	0.35
812.00	0.56	255.96	811.98	0.31 N	5.20 W	5.21	0.15
903.00	0.74	232.94	902.97	0.15 S	6.10 W	6.09	0.34
996.00	0.73	219.29	995.96	0.97 S	6.96 W	6.90	0.19
1087.00	0.58	231.60	1086.96	1.71 S	7.68 W	7.59	0.23
1180.00	0.59	228.60	1179.95	2.32 S	8.41 W	8.29	0.03
1273.00	0.50	233.57	1272.95	2.87 S	9.10 W	8.94	0.11
1366.00	0.73	106.85	1365.95	3.29 S	8.86 W	8.68	1.19
1457.00	0.46	277.10	1456.94	3.41 S	8.66 W	8.49	1.30
1549.00	0.52	251.46	1548.94	3.50 S	9.43 W	9.24	0.24
1641.00	0.57	267.95	1640.94	3.65 S	10.28 W	10.09	0.18
1736.00	0.67	245.25	1735.93	3.90 S	11.26 W	11.05	0.28
1831.00	0.46	103.95	1830.93	4.22 S	11.39 W	11.17	1.12
1926.00	0.07	355.94	1925.93	4.25 S	11.02 W	10.80	0.51
2020.00	0.29	300.73	2019.93	4.08 S	11.23 W	11.02	0.27
2115.00	0.63	67.22	2114.93	3.75 S	10.96 W	10.76	0.88
2210.00	0.41	65.37	2209.92	3.41 S	10.17 W	9.99	0.23
2399.00	0.30	67.99	2398.92	2.94 S	9.09 W	8.94	0.06
2494.00	0.39	113.21	2493.92	2.97 S	8.57 W	8.41	0.29
2589.00	0.59	130.00	2588.91	3.41 S	7.89 W	7.72	0.26
2683.00	0.28	251.46	2682.91	3.80 S	7.74 W	7.55	0.82
2778.00	2.69	351.38	2777.88	1.67 S	8.30 W	8.20	2.90
2873.00	3.76	349.04	2872.73	3.59 N	9.22 W	9.39	1.13
2968.00	6.05	334.65	2967.37	11.18 N	11.96 W	12.49	2.72
3062.00	8.20	331.12	3060.64	21.53 N	17.32 W	18.36	2.33
3157.00	8.19	342.12	3154.68	33.90 N	22.67 W	24.31	1.65
3252.00	8.76	349.31	3248.64	47.45 N	26.09 W	28.39	1.27
3347.00	8.88	350.54	3342.52	61.79 N	28.63 W	31.64	0.24
3441.00	9.78	350.53	3435.28	76.82 N	31.14 W	34.88	0.96
3536.00	10.05	347.25	3528.86	92.86 N	34.30 W	38.82	0.66
3631.00	14.46	347.51	3621.67	112.54 N	38.69 W	44.18	4.64

3726.00	16.63	347.17	3713.19	137.38 N	44.28 W	50.98	2.29
3819.00	18.08	346.63	3801.95	164.39 N	50.57 W	58.60	1.57
3914.00	16.27	346.52	3892.71	191.68 N	57.08 W	66.44	1.91
4009.00	14.19	344.43	3984.37	215.84 N	63.31 W	73.85	2.26
4104.00	12.54	341.78	4076.80	236.85 N	69.66 W	81.23	1.85
4198.00	10.26	338.47	4168.94	254.34 N	75.93 W	88.35	2.52
4293.00	8.81	333.34	4262.63	268.71 N	82.29 W	95.41	1.77
4388.00	10.04	334.44	4356.34	282.68 N	89.13 W	102.93	1.31
4483.00	10.99	332.32	4449.75	298.17 N	96.91 W	111.46	1.08
4577.00	10.52	332.25	4542.09	313.70 N	105.07 W	120.38	0.50
4672.00	9.88	334.87	4635.59	328.75 N	112.57 W	128.61	0.83
4767.00	10.01	345.23	4729.17	344.12 N	118.14 W	134.92	1.89
4862.00	10.88	346.74	4822.60	360.83 N	122.30 W	139.90	0.96
4957.00	11.57	343.90	4915.78	378.71 N	127.00 W	145.47	0.93
5052.00	8.36	341.03	5009.34	394.40 N	131.88 W	151.13	3.42
5146.00	5.82	339.89	5102.61	405.34 N	135.74 W	155.52	2.71
5241.00	6.21	343.03	5197.09	414.77 N	138.90 W	159.14	0.54
5336.00	7.27	348.67	5291.43	425.58 N	141.58 W	162.35	1.31
5430.00	6.06	337.97	5384.80	436.02 N	144.61 W	165.89	1.84
5525.00	4.31	335.83	5479.40	443.92 N	147.95 W	169.61	1.85
5620.00	3.09	332.81	5574.20	449.46 N	150.59 W	172.52	1.30
5715.00	2.30	333.49	5669.10	453.44 N	152.61 W	174.73	0.83
5801.00	1.20	298.13	5755.06	455.41 N	154.17 W	176.39	1.74
5863.00	1.26	303.03	5817.04	456.09 N	155.31 W	177.56	0.20
5904.00	1.42	291.35	5858.03	456.52 N	156.17 W	178.44	0.77
5952.00	5.48	246.07	5905.94	455.80 N	158.82 W	181.05	9.57
5999.00	9.82	250.85	5952.51	453.58 N	164.66 W	186.77	9.32
6047.00	14.17	251.01	5999.45	450.32 N	174.08 W	196.03	9.06
6094.00	17.42	254.66	6044.67	446.59 N	186.31 W	208.06	7.23
6142.00	20.01	256.34	6090.13	442.75 N	201.22 W	222.76	5.51
6188.00	22.56	257.16	6132.99	438.93 N	217.48 W	238.81	5.58
6236.00	24.61	260.23	6176.98	435.18 N	236.31 W	257.43	4.98
6283.00	27.85	265.55	6219.14	432.67 N	256.90 W	277.88	8.51
6331.00	32.53	269.78	6260.62	431.75 N	281.00 W	301.90	10.70
6378.00	39.38	273.66	6298.65	432.65 N	308.56 W	329.47	15.35
6426.00	50.06	275.64	6332.71	435.44 N	342.16 W	363.17	22.44
6473.00	57.09	277.34	6360.60	439.74 N	379.71 W	400.88	15.24
6521.00	59.37	276.75	6385.87	444.74 N	420.21 W	441.58	4.86
6568.00	61.51	273.06	6409.06	448.22 N	460.93 W	482.42	8.21
6616.00	62.81	271.52	6431.48	449.91 N	503.34 W	524.86	3.92
6662.00	64.10	268.14	6452.04	449.79 N	544.48 W	565.95	7.15
6710.00	69.27	266.70	6471.04	447.79 N	588.50 W	609.81	11.12
6757.00	74.60	267.12	6485.60	445.39 N	633.10 W	654.24	11.37
6805.00	79.44	268.21	6496.38	443.48 N	679.82 W	700.81	10.32
6858.00	85.62	268.63	6503.27	442.04 N	732.32 W	753.18	11.69

**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 272.82 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.57 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 6858.00 FEET  
IS 855.39 FEET ALONG 301.12 DEGREES (GRID)**

First Survey from 3rd party source (Multi Shot EMS) and provided by CO-man on location before drilling.  
Survey Depth 623 Inc 0.6 Azi 283.67  
Tied in @ Surface  
Magnetic direction of 7.566 has been added to AZI for grid direction correction.