

Max Tool Temp (degF) / Source	141.70 / PCM	162.80 / PCM			
Rm @ Max Tool Temp (degF)	N/A @ 141.70	N/A @ 162.80			
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	11342302	11342302			
Insert Serial Number	11620297	11620297			
Date and Time Initialized	28-Sep-13 17:47	01-Jan-70 00:00			
Date and Time Read	01-Jan-70 00:00	01-Oct-13 15:40			
ECMB SW Version	N/A	N/A			

Directional Sensor Information

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

Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	50.53	48.55			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	11342302	11342302			
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: 0.1 ft
 Interval Distance: 1.2 ft

6. Insite Version v8.0.0

WARRANTY

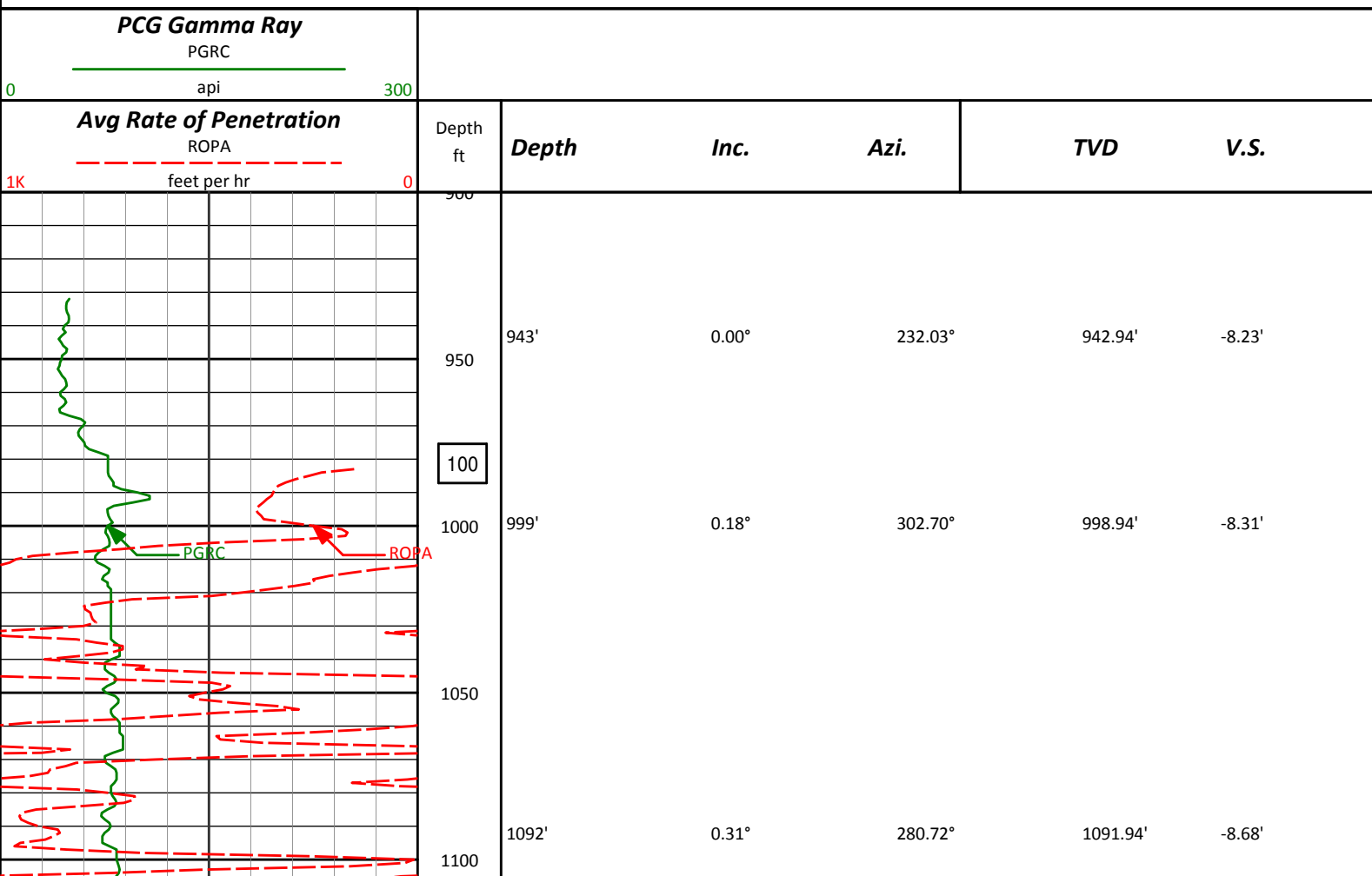
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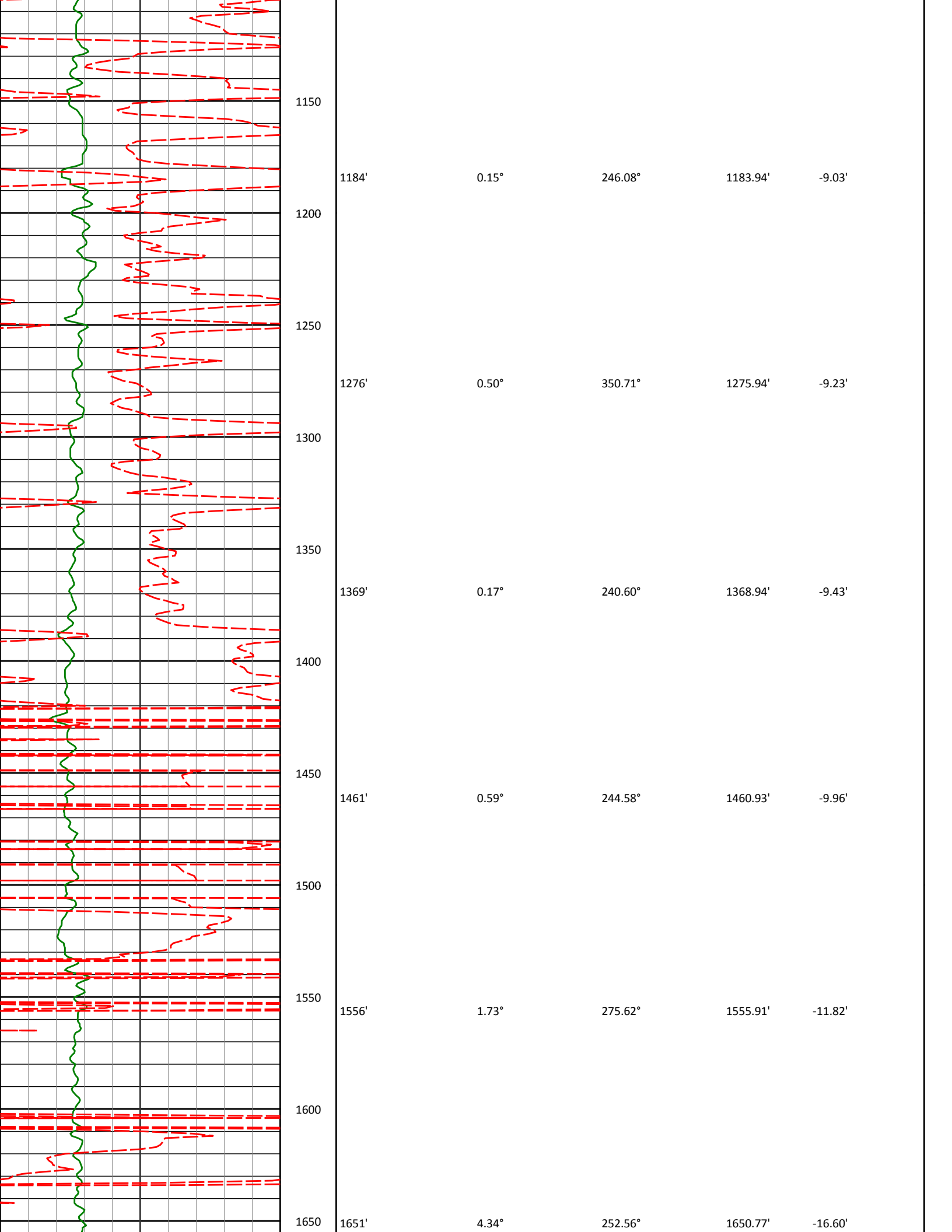
HALLIBURTON

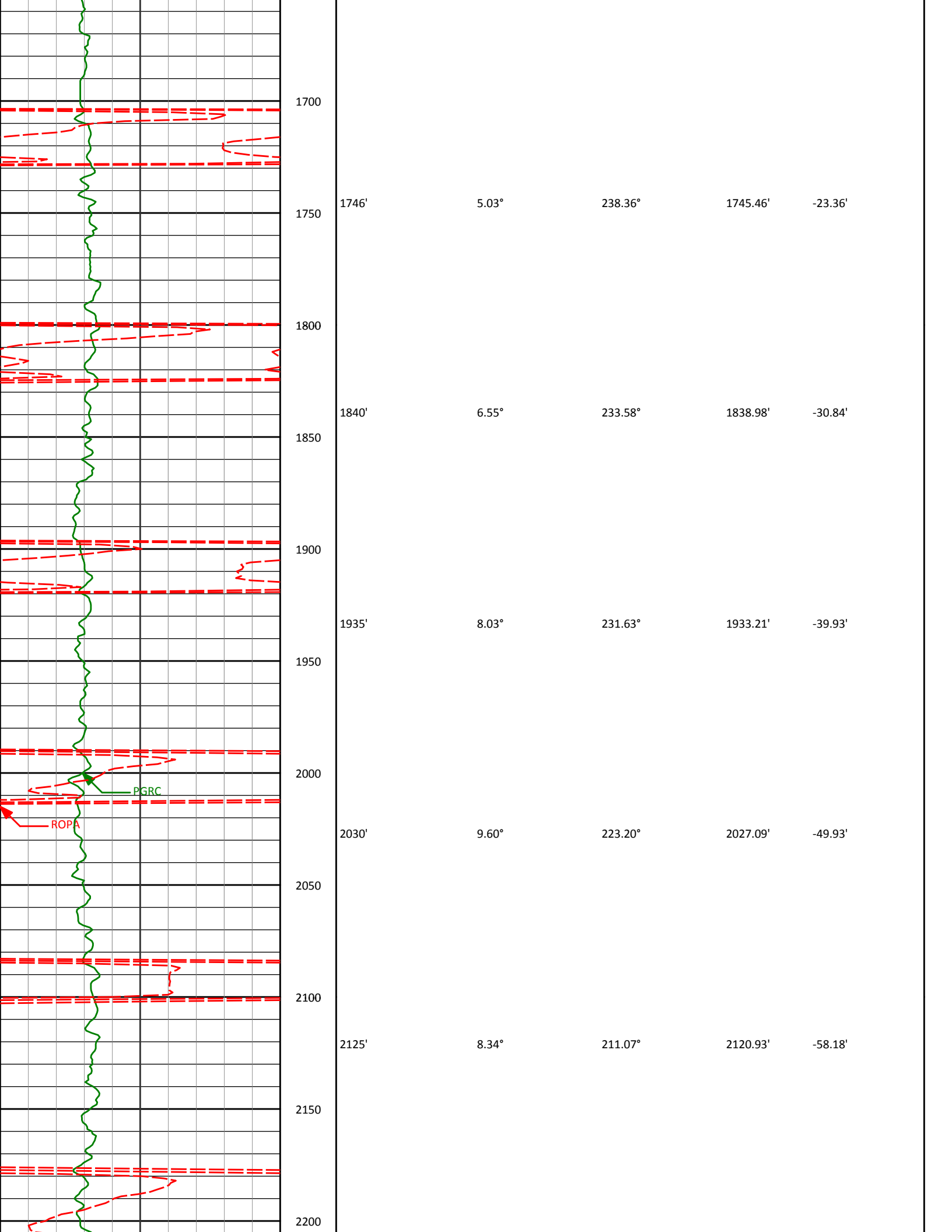
Sperry Drilling Services

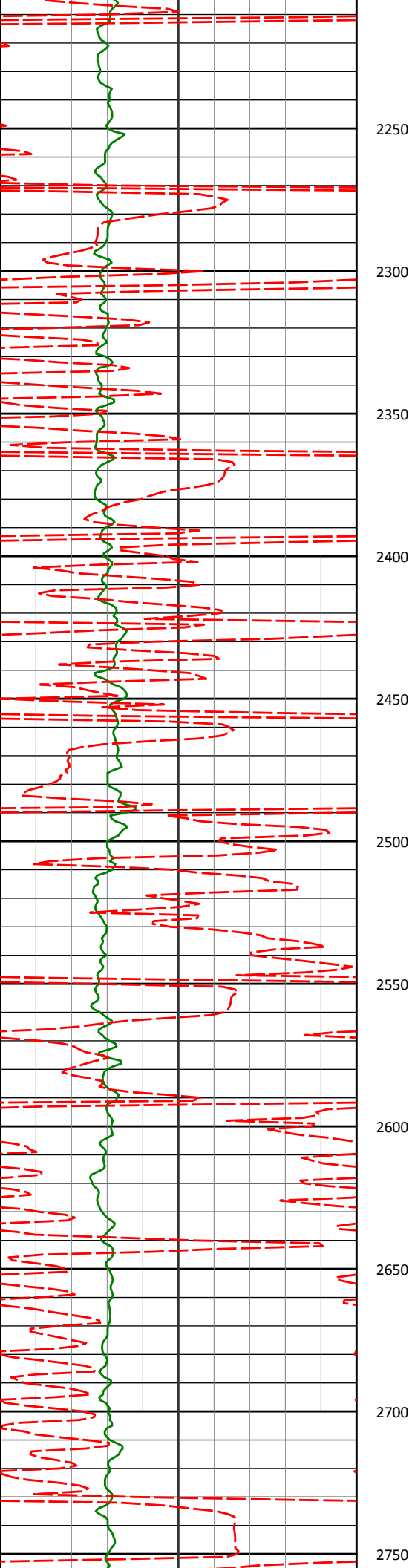
TVD Correlation Log 1:600

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









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°

194.05°

2400.25'

-68.69'

2450

2500

2504'

12.85°

194.56°

2492.96'

-72.56'

2550

2599'

16.01°

195.96°

2584.95'

-77.42'

2600

2650

2693'

14.46°

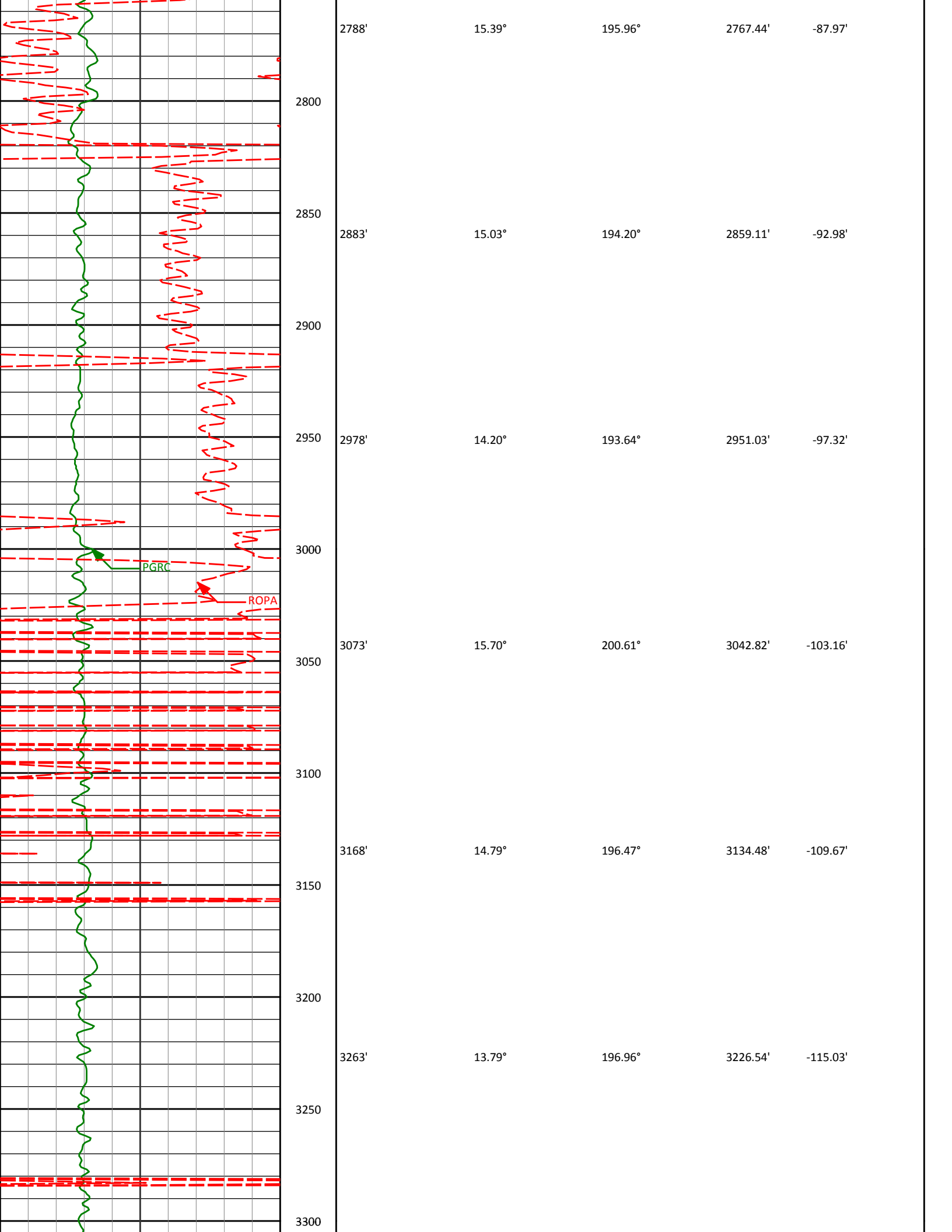
195.78°

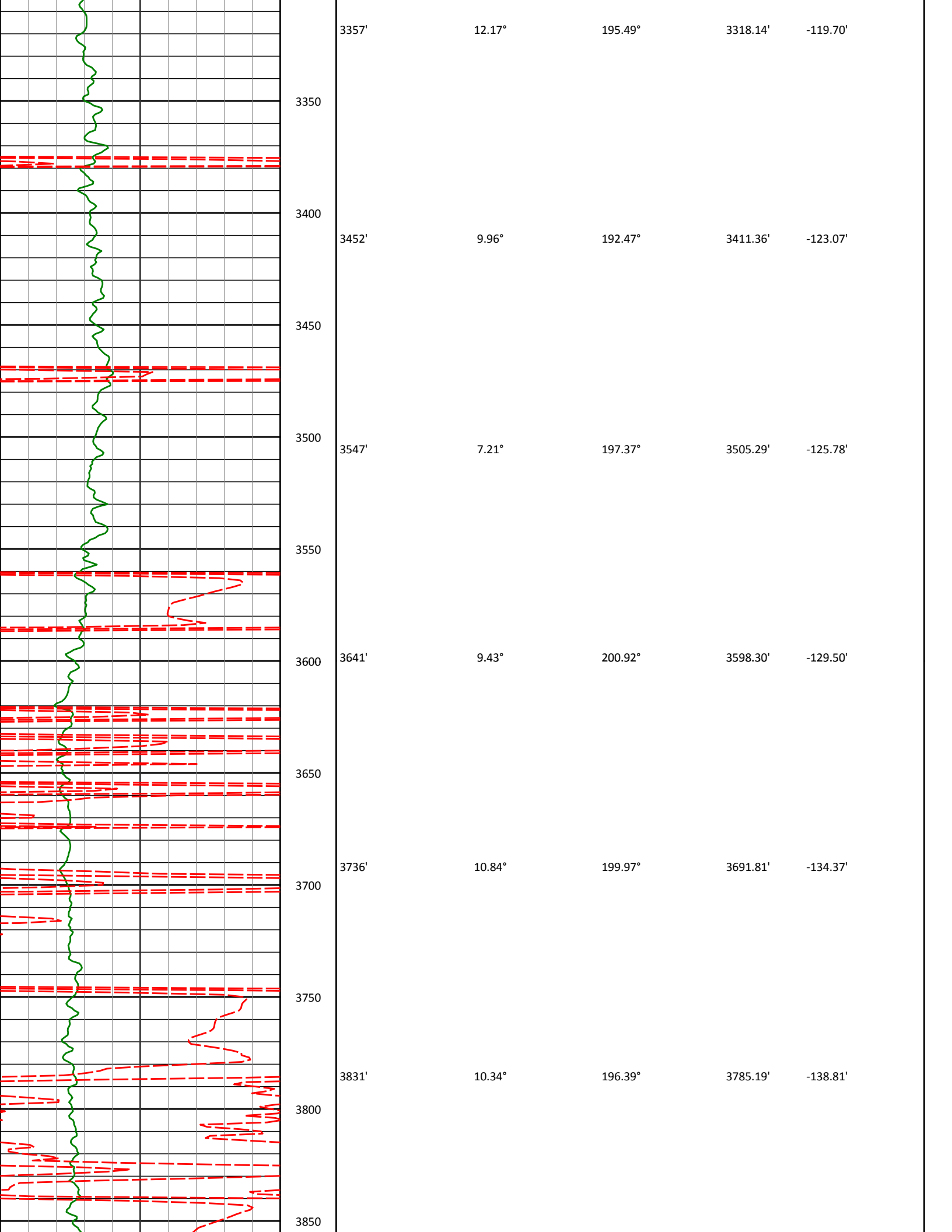
2675.64'

-82.72'

2700

2750





3357' 12.17° 195.49° 3318.14' -119.70'

3350

3400

3452' 9.96° 192.47° 3411.36' -123.07'

3450

3500

3547' 7.21° 197.37° 3505.29' -125.78'

3550

3600

3641' 9.43° 200.92° 3598.30' -129.50'

3650

3700

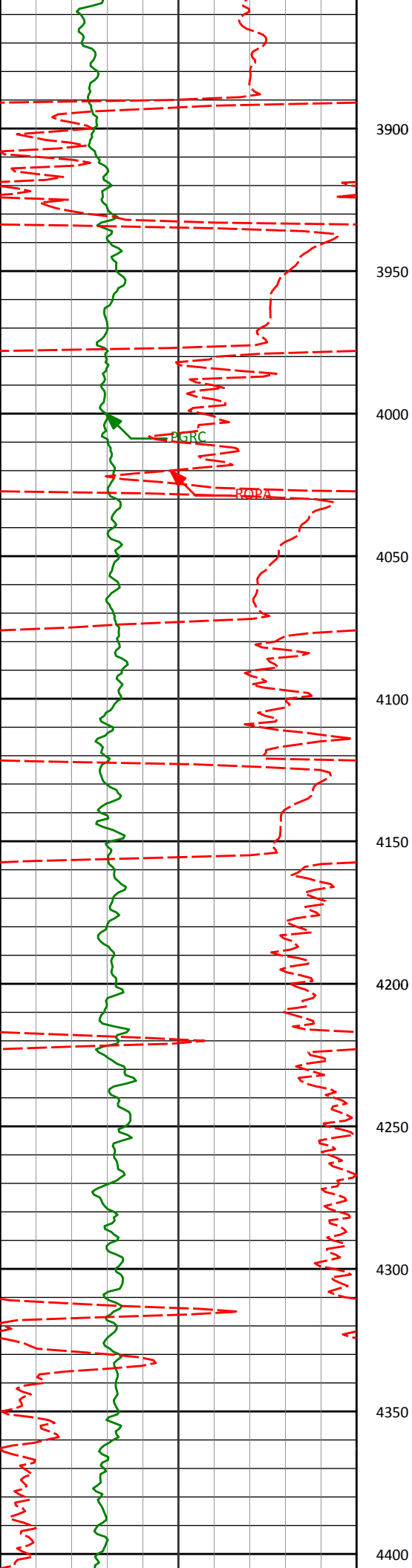
3736' 10.84° 199.97° 3691.81' -134.37'

3750

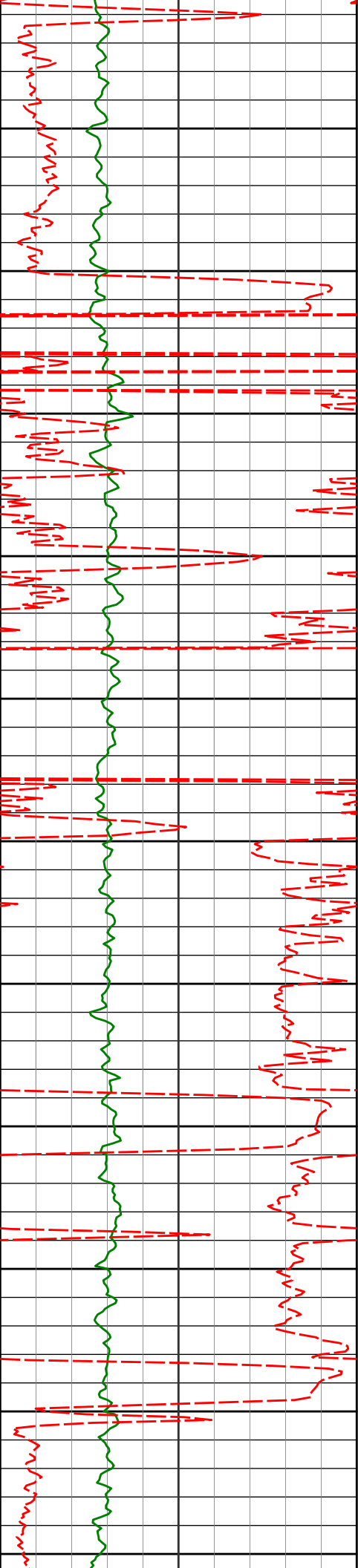
3800

3831' 10.34° 196.39° 3785.19' -138.81'

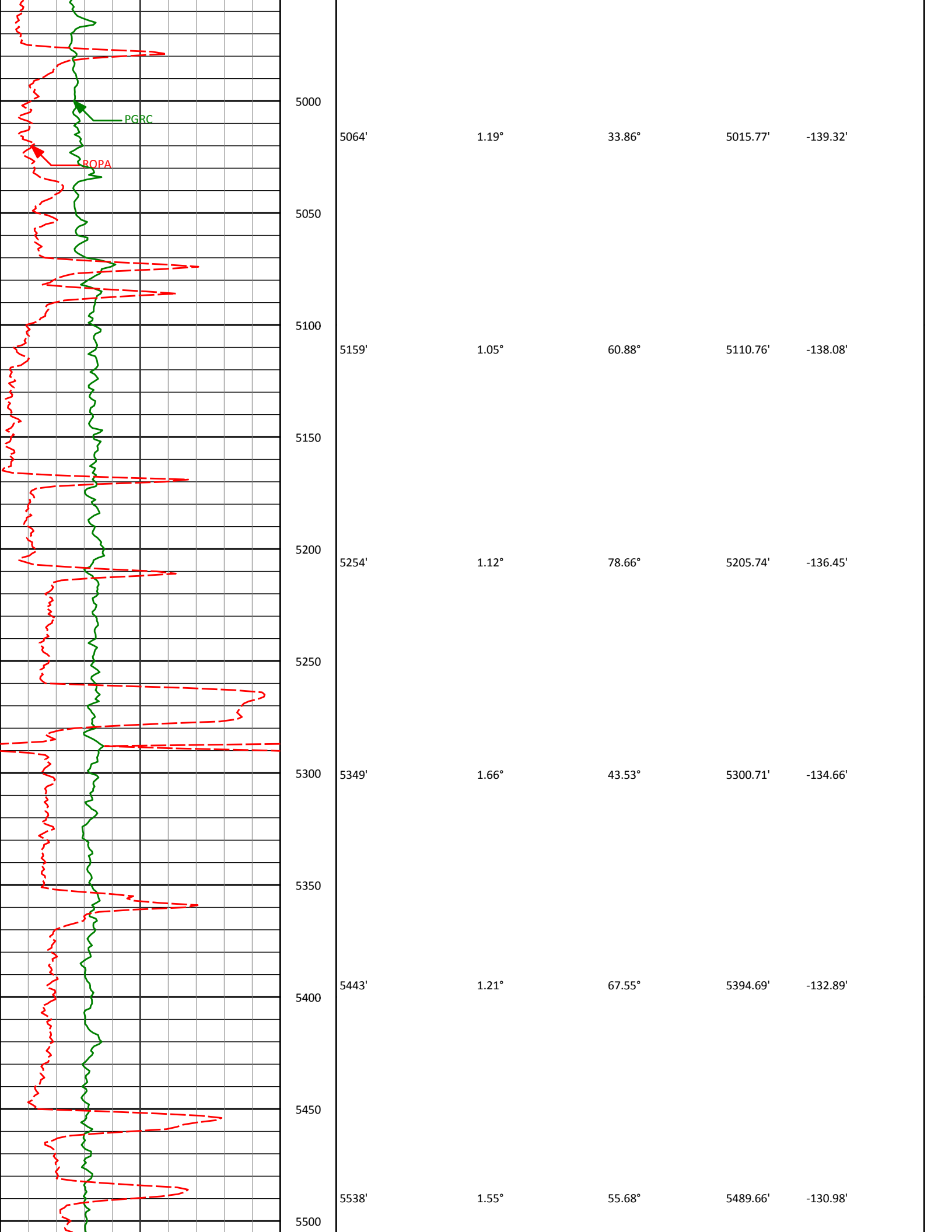
3850

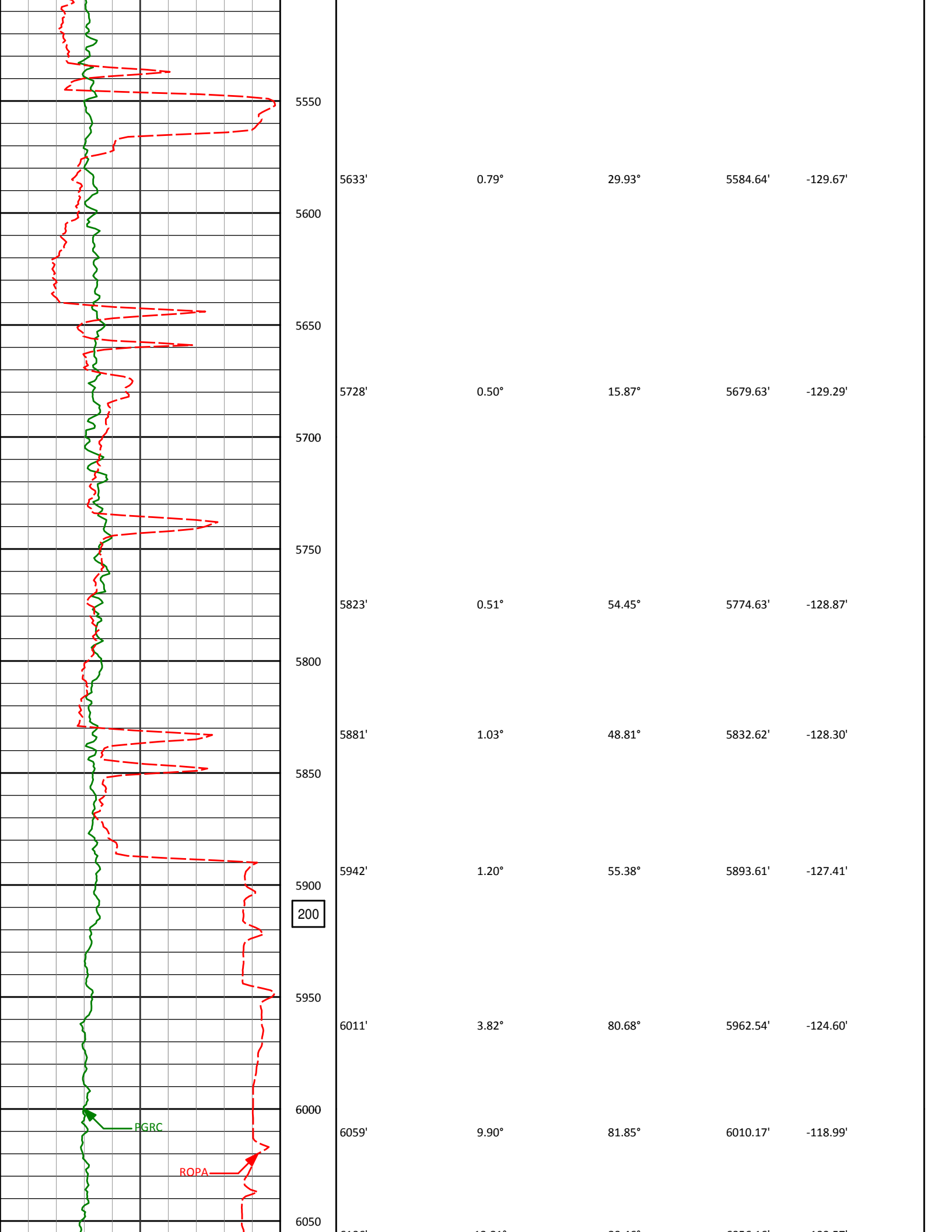


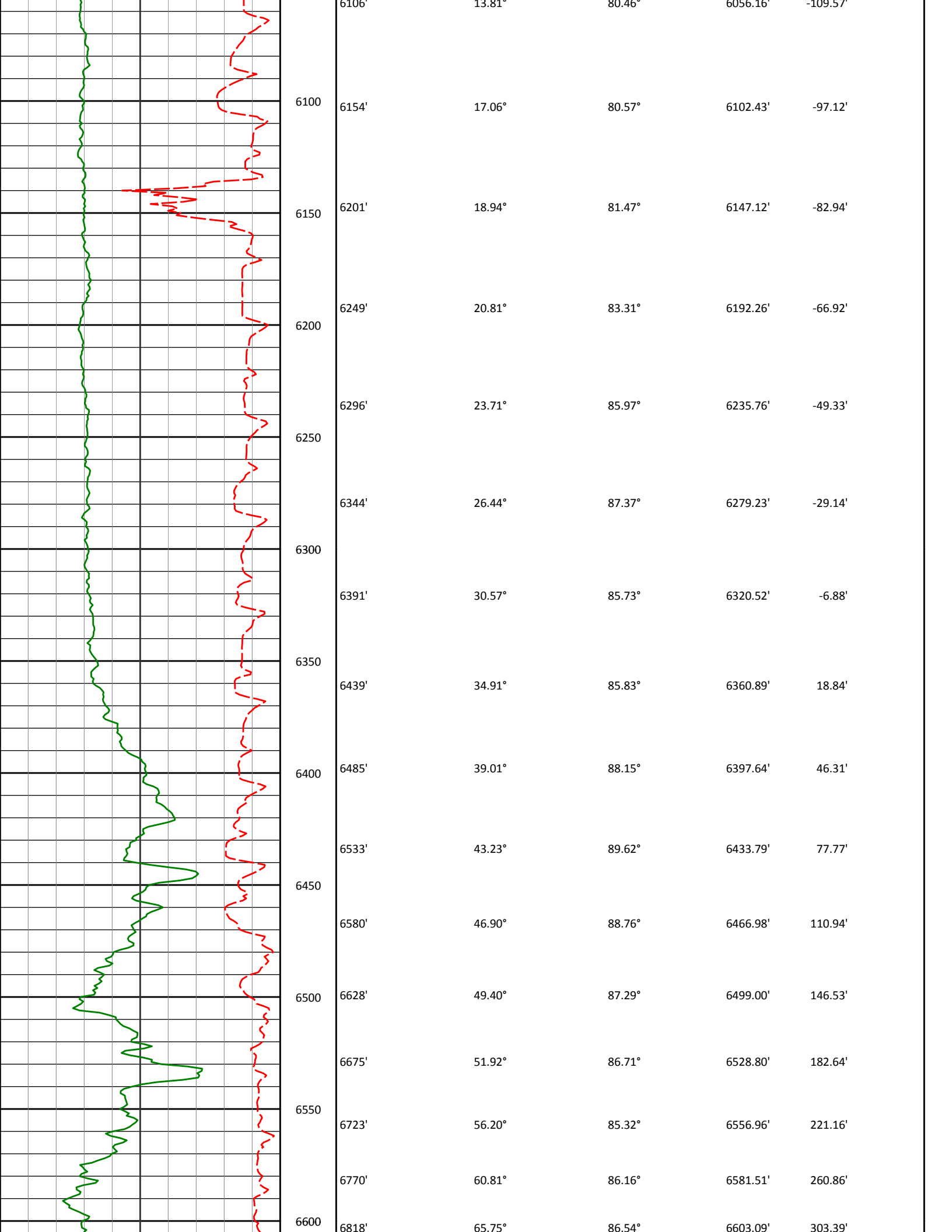
3926'	8.76°	185.23°	3878.88'	-140.93'
3900				
4021'	5.50°	174.76°	3973.14'	-140.46'
4000				
4116'	2.76°	158.57°	4067.89'	-138.81'
4100				
4210'	0.46°	44.60°	4161.85'	-137.61'
4200				
4305'	0.52°	354.50°	4256.85'	-137.43'
4300				
4400'	0.40°	307.80°	4351.85'	-137.77'

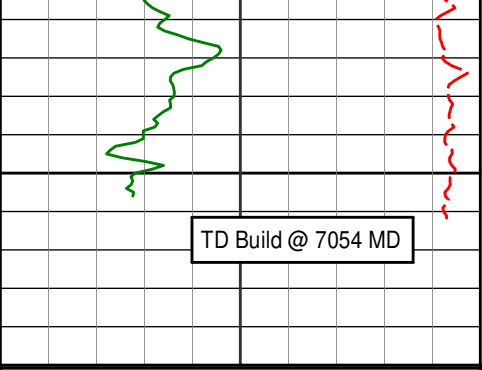


4450	4495'	0.52°	297.08°	4446.84'	-138.44'
4550	4590'	0.99°	329.31°	4541.83'	-139.30'
4650	4685'	0.89°	244.97°	4636.83'	-140.40'
4750	4780'	1.10°	208.65°	4731.81'	-141.44'
4850	4874'	0.62°	100.49°	4825.81'	-141.31'
4950	4969'	1.21°	32.76°	4920.80'	-140.31'









6865'	70.14°	87.98°	6620.74'	346.68'
6913'	74.12°	90.00°	6635.46'	392.21'
6959'	77.68°	90.18°	6646.67'	436.74'
6999'	80.71°	89.73°	6654.16'	475.95'

Avg Rate of Penetration ROPA feet per hr 1K 0	Depth ft	Depth	Inc.	Azi.	TVD	V.S.

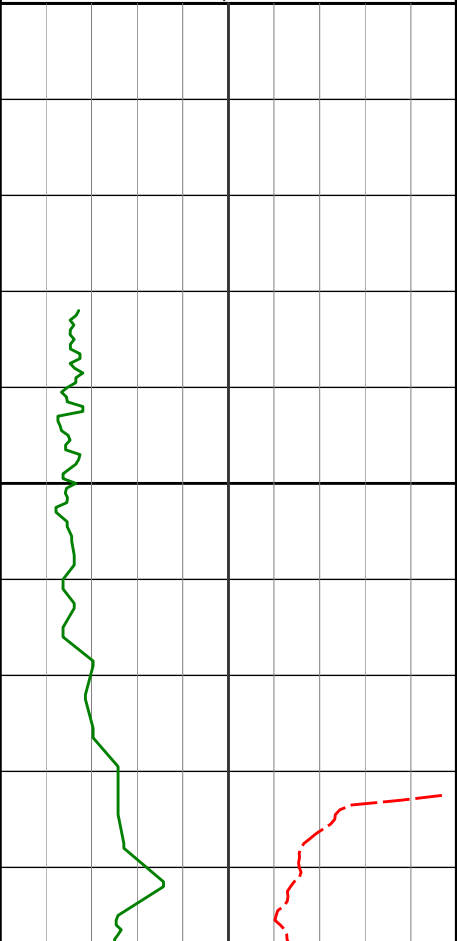
HALLIBURTON

Sperry Drilling Services

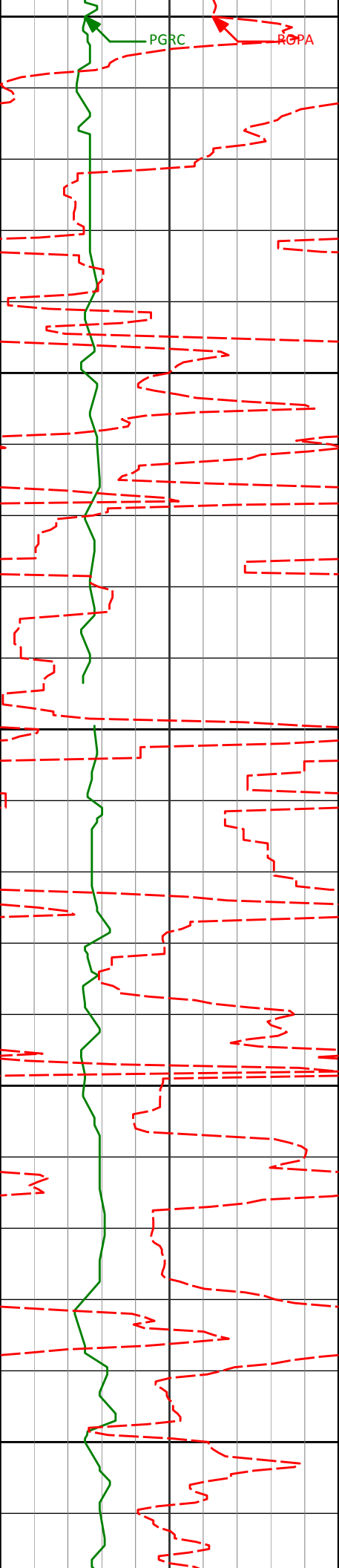
TVD Detail Log 1:240

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

PCG Gamma Ray PGRC api 0 300	Depth ft	Depth	Inc.	Azi.	TVD	V.S.



943'	0.00°	232.03°	942.94'	-8.23'
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1000

1050

1100

1150

1200

999'

1092'

1184'

0.18°

0.31°

0.15°

302.70°

280.72°

246.08°

998.94'

1091.94'

1183.94'

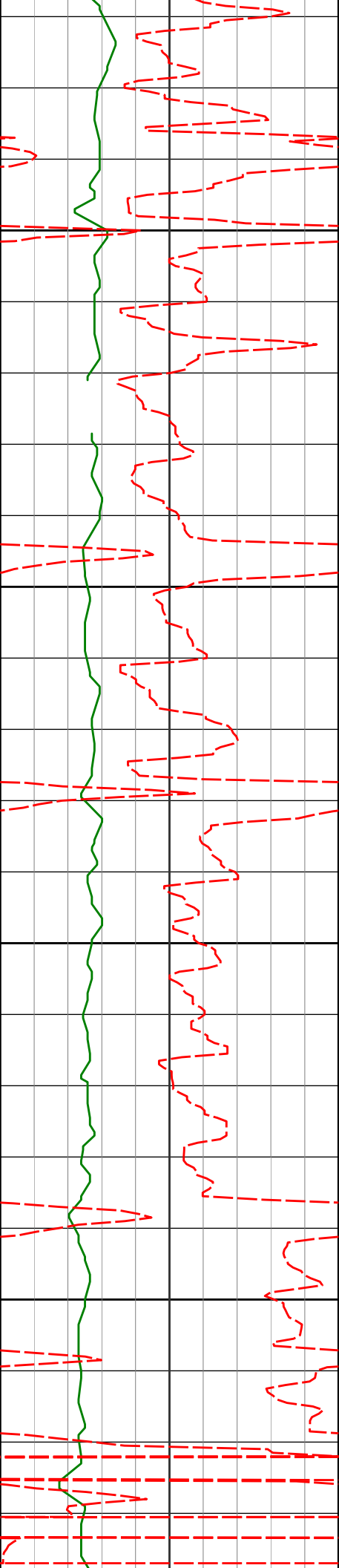
-8.31'

-8.68'

-9.03'

PGRC

ROPA



1250

1276'

0.50°

350.71°

1275.94'

-9.23'

1300

1350

1369'

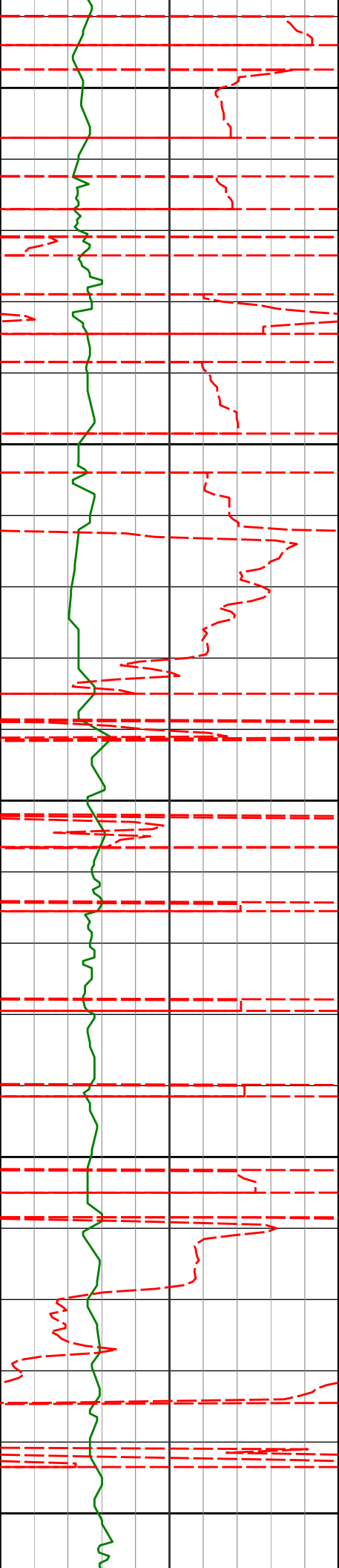
0.17°

240.60°

1368.94'

-9.43'

1400



1450

1461'

0.59°

244.58°

1460.93'

-9.96'

1500

1550

1556'

1.73°

275.62°

1555.91'

-11.82'

1600

1650

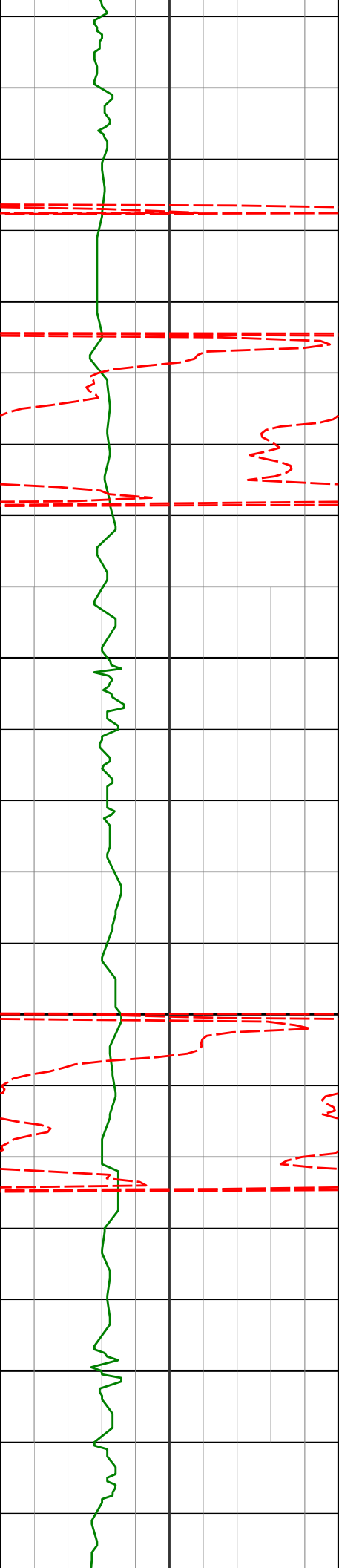
1651'

4.34°

252.56°

1650.77'

-16.60'



1700

1750

1800

1850

1746'

5.03°

238.36°

1745.46'

-23.36'

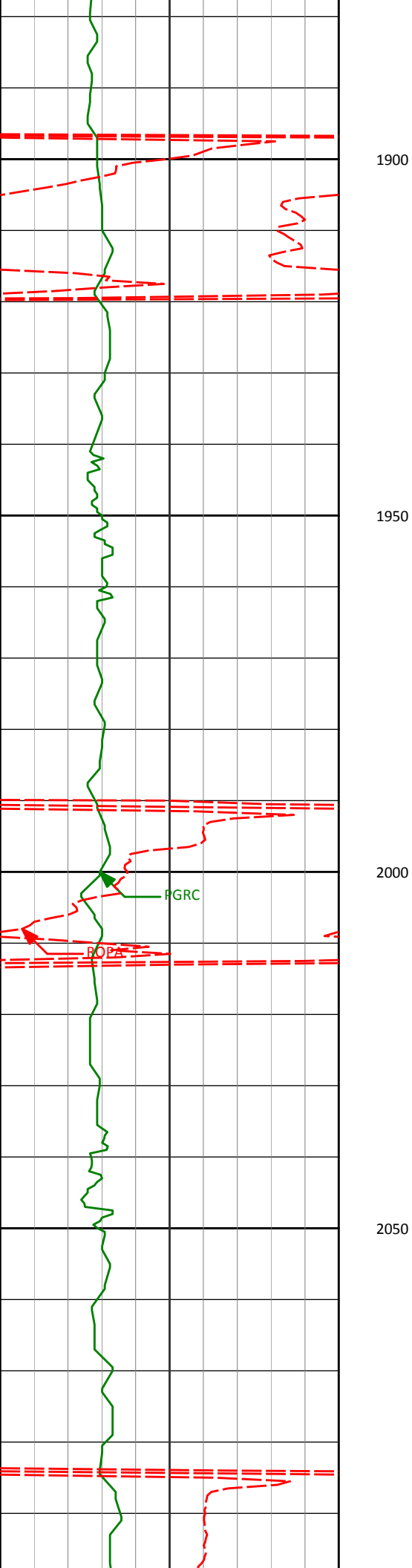
1840'

6.55°

233.58°

1838.98'

-30.84'



1935'

8.03°

231.63°

1933.21'

-39.93'

1900

1950

2000

2050

PGRC

POPA

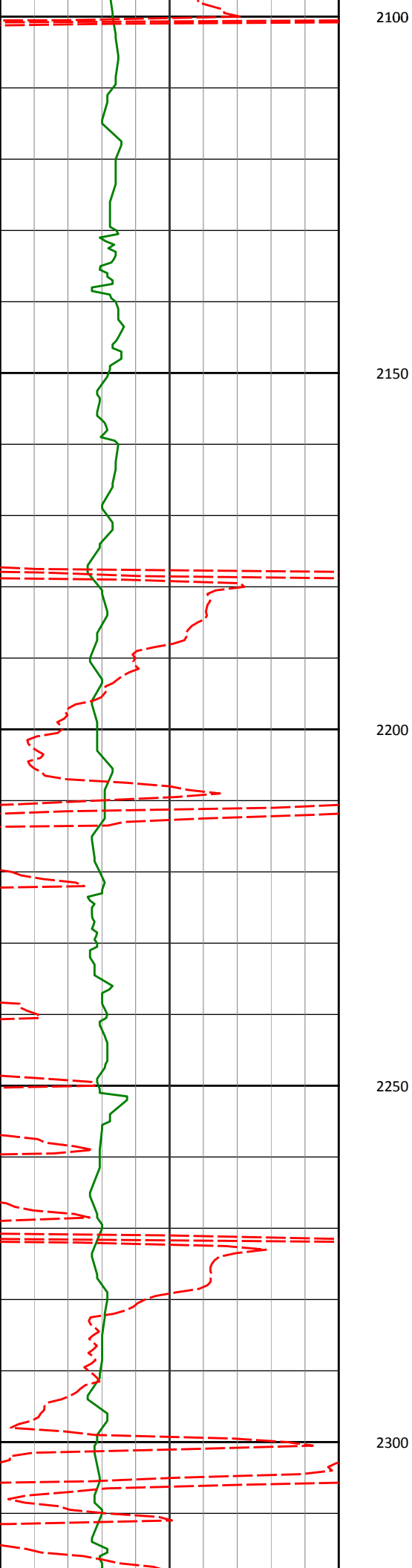
2030'

9.60°

223.20°

2027.09'

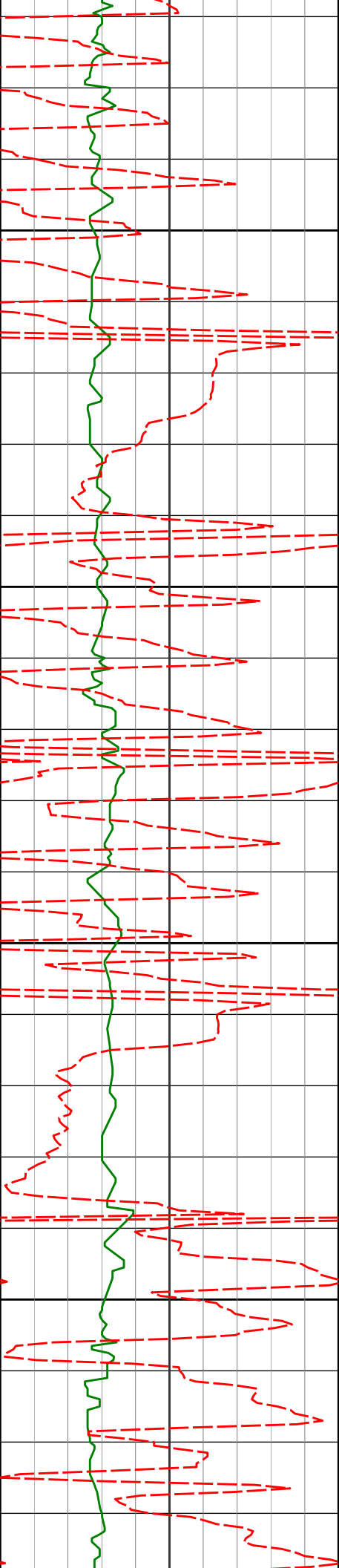
-49.93'



2125' 8.34° 211.07° 2120.93' -58.18'

2220' 9.52° 199.46° 2214.79' -63.54'

2315' 11.37° 187.06° 2308.22' -66.28'



2350

2400

2450

2500

2409'

12.27°

194.03°

2400.23'

-68.69'

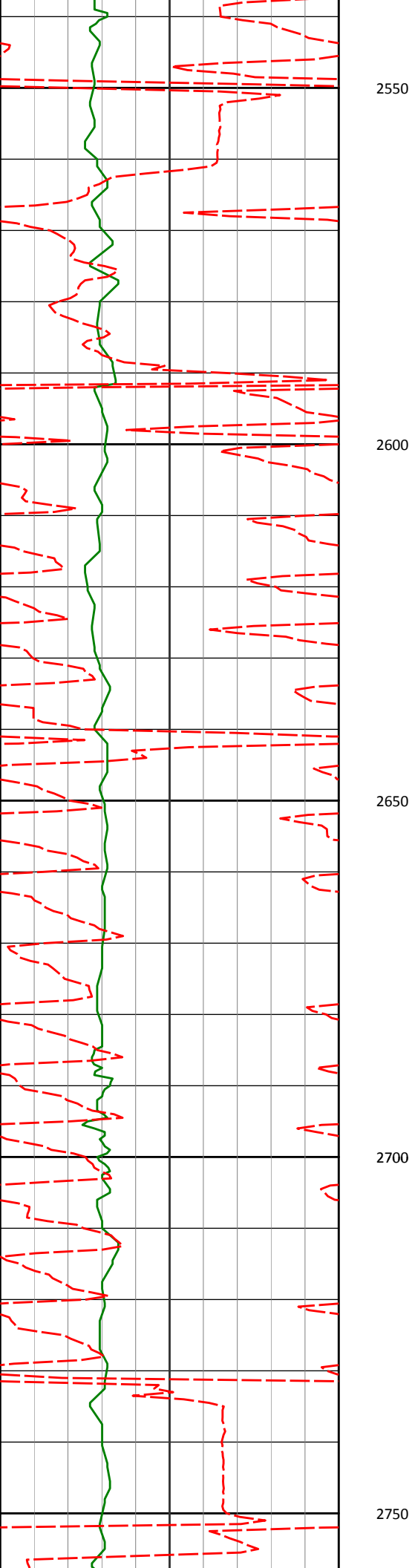
2504'

12.85°

194.56°

2492.96'

-72.56'



2599'

16.01°

195.96°

2584.95'

-77.42'

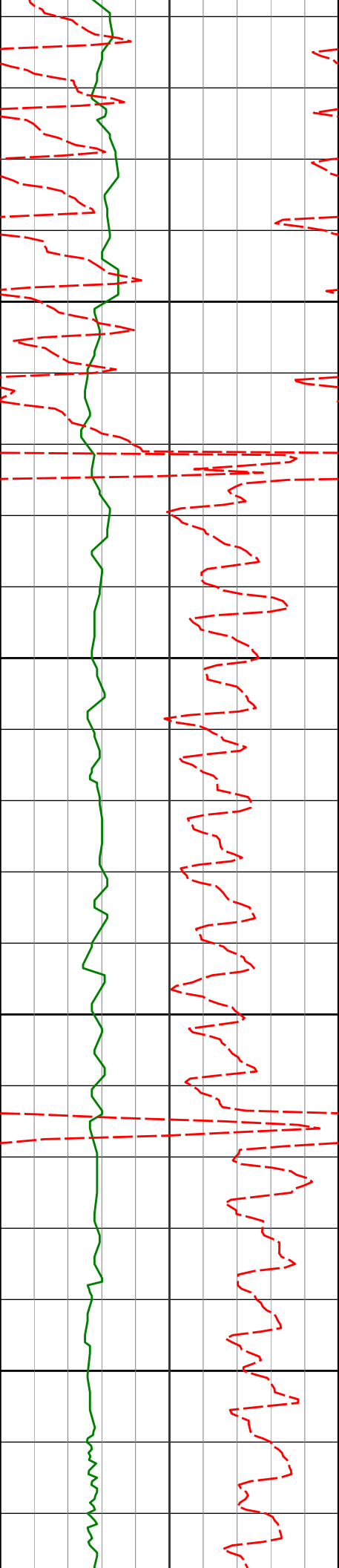
2693'

14.46°

195.78°

2675.64'

-82.72'



2788'

15.39°

195.96°

2767.44'

-87.97'

2800

2850

2883'

15.03°

194.20°

2859.11'

-92.98'

2900

2950

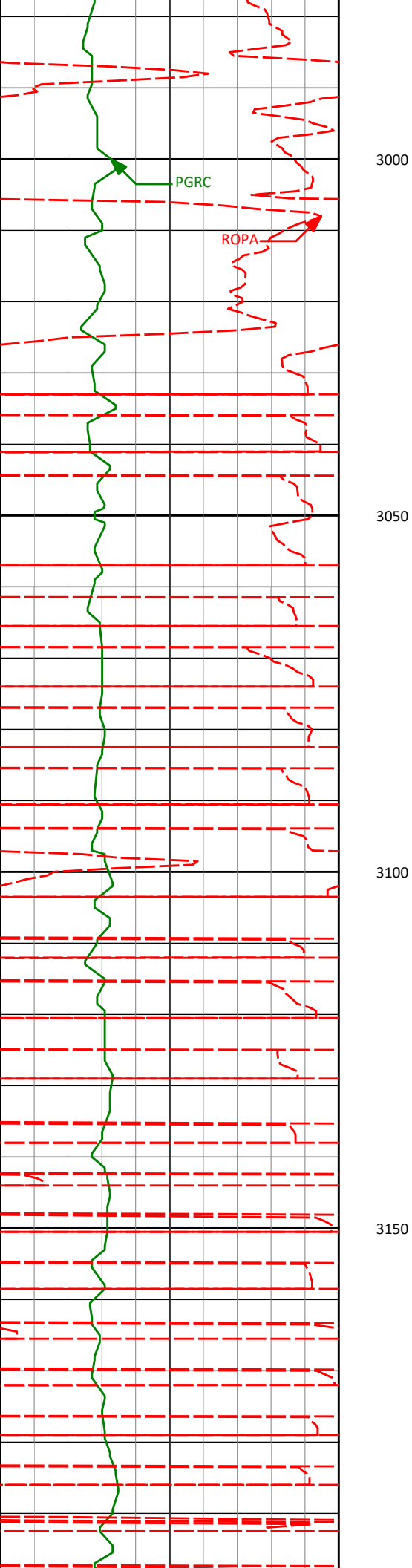
2978'

14.20°

193.64°

2951.03'

-97.32'



3073' 15.70° 200.61° 3042.82' -103.16'

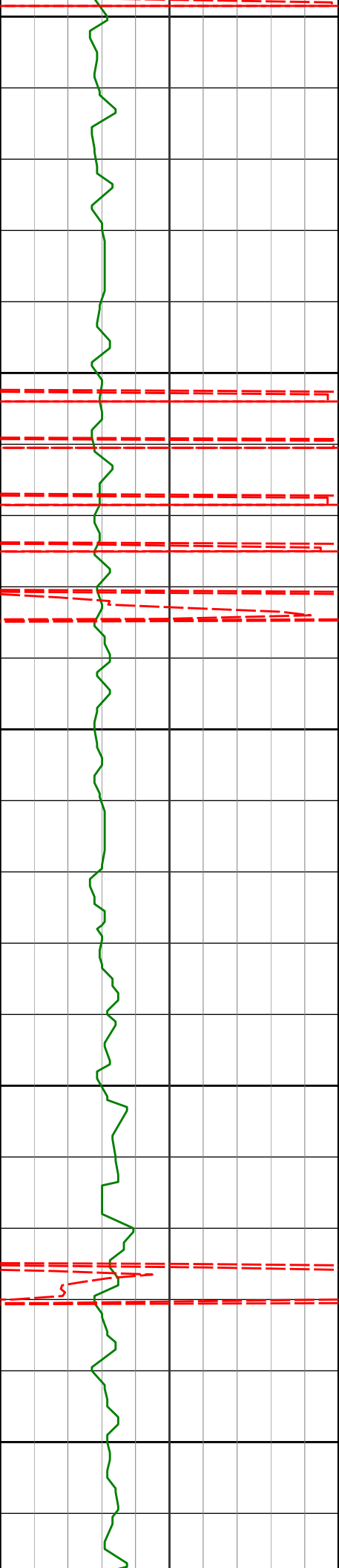
3000

3050

3100

3168' 14.79° 196.47° 3134.48' -109.67'

3150



3200

3263'

13.79°

196.96°

3226.54'

-115.03'

3250

3300

3357'

12.17°

195.49°

3318.14'

-119.70'

3350

3400

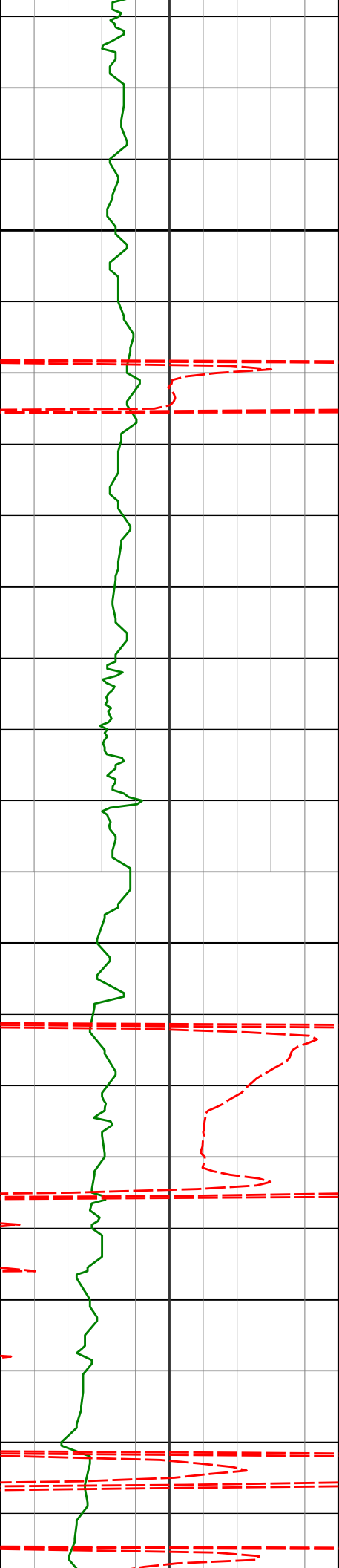
3452'

9.96°

192.47°

3411.36'

-123.07'



3450

3500

3550

3600

3547'

7.21°

197.37°

3505.29'

-125.78'

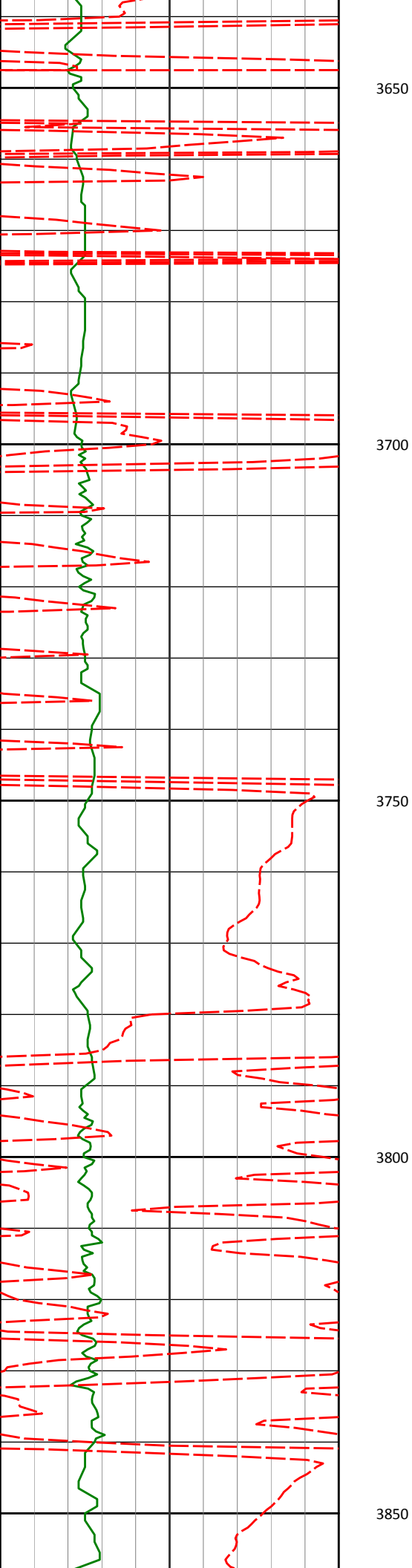
3641'

9.43°

200.92°

3598.30'

-129.50'



3736'

10.84°

199.97°

3691.81'

-134.37'

3650

3700

3750

3831'

10.34°

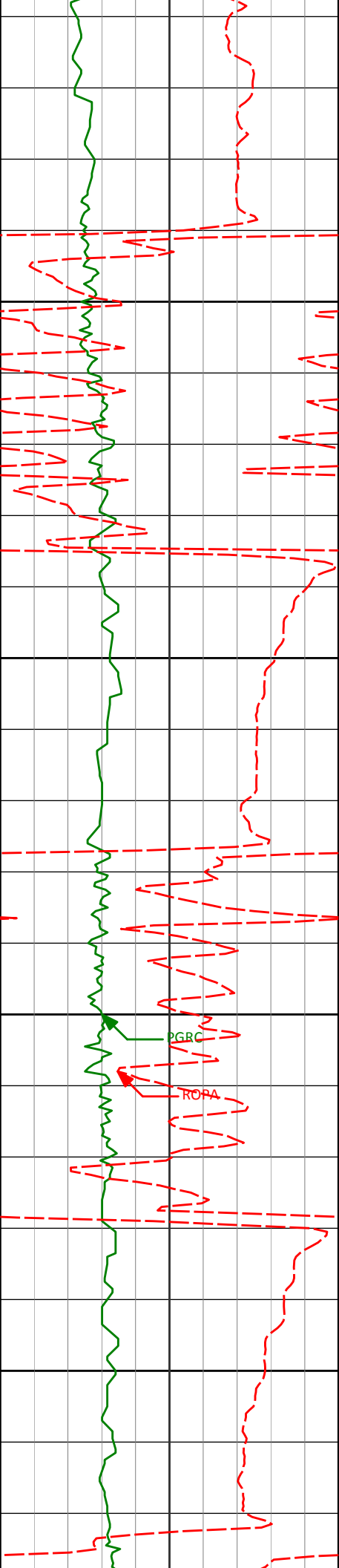
196.39°

3785.19'

-138.81'

3800

3850



3926'

8.76°

185.23°

3878.88'

-140.93'

3900

3950

4021'

5.50°

174.76°

3973.14'

-140.46'

4000

GRC

ROPA

4050

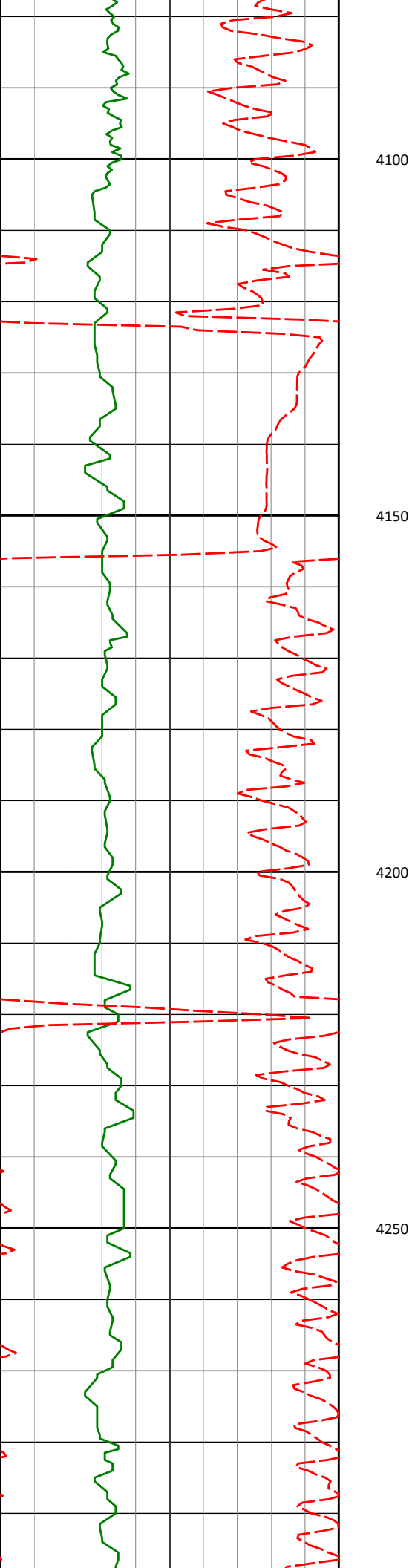
4116'

2.76°

158.57°

4067.89'

-138.81'



4100

4150

4200

4250

4210'

0.46°

44.60°

4161.85'

-137.61'

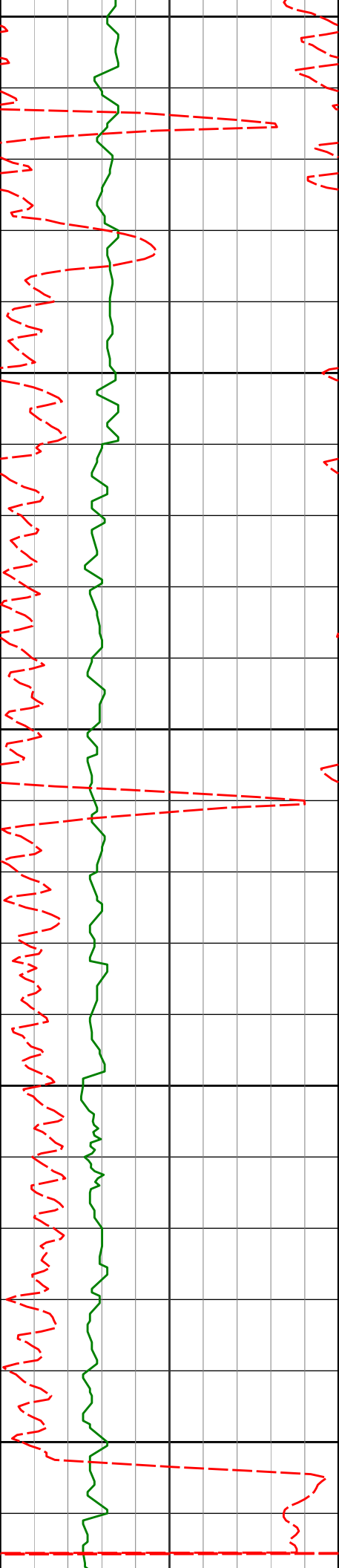
4305'

0.52°

354.50°

4256.85'

-137.43'



4300

4350

4400

4450

4500

4400'

0.40°

307.80°

4351.85'

-137.77'

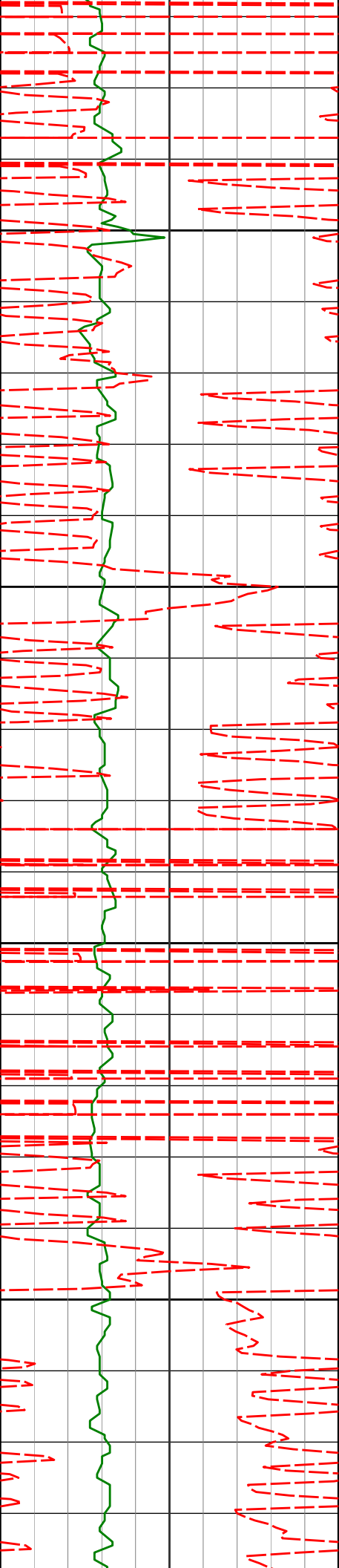
4495'

0.52°

297.08°

4446.84'

-138.44'



4590'

0.99°

329.31°

4541.83'

-139.30'

4550

4600

4685'

0.89°

244.97°

4636.83'

-140.40'

4650

4700

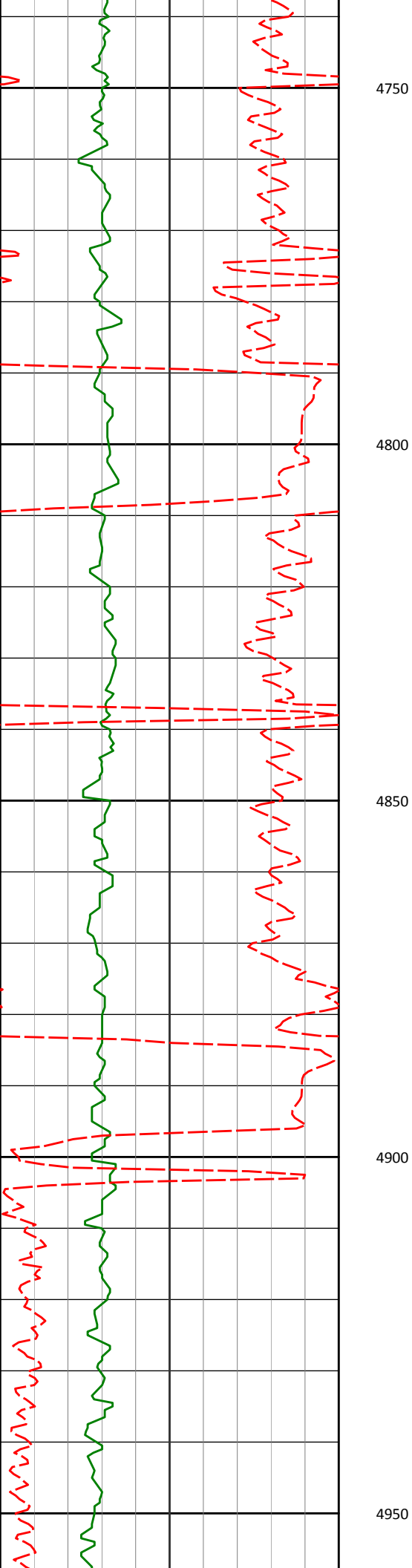
4780'

1.10°

208.65°

4731.81'

-141.44'



4750

4800

4850

4900

4950

4874'

0.62°

100.49°

4825.81'

-141.31'

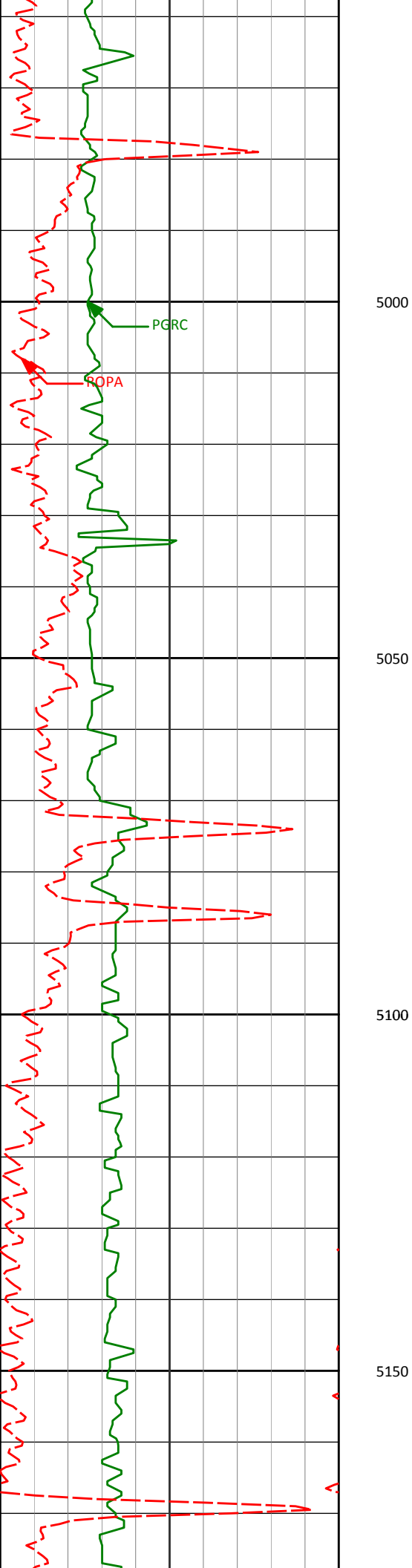
4969'

1.21°

32.76°

4920.80'

-140.31'



5064'

1.19°

33.86°

5015.77'

-139.32'

5000

5050

5100

5150

5159'

1.05°

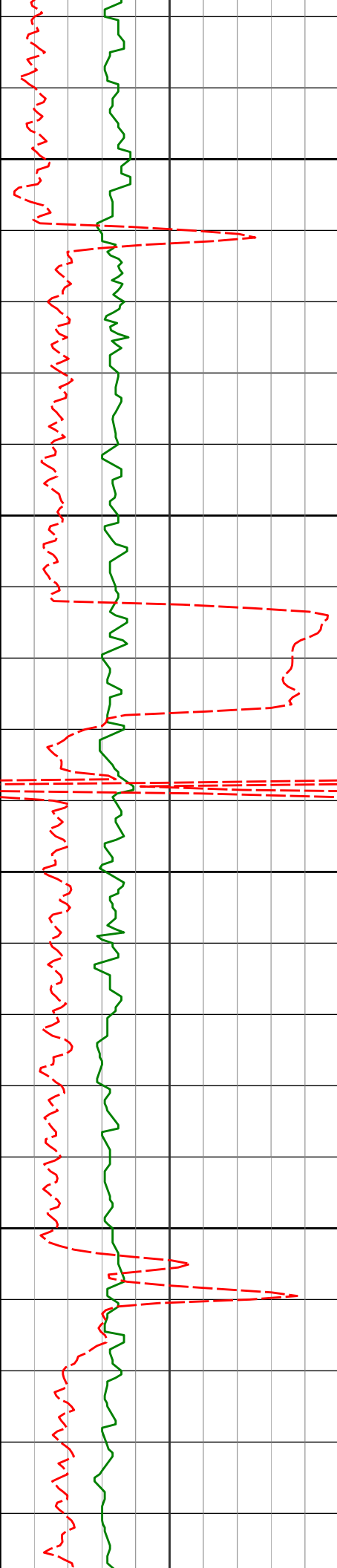
60.88°

5110.76'

-138.08'

PGRC

POPA



5200

5254'

1.12°

78.66°

5205.74'

-136.45'

5250

5300

5349'

1.66°

43.53°

5300.71'

-134.66'

5350

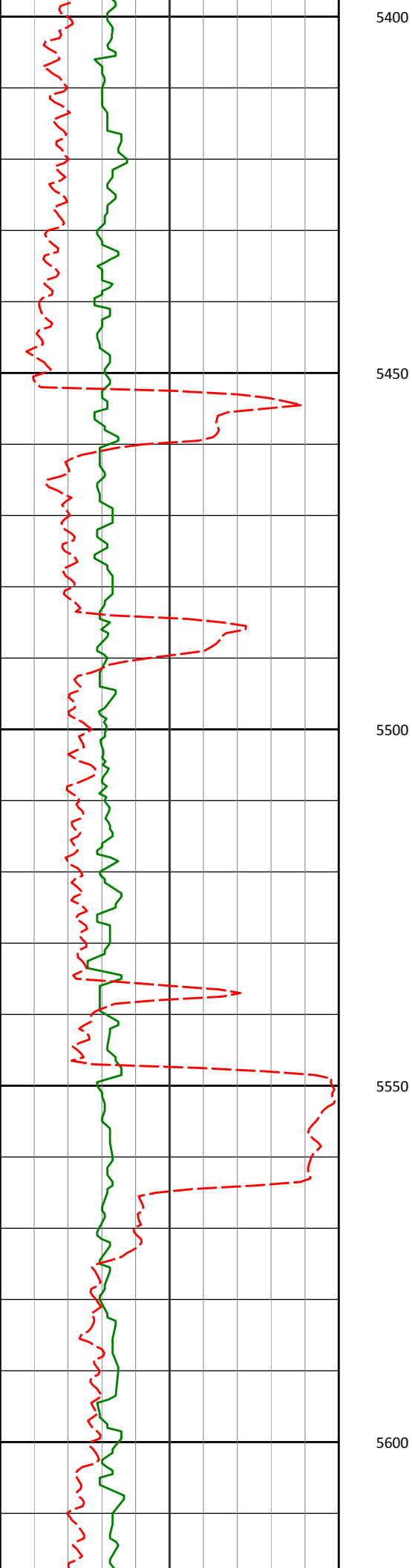
5443'

1.21°

67.55°

5394.69'

-132.89'



5538'

1.55°

55.68°

5489.66'

-130.98'

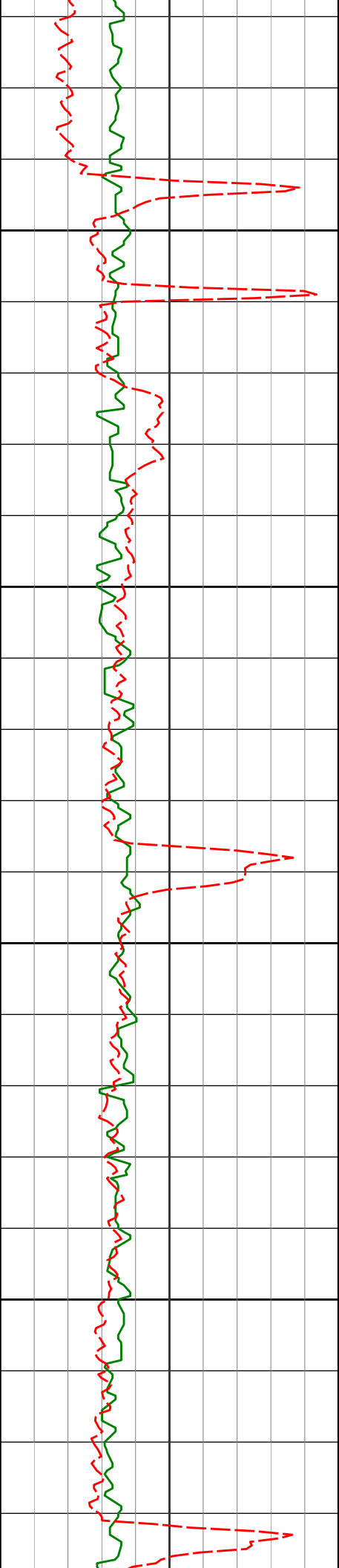
5633'

0.79°

29.93°

5584.64'

-129.67'



5650

5728'

0.50°

15.87°

5679.63'

-129.29'

5700

5750

5823'

0.51°

54.45°

5774.63'

-128.87'

5800

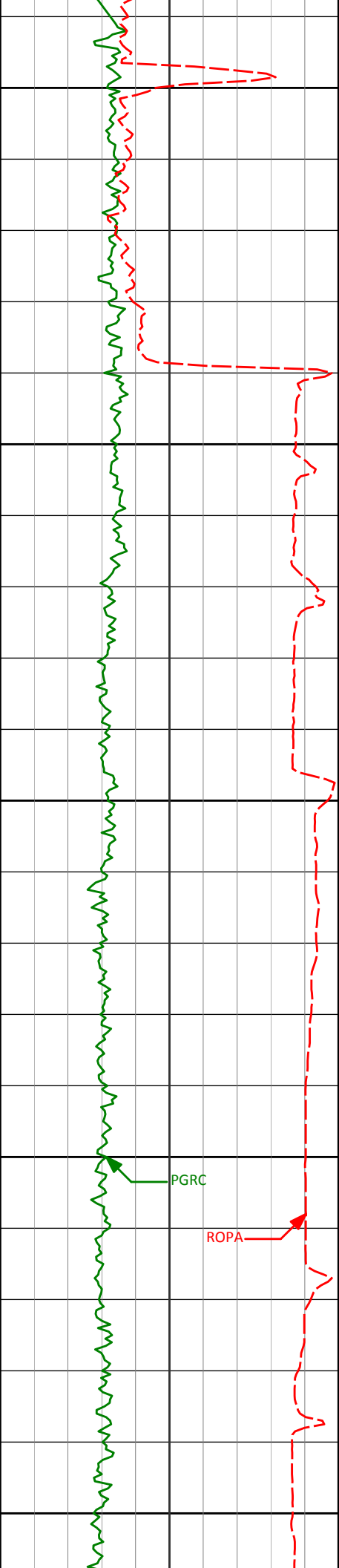
5881'

1.03°

48.81°

5832.62'

-128.30'



5850

5942'

1.20°

55.38°

5893.61'

-127.41'

5900

200

5950

6011'

3.82°

80.68°

5962.54'

-124.60'

6000

PGRC

ROPA

6059'

9.90°

81.85°

6010.17'

-118.99'

6050

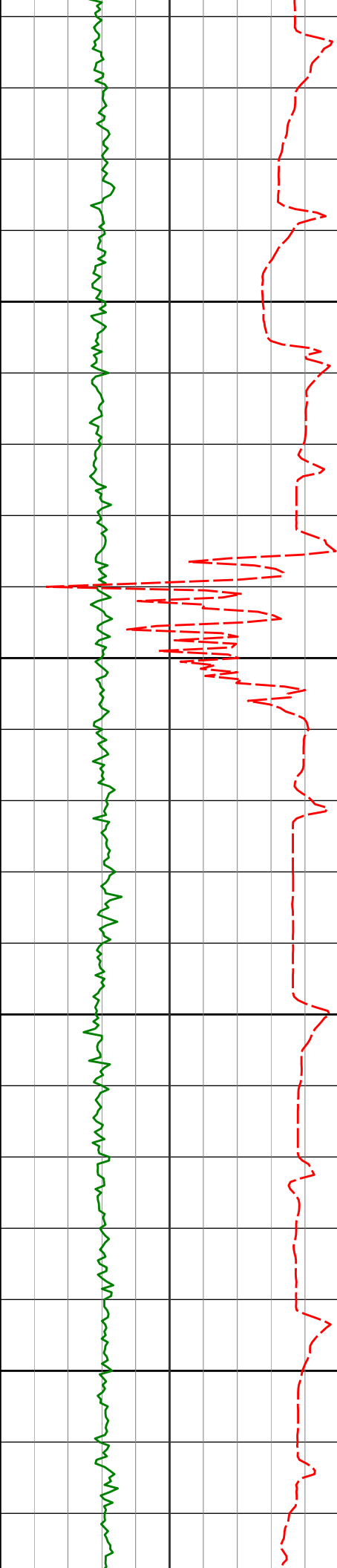
6106'

13.81°

80.46°

6056.16'

-109.57'



6100

6154'

17.06°

80.57°

6102.43'

-97.12'

6150

6201'

18.94°

81.47°

6147.12'

-82.94'

6200

6249'

20.81°

83.31°

6192.26'

-66.92'

6250

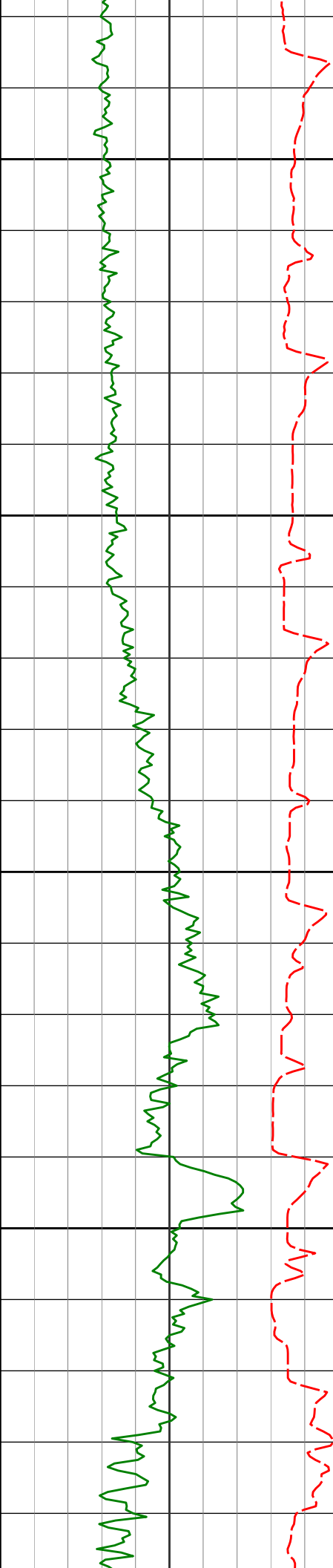
6296'

23.71°

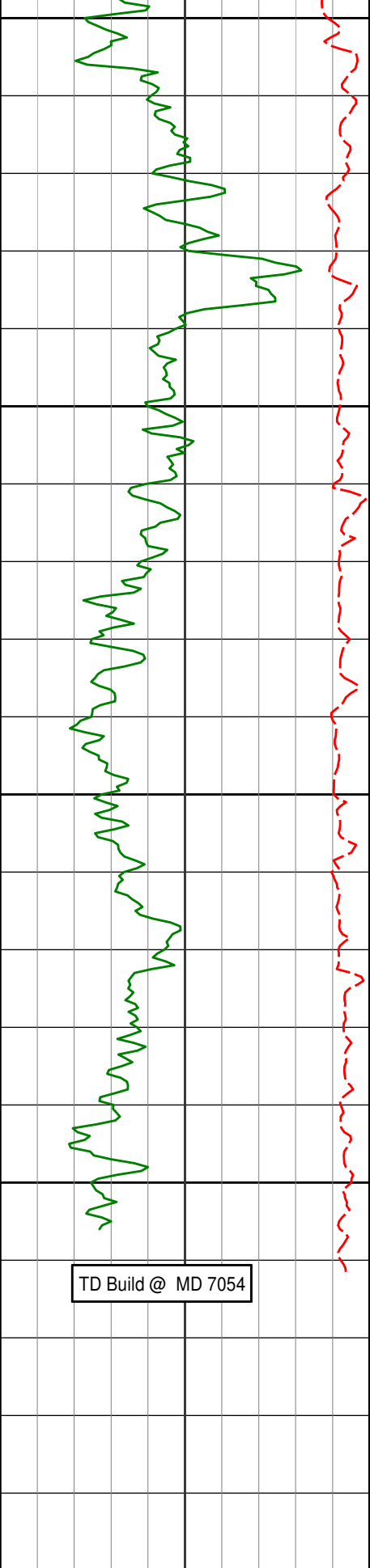
85.97°

6235.76'

-49.33'



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'
6580'	46.90°	88.76°	6466.98'	110.94'



6500	6628'	49.40°	87.29°	6499.00'	146.53'
	6675'	51.92°	86.71°	6528.80'	182.64'
6550	6723'	56.20°	85.32°	6556.96'	221.16'
	6770'	60.81°	86.16°	6581.51'	260.86'
6600	6818'	65.75°	86.54°	6603.09'	303.39'
	6865'	70.14°	87.98°	6620.74'	346.68'
	6913'	74.12°	90.00°	6635.46'	392.21'
	6959'	77.68°	90.18°	6646.67'	436.74'
6650	6999'	80.71°	89.73°	6654.16'	475.95'

TD Build @ MD 7054

Avg Rate of Penetration

ROPA

1K 0
feet per hr

PCG Gamma Ray

PGRC

Depth
ft

Depth

Inc.

Azi.

TVD

V.S.

HALLIBURTON

DIRECTIONAL SURVEY REPORT

Noble Energy
Wells Ranch AE20-67-1HN
Wattenburg
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

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 6999.00 FEET
IS 594.27 FEET ALONG 130.27 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

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