

**PCDC - Pressure Case Directional**  
**PCGK - Pressure Case Gamma**

**1 : 600 / 1 : 240**

Country		: USA					
Field		: Wattenburg					
Location		: Lat: 40°30' 37.01" North Long: 104° 27' 1.15" West					
Well		: NCLP PC AA04-63-1HN					
Company		: Noble Energy					
Rig		: H&P 321					
LOCATION		Latitude : 40°30'37.01" North Longitude : 104° 27' 1.15" West		UTM Easting = 3,291,864.370 ft UTM Northing = 1,430,463.030 ft		Other Services Directional Drilling	
Permanent Datum		: Ground Level		Elevation : 4710.00 ft		Elev. KB N/A	
Log Measured From		: Drill Floor		30.00 ft Above Permanent Datum		DF 4740.00 ft GL 4710.00 ft WD N/A	
Drilling Measured From		: Drill Floor		TVD LOG			
Depth Logged		: 644.99 ft To 6,662.84 ft		Unit No. : 11210424		Job No. :CA-XX-0900859730	
Date Logged		: 15-Jan-14 To 19-Jan-14		Plot Type : Final			
Total Depth MD		: 7,099.00 ft TVD : 6,662.84 ft		Plot Date : 19-Jan-14			
Spud Date		: 15-Jan-14					
Run No.		Borehole Record (TVD)		Run No.		Borehole Record (TVD)	
Size		From To		Size		From To	
0100		8.750 in 644.99 ft 4,565.52 ft					
0200		8.750 in 4,565.52 ft 6,662.84 ft					

Max Tool Temp (degF) / Source	124.80 / PCM	162.80 / PCM			
Rm @ Max Tool Temp (degF)	N/A @ 124.80	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	246470	246470			
Insert Serial Number	11680744	11680744			
Date and Time Initialized	14-Jan-14 22:06	14-Jan-14 22:06			
Date and Time Read	18-Jan-14 19:02	18-Jan-14 19:12			
ECMB SW Version	N/A	N/A			

### Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	58.00	54.00			
Software Version	6.21	6.21			
Sub Serial Number	246470	246470			
Sonde Serial Number	11297580	11297580			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	18.48	212.49			

### Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	51.08	47.62			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	246470	246470			
Insert/Sonde Serial Number	11293386	11293386			

## 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

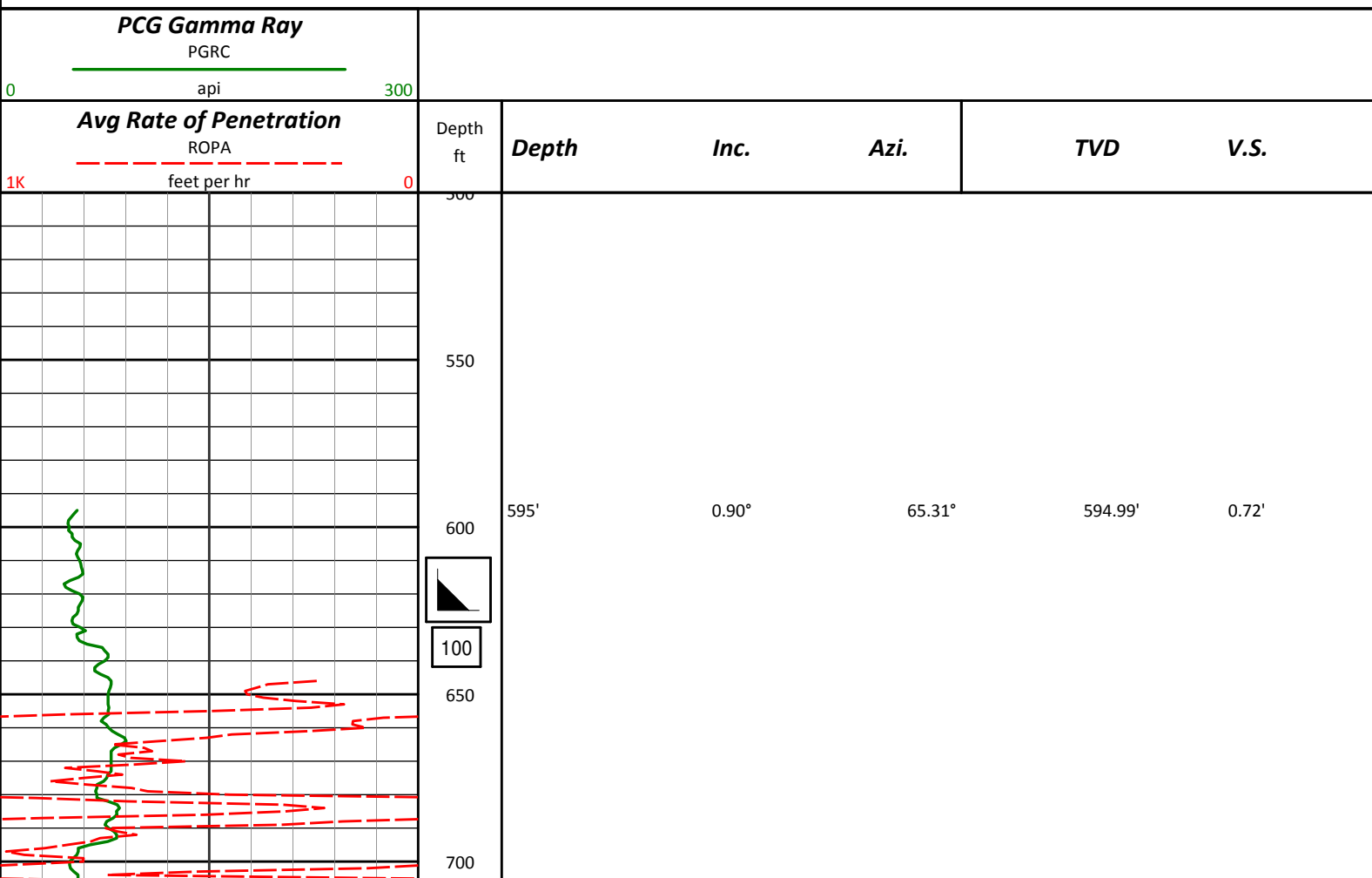
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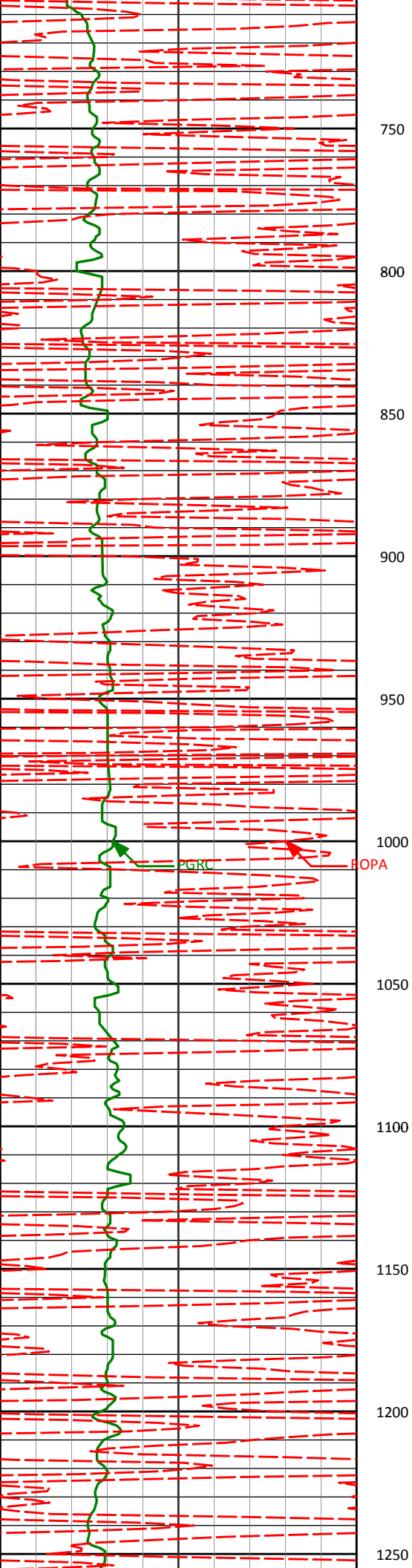
# HALLIBURTON

## Sperry Drilling Services

### TVD Correlation Log 1:600

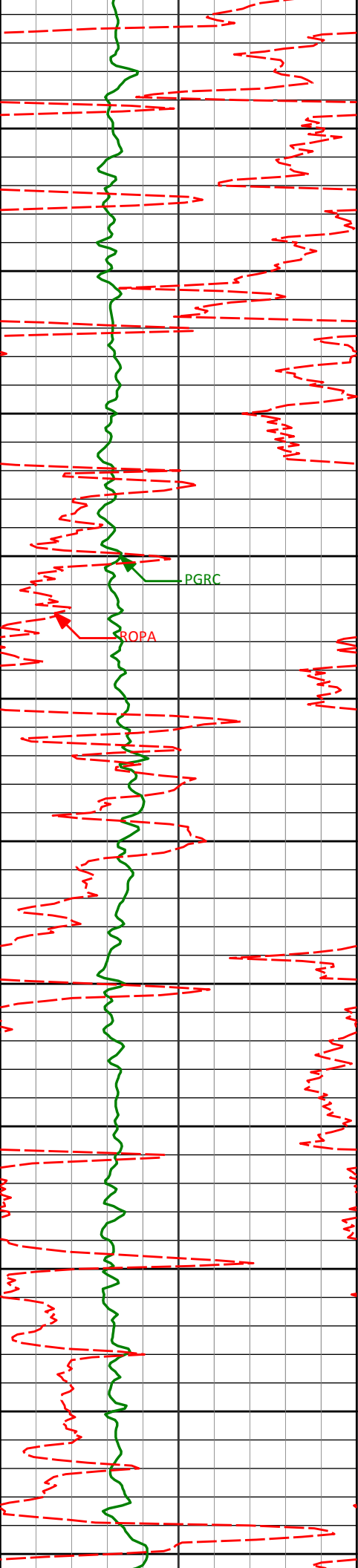
Noble Energy  
NCLP PC AA04-63-1HN  
H&P 321  
Sec. 4-T6N-R63W





720'	0.44°	132.91°	719.98'	1.96'
750				
800				
811'	0.29°	310.20°	810.98'	2.04'
850				
900				
903'	0.09°	267.34°	902.98'	1.80'
950				
996'	0.17°	29.41°	995.98'	1.80'
1000				
1050				
1087'	1.08°	358.88°	1086.98'	1.91'
1100				
1150				
1181'	1.60°	1.99°	1180.95'	2.08'
1200				
1250				





1826'	0.86°	244.26°	1825.77'	4.15'
-------	-------	---------	----------	-------

1850

1900

1919'	1.02°	218.20°	1918.75'	2.95'
-------	-------	---------	----------	-------

1950

2000

2014'	0.65°	241.65°	2013.74'	1.89'
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2050

2100

2150

2200

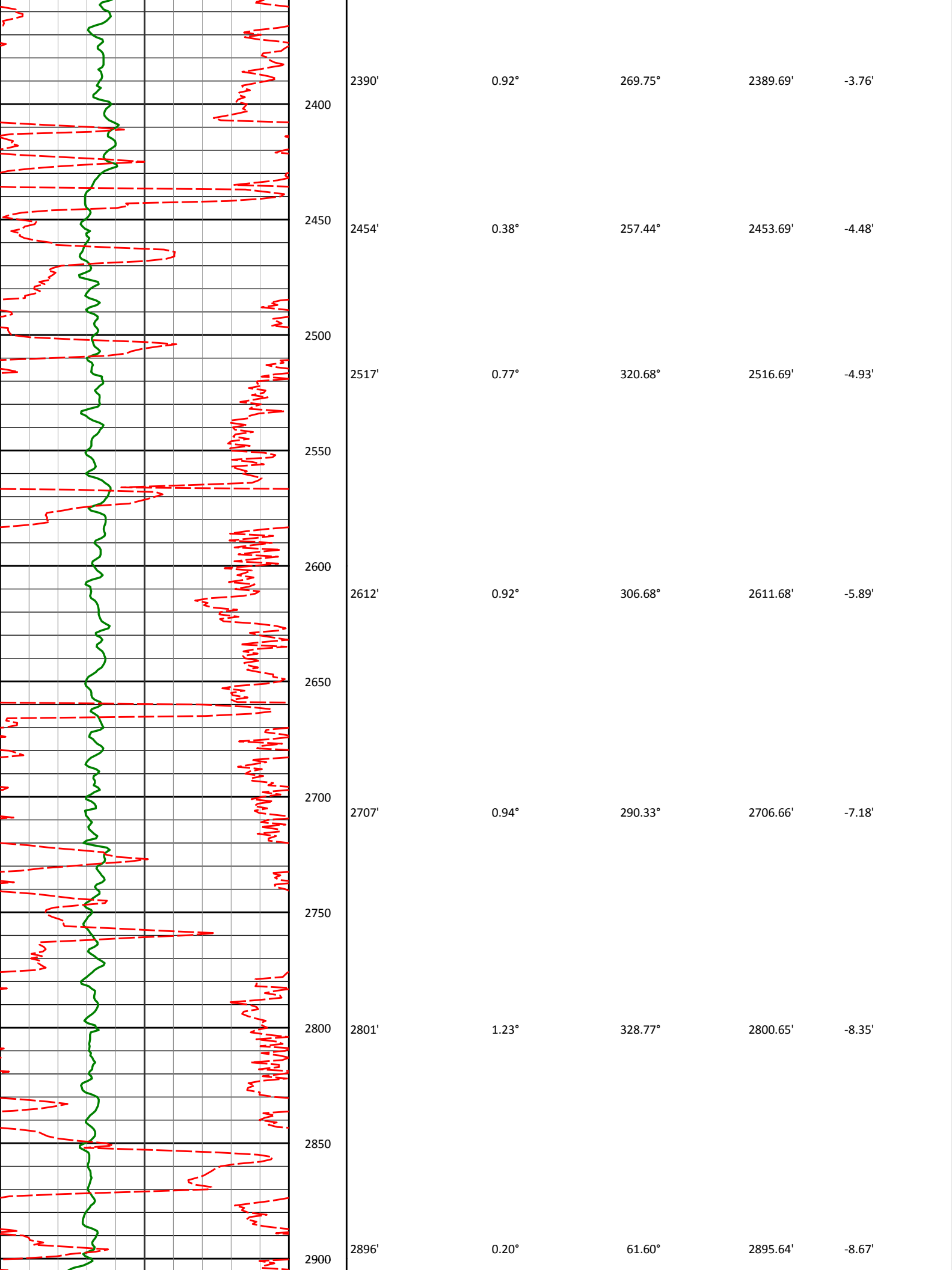
2201'	1.10°	241.08°	2200.72'	-0.69'
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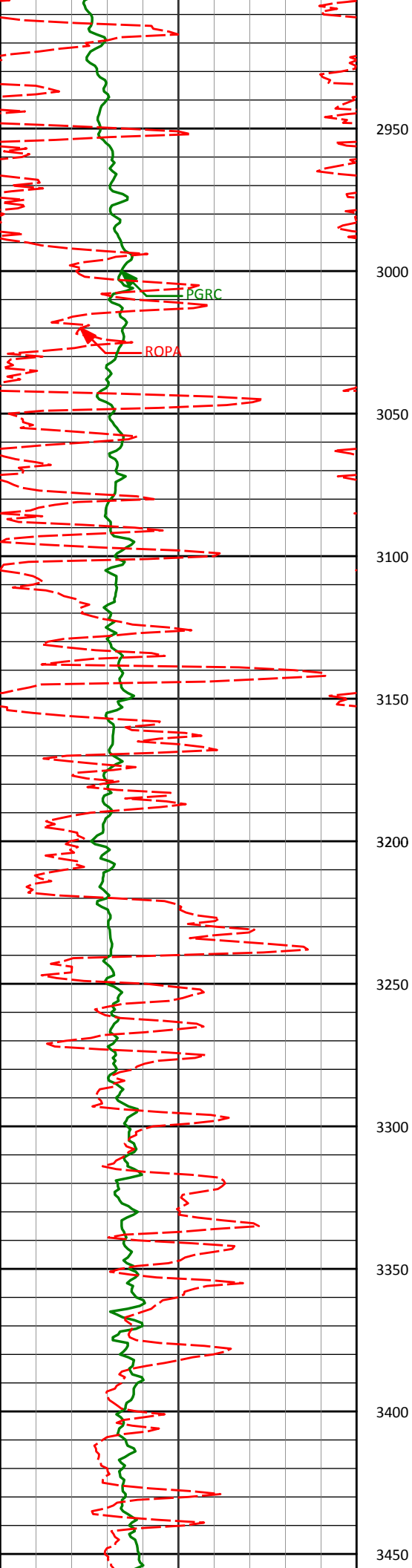
2250

2300

2296'	1.00°	240.62°	2295.71'	-2.26'
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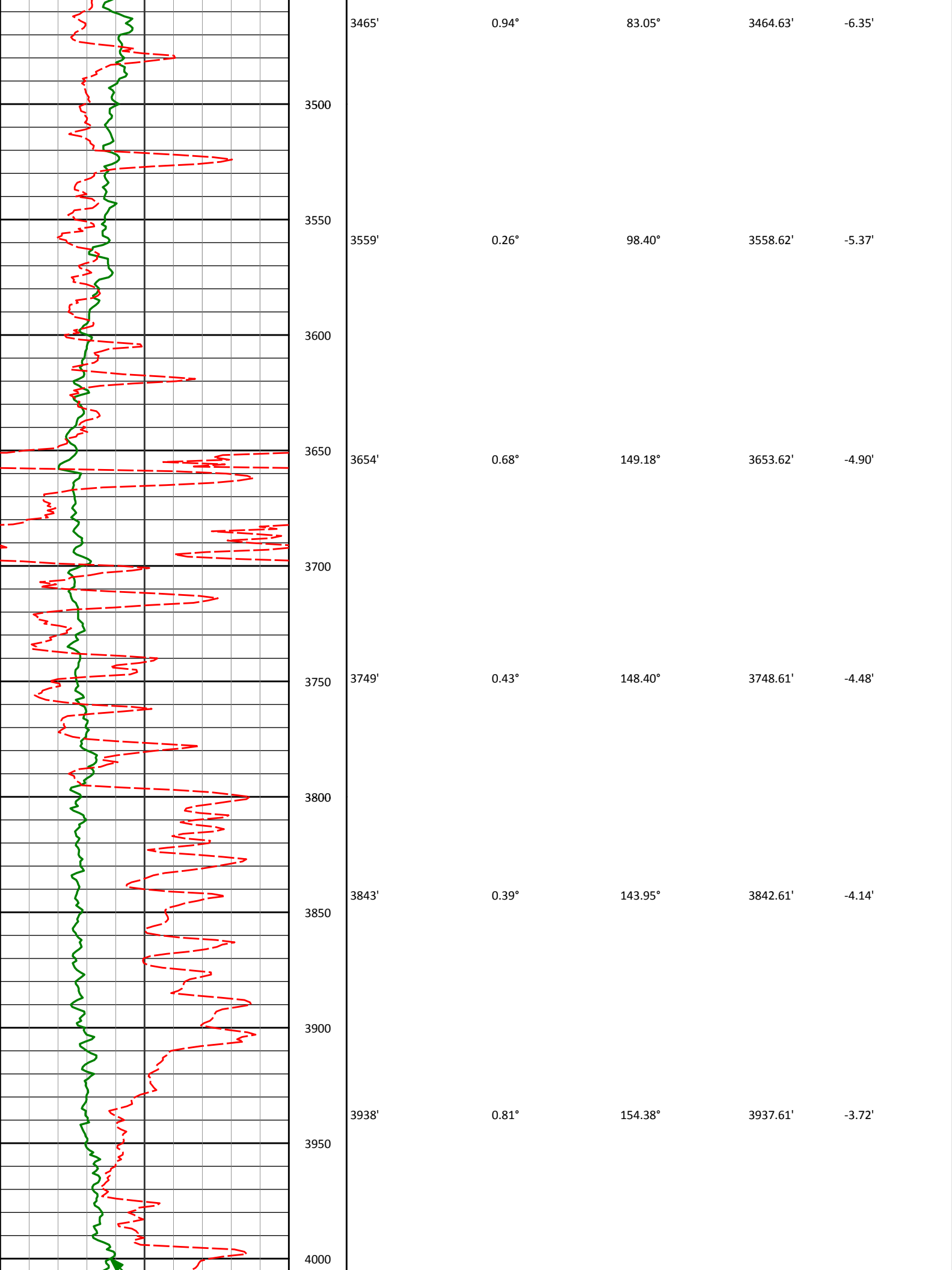
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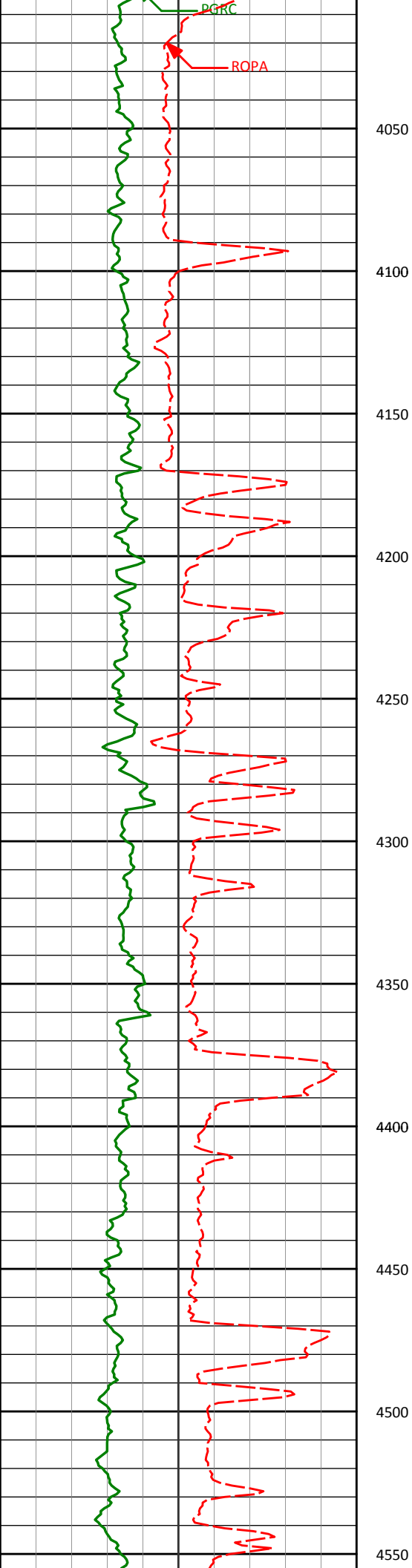




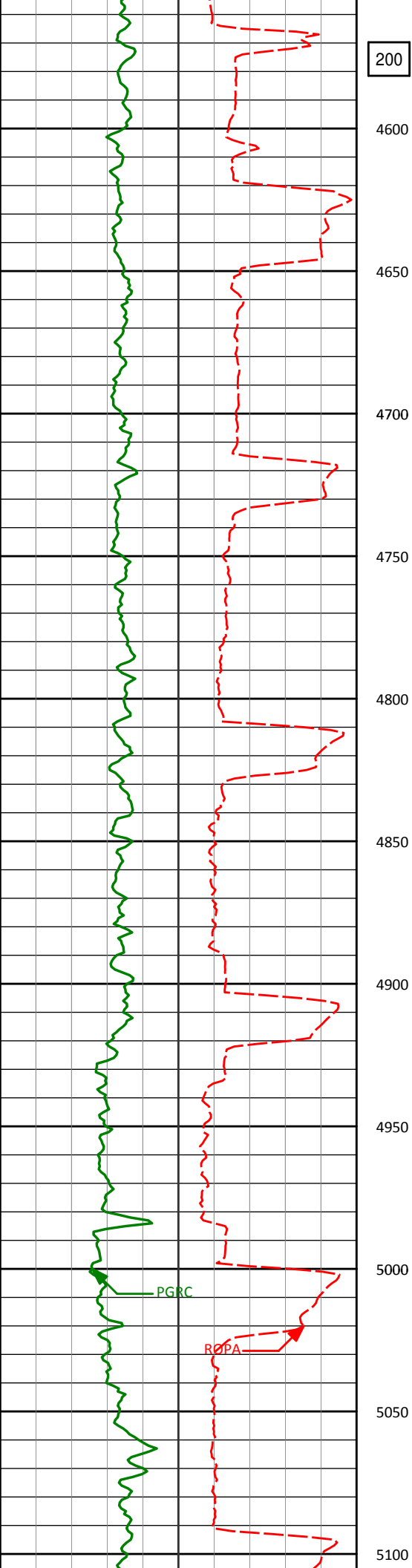
2950				
2991'	0.28°	66.67°	2990.64'	-8.31'
3000				
3050				
3086'	0.28°	167.13°	3085.64'	-8.05'
3100				
3150				
3181'	0.41°	188.67°	3180.64'	-8.08'
3200				
3250				
3275'	0.25°	117.30°	3274.64'	-7.98'
3300				
3350				
3370'	0.47°	116.39°	3369.63'	-7.47'
3400				
3450				



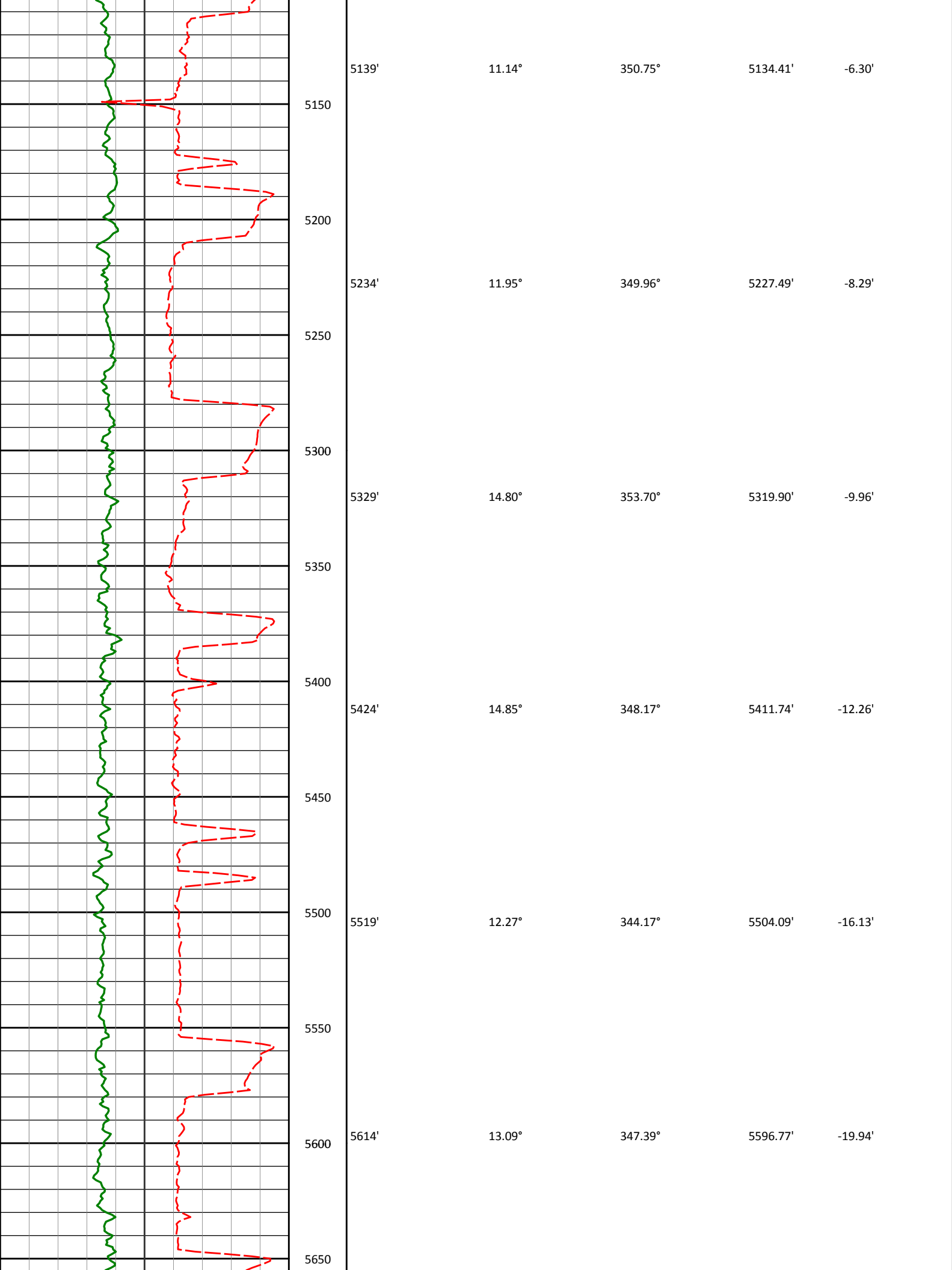


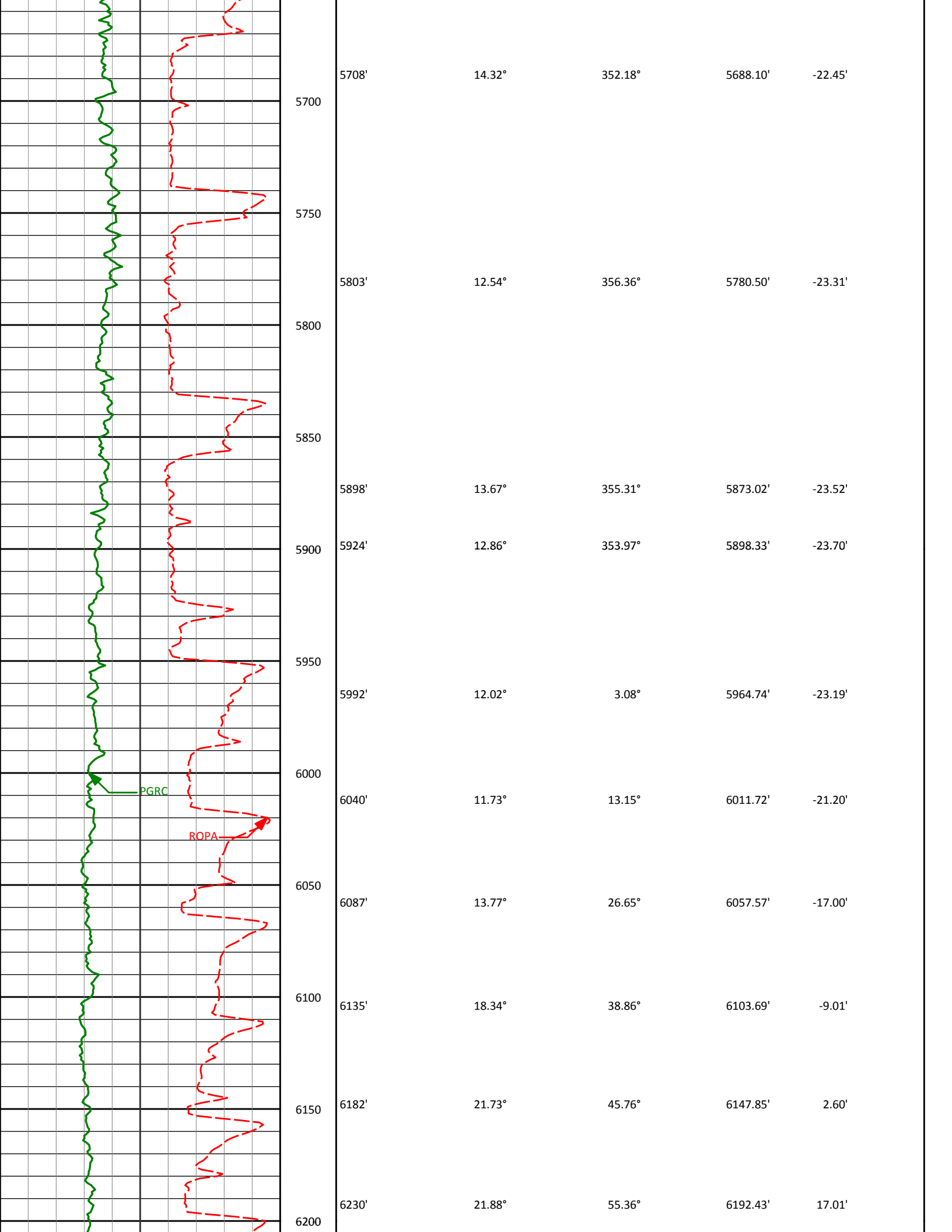


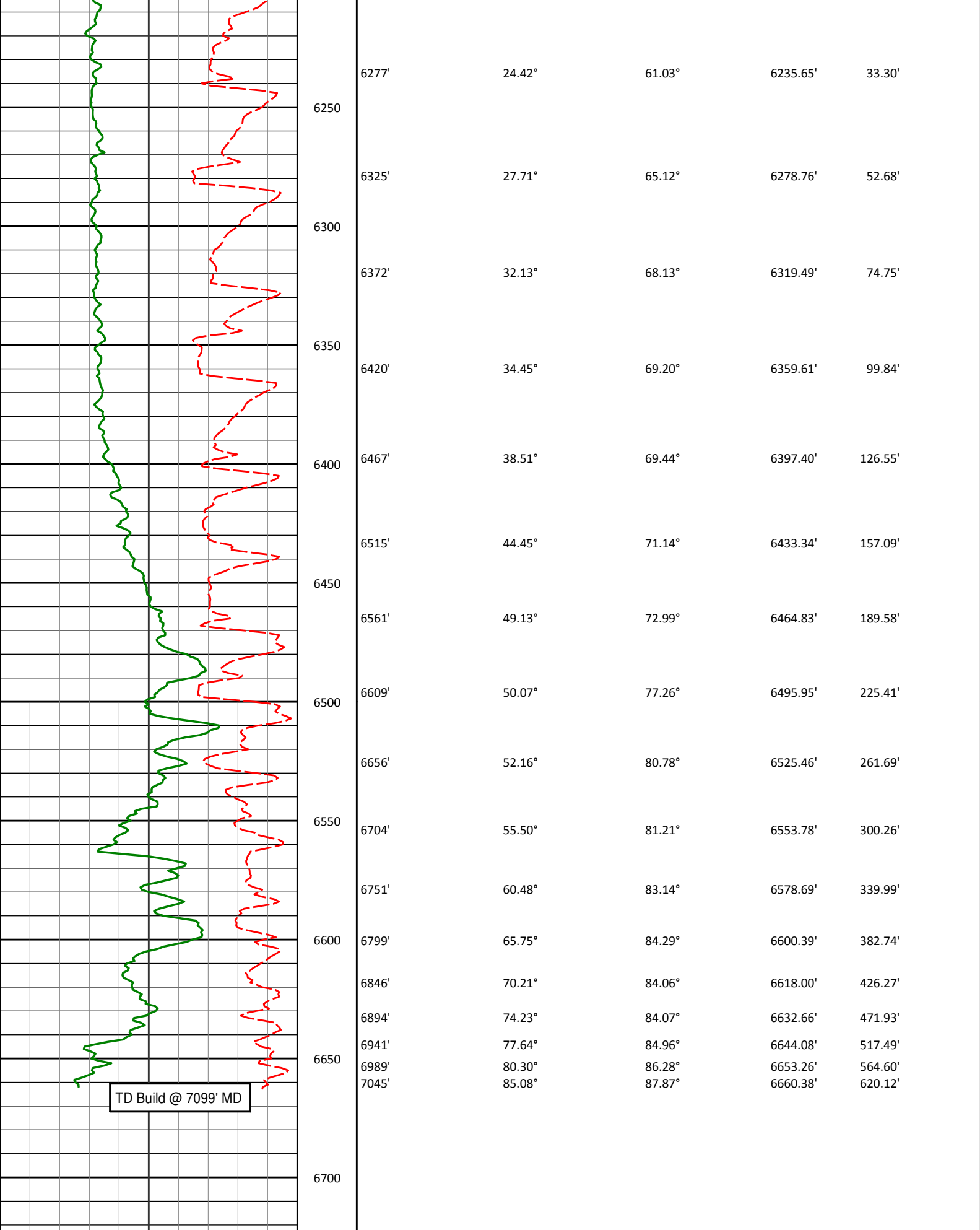
4033'	0.68°	160.63°	4032.60'	-3.31'
4050				
4100				
4128'	0.84°	151.61°	4127.59'	-2.87'
4150				
4200				
4223'	0.99°	148.30°	4222.58'	-2.19'
4250				
4300				
4318'	1.51°	143.74°	4317.55'	-1.13'
4350				
4400				
4413'	0.89°	166.22°	4412.53'	-0.32'
4450				
4500				
4550				



4570'	0.62°	211.32°	4569.52'	0.13'
4600				
4650				
4665'	3.26°	342.09°	4664.47'	-0.83'
4700				
4750				
4760'	4.90°	344.25°	4759.23'	-2.34'
4800				
4850				
4855'	6.50°	349.46°	4853.76'	-3.84'
4900				
4950				
4949'	7.23°	354.66°	4947.08'	-4.66'
5000				
5044'	9.93°	354.41°	5041.01'	-5.12'
5050				
5100				

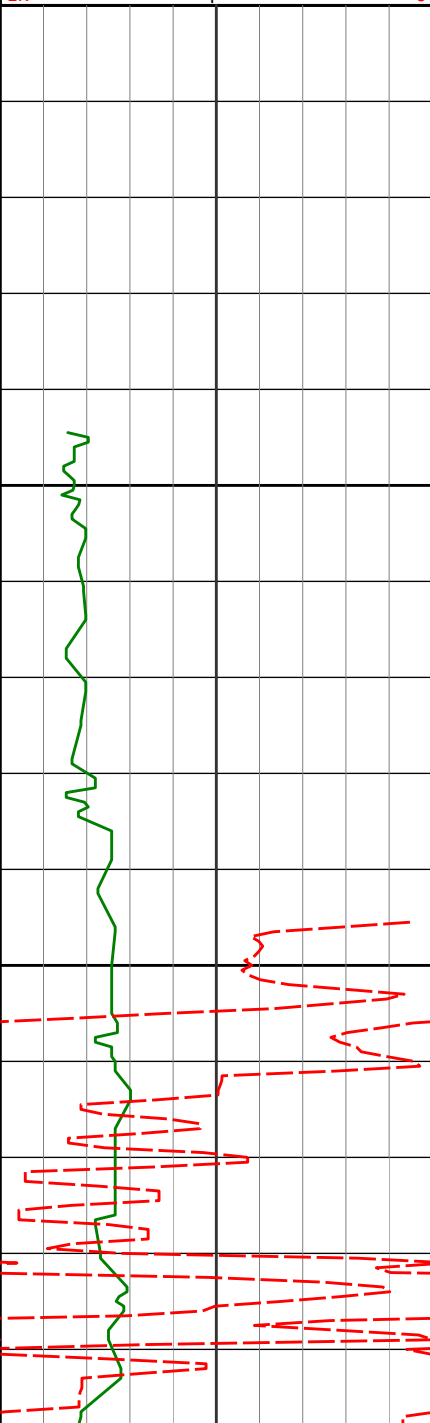



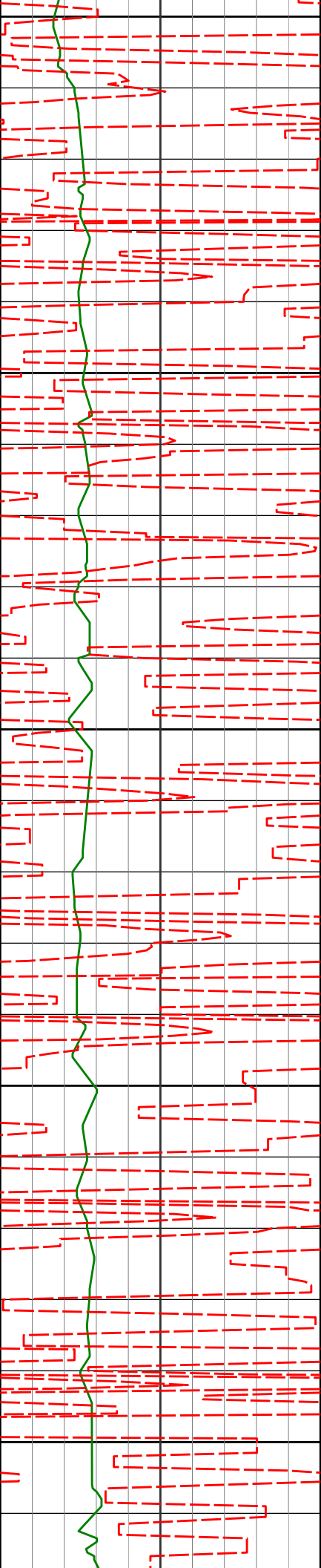




TD Build @ 7099' MD

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

PCG Gamma Ray							
PGRC							
0							
api							
300							
Avg Rate of Penetration		Depth	Inc.	Azi.	TVD	V.S.	
ROPA		ft					
feet per hr							
1K							
0							
		550					
		600	595'	0.90°	65.31°	594.99'	0.72'
		650					



700

720'

0.44°

132.91°

719.98'

1.96'

750

800

811'

0.29°

310.20°

810.98'

2.04'

850

900

903'

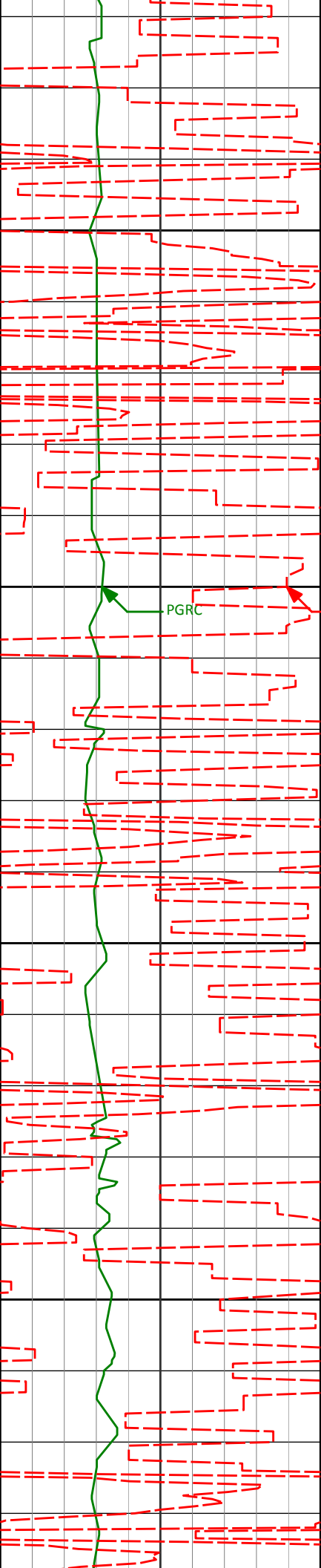
0.09°

267.34°

902.98'

1.80'





950

996'

0.17°

29.41°

995.98'

1.80'

1000

PGRC

ROPA

1050

1087'

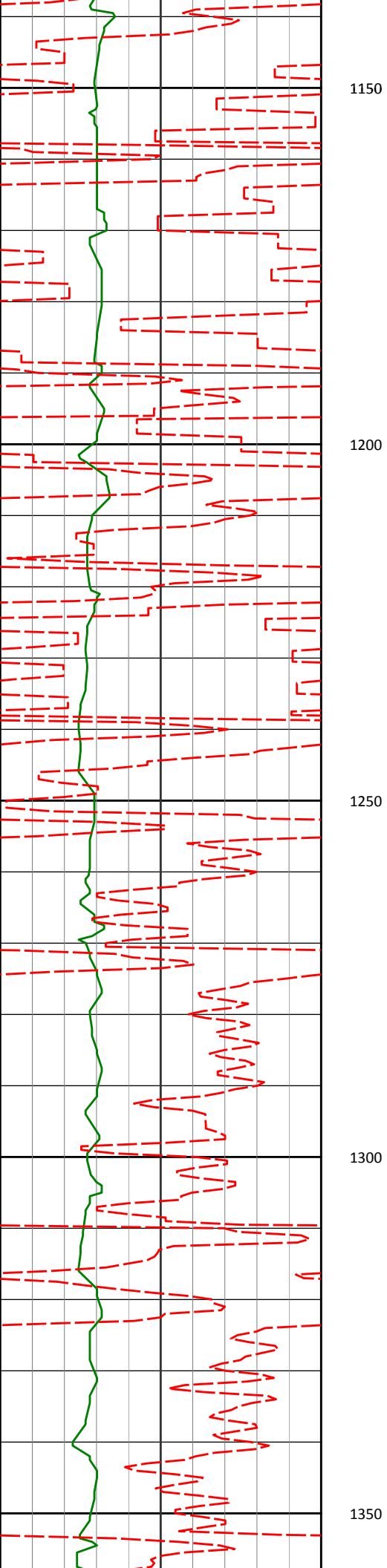
1.08°

358.88°

1086.98'

1.91'

1100



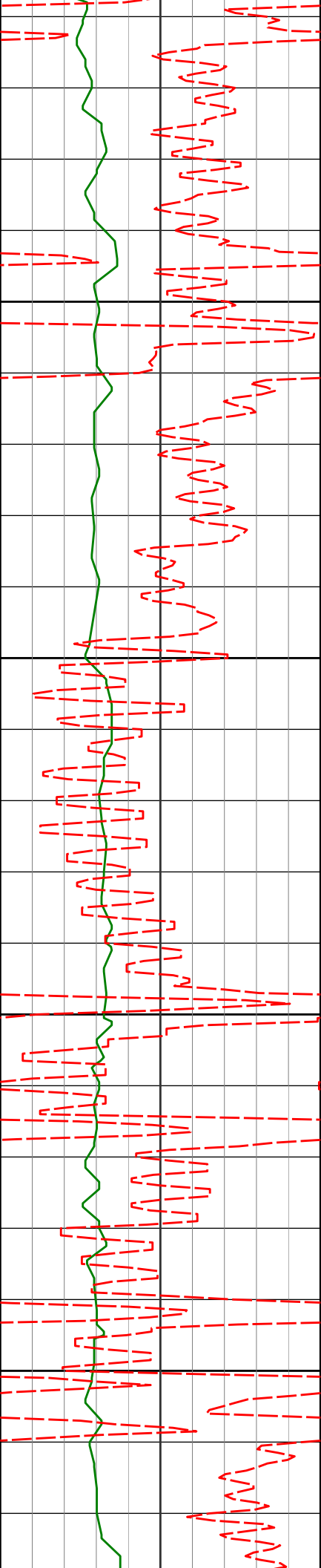
1181'

1.60°

1.99°

1180.95'

2.08'



1365'

1.42°

4.51°

1364.89'

2.65'

1400

1450

1458'

1.74°

10.64°

1457.85'

3.16'

1500

1550

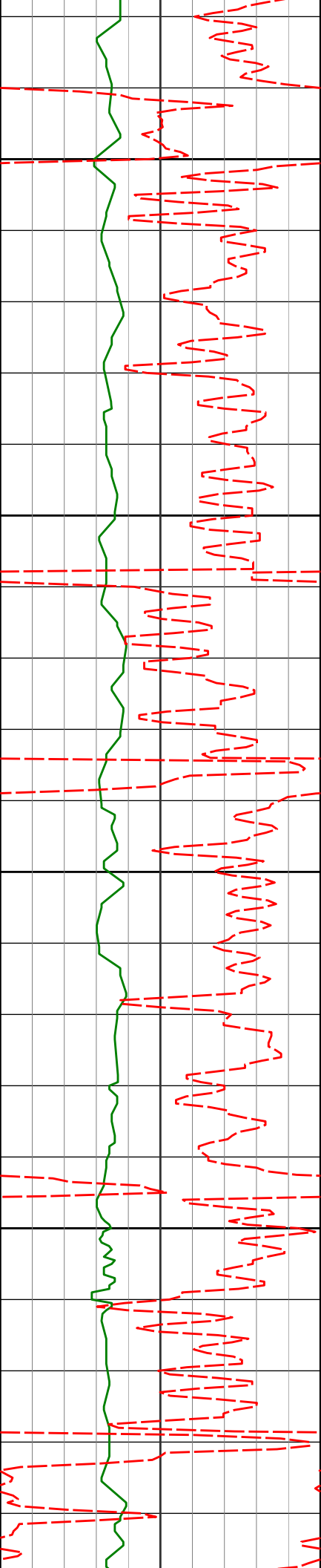
1550'

1.49°

8.51°

1549.82'

3.76'



1600

1650

1700

1750

1642'

1.10°

6.74°

1641.79'

4.17'

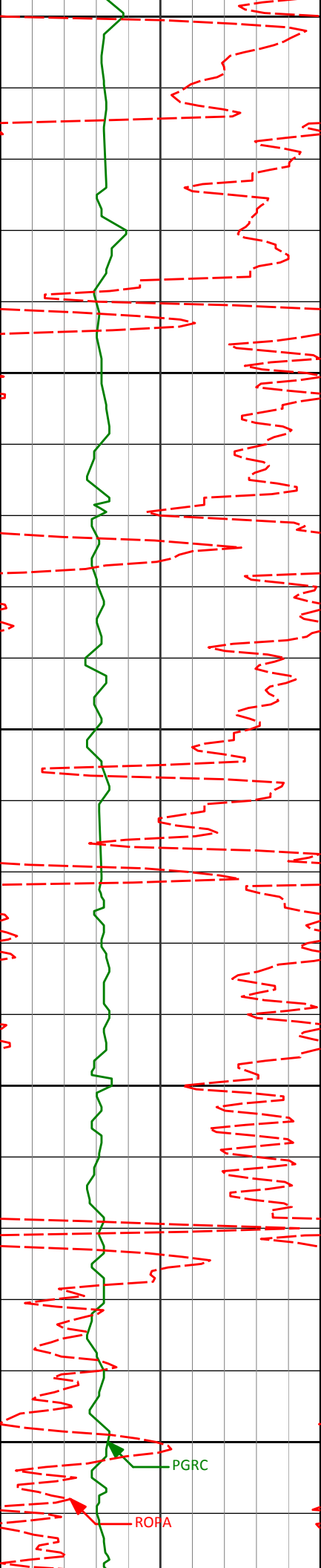
1733'

1.16°

10.87°

1732.77'

4.56'



1800

1826'

0.86°

244.26°

1825.77'

4.15'

1850

1900

1919'

1.02°

218.20°

1918.75'

2.95'

1950

2000

PGRC

ROFA

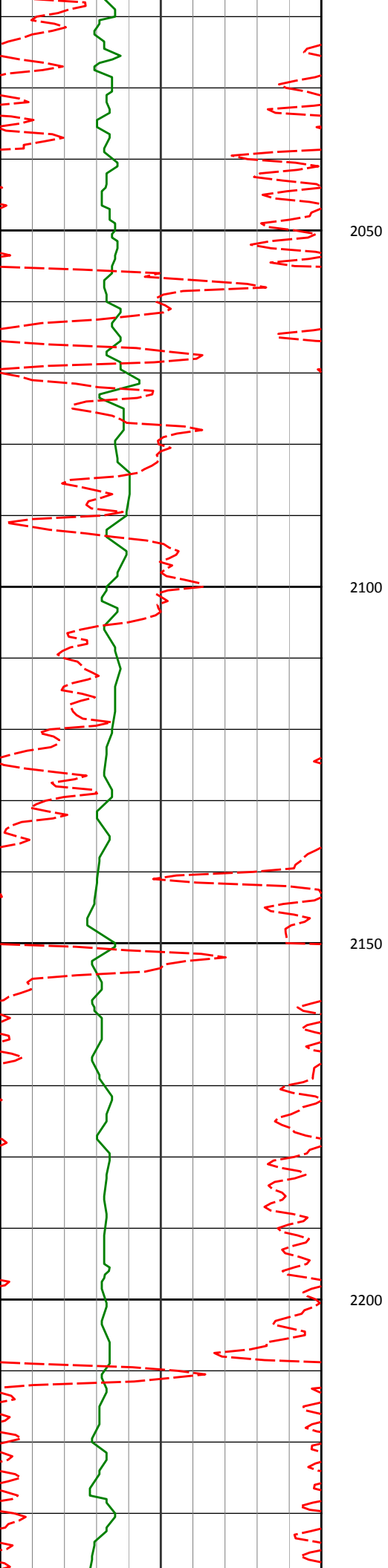
2014'

0.65°

241.65°

2013.74'

1.89'



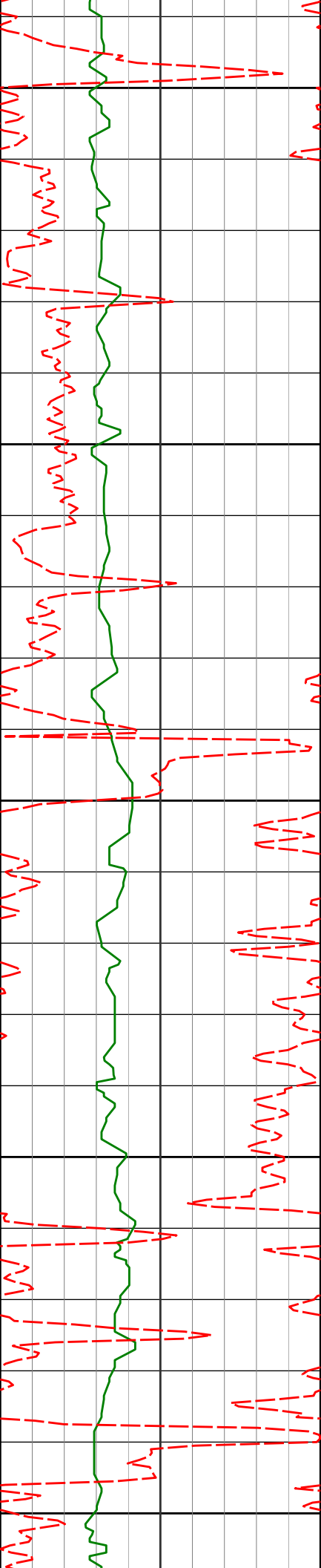
2201'

1.10°

241.08°

2200.72'

-0.69'



2250

2296'

1.00°

240.62°

2295.71'

-2.26'

2300

2350

2390'

0.92°

269.75°

2389.69'

-3.76'

2400

2450

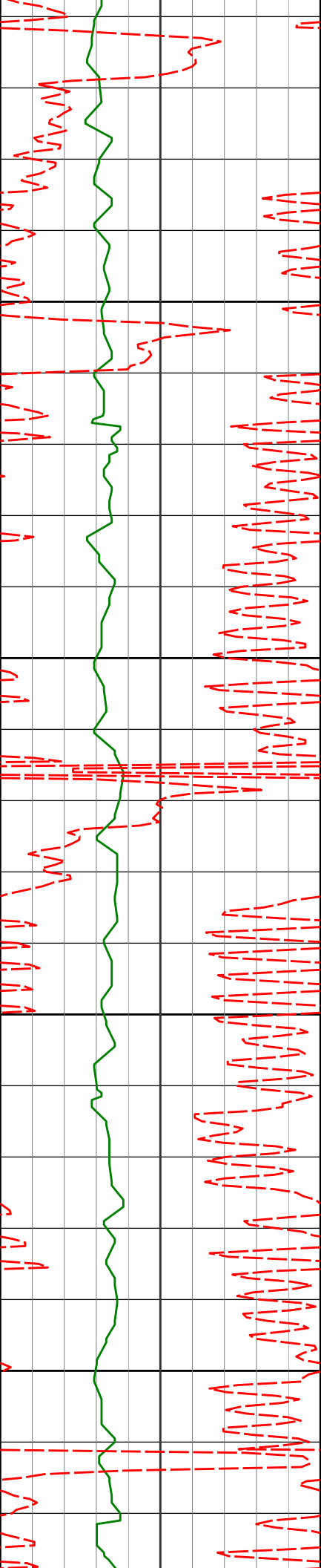
2454'

0.38°

257.44°

2453.69'

-4.48'



2500

2550

2600

2650

2517'

0.77°

320.68°

2516.69'

-4.93'

2612'

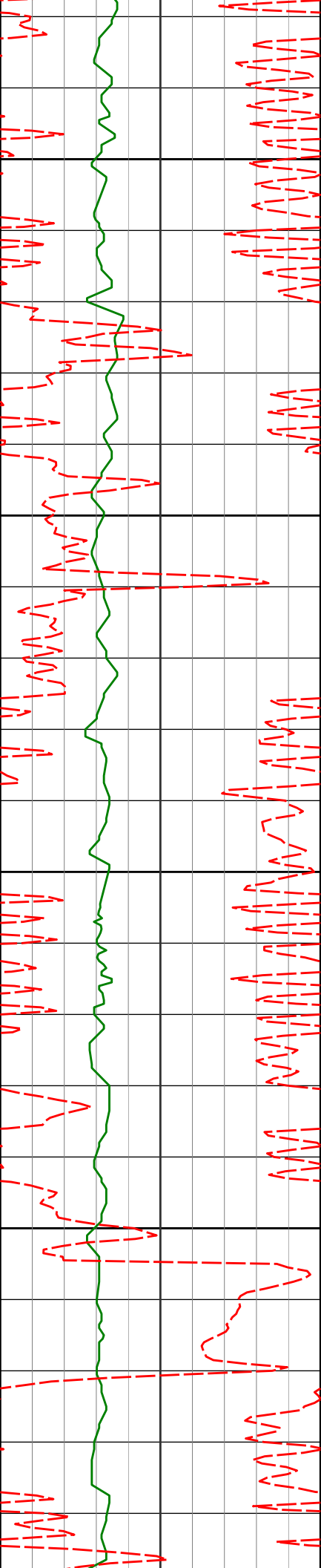
0.92°

306.68°

2611.68'

-5.89'





2700

2707'

0.94°

290.33°

2706.66'

-7.18'

2750

2800

2801'

1.23°

328.77°

2800.65'

-8.35'

2850

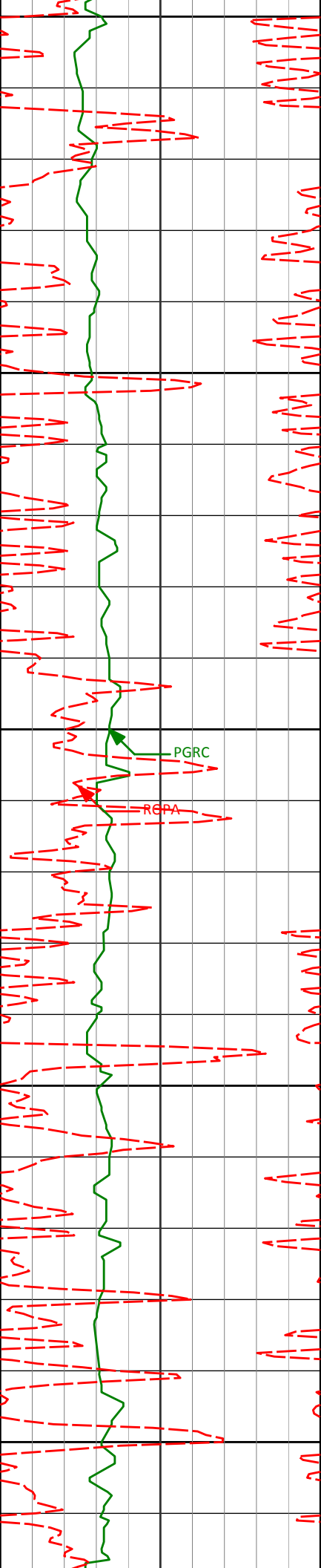
2896'

0.20°

61.60°

2895.64'

-8.67'



2900

2950

2991'

0.28°

66.67°

2990.64'

-8.31'

3000

PGRC

RCPA

3050

3086'

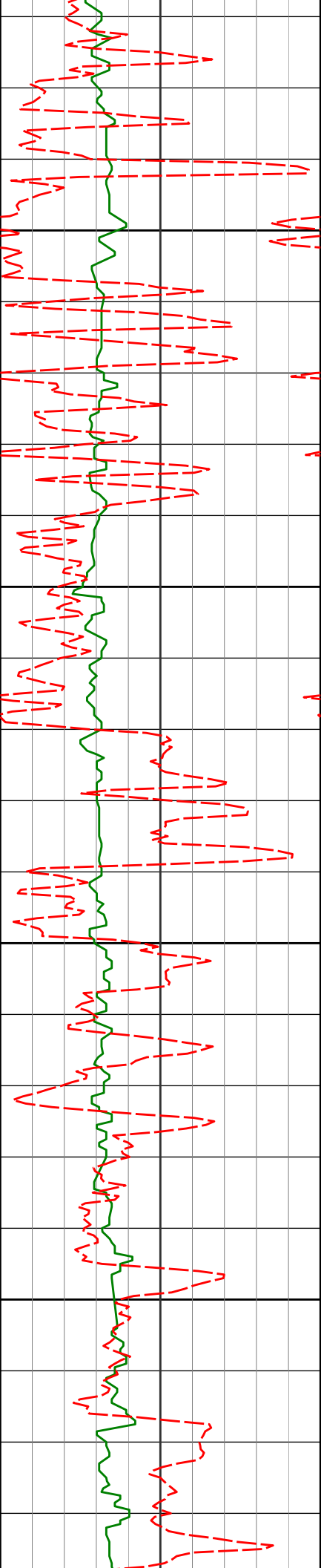
0.28°

167.13°

3085.64'

-8.05'

3100



3150

3200

3250

3300

3181'

0.41°

188.67°

3180.64'

-8.08'

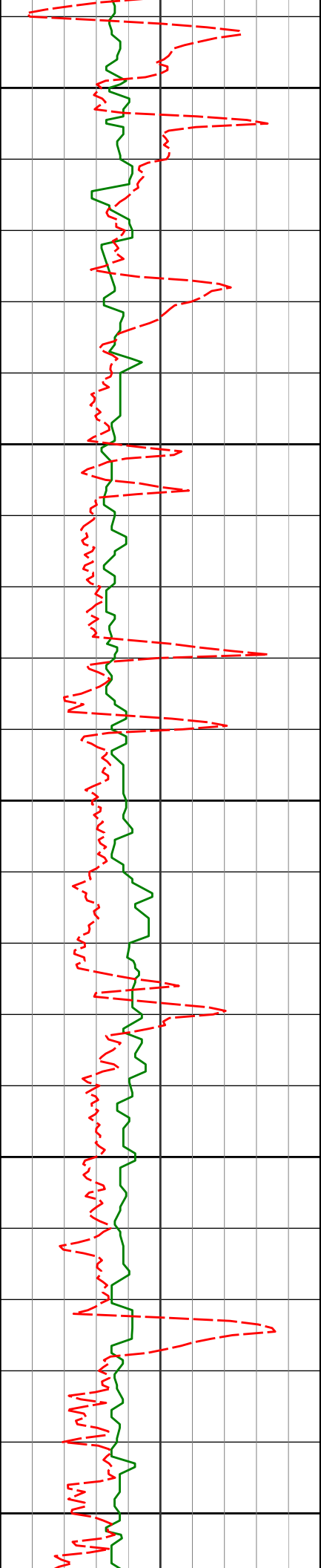
3275'

0.25°

117.30°

3274.64'

-7.98'



3350

3370'

0.47°

116.39°

3369.63'

-7.47'

3400

3450

3465'

0.94°

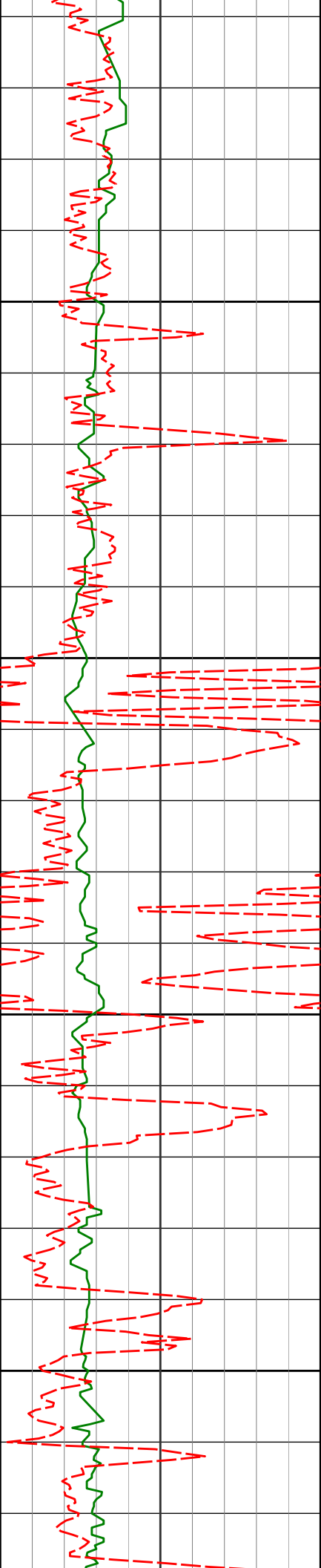
83.05°

3464.63'

-6.35'

3500

3550



3600

3650

3700

3750

3559'

0.26°

98.40°

3558.62'

-5.37'

3654'

0.68°

149.18°

3653.62'

-4.90'

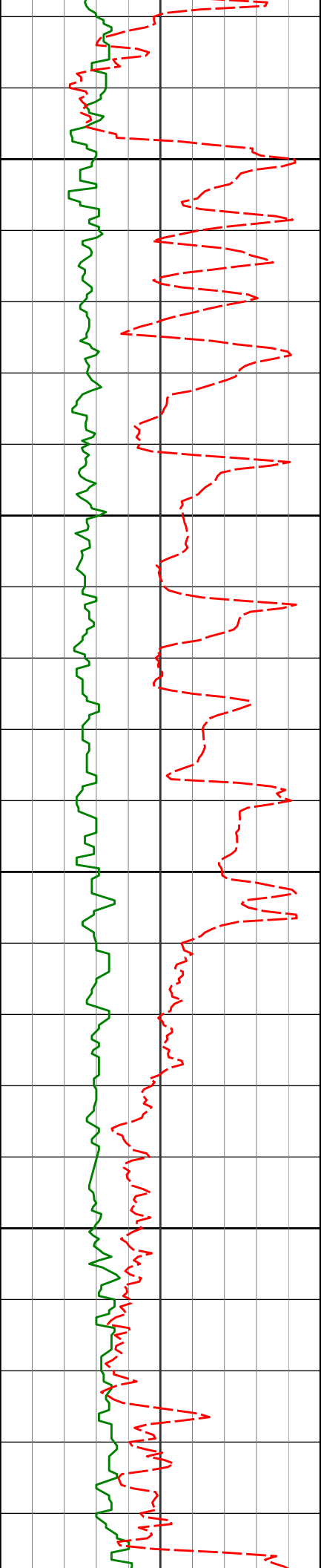
3749'

0.43°

148.40°

3748.61'

-4.48'



3800

3843'

0.39°

143.95°

3842.61'

-4.14'

3850

3900

3938'

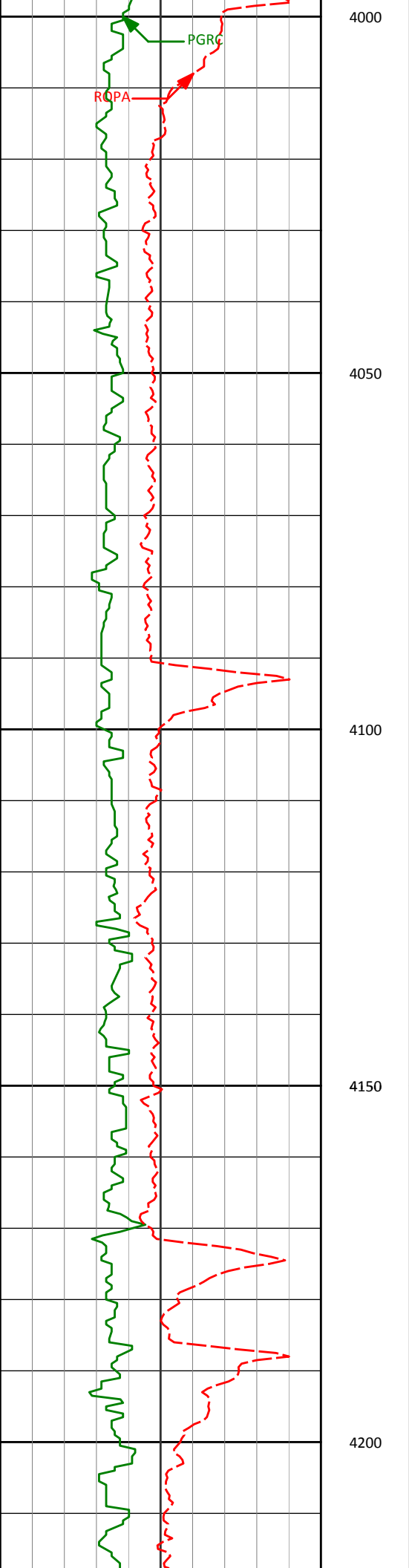
0.81°

154.38°

3937.61'

-3.72'

3950



4033'

0.68°

160.63°

4032.60'

-3.31'

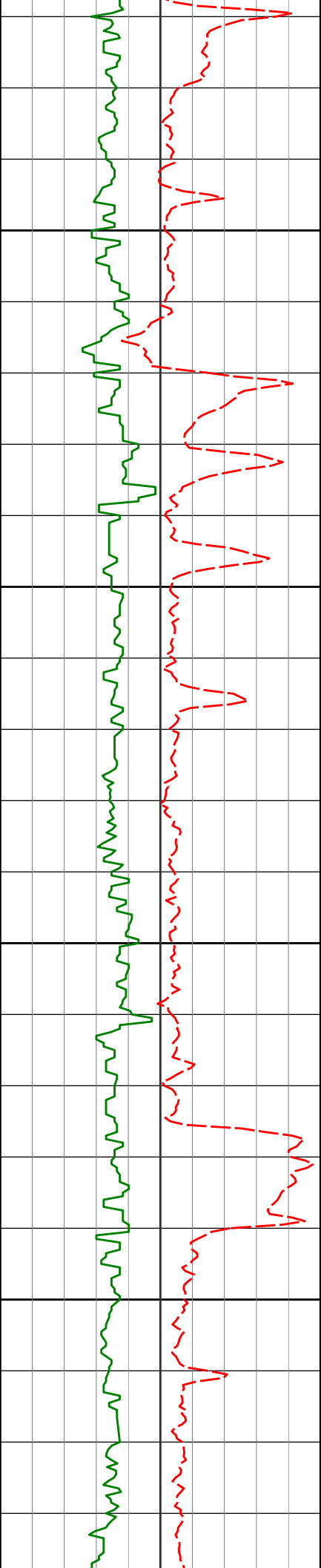
4128'

0.84°

151.61°

4127.59'

-2.87'



4223'

0.99°

148.30°

4222.58'

-2.19'

4250

4300

4318'

1.51°

143.74°

4317.55'

-1.13'

4350

4400

4413'

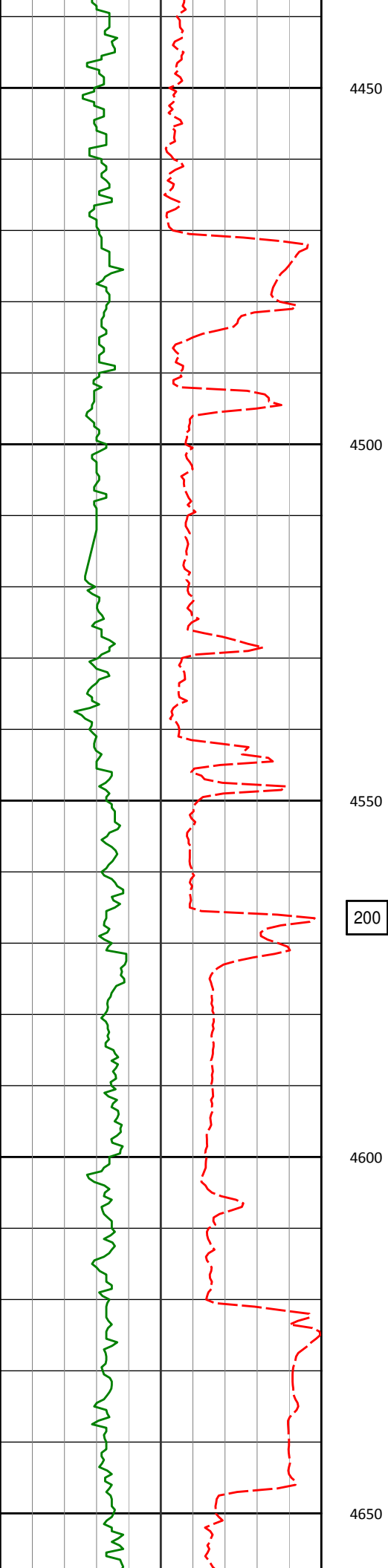
0.89°

166.22°

4412.53'

-0.32'





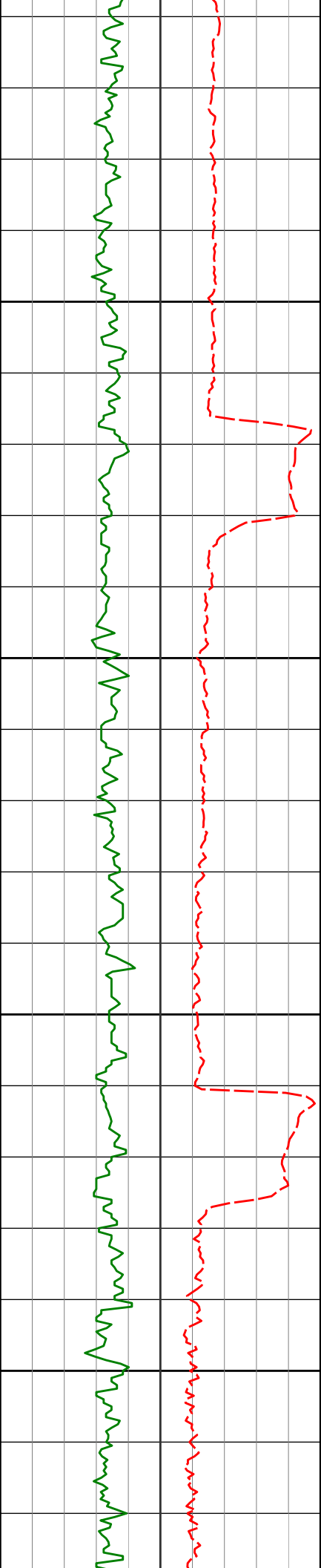
4570'

0.62°

211.32°

4569.52'

0.13'



4665'

3.26°

342.09°

4664.47'

-0.83'

4700

4750

4760'

4.90°

344.25°

4759.23'

-2.34'

4800

4850

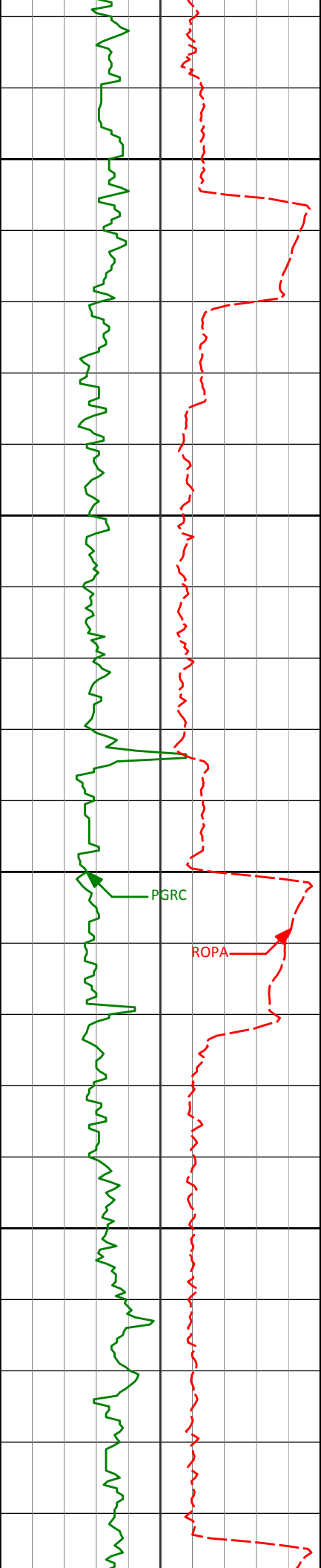
4855'

6.50°

349.46°

4853.76'

-3.84'



4900

4950

5000

5050

4949'

7.23°

354.66°

4947.08'

-4.66'

PGRC

ROPA

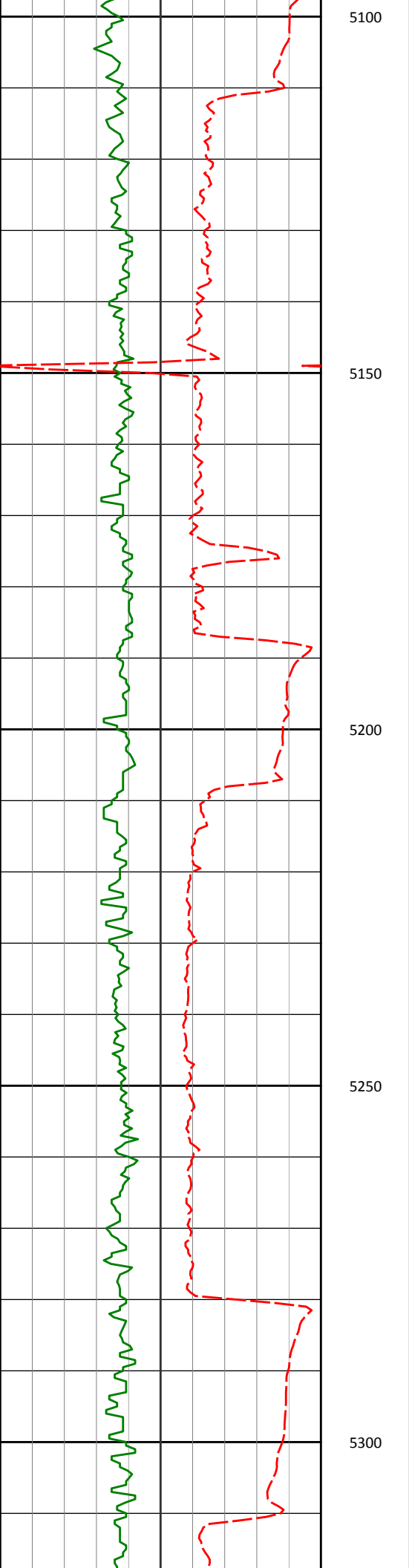
5044'

9.93°

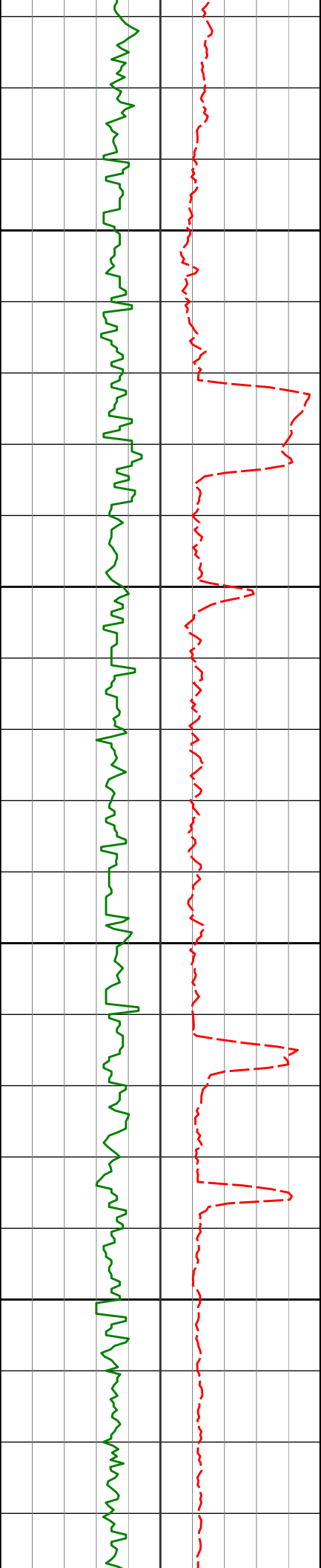
354.41°

5041.01'

-5.12'



5100				
5139'	11.14°	350.75°	5134.41'	-6.30'
5150				
5200				
5234'	11.95°	349.96°	5227.49'	-8.29'
5250				
5300				



5350

5400

5450

5500

5329' 14.80° 353.70° 5319.90' -9.96'

5424' 14.85° 348.17° 5411.74' -12.26'

5519' 12.27° 344.17° 5504.09' -16.13'



5550

5614'

13.09°

347.39°

5596.77'

-19.94'

5600

5650

5708'

14.32°

352.18°

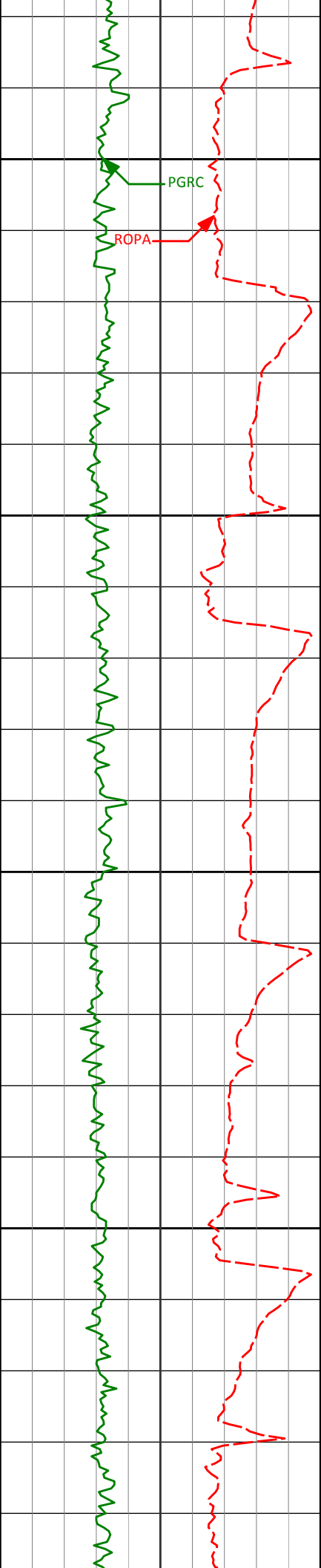
5688.10'

-22.45'

5700

5750





6000

6040'

11.73°

13.15°

6011.72'

-21.20'

6050

6087'

13.77°

26.65°

6057.57'

-17.00'

6100

6135'

18.34°

38.86°

6103.69'

-9.01'

6150

6182'

21.73°

45.76°

6147.85'

2.60'

6230'

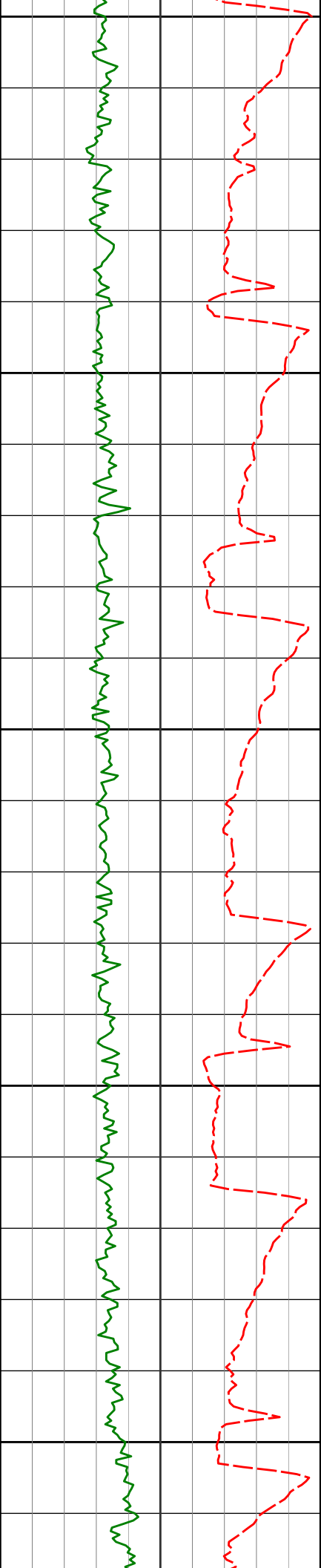
21.88°

55.36°

6192.43'

17.01'





6200

6277'

24.42°

61.03°

6235.65'

33.30'

6250

6325'

27.71°

65.12°

6278.76'

52.68'

6300

6372'

32.13°

68.13°

6319.49'

74.75'

6350

6420'

34.45°

69.20°

6359.61'

99.84'

6400

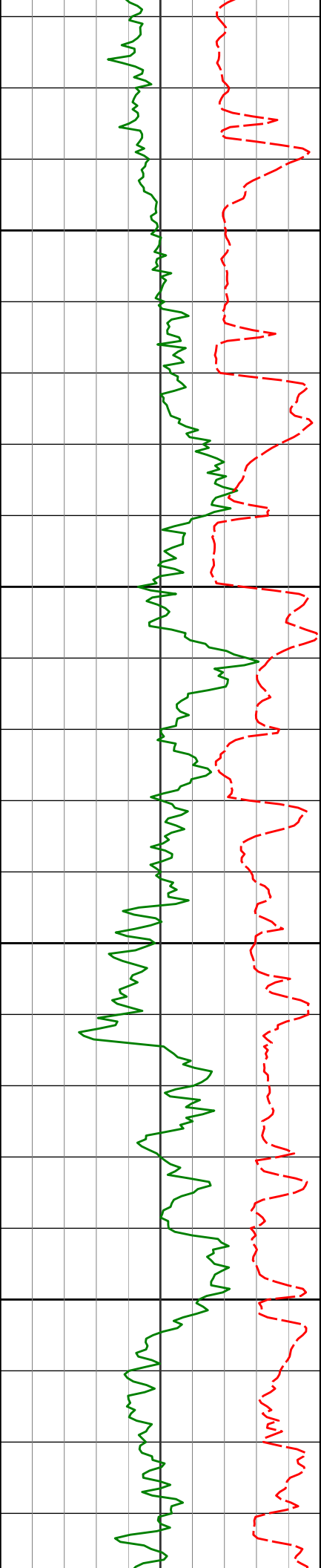
6467'

38.51°

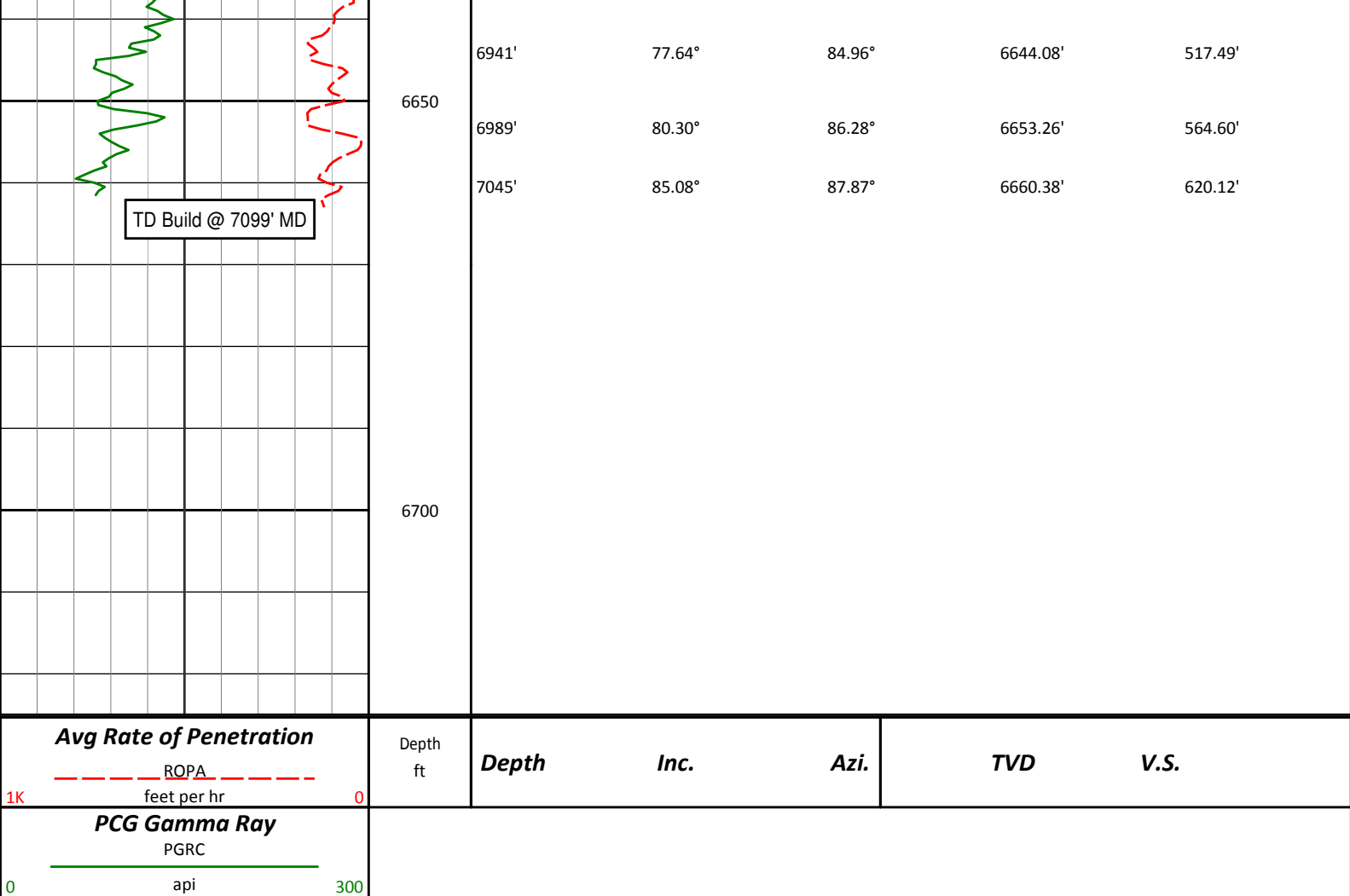
69.44°

6397.40'

126.55'



6450	6515'	44.45°	71.14°	6433.34'	157.09'
	6561'	49.13°	72.99°	6464.83'	189.58'
6500					
	6609'	50.07°	77.26°	6495.95'	225.41'
6550	6656'	52.16°	80.78°	6525.46'	261.69'
	6704'	55.50°	81.21°	6553.78'	300.26'
6600					
	6751'	60.48°	83.14°	6578.69'	339.99'
	6799'	65.75°	84.29°	6600.39'	382.74'
	6846'	70.21°	84.06°	6618.00'	426.27'
	6894'	74.23°	84.07°	6632.66'	471.93'



## HALLIBURTON

### DIRECTIONAL SURVEY REPORT

**Noble Energy**  
**NCLP PC AA04-63-1HN**  
**Wattenburg**  
**Weld Colorado**  
**USA**  
**CA-XX-0900859730**

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
250.00	0.40	140.31	250.00	0.67 S	0.56 E	0.51	0.16
500.00	0.40	299.51	500.00	0.91 S	0.36 E	0.30	0.31
595.00	0.90	65.31	594.99	0.44 S	0.74 E	0.72	1.24
720.00	0.44	132.91	719.98	0.35 S	1.99 E	1.96	0.67
811.00	0.29	310.20	810.98	0.44 S	2.07 E	2.04	0.80
903.00	0.09	267.34	902.98	0.30 S	1.82 E	1.80	0.25
996.00	0.17	29.41	995.98	0.18 S	1.81 E	1.80	0.25
1087.00	1.08	358.88	1086.98	0.79 N	1.86 E	1.91	1.03
1181.00	1.60	1.99	1180.95	2.99 N	1.89 E	2.08	0.56
1365.00	1.42	4.51	1364.89	7.83 N	2.16 E	2.65	0.10
1458.00	1.74	10.64	1457.85	10.37 N	2.51 E	3.16	0.39
1550.00	1.49	8.51	1549.82	12.92 N	2.95 E	3.76	0.28
1642.00	1.10	6.74	1641.79	14.98 N	3.23 E	4.17	0.43
1733.00	1.16	10.87	1732.77	16.76 N	3.50 E	4.56	0.11
1826.00	0.86	244.26	1825.77	17.38 N	3.05 E	4.15	1.95
1919.00	1.02	218.20	1918.75	16.42 N	1.91 E	2.95	0.49
2014.00	0.65	241.65	2013.74	15.50 N	0.91 E	1.89	0.52
2111.00	0.42	211.22	2110.73	14.52 N	1.50 W	1.82	0.24

2201.00	1.10	241.08	2200.72	14.13 N	1.59 W	-0.69	0.24
2296.00	1.00	240.62	2295.71	13.28 N	3.11 W	-2.26	0.11
2390.00	0.92	269.75	2389.69	12.88 N	4.58 W	-3.76	0.52
2454.00	0.38	257.44	2453.69	12.83 N	5.30 W	-4.48	0.87
2517.00	0.77	320.68	2516.69	13.11 N	5.77 W	-4.93	1.09
2612.00	0.92	306.68	2611.68	14.06 N	6.79 W	-5.89	0.27
2707.00	0.94	290.33	2706.66	14.79 N	8.13 W	-7.18	0.28
2801.00	1.23	328.77	2800.65	15.92 N	9.38 W	-8.35	0.81
2896.00	0.20	61.60	2895.64	16.87 N	9.76 W	-8.67	1.32
2991.00	0.28	66.67	2990.64	17.04 N	9.40 W	-8.31	0.09
3086.00	0.28	167.13	3085.64	16.91 N	9.14 W	-8.05	0.45
3181.00	0.41	188.67	3180.64	16.34 N	9.14 W	-8.08	0.19
3275.00	0.25	117.30	3274.64	15.92 N	9.01 W	-7.98	0.43
3370.00	0.47	116.39	3369.63	15.65 N	8.47 W	-7.47	0.23
3465.00	0.94	83.05	3464.63	15.57 N	7.35 W	-6.35	0.64
3559.00	0.26	98.40	3558.62	15.63 N	6.37 W	-5.37	0.74
3654.00	0.68	149.18	3653.62	15.12 N	5.87 W	-4.90	0.58
3749.00	0.43	148.40	3748.61	14.33 N	5.40 W	-4.48	0.26
3843.00	0.39	143.95	3842.61	13.77 N	5.02 W	-4.14	0.05
3938.00	0.81	154.38	3937.61	12.90 N	4.54 W	-3.72	0.45
4033.00	0.68	160.63	4032.60	11.77 N	4.07 W	-3.31	0.16
4128.00	0.84	151.61	4127.59	10.62 N	3.55 W	-2.87	0.21
4223.00	0.99	148.30	4222.58	9.31 N	2.78 W	-2.19	0.17
4318.00	1.51	143.74	4317.55	7.60 N	1.61 W	-1.13	0.56
4413.00	0.89	166.22	4412.53	5.88 N	0.70 W	-0.32	0.81
4512.00	0.84	150.46	4511.52	4.50 N	0.16 W	0.13	0.24
4570.00	0.62	211.32	4569.52	3.86 N	0.11 W	0.13	1.32
4665.00	3.26	342.09	4664.47	5.99 N	1.21 W	-0.83	3.89
4760.00	4.90	344.25	4759.23	12.47 N	3.14 W	-2.34	1.73
4855.00	6.50	349.46	4853.76	21.66 N	5.23 W	-3.84	1.77
4949.00	7.23	354.66	4947.08	32.78 N	6.75 W	-4.66	1.02
5044.00	9.93	354.41	5041.01	46.89 N	8.10 W	-5.12	2.84
5139.00	11.14	350.75	5134.41	64.10 N	10.38 W	-6.30	1.45
5234.00	11.95	349.96	5227.49	82.84 N	13.57 W	-8.29	0.87
5329.00	14.80	353.70	5319.90	104.59 N	16.61 W	-9.96	3.13
5424.00	14.85	348.17	5411.74	128.57 N	20.44 W	-12.26	1.49
5519.00	12.27	344.17	5504.09	150.20 N	25.69 W	-16.13	2.89
5614.00	13.09	347.39	5596.77	170.41 N	30.79 W	-19.94	1.14
5708.00	14.32	352.18	5688.10	192.32 N	34.70 W	-22.45	1.78
5803.00	12.54	356.36	5780.50	214.25 N	36.95 W	-23.31	2.13
5898.00	13.67	355.31	5873.02	235.73 N	38.53 W	-23.52	1.22
5924.00	12.86	353.97	5898.33	241.67 N	39.08 W	-23.70	3.33
5992.00	12.02	3.08	5964.74	256.27 N	39.50 W	-23.19	3.14
6040.00	11.73	13.15	6011.72	266.01 N	38.12 W	-21.20	4.35
6087.00	13.77	26.65	6057.57	275.67 N	34.52 W	-17.00	7.65
6135.00	18.34	38.86	6103.69	286.66 N	27.21 W	-9.01	11.79
6182.00	21.73	45.76	6147.85	298.49 N	16.34 W	2.60	8.78
6230.00	21.88	55.36	6192.43	309.78 N	2.61 W	17.01	7.43
6277.00	24.42	61.03	6235.65	319.47 N	13.10 E	33.30	7.18
6325.00	27.71	65.12	6278.76	328.97 N	31.91 E	52.68	7.81
6372.00	32.13	68.13	6319.49	338.23 N	53.44 E	74.75	9.93
6420.00	34.45	69.20	6359.61	347.81 N	77.98 E	99.84	4.99
6467.00	38.51	69.44	6397.40	357.67 N	104.12 E	126.55	8.64
6515.00	44.45	71.14	6433.34	368.36 N	134.04 E	157.09	12.59
6561.00	49.13	72.99	6464.83	378.66 N	165.93 E	189.58	10.59
6609.00	50.07	77.26	6495.95	388.03 N	201.25 E	225.41	7.05
6656.00	52.16	80.78	6525.46	394.98 N	237.16 E	261.69	7.33
6704.00	55.50	81.21	6553.78	401.04 N	275.42 E	300.26	7.00
6751.00	60.48	83.14	6578.69	406.45 N	314.89 E	339.99	11.15
6799.00	65.75	84.29	6600.39	411.12 N	357.43 E	382.74	11.18
6846.00	70.21	84.06	6618.00	415.55 N	400.77 E	426.27	9.50
6894.00	74.23	84.07	6632.66	420.27 N	446.22 E	471.93	8.38
6941.00	77.64	84.96	6644.08	424.63 N	491.60 E	517.49	7.48
6989.00	80.30	86.28	6653.26	428.22 N	538.57 E	564.60	6.16
7045.00	85.08	87.87	6660.38	431.05 N	594.02 E	620.12	8.99

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 86.37 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.71 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 7045.00 FEET  
IS 733.94 FEET ALONG 54.03 DEGREES (GRID)

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

Depth 250 Inc 0.4 Azi 140.31

Depth 500 Inc 0.4 Azi 299.51

Depth 595 Inc 0.9 Azi 65.31

Tied in @ Surface

Magnetic direction of 7.712 has been added to AZI for grid direction correction.

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