

## PCGK - Pressure Case Gamma

**1 : 600 / 1 : 240**

[illegible]

## WELL INFORMATION

MWD Run Number	100	200			
Date run completed	12-Dec-13	13-Dec-13			
Rig Bit Number	2	3			
Bit Size (in)	8.750	8.750			
Tool Nominal OD (in)	6.860	6.860			
Log Start Depth (MD, ft)	758.00	5,583.00			
Log End Depth (MD, ft)	5,583.00	7,087.00			
Drill or Wipe	Drill	Drill			
Drill/Wipe Start Date and Time	11-Dec-13 06:10	12-Dec-13 14:00			
Drill/Wipe End Date and Time	12-Dec-13 05:00	13-Dec-13 10:33			
Min Inc (deg) @ Depth (MD, ft)	0.11 @ 2,105.00	11.54 @ 5,611.00			
Max Inc (deg) @ Depth (MD, ft)	14.12 @ 5,043.00	81.29 @ 7,033.00			
Bit TFA(in2) / Bit Type	0.78 / PDC	1.24 / PDC			
Flow Rate (gpm)	556.69	539.55			
Max AV (fpm) / CV (fpm) @ MWD	N/A / N/A	N/A / N/A			
Fluid Type	Fresh Water Gel	Fresh Water Gel			
Density (ppg) / Viscosity (spqt)	8.70 / 32.00	9.20 / 39.00			
Filtrate CL (ppm)	2,100.00	2,800.00			
pH / Fluid Loss (mptm)	8.30 / 13	8.00 / 7			
PV (cP) / YP (lbf2)	6 / 5.00	12 / 14.00			
% Solids / % Sand	2.90 / 0.50	5.00 / 0.25			
% Oil / Oil:Water Ratio	N/A / N/A	N/A / N/A			
Rm @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Rmf @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Rmc @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Max Tool Temp (in F) / C	122.00 / 50.00	122.00 / 50.00			

Max Tool Temp (degF) / Source	129.00 / PCM	162.80 / PCM			
Rm @ Max Tool Temp (degF)	N/A @ 129.00	N/A @ 162.80			
Lead MWD Engineer	Kyle Wass	Kyle Wass			
Customer Representative	Stetson Nielsen	Stetson Nielsen			

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM			
Software Version	5.76	5.76			
Sub Serial Number	11341339	11341339			
Insert Serial Number	11680735	11680735			
Date and Time Initialized	09-Dec-13 18:21	09-Dec-13 18:21			
Date and Time Read	13-Dec-13 22:52	13-Dec-13 22:58			
ECMB SW Version	N/A	N/A			

### Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	57.00	54.00			
Software Version	6.21	6.21			
Sub Serial Number	11341339	11341339			
Sonde Serial Number	11638628	11638628			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	223.08	210.89			

### Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	50.39	47.21			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	11341339	11341339			
Insert/Sonde Serial Number	11579771	11579771			

## 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 V8.0.0

## WARRANTY

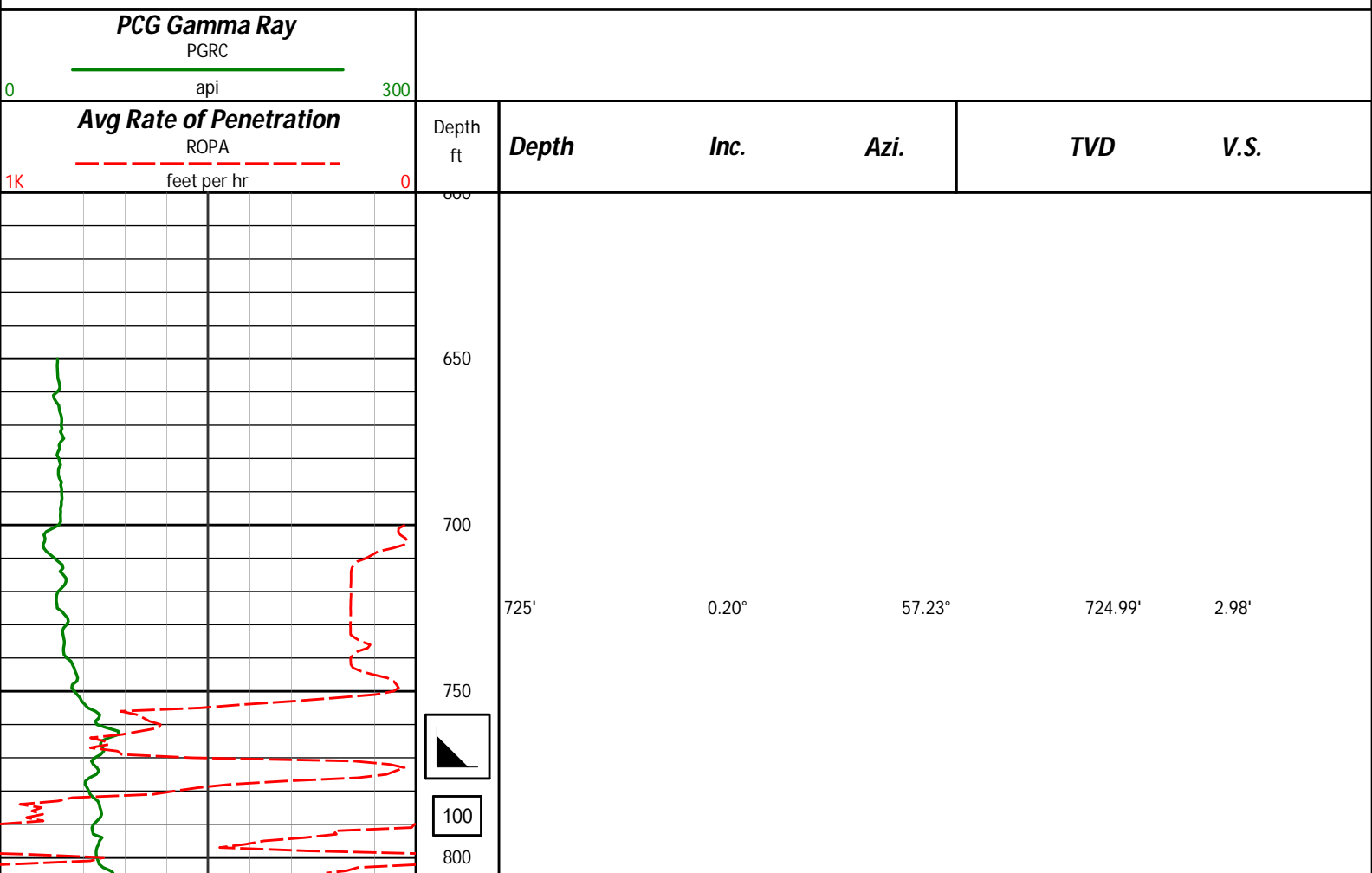
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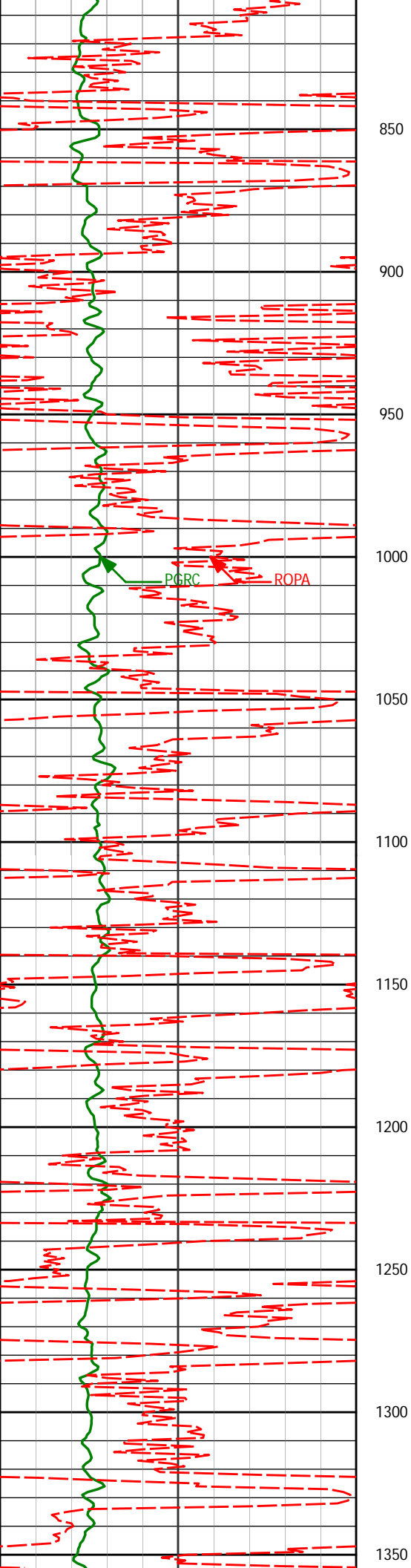
# HALLIBURTON

## Sperry Drilling Services

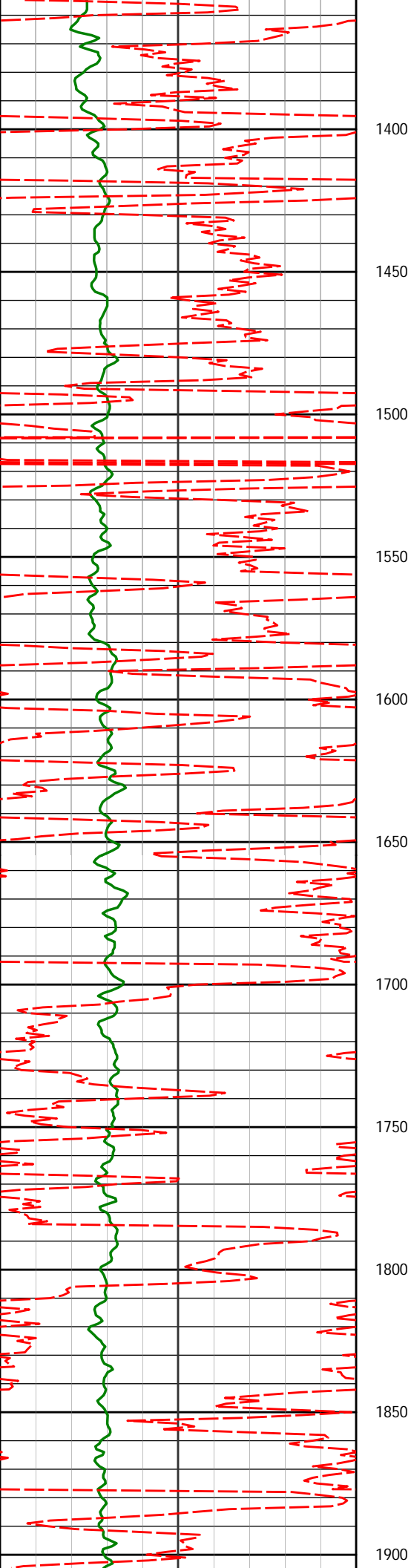
### TVD Correlation Log 1:600

Noble Energy  
NCLP PC AA04-68-1HN  
H&P 321  
Sec. 4-T6N-R63W

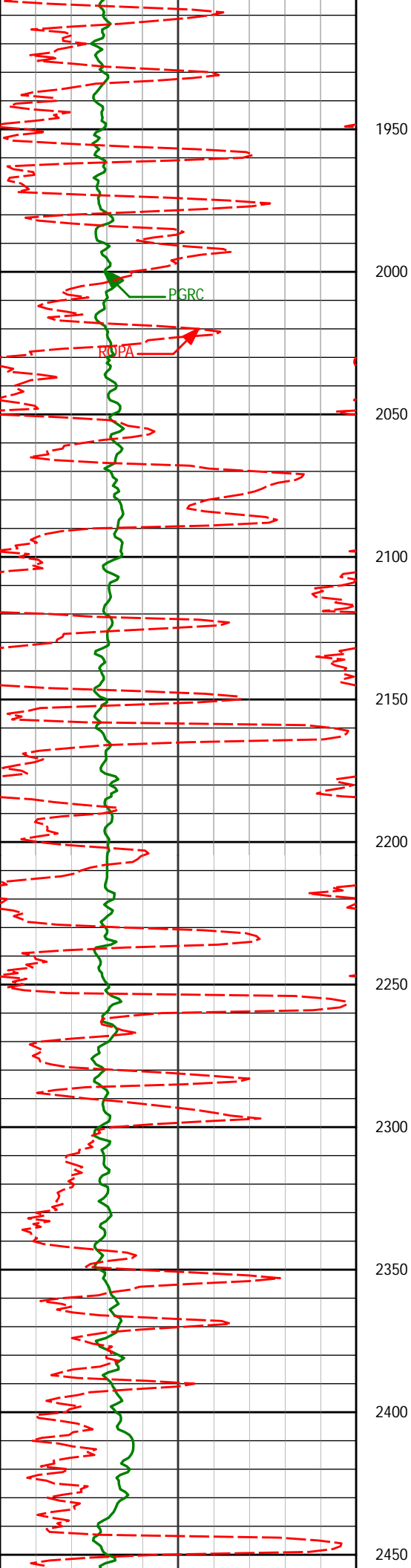




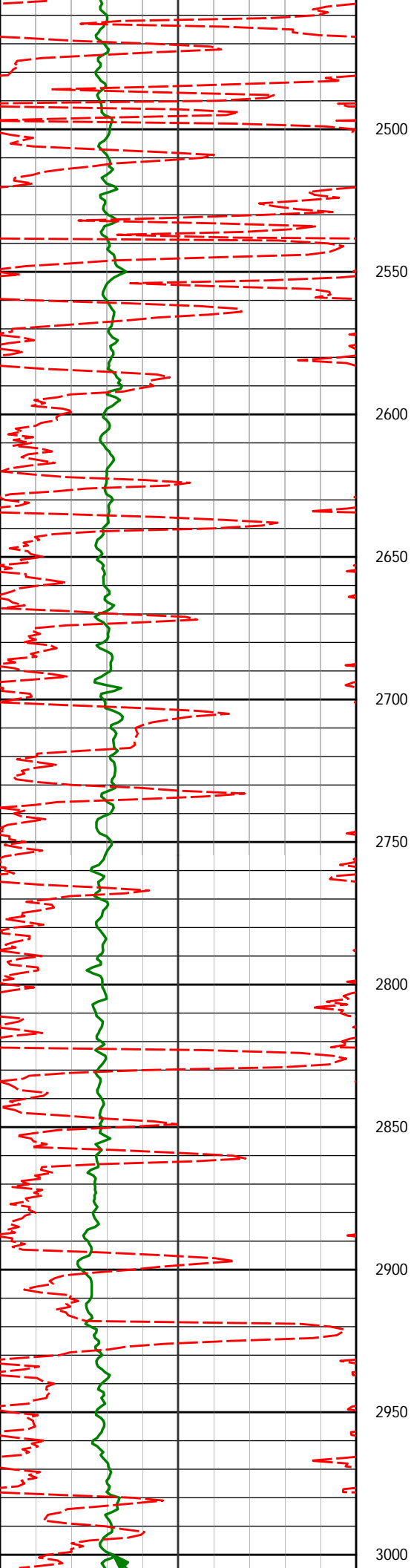
810'	0.85°	319.22°	809.98'	2.73'
902'	1.20°	326.92°	901.97'	1.84'
1086'	1.18°	352.26°	1085.93'	0.76'
1180'	1.08°	4.66°	1179.91'	0.81'
		</		



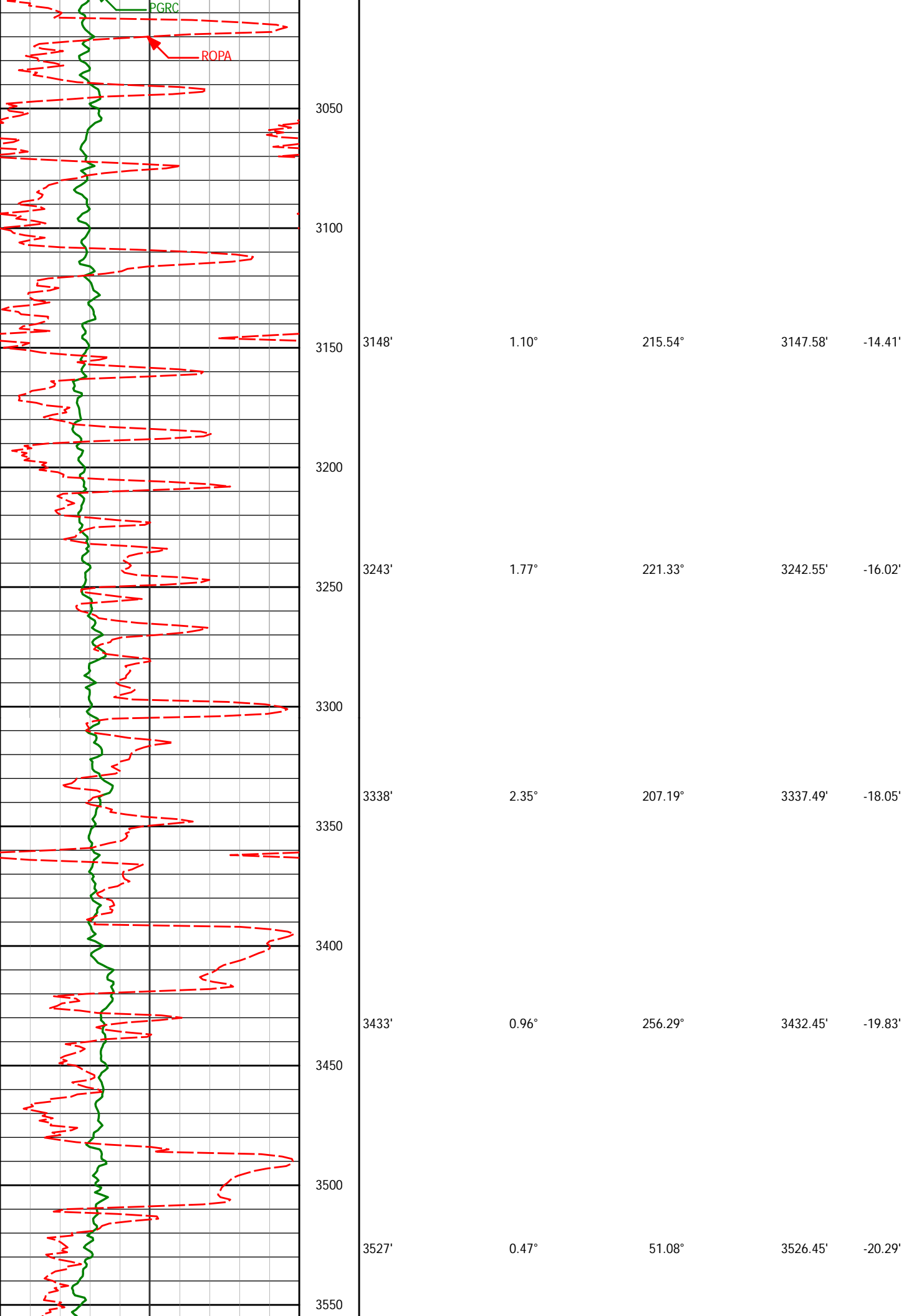
1364'	1.58°	353.10°	1363.86'	0.91'	
1400					
1450					
1457'	1.21°	322.16°	1456.84'	0.29'	
1500					
1550	1549'	1.05°	337.57°	1548.82'	-0.53'
1600					
1641'	1.57°	336.96°	1640.79'	-1.23'	
1650					
1700					
1732'	1.55°	313.67°	1731.76'	-2.48'	
1750					
1800					
1825'	0.83°	355.18°	1824.74'	-3.35'	
1850					
1900					



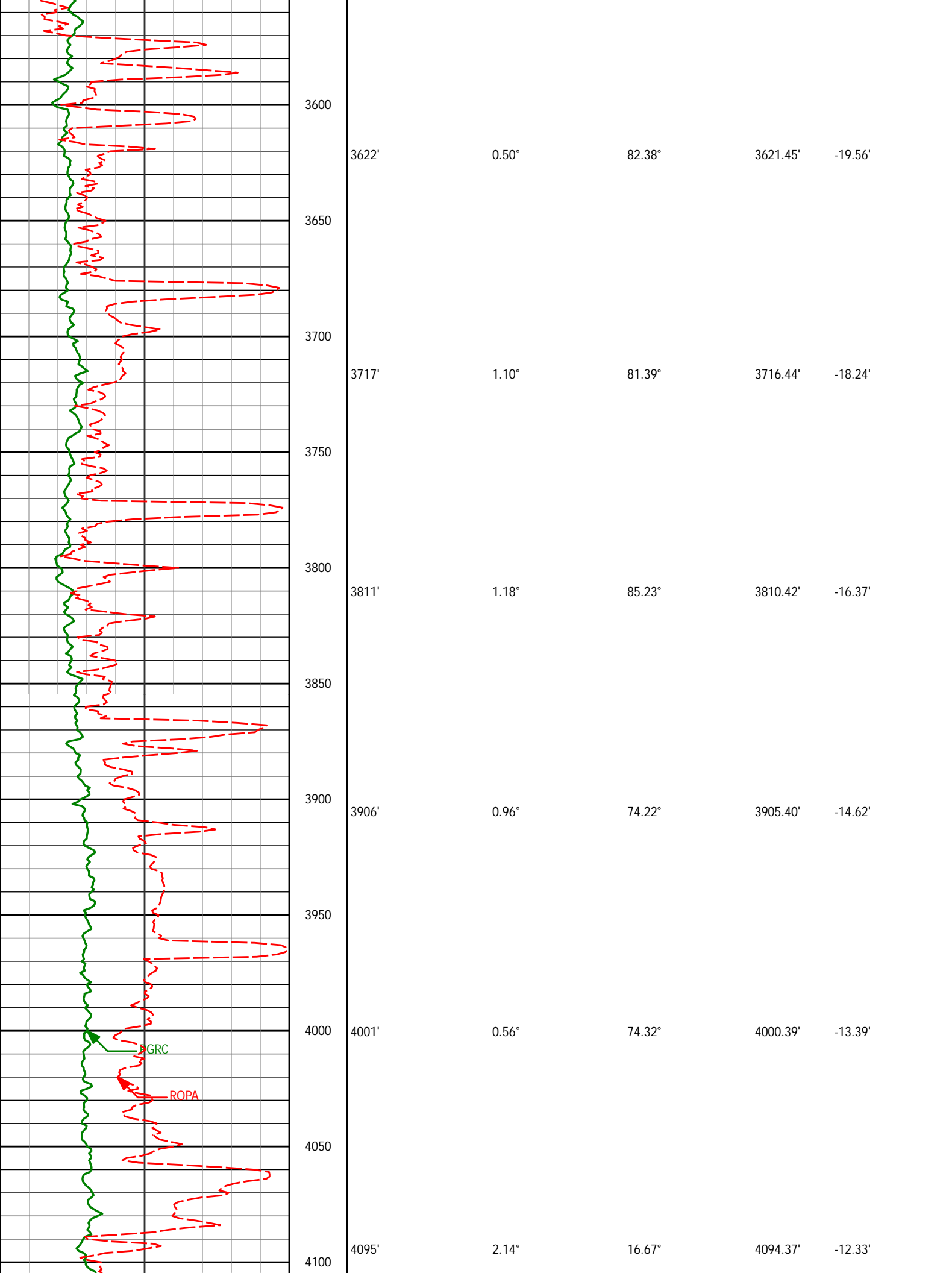
1918'	1.01°	1.00°	1917.73'	-3.30'
2013'	1.31°	326.25°	2012.71'	-3.78'
2105'	0.11°	204.22°	2104.70'	-4.35'
2200'	0.72°	141.15°	2199.70'	-4.04'
2389'	0.84°	200.14°	2388.69'	-3.91'

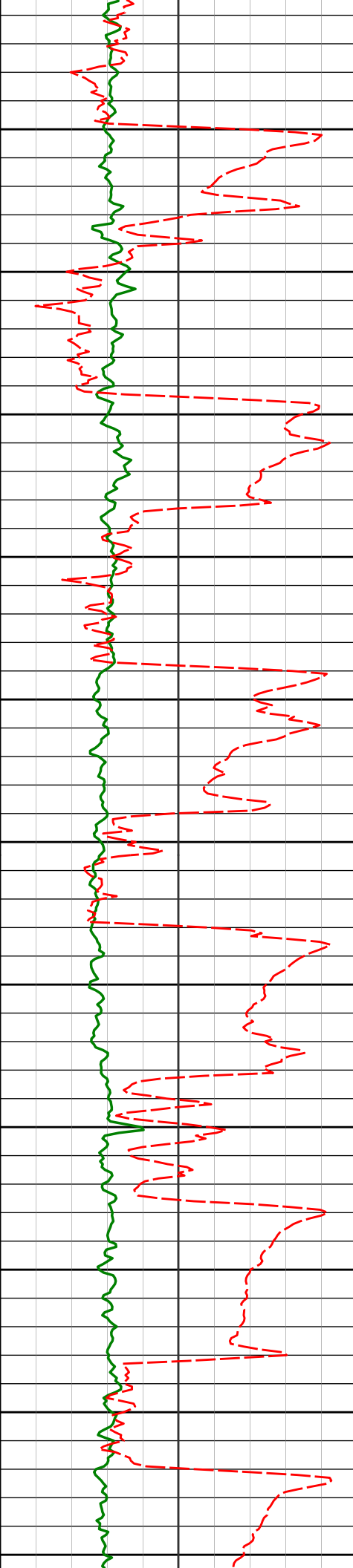


2485'	1.23°	215.77°	2484.67'	-4.85'
2500				
2550				
2600				
2650				
2674'	0.77°	265.27°	2673.65'	-7.41'
2700				
2750				
2769'	0.68°	268.70°	2768.64'	-8.61'
2800				
2850				
2864'	0.84°	261.65°	2863.63'	-9.86'
2900				
2950				
2959'	1.11°	256.23°	2958.62'	-11.46'
3000				









4150

4190'	3.14°	358.16°	4189.27'	-11.64'
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4200

4250

4285'	4.07°	3.30°	4284.08'	-11.16'
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4300

4350

4380'	5.49°	1.91°	4378.75'	-10.32'
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4400

4450

4475'	7.39°	357.90°	4473.14'	-9.73'
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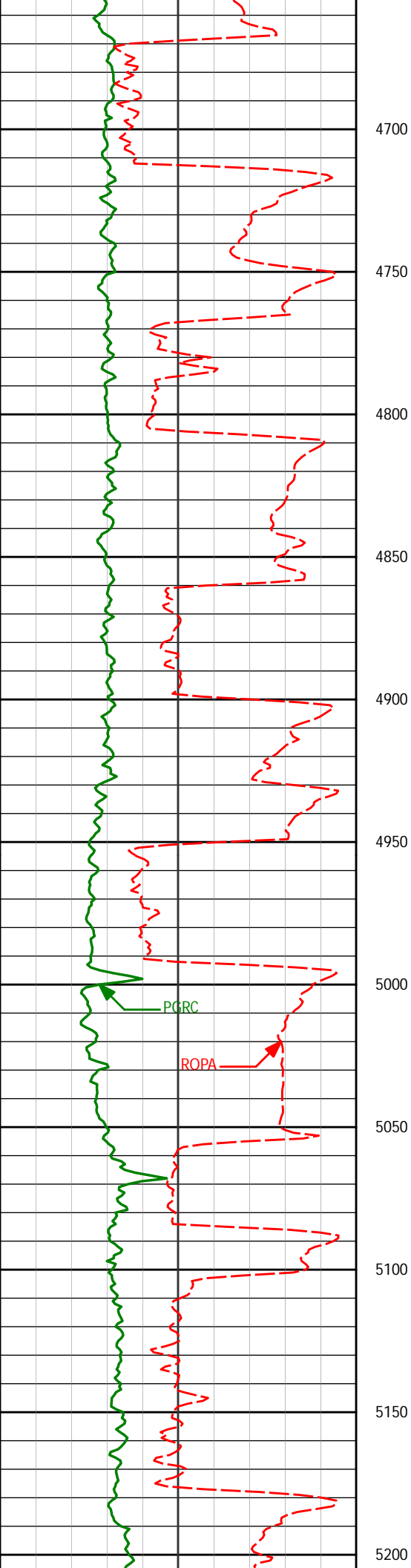
4500

4550

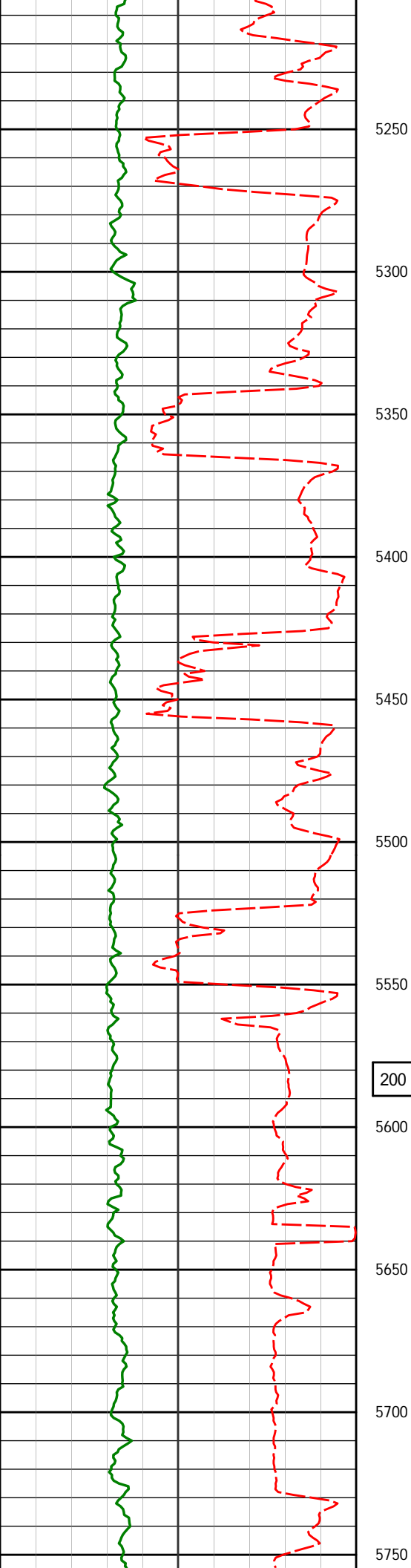
4569'	9.67°	357.61°	4566.10'	-9.41'
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4600

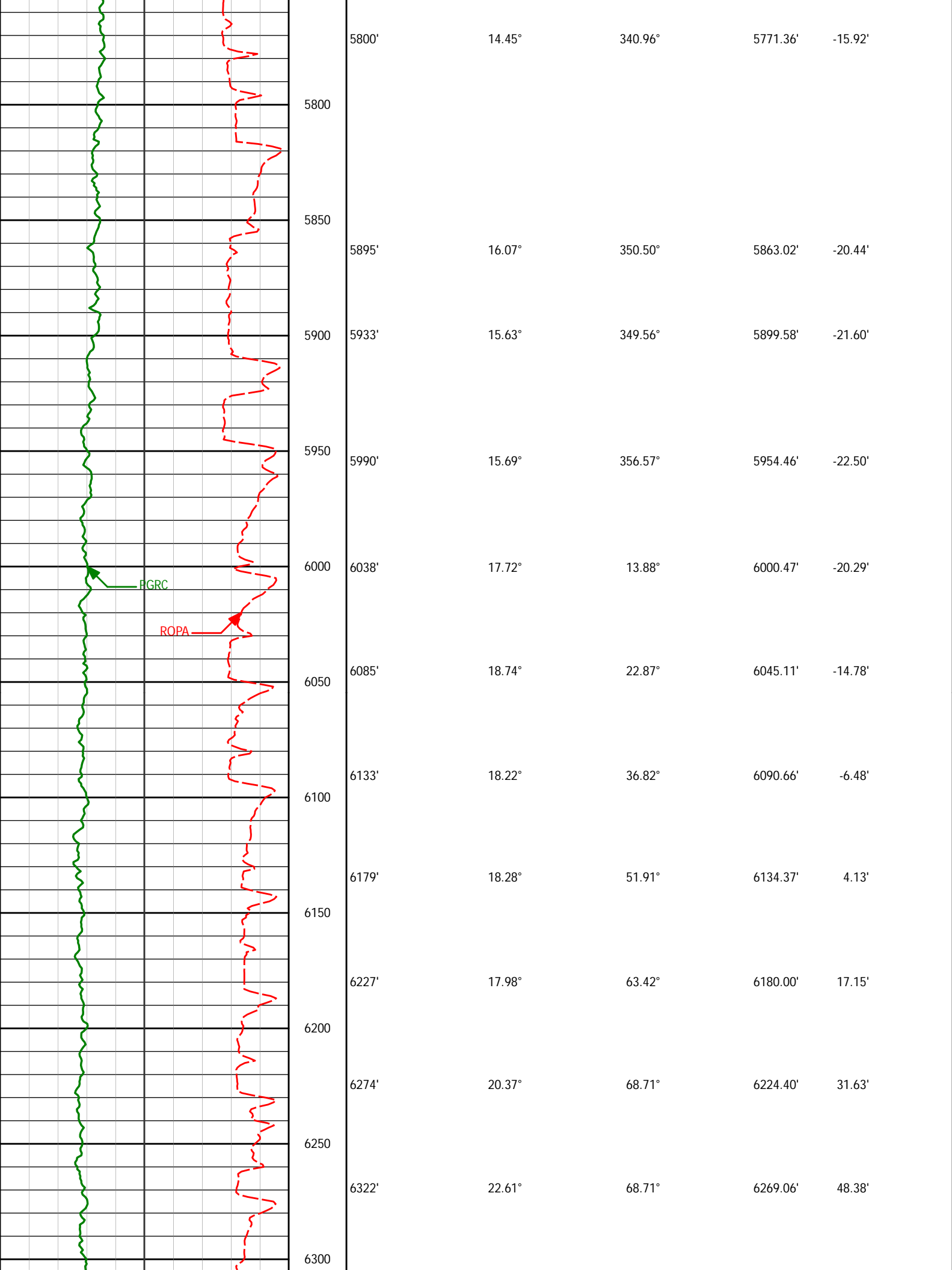
4650

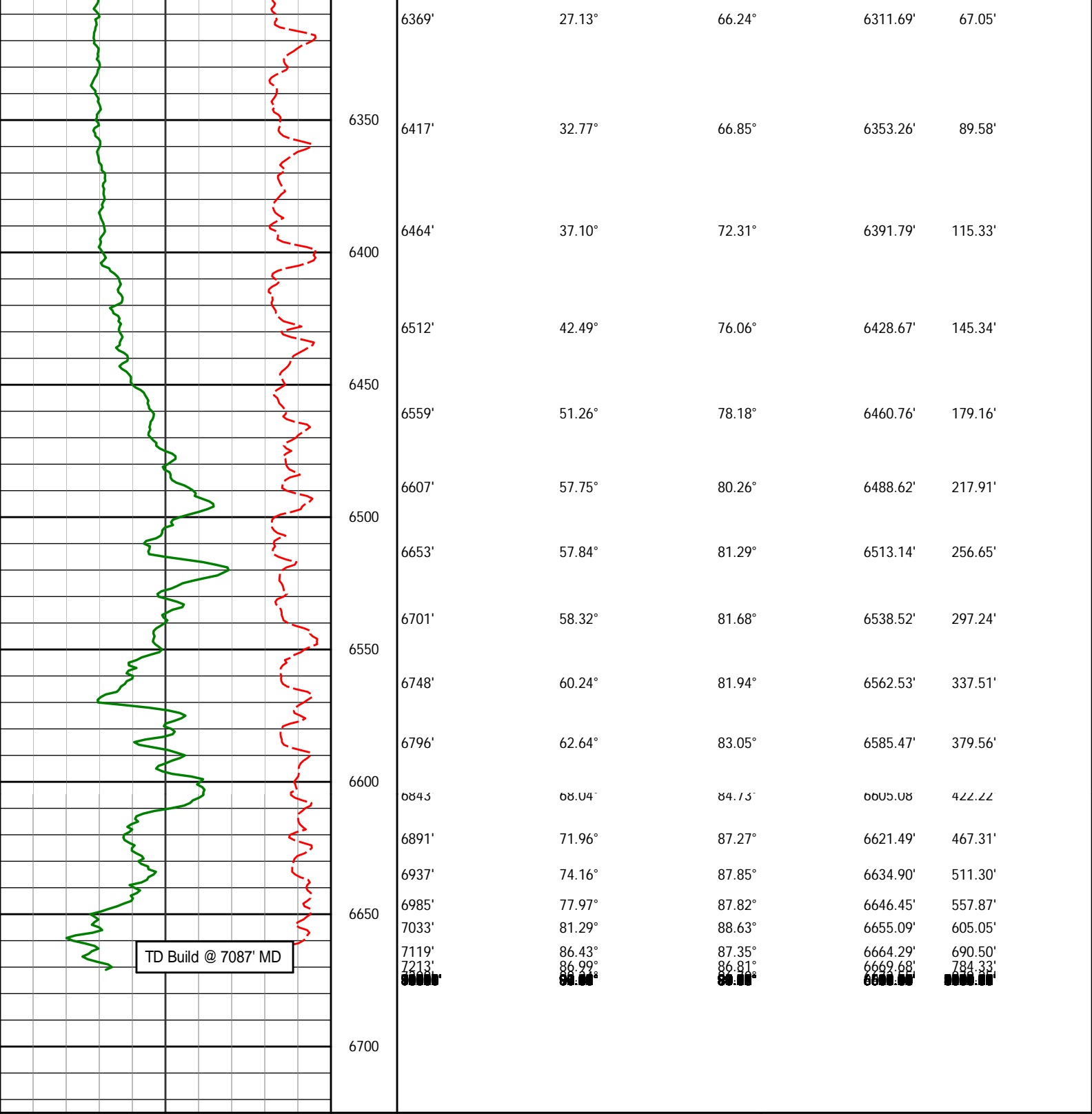


4664'	11.18°	358.29°	4659.52'	-8.95'
4759'	11.90°	3.67°	4752.61'	-7.41'
4853'	11.74°	2.62°	4844.61'	-5.16'
4948'	11.73°	359.08°	4937.63'	-3.67'
5043'	14.12°	355.53°	5030.22'	-3.41'
5138'	11.62°	355.15°	5122.82'	-3.80'

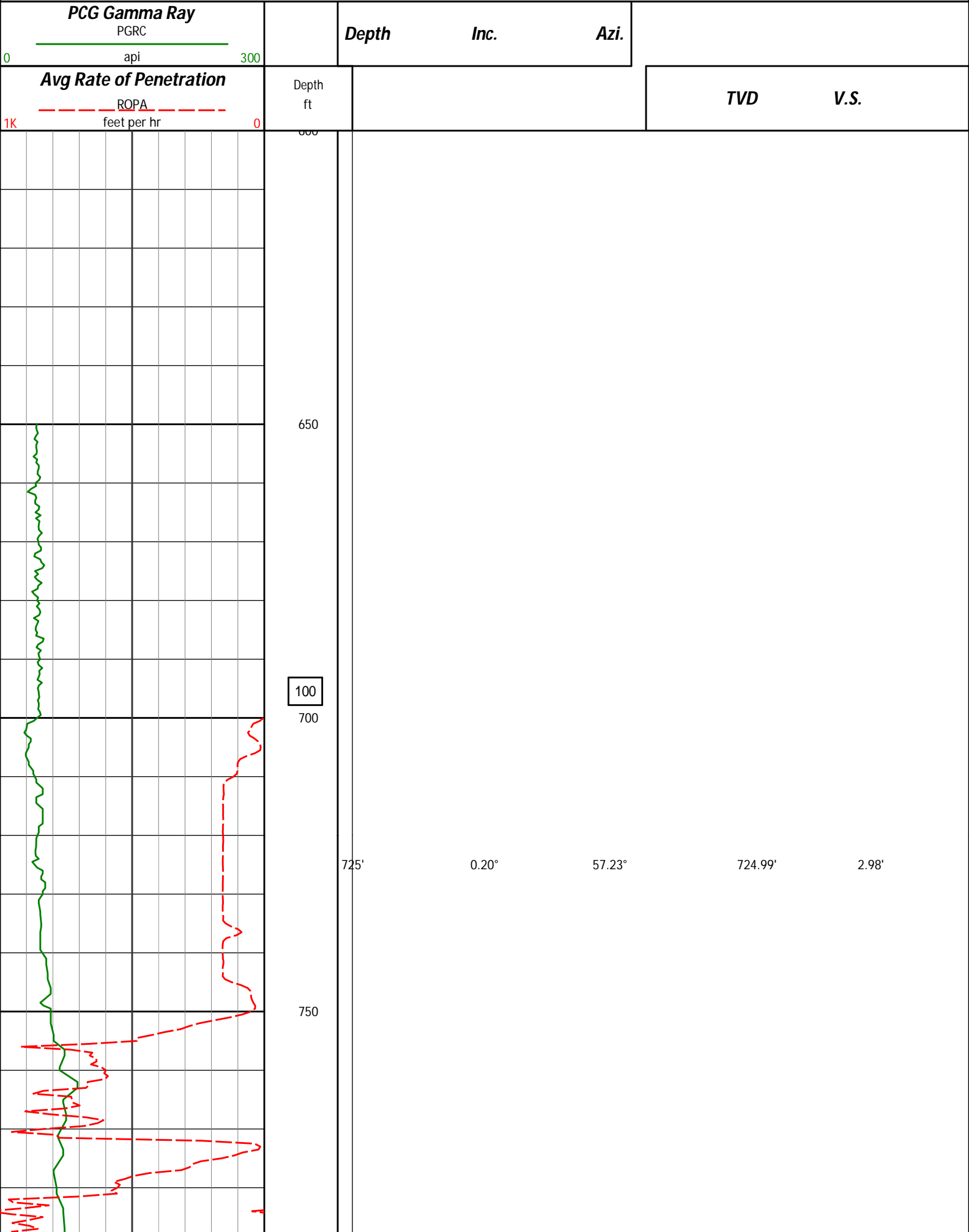


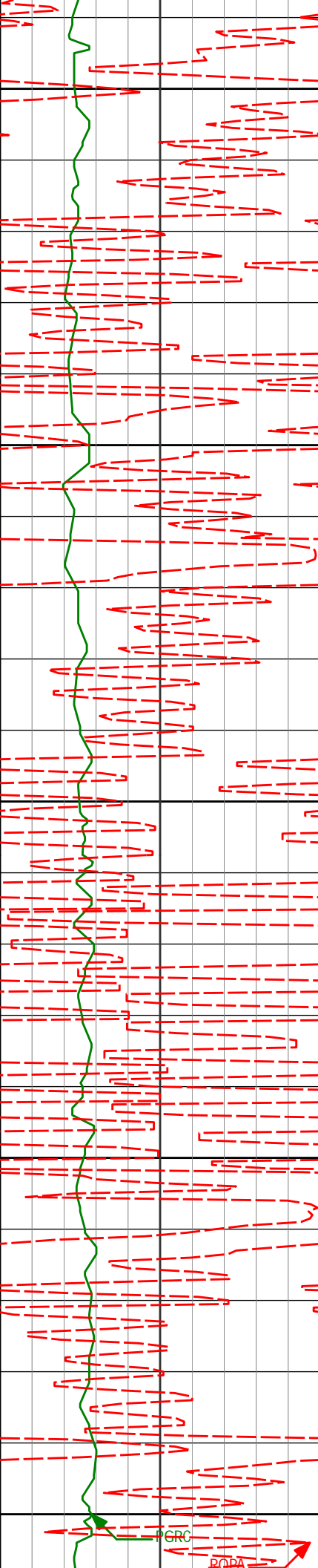
5233'	9.26°	355.82°	5216.24'	-4.10'
5250				
5300				
5327'	11.05°	352.59°	5308.77'	-4.78'
5350				
5400				
5422'	10.93°	356.49°	5402.03'	-5.38'
5450				
5500				
5517'	9.65°	2.47°	5495.50'	-4.54'
5550				
5600				
5611'	11.54°	348.35°	5587.91'	-5.03'
5650				
5700				
5706'	14.80°	340.99°	5680.40'	-9.60'
5750				





<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>							





800

810'

0.85°

319.22°

809.98'

2.73'

850

900

902'

1.20°

326.92°

901.97'

1.84'

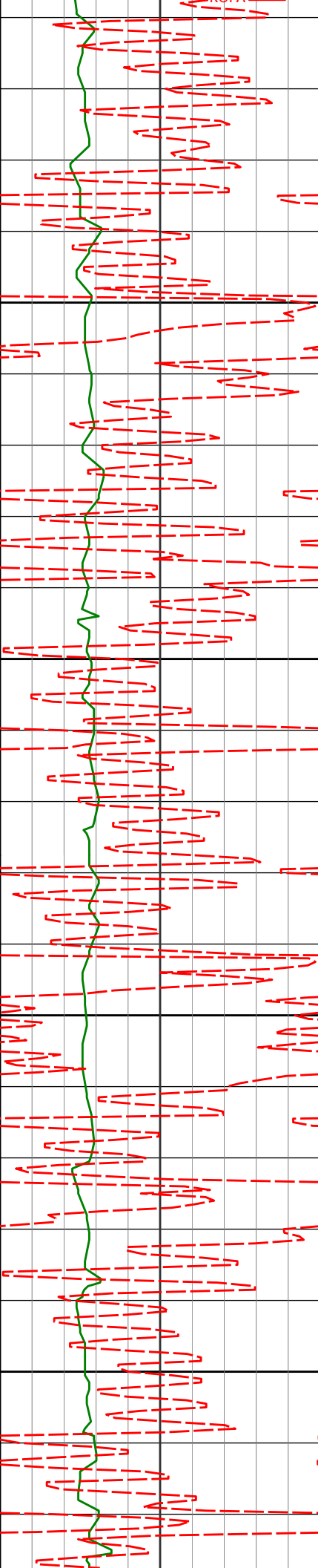
950

1000

PCRC

PDPA





1050

1100

1150

1200

1086'

1.18°

352.26°

1085.93'

0.76'

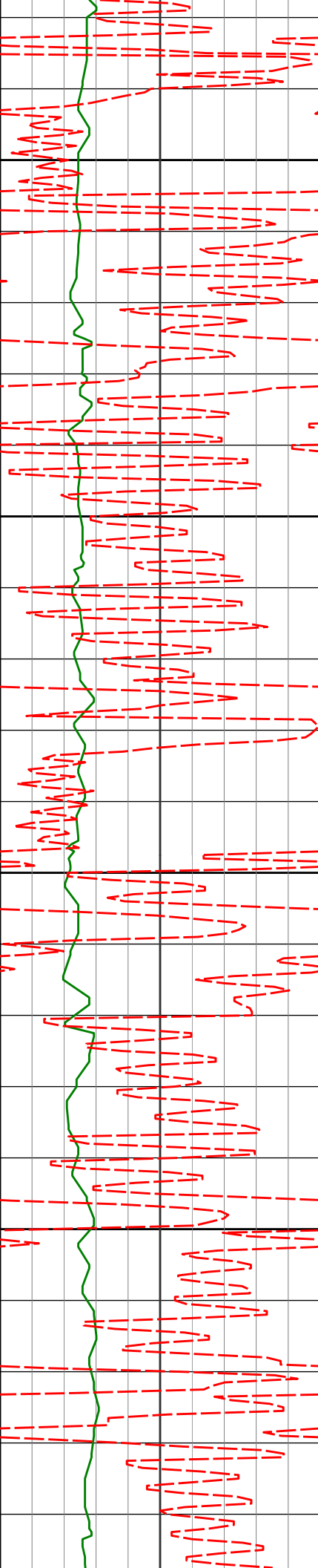
1180'

1.08°

4.66°

1179.91'

0.81'



1250

1300

1350

1400

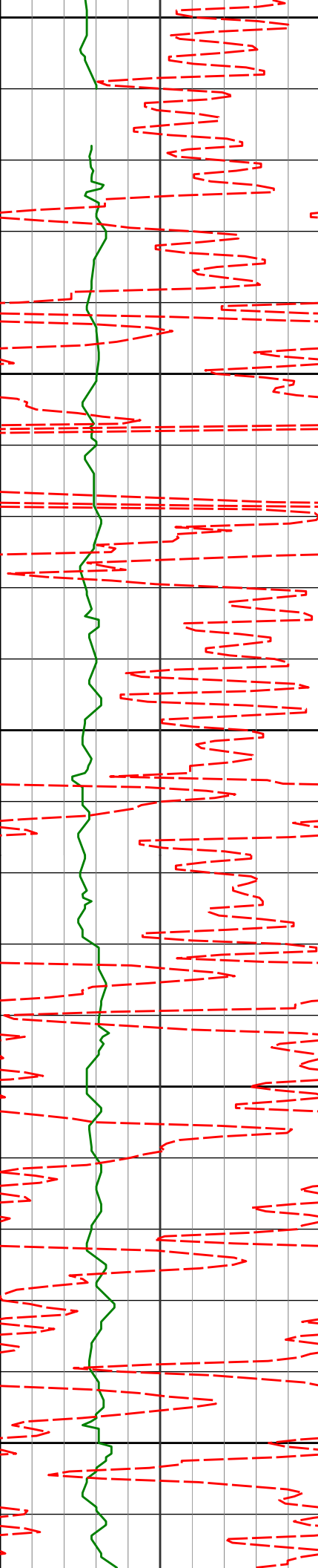
1364'

1.58°

353.10°

1363.86'

0.91'



1450

1457'

1.21°

322.16°

1456.84'

0.29'

1500

1550

1549'

1.05°

337.57°

1548.82'

-0.53'

1600

1650

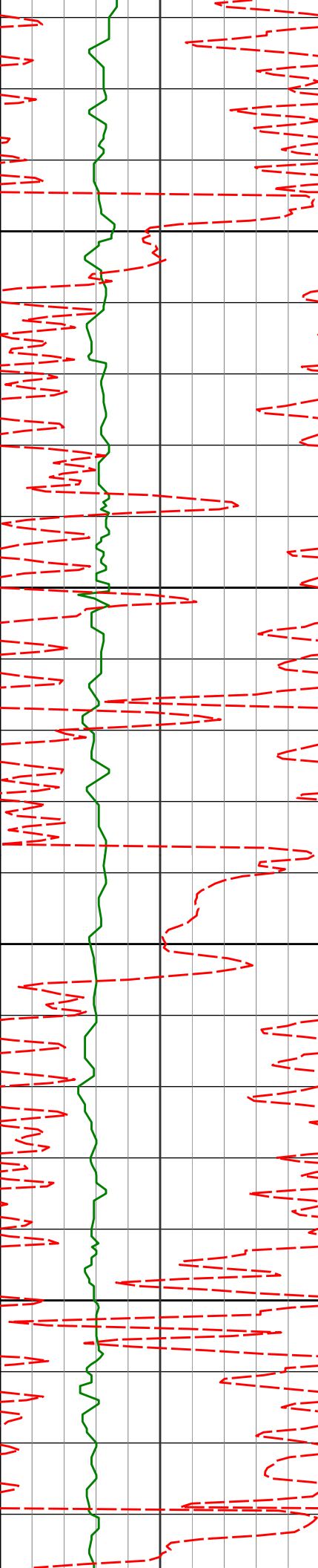
1641'

1.57°

336.96°

1640.79'

-1.23'



1700

1732'

1.55°

313.67°

1731.76'

-2.48'

1750

1800

1825'

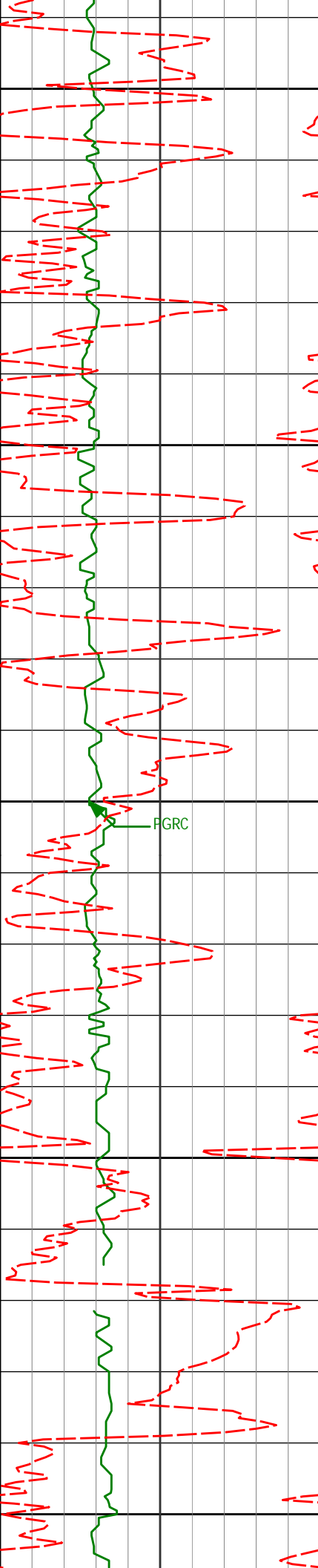
0.83°

355.18°

1824.74'

-3.35'

1850



1900

1918'

1.01°

1.00°

1917.73'

-3.30'

1950

2000

PGRC

2013'

1.31°

326.25°

2012.71'

-3.78'

2050

2100

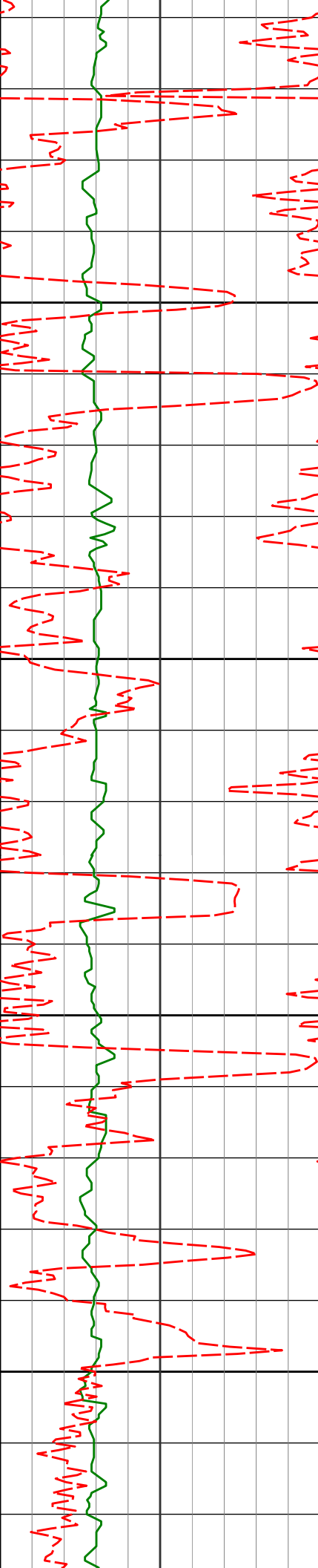
2105'

0.11°

204.22°

2104.70'

-4.35'



2150

2200

2250

2300

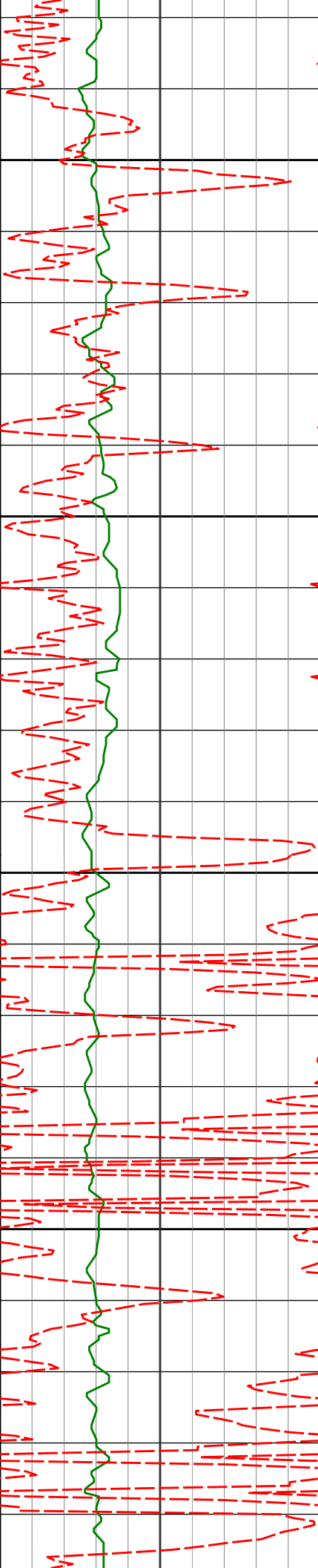
2200'

0.72°

141.15°

2199.70'

-4.04'



2350

2389'

0.84°

200.14°

2388.69'

-3.91'

2400

2450

2485'

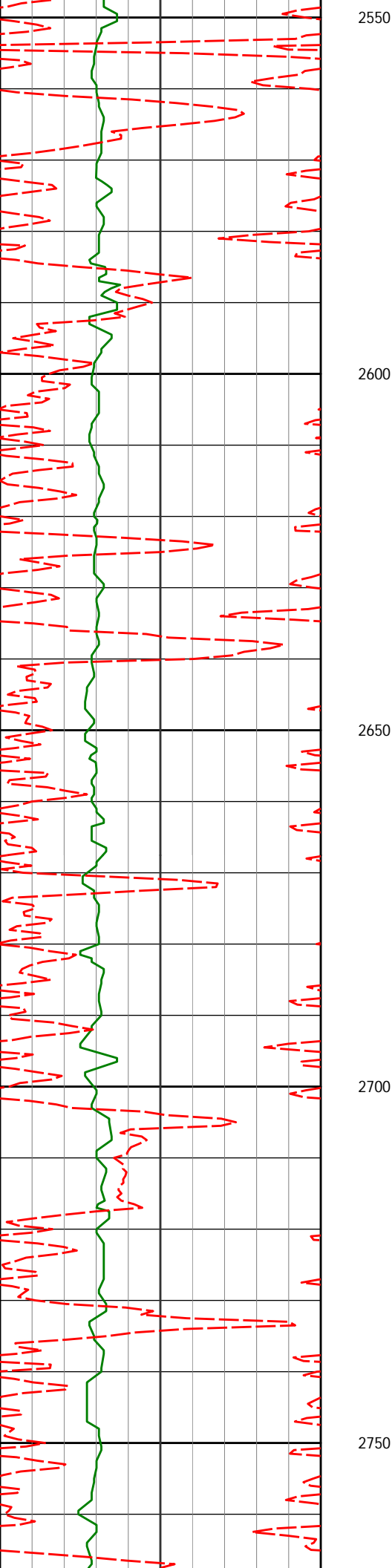
1.23°

215.77°

2484.67'

-4.85'

2500



2674'

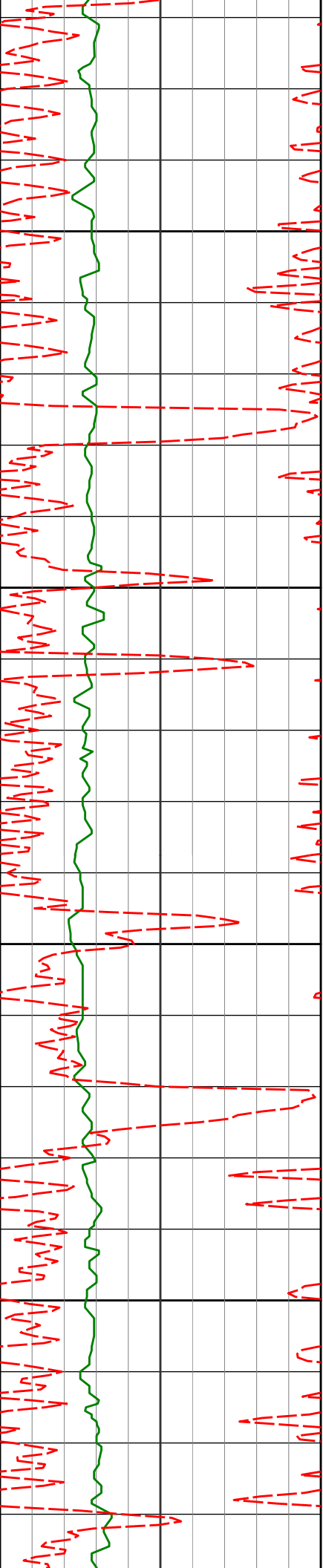
0.77°

265.27°

2673.65'

-7.41'





2800

2850

2900

2950

2769'

2864'

2959'

0.68°

0.84°

1.11°

268.70°

261.65°

256.23°

2768.64'

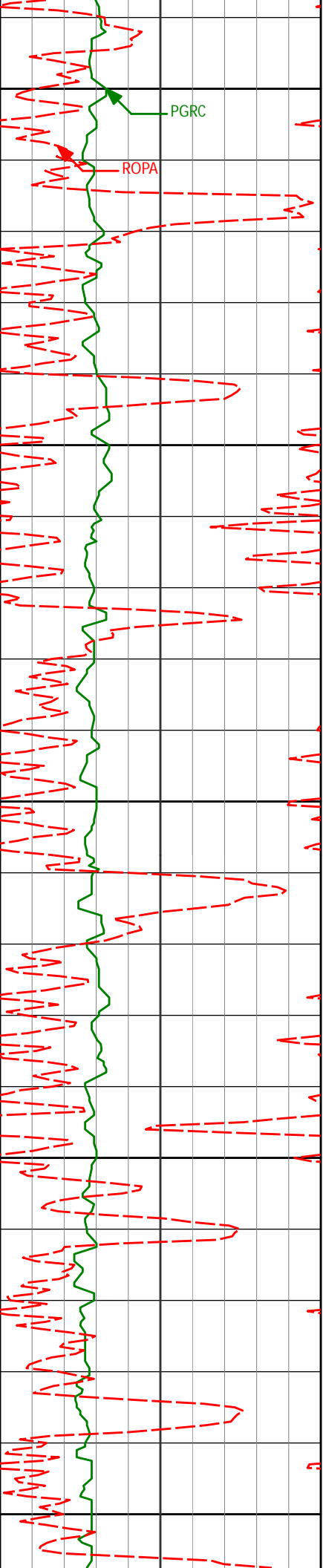
2863.63'

2958.62'

-8.61'

-9.86'

-11.46'



3000

PGRC

ROPA

3050

3100

3150

3200

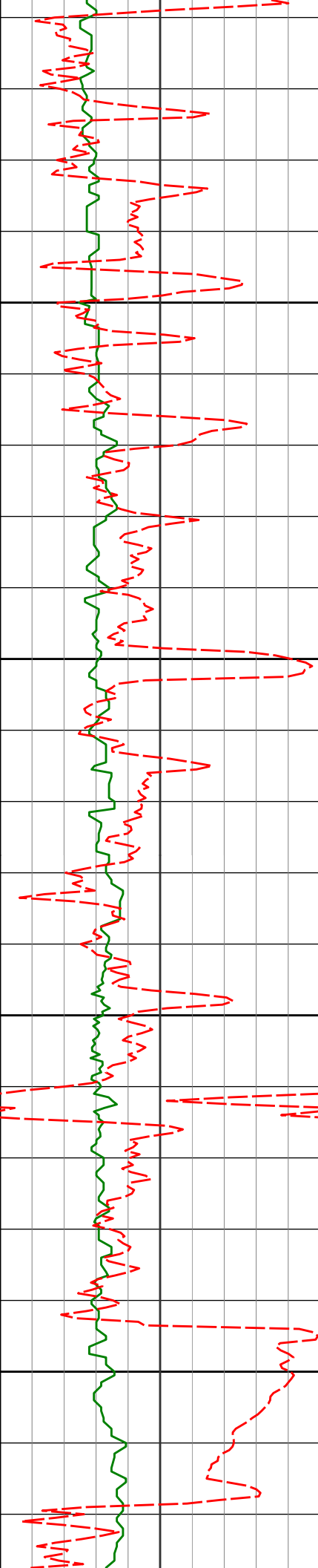
3148'

1.10°

215.54°

3147.58'

-14.41'



3243'	1.77°	221.33°	3242.55'	-16.02'
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3250

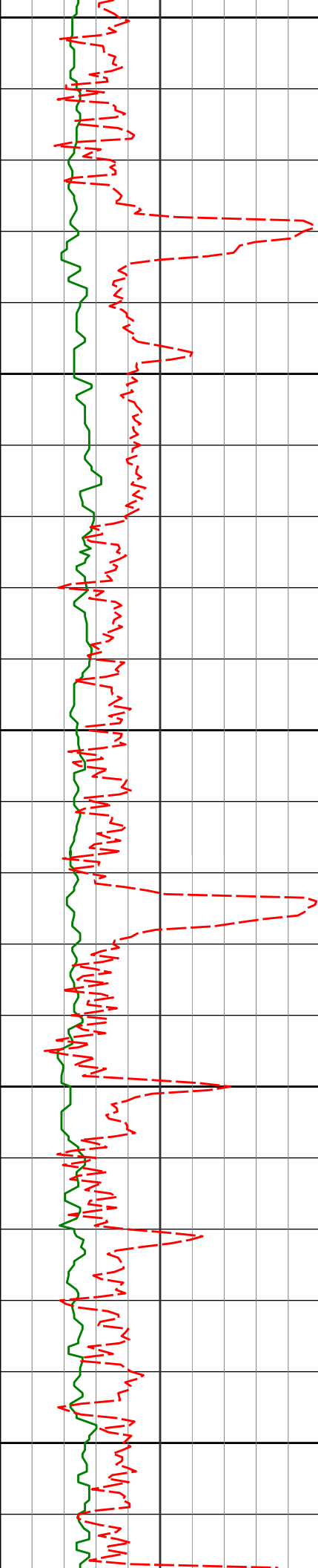
3300

3338'	2.35°	207.19°	3337.49'	-18.05'
-------	-------	---------	----------	---------

3350

3400





3650

3700

3750

3800

3850

3717'

1.10°

81.39°

3716.44'

-18.24'

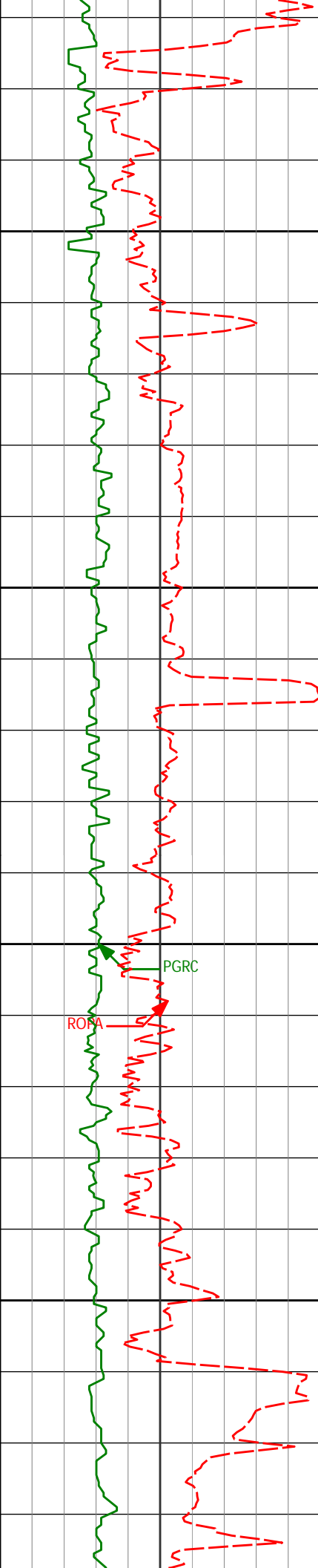
3811'

1.18°

85.23°

3810.42'

-16.37'



3900

3906'

0.96°

74.22°

3905.40'

-14.62'

3950

4000

4001'

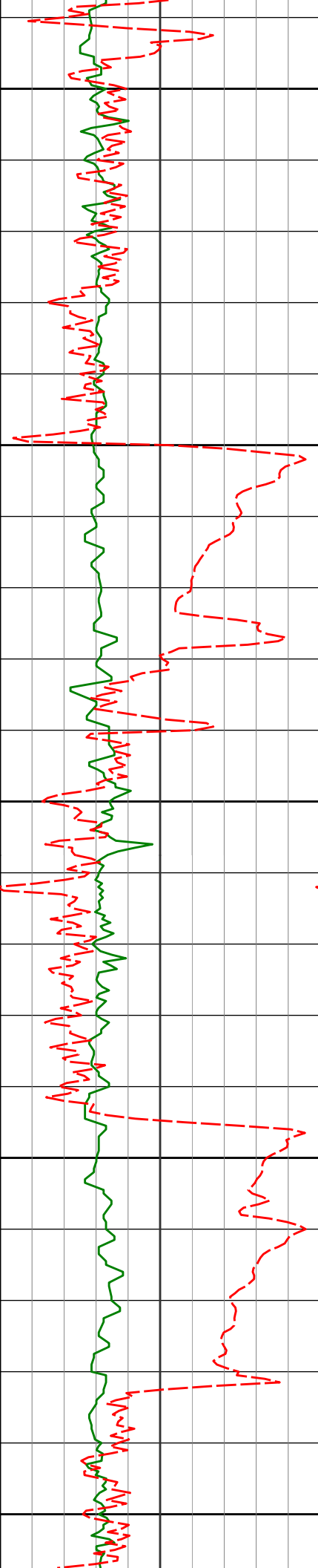
0.56°

74.32°

4000.39'

-13.39'

4050



4100

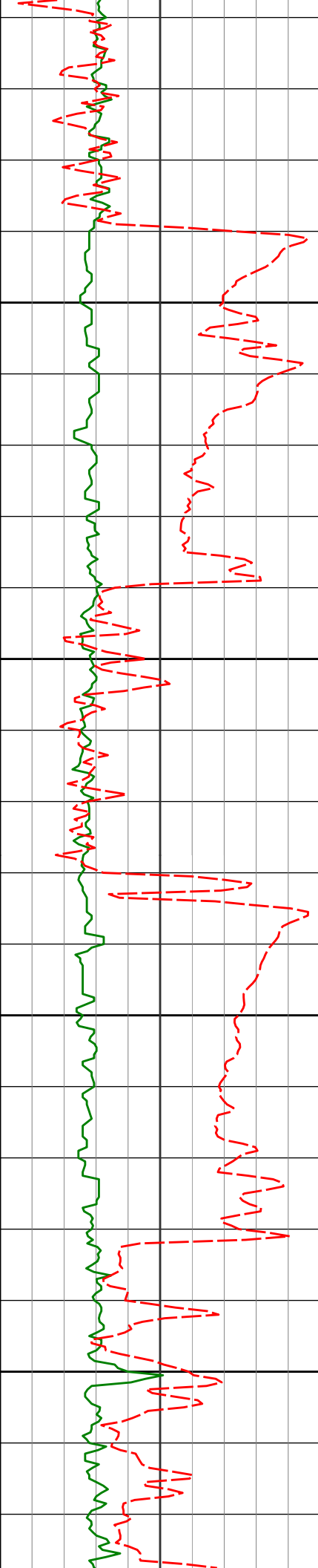
4150

4200

4250

4300

4095'	2.14°	16.67°	4094.37'	-12.33'
4190'	3.14°	358.16°	4189.27'	-11.64'
4285'	4.07°	3.30°	4284.08'	-11.16'



4350

4380'

5.49°

1.91°

4378.75'

-10.32'

4400

4450

4475'

7.39°

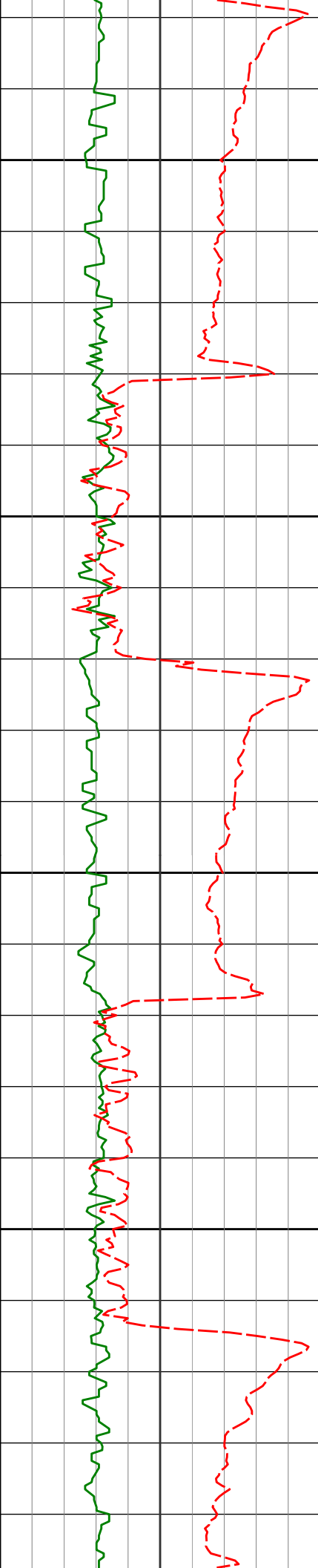
357.90°

4473.14'

-9.73'

4500





4550

4569'

9.67°

357.61°

4566.10'

-9.41'

4600

4650

4664'

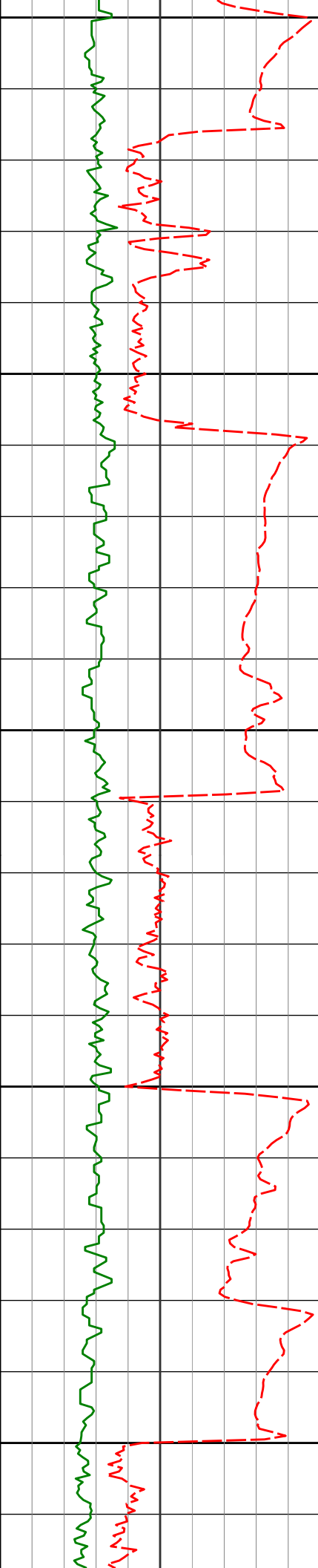
11.18°

358.29°

4659.52'

-8.95'

4700



4750

4759'

11.90°

3.67°

4752.61'

-7.41'

4800

4850

4853'

11.74°

2.62°

4844.61'

-5.16'

4900

4950

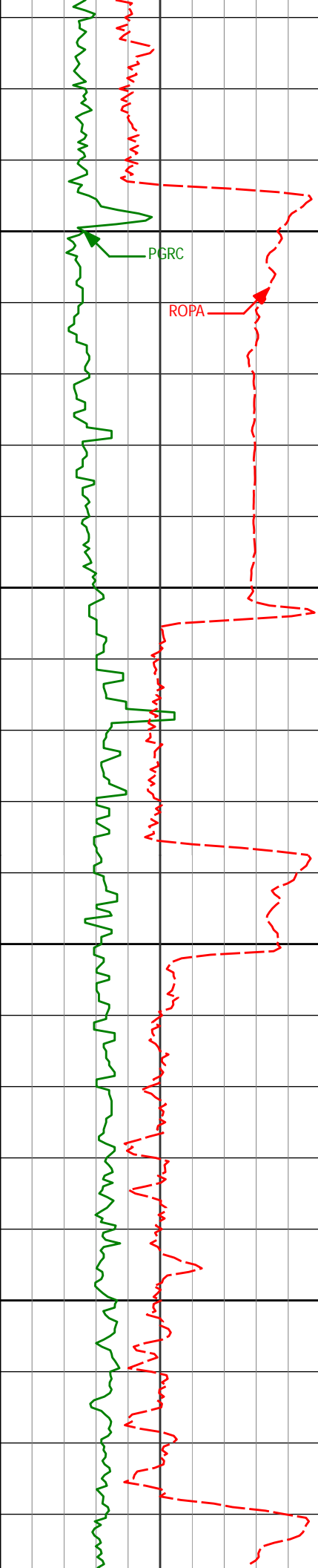
4948'

11.73°

359.08°

4937.63'

-3.67'



5000

5043'

14.12°

355.53°

5030.22'

-3.41'

5050

5100

5138'

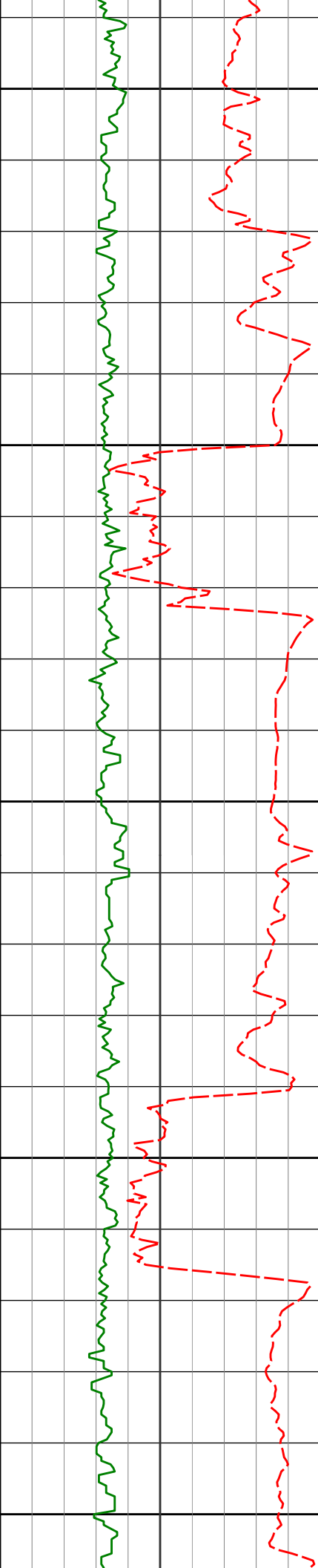
11.62°

355.15°

5122.82'

-3.80'

5150



5200

5233'

9.26°

355.82°

5216.24'

-4.10'

5250

5300

5327'

11.05°

352.59°

5308.77'

-4.78'

5350

200

5400

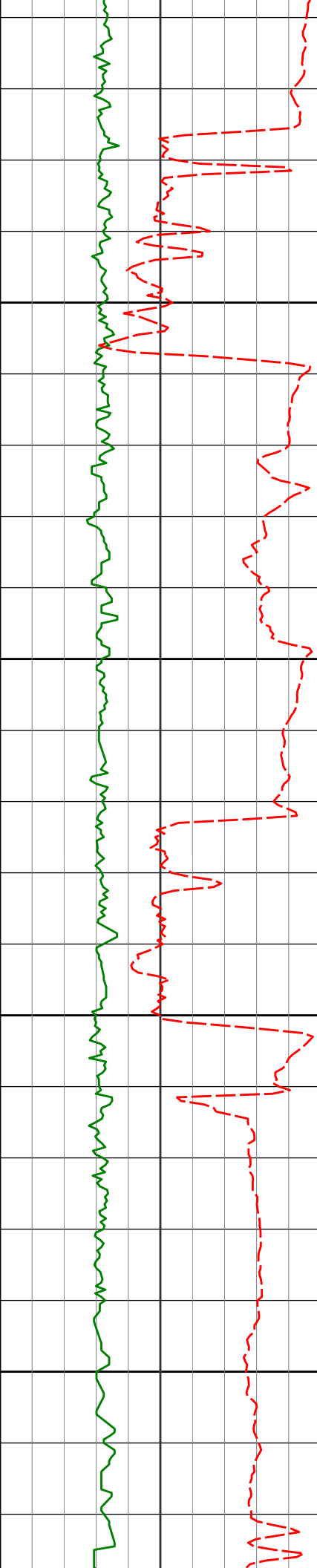
5422'

10.93°

356.49°

5402.03'

-5.38'



5450

5500

5550

200

5600

5517'

9.65°

 $2.47^\circ$ 

5495.50'

-4.54'

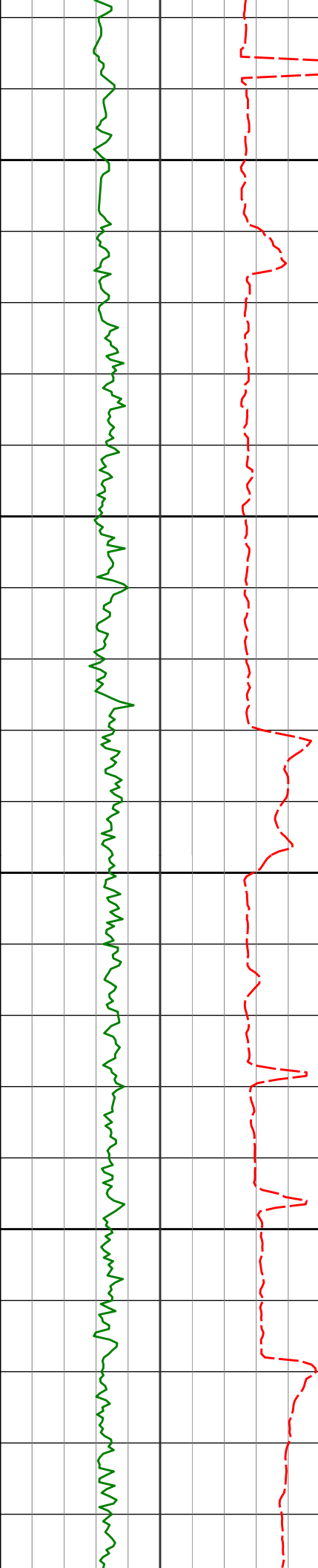
5611'

11.54°

348.35°

5587.91'

-5.03'



5650

5706'

14.80°

340.99°

5680.40'

-9.60'

5700

5750

5800'

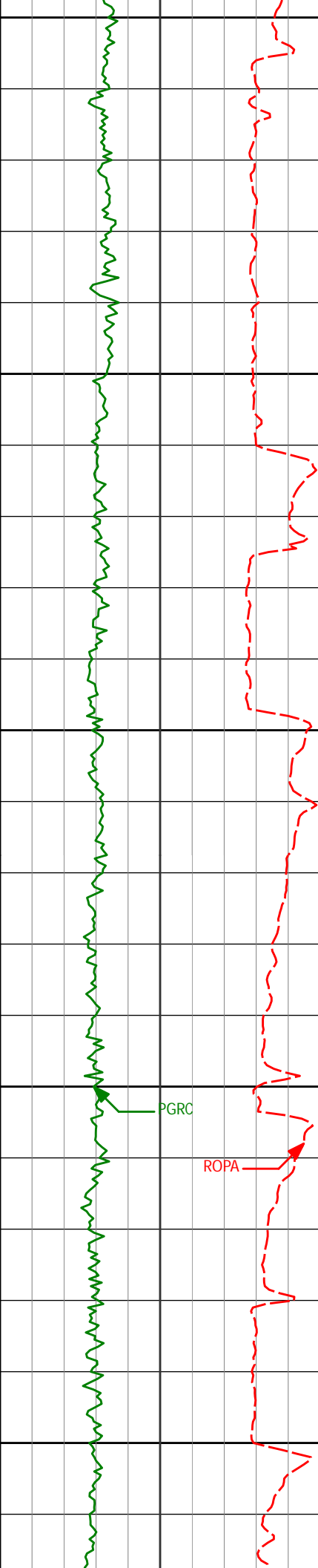
14.45°

340.96°

5771.36'

-15.92'

5800



5850

5895'

16.07°

350.50°

5863.02'

-20.44'

5900

5933'

15.63°

349.56°

5899.58'

-21.60'

5950

5990'

15.69°

356.57°

5954.46'

-22.50'

6000

6038'

17.72°

13.88°

6000.47'

-20.29'

6050

6085'

18.74°

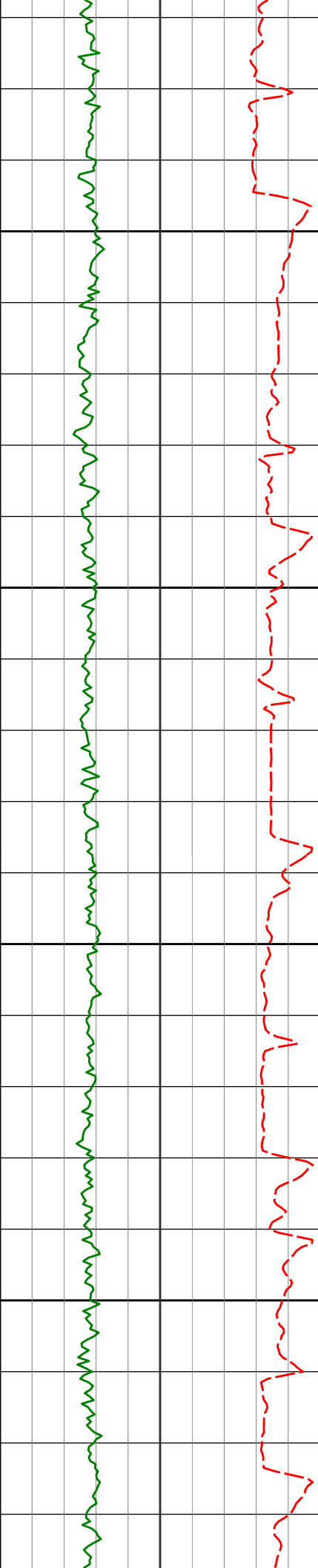
22.87°

6045.11'

-14.78'

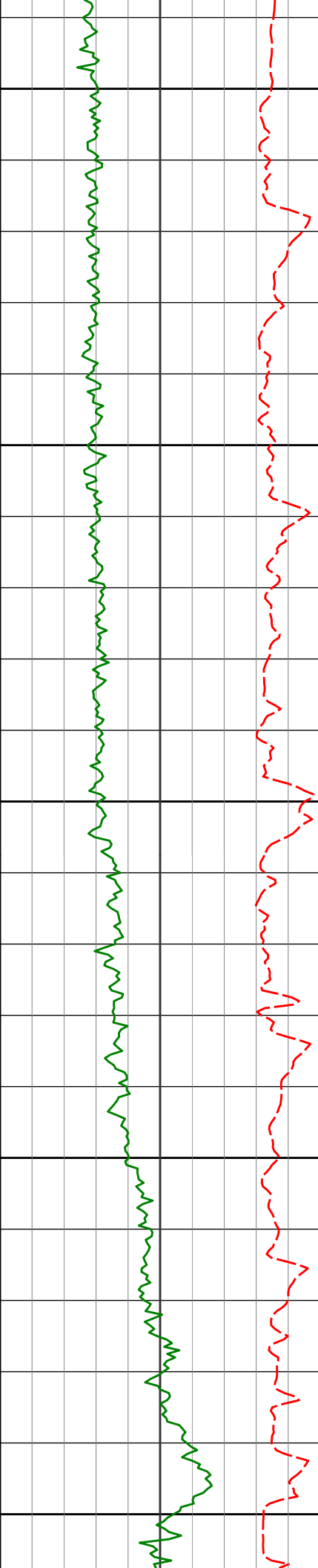
PGRC

ROPA



6133'	18.22°	36.82°	6090.66'	-6.48'
6100				
6179'	18.28°	51.91°	6134.37'	4.13'
6150				
6227'	17.98°	63.42°	6180.00'	17.15'
6200				
6274'	20.37°	68.71°	6224.40'	31.63'
6250				
6322'	22.61°	68.71°	6269.06'	48.38'





6300

6369'

27.13°

66.24°

6311.69'

67.05'

6350

6417'

32.77°

66.85°

6353.26'

89.58'

6464'

37.10°

72.31°

6391.79'

115.33'

6400

6512'

42.49°

76.06°

6428.67'

145.34'

6450

6559'

51.26°

78.18°

6460.76'

179.16'

6607'

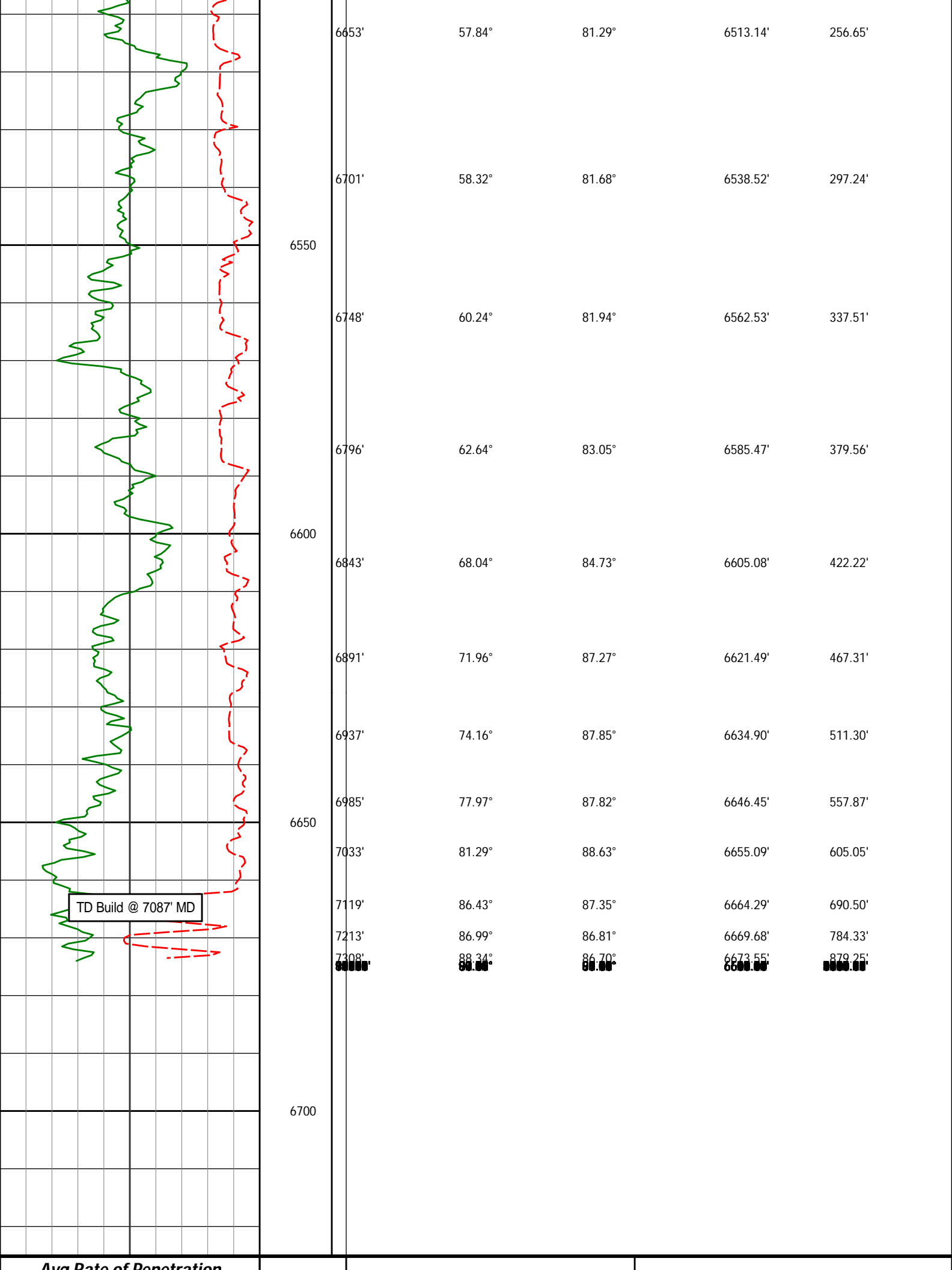
57.75°

80.26°

6488.62'

217.91'

6500



<div>Avg Rate of Penetration</div> <div><div>1K</div><div>ROPA</div><div>feet per hr</div><div>0</div></div>		<div>Depth</div> <div>ft</div>	<div>TVD</div> <div>V.S.</div>		
<div>PCG Gamma Ray</div> <div><div>0</div><div>PGRC</div><div>api</div><div>300</div></div>			<div>Depth</div>	<div>Inc.</div>	<div>Azi.</div>

# HALLIBURTON

## DIRECTIONAL SURVEY REPORT

Noble Energy  
NCLP PC AA04-69-1HN  
Wattenburg  
Weld Colorado  
USA  
CA-XX-0900859724

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
241.00	0.60	68.53	241.00	0.46 N	1.17 E	1.20	0.25
511.00	0.40	172.73	510.99	0.04 N	2.61 E	2.61	0.30
725.00	0.20	57.23	724.99	0.49 S	3.02 E	2.98	0.24
810.00	0.85	319.22	809.98	0.06 N	2.73 E	2.73	1.06
902.00	1.20	326.92	901.97	1.39 N	1.76 E	1.84	0.41
1086.00	1.18	352.26	1085.93	4.88 N	0.45 E	0.76	0.28
1180.00	1.08	4.66	1179.91	6.72 N	0.39 E	0.81	0.28
1364.00	1.58	353.10	1363.86	10.97 N	0.23 E	0.91	0.31
1457.00	1.21	322.16	1456.84	13.02 N	0.53 W	0.29	0.89
1549.00	1.05	337.57	1548.82	14.56 N	1.44 W	-0.53	0.37
1641.00	1.57	336.96	1640.79	16.50 N	2.26 W	-1.23	0.57
1732.00	1.55	313.67	1731.76	18.50 N	3.64 W	-2.48	0.69
1825.00	0.83	355.18	1824.74	20.04 N	4.60 W	-3.35	1.16
1918.00	1.01	1.00	1917.73	21.53 N	4.65 W	-3.30	0.22
2013.00	1.31	326.25	2012.71	23.27 N	5.23 W	-3.78	0.79
2105.00	0.11	204.22	2104.70	24.06 N	5.85 W	-4.35	1.49
2200.00	0.72	141.15	2199.70	23.51 N	5.52 W	-4.04	0.71
2389.00	0.84	200.14	2388.69	21.29 N	5.25 W	-3.91	0.41
2485.00	1.23	215.77	2484.67	19.79 N	6.09 W	-4.85	0.50
2674.00	0.77	265.27	2673.65	18.04 N	8.55 W	-7.41	0.50
2769.00	0.68	268.70	2768.64	17.98 N	9.75 W	-8.61	0.11
2864.00	0.84	261.65	2863.63	17.86 N	11.00 W	-9.86	0.19
2959.00	1.11	256.23	2958.62	17.54 N	12.58 W	-11.46	0.30
3148.00	1.10	215.54	3147.58	15.63 N	15.41 W	-14.41	0.41
3243.00	1.77	221.33	3242.55	13.79 N	16.91 W	-16.02	0.72
3338.00	2.35	207.19	3337.49	10.95 N	18.77 W	-18.05	0.81
3433.00	0.96	256.29	3432.45	9.03 N	20.43 W	-19.83	1.97
3527.00	0.47	51.08	3526.45	9.09 N	20.90 W	-20.29	1.49
3622.00	0.50	82.38	3621.45	9.39 N	20.19 W	-19.56	0.28
3717.00	1.10	81.39	3716.44	9.58 N	18.87 W	-18.24	0.63
3811.00	1.18	85.23	3810.42	9.79 N	17.02 W	-16.37	0.12
3906.00	0.96	74.22	3905.40	10.09 N	15.28 W	-14.62	0.32
4001.00	0.56	74.32	4000.39	10.43 N	14.06 W	-13.39	0.42
4095.00	2.14	16.67	4094.37	12.24 N	13.12 W	-12.33	2.02
4190.00	3.14	358.16	4189.27	16.54 N	12.69 W	-11.64	1.37
4285.00	4.07	3.30	4284.08	22.51 N	12.58 W	-11.16	1.04
4380.00	5.49	1.91	4378.75	30.41 N	12.24 W	-10.32	1.50
4475.00	7.39	357.90	4473.14	41.06 N	12.31 W	-9.73	2.05
4569.00	9.67	357.61	4566.10	54.99 N	12.86 W	-9.41	2.43
4664.00	11.18	358.29	4659.52	72.17 N	13.47 W	-8.95	1.59
4759.00	11.90	3.67	4752.61	91.15 N	13.11 W	-7.41	1.36
4853.00	11.74	2.62	4844.61	110.38 N	12.06 W	-5.16	0.29
4948.00	11.73	359.08	4937.63	129.69 N	11.77 W	-3.67	0.76
5043.00	14.12	355.53	5030.22	150.90 N	12.83 W	-3.41	2.65
5138.00	11.62	355.15	5122.82	171.99 N	14.54 W	-3.80	2.63
5233.00	9.26	355.82	5216.24	189.15 N	15.91 W	-4.10	2.49
5327.00	11.05	352.59	5308.77	205.62 N	17.62 W	-4.78	2.00
5422.00	10.93	356.49	5402.03	223.64 N	19.35 W	-5.38	0.79
5517.00	9.65	2.47	5495.50	240.59 N	19.55 W	-4.54	1.75

5611.00	11.54	348.35	5587.91	257.67 N	21.11 W	-5.03	3.40
5706.00	14.80	340.99	5680.40	278.46 N	26.99 W	-9.60	3.85
5800.00	14.45	340.96	5771.36	300.90 N	34.72 W	-15.92	0.37
5895.00	16.07	350.50	5863.02	325.07 N	40.76 W	-20.44	3.14
5933.00	15.63	349.56	5899.58	335.30 N	42.56 W	-21.60	1.34
5990.00	15.69	356.57	5954.46	350.54 N	44.41 W	-22.50	3.32
6038.00	17.72	13.88	6000.47	364.12 N	43.05 W	-20.29	11.14
6085.00	18.74	22.87	6045.11	378.03 N	38.39 W	-14.78	6.36
6133.00	18.22	36.82	6090.66	391.14 N	30.90 W	-6.48	9.25
6179.00	18.28	51.91	6134.37	401.36 N	20.90 W	4.13	10.25
6227.00	17.98	63.42	6180.00	409.32 N	8.35 W	17.15	7.48
6274.00	20.37	68.71	6224.40	415.54 N	5.76 E	31.63	6.28
6322.00	22.61	68.71	6269.06	421.92 N	22.15 E	48.38	4.67
6369.00	27.13	66.24	6311.69	429.52 N	40.38 E	67.05	9.87
6417.00	32.77	66.85	6353.26	439.05 N	62.36 E	89.58	11.77
6464.00	37.10	72.31	6391.79	448.36 N	87.58 E	115.33	11.36
6512.00	42.49	76.06	6428.67	456.67 N	117.13 E	145.34	12.29
6559.00	51.26	78.18	6460.76	464.27 N	150.55 E	179.16	18.95
6607.00	57.75	80.26	6488.62	471.54 N	188.92 E	217.91	13.97
6653.00	57.84	81.29	6513.14	477.78 N	227.34 E	256.65	1.90
6701.00	58.32	81.68	6538.52	483.81 N	267.63 E	297.24	1.21
6748.00	60.24	81.94	6562.53	489.57 N	307.62 E	337.51	4.11
6796.00	62.64	83.05	6585.47	495.07 N	349.41 E	379.56	5.40
6843.00	68.04	84.73	6605.08	499.60 N	391.87 E	422.22	11.94
6891.00	71.96	87.27	6621.49	502.73 N	436.85 E	467.31	9.56
6937.00	74.16	87.85	6634.90	504.61 N	480.81 E	511.30	4.93
6985.00	77.97	87.82	6646.45	506.37 N	527.36 E	557.87	7.94
7033.00	81.29	88.63	6655.09	507.83 N	574.55 E	605.05	7.11
7119.00	86.43	87.35	6664.29	510.83 N	659.97 E	690.50	6.16
7213.00	86.99	86.81	6669.68	515.61 N	753.69 E	784.33	0.83
7308.00	88.34	86.70	6673.55	520.98 N	848.46 E	879.25	1.43
7403.00	90.03	88.27	6674.90	525.15 N	943.35 E	974.22	2.43
7498.00	92.90	90.44	6672.48	526.22 N	1038.30 E	1069.05	3.79
7592.00	90.86	89.71	6669.39	526.10 N	1132.24 E	1162.80	2.30
7687.00	90.89	87.31	6667.94	528.57 N	1227.19 E	1257.72	2.53
7782.00	91.66	88.32	6665.83	532.19 N	1322.10 E	1352.67	1.34
7876.00	92.16	90.35	6662.69	533.28 N	1416.03 E	1446.49	2.22
7971.00	91.11	91.50	6659.98	531.75 N	1510.98 E	1541.16	1.64

# **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 86.43 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.72 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 7971.00 FEET  
IS 1601.82 FEET ALONG 70.61 DEGREES (GRID)**

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

**Depth 241 Inc 0.60 Azi 68.53  
Depth 511 Inc 0.40 Azi 172.73  
Depth 725 Inc 0.20 Azi 57.23**

**Tied in @ Surface**

**Magnetic direction of 7.724 has been added to AZI for grid direction correction.**