

PCD Pressure Case Directional  
DGR Dual Gamma Ray

[illegible]

## WELL INFORMATION

<b>MWD Run Number</b>	100	200			
<b>Date run completed</b>	03-Aug-13	09-Aug-13			
<b>Rig Bit Number</b>	1	0200			
<b>Bit Size (in)</b>	8.750	6.125			
<b>Tool Nominal OD (in)</b>	6.750	4.750			
<b>Log Start Depth (MD, ft)</b>	944.00	8,170.00			
<b>Log End Depth (MD, ft)</b>	8,170.00	12,120.00			
<b>Drill or Wipe</b>	Drill	Drill			
<b>Drill/Wipe Start Date and Time</b>	31-Jul-13 11:30	06-Aug-13 20:45			
<b>Drill/Wipe End Date and Time</b>	03-Aug-13 04:26	08-Aug-13 20:00			
<b>Min Inc (deg) @ Depth (MD, ft)</b>	.06 @ 957.00	87.22 @ 9,228.00			
<b>Max Inc (deg) @ Depth (MD, ft)</b>	88.70 @ 8,122.00	93.16 @ 10,260.00			
<b>Bit TFA(in2) / Bit Type</b>	2.23 / PDC	.98 / PDC			
<b>Flow Rate (gpm)</b>	583.30	300.00			
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	N/A / N/A	N/A / N/A			
<b>Fluid Type</b>	Fresh Water Gel	Native/Spud Mud			
<b>Density (ppg) / Viscosity (spqt)</b>	9.13 / 45.00	9.80 / 45.00			
<b>Filtrate CL (ppm)</b>	60.00	1,100.00			
<b>pH / Fluid Loss (mptm)</b>	N/A / N/A	8.00 / 4			
<b>PV (cP) / YP (lhf2)</b>	9 / 12.00	15 / 12.00			
<b>% Solids / % Sand</b>	3.30 / 0.10	9 / 0.1			
<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>Max Tool Temp (degF) / Source</b>	183.90 / PCM	222.59 / HCIM			
<b>Rm @ Max Tool Temp (degF)</b>	N/A @ 183.90	N/A @ 222.59			
<b>Lead MWD Engineer</b>	Caleb Jones	Clay Wass			
<b>Customer Representative</b>	Hal Curlett				

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM	HCIM			
Software Version	5.84	88.56			
Sub Serial Number	11404277	123			
Insert Serial Number	11620311	23			
Date and Time Initialized	30-Jul-13 19:37	06-Aug-13 10:59			
Date and Time Read	05-Aug-13 11:31	01-Jan-70 00:00			
ECMB SW Version	N/A	N/A			

Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	45.33	50.91			
Software Version	6.21	6.21			
Sub Serial Number	11404277	11917160			
Sonde Serial Number	12177532	11478086			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	298.02	167.90			

Gamma Ray Sensor Information

Tool Type	PCG	DGR			
Distance From Bit (ft)	55.67	72.81			
Recorded Sample Period (sec)	10	8			
Software Version	8.15	N/A			
Sub Serial Number	11404277	123			
Insert/Sonde Serial Number	11293433	12345			

REMARKS

1. Depths are measured depths, referenced to the Driller's pipe tally and are measured from the Drill Floor, unless otherwise specified.
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 "Bingham Plastic" model for synthetic and oil based fluids.
4. All data presented is recorded data unless otherwise specified.  
--ROPA is real time data
5. The following smoothing parameters have been applied to the data:  
ROPA: 0.5 ft interval, 1.2 ft coercion distance, 3 ft gap fill  
PGRC: 0.5 ft interval, 0.6 ft coercion distance, 3 ft gap fill  
DGRCC: 0.5 ft interval, 0.6 ft coercion distance, 3 ft gap fill
6. Insite Version 7.4.2

WARRANTY

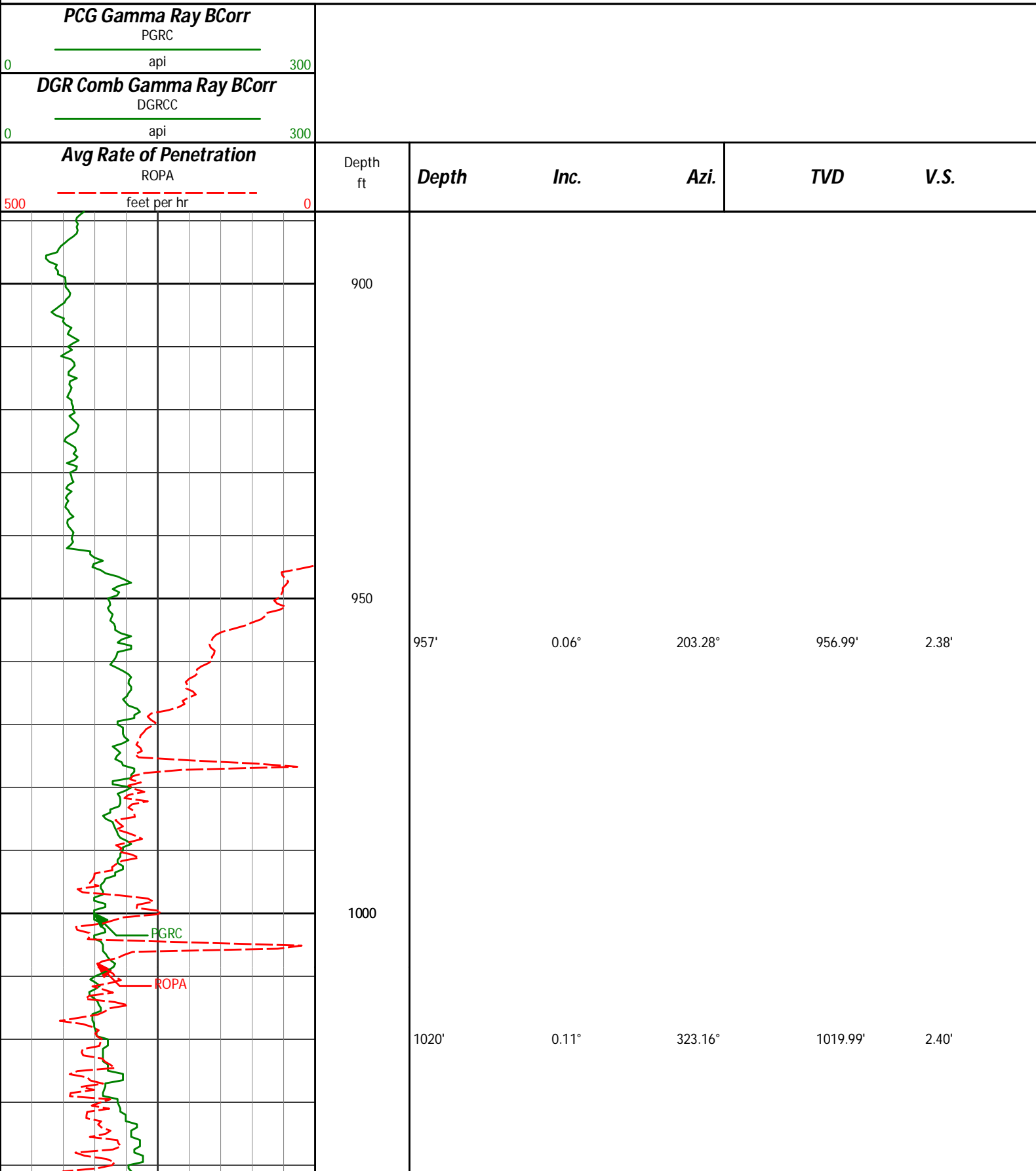
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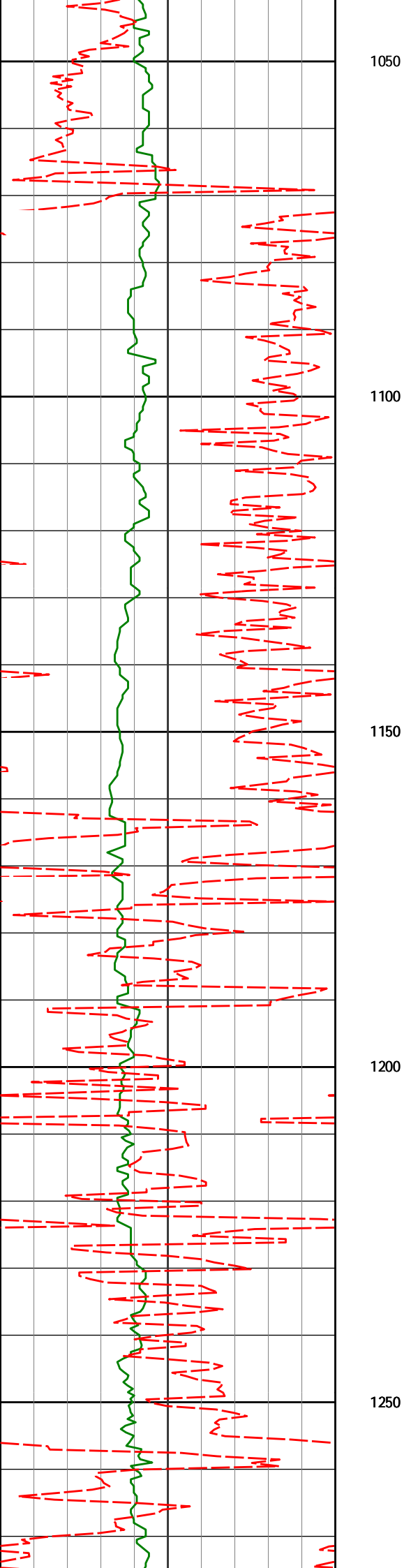
# HALLIBURTON

## Sperry Drilling Services

### MD Detail Log 1:240

Anadarko  
Underhill 28N-17HZ  
Xtreme 22  
05123369160000





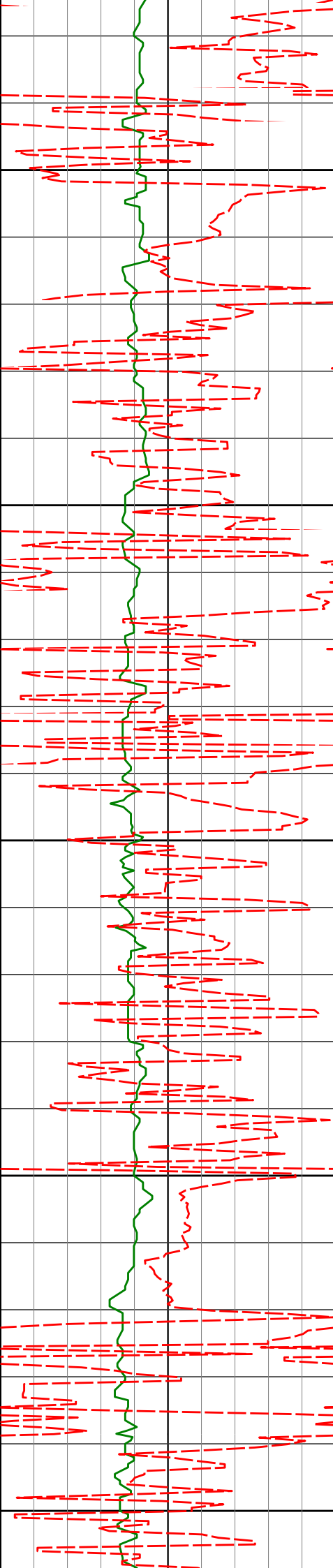
1211'

0.22°

314.93°

1210.99'

2.81'



1300

1305'

1.77°

255.53°

1304.97'

2.58'

1350

1400

1401'

3.02°

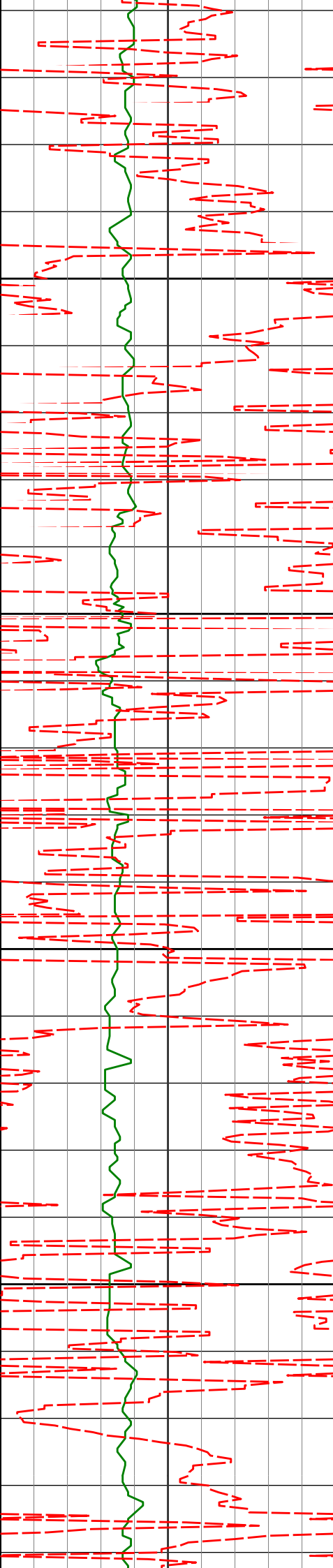
248.37°

1400.89'

1.29'

1450

1500



1550

1600

1650

1700

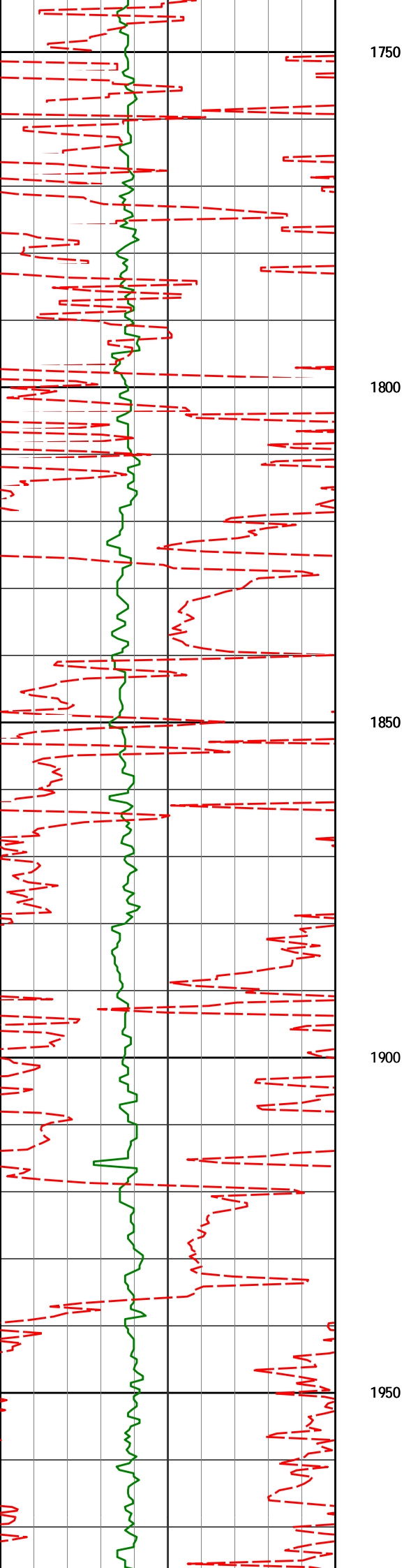
1591'

7.07°

240.64°

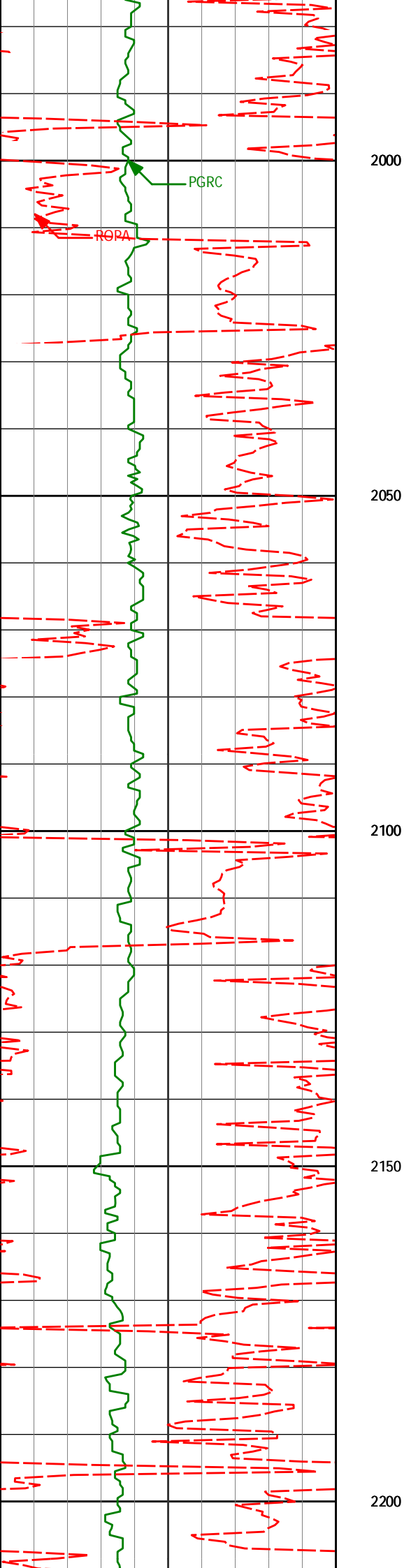
1590.11'

-6.25'



1778' 8.48° 237.72° 1775.39' -19.18'

1961' 10.60° 221.03° 1955.88' -39.02'



2000

2050

2100

2150

2200

2145'

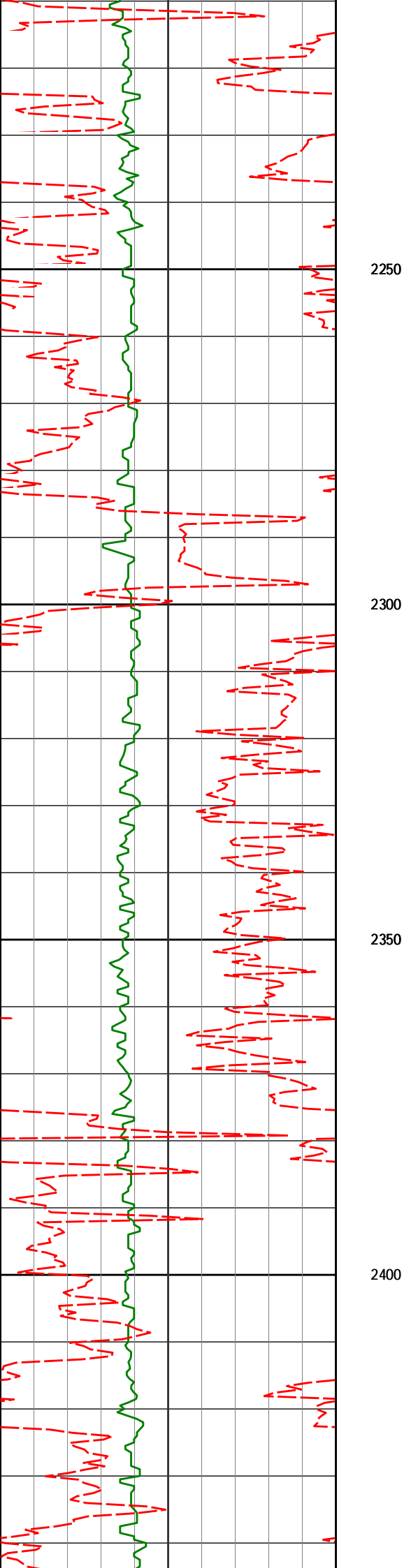
12.89°

224.98°

2136.02'

-66.23'





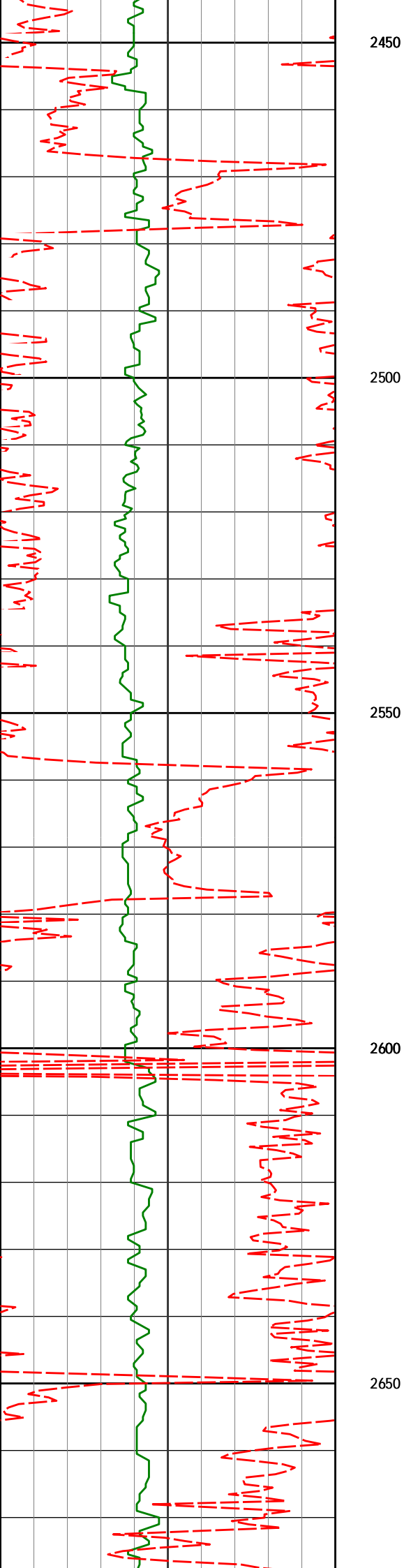
2327'

12.98°

224.00°

2313.40'

-95.20'



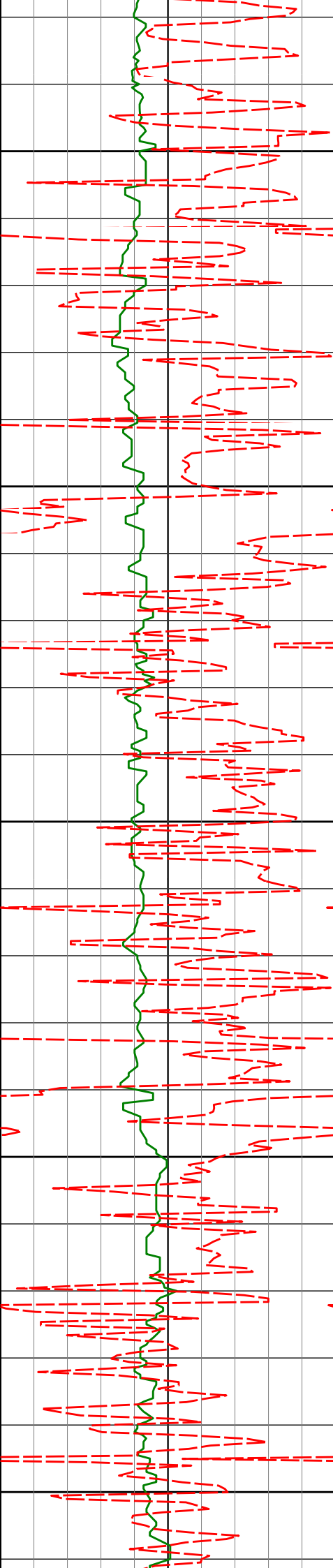
2510'

12.15°

223.10°

2492.01'

-123.96'



2700

2750

2800

2850

2900

2694'

12.91°

230.42°

2671.64'

-151.10'

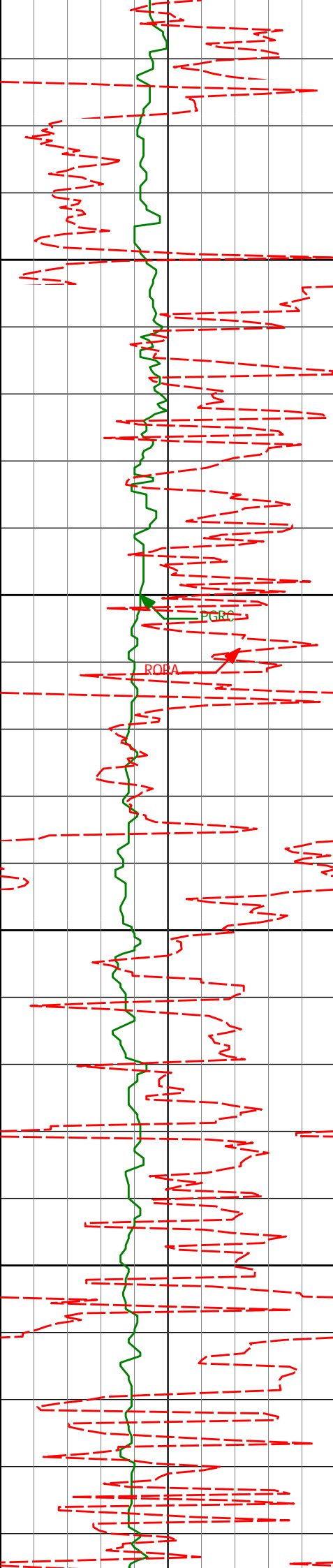
2876'

11.08°

221.29°

2849.67'

-177.11'



2950

3000

3050

3100

3059'

13.05°

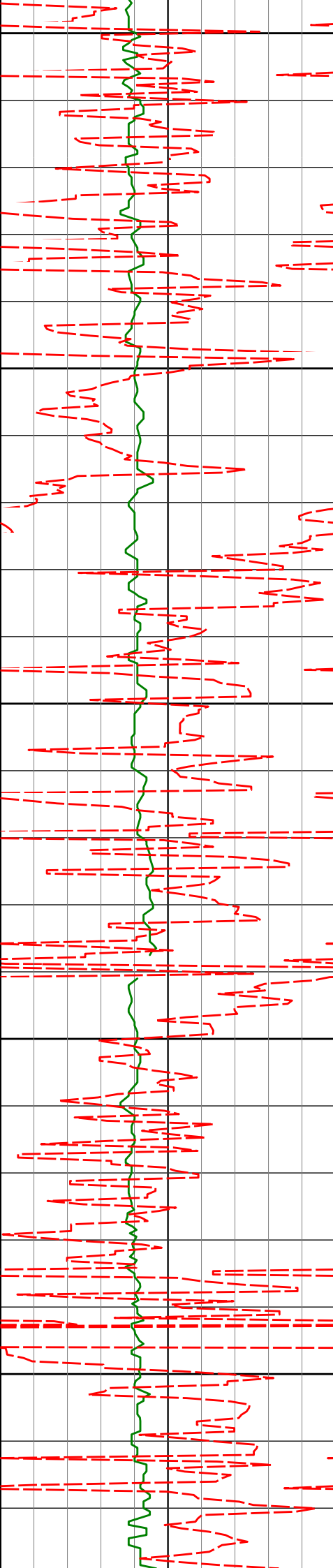
232.16°

3028.65'

-202.90'

PGBC

ROBA



3150

3200

3250

3300

3350

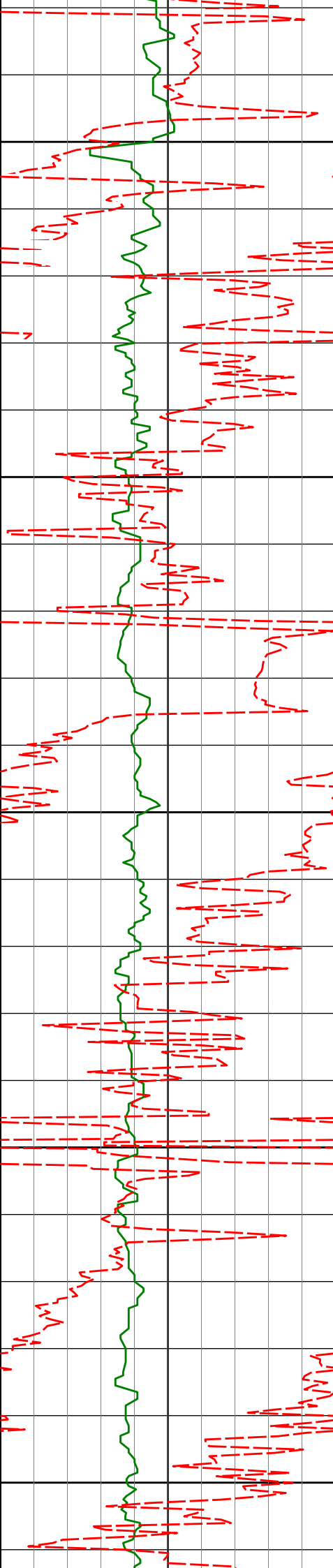
3242'

12.71°

232.15°

3207.04'

-227.83'



3400

3425'

11.73°

228.15°

3385.90'

-252.49'

3450

3500

3550

3600

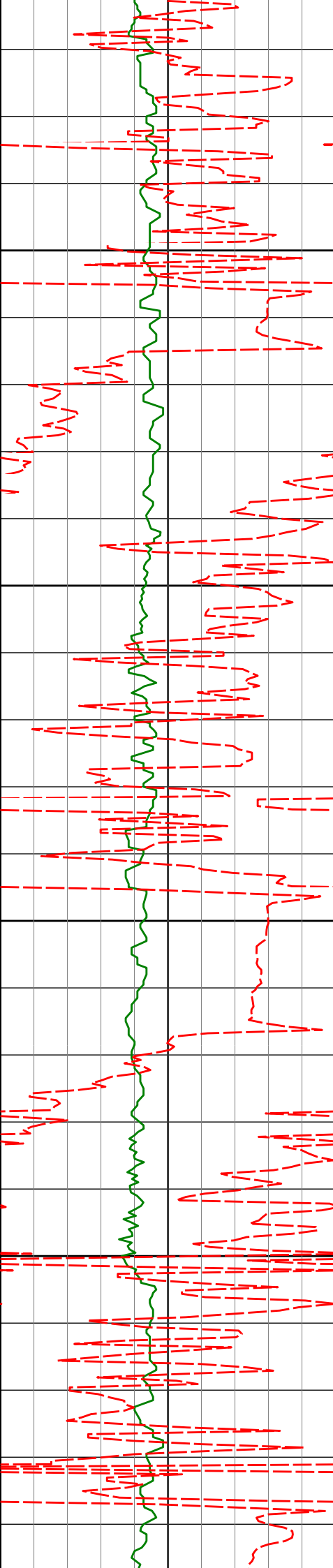
3609'

11.33°

228.83°

3566.18'

-276.77'



3650

3700

3750

3800

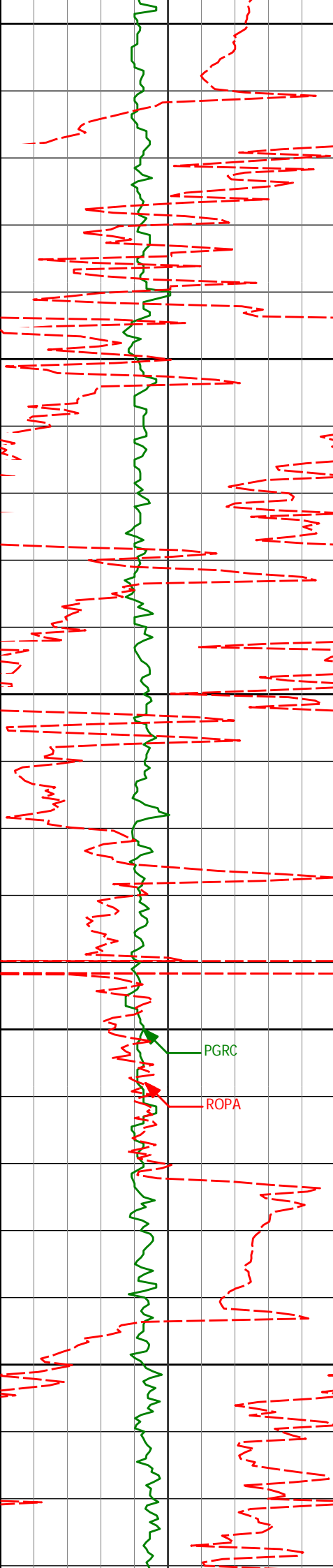
3792'

12.99°

226.20°

3745.07'

-302.75'



3850

3900

3950

4000

4050

PGRC

ROPA

3975'

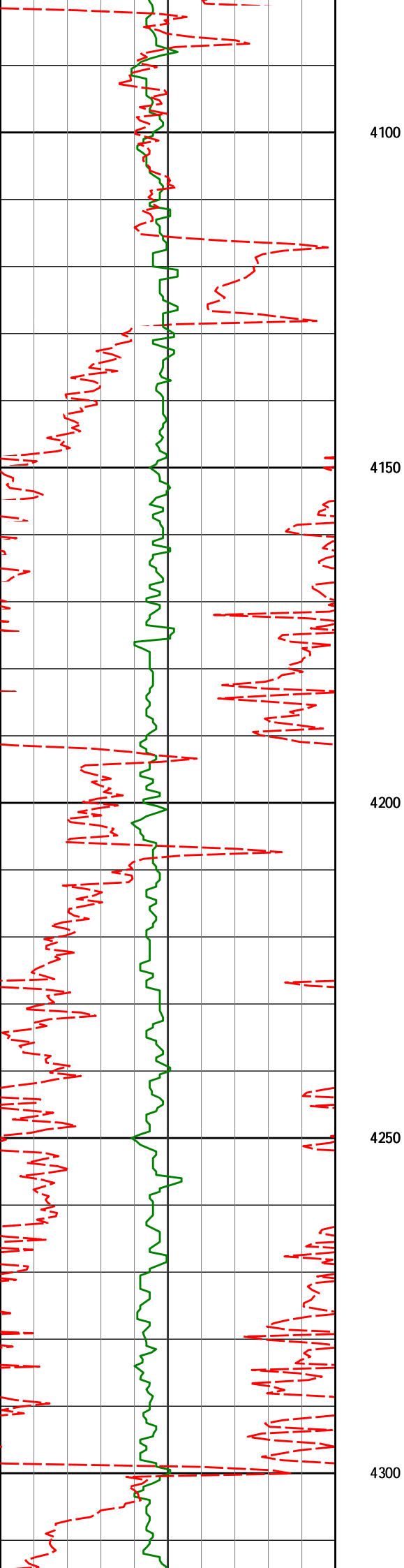
13.27°

221.66°

3923.29'

-332.58'





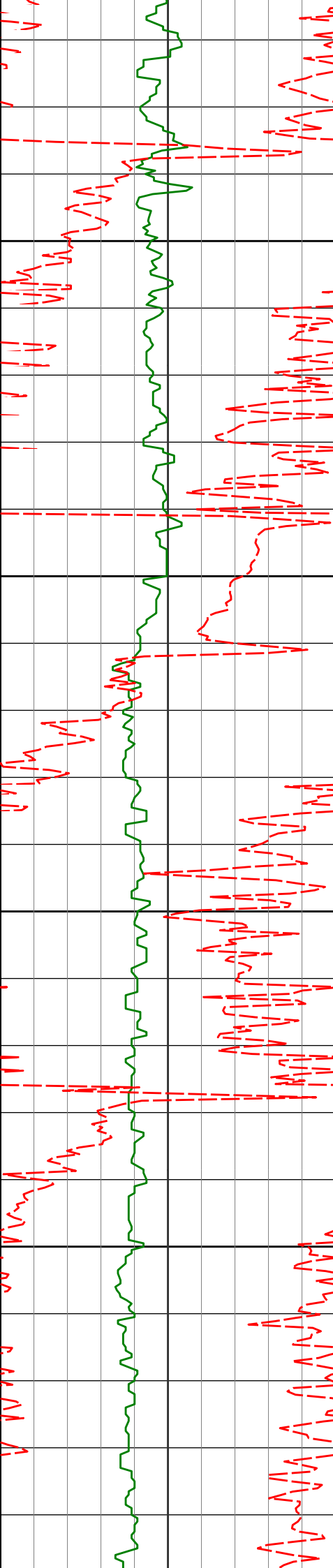
4158'

14.60°

222.33°

4100.91'

-365.23'



4350

4400

4450

4500

4341'

12.93°

221.36°

4278.65'

-397.54'

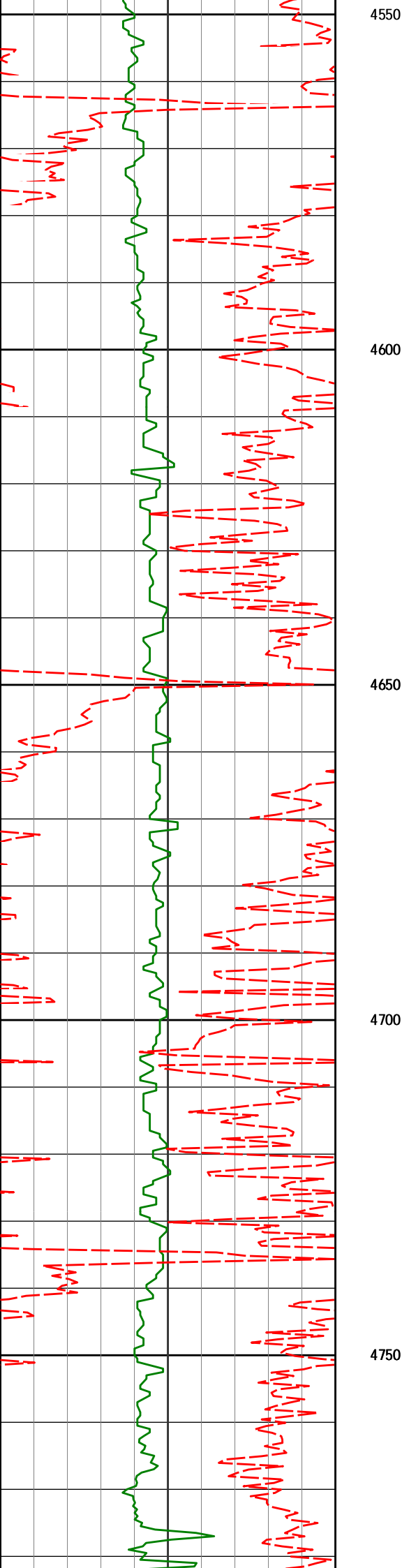
4513'

14.42°

223.73°

4445.77'

-427.37'



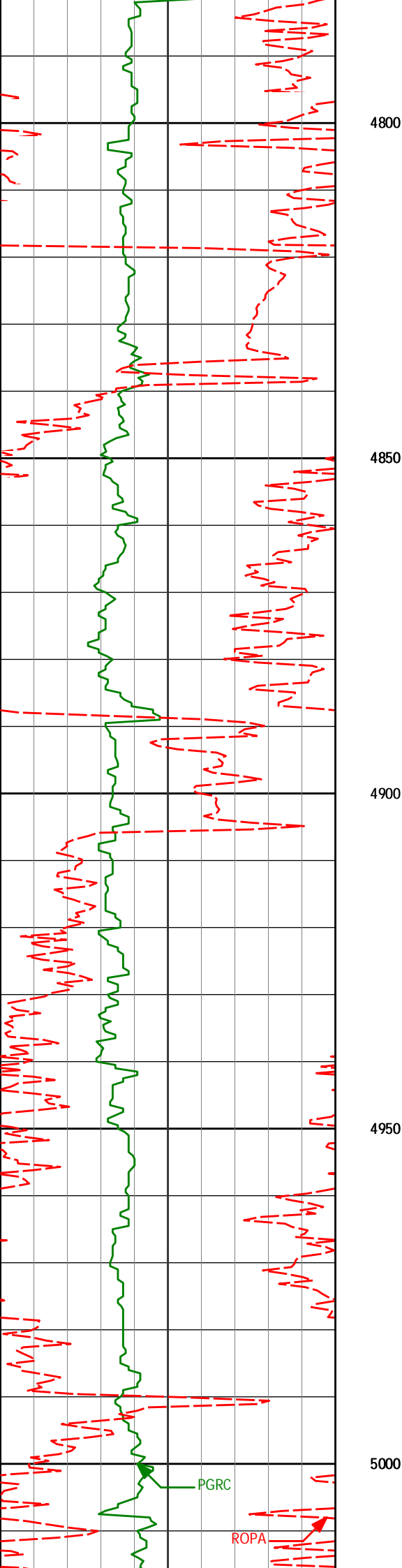
4684'

12.94°

222.58°

4611.92'

-456.76'



4800

4850

4900

4950

5000

4855'

12.99°

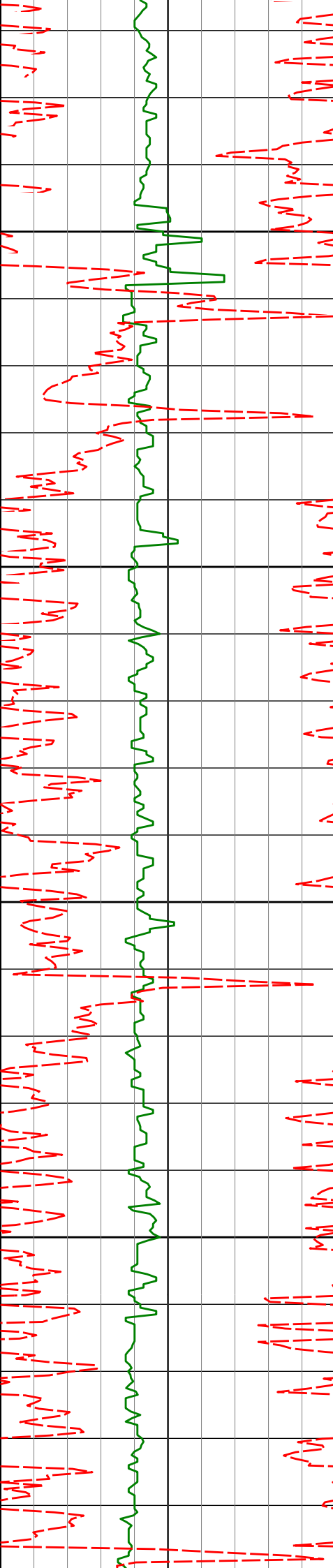
220.02°

4778.56'

-485.49'

PGRC

ROPA



5050

5100

5150

5200

5250

5027'

13.17°

220.37°

4946.10'

-515.13'

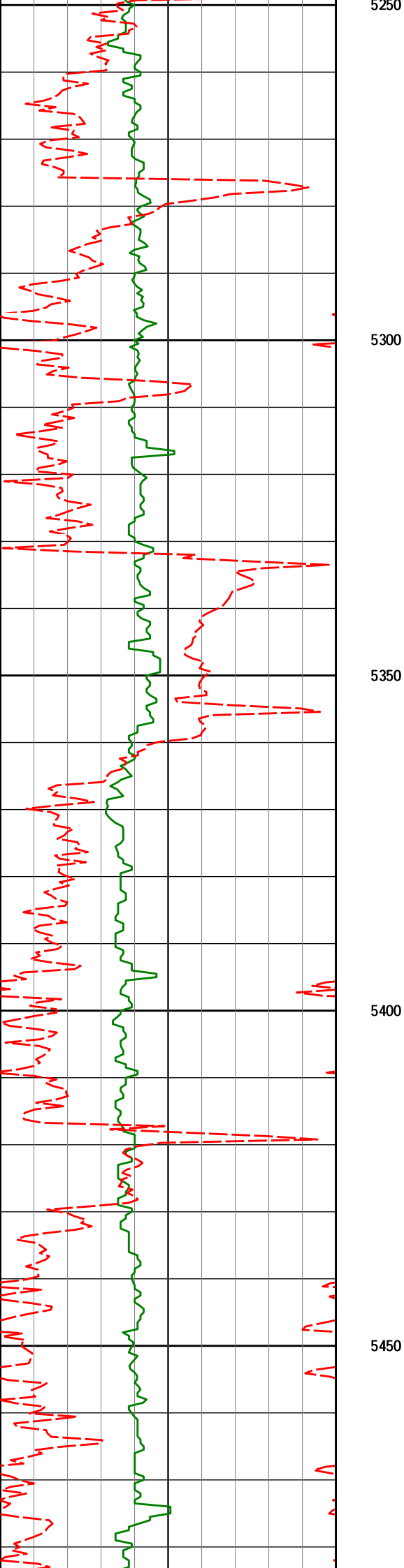
5198'

12.28°

219.19°

5112.90'

-543.98'



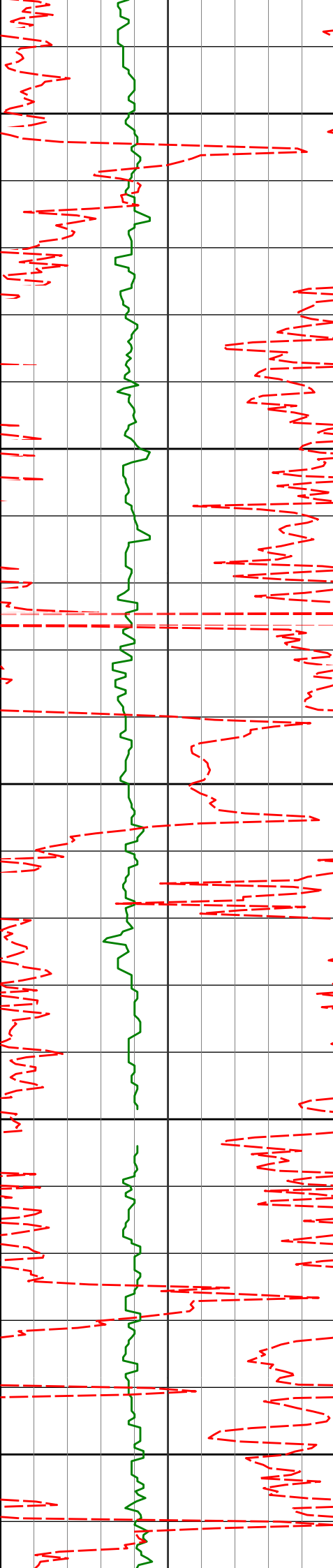
5370'

12.30°

221.15°

5280.96'

-571.88'



5500

5541'

11.93°

217.80°

5448.15'

-599.47'

5550

5600

5650

5700

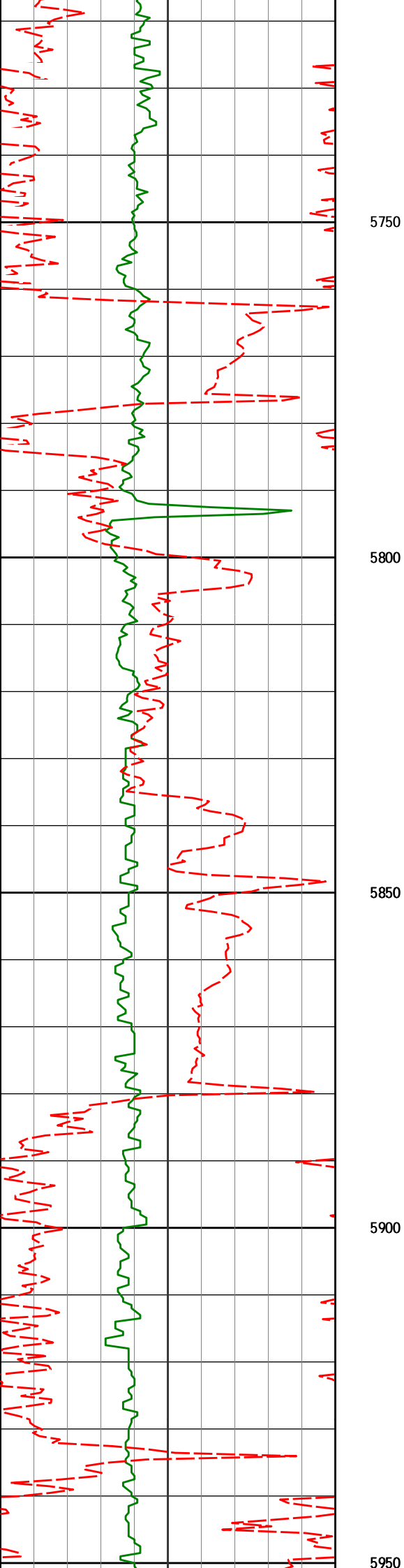
5712'

12.67°

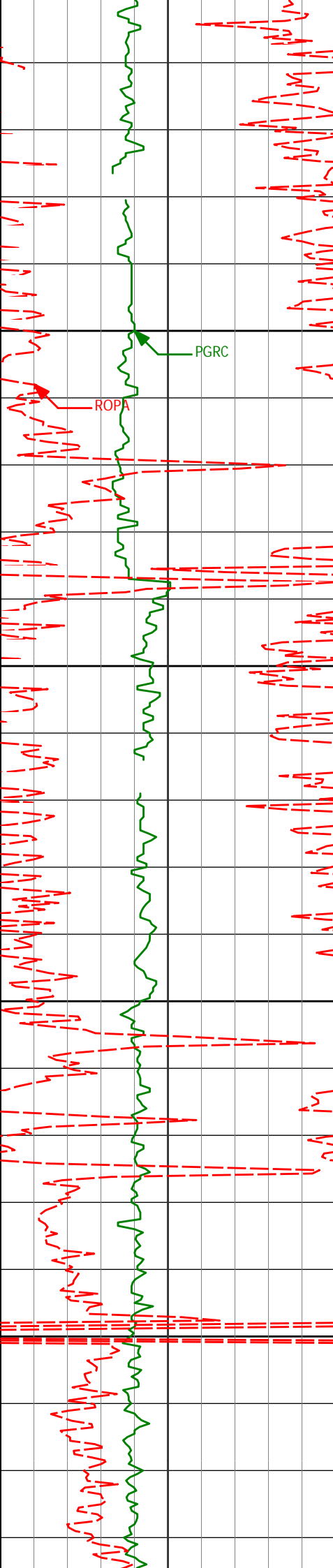
217.38°

5615.23'

-628.26'







6000  
6050  
6100  
6150

5969'

14.30°

232.18°

5865.21'

-669.98'

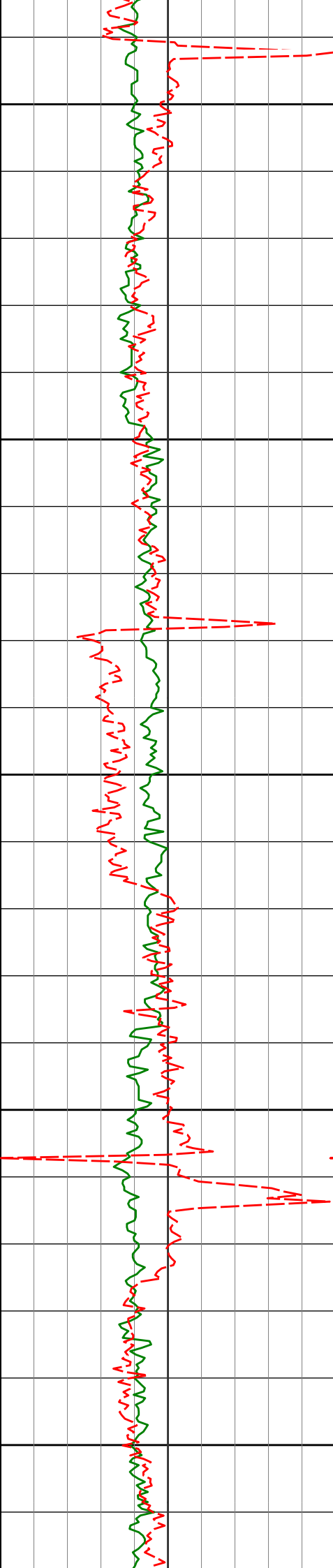
6141'

12.09°

230.12°

6032.66'

-694.45'



6200

6250

6300

6350

6400

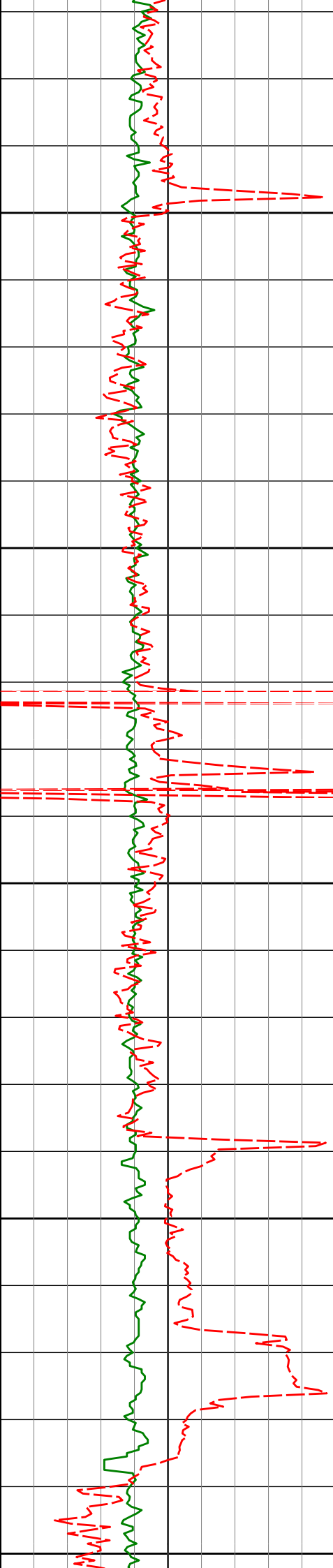
6312'

9.81°

229.14°

6200.54'

-715.38'



6450

6483'

8.48°

229.24°

6369.37'

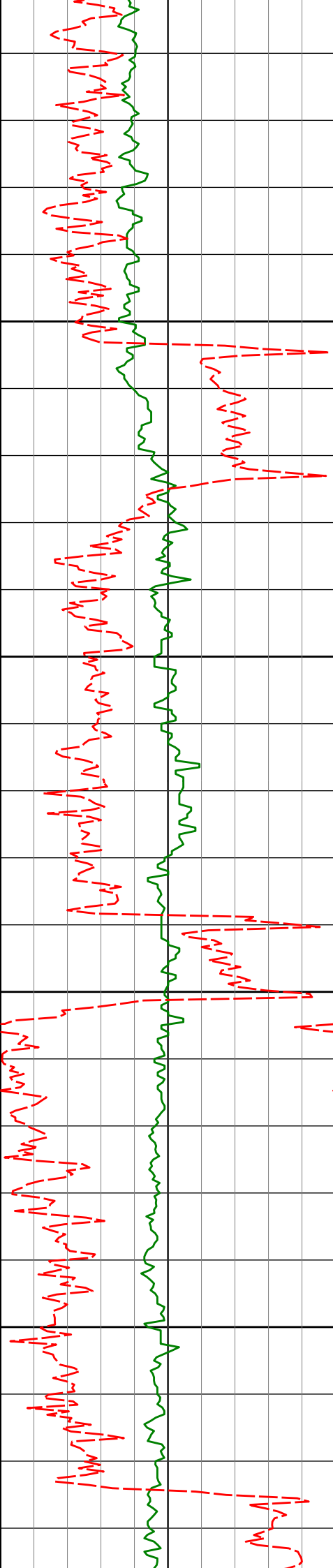
-733.07'

6500

6550

6600

6650



6700

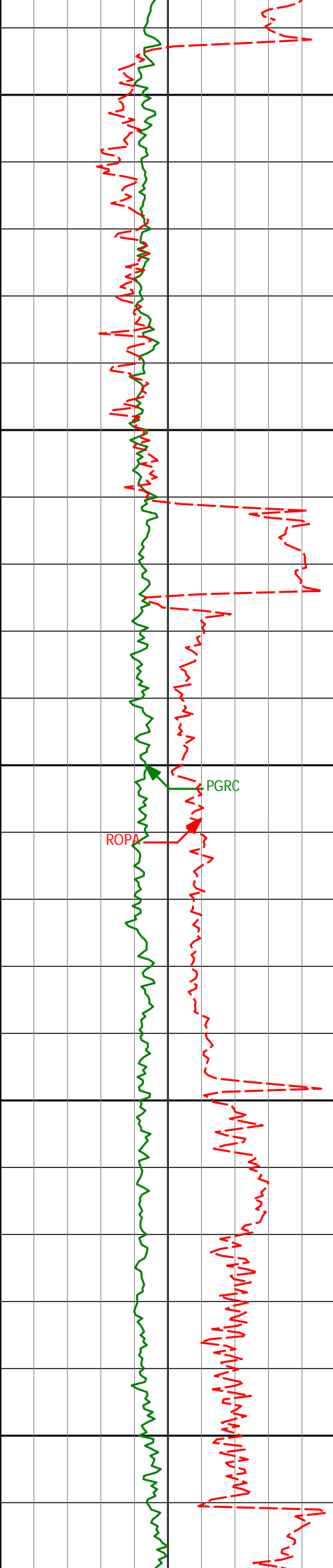
6750

6800

6850

6655'	6.20°	230.65°	6539.94'	-747.19'
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6826'	3.69°	209.66°	6710.31'	-757.79'
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6900

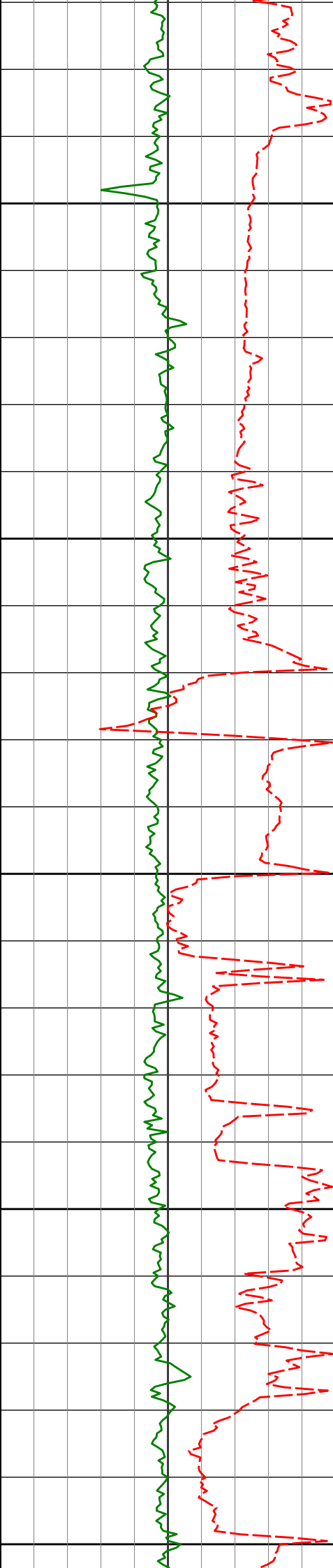
6950

7000

7050

7100

6997'	2.39°	229.96°	6881.07'	-764.84'
7040'	3.36°	229.93°	6924.01'	-766.23'
7083'	3.94°	318.93°	6966.95'	-765.92'



7150

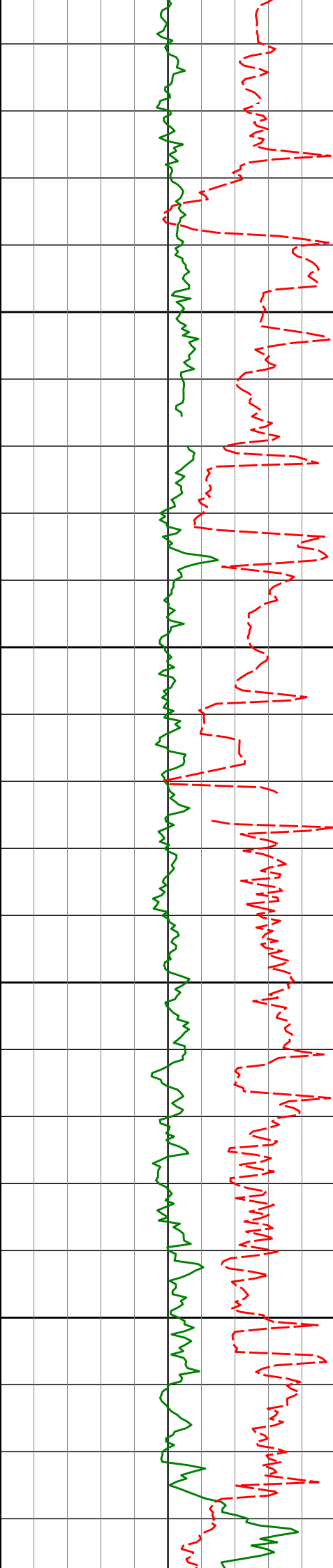
7200

7250

7300

7350

7126'	8.41°	335.23°	7009.70'	-761.94'
7169'	16.34°	346.38°	7051.67'	-753.18'
7212'	25.05°	353.06°	7091.86'	-738.23'
7254'	26.00°	355.88°	7129.76'	-720.21'
7297'	26.59°	355.44°	7168.31'	-701.21'
7340'	28.83°	357.45°	7206.38'	-681.25'



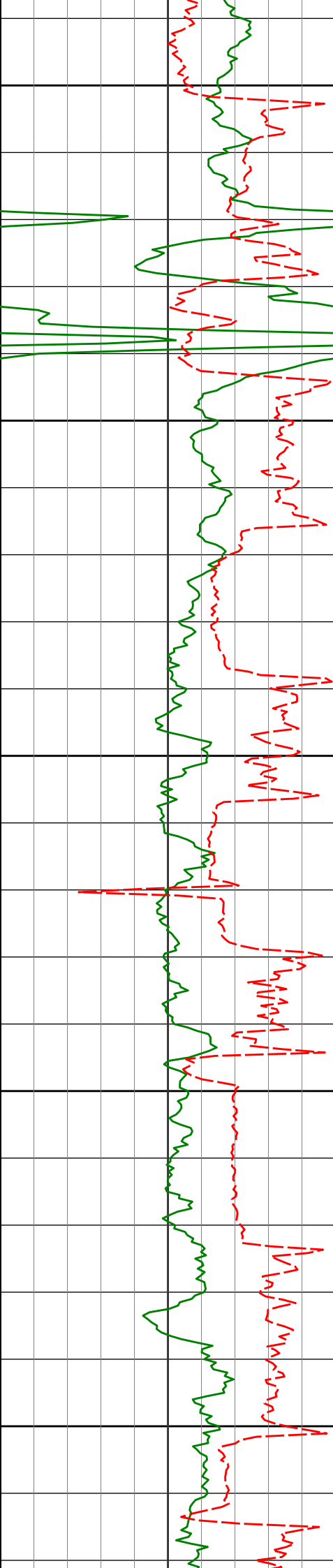
7400

7450

7500

7550

7383'	31.56°	2.10°	7243.55'	-659.64'
7426'	35.24°	3.33°	7279.44'	-636.01'
7469'	36.71°	4.96°	7314.23'	-610.82'
7511'	42.27°	4.85°	7346.63'	-584.22'
7554'	49.09°	4.01°	7376.66'	-553.58'



7600

7597'

50.93°

4.04°

7404.30'

-520.73'

7650

7640'

55.28°

3.52°

7430.11'

-486.43'

7700

7683'

58.69°

1.94°

7453.54'

-450.43'

7750

7726'

61.56°

2.61°

7474.95'

-413.18'

7800

7769'

63.80°

2.84°

7494.69'

-375.03'

7811'

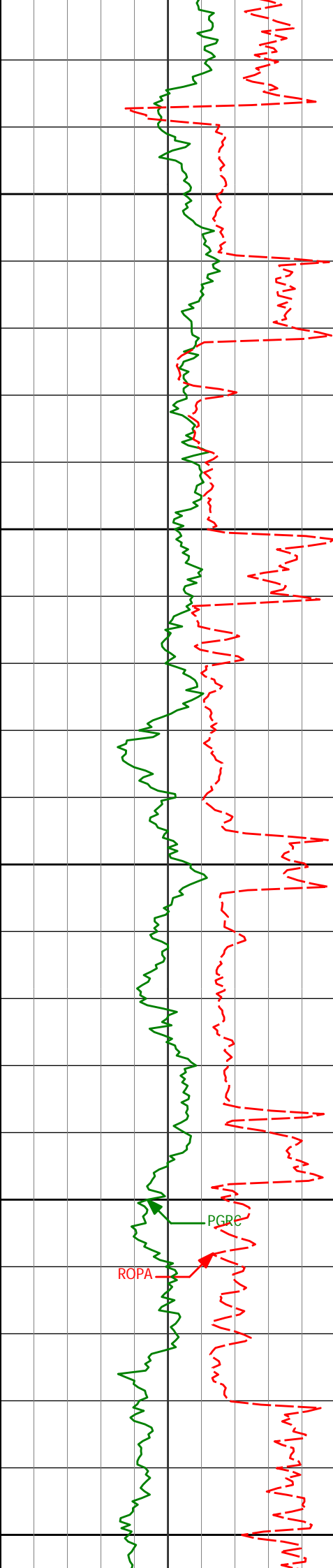
69.11°

1.74°

7511.46'

-336.58'





7850

7854'	73.08°	0.24°	7525.40'	-295.92'
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7900

7897'	75.83°	0.19°	7536.92'	-254.50'
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7950

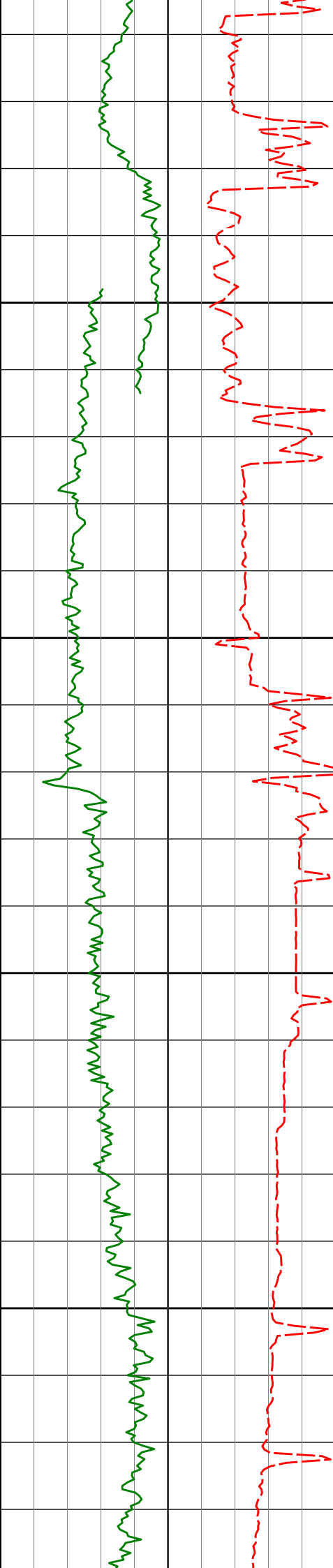
7940'	77.92°	359.89°	7546.69'	-212.62'
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8000

7983'	79.59°	359.78°	7555.07'	-170.45'
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8050

8026'	81.75°	359.40°	7562.04'	-128.02'
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8100

8150

8200

8250

8069'

86.36°

359.09°

7566.50'

-85.27'

8122'

88.70°

358.86°

7568.78'

-32.33'

8200'

90.99°

359.82°

7568.99'

45.67'

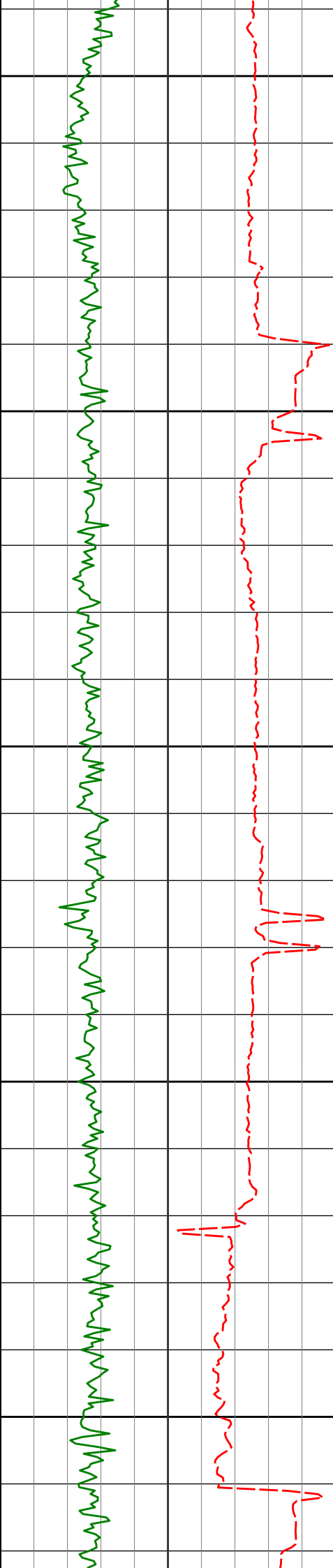
8286'

91.36°

359.81°

7567.22'

131.65'



8300

8350

8400

8450

8500

8372'

90.49°

0.59°

7565.83'

217.63'

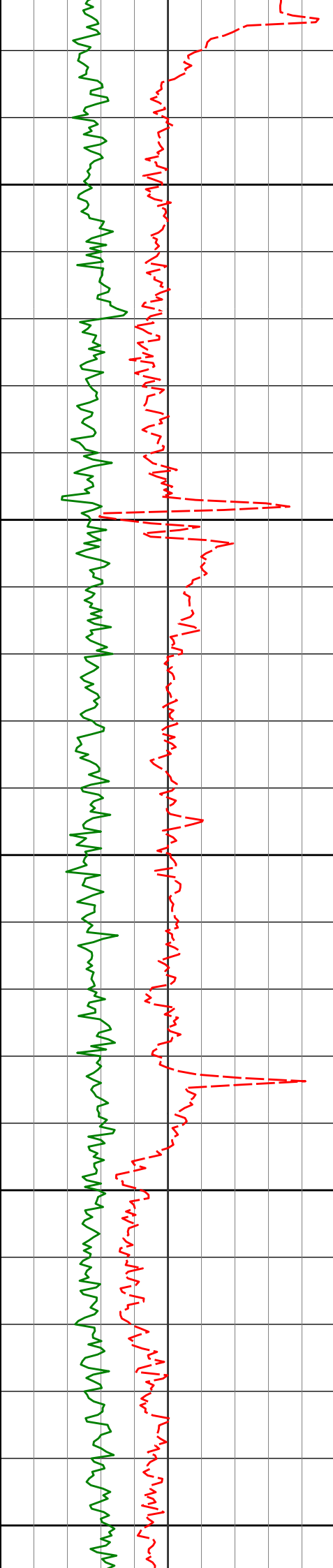
8457'

91.17°

0.99°

7564.60'

302.61'



8550

8600

8650

8700

8750

8543'

89.51°

359.88°

7564.09'

388.60'

8629'

90.12°

0.53°

7564.37'

474.60'

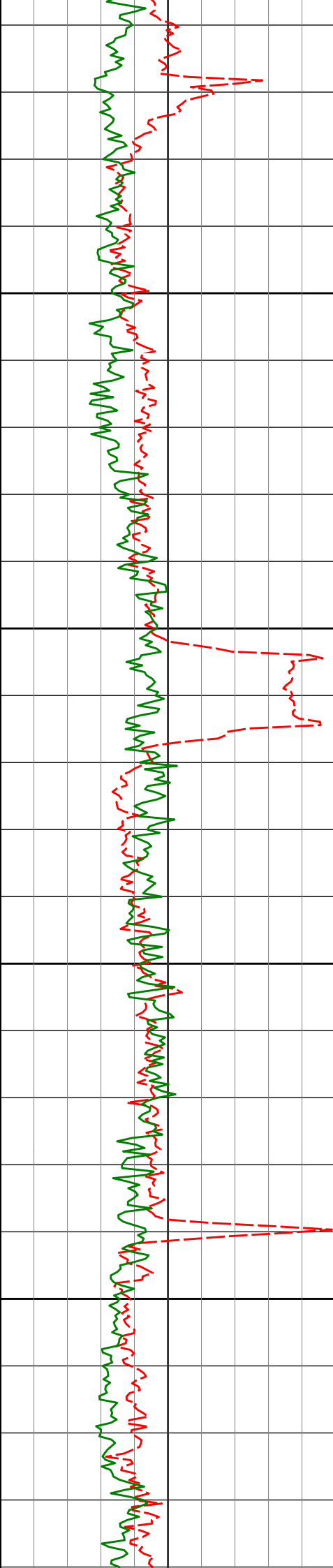
8714'

90.74°

0.03°

7563.73'

559.59'



8800

8800'

91.61°

359.77°

7561.97'

645.57'

8850

8886'

90.74°

358.62°

7560.21'

731.55'

8900

8950

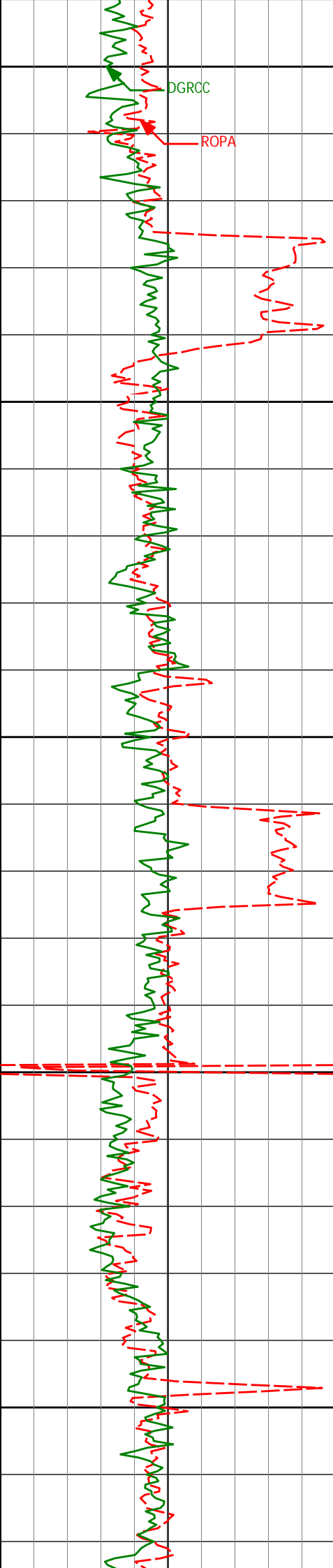
8971'

91.17°

358.19°

7558.79'

816.51'



9000

DGRCC

ROPA

9050

9057'

90.19°

358.81°

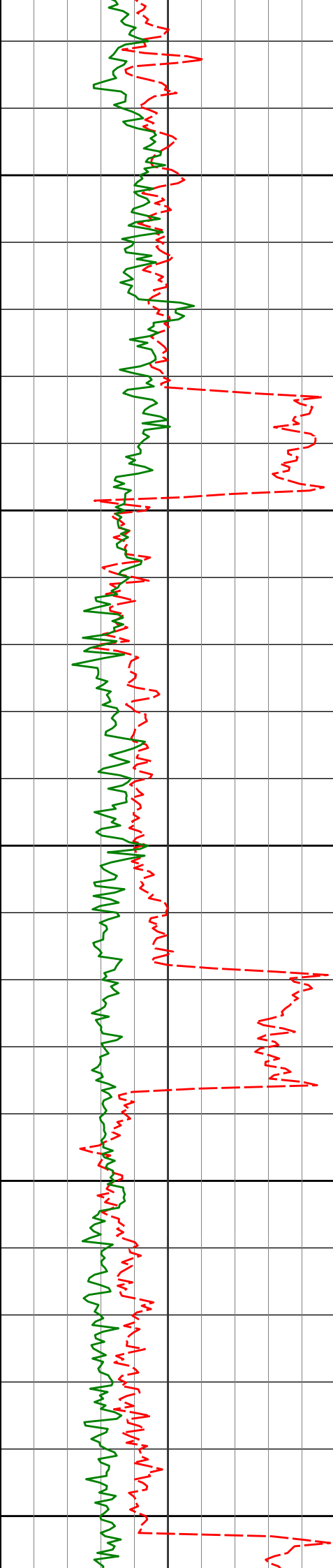
7557.77'

902.48'

9100

9150

9200



9250

9300

9350

9400

9450

9228'

87.22°

356.14°

7561.64'

1073.26'

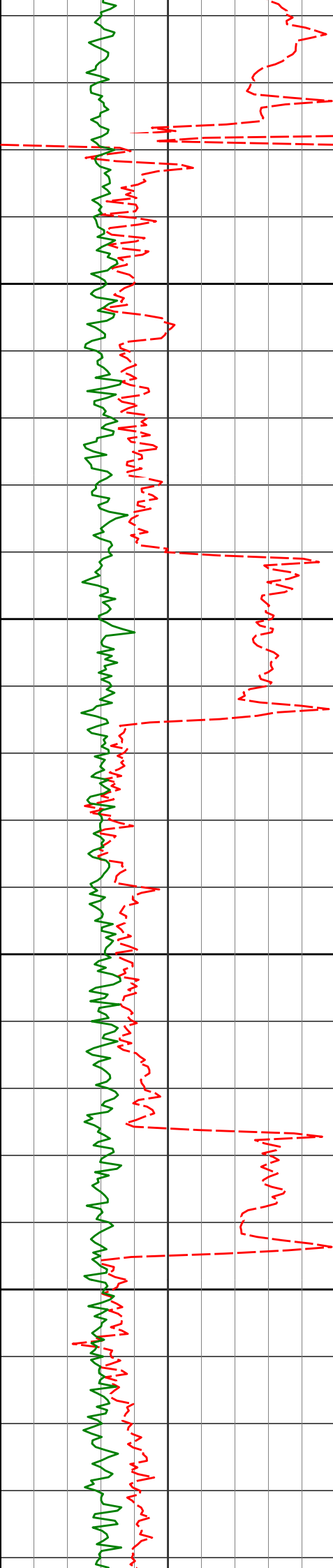
9403'

88.95°

356.51°

7567.49'

1247.83'



9500

9550

9600

9650

9574'

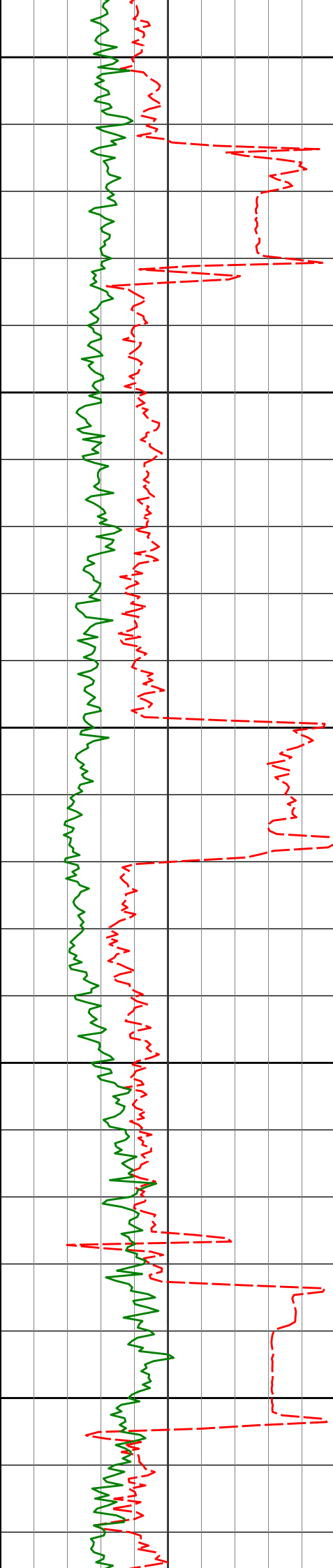
90.00°

359.11°

7569.06'

1418.70'





9700

9750

9800

9850

9900

9745'

89.38°

0.40°

7569.98'

1589.69'

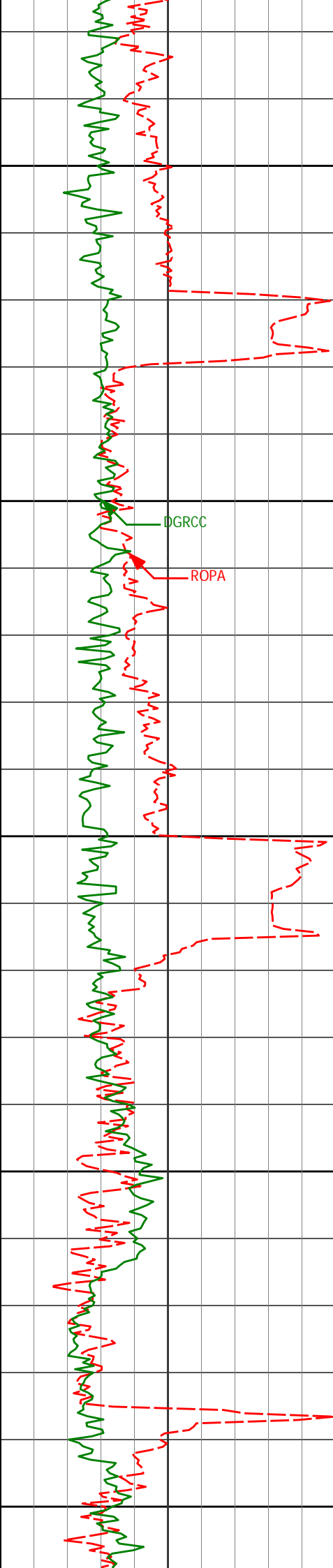
9917'

88.89°

3.61°

7572.57'

1761.53'



9950

10000

10050

10100

10150

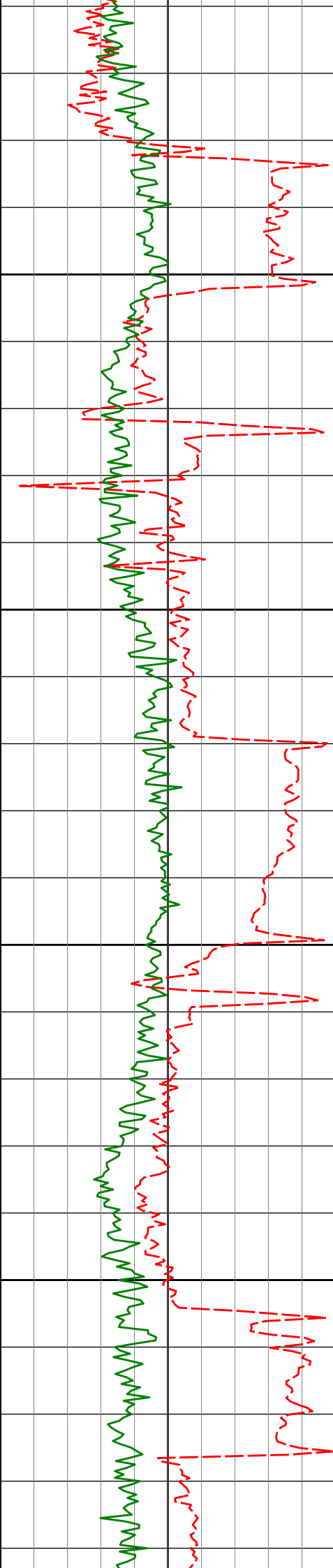
10088'

92.60°

2.42°

7570.36'

1932.21'



10200

10250

10300

10350

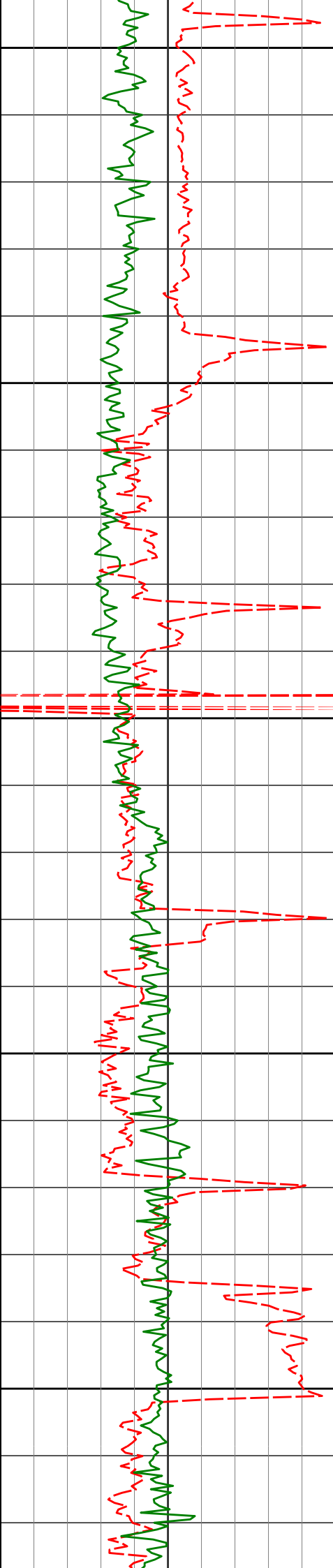
10260'

93.16°

359.96°

7561.73'

2103.93'



10400

10431'

88.89°

356.10°

7558.68'

2274.75'

10450

10500

10550

10600

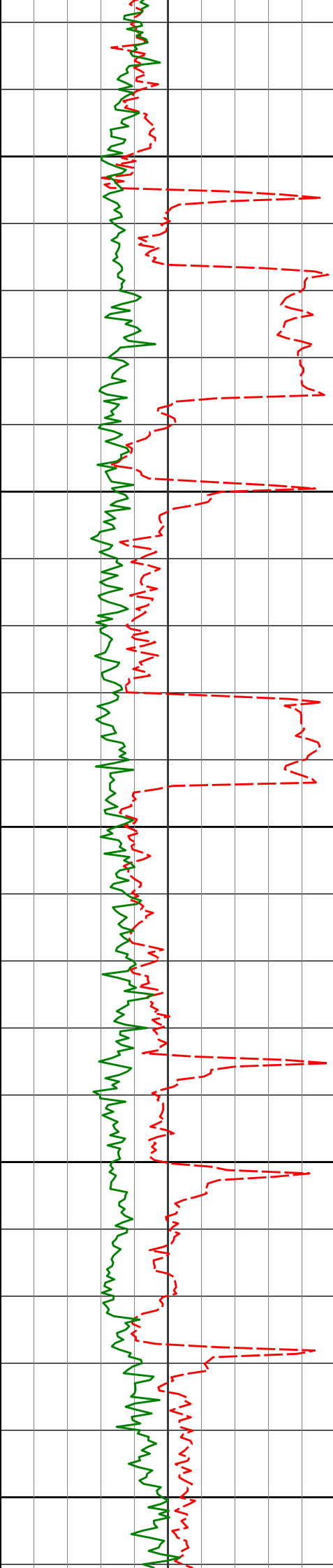
10603'

88.08°

356.53°

7563.23'

2446.37'



10650

10700

10750

10800

10850

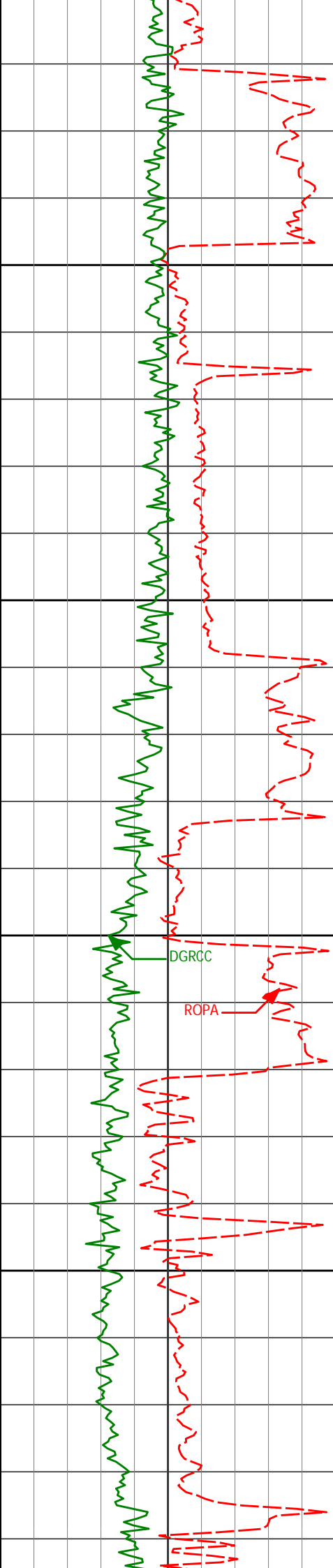
10774'

91.24°

358.06°

7564.25'

2617.17'



10900

10950

11000

11050

10946'

91.54°

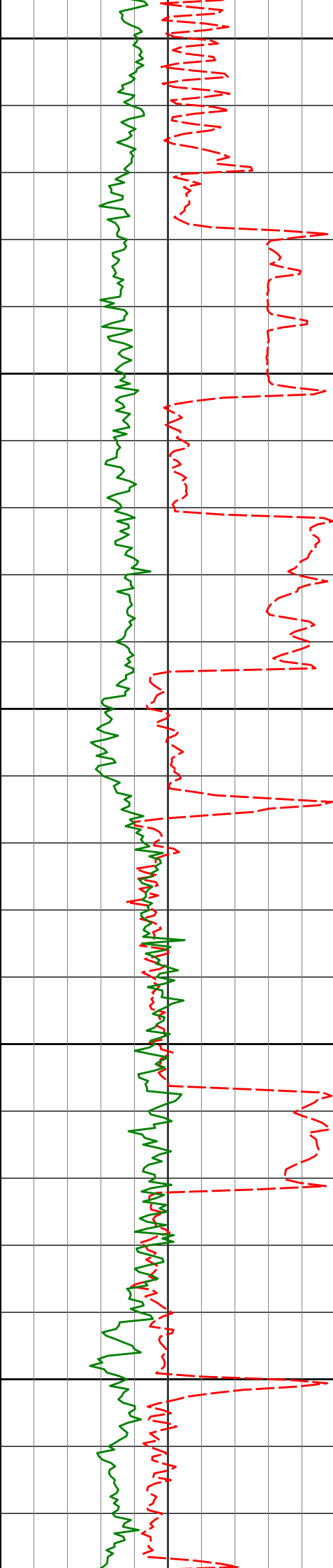
356.93°

7560.07'

2788.98'

DGRCC

ROPA



11100

11118'

91.42°

359.17°

7555.62'

2960.83'

11150

11200

11250

11289'

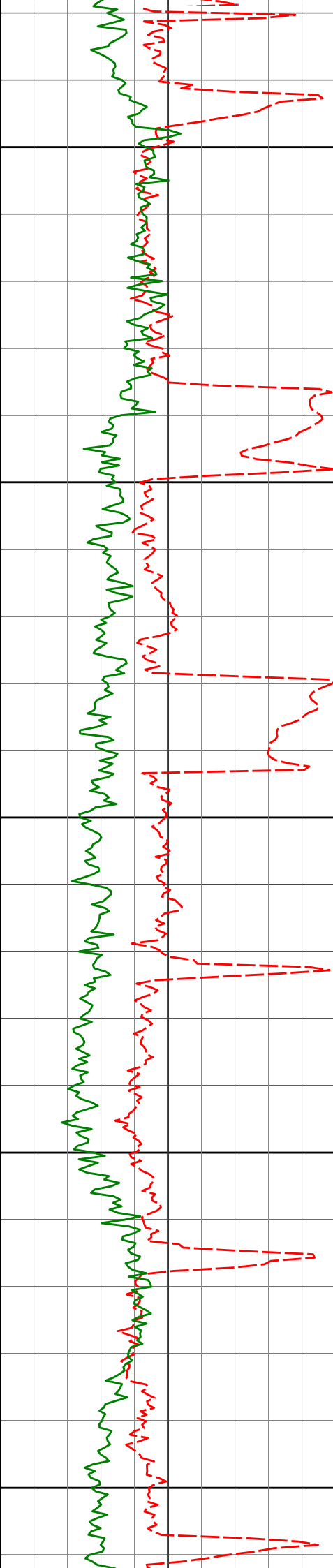
87.71°

1.61°

7556.92'

3131.77'

11300



11350

11400

11450

11500

11550

11461'

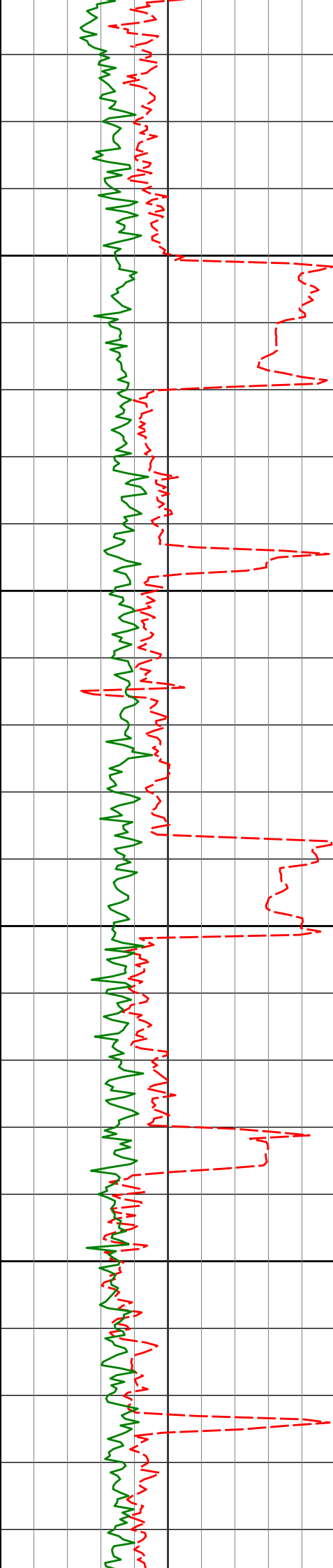
88.15°

3.23°

7563.13'

3303.48'





11600

11650

11700

11750

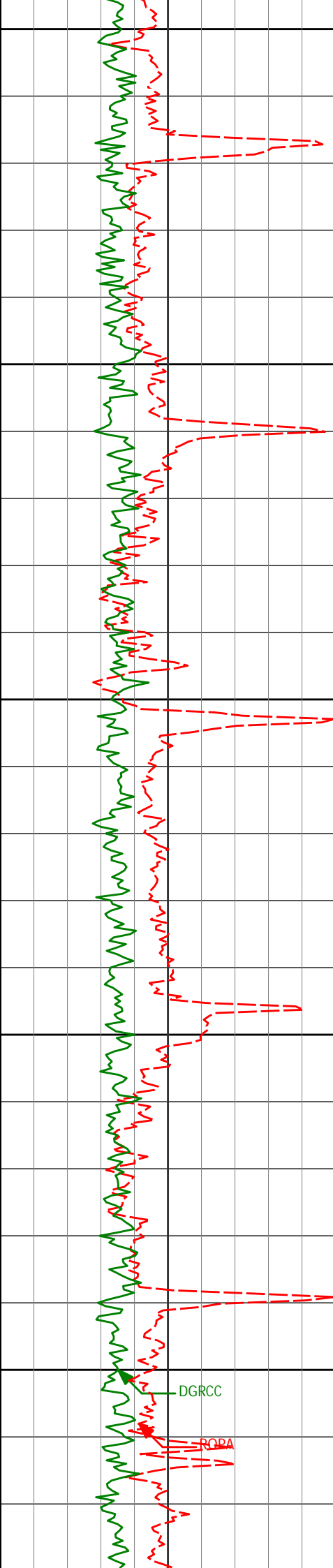
11632'

88.52°

3.51°

7568.11'

3474.07'



11800

11803'

90.00°

3.35°

7570.32'

3644.71'

11850

11900

11950

12000

11975'

90.12°

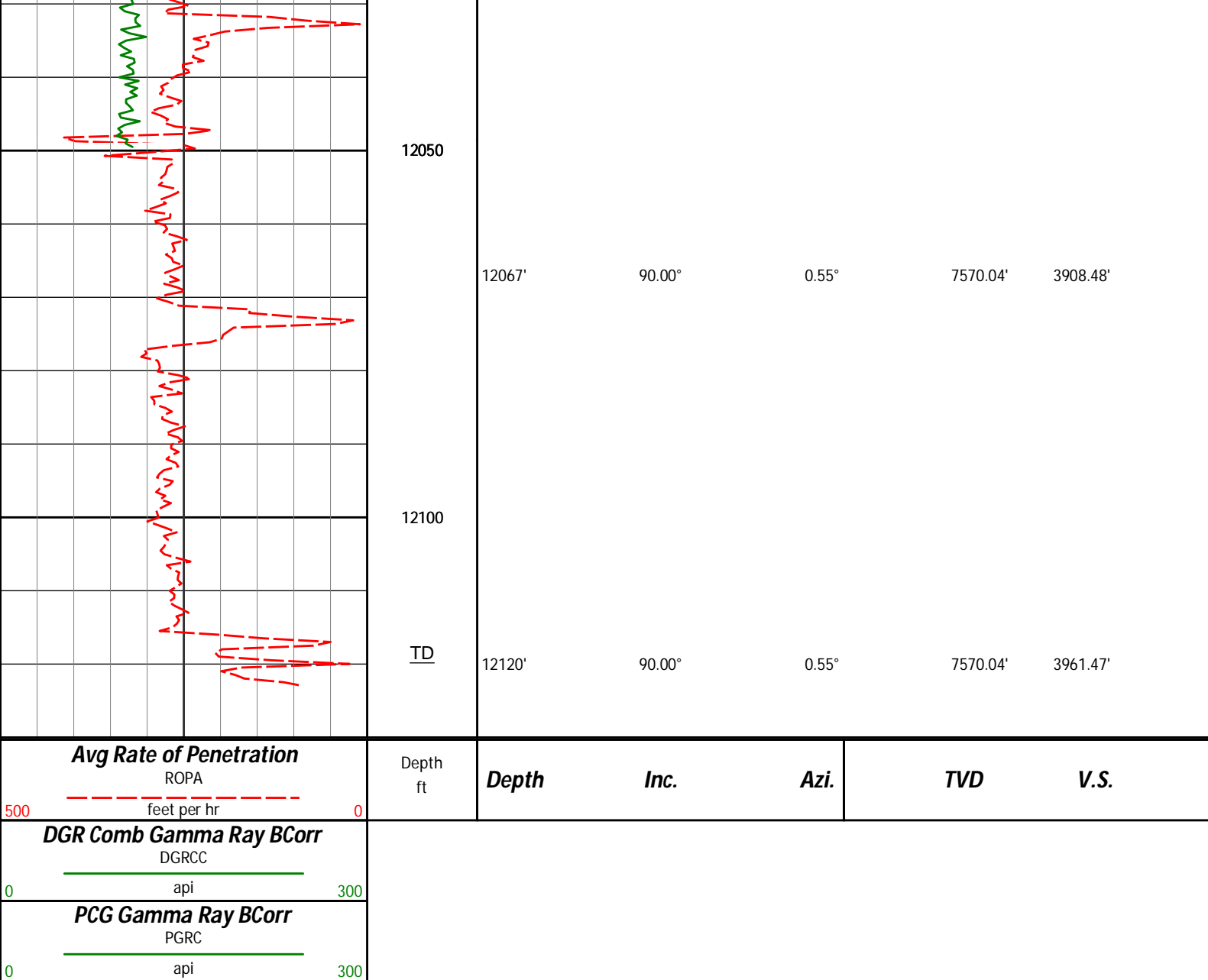
1.84°

7570.14'

3816.51'

DGRCC

RQDA



**HALLIBURTON**

## DIRECTIONAL SURVEY REPORT

Anadarko Petroleum Corporation  
Underhill 28N-17HZ  
Wattenberg  
Weld Colorado  
USA  
CA-XX-0900550718

Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
795.00	0.45	307.68	794.99	2.06 N	2.74 W	2.07	TIE-IN
957.00	0.06	203.28	956.99	2.37 N	3.28 W	2.38	0.29
1020.00	0.11	323.16	1019.99	2.39 N	3.33 W	2.40	0.24
1211.00	0.22	314.93	1210.99	2.80 N	3.70 W	2.81	0.06
1305.00	1.77	255.53	1304.97	2.56 N	5.24 W	2.58	1.77
1401.00	3.02	248.37	1400.89	1.26 N	9.03 W	1.29	1.34
1591.00	7.07	240.64	1590.11	6.33 S	23.88 W	-6.25	2.15
1778.00	8.48	237.72	1775.39	19.34 S	45.57 W	-19.18	0.79
1961.00	10.60	221.03	1955.88	39.25 S	68.04 W	-39.02	1.89
2145.00	12.89	224.98	2136.02	66.54 S	93.67 W	-66.23	1.32
2327.00	12.98	224.00	2313.40	95.61 S	122.22 W	-95.20	0.13
2510.00	12.15	223.10	2492.01	124.46 S	149.66 W	-123.96	0.47
2694.00	12.91	230.42	2671.64	151.69 S	178.74 W	-151.10	0.96
2876.00	11.08	221.29	2849.67	177.79 S	205.95 W	-177.11	1.45
3059.00	13.05	232.16	3028.65	203.68 S	233.88 W	-202.90	1.64

3242.00	12.71	232.15	3207.04	228.71 S	266.10 W	-227.83	0.19
3425.00	11.73	228.15	3385.90	253.47 S	295.85 W	-252.49	0.71
3609.00	11.33	228.83	3566.18	277.85 S	323.38 W	-276.77	0.23
3792.00	12.99	226.20	3745.07	303.92 S	351.76 W	-302.75	0.95
3975.00	13.27	221.66	3923.29	333.85 S	380.57 W	-332.58	0.58
4158.00	14.60	222.33	4100.91	366.59 S	410.06 W	-365.23	0.73
4341.00	12.93	221.36	4278.65	399.00 S	439.11 W	-397.54	0.92
4513.00	14.42	223.73	4445.77	428.92 S	466.62 W	-427.37	0.92
4684.00	12.94	222.58	4611.92	458.40 S	494.30 W	-456.76	0.88
4855.00	12.99	220.02	4778.56	487.22 S	519.61 W	-485.49	0.34
5027.00	13.17	220.37	4946.10	516.94 S	544.72 W	-515.13	0.11
5198.00	12.28	219.19	5112.90	545.87 S	568.83 W	-543.98	0.54
5370.00	12.30	221.15	5280.96	573.84 S	592.44 W	-571.88	0.24
5541.00	11.93	217.80	5448.15	601.52 S	615.26 W	-599.47	0.46
5712.00	12.67	217.38	5615.23	630.38 S	637.47 W	-628.26	0.43
5969.00	14.30	232.18	5865.21	672.24 S	679.66 W	-669.98	1.48
6141.00	12.09	230.12	6032.66	696.81 S	710.26 W	-694.45	1.31
6312.00	9.81	229.14	6200.54	717.82 S	735.01 W	-715.38	1.34
6483.00	8.48	229.24	6369.37	735.58 S	755.58 W	-733.07	0.78
6655.00	6.20	230.65	6539.94	749.75 S	772.37 W	-747.19	1.33
6826.00	3.69	209.66	6710.31	760.39 S	782.23 W	-757.79	1.79
6997.00	2.39	229.96	6881.07	767.46 S	787.69 W	-764.84	0.97
7040.00	3.36	229.93	6924.01	768.85 S	789.34 W	-766.23	2.25
7083.00	3.94	318.93	6966.95	768.55 S	791.27 W	-765.92	11.93
7126.00	8.41	335.23	7009.70	764.58 S	793.56 W	-761.94	11.07
7169.00	16.34	346.38	7051.67	755.83 S	796.31 W	-753.18	19.19
7212.00	25.05	353.06	7091.86	740.88 S	798.84 W	-738.23	20.95
7254.00	26.00	355.88	7129.76	722.87 S	800.57 W	-720.21	3.67
7297.00	26.59	355.44	7168.31	703.87 S	802.02 W	-701.21	1.45
7340.00	28.83	357.45	7206.38	683.92 S	803.24 W	-681.25	5.64
7383.00	31.56	2.10	7243.55	662.31 S	803.29 W	-659.64	8.34
7426.00	35.24	3.33	7279.44	638.67 S	802.16 W	-636.01	8.72
7469.00	36.71	4.96	7314.23	613.48 S	800.33 W	-610.82	4.08
7511.00	42.27	4.85	7346.63	586.88 S	798.05 W	-584.22	13.22
7554.00	49.09	4.01	7376.66	556.22 S	795.69 W	-553.58	15.92
7597.00	50.93	4.04	7404.30	523.36 S	793.38 W	-520.73	4.28
7640.00	55.28	3.52	7430.11	489.06 S	791.12 W	-486.43	10.16
7683.00	58.69	1.94	7453.54	453.05 S	789.41 W	-450.43	8.52
7726.00	61.56	2.61	7474.95	415.80 S	787.93 W	-413.18	6.80
7769.00	63.80	2.84	7494.69	377.64 S	786.11 W	-375.03	5.23
7811.00	69.11	1.74	7511.46	339.18 S	784.58 W	-336.58	12.88
7854.00	73.08	0.24	7525.40	298.52 S	783.88 W	-295.92	9.80
7897.00	75.83	0.19	7536.92	257.10 S	783.72 W	-254.50	6.40
7940.00	77.92	359.89	7546.69	215.22 S	783.70 W	-212.62	4.91
7983.00	79.59	359.78	7555.07	173.05 S	783.82 W	-170.45	3.90
8026.00	81.75	359.40	7562.04	130.62 S	784.13 W	-128.02	5.09
8069.00	86.36	359.09	7566.50	87.87 S	784.69 W	-85.27	10.76
8122.00	88.70	358.86	7568.78	34.93 S	785.63 W	-32.33	4.44
8200.00	90.99	359.82	7568.99	43.06 N	786.53 W	45.67	3.18
8286.00	91.36	359.81	7567.22	129.04 N	786.81 W	131.65	0.43
8372.00	90.49	0.59	7565.83	215.03 N	786.51 W	217.63	1.36
8457.00	91.17	0.99	7564.60	300.01 N	785.34 W	302.61	0.93
8543.00	89.51	359.88	7564.09	386.00 N	784.68 W	388.60	2.33
8629.00	90.12	0.53	7564.37	472.00 N	784.37 W	474.60	1.04
8714.00	90.74	0.03	7563.73	556.99 N	783.95 W	559.59	0.94
8800.00	91.61	359.77	7561.97	642.97 N	784.11 W	645.57	1.05
8886.00	90.74	358.62	7560.21	728.94 N	785.32 W	731.55	1.67
8971.00	91.17	358.19	7558.79	813.90 N	787.68 W	816.51	0.71
9057.00	90.19	358.81	7557.77	899.86 N	789.93 W	902.48	1.35
9228.00	87.22	356.14	7561.64	1070.62 N	797.47 W	1073.26	2.33
9403.00	88.95	356.51	7567.49	1245.15 N	808.68 W	1247.83	1.01
9574.00	90.00	359.11	7569.06	1416.00 N	815.22 W	1418.70	1.64
9745.00	89.38	0.40	7569.98	1587.00 N	815.95 W	1589.69	0.84
9917.00	88.89	3.61	7572.57	1758.85 N	809.94 W	1761.53	1.89
10088.00	92.60	2.42	7570.36	1929.56 N	800.95 W	1932.21	2.28
10260.00	93.16	359.96	7561.73	2101.30 N	797.38 W	2103.93	1.46
10431.00	88.89	356.10	7558.68	2272.10 N	803.25 W	2274.75	3.37
10603.00	88.08	356.53	7563.23	2443.68 N	814.29 W	2446.37	0.53
10774.00	91.24	358.06	7564.25	2614.46 N	822.36 W	2617.17	2.05
10946.00	91.54	356.93	7560.07	2786.24 N	829.88 W	2788.98	0.68
11118.00	91.42	359.17	7555.62	2958.07 N	835.72 W	2960.83	1.31
11289.00	87.71	1.61	7556.92	3129.02 N	834.56 W	3131.77	2.59
11461.00	88.15	3.23	7563.13	3300.75 N	827.32 W	3303.48	0.97
11632.00	88.52	3.51	7568.11	3471.38 N	817.28 W	3474.07	0.27
11803.00	90.00	3.35	7570.32	3642.06 N	807.05 W	3644.71	0.87

11975.00	90.12	1.84	7570.14	3813.88 N	799.27 W	3816.51	0.88
12067.00	90.00	0.55	7570.04	3905.85 N	797.35 W	3908.48	1.40
12120.00	90.00	0.55	7570.04	3958.85 N	796.84 W	3961.47	0.00

**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 359.81 DEGREES (TRUE)  
A TOTAL CORRECTION OF 8.66 DEG FROM MAGNETIC NORTH TO TRUE NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 12120.00 FEET  
IS 4038.25 FEET ALONG 348.62 DEGREES (TRUE)**

**Directional Surveys Tied on to Gyro's @ 795' MD. Final Survey is a straightline projection to bit.**

**Date Printed:05 September 2013**