

## PCG Pressure Case Gamma Ray PCDC Pressure Case Directional

Company : Whiting Oil and Gas						
Rig : Frontier 26						
Well : Razor 27J-3409A						
Field : Redtail						
Country : USA						
API Number : 05-123-38064						
<div>LOCATION</div> <div>Latitude : 40° 48' 31.14" North Longitude : 103° 50' 56.20" West UTM Easting = 3,457,037.828 ft UTM Northing = 1,541,693.202 ft</div>				<div>Other Services</div> <div>Directional Drilling</div>		
Permanent Datum : Ground Level				Elevation :	4767.00 ft	Elev.
Log Measured From : Drill Floor				22.00 ft Above Permanent Datum		KB DF GL WD N/A 4789.00 ft 4767.00 ft N/A
Drilling Measured From : Drill Floor				MD LOG		
Depth Logged : 81.00 ft To 13,113.00 ft				Unit No. : Command Cented Job No.: CA-XX-0901619872		
Date Logged : 20-Sep-14 To 03-Oct-14				Plot Type : Final		
Total Depth MD : 13,113.00 ft TVD : 5,639.37 ft				Plot Date : 03-Oct-14		
Spud Date : 20-Sep-14						
Run No.	Borehole Record (MD)			Run No.	Borehole Record (MD)	
	Size	From	To		Size	To
0100	13,500 in	81.00 ft	1,600.00 ft			
0200	8,750 in	1,600.00 ft	6,165.00 ft			
0300	6,000 in	6,165.00 ft	7,309.00 ft			
0400	6,000 in	7,309.00 ft	10,020.00 ft			
0500	6,000 in	10,020.00 ft	10,385.00 ft	Size	Casing Record (MD)	
0600	6,000 in	10,385.00 ft	13,113.00 ft	Weight	From	To
				9.625 in	36.00 lbpf	SURFACE 1,590.00 ft
				7.000 in	29.00 lbpf	SURFACE 6,154.00 ft

## WELL INFORMATION

MWD Run Number	100	200	300	400	500
Date run completed	21-Sep-14	23-Sep-14	24-Sep-14	26-Sep-14	28-Sep-14
Rig Bit Number	0100	0200	0300	0400	0500
Bit Size (in)	13.500	8.750	6.000	6.000	6.000
Tool Nominal OD (in)	6.750	6.750	4.750	4.750	4.750
Log Start Depth (MD, ft)	81.00	1,600.00	6,165.00	7,309.00	10,020.00
Log End Depth (MD, ft)	1,600.00	6,165.00	7,309.00	10,020.00	10,385.00
Drill or Wipe	Drill	Drill	Drill	Drill	Drill
Drill/Wipe Start Date and Time	20-Sep-14 22:00	21-Sep-14 23:00	24-Sep-14 03:55	24-Sep-14 20:11	26-Sep-14 22:50
Drill/Wipe End Date and Time	21-Sep-14 04:07	22-Sep-14 21:00	24-Sep-14 11:08	26-Sep-14 00:25	27-Sep-14 18:50
Min Inc (deg) @ Depth (MD, ft)	0.10 @ 911.00	1.19 @ 4,931.00	85.86 @ 6,315.00	88.67 @ 9,117.00	90.25 @ 10,304.00
Max Inc (deg) @ Depth (MD, ft)	9.32 @ 1,542.00	82.15 @ 6,112.00	90.97 @ 6,977.00	93.54 @ 8,296.00	92.72 @ 10,212.00
Bit TFA(in2) / Bit Type	1.05 / PDC	0.88 / PDC	0.98 / PDC	0.98 / PDC	0.98 / PDC
Flow Rate (gpm)	732.61	539.27	436.52	232.00	239.44
Max AV (fpm) / CV (fpm) @ MWD	NA / NA	NA / NA	NA / NA	NA / NA	0 / NA
Fluid Type	Native/Spud Mud	Polymer	Polymer	Polymer	Polymer
Density (ppg) / Viscosity (spqt)	8.50 / 0.00	9.90 / 48.00	9.90 / 42.00	10.10 / 48.00	10.20 / 42.00
Filtrate CL (ppm)	0.00	2,000.00	2,000.00	1,900.00	1,900.00
pH / Fluid Loss (mptm)	8.30 / 0	9.00 / 0	8.70 / 0	8.60 / 0	8.65 / 0
PV (cP) / YP (lbf2)	NA / NA	15 / 21.00	14 / 15.00	18 / 15.00	14 / 15.00
% Solids / % Sand	12 / 0.25	12 / 0.25	12 / 0.25	11.5 / 0.25	11.5 / 0.25
% Oil / Oil:Water Ratio	NA / NA	NA / NA	NA / NA	NA / NA	NA / NA
Rm @ Measured Temp (degF)	NA @ NA	NA @ NA	NA @ NA	NA @ NA	NA @ NA
Rmf @ Measured Temp (degF)	NA @ NA	NA @ NA	NA @ NA	NA @ NA	NA @ NA
Rmc @ Measured Temp (degF)	NA @ NA	NA @ NA	NA @ NA	NA @ NA	NA @ NA
Max Tool Temp (in F) / S	115.58 / PDM	122.22 / PDM	122.22 / PDM	225.12 / PDM	210.21 / PDM

Max Tool Temp (degF) / Source	115.56 / PCM	180.09 / PCM	180.09 / PCM	205.16 / PCM	210.31 / PCM
Rm @ Max Tool Temp (degF)	NA @ 115.56	NA @ 180.09	NA @ 180.09	NA @ 205.16	NA @ 210.31
Lead MWD Engineer	Scott Trowbridge	Scott Trowbridge	Scott Trowbridge	Scott Trowbridge	Scott Trowbridge
Customer Representative	Kennith Wilkerson	Kennith Wilkerson	Kennith Wilkerson	Kennith Wilkerson	Kennith Wilkerson
SENSOR INFORMATION					
Downhole Processor Information					
Tool Type	PCM	PCM	PCM	PCM	PCM
Software Version	5.93	5.93	5.93	5.93	5.93
Sub Serial Number	11341342	11341342	12463936	12463936	
Insert Serial Number	11680789	11680744	11680789	11680744	11227504
Date and Time Initialized	20-Sep-14 08:32	21-Sep-14 17:09	23-Sep-14 17:06	24-Sep-14 15:37	26-Sep-14 14:55
Date and Time Read	21-Sep-14 09:17	23-Sep-14 07:35	01-Jan-70 00:00	01-Jan-70 00:00	01-Jan-70 00:00
ECMB SW Version	N/A	N/A	N/A	N/A	N/A
Directional Sensor Information					
Tool Type	PCDC	PCDC	PCDC	PCDC	PCDC
Distance From Bit (ft)	56.22	51.24	46.43	46.43	46.43
Software Version	6.21	6.21	6.21	6.21	6.21
Sub Serial Number	11341342	11341342	12463936	12463936	12463936
Sonde Serial Number	11638497	11478073	11638497	11478073	11297622
Sensor ID Number	N/A	N/A	N/A	N/A	N/A
Toolface Offset (deg)	347.01	304.29	312.35	306.30	336.46
Gamma Ray Sensor Information					
Tool Type		PCG	PCG	PCG	PCG
Distance From Bit (ft)		46.14	41.33	41.33	41.33
Recorded Sample Period (sec)		10	10	10	10
Software Version		8.15	8.15	8.15	8.15
Sub Serial Number		11341342	12463936	12463936	12463936
Insert/Sonde Serial Number		11681054	12071281	11681054	11681029
WELL INFORMATION					
MWD Run Number	600				
Date run completed	01-Oct-14				
Rig Bit Number	0600				
Bit Size (in)	6.000				
Tool Nominal OD (in)	4.750				
Log Start Depth (MD, ft)	10,385.00				
Log End Depth (MD, ft)	13,113.00				
Drill or Wipe	Drill				
Drill/Wipe Start Date and Time	28-Sep-14 12:00				
Drill/Wipe End Date and Time	30-Sep-14 12:05				
Min Inc (deg) @ Depth (MD, ft)	88.08 @ 12,312.00				
Max Inc (deg) @ Depth (MD, ft)	91.60 @ 11,671.00				
Bit TFA(in2) / Bit Type	0.86 / PDC				
Flow Rate (gpm)	236.13				
Max AV (fpm) / CV (fpm) @ MWD	NA / NA				
Fluid Type	Polymer				
Density (ppg) / Viscosity (spqt)	10.40 / 55.00				
Filtrate CL (ppm)	2,000.00				
pH / Fluid Loss (mptm)	8.60 / 0				
PV (cP) / YP (lhf2)	18 / 19.00				
% Solids / % Sand	10 / .2				
% Oil / Oil:Water Ratio	NA / NA				

Rm @ Measured Temp (degF)	NA @ NA				
Rmf @ Measured Temp (degF)	NA @ NA				
Rmc @ Measured Temp (degF)	NA @ NA				
Max Tool Temp (degF) / Source	215.51 / PCM				
Rm @ Max Tool Temp (degF)	NA @ 215.51				
Lead MWD Engineer	Scott Trowbridge				
Customer Representative	Kennith Wilkerson				

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM				
Software Version	5.93				
Sub Serial Number	12463936				
Insert Serial Number	11680744				
Date and Time Initialized	28-Sep-14 00:07				
DATE and Time Read	01-Oct-14 13:54				
ECMB SW Version	N/A				

Directional Sensor Information

Tool Type	PCDC				
Distance From Bit (ft)	41.51				
Software Version	6.21				
Sub Serial Number	12463936				
Sonde Serial Number	11478073				
Sensor ID Number	N/A				
Toolface Offset (deg)	141.72				

Gamma Ray Sensor Information

Tool Type	PCG				
Distance From Bit (ft)	36.41				
Recorded Sample Period (sec)	10				
Software Version	8.15				
Sub Serial Number	12463936				
Insert/Sonde Serial Number	11681054				

REMARKS

1. All depths are measured bit depths, referenced to the Driller's pipe tally and are measured from the Drill Floor, unless otherwise speci fied.
2. No depth corrections have been made for pipe stretch or compression.
3.Critical annular velocities are calculated using the "Power Law" for water based fluids and the "Bingham Plastic" model for oil and synthetic based fluids.
4. All data is stored data unless otherwise speci fied.
5. The following smoothing parameters have been applied to the data:
PCG Gamma Ray BCorr (PGRC)
Interval Resolution: .5
Interval Distance: .6
Gap Fill: 3

Average Rate of Penetration (ROPA)  
Interval Resolution: .5  
Interval Distance: 1.2  
Gap Fill: 3

6. INSITE Version 8.0.20

## WARRANTY

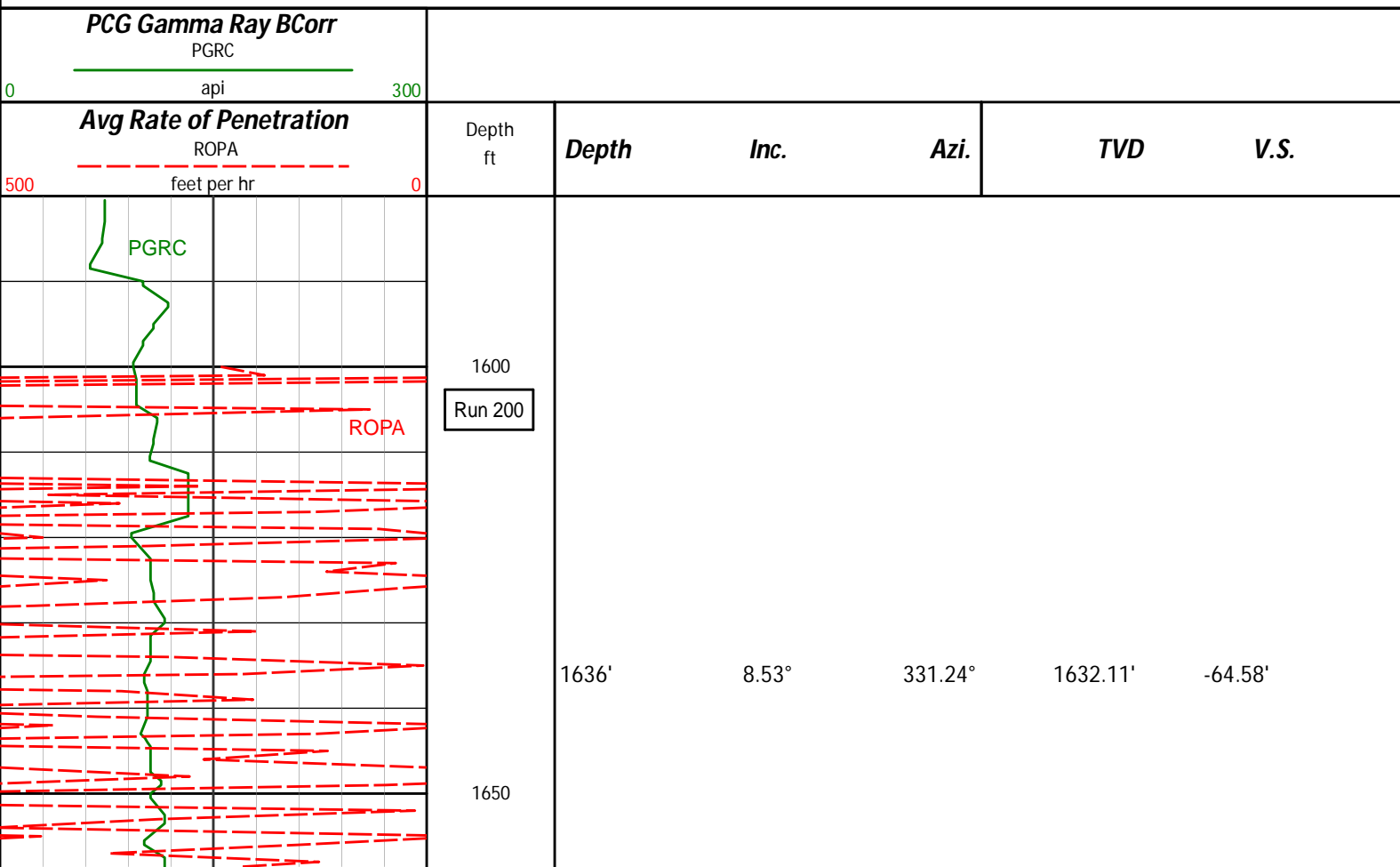
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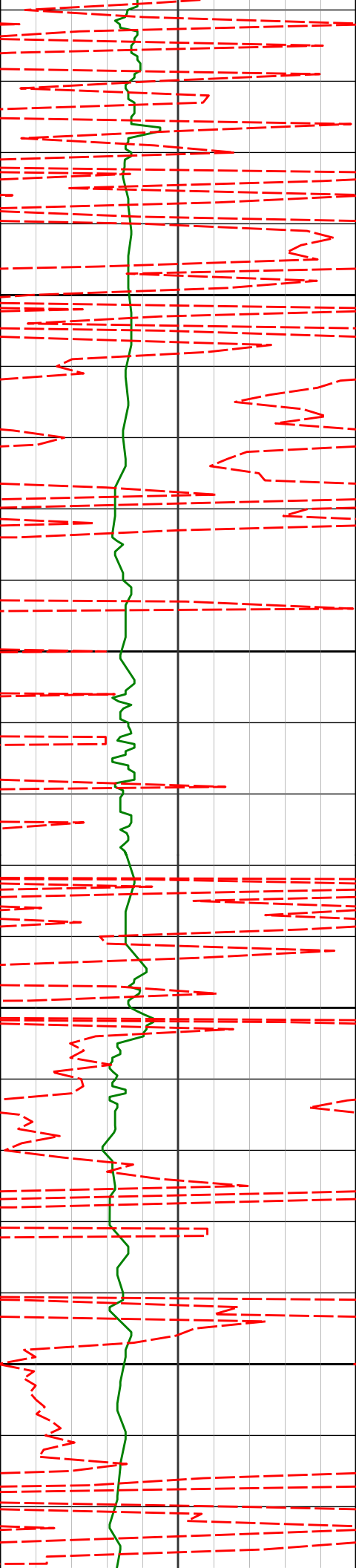
# HALLIBURTON

## Sperry Drilling Services

### MD Main Log 1:240

Whiting Oil and Gas  
Razor 27J-3409A  
Frontier 26  
Sec. 27-T10N-R58W





1700

1750

1800

1850

1728'

9.16°

326.29°

1723.02'

-76.27'

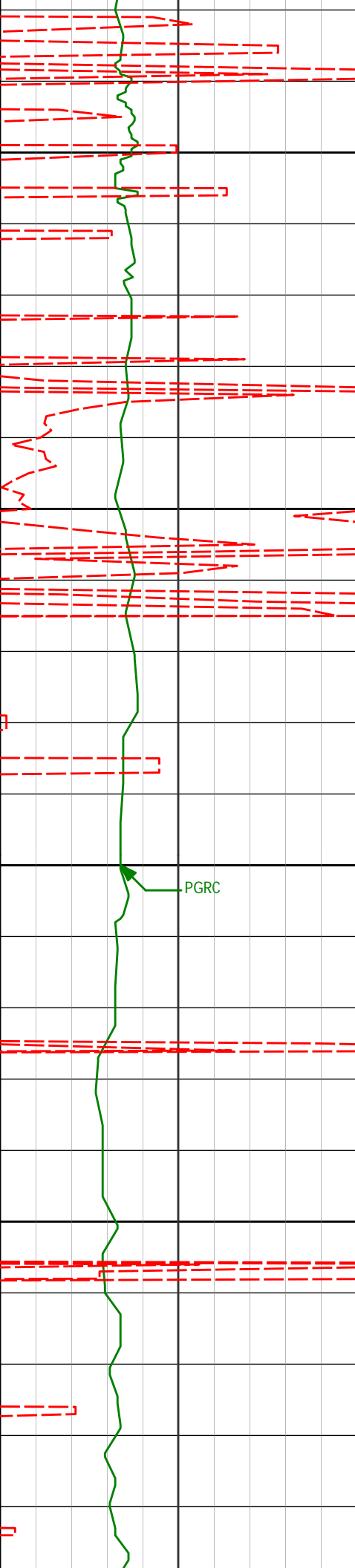
1819'

11.14°

321.89°

1812.59'

-88.73'



1900

1950

2000

2050

1911'

14.16°

329.21°

1902.35'

-104.81'

2002'

16.92°

329.09°

1990.02'

-125.09'

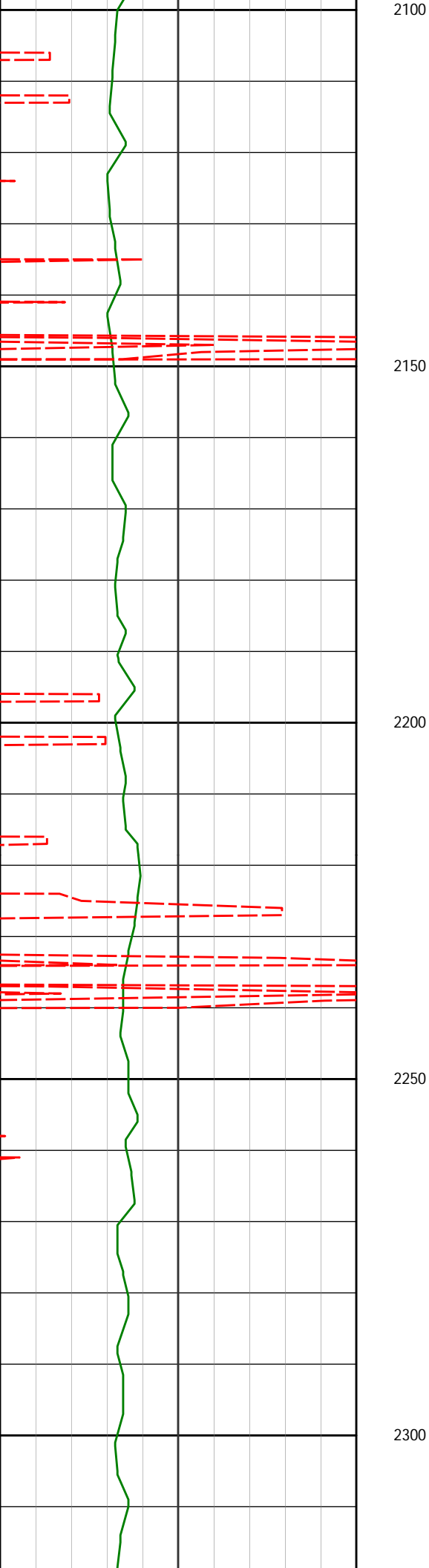
2094'

16.56°

328.31°

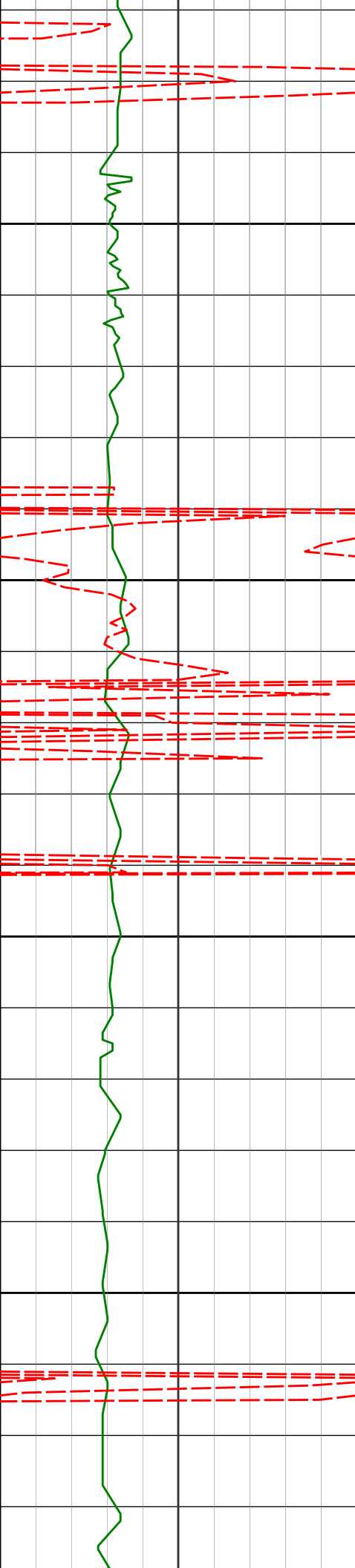
2078.12'

-147.02'



2185'      15.63°      327.24°      2165.55'      -167.67'

2277'      14.38°      325.32°      2254.41'      -186.81'



2350

2368'

13.41°

324.41°

2342.75'

-204.04'

2400

2450

2459'

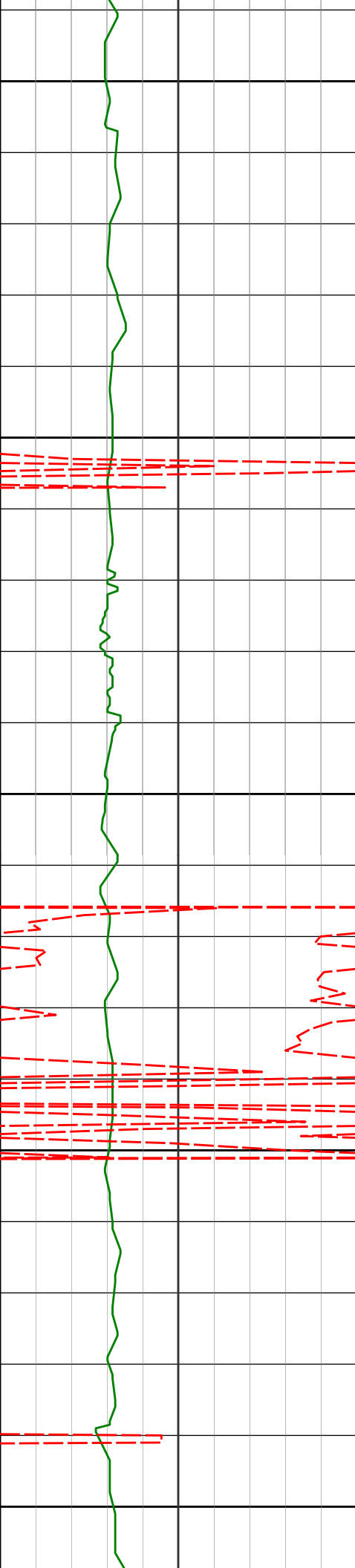
16.57°

324.27°

2430.64'

-222.45'

2500



2550

2551'

15.91°

321.99°

2518.97'

-242.24'

2600

2650

2642'

15.38°

321.87°

2606.60'

-260.79'

2700

2733'

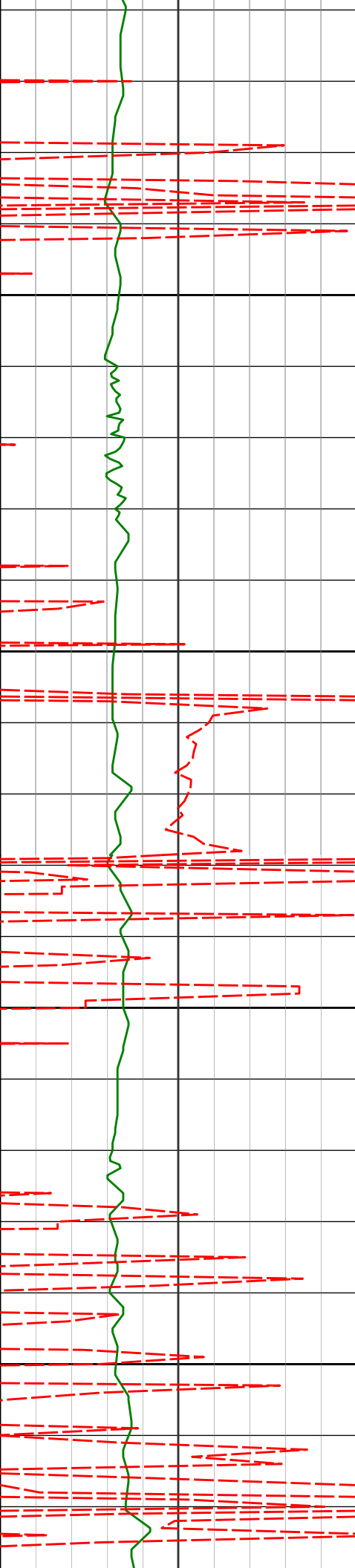
17.24°

329.02°

2693.94'

-281.10'

2750



2800

2825'

16.69°

327.79°

2781.94'

-303.24'

2850

2900

2917'

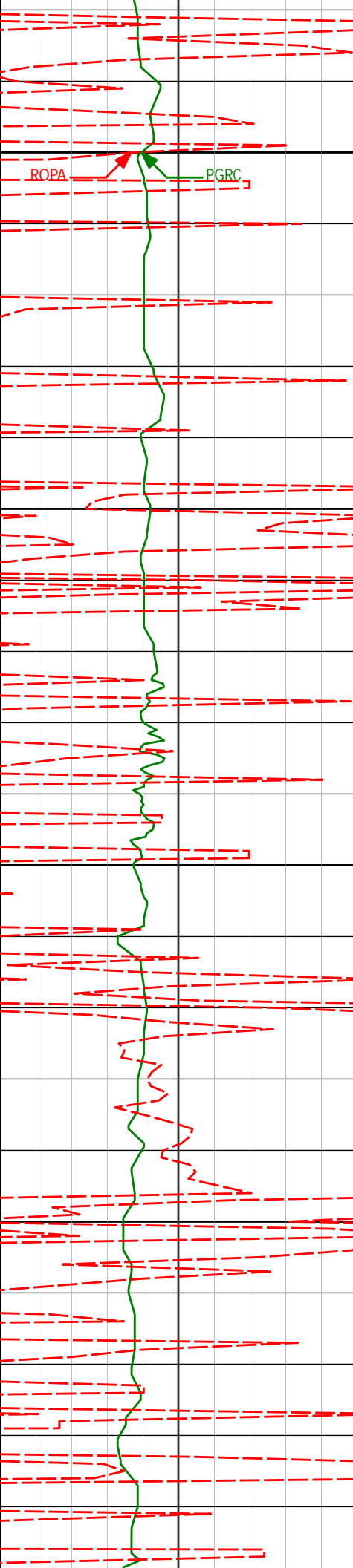
14.23°

335.82°

2870.61'

-324.13'

2950



3000

3008'

12.55°

334.40°

2959.14'

-342.79'

3050

3100

3100'

10.52°

331.40°

3049.28'

-358.74'

3150

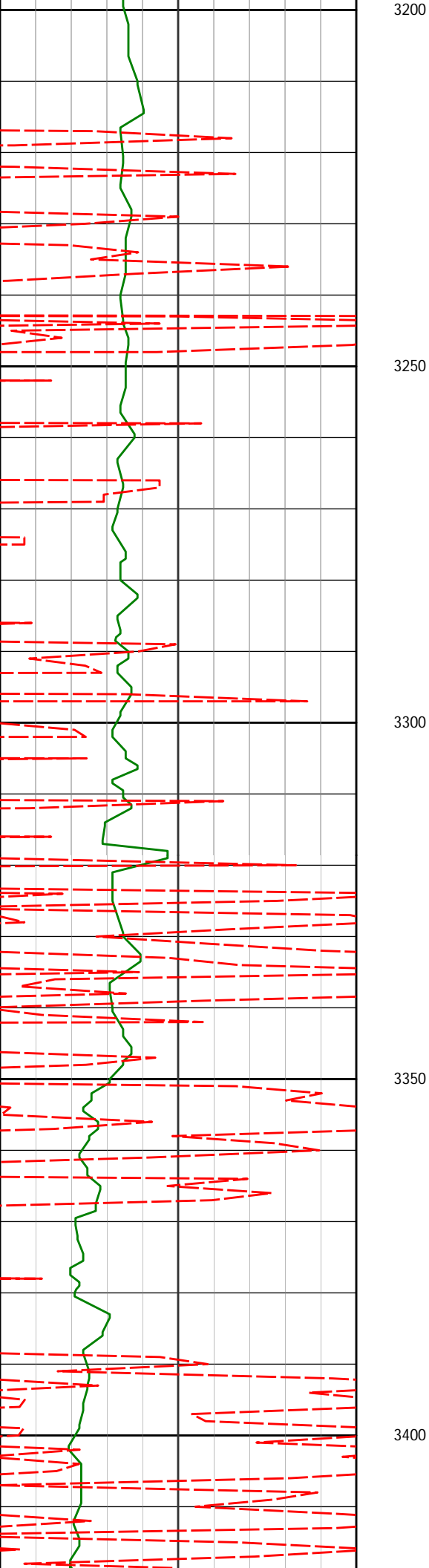
3192'

11.88°

340.31°

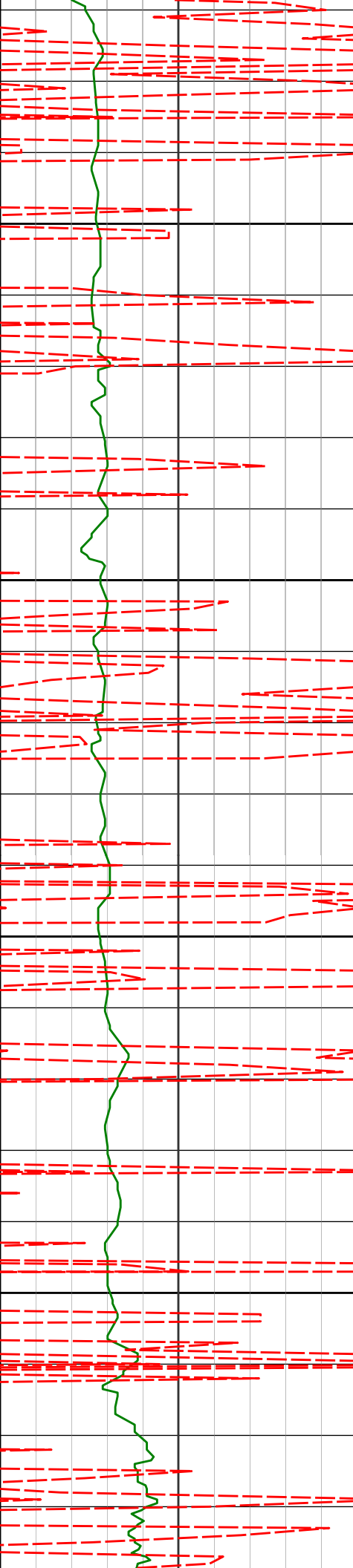
3139.53'

-374.66'



3283'	11.76°	339.89°	3228.60'	-391.85'
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3375'	11.69°	340.55°	3318.68'	-409.10'
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3450

3467'

11.77°

338.79°

3408.76'

-426.29'

3500

3550

3558'

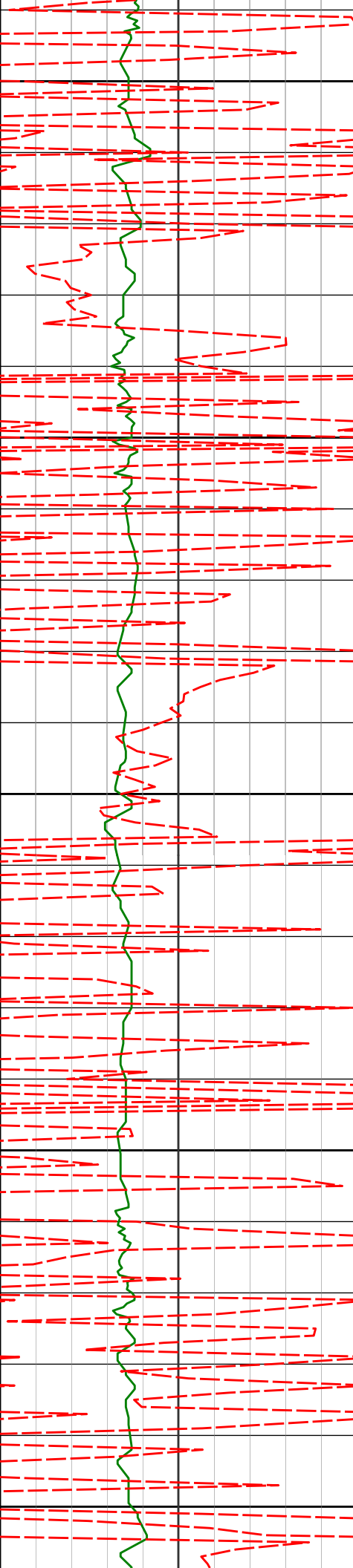
12.03°

337.54°

3497.80'

-443.34'

3600



3650

3649'

11.92°

335.70°

3586.82'

-460.28'

3700

3741'

11.75°

335.01°

3676.87'

-477.02'

3750

3800

3832'

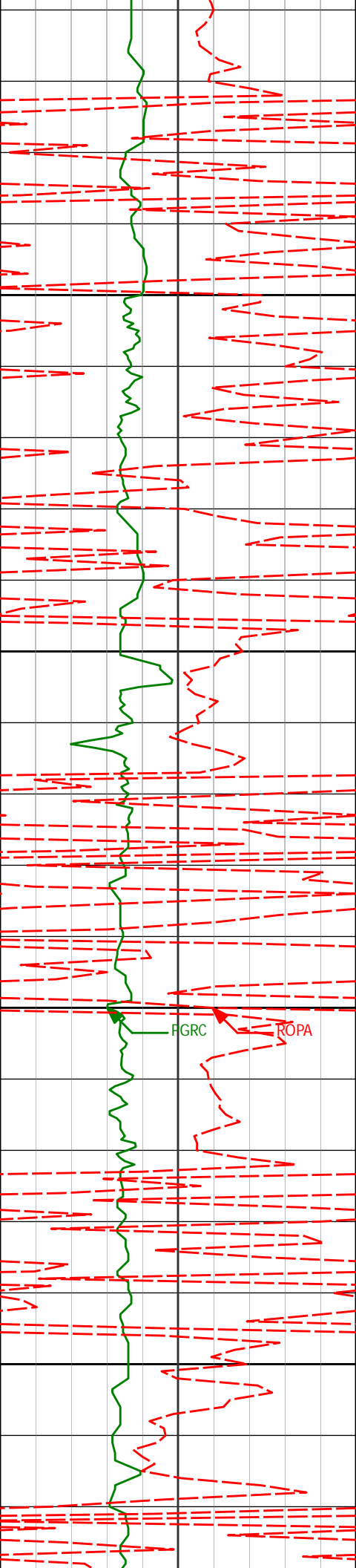
11.40°

331.29°

3766.02'

-492.87'

3850



3900

3924'

11.48°

331.06°

3856.19'

-508.40'

3950

4000

FGRC

ROPA

4015'

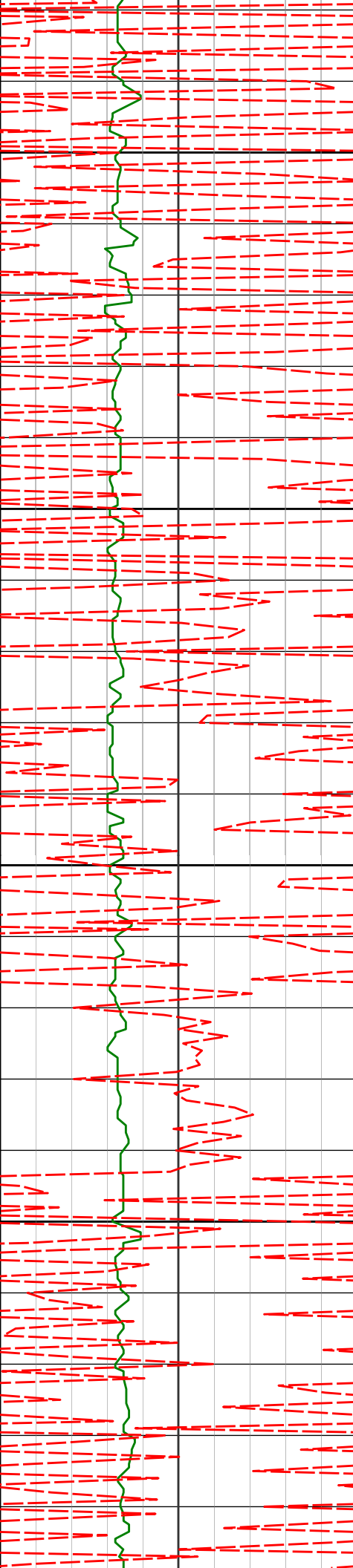
14.51°

343.33°

3944.87'

-526.85'

4050



4100

4106'

16.48°

344.57°

4032.55'

-549.85'

4150

4200

4197'

15.58°

343.52°

4120.02'

-573.64'

4250

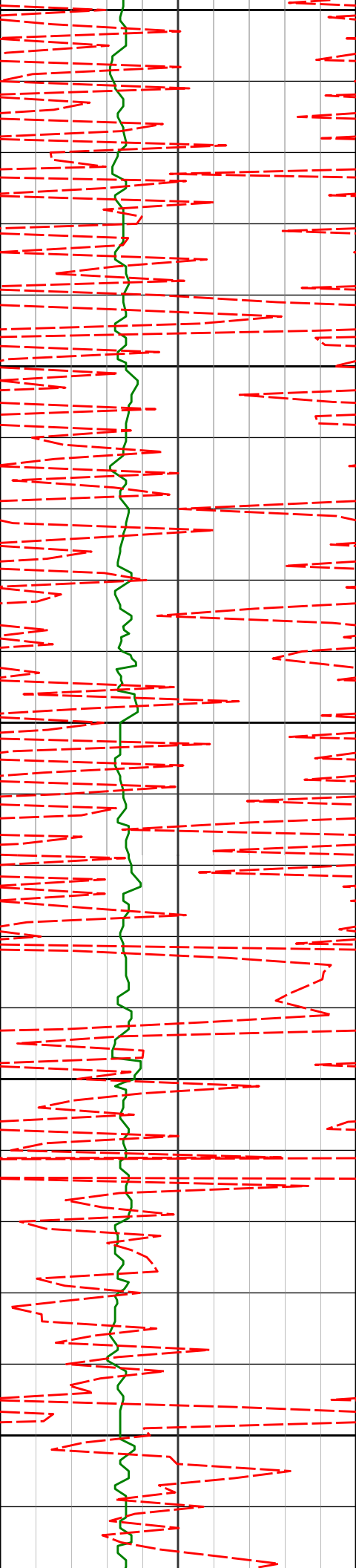
4289'

14.72°

344.03°

4208.82'

-596.36'



4300

4350

4380'

13.16°

342.01°

4297.13'

-616.99'

4400

4450

4473'

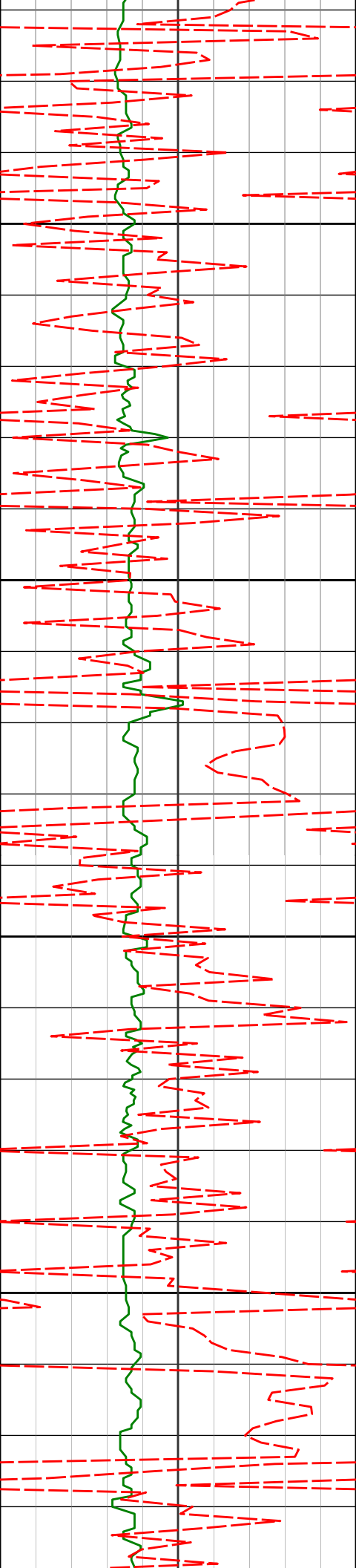
10.91°

341.37°

4388.08'

-635.08'

4500



4550

4563'

9.69°

342.92°

4476.63'

-650.12'

4600

4650

4655'

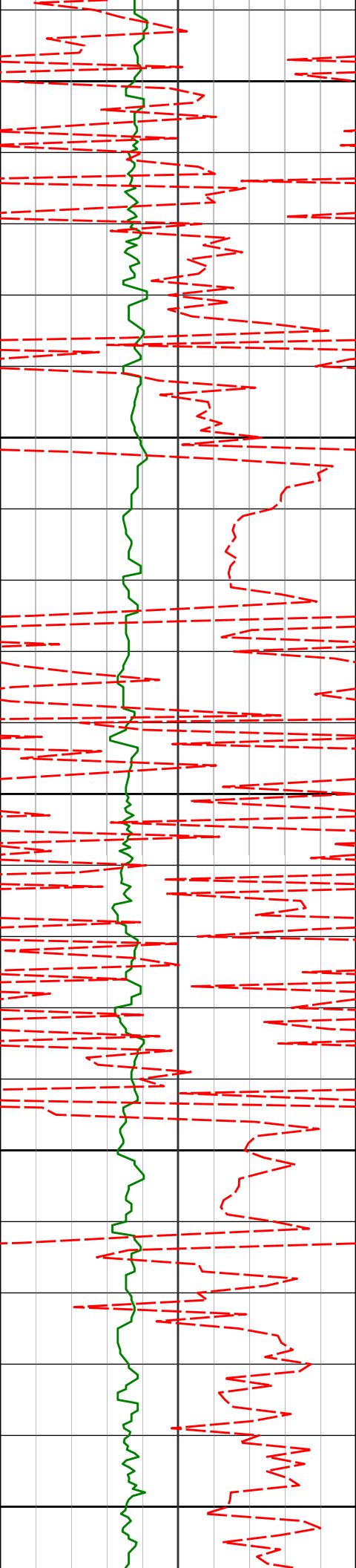
7.13°

343.00°

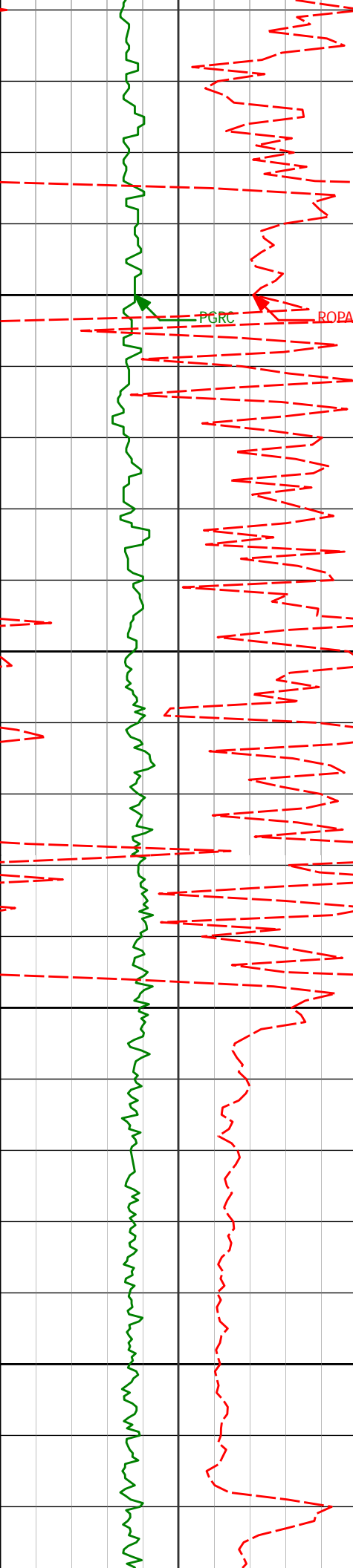
4567.64'

-662.78'

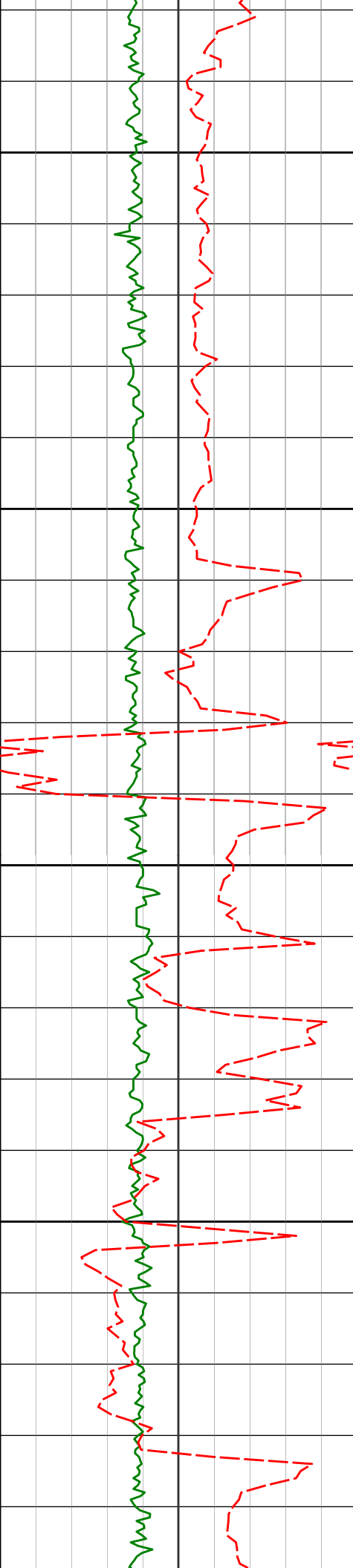
4700



4750	4747'	5.82°	342.93°	4659.05'	-672.53'
4800					
4850	4839'	2.37°	320.44°	4750.80'	-678.32'
4900					
4950	4931'	1.19°	163.49°	4842.78'	-678.83'



5000	PGRC					ROPA				
5023'	2.52°	165.43°	4934.73'	-676.00'						
5050										
KOP 5096' MD										
5115'	4.80°	170.42°	5026.54'	-670.31'						
5150										
5146'	11.37°	184.06°	5057.22'	-665.98'						
5176'										
5176'	15.50°	181.08°	5086.39'	-659.01'						



5200

5206'

20.34°

181.79°

5114.93'

-649.79'

5238'

27.58°

184.28°

5144.15'

-636.80'

5250

5268'

32.37°

185.06°

5170.13'

-621.83'

5300

5299'

35.04°

184.61°

5195.92'

-604.64'

5329'

37.42°

184.03°

5220.11'

-586.91'

5350

5359'

37.51°

182.89°

5243.93'

-568.67'

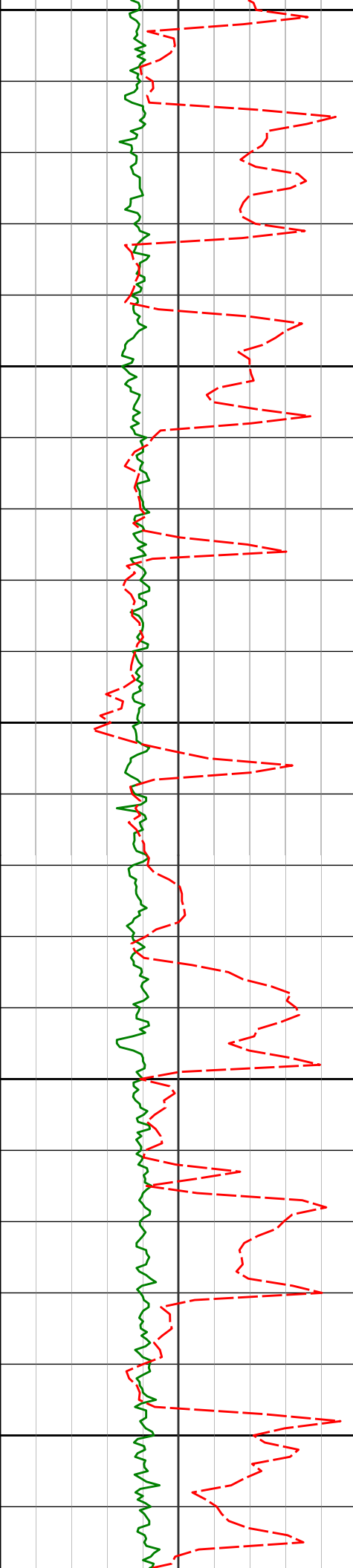
5389'

38.60°

183.23°

5267.55'

-550.18'



5400

5420'

40.37°

185.24°

5291.47'

-530.47'

5450

5451'

42.39°

184.65°

5314.73'

-509.99'

5482'

43.37°

184.12°

5337.45'

-488.91'

5500

5513'

43.38°

184.45°

5359.98'

-467.63'

5543'

43.98°

182.59°

5381.68'

-446.91'

5550

5573'

45.73°

181.91°

5402.95'

-425.75'

5600

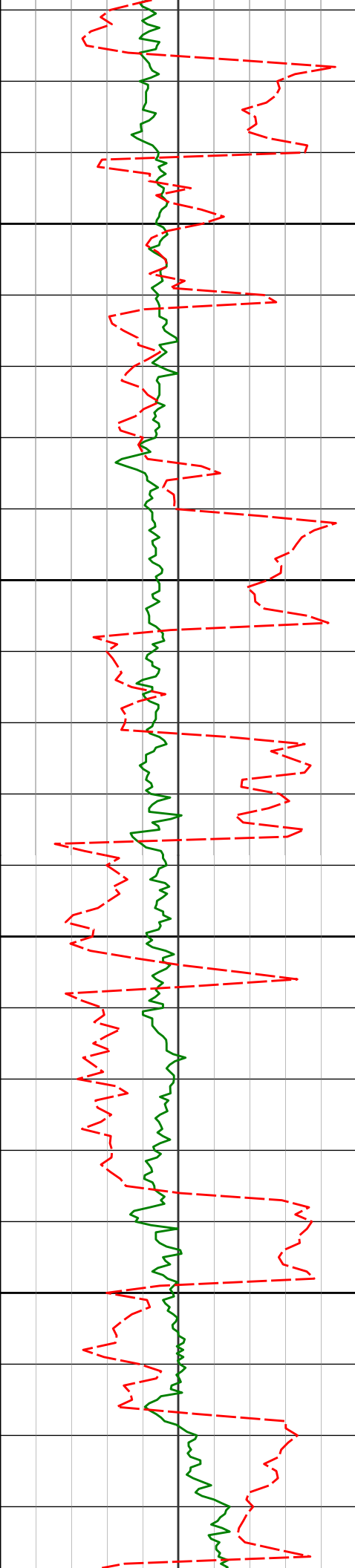
5605'

48.16°

180.00°

5424.79'

-402.39'



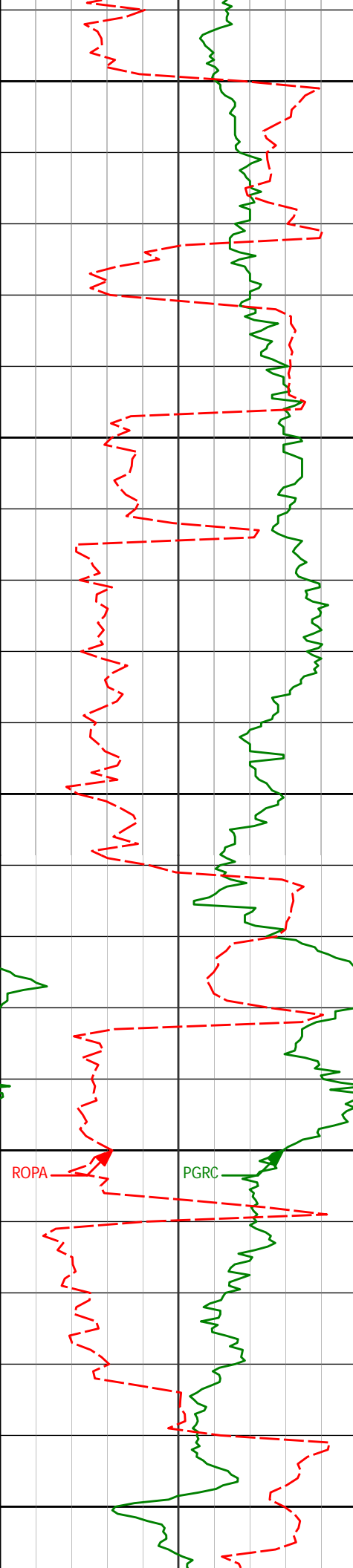
5650

5700

5750

5800

5637'	50.53°	178.87°	5445.64'	-378.16'
5669'	51.03°	178.32°	5465.87'	-353.43'
5700'	53.56°	178.85°	5484.83'	-328.98'
5732'	55.55°	178.85°	5503.39'	-302.97'
5764'	56.17°	178.58°	5521.35'	-276.56'
5795'	57.93°	179.48°	5538.21'	-250.60'
5827'	61.30°	180.05°	5554.39'	-223.04'



5850

5858'	64.85°	181.41°	5568.43'	-195.43'
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5890'	68.68°	181.55°	5581.05'	-166.04'
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5900

5921'	69.69°	181.60°	5592.06'	-137.07'
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5950

5953'	71.07°	181.34°	5602.81'	-106.93'
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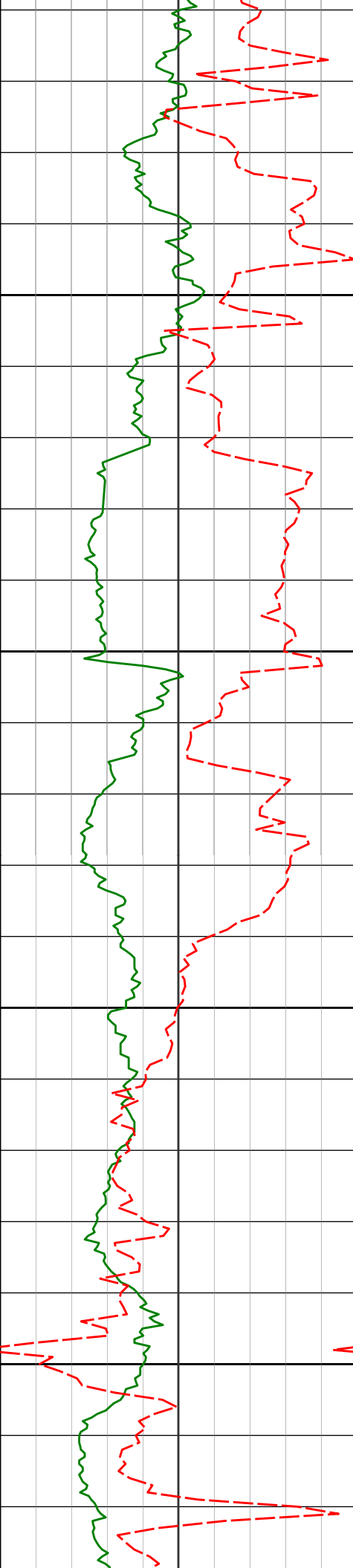
5984'	74.36°	180.86°	5612.02'	-77.35'
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6000

6016'	75.29°	181.31°	5620.39'	-46.48'
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6050

6047'	77.57°	180.49°	5627.67'	-16.37'
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6079'

81.05°

179.77°

5633.60'

15.04'

6100

6112'

82.15°

179.43°

5638.42'

47.63'

6150

Casing at 6154' MD

Run 300

6200

6221'

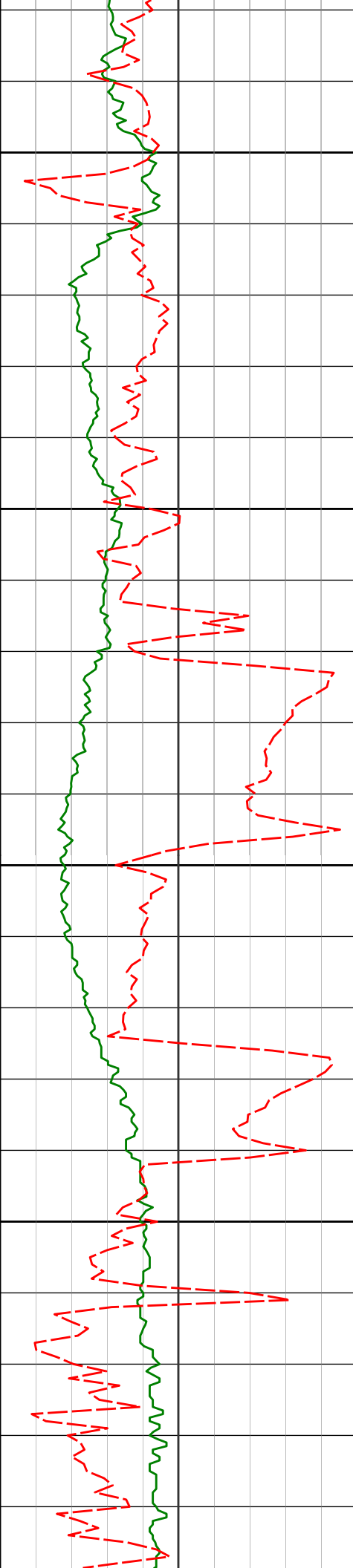
87.01°

179.99°

5648.72'

155.95'

6250



6300

6315'

85.86°

179.35°

5654.56'

249.62'

6350

6400

6410'

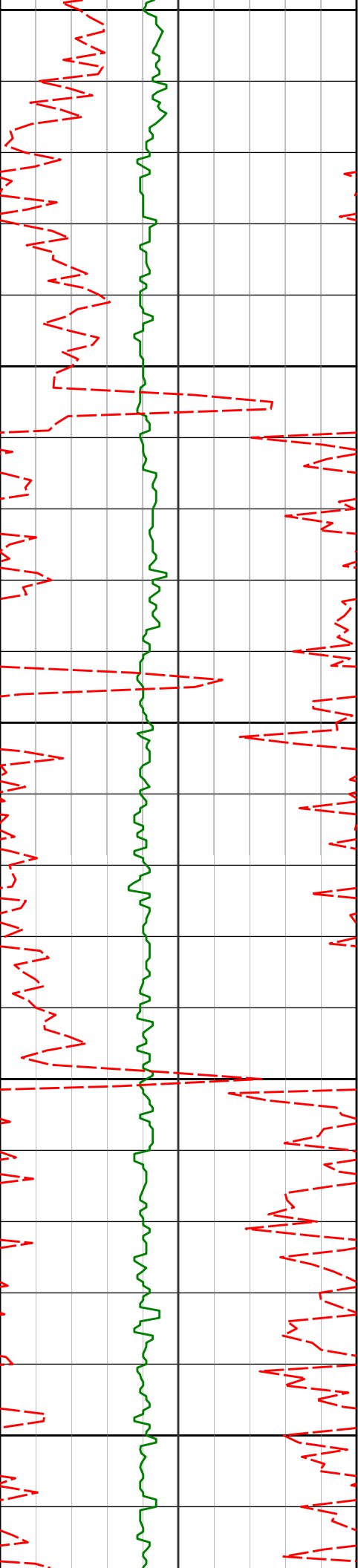
88.30°

179.81°

5659.40'

344.33'

6450



6500

6504'

90.76°

180.97°

5660.17'

438.23'

6550

6600

6599'

90.30°

180.55°

5659.29'

533.17'

6650

6700

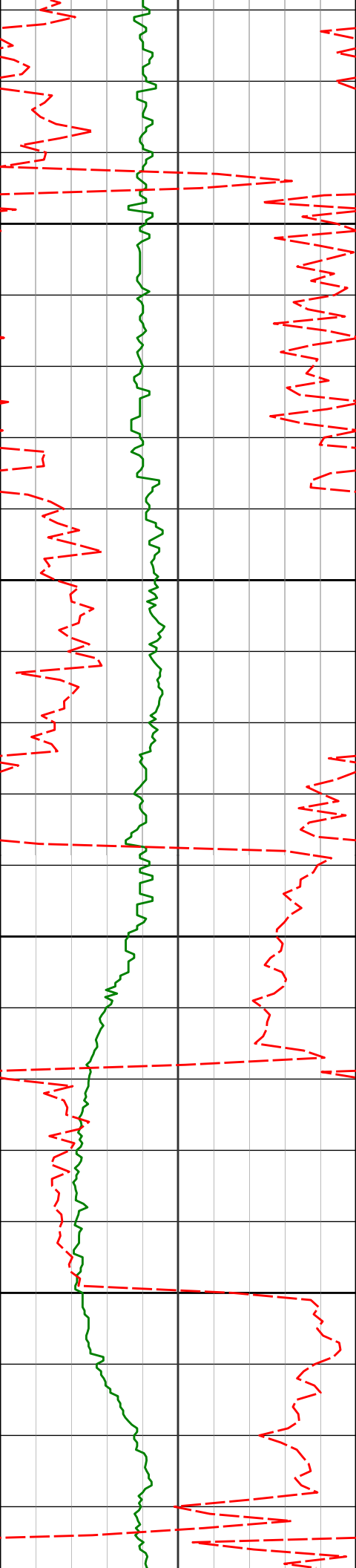
6693'

89.87°

182.98°

5659.15'

627.14'



6750

6788'

89.50°

185.06°

5659.67'

722.12'

6800

6850

6883'

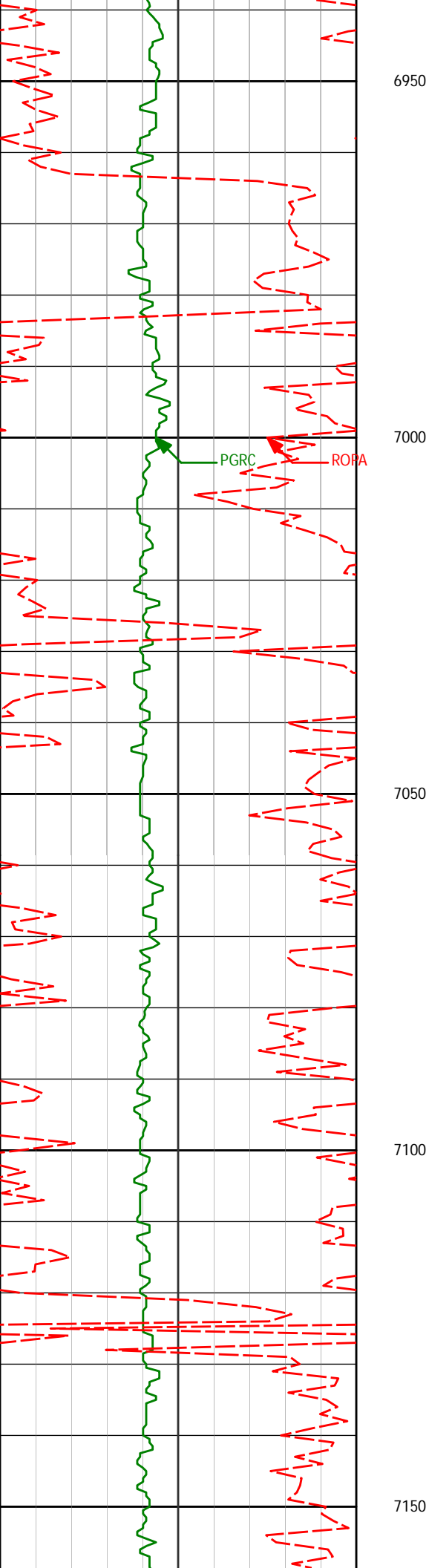
90.60°

182.56°

5659.59'

817.09'

6900



6977'

90.97°

179.30°

5658.30'

911.02'

7000

PGRC

ROPA

7050

7072'

90.67°

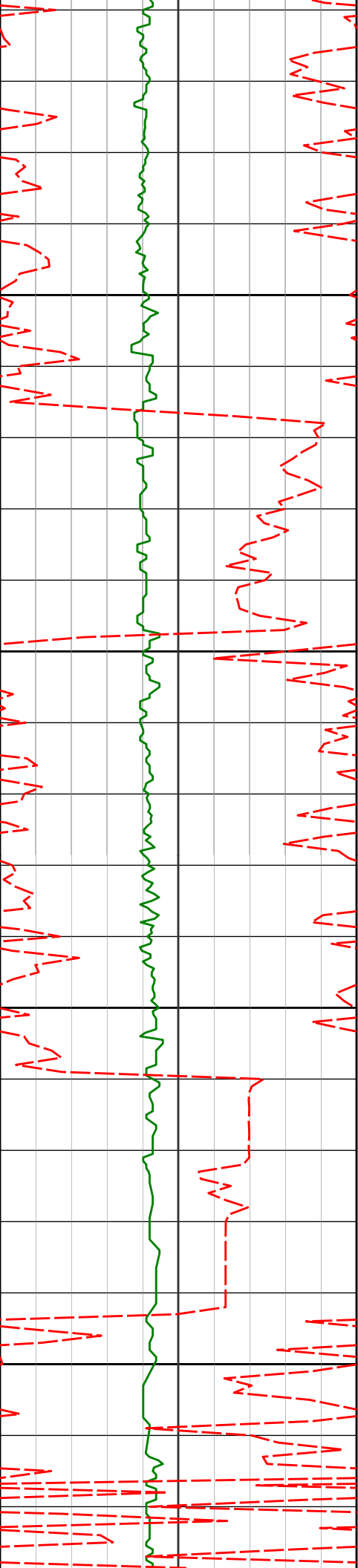
179.26°

5656.94'

1005.82'

7100

7150



Run 400

7166'

90.97°

181.13°

5655.60'

1099.71'

7200

7250

7261'

90.08°

178.52°

5654.73'

1194.56'

7300

7350

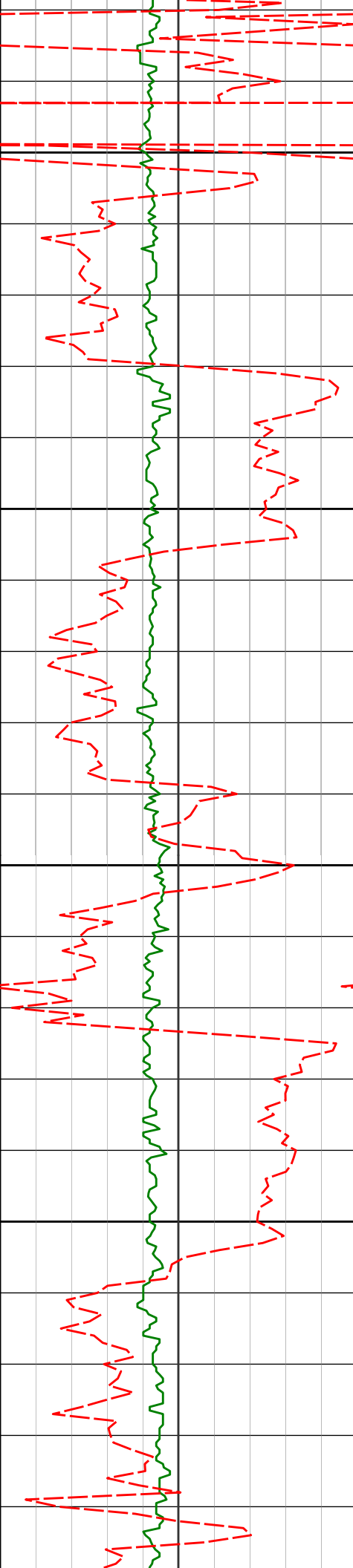
7355'

90.39°

182.40°

5654.34'

1288.46'



7400

7450

7500

7550

7450'

90.42°

182.97°

5653.67'

1383.46'

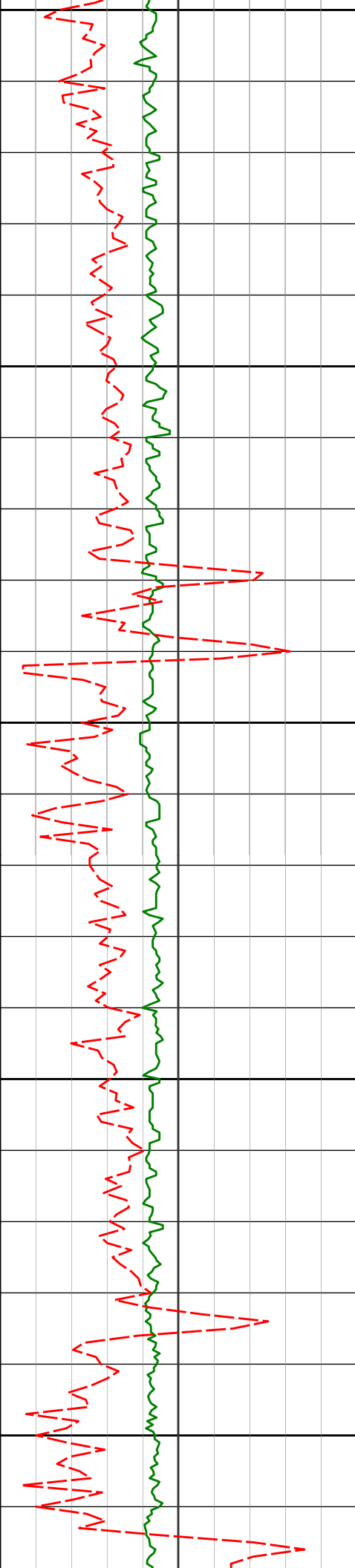
7545'

89.90°

178.67°

5653.41'

1478.38'



7639'

89.62°

180.90°

5653.80'

1572.24'

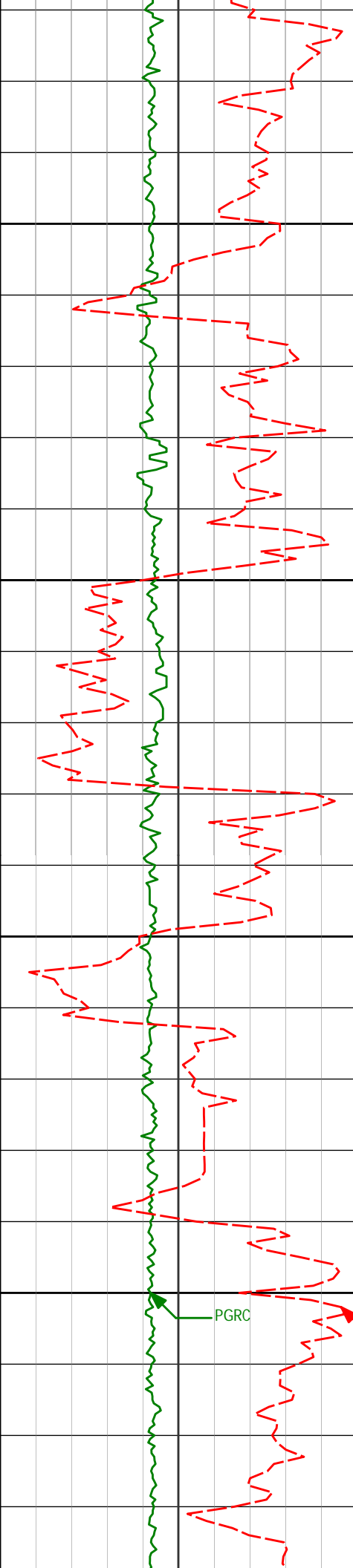
7734'

89.74°

183.97°

5654.33'

1667.22'



7828'

89.85°

186.51°

5654.67'

1761.13'

7850

7900

7923'

89.04°

175.16°

5655.59'

1855.91'

7950

8000

PGRC

ROPA

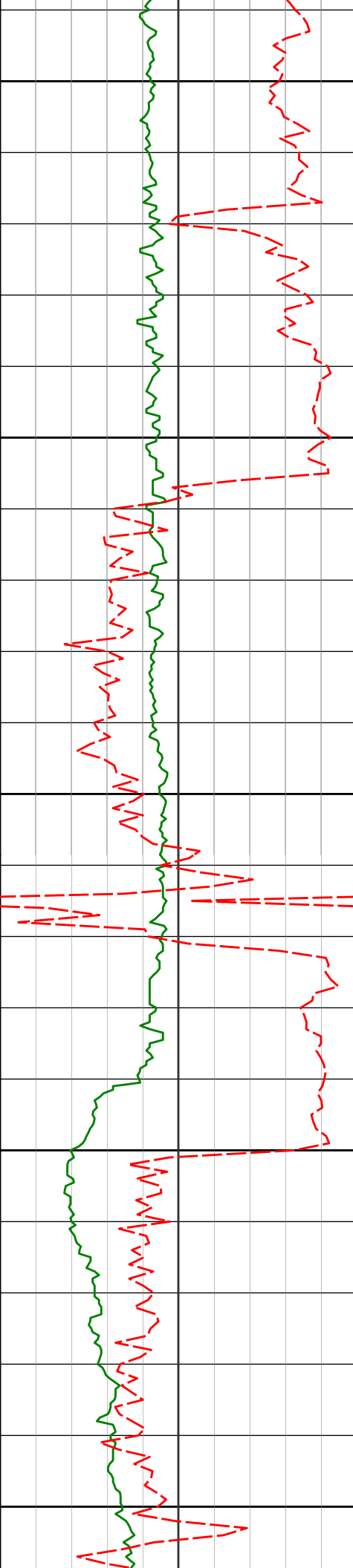
8018'

89.53°

177.19°

5656.78'

1950.26'



8050

8100

8150

8200

8250

8113'

90.03°

178.40°

5657.14'

2044.88'

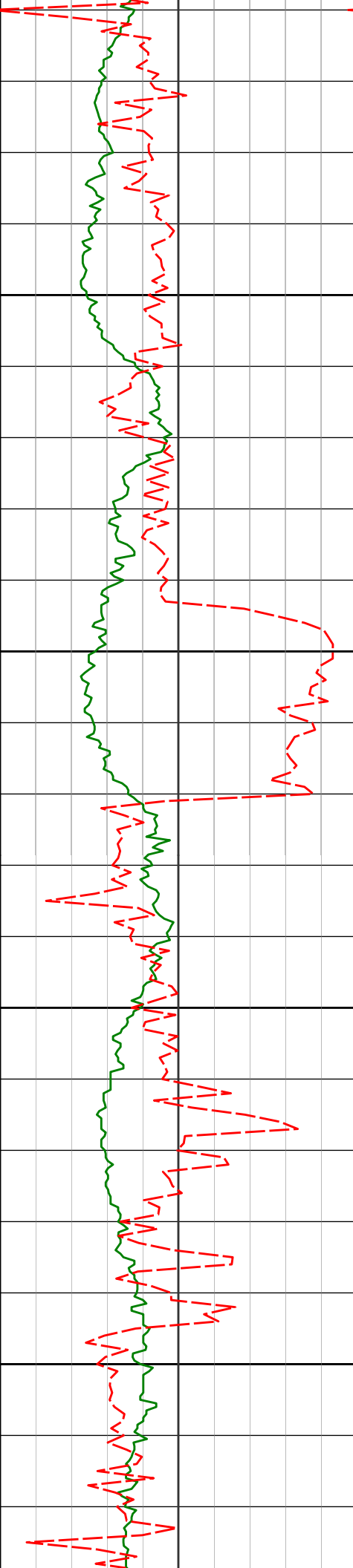
8205'

93.21°

179.03°

5654.54'

2136.60'



8300

8350

8400

8450

8296'

93.54°

178.58°

5649.18'

2227.21'

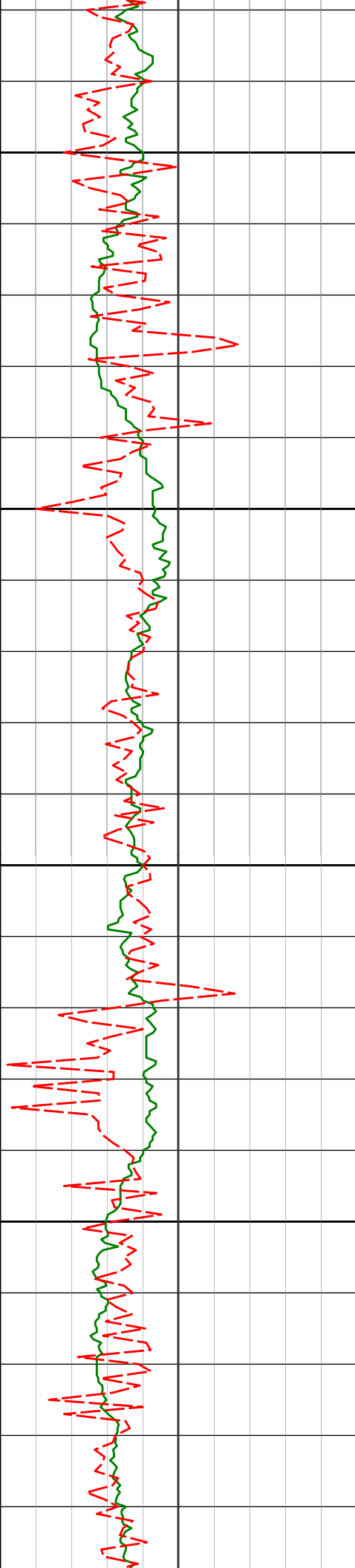
8387'

91.68°

178.54°

5645.04'

2317.86'



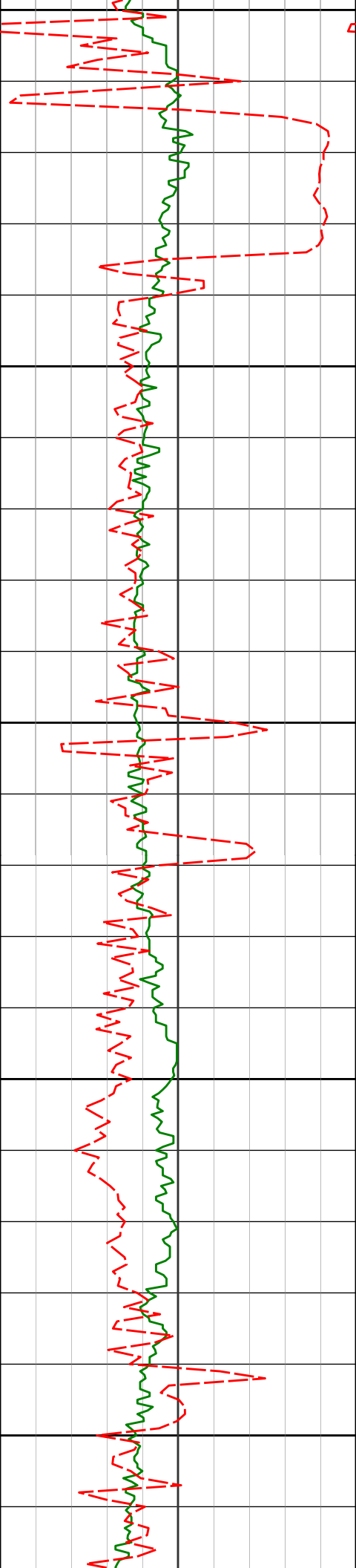
8500

8550

8600

8650

8479	91.94°	178.27°	5642.13	2409.53
8569'	91.81°	177.94°	5639.19'	2499.18'
8660'	91.87°	177.52°	5636.27'	2589.77'



8700

8750

8800

8850

8900

8751'

90.24°

178.95°

5634.59'

2680.45'

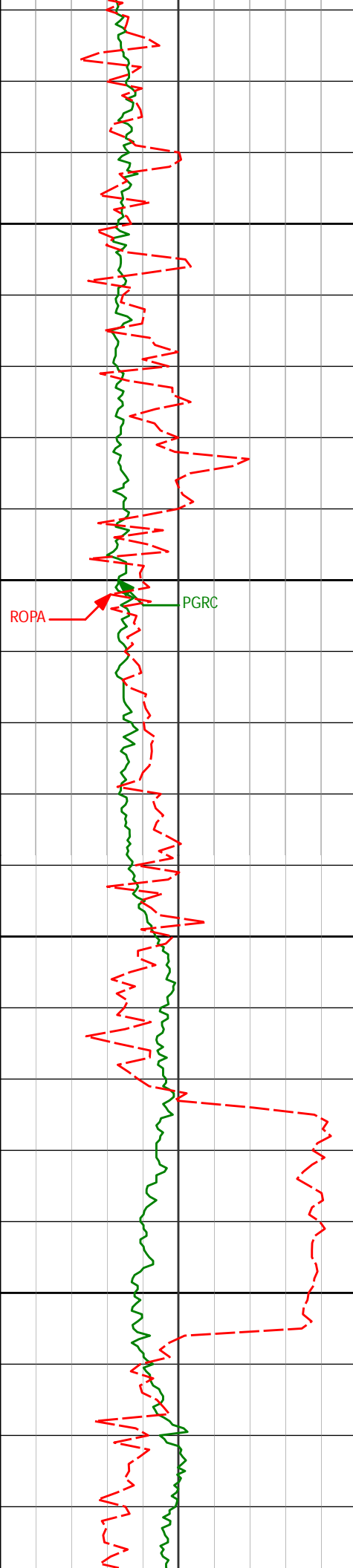
8842'

90.73°

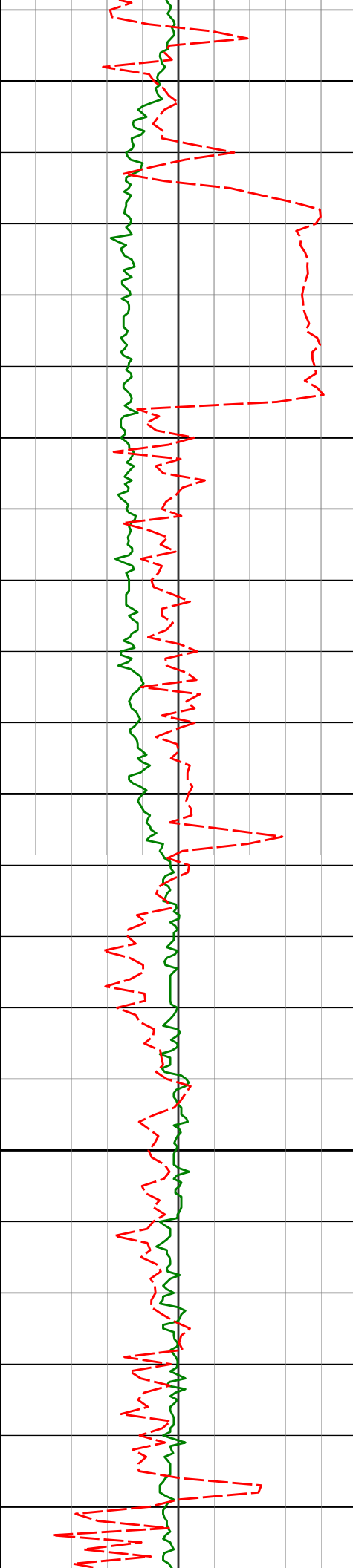
178.99°

5633.82'

2771.24'



8934'	90.65°	178.25°	5632.71'	2862.98'
8950				
9000				
9025'	88.95°	176.09°	5633.03'	2953.53'
9050				
9100				
9117'	88.67°	177.84°	5634.94'	3045.02'



9150

9200

9250

9300

9350

9209'

89.93°

181.16°

5636.07'

3136.84'

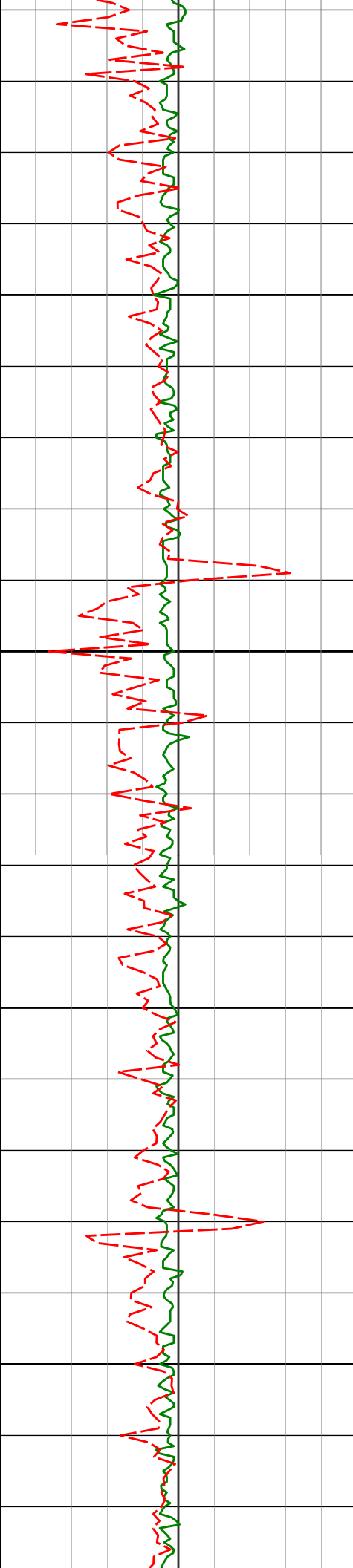
9300'

89.69°

180.29°

5636.37'

3227.78'



9391'

89.93°

181.16°

5636.67'

3318.71'

9400

9450

9482'

89.90°

181.50°

5636.80'

3409.68'

9500

9550

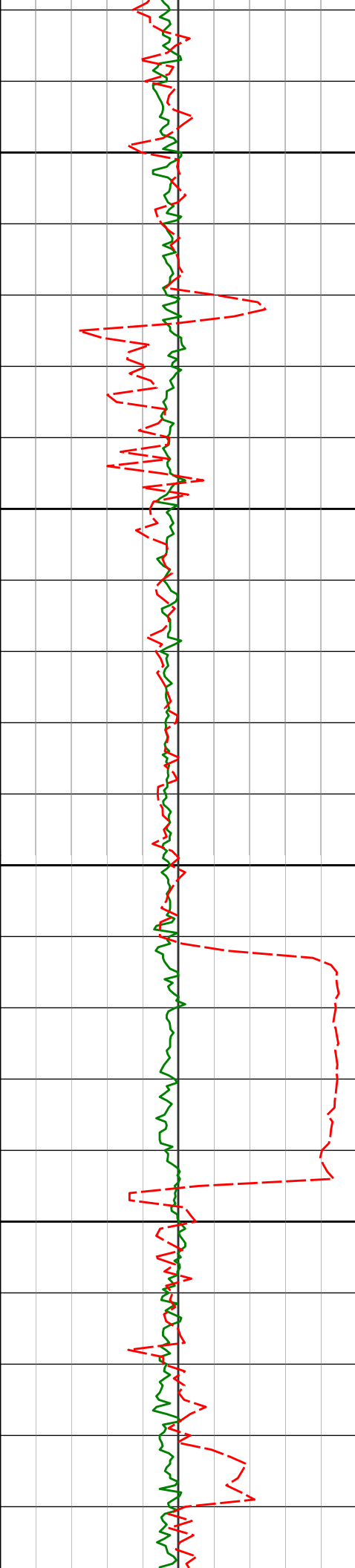
9573'

89.87°

182.16°

5636.99'

3500.66'



9600

9650

9700

9750

9663'

89.91°

182.77°

5637.16'

3590.66'

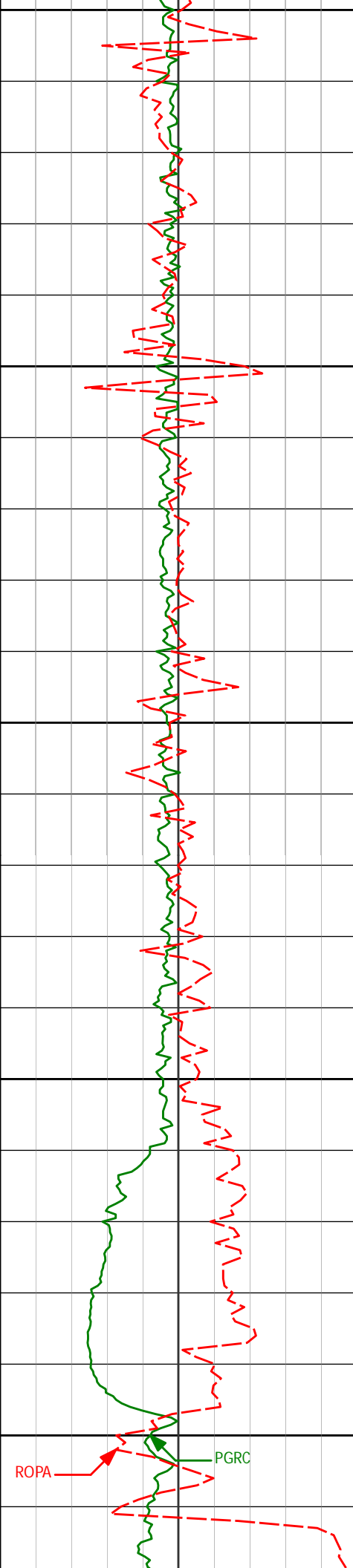
9756'

89.99°

179.65°

5637.24'

3683.61'



9800

9850

9900

9950

10000

9847'

89.62°

179.46°

5637.55'

3774.46'

9939'

89.46°

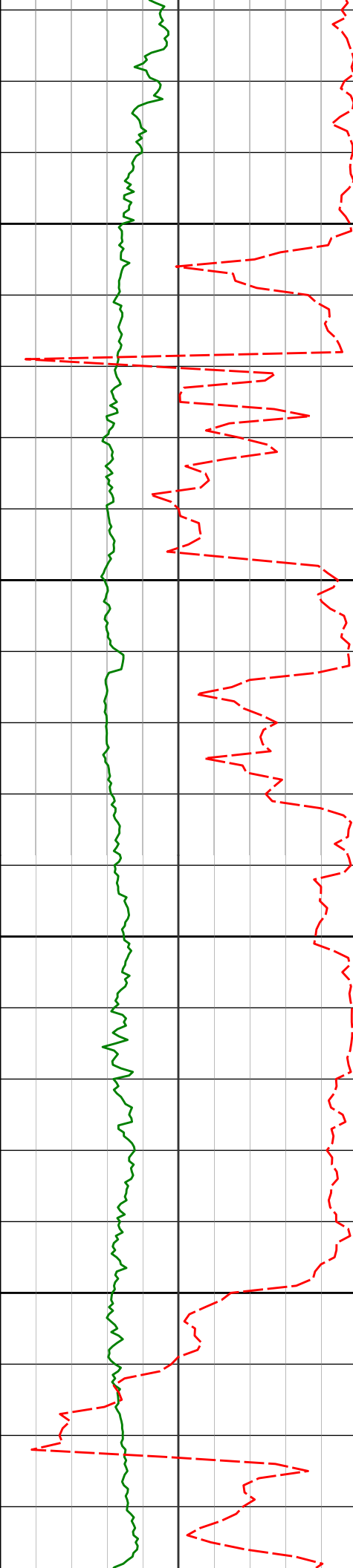
179.95°

5638.29'

3866.32'

ROPA

PGRC



Run 500

10029'

90.51°

180.91°

5638.31'

3956.24'

10050

10100

10121'

91.91°

180.20°

5636.37'

4048.14'

10150

10200

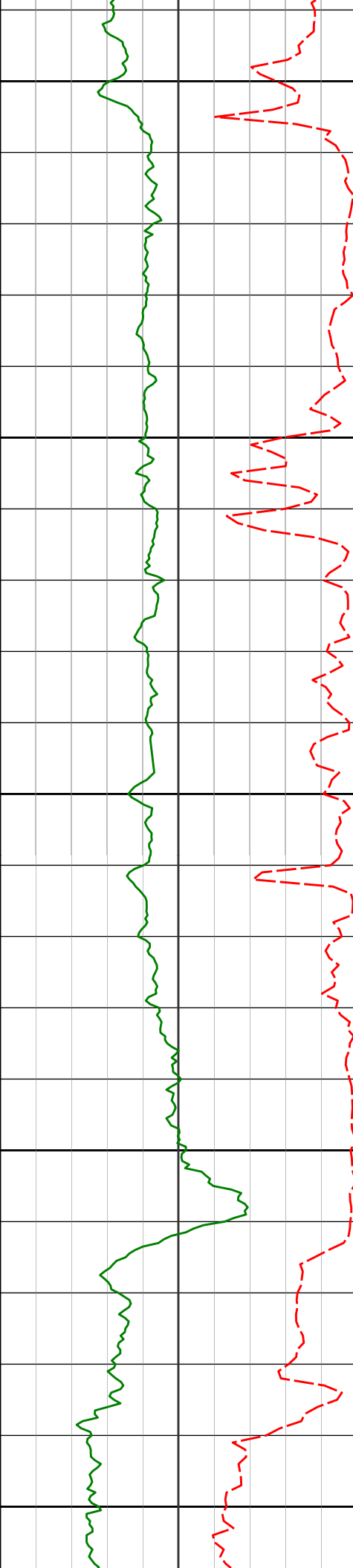
10212'

92.72°

180.15°

5632.69'

4138.96'



10250

10300

10350

Run 600

10400

10450

10304'

90.25°

179.72°

5630.31'

4230.81'

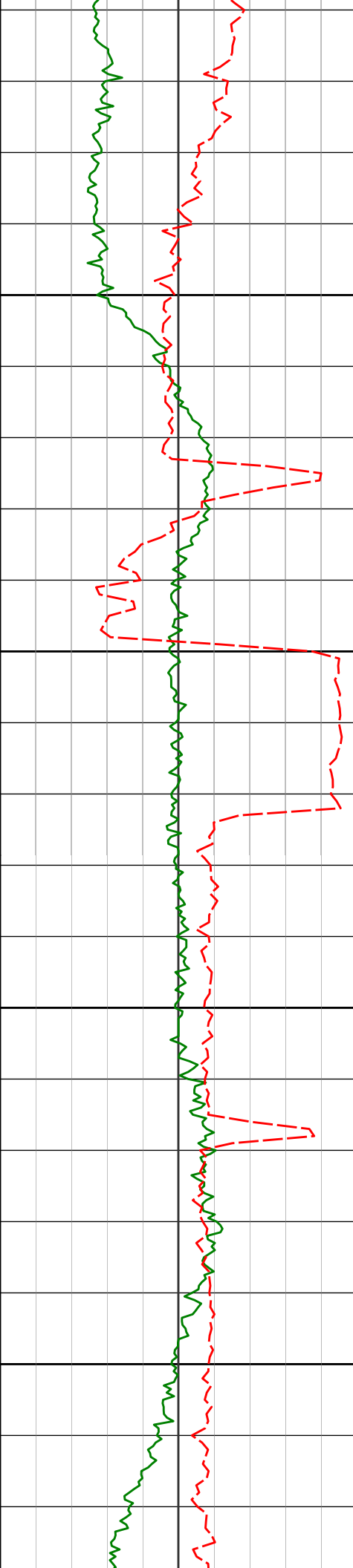
10389'

90.52°

180.18°

5629.74'

4315.70'



10480'

90.99°

179.75°

5628.54'

4406.57'

10500

10550

10572'

89.05°

179.78°

5628.51'

4498.44'

10600

10650

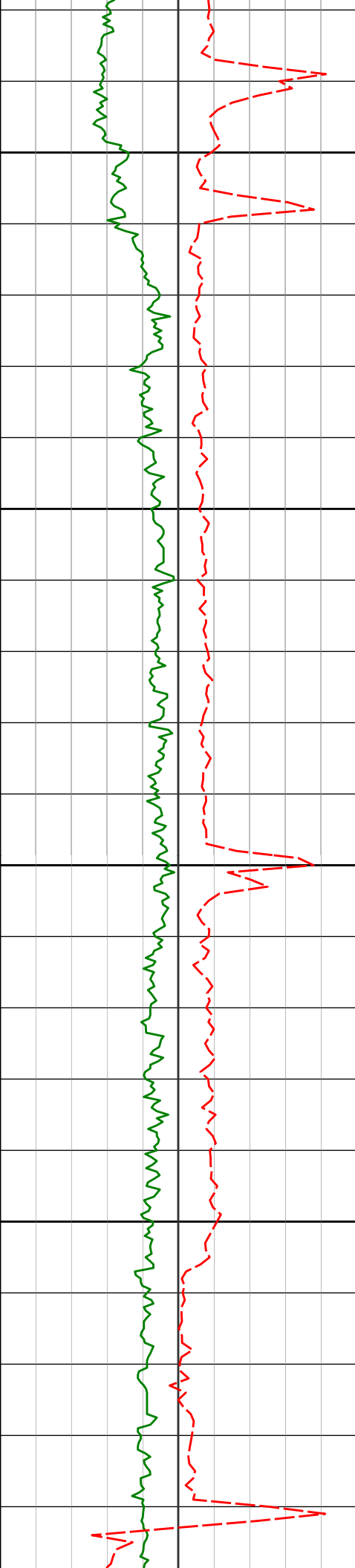
10663'

89.23°

179.71°

5629.87'

4589.29'



10700

10750

10800

10850

10754'

89.86°

179.96°

5630.60'

4680.16'

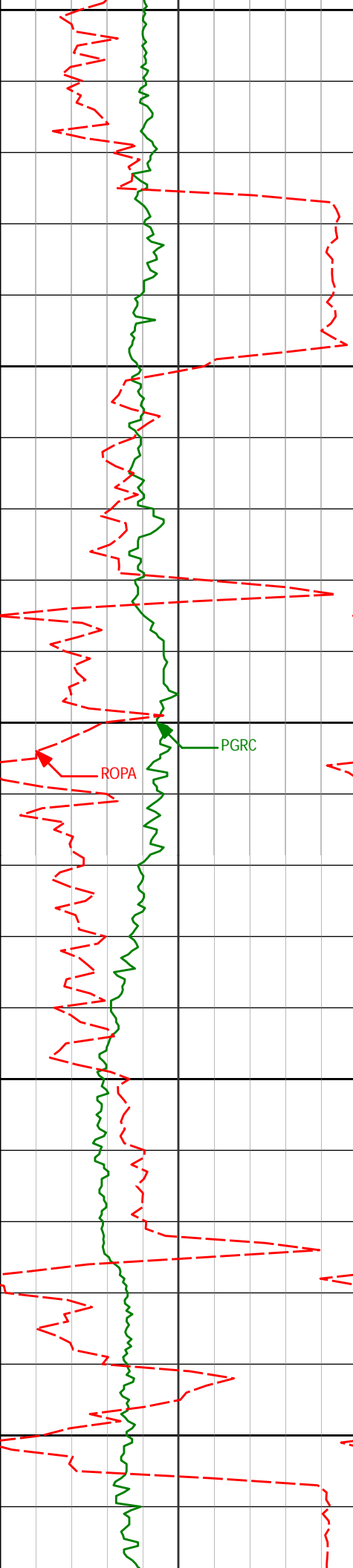
10846'

90.38°

179.80°

5630.40'

4772.04'



10900

10938'

89.78°

179.69°

5630.28'

4863.90'

10950

11000

ROPA

PGRC

11029'

89.88°

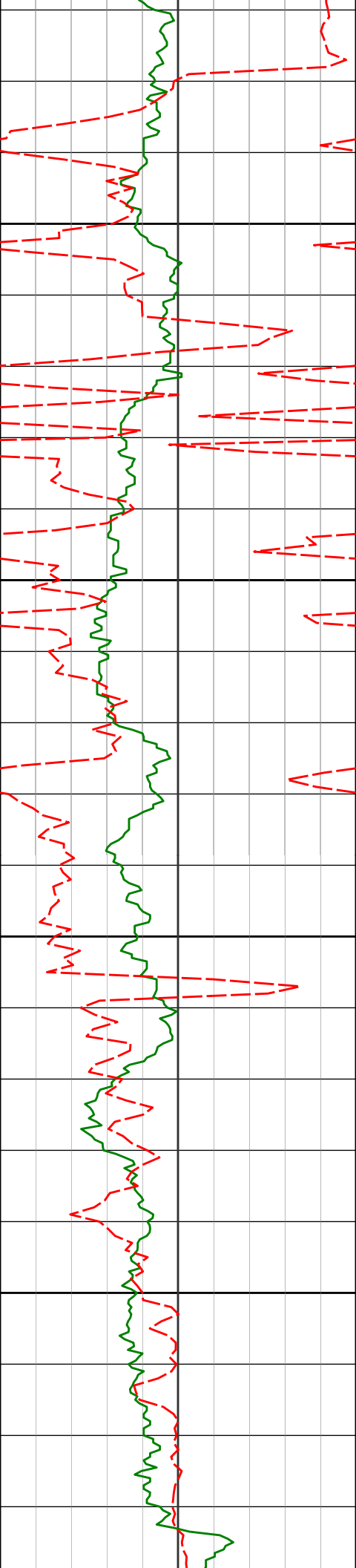
180.00°

5630.55'

4954.78'

11050

11100



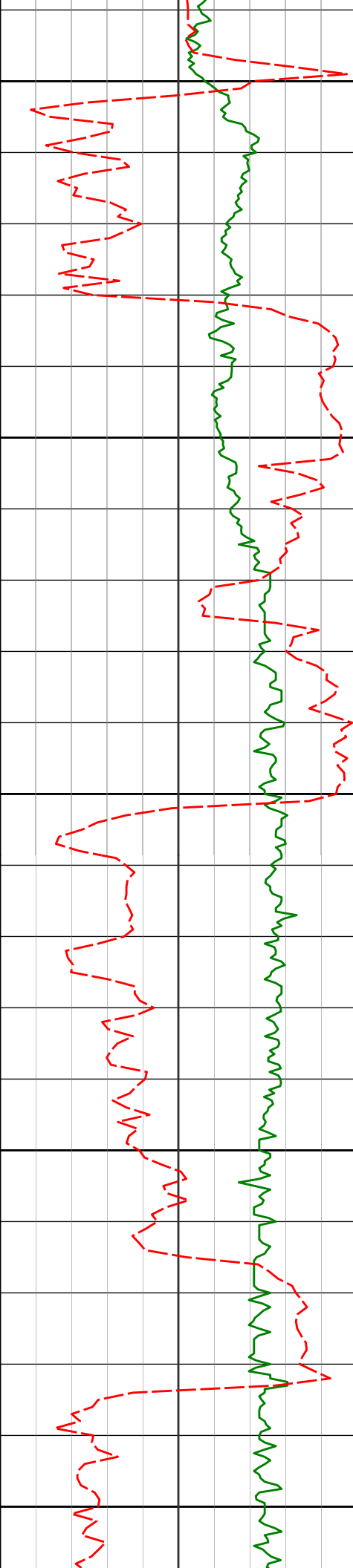
11150

11200

11250

11300

11120'	88.77°	180.13°	5631.62'	5045.66'
11212'	89.26°	180.64°	5633.20'	5137.56'
11305'	89.11°	179.78°	5634.52'	5230.45'



11350

11400

11450

11500

11550

11396'

89.78°

180.30°

5635.40'

5321.34'

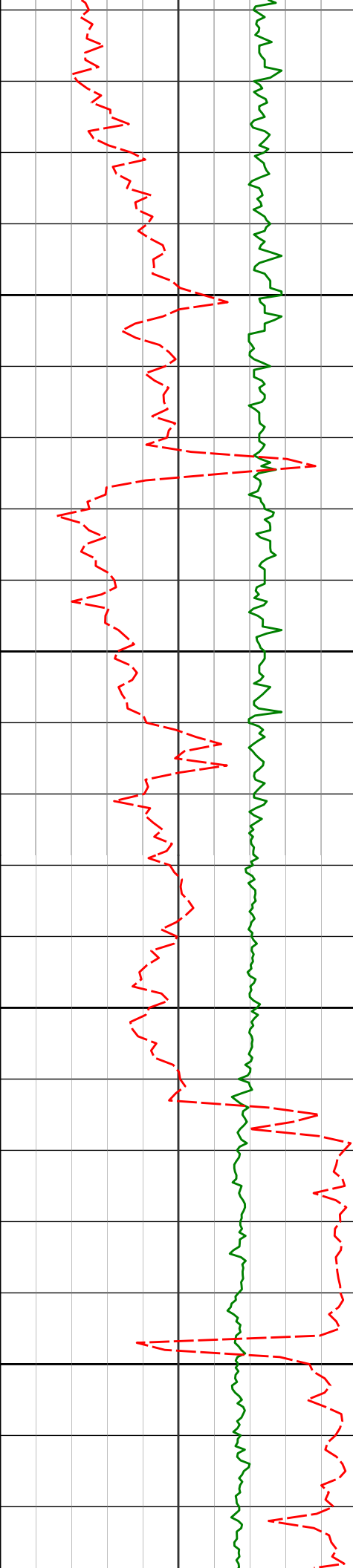
11487'

90.79°

180.80°

5634.95'

5412.26'



11579'	91.17°	180.55°	5633.38'	5504.18'
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11600

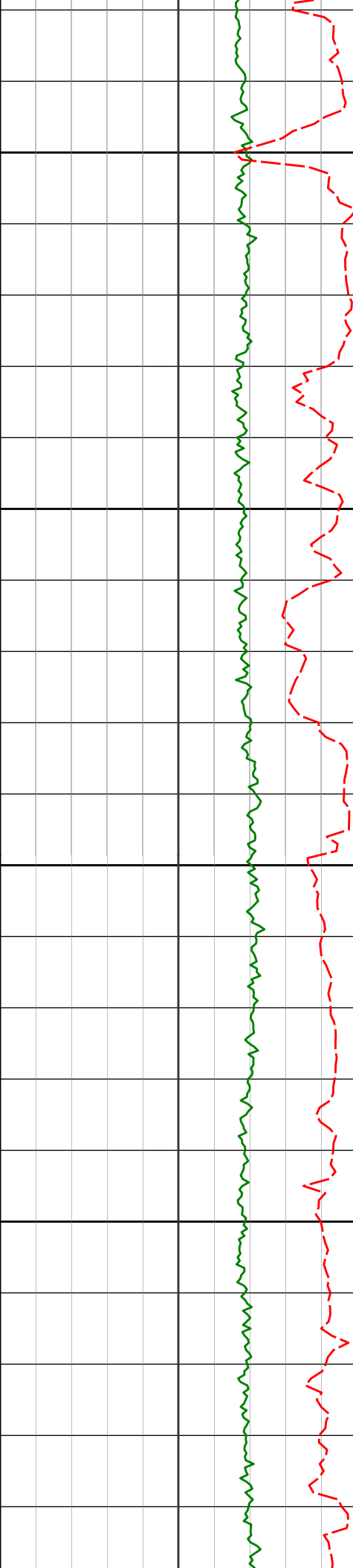
11650

11671'	91.60°	180.16°	5631.15'	5596.07'
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11700

11750

11761'	90.34°	180.42°	5629.63'	5685.96'
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11800

11850

11900

11950

11854'

89.66°

178.80°

5629.63'

5778.81'

11945'

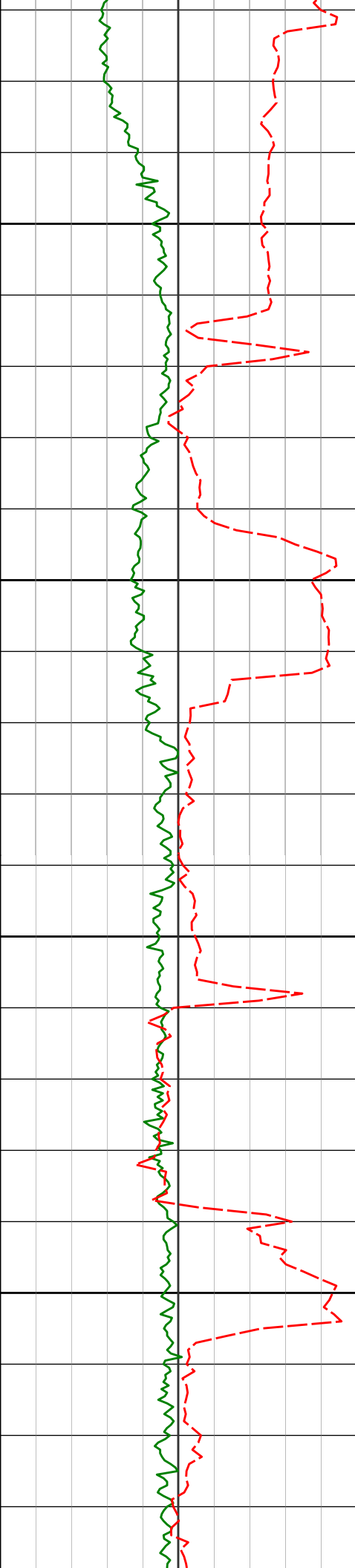
88.71°

178.89°

5630.92'

5869.58'





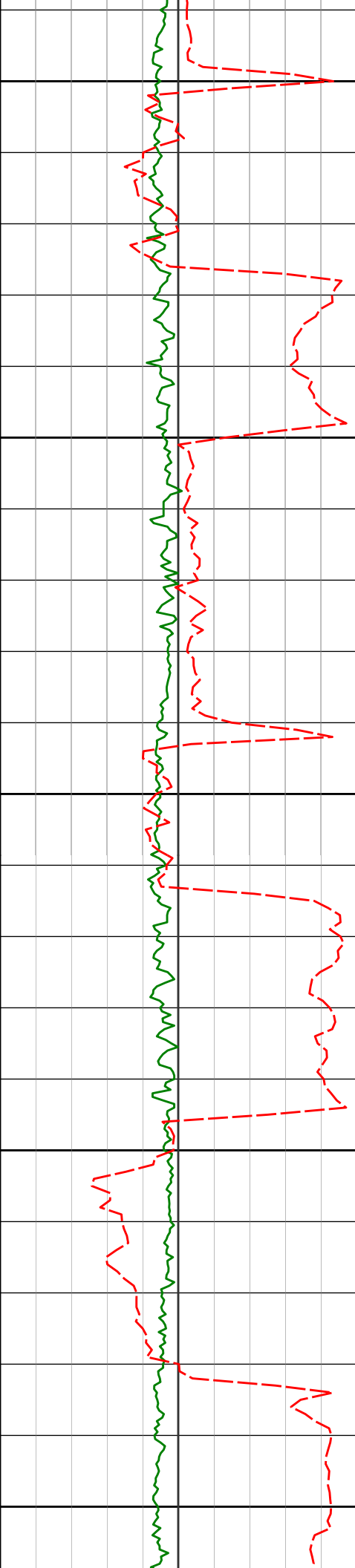
12250

12300

12350

12400

12220'	89.94°	177.86°	5632.94'	6143.76'
12312'	88.08°	177.66°	5634.53'	6235.38'
12403'	88.92°	177.55°	5636.91'	6325.96'



12450

12500

12550

12600

12650

12496'

89.84°

177.54°

5637.92'

6418.56'

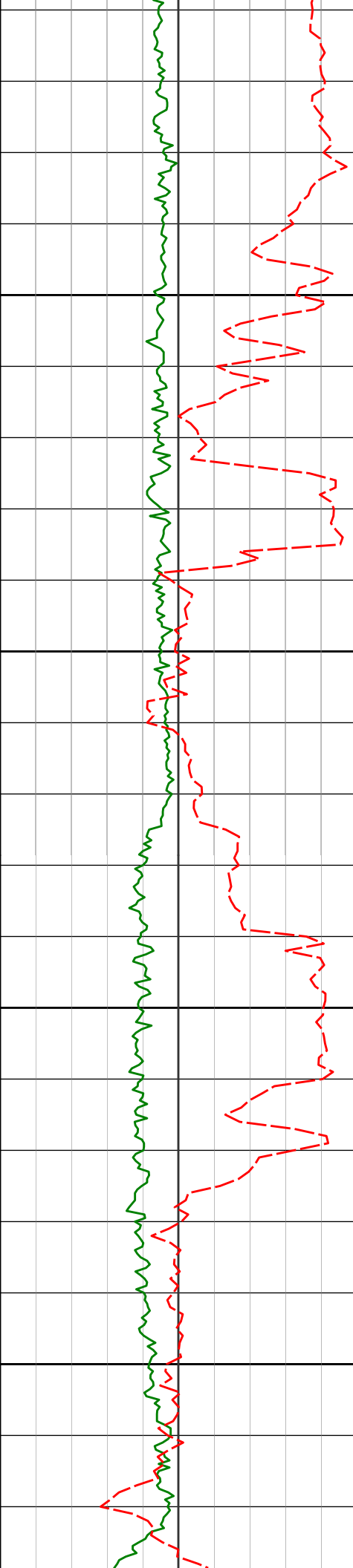
12588'

89.78°

179.66°

5638.22'

6510.30'



12700

12750

12800

12850

12679'

90.84°

181.56°

5637.73'

6601.22'

12770'

90.83°

182.61°

5636.40'

6692.20'

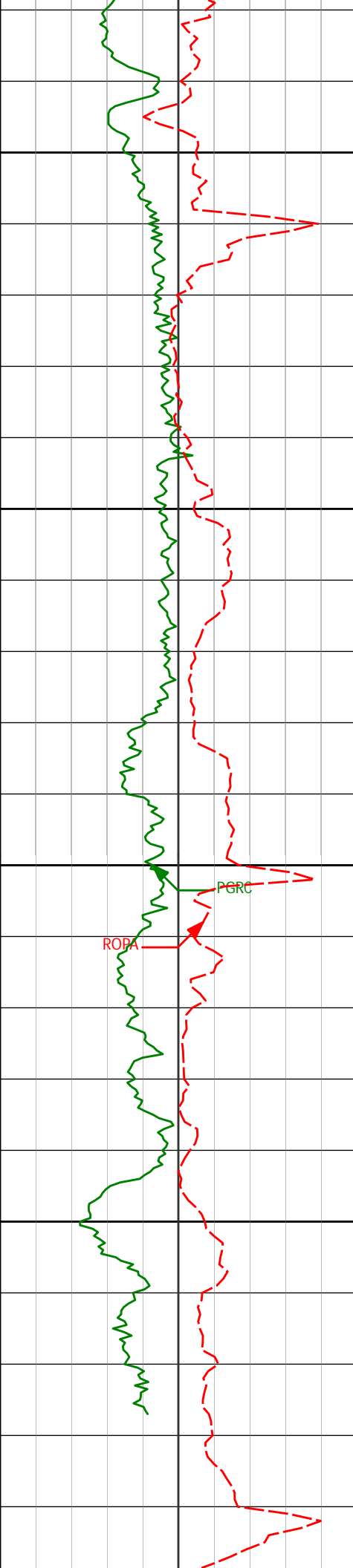
12862'

89.05°

182.80°

5636.50'

6784.20'



12900

12950

13000

13050

12955'

89.47°

181.92°

5637.70'

6877.19'

13046'

89.41°

181.65°

5638.59'

6968.17'

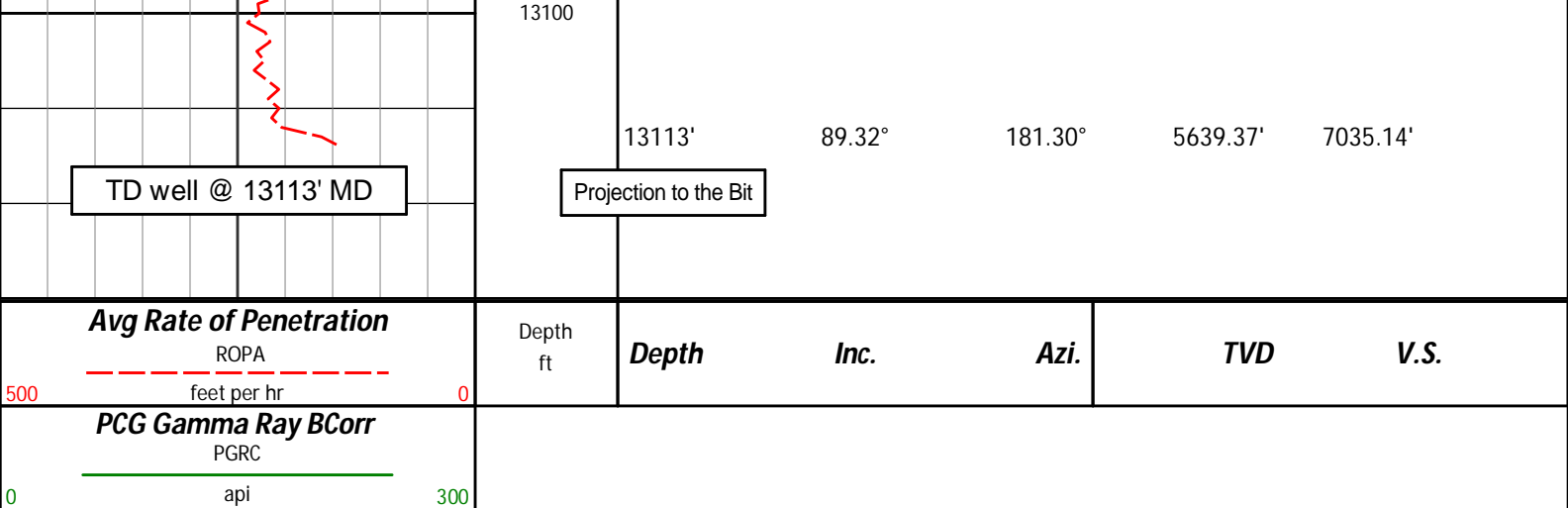
13069'

89.32°

181.30°

5638.84'

6991.16'



## HALLIBURTON

### DIRECTIONAL SURVEY REPORT

Whiting Oil and Gas  
Razor 27J-3409A  
Redtail  
Weld Colorado  
USA  
CA-XX-0901619872  
Surveys are Sag, IFR and MS corrected.

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
177.00	0.11	322.84	177.00	0.14 N	0.10 W	-0.13	0.06
268.00	0.56	357.90	268.00	0.65 N	0.17 W	-0.64	0.52
359.00	0.62	351.97	358.99	1.58 N	0.26 W	-1.57	0.09
451.00	0.66	336.12	450.99	2.56 N	0.54 W	-2.53	0.20
544.00	0.69	339.90	543.98	3.57 N	0.95 W	-3.52	0.06
635.00	0.36	311.79	634.98	4.28 N	1.35 W	-4.21	0.45
727.00	0.15	293.42	726.98	4.52 N	1.68 W	-4.43	0.24
819.00	0.33	241.09	818.98	4.44 N	2.02 W	-4.33	0.29
911.00	0.10	241.87	910.97	4.27 N	2.32 W	-4.15	0.25
993.00	1.00	334.75	992.97	4.89 N	2.69 W	-4.75	1.23
1087.00	2.41	348.80	1086.93	7.57 N	3.42 W	-7.39	1.55
1176.00	4.05	356.77	1175.78	12.54 N	3.97 W	-12.33	1.91
1268.00	5.14	351.43	1267.49	19.86 N	4.76 W	-19.60	1.27
1360.00	6.50	346.79	1359.01	29.01 N	6.57 W	-28.64	1.56
1451.00	7.97	341.48	1449.28	40.00 N	9.75 W	-39.47	1.77
1542.00	9.32	335.41	1539.25	52.69 N	14.82 W	-51.88	1.79
1636.00	8.53	331.24	1632.11	65.72 N	21.34 W	-64.58	1.09
1728.00	9.16	326.29	1723.02	77.79 N	28.69 W	-76.27	1.07
1819.00	11.14	321.89	1812.59	90.74 N	38.13 W	-88.73	2.34
1911.00	14.16	329.21	1902.35	107.40 N	49.38 W	-104.81	3.71
2002.00	16.92	329.09	1990.02	128.33 N	61.89 W	-125.09	3.03
2094.00	16.56	328.31	2078.12	150.97 N	75.65 W	-147.02	0.46
2185.00	15.63	327.24	2165.55	172.32 N	89.10 W	-167.67	1.07
2277.00	14.38	325.32	2254.41	192.13 N	102.30 W	-186.81	1.46
2368.00	13.41	324.41	2342.75	210.01 N	114.87 W	-204.04	1.09
2459.00	16.57	324.27	2430.64	229.13 N	128.60 W	-222.45	3.47
2551.00	15.91	321.99	2518.97	249.71 N	144.02 W	-242.24	1.00
2642.00	15.38	321.87	2606.60	269.03 N	159.16 W	-260.79	0.58
2733.00	17.24	329.02	2693.94	290.09 N	173.55 W	-281.10	3.00
2825.00	16.69	327.79	2781.94	312.96 N	187.61 W	-303.24	0.71
2917.00	14.23	335.82	2870.61	334.45 N	199.29 W	-324.13	3.54
3008.00	12.55	334.40	2959.14	353.58 N	208.14 W	-342.79	1.88
3100.00	10.52	331.40	3049.28	369.97 N	216.48 W	-358.74	2.30
3192.00	11.88	340.31	3139.53	386.26 N	223.69 W	-374.66	2.39
3283.00	11.76	339.89	3228.60	403.78 N	230.04 W	-391.85	0.16
3375.00	11.69	340.55	3318.68	421.38 N	236.36 W	-409.10	0.16

3467.00	11.77	338.79	3408.76	438.91 N	242.86 W	-426.29	0.40
3558.00	12.03	337.54	3497.80	456.33 N	249.84 W	-443.34	0.40
3649.00	11.92	335.70	3586.82	473.66 N	257.33 W	-460.28	0.44
3741.00	11.75	335.01	3676.87	490.81 N	265.20 W	-477.02	0.24
3832.00	11.40	331.29	3766.02	507.09 N	273.44 W	-492.87	0.91
3924.00	11.48	331.06	3856.19	523.08 N	282.23 W	-508.40	0.10
4015.00	14.51	343.33	3944.87	541.94 N	289.89 W	-526.85	4.49
4106.00	16.48	344.57	4032.55	565.30 N	296.59 W	-549.85	2.20
4197.00	15.58	343.52	4120.02	589.46 N	303.49 W	-573.64	1.04
4289.00	14.72	344.03	4208.82	612.55 N	310.22 W	-596.36	0.95
4380.00	13.16	342.01	4297.13	633.52 N	316.60 W	-616.99	1.80
4473.00	10.91	341.37	4388.08	651.93 N	322.68 W	-635.08	2.42
4563.00	9.69	342.92	4476.63	667.24 N	327.62 W	-650.12	1.39
4655.00	7.13	343.00	4567.64	680.10 N	331.57 W	-662.78	2.78
4747.00	5.82	342.93	4659.05	690.02 N	334.61 W	-672.53	1.42
4839.00	2.37	320.44	4750.80	695.95 N	337.19 W	-678.32	4.07
4931.00	1.19	163.49	4842.78	696.50 N	338.13 W	-678.83	3.80
5023.00	2.52	165.43	4934.73	693.63 N	337.35 W	-676.00	1.45
5115.00	4.80	170.42	5026.54	687.87 N	336.20 W	-670.31	2.50
5146.00	11.37	184.06	5057.22	683.54 N	336.20 W	-665.98	21.93
5176.00	15.50	181.08	5086.39	676.58 N	336.48 W	-659.01	13.95
5206.00	20.34	181.79	5114.93	667.36 N	336.72 W	-649.79	16.15
5238.00	27.58	184.28	5144.15	654.39 N	337.45 W	-636.80	22.84
5268.00	32.37	185.06	5170.13	639.46 N	338.68 W	-621.83	16.02
5299.00	35.04	184.67	5195.92	622.32 N	340.13 W	-604.64	8.64
5329.00	37.42	184.03	5220.11	604.64 N	341.48 W	-586.91	8.03
5359.00	37.51	182.89	5243.93	586.43 N	342.58 W	-568.67	2.33
5389.00	38.60	183.23	5267.55	567.96 N	343.57 W	-550.18	3.70
5420.00	40.37	185.24	5291.47	548.31 N	345.03 W	-530.47	7.04
5451.00	42.39	184.65	5314.73	527.89 N	346.79 W	-509.99	6.64
5482.00	43.37	184.12	5337.45	506.86 N	348.40 W	-488.91	3.37
5513.00	43.38	184.45	5359.98	485.63 N	349.99 W	-467.63	0.73
5543.00	43.98	182.59	5381.68	464.95 N	351.26 W	-446.91	4.73
5573.00	45.73	181.91	5402.95	443.81 N	352.09 W	-425.75	6.05
5605.00	48.16	180.00	5424.79	420.43 N	352.47 W	-402.39	8.76
5637.00	50.53	178.87	5445.64	396.16 N	352.23 W	-378.16	7.88
5669.00	51.03	178.32	5465.87	371.38 N	351.62 W	-353.43	2.05
5700.00	53.56	178.85	5484.83	346.86 N	351.02 W	-328.98	8.27
5732.00	55.55	178.85	5503.39	320.80 N	350.50 W	-302.97	6.22
5764.00	56.17	178.58	5521.35	294.32 N	349.90 W	-276.56	2.06
5795.00	57.93	179.48	5538.21	268.31 N	349.46 W	-250.60	6.18
5827.00	61.30	180.05	5554.39	240.71 N	349.35 W	-223.04	10.64
5858.00	64.85	181.41	5568.43	213.08 N	349.71 W	-195.43	12.10
5890.00	68.68	181.55	5581.05	183.69 N	350.47 W	-166.04	11.98
5921.00	69.69	181.60	5592.06	154.72 N	351.27 W	-137.07	3.26
5953.00	71.07	181.34	5602.81	124.59 N	352.04 W	-106.93	4.38
5984.00	74.36	180.86	5612.02	95.00 N	352.61 W	-77.35	10.72
6016.00	75.29	181.31	5620.39	64.12 N	353.19 W	-46.48	3.21
6047.00	77.57	180.49	5627.67	33.99 N	353.66 W	-16.37	7.79
6079.00	81.05	179.77	5633.60	2.55 N	353.73 W	15.04	11.10
6112.00	82.15	179.43	5638.42	30.09 S	353.51 W	47.63	3.49
6221.00	87.01	179.99	5648.72	138.57 S	352.96 W	155.95	4.49
6315.00	85.86	179.35	5654.56	232.38 S	352.42 W	249.62	1.40
6410.00	88.30	179.81	5659.40	327.25 S	351.72 W	344.33	2.61
6504.00	90.76	180.97	5660.17	421.24 S	352.36 W	438.23	2.89
6599.00	90.30	180.55	5659.29	516.22 S	353.62 W	533.17	0.66
6693.00	89.87	182.98	5659.15	610.17 S	356.52 W	627.14	2.63
6788.00	89.50	185.06	5659.67	704.93 S	363.18 W	722.12	2.22
6883.00	90.60	182.56	5659.59	799.71 S	369.49 W	817.09	2.88
6977.00	90.97	179.30	5658.30	893.68 S	371.01 W	911.02	3.49
7072.00	90.67	179.26	5656.94	988.66 S	369.82 W	1005.82	0.32
7166.00	90.97	181.13	5655.60	1082.65 S	370.14 W	1099.71	2.01
7261.00	90.08	178.52	5654.73	1177.63 S	369.85 W	1194.56	2.90
7355.00	90.39	182.40	5654.34	1271.61 S	370.61 W	1288.46	4.14
7450.00	90.42	182.97	5653.67	1366.50 S	375.06 W	1383.46	0.60
7545.00	89.90	178.67	5653.41	1461.47 S	376.41 W	1478.38	4.56
7639.00	89.62	180.90	5653.80	1555.46 S	376.06 W	1572.24	2.39
7734.00	89.74	183.97	5654.33	1650.36 S	380.10 W	1667.22	3.23
7828.00	89.85	186.51	5654.67	1743.96 S	388.68 W	1761.13	2.70
7923.00	89.04	175.16	5655.59	1838.79 S	390.06 W	1855.91	11.98
8018.00	89.53	177.19	5656.78	1933.57 S	383.73 W	1950.26	2.20
8113.00	90.03	178.40	5657.14	2028.49 S	380.07 W	2044.88	1.38
8205.00	93.21	179.03	5654.54	2120.42 S	378.01 W	2136.60	3.52
8296.00	93.54	178.58	5649.18	2211.24 S	376.12 W	2227.21	0.61

8387.00	91.68	178.54	5645.04	2302.12 S	373.83 W	2317.86	2.04
8479.00	91.94	178.27	5642.13	2394.04 S	371.27 W	2409.53	0.41
8569.00	91.81	177.94	5639.19	2483.94 S	368.30 W	2499.18	0.39
8660.00	91.87	177.52	5636.27	2574.82 S	364.69 W	2589.77	0.47
8751.00	90.24	178.95	5634.59	2665.76 S	361.89 W	2680.45	2.38
8842.00	90.73	178.99	5633.82	2756.74 S	360.26 W	2771.24	0.54
8934.00	90.65	178.25	5632.71	2848.70 S	358.04 W	2862.98	0.81
9025.00	88.95	176.09	5633.03	2939.58 S	353.55 W	2953.53	3.02
9117.00	88.67	177.84	5634.94	3031.43 S	348.68 W	3045.02	1.93
9209.00	89.93	181.16	5636.07	3123.41 S	347.88 W	3136.84	3.86
9300.00	89.69	180.29	5636.37	3214.40 S	349.03 W	3227.78	0.99
9391.00	89.93	181.16	5636.67	3305.39 S	350.18 W	3318.71	0.99
9482.00	89.90	181.50	5636.80	3396.36 S	352.29 W	3409.68	0.38
9573.00	89.87	182.16	5636.99	3487.32 S	355.20 W	3500.66	0.73
9663.00	89.91	182.77	5637.16	3577.23 S	359.07 W	3590.66	0.68
9756.00	89.99	179.65	5637.24	3670.20 S	361.03 W	3683.61	3.36
9847.00	89.62	179.46	5637.55	3761.20 S	360.32 W	3774.46	0.46
9939.00	89.46	179.95	5638.29	3853.19 S	359.85 W	3866.32	0.56
10029.00	90.51	180.91	5638.31	3943.19 S	360.53 W	3956.24	1.58
10121.00	91.91	180.20	5636.37	4035.16 S	361.42 W	4048.14	1.71
10212.00	92.72	180.15	5632.69	4126.08 S	361.70 W	4138.96	0.89
10304.00	90.25	179.72	5630.31	4218.05 S	361.59 W	4230.81	2.73
10389.00	90.52	180.18	5629.74	4303.04 S	361.52 W	4315.70	0.63
10480.00	90.99	179.75	5628.54	4394.04 S	361.46 W	4406.57	0.70
10572.00	89.05	179.78	5628.51	4486.03 S	361.08 W	4498.44	2.11
10663.00	89.23	179.71	5629.87	4577.02 S	360.68 W	4589.29	0.21
10754.00	89.86	179.96	5630.60	4668.02 S	360.42 W	4680.16	0.74
10846.00	90.38	179.80	5630.40	4760.01 S	360.22 W	4772.04	0.59
10938.00	89.78	179.69	5630.28	4852.01 S	359.81 W	4863.90	0.66
11029.00	89.88	180.00	5630.55	4943.01 S	359.57 W	4954.78	0.36
11120.00	88.77	180.13	5631.62	5034.00 S	359.67 W	5045.66	1.23
11212.00	89.26	180.64	5633.20	5125.99 S	360.29 W	5137.56	0.77
11305.00	89.11	179.78	5634.52	5218.98 S	360.63 W	5230.45	0.94
11396.00	89.78	180.30	5635.40	5309.97 S	360.69 W	5321.34	0.93
11487.00	90.79	180.80	5634.95	5400.97 S	361.57 W	5412.26	1.24
11579.00	91.17	180.55	5633.38	5492.95 S	362.65 W	5504.18	0.49
11671.00	91.60	180.16	5631.15	5584.92 S	363.22 W	5596.07	0.63
11761.00	90.34	180.42	5629.63	5674.90 S	363.68 W	5685.96	1.43
11854.00	89.66	178.80	5629.63	5767.89 S	363.04 W	5778.81	1.89
11945.00	88.71	178.89	5630.92	5858.87 S	361.21 W	5869.58	1.05
12036.00	89.29	178.51	5632.51	5949.83 S	359.14 W	5960.33	0.76
12128.00	90.12	178.52	5632.99	6041.80 S	356.76 W	6052.06	0.90
12220.00	89.94	177.86	5632.94	6133.75 S	353.85 W	6143.76	0.74
12312.00	88.08	177.66	5634.53	6225.66 S	350.26 W	6235.38	2.03
12403.00	88.92	177.55	5636.91	6316.55 S	346.46 W	6325.96	0.93
12496.00	89.84	177.54	5637.92	6409.46 S	342.47 W	6418.56	0.99
12588.00	89.78	179.66	5638.22	6501.42 S	340.23 W	6510.30	2.31
12679.00	90.84	181.56	5637.73	6592.41 S	341.20 W	6601.22	2.39
12770.00	90.83	182.61	5636.40	6683.34 S	344.51 W	6692.20	1.15
12862.00	89.05	182.80	5636.50	6775.23 S	348.85 W	6784.20	1.95
12955.00	89.47	181.92	5637.70	6868.15 S	352.68 W	6877.19	1.05
13046.00	89.41	181.65	5638.59	6959.10 S	355.51 W	6968.17	0.30
13069.00	89.32	181.30	5638.84	6982.09 S	356.10 W	6991.16	1.57
13113.00	89.32	181.30	5639.37	7026.07 S	357.10 W	7035.14	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 182.85 DEGREES (TRUE)  
A TOTAL CORRECTION OF 7.52 DEG FROM MAGNETIC NORTH TO TRUE NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 13113.00 FEET  
IS 7035.14 FEET ALONG 182.91 DEGREES (TRUE)**

**Tie onto surface at 0' MD  
Final survey is a projection to the bit at TD**