

PCG - Pressure Cased Gamma

1 : 600 / 1 : 240

[illegible]

WELL INFORMATION

MWD Run Number	100	200			
Date run completed	20-Dec-14	27-Dec-14			
Rig Bit Number	2	3			
Bit Size (in)	8.750	6.125			
Tool Nominal OD (in)	6.750	4.750			
Log Start Depth (MD, ft)	697.00	7,046.00			
Log End Depth (MD, ft)	7,046.00	16,966.00			
Drill or Wipe	Drill	Drill			
Drill/Wipe Start Date and Time	18-Dec-14 10:11	21-Dec-14 23:37			
Drill/Wipe End Date and Time	19-Dec-14 22:58	26-Dec-14 16:10			
Min Inc (deg) @ Depth (MD, ft)	0.38 @ 819.00	85.31 @ 7,120.00			
Max Inc (deg) @ Depth (MD, ft)	79.25 @ 6,988.00	91.85 @ 13,234.00			
Bit TFA(in2) / Bit Type	0.91 / PDC	0.65 / PDC			
Flow Rate (gpm)	620.85	304.06			
Max AV (fpm) / CV (fpm) @ MWD	N/A / N/A	N/A / N/A			
Fluid Type	Native/Spud Mud	Native/Spud Mud			
Density (ppg) / Viscosity (spqt)	9.18 / 42.00	9.29 / 37.00			
Filtrate CL (ppm)	800.00	1,000.00			
pH / Fluid Loss (mptm)	9.30 / 7	9.00 / 7			
PV (cP) / YP (lbf2)	12 / 14.00	13 / 12.00			
% Solids / % Sand	8.80 / 0.25	6.20 / 0.60			
% 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) / S	105.50 / PGM	215.00 / PGM			

Max Tool Temp (degF) / Source	165.58 / PCM	245.03 / PCM			
Rm @ Max Tool Temp (degF)	N/A @ N/A	N/A @ N/A			
Lead MWD Engineer	Paul Sheets	Paul Sheets			
Customer Representative	Martin Suarez	Martin Suarez			

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM	PCM			
Software Version	5.93	5.93			
Sub Serial Number	11404272	12301676			
Insert Serial Number	11680742	11680742			
Date and Time Initialized	16-Dec-14 22:59	20-Dec-14 15:25			
Date and Time Read	20-Dec-14 08:32	27-Dec-14 09:16			
ECMB SW Version	N/A	N/A			

Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	55.74	58.69			
Software Version	6.21	6.21			
Sub Serial Number	11404272	12301676			
Sonde Serial Number	11638470	11638470			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	99.35	180.34			

Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	50.64	53.59			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	11404272	12301676			
Insert/Sonde Serial Number	11293343	11293343			

REMARKS

1. All depths are calibrated to driller's pipe tally and are measured from the rig drill floor.
2. No depth corrections have been made for pipe stretch or compression.
3. All data presented is recorded (memory data) unless otherwise stated.
4. The following smoothing parameters have been applied to the data.
-All 2" (1:600) logs - 1ft. interval, 3 ft. coercion distance.
-All 5" (1:240) logs - .5ft interval, .6 ft. coercion distance.
5. INSITE version 8.1.10
6. Gamma presented inside casing/cement from 6992' MD to 7038' MD.

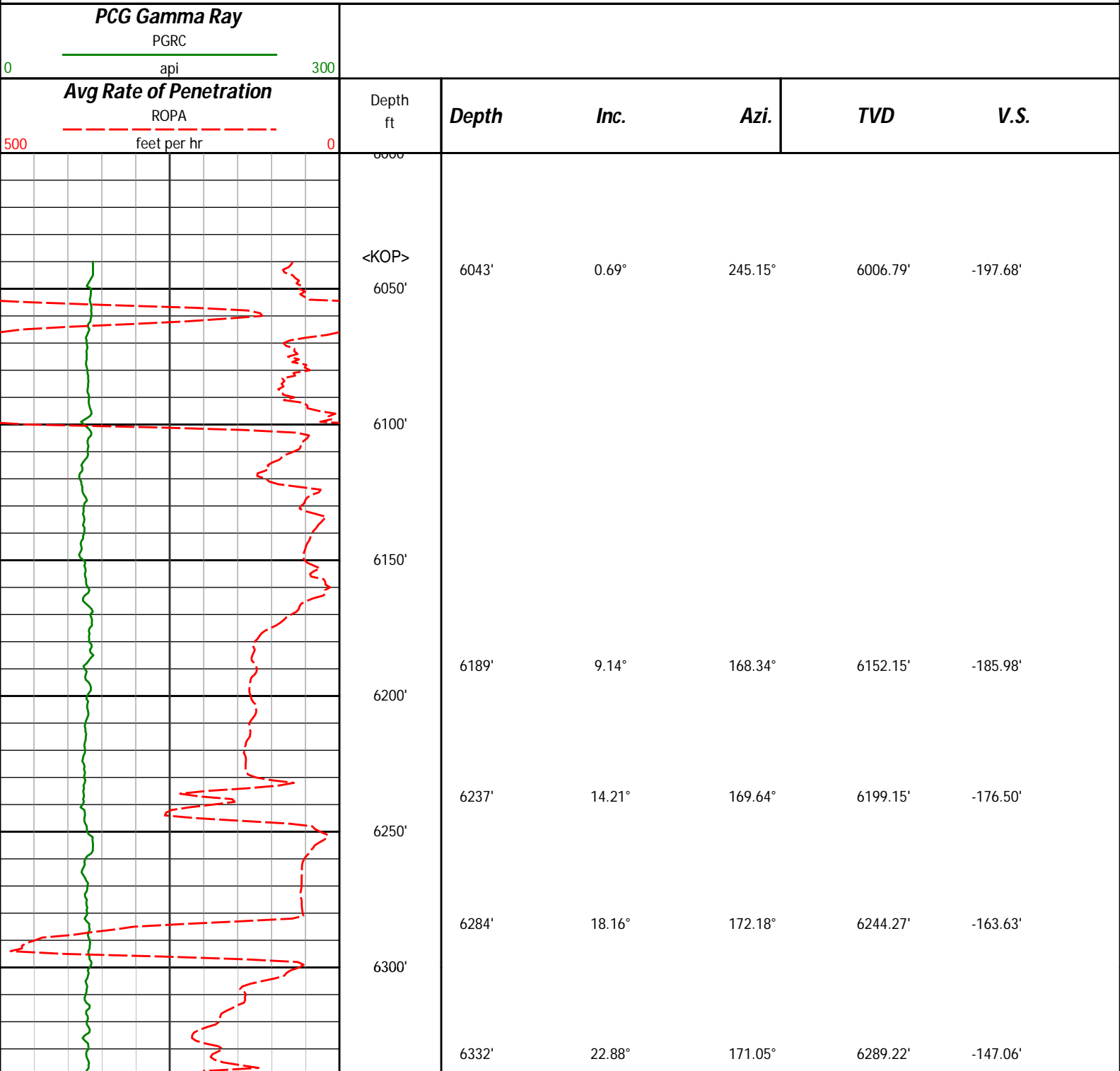
WARRANTY

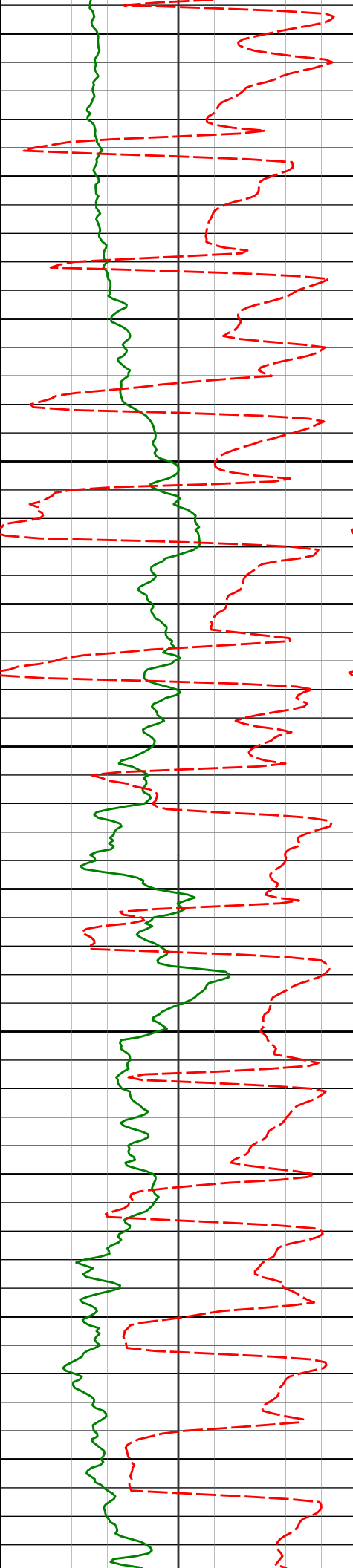
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HALLIBURTON
Sperry Drilling Services
MD Detail Log 1:600

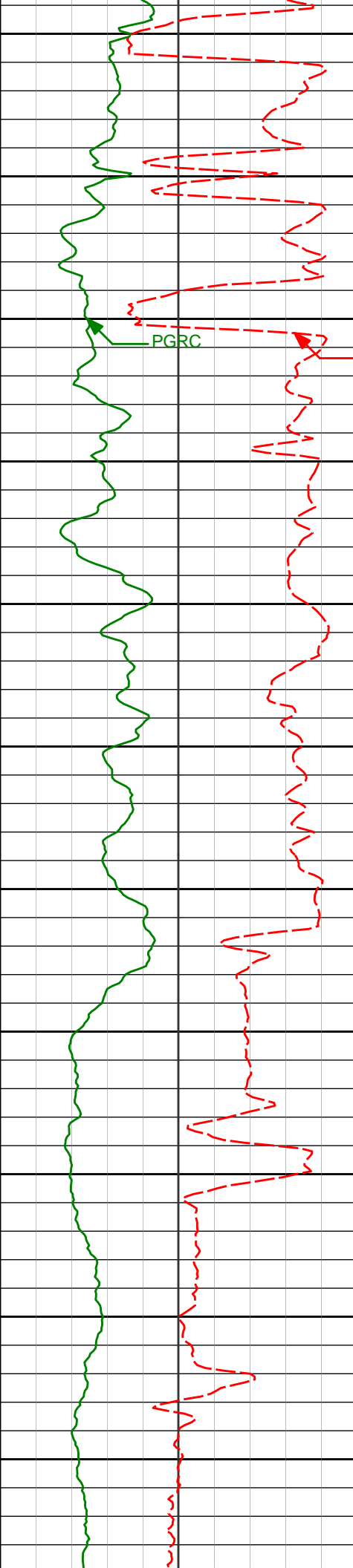
Noble Energy, Inc
Crow Creek AA01-789
H&P 315
T6N R63W





6350'
6379'
6400'
6427'
6450'
6473'
6500'
6521'
6550'
6568'
6600'
6616'
6650'
6663'
6700'
6711'
6750'
6758'
6800'
6806'
6850'
6853'

27.60°	170.65°	6331.72'	-127.38'
32.47°	175.49°	6373.27'	-103.64'
35.16°	178.05°	6411.48'	-78.13'
38.15°	178.28°	6449.99'	-49.53'
42.51°	177.76°	6485.81'	-19.18'
45.05°	179.17°	6520.46'	13.98'
49.17°	180.09°	6552.44'	48.38'
54.89°	179.90°	6581.96'	86.19'
60.47°	181.24°	6607.08'	125.89'
64.49°	182.34°	6629.26'	168.45'
67.66°	183.73°	6648.32'	211.39'



6900'

6950'

7000'

7050'

7100'

7150'

7200'

7250'

7300'

7350'

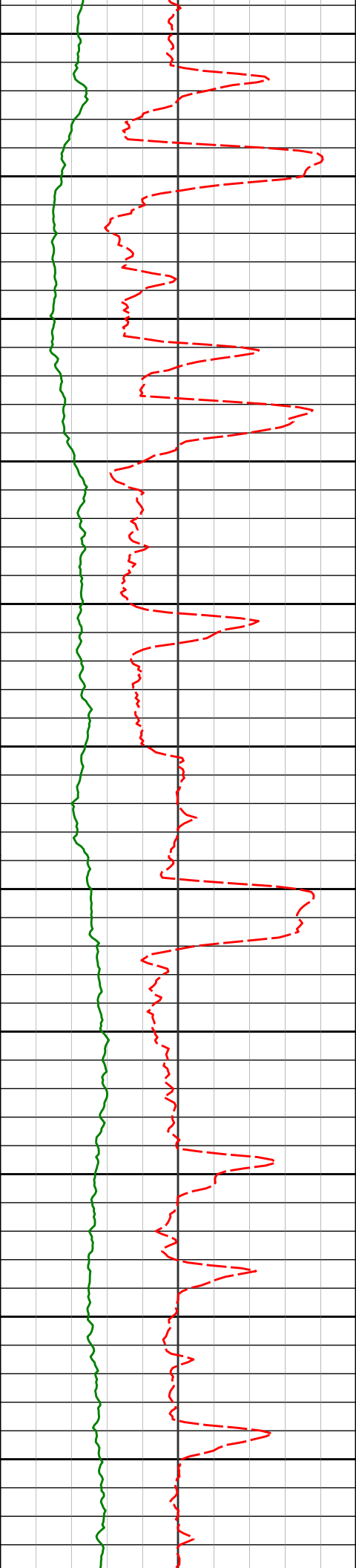
7400'

PGRC

ROPA

Run 200

6901'	71.73°	181.98°	6664.97'	256.38'
6948'	75.84°	180.48°	6678.09'	301.50'
6988'	79.25°	179.94°	6686.72'	340.54'
<7" casing set at 7038' MD>				
7120'	85.31°	178.88°	6704.44'	471.19'
7215'	87.93°	179.42°	6710.04'	565.93'
7310'	89.14°	179.20°	6712.47'	660.82'
7404'	89.01°	178.90°	6713.99'	754.71'



7450'

7500'

7550'

7600'

7650'

7700'

7750'

7800'

7850'

7900'

7950'

7499'

7594'

7689'

7784'

7878'

7973'

89.82°

91.11°

91.48°

90.18°

89.82°

90.34°

177.90°

178.02°

177.78°

178.94°

178.51°

178.31°

6714.96'

6714.19'

6712.04'

6710.66'

6710.66'

6710.53'

849.56'

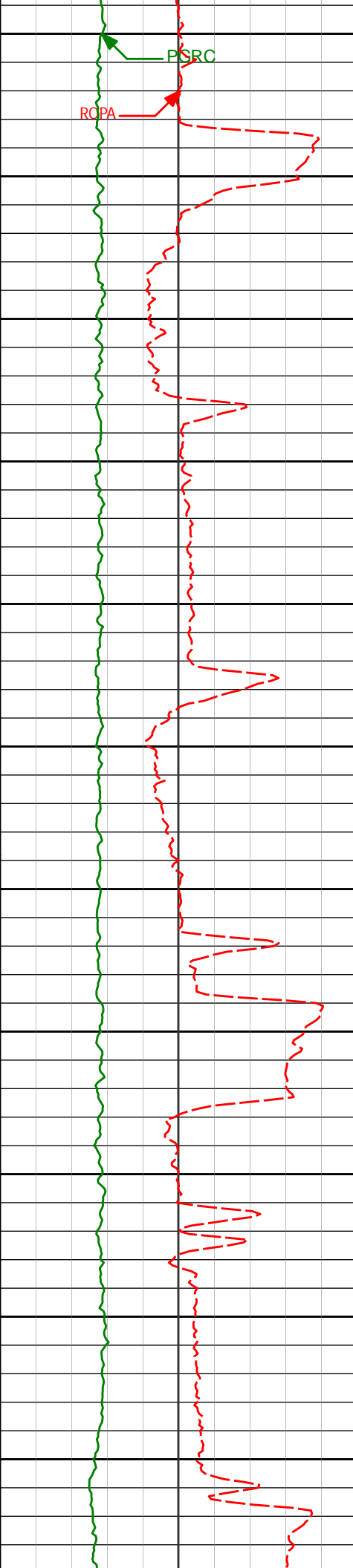
944.36'

1039.14'

1133.97'

1227.85'

1322.71'



8000'

8050'

8100'

8150'

8200'

8250'

8300'

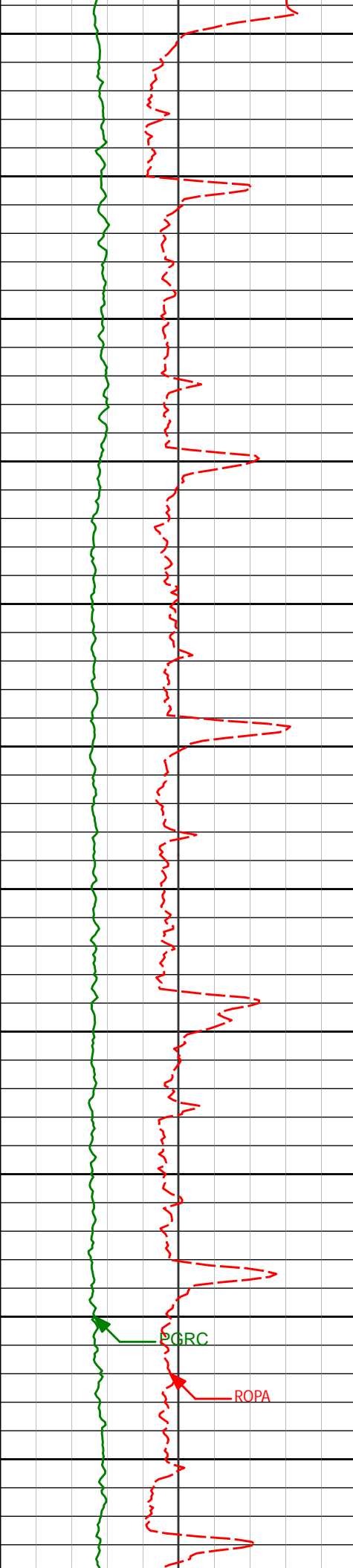
8350'

8400'

8450'

8500'

8068'	89.63°	178.85°	6710.56'	1417.57'
8163'	89.91°	177.84°	6710.94'	1512.42'
8258'	89.75°	176.92°	6711.22'	1607.16'
8353'	89.97°	178.21°	6711.45'	1701.92'
8447'	89.85°	178.73°	6711.60'	1795.78'



8550'

8600'

8650'

8700'

8750'

8800'

8850'

8900'

8950'

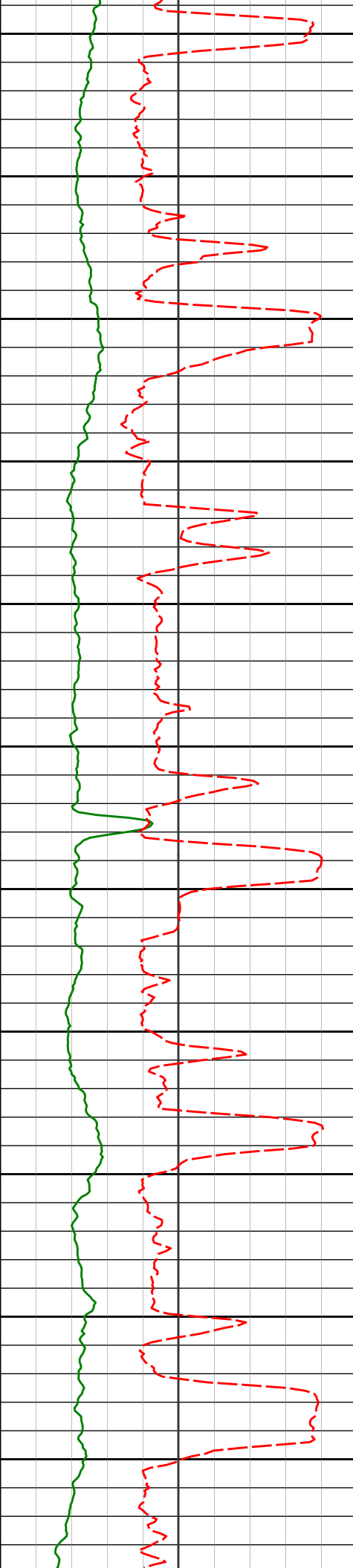
9000'

9050'

8542'	90.28°	181.27°	6711.49'	1890.73'
8637'	89.97°	180.68°	6711.29'	1985.73'
8732'	90.89°	180.33°	6710.57'	2080.71'
8827'	90.37°	180.02°	6709.53'	2175.67'
8922'	90.74°	179.63°	6708.61'	2270.62'
9017'	91.05°	179.51°	6707.12'	2365.55'

PGRC

ROPA



9100'

9150'

9200'

9250'

9300'

9350'

9400'

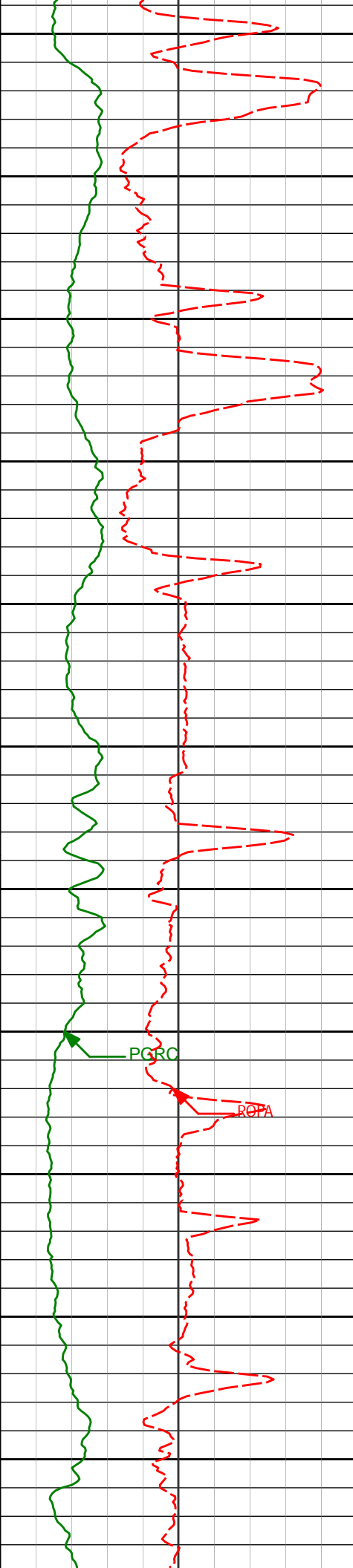
9450'

9500'

9550'

9600'

9112'	91.39°	179.04°	6705.10'	2460.45'
9207'	89.48°	179.29°	6704.38'	2555.36'
9301'	90.15°	179.01°	6704.68'	2649.27'
9396'	90.09°	178.58°	6704.48'	2744.16'
9491'	88.06°	178.16°	6706.02'	2838.99'
9586'	87.97°	179.44°	6709.31'	2933.81'



9650'

9700'

9750'

9800'

9850'

9900'

9950'

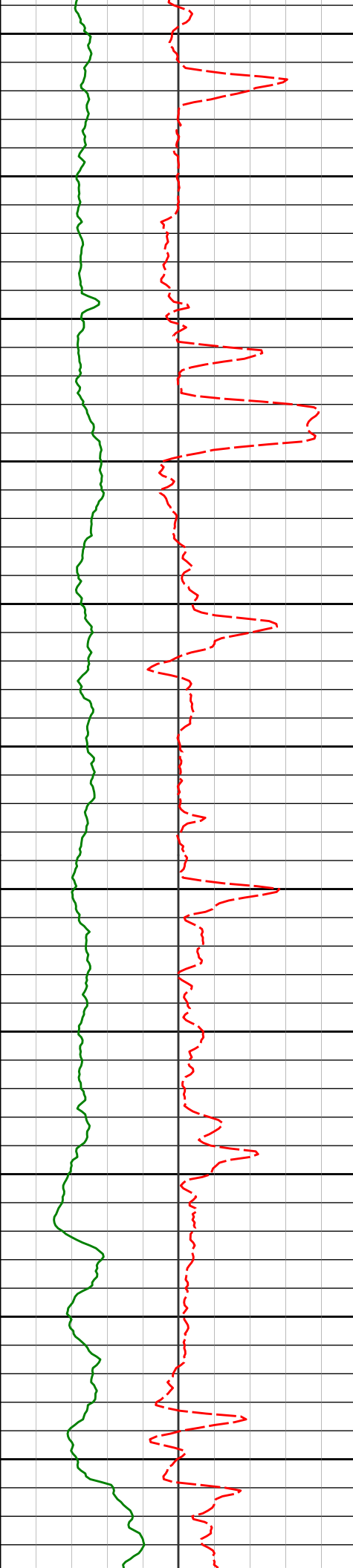
10000'

10050'

10100'

10150'

9681'	88.86°	179.04°	6711.94'	3028.70'
9776'	90.99°	180.63°	6712.06'	3123.64'
9871'	91.02°	180.59°	6710.39'	3218.61'
9966'	90.34°	180.38°	6709.27'	3313.59'
10061'	90.40°	180.19°	6708.65'	3408.56'
10156'	90.80°	180.24°	6707.66'	3503.53'



10200'

10250'

10300'

10350'

10400'

10450'

10500'

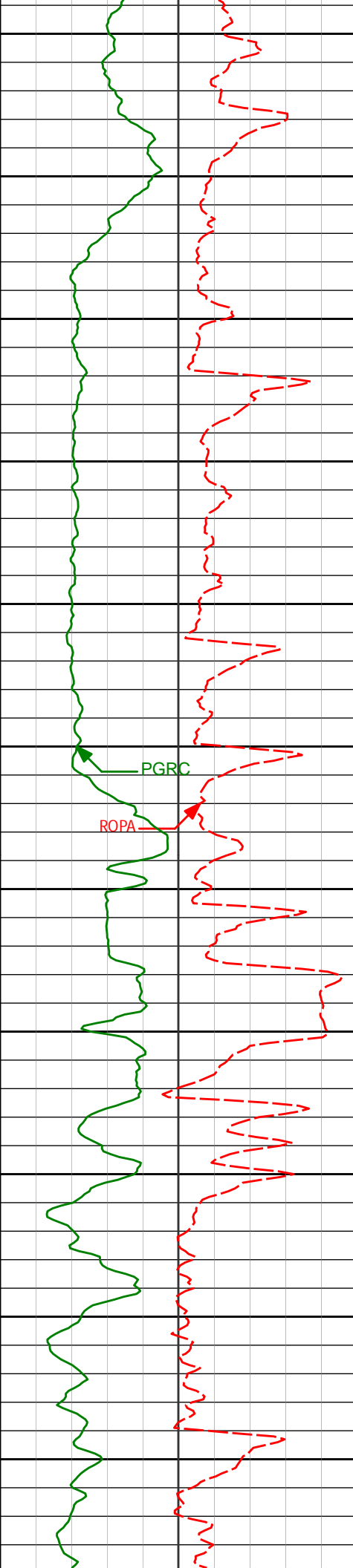
10550'

10600'

10650'

10700'

10250'	91.26°	180.32°	6705.97'	3597.49'
10345'	89.51°	179.30°	6705.33'	3692.44'
10439'	89.45°	179.24°	6706.18'	3786.35'
10531'	89.54°	179.19°	6706.99'	3878.27'
10624'	89.63°	179.18°	6707.67'	3971.19'
10716'	89.85°	179.43°	6708.09'	4063.11'



10750'

10800'

10850'

10900'

10950'

11000'

11050'

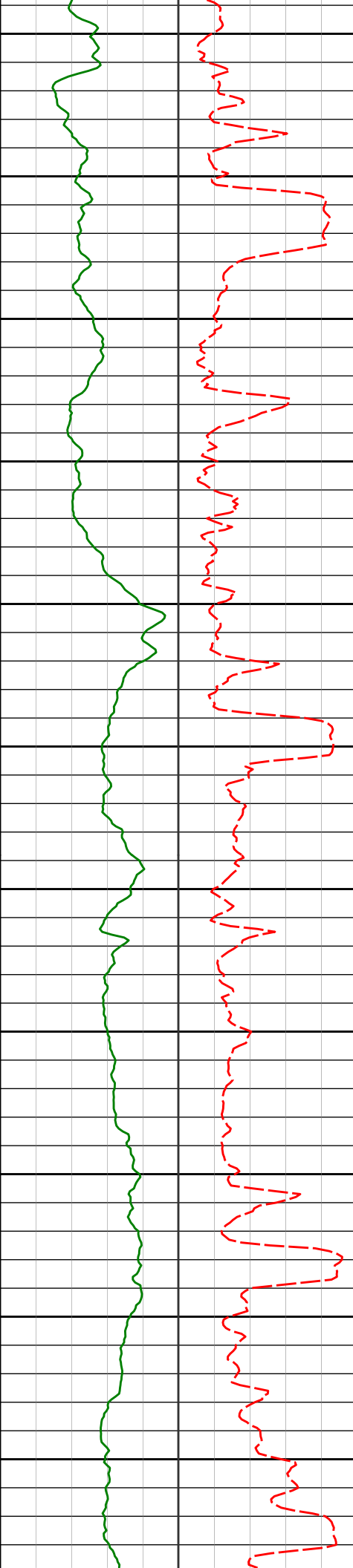
11100'

11150'

11200'

11250'

10810'	89.57°	179.33°	6708.56'	4157.04'
10903'	89.35°	178.69°	6709.44'	4249.94'
10996'	89.23°	177.45°	6710.59'	4342.75'
11087'	90.09°	177.71°	6711.13'	4433.53'
11180'	90.77°	178.96°	6710.43'	4526.37'
11272'	91.14°	178.32°	6708.90'	4618.23'



11300'

11350'

11400'

11450'

11500'

11550'

11600'

11650'

11700'

11750'

11800'

11365'

90.71°

179.01°

6707.40'

4711.10'

11458'

91.08°

178.97°

6705.95'

4803.99'

11551'

90.15°

179.60°

6704.95'

4896.91'

11646'

90.49°

179.43°

6704.42'

4991.84'

11740'

90.03°

180.30°

6703.99'

5085.80'

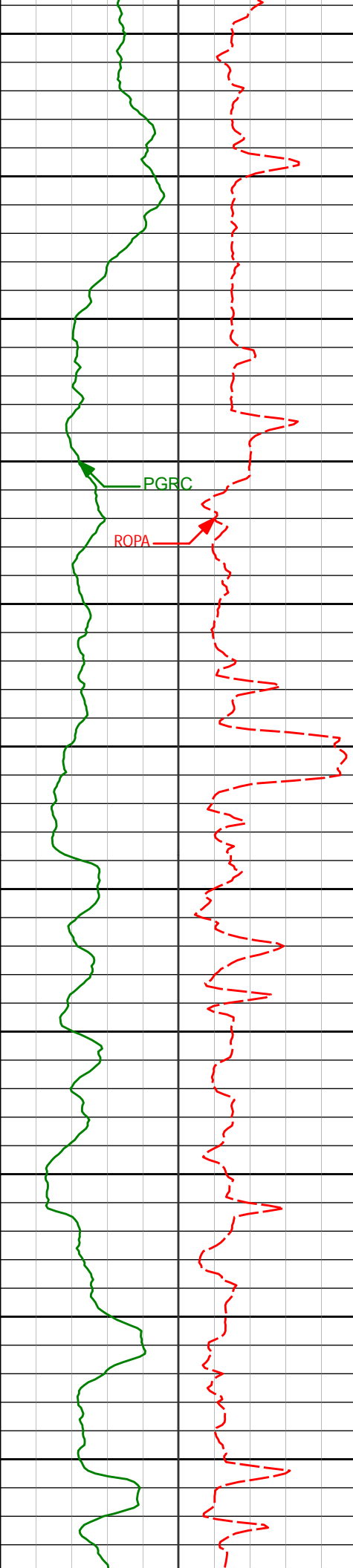
11832'

89.01°

180.78°

6704.76'

5177.78'



11850'

11900'

11924'

88.98°

180.77°

6706.37'

5269.76'

11950'

12000'

12016'

88.67°

180.47°

6708.26'

5361.72'

12050'

12100'

12108'

89.32°

179.31°

6709.87'

5453.67'

12150'

12200'

12201'

88.98°

179.12°

6711.25'

5546.57'

12250'

12300'

12294'

88.80°

178.93°

6713.06'

5639.46'

12350'

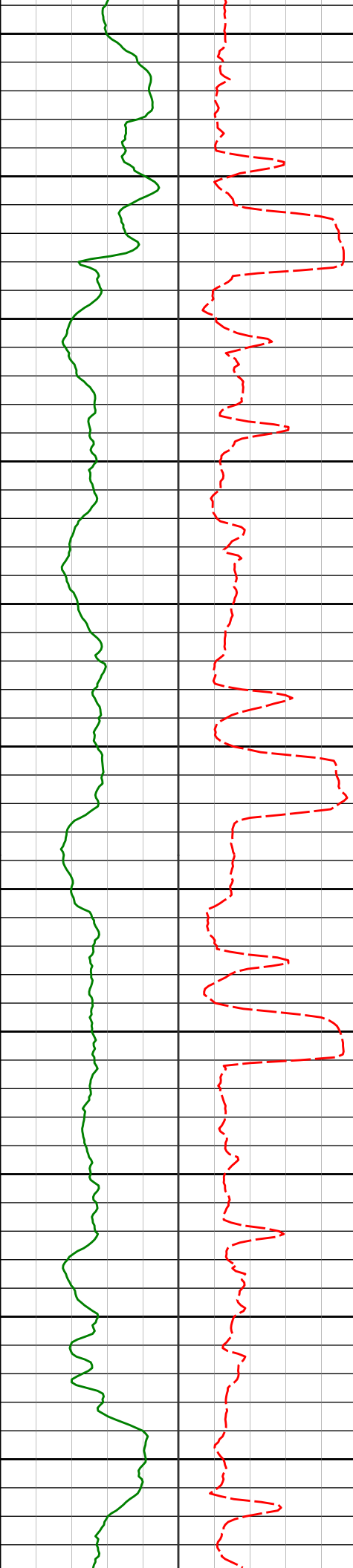
12385'

88.52°

179.24°

6715.18'

5730.35'



12400'

12450'

12478'

90.31°

177.06°

6716.13'

5823.17'

12500'

12550'

12572'

90.71°

176.65°

6715.30'

5916.84'

12600'

12650'

12665'

91.79°

177.74°

6713.27'

6009.54'

12700'

12750'

12759'

90.28°

179.19°

6711.57'

6103.38'

12800'

12850'

12854'

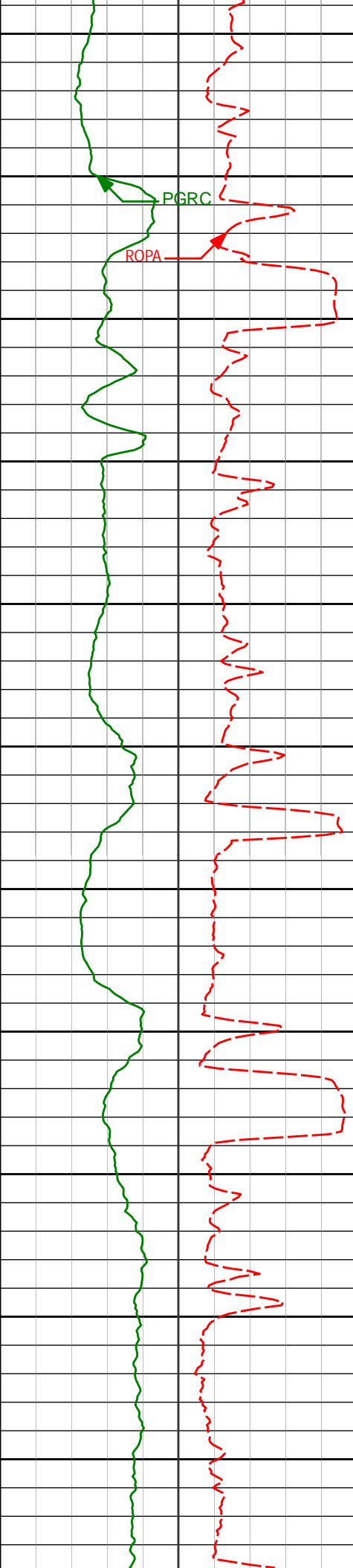
90.34°

178.59°

6711.06'

6198.27'

12900'



12950'

13000'

13050'

13100'

13150'

13200'

13250'

13300'

13350'

13400'

13450'

12949'

13044'

13139'

13234'

13329'

13424'

89.97°

91.48°

91.57°

91.85°

88.98°

89.54°

178.01°

179.46°

179.48°

180.21°

180.29°

179.42°

6710.80'

6709.60'

6707.07'

6704.23'

6703.55'

6704.77'

6293.11'

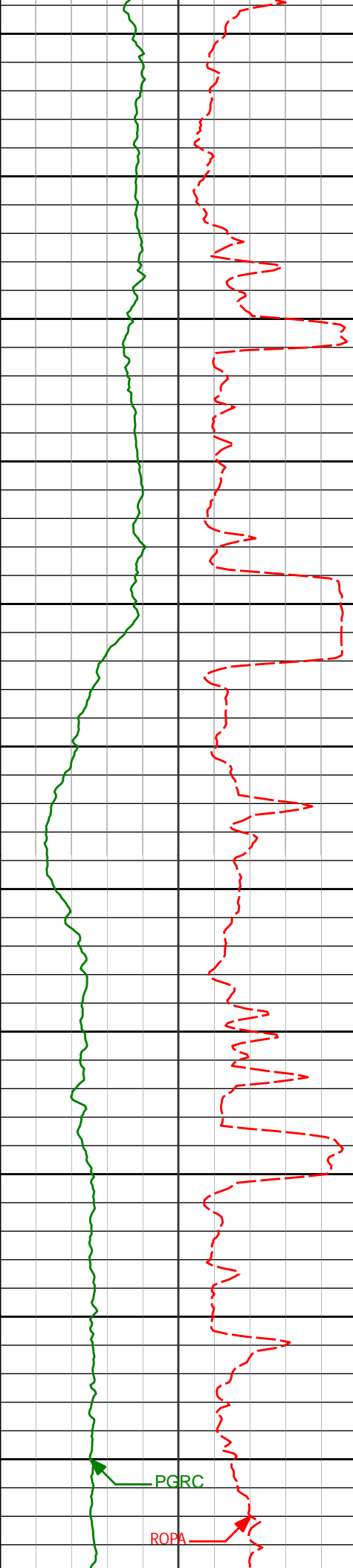
6387.98'

6482.88'

6577.79'

6672.76'

6767.70'



13500'

13550'

13600'

13650'

13700'

13750'

13800'

13850'

13900'

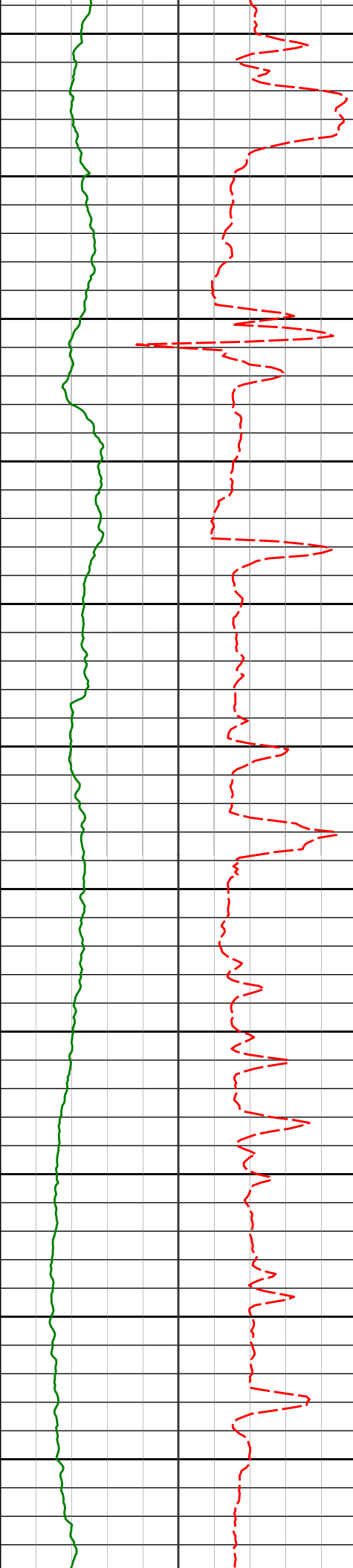
13950'

14000'

13519'	88.89°	178.08°	6706.07'	6862.57'
13614'	89.32°	176.57°	6707.56'	6957.29'
13709'	90.89°	178.84°	6707.38'	7052.07'
13804'	91.32°	178.79°	6705.55'	7146.94'
13899'	90.43°	179.21°	6704.10'	7241.83'
13994'	90.93°	179.14°	6702.97'	7336.73'

PGRC

ROPA



14050'

14088'

89.41°

179.01°

6702.70'

7430.64'

14100'

14150'

14183'

89.11°

178.69°

6703.92'

7525.52'

14200'

14250'

14278'

89.72°

179.00°

6704.89'

7620.41'

14300'

14350'

14373'

89.57°

178.55°

6705.48'

7715.29'

14400'

14450'

14468'

90.15°

179.00°

6705.71'

7810.17'

14500'

14550'

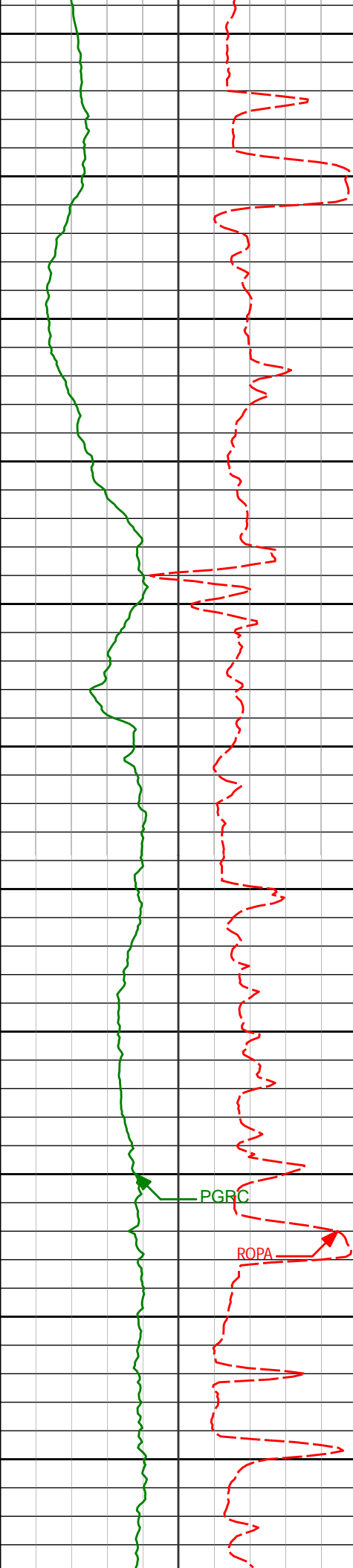
14563'

90.99°

178.97°

6704.77'

7905.07'



14600'

14650'

14700'

14750'

14800'

14850'

14900'

14950'

15000'

15050'

15100'

14658'

89.35°

179.14°

6704.49'

7999.97'

14753'

89.66°

179.07°

6705.31'

8094.88'

14848'

90.06°

178.90°

6705.54'

8189.78'

14943'

91.14°

179.03°

6704.54'

8284.67'

15037'

90.00°

178.96°

6703.61'

8378.57'

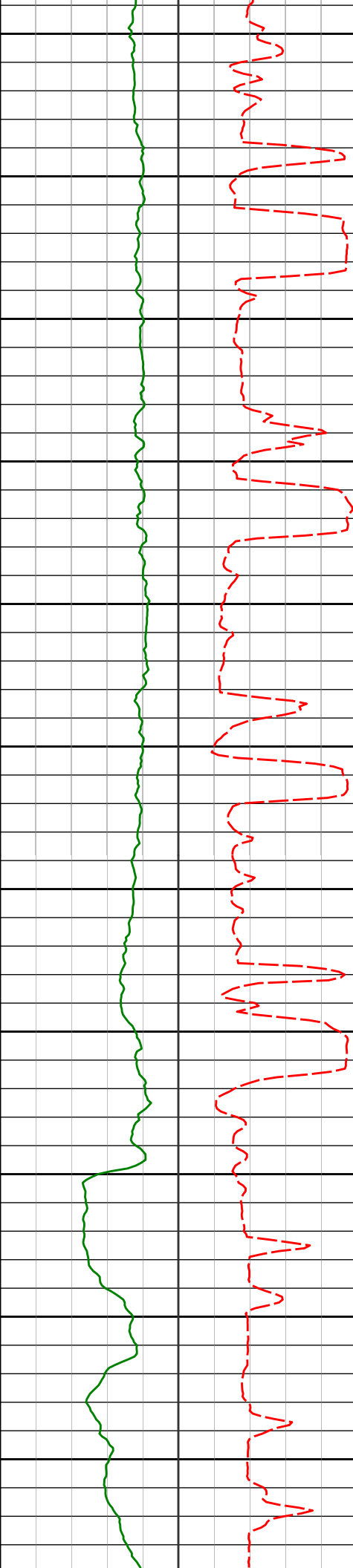
15132'

90.34°

177.65°

6703.33'

8473.41'



15150'

15200'

15227'

90.09°

178.35°

6702.97'

8568.22'

15250'

15300'

15322'

89.91°

178.82°

6702.97'

8663.09'

15350'

15400'

15417'

90.49°

180.93°

6702.64'

8758.04'

15450'

15500'

15511'

88.12°

180.21°

6703.78'

8852.01'

15550'

15600'

15606'

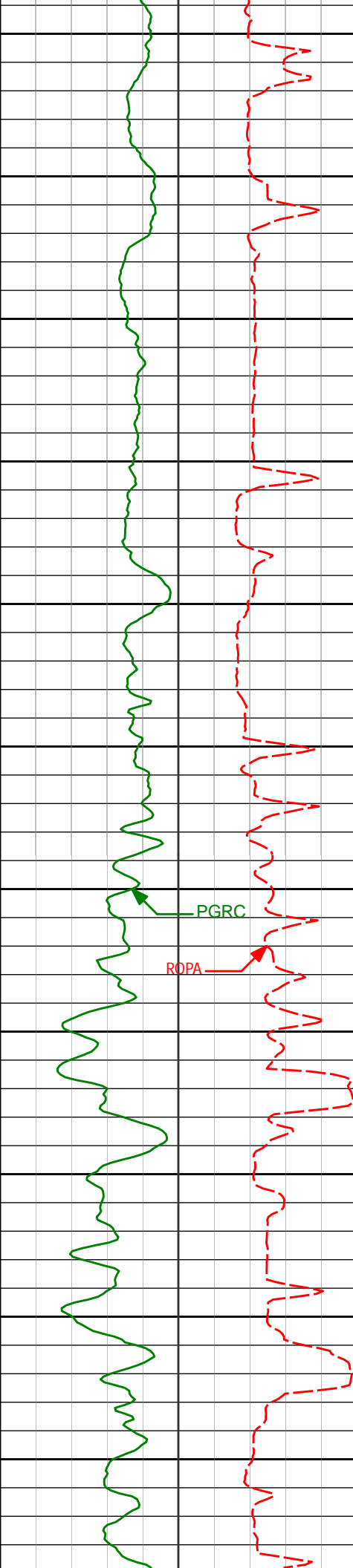
88.46°

179.96°

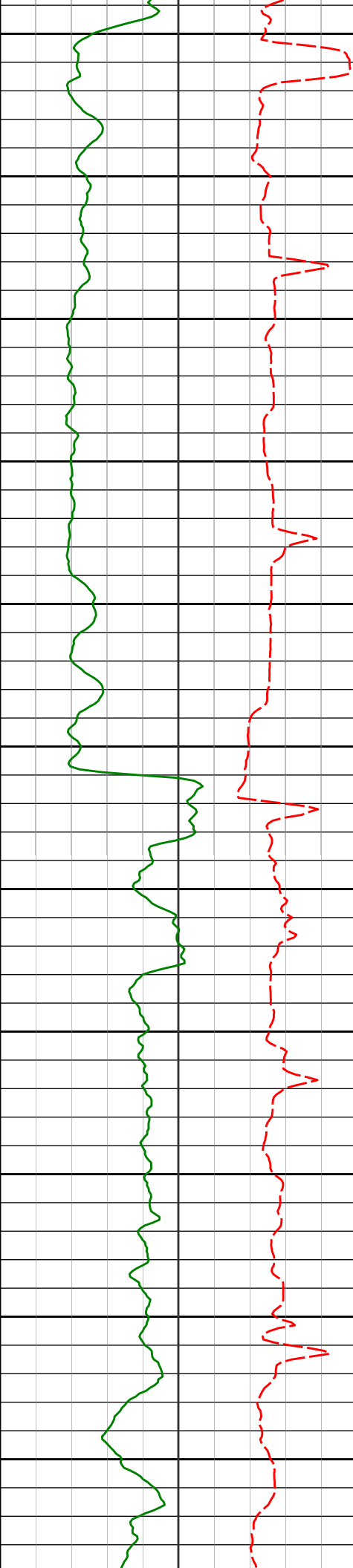
6706.61'

8946.93'

15650'



15700'	15701'	88.71°	179.83°	6708.96'	9041.86'
15750'					
15800'	15796'	89.29°	179.71°	6710.62'	9136.80'
15850'					
15900'	15891'	88.55°	178.50°	6712.41'	9231.69'
15950'					
16000'	15986'	88.58°	177.89°	6714.79'	9326.49'
16050'					
16100'	16081'	88.80°	178.48°	6716.96'	9421.30'
16150'					
16200'	16176'	89.38°	178.35°	6718.47'	9516.14'



16250'

16271'

16300'

16350'

16400'

16450'

16500'

16550'

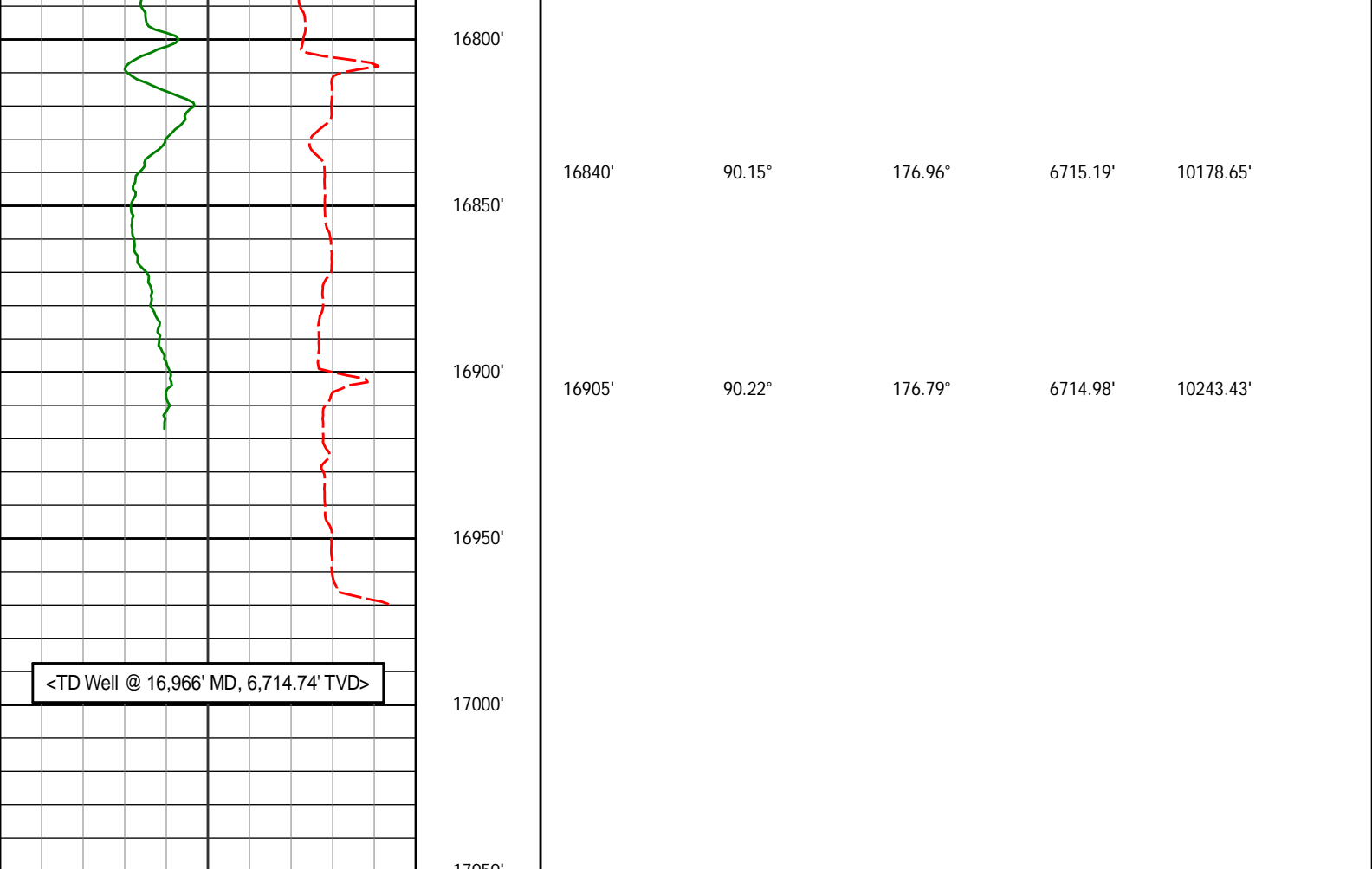
16600'

16650'

16700'

16750'

16271'	89.82°	178.30°	6719.13'	9610.98'
16366'	90.25°	178.17°	6719.07'	9705.82'
16460'	90.89°	178.20°	6718.14'	9799.64'
16555'	90.86°	177.98°	6716.69'	9894.46'
16650'	90.46°	177.56°	6715.59'	9989.24'
16745'	89.94°	176.99°	6715.26'	10083.96'



Avg Rate of Penetration ROPA feet per hr	Depth ft	Depth	Inc.	Azi.	TVD	V.S.
500 0						

PCG Gamma Ray PGRC api	
0 300	

HALLIBURTON

Sperry Drilling Services

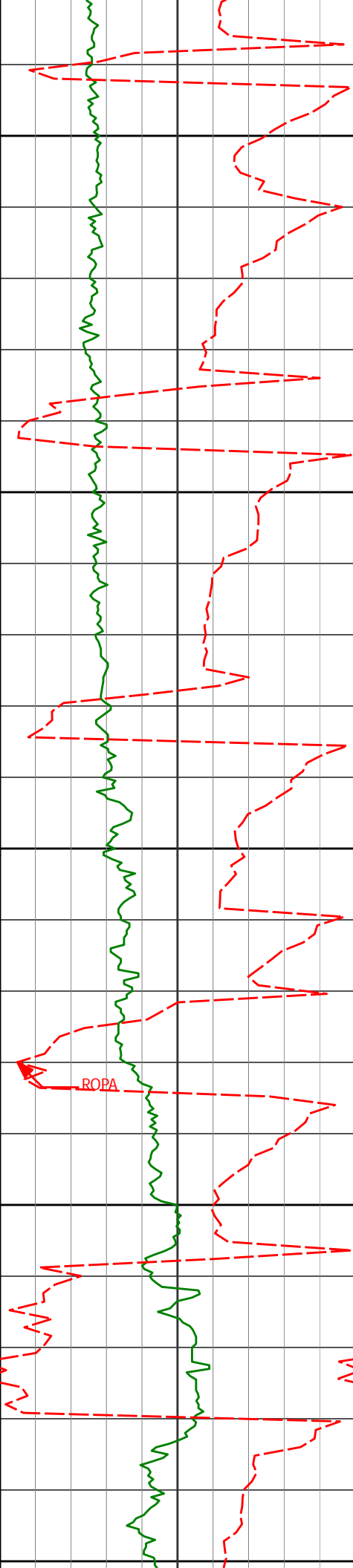
MD Detail Log 1:240

Noble Energy, Inc
Crow Creek AA01-789
H&P 315
T6N R63W

PCG Gamma Ray PGRC api		TVD	V.S.
0 300			

Avg Rate of Penetration ROPA feet per hr	Depth ft	Depth	Inc.	Azi.
500 0				





6350'

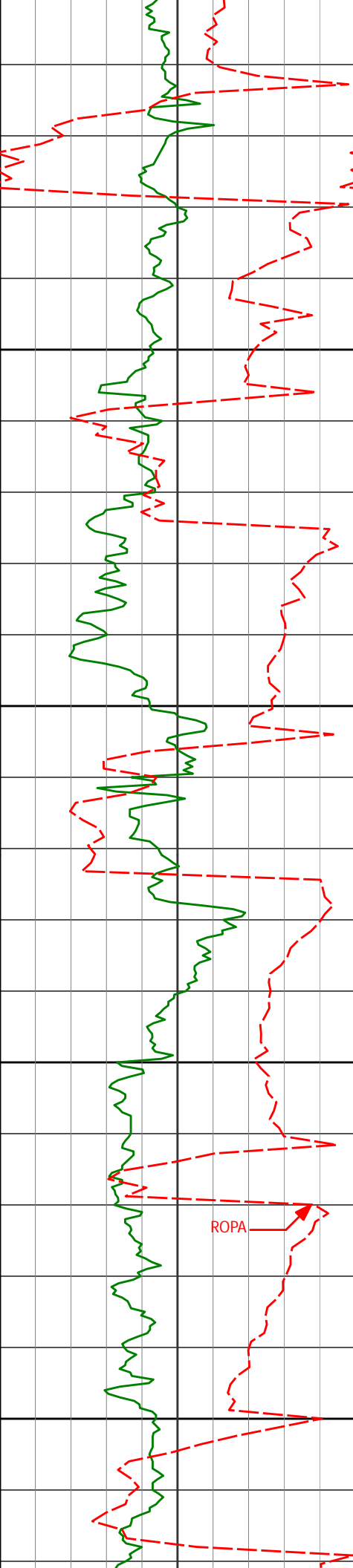
6400'

6450'

6500'

6550'

6332'	22.88°	171.05°	6289.22'	-147.06'
6379'	27.60°	170.65°	6331.72'	-127.38'
6427'	32.47°	175.49°	6373.27'	-103.64'
6473'	35.16°	178.05°	6411.48'	-78.13'
6521'	38.15°	178.28°	6449.99'	-49.53'



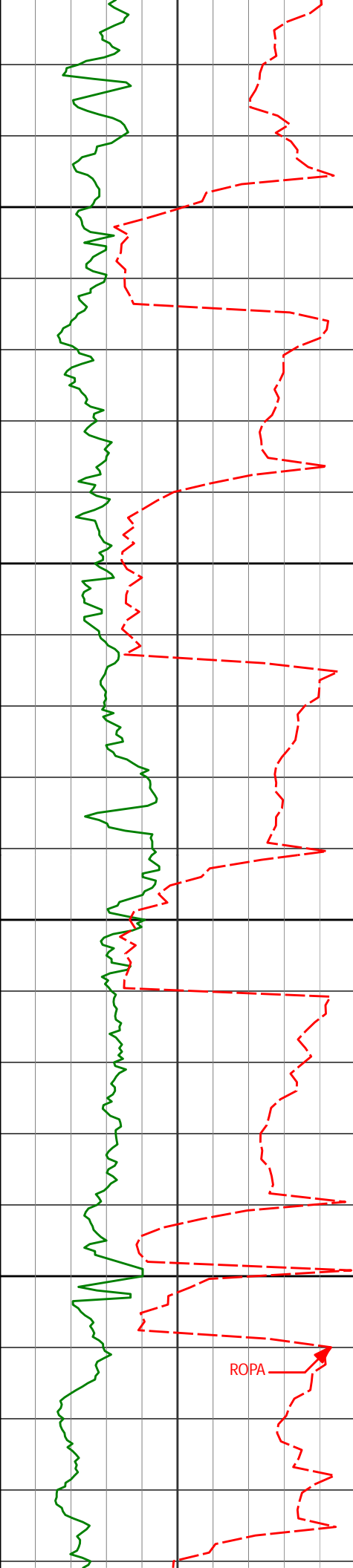
6600'

6650'

6700'

6750'

6568'	42.51°	177.76°	6485.81'	-19.18'
6616'	45.05°	179.17°	6520.46'	13.98'
6663'	49.17°	180.09°	6552.44'	48.38'
6711'	54.89°	179.90°	6581.96'	86.19'
6758'	60.47°	181.24°	6607.08'	125.89'



6800'

6806'

64.49°

182.34°

6629.26'

168.45'

6850'

6853'

67.66°

183.73°

6648.32'

211.39'

6900'

6901'

71.73°

181.98°

6664.97'

256.38'

6950'

6948'

75.84°

180.48°

6678.09'

301.50'

ROPA

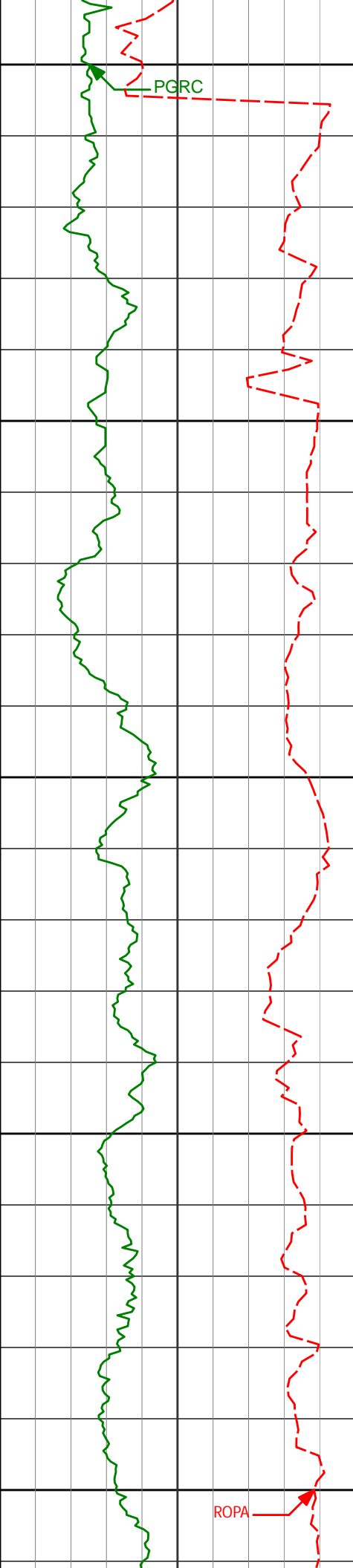
6988'

79.25°

179.94°

6686.72'

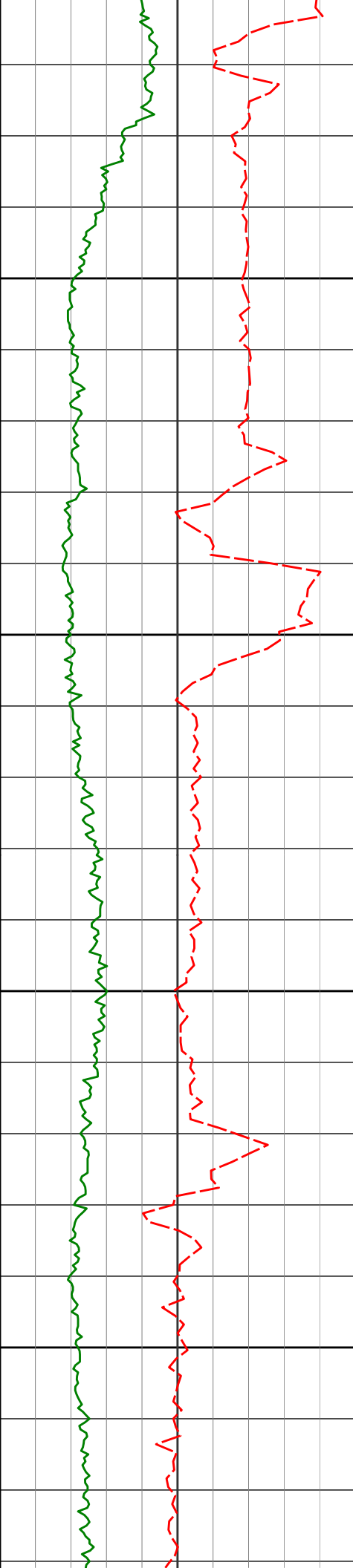
340.54'



Run 200

<7" casing set at 7038' MD>

7120'	85.31°	178.88°	6704.44'	471.19'
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7215'

87.93°

179.42°

6710.04'

565.93'

7250'

7300'

7310'

89.14°

179.20°

6712.47'

660.82'

7350'

7400'

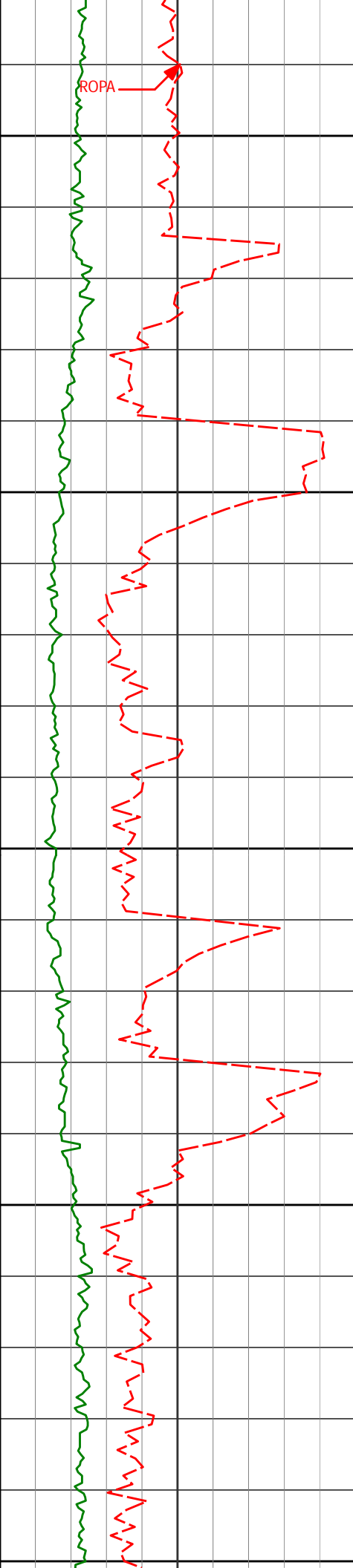
7404'

89.01°

178.90°

6713.99'

754.71'



7450'

7500'

7550'

7600'

7650'

7499'

89.82°

177.90°

6714.96'

849.56'

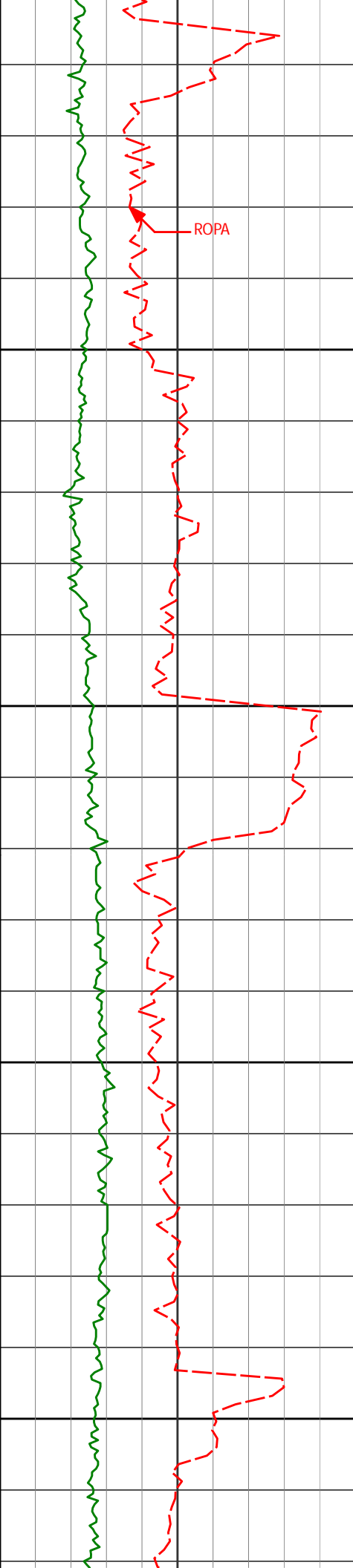
7594'

91.11°

178.02°

6714.19'

944.36'



7700'

7750'

7800'

7850'

7689'

91.48°

177.78°

6712.04'

1039.14'

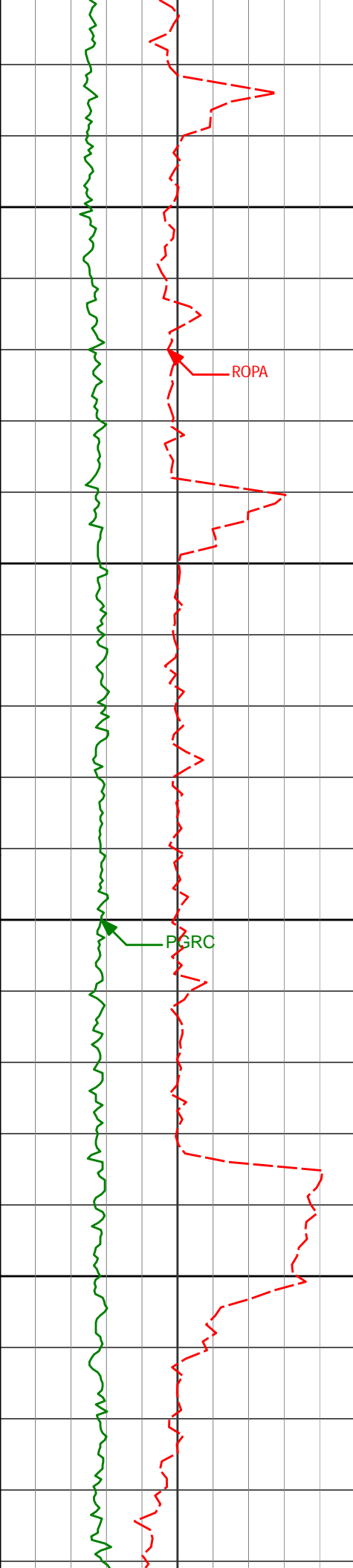
7784'

90.18°

178.94°

6710.66'

1133.97'



7878'	89.82°	178.51°	6710.66'	1227.85'
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7900'

ROPA

7950'

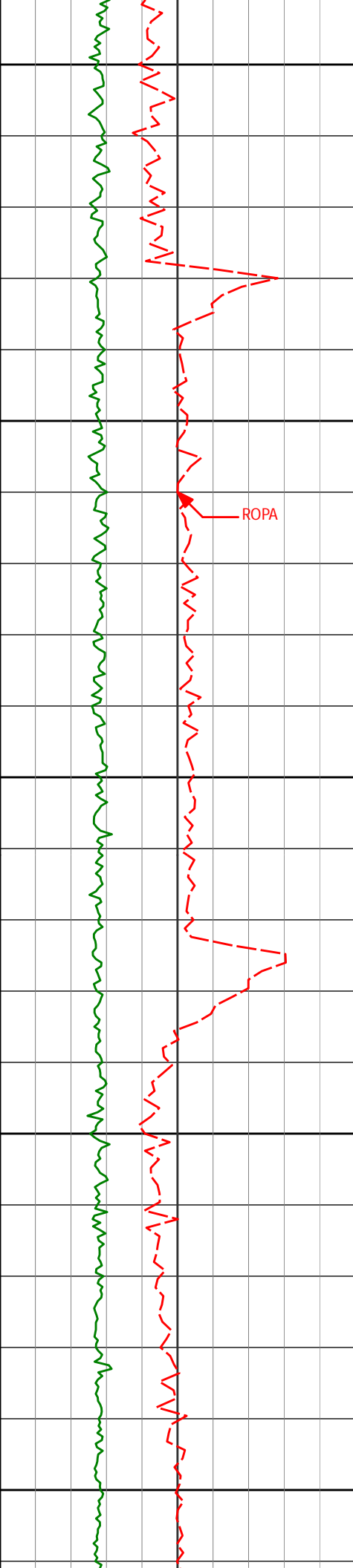
7973'	90.34°	178.31°	6710.53'	1322.71'
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8000'

PGRC

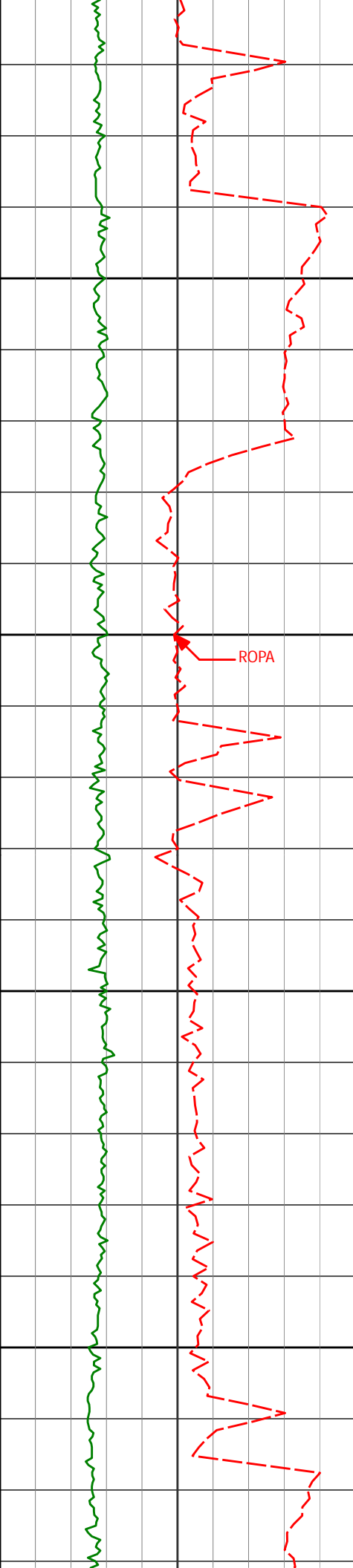
8050'

8068'	89.63°	178.85°	6710.56'	1417.57'
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8163'	89.91°	177.84°	6710.94'	1512.42'
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8258'	89.75°	176.92°	6711.22'	1607.16'
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8350'

8353'

89.97°

178.21°

6711.45'

1701.92'

8400'

ROPA

8450'

8447'

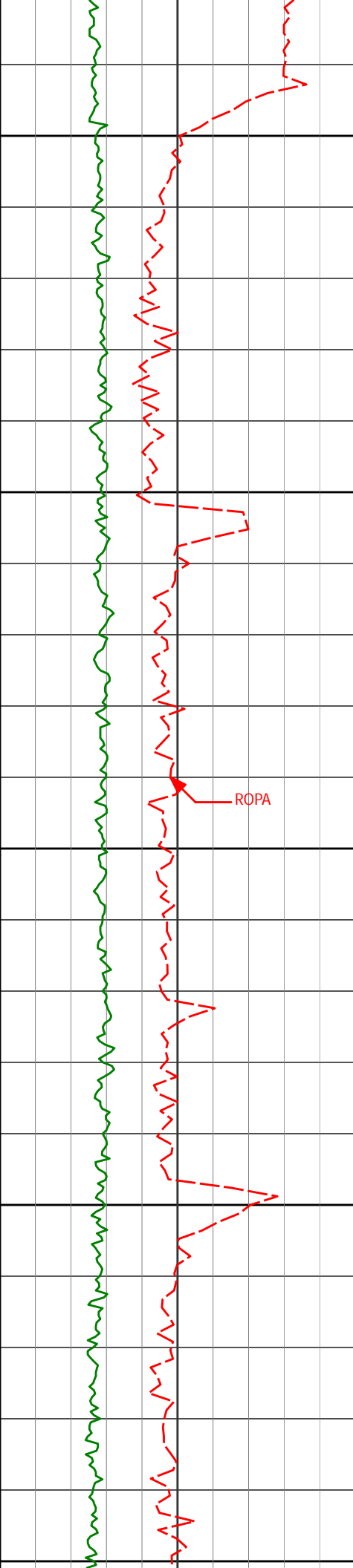
89.85°

178.73°

6711.60'

1795.78'

8500'



8550'

8600'

8650'

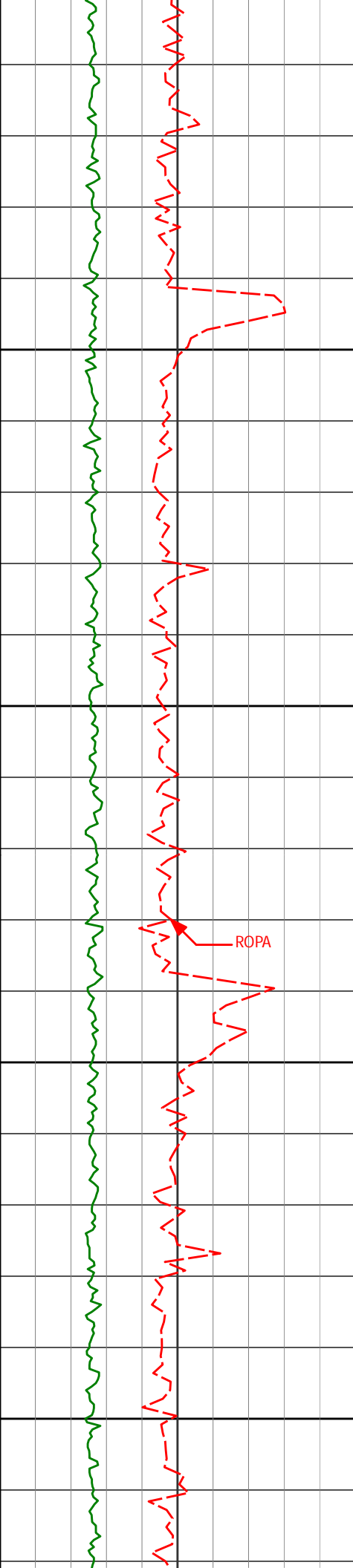
8700'

8750'

8542' 90.28° 181.27° 6711.49' 1890.73'

8637' 89.97° 180.68° 6711.29' 1985.73'

8732' 90.89° 180.33° 6710.57' 2080.71'



8800'

8827'

90.37°

180.02°

6709.53'

2175.67'

8850'

ROPA

8900'

8922'

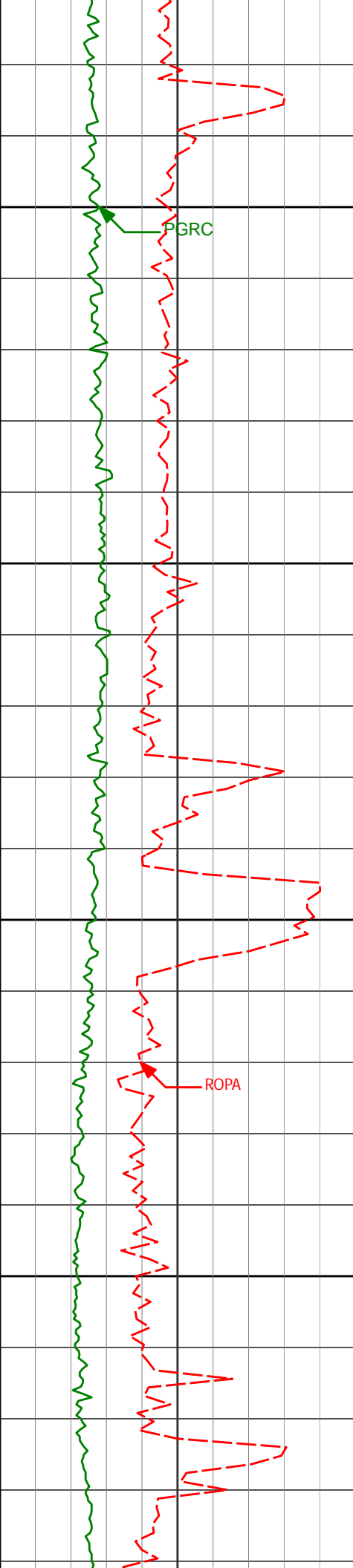
90.74°

179.63°

6708.61'

2270.62'

8950'



9000'

9017'

91.05°

179.51°

6707.12'

2365.55'

9050'

9100'

9112'

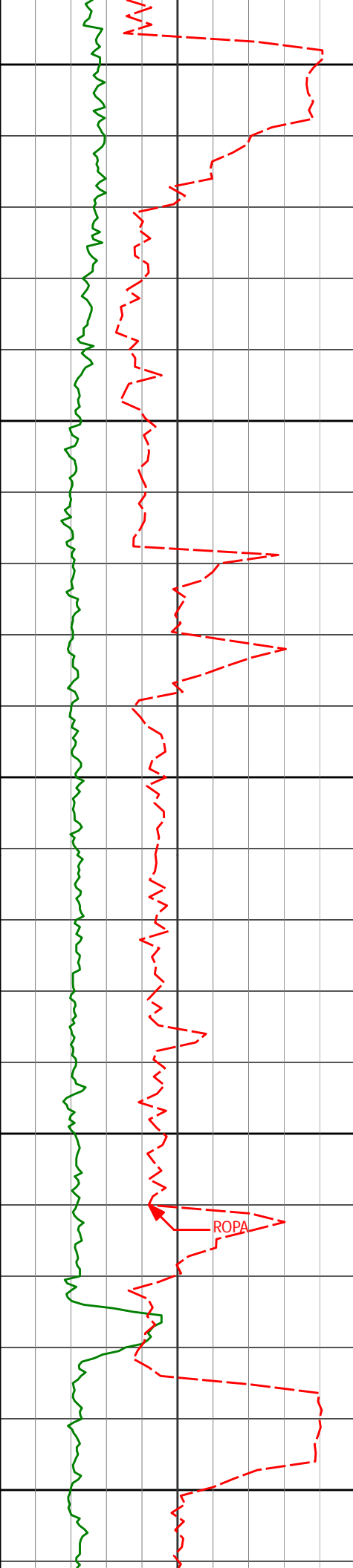
91.39°

179.04°

6705.10'

2460.45'

9150'



9200'

9207'

89.48°

179.29°

6704.38'

2555.36'

9250'

9300'

9301'

90.15°

179.01°

6704.68'

2649.27'

9350'

ROPA

9400'

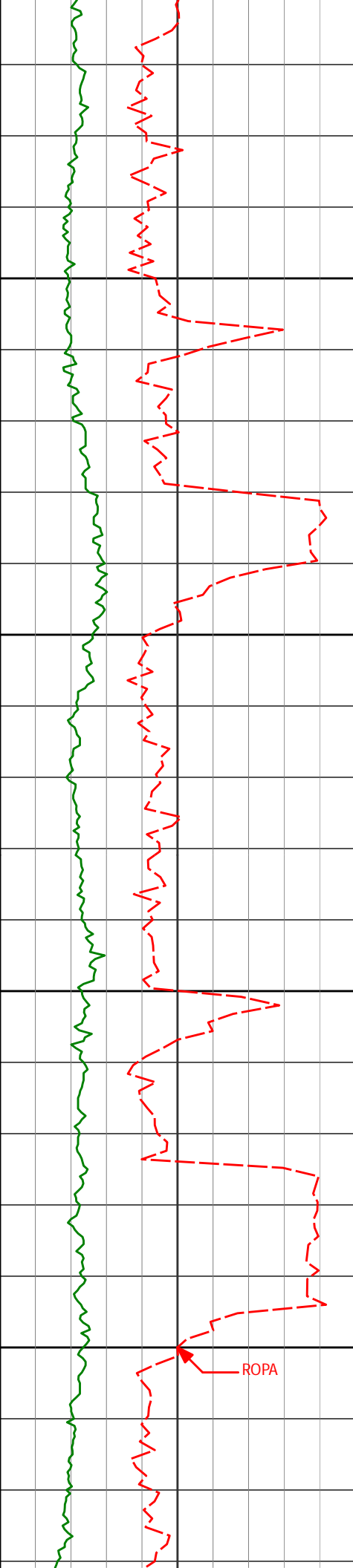
9396'

90.09°

178.58°

6704.48'

2744.16'



9450'

9491'

88.06°

178.16°

6706.02'

2838.99'

9500'

9550'

9586'

87.97°

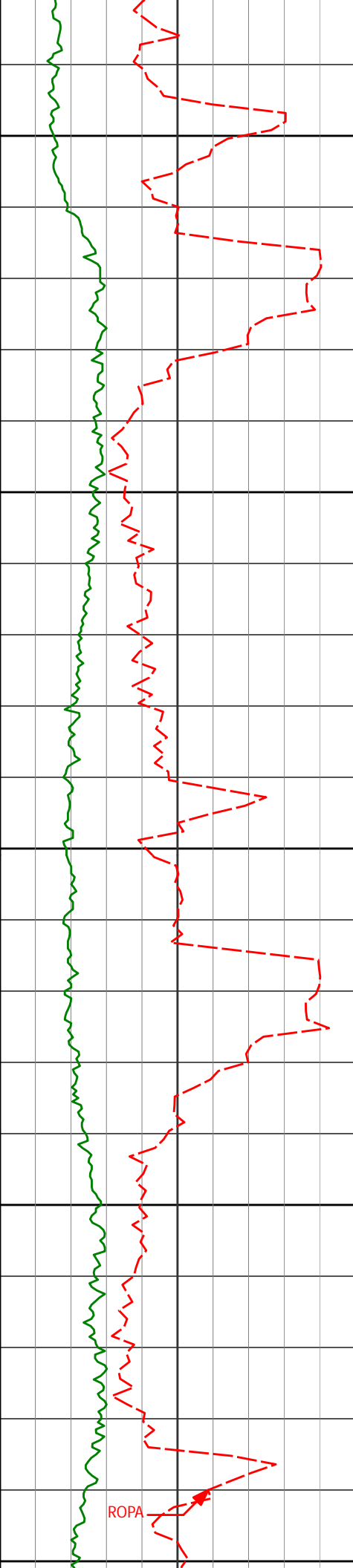
179.44°

6709.31'

2933.81'

9600'

ROPA



9650'

9681'

88.86°

179.04°

6711.94'

3028.70'

9700'

9750'

9776'

90.99°

180.63°

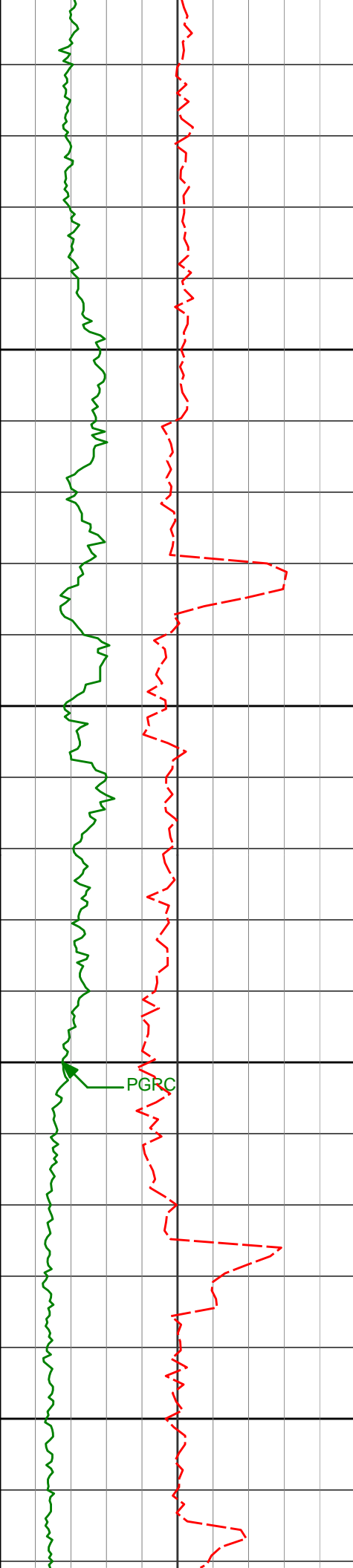
6712.06'

3123.64'

9800'

ROPA

9850'



9900'

9950'

10000'

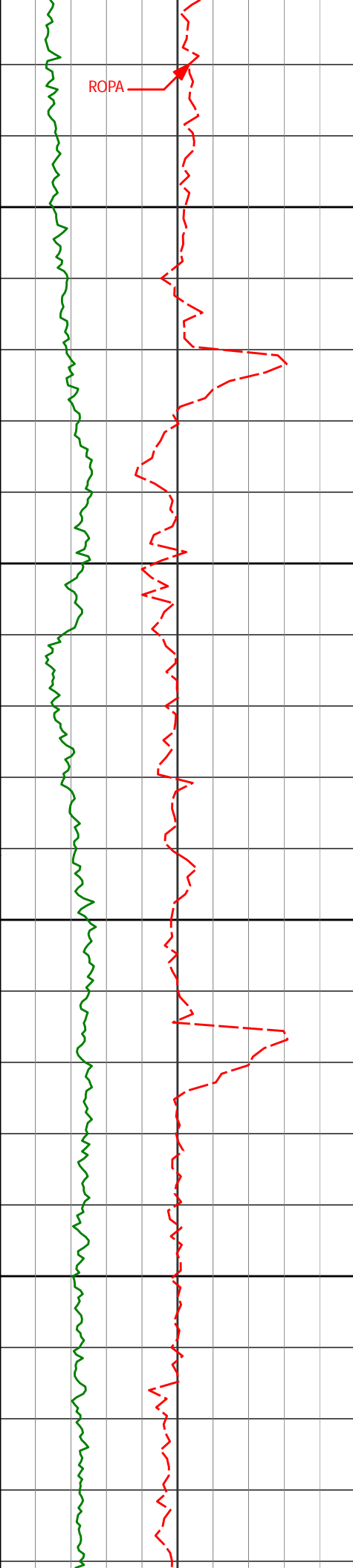
10050'

PGRC

9871'	91.02°	180.59°	6710.39'	3218.61'
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9966'	90.34°	180.38°	6709.27'	3313.59'
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10061'	90.40°	180.19°	6708.65'	3408.56'
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10100'

10150'

10200'

10250'

10156'

90.80°

180.24°

6707.66'

3503.53'

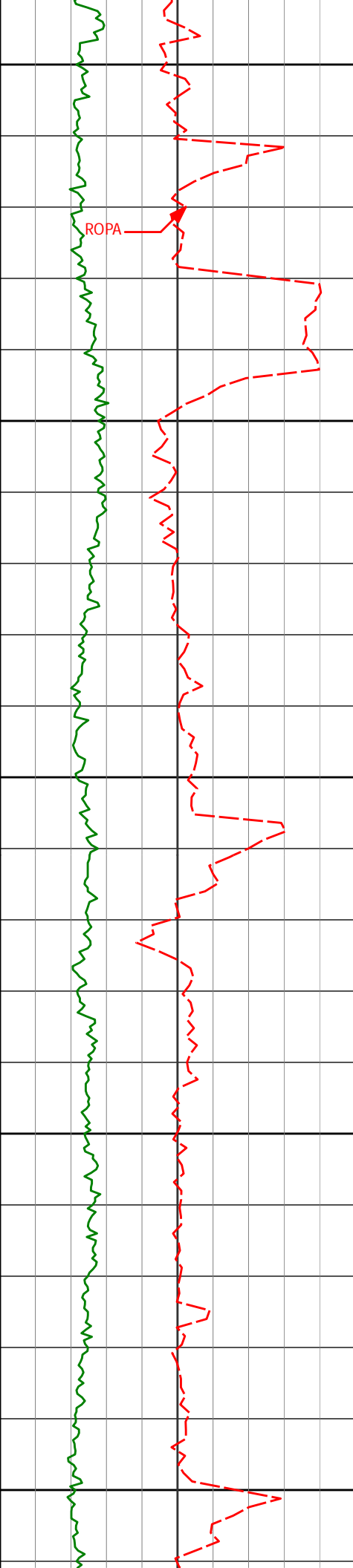
10250'

91.26°

180.32°

6705.97'

3597.49'



10300'

ROPA

10350'

10400'

10450'

10500'

10345'

89.51°

179.30°

6705.33'

3692.44'

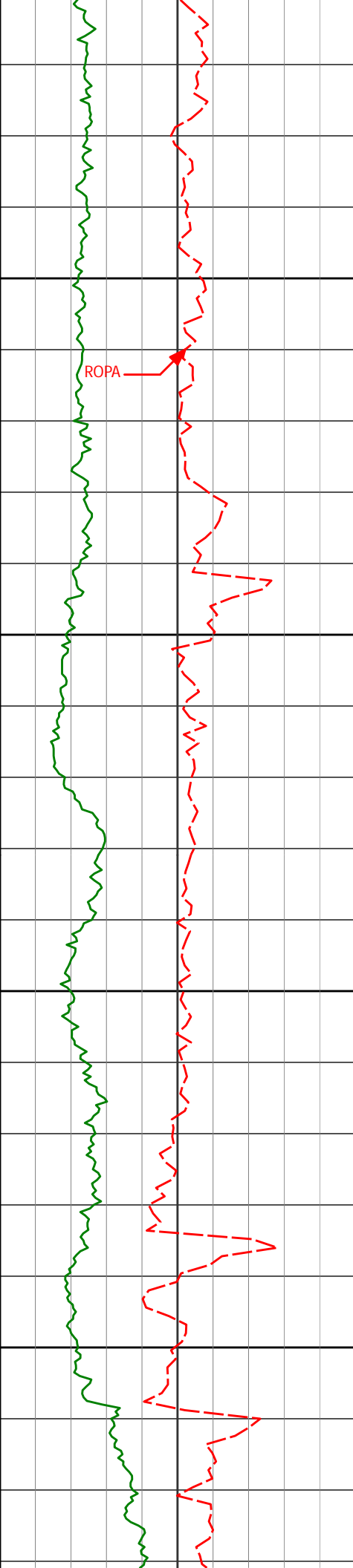
10439'

89.45°

179.24°

6706.18'

3786.35'



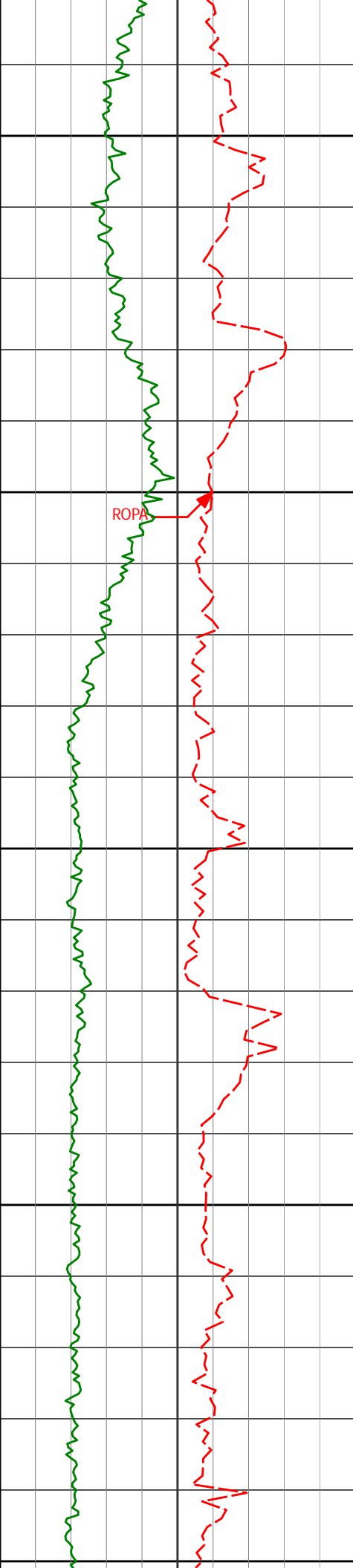
10550'

10600'

10650'

10700'

10531'	89.54°	179.19°	6706.99'	3878.27'
10624'	89.63°	179.18°	6707.67'	3971.19'
10716'	89.85°	179.43°	6708.09'	4063.11'



10750'

10800'

10850'

10900'

10950'

ROPA

10810'

89.57°

179.33°

6708.56'

4157.04'

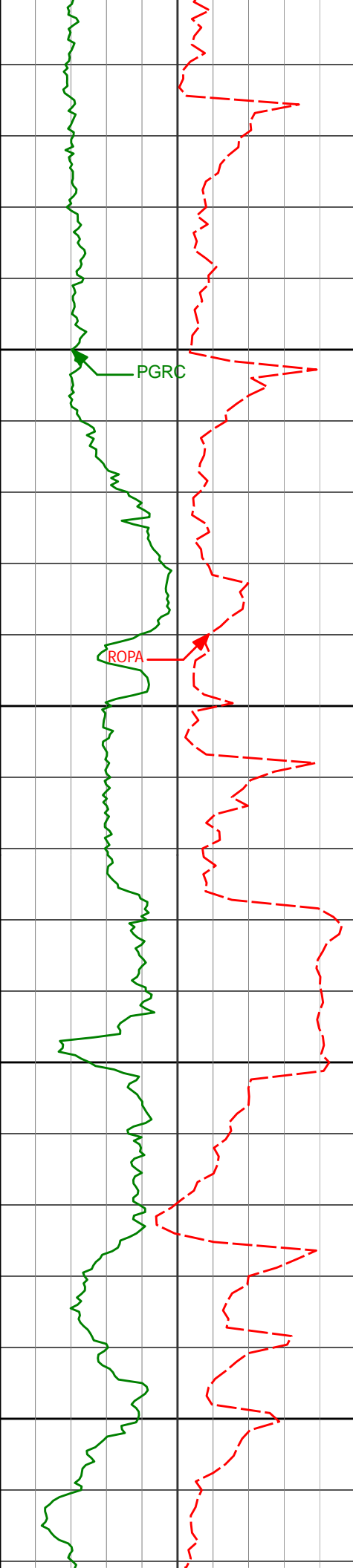
10903'

89.35°

178.69°

6709.44'

4249.94'



11000'

11050'

11100'

11150'

10996'

89.23°

177.45°

6710.59'

4342.75'

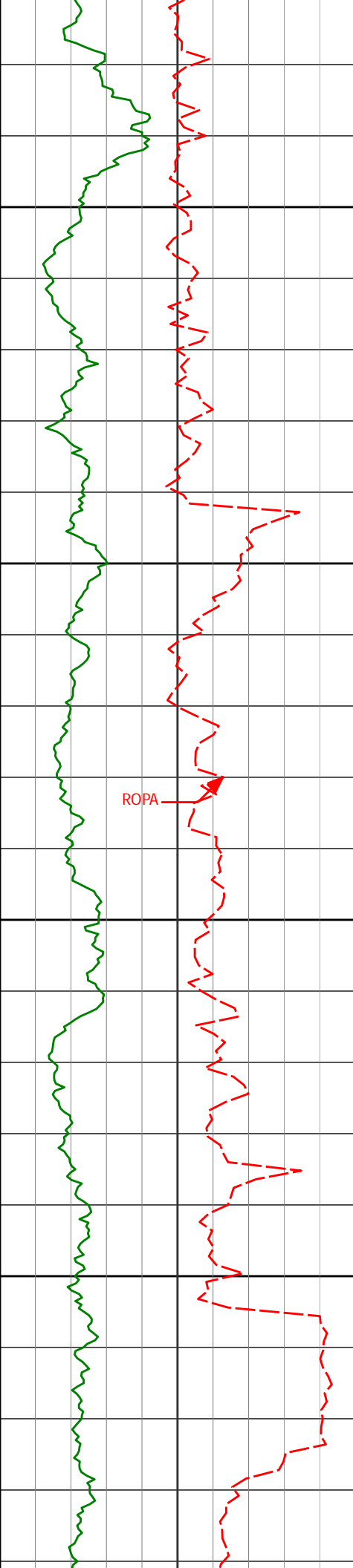
11087'

90.09°

177.71°

6711.13'

4433.53'



11200'

11250'

11300'

11350'

11180'

90.77°

178.96°

6710.43'

4526.37'

11272'

91.14°

178.32°

6708.90'

4618.23'

ROPA

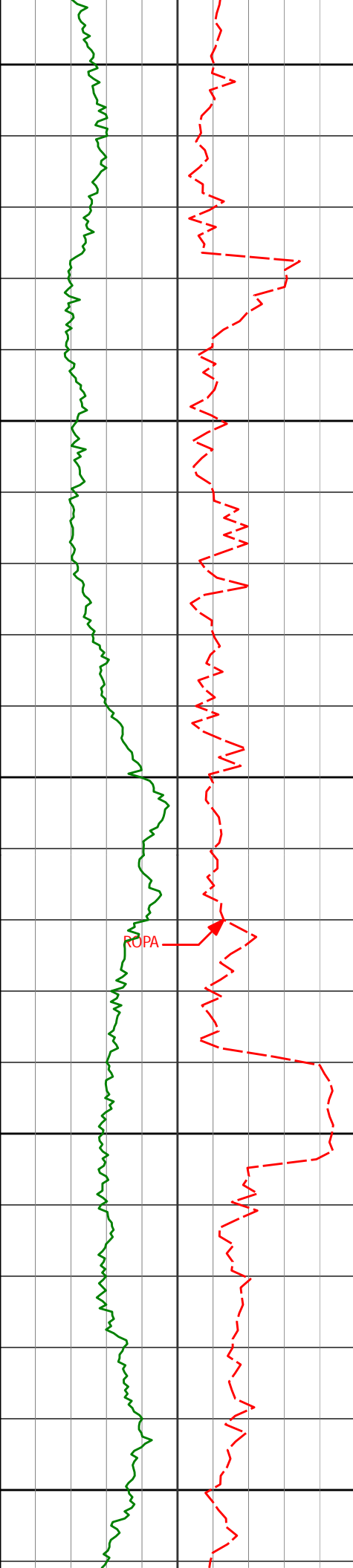
11365'

90.71°

179.01°

6707.40'

4711.10'



11400'

11450'

11500'

11550'

11600'

ROPA

11458'

91.08°

178.97°

6705.95'

4803.99'

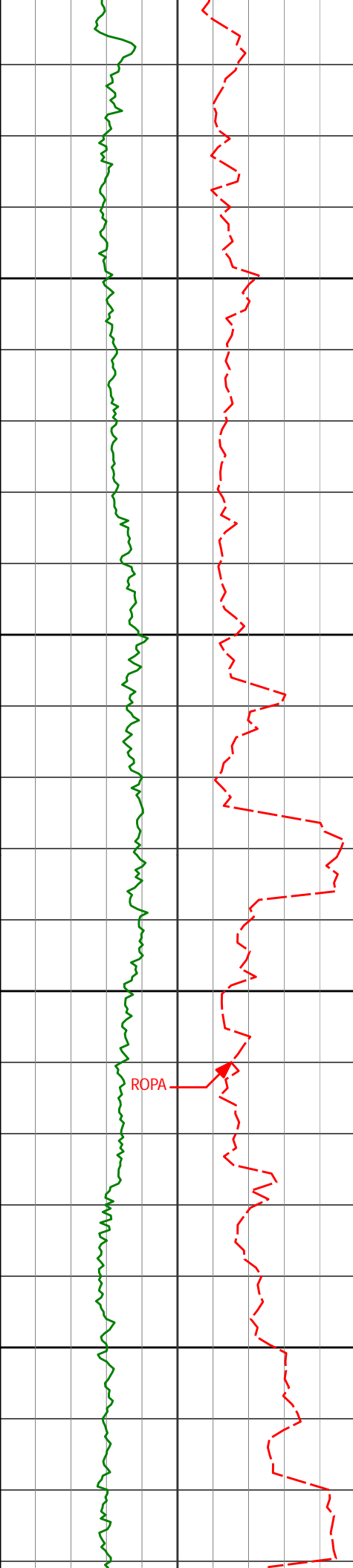
11551'

90.15°

179.60°

6704.95'

4896.91'



11650'

11700'

11750'

11800'

ROPA

11646'

90.49°

179.43°

6704.42'

4991.84'

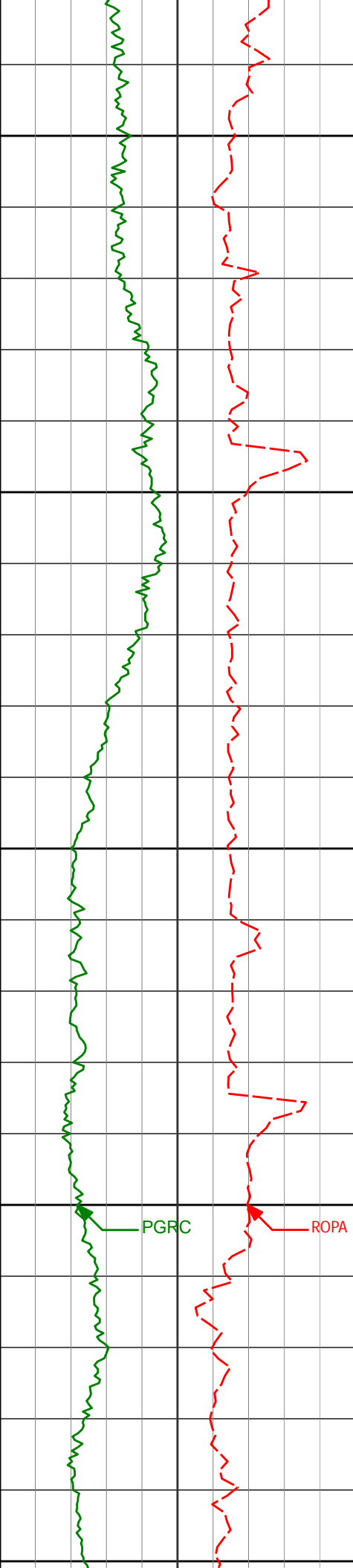
11740'

90.03°

180.30°

6703.99'

5085.80'



11850'

11900'

11950'

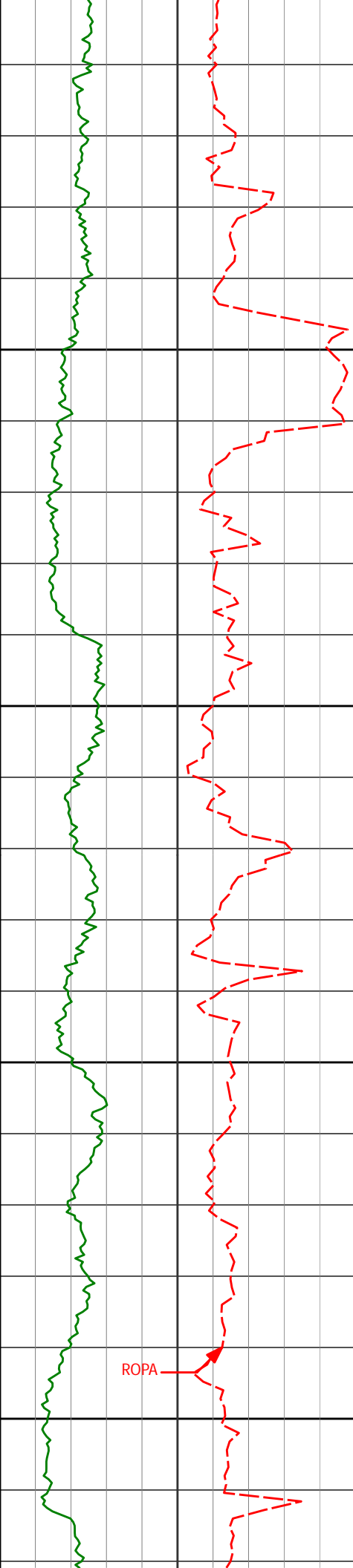
12000'

12050'

PGRC

ROPA

11832'	89.01°	180.78°	6704.76'	5177.78'
11924'	88.98°	180.77°	6706.37'	5269.76'
12016'	88.67°	180.47°	6708.26'	5361.72'



12100'

12108'

89.32°

179.31°

6709.87'

5453.67'

12150'

12200'

12201'

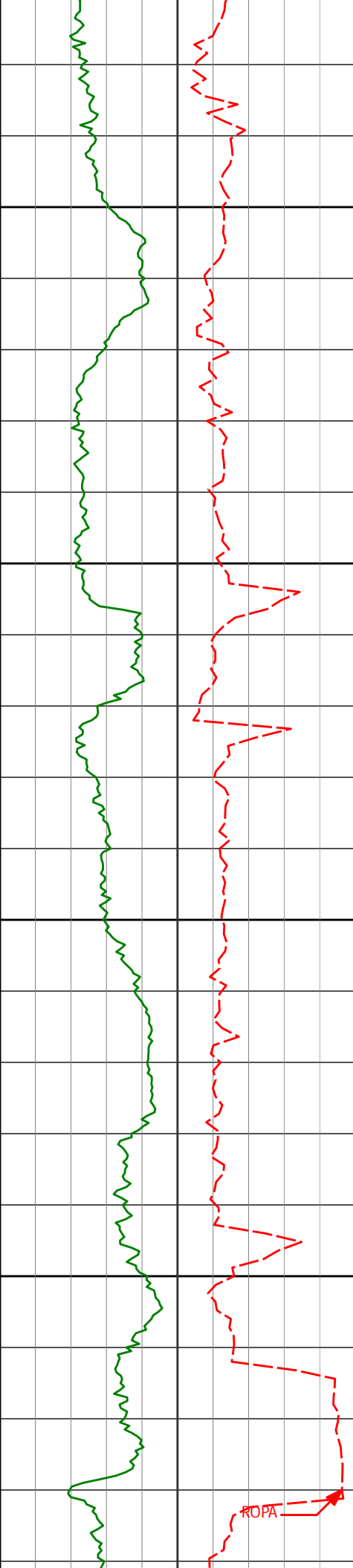
88.98°

179.12°

6711.25'

5546.57'

12250'



12300'

12350'

12400'

12450'

12294'

88.80°

178.93°

6713.06'

5639.46'

12385'

88.52°

179.24°

6715.18'

5730.35'

12478'

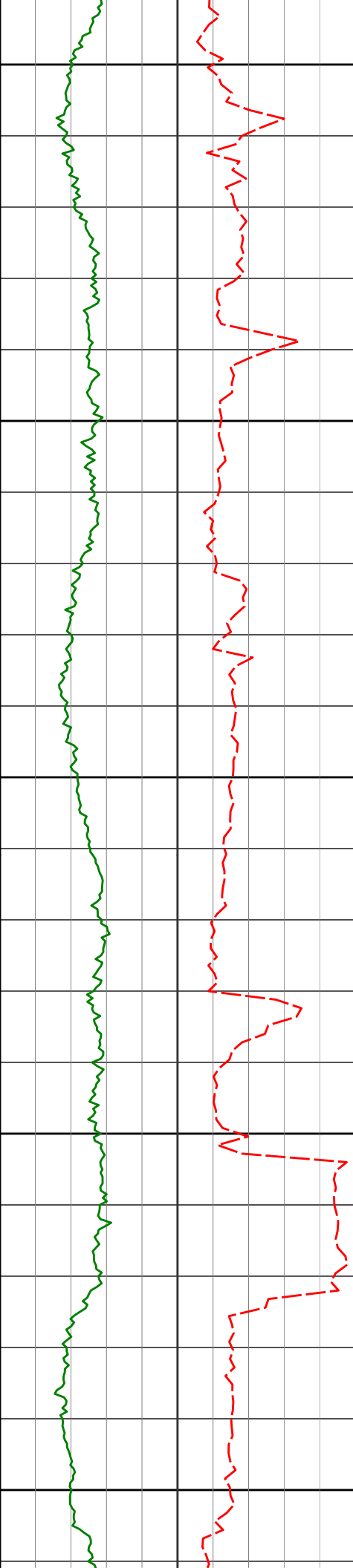
90.31°

177.06°

6716.13'

5823.17'

ROPA



12500'

12550'

12572'

90.71°

176.65°

6715.30'

5916.84'

12600'

12650'

12665'

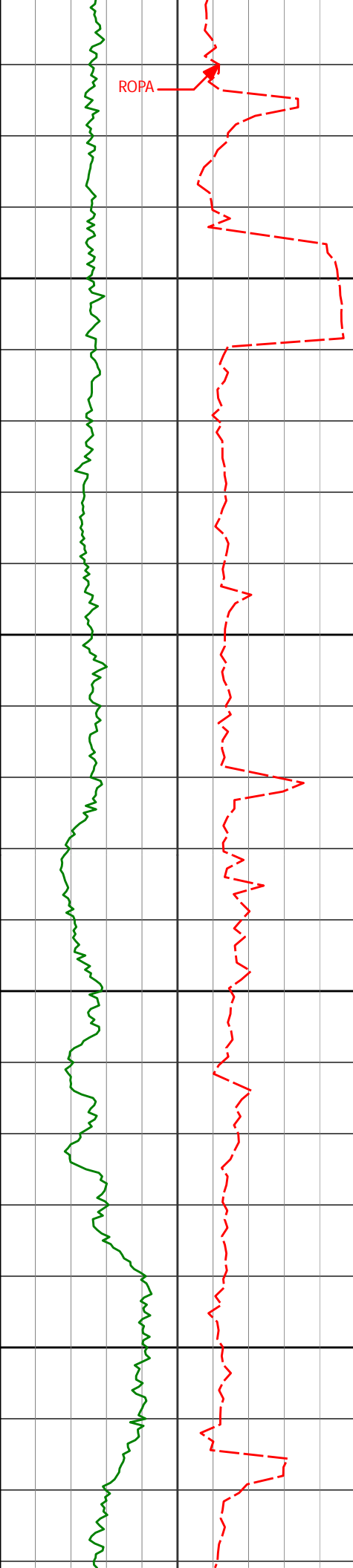
91.79°

177.74°

6713.27'

6009.54'

12700'



ROPA

12750'

12800'

12850'

12900'

12759'

90.28°

179.19°

6711.57'

6103.38'

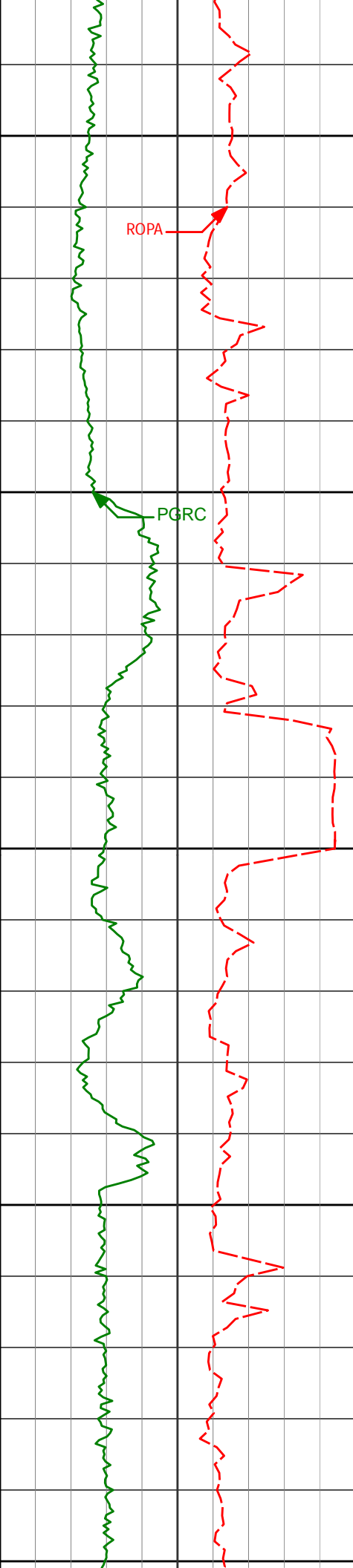
12854'

90.34°

178.59°

6711.06'

6198.27'



12950'

12949'

89.97°

178.01°

6710.80'

6293.11'

13000'

13044'

91.48°

179.46°

6709.60'

6387.98'

13050'

13100'

13139'

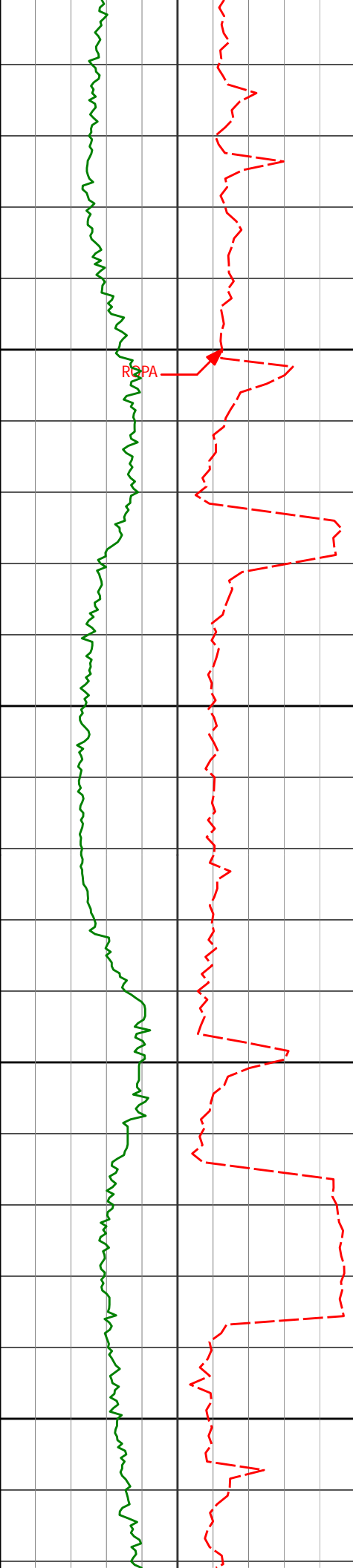
91.57°

179.48°

6707.07'

6482.88'

13150'



13200'

13234'

91.85°

180.21°

6704.23'

6577.79'

13250'

13300'

13329'

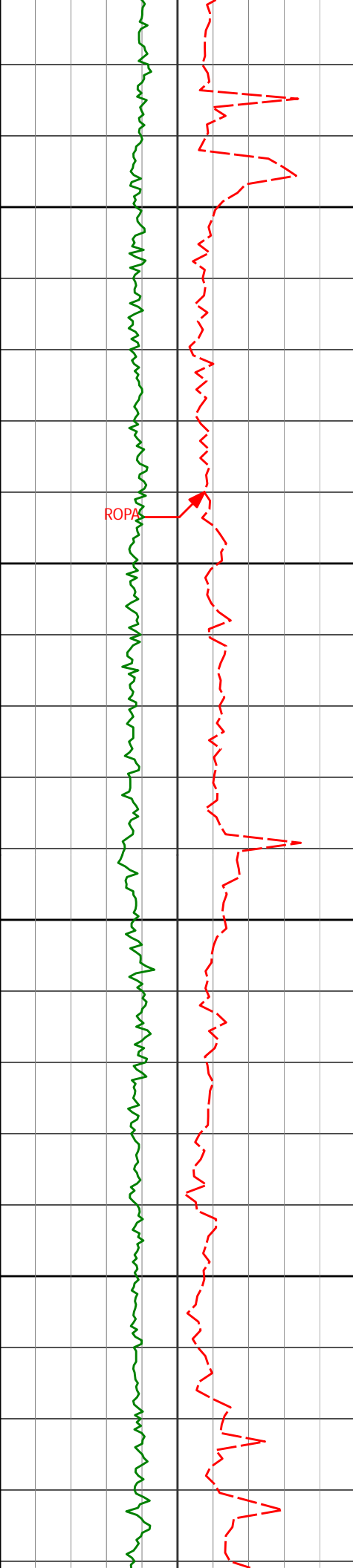
88.98°

180.29°

6703.55'

6672.76'

13350'



13400'

13424'

89.54°

179.42°

6704.77'

6767.70'

13450'

13500'

13519'

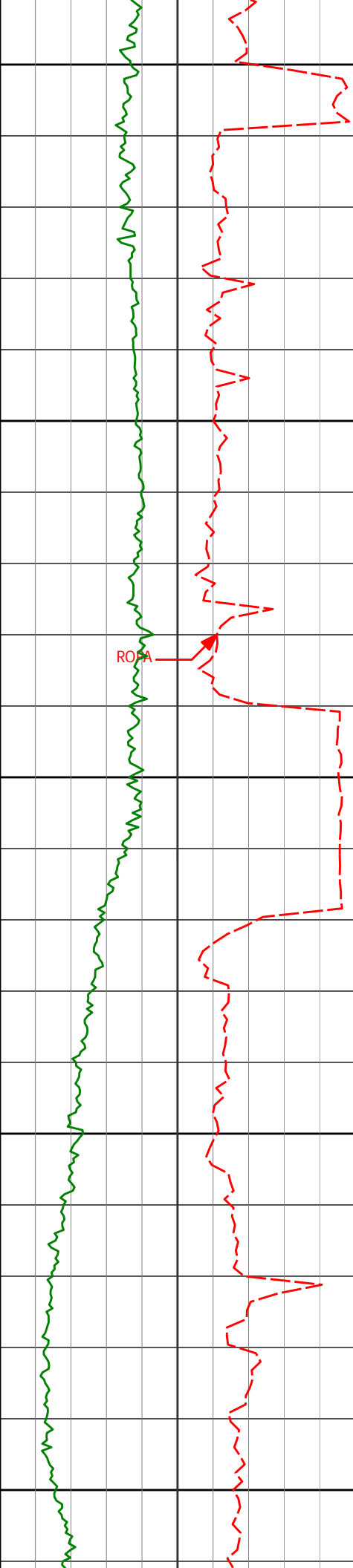
88.89°

178.08°

6706.07'

6862.57'

13550'



13600'

13614'

89.32°

176.57°

6707.56'

6957.29'

13650'

13700'

13709'

90.89°

178.84°

6707.38'

7052.07'

13750'

13800'

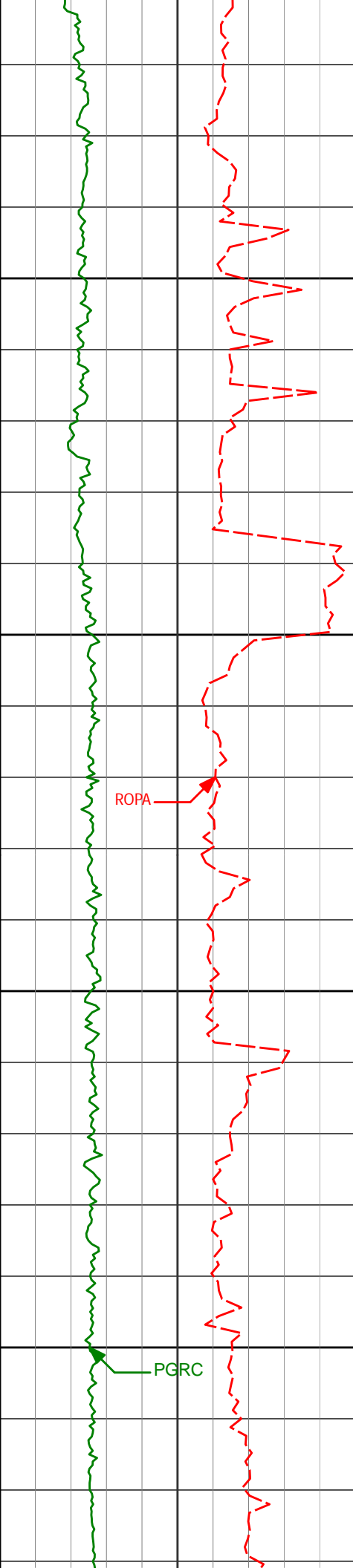
13804'

91.32°

178.79°

6705.55'

7146.94'



13850'

13900'

13950'

14000'

ROPA

PGRC

13899'

90.43°

179.21°

6704.10'

7241.83'

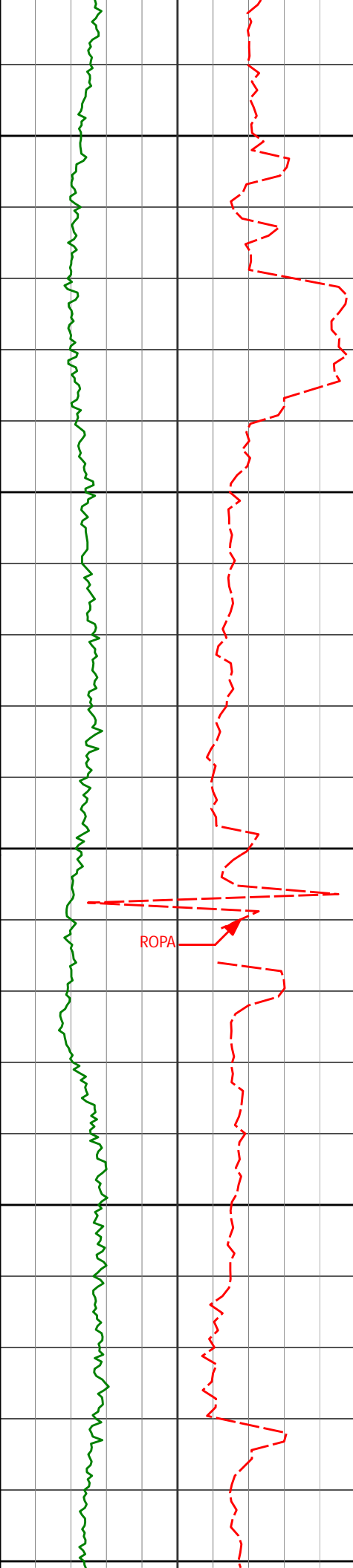
13994'

90.93°

179.14°

6702.97'

7336.73'



14050'

14088'

89.41°

179.01°

6702.70'

7430.64'

14100'

14150'

ROPA



14183'

89.11°

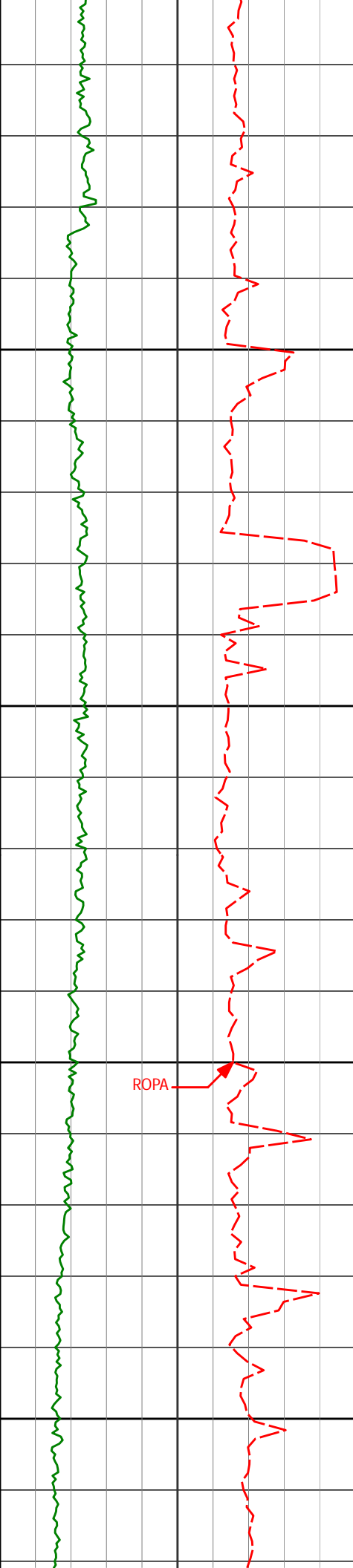
178.69°

6703.92'

7525.52'

14200'

14250'



14300'

14350'

14400'

14450'

14278'

89.72°

179.00°

6704.89'

7620.41'

14373'

89.57°

178.55°

6705.48'

7715.29'

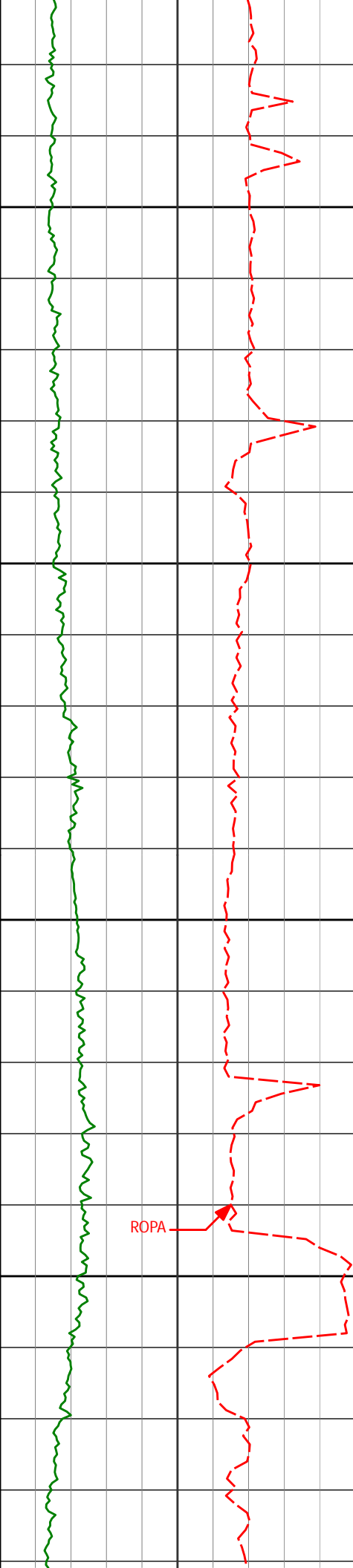
14468'

90.15°

179.00°

6705.71'

7810.17'



14500'

14550'

14600'

14650'

14563'

90.99°

178.97°

6704.77'

7905.07'

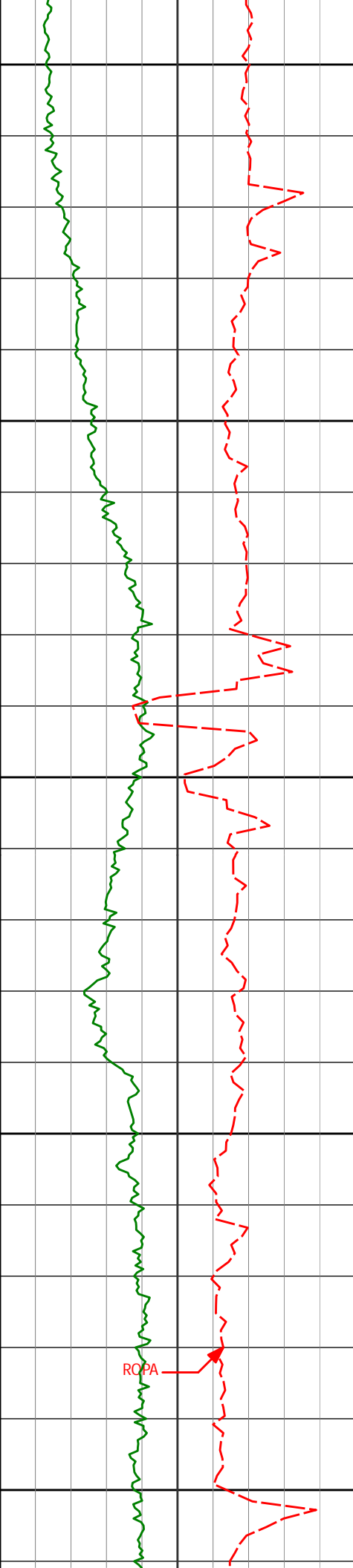
14658'

89.35°

179.14°

6704.49'

7999.97'



14700'

14750'

14800'

14850'

14900'

14753'

89.66°

179.07°

6705.31'

8094.88'

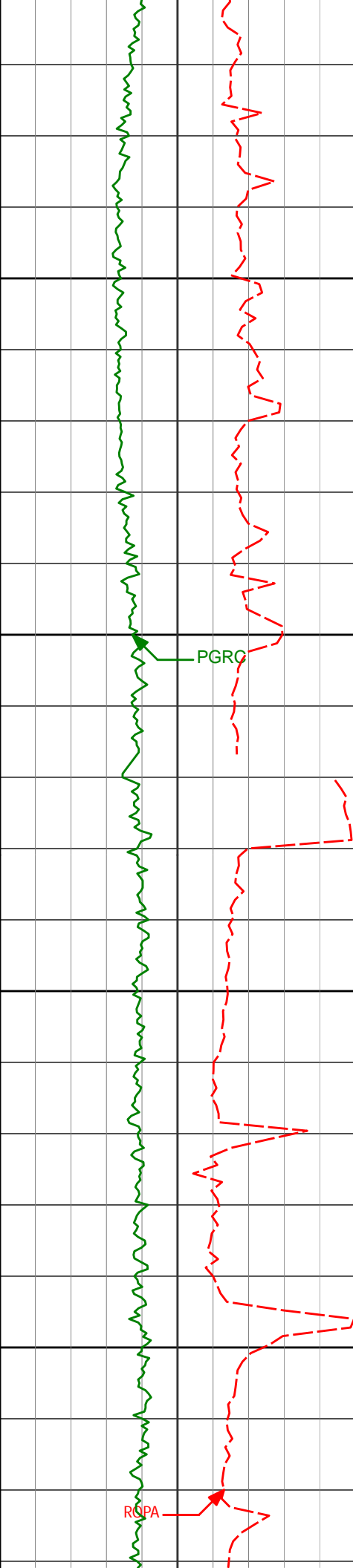
14848'

90.06°

178.90°

6705.54'

8189.78'



14943'	91.14°	179.03°	6704.54'	8284.67'
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14950'

15000'

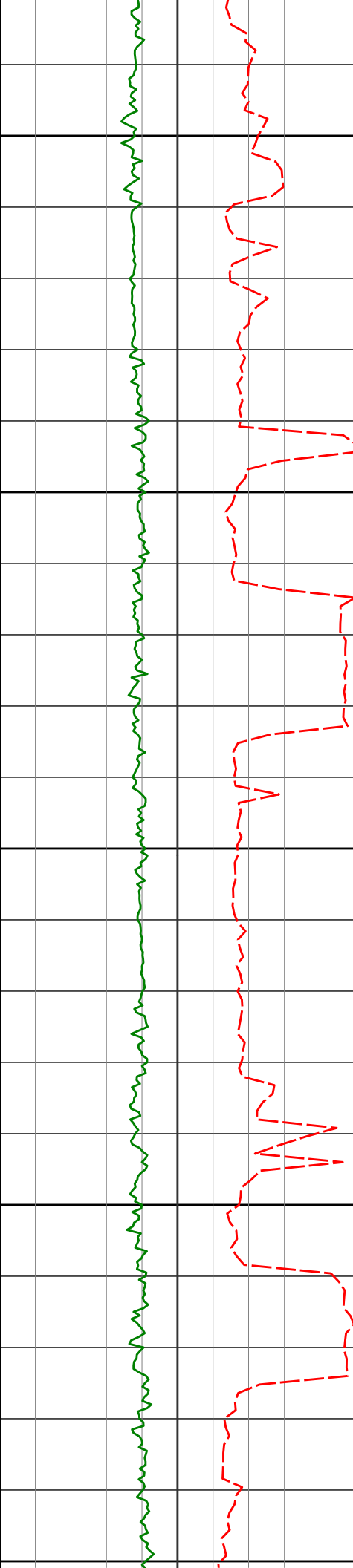
PGRC

15037'	90.00°	178.96°	6703.61'	8378.57'
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15050'

15100'

RUPA



15150'

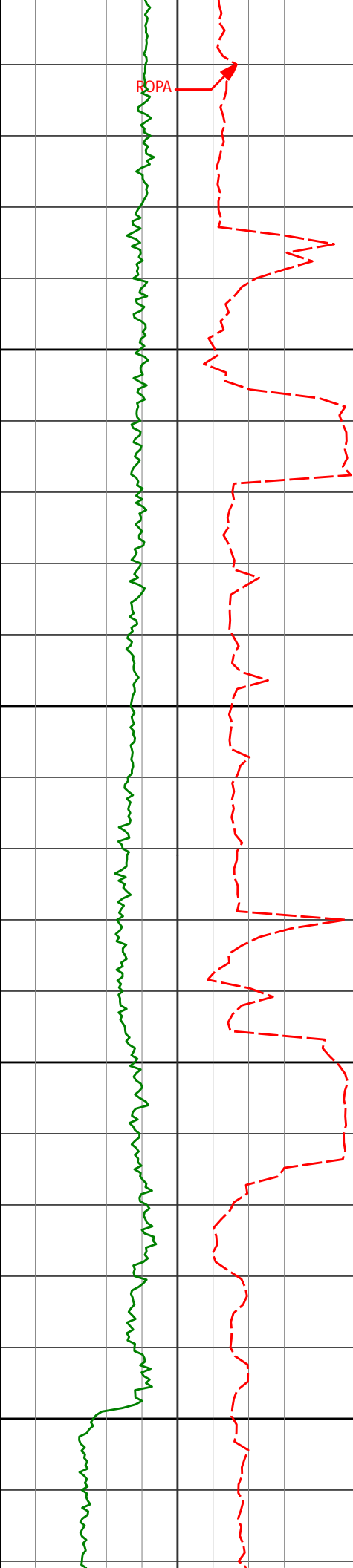
15200'

15250'

15300'

15350'

15132'	90.34°	177.65°	6703.33'	8473.41'
15227'	90.09°	178.35°	6702.97'	8568.22'
15322'	89.91°	178.82°	6702.97'	8663.09'



15400'

15417'

90.49°

180.93°

6702.64'

8758.04'

15450'

15500'

15511'

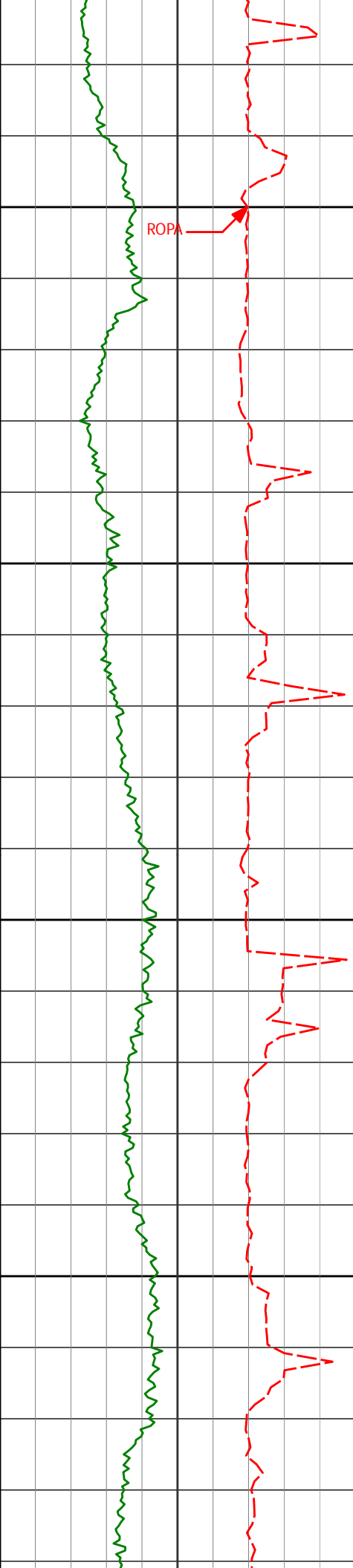
88.12°

180.21°

6703.78'

8852.01'

15550'



15600'

15606'

88.46°

179.96°

6706.61'

8946.93'

15650'

15700'

15701'

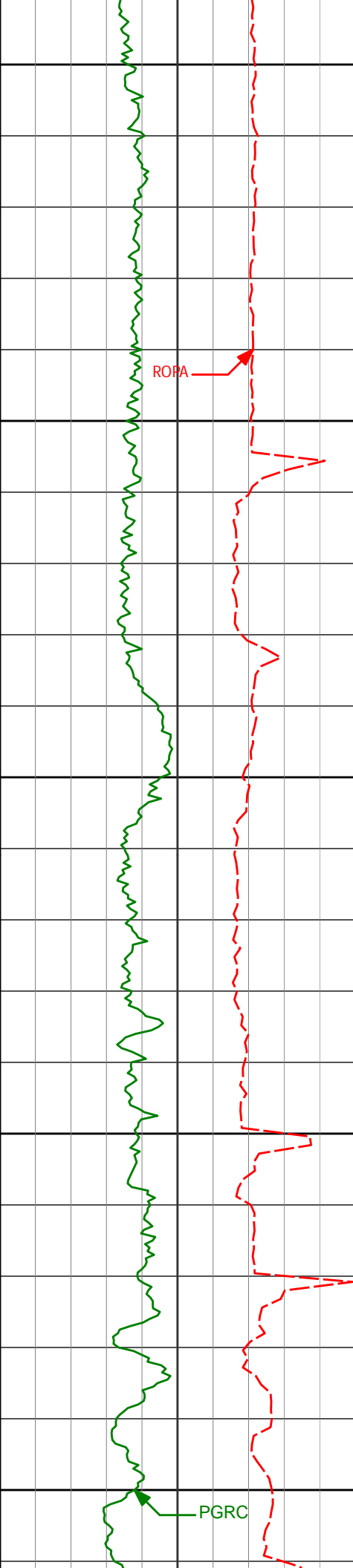
88.71°

179.83°

6708.96'

9041.86'

15750'



15800'

15850'

15900'

15950'

16000'

ROPA

PGRC

15796'

89.29°

179.71°

6710.62'

9136.80'

15891'

88.55°

178.50°

6712.41'

9231.69'

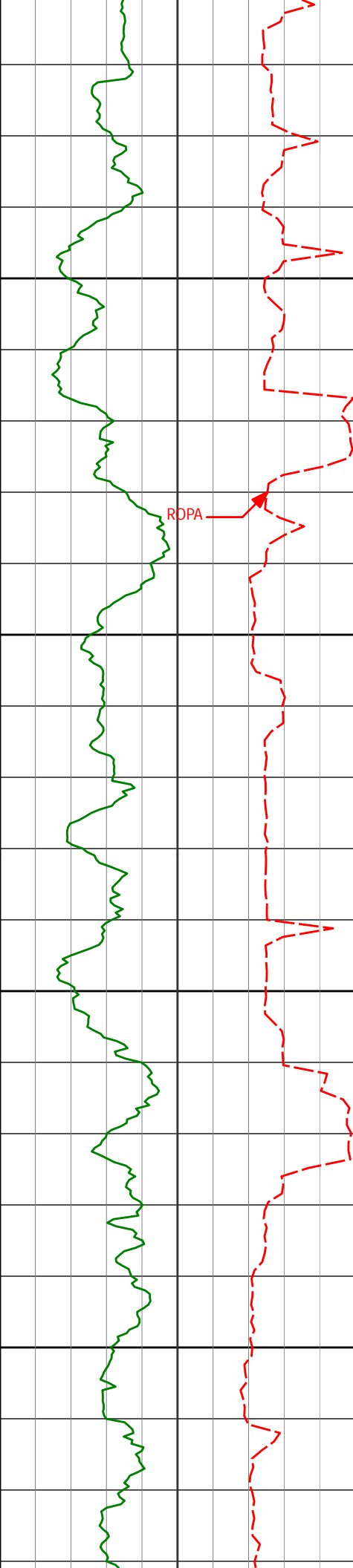
15986'

88.58°

177.89°

6714.79'

9326.49'



16050'

16081'

88.80°

178.48°

6716.96'

9421.30'

16100'

16150'

16176'

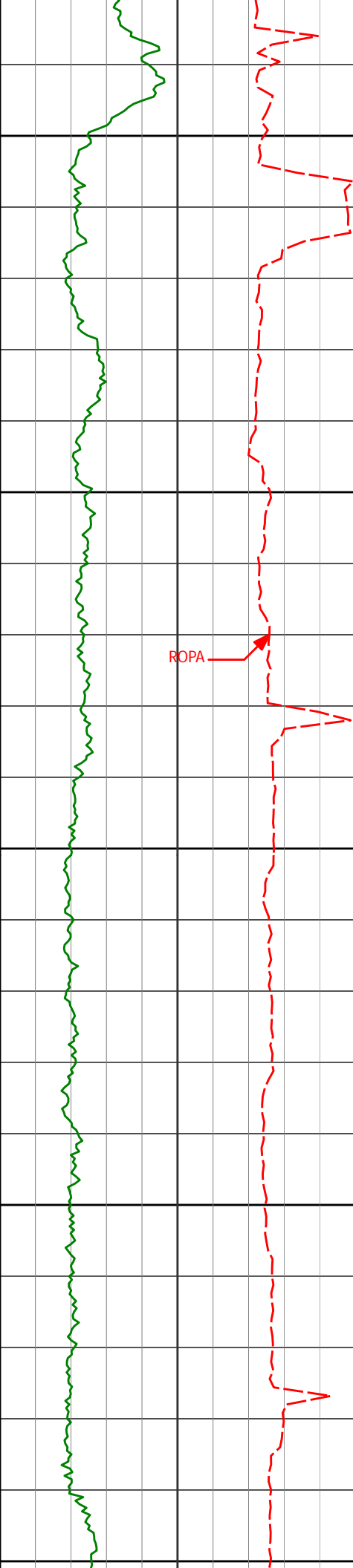
89.38°

178.35°

6718.47'

9516.14'

16200'



16250'

16271'

89.82°

178.30°

6719.13'

9610.98'

16300'

ROPA

16350'

16366'

90.25°

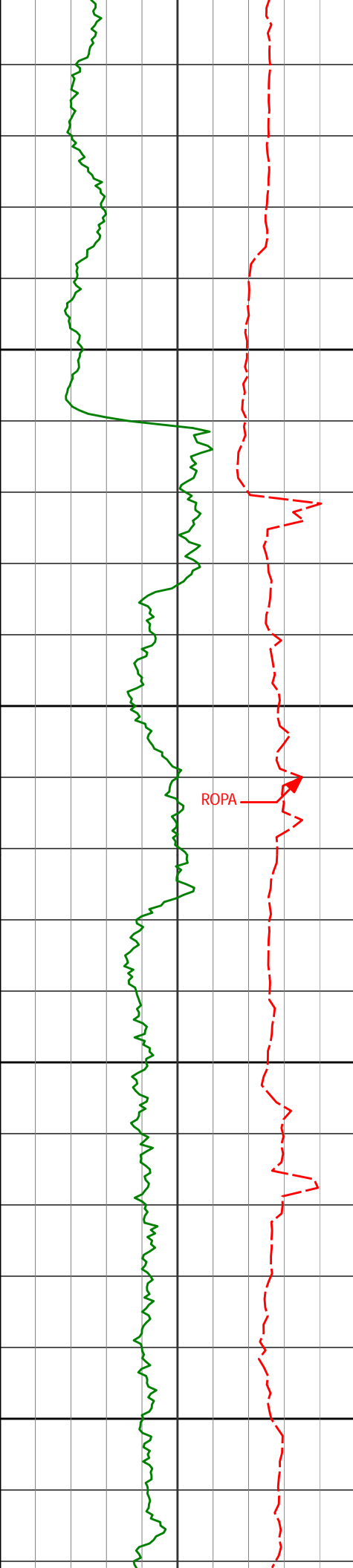
178.17°

6719.07'

9705.82'

16400'

16450'



16500'

16550'

16600'

16650'

16460'

90.89°

178.20°

6718.14'

9799.64'

16555'

90.86°

177.98°

6716.69'

9894.46'

ROPA

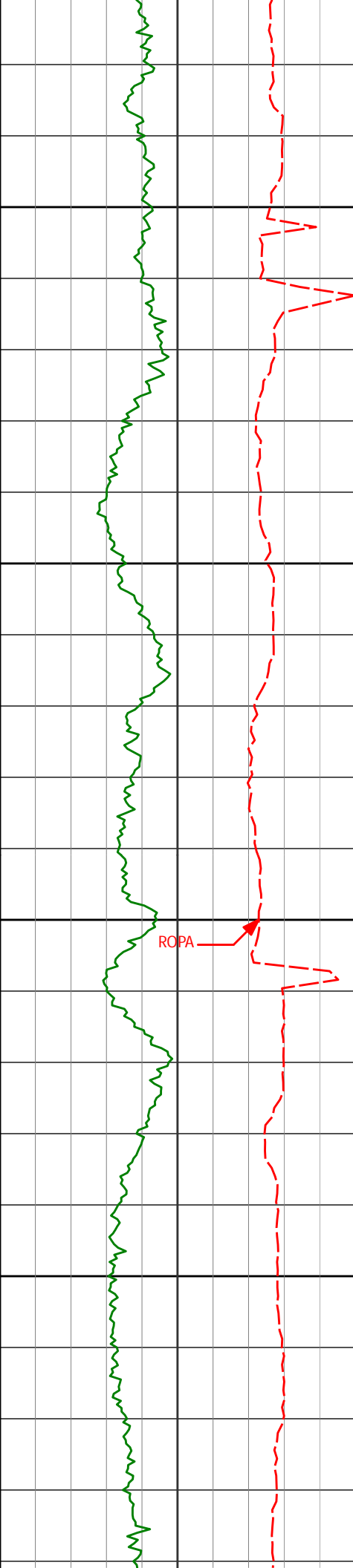
16650'

90.46°

177.56°

6715.59'

9989.24'



16700'

16750'

16800'

16850'

ROPA

16745'

89.94°

176.99°

6715.26'

10083.96'

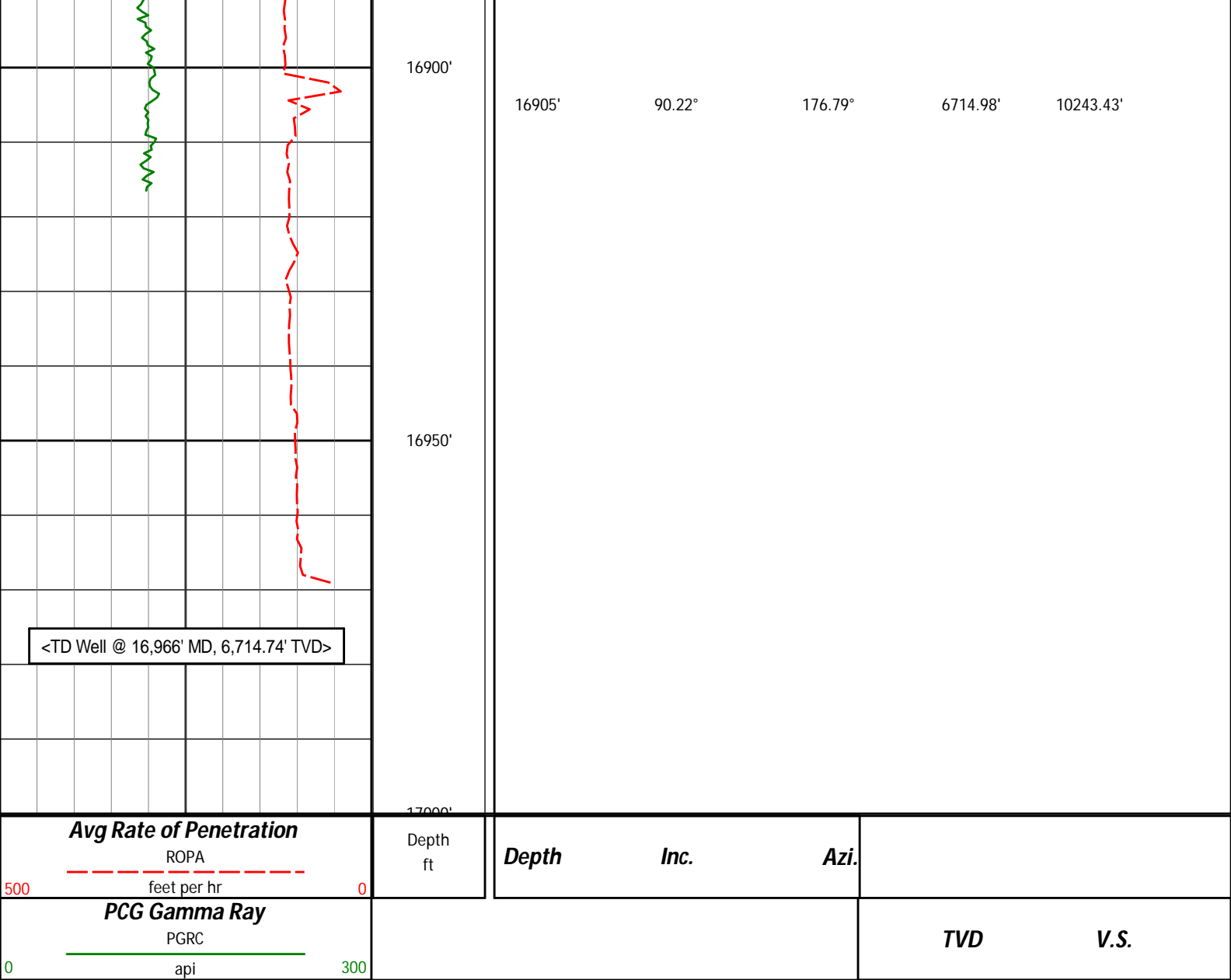
16840'

90.15°

176.96°

6715.19'

10178.65'



HALLIBURTON

DIRECTIONAL SURVEY REPORT

Noble Energy
Crow Creek AA01-789
Wattenberg
Weld Colorado
USA
CA-XX-0901850044

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
253.00	1.00	175.75	252.99	2.20 S	0.16 E	2.20	0.40
506.00	0.30	142.35	505.97	4.93 S	0.73 E	4.91	0.30
726.00	0.42	181.39	725.97	6.19 S	1.06 E	6.16	0.12
819.00	0.38	166.84	818.96	6.83 S	1.13 E	6.80	0.12
912.00	0.46	167.24	911.96	7.50 S	1.28 E	7.46	0.09
1006.00	0.67	317.71	1005.96	7.46 S	0.99 E	7.43	1.16
1098.00	0.63	333.24	1097.95	6.61 S	0.40 E	6.59	0.20
1191.00	0.68	341.69	1190.95	5.63 S	0.00 W	5.62	0.12
1283.00	0.83	333.33	1282.94	4.51 S	0.47 W	4.52	0.20
1376.00	0.77	342.57	1375.93	3.32 S	0.96 W	3.34	0.15
1468.00	0.97	353.59	1467.93	1.95 S	1.35 W	1.98	0.37

1468.00	0.97	332.90	1467.92	1.93 S	1.23 W	1.99	0.27
1560.00	0.83	349.12	1559.91	0.53 S	1.48 W	0.57	0.16
1653.00	0.90	334.82	1652.90	0.80 N	1.91 W	-0.74	0.24
1747.00	0.81	322.52	1746.89	1.99 N	2.63 W	-1.92	0.22
1841.00	0.75	332.91	1840.88	3.07 N	3.32 W	-2.97	0.16
1935.00	0.79	325.87	1934.87	4.15 N	3.96 W	-4.04	0.11
2028.00	3.66	295.68	2027.79	5.97 N	7.00 W	-5.77	3.23
2119.00	5.68	294.73	2118.49	9.11 N	13.70 W	-8.72	2.22
2212.00	5.58	290.78	2211.04	12.64 N	22.11 W	-12.02	0.43
2304.00	7.24	295.36	2302.46	16.71 N	31.53 W	-15.82	1.89
2397.00	6.86	296.90	2394.76	21.73 N	41.78 W	-20.56	0.46
2492.00	8.77	289.11	2488.87	26.67 N	53.69 W	-25.16	2.29
2587.00	8.51	289.48	2582.79	31.39 N	67.16 W	-29.50	0.28
2681.00	8.91	292.38	2675.71	36.48 N	80.44 W	-34.22	0.63
2776.00	8.60	290.66	2769.60	41.78 N	93.89 W	-39.15	0.43
2871.00	8.51	289.35	2863.55	46.62 N	107.17 W	-43.61	0.23
2966.00	8.95	295.94	2957.45	52.18 N	120.45 W	-48.80	1.15
3061.00	9.08	294.67	3051.27	58.54 N	133.91 W	-54.78	0.25
3156.00	9.19	299.36	3145.07	65.39 N	147.33 W	-61.25	0.79
3251.00	8.81	297.97	3238.90	72.52 N	160.37 W	-68.02	0.46
3346.00	8.10	296.49	3332.87	78.92 N	172.78 W	-74.07	0.78
3441.00	7.23	296.07	3427.02	84.53 N	184.14 W	-79.36	0.92
3536.00	8.45	299.12	3521.13	90.56 N	195.61 W	-85.06	1.36
3631.00	8.01	298.93	3615.15	97.16 N	207.50 W	-91.32	0.46
3726.00	9.55	296.42	3709.03	103.86 N	220.35 W	-97.67	1.67
3820.00	10.20	296.16	3801.64	111.00 N	234.81 W	-104.40	0.69
3915.00	10.45	296.76	3895.10	118.59 N	250.05 W	-111.56	0.29
4010.00	10.90	296.28	3988.46	126.45 N	265.80 W	-118.98	0.48
4105.00	10.34	294.98	4081.83	134.02 N	281.58 W	-126.11	0.64
4200.00	10.13	294.08	4175.32	141.03 N	296.93 W	-132.69	0.28
4295.00	9.22	292.63	4268.97	147.37 N	311.59 W	-138.61	0.99
4389.00	8.00	291.80	4361.91	152.70 N	324.61 W	-143.57	1.30
4483.00	7.48	288.54	4455.05	157.07 N	336.48 W	-147.62	0.72
4578.00	7.35	292.44	4549.26	161.36 N	347.96 W	-151.58	0.55
4672.00	7.01	294.46	4642.52	166.03 N	358.74 W	-155.95	0.45
4767.00	8.24	295.41	4736.68	171.35 N	370.17 W	-160.95	1.30
4861.00	8.69	301.18	4829.66	177.92 N	382.33 W	-167.17	1.02
4956.00	7.66	298.32	4923.69	184.64 N	394.04 W	-173.56	1.17
5051.00	8.78	296.40	5017.71	190.86 N	406.11 W	-179.45	1.21
5146.00	7.92	296.00	5111.70	196.96 N	418.49 W	-185.20	0.91
5240.00	6.49	293.67	5204.96	201.93 N	429.18 W	-189.87	1.55
5335.00	5.28	293.62	5299.46	205.84 N	438.10 W	-193.52	1.27
5430.00	4.29	295.67	5394.12	209.13 N	445.31 W	-196.61	1.06
5525.00	3.08	297.40	5488.93	211.84 N	450.77 W	-199.17	1.28
5620.00	1.42	280.90	5583.85	213.24 N	454.20 W	-200.47	1.86
5714.00	1.11	247.75	5677.83	213.11 N	456.18 W	-200.29	0.83
5809.00	1.04	240.63	5772.81	212.34 N	457.79 W	-199.48	0.16
5904.00	0.85	238.46	5867.80	211.55 N	459.14 W	-198.65	0.20
5999.00	0.73	240.23	5962.79	210.88 N	460.26 W	-197.95	0.13
6043.00	0.69	245.15	6006.79	210.63 N	460.75 W	-197.68	0.17
6189.00	9.14	168.34	6152.15	198.88 N	459.20 W	-185.98	6.17
6237.00	14.21	169.64	6199.15	189.35 N	457.37 W	-176.50	10.58
6284.00	18.16	172.18	6244.27	176.41 N	455.33 W	-163.63	8.54
6332.00	22.88	171.05	6289.22	159.77 N	452.86 W	-147.06	9.87
6379.00	27.60	170.65	6331.72	139.99 N	449.67 W	-127.38	10.05
6427.00	32.47	175.49	6373.27	116.16 N	446.85 W	-103.64	11.32
6473.00	35.16	178.05	6411.48	90.61 N	445.43 W	-78.13	6.62
6521.00	38.15	178.28	6449.99	61.97 N	444.51 W	-49.53	6.24
6568.00	42.51	177.76	6485.81	31.58 N	443.45 W	-19.18	9.30
6616.00	45.05	179.17	6520.46	1.62 S	442.57 W	13.98	5.67
6663.00	49.17	180.09	6552.44	36.05 S	442.36 W	48.38	8.88
6711.00	54.89	179.90	6581.96	73.87 S	442.35 W	86.19	11.92
6758.00	60.47	181.24	6607.08	113.57 S	442.76 W	125.89	12.11
6806.00	64.49	182.34	6629.26	156.11 S	444.10 W	168.45	8.62
6853.00	67.66	183.73	6648.32	199.00 S	446.38 W	211.39	7.27
6901.00	71.73	181.98	6664.97	243.95 S	448.61 W	256.38	9.14
6948.00	75.84	180.48	6678.09	289.06 S	449.58 W	301.50	9.27
6988.00	79.25	179.94	6686.72	328.11 S	449.72 W	340.54	8.63
7120.00	85.31	178.88	6704.44	458.85 S	448.36 W	471.19	4.66
7215.00	87.93	179.42	6710.04	553.66 S	446.96 W	565.93	2.82
7310.00	89.14	179.20	6712.47	648.62 S	445.81 W	660.82	1.29
7404.00	89.01	178.90	6713.99	742.60 S	444.25 W	754.71	0.35
7499.00	89.82	177.90	6714.96	837.55 S	441.60 W	849.56	1.35
7594.00	91.11	178.02	6714.19	932.49 S	438.22 W	944.36	1.36
7689.00	91.48	177.78	6712.04	1027.40 S	434.74 W	1039.14	0.46

7784.00	90.18	178.94	6710.66	1122.35 S	432.02 W	1133.97	1.83
7878.00	89.82	178.51	6710.66	1216.32 S	429.93 W	1227.85	0.60
7973.00	90.34	178.31	6710.53	1311.29 S	427.29 W	1322.71	0.59
8068.00	89.63	178.85	6710.56	1406.26 S	424.94 W	1417.57	0.94
8163.00	89.91	177.84	6710.94	1501.21 S	422.20 W	1512.42	1.10
8258.00	89.75	176.92	6711.22	1596.11 S	417.85 W	1607.16	0.98
8353.00	89.97	178.21	6711.45	1691.03 S	413.82 W	1701.92	1.38
8447.00	89.85	178.73	6711.60	1784.99 S	411.31 W	1795.78	0.57
8542.00	90.28	181.27	6711.49	1879.98 S	411.31 W	1890.73	2.71
8637.00	89.97	180.68	6711.29	1974.97 S	412.92 W	1985.73	0.70
8732.00	90.89	180.33	6710.57	2069.96 S	413.76 W	2080.71	1.04
8827.00	90.37	180.02	6709.53	2164.95 S	414.05 W	2175.67	0.64
8922.00	90.74	179.63	6708.61	2259.95 S	413.76 W	2270.62	0.57
9017.00	91.05	179.51	6707.12	2354.94 S	413.05 W	2365.55	0.35
9112.00	91.39	179.04	6705.10	2449.91 S	411.85 W	2460.45	0.61
9207.00	89.48	179.29	6704.38	2544.89 S	410.46 W	2555.36	2.03
9301.00	90.15	179.01	6704.68	2638.88 S	409.07 W	2649.27	0.77
9396.00	90.09	178.58	6704.48	2733.86 S	407.07 W	2744.16	0.46
9491.00	88.06	178.16	6706.02	2828.80 S	404.37 W	2838.99	2.18
9586.00	87.97	179.44	6709.31	2923.72 S	402.38 W	2933.81	1.35
9681.00	88.86	179.04	6711.94	3018.67 S	401.12 W	3028.70	1.03
9776.00	90.99	180.63	6712.06	3113.66 S	400.85 W	3123.64	2.80
9871.00	91.02	180.59	6710.39	3208.64 S	401.86 W	3218.61	0.05
9966.00	90.34	180.38	6709.27	3303.63 S	402.66 W	3313.59	0.75
10061.00	90.40	180.19	6708.65	3398.63 S	403.13 W	3408.56	0.21
10156.00	90.80	180.24	6707.66	3493.62 S	403.49 W	3503.53	0.42
10250.00	91.26	180.32	6705.97	3587.61 S	403.95 W	3597.49	0.50
10345.00	89.51	179.30	6705.33	3682.60 S	403.63 W	3692.44	2.13
10439.00	89.45	179.24	6706.18	3776.59 S	402.44 W	3786.35	0.09
10531.00	89.54	179.19	6706.99	3868.58 S	401.18 W	3878.27	0.11
10624.00	89.63	179.18	6707.67	3961.57 S	399.85 W	3971.19	0.10
10716.00	89.85	179.43	6708.09	4053.56 S	398.74 W	4063.11	0.36
10810.00	89.57	179.33	6708.56	4147.55 S	397.72 W	4157.04	0.32
10903.00	89.35	178.69	6709.44	4240.53 S	396.11 W	4249.94	0.73
10996.00	89.23	177.45	6710.59	4333.47 S	392.98 W	4342.75	1.34
11087.00	90.09	177.71	6711.13	4424.39 S	389.14 W	4433.53	0.99
11180.00	90.77	178.96	6710.43	4517.34 S	386.44 W	4526.37	1.53
11272.00	91.14	178.32	6708.90	4609.30 S	384.25 W	4618.23	0.80
11365.00	90.71	179.01	6707.40	4702.26 S	382.09 W	4711.10	0.87
11458.00	91.08	178.97	6705.95	4795.24 S	380.45 W	4803.99	0.40
11551.00	90.15	179.60	6704.95	4888.22 S	379.29 W	4896.91	1.21
11646.00	90.49	179.43	6704.42	4983.22 S	378.48 W	4991.84	0.40
11740.00	90.03	180.30	6703.99	5077.22 S	378.26 W	5085.80	1.05
11832.00	89.01	180.78	6704.76	5169.21 S	379.13 W	5177.78	1.23
11924.00	88.98	180.77	6706.37	5261.19 S	380.37 W	5269.76	0.03
12016.00	88.67	180.47	6708.26	5353.16 S	381.37 W	5361.72	0.47
12108.00	89.32	179.31	6709.87	5445.14 S	381.19 W	5453.67	1.45
12201.00	88.98	179.12	6711.25	5538.13 S	379.92 W	5546.57	0.42
12294.00	88.80	178.93	6713.06	5631.09 S	378.34 W	5639.46	0.28
12385.00	88.52	179.24	6715.18	5722.06 S	376.88 W	5730.35	0.46
12478.00	90.31	177.06	6716.13	5815.00 S	373.88 W	5823.17	3.03
12572.00	90.71	176.65	6715.30	5908.85 S	368.72 W	5916.84	0.61
12665.00	91.79	177.74	6713.27	6001.71 S	364.17 W	6009.54	1.65
12759.00	90.28	179.19	6711.57	6095.66 S	361.66 W	6103.38	2.23
12854.00	90.34	178.59	6711.06	6190.64 S	359.82 W	6198.27	0.63
12949.00	89.97	178.01	6710.80	6285.60 S	357.00 W	6293.11	0.72
13044.00	91.48	179.46	6709.60	6380.56 S	354.90 W	6387.98	2.20
13139.00	91.57	179.48	6707.07	6475.52 S	354.02 W	6482.88	0.10
13234.00	91.85	180.21	6704.23	6570.48 S	353.77 W	6577.79	0.82
13329.00	88.98	180.29	6703.55	6665.47 S	354.18 W	6672.76	3.02
13424.00	89.54	179.42	6704.77	6760.46 S	353.94 W	6767.70	1.09
13519.00	88.89	178.08	6706.07	6855.42 S	351.87 W	6862.57	1.57
13614.00	89.32	176.57	6707.56	6950.30 S	347.43 W	6957.29	1.65
13709.00	90.89	178.84	6707.38	7045.22 S	343.63 W	7052.07	2.91
13804.00	91.32	178.79	6705.55	7140.18 S	341.67 W	7146.94	0.46
13899.00	90.43	179.21	6704.10	7235.15 S	340.01 W	7241.83	1.04
13994.00	90.93	179.14	6702.97	7330.14 S	338.64 W	7336.73	0.53
14088.00	89.41	179.01	6702.70	7424.12 S	337.12 W	7430.64	1.62
14183.00	89.11	178.69	6703.92	7519.09 S	335.22 W	7525.52	0.46
14278.00	89.72	179.00	6704.89	7614.07 S	333.30 W	7620.41	0.72
14373.00	89.57	178.55	6705.48	7709.05 S	331.27 W	7715.29	0.50
14468.00	90.15	179.00	6705.71	7804.02 S	329.24 W	7810.17	0.77
14563.00	90.99	178.97	6704.77	7899.00 S	327.56 W	7905.07	0.88
14658.00	89.35	179.14	6704.49	7993.99 S	325.99 W	7999.97	1.74
14753.00	89.33	178.97	6705.94	8088.97 S	324.54 W	8084.93	2.83

14753.00	89.66	179.07	6705.31	8088.97 S	324.51 W	8094.88	0.33
14848.00	90.06	178.90	6705.54	8183.96 S	322.82 W	8189.78	0.46
14943.00	91.14	179.03	6704.54	8278.93 S	321.11 W	8284.67	1.15
15037.00	90.00	178.96	6703.61	8372.91 S	319.46 W	8378.57	1.22
15132.00	90.34	177.65	6703.33	8467.87 S	316.65 W	8473.41	1.42
15227.00	90.09	178.35	6702.97	8562.81 S	313.33 W	8568.22	0.78
15322.00	89.91	178.82	6702.97	8657.78 S	310.99 W	8663.09	0.53
15417.00	90.49	180.93	6702.64	8752.77 S	310.78 W	8758.04	2.30
15511.00	88.12	180.21	6703.78	8846.75 S	311.71 W	8852.01	2.64
15606.00	88.46	179.96	6706.61	8941.71 S	311.86 W	8946.93	0.44
15701.00	88.71	179.83	6708.96	9036.68 S	311.68 W	9041.86	0.30
15796.00	89.29	179.71	6710.62	9131.67 S	311.30 W	9136.80	0.62
15891.00	88.55	178.50	6712.41	9226.64 S	309.82 W	9231.69	1.49
15986.00	88.58	177.89	6714.79	9321.56 S	306.83 W	9326.49	0.64
16081.00	88.80	178.48	6716.96	9416.49 S	303.82 W	9421.30	0.66
16176.00	89.38	178.35	6718.47	9511.44 S	301.19 W	9516.14	0.63
16271.00	89.82	178.30	6719.13	9606.39 S	298.41 W	9610.98	0.47
16366.00	90.25	178.17	6719.07	9701.35 S	295.49 W	9705.82	0.47
16460.00	90.89	178.20	6718.14	9795.30 S	292.51 W	9799.64	0.68
16555.00	90.86	177.98	6716.69	9890.23 S	289.34 W	9894.46	0.23
16650.00	90.46	177.56	6715.59	9985.15 S	285.65 W	9989.24	0.61
16745.00	89.94	176.99	6715.26	10080.04 S	281.13 W	10083.96	0.81
16840.00	90.15	176.96	6715.19	10174.91 S	276.12 W	10178.65	0.22
16905.00	90.22	176.79	6714.98	10239.82 S	272.57 W	10243.43	0.28
16966.00	90.22	176.79	6714.74	10300.72 S	269.16 W	10304.22	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 181.60 DEGREES (GRID)
A TOTAL CORRECTION OF 7.45 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.
HORIZONTAL DISPLACEMENT(CLOSURE) AT 16966.00 FEET
IS 10304.23 FEET ALONG 181.50 DEGREES (GRID)**

Surface surveys at 253' and 506' MD have had azimuth corrections to grid north, but were not taken by Halliburton.

Last survey is a projection from 16905' MD to bit at 16966' MD.