

## PCGK - Pressure Case Gamma

[illegible]

## WELL INFORMATION

<b>MWD Run Number</b>	100	200			
<b>Date run completed</b>	02-Oct-13	06-Oct-13			
<b>Rig Bit Number</b>	0200	0300			
<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>	645.00	7,414.00			
<b>Log End Depth (MD, ft)</b>	7,414.00	11,544.00			
<b>Drill or Wipe</b>	Drill	Drill			
<b>Drill/Wipe Start Date and Time</b>	29-Sep-13 02:45	04-Oct-13 00:00			
<b>Drill/Wipe End Date and Time</b>	01-Oct-13 21:45	05-Oct-13 17:05			
<b>Min Inc (deg) @ Depth (MD, ft)</b>	0.47 @ 698.00	84.63 @ 7,484.00			
<b>Max Inc (deg) @ Depth (MD, ft)</b>	80.68 @ 7,364.00	92.10 @ 8,739.00			
<b>Bit TFA(in2) / Bit Type</b>	0.84 / PDC	0.75 / PDC			
<b>Flow Rate (gpm)</b>	576.58	281.44			
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	325.7 / 208.8	318.0 / 237.0			
<b>Fluid Type</b>	Fresh Water Gel	Fresh Water Gel			
<b>Density (ppg) / Viscosity (spqt)</b>	9.48 / 40.00	9.55 / 35.00			
<b>Filtrate CL (ppm)</b>	700.00	800.00			
<b>pH / Fluid Loss (mptm)</b>	9.80 / 0	9.70 / 10			
<b>PV (cP) / YP (lbf2)</b>	10 / 6.00	11 / 4.00			
<b>% Solids / % Sand</b>	9.60 / 0.25	5.80 / 0.25			
<b>% Oil / Oil:Water Ratio</b>	Na / Na	Na / Na			
<b>Rm @ Measured Temp (degF)</b>	Na @ Na	Na @ Na			
<b>Rmf @ Measured Temp (degF)</b>	Na @ Na	Na @ Na			
<b>Rmc @ Measured Temp (degF)</b>	Na @ Na	Na @ Na			
<b>Max Tool Temp (in F) / C</b>	105.58 / 40.88	221.40 / 83.56			

Max Tool Temp (degF) / Source	165.58 / PCM	231.42 / PCM			
Rm @ Max Tool Temp (degF)	Na @ 165.58	Na @ 231.42			
Lead MWD Engineer	Scott Trowbridge	Scott Trowbridge			
Customer Representative	JW Irwin	JW Irwin			

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM			
Software Version	5.84	5.84			
Sub Serial Number	11404283	11670106			
Insert Serial Number	11619990	11227547			
Date and Time Initialized	27-Sep-13 18:52	02-Oct-13 14:12			
Date and Time Read	02-Oct-13 07:37	06-Oct-13 08:54			
ECMB SW Version	N/A	N/A			

### Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	50.00	63.00			
Software Version	6.21	6.21			
Sub Serial Number	11404283	11670106			
Sonde Serial Number	11297574	12174339			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	286.82	102.86			

### Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	52.94	65.90			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	11404283	11670106			
Insert/Sonde Serial Number	11579779	11579811			

## REMARKS

1. All depths are true Measured bit 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" for water based fluids and the "Bingham Plastic" model for oil and synthetic based fluids.

4. All data is stored data unless otherwise specified.

5. The following smoothing parameters have been applied to the data:

PCG Gamma Ray BCorr (Gamma Ray Cor)  
Interval Resolution: 0.5  
Interval Distance: 0.6  
Gap Fill: 3

ROPA (Average Rate of Penetration)  
Interval Resolution: 0.5  
Interval Distance: 1.2  
Gap Fill: 3

6. INSITE Version 8.0.0

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HALLIBURTON

Sperry Drilling Services

MD Detail Log 1:600

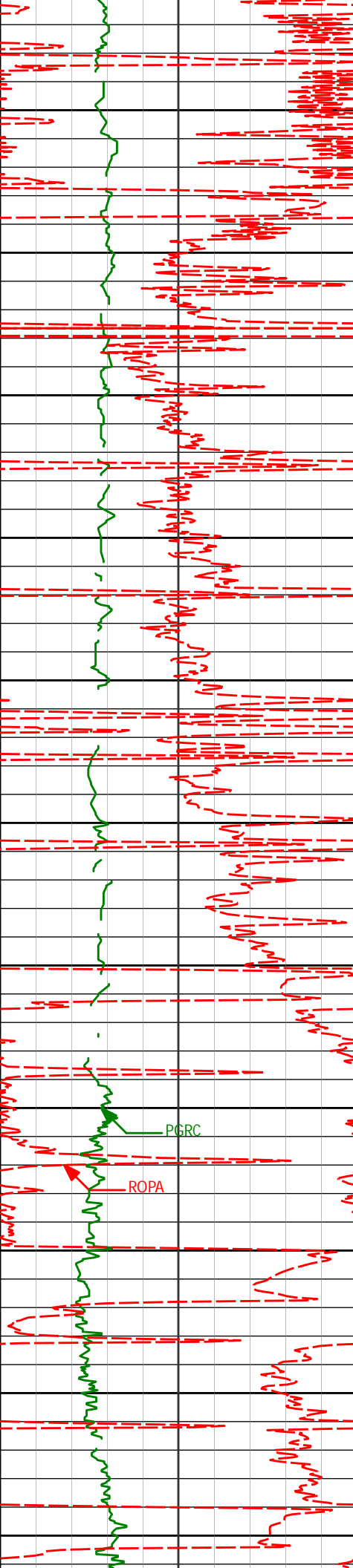
Noble Energy

Loeffler K1-65HN-A2

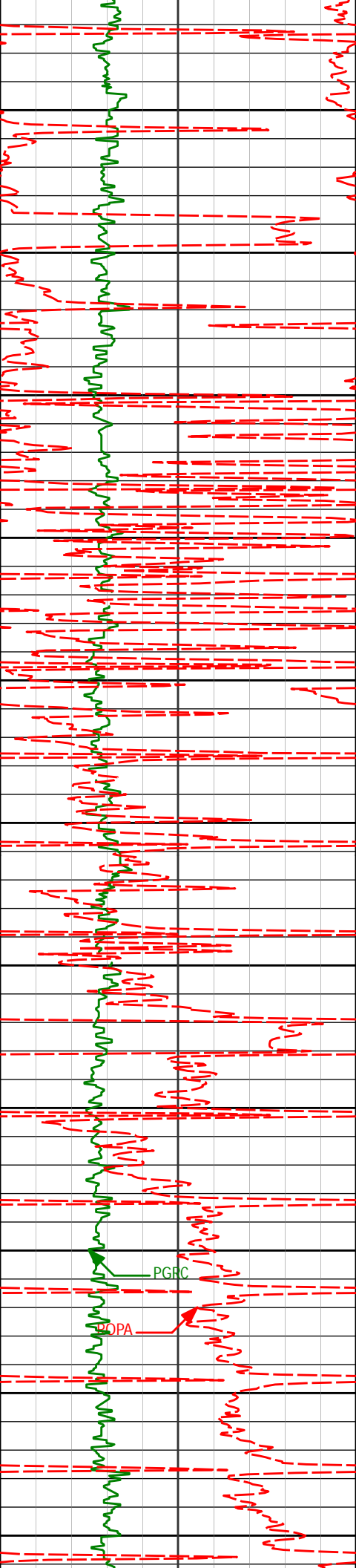
PD 829

1-T4N-R66W

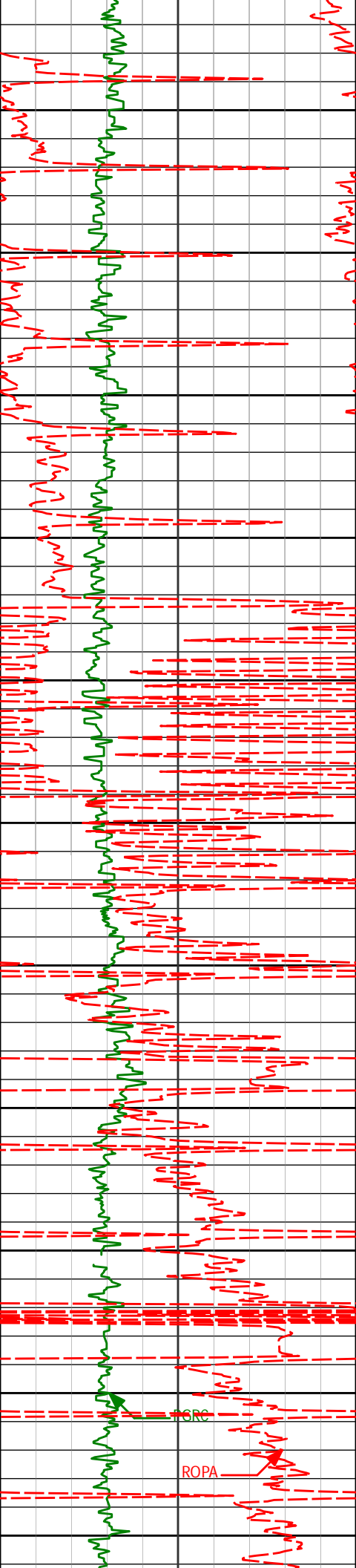




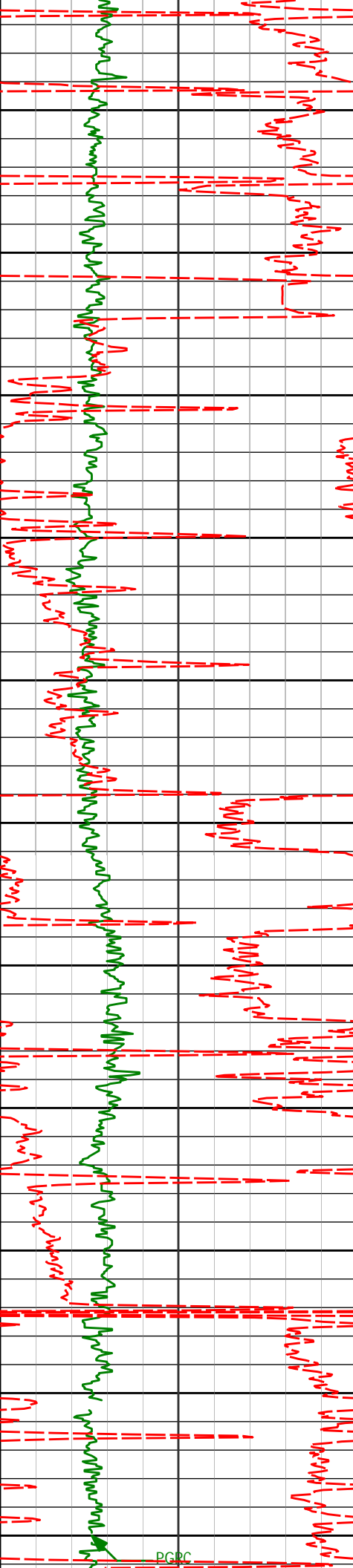
832'	0.68°	280.06°	831.98'	-1.27'
966'	1.28°	190.85°	965.97'	-2.07'
1101'	0.65°	185.90°	1100.95'	-2.02'
1198'	1.63°	185.92°	1197.93'	-1.86'
1292'	3.59°	199.94°	1291.83'	-2.23'



1386'	6.51°	198.06°	1385.45'	-3.41'
1481'	7.08°	198.47°	1479.79'	-4.91'
1575'	7.68°	191.75°	1573.01'	-5.84'
1669'	6.89°	182.55°	1666.25'	-5.18'
1763'	8.03°	190.89°	1759.46'	-4.43'
1857'	7.22°	196.98°	1852.63'	-5.13'



1950	1952'	7.96°	198.56°	1946.79'	-6.71'
2000					
2050	2046'	6.46°	197.62°	2040.05'	-8.26'
2100					
2150	2140'	7.27°	202.71°	2133.37'	-10.16'
2200					
2250	2234'	4.73°	191.91°	2226.85'	-11.50'
2300					
2350	2326'	5.01°	192.46°	2318.52'	-11.72'
2400					
2450	2418'	6.79°	199.19°	2410.03'	-12.67'



2500

2512'

6.19°

192.29°

2503.43'

-13.66'

2550

2600

2601'

7.80°

190.19°

2591.77'

-13.76'

2650

2700

2691'

9.08°

190.21°

2680.79'

-13.68'

2750

2800

2781'

10.26°

192.47°

2769.51'

-13.90'

2850

2900

2870'

8.72°

194.41°

2857.29'

-14.61'

2950

2960'

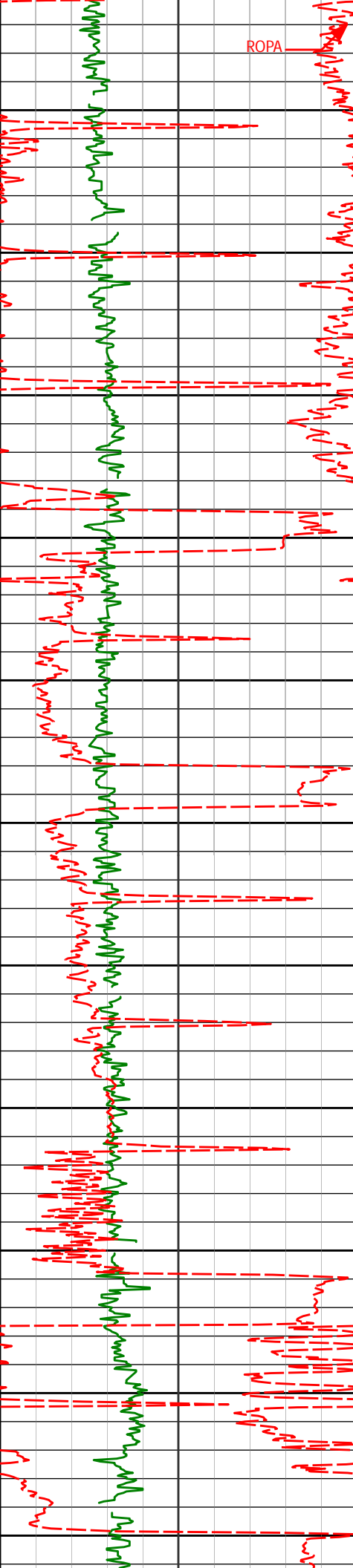
8.96°

192.78°

2946.22'

-15.34'

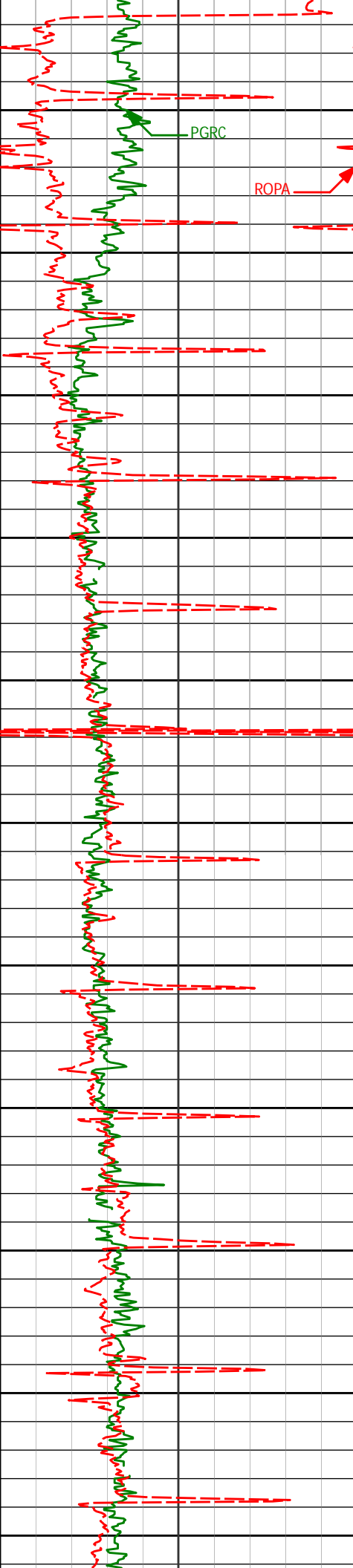
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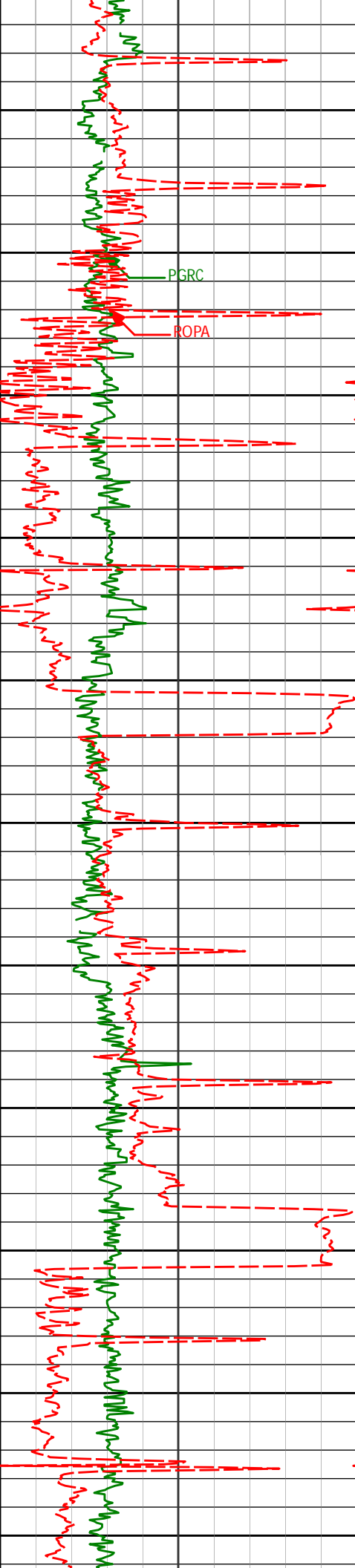
ROPA

3050	3050'	7.75°	202.45°	3035.27'	-16.86'
3100					
3139	3139'	6.38°	184.82°	3123.60'	-17.60'
3150					
3200					
3229	3229'	6.69°	183.89°	3213.02'	-16.49'
3250					
3300					
3318	3318'	8.46°	194.53°	3301.24'	-16.34'
3350					
3400					
3408	3408'	6.57°	188.18°	3390.46'	-16.58'
3450					
3498	3498'	7.81°	198.82°	3479.76'	-17.24'
3500					
3550					

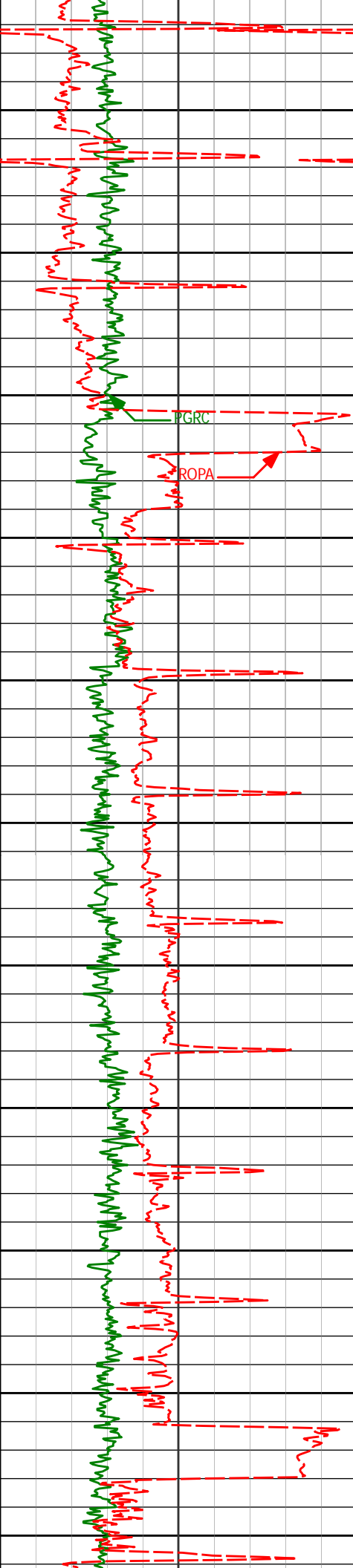




3587'	9.63°	198.22°	3567.73'	-19.10'
3600				
3677'	8.36°	192.06°	3656.62'	-20.27'
3700				
3767'	9.53°	192.19°	3745.52'	-20.65'
3800				
3857'	9.91°	190.94°	3834.23'	-20.91'
3900				
3946'	9.11°	189.76°	3922.01'	-20.86'
4000				
4036'	9.08°	197.21°	4010.88'	-21.58'
4050				
4100				



4125'	7.04°	187.63°	4099.00'	-22.12'
4150				
4200				
4215'	7.91°	197.35°	4188.24'	-22.57'
4250				
4300				
4304'	6.04°	185.67°	4276.58'	-22.89'
4350				
4394'	7.10°	202.11°	4365.99'	-23.60'
4400				
4450				
4484'	6.23°	192.48°	4455.39'	-24.87'
4500				
4550				
4573'	9.09°	197.39°	4543.59'	-25.87'
4600				
4650				



4700

4750

4800

4850

4900

4950

5000

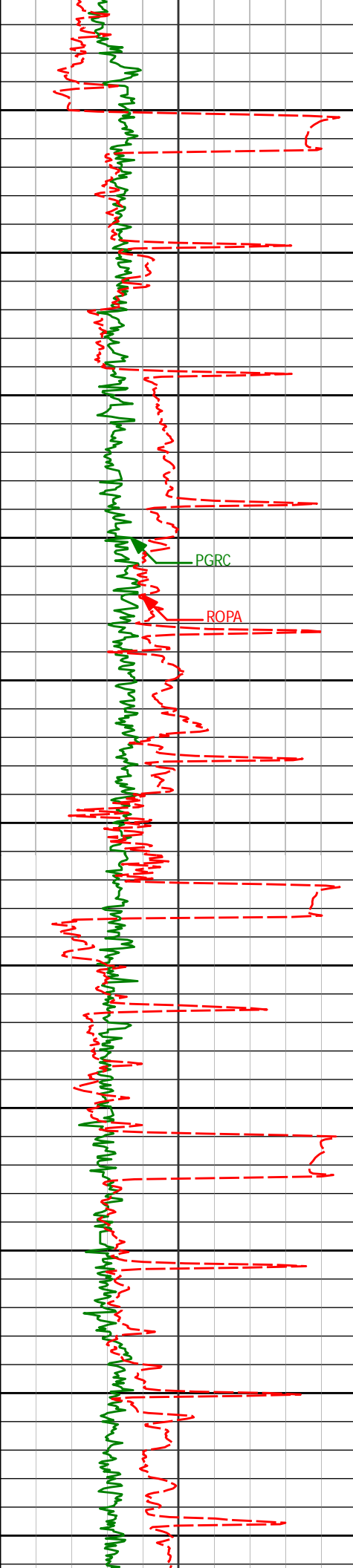
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5100

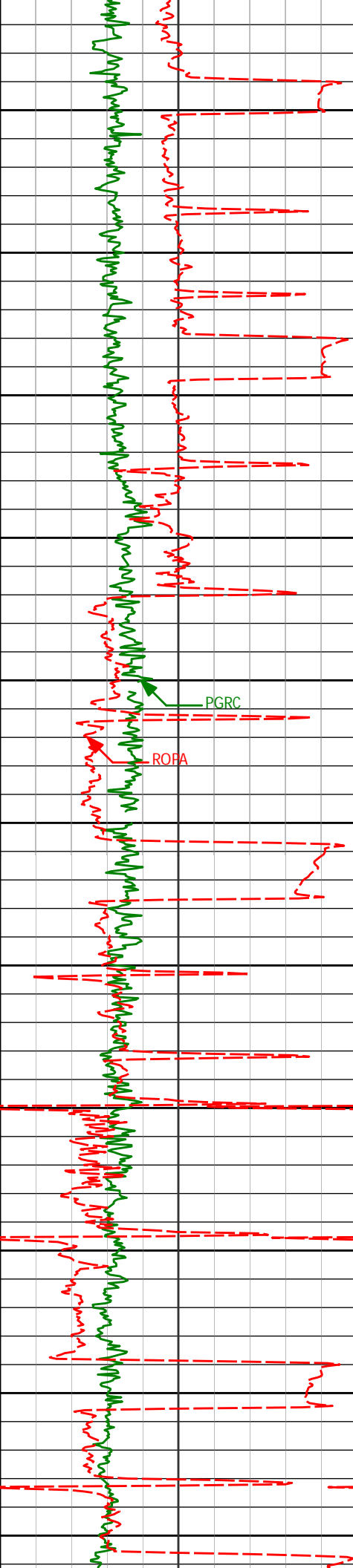
5150

5200

4663'	8.21°	198.89°	4632.56'	-27.64'
4752'	7.30°	199.01°	4720.75'	-29.39'
4842'	8.50°	198.81°	4809.89'	-31.18'
4932'	8.10°	191.38°	4898.95'	-32.23'
5021'	7.86°	191.88°	4987.09'	-32.45'
5111'	6.47°	196.65°	5076.38'	-33.13'
5201'	7.91°	191.06°	5165.68'	-33.72'



5250					
	5290'	9.44°	189.24°	5253.65'	-33.61'
5300					
5350					
	5380'	8.20°	191.97°	5342.59'	-33.59'
5400					
5450					
	5469'	6.29°	194.47°	5430.87'	-34.08'
5500					
5550					
	5559'	7.18°	185.53°	5520.25'	-33.92'
5600					
5650	5649'	8.70°	188.06°	5609.39'	-33.13'
5700					
	5738'	7.44°	187.85°	5697.51'	-32.56'
5750					



5800

5828'

7.48°

184.53°

5786.75'

-31.67'

5850

5900

5917'

8.79°

186.82°

5874.85'

-30.61'

5950

6000

6007'

7.20°

185.05°

5963.97'

-29.62'

6050

6100

6097'

8.54°

191.10°

6053.12'

-29.14'

6150

6186'

6.82°

187.63°

6141.32'

-28.93'

6200

6250

6276'

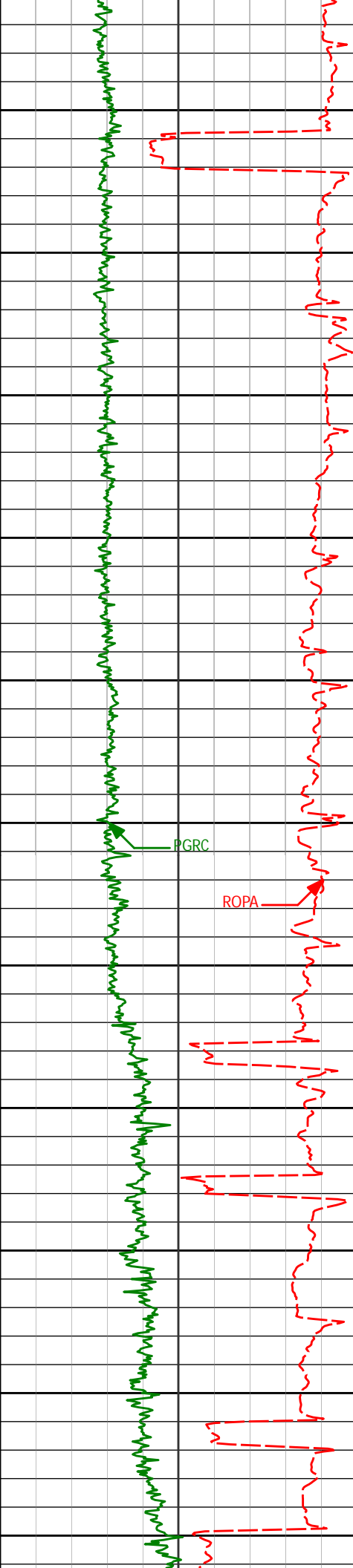
7.48°

193.65°

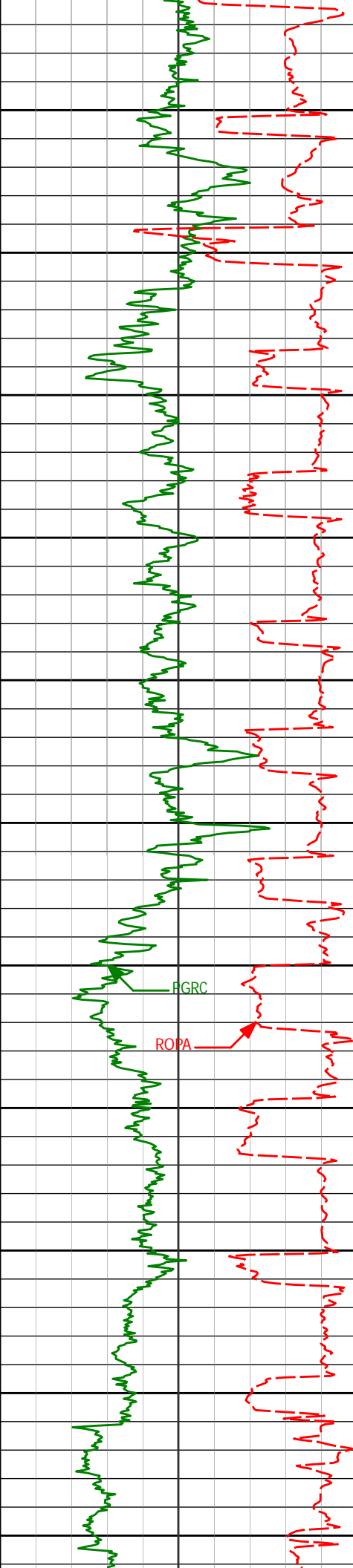
6230.62'

-28.97'

6300

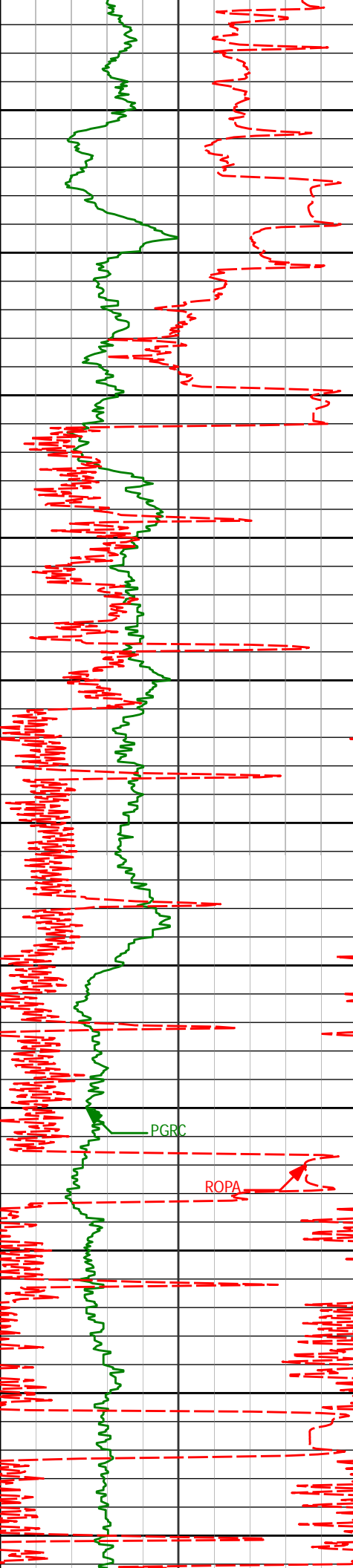


6321'	8.97°	185.25°	6275.16'	-28.80'
6350				
6366'	11.95°	183.22°	6319.41'	-27.88'
6400				
6411'	14.98°	181.85°	6363.17'	-26.40'
6450				
6455'	18.11°	180.68°	6405.34'	-24.36'
6500				
6500'	19.83°	168.13°	6447.91'	-20.25'
6550				
6545'	21.21°	158.07°	6490.07'	-12.96'
6600				
6590'	24.75°	150.83°	6531.50'	-2.56'
6635'	27.32°	142.67°	6571.94'	11.13'
6650				
6679'	29.16°	133.86°	6610.72'	27.60'
6700				
6724'	32.38°	130.75°	6649.38'	47.18'
6750				
6769'	36.71°	124.93°	6686.45'	69.87'
6800				
6814'	40.73°	122.56°	6721.55'	95.75'
6850				
6859'	43.63°	119.06°	6754.90'	124.09'



6900	6903'	45.31°	113.10°	6786.31'	153.77'
6950	6948'	48.12°	107.99°	6817.17'	186.02'
7000	6993'	49.70°	103.83°	6846.76'	219.77'
7050	7038'	52.27°	99.26°	6875.09'	254.71'
7100	7083'	56.65°	97.99°	6901.24'	291.30'
7150	7127'	60.77°	96.86°	6924.09'	328.83'
7200	7172'	64.79°	95.40°	6944.67'	368.72'
7250	7217'	67.49°	94.90°	6962.87'	409.68'
7300	7262'	70.39°	93.99°	6979.04'	451.43'
7350	7307'	74.93°	92.41°	6992.45'	494.02'
7400	7364'	80.68°	91.74°	7004.49'	549.10'

Casing shoe at 7404' MD



Run 200

7450

7484'

84.63°

91.13°

7019.83'

666.58'

7500

7550

7574'

86.86°

91.47°

7026.50'

755.15'

7600

7650

7663'

87.53°

91.09°

7030.86'

842.88'

7700

7750

7753'

87.63°

91.12°

7034.66'

931.57'

7800

PGRC

ROPA

7850

7842'

88.67°

89.58°

7037.53'

1019.11'

7900

7950

7932'

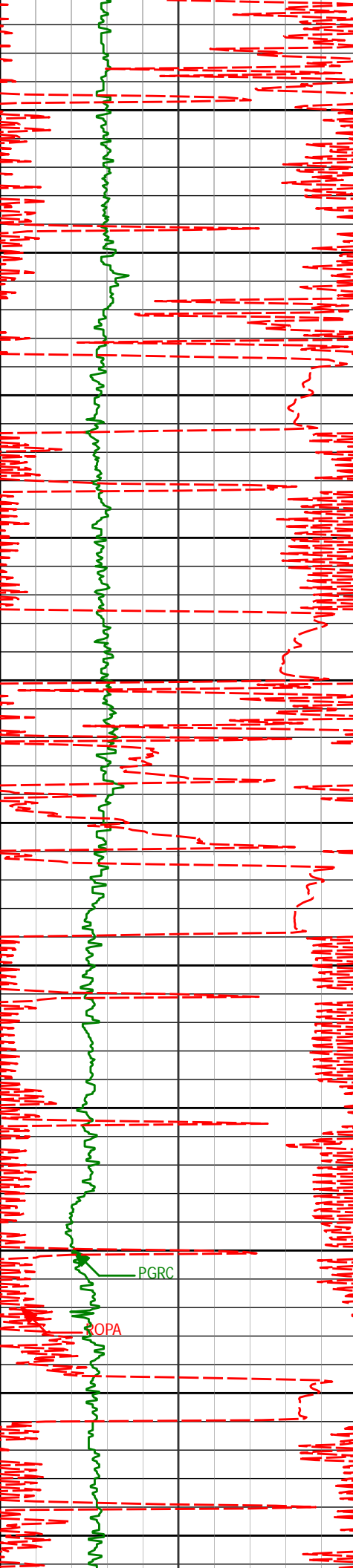
90.40°

88.77°

7038.26'

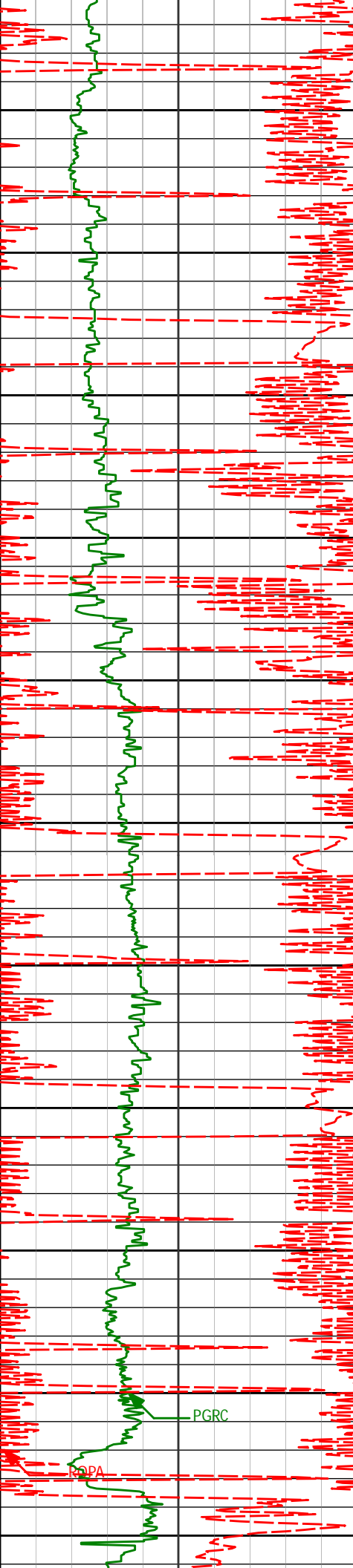
1107.33'





8000  
8050  
8100  
8150  
8200  
8250  
8300  
8350  
8400  
8450  
8500

8022'	90.65°	84.50°	7037.44'	1194.66'
8111'	90.06°	86.10°	7036.89'	1280.51'
8201'	90.00°	87.21°	7036.84'	1367.87'
8291'	90.68°	90.48°	7036.30'	1455.98'
8380'	91.79°	91.42°	7034.39'	1543.70'
8470'	90.55°	90.90°	7032.55'	1632.47'



8550

8560'

91.23°

89.55°

7031.15'

1720.99'

8600

8650

8649'

90.25°

90.44°

7030.00'

1808.47'

8700

8750

8739'

92.10°

91.58°

7028.16'

1897.20'

8800

8850

8829'

91.14°

90.78°

7025.61'

1985.96'

8900

8950

8918'

89.38°

90.92°

7025.21'

2073.67'

9000

9008'

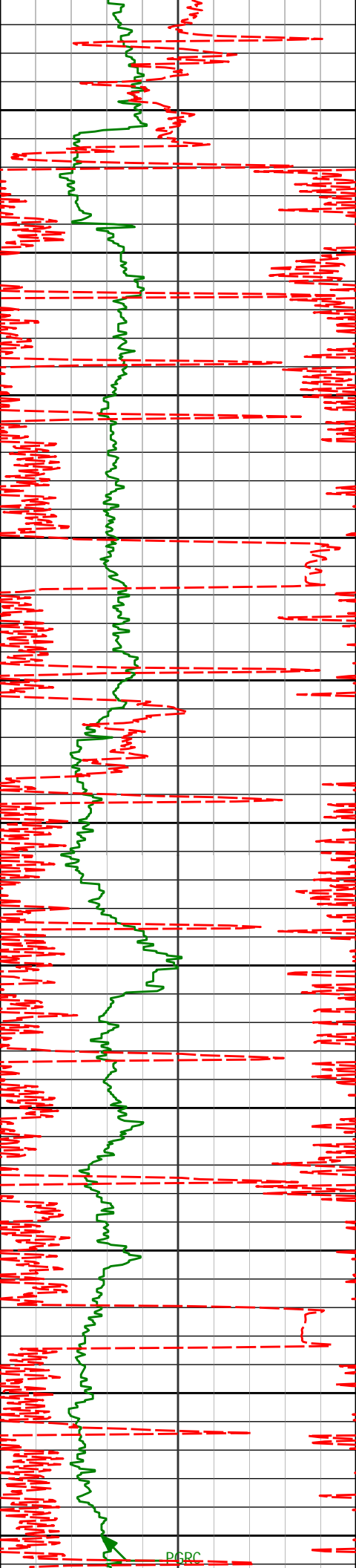
89.85°

91.03°

7025.81'

2162.41'

9050



9100

9098'

89.88°

90.46°

7026.02'

2251.09'

9150

9187'

90.52°

90.72°

7025.71'

2338.75'

9200

9250

9277'

88.77°

89.86°

7026.27'

2427.29'

9300

9350

9366'

88.46°

88.90°

7028.42'

2514.58'

9400

9450

9456'

87.97°

88.36°

7031.23'

2602.59'

9500

9550

9546'

89.97°

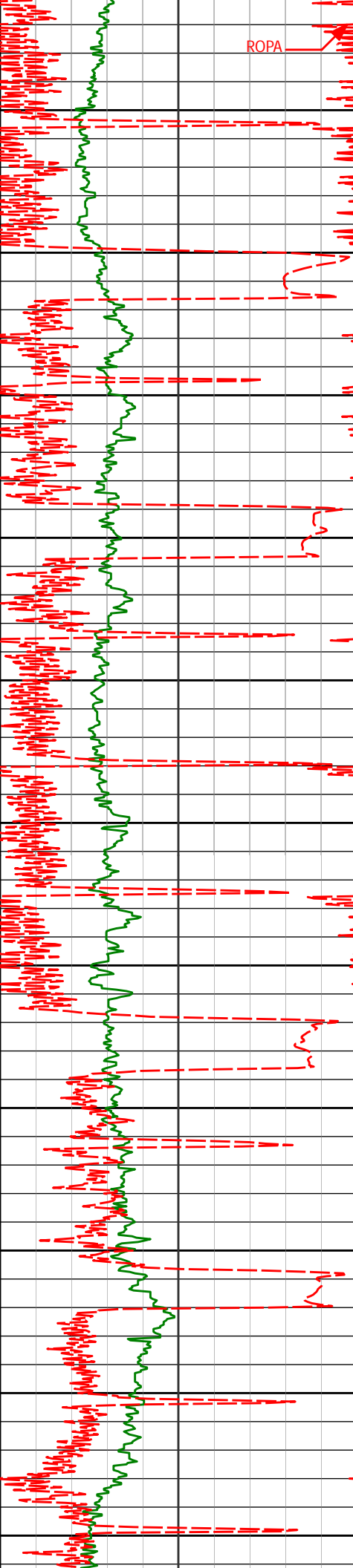
89.76°

7032.84'

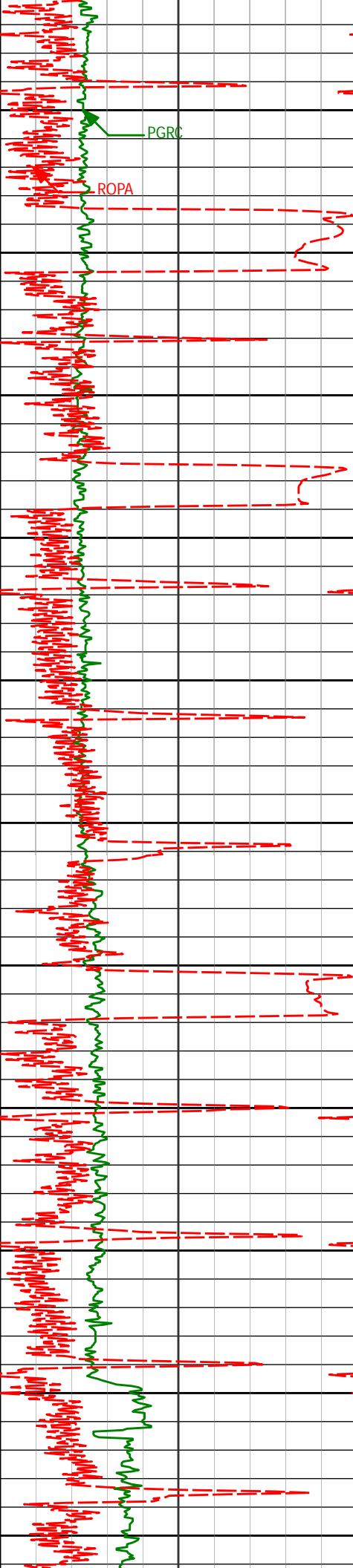
2690.75'

9600

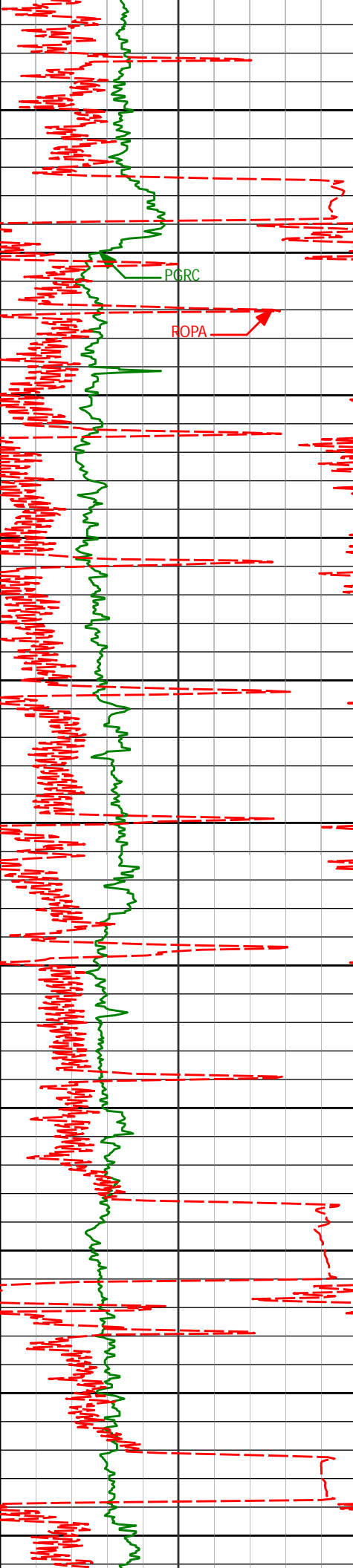
PCRC



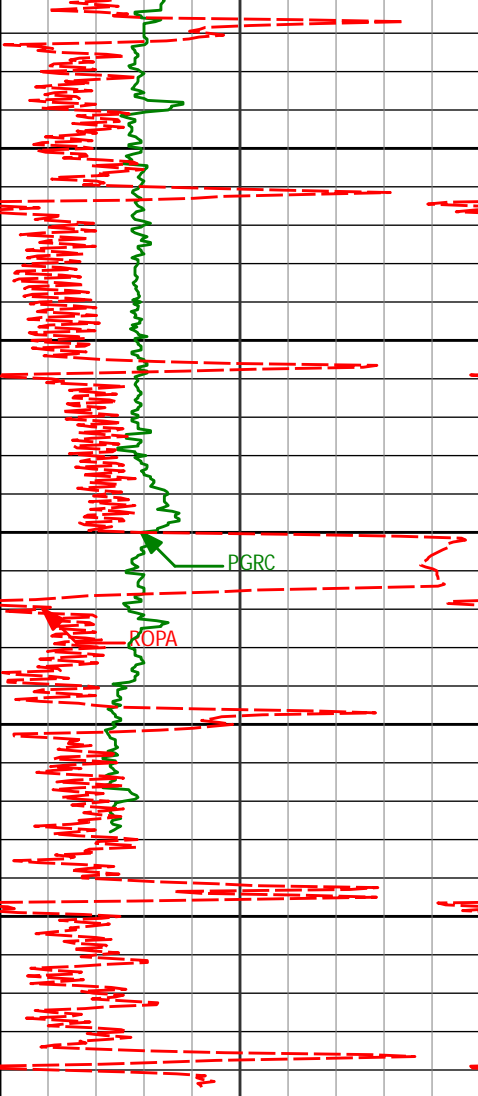
9635'	91.29°	90.21°	7031.86'	2778.23'
9650				
9700				
9725'	91.64°	89.67°	7029.56'	2866.66'
9750				
9800				
9814'	89.94°	87.85°	7028.34'	2953.76'
9850				
9900	9904'	91.33°	87.46°	7027.34'
9950				
10000	9994'	89.97°	87.88°	7026.32'
10050				
10083'	88.83°	87.55°	7027.25'	3215.96'
10100				
10150				



10173'	88.83°	85.93°	7029.09'	3303.33'
10200				
10263'	87.72°	88.47°	7031.80'	3390.84'
10300				
10352'	88.83°	90.97°	7034.48'	3478.20'
10400				
10442'	88.80°	92.15°	7036.34'	3567.07'
10500				
10531'	90.34°	91.99°	7037.01'	3655.09'
10550				
10600				
10621'	90.31°	91.42°	7036.50'	3744.01'
10650				
10700				
10710'	91.11°	90.81°	7035.39'	3831.79'



10750					
10800	10800'	89.57°	89.23°	7034.86'	3920.27'
10850					
10900	10890'	89.97°	88.31°	7035.22'	4008.36'
10950					
11000	10979'	90.19°	88.36°	7035.10'	4095.34'
11050					
11100	11069'	92.03°	88.03°	7033.35'	4183.23'
11150	11158'	90.68°	87.50°	7031.25'	4269.99'
11200					
11250	11248'	89.11°	89.59°	7031.41'	4358.01'



11300

11337'

90.52°

89.64°

7031.70'

4445.38'

11350

11400

PGRC

ROPA

11427'

90.09°

88.21°

7031.22'

4533.53'

11450

11500

11550

11481'

91.51°

87.46°

7030.47'

4586.19'

11544'

91.51°

87.46°

7028.81'

4647.53'

TD well at 11544' MD

**Avg Rate of Penetration**

ROPA

feet per hr

500

0

Depth  
ft

**Depth**

**Inc.**

**Azi.**

**TVD**

**V.S.**

**PCG Gamma Ray BCorr**

api

0

300

# HALLIBURTON

## Sperry Drilling Services

### MD Detail Log 1:240

Noble Energy  
Loeffler K1-65HN-A2  
PD 829  
1-T4N-R66W

**PCG Gamma Ray BCorr**

api

0

300

**Avg Rate of Penetration**

ROPA

feet per hr

500

0

Depth  
ft

**Depth**

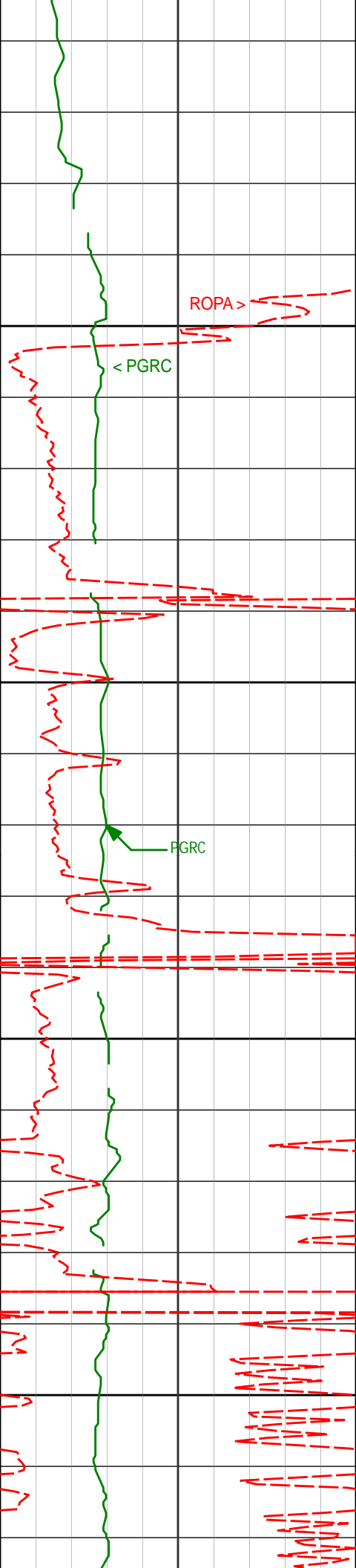
**Inc.**

**Azi.**

**TVD**

**V.S.**

600



Run 100

650

700

750

800

623'

0.40°

315.67°

622.99'

0.59'

698'

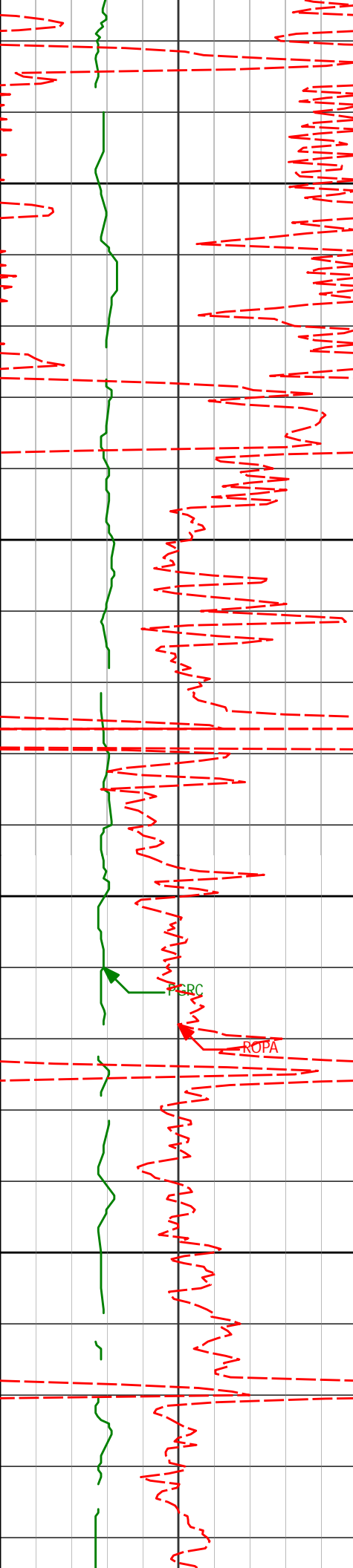
0.47°

284.63°

697.99'

0.07'





832'

0.68°

280.06°

831.98'

-1.27'

850

900

950

966'

1.28°

190.85°

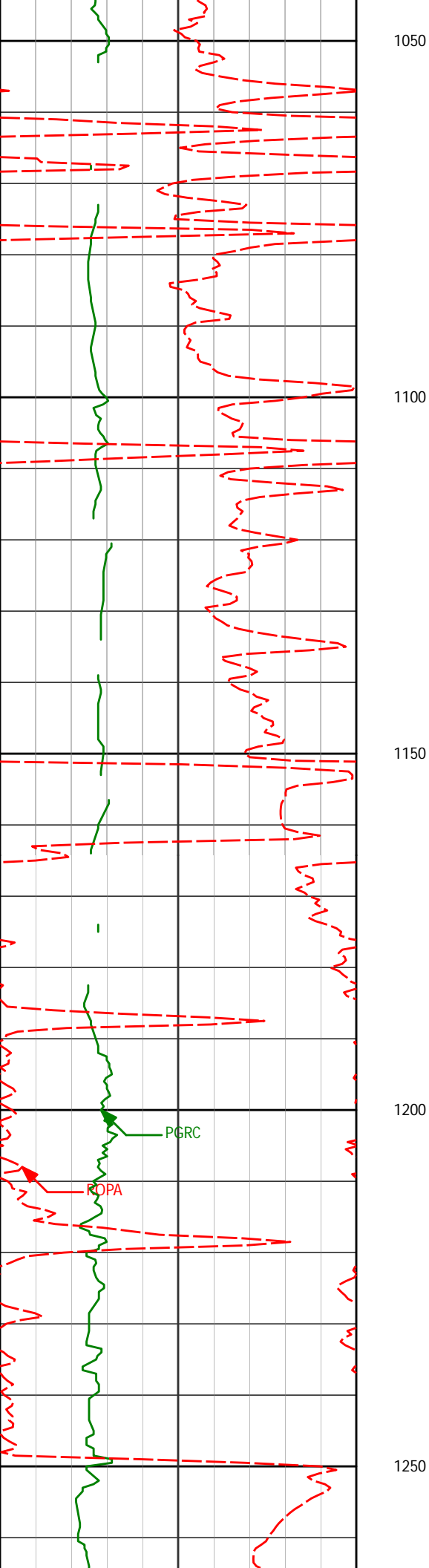
965.97'

-2.07'

1000

BC

ROPA



1101'

0.65°

185.90°

1100.95'

-2.02'

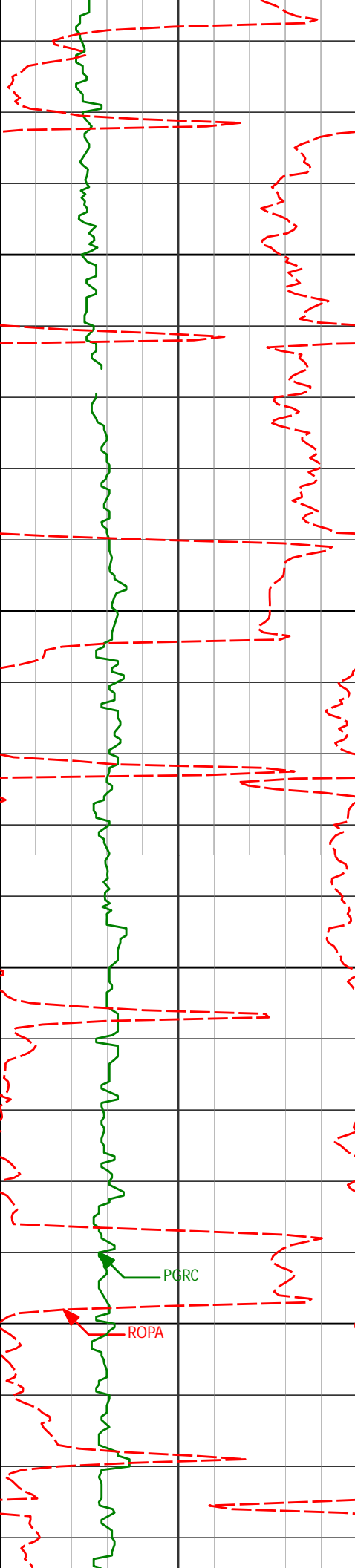
1198'

1.63°

185.92°

1197.93'

-1.86'



1292'	3.59°	199.94°	1291.83'	-2.23'
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1300

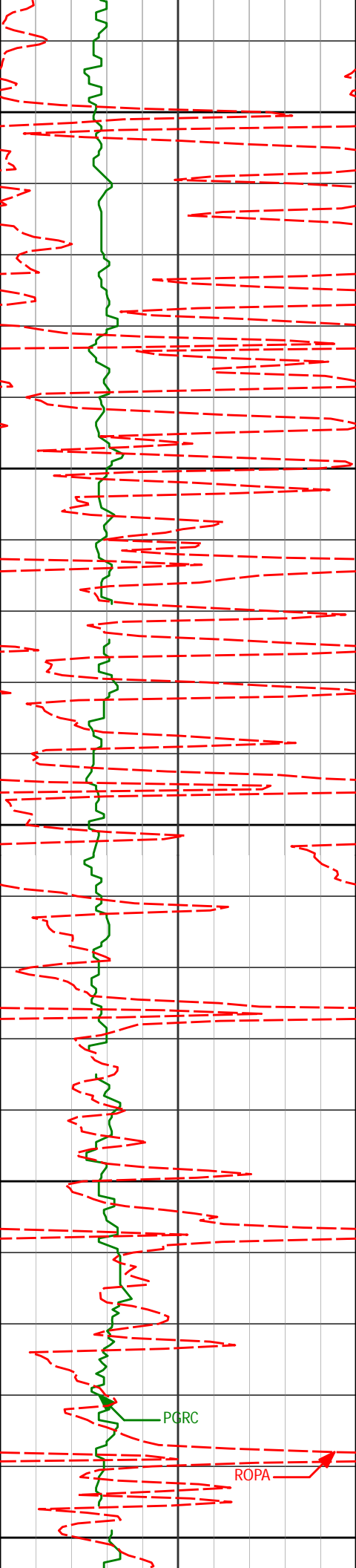
1350

1386'	6.51°	198.06°	1385.45'	-3.41'
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1400

1450

1481'	7.08°	198.47°	1479.79'	-4.91'
-------	-------	---------	----------	--------



1500

1550

1575'

7.68°

191.75°

1573.01'

-5.84'

1600

1650

1669'

6.89°

182.55°

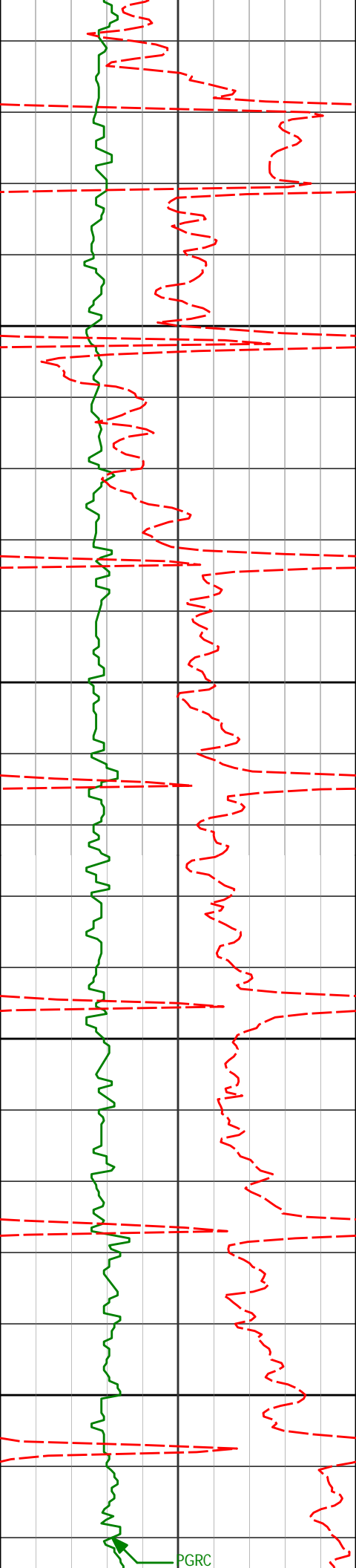
1666.25'

-5.18'

1700

PGRC

ROPA



1750

1800

1850

1900

1763'

8.03°

190.89°

1759.46'

-4.43'

1857'

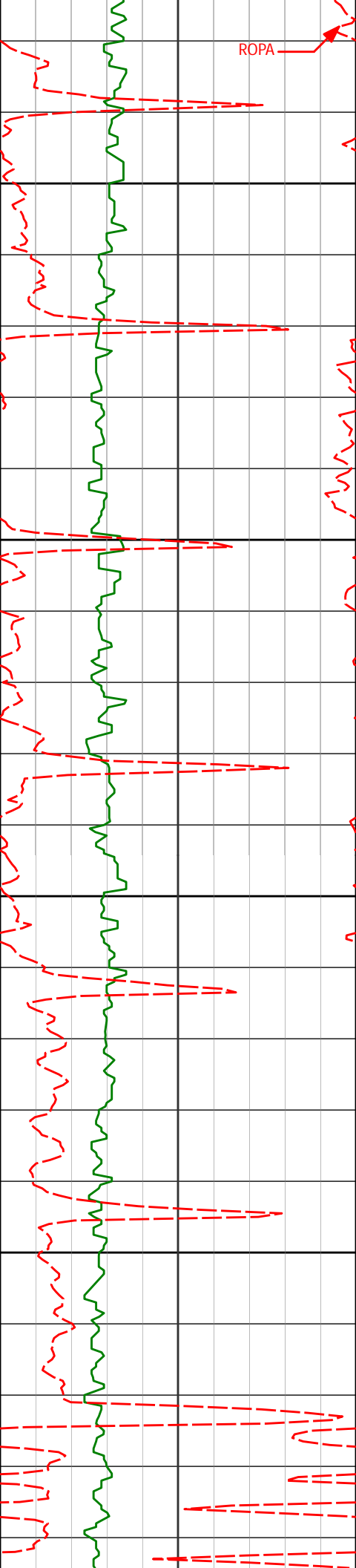
7.22°

196.98°

1852.63'

-5.13'

PGRC



1950

1952'

7.96°

198.56°

1946.79'

-6.71'

2000

2050

2046'

6.46°

197.62°

2040.05'

-8.26'

2100

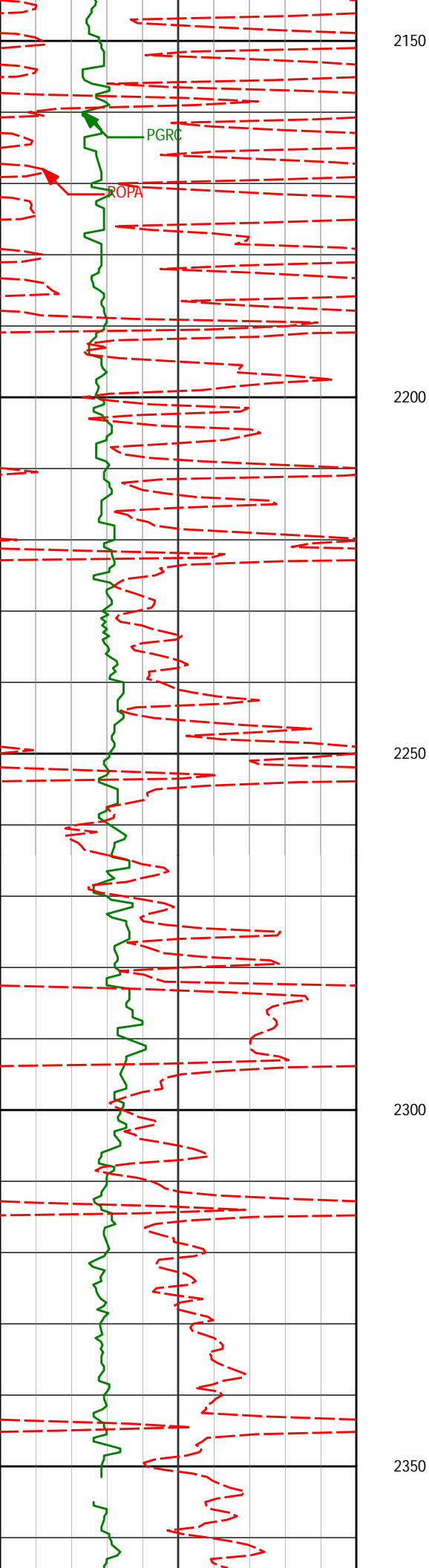
2140'

7.27°

202.71°

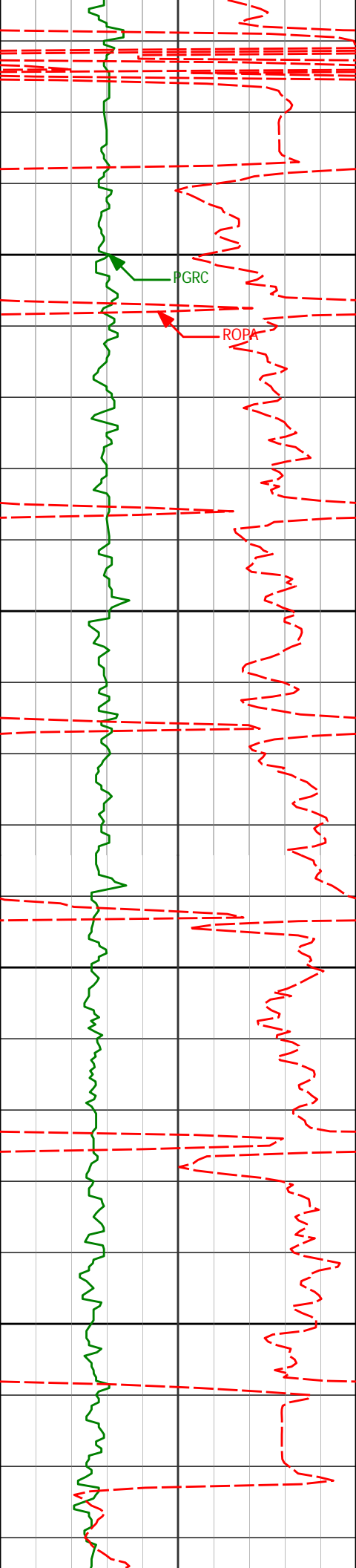
2133.37'

-10.16'



2234'	4.73°	191.91°	2226.85'	-11.50'
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2326'	5.01°	192.46°	2318.52'	-11.72'
-------	-------	---------	----------	---------



2400

2418'

6.79°

199.19°

2410.03'

-12.67'

2450

2500

2512'

6.19°

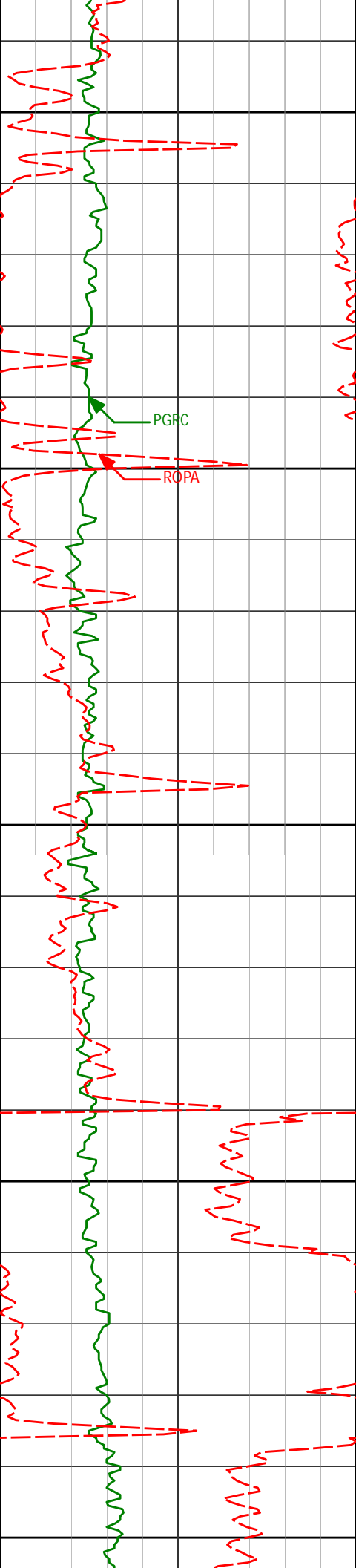
192.29°

2503.43'

-13.66'

2550





2600

2601'

7.80°

190.19°

2591.77'

-13.76'

2650

2691'

9.08°

190.21°

2680.79'

-13.68'

2700

2750

2781'

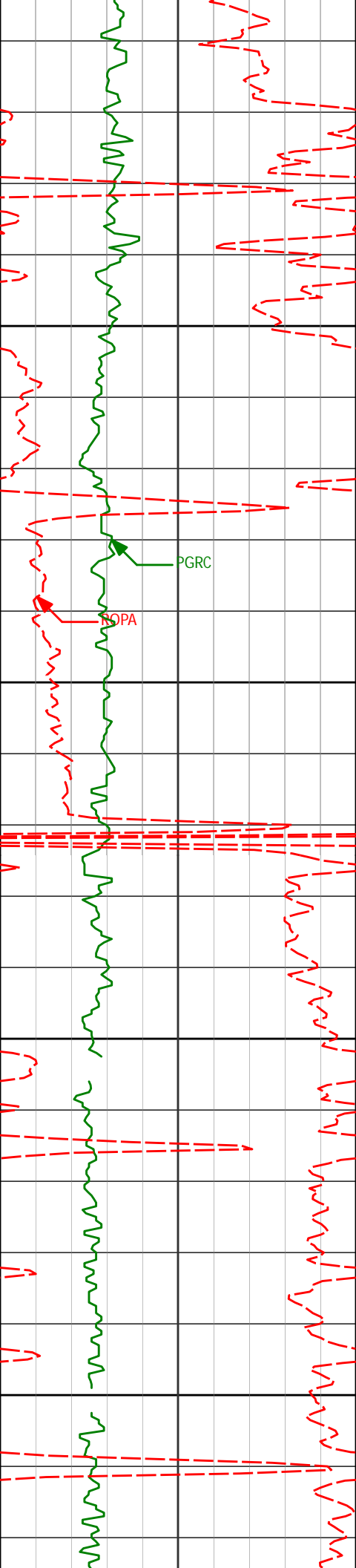
10.26°

192.47°

2769.51'

-13.90'

2800



2850

2870'

8.72°

194.41°

2857.29'

-14.61'

2900

2950

2960'

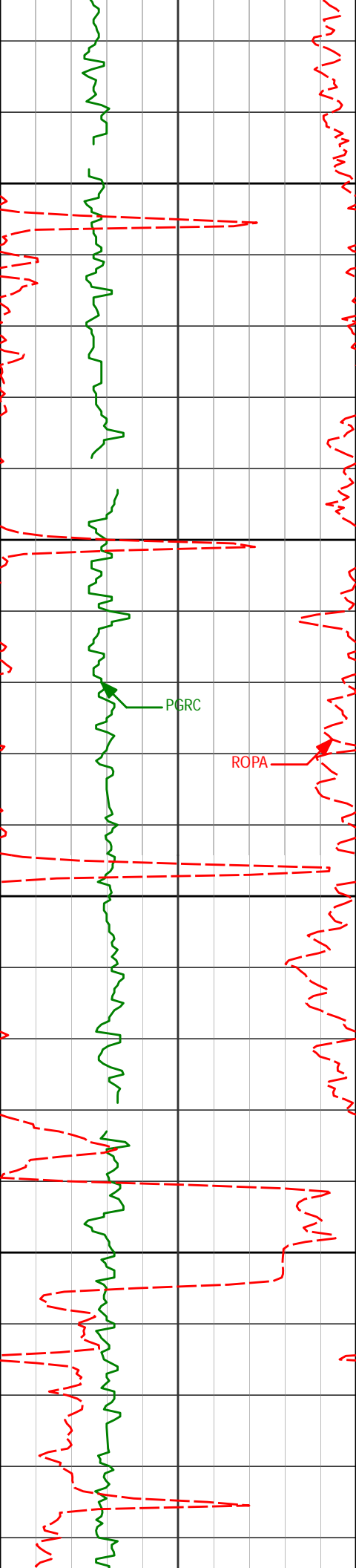
8.96°

192.78°

2946.22'

-15.34'

3000



3050

3050'

7.75°

202.45°

3035.27'

-16.86'

3100

3139'

6.38°

184.82°

3123.60'

-17.60'

3150

3200

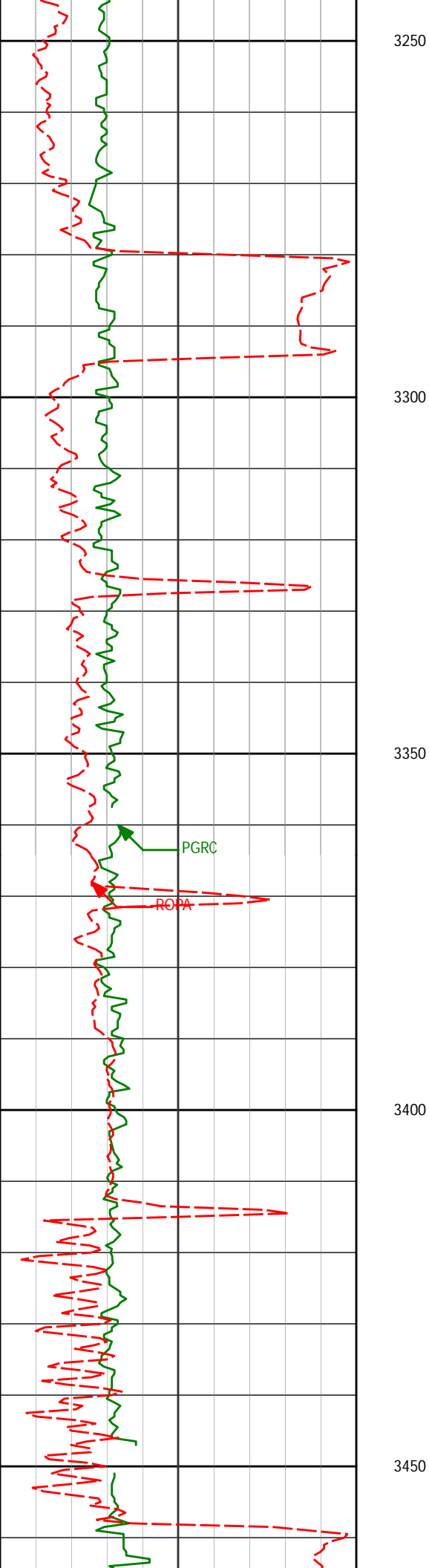
3229'

6.69°

183.89°

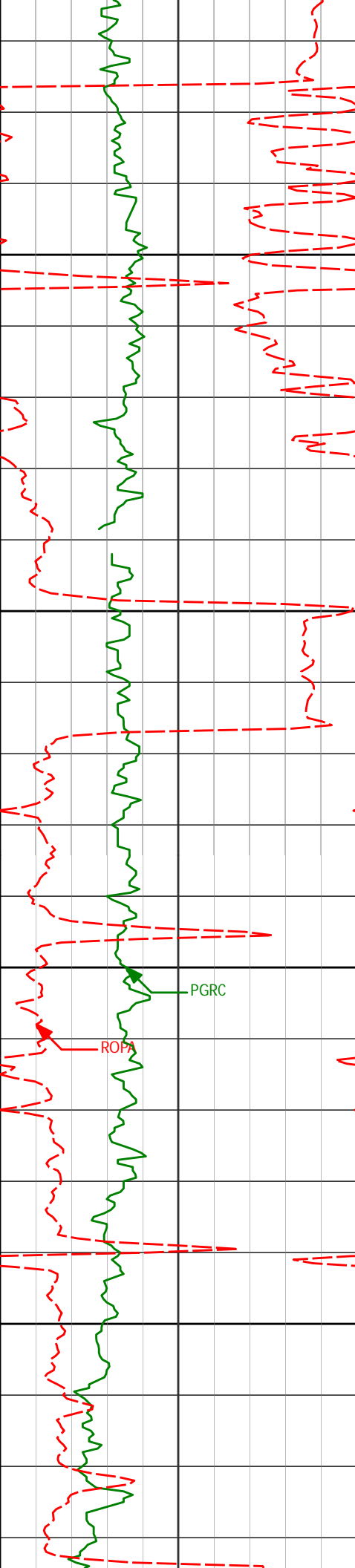
3213.02'

-16.49'



3318'      8.46°      194.53°      3301.24'      -16.34'

3408'      6.57°      188.18°      3390.46'      -16.58'



3500

3550

3600

3650

3498'

7.81°

198.82°

3479.76'

-17.24'

3587'

9.63°

198.22°

3567.73'

-19.10'

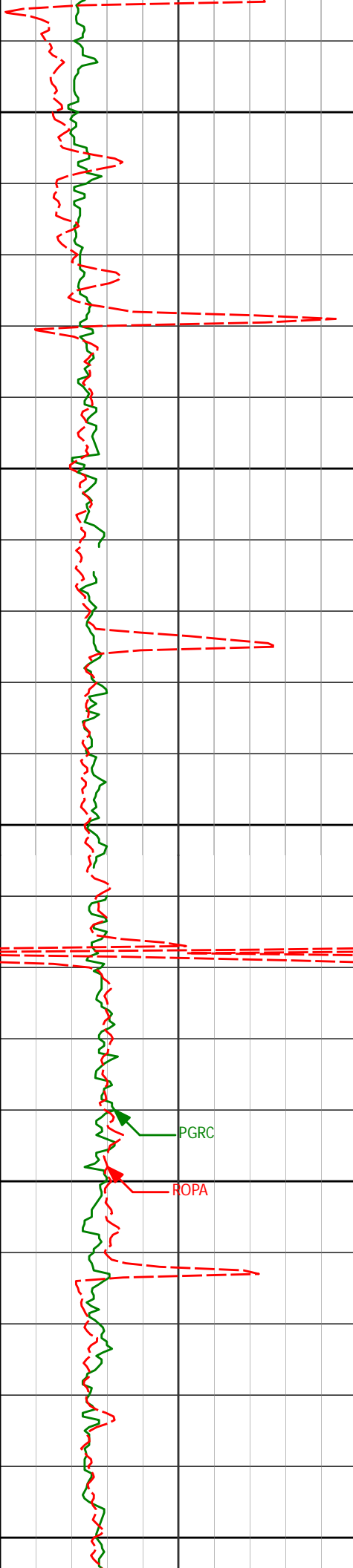
3677'

8.36°

192.06°

3656.62'

-20.27'



3700

3750

3800

3850

3900

3767'

9.53°

192.19°

3745.52'

-20.65'

3857'

9.91°

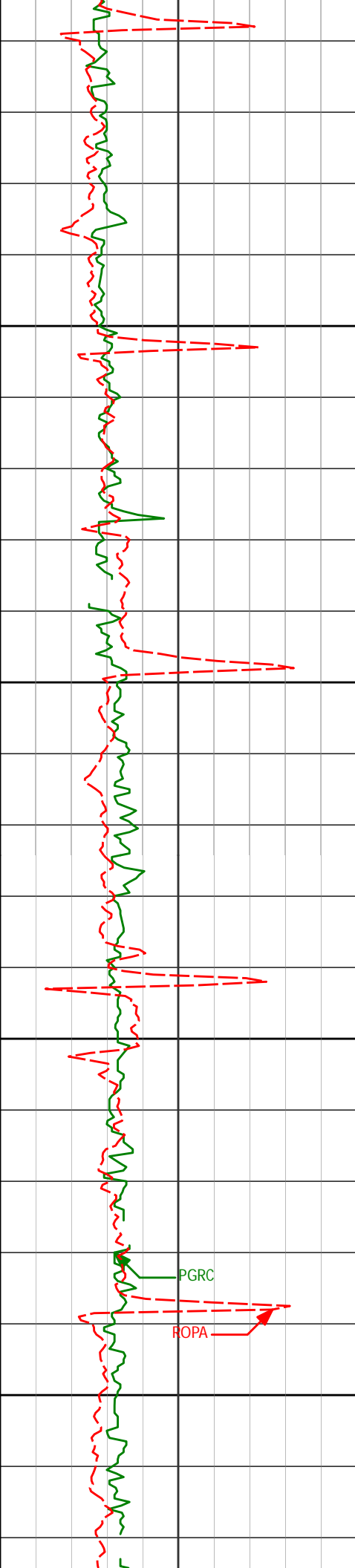
190.94°

3834.23'

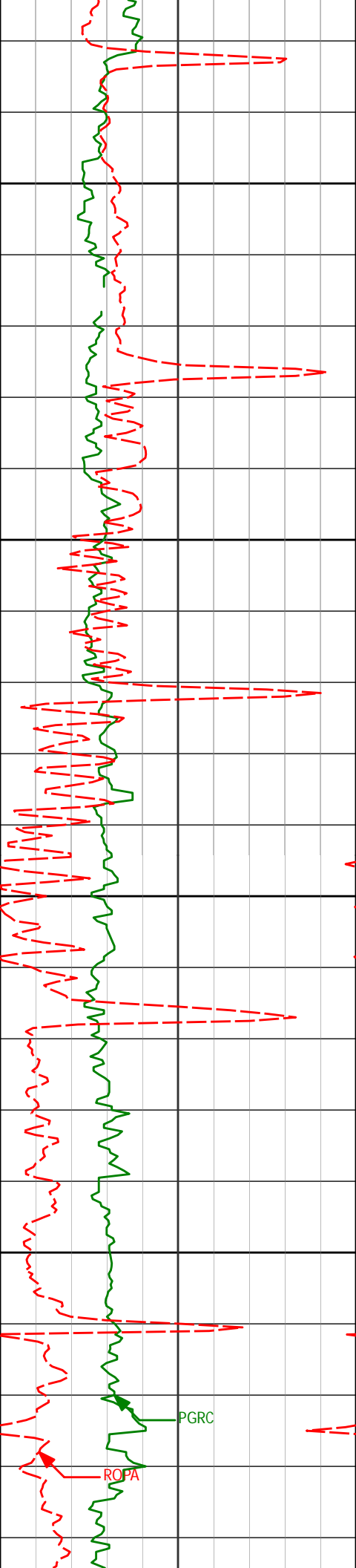
-20.91'

PGRC

ROPA



3946'	9.11°	189.76°	3922.01'	-20.86'
3950				
4000				
4036'	9.08°	197.21°	4010.88'	-21.58'
4050				
4100				



4150

4200

4250

4300

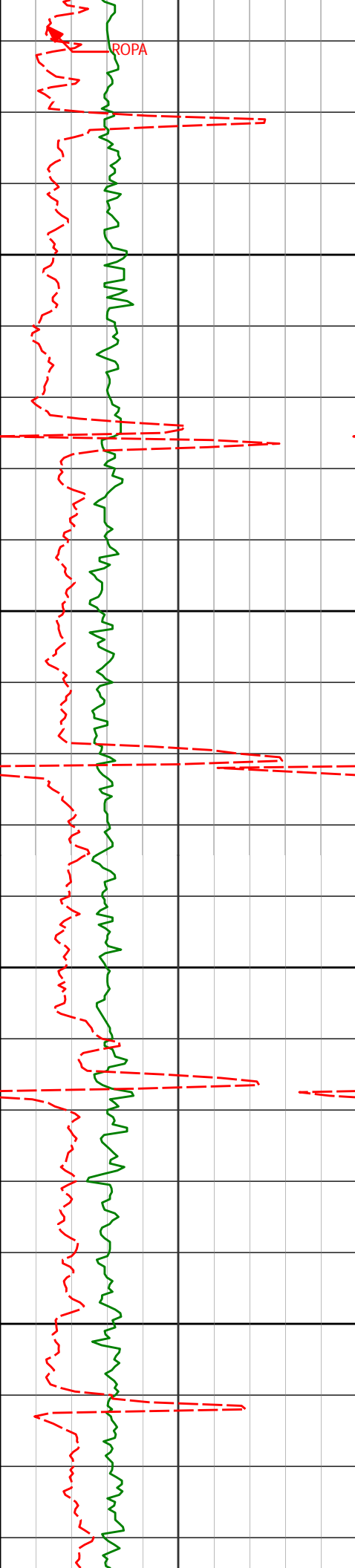
4125'	7.04°	187.63°	4099.00'	-22.12'
4215'	7.91°	197.35°	4188.24'	-22.57'
4304'	6.04°	185.67°	4276.58'	-22.89'

PGRC

ROFA







4573'

9.09°

197.39°

4543.59'

-25.87'

4600

4650

4663'

8.21°

198.89°

4632.56'

-27.64'

4700

4750

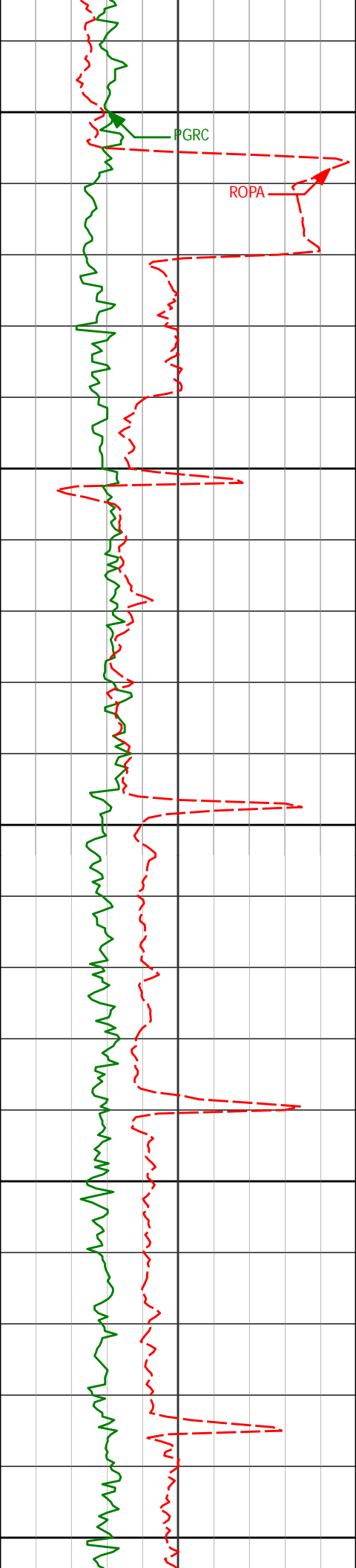
4752'

7.30°

199.01°

4720.75'

-29.39'



4800

PGRC

ROPA

4850

4900

4950

5000

4842'

8.50°

198.81°

4809.89'

-31.18'

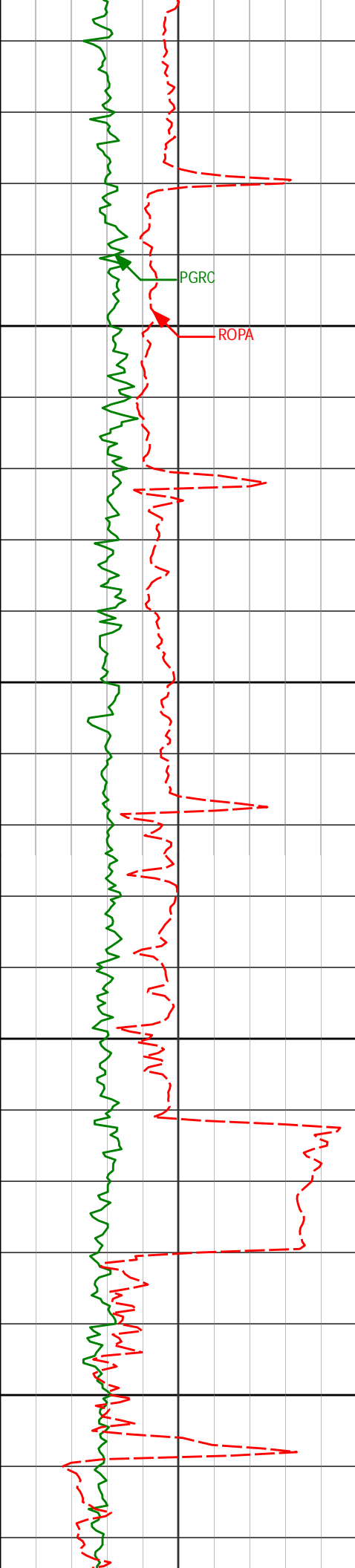
4932'

8.10°

191.38°

4898.95'

-32.23'



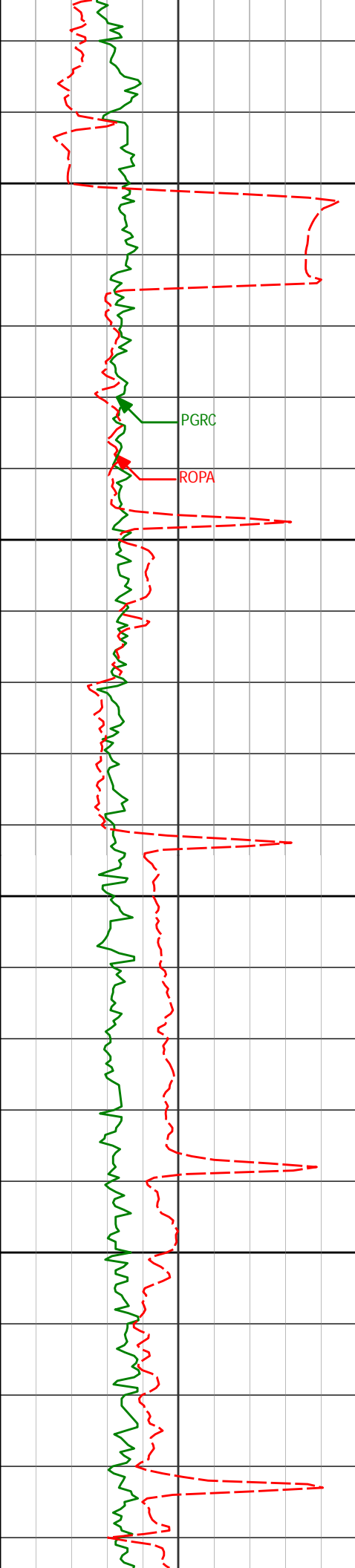
5050

5100

5150

5200

5021'	7.86°	191.88°	4987.09'	-32.45'
5111'	6.47°	196.65°	5076.38'	-33.13'
5201'	7.91°	191.06°	5165.68'	-33.72'



5250

5290'

9.44°

189.24°

5253.65'

-33.61'

5300

5350

5380'

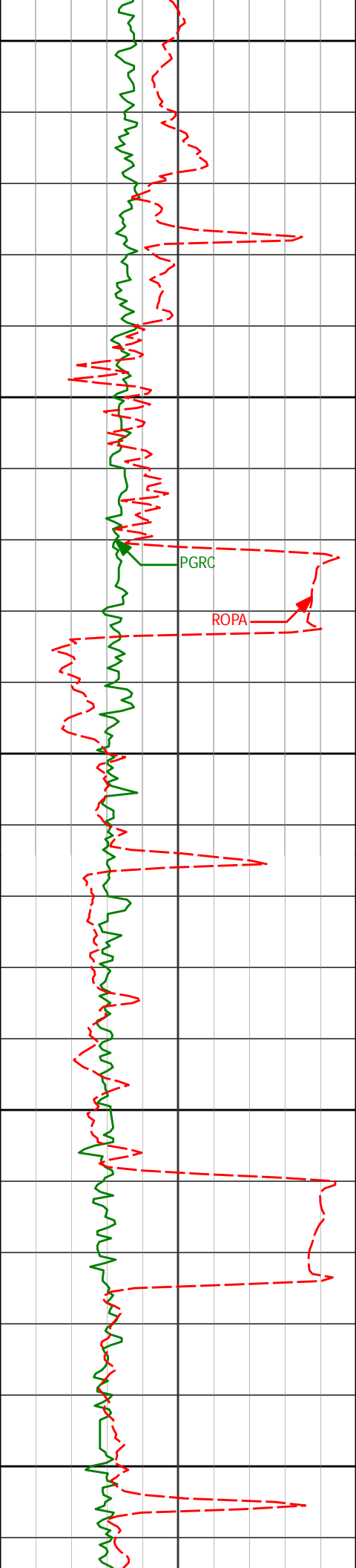
8.20°

191.97°

5342.59'

-33.59'

5400



5450

5469'

6.29°

194.47°

5430.87'

-34.08'

5500

PGRC

ROPA

5550

5559'

7.18°

185.53°

5520.25'

-33.92'

5600

5650

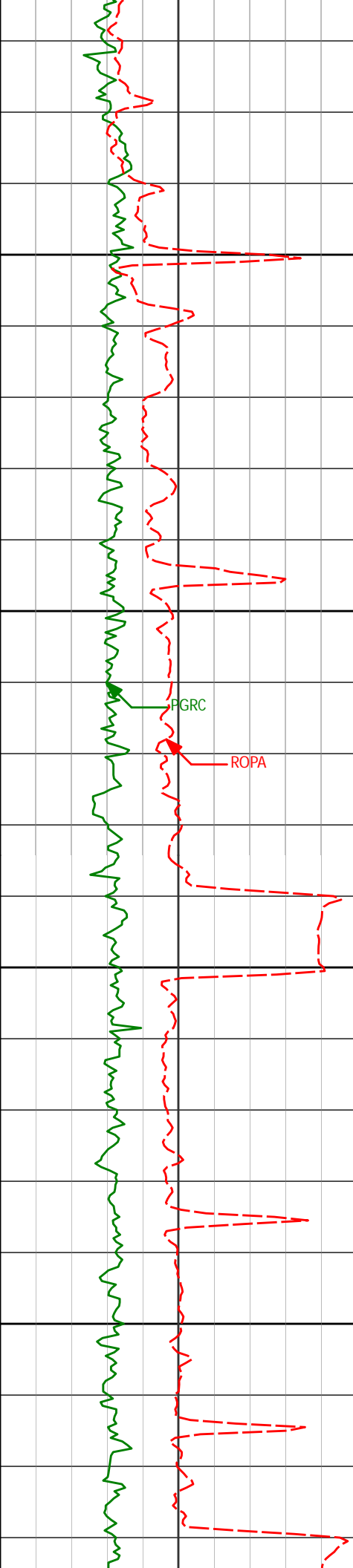
5649'

8.70°

188.06°

5609.39'

-33.13'



5700

5738'

7.44°

187.85°

5697.51'

-32.56'

5750

5800

5828'

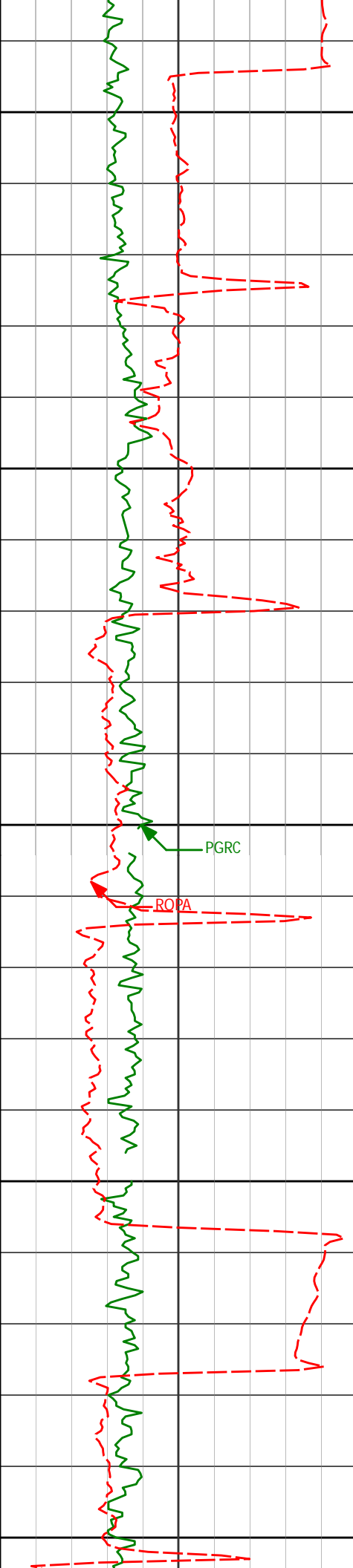
7.48°

184.53°

5786.75'

-31.67'

5850



5900

5917'

8.79°

186.82°

5874.85'

-30.61'

5950

6000

6007'

7.20°

185.05°

5963.97'

-29.62'

6050

6100

6097'

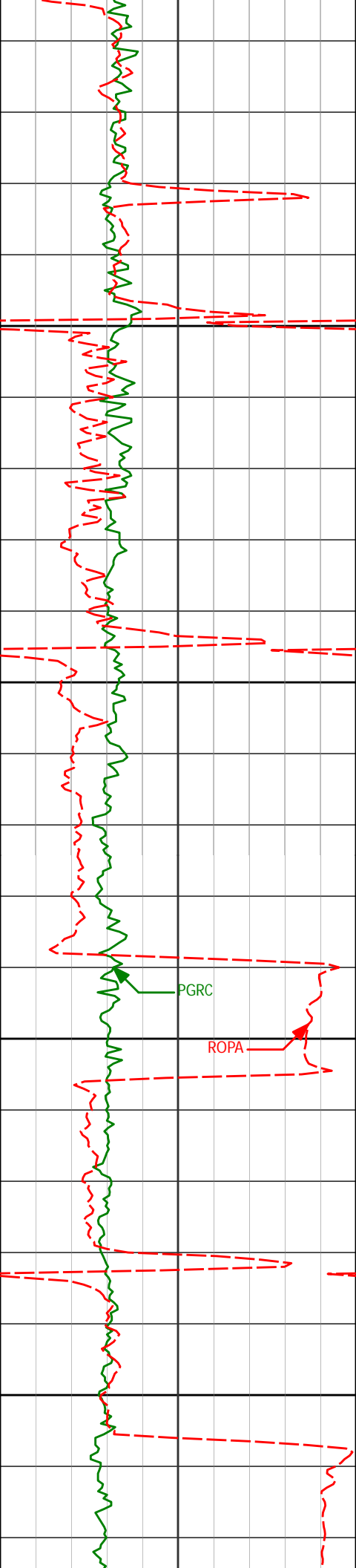
8.54°

191.10°

6053.12'

-29.14'





6150

6186'

6.82°

187.63°

6141.32'

-28.93'

6200

6250

6276'

7.48°

193.65°

6230.62'

-28.97'

6300

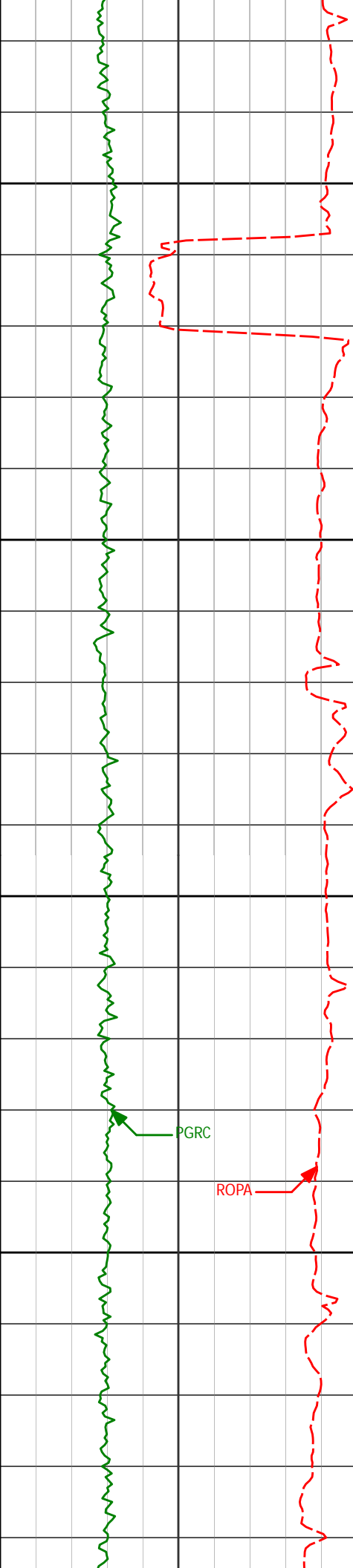
6321'

8.97°

185.25°

6275.16'

-28.80'



6350

6366'

11.95°

183.22°

6319.41'

-27.88'

6400

6411'

14.98°

181.85°

6363.17'

-26.40'

6450

6455'

18.11°

180.68°

6405.34'

-24.36'

PGRC

ROPA

6500

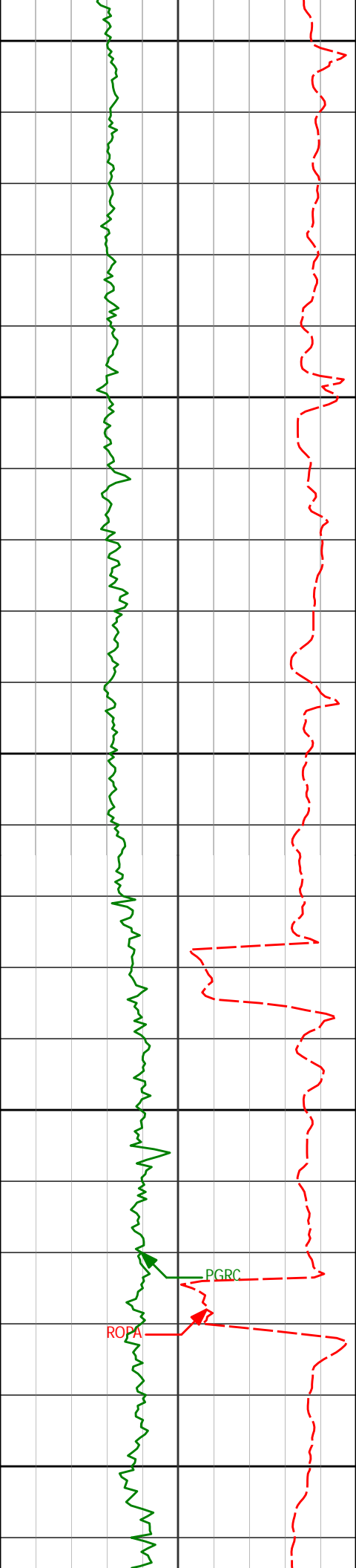
6500'

19.83°

168.13°

6447.91'

-20.25'



6550

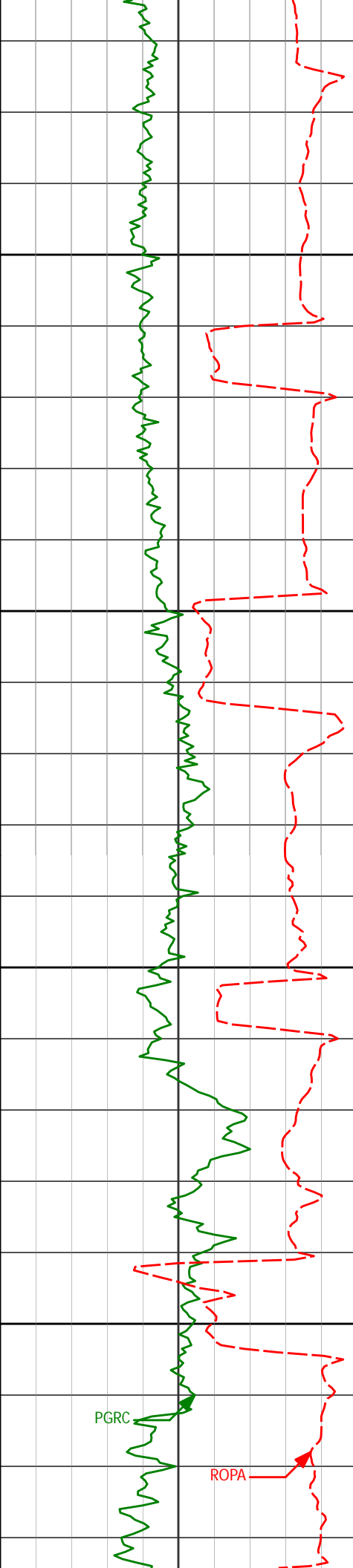
6600

6650

6700

6750

6545'	21.21°	158.07°	6490.07'	-12.96'
6590'	24.75°	150.83°	6531.50'	-2.56'
6635'	27.32°	142.67°	6571.94'	11.13'
6679'	29.16°	133.86°	6610.72'	27.60'
6724'	32.38°	130.75°	6649.38'	47.18'



6800

6850

6900

6950

6769'

36.71°

124.93°

6686.45'

69.87'

6814'

40.73°

122.56°

6721.55'

95.75'

6859'

43.63°

119.06°

6754.90'

124.09'

6903'

45.31°

113.10°

6786.31'

153.77'

6948'

48.12°

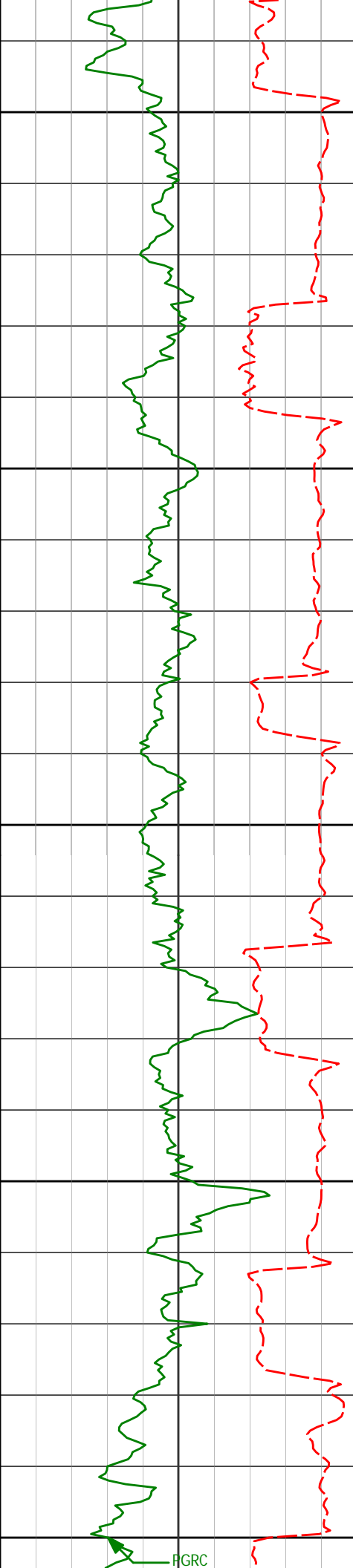
107.99°

6817.17'

186.02'

PGRC

ROPA



7000

7050

7100

7150

7200

6993'

49.70°

103.83°

6846.76'

219.77'

7038'

52.27°

99.26°

6875.09'

254.71'

7083'

56.65°

97.99°

6901.24'

291.30'

7127'

60.77°

96.86°

6924.09'

328.83'

7172'

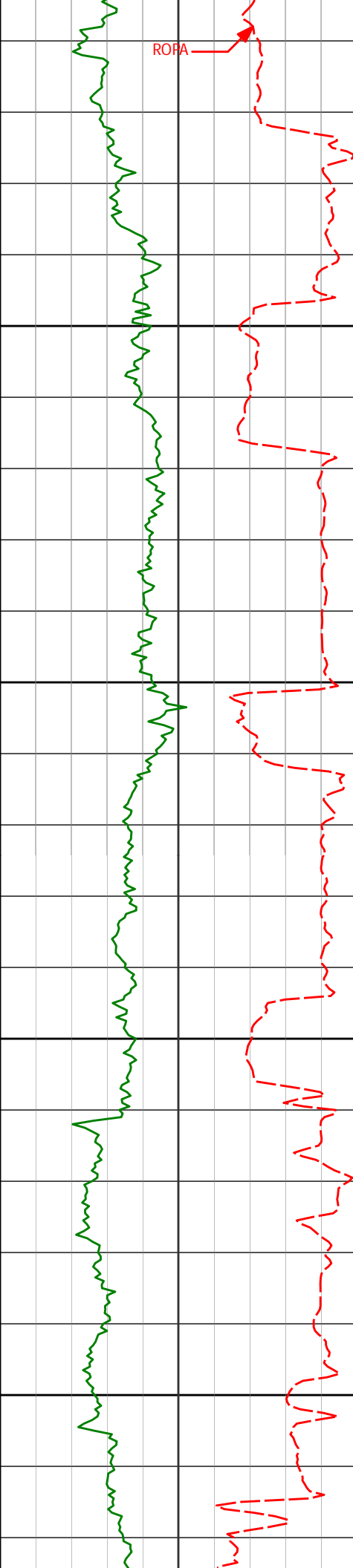
64.79°

95.40°

6944.67'

368.72'

FGRC



7217'      67.49°      94.90°      6962.87'      409.68'

7250

7262'      70.39°      93.99°      6979.04'      451.43'

7300

7307'      74.93°      92.41°      6992.45'      494.02'

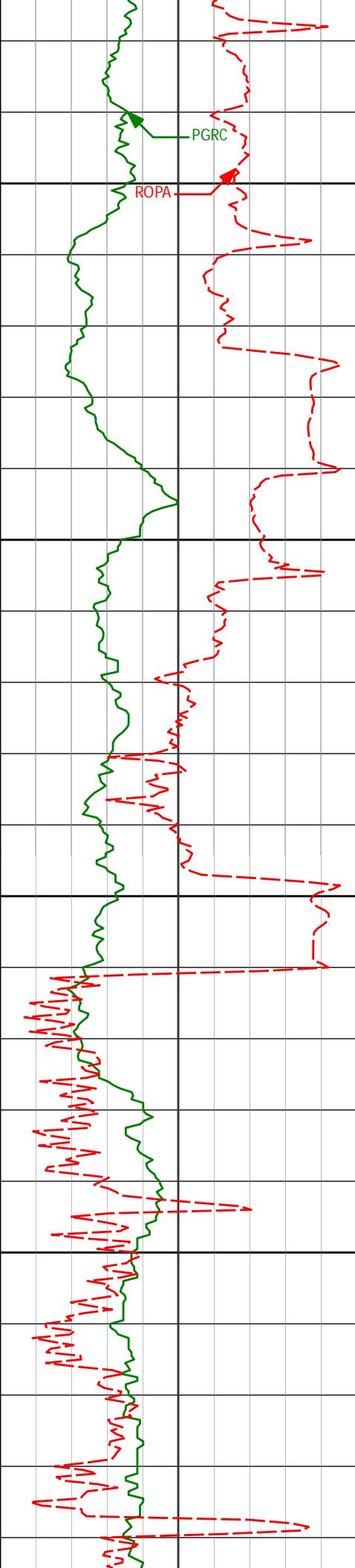
7350

7364'      80.68°      91.74°      7004.49'      549.10'

7400

Casing shoe at 7404' MD

Run 200



7450

7484'

84.63°

91.13°

7019.83'

666.58'

7500

7550

7574'

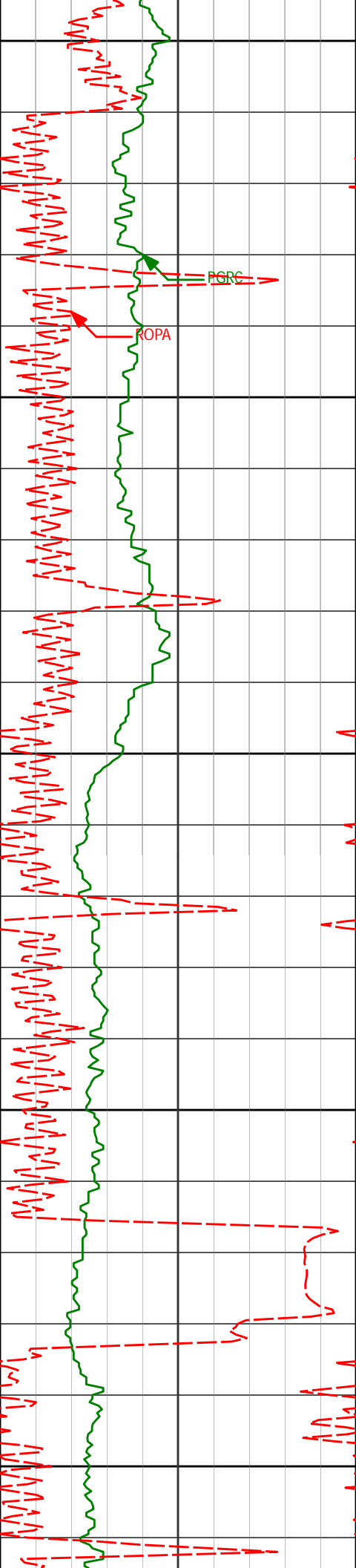
86.86°

91.47°

7026.50'

755.15'

7600



7650

7663'

87.53°

91.09°

7030.86'

842.88'

7700

7750

7753'

87.63°

91.12°

7034.66'

931.57'

7800

7850

7842'

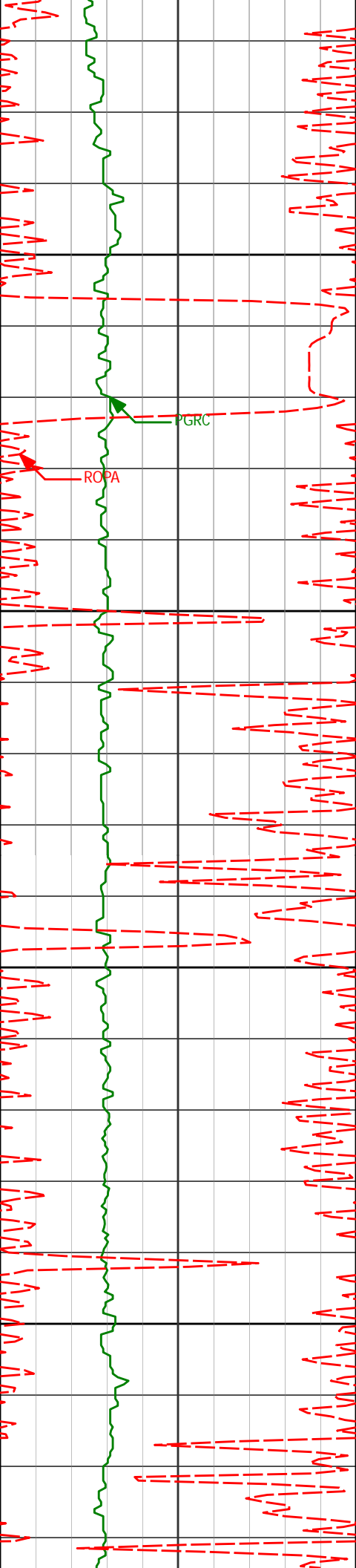
88.67°

89.58°

7037.53'

1019.11'





7900

7950

8000

8050

7932'

90.40°

88.77°

7038.26'

1107.33'

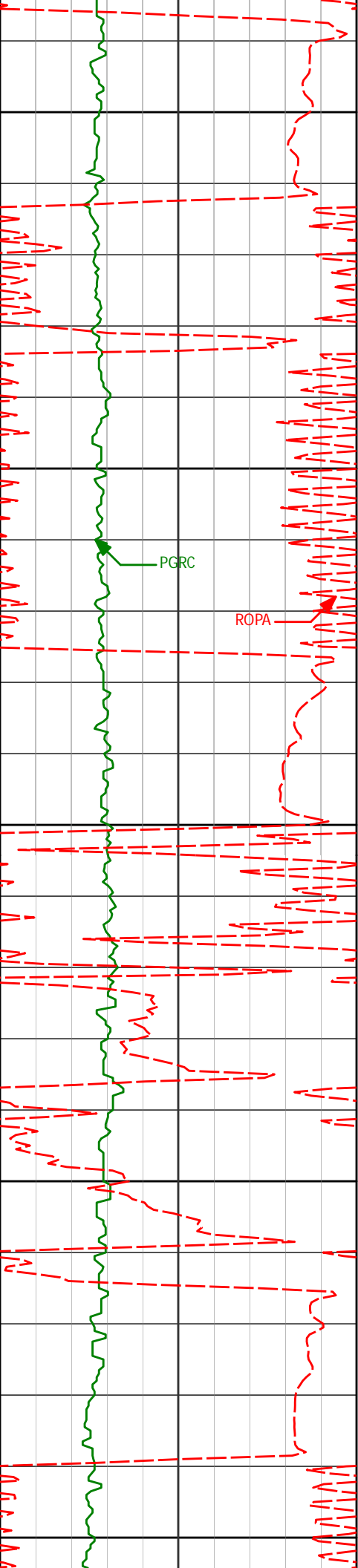
8022'

90.65°

84.50°

7037.44'

1194.66'



8100

8111'

90.06°

86.10°

7036.89'

1280.51'

8150

PGRC

ROPA

8200

8201'

90.00°

87.21°

7036.84'

1367.87'

8250

8291'

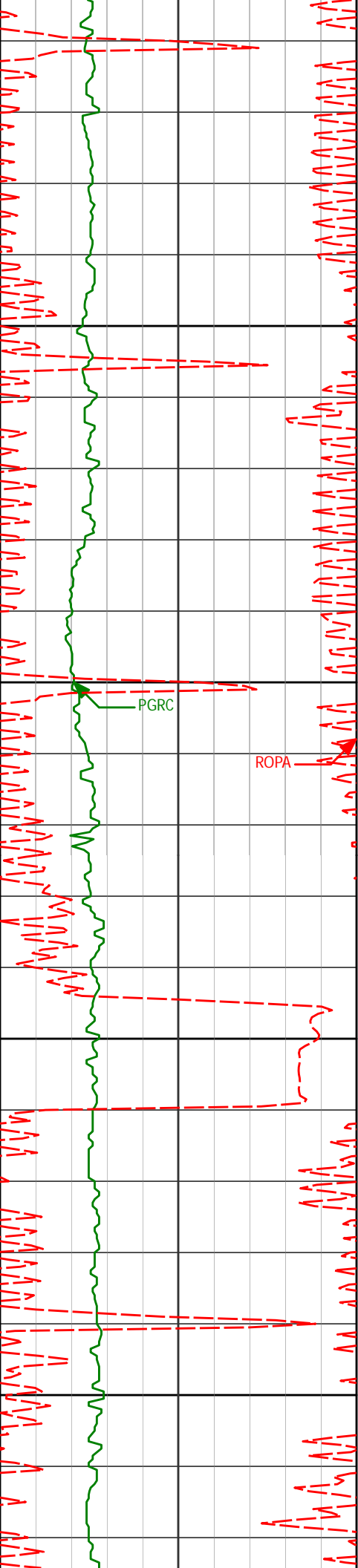
90.68°

90.48°

7036.30'

1455.98'

8300



8350

8380'

91.79°

91.42°

7034.39'

1543.70'

8400

PGRC

ROPA

8450

8470'

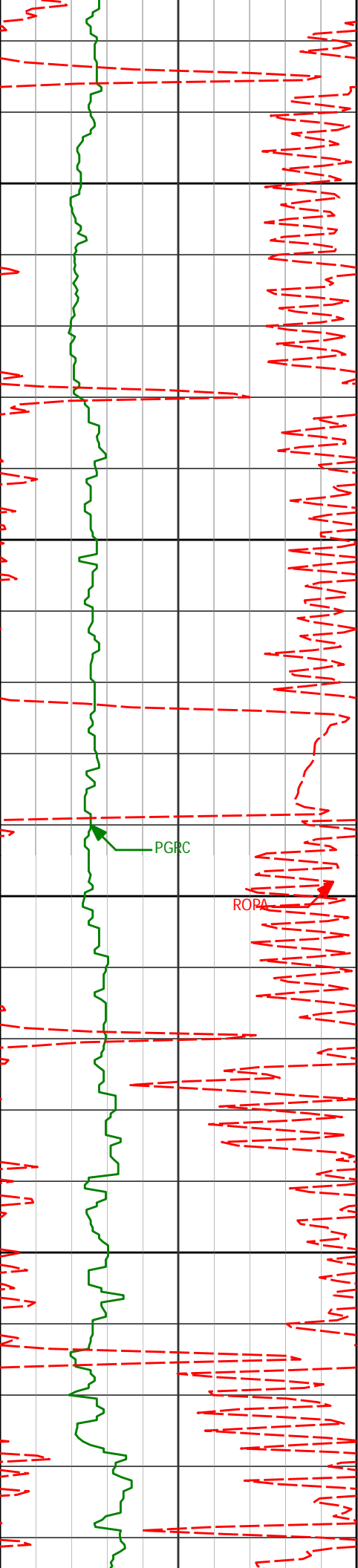
90.55°

90.90°

7032.55'

1632.47'

8500



8550

8560'

91.23°

89.55°

7031.15'

1720.99'

8600

8650

8649'

90.25°

90.44°

7030.00'

1808.47'

8700

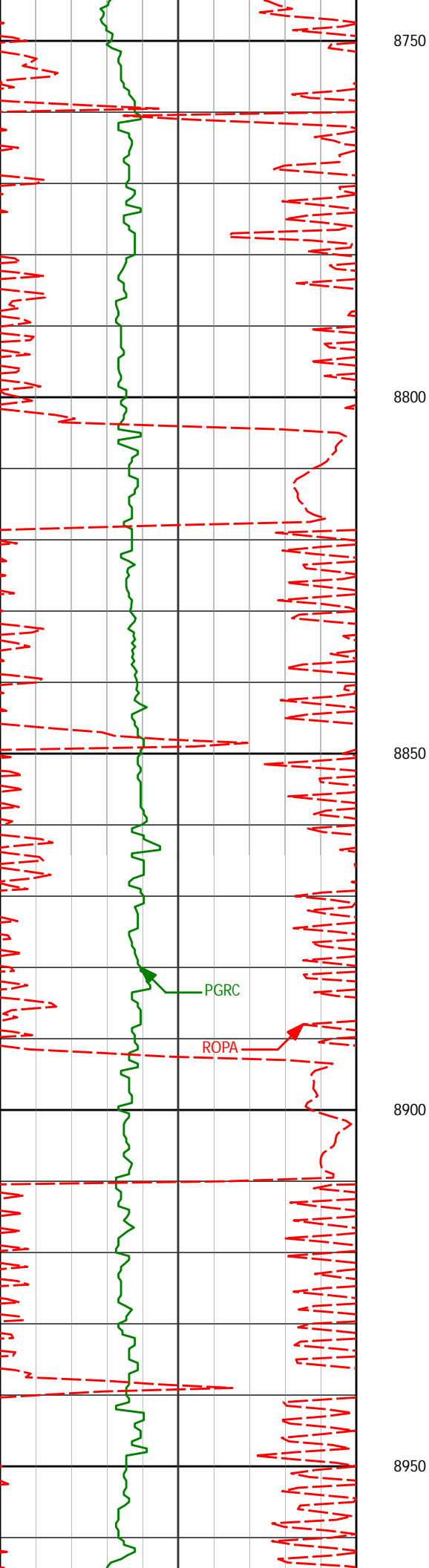
8739'

92.10°

91.58°

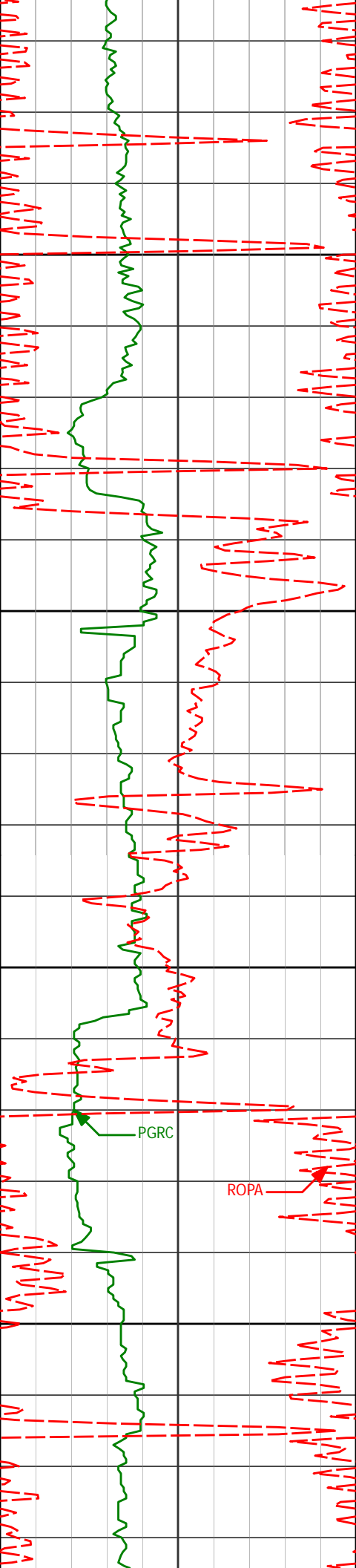
7028.16'

1897.20'



8829'	91.14°	90.78°	7025.61'	1985.96'
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8918'	89.38°	90.92°	7025.21'	2073.67'
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9000

9050

9100

9150

9008'

89.85°

91.03°

7025.81'

2162.41'

9098'

89.88°

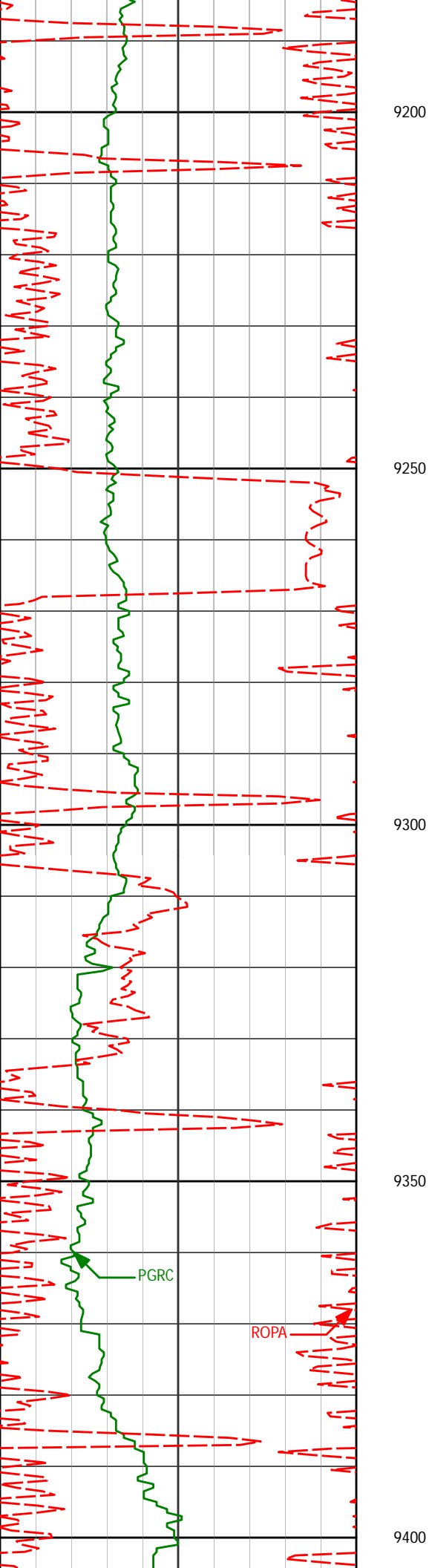
90.46°

7026.02'

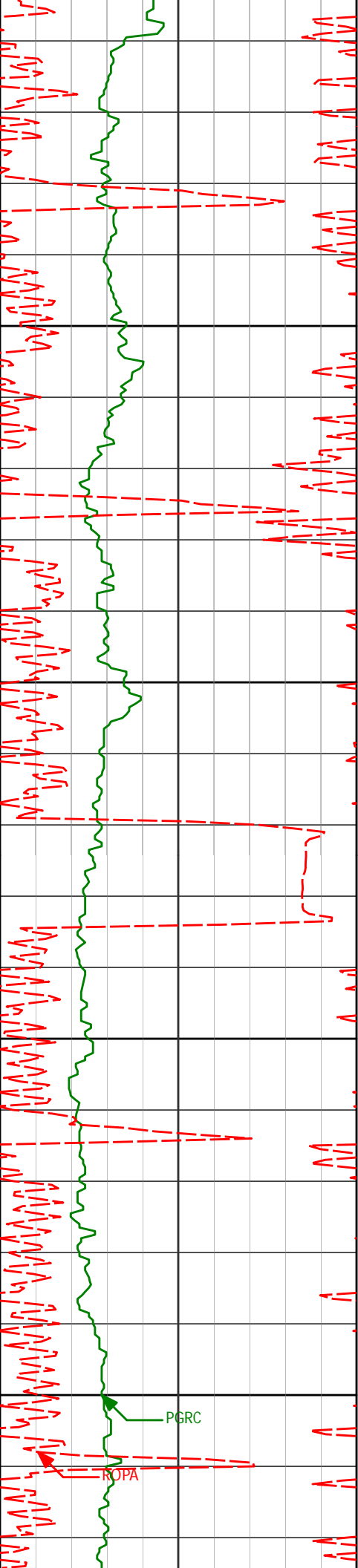
2251.09'

PGRC

ROPA



9187'	90.52°	90.72°	7025.71'	2338.75'
9200				
9250				
9277'	88.77°	89.86°	7026.27'	2427.29'
9300				
9350				
9366'	88.46°	88.90°	7028.42'	2514.58'



9450

9456'

87.97°

88.36°

7031.23'

2602.59'

9500

9550

9546'

89.97°

89.76°

7032.84'

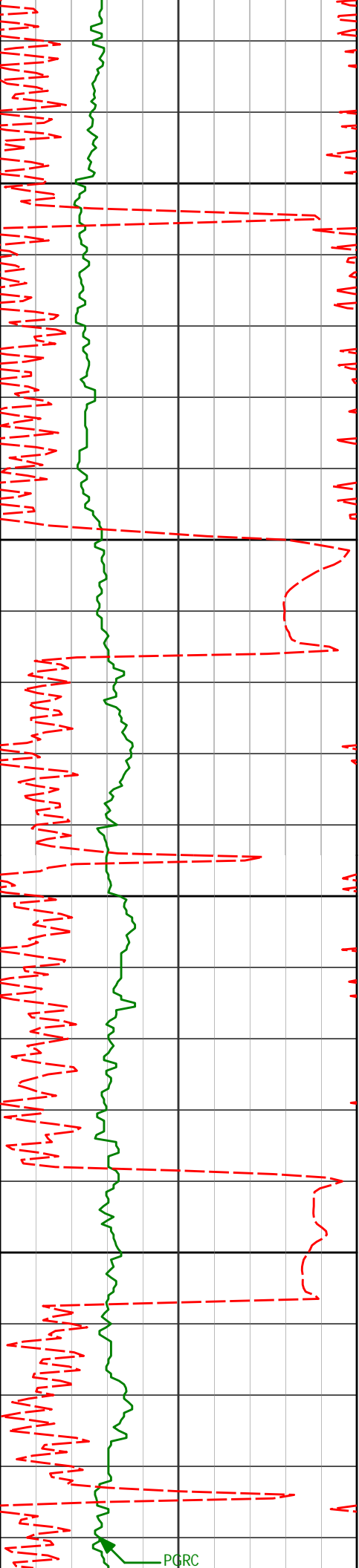
2690.75'

9600

PGRC

ROPA





9635'

91.29°

90.21°

7031.86'

2778.23'

9650

9700

9725'

91.64°

89.67°

7029.56'

2866.66'

9750

9800

9814'

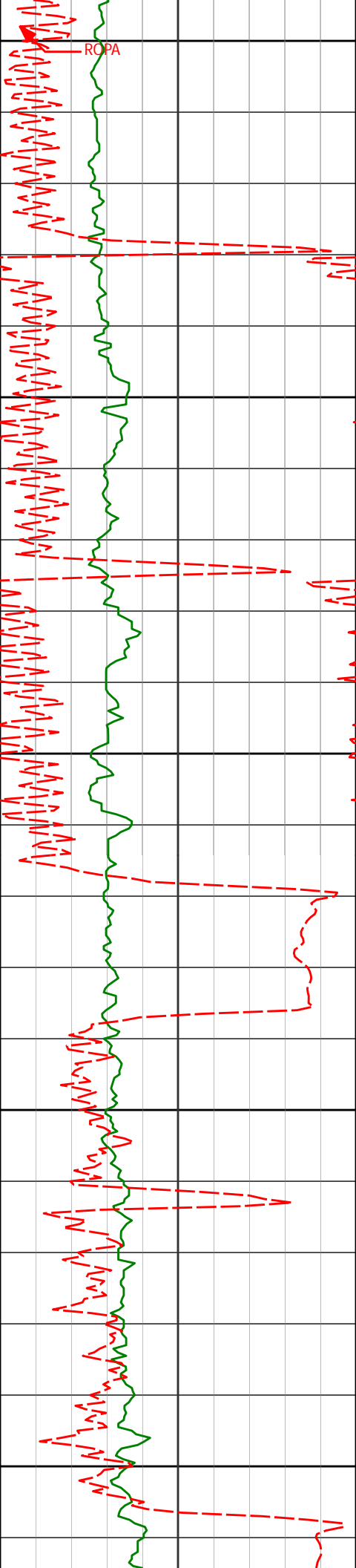
89.94°

87.85°

7028.34'

2953.76'

PGRC



9850

9900

9950

10000

10050

9904'

91.33°

87.46°

7027.34'

3041.48'

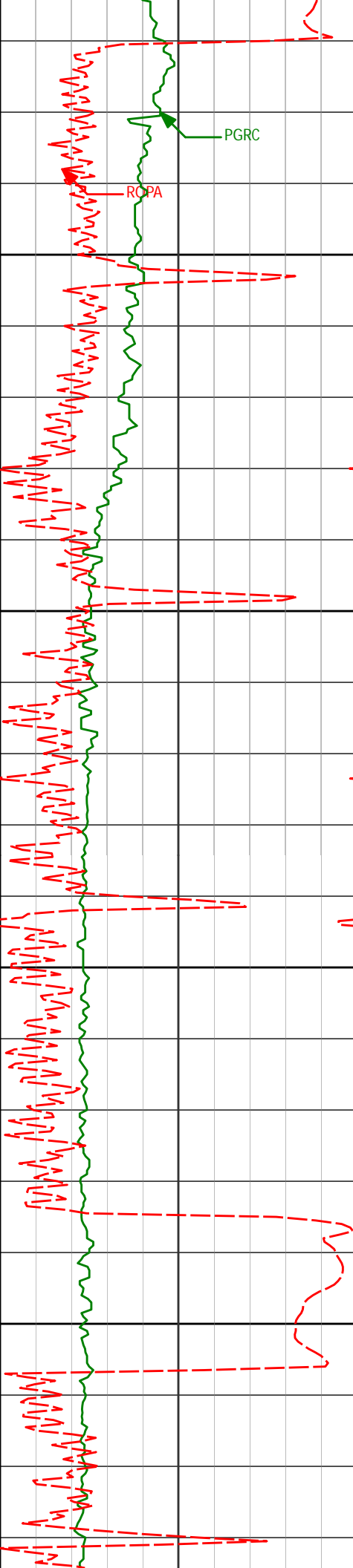
9994'

89.97°

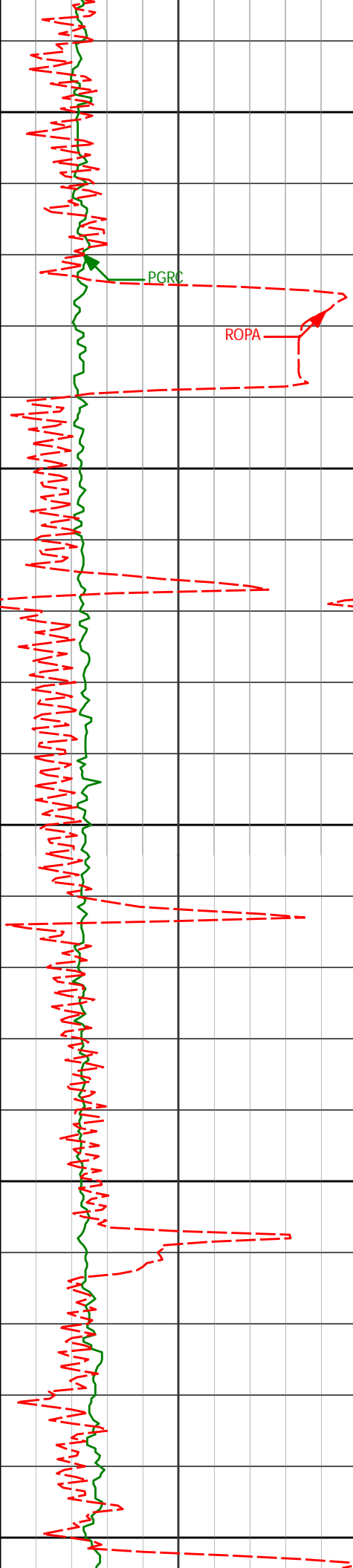
87.88°

7026.32'

3129.20'



10083'	88.83°	87.55°	7027.25'	3215.96'
10100				
10150				
10173'	88.83°	85.93°	7029.09'	3303.33'
10200				
10250				
10263'	87.72°	88.47°	7031.80'	3390.84'



10300

10350

10400

10450

10500

10352'

88.83°

90.97°

7034.48'

3478.20'

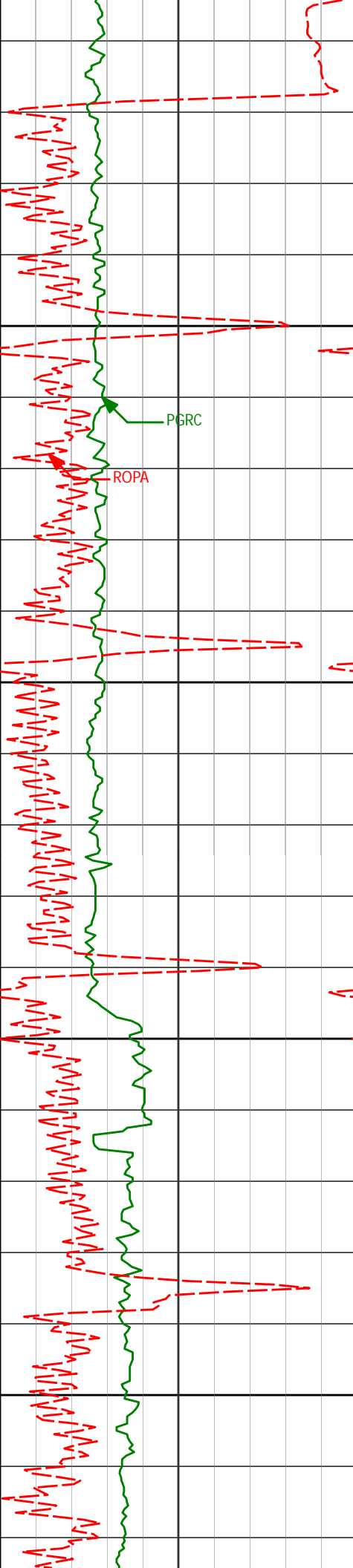
10442'

88.80°

92.15°

7036.34'

3567.07'



10531'

10550

10600

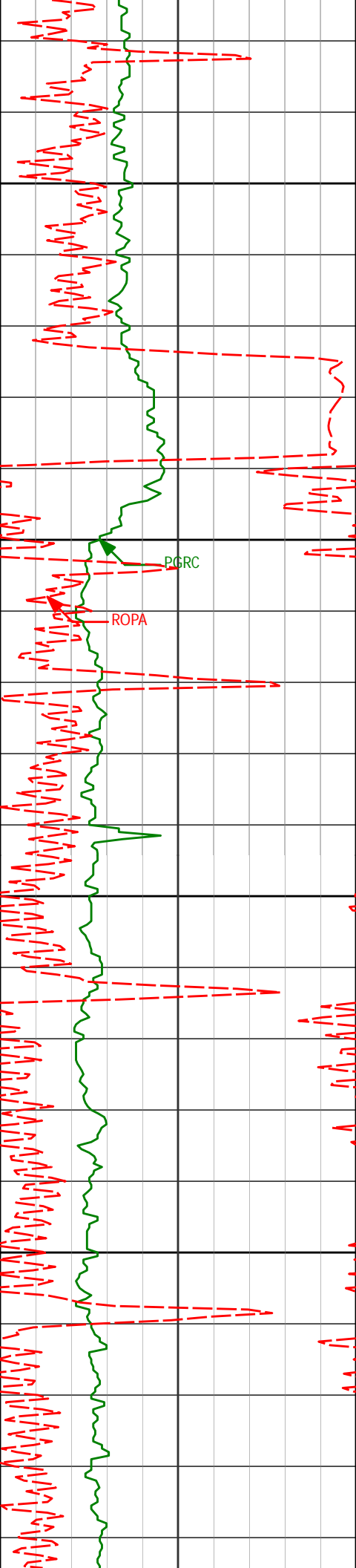
10650

10700

10531'	90.34°	91.99°	7037.01'	3655.09'
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10621'	90.31°	91.42°	7036.50'	3744.01'
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10710'	91.11°	90.81°	7035.39'	3831.79'
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10750

10800

10850

10900

10800'

10890'

89.57°

89.97°

89.23°

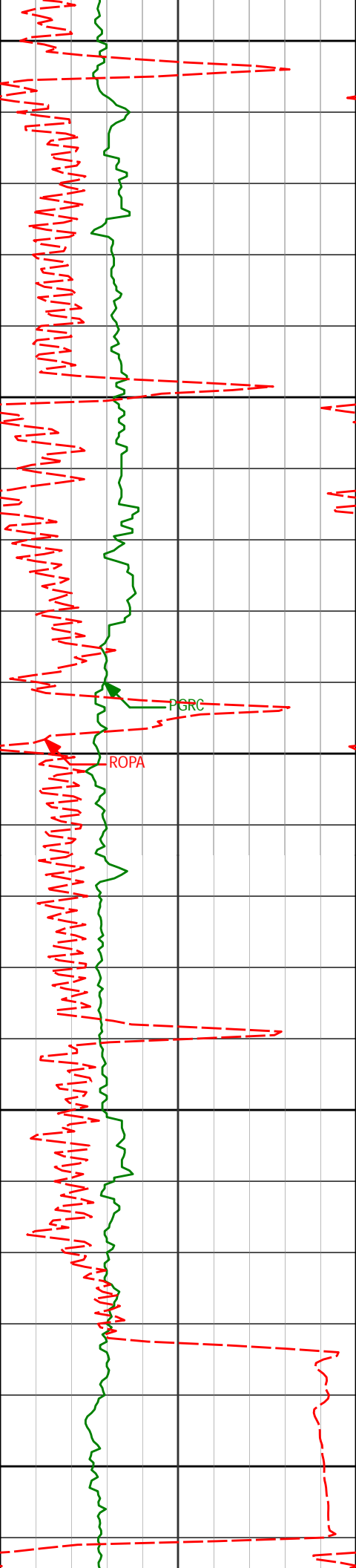
88.31°

7034.86'

7035.22'

3920.27'

4008.36'



10950

10979'

90.19°

88.36°

7035.10'

4095.34'

11000

11050

11069'

92.03°

88.03°

7033.35'

4183.23'

11100

11150

11158'

90.68°

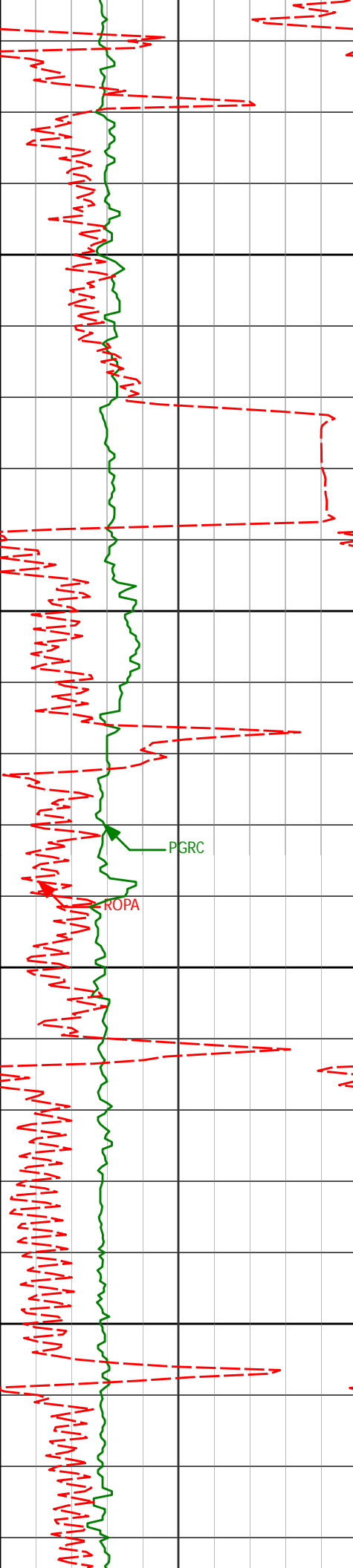
87.50°

7031.25'

4269.99'

PGRC

ROPA



11200

11250

11300

11350

PGRC

ROPA

11248'

89.11°

89.59°

7031.41'

4358.01'

11337'

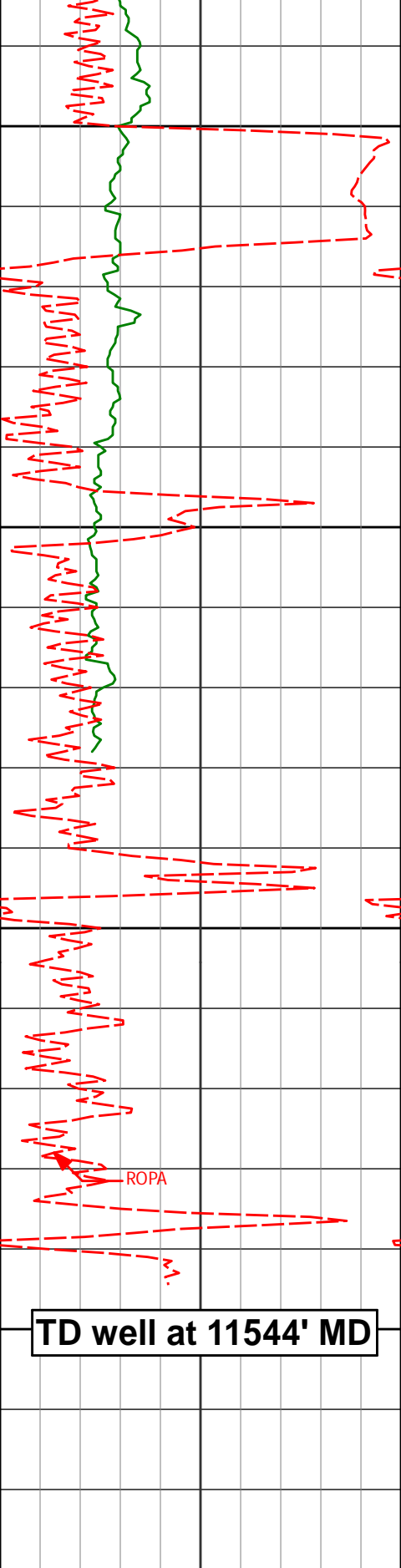
90.52°

89.64°

7031.70'

4445.38'





11400

11427'

90.09°

88.21°

7031.22'

4533.53'

11450

11481'

91.51°

87.46°

7030.47'

4586.19'

11500

11544'

91.51°

87.46°

7028.81'

4647.53'

11550

TD well at 11544' MD

**Avg Rate of Penetration**

ROPA

-----

feet per hr

500

0

**PCG Gamma Ray BCorr**

api

-----

0

300

Depth  
ft

**Depth**

**Inc.**

**Azi.**

**TVD**

**V.S.**

# HALLIBURTON

## DIRECTIONAL SURVEY REPORT

Noble Energy  
Loeffler K1-65HN-A2  
Wattenburg  
Weld Colorado  
USA  
CA-XX-0900735959

Tie in to shoe at 623' md First two surveys are imported wire line surveys corrected to gird North.

Final survey is a projection to bit at TD

<i>Measured Depth (feet)</i>	<i>Inclination (degrees)</i>	<i>Direction (degrees)</i>	<i>Vertical Depth (feet)</i>	<i>Latitude (feet)</i>	<i>Departure (feet)</i>	<i>Vertical Section (feet)</i>	<i>Dogleg (deg/100ft)</i>
0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
306.00	0.40	54.17	306.00	0.63 N	0.87 E	0.74	0.13
623.00	0.40	315.67	622.99	2.06 N	0.99 E	0.59	0.19
698.00	0.47	284.63	697.99	2.33 N	0.51 E	0.07	0.32
832.00	0.68	280.06	831.98	2.61 N	0.81 W	-1.27	0.16
966.00	1.28	190.85	965.97	1.28 N	1.87 W	-2.07	1.08
1101.00	0.65	185.90	1100.95	0.97 S	2.23 W	-2.02	0.47
1198.00	1.63	185.92	1197.93	2.89 S	2.43 W	-1.86	1.01
1292.00	3.59	199.94	1291.83	6.98 S	3.57 W	-2.23	2.18
1386.00	6.51	198.06	1385.45	14.82 S	6.23 W	-3.41	3.11
1481.00	7.08	198.47	1479.79	25.49 S	9.75 W	-4.91	0.60
1575.00	7.68	191.75	1573.01	37.13 S	12.87 W	-5.84	1.12
1669.00	6.89	182.55	1666.25	48.92 S	14.40 W	-5.18	1.50
1763.00	8.03	190.89	1759.46	61.00 S	15.89 W	-4.43	1.67
1857.00	7.22	196.98	1852.63	73.10 S	18.85 W	-5.13	1.22
1952.00	7.96	198.56	1946.79	85.04 S	22.69 W	-6.71	0.81
2046.00	6.46	197.62	2040.05	96.25 S	26.36 W	-8.26	1.60
2140.00	7.27	202.71	2133.37	106.78 S	30.26 W	-10.16	1.08
2234.00	4.73	191.91	2226.85	116.06 S	33.36 W	-11.50	2.95
2326.00	5.01	192.46	2318.52	123.69 S	35.01 W	-11.72	0.31
2418.00	6.79	199.19	2410.03	132.75 S	37.66 W	-12.67	2.07
2512.00	6.19	192.29	2503.43	142.95 S	40.57 W	-13.66	1.05
2601.00	7.80	190.19	2591.77	153.59 S	42.66 W	-13.76	1.83
2691.00	9.08	190.21	2680.79	166.59 S	45.00 W	-13.68	1.42
2781.00	10.26	192.47	2769.51	181.40 S	47.99 W	-13.90	1.38
2870.00	8.72	194.41	2857.29	195.68 S	51.38 W	-14.61	1.77
2960.00	8.96	192.78	2946.22	209.12 S	54.63 W	-15.34	0.39
3050.00	7.75	202.45	3035.27	221.56 S	58.49 W	-16.86	2.06
3139.00	6.38	184.82	3123.60	232.04 S	61.20 W	-17.60	2.86
3229.00	6.69	183.89	3213.02	242.25 S	61.98 W	-16.49	0.36
3318.00	8.46	194.53	3301.24	253.76 S	63.97 W	-16.34	2.53
3408.00	6.57	188.18	3390.46	265.27 S	66.36 W	-16.58	2.29
3498.00	7.81	198.82	3479.76	276.15 S	69.07 W	-17.24	2.02
3587.00	9.63	198.22	3567.73	288.95 S	73.35 W	-19.10	2.05
3677.00	8.36	192.06	3656.62	302.50 S	77.07 W	-20.27	1.77
3767.00	9.53	192.19	3745.52	316.18 S	80.01 W	-20.65	1.30
3857.00	9.91	190.94	3834.23	331.07 S	83.05 W	-20.91	0.48
3946.00	9.11	189.76	3922.01	345.53 S	85.70 W	-20.86	0.93
4036.00	9.08	197.21	4010.88	359.34 S	89.01 W	-21.58	1.31
4125.00	7.04	187.63	4099.00	371.45 S	91.81 W	-22.12	2.74
4215.00	7.91	197.35	4188.24	382.83 S	94.39 W	-22.57	1.70
4304.00	6.04	185.67	4276.58	393.34 S	96.68 W	-22.89	2.63
4394.00	7.10	202.11	4365.99	403.20 S	99.24 W	-23.60	2.39
4484.00	6.23	192.48	4455.39	413.12 S	102.39 W	-24.87	1.57
4573.00	9.09	197.39	4543.59	424.55 S	105.54 W	-25.87	3.29
4663.00	8.21	198.89	4632.56	437.42 S	109.74 W	-27.64	1.01
4752.00	7.30	199.01	4720.75	448.77 S	113.64 W	-29.39	1.02
4842.00	8.50	198.81	4809.89	460.48 S	117.65 W	-31.18	1.33
4932.00	8.10	191.38	4898.95	472.99 S	121.04 W	-32.23	1.27
5021.00	7.86	191.88	4987.09	485.09 S	123.53 W	-32.45	0.28
5111.00	6.47	196.65	5076.38	495.97 S	126.25 W	-33.13	1.68

5201.00	7.91	191.06	5165.68	506.91 S	128.90 W	-33.72	1.78
5290.00	9.44	189.24	5253.65	520.12 S	131.24 W	-33.61	1.75
5380.00	8.20	191.97	5342.59	533.69 S	133.76 W	-33.59	1.45
5469.00	6.29	194.47	5430.87	544.62 S	136.29 W	-34.08	2.17
5559.00	7.18	185.53	5520.25	554.99 S	138.07 W	-33.92	1.53
5649.00	8.70	188.06	5609.39	567.33 S	139.56 W	-33.13	1.73
5738.00	7.44	187.85	5697.51	579.70 S	141.29 W	-32.56	1.42
5828.00	7.48	184.53	5786.75	591.32 S	142.55 W	-31.67	0.48
5917.00	8.79	186.82	5874.85	603.84 S	143.82 W	-30.61	1.52
6007.00	7.20	185.05	5963.97	616.29 S	145.13 W	-29.62	1.79
6097.00	8.54	191.10	6053.12	628.47 S	146.91 W	-29.14	1.75
6186.00	6.82	187.63	6141.32	640.19 S	148.89 W	-28.93	2.00
6276.00	7.48	193.65	6230.62	651.18 S	150.98 W	-28.97	1.11
6321.00	8.97	185.25	6275.16	657.52 S	151.99 W	-28.80	4.25
6366.00	11.95	183.22	6319.41	665.67 S	152.58 W	-27.88	6.67
6411.00	14.98	181.85	6363.17	676.13 S	153.03 W	-26.40	6.77
6455.00	18.11	180.68	6405.34	688.66 S	153.29 W	-24.36	7.15
6500.00	19.83	168.13	6447.91	703.13 S	151.80 W	-20.25	9.82
6545.00	21.21	158.07	6490.07	718.15 S	147.19 W	-12.96	8.40
6590.00	24.75	150.83	6531.50	733.94 S	139.56 W	-2.56	10.05
6635.00	27.32	142.67	6571.94	750.38 S	128.70 W	11.13	9.78
6679.00	29.16	133.86	6610.72	765.85 S	114.84 W	27.60	10.35
6724.00	32.38	130.75	6649.38	781.31 S	97.80 W	47.18	7.98
6769.00	36.71	124.93	6686.45	796.89 S	77.63 W	69.87	12.09
6814.00	40.73	122.56	6721.55	812.50 S	54.22 W	95.75	9.52
6859.00	43.63	119.06	6754.90	827.95 S	28.26 W	124.09	8.29
6903.00	45.31	113.10	6786.31	841.47 S	0.59 W	153.77	10.23
6948.00	48.12	107.99	6817.17	852.92 S	30.07 E	186.02	10.36
6993.00	49.70	103.83	6846.76	862.20 S	62.68 E	219.77	7.80
7038.00	52.27	99.26	6875.09	869.17 S	96.92 E	254.71	9.74
7083.00	56.65	97.99	6901.24	874.65 S	133.11 E	291.30	10.00
7127.00	60.77	96.86	6924.09	879.50 S	170.39 E	328.83	9.62
7172.00	64.79	95.40	6944.67	883.76 S	210.17 E	368.72	9.39
7217.00	67.49	94.90	6962.87	887.45 S	251.15 E	409.68	6.09
7262.00	70.39	93.99	6979.04	890.70 S	293.02 E	451.43	6.71
7307.00	74.93	92.41	6992.45	893.09 S	335.89 E	494.02	10.63
7364.00	80.68	91.74	7004.49	895.11 S	391.54 E	549.10	10.15
7484.00	84.63	91.13	7019.83	898.08 S	510.50 E	666.58	3.33
7574.00	86.86	91.47	7026.50	900.12 S	600.22 E	755.15	2.51
7663.00	87.53	91.09	7030.86	902.11 S	689.09 E	842.88	0.87
7753.00	87.63	91.12	7034.66	903.84 S	779.00 E	931.57	0.12
7842.00	88.67	89.58	7037.53	904.38 S	867.94 E	1019.11	2.09
7932.00	90.40	88.77	7038.26	903.09 S	957.93 E	1107.33	2.12
8022.00	90.65	84.50	7037.44	897.81 S	1047.75 E	1194.66	4.75
8111.00	90.06	86.10	7036.89	890.51 S	1136.44 E	1280.51	1.92
8201.00	90.00	87.21	7036.84	885.26 S	1226.29 E	1367.87	1.24
8291.00	90.68	90.48	7036.30	883.45 S	1316.26 E	1455.98	3.71
8380.00	91.79	91.42	7034.39	884.92 S	1405.22 E	1543.70	1.63
8470.00	90.55	90.90	7032.55	886.74 S	1495.18 E	1632.47	1.49
8560.00	91.23	89.55	7031.15	887.10 S	1585.17 E	1720.99	1.68
8649.00	90.25	90.44	7030.00	887.09 S	1674.16 E	1808.47	1.49
8739.00	92.10	91.58	7028.16	888.68 S	1764.12 E	1897.20	2.41
8829.00	91.14	90.78	7025.61	890.53 S	1854.06 E	1985.96	1.39
8918.00	89.38	90.92	7025.21	891.85 S	1943.05 E	2073.67	1.98
9008.00	89.85	91.03	7025.81	893.38 S	2033.03 E	2162.41	0.54
9098.00	89.88	90.46	7026.02	894.55 S	2123.02 E	2251.09	0.63
9187.00	90.52	90.72	7025.71	895.47 S	2212.02 E	2338.75	0.78
9277.00	88.77	89.86	7026.27	895.92 S	2302.01 E	2427.29	2.17
9366.00	88.46	88.90	7028.42	894.96 S	2390.98 E	2514.58	1.13
9456.00	87.97	88.36	7031.23	892.81 S	2480.91 E	2602.59	0.81
9546.00	89.97	89.76	7032.84	891.33 S	2570.88 E	2690.75	2.71
9635.00	91.29	90.21	7031.86	891.31 S	2659.87 E	2778.23	1.57
9725.00	91.64	89.67	7029.56	891.22 S	2749.84 E	2866.66	0.71
9814.00	89.94	87.85	7028.34	889.29 S	2838.80 E	2953.76	2.80
9904.00	91.33	87.46	7027.34	885.61 S	2928.72 E	3041.48	1.60
9994.00	89.97	87.88	7026.32	881.95 S	3018.64 E	3129.20	1.58
10083.00	88.83	87.55	7027.25	878.40 S	3107.56 E	3215.96	1.33
10173.00	88.83	85.93	7029.09	873.28 S	3197.39 E	3303.33	1.80
10263.00	87.72	88.47	7031.80	868.89 S	3287.23 E	3390.84	3.08
10352.00	88.83	90.97	7034.48	868.45 S	3376.18 E	3478.20	3.07
10442.00	88.80	92.15	7036.34	870.90 S	3466.13 E	3567.07	1.31
10531.00	90.34	91.99	7037.01	874.12 S	3555.07 E	3655.09	1.74
10621.00	90.31	91.42	7036.50	876.80 S	3645.03 E	3744.01	0.63
10710.00	91.11	90.81	7035.39	878.53 S	3734.00 E	3831.79	1.13
10800.00	89.57	89.88	7034.88	879.58 S	3822.98 E	3922.27	2.45

10800.00	89.57	89.23	7034.86	878.56 S	3823.99 E	3920.27	2.45
10890.00	89.97	88.31	7035.22	876.63 S	3913.97 E	4008.36	1.11
10979.00	90.19	88.36	7035.10	874.04 S	4002.93 E	4095.34	0.25
11069.00	92.03	88.03	7033.35	871.21 S	4092.87 E	4183.23	2.08
11158.00	90.68	87.50	7031.25	867.74 S	4181.77 E	4269.99	1.63
11248.00	89.11	89.59	7031.41	865.45 S	4271.74 E	4358.01	2.90
11337.00	90.52	89.64	7031.70	864.85 S	4360.73 E	4445.38	1.59
11427.00	90.09	88.21	7031.22	863.17 S	4450.71 E	4533.53	1.66
11481.00	91.51	87.46	7030.47	861.13 S	4504.67 E	4586.19	2.97
11544.00	91.51	87.46	7028.81	858.34 S	4567.58 E	4647.53	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 100.57 DEGREES (GRID)  
A TOTAL CORRECTION OF 8.07 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 11544.00 FEET  
IS 4647.53 FEET ALONG 100.64 DEGREES (GRID)**