

DC - Pressure Case Directional  
PCGK - Pressure Case Gamma



**1 : 600 / 1 : 240**

[illegible]

## WELL INFORMATION

|   |                  |                  |                  |  |  |
|---|------------------|------------------|------------------|--|--|
| <b>MWD Run Number</b>                   | 100              | 200              | 300              |  |  |
| <b>Date run completed</b>               | 22-Sep-13        | 24-Sep-13        | 27-Sep-13        |  |  |
| <b>Rig Bit Number</b>                   | 2                | 3                | 4                |  |  |
| <b>Bit Size (in)</b>                    | 8.750            | 8.750            | 6.125            |  |  |
| <b>Tool Nominal OD (in)</b>             | 6.840            | 6.840            | 4.770            |  |  |
| <b>Log Start Depth (MD, ft)</b>         | 980.00           | 5,878.00         | 7,010.00         |  |  |
| <b>Log End Depth (MD, ft)</b>           | 5,878.00         | 7,010.00         | 10,951.00        |  |  |
| <b>Drill or Wipe</b>                    | Drill            | Drill            | Drill            |  |  |
| <b>Drill/Wipe Start Date and Time</b>   | 21-Sep-13 22:31  | 23-Sep-13 01:31  | 25-Sep-13 08:58  |  |  |
| <b>Drill/Wipe End Date and Time</b>     | 22-Sep-13 15:34  | 23-Sep-13 21:04  | 26-Sep-13 18:22  |  |  |
| <b>Min Inc (deg) @ Depth (MD, ft)</b>   | 0.24 @ 5,537.00  | 0.44 @ 5,916.00  | 83.58 @ 7,088.00 |  |  |
| <b>Max Inc (deg) @ Depth (MD, ft)</b>   | 17.43 @ 3,735.00 | 82.21 @ 6,955.00 | 91.82 @ 8,889.00 |  |  |
| <b>Bit TFA(in2) / Bit Type</b>          | 0.78 / PDC       | 0.98 / PDC       | 0.98 / N/A       |  |  |
| <b>Flow Rate (gpm)</b>                  | 591.28           | 534.46           | 309.76           |  |  |
| <b>Max AV (fpm) / CV (fpm) @ MWD</b>    | N/A / N/A        | N/A / N/A        | N/A / N/A        |  |  |
| <b>Fluid Type</b>                       | Fresh Water Gel  | Fresh Water Gel  | Fresh Water Gel  |  |  |
| <b>Density (ppg) / Viscosity (spqt)</b> | 9.10 / 31.00     | 10.50 / 39.00    | 9.35 / 33.00     |  |  |
| <b>Filtrate CL (ppm)</b>                | 1,800.00         | 1,900.00         | 2,200.00         |  |  |
| <b>pH / Fluid Loss (mptm)</b>           | 9.10 / 37        | 9.50 / 10        | 9.00 / 12        |  |  |
| <b>PV (cP) / YP (lbf2)</b>              | 2 / 4.00         | 10 / 11.00       | 7 / 5.00         |  |  |
| <b>% Solids / % Sand</b>                | 5.00 / 1.50      | 10.00 / 0.20     | 6.10 / 0.05      |  |  |
| <b>% Oil / Oil:Water Ratio</b>          | N/A / N/A        | N/A / N/A        | N/A / N/A        |  |  |
| <b>Rm @ Measured Temp (degF)</b>        | N/A @ N/A        | N/A @ N/A        | N/A @ N/A        |  |  |
| <b>Rmf @ Measured Temp (degF)</b>       | N/A @ N/A        | N/A @ N/A        | N/A @ N/A        |  |  |
| <b>Rmc @ Measured Temp (degF)</b>       | N/A @ N/A        | N/A @ N/A        | N/A @ N/A        |  |  |
| <b>Min Tool Temp (deg F) @ 100 ft</b>   | 152.10 / PDM     | 122.22 / PDM     | 212.10 / PDM     |  |  |

|                               |                 |                 |              |  |  |
|-------------------------------|-----------------|-----------------|--------------|--|--|
| Max Tool Temp (degF) / Source | 150.10 / PCM    | 162.80 / PCM    | 213.40 / PCM |  |  |
| Rm @ Max Tool Temp (degF)     | N/A @ 150.10    | N/A @ 162.80    | N/A @ 213.40 |  |  |
| Lead MWD Engineer             | Kyle Wass       | Kyle Wass       | Kyle Wass    |  |  |
| Customer Representative       | Stetson Nielsen | Stetson Nielsen | Jim Turner   |  |  |

## SENSOR INFORMATION

### Downhole Processor Information

|                           |                 |                 |                 |  |  |
|---------------------------|-----------------|-----------------|-----------------|--|--|
| Tool Type                 | PCM             | PCM             | PCM             |  |  |
| Software Version          | 5.84            | 5.84            | 5.84            |  |  |
| Sub Serial Number         | 11342302        | 11342302        | 11744846        |  |  |
| Insert Serial Number      | 11680773        | 11680773        | 11680708        |  |  |
| Date and Time Initialized | 21-Sep-13 10:51 | 21-Sep-13 10:51 | 24-Sep-13 01:31 |  |  |
| Date and Time Read        | 24-Jan-13 04:38 | 24-Sep-13 04:38 | 27-Sep-13 04:26 |  |  |
| ECMB SW Version           | N/A             | N/A             | N/A             |  |  |

### Directional Sensor Information

|                        |          |          |          |  |  |
|------------------------|----------|----------|----------|--|--|
| Tool Type              | PCDC     | PCDC     | PCDC     |  |  |
| Distance From Bit (ft) | 58.00    | 55.00    | 66.00    |  |  |
| Software Version       | 6.21     | 6.21     | 6.21     |  |  |
| Sub Serial Number      | 11342302 | 11342302 | 11744846 |  |  |
| Sonde Serial Number    | 11297617 | 11297617 | 12177539 |  |  |
| Sensor ID Number       | N/A      | N/A      | N/A      |  |  |
| Toolface Offset (deg)  | 165.64   | 282.97   | 208.38   |  |  |

### Gamma Ray Sensor Information

|                              |          |          |          |  |  |
|------------------------------|----------|----------|----------|--|--|
| Tool Type                    | PCG      | PCG      | PCG      |  |  |
| Distance From Bit (ft)       | 50.79    | 48.46    | 68.47    |  |  |
| Recorded Sample Period (sec) | 10       | 10       | 10       |  |  |
| Software Version             | 8.15     | 8.15     | 8.15     |  |  |
| Sub Serial Number            | 11342302 | 11342302 | 11744846 |  |  |
| Insert/Sonde Serial Number   | 11293386 | 11293386 | 12071268 |  |  |

## REMARKS

1. All depths are calibrated to driller's pipe tally and are measured depth's from the Drill Floor.
2. No depth corrections have been made for pipe stretch or compression.
3. Critical annular velocities are calculated using the "Power Law" model for water based fluids and the "Brigham Plastic" model for oil and synthetic based fluids.
4. All data presented is recorded data unless otherwise specified.
5. The following smoothing parameters have been applied to the data:  
1:600 Log  
PGRC (Gamma CG) and ROPA (Average Rate of Penetration)  
Interval Resolution: 1.0 ft  
Interval Distance: 3.0 ft  
  
1:240 Log  
PGRC (Gamma CG):  
Interval Resolution: 0.5 ft  
Interval Distance: 0.6 ft  
  
ROPA (Average Rate Of Penetration):  
Interval Resolution: 0.5 ft

Interval Resolution: 1.2 ft

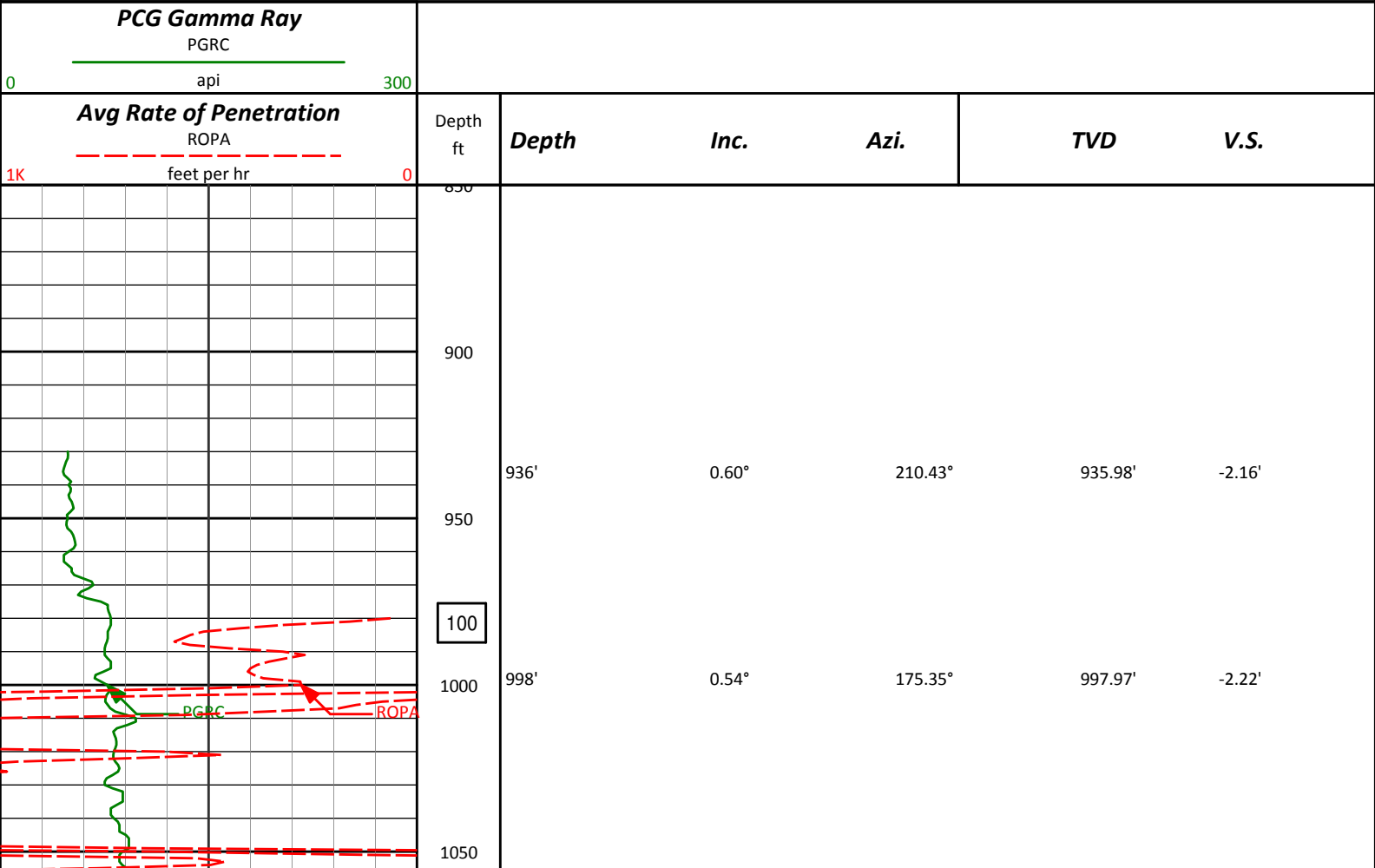
6. Insite Version v8.0.0

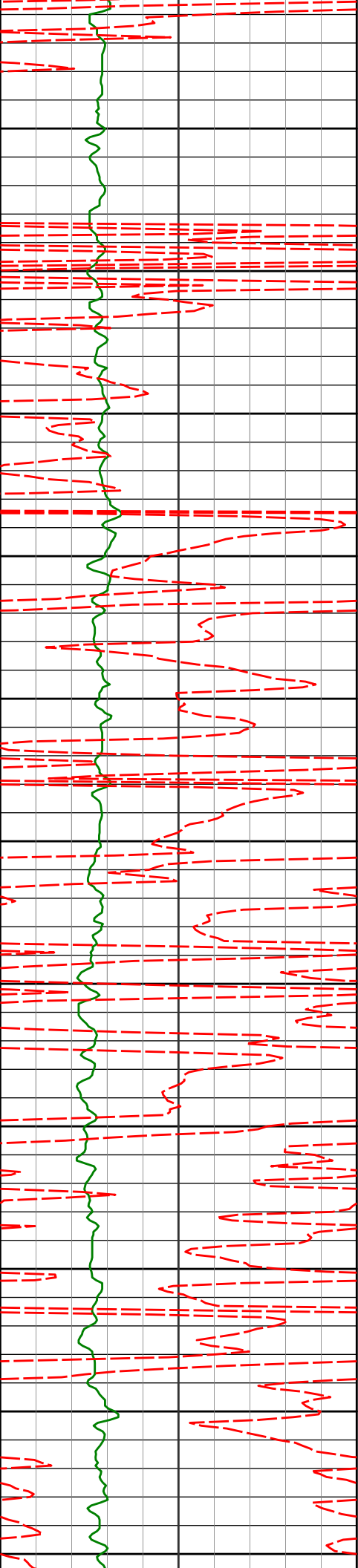
WARRANTY

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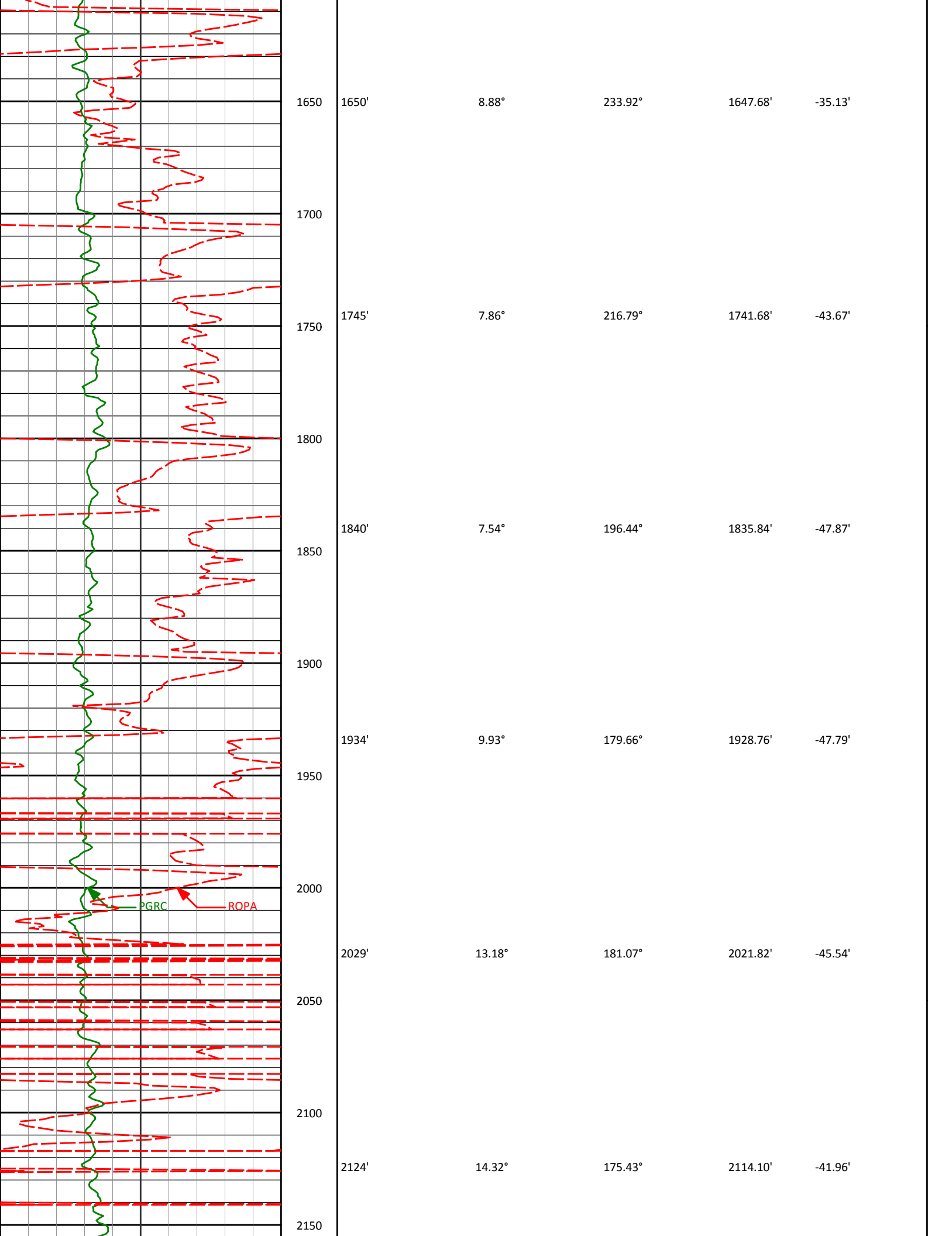
HALLIBURTON  
Sperry Drilling Services  
MD Correlation Log 1:600

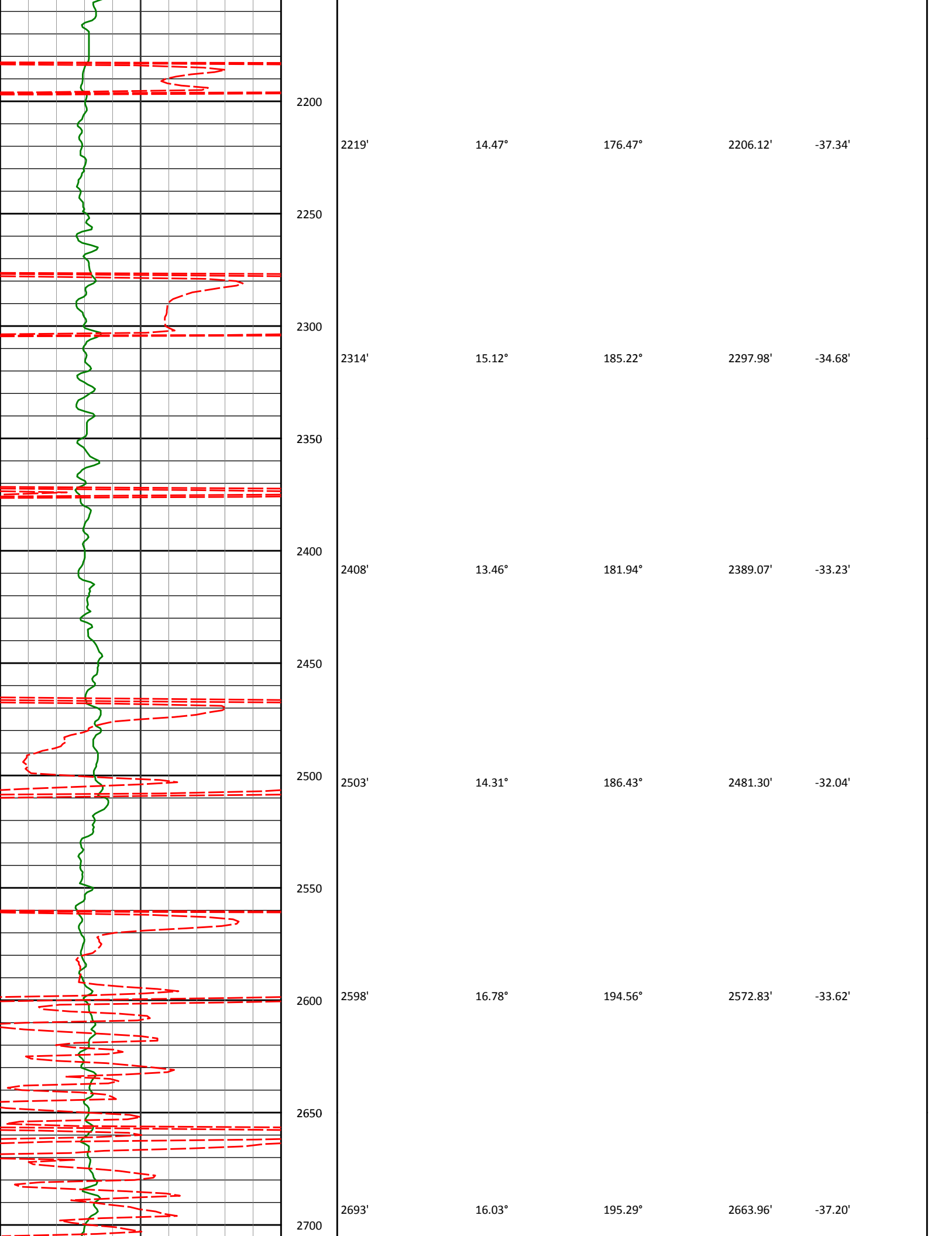
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Wells Ranch AE20-66HN  
H&P 321  
Sec. 20-T6N-R62W

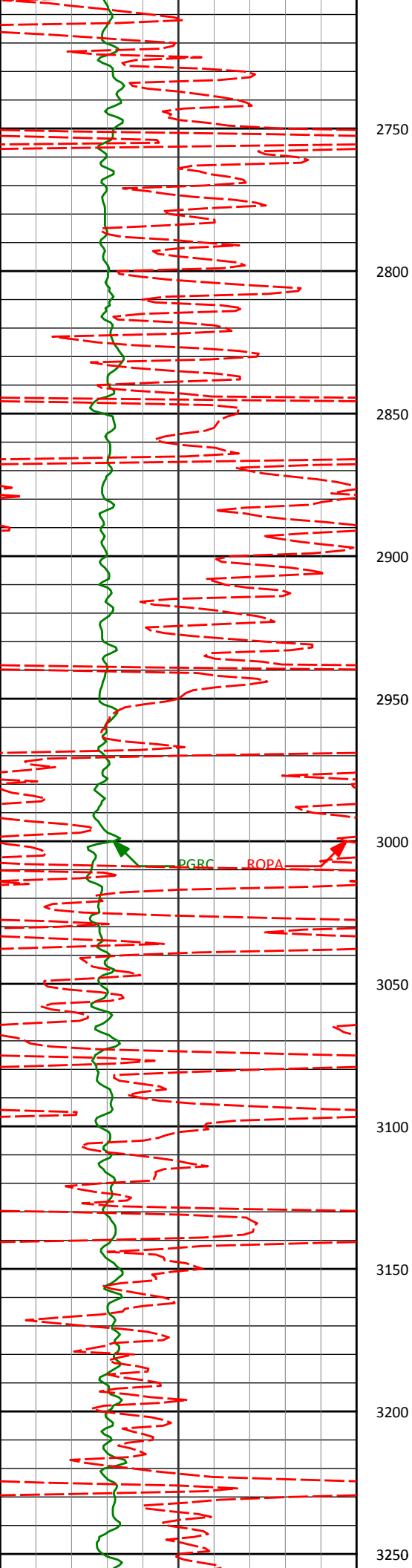




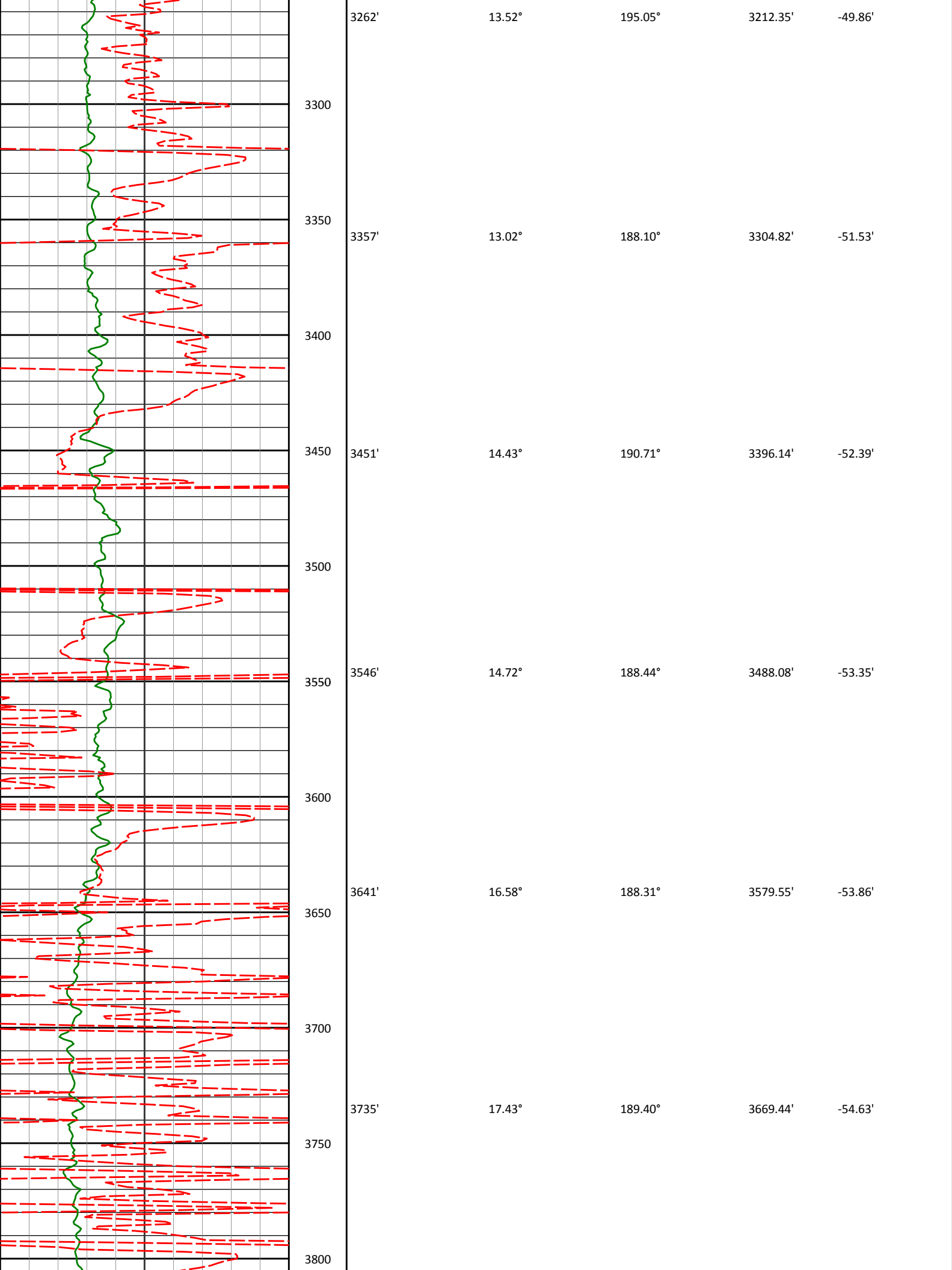
|       |       |         |          |         |
|-------|-------|---------|----------|---------|
| 1091' | 0.59° | 198.72° | 1090.97' | -2.23'  |
| 1100  |       |         |          |         |
| 1150  |       |         |          |         |
| 1184' | 0.41° | 221.43° | 1183.97' | -2.51'  |
| 1200  |       |         |          |         |
| 1250  |       |         |          |         |
| 1275' | 1.78° | 232.14° | 1274.95' | -3.69'  |
| 1300  |       |         |          |         |
| 1350  |       |         |          |         |
| 1368' | 3.63° | 253.75° | 1367.84' | -7.41'  |
| 1400  |       |         |          |         |
| 1450  |       |         |          |         |
| 1460' | 6.51° | 247.66° | 1459.47' | -14.62' |
| 1500  |       |         |          |         |
| 1550  |       |         |          |         |
| 1555' | 8.01° | 239.73° | 1553.71' | -24.55' |
| 1600  |       |         |          |         |

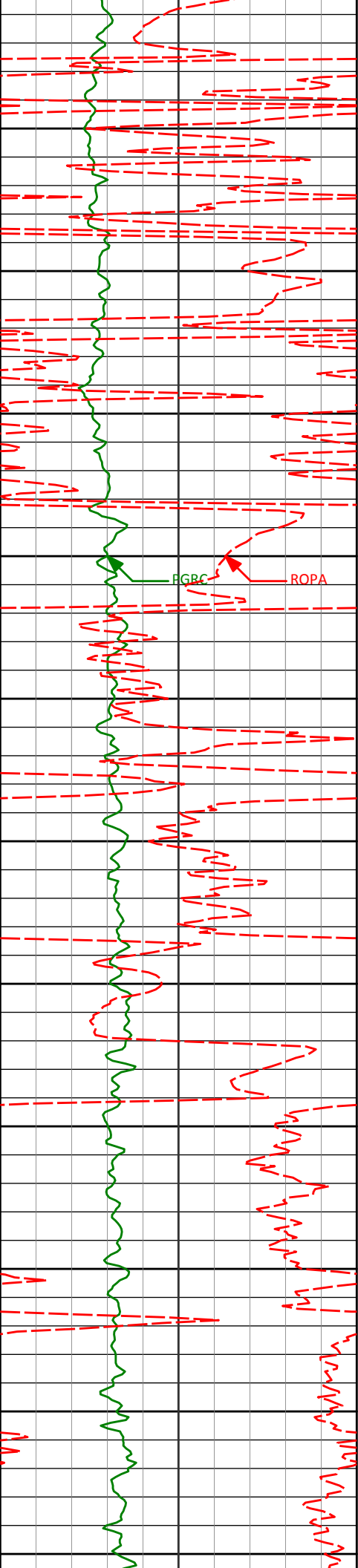




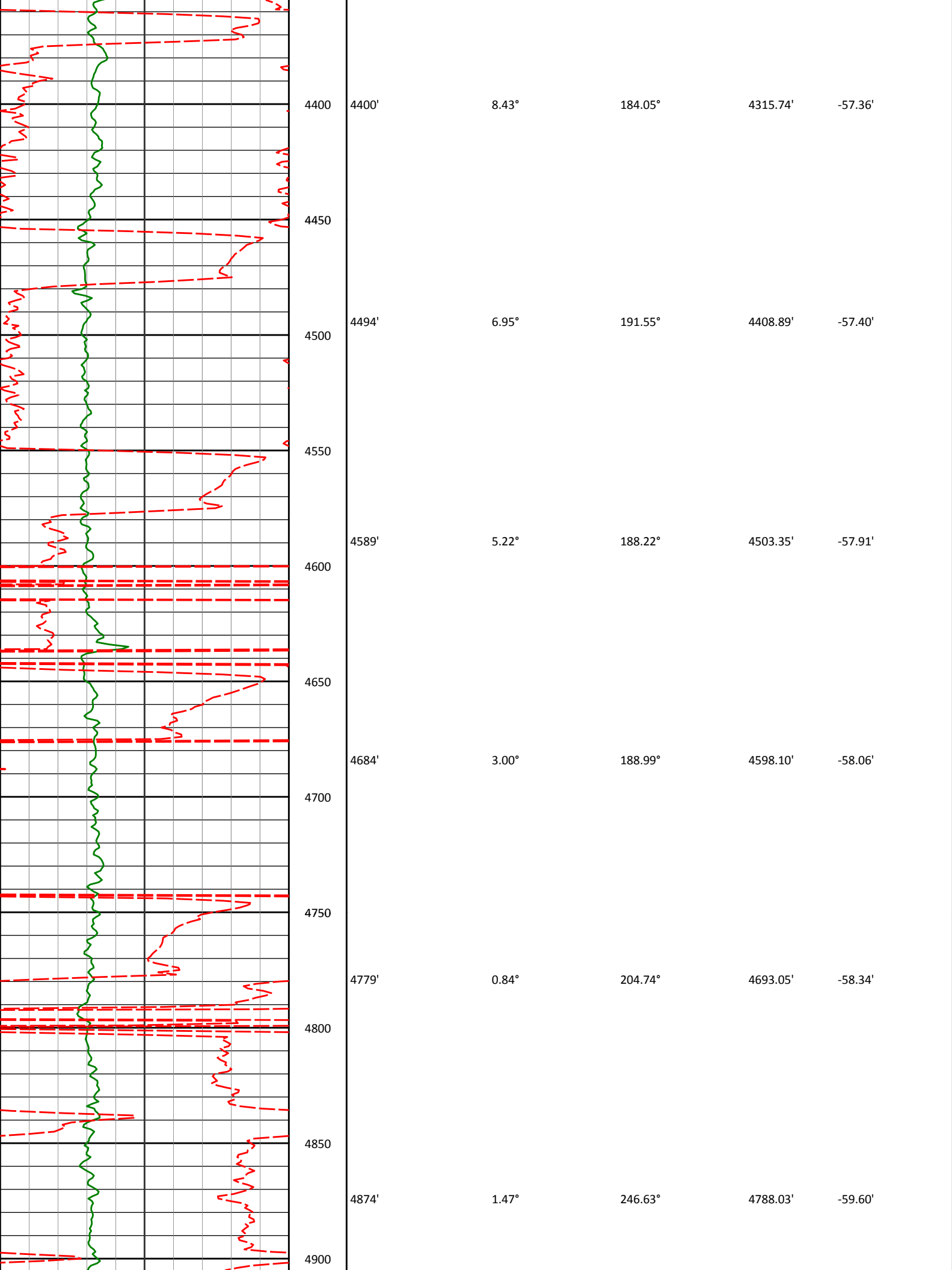


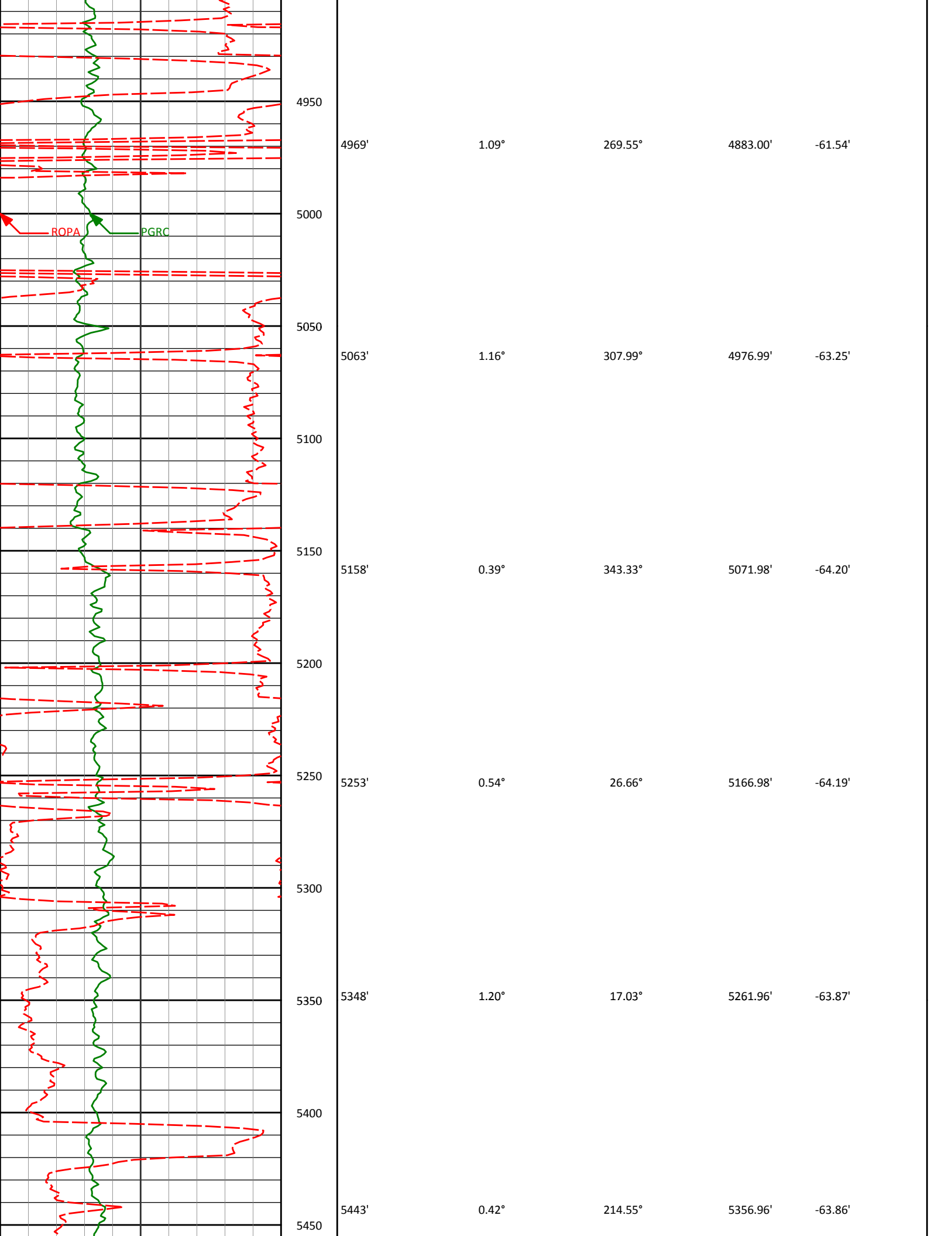
|       |        |         |          |         |
|-------|--------|---------|----------|---------|
| 2788' | 15.23° | 191.83° | 2755.45' | -40.03' |
| 2882' | 14.65° | 192.02° | 2846.27' | -42.00' |
| 2977' | 16.19° | 191.59° | 2937.85' | -44.00' |
| 3072' | 16.44° | 191.01° | 3029.02' | -45.89' |
| 3167' | 15.43° | 190.84° | 3120.37' | -47.56' |

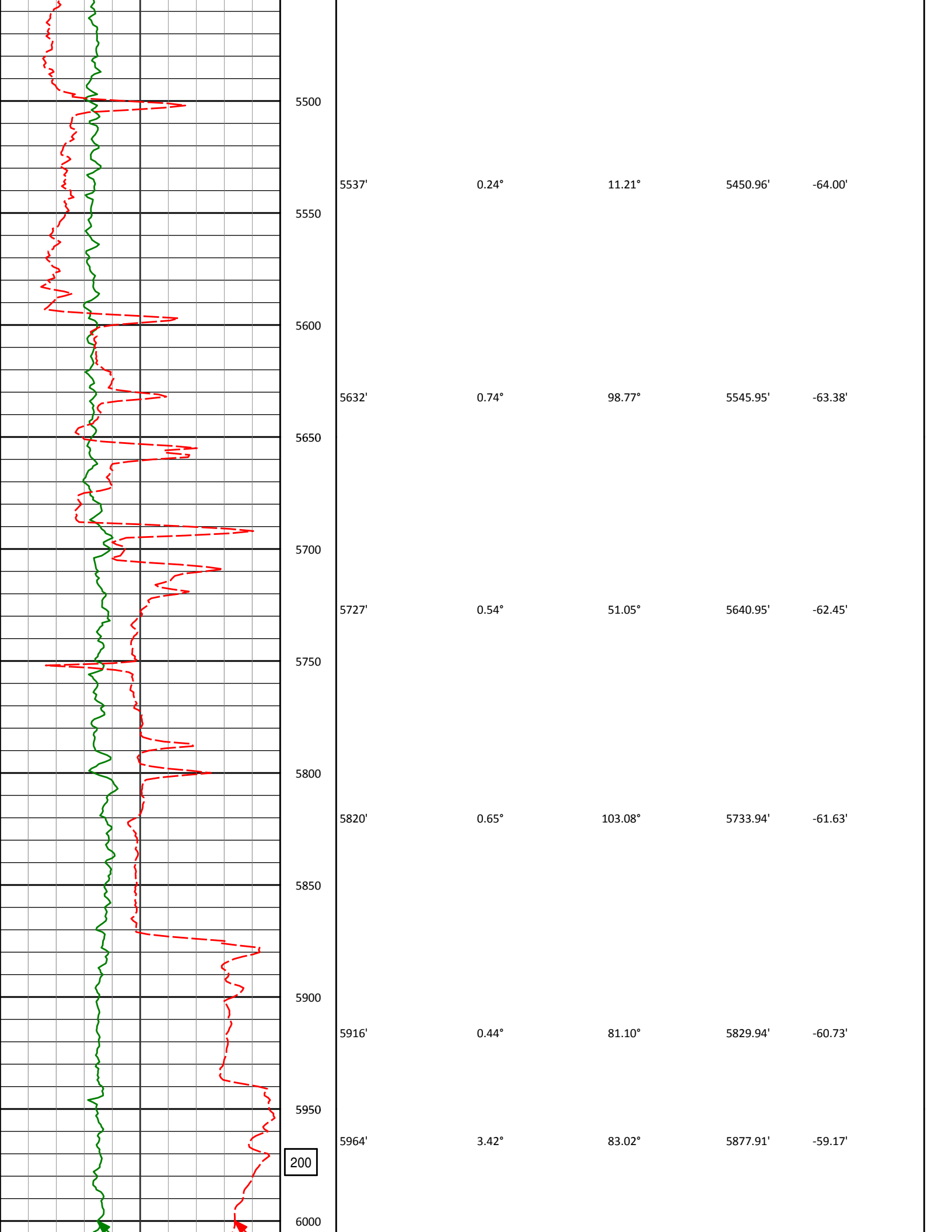


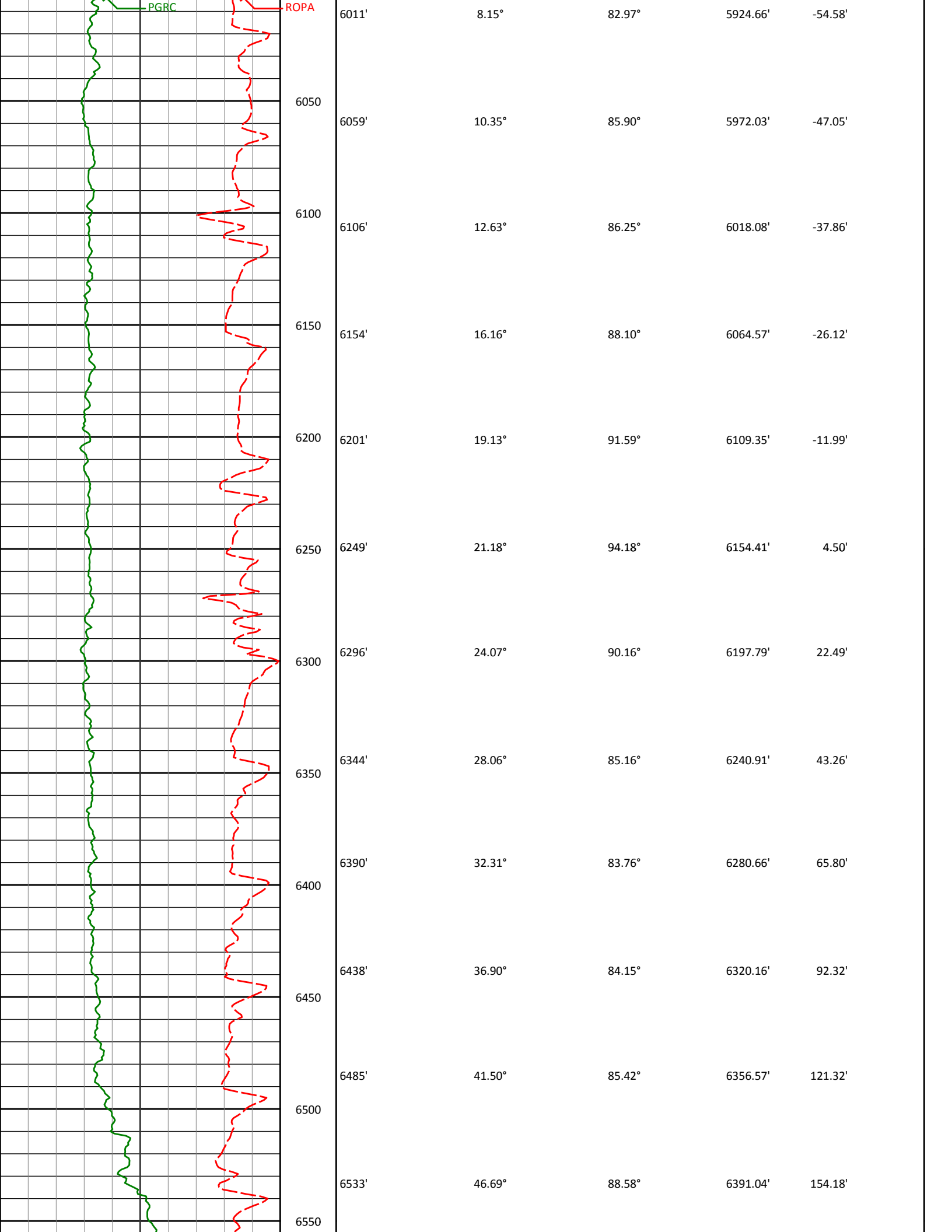


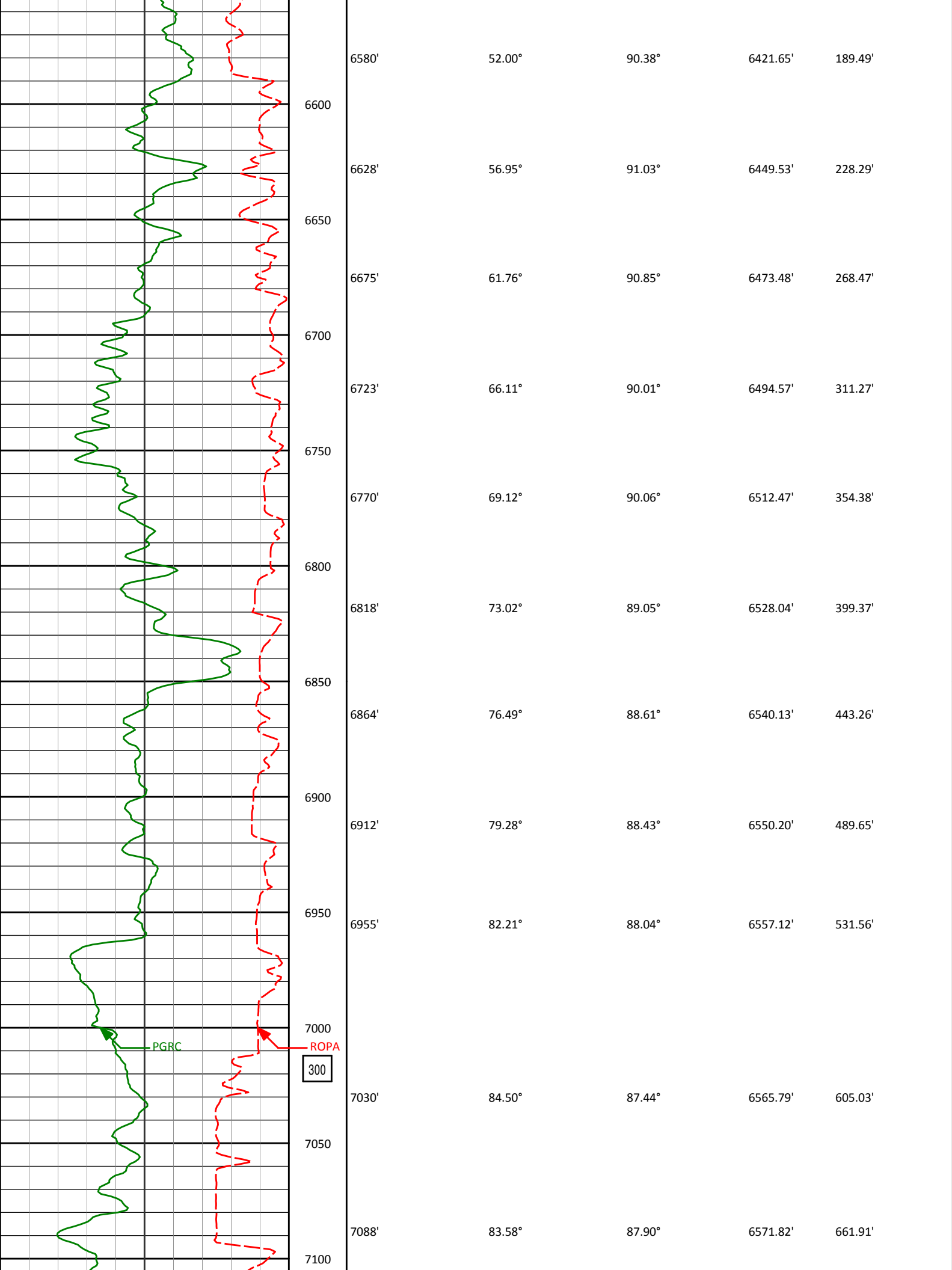
|       |        |         |          |         |
|-------|--------|---------|----------|---------|
| 3830' | 16.61° | 187.40° | 3760.28' | -55.20' |
| 3850  |        |         |          |         |
| 3900  |        |         |          |         |
| 3925' | 15.75° | 187.87° | 3851.52' | -55.38' |
| 3950  |        |         |          |         |
| 4000  |        |         |          |         |
| 4020' | 13.68° | 186.50° | 3943.40' | -55.37' |
| 4050  |        |         |          |         |
| 4100  |        |         |          |         |
| 4115' | 13.27° | 186.74° | 4035.78' | -55.13' |
| 4150  |        |         |          |         |
| 4200  |        |         |          |         |
| 4210' | 11.48° | 191.04° | 4128.58' | -55.65' |
| 4250  |        |         |          |         |
| 4300  |        |         |          |         |
| 4305' | 9.81°  | 192.47° | 4221.94' | -57.01' |
| 4350  |        |         |          |         |

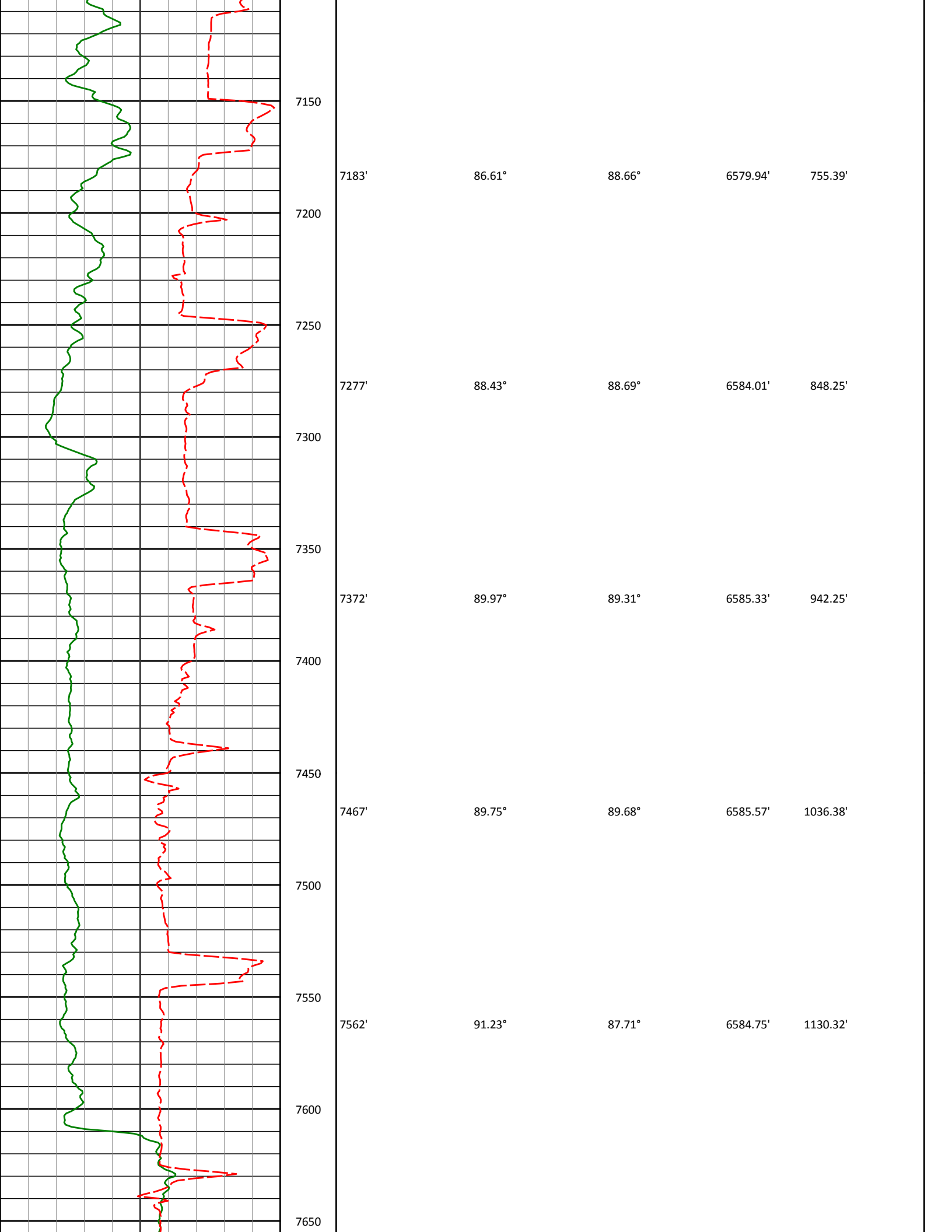


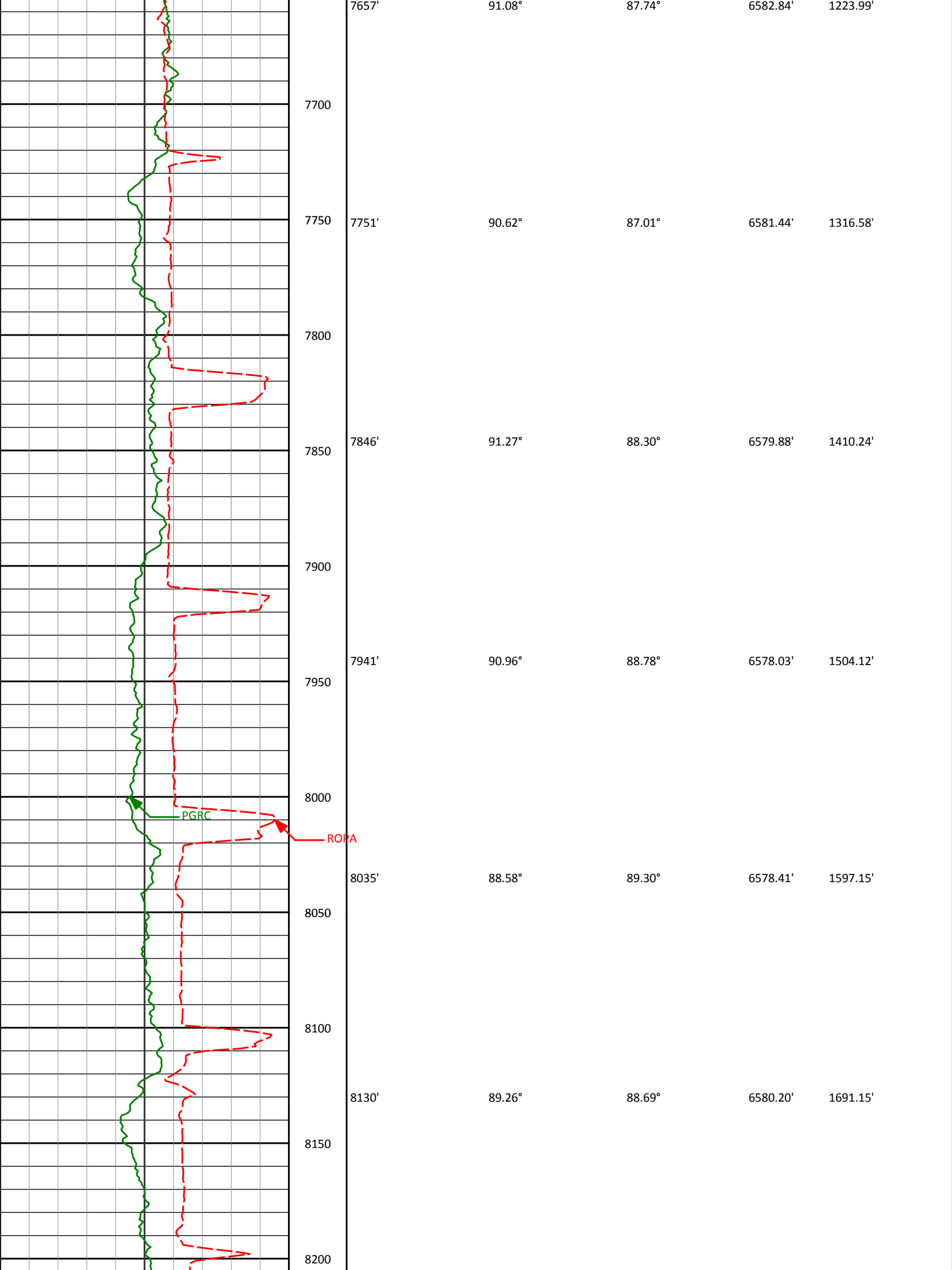


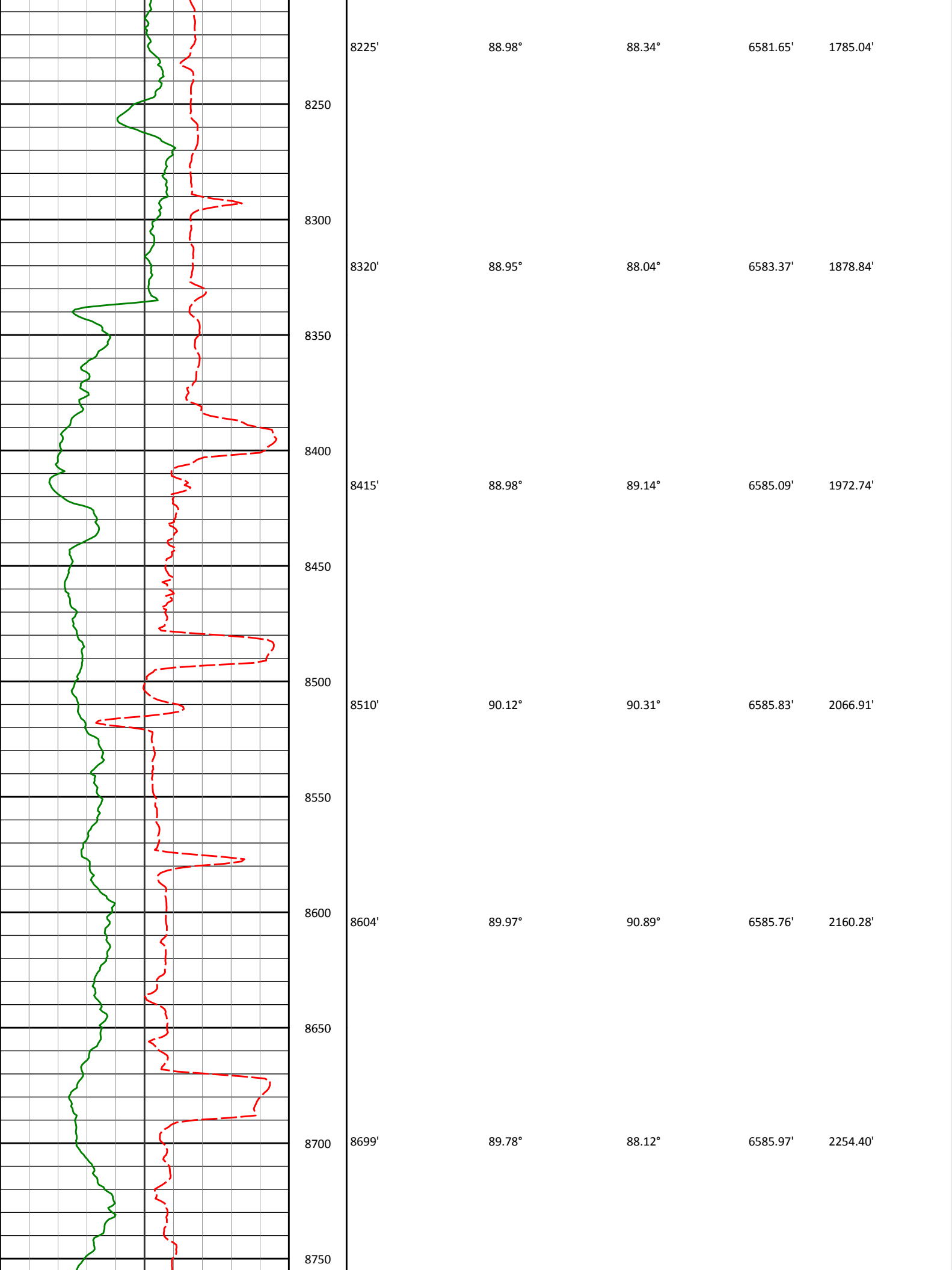


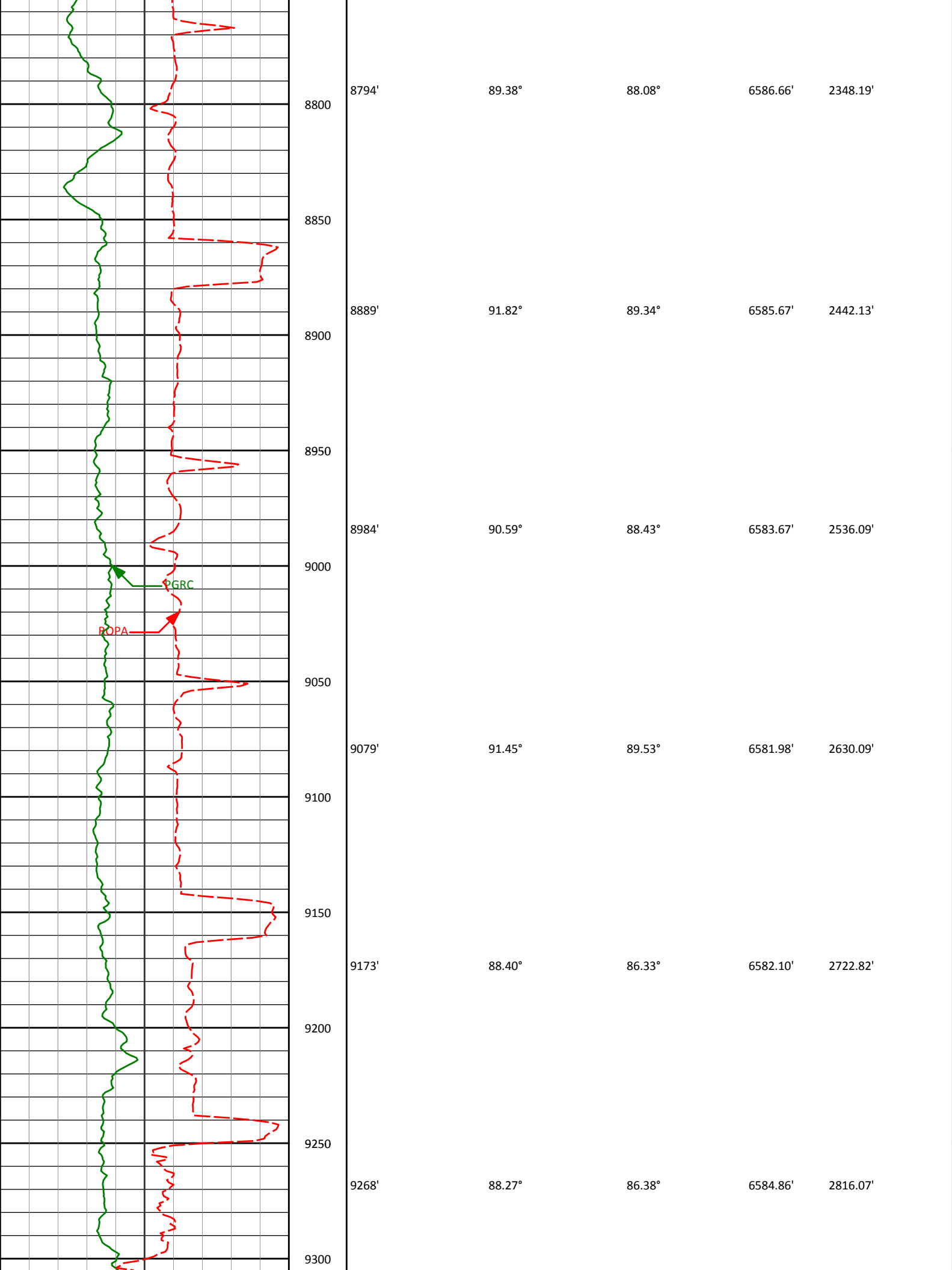


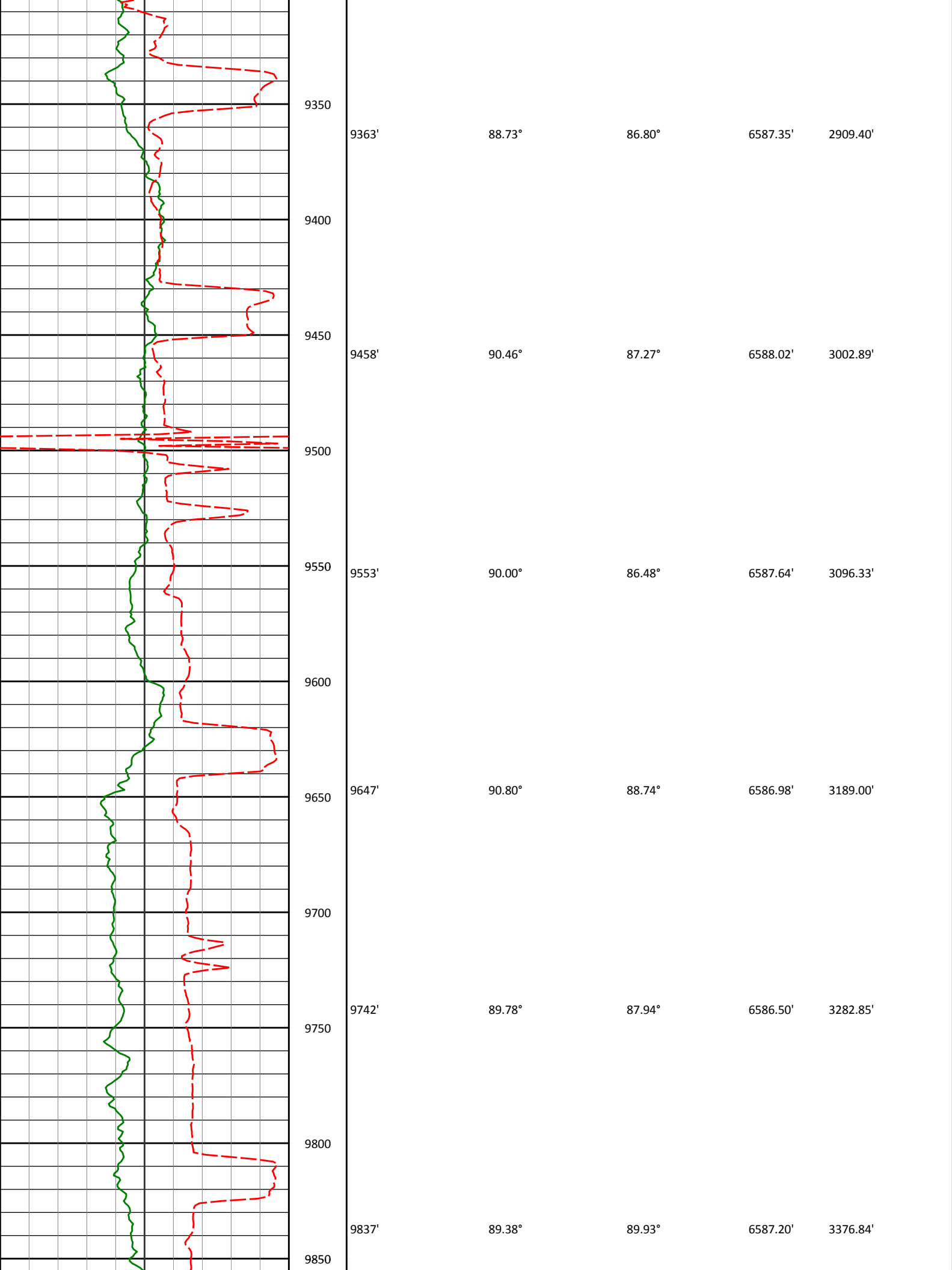


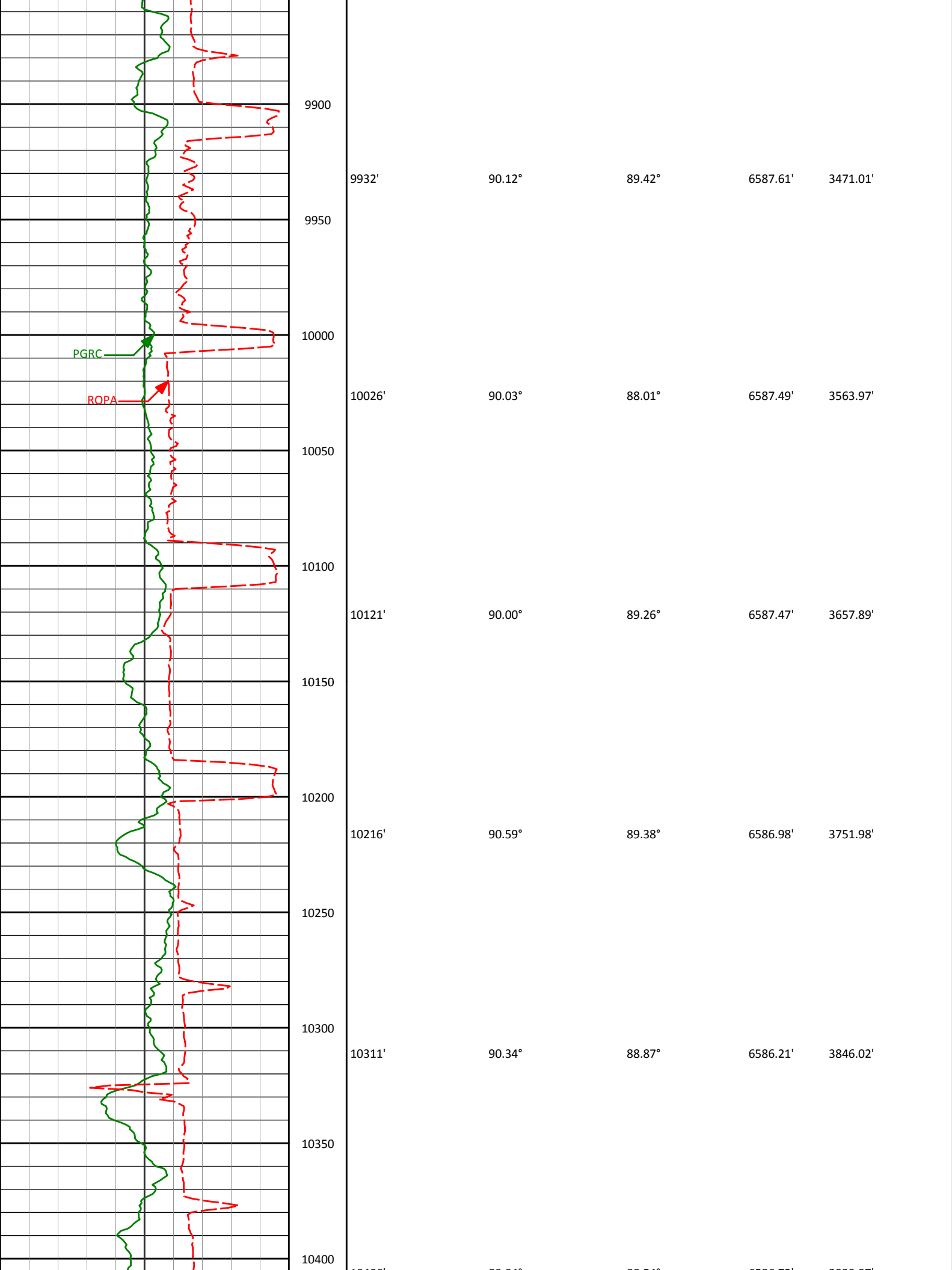


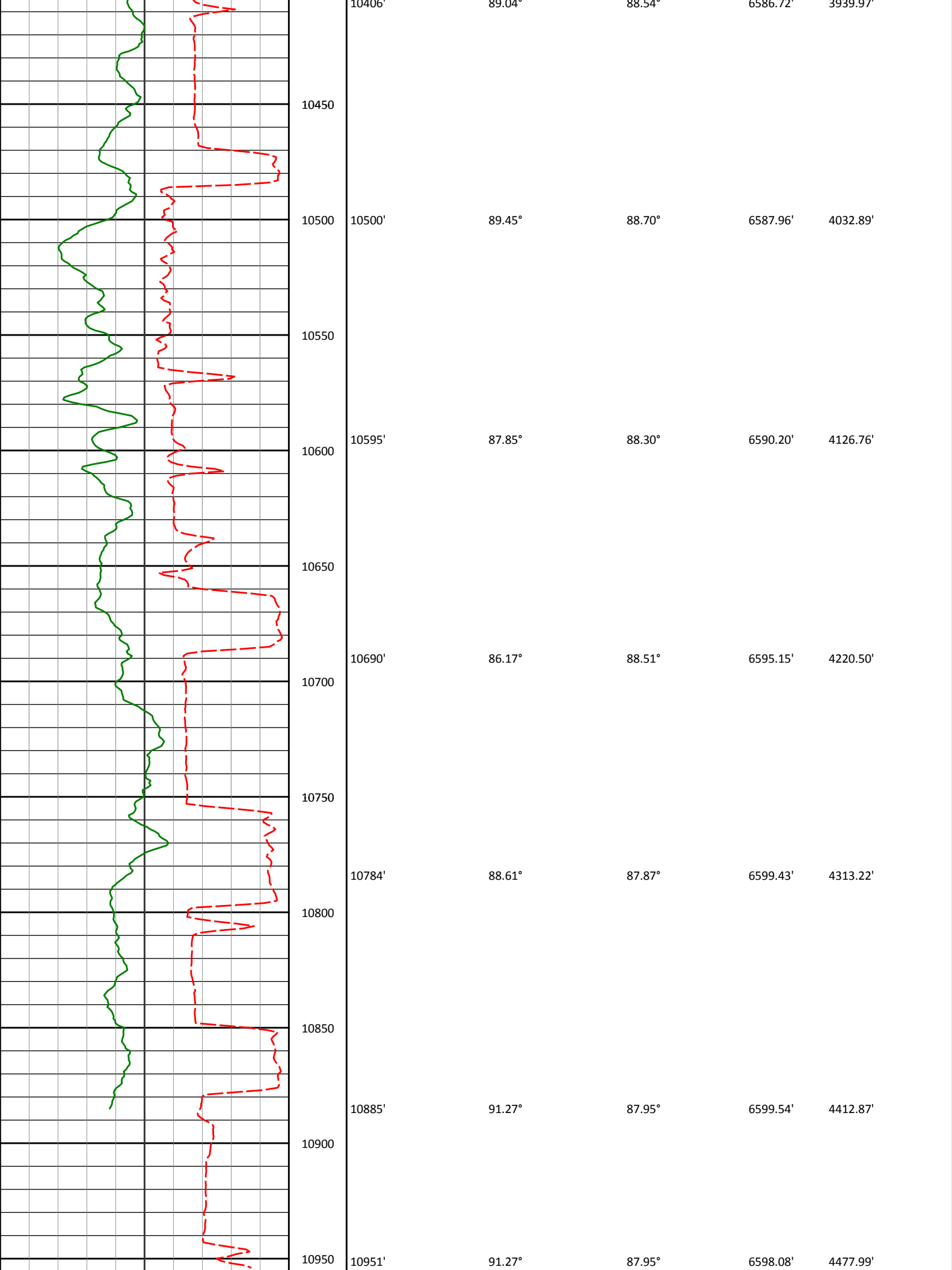




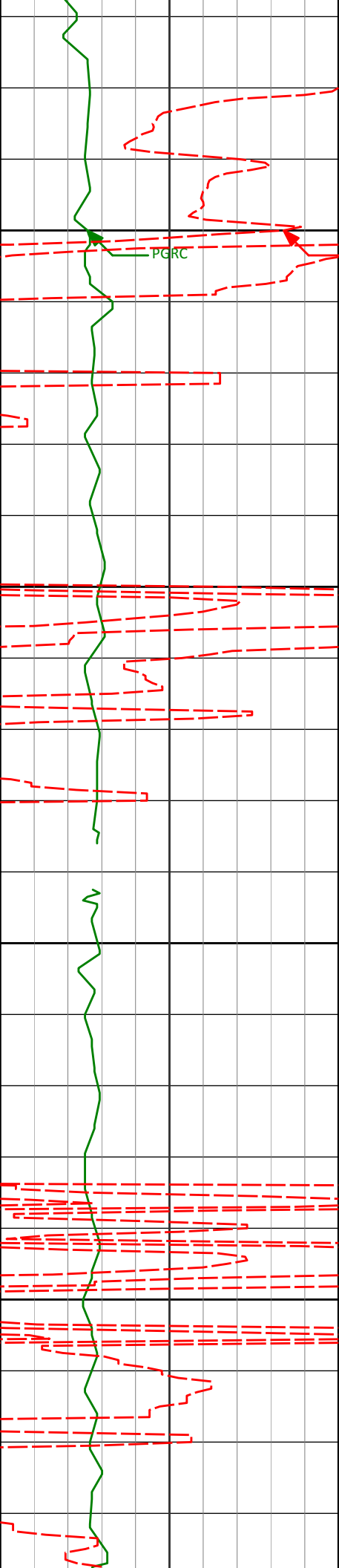








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100

1000

1050

1100

1150

998'

0.54°

175.35°

997.97'

-2.22'

1091'

0.59°

198.72°

1090.97'

-2.23'

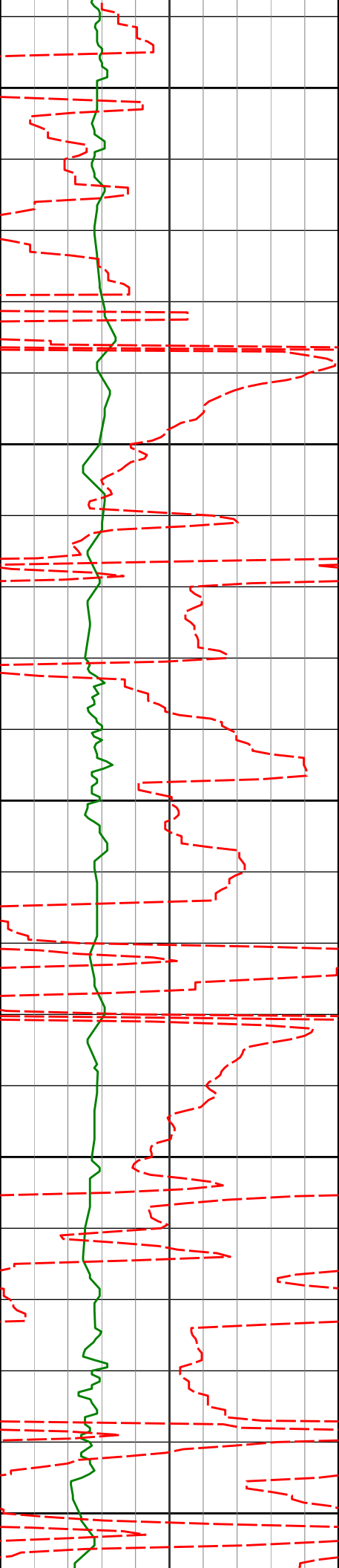
1184'

0.41°

221.43°

1183.97'

-2.51'



1200

1250

1300

1350

1400

1275'

1.78°

232.14°

1274.95'

-3.69'

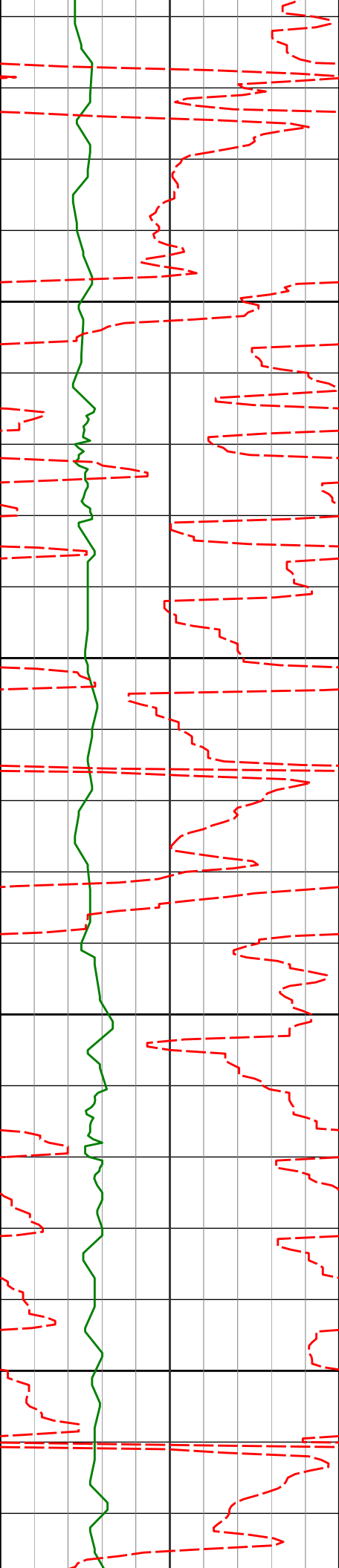
1368'

3.63°

253.75°

1367.84'

-7.41'



1450

1460'

6.51°

247.66°

1459.47'

-14.62'

1500

1550

1555'

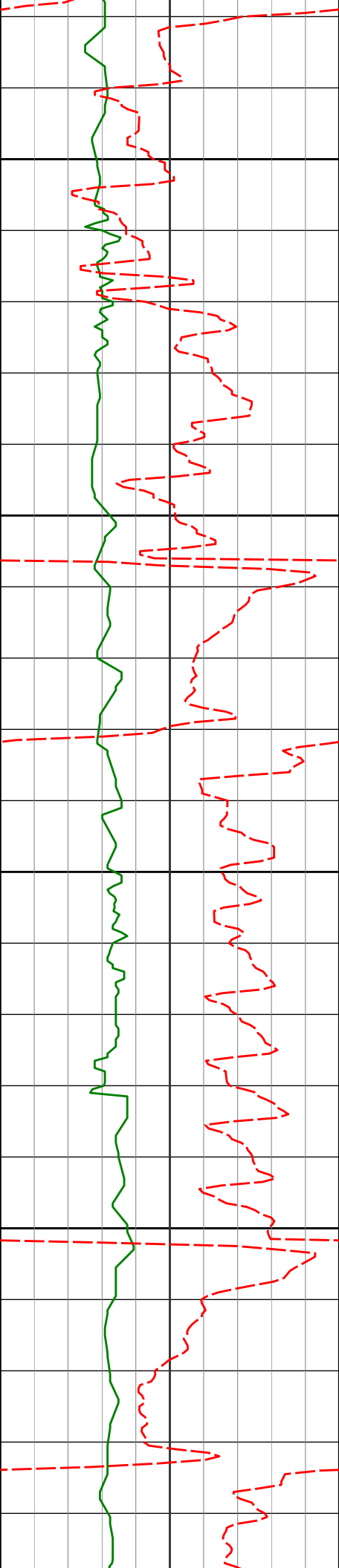
8.01°

239.73°

1553.71'

-24.55'

1600



1650

1650'

8.88°

233.92°

1647.68'

-35.13'

1700

1745'

7.86°

216.79°

1741.68'

-43.67'

1750

1800

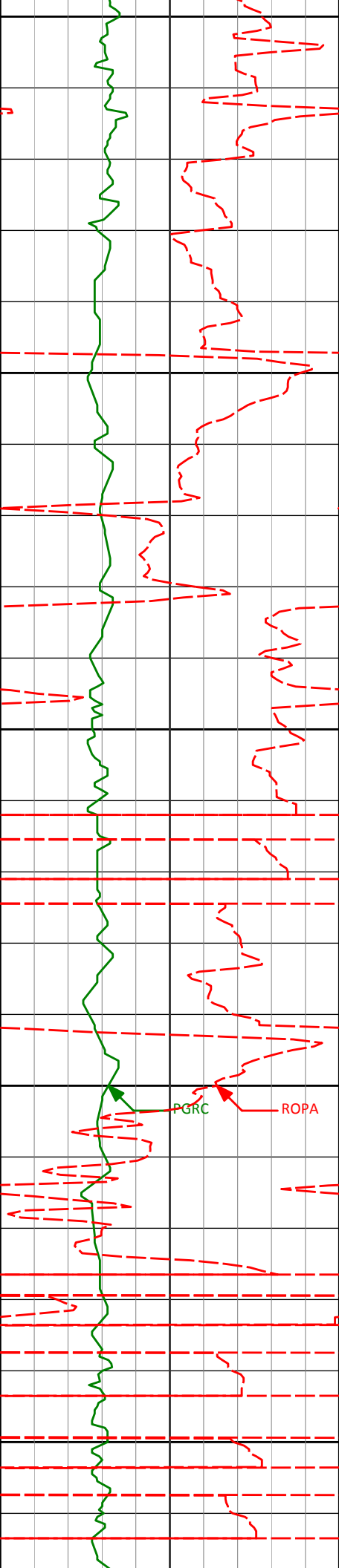
1840'

7.54°

196.44°

1835.84'

-47.87'



1850

1900

1950

2000

2050

1934'

9.93°

179.66°

1928.76'

-47.79'

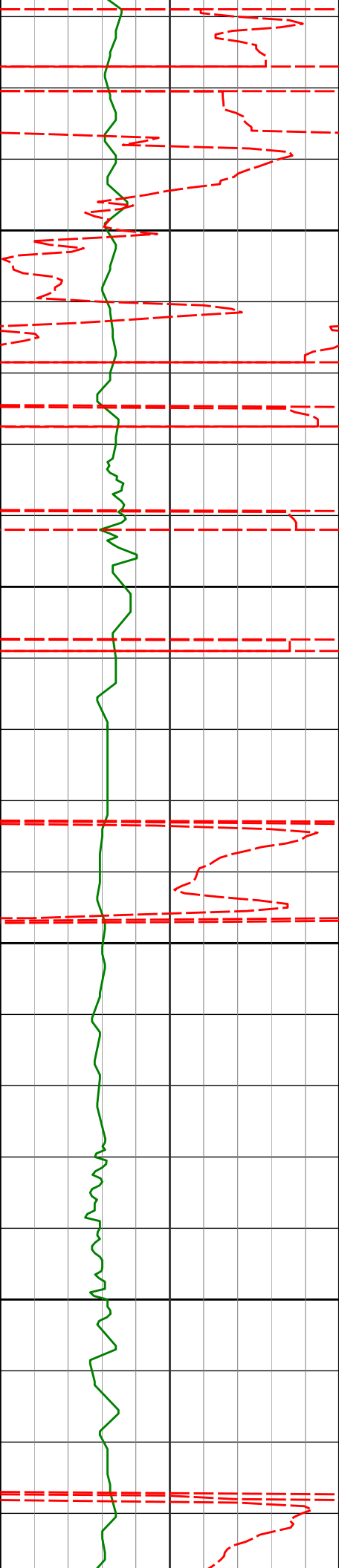
2029'

13.18°

181.07°

2021.82'

-45.54'



2100

2124'

14.32°

175.43°

2114.10'

-41.96'

2150

2200

2219'

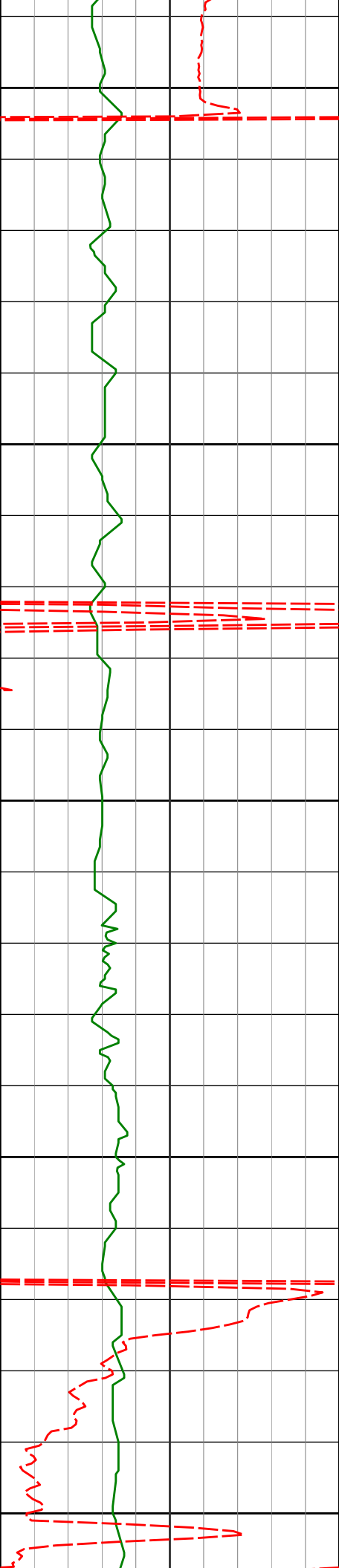
14.47°

176.47°

2206.12'

-37.34'

2250



2300

2314'

15.12°

185.22°

2297.98'

-34.68'

2350

2400

2408'

13.46°

181.94°

2389.07'

-33.23'

2450

2500

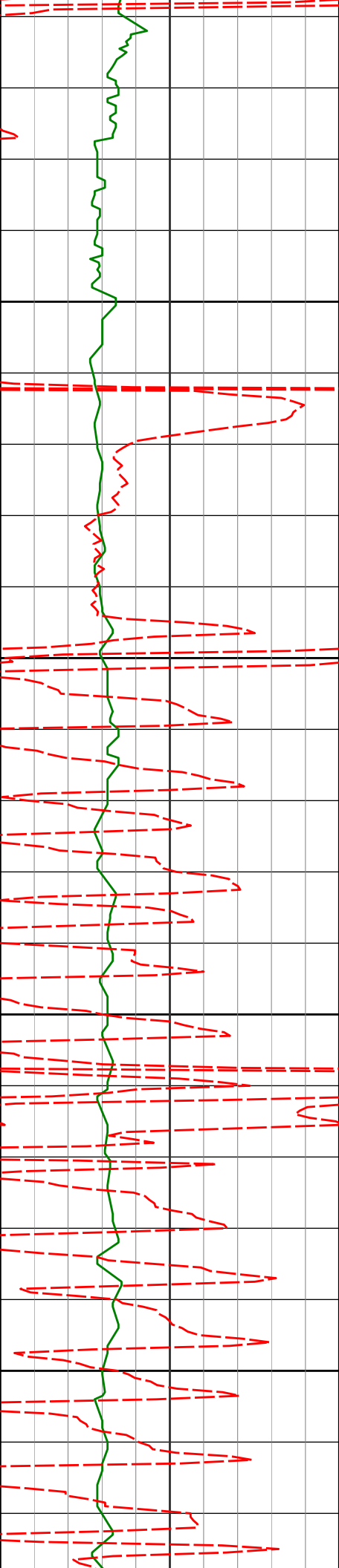
2503'

14.31°

186.43°

2481.30'

-32.04'



2550

2600

2650

2700

2598'

16.78°

194.56°

2572.83'

-33.62'

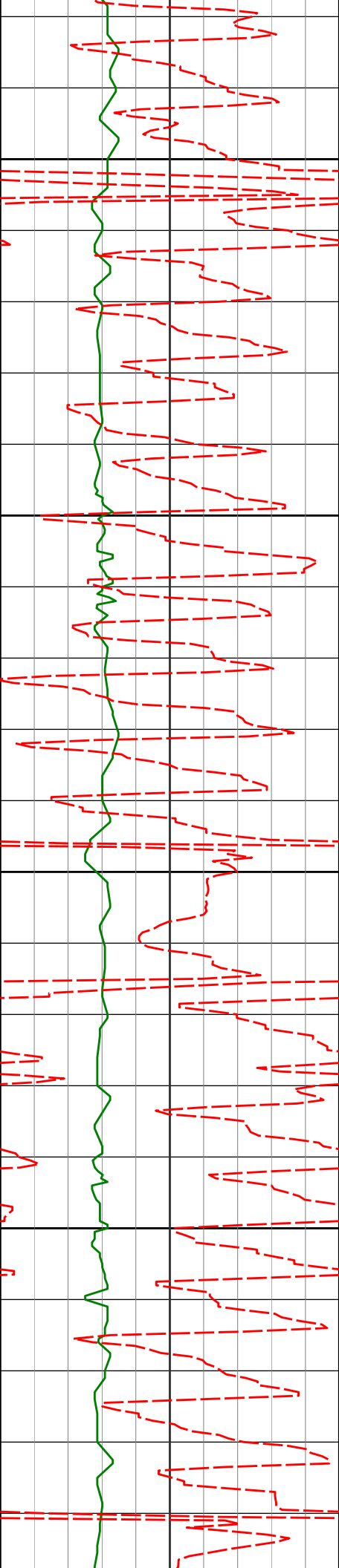
2693'

16.03°

195.29°

2663.96'

-37.20'



2750

2788'

15.23°

191.83°

2755.45'

-40.03'

2800

2850

2882'

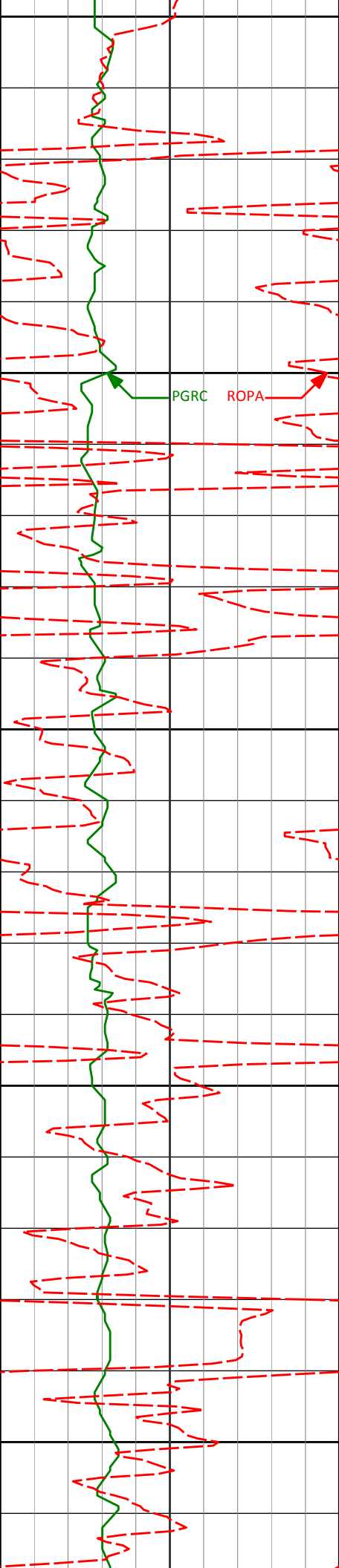
14.65°

192.02°

2846.27'

-42.00'

2900



2950

2977'

16.19°

191.59°

2937.85'

-44.00'

3000

PGRC

ROPA

3050

3072'

16.44°

191.01°

3029.02'

-45.89'

3100

3150

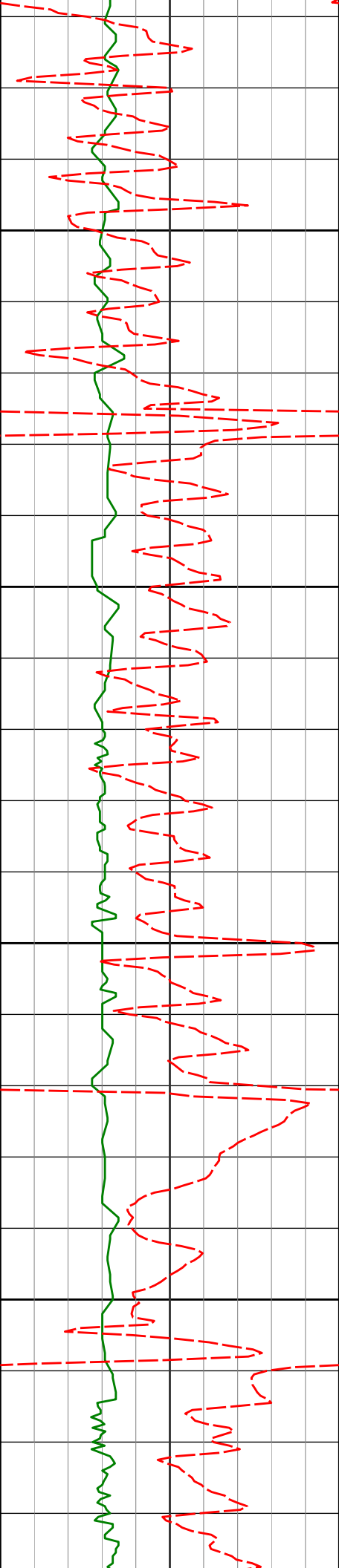
3167'

15.43°

190.84°

3120.37'

-47.56'



3200

3250

3300

3350

3262'

13.52°

195.05°

3212.35'

-49.86'

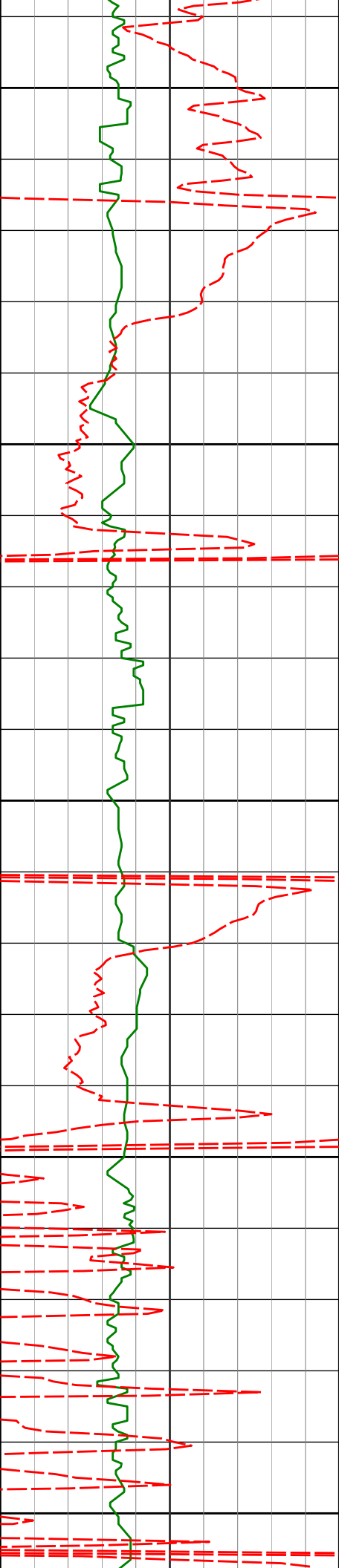
3357'

13.02°

188.10°

3304.82'

-51.53'



3400

3450

3500

3550

3600

3451'

14.43°

190.71°

3396.14'

-52.39'

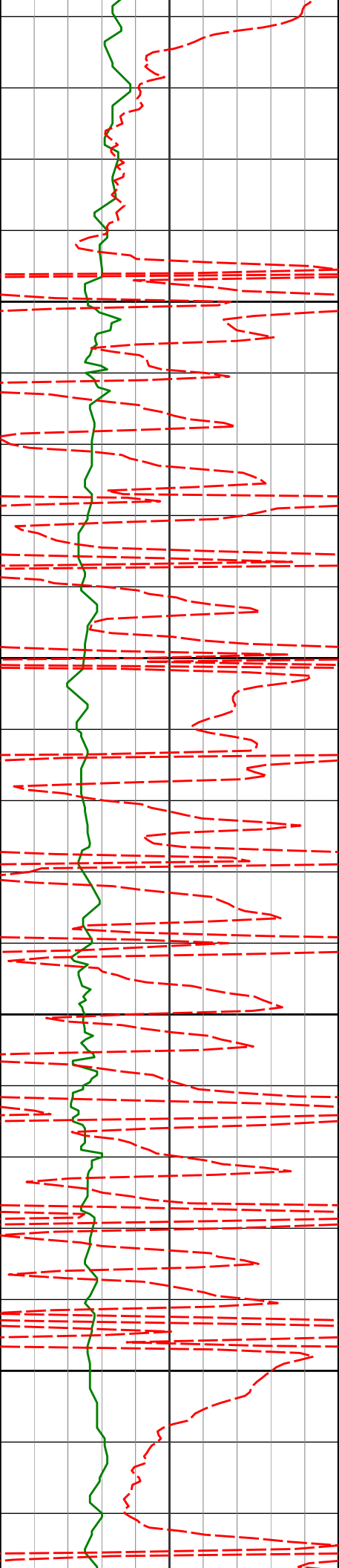
3546'

14.72°

188.44°

3488.08'

-53.35'



3641'

16.58°

188.31°

3579.55'

-53.86'

3650

3700

3750

3800

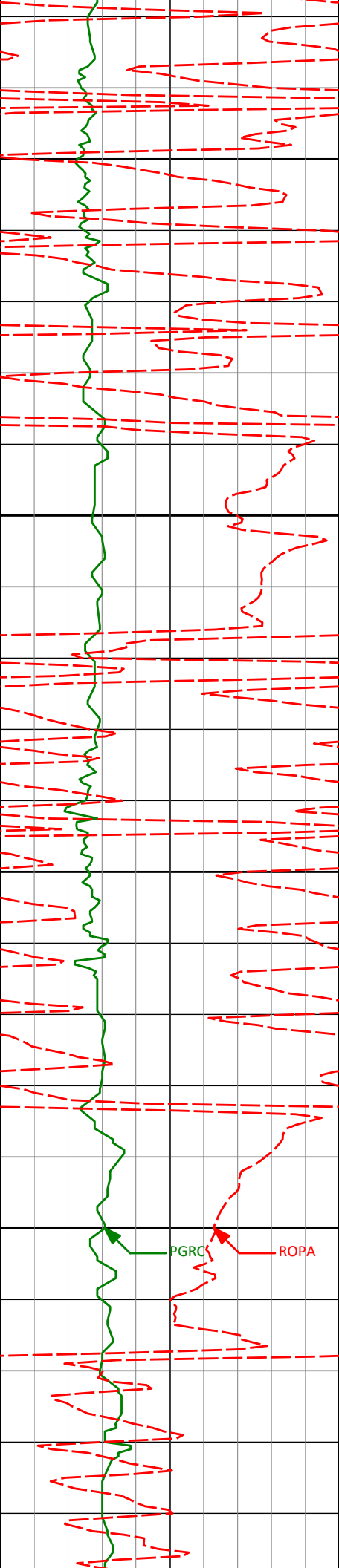
3735'

17.43°

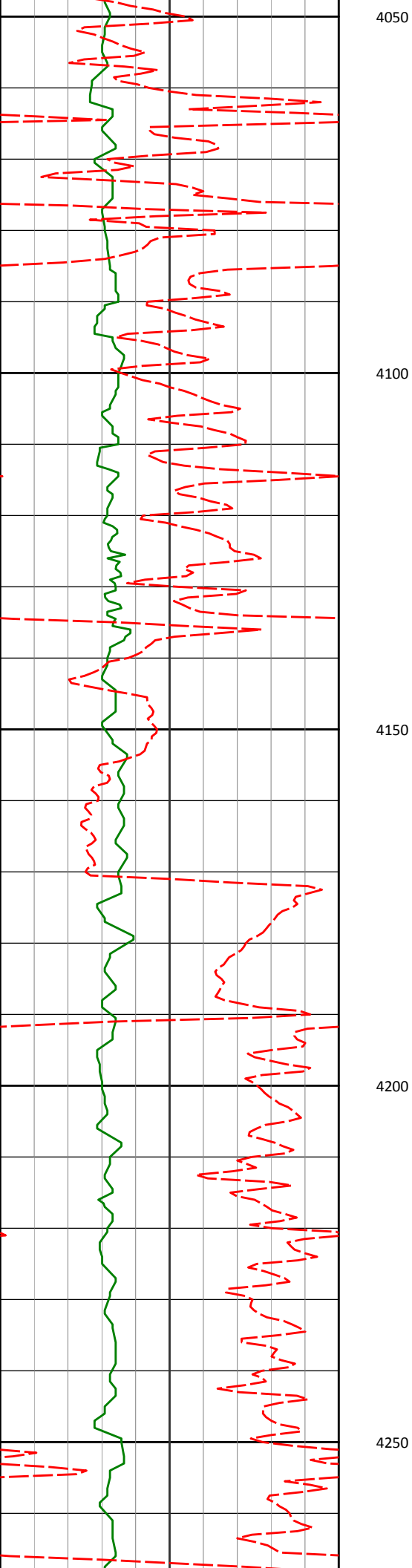
189.40°

3669.44'

-54.63'



|       |        |         |          |         |
|-------|--------|---------|----------|---------|
| 3830' | 16.61° | 187.40° | 3760.28' | -55.20' |
| 3850  |        |         |          |         |
| 3900  |        |         |          |         |
| 3925' | 15.75° | 187.87° | 3851.52' | -55.38' |
| 3950  |        |         |          |         |
| 4000  |        |         |          |         |
| 4020' | 13.68° | 186.50° | 3943.40' | -55.37' |



4115'

13.27°

186.74°

4035.78'

-55.13'

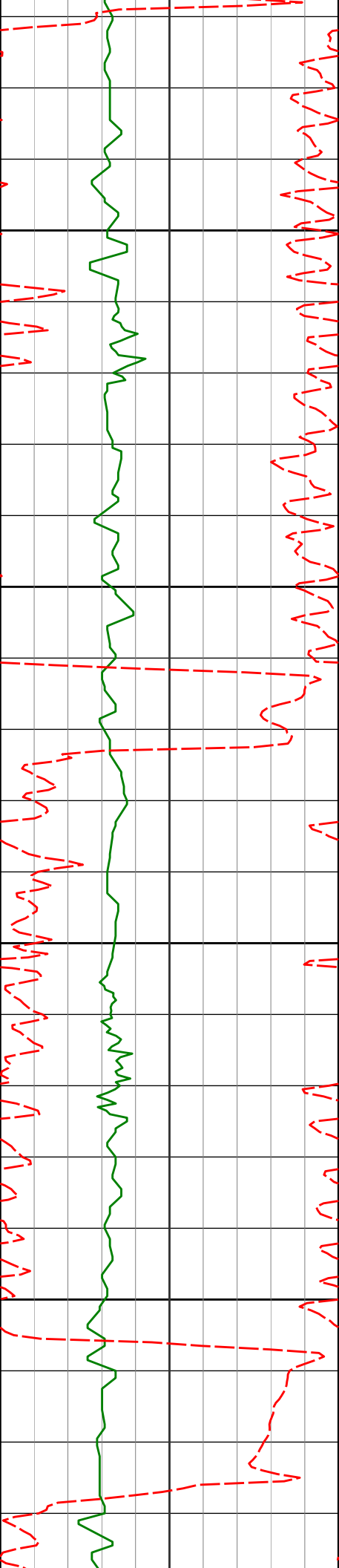
4210'

11.48°

191.04°

4128.58'

-55.65'



4300

4305'

9.81°

192.47°

4221.94'

-57.01'

4350

4400

4400'

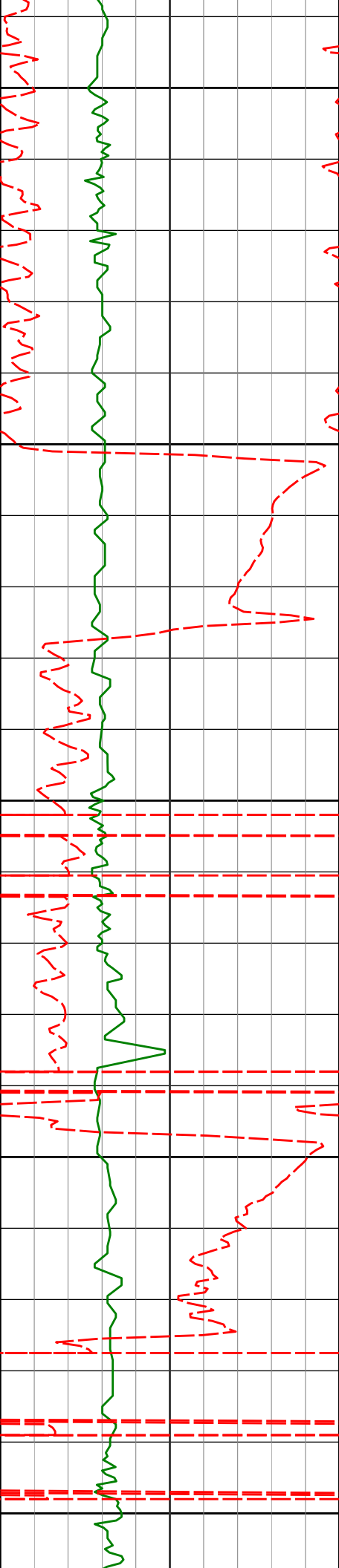
8.43°

184.05°

4315.74'

-57.36'

4450



4494'

6.95°

191.55°

4408.89'

-57.40'

4500

4550

4589'

5.22°

188.22°

4503.35'

-57.91'

4600

4650

4684'

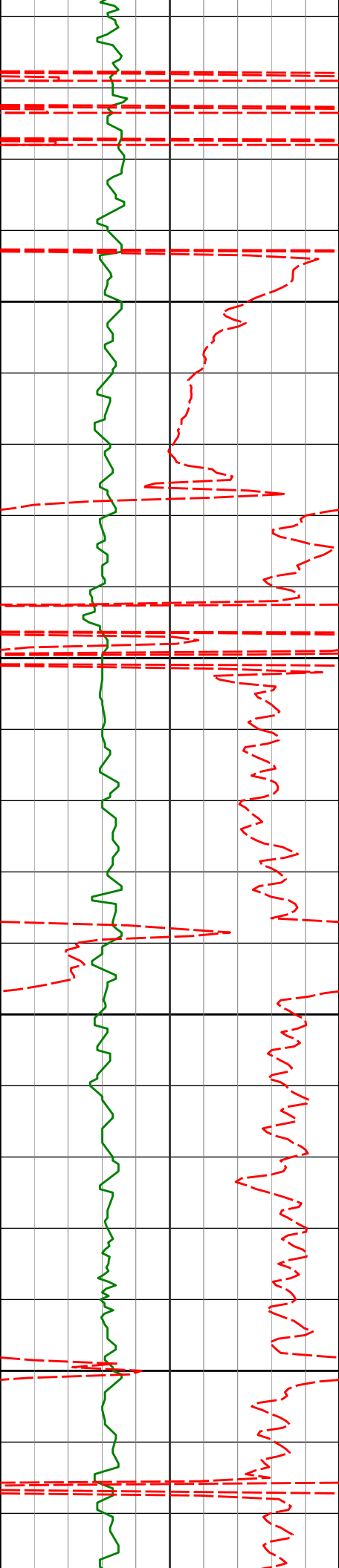
3.00°

188.99°

4598.10'

-58.06'

4700



4750

4779'

0.84°

204.74°

4693.05'

-58.34'

4800

4850

4874'

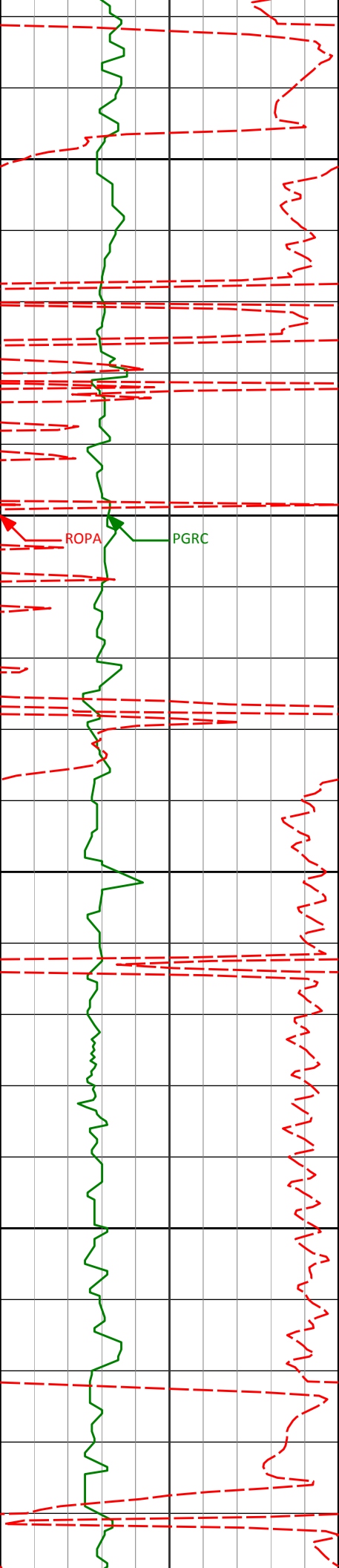
1.47°

246.63°

4788.03'

-59.60'

4900



4950

4969'

1.09°

269.55°

4883.00'

-61.54'

5000

ROPA

PGRC

5050

5063'

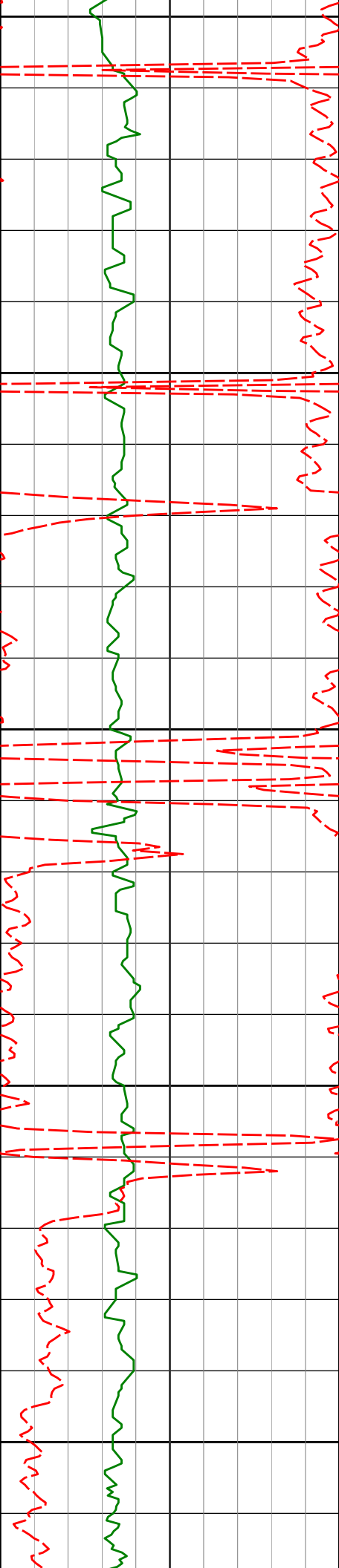
1.16°

307.99°

4976.99'

-63.25'

5100



5150

5158'

0.39°

343.33°

5071.98'

-64.20'

5200

5250

5253'

0.54°

26.66°

5166.98'

-64.19'

5300

5350

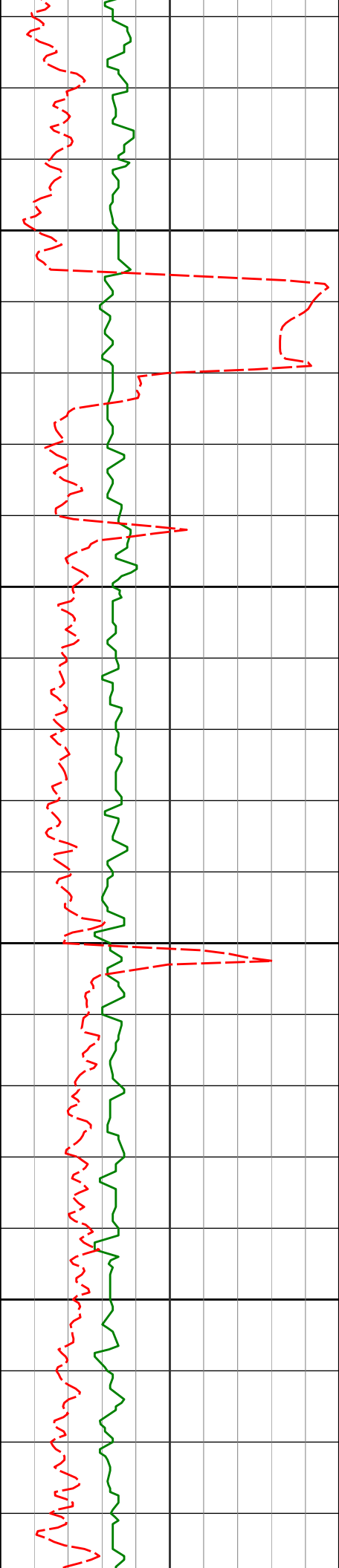
5348'

1.20°

17.03°

5261.96'

-63.87'



5400

5443'

0.42°

214.55°

5356.96'

-63.86'

5450

5500

5537'

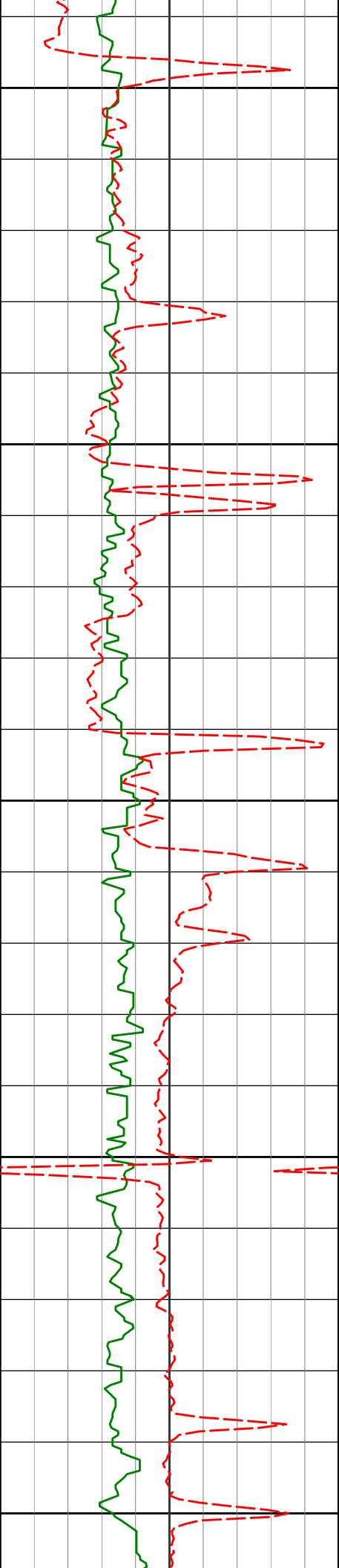
0.24°

11.21°

5450.96'

-64.00'

5550



5600

5632'

0.74°

98.77°

5545.95'

-63.38'

5650

5700

5727'

0.54°

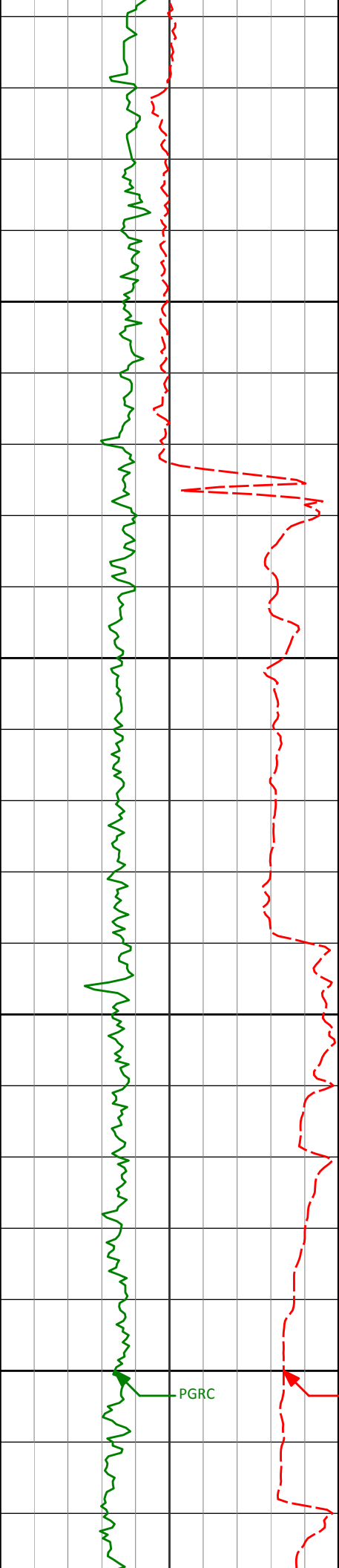
51.05°

5640.95'

-62.45'

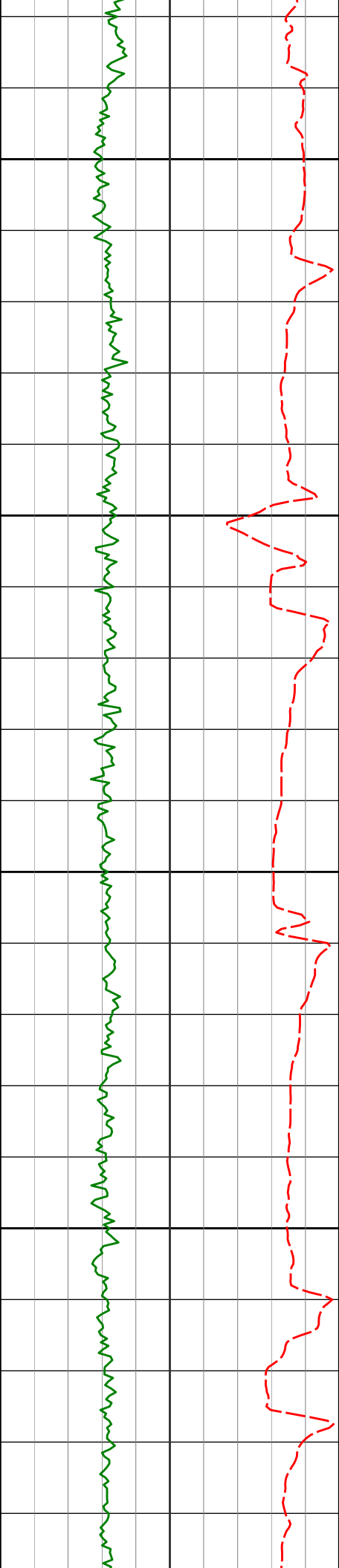
5750

5800



200

|       |       |         |          |         |
|-------|-------|---------|----------|---------|
| 5820' | 0.65° | 103.08° | 5733.94' | -61.63' |
| 5850  |       |         |          |         |
| 5900  |       |         |          |         |
| 5916' | 0.44° | 81.10°  | 5829.94' | -60.73' |
| 5950  |       |         |          |         |
| 5964' | 3.42° | 83.02°  | 5877.91' | -59.17' |
| 6000  |       |         |          |         |
| 6011' | 8.15° | 82.97°  | 5924.66' | -54.58' |



6050

6059'

10.35°

85.90°

5972.03'

-47.05'

6100

6106'

12.63°

86.25°

6018.08'

-37.86'

6150

6154'

16.16°

88.10°

6064.57'

-26.12'

6200

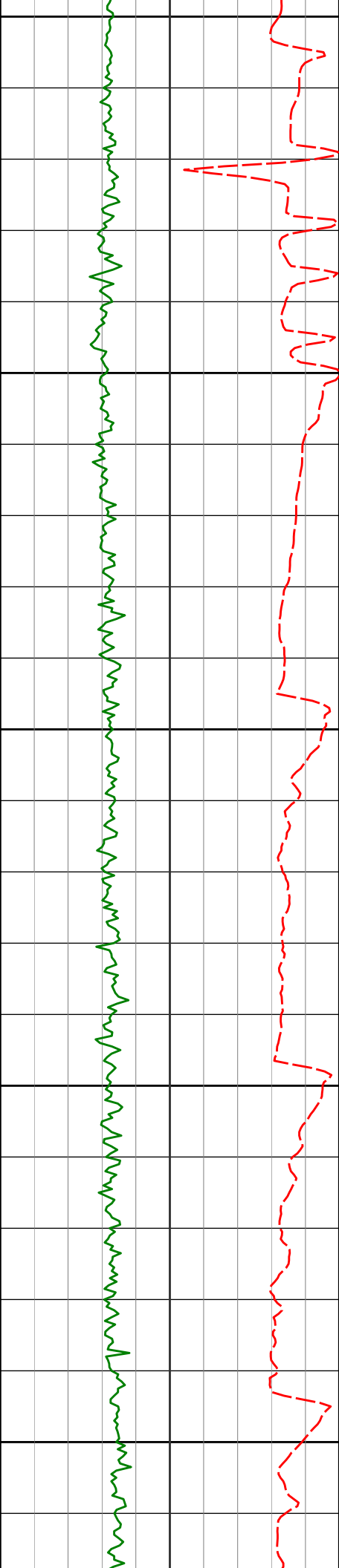
6201'

19.13°

91.59°

6109.35'

-11.99'



6250

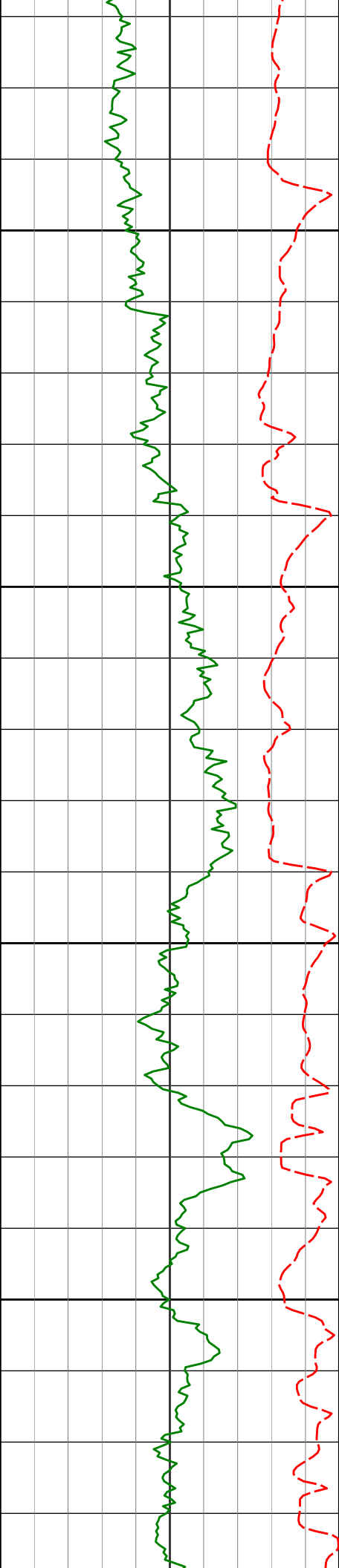
6300

6350

6400

6450

|       |        |        |          |        |
|-------|--------|--------|----------|--------|
| 6249' | 21.18° | 94.18° | 6154.41' | 4.50'  |
| 6296' | 24.07° | 90.16° | 6197.79' | 22.49' |
| 6344' | 28.06° | 85.16° | 6240.91' | 43.26' |
| 6390' | 32.31° | 83.76° | 6280.66' | 65.80' |
| 6438' | 36.90° | 84.15° | 6320.16' | 92.32' |



6500

6550

6600

6650

6485'

41.50°

85.42°

6356.57'

121.32'

6533'

46.69°

88.58°

6391.04'

154.18'

6580'

52.00°

90.38°

6421.65'

189.49'

6628'

56.95°

91.03°

6449.53'

228.29'

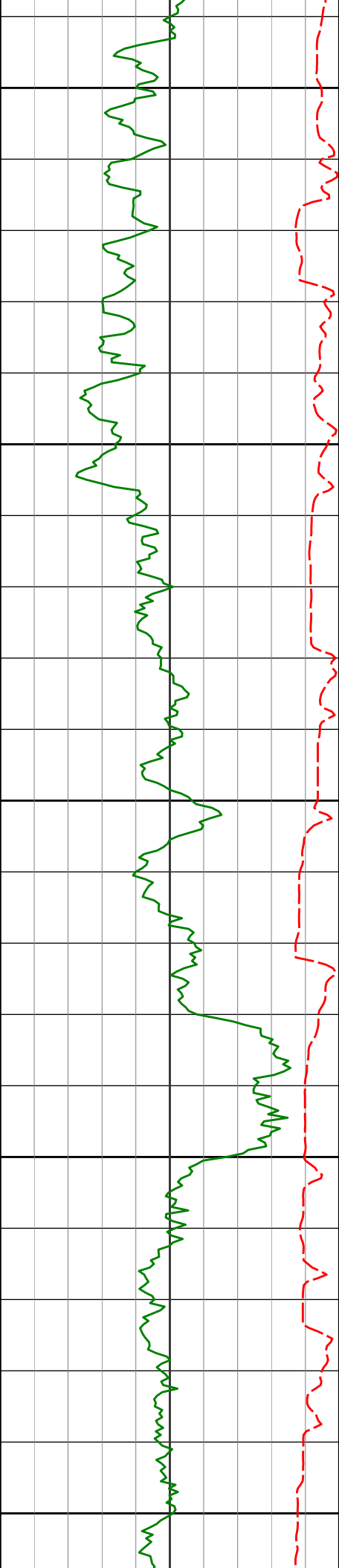
6675'

61.76°

90.85°

6473.48'

268.47'



6700

6723'

66.11°

90.01°

6494.57'

311.27'

6750

6770'

69.12°

90.06°

6512.47'

354.38'

6800

6818'

73.02°

89.05°

6528.04'

399.37'

6850

6864'

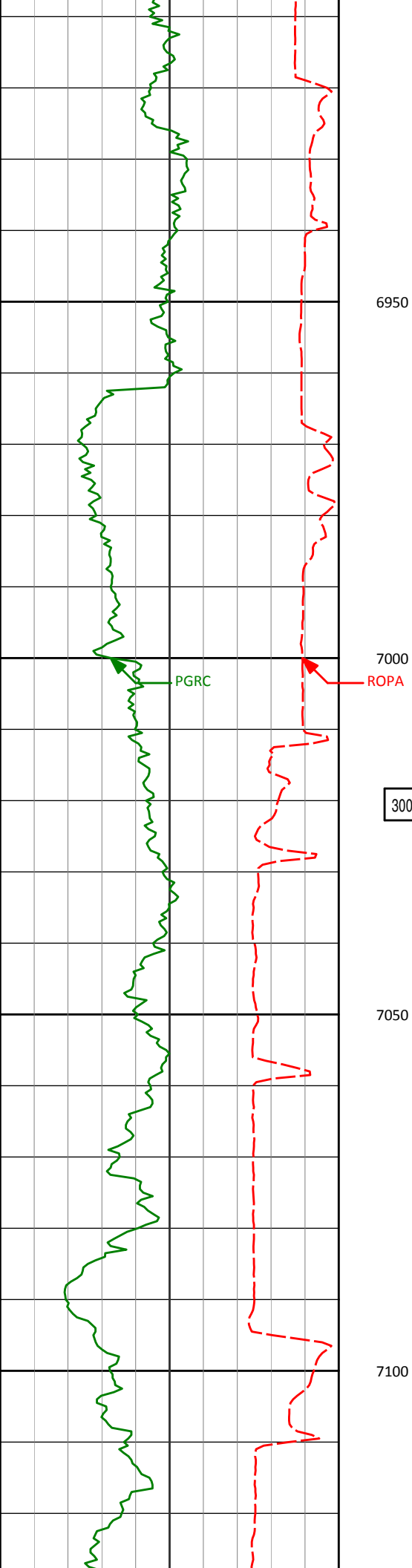
76.49°

88.61°

6540.13'

443.26'

6900

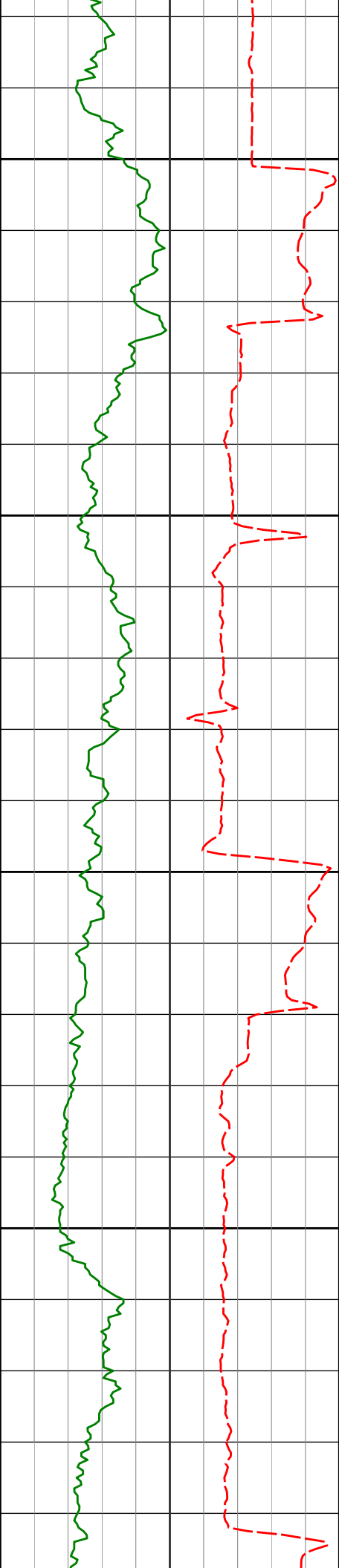


|       |        |        |          |         |
|-------|--------|--------|----------|---------|
| 6912' | 79.28° | 88.43° | 6550.20' | 489.65' |
|-------|--------|--------|----------|---------|

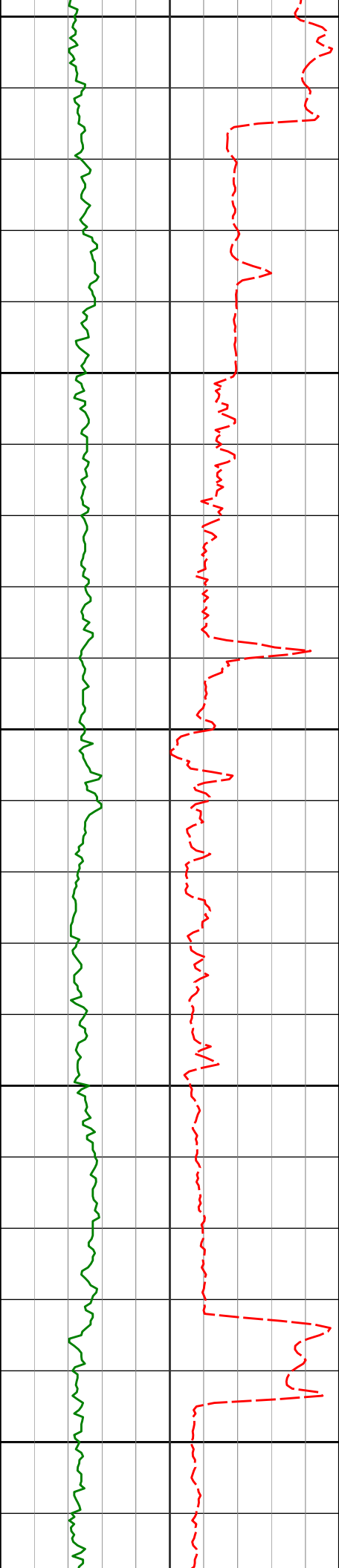
|       |        |        |          |         |
|-------|--------|--------|----------|---------|
| 6955' | 82.21° | 88.04° | 6557.12' | 531.56' |
|-------|--------|--------|----------|---------|

|       |        |        |          |         |
|-------|--------|--------|----------|---------|
| 7030' | 84.50° | 87.44° | 6565.79' | 605.03' |
|-------|--------|--------|----------|---------|

|       |        |        |          |         |
|-------|--------|--------|----------|---------|
| 7088' | 83.58° | 87.90° | 6571.82' | 661.91' |
|-------|--------|--------|----------|---------|



|       |        |        |          |         |
|-------|--------|--------|----------|---------|
| 7183' | 86.61° | 88.66° | 6579.94' | 755.39' |
| 7277' | 88.43° | 88.69° | 6584.01' | 848.25' |



7350

7372'

89.97°

89.31°

6585.33'

942.25'

7400

7450

7467'

89.75°

89.68°

6585.57'

1036.38'

7500

7550

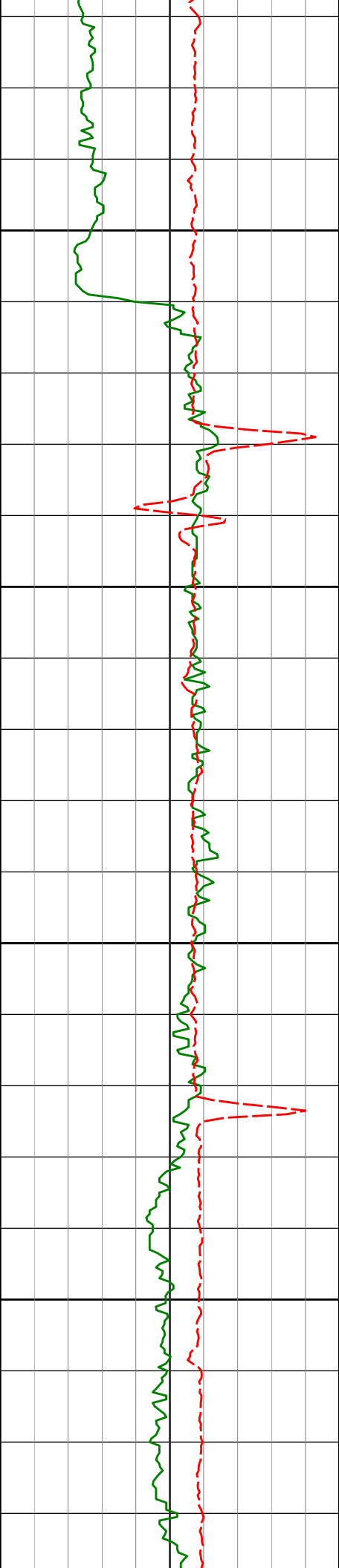
7562'

91.23°

87.71°

6584.75'

1130.32'



7600

7650

7700

7750

7657'

91.08°

87.74°

6582.84'

1223.99'

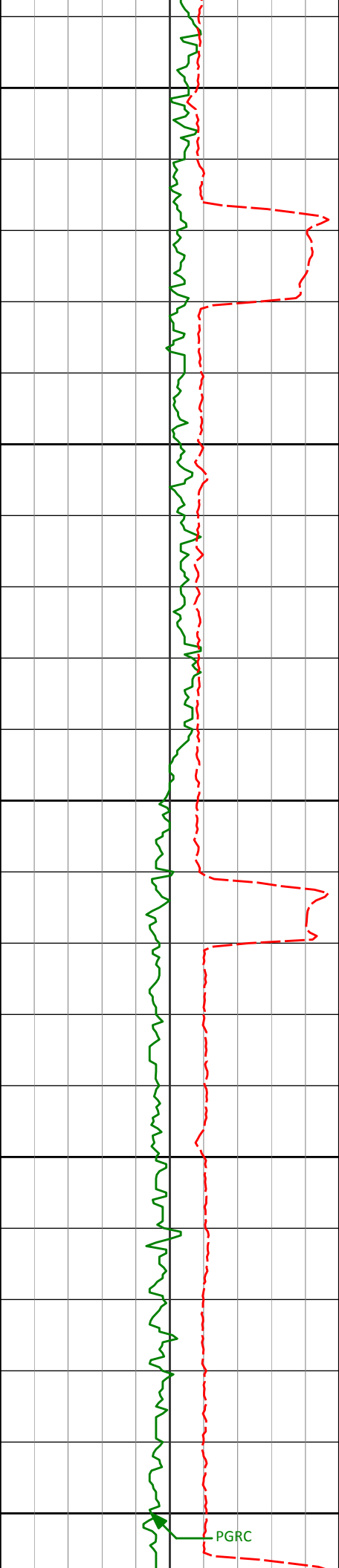
7751'

90.62°

87.01°

6581.44'

1316.58'



7800

7850

7900

7950

8000

7846'

91.27°

88.30°

6579.88'

1410.24'

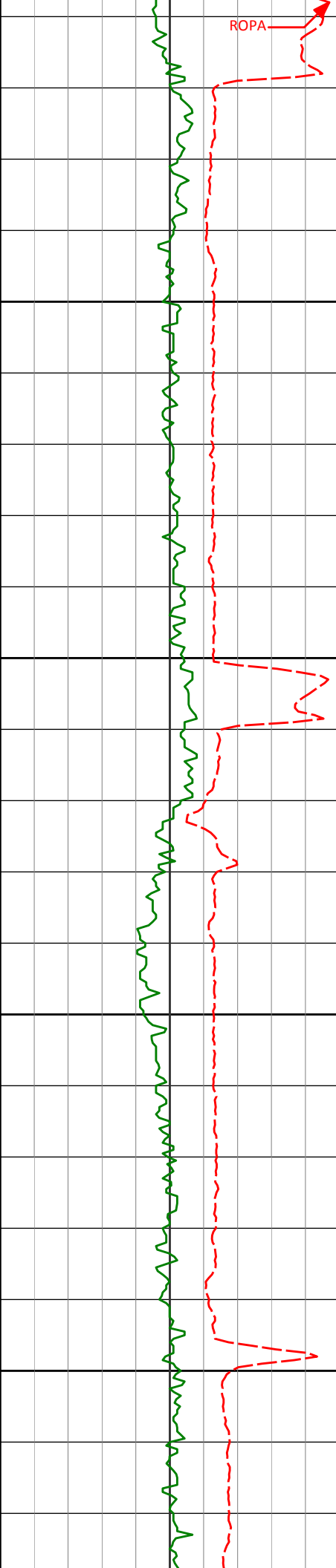
7941'

90.96°

88.78°

6578.03'

1504.12'



8035'

88.58°

89.30°

6578.41'

1597.15'

8130'

89.26°

88.69°

6580.20'

1691.15'

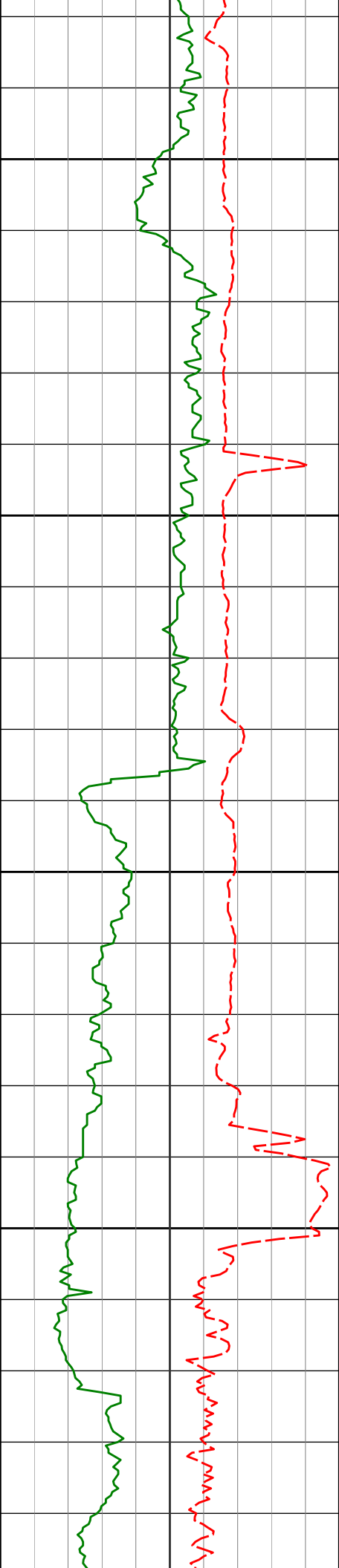
8225'

88.98°

88.34°

6581.65'

1785.04'



8250

8300

8350

8400

8320'

88.95°

88.04°

6583.37'

1878.84'

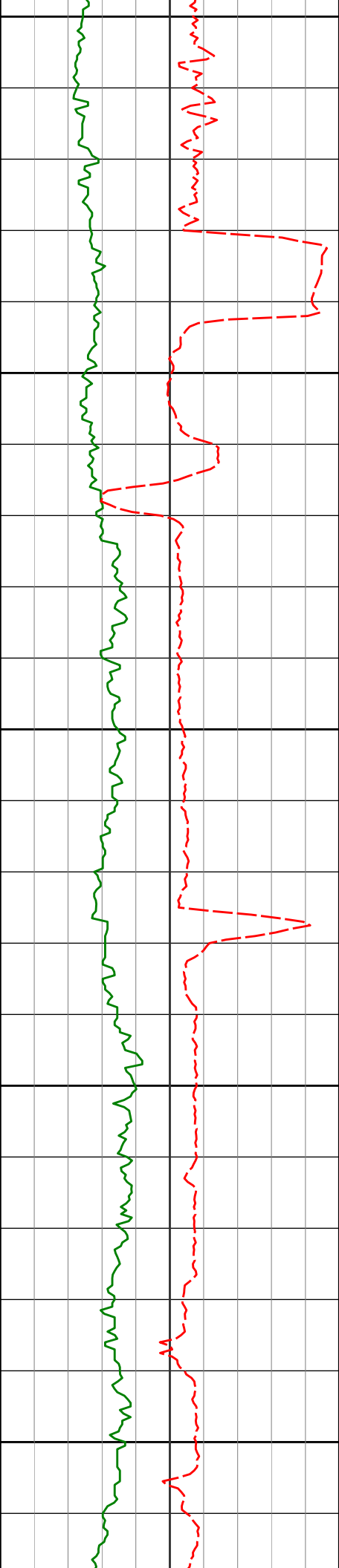
8415'

88.98°

89.14°

6585.09'

1972.74'



8450

8500

8550

8600

8650

8510'

90.12°

90.31°

6585.83'

2066.91'

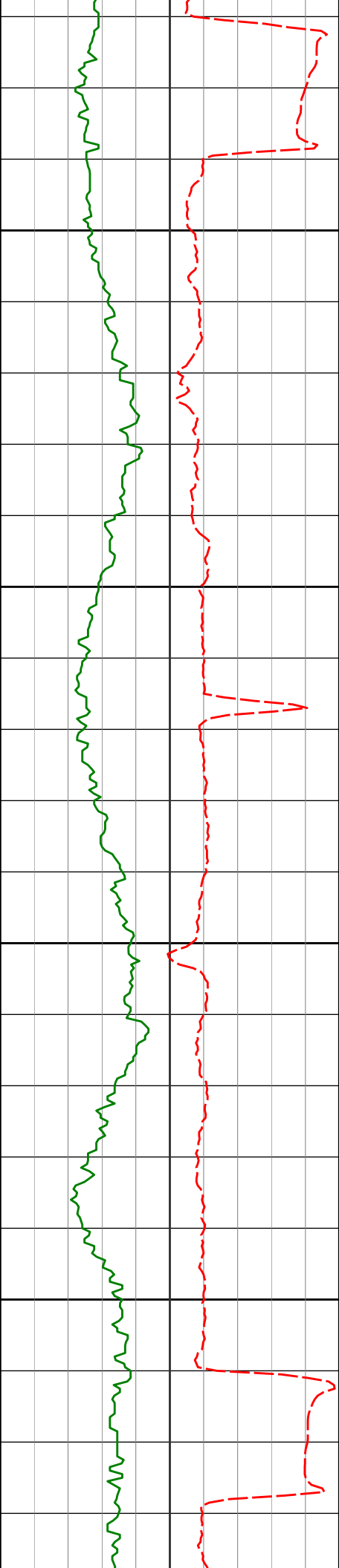
8604'

89.97°

90.89°

6585.76'

2160.28'



8700

8750

8800

8850

8699'

89.78°

88.12°

6585.97'

2254.40'

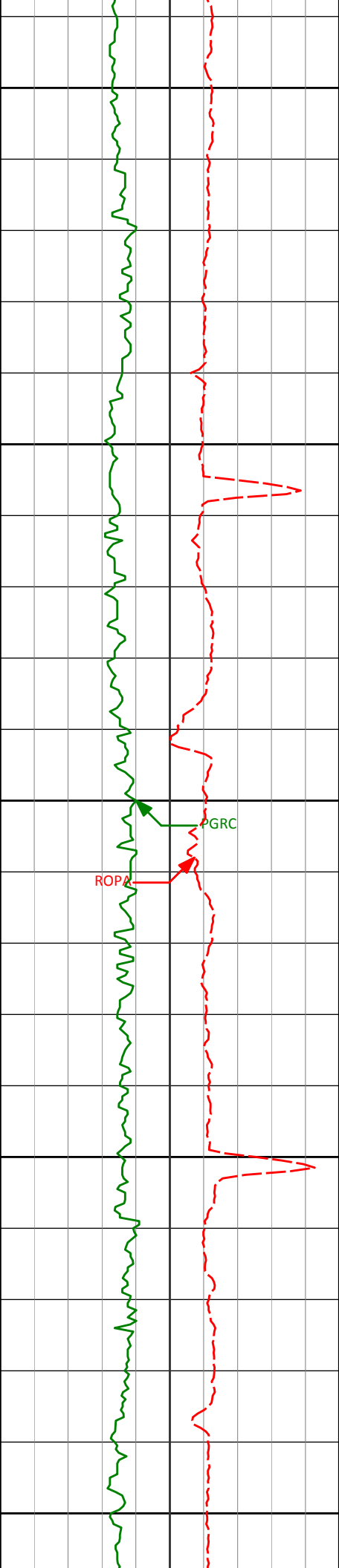
8794'

89.38°

88.08°

6586.66'

2348.19'



8900

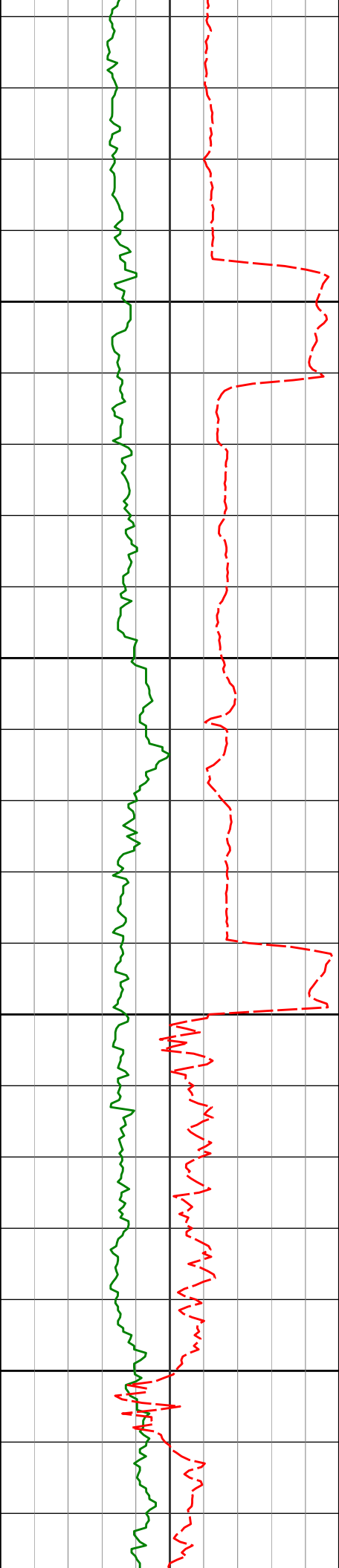
8950

9000

9050

9100

|       |        |        |          |          |
|-------|--------|--------|----------|----------|
| 8889' | 91.82° | 89.34° | 6585.67' | 2442.13' |
|       |        |        |          |          |
| 8984' | 90.59° | 88.43° | 6583.67' | 2536.09' |
|       |        |        |          |          |
| 9079' | 91.45° | 89.53° | 6581.98' | 2630.09' |



9150

9173'

88.40°

86.33°

6582.10'

2722.82'

9200

9250

9268'

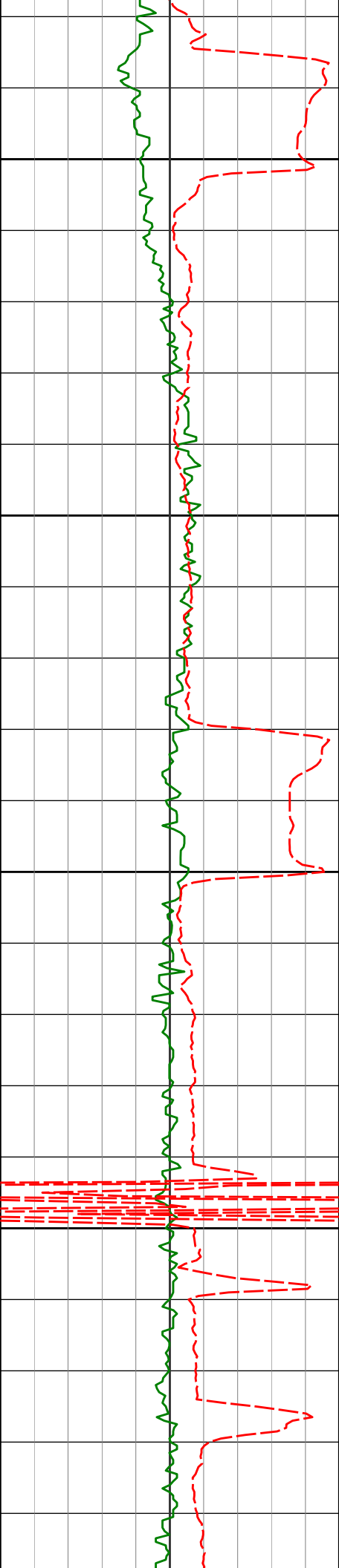
88.27°

86.38°

6584.86'

2816.07'

9300



9350

9363'

88.73°

86.80°

6587.35'

2909.40'

9400

9450

9458'

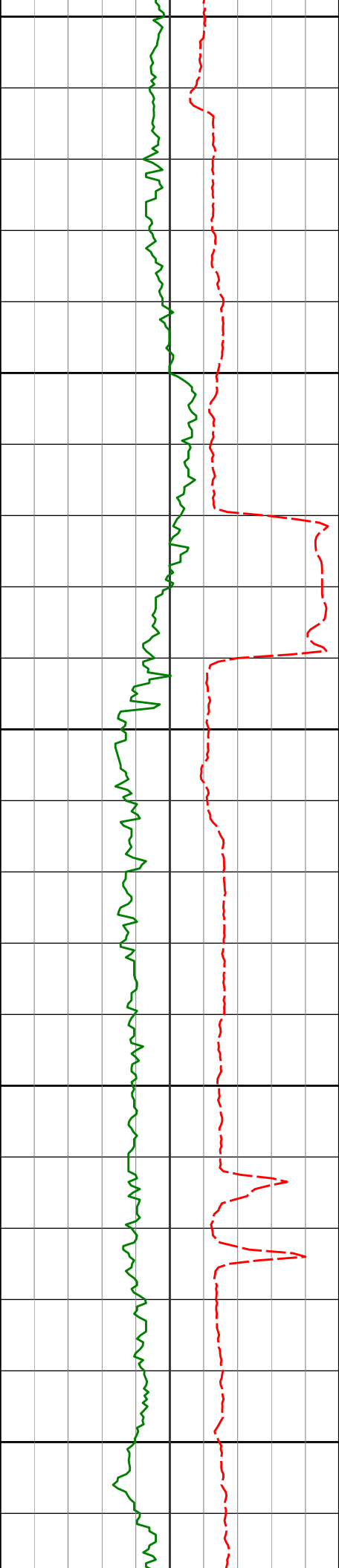
90.46°

87.27°

6588.02'

3002.89'

9500



9550

9553'

90.00°

86.48°

6587.64'

3096.33'

9600

9650

9647'

90.80°

88.74°

6586.98'

3189.00'

9700

9750

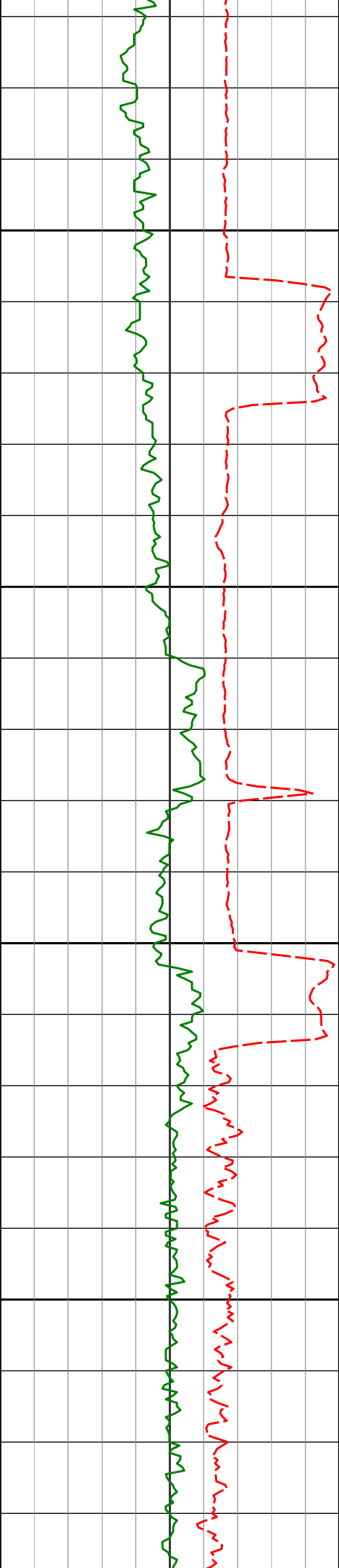
9742'

89.78°

87.94°

6586.50'

3282.85'



9800

9850

9900

9950

9837'

89.38°

89.93°

6587.20'

3376.84'

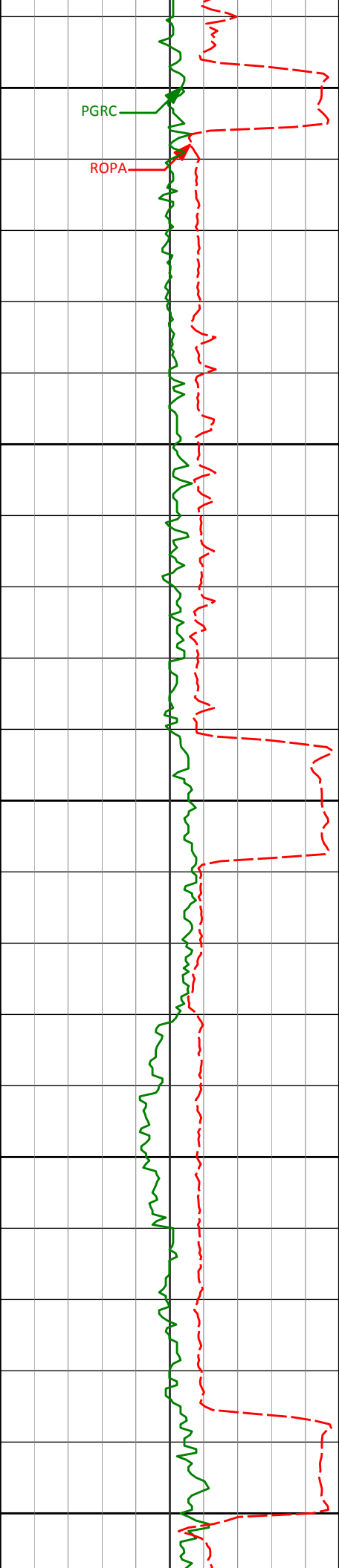
9932'

90.12°

89.42°

6587.61'

3471.01'



10000

PGRC

ROPA

10050

10100

10150

10200

10026'

90.03°

88.01°

6587.49'

3563.97'

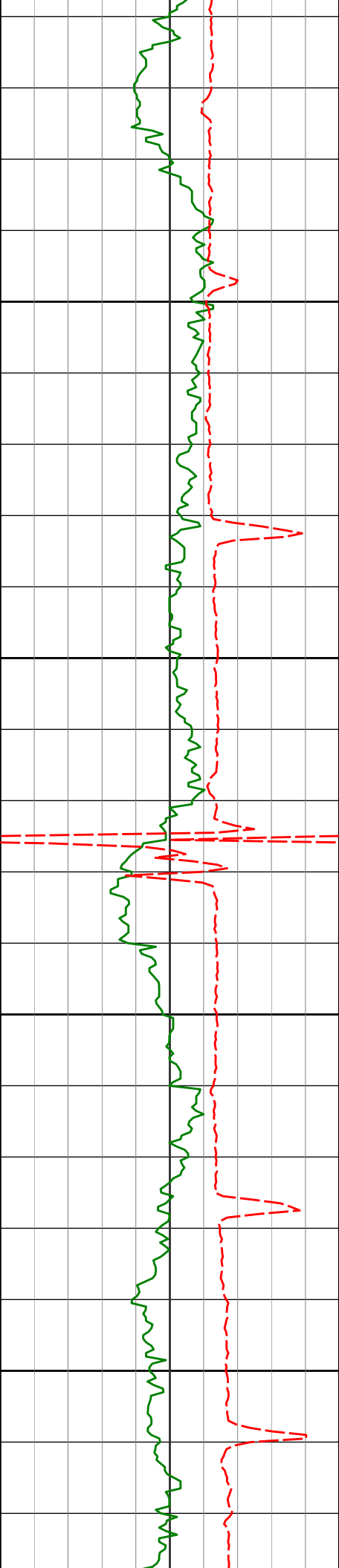
10121'

90.00°

89.26°

6587.47'

3657.89'



10216'

90.59°

89.38°

6586.98'

3751.98'

10250

10300

10311'

90.34°

88.87°

6586.21'

3846.02'

10350

10400

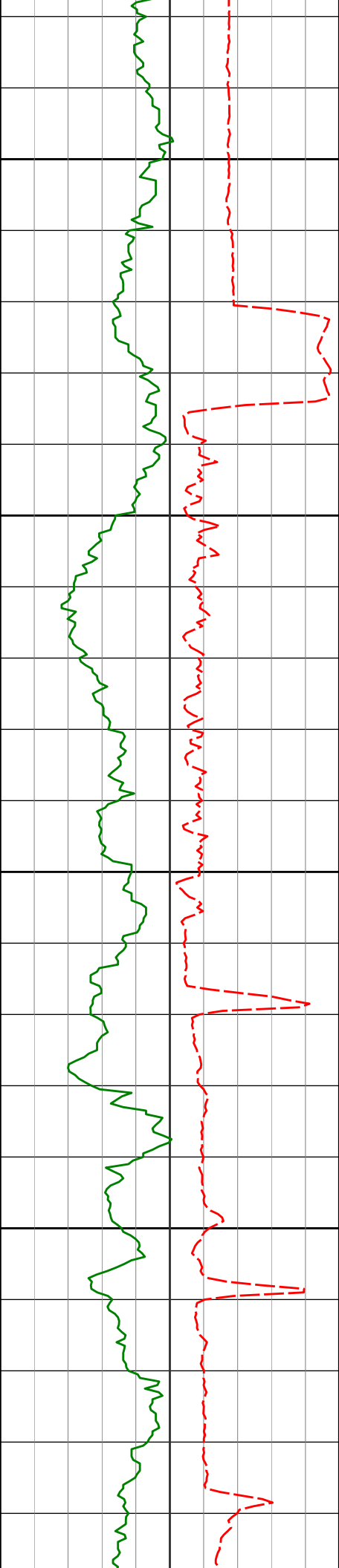
10406'

89.04°

88.54°

6586.72'

3939.97'



10450

10500

10550

10600

10500'

10595'

89.45°

87.85°

88.70°

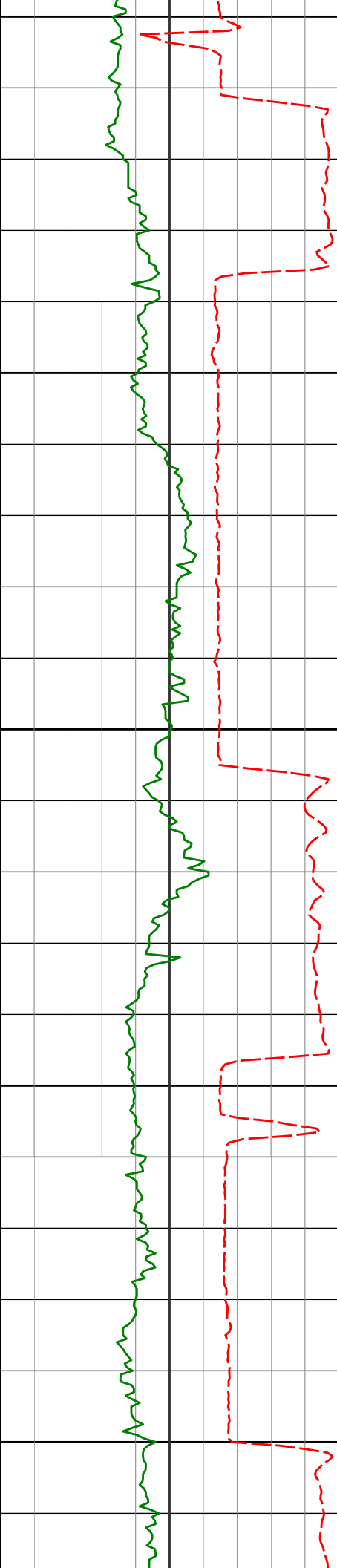
88.30°

6587.96'

6590.20'

4032.89'

4126.76'



10650

10690'

86.17°

88.51°

6595.15'

4220.50'

10700

10750

10784'

88.61°

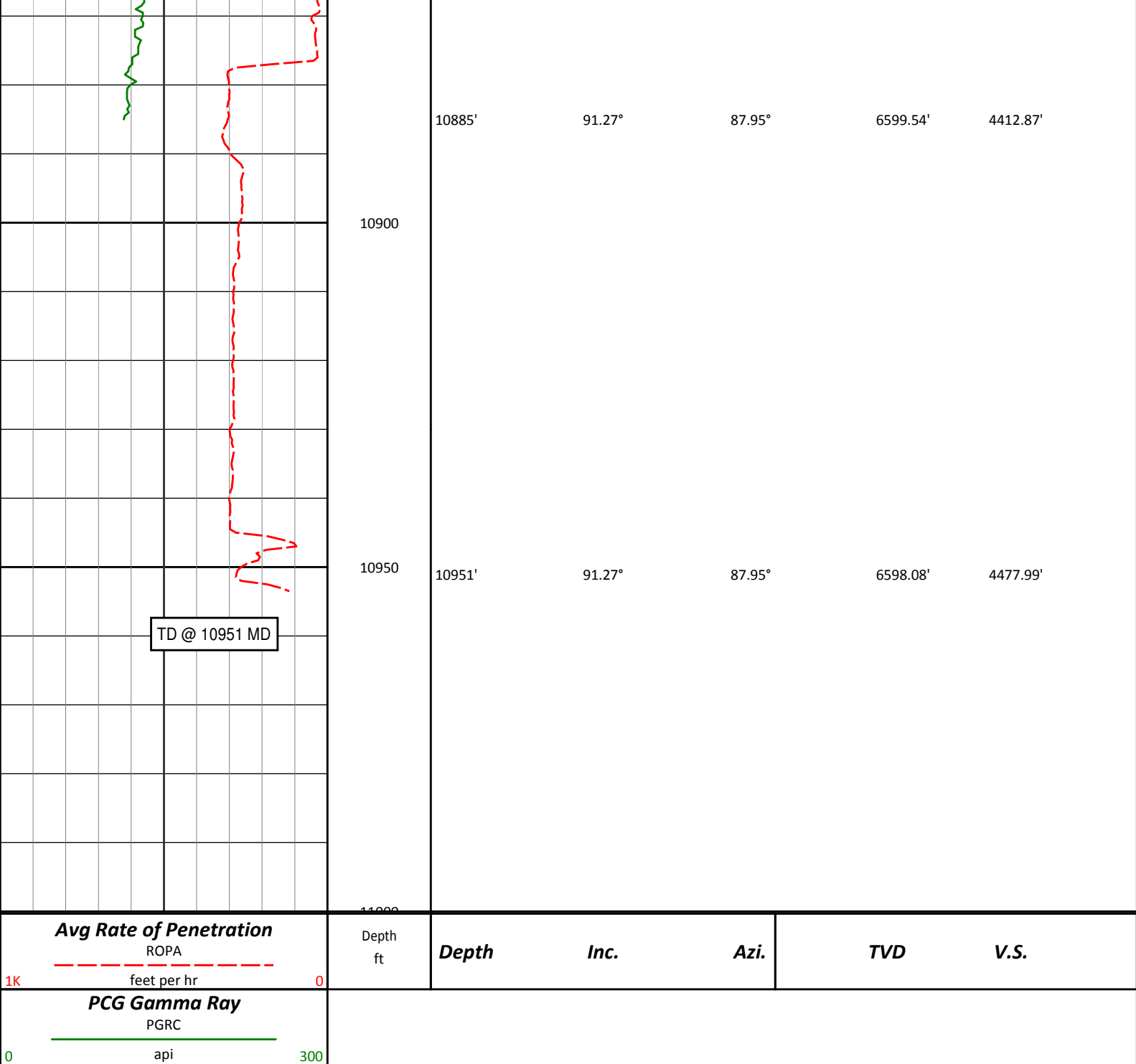
87.87°

6599.43'

4313.22'

10800

10850



|  |  |             |       |      |      |     |      |
|--|--|-------------|-------|------|------|-----|------|
| <div><div>Avg Rate of Penetration</div><div>ROPA</div><div>feet per hr</div></div> |  | Depth<br>ft | Depth | Inc. | Azi. | TVD | V.S. |
| <div><div>PCG Gamma Ray</div><div>PGRC</div><div>api</div></div>                   |  |             |       |      |      |     |      |

HALLIBURTON

DIRECTIONAL SURVEY REPORT

Noble Energy  
Wells Ranch AE20-66HN  
Wattenburg  
Weld Colorado  
USA  
CA-XX-0900735963

| Measured<br>Depth<br>(feet) | Inclination<br>(degrees) | Direction<br>(degrees) | Vertical<br>Depth<br>(feet) | Latitude<br>(feet) | Departure<br>(feet) | Vertical<br>Section<br>(feet) | Dogleg<br>(deg/100ft) |
|-----------------------------|--------------------------|------------------------|-----------------------------|--------------------|---------------------|-------------------------------|-----------------------|
| 0.00                        | 0.00                     | 0.00                   | 0.00                        | 0.00 N             | 0.00 E              | 0.00                          | TIE-IN                |
| 323.00                      | 0.70                     | 265.83                 | 322.99                      | 0.14 S             | 1.97 W              | -1.93                         | 0.22                  |
| 569.00                      | 0.30                     | 54.43                  | 568.99                      | 0.12 N             | 2.94 W              | -2.93                         | 0.39                  |
| 813.00                      | 0.60                     | 24.33                  | 812.98                      | 1.66 N             | 1.90 W              | -2.09                         | 0.15                  |

|         |       |        |         |          |          |        |       |
|---------|-------|--------|---------|----------|----------|--------|-------|
| 936.00  | 0.60  | 210.43 | 935.98  | 1.69 N   | 1.96 W   | -2.16  | 0.97  |
| 998.00  | 0.54  | 175.35 | 997.97  | 1.12 N   | 2.10 W   | -2.22  | 0.56  |
| 1091.00 | 0.59  | 198.72 | 1090.97 | 0.23 N   | 2.22 W   | -2.23  | 0.25  |
| 1184.00 | 0.41  | 221.43 | 1183.97 | 0.48 S   | 2.59 W   | -2.51  | 0.28  |
| 1275.00 | 1.78  | 232.14 | 1274.95 | 1.59 S   | 3.92 W   | -3.69  | 1.52  |
| 1368.00 | 3.63  | 253.75 | 1367.84 | 3.30 S   | 7.89 W   | -7.41  | 2.24  |
| 1460.00 | 6.51  | 247.66 | 1459.47 | 6.10 S   | 15.51 W  | -14.62 | 3.18  |
| 1555.00 | 8.01  | 239.73 | 1553.71 | 11.48 S  | 26.21 W  | -24.55 | 1.90  |
| 1650.00 | 8.88  | 233.92 | 1647.68 | 19.13 S  | 37.85 W  | -35.13 | 1.28  |
| 1745.00 | 7.86  | 216.79 | 1741.68 | 28.66 S  | 47.67 W  | -43.67 | 2.82  |
| 1840.00 | 7.54  | 196.44 | 1835.84 | 39.84 S  | 53.33 W  | -47.87 | 2.87  |
| 1934.00 | 9.93  | 179.66 | 1928.76 | 53.86 S  | 55.02 W  | -47.79 | 3.69  |
| 2029.00 | 13.18 | 181.07 | 2021.82 | 72.89 S  | 55.18 W  | -45.54 | 3.43  |
| 2124.00 | 14.32 | 175.43 | 2114.10 | 95.43 S  | 54.44 W  | -41.96 | 1.85  |
| 2219.00 | 14.47 | 176.47 | 2206.12 | 118.99 S | 52.78 W  | -37.34 | 0.31  |
| 2314.00 | 15.12 | 185.22 | 2297.98 | 143.17 S | 53.17 W  | -34.68 | 2.45  |
| 2408.00 | 13.46 | 181.94 | 2389.07 | 166.32 S | 54.66 W  | -33.23 | 1.96  |
| 2503.00 | 14.31 | 186.43 | 2481.30 | 189.04 S | 56.35 W  | -32.04 | 1.44  |
| 2598.00 | 16.78 | 194.56 | 2572.83 | 213.98 S | 61.11 W  | -33.62 | 3.46  |
| 2693.00 | 16.03 | 195.29 | 2663.96 | 239.91 S | 68.02 W  | -37.20 | 0.82  |
| 2788.00 | 15.23 | 191.83 | 2755.45 | 264.77 S | 74.03 W  | -40.03 | 1.29  |
| 2882.00 | 14.65 | 192.02 | 2846.27 | 288.49 S | 79.04 W  | -42.00 | 0.62  |
| 2977.00 | 16.19 | 191.59 | 2937.85 | 313.21 S | 84.20 W  | -44.00 | 1.63  |
| 3072.00 | 16.44 | 191.01 | 3029.02 | 339.38 S | 89.43 W  | -45.89 | 0.31  |
| 3167.00 | 15.43 | 190.84 | 3120.37 | 364.99 S | 94.38 W  | -47.56 | 1.06  |
| 3262.00 | 13.52 | 195.05 | 3212.35 | 388.13 S | 99.64 W  | -49.86 | 2.29  |
| 3357.00 | 13.02 | 188.10 | 3304.82 | 409.45 S | 104.03 W | -51.53 | 1.76  |
| 3451.00 | 14.43 | 190.71 | 3396.14 | 431.44 S | 107.70 W | -52.39 | 1.64  |
| 3546.00 | 14.72 | 188.44 | 3488.08 | 455.01 S | 111.67 W | -53.35 | 0.67  |
| 3641.00 | 16.58 | 188.31 | 3579.55 | 480.36 S | 115.40 W | -53.86 | 1.96  |
| 3735.00 | 17.43 | 189.40 | 3669.44 | 507.53 S | 119.64 W | -54.63 | 0.97  |
| 3830.00 | 16.61 | 187.40 | 3760.28 | 535.03 S | 123.71 W | -55.20 | 1.06  |
| 3925.00 | 15.75 | 187.87 | 3851.52 | 561.27 S | 127.22 W | -55.38 | 0.92  |
| 4020.00 | 13.68 | 186.50 | 3943.40 | 585.20 S | 130.26 W | -55.37 | 2.21  |
| 4115.00 | 13.27 | 186.74 | 4035.78 | 607.19 S | 132.81 W | -55.13 | 0.44  |
| 4210.00 | 11.48 | 191.04 | 4128.58 | 627.30 S | 135.90 W | -55.65 | 2.12  |
| 4305.00 | 9.81  | 192.47 | 4221.94 | 644.48 S | 139.46 W | -57.01 | 1.78  |
| 4400.00 | 8.43  | 184.05 | 4315.74 | 659.33 S | 141.70 W | -57.36 | 2.02  |
| 4494.00 | 6.95  | 191.55 | 4408.89 | 671.78 S | 143.33 W | -57.40 | 1.90  |
| 4589.00 | 5.22  | 188.22 | 4503.35 | 681.69 S | 145.10 W | -57.91 | 1.86  |
| 4684.00 | 3.00  | 188.99 | 4598.10 | 688.42 S | 146.10 W | -58.06 | 2.34  |
| 4779.00 | 0.84  | 204.74 | 4693.05 | 691.51 S | 146.78 W | -58.34 | 2.32  |
| 4874.00 | 1.47  | 246.63 | 4788.03 | 692.62 S | 148.19 W | -59.60 | 1.07  |
| 4969.00 | 1.09  | 269.55 | 4883.00 | 693.11 S | 150.21 W | -61.54 | 0.66  |
| 5063.00 | 1.16  | 307.99 | 4976.99 | 692.54 S | 151.86 W | -63.25 | 0.79  |
| 5158.00 | 0.39  | 343.33 | 5071.98 | 691.63 S | 152.71 W | -64.20 | 0.92  |
| 5253.00 | 0.54  | 26.66  | 5166.98 | 690.92 S | 152.60 W | -64.19 | 0.39  |
| 5348.00 | 1.20  | 17.03  | 5261.96 | 689.57 S | 152.11 W | -63.87 | 0.71  |
| 5443.00 | 0.42  | 214.55 | 5356.96 | 688.91 S | 152.01 W | -63.86 | 1.69  |
| 5537.00 | 0.24  | 11.21  | 5450.96 | 689.00 S | 152.17 W | -64.00 | 0.69  |
| 5632.00 | 0.74  | 98.77  | 5545.95 | 688.90 S | 151.53 W | -63.38 | 0.81  |
| 5727.00 | 0.54  | 51.05  | 5640.95 | 688.71 S | 150.57 W | -62.45 | 0.58  |
| 5820.00 | 0.65  | 103.08 | 5733.94 | 688.55 S | 149.72 W | -61.63 | 0.57  |
| 5916.00 | 0.44  | 81.10  | 5829.94 | 688.62 S | 148.82 W | -60.73 | 0.30  |
| 5964.00 | 3.42  | 83.02  | 5877.91 | 688.42 S | 147.22 W | -59.17 | 6.21  |
| 6011.00 | 8.15  | 82.97  | 5924.66 | 687.84 S | 142.52 W | -54.58 | 10.06 |
| 6059.00 | 10.35 | 85.90  | 5972.03 | 687.11 S | 134.84 W | -47.05 | 4.69  |
| 6106.00 | 12.63 | 86.25  | 6018.08 | 686.48 S | 125.50 W | -37.86 | 4.85  |
| 6154.00 | 16.16 | 88.10  | 6064.57 | 685.91 S | 113.58 W | -26.12 | 7.42  |
| 6201.00 | 19.13 | 91.59  | 6109.35 | 685.91 S | 99.35 W  | -11.99 | 6.71  |
| 6249.00 | 21.18 | 94.18  | 6154.41 | 686.76 S | 82.83 W  | 4.50   | 4.66  |
| 6296.00 | 24.07 | 90.16  | 6197.79 | 687.40 S | 64.78 W  | 22.49  | 6.97  |
| 6344.00 | 28.06 | 85.16  | 6240.91 | 686.48 S | 43.73 W  | 43.26  | 9.48  |
| 6390.00 | 32.31 | 83.76  | 6280.66 | 684.23 S | 20.72 W  | 65.80  | 9.36  |
| 6438.00 | 36.90 | 84.15  | 6320.16 | 681.36 S | 6.39 E   | 92.32  | 9.57  |
| 6485.00 | 41.50 | 85.42  | 6356.57 | 678.68 S | 35.96 E  | 121.32 | 9.93  |
| 6533.00 | 46.69 | 88.58  | 6391.04 | 676.98 S | 69.30 E  | 154.18 | 11.74 |
| 6580.00 | 52.00 | 90.38  | 6421.65 | 676.68 S | 104.94 E | 189.49 | 11.66 |
| 6628.00 | 56.95 | 91.03  | 6449.53 | 677.16 S | 143.99 E | 228.29 | 10.37 |
| 6675.00 | 61.76 | 90.85  | 6473.48 | 677.82 S | 184.41 E | 268.47 | 10.24 |
| 6723.00 | 66.11 | 90.01  | 6494.57 | 678.14 S | 227.51 E | 311.27 | 9.20  |

|          |       |       |         |          |           |         |      |
|----------|-------|-------|---------|----------|-----------|---------|------|
| 6770.00  | 69.12 | 90.06 | 6512.47 | 678.17 S | 270.97 E  | 354.38  | 6.41 |
| 6818.00  | 73.02 | 89.05 | 6528.04 | 677.81 S | 316.36 E  | 399.37  | 8.37 |
| 6864.00  | 76.49 | 88.61 | 6540.13 | 676.90 S | 360.72 E  | 443.26  | 7.60 |
| 6912.00  | 79.28 | 88.43 | 6550.20 | 675.69 S | 407.63 E  | 489.65  | 5.82 |
| 6955.00  | 82.21 | 88.04 | 6557.12 | 674.38 S | 450.05 E  | 531.56  | 6.87 |
| 7030.00  | 84.50 | 87.44 | 6565.79 | 671.45 S | 524.48 E  | 605.03  | 3.16 |
| 7088.00  | 83.58 | 87.90 | 6571.82 | 669.10 S | 582.12 E  | 661.91  | 1.77 |
| 7183.00  | 86.61 | 88.66 | 6579.94 | 666.26 S | 676.72 E  | 755.39  | 3.29 |
| 7277.00  | 88.43 | 88.69 | 6584.01 | 664.09 S | 770.60 E  | 848.25  | 1.94 |
| 7372.00  | 89.97 | 89.31 | 6585.33 | 662.43 S | 865.57 E  | 942.25  | 1.75 |
| 7467.00  | 89.75 | 89.68 | 6585.57 | 661.59 S | 960.57 E  | 1036.38 | 0.45 |
| 7562.00  | 91.23 | 87.71 | 6584.75 | 659.43 S | 1055.53 E | 1130.32 | 2.59 |
| 7657.00  | 91.08 | 87.74 | 6582.84 | 655.66 S | 1150.44 E | 1223.99 | 0.16 |
| 7751.00  | 90.62 | 87.01 | 6581.44 | 651.36 S | 1244.33 E | 1316.58 | 0.92 |
| 7846.00  | 91.27 | 88.30 | 6579.88 | 647.47 S | 1339.24 E | 1410.24 | 1.52 |
| 7941.00  | 90.96 | 88.78 | 6578.03 | 645.05 S | 1434.19 E | 1504.12 | 0.60 |
| 8035.00  | 88.58 | 89.30 | 6578.41 | 643.48 S | 1528.17 E | 1597.15 | 2.59 |
| 8130.00  | 89.26 | 88.69 | 6580.20 | 641.81 S | 1623.13 E | 1691.15 | 0.96 |
| 8225.00  | 88.98 | 88.34 | 6581.65 | 639.35 S | 1718.09 E | 1785.04 | 0.47 |
| 8320.00  | 88.95 | 88.04 | 6583.37 | 636.35 S | 1813.03 E | 1878.84 | 0.32 |
| 8415.00  | 88.98 | 89.14 | 6585.09 | 634.01 S | 1907.98 E | 1972.74 | 1.16 |
| 8510.00  | 90.12 | 90.31 | 6585.83 | 633.55 S | 2002.97 E | 2066.91 | 1.72 |
| 8604.00  | 89.97 | 90.89 | 6585.76 | 634.54 S | 2096.97 E | 2160.28 | 0.64 |
| 8699.00  | 89.78 | 88.12 | 6585.97 | 633.72 S | 2191.96 E | 2254.40 | 2.92 |
| 8794.00  | 89.38 | 88.08 | 6586.66 | 630.57 S | 2286.90 E | 2348.19 | 0.42 |
| 8889.00  | 91.82 | 89.34 | 6585.67 | 628.43 S | 2381.86 E | 2442.13 | 2.89 |
| 8984.00  | 90.59 | 88.43 | 6583.67 | 626.58 S | 2476.82 E | 2536.09 | 1.61 |
| 9079.00  | 91.45 | 89.53 | 6581.98 | 624.89 S | 2571.79 E | 2630.09 | 1.47 |
| 9173.00  | 88.40 | 86.33 | 6582.10 | 621.50 S | 2665.70 E | 2722.82 | 4.70 |
| 9268.00  | 88.27 | 86.38 | 6584.86 | 615.46 S | 2760.47 E | 2816.07 | 0.15 |
| 9363.00  | 88.73 | 86.80 | 6587.35 | 609.81 S | 2855.27 E | 2909.40 | 0.66 |
| 9458.00  | 90.46 | 87.27 | 6588.02 | 604.90 S | 2950.14 E | 3002.89 | 1.89 |
| 9553.00  | 90.00 | 86.48 | 6587.64 | 599.72 S | 3044.99 E | 3096.33 | 0.96 |
| 9647.00  | 90.80 | 88.74 | 6586.98 | 595.80 S | 3138.90 E | 3189.00 | 2.55 |
| 9742.00  | 89.78 | 87.94 | 6586.50 | 593.05 S | 3233.86 E | 3282.85 | 1.36 |
| 9837.00  | 89.38 | 89.93 | 6587.20 | 591.28 S | 3328.84 E | 3376.84 | 2.14 |
| 9932.00  | 90.12 | 89.42 | 6587.61 | 590.74 S | 3423.83 E | 3471.01 | 0.95 |
| 10026.00 | 90.03 | 88.01 | 6587.49 | 588.63 S | 3517.81 E | 3563.97 | 1.50 |
| 10121.00 | 90.00 | 89.26 | 6587.47 | 586.37 S | 3612.78 E | 3657.89 | 1.32 |
| 10216.00 | 90.59 | 89.38 | 6586.98 | 585.24 S | 3707.77 E | 3751.98 | 0.63 |
| 10311.00 | 90.34 | 88.87 | 6586.21 | 583.79 S | 3802.75 E | 3846.02 | 0.60 |
| 10406.00 | 89.04 | 88.54 | 6586.72 | 581.65 S | 3897.73 E | 3939.97 | 1.41 |
| 10500.00 | 89.45 | 88.70 | 6587.96 | 579.38 S | 3991.69 E | 4032.89 | 0.47 |
| 10595.00 | 87.85 | 88.30 | 6590.20 | 576.90 S | 4086.63 E | 4126.76 | 1.74 |
| 10690.00 | 86.17 | 88.51 | 6595.15 | 574.26 S | 4181.46 E | 4220.50 | 1.78 |
| 10784.00 | 88.61 | 87.87 | 6599.43 | 571.29 S | 4275.31 E | 4313.22 | 2.68 |
| 10885.00 | 91.27 | 87.95 | 6599.54 | 567.61 S | 4376.23 E | 4412.87 | 2.63 |
| 10951.00 | 91.27 | 87.95 | 6598.08 | 565.25 S | 4442.17 E | 4477.99 | 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 97.25 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.63 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 10951.00 FEET  
IS 4477.99 FEET ALONG 97.25 DEGREES (GRID)**

First four survey's are from 3rd party source (Muilti Shot EMS) and provided by CO-man on location before drilling.  
Depth 323 Inc 0.70 Azi 265.83  
Depth 569 Inc 0.30 Azi 54.53  
Depth 813 Inc 0.60 Azi 24.33  
Depth 936 Inc 0.60 Azi 210.43  
Tied in @ Surface

Magnettic direction of 7.631 has been added to AZI for grid direction correction.