



WELL INFORMATION					
MWD Run Number	100	200	300		
Date run completed	16-Jun-15	17-Jun-15	18-Jun-15		
Rig Bit Number	0200	3	4		
Bit Size (in)	8.750	8.750	8.750		
Tool Nominal OD (in)	6.750	4.800	6.750		
Log Start Depth (MD, ft)	638.00	4,816.00	6,615.00		
Log End Depth (MD, ft)	4,816.00	6,615.00	7,159.00		
Drill or Wipe	Drill	Drill	Drill		
Drill/Wipe Start Date and Time	15-Jun-15 21:43	16-Jun-15 21:21	17-Jun-15 15:32		
Drill/Wipe End Date and Time	16-Jun-15 14:55	17-Jun-15 07:30	18-Jun-15 00:35		
Min Inc (deg) @ Depth (MD, ft)	0.07 @ 917.00	0.18 @ 5,329.00	29.27 @ 6,616.00		
Max Inc (deg) @ Depth (MD, ft)	8.52 @ 2,221.00	26.20 @ 6,561.00	84.82 @ 7,105.00		
Bit TFA(in2) / Bit Type	0.98 / PDC	1.37 / PDC	1.49 / PDC		
Flow Rate (gpm)	600.00	594.29	550.00		
Max AV (fpm) / CV (fpm) @ MWD	N/A / N/A	N/A / N/A	N/A / N/A		
Fluid Type	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
Density (ppg) / Viscosity (spqt)	8.90 / 31.00	9.80 / 31.00	10.75 / 37.00		
Filtrate CL (ppm)	0.00	1,700.00	2,200.00		
pH / Fluid Loss (mptm)	8.40 / 10	/ 0	9.00 / 7		
PV (cP) / YP (lbf2)	4 / 3.00	4 / 3.00	9 / 9.00		
% Solids / % Sand	3.50 / 0.75	4 / .2	11.00 / 0.25		
% Oil / Oil:Water Ratio	0.50 / N/A	/ N/A	0.50 / N/A		
Rm @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Rmf @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Rmc @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Min Temp (in) / Min Temp (degF)	112.00 / 112.00	172.10 / 320.00	166.00 / 320.00		

Max Tool Temp (degF) / Source	116.00 / 116.00	156.13 / PCM	162.80 / PCM		
Rm @ Max Tool Temp (degF)	N/A @ 116.00	N/A @ 156.13	N/A @ 162.80		
Lead MWD Engineer	Robert Barnes	Robert Barnes	Robert Barnes		
Customer Representative	Jim Turner	Jim Turner	Jim Turner		

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM	PCM		
Software Version	5.93	5.93	5.93		
Sub Serial Number	11342302	11342302	11342302		
Insert Serial Number	11680779	11680779	11680727		
Date and Time Initialized	14-Jun-15 20:03	01-Jan-70 00:00	17-Jun-15 10:04		
Date and Time Read	17-Jun-15 13:32	17-Jun-15 13:38	18-Jun-15 06:39		
ECMB SW Version	N/A	N/A	N/A		

### Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	55.00	54.00	54.00		
Software Version	6.21	6.21	6.33		
Sub Serial Number	11342302	11342302	11342302		
Sonde Serial Number	11638567	11638567	11478122		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	226.30	124.10	9.10		

### Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	48.66	47.26	47.28		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	11342302	11342302	11342302		
Insert/Sonde Serial Number	11579806	11579806	11680921		

## REMARKS

1. All depths are calibrated to driller's pipe tally and are true vertical depth 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

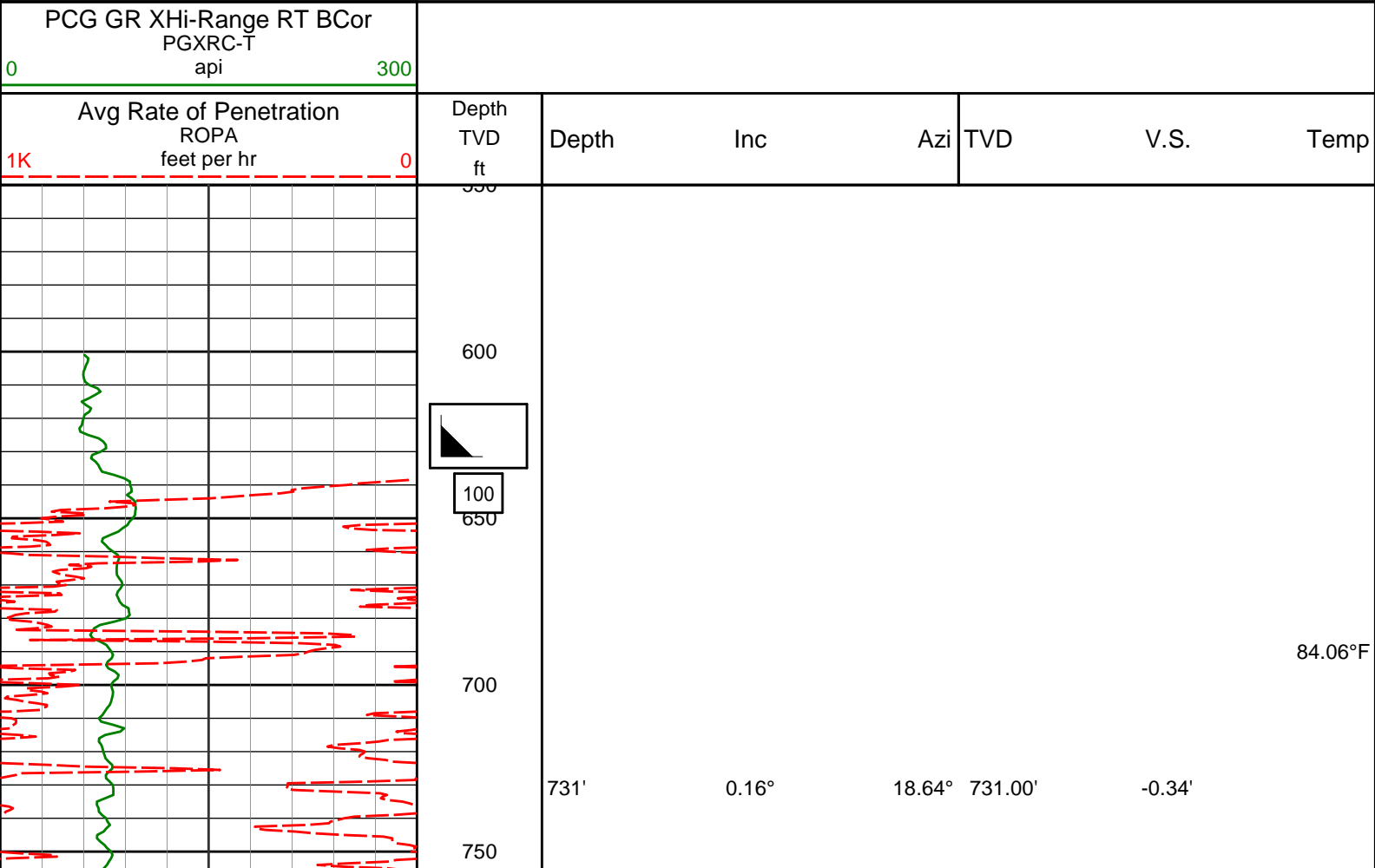
Interval Resolution: 1.2 ft

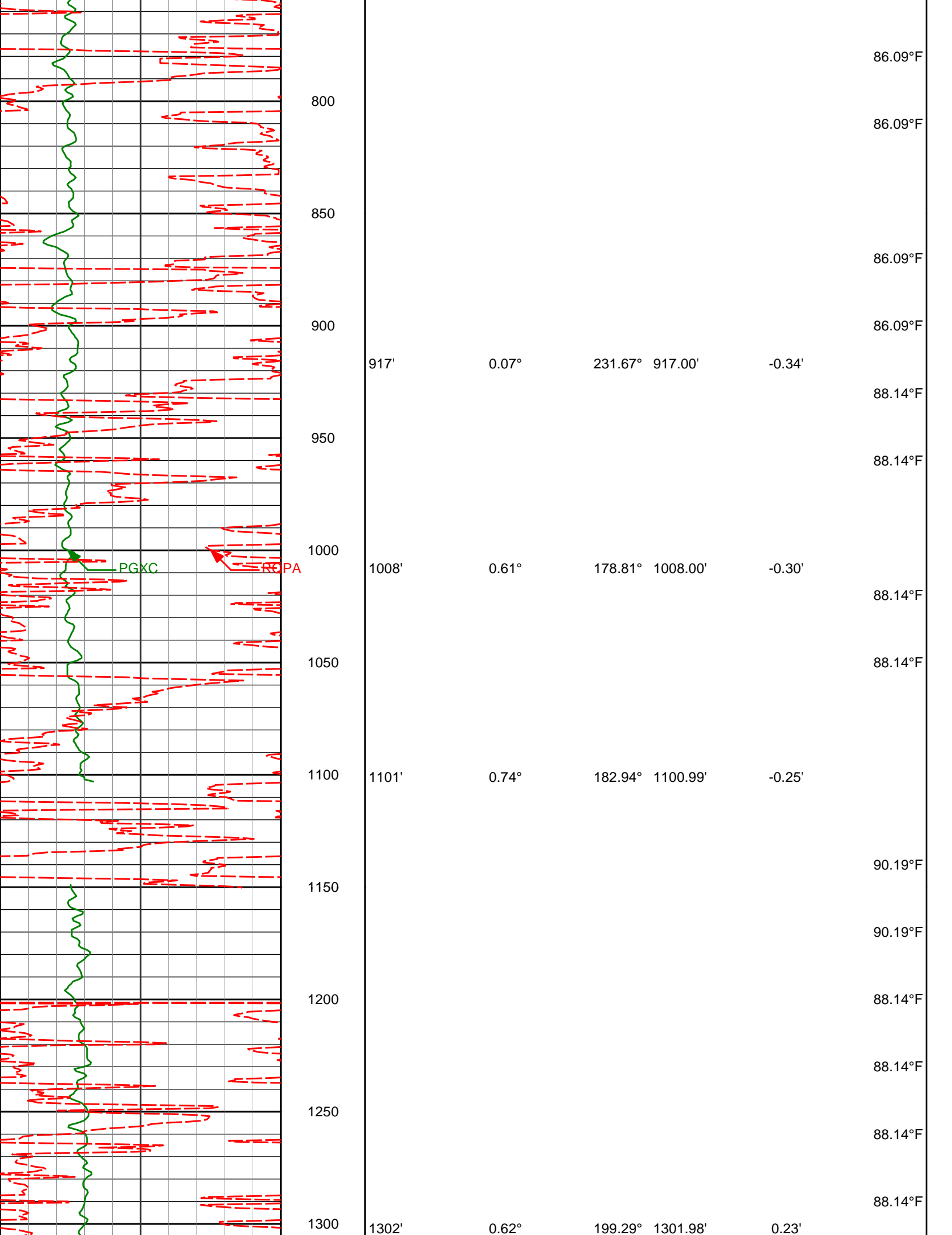
6. Insite Version v8.1.10

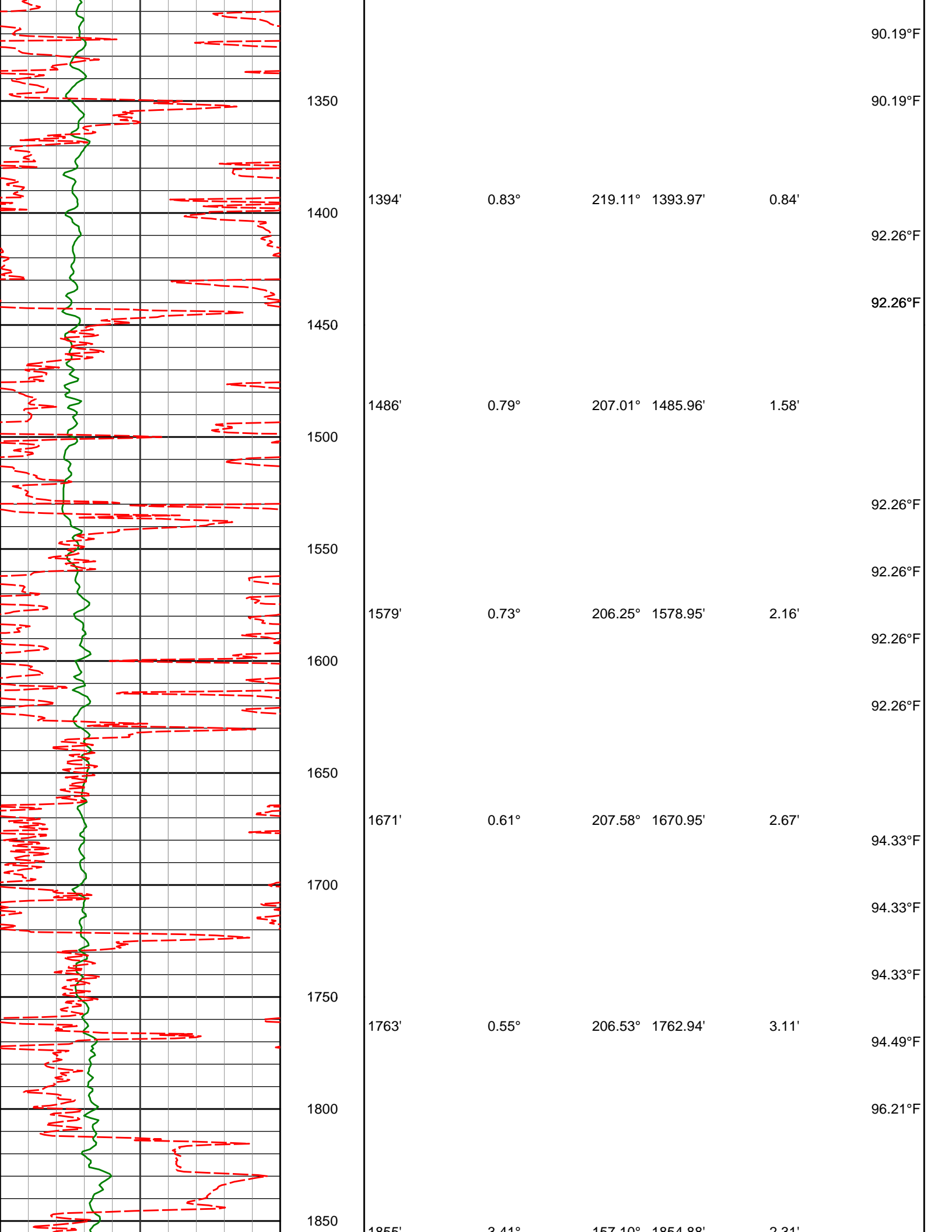
WARRANTY

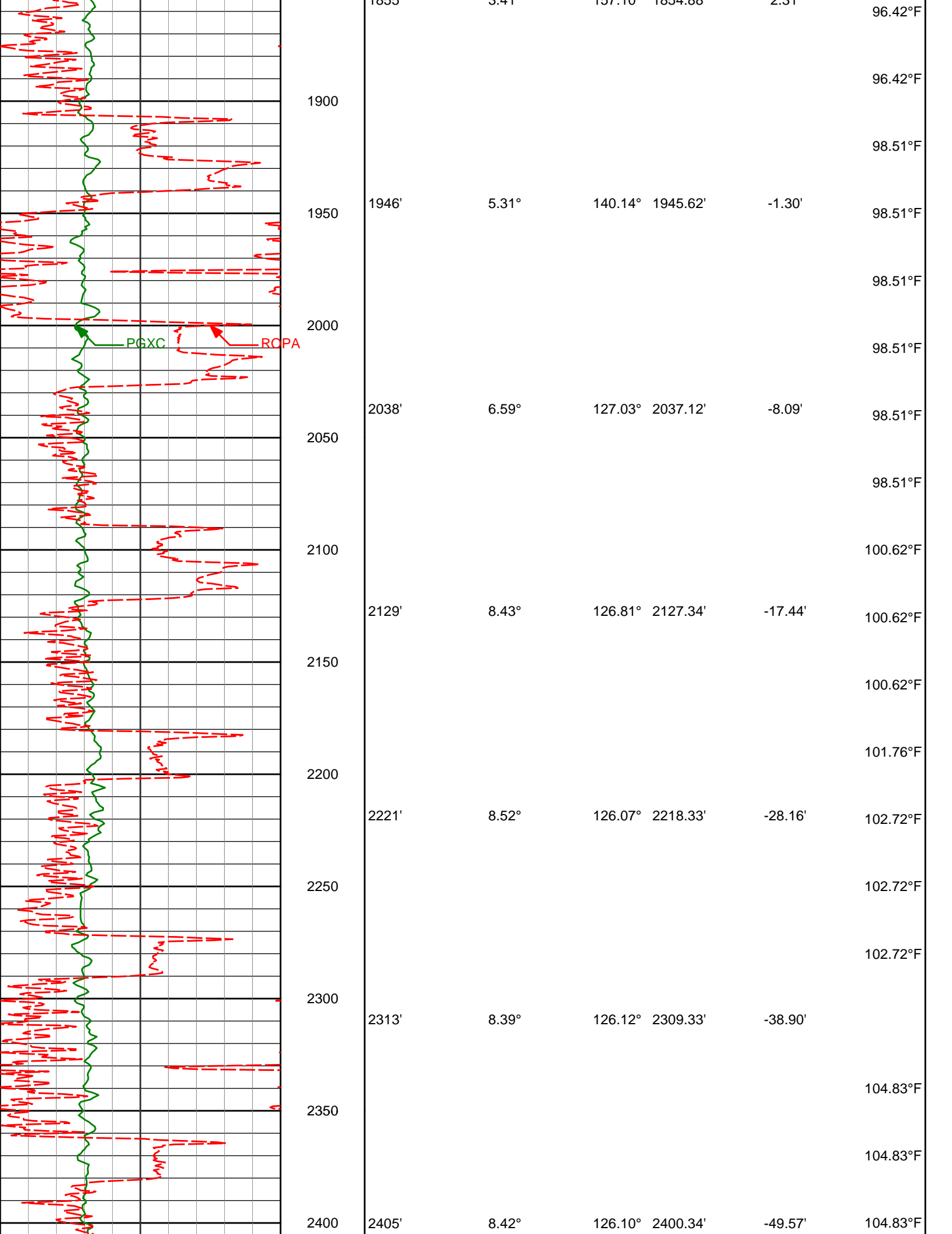
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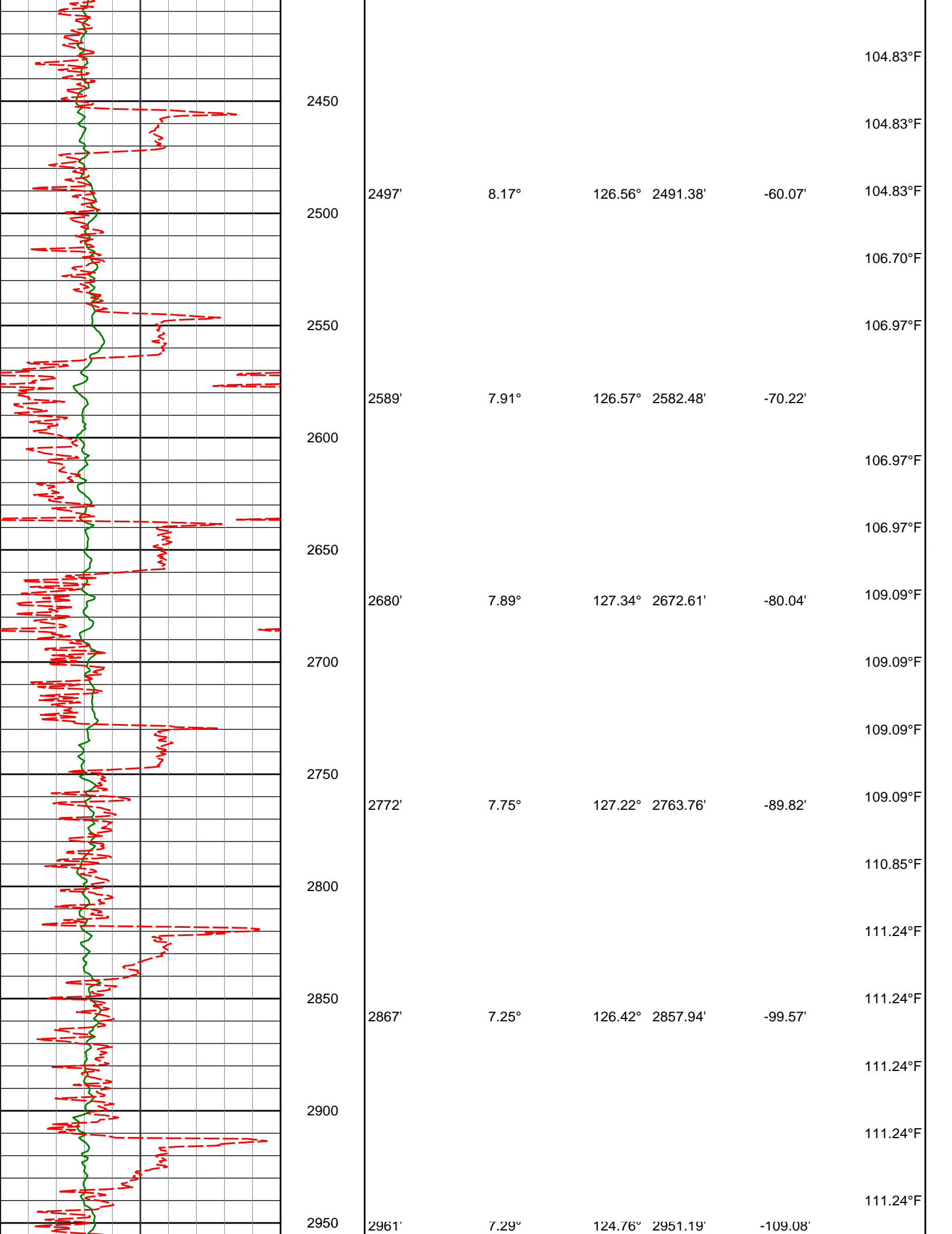
TVD Detail 1:600 Scale

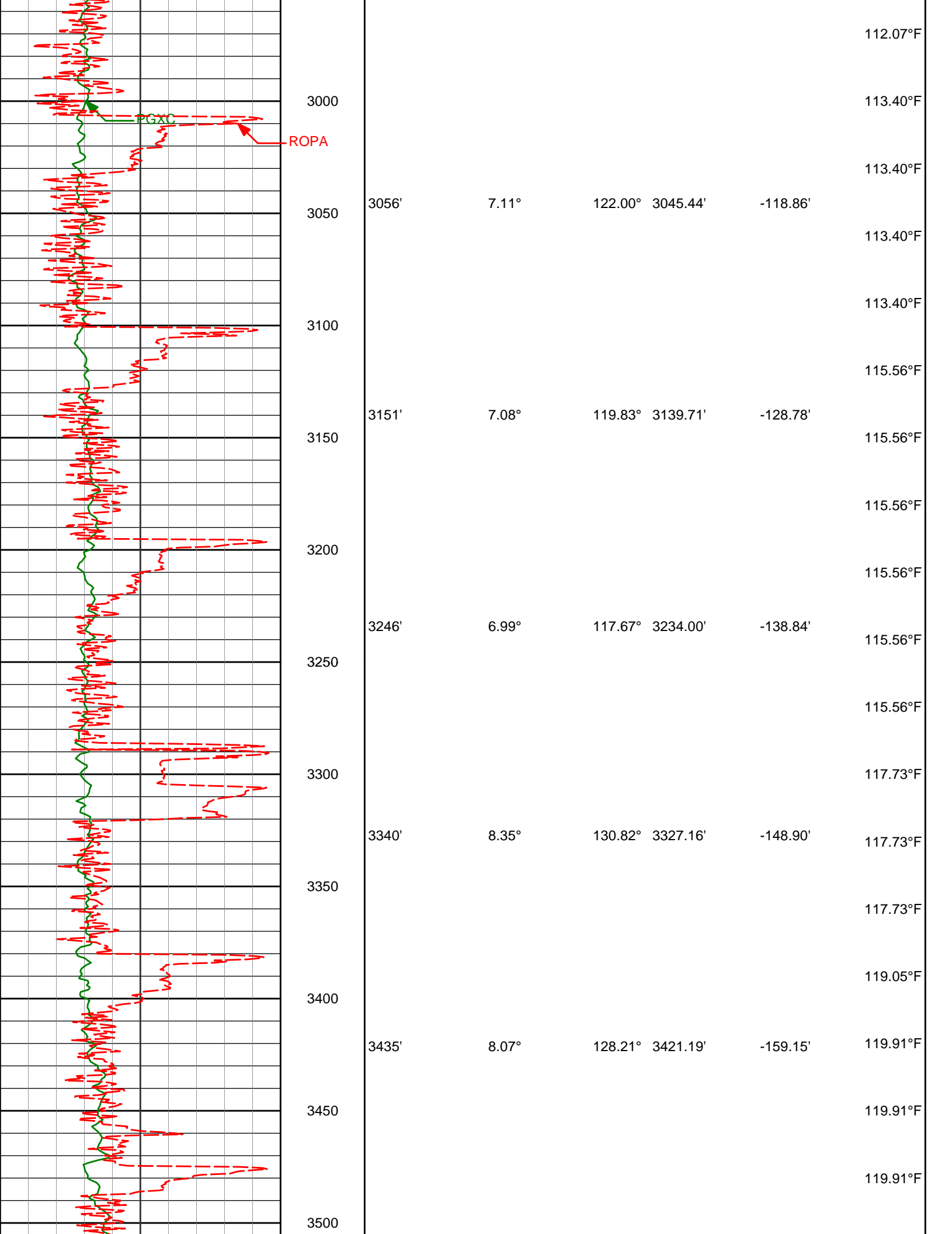




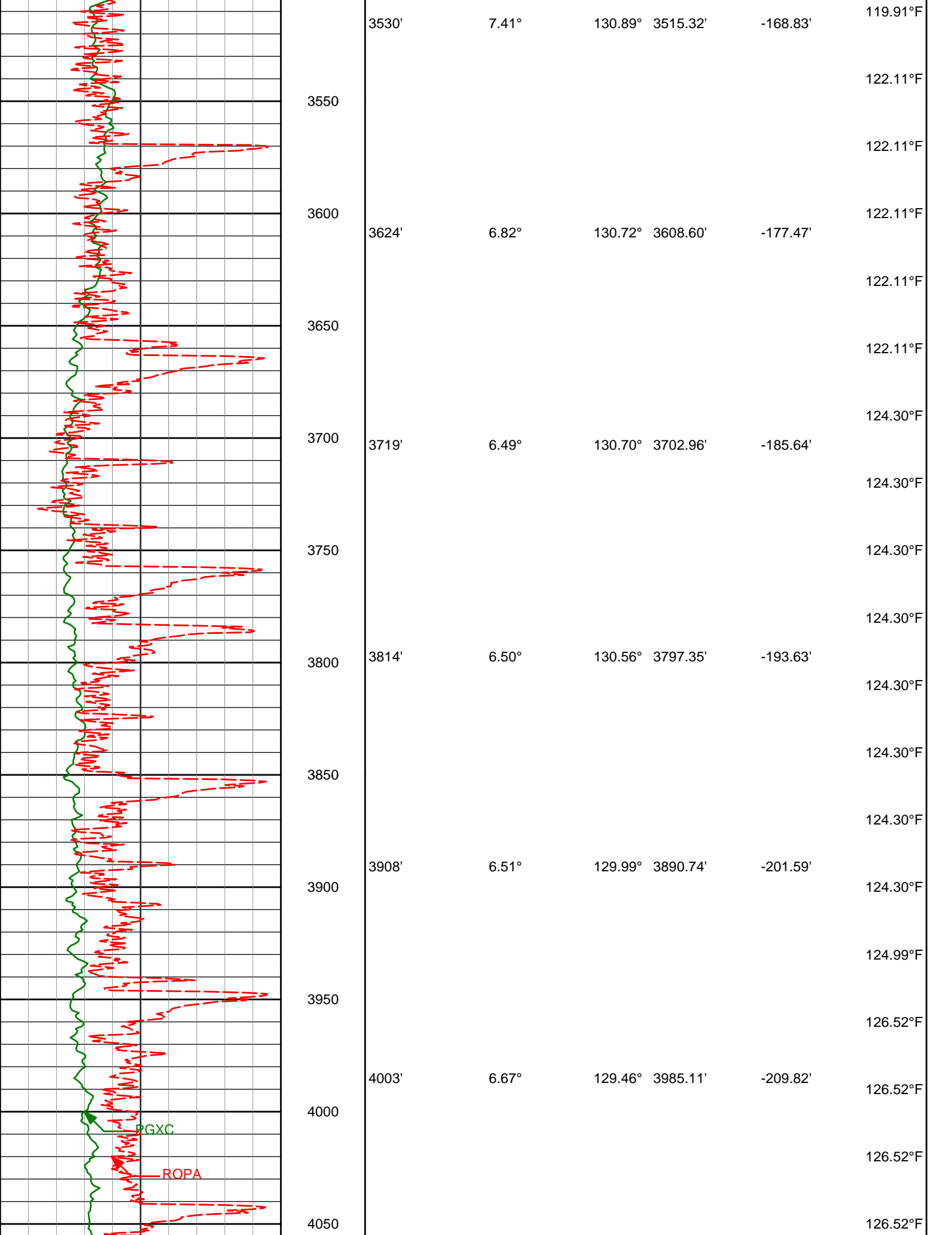


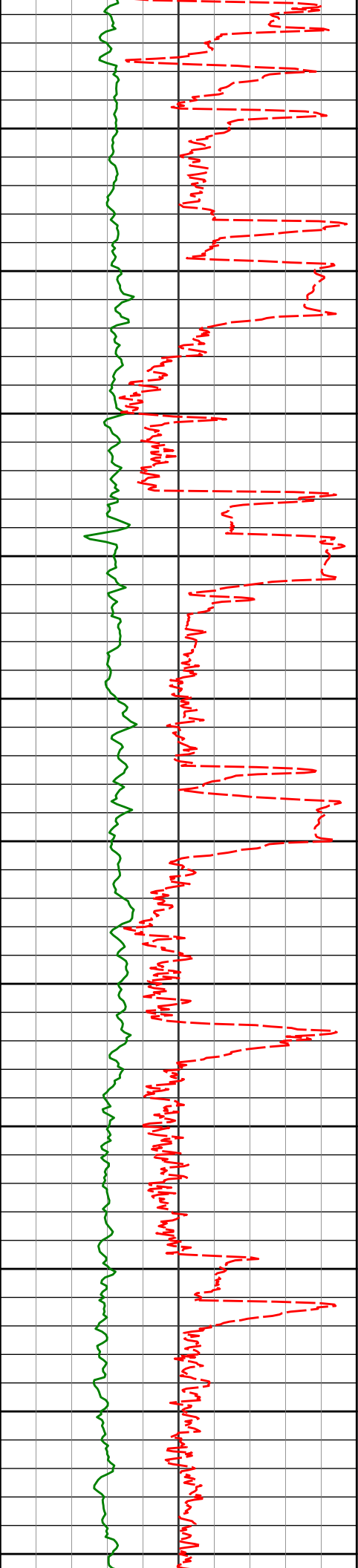












4100

4150

4200

4250

4300

4350

4400

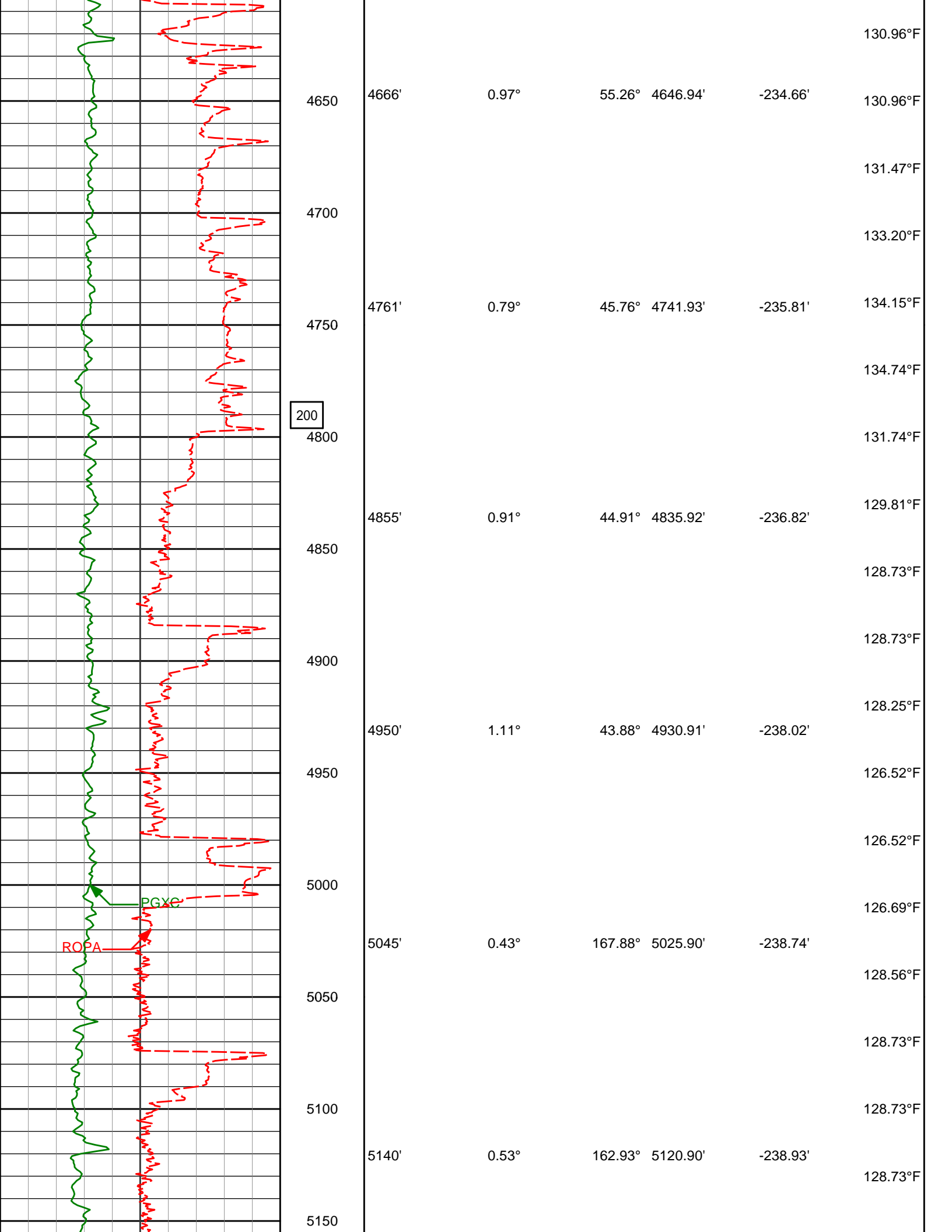
4450

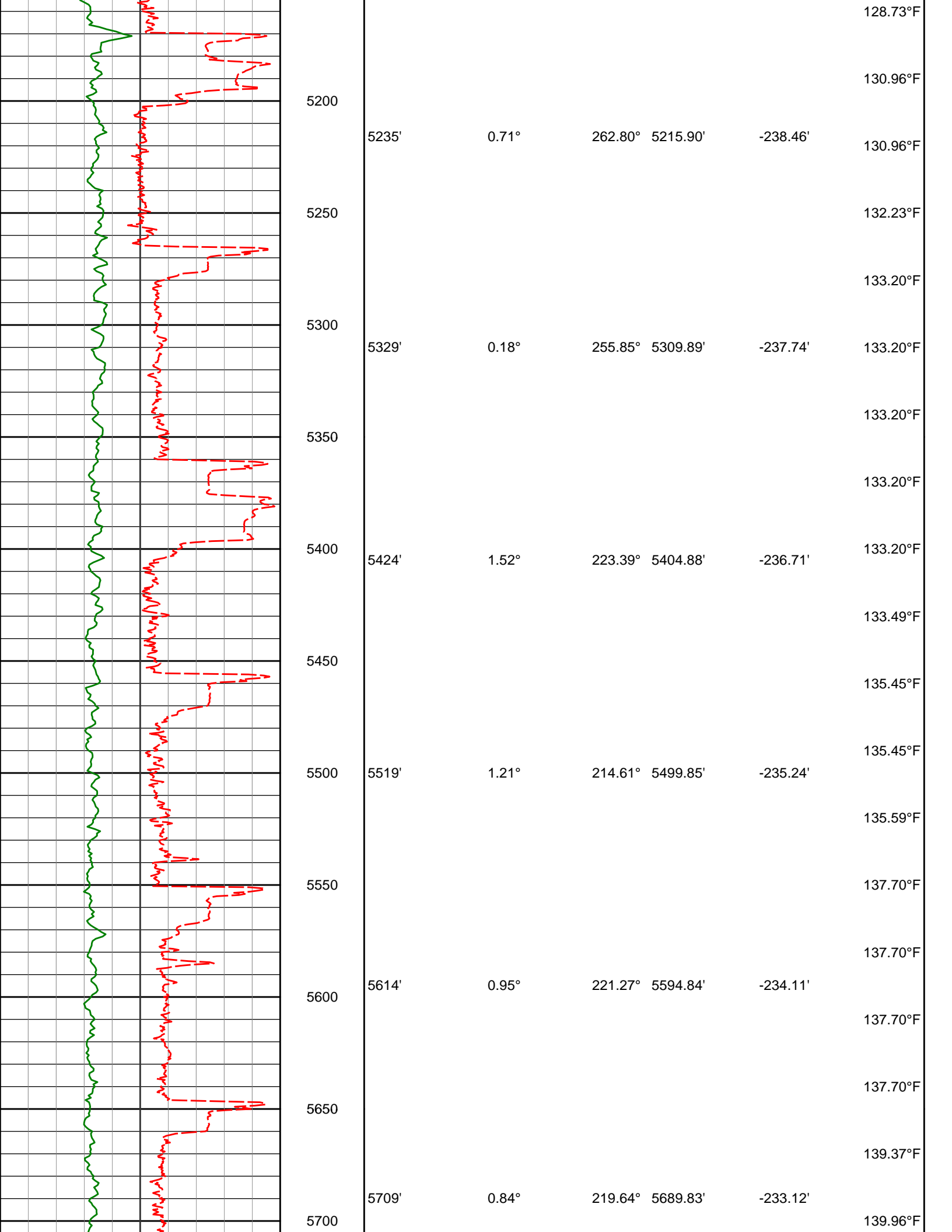
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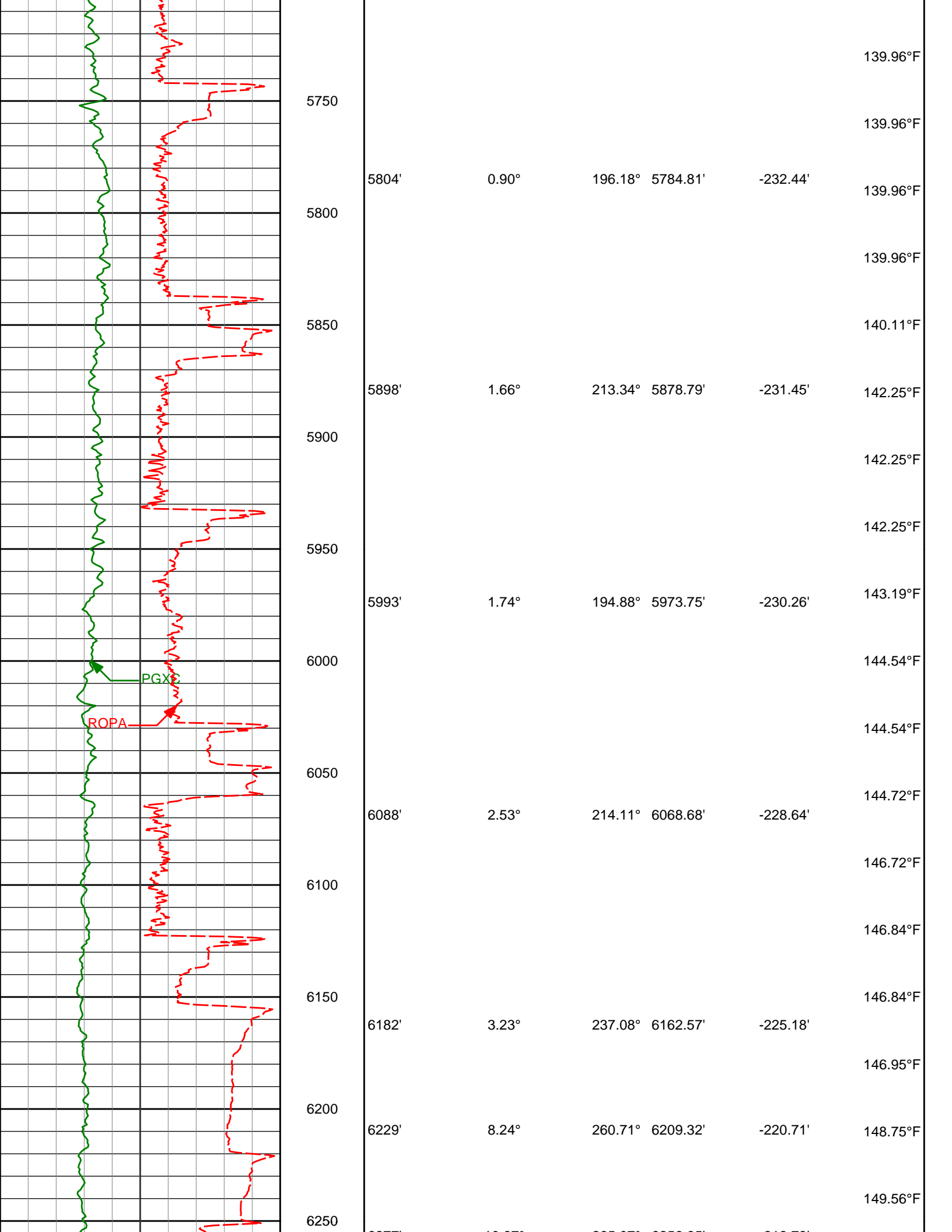
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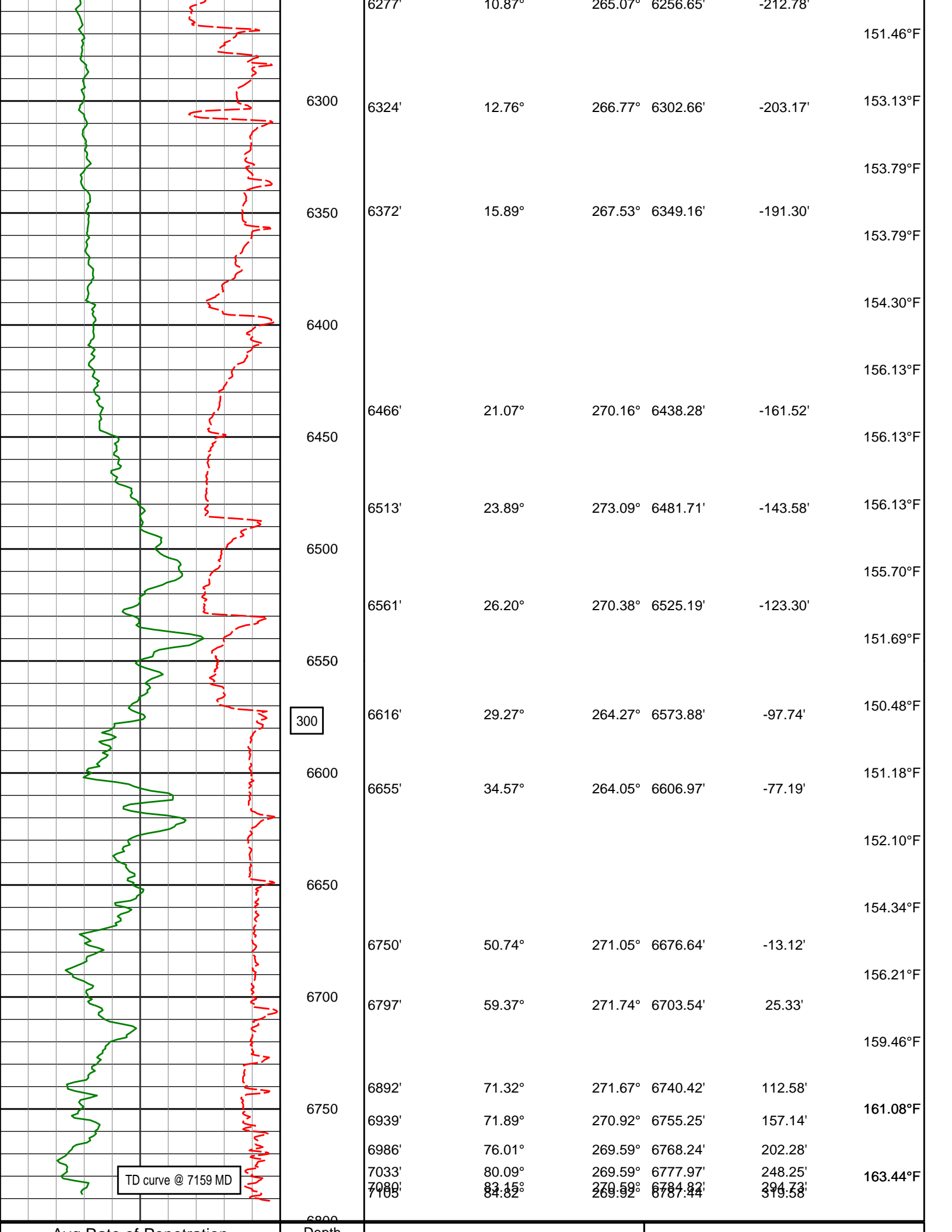
4600

4097'	5.60°	140.51°	4078.57'	-216.79'	126.52°F
					126.52°F
					126.52°F
					126.52°F
4192'	4.50°	119.22°	4173.21'	-222.86'	128.73°F
					128.49°F
					127.24°F
4287'	2.41°	111.59°	4268.04'	-227.91'	128.40°F
					126.52°F
					124.69°F
					125.84°F
4382'	1.21°	45.53°	4362.99'	-230.48'	126.52°F
					126.52°F
					126.52°F
					127.55°F
					128.73°F
					128.73°F
4571'	1.02°	53.52°	4551.96'	-233.31'	128.73°F
					130.96°F









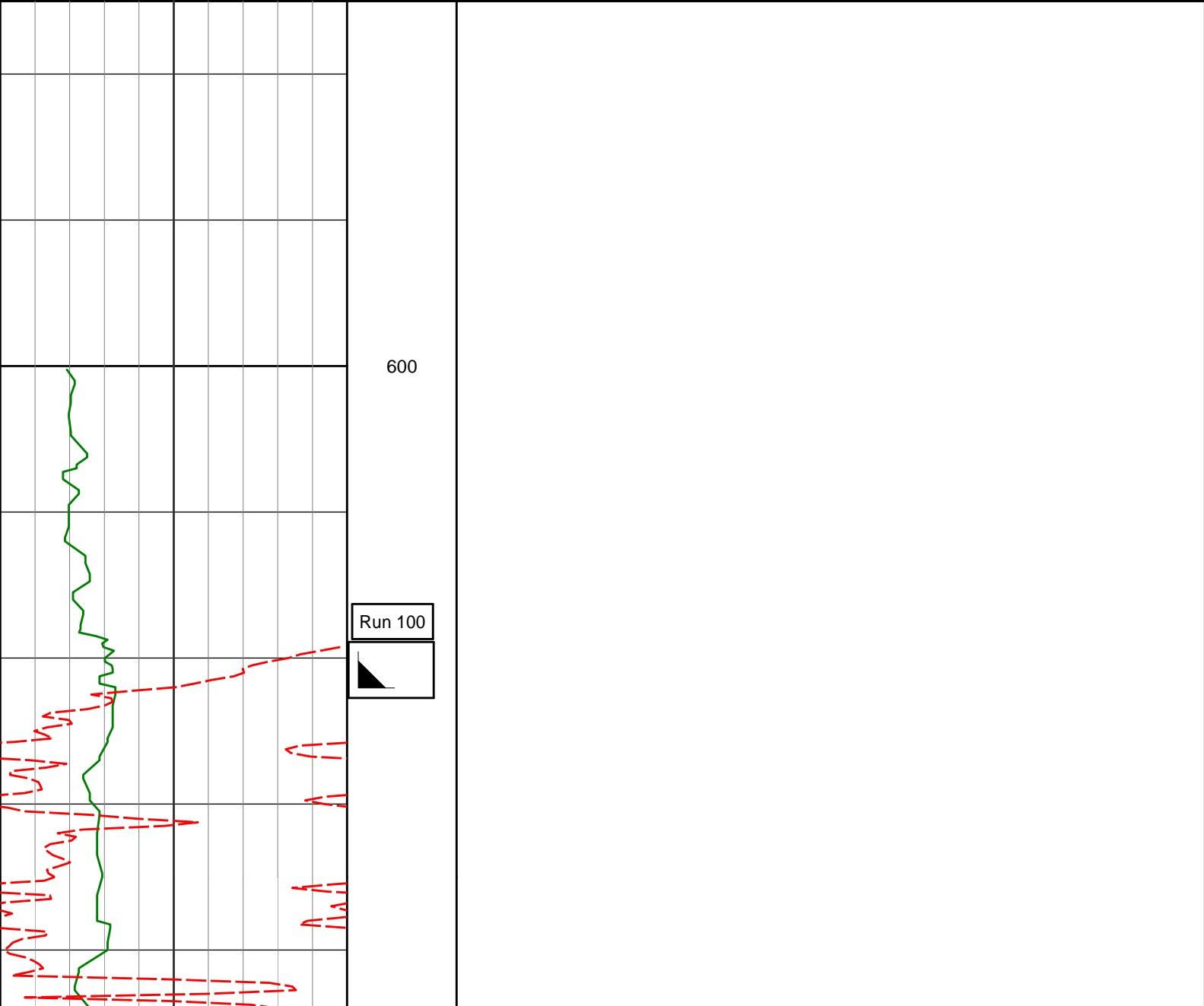
Avg Rate of Penetration ROPA feet per hr		Depth TVD ft	Depth	Inc	Azi	TVD	V.S.	Temp
1K 0								

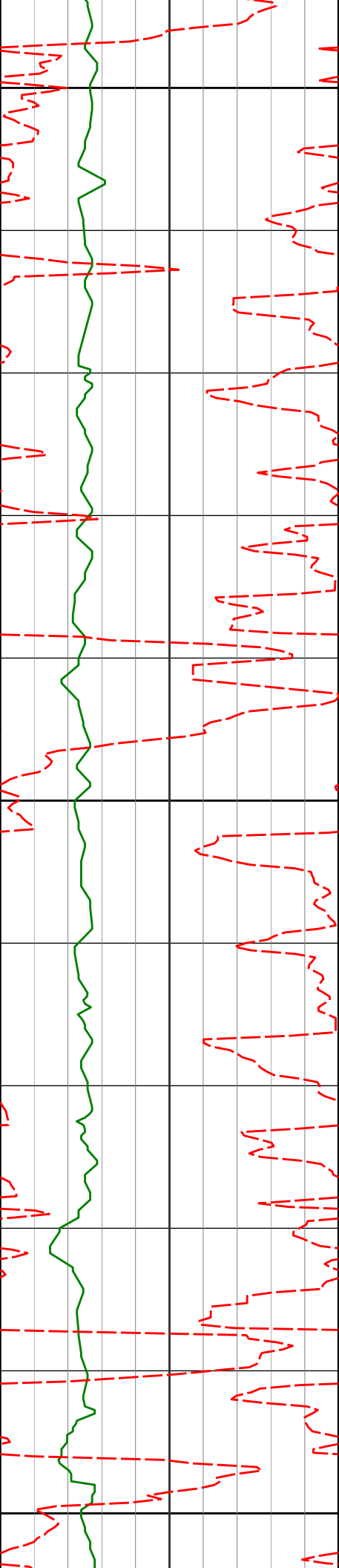
PCG GR XHi-Range RT BCor PGXRC-T api								
0 300								

TVD Detail 1:240 Scale

PCG GR XHi-Range RT BCor PGXRC-T api								
0 300								

Avg Rate of Penetration ROPA feet per hr		Depth TVD ft	Depth	Inc	Azi	TVD	V.S.	Temp
1K 0								





700

731'

0.16°

18.64° 731.00'

-0.34'

800

900

84.06°F

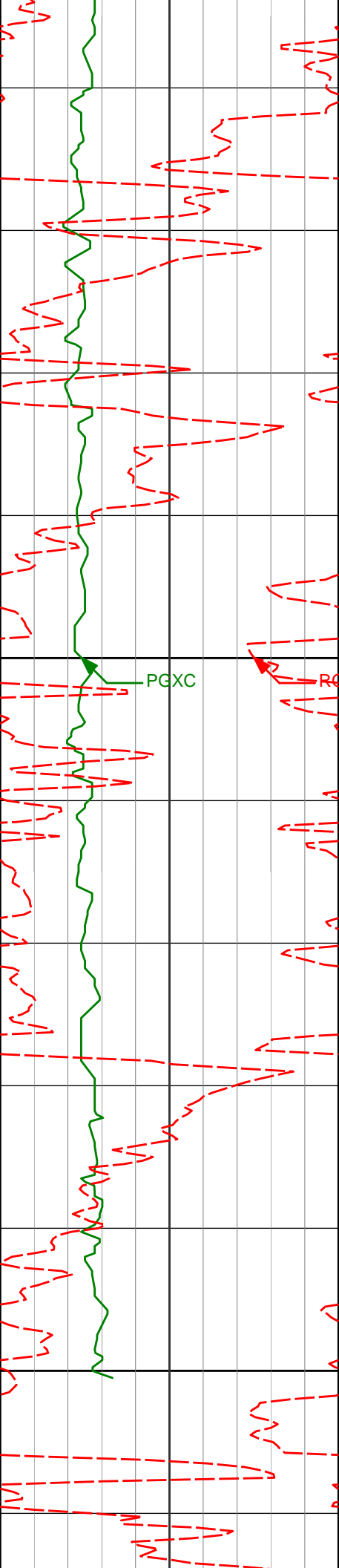
86.09°F

86.09°F

86.09°F

86.09°F





917'

0.07°

231.67° 917.00'

-0.34'

88.14°F

88.14°F

1000

PGXC

ROPA

1008'

0.61°

178.81° 1008.00'

-0.30'

88.14°F

88.14°F

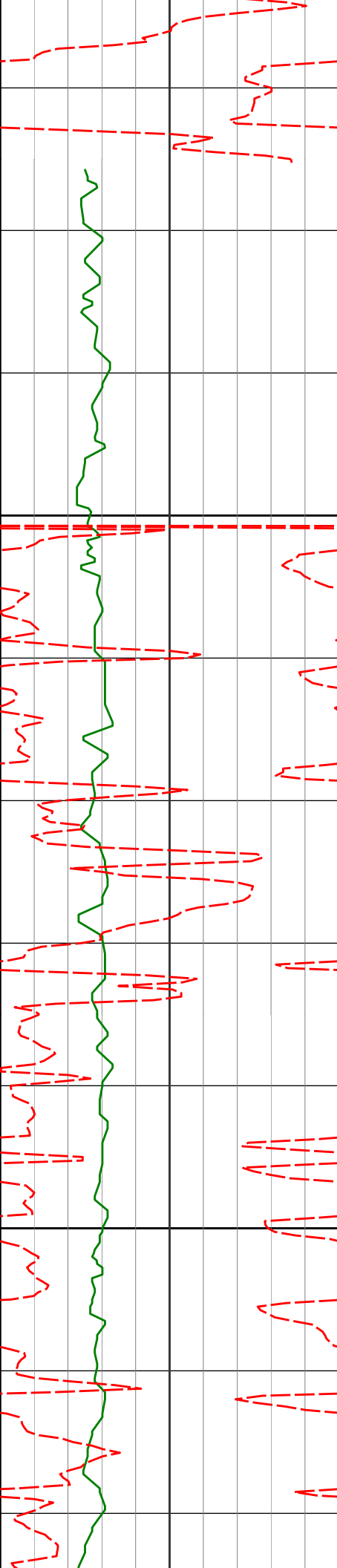
1100

1101'

0.74°

182.94° 1100.99'

-0.25'



1200

1300

1302'

0.62°

199.29°

1301.98'

0.23'

90.19°F

90.19°F

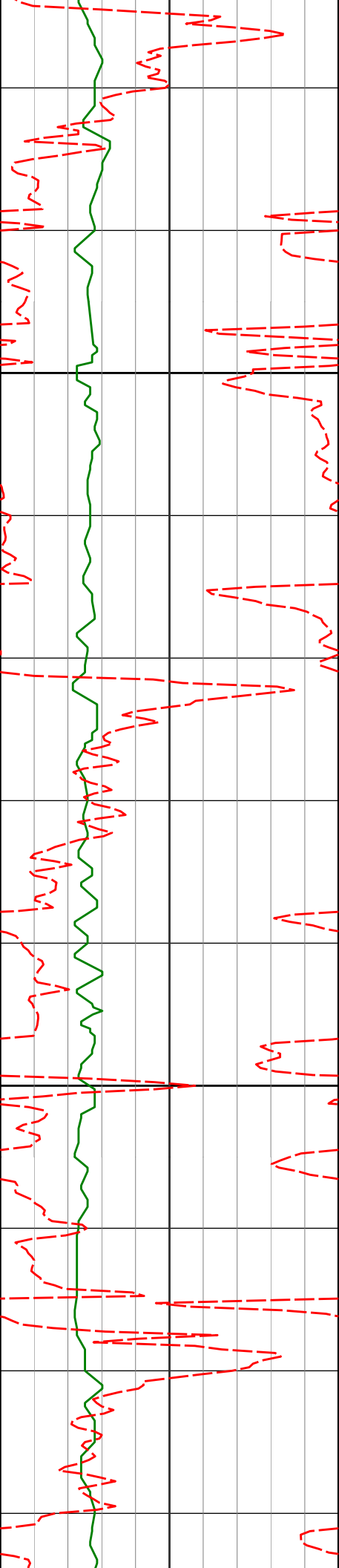
88.14°F

88.14°F

88.14°F

88.14°F

90.19°F



1400

1500

1394'

0.83°

219.11°

1393.97'

0.84'

1486'

0.79°

207.01°

1485.96'

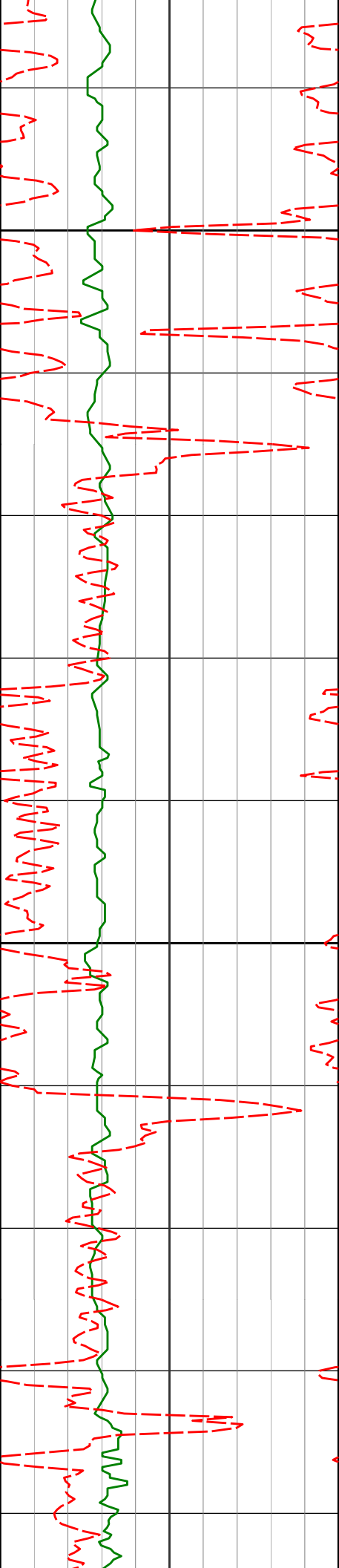
1.58'

90.19°F

92.26°F

92.26°F

92.26°F



1579'

0.73°

206.25°

1578.95'

2.16'

92.26°F

1600

92.26°F

1671'

0.61°

207.58°

1670.95'

2.67'

94.33°F

1700

94.33°F

94.33°F

1763'

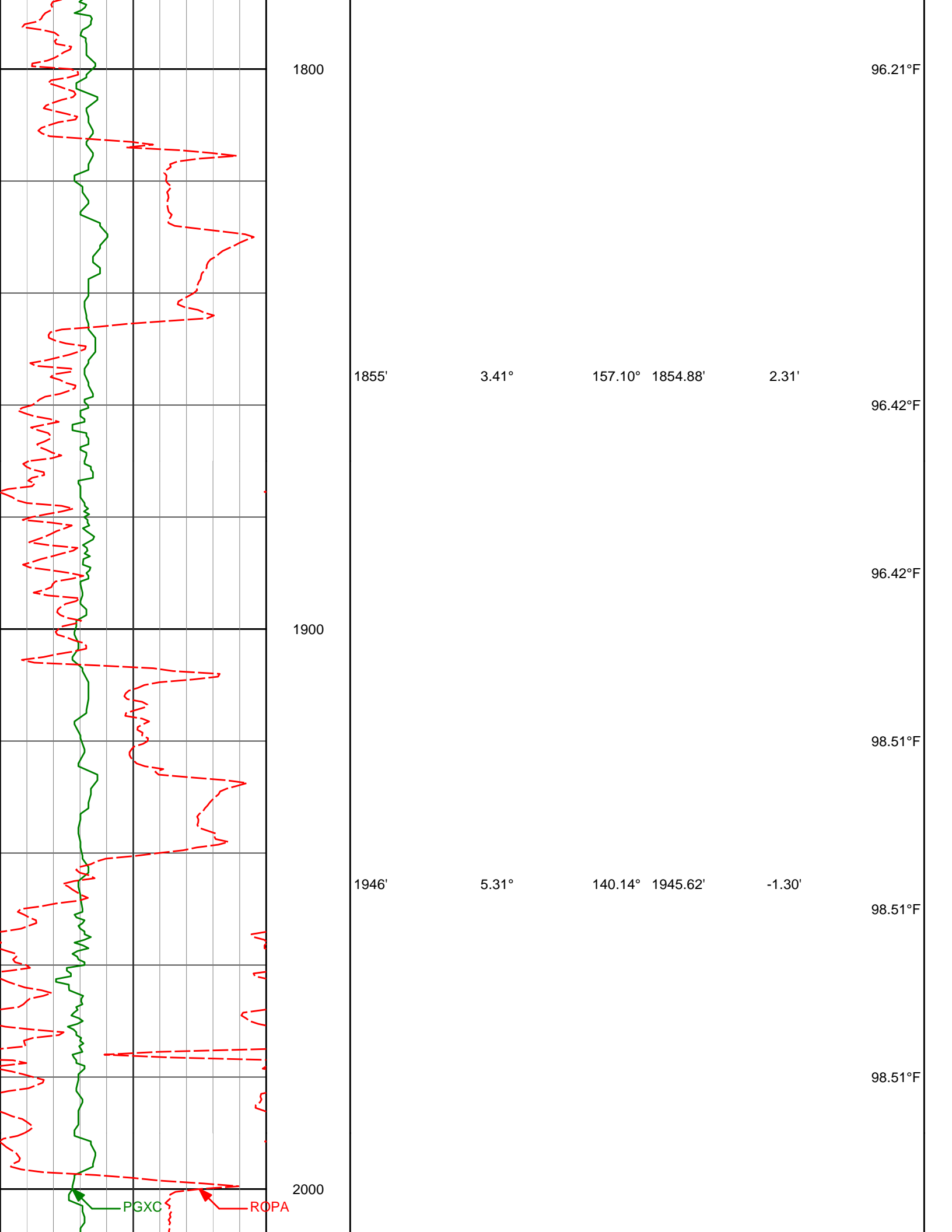
0.55°

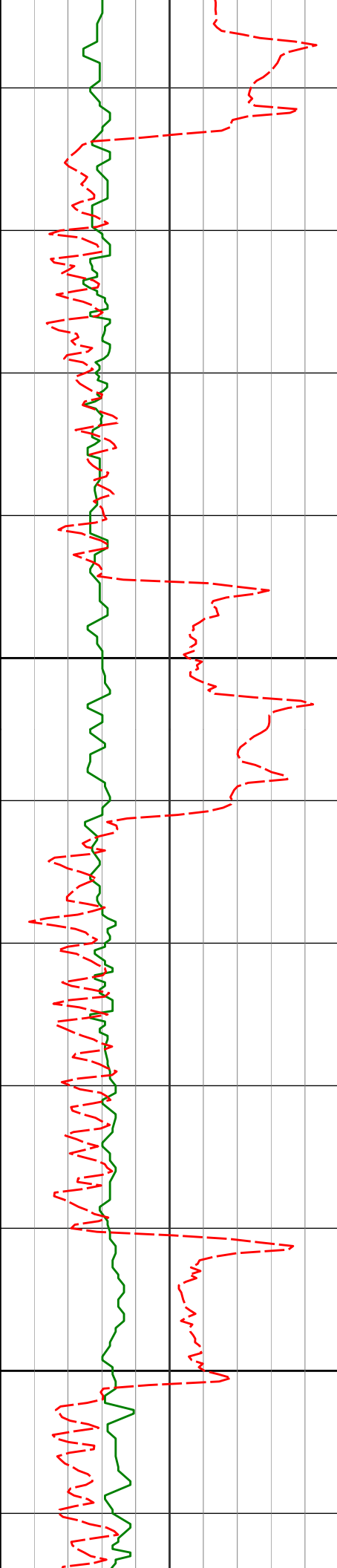
206.53°

1762.94'

3.11'

94.49°F





2038'

6.59°

127.03°

2037.12'

-8.09'

98.51°F

98.51°F

2100

100.62°F

2129'

8.43°

126.81°

2127.34'

-17.44'

100.62°F

100.62°F

2200

101.76°F

2221'

8.52°

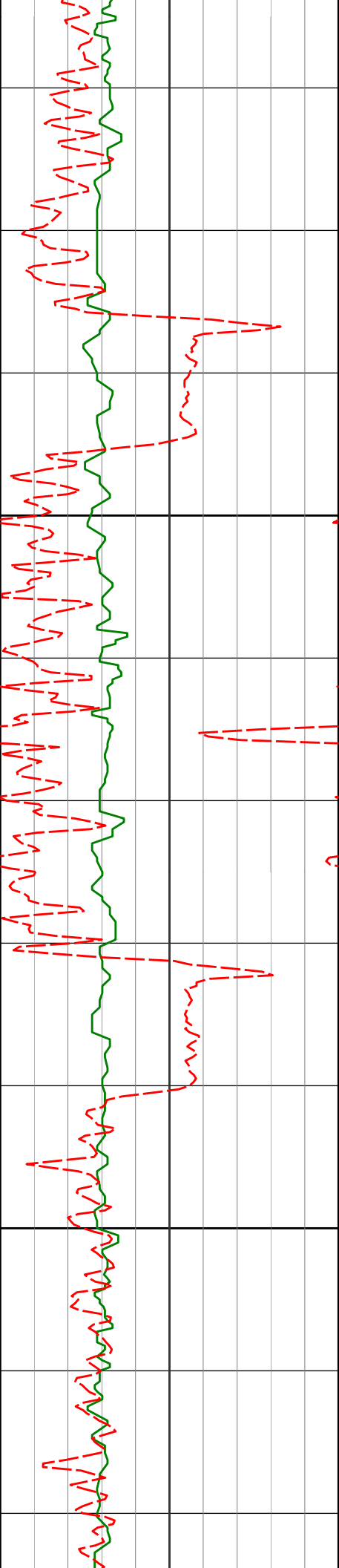
126.07°

2218.33'

-28.16'

102.72°F

98.51°F



2300

2313'

8.39°

126.12°

2309.33'

-38.90'

102.72°F

102.72°F

104.83°F

104.83°F

2400

2405'

8.42°

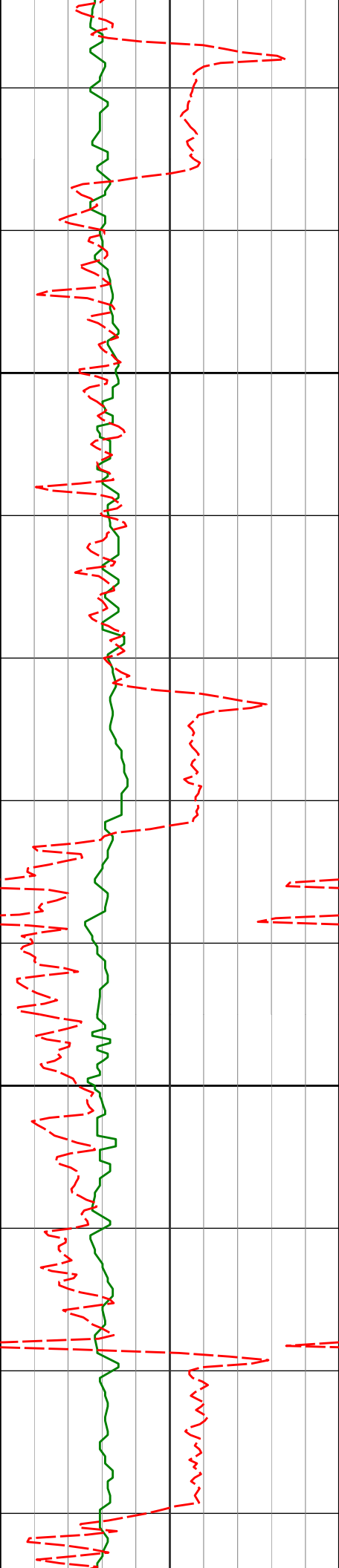
126.10°

2400.34'

-49.57'

104.83°F

104.83°F



2500

2600

2497'

8.17°

126.56°

2491.38'

-60.07'

104.83°F

106.70°F

106.97°F

2589'

7.91°

126.57°

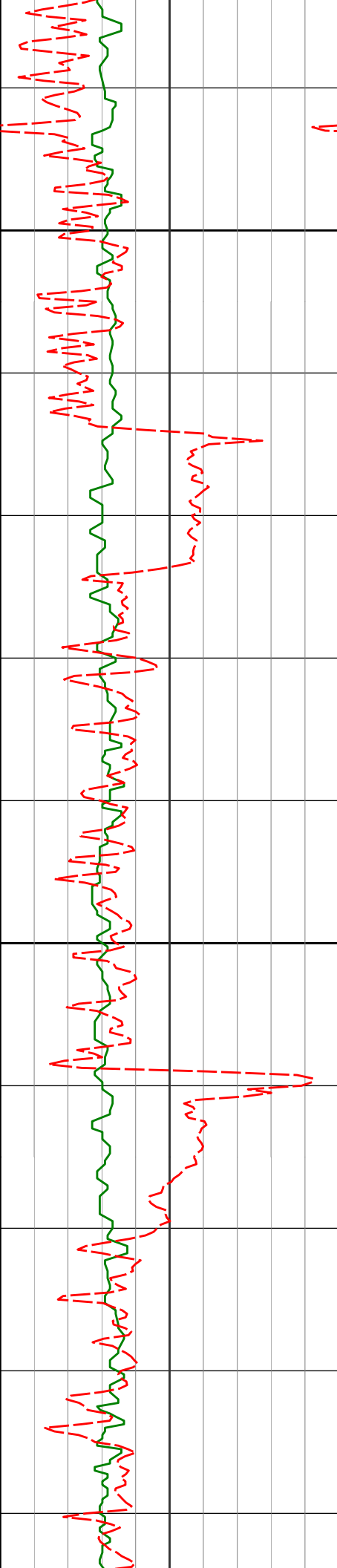
2582.48'

-70.22'

106.97°F

106.97°F





2680'

7.89°

127.34° 2672.61'

-80.04'

109.09°F

2700

109.09°F

109.09°F

2772'

7.75°

127.22° 2763.76'

-89.82'

109.09°F

110.85°F

2800

111.24°F

111.24°F

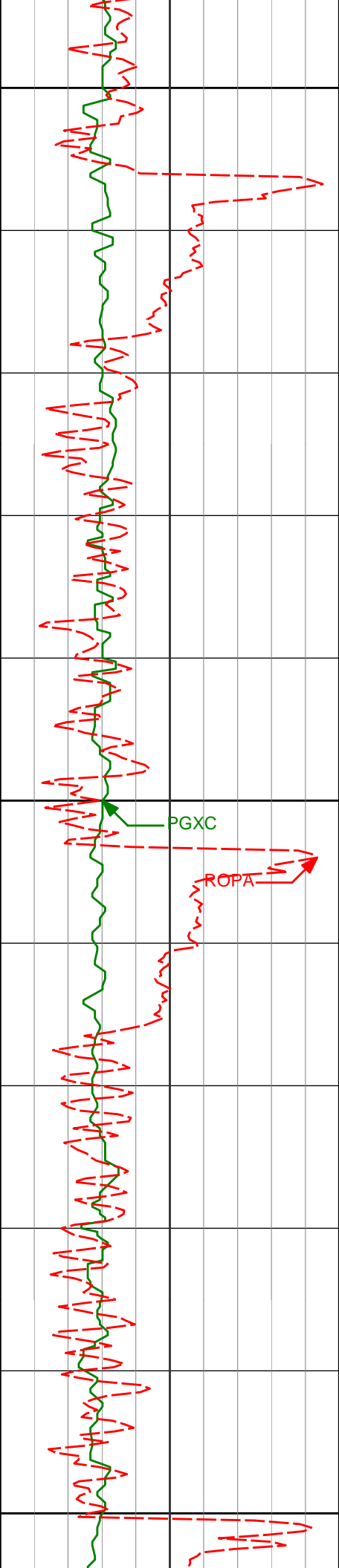
2867'

7.25°

126.42° 2857.94'

-99.57'

111.24°F



2900

111.24°F

111.24°F

2961'

7.29°

124.76°

2951.19'

-109.08'

112.07°F

3000

113.40°F

PGXC

ROPA

113.40°F

3056'

7.11°

122.00°

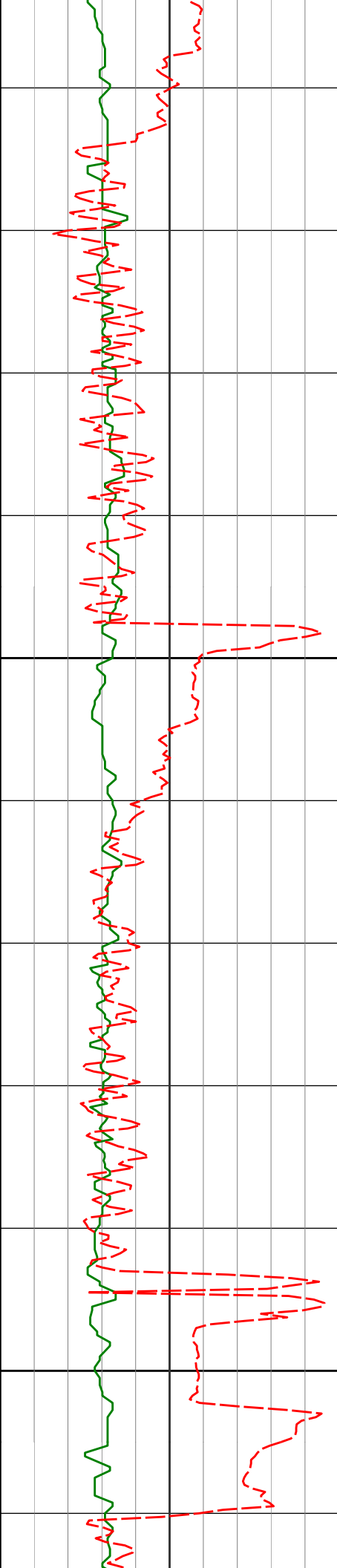
3045.44'

-118.86'

113.40°F

113.40°F

3100



3200

3300

3151'

3246'

3340'

7.08°

6.99°

8.35°

119.83°

117.67°

130.82°

3139.71'

3234.00'

3327.16'

-128.78'

-138.84'

-148.90'

115.56°F

115.56°F

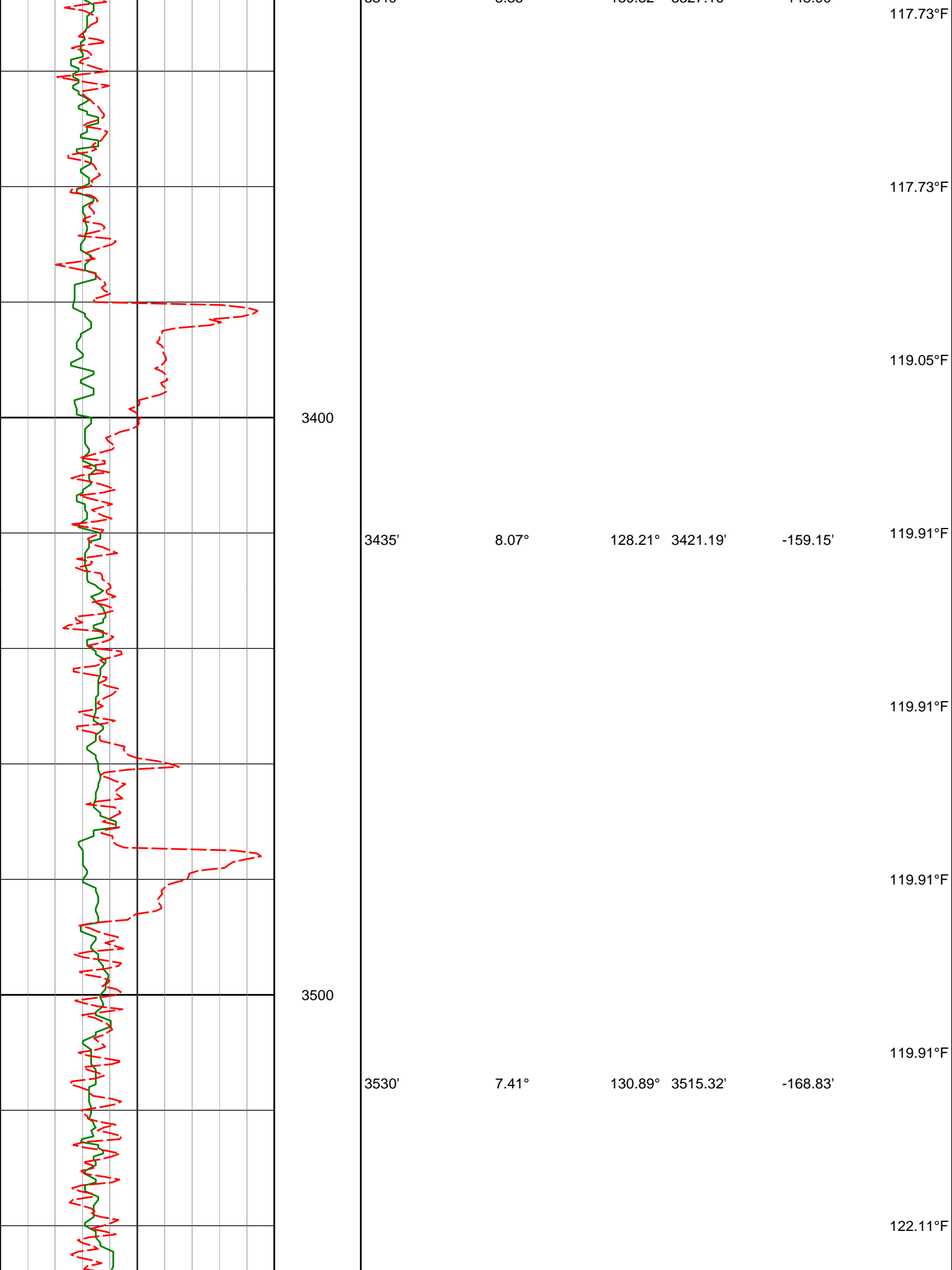
115.56°F

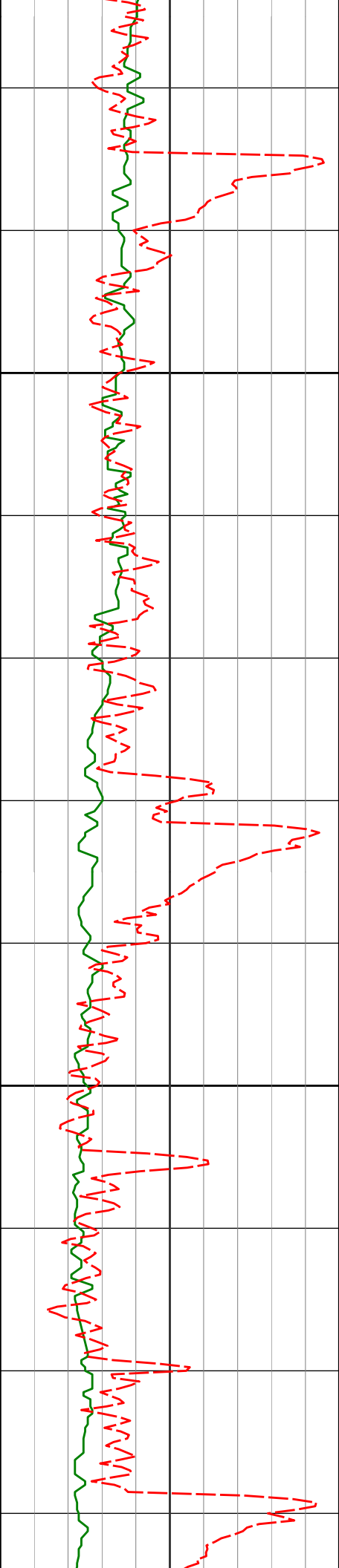
115.56°F

115.56°F

115.56°F

117.73°F





3600

3624'

6.82°

130.72°

3608.60'

-177.47'

3700

3719'

6.49°

130.70°

3702.96'

-185.64'

122.11°F

122.11°F

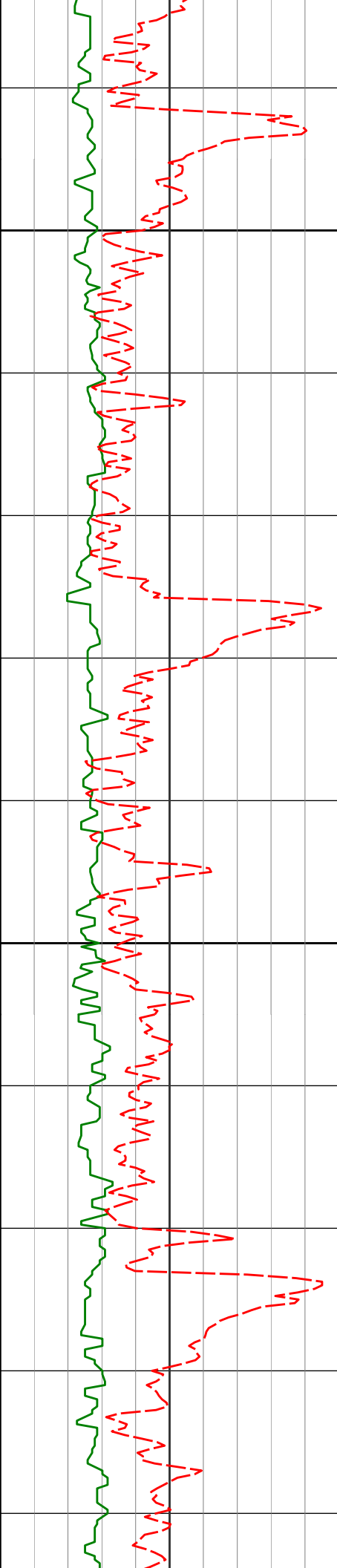
122.11°F

122.11°F

124.30°F

124.30°F

124.30°F



3800

3814'

6.50°

130.56°

3797.35'

-193.63'

124.30°F

124.30°F

124.30°F

124.30°F

3900

3908'

6.51°

129.99°

3890.74'

-201.59'

124.30°F

124.99°F

126.52°F

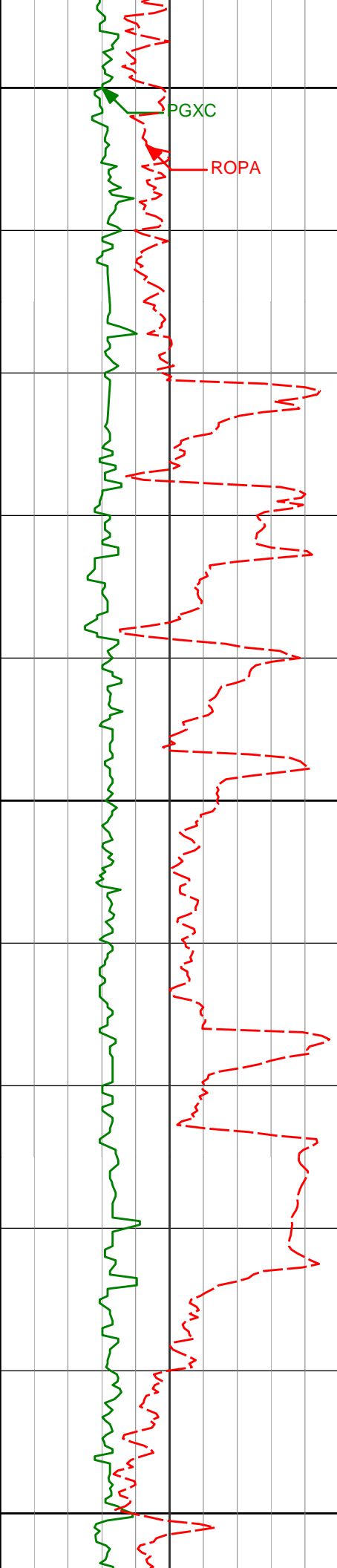
4003'

6.67°

129.46°

3985.11'

-209.82'



4000

126.52°F

126.52°F

126.52°F

4097'

5.60°

140.51° 4078.57'

-216.79'

126.52°F

4100

126.52°F

126.52°F

4192'

4.50°

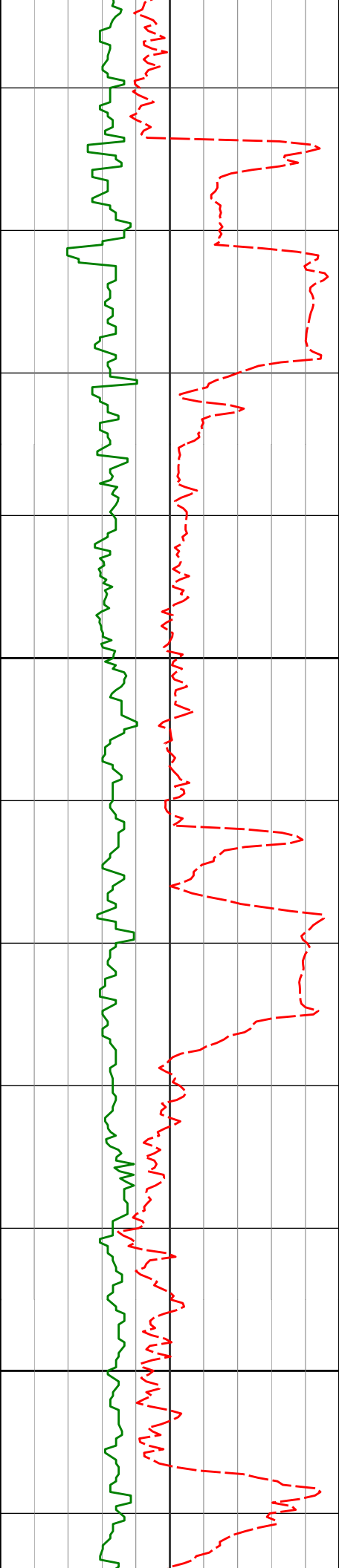
119.22° 4173.21'

-222.86'

128.73°F

4200

128.49°F



4300

4400

4287'

4382'

2.41°

1.21°

111.59°

45.53°

4268.04'

4362.99'

-227.91'

-230.48'

127.24°F

128.40°F

126.52°F

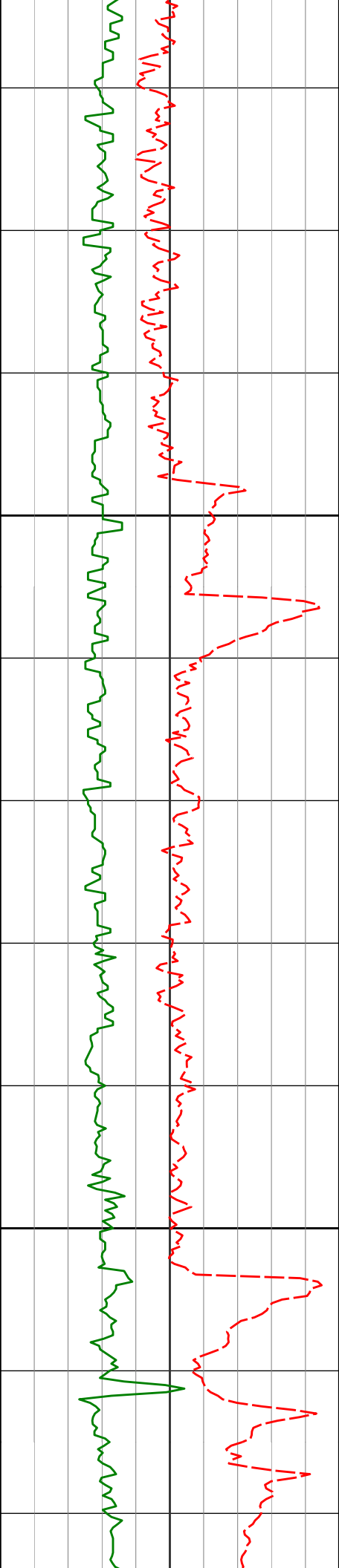
124.69°F

125.84°F

126.52°F

126.52°F





4500

4600

4571'

4666'

1.02°

0.97°

53.52°

55.26°

4551.96'

4646.94'

-233.31'

-234.66'

126.52°F

127.55°F

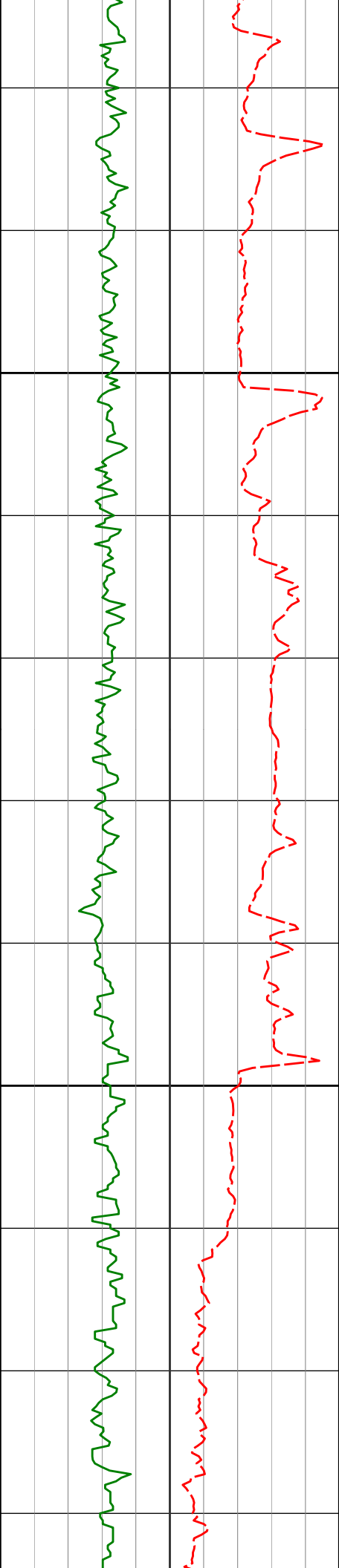
128.73°F

128.73°F

128.73°F

130.96°F

130.96°F



4700

4761'

0.79°

45.76°

4741.93'

-235.81'

134.15°F

134.74°F

131.74°F

129.81°F

128.73°F

200

4800

4855'

0.91°

44.91°

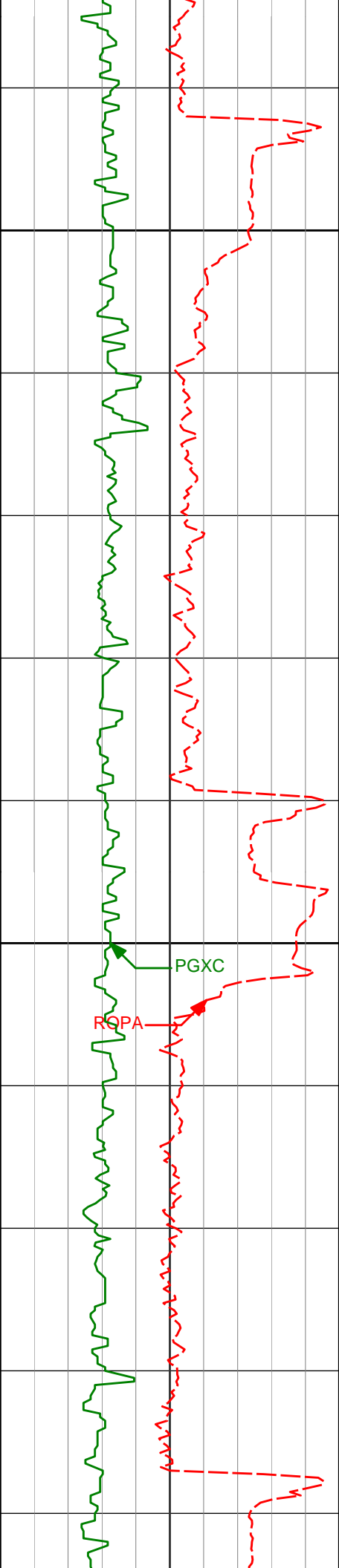
4835.92'

-236.82'

130.96°F

131.47°F

133.20°F



4900

4950'

1.11°

43.88°

4930.91'

-238.02'

5000

5045'

0.43°

167.88°

5025.90'

-238.74'

128.73°F

128.25°F

126.52°F

126.52°F

126.69°F

128.56°F

128.73°F

PGXC

POPA



5100

128.73°F

5140'

0.53°

162.93°

5120.90'

-238.93'

128.73°F

128.73°F

130.96°F

5200

5235'

0.71°

262.80°

5215.90'

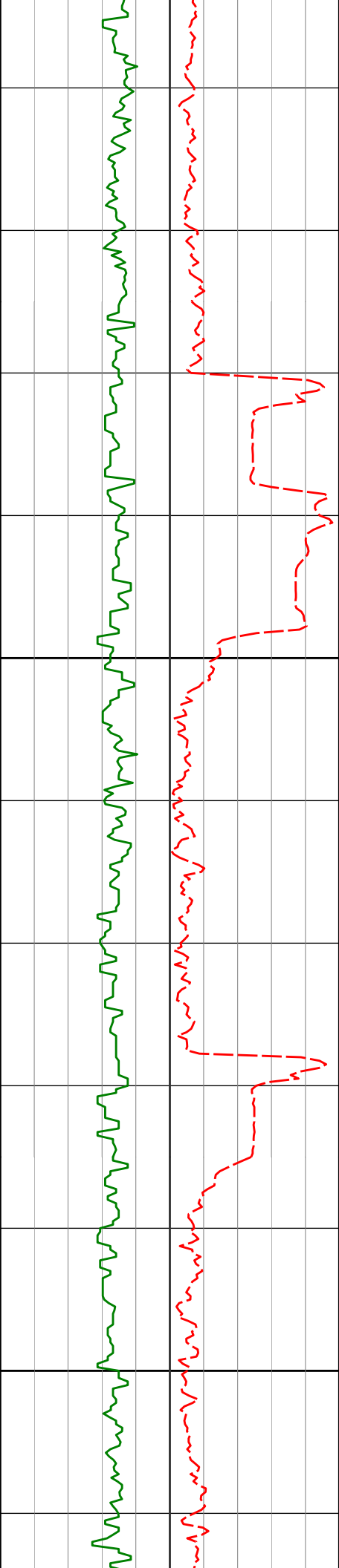
-238.46'

130.96°F

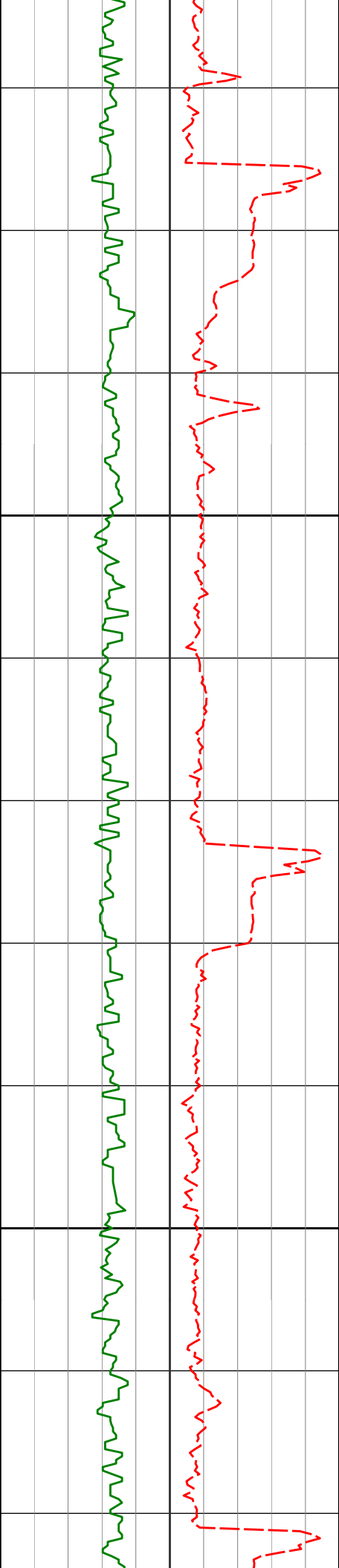
132.23°F

133.20°F

5300



	5329'	0.18°	255.85°	5309.89'	-237.74'	133.20°F
						133.20°F
						133.20°F
5400	5424'	1.52°	223.39°	5404.88'	-236.71'	133.20°F
						133.49°F
						135.45°F
						135.45°F
5500	5519'	1.21°	214.61°	5499.85'	-235.24'	
						135.59°F



5600

5614'

0.95°

221.27°

5594.84'

-234.11'

137.70°F

137.70°F

137.70°F

137.70°F

139.37°F

5700

5709'

0.84°

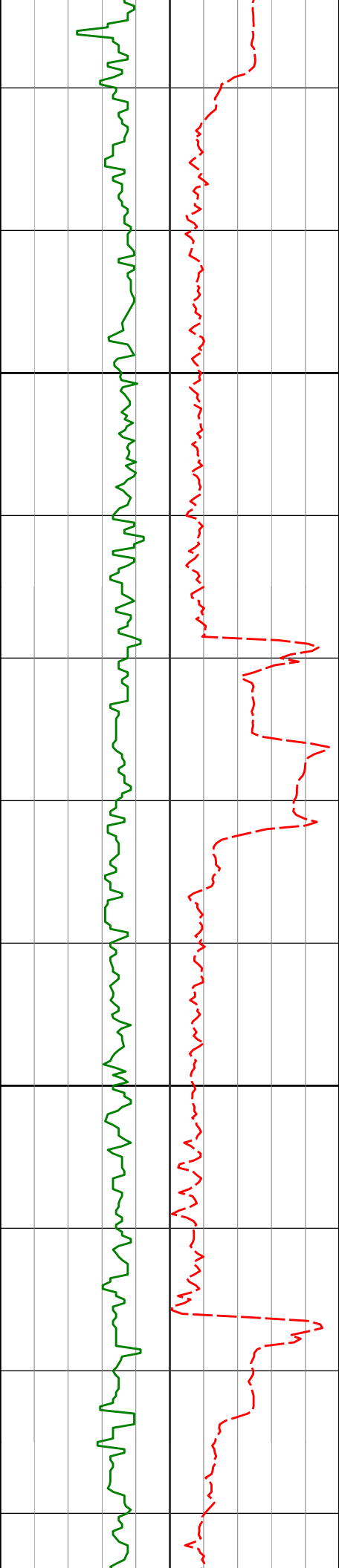
219.64°

5689.83'

-233.12'

139.96°F

139.96°F



5800

5900

5804'

0.90°

196.18°

5784.81'

-232.44'

5898'

1.66°

213.34°

5878.79'

-231.45'

139.96°F

139.96°F

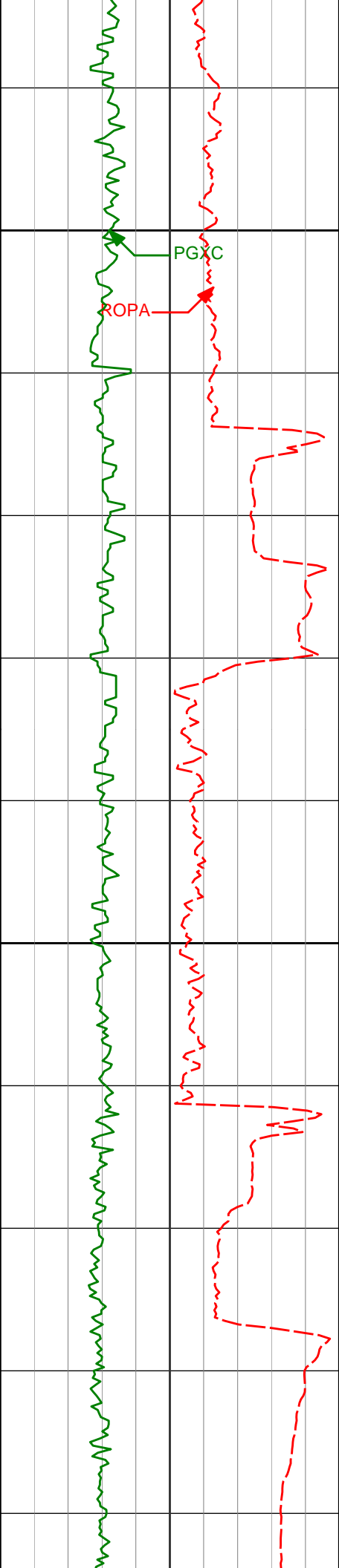
139.96°F

140.11°F

142.25°F

142.25°F

142.25°F



5993'

1.74°

194.88° 5973.75'

-230.26'

143.19°F

6000

144.54°F

PGXC

ROPA

144.54°F

144.72°F

6088'

2.53°

214.11° 6068.68'

-228.64'

146.72°F

6100

146.84°F

146.84°F

6182'

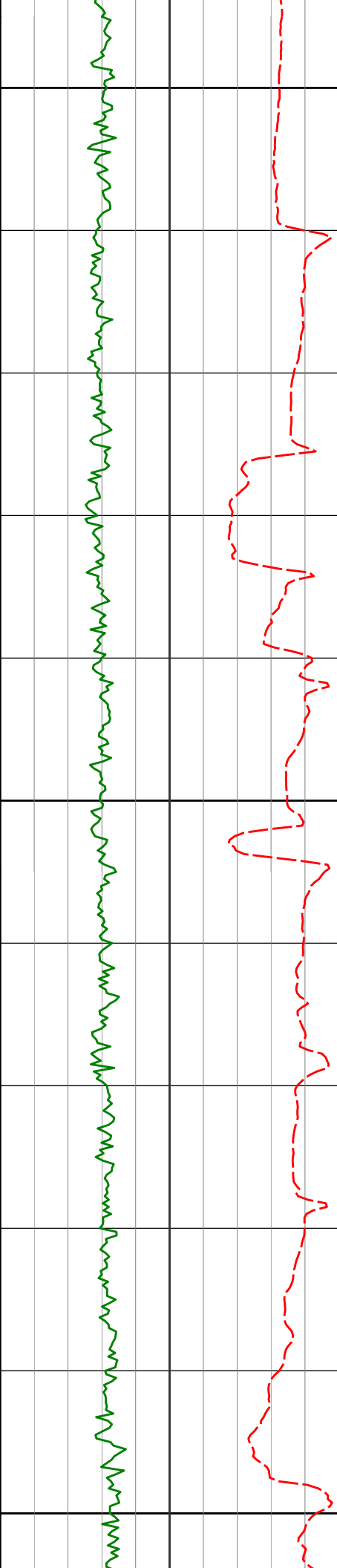
3.23°

237.08° 6162.57'

-225.18'

146.95°F





6200

6229'

8.24°

260.71°

6209.32'

-220.71'

148.75°F

149.56°F

6277'

10.87°

265.07°

6256.65'

-212.78'

151.46°F

6300

6324'

12.76°

266.77°

6302.66'

-203.17'

153.13°F

153.79°F

6372'

15.89°

267.53°

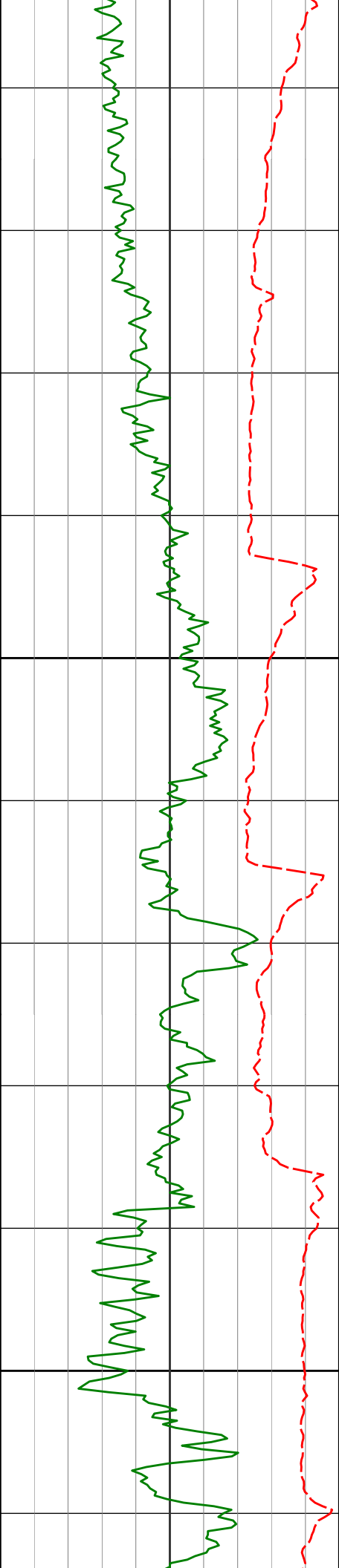
6349.16'

-191.30'

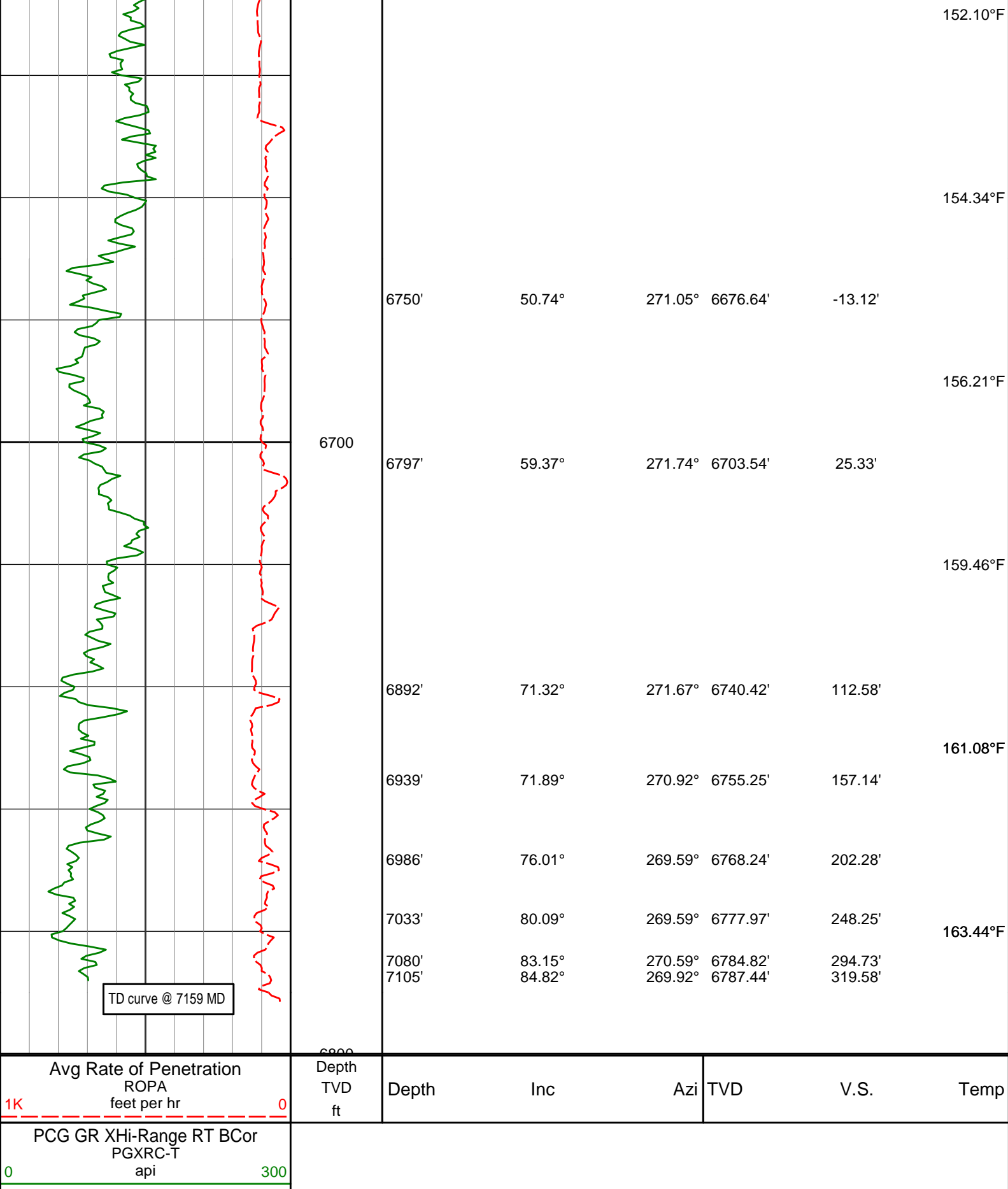
153.79°F

154.30°F

6400



					156.13°F
6466'	21.07°	270.16°	6438.28'	-161.52'	
					156.13°F
6513'	23.89°	273.09°	6481.71'	-143.58'	156.13°F
6500					155.70°F
6561'	26.20°	270.38°	6525.19'	-123.30'	151.69°F
					150.48°F
300	6616'	29.27°	264.27°	6573.88'	-97.74'
6600					151.18°F
6655'	34.57°	264.05°	6606.97'	-77.19'	



HALLIBURTON

DIRECTIONAL SURVEY REPORT

Noble Energy  
Wells Ranch AA11-676  
Wattenberg  
Weld Colorado  
USA  
CA-XX-0902421171  
Tied in @ Surface

Final survey projected to bit.

<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
731.00	0.16	18.64	731.00	0.95 N	0.32 E	-0.34	0.02
917.00	0.07	231.67	917.00	1.12 N	0.31 E	-0.34	0.12
1008.00	0.61	178.81	1008.00	0.61 N	0.28 E	-0.30	0.62
1101.00	0.74	182.94	1100.99	0.48 S	0.26 E	-0.25	0.15
1302.00	0.62	199.29	1301.98	2.81 S	0.17 W	0.23	0.11
1394.00	0.83	219.11	1393.97	3.80 S	0.75 W	0.84	0.35
1486.00	0.79	207.01	1485.96	4.89 S	1.46 W	1.58	0.19
1579.00	0.73	206.25	1578.95	5.99 S	2.02 W	2.16	0.06
1671.00	0.61	207.58	1670.95	6.96 S	2.51 W	2.67	0.14
1763.00	0.55	206.53	1762.94	7.78 S	2.93 W	3.11	0.07
1855.00	3.41	157.10	1854.88	10.70 S	2.06 W	2.31	3.35
1946.00	5.31	140.14	1945.62	16.42 S	1.69 E	-1.30	2.50
2038.00	6.59	127.03	2037.12	22.87 S	8.63 E	-8.09	2.03
2129.00	8.43	126.81	2127.34	30.02 S	18.15 E	-17.44	2.02
2221.00	8.52	126.07	2218.33	38.07 S	29.06 E	-28.16	0.15
2313.00	8.39	126.12	2309.33	46.04 S	39.99 E	-38.90	0.15
2405.00	8.42	126.10	2400.34	53.97 S	50.86 E	-49.57	0.03
2497.00	8.17	126.56	2491.38	61.83 S	61.54 E	-60.07	0.28
2589.00	7.91	126.57	2582.48	69.50 S	71.88 E	-70.22	0.28
2680.00	7.89	127.34	2672.61	77.02 S	81.88 E	-80.04	0.12
2772.00	7.75	127.22	2763.76	84.60 S	91.84 E	-89.82	0.15
2867.00	7.25	126.42	2857.94	92.03 S	101.76 E	-99.57	0.54
2961.00	7.29	124.76	2951.19	98.96 S	111.44 E	-109.08	0.23
3056.00	7.11	122.00	3045.44	105.51 S	121.38 E	-118.86	0.41
3151.00	7.08	119.83	3139.71	111.54 S	131.44 E	-128.78	0.28
3246.00	6.99	117.67	3234.00	117.13 S	141.64 E	-138.84	0.29
3340.00	8.35	130.82	3327.16	124.25 S	151.87 E	-148.90	2.35
3435.00	8.07	128.21	3421.19	132.89 S	162.33 E	-159.15	0.49
3530.00	7.41	130.89	3515.32	141.03 S	172.20 E	-168.83	0.79
3624.00	6.82	130.72	3608.60	148.64 S	181.02 E	-177.47	0.63
3719.00	6.49	130.70	3702.96	155.82 S	189.37 E	-185.64	0.34
3814.00	6.50	130.56	3797.35	162.82 S	197.52 E	-193.63	0.02
3908.00	6.51	129.99	3890.74	169.70 S	205.65 E	-201.59	0.07
4003.00	6.67	129.46	3985.11	176.68 S	214.04 E	-209.82	0.18
4097.00	5.60	140.51	4078.57	183.69 S	221.18 E	-216.79	1.69
4192.00	4.50	119.22	4173.21	189.09 S	227.38 E	-222.86	2.27
4287.00	2.41	111.59	4268.04	191.64 S	232.49 E	-227.91	2.25
4382.00	1.21	45.53	4362.99	191.68 S	235.06 E	-230.48	2.33
4571.00	1.02	53.52	4551.96	189.28 S	237.83 E	-233.31	0.13
4666.00	0.97	55.26	4646.94	188.33 S	239.17 E	-234.66	0.06
4761.00	0.79	45.76	4741.93	187.41 S	240.29 E	-235.81	0.24
4855.00	0.91	44.91	4835.92	186.44 S	241.28 E	-236.82	0.13
4950.00	1.11	43.88	4930.91	185.24 S	242.45 E	-238.02	0.21
5045.00	0.43	167.88	5025.90	184.92 S	243.17 E	-238.74	1.47
5140.00	0.53	162.93	5120.90	185.69 S	243.37 E	-238.93	0.11
5235.00	0.71	262.80	5215.90	186.18 S	242.92 E	-238.46	1.00
5329.00	0.18	255.85	5309.89	186.29 S	242.20 E	-237.74	0.56
5424.00	1.52	223.39	5404.88	187.24 S	241.19 E	-236.71	1.44
5519.00	1.21	214.61	5499.85	188.98 S	239.76 E	-235.24	0.39
5614.00	0.95	221.27	5594.84	190.40 S	238.67 E	-234.11	0.31
5709.00	0.84	219.64	5689.83	191.53 S	237.70 E	-233.12	0.12
5804.00	0.90	196.18	5784.81	192.78 S	237.05 E	-232.44	0.38
5898.00	1.66	213.34	5878.79	194.62 S	236.10 E	-231.45	0.90
5993.00	1.74	194.88	5973.75	197.17 S	234.97 E	-230.26	0.58
6088.00	2.53	214.11	6068.68	200.31 S	233.42 E	-228.64	1.11
6182.00	3.23	237.08	6162.57	203.46 S	230.03 E	-225.18	1.42

6229.00	8.24	260.71	6209.32	204.73 S	225.59 E	-220.71	11.57
6277.00	10.87	265.07	6256.65	205.67 S	217.69 E	-212.78	5.67
6324.00	12.76	266.77	6302.66	206.34 S	208.09 E	-203.17	4.10
6372.00	15.89	267.53	6349.16	206.93 S	196.23 E	-191.30	6.54
6466.00	21.07	270.16	6438.28	207.43 S	166.46 E	-161.52	5.58
6513.00	23.89	273.09	6481.71	206.90 S	148.50 E	-143.58	6.46
6561.00	26.20	270.38	6525.19	206.30 S	128.19 E	-123.30	5.37
6616.00	29.27	264.27	6573.88	207.57 S	102.66 E	-97.74	7.60
6655.00	34.57	264.05	6606.97	209.67 S	82.16 E	-77.19	13.59
6750.00	50.74	271.05	6676.64	211.80 S	18.12 E	-13.12	17.72
6797.00	59.37	271.74	6703.54	210.85 S	20.36 W	25.33	18.40
6845.00	68.93	271.07	6724.44	209.81 S	63.50 W	68.42	19.95
6892.00	71.32	271.08	6740.42	208.98 S	107.69 W	112.58	5.09
6939.00	71.89	270.81	6755.25	208.24 S	152.28 W	157.14	1.33
6986.00	76.01	269.44	6768.24	208.15 S	197.44 W	202.28	9.20
7033.00	80.09	269.70	6777.97	208.49 S	243.41 W	248.25	8.70
7080.00	83.15	270.21	6784.82	208.53 S	289.90 W	294.73	6.60
7105.00	84.82	271.22	6787.44	208.22 S	314.76 W	319.58	7.80
7159.00	87.55	271.22	6791.03	207.07 S	368.62 W	373.40	5.06

**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 268.65 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.65 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 7159.00 FEET  
IS 422.80 FEET ALONG 240.67 DEGREES (GRID)**