

### PCG Pressure Case Directional



**1:600 / 1:240**

Country	: USA
Field	: Wattenburg
Location	: Lat: 40° 12' 9.32" North Long: 104° 38' 31.34" West
Well	: Moser H22-711
Company	: Noble Energy
Rig	: H&P 343
LOCATION	
Latitude : 40° 12' 9.32" North Longitude : 104° 38' 31.34" West UTM Easting = 3,239,643.118 usft UTM Northing = 1,317,804.874 usft	Company : Noble Energy Rig : H&P 343 Well : Moser H22-711 Field : Wattenburg Country : USA API Number : 05-123-40757
Other Services Directional Drilling	

[illegible]

## WELL INFORMATION

<b>MWD Run Number</b>	100				
<b>Date run completed</b>	01-Dec-15				
<b>Rig Bit Number</b>	0100				
<b>Bit Size (in)</b>	8.750				
<b>Tool Nominal OD (in)</b>	6.750				
<b>Log Start Depth (TVD, ft)</b>	897.99				
<b>Log End Depth (TVD, ft)</b>	7,014.65				
<b>Drill or Wipe</b>	Drill				
<b>Drill/Wipe Start Date and Time</b>	30-Nov-15 03:30				
<b>Drill/Wipe End Date and Time</b>	01-Dec-15 02:36				
<b>Min Inc (deg) @ Depth (TVD, ft)</b>	0.52 @ 927.99				
<b>Max Inc (deg) @ Depth (TVD, ft)</b>	83.15 @ 7,009.25				
<b>Bit TFA(in2) / Bit Type</b>	0.98 / PDC				
<b>Flow Rate (gpm)</b>	589.90				
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	N/A / N/A				
<b>Fluid Type</b>	Native/Spud Mud				
<b>Density (ppg) / Viscosity (spqt)</b>	8.60 / 28.00				
<b>Filtrate CL (ppm)</b>	16.00				
<b>pH / Fluid Loss (mptm)</b>	9.20 / 35				
<b>PV (cP) / YP (lhf2)</b>	3 / 3.00				
<b>% Solids / % Sand</b>	3.70 / 0.20				
<b>% Oil / Oil:Water Ratio</b>	N/A / N/A				
<b>Rm @ Measured Temp (degF)</b>	N/A @ N/A				
<b>Rmf @ Measured Temp (degF)</b>	N/A @ N/A				
<b>Rmc @ Measured Temp (degF)</b>	N/A @ N/A				
<b>Max Tool Temp (degF) / Source</b>	177.64 / PCM				
<b>Rm @ Max Tool Temp (degF)</b>	N/A @ N/A				
<b>Lead MWD Engineer</b>	Matt Busche				
<b>Customer Representative</b>	John Druhota				

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM				
Software Version	5.93				
Sub Serial Number	11341333				
Insert Serial Number	11620295				
Date and Time Initialized	28-Nov-15 22:45				
Date and Time Read	01-Dec-15 10:42				
ECMB SW Version	N/A				

Directional Sensor Information

Tool Type	PCDC				
Distance From Bit (ft)	55.00				
Software Version	6.33				
Sub Serial Number	11341333				
Sonde Serial Number	11062040				
Sensor ID Number	N/A				
Toolface Offset (deg)	51.70				

Gamma Ray Sensor Information

Tool Type	PCG				
Distance From Bit (ft)	48.42				
Recorded Sample Period (sec)	10				
Software Version	8.15				
Sub Serial Number	11341333				
Insert/Sonde Serial Number	11680938				

REMARKS

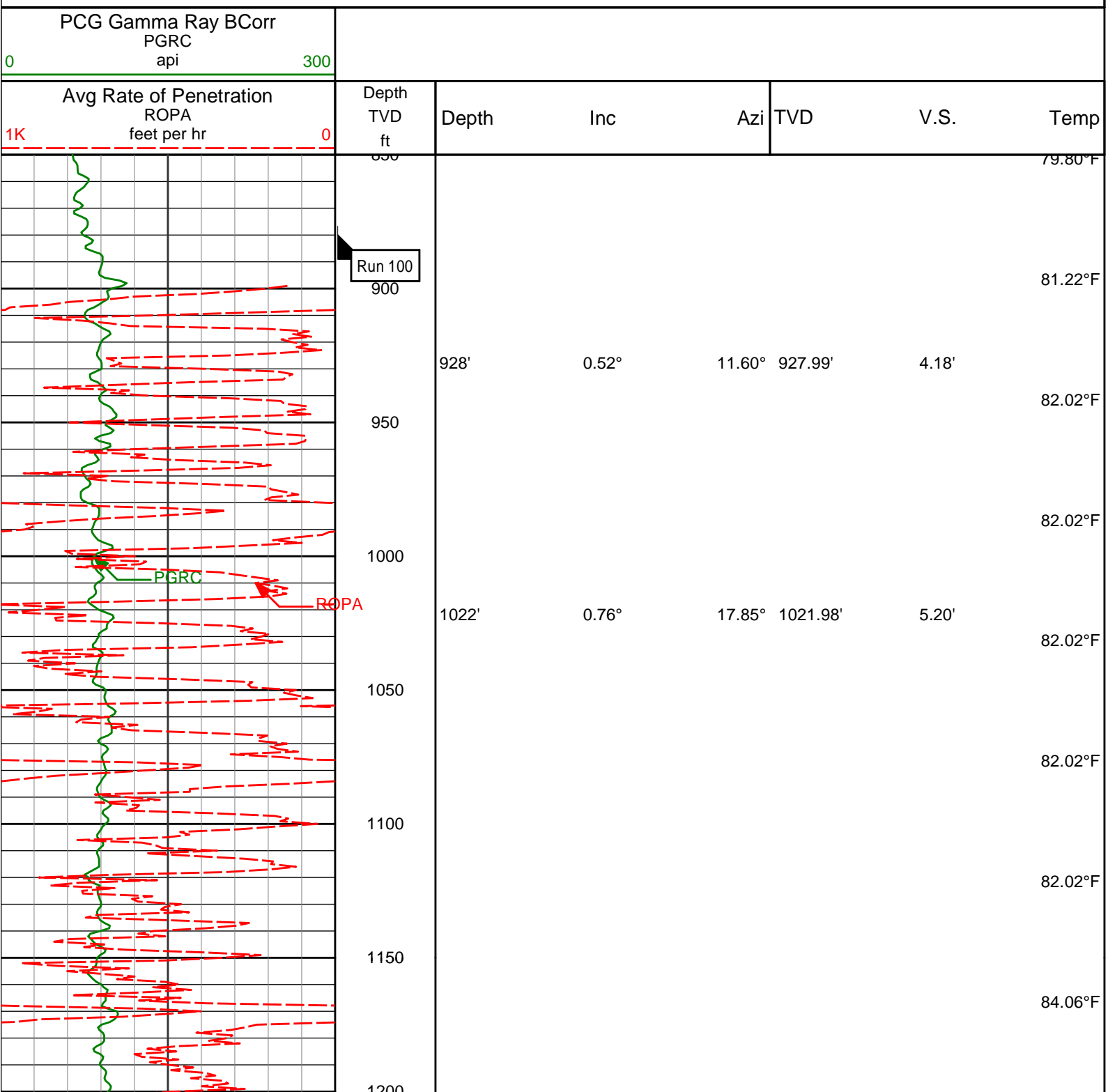
1. All depths are calibrated to driller's pipe tally and are total vertical depth from the drill floor.
2. No depth corrections have been made for pipe stretch or compression.
3. All data presented is recorded (memory data) unless otherwise stated.
4. Environmental parameters used in gamma and resistance processing:  
  
Hole Size: 8.75"  
Mud Density: 8.75-10.75ppg
5. The following smoothing parameters have been applied to the data:  
  
1:600 (2"):  
Interval: 1.0 ft  
Coercion Distance: 3.0 ft (ROPA)  
Interval: 1.0 ft  
Coercion Distance: 3.0 ft (Gamma Ray)  
  
1:240 (5")  
Interval: 0.5 ft  
Coercion Distance: 1.2 ft (ROPA)  
Interval: 0.5 ft  
Coercion Distance: 0.6 ft (Gamma Ray)

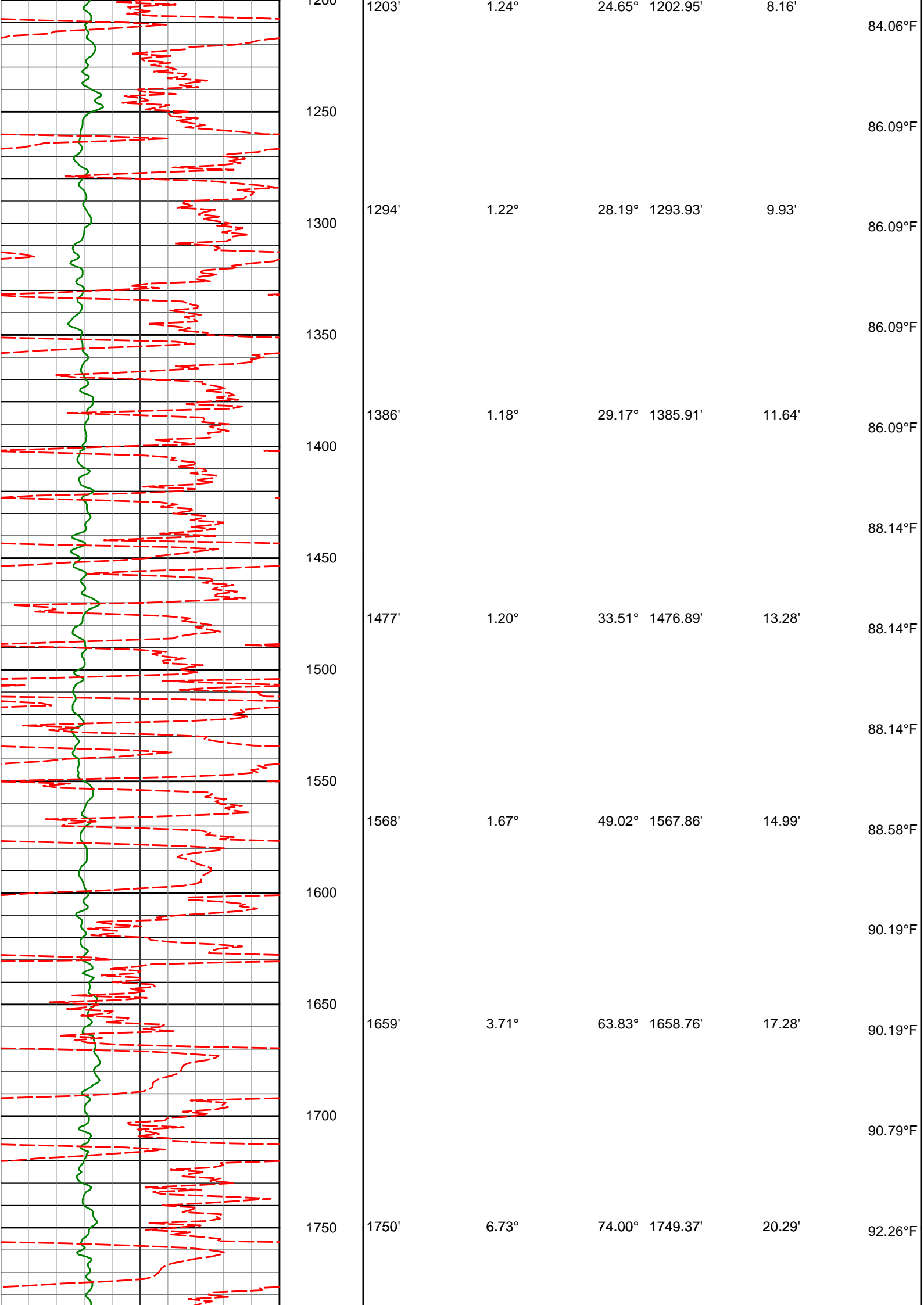
WARRANTY

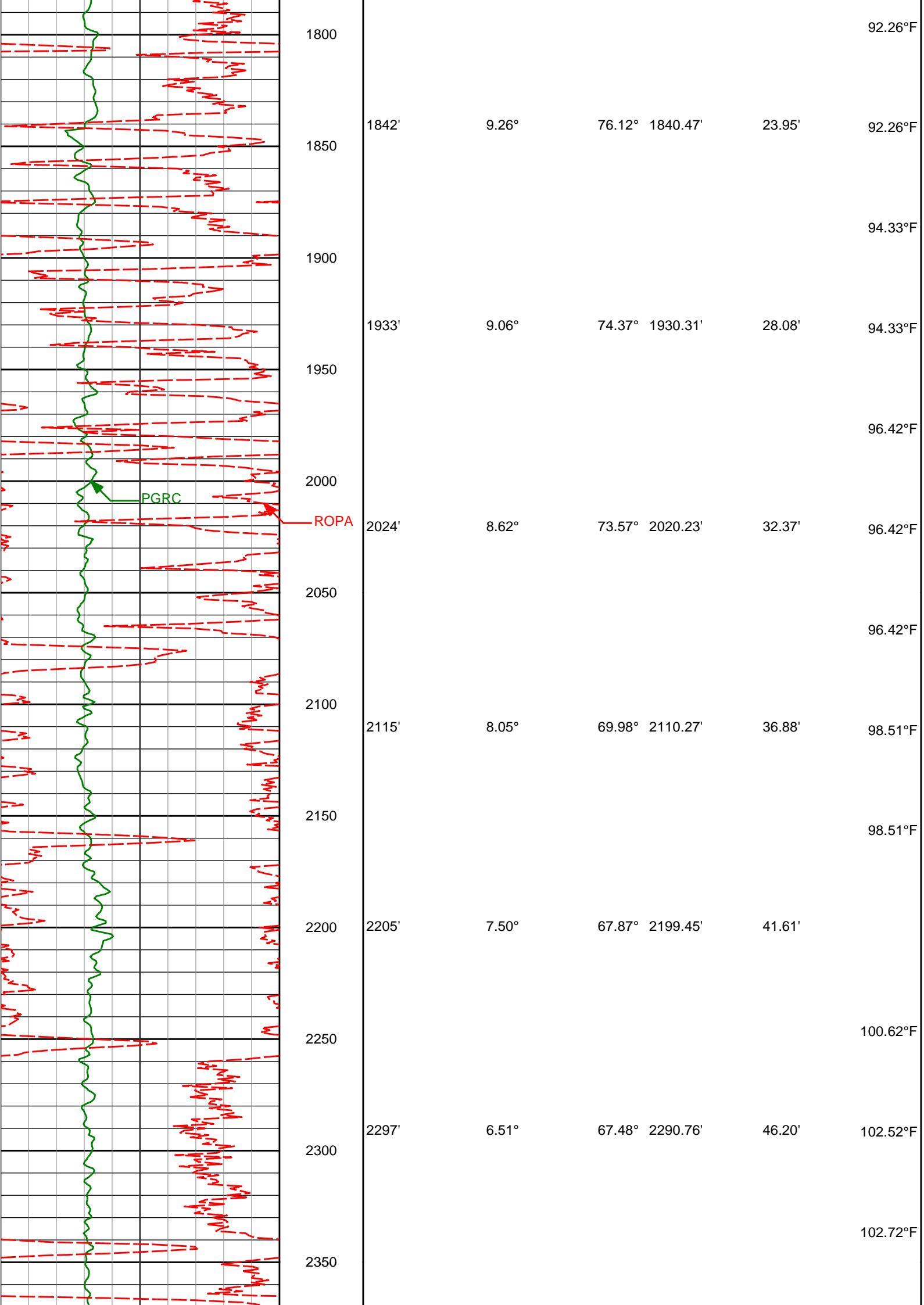
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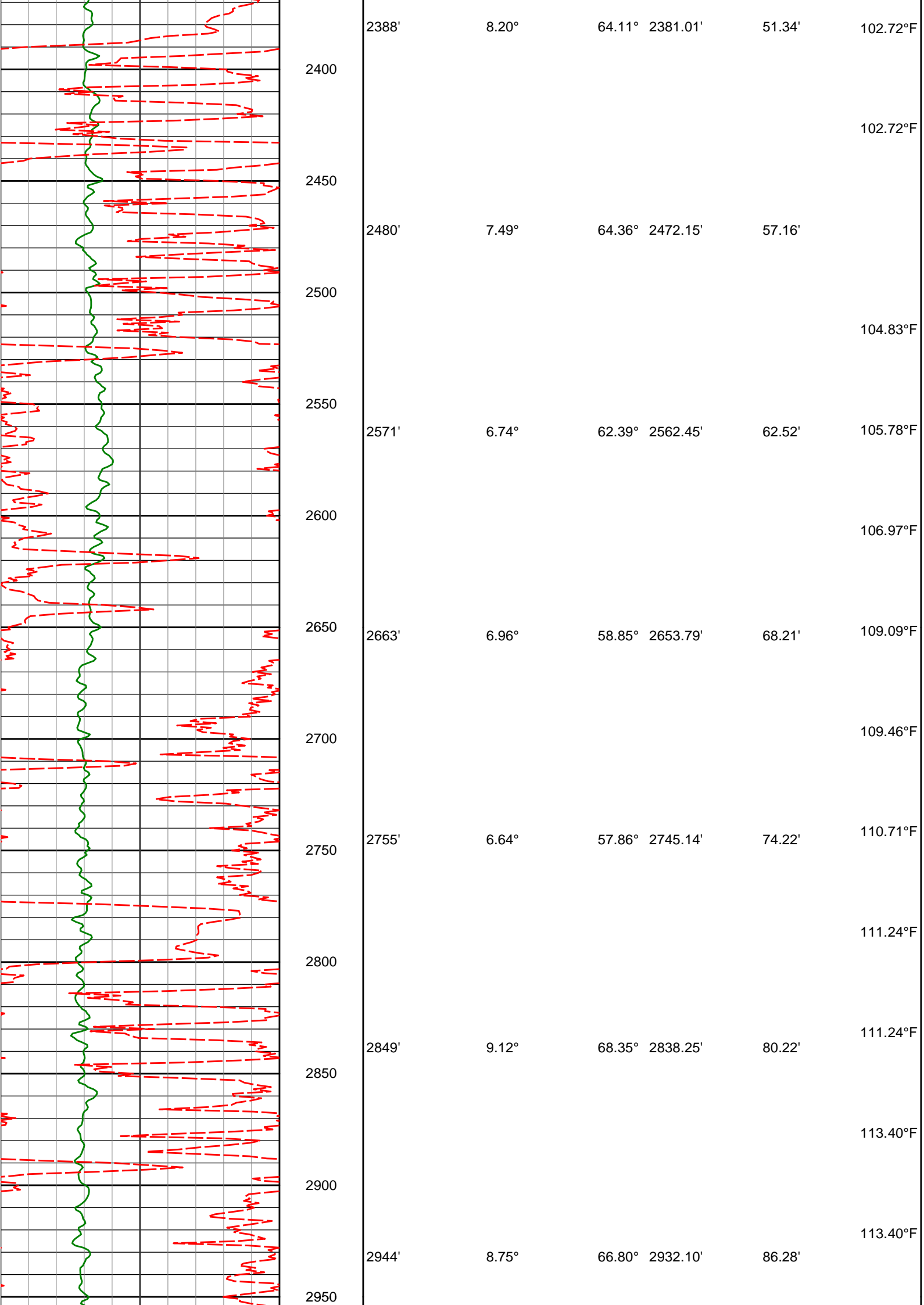
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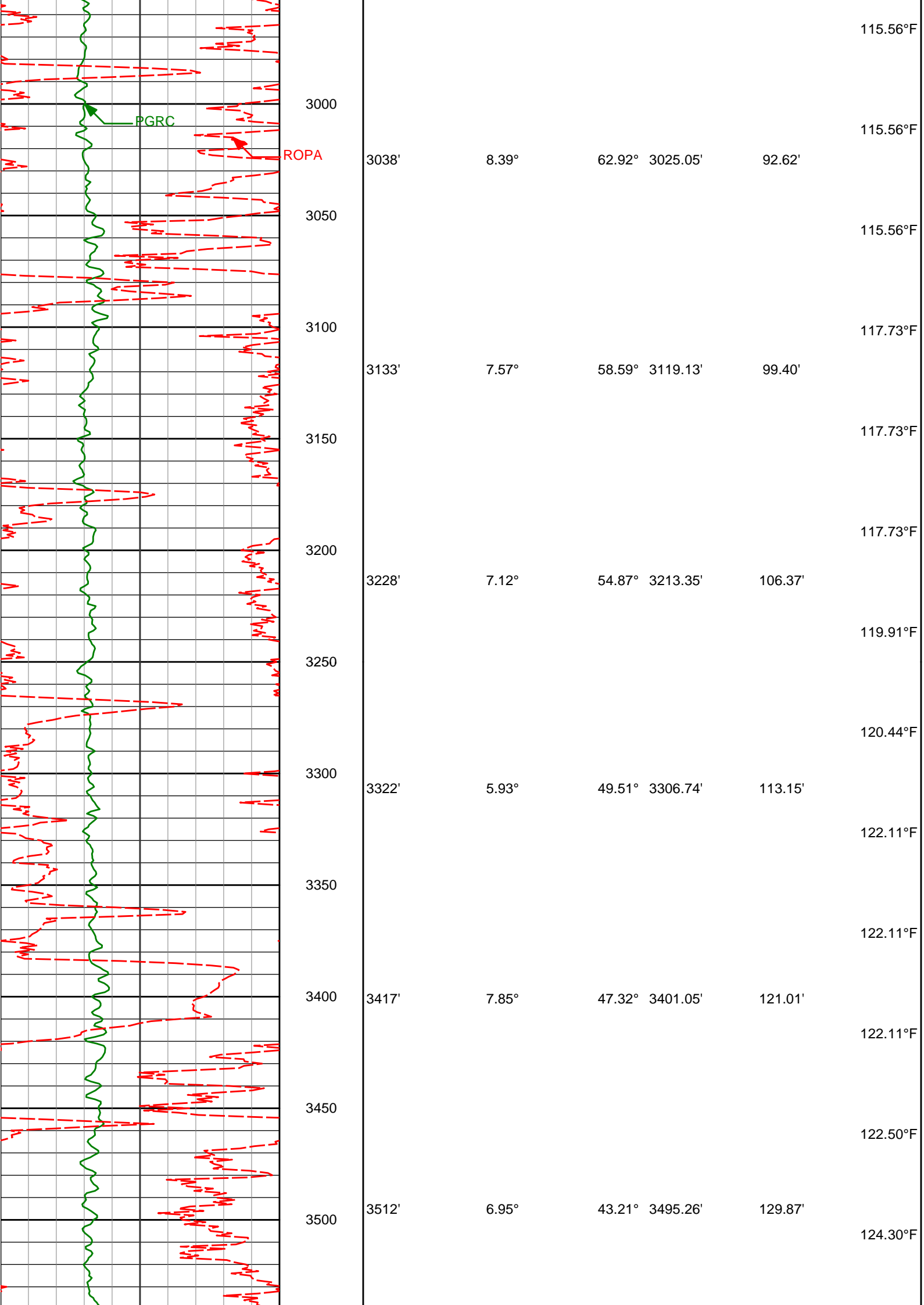
# TVD Detail 1:600 Scale

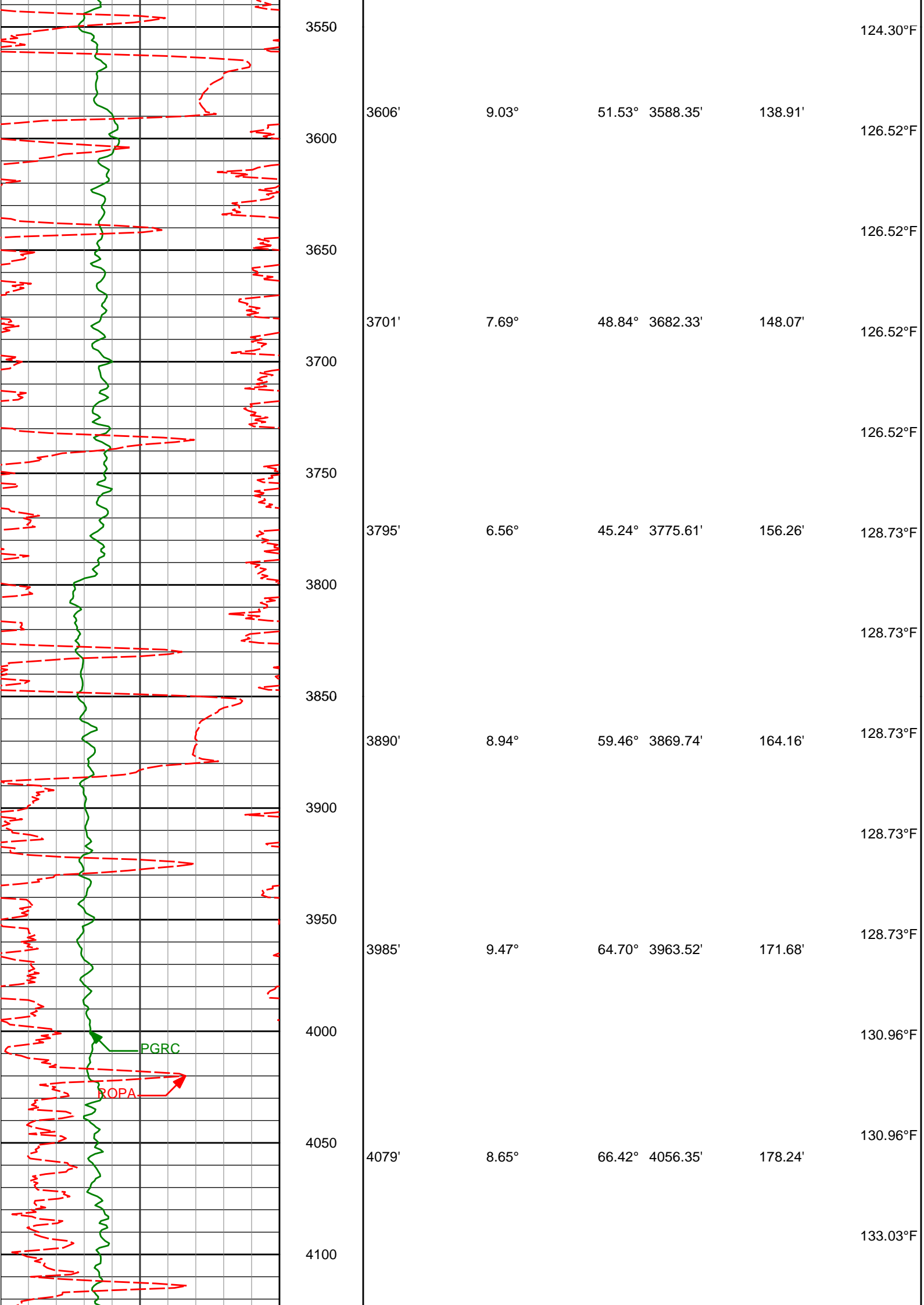




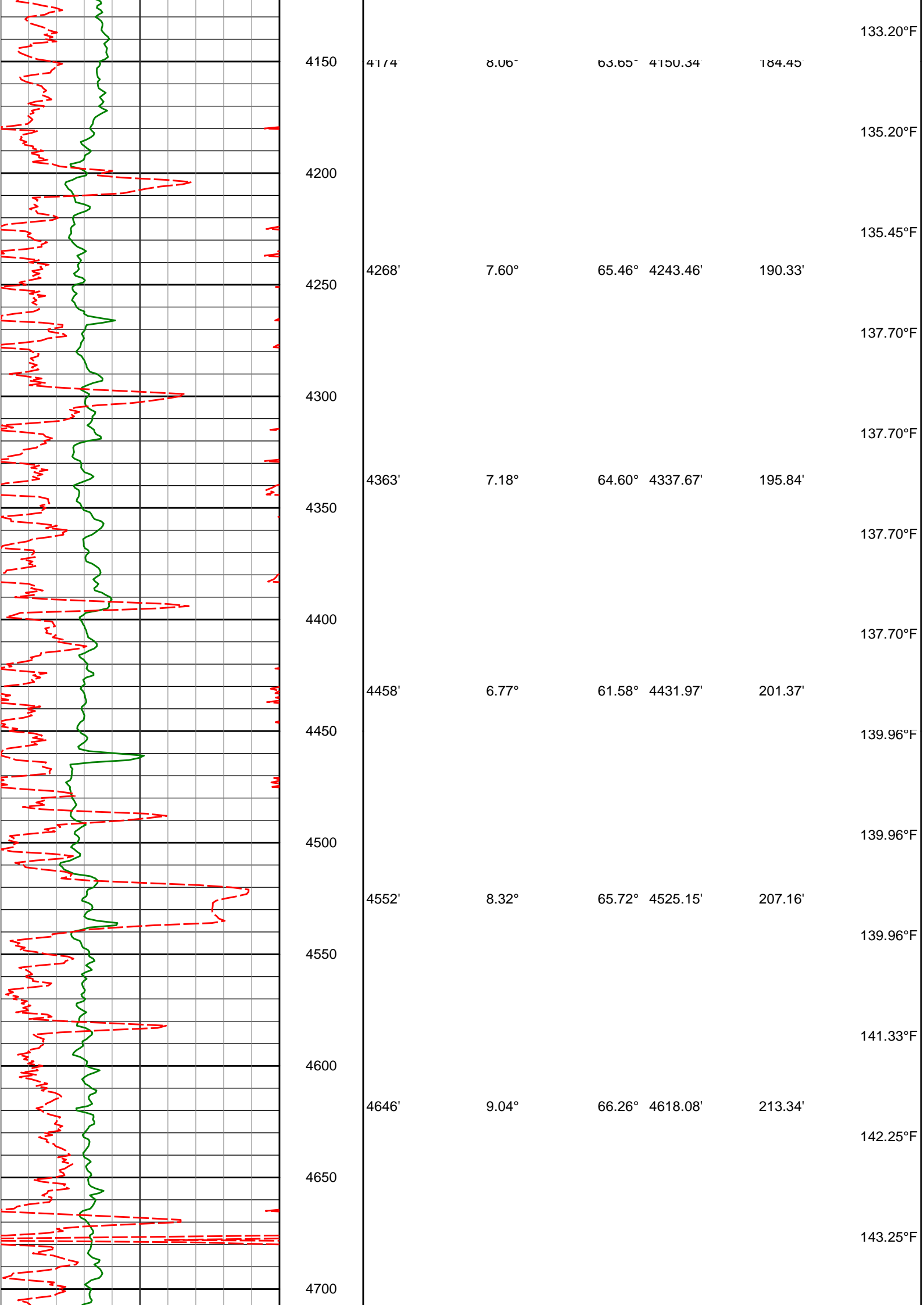


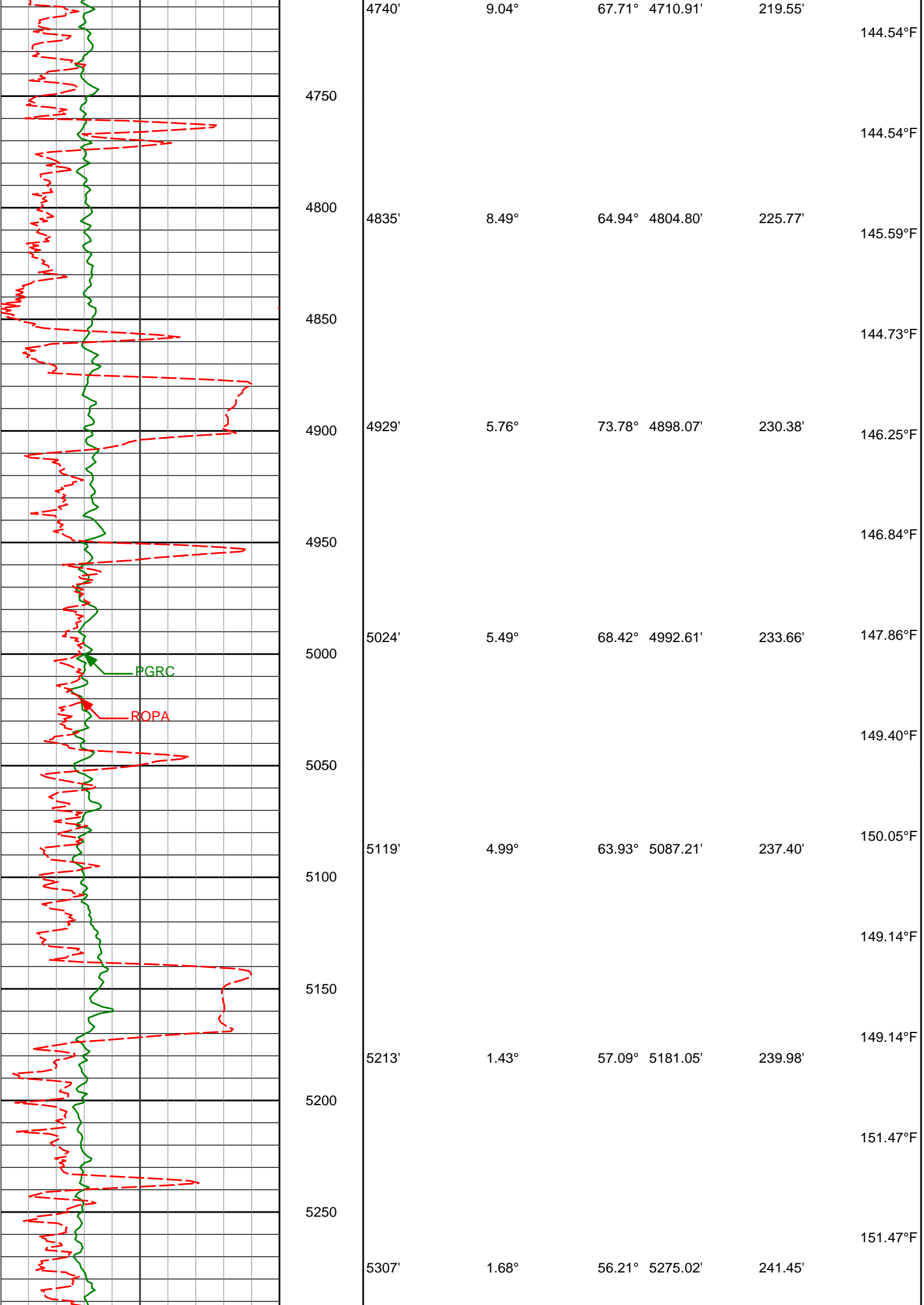


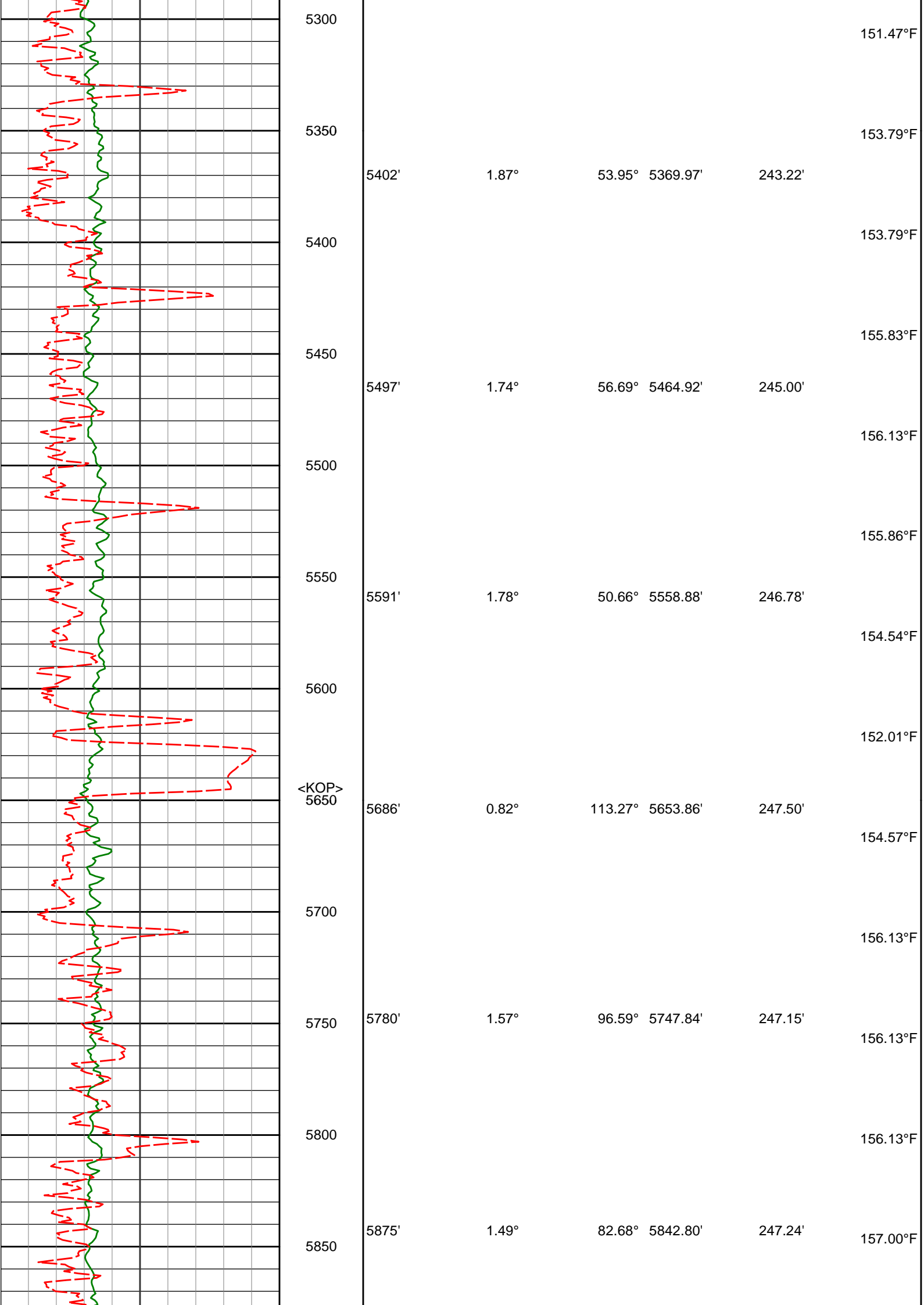


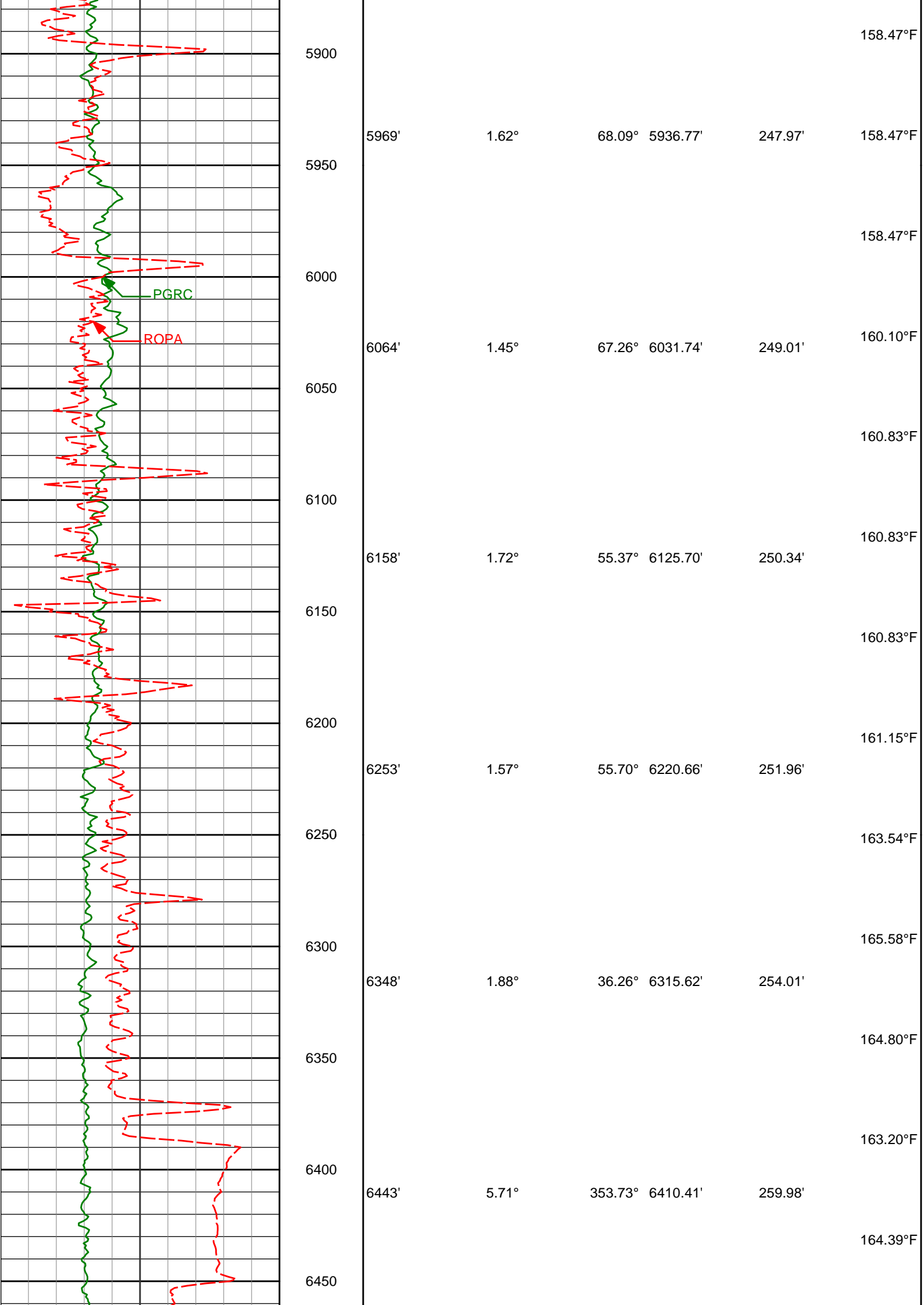


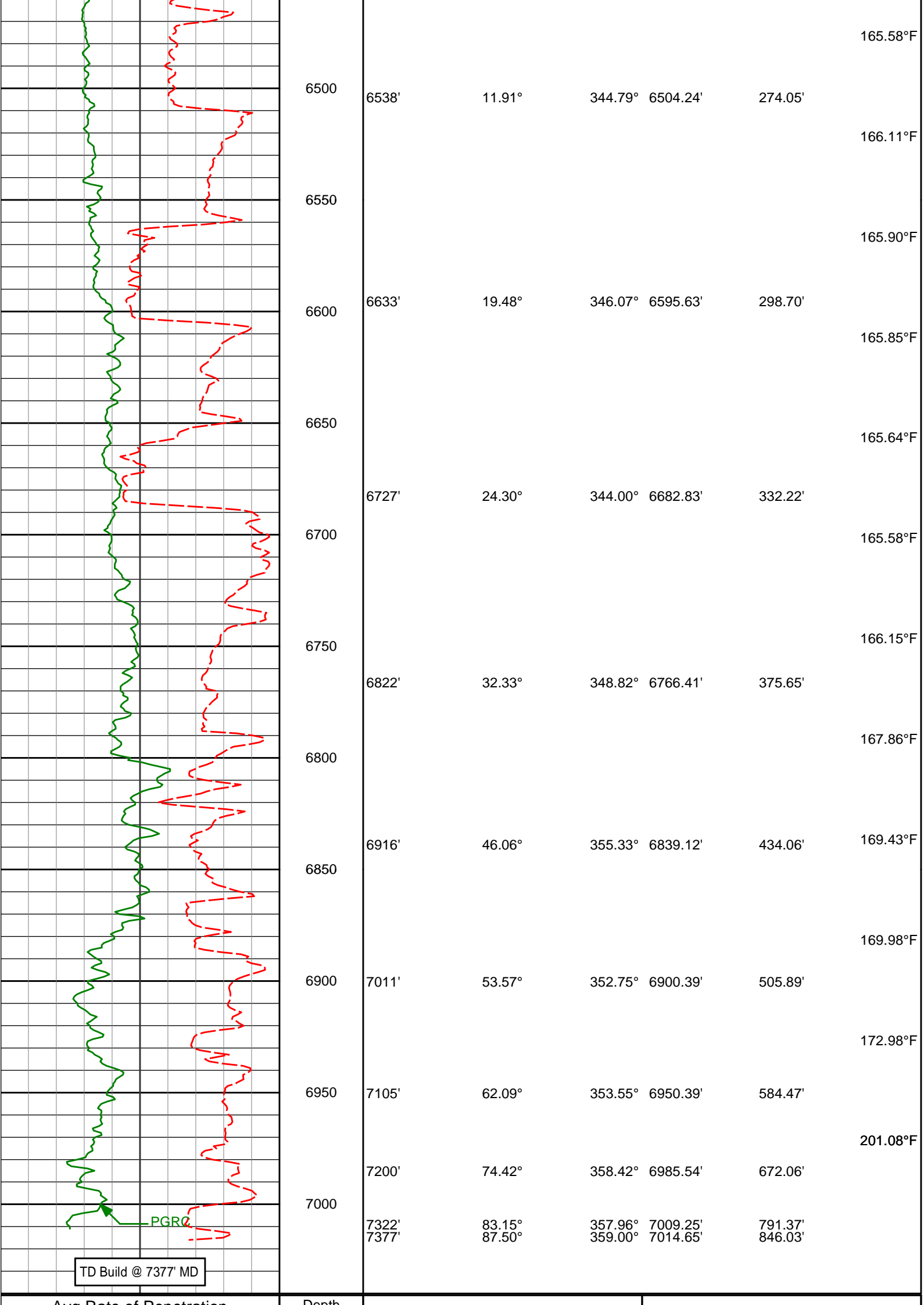


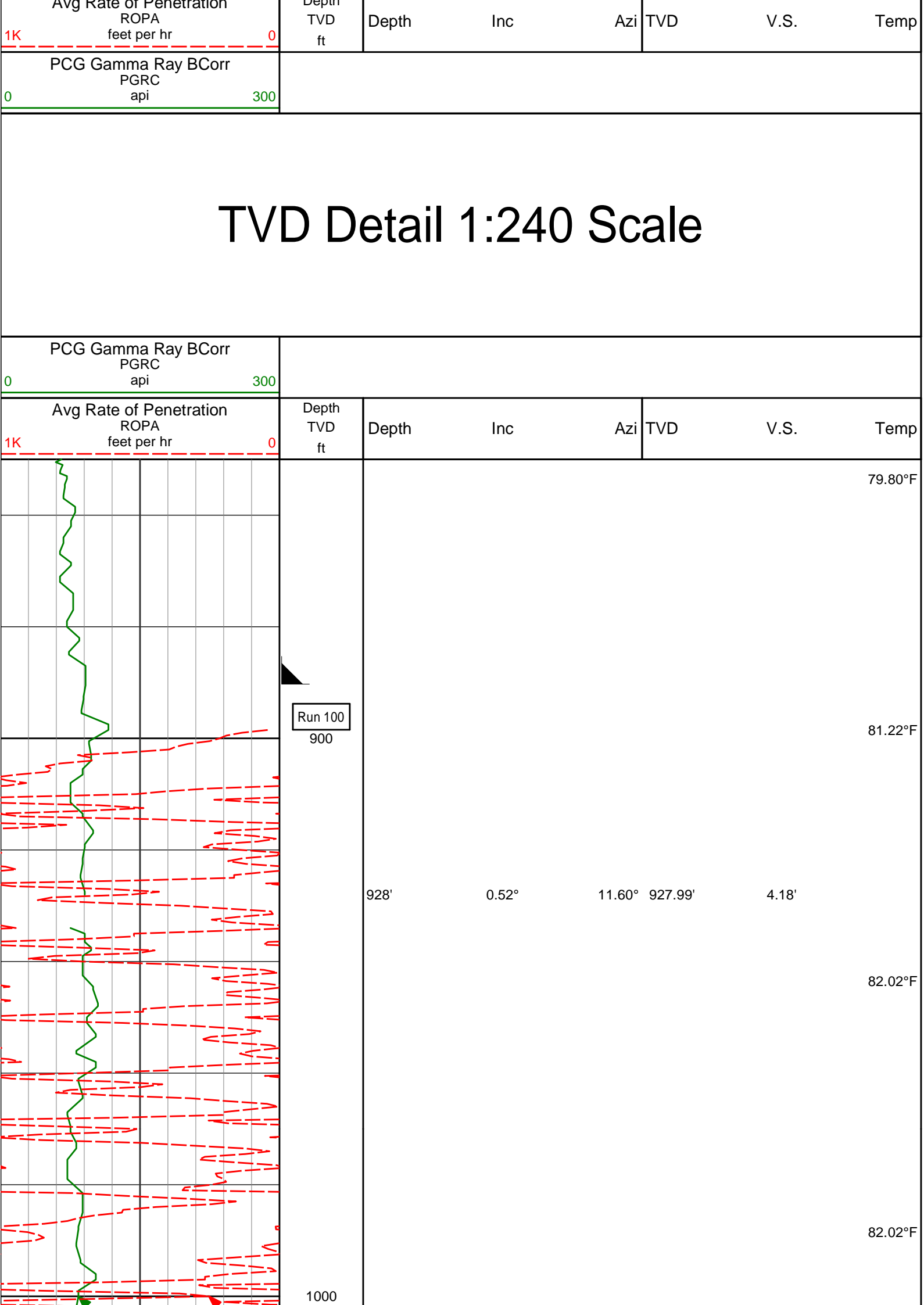


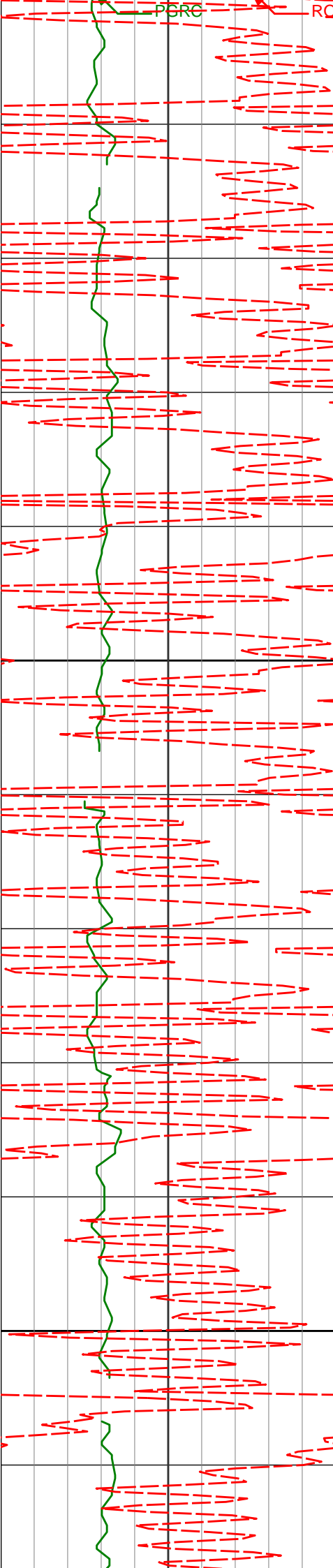












1022'

0.76°

17.85°

1021.98'

5.20'

82.02°F

82.02°F

1100

82.02°F

84.06°F

1200

1203'

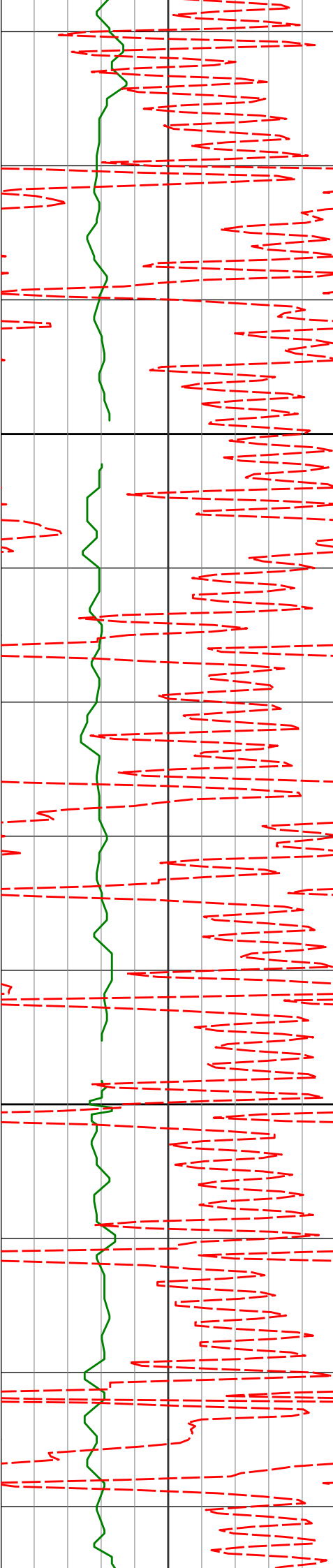
1.24°

24.65°

1202.95'

8.16'

84.06°F



1300

1400

1294'

1.22°

28.19°

1293.93'

9.93'

1386'

1.18°

29.17°

1385.91'

11.64'

86.09°F

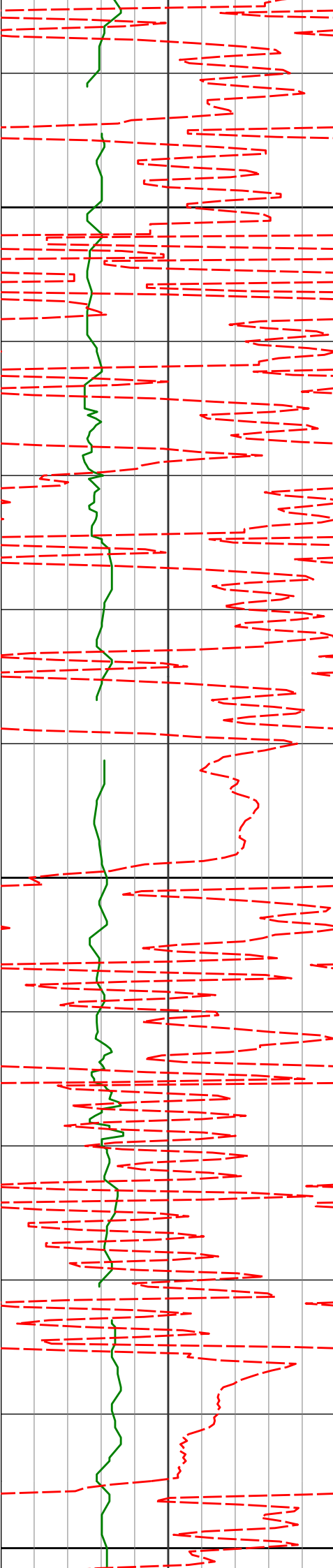
86.09°F

86.09°F

86.09°F

88.14°F





1500

1600

1700

1477'

1.20°

33.51°

1476.89'

13.28'

88.14°F

1568'

1.67°

49.02°

1567.86'

14.99'

88.58°F

1659'

3.71°

63.83°

1658.76'

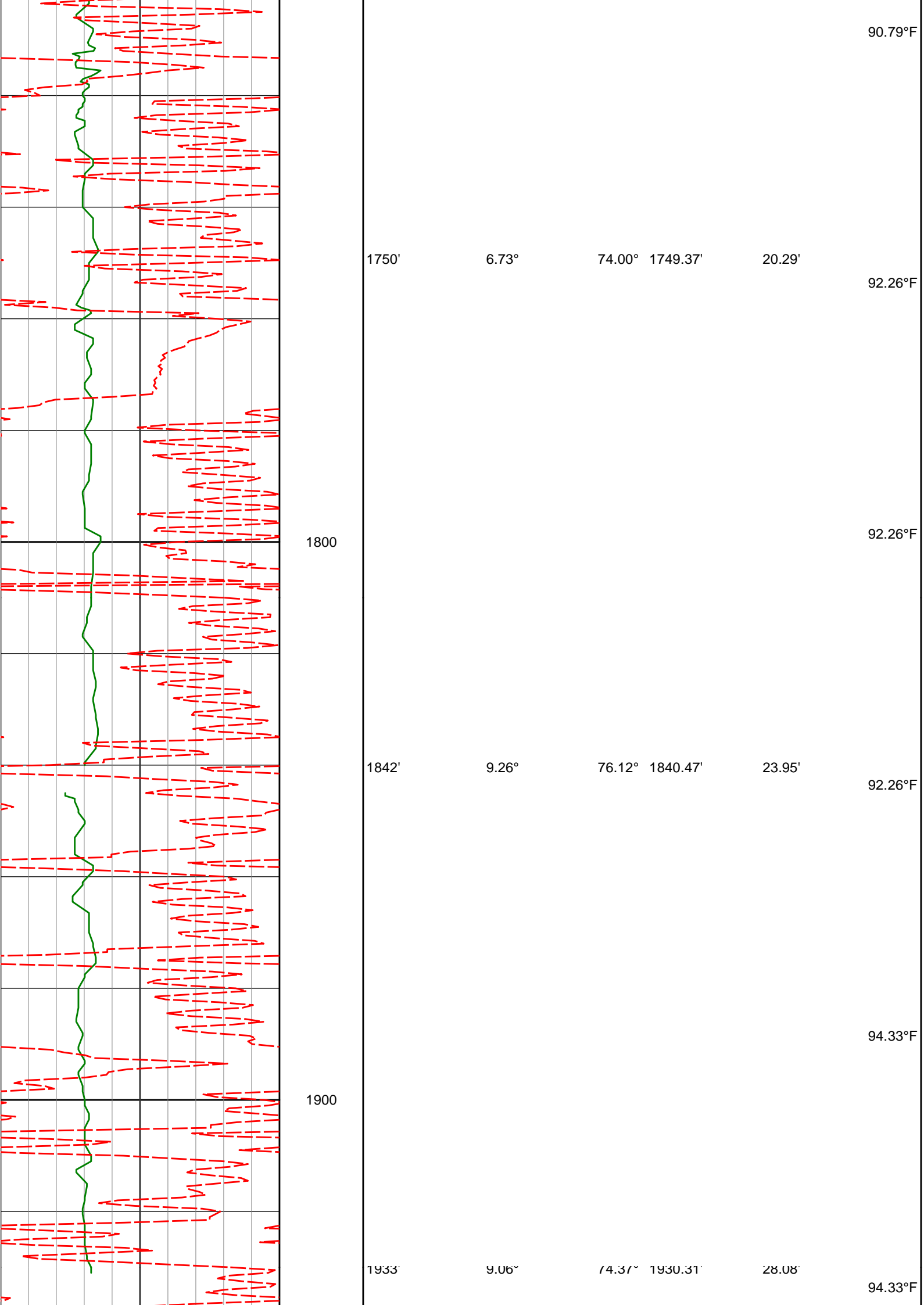
17.28'

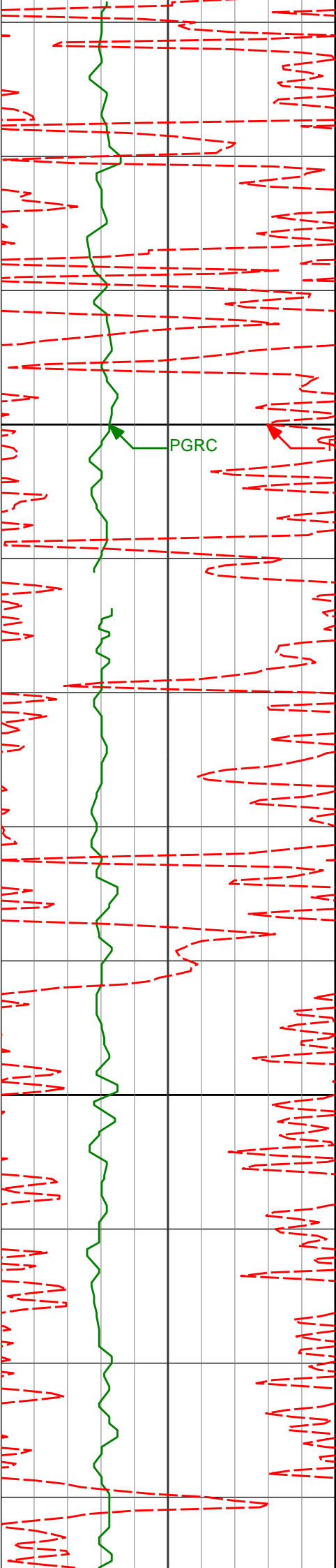
90.19°F

88.14°F

90.19°F

90.19°F





2000

PGRC

ROPA

2024'

8.62°

73.57°

2020.23'

32.37'

96.42°F

96.42°F

96.42°F

2100

2115'

8.05°

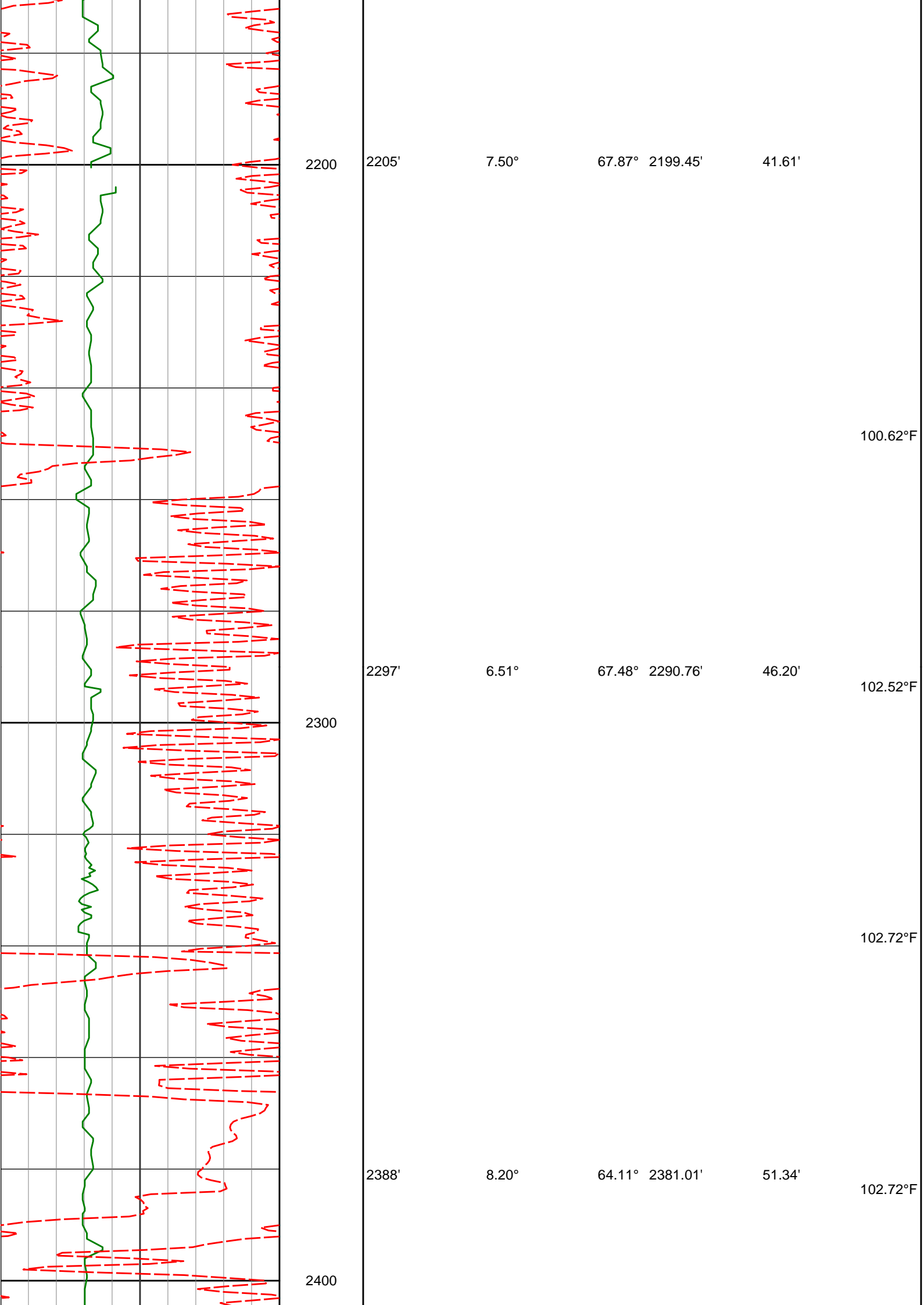
69.98°

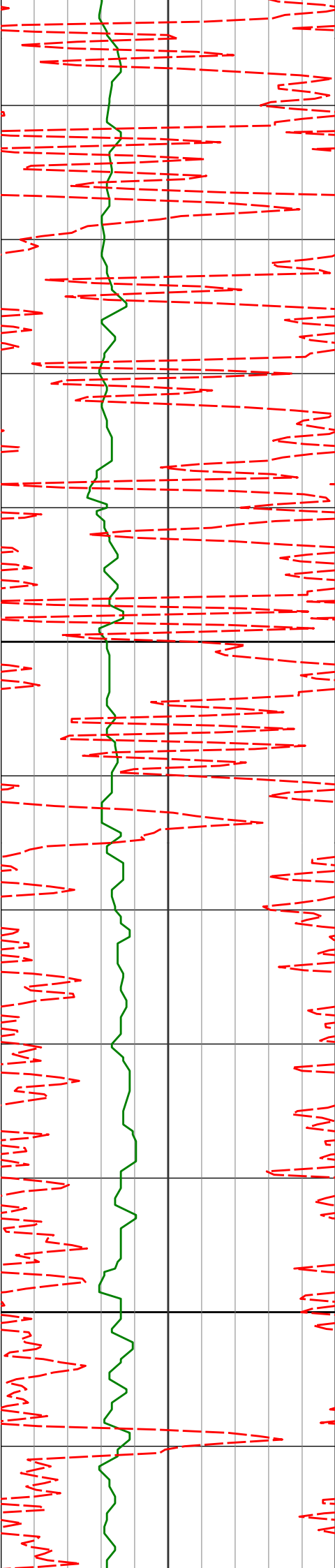
2110.27'

36.88'

98.51°F

98.51°F





2500

2600

2480'

7.49°

64.36°

2472.15'

57.16'

102.72°F

104.83°F

2571'

6.74°

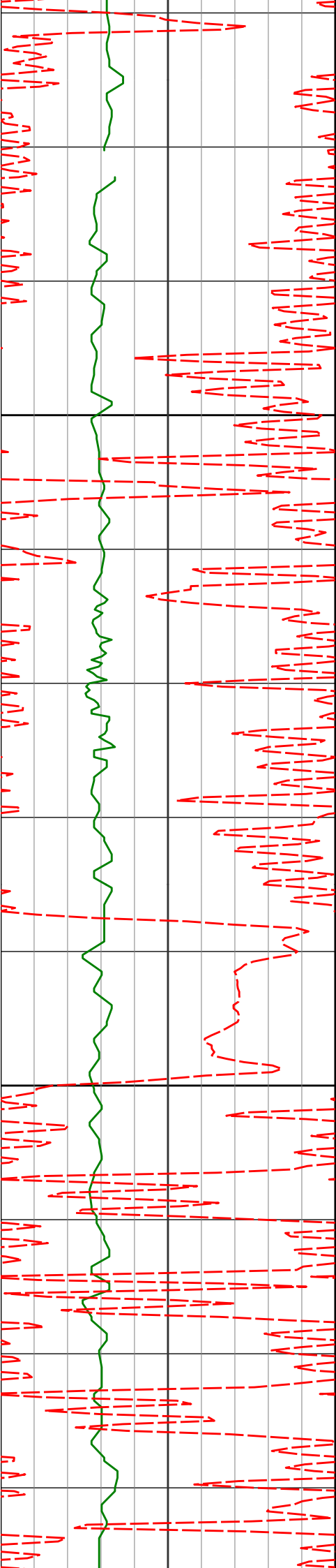
62.39°

2562.45'

62.52'

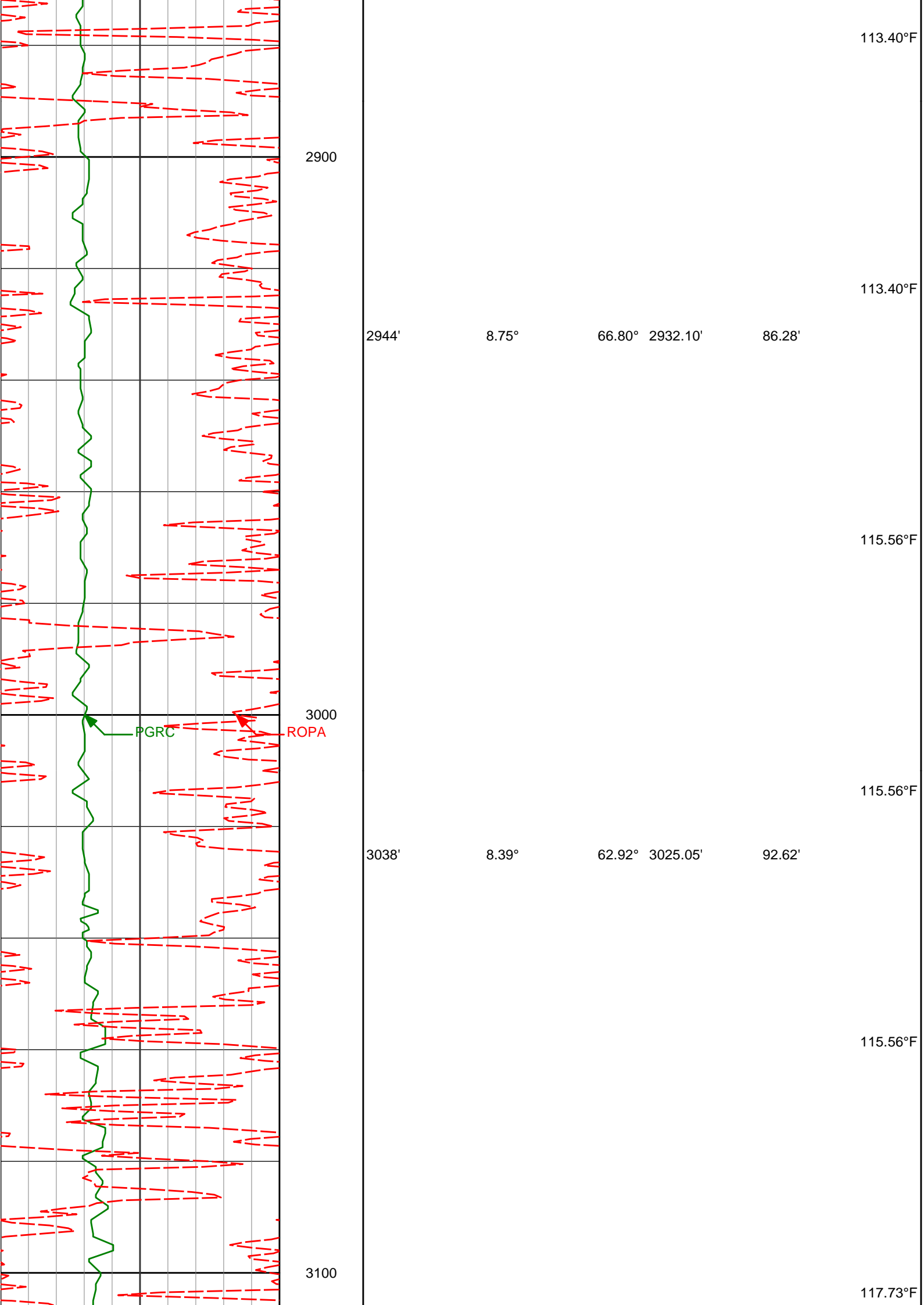
105.78°F

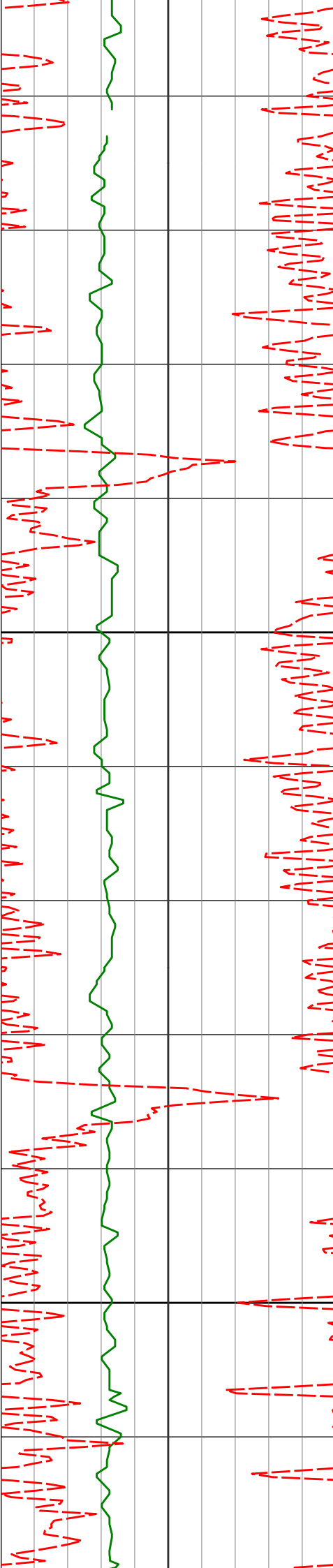
106.97°F



2700

2800





3200

3300

3133'

7.57°

58.59° 3119.13'

99.40'

117.73°F

117.73°F

3228'

7.12°

54.87° 3213.35'

106.37'

119.91°F

120.44°F

3322'

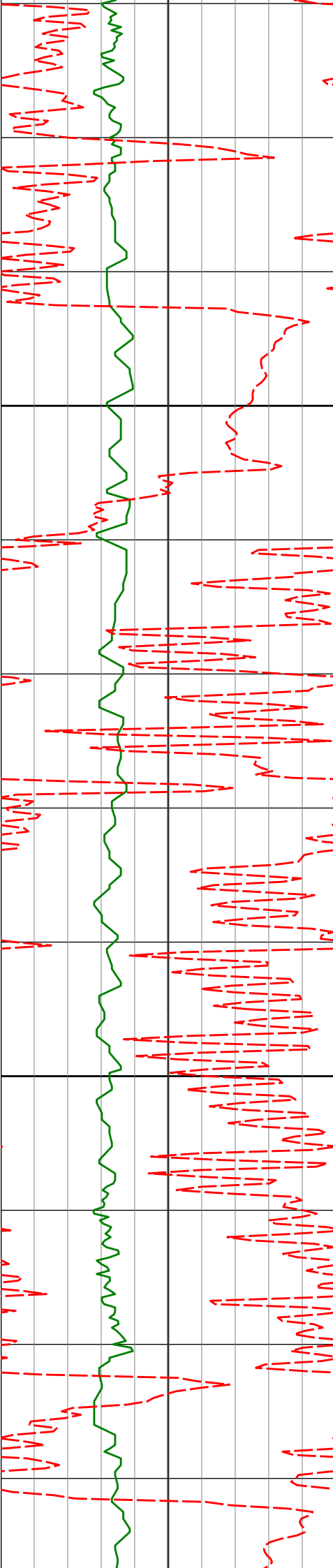
5.93°

49.51° 3306.74'

113.15'

122.11°F





3400

3417'

7.85°

47.32°

3401.05'

121.01'

122.11°F

122.11°F

122.50°F

3500

3512'

6.95°

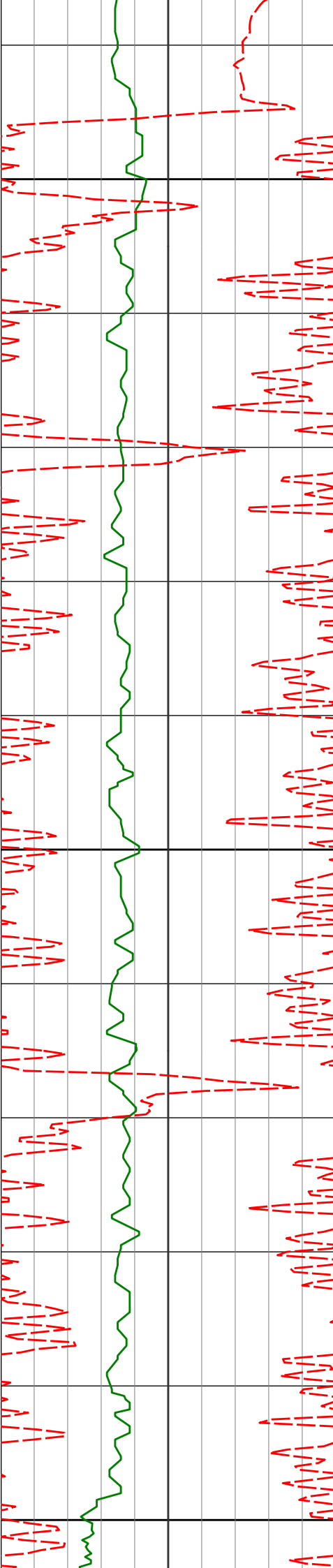
43.21°

3495.26'

129.87'

124.30°F

124.30°F



3600

3700

3800

3606'

9.03°

51.53° 3588.35'

138.91'

126.52°F

126.52°F

3701'

7.69°

48.84° 3682.33'

148.07'

126.52°F

126.52°F

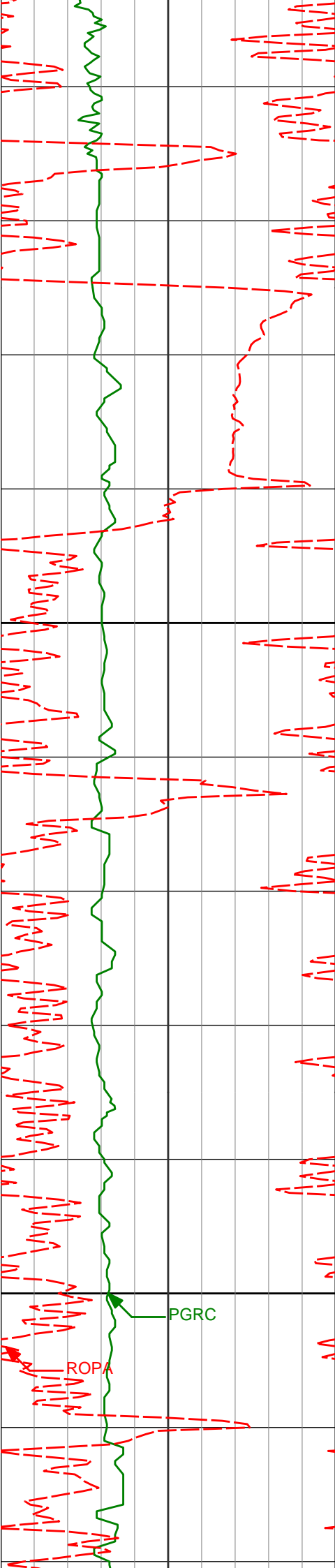
3795'

6.56°

45.24° 3775.61'

156.26'

128.73°F



3900

4000

3890'

8.94°

59.46°

3869.74'

164.16'

128.73°F

128.73°F

128.73°F

3985'

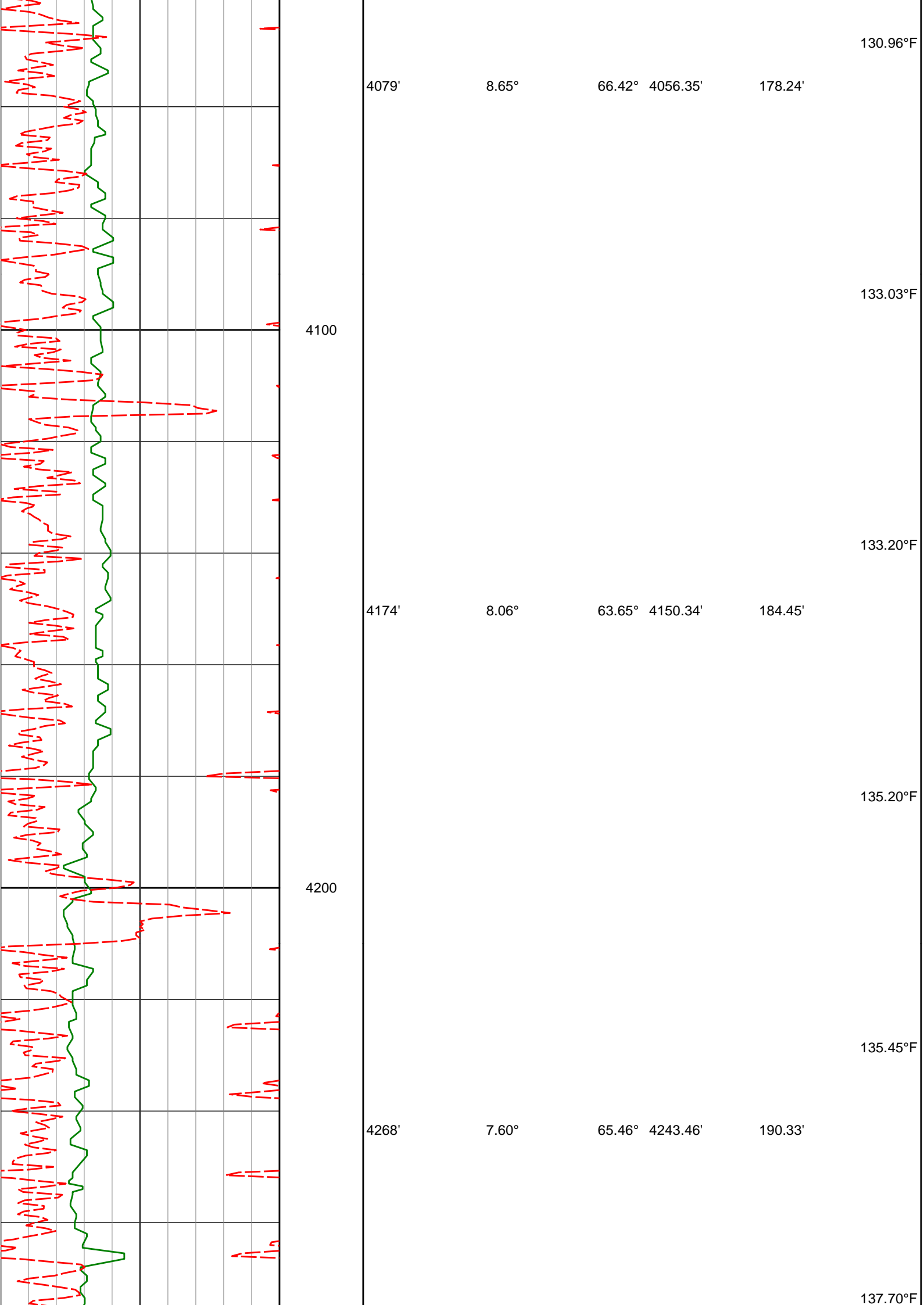
9.47°

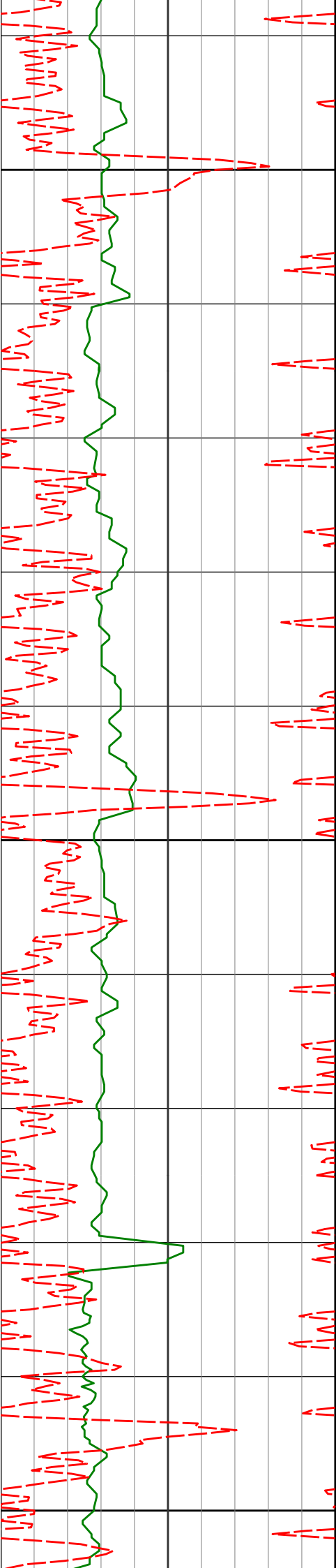
64.70°

3963.52'

171.68'

130.96°F





4300

137.70°F

4363'

7.18°

64.60° 4337.67'

195.84'

137.70°F

4400

137.70°F

4458'

6.77°

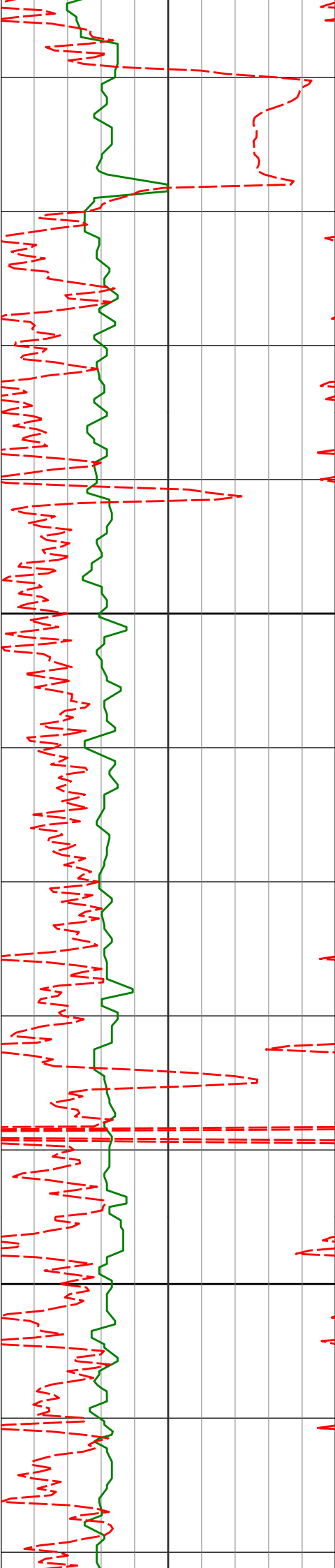
61.58° 4431.97'

201.37'

139.96°F

4500

139.96°F



4600

4700

4552'

8.32°

65.72°

4525.15'

207.16'

139.96°F

141.33°F

4646'

9.04°

66.26°

4618.08'

213.34'

142.25°F

143.25°F

4740'

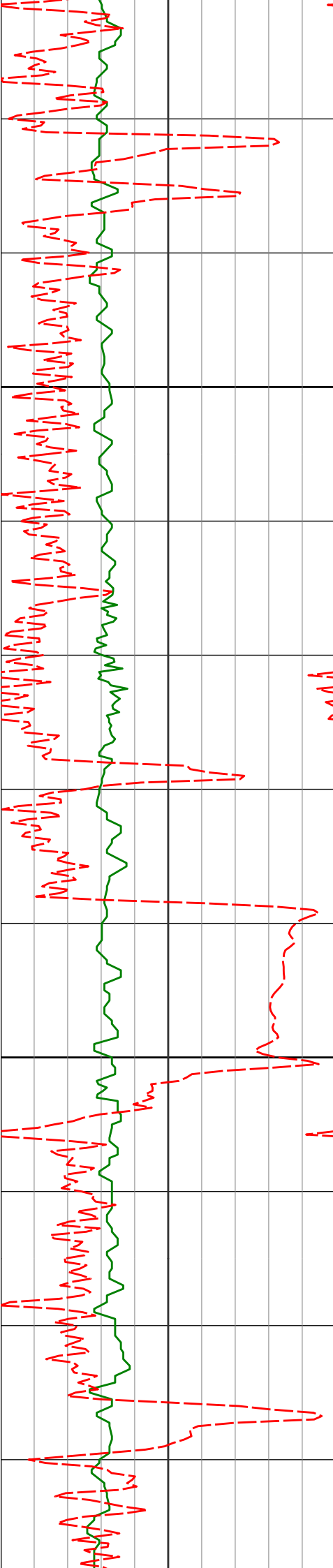
9.04°

67.71°

4710.91'

219.55'

144.54°F



4800

4900

4835'

8.49°

64.94°

4804.80'

225.77'

4929'

5.76°

73.78°

4898.07'

230.38'

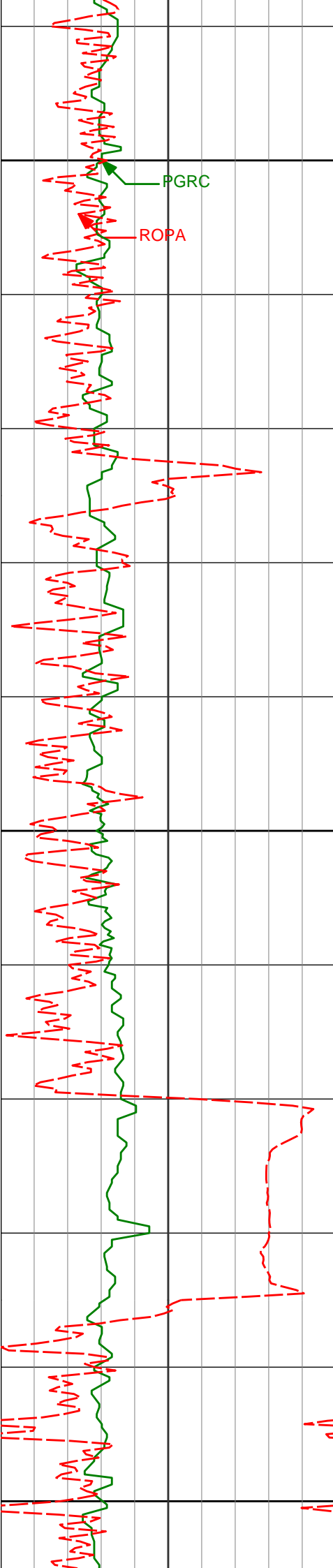
144.54°F

145.59°F

144.73°F

146.25°F

146.84°F



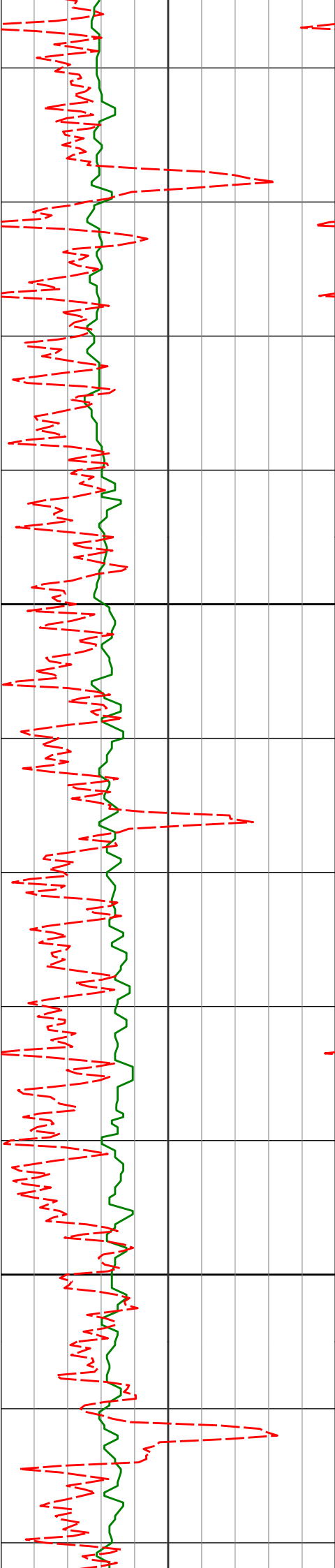
5000

5100

5200

5024'	5.49°	68.42°	4992.61'	233.66'	147.86°F
5119'	4.99°	63.93°	5087.21'	237.40'	150.05°F
5213'	1.43°	57.09°	5181.05'	239.98'	149.14°F





5300

5400

5307'

1.68°

56.21° 5275.02'

241.45'

5402'

1.87°

53.95° 5369.97'

243.22'

151.47°F

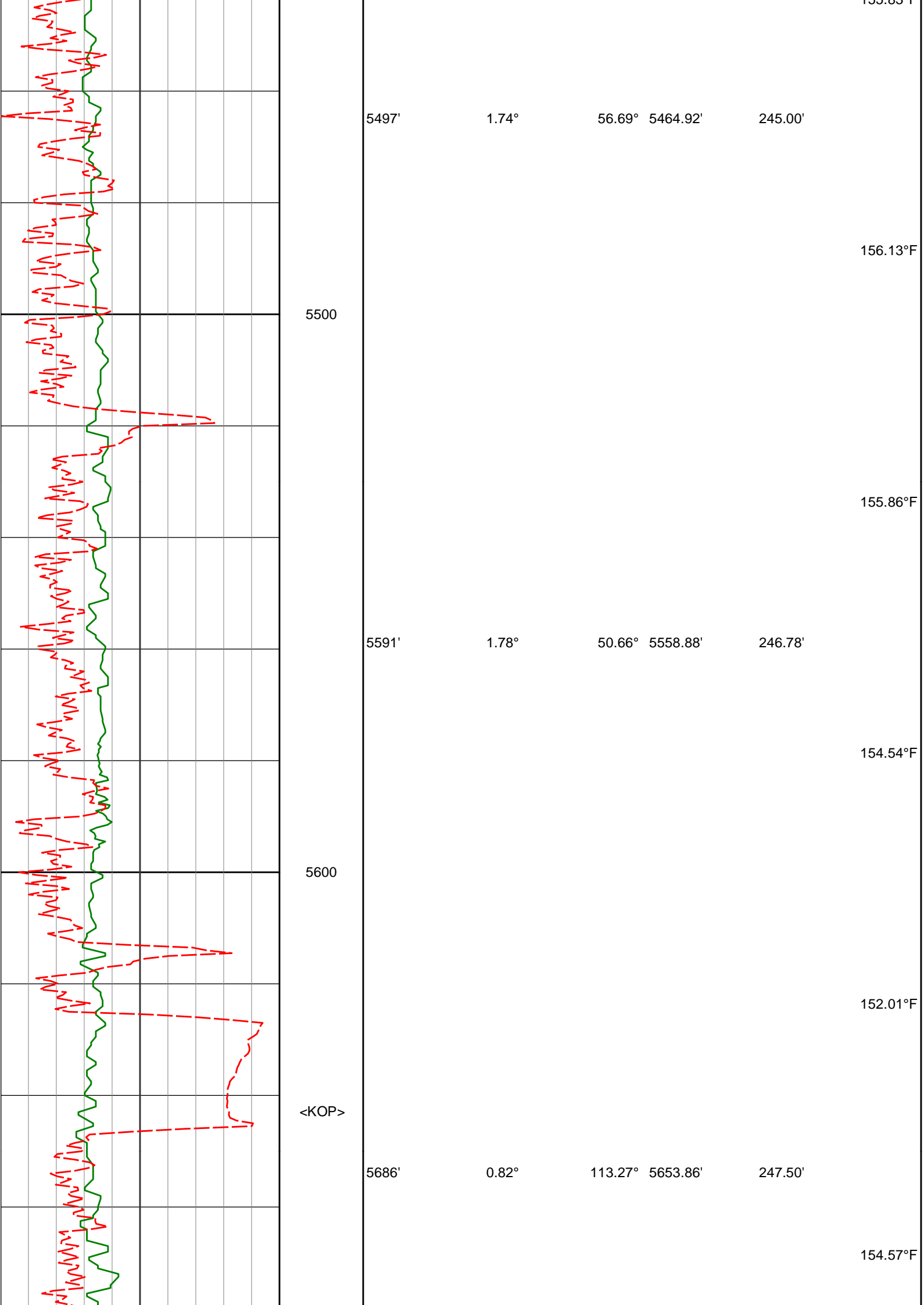
151.47°F

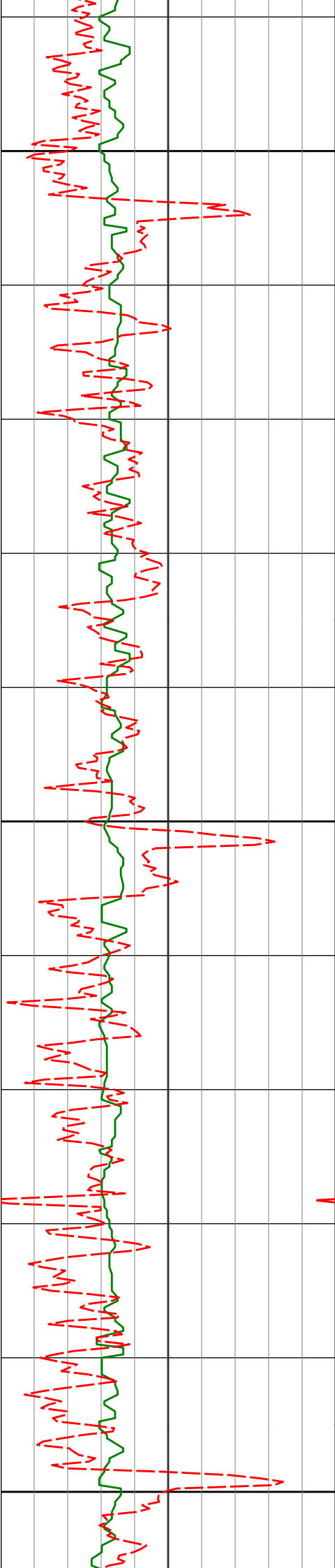
151.47°F

153.79°F

153.79°F

155.83°F





5700

156.13°F

5780'

1.57°

96.59° 5747.84'

247.15'

156.13°F

5800

156.13°F

5875'

1.49°

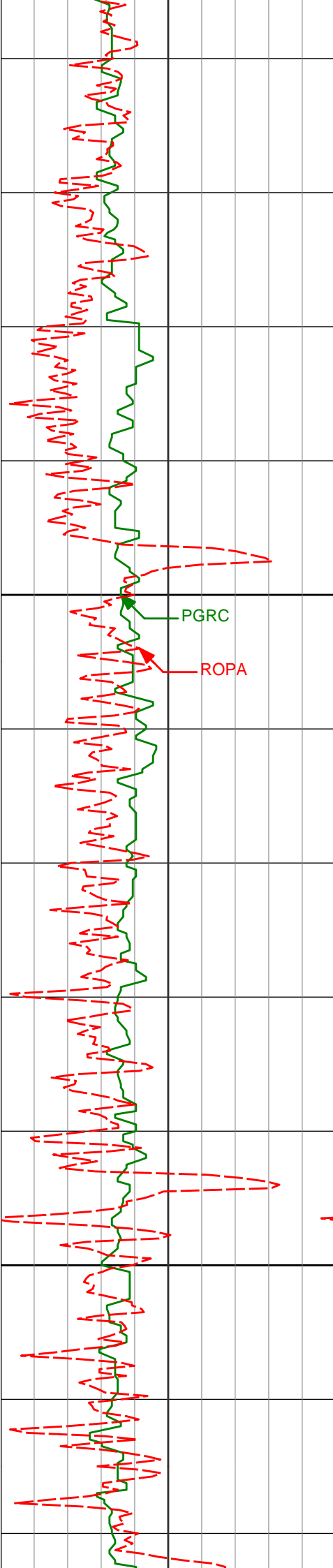
82.68° 5842.80'

247.24'

157.00°F

5900

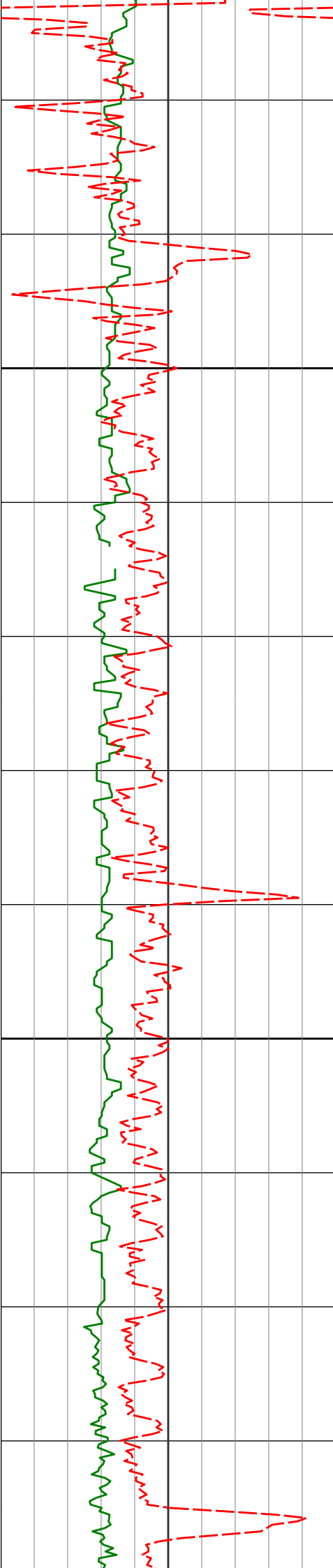
158.47°F



6000

6100

5969'	1.62°	68.09°	5936.77'	247.97'	158.47°F
					158.47°F
6064'	1.45°	67.26°	6031.74'	249.01'	160.10°F
					160.83°F
6158'	1.72°	55.37°	6125.70'	250.34'	160.83°F



6200

6253'

1.57°

55.70°

6220.66'

251.96'

160.83°F

161.15°F

163.54°F

6300

6348'

1.88°

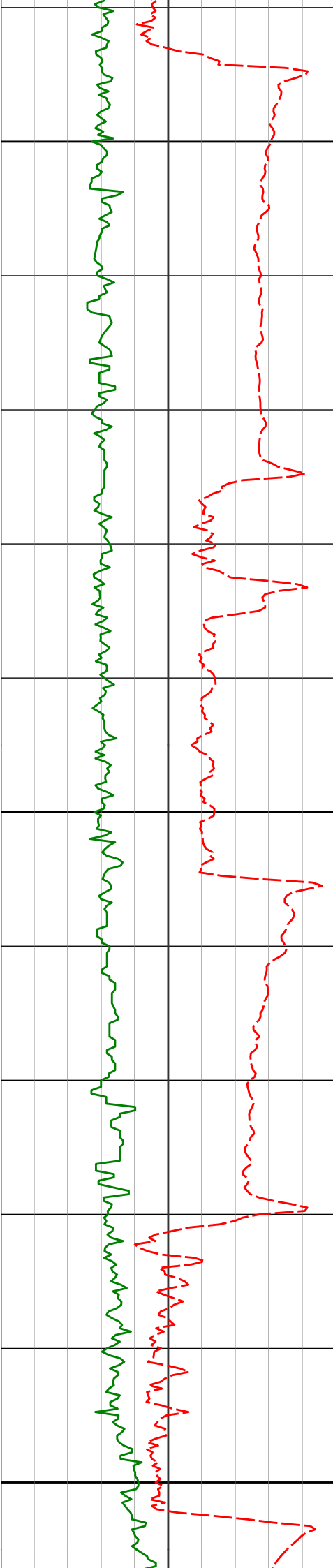
36.26°

6315.62'

254.01'

165.58°F

164.80°F



6400

6443'

5.71°

353.73°

6410.41'

259.98'

163.20°F

164.39°F

165.58°F

6500

6538'

11.91°

344.79°

6504.24'

274.05'

166.11°F

165.90°F

6600

6633'

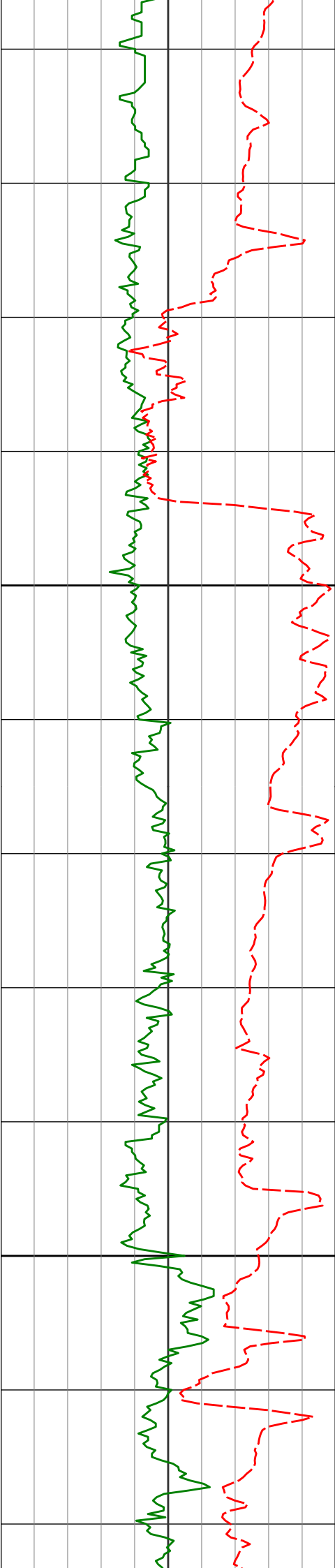
19.48°

346.07°

6595.63'

298.70'

165.85°F



6700

6800

6727'

24.30°

344.00°

6682.83'

332.22'

6822'

32.33°

348.82°

6766.41'

375.65'

6916'

46.06°

355.33°

6839.12'

434.06'

165.85°F

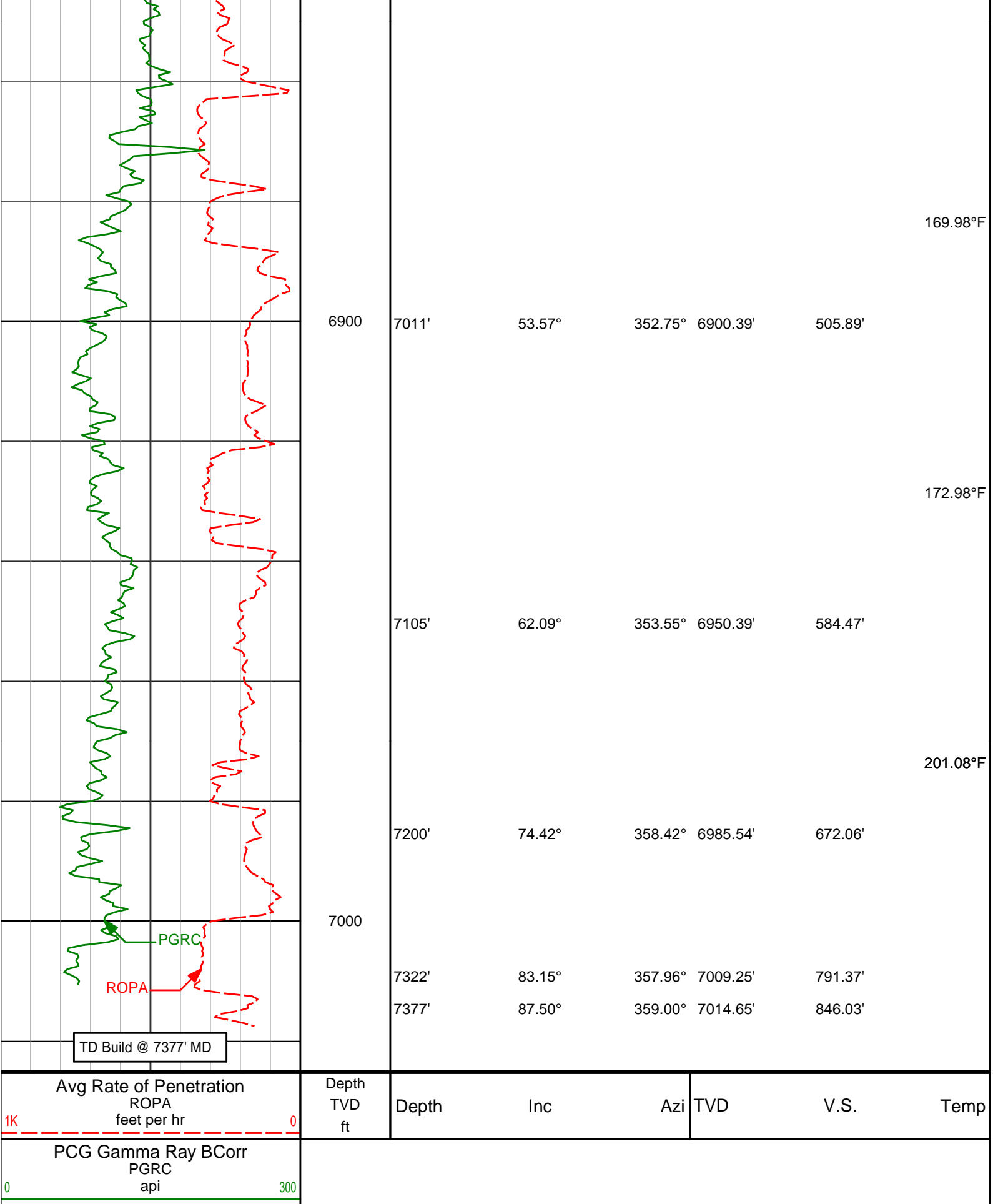
165.64°F

165.58°F

166.15°F

167.86°F

169.43°F



HALLIBURTON

DIRECTIONAL SURVEY REPORT

Noble Energy  
Moser H22-711  
Wattenburg



Weld Colorado USA CA-XX-0902863040							
Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
928.00	0.52	11.60	927.99	4.15 N	0.85 E	4.18	0.06
1022.00	0.76	17.85	1021.98	5.17 N	1.13 E	5.20	0.26
1203.00	1.24	24.65	1202.95	8.09 N	2.31 E	8.16	0.27
1294.00	1.22	28.19	1293.93	9.83 N	3.18 E	9.93	0.09
1386.00	1.18	29.17	1385.91	11.52 N	4.10 E	11.64	0.05
1477.00	1.20	33.51	1476.89	13.13 N	5.08 E	13.28	0.10
1568.00	1.67	49.02	1567.86	14.79 N	6.61 E	14.99	0.66
1659.00	3.71	63.83	1658.76	16.96 N	10.25 E	17.28	2.35
1750.00	6.73	74.00	1749.37	19.72 N	18.02 E	20.29	3.46
1842.00	9.26	76.12	1840.47	22.99 N	30.39 E	23.95	2.77
1933.00	9.06	74.37	1930.31	26.67 N	44.39 E	28.08	0.38
2024.00	8.62	73.57	2020.23	30.53 N	57.83 E	32.37	0.50
2115.00	8.05	69.98	2110.27	34.64 N	70.35 E	36.88	0.85
2205.00	7.50	67.87	2199.45	39.01 N	81.71 E	41.61	0.68
2297.00	6.51	67.48	2290.76	43.26 N	92.09 E	46.20	1.08
2388.00	8.20	64.11	2381.01	48.07 N	102.69 E	51.34	1.92
2480.00	7.49	64.36	2472.15	53.53 N	113.99 E	57.16	0.77
2571.00	6.74	62.39	2562.45	58.57 N	124.07 E	62.52	0.87
2663.00	6.96	58.85	2653.79	63.95 N	133.62 E	68.21	0.52
2755.00	6.64	57.86	2745.14	69.66 N	142.89 E	74.22	0.37
2849.00	9.12	68.35	2838.25	75.30 N	154.42 E	80.22	3.04
2944.00	8.75	66.80	2932.10	80.93 N	168.05 E	86.28	0.46
3038.00	8.39	62.92	3025.05	86.86 N	180.73 E	92.62	0.73
3133.00	7.57	58.59	3119.13	93.28 N	192.24 E	99.40	1.07
3228.00	7.12	54.87	3213.35	99.93 N	202.39 E	106.37	0.68
3322.00	5.93	49.51	3306.74	106.43 N	210.85 E	113.15	1.42
3417.00	7.85	47.32	3401.05	114.02 N	219.36 E	121.01	2.04
3512.00	6.95	43.21	3495.26	122.61 N	228.06 E	129.87	1.11
3606.00	9.03	51.53	3588.35	131.34 N	237.73 E	138.91	2.53
3701.00	7.69	48.84	3682.33	140.17 N	248.36 E	148.07	1.47
3795.00	6.56	45.24	3775.61	148.09 N	256.91 E	156.26	1.30
3890.00	8.94	59.46	3869.74	155.66 N	267.12 E	164.16	3.20
3985.00	9.47	64.70	3963.52	162.75 N	280.54 E	171.68	1.04
4079.00	8.65	66.42	4056.35	168.89 N	294.01 E	178.24	0.91
4174.00	8.06	63.65	4150.34	174.70 N	306.53 E	184.45	0.76
4268.00	7.60	65.46	4243.46	180.21 N	318.09 E	190.33	0.55
4363.00	7.18	64.60	4337.67	185.36 N	329.17 E	195.84	0.46
4458.00	6.77	61.58	4431.97	190.57 N	339.45 E	201.37	0.58
4552.00	8.32	65.72	4525.15	196.01 N	350.52 E	207.16	1.75
4646.00	9.04	66.26	4618.08	201.78 N	363.48 E	213.34	0.76
4740.00	9.04	67.71	4710.91	207.55 N	377.07 E	219.55	0.24
4835.00	8.49	64.94	4804.80	213.35 N	390.33 E	225.77	0.73
4929.00	5.76	73.78	4898.07	217.61 N	401.15 E	230.38	3.11
5024.00	5.49	68.42	4992.61	220.61 N	409.95 E	233.66	0.63
5119.00	4.99	63.93	5087.21	224.10 N	417.89 E	237.40	0.68
5213.00	1.43	57.09	5181.05	226.53 N	422.55 E	239.98	3.80
5307.00	1.68	56.21	5275.02	227.94 N	424.68 E	241.45	0.27
5402.00	1.87	53.95	5369.97	229.62 N	427.09 E	243.22	0.21
5497.00	1.74	56.69	5464.92	231.33 N	429.55 E	245.00	0.17
5591.00	1.78	50.66	5558.88	233.03 N	431.86 E	246.78	0.20
5686.00	0.82	113.27	5653.86	233.70 N	433.63 E	247.50	1.66
5780.00	1.57	96.59	5747.84	233.29 N	435.52 E	247.15	0.87
5875.00	1.49	82.68	5842.80	233.30 N	438.04 E	247.24	0.40
5969.00	1.62	68.09	5936.77	233.95 N	440.49 E	247.97	0.44
6064.00	1.45	67.26	6031.74	234.91 N	442.85 E	249.01	0.18
6158.00	1.72	55.37	6125.70	236.17 N	445.10 E	250.34	0.45
6253.00	1.57	55.70	6220.66	237.72 N	447.35 E	251.96	0.15
6348.00	1.88	36.26	6315.62	239.71 N	449.35 E	254.01	0.69
6443.00	5.71	353.73	6410.41	245.67 N	449.75 E	259.98	4.75
6538.00	11.91	344.79	6504.24	259.84 N	446.66 E	274.05	6.66
6633.00	19.48	346.07	6595.63	284.71 N	440.27 E	298.70	7.97
6727.00	24.30	344.00	6682.83	318.54 N	431.16 E	332.22	5.19
6822.00	32.33	348.82	6766.41	362.32 N	420.83 E	375.65	8.78
6916.00	46.06	355.33	6839.12	421.01 N	413.16 E	434.06	15.23
7011.00	53.57	352.75	6900.39	493.12 N	405.54 E	505.89	8.18
7105.00	62.09	353.55	6950.39	572.05 N	396.08 E	584.47	9.09
7200.00	74.42	358.42	6985.54	659.88 N	390.07 E	672.06	13.82
7322.00	83.15	357.96	7009.25	779.37 N	386.28 E	791.37	7.17

**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 1.84 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.79 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.**

**HORIZONTAL DISPLACEMENT(CLOSURE) AT 7322.00 FEET  
IS 869.85 FEET ALONG 26.36 DEGREES (GRID)**

**Final survey is a projection to the bit at TD.**

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