

PCG Pressure Case Gamma  
PCG Pressure Case Directional



1 : 600 / 1 : 240

Country : USA		Field : Wattenburg		Location : Lat: 40° 42' 55.94" North Long: 103° 57' 5.65" West		Well : Douglas LC35-780		Company : Noble Energy		Rig : H&P 343		Company : Noble Energy Rig : H&P 343 Well : Douglas LC35-780 Field : Wattenburg Country : USA API Number : 05-123-40667			
LOCATION						Latitude : 40° 42' 55.94" North Longitude : 103° 57' 5.65" West		UTM Easting = 3,429,224.810 usft UTM Northing = 1,507,262.411 usft						Other Services Directional Drilling	
Permanent Datum : Ground Level		Elevation : 4812.00 ft		Elev. KB N/A		DF 4836.00 ft GL 4812.00 ft WD N/A									
Log Measured From : Drill Floor		24.00 ft Above Permanent Datum		TVD LOG											
Drilling Measured From : Drill Floor															
Depth Logged : 623.99 ft To 5,991.12 ft		Unit No. : 11610115		Job No. : CA-XX-0902973209											
Date Logged : 23-Dec-15 To 27-Dec-15															
Total Depth MD : 6,367.00 ft TVD: 5,991.12 ft		Plot Type : Final													
Spud Date : 23-Dec-15		Plot Date : 26-Dec-15													
Run No.	Borehole Record (TVD)			Size		Casing Record (TVD)									
	Size	From	To	Weight	From	To									
0100	8.750 in	623.99 ft	5,991.10 ft	9.625 in	36.60 lbpf	SURFACE	613.99 ft								

Max Tool Temp (degF) / Source	165.58 / PCM				
Rm @ Max Tool Temp (degF)	N/A @ N/A				
Lead MWD Engineer	Brian Neu				
Customer Representative	Bryant Dear				

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM				
Software Version	5.93				
Sub Serial Number	11404299				
Insert Serial Number	11145577				
Date and Time Initialized	24-Dec-15 10:45				
Date and Time Read	25-Dec-15 20:47				
ECMB SW Version	N/A				

### Directional Sensor Information

Tool Type	PCDC				
Distance From Bit (ft)	56.00				
Software Version	6.33				
Sub Serial Number	11404299				
Sonde Serial Number	11902176				
Sensor ID Number	N/A				
Toolface Offset (deg)	65.80				

### Gamma Ray Sensor Information

Tool Type	PCG				
Distance From Bit (ft)	49.20				
Recorded Sample Period (sec)	10				
Software Version	8.15				
Sub Serial Number	11404299				
Insert/Sonde Serial Number	11681003				

## 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: 8.75-10.7ppg

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)

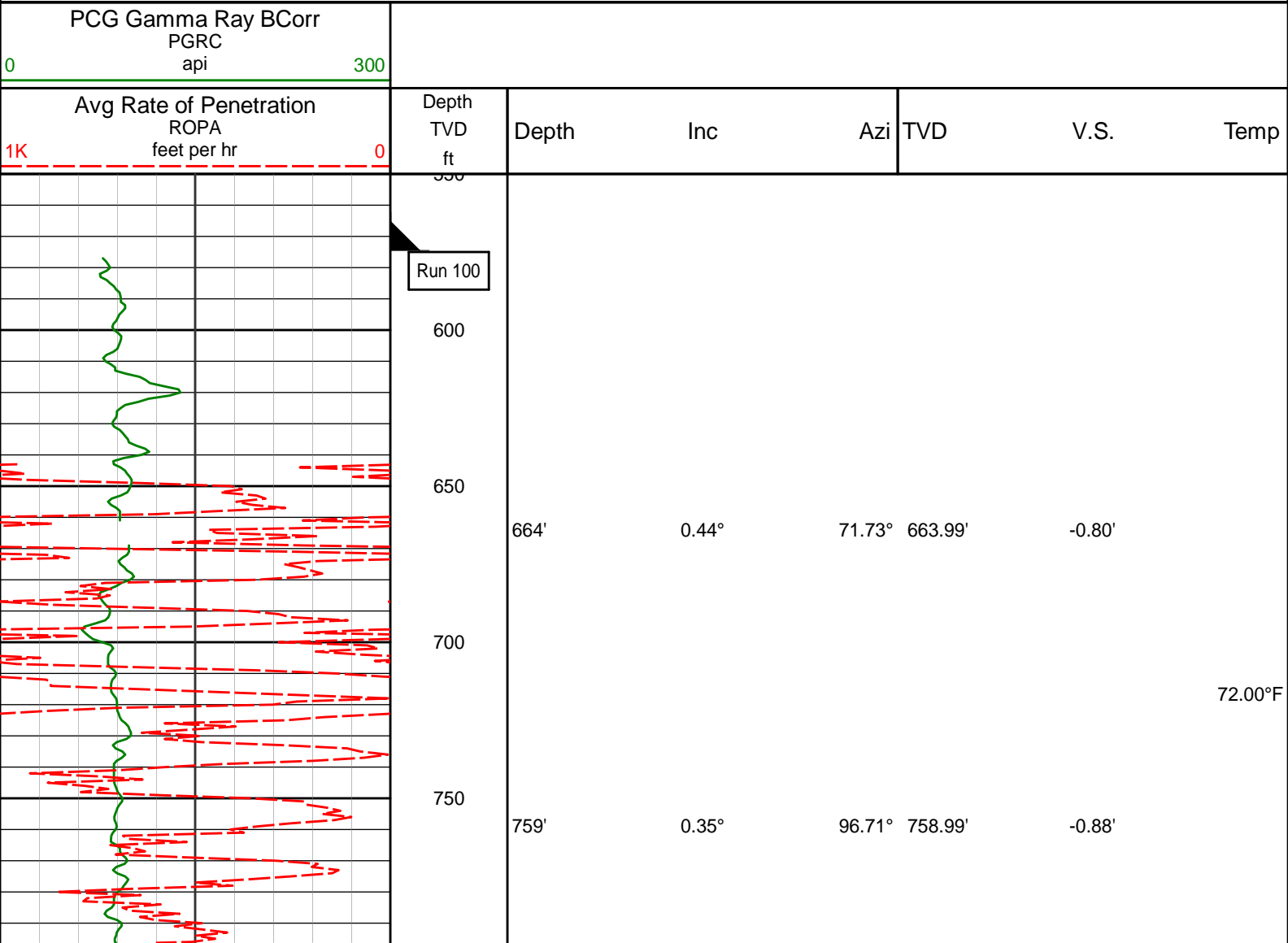
Interval: 0.5 ft

Coercion Distance: 0.6 ft (Gamma Ray)

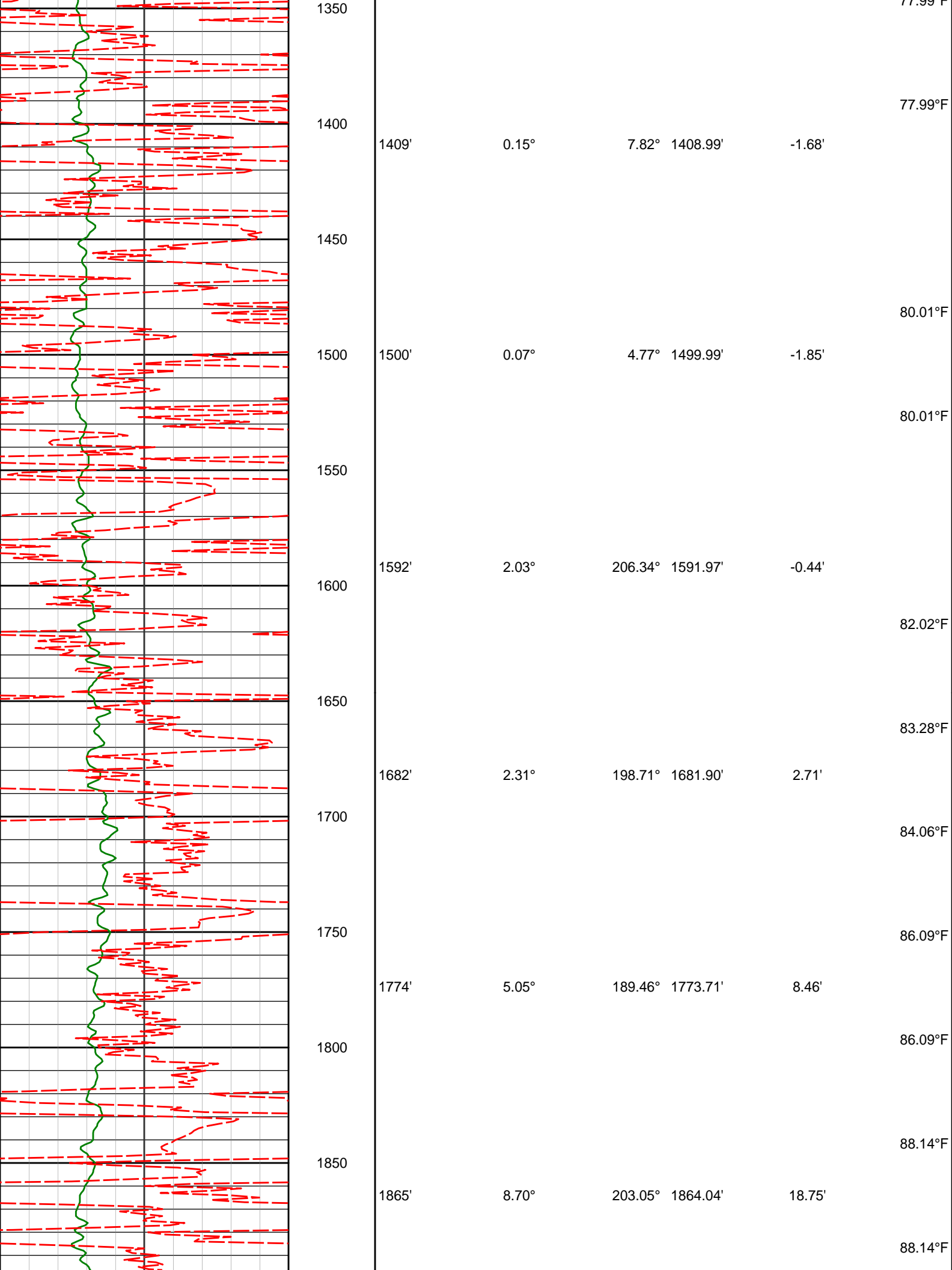
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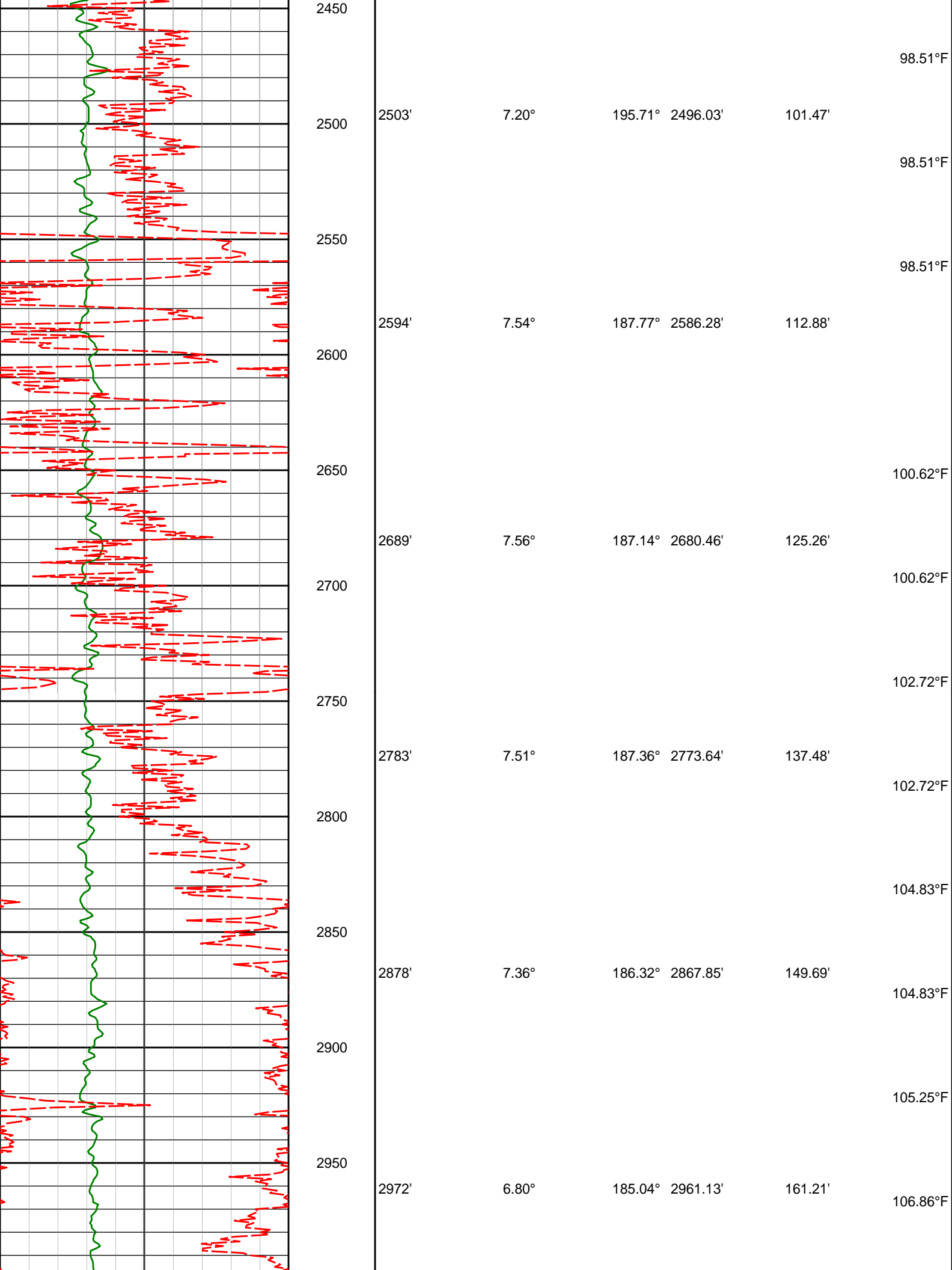
TVD Detail 1:600 Scale

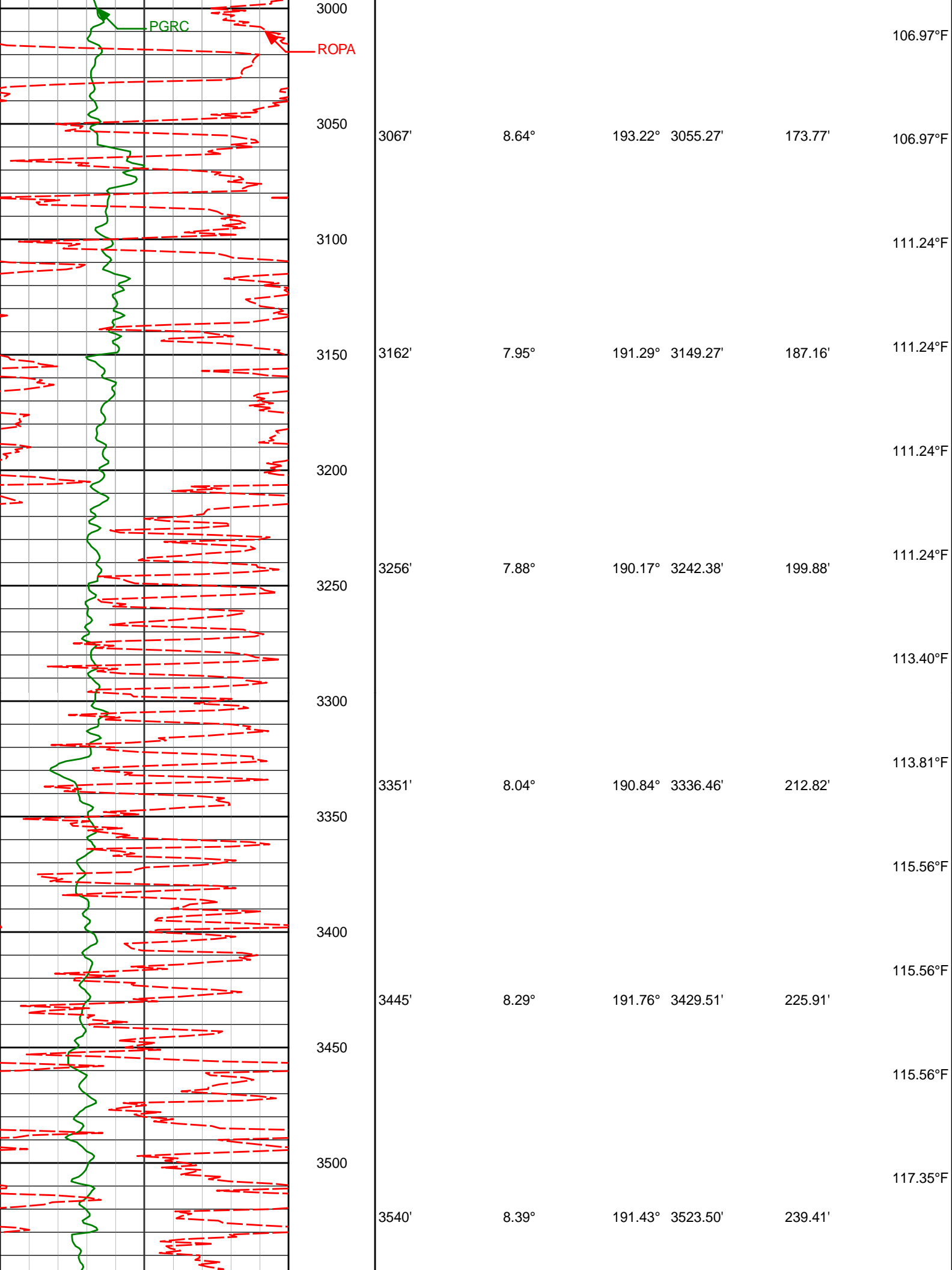




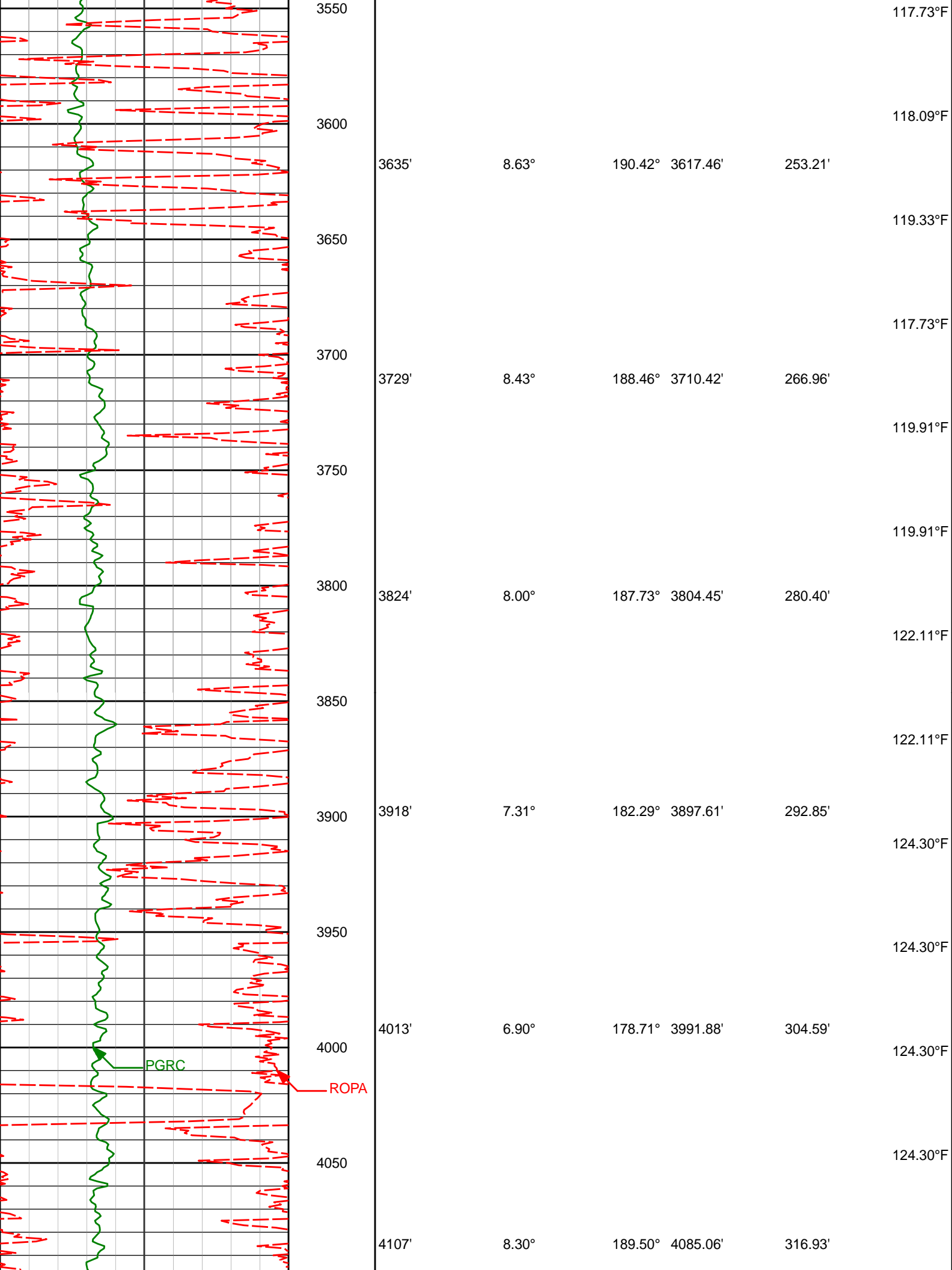


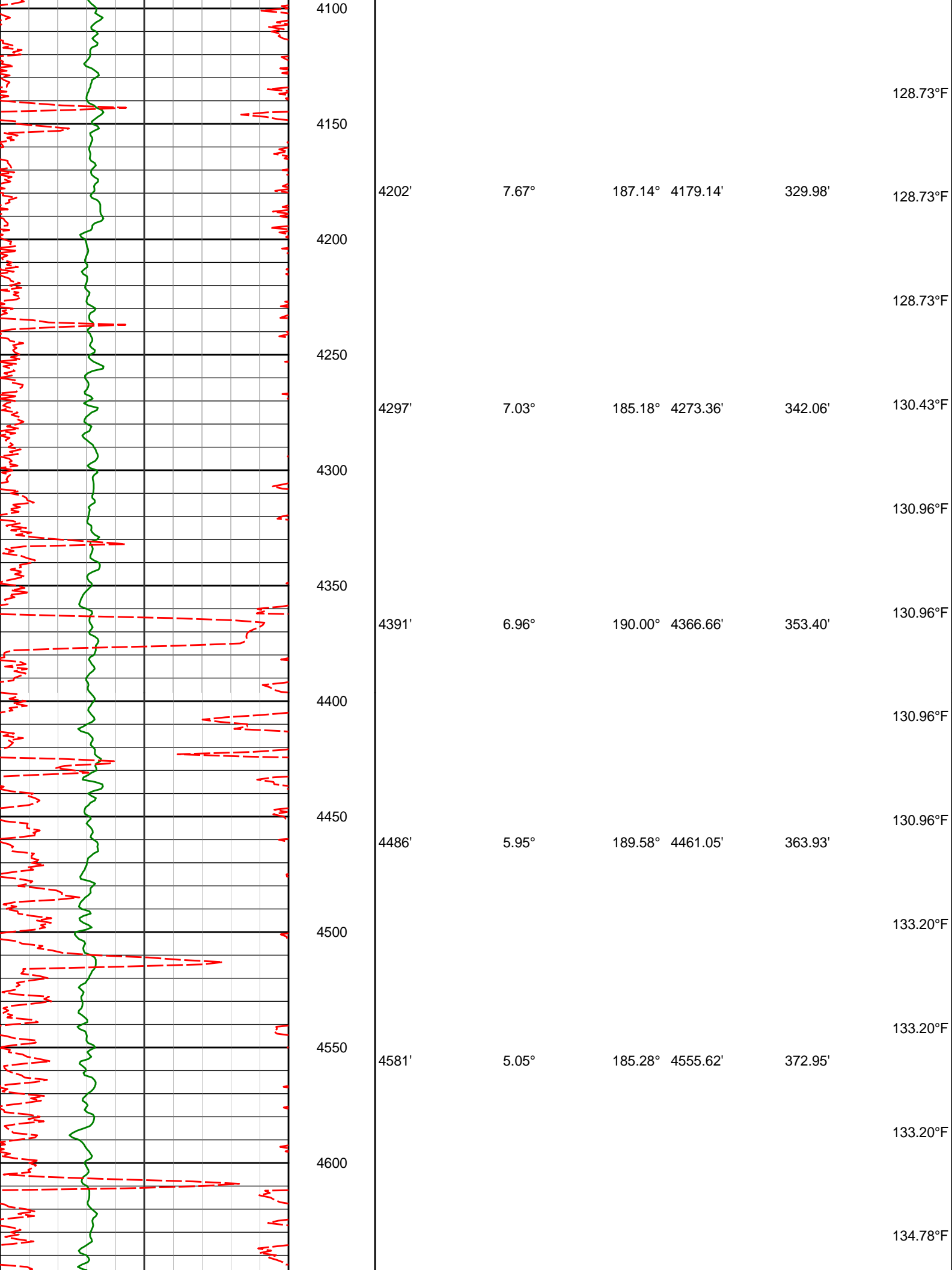


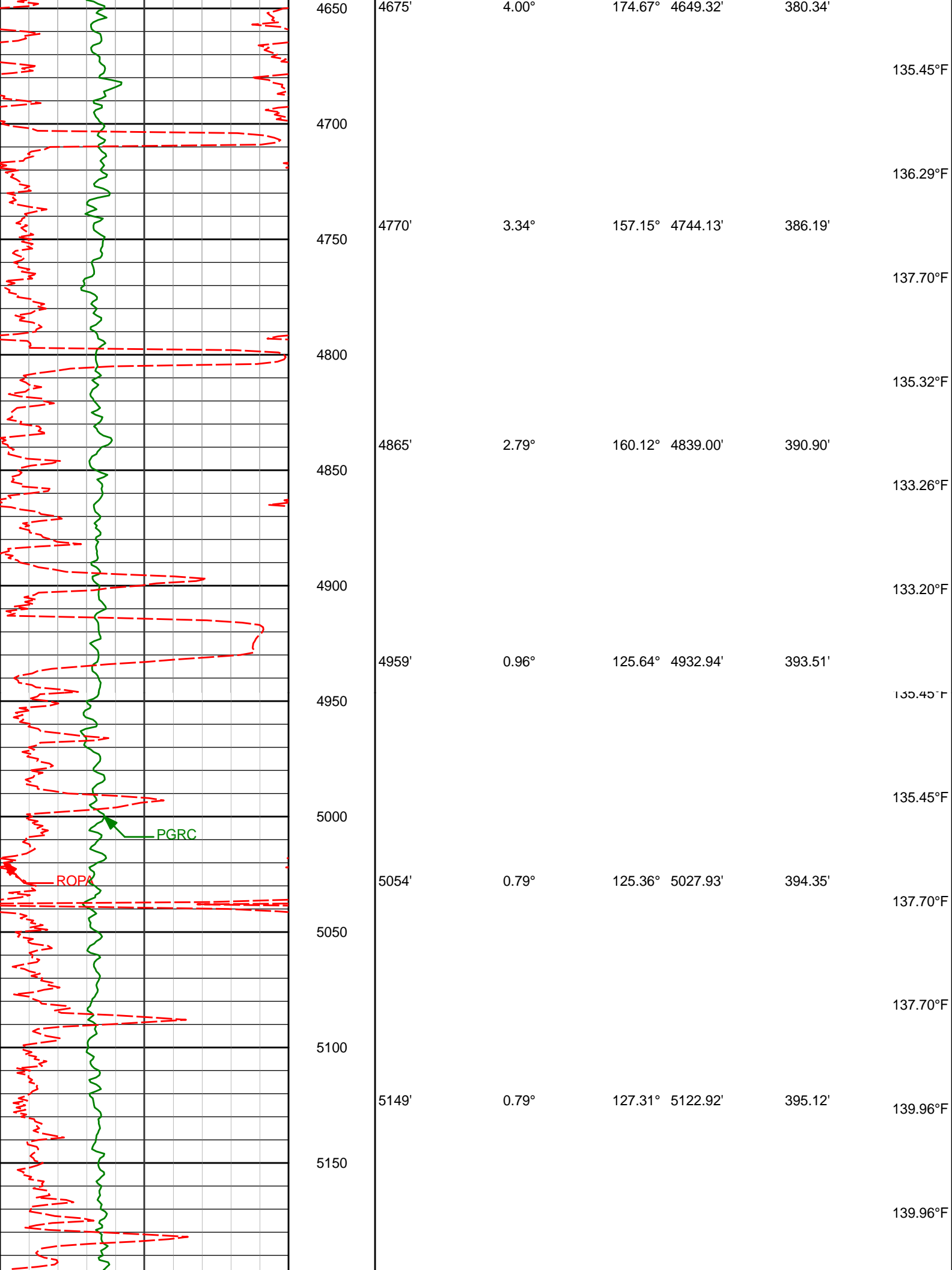


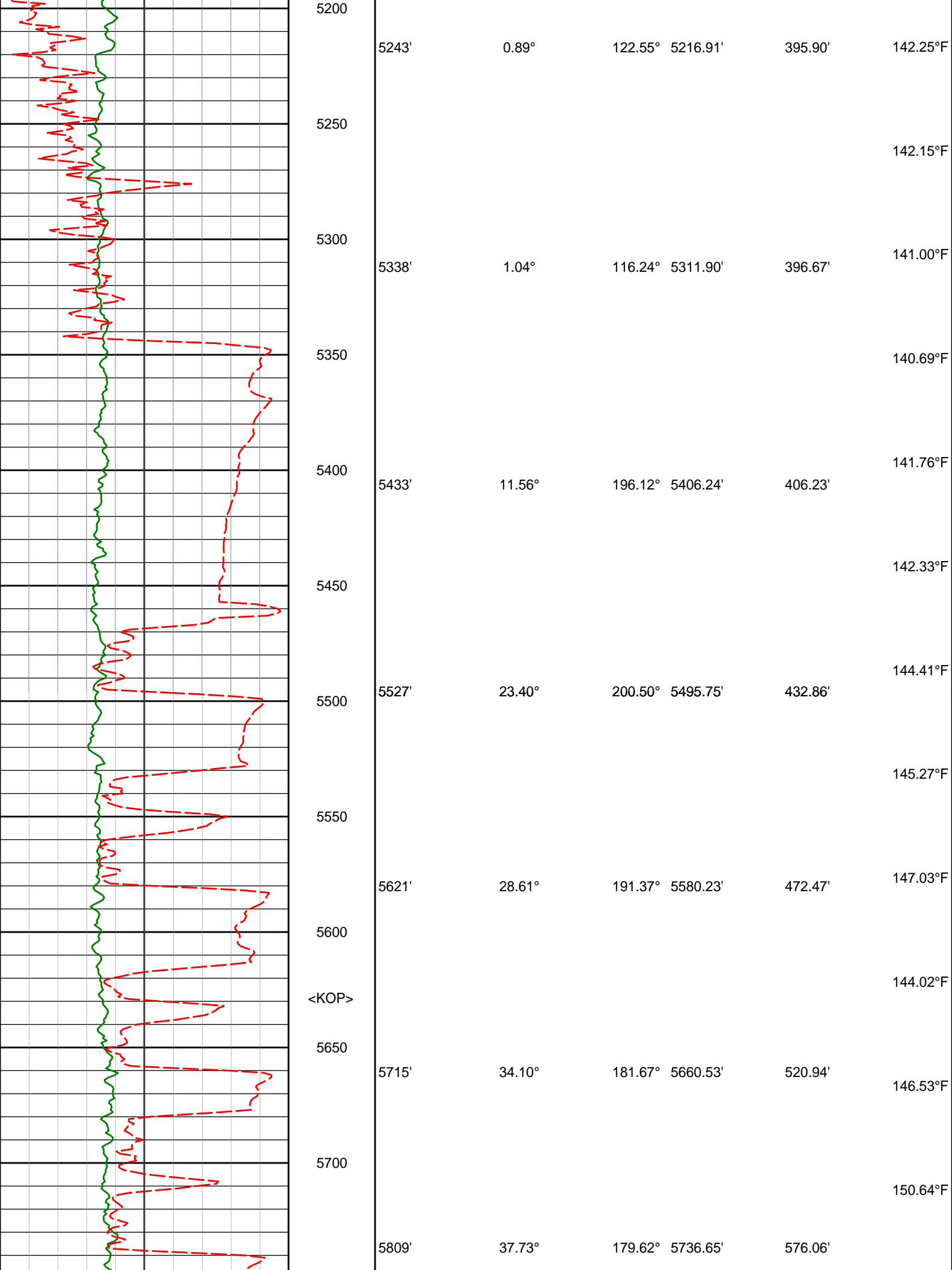


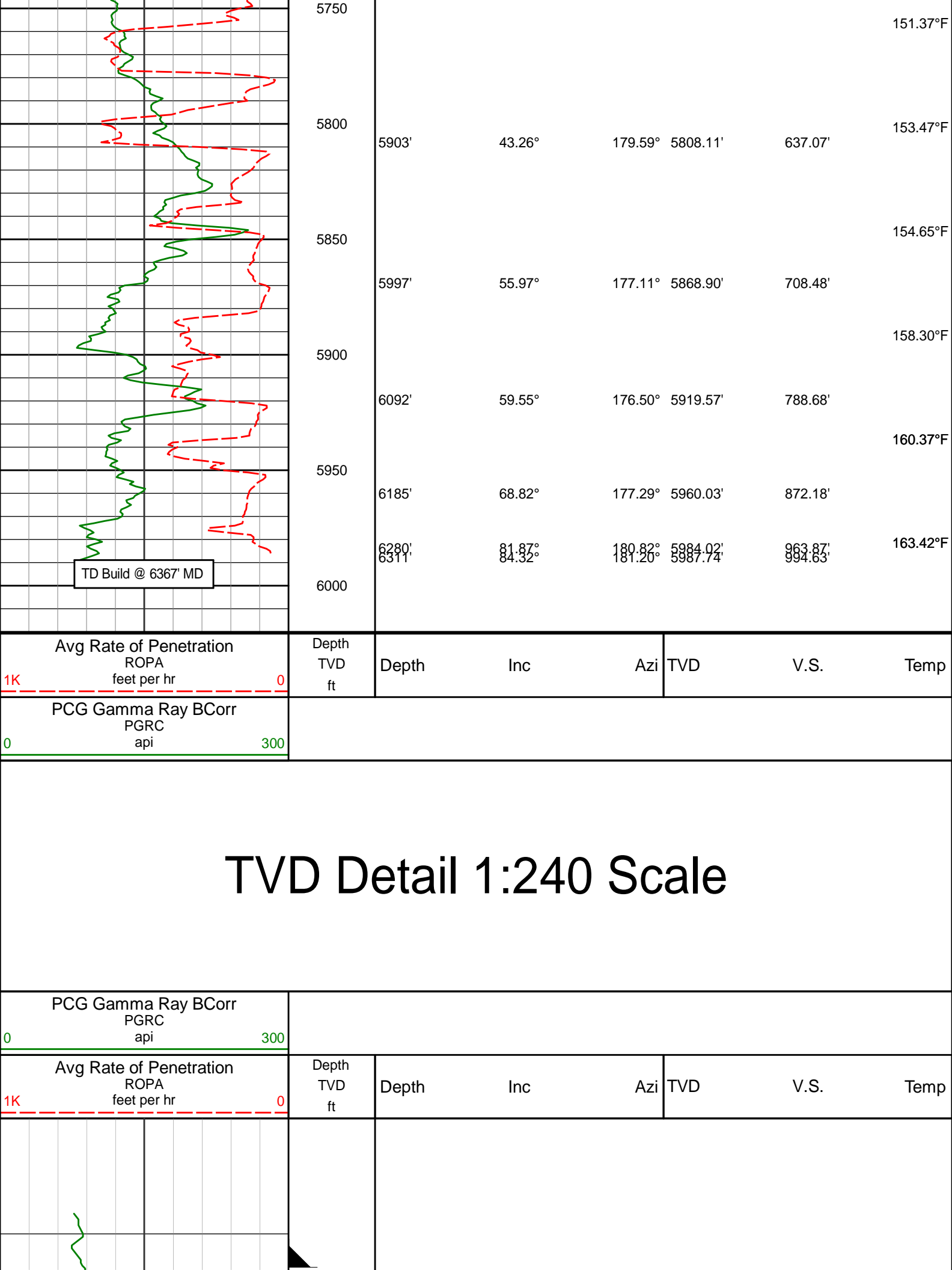


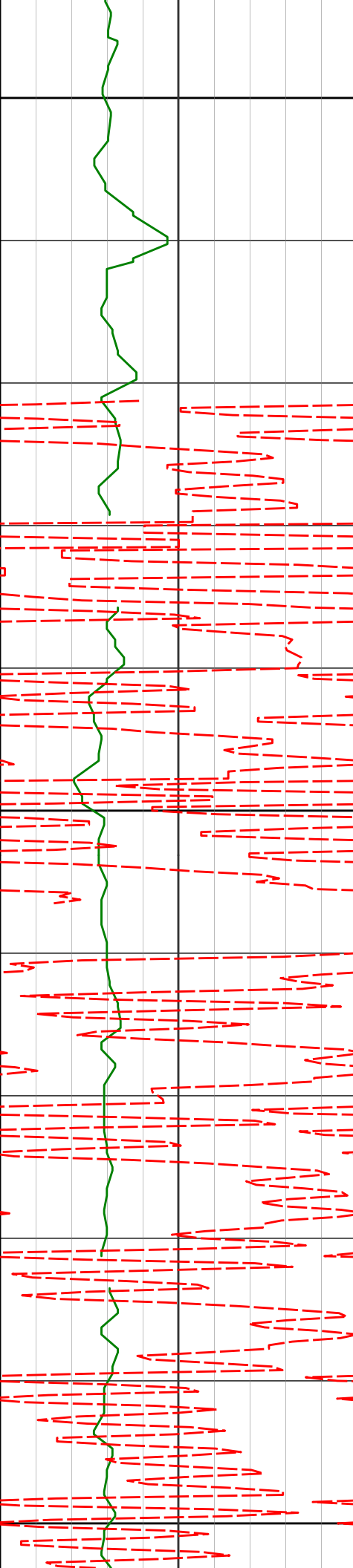












Run 100

600

664'

0.44°

71.73° 663.99'

-0.80'

700

72.00°F

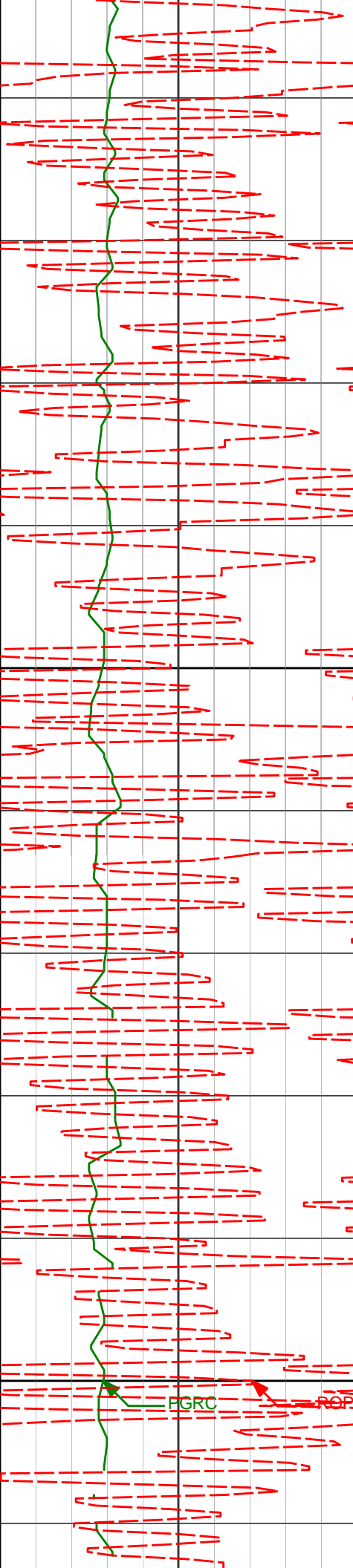
759'

0.35°

96.71° 758.99'

-0.88'

800



853'

0.22°

76.72° 852.99'

-0.89'

72.00°F

900

73.98°F

948'

0.07°

346.76° 947.99'

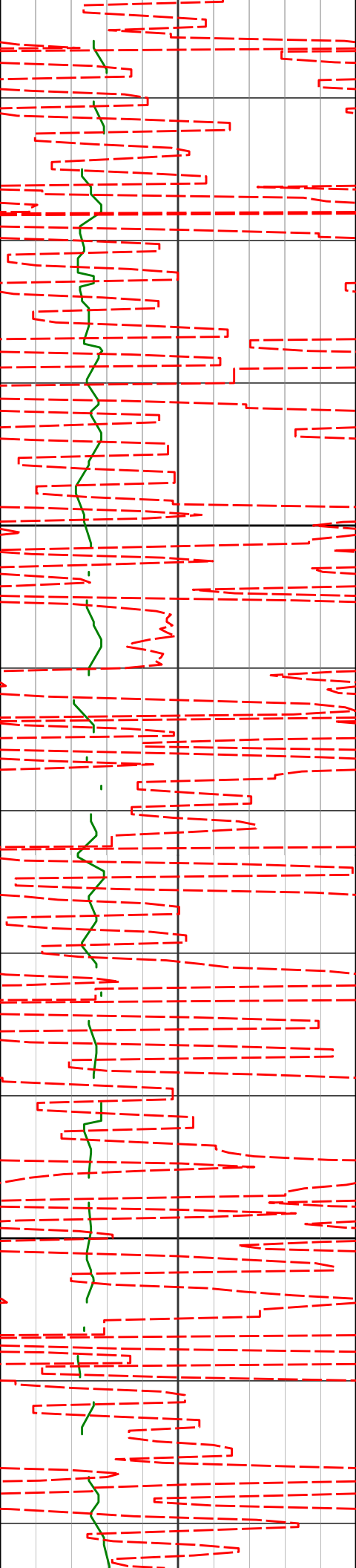
-0.98'

73.98°F

1000

FGRC

ROPA



1100

1200

1042'

0.14°

272.99° 1041.99'

-1.04'

1134'

0.24°

308.44° 1133.99'

-1.17'

1225'

0.28°

289.64° 1224.99'

-1.36'

74.11°F

75.27°F

76.12°F

77.85°F





1300

1317'

0.17°

296.80° 1316.99'

-1.50'

77.99°F

1400

1409'

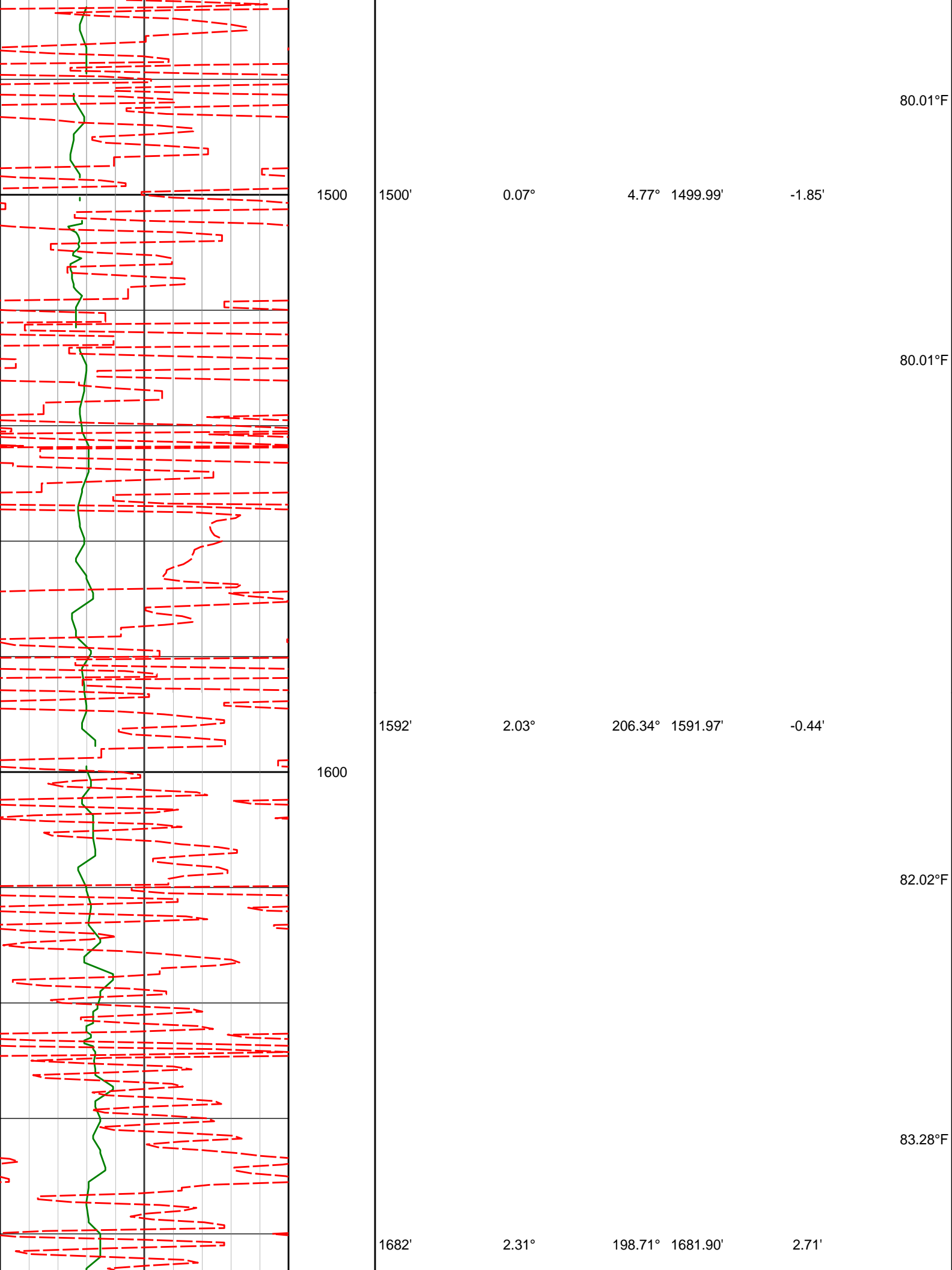
0.15°

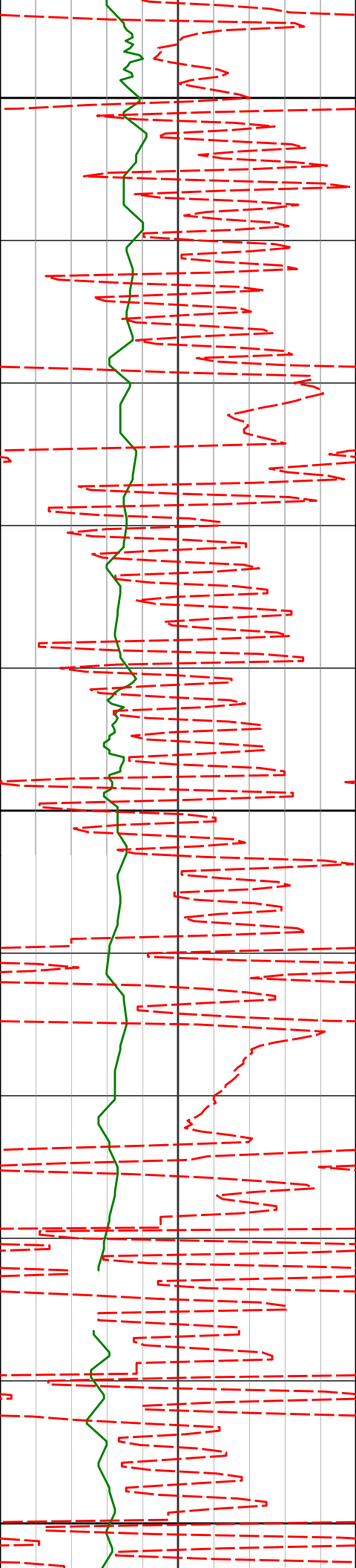
7.82° 1408.99'

-1.68'

77.99°F

77.99°F





1700

84.06°F

86.09°F

1774'

5.05°

189.46°

1773.71'

8.46'

1800

86.09°F

88.14°F

1865'

8.70°

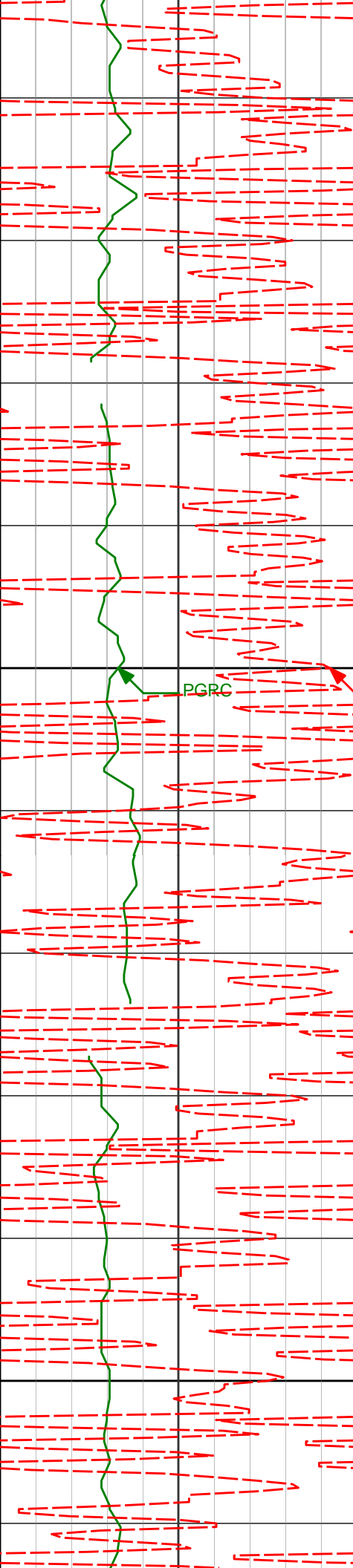
203.05°

1864.04'

18.75'

1900

88.14°F



1955'

8.48°

201.65° 1953.03'

31.19'

88.14°F

88.14°F

2000  
ROPA

PGRC

90.19°F

2047'

8.17°

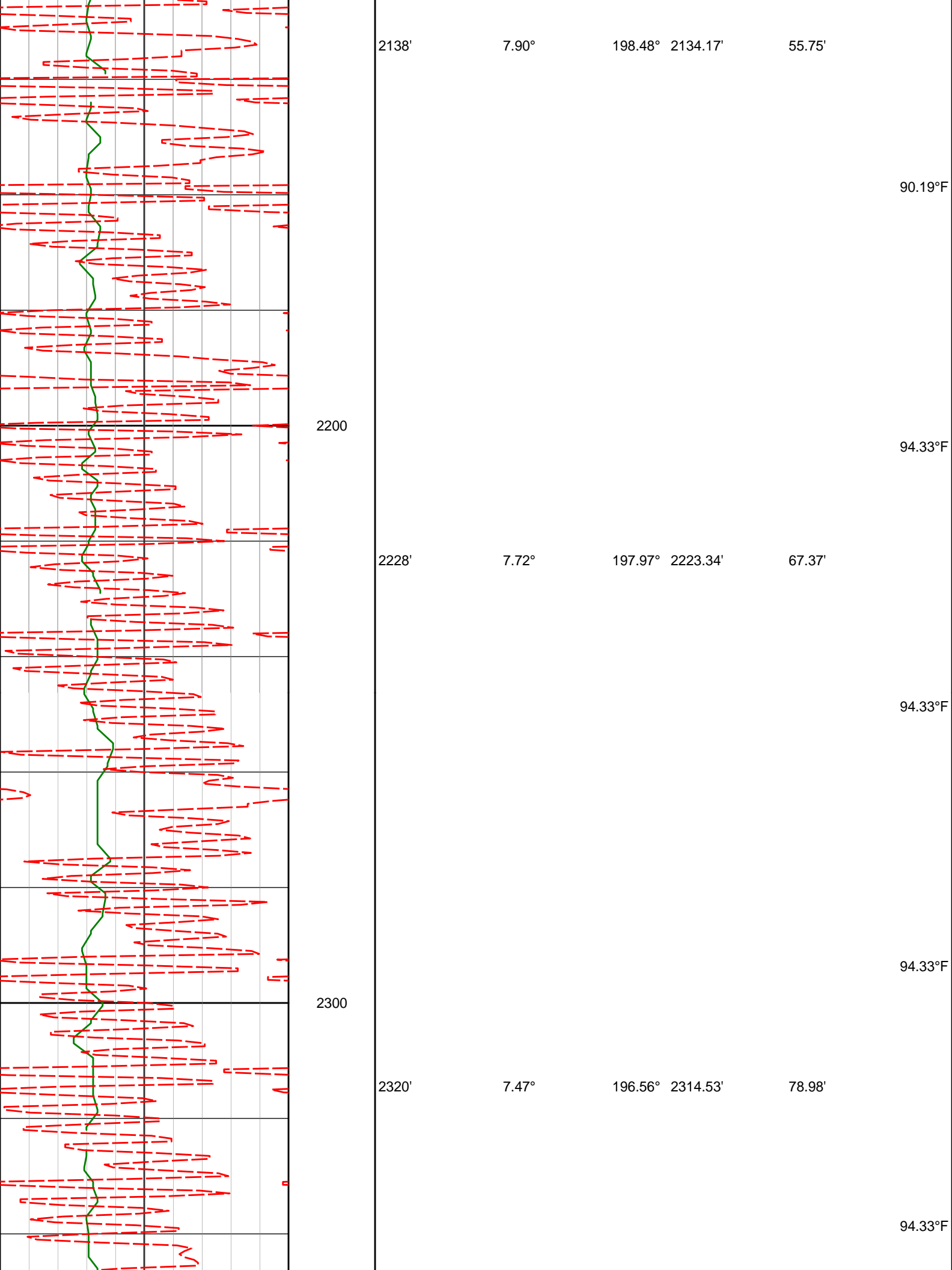
198.66° 2044.06'

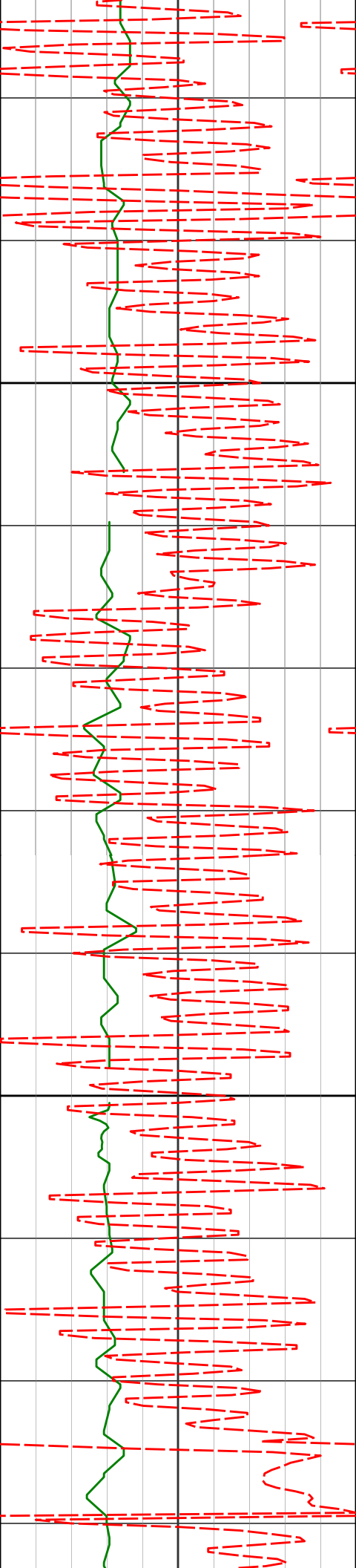
43.69'

90.19°F

2100

90.19°F





2400

2411'

7.34°

195.65° 2404.77'

90.26'

96.42°F

96.42°F

98.51°F

2500

2503'

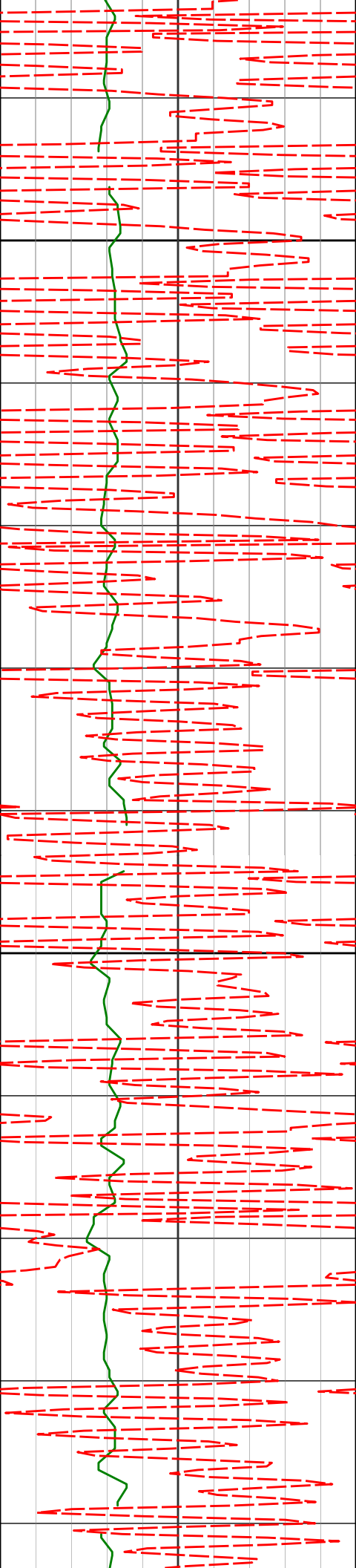
7.20°

195.71° 2496.03'

101.47'

98.51°F

98.51°F



2594'

7.54°

187.77° 2586.28'

112.88'

2600

100.62°F

2689'

7.56°

187.14° 2680.46'

125.26'

2700

100.62°F

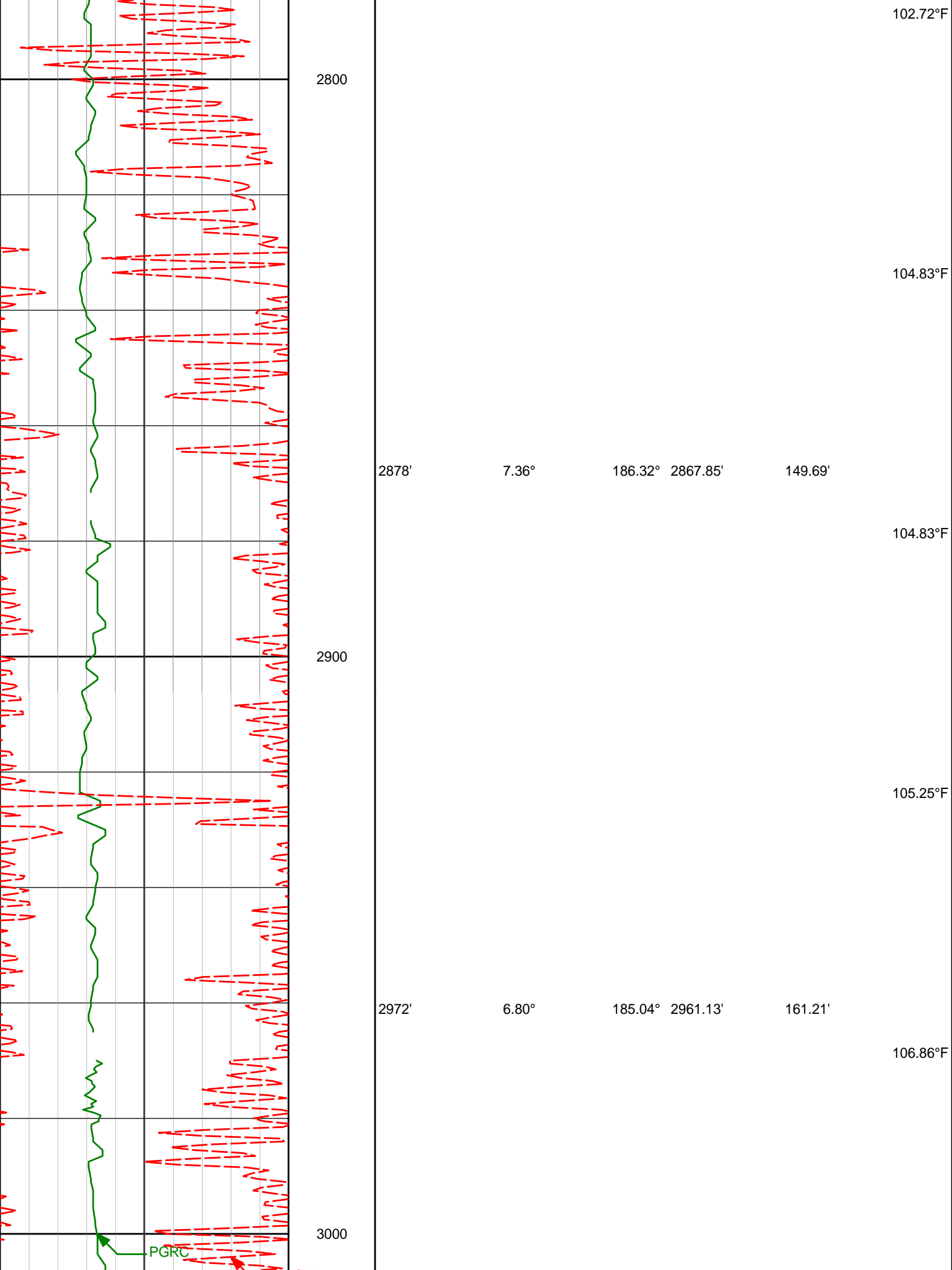
102.72°F

2783'

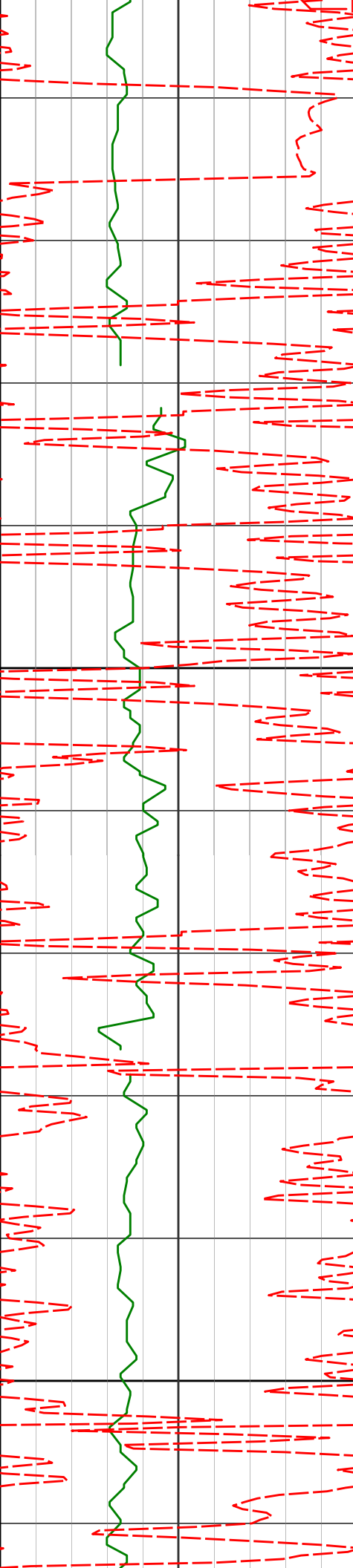
7.51°

187.36° 2773.64'

137.48'







ROPA

3067'

8.64°

193.22°

3055.27'

173.77'

3100

3162'

7.95°

191.29°

3149.27'

187.16'

3200

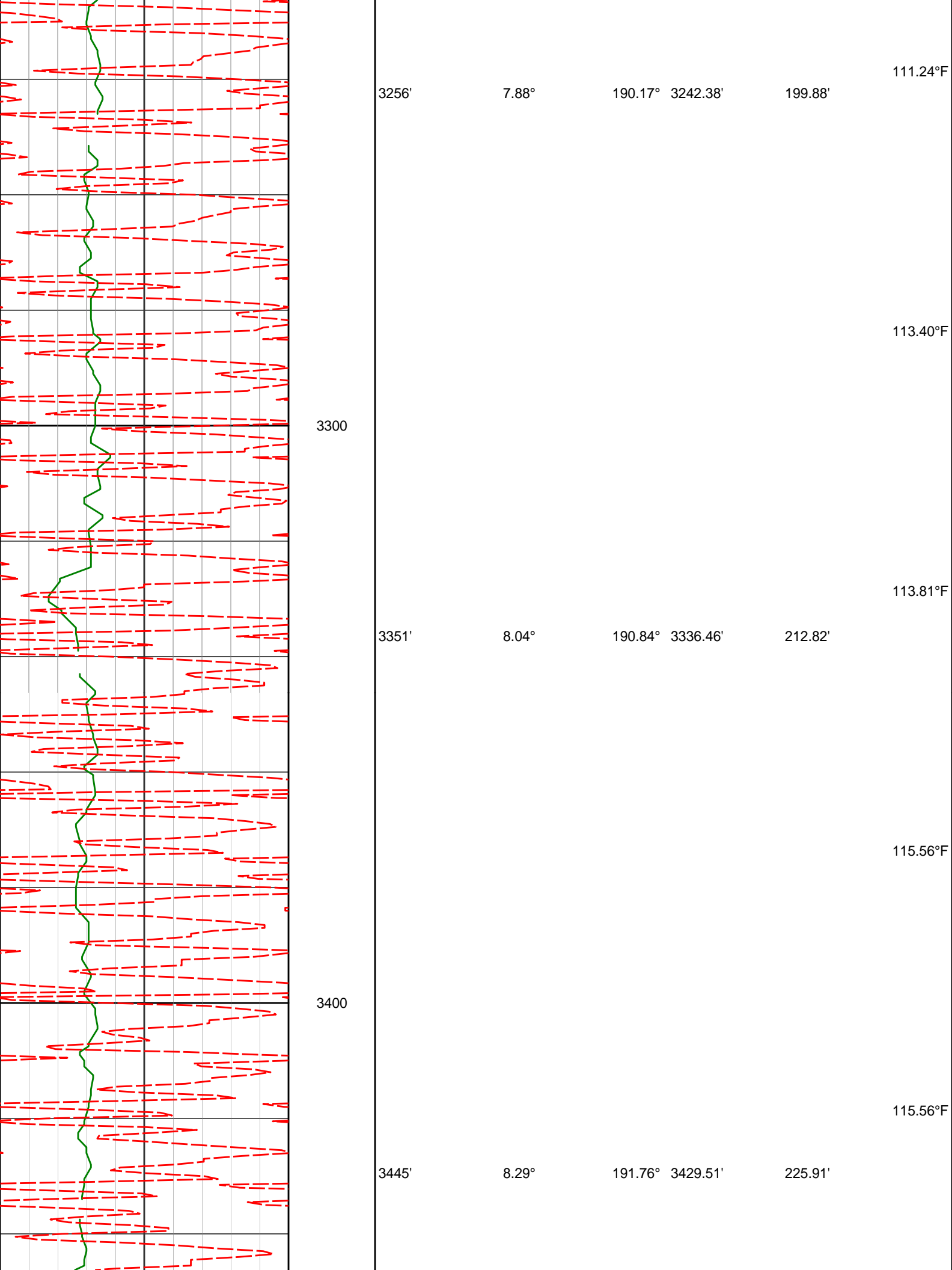
106.97°F

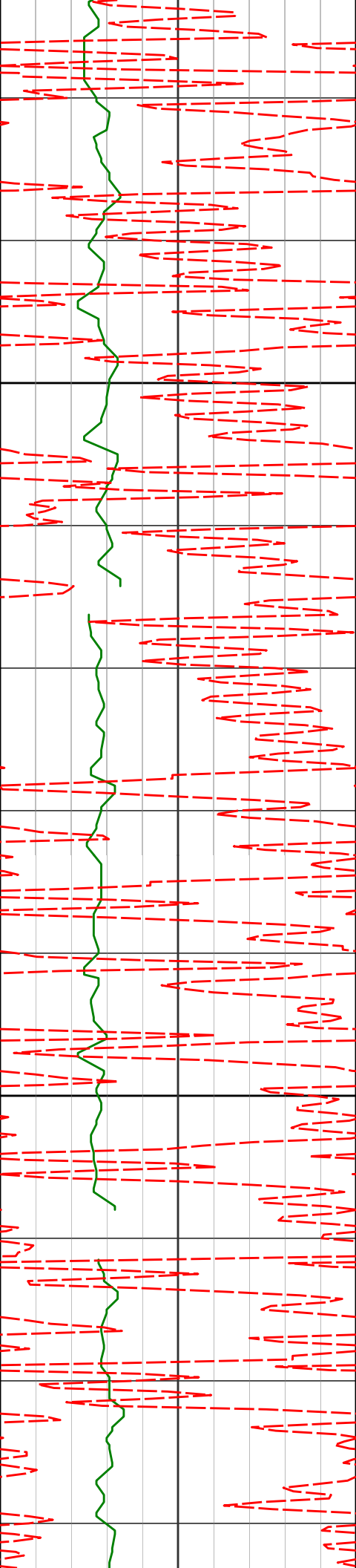
106.97°F

111.24°F

111.24°F

111.24°F





3500

3600

3540'

3635'

8.39°

8.63°

191.43°

190.42°

3523.50'

3617.46'

239.41'

253.21'

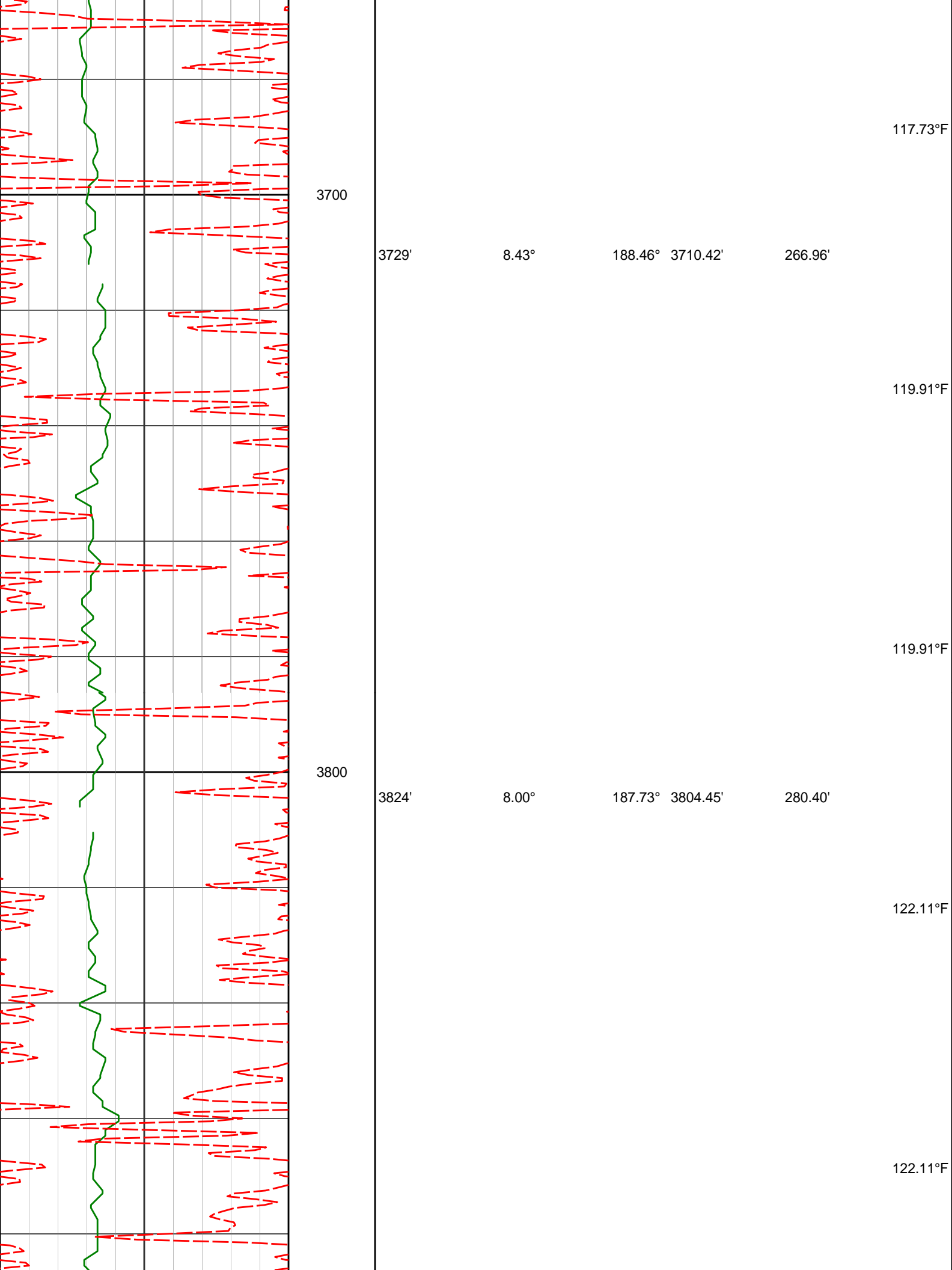
115.56°F

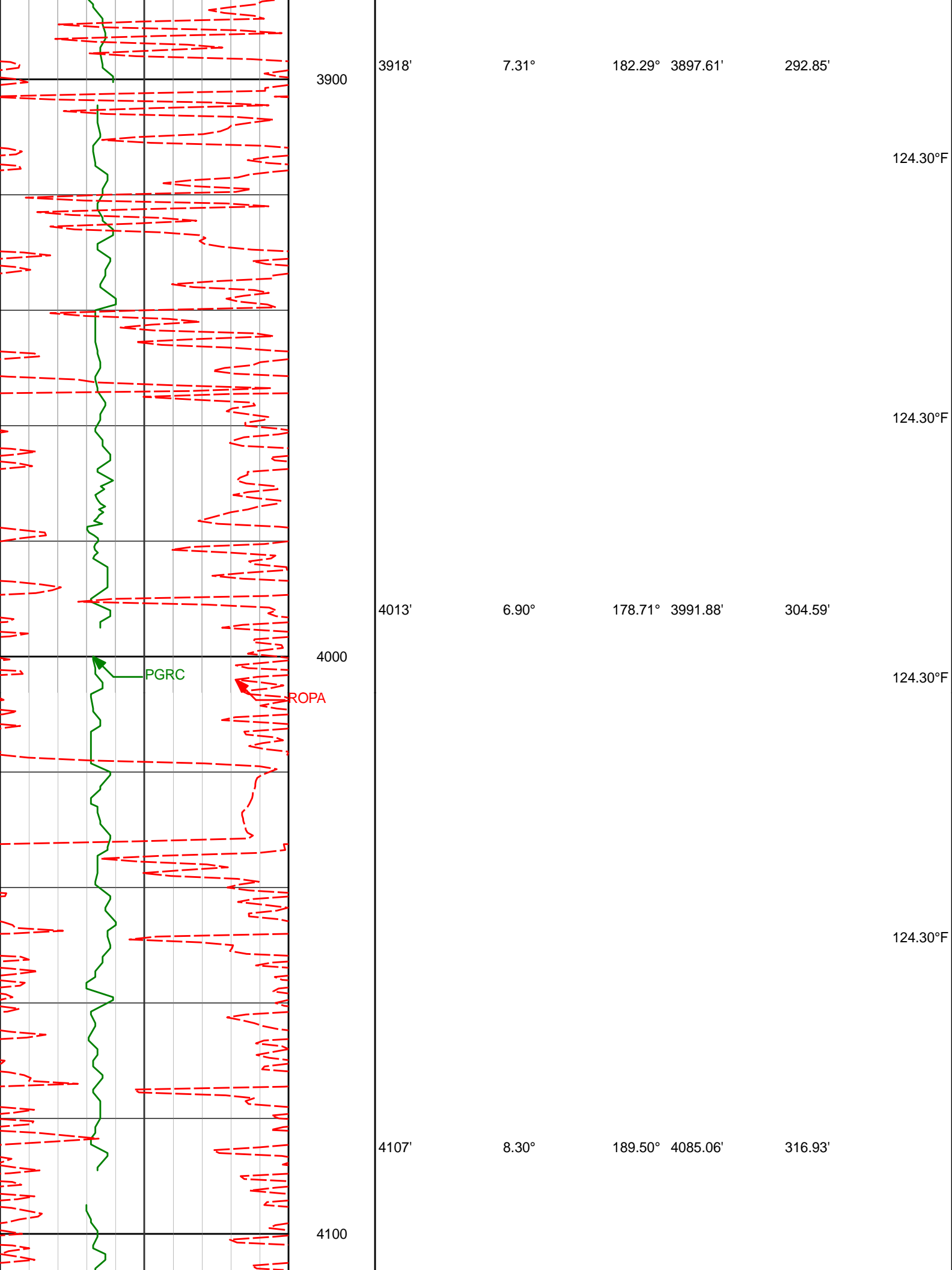
117.35°F

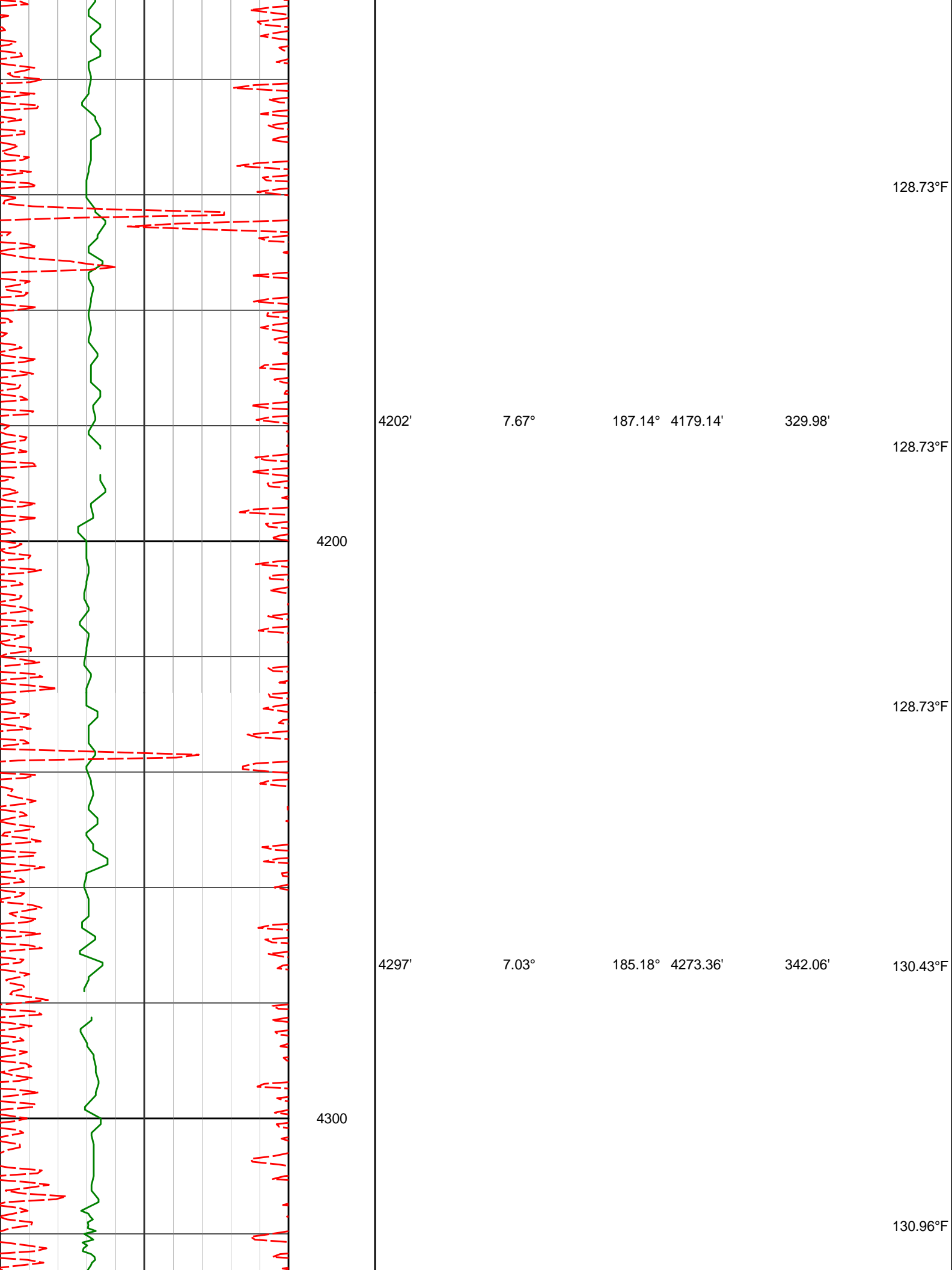
117.73°F

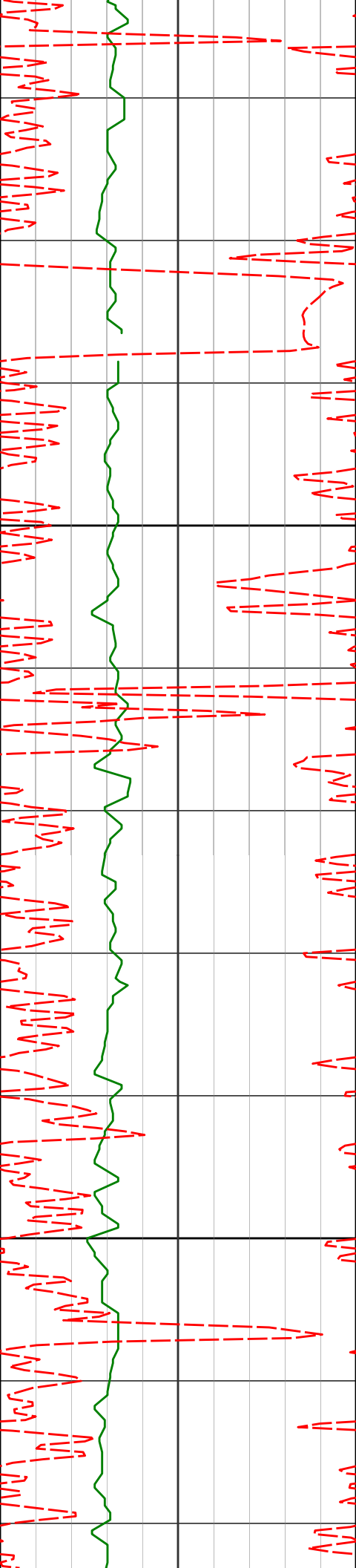
118.09°F

119.33°F









4400

4500

4391'

6.96°

190.00° 4366.66'

353.40'

130.96°F

130.96°F

130.96°F

4486'

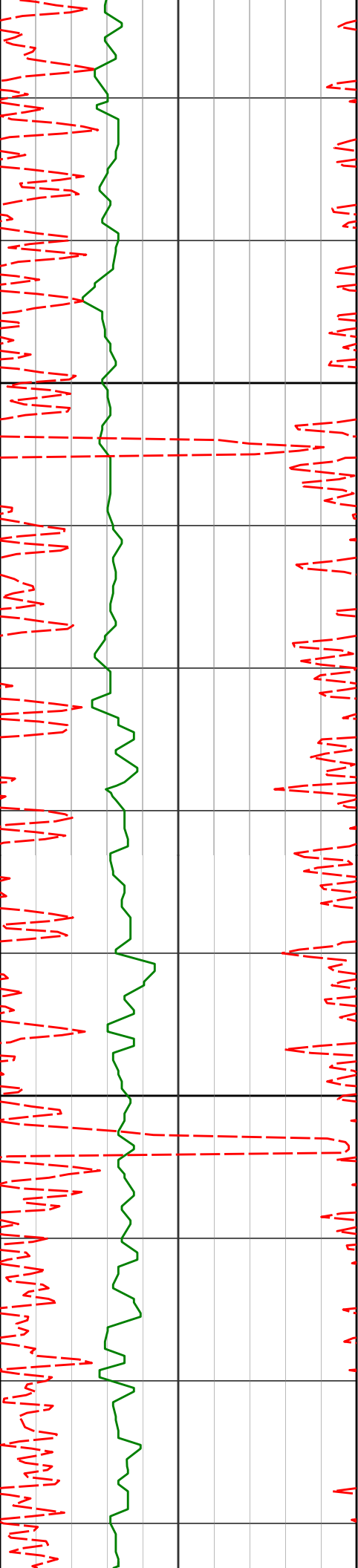
5.95°

189.58° 4461.05'

363.93'

133.20°F

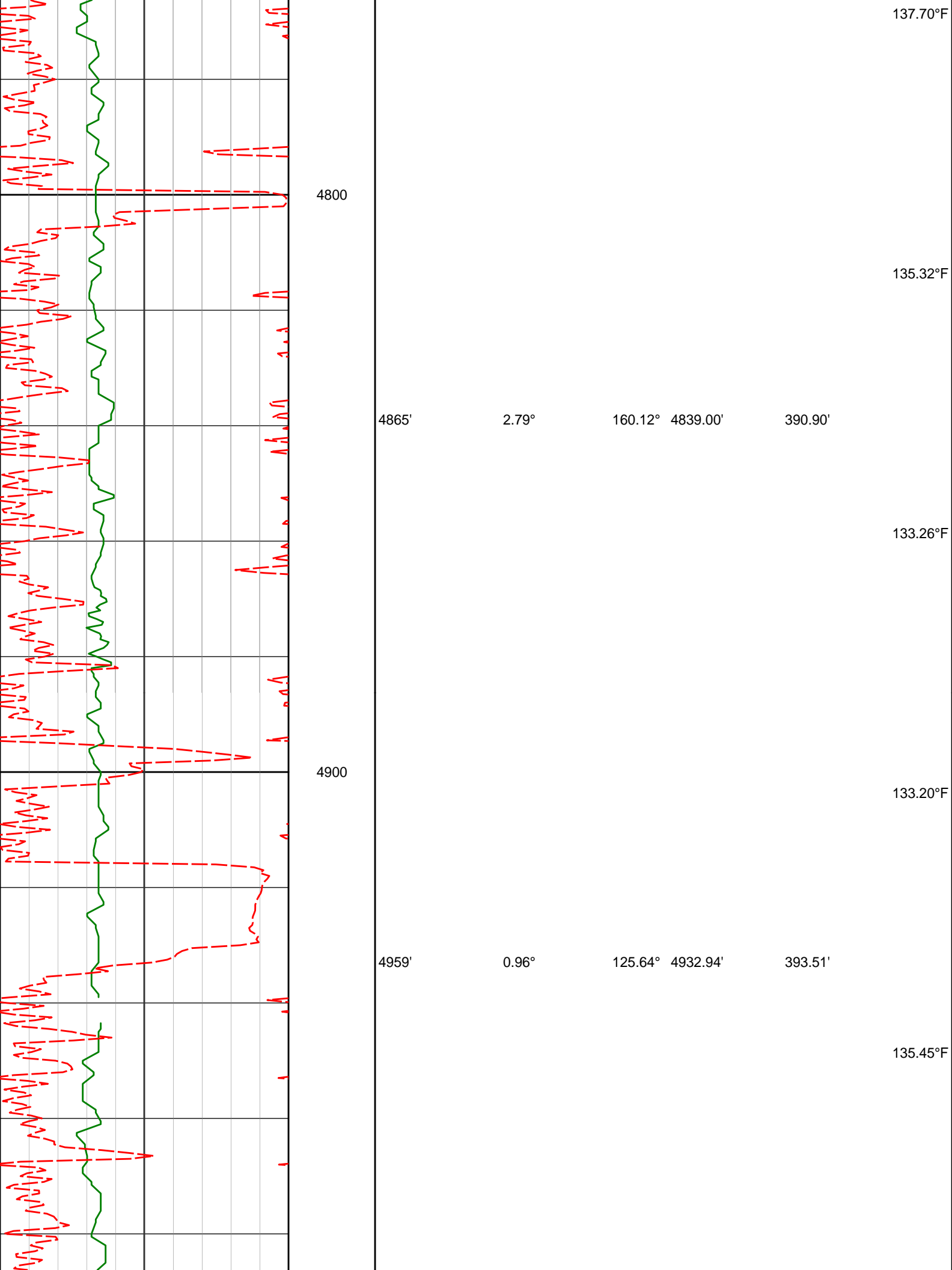
133.20°F

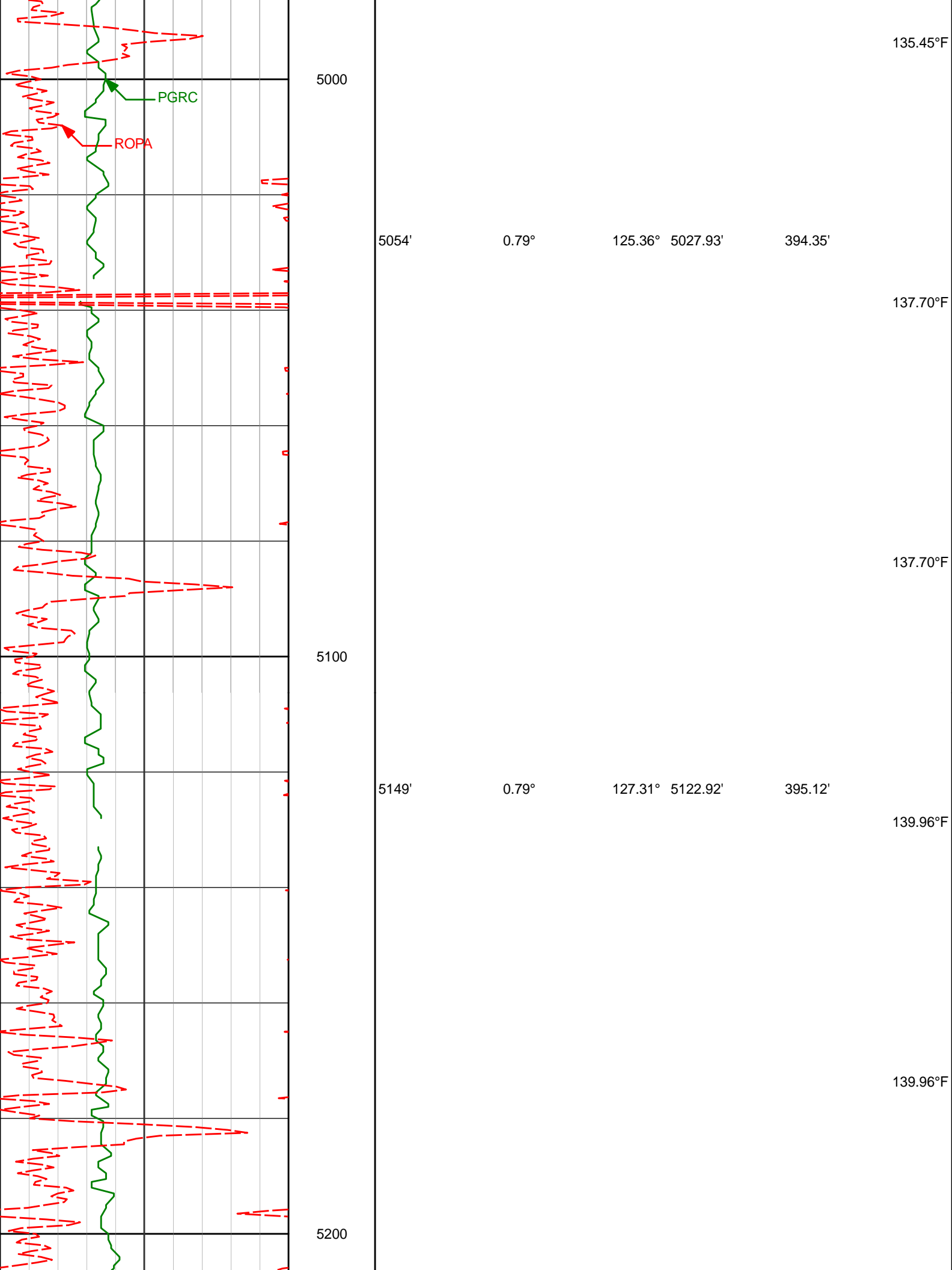


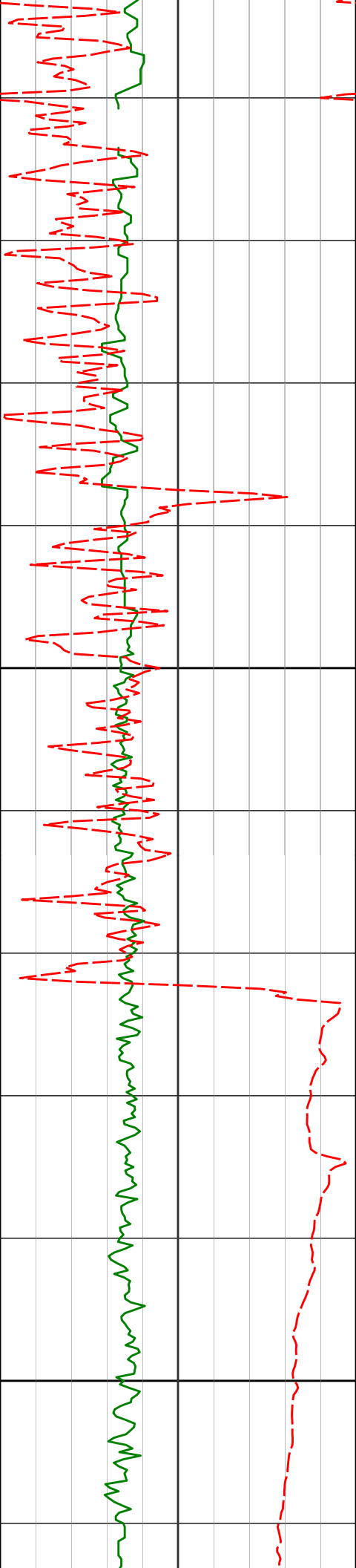
4600

4700









5243'

0.89°

122.55° 5216.91'

395.90'

142.25°F

5300

5338'

1.04°

116.24° 5311.90'

396.67'

141.00°F

5400

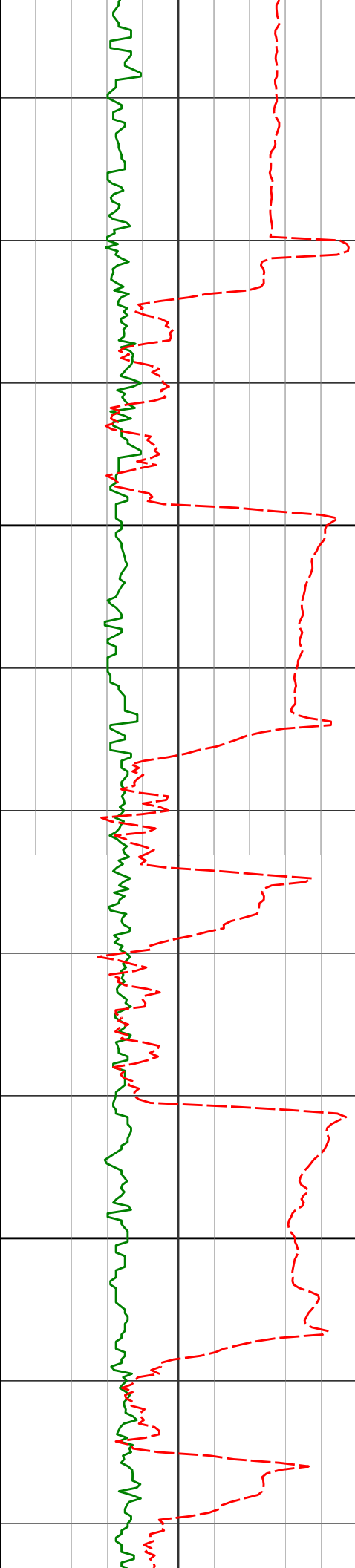
5433'

11.56°

196.12° 5406.24'

406.23'

141.76°F



5500

5600

5527'

23.40°

200.50° 5495.75'

432.86'

142.33°F

144.41°F

145.27°F

5621'

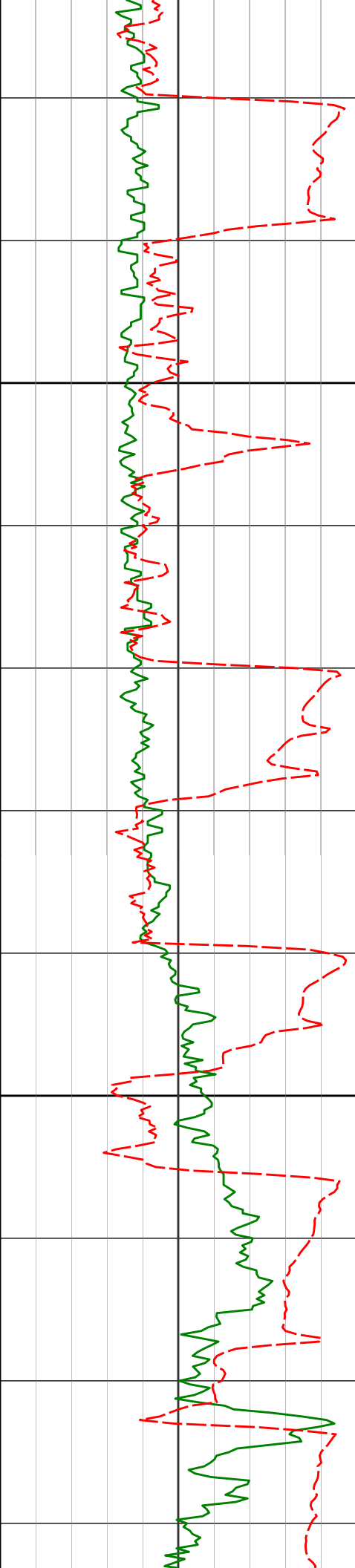
28.61°

191.37° 5580.23'

472.47'

147.03°F

144.02°F



5715'

34.10°

181.67° 5660.53'

520.94'

146.53°F

5700

150.64°F

5809'

37.73°

179.62° 5736.65'

576.06'

151.37°F

5800

153.47°F

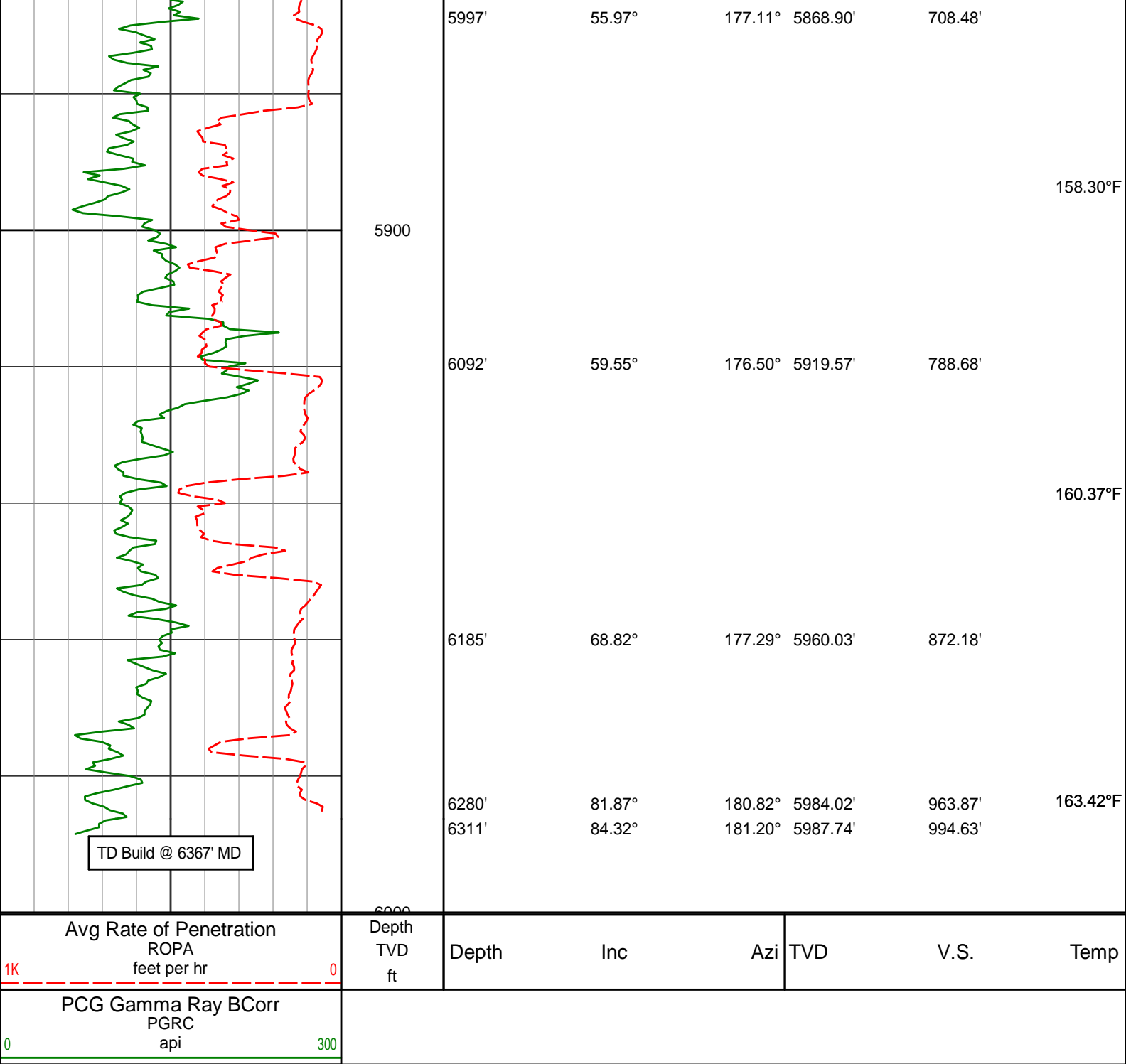
5903'

43.26°

179.59° 5808.11'

637.07'

154.65°F



**HALLIBURTON**

**DIRECTIONAL SURVEY REPORT**

Noble Energy  
Douglas LC35-780  
Wattenburg  
Weld Colorado  
USA  
CA-XX-0902973209

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
664.00	0.44	71.73	663.99	0.80 N	2.41 E	-0.80	0.07
759.00	0.35	96.71	758.99	0.88 N	3.04 E	-0.88	0.20
853.00	0.33	70.73	852.99	0.89 N	2.52 E	0.89	0.17

853.00	0.22	76.72	852.99	0.88 N	3.50 E	-0.89	0.17
948.00	0.07	346.76	947.99	0.98 N	3.66 E	-0.98	0.24
1042.00	0.14	272.99	1041.99	1.04 N	3.54 E	-1.04	0.14
1134.00	0.24	308.44	1133.99	1.17 N	3.27 E	-1.17	0.16
1225.00	0.28	289.64	1224.99	1.36 N	2.92 E	-1.36	0.10
1317.00	0.17	296.80	1316.99	1.50 N	2.59 E	-1.50	0.13
1409.00	0.15	7.82	1408.99	1.67 N	2.48 E	-1.68	0.20
1500.00	0.07	4.77	1499.99	1.85 N	2.50 E	-1.85	0.09
1592.00	2.03	206.34	1591.97	0.44 N	1.78 E	-0.44	2.28
1682.00	2.31	198.71	1681.90	2.71 S	0.49 E	2.71	0.44
1774.00	5.05	189.46	1773.71	8.46 S	0.77 W	8.46	3.04
1865.00	8.70	203.05	1864.04	18.75 S	4.12 W	18.75	4.37
1955.00	8.48	201.65	1953.03	31.18 S	9.23 W	31.19	0.34
2047.00	8.17	198.66	2044.06	43.68 S	13.83 W	43.69	0.57
2138.00	7.90	198.48	2134.17	55.73 S	17.88 W	55.75	0.30
2228.00	7.72	197.97	2223.34	67.35 S	21.70 W	67.37	0.22
2320.00	7.47	196.56	2314.53	78.96 S	25.31 W	78.98	0.33
2411.00	7.34	195.65	2404.77	90.23 S	28.57 W	90.26	0.19
2503.00	7.20	195.71	2496.03	101.44 S	31.72 W	101.47	0.16
2594.00	7.54	187.77	2586.28	112.85 S	34.07 W	112.88	1.18
2689.00	7.56	187.14	2680.46	125.22 S	35.69 W	125.26	0.09
2783.00	7.51	187.36	2773.64	137.45 S	37.24 W	137.48	0.06
2878.00	7.36	186.32	2867.85	149.65 S	38.71 W	149.69	0.21
2972.00	6.80	185.04	2961.13	161.17 S	39.86 W	161.21	0.61
3067.00	8.64	193.22	3055.27	173.73 S	41.99 W	173.77	2.25
3162.00	7.95	191.29	3149.27	187.12 S	44.90 W	187.16	0.79
3256.00	7.88	190.17	3242.38	199.83 S	47.31 W	199.88	0.18
3351.00	8.04	190.84	3336.46	212.77 S	49.71 W	212.82	0.20
3445.00	8.29	191.76	3429.51	225.86 S	52.33 W	225.91	0.29
3540.00	8.39	191.43	3523.50	239.36 S	55.10 W	239.41	0.12
3635.00	8.63	190.42	3617.46	253.15 S	57.76 W	253.21	0.29
3729.00	8.43	188.46	3710.42	266.90 S	60.05 W	266.96	0.38
3824.00	8.00	187.73	3804.45	280.33 S	61.96 W	280.40	0.46
3918.00	7.31	182.29	3897.61	292.78 S	63.08 W	292.85	1.06
4013.00	6.90	178.71	3991.88	304.53 S	63.20 W	304.59	0.63
4107.00	8.30	189.50	4085.06	316.86 S	64.19 W	316.93	2.12
4202.00	7.67	187.14	4179.14	329.91 S	66.11 W	329.98	0.75
4297.00	7.03	185.18	4273.36	341.99 S	67.42 W	342.06	0.73
4391.00	6.96	190.00	4366.66	353.32 S	68.93 W	353.40	0.63
4486.00	5.95	189.58	4461.05	363.85 S	70.75 W	363.93	1.06
4581.00	5.05	185.28	4555.62	372.88 S	71.95 W	372.95	1.04
4675.00	4.00	174.67	4649.32	380.27 S	72.03 W	380.34	1.43
4770.00	3.34	157.15	4744.13	386.11 S	70.65 W	386.19	1.36
4865.00	2.79	160.12	4839.00	390.83 S	68.79 W	390.90	0.60
4959.00	0.96	125.64	4932.94	393.44 S	67.37 W	393.51	2.20
5054.00	0.79	125.36	5027.93	394.28 S	66.20 W	394.35	0.18
5149.00	0.79	127.31	5122.92	395.05 S	65.15 W	395.12	0.03
5243.00	0.89	122.55	5216.91	395.83 S	64.02 W	395.90	0.13
5338.00	1.04	116.24	5311.90	396.61 S	62.63 W	396.67	0.19
5433.00	11.56	196.12	5406.24	406.16 S	64.51 W	406.23	12.02
5527.00	23.40	200.50	5495.75	432.79 S	73.69 W	432.86	12.67
5621.00	28.61	191.37	5580.23	472.38 S	84.68 W	472.47	6.98
5715.00	34.10	181.67	5660.53	520.85 S	89.89 W	520.94	7.92
5809.00	37.73	179.62	5736.65	575.96 S	90.46 W	576.06	4.07
5903.00	43.26	179.59	5808.11	636.98 S	90.04 W	637.07	5.89
5997.00	55.97	177.11	5868.90	708.38 S	87.84 W	708.48	13.66
6092.00	59.55	176.50	5919.57	788.60 S	83.35 W	788.68	3.81
6185.00	68.82	177.29	5960.03	872.10 S	78.85 W	872.18	10.00
6280.00	81.87	180.82	5984.02	963.79 S	77.42 W	963.87	14.20
6311.00	84.32	181.20	5987.74	994.55 S	77.96 W	994.63	7.99

# 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 180.06 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.03 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 6311.00 FEET  
IS 997.60 FEET ALONG 184.48 DEGREES (GRID)

