

PCG Pressure Case Gamma  
PCG Pressure Case Directional



1 : 600 / 1 : 240

Country : USA		Field : Wattenburg		Location : Lat: 40° 26' 30.05" North Long: 104° 21' 15.84" West		Well : Wells Ranch AE32-645		Company : Noble Energy		Rig : H&P 343		Company : Noble Energy Rig : H&P 343 Well : Wells Ranch AE32-645 Field : Wattenburg Country : USA API Number : 05-123-41728		Other Services Directional Drilling	
Permanent Datum : Ground Level		Elevation : 4723.00 ft		Log Measured From : Drill Floor		24.00 ft Above Permanent Datum		Drilling Measured From : Drill Floor		TVD LOG		Elev. KB N/A		DF 4747.00 ft GL 4723.00 ft WD N/A	
Depth Logged : 629.00 ft To 6,442.75 ft		Date Logged : 15-Sep-15 To 21-Sep-15		Total Depth MD : 6,841.00 ft		TVD : 6,442.75 ft		Spud Date : 15-Sep-15		Unit No. : 11610115		Job No. : CA-XX-0902674376			
Run No.		Borehole Record (TVD)		Size		Weight		Casing Record (TVD)							
0100		8.750 in		629.00 ft		6,442.75 ft		9.625 in		36.60 lbpf		SURFACE		628.00 ft	

Max Tool Temp (degF) / Source	177.64 / PCM				
Rm @ Max Tool Temp (degF)	N/A @ N/A				
Lead MWD Engineer	Brian Neu				
Customer Representative	Derek D				

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM				
Software Version	5.93				
Sub Serial Number	11404299				
Insert Serial Number	11400842				
Date and Time Initialized	15-Sep-15 14:52				
Date and Time Read	18-Sep-15 03:12				
ECMB SW Version	N/A				

### Directional Sensor Information

Tool Type	PCDC				
Distance From Bit (ft)	65.00				
Software Version	6.33				
Sub Serial Number	11404299				
Sonde Serial Number	11902092				
Sensor ID Number	N/A				
Toolface Offset (deg)	331.60				

### Gamma Ray Sensor Information

Tool Type	PCG				
Distance From Bit (ft)	58.76				
Recorded Sample Period (sec)	10				
Software Version	8.15				
Sub Serial Number	11404299				
Insert/Sonde Serial Number	11681061				

## REMARKS

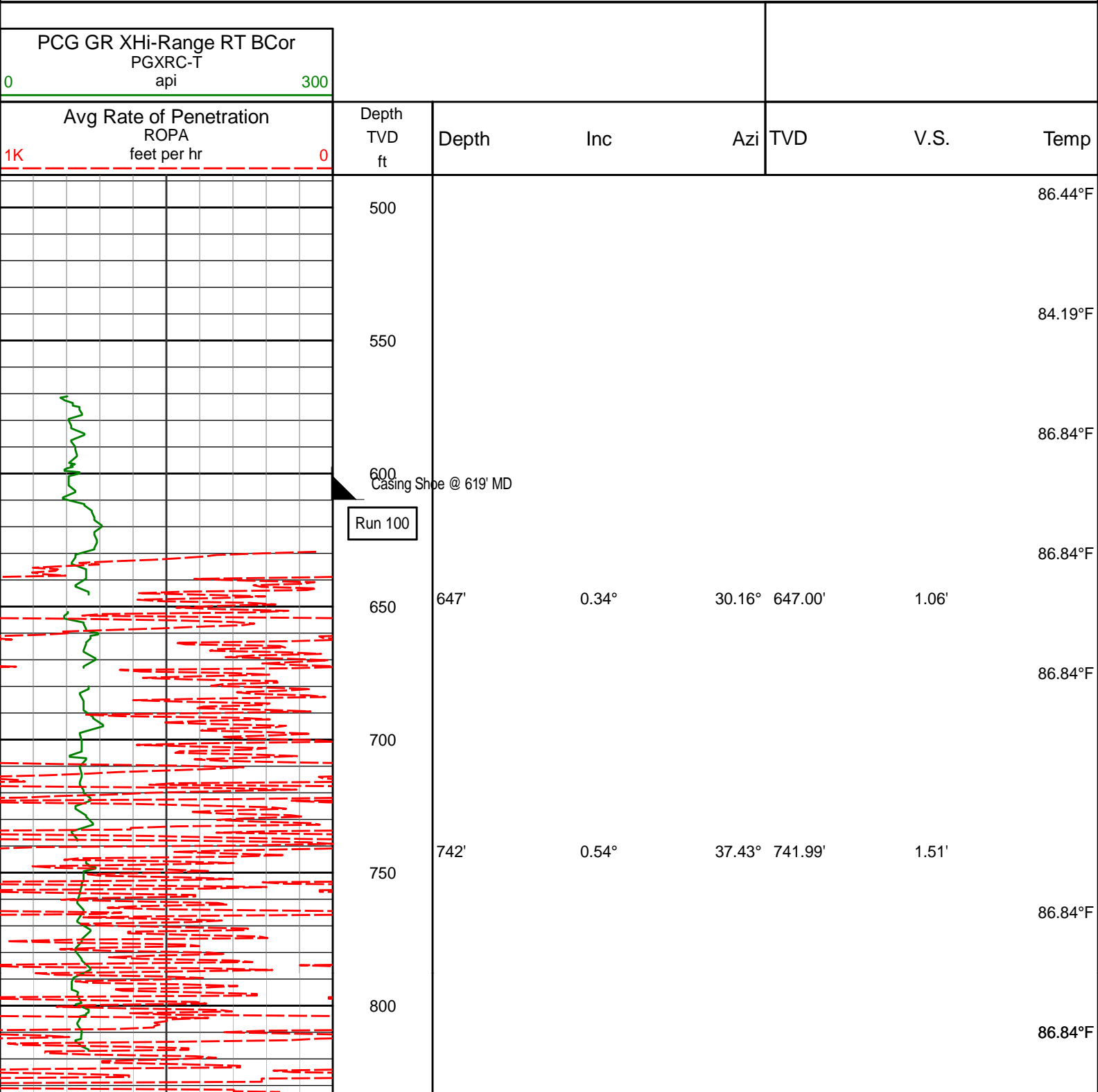
1. All depths are calibrated to driller's pipe tally and are total vertical depth from the drill floor.
2. No depth corrections have been made for pipe stretch or compression.
3. All data presented is recorded (memory data) unless otherwise stated.
4. Environmental parameters used in gamma and resistance processing:  
Hole Size: 8.75"  
Mud Density: 9.9-11.0
5. The following smoothing parameters have been applied to the data:  
Interval: 0.5 ft  
Coercion Distance: 1.2 ft (ROPA)  
Interval: 0.5 ft  
Coercion Distance: 0.6 ft (Gamma Ray)

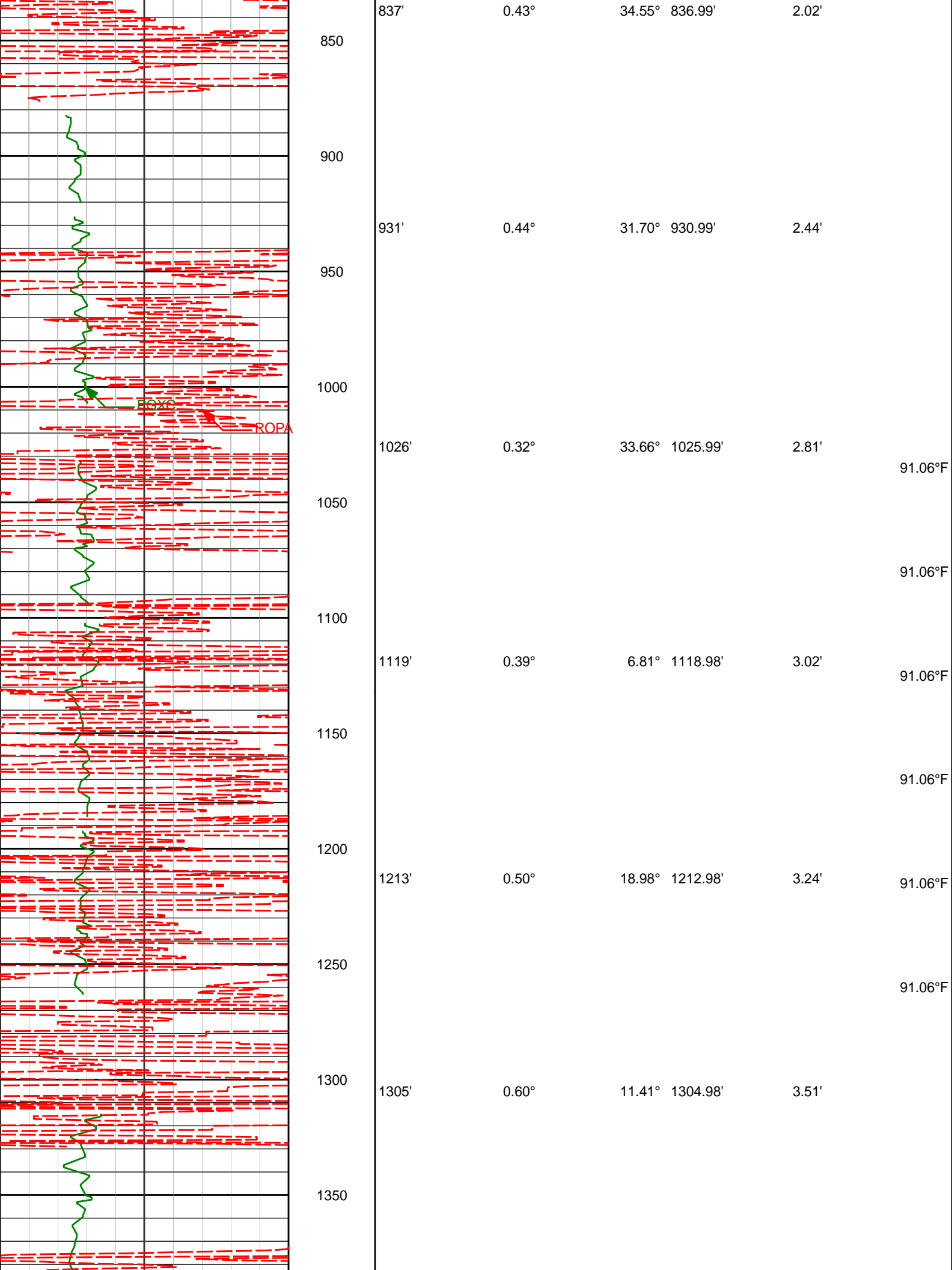
## WARRANTY

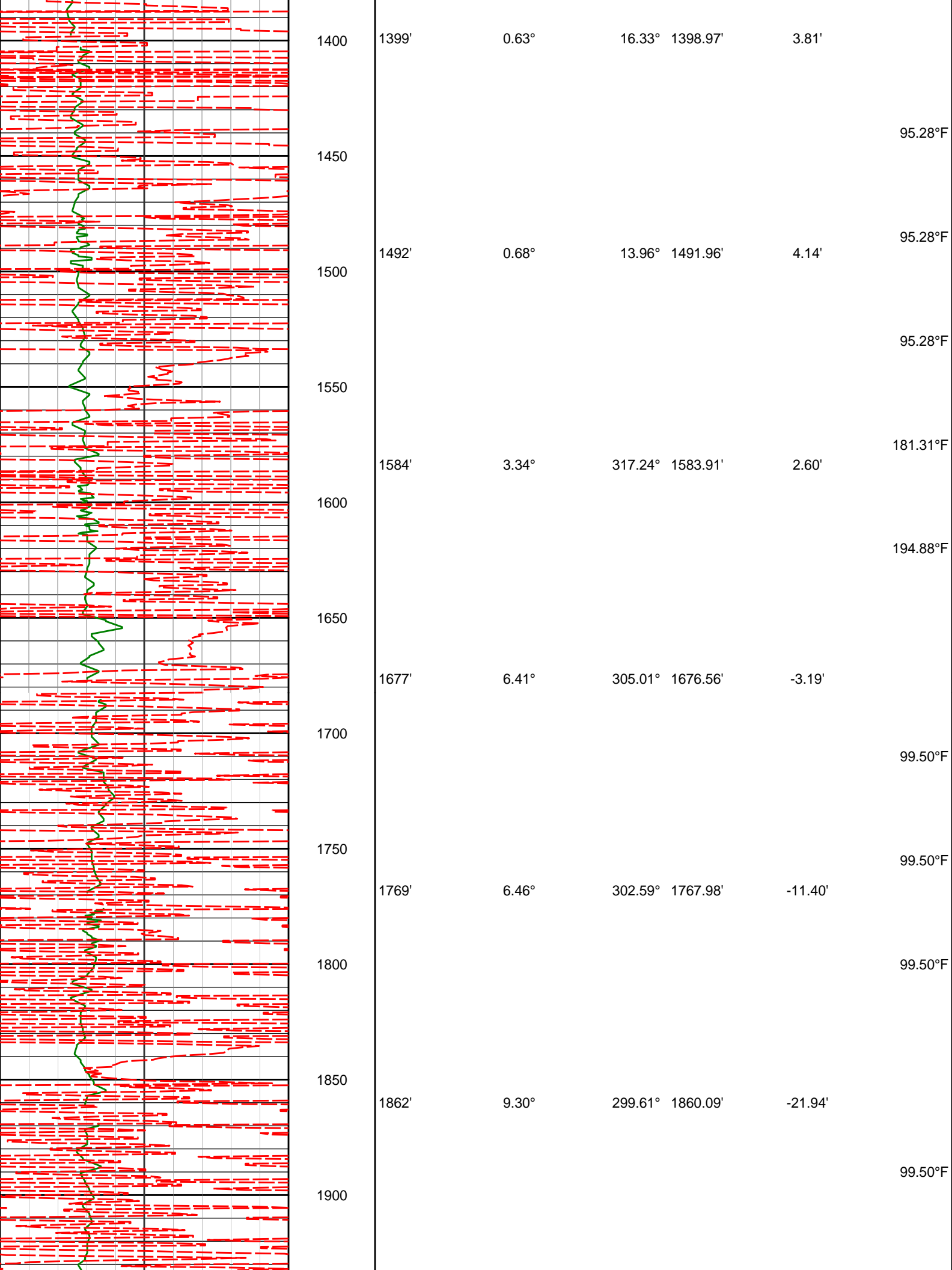
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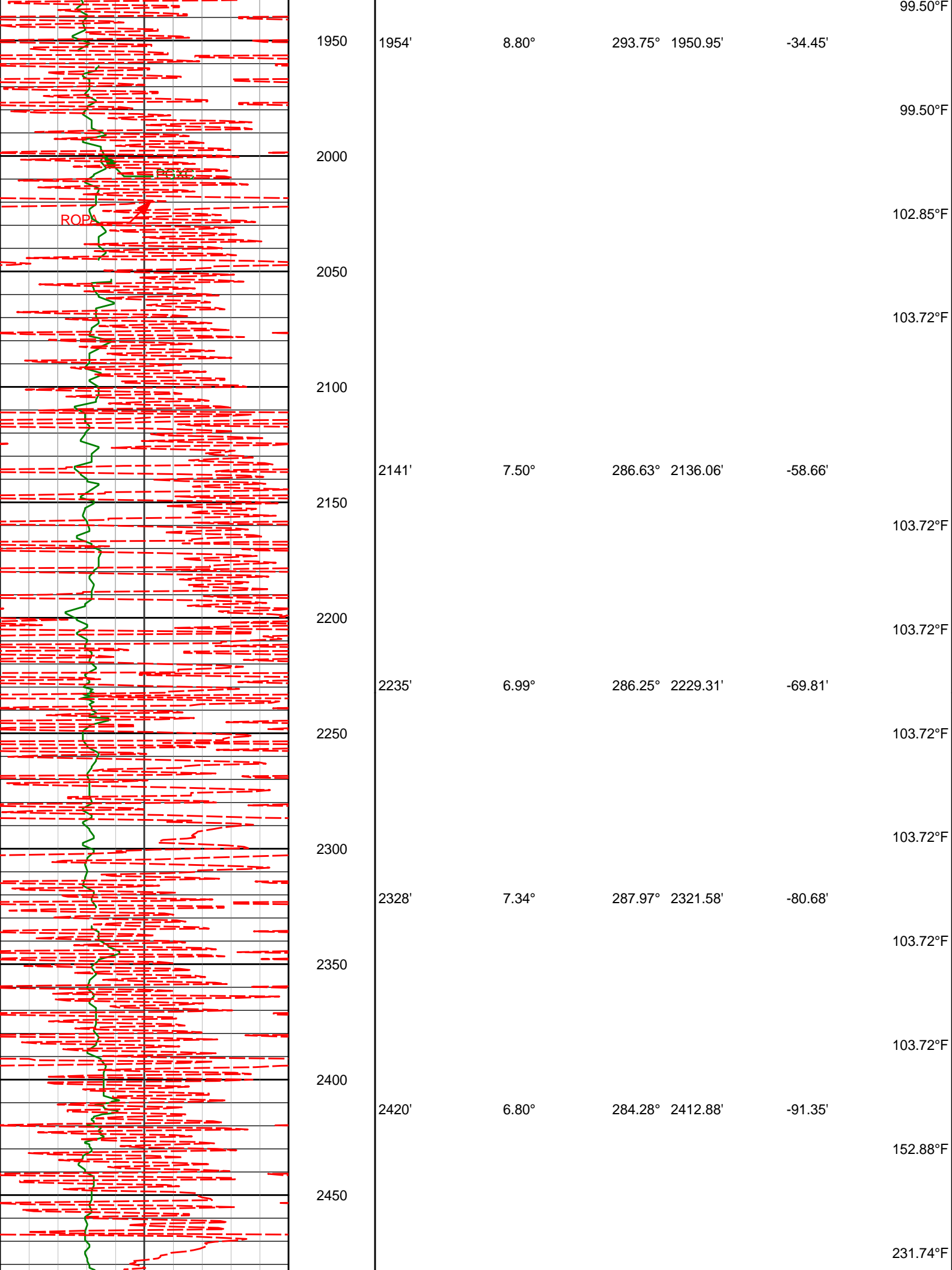
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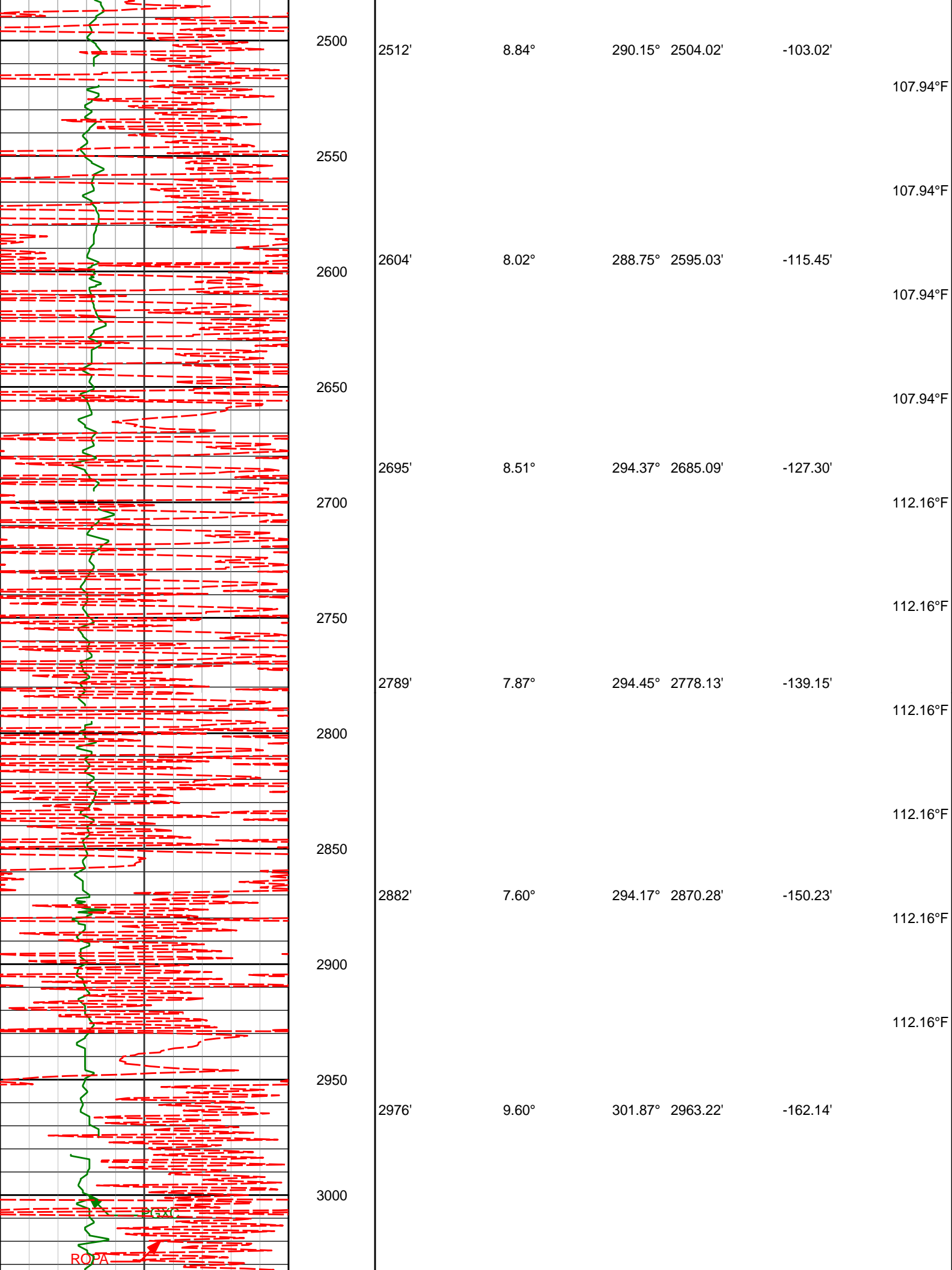
# TVD Detail 1:600 Scale

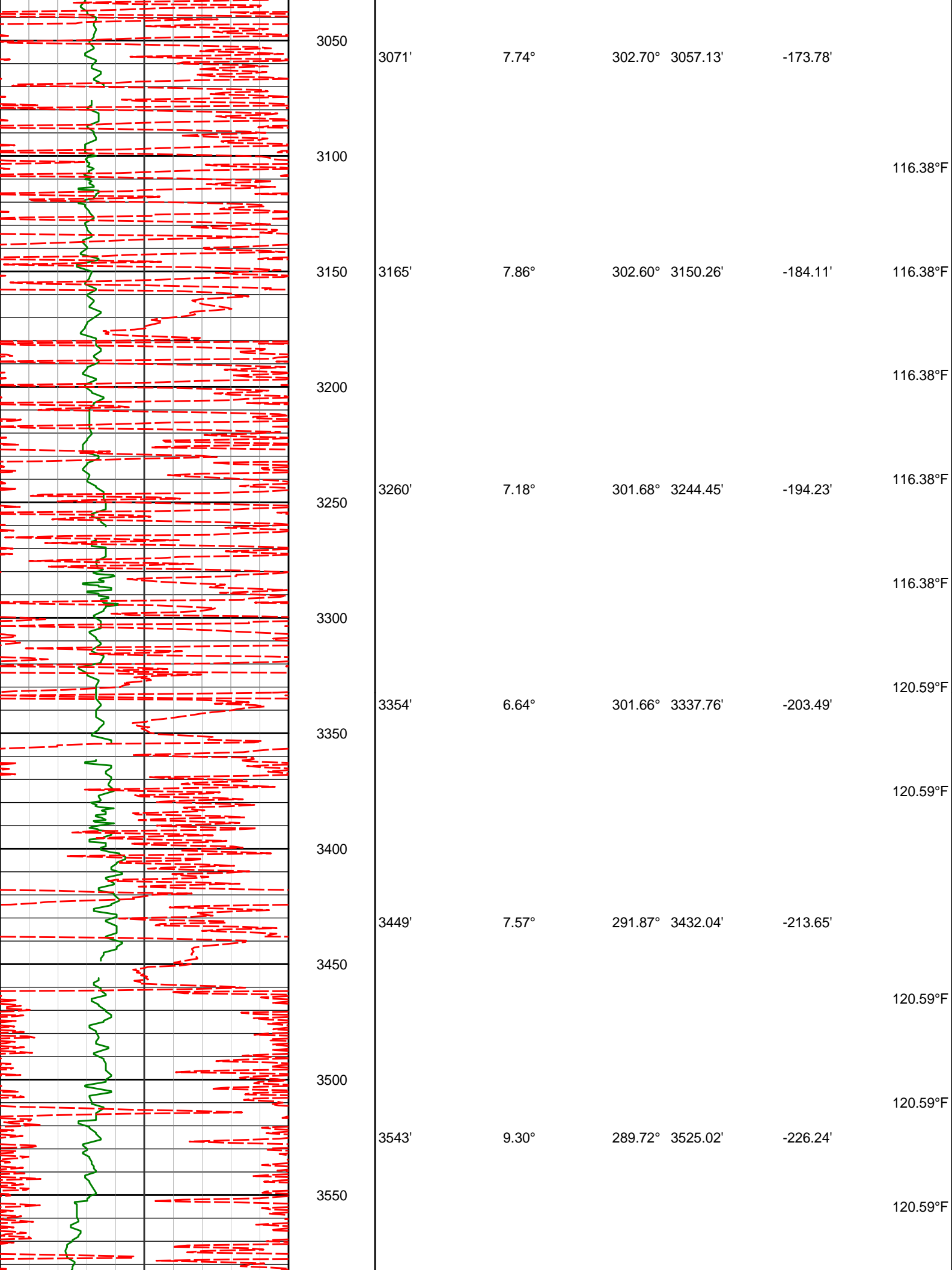




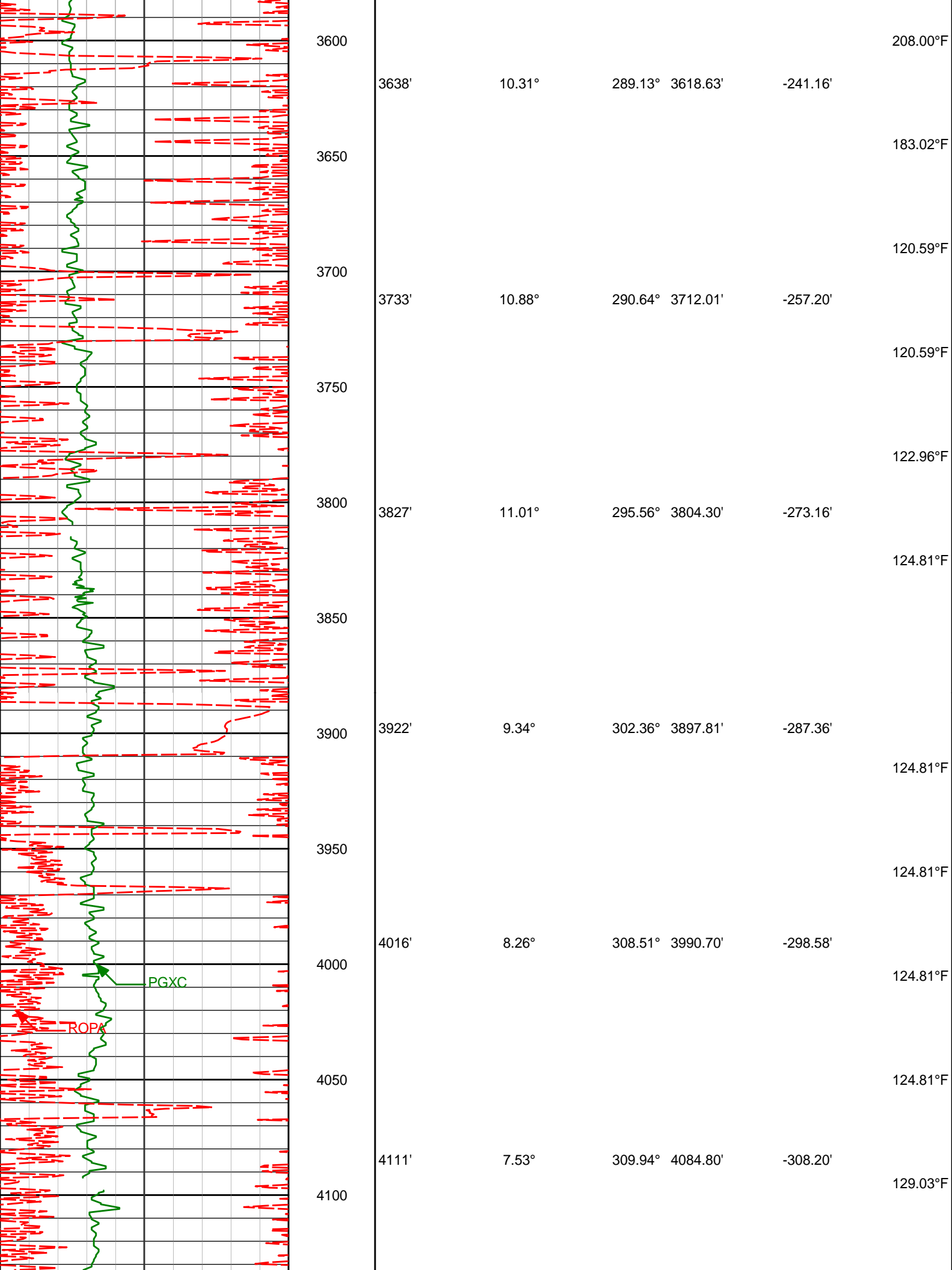


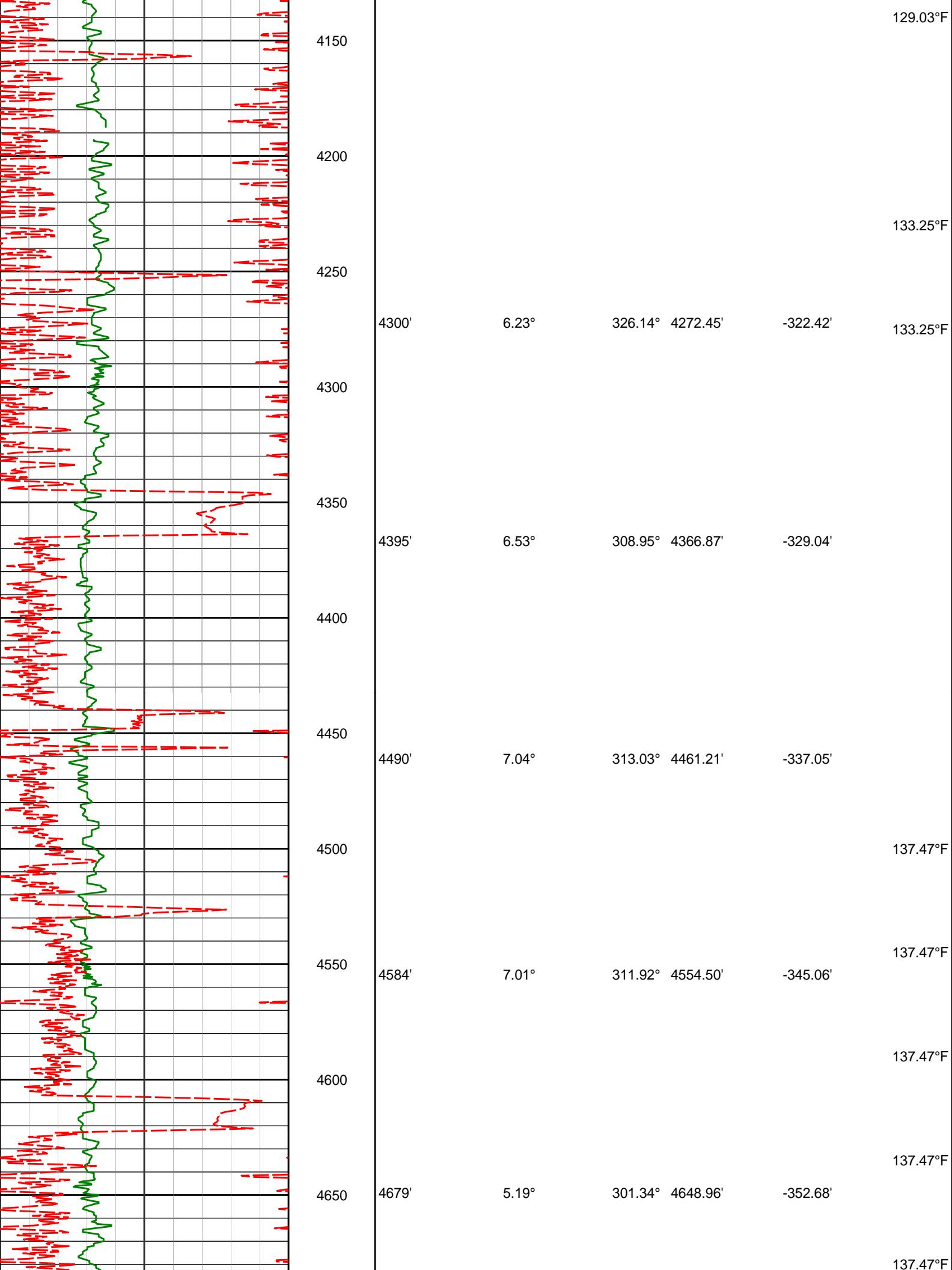


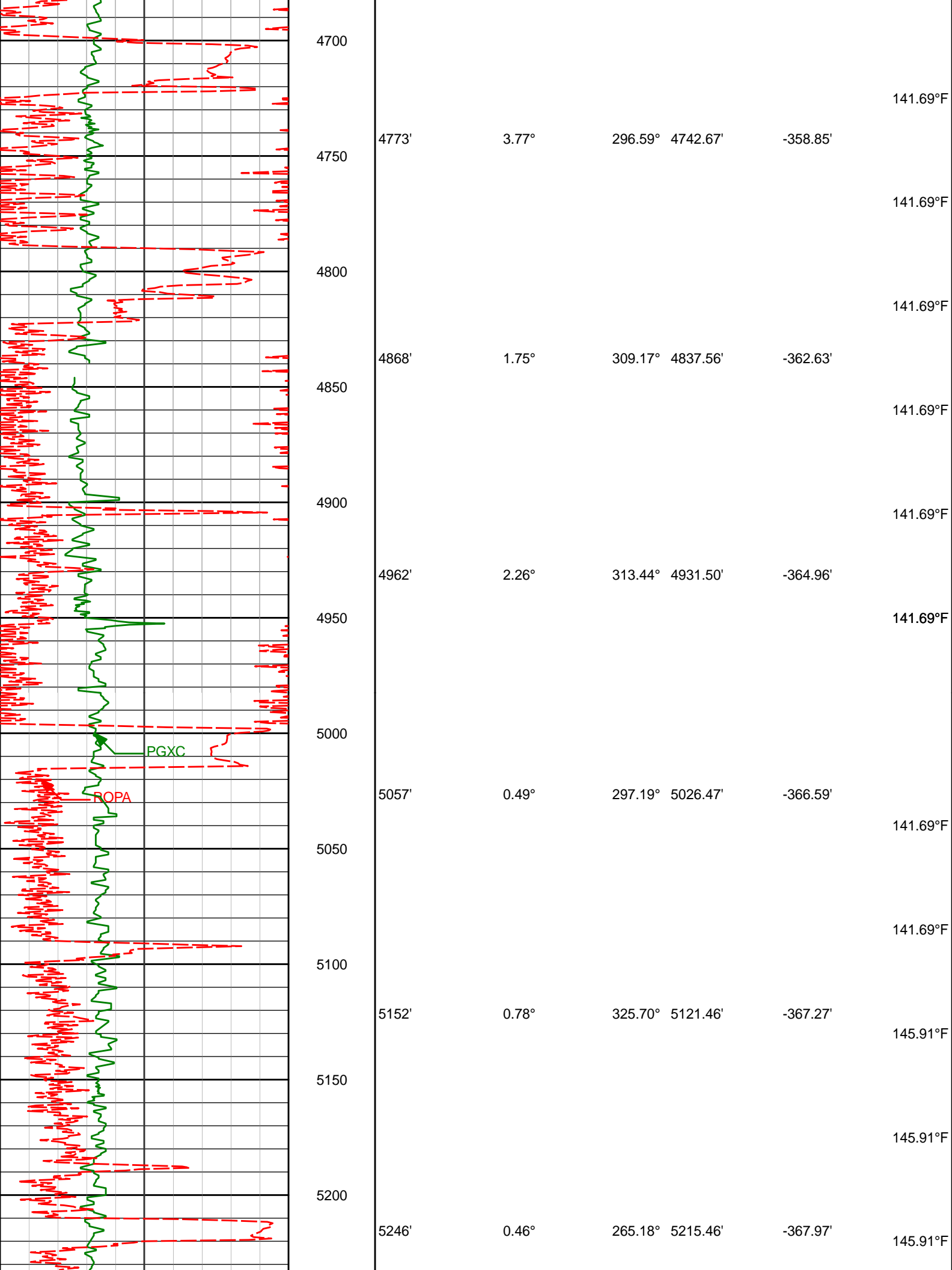


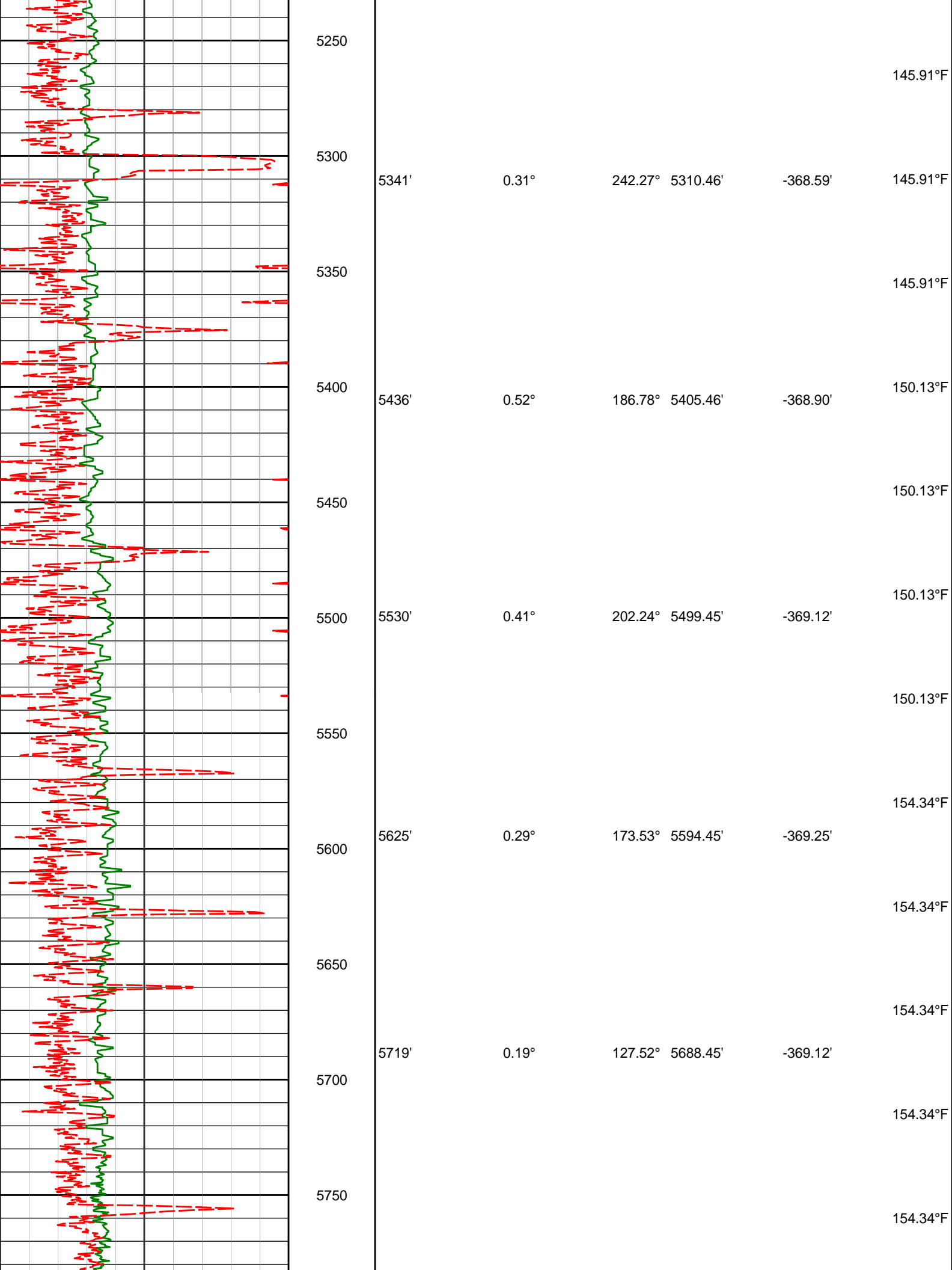


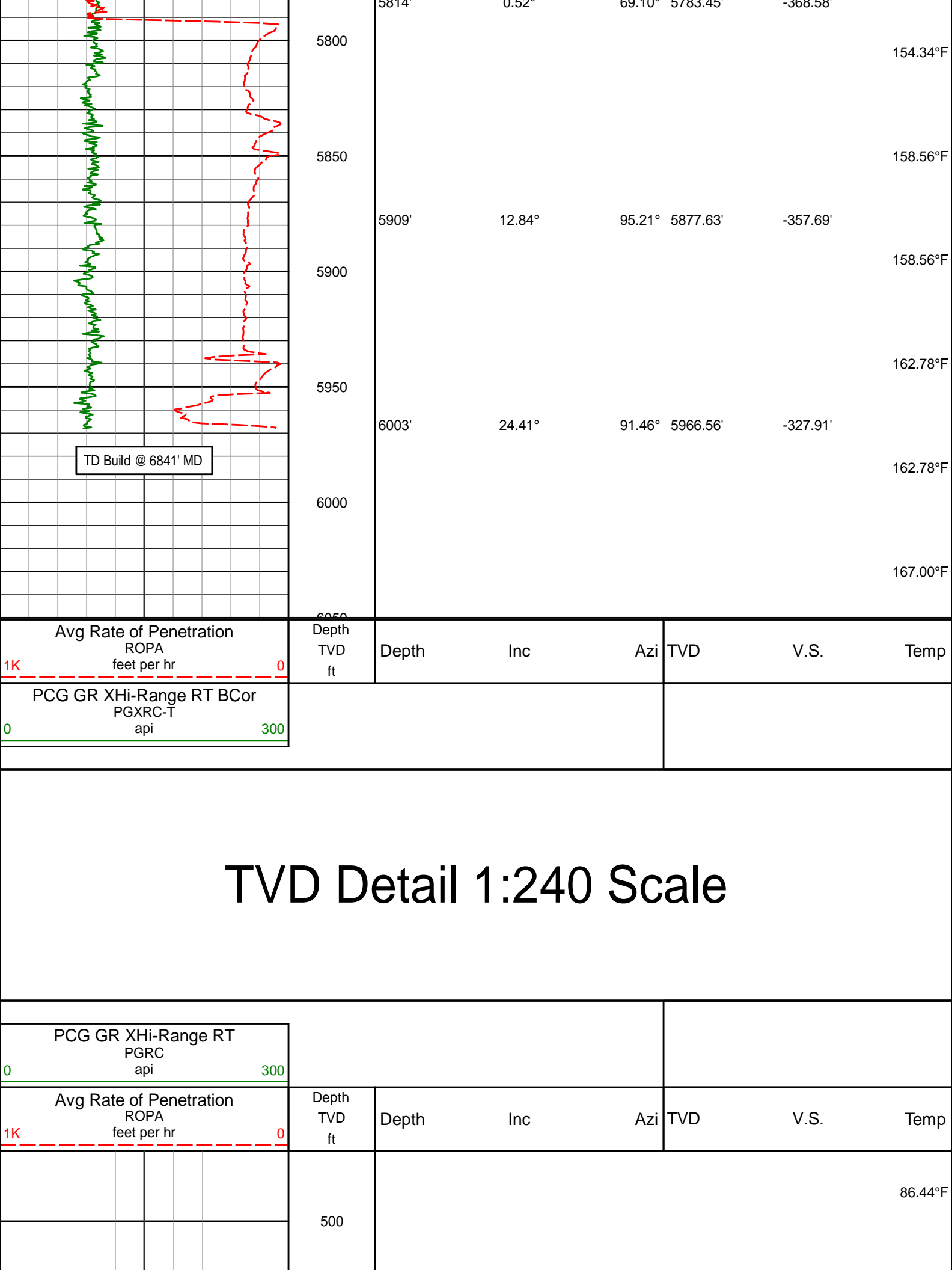










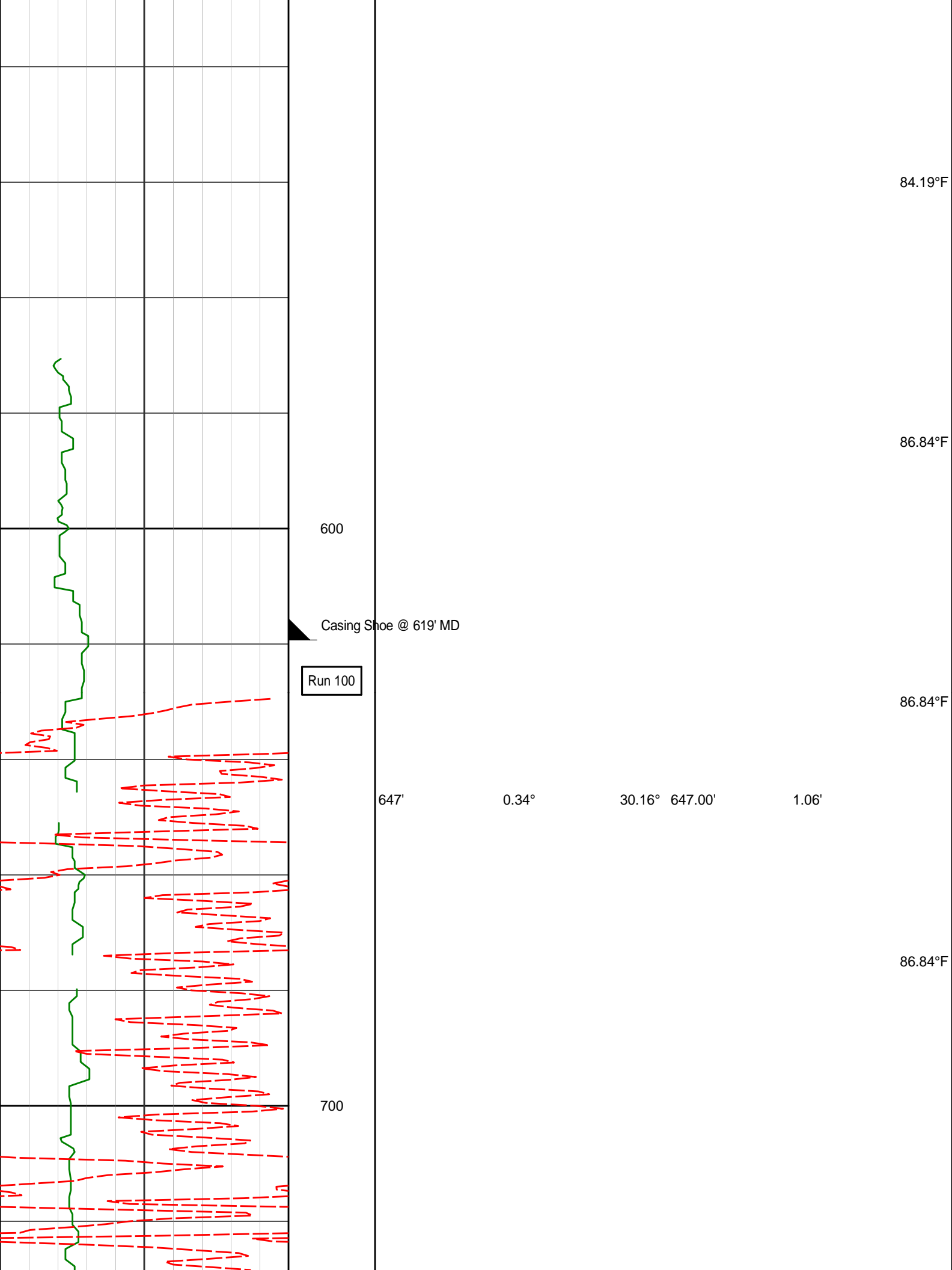


Avg Rate of Penetration ROPA feet per hr		Depth TVD ft	Depth	Inc	Azi	TVD	V.S.	Temp
1K 0								

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

# TVD Detail 1:240 Scale

PCG GR XHi-Range RT PGRC api																																											
0300																																											
Avg Rate of Penetration ROPA feet per hr										Depth TVD ft		Depth				Inc				Azi				TVD				V.S.				Temp											
1K0										500		86.44°F																															



84.19°F

86.84°F

600

Casing Shoe @ 619' MD

Run 100

86.84°F

647'

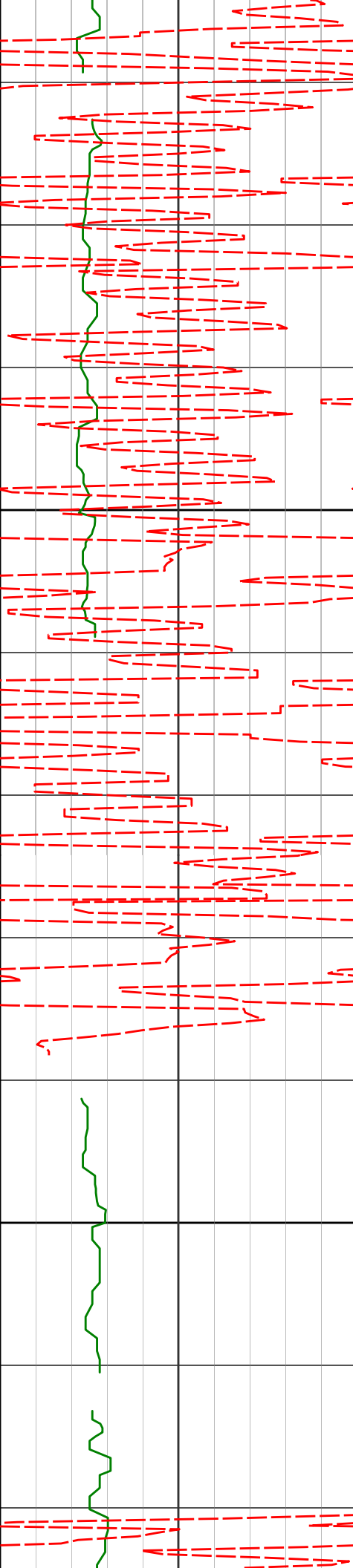
0.34°

30.16° 647.00'

1.06'

86.84°F

700



742'

0.54°

37.43° 741.99'

1.51'

86.84°F

800

86.84°F

837'

0.43°

34.55° 836.99'

2.02'

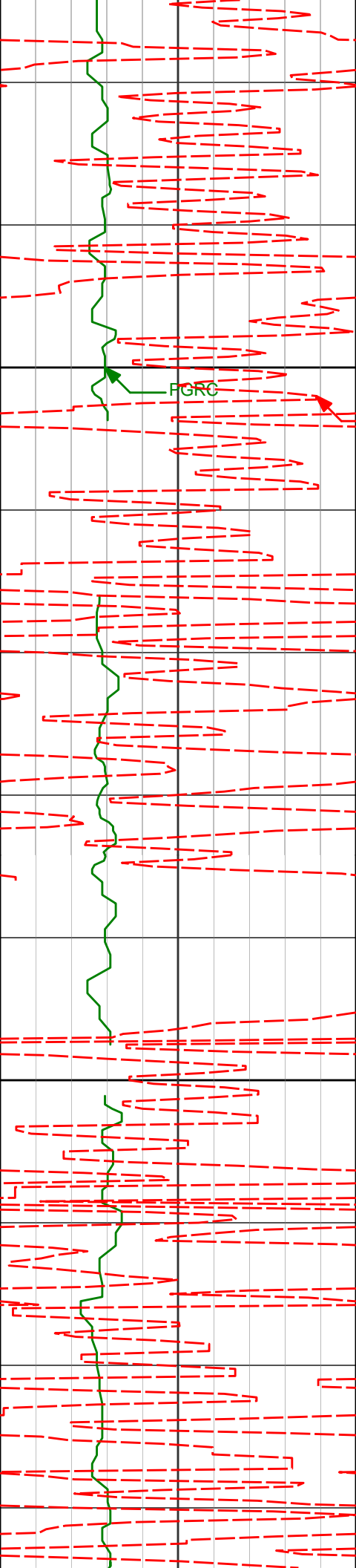
900

931'

0.44°

31.70° 930.99'

2.44'



1000

FORC

ROPA

1026'

0.32°

33.66° 1025.99'

2.81'

91.06°F

1100

1119'

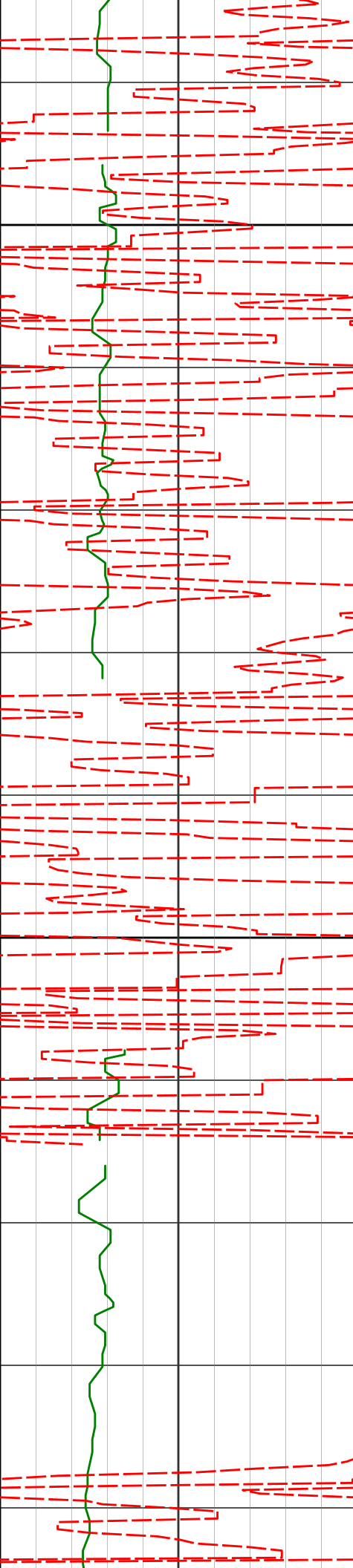
0.39°

6.81° 1118.98'

3.02'

91.06°F





1200

1213'

0.50°

18.98°

1212.98'

3.24'

91.06°F

1300

1305'

0.60°

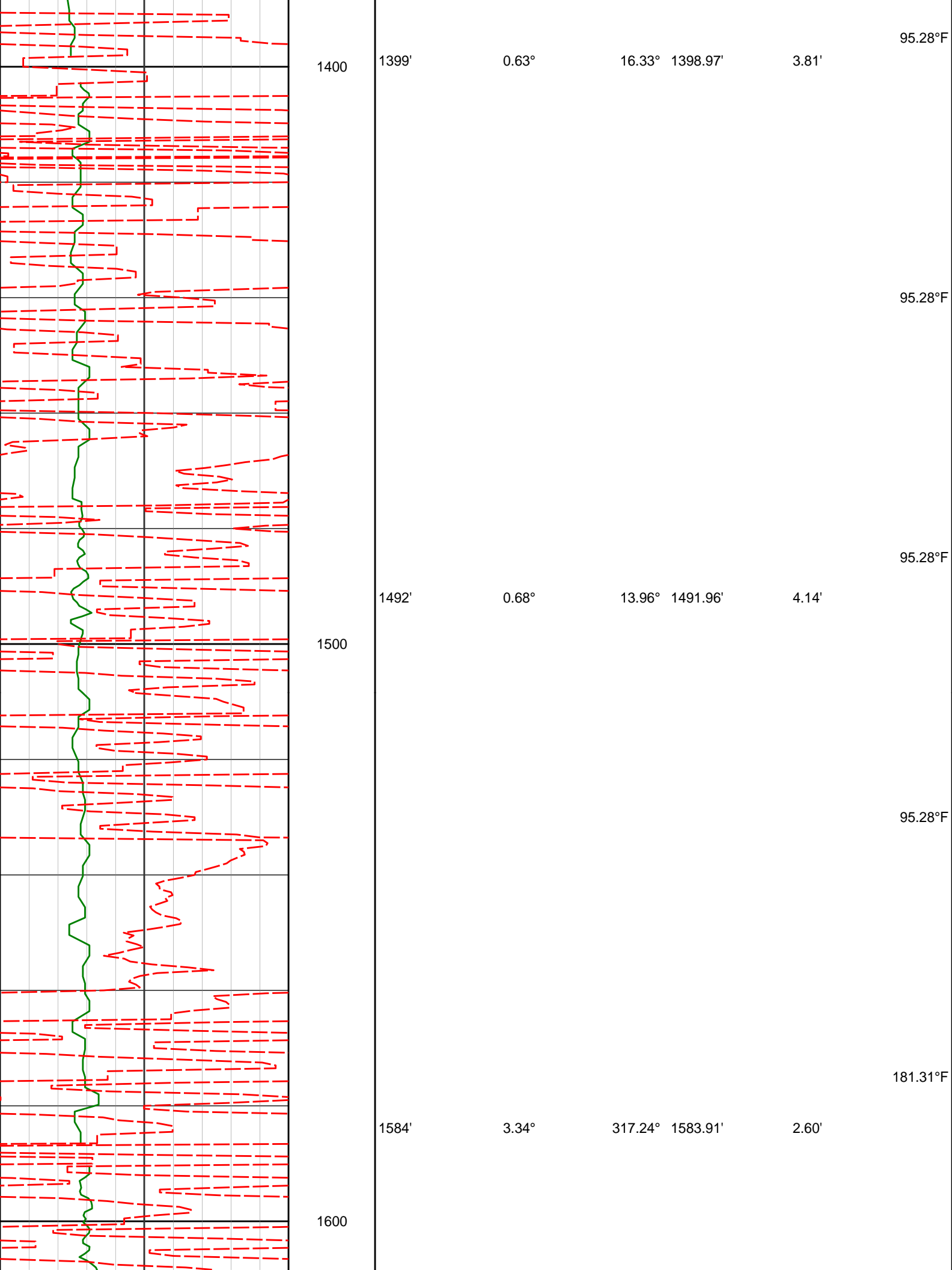
11.41°

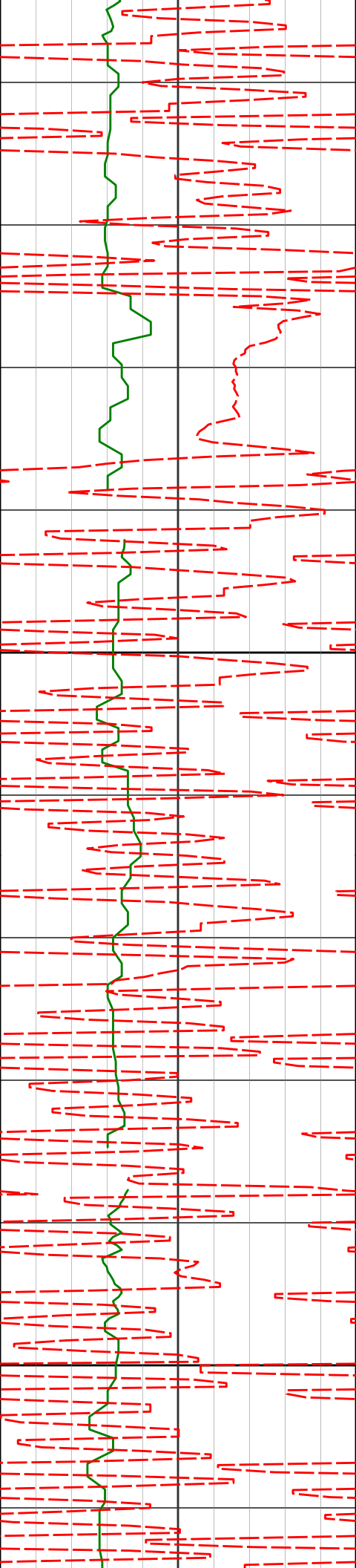
1304.98'

3.51'

91.06°F

91.06°F





1700

1800

1677'

6.41°

305.01°

1676.56'

-3.19'

1769'

6.46°

302.59°

1767.98'

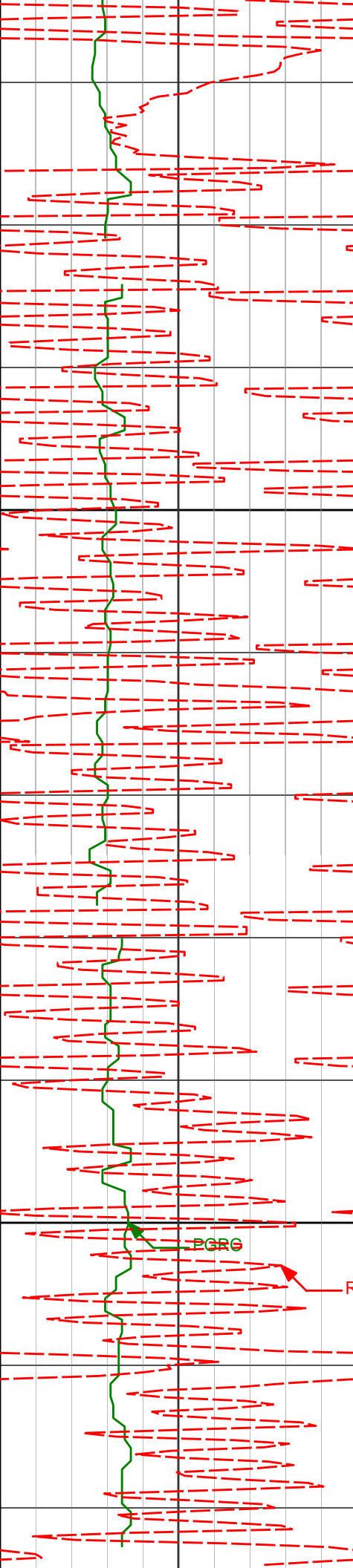
-11.40'

194.88°F

99.50°F

99.50°F

99.50°F



1900

2000

PGRG

ROPA

1862'

9.30°

299.61°

1860.09'

-21.94'

99.50°F

99.50°F

1954'

8.80°

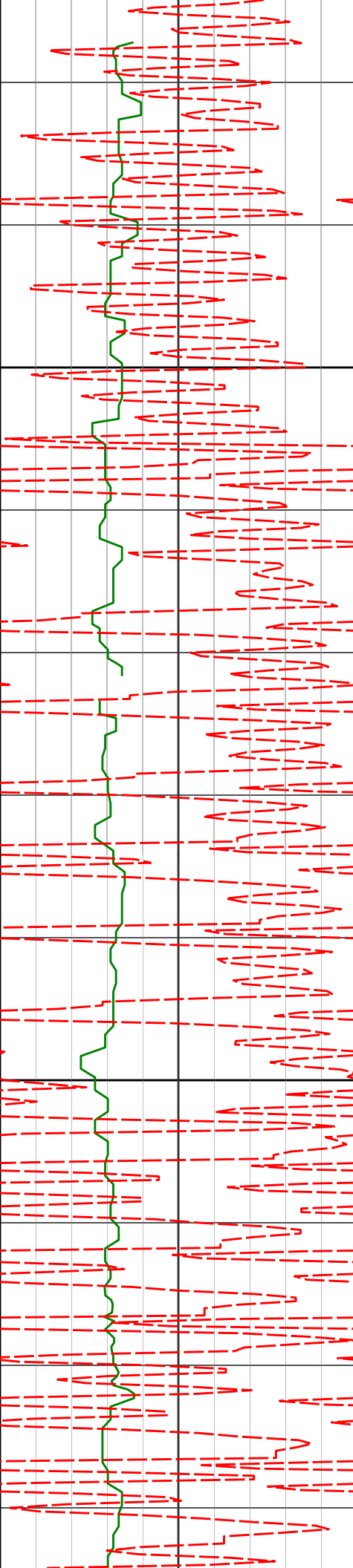
293.75°

1950.95'

-34.45'

99.50°F

102.85°F



2100

2141'

7.50°

286.63° 2136.06'

-58.66'

2200

2235'

6.99°

286.25° 2229.31'

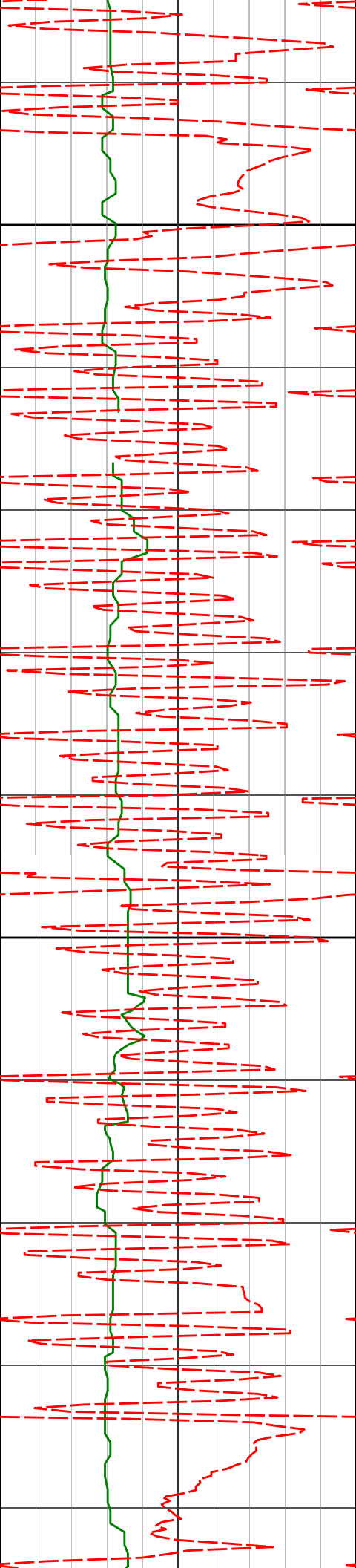
-69.81'

103.72°F

103.72°F

103.72°F

103.72°F



2300

2328'

7.34°

287.97°

2321.58'

-80.68'

103.72°F

103.72°F

103.72°F

2400

2420'

6.80°

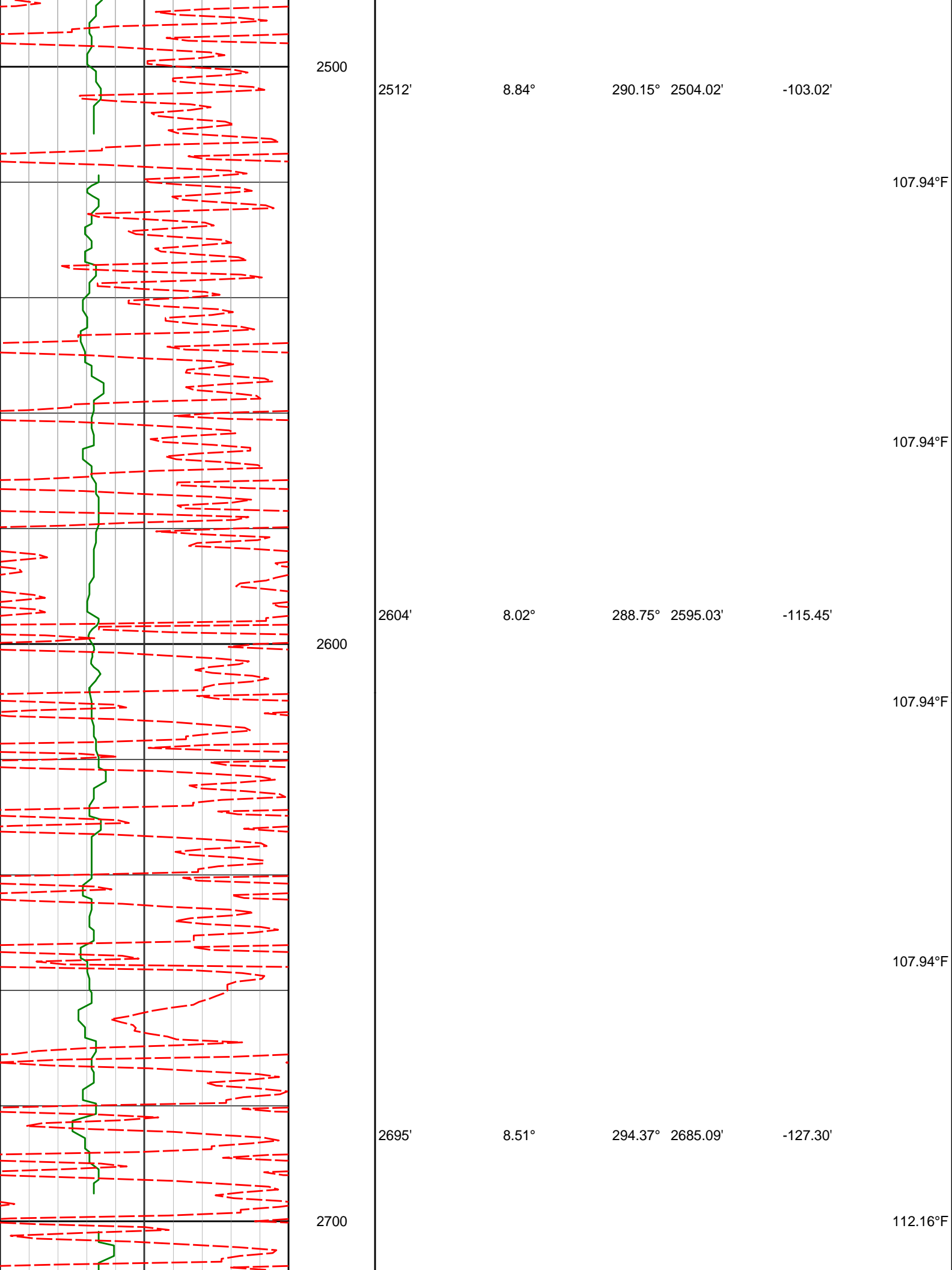
284.28°

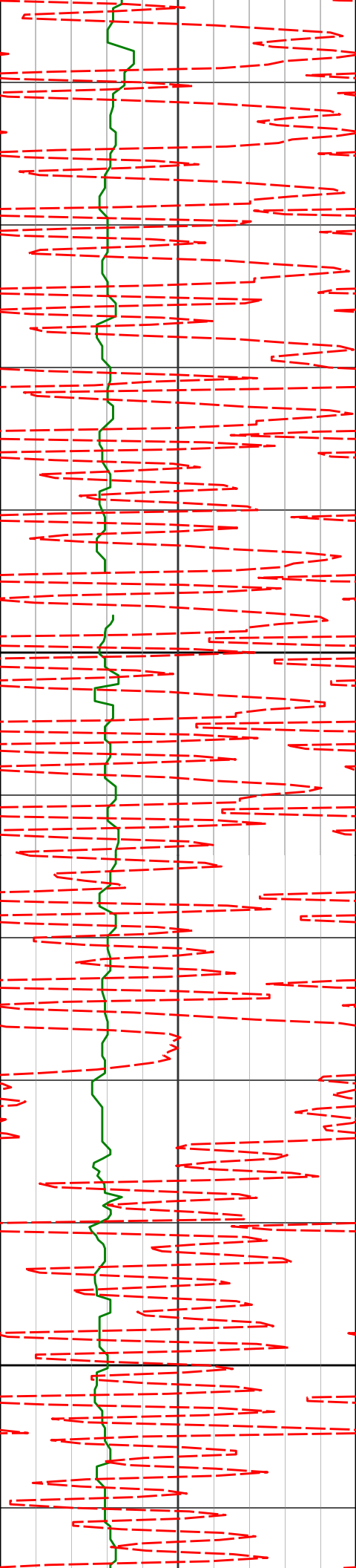
2412.88'

-91.35'

152.88°F

231.74°F





2800

2900

2789'

7.87°

294.45° 2778.13'

-139.15'

2882'

7.60°

294.17° 2870.28'

-150.23'

112.16°F

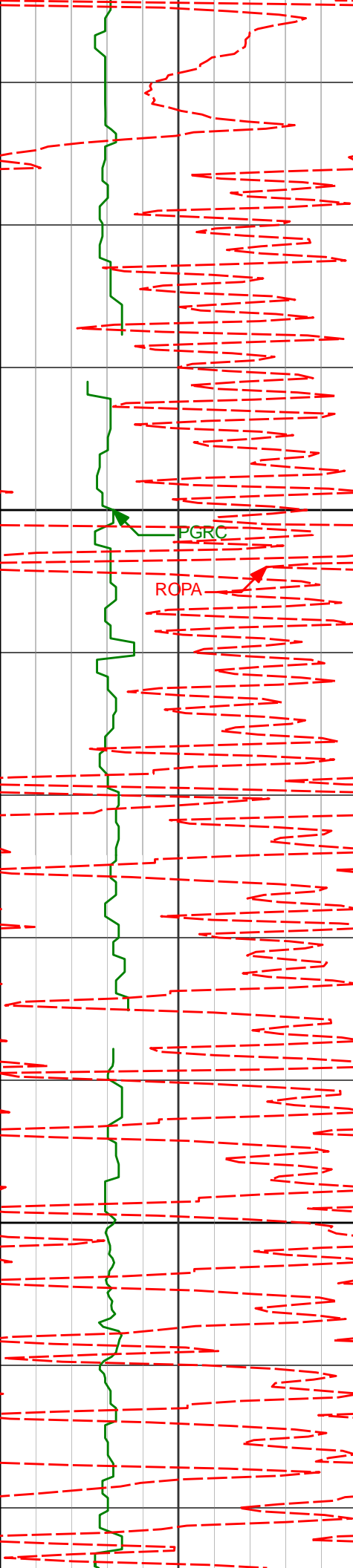
112.16°F

112.16°F

112.16°F

112.16°F





3000

2976'

9.60°

301.87° 2963.22'

-162.14'

3071'

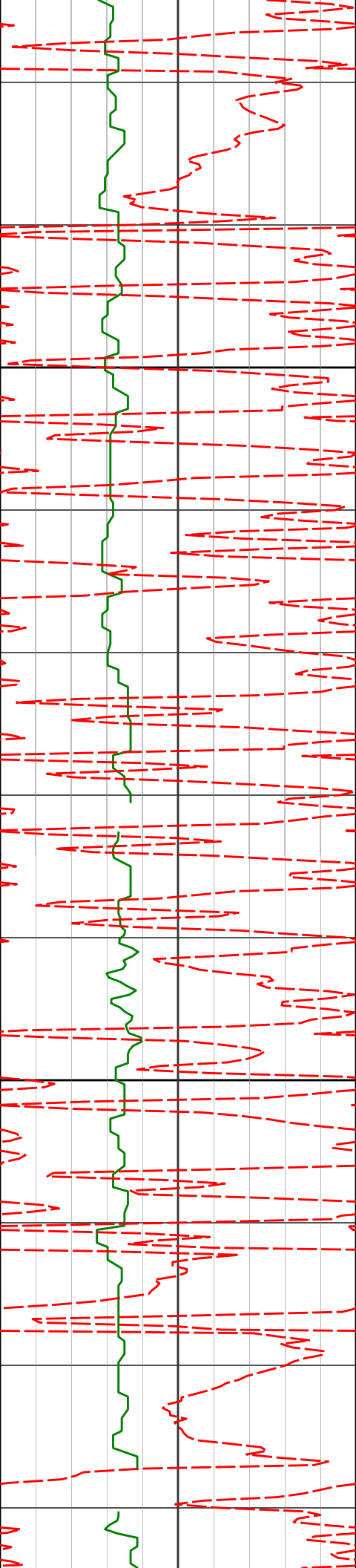
7.74°

302.70° 3057.13'

-173.78'

3100

116.38°F



3200

3300

3165'

3260'

3354'

7.86°

7.18°

6.64°

302.60°

301.68°

301.66°

3150.26'

3244.45'

3337.76'

-184.11'

-194.23'

-203.49'

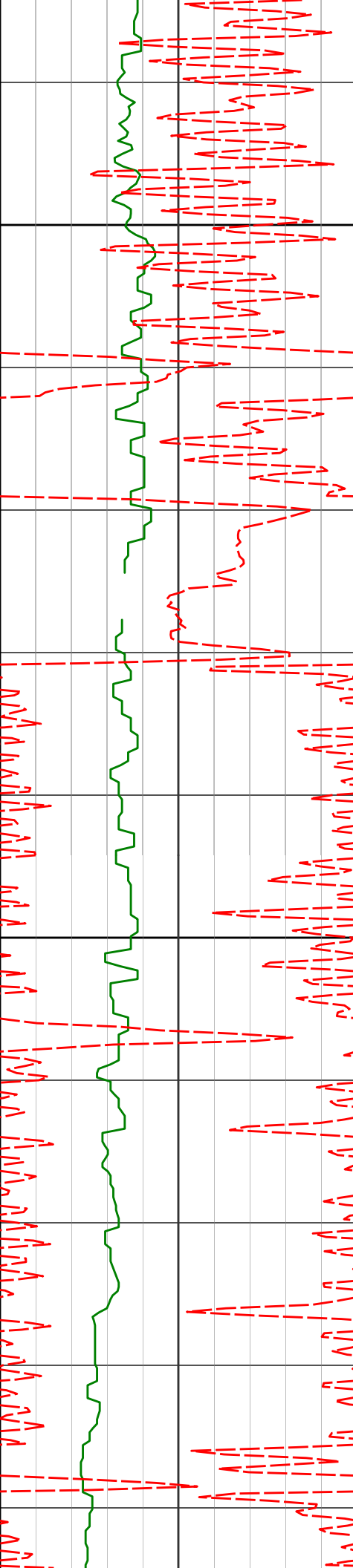
116.38°F

116.38°F

116.38°F

116.38°F

120.59°F



3400

3449'

7.57°

291.87°

3432.04'

-213.65'

120.59°F

120.59°F

3500

3543'

9.30°

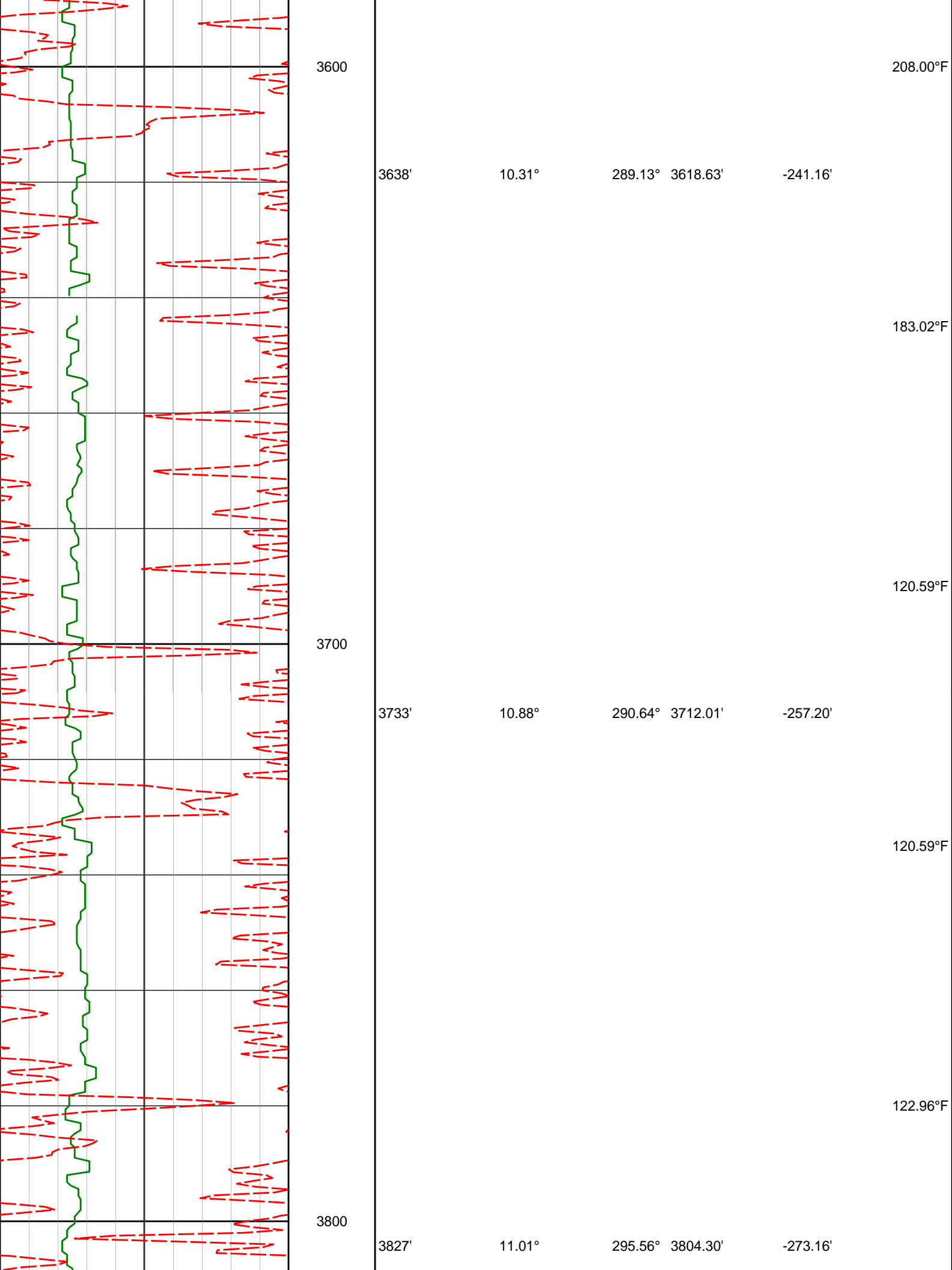
289.72°

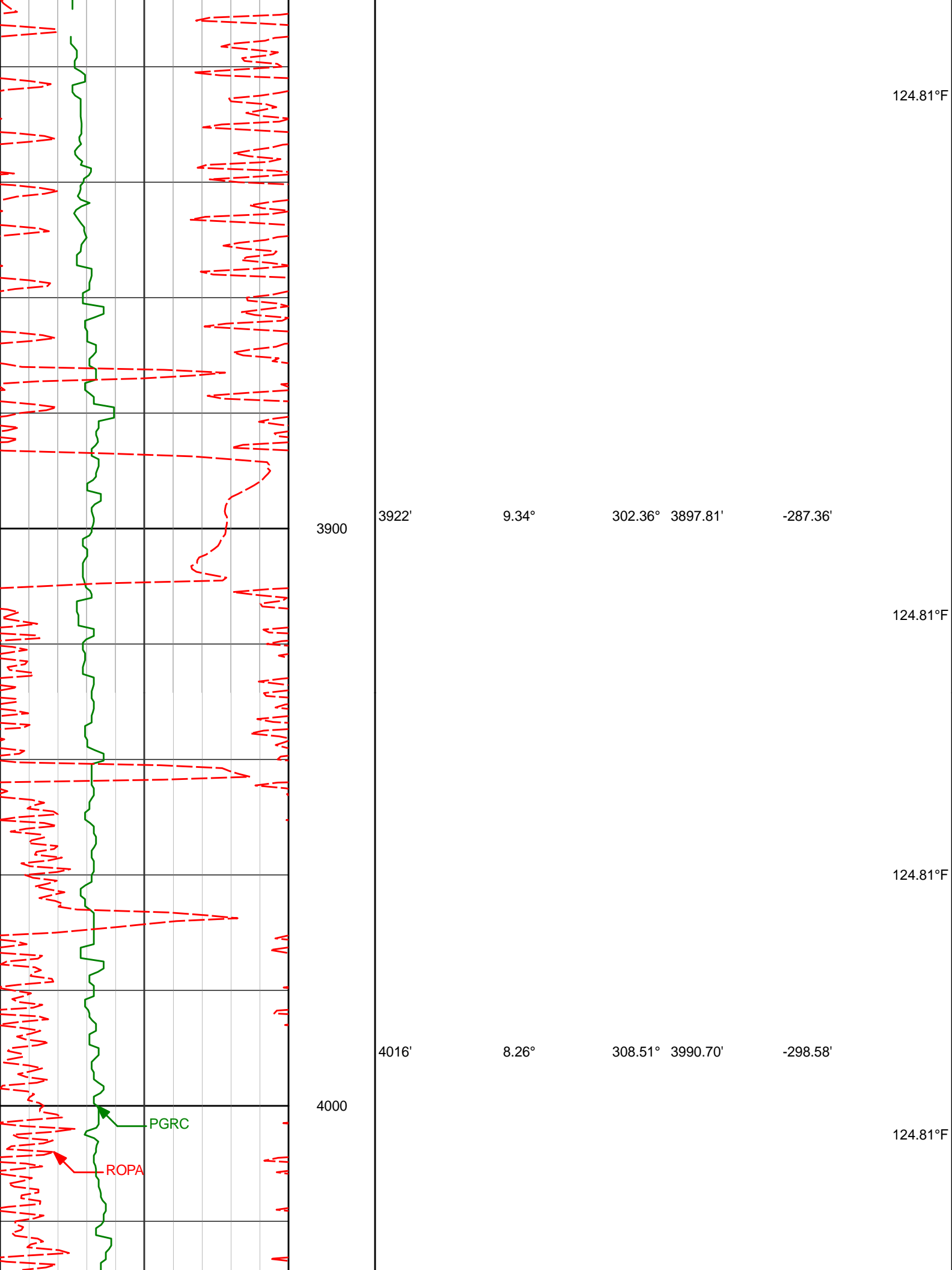
3525.02'

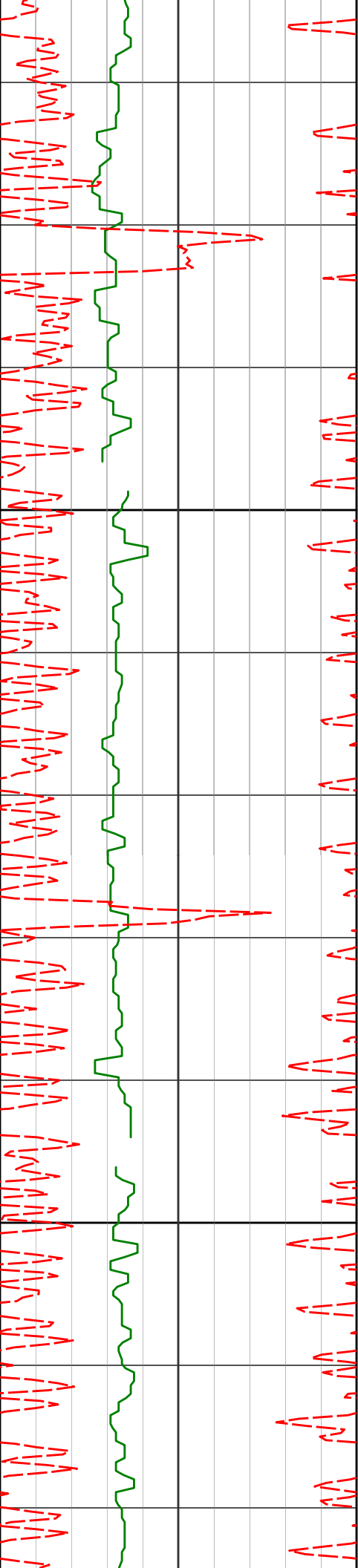
-226.24'

120.59°F

120.59°F







4100

4200

4111'

7.53°

309.94° 4084.80'

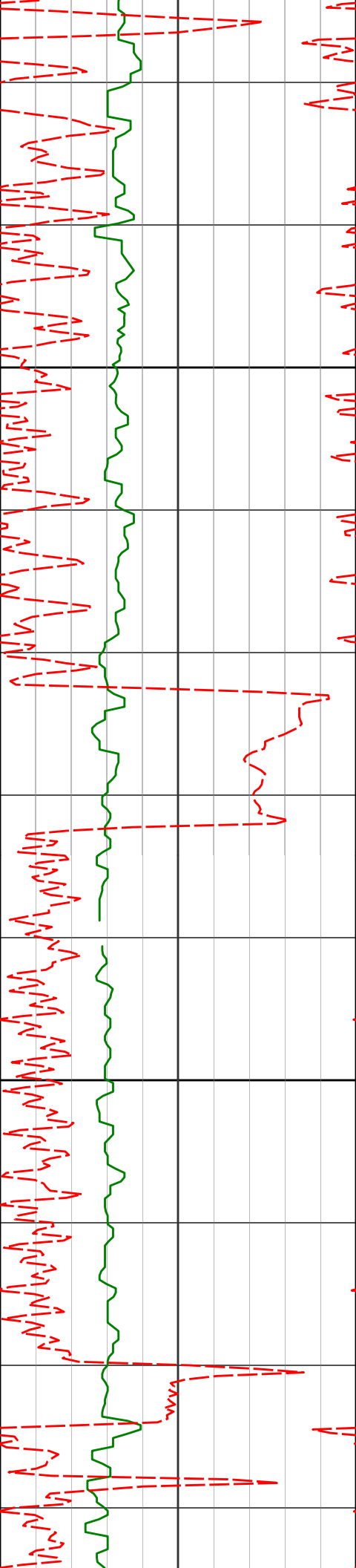
-308.20'

124.81°F

129.03°F

129.03°F

133.25°F



4300

4400

4300'

6.23°

326.14° 4272.45'

-322.42'

133.25°F

4395'

6.53°

308.95° 4366.87'

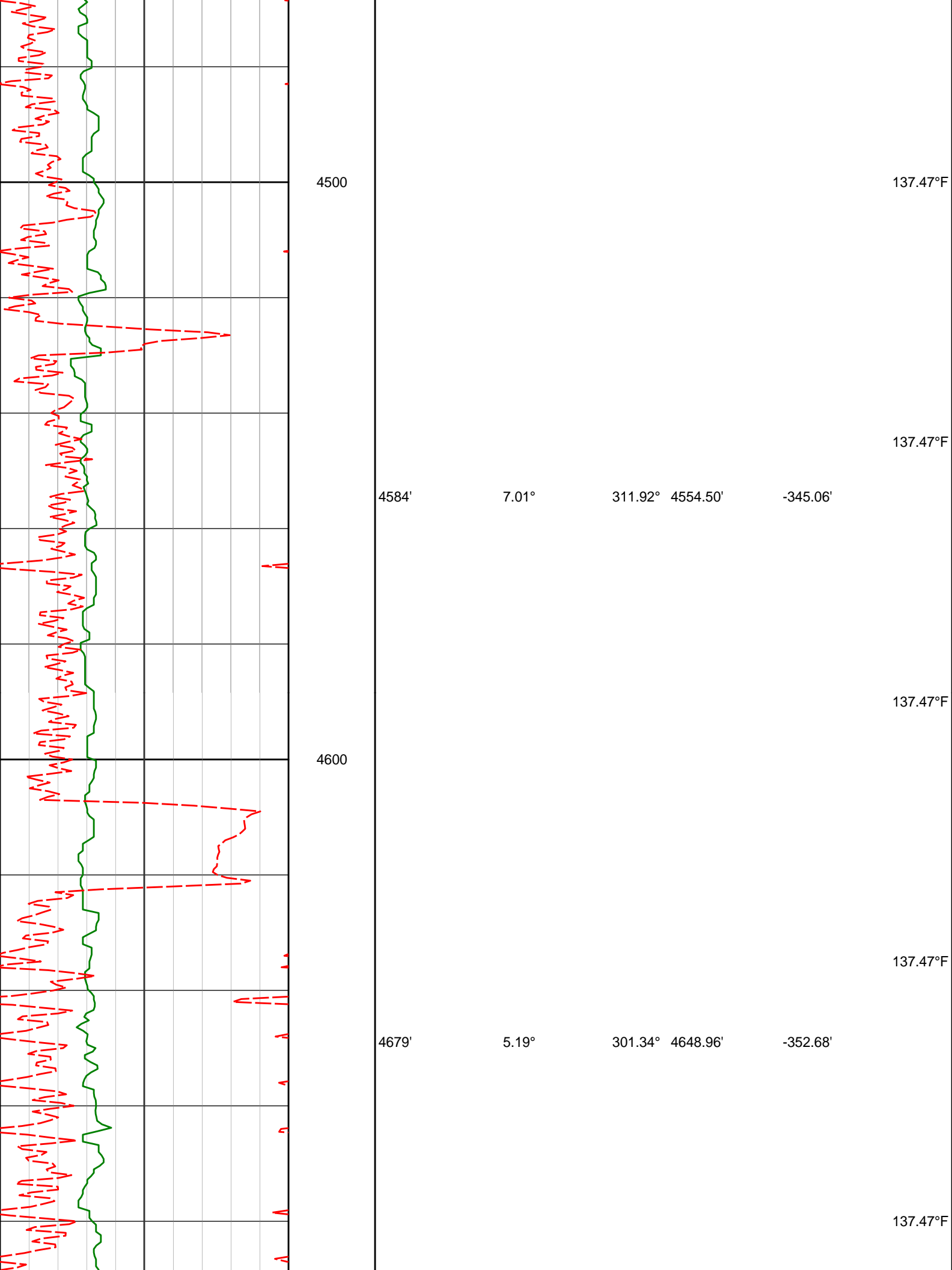
-329.04'

4490'

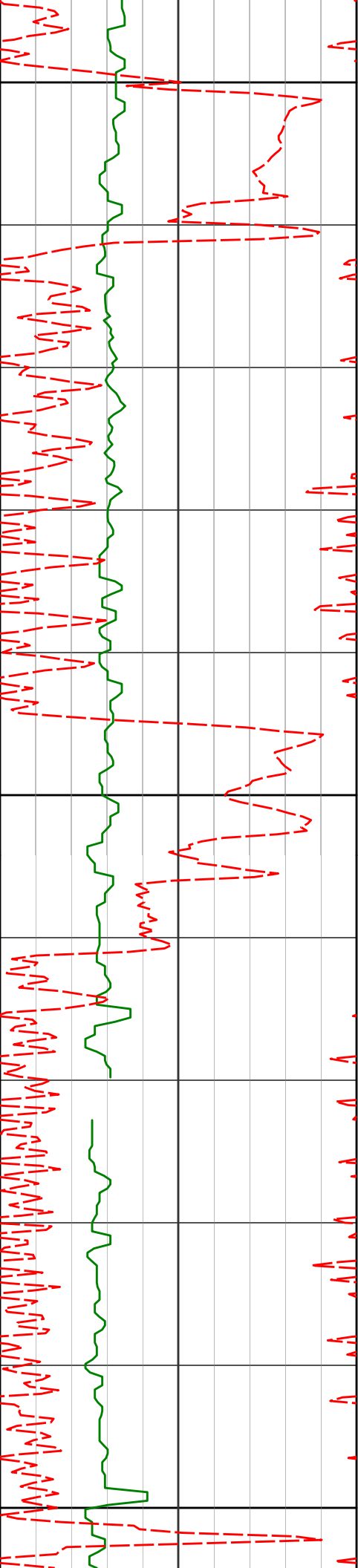
7.04°

313.03° 4461.21'

-337.05'







4700

141.69°F

4773'

3.77°

296.59°

4742.67'

-358.85'

141.69°F

4800

141.69°F

4868'

1.75°

309.17°

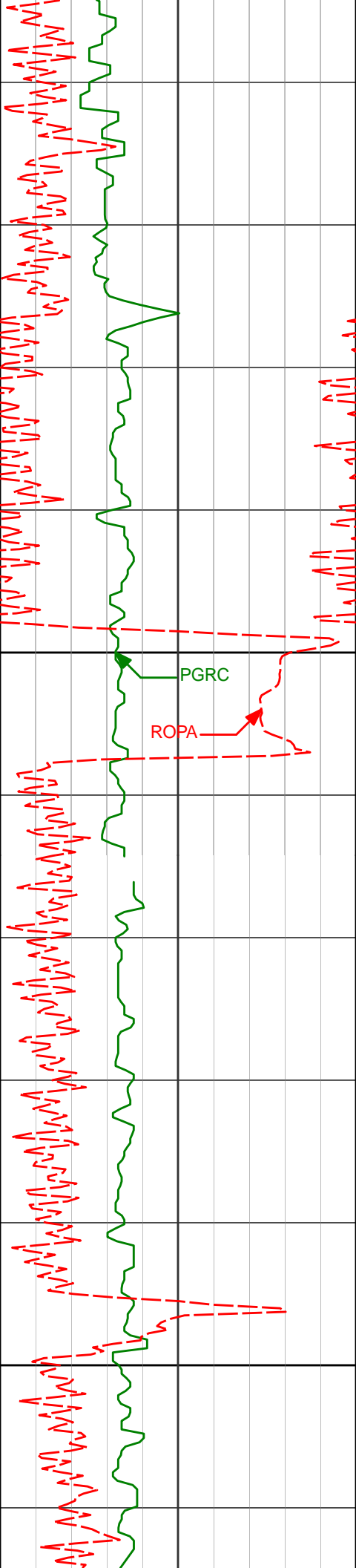
4837.56'

-362.63'

141.69°F

4900

141.69°F



5000

5100

4962'

2.26°

313.44° 4931.50'

-364.96'

141.69°F

5057'

0.49°

297.19° 5026.47'

-366.59'

141.69°F

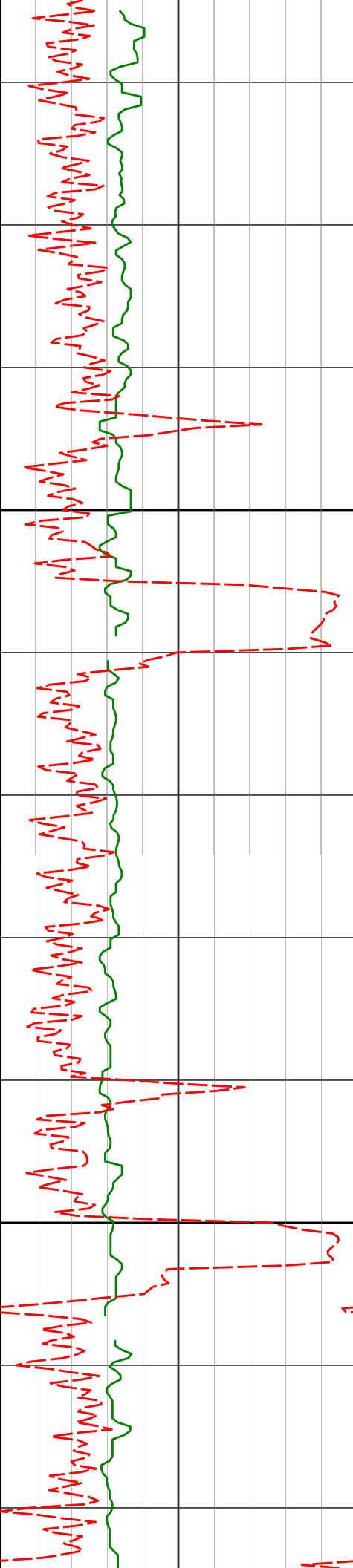
5152'

0.78°

325.70° 5121.46'

-367.27'

141.69°F



5200

5300

5246'

5341'

0.46°

0.31°

265.18°

242.27°

5215.46'

5310.46'

-367.97'

-368.59'

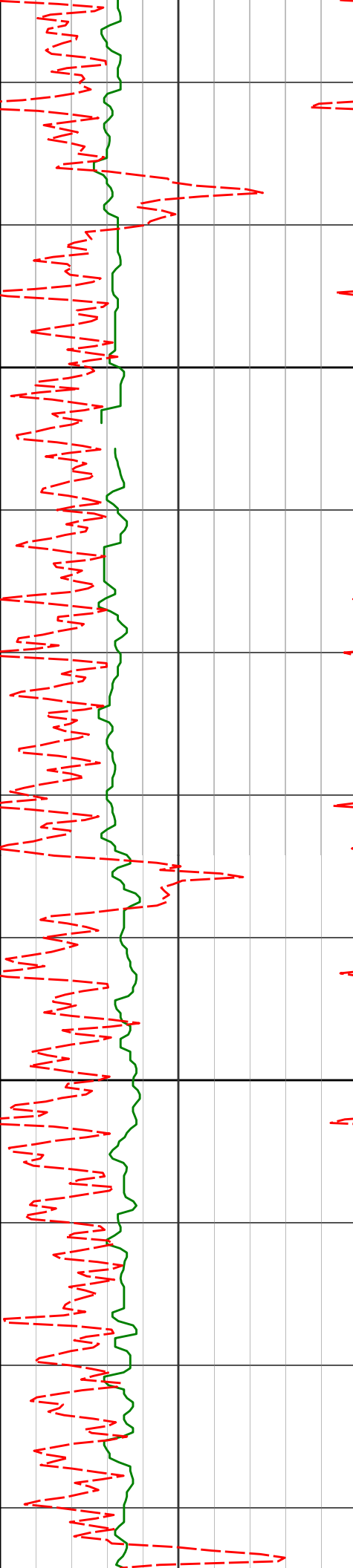
145.91°F

145.91°F

145.91°F

145.91°F

145.91°F



5400

5500

5436'

5530'

0.52°

0.41°

186.78°

202.24°

5405.46'

5499.45'

-368.90'

-369.12'

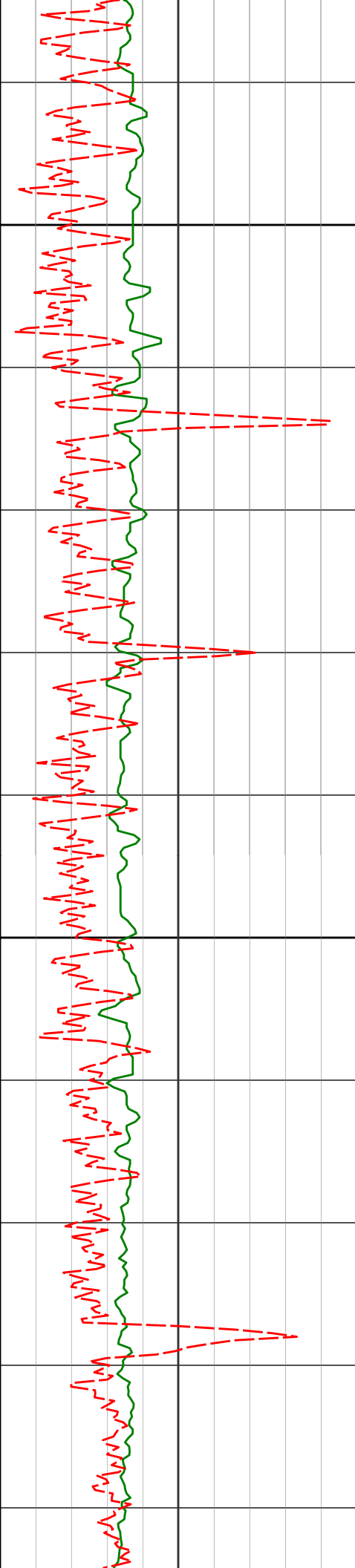
145.91°F

150.13°F

150.13°F

150.13°F

150.13°F



5600

5700

5625'

0.29°

173.53° 5594.45'

-369.25'

5719'

0.19°

127.52° 5666.45'

-369.12'

5814'

0.52°

69.10° 5783.45'

-368.58'

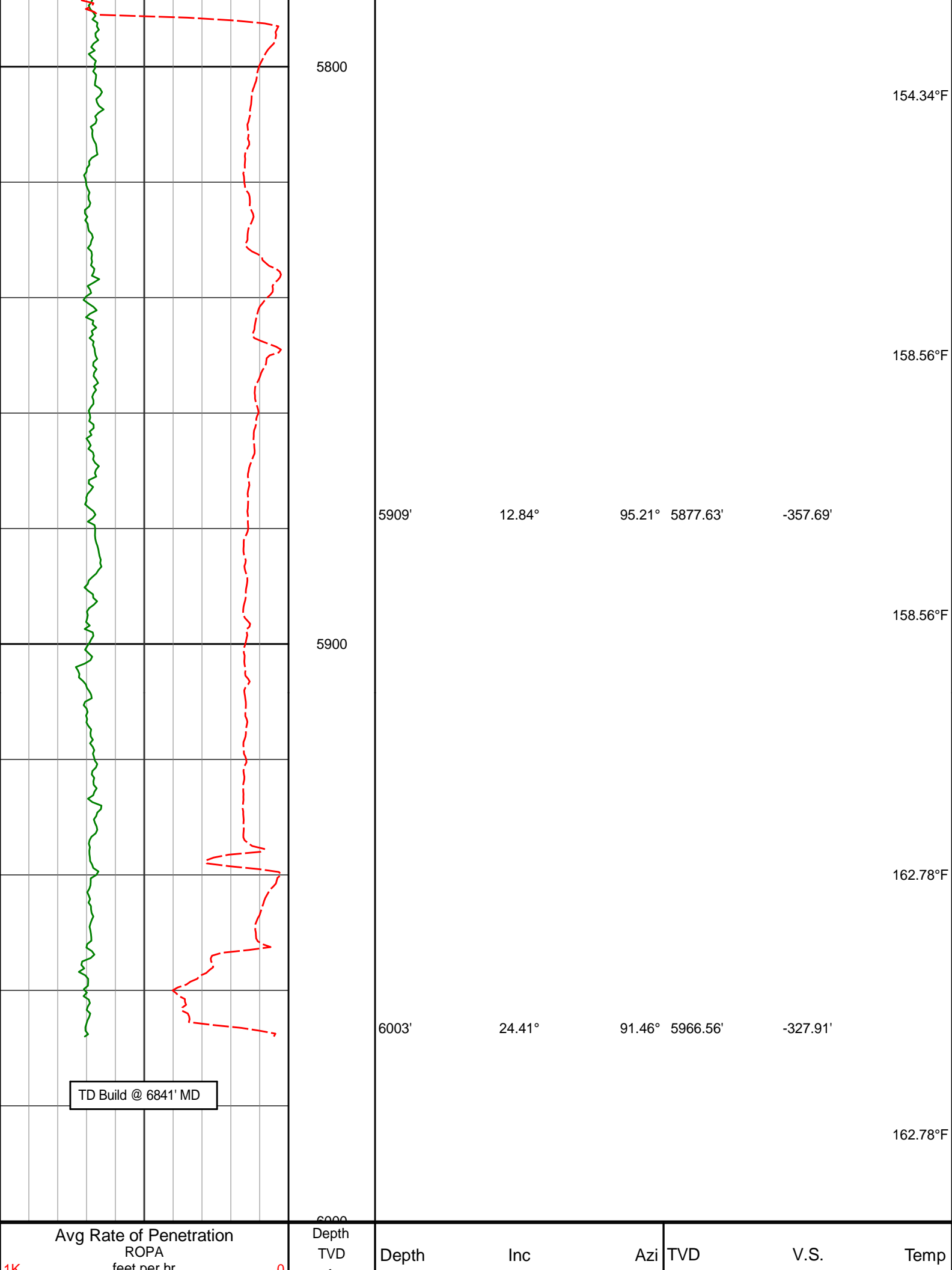
154.34°F

154.34°F

154.34°F

154.34°F

154.34°F



ft		
PCG GR XHi-Range RT PGRC api	300	

HALLIBURTON

DIRECTIONAL SURVEY REPORT

Noble Energy  
Wells Ranch AE32-645  
Wattenburg  
Weld Colorado  
USA  
CA-XX-0902674376

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
647.00	0.34	30.16	647.00	1.65 N	0.96 E	1.06	0.05
742.00	0.54	37.43	741.99	2.25 N	1.38 E	1.51	0.22
837.00	0.43	34.55	836.99	2.91 N	1.85 E	2.02	0.12
931.00	0.44	31.70	930.99	3.51 N	2.24 E	2.44	0.02
1026.00	0.32	33.66	1025.99	4.03 N	2.58 E	2.81	0.13
1119.00	0.39	6.81	1118.98	4.57 N	2.76 E	3.02	0.20
1213.00	0.50	18.98	1212.98	5.27 N	2.93 E	3.24	0.15
1305.00	0.60	11.41	1304.98	6.12 N	3.16 E	3.51	0.14
1399.00	0.63	16.33	1398.97	7.10 N	3.40 E	3.81	0.07
1492.00	0.68	13.96	1491.96	8.12 N	3.68 E	4.14	0.06
1584.00	3.34	317.24	1583.91	10.61 N	1.99 E	2.60	3.28
1677.00	6.41	305.01	1676.56	15.58 N	4.10 W	-3.19	3.47
1769.00	6.46	302.59	1767.98	21.32 N	12.67 W	-11.40	0.30
1862.00	9.30	299.61	1860.09	27.85 N	23.61 W	-21.94	3.08
1954.00	8.80	293.75	1950.95	34.36 N	36.52 W	-34.45	1.14
2141.00	7.50	286.63	2136.06	43.61 N	61.31 W	-58.66	0.88
2235.00	6.99	286.25	2229.31	46.97 N	72.68 W	-69.81	0.55
2328.00	7.34	287.97	2321.58	50.39 N	83.77 W	-80.68	0.45
2420.00	6.80	284.28	2412.88	53.54 N	94.64 W	-91.35	0.77
2512.00	8.84	290.15	2504.02	57.32 N	106.55 W	-103.02	2.38
2604.00	8.02	288.75	2595.03	61.82 N	119.27 W	-115.45	0.92
2695.00	8.51	294.37	2685.09	66.64 N	131.41 W	-127.30	1.04
2789.00	7.87	294.45	2778.13	72.17 N	143.61 W	-139.15	0.68
2882.00	7.60	294.17	2870.28	77.33 N	155.01 W	-150.23	0.30
2976.00	9.60	301.87	2963.22	84.01 N	167.34 W	-162.14	2.45
3071.00	7.74	302.70	3057.13	91.65 N	179.45 W	-173.78	1.96
3165.00	7.86	302.60	3150.26	98.53 N	190.19 W	-184.11	0.13
3260.00	7.18	301.68	3244.45	105.15 N	200.71 W	-194.23	0.73
3354.00	6.64	301.66	3337.76	111.08 N	210.34 W	-203.49	0.57
3449.00	7.57	291.87	3432.04	116.30 N	220.82 W	-213.65	1.61
3543.00	9.30	289.72	3525.02	121.17 N	233.72 W	-226.24	1.86
3638.00	10.31	289.13	3618.63	126.54 N	248.98 W	-241.16	1.07
3733.00	10.88	290.64	3712.01	132.49 N	265.39 W	-257.20	0.66
3827.00	11.01	295.56	3804.30	139.48 N	281.79 W	-273.16	1.00
3922.00	9.34	302.36	3897.81	147.53 N	296.48 W	-287.36	2.16
4016.00	8.26	308.51	3990.70	155.81 N	308.21 W	-298.58	1.52
4111.00	7.53	309.94	4084.80	164.06 N	318.33 W	-308.20	0.79
4300.00	6.23	326.14	4272.45	180.53 N	333.54 W	-322.42	1.23
4395.00	6.53	308.95	4366.87	188.21 N	340.62 W	-329.04	2.03
4490.00	7.04	313.03	4461.21	195.58 N	349.08 W	-337.05	0.74
4584.00	7.01	311.92	4554.50	203.35 N	357.56 W	-345.06	0.15
4679.00	5.19	301.34	4648.96	209.46 N	365.54 W	-352.68	2.24
4773.00	3.77	296.59	4742.67	213.05 N	371.94 W	-358.85	1.56
4868.00	1.75	309.17	4837.56	215.37 N	375.86 W	-362.63	2.20
4962.00	2.26	313.44	4931.50	217.55 N	378.32 W	-364.96	0.56
5057.00	0.49	297.19	5026.47	219.02 N	380.03 W	-366.59	1.89
5152.00	0.78	325.70	5121.46	219.74 N	380.76 W	-367.27	0.45
5246.00	0.46	265.18	5215.46	220.24 N	381.50 W	-367.97	0.73
5341.00	0.31	242.27	5310.46	220.09 N	382.10 W	-368.59	0.22

5436.00	0.52	186.78	5405.46	219.54 N	382.38 W	-368.90	0.45
5530.00	0.41	202.24	5499.45	218.80 N	382.56 W	-369.12	0.18
5625.00	0.29	173.53	5594.45	218.25 N	382.66 W	-369.25	0.22
5719.00	0.19	127.52	5688.45	217.92 N	382.51 W	-369.12	0.22
5814.00	0.52	69.10	5783.45	217.97 N	381.97 W	-368.58	0.48
5909.00	12.84	95.21	5877.63	217.17 N	371.02 W	-357.69	13.02
6003.00	24.41	91.46	5966.56	215.72 N	341.10 W	-327.91	12.37
6098.00	27.82	86.63	6051.86	216.53 N	299.33 W	-286.17	4.23
6192.00	30.62	85.35	6133.89	219.76 N	253.57 W	-240.30	3.05
6287.00	43.53	92.13	6209.56	220.51 N	196.50 W	-183.28	14.24
6381.00	47.87	93.25	6275.20	217.33 N	129.32 W	-116.40	4.70
6476.00	54.85	90.69	6334.48	214.86 N	55.22 W	-42.56	7.64
6571.00	63.77	84.67	6382.95	218.36 N	26.26 E	38.98	10.84
6665.00	73.31	86.18	6417.31	225.29 N	113.37 E	126.34	10.26
6760.00	81.38	87.20	6438.11	230.62 N	205.83 E	218.95	8.55
6776.00	83.48	87.66	6440.22	231.33 N	221.67 E	234.81	13.46

**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 86.65 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.32 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 6776.00 FEET  
IS 320.40 FEET ALONG 43.78 DEGREES (GRID)**

**Final survey is a straight line projection to TD.**