



1 : 240

[illegible]

<b>MWD Run Number</b>	100	200	300		
<b>Date run completed</b>	08-May-13	10-May-13	13-May-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>	6.750	6.750	4.750		
<b>Log Start Depth (MD, ft)</b>	640.00	4,944.00	6,116.00		
<b>Log End Depth (MD, ft)</b>	4,944.00	6,116.00	9,975.00		
<b>Drill or Wipe</b>	Drill	Drill	Drill		
<b>Drill/Wipe Start Date and Time</b>	08-May-13 04:56	09-May-13 04:31	11-May-13 02:03		
<b>Drill/Wipe End Date and Time</b>	08-May-13 18:19	09-May-13 18:20	12-May-13 15:50		
<b>Min Inc (deg) @ Depth (MD, ft)</b>	.10 @ 338.00	.34 @ 4,976.00	84.79 @ 6,183.00		
<b>Max Inc (deg) @ Depth (MD, ft)</b>	13.15 @ 3,275.00	78.14 @ 6,061.00	91.79 @ 8,080.00		
<b>Bit TFA(in2) / Bit Type</b>	.75 / PDC	.86 / PDC	.46 / PDC		
<b>Flow Rate (gpm)</b>	576.00	538.00	269.00		
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	462.9 / 462.9	413.0 / 413.0	369.6 / 369.6		
<b>Fluid Type</b>	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
<b>Density (ppg) / Viscosity (spqt)</b>	8.65 / 30.00	10.05 / 37.00	10.20 / 37.00		
<b>Filtrate CL (ppm)</b>	2,200.00	1,900.00	1,700.00		
<b>pH / Fluid Loss (mptm)</b>	9.20 / N/A	9.90 / N/A	8.50 / N/A		
<b>PV (cP) / YP (Ihf2)</b>	4 / 4.00	12 / 8.00	10 / 10.00		
<b>% Solids / % Sand</b>	3.20 / 0.50	11.20 / 0.50	8.70 / 0.75		
<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>Max Tool Temp (deg F) / S</b>	167.50 / PDM	151.00 / PDM	220.00 / PDM		

Max Tool Temp (degF) / Source	137.50 / PCM	154.30 / PCM	200.80 / PCM		
Rm @ Max Tool Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Lead MWD Engineer	Robert Ley	Robert Ley	Robert Ley		
Customer Representative	Charles Colver	Charles Colver	Charles Colver		

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM	PCM		
Software Version	5.84	5.84	5.84		
Sub Serial Number	161211	161211	11718501		
Insert Serial Number	11680786	11680786	11680786		
Date and Time Initialized	07-May-13 15:50	07-May-13 15:50	10-May-13 03:04		
Date and Time Read	10-May-13 01:08	10-May-13 01:03	13-May-13 03:19		
ECMB SW Version	N/A	N/A	N/A		

### Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	56.00	55.00	61.00		
Software Version	6.21	6.21	6.21		
Sub Serial Number	161211	161211	11718501		
Sonde Serial Number	10919505	10919505	10919505		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	49.85	118.08	253.36		

### Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	49.71	46.65	54.68		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	161211	161211	11718501		
Insert/Sonde Serial Number	11579845	11579845	11579845		

## REMARKS

1. All depths are measured depths and are calibrated to the driller' pipe tally and are measured 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. The Following smoothing parameters have been applied to the data"

PGRC (Gamma Ray Corrected):

Interval Resolution: 0.5 feet  
Coercion Distance: 0.6 feet  
Gap Fill: 3.0 feet

ROPA (Rate of Penetration):

Interval Resolution: 0.5 feet  
Coercion Distance: 1.2 feet  
Gap Fill: 3.0 feet


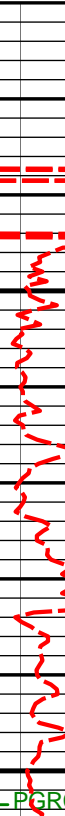
Insite Version 7.3.40 build 25

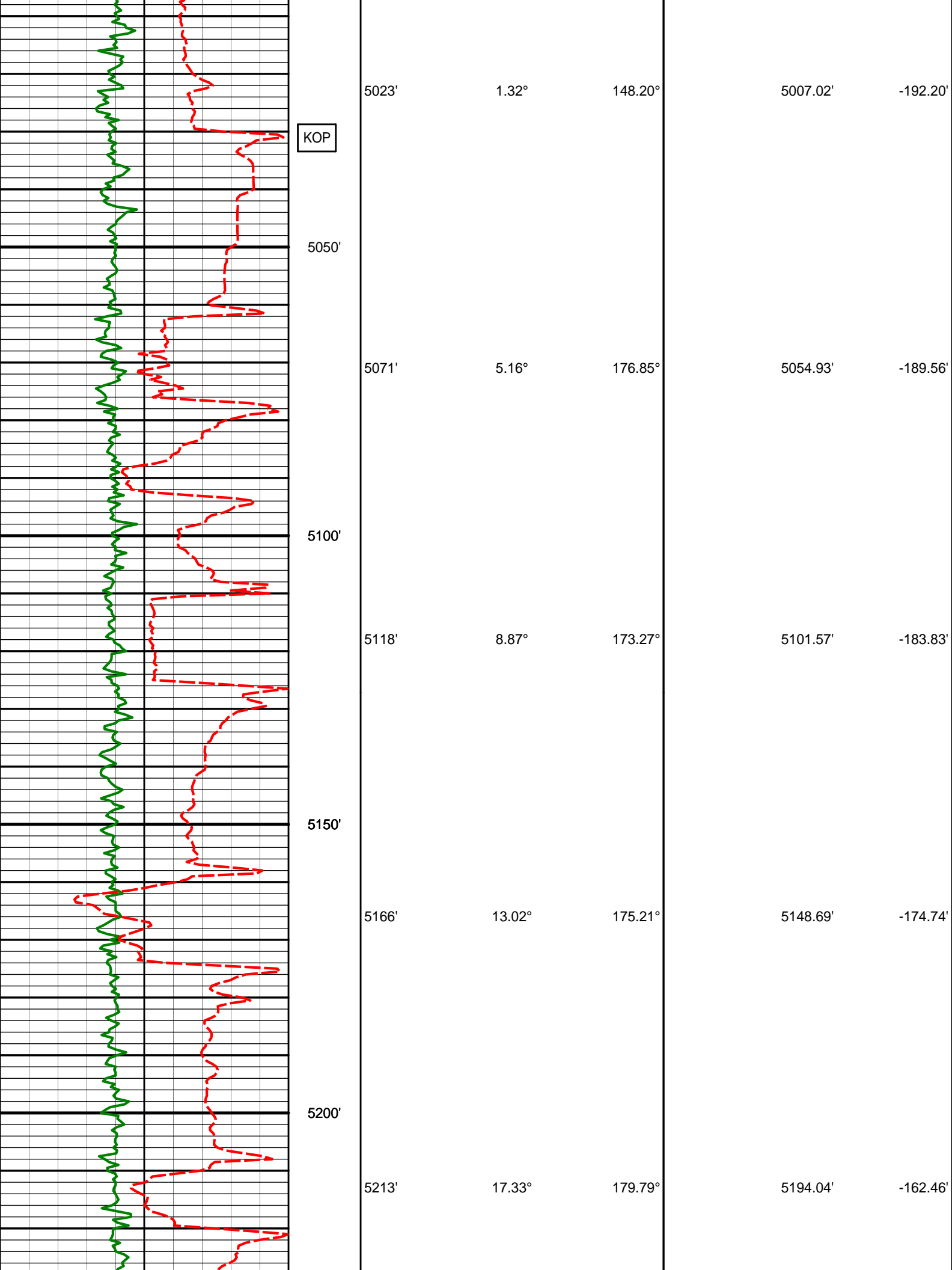
## WARRANTY

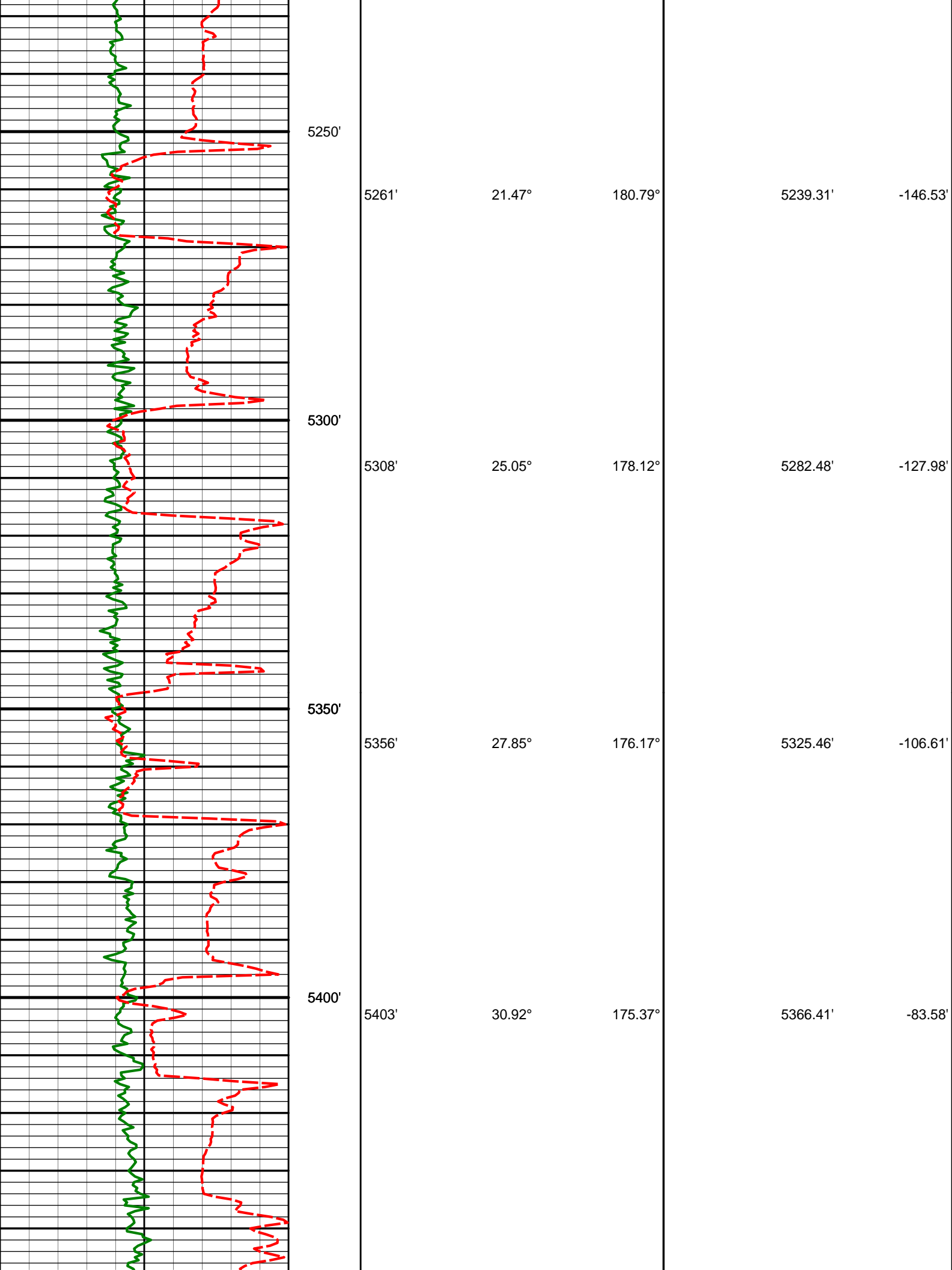
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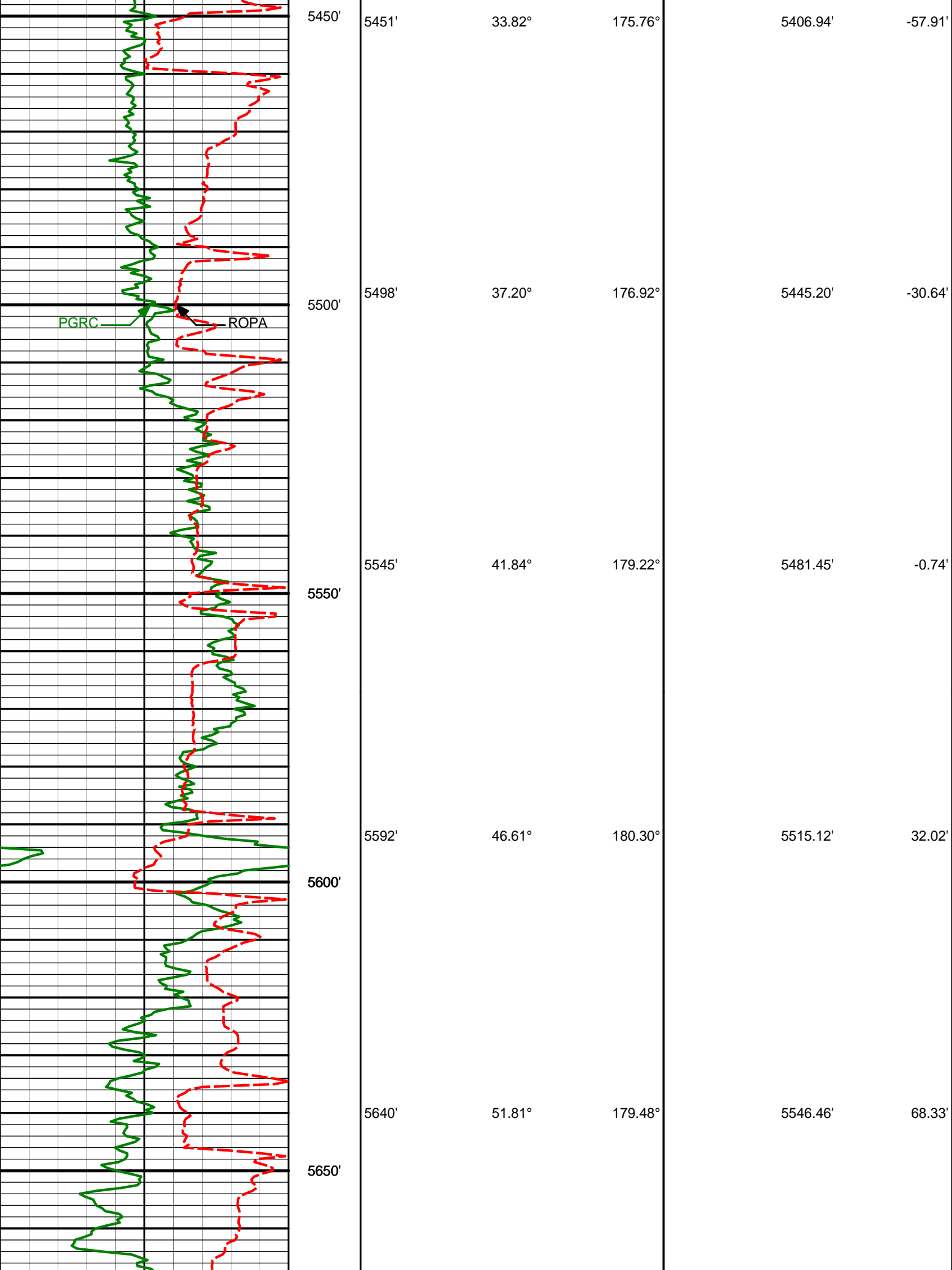
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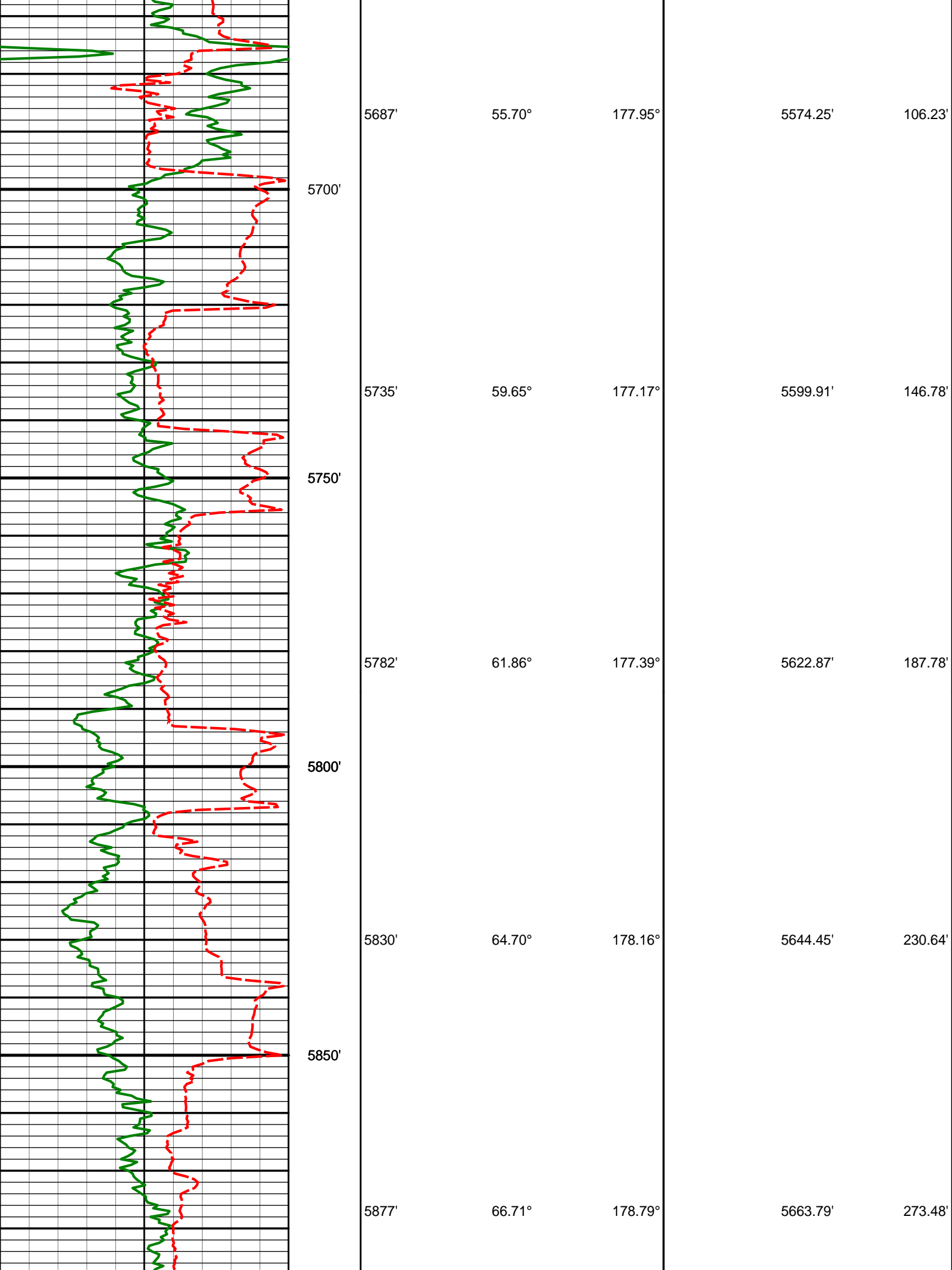
## MD Detail Log 1:240

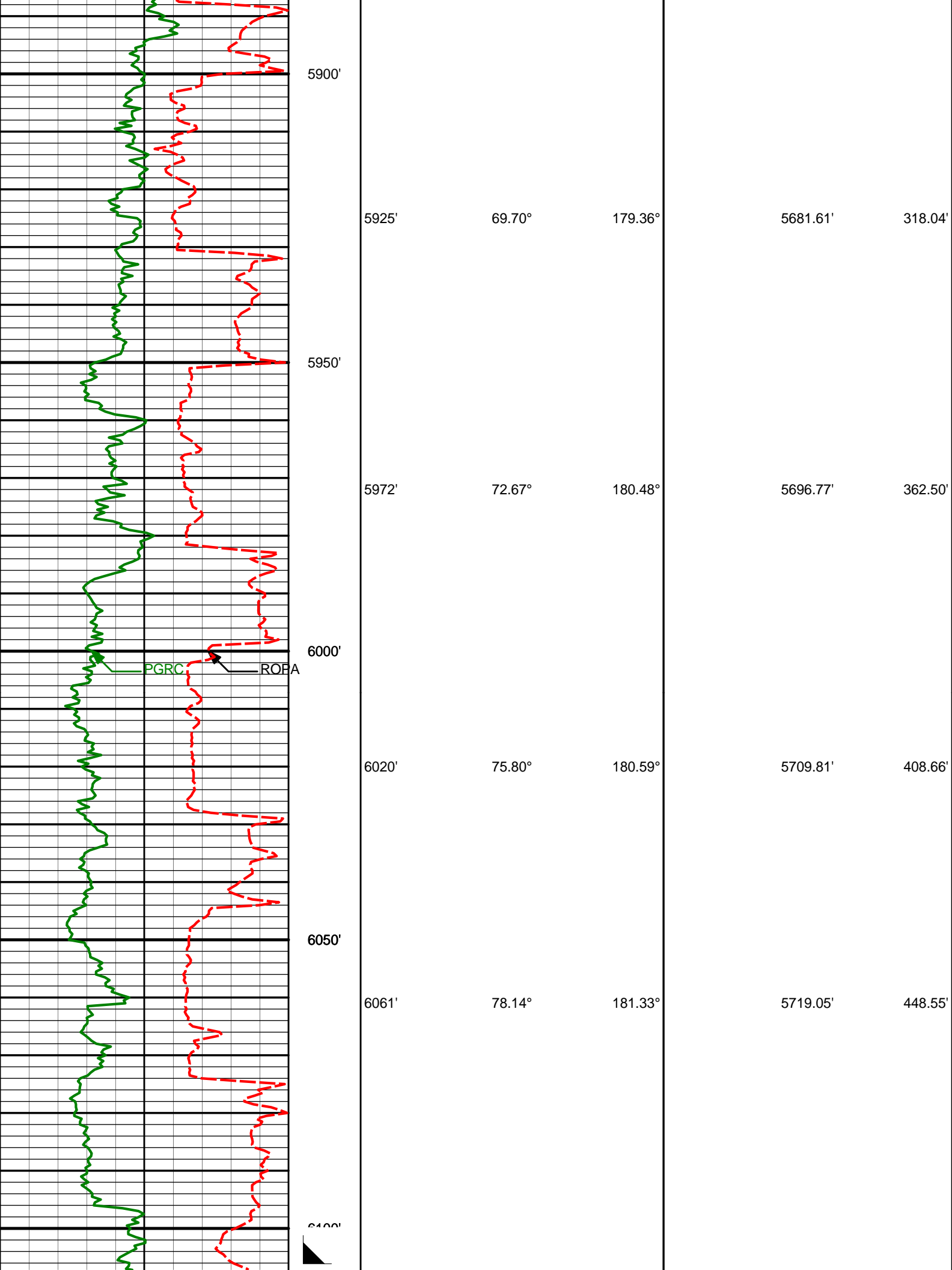
Gamma Ray (PGRC) (Api)					
0	300				
Avg Rate of Penetration feet per hr		Feet			
600	0		Depth	Inc	Azm
					TVD
					Vsec
		Run 200 4950'	4976'	0.34°	260.01°
		5000'			4960.02' -192.69'



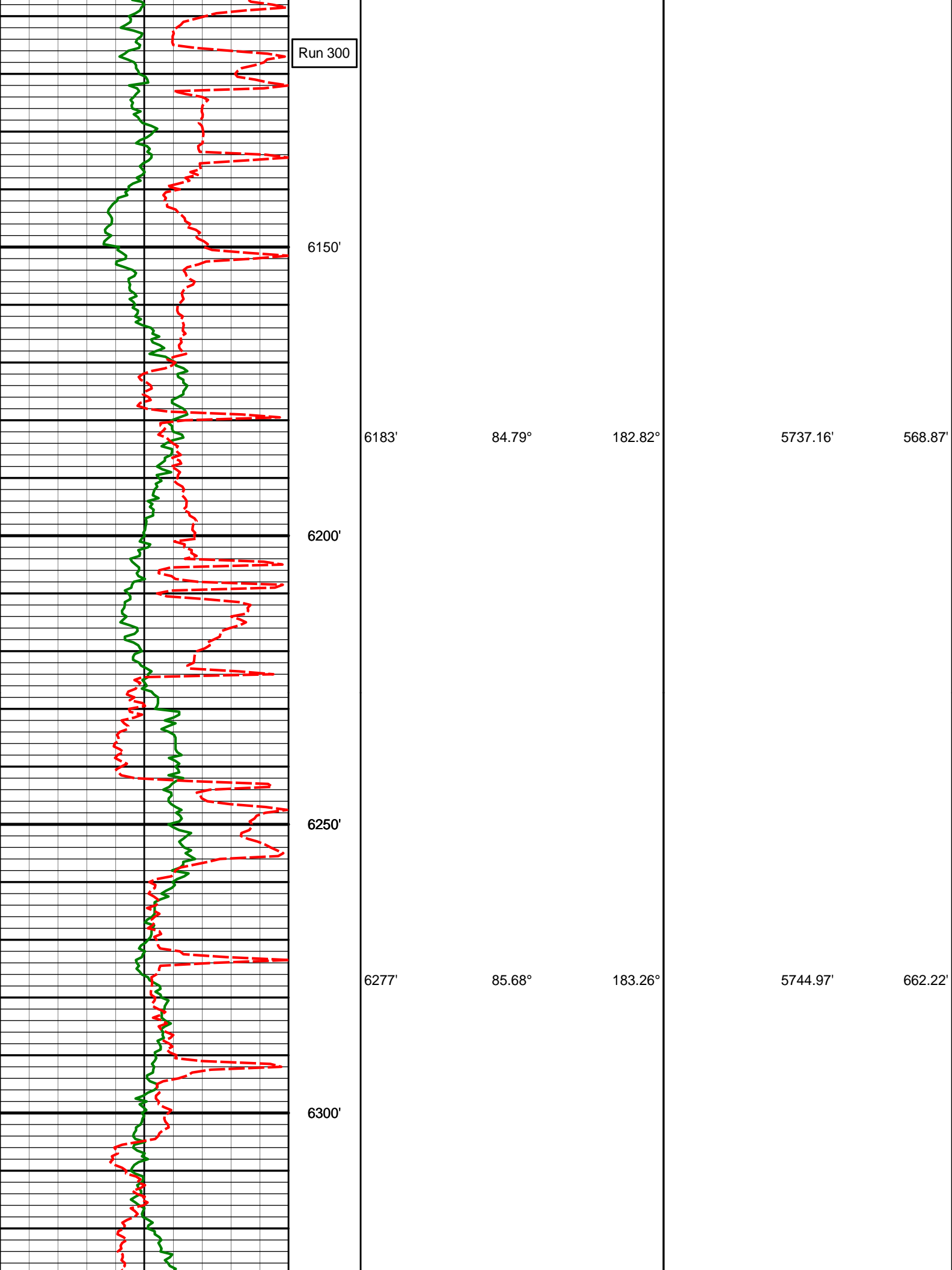


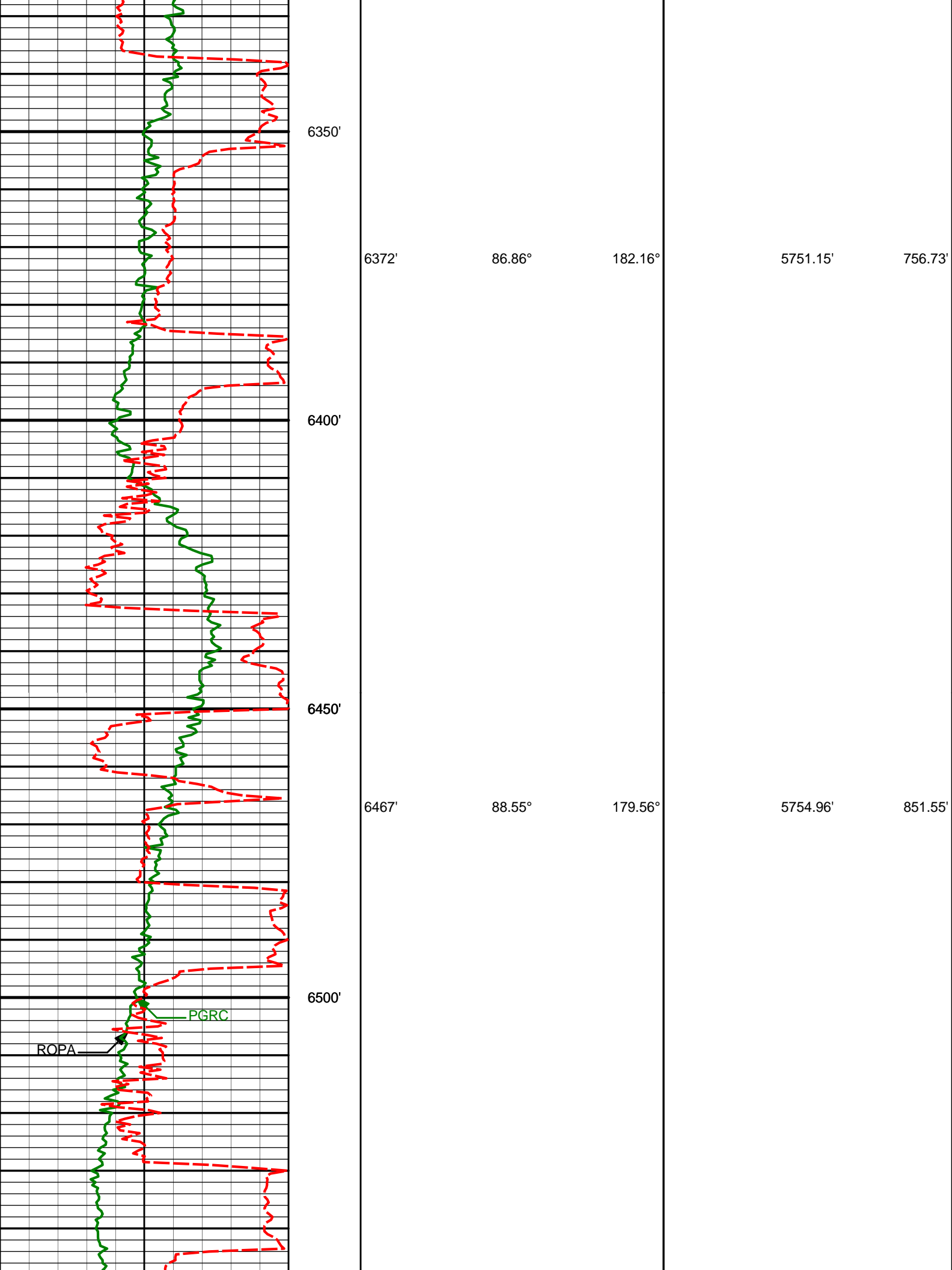


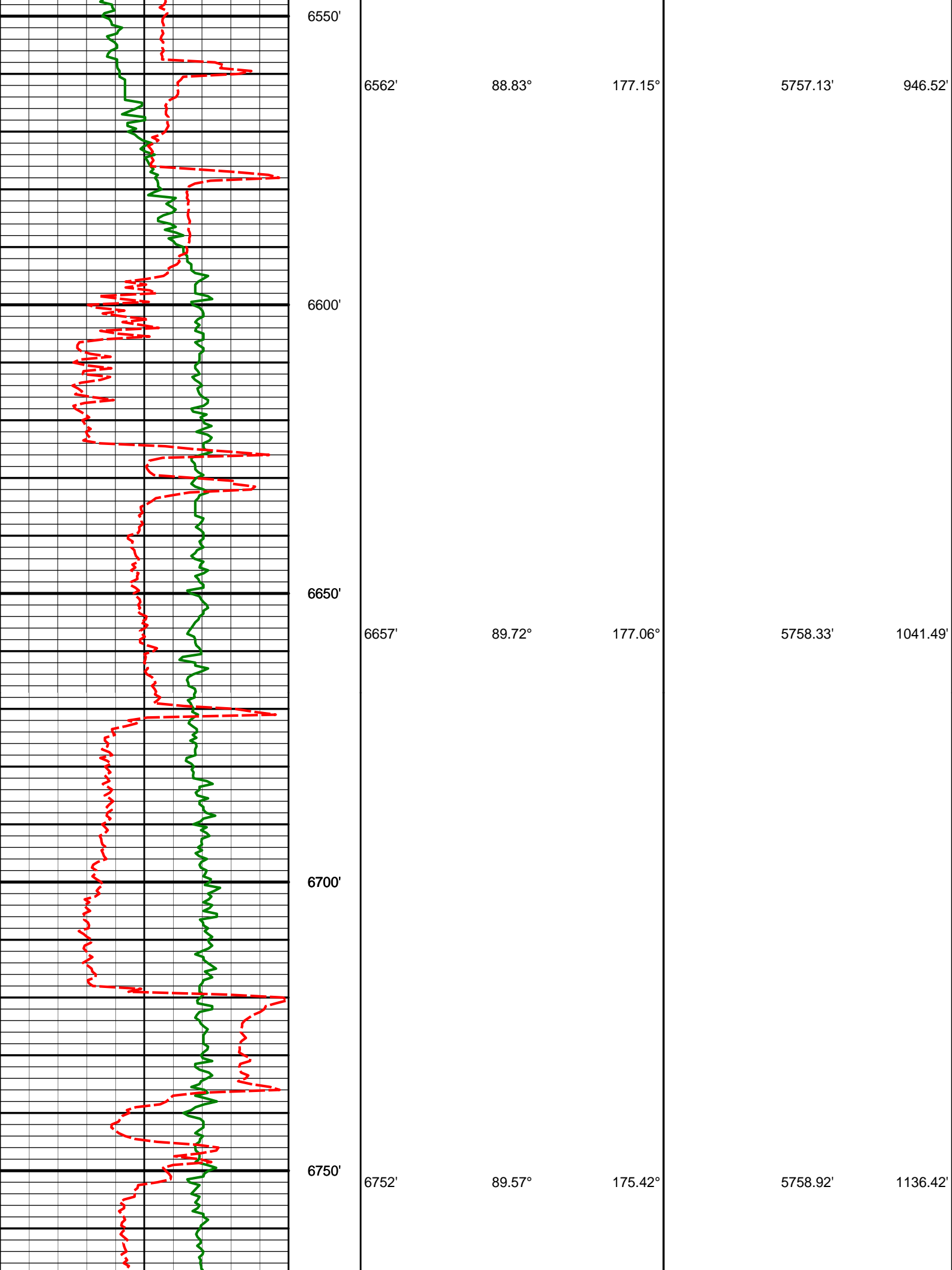


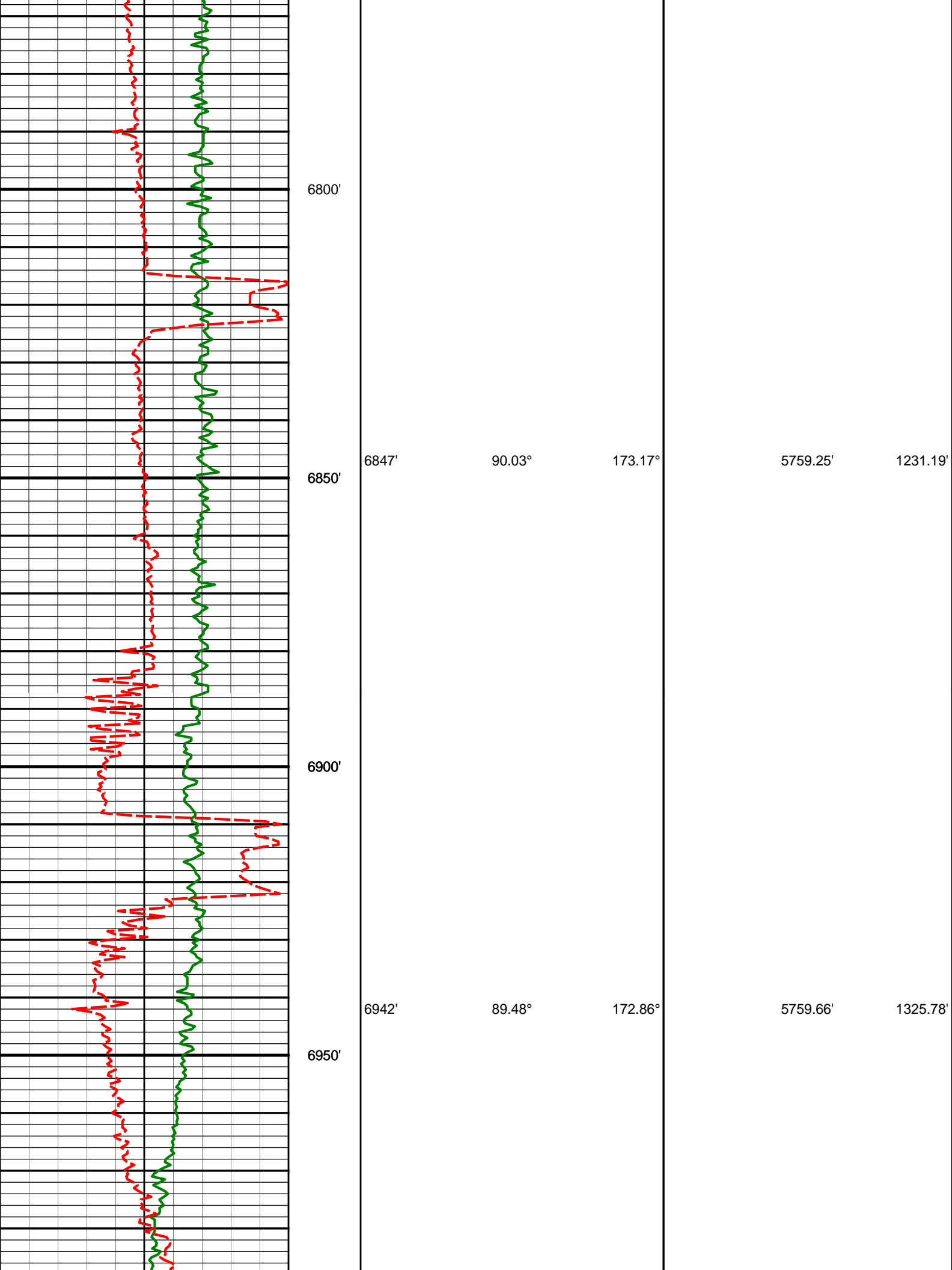


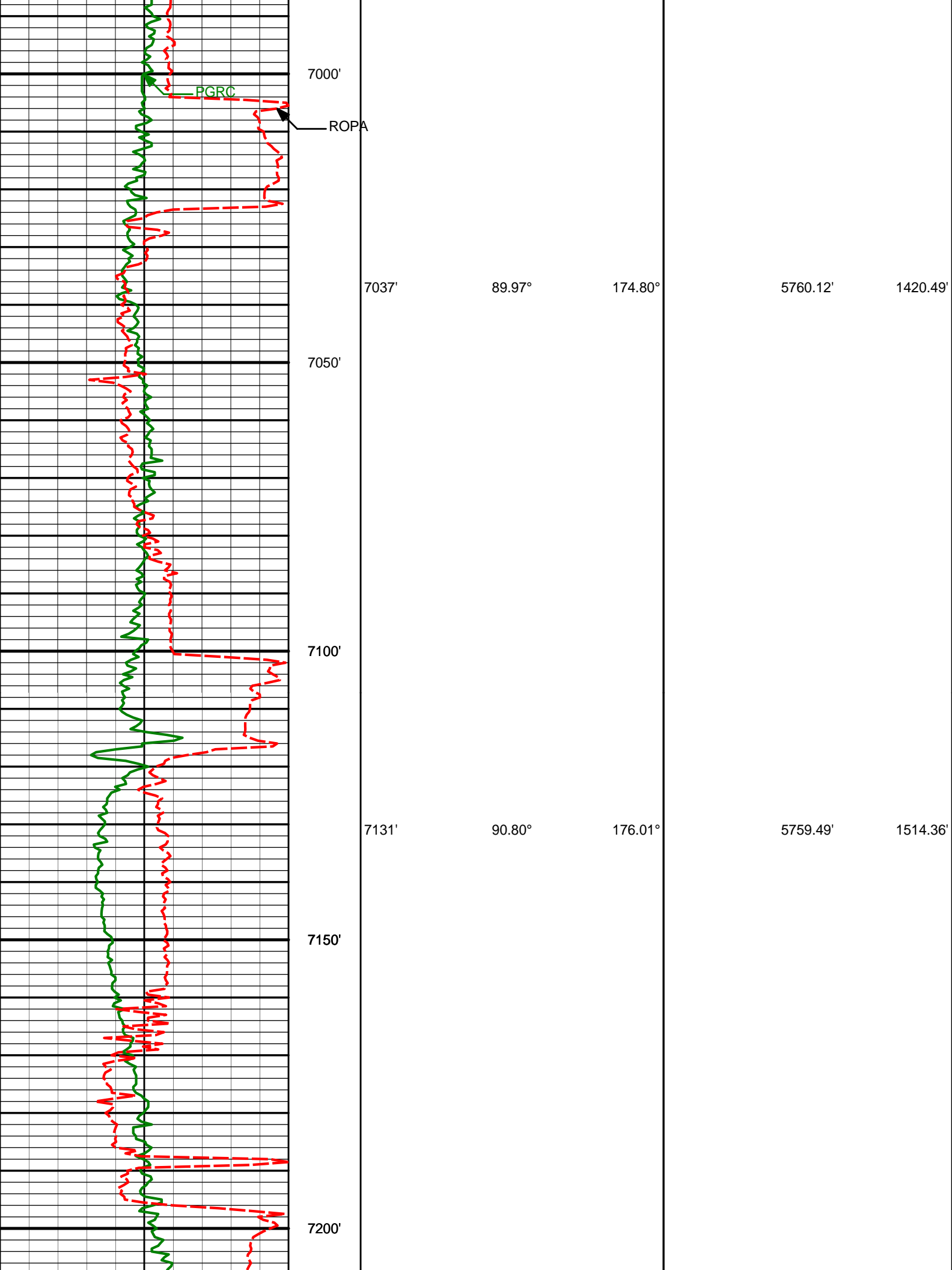


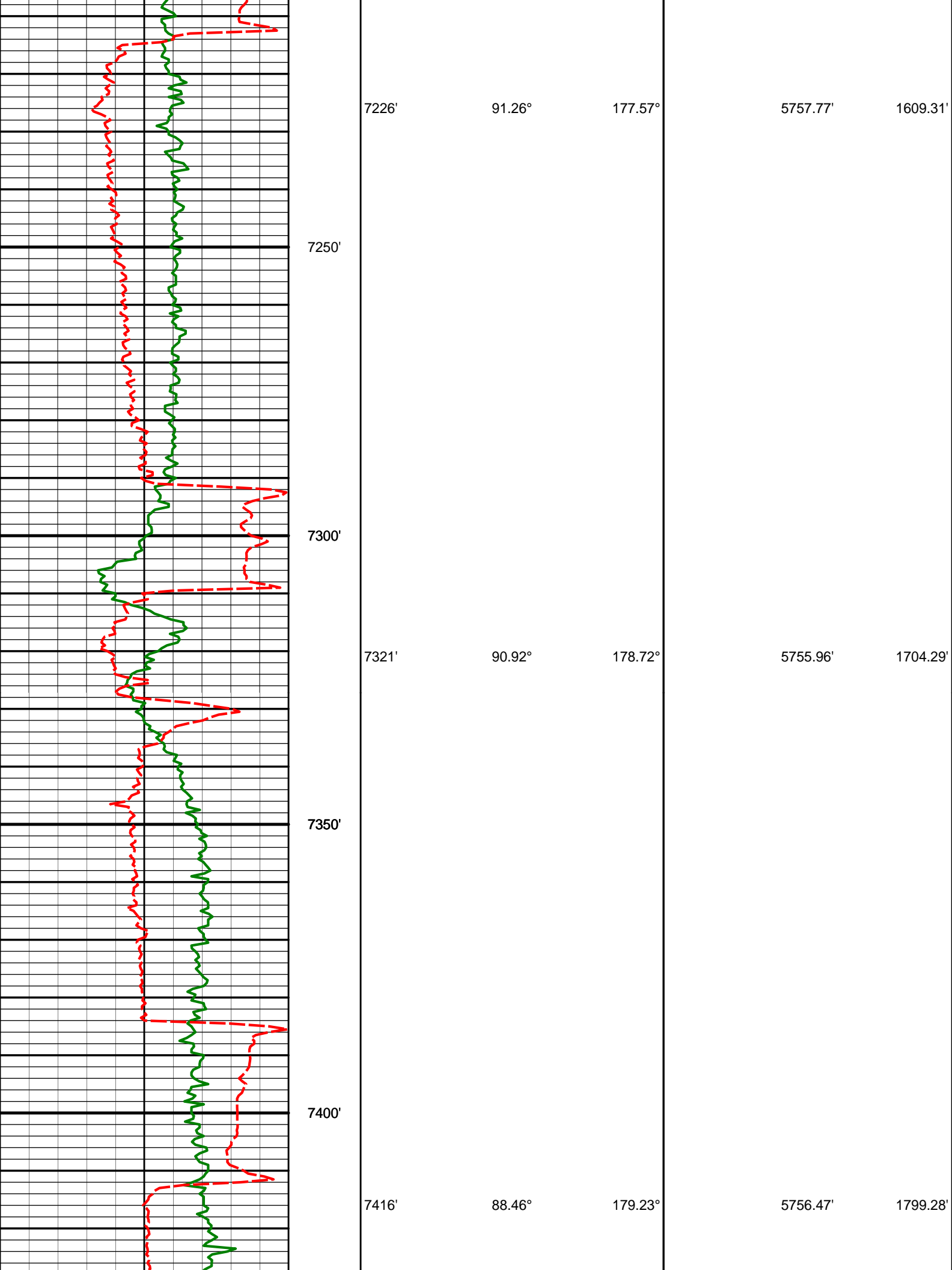


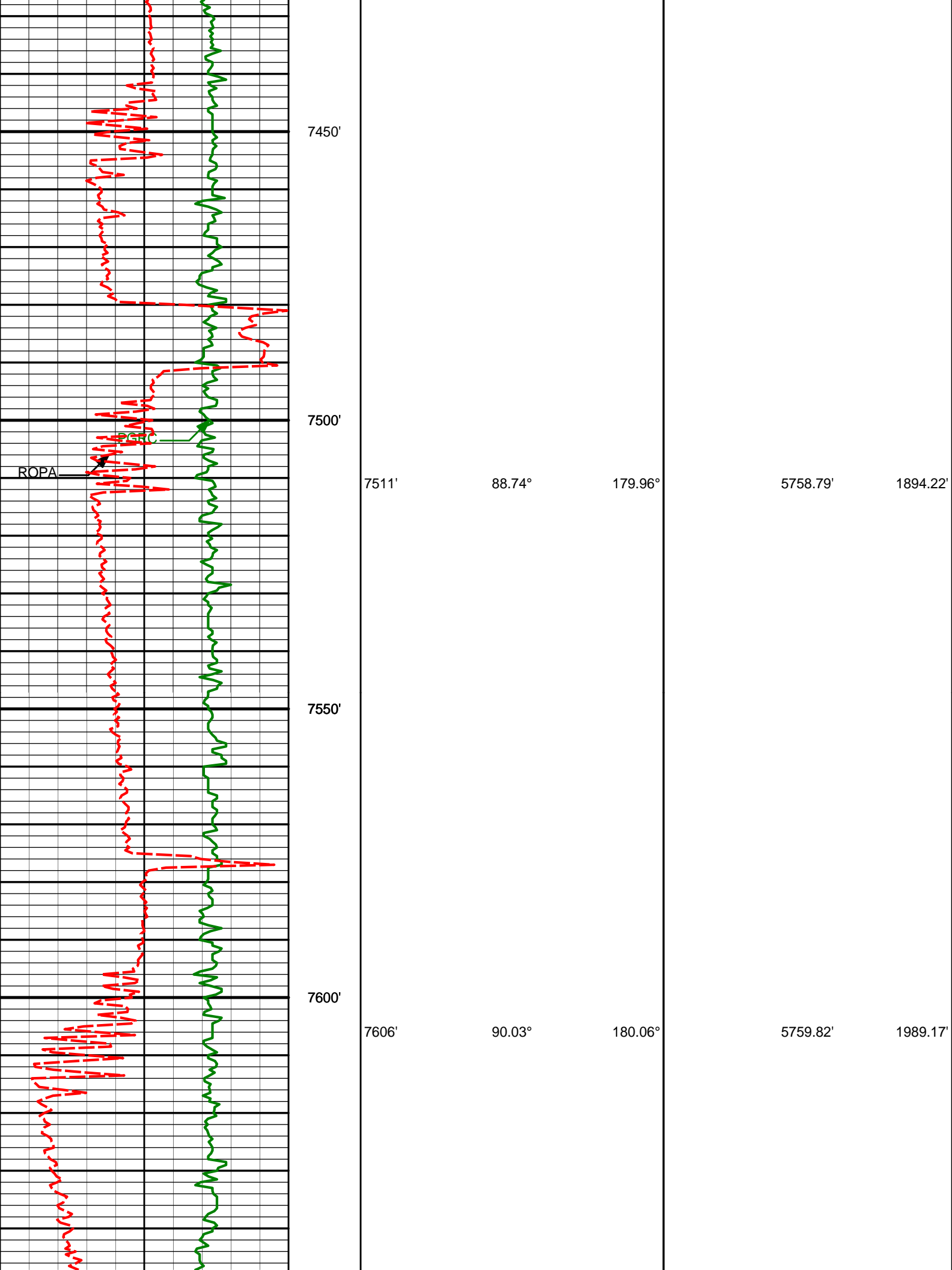


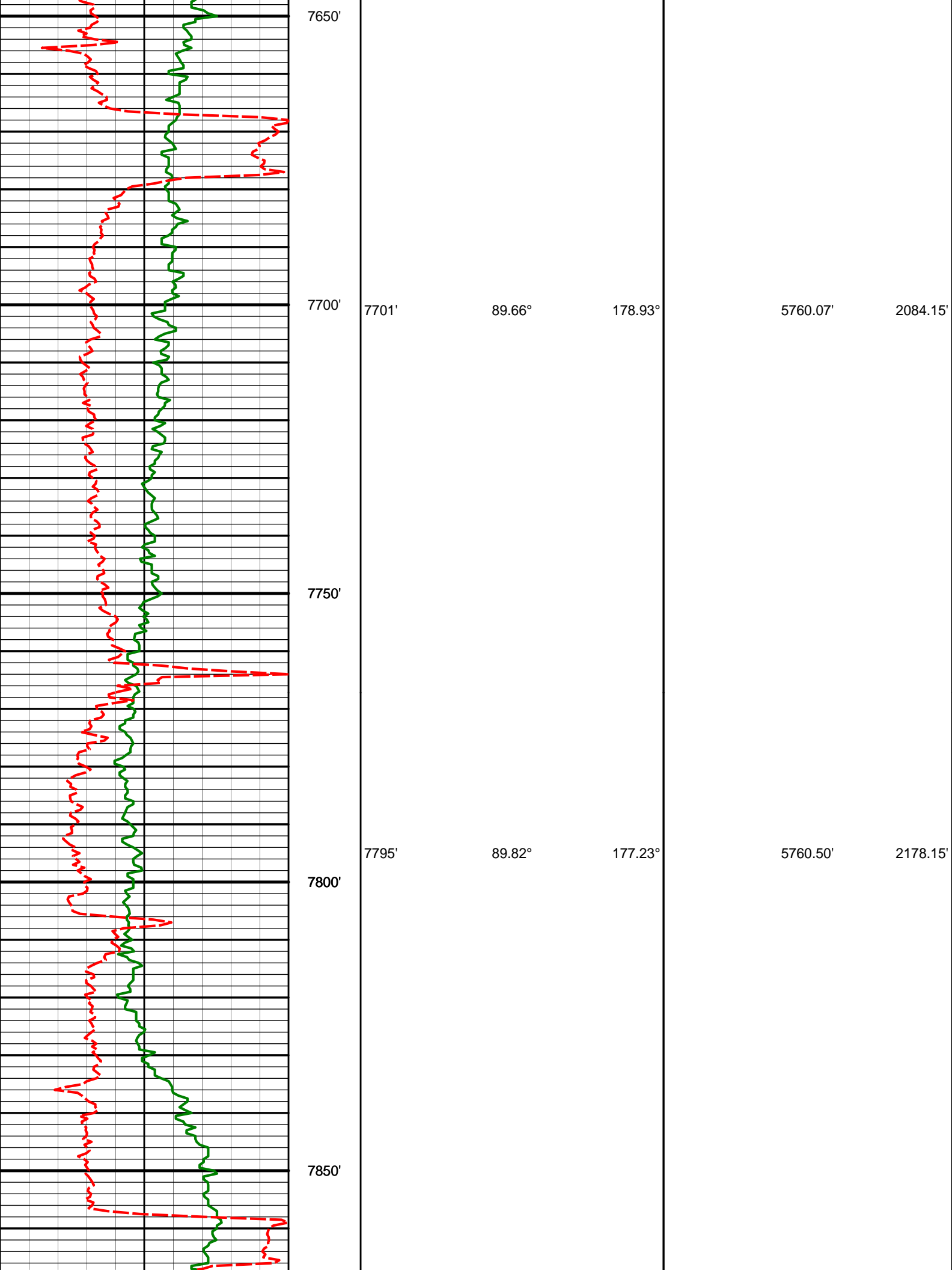




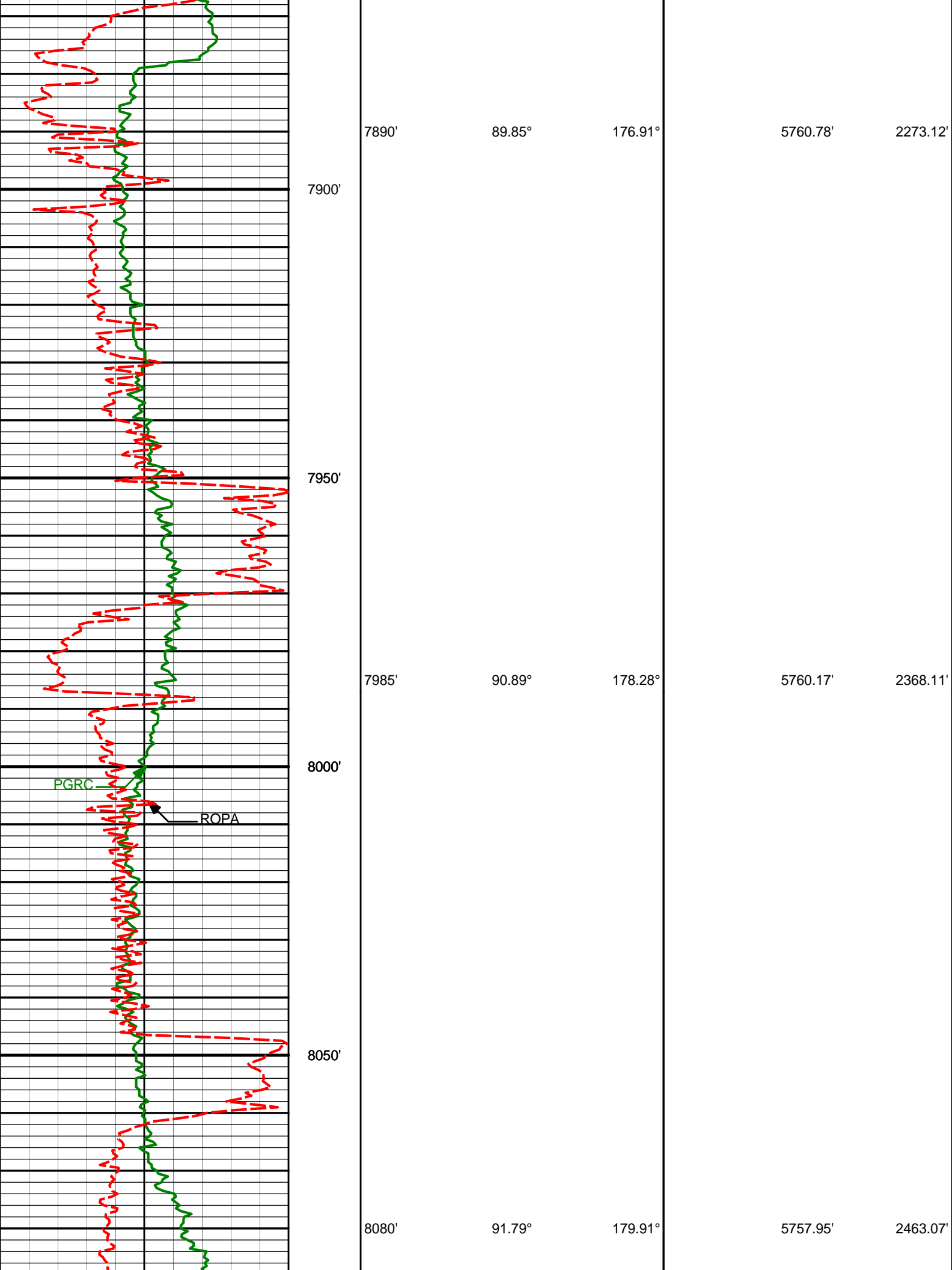


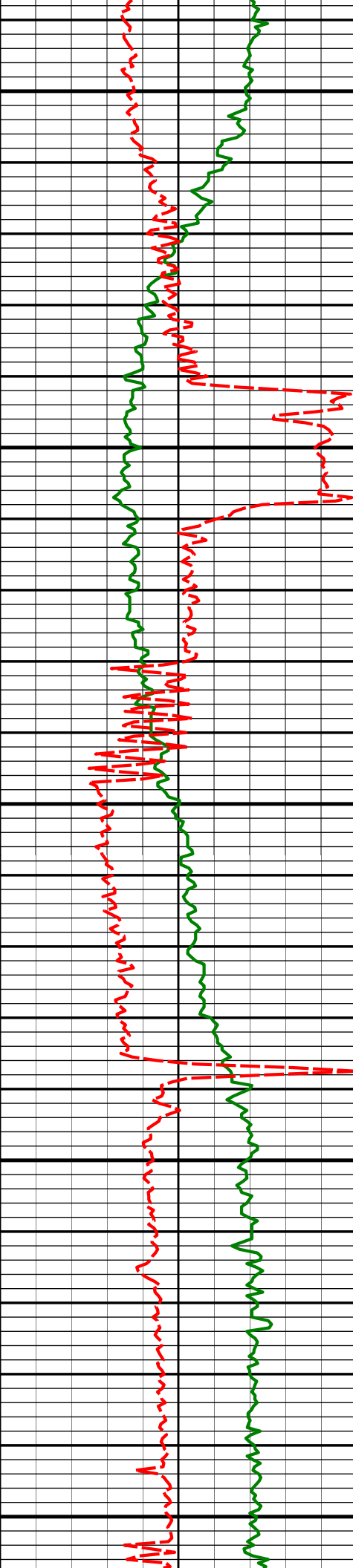












8100'

8150'

8175'

89.85°

177.91°

5756.59'

2558.05'

8200'

8250'

8270'

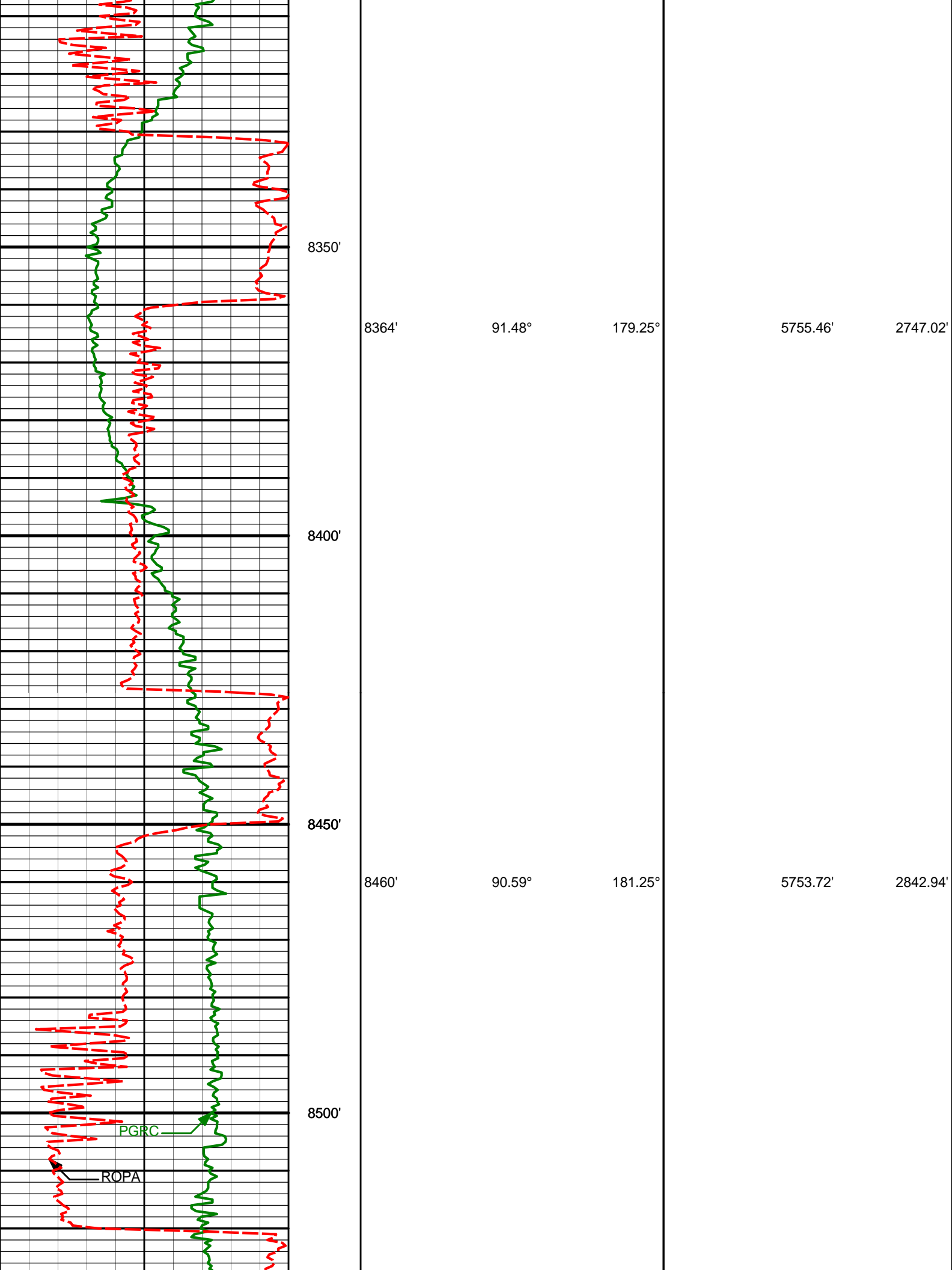
90.03°

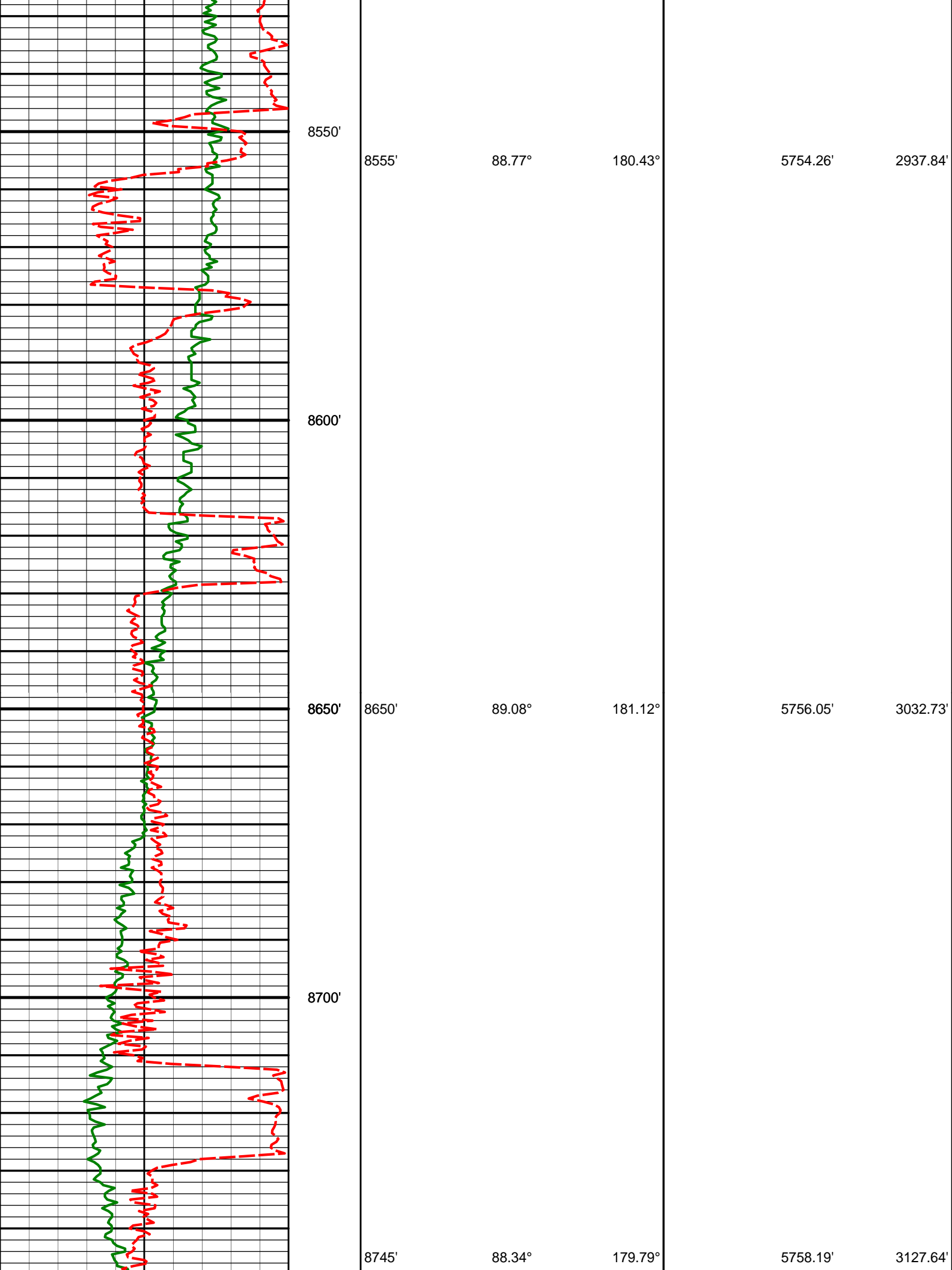
176.92°

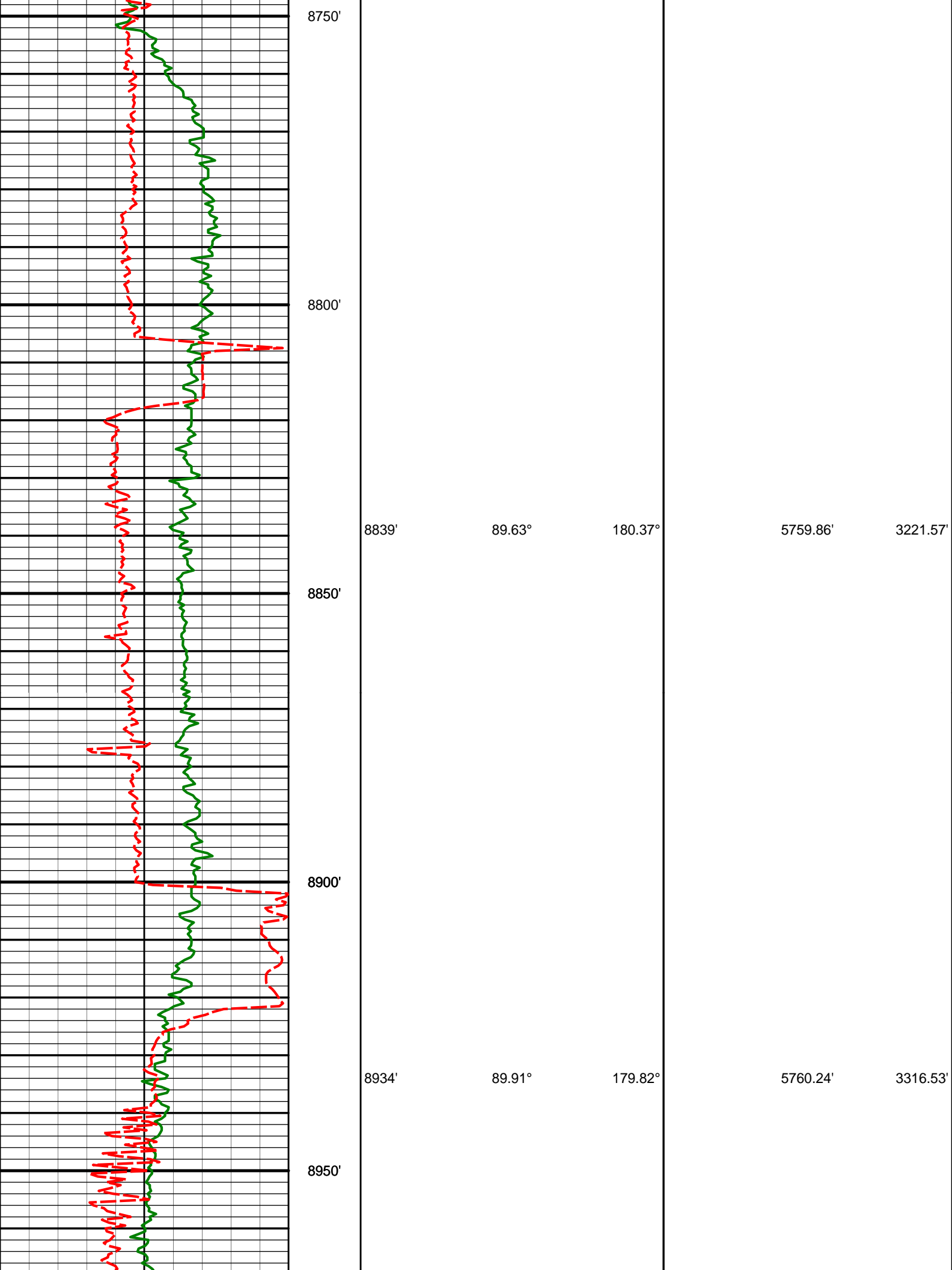
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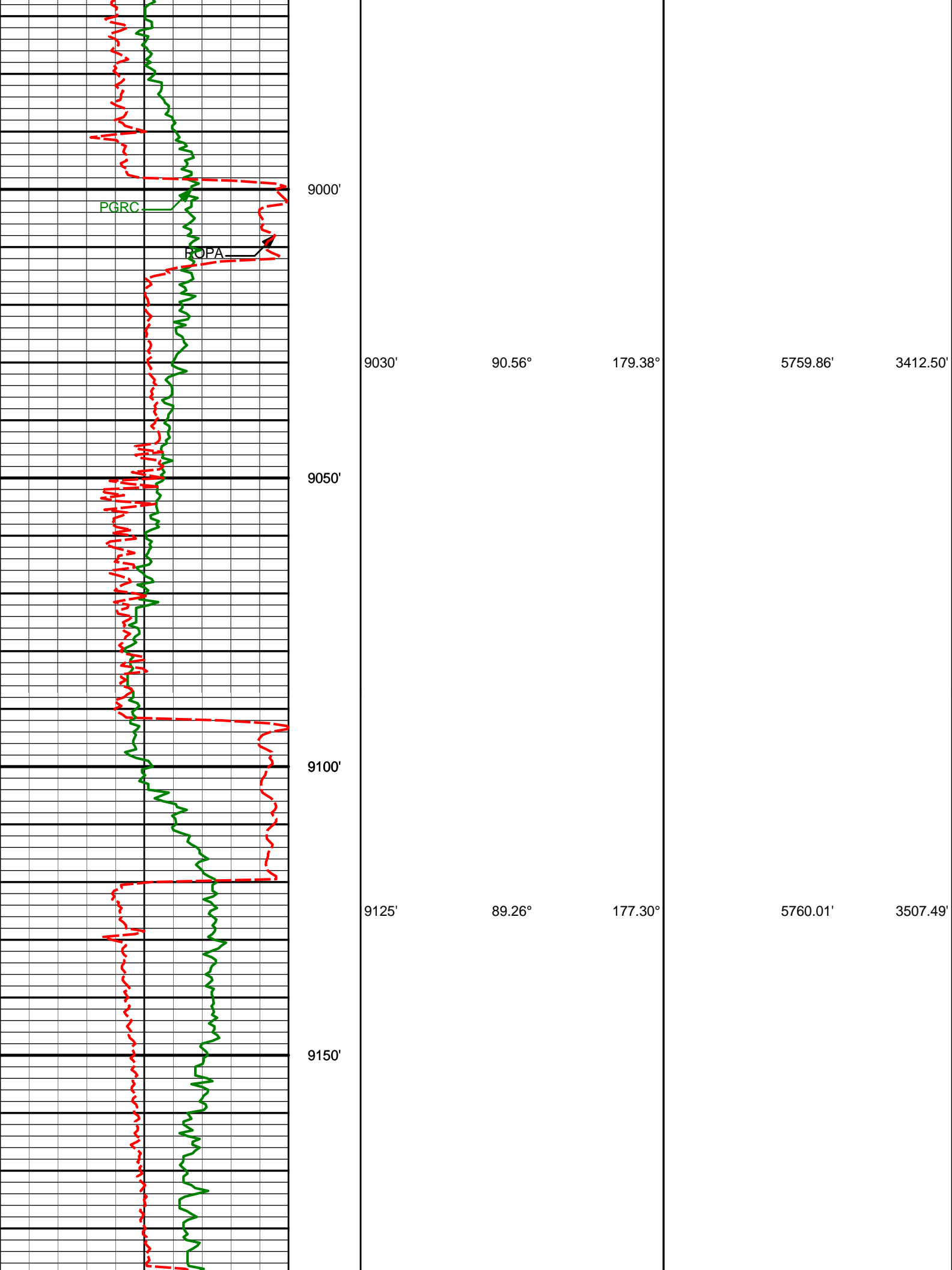
2653.03'

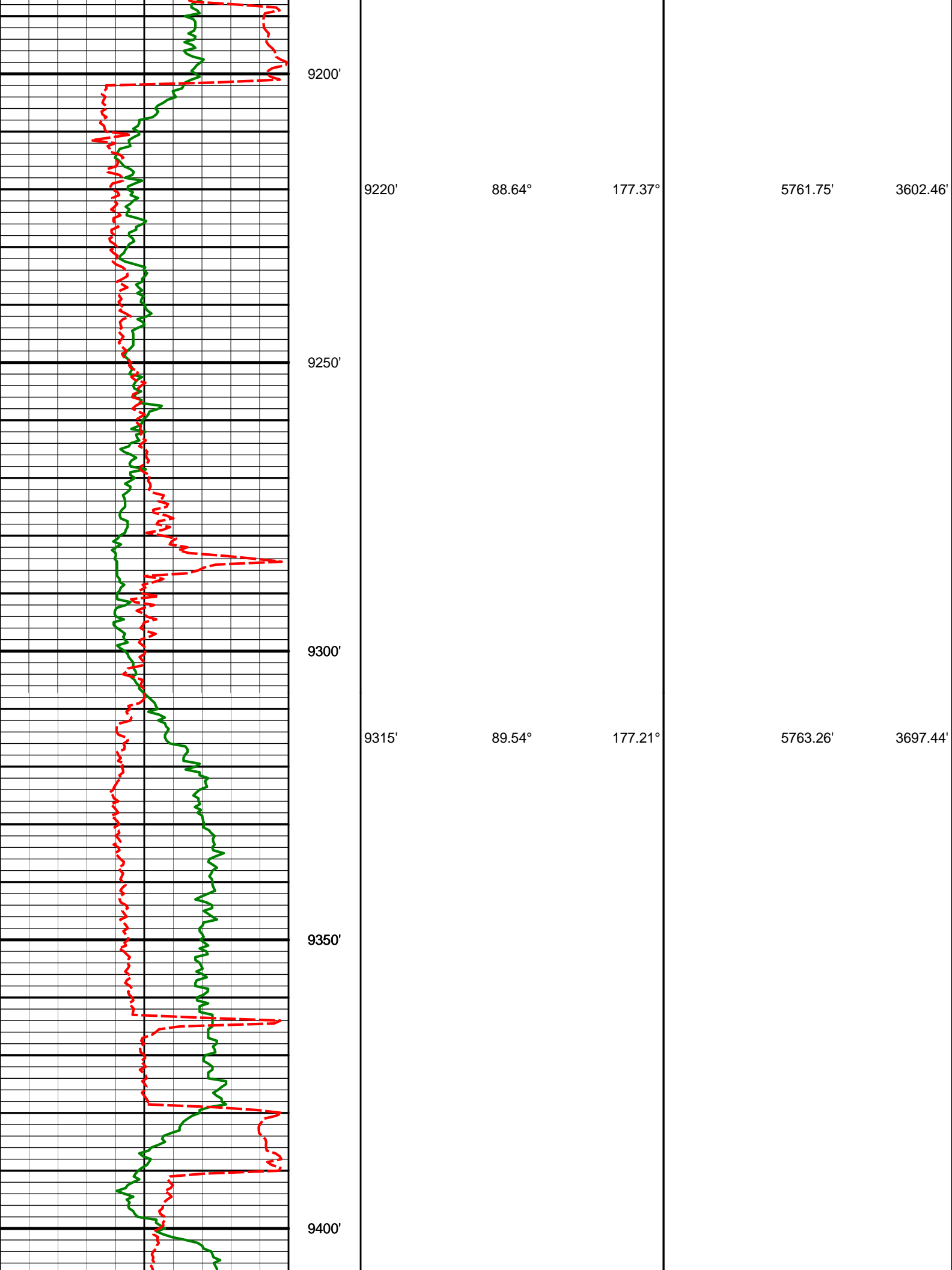
8300'

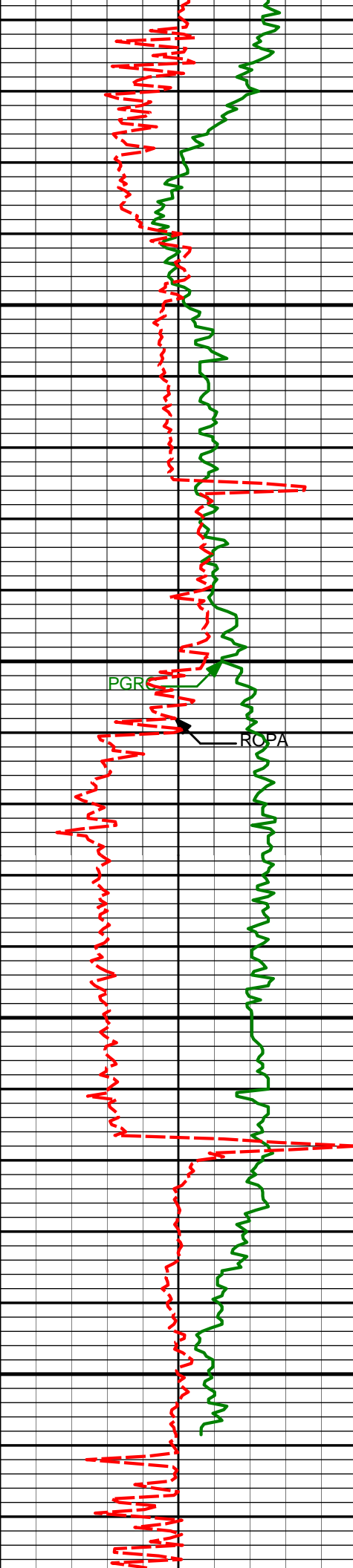












9450'

9500'

9550'

9600'

9410'

88.92°

177.01°

5764.53'

3792.41'

9505'

89.66°

177.22°

5765.71'

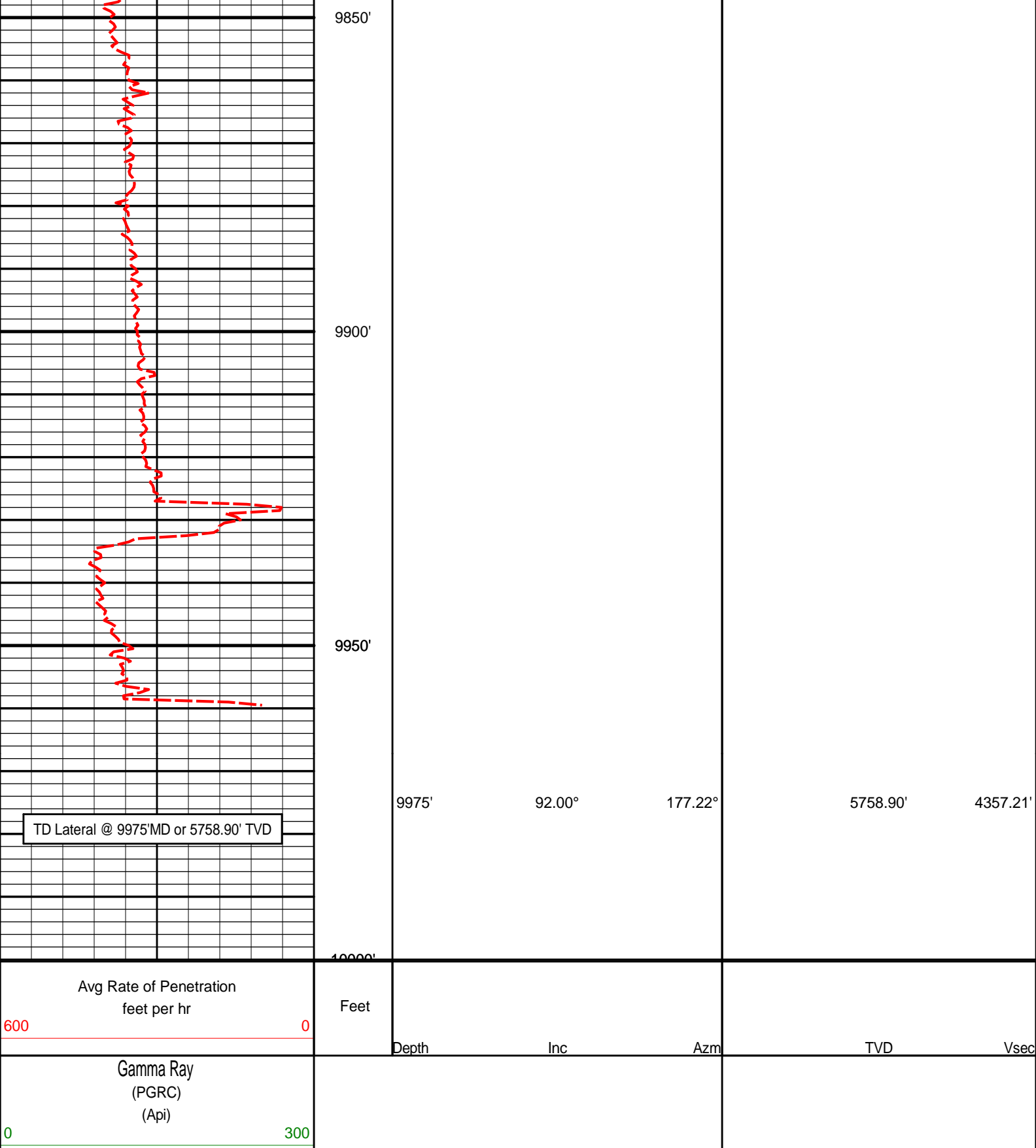
3887.38'

PGR

ROPA







**HALLIBURTON**

## DIRECTIONAL SURVEY REPORT

Noble Energy  
Cook State LD36-78HN  
Wattenberg  
Weld Colorado  
USA

0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
338.00	0.10	12.60	338.00	0.29 N	0.06 E	-0.29	0.03
620.00	0.10	33.20	620.00	0.73 N	0.25 E	-0.73	0.01
728.00	0.26	321.12	728.00	1.00 N	0.15 E	-1.00	0.23
821.00	0.44	292.30	821.00	1.31 N	0.31 W	-1.31	0.27
914.00	0.61	330.06	913.99	1.87 N	0.89 W	-1.89	0.40
1007.00	0.51	325.04	1006.99	2.63 N	1.37 W	-2.67	0.11
1193.00	0.46	348.09	1192.98	4.04 N	2.00 W	-4.10	0.11
1379.00	0.45	12.03	1378.98	5.48 N	2.00 W	-5.54	0.10
1472.00	0.35	354.73	1471.97	6.12 N	1.95 W	-6.17	0.17
1567.00	0.36	38.04	1566.97	6.64 N	1.80 W	-6.69	0.28
1662.00	0.56	79.70	1661.97	6.96 N	1.16 W	-6.99	0.39
1757.00	0.50	86.62	1756.97	7.07 N	0.29 W	-7.07	0.09
1852.00	0.86	76.56	1851.96	7.26 N	0.83 E	-7.23	0.40
1946.00	0.31	14.04	1945.95	7.67 N	1.58 E	-7.62	0.82
2041.00	0.26	315.09	2040.95	8.08 N	1.49 E	-8.03	0.30
2136.00	0.43	253.19	2135.95	8.13 N	0.99 E	-8.10	0.41
2231.00	0.89	236.48	2230.95	7.62 N	0.03 E	-7.61	0.52
2326.00	0.71	223.94	2325.94	6.78 N	1.00 W	-6.81	0.26
2421.00	0.48	190.81	2420.93	5.97 N	1.48 W	-6.01	0.43
2516.00	1.78	21.84	2515.92	6.94 N	1.01 W	-6.97	2.37
2611.00	3.57	359.21	2610.81	11.27 N	0.50 W	-11.28	2.16
2706.00	5.11	354.14	2705.54	18.44 N	0.97 W	-18.46	1.67
2801.00	7.58	355.80	2799.95	28.89 N	1.87 W	-28.93	2.60
2896.00	7.61	356.07	2894.12	41.41 N	2.75 W	-41.48	0.05
2990.00	9.56	3.58	2987.06	55.42 N	2.69 W	-55.47	2.39
3085.00	11.08	0.40	3080.52	72.42 N	2.14 W	-72.45	1.70
3180.00	12.36	3.74	3173.54	91.69 N	1.41 W	-91.69	1.52
3275.00	13.15	6.19	3266.20	112.57 N	0.42 E	-112.51	1.01
3370.00	12.67	7.85	3358.80	133.63 N	3.01 E	-133.49	0.64
3465.00	11.26	6.10	3451.73	153.18 N	5.42 E	-152.95	1.53
3560.00	8.90	349.87	3545.28	169.64 N	5.11 E	-169.41	3.86
3655.00	5.01	340.70	3639.56	180.80 N	2.45 E	-180.64	4.25
3750.00	2.97	326.59	3734.33	186.77 N	0.28 W	-186.69	2.37
3844.00	2.72	318.57	3828.22	190.47 N	3.09 W	-190.48	0.50
3939.00	1.54	317.19	3923.15	193.09 N	5.45 W	-193.17	1.24
4034.00	0.99	39.64	4018.13	194.66 N	5.79 W	-194.75	1.81
4129.00	0.80	61.30	4113.12	195.61 N	4.69 W	-195.67	0.41
4224.00	0.94	73.95	4208.11	196.15 N	3.36 W	-196.16	0.25
4319.00	1.09	65.14	4303.09	196.74 N	1.79 W	-196.71	0.23
4414.00	1.49	61.91	4398.07	197.70 N	0.11 E	-197.61	0.43
4508.00	1.13	176.43	4492.06	197.35 N	1.25 E	-197.22	2.35
4603.00	1.05	190.54	4587.04	195.56 N	1.15 E	-195.44	0.30
4698.00	0.74	221.98	4682.03	194.25 N	0.58 E	-194.15	0.60
4793.00	0.25	203.18	4777.03	193.60 N	0.09 E	-193.51	0.53
4888.00	0.60	229.76	4872.02	193.09 N	0.38 W	-193.01	0.41
4976.00	0.34	260.01	4960.02	192.74 N	0.99 W	-192.69	0.39
5023.00	1.32	148.20	5007.02	192.26 N	0.84 W	-192.20	3.15
5071.00	5.16	176.85	5054.93	189.63 N	0.43 W	-189.56	8.45
5118.00	8.87	173.27	5101.57	183.92 N	0.11 E	-183.83	7.94
5166.00	13.02	175.21	5148.69	174.85 N	0.99 E	-174.74	8.67
5213.00	17.33	179.79	5194.04	162.57 N	1.46 E	-162.46	9.51
5261.00	21.47	180.79	5239.31	146.64 N	1.37 E	-146.53	8.65
5308.00	25.05	178.12	5282.48	128.09 N	1.58 E	-127.98	7.95
5356.00	27.85	176.17	5325.46	106.74 N	2.66 E	-106.61	6.10
5403.00	30.92	175.37	5366.41	83.75 N	4.37 E	-83.58	6.59
5451.00	33.82	175.76	5406.94	58.13 N	6.35 E	-57.91	6.07
5498.00	37.20	176.92	5445.20	30.89 N	8.08 E	-30.64	7.33
5545.00	41.84	179.22	5481.45	1.01 N	9.06 E	-0.74	10.35
5592.00	46.61	180.30	5515.12	31.76 S	9.18 E	32.02	10.28
5640.00	51.81	179.48	5546.46	68.09 S	9.26 E	68.33	10.91
5687.00	55.70	177.95	5574.25	105.97 S	10.13 E	106.23	8.67
5735.00	59.65	177.17	5599.91	146.49 S	11.86 E	146.78	8.35
5782.00	61.86	177.39	5622.87	187.45 S	13.80 E	187.78	4.71
5830.00	64.70	178.16	5644.45	230.29 S	15.46 E	230.64	6.08
5877.00	66.71	178.79	5663.79	273.10 S	16.60 E	273.48	4.45
5925.00	69.70	179.36	5681.61	317.66 S	17.32 E	318.04	6.33
5972.00	72.67	180.48	5696.77	362.15 S	17.38 E	362.50	6.71
6020.00	75.80	180.59	5709.81	408.33 S	16.95 E	408.66	6.52

6061.00	78.14	181.33	5719.05	448.27 S	16.27 E	448.55	5.97
6183.00	84.79	182.82	5737.16	568.76 S	11.89 E	568.87	5.58
6277.00	85.68	183.26	5744.97	662.31 S	6.93 E	662.22	1.06
6372.00	86.86	182.16	5751.15	757.00 S	2.45 E	756.73	1.69
6467.00	88.55	179.56	5754.96	851.90 S	1.03 E	851.55	3.27
6562.00	88.83	177.15	5757.13	946.83 S	3.76 E	946.52	2.55
6657.00	89.72	177.06	5758.33	1041.70 S	8.55 E	1041.49	0.95
6752.00	89.57	175.42	5758.92	1136.49 S	14.78 E	1136.42	1.73
6847.00	90.03	173.17	5759.25	1231.01 S	24.22 E	1231.19	2.42
6942.00	89.48	172.86	5759.66	1325.31 S	35.77 E	1325.78	0.67
7037.00	89.97	174.80	5760.12	1419.75 S	45.98 E	1420.49	2.10
7131.00	90.80	176.01	5759.49	1513.44 S	53.50 E	1514.36	1.57
7226.00	91.26	177.57	5757.77	1608.27 S	58.82 E	1609.31	1.70
7321.00	90.92	178.72	5755.96	1703.21 S	61.90 E	1704.29	1.26
7416.00	88.46	179.23	5756.47	1798.18 S	63.60 E	1799.28	2.65
7511.00	88.74	179.96	5758.79	1893.15 S	64.27 E	1894.22	0.82
7606.00	90.03	180.06	5759.82	1988.14 S	64.26 E	1989.17	1.37
7701.00	89.66	178.93	5760.07	2083.14 S	65.09 E	2084.15	1.25
7795.00	89.82	177.23	5760.50	2177.08 S	68.23 E	2178.15	1.82
7890.00	89.85	176.91	5760.78	2271.95 S	73.09 E	2273.12	0.34
7985.00	90.89	178.28	5760.17	2366.87 S	77.08 E	2368.11	1.81
8080.00	91.79	179.91	5757.95	2461.82 S	78.59 E	2463.07	1.96
8175.00	89.85	177.91	5756.59	2556.79 S	80.40 E	2558.05	2.93
8270.00	90.03	176.92	5756.69	2651.69 S	84.68 E	2653.03	1.06
8364.00	91.48	179.25	5755.46	2745.62 S	87.82 E	2747.02	2.92
8460.00	90.59	181.25	5753.72	2841.60 S	87.40 E	2842.94	2.28
8555.00	88.77	180.43	5754.26	2936.58 S	86.00 E	2937.84	2.10
8650.00	89.08	181.12	5756.05	3031.55 S	84.72 E	3032.73	0.79
8745.00	88.34	179.79	5758.19	3126.52 S	83.96 E	3127.64	1.60
8839.00	89.63	180.37	5759.86	3220.51 S	83.84 E	3221.57	1.51
8934.00	89.91	179.82	5760.24	3315.51 S	83.69 E	3316.53	0.65
9030.00	90.56	179.38	5759.86	3411.50 S	84.36 E	3412.50	0.81
9125.00	89.26	177.30	5760.01	3506.45 S	87.10 E	3507.49	2.58
9220.00	88.64	177.37	5761.75	3601.34 S	91.52 E	3602.46	0.65
9315.00	89.54	177.21	5763.26	3696.22 S	96.00 E	3697.44	0.95
9410.00	88.92	177.01	5764.53	3791.09 S	100.79 E	3792.41	0.69
9505.00	89.66	177.22	5765.71	3885.96 S	105.57 E	3887.38	0.81
9975.00	92.00	177.22	5758.90	4355.32 S	128.34 E	4357.21	0.50

# **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 178.29 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.09 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 9975.00 FEET  
IS 4357.21 FEET ALONG 178.31 DEGREES (GRID)**

**Casing set at 6106 ft.**

**Surveys at 338 ft and 620 ft were taken and provided by HP 322 while they were drilling the surface hole.**

**Due to an MWD Failure:  
The last Survey was recorded at 9505 ft  
Gamma Stopped tracking at 9608 ft  
ROP from 9659 ft is tracking 15 ft behind**