

## PCGK - Pressure Case Gamma

1 : 240

[illegible]

## WELL INFORMATION

<b>MWD Run Number</b>	100	200	300		
<b>Date run completed</b>	08-Apr-14	09-Apr-14	13-Apr-14		
<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>	660.00	5,767.00	6,779.00		
<b>Log End Depth (MD, ft)</b>	5,767.00	6,779.00	11,885.00		
<b>Drill or Wipe</b>	Drill	Drill	Drill		
<b>Drill/Wipe Start Date and Time</b>	06-Apr-14 20:53	08-Apr-14 04:37	09-Apr-14 12:00		
<b>Drill/Wipe End Date and Time</b>	07-Apr-14 18:48	09-Apr-14 05:09	12-Apr-14 20:30		
<b>Min Inc (deg) @ Depth (MD, ft)</b>	0.19 @ 1,759.00	0.13 @ 5,782.00	84.72 @ 6,822.00		
<b>Max Inc (deg) @ Depth (MD, ft)</b>	9.65 @ 3,464.00	76.17 @ 6,721.00	92.00 @ 8,850.00		
<b>Bit TFA(in2) / Bit Type</b>	0.91 / PDC	0.98 / PDC	0.98 / PDC		
<b>Flow Rate (gpm)</b>	540.00	536.00	271.00		
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	213.6 / 213.6	427.3 / 427.3	429.3 / 429.3		
<b>Fluid Type</b>	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
<b>Density (ppg) / Viscosity (spqt)</b>	9.20 / 44.00	10.65 / 40.00	9.70 / 41.00		
<b>Filtrate CL (ppm)</b>	1,900.00	1,900.00	1,800.00		
<b>pH / Fluid Loss (mptm)</b>	10.30 / N/A	10.00 / N/A	9.90 / N/A		
<b>PV (cP) / YP (lbf2)</b>	12 / 12.00	14 / 10.00	10 / 12.00		
<b>% Solids / % Sand</b>	6.5 / .5	11.9 / .25	6.7 / .1		
<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 (degF) / S</b>	145.00 / PGM	150.47 / PGM	210.01 / PGM		

Max Tool Temp (degF) / Source	145.90 / PCM	158.47 / PCM	210.31 / 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	Jeremy Stolz	Charles Collver	Charles Collver		

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM	PCM		
Software Version	5.84	5.84	5.84		
Sub Serial Number	11404277	11404277	12334775		
Insert Serial Number	11680106	11680106	11620293		
Date and Time Initialized	05-Apr-14 17:06	01-Jan-70 00:00	09-Apr-14 14:32		
Date and Time Read	09-Apr-14 11:03	09-Apr-14 10:53	13-Apr-14 13:45		
ECMB SW Version	N/A	N/A	N/A		

### Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	58.00	58.00	68.00		
Software Version	6.21	6.21	6.21		
Sub Serial Number	11404277	11404277	12334775		
Sonde Serial Number	11478090	11478090	11168934		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	149.32	121.99	156.10		

### Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	51.12	50.84	60.86		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	11404277	11404277	12334775		
Insert/Sonde Serial Number	12071281	12071281	11120594		

## 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"

PGXR (Gamma Ray):

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

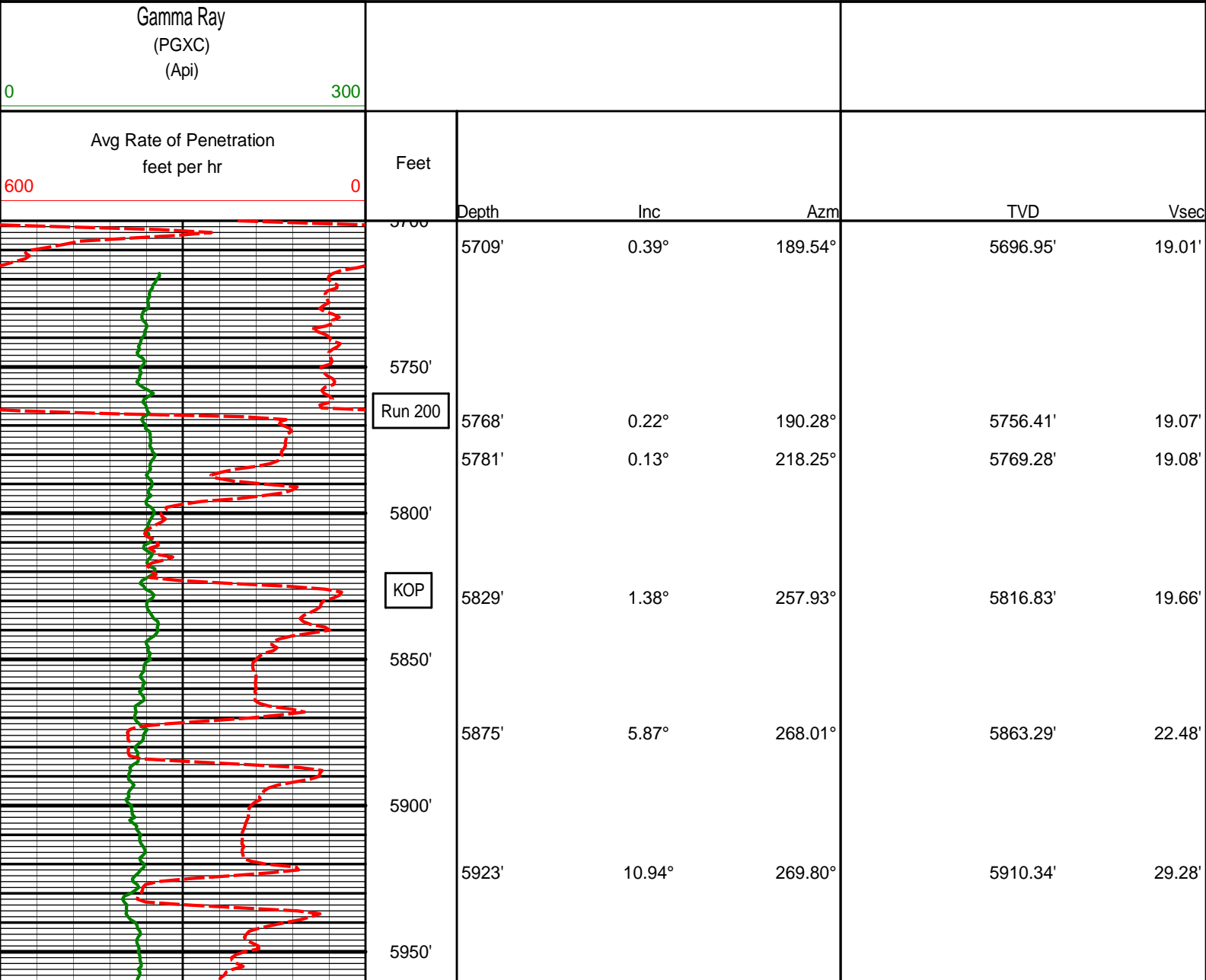
5. There is 16 feet of gamma missing due to pressure fluctuation

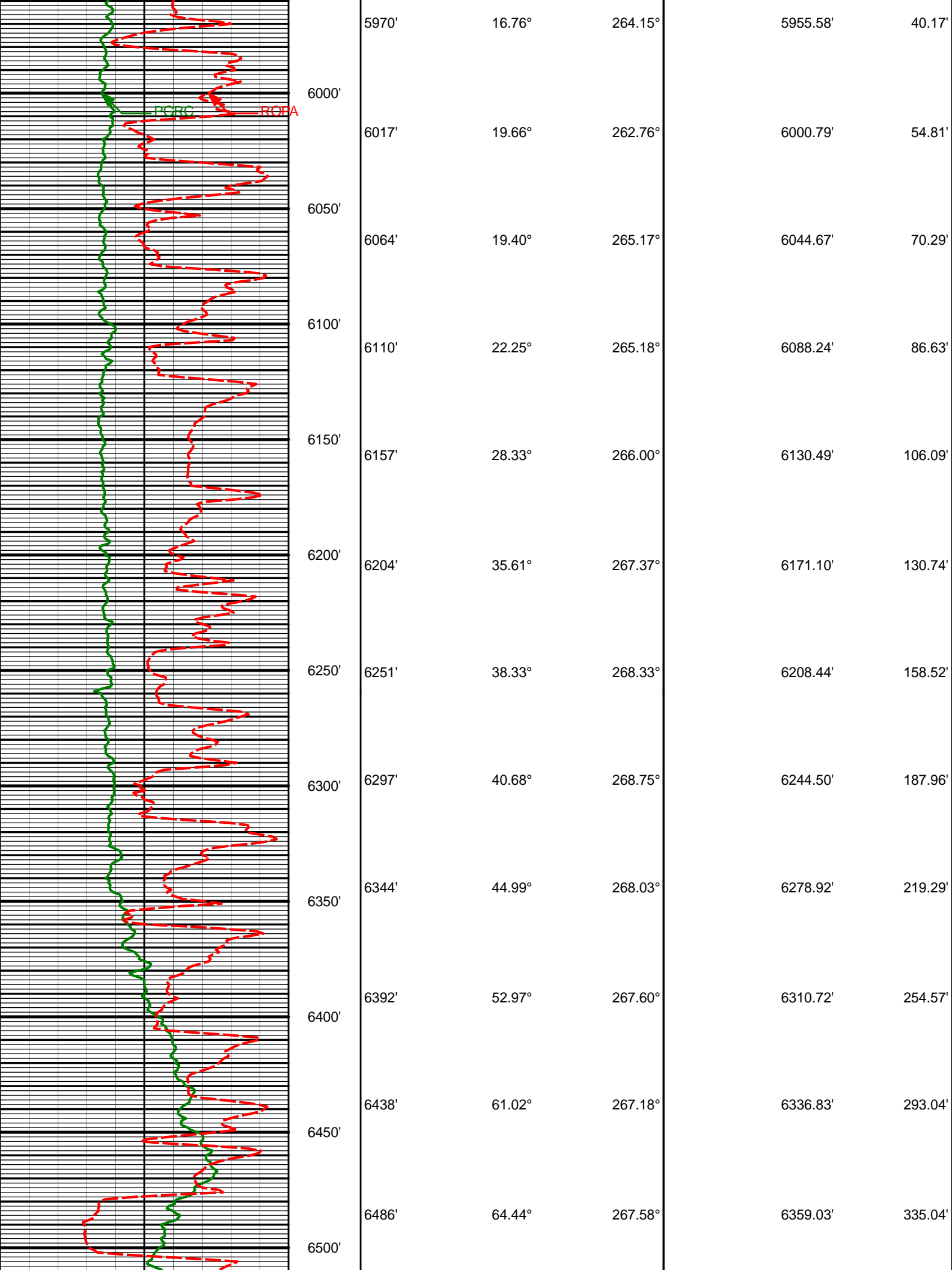
## WARRANTY

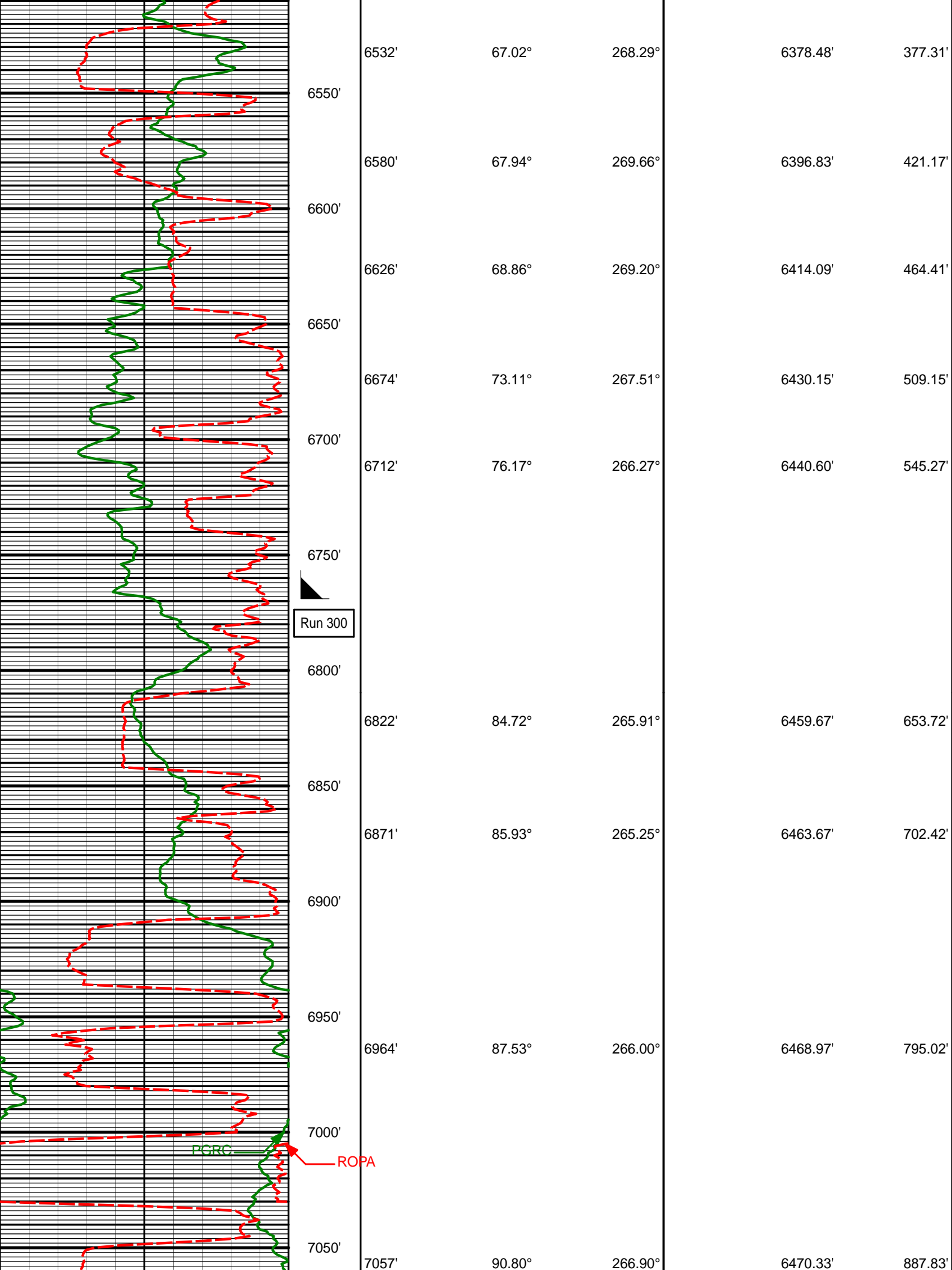
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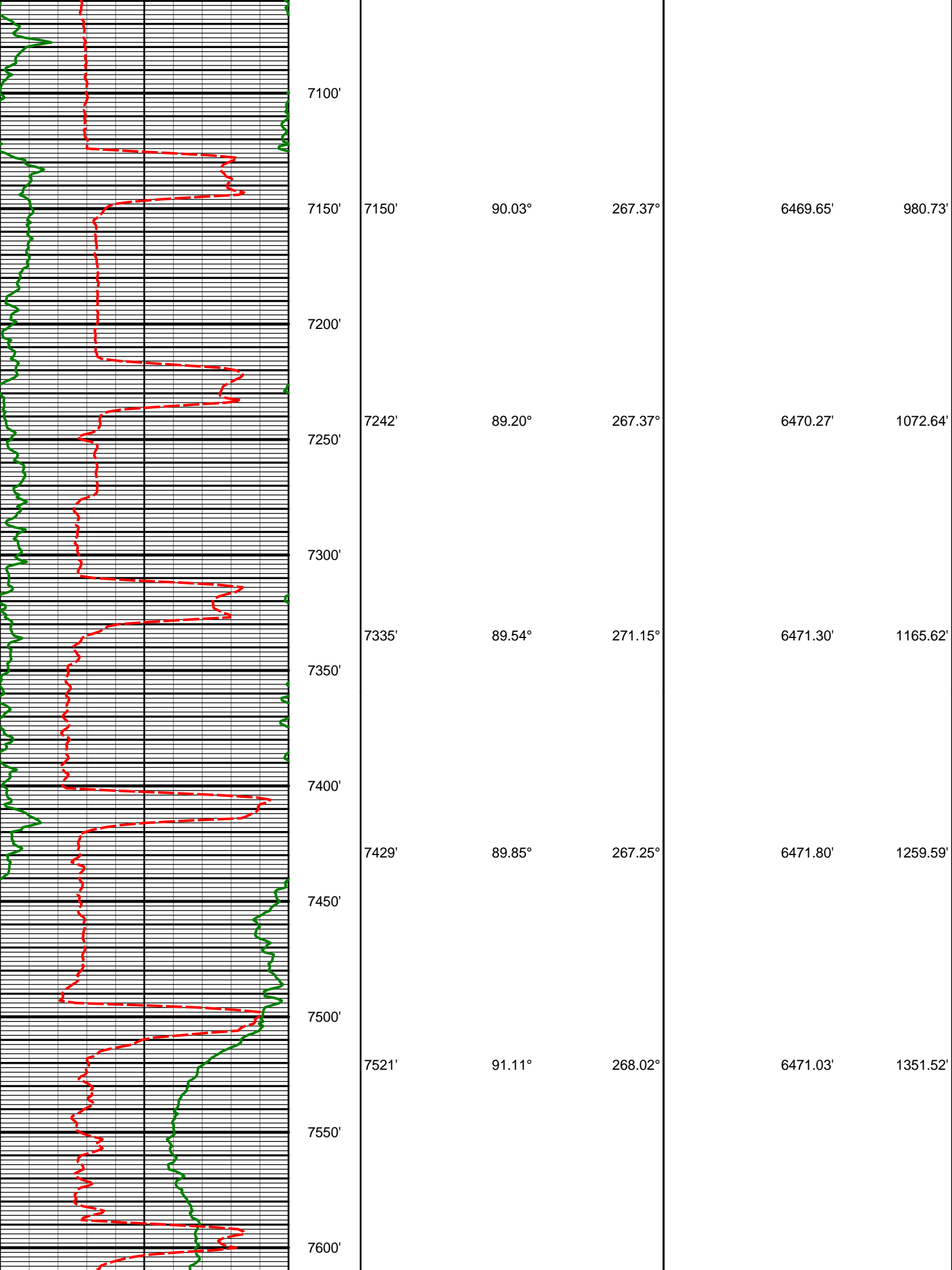
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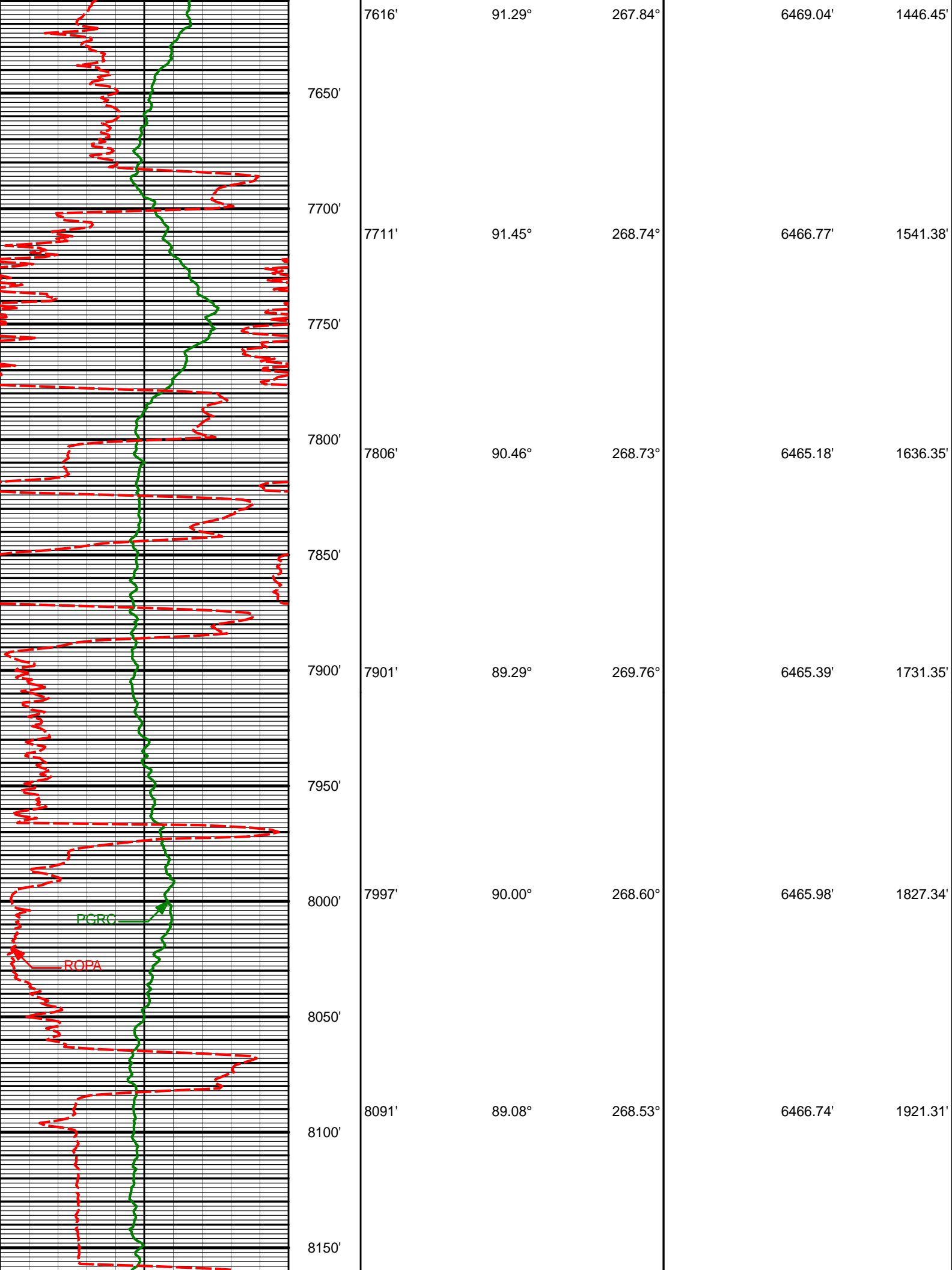
MD Detail Log 1:600

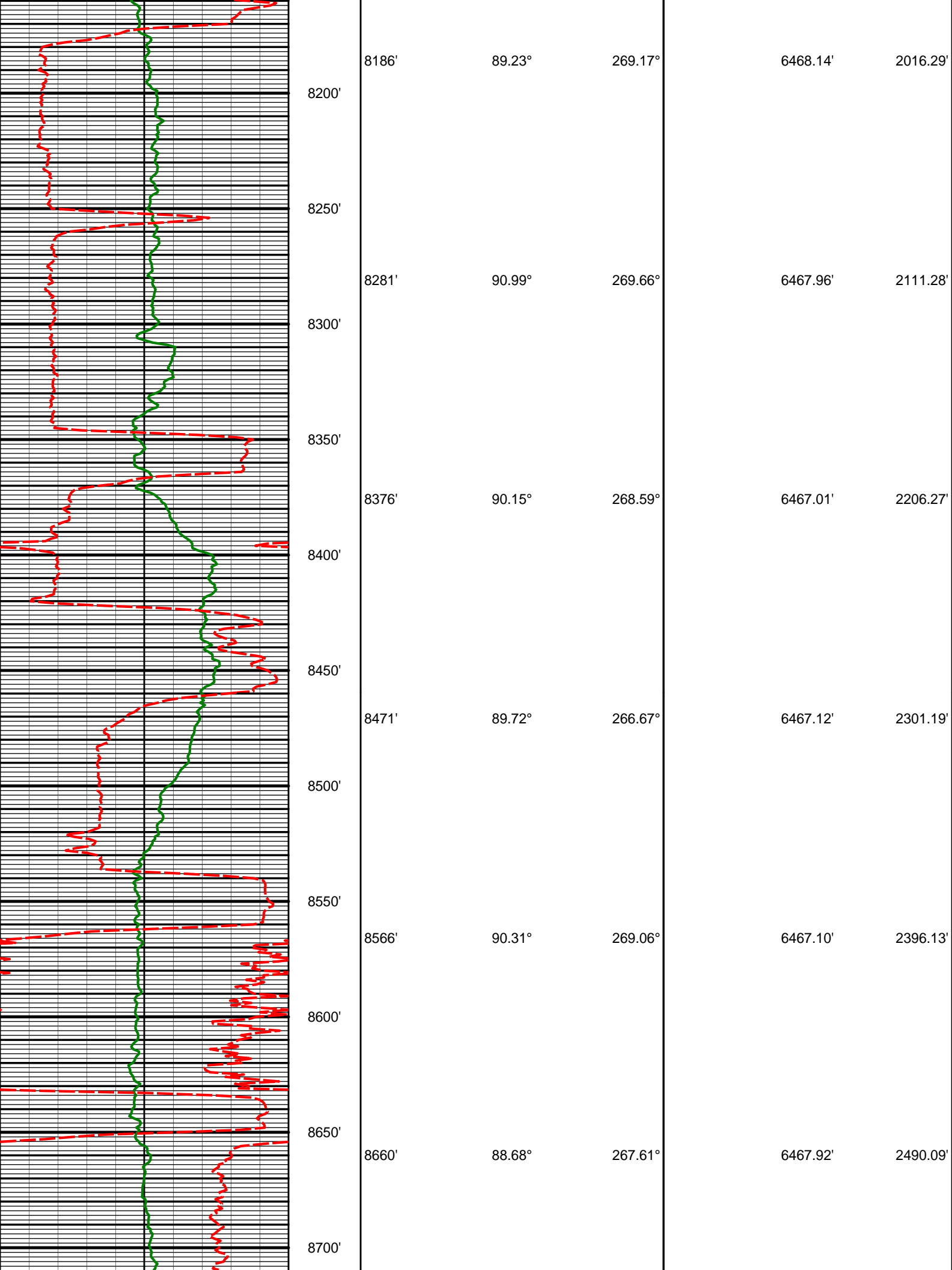


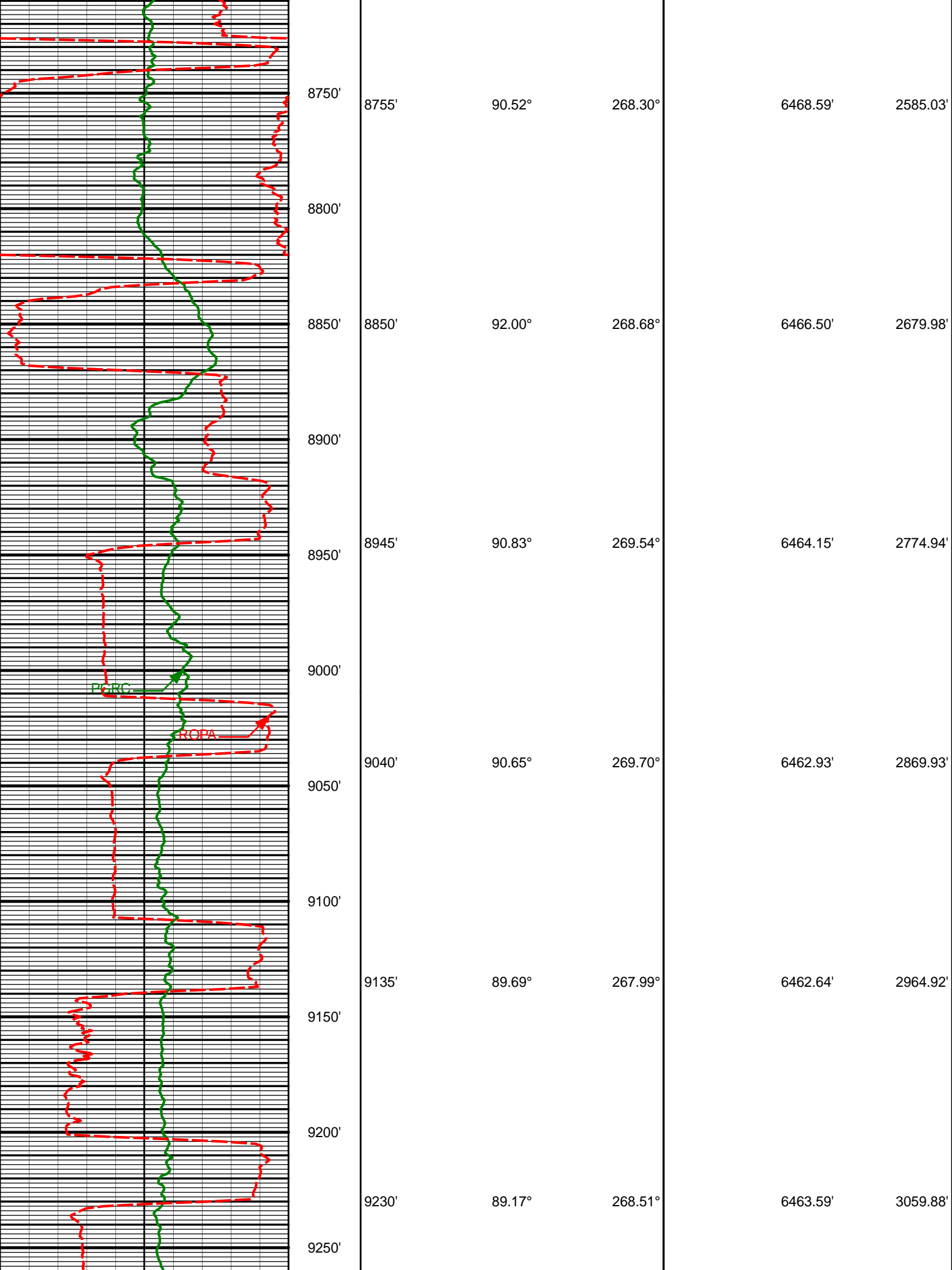


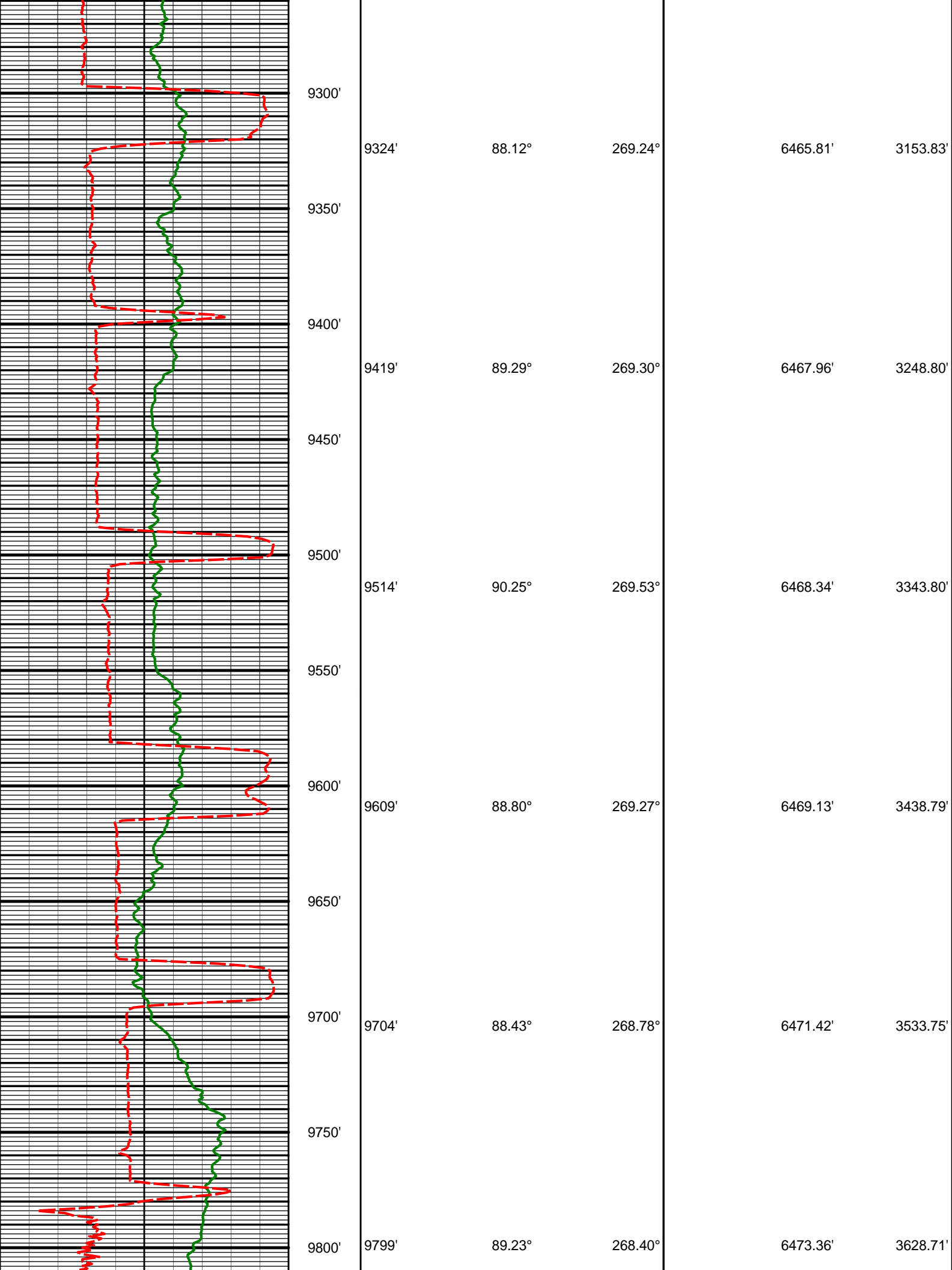


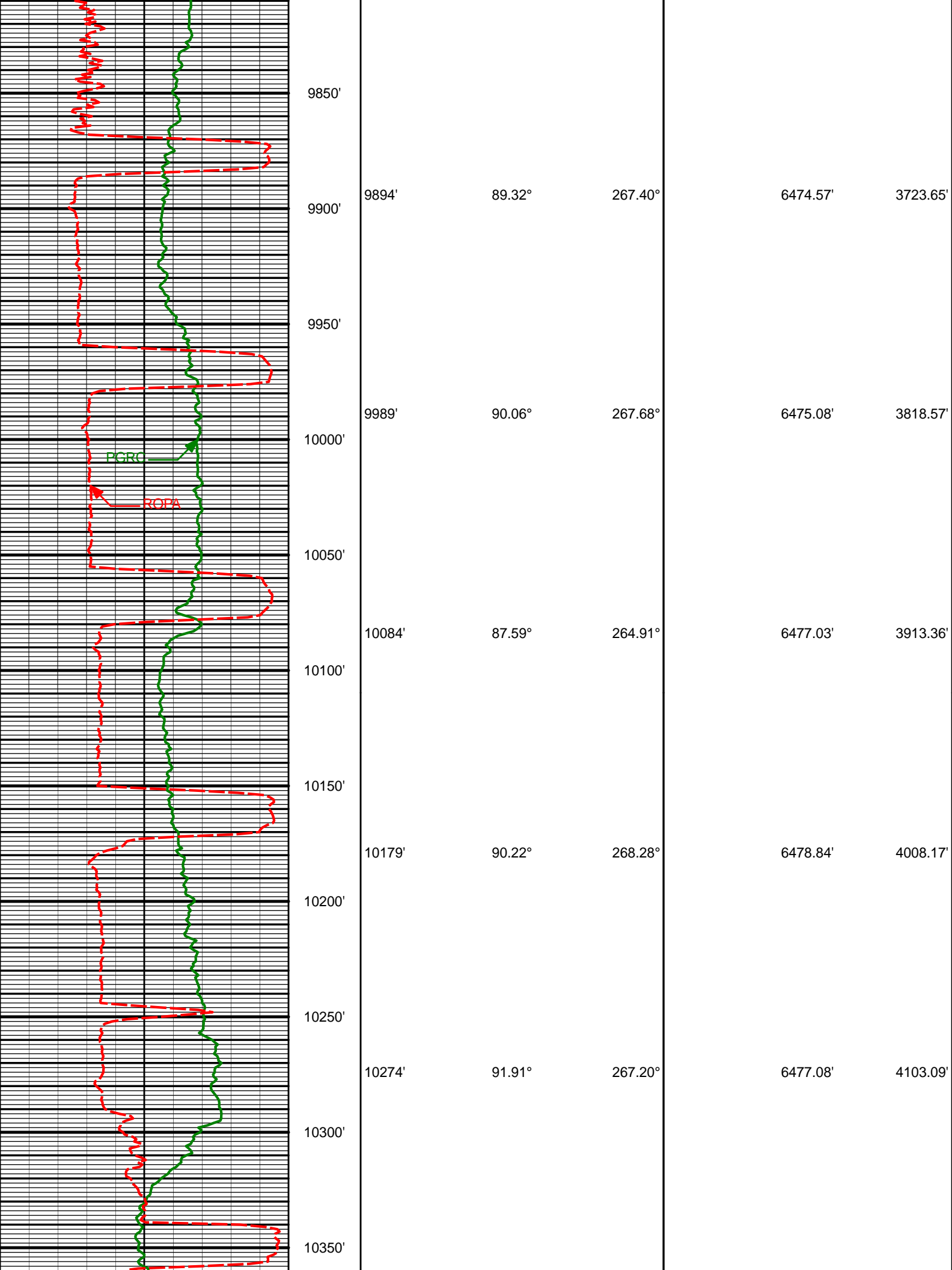


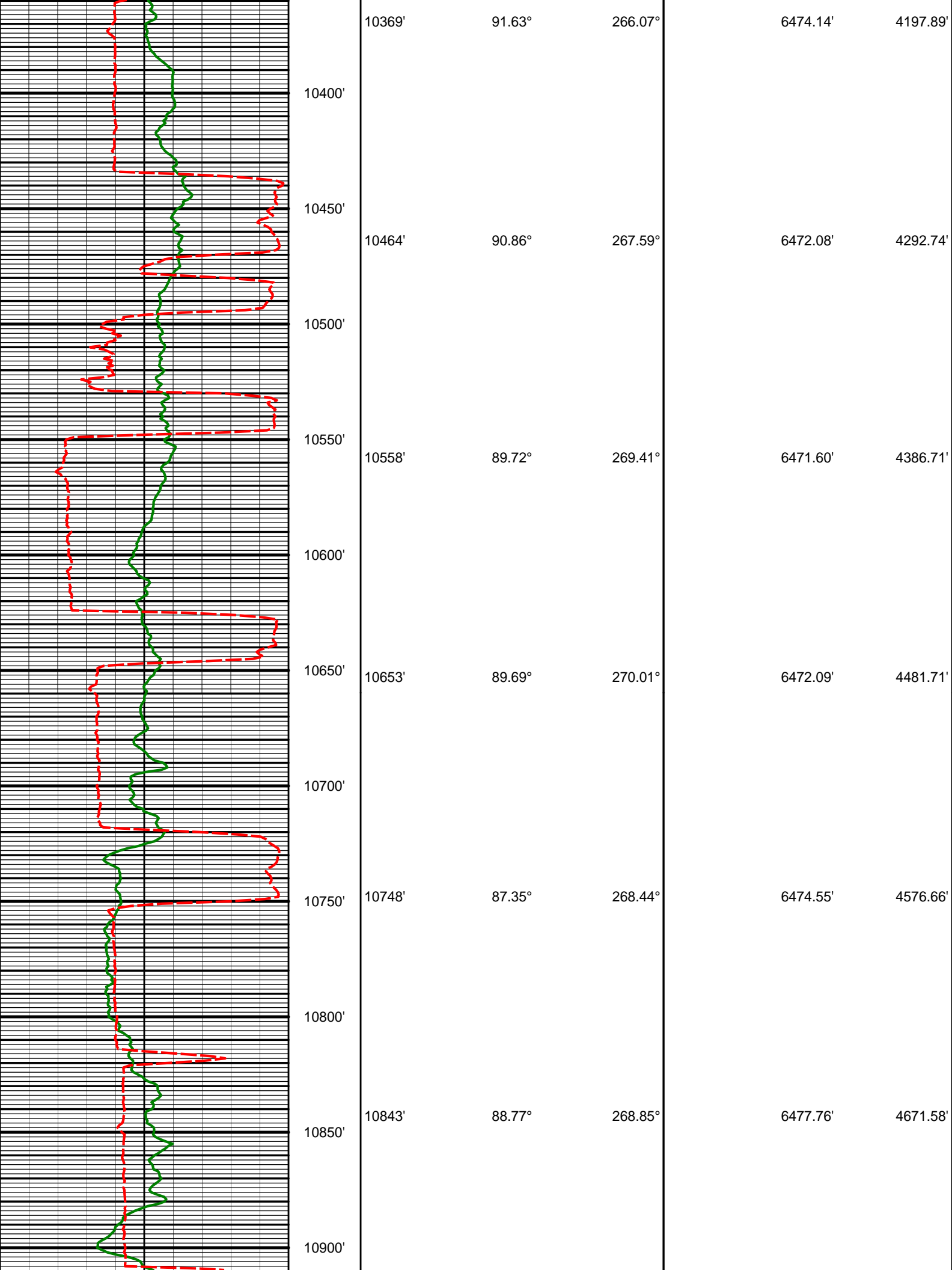


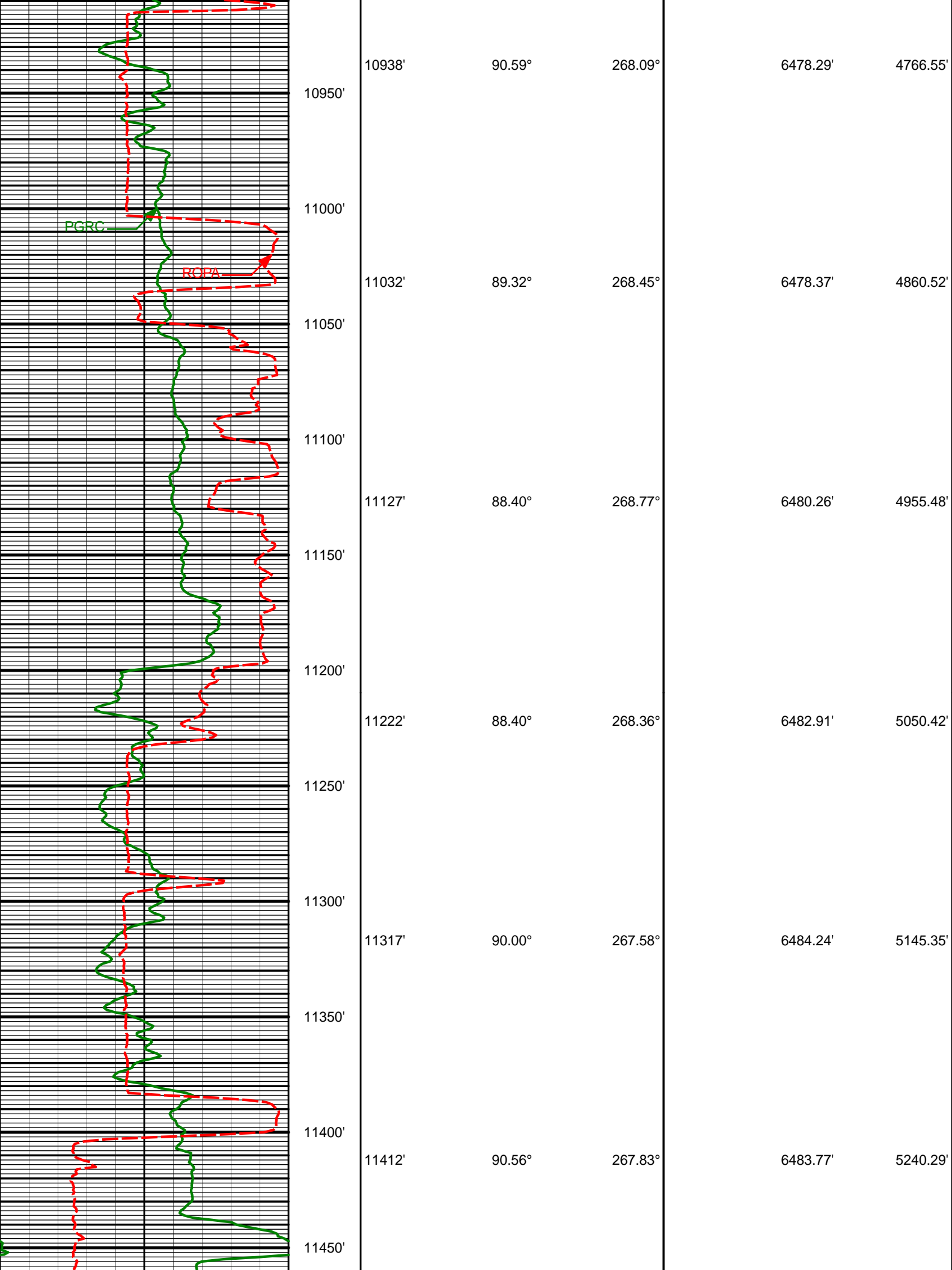


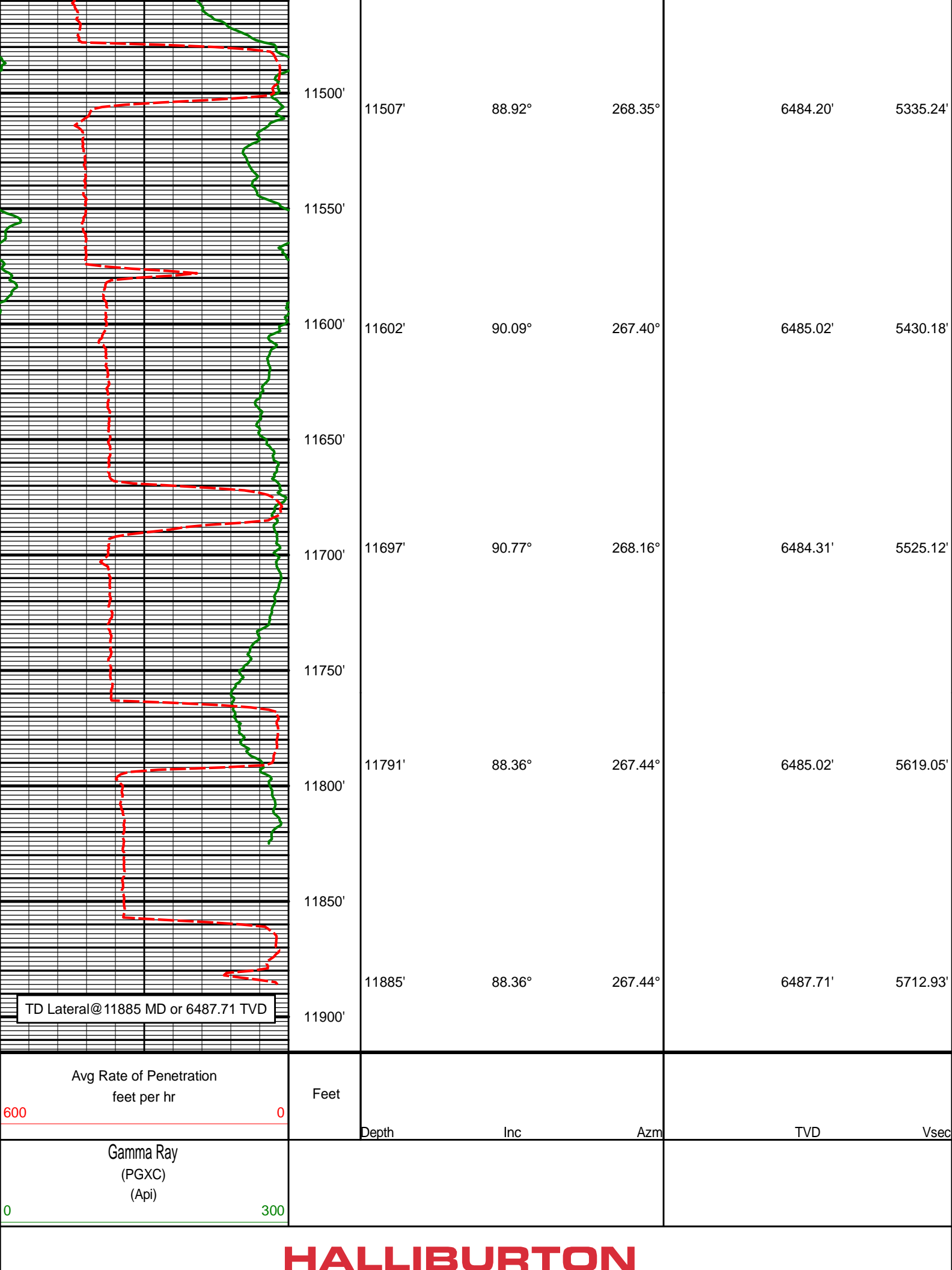




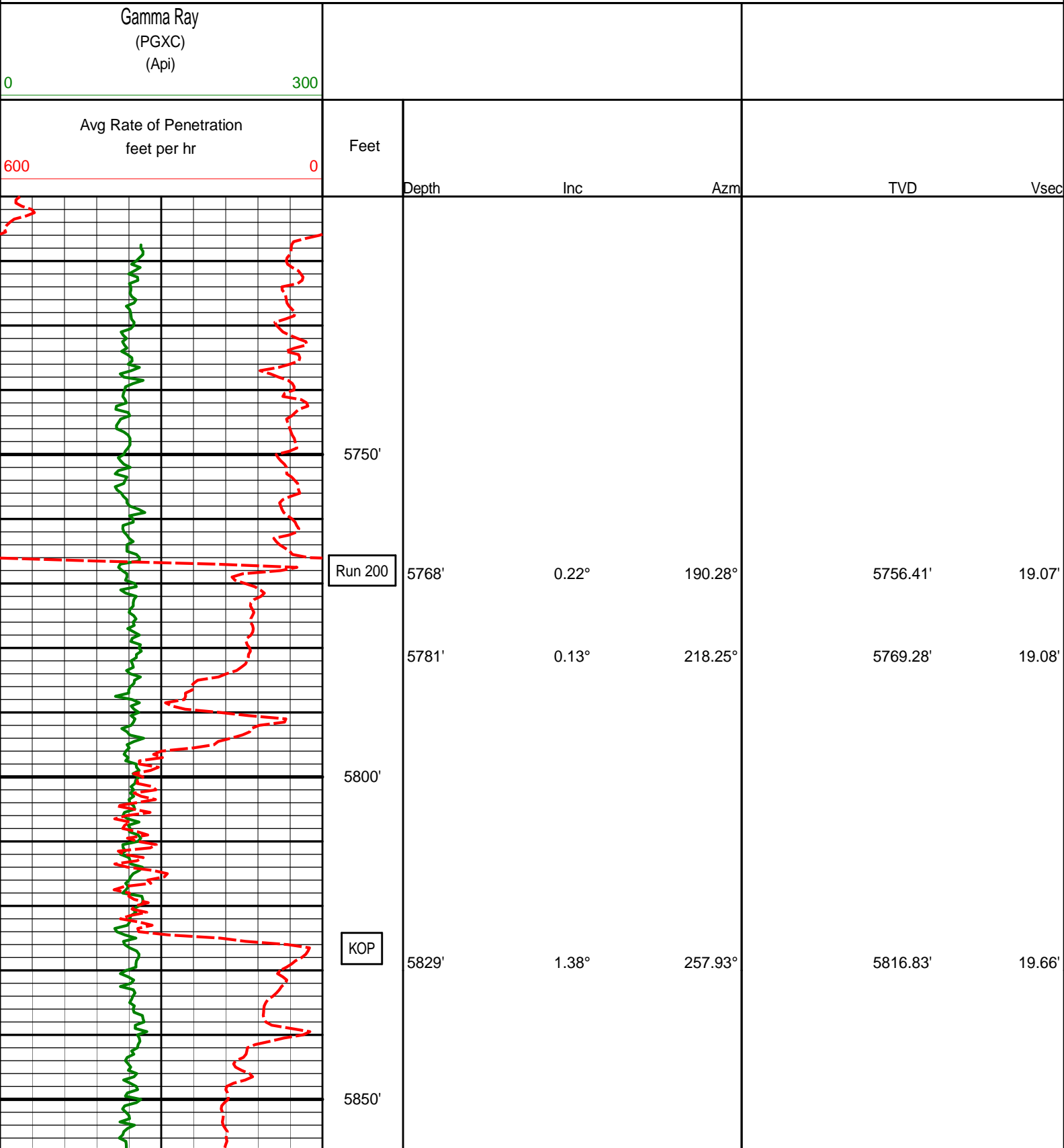


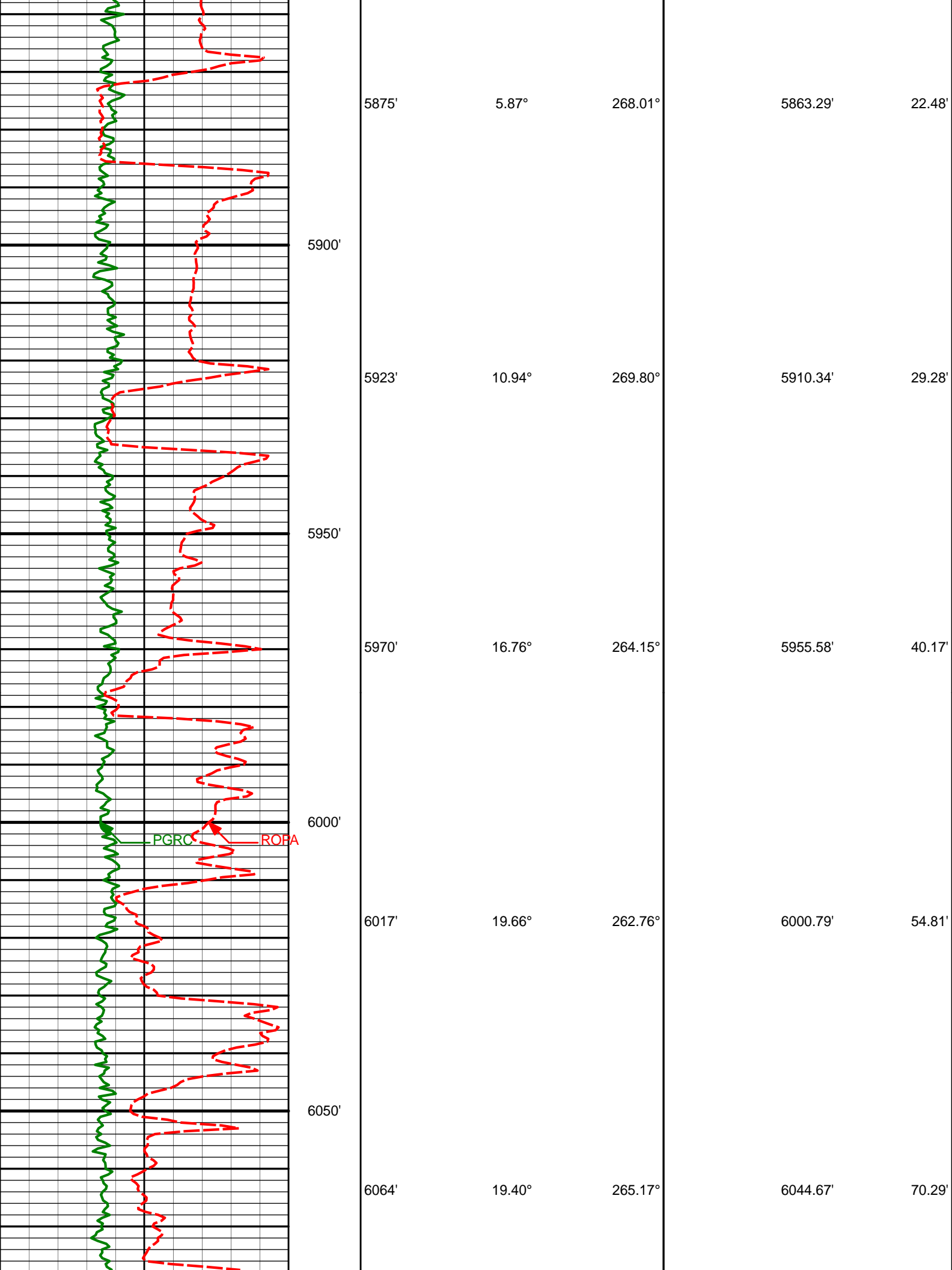


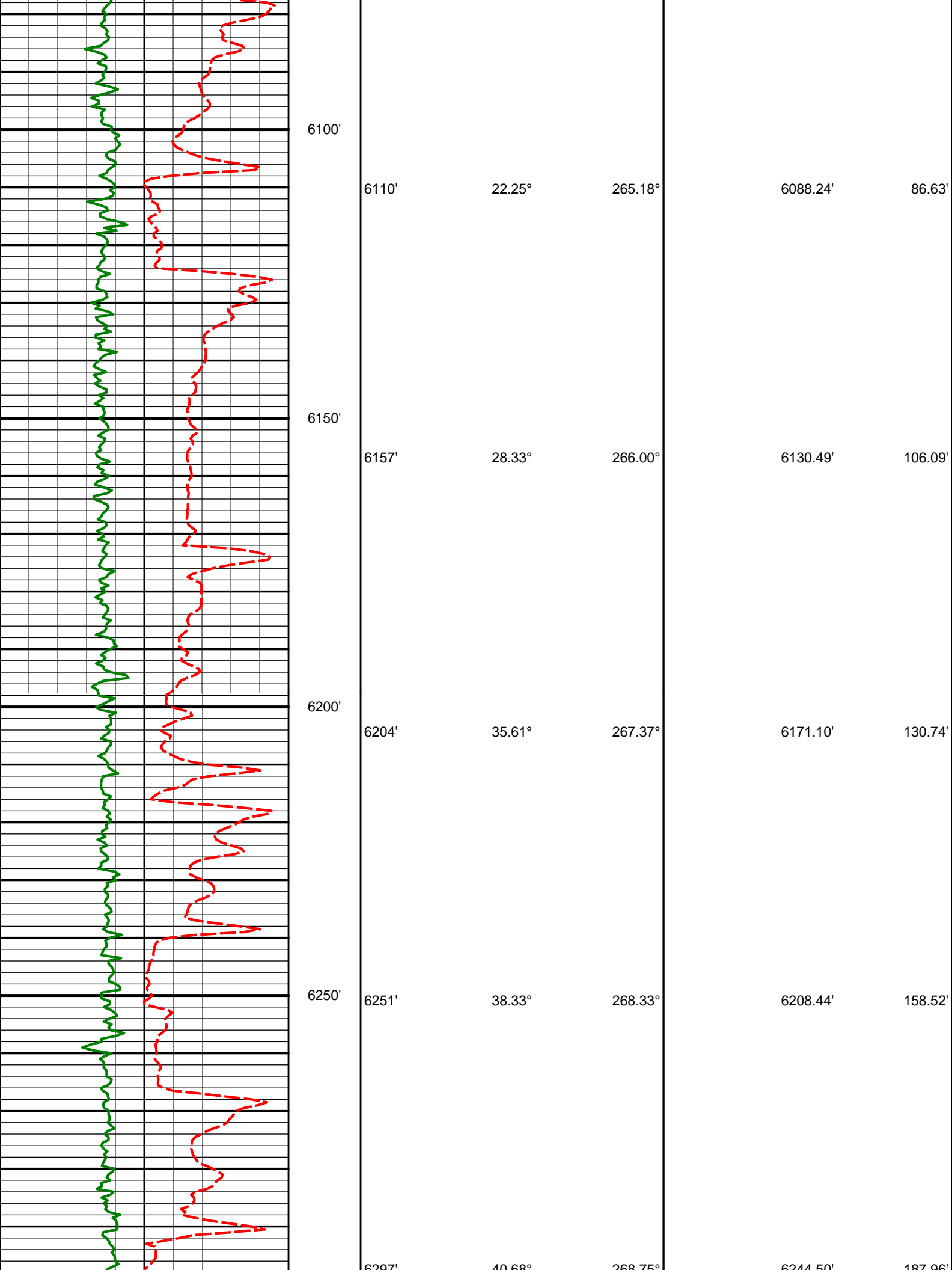


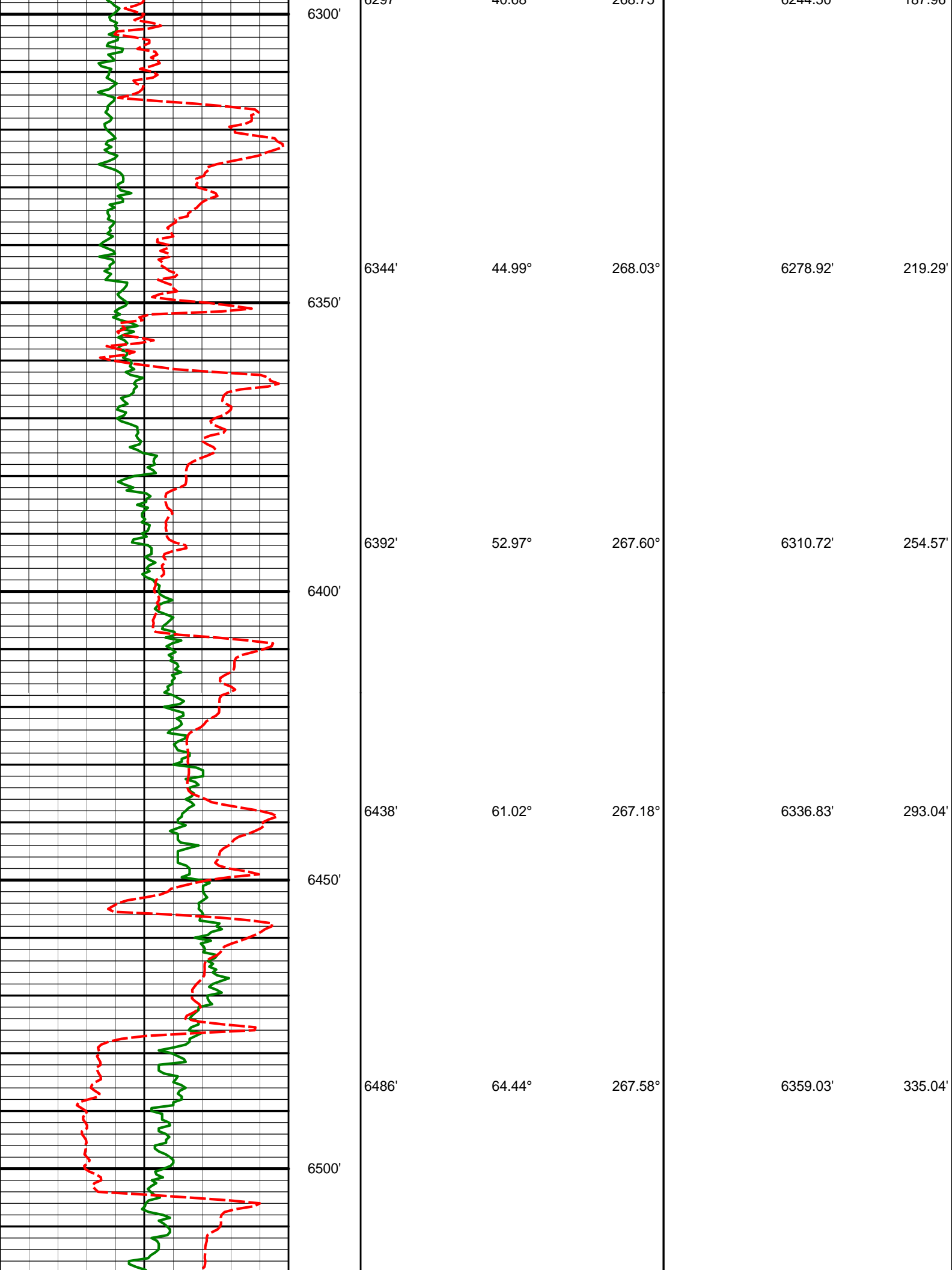


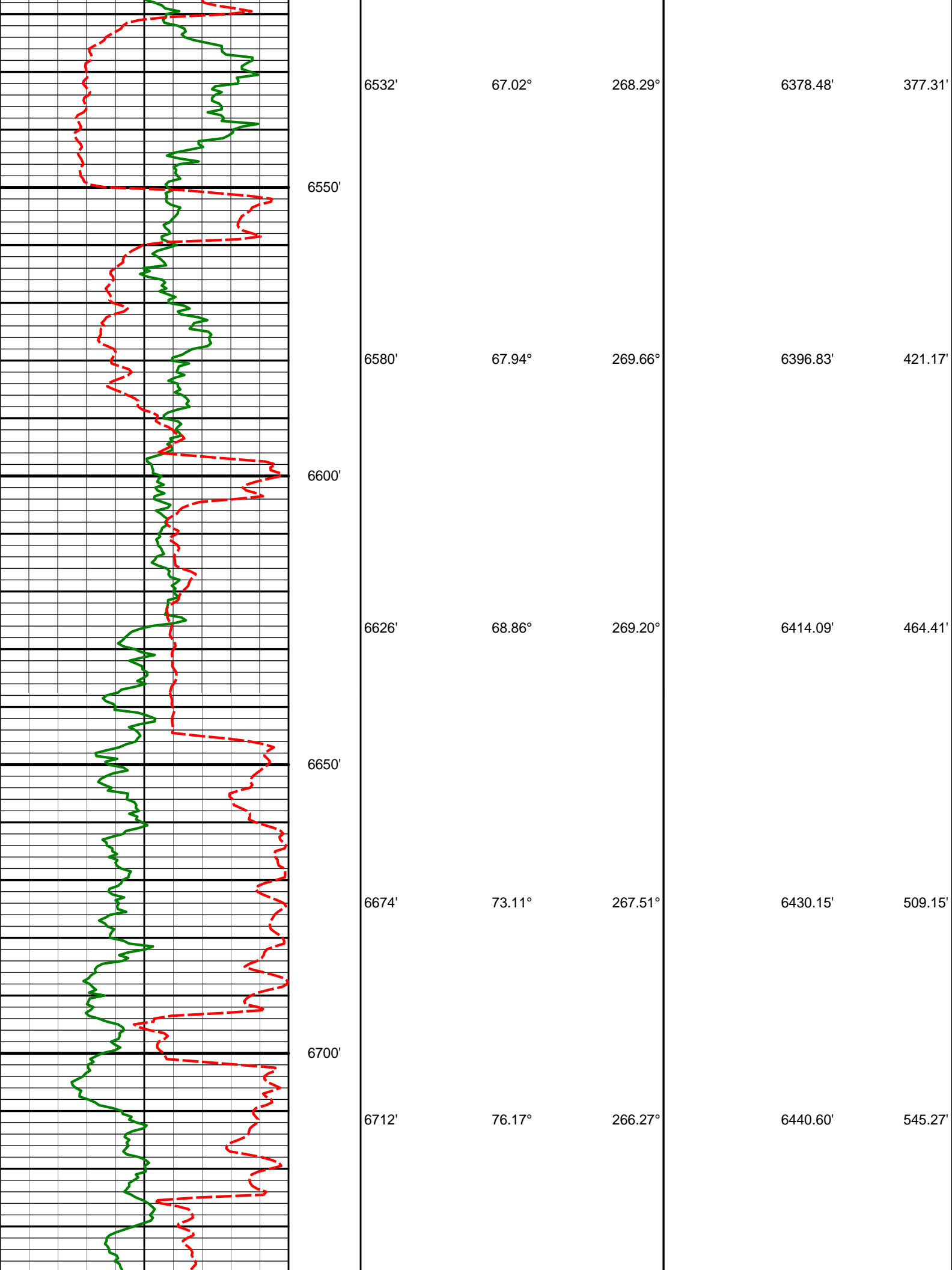
MD Detail Log 1:240

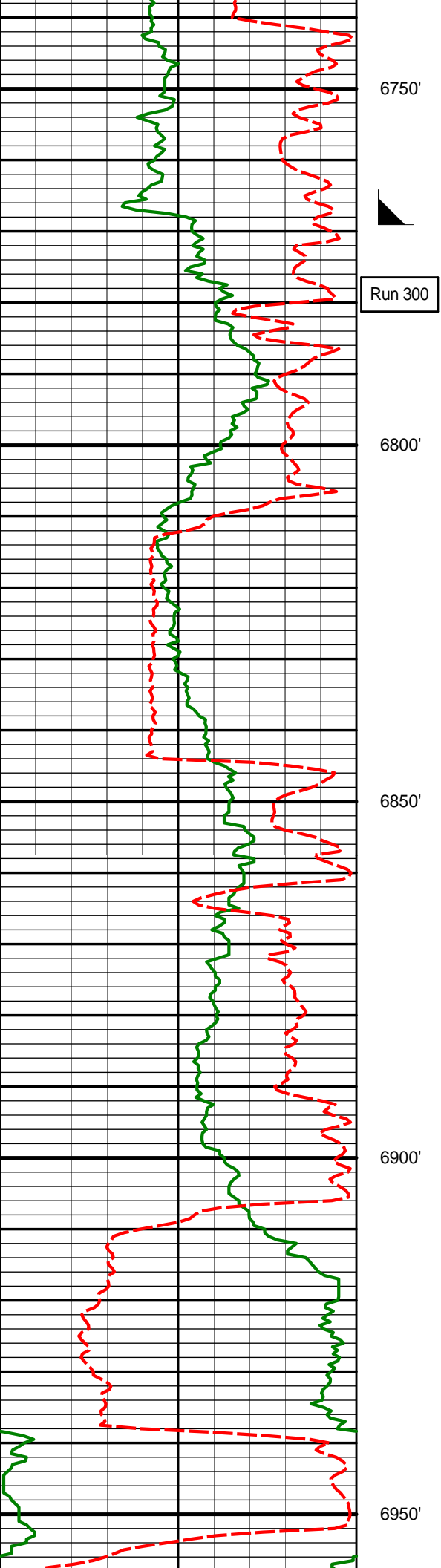












6822'

84.72°

265.91°

6459.67'

653.72'

6850'

6871'

85.93°

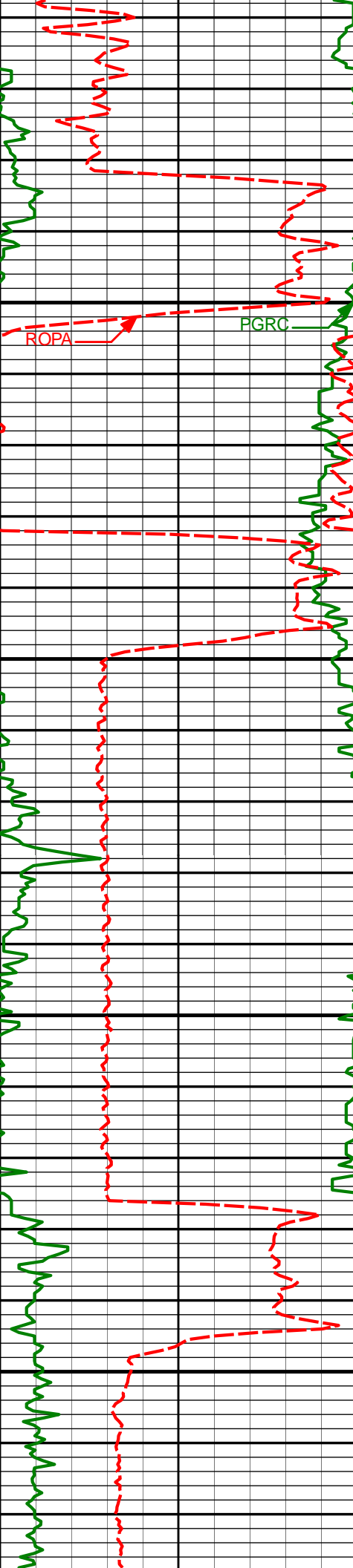
265.25°

6463.67'

702.42'

6900'

6950'



6964'

87.53°

266.00°

6468.97'

795.02'

7000'

ROPA

PGRC

7050'

7057'

90.80°

266.90°

6470.33'

887.83'

7100'

7150'

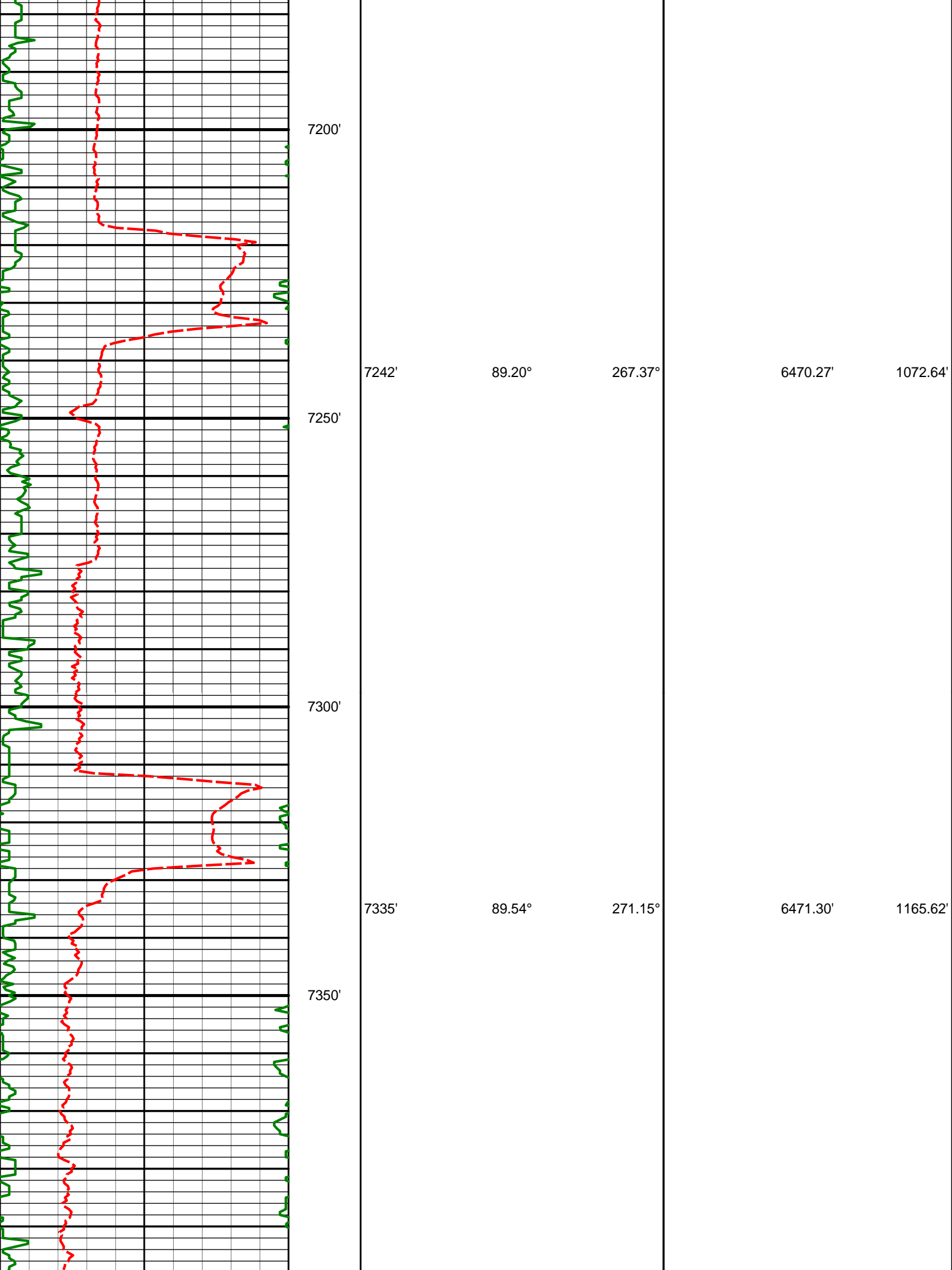
7150'

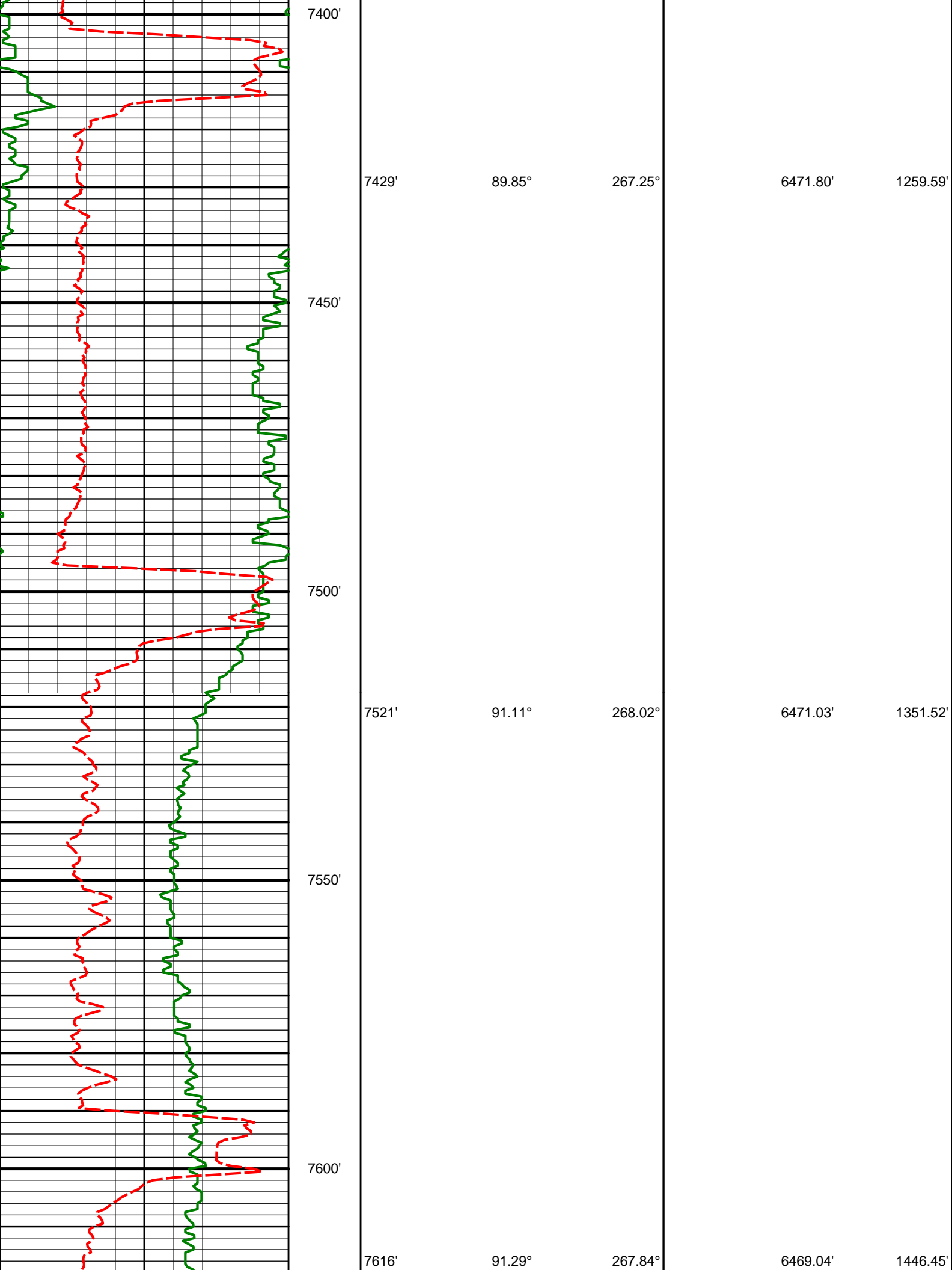
90.03°

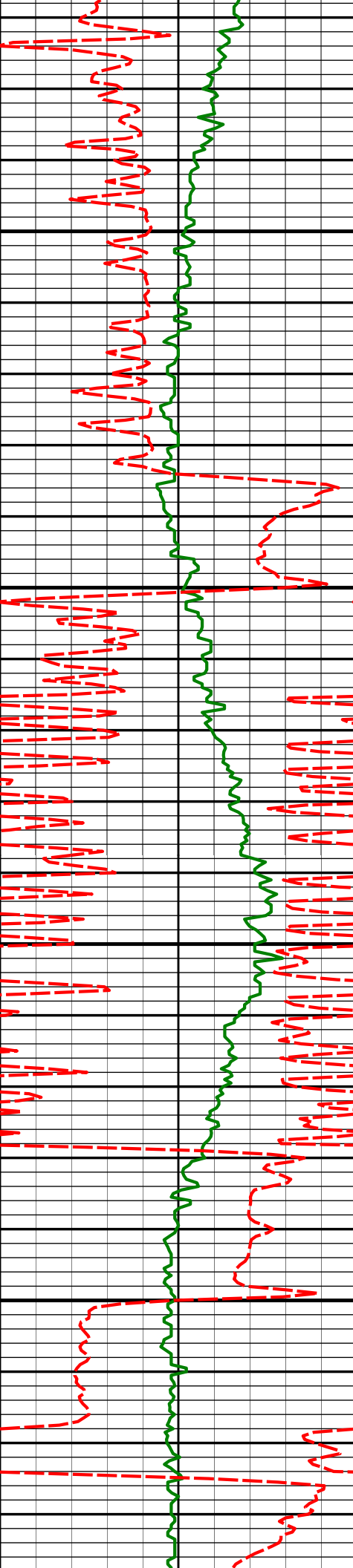
267.37°

6469.65'

980.73'







7650'

7700'

7750'

7800'

7711'

7806'

91.45°

90.46°

268.74°

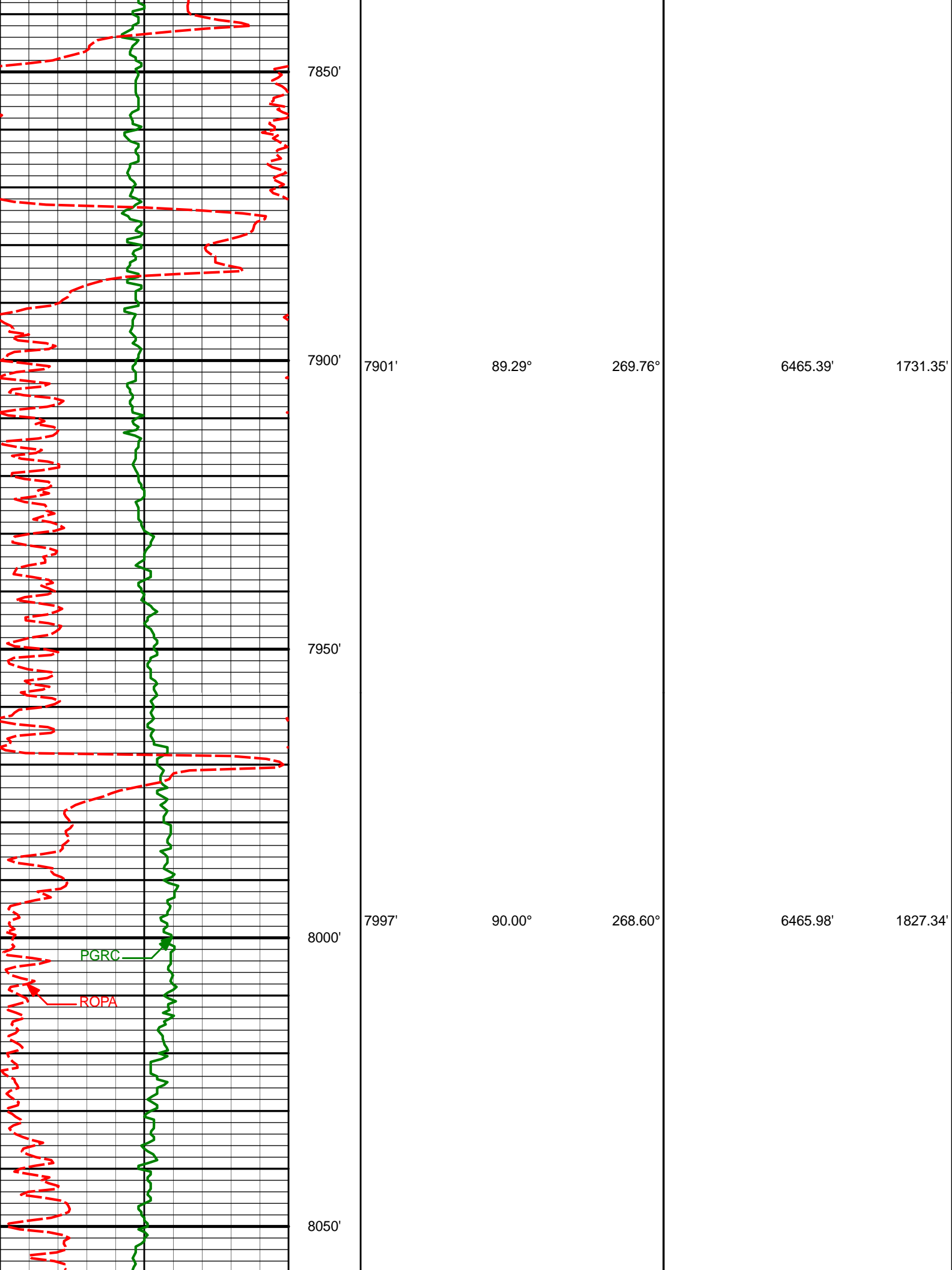
268.73°

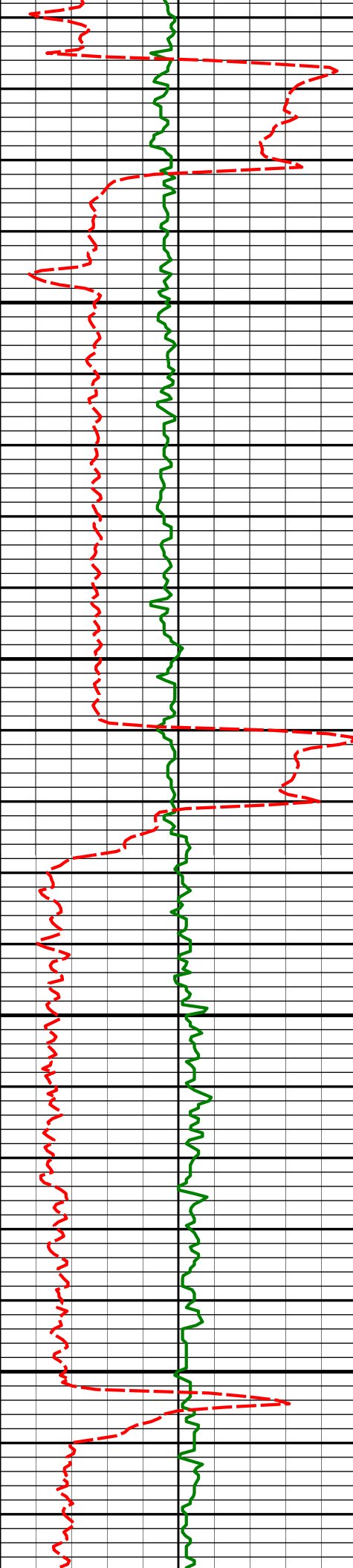
6466.77'

6465.18'

1541.38'

1636.35'





8091'

8100'

8150'

8186'

8200'

8250'

8091'

8186'

89.08°

89.23°

268.53°

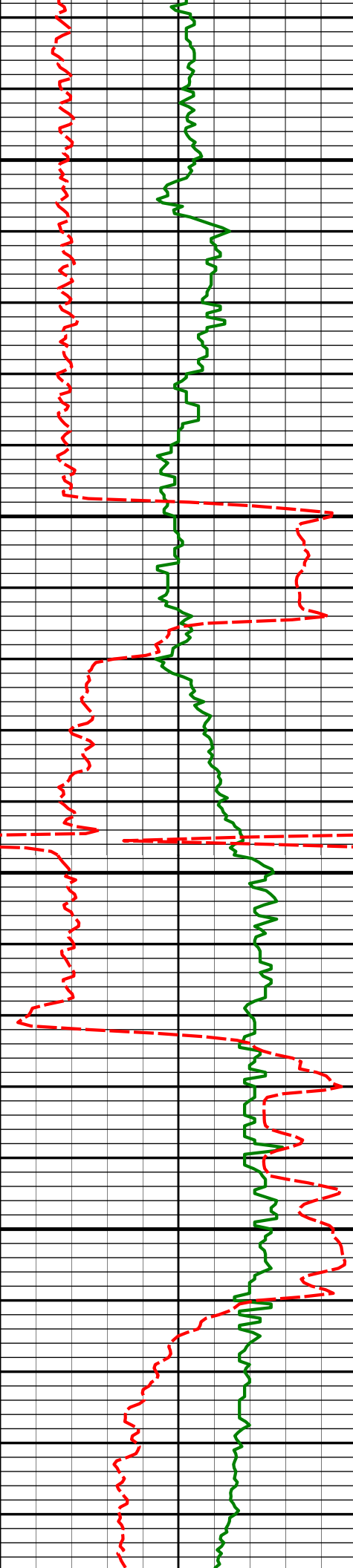
269.17°

6466.74'

6468.14'

1921.31'

2016.29'



8300'

8350'

8400'

8450'

8281'

90.99°

269.66°

6467.96'

2111.28'

8376'

90.15°

268.59°

6467.01'

2206.27'

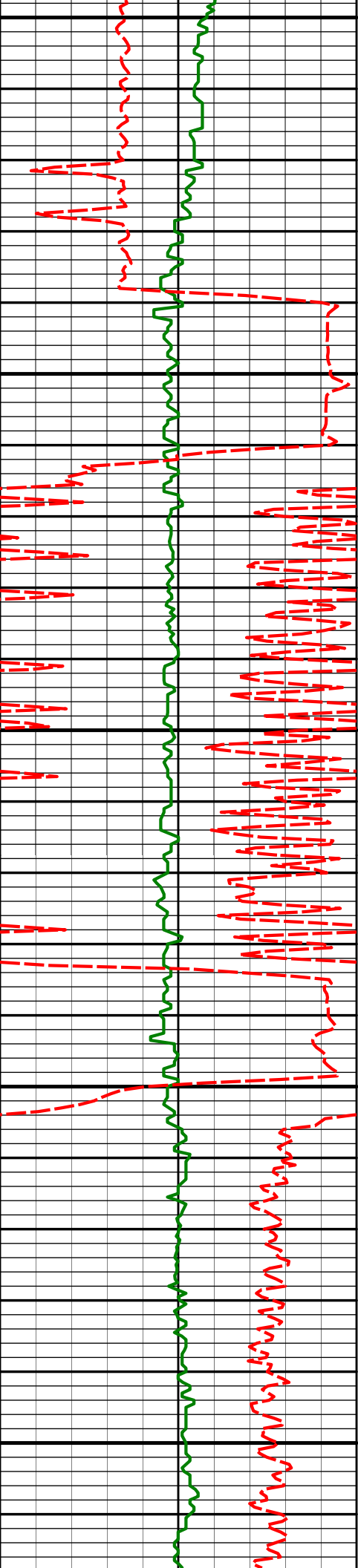
8471'

89.72°

266.67°

6467.12'

2301.19'



8500'

8550'

8566'

90.31°

269.06°

6467.10'

2396.13'

8600'

8650'

8660'

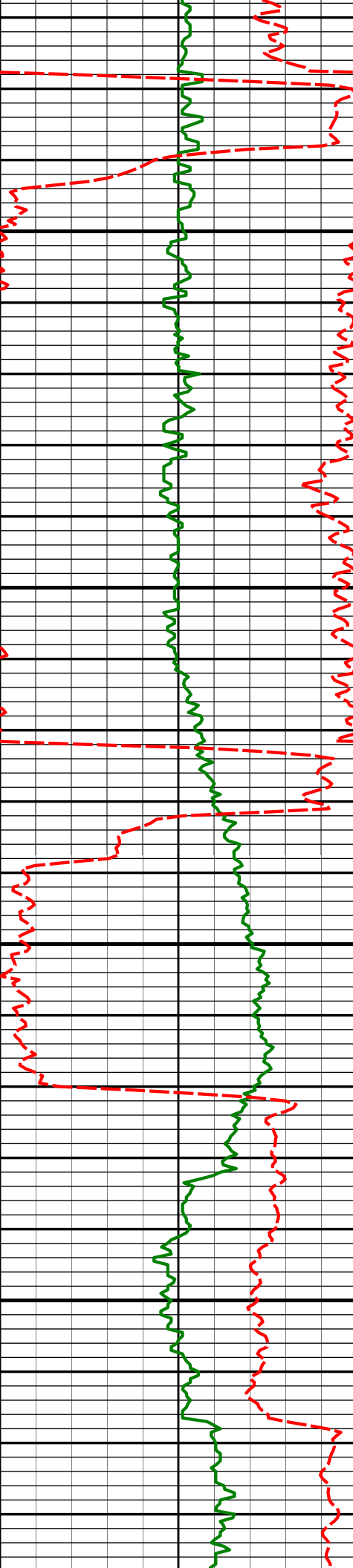
88.68°

267.61°

6467.92'

2490.09'

8700'



8750'

8755'

90.52°

268.30°

6468.59'

2585.03'

8800'

8850'

8850'

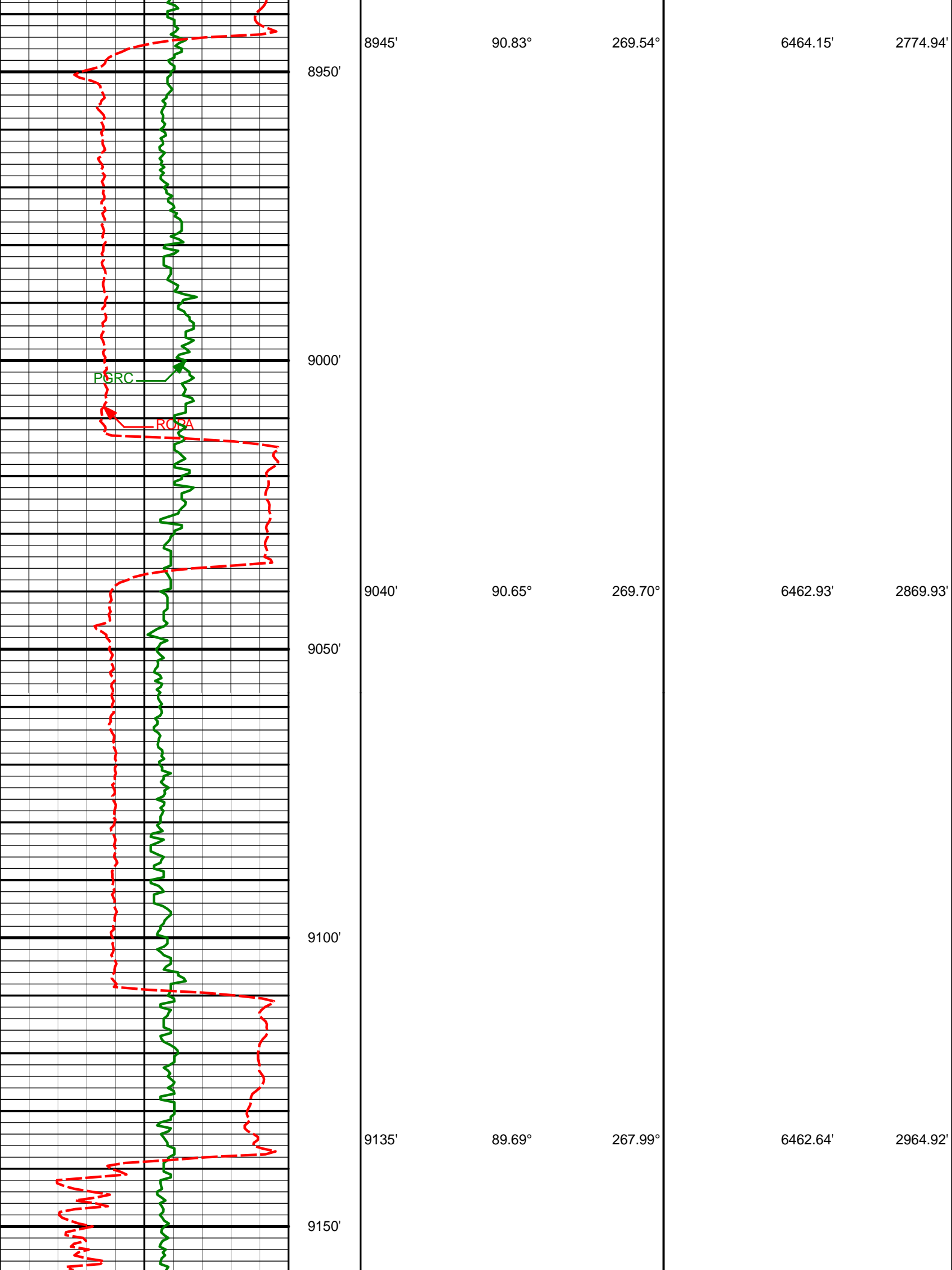
92.00°

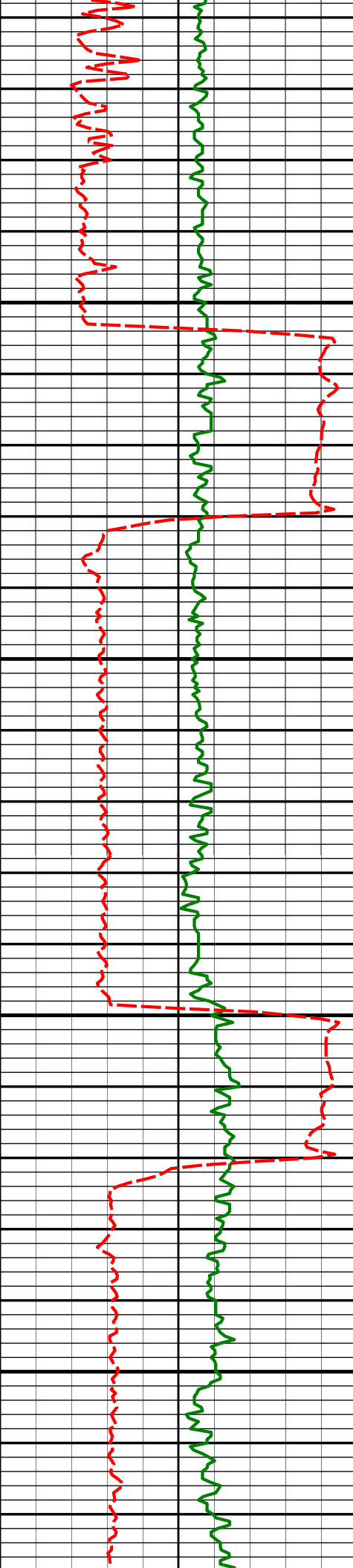
268.68°

6466.50'

2679.98'

8900'





9200'

9230'

9250'

9300'

9324'

9350'

89.17°

268.51°

6463.59'

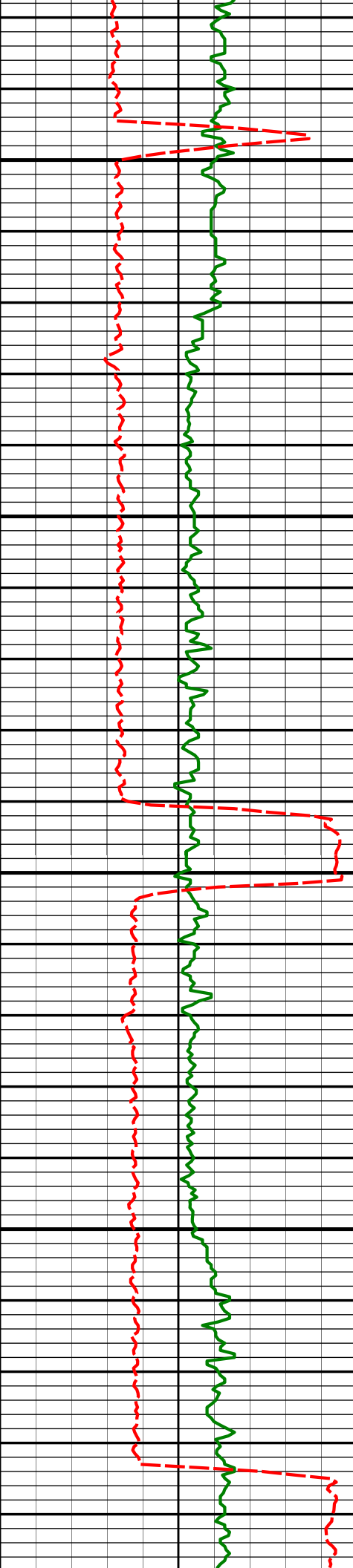
3059.88'

88.12°

269.24°

6465.81'

3153.83'



9400'

9419'

89.29°

269.30°

6467.96'

3248.80'

9450'

9500'

9514'

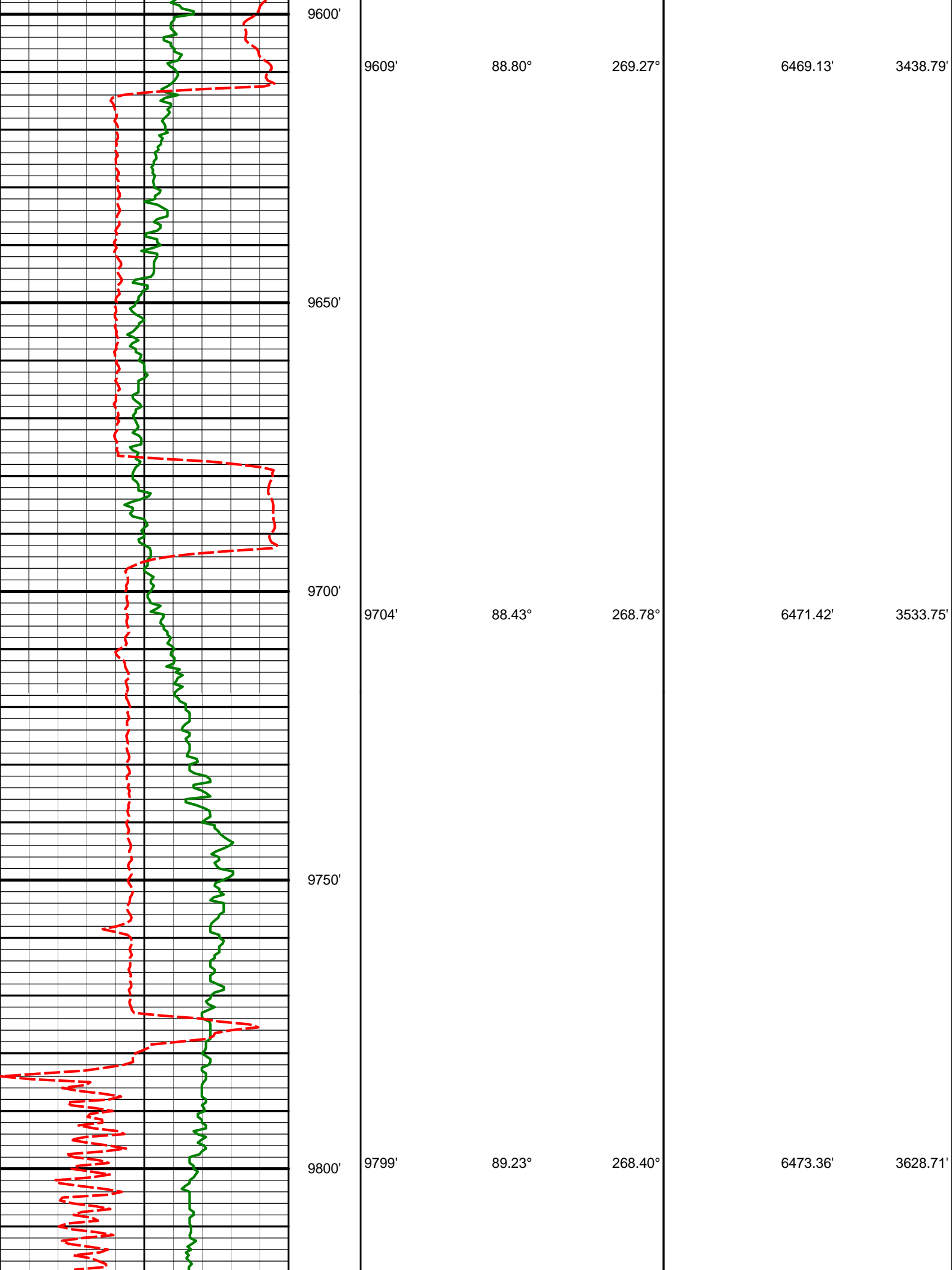
90.25°

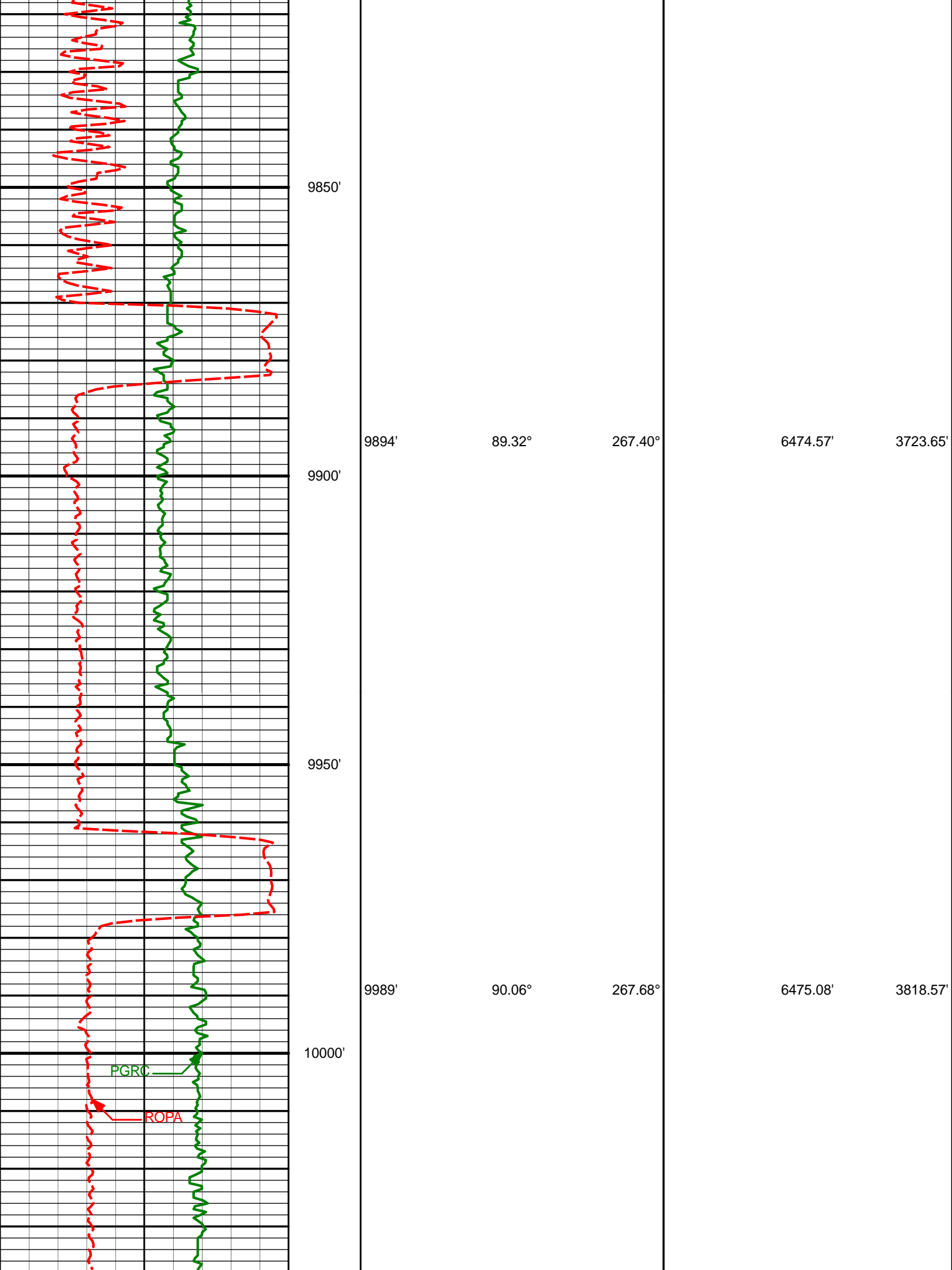
269.53°

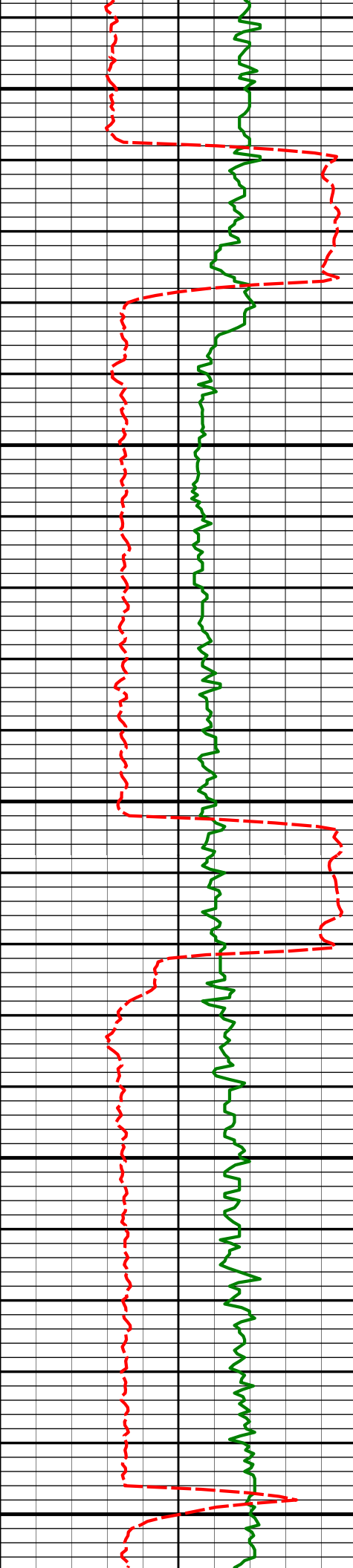
6468.34'

3343.80'

9550'







10050'

10084'

87.59°

264.91°

6477.03'

3913.36'

10100'

10150'

10179'

90.22°

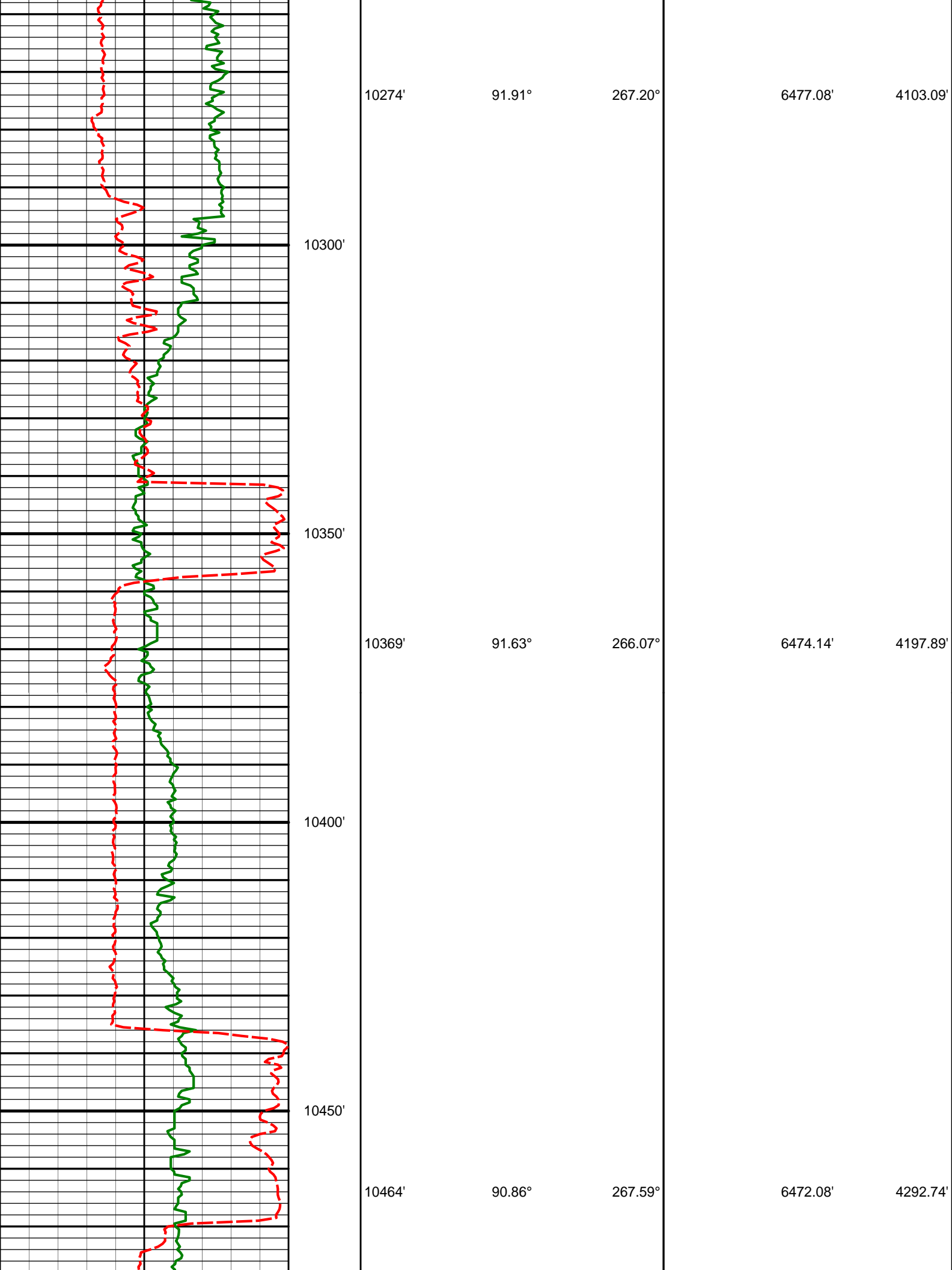
268.28°

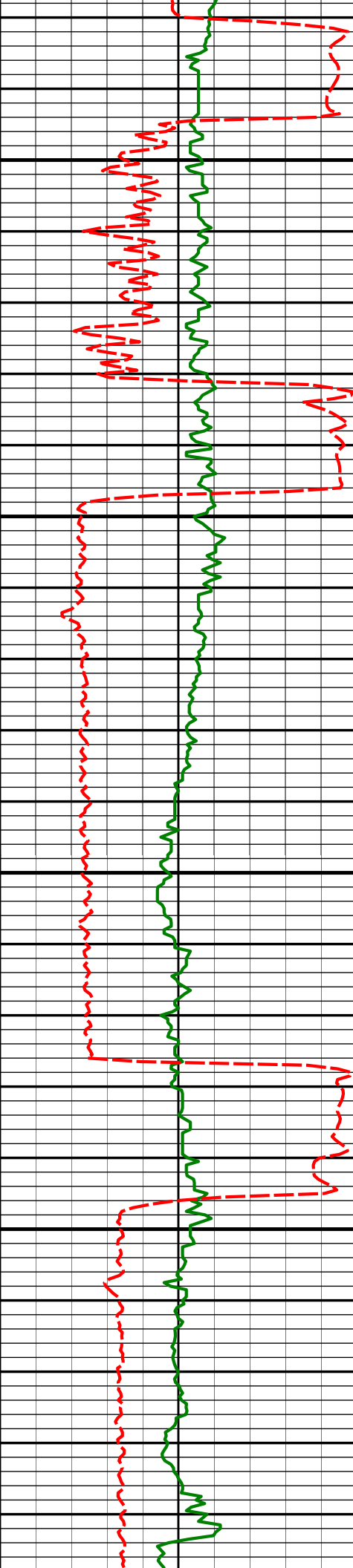
6478.84'

4008.17'

10200'

10250'





10500'

10550'

10600'

10650'

10558'

89.72°

269.41°

6471.60'

4386.71'

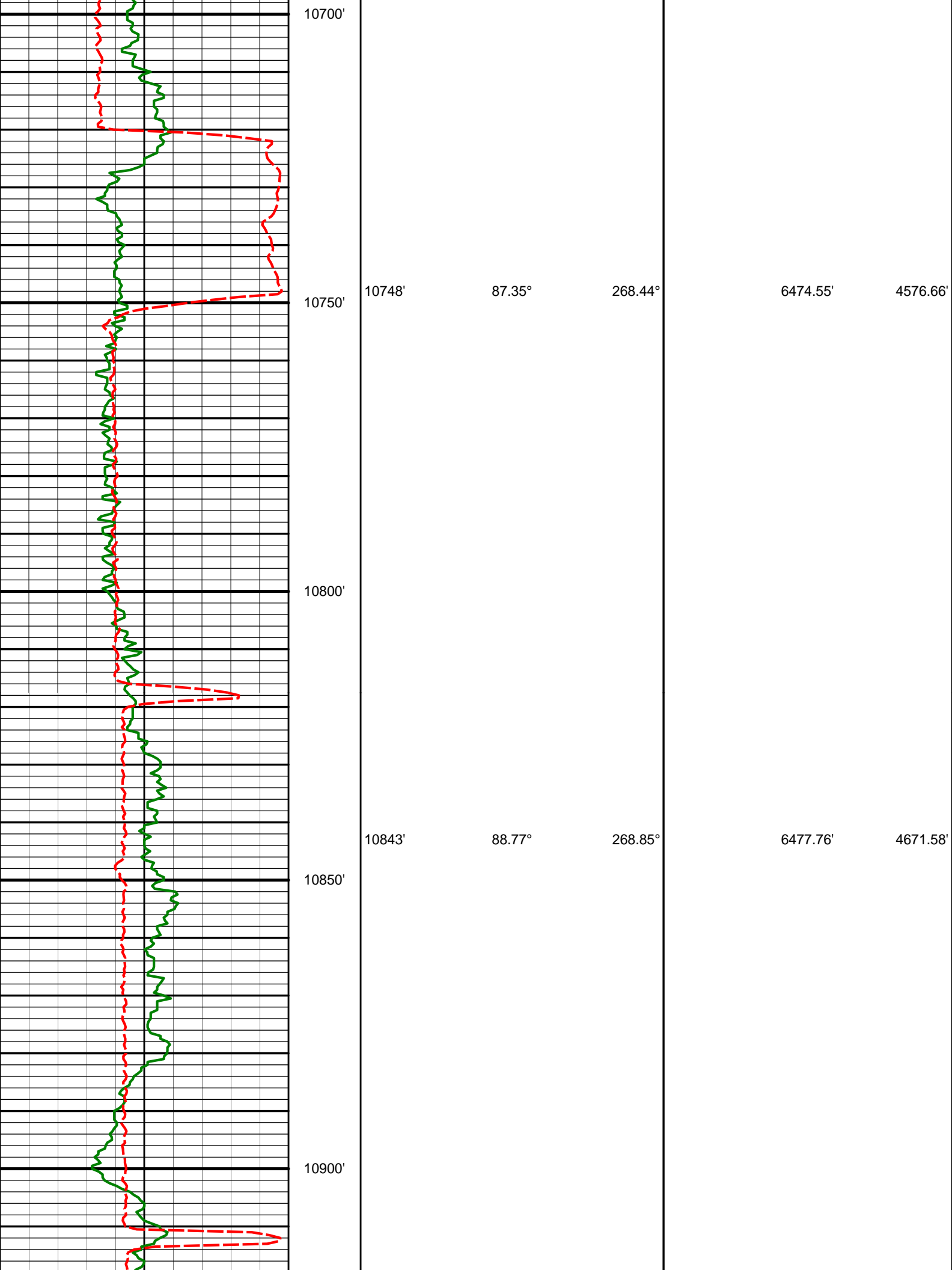
10653'

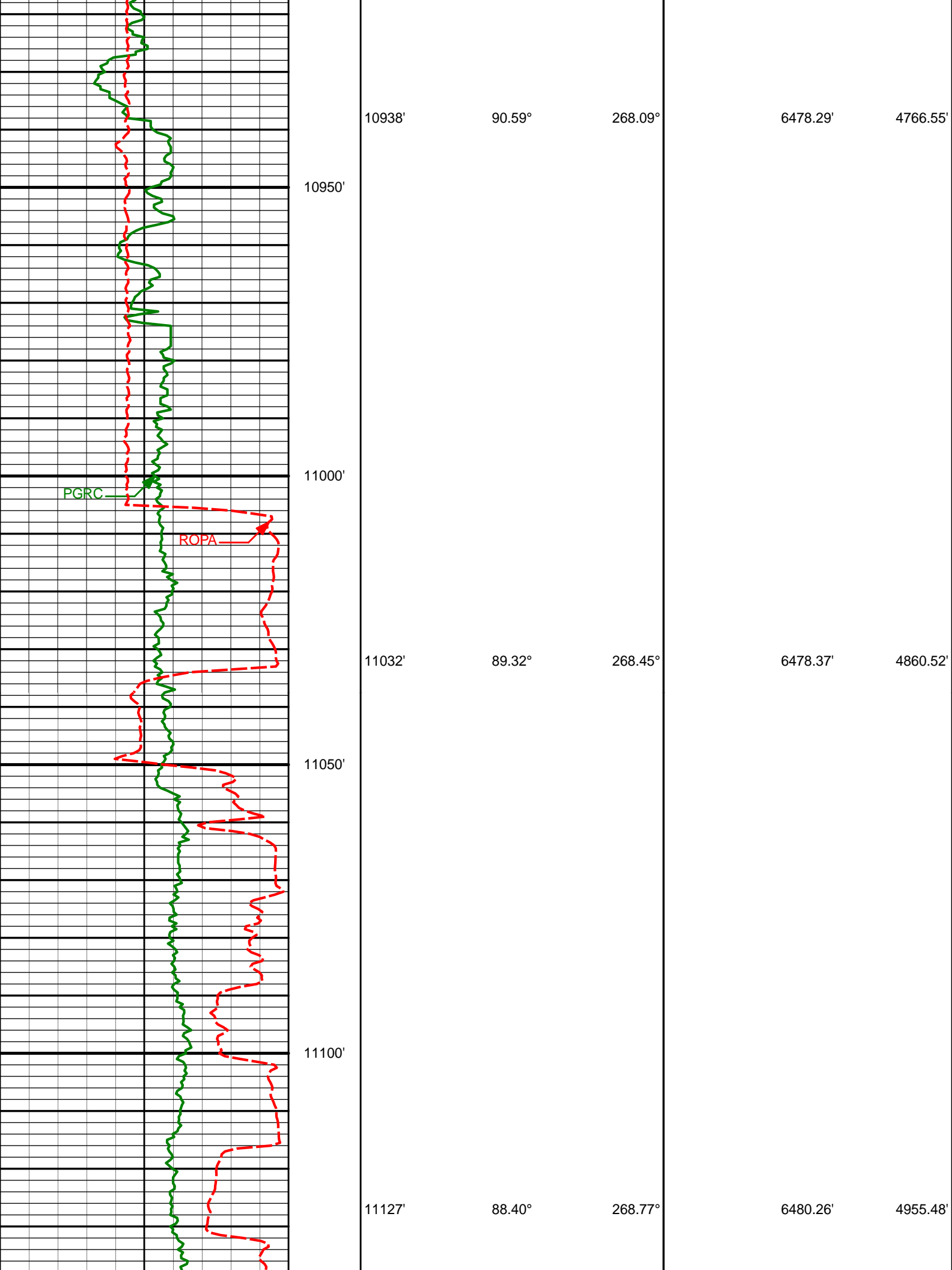
89.69°

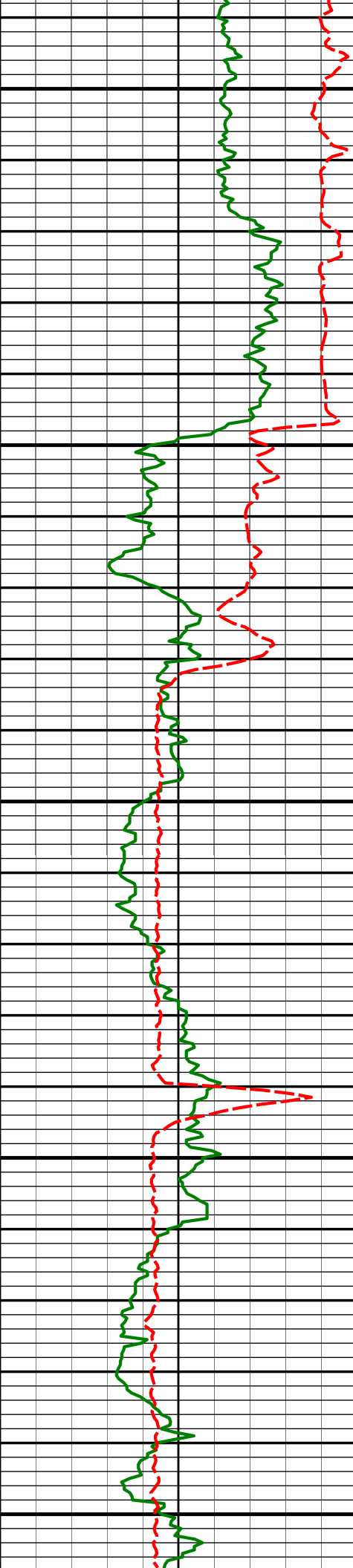
270.01°

6472.09'

4481.71'







11150'

11200'

11250'

11300'

11350'

11222'

88.40°

268.36°

6482.91'

5050.42'

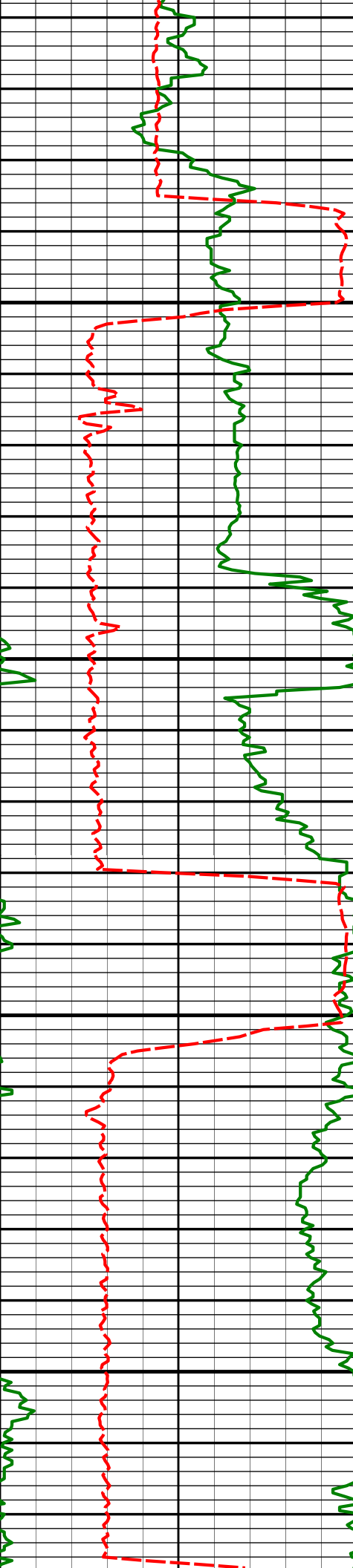
11317'

90.00°

267.58°

6484.24'

5145.35'



11400'

11412'

90.56°

267.83°

6483.77'

5240.29'

11450'

11500'

11507'

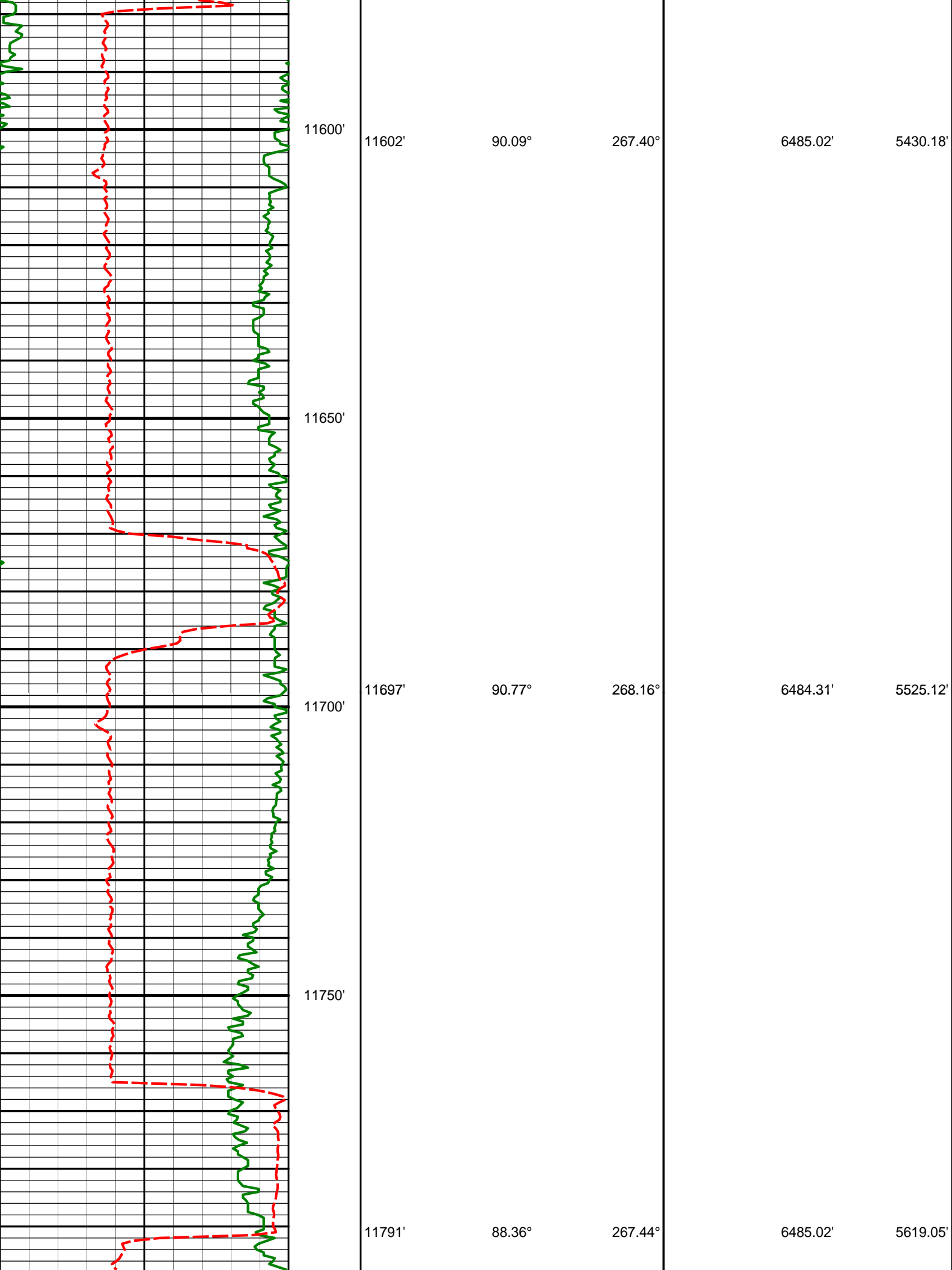
88.92°

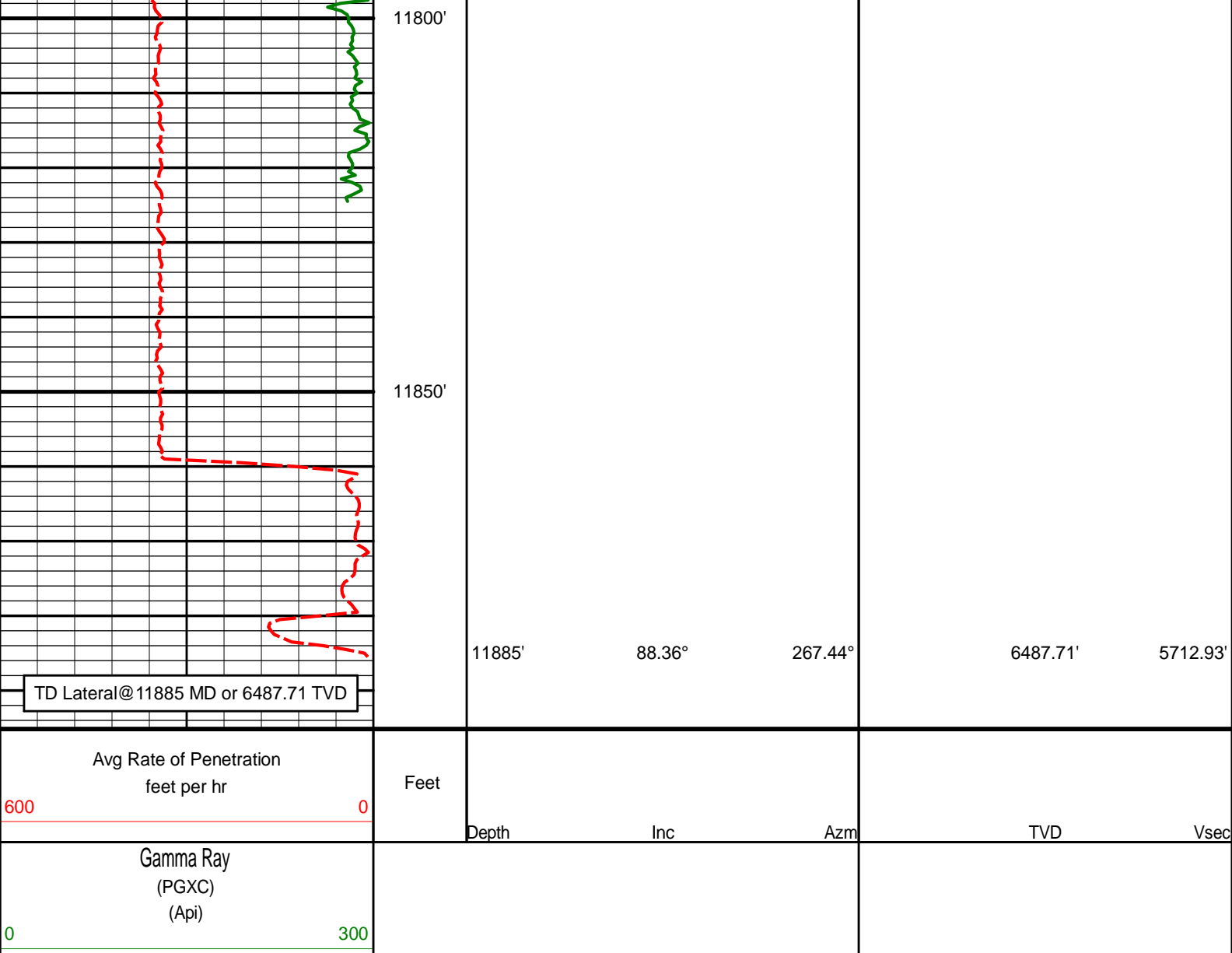
268.35°

6484.20'

5335.24'

11550'





## DIRECTIONAL SURVEY REPORT

Noble Energy  
Wells Ranch AE30-67-1BHNA  
Wattenburg  
Weld Colorado  
USA  
CA-XX-0901176693

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
250.00	0.50	22.07	250.00	1.01 N	0.41 E	-0.41	0.20
500.00	0.20	214.17	499.99	1.66 N	0.57 E	-0.58	0.28
629.00	0.70	180.17	628.99	0.69 N	0.45 E	-0.45	0.42
731.00	0.42	201.32	730.99	0.28 S	0.31 E	-0.31	0.34
824.00	0.46	171.23	823.98	0.97 S	0.24 E	-0.24	0.25
917.00	0.72	164.92	916.98	1.90 S	0.45 E	-0.44	0.29
1010.00	0.81	163.79	1009.97	3.10 S	0.79 E	-0.78	0.10
1103.00	0.72	156.43	1102.96	4.27 S	1.20 E	-1.19	0.14
1196.00	0.57	156.70	1195.96	5.23 S	1.62 E	-1.60	0.16
1289.00	0.37	172.58	1288.95	5.95 S	1.84 E	-1.82	0.25
1382.00	0.64	158.53	1381.95	6.73 S	2.07 E	-2.05	0.32
1475.00	0.75	55.71	1474.94	6.87 S	2.76 E	-2.74	1.17
1570.00	0.79	47.66	1569.94	6.08 S	3.76 E	-3.74	0.12
1664.00	0.64	60.78	1663.93	5.39 S	4.70 E	-4.68	0.24
1759.00	0.19	43.81	1758.93	5.01 S	5.27 E	-5.25	0.49

1755.00	0.19	43.01	1758.93	3.81 S	3.27 E	-5.23	0.43
1853.00	0.40	36.19	1852.92	4.64 S	5.57 E	-5.56	0.23
1948.00	0.30	298.21	1947.92	4.25 S	5.55 E	-5.53	0.56
2042.00	0.66	285.02	2041.92	4.00 S	4.81 E	-4.80	0.40
2137.00	0.90	303.06	2136.91	3.45 S	3.65 E	-3.64	0.36
2232.00	1.05	307.89	2231.90	2.51 S	2.34 E	-2.33	0.18
2327.00	0.61	91.67	2326.89	1.99 S	2.16 E	-2.15	1.67
2422.00	1.27	100.39	2421.88	2.19 S	3.70 E	-3.69	0.71
2516.00	0.52	75.53	2515.87	2.27 S	5.14 E	-5.13	0.88
2611.00	1.14	10.82	2610.86	1.24 S	5.73 E	-5.73	1.09
2706.00	2.33	11.97	2705.81	1.58 N	6.31 E	-6.32	1.25
2801.00	3.72	358.03	2800.68	6.55 N	6.61 E	-6.63	1.65
2896.00	4.89	347.57	2895.41	13.59 N	5.63 E	-5.67	1.48
2990.00	6.20	350.49	2988.97	22.51 N	3.93 E	-4.00	1.43
3085.00	7.50	353.35	3083.29	33.72 N	2.36 E	-2.47	1.41
3179.00	8.00	353.39	3176.43	46.31 N	0.90 E	-1.05	0.53
3274.00	8.33	353.65	3270.47	59.72 N	0.62 W	0.42	0.35
3369.00	8.29	347.52	3364.47	73.25 N	2.86 W	2.62	0.93
3464.00	9.65	356.79	3458.31	87.89 N	4.79 W	4.50	2.08
3559.00	9.30	354.58	3552.02	103.48 N	5.96 W	5.62	0.53
3653.00	9.61	354.11	3644.74	118.84 N	7.48 W	7.09	0.34
3748.00	9.19	349.34	3738.47	134.19 N	9.70 W	9.26	0.93
3843.00	8.20	350.00	3832.37	148.31 N	12.28 W	11.79	1.05
3938.00	6.26	345.41	3926.61	160.00 N	14.76 W	14.23	2.13
4033.00	3.98	338.21	4021.23	168.08 N	17.29 W	16.73	2.49
4129.00	1.84	340.93	4117.10	172.63 N	19.03 W	18.46	2.23
4224.00	0.76	186.89	4212.09	173.44 N	19.61 W	19.03	2.68
4318.00	0.59	192.84	4306.08	172.35 N	19.79 W	19.22	0.20
4413.00	1.31	179.77	4401.07	170.79 N	19.89 W	19.33	0.79
4508.00	1.62	195.35	4496.04	168.41 N	20.24 W	19.68	0.53
4602.00	0.85	204.40	4590.01	166.49 N	20.88 W	20.33	0.84
4697.00	1.08	205.24	4685.00	165.04 N	21.56 W	21.01	0.24
4793.00	0.64	209.11	4780.99	163.75 N	22.20 W	21.66	0.46
4887.00	0.73	120.85	4874.98	162.99 N	21.94 W	21.40	1.02
4982.00	0.68	142.11	4969.98	162.23 N	21.08 W	20.54	0.28
5077.00	0.44	119.93	5064.97	161.60 N	20.42 W	19.88	0.34
5171.00	0.45	204.22	5158.97	161.09 N	20.25 W	19.72	0.64
5266.00	0.59	251.01	5253.97	160.59 N	20.87 W	20.34	0.46
5361.00	0.47	119.63	5348.97	160.24 N	20.99 W	20.46	1.02
5456.00	0.63	133.01	5443.96	159.69 N	20.27 W	19.74	0.21
5550.00	0.62	160.80	5537.96	158.86 N	19.73 W	19.20	0.32
5709.00	0.39	189.54	5696.95	157.51 N	19.53 W	19.01	0.21
5769.00	0.22	190.28	5756.95	157.19 N	19.59 W	19.07	0.28
5782.00	0.13	218.25	5769.95	157.16 N	19.60 W	19.08	0.94
5830.00	1.38	257.93	5817.94	156.99 N	20.20 W	19.68	2.67
5877.00	5.87	268.01	5864.84	156.79 N	23.16 W	22.64	9.61
5925.00	10.94	269.80	5912.31	156.69 N	30.17 W	29.65	10.58
5972.00	16.76	264.15	5957.92	155.98 N	41.38 W	40.86	12.70
6020.00	19.66	262.76	6003.52	154.26 N	56.28 W	55.77	6.11
6067.00	19.40	265.17	6047.81	152.61 N	71.90 W	71.39	1.80
6114.00	22.25	265.18	6091.74	151.20 N	88.55 W	88.05	6.06
6161.00	28.33	266.00	6134.21	149.68 N	108.56 W	108.06	12.96
6209.00	35.61	267.37	6174.90	148.24 N	133.92 W	133.42	15.24
6256.00	38.33	268.33	6212.45	147.18 N	162.16 W	161.67	5.92
6303.00	40.68	268.75	6248.71	146.43 N	192.05 W	191.56	5.03
6350.00	44.99	268.03	6283.17	145.52 N	223.98 W	223.50	9.23
6398.00	52.97	267.60	6314.65	144.13 N	260.14 W	259.66	16.64
6445.00	61.02	267.18	6340.23	142.33 N	299.48 W	299.01	17.14
6493.00	64.44	267.58	6362.22	140.38 N	342.09 W	341.63	7.16
6540.00	67.02	268.29	6381.54	138.84 N	384.91 W	384.45	5.66
6588.00	67.94	269.66	6399.92	138.05 N	429.24 W	428.78	3.26
6635.00	68.86	269.20	6417.22	137.62 N	472.94 W	472.48	2.16
6683.00	73.11	267.51	6432.86	136.31 N	518.29 W	517.83	9.46
6721.00	76.17	266.27	6442.92	134.32 N	554.87 W	554.42	8.65
6822.00	84.72	265.91	6459.67	127.53 N	654.14 W	653.72	8.47
6871.00	85.93	265.25	6463.67	123.76 N	702.83 W	702.42	2.81
6964.00	87.53	266.00	6468.97	116.68 N	795.41 W	795.02	1.90
7057.00	90.80	266.90	6470.33	110.92 N	888.21 W	887.83	3.65
7150.00	90.03	267.37	6469.65	106.27 N	981.09 W	980.73	0.97
7242.00	89.20	267.37	6470.27	102.05 N	1072.99 W	1072.64	0.90
7335.00	89.54	271.15	6471.30	100.85 N	1165.96 W	1165.62	4.08
7429.00	89.85	267.25	6471.80	99.54 N	1259.93 W	1259.59	4.16
7521.00	91.11	268.02	6471.03	95.74 N	1351.84 W	1351.52	1.61
7616.00	91.29	267.84	6469.04	92.31 N	1446.76 W	1446.45	0.27
7711.00	91.45	268.74	6466.77	89.48 N	1541.69 W	1541.38	0.96

7806.00	90.46	268.73	6465.18	87.38 N	1636.65 W	1636.35	1.04
7901.00	89.29	269.76	6465.39	86.13 N	1731.64 W	1731.35	1.64
7997.00	90.00	268.60	6465.98	84.76 N	1827.63 W	1827.34	1.42
8091.00	89.08	268.53	6466.74	82.40 N	1921.59 W	1921.31	0.98
8186.00	89.23	269.17	6468.14	80.50 N	2016.56 W	2016.29	0.69
8281.00	90.99	269.66	6467.96	79.53 N	2111.55 W	2111.28	1.92
8376.00	90.15	268.59	6467.01	78.08 N	2206.54 W	2206.27	1.43
8471.00	89.72	266.67	6467.12	74.15 N	2301.45 W	2301.19	2.07
8566.00	90.31	269.06	6467.10	70.61 N	2396.38 W	2396.13	2.59
8660.00	88.68	267.61	6467.92	67.88 N	2490.33 W	2490.09	2.32
8755.00	90.52	268.30	6468.59	64.49 N	2585.26 W	2585.03	2.07
8850.00	92.00	268.68	6466.50	61.98 N	2680.20 W	2679.98	1.61
8945.00	90.83	269.54	6464.15	60.51 N	2775.16 W	2774.94	1.53
9040.00	90.65	269.70	6462.93	59.88 N	2870.15 W	2869.93	0.25
9135.00	89.69	267.99	6462.64	57.96 N	2965.12 W	2964.92	2.06
9230.00	89.17	268.51	6463.59	55.06 N	3060.07 W	3059.88	0.77
9324.00	88.12	269.24	6465.81	53.22 N	3154.03 W	3153.83	1.36
9419.00	89.29	269.30	6467.96	52.01 N	3248.99 W	3248.80	1.23
9514.00	90.25	269.53	6468.34	51.04 N	3343.99 W	3343.80	1.04
9609.00	88.80	269.27	6469.13	50.04 N	3438.98 W	3438.79	1.55
9704.00	88.43	268.78	6471.42	48.43 N	3533.94 W	3533.75	0.65
9799.00	89.23	268.40	6473.36	46.09 N	3628.89 W	3628.71	0.93
9894.00	89.32	267.40	6474.57	42.61 N	3723.81 W	3723.65	1.06
9989.00	90.06	267.68	6475.08	38.53 N	3818.72 W	3818.57	0.83
10084.00	87.59	264.91	6477.03	32.40 N	3913.49 W	3913.36	3.91
10179.00	90.22	268.28	6478.84	26.76 N	4008.28 W	4008.17	4.50
10274.00	91.91	267.20	6477.08	23.01 N	4103.19 W	4103.09	2.11
10369.00	91.63	266.07	6474.14	17.44 N	4197.98 W	4197.89	1.22
10464.00	90.86	267.59	6472.08	12.19 N	4292.80 W	4292.74	1.79
10558.00	89.72	269.41	6471.60	9.73 N	4386.77 W	4386.71	2.28
10653.00	89.69	270.01	6472.09	9.24 N	4481.76 W	4481.71	0.63
10748.00	87.35	268.44	6474.55	7.96 N	4576.71 W	4576.66	2.97
10843.00	88.77	268.85	6477.76	5.72 N	4671.63 W	4671.58	1.56
10938.00	90.59	268.09	6478.29	3.18 N	4766.59 W	4766.55	2.08
11032.00	89.32	268.45	6478.37	0.34 N	4860.54 W	4860.52	1.40
11127.00	88.40	268.77	6480.26	1.96 S	4955.50 W	4955.48	1.03
11222.00	88.40	268.36	6482.91	4.34 S	5050.43 W	5050.42	0.43
11317.00	90.00	267.58	6484.24	7.71 S	5145.36 W	5145.35	1.87
11412.00	90.56	267.83	6483.77	11.51 S	5240.28 W	5240.29	0.65
11507.00	88.92	268.35	6484.20	14.68 S	5335.22 W	5335.24	1.81
11602.00	90.09	267.40	6485.02	18.20 S	5430.15 W	5430.18	1.59
11697.00	90.77	268.16	6484.31	21.88 S	5525.07 W	5525.12	1.07
11791.00	88.36	267.44	6485.02	25.49 S	5618.99 W	5619.05	2.68
11885.00	88.36	267.44	6487.71	29.68 S	5712.86 W	5712.93	0.00

**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 269.81 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.57 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 11885.00 FEET  
IS 5712.94 FEET ALONG 269.70 DEGREES (GRID)**

**Tie-In @ Surface**

**Surveys at 250 ft, 500ft and 629 ft, were taken and provided by HP 322 while they were drilling the surface hole and have been converted from magnetic north to grid north.**