

## PCGK - Pressure Case Gamma

1 : 240

[illegible]

## WELL INFORMATION

MWD Run Number	100	200	300		
Date run completed	19-Dec-13	20-Dec-13	24-Dec-13		
Rig Bit Number	100	200	0300		
Bit Size (in)	8.750	8.750	6.125		
Tool Nominal OD (in)	6.750	6.750	4.750		
Log Start Depth (MD, ft)	839.00	5,897.00	7,039.00		
Log End Depth (MD, ft)	5,897.00	7,039.00	11,559.00		
Drill or Wipe	Drill	Drill	Drill		
Drill/Wipe Start Date and Time	18-Dec-13 13:15	19-Dec-13 15:45	22-Dec-13 00:24		
Drill/Wipe End Date and Time	19-Dec-13 06:30	20-Dec-13 15:00	23-Dec-13 07:45		
Min Inc (deg) @ Depth (MD, ft)	0.15 @ 4,605.00	2.51 @ 5,975.00	84.04 @ 7,045.00		
Max Inc (deg) @ Depth (MD, ft)	13.08 @ 2,613.00	78.93 @ 6,982.00	92.50 @ 7,520.00		
Bit TFA(in2) / Bit Type	0.75 / PDC	0.90 / PDC	0.86 / PDC		
Flow Rate (gpm)	569.00	539.00	270.00		
Max AV (fpm) / CV (fpm) @ MWD	405.9 / 405.9	405.9 / 405.9	529.2 / 529.2		
Fluid Type	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
Density (ppg) / Viscosity (spqt)	9.40 / 34.00	10.53 / 41.00	9.60 / 38.00		
Filtrate CL (ppm)	3,000.00	3,000.00	2,100.00		
pH / Fluid Loss (mptm)	8.70 / N/A	9.60 / N/A	8.40 / N/A		
PV (cP) / YP (lbf2)	6 / 4.00	12 / 11.00	10 / 9.50		
% Solids / % Sand	7.00 / 0.65	11.50 / 0.35	6.8 / .4		
% Oil / Oil:Water Ratio	N/A / N/A	N/A / N/A	N/A / N/A		
Rm @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Rmf @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Rmc @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Max Tool Temp (in F) / C	159.45 / 70.8	159.45 / 70.8	215.51 / 80.3		

Max Tool Temp (degF) / Source	158.47 / PCM	158.47 / PCM	215.51 / PCM		
Rm @ Max Tool Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Lead MWD Engineer	Robret Ley	Robret Ley	Robret Ley		
Customer Representative	Charles Collver	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	11341341	11341341	12187587		
Insert Serial Number	11680106	11680106	12001055		
Date and Time Initialized	18-Dec-13 07:30	18-Dec-13 07:20	21-Dec-13 07:19		
Date and Time Read	20-Dec-13 21:17	20-Dec-13 21:08	24-Dec-13 17:48		
ECMB SW Version	N/A	N/A	N/A		

### Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	59.00	57.00	54.00		
Software Version	6.21	6.21	6.21		
Sub Serial Number	11341341	11341341	12187587		
Sonde Serial Number	12174582	12174582	11833221		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	9.64	236.20	285.90		

### Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	51.98	50.42	47.11		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	11341341	11341341	12187587		
Insert/Sonde Serial Number	12037396	12037396	12071301		

## REMARKS

1. All depths are true vertical 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 CG):  
Interval Resolution: 0.5 feet  
Coercion Distance: 0.6 feet  
Gap Fill: 3.0 feet

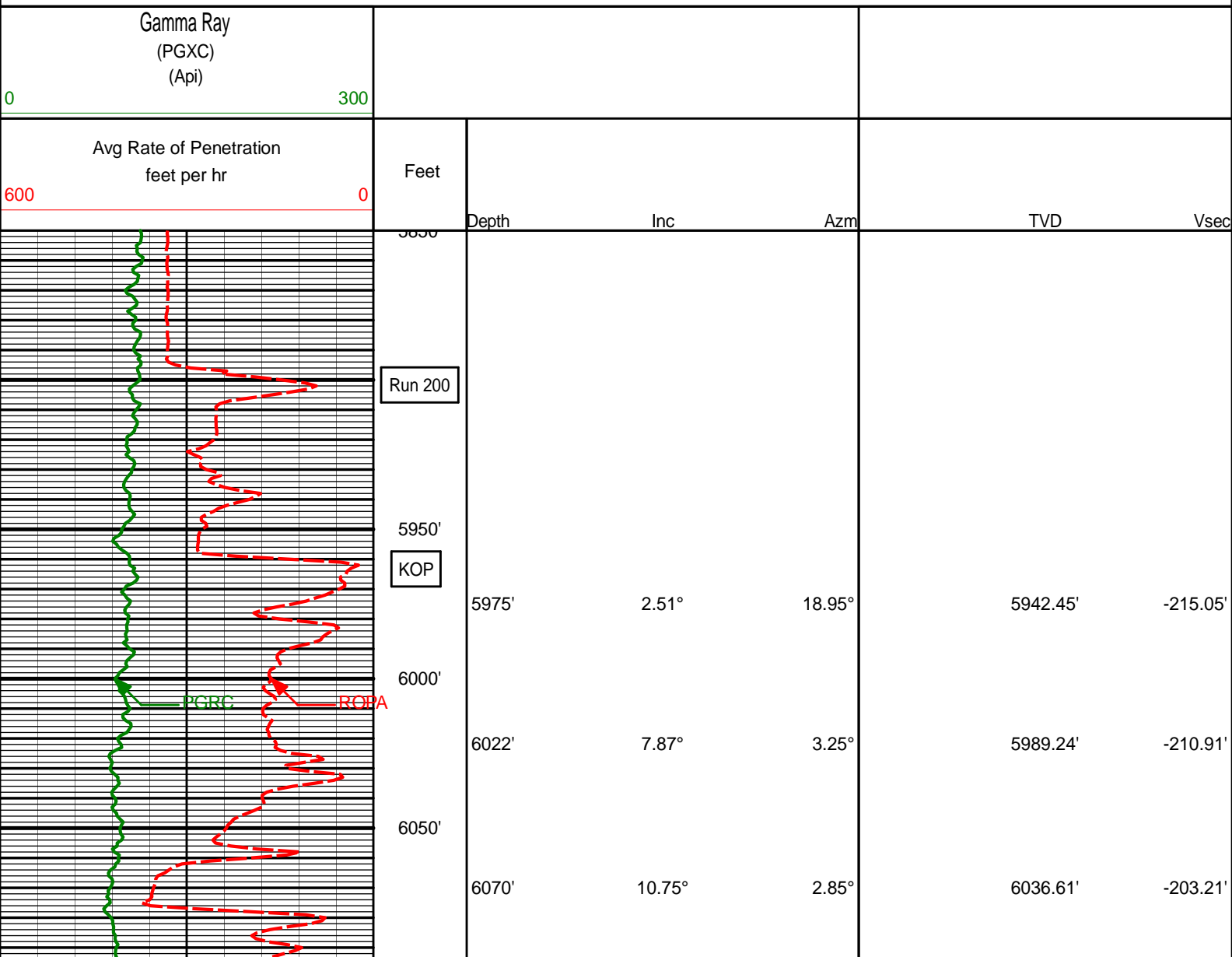
ROPA (Rate of Penetration):  
Interval Resolution: 0.5 feet  
Coercion Distance: 1.2 feet

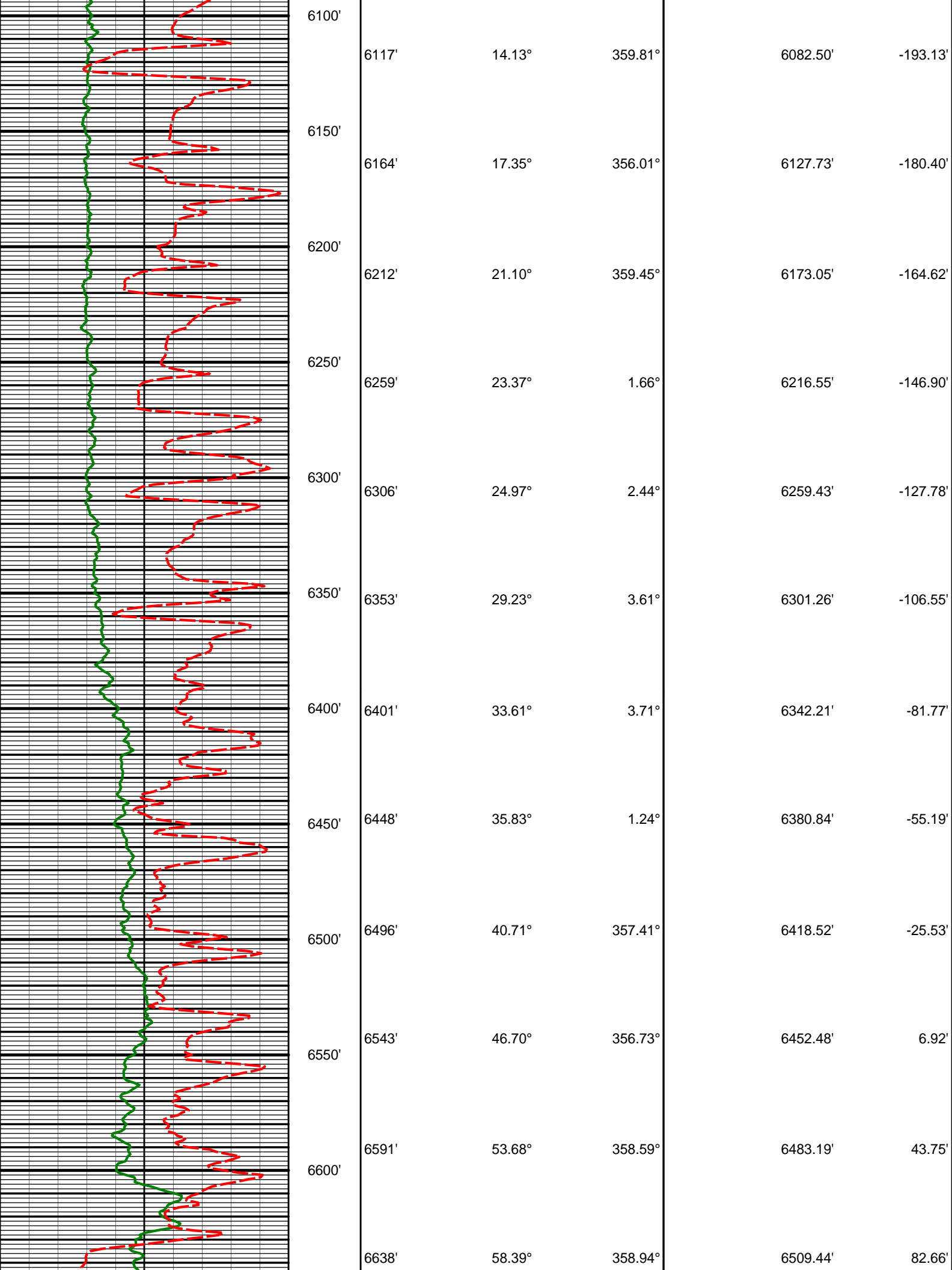
5. Gamma from 5757 ft to 5768 ft TVD is missing due to communication error with tool.

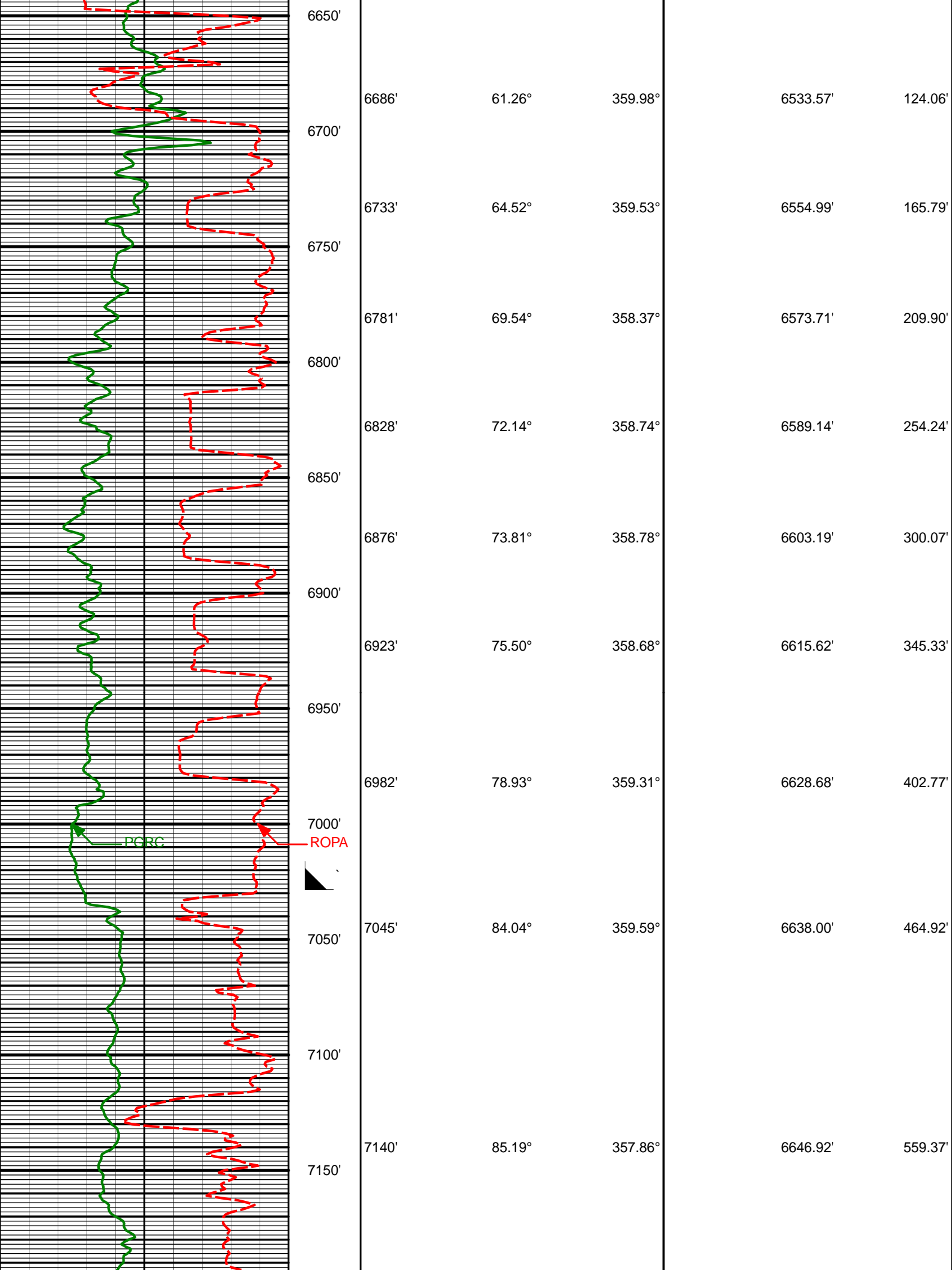
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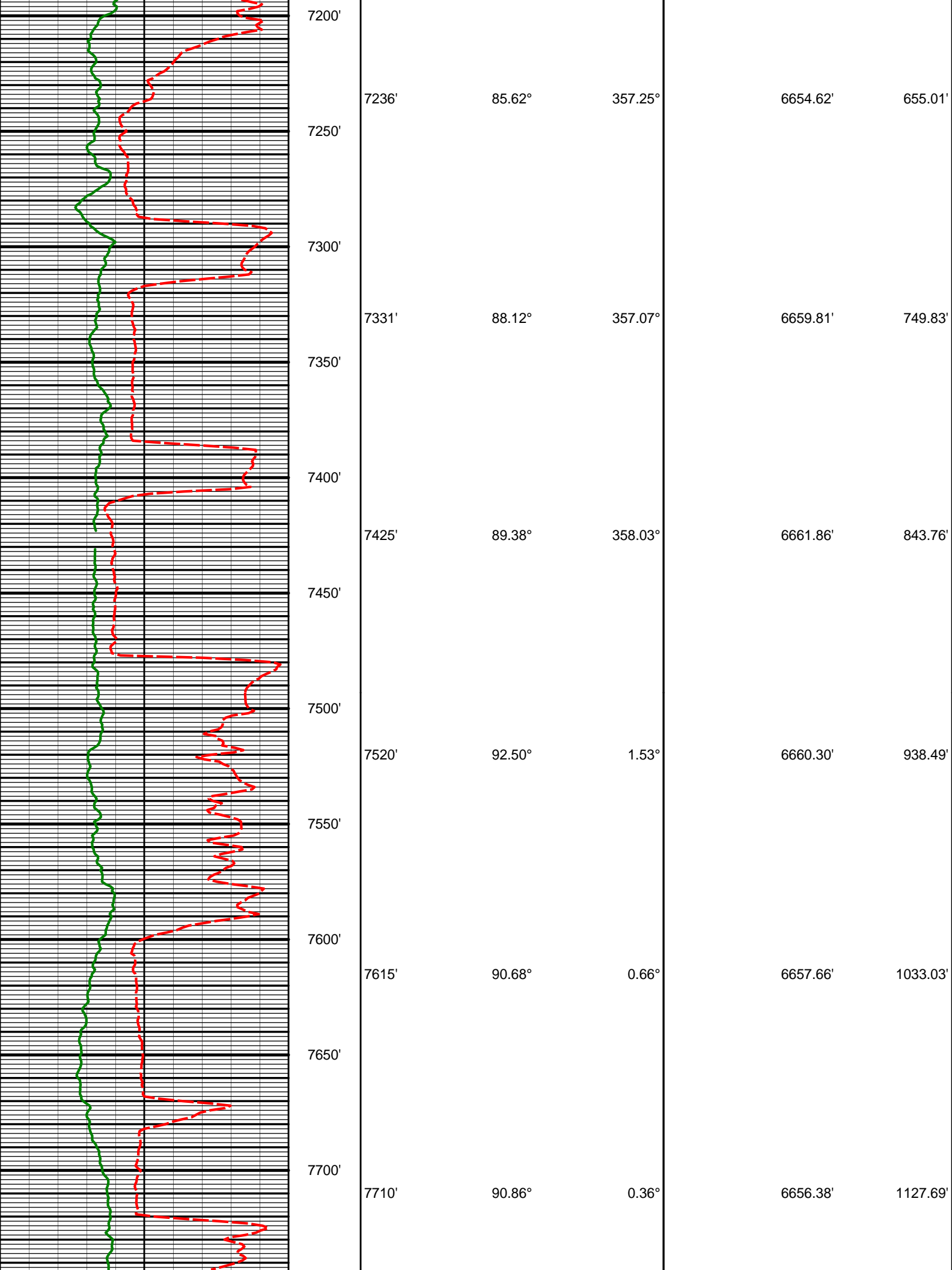
# HALLIBURTON

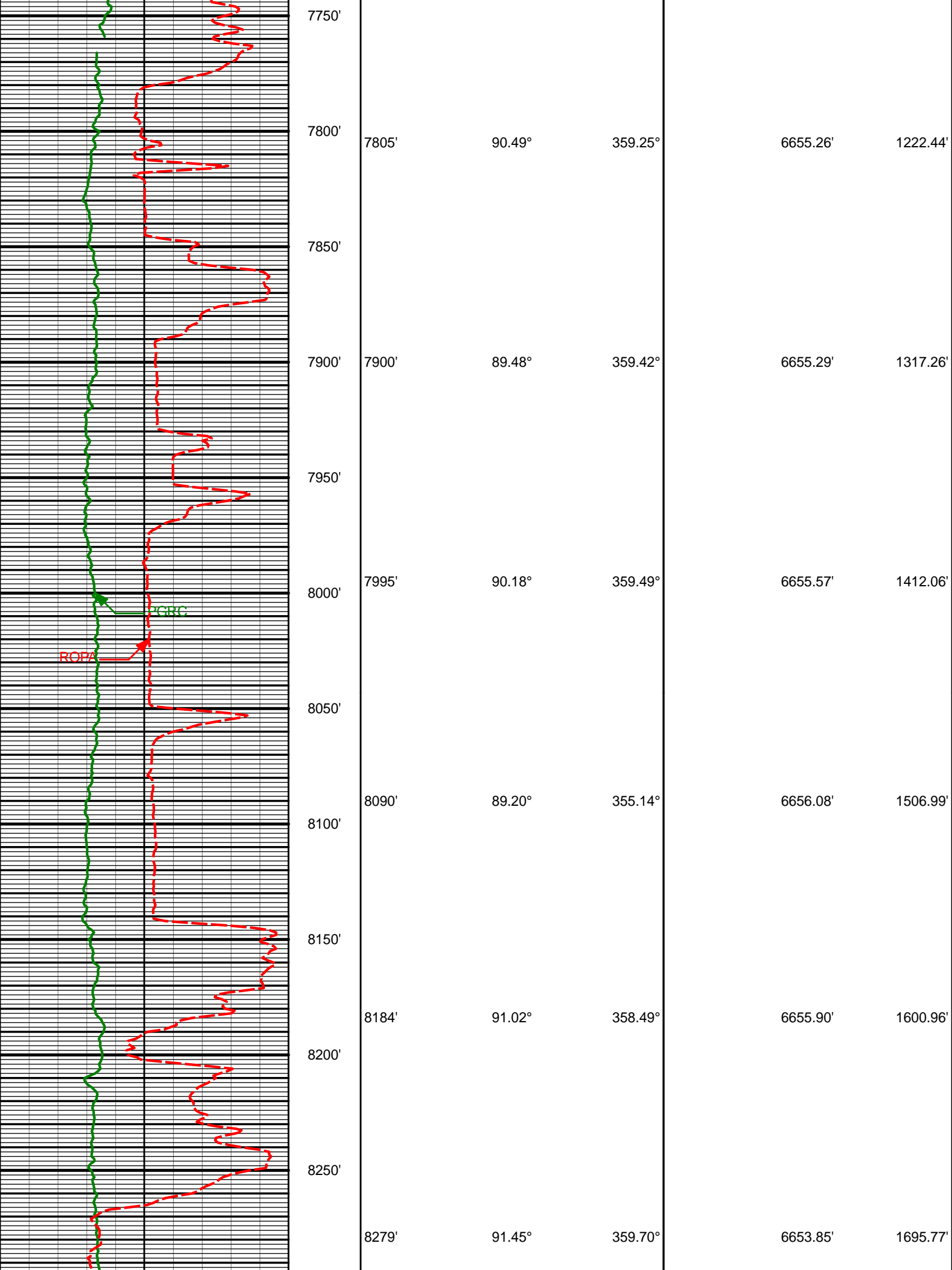
## TVD Detail Log 1:600

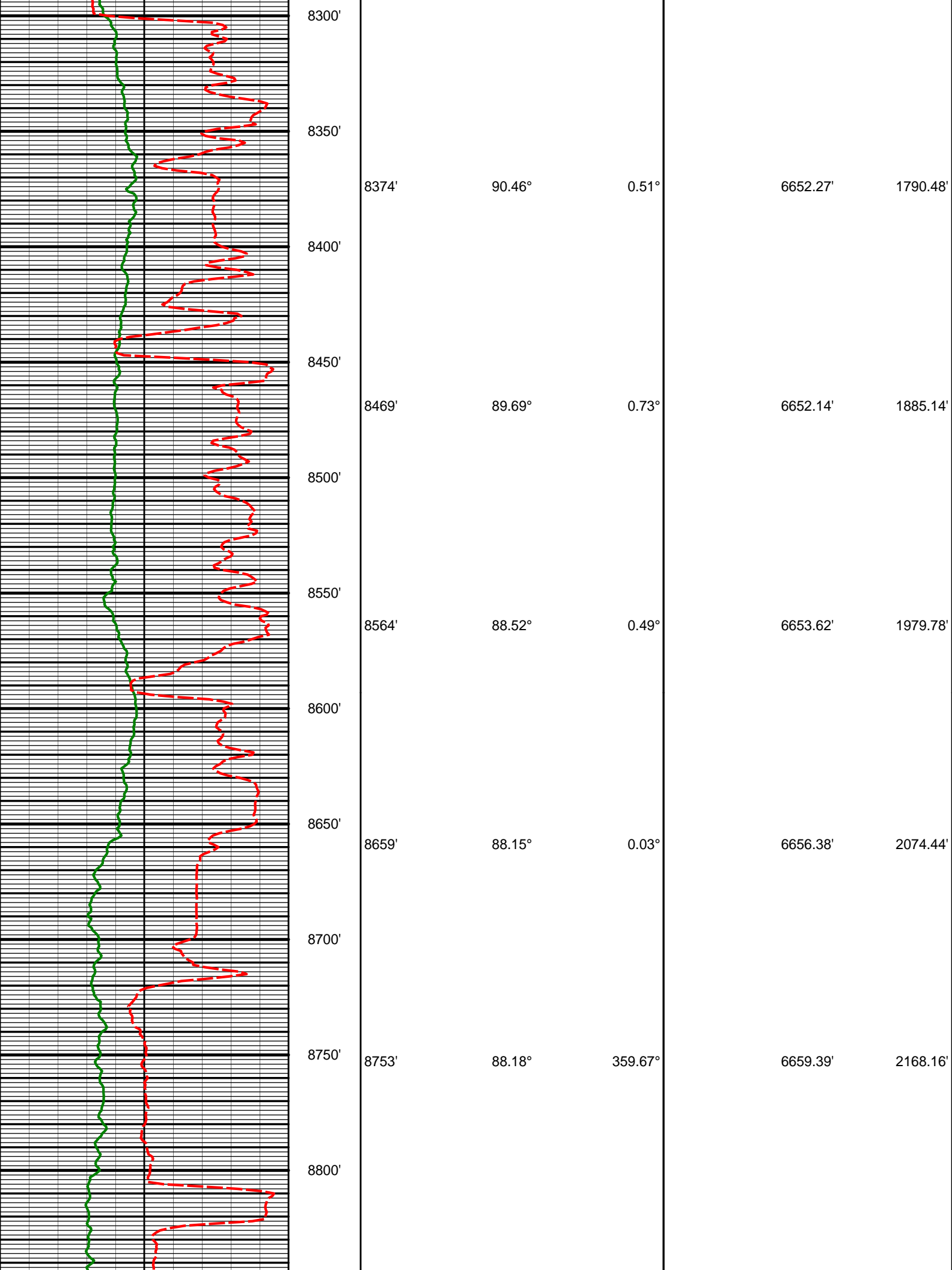




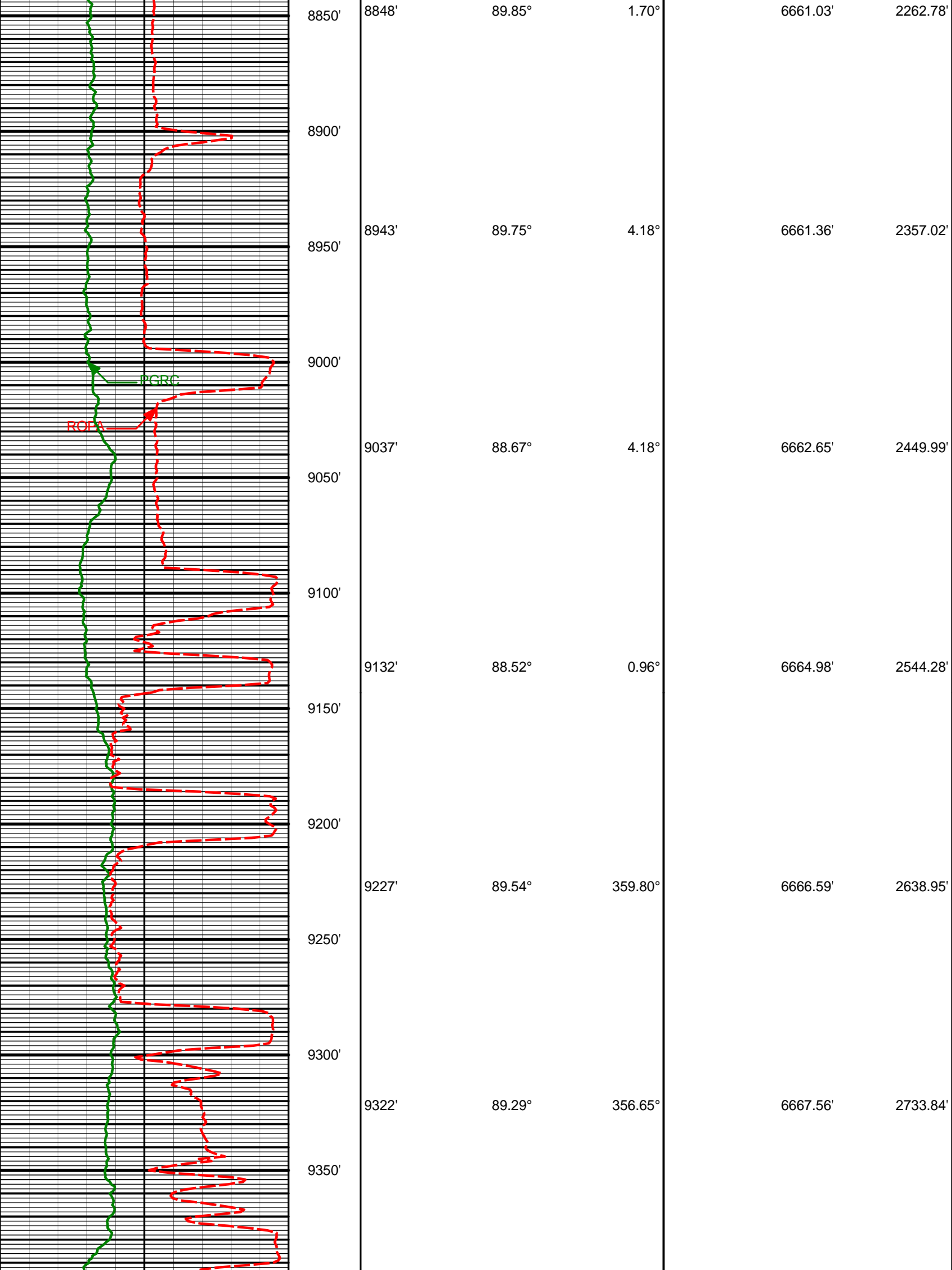


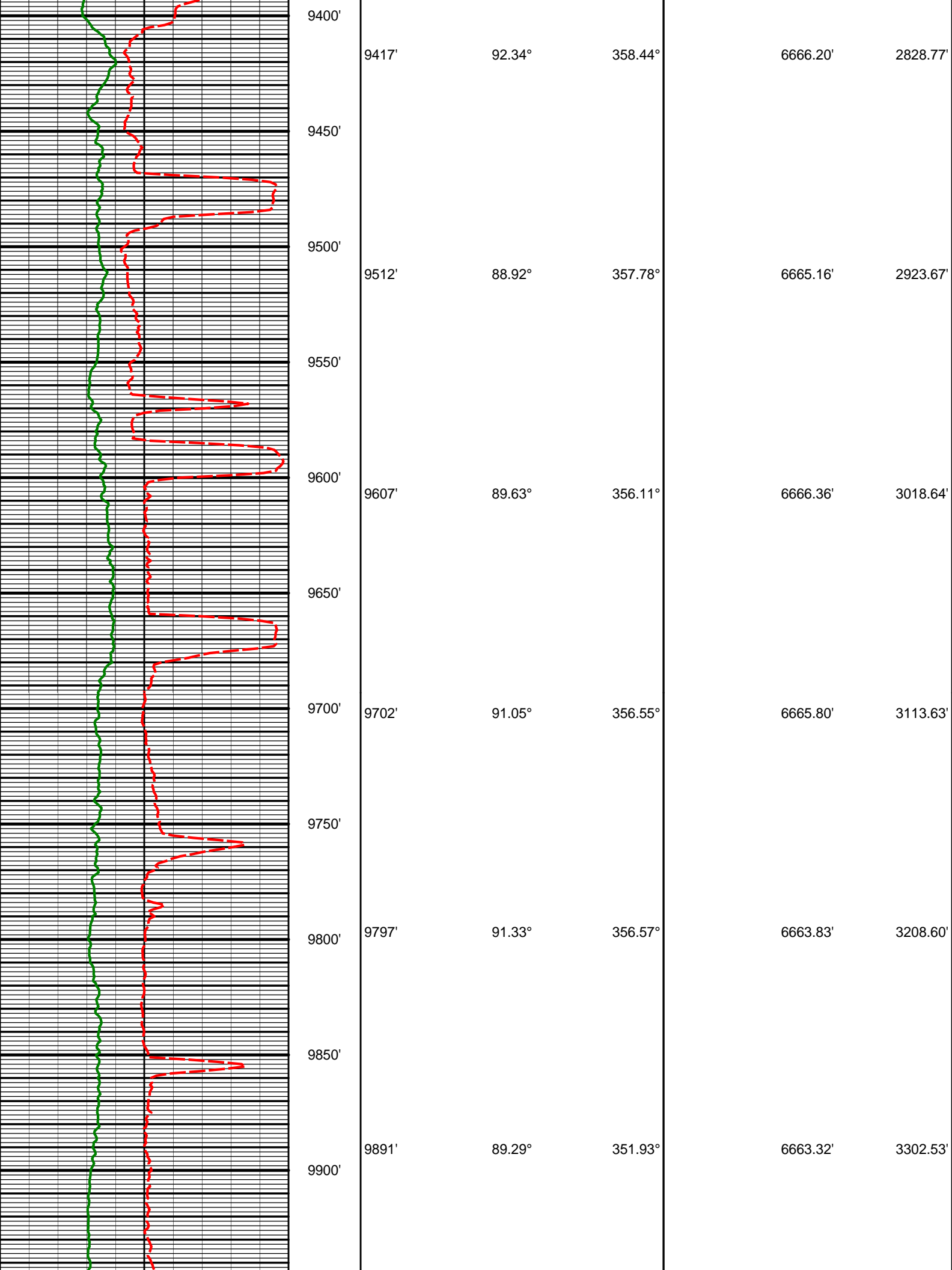


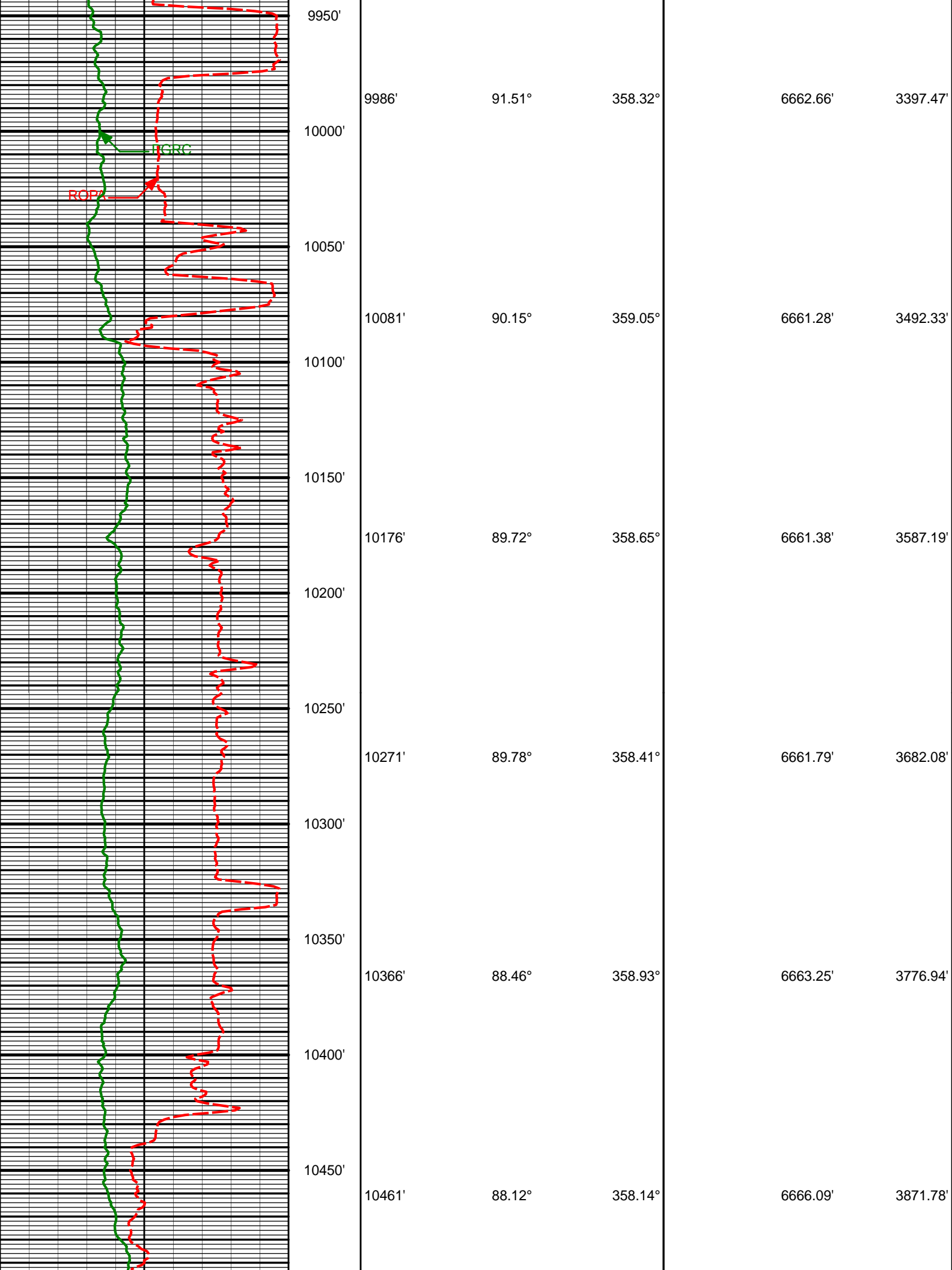


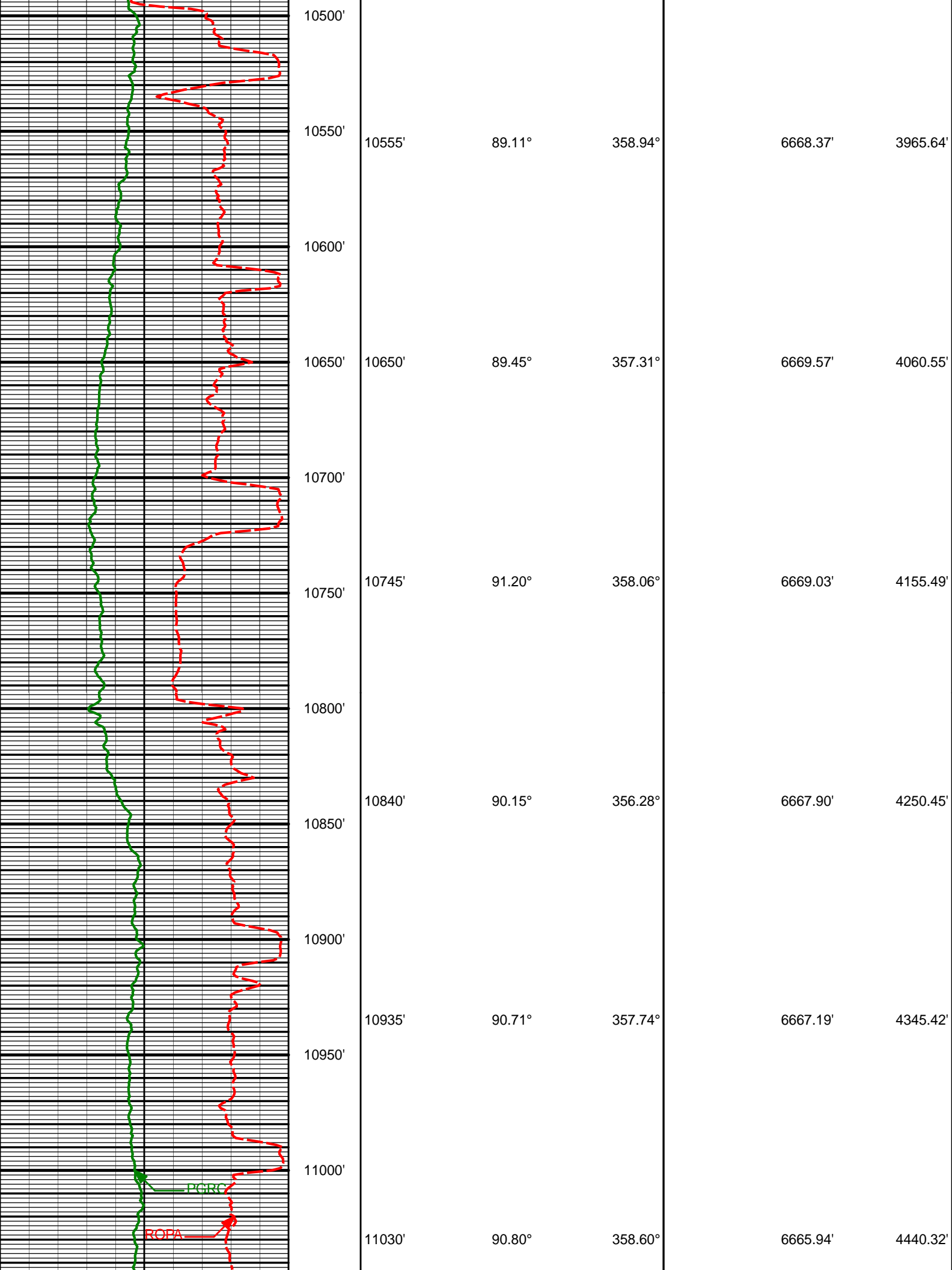


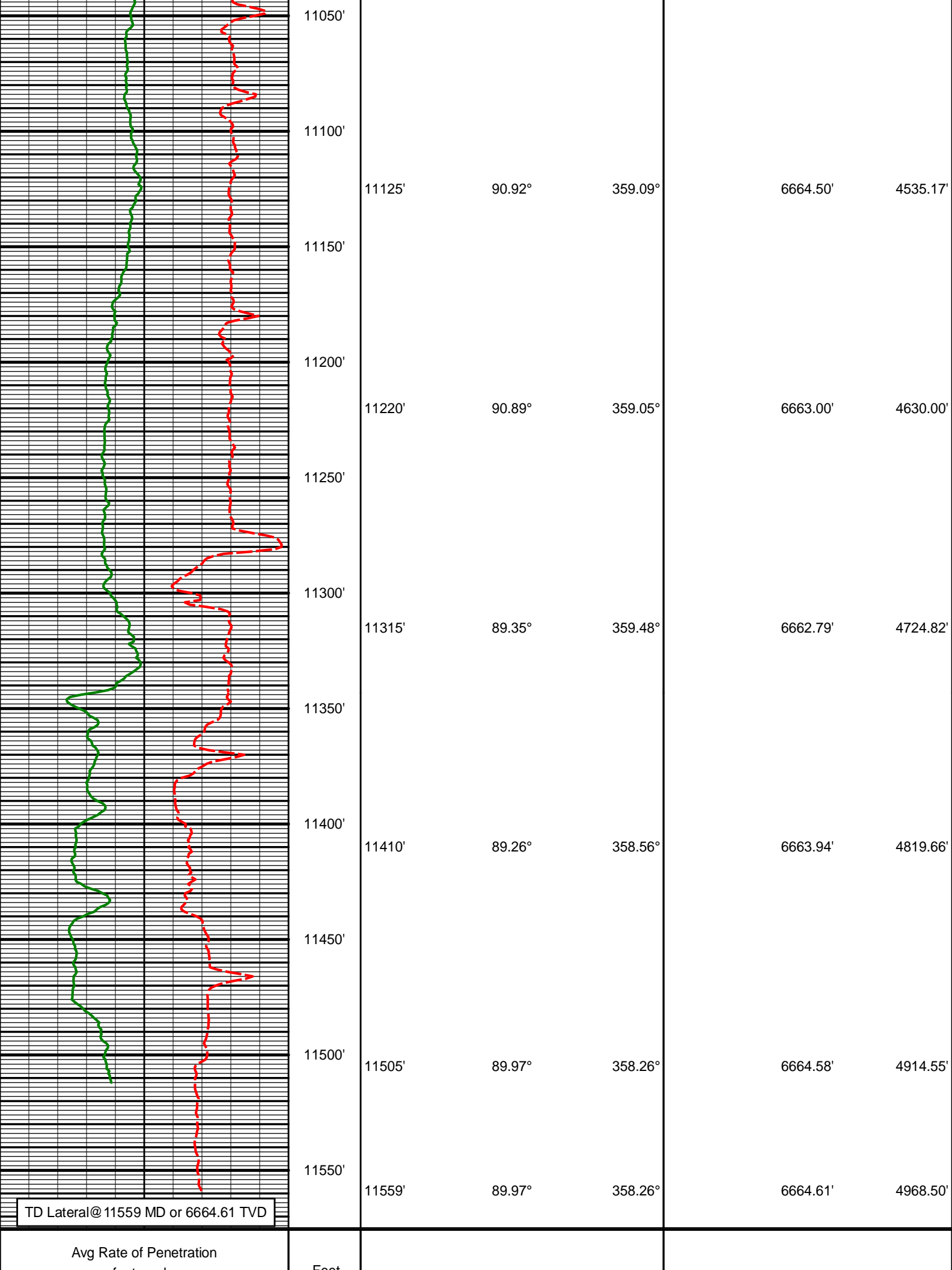




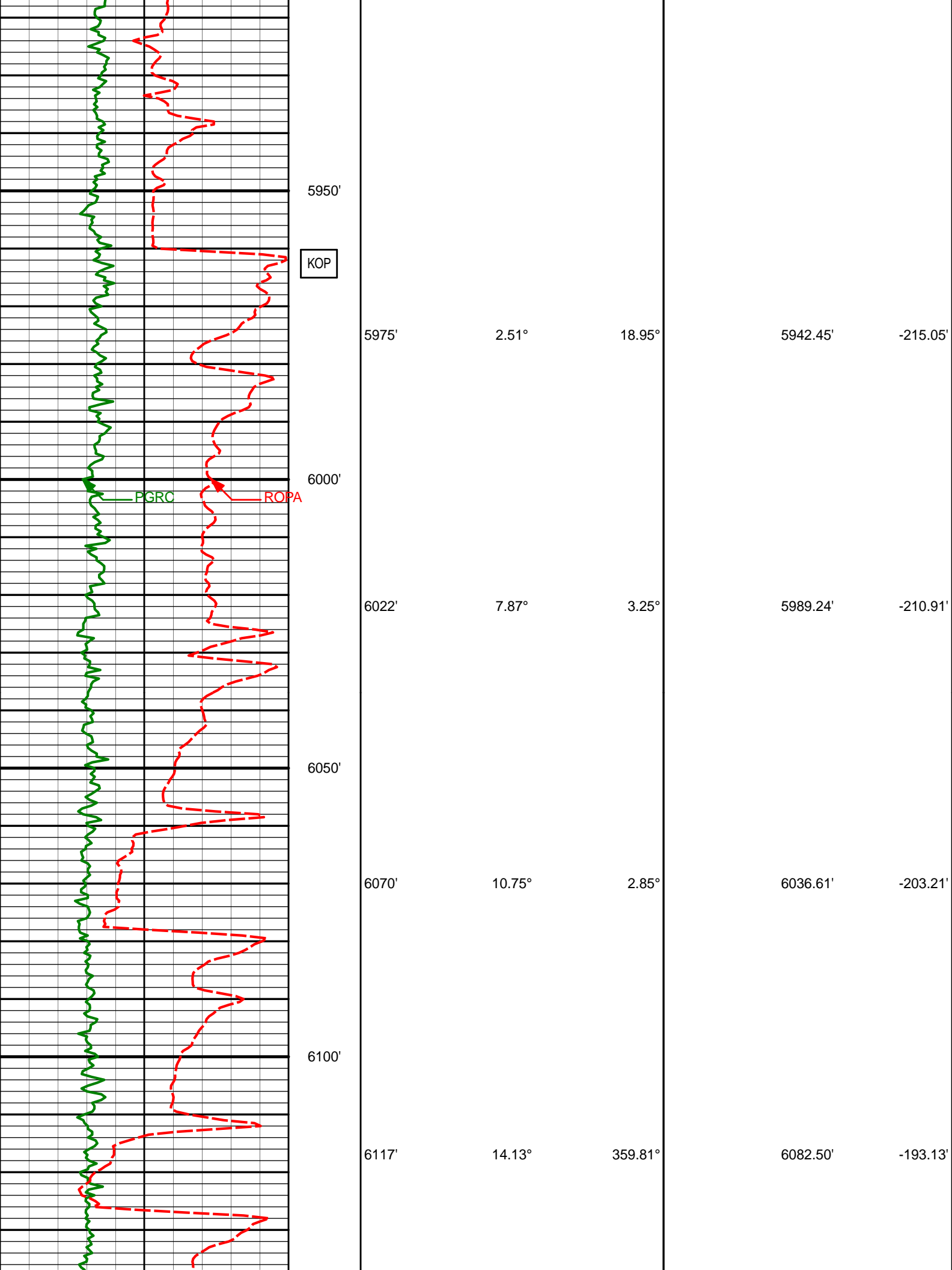


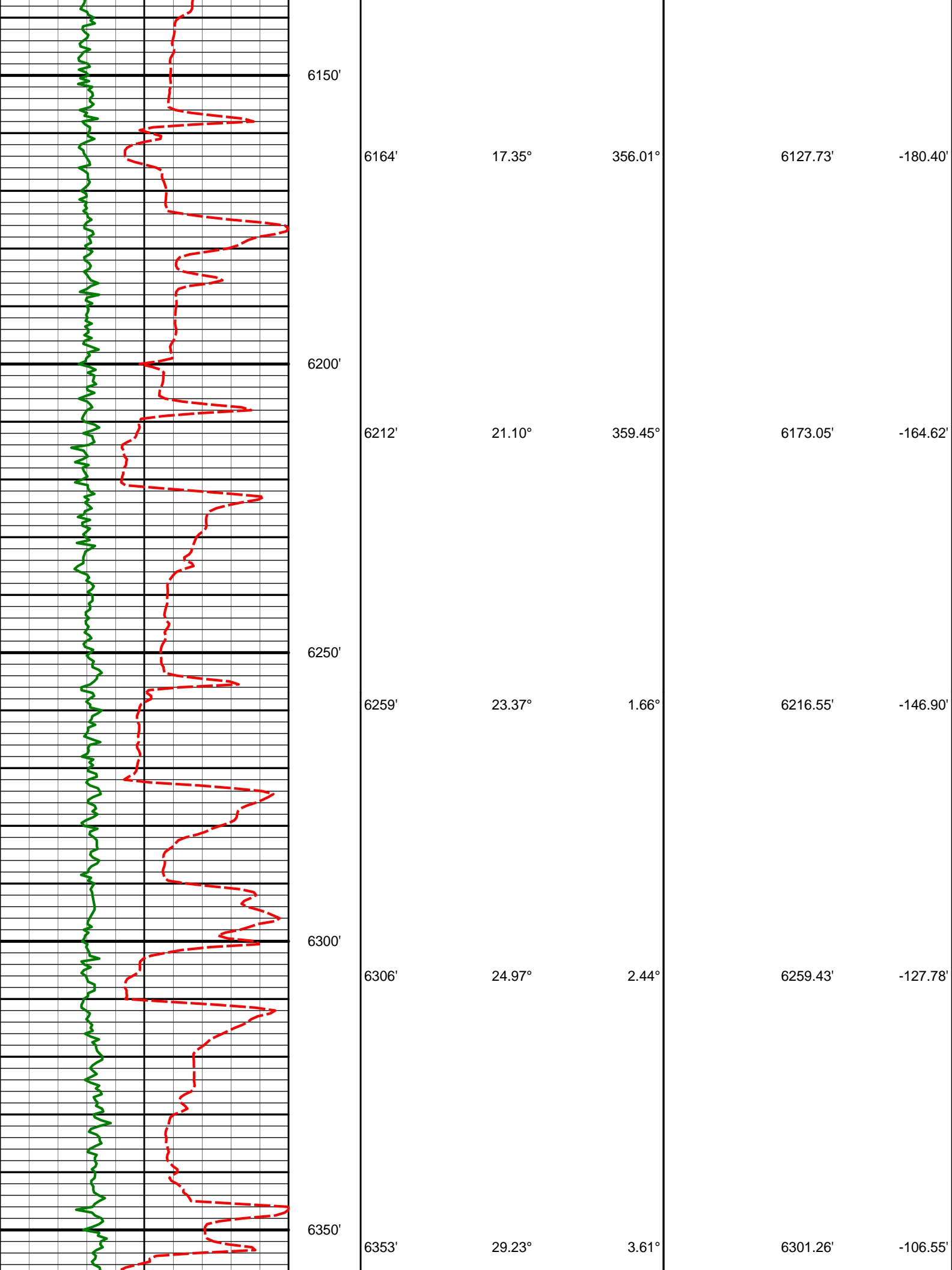




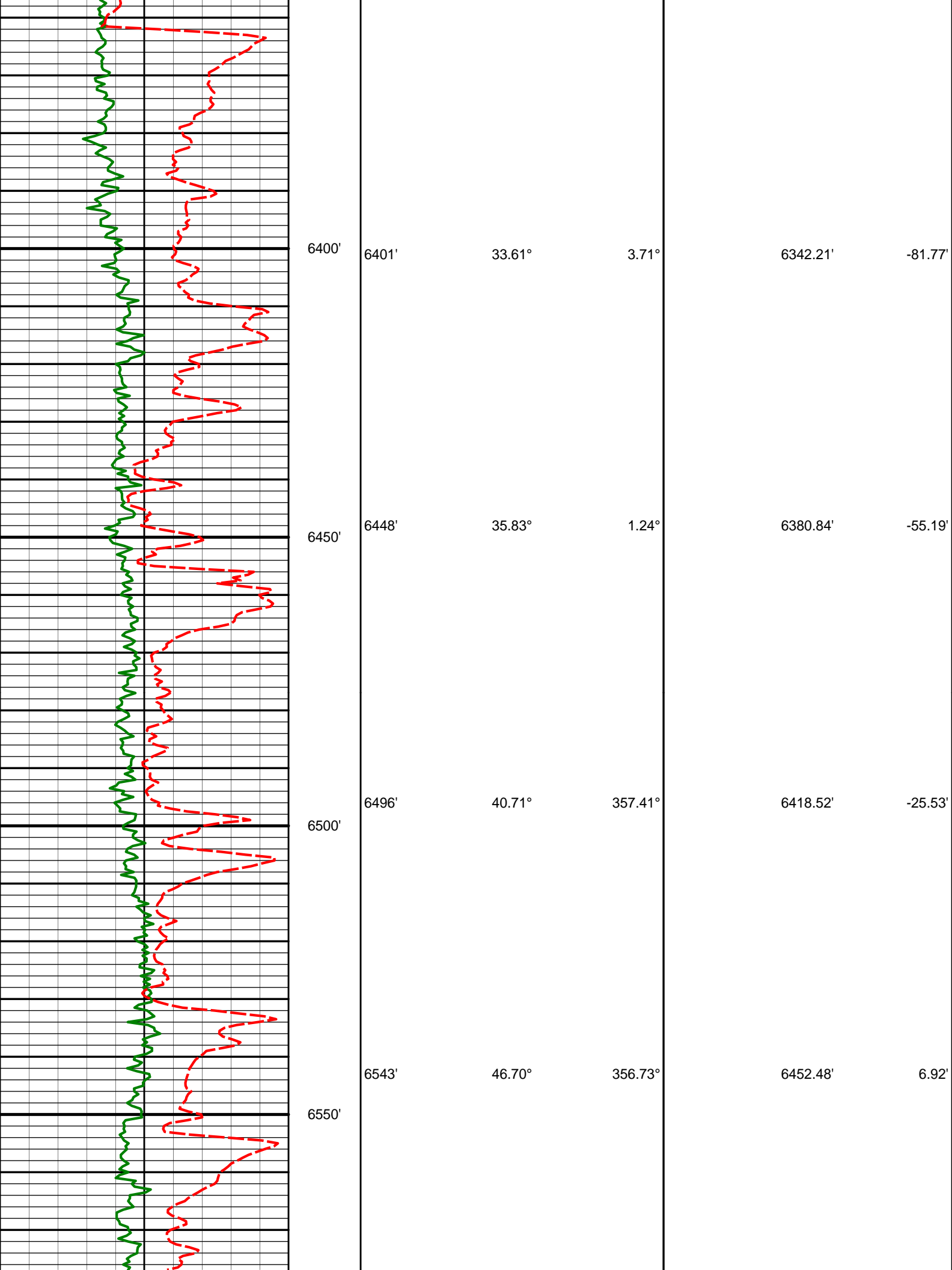


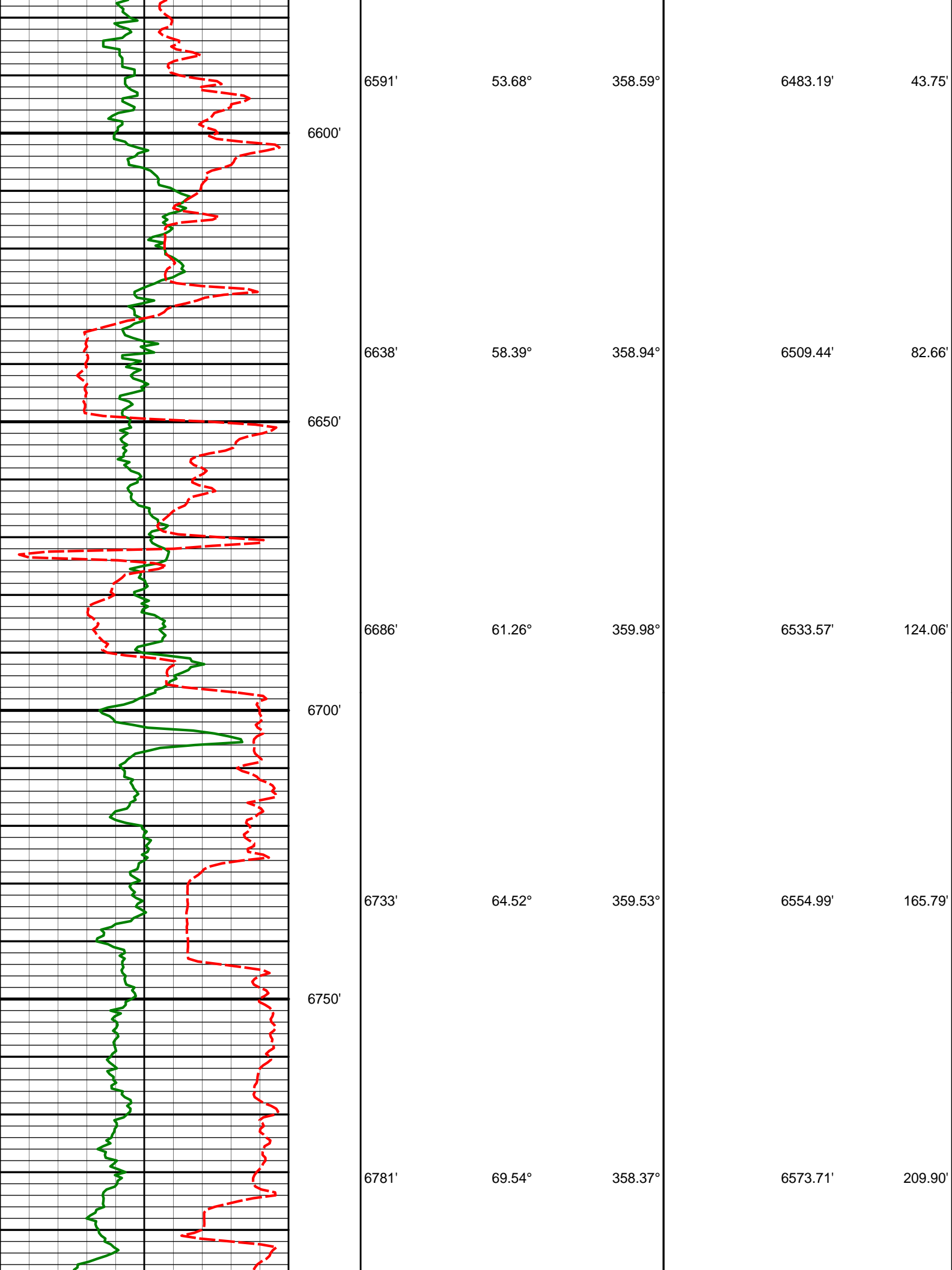
feet per hr	Feet	Depth	Inc	Azm	TVD	Vsec
600	0					
Gamma Ray (PGXC) (Api)						
0	300					
<div>HALLIBURTON</div> <div>TVD Detail Log 1:240</div>						
Gamma Ray (PGXC) (Api)						
0	300					
Avg Rate of Penetration feet per hr	Feet	Depth	Inc	Azm	TVD	Vsec
600	0					
	5800					
		5838'	0.63°	73.14°	5805.50'	-217.97'
	5850'					
	Run 200					
	5900					

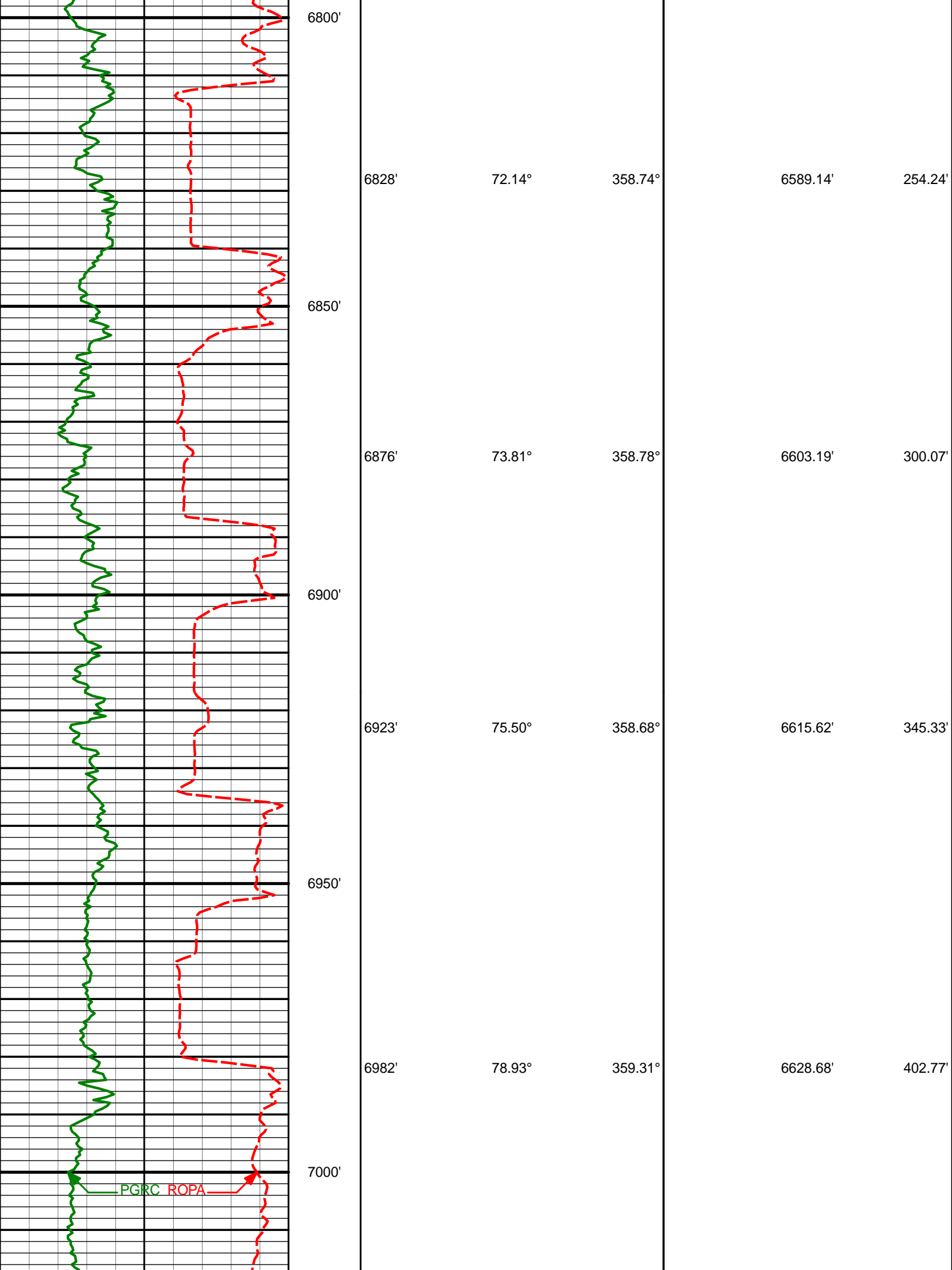


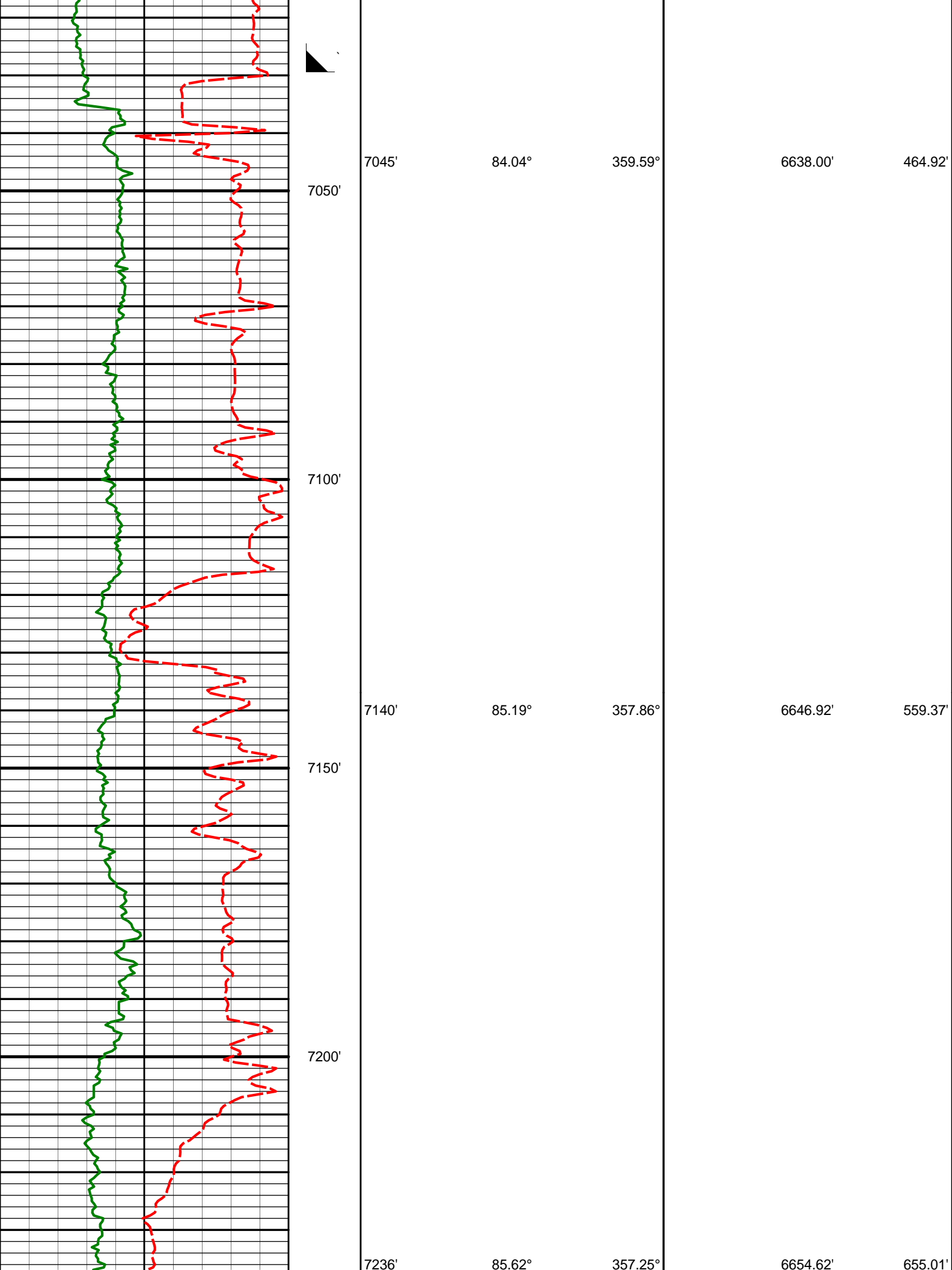


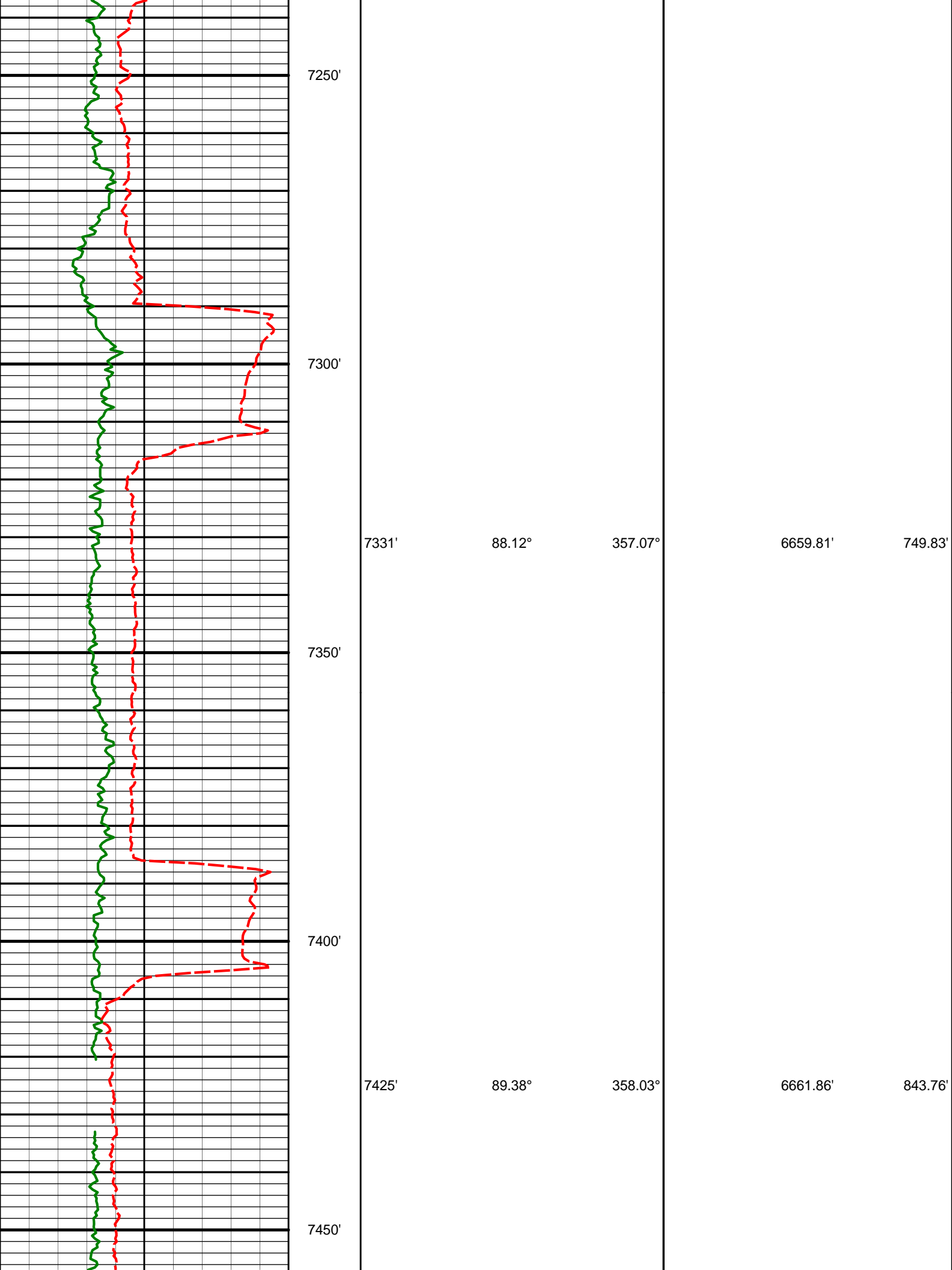


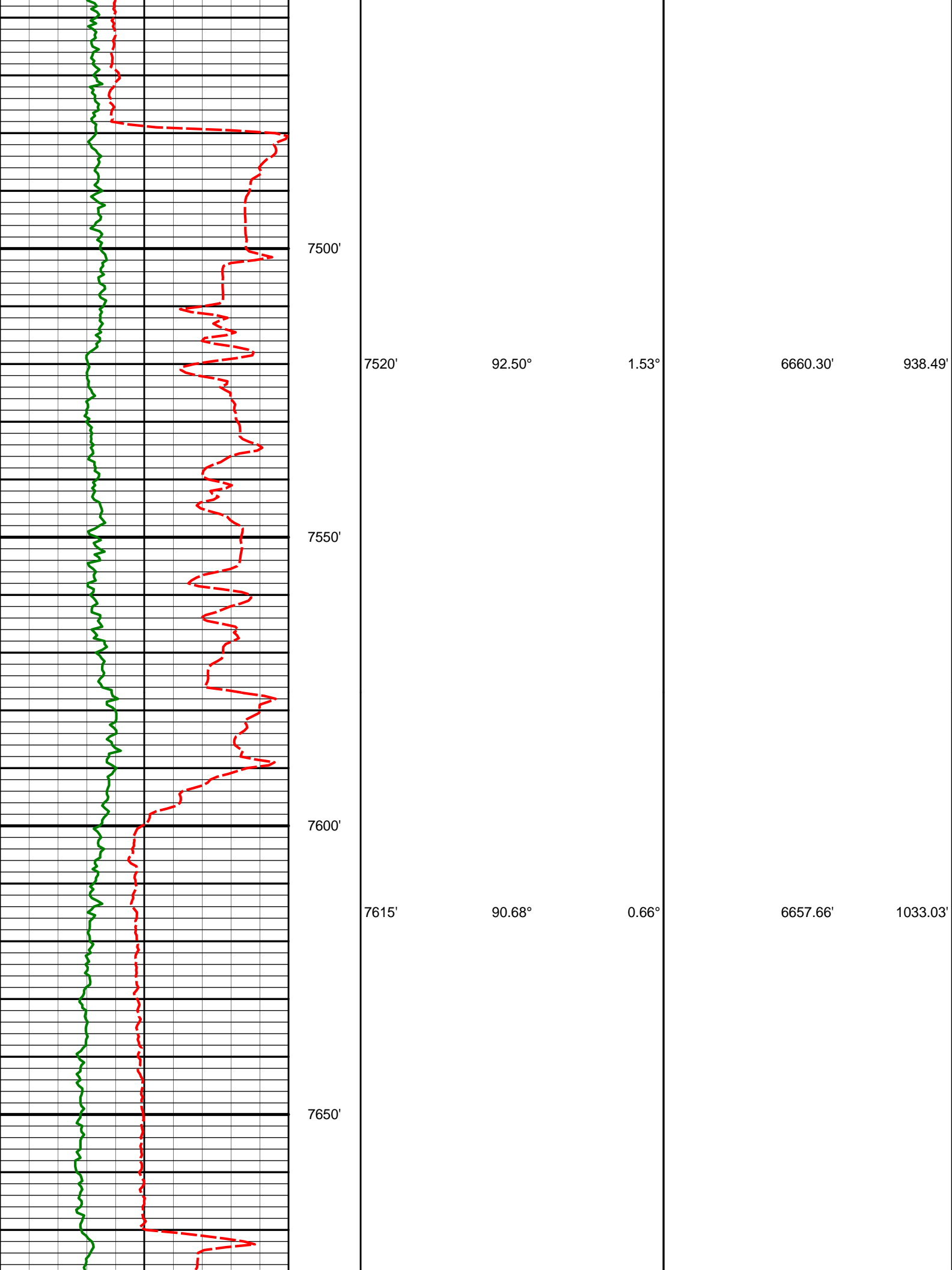


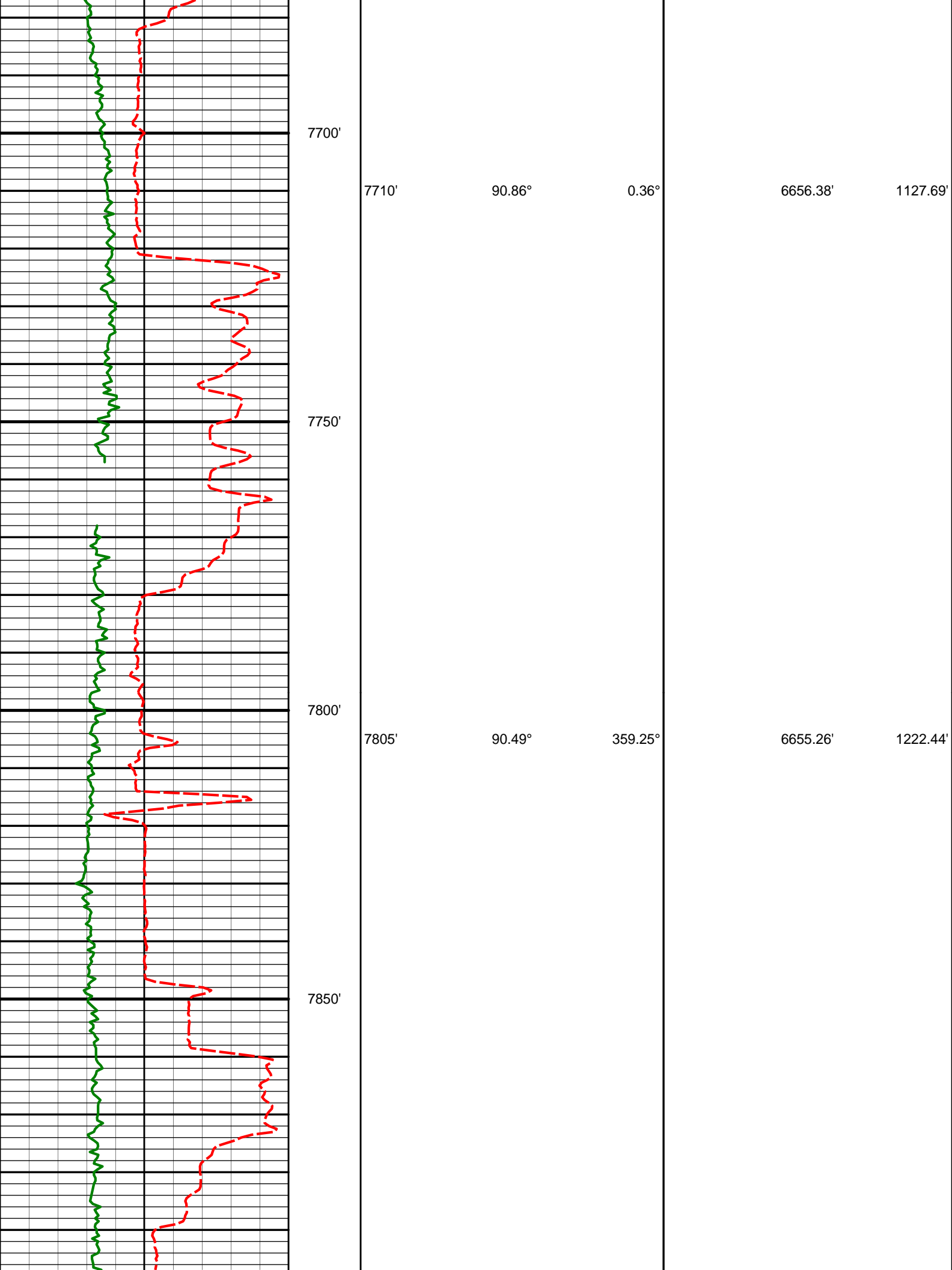


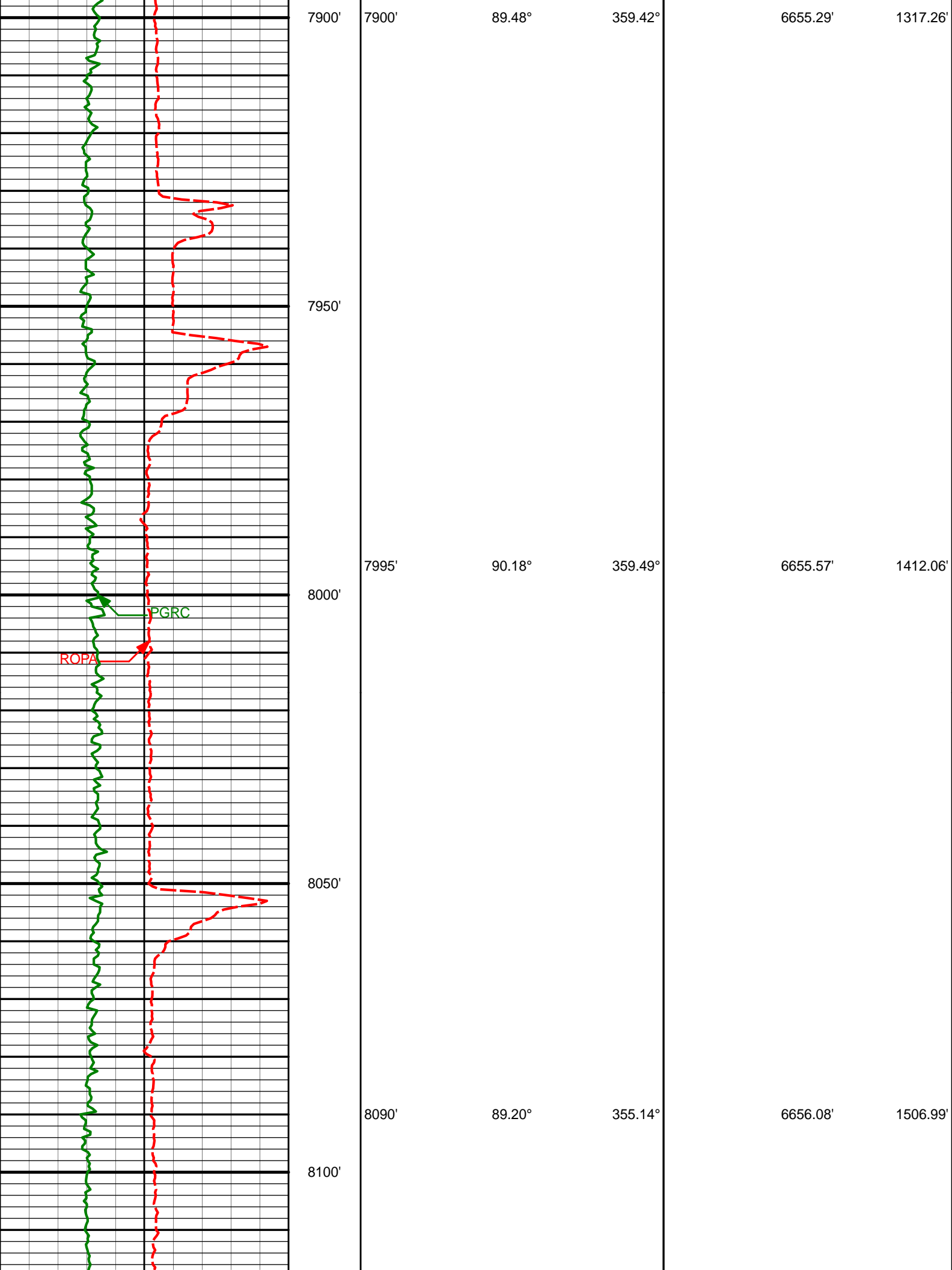




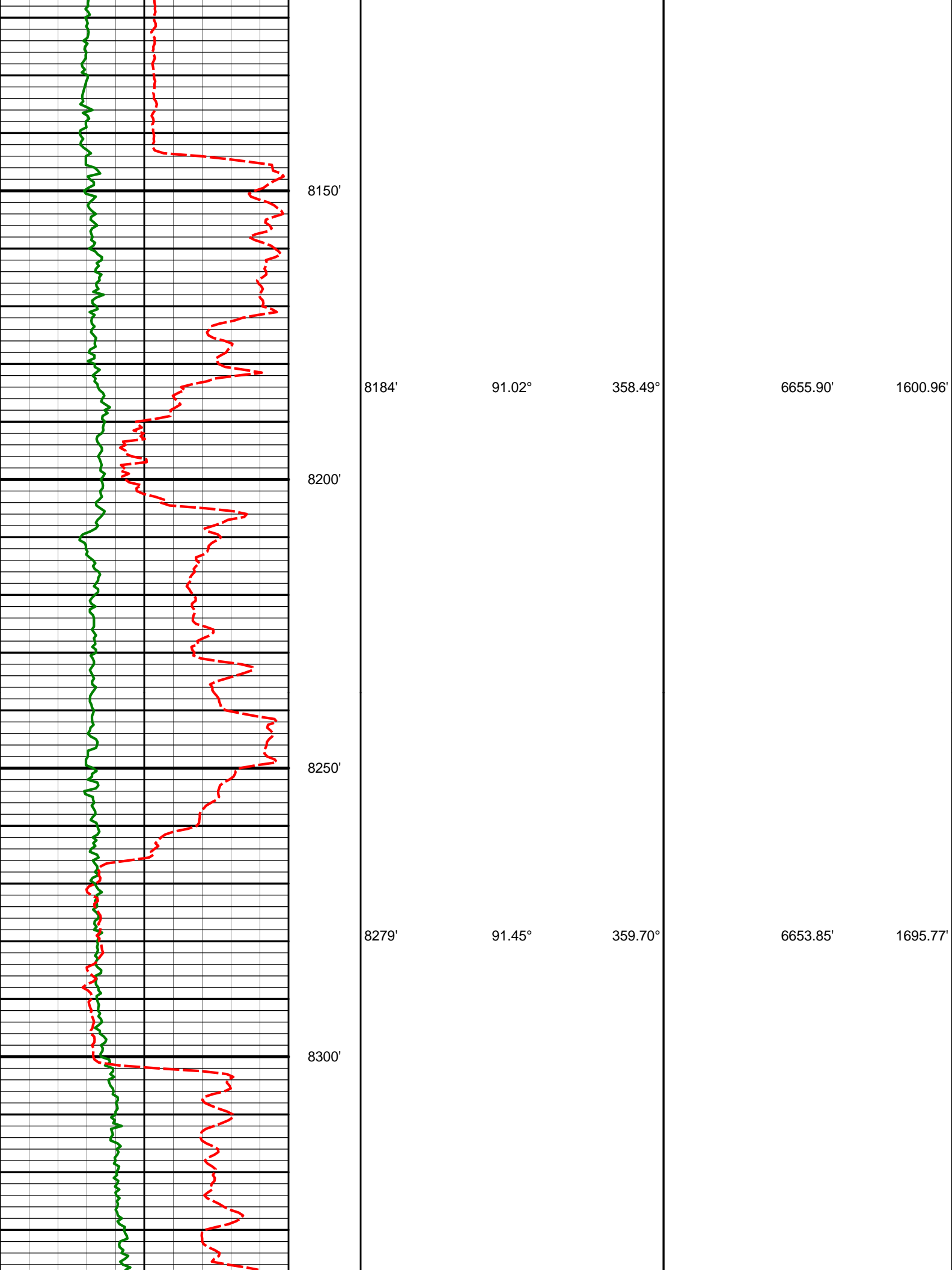


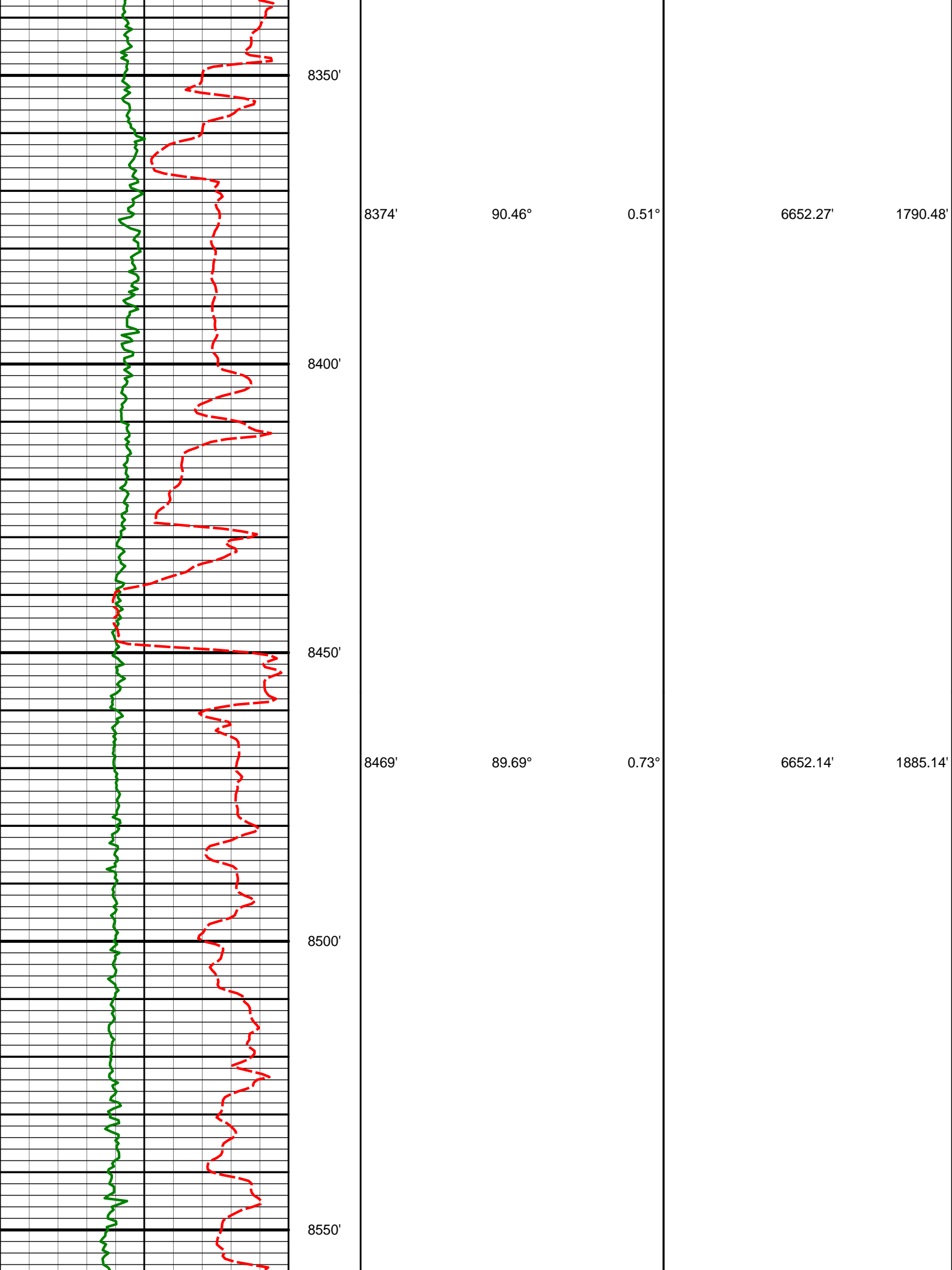


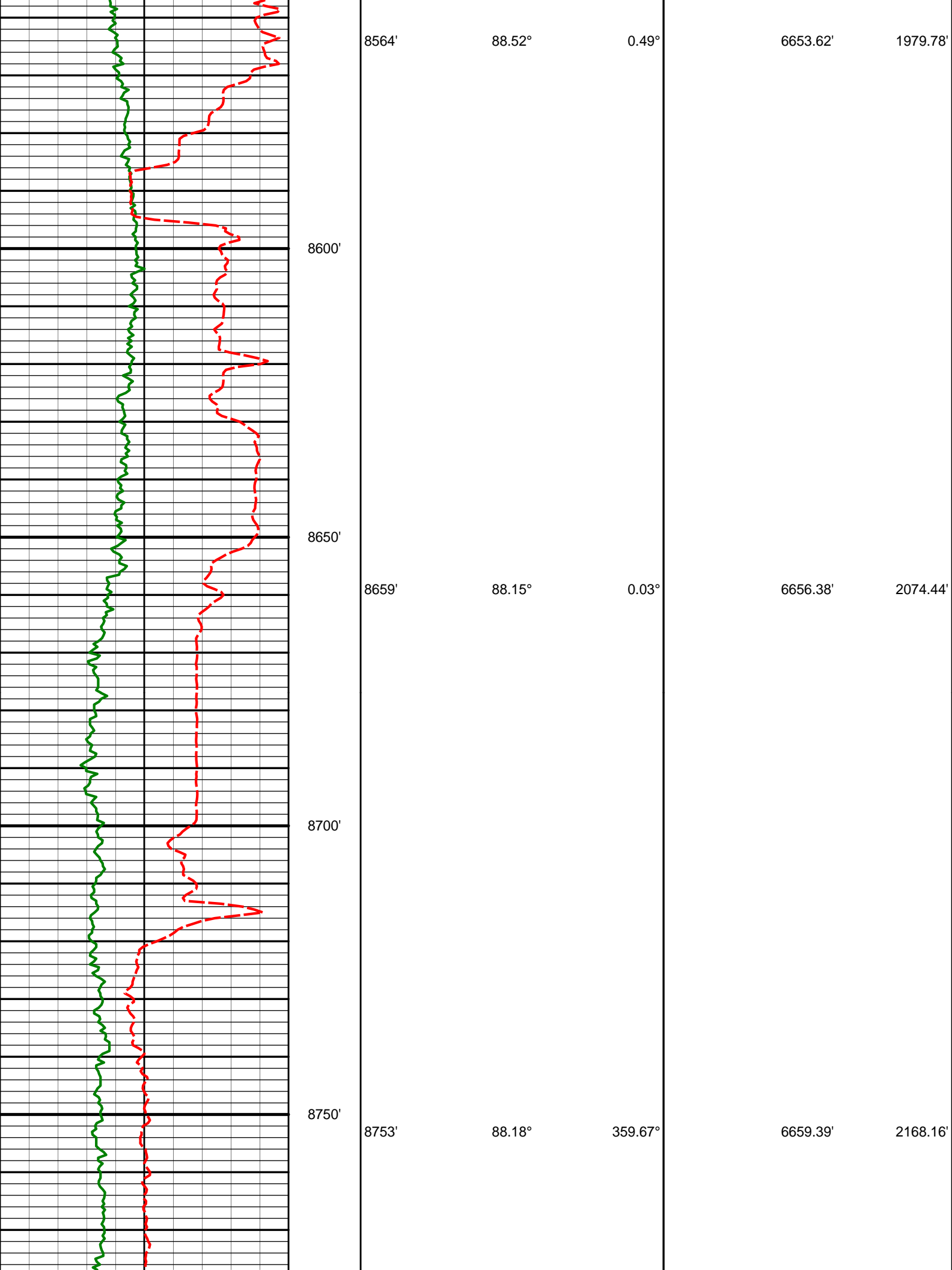


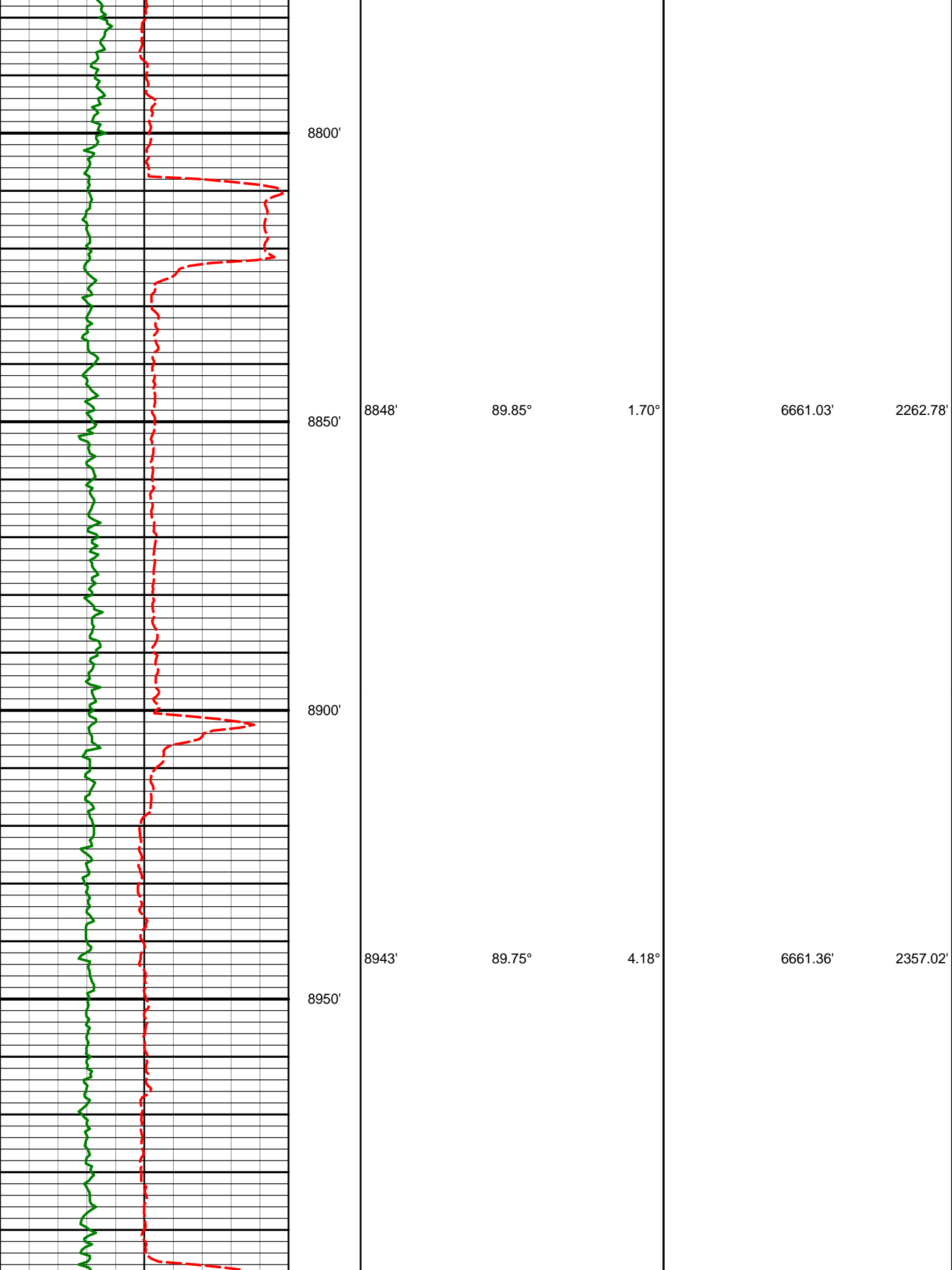


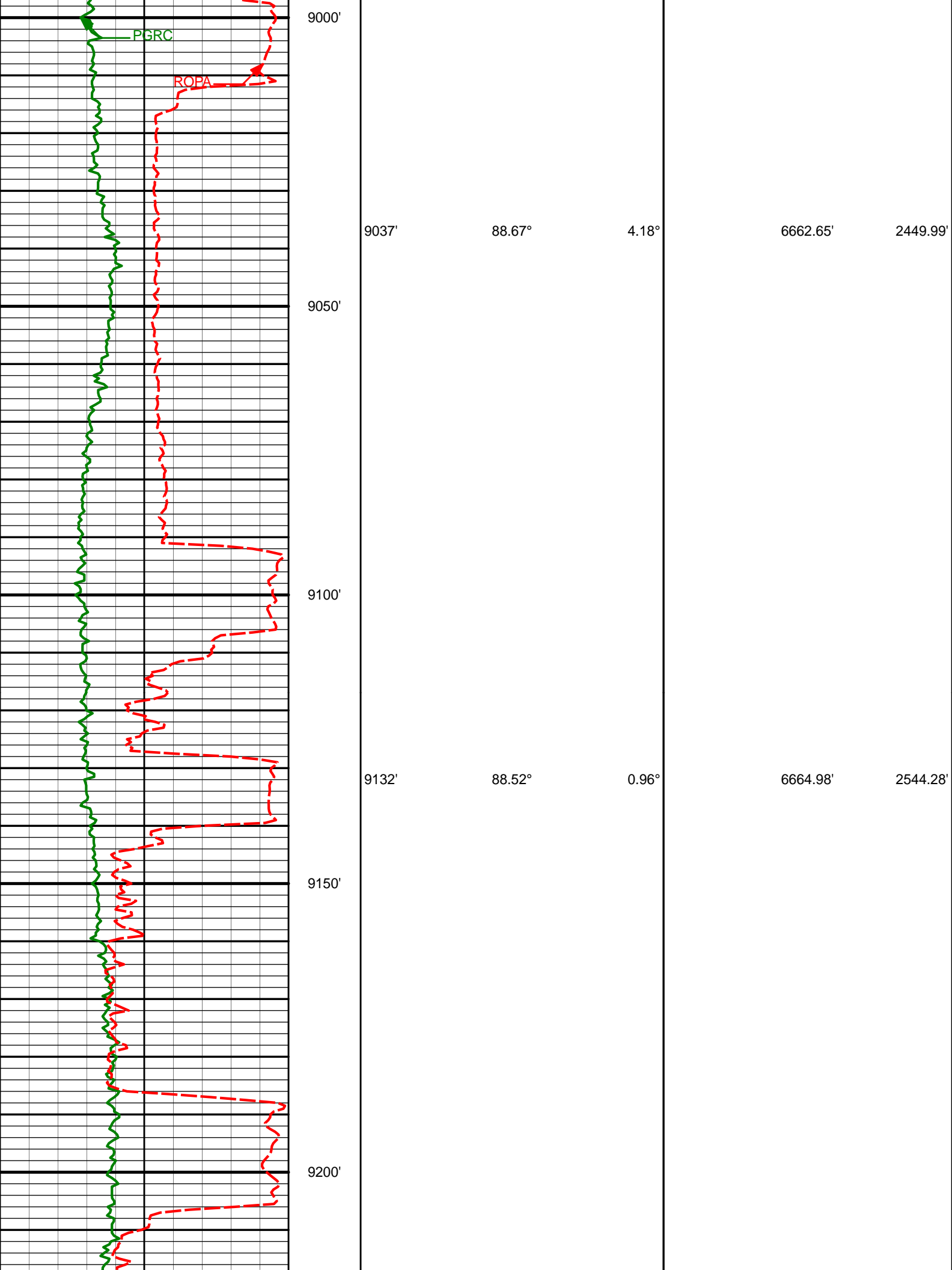


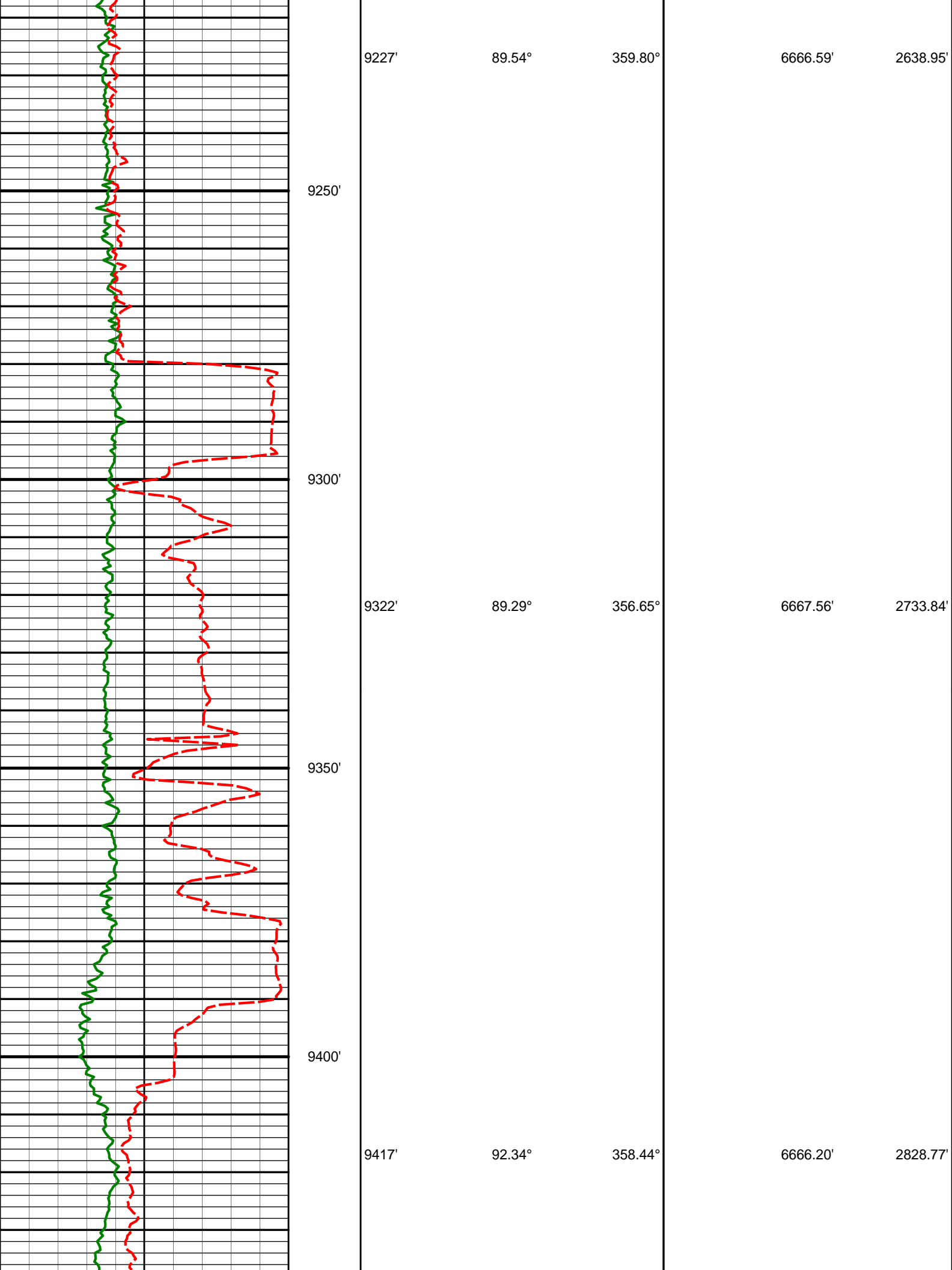


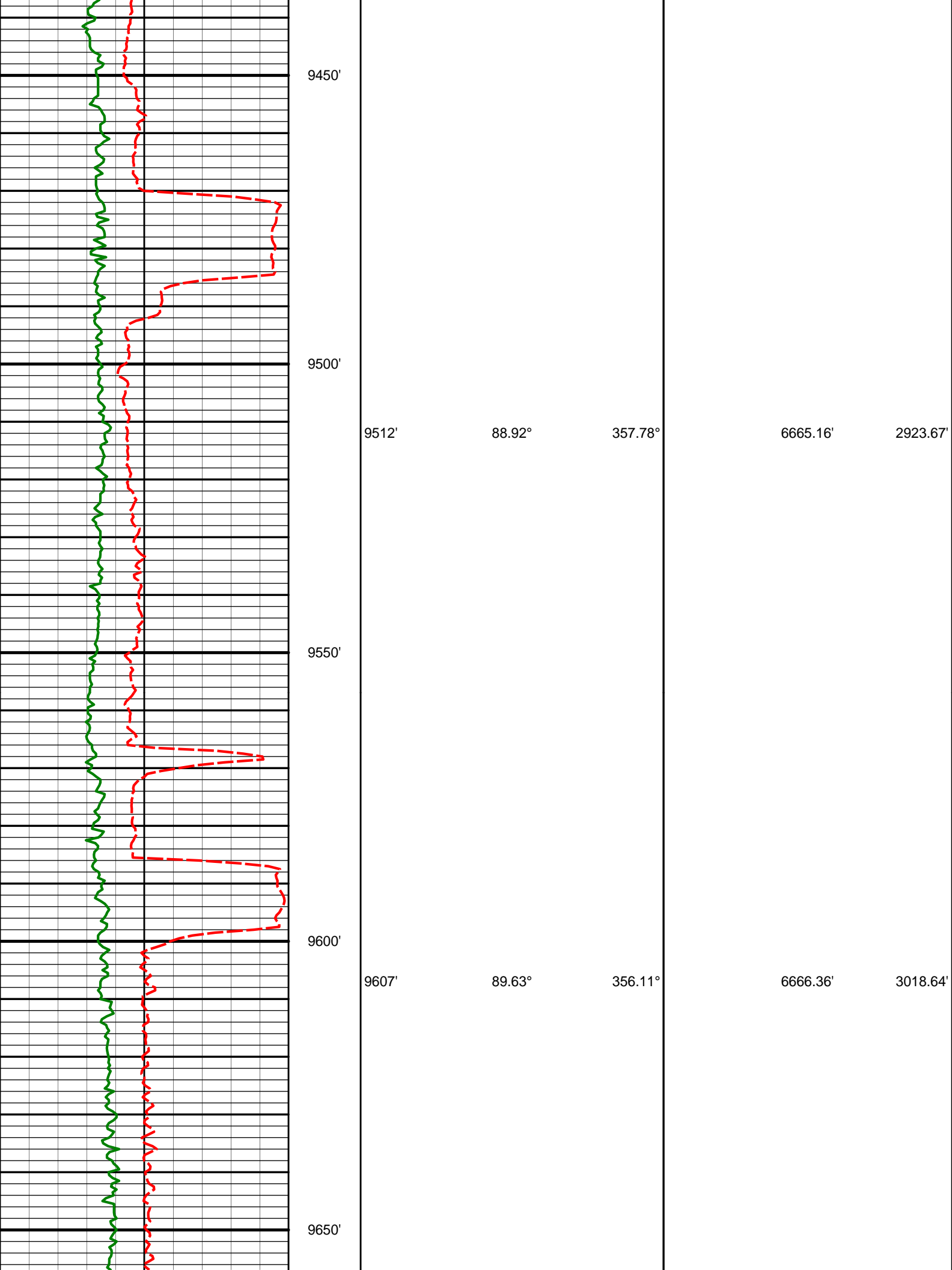


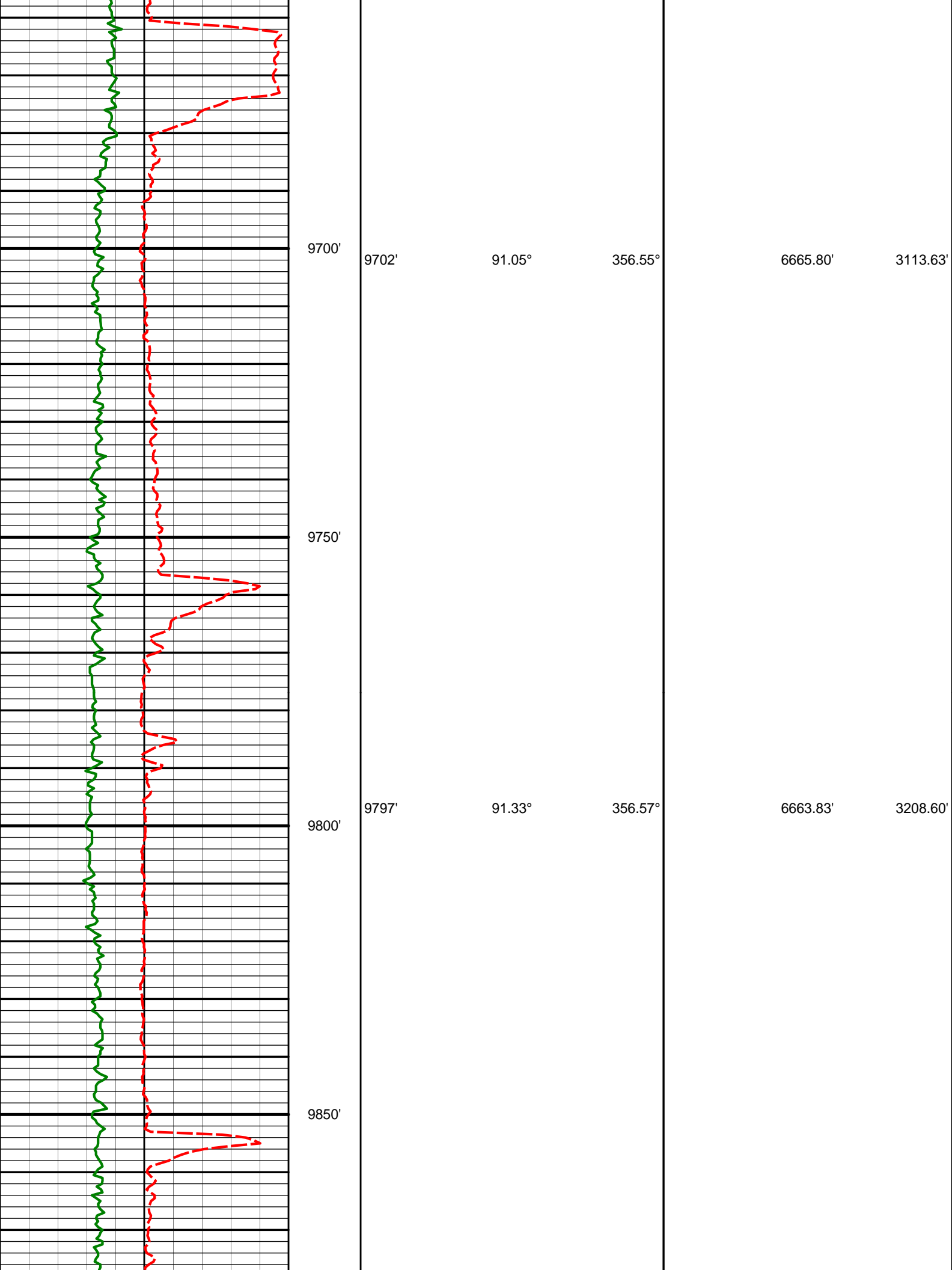




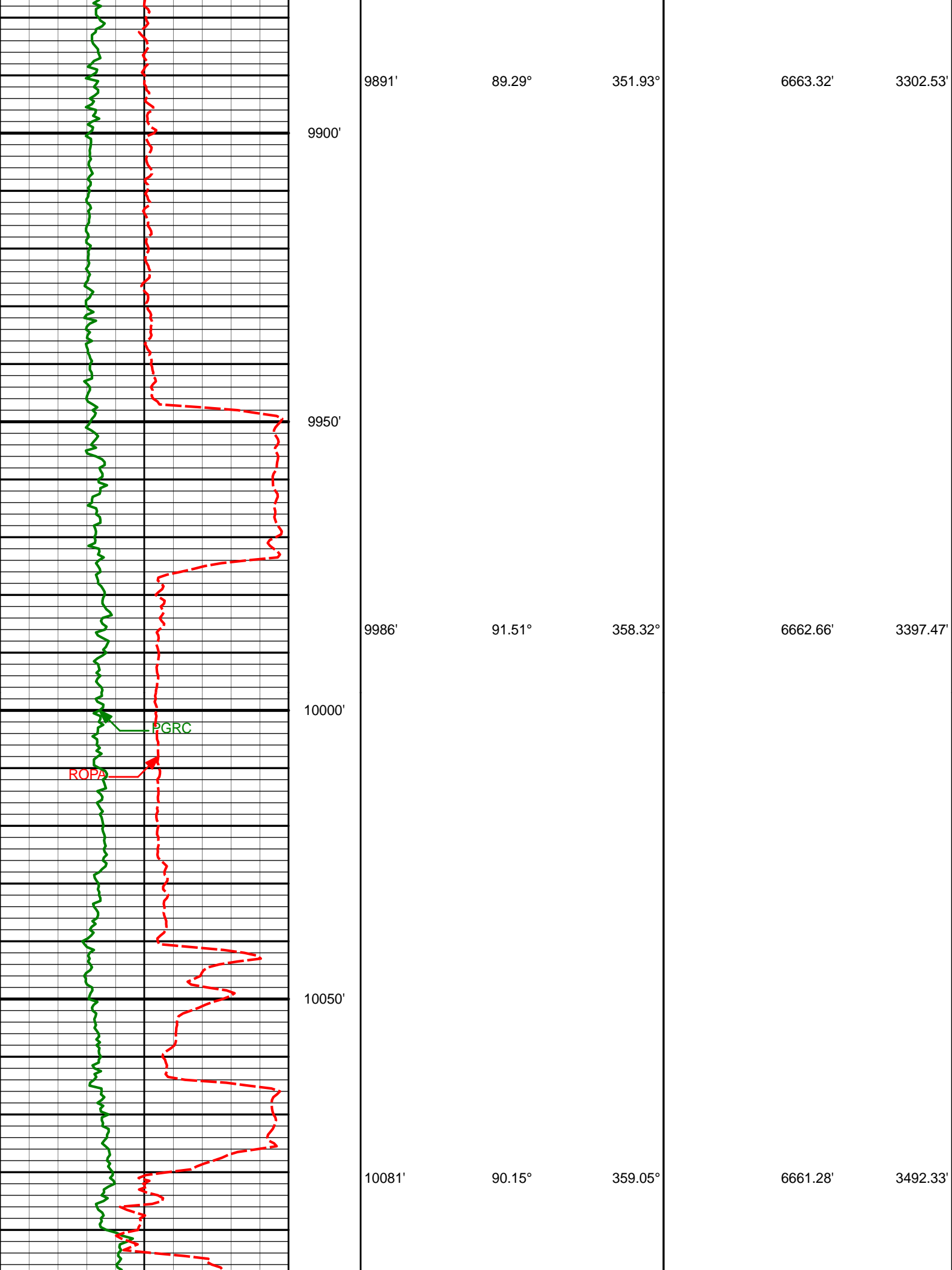


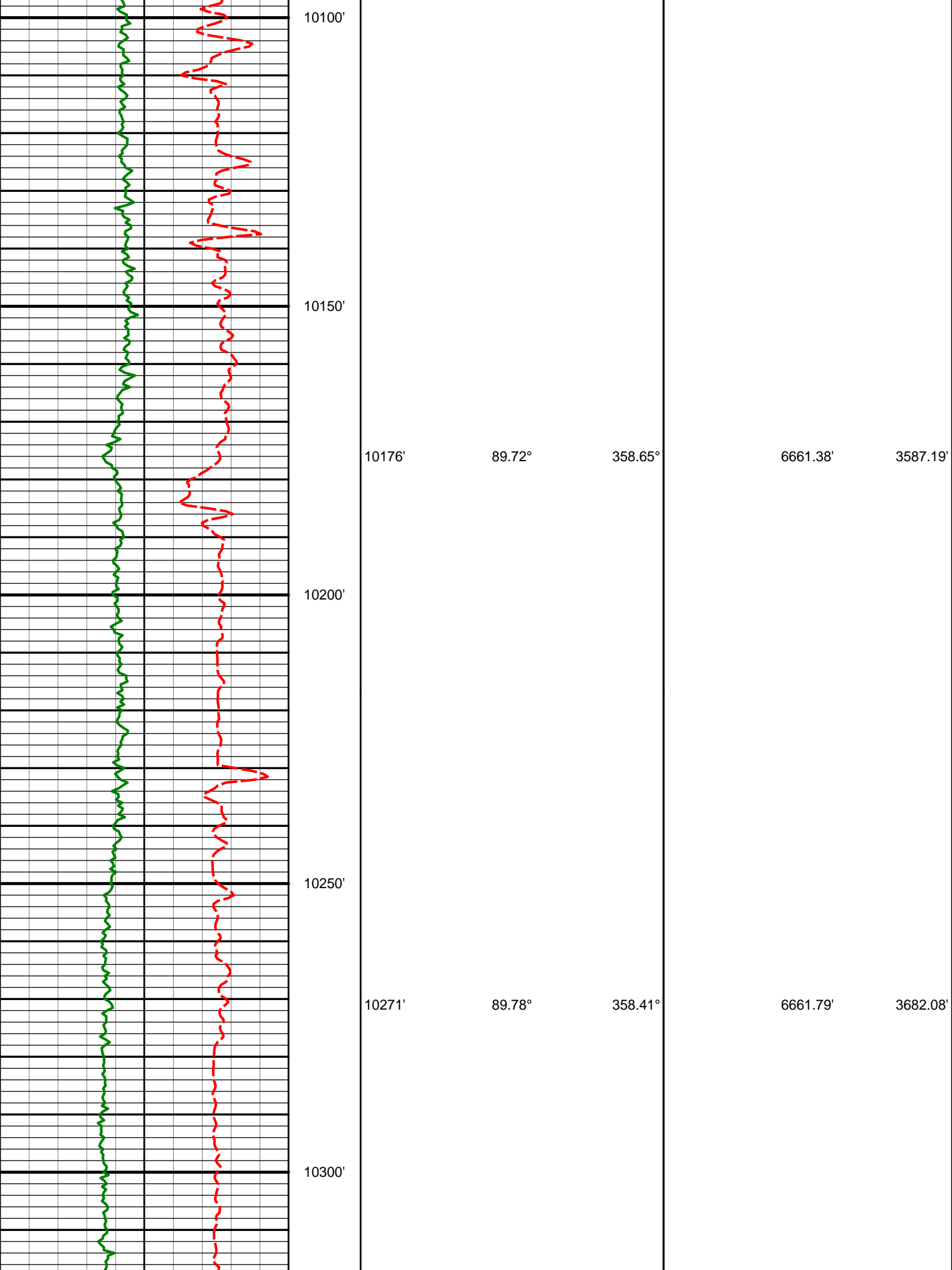


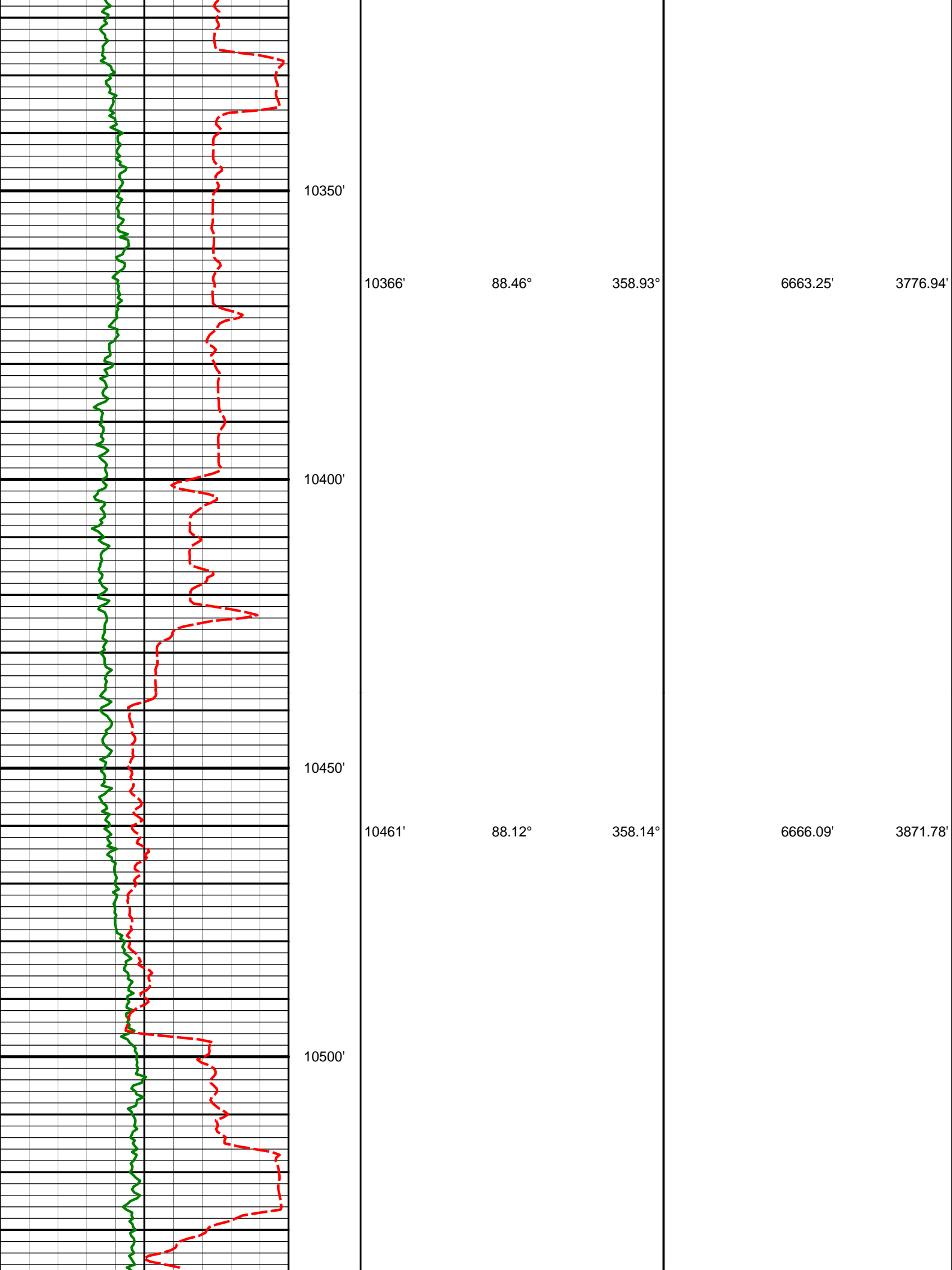


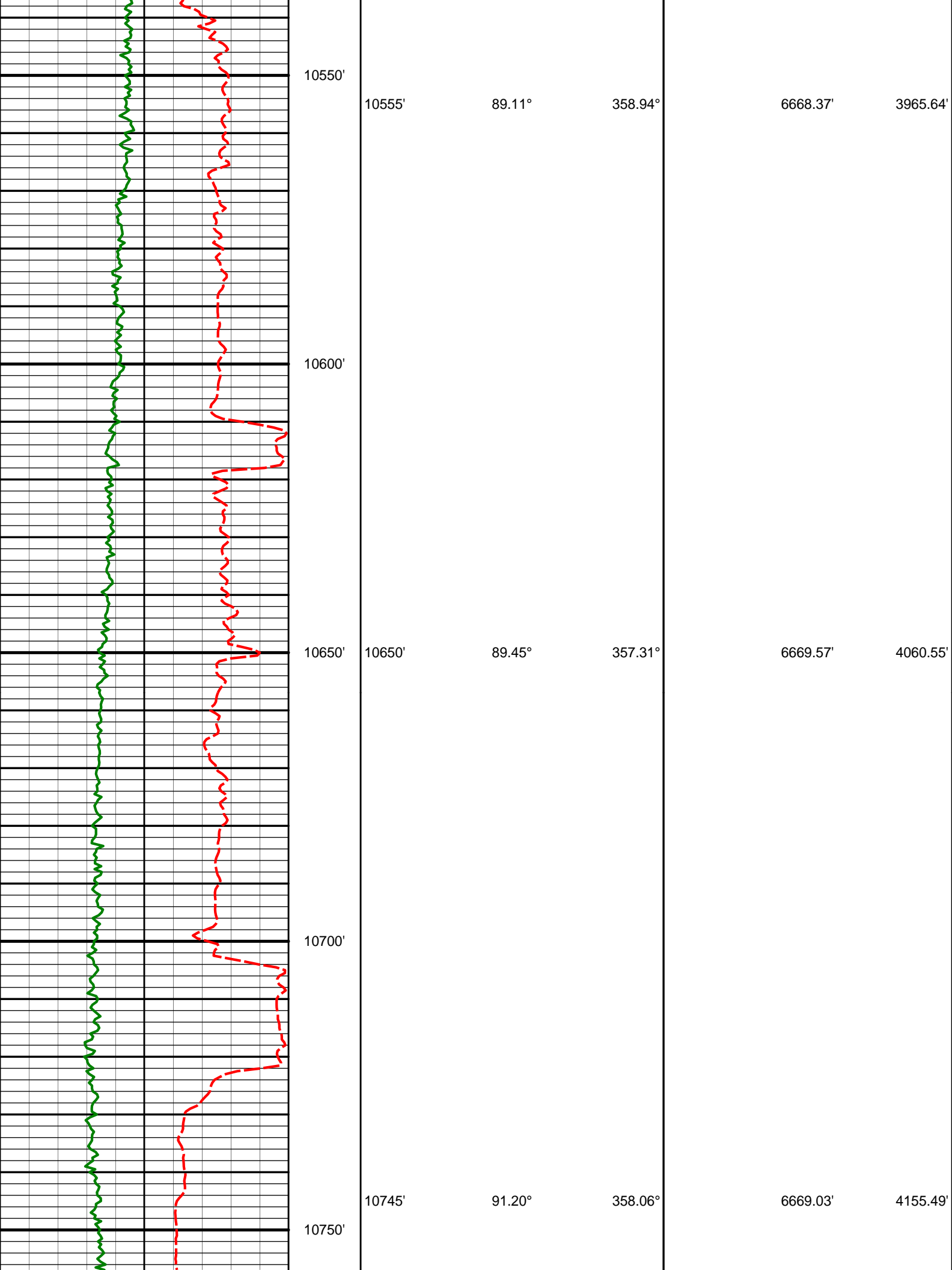


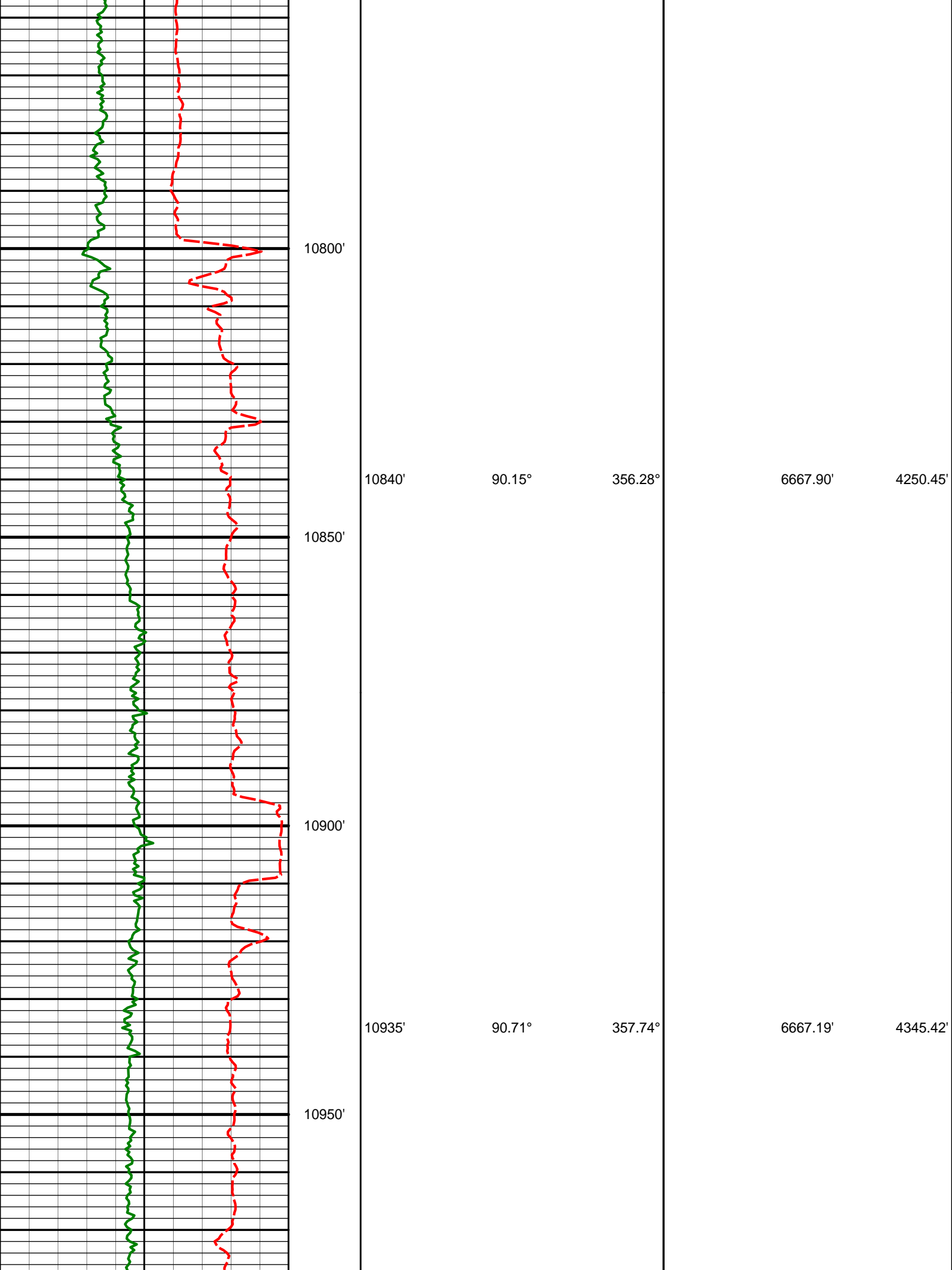


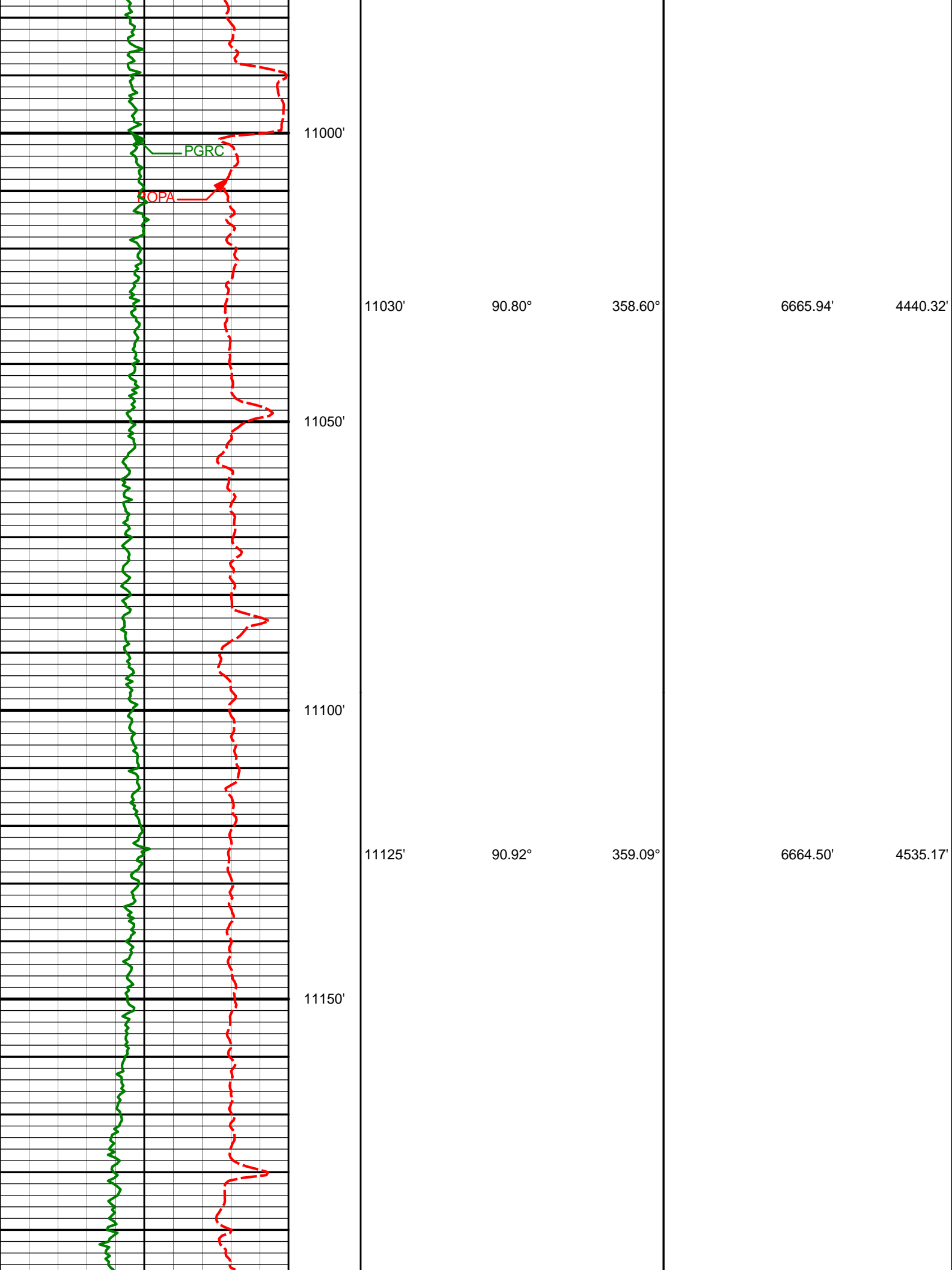


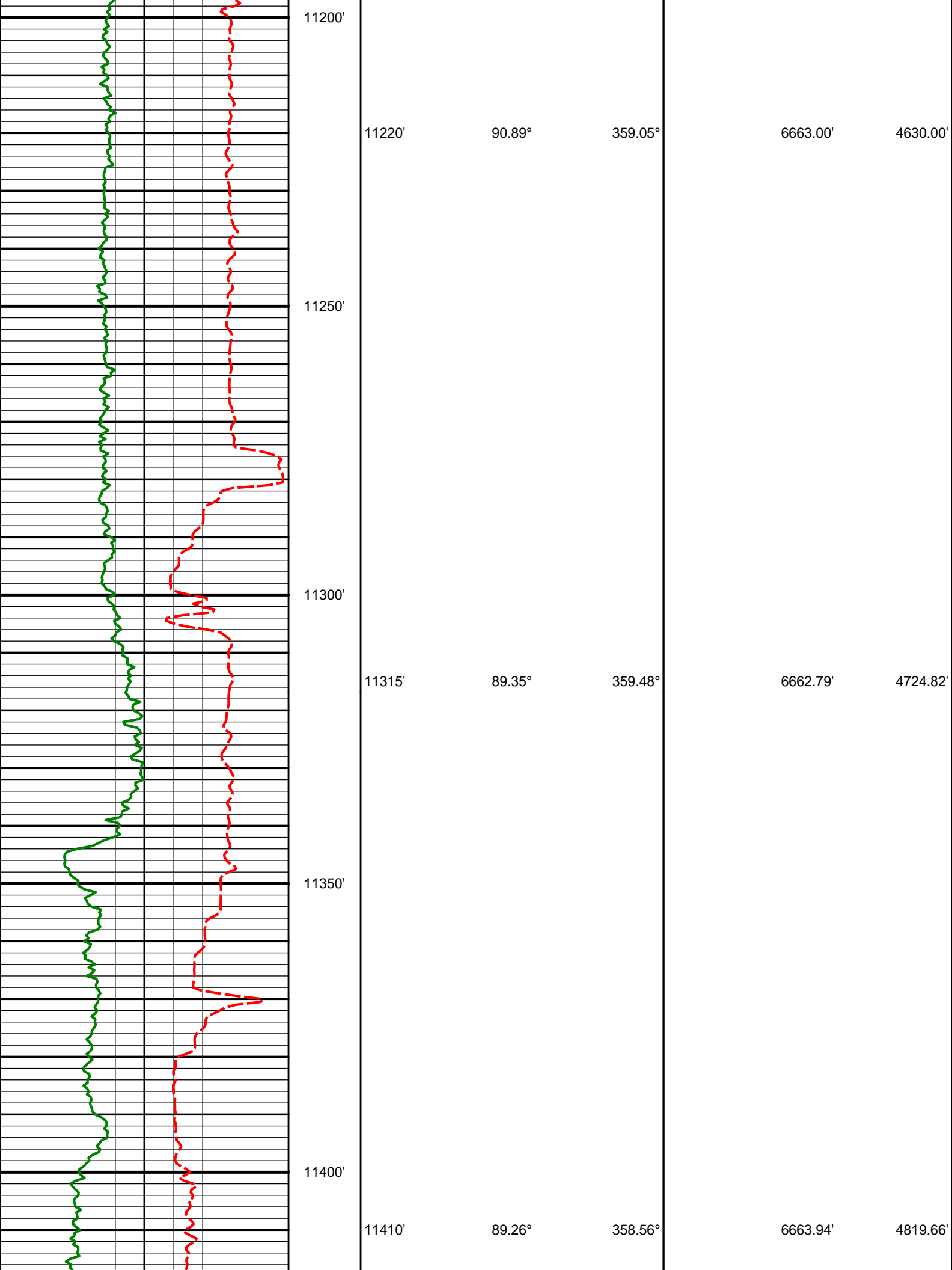


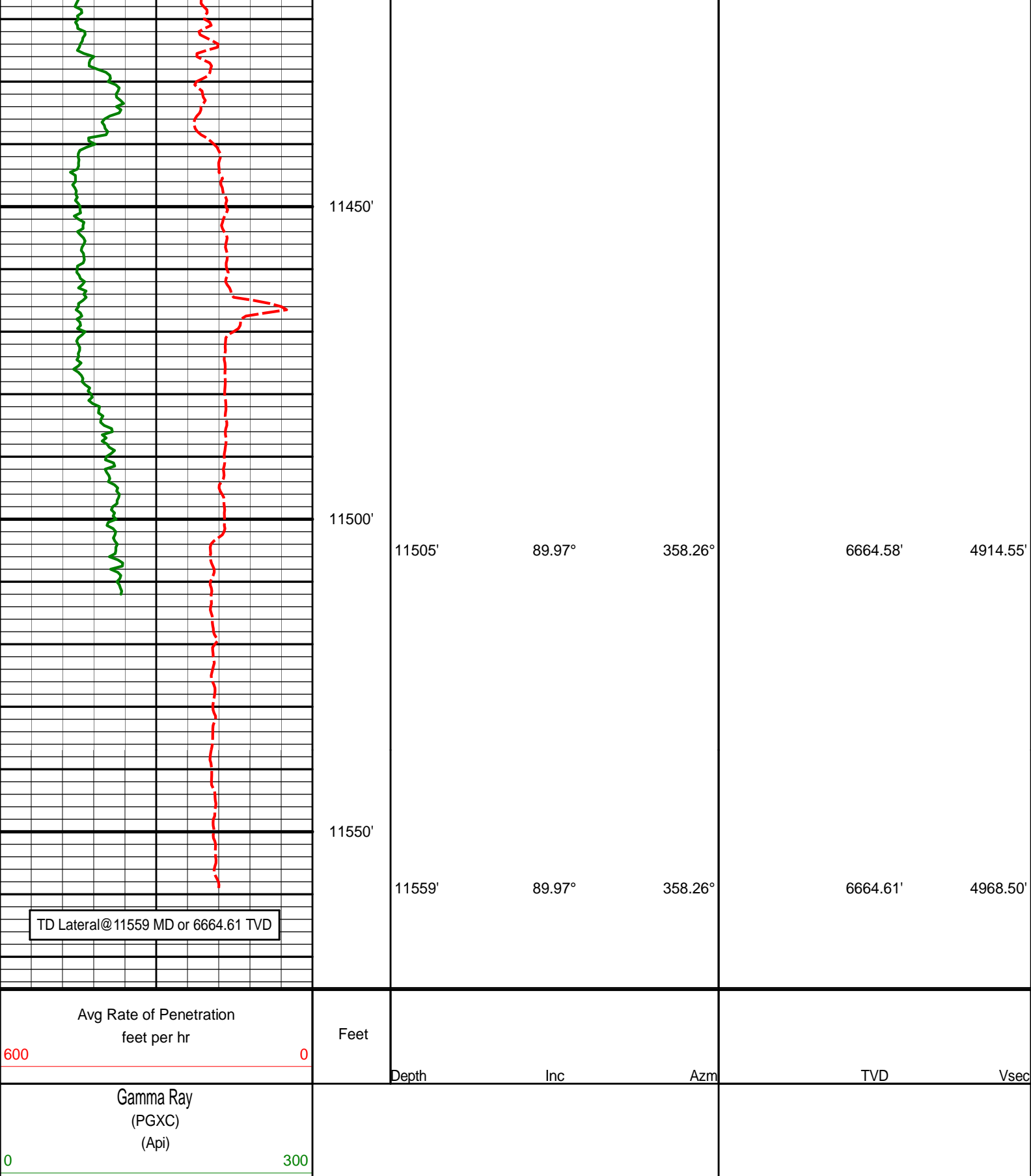












## DIRECTIONAL SURVEY REPORT

Noble Energy  
Guttersen State DD17-79HN  
Wattenberg  
Weld Colorado  
USA  
CA-XX-0900894767



	0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
	249.00	0.60	187.22	249.00	1.29 S	0.16 W	-1.28	0.24
	502.00	0.20	348.72	501.99	2.17 S	0.42 W	-2.14	0.31
	750.00	0.50	121.52	749.99	2.32 S	0.42 E	-2.34	0.26
	814.00	0.30	114.52	813.99	2.53 S	0.81 E	-2.58	0.32
	918.00	0.39	207.32	917.99	2.96 S	0.90 E	-3.02	0.49
	1011.00	0.23	106.60	1010.99	3.30 S	0.93 E	-3.36	0.53
	1104.00	0.65	187.72	1103.98	3.87 S	1.04 E	-3.94	0.70
	1197.00	0.42	130.22	1196.98	4.61 S	1.23 E	-4.69	0.59
	1290.00	0.58	153.93	1289.98	5.25 S	1.70 E	-5.36	0.27
	1383.00	0.72	172.21	1382.97	6.25 S	1.98 E	-6.38	0.27
	1476.00	0.83	155.33	1475.96	7.44 S	2.34 E	-7.59	0.27
	1571.00	2.45	263.34	1570.93	8.30 S	0.61 E	-8.32	2.97
	1665.00	4.41	255.40	1664.76	9.45 S	4.89 W	-9.06	2.14
	1760.00	7.04	238.10	1759.28	13.44 S	13.36 W	-12.41	3.28
	1855.00	9.04	232.90	1853.35	21.02 S	24.25 W	-19.16	2.24
	1950.00	10.82	234.90	1946.92	30.65 S	37.50 W	-27.78	1.91
	2044.00	12.79	233.00	2038.93	41.98 S	53.03 W	-37.92	2.13
	2139.00	12.57	233.53	2131.61	54.45 S	69.73 W	-49.12	0.26
	2234.00	12.22	233.54	2224.40	66.56 S	86.13 W	-59.98	0.37
	2329.00	11.81	230.21	2317.32	78.76 S	101.69 W	-70.99	0.85
	2423.00	12.30	230.89	2409.25	91.23 S	116.84 W	-82.30	0.54
	2518.00	11.49	230.76	2502.21	103.60 S	132.02 W	-93.50	0.85
	2613.00	13.08	230.66	2595.03	116.40 S	147.66 W	-105.11	1.68
	2708.00	12.49	230.26	2687.67	129.78 S	163.88 W	-117.25	0.63
	2803.00	11.87	225.39	2780.54	143.21 S	178.74 W	-129.54	1.26
	2898.00	11.54	227.99	2873.56	156.44 S	192.76 W	-141.69	0.66
	2993.00	11.21	227.68	2966.70	169.01 S	206.64 W	-153.20	0.36
	3088.00	9.96	229.08	3060.08	180.61 S	219.67 W	-163.79	1.34
	3183.00	8.25	225.66	3153.88	190.76 S	230.76 W	-173.09	1.88
	3277.00	7.76	223.70	3246.96	200.06 S	239.97 W	-181.68	0.60
	3372.00	6.46	223.90	3341.23	208.55 S	248.10 W	-189.54	1.38
	3467.00	5.77	234.28	3435.69	215.18 S	255.68 W	-195.60	1.37
	3562.00	5.57	229.71	3530.23	220.95 S	263.08 W	-200.80	0.52
	3657.00	3.76	225.11	3624.91	226.13 S	268.80 W	-205.54	1.94
	3752.00	1.59	225.34	3719.80	229.26 S	271.95 W	-208.43	2.28
	3847.00	1.40	243.88	3814.77	230.70 S	273.93 W	-209.71	0.55
	3941.00	1.54	235.21	3908.74	231.92 S	275.99 W	-210.78	0.28
	4036.00	0.96	308.48	4003.72	232.16 S	277.66 W	-210.89	1.64
	4131.00	0.47	320.08	4098.71	231.37 S	278.53 W	-210.04	0.53
	4226.00	0.32	209.97	4193.71	231.30 S	278.92 W	-209.94	0.69
	4321.00	0.79	215.45	4288.71	232.06 S	279.43 W	-210.66	0.51
	4415.00	0.71	210.15	4382.70	233.09 S	280.10 W	-211.64	0.12
	4510.00	0.83	188.78	4477.69	234.29 S	280.50 W	-212.80	0.33
	4605.00	0.15	221.98	4572.69	235.06 S	280.69 W	-213.56	0.75
	4700.00	1.12	228.32	4667.68	235.77 S	281.47 W	-214.21	1.01
	4795.00	1.36	232.64	4762.66	237.07 S	283.06 W	-215.39	0.28
	4890.00	2.24	229.88	4857.61	238.96 S	285.37 W	-217.10	0.93
	4984.00	0.86	190.41	4951.57	240.83 S	286.91 W	-218.85	1.78
	5079.00	0.62	189.51	5046.57	242.03 S	287.12 W	-220.04	0.25
	5174.00	0.50	220.85	5141.56	242.85 S	287.48 W	-220.83	0.34
	5269.00	0.70	79.42	5236.56	243.06 S	287.17 W	-221.05	1.20
	5364.00	0.79	86.81	5331.55	242.91 S	285.95 W	-221.00	0.13
	5459.00	0.94	37.49	5426.54	242.26 S	284.82 W	-220.43	0.77
	5554.00	0.81	69.65	5521.53	241.40 S	283.71 W	-219.66	0.53
	5649.00	0.93	63.29	5616.52	240.82 S	282.39 W	-219.18	0.16
	5744.00	0.71	42.77	5711.51	240.04 S	281.30 W	-218.48	0.38
	5838.00	0.63	73.14	5805.50	239.47 S	280.41 W	-217.97	0.38
	5975.00	2.51	18.95	5942.45	236.41 S	278.72 W	-215.05	1.61
	6022.00	7.87	3.25	5989.24	232.22 S	278.20 W	-210.91	11.68
	6070.00	10.75	2.85	6036.61	224.46 S	277.79 W	-203.21	6.00
	6117.00	14.13	359.81	6082.50	214.35 S	277.59 W	-193.13	7.32
	6164.00	17.35	356.01	6127.73	201.62 S	278.10 W	-180.40	7.20
	6212.00	21.10	359.45	6173.05	185.83 S	278.68 W	-164.62	8.16
	6259.00	23.37	1.66	6216.55	168.05 S	278.49 W	-146.90	5.14
	6306.00	24.97	2.44	6259.43	148.82 S	277.80 W	-127.78	3.48
	6353.00	29.23	3.61	6301.26	127.45 S	276.66 W	-106.55	9.14
	6401.00	33.61	3.71	6342.21	102.48 S	275.06 W	-81.77	9.13
	6448.00	35.83	1.24	6380.84	75.74 S	273.92 W	-55.19	5.59
	6496.00	40.71	357.41	6418.52	46.04 S	274.32 W	-25.53	11.31

6543.00	46.70	356.73	6452.48	13.62 S	275.99 W	6.92	12.78
6591.00	53.68	358.59	6483.19	23.20 N	277.47 W	43.75	14.83
6638.00	58.39	358.94	6509.44	62.16 N	278.30 W	82.66	10.04
6686.00	61.26	359.98	6533.57	103.65 N	278.69 W	124.06	6.26
6733.00	64.52	359.53	6554.99	145.48 N	278.87 W	165.79	6.99
6781.00	69.54	358.37	6573.71	189.65 N	279.69 W	209.90	10.71
6828.00	72.14	358.74	6589.14	234.03 N	280.81 W	254.24	5.59
6876.00	73.81	358.78	6603.19	279.91 N	281.80 W	300.07	3.48
6923.00	75.50	358.68	6615.62	325.23 N	282.80 W	345.33	3.60
6982.00	78.93	359.31	6628.68	382.74 N	283.81 W	402.77	5.89
7045.00	84.04	359.59	6638.00	445.03 N	284.40 W	464.92	8.13
7140.00	85.19	357.86	6646.92	539.58 N	286.50 W	559.37	2.18
7236.00	85.62	357.25	6654.62	635.18 N	290.58 W	655.01	0.78
7331.00	88.12	357.07	6659.81	729.92 N	295.28 W	749.83	2.64
7425.00	89.38	358.03	6661.86	823.80 N	299.29 W	843.76	1.69
7520.00	92.50	1.53	6660.30	918.76 N	299.65 W	938.49	4.93
7615.00	90.68	0.66	6657.66	1013.71 N	297.83 W	1033.03	2.13
7710.00	90.86	0.36	6656.38	1108.69 N	296.99 W	1127.69	0.37
7805.00	90.49	359.25	6655.26	1203.68 N	297.32 W	1222.44	1.23
7900.00	89.48	359.42	6655.29	1298.68 N	298.42 W	1317.26	1.09
7995.00	90.18	359.49	6655.57	1393.67 N	299.32 W	1412.06	0.75
8090.00	89.20	355.14	6656.08	1488.54 N	303.76 W	1506.99	4.70
8184.00	91.02	358.49	6655.90	1582.38 N	308.98 W	1600.96	4.05
8279.00	91.45	359.70	6653.85	1677.34 N	310.47 W	1695.77	1.35
8374.00	90.46	0.51	6652.27	1772.33 N	310.30 W	1790.48	1.34
8469.00	89.69	0.73	6652.14	1867.32 N	309.28 W	1885.14	0.85
8564.00	88.52	0.49	6653.62	1962.30 N	308.26 W	1979.78	1.26
8659.00	88.15	0.03	6656.38	2057.26 N	307.83 W	2074.44	0.62
8753.00	88.18	359.67	6659.39	2151.21 N	308.08 W	2168.16	0.39
8848.00	89.85	1.70	6661.03	2246.18 N	306.94 W	2262.78	2.77
8943.00	89.75	4.18	6661.36	2341.05 N	302.07 W	2357.02	2.61
9037.00	88.67	4.18	6662.65	2434.79 N	295.22 W	2449.99	1.15
9132.00	88.52	0.96	6664.98	2529.65 N	290.96 W	2544.28	3.39
9227.00	89.54	359.80	6666.59	2624.64 N	290.32 W	2638.95	1.62
9322.00	89.29	356.65	6667.56	2719.57 N	293.26 W	2733.84	3.33
9417.00	92.34	358.44	6666.20	2814.46 N	297.33 W	2828.77	3.73
9512.00	88.92	357.78	6665.16	2909.39 N	300.46 W	2923.67	3.67
9607.00	89.63	356.11	6666.36	3004.24 N	305.53 W	3018.64	1.91
9702.00	91.05	356.55	6665.80	3099.04 N	311.62 W	3113.63	1.56
9797.00	91.33	356.57	6663.83	3193.85 N	317.31 W	3208.60	0.29
9891.00	89.29	351.93	6663.32	3287.35 N	326.72 W	3302.53	5.39
9986.00	91.51	358.32	6662.66	3381.95 N	334.79 W	3397.47	7.12
10081.00	90.15	359.05	6661.28	3476.91 N	336.97 W	3492.33	1.62
10176.00	89.72	358.65	6661.38	3571.89 N	338.88 W	3587.19	0.61
10271.00	89.78	358.41	6661.79	3666.86 N	341.31 W	3682.08	0.26
10366.00	88.46	358.93	6663.25	3761.82 N	343.51 W	3776.94	1.49
10461.00	88.12	358.14	6666.09	3856.74 N	345.94 W	3871.78	0.90
10555.00	89.11	358.94	6668.37	3950.68 N	348.34 W	3965.64	1.35
10650.00	89.45	357.31	6669.57	4045.62 N	351.44 W	4060.55	1.75
10745.00	91.20	358.06	6669.03	4140.54 N	355.28 W	4155.49	2.01
10840.00	90.15	356.28	6667.90	4235.41 N	359.97 W	4250.45	2.17
10935.00	90.71	357.74	6667.19	4330.27 N	364.93 W	4345.42	1.64
11030.00	90.80	358.60	6665.94	4425.22 N	367.96 W	4440.32	0.91
11125.00	90.92	359.09	6664.50	4520.19 N	369.88 W	4535.17	0.53
11220.00	90.89	359.05	6663.00	4615.16 N	371.43 W	4630.00	0.05
11315.00	89.35	359.48	6662.79	4710.15 N	372.65 W	4724.82	1.68
11410.00	89.26	358.56	6663.94	4805.13 N	374.28 W	4819.66	0.97
11505.00	89.97	358.26	6664.58	4900.09 N	376.91 W	4914.55	0.81
11559.00	89.97	358.26	6664.61	4954.06 N	378.55 W	4968.50	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 355.74 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.72 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 11559.00 FEET  
IS 4968.51 FEET ALONG 355.63 DEGREES (GRID)

He-in @ Surface

Surveys at 249 ft, 502 ft, 750 ft, and 814 were taken and provided by HP 322 while they were drilling the surface hole and have been covered from magnetic north to grid north.  
Final survey is a projection to the bit.

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