

**PCDC - Pressure Case Directional**  
**PCGK - Pressure Case Gamma**

**1 : 240**

Country : USA			
Field : Wattenberg			
Location : Lat: 40° 28' 3.65" North Long: 104° 26' 2.87" West			
Well : Wells Ranch AA21-63HN			
Company : Noble Energy			
Rig : H&P 322			
LOCATION			
Latitude : 40° 28' 3.65" North Longitude : 104° 26' 2.87" West		Other Services Directional Drilling	
UTM Easting = 3296552.173 ft UTM Northing = 1414998.691 ft			
Permanent Datum : Ground Level		Elevation : 4730.00 ft	Elev. KB N/A
Log Measured From : Drill Floor		24.00 ft Above Permanent Datum	DF 4754.00 ft
Drilling Measured From : Drill Floor		MD LOG	GL 4730.00 ft
			WD N/A
Depth Logged : 962.00 ft To 11,050.00 ft		Unit No. : 11210425	
Date Logged : 24-Jan-14 To 31-Jan-14		Job No. : CA-XX-0900918612	
Total Depth MD : 11,050.00 ft TVD: 6,723.87 ft		Plot Type : Final	
Spud Date : 24-Jan-14		Plot Date : 31-Jan-14	
Run No.	Borehole Record (MD)		Run No.
	Size	From	
2	8.750 in	962.00 ft	6,058.00 ft
3	8.750 in	6,058.00 ft	7,056.00 ft
4	6.125 in	7,056.00 ft	11,050.00 ft
		Casing Record (MD)	
		Size	Weight
		9.625 in	36.00 lbpf
		7.000 in	26.00 lbpf
		SURFACE	
		7,046.00 ft	

**WELL INFORMATION**

MWD Run Number	100	200	300		
Date run completed	26-Jan-14	27-Jan-14	31-Jan-14		
Rig Bit Number	2	3	4		
Bit Size (in)	8.750	8.750	6.125		
Tool Nominal OD (in)	6.750	6.750	4.750		
Log Start Depth (MD, ft)	962.00	6,058.00	7,056.00		
Log End Depth (MD, ft)	6,058.00	7,056.00	11,050.00		
Drill or Wipe	Drill	Drill	Drill		
Drill/Wipe Start Date and Time	25-Jan-14 22:20	27-Jan-14 02:00	29-Jan-14 03:45		
Drill/Wipe End Date and Time	26-Jan-14 14:30	27-Jan-14 11:30	30-Jan-14 23:00		
Min Inc (deg) @ Depth (MD, ft)	0.20 @ 750.00	1.84 @ 6,116.00	84.10 @ 9,707.00		
Max Inc (deg) @ Depth (MD, ft)	11.58 @ 2,518.00	80.51 @ 6,998.00	92.25 @ 9,043.00		
Bit TFA(in2) / Bit Type	0.75 / PDC	0.98 / PDC	0.86 / PDC		
Flow Rate (gpm)	556.00	585.00	285.00		
Max AV (fpm) / CV (fpm) @ MWD	510.0 / 510.0	500.0 / 500.0	465.0 / 465.0		
Fluid Type	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
Density (ppg) / Viscosity (spqt)	9.05 / 28.00	10.85 / 37.00	9.58 / 36.00		
Filtrate CL (ppm)	2,900.00	3,000.00	2,700.00		
pH / Fluid Loss (mptm)	8.30 / N/A	9.60 / N/A	9.20 / N/A		
PV (cP) / YP (lbf/ft2)	2 / 3.00	9 / 10.00	8 / 10.00		
% Solids / % Sand	4.50 / 0.25	11.60 / 0.50	6.00 / 0.15		
% 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 (degF) / Source	150.10 / PCM	160.83 / PCM	217.60 / PCM		
Rm @ Max Tool Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A		
Lead MWD Engineer	Garry Igunbor	Robert Ley	Robert 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	246473	246473	12187590		
Insert Serial Number	11680738	11680738	11145509		
Date and Time Initialized	25-Jan-14 08:01	01-Jan-70 00:00	27-Jan-14 15:55		
Date and Time Read	27-Jan-14 17:52	27-Jan-14 17:43	31-Jan-14 08:24		
ECMB SW Version	N/A	N/A	N/A		

### Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	61.00	58.00	62.00		
Software Version	6.21	6.21	6.21		
Sub Serial Number	246473	246473	12187590		
Sonde Serial Number	11638621	11638621	11297588		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	106.07	316.54	112.69		

### Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	53.82	50.92	55.57		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	246473	246473	12187590		
Insert/Sonde Serial Number	11681001	11681001	11293266		

## 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 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

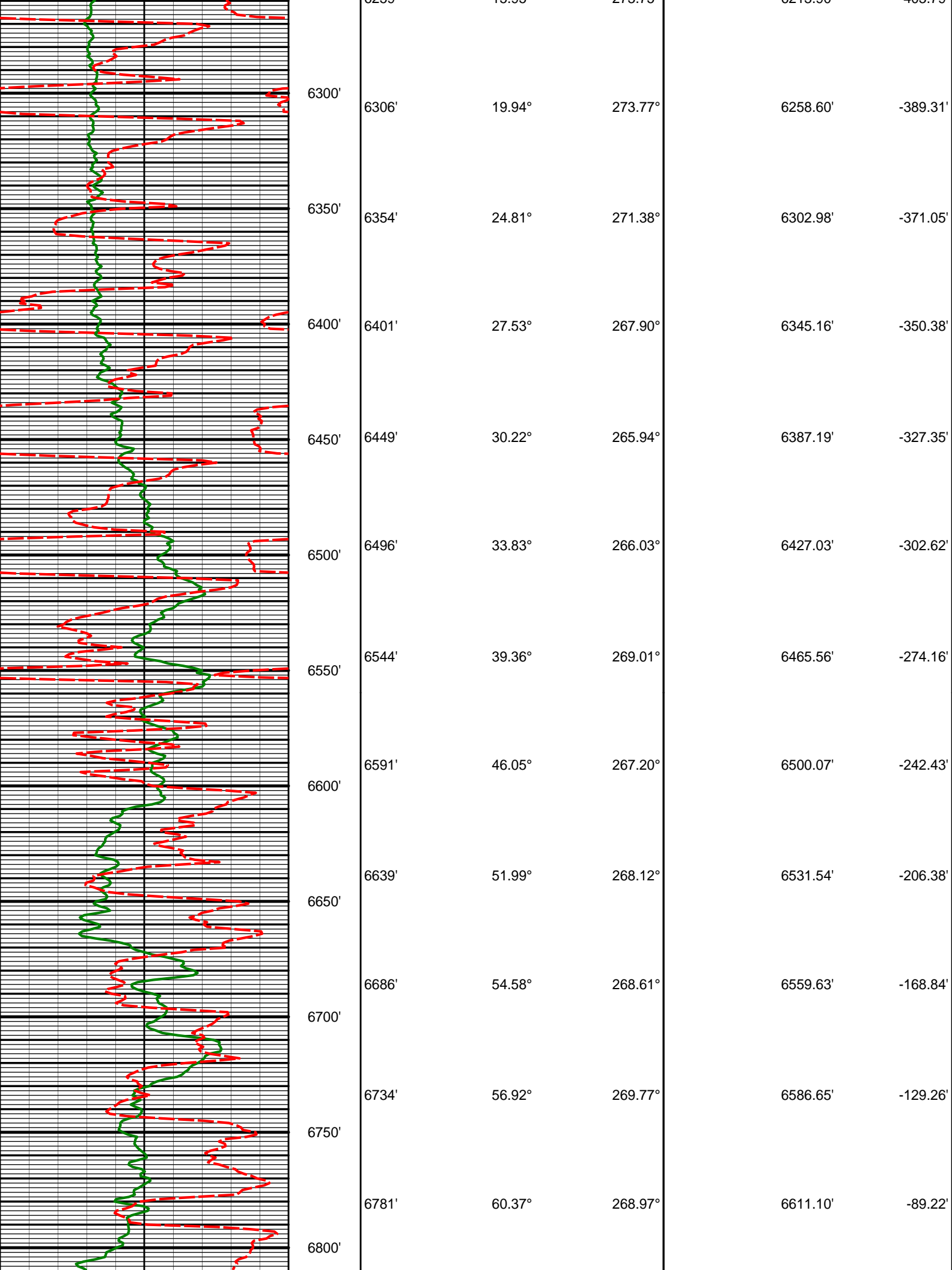
## WARRANTY

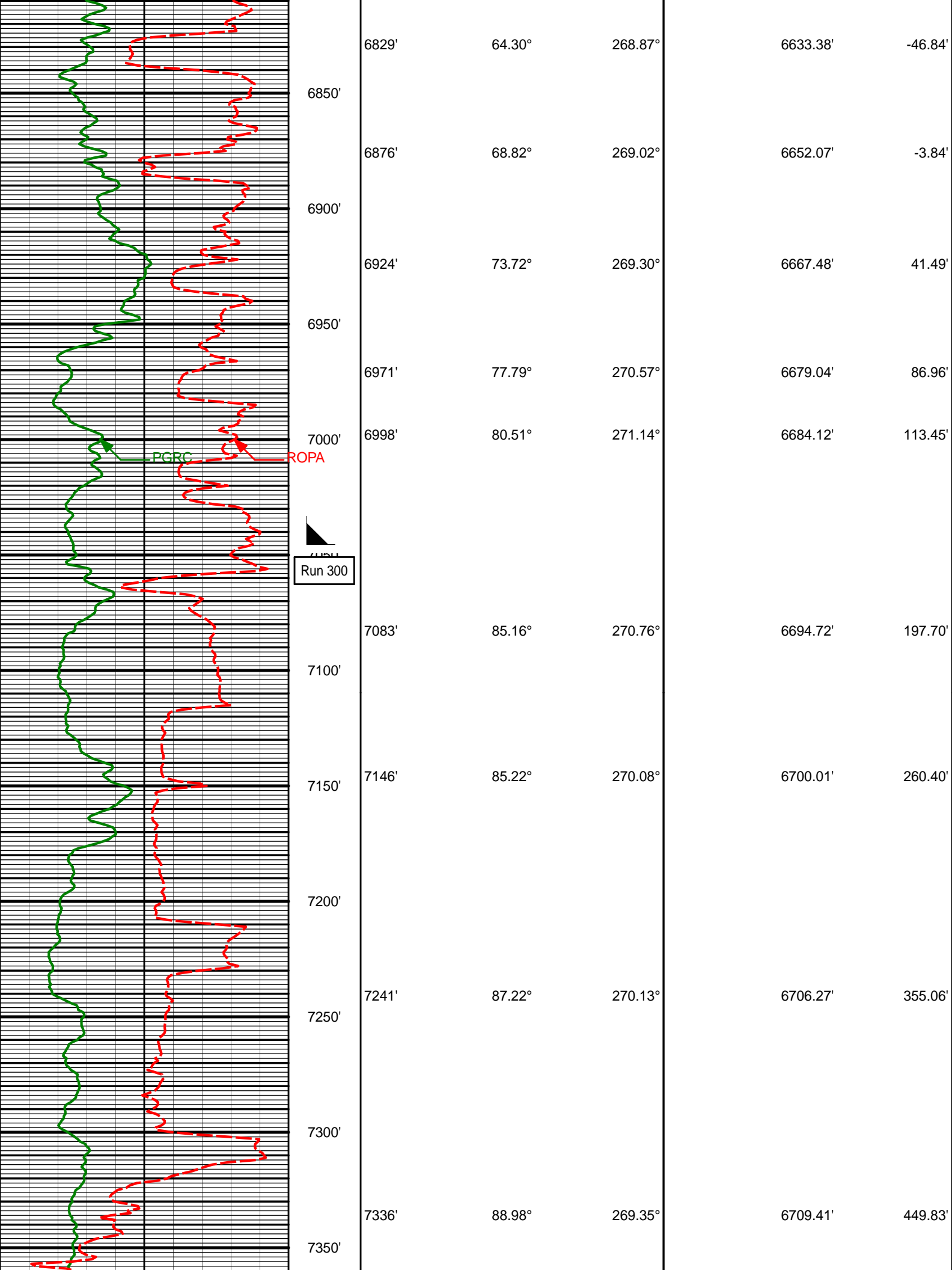
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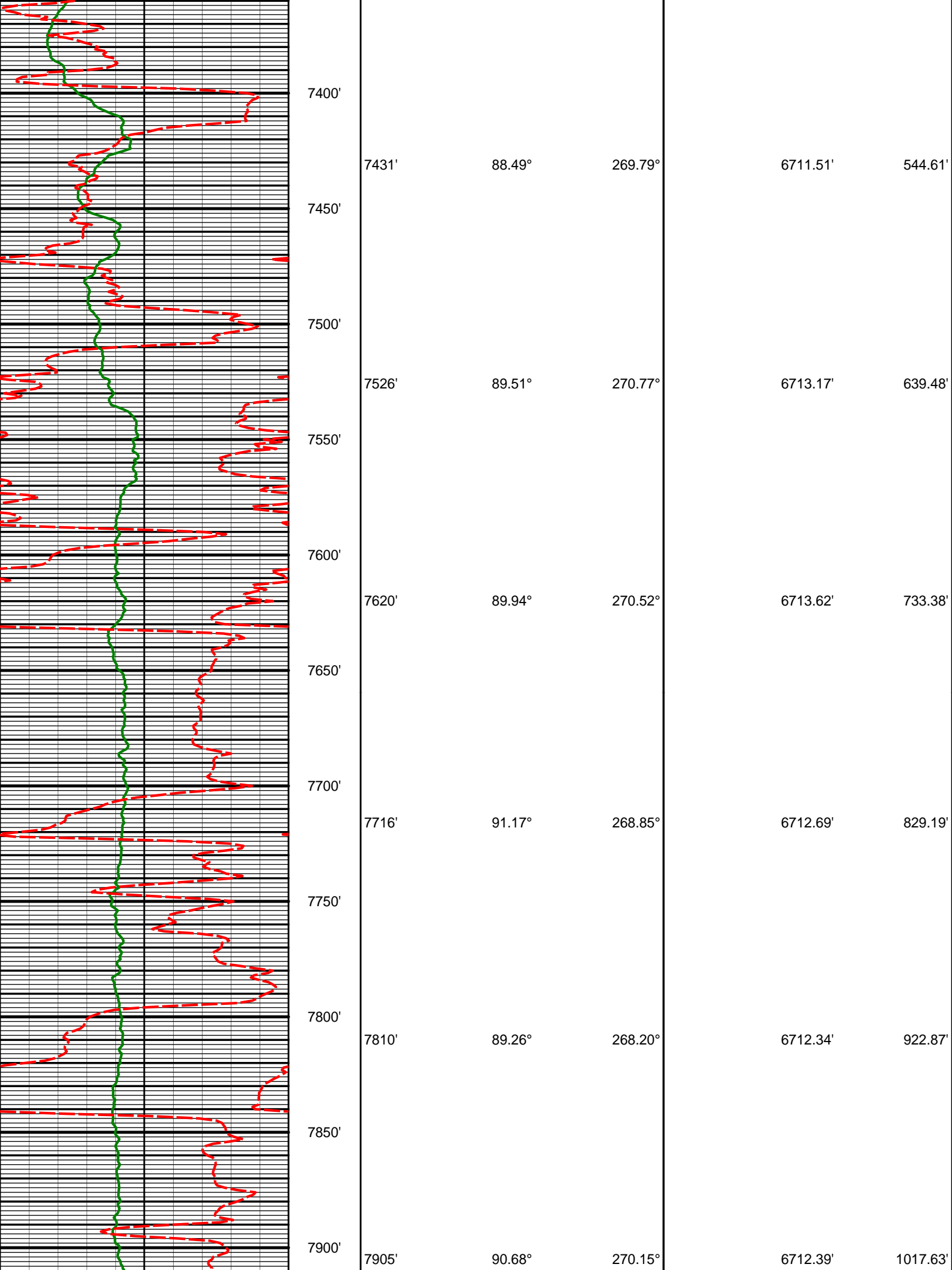
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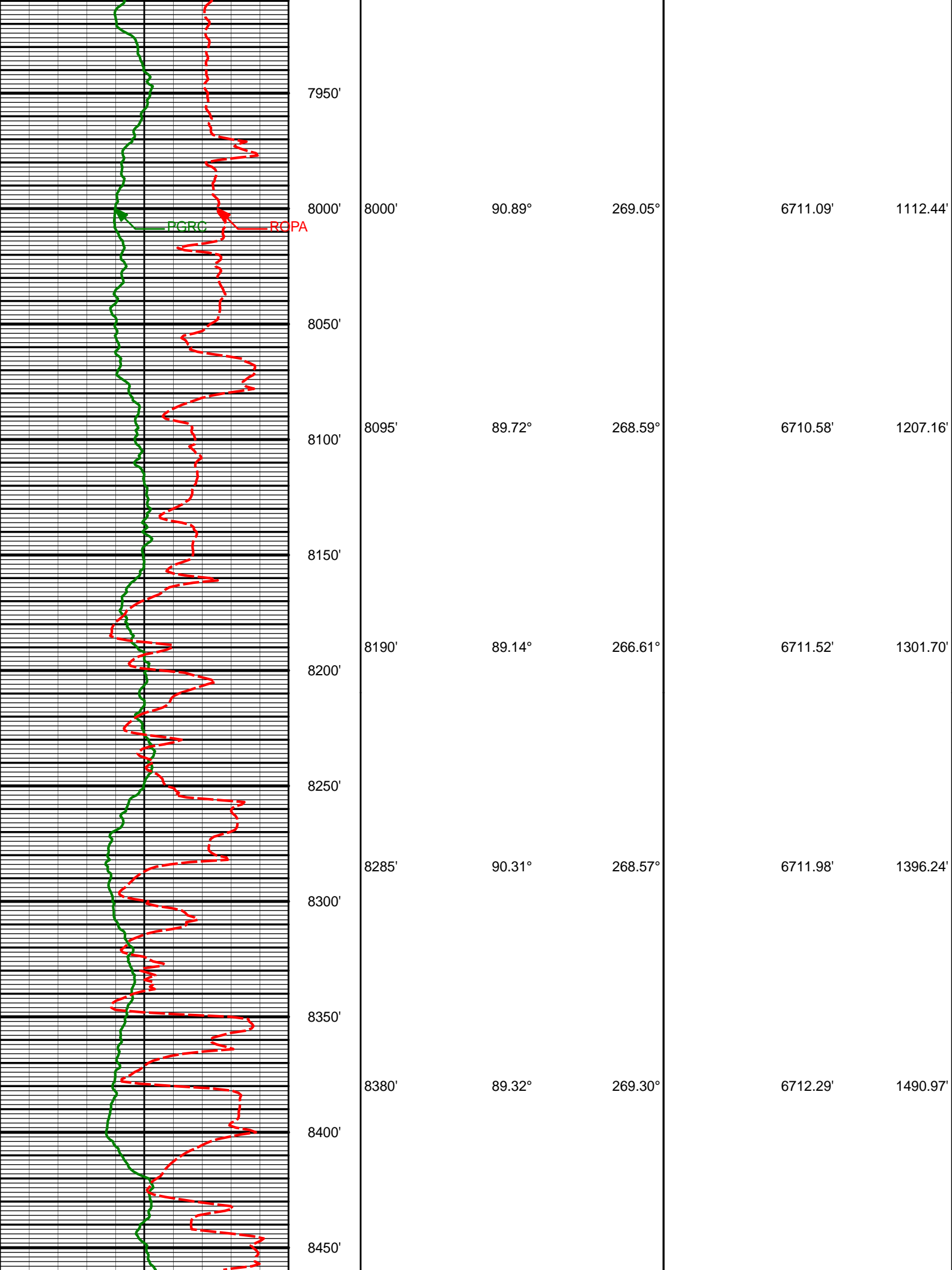
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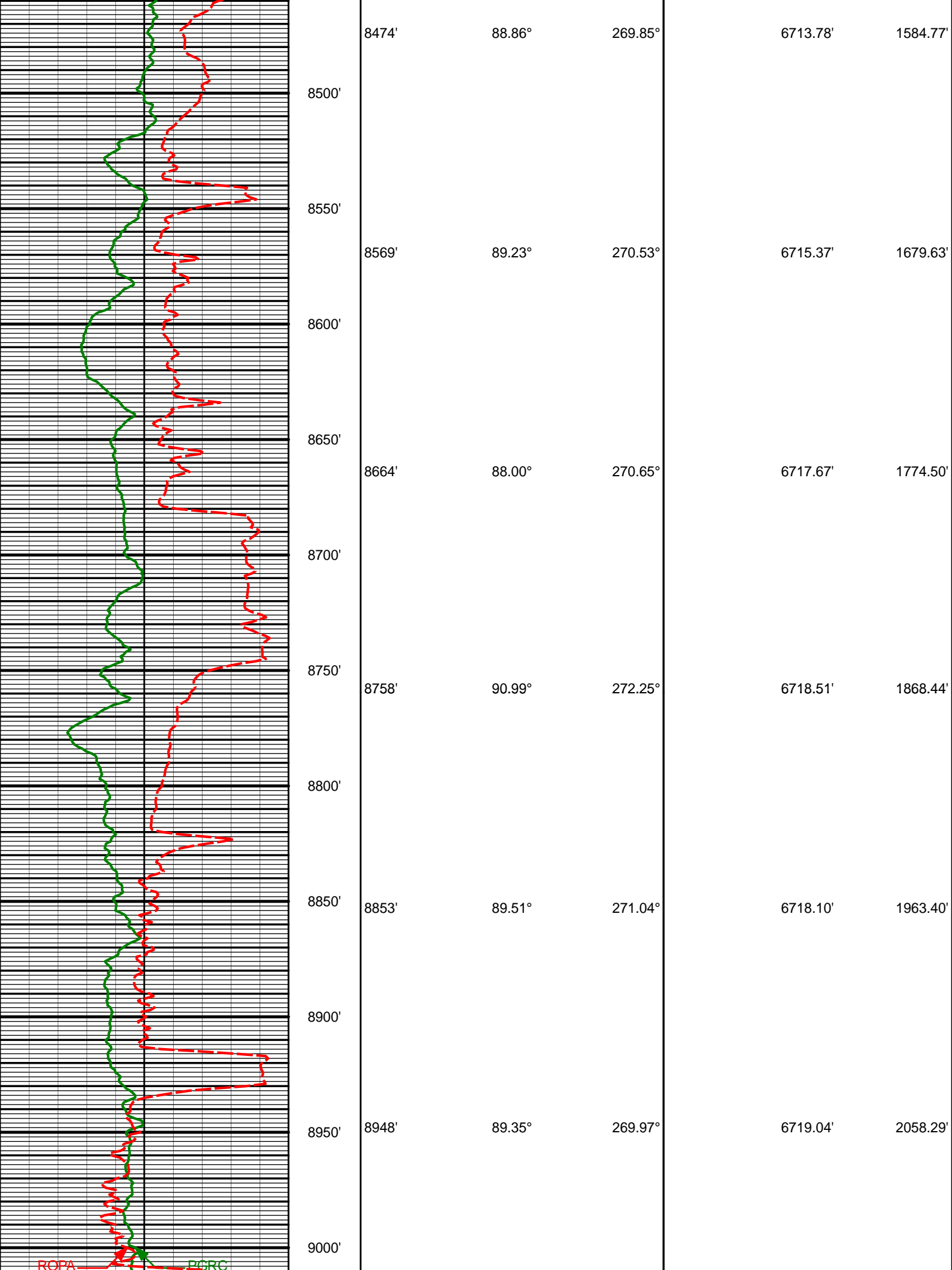
Gamma Ray (PGXC) (Api)						
0300						
Avg Rate of Penetration feet per hr		Feet				
6000						
	6050'					
	Run 200					
	6100'					
	KOP	6116'	1.84°	250.08°	6073.36'	-427.90'
	6150'					
	6164'	7.49°	276.56°	6121.19'	-424.06'	
	6200'					
	6211'	12.96°	278.45°	6167.42'	-415.75'	
	6250'					
		6259'	15.95°	273.75°	6213.90'	-403.79'



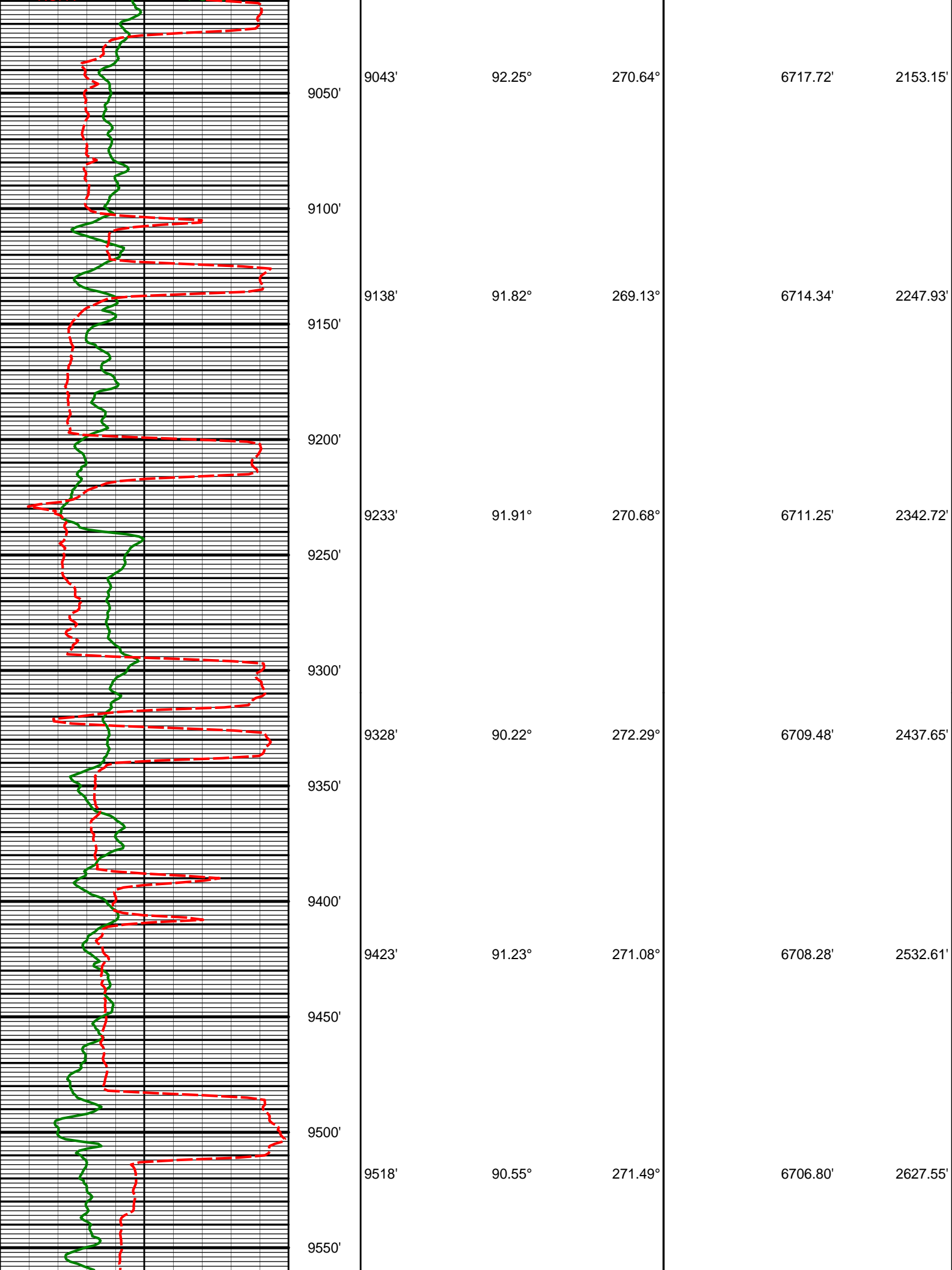


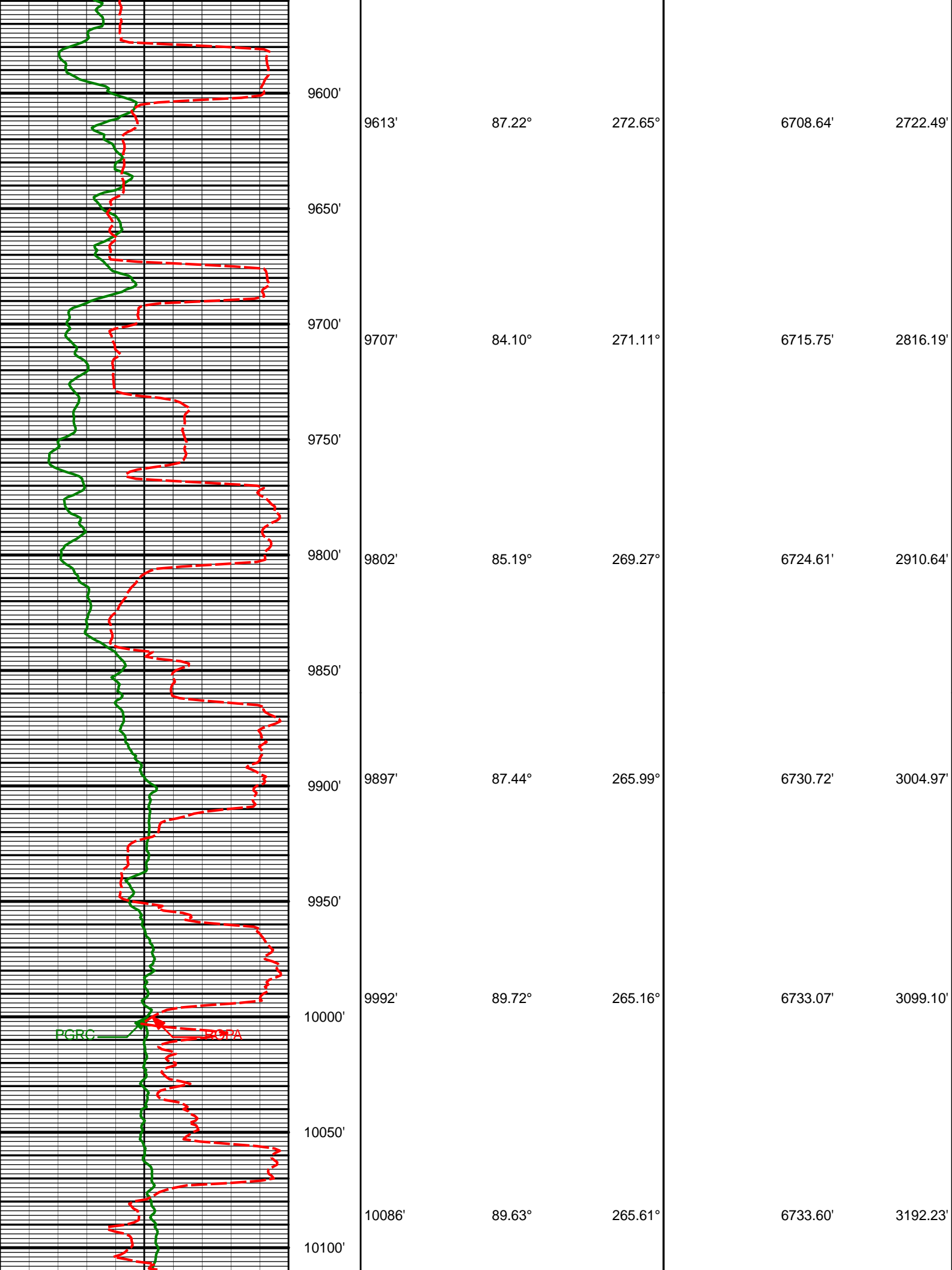


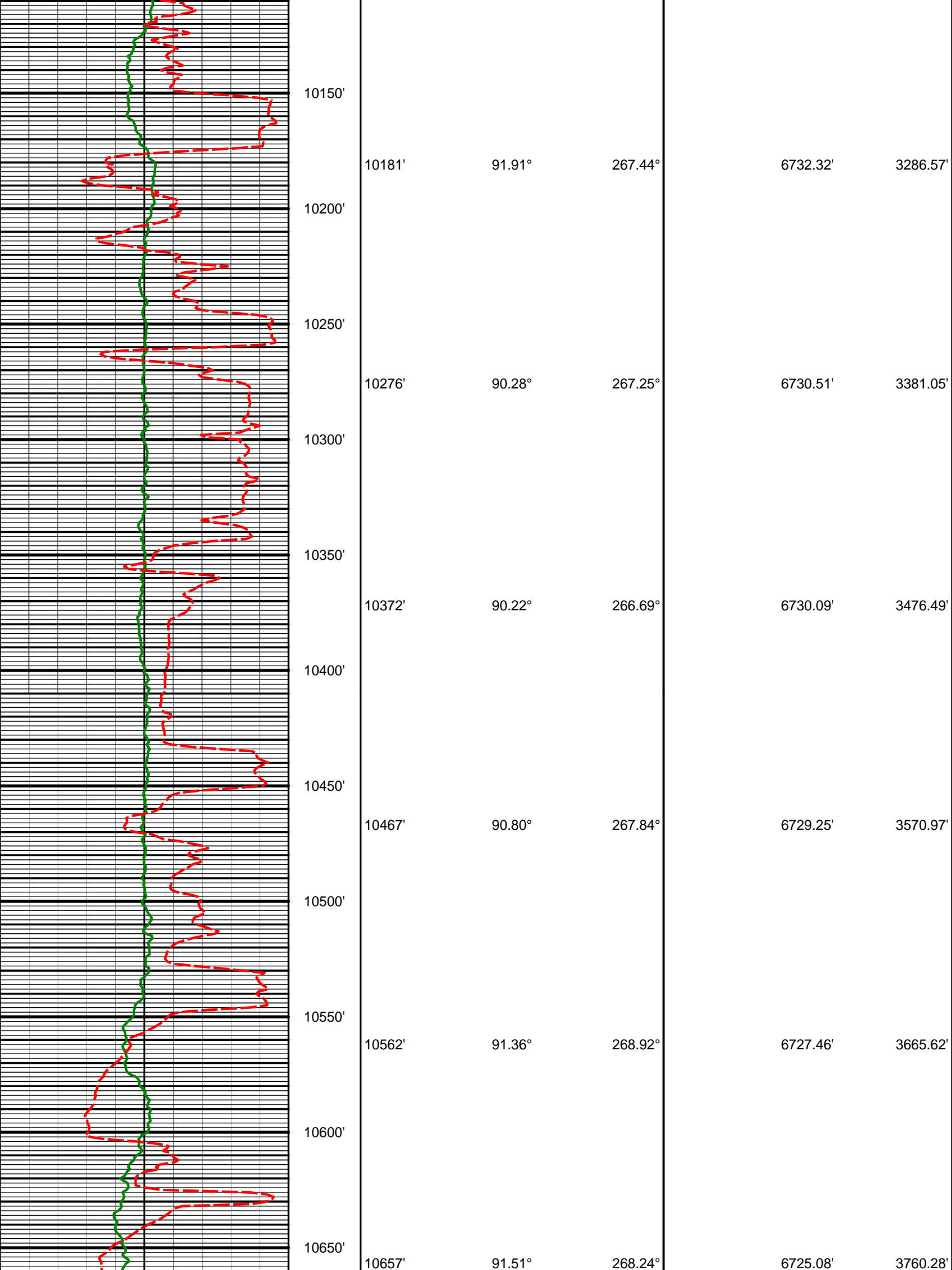


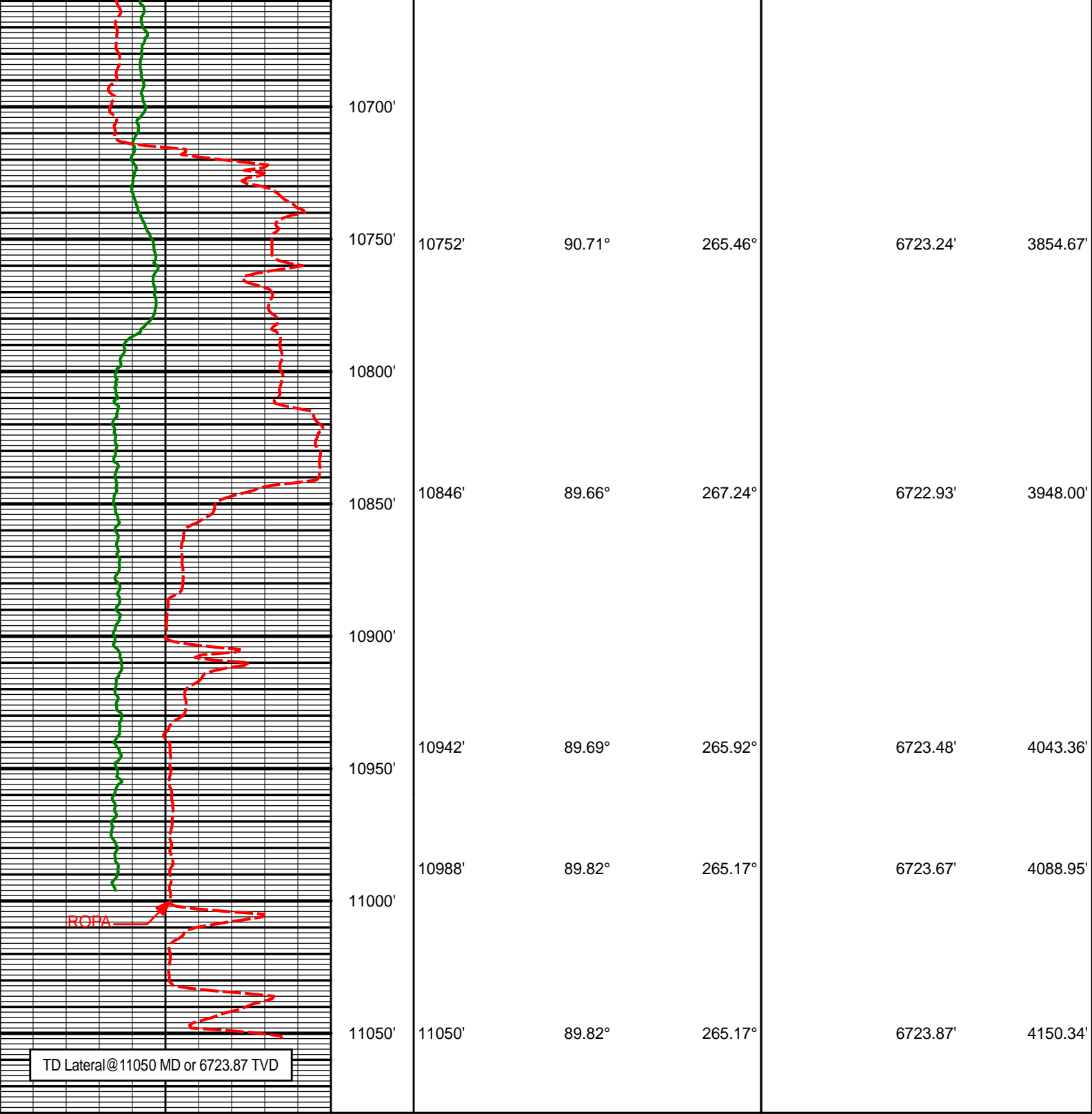








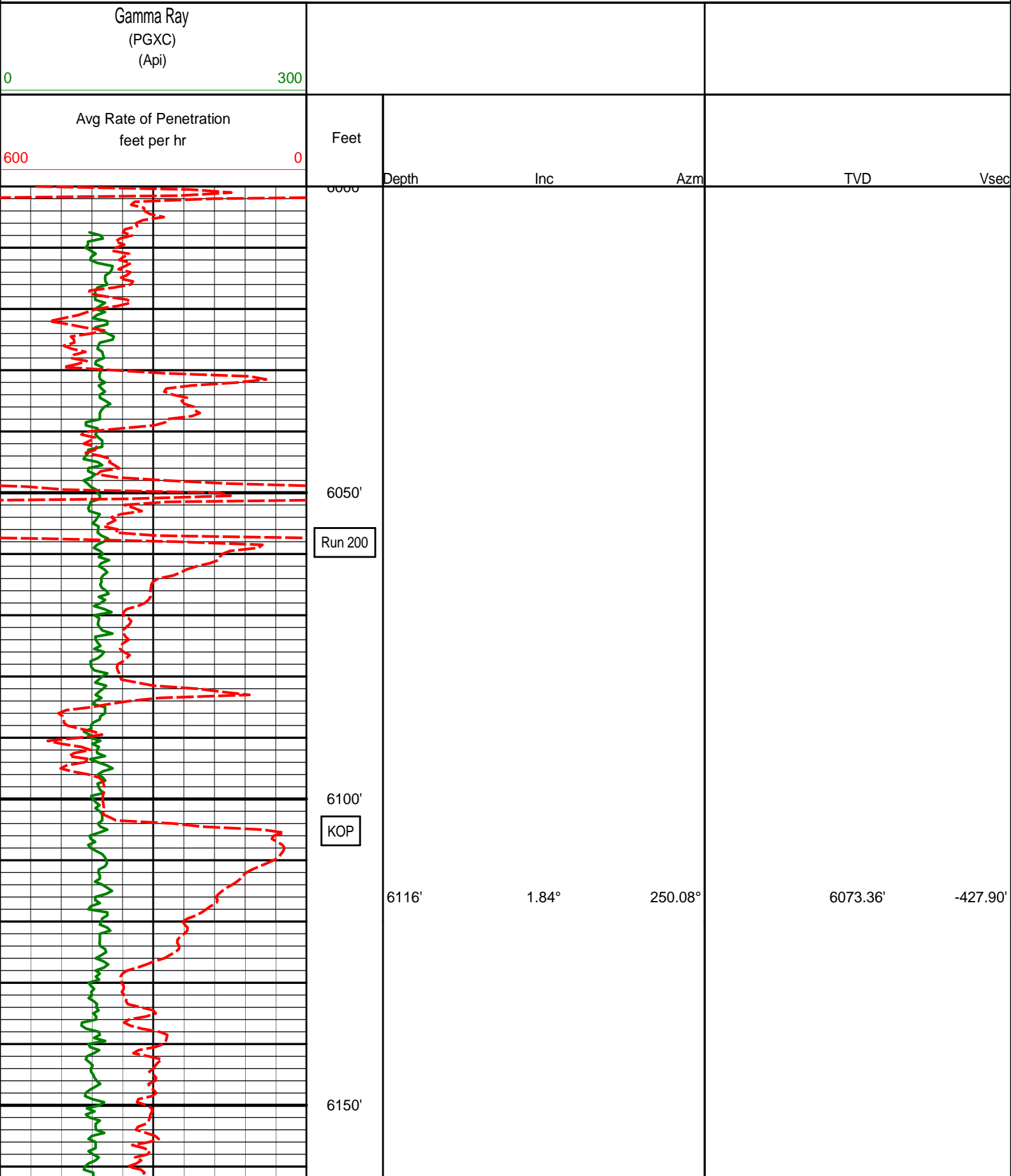


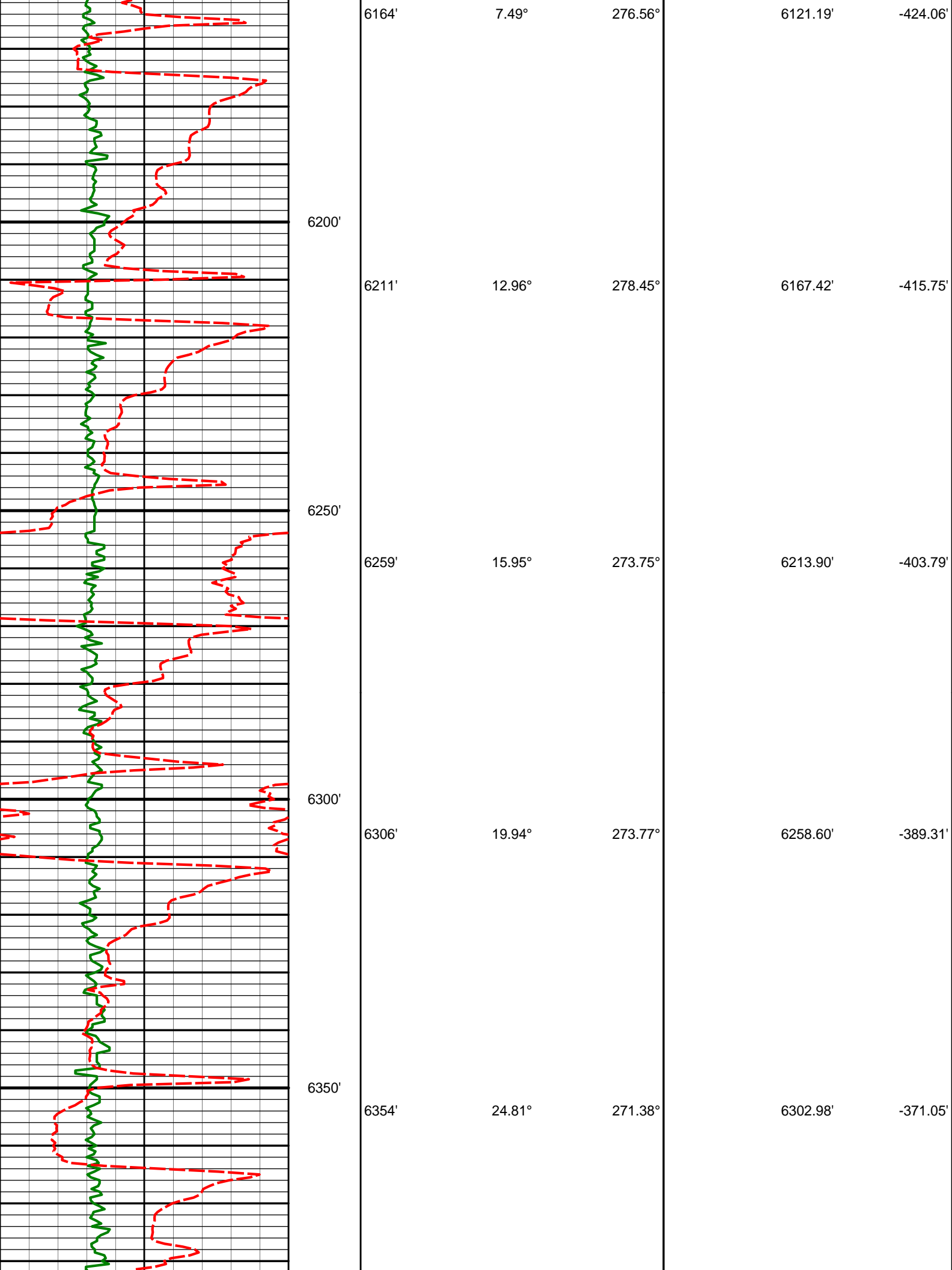


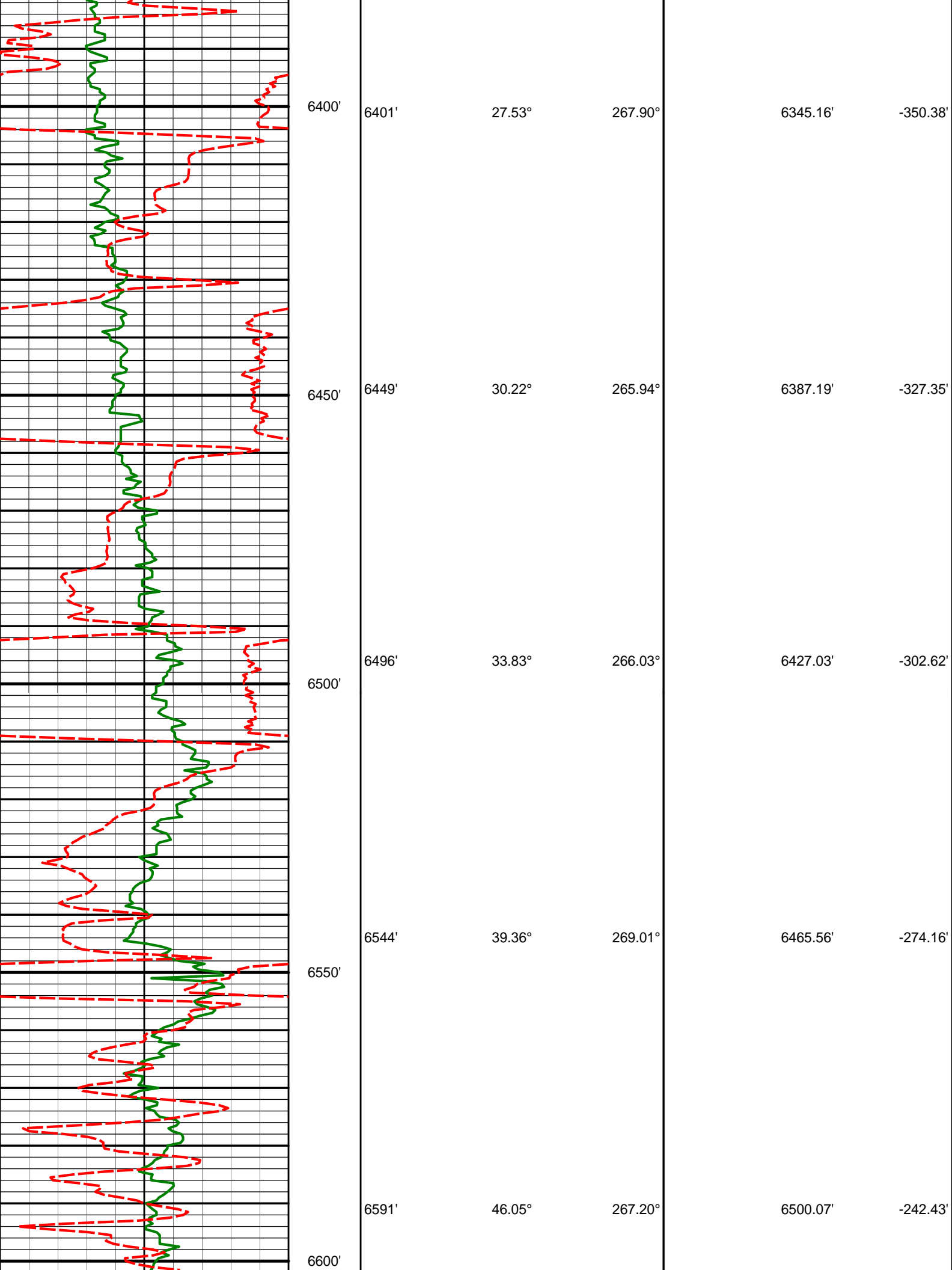
Avg Rate of Penetration feet per hr		Feet			
600	0		Depth	Inc	Azm
Gamma Ray (PGXC) (Api)			TVD		
0	300		Vsec		

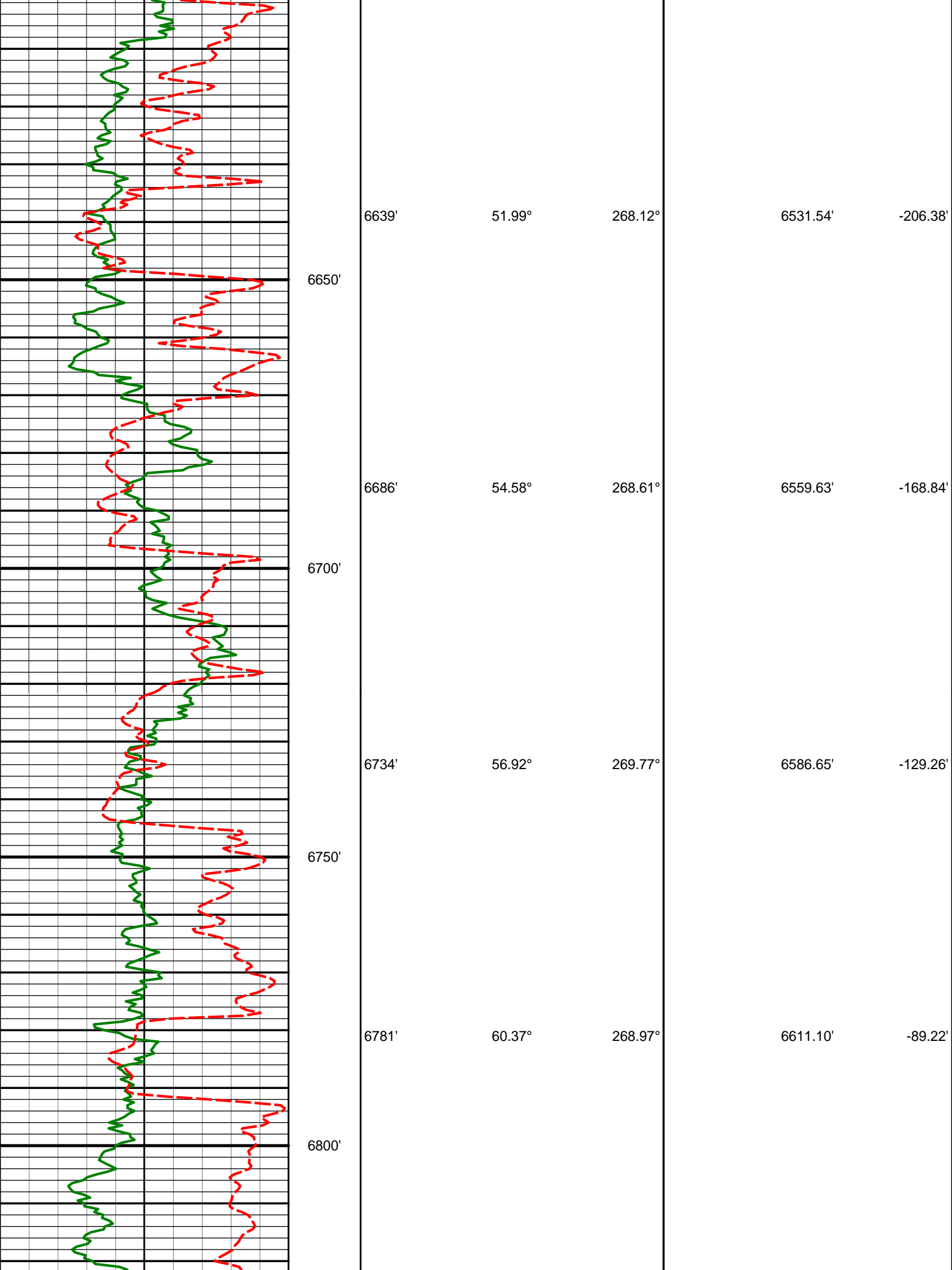
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MD Detail Log 1:240

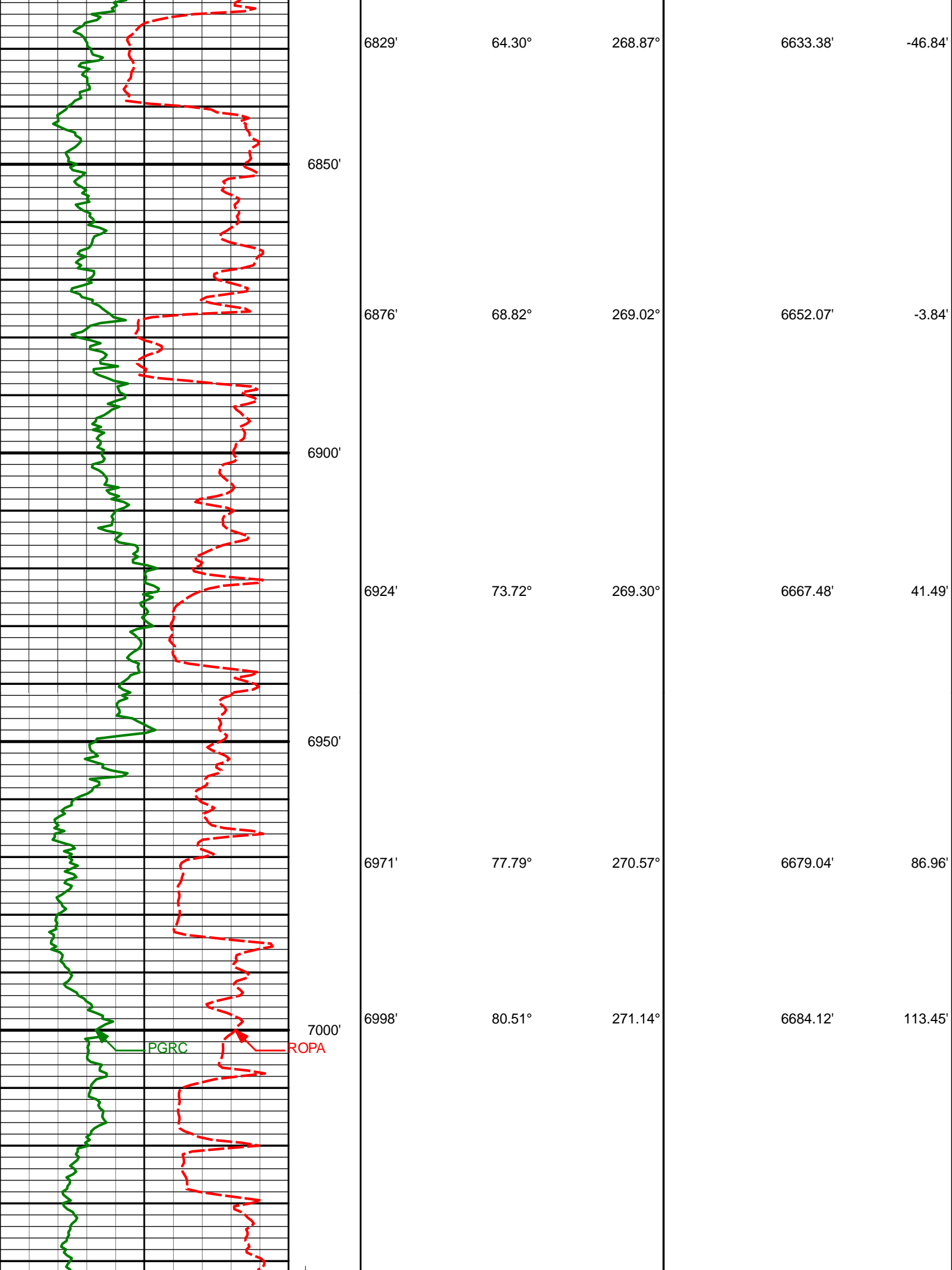


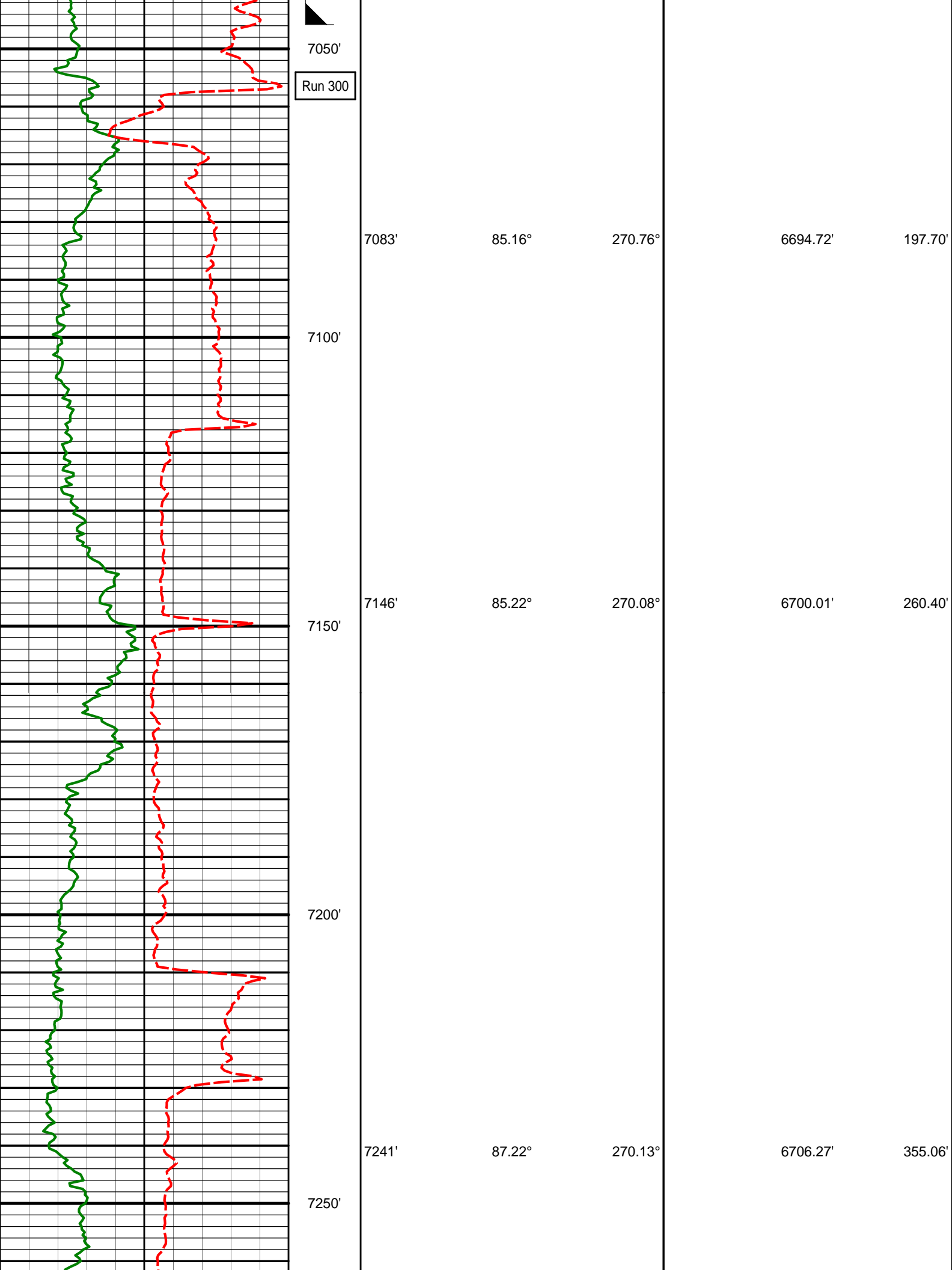


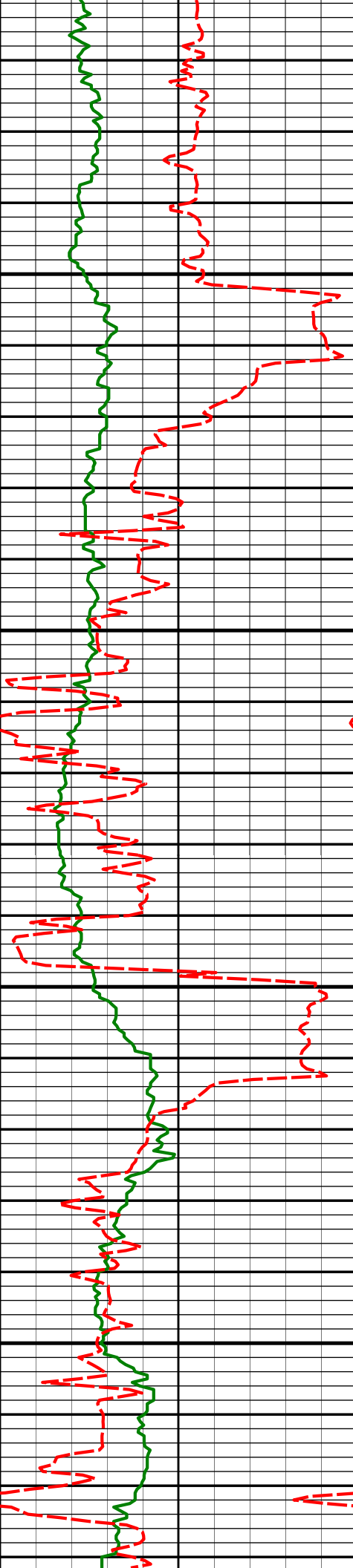












7300'

7336'

88.98°

269.35°

6709.41'

449.83'

7350'

7400'

7431'

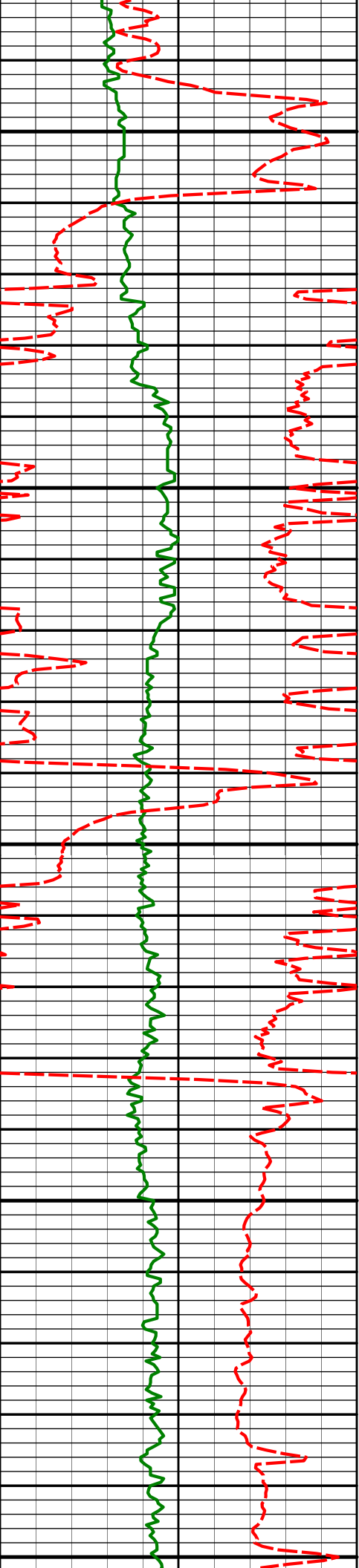
88.49°

269.79°

6711.51'

544.61'

7450'



7500'

7526'

89.51°

270.77°

6713.17'

639.48'

7550'

7600'

7620'

89.94°

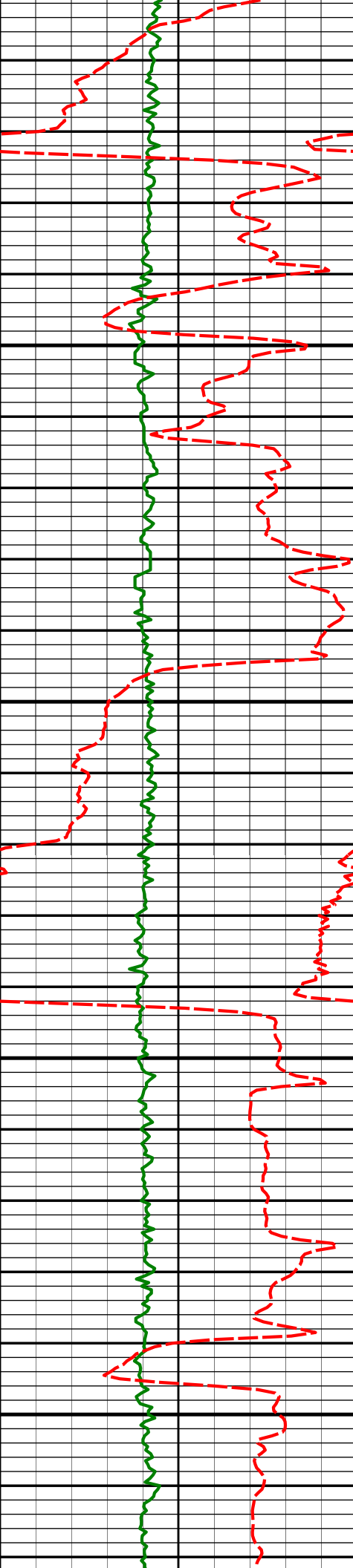
270.52°

6713.62'

733.38'

7650'

7700'



7750'

7850'

7900'

7716'

7810'

7905'

91.17°

89.26°

90.68°

268.85°

268.20°

270.15°

6712.69'

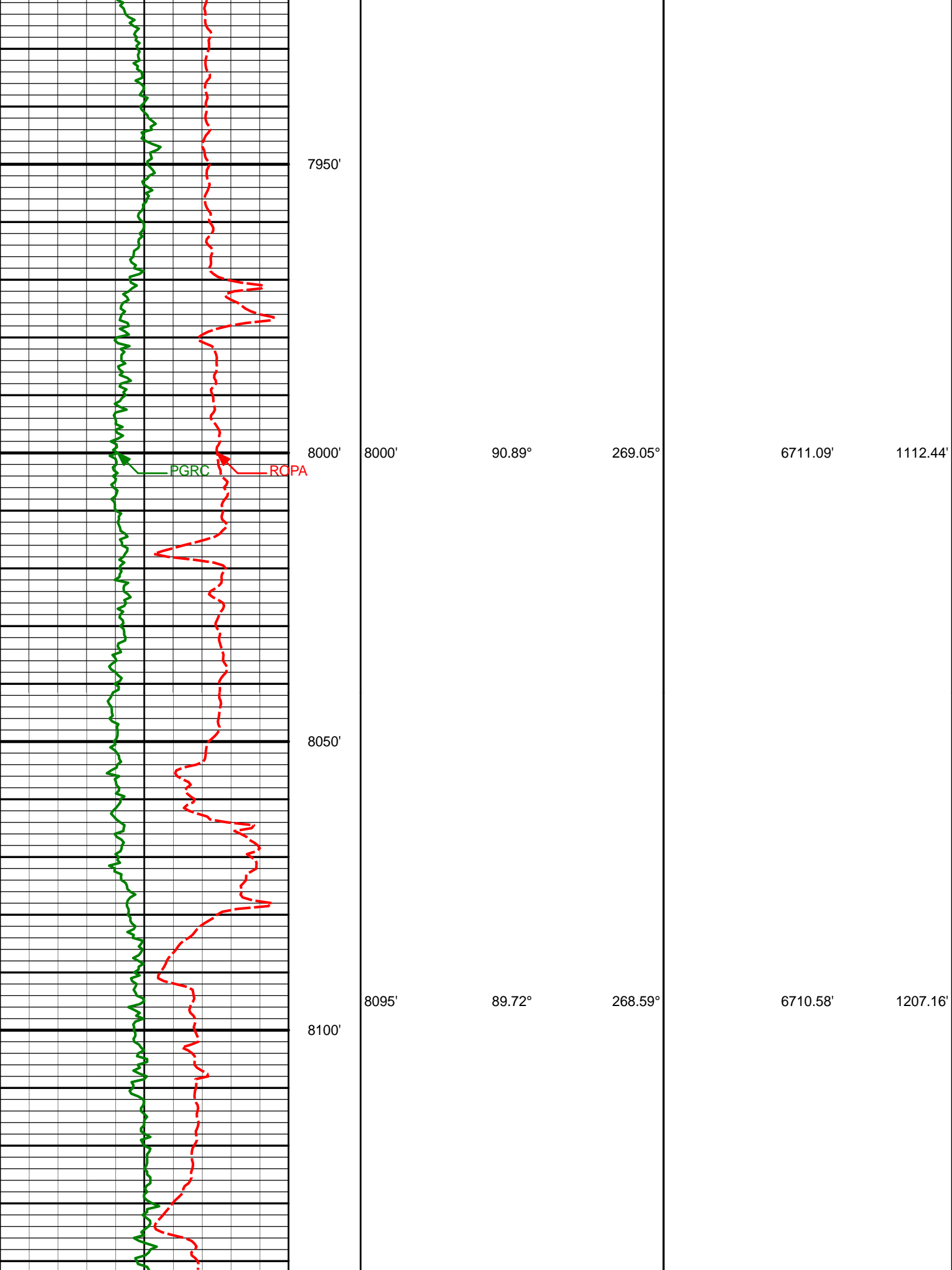
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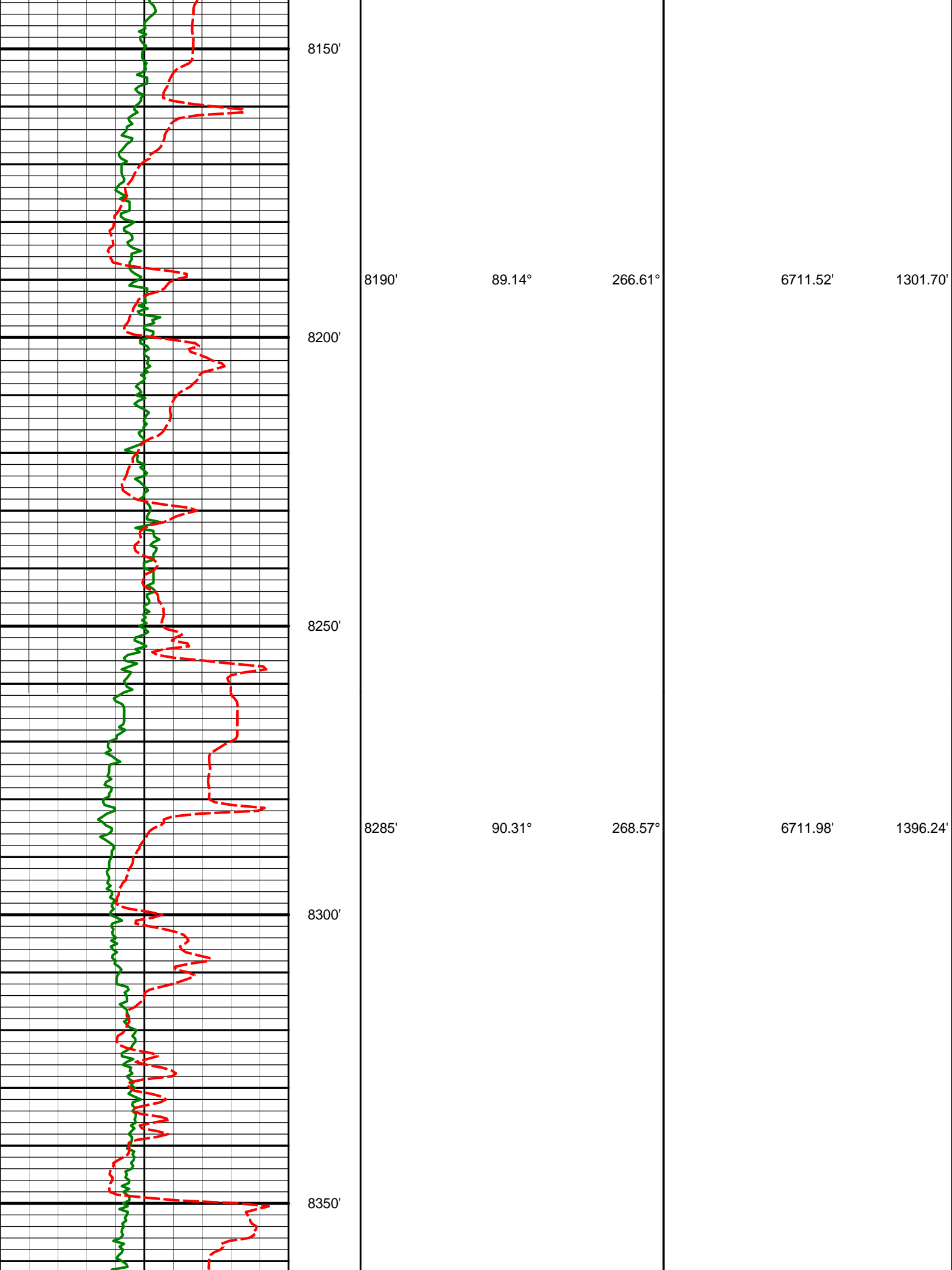
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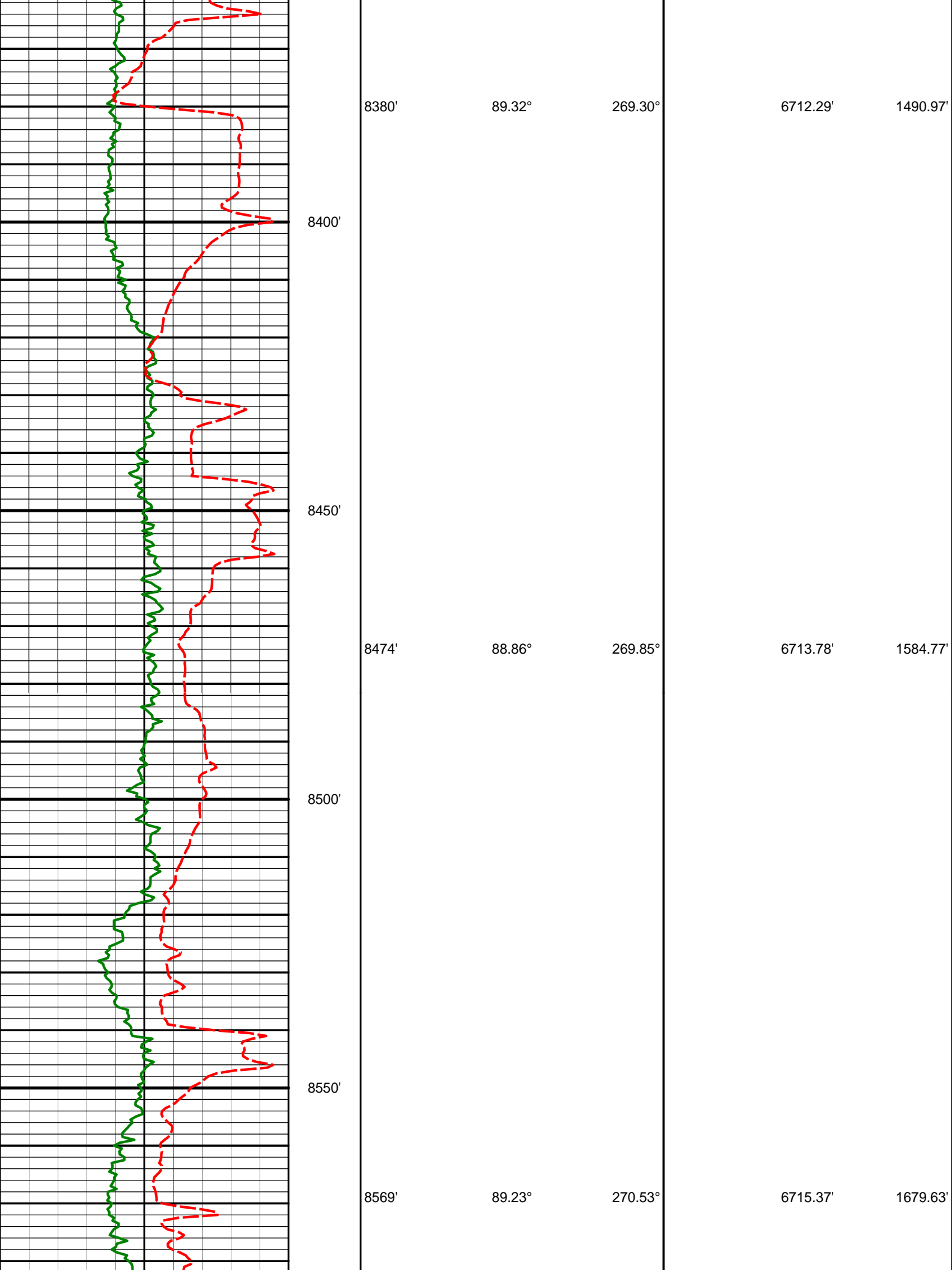
829.19'

922.87'

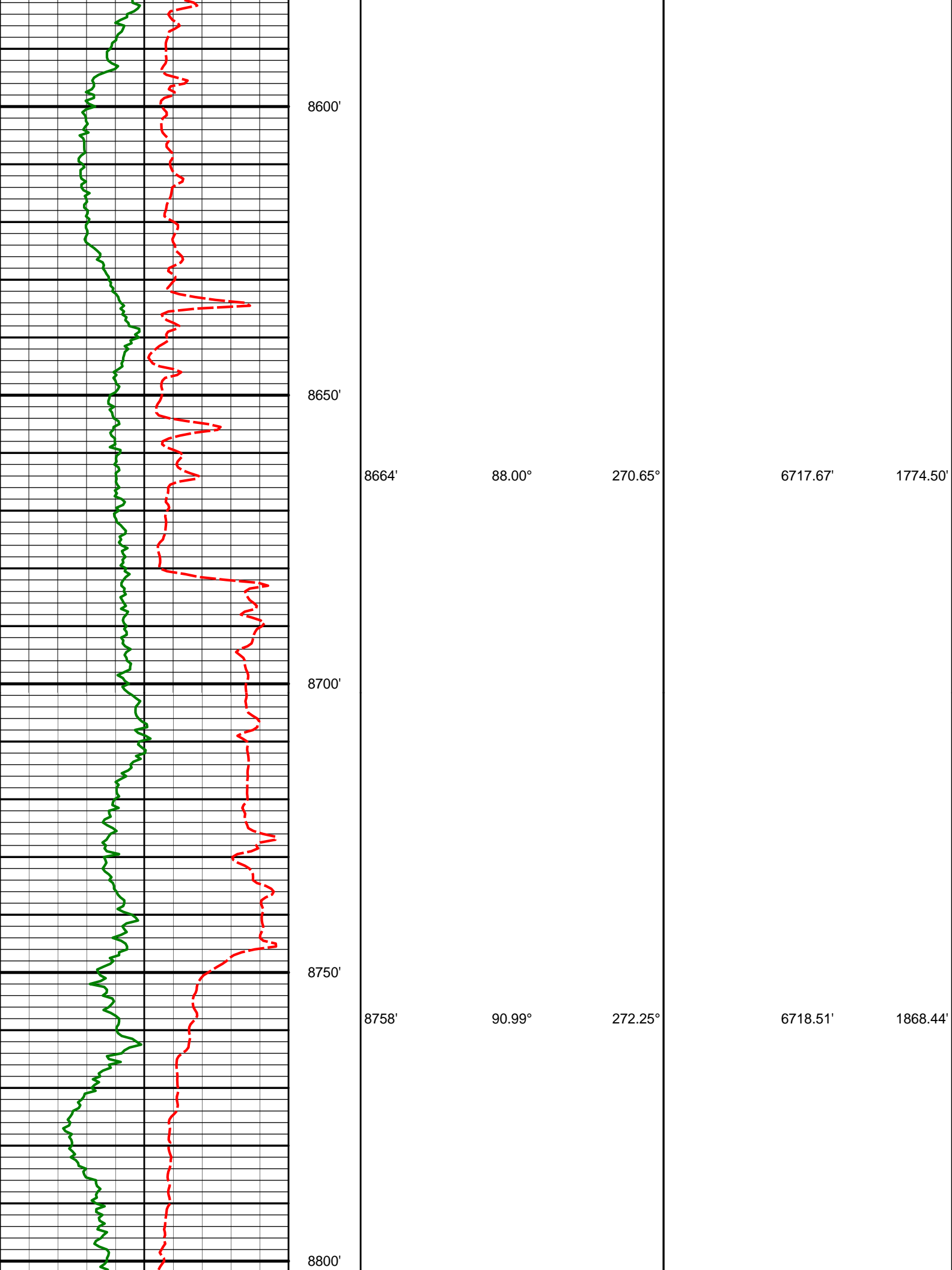
1017.63'

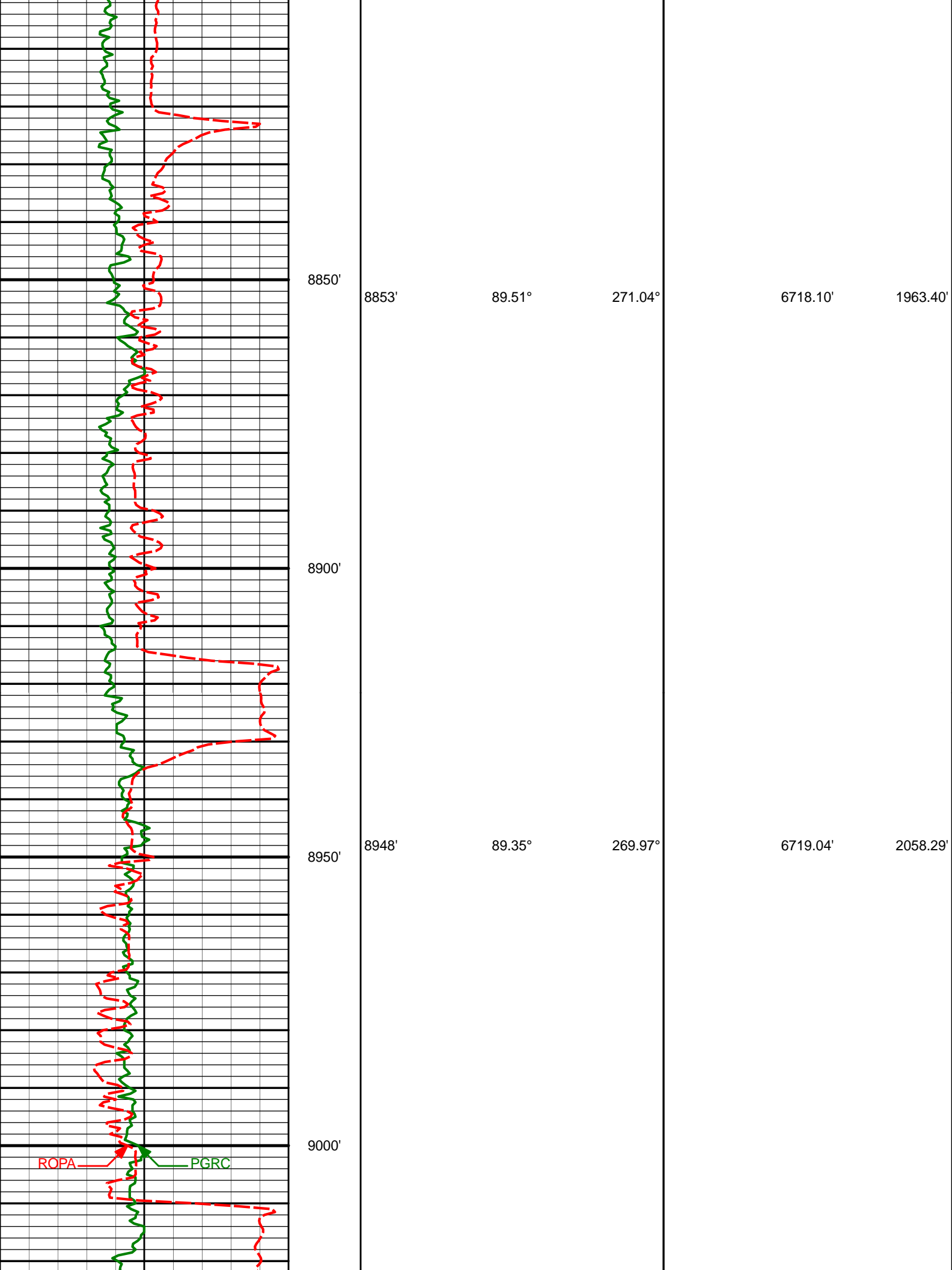


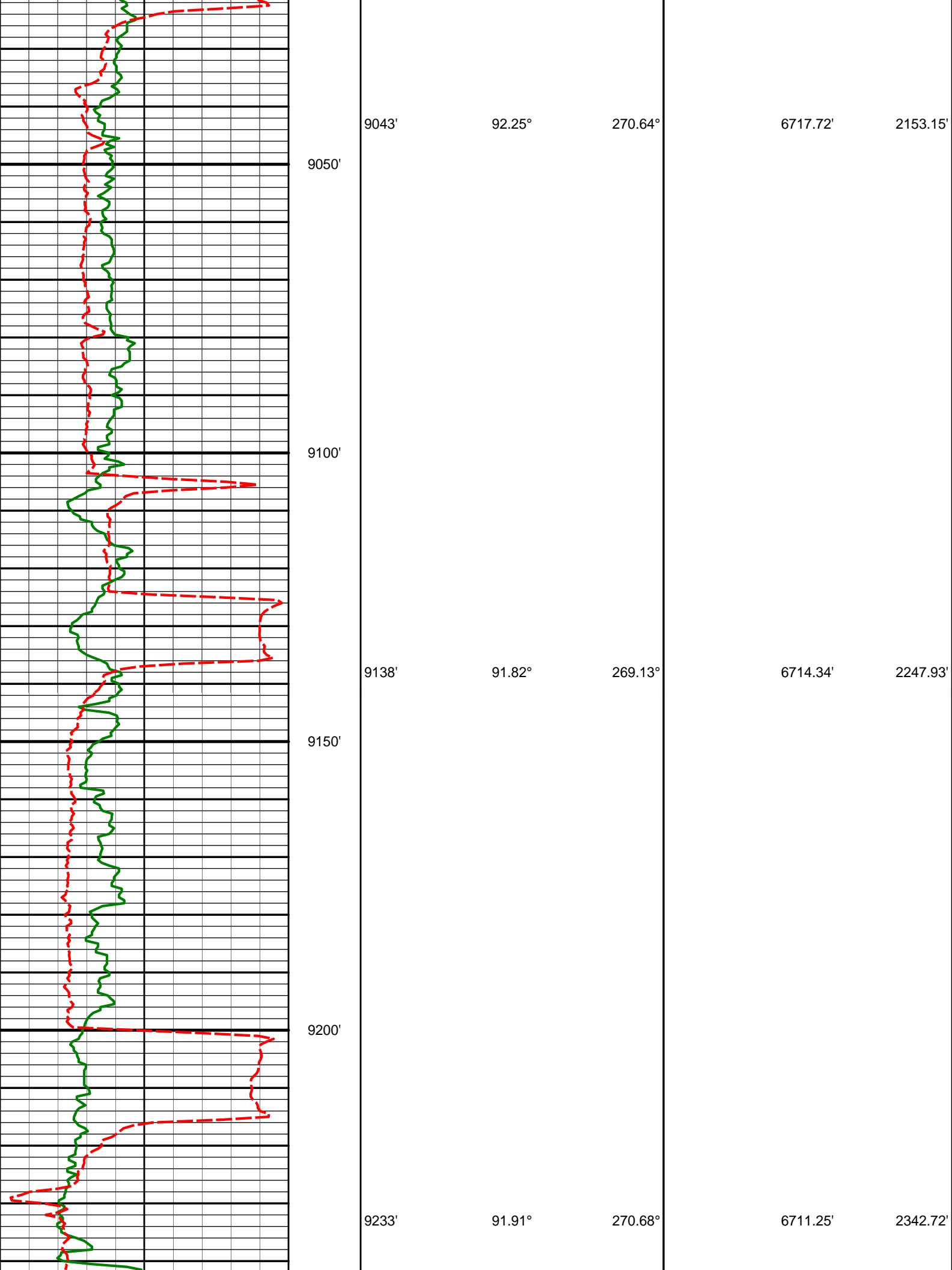


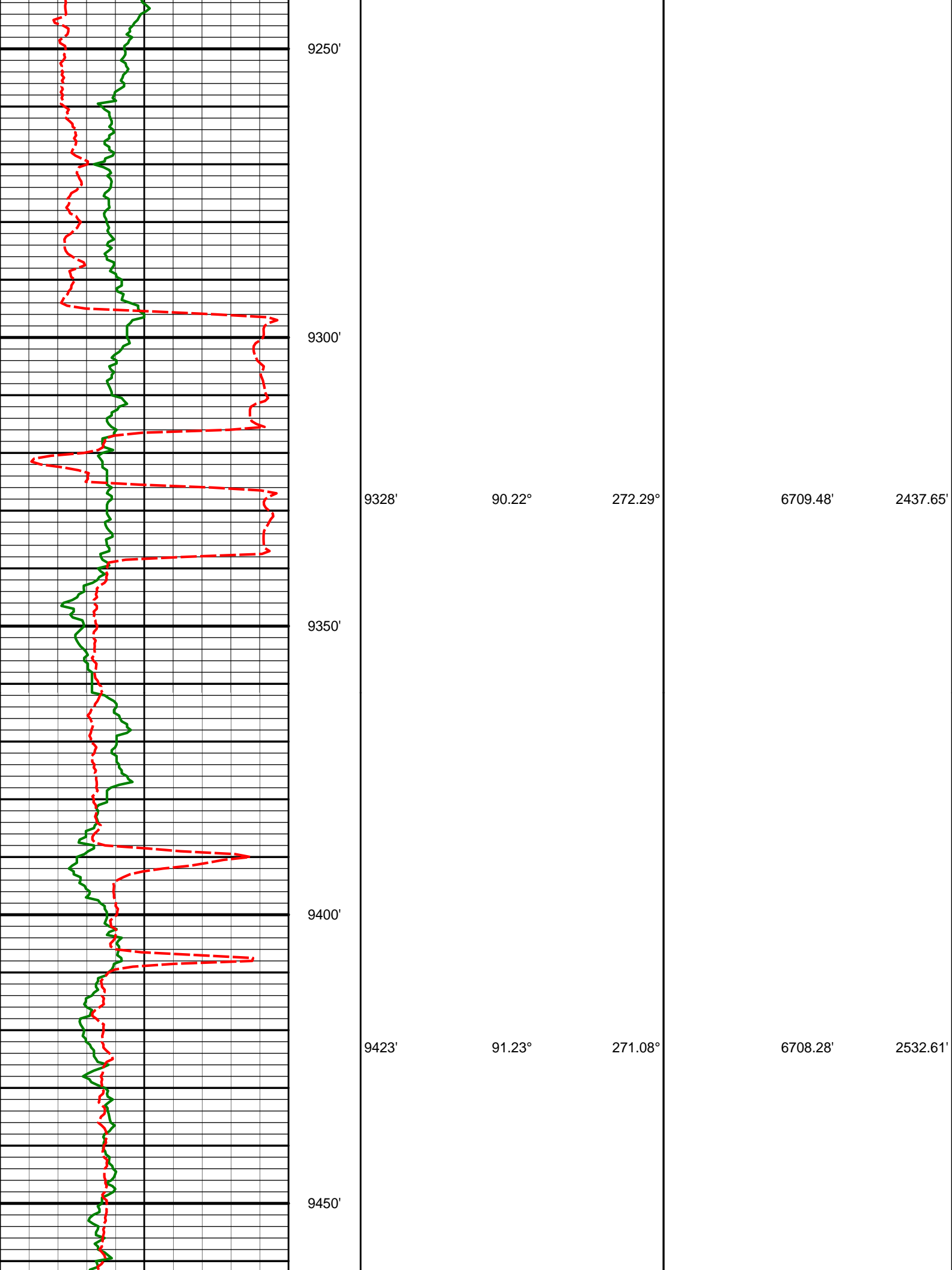


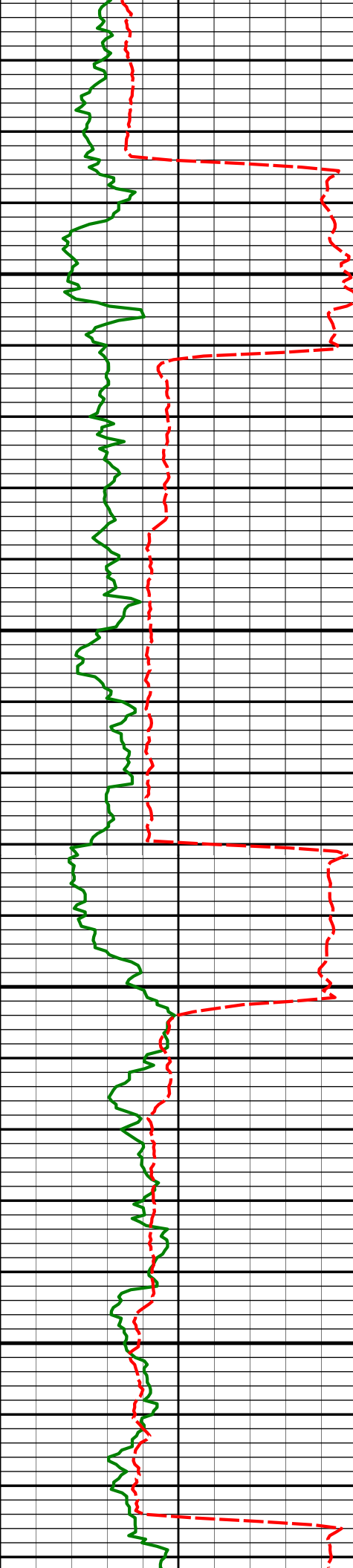












9500'

9518'

90.55°

271.49°

6706.80'

2627.55'

9550'

9600'

9613'

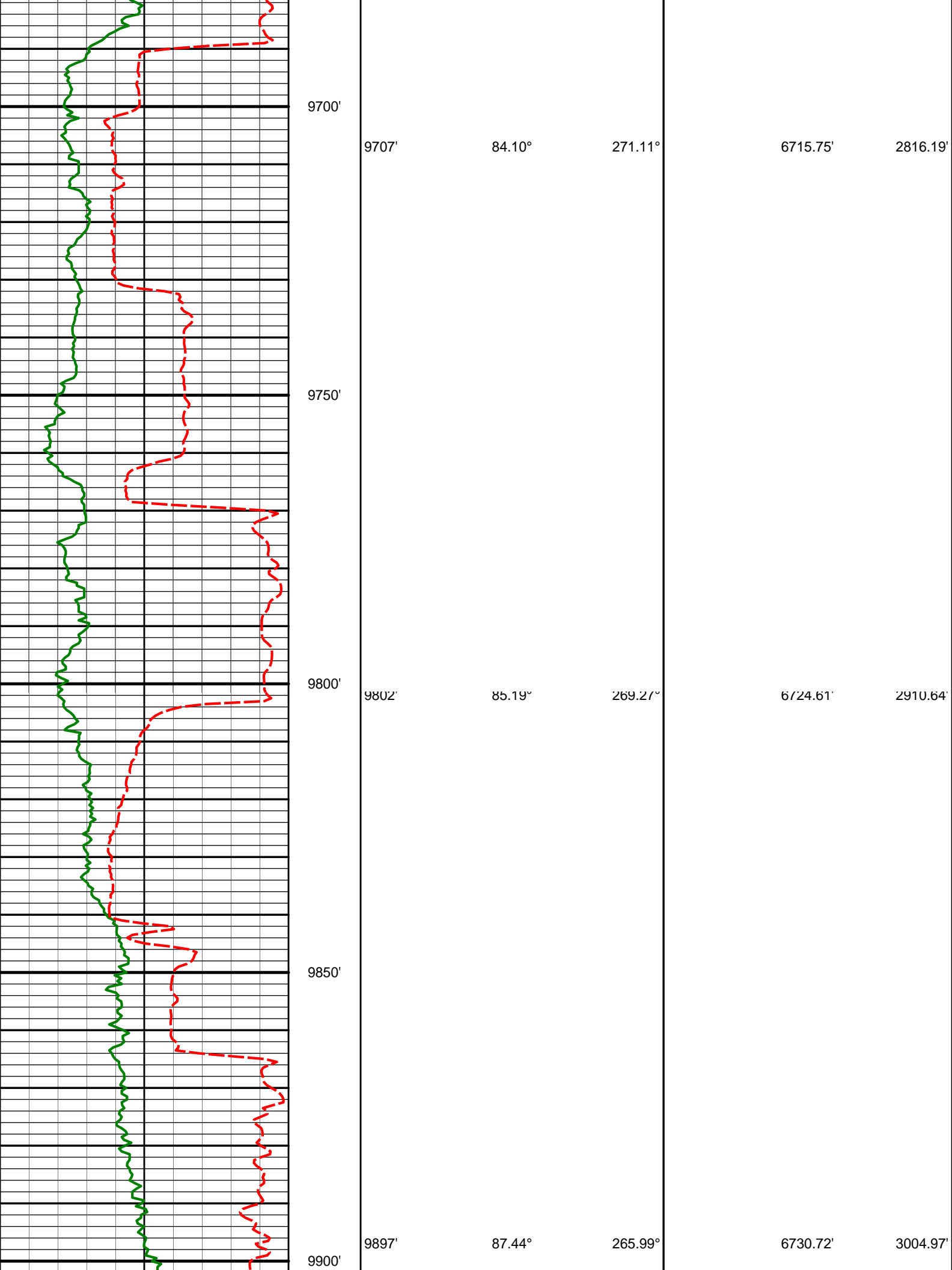
87.22°

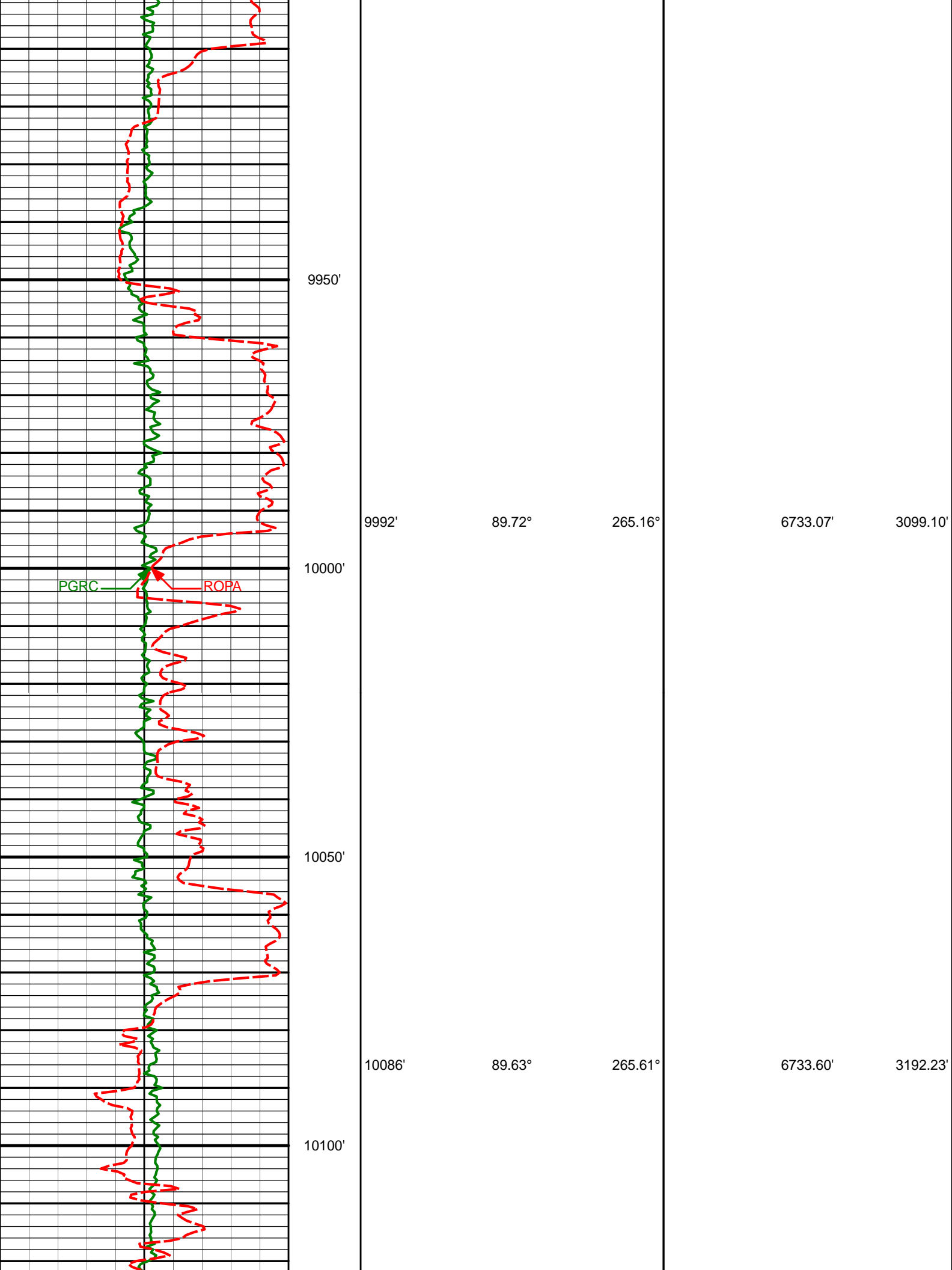
272.65°

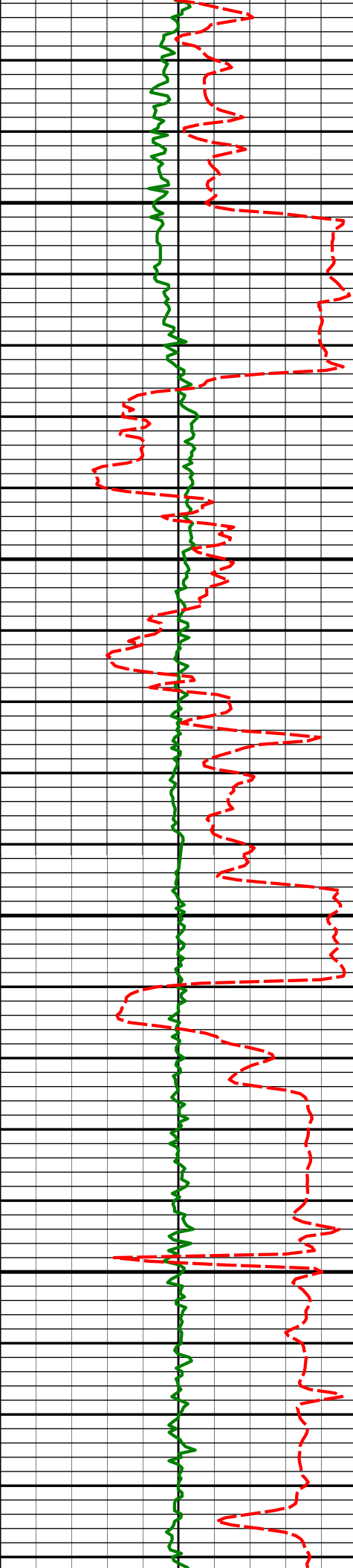
6708.64'

2722.49'

9650'







10150'

10181'

91.91°

267.44°

6732.32'

3286.57'

10200'

10250'

10276'

90.28°

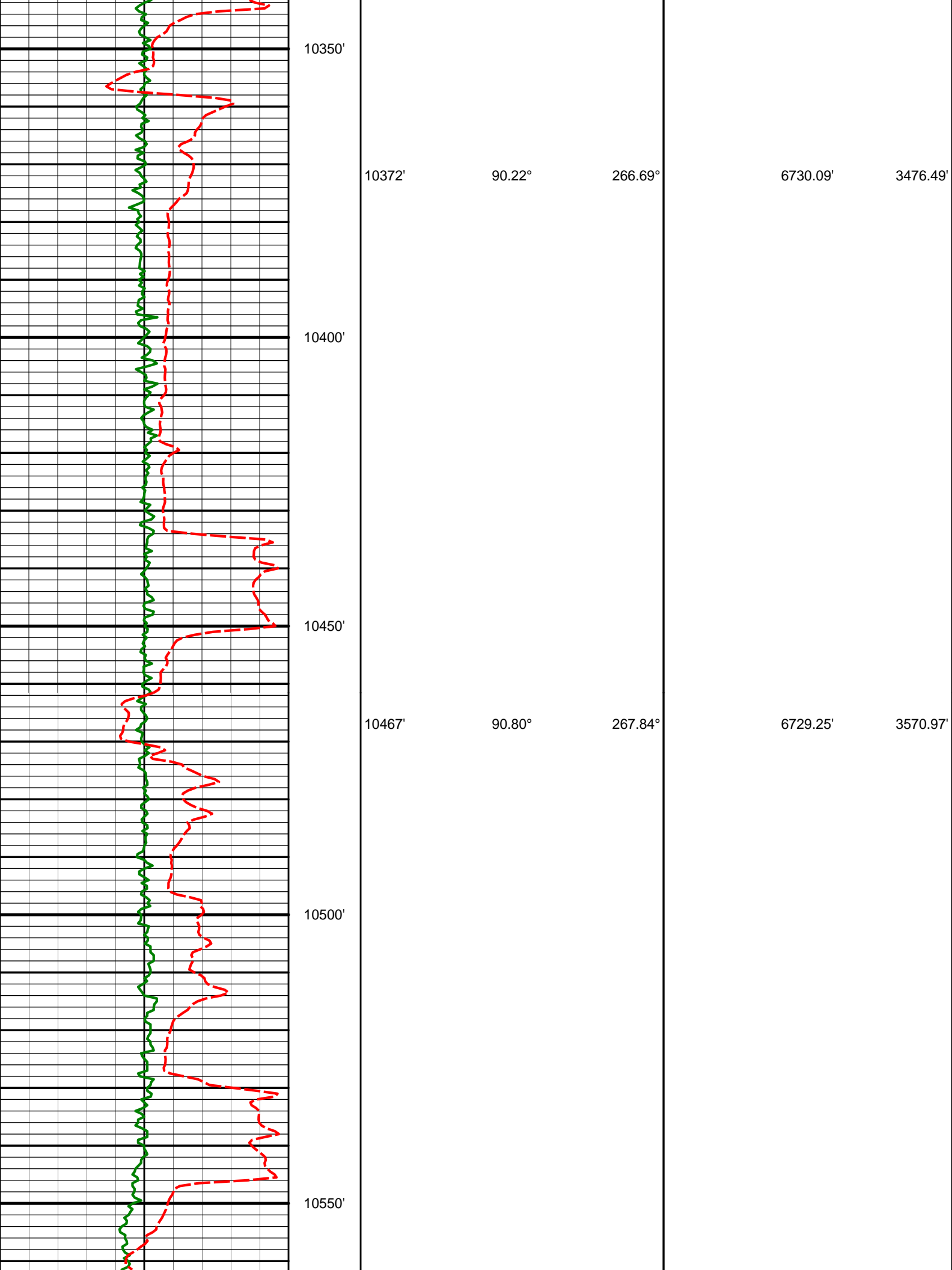
267.25°

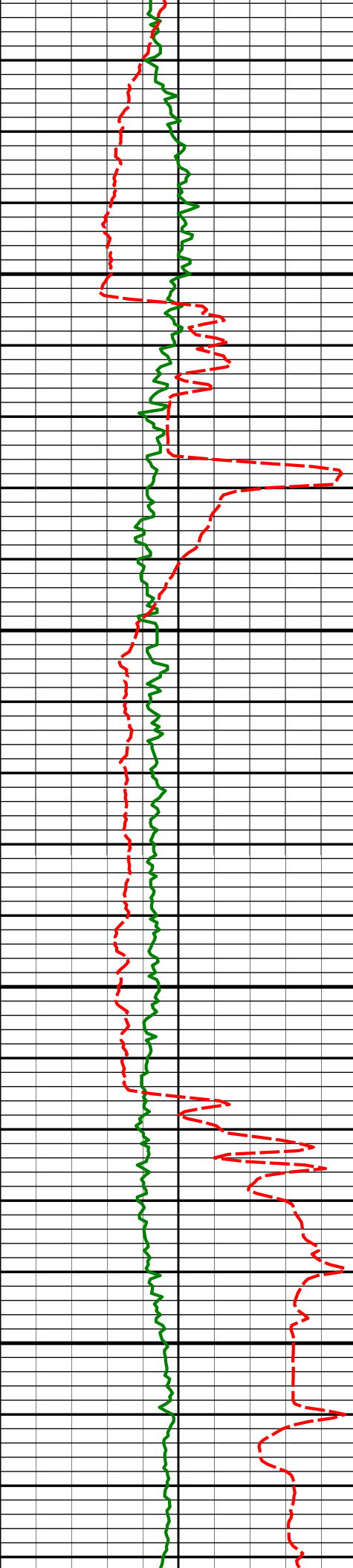
6730.51'

3381.05'

10300'







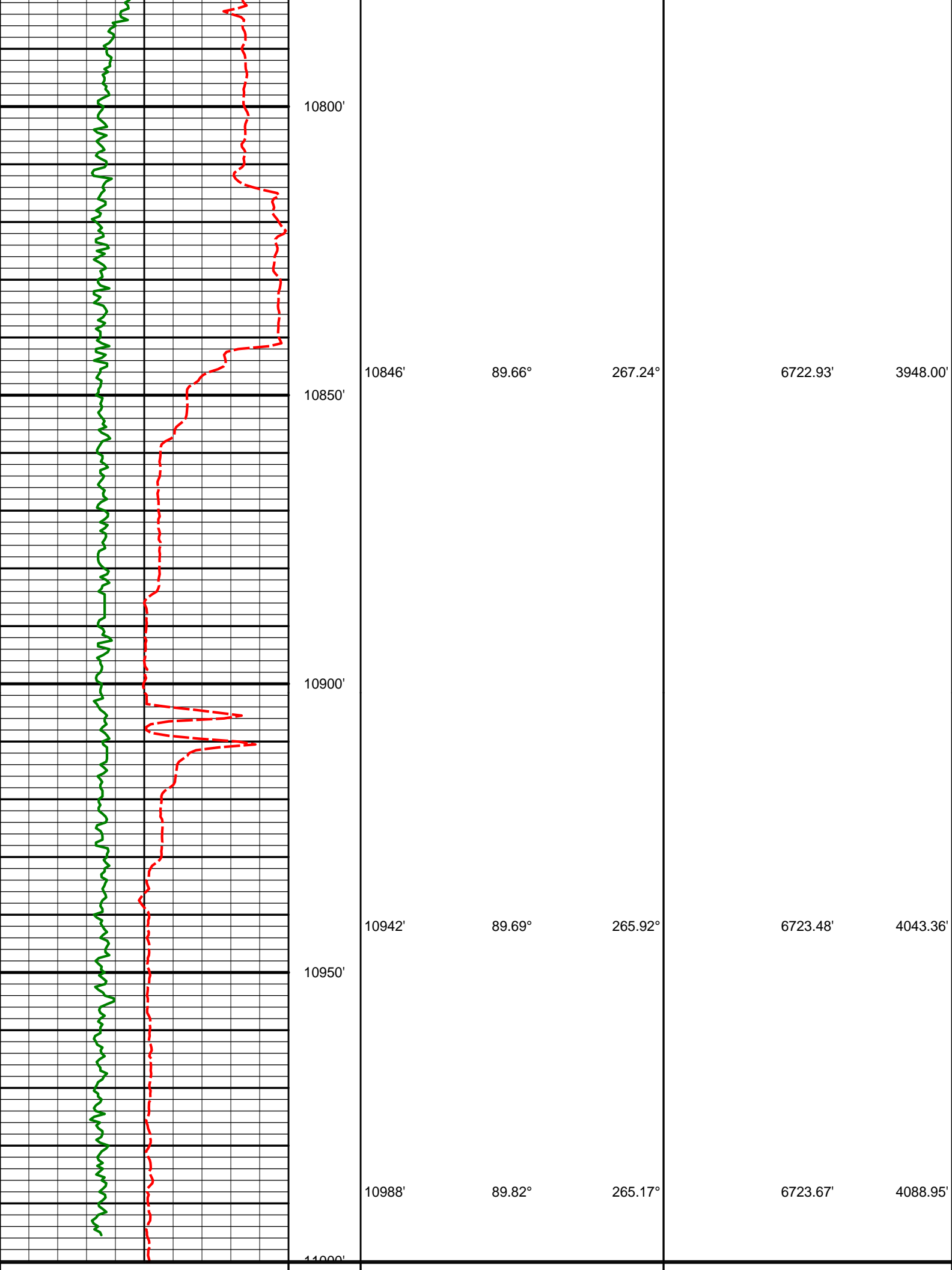
10600'

10650'

10700'

10750'

10562'	91.36°	268.92°	6727.46'	3665.62'
10657'	91.51°	268.24°	6725.08'	3760.28'
10752'	90.71°	265.46°	6723.24'	3854.67'



Avg Rate of Penetration feet per hr		Feet					
600	0		Depth	Inc	Azm	TVD	Vsec
Gamma Ray (PGXC) (Api)							
0	300						

# DIRECTIONAL SURVEY REPORT

Noble Energy  
 Wells Ranch AA21-63HN  
 Wattenberg  
 Weld Colorado  
 USA  
 CA-XX-0900918612

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
235.00	0.50	266.19	235.00	0.07 S	1.02 W	1.02	0.21
512.00	0.50	313.79	511.99	0.69 N	3.10 W	3.14	0.15
750.00	0.20	245.39	749.98	1.23 N	4.23 W	4.29	0.20
940.00	0.40	314.89	939.98	1.56 N	5.00 W	5.08	0.20
1103.00	0.41	163.37	1102.98	1.41 N	5.24 W	5.31	0.48
1196.00	0.52	144.72	1195.98	0.75 N	4.90 W	4.93	0.20
1289.00	1.74	86.37	1288.96	0.49 N	3.24 W	3.26	1.65
1382.00	3.46	69.73	1381.86	1.56 N	0.81 E	-0.72	2.00
1475.00	5.15	67.93	1474.60	4.10 N	7.31 E	-7.07	1.82
1570.00	7.18	58.77	1569.04	8.78 N	16.34 E	-15.82	2.37
1665.00	8.31	53.99	1663.18	15.89 N	26.97 E	-26.04	1.37
1759.00	9.12	52.12	1756.09	24.46 N	38.34 E	-36.92	0.91
1854.00	10.48	49.71	1849.70	34.67 N	50.88 E	-48.87	1.50
1949.00	8.97	48.25	1943.33	45.20 N	63.00 E	-60.38	1.61
2044.00	8.59	53.82	2037.22	54.32 N	74.25 E	-71.11	0.98
2139.00	9.07	55.99	2131.09	62.69 N	86.18 E	-82.56	0.62
2234.00	9.94	53.83	2224.79	71.72 N	99.01 E	-94.87	0.98
2329.00	10.06	56.20	2318.35	81.18 N	112.53 E	-107.84	0.45
2423.00	10.01	59.98	2410.91	89.84 N	126.43 E	-121.23	0.70
2518.00	11.58	60.34	2504.22	98.69 N	141.87 E	-136.15	1.65
2613.00	9.99	56.16	2597.54	108.00 N	157.00 E	-150.75	1.86
2708.00	10.10	52.53	2691.09	117.65 N	170.46 E	-163.65	0.68
2803.00	11.00	58.19	2784.48	127.50 N	184.77 E	-177.39	1.44
2898.00	11.47	58.73	2877.67	137.17 N	200.54 E	-192.59	0.51
2993.00	11.05	59.08	2970.84	146.75 N	216.42 E	-207.91	0.45
3088.00	10.44	60.93	3064.17	155.61 N	231.74 E	-222.73	0.74
3183.00	10.54	57.38	3157.59	164.47 N	246.58 E	-237.05	0.69
3277.00	8.60	56.17	3250.27	173.02 N	259.66 E	-249.63	2.08
3372.00	8.52	60.21	3344.22	180.47 N	271.66 E	-261.20	0.64
3467.00	8.83	66.56	3438.13	186.86 N	284.46 E	-273.62	1.06
3562.00	9.01	70.37	3531.99	192.26 N	298.15 E	-286.99	0.65
3657.00	10.11	66.19	3625.67	198.12 N	312.78 E	-301.27	1.37
3752.00	10.38	66.48	3719.15	204.90 N	328.25 E	-316.34	0.29
3847.00	10.94	61.46	3812.52	212.63 N	344.02 E	-331.65	1.14
3941.00	10.87	56.74	3904.82	221.75 N	359.26 E	-346.37	0.95
4036.00	8.72	56.36	3998.43	230.65 N	372.75 E	-359.33	2.26
4130.00	8.47	52.56	4091.38	238.80 N	384.18 E	-370.29	0.66
4225.00	8.57	52.28	4185.33	247.39 N	395.33 E	-380.95	0.11
4320.00	7.71	52.58	4279.37	255.59 N	405.99 E	-391.14	0.91
4415.00	5.96	50.39	4373.69	262.60 N	414.85 E	-399.59	1.86
4510.00	5.18	46.22	4468.24	268.71 N	421.74 E	-406.13	0.93
4605.00	3.55	42.20	4562.97	273.86 N	426.81 E	-410.91	1.74
4700.00	2.83	36.83	4657.82	277.92 N	430.20 E	-414.06	0.82
4795.00	2.78	30.34	4752.70	281.78 N	432.77 E	-416.42	0.34
4890.00	2.15	12.61	4847.62	285.51 N	434.32 E	-417.76	1.04
4985.00	1.76	12.11	4942.56	288.67 N	435.01 E	-418.28	0.41
5174.00	0.66	42.72	5131.52	292.31 N	436.36 E	-419.42	0.65
5364.00	0.31	103.55	5321.51	293.00 N	437.61 E	-420.63	0.31
5459.00	0.44	106.50	5416.51	292.83 N	438.21 E	-421.23	0.14

5554.00	0.76	146.61	5511.50	292.20 N	438.90 E	-421.96	0.54
5649.00	1.07	144.01	5606.49	290.96 N	439.77 E	-422.90	0.33
5744.00	1.42	136.79	5701.47	289.39 N	441.10 E	-424.31	0.40
5839.00	1.42	139.81	5796.44	287.63 N	442.66 E	-425.96	0.08
5934.00	1.37	139.06	5891.41	285.88 N	444.16 E	-427.56	0.05
5997.00	1.60	145.08	5954.39	284.59 N	445.15 E	-428.63	0.45
6116.00	1.84	250.08	6073.36	282.57 N	444.31 E	-427.90	2.30
6164.00	7.49	276.56	6121.19	282.67 N	440.47 E	-424.06	12.28
6211.00	12.96	278.45	6167.42	283.79 N	432.21 E	-415.75	11.67
6259.00	15.95	273.75	6213.90	285.01 N	420.30 E	-403.79	6.68
6306.00	19.94	273.77	6258.60	285.96 N	405.85 E	-389.31	8.48
6354.00	24.81	271.38	6302.98	286.75 N	387.61 E	-371.05	10.32
6401.00	27.53	267.90	6345.16	286.58 N	366.89 E	-350.38	6.64
6449.00	30.22	265.94	6387.19	285.32 N	343.76 E	-327.35	5.94
6496.00	33.83	266.03	6427.03	283.58 N	318.90 E	-302.62	7.70
6544.00	39.36	269.01	6465.56	282.39 N	290.32 E	-274.16	12.09
6591.00	46.05	267.20	6500.07	281.30 N	258.49 E	-242.43	14.47
6639.00	51.99	268.12	6531.54	279.84 N	222.29 E	-206.38	12.44
6686.00	54.58	268.61	6559.63	278.76 N	184.64 E	-168.84	5.59
6734.00	56.92	269.77	6586.65	278.21 N	144.97 E	-129.26	5.25
6781.00	60.37	268.97	6611.10	277.76 N	104.84 E	-89.22	7.50
6829.00	64.30	268.87	6633.38	276.96 N	62.34 E	-46.84	8.18
6876.00	68.82	269.02	6652.07	276.17 N	19.24 E	-3.84	9.63
6924.00	73.72	269.30	6667.48	275.51 N	26.20 W	41.49	10.23
6971.00	77.79	270.57	6679.04	275.46 N	71.74 W	86.96	9.04
6998.00	80.51	271.14	6684.12	275.85 N	98.25 W	113.45	10.30
7083.00	85.16	270.76	6694.72	277.25 N	182.56 W	197.70	5.49
7146.00	85.22	270.08	6700.01	277.71 N	245.33 W	260.40	1.07
7241.00	87.22	270.13	6706.27	277.88 N	340.12 W	355.06	2.11
7336.00	88.98	269.35	6709.41	277.45 N	435.06 W	449.83	2.03
7431.00	88.49	269.79	6711.51	276.73 N	530.04 W	544.61	0.70
7526.00	89.51	270.77	6713.17	277.20 N	625.02 W	639.48	1.49
7620.00	89.94	270.52	6713.62	278.26 N	719.01 W	733.38	0.53
7716.00	91.17	268.85	6712.69	277.73 N	815.00 W	829.19	2.16
7810.00	89.26	268.20	6712.34	275.31 N	908.96 W	922.87	2.14
7905.00	90.68	270.15	6712.39	273.95 N	1003.95 W	1017.63	2.54
8000.00	90.89	269.05	6711.09	273.29 N	1098.93 W	1112.44	1.18
8095.00	89.72	268.59	6710.58	271.34 N	1193.91 W	1207.16	1.33
8190.00	89.14	266.61	6711.52	267.36 N	1288.82 W	1301.70	2.17
8285.00	90.31	268.57	6711.98	263.36 N	1383.73 W	1396.24	2.40
8380.00	89.32	269.30	6712.29	261.60 N	1478.71 W	1490.97	1.29
8474.00	88.86	269.85	6713.78	260.90 N	1572.69 W	1584.77	0.76
8569.00	89.23	270.53	6715.37	261.21 N	1667.68 W	1679.63	0.82
8664.00	88.00	270.65	6717.67	262.19 N	1762.64 W	1774.50	1.31
8758.00	90.99	272.25	6718.51	264.56 N	1856.59 W	1868.44	3.61
8853.00	89.51	271.04	6718.10	267.29 N	1951.55 W	1963.40	2.01
8948.00	89.35	269.97	6719.04	268.12 N	2046.54 W	2058.29	1.14
9043.00	92.25	270.64	6717.72	268.63 N	2141.52 W	2153.15	3.13
9138.00	91.82	269.13	6714.34	268.43 N	2236.46 W	2247.93	1.65
9233.00	91.91	270.68	6711.25	268.28 N	2331.40 W	2342.72	1.63
9328.00	90.22	272.29	6709.48	270.74 N	2426.35 W	2437.65	2.46
9423.00	91.23	271.08	6708.28	273.53 N	2521.30 W	2532.61	1.66
9518.00	90.55	271.49	6706.80	275.66 N	2616.26 W	2627.55	0.84
9613.00	87.22	272.65	6708.64	279.09 N	2711.17 W	2722.49	3.71
9707.00	84.10	271.11	6715.75	282.17 N	2804.83 W	2816.19	3.70
9802.00	85.19	269.27	6724.61	282.47 N	2899.41 W	2910.64	2.24
9897.00	87.44	265.99	6730.72	278.55 N	2994.11 W	3004.97	4.18
9992.00	89.72	265.16	6733.07	271.22 N	3088.79 W	3099.10	2.55
10086.00	89.63	265.61	6733.60	263.66 N	3182.49 W	3192.23	0.49
10181.00	91.91	267.44	6732.32	257.90 N	3277.29 W	3286.57	3.08
10276.00	90.28	267.25	6730.51	253.50 N	3372.17 W	3381.05	1.73
10372.00	90.22	266.69	6730.09	248.43 N	3468.04 W	3476.49	0.59
10467.00	90.80	267.84	6729.25	243.89 N	3562.92 W	3570.97	1.35
10562.00	91.36	268.92	6727.46	241.20 N	3657.87 W	3665.62	1.28
10657.00	91.51	268.24	6725.08	238.85 N	3752.81 W	3760.28	0.74
10752.00	90.71	265.46	6723.24	233.63 N	3847.63 W	3854.67	3.04
10846.00	89.66	267.24	6722.93	227.64 N	3941.44 W	3948.00	2.19
10942.00	89.69	265.92	6723.48	221.92 N	4037.26 W	4043.36	1.37
10988.00	89.82	265.17	6723.67	218.34 N	4083.12 W	4088.95	1.67
11050.00	89.82	265.17	6723.87	213.12 N	4144.90 W	4150.34	0.01

CALCULATION BASED ON MINIMUM CURVATURE METHOD

SURVEY COORDINATES RELATIVE TO WELL SYSTEM REFERENCE POINT

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 273.19 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.69 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 11050.00 FEET  
IS 4150.38 FEET ALONG 272.94 DEGREES (GRID)

Tie-In @ Surface

Surveys at 235 ft, 512 ft, 750 ft, and 940 were taken and provided by HP 322 while they were drilling the surface hole and have been converted from magnetic north to grid north.

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