

## Pressure Case Gamma

**1 : 600 / 1 : 240**

[illegible]

## WELL INFORMATION

<b>MWD Run Number</b>	100	200	300		
<b>Date run completed</b>	28-Jan-13	30-Jan-13	02-Feb-13		
<b>Rig Bit Number</b>	2	3	4		
<b>Bit Size (in)</b>	8.750	8.75	6.125		
<b>Tool Nominal OD (in)</b>	6.750	6.75	4.750		
<b>Log Start Depth (MD, ft)</b>	1,178	6,438	7,575		
<b>Log End Depth (MD, ft)</b>	6,237.00	7,575	11,624		
<b>Drill or Wipe</b>	Drill	Drill	Drill		
<b>Drill/Wipe Start Date and Time</b>	27-Jan-13 07:30	28-Jan-13 00:30	31-Jan-13 09:45		
<b>Drill/Wipe End Date and Time</b>	28-Jan-13 10:45	29-Jan-13 21:30	01-Feb-13 22:45		
<b>Min Inc (deg) @ Depth (MD, ft)</b>	.06 @ 1,935.00	.75 @ 6,440	84.87 @ 7,609		
<b>Max Inc (deg) @ Depth (MD, ft)</b>	13.87 @ 2,789.00	85.02 @ 7,520	92.07 @ 10,064		
<b>Bit TFA(in2) / Bit Type</b>	.75 / PDC	.86 / PDC	.46 / PDC		
<b>Flow Rate (gpm)</b>	585	547.20	266		
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	N/A / N/A	466 / 364	450 / N/A		
<b>Fluid Type</b>	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
<b>Density (ppg) / Viscosity (spqt)</b>	8.8 / 29	10.5 / 10.5	9.2 / 33		
<b>Filtrate CL (ppm)</b>	2,400	2,600	2,600		
<b>pH / Fluid Loss (mptm)</b>	9 / 9	9.3 / 9.3	10.3 / 10.3		
<b>PV (cP) / YP (lhf2)</b>	2 / 3	13 / 22	7 / 6		
<b>% Solids / % Sand</b>	.7 / 0.6	11 / 0.2	4.00 / 10.00		
<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) / Source</b>	141.7 / PCM	167 / PCM	255.6 / PCM		
<b>Rm @ Max Tool Temp (degF)</b>	N/A @ 141.7	N/A @ 167	N/A @ 255.6		
<b>Lead MWD Engineer</b>	Kyle Wass	Kyle Wass	Kyle Wass		
<b>Customer Representative</b>	Jim Turner	Jim Turner	Mike Pino		

SENSOR INFORMATION

Downhole Processor Information					
Tool Type	PCM	PCM	PCM		
Software Version	5.76	5.76	5.76		
Sub Serial Number	11024568	11024568	11024568		
Insert Serial Number	11620309	11620309	11620309		
Date and Time Initialized	25-Jan-13 17:30	25-Jan-13 17:30	30-Jan-13 06:03		
Date and Time Read	30-Jan-13 04:05	30-Jan-13 04:12	02-Feb-13 08:22		
ECMB SW Version	N/A	N/A	N/A		

Directional Sensor Information					
Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	54	55	57		
Software Version	6.21	6.21	6.21		
Sub Serial Number	11024568	11024568	11750419		
Sonde Serial Number	11638477	11638477	11638477		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	230.20	313.39	55.44		

Gamma Ray Sensor Information					
Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	49.08	48.13	64.73		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	11024568	11024568	11024568		
Insert/Sonde Serial Number	11292593	11292593	11292593		

REMARKS
<p>1. All depths are calibrated to driller's pipe tally and are measured from the Drill Floor.</p> <p>2. No depth corrections have been made for pipe stretch or compression.</p> <p>3. Critical annular velocities are calculated using the "Power Law" model for water based fluids and the "Brigham Plastic" model for oil and synthetic based fluids.</p> <p>4. All data presented is recorded data unless otherwise specified.</p> <p>5. The following smoothing parameters have been applied to the data:</p> <p>PGRC (Gamma CG): Interval Resolution: 0.5 ft Interval Distance: 0.6 ft Gap Fill: 3.0 ft</p> <p>ROPA (Average Rate Of Penetration): Interval Resolution: 0.5 ft Interval Distance: 1.2 ft Gap Fill: 3.0 ft</p> <p>6. Insite Version 7.4.1</p>

WARRANTY

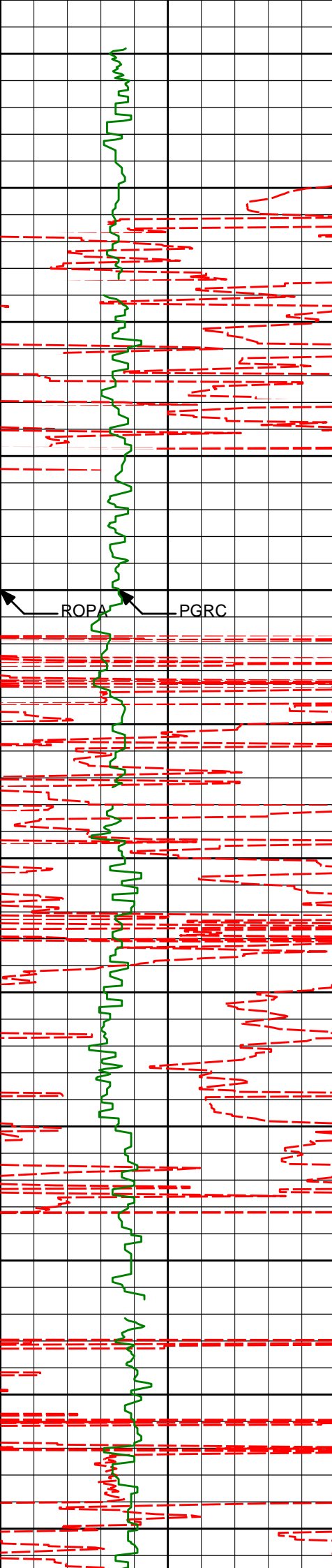
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**HALLIBURTON**  
**Sperry Drilling Services**  
MD Main Log 1:600

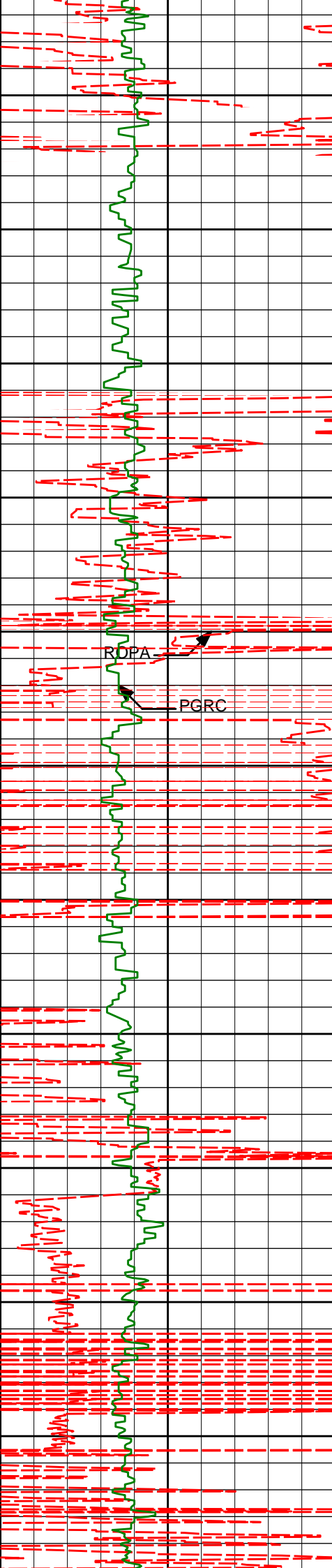
Noble Energy  
LDS E35-79HC  
H&P 321  
Sec 34-T6N-R65W

Avg Rate of Penetration (ROPA) feet per hr						
1K 0						
PCG Gamma Ray BCOR (PGRC) api		MD ft	Depth	Inc	Azm	TVD V/S
0 300						
		650				
		100				
		700	716'	0.93°	211.15°	716.00' 0.35'
		750				
		800				
		850				
		900				
		950				



1000  
1050  
1100  
1150  
1200  
1250  
1300  
1350  
1400  
1450  
1500  
1550

991'	1.27°	204.68°	990.95'	5.00'
1083'	0.68°	150.51°	1082.94'	6.40'
1368'	0.33°	86.18°	1367.93'	7.83'



1600

1650

1700

1750

1800

1850

1900

1950

2000

2050

2100

2150

1652'

0.56°

40.55°

1651.92'

6.74'

1935'

0.06°

124.00°

1934.91'

5.78'

2125'

0.19°

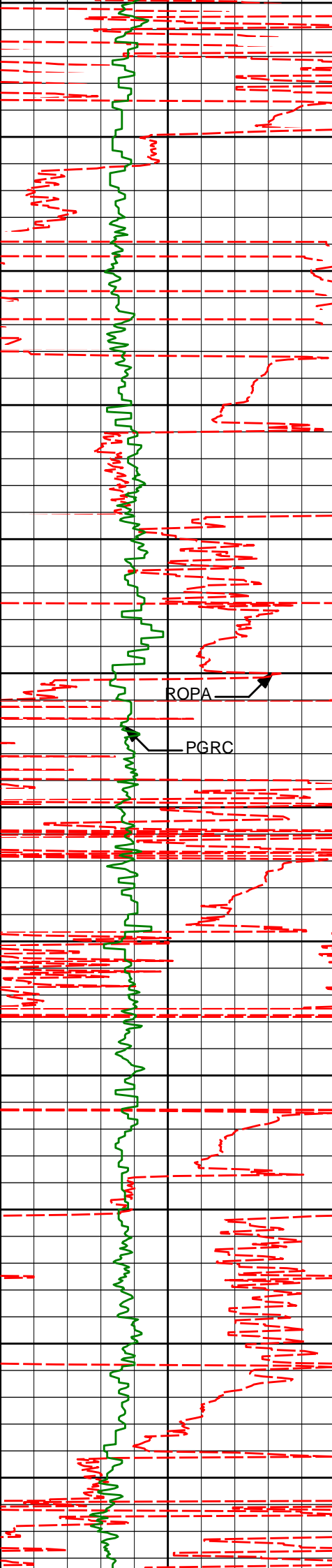
27.85°

2124.91'

5.57'

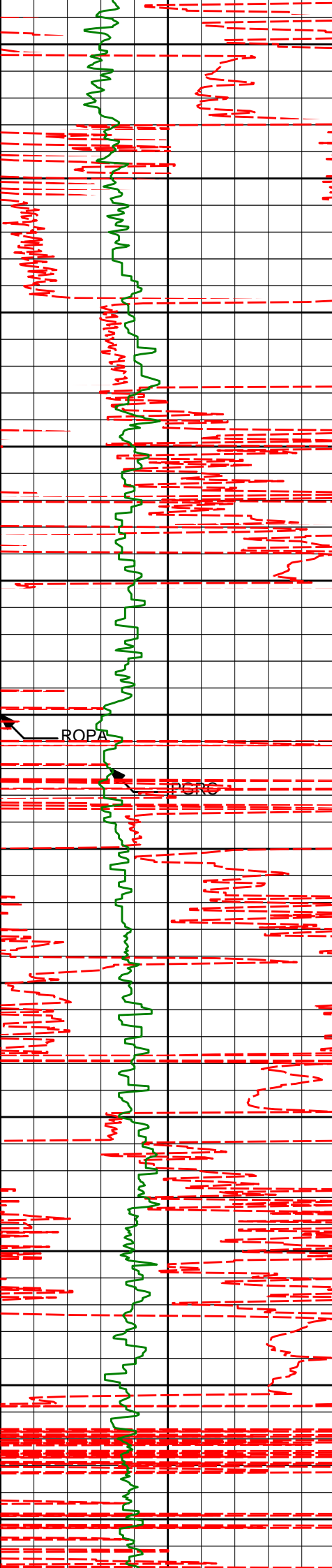
RDPA

PGRC



2150  
2200  
2250  
2300  
2350  
2400  
2450  
2500  
2550  
2600  
2650  
2700

2220'	0.83°	54.37°	2219.91'	5.03'
2315'	3.03°	35.89°	2314.85'	2.61'
2409'	5.56°	34.17°	2408.58'	-3.15'
2504'	8.53°	32.00°	2502.85'	-12.90'
2599'	9.53°	35.42°	2596.67'	-25.24'
2694'	11.71°	39.22°	2690.04'	-39.06'



2750

2800

2850

2900

2950

3000

3050

3100

3150

3200

3250

3300

2789'

13.87°

39.13°

2782.68'

-55.30'

2883'

13.13°

38.27°

2874.08'

-72.35'

2978'

13.18°

40.70°

2966.59'

-88.95'

3073'

12.58°

39.99°

3059.20'

-105.01'

3168'

11.58°

38.04°

3152.09'

-120.38'

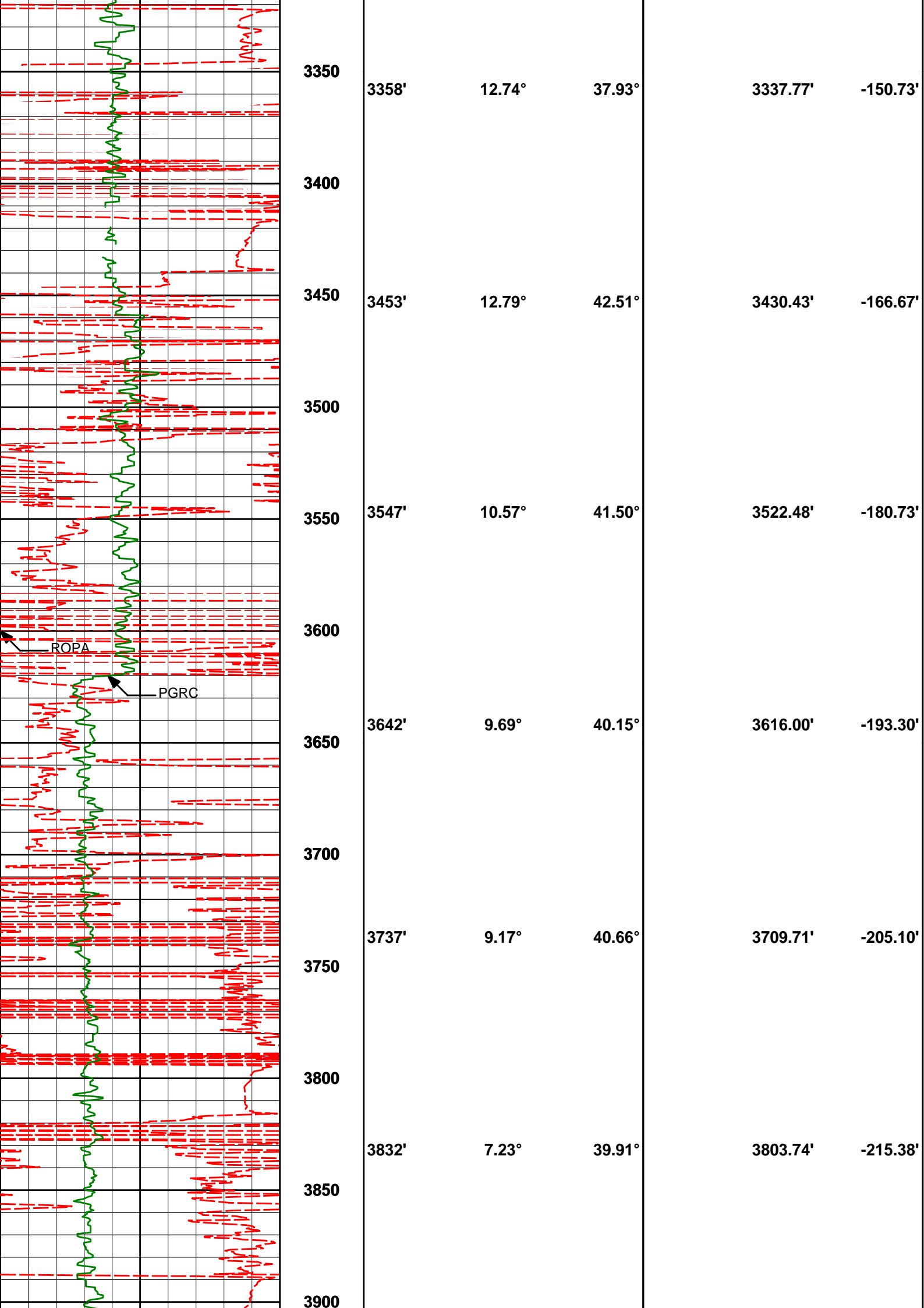
3263'

12.33°

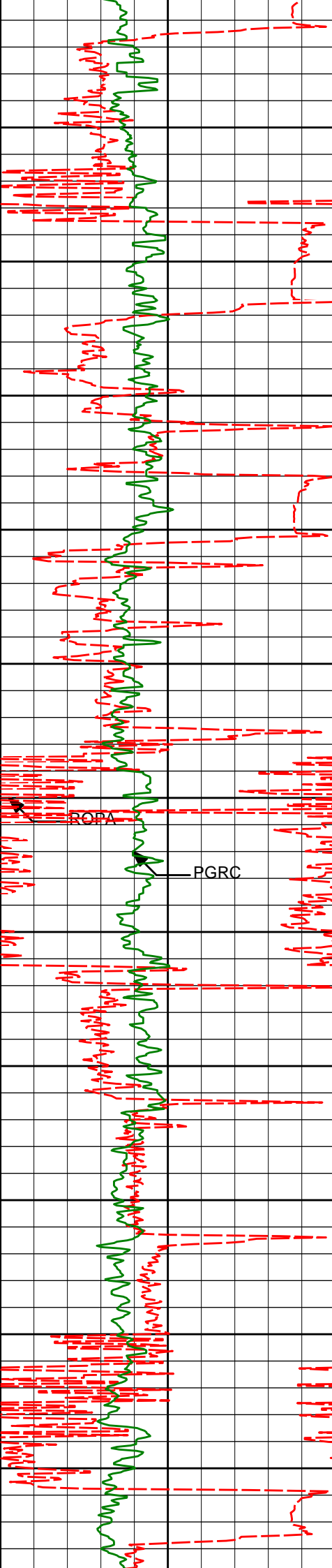
43.48°

3245.03'

-135.18'







3950

4000

4050

4100

4150

4200

4250

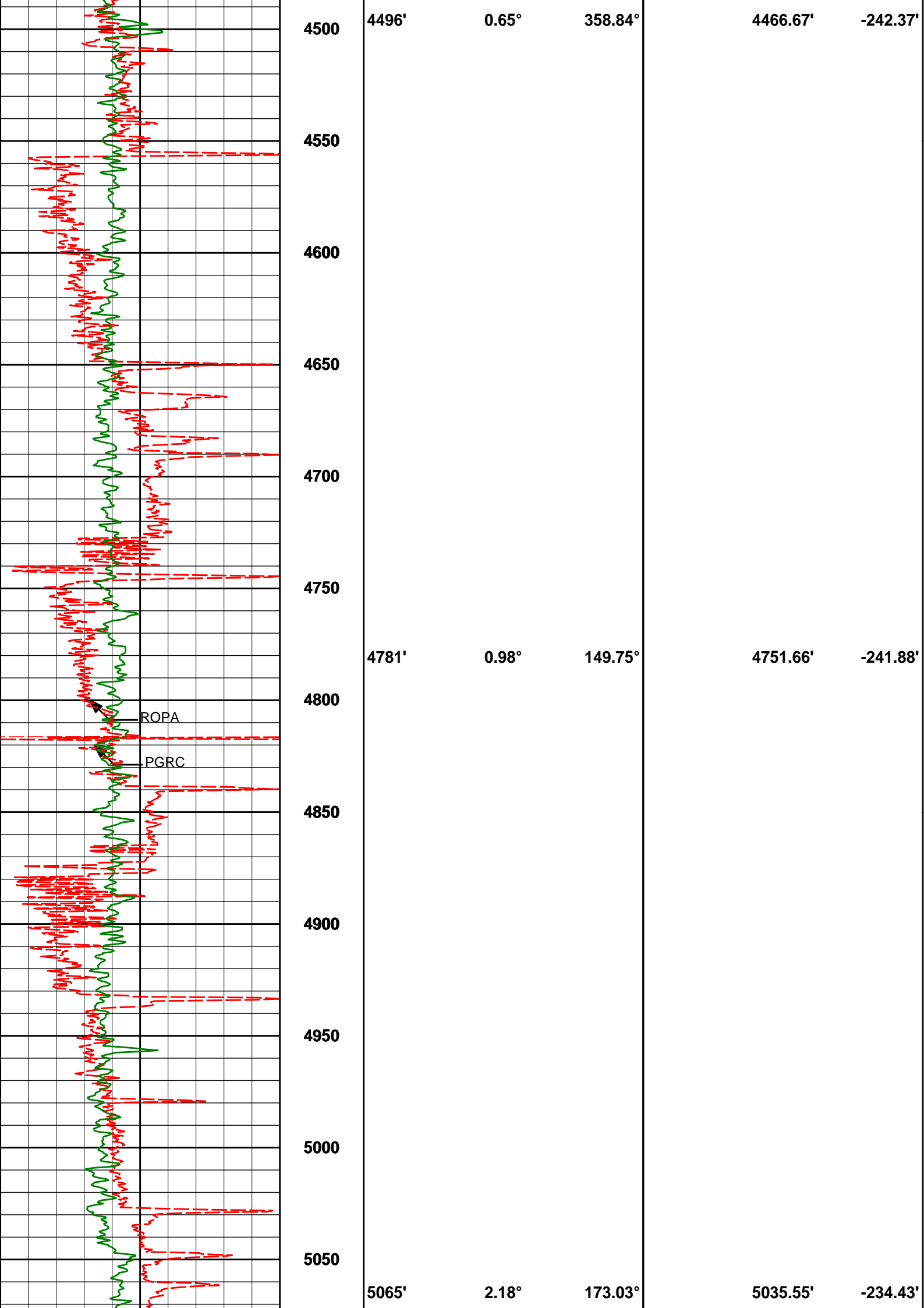
4300

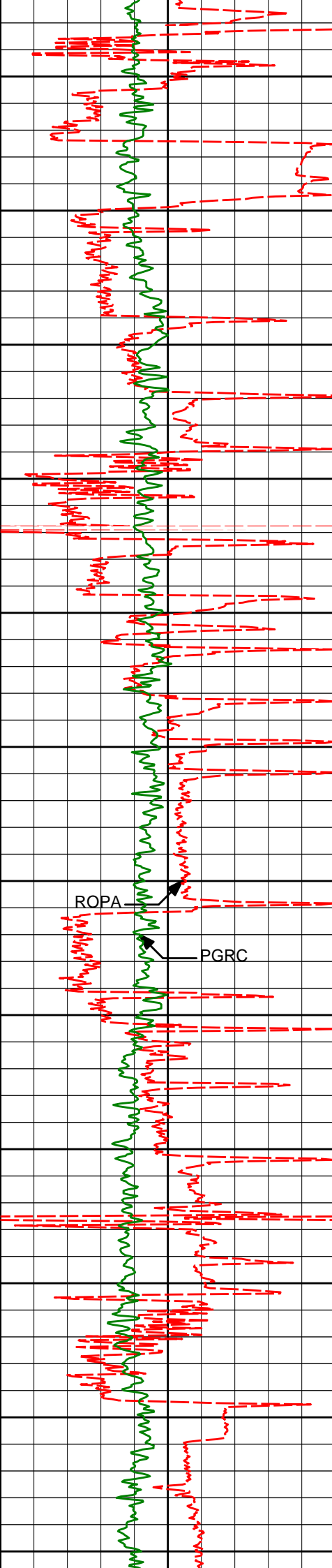
4350

4400

4450

3927'	5.76°	29.54°	3898.13'	-224.08'
4022'	2.71°	21.17°	3992.86'	-230.30'
4117'	1.25°	323.33°	4087.81'	-233.22'
4401'	1.94°	341.59°	4371.70'	-240.30'





5100

5150

5200

5250

5300

5350

5400

5450

5500

5550

5600

5650

5160'

0.60°

244.73°

5130.52'

-232.43'

ROPA

PGRC

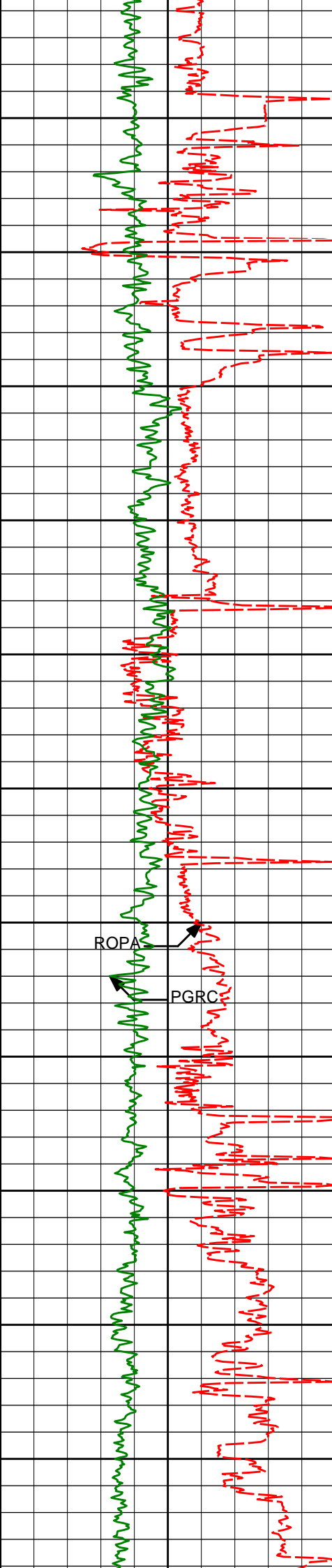
5445'

0.91°

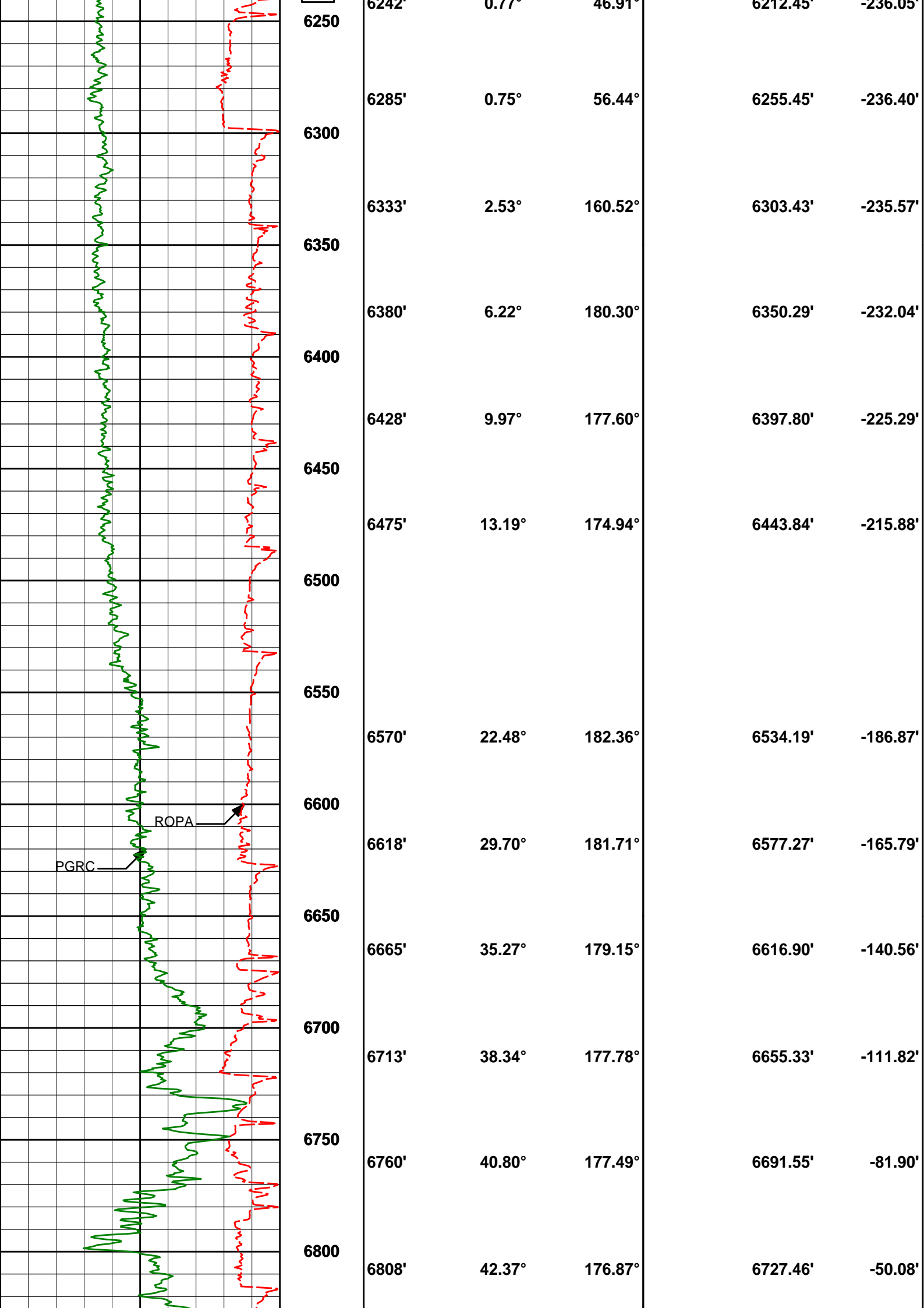
267.85°

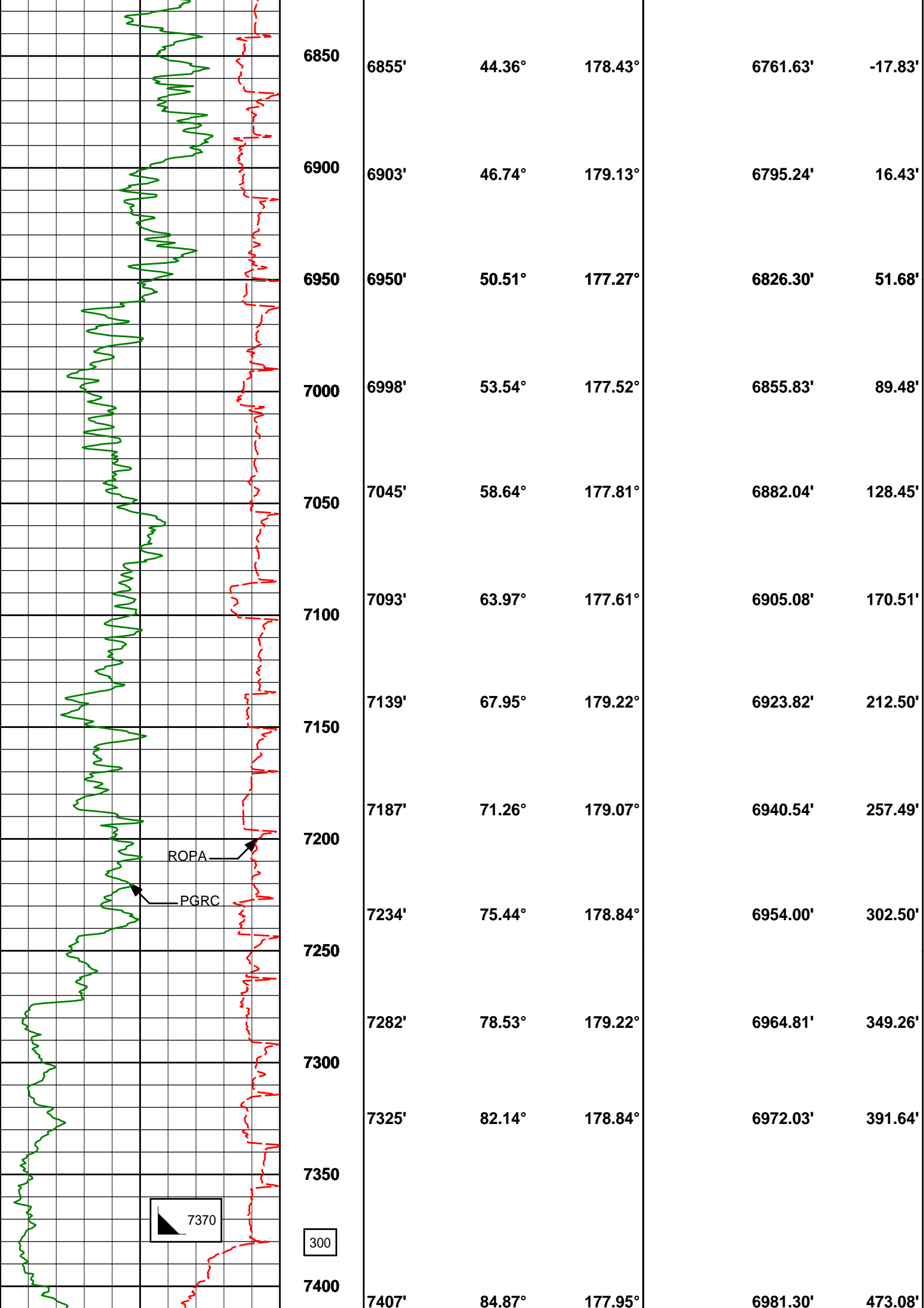
5415.50'

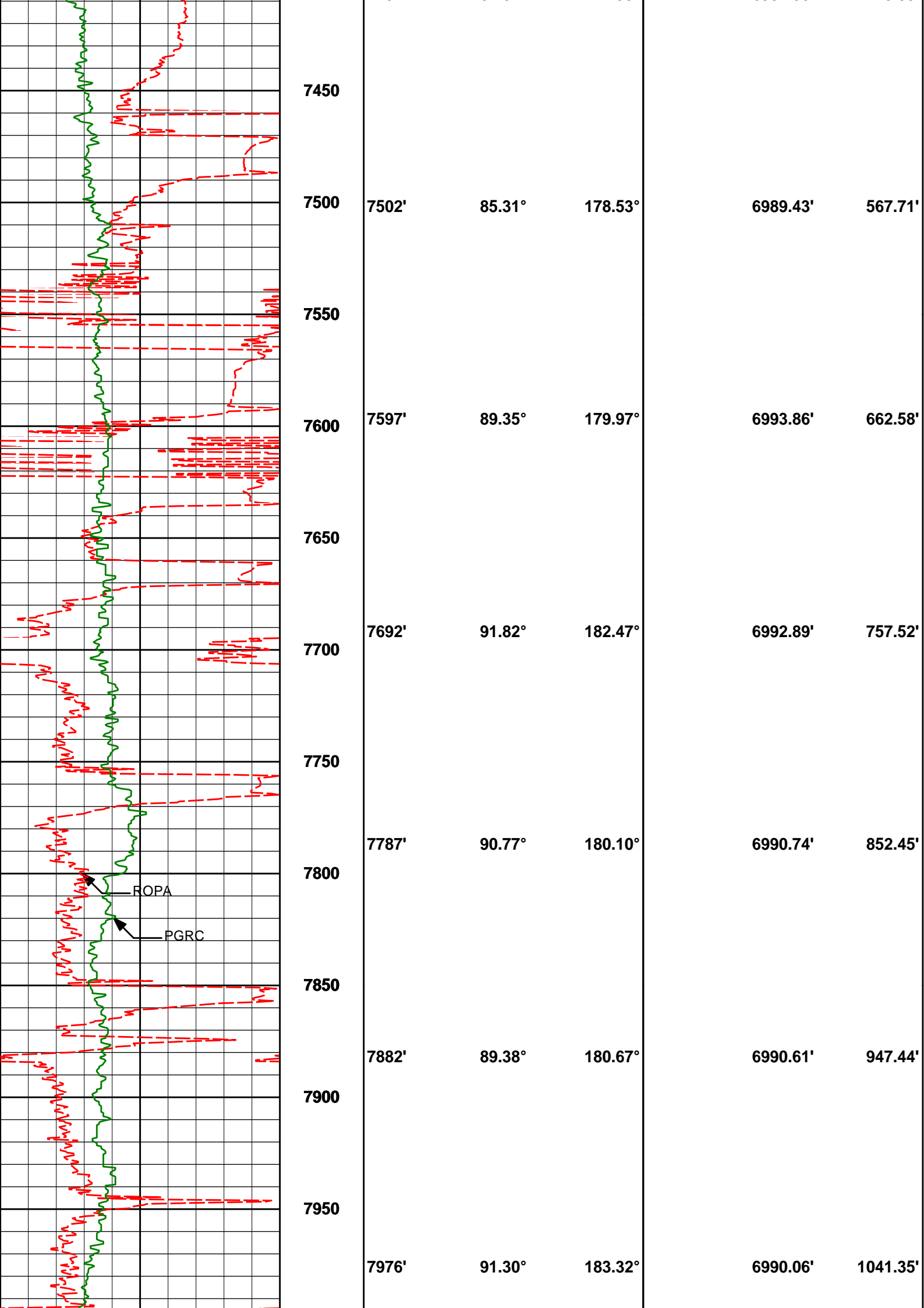
-231.73'

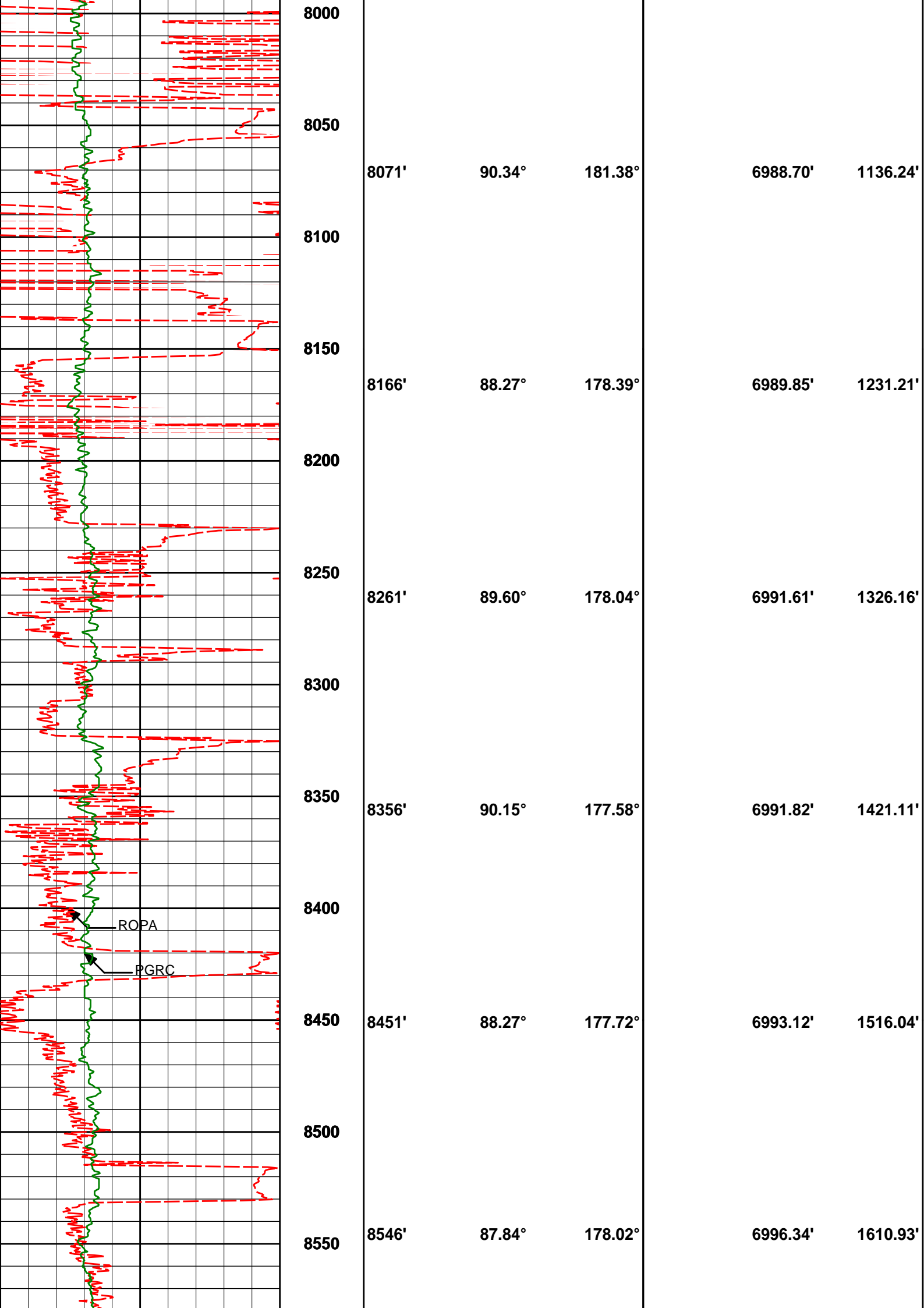


5700					
5729'	0.13°	64.57°	5699.49'	-231.79'	
5750					
5800					
5850					
5900					
5950					
6000	6014'	0.76°	34.30°	5984.48'	-233.49'
6050					
6100					
6150					
6181'	0.98°	44.91°	6151.46'	-235.41'	
6200					
200	6210'	0.77°	46.04°	6210.45'	-236.05'

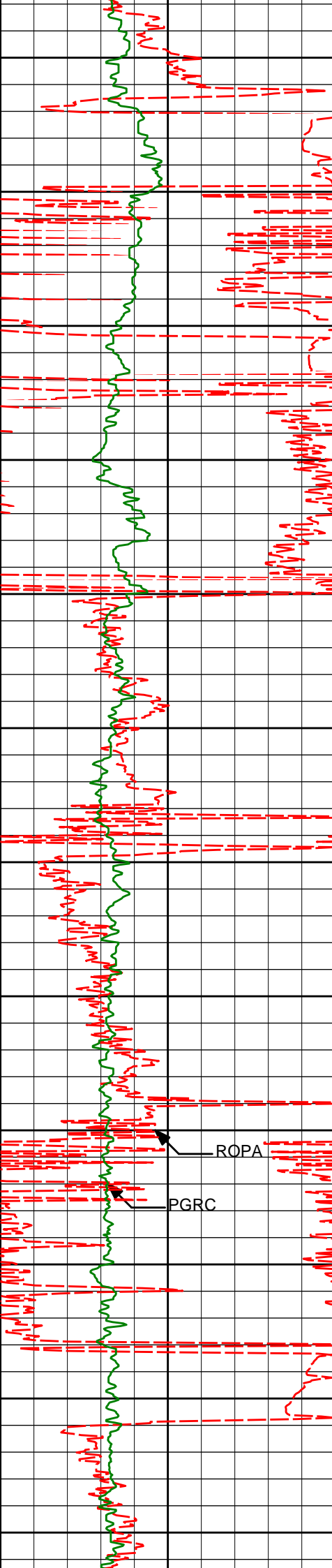












8600

8640'

89.10°

180.23°

6998.85'

1704.89'

8650

8700

8735'

90.31°

179.55°

6999.34'

1799.88'

8750

8800

8830'

90.40°

178.69°

6998.75'

1894.88'

8850

8900

8925'

90.25°

178.30°

6998.21'

1989.86'

8950

9000

9020'

88.40°

175.99°

6999.33'

2084.74'

9050

9100

9115'

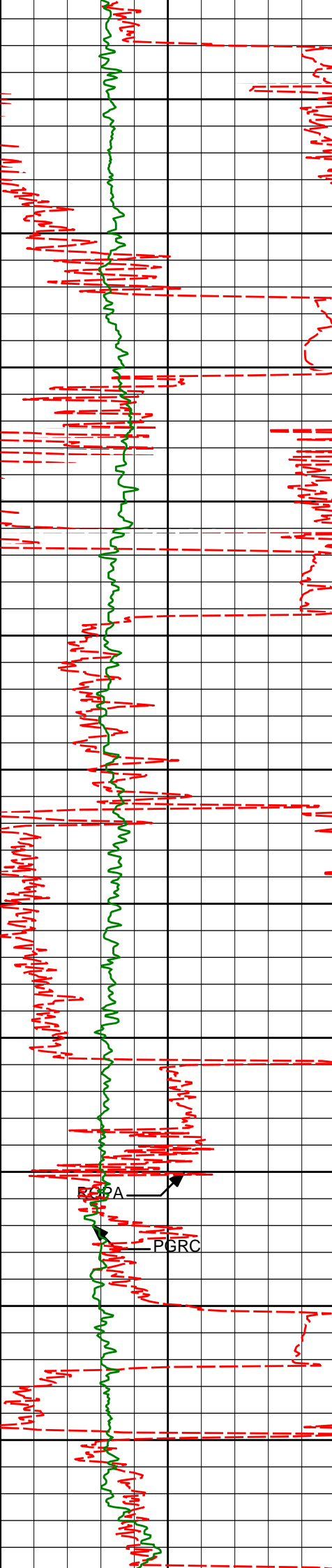
89.66°

176.41°

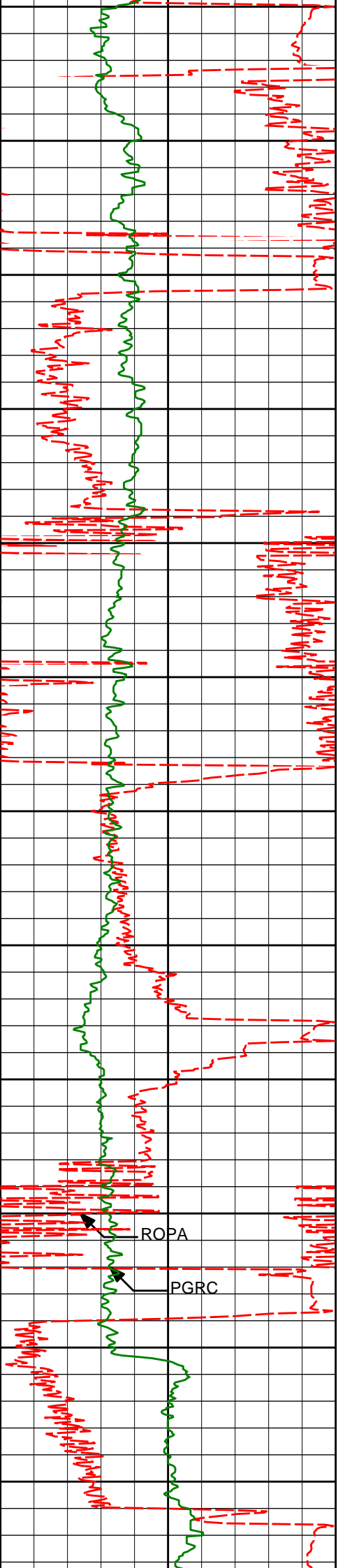
7000.94'

2179.55'

9150



9200	9210'	88.40°	176.02°	7002.56'	2274.36'
9250					
9300	9305'	88.83°	179.19°	7004.86'	2369.26'
9350					
9400	9400'	92.07°	180.54°	7004.12'	2464.24'
9450					
9500	9494'	92.07°	179.92°	7000.73'	2558.17'
9550					
9600	9589'	91.26°	178.86°	6997.97'	2653.13'
9650					
9700	9684'	87.78°	179.20°	6998.76'	2748.11'
9750					



9750

9800

9850

9900

9950

10000

10050

10100

10150

10200

10250

10300

9779'

90.28°

178.95°

7000.37'

2843.08'

9874'

90.22°

180.80°

6999.96'

2938.07'

9969'

90.89°

180.90°

6999.04'

3033.05'

10063'

91.08°

179.51°

6997.42'

3127.03'

10158'

88.33°

176.54°

6997.90'

3221.97'

10253'

87.56°

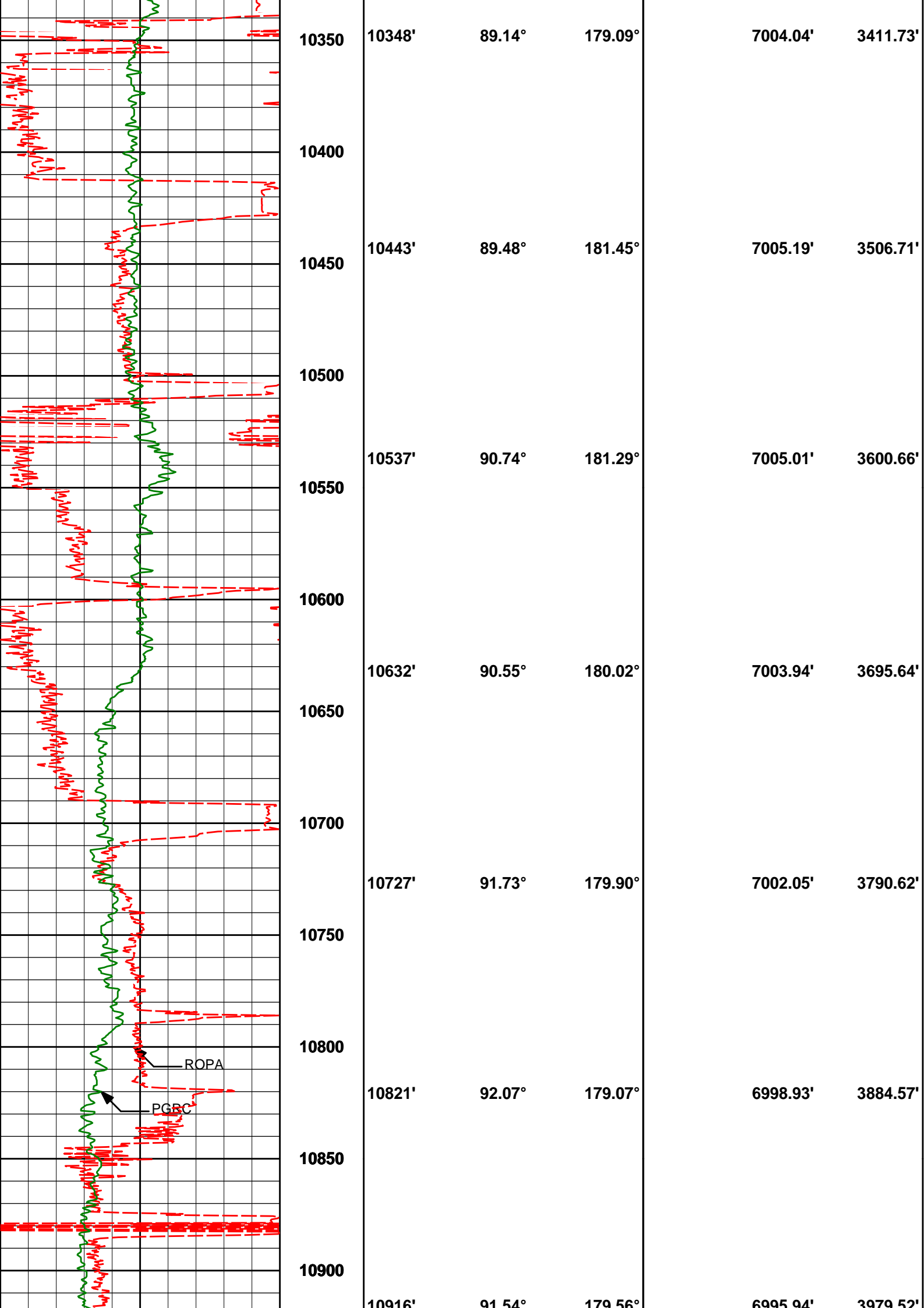
177.44°

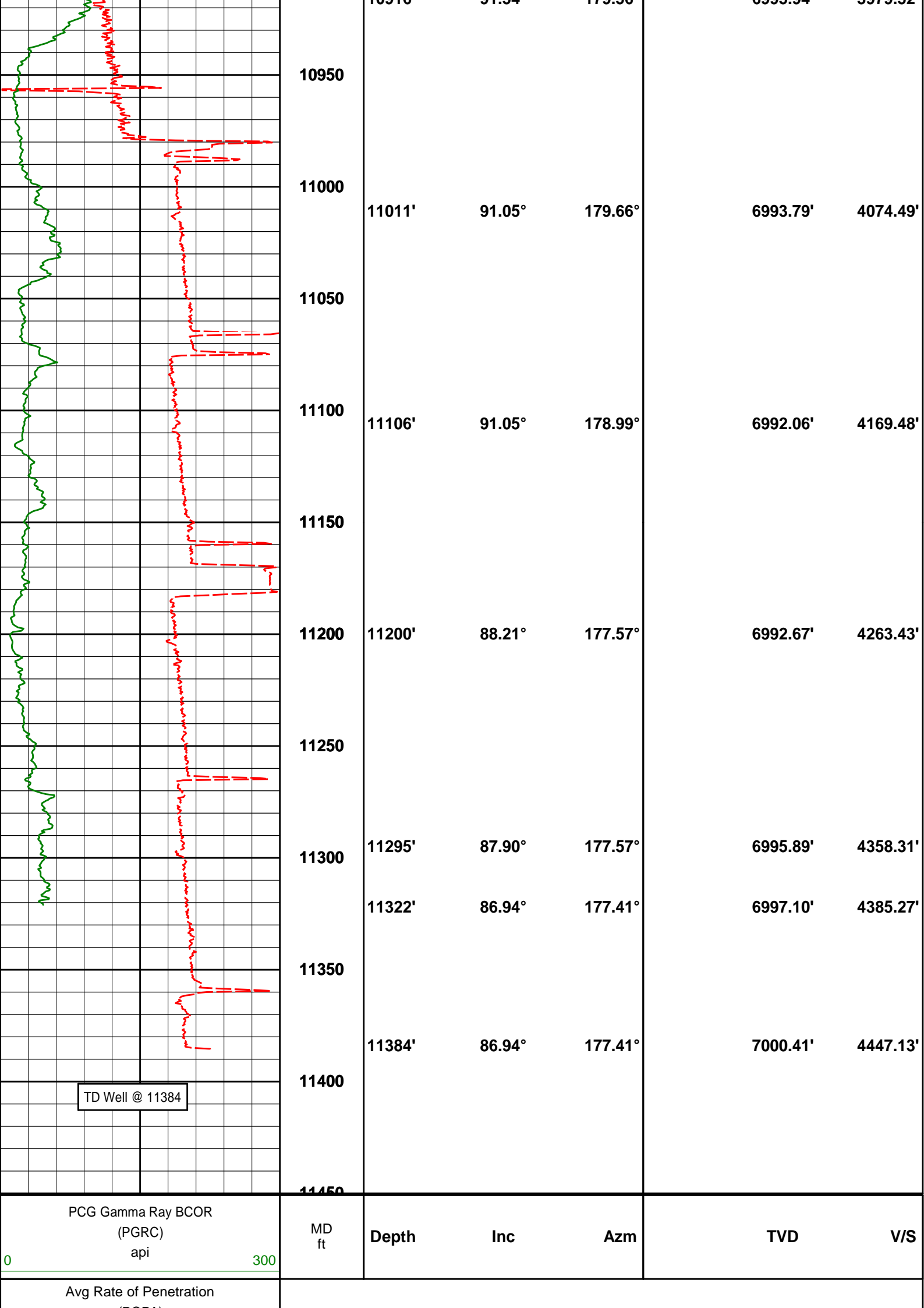
7001.30'

3316.80'

ROPA

PGRC





TD Well @ 11384

PCG Gamma Ray BCOR  
(PGRC)  
api

MD  
ft

Depth

Inc

Azm

TVD

V/S

Avg Rate of Penetration  
(ROP)



# HALLIBURTON

## DIRECTIONAL SURVEY REPORT

Noble Energy  
LDS E35-79HC  
Wattenburg  
Weld Colorado  
USA  
CA-XX-0900135793

Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
665.00	0.00	0.00	665.00	0.00 N	0.00 E	0.00	TIE-IN
716.00	0.93	211.15	716.00	0.35 S	0.21 W	0.35	1.82
991.00	1.27	204.68	990.95	5.02 S	2.63 W	5.00	0.13
1083.00	0.68	150.51	1082.94	6.42 S	2.79 W	6.40	1.12
1368.00	0.33	86.18	1367.93	7.84 S	1.13 W	7.83	0.22
1652.00	0.56	40.55	1651.92	6.73 S	0.59 E	6.74	0.14
1935.00	0.06	124.00	1934.91	5.78 S	1.61 E	5.78	0.20
2125.00	0.19	27.85	2124.91	5.56 S	1.84 E	5.57	0.11
2220.00	0.83	54.37	2219.91	5.02 S	2.47 E	5.03	0.70
2315.00	3.03	35.89	2314.85	2.58 S	4.50 E	2.61	2.38
2409.00	5.56	34.17	2408.58	3.19 N	8.51 E	-3.15	2.69
2504.00	8.53	32.00	2502.85	12.98 N	14.83 E	-12.90	3.14
2599.00	9.53	35.42	2596.67	25.37 N	23.12 E	-25.24	1.19
2694.00	11.71	39.22	2690.04	39.25 N	33.78 E	-39.06	2.41
2789.00	13.87	39.13	2782.68	55.55 N	47.07 E	-55.30	2.28
2883.00	13.13	38.27	2874.08	72.68 N	60.79 E	-72.35	0.82
2978.00	13.18	40.70	2966.59	89.36 N	74.53 E	-88.95	0.58
3073.00	12.58	39.99	3059.20	105.49 N	88.24 E	-105.01	0.65
3168.00	11.58	38.04	3152.09	120.93 N	100.77 E	-120.38	1.14
3263.00	12.33	43.48	3245.03	135.80 N	113.62 E	-135.18	1.42
3358.00	12.74	37.93	3337.77	151.42 N	127.04 E	-150.73	1.34
3453.00	12.79	42.51	3430.43	167.44 N	140.59 E	-166.67	1.07
3547.00	10.57	41.50	3522.48	181.56 N	153.33 E	-180.73	2.37
3642.00	9.69	40.15	3616.00	194.20 N	164.26 E	-193.30	0.96
3737.00	9.17	40.66	3709.71	206.05 N	174.34 E	-205.10	0.55
3832.00	7.23	39.91	3803.74	216.37 N	183.11 E	-215.38	2.05
3927.00	5.76	29.54	3898.13	225.10 N	189.29 E	-224.08	1.97
4022.00	2.71	21.17	3992.86	231.34 N	192.45 E	-230.30	3.27
4117.00	1.25	323.33	4087.81	234.27 N	192.64 E	-233.22	2.42
4401.00	1.94	341.59	4371.70	241.32 N	189.27 E	-240.30	0.30
4496.00	0.65	358.84	4466.67	243.39 N	188.75 E	-242.37	1.41
4781.00	0.98	149.75	4751.66	242.92 N	189.94 E	-241.88	0.55
5065.00	2.18	173.03	5035.55	235.47 N	191.81 E	-234.43	0.47
5160.00	0.60	244.73	5130.52	233.47 N	191.58 E	-232.43	2.18
5445.00	0.91	267.85	5415.50	232.75 N	187.98 E	-231.73	0.15
5729.00	0.13	64.57	5699.49	232.80 N	186.02 E	-231.79	0.36
6014.00	0.76	34.30	5984.48	234.50 N	187.37 E	-233.49	0.23
6181.00	0.98	44.91	6151.46	236.43 N	189.01 E	-235.41	0.16
6242.00	0.77	46.91	6212.45	237.08 N	189.67 E	-236.05	0.35
6285.00	0.75	56.44	6255.45	237.43 N	190.12 E	-236.40	0.30
6333.00	2.53	160.52	6303.43	236.61 N	190.73 E	-235.57	5.85
6380.00	6.22	180.30	6350.29	233.08 N	191.06 E	-232.04	8.36
6428.00	9.97	177.60	6397.80	226.33 N	191.22 E	-225.29	7.86
6475.00	13.19	174.94	6443.84	216.92 N	191.87 E	-215.88	6.94
6570.00	22.48	182.36	6534.19	187.91 N	192.08 E	-186.87	10.05
6618.00	29.70	181.71	6577.27	166.83 N	191.34 E	-165.79	15.06
6665.00	35.27	179.15	6616.90	141.60 N	191.19 E	-140.56	12.21
6713.00	38.34	177.78	6655.33	112.86 N	191.98 E	-111.82	6.60
6760.00	40.80	177.49	6691.55	82.95 N	193.21 E	-81.90	5.26
6808.00	42.37	176.87	6727.46	51.13 N	194.78 E	-50.08	3.38
6855.00	44.36	178.43	6761.63	18.89 N	196.10 E	-17.83	4.80
6903.00	46.74	179.13	6795.24	15.36 S	196.82 E	16.43	5.07
6950.00	50.51	177.27	6826.30	50.61 S	197.95 E	51.68	8.56
6998.00	53.54	177.52	6855.83	88.40 S	199.67 E	89.48	6.32
7045.00	58.64	177.81	6882.04	127.36 S	201.25 E	128.45	10.87

7093.00	63.97	177.61	6905.08	169.42 S	202.94 E	170.51	11.09
7139.00	67.95	179.22	6923.82	211.40 S	204.09 E	212.50	9.23
7187.00	71.26	179.07	6940.54	256.38 S	204.76 E	257.49	6.91
7234.00	75.44	178.84	6954.00	301.39 S	205.58 E	302.50	8.90
7282.00	78.53	179.22	6964.81	348.15 S	206.38 E	349.26	6.49
7325.00	82.14	178.84	6972.03	390.53 S	207.10 E	391.64	8.43
7407.00	84.87	177.95	6981.30	471.96 S	209.38 E	473.08	3.51
7502.00	85.31	178.53	6989.43	566.57 S	212.29 E	567.71	0.75
7597.00	89.35	179.97	6993.86	661.43 S	213.53 E	662.58	4.52
7692.00	91.82	182.47	6992.89	756.39 S	211.51 E	757.52	3.69
7787.00	90.77	180.10	6990.74	851.33 S	209.38 E	852.45	2.72
7882.00	89.38	180.67	6990.61	946.33 S	208.74 E	947.44	1.58
7976.00	91.30	183.32	6990.06	1040.26 S	205.46 E	1041.35	3.48
8071.00	90.34	181.38	6988.70	1135.16 S	201.56 E	1136.24	2.28
8166.00	88.27	178.39	6989.85	1230.14 S	201.74 E	1231.21	3.83
8261.00	89.60	178.04	6991.61	1325.07 S	204.69 E	1326.16	1.44
8356.00	90.15	177.58	6991.82	1420.00 S	208.32 E	1421.11	0.76
8451.00	88.27	177.72	6993.12	1514.91 S	212.21 E	1516.04	1.98
8546.00	87.84	178.02	6996.34	1609.79 S	215.74 E	1610.93	0.56
8640.00	89.10	180.23	6998.85	1703.74 S	217.18 E	1704.89	2.70
8735.00	90.31	179.55	6999.34	1798.73 S	217.37 E	1799.88	1.45
8830.00	90.40	178.69	6998.75	1893.72 S	218.83 E	1894.88	0.90
8925.00	90.25	178.30	6998.21	1988.69 S	221.31 E	1989.86	0.44
9020.00	88.40	175.99	6999.33	2083.55 S	226.04 E	2084.74	3.12
9115.00	89.66	176.41	7000.94	2178.33 S	232.34 E	2179.55	1.40
9210.00	88.40	176.02	7002.56	2273.10 S	238.61 E	2274.36	1.39
9305.00	88.83	179.19	7004.86	2367.98 S	242.58 E	2369.26	3.37
9400.00	92.07	180.54	7004.12	2462.96 S	242.80 E	2464.24	3.69
9494.00	92.07	179.92	7000.73	2556.90 S	242.42 E	2558.17	0.66
9589.00	91.26	178.86	6997.97	2651.85 S	243.44 E	2653.13	1.40
9684.00	87.78	179.20	6998.76	2746.82 S	245.05 E	2748.11	3.69
9779.00	90.28	178.95	7000.37	2841.79 S	246.59 E	2843.08	2.64
9874.00	90.22	180.80	6999.96	2936.78 S	246.80 E	2938.07	1.95
9969.00	90.89	180.90	6999.04	3031.77 S	245.39 E	3033.05	0.72
10063.00	91.08	179.51	6997.42	3125.75 S	245.05 E	3127.03	1.49
10158.00	88.33	176.54	6997.90	3220.67 S	248.33 E	3221.97	4.26
10253.00	87.56	177.44	7001.30	3315.48 S	253.31 E	3316.80	1.25
10348.00	89.14	179.09	7004.04	3410.39 S	256.19 E	3411.73	2.40
10443.00	89.48	181.45	7005.19	3505.37 S	255.74 E	3506.71	2.51
10537.00	90.74	181.29	7005.01	3599.35 S	253.49 E	3600.66	1.36
10632.00	90.55	180.02	7003.94	3694.33 S	252.41 E	3695.64	1.35
10727.00	91.73	179.90	7002.05	3789.31 S	252.47 E	3790.62	1.24
10821.00	92.07	179.07	6998.93	3883.25 S	253.32 E	3884.57	0.96
10916.00	91.54	179.56	6995.94	3978.20 S	254.46 E	3979.52	0.76
11011.00	91.05	179.66	6993.79	4073.17 S	255.11 E	4074.49	0.53
11106.00	91.05	178.99	6992.06	4168.15 S	256.23 E	4169.48	0.70
11200.00	88.21	177.57	6992.67	4262.09 S	259.04 E	4263.43	3.38
11295.00	87.90	177.57	6995.89	4356.95 S	263.07 E	4358.31	0.32
11322.00	86.94	177.41	6997.10	4383.90 S	264.25 E	4385.27	3.60
11384.00	86.94	177.41	7000.41	4445.75 S	267.05 E	4447.13	0.01

# **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 CLOSURE OF 176.56 DEGREES (GRID)  
A TOTAL CORRECTION OF 8.08 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 11384.00 FEET  
IS 4453.76 FEET ALONG 176.56 DEGREES (GRID)**