

PCDC - Pressure Case Directional
PCGK - Pressure Case Gamma

1 : 240

Country : USA			
Field : Wattenberg			
Location : 40° 45' 34.47" North 103° 49' 9.65" West			
Well : Castor Federal LD13-78HN			
Company : Noble Energy			
Rig : H&P 322			
LOCATION			
Latitude : 40° 45' 34.47" North Longitude : 103° 49' 9.65" West			
UTM Easting = 3465568.525 ft UTM Northing = 1523970.548 ft			
Other Services Directional Drilling			
Company : Noble Energy			
Rig : H&P 322			
Well : Castor Federal LD13-78HN			
Field : Wattenberg			
Country : USA			
API Number : 05-123-37097			
Permanent Datum : Ground Level			
Elevation : 4628.00 ft			
Log Measured From : Drill Floor			
24.00 ft Above Permanent Datum			
Drilling Measured From : Drill Floor			
MD LOG			
Depth Logged : 1,242.00 ft To 9,888.00 ft			
Unit No. : 11210425			
Job No. : CA-XX-0900391394			
Date Logged : 23-May-13 To 29-May-13			
Total Depth MD : 9,888.00 ft TVD : 5,519.47 ft			
Plot Type : Final			
Spud Date : 23-May-13			
Plot Date : 29-May-13			
Run No.	Borehole Record (MD)		Run No.
	Size	To	
2	8.750 in	1242.00 ft	4747.00 ft
3	8.750 in	4747.00 ft	5313.00 ft
4	8.750 in	5313.00 ft	5876.00 ft
5	6.125 in	5876.00 ft	9,888.00 ft
	Casing Record (MD)		
	Size	Weight	From
	9.625 in	36.00 lbpf	SURFACE
	7.000 in	26.00 lbpf	SURFACE
			1242.00 ft
			5871.00 ft

WELL INFORMATION

MWD Run Number	100	200	300	400	
Date run completed	25-May-13	25-May-13	26-May-13	29-May-13	
Rig Bit Number	2	3	4	5	
Bit Size (in)	8.750	8.750	8.750	6.125	
Tool Nominal OD (in)	6.750	6.750	6.750	4.750	
Log Start Depth (MD, ft)	1,242.00	4,747.00	5,313.00	5,876.00	
Log End Depth (MD, ft)	4,747.00	5,313.00	5,876.00	9,888.00	
Drill or Wipe	Drill	Drill	Drill	Drill	
Drill/Wipe Start Date and Time	24-May-13 14:54	25-May-13 07:34	25-May-13 21:37	27-May-13 11:00	
Drill/Wipe End Date and Time	25-May-13 00:15	25-May-13 13:03	26-May-13 06:02	28-May-13 17:08	
Min Inc (deg) @ Depth (MD, ft)	0 @ 1,242.00	.49 @ 4,781.00	33.97 @ 5,316.00	87.66 @ 7,705.00	
Max Inc (deg) @ Depth (MD, ft)	13.45 @ 2,130.00	27.46 @ 5,256.00	81.96 @ 5,824.00	91.39 @ 9,698.00	
Bit TFA(in2) / Bit Type	.75 / PDC	.86 / PDC	.86 / PDC	.46 / PDC	
Flow Rate (gpm)	585.00	528.00	540.00	270.00	
Max AV (fpm) / CV (fpm) @ MWD	477.1 / 477.1	477.1 / 477.1	477.1 / 477.1	442.9 / 442.9	
Fluid Type	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel	
Density (ppg) / Viscosity (spqt)	8.43 / 27.00	9.65 / 38.00	9.65 / 38.00	10.30 / 38.00	
Filtrate CL (ppm)	2,100.00	1,900.00	1,900.00	1,700.00	
pH / Fluid Loss (mptm)	11.50 / N/A	10.00 / N/A	10.00 / N/A	8.80 / N/A	
PV (cP) / YP (lbf2)	1 / 3.00	14 / 9.00	14 / 9.00	13 / 12.00	
% Solids / % Sand	0.40 / 0.10	8.50 / 0.35	8.50 / 0.35	9.20 / 1.00	
% Oil / Oil:Water Ratio	N/A / N/A	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	N/A @ N/A	
Rmf @ Measured Temp (degF)	N/A @ N/A	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	N/A @ N/A	

Max Tool Temp (degF) / Source	137.50 / PCM	158.47 / PCM	158.47 / PCM	200.80 / PCM	
Rm @ Max Tool Temp (degF)	.7401 @ 137.50	.6462 @ 158.47	.6462 @ 158.47	.5144 @ 200.80	
Lead MWD Engineer	Osahon Igunbor	Osahon Igunbor	Osahon Igunbor	Osahon Igunbor	
Customer Representative	Jeremy Stolz	Jeremy Stolz	Jeremy Stolz	Jeremy Stolz	

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM	PCM	PCM	PCM	
Software Version	5.84	5.84	5.84	5.84	
Sub Serial Number	161211	161211	161211	11718501	
Insert Serial Number	11145581	11145581	11145581	10868872	
Date and Time Initialized	23-May-13 21:27	23-May-13 21:27	23-May-13 21:27	27-May-13 00:14	
Date and Time Read	26-May-13 20:58	26-May-13 20:53	26-May-13 20:47	29-May-13 04:29	
ECMB SW Version	N/A	N/A	N/A	N/A	

Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC	PCDC	
Distance From Bit (ft)	54.00	55.00	52.00	62.00	
Software Version	6.21	6.21	6.21	6.21	
Sub Serial Number	161211	161211	161211	11718501	
Sonde Serial Number	11833052	11833052	11833052	11638497	
Sensor ID Number	N/A	N/A	N/A	N/A	
Toolface Offset (deg)	10.13	349.14	158.70	100.13	

Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG	PCG	
Distance From Bit (ft)	47.69	48.25	45.48	55.13	
Recorded Sample Period (sec)	10	10	10	10	
Software Version	8.15	8.15	8.15	8.15	
Sub Serial Number	161211	161211	161211	11718501	
Insert/Sonde Serial Number	11579768	11579768	11579768	11579852	

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

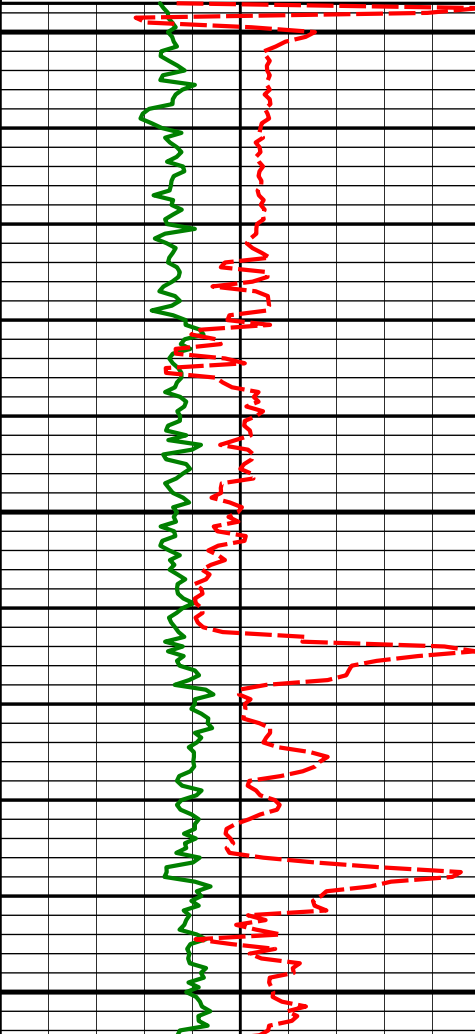
WARRANTY

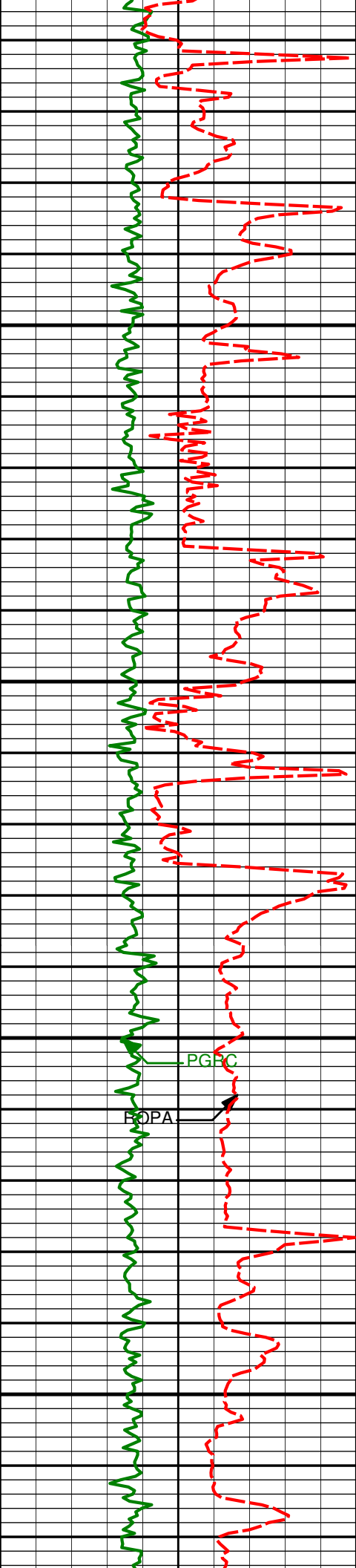
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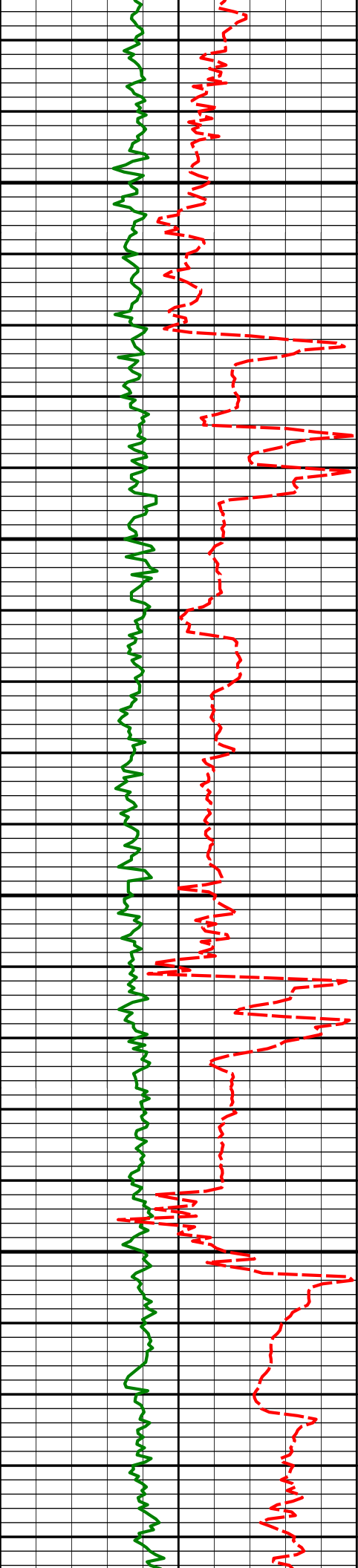
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MD Detail Log 1:240

Gamma Ray (PGRC) (Api)							
0300							
Avg Rate of Penetration feet per hr		Feet					
6000			Depth	Inc	Azm	TVDVsec	
		4750'					
		Run 200					
		4781'	0.49°	141.20°	4760.80'	231.85'	
		4800'					
		KOP					
		4828'	2.87°	171.02°	4807.78'	233.17'	
		4850'					



4876'	6.25°	173.80°	4855.62'	236.97'
4900'				
4923'	7.62°	176.74°	4902.27'	242.64'
4950'				
4971'	9.24°	172.64°	4949.75'	249.66'
5000'				
5050'				
5066'	17.85°	176.96°	5042.03'	271.85'



5100'

5150'

5200'

5250'

5161'

22.18°

180.89°

5131.27'

304.33'

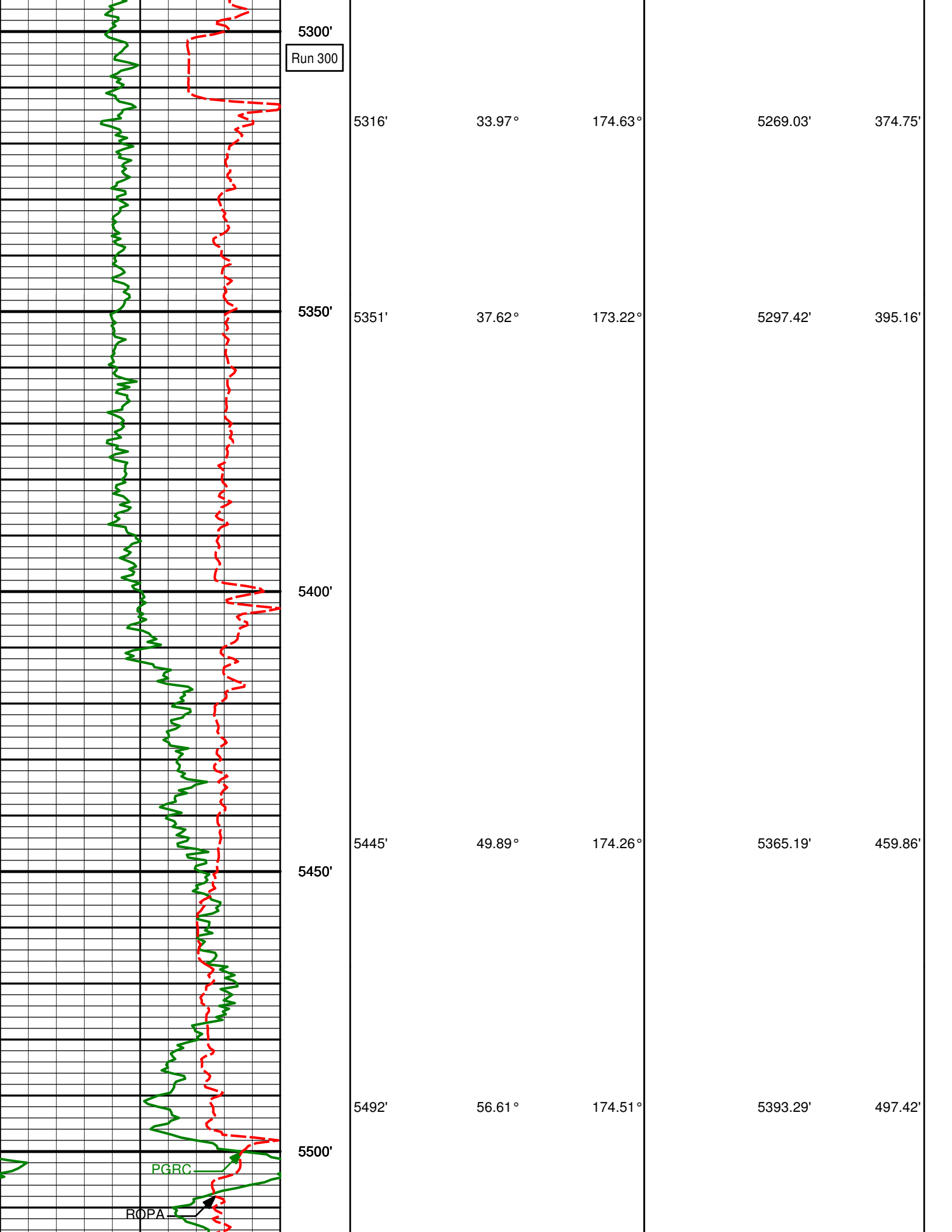
5256'

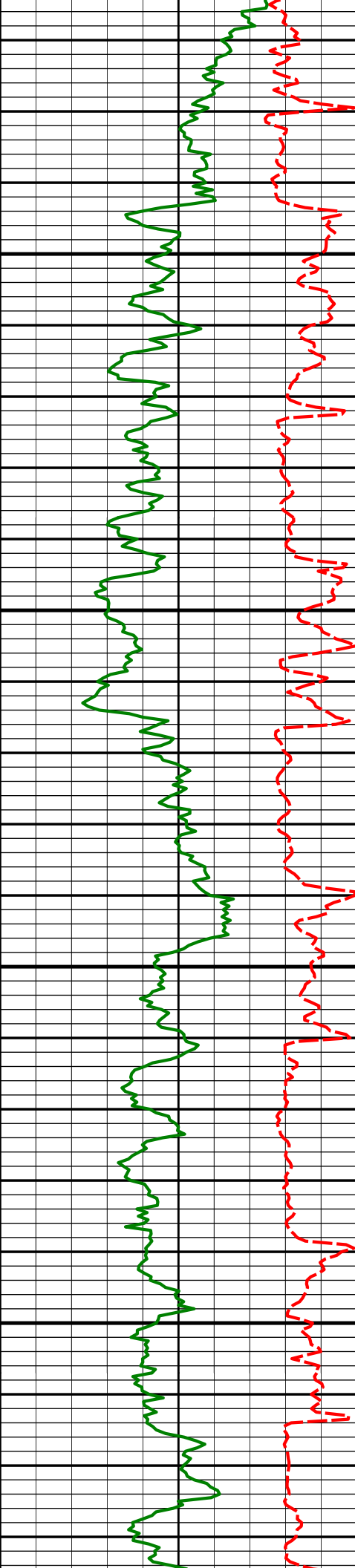
27.46°

175.94°

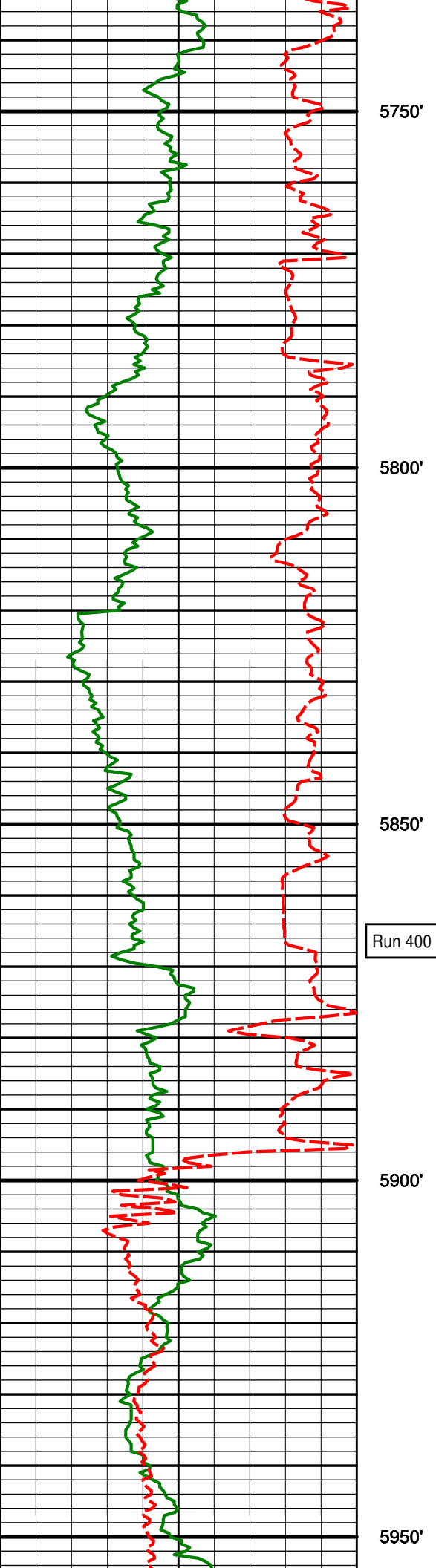
5217.48'

344.16'





5540'	62.38°	174.23°	5417.64'	538.68'
5550'				
5587'	65.59°	175.11°	5438.25'	580.83'
5600'				
5635'	68.83°	176.69°	5456.84'	625.05'
5650'				
5682'	71.17°	178.50°	5472.92'	669.21'
5700'				
5730'	74.19°	178.75°	5487.21'	715.02'



Run 400

5750'

5800'

5850'

5900'

5950'

5824'

81.96°

179.53°

5506.61'

806.91'

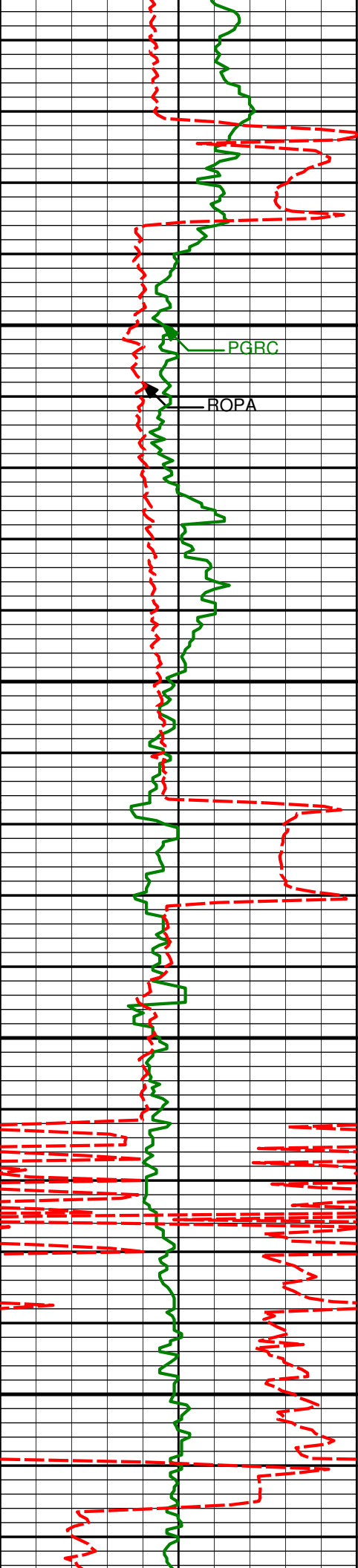
5911'

89.26°

178.10°

5513.27'

893.59'



6000'

6004'

89.51°

178.83°

5514.27'

986.58'

6050'

6100'

6097'

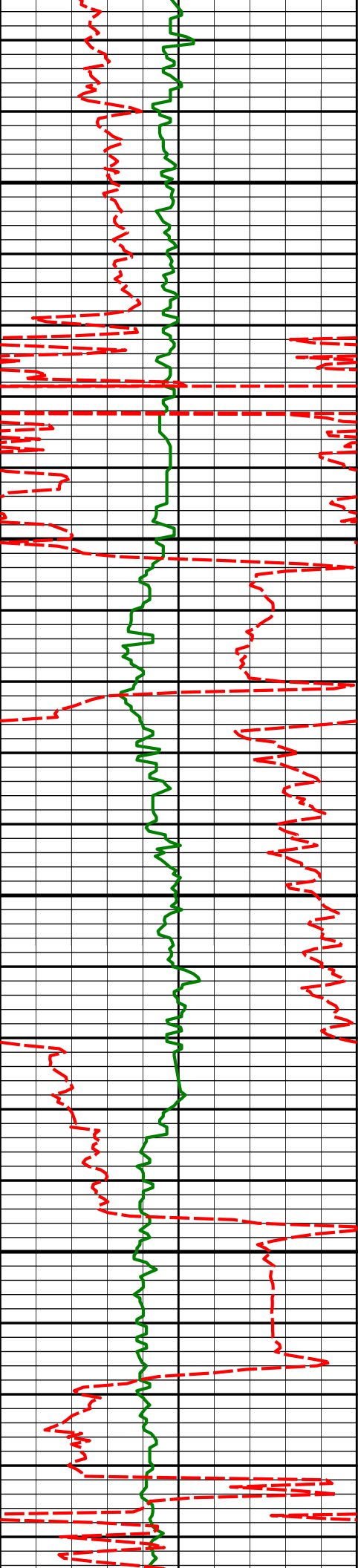
88.30°

178.34°

5516.04'

1079.55'

6150'



6190'

88.09°

176.35°

5518.97'

1172.50'

6200'

6250'

6283'

91.20°

176.11°

5519.55'

1265.43'

6300'

6350'

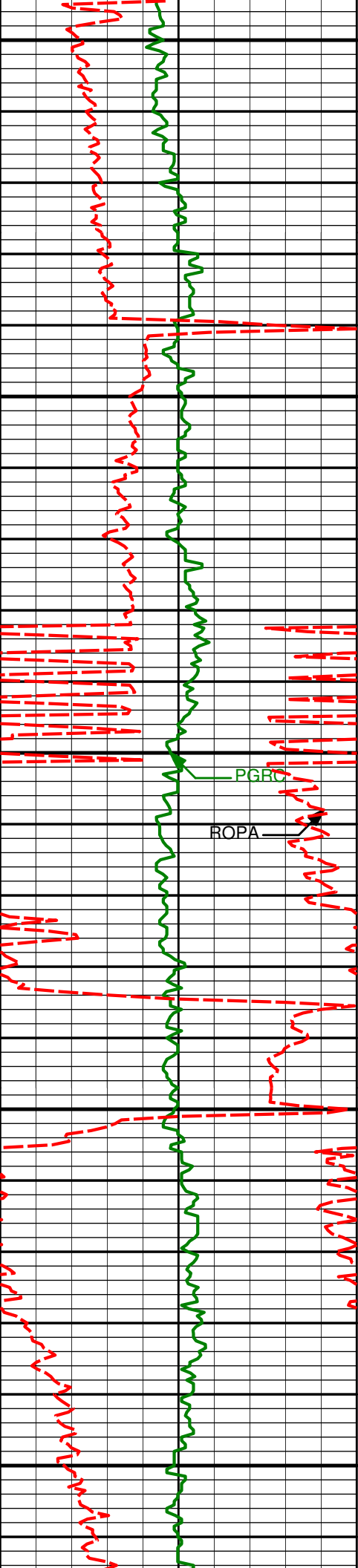
6376'

89.66°

177.78°

5518.85'

1358.41'



6400'

6450'

6471'

89.63°

176.40°

5519.44'

1453.39'

6500'

PGRC

ROPA

6550'

6566'

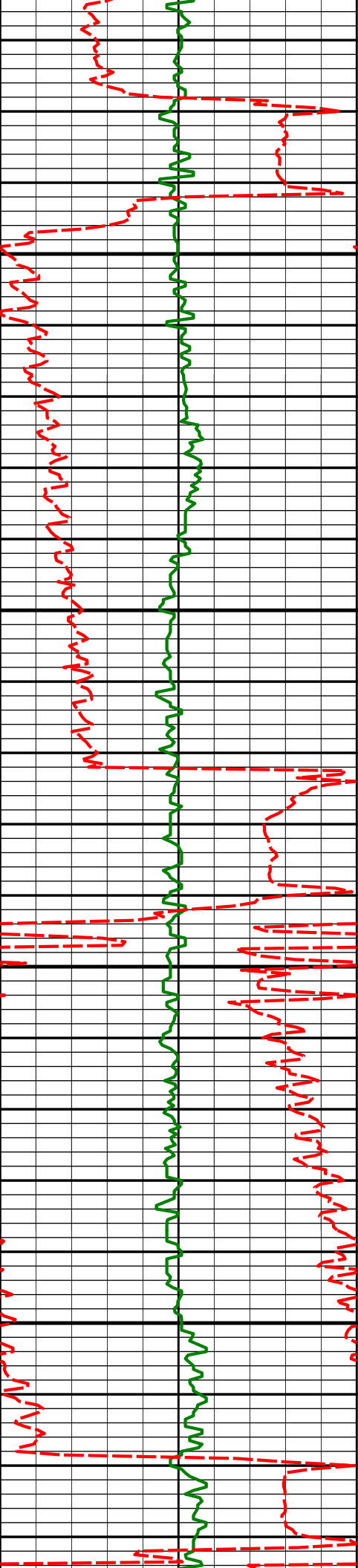
90.83°

178.10°

5519.05'

1548.37'

6600'



6650'

6661'

89.78°

178.67°

5518.54'

1643.37'

6700'

6750'

6756'

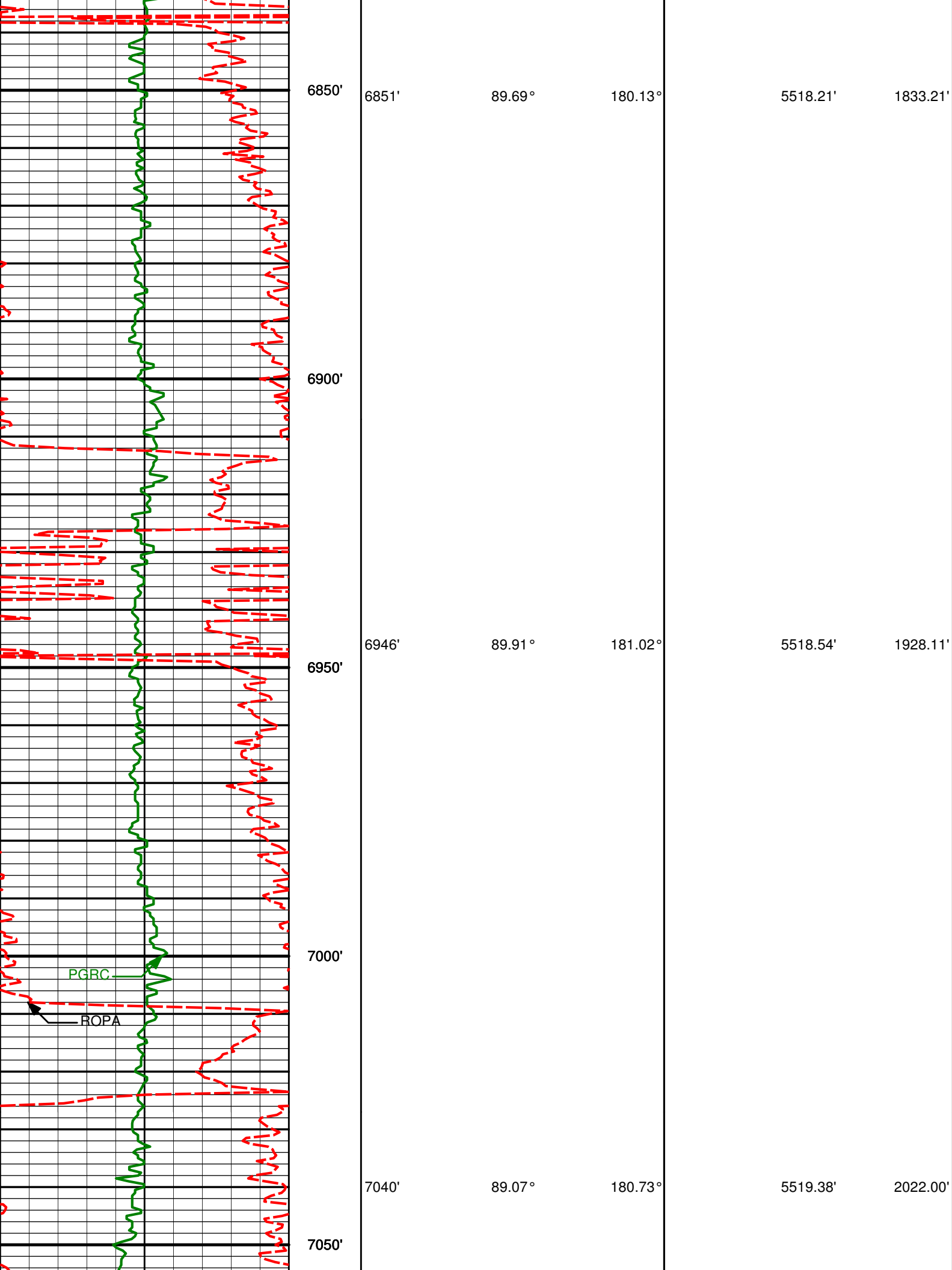
90.46°

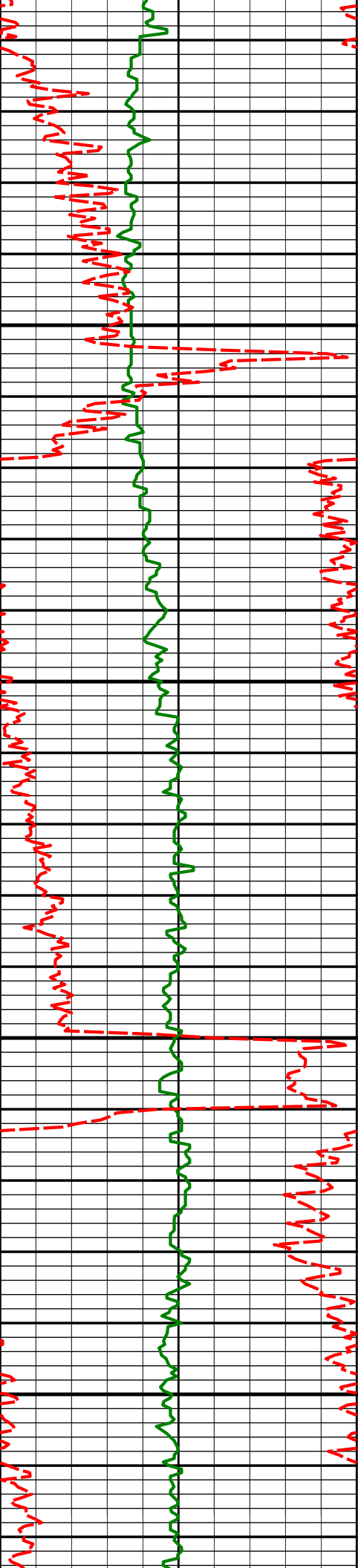
181.27°

5518.34'

1738.31'

6800'





7100'

7135'

89.81°

180.20°

5520.30'

2116.91'

7150'

7200'

7230'

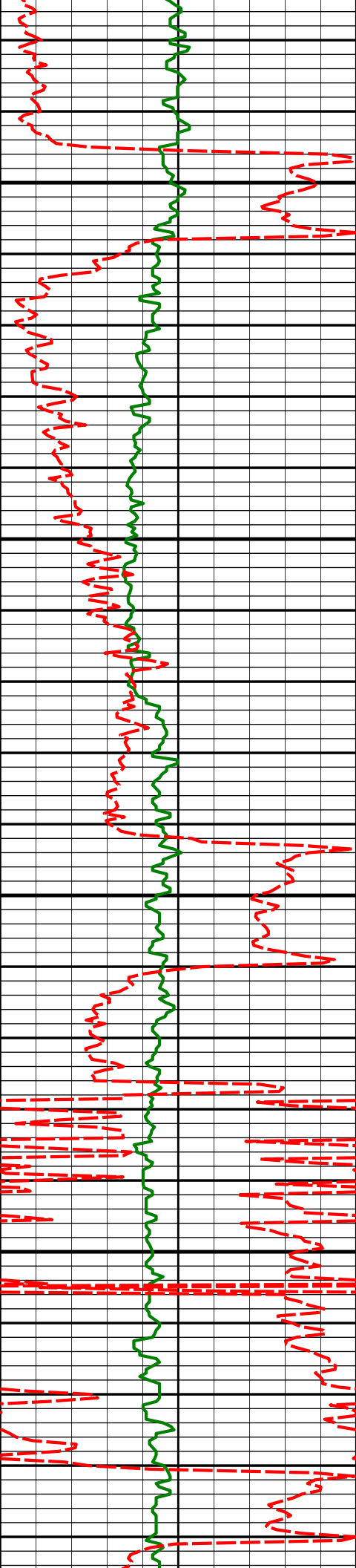
89.78°

178.40°

5520.63'

2211.88'

7250'



7300'

7325'

91.14°

179.57°

5519.87'

2306.86'

7350'

7400'

7420'

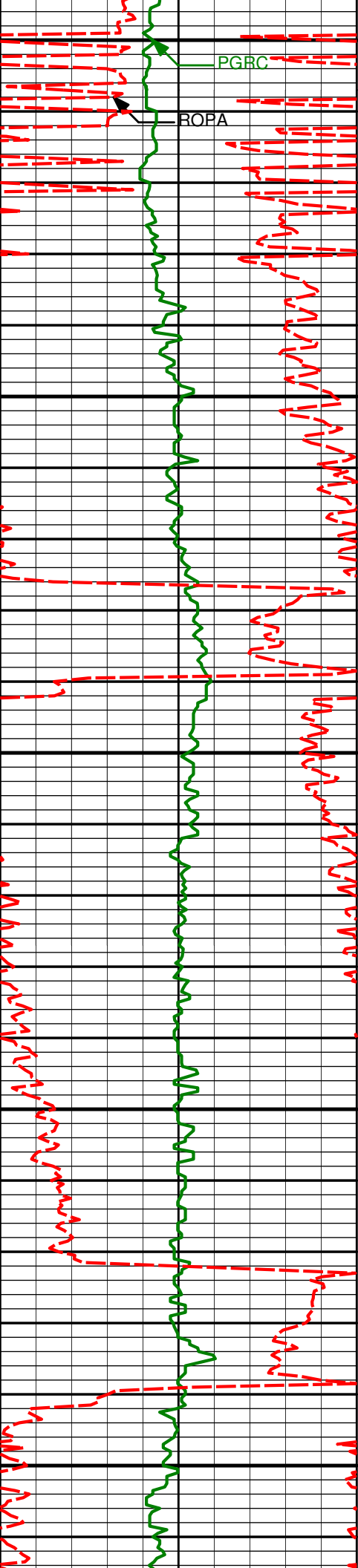
89.82°

178.29°

5519.07'

2401.85'

7450'



7500'

PGRC

ROPA

7515'

90.52°

178.42°

5518.79'

2496.84'

7550'

7600'

7610'

90.74°

177.24°

5517.75'

2591.84'

7650'

7700'

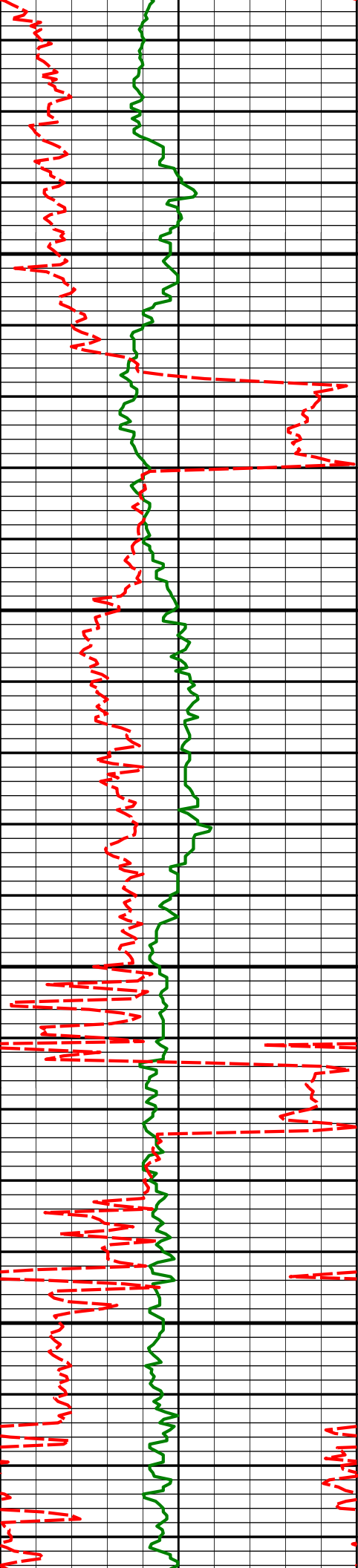
7705'

87.66°

175.43°

5519.07'

2686.77'



7750'

7800'

7850'

7900'

7800'

88.86°

176.64°

5521.96'

2781.66'

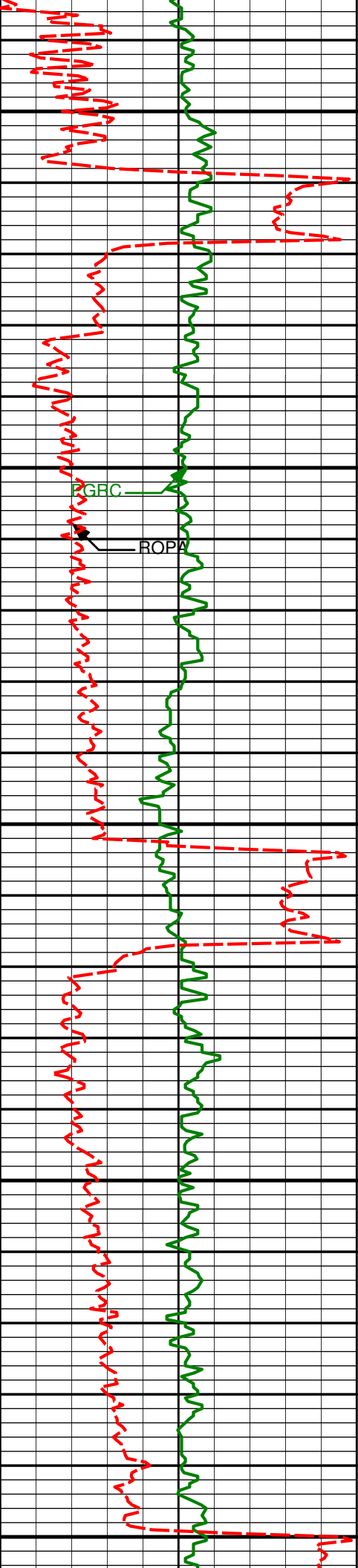
7895'

90.68°

178.26°

5522.34'

2876.65'



7950'

7989'

8000'

8050'

8084'

8100'

8150'

90.68°

177.65°

5521.23'

2970.64'

89.66°

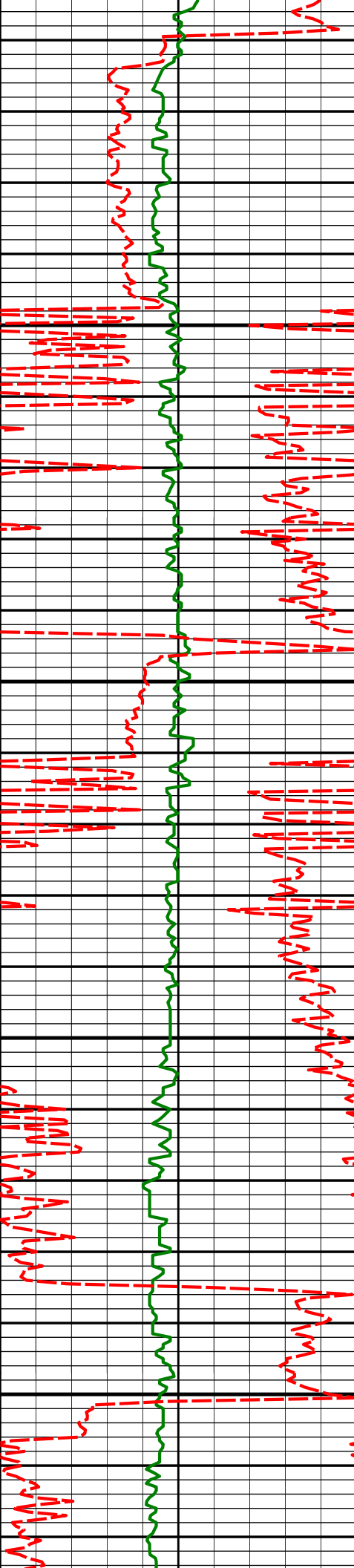
178.18°

5520.95'

3065.64'

GBC

ROPV



8179'

89.17°

177.92°

5521.92'

3160.63'

8200'

8250'

8274'

91.02°

178.73°

5521.77'

3255.62'

8300'

8350'

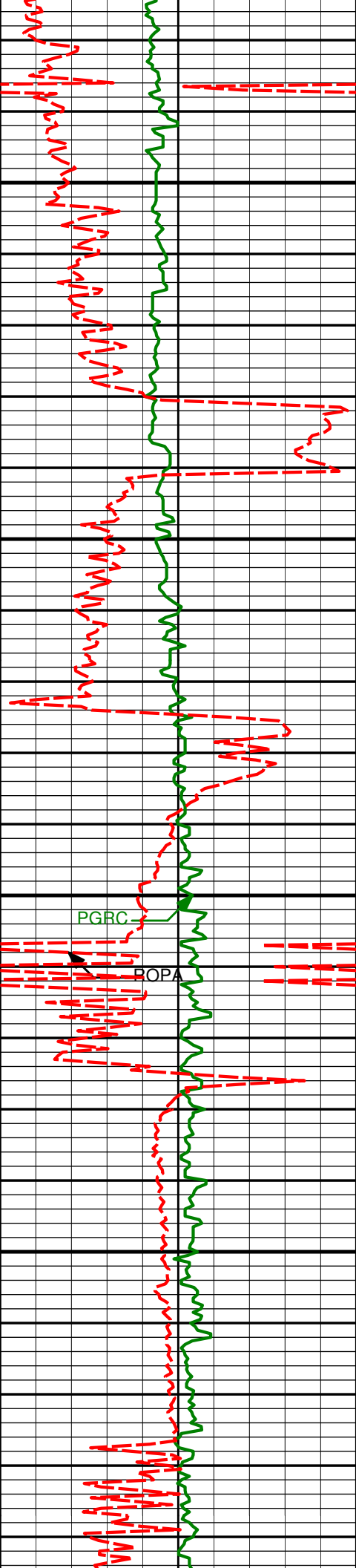
8369'

89.88°

178.43°

5521.02'

3350.62'



8400'

8450'

8500'

8550'

8464'

8559'

89.17°

90.06°

177.45°

178.34°

5521.82'

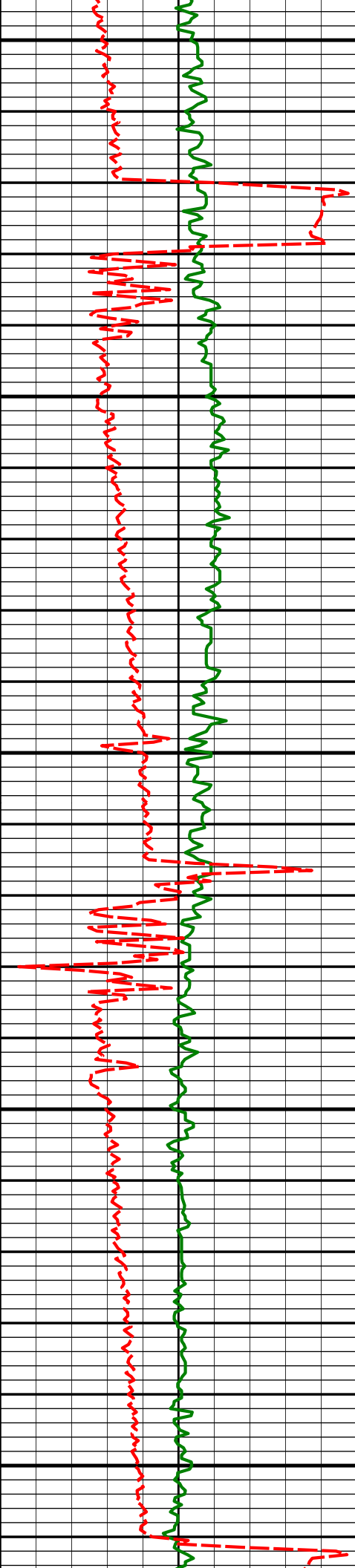
5522.46'

3445.61'

3540.61'

PGRC

POPA



8600'

8650'

8700'

8750'

8800'

8654'

89.51°

177.57°

5522.81'

3635.60'

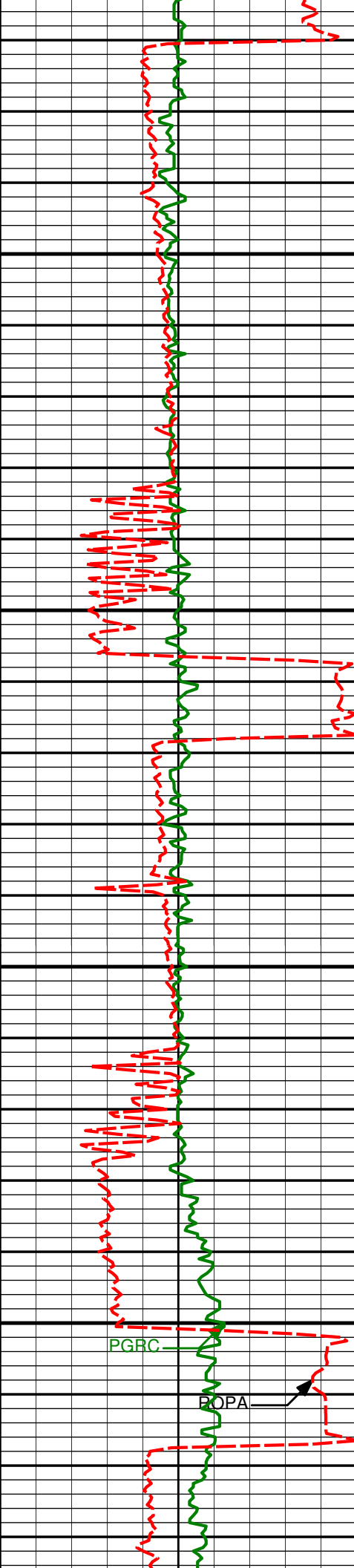
8749'

90.09°

177.02°

5523.15'

3730.59'



8850'

8844'

90.15°

178.18°

5522.94'

3825.59'

8900'

8938'

90.25°

177.80°

5522.61'

3919.59'

8950'

9000'

PGRC

BOPA

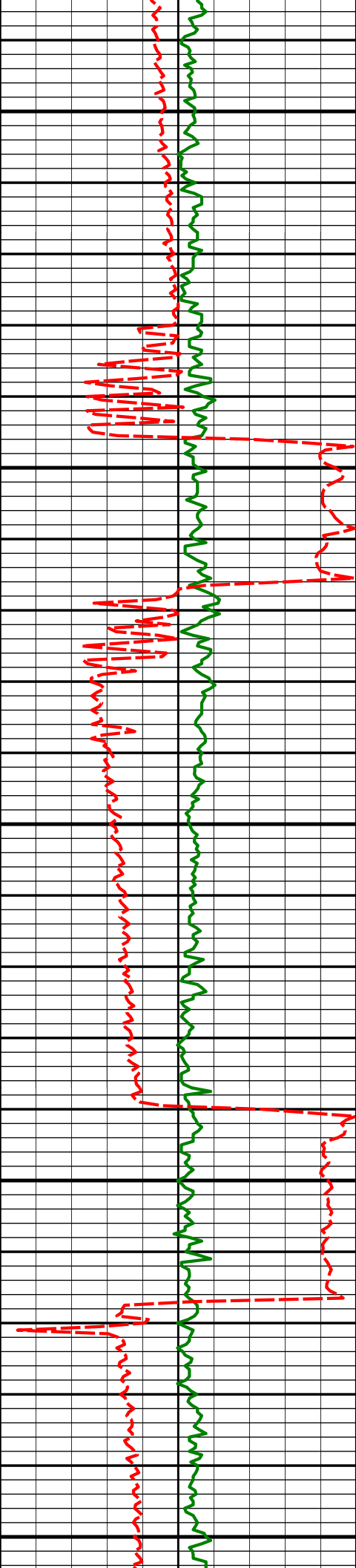
9033'

90.92°

179.35°

5521.65'

4014.58'



9050'

9100'

9150'

9200'

9250'

9128'

90.62°

178.72°

5520.37'

4109.55'

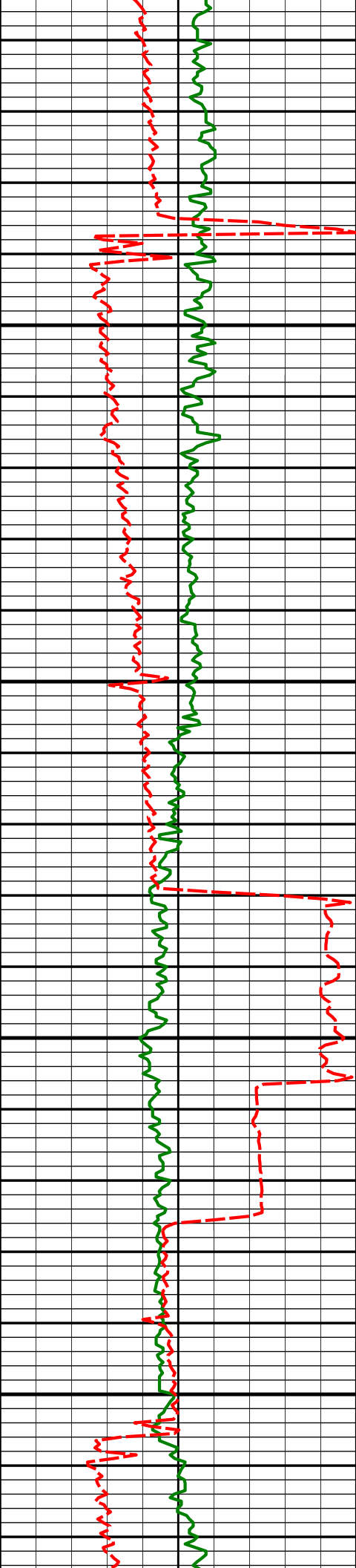
9223'

88.92°

180.11°

5520.75'

4204.52'



9300'

9318'

91.14°

181.30°

5520.70'

4299.42'

9350'

9400'

9413'

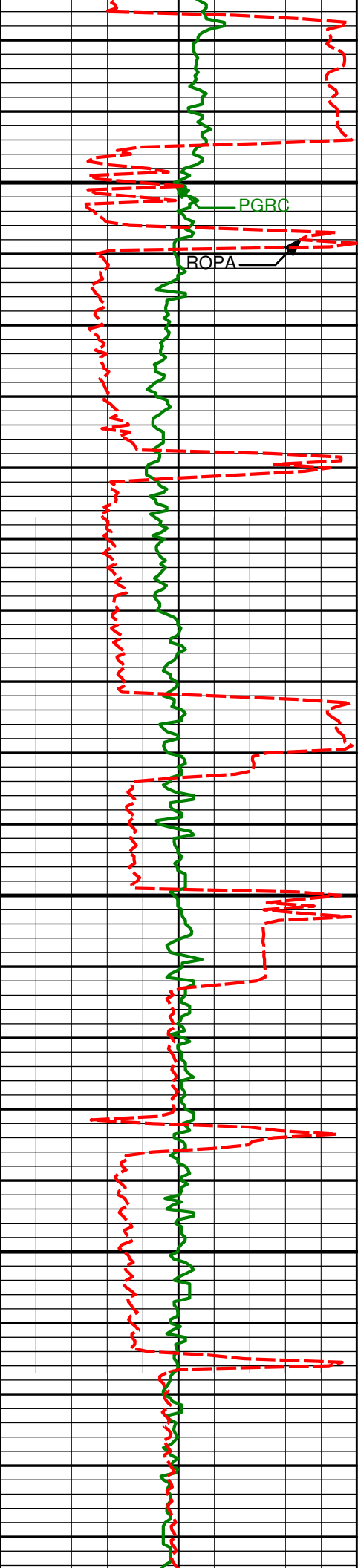
90.28°

180.50°

5519.52'

4394.29'

9450'



9500'

9508'

89.01°

179.89°

5520.11'

4489.22'

9550'

9600'

9603'

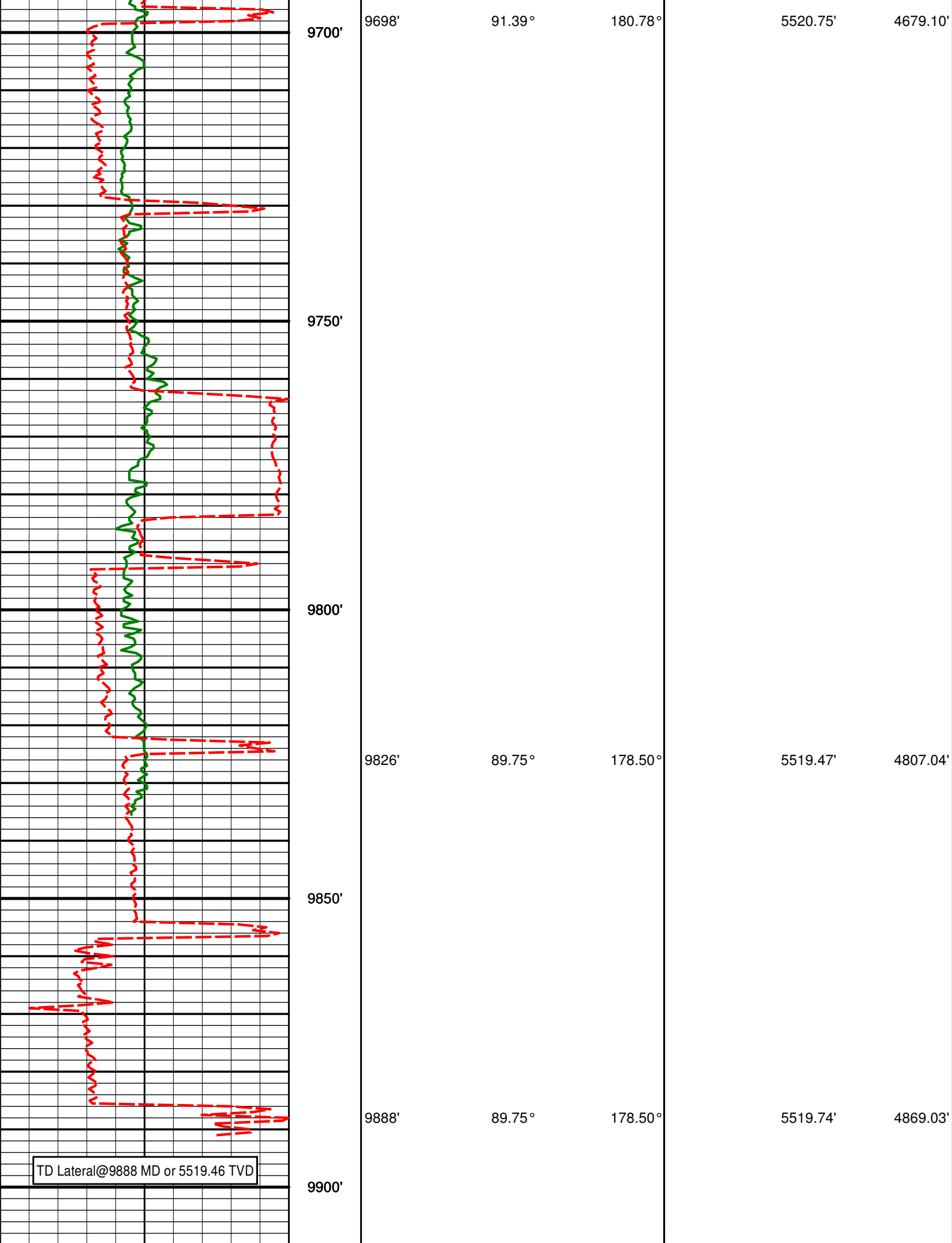
89.41°

179.53°

5521.41'

4584.17'

9650'



Avg Rate of Penetration

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



HALLIBURTON

DIRECTIONAL SURVEY REPORT

Noble Energy
Castor Federal LD13-78HN
Wattenberg
Weld Colorado
USA
CA-XX-0900391394

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
275.00	0.30	248.20	275.00	0.27 S	0.67 W	0.24	0.11
597.00	0.20	281.70	597.00	0.47 S	2.00 W	0.40	0.05
900.00	0.20	194.80	899.99	0.87 S	2.65 W	0.78	0.09
1242.00	0.00	72.70	1241.99	1.45 S	2.81 W	1.35	0.06
1280.00	0.45	208.68	1279.99	1.58 S	2.88 W	1.48	1.18
1373.00	1.76	175.33	1372.97	3.32 S	2.94 W	3.22	1.52
1466.00	1.59	164.58	1465.94	5.99 S	2.48 W	5.91	0.39
1561.00	1.97	163.39	1560.89	8.83 S	1.66 W	8.77	0.41
1655.00	5.49	182.90	1654.68	14.87 S	1.42 W	14.81	3.92
1750.00	7.11	172.21	1749.11	25.23 S	0.86 W	25.19	2.10
1845.00	9.62	175.13	1843.09	38.96 S	0.61 E	38.96	2.68
1940.00	13.06	181.93	1936.22	57.61 S	0.93 E	57.60	3.88
2035.00	12.21	179.91	2028.92	78.38 S	0.58 E	78.36	1.00
2130.00	13.45	175.30	2121.55	99.44 S	1.51 E	99.44	1.69
2225.00	12.69	172.70	2214.09	120.81 S	3.74 E	120.87	1.02
2319.00	12.43	173.61	2305.84	141.10 S	6.17 E	141.23	0.35
2414.00	13.27	177.55	2398.46	162.15 S	7.78 E	162.32	1.28
2509.00	11.37	184.45	2491.27	182.39 S	7.52 E	182.54	2.52
2604.00	8.28	179.64	2584.87	198.57 S	6.83 E	198.69	3.37
2700.00	5.06	173.94	2680.21	209.70 S	7.33 E	209.83	3.41
2795.00	3.08	190.66	2774.97	216.38 S	7.30 E	216.50	2.41
2890.00	1.80	179.05	2869.88	220.38 S	6.85 E	220.49	1.44
2985.00	0.81	235.76	2964.86	222.25 S	6.31 E	222.34	1.59
3080.00	0.66	233.65	3059.85	222.95 S	5.32 E	223.01	0.17
3175.00	0.39	281.90	3154.85	223.21 S	4.56 E	223.24	0.52
3270.00	0.32	269.85	3249.84	223.14 S	3.97 E	223.15	0.11
3365.00	0.47	271.90	3344.84	223.13 S	3.32 E	223.12	0.15
3460.00	0.43	246.86	3439.84	223.26 S	2.61 E	223.22	0.21
3555.00	0.31	199.38	3534.84	223.64 S	2.19 E	223.59	0.34
3650.00	0.71	159.72	3629.83	224.43 S	2.31 E	224.39	0.54
3745.00	0.57	196.97	3724.83	225.44 S	2.38 E	225.39	0.45
3839.00	0.35	181.56	3818.82	226.17 S	2.23 E	226.12	0.26
3934.00	0.38	169.88	3913.82	226.77 S	2.28 E	226.72	0.08
4030.00	0.48	158.85	4009.82	227.46 S	2.48 E	227.41	0.14
4124.00	0.48	158.99	4103.82	228.19 S	2.77 E	228.16	0.00
4219.00	0.67	173.78	4198.81	229.12 S	2.97 E	229.09	0.25
4314.00	0.40	211.30	4293.81	229.96 S	2.86 E	229.93	0.45
4409.00	0.35	248.77	4388.81	230.35 S	2.42 E	230.30	0.26
4503.00	0.07	168.86	4482.81	230.51 S	2.16 E	230.45	0.36
4598.00	0.28	150.38	4577.81	230.76 S	2.29 E	230.71	0.22
4693.00	0.46	147.73	4672.80	231.28 S	2.60 E	231.24	0.19
4781.00	0.49	141.20	4760.80	231.87 S	3.03 E	231.85	0.07
4828.00	2.87	171.02	4807.78	233.19 S	3.34 E	233.17	5.22
4876.00	6.25	173.80	4855.62	236.98 S	3.81 E	236.97	7.05

4923.00	7.62	176.74	4902.27	242.64 S	4.26 E	242.64	3.02
4971.00	9.24	172.64	4949.75	249.64 S	4.93 E	249.66	3.59
5066.00	17.85	176.96	5042.03	271.78 S	6.69 E	271.85	9.12
5161.00	22.18	180.89	5131.27	304.26 S	7.18 E	304.33	4.77
5256.00	27.46	175.94	5217.48	344.07 S	8.45 E	344.16	5.97
5316.00	33.97	174.63	5269.03	374.59 S	11.00 E	374.75	10.91
5351.00	37.62	173.22	5297.42	394.94 S	13.18 E	395.16	10.70
5445.00	49.89	174.26	5365.19	459.44 S	20.19 E	459.86	13.07
5492.00	56.61	174.51	5393.29	496.90 S	23.87 E	497.42	14.31
5540.00	62.38	174.23	5417.64	538.04 S	27.93 E	538.68	12.03
5587.00	65.59	175.11	5438.25	580.09 S	31.85 E	580.83	7.03
5635.00	68.83	176.69	5456.84	624.23 S	35.01 E	625.05	7.40
5682.00	71.17	178.50	5472.92	668.35 S	36.86 E	669.21	6.14
5730.00	74.19	178.75	5487.21	714.15 S	37.96 E	715.02	6.31
5824.00	81.96	179.53	5506.61	806.04 S	39.34 E	806.91	8.31
5911.00	89.26	178.10	5513.27	892.71 S	41.14 E	893.59	8.55
6004.00	89.51	178.83	5514.27	985.67 S	43.63 E	986.58	0.82
6097.00	88.30	178.34	5516.04	1078.62 S	45.93 E	1079.55	1.39
6190.00	88.09	176.35	5518.97	1171.47 S	50.23 E	1172.50	2.15
6283.00	91.20	176.11	5519.55	1264.26 S	56.34 E	1265.43	3.36
6376.00	89.66	177.78	5518.85	1357.12 S	61.29 E	1358.41	2.44
6471.00	89.63	176.40	5519.44	1451.99 S	66.12 E	1453.39	1.46
6566.00	90.83	178.10	5519.05	1546.87 S	70.68 E	1548.37	2.19
6661.00	89.78	178.67	5518.54	1641.83 S	73.36 E	1643.37	1.26
6756.00	90.46	181.27	5518.34	1736.82 S	73.40 E	1738.31	2.83
6851.00	89.69	180.13	5518.21	1831.81 S	72.23 E	1833.21	1.45
6946.00	89.91	181.02	5518.54	1926.81 S	71.27 E	1928.11	0.96
7040.00	89.07	180.73	5519.38	2020.79 S	69.83 E	2022.00	0.94
7135.00	89.81	180.20	5520.30	2115.78 S	69.06 E	2116.91	0.96
7230.00	89.78	178.40	5520.63	2210.77 S	70.22 E	2211.88	1.89
7325.00	91.14	179.57	5519.87	2305.75 S	71.90 E	2306.86	1.88
7420.00	89.82	178.29	5519.07	2400.73 S	73.67 E	2401.85	1.94
7515.00	90.52	178.42	5518.79	2495.69 S	76.39 E	2496.84	0.76
7610.00	90.74	177.24	5517.75	2590.61 S	79.98 E	2591.84	1.26
7705.00	87.66	175.43	5519.07	2685.39 S	86.06 E	2686.77	3.77
7800.00	88.86	176.64	5521.96	2780.12 S	92.62 E	2781.66	1.80
7895.00	90.68	178.26	5522.34	2875.01 S	96.85 E	2876.65	2.56
7989.00	90.68	177.65	5521.23	2968.95 S	100.20 E	2970.64	0.65
8084.00	89.66	178.18	5520.95	3063.88 S	103.66 E	3065.64	1.21
8179.00	89.17	177.92	5521.92	3158.82 S	106.88 E	3160.63	0.59
8274.00	91.02	178.73	5521.77	3253.78 S	109.66 E	3255.62	2.12
8369.00	89.88	178.43	5521.02	3348.74 S	112.01 E	3350.62	1.24
8464.00	89.17	177.45	5521.82	3443.68 S	115.43 E	3445.61	1.27
8559.00	90.06	178.34	5522.46	3538.61 S	118.92 E	3540.61	1.33
8654.00	89.51	177.57	5522.81	3633.55 S	122.31 E	3635.60	1.00
8749.00	90.09	177.02	5523.15	3728.44 S	126.79 E	3730.59	0.84
8844.00	90.15	178.18	5522.94	3823.35 S	130.77 E	3825.59	1.22
8938.00	90.25	177.80	5522.61	3917.30 S	134.06 E	3919.59	0.41
9033.00	90.92	179.35	5521.65	4012.26 S	136.42 E	4014.58	1.77
9128.00	90.62	178.72	5520.37	4107.24 S	138.03 E	4109.55	0.74
9223.00	88.92	180.11	5520.75	4202.22 S	139.01 E	4204.52	2.31
9318.00	91.14	181.30	5520.70	4297.21 S	137.84 E	4299.42	2.65
9413.00	90.28	180.50	5519.52	4392.19 S	136.35 E	4394.29	1.23
9508.00	89.01	179.89	5520.11	4487.18 S	136.03 E	4489.22	1.48
9603.00	89.41	179.53	5521.41	4582.17 S	136.52 E	4584.17	0.57
9698.00	91.39	180.78	5520.75	4677.16 S	136.26 E	4679.10	2.46
9826.00	89.75	178.50	5519.47	4805.14 S	137.06 E	4807.04	2.20
9888.00	89.75	178.50	5519.74	4867.12 S	138.69 E	4869.03	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 DIRECTION OF 178.08 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 9888.00 FEET
IS 4869.10 FEET ALONG 178.37 DEGREES (GRID)**

Casing set at 5871 ft.

Surveys at 275 ft, 597 ft, 900 ft and 1242 ft were taken and provided by HP 322 while they were drilling the surface hole.

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