

# DGR Dual Gamma Ray Magnetic Wave Resistivity

[illegible]

## WELL INFORMATION

<b>MWD Run Number</b>	200				
<b>Date run completed</b>	19-Aug-13				
<b>Rig Bit Number</b>	0200				
<b>Bit Size (in)</b>	6.125				
<b>Tool Nominal OD (in)</b>	4.750				
<b>Log Start Depth (MD, ft)</b>	8,235.00				
<b>Log End Depth (MD, ft)</b>	12,395.00				
<b>Drill or Wipe</b>	Drill				
<b>Drill/Wipe Start Date and Time</b>	17-Aug-13 19:45				
<b>Drill/Wipe End Date and Time</b>	19-Aug-13 06:20				
<b>Min Inc (deg) @ Depth (MD, ft)</b>	88.15 @ 12,342.00				
<b>Max Inc (deg) @ Depth (MD, ft)</b>	91.42 @ 10,945.00				
<b>Bit TFA(in2) / Bit Type</b>	1.53 / PDC				
<b>Flow Rate (gpm)</b>	298.67				
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	N/A / N/A				
<b>Fluid Type</b>	Native/Spud Mud				
<b>Density (ppg) / Viscosity (spqt)</b>	9.40 / 40.00				
<b>Filtrate CL (ppm)</b>	1,300.00				
<b>pH / Fluid Loss (mptm)</b>	8.50 / 3				
<b>PV (cP) / YP (lbf2)</b>	9 / 8.00				
<b>% Solids / % Sand</b>	6.50 / 0.00				
<b>% Oil / Oil:Water Ratio</b>	4.00 / N/A				
<b>Rm @ Measured Temp (degF)</b>	N/A @ N/A				
<b>Rmf @ Measured Temp (degF)</b>	N/A @ N/A				
<b>Rmc @ Measured Temp (degF)</b>	N/A @ N/A				
<b>Max Tool Temp (degF) / Source</b>	233.18 / HCIM				
<b>Rm @ Max Tool Temp (degF)</b>	N/A @ 233.18				
<b>Lead MWD Engineer</b>	Clay Wass				
<b>Customer Representative</b>					

SENSOR INFORMATION					
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Downhole Processor Information					
Tool Type	HCIM				
Software Version	88.56				
Sub Serial Number	047269				
Insert Serial Number	11436722				
Date and Time Initialized	17-Aug-13 11:07				
Date and Time Read	19-Aug-13 23:39				
ECMB SW Version	N/A				

Directional Sensor Information					
Tool Type	PCDC				
Distance From Bit (ft)	50.93				
Software Version	6.21				
Sub Serial Number	11917160				
Sonde Serial Number	11478086				
Sensor ID Number	N/A				
Toolface Offset (deg)	256.39				

Gamma Ray Sensor Information					
Tool Type	DGR				
Distance From Bit (ft)	72.87				
Recorded Sample Period (sec)	8				
Software Version	N/A				
Sub Serial Number	047296				
Insert/Sonde Serial Number	266030				

Resistivity Sensor Information					
Tool Type	Slim P4				
Distance From Bit (ft)	65.87				
Recorded Sample Period (sec)	10				
Software Version	5.55				
Sub Serial Number	47296				
Receiver Insert Serial Number	260883				
Transmitter Insert Serial Number	11062260				
Receiver Orientation	Down				

Pulser Controller Sensor Information					
Tool Type	PCM				
Software Version	8.04				
PIC Software Version					
Sub/HOC Serial Number	11644599				
Insert/Probe/Module SN	11400950				
Battery Serial Number	N/A				
Valve Insert SN	N/A				
DC Insert Serial Number	N/A				
Choke Size (32nd)	N/A				
Driver Current (amps)	N/A				
Driver SMI Current (amps)	N/A				
Boot Strap Version					

DDSr-DGR Sensor Information					
Tool Type	DDSr-DGR				
Distance From Bit (ft)	75.77				
Recorded Sample Period (sec)	12				
Software Version	10.88				

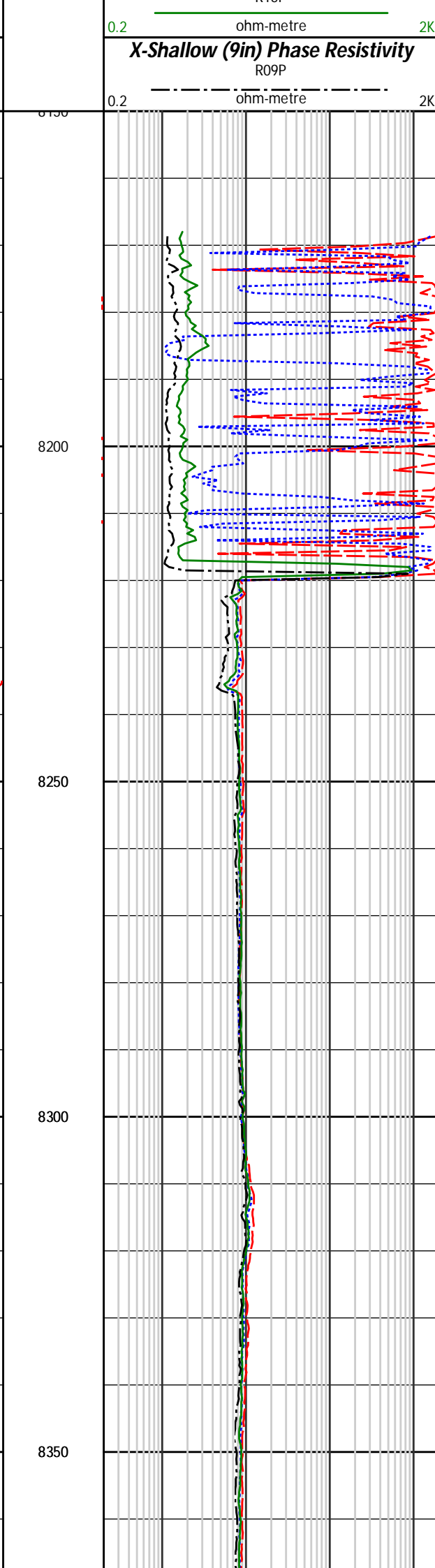
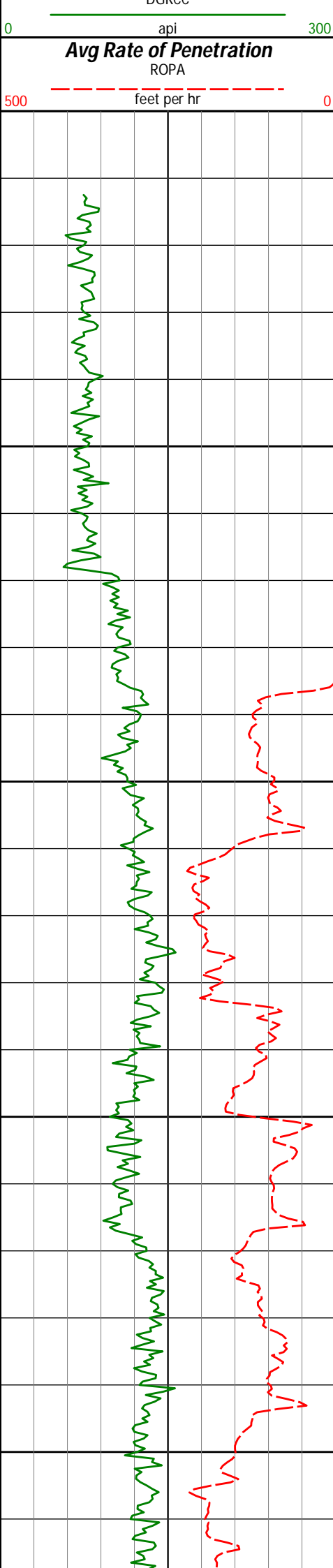
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Insert Serial Number	11270370				
Sensor ID Number	7035				

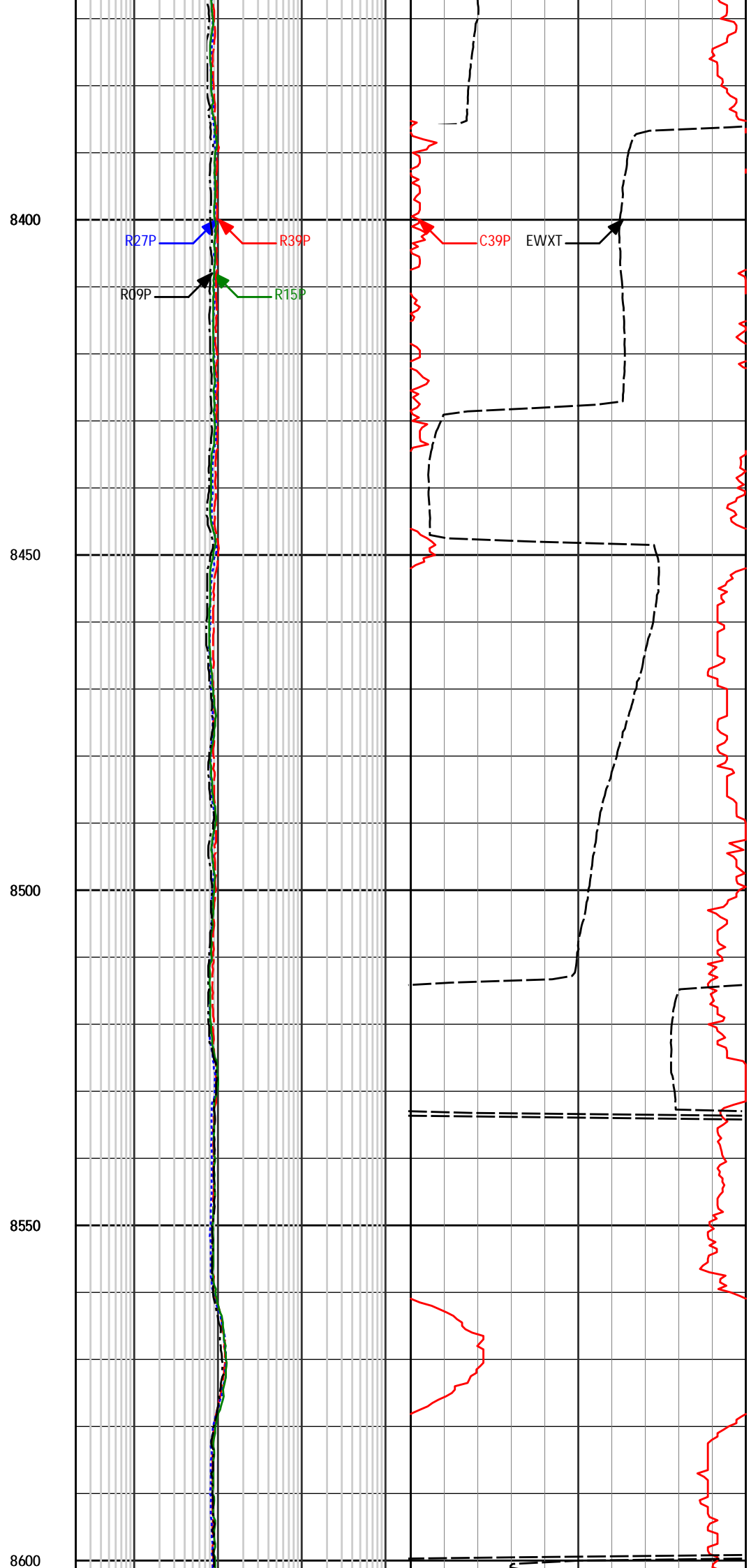
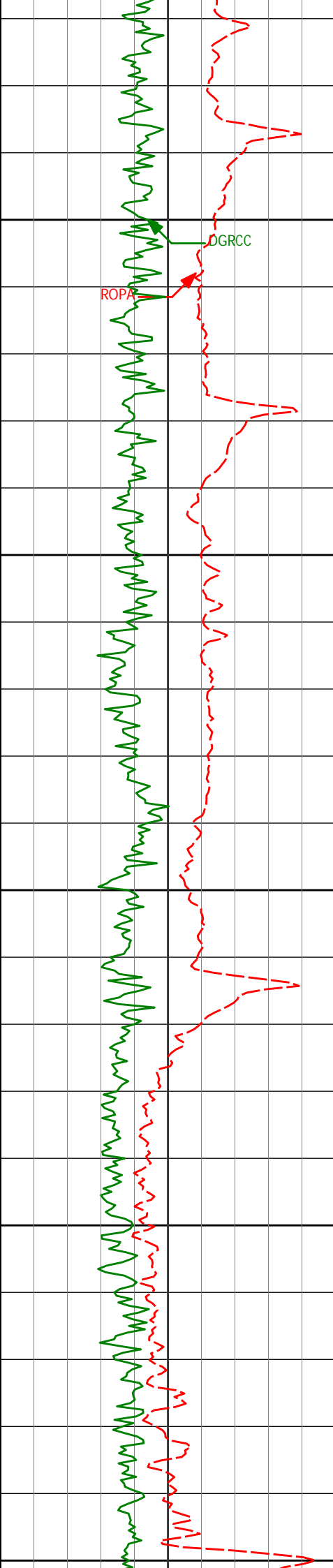
REMARKS
<p>1. All depths are calibrated to the driller's pipe tally and are measured bit depths, measured from the drill floor.</p> <p>2. No depth corrections have been made for pipe stretch or compression.</p> <p>3. Critical annular velocities have been calculated using the "Power Law" model for water based fluids and the "Bingham Plastic" model for syntheic and oil based fluids.</p> <p>4. All data presented is recorded (memory) data unless otherwise stated. ROPA is realtime data</p> <p>5. Enviromental parameters used to process the data are as follows: Hole Diameter: 6.13 inches Mud Weight: 8.4-10 ppg KCl Concentration: 0% Mud Resistivity: .5 ohmm</p> <p>6. The following smoothing parameters have been applied to the data: ROPA: 0.5 ft interval, 1.2 ft coercion distance, 3 ft gap fill RXXP: 0.5 ft interval, 0.6 ft coercion distance, 3 ft gap fill C39P: 0.5 ft interval, 0.6 ft coercion distance, 3 ft gap fill EWXT: 0.5 ft interval, 0.6 ft coercion distance, 3 ft gap fill DGRCC: 0.5 ft interval, 0.6 ft coercion distance, 3 ft gap fill</p> <p>7. Insite Version 7.4.2</p>

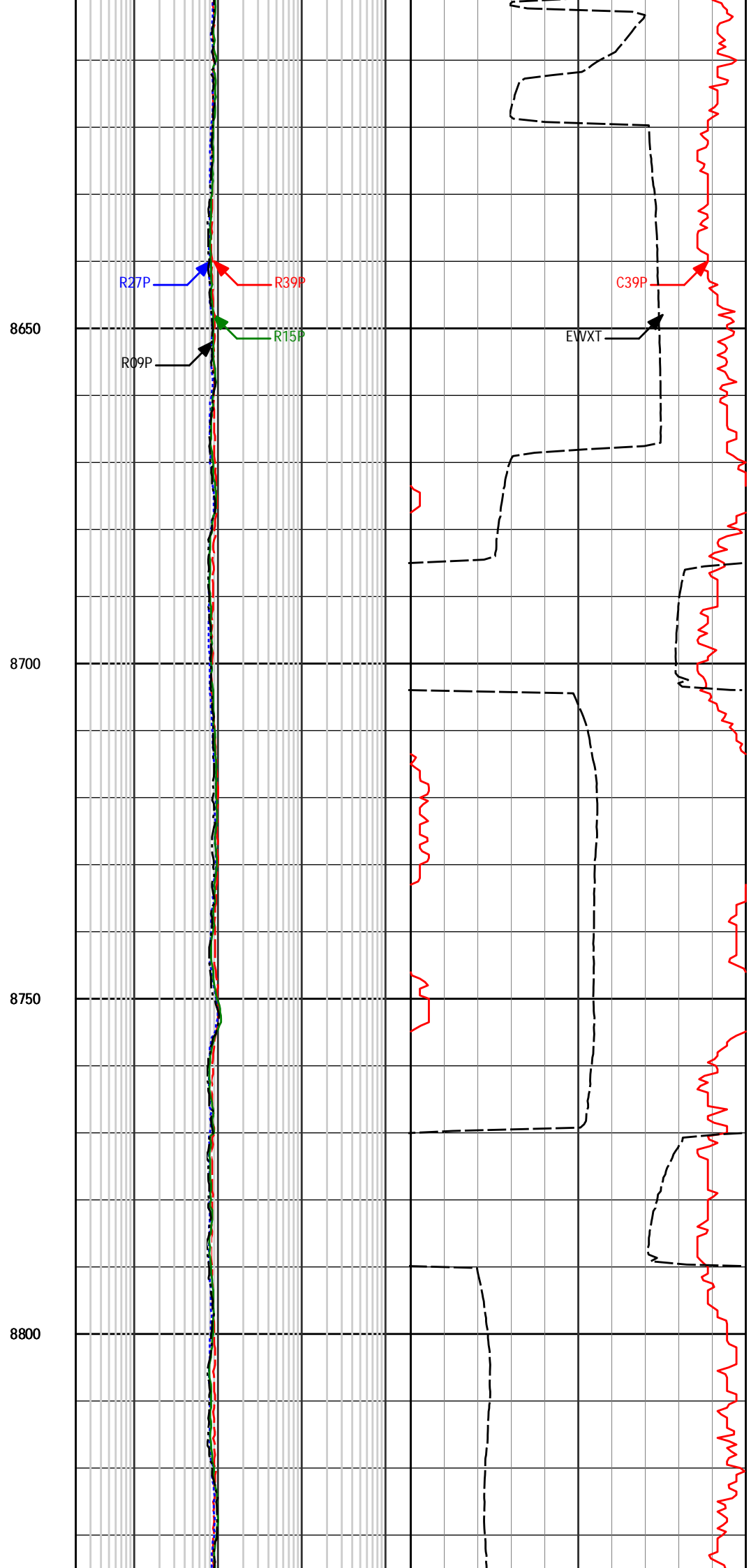
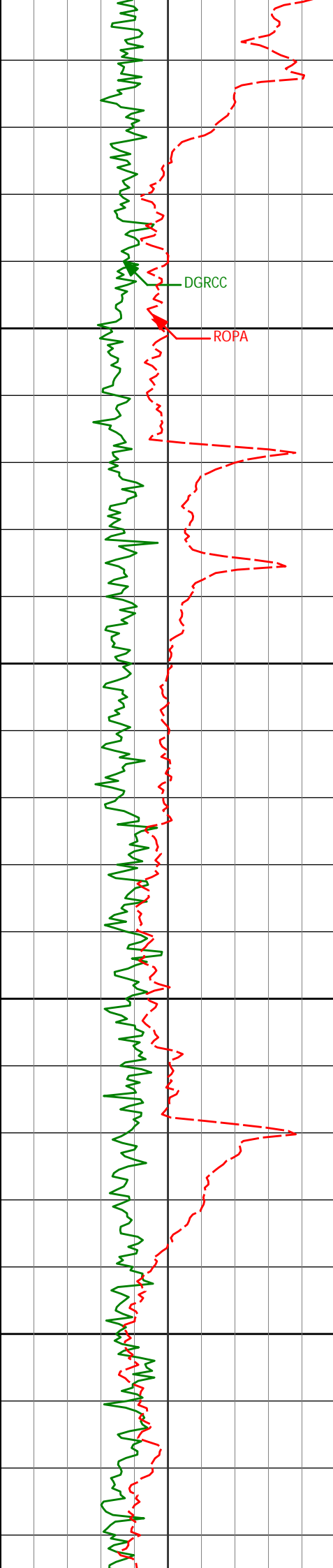
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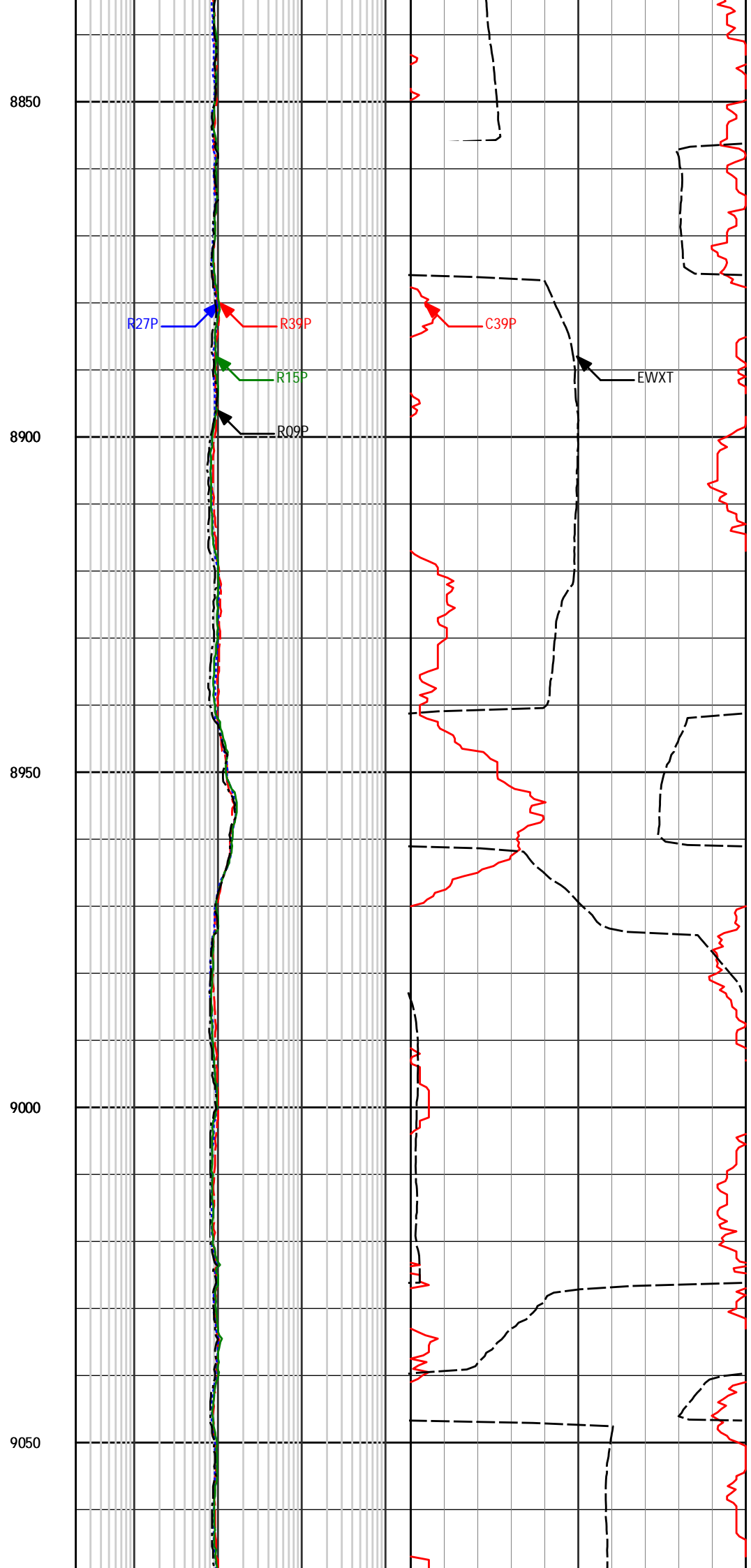
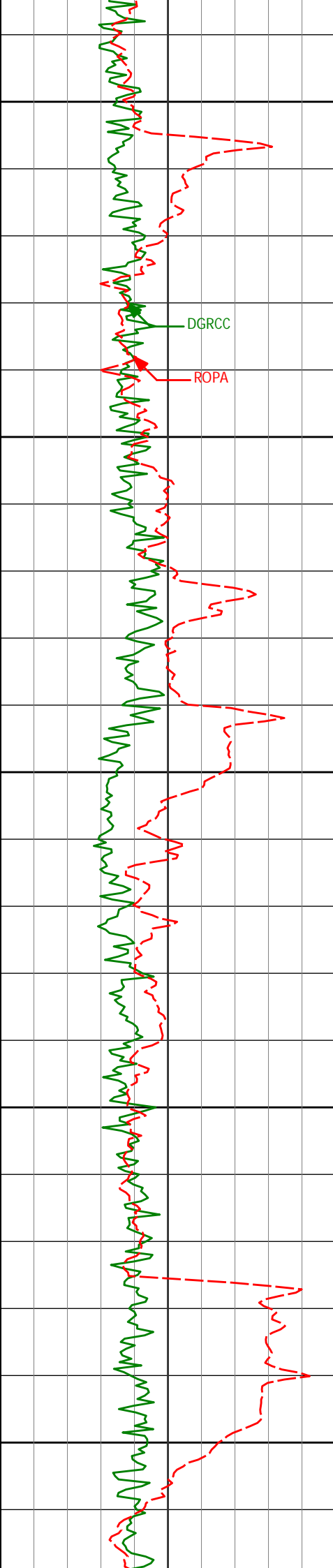
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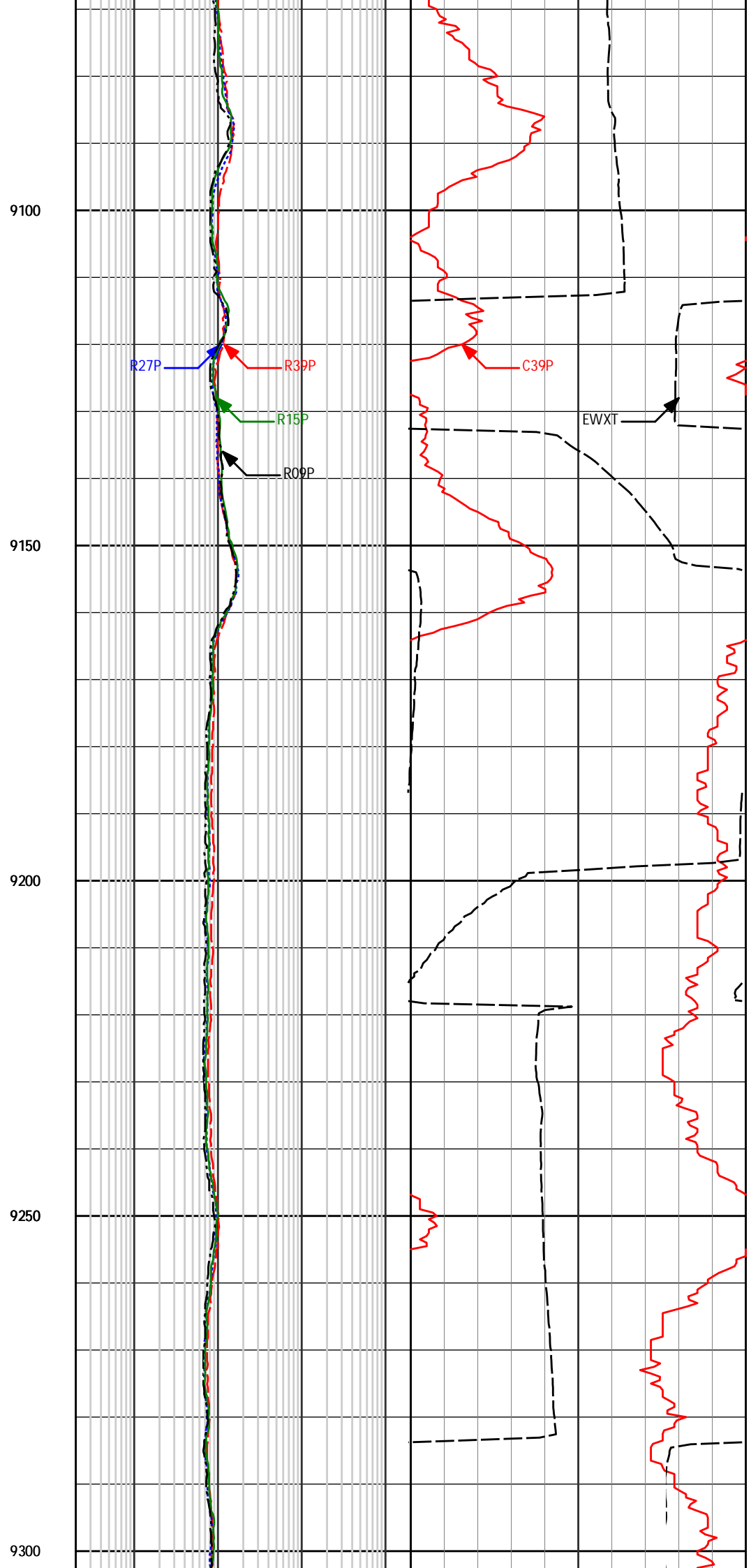
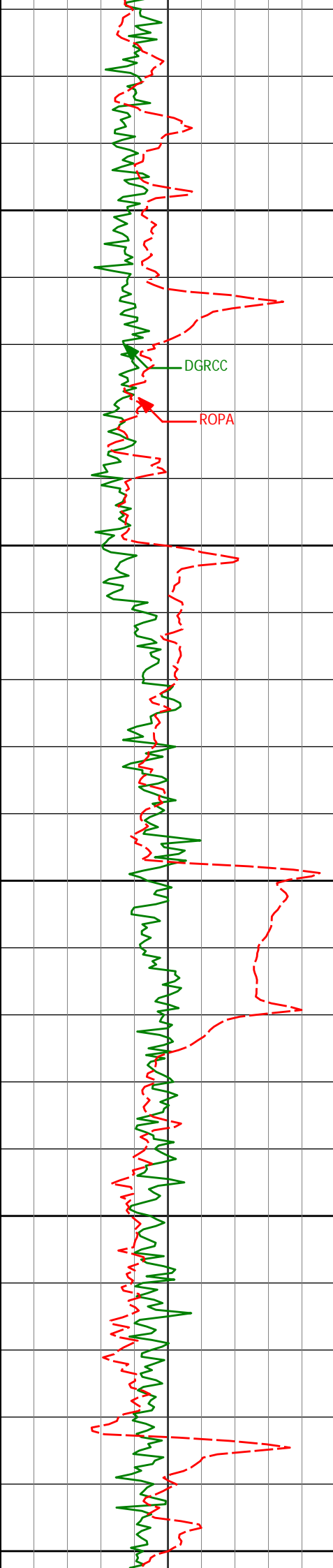
<div>DGR Gamma Ray Comb BCorr DGRCC</div>	<div>Deep (39in) Phase Resistivity R39P 0.2ohm-metre2K</div>	
	<div>Medium (27in) Phase Resistivity R27P 0.2ohm-metre2K</div>	
	<div>Shallow (15in) Phase Resistivity R15P</div>	
		<div>EWR Formation Exposure Time EWXT</div>



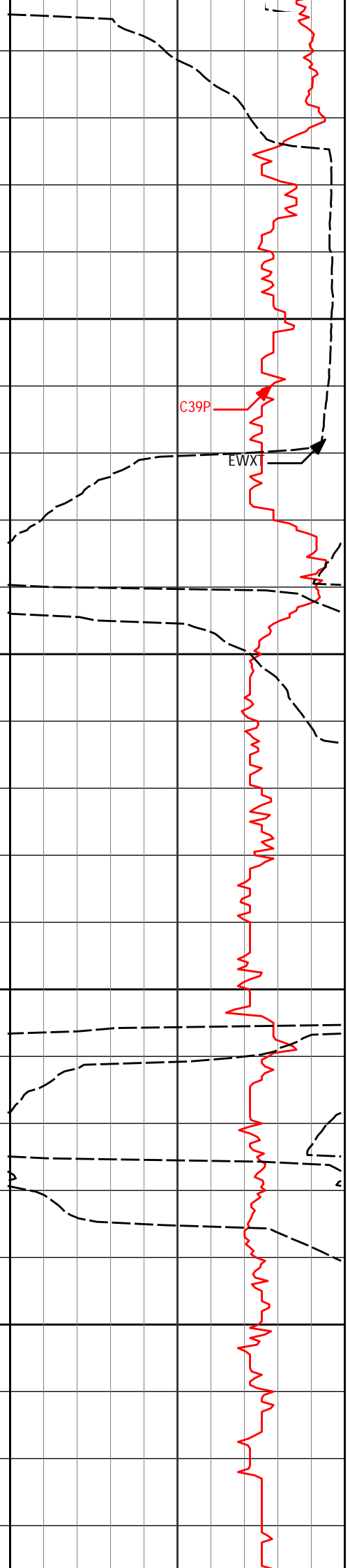
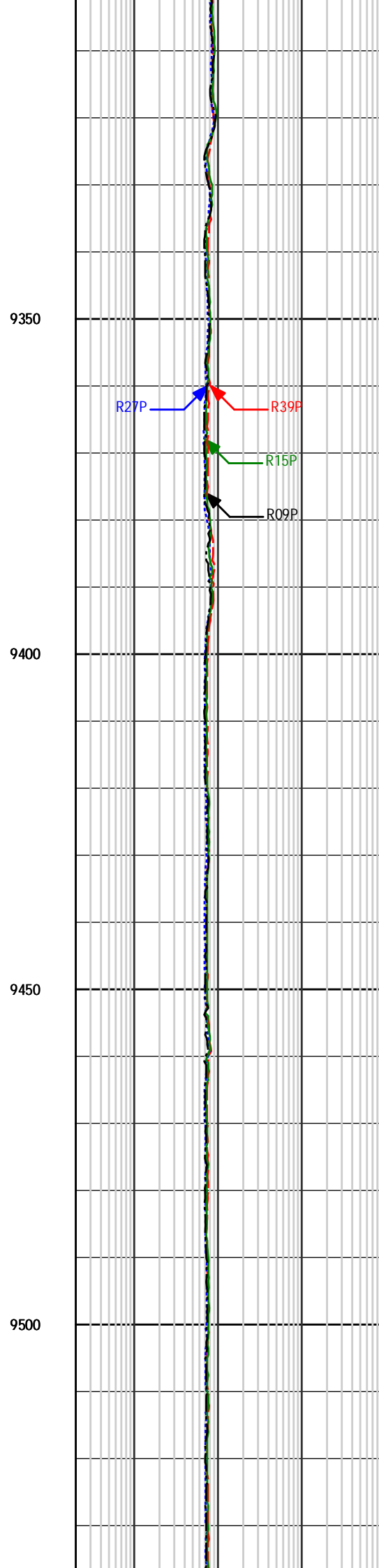
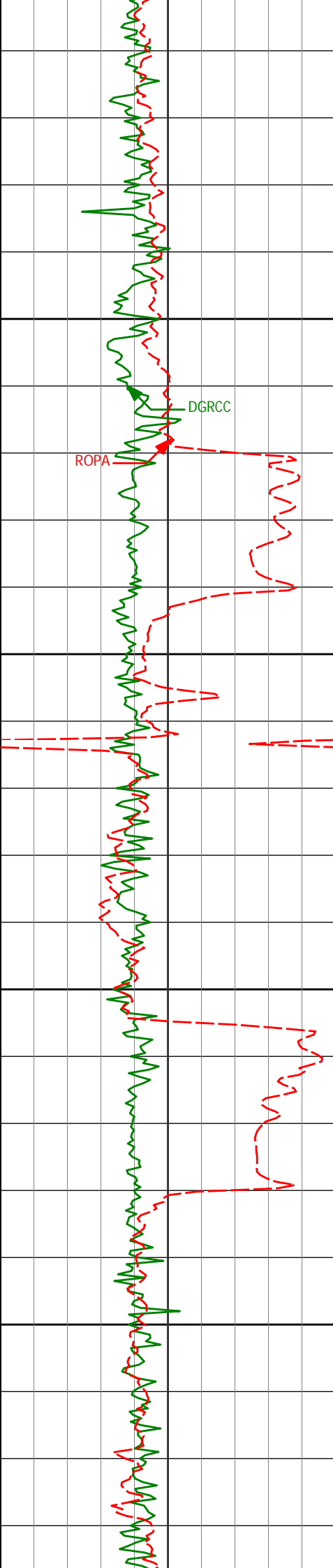


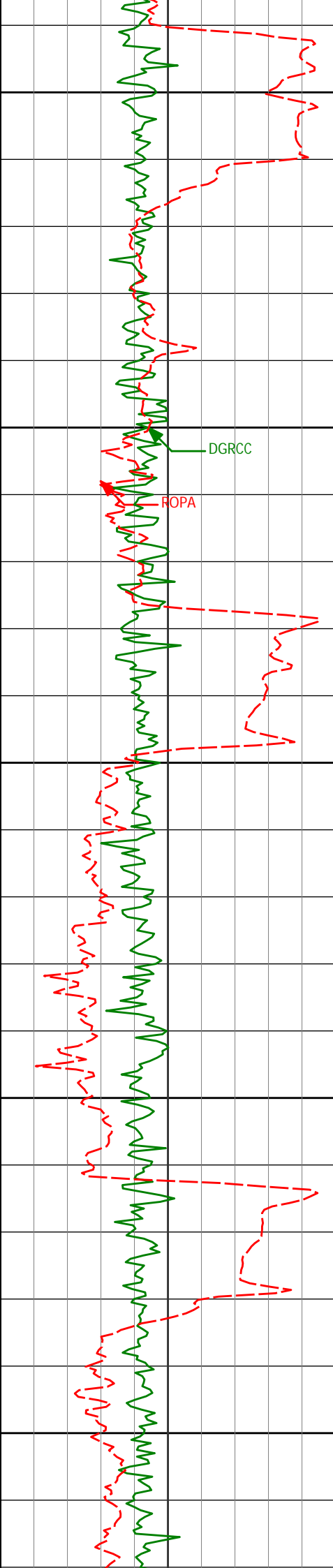












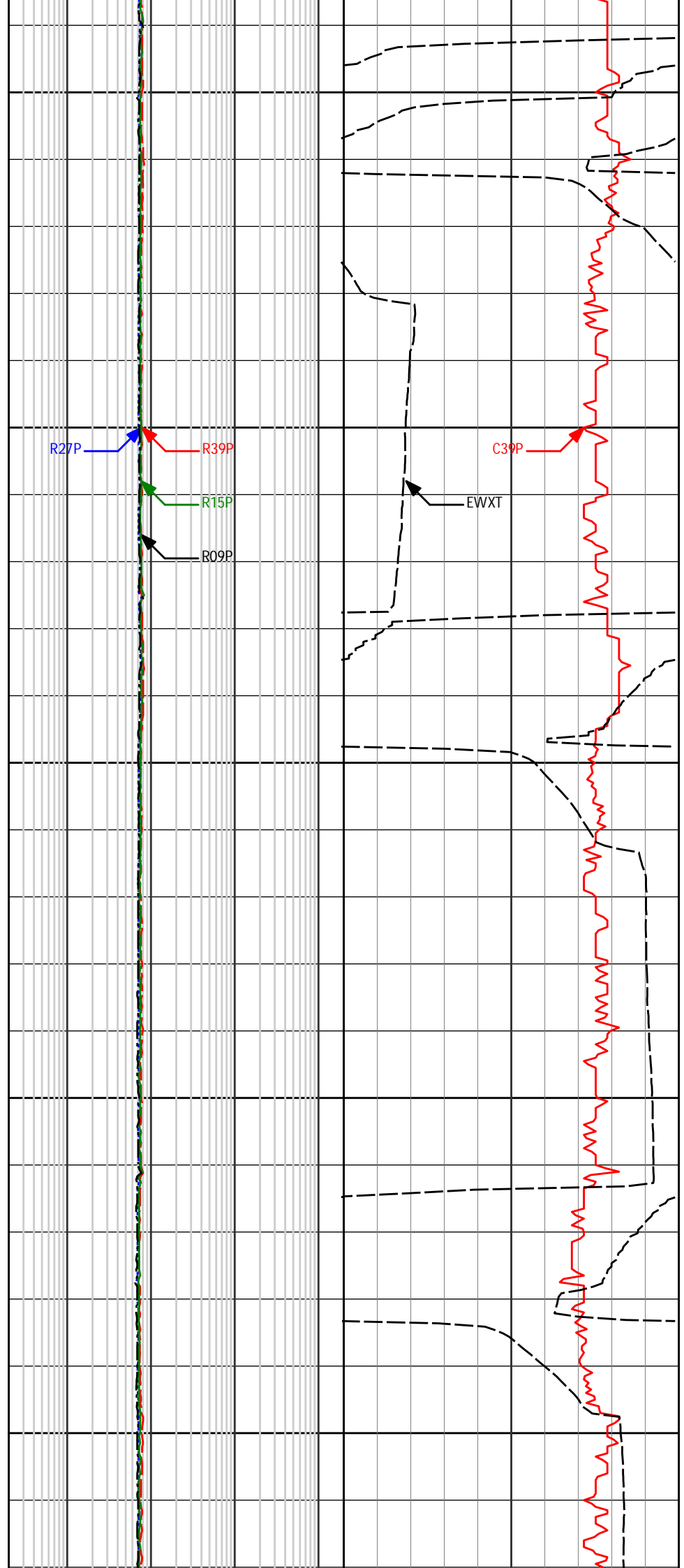
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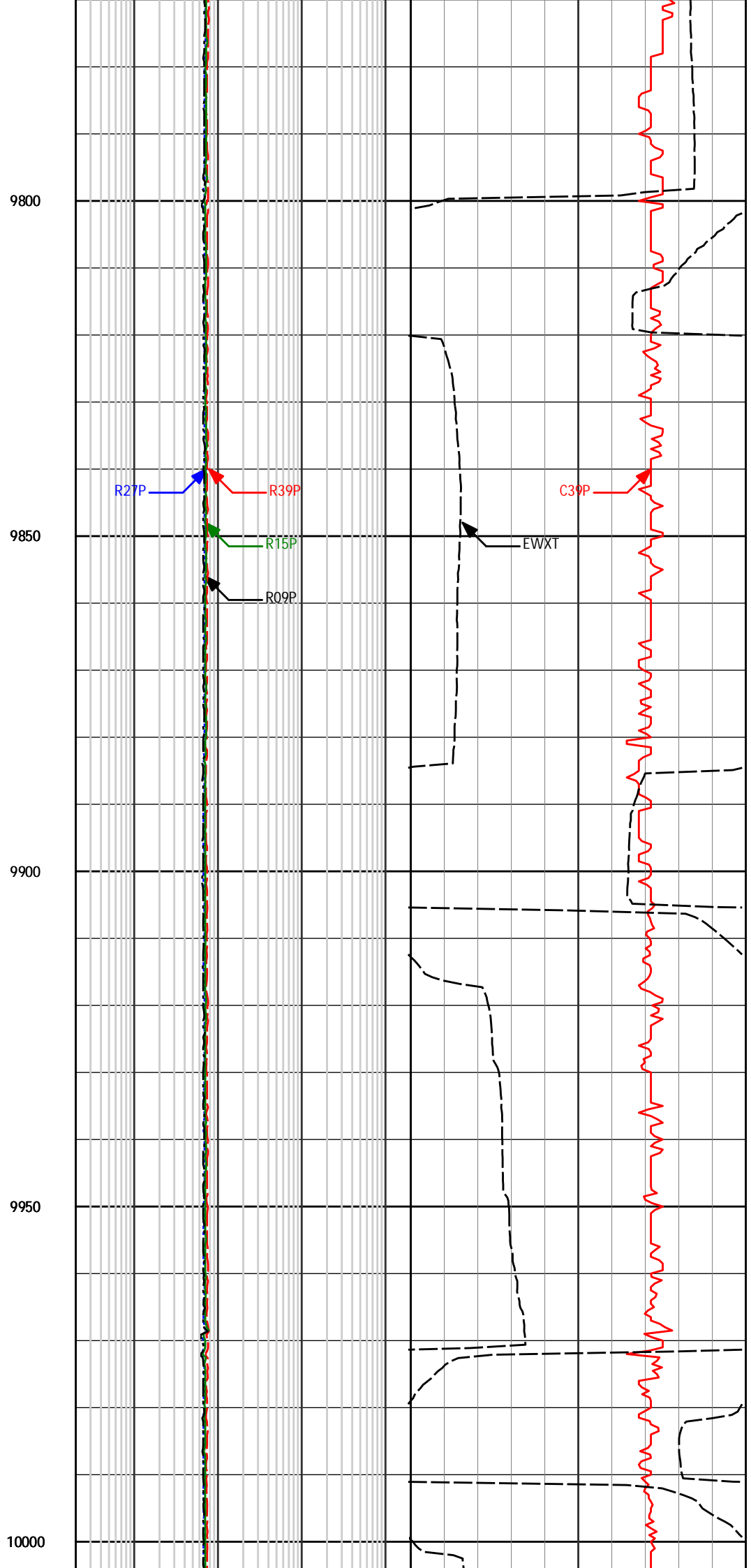
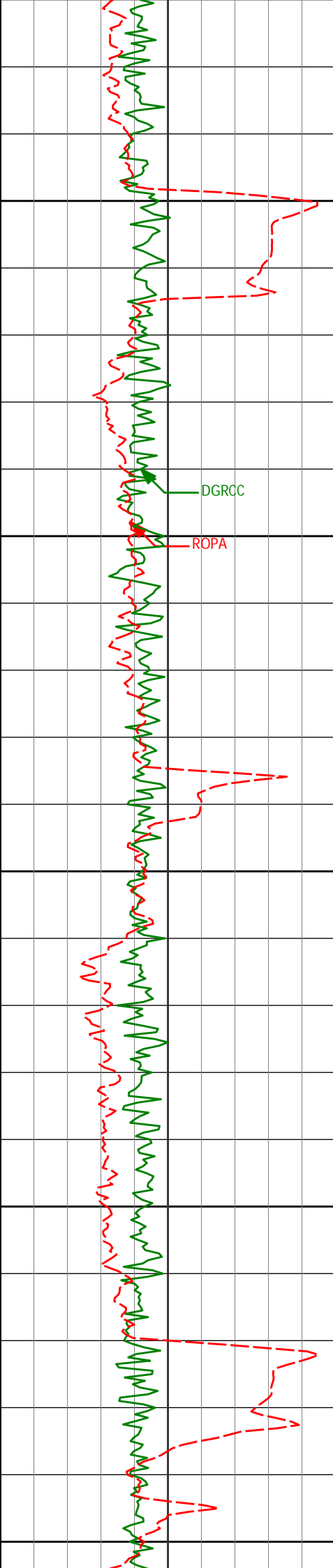
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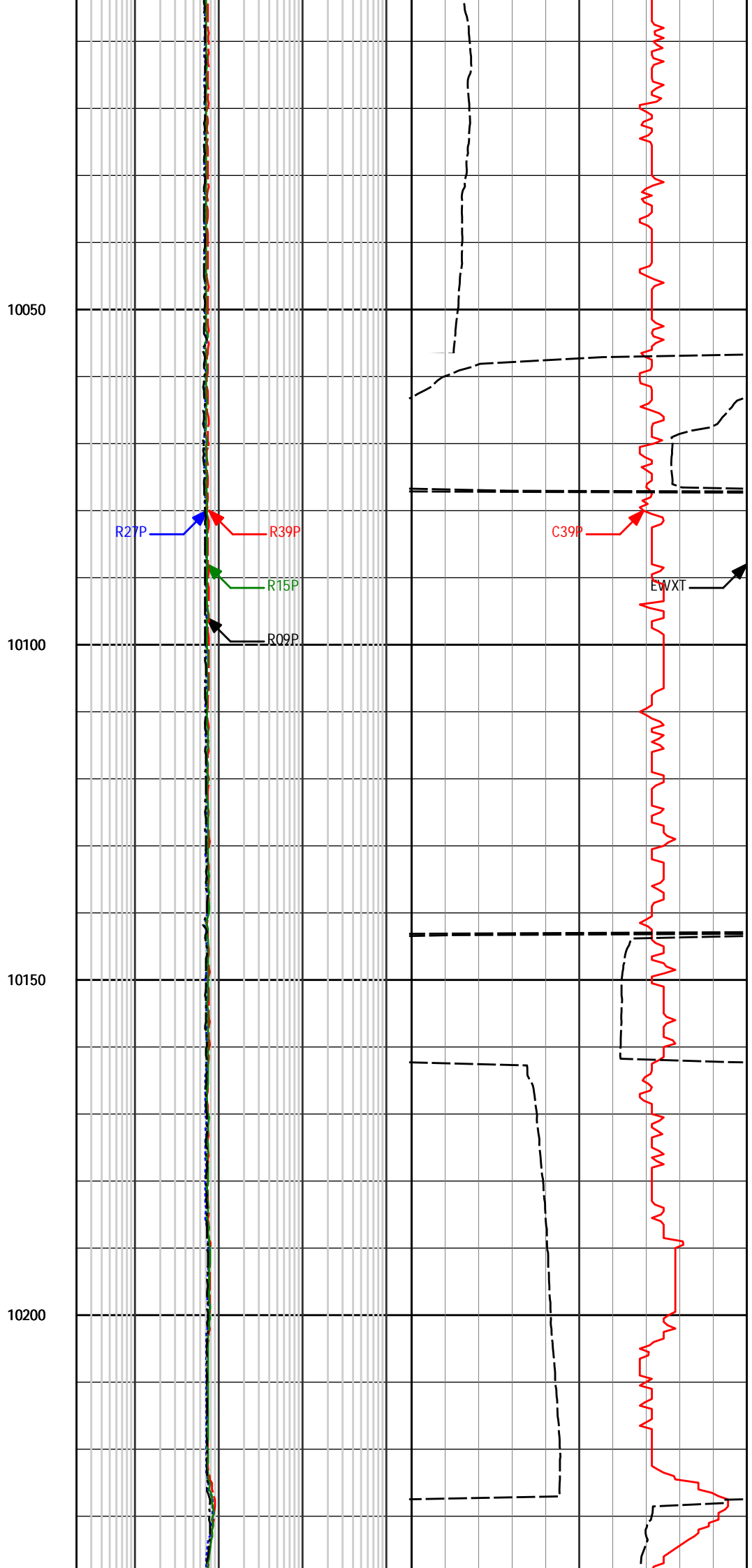
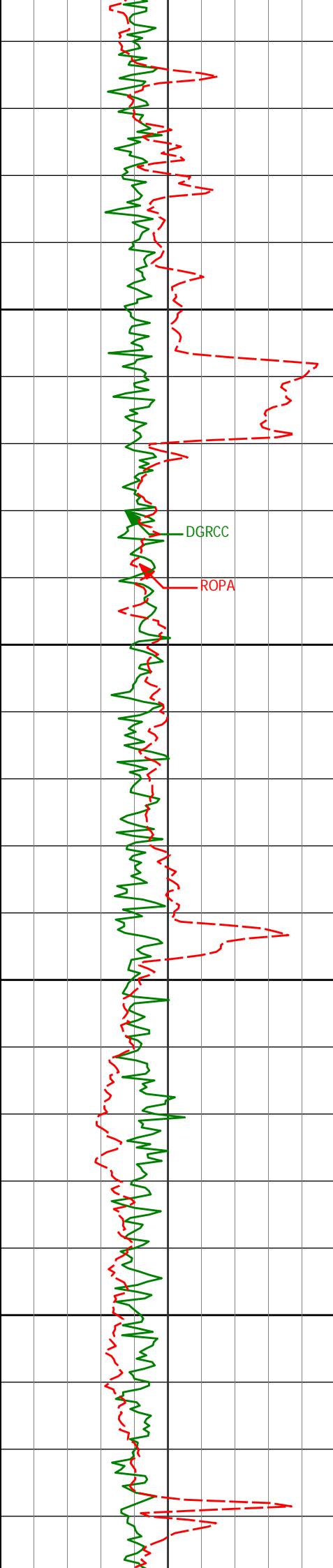
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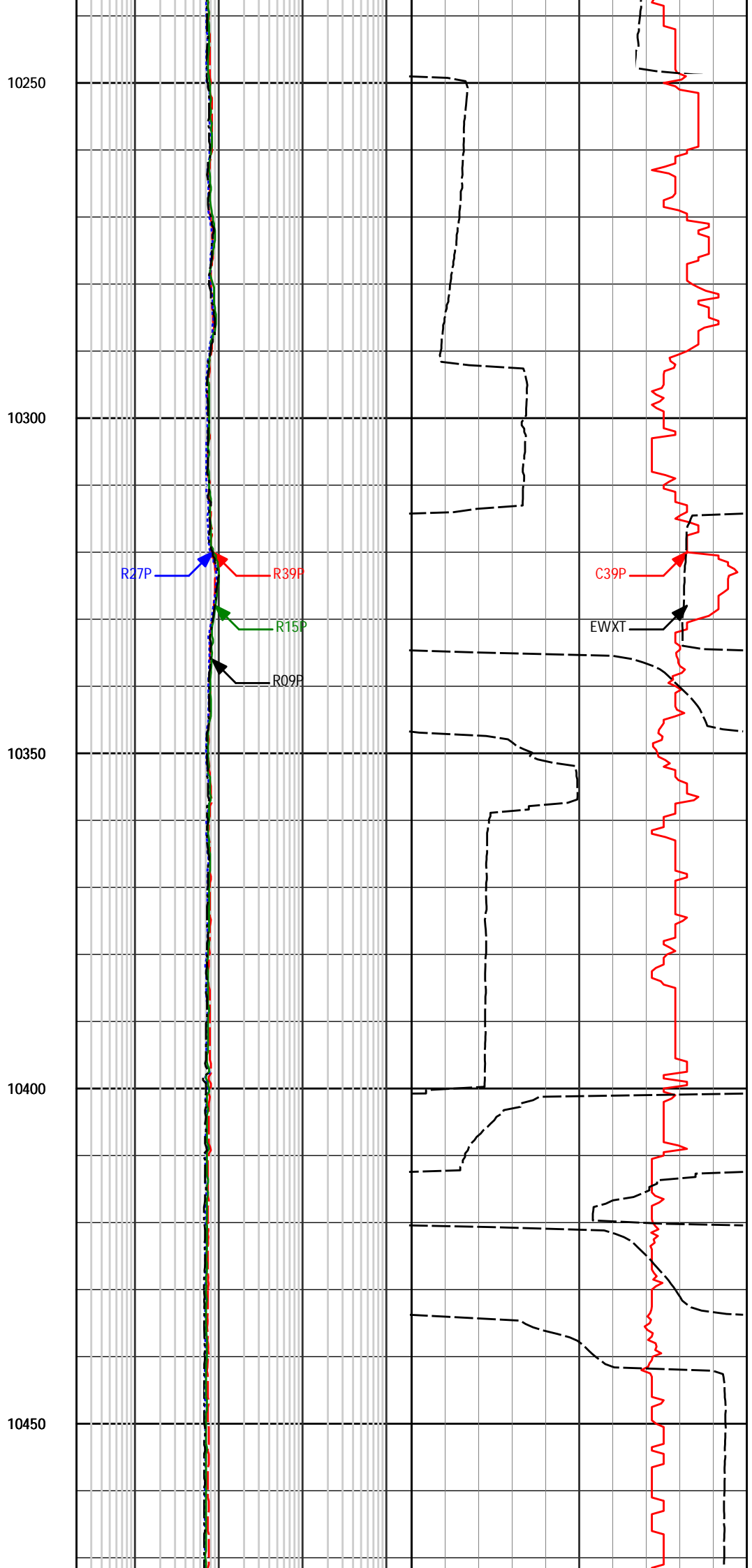
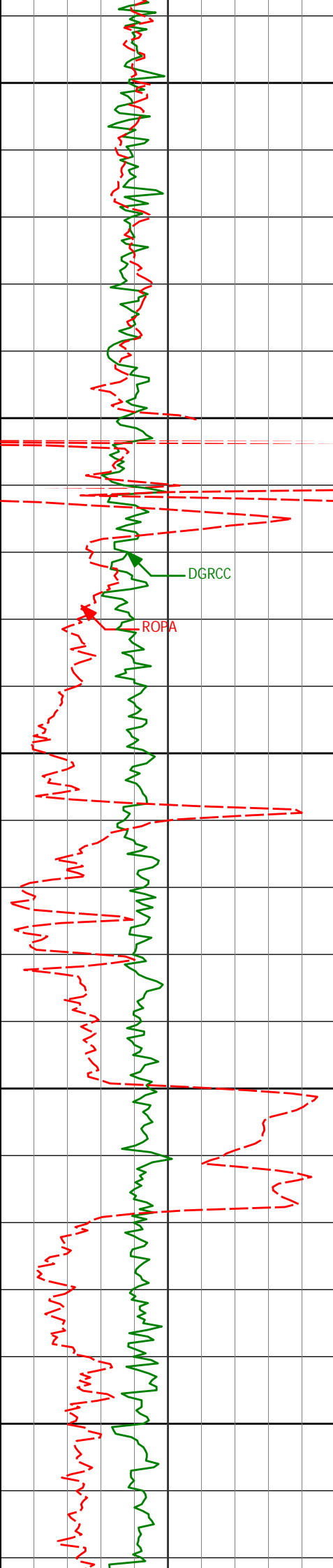
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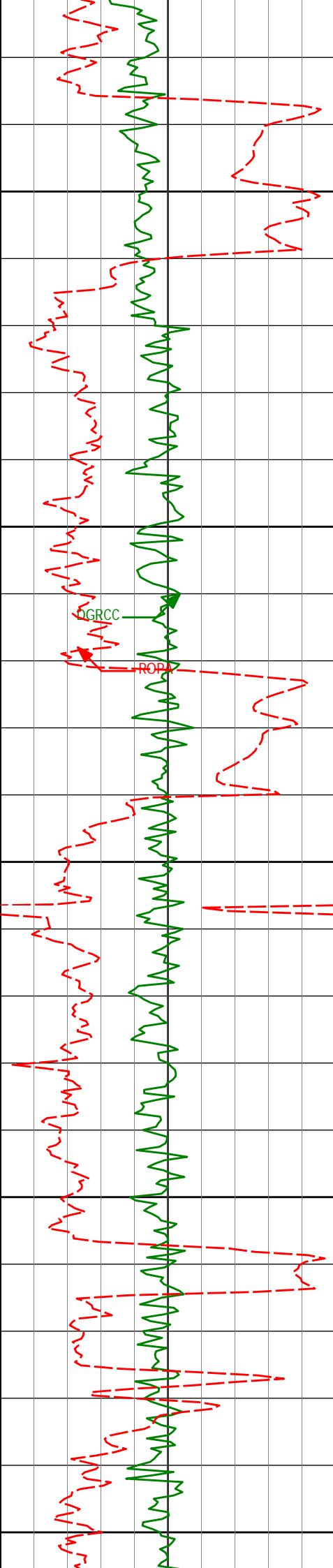
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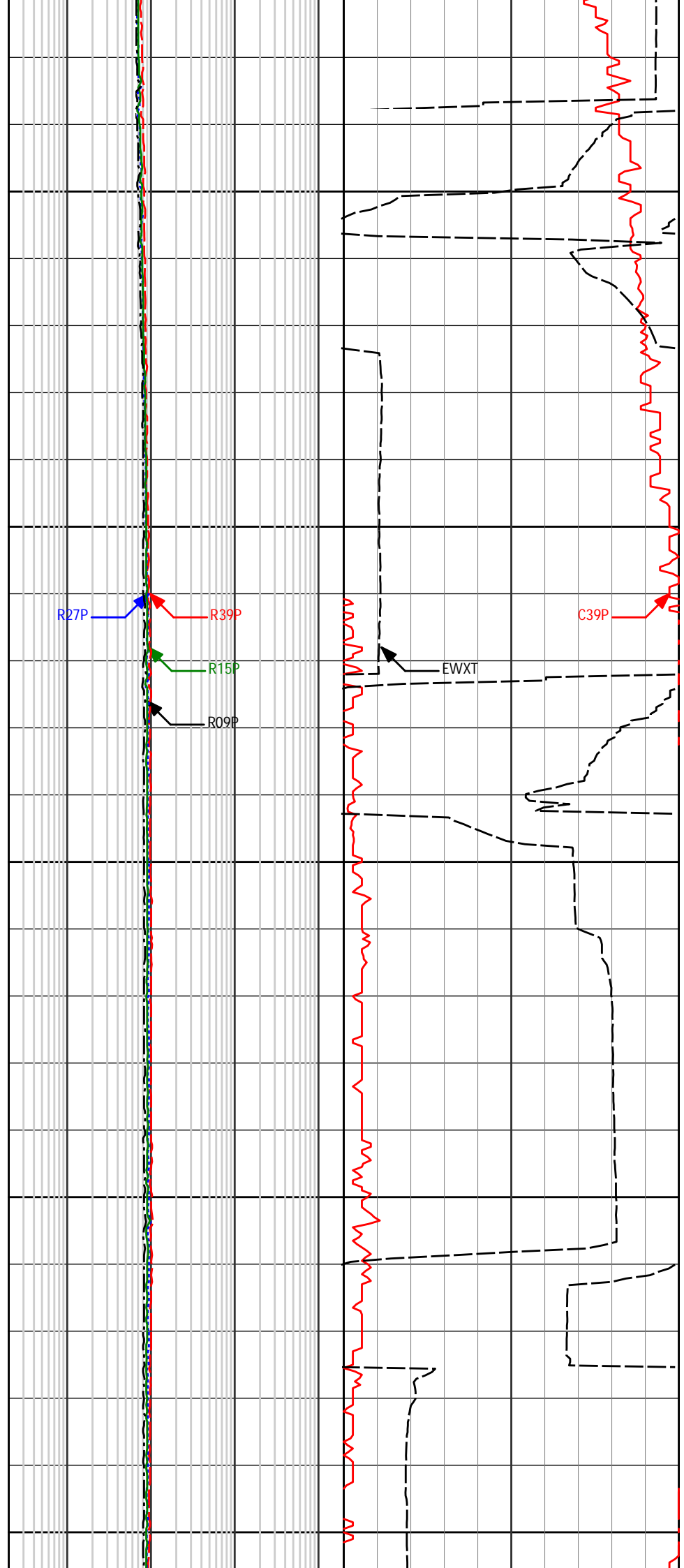
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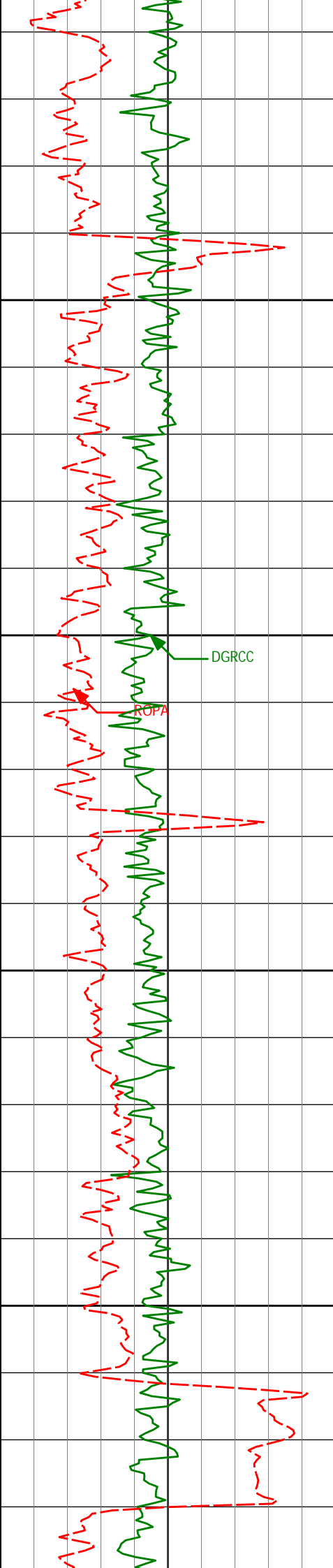
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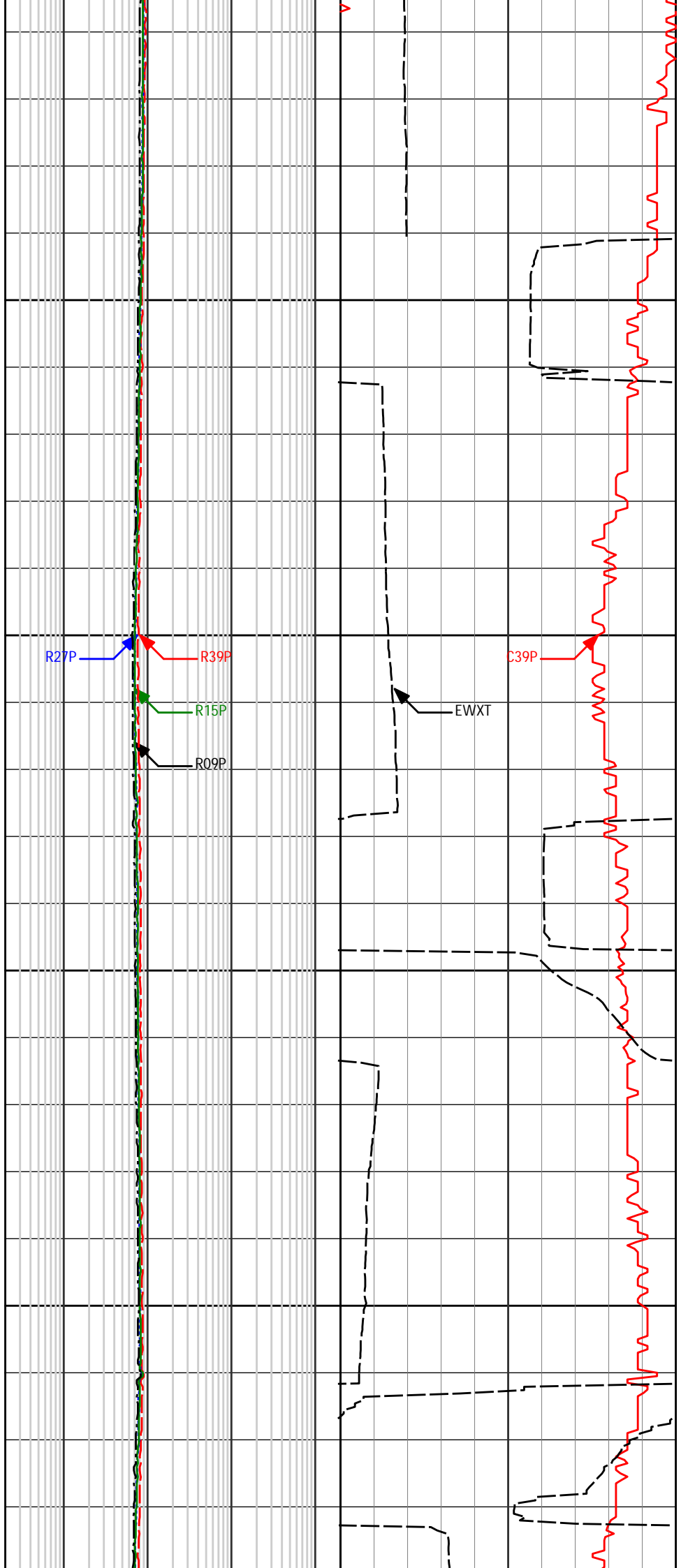
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DGRCC

ROPA



R27P

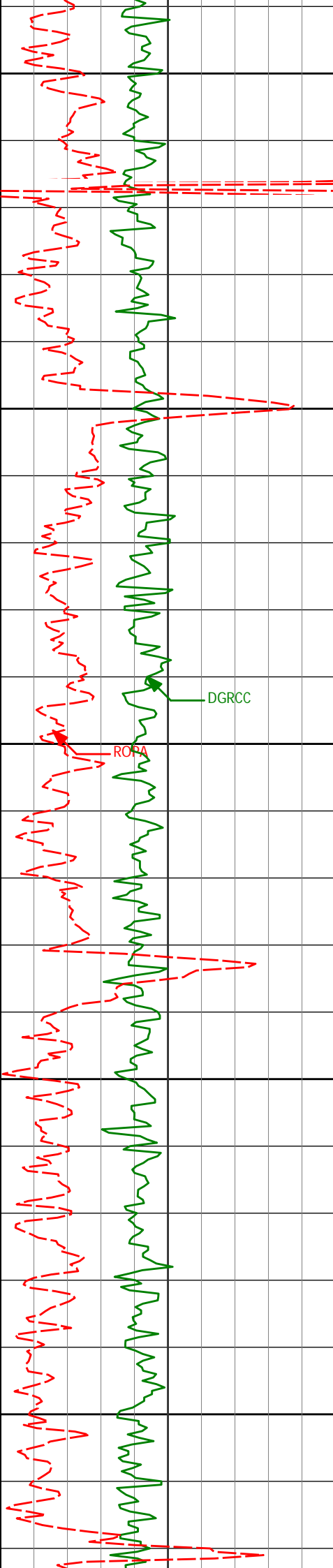
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R15P

R09P

EWXT

C39P



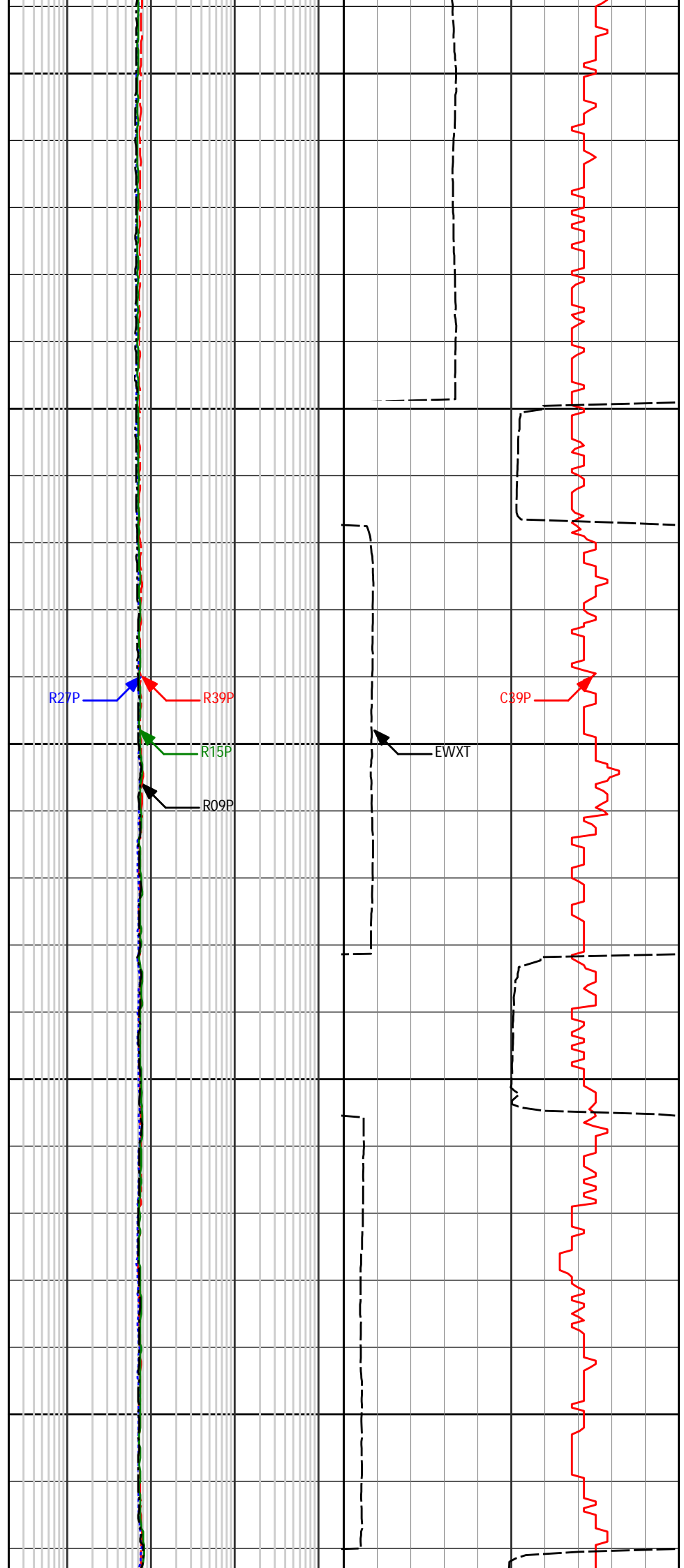
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11100

11150



R27P

R39P

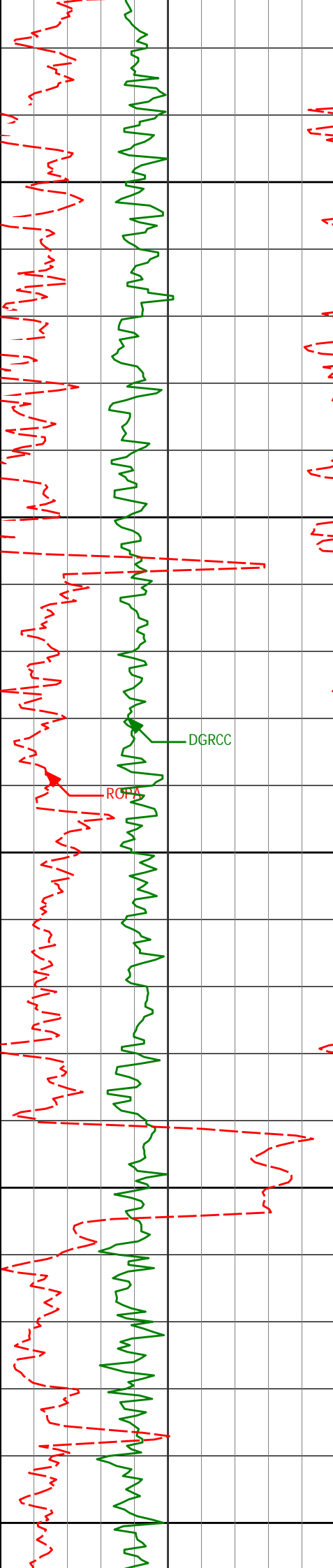
R15P

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EWXT

C39P





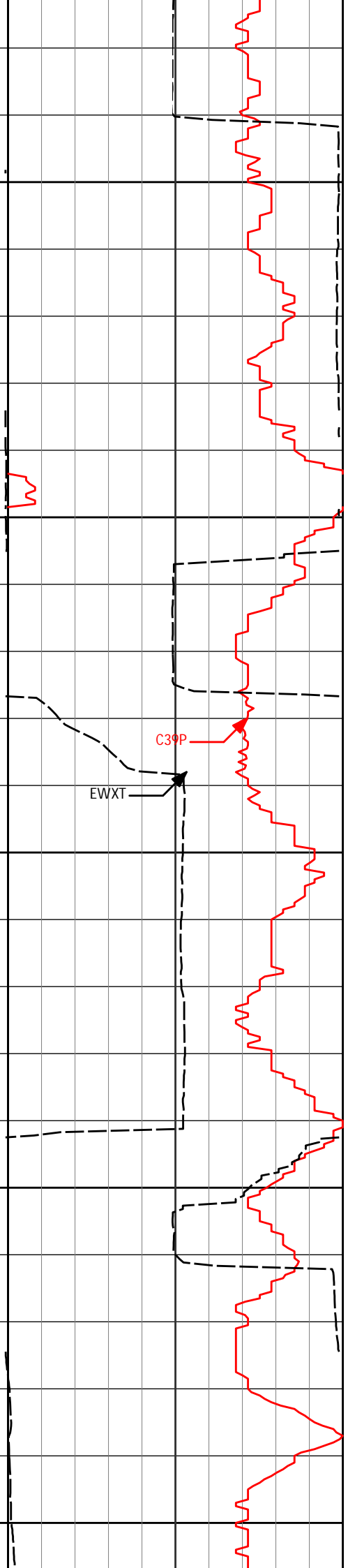
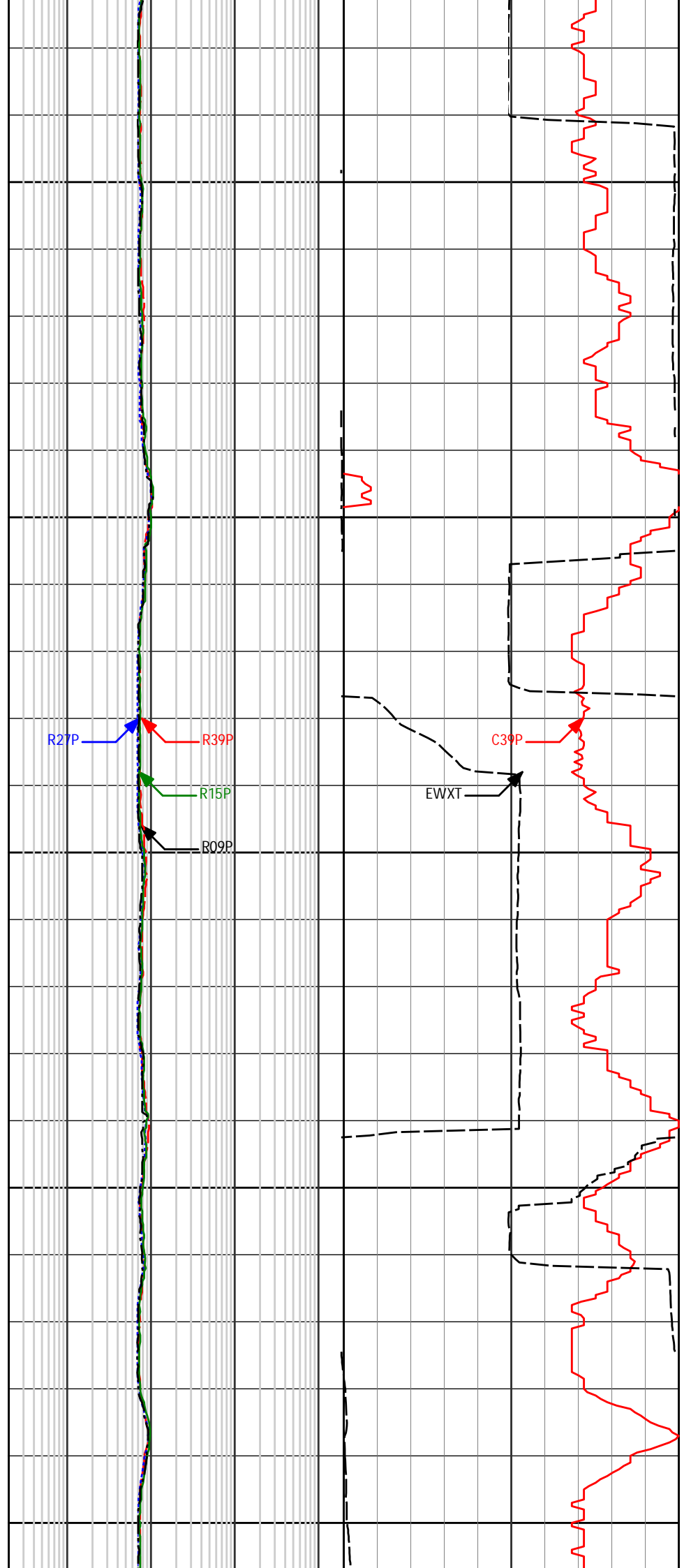
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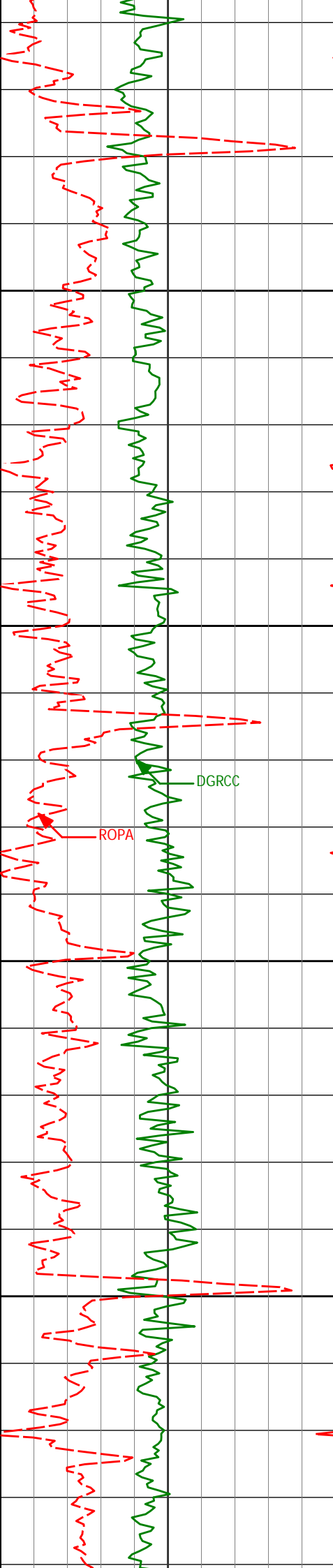
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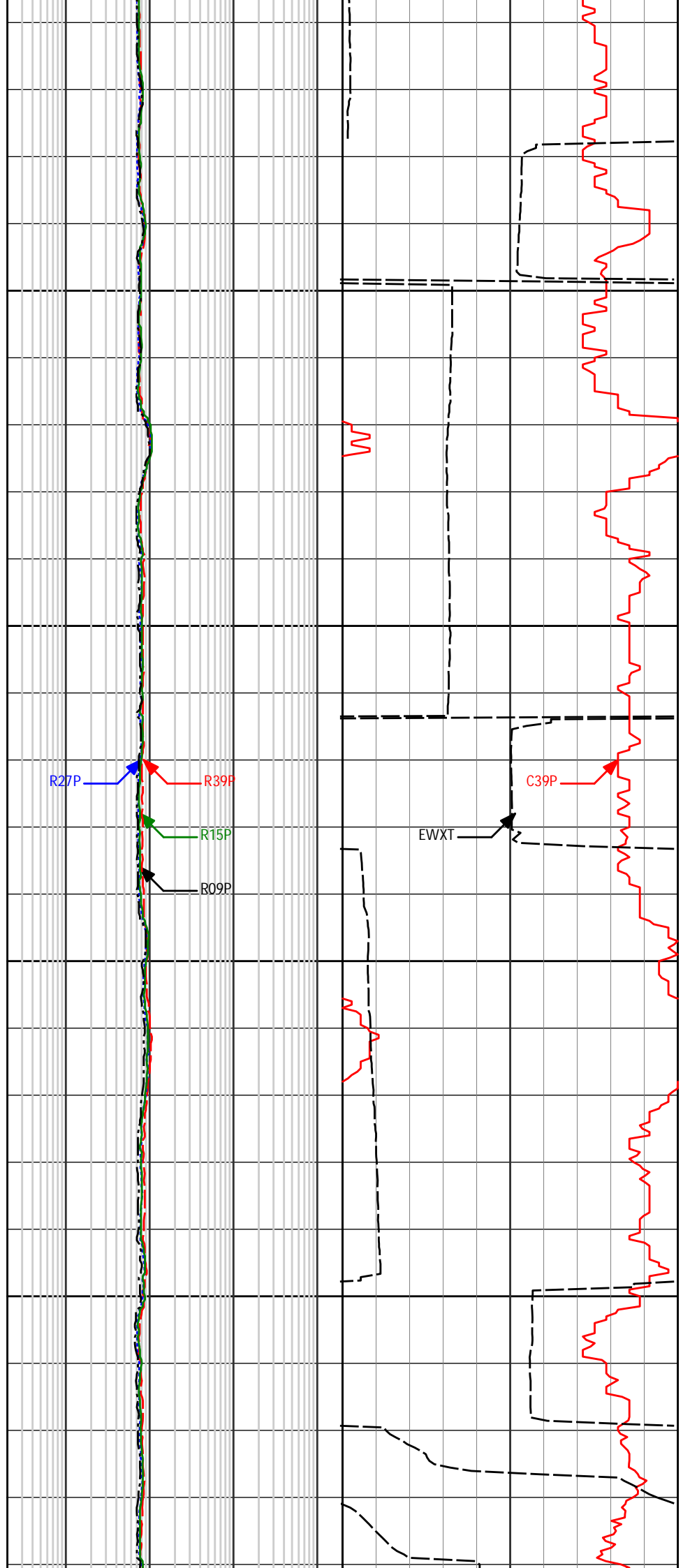


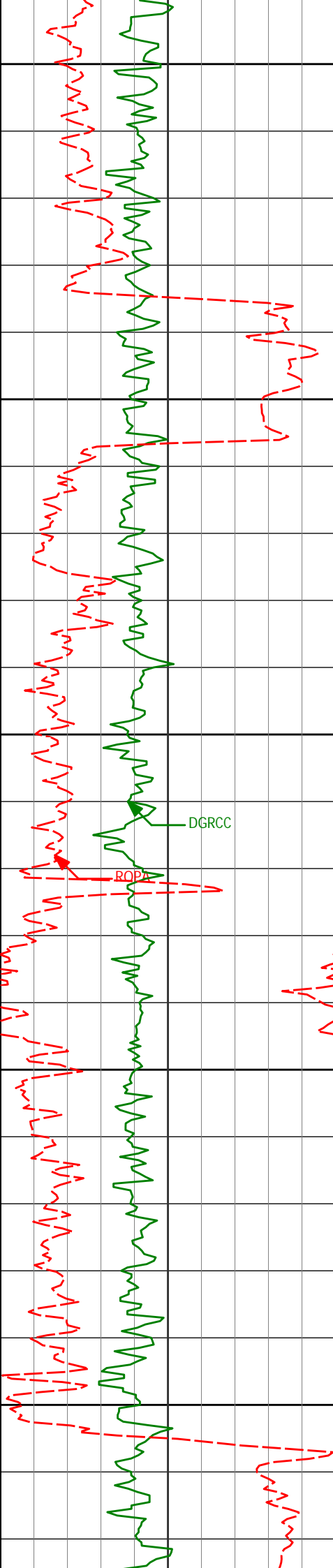
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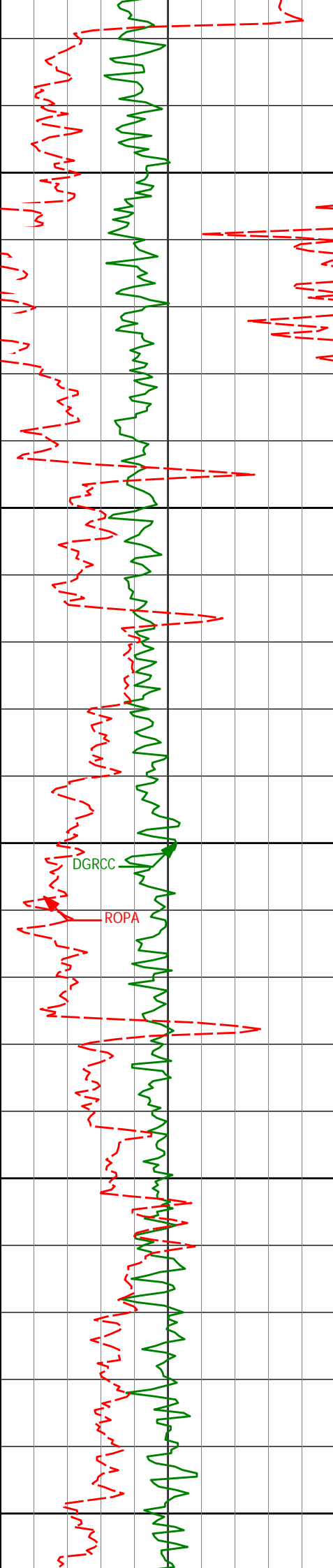
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R15P

R09P

C39P

EWXT



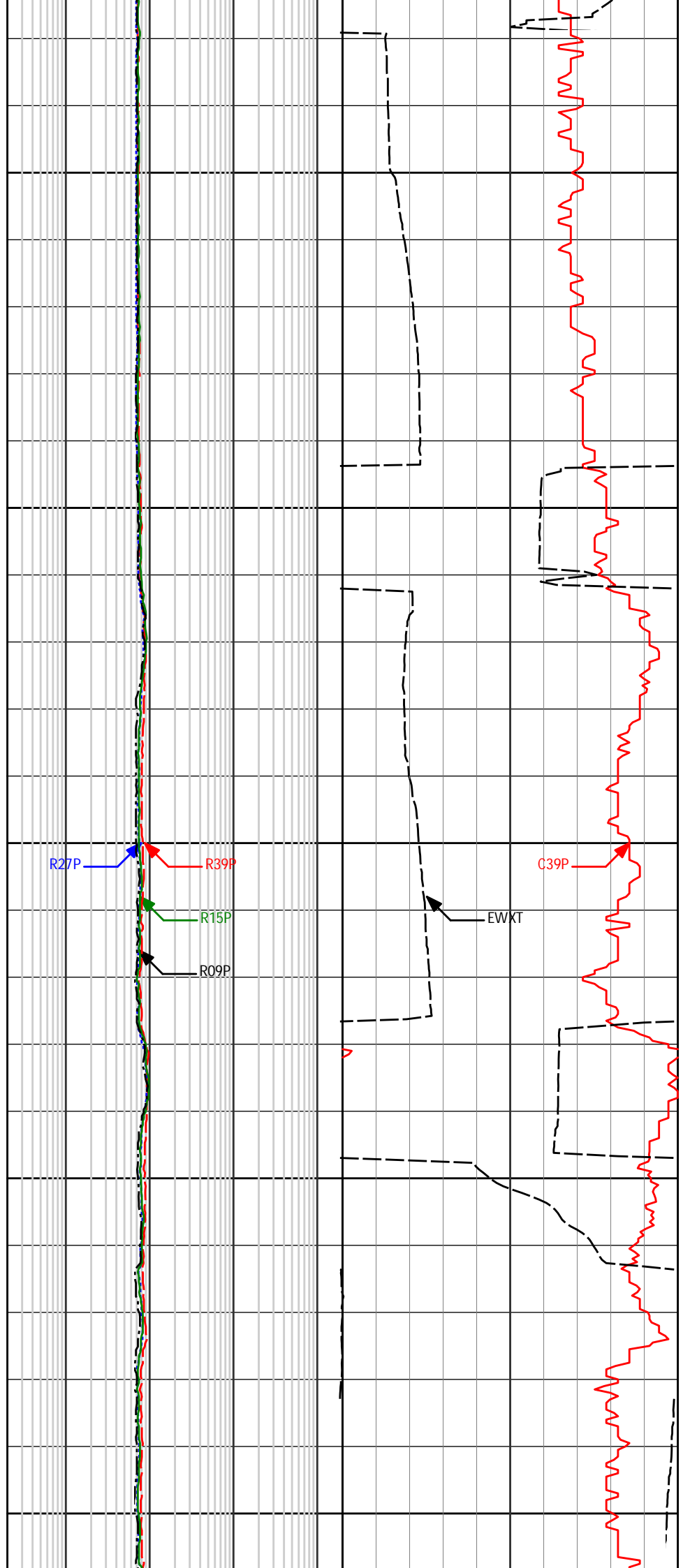
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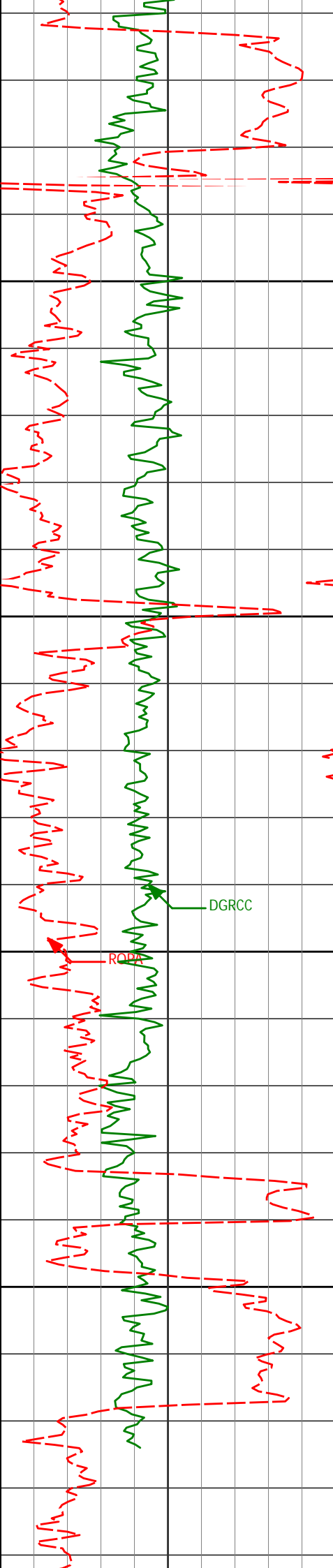
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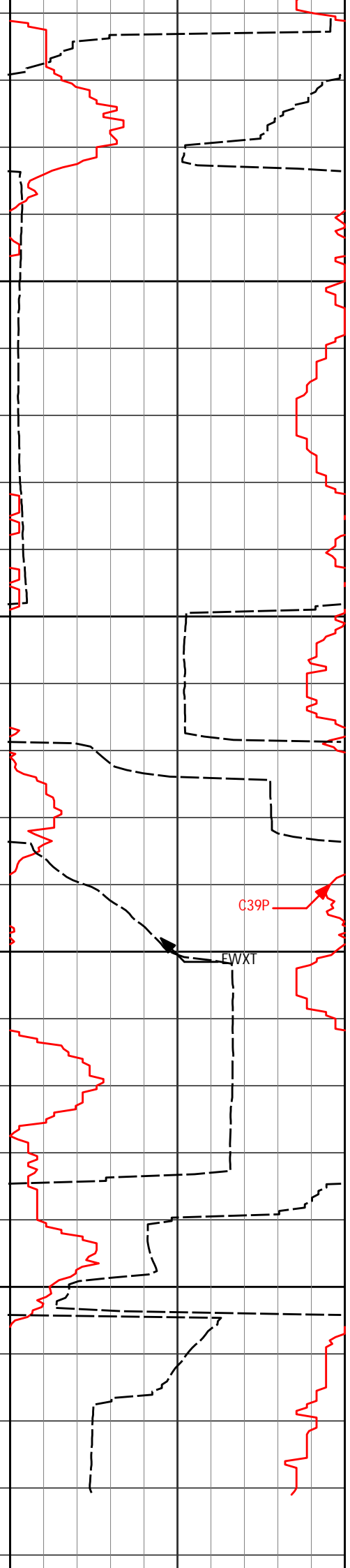
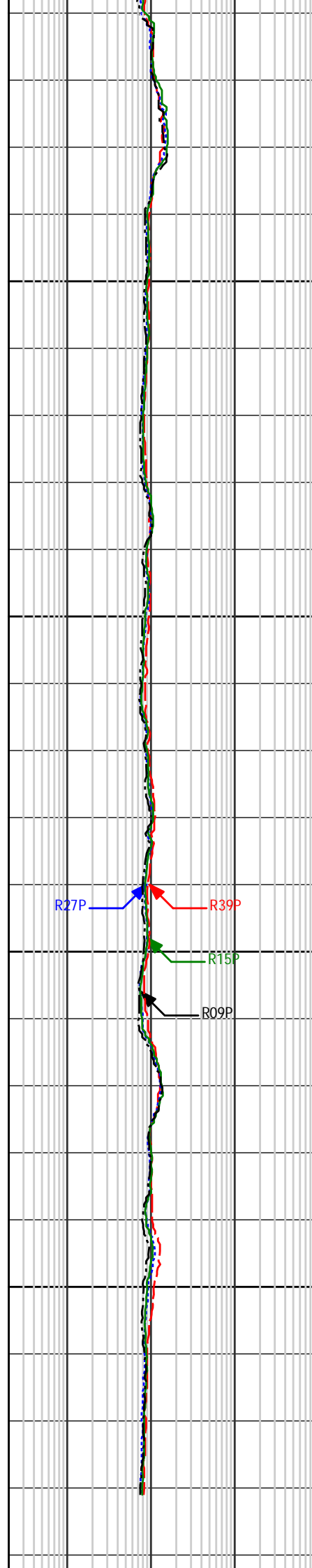


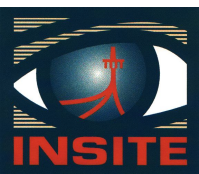
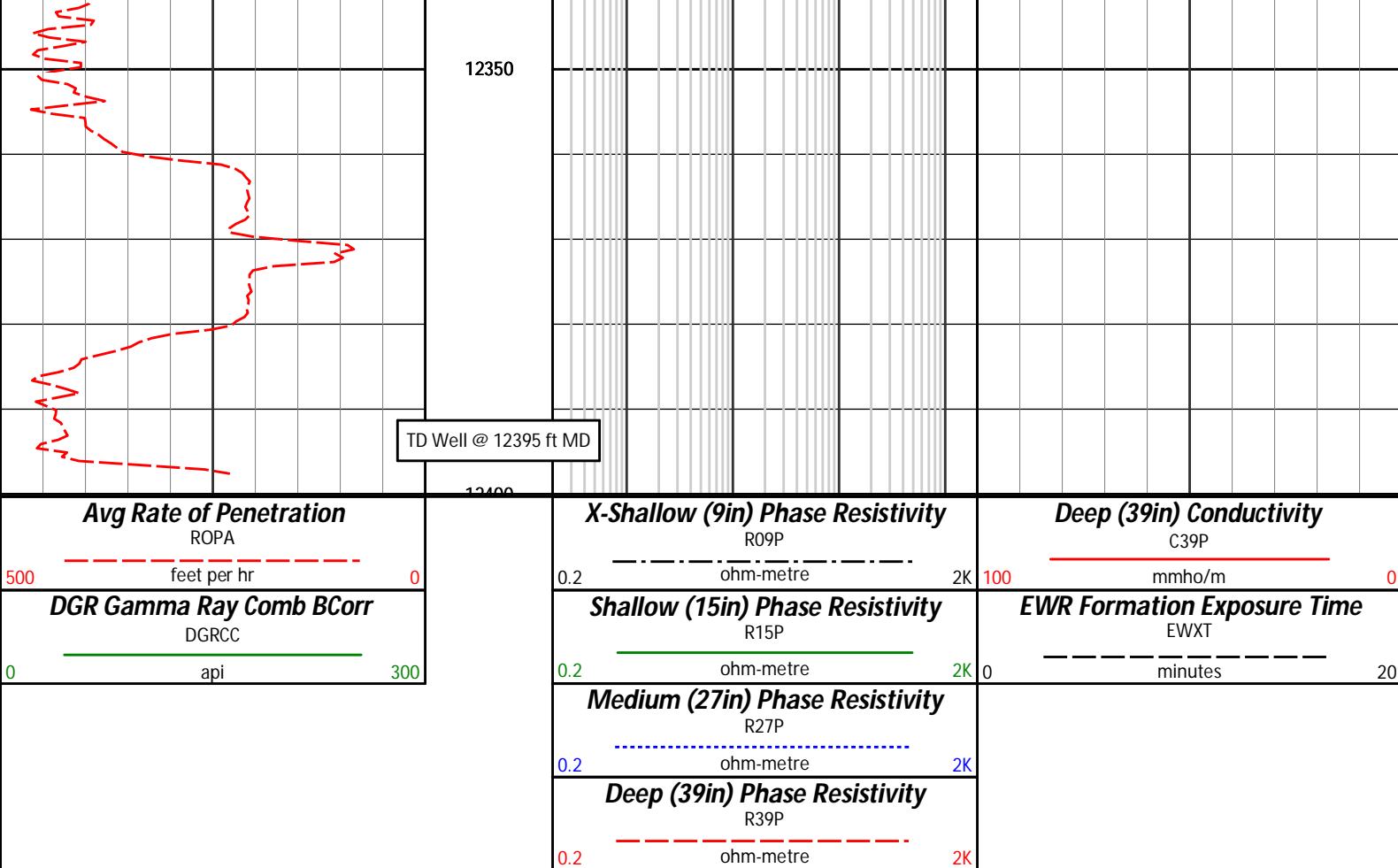
12150

12200

12250

12300





## HALLIBURTON

### DIRECTIONAL SURVEY REPORT

Anadarko Petroleum Corporation  
UNDERHILL 2C-17HZ  
Wattenberg  
Weld Colorado  
USA  
CA-XX-0900550721

Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
894.00	0.24	146.01	893.98	3.22 N	0.80 E	3.23	TIE-IN
1018.00	0.28	299.36	1017.98	3.15 N	0.68 E	3.16	0.41
1113.00	0.11	305.46	1112.98	3.32 N	0.41 E	3.33	0.18
1305.00	0.26	265.60	1304.98	3.39 N	0.19 W	3.39	0.10
1495.00	0.48	229.18	1494.97	2.84 N	1.22 W	2.82	0.16
1591.00	2.37	231.31	1590.94	1.34 N	3.08 W	1.29	1.98
1686.00	3.77	227.07	1685.80	2.02 S	6.90 W	-2.12	1.49
1779.00	6.39	221.70	1778.43	7.97 S	12.58 W	-8.15	2.86
1871.00	7.66	213.19	1869.74	16.93 S	19.35 W	-17.21	1.78
1962.00	9.77	207.47	1959.68	28.85 S	26.23 W	-29.23	2.50
2054.00	11.76	206.09	2050.06	44.20 S	33.95 W	-44.68	2.18
2146.00	11.44	205.57	2140.18	60.85 S	42.01 W	-61.45	0.36
2239.00	11.04	204.95	2231.40	77.24 S	49.75 W	-77.95	0.46
2330.00	10.74	203.42	2320.76	92.92 S	56.80 W	-93.73	0.45
2422.00	11.33	204.45	2411.06	109.02 S	63.94 W	-109.93	0.67
2514.00	10.61	204.08	2501.38	124.97 S	71.14 W	-125.99	0.79
2606.00	11.98	204.52	2591.59	141.39 S	78.55 W	-142.51	1.49
2791.00	10.35	201.55	2773.09	174.31 S	92.62 W	-175.63	0.93
2974.00	10.29	205.48	2953.13	204.35 S	105.69 W	-205.86	0.39
3158.00	11.50	211.59	3133.82	234.80 S	122.37 W	-236.55	0.91
3342.00	10.96	212.56	3314.30	265.17 S	141.39 W	-267.19	0.31
3526.00	11.35	206.28	3494.82	296.16 S	158.83 W	-298.43	0.69
3708.00	9.59	205.15	3673.78	325.95 S	173.21 W	-328.43	0.97
3891.00	11.77	206.22	3853.60	356.50 S	187.94 W	-359.19	1.20
4075.00	10.98	204.16	4033.99	389.33 S	203.40 W	-392.24	0.48

4257.00	10.47	201.67	4212.81	420.53 S	216.61 W	-423.62	0.38
4434.00	11.91	207.70	4386.44	451.66 S	231.04 W	-454.96	1.05
4605.00	11.10	205.27	4554.00	482.17 S	246.27 W	-485.69	0.55
4776.00	10.58	198.59	4721.96	511.94 S	258.31 W	-515.63	0.79
4947.00	12.84	202.96	4889.39	544.32 S	270.72 W	-548.19	1.42
5118.00	11.82	211.04	5056.46	576.83 S	287.17 W	-580.93	1.17
5289.00	10.91	209.15	5224.10	605.98 S	304.09 W	-610.32	0.58
5461.00	10.04	207.58	5393.23	633.48 S	318.96 W	-638.04	0.53
5632.00	10.83	205.10	5561.40	661.25 S	332.68 W	-666.00	0.53
5804.00	10.17	197.12	5730.53	690.40 S	344.01 W	-695.31	0.93
5975.00	10.79	204.37	5898.68	719.42 S	355.06 W	-724.48	0.85
6147.00	9.85	211.84	6067.90	746.59 S	369.47 W	-751.86	0.95
6232.00	10.80	212.86	6151.53	759.45 S	377.62 W	-764.84	1.13
6318.00	9.35	210.63	6236.20	772.23 S	385.56 W	-777.74	1.74
6404.00	8.12	210.04	6321.20	783.50 S	392.16 W	-789.10	1.44
6575.00	6.44	210.26	6490.81	802.24 S	403.03 W	-807.99	0.98
6747.00	4.81	214.95	6661.98	816.48 S	412.02 W	-822.36	0.98
6918.00	2.73	223.13	6832.60	825.33 S	418.92 W	-831.31	1.25
7090.00	0.48	276.40	7004.53	828.24 S	422.44 W	-834.28	1.44
7261.00	0.60	212.57	7175.52	828.92 S	423.63 W	-834.97	0.34
7304.00	1.93	6.14	7218.52	828.39 S	423.68 W	-834.44	5.76
7347.00	4.07	6.70	7261.46	826.15 S	423.42 W	-832.20	4.98
7390.00	7.26	355.41	7304.24	821.92 S	423.46 W	-827.97	7.84
7433.00	12.74	353.52	7346.57	814.50 S	424.21 W	-820.56	12.75
7476.00	17.66	357.81	7388.06	803.26 S	425.00 W	-809.33	11.75
7519.00	20.36	1.39	7428.71	789.26 S	425.07 W	-795.34	6.83
7561.00	24.13	0.91	7467.57	773.36 S	424.75 W	-779.44	8.99
7604.00	28.92	1.51	7506.04	754.17 S	424.34 W	-760.24	11.14
7647.00	32.93	2.51	7542.92	732.09 S	423.55 W	-738.15	9.42
7690.00	36.27	2.81	7578.31	707.70 S	422.41 W	-713.75	7.76
7733.00	41.33	6.15	7611.81	680.87 S	420.27 W	-686.88	12.74
7776.00	47.46	6.28	7642.52	650.97 S	417.01 W	-656.95	14.27
7819.00	52.86	4.10	7670.06	618.10 S	414.05 W	-624.04	13.14
7862.00	57.96	2.57	7694.46	582.78 S	412.00 W	-588.68	12.22
7905.00	61.19	2.45	7716.23	545.74 S	410.38 W	-551.63	7.51
7947.00	62.93	2.70	7735.91	508.67 S	408.71 W	-514.54	4.18
7990.00	63.81	1.48	7755.19	470.26 S	407.31 W	-476.11	3.26
8033.00	67.80	359.78	7772.81	431.05 S	406.89 W	-436.90	9.96
8076.00	73.51	359.06	7787.04	390.50 S	407.30 W	-396.36	13.37
8119.00	78.05	359.94	7797.60	348.83 S	407.66 W	-354.70	10.75
8162.00	80.99	359.81	7805.42	306.55 S	407.75 W	-312.42	6.83
8188.00	84.88	359.85	7808.62	280.75 S	407.83 W	-286.63	14.97
8245.00	88.70	0.72	7811.81	223.85 S	407.55 W	-229.73	6.88
8331.00	90.31	0.44	7812.55	137.86 S	406.69 W	-143.74	1.90
8374.00	90.43	0.12	7812.28	94.86 S	406.48 W	-100.74	0.79
8459.00	90.80	0.74	7811.36	9.87 S	405.83 W	-15.75	0.85
8545.00	91.24	0.83	7809.83	76.11 N	404.65 W	70.24	0.51
8716.00	89.75	359.75	7808.35	247.09 N	403.78 W	241.21	1.07
8887.00	89.75	359.81	7809.09	418.09 N	404.44 W	412.18	0.03
9059.00	89.26	358.72	7810.58	590.06 N	406.66 W	584.11	0.70
9230.00	90.12	356.90	7811.50	760.93 N	413.21 W	754.86	1.18
9402.00	90.43	355.58	7810.66	932.55 N	424.49 W	926.30	0.78
9573.00	90.12	358.09	7809.83	1103.27 N	433.92 W	1096.87	1.48
9745.00	89.88	1.36	7809.83	1275.25 N	434.74 W	1268.82	1.90
9916.00	89.57	2.39	7810.66	1446.15 N	429.15 W	1439.78	0.63
10088.00	91.05	2.10	7809.74	1618.01 N	422.40 W	1611.72	0.88
10259.00	90.80	1.10	7806.97	1788.92 N	417.63 W	1782.68	0.60
10431.00	88.58	1.18	7807.90	1960.87 N	414.20 W	1954.67	1.29
10602.00	89.69	3.60	7810.48	2131.69 N	407.08 W	2125.57	1.56
10774.00	90.49	3.35	7810.20	2303.37 N	396.67 W	2297.39	0.49
10945.00	91.42	3.38	7807.34	2474.05 N	386.64 W	2468.19	0.54
11117.00	90.62	3.06	7804.28	2645.75 N	376.98 W	2640.01	0.50
11288.00	89.69	1.87	7803.82	2816.59 N	369.63 W	2810.94	0.88
11460.00	90.80	0.67	7803.08	2988.54 N	365.81 W	2982.93	0.95
11631.00	89.51	1.09	7802.62	3159.51 N	363.18 W	3153.92	0.80
11802.00	89.38	0.96	7804.27	3330.48 N	360.14 W	3324.91	0.10
11973.00	91.11	0.38	7803.54	3501.46 N	358.15 W	3495.90	1.07
12145.00	89.94	2.15	7801.96	3673.40 N	354.37 W	3667.88	1.23
12342.00	88.15	1.67	7805.25	3870.25 N	347.81 W	3864.81	0.94
12395.00	88.15	1.67	7806.97	3923.20 N	346.27 W	3917.78	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 0.83 DEGREES (TRUE)  
A TOTAL CORRECTION OF 8.65 DEG FROM MAGNETIC NORTH TO TRUE NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 12395.00 FEET  
IS 3938.46 FEET ALONG 354.96 DEGREES (TRUE)

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