



Composite Log

Multiple Propagation Resistivity
Gamma Ray

Scale: 1:240 Measure Depth

Company: Noble Energy
Well: Wells Ranch State BB01-690
Field: Weld County
County: Weld State: Colorado

Status: Final Print
API Number: 05-123-41986-00
Surface Location: Latitude: 40° 26' 1.968" N Longitude: 104° 21' 17.892" W
SEC: 05 TWP: 5N RNG: 62W
Other Services: Directional VSS

Permanent Datum (P.D.): Ground Level
Log Measured From: Rig Floor
Depth Reference: Driller's Depth
Elevation: 4702.00 ft.
Above P.D.
Elevations: N/A
KB: 4732.00 ft.
DF: 4702.00 ft.
GL:

Interval Logged
Top: 1882.0 ft. Date From: 11/Mar/2016 Date To: 13/Mar/2016
Bottom: 5818.0 ft. Date To: 13/Mar/2016
Spud Date: 11/Mar/2016
Dip Angle: 67.05°
Total
Field Strength: 52635.0 nT
North Correction: 7.51°

Borehole Record			Casing Record		
Hole Size	From	To	Size	Weight	From
13.500 in.	Surface	1926.0 ft.	9.625 in.	36.00 lb/ft	Surface
8.500 in.	1916.0 ft.	5818.0 ft.			

Mud Record			Deviation Record		
Type	From	To	Hole Size	Interval	Inc / Az (Start)
Oil Based Mud	Surface	5818.0 ft.	13.500 in.	1896.0 ft.	0.0° / 138.6°
			8.500 in.	3902.0 ft.	0.5° / 357.5°
					10.4° / 326.4°
					/
					/
					/
					/
					/
					/

Acquisition System			Software Version			Other		
Advantage	2.20U4	Rig:	H&P 321	/	Helmerich & Payne Drilling Co			
PATS	6.4.1.34	Job No:	7841194					
		District / Unit:	RMD		/ D&E			

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Log Run Summary													
LWD Run No.	BHA Run No.	Bit Run No.	Bit Size (in.)	Bit Type	Bit Gauge Length (in.)	Assembly Type	Logged Interval		Bit Depth Interval		Date / Time		Circ. Time (hrs.)
							Top	Bottom	From	To	Start	End	
							(ft.)	(ft.)	(ft.)	(ft.)			
1	1	2	8.500	PDC	2.000	Steerable	1882.0	5818.0	1916.0	5818.0	12/Mar/2016 12:00	13/Mar/2016 7:45	11.3

Crew								
Name			Arrive	Depart	Name			Arrive
			Wellsite	Wellsite				Wellsite
Matthew Delmore			11/Mar/2016	13/Mar/2016	Mike Gurnsey			11/Mar/2016
Alex Osborne			11/Mar/2016	13/Mar/2016	Nick Brownwood			11/Mar/2016
Austin Small			11/Mar/2016	13/Mar/2016	Hans Cary			11/Mar/2016

Mud Properties Record

Date / Time		LWD Run No.	Measured Depth (ft.)	Mud Type	Density (ppg)	Viscosity (cp)	pH	Fluid Loss (cc)	Oil / Water	Source	Total Chlorides (ppm)	K+ (%)
12/Mar/2016	13:00	1	1926.0	Oil Based Mud	9.8	17	N/A	13.8	61.8/25.3	Active Pits	33000	N/A
13/Mar/2016	01:00	1	5356.0	Oil Based Mud	9.5	14	N/A	14.4	63.3/25.5	Active Pits	39000	N/A

Mud Resistivity Record

				Surface				Downhole			
Date / Time		LWD Run No.	Measured Depth (ft.)	Surface Temp (deg F)	Rm (ohm.m)	Rmf (ohm.m)	Rmc (ohm.m)	BHCT (deg F)	Rm @ BHCT (ohm.m)	Rmf @ BHCT (ohm.m)	Rmc @ BHCT (ohm.m)
12/Mar/2016	13:40	1	1850.0	70	100.00	100.00	100.00	122	57.69	57.69	57.69

Mnemonics

Curve	Description	Units
CACLM	Conductivity (AT) (LS) 400kHz – Compensated Borehole Corrected	mho/o
GRAM	Gamma Ray Apparent, 0.5 ft. Avg	API
GRIM	Gamma Ray Density	points
RACHM	Resistivity, Attenuation (LS) 2 MHZ – Compensated Borehole Corrected	ohm.m
RACLM	Resistivity, Attenuation (LS) 400 kHz – Compensated Borehole Corrected	ohm.m
ROPA	Rate of Penetration, 3.0 ft. Avg	ft/hr
RPCHM	Resistivity, Phase Difference (LS) 2 MHZ – Compensated Borehole Corrected	ohm.m
RPCLM	Resistivity, Phase Difference (LS) 400 kHz – Compensated Borehole Corrected	ohm.m
RPSIHM	Resistivity Slide Indicator	unitless
RPTHM	Time Since Drilled	min

Equipment and Service Data

LWD Run No.	Tool	Serial Number	Measurement	Bit Offset (ft)	Max O.D. (in.)	Min I.D. (in.)
1	CS	12445995	-	83.90	7.000	2.165
1	BCPM	11823270	Telemetry	73.70	7.000	2.165
1	FLEX SUB	13651950	-	66.55	6.250	2.165
1	OTK	12349020	Directional	61.68	7.031	2.165
1	OTK	12349020	Resistivity	55.87	7.031	2.165
1	OTK	12349020	Gamma	51.84	7.031	2.165
1	OTK	12349020	Pressure	50.95	7.031	2.165
1	CS	13351962	-	48.25	7.000	2.165

Service and Tool Mnemonics

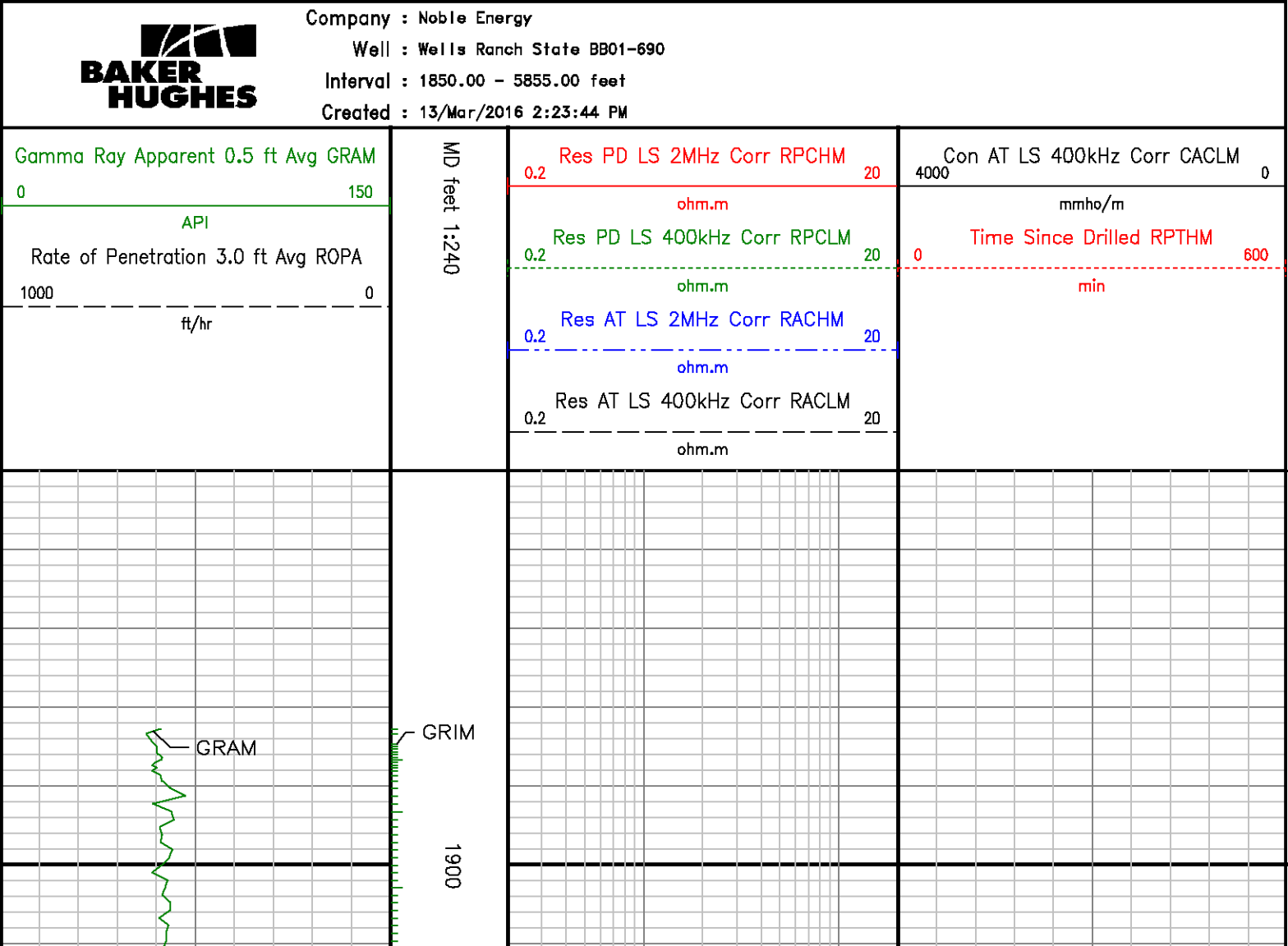
Mnemonic	Name	Description
BCPM	BCPM	Mud pulse telemetry and downhole tool power module
FLEX SUB	Flex Sub	Flexible sub connection
OTK	OnTrak	Propagation resistivity, propagation conductivity, gamma ray, directional, annular pressure, system memory and VSS

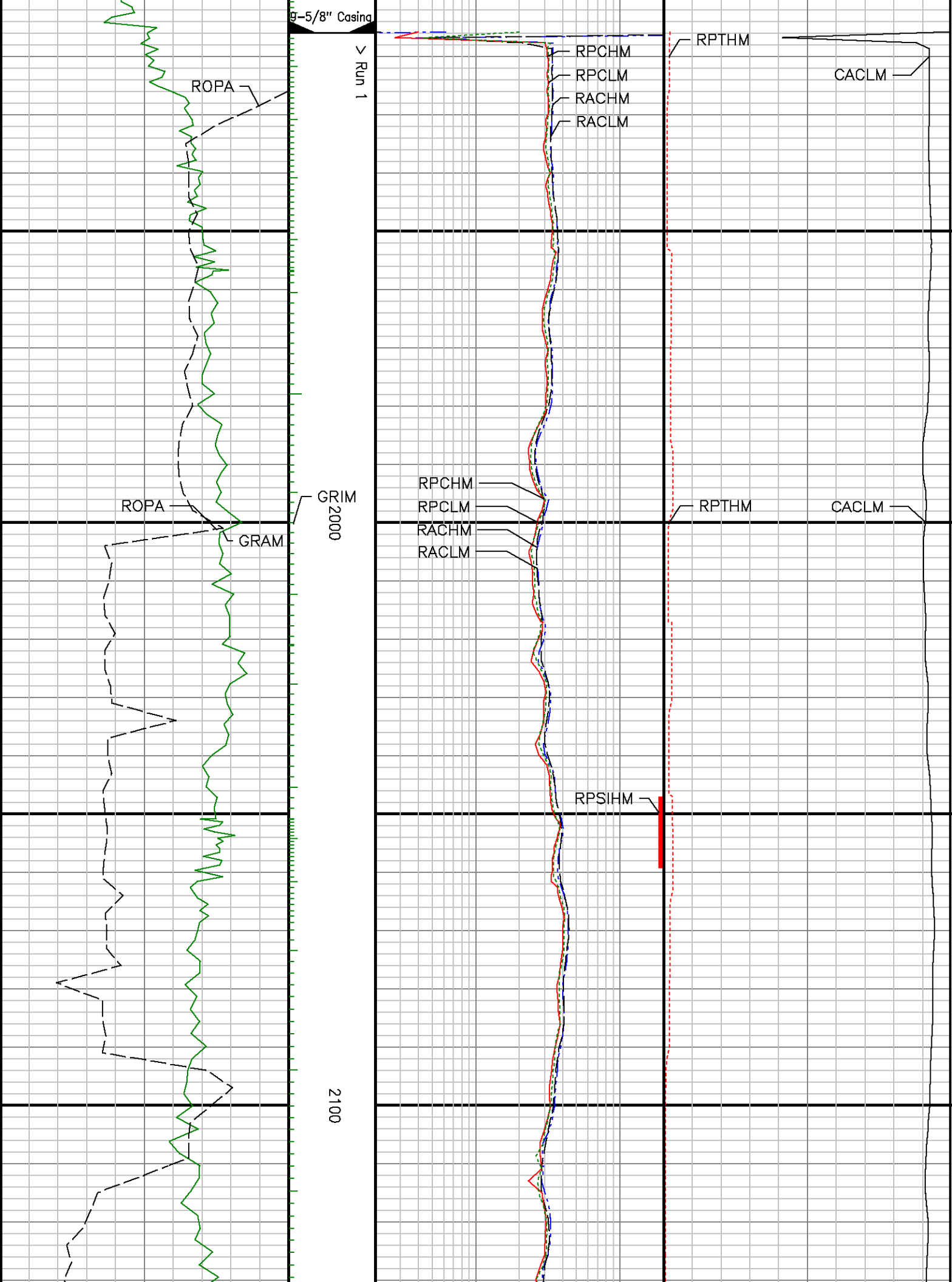
Comments

1. Baker Hughes INTEQ run 1 utilized 6 3/4 inch Ontrak Services. (Multiple Propagation Resistivity, Gamma Ray, VSS, and Directional) behind an 8 1/2 inch bit and steerable assembly from 1916 to 5818 feet MD (1915.90 to 5765.00 feet TVD).
2. A sliding indicator is shown to the right of track 2 as a heavy red line. The indicator has been depth-shifted to the resistivity sensor offset to correspond with data acquired while sliding.
3. Depth measurements were obtained from a depth tracking system not supplied or operated by Baker Hughes. Due to the lack of control by Baker Hughes LWD logging engineers, depth calibrations and measurements could not be independently verified and the unverified depths as supplied to Baker Hughes are being used to present logging data.

Remarks

Number	Measured Depth (ft)	Hole Section (in.)	LWD Run No.	Remark
1	5795	8.500	1	The interval from 5774 to 5818 feet MD (5721.72 to 5765.00 feet TVD) does not contain resistivity or gamma data due to the sensor to bit offset at the end of the run.

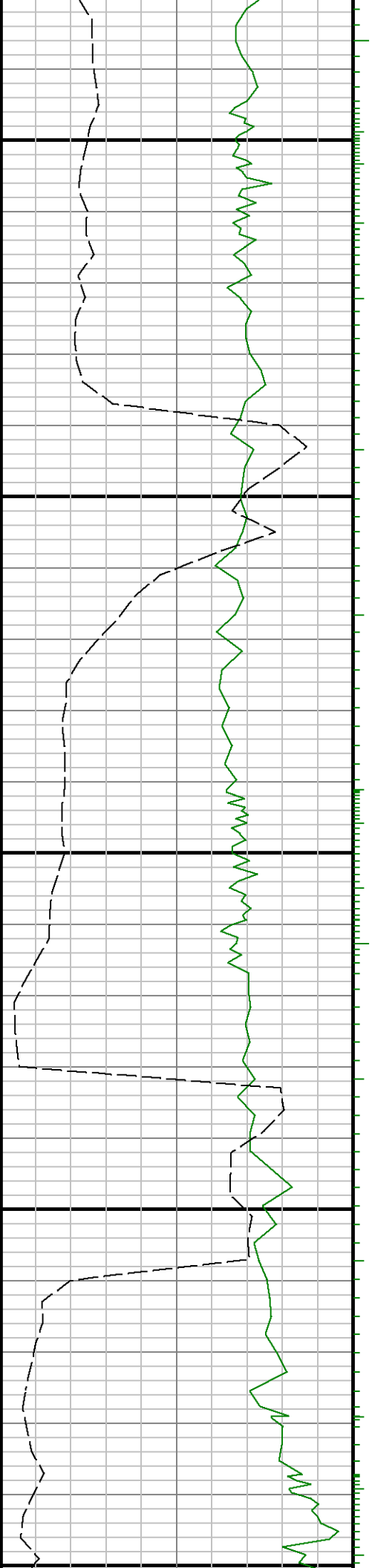


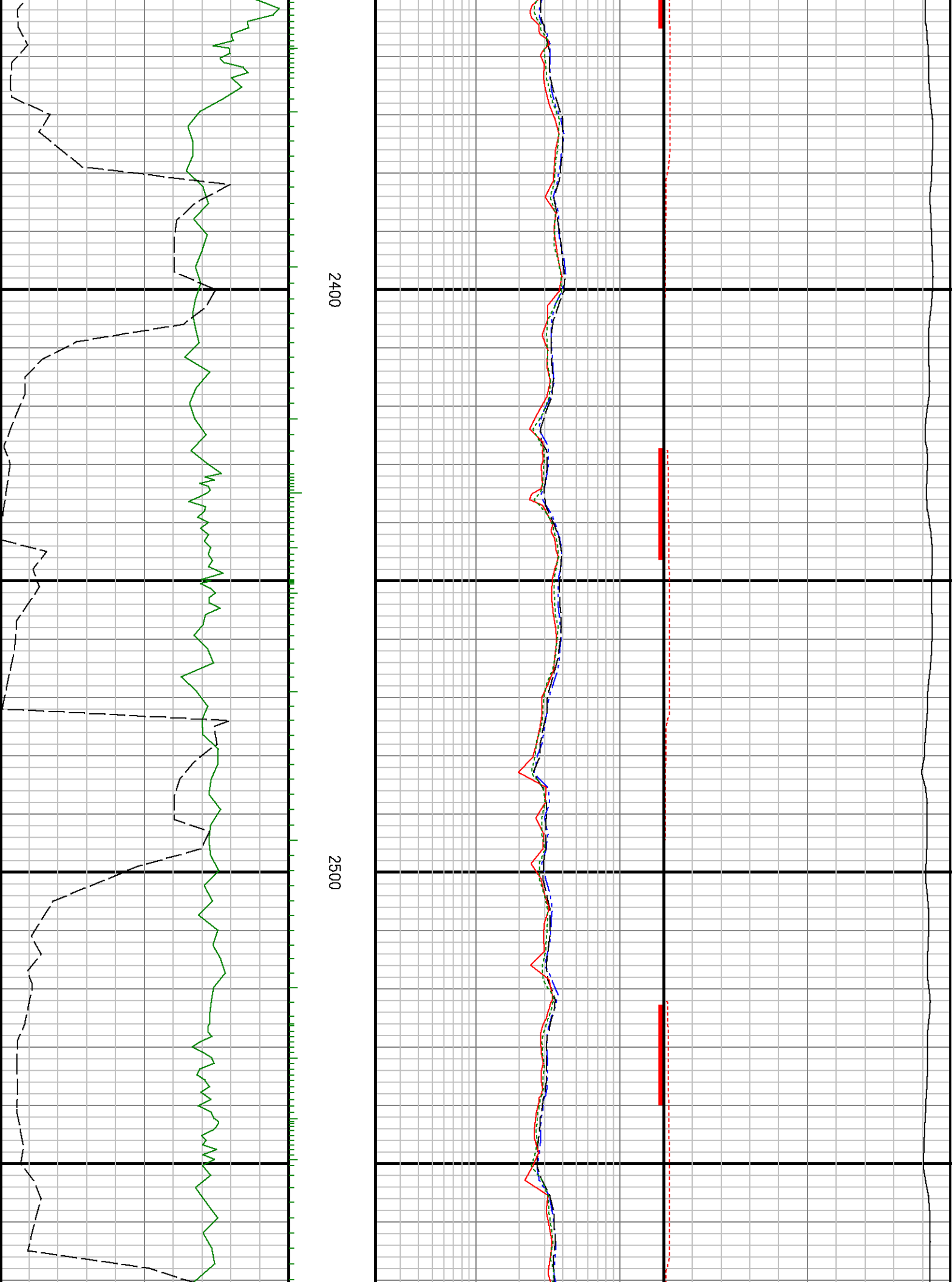


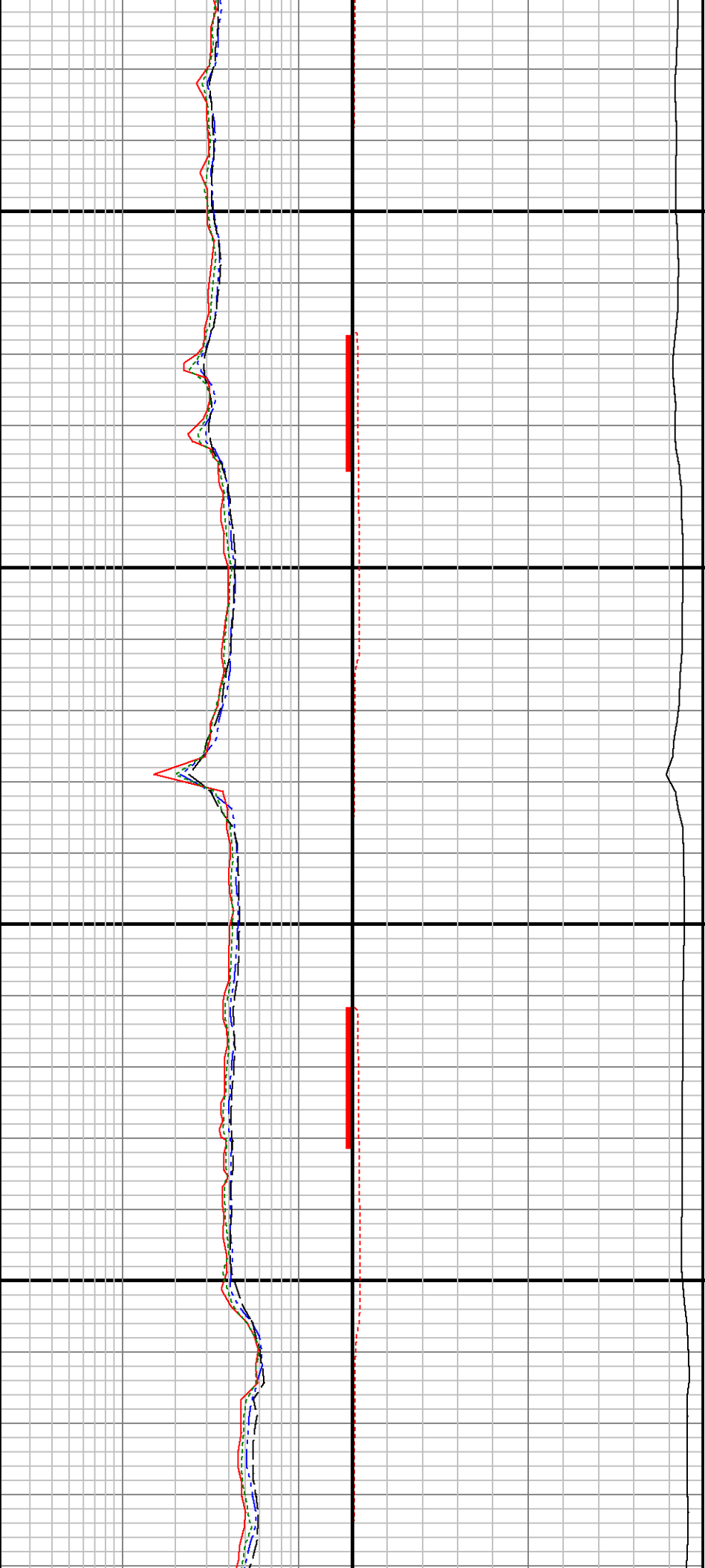


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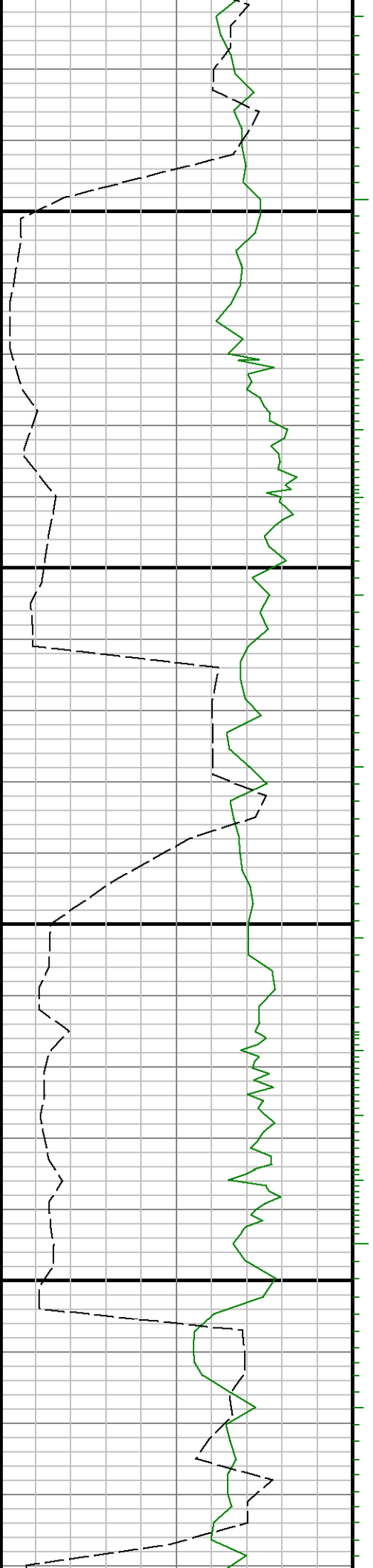


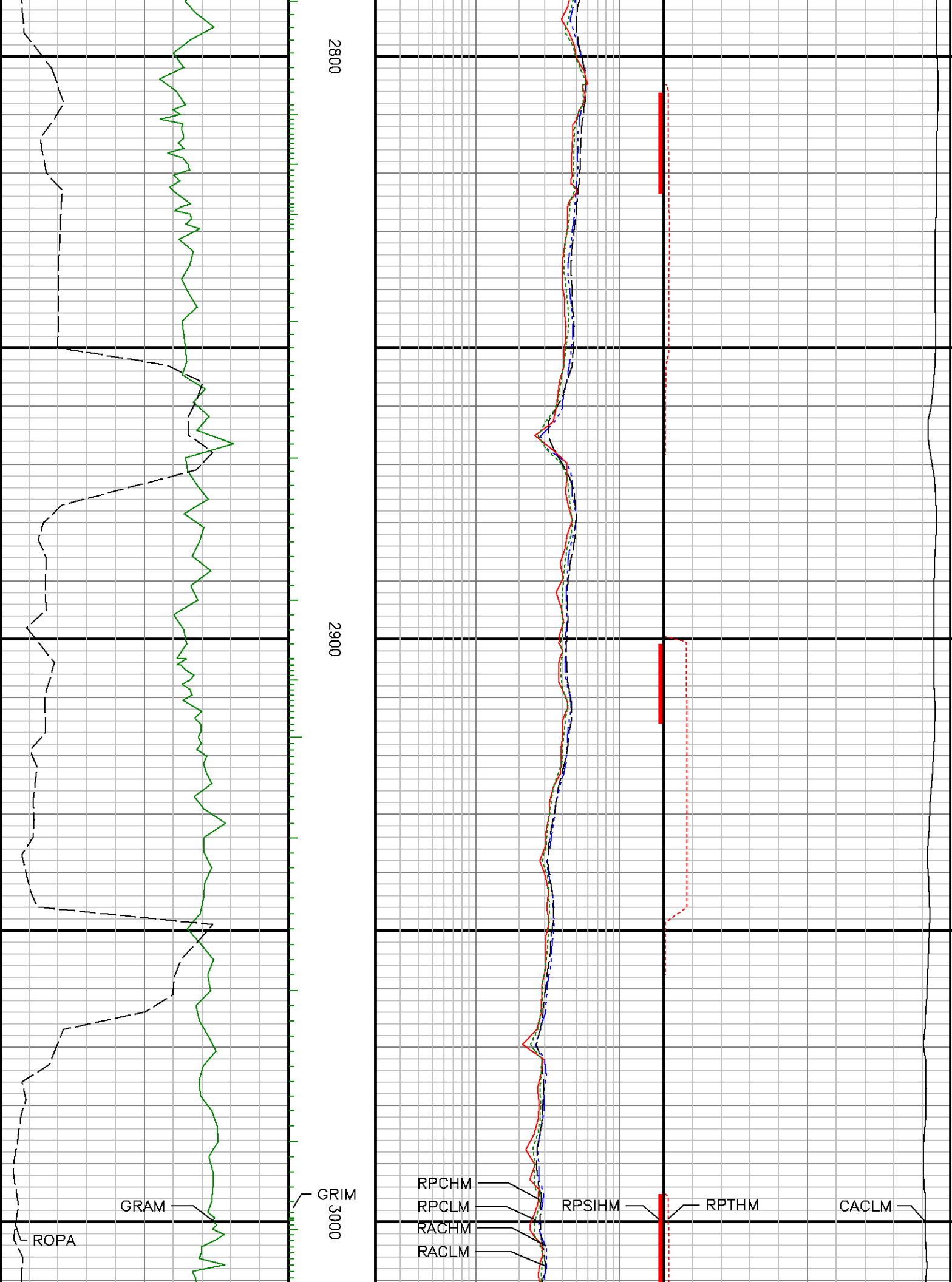




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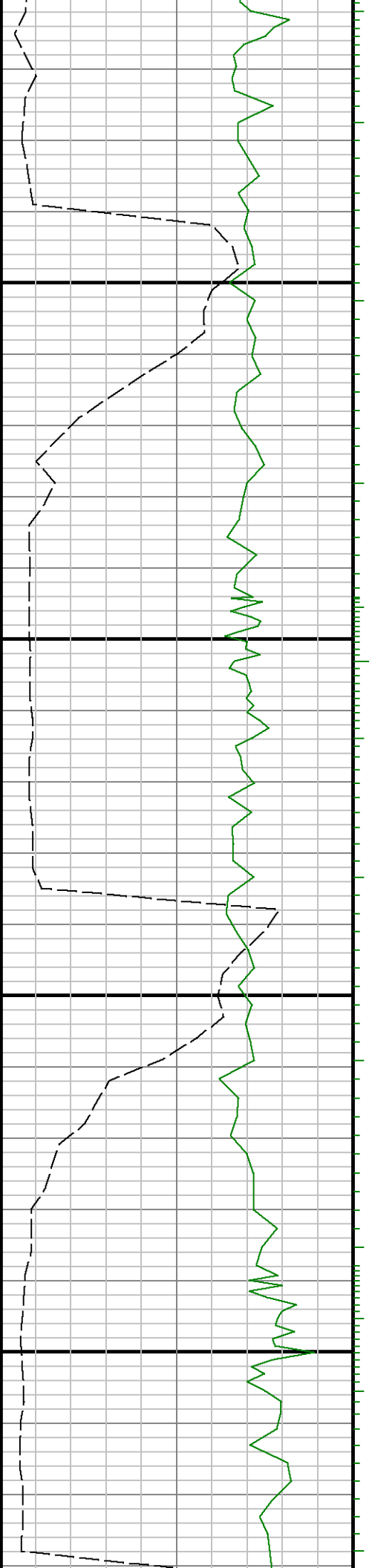






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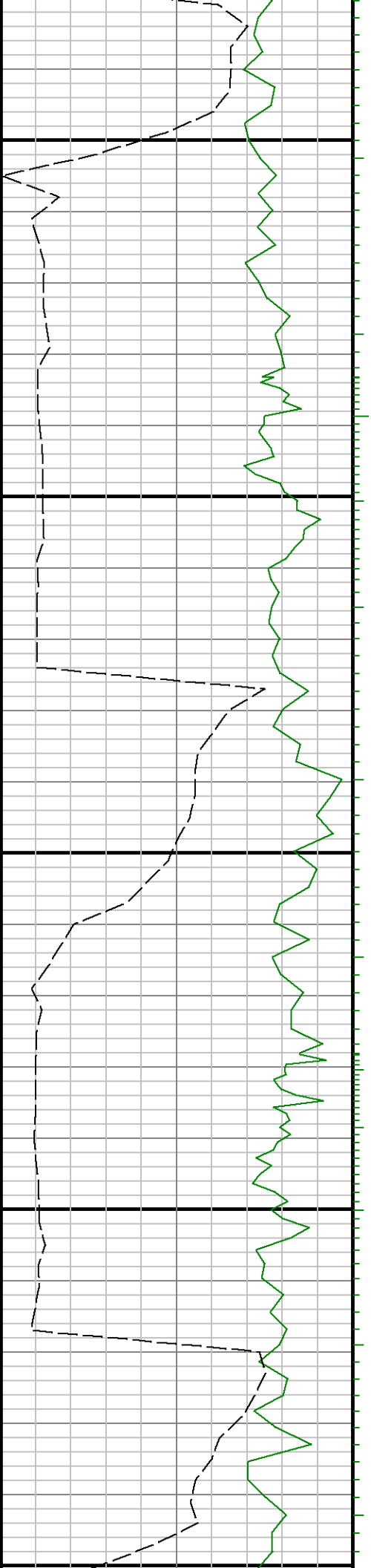
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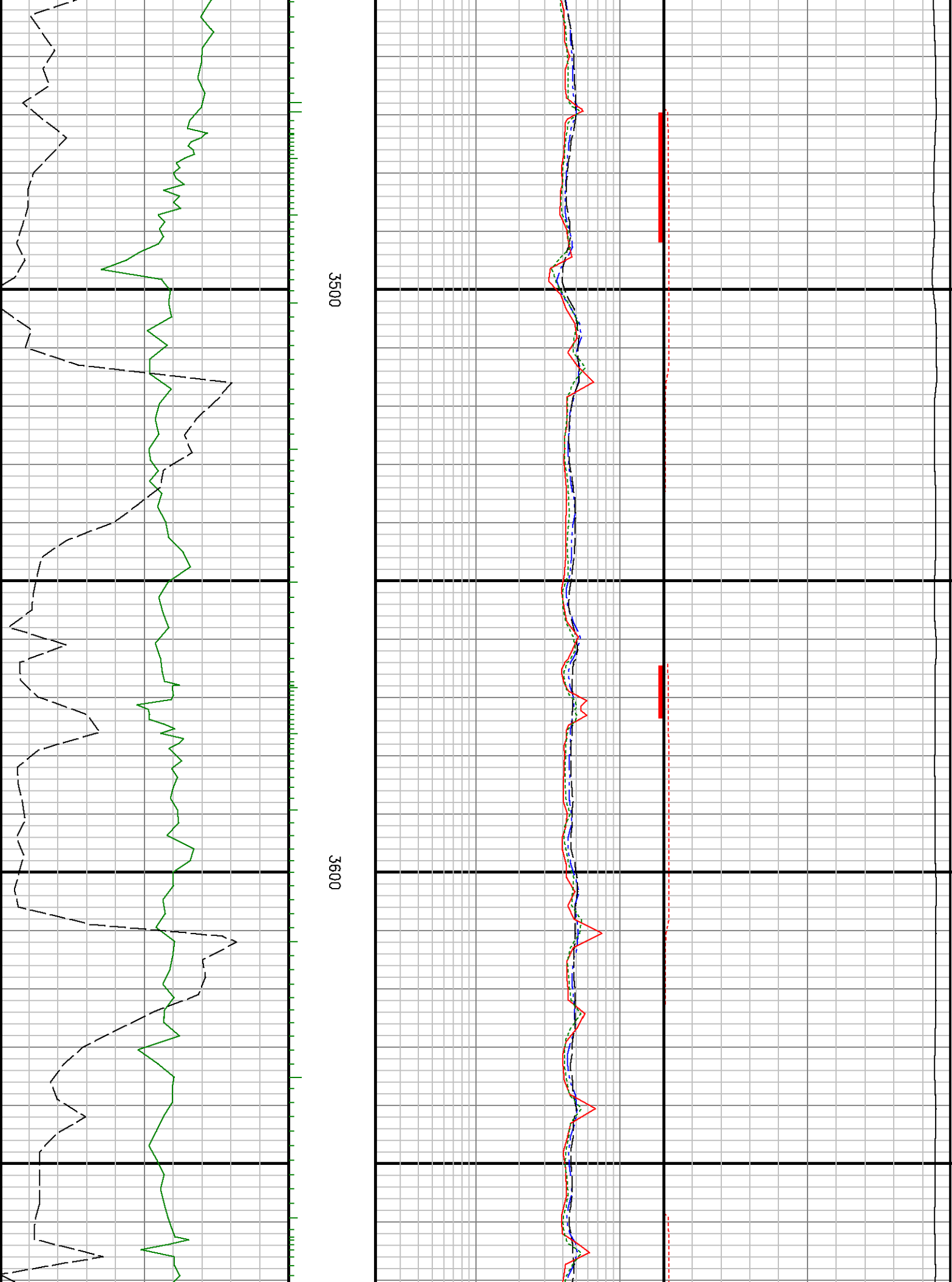


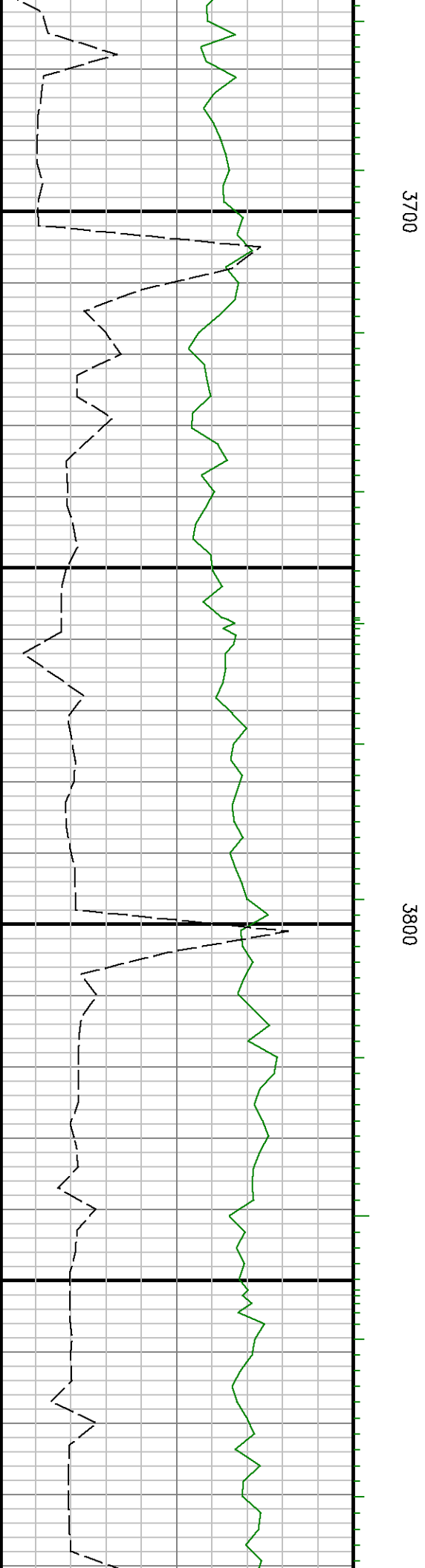


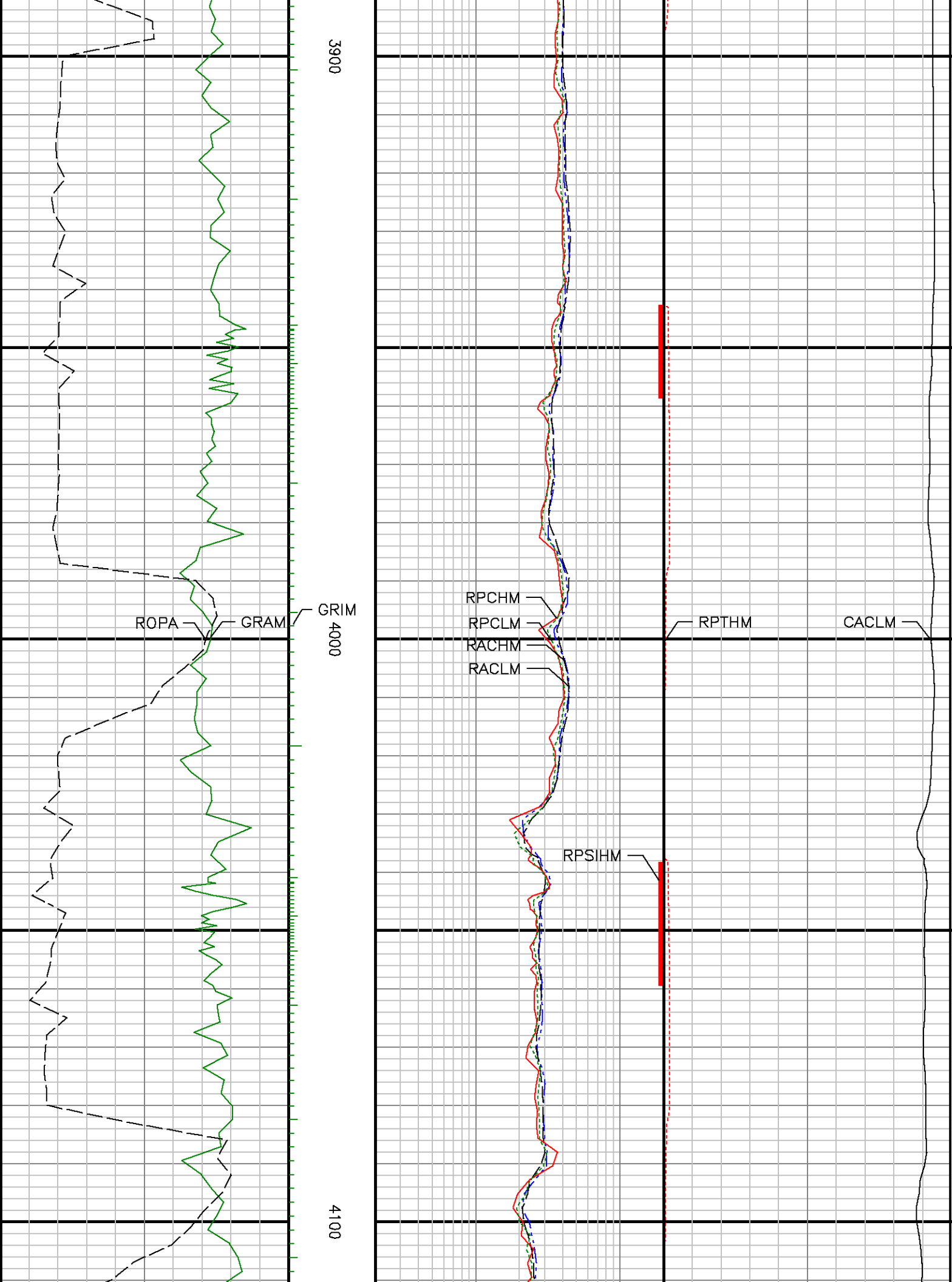
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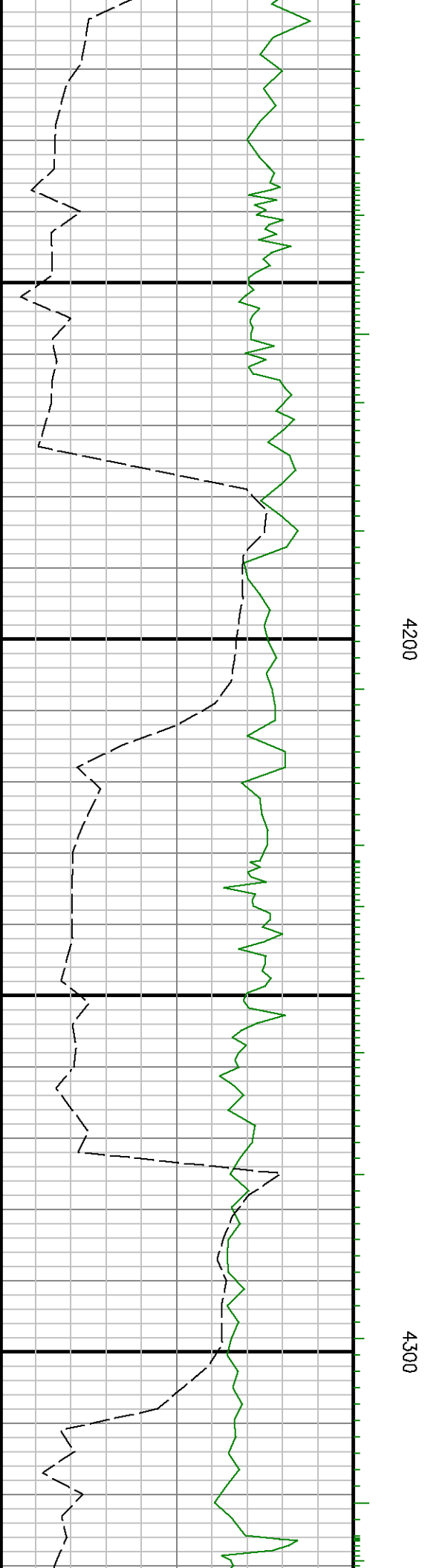
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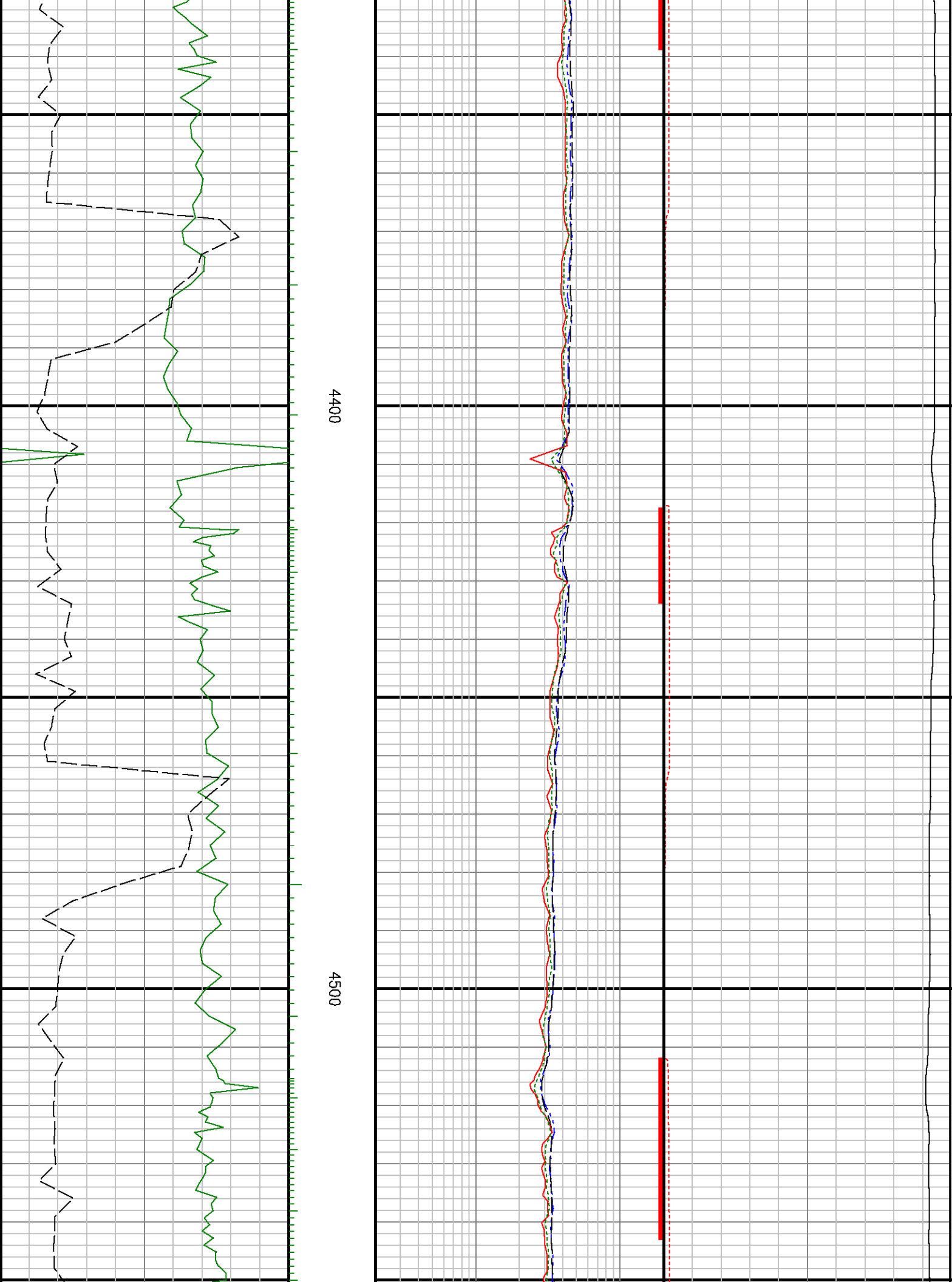


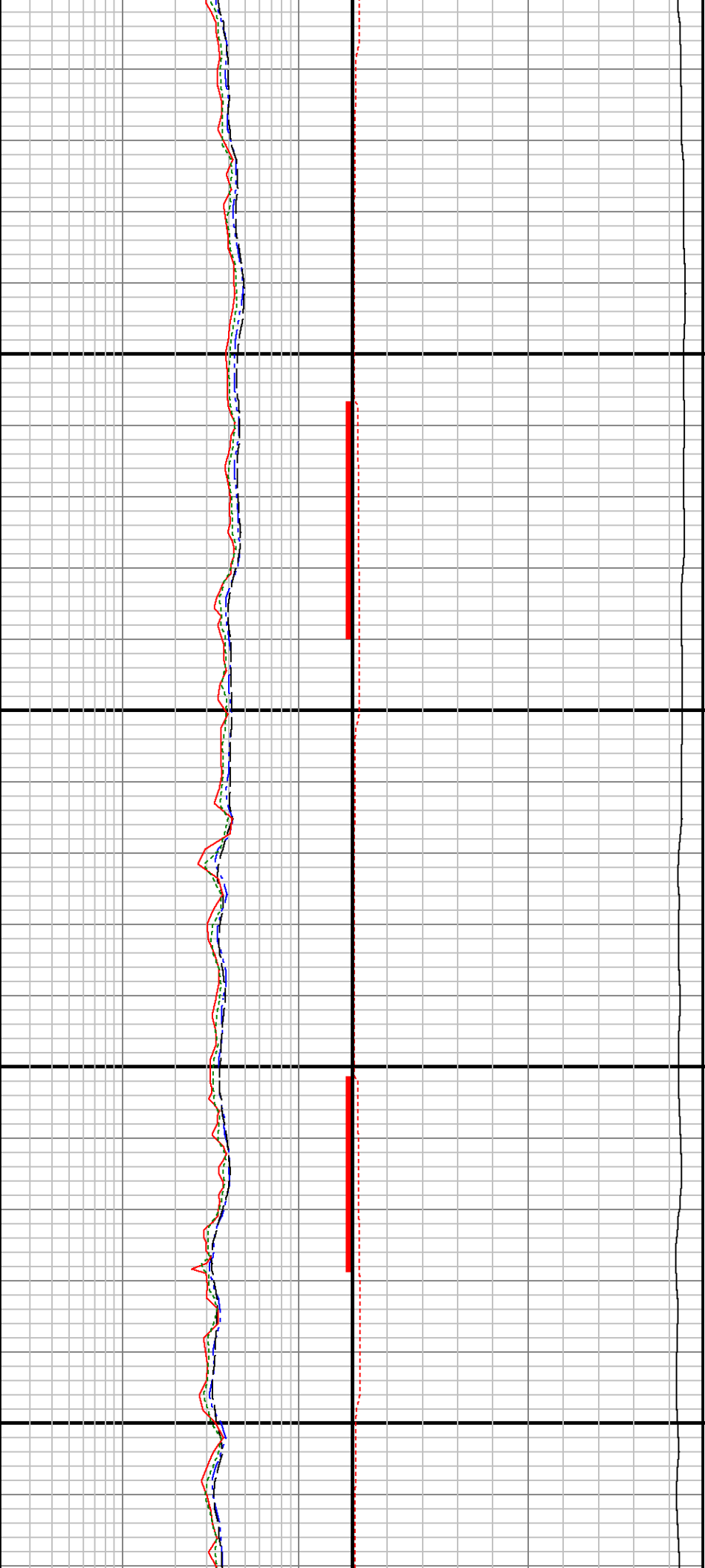






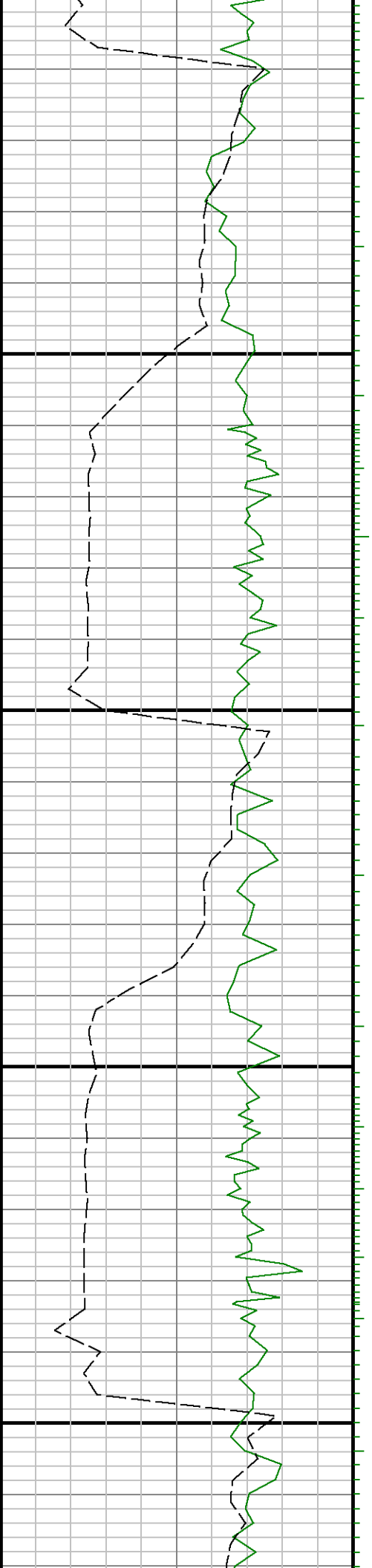


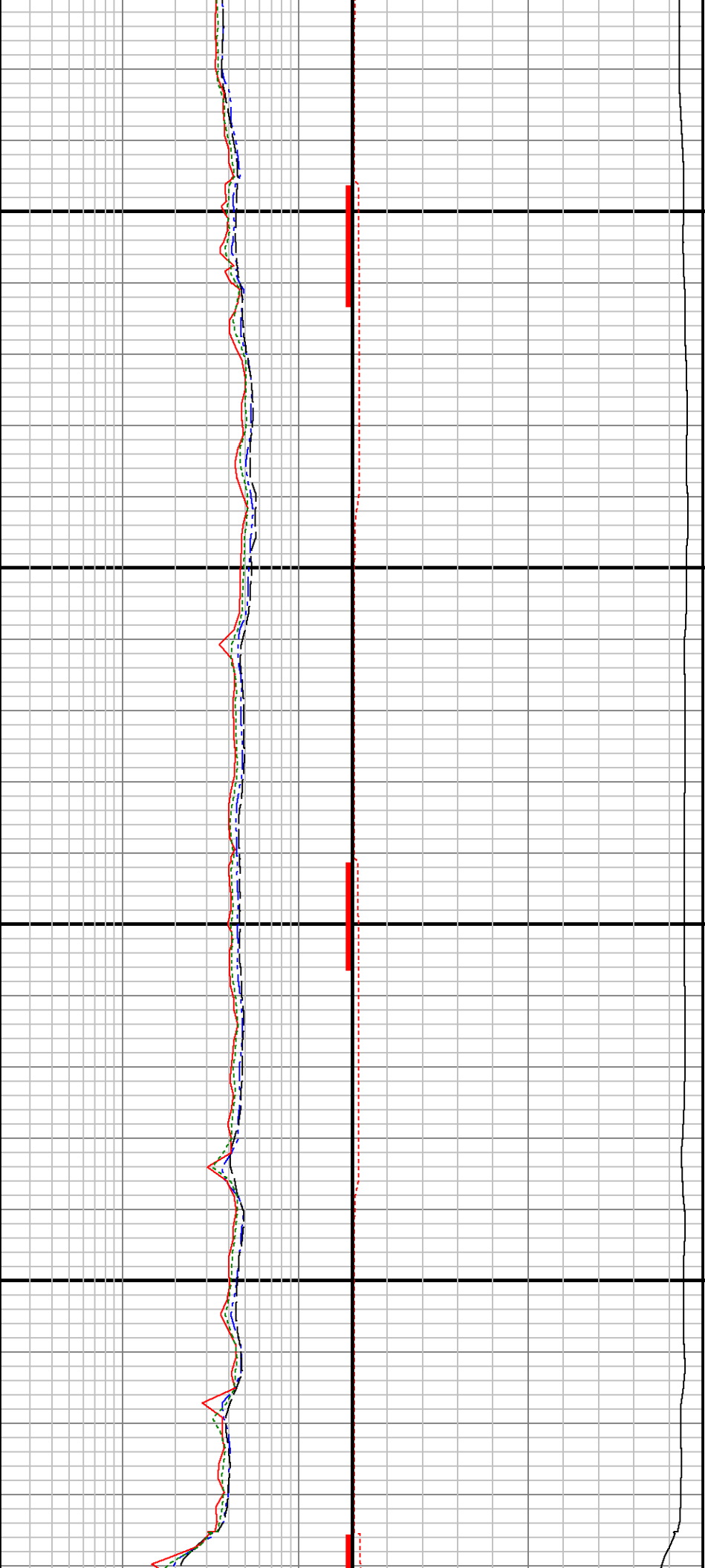




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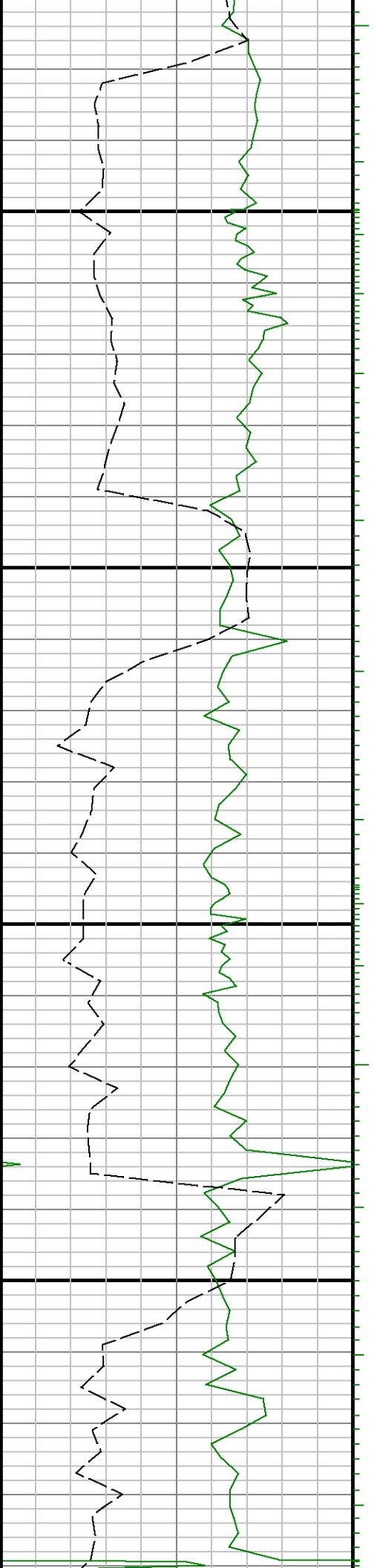
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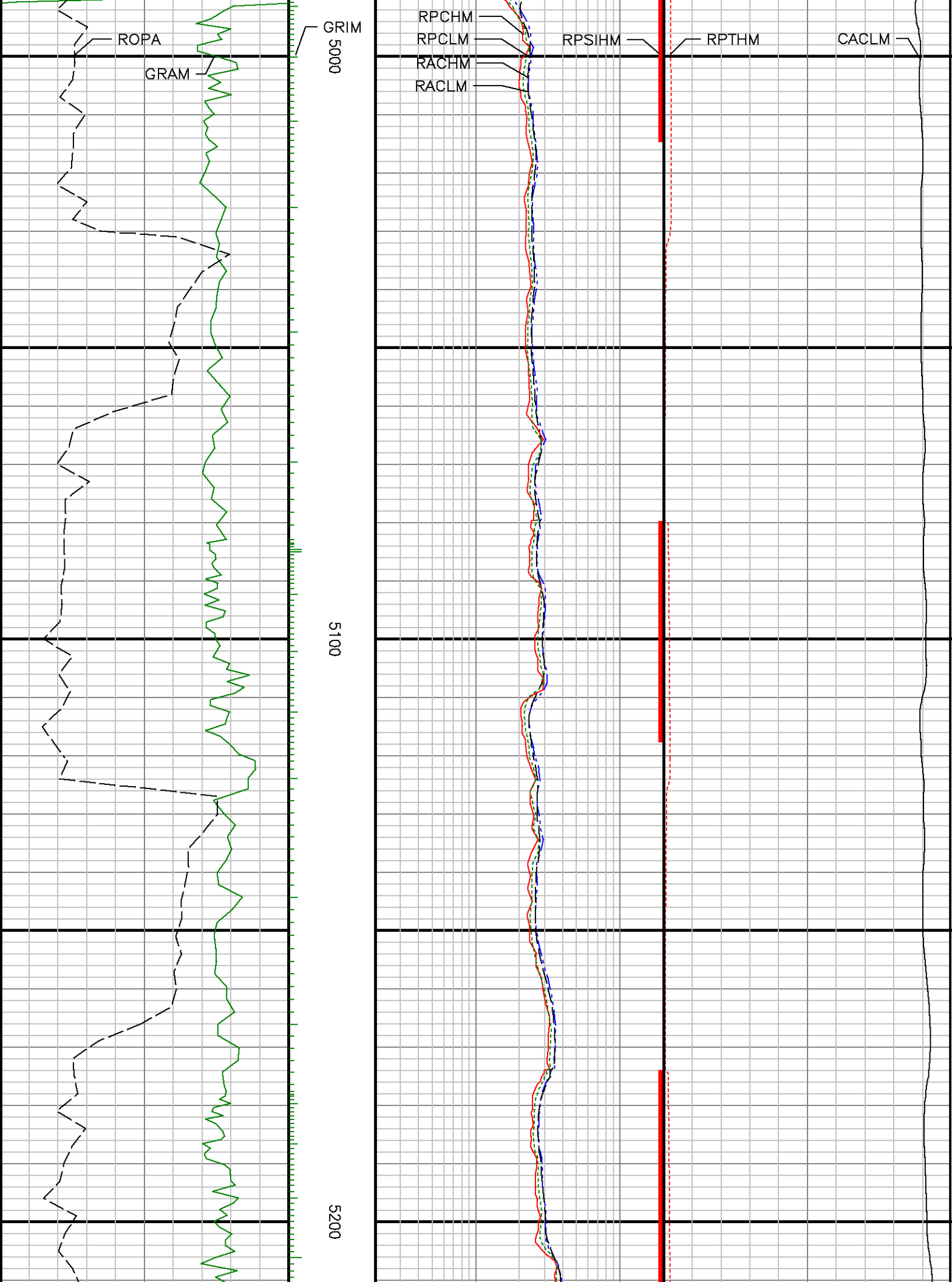




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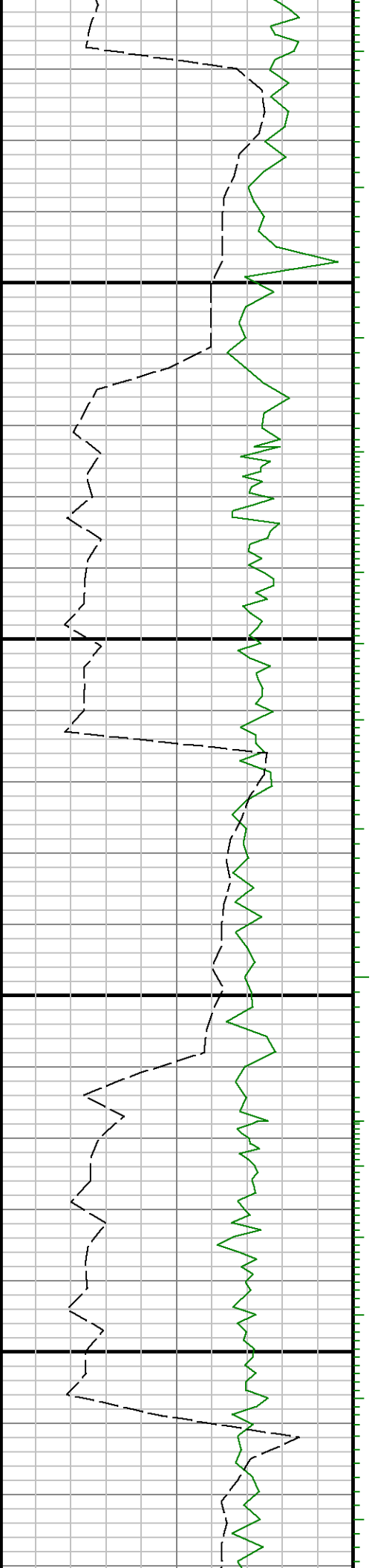


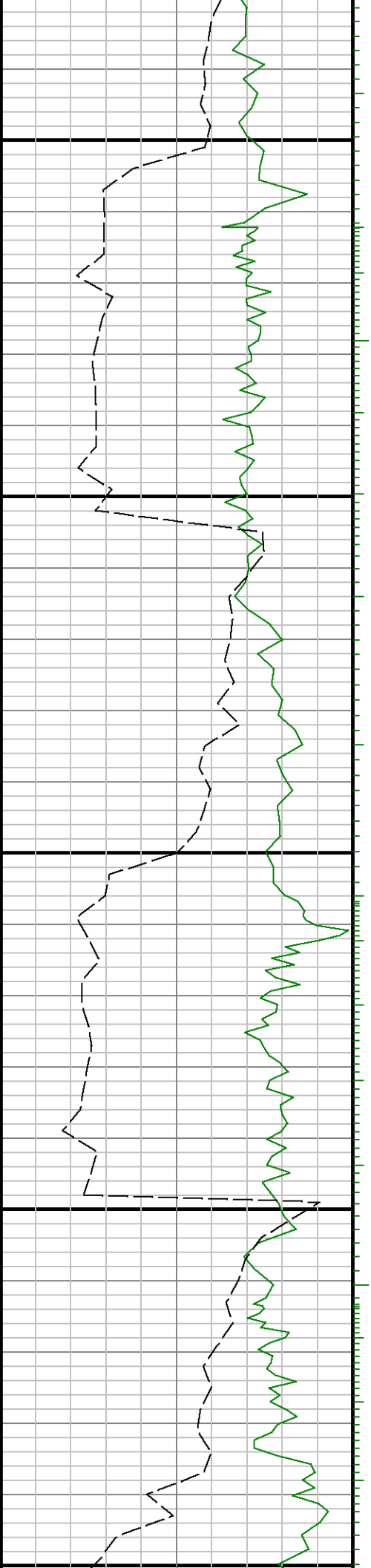




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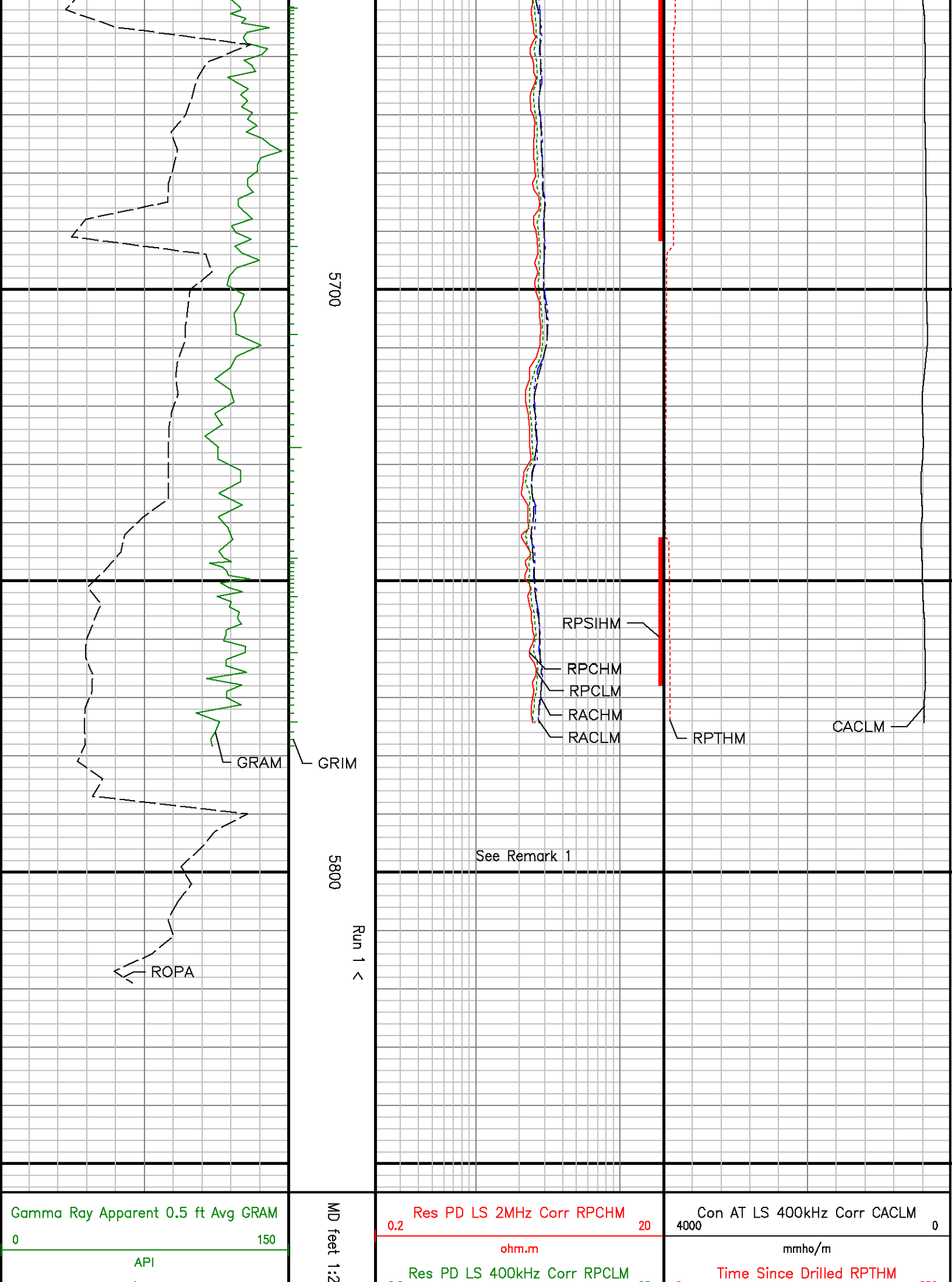




5500

5600





Gamma Ray Apparent 0.5 ft Avg GRAM
0 150
API

MD feet 1:2
Run 1 <

Res PD LS 2MHz Corr RPCHM 20
0.2 ohm.m
Res PD LS 400kHz Corr RPCLM

Con AT LS 400kHz Corr CACLM 0
4000 mmho/m
Time Since Drilled RPTHM

Rate of Penetration 3.0 ft Avg ROPA	40	0.2	20	0	600
1000	0	ohm.m		min	
ft/hr		Res AT LS 2MHz Corr RACHM			
		0.2	20		
		ohm.m			
		Res AT LS 400kHz Corr RACLM			
		0.2	20		
		ohm.m			