



Gamma Ray, Propagation Resistivity

Scale:	Company: Kerr McGee Oil & Gas Onshore, LP
1:240 MEASURED DEPTH	Well: Nichols 30C-5HZ
	Field: Wattenberg
	County: Weld State: Colorado

Status:	FIELD PRINT	Surface Location:	Other Services:
API Number:	05-123-35919	Latitude: 40° 9' 14.090" N Longitude: 104° 41' 46.601" W	Directional
Permanent Datum (P.D.):	Mean Sea Level	Elevation: 0.00 ft.	Elevations: N/A
Log Measured From:	Rig Floor	4962.00 ft.	Above P.D.
Depth Reference:	Driller's Depth	GL:	4946.00 ft.

Interval Logged	Dates	Magnetic Field Reference
Top: 6698.0 ft.	Date From: 07/Feb/13	Dip Angle: 66.94° Azi Reference North: True
Bottom: 14296.0 ft.	Date To: 19/Feb/13	Total Mag to Reference
Spud Date: 07/Feb/13	Field Strength: 52820.0 nT	North Correction: 8.64°

Borehole Record			Casing Record		
Hole Size	From	To	Size	Weight	From
13.500 in.	Surface	741.0 ft.	9.625 in.	36.00 lb/ft	Surface
8.750 in.	741.0 ft.	7719.0 ft.	7.000 in.	26.00 lb/ft	Surface
6.125 in.	7719.0 ft.	14348.0 ft.			

Mud Record			Deviation Record		
Type	From	To	Hole Size	Interval	Inc / Az (Start)
Water Based Mud	Surface	14348.0 ft.	8.750 in.	6978.0 ft.	0.2° / 226.1°
			6.125 in.	6629.0 ft.	91.7° / 359.4°
					89.9° / 358.8°
					/
					/
					/
					/

Acquisition System		Software Version		Other	
Advantage	2.20U3	Rig:	Xtreme 20	/ Xtreme Coil Drilling	
PATS	6.4.1.34	Job No:	5199630	/ D&E	
		District / Unit:	Rocky Mountains		

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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 (ft.)	Bottom (ft.)	From (ft.)	To (ft.)	Start	End	
2	2	2	8.750	PDC	3.000	Steerable	6698.0	7558.0	6748.0	7608.0	09/Feb/2013 07:00	09/Feb/2013 02:50	20.1
3	3	2RR	8.750	PDC	3.000	Steerable	7558.0	7668.0	7608.0	7719.0	10/Feb/2013 14:50	10/Feb/2013 18:20	5.4
4	4	3	6.125	PDC	3.000	Steerable	7668.0	13118.0	7719.0	13162.0	12/Feb/2013 09:35	15/Feb/2013 07:45	61.8
5	5	4	6.125	PDC	3.000	Steerable	13118.0	14296.0	13162.0	14348.0	17/Feb/2013 03:45	18/Feb/2014 01:55	38.8

Crew

Name	Arrive	Depart	Name	Arrive	Depart	Name	Arrive	Depart
	Wellsite	Wellsite		Wellsite	Wellsite		Wellsite	Wellsite
Adam Schlenz	07/Feb/13	19/Feb/13	Robert Dix	07/Feb/13	10/Feb/13	Mark Dix	10/Feb/13	19/Feb/13

Witness

Name	LWD Run Number
Marvin Hackworth	2,3
James Adkins	4,5

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+ (%)
09/Feb/13 08:00	2	6812.0	Water Based	9.8	14	8.7	N/A	-/92	Active Pit	1600	N/A
09/Feb/13 19:30	2	7363.0	Water Based	9.8	12	8.7	N/A	-/92.2	Active Pit	1800	N/A
11/Feb/13 08:00	3	7720.0	Water Based	10.0	14	8.5	N/A	-/91.4	Active Pit	1600	N/A
11/Feb/13 20:00	3	7720.0	Water Based	9.8	12	8.0	N/A	-/92.2	Active Pit	1750	N/A
12/Feb/13 12:00	4	7900.0	Water Based	9.4	9	10.5	N/A	-/93.8	Active Pit	1300	N/A
12/Feb/13 20:00	4	8581.0	Water Based	9.8	12	11.5	N/A	-/90.2	Active Pit	1400	N/A
13/Feb/13 07:30	4	10204.0	Water Based	9.8	15	10.5	N/A	-/89.2	Active Pit	1400	N/A
13/Feb/13 17:30	4	11221.0	Water Based	9.8	13	10.5	N/A	-/88	Active Pit	1500	N/A
14/Feb/13 07:00	4	12217.0	Water Based	9.8	13	10.5	N/A	-/87	Active Pit	1450	N/A
14/Feb/13 18:00	4	12530.0	Water Based	9.8	14	10.5	N/A	-/85.8	Active Pit	1500	N/A
15/Feb/13 07:00	4	13160.0	Water Based	9.8	14	10.8	N/A	-/85.7	Active Pit	1450	N/A
15/Feb/13 18:00	4	13168.0	Water Based	9.8	15	11.0	N/A	-/85.8	Active Pit	1400	N/A
16/Feb/13 10:00	4	13168.0	Water Based	9.8	15	11.5	N/A	-/85.6	Active Pit	1500	N/A
16/Feb/13 20:00	4	13168.0	Water Based	9.9	16	11.0	N/A	-/85.4	Active Pit	1600	N/A
17/Feb/13 07:00	5	13321.0	Water Based	10.2	15	11.0	N/A	-/84.4	Active Pit	1600	N/A
17/Feb/13 18:00	5	13763.0	Water Based	10.2	16	11.5	N/A	-/84.2	Active Pit	1800	N/A

Mud Resistivity Record

Date / Time		LWD	Measured	Surface	Rm	Rmf	Rmc	BHCT	Rm	Rmf	Rmc
		Run No.	Depth	Temp					@ BHCT	@ BHCT	@ BHCT
			(ft.)	(deg F)	(ohm.m)	(ohm.m)	(ohm.m)	(deg F)	(ohm.m)	(ohm.m)	(ohm.m)
12/Feb/2013	00:15	4	7719.0	73	1.10	N/A	N/A	180	0.46	N/A	N/A
13/Feb/2013	00:34	4	9251.0	71	0.80	N/A	N/A	210	0.28	N/A	N/A
13/Feb/2013	12:58	4	10943.0	75	0.67	N/A	N/A	231	0.23	N/A	N/A
13/Feb/2013	23:46	4	11881.0	72	0.72	N/A	N/A	234	0.23	N/A	N/A
14/Feb/2013	15:54	4	12477.0	71	0.60	N/A	N/A	237	0.19	N/A	N/A
14/Feb/2013	23:53	4	12901.0	71	0.68	N/A	N/A	242	0.21	N/A	N/A
16/Feb/2013	04:13	5	13163.0	73	0.70	N/A	N/A	241	0.22	N/A	N/A
17/Feb/2013	23:59	5	14198.0	76	0.55	N/A	N/A	253	0.17	N/A	N/A

Mnemonics

Curve	Description	Units
ROPA	Rate of Penetration, 3.0 ft. Avg	ft/hr
GRAX	Gamma Ray – Apparent, 0.5 ft. Avg	API

GRIX	Gamma Ray – Data Point Indicator	unitless
GRIM	Gamma Ray Data Point Indicator	unitless
GRAM	Gamma Ray – Apparent, 0.5 ft. Avg	API
RPCHM	Resistivity Phase – Corrected – 2MHz	ohm.m
RPCLM	Resistivity Phase – Corrected – 400kHz	ohm.m
RACHM	Resistivity Attenuation – Corrected – 2MHz	ohm.m
RACLM	Resistivity Attenuation – Corrected – 400kHz	ohm.m
RPTHM	Resistivity Time Since Drilled	min
RPSIHM	Resistivity Phase Short Space Sliding Indicator – 2MHz	unitless
CACLM	Conductivity Attenuation – Corrected – 400KHz	mmho/m
TCDX	Downhole Temperature	degF
TCDM	Downhole Temperature	degF

Equipment and Service Data

LWD Run No.	Tool	Serial Number	Measurement	Bit Offset (ft)	Max O.D. (in.)	Min I.D. (in.)
2	DIR	12546334	Directional	53.31	6.750	0.000
2	SRIG	12604925	Gamma	49.94	6.750	0.000
3	DIR	11670150	Directional	53.42	6.750	3.250
3	SRIG	12131373	Gamma	50.04	6.750	0.000
4	CS	12016837	-	76.14	4.910	1.750
4	BCPM	12015762	Telemetry	65.08	5.000	1.750
4	STAB	11781612	-	61.88	5.625	1.750
4	OTK	11983648	Directional	56.44	5.066	1.750
4	OTK	11983648	Resistivity	43.26	7.031	2.165
4	APR	11983648	Resistivity	43.26	0.000	0.000
4	OTK	11983648	Gamma	51.75	5.066	1.750
4	OTK	11983648	Pressure	47.70	5.066	1.750
4	CS	12018734	-	36.89	4.980	1.750
5	CS	12016837	-	72.54	4.910	1.750
5	BCPM	10411250	Telemetry	61.45	5.000	1.750
5	STAB	11781612	-	58.25	5.625	1.750
5	OTK	10208007	Directional	53.87	4.843	2.569
5	OTK	10208007	Resistivity	47.90	7.031	2.165
5	OTK	10208007	Gamma	40.71	4.843	2.569
5	OTK	10208007	Pressure	43.34	4.843	2.569
5	CS	12018734	-	36.83	4.980	1.750

Service and Tool Mnemonics

Mnemonic	Name	Description
APR	Resistivity	Azimuthal propagation resistivity, azimuthal propagation resistivity image
BCPM	BCPM	Mud pulse telemetry and downhole tool power module
DIR	Directional	Wellbore directional survey
OTK	O.T.K.	Resistivity, gamma ray, pressure, and temperature tool

OnTrak	OnTrak	Propagation resistivity, propagation conductivity, gamma ray, directional, annular pressure, system memory and VSS
SRIG	Inclination and Gamma	Probe based gamma ray and inclination module
STAB	Stabilizer	Stabilizer assembly
CS	Closure Sub	BHA power ring isolator allowing insertion of inert sub into electrically powered BHA

Comments

- (1) Baker Hughes INTEQ run 2 & 3 utilized 6 3/4 inch NaviGamma services (Gamma Ray and Directional) behind an 8 3/4 inch bit and steerable assembly from 6748 to 7719 feet MD (6733 to 7314 feet TVD).
- (2) Baker Hughes INTEQ run 4 & 5 utilized 4 3/4 inch OnTrak services (Multiple Propagation Resistivity, Gamma Ray, and Directional) behind a 6 1/8 inch bit and steerable assembly from 7719 to 14348 feet MD (7314 to 7301 feet TVD).
- (3) A sliding indicator is shown to the right edged of track 2 as a heavy line. The indicator has been depth-shifted to the resistivity sensor offset to correspond with resistivity data acquired while sliding.

Remarks

Number	Measured Depth (ft)	Hole Section (in.)	LWD Run No.	Remark
1	6748	8.750	2	The interval from 6698 to 6748 feet MD (6683 to 6733 feet TVD) was logged up to 10 hours after being drilled due to a trip out of the hole to pick up the build assembly.
2	7608	8.750	3	The interval from 7558 to 7608 feet MD (7298 to 7306 feet TVD) was logged up to 10 hours after being drilled due to a trip out of the hole to pick up a new MWD.
3	7719	6.125	4	The interval from 7668 to 7719 feet MD (7312 to 7314 feet TVD) was logged up to 10 hours after being drilled due to a trip out of the hole for casing and cement operations and to pickup the lateral assembly.
4	7712	6.125	4	Driller's casing depth was 7712 feet MD (7314 feet TVD). MWD's casing depth was 7704 feet MD (7314 feet TVD).
5	13162	6.125	5	The interval from 13118 to 13162 feet MD (7296 feet TVD) was logged up to 10 hours after being drilled due to a trip out of the hole to check the torque on all of the tool joints and pickup a new BHA.
6	14348	6.125	5	The interval from 14296 to 14348 feet MD (7301 feet TVD) was not logged up due to sensors offsets to bit at TD.



Company : Kerr McGee Oil & Gas Onshore, LP

Well : Nichols 30C-5HZ

Interval : 6670.00 - 14370.00 feet

Created : 16/Feb/2013 2:16:38 AM

Gamma Ray Apparent 0.5 ft Avg [GRAX] 0 200	MD feet 1:240	Res PD LS 2MHz Corr [RPCMH] 0.2 200 ohm.m	Time Since Drilled [RPTHM] 0 600 min
API Gamma Ray Apparent 0.5 ft Avg [GRAM] 0 200		Res PD LS 400kHz Corr [RPCLM] 0.2 200 ohm.m	Con AT LS 400kHz Corr [CACLM] 200 0
API Rate of Penetration 3.0 ft Avg [ROPA] 1000 0		Res AT LS 2MHz Corr [RACHM] 0.2 200 ohm.m	mmho/m Downhole Temperature [TCDX] 100 300 degF
ft/hr		Res AT LS 400kHz Corr [RACLM] 0.2 200 ohm.m	Downhole Temperature [TCDM] 100 300 degF

ohm.m

See Remark 1

> Run 2

6700

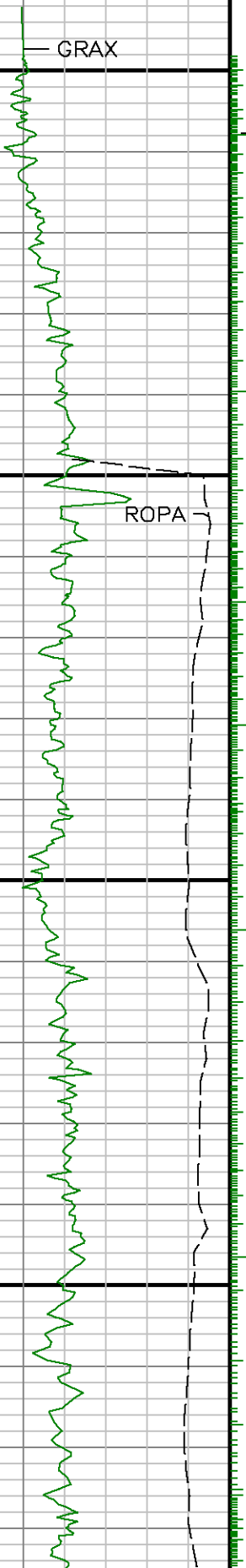
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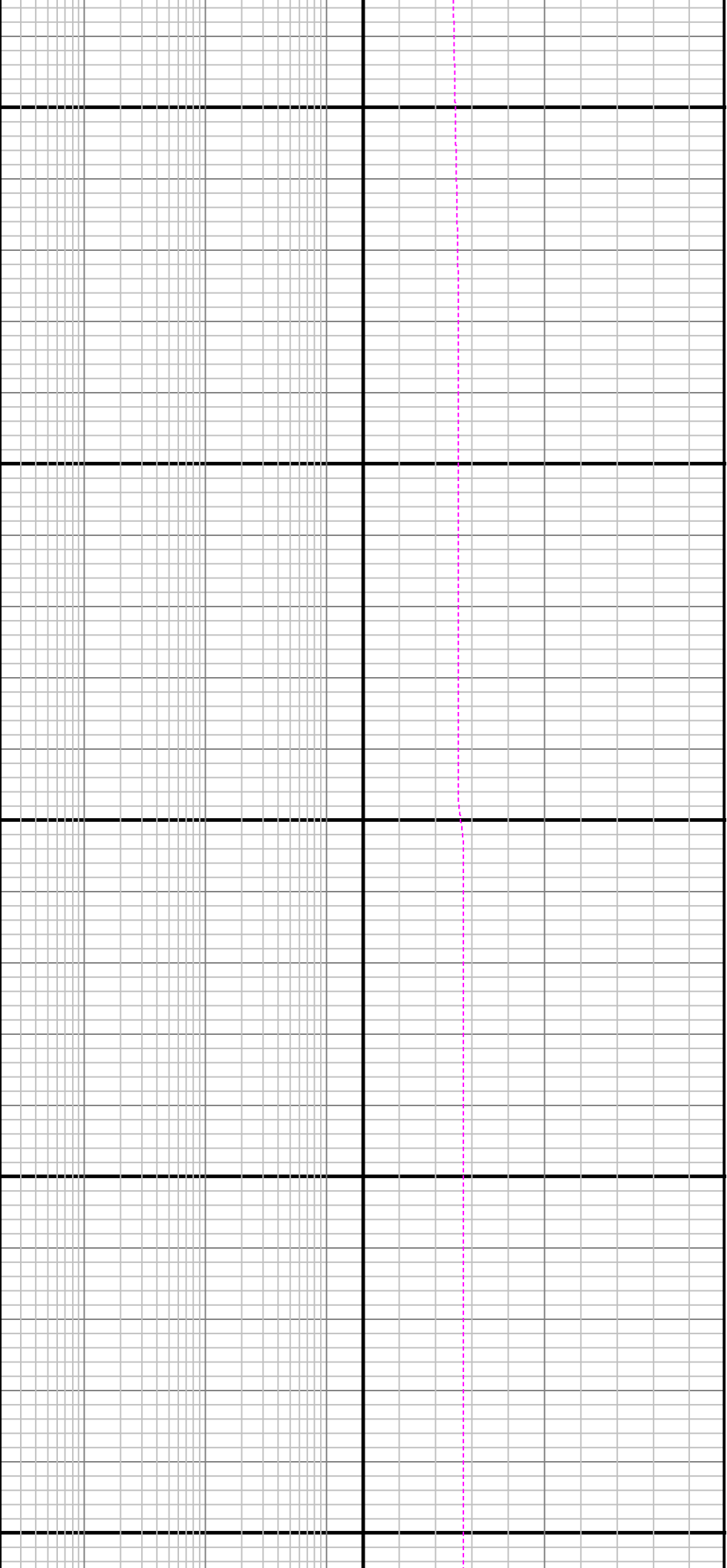
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GRIX

ROPA

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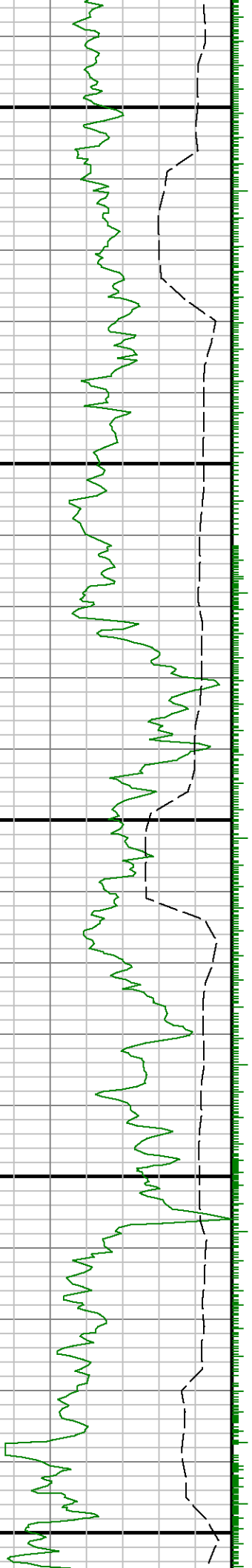


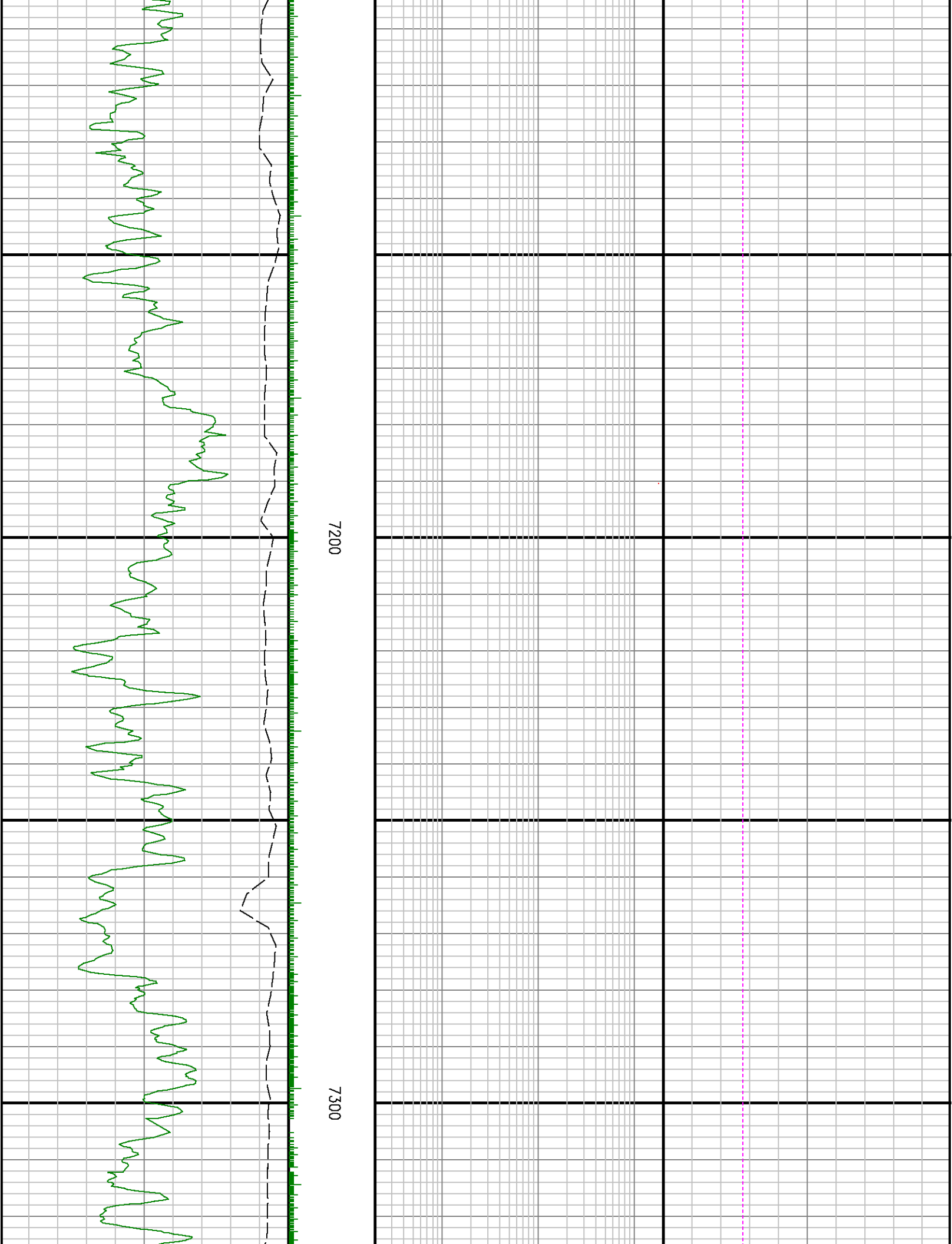


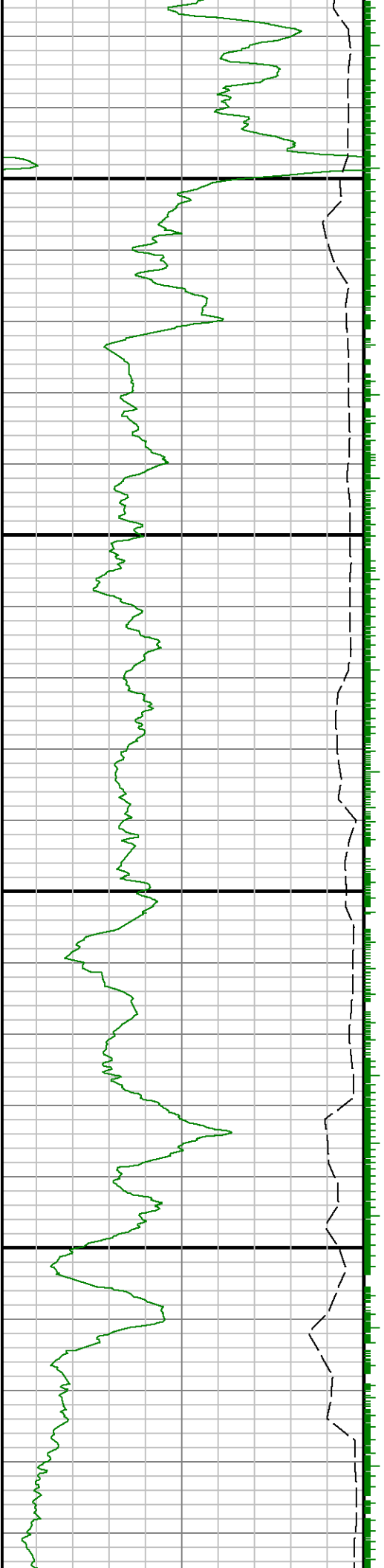
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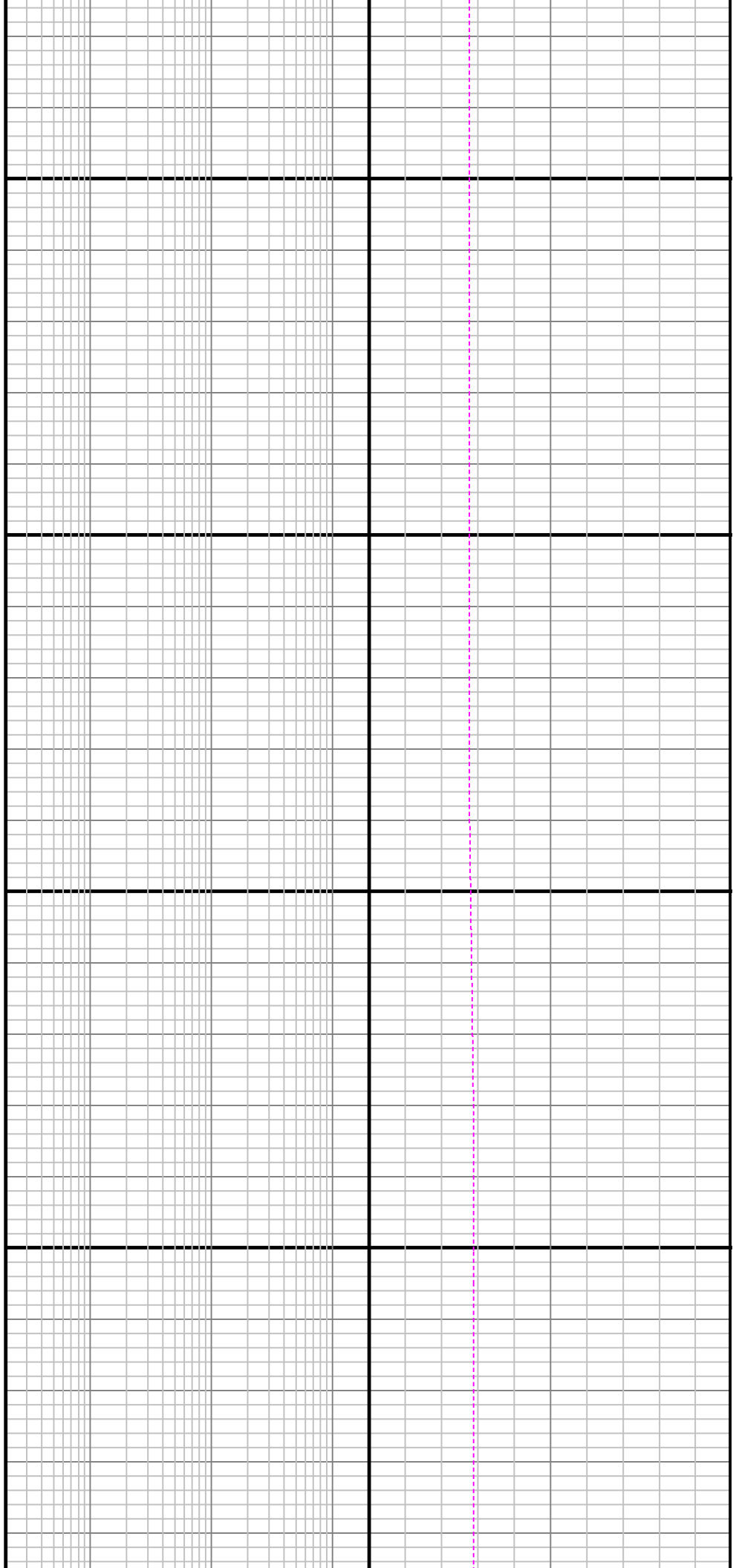


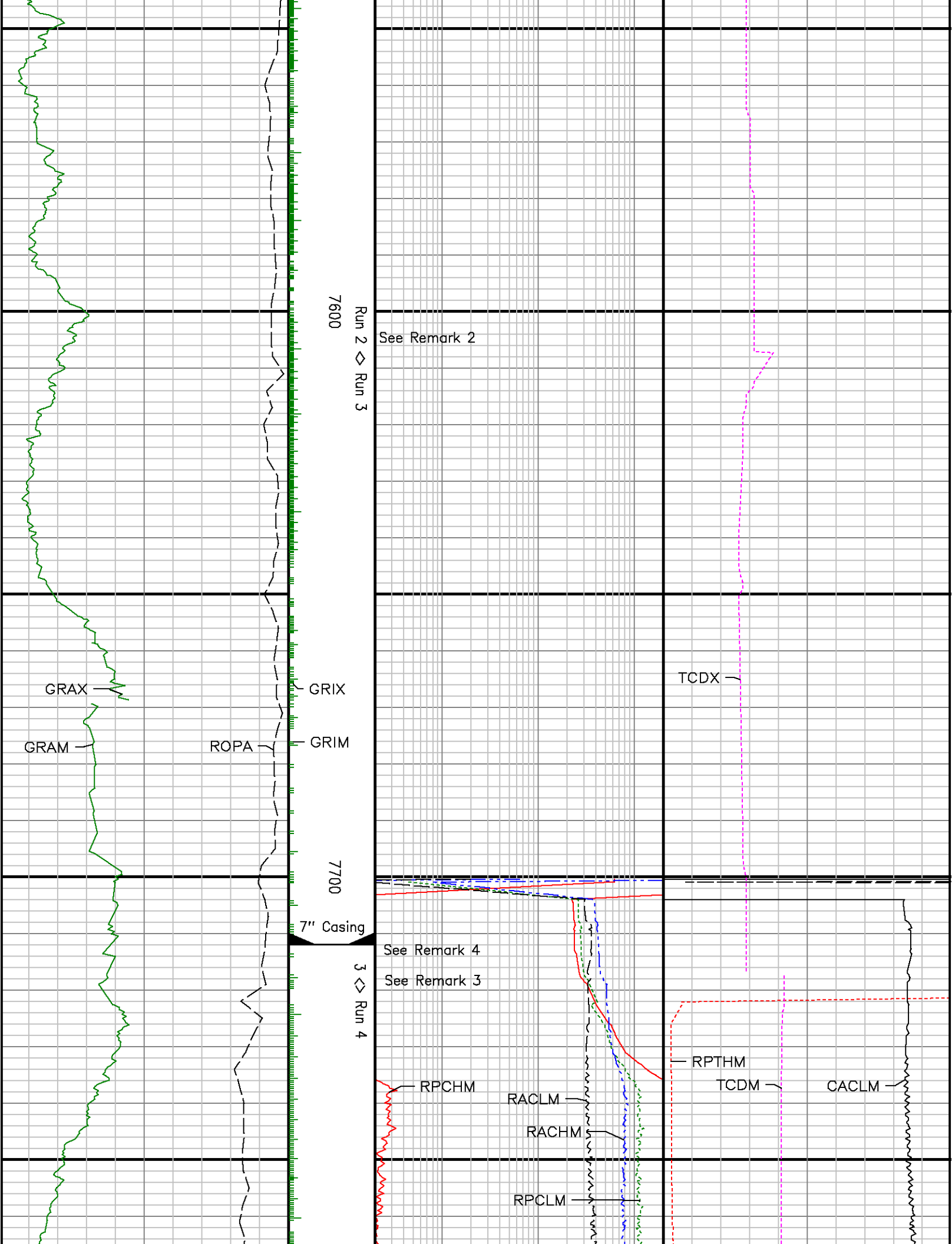


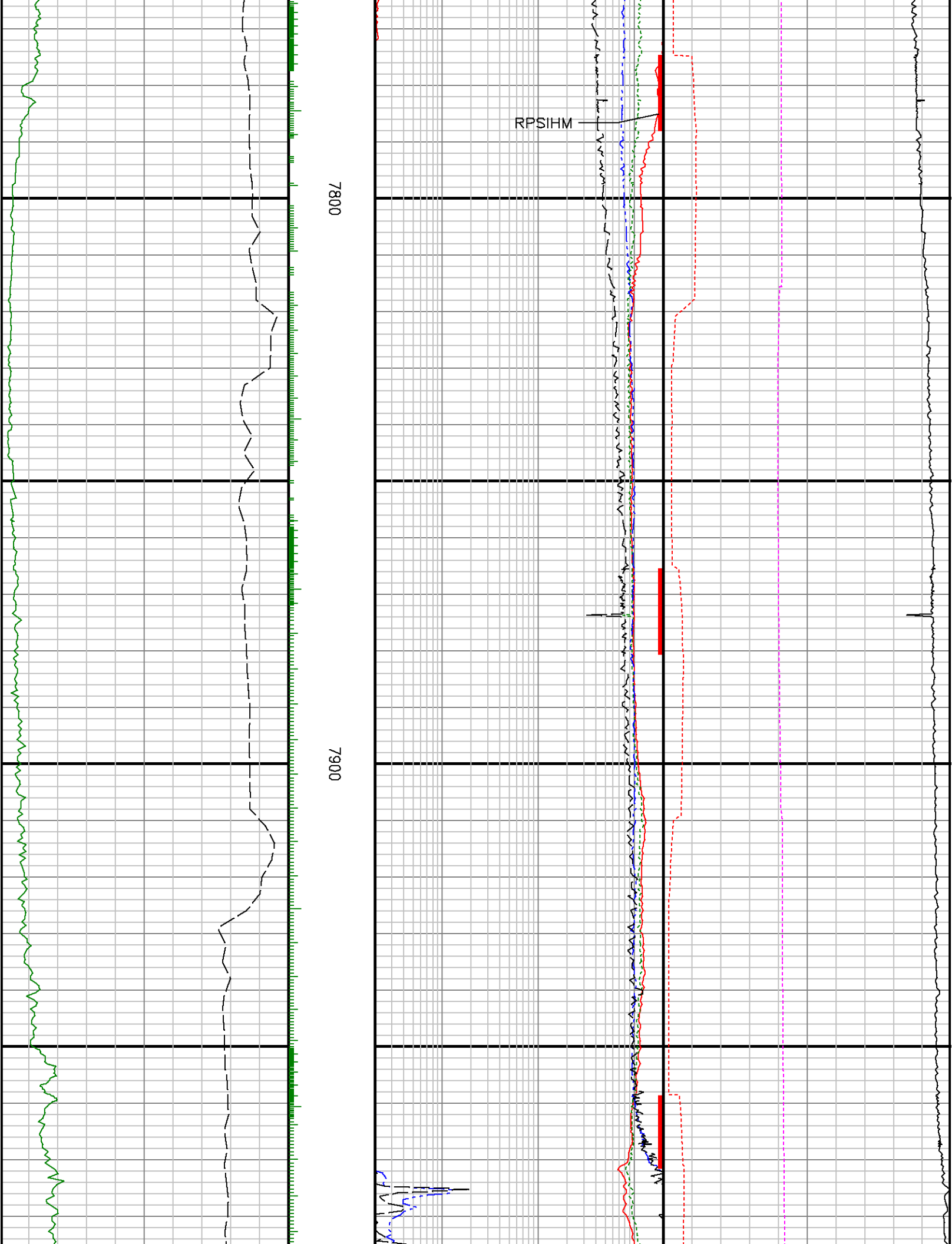


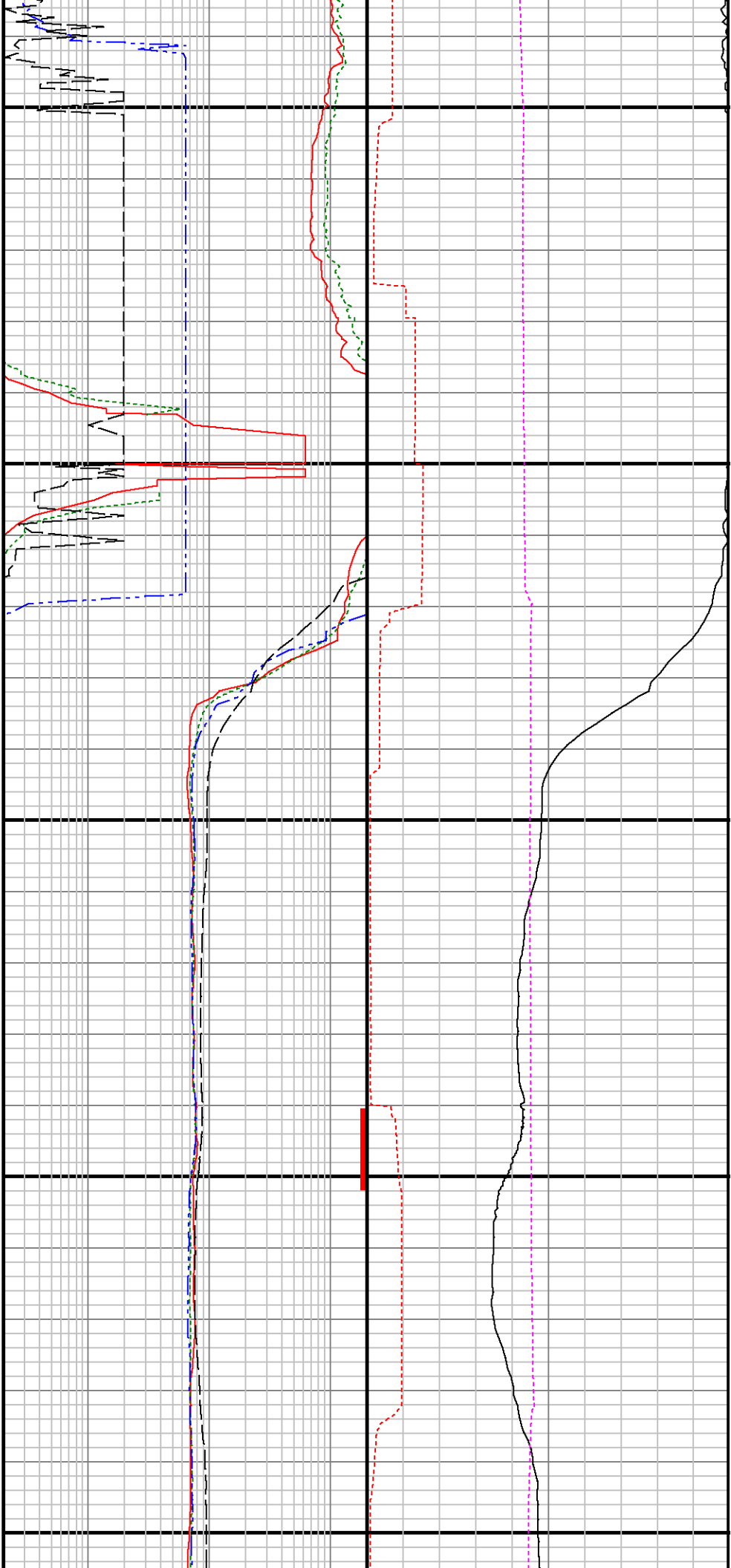
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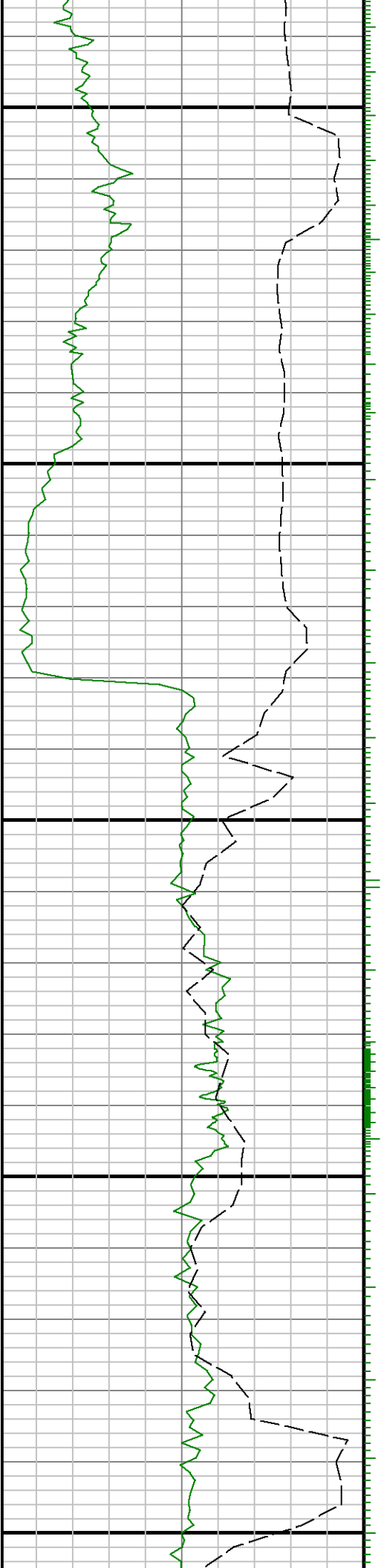


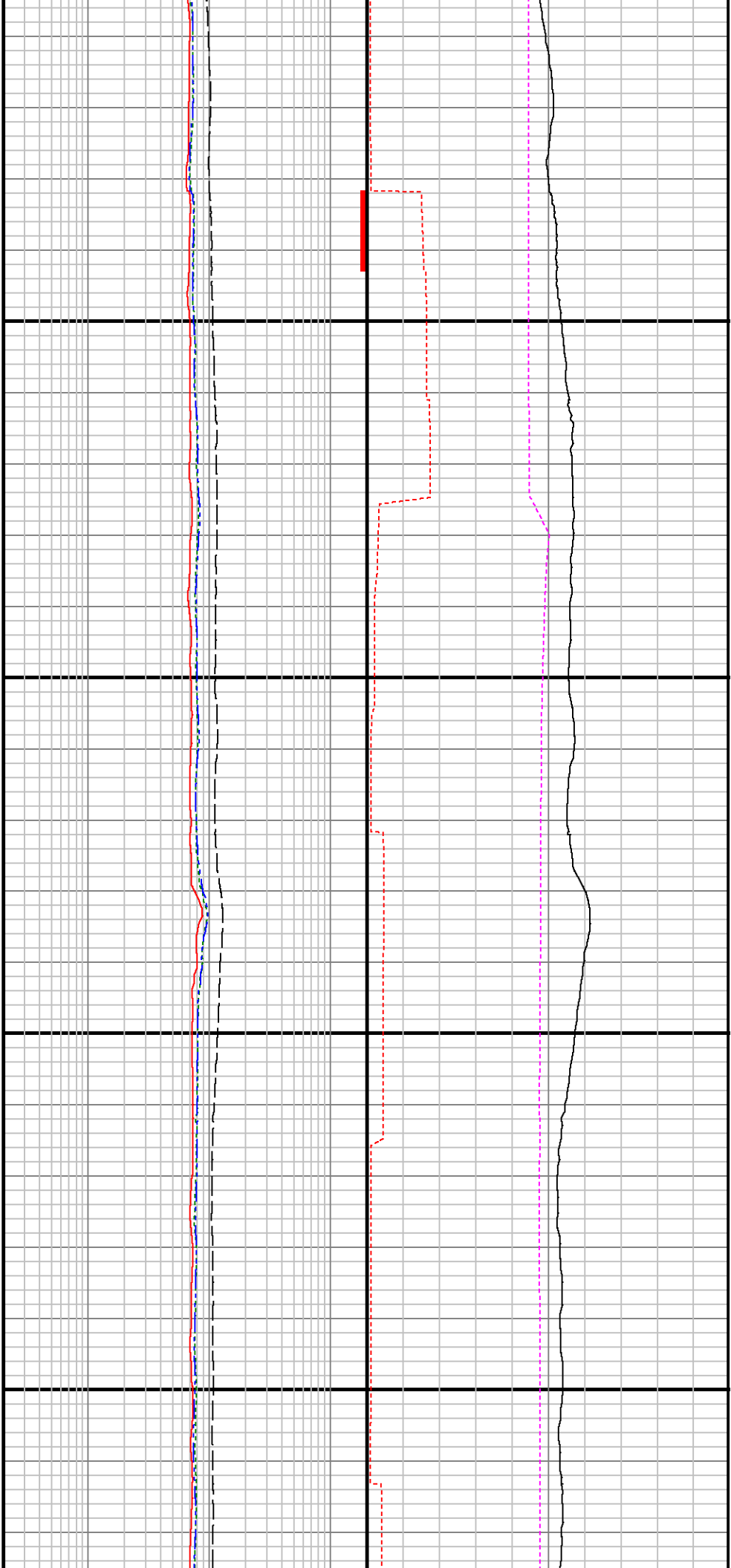


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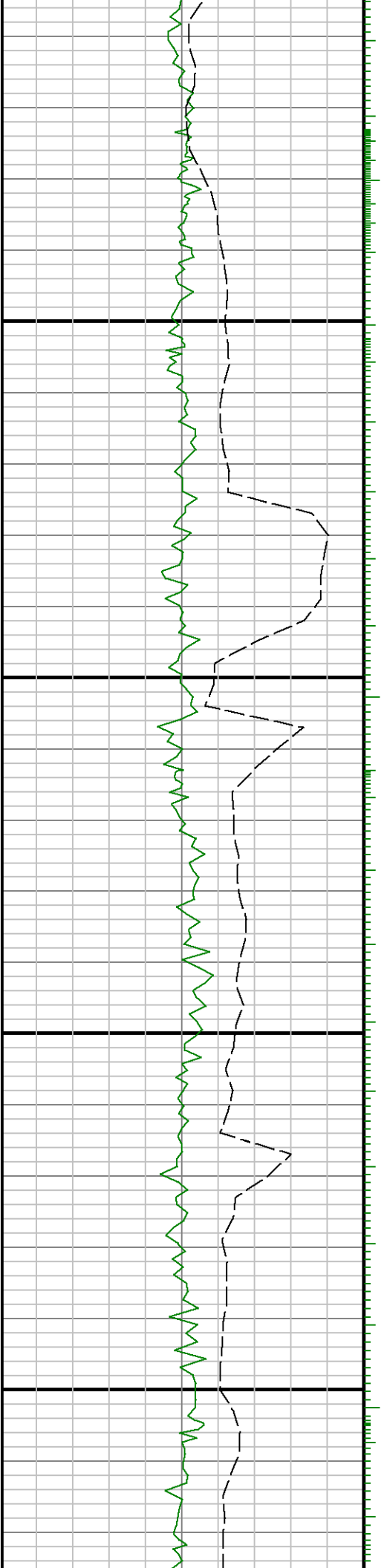
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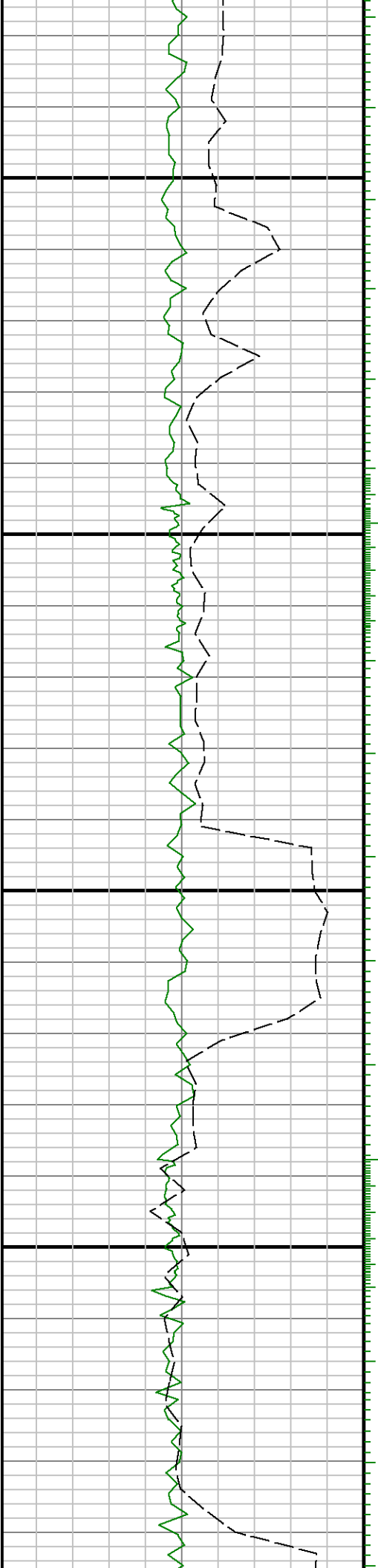




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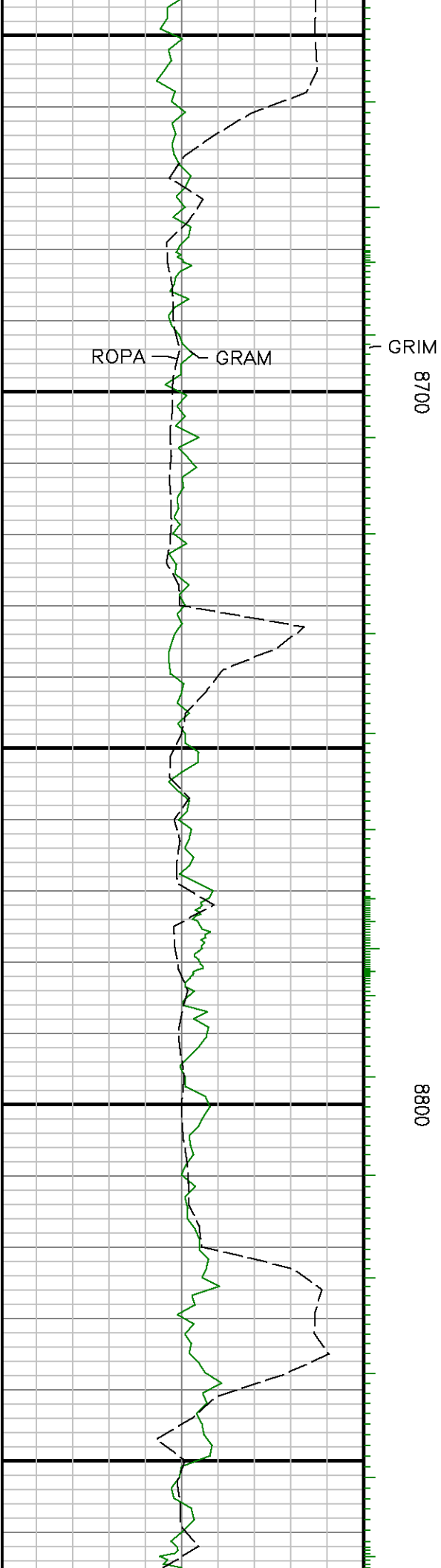


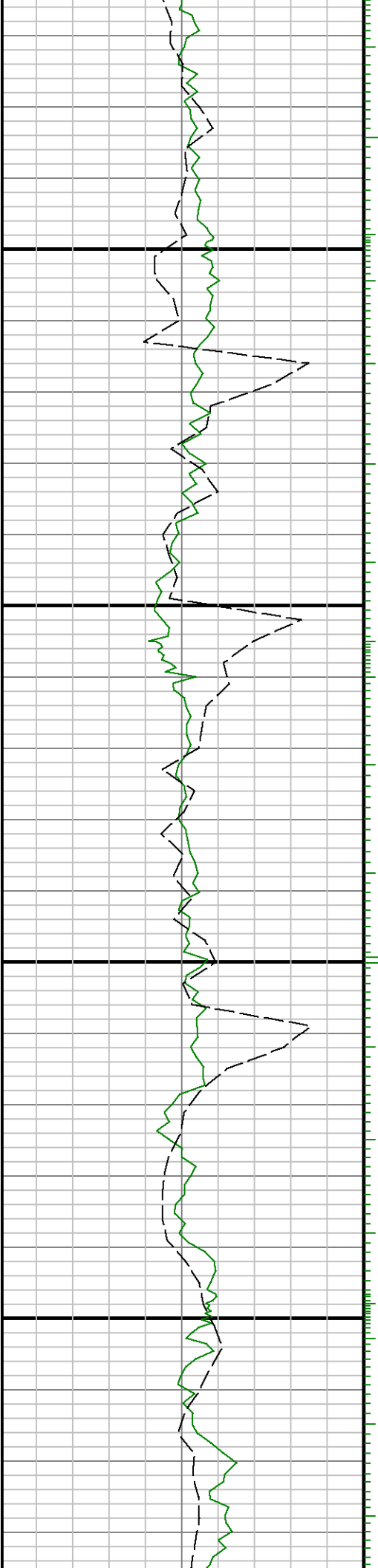


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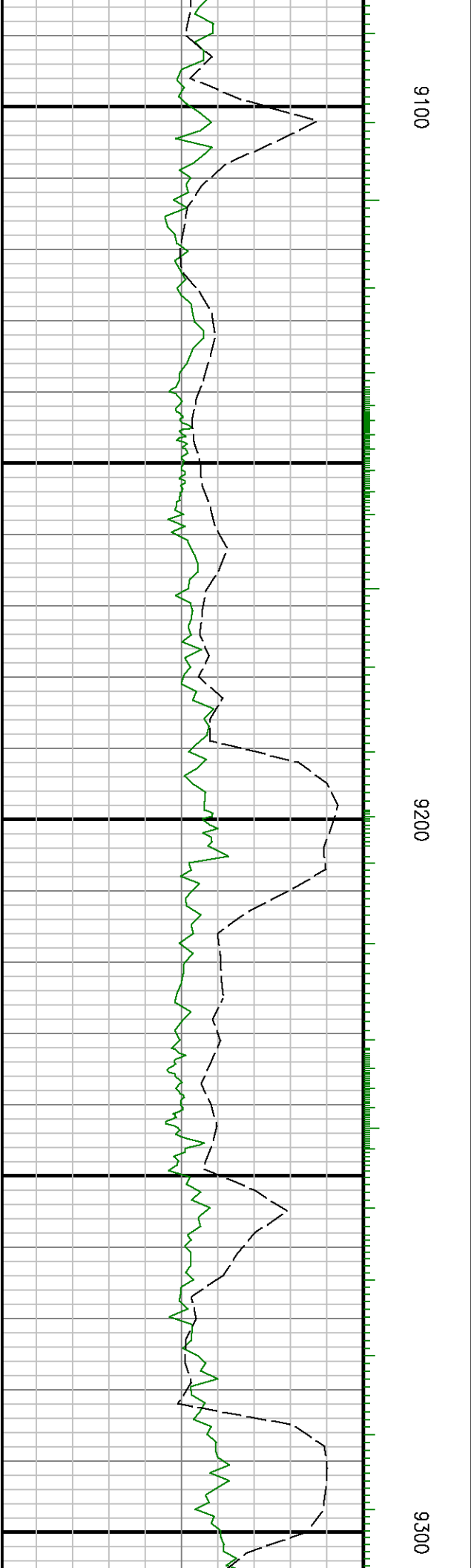
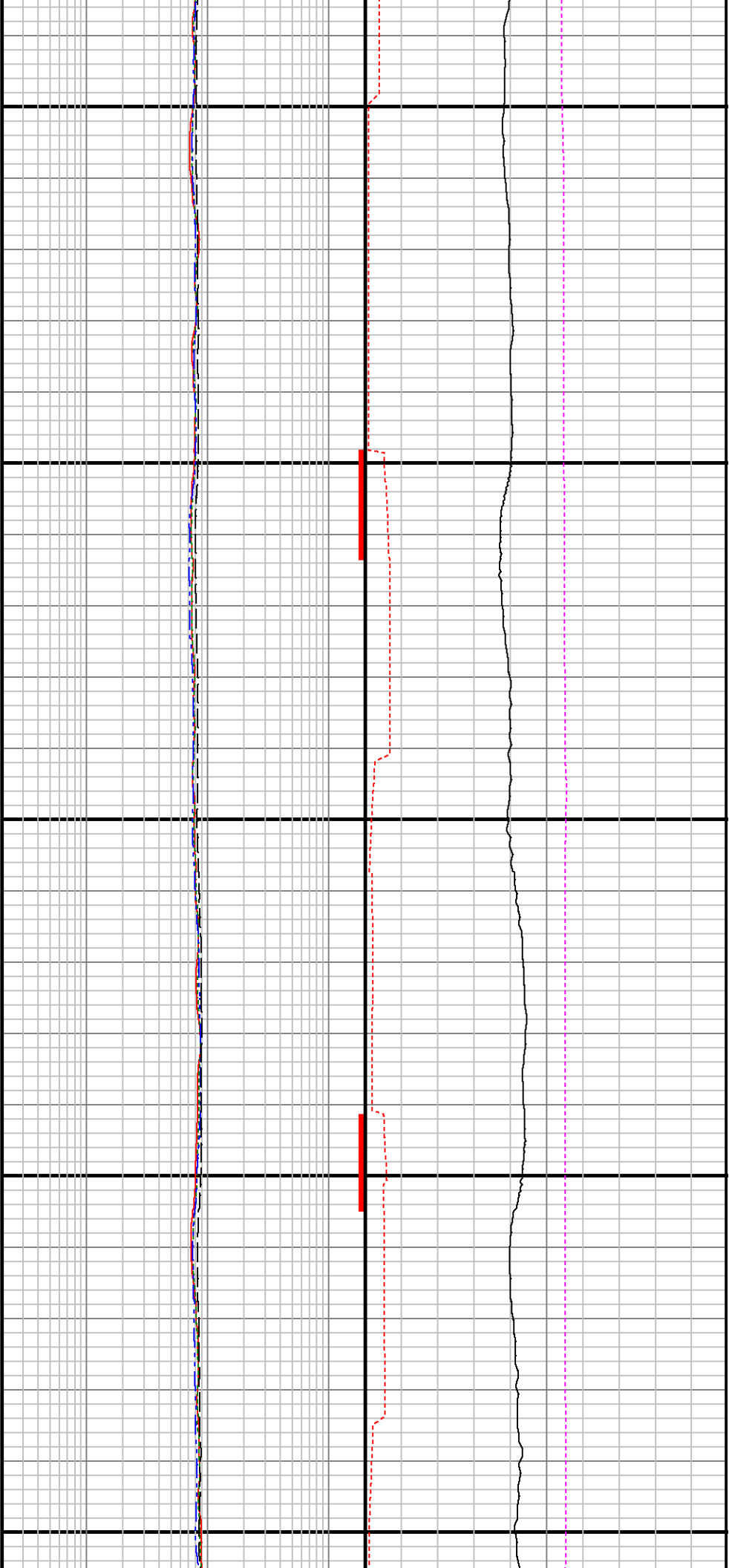


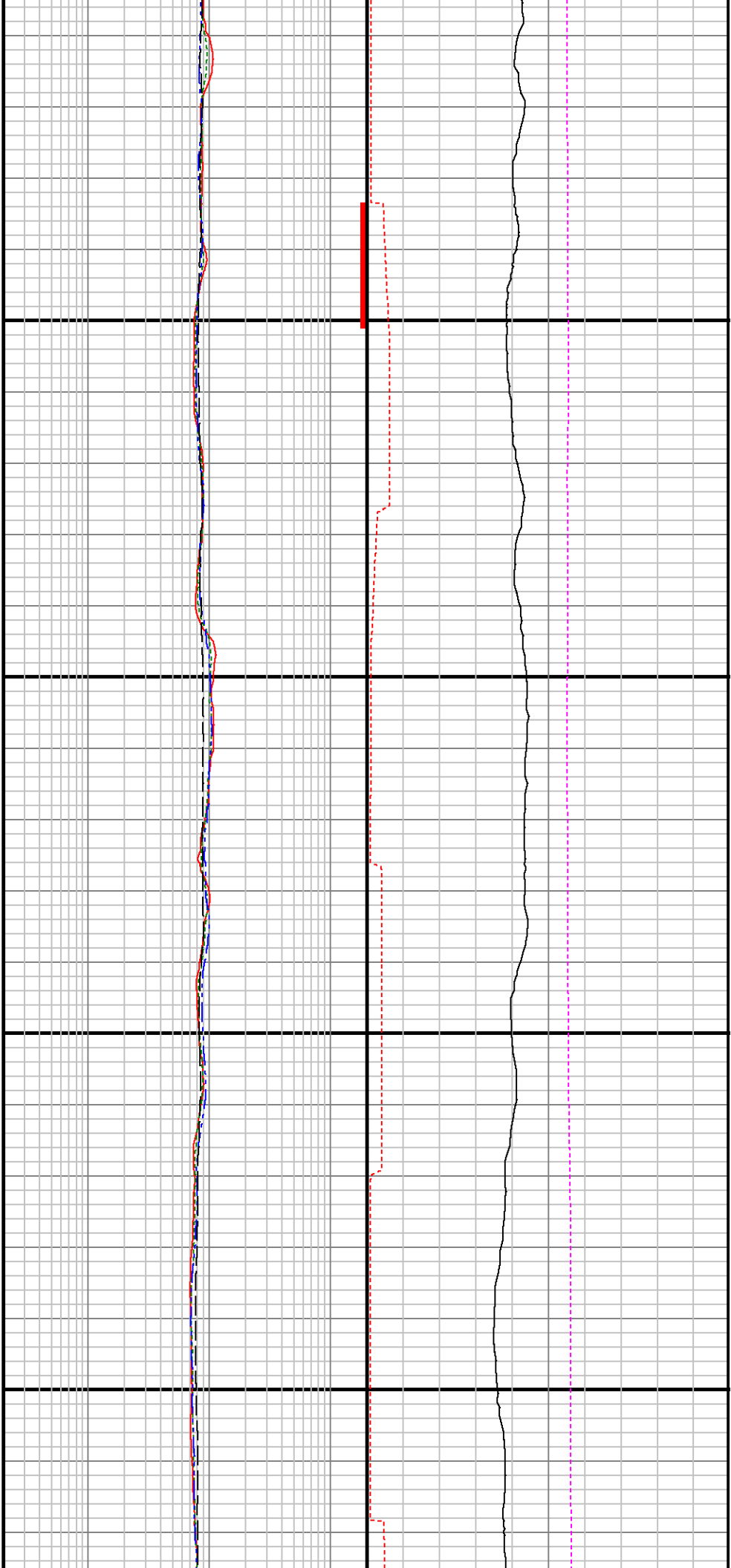


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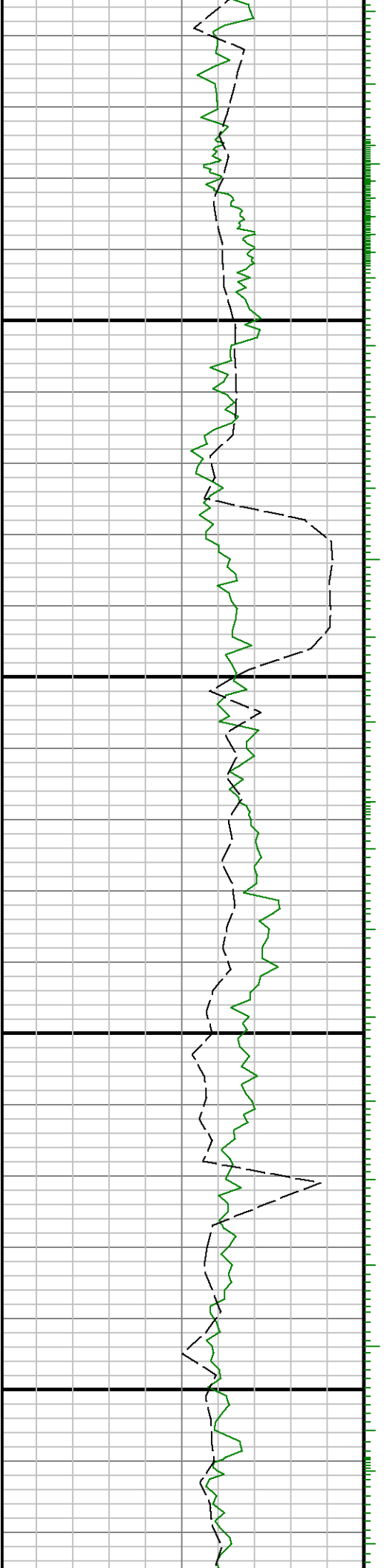


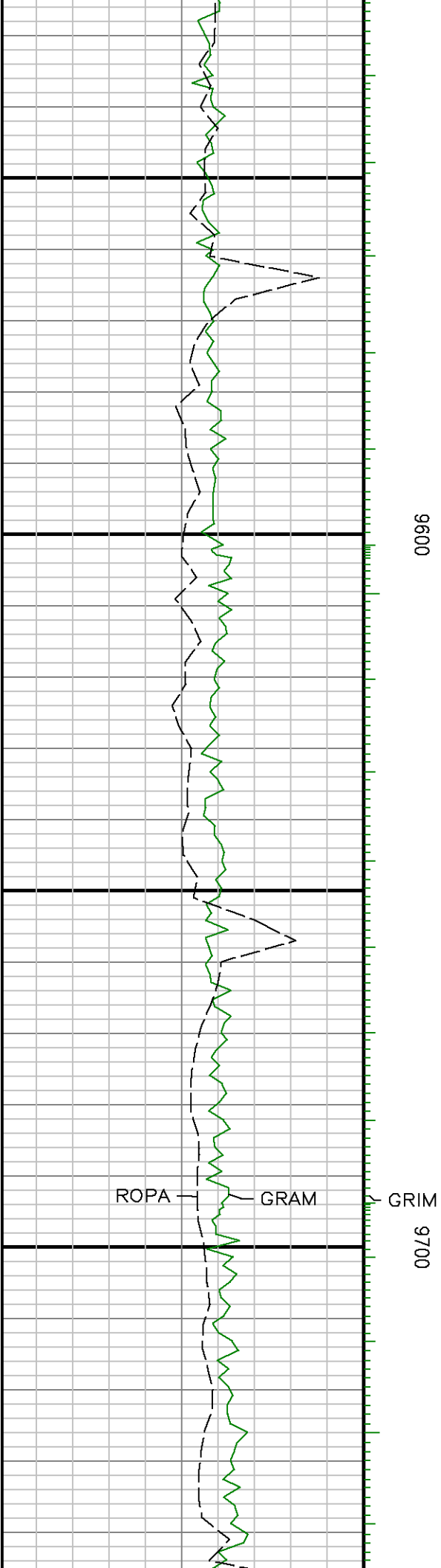


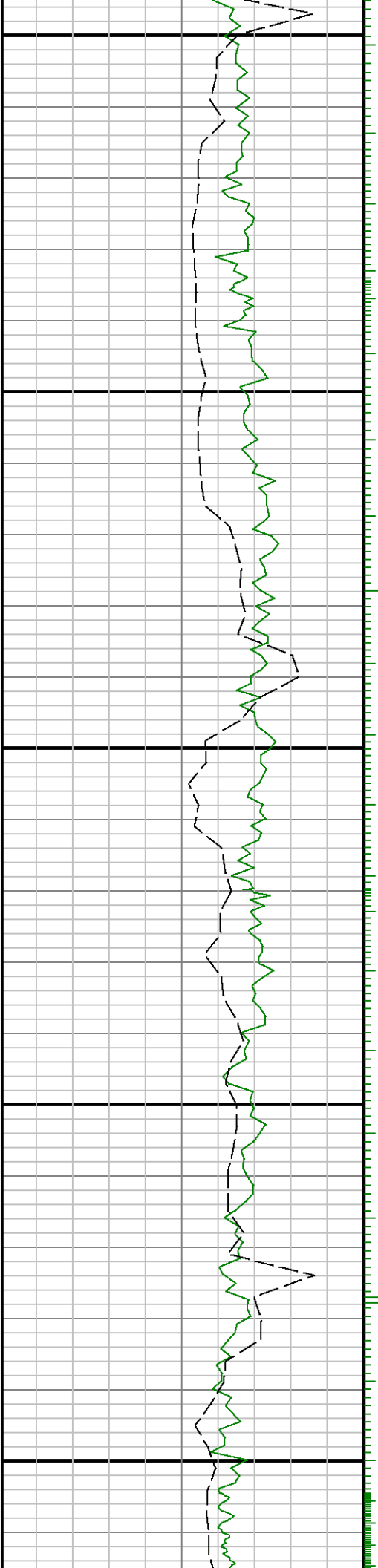


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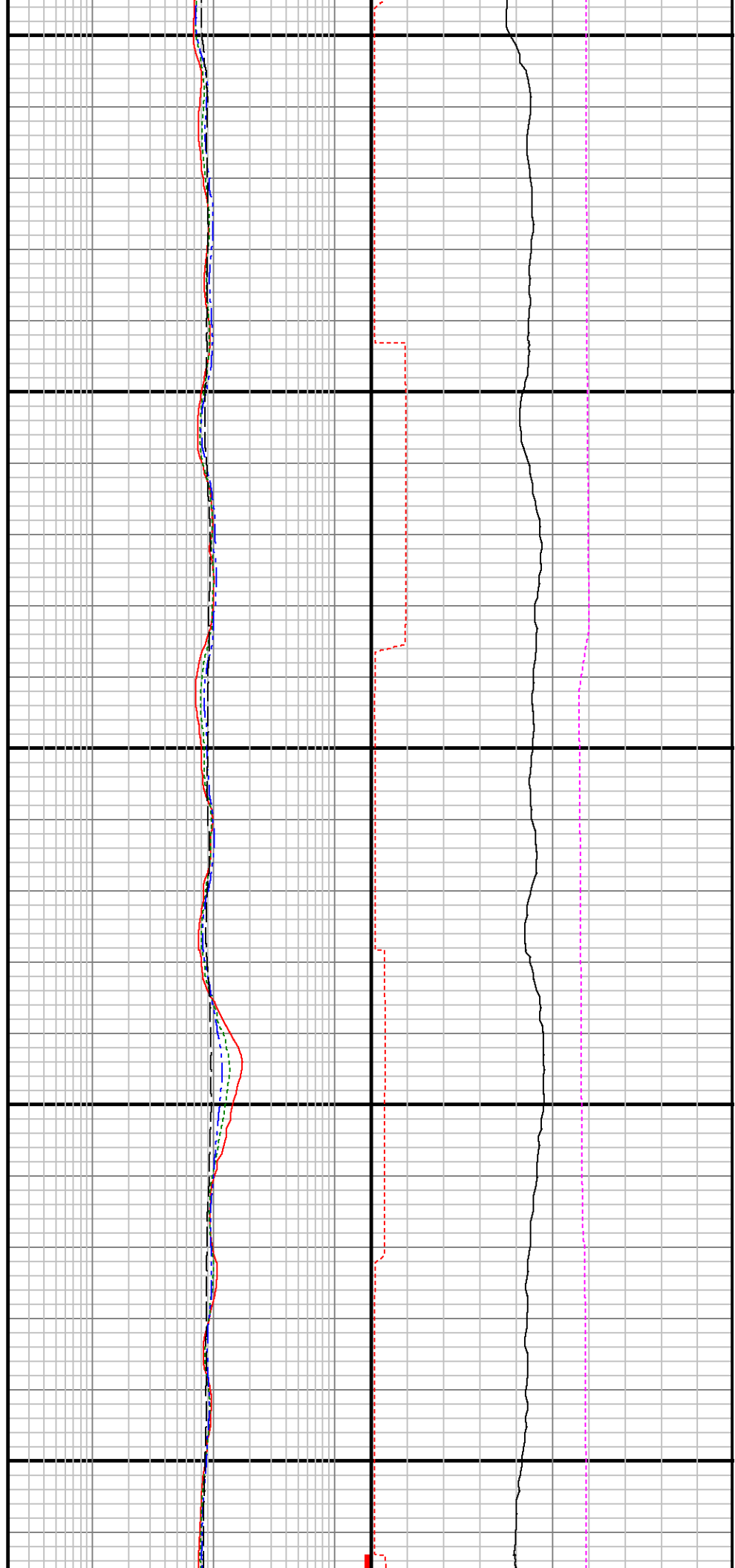






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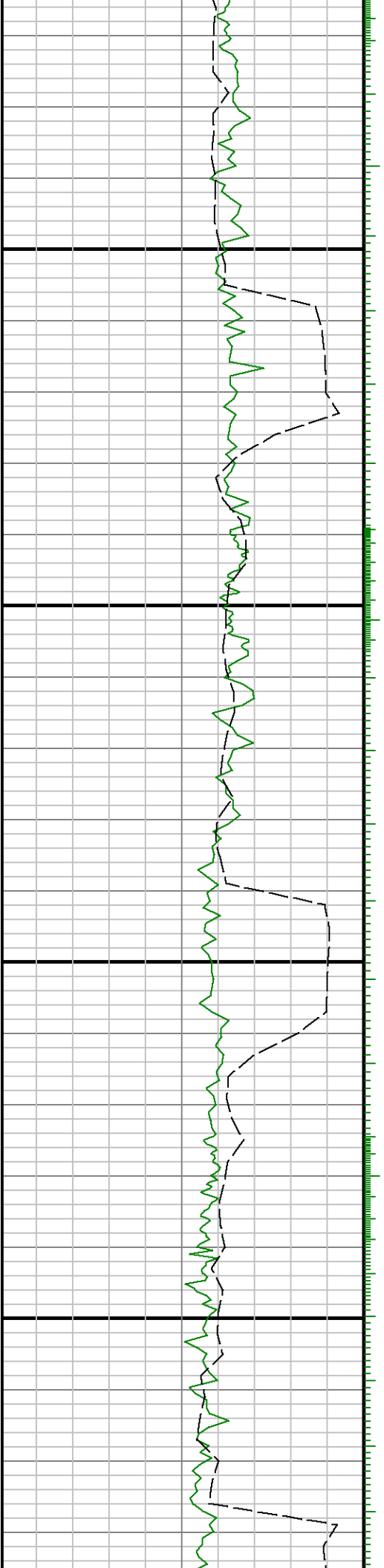
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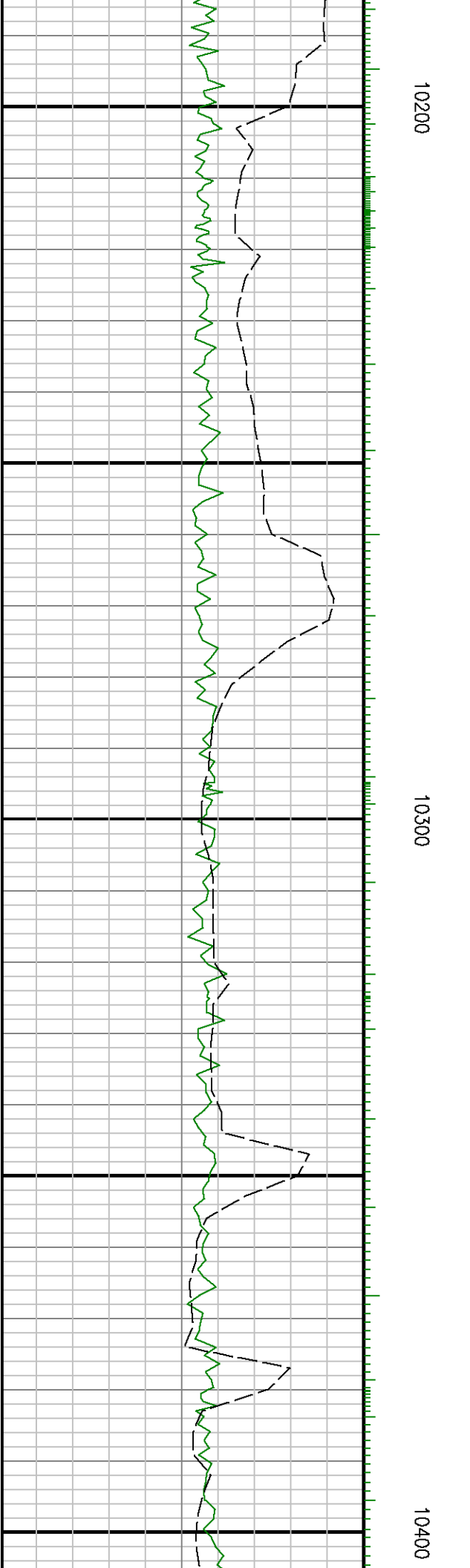
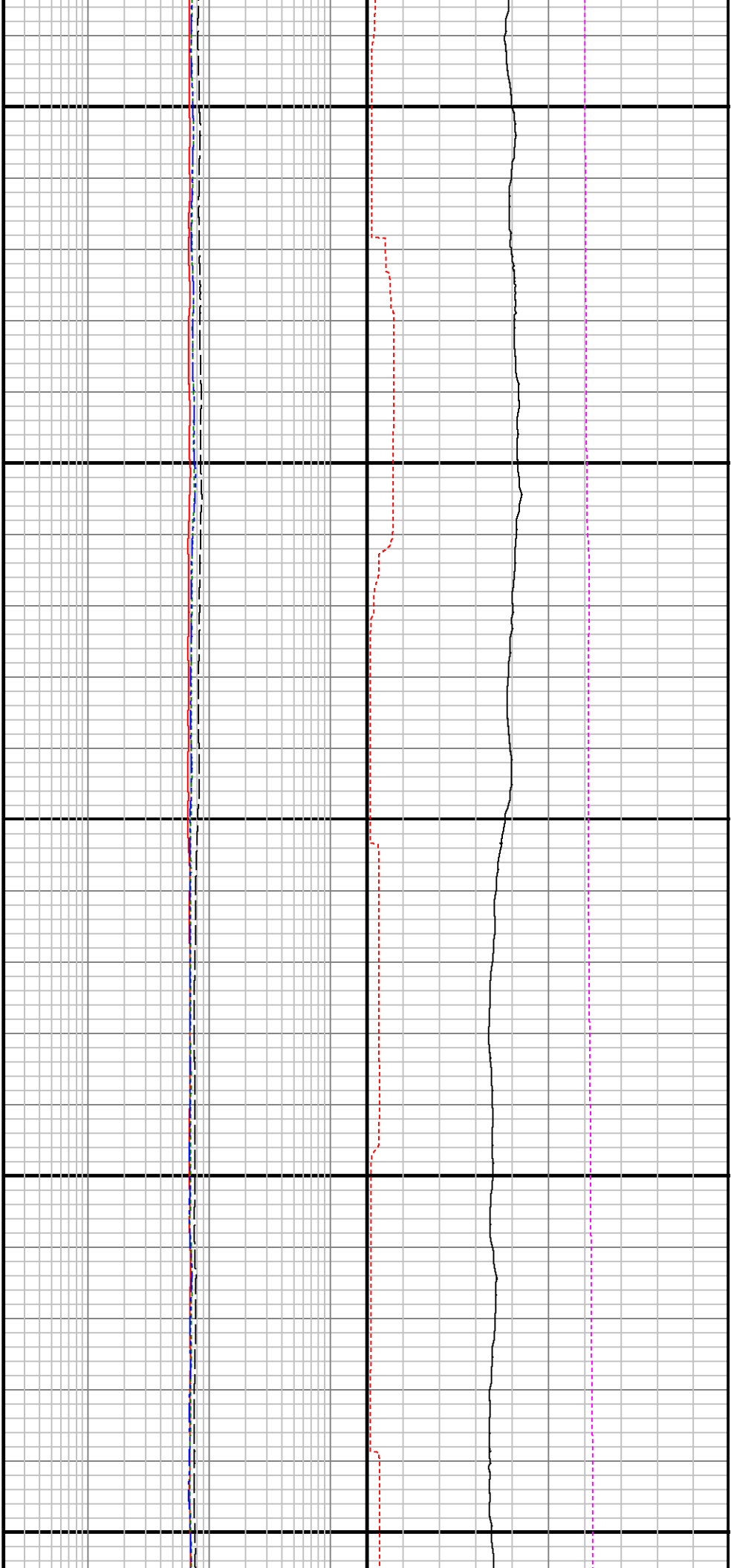




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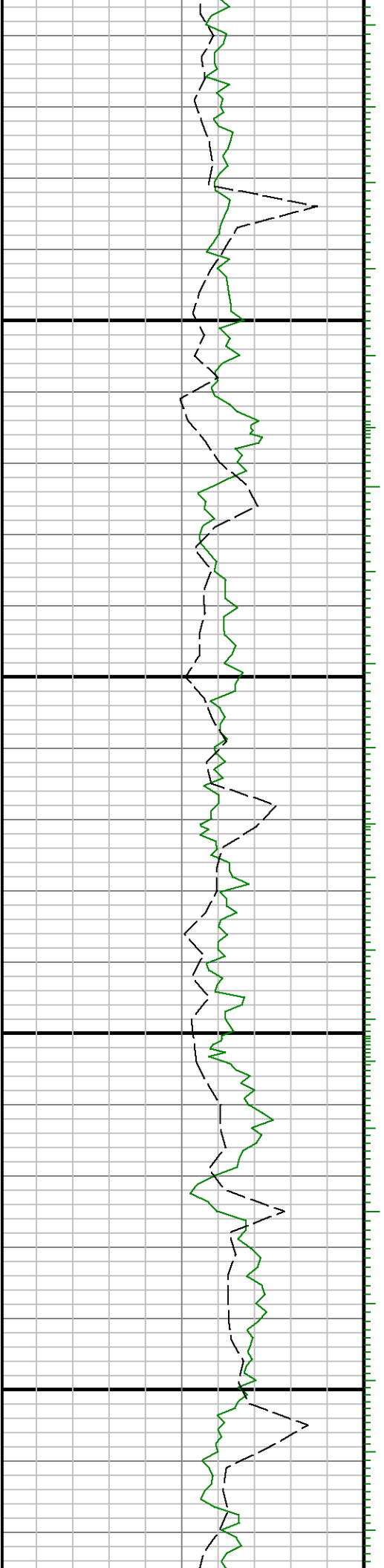


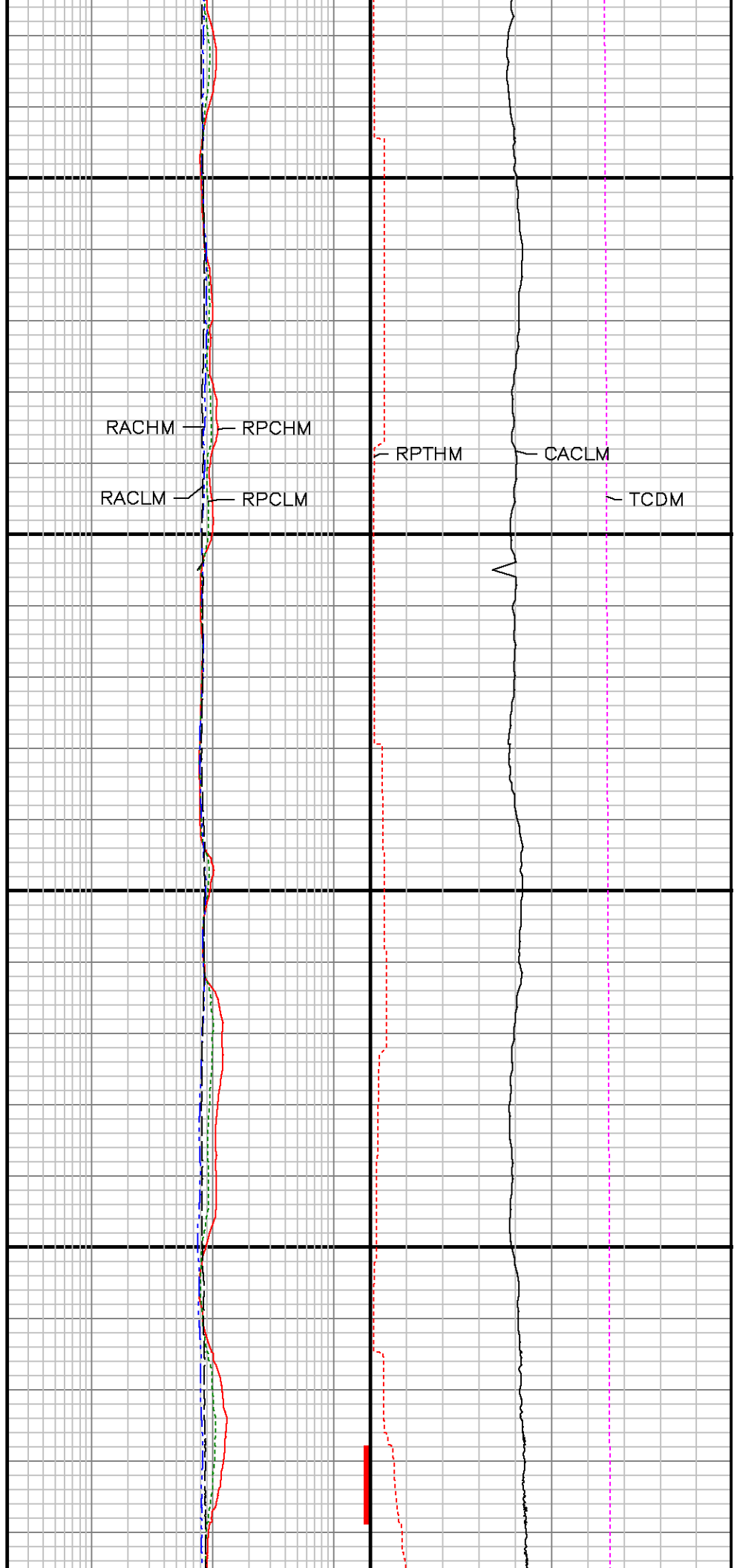
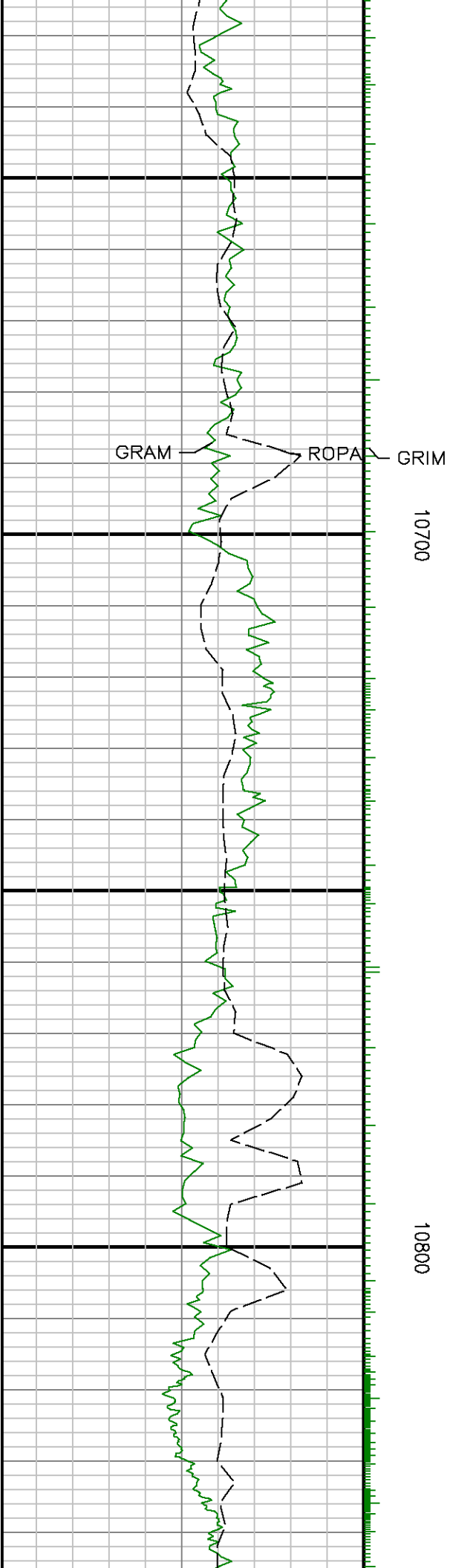


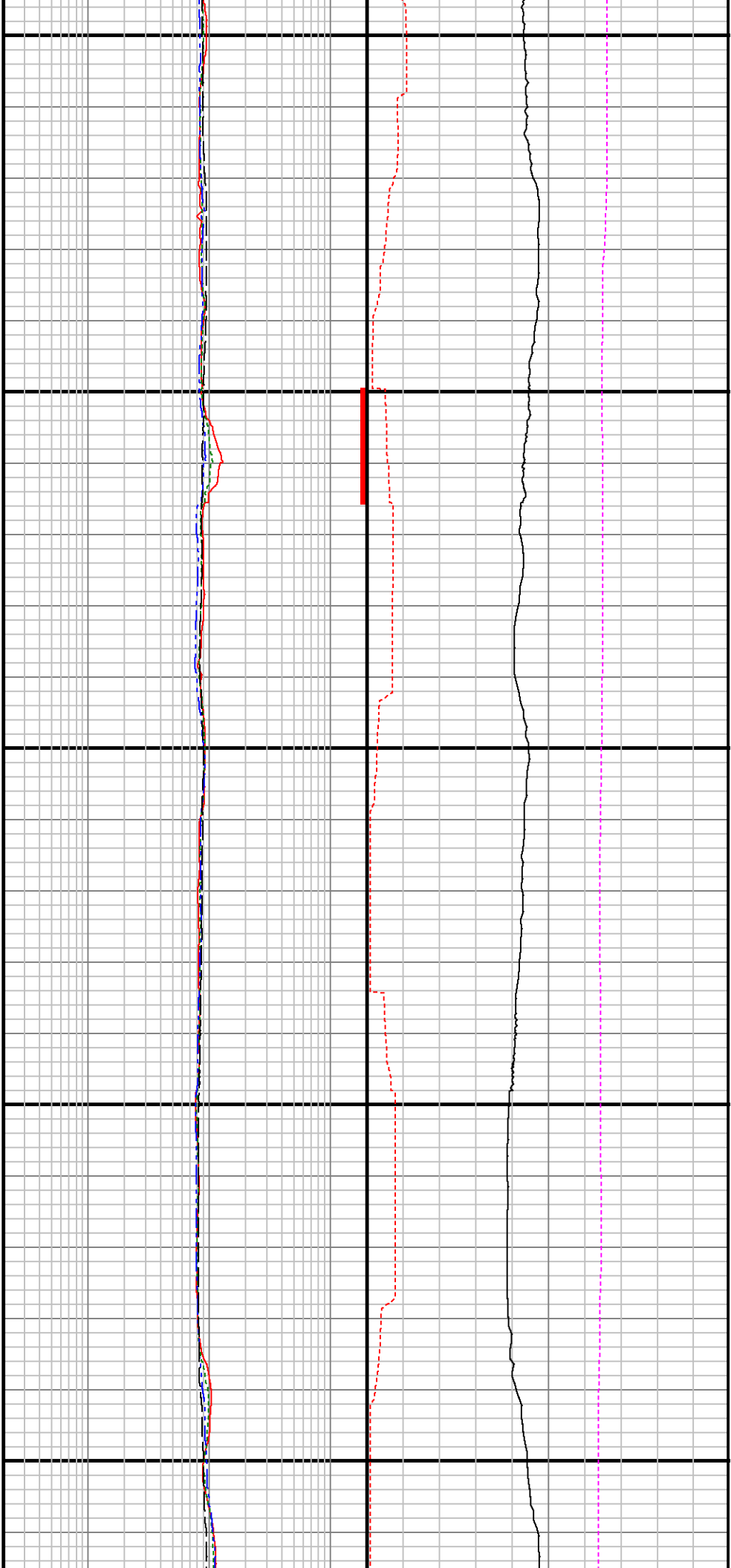


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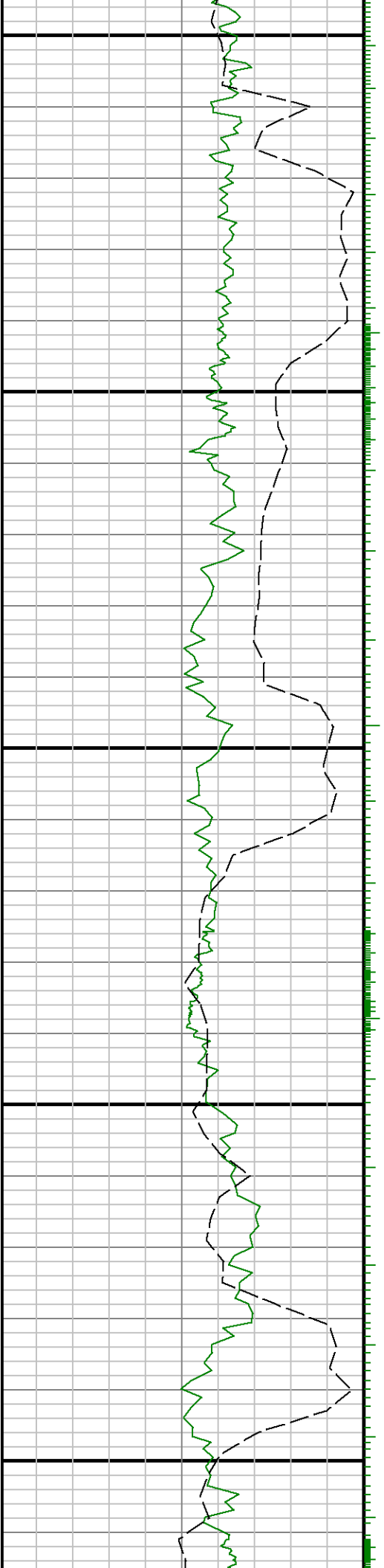


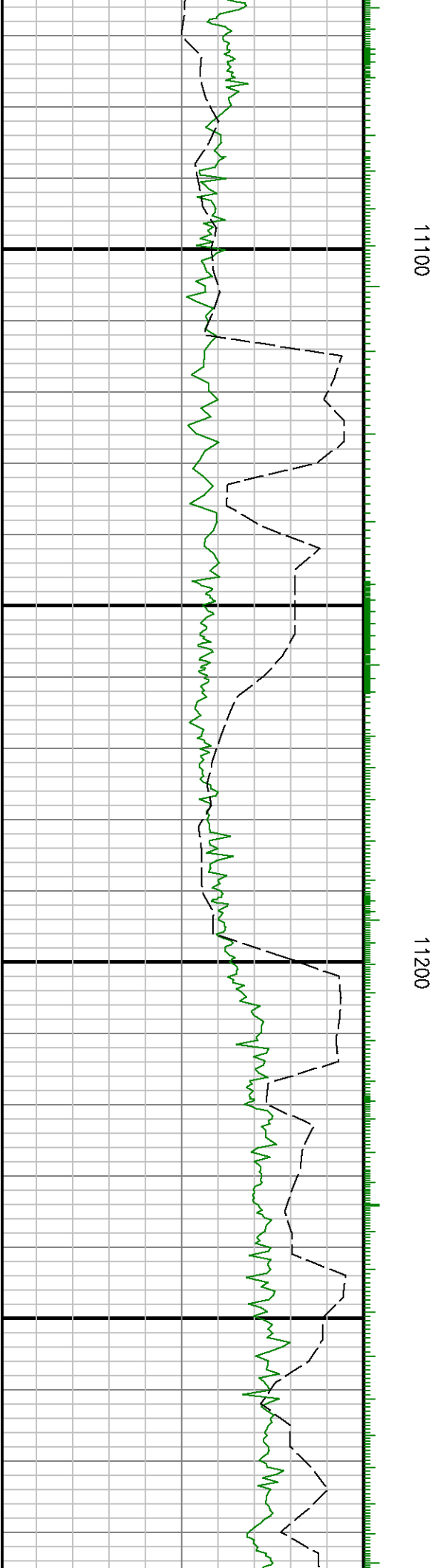
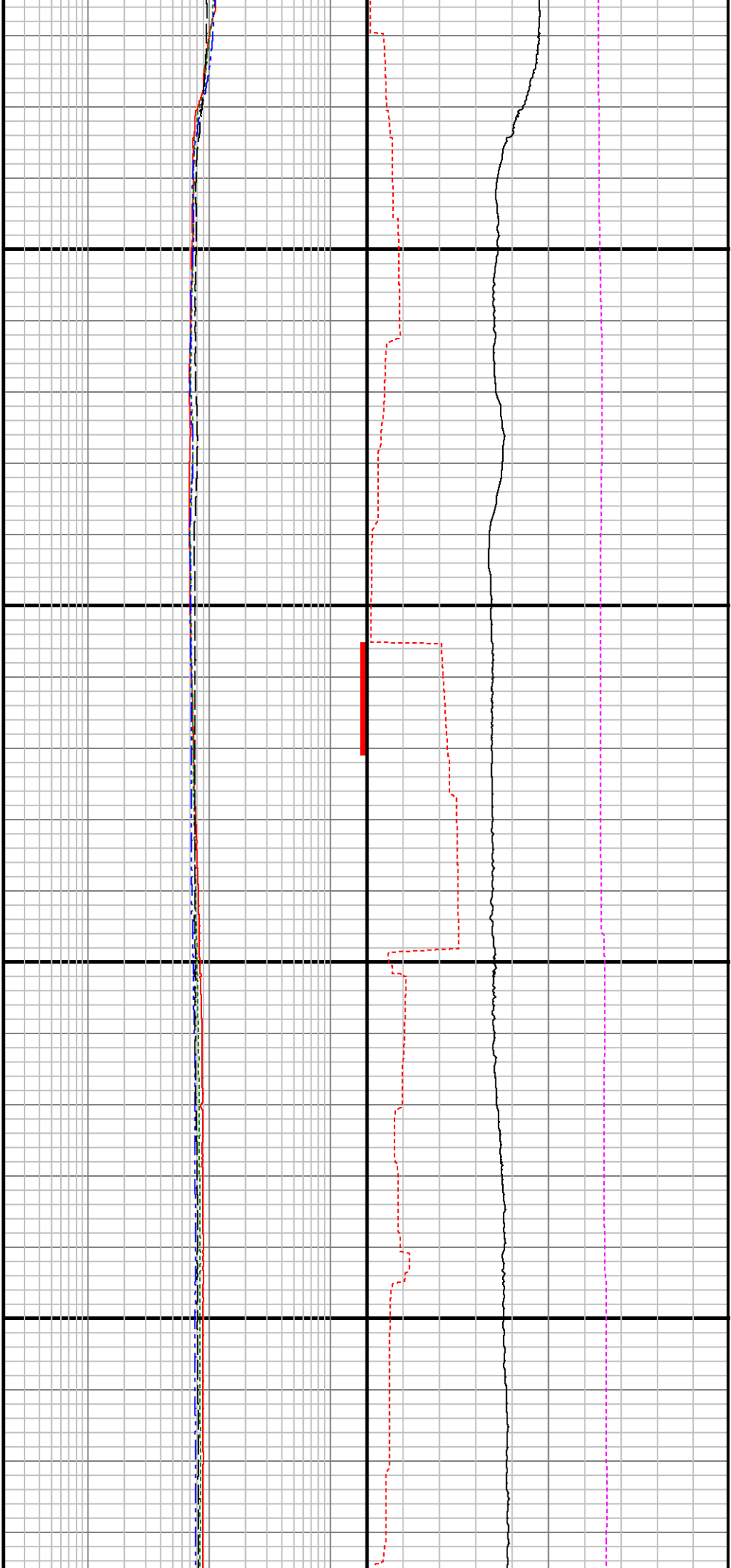




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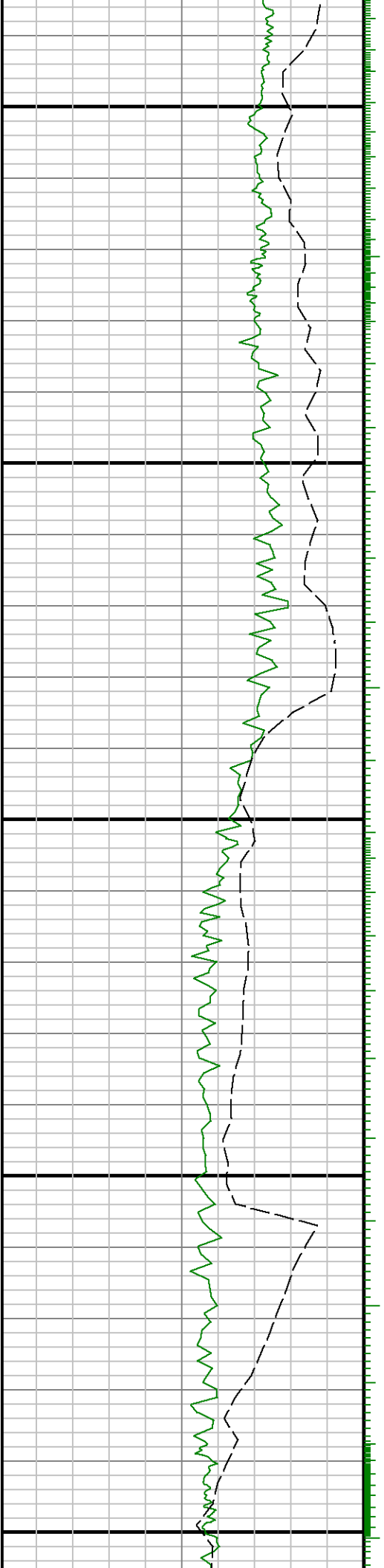
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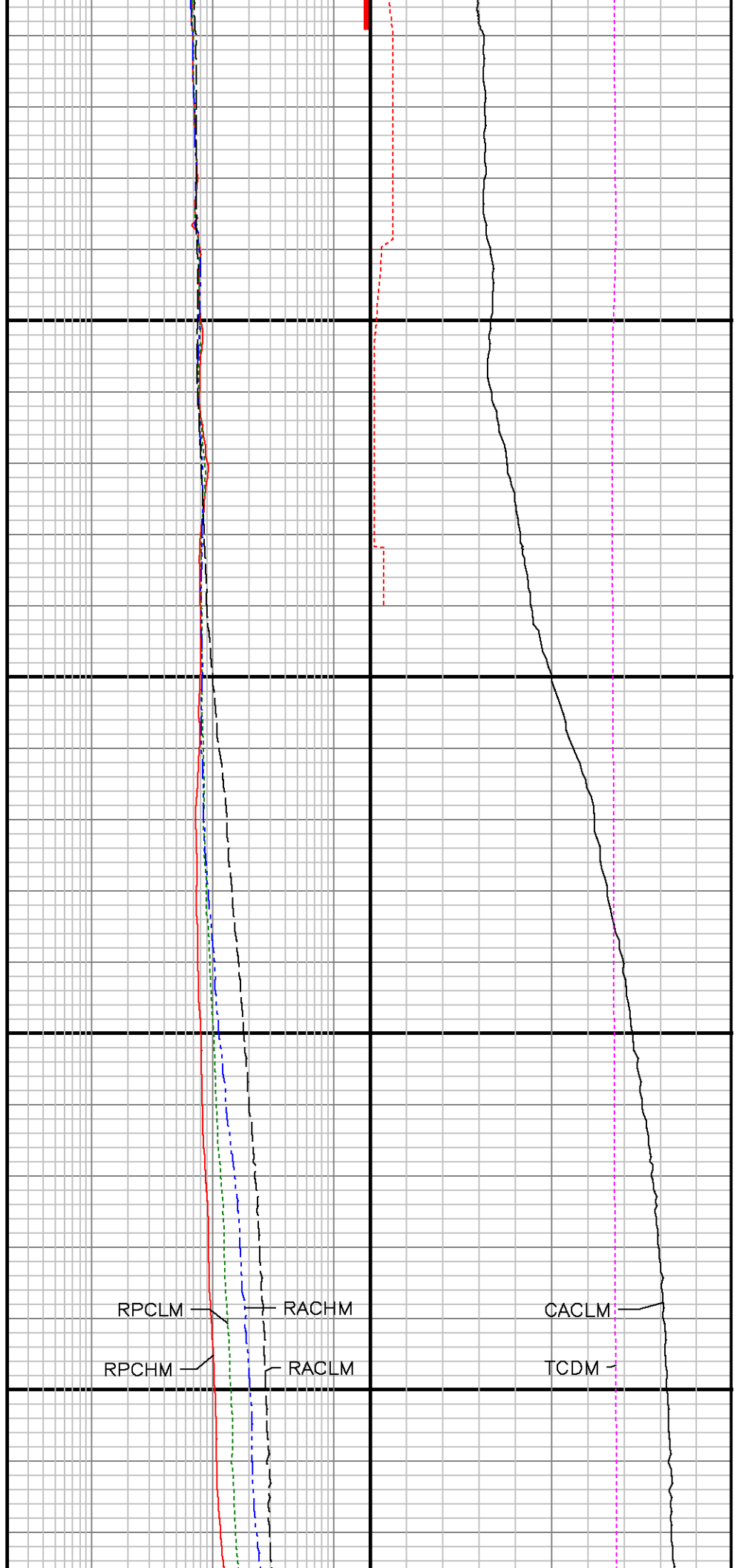
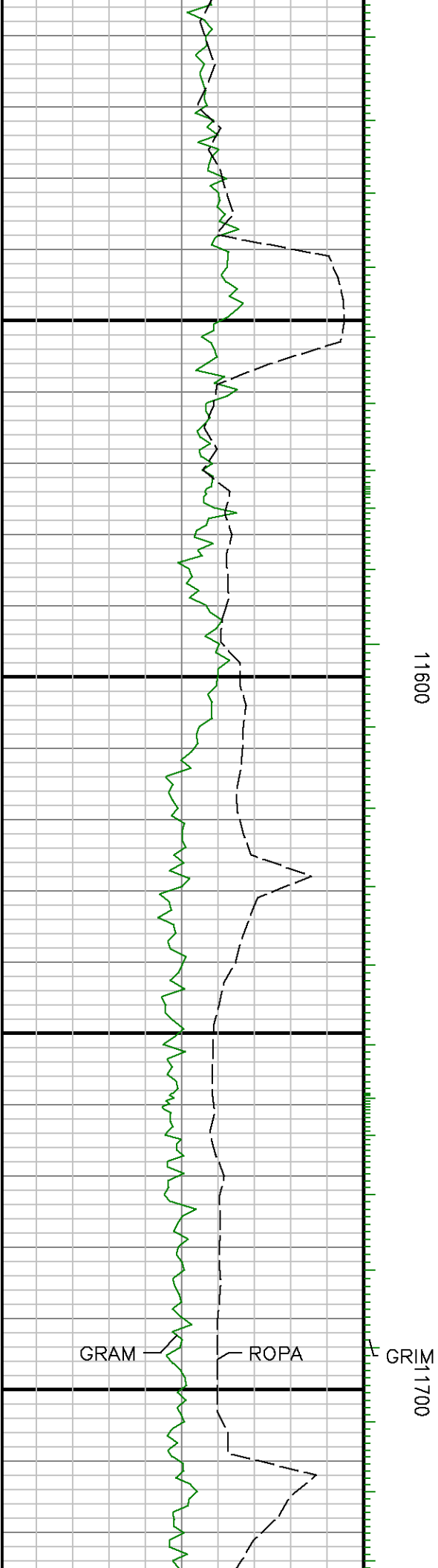


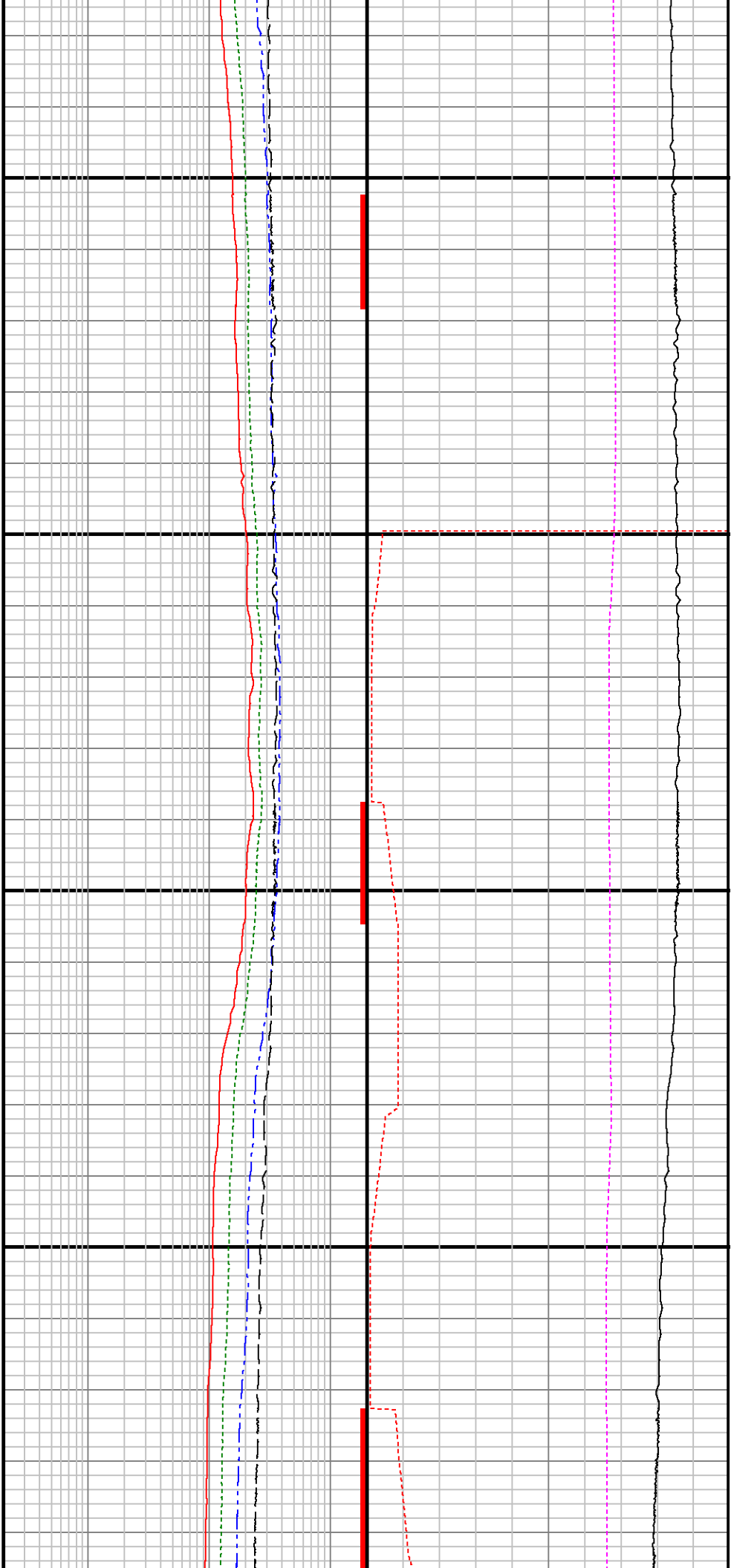




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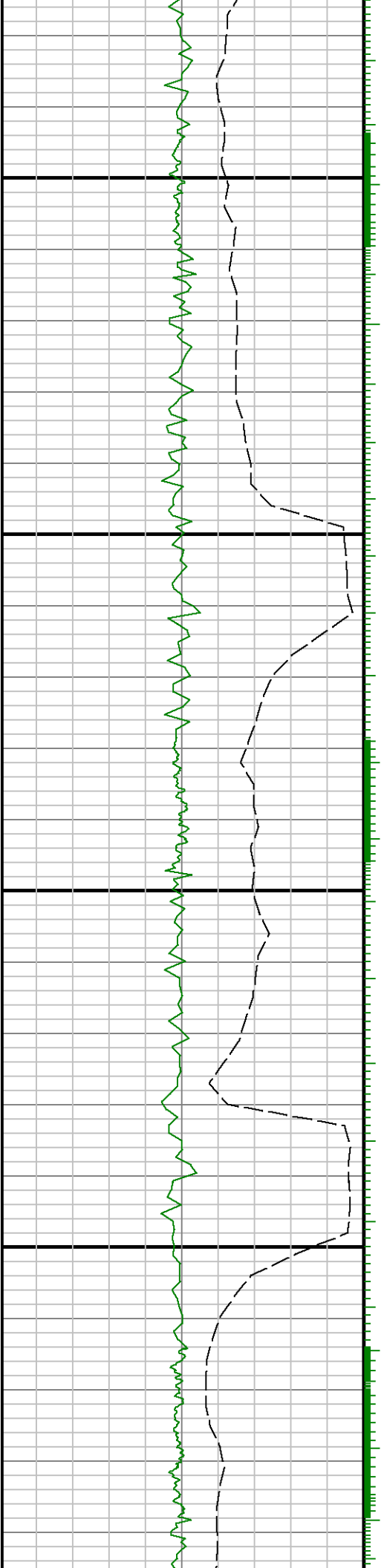


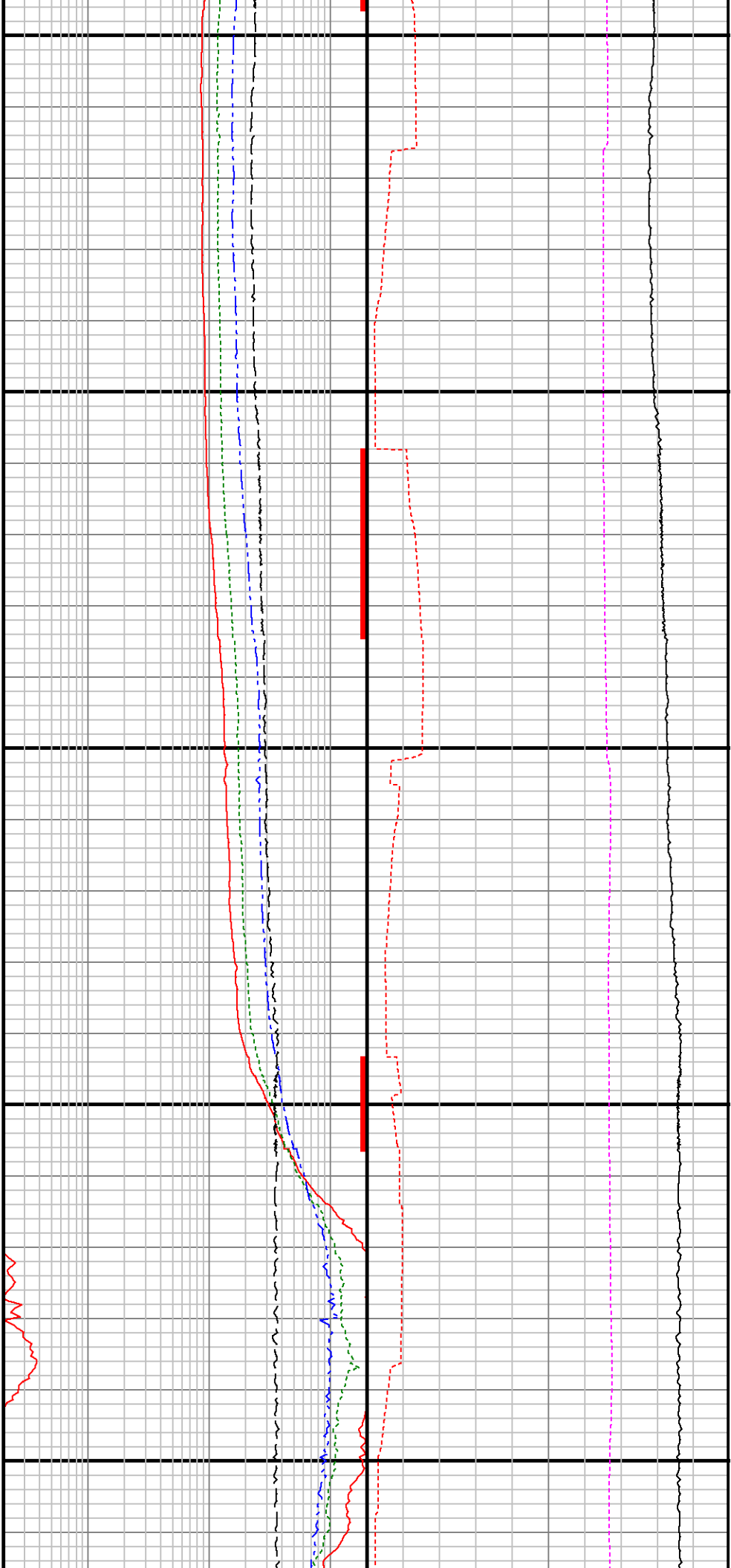




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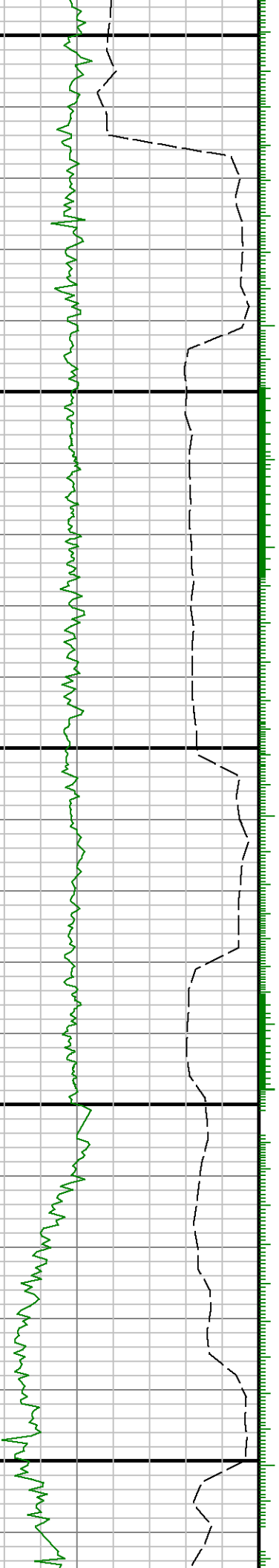
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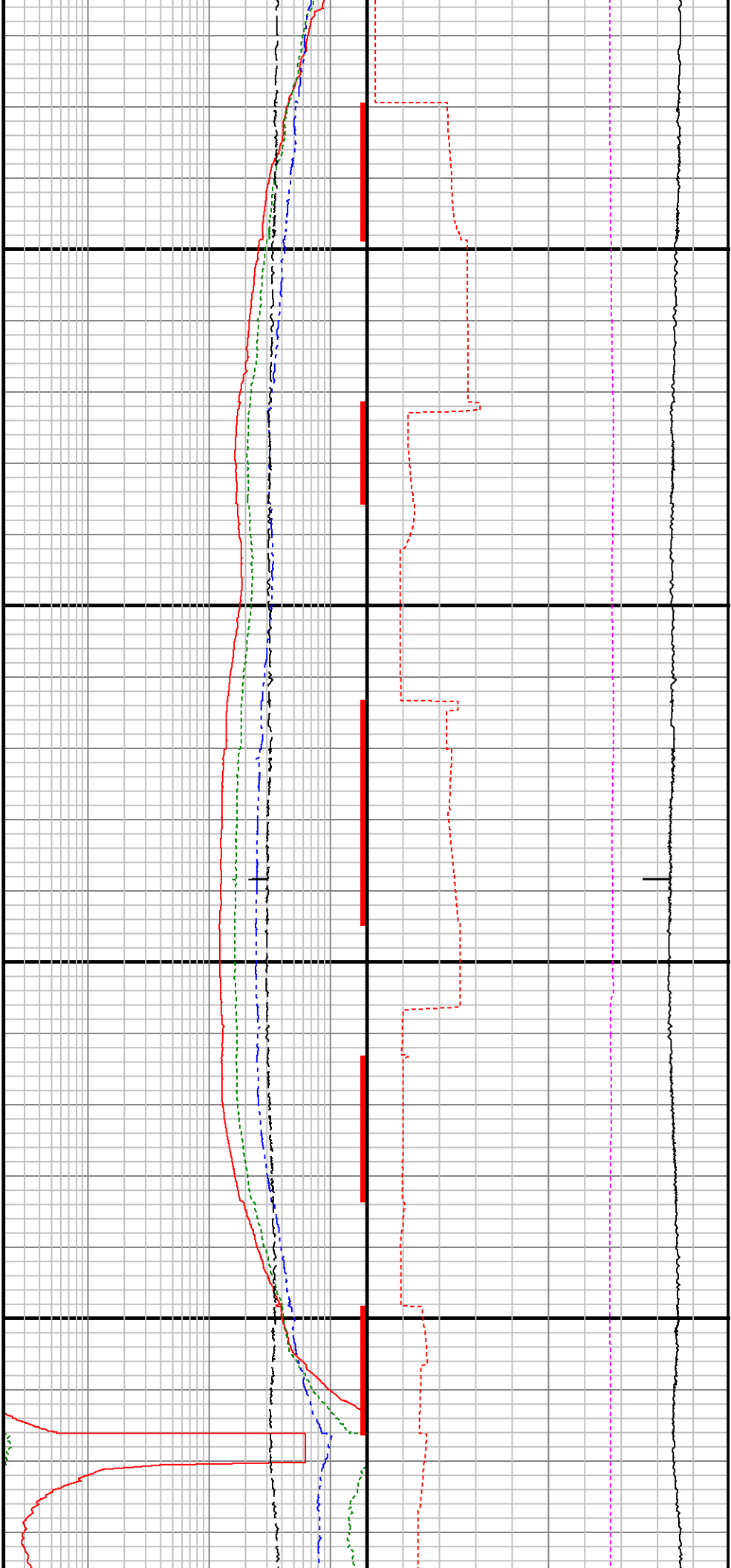




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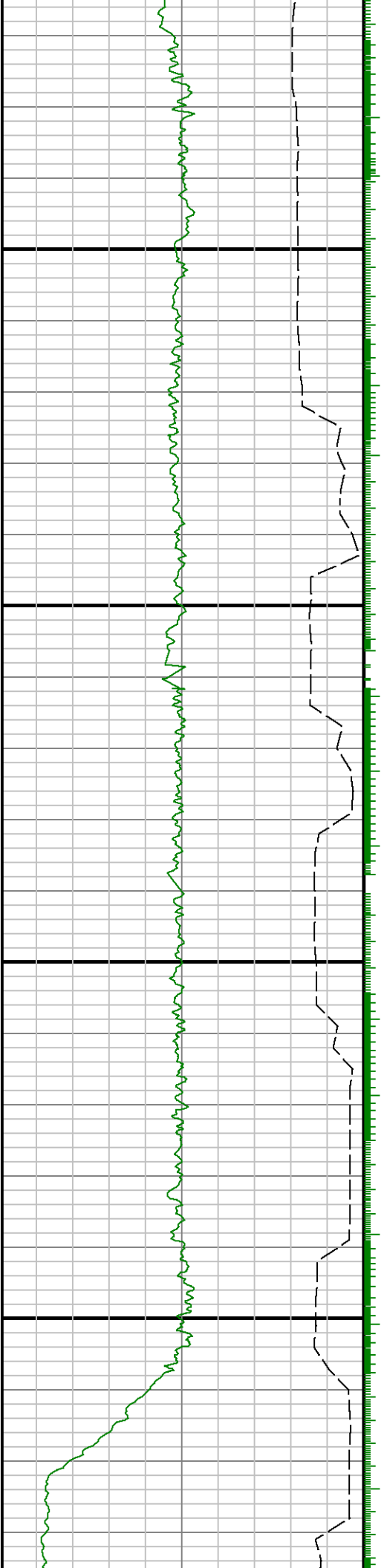
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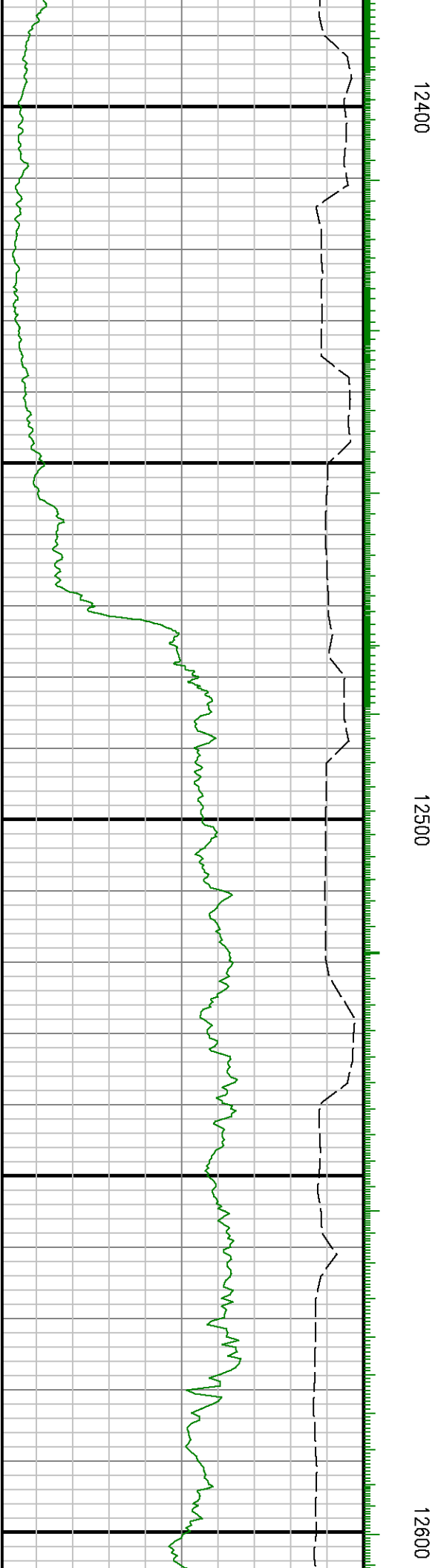
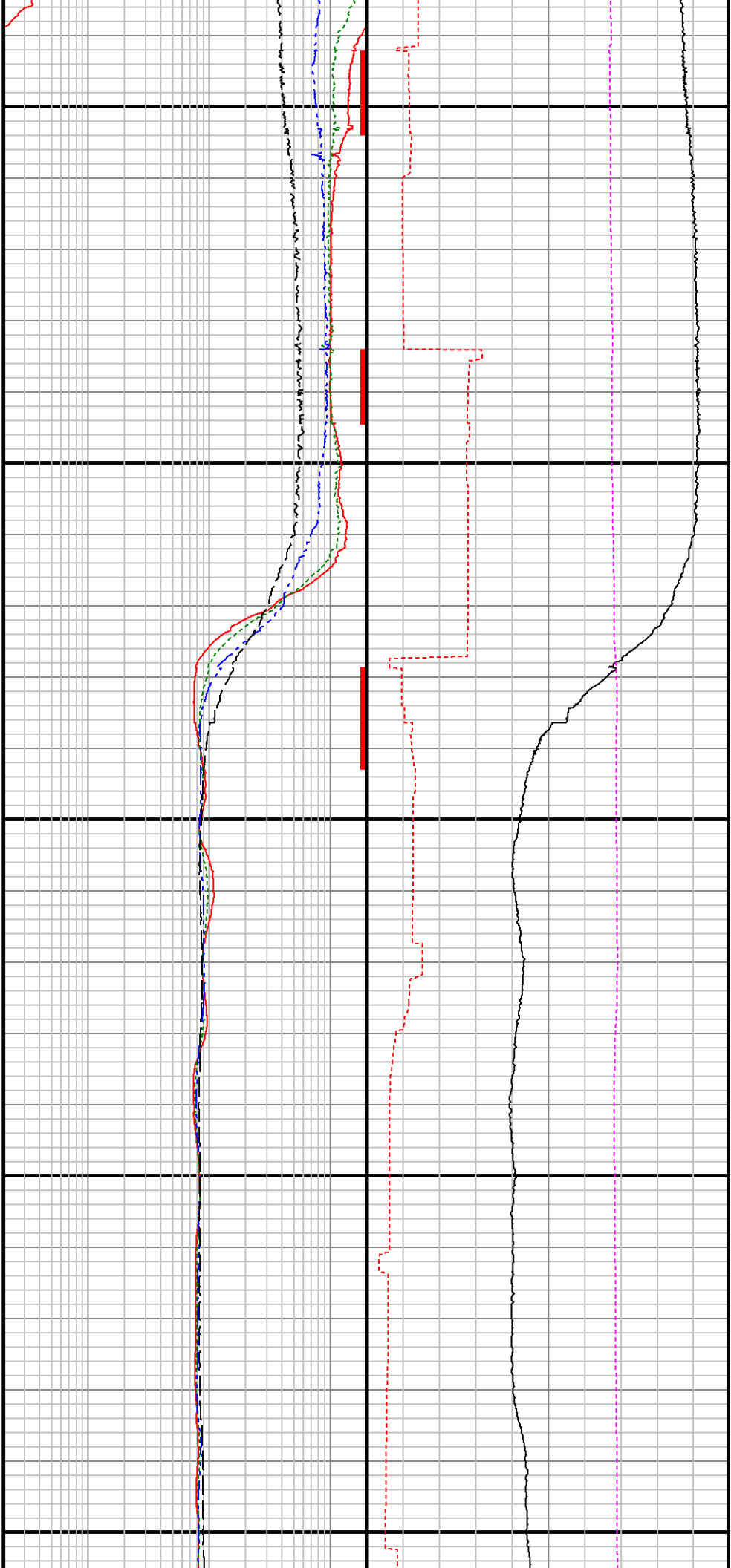


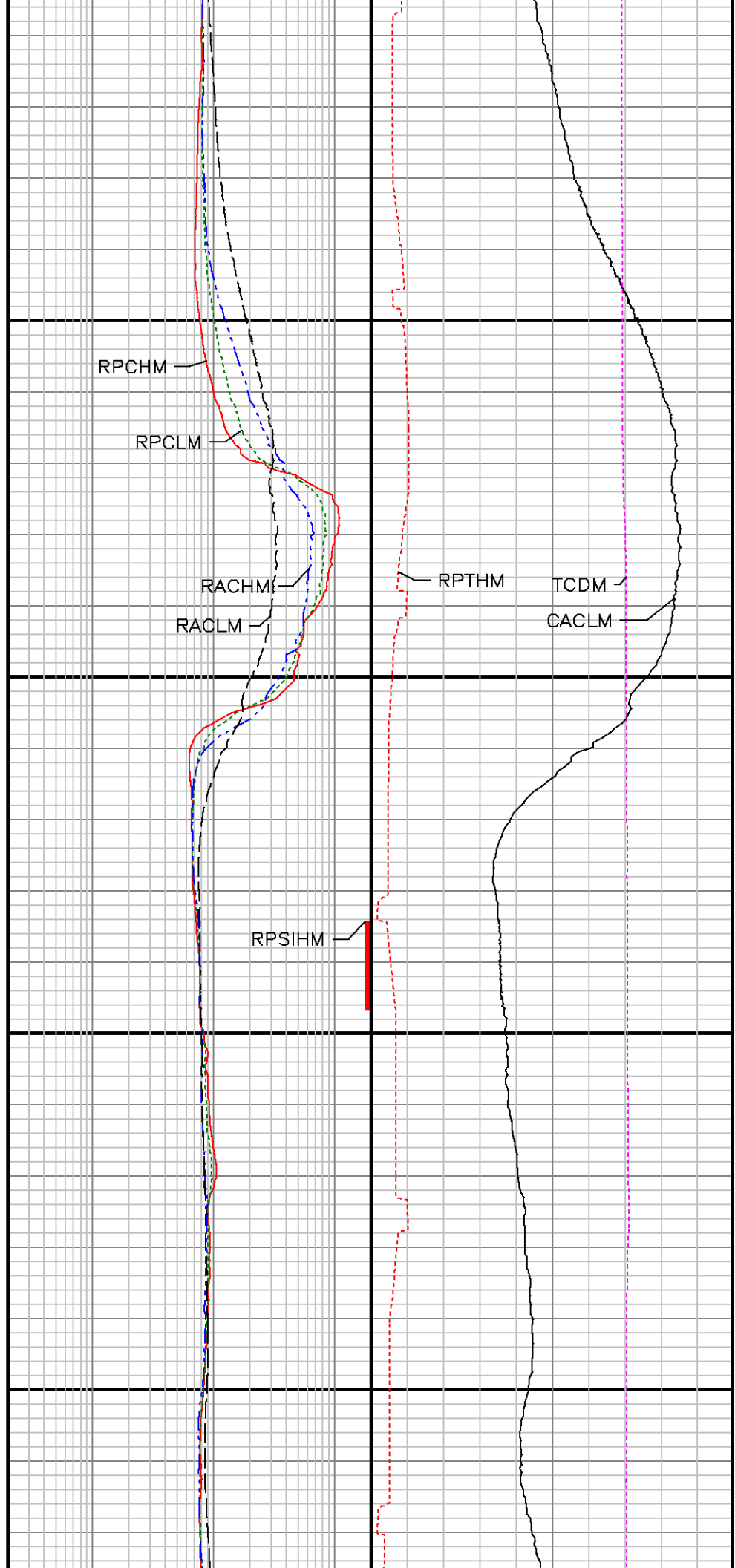
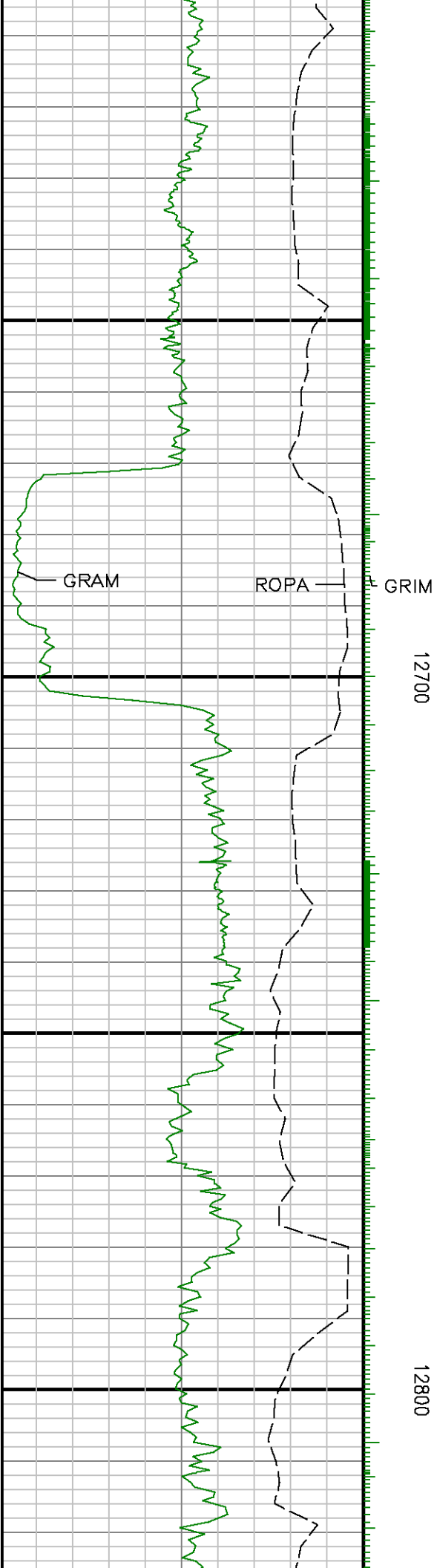


12200

12300



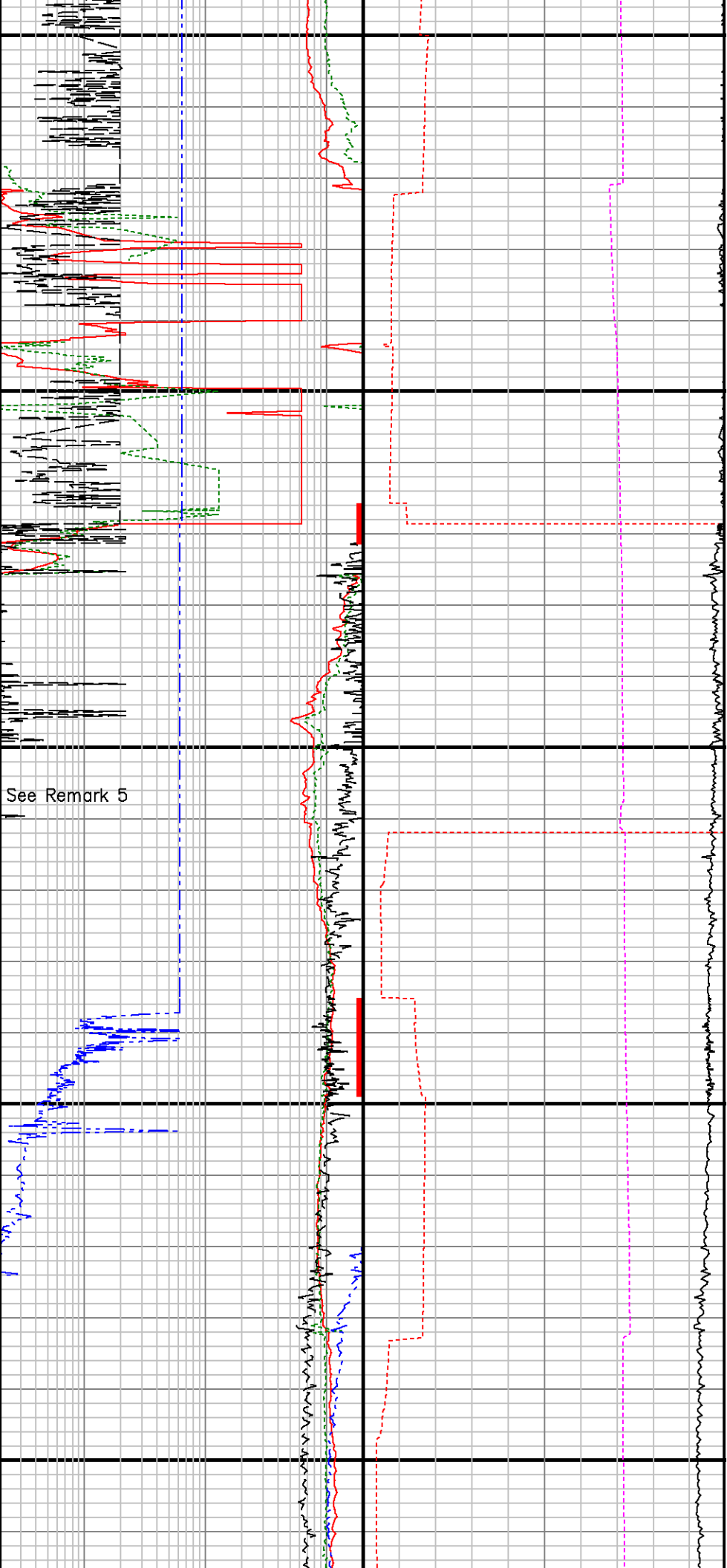






12900

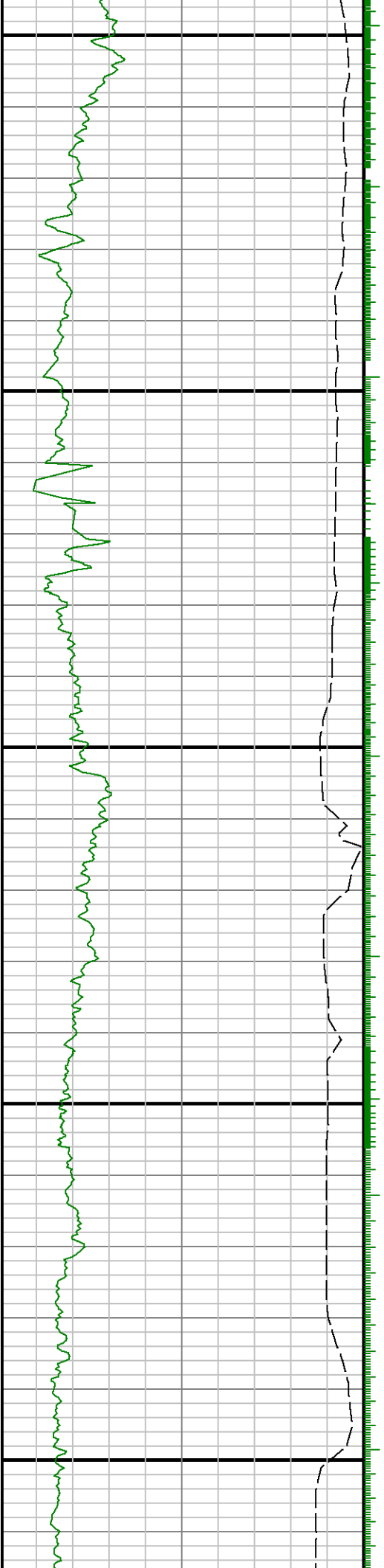
13000

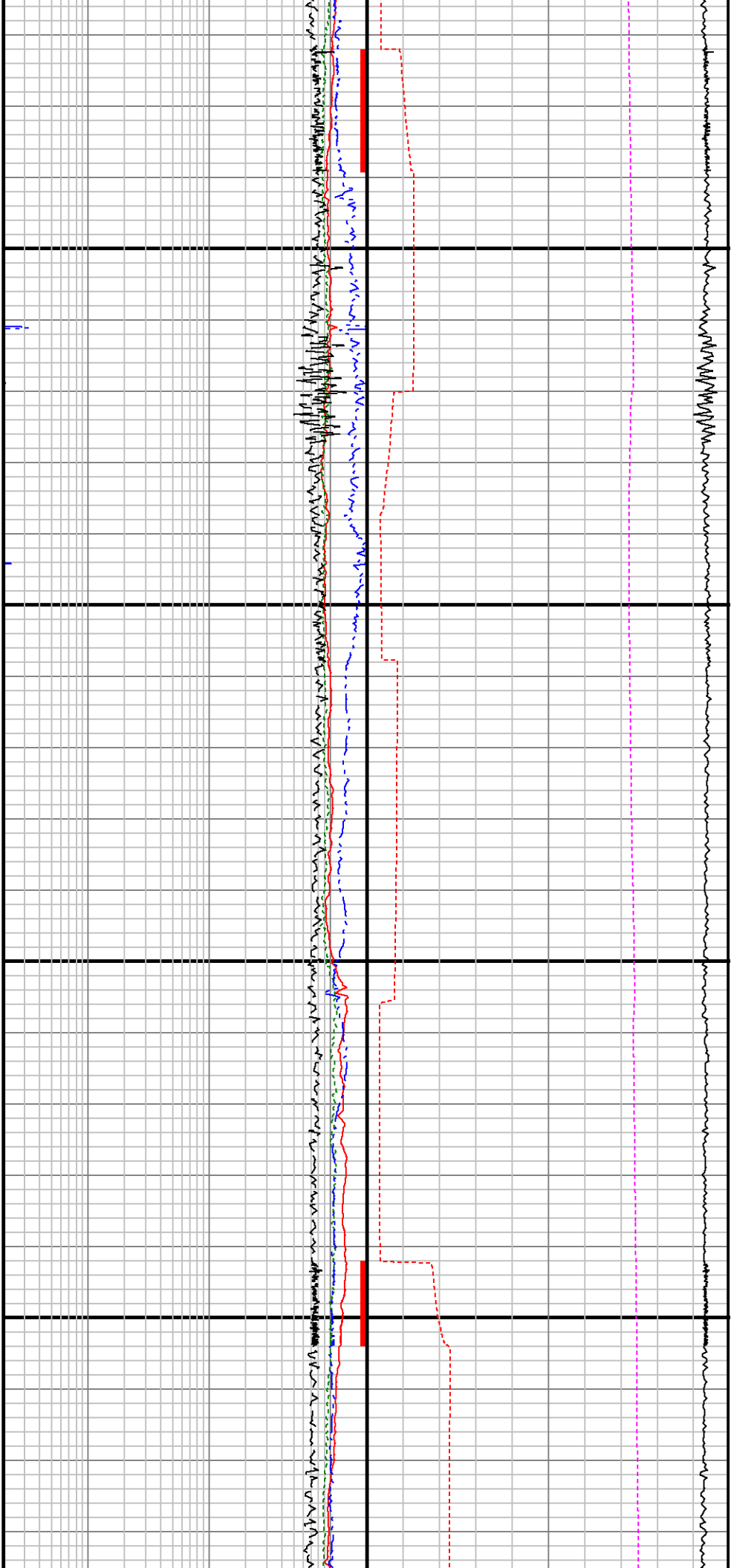


13100

13200

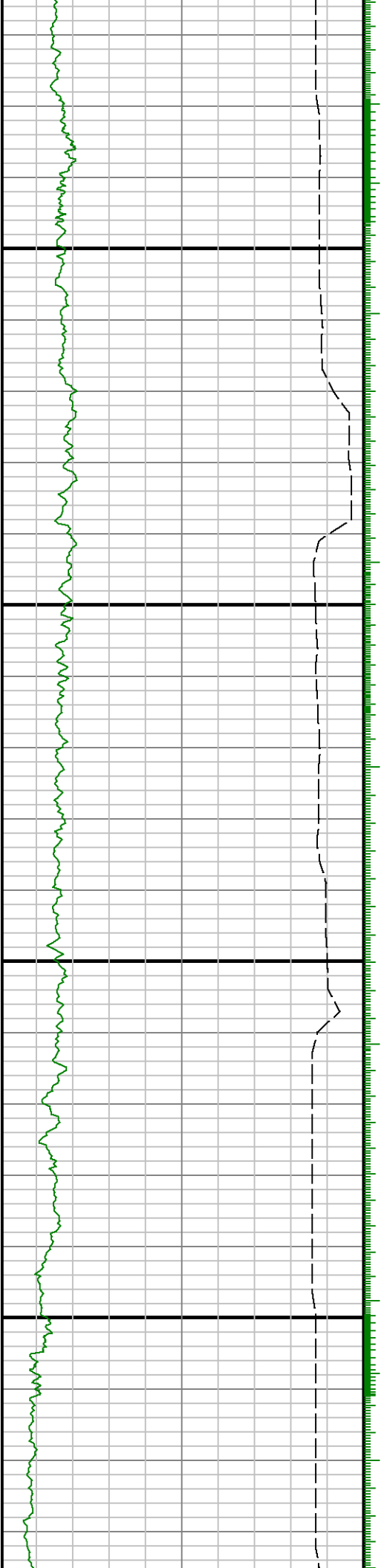
Run 4 ◇ Run 5

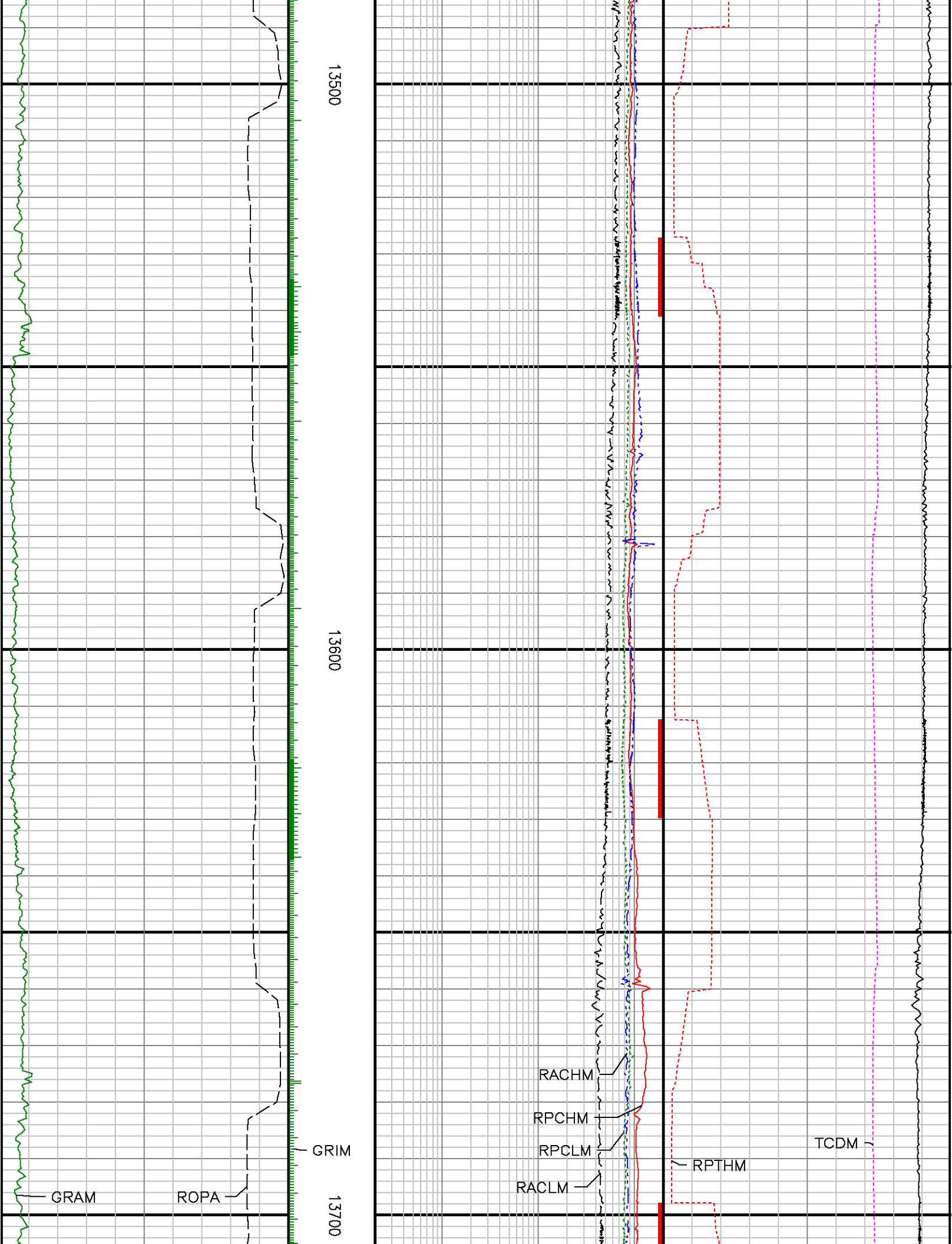




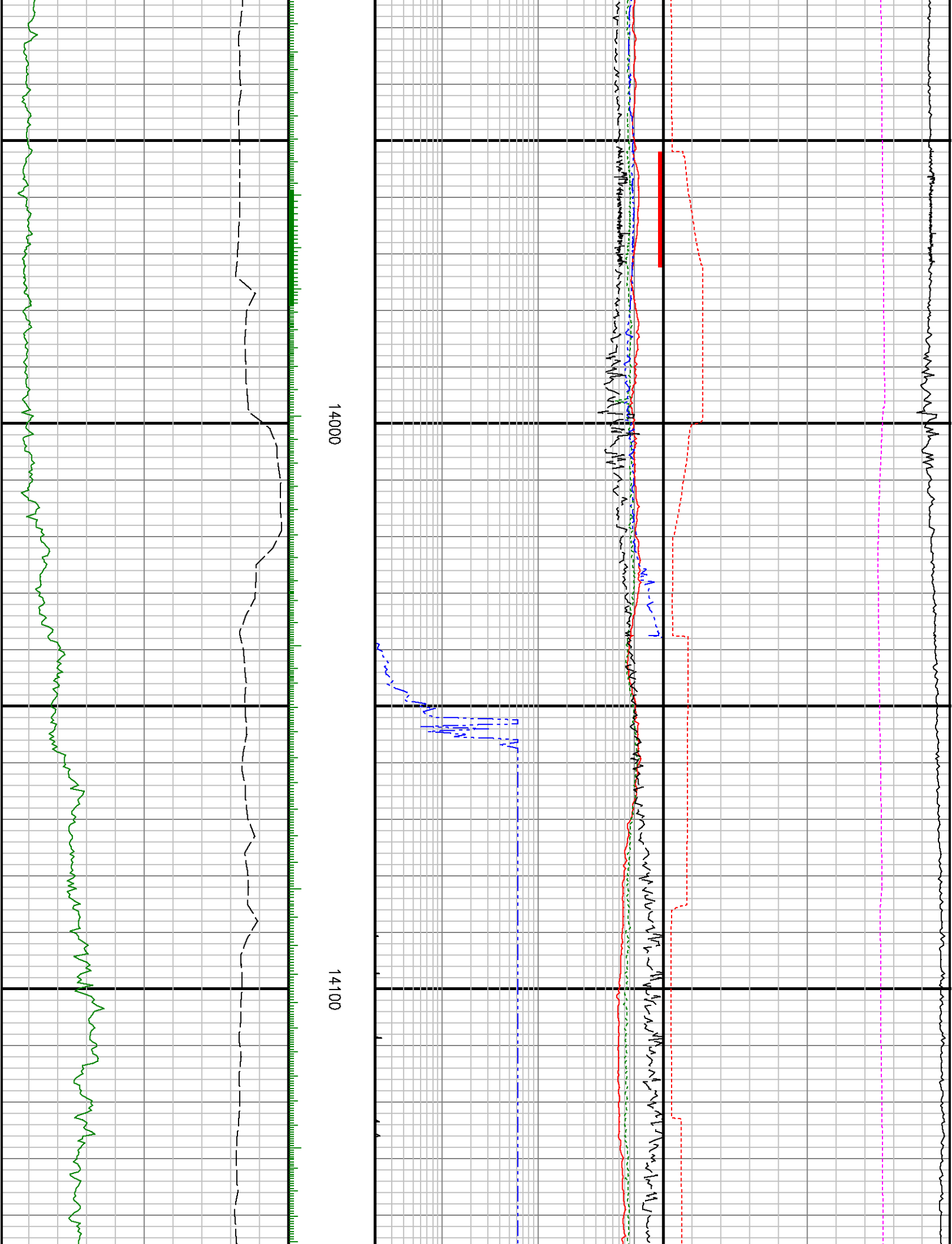
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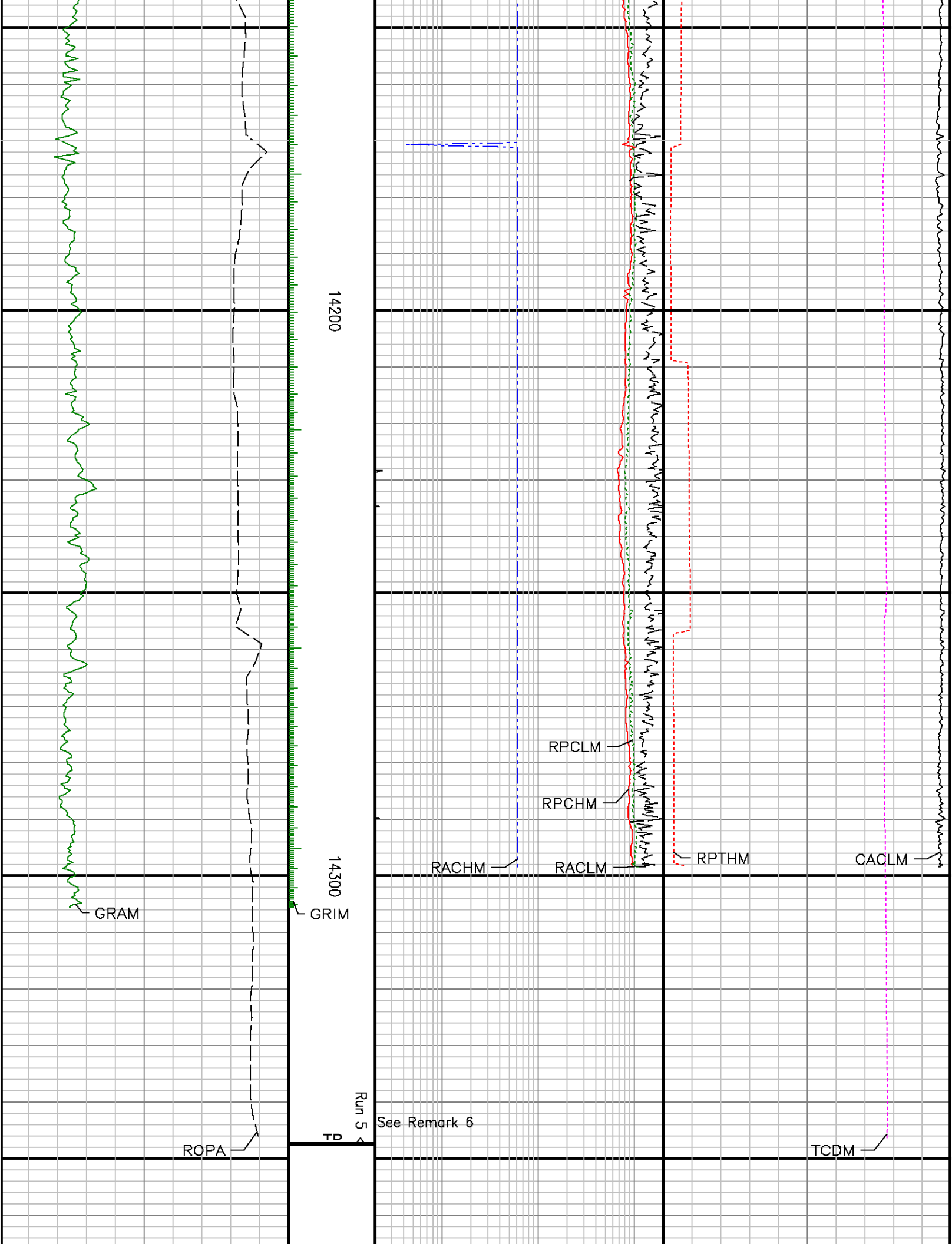
13400











Gamma Ray Apparent 0.5 ft Avg [GRAX]	MD feet 1:240	Res PD LS 2MHz Corr [RPCHM]	Time Since Drilled [RPTHM]
0 200		0.2 200	0 600
API		ohm.m	min
Gamma Ray Apparent 0.5 ft Avg [GRAM]		Res PD LS 400kHz Corr [RPCLM]	Con AT LS 400kHz Corr [CACLM]
0 200		0.2 200	200 0
API		ohm.m	mmho/m
Rate of Penetration 3.0 ft Avg [ROPA]	Res AT LS 2MHz Corr [RACHM]	Downhole Temperature [TCDX]	100 300
1000 0	0.2 200	ohm.m	degF
ft/hr	Res AT LS 400kHz Corr [RACLM]	Downhole Temperature [TCDM]	100 300
	0.2 200	ohm.m	degF