



LWD MEMORY LOG

Gamma Ray

Scale:		Company: Noble Energy				
1:240 MD		Well: Bison Ridge Y22-779				
Depth Reference:		Field: Wattenberg				
Driller's Depth		County: Weld		Country: United States		
Status:		State: Colorado		Other Services:		
Final Print		Surface Location:		Latitude: 40° 45' 00" N Longitude: 106° 40' 00" W		
API No: 05-123-45378		SEC: 10 TWN: 2N RGE: 64W		Directional		
Job ID: 8797939		Permanent Datum (P.D.): Ground Level		Elevation: 4930.00 ft		
Log Measured From: Rig Floor		Above P.D.		Elev. KB: 4960.00 ft Elev. DF: 4930.00 ft		
Dates		Interval Logged		Magnetic Field Reference		
Date From: 2017-12-25		Top: (ft) 2066.00		Azi Reference North: Grid		
Date To: 2017-12-28		Bottom: (ft) 17191.00		Total Magnetic Field Strength: (nT) 52245		
Spud Date: 2017-12-23				Mag to Reference North Correction: (deg) 7.44 E		
Borehole Record				Casing Record		
Hole Size (in)	From (ft)	To (ft)	Size (in)	Weight (lb/ft)	From (ft)	To (ft)
13.500	30.00	2066.00	9.625	36.00	30.00	2054.00
8.500	2066.00	17191.00				
Mud Record				Deviation Record		
Type	From (ft)	To (ft)	Hole Size (in)	Interval (ft)	Inc Az (Start)	Inc Az (End)
Oil Based Mud	2066.00	17191.00	8.500	15125.00	0.09 8.82	89.91 182.67
Acquisition System		Software Version		Other		
Baker Hughes Cadence		RT4.1		Rig: H&P 517		
PlotStudio		4.1.763.3		Contractor: Helmerich & Payne Drilling Co		
				District: RMA Unit: D&E		

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Log Run Summary

Run No	Bit Run No.	Bit Size (in)	Bit Type	Bit Gauge Length (in)	Assembly Type	Logged Interval		Bit Depth Interval		Date / Time		Circ. Hours (h)
						Top	Bottom	From	To	Start Logging	End Logging	
						(ft)	(ft)	(ft)	(ft)			
1	1	8.500	PDC	3.00	Rotary Steerable	2066.00	14544.00	2066.00	14556.00	2017-12-25 05:12	2017-12-27 07:20	46.02
2	2	8.500	PDC	3.00	Rotary Steerable	14544.00	17178.00	14556.00	17191.00	2017-12-27 22:24	2017-12-28 10:20	11.17

Crew

Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite
Mark Herpin	2017-12-23	2017-12-29	Mohammad Odetallah	2017-12-23	2017-12-27	Adam Schlenz	2017-12-27	2017-12-29

Mud Properties Record

Date / Time	Run No.	Measured Depth	Mud Type	Density	Viscosity	pH	Fluid Loss	Oil / Water	Source	Total Chlorides	K+
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		(ft)		(ppg)	(cP)		(cm3)			(ppm)	(%)
2017-12-25 04:00	1	2066.00	Oil Based Mud	9.0	10	N/A	81.4	73.5/26.5	Active Pit	18500	0.00
2017-12-25 13:30	1	4466.00	Oil Based Mud	9.0	10	N/A	19.6	83.1/16.9	Active Pit	22000	0.00
2017-12-26 02:30	1	7684.00	Oil Based Mud	9.3	10	N/A	19.4	83.3/16.7	Active Pit	22000	0.00
2017-12-26 13:30	1	10636.00	Oil Based Mud	9.5	10	N/A	19.2	84.1/15.9	Active Pit	22000	0.00
2017-12-27 02:30	1	13636.00	Oil Based Mud	9.4	10	N/A	19.4	84.2/15.8	Active Pit	22000	0.00
2017-12-27 16:22	2	14556.00	Oil Based Mud	9.4	10	N/A	19.4	84.2/15.8	Active Pit	22000	0.00
2017-12-28 11:29	2	17191.00	Oil Based Mud	9.5	10	N/A	21.2	84.1/15.9	Active Pit	21000	0.00

Equipment and Service Data

Run No.	Tool	Serial Number	Measurement	Sensor Offset (ft)	Bit Offset (ft)	Max O.D. (in)	Min I.D. (in)
1	ATC_SU	11994997	Near Bit Inclination	5.93	6.73	6.750	4.330
1	ATC_SU	11994997	Near Bit VSS	5.93	6.73	6.750	4.330
1	ATC_MWD	14146740	Gamma (single)	2.80	12.95	7.000	3.250
1	ATC_MWD	14146740	Directional (mag)	12.27	22.42	7.000	3.250
2	ATC_SU	11994997	Near Bit Inclination	5.93	6.73	6.750	4.330
2	ATC_SU	11994997	Near Bit VSS	5.93	6.73	6.750	4.330
2	ATC_MWD	14146740	Gamma (single)	2.80	12.95	7.000	3.250
2	ATC_MWD	14146740	Directional (mag)	12.27	22.42	7.000	3.250

Service and Tool Mnemonics

Mnemonic	Name	Description
ATC_SU	ATC_SU	Auto Trak Curve Steering Unit
ATC_MWD	ATC_MWD	Auto Trak Curve MWD
ATC_LCPM	ATC_LCPM	Auto Trak Curve LCPM

Comments


1	Depth measurements were obtained from a depth control system not supplied or operated by Baker Hughes. Due to the lack of control by Baker Hughes, depth calibrations and measurements could not be independently verified.
2	Baker Hughes LWD runs 1 and 2 utilized a 6.75 inch NaviGamma service (Directional and Gamma Ray) behind a 8.5 inch bit and rotary steerable assembly from 2066 to 17191 feet MD (2066 to 6956 feet TVD).
3	VOA of 2066 to 17191 feet MD (2066 to 6956 feet TVD) was not logged after being drilled due to sensor to bit offset at well TD.

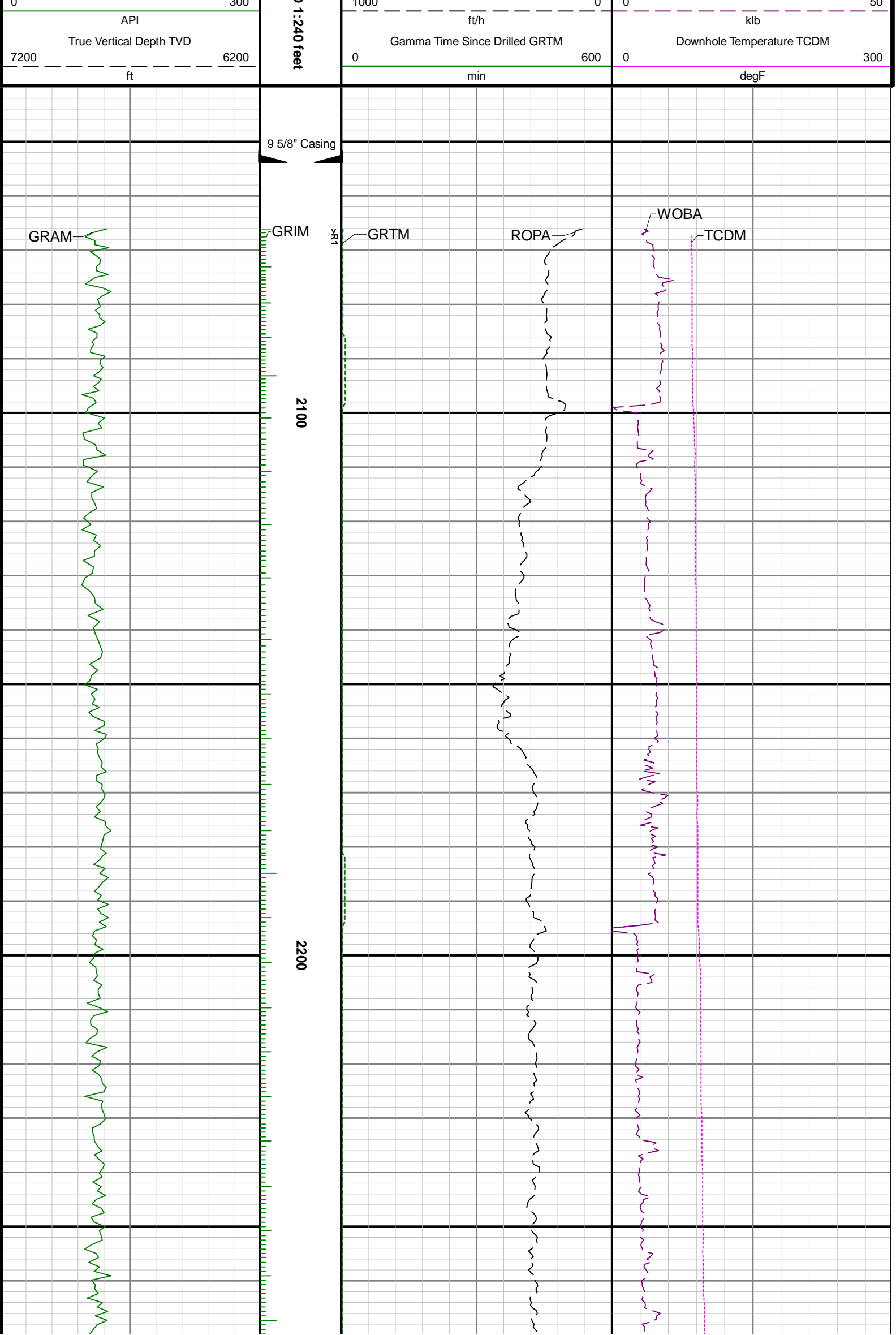
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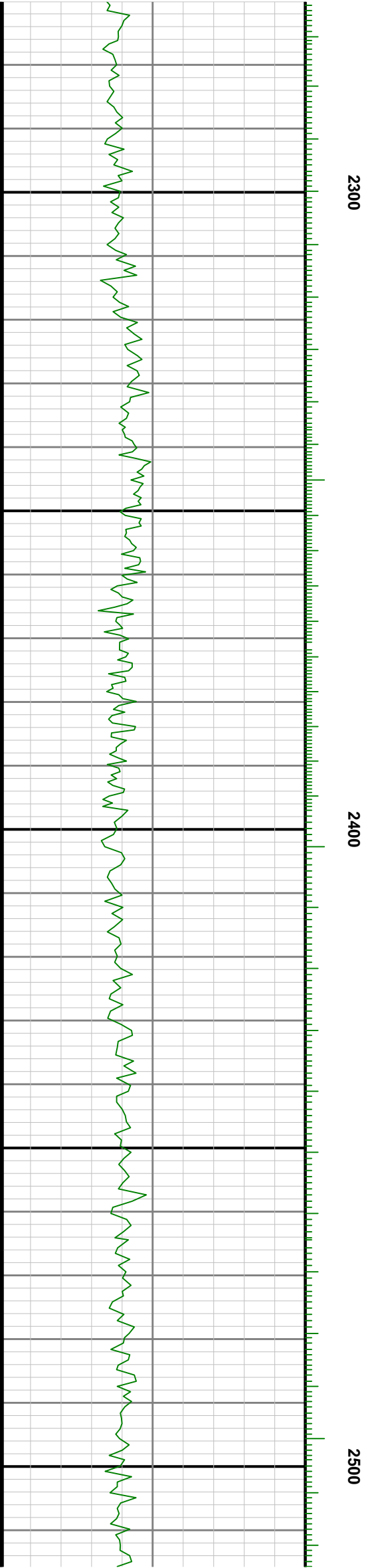
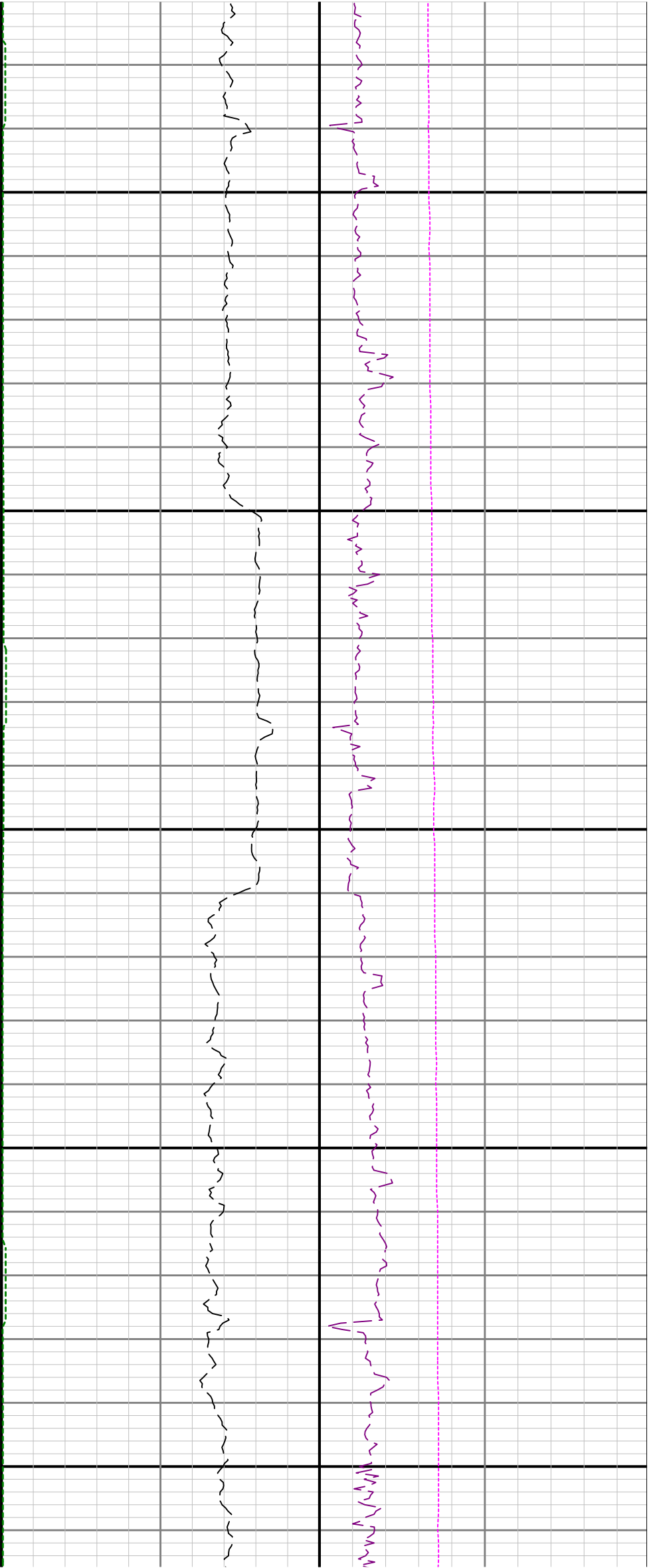
Number	Measured Depth (ft)	Hole Section (in)	Run No.	Remark
1	14489.00	8.500	1	The interval from 14488 to 14544 feet MD (6970 to 6969 feet TVD) has a gap in gamma ray data due to, a downhole MWD tool communication issue.
2	17185.00	8.500	2	The interval from 17178 to 17191 feet MD (6956 feet TVD) was not logged after being drilled due to sensor to bit offset at well TD.

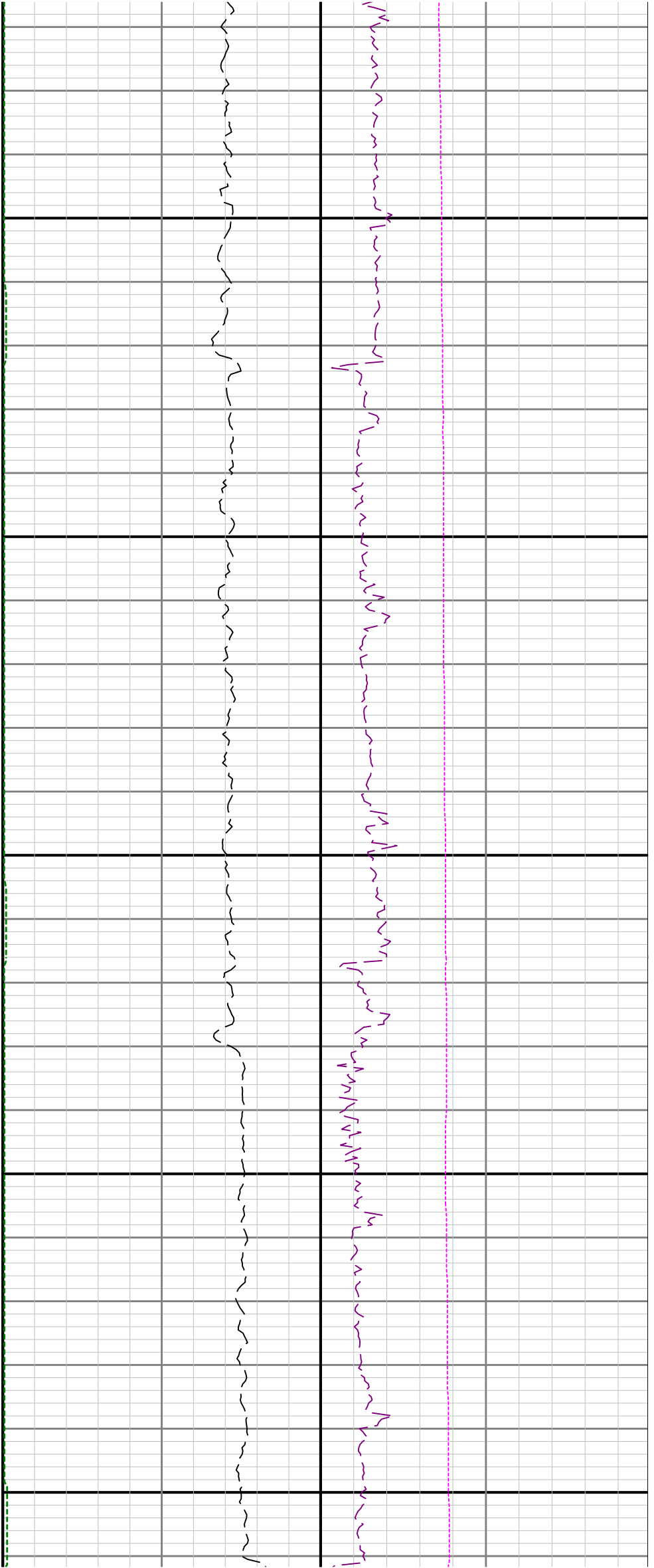
Curve Mnemonics

Presented Curves	Description	Units
ROPA	Depth Averaged ROP 3 ft Average	ft/h
TVD	True Vertical Depth	ft
WOBA	Weight On Bit, Average 1 ft Average	klb
GRAM	Gamma Ray - Apparent - Memory 0.5 ft Average	API
GRIM	Gamma Ray - Data Point Indicator - Memory	unitless
GRTM	Gamma Ray - Time Since Drilled - Memory	min
TCDM	Downhole Temperature	degF

	Company	Noble Energy									
	Well	Bison Ridge Y22-779									
	Interval	Date From:	2017-12-25 05:12:42	Top:	2066.00						
		Date To:	2017-12-28 10:20:13	Bottom:	17191.00						
	Created	2017-12-28 19:34:57									
Gamma Ray - Apparent 0.5 ft Average GRAM			MD	Depth Averaged ROP 3 ft Average ROPA			Weight On Bit, Average 1 ft Average WOBA				

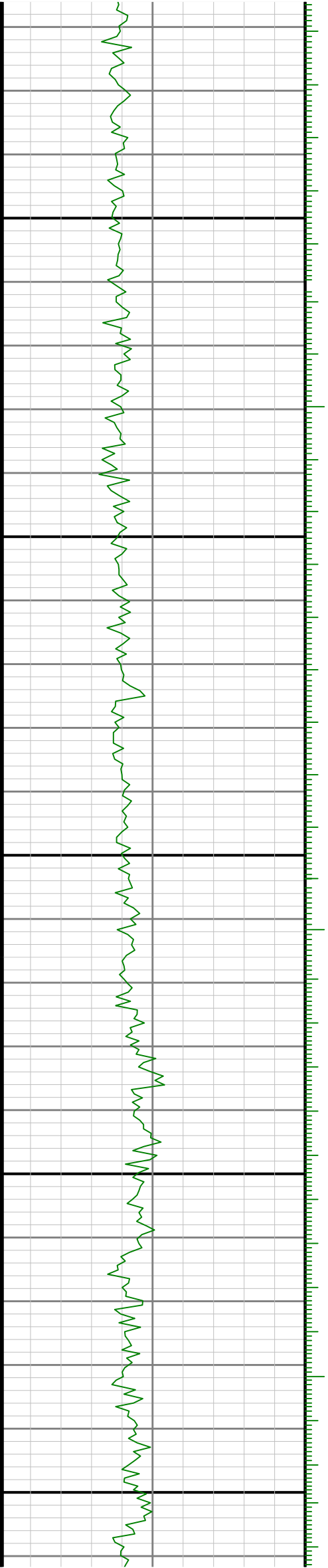


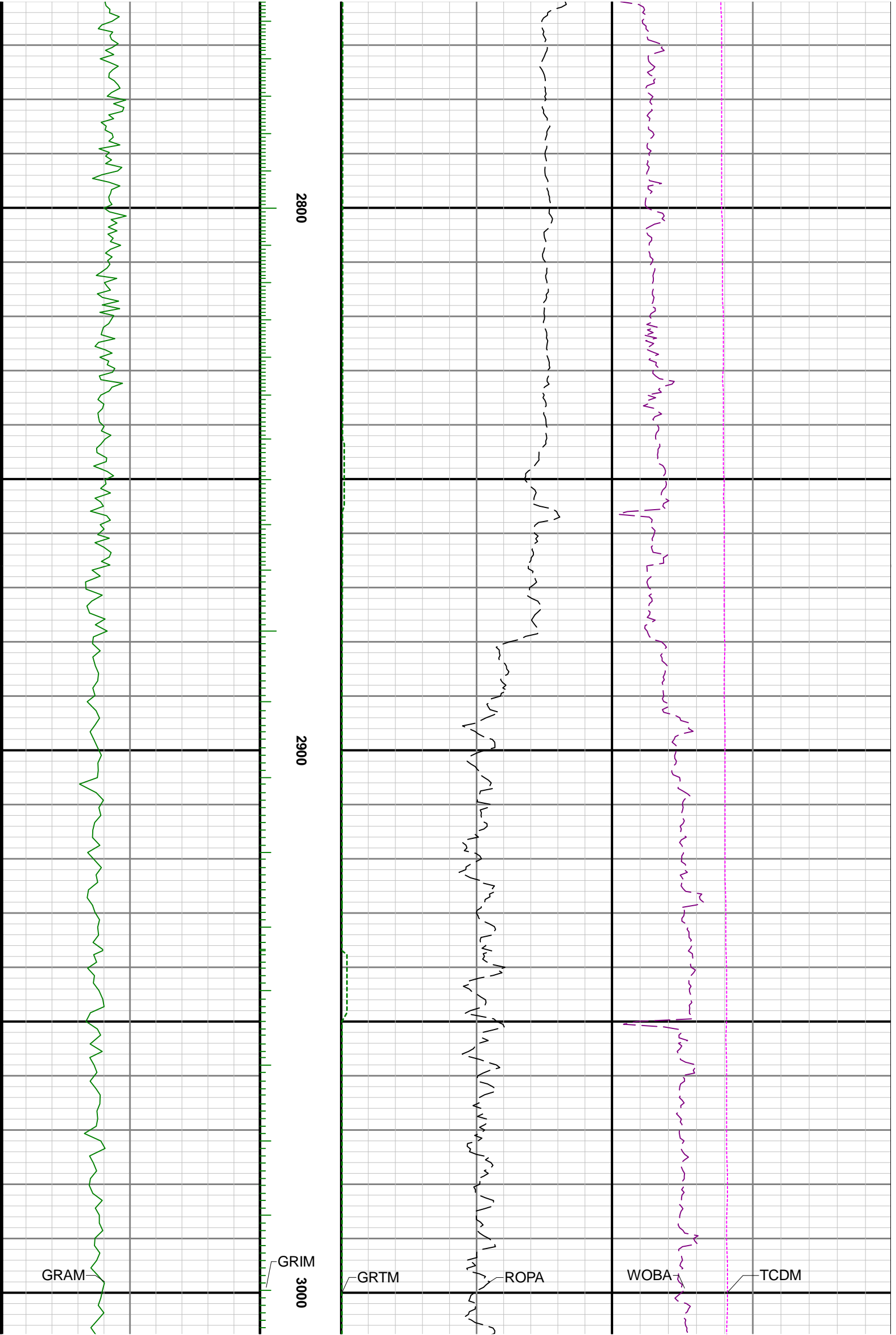


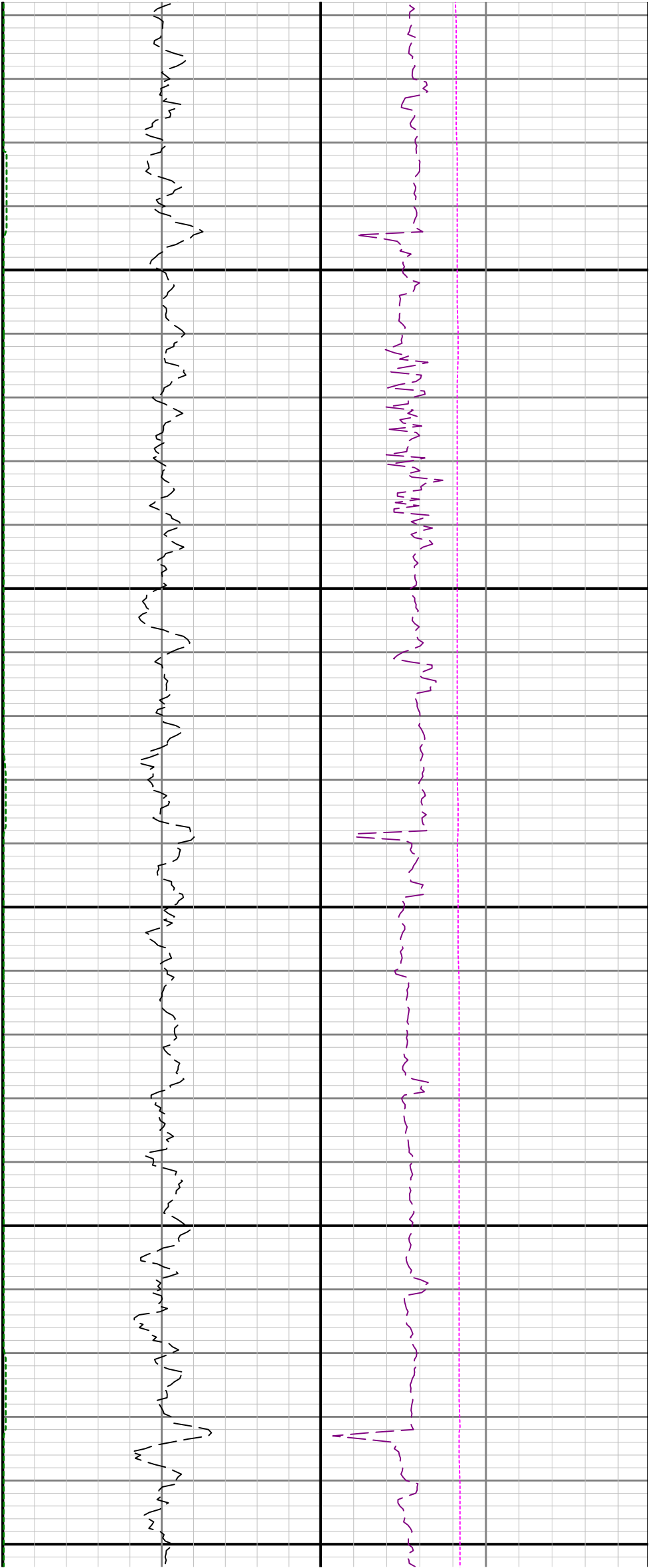


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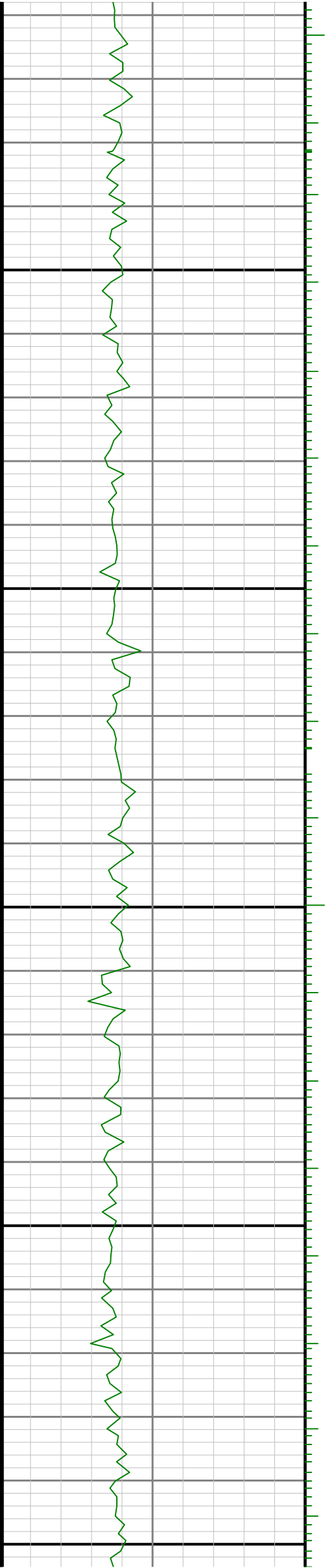


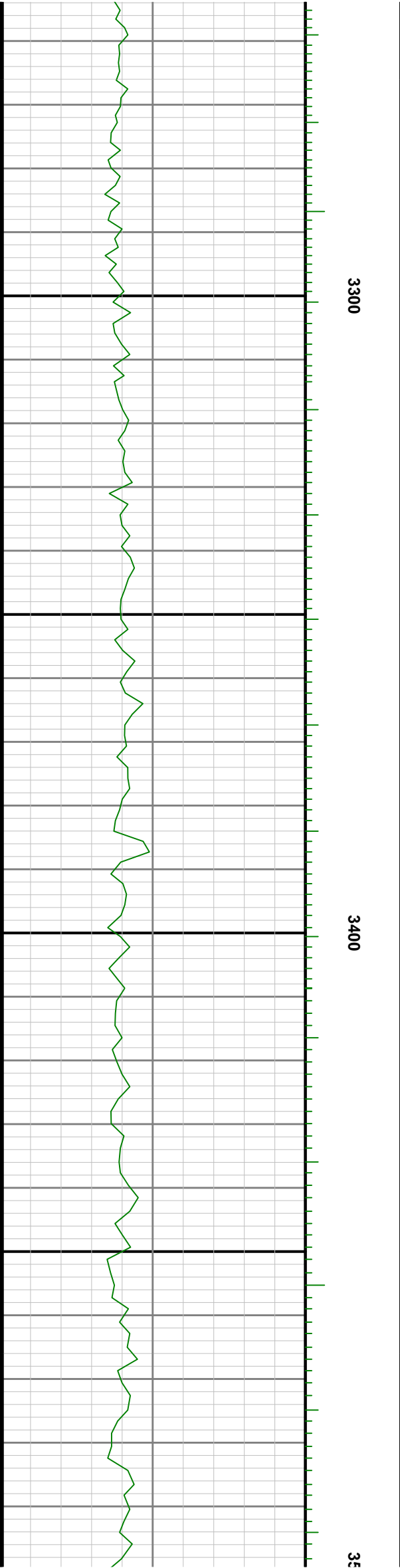
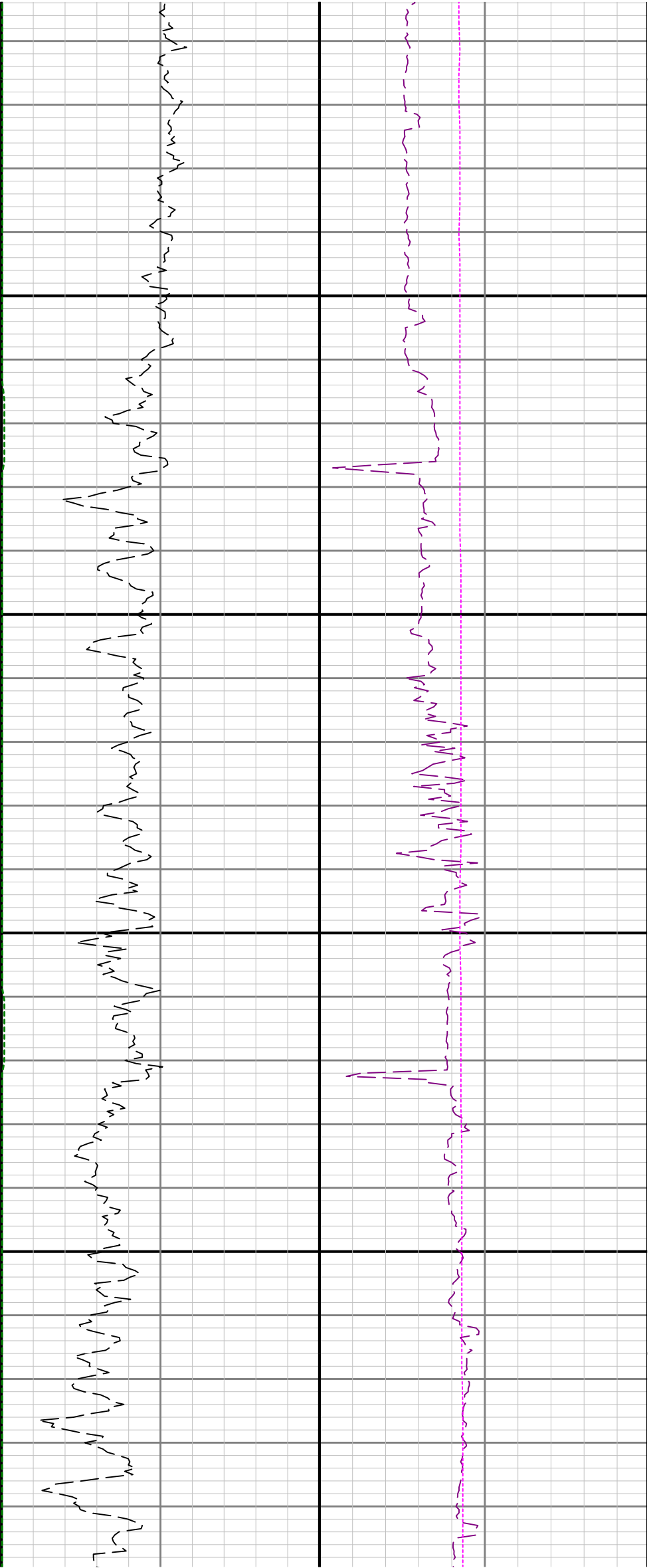


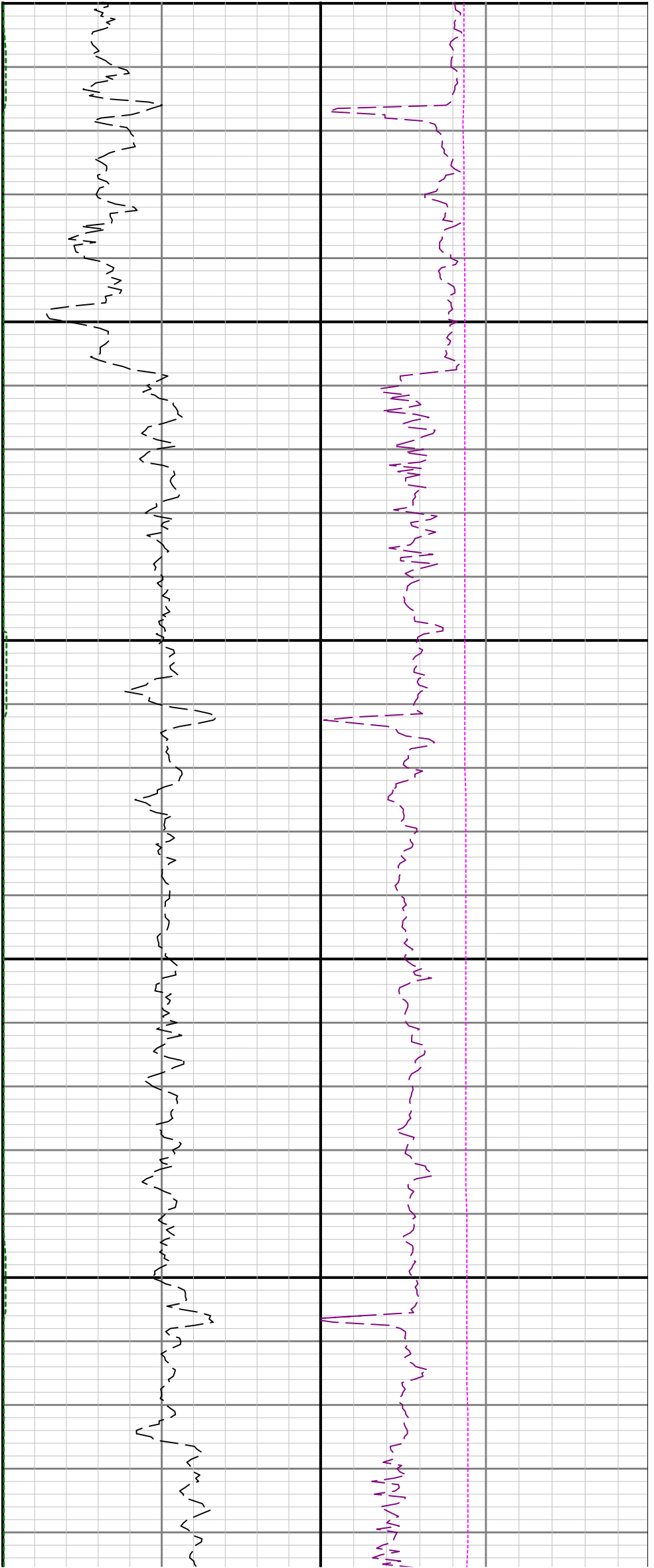


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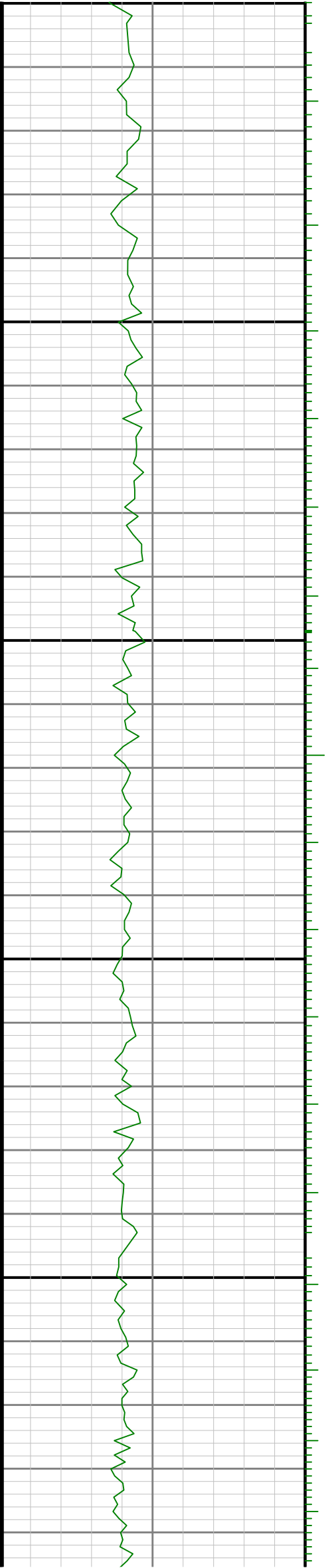


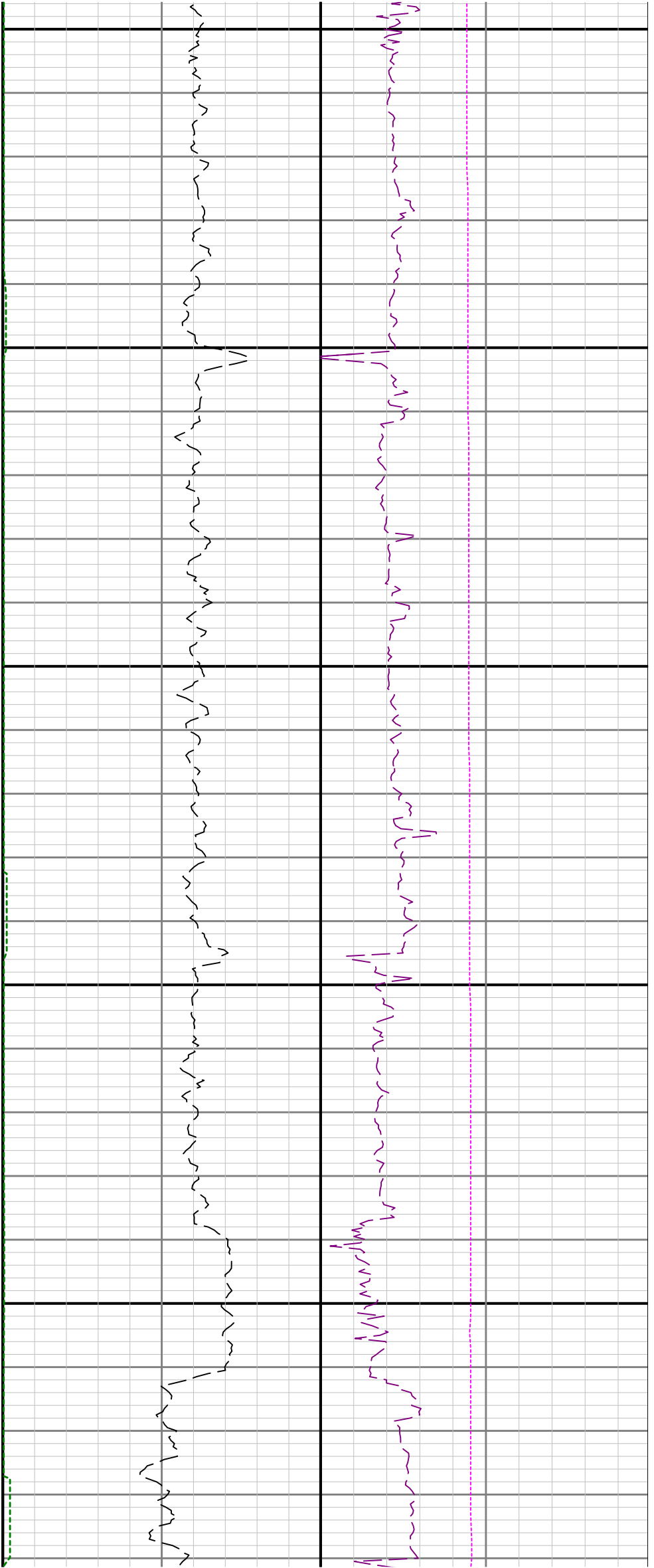


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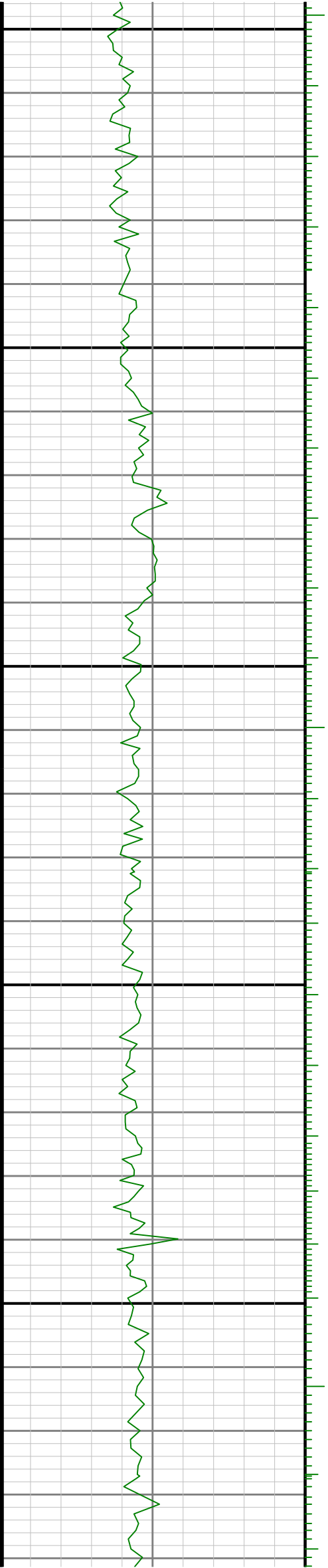
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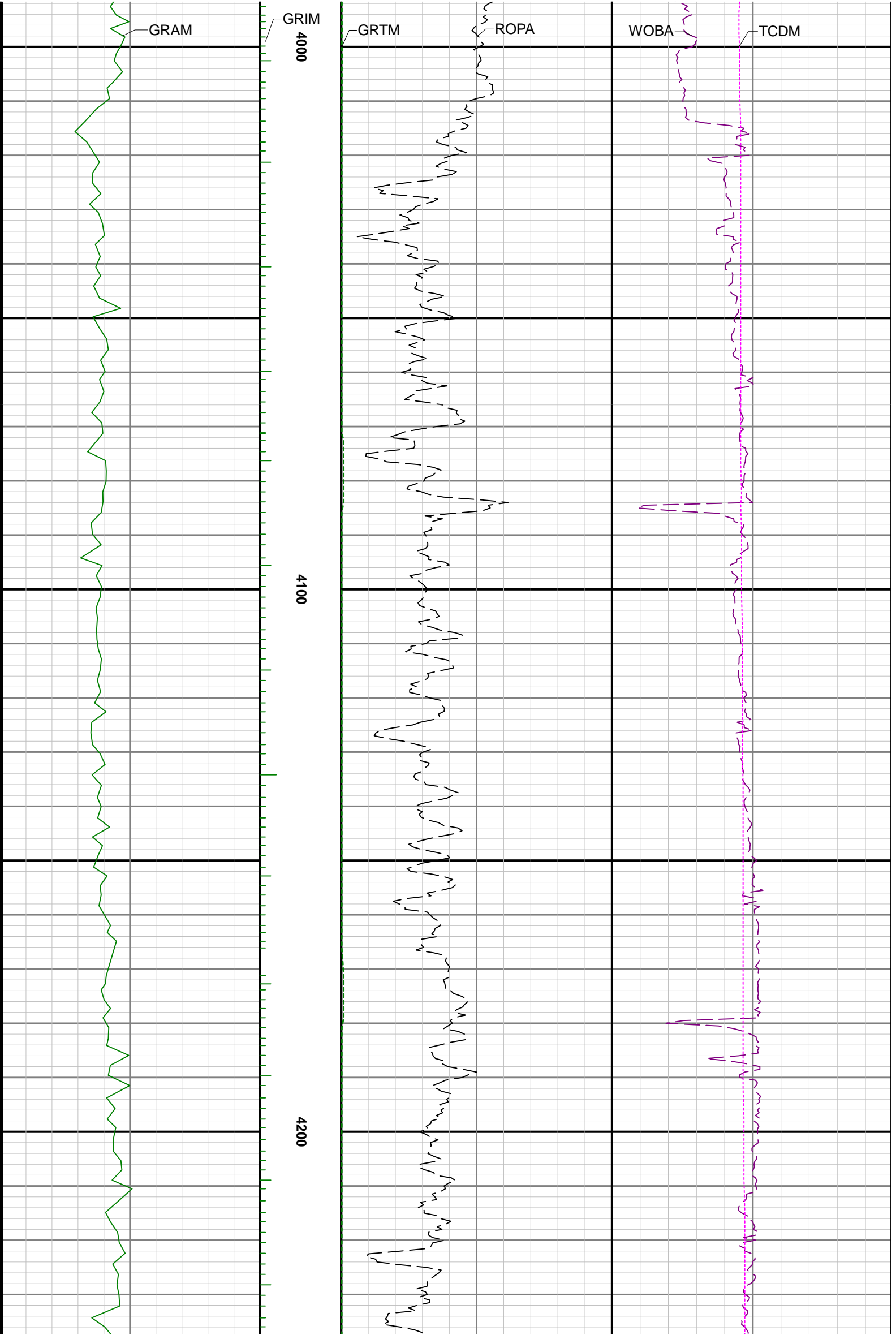


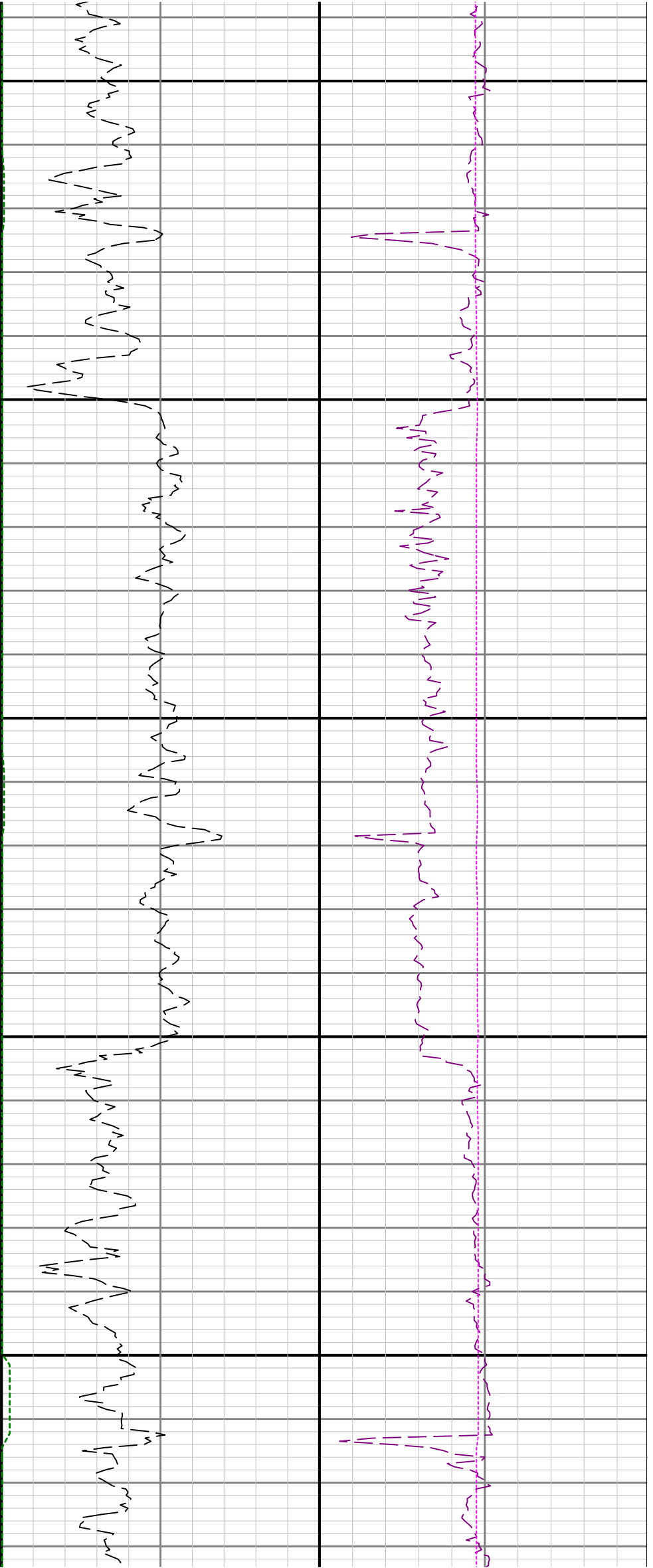


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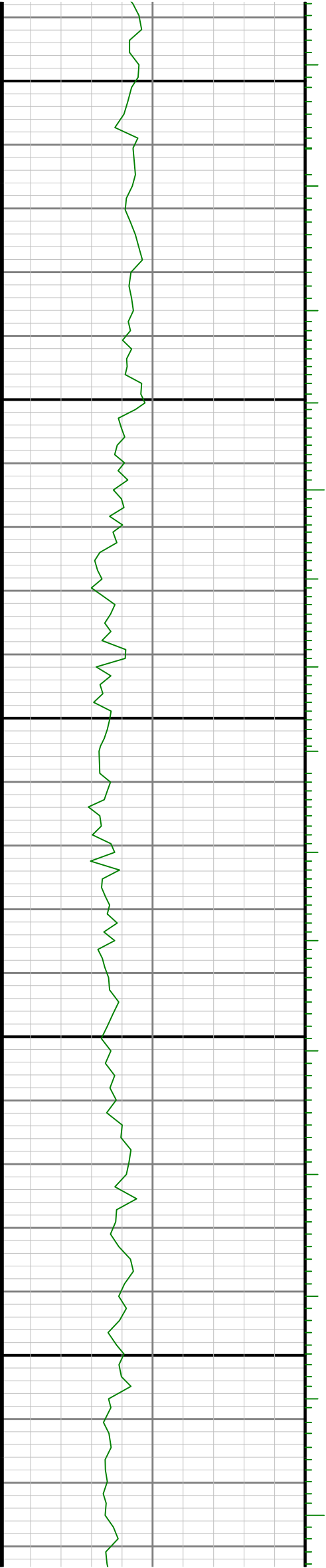


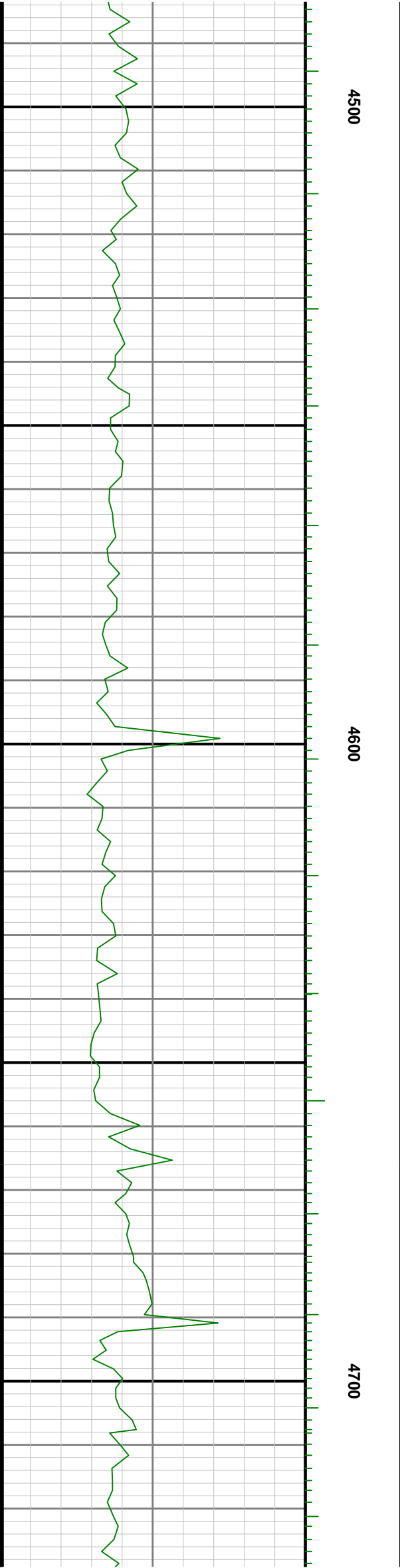
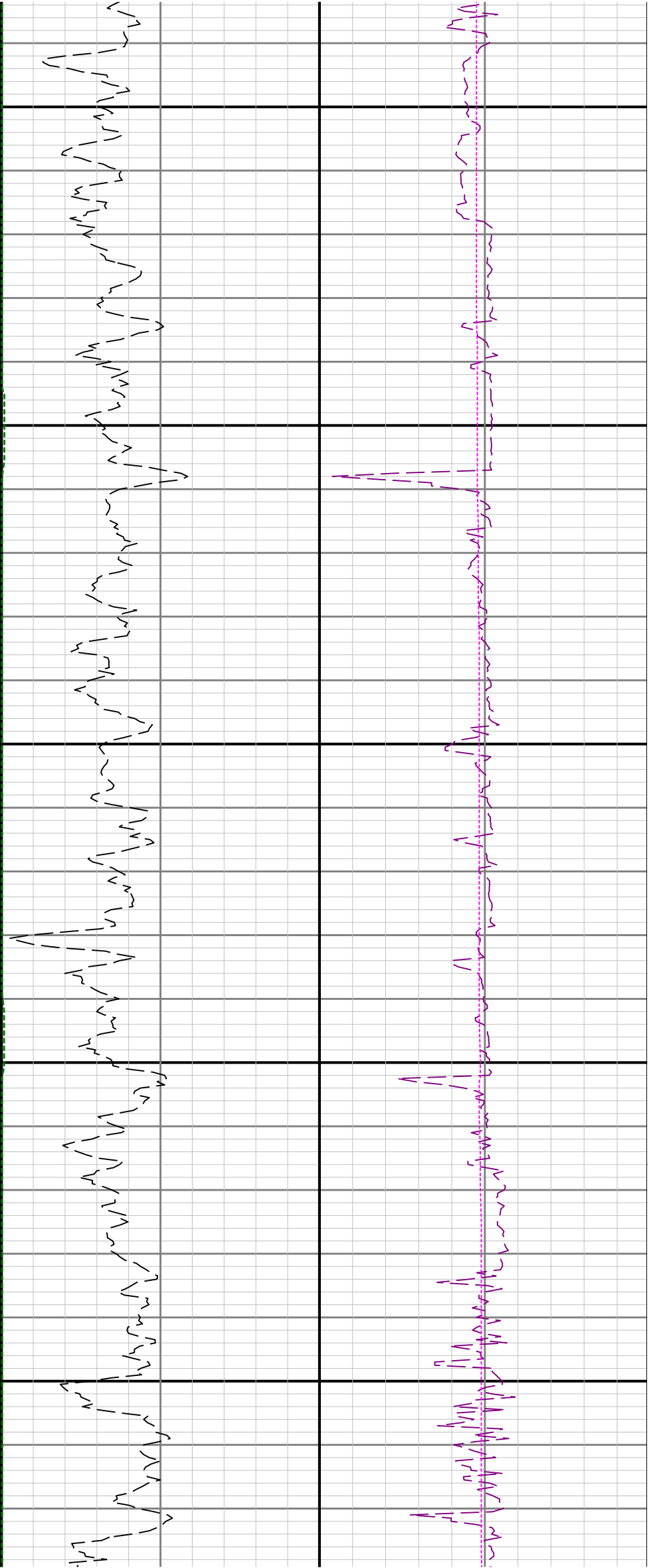


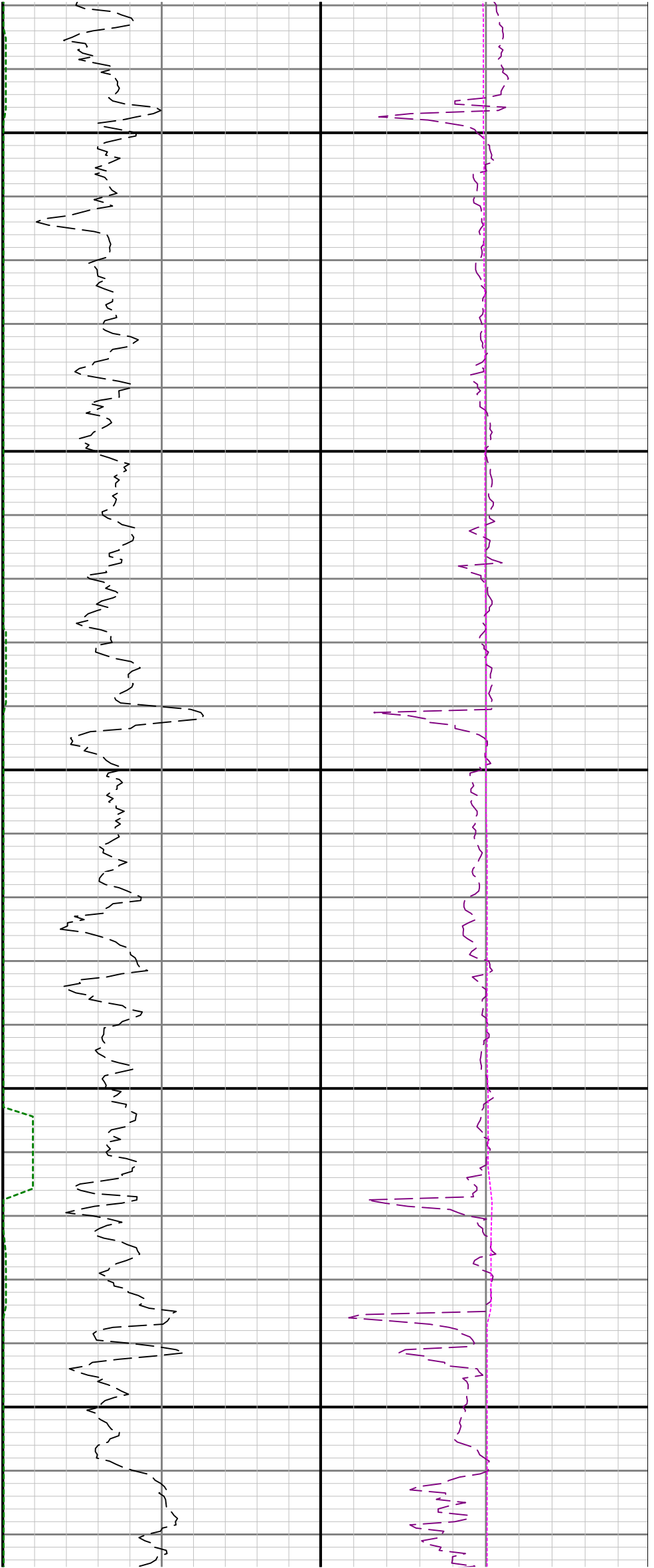


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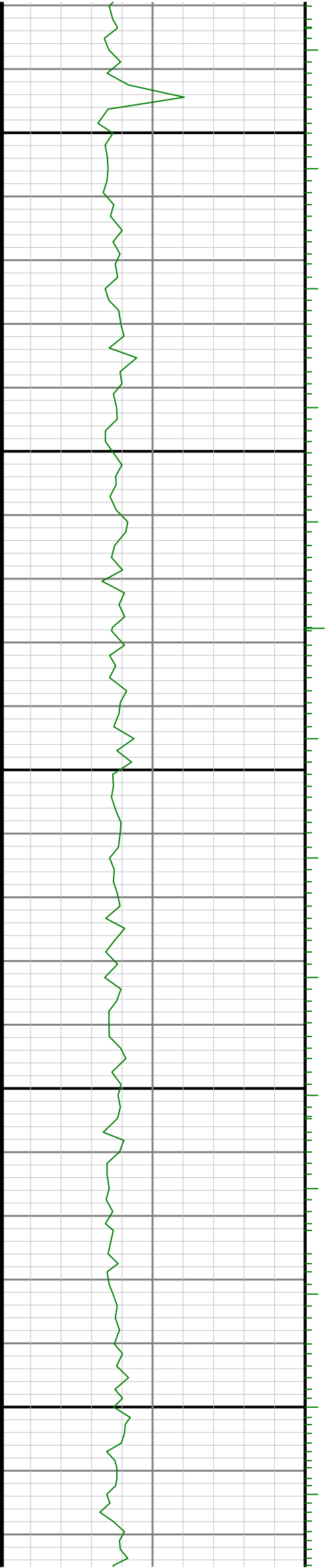


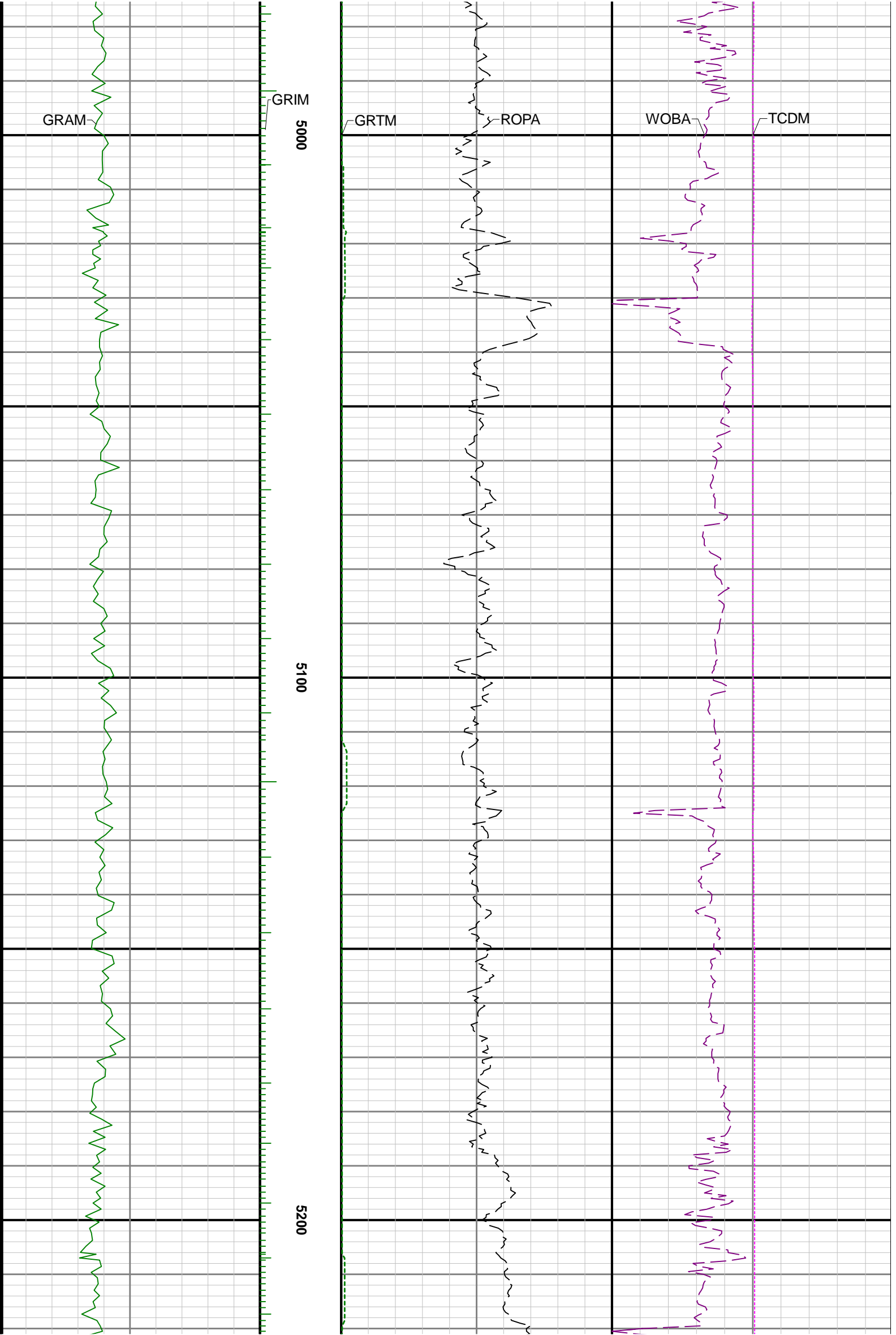


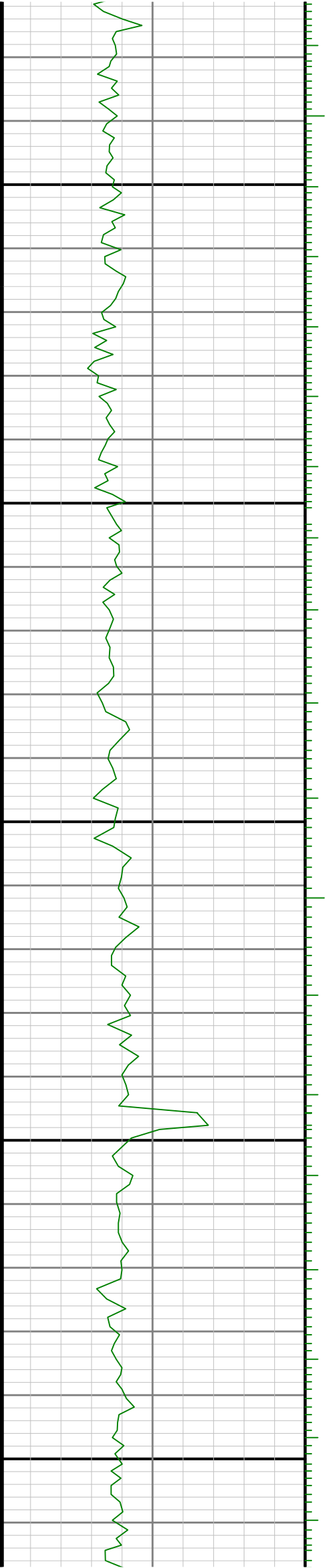
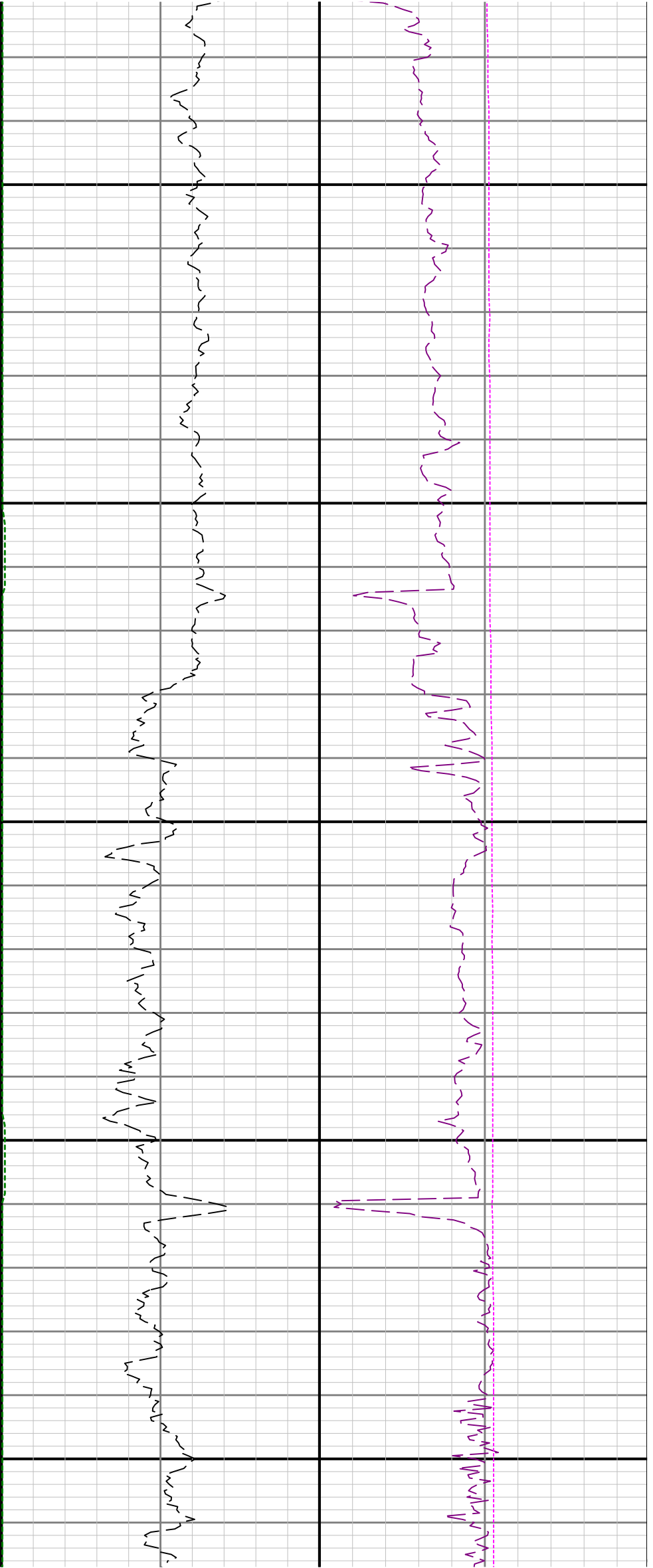


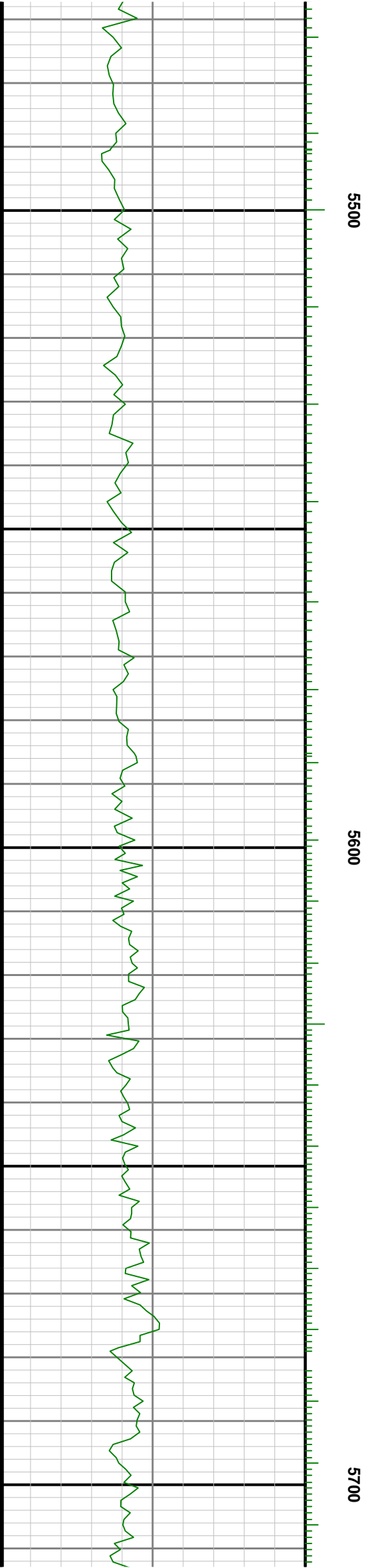
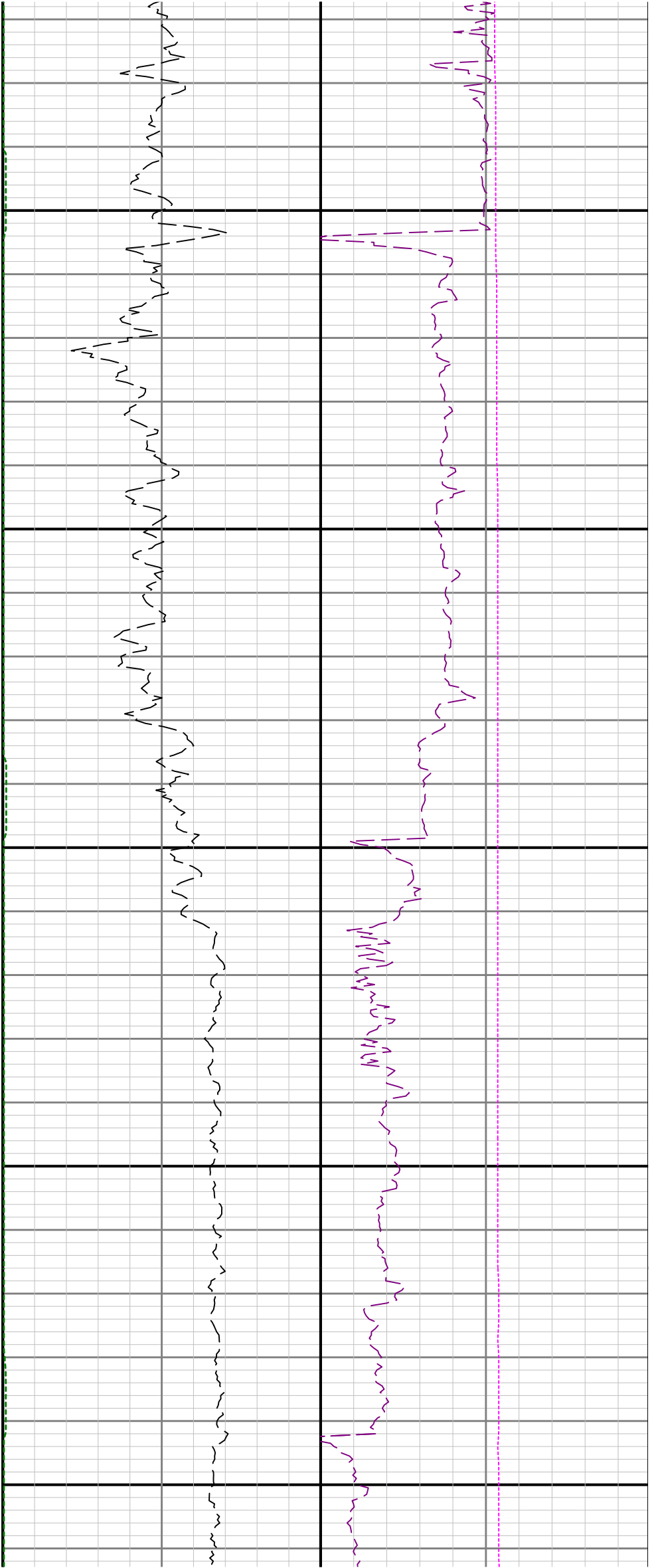
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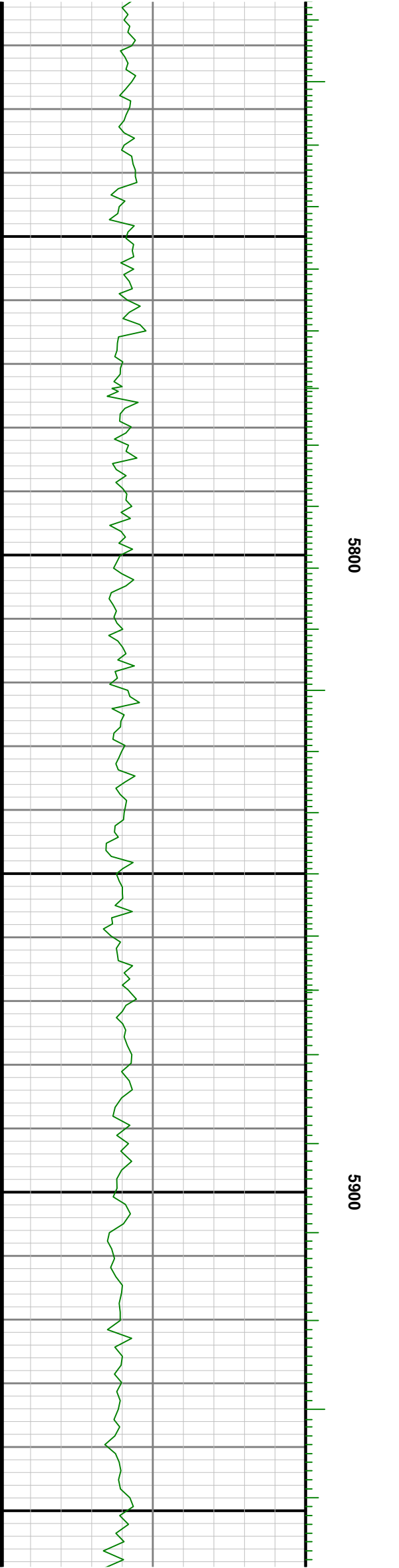
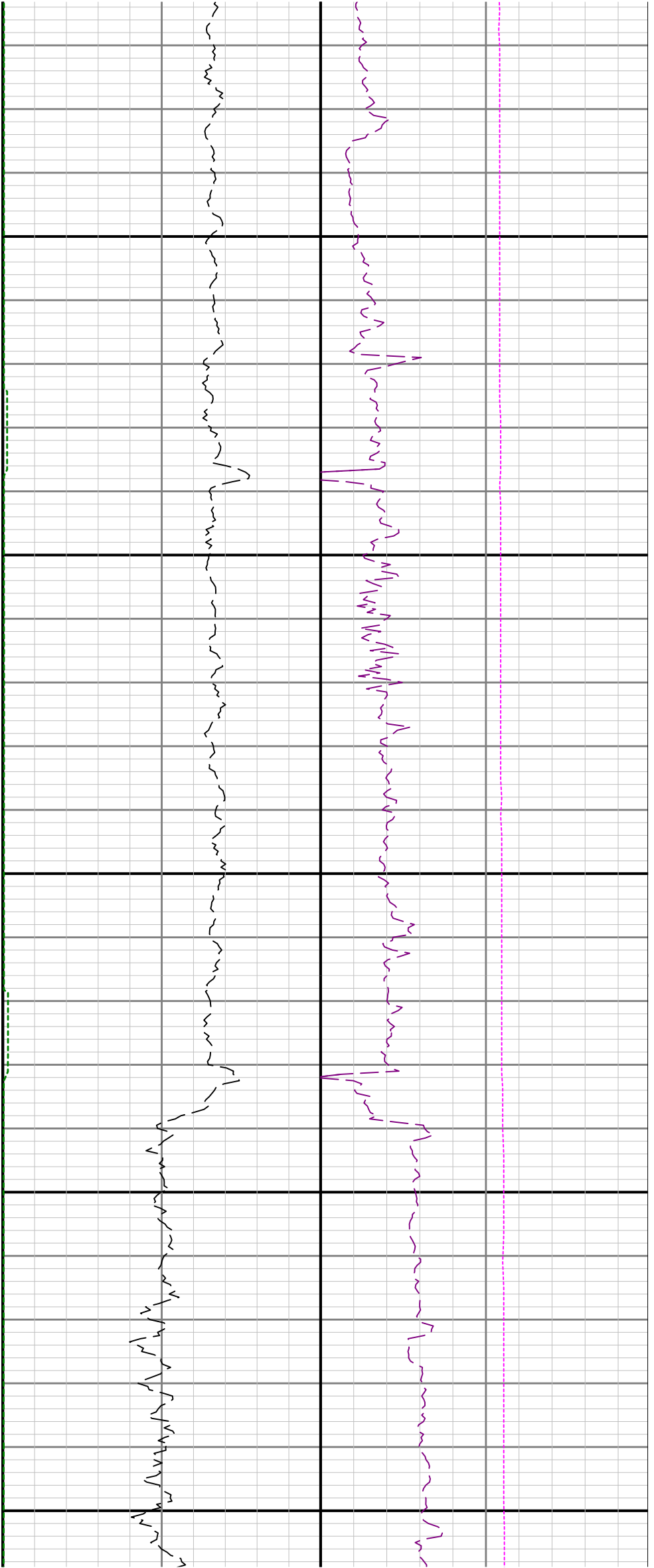
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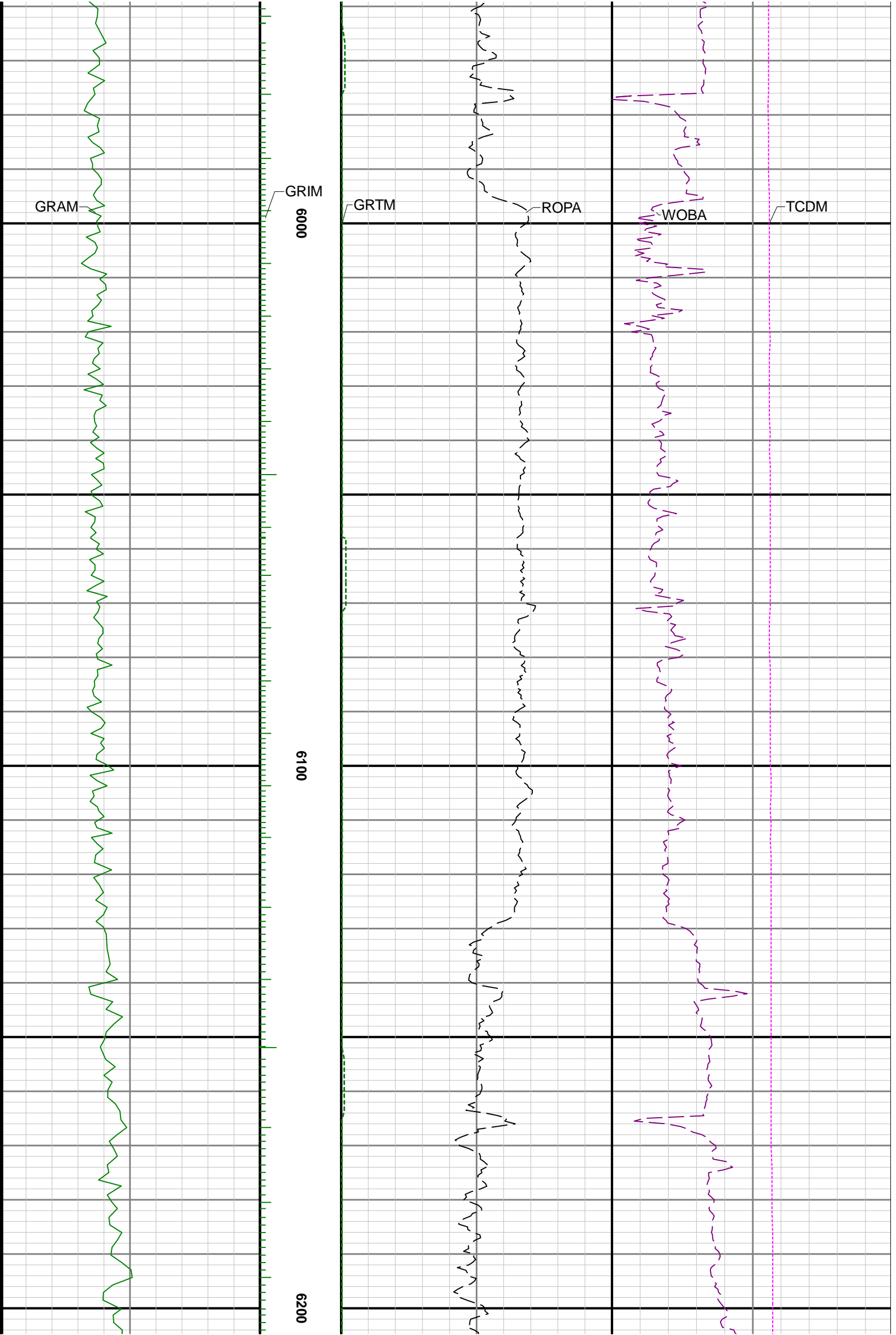








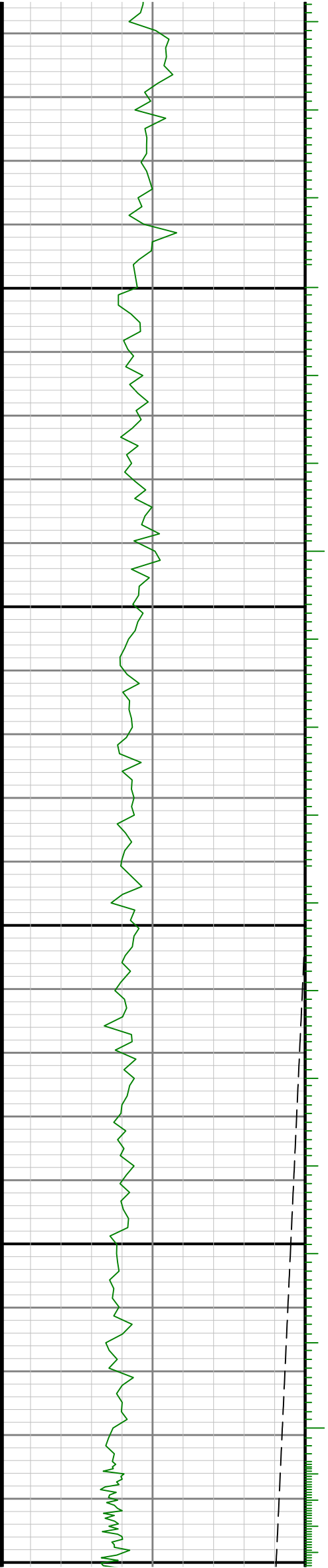


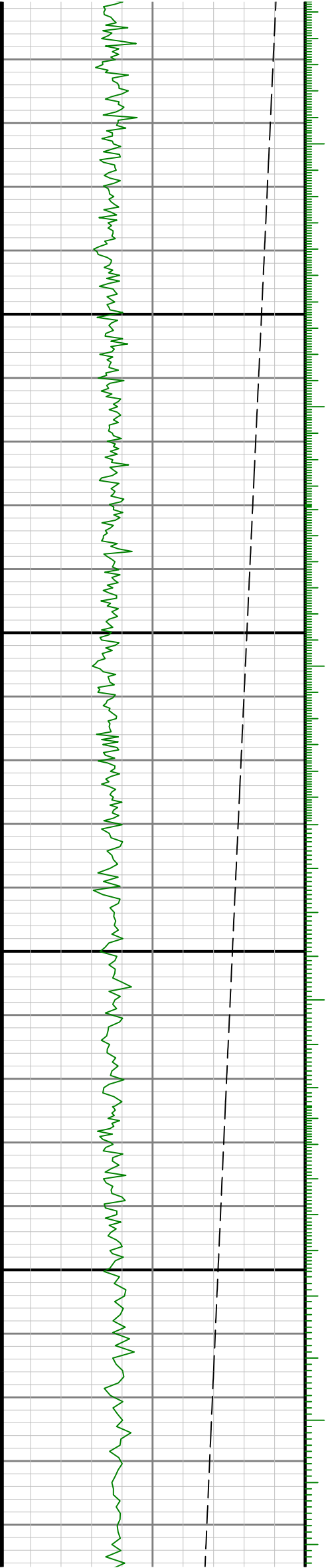




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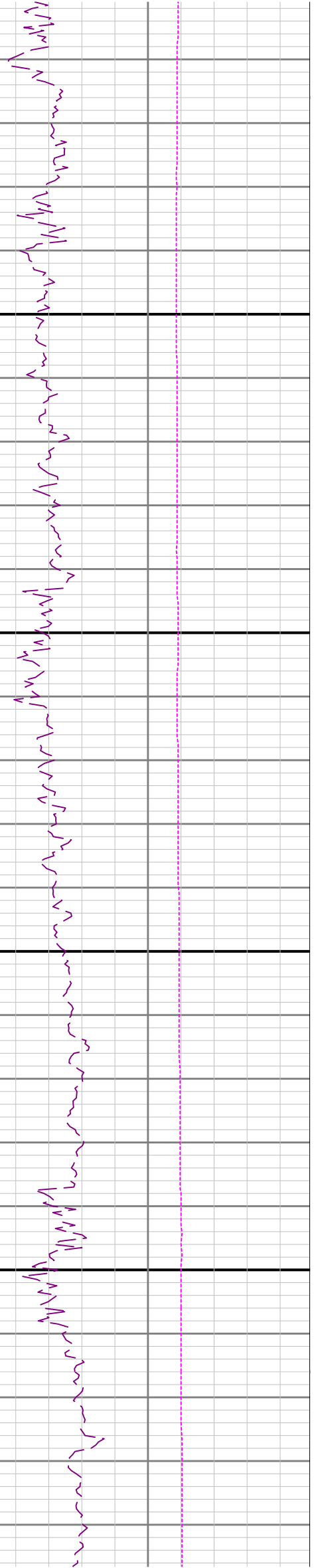
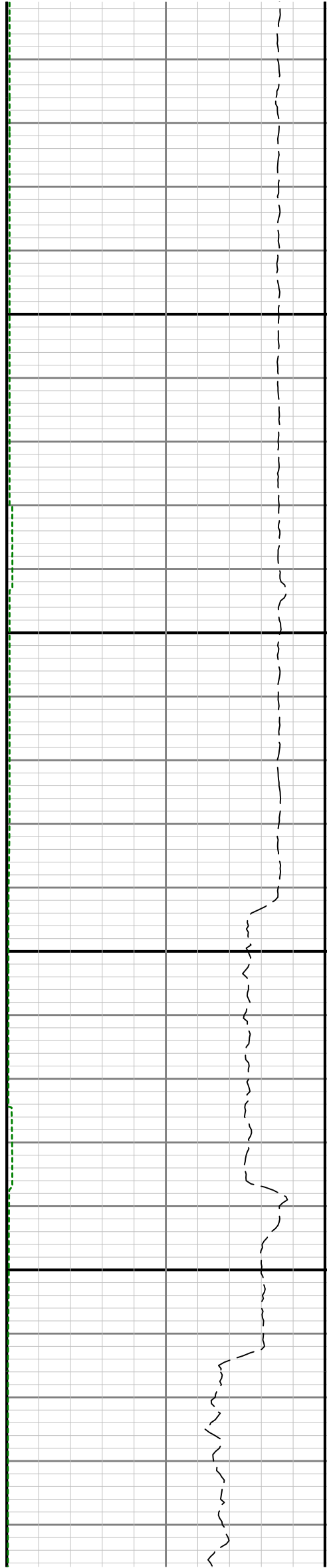
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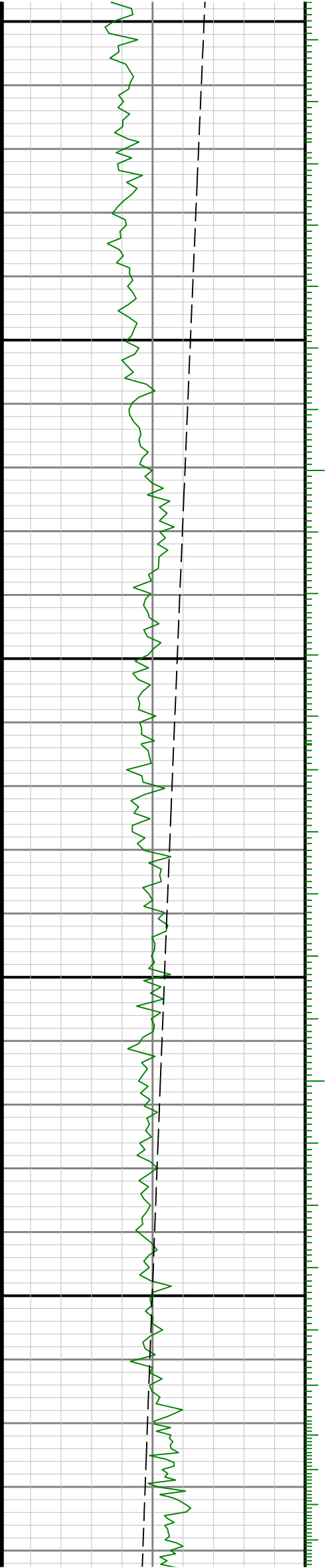




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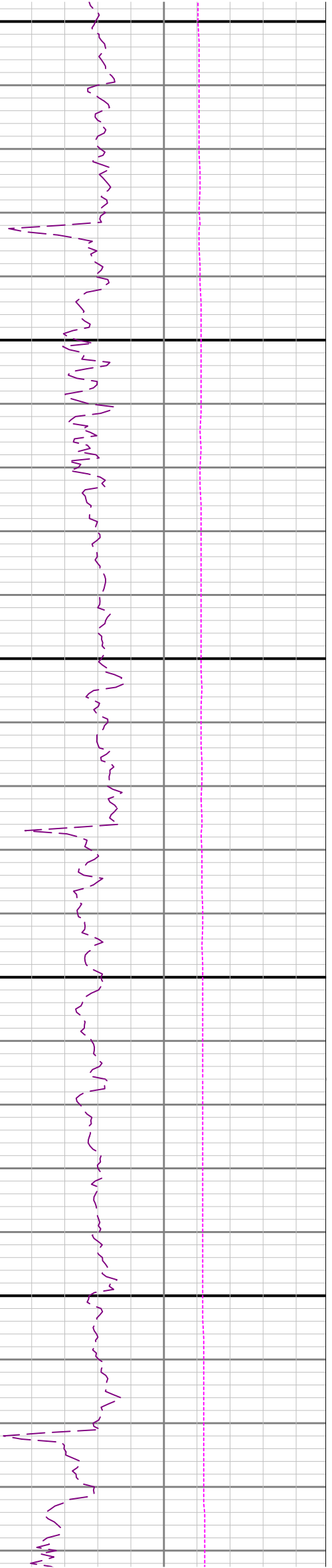
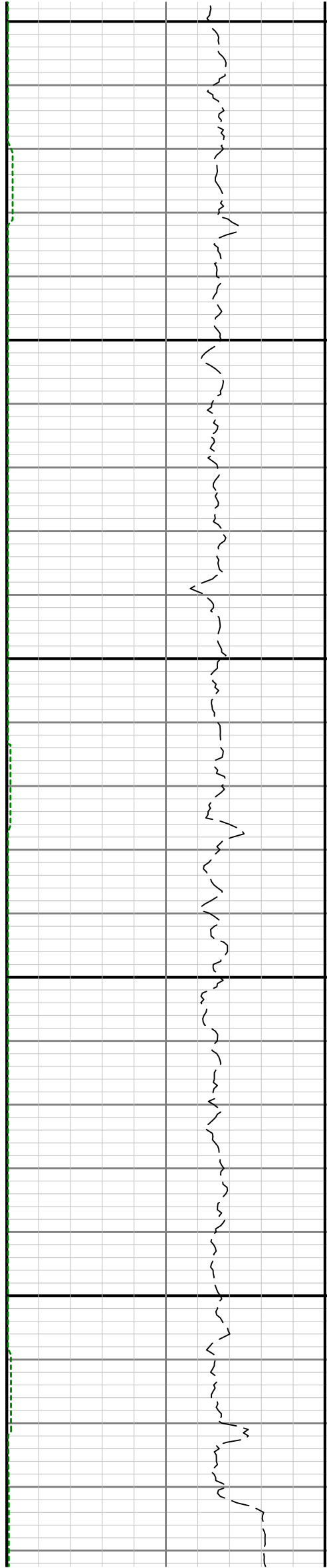


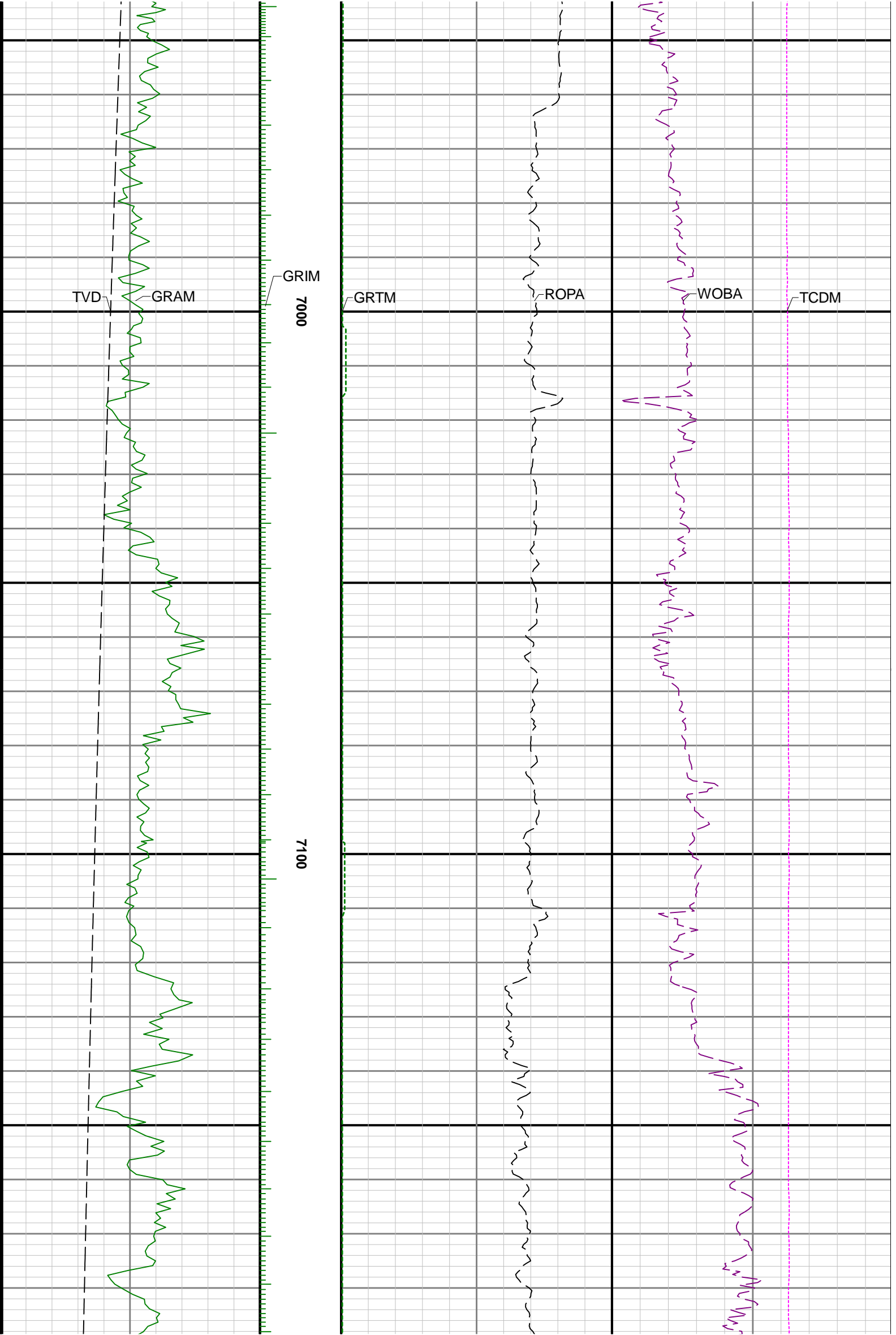


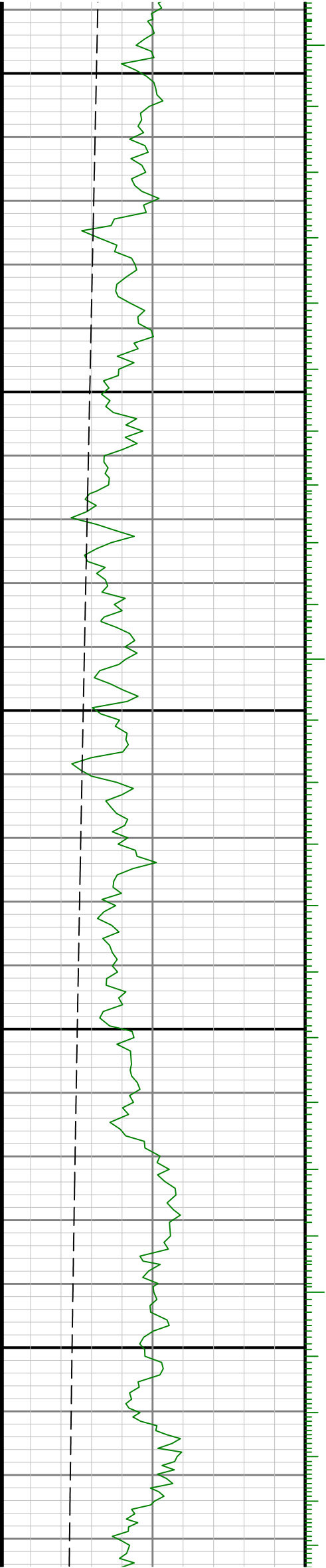
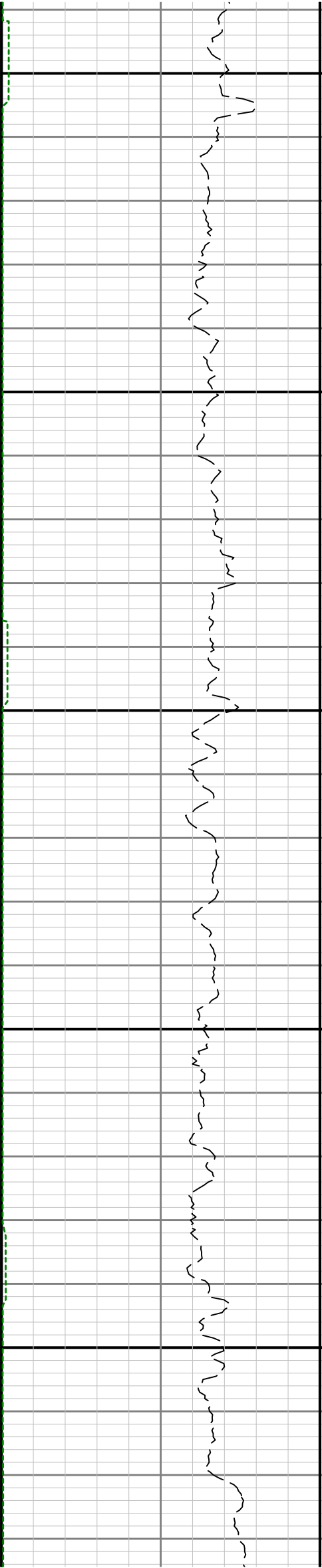
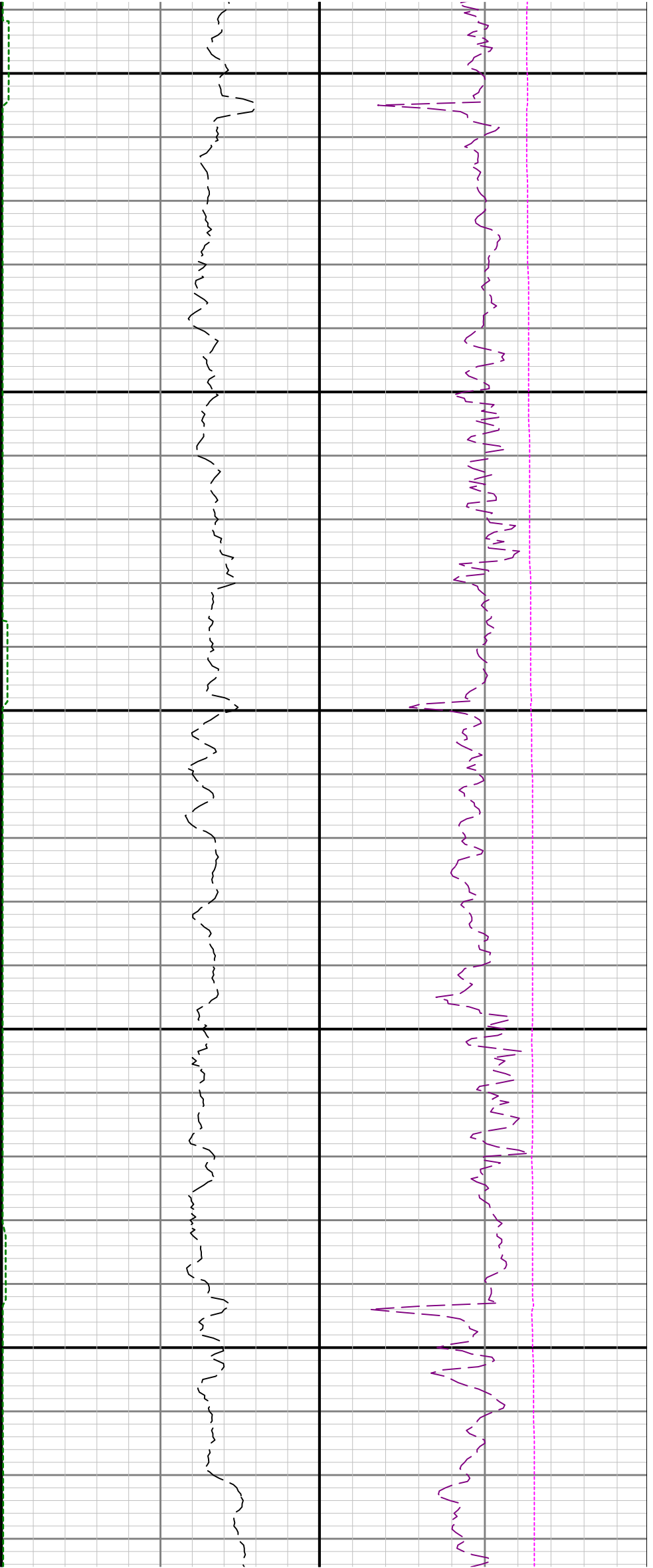
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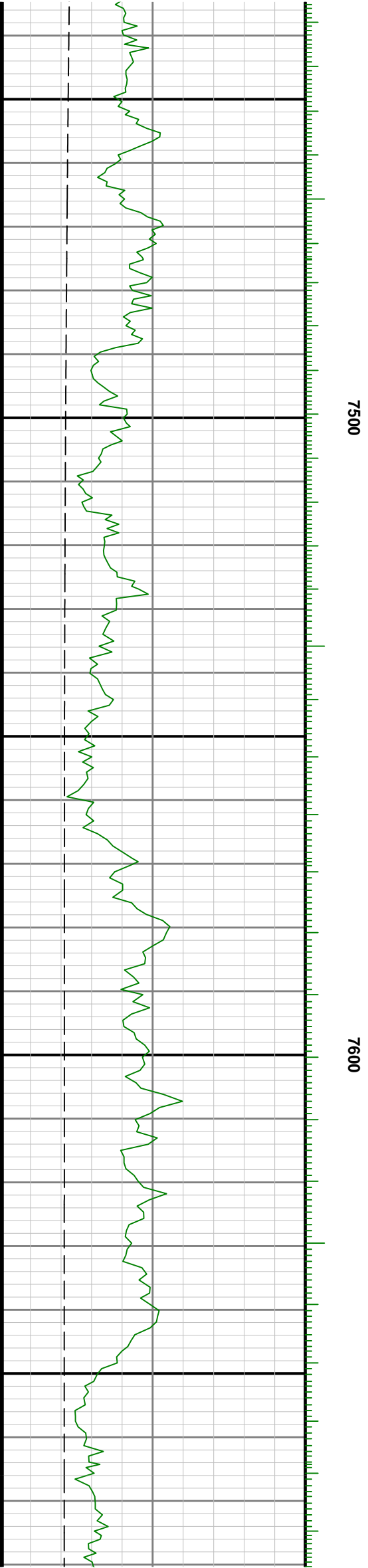
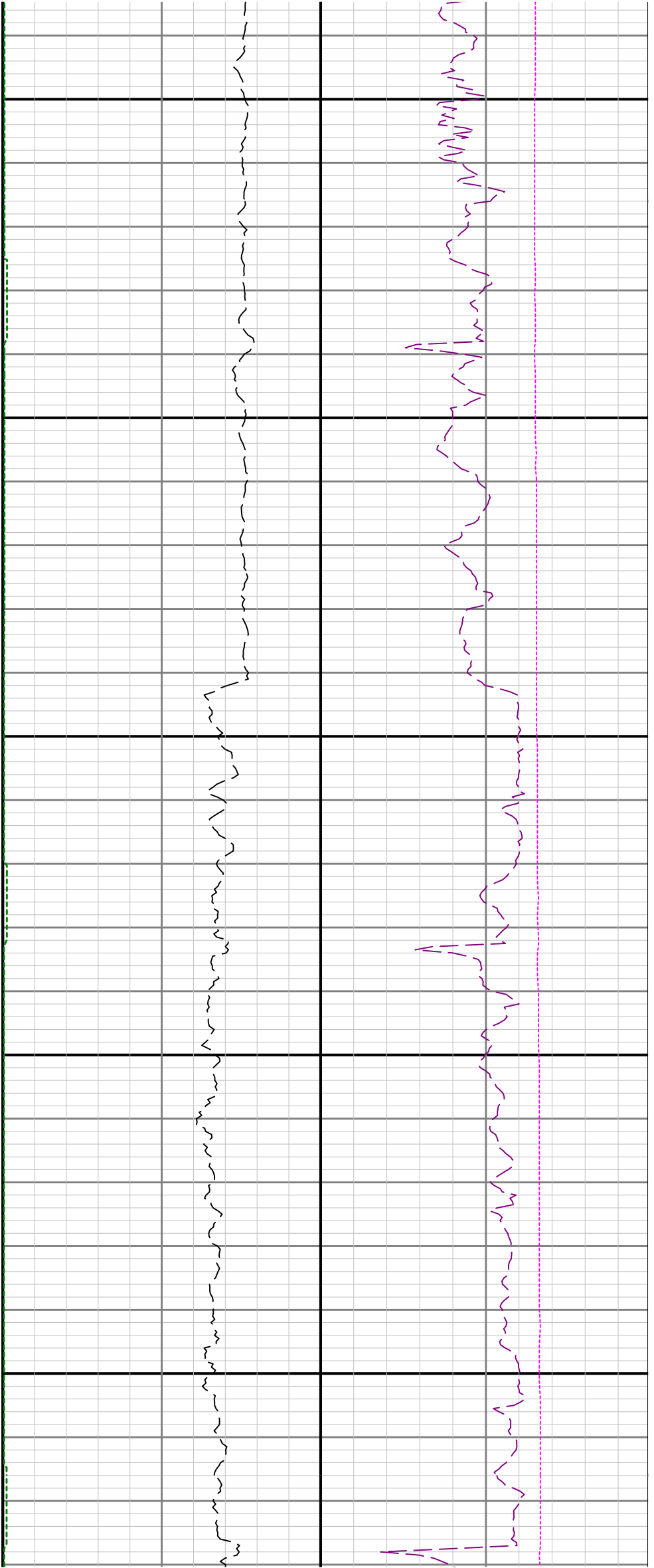
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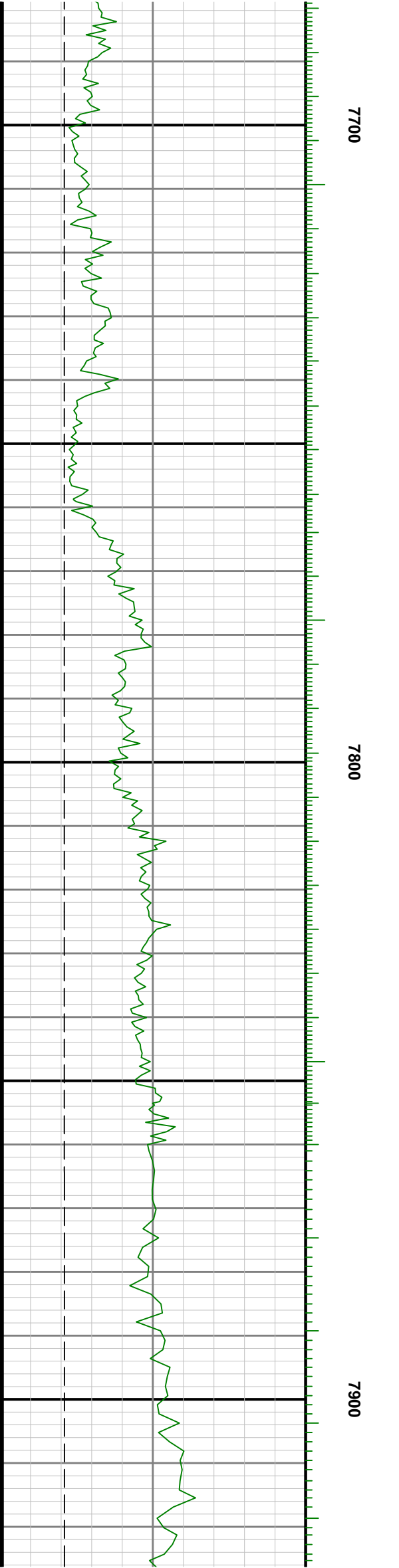
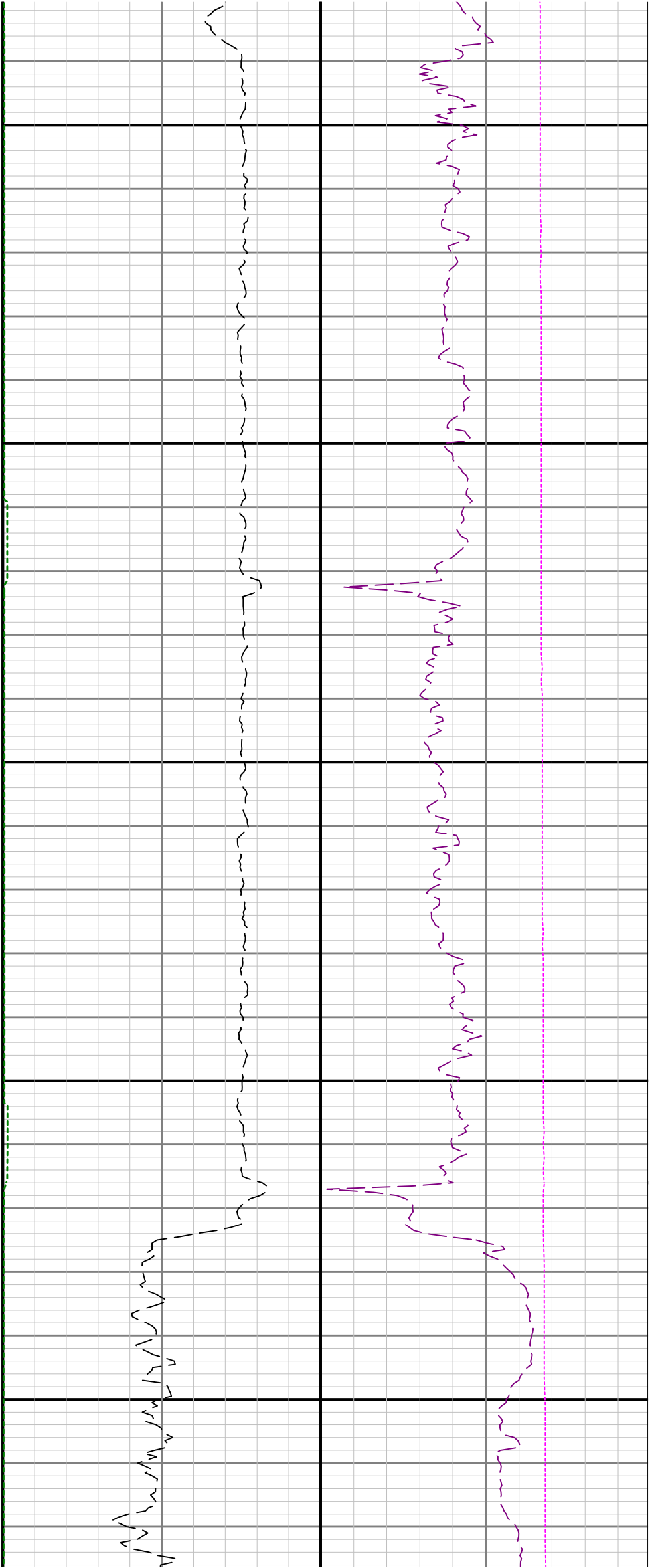
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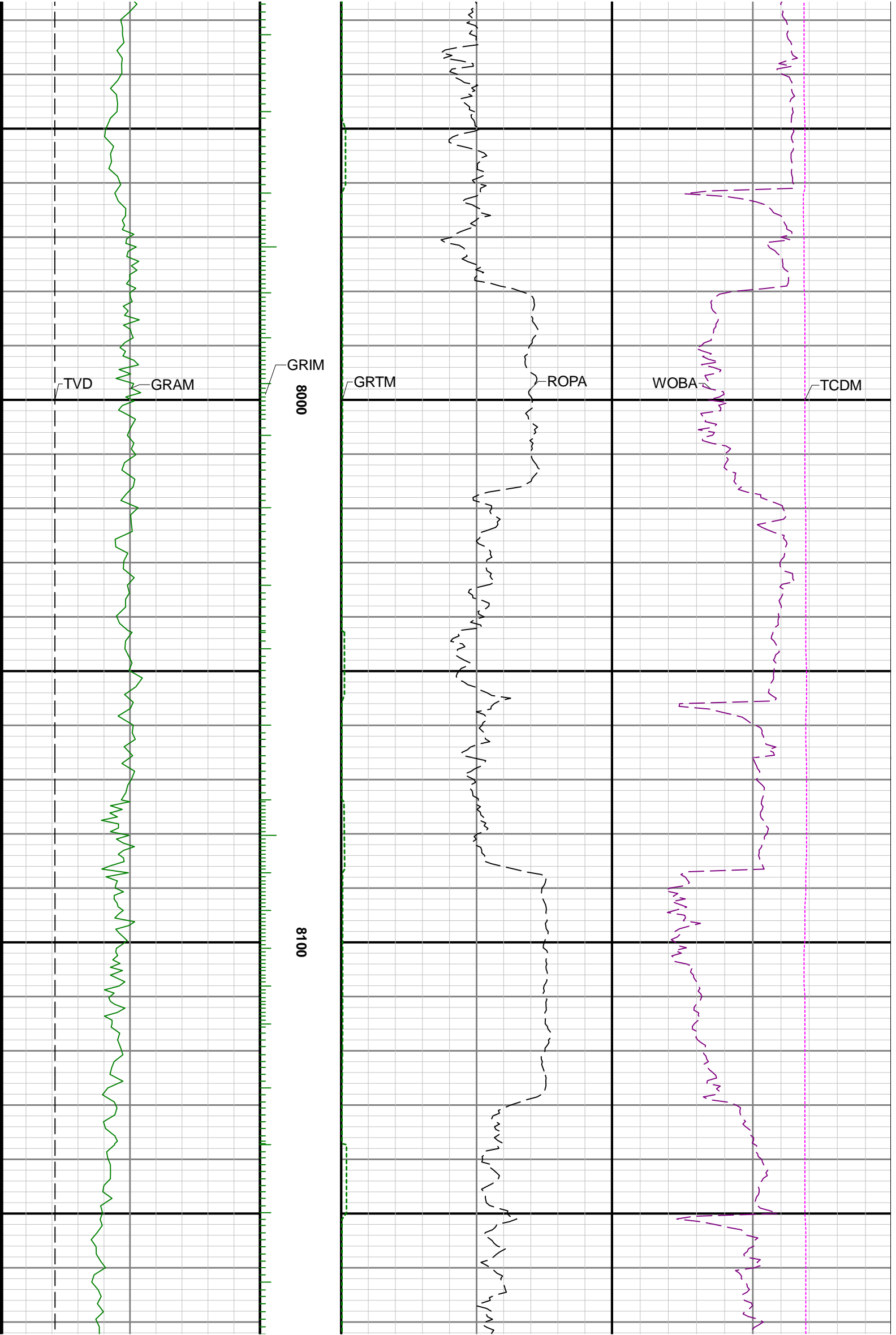


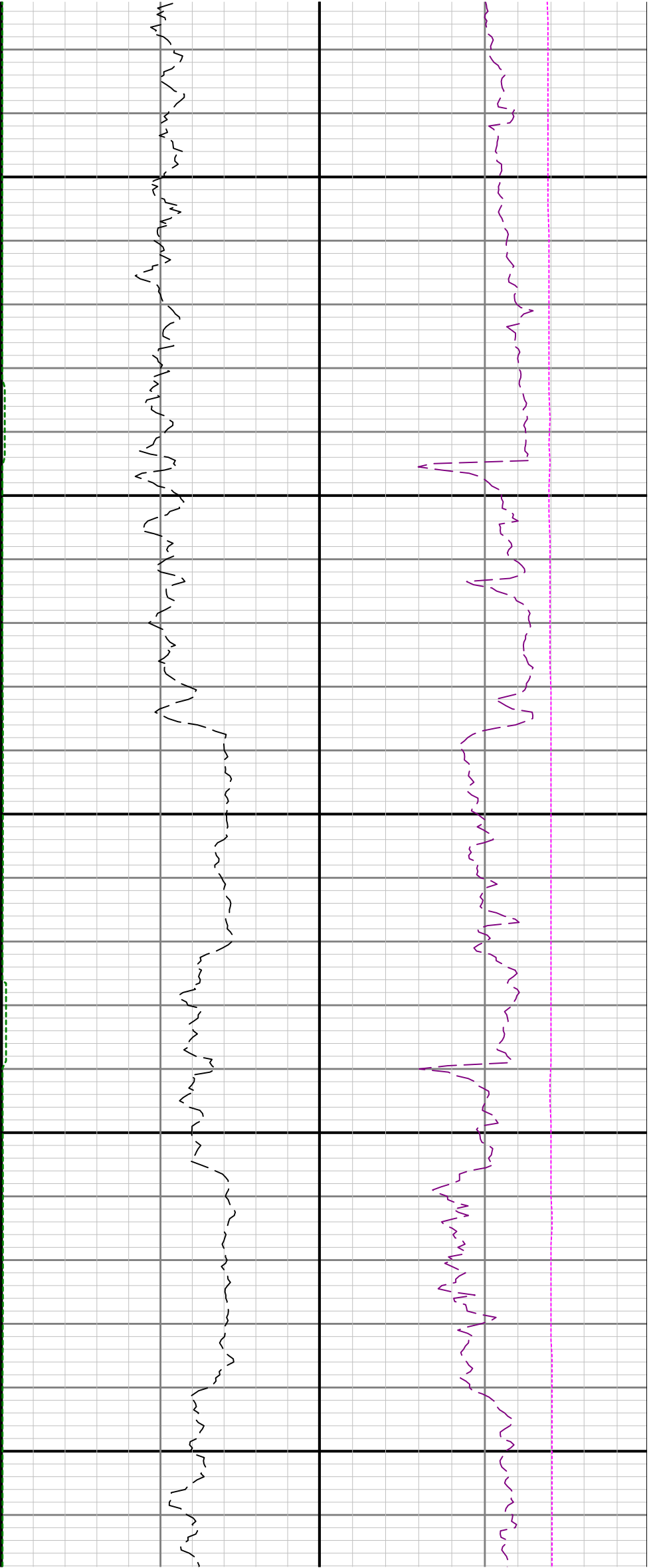








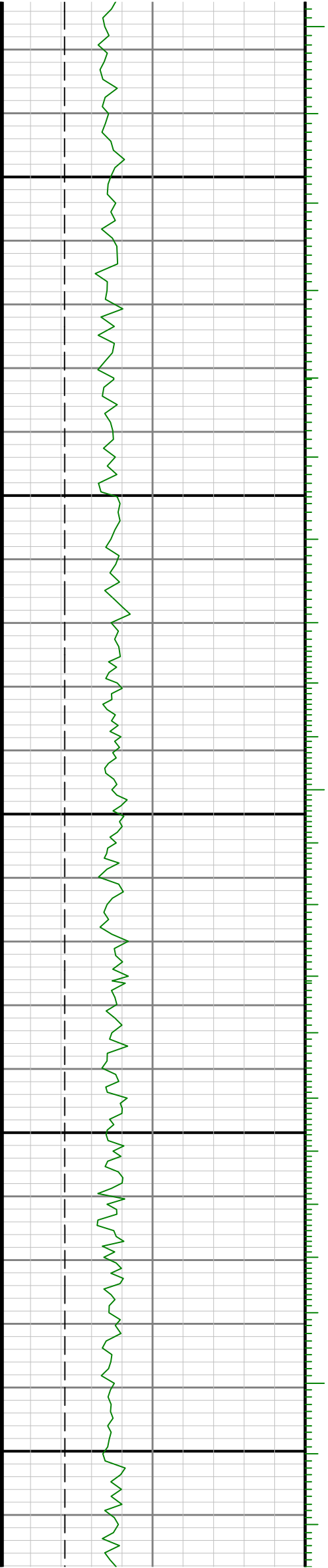


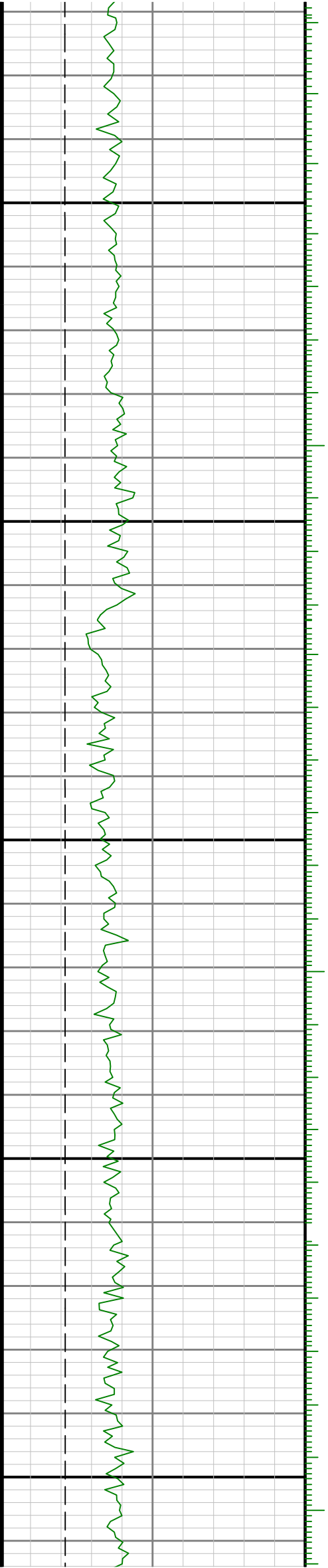


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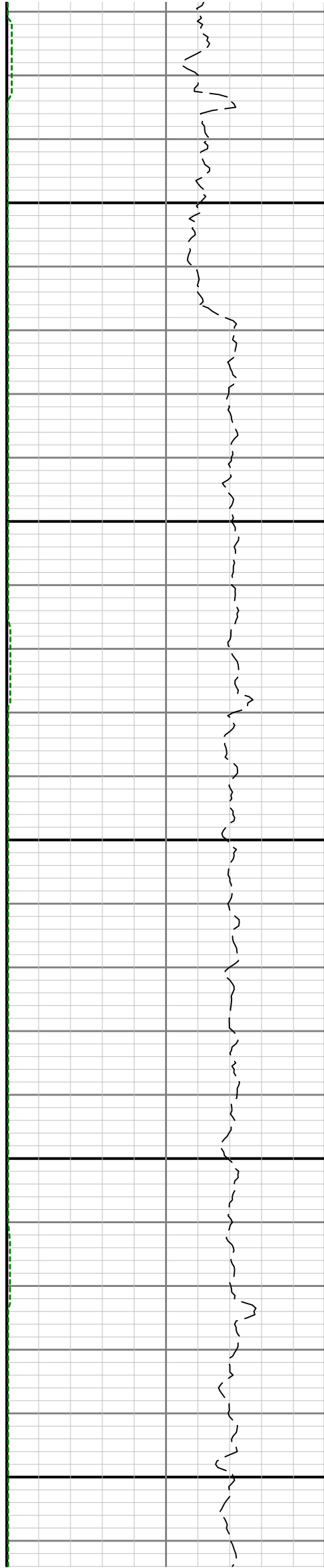
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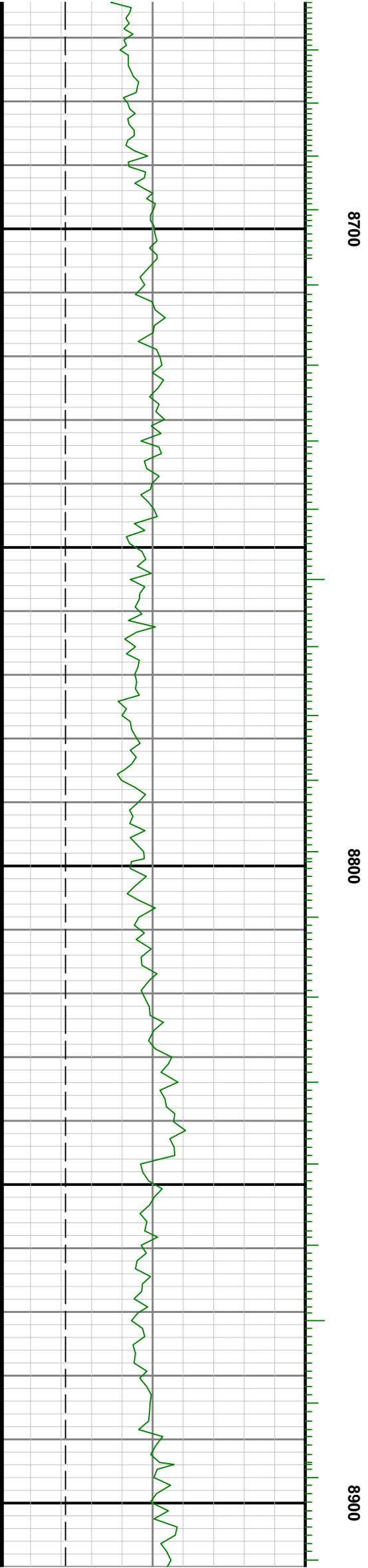
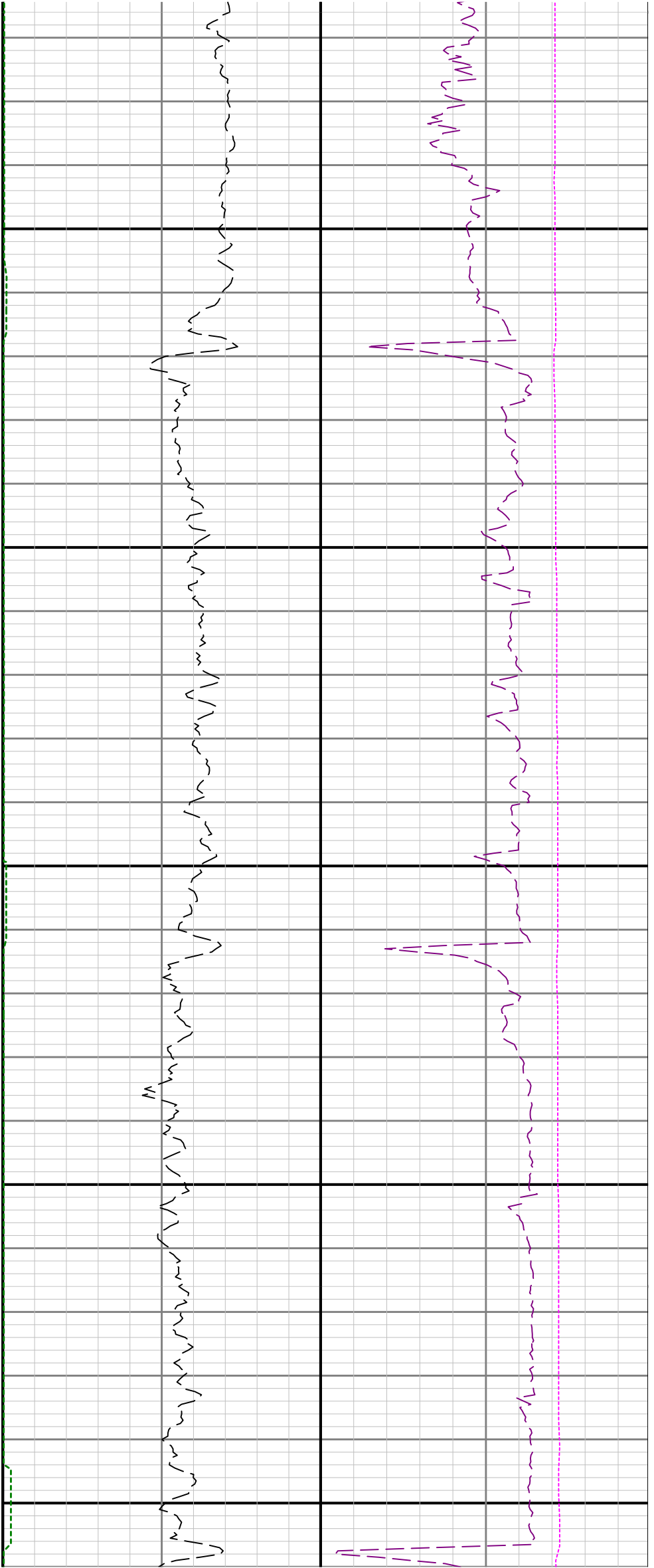


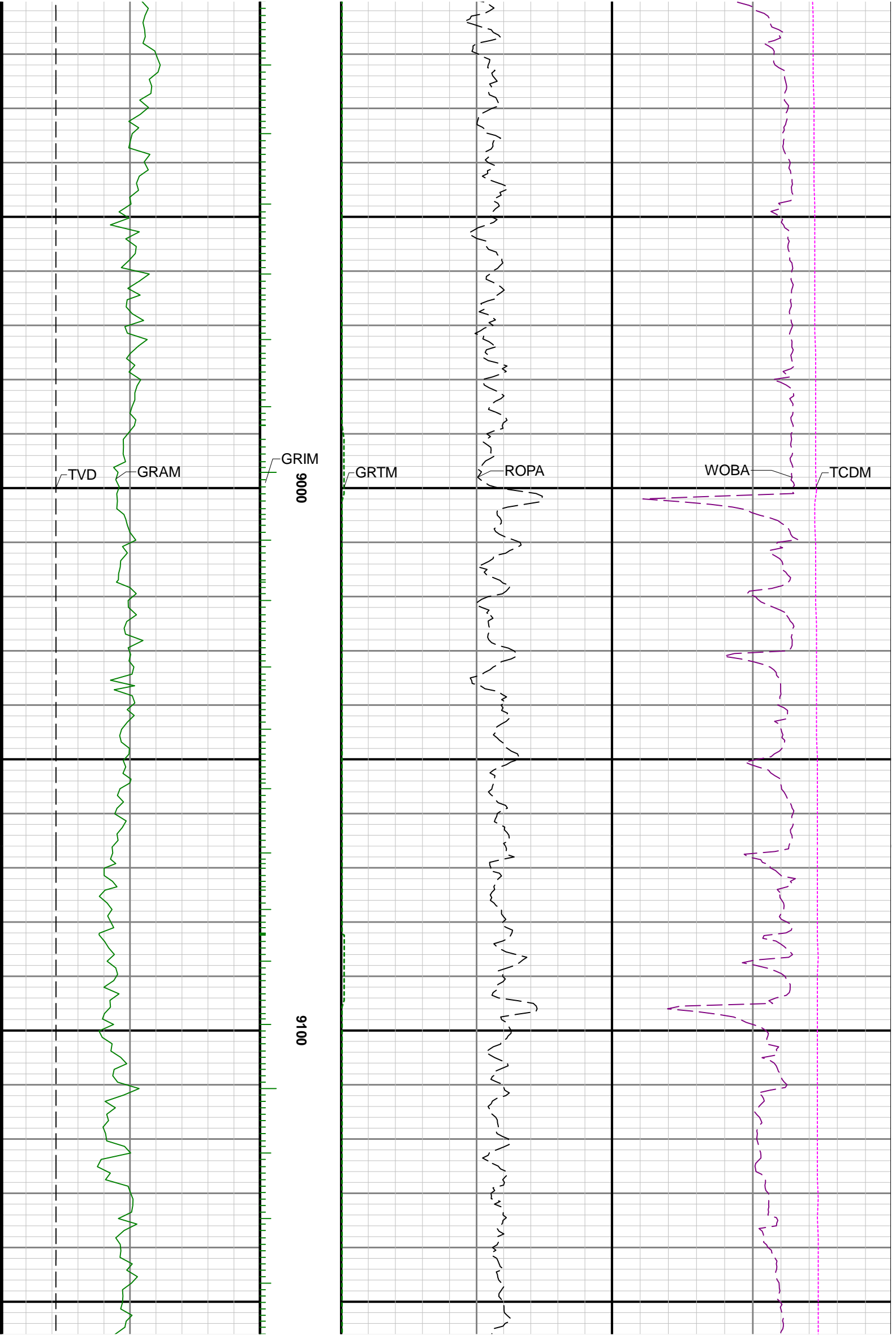


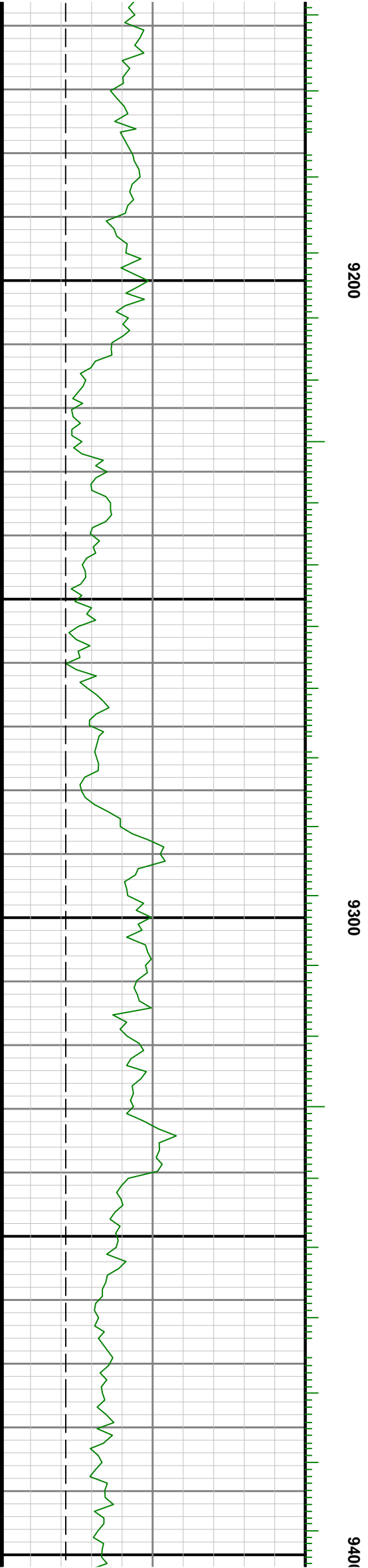
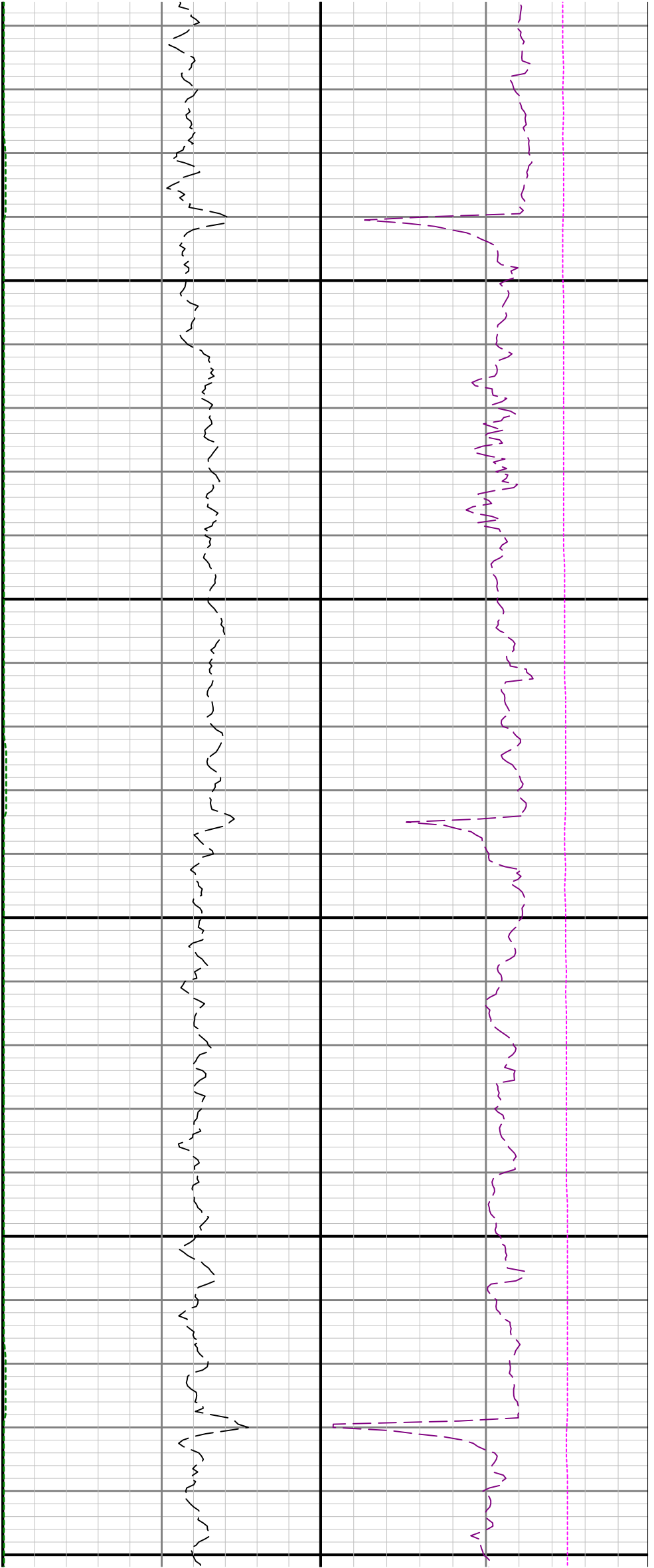
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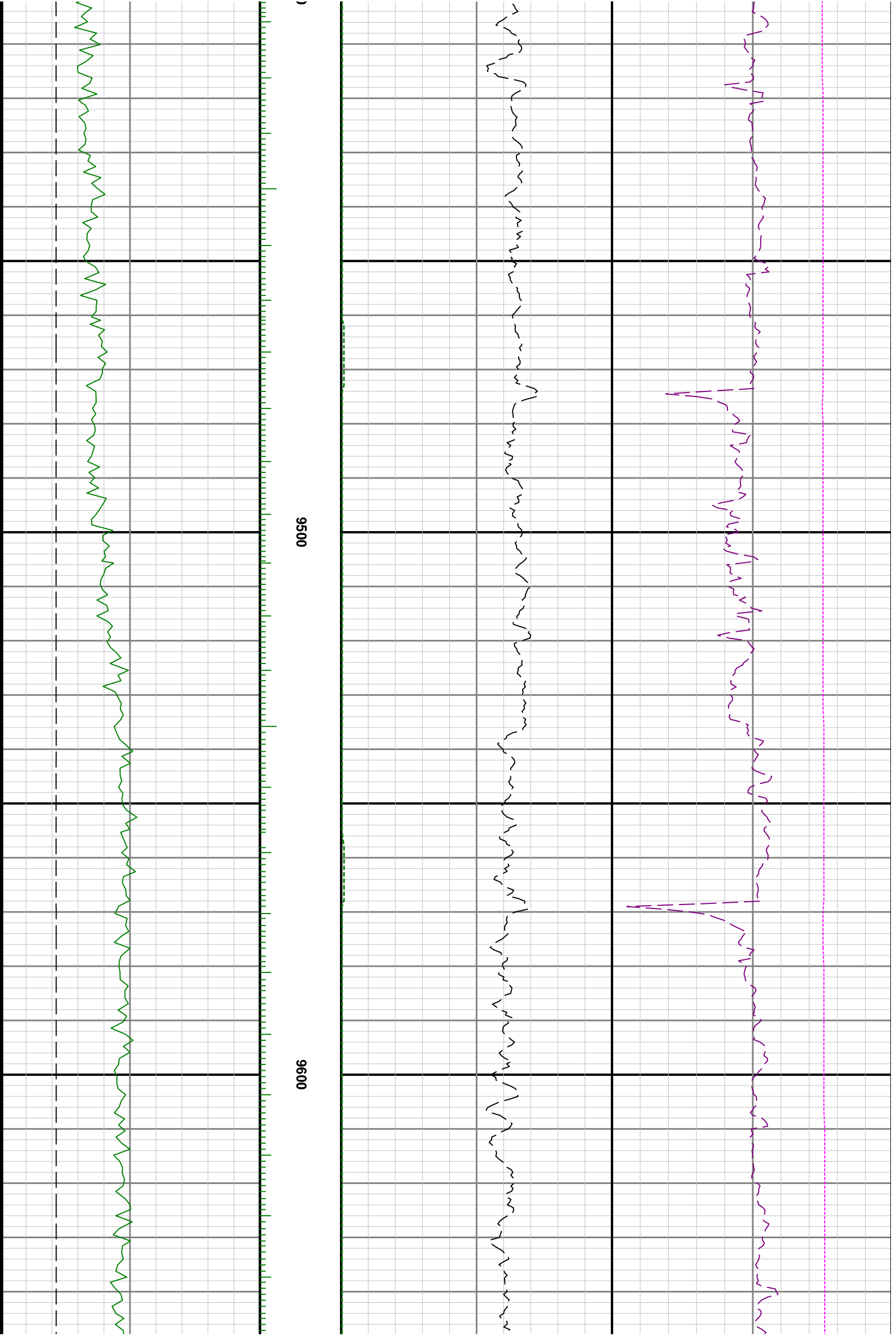
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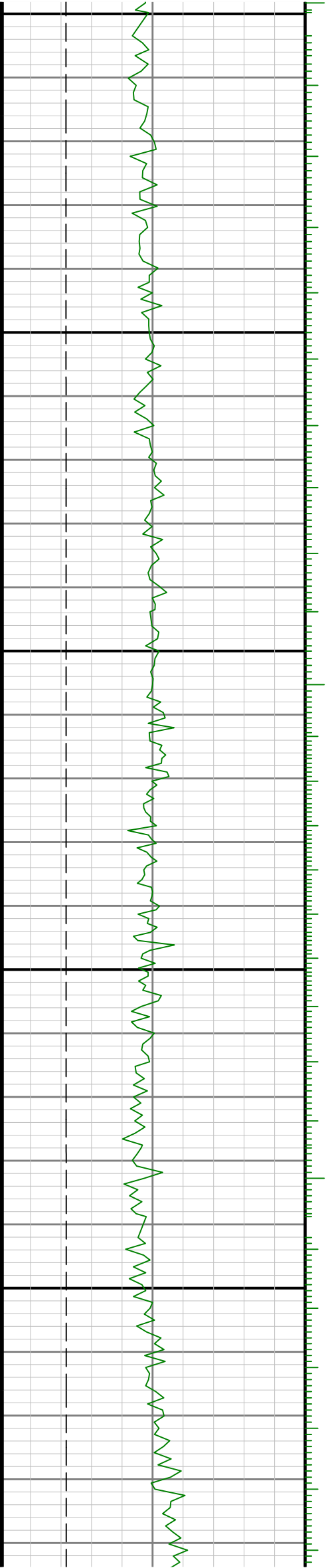






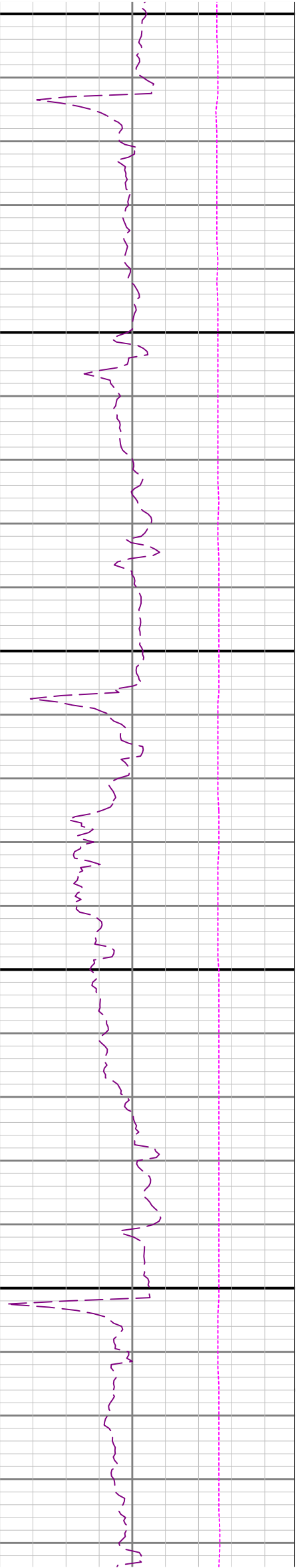
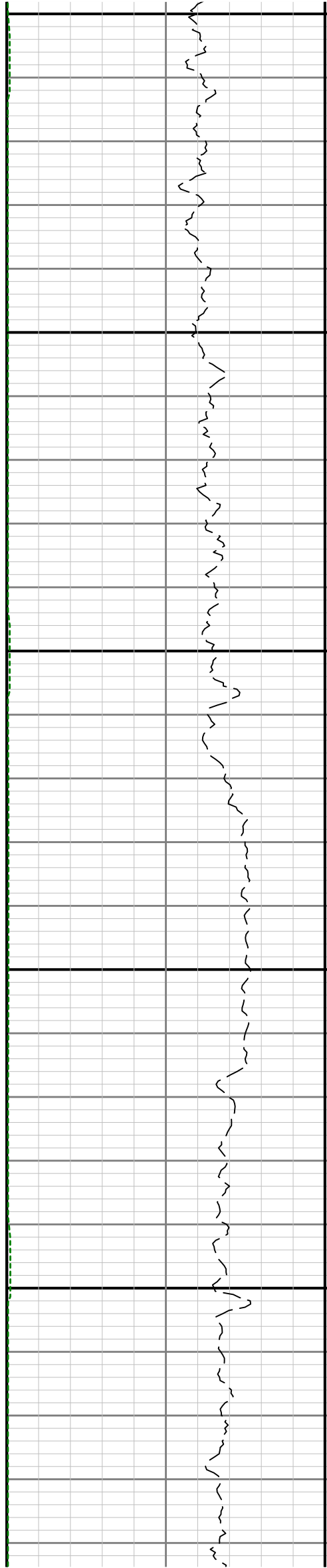


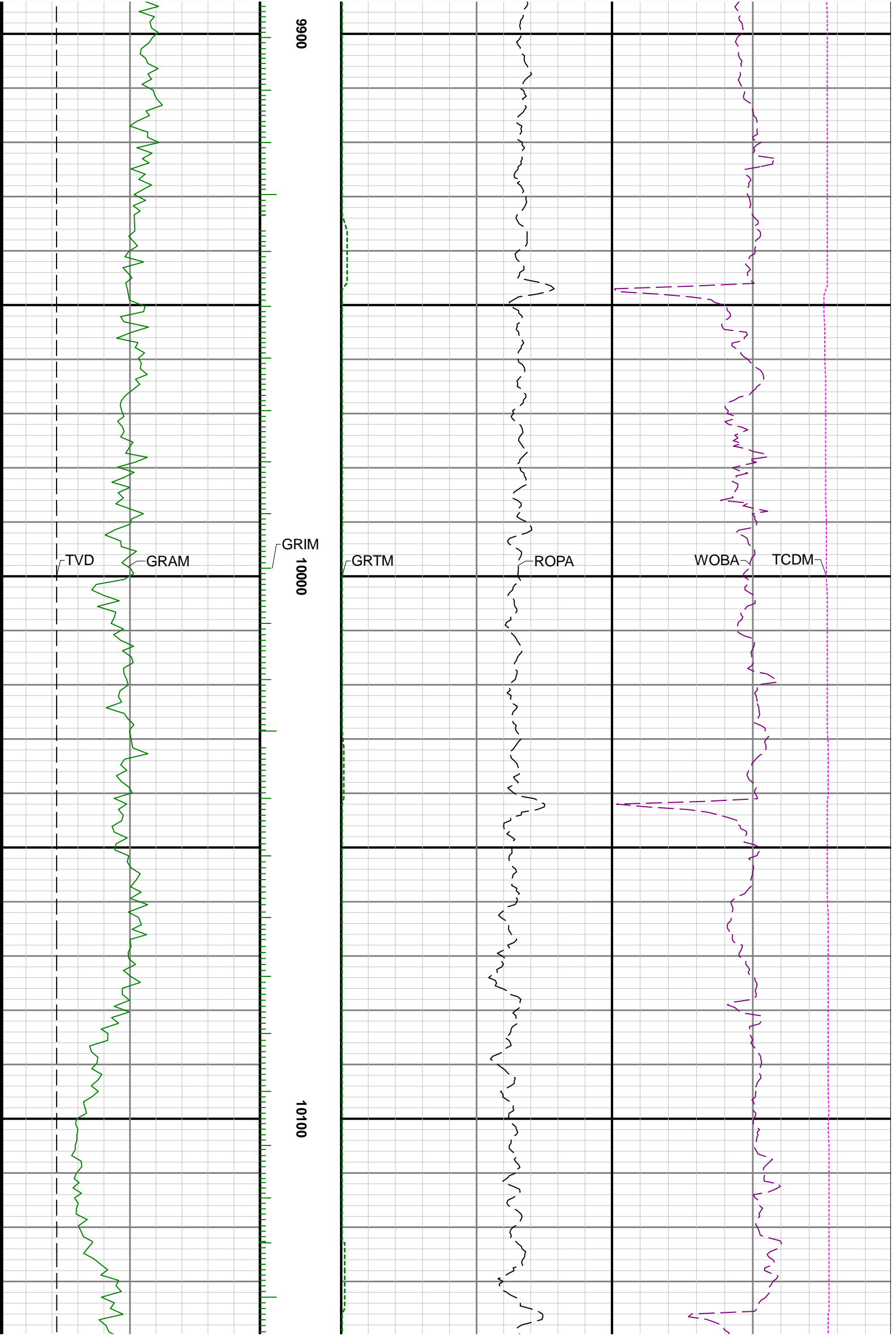


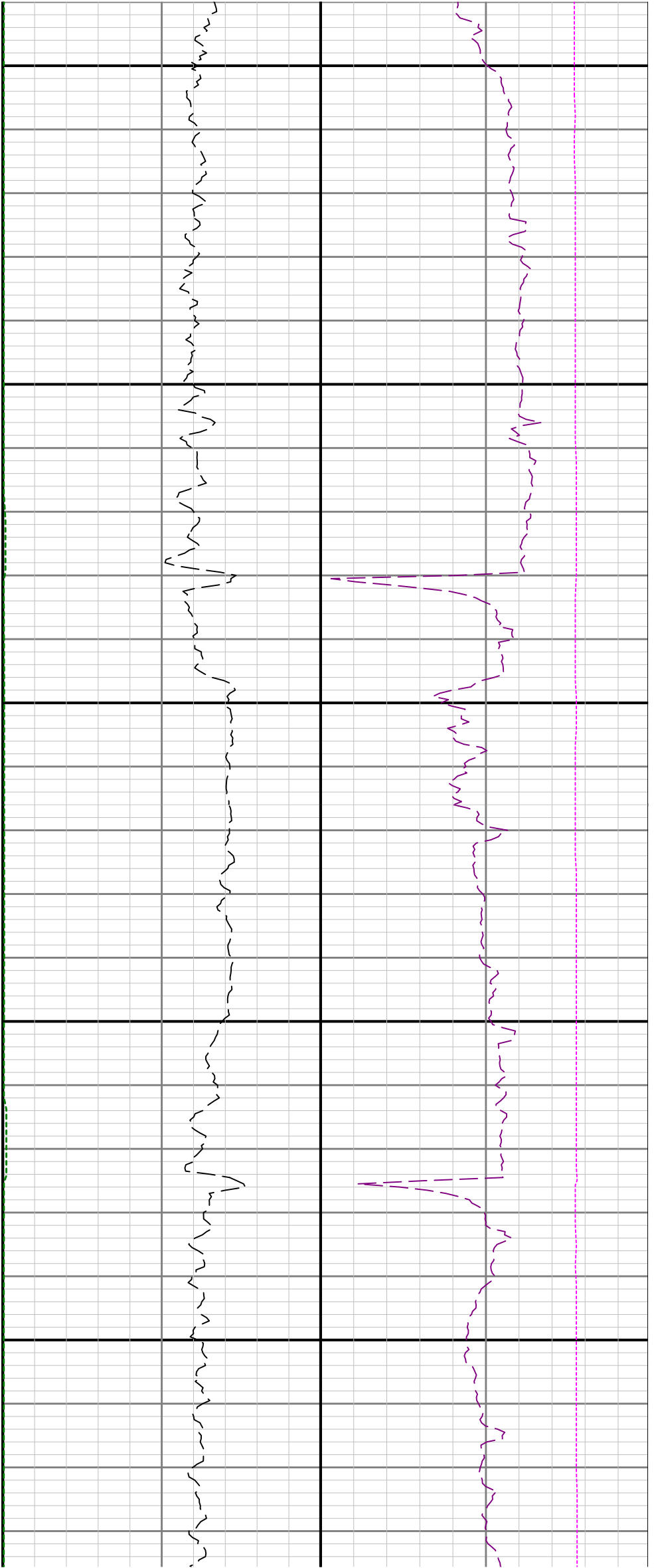


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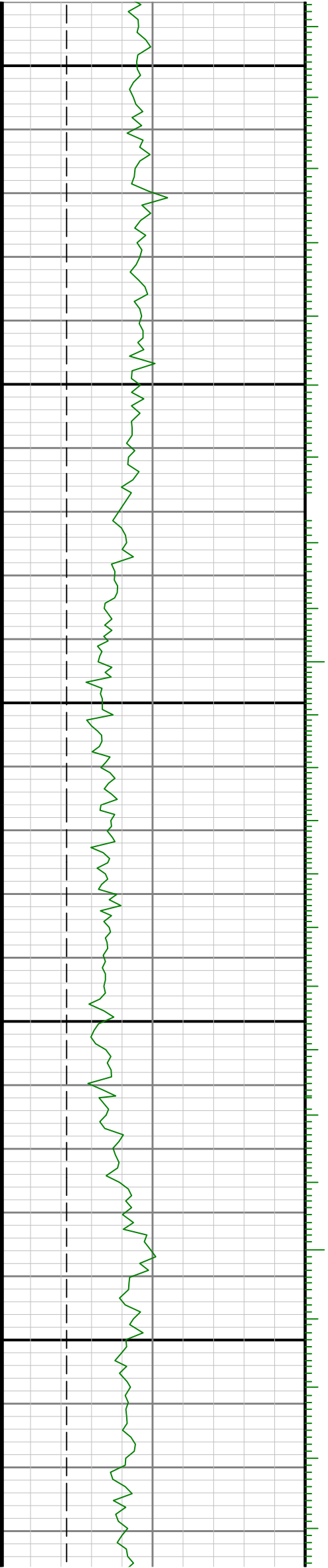


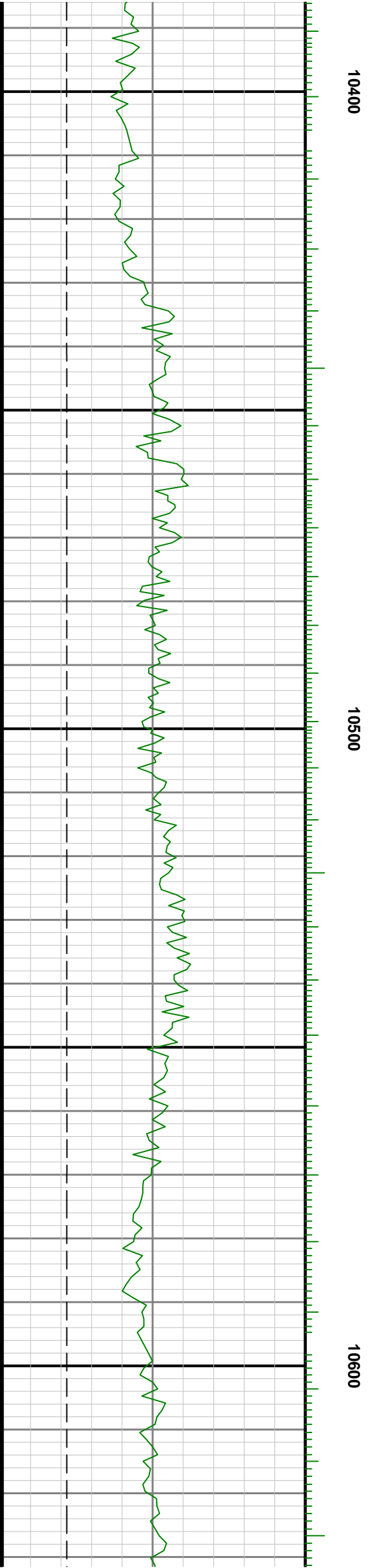
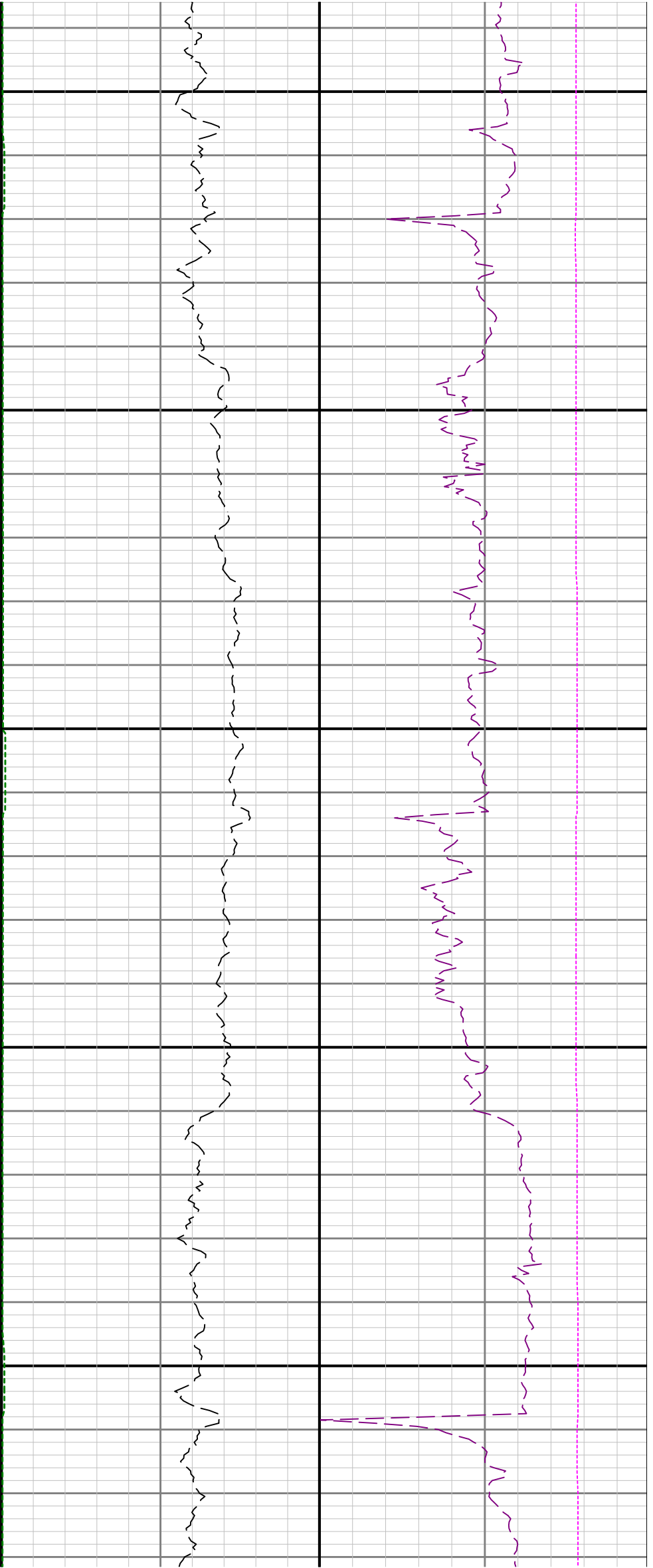


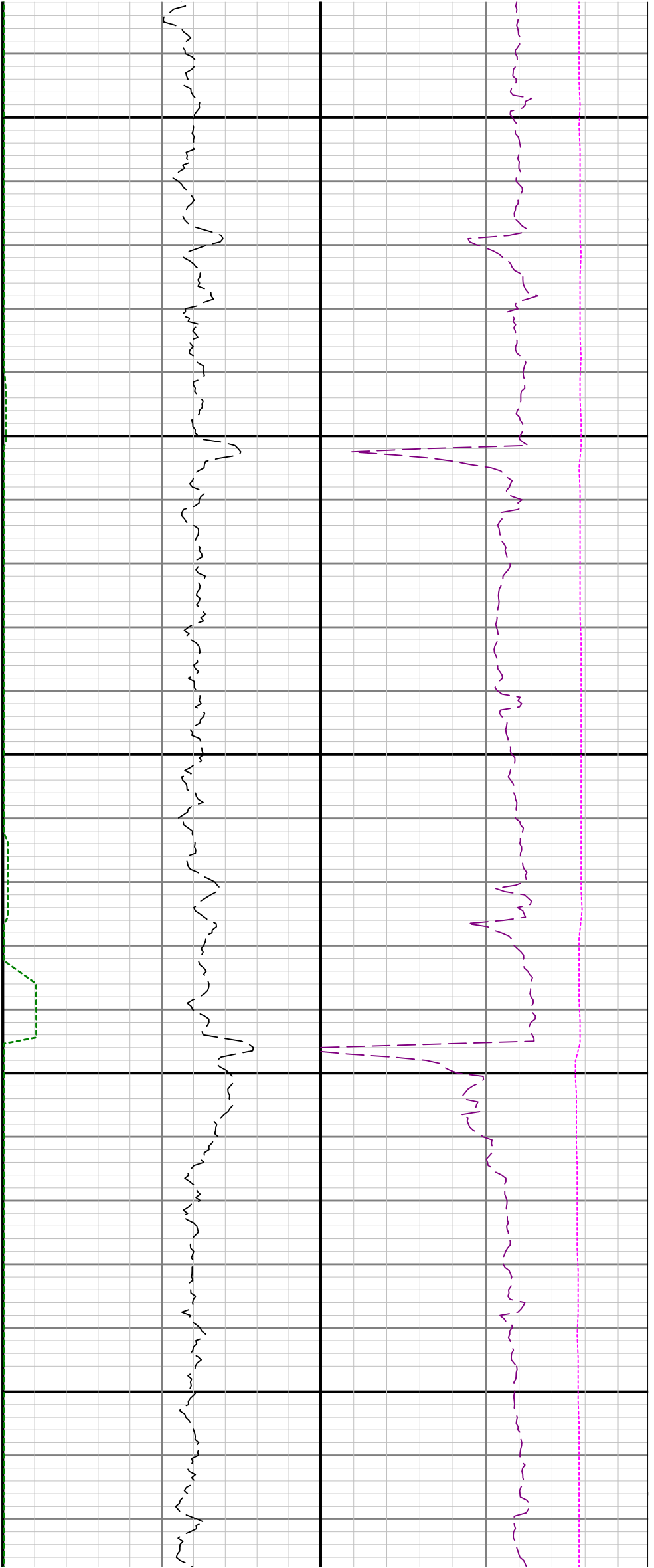


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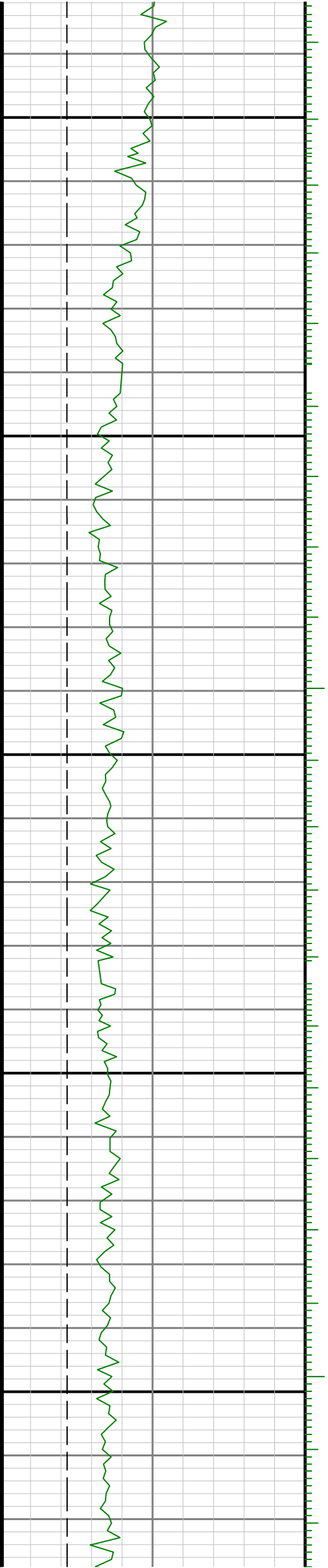


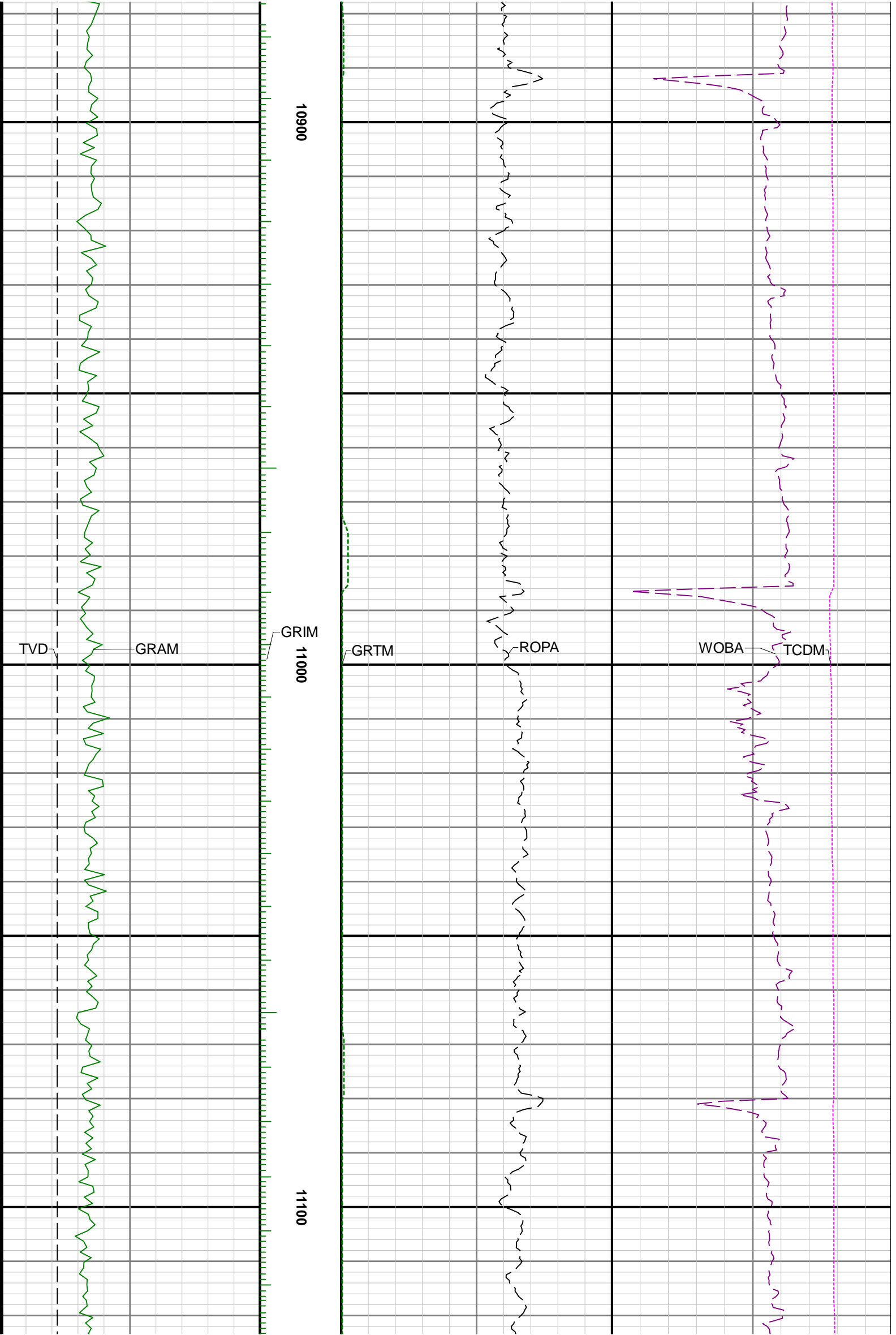


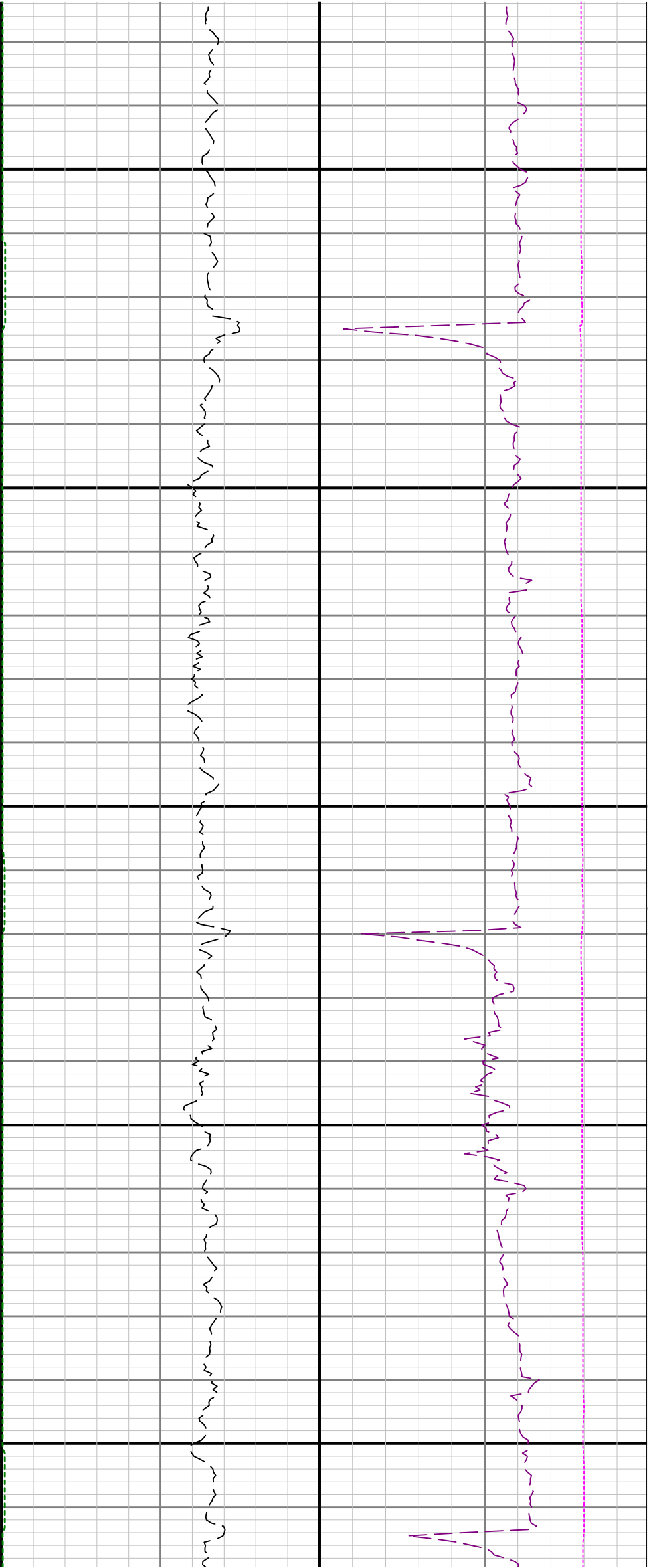


10700

10800

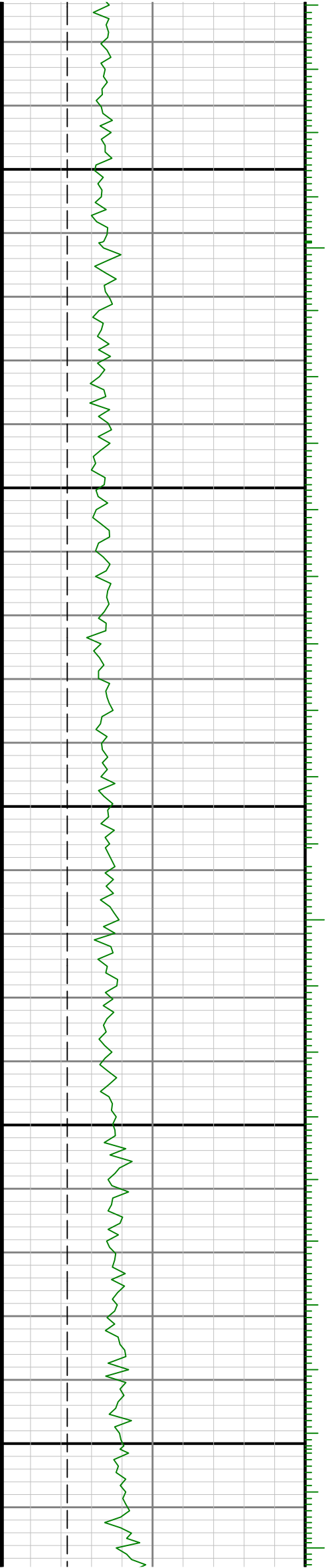


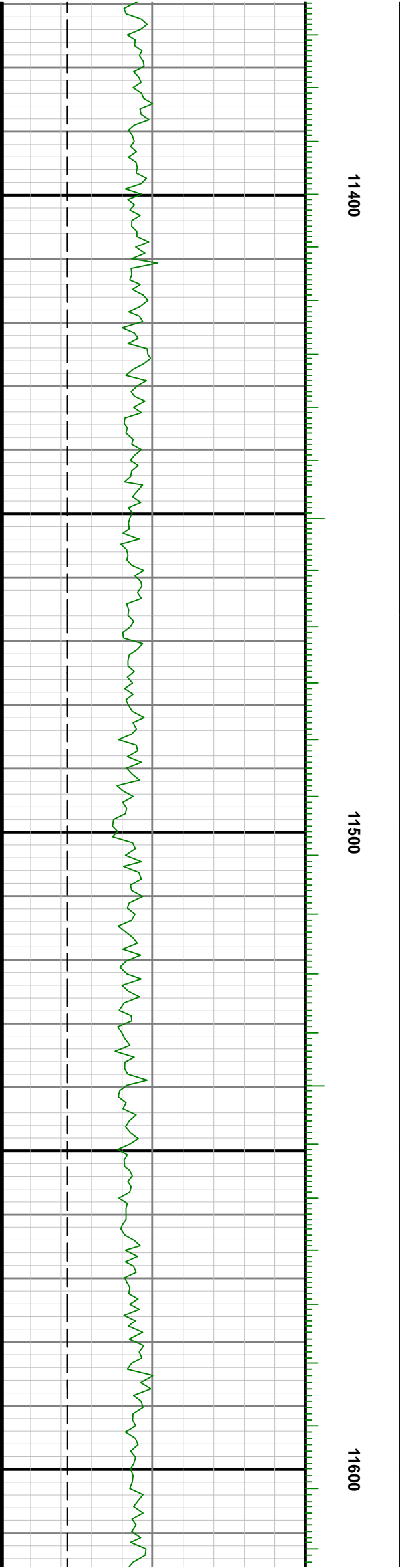
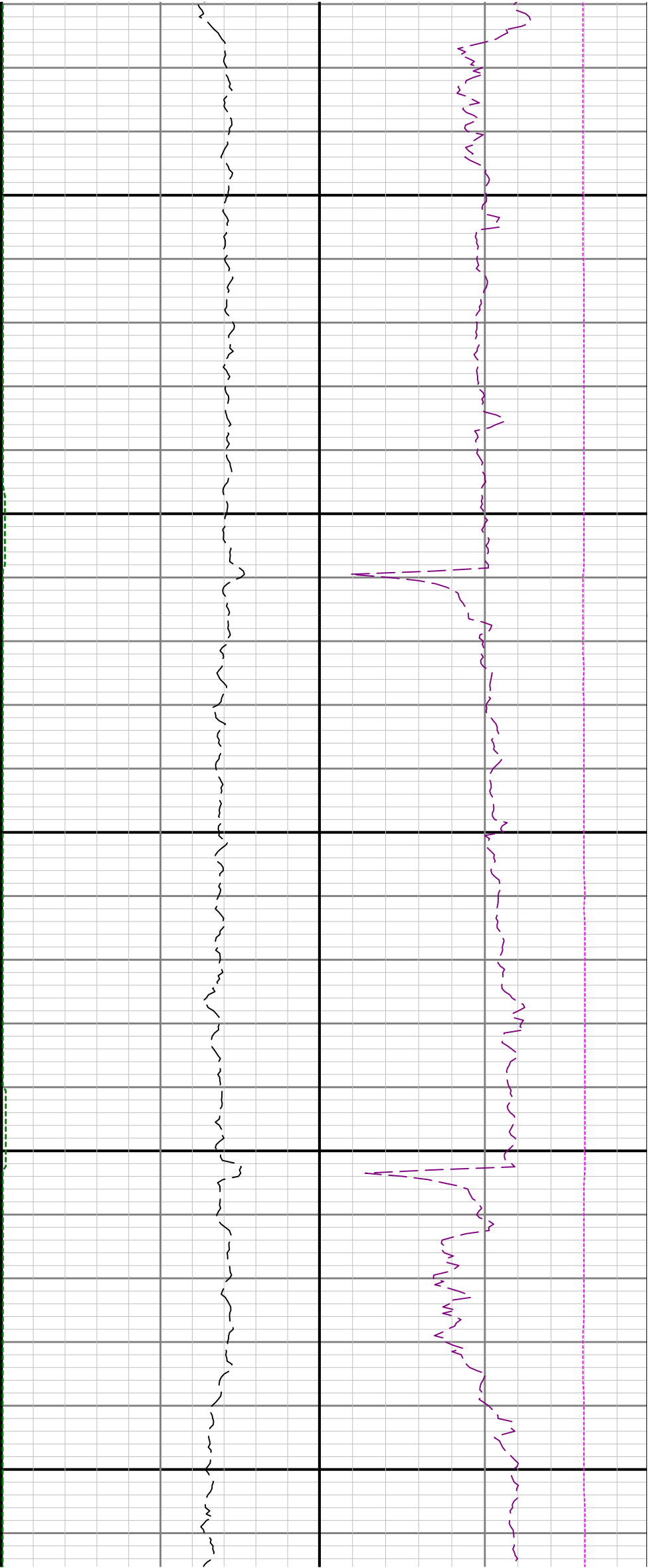


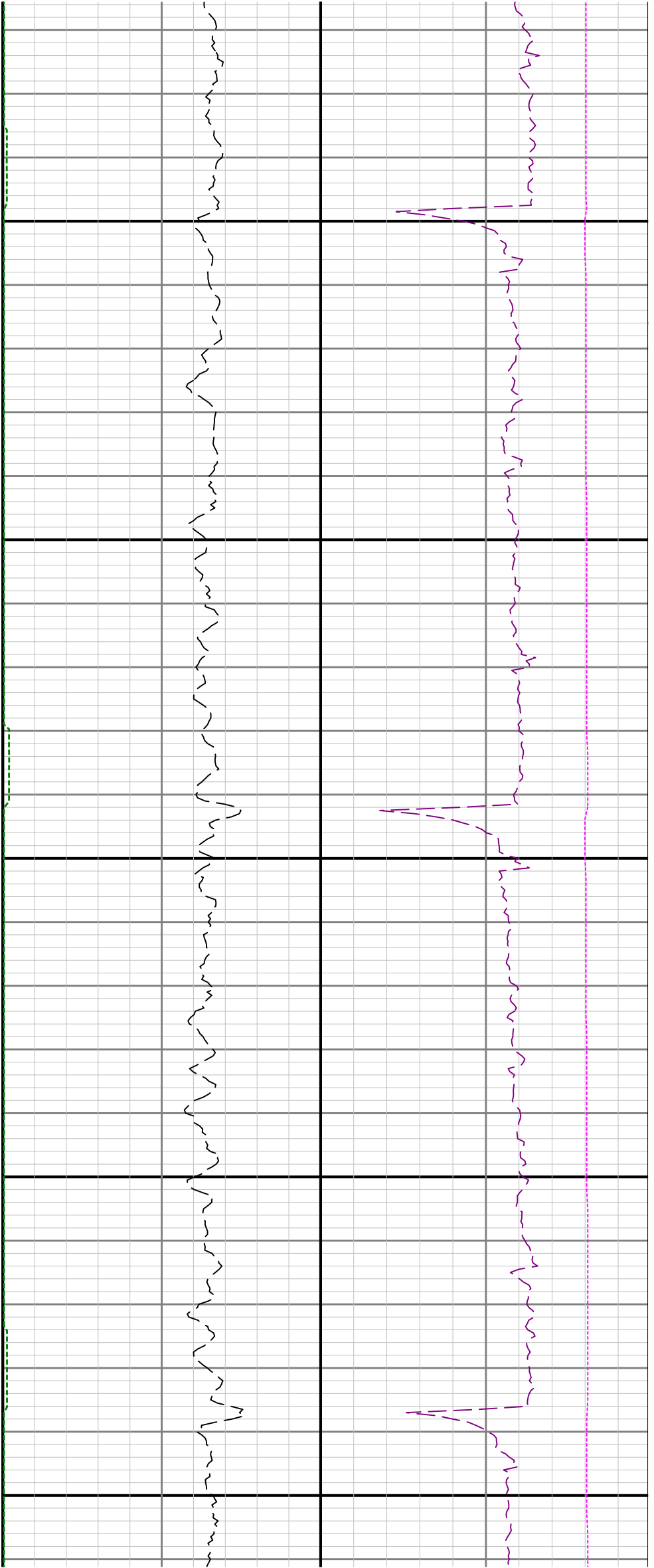


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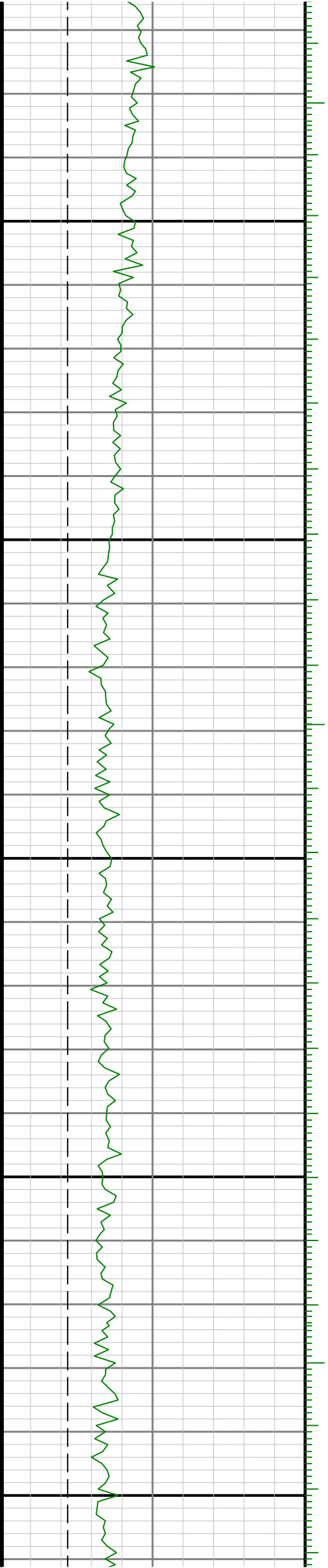


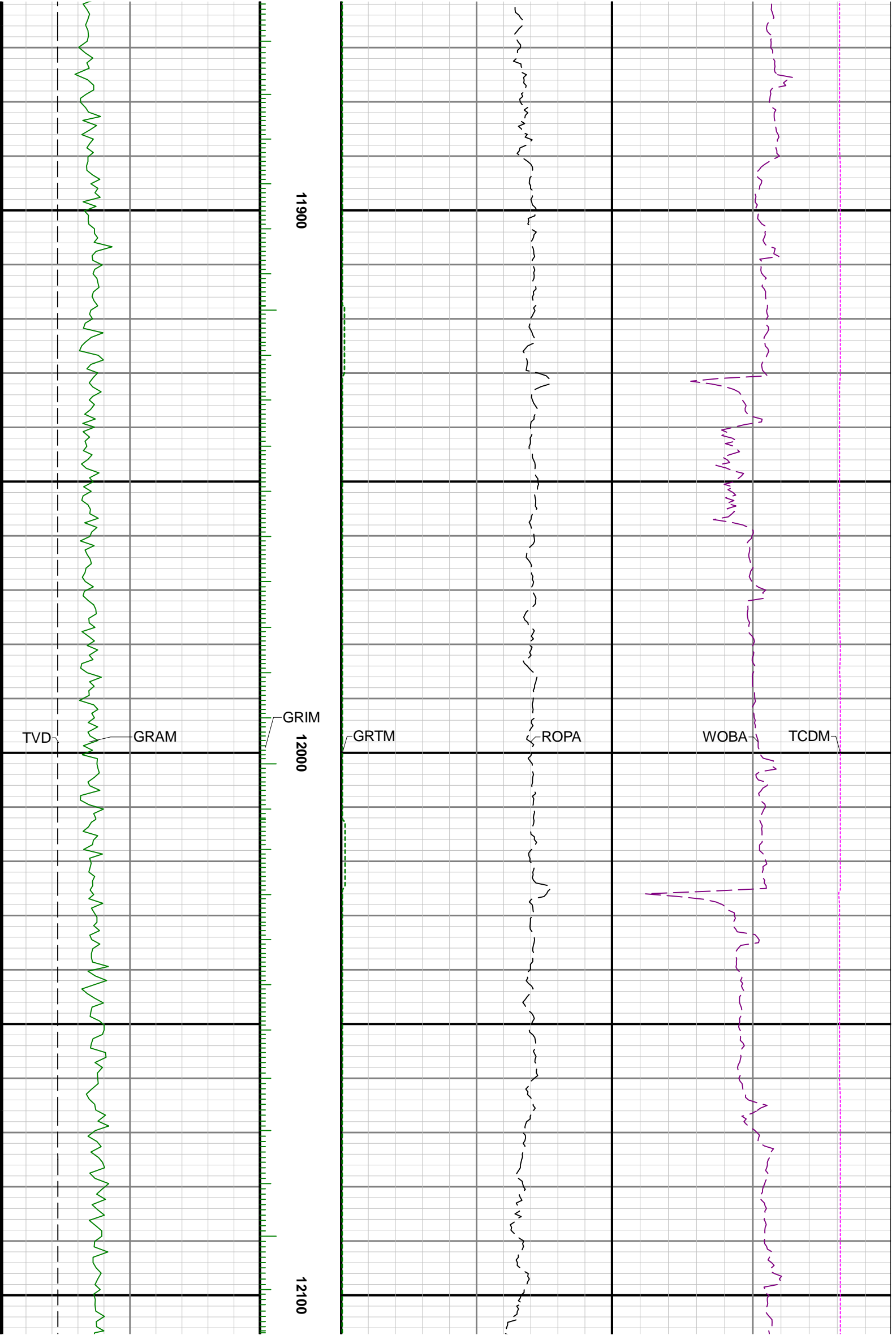


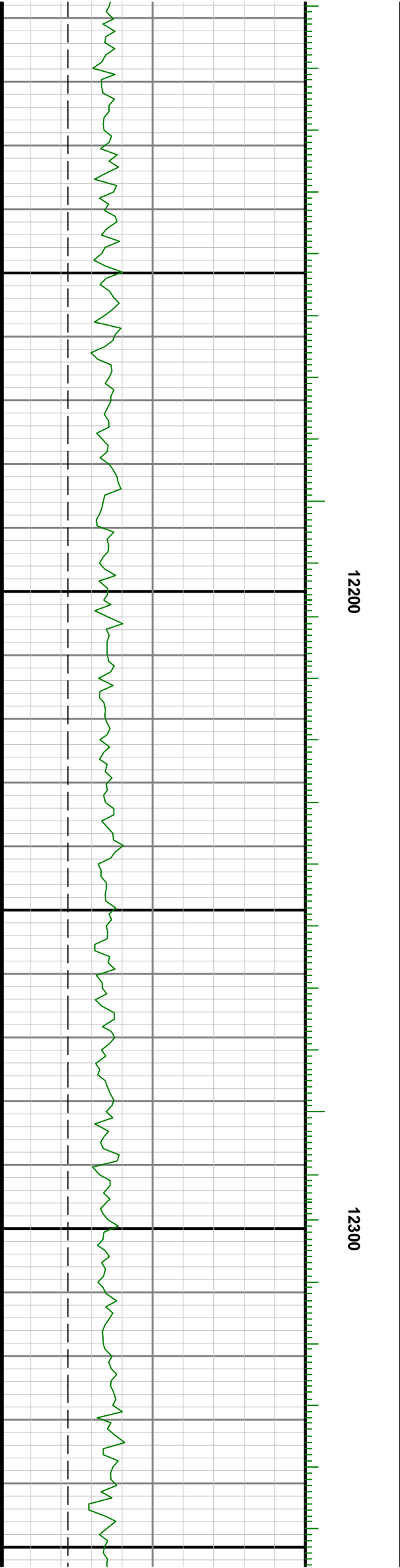
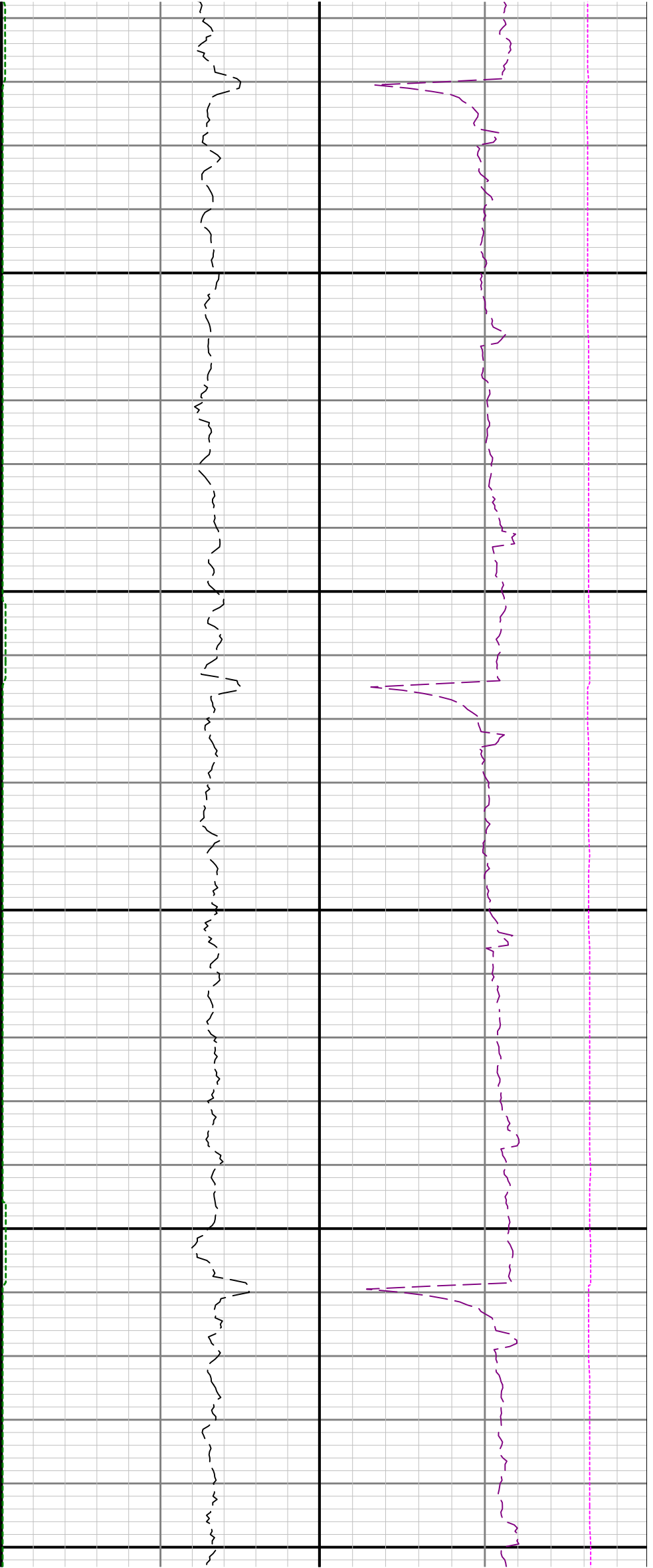


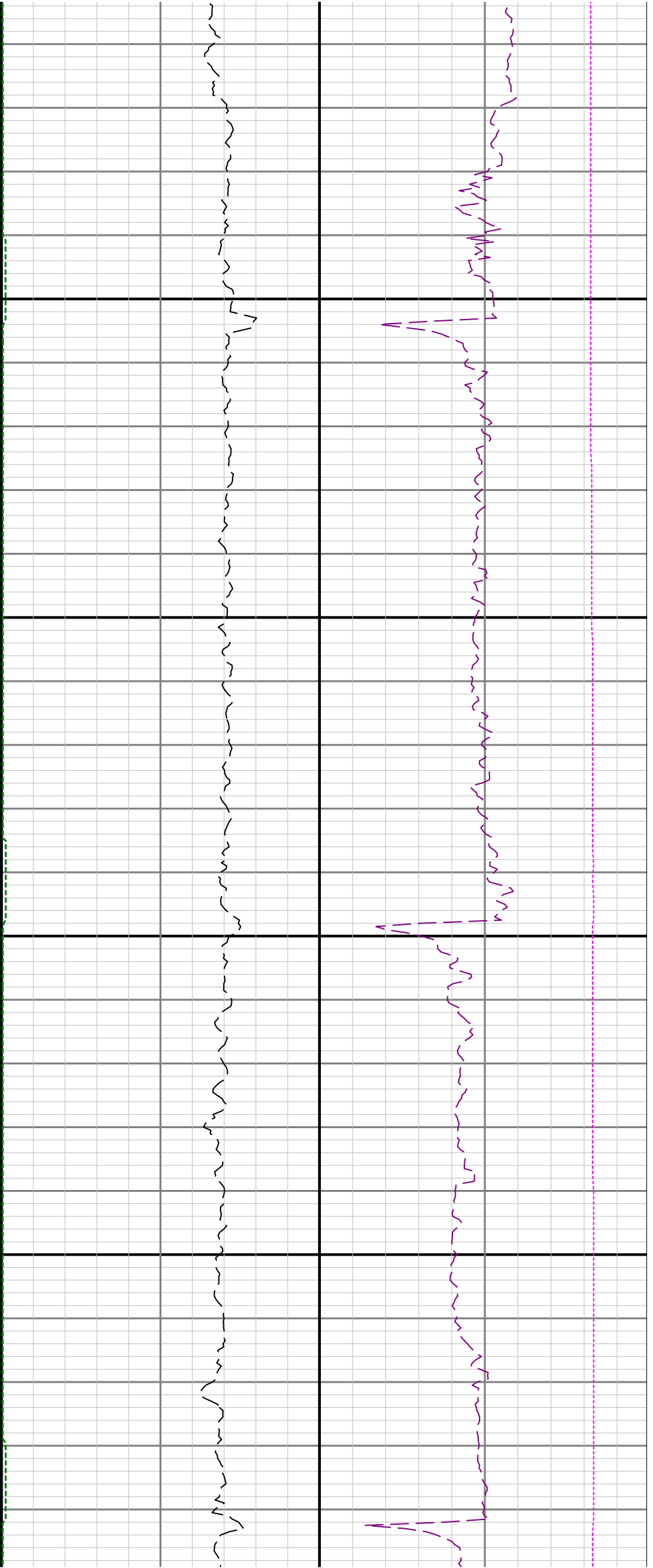
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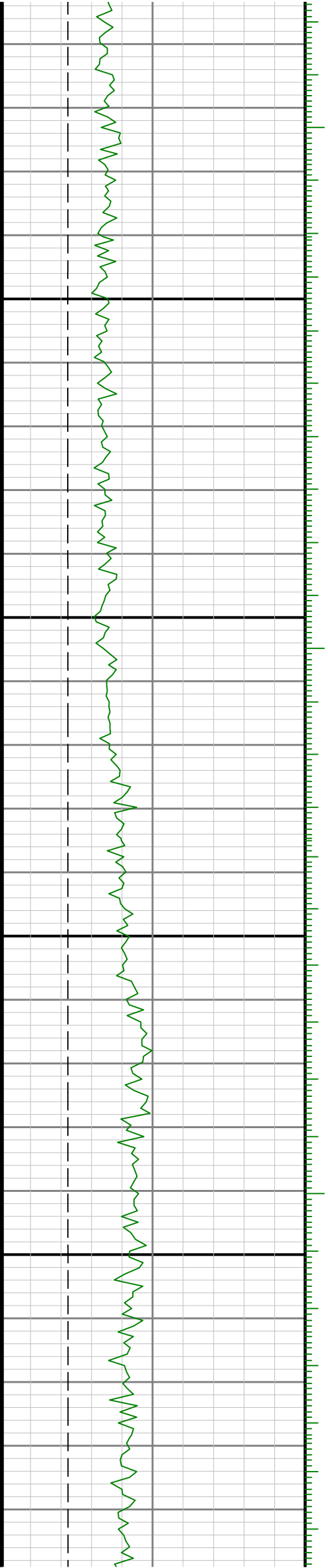


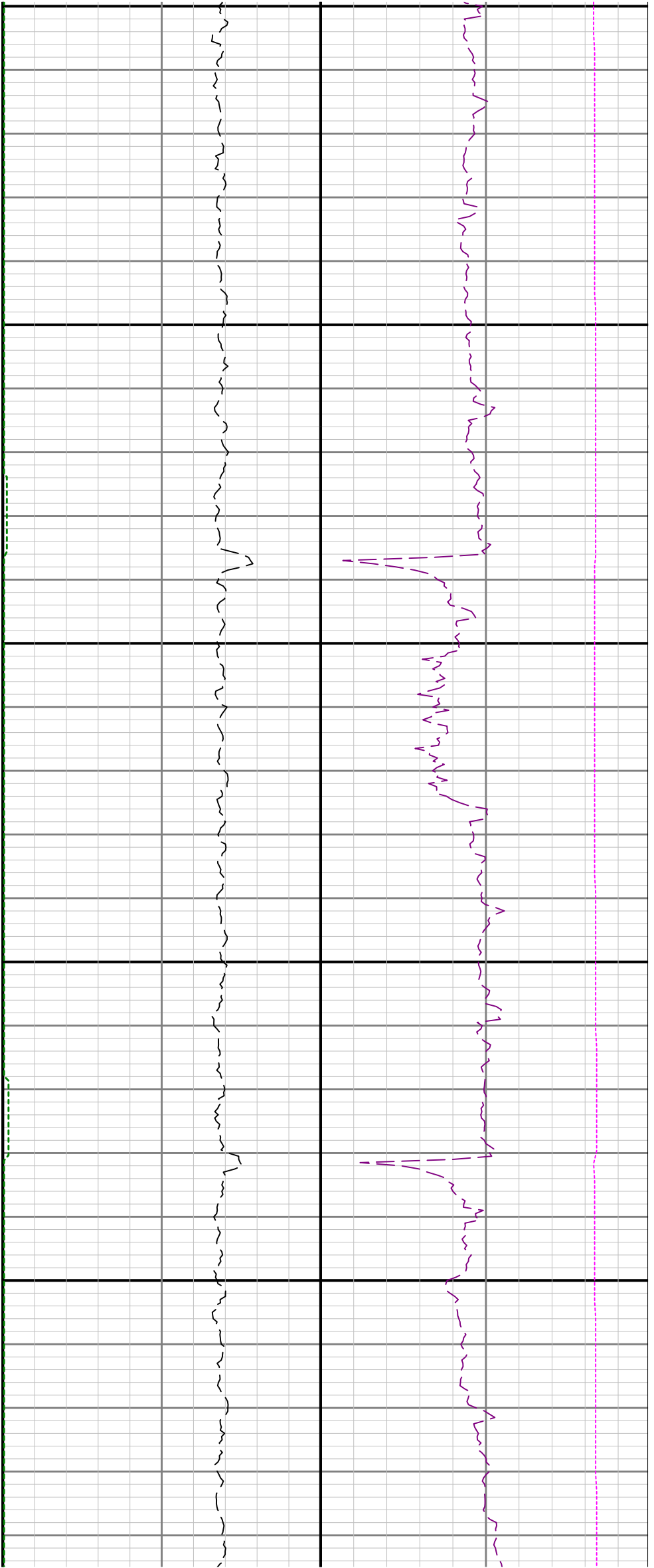


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12500

12

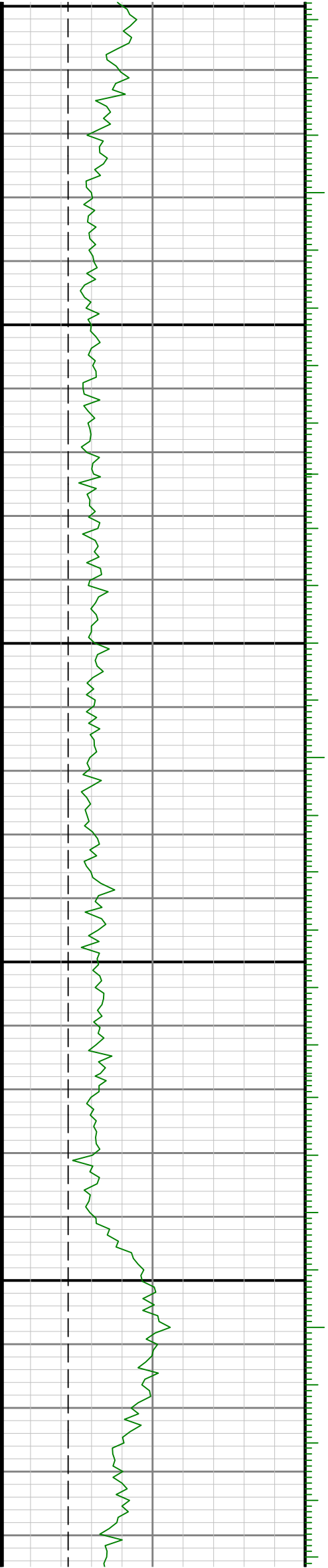


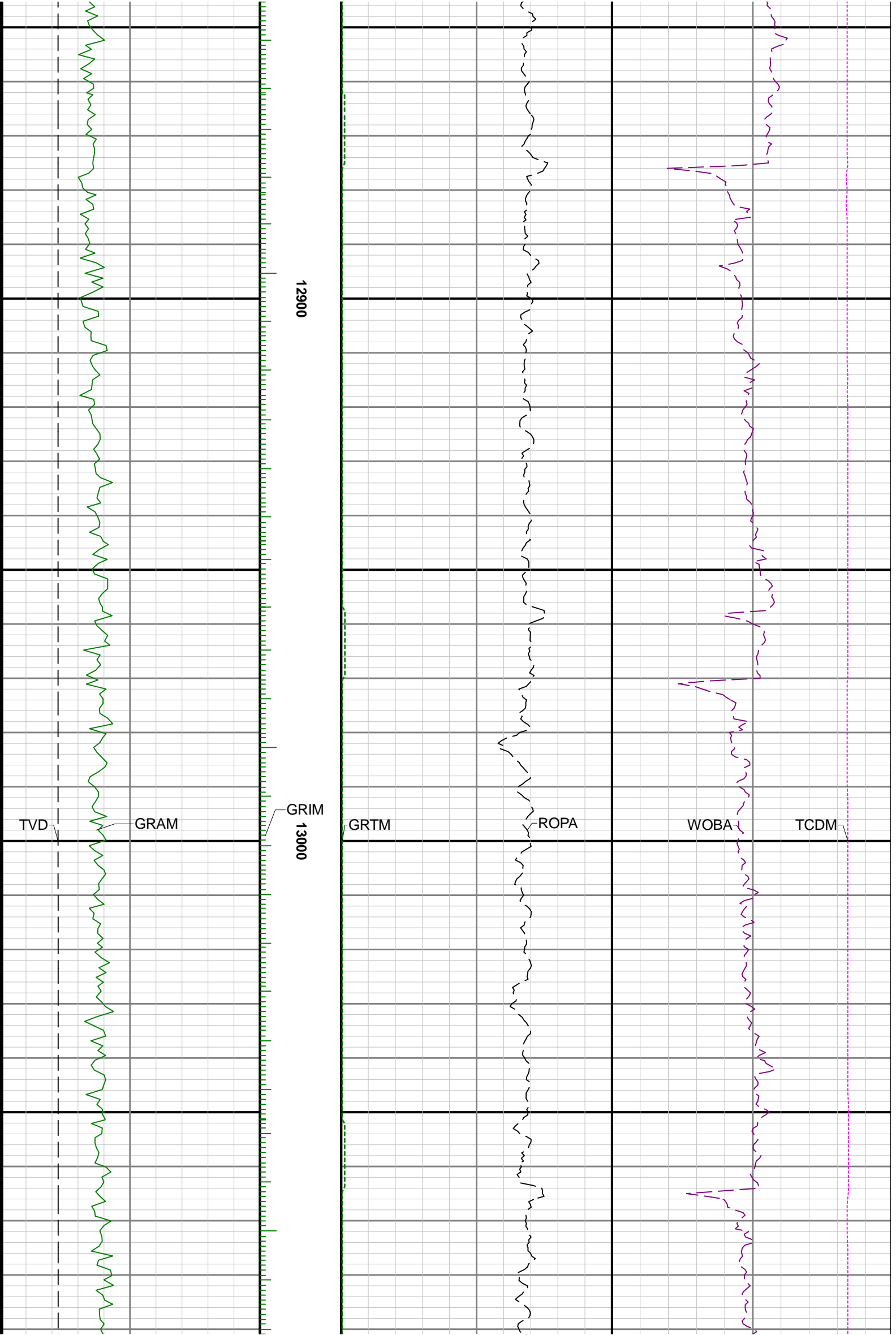


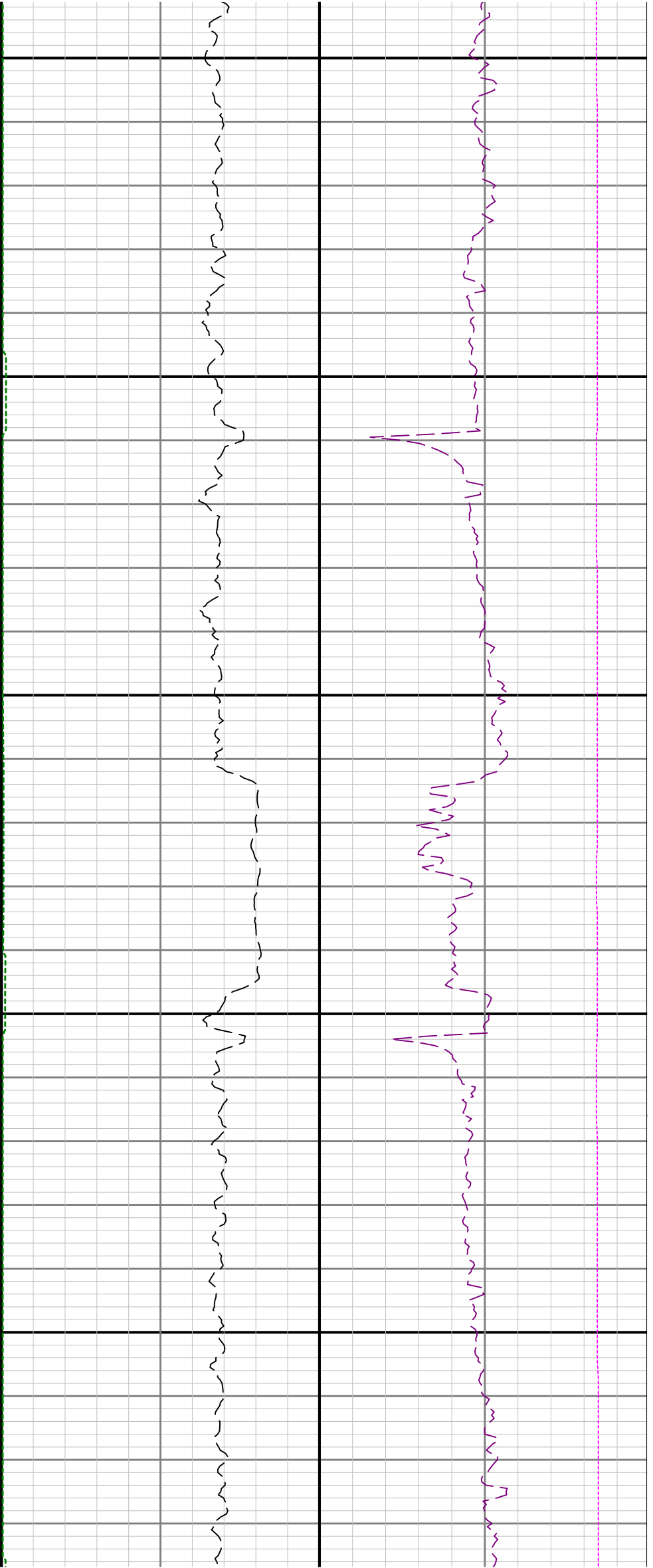
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12700

12800



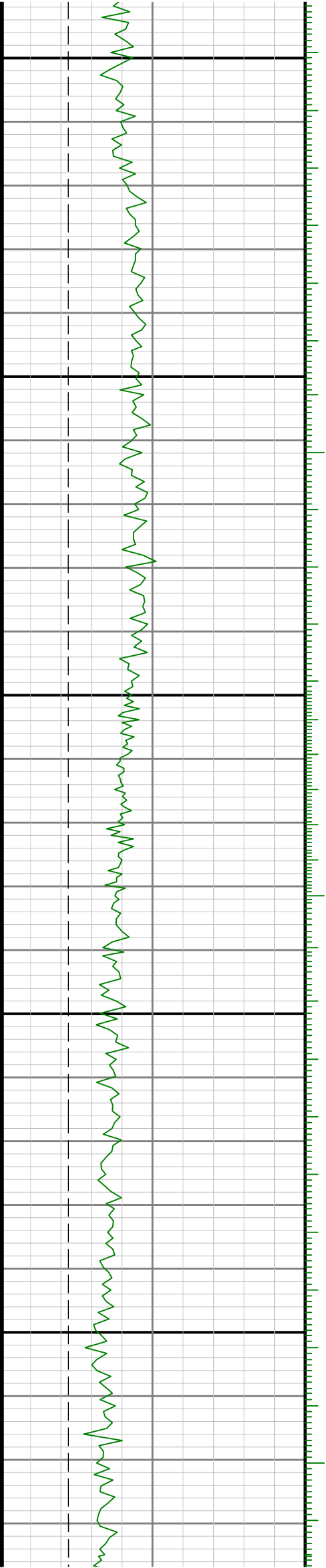


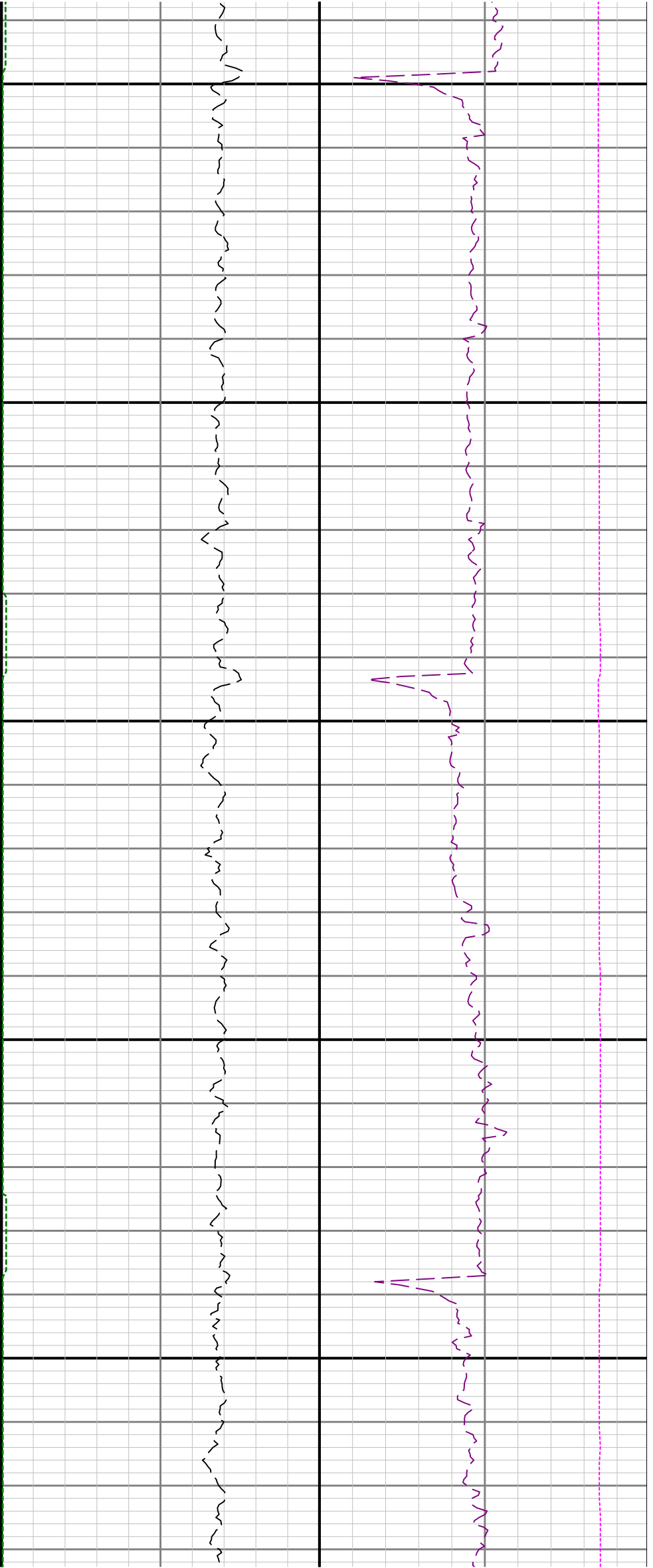


13100

13200

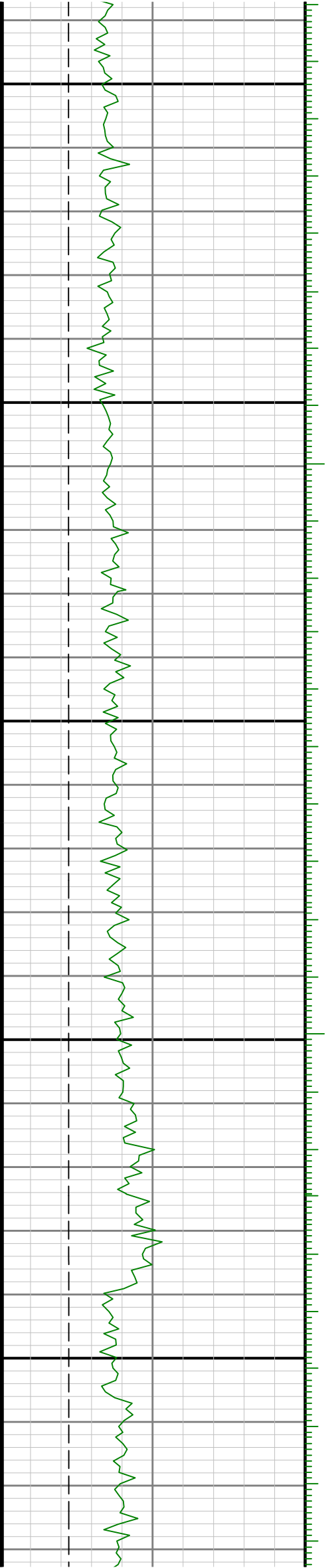
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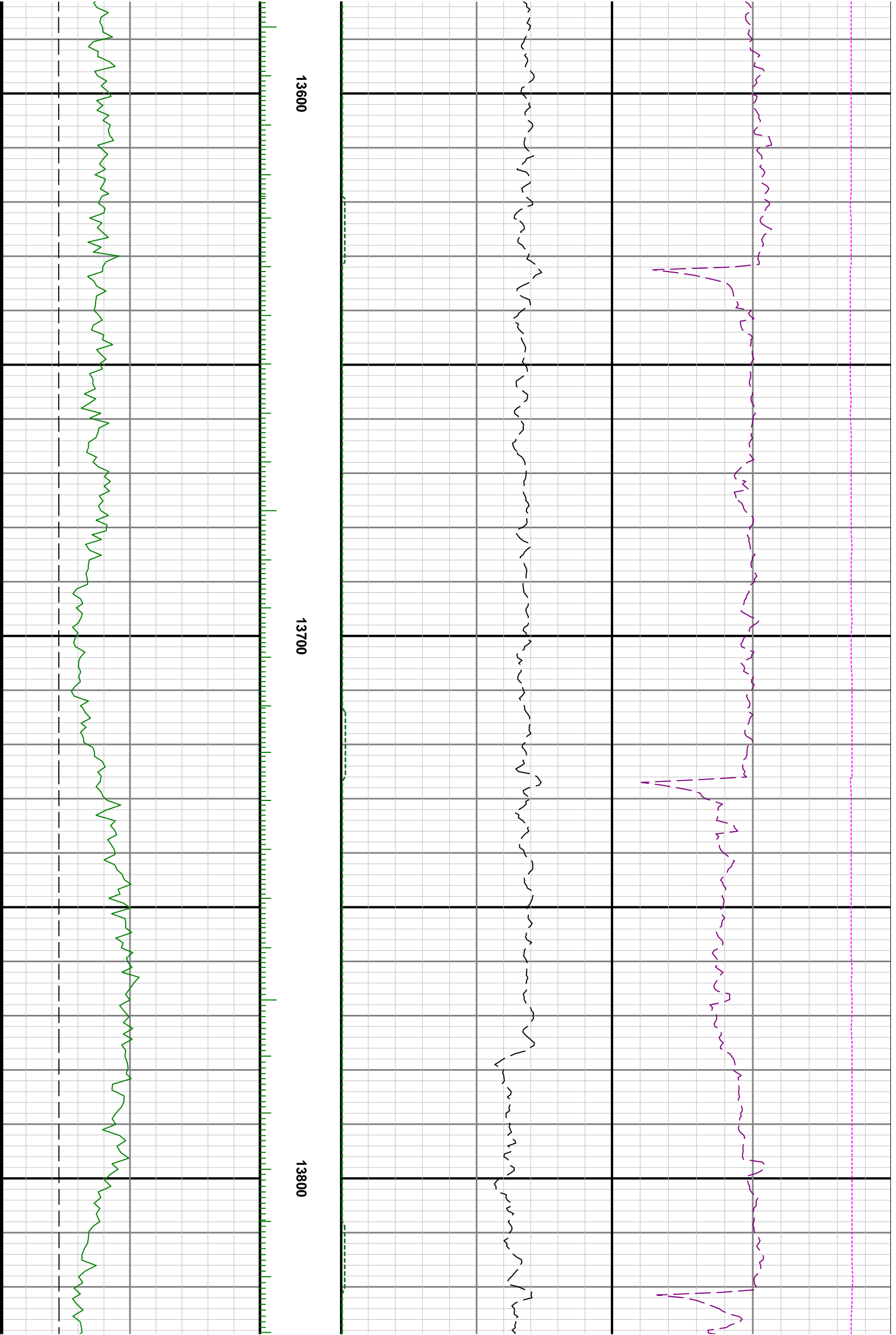


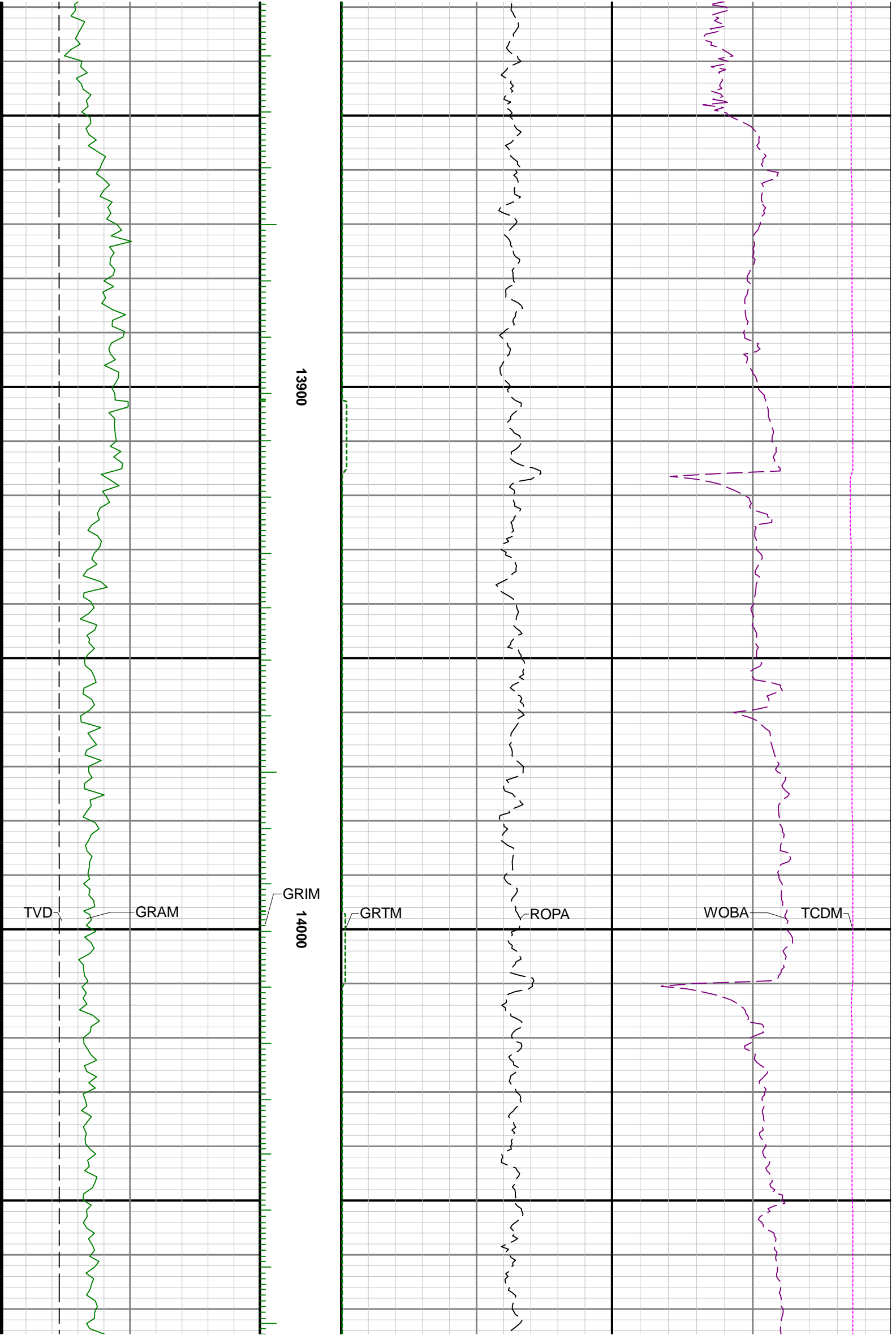


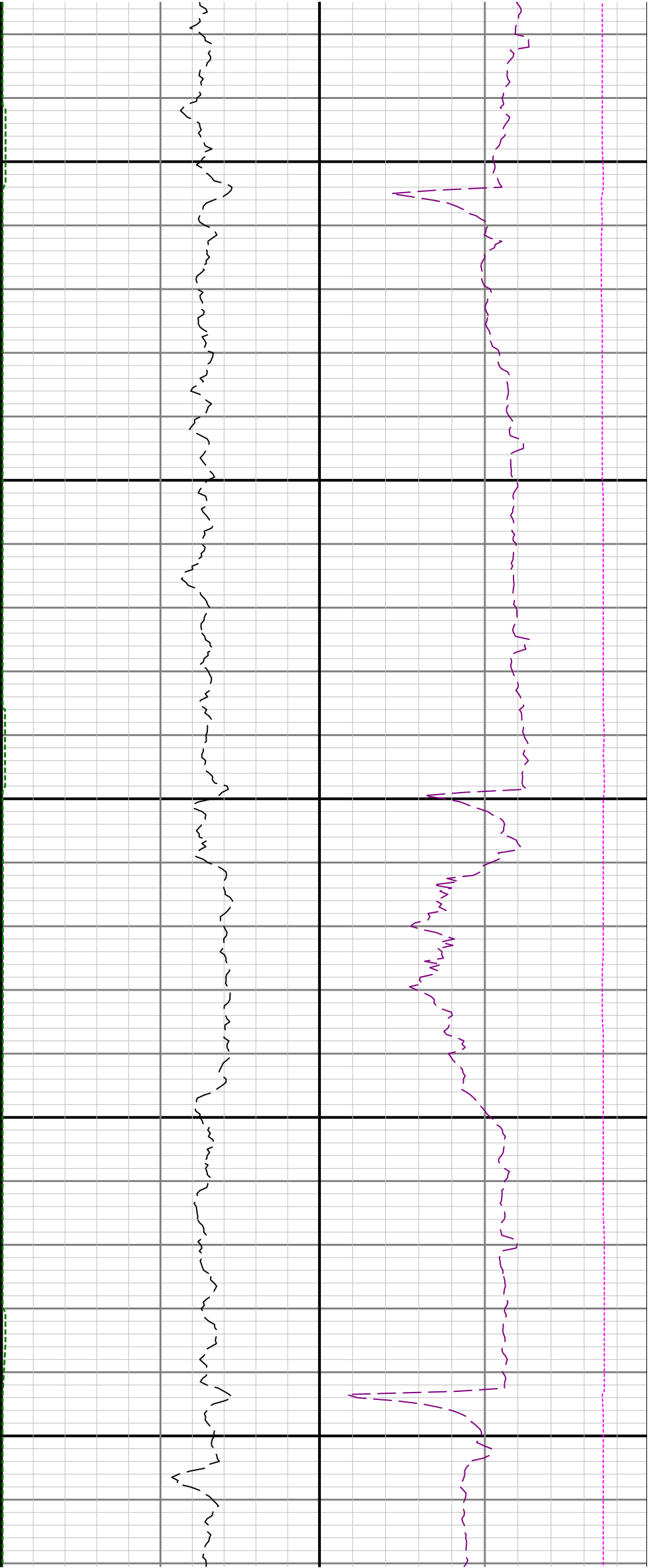
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13500





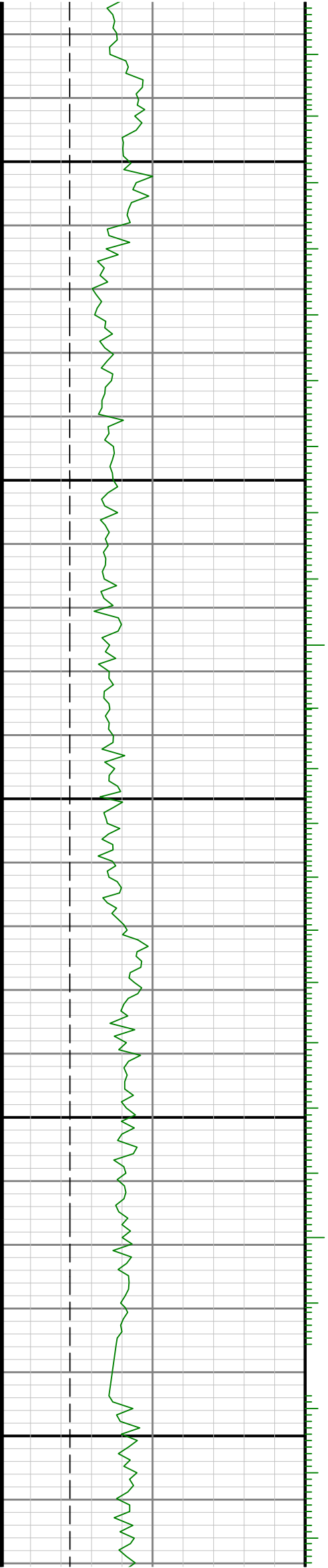


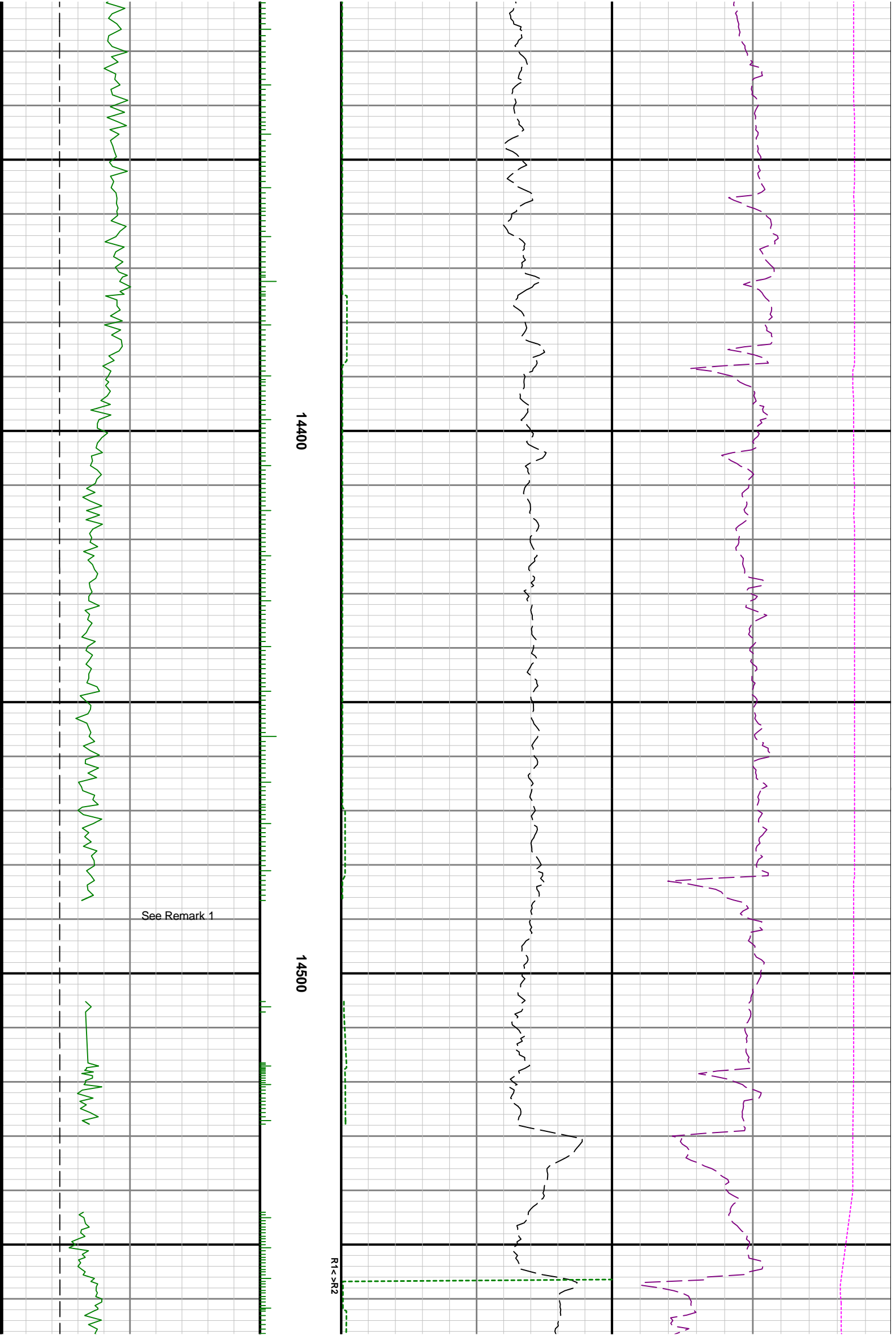


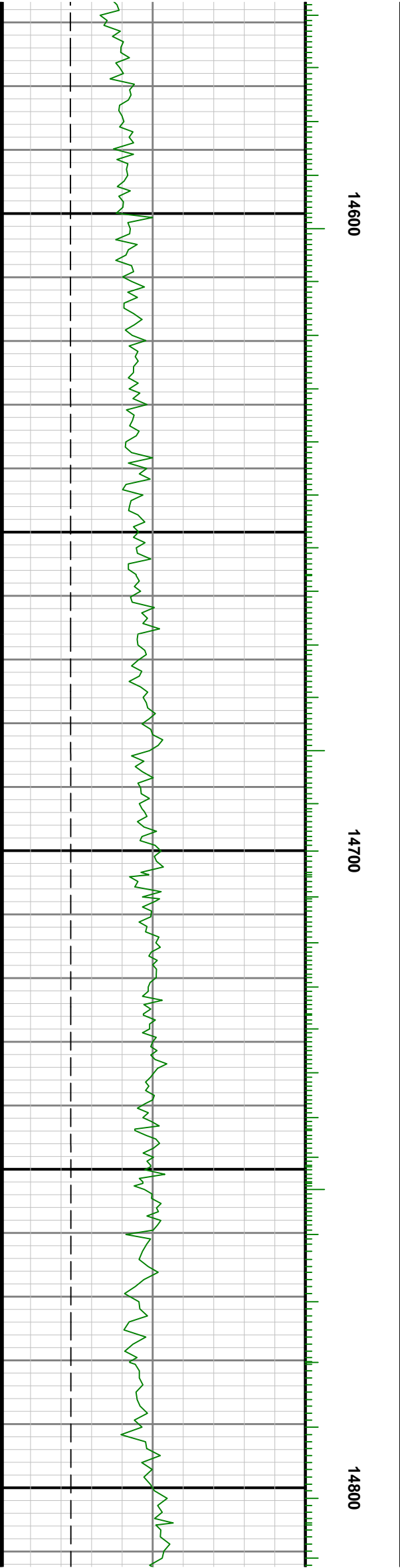
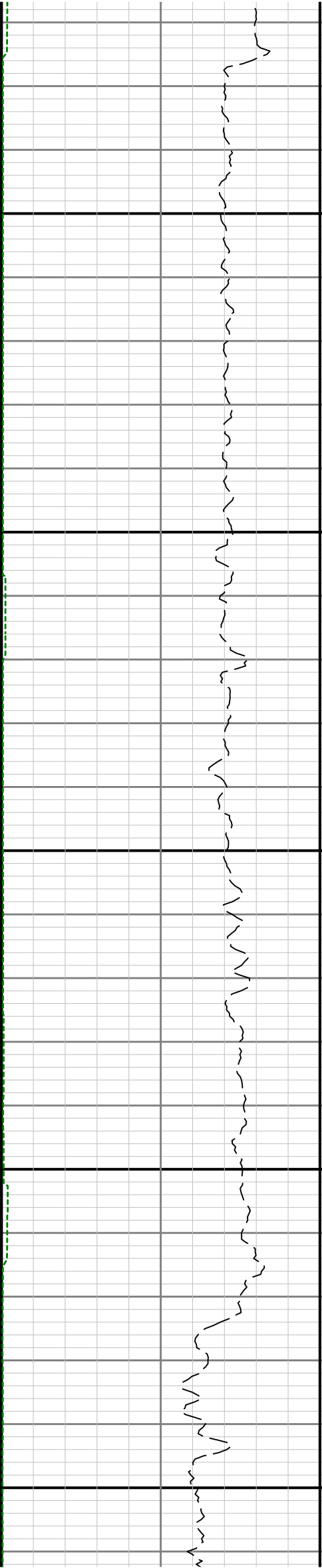
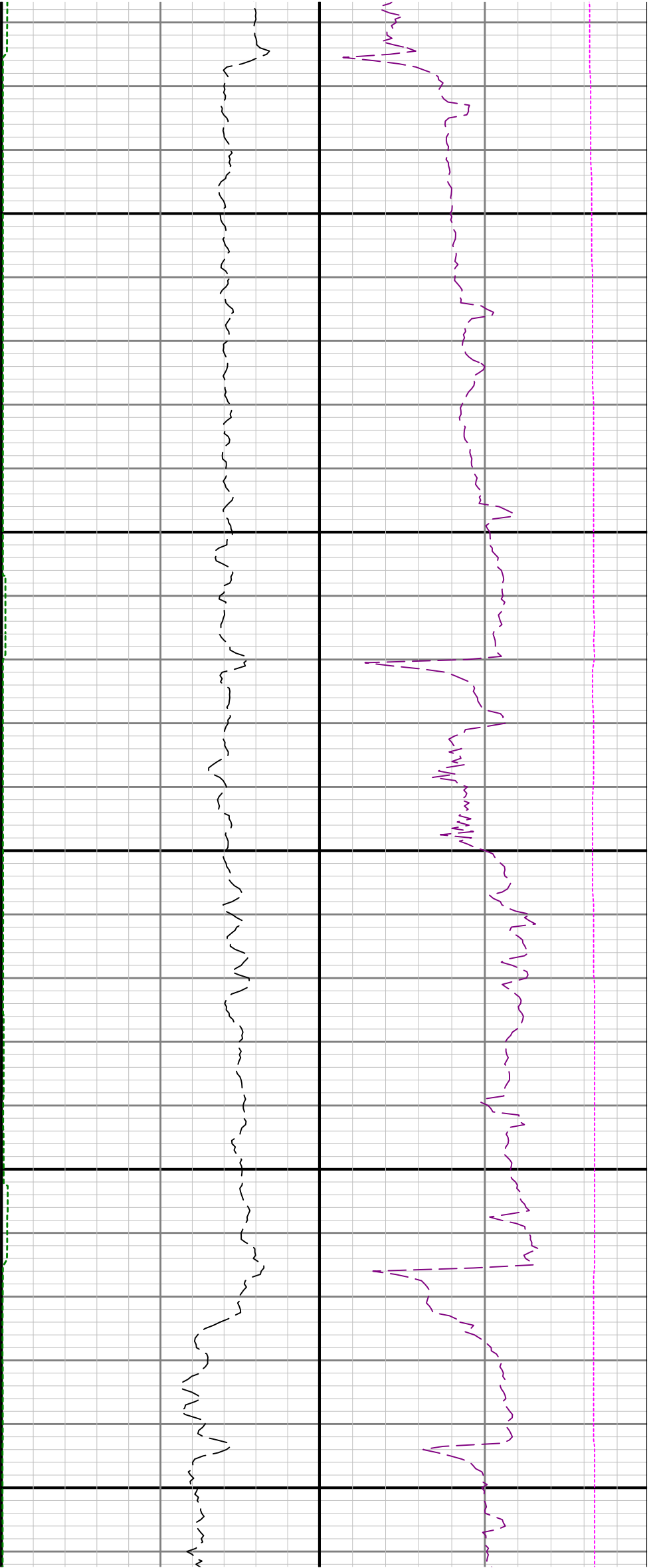
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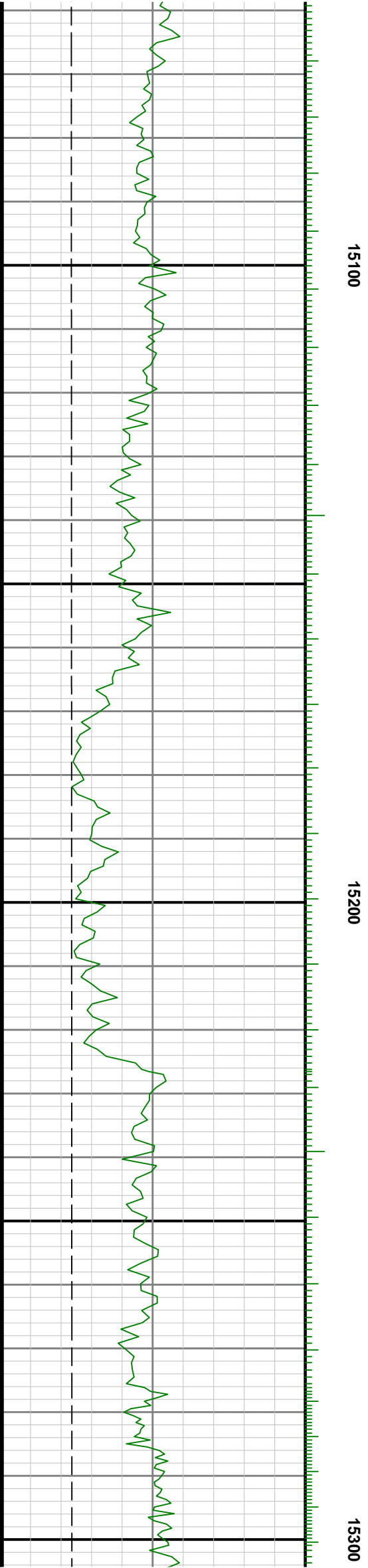
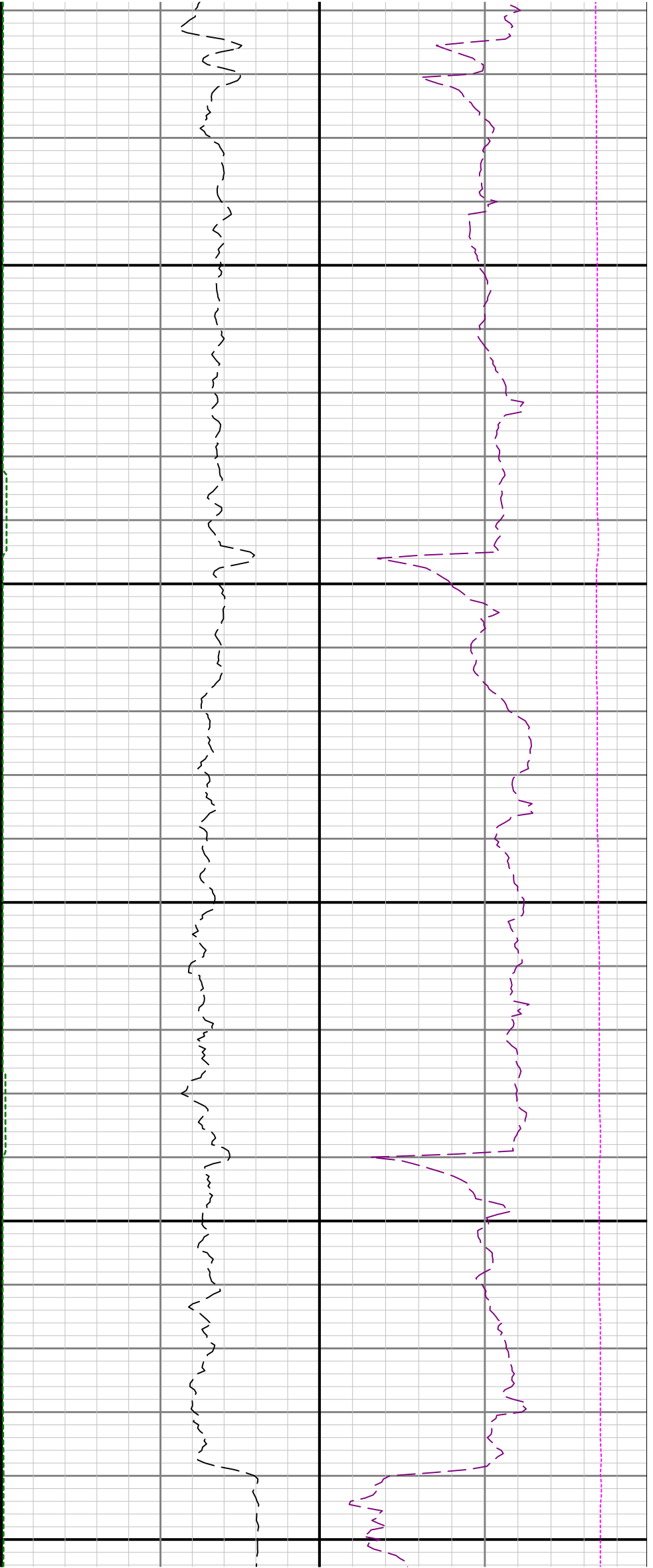
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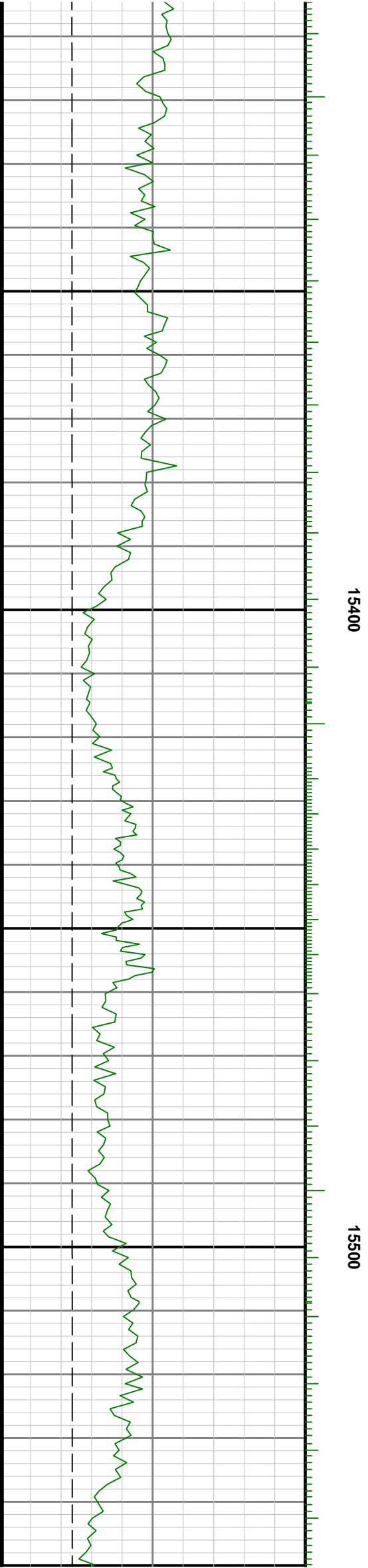


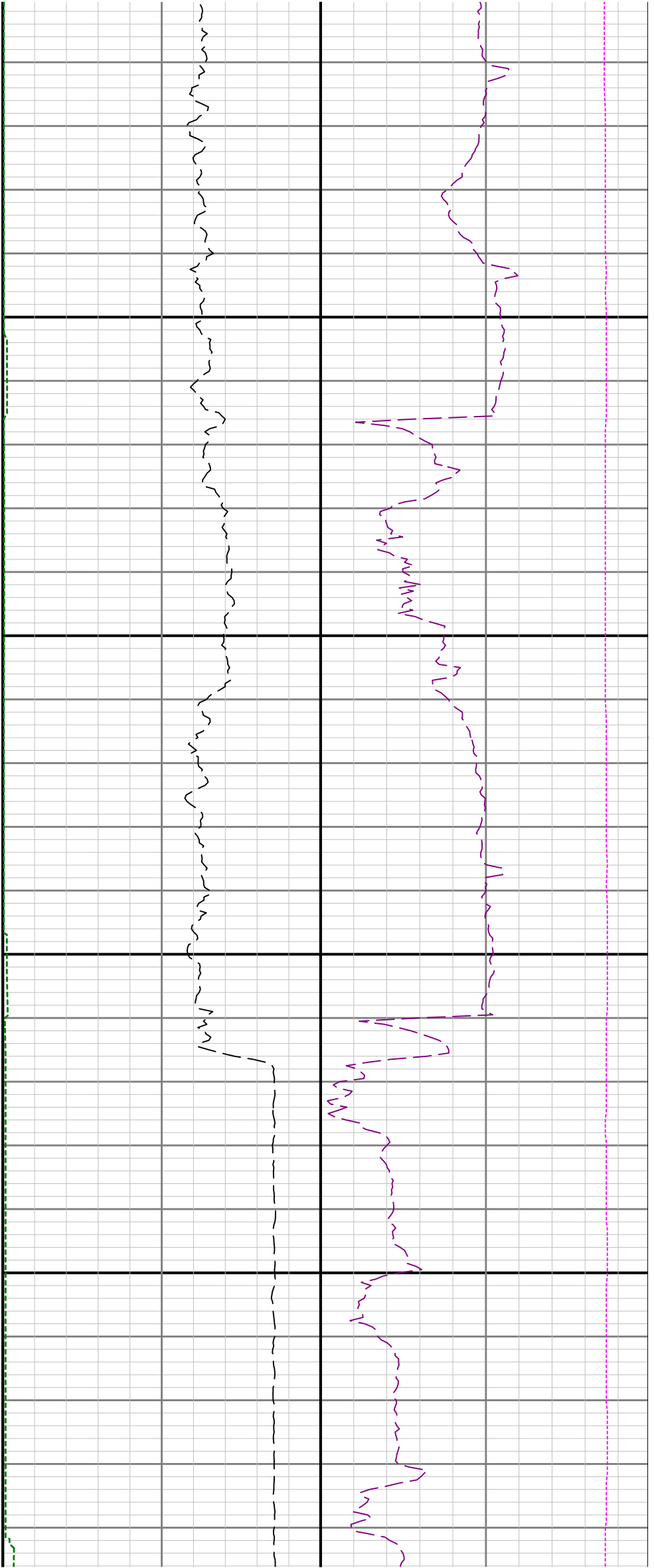






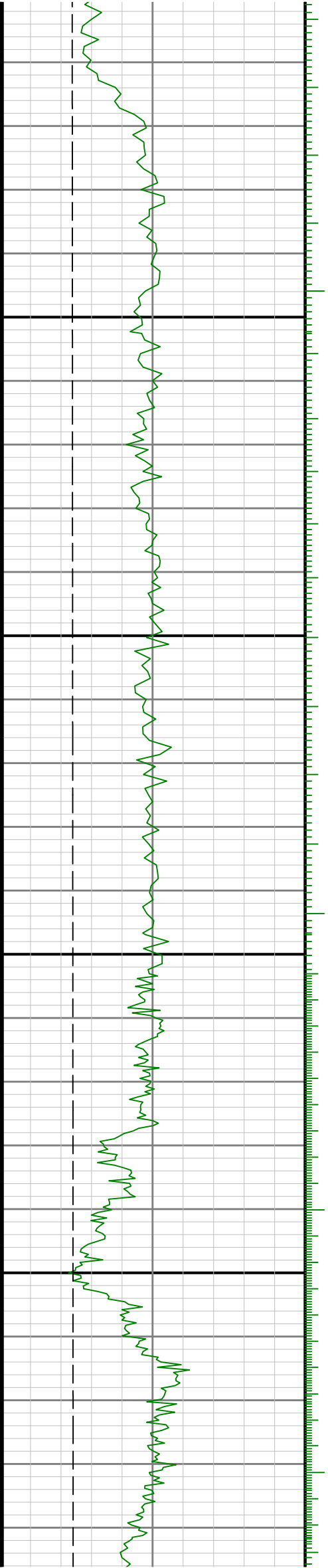


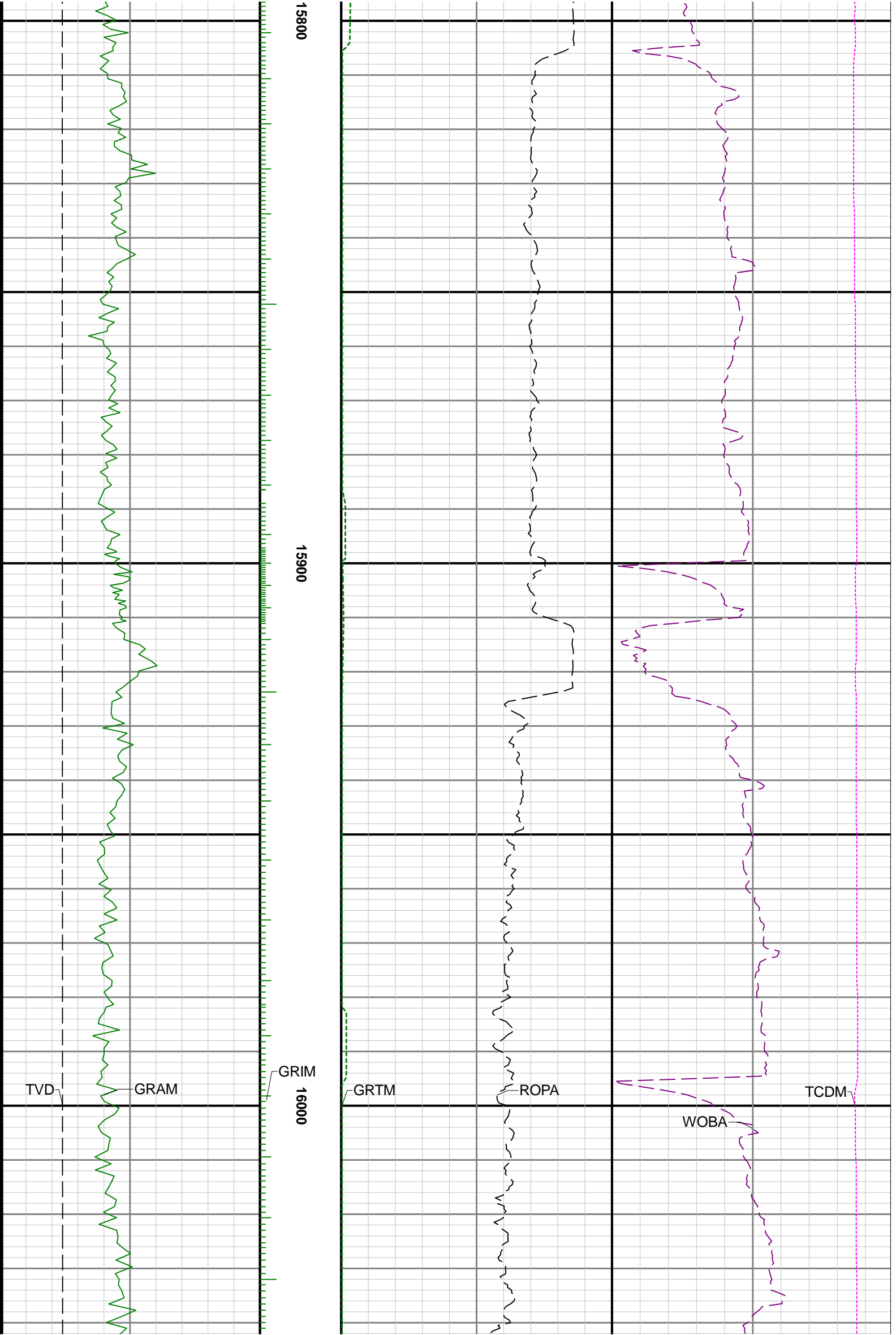


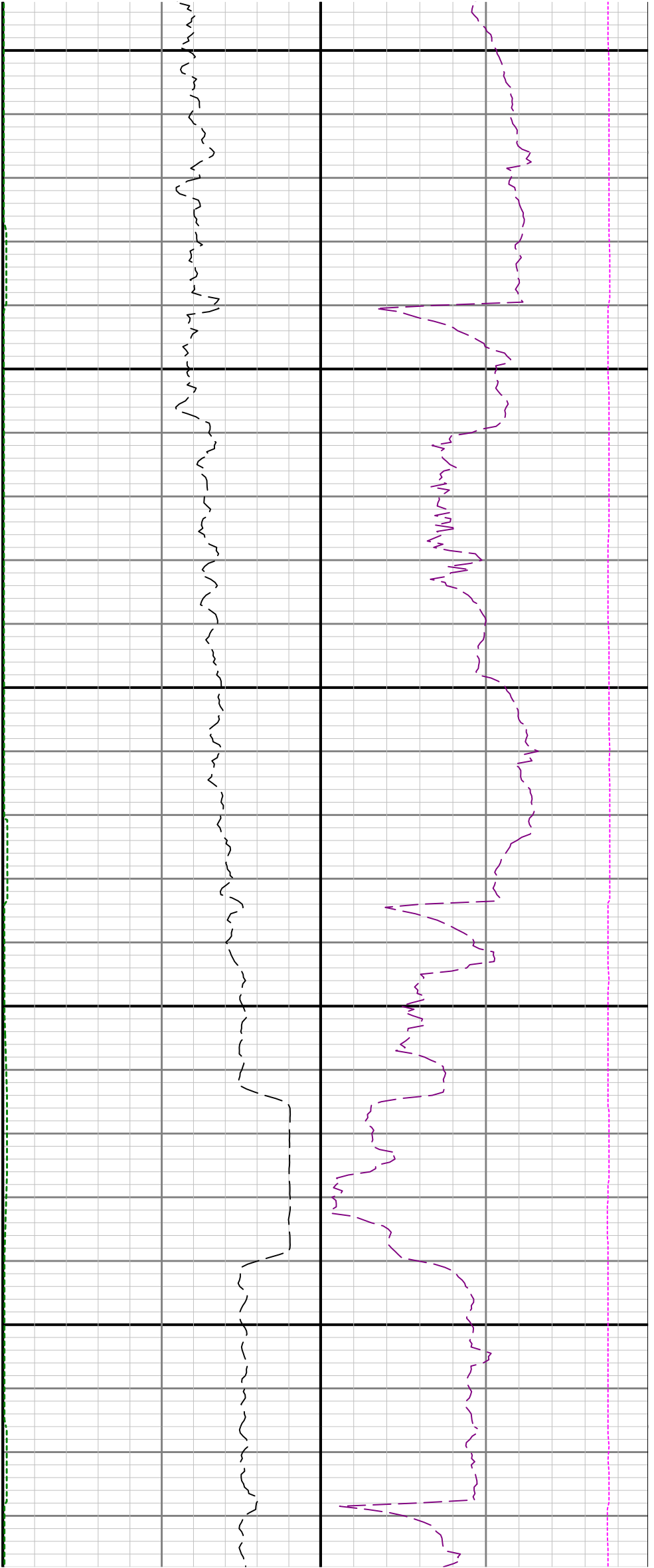


15600

15700







16100

16200

