



LWD MEMORY LOG

Gamma Ray

Scale:	Company: Noble Energy			
1:240 MD	Well:	Larson AA19-630		
	Field:	Wattenberg		
	County:	Weld	Country:	United States
Depth Reference:	State:	Colorado		
Driller's Depth				

Status:	Surface Location:		Other Services:	
Final Print	Latitude:	Elev. KB: Elev. DF: Elev. GL:		
API No: 05-123-45553-00	Longitude:			
Job ID: 9058480	SEC: 24	TWN: 6N	RGE: 64W	Directional
Permanent Datum (P.D.):	Ground Level	Elevation:	4646.00 ft	N/A
Log Measured From:	Rig Floor	Above P.D.	30.00 ft	4676.00 ft 4646.00 ft

Dates		Interval Logged		Magnetic Field Reference			
Date From:	2018-05-01	Top: (ft)	1956.00	Azi Reference North:	Grid	Dip Angle: (deg)	67.04
Date To:	2018-05-04	Bottom: (ft)	17834.00	Total Magnetic Field Strength: (nT)			52218
Spud Date:	2018-04-30			Mag to Reference North Correction: (deg)			7.23 E

[illegible][illegible]

Acquisition System	Software Version	Other
Baker Hughes Cadence	RT4.1	
PlotStudio	4.1.7763.3	
	Rig:	H&P 517
	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 (ft)	Bottom (ft)	From (ft)	To (ft)	Start Logging	End Logging	
1	1	8.500	PDC	3.00	Rotary Steerable	1943.10	15794.00	1956.00	15807.00	2018-05-01 01:54	2018-05-03 03:45	44.62
2	2	8.500	PDC	3.00	Rotary Steerable	15794.00	17821.00	15807.00	17834.00	2018-05-03 18:42	2018-05-04 04:45	11.08

Crew

Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite
Adam Schlenz	2018-04-30	2018-05-04						

Mud Properties Record

Date / Time	Run No.	Measured Depth (ft)	Mud Type	Density (ppg)	Viscosity (cP)	pH	Fluid Loss (cm3)	Oil / Water	Source	Total Chlorides (ppm)	K+ (%)
2018-05-01 03:00	1	2288.00	Oil Based Mud	9.4	11	N/A	20.8	70.2/29.8	Active Pit	27500	0.00
2018-05-01 13:30	1	5957.00	Oil Based Mud	9.5	11	N/A	16.0	72.2/27.8	Active Pit	27500	0.00

2018-05-02 02:45	1	8815.00	Oil Based Mud	9.5	13	N/A	16.0	74/26	Active Pit	29000	0.00
2018-05-02 13:30	1	11768.00	Oil Based Mud	9.4	12	N/A	18.0	74/26	Active Pit	26000	0.00
2018-05-03 13:30	2	15849.00	Oil Based Mud	9.7	13	N/A	21.2	71.2/28.8	Active Pit	23000	0.00
2018-05-04 03:15	2	17516.00	Oil Based Mud	9.5	12	N/A	20.8	73/27	Active Pit	23000	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	12142976	Near Bit VSS	5.93	6.73	7.000	4.330
1	ATC_SU	12142976	Near Bit Inclination	5.93	6.73	7.000	4.330
1	ATC_MWD	12049472	Gamma (single)	2.76	12.90	7.000	3.250
1	ATC_MWD	12049472	Directional (mag)	12.27	22.41	7.000	3.250
2	ATC_SU	14381513	Near Bit VSS	5.93	6.73	7.000	4.330
2	ATC_SU	14381513	Near Bit Inclination	5.93	6.73	7.000	4.330
2	ATC_MWD	14322612	Gamma (single)	2.75	12.90	7.000	3.250
2	ATC_MWD	14322612	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 1956 to 17834 feet MD (1956 to 6577 feet TVD).
3	V@A@ { aUaA] a^) QUC Dazda A!^•^) c a /A A K E A E U Q A / A @ A & • q { ^ i q A ^ ~ ^ • d A

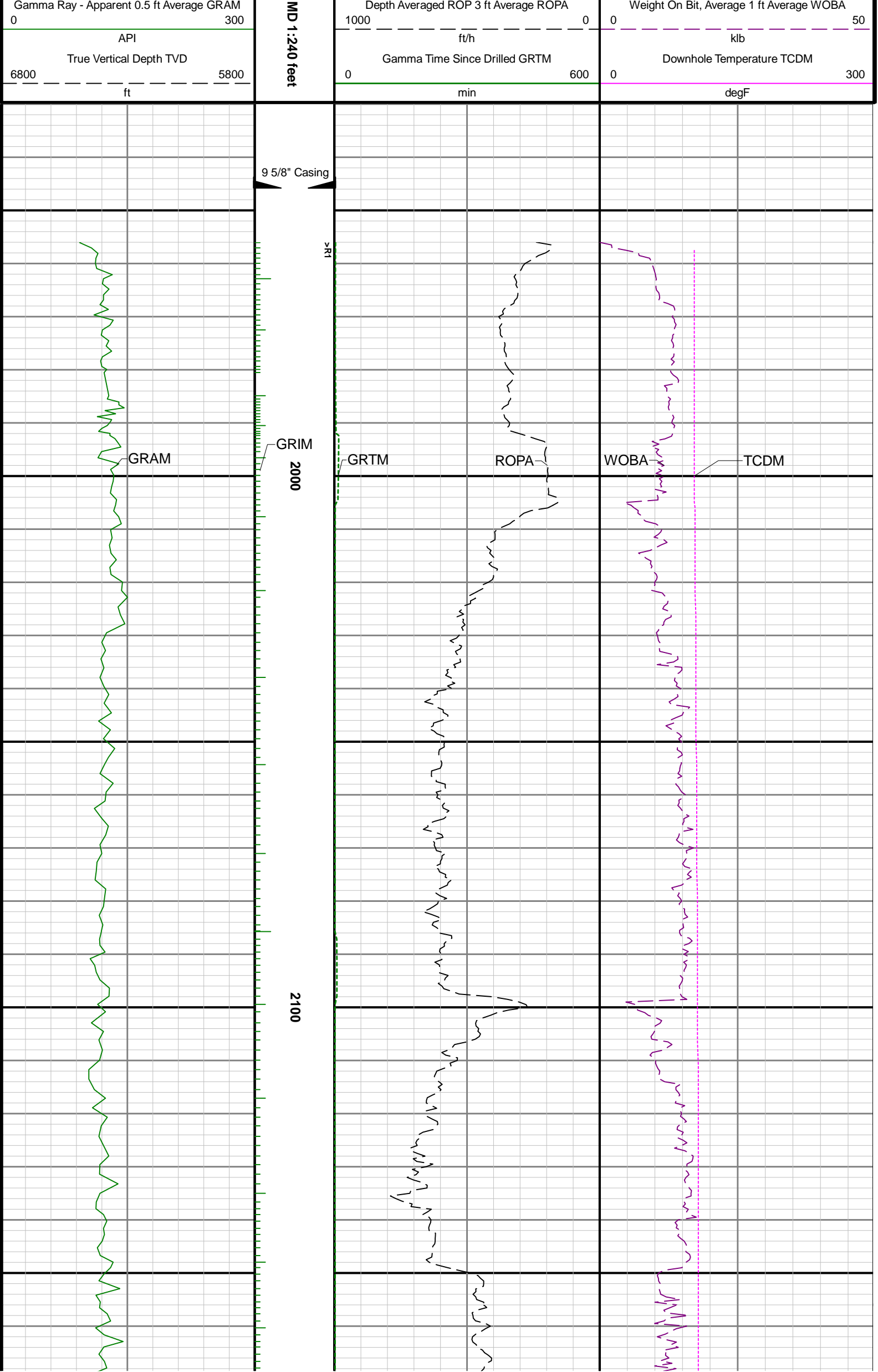
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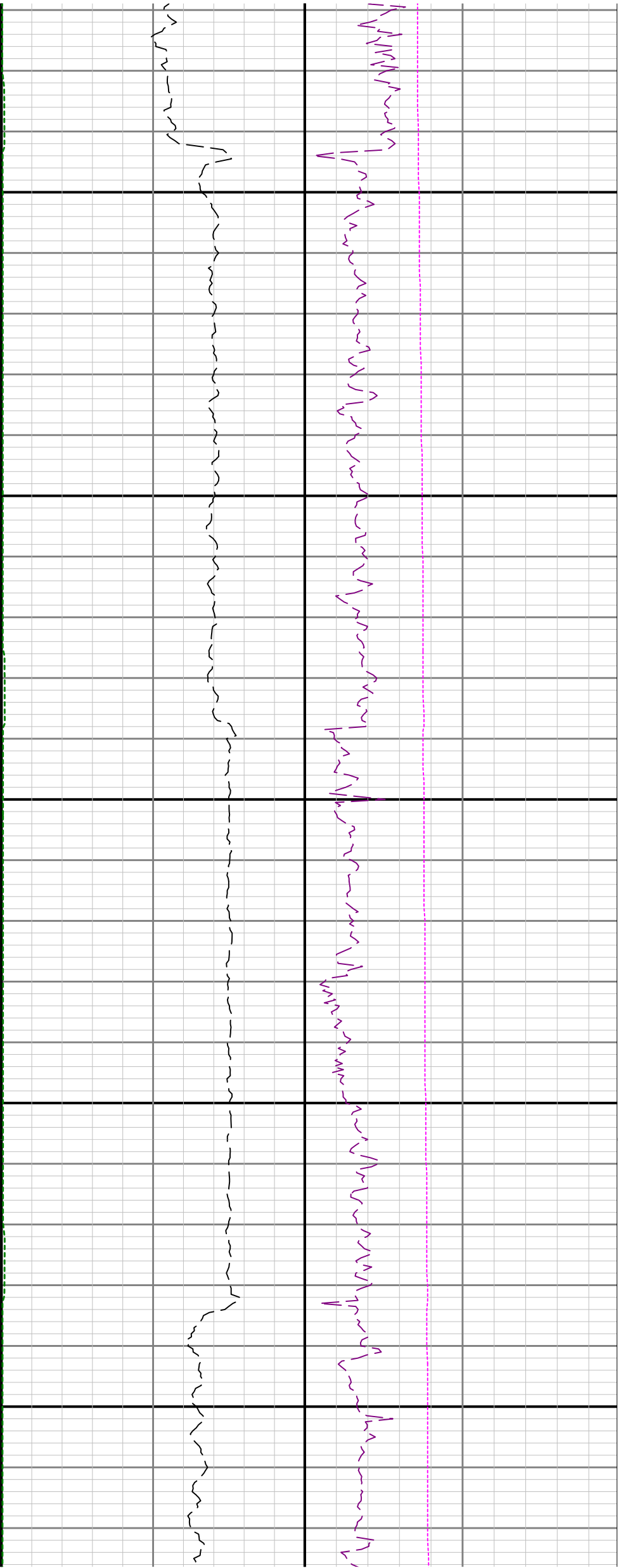
Number	Measured Depth (ft)	Hole Section (in)	Run No.	Remark
1	4481.00	8.500	1	The interval from 4448 to 4481 feet MD (4412 to 4445 feet TVD) does not have gamma ray data, due to a downhole MWD tool communication issue.
2	15807.00	8.500	2	The interval from 15794 to 15807 feet MD (6589 feet TVD) was logged more than 10 hours after being drilled, due to a trip out of the hole to pick up a new rotary steerable assembly.
3	16090.00	8.500	2	The interval from 16074 to 16090 feet MD (6587 feet TVD) does not have gamma ray data, due to a downhole MWD tool communication issue.
4	16184.00	8.500	2	The interval from 16170 to 16184 feet MD (6586 feet TVD) does not have gamma ray data, due to a downhole MWD tool communication issue.
5	17834.00	8.500	2	The interval from 17821 to 17834 feet MD (6577 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	Larson AA19-630			
	Interval	Date From:	2018-05-01 19:54:09	Top:	1956.00
	Created	Date To:	2018-05-04 22:28:30	Bottom:	15850.00
			2018-05-04 14:24:12		

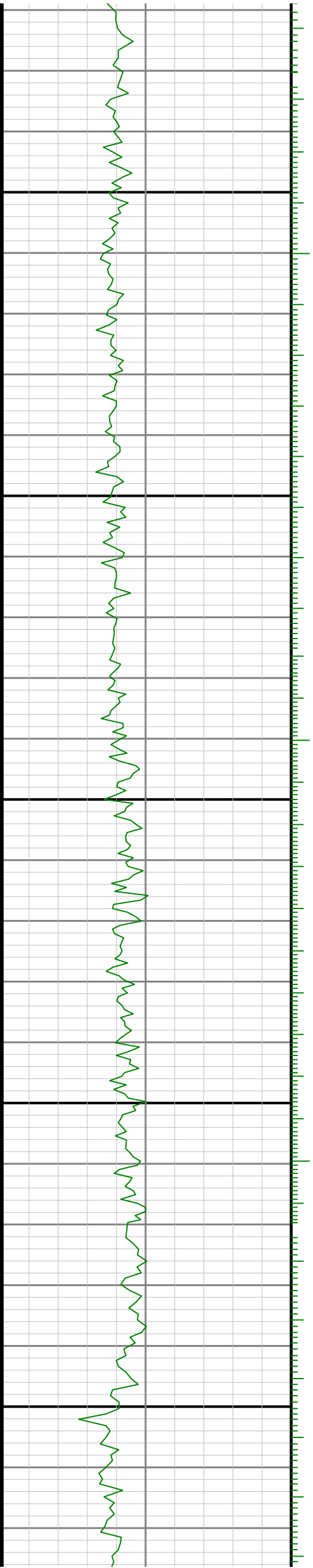


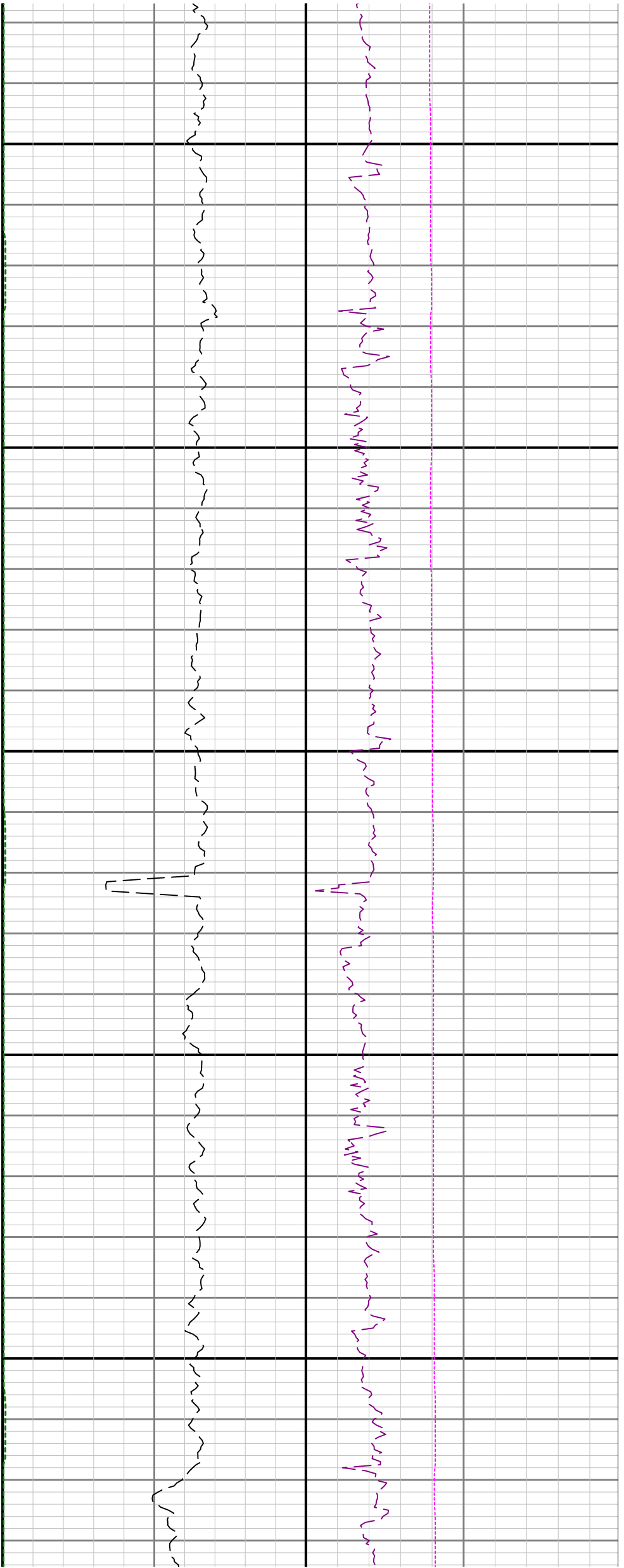


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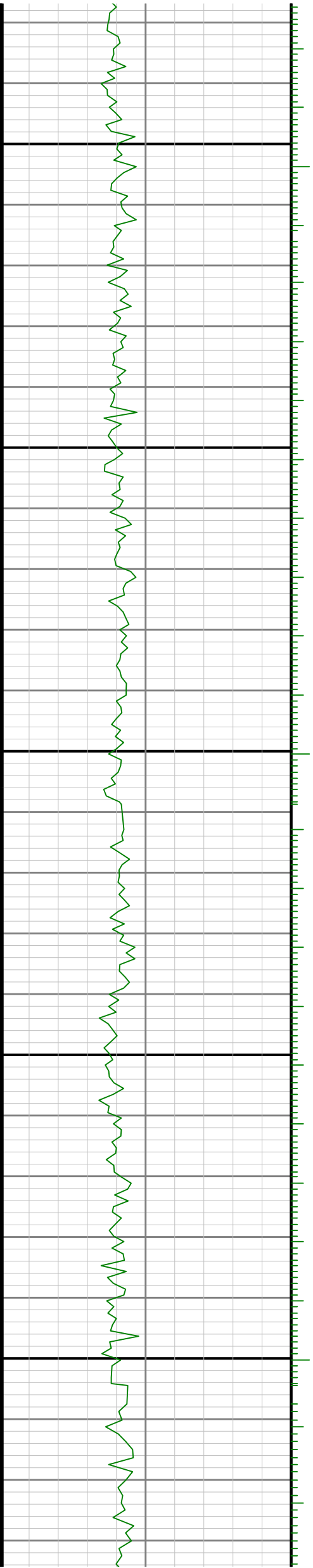
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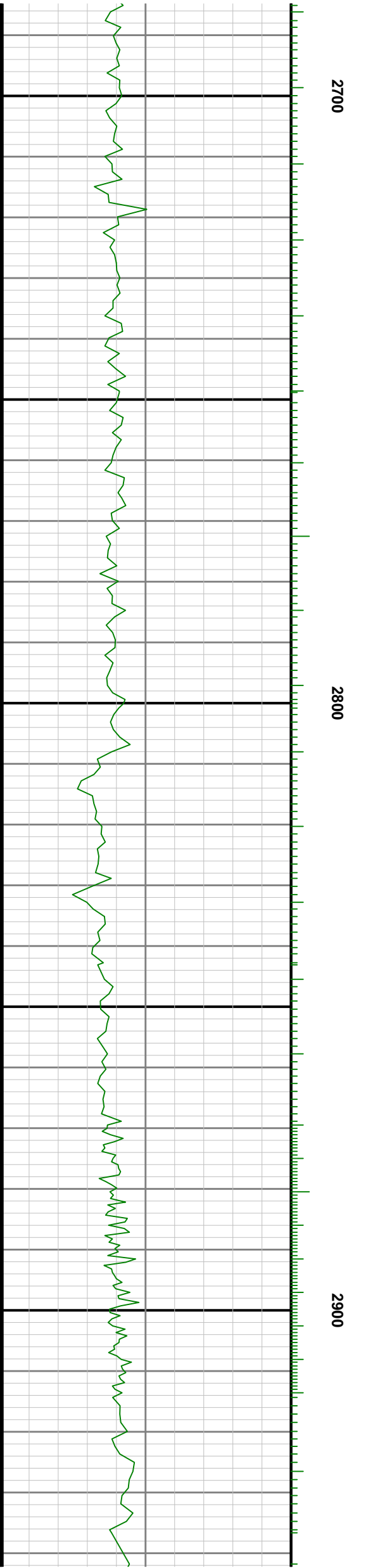
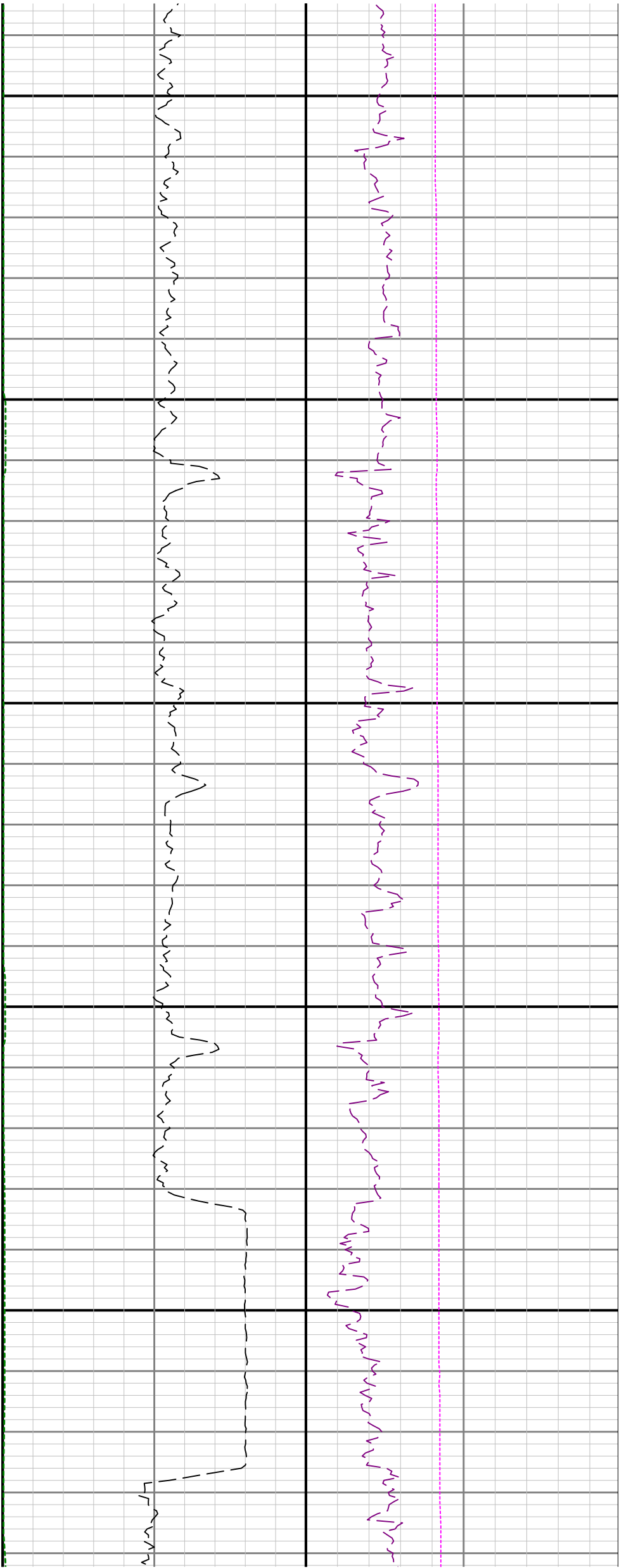


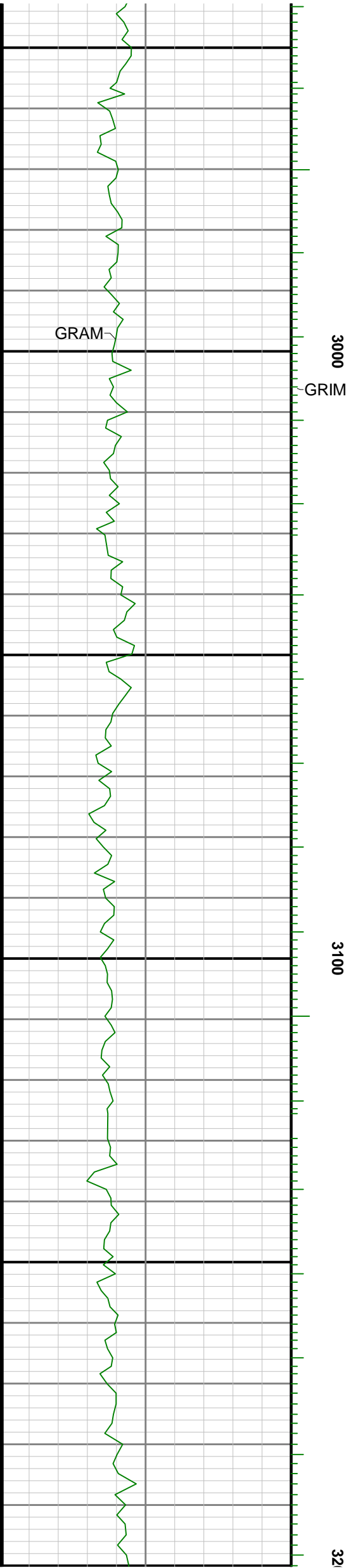
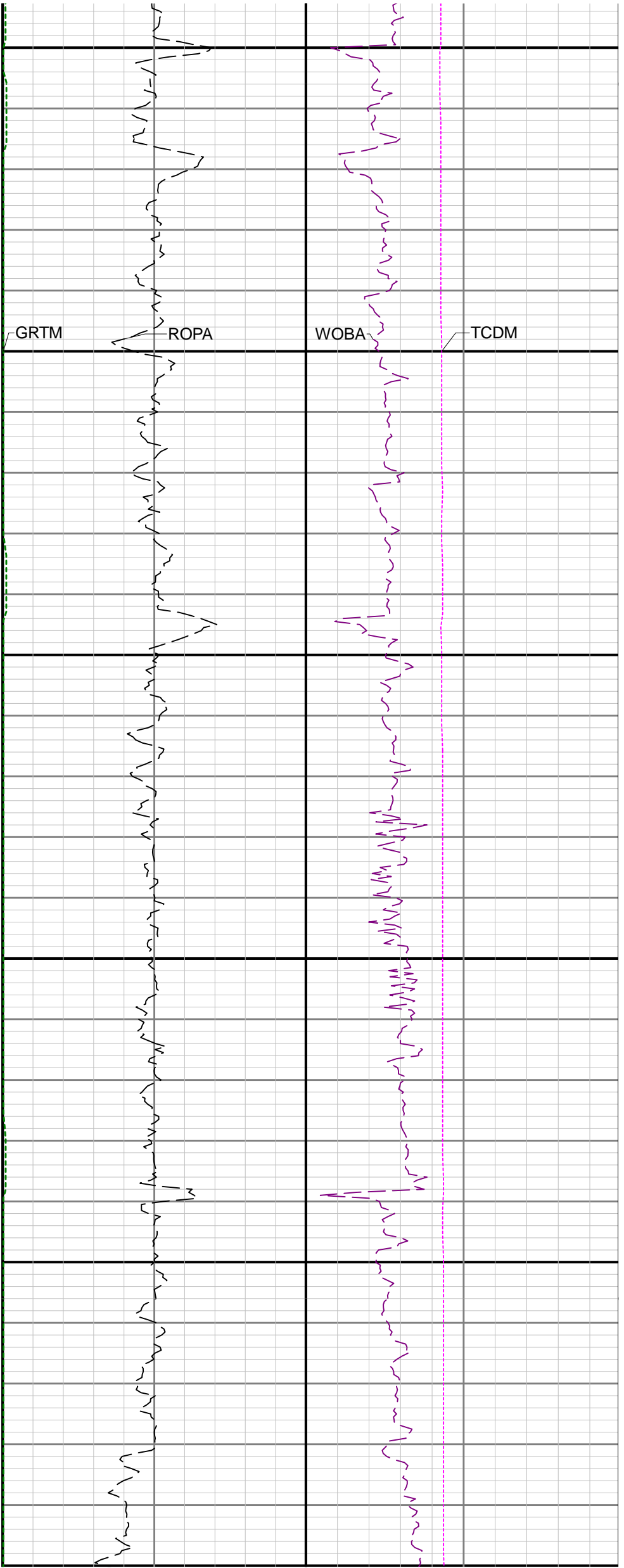


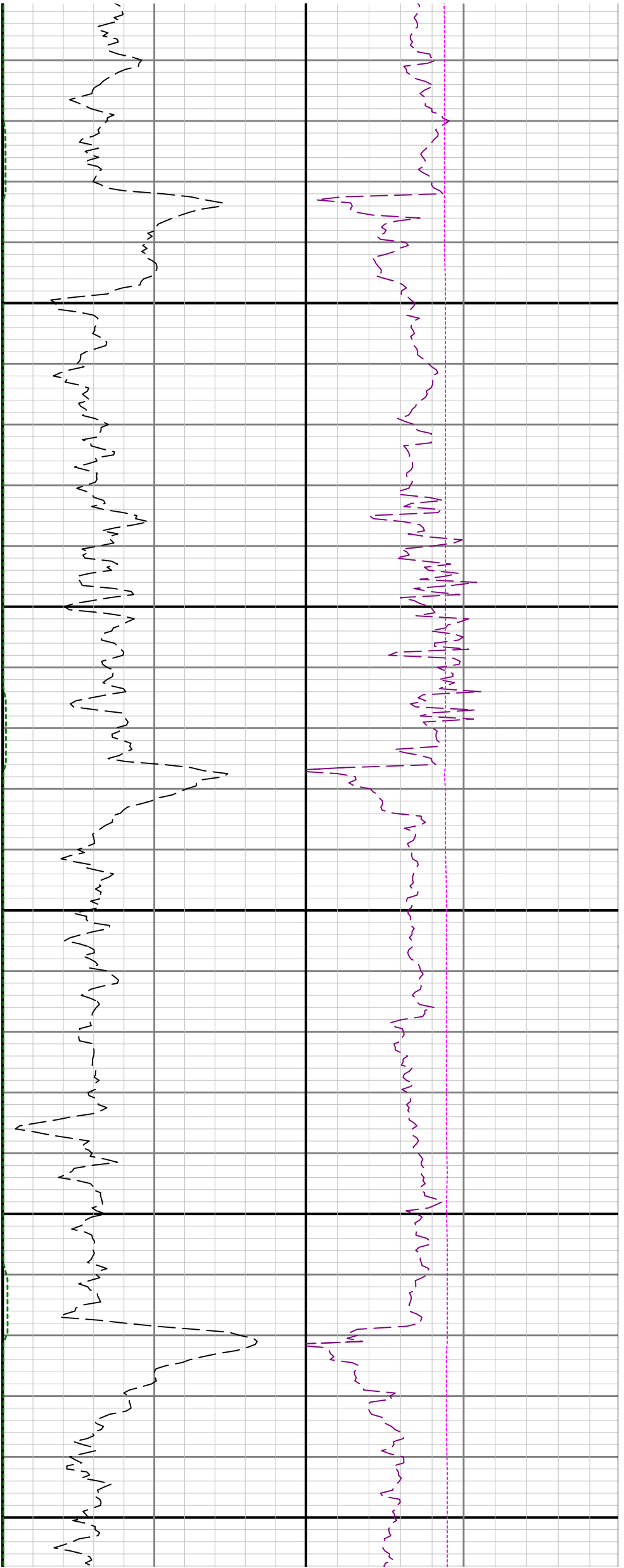
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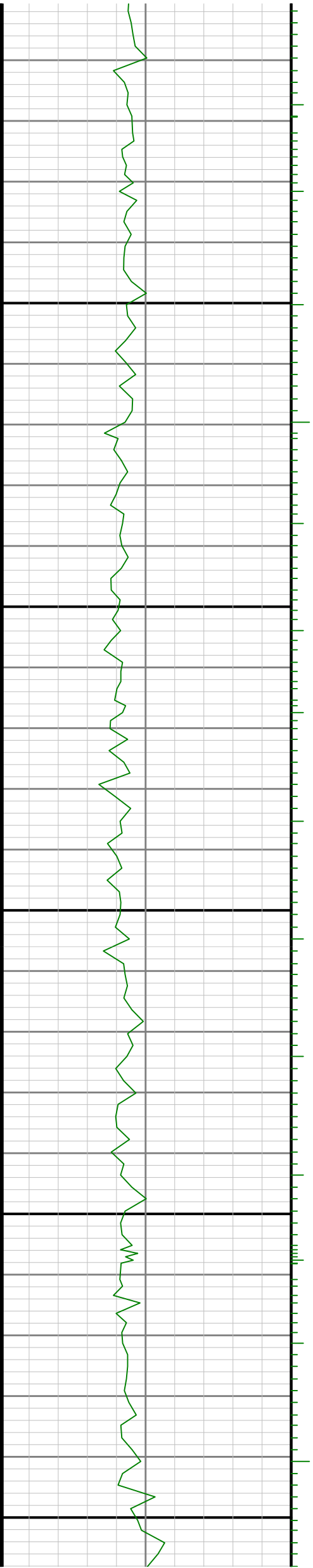


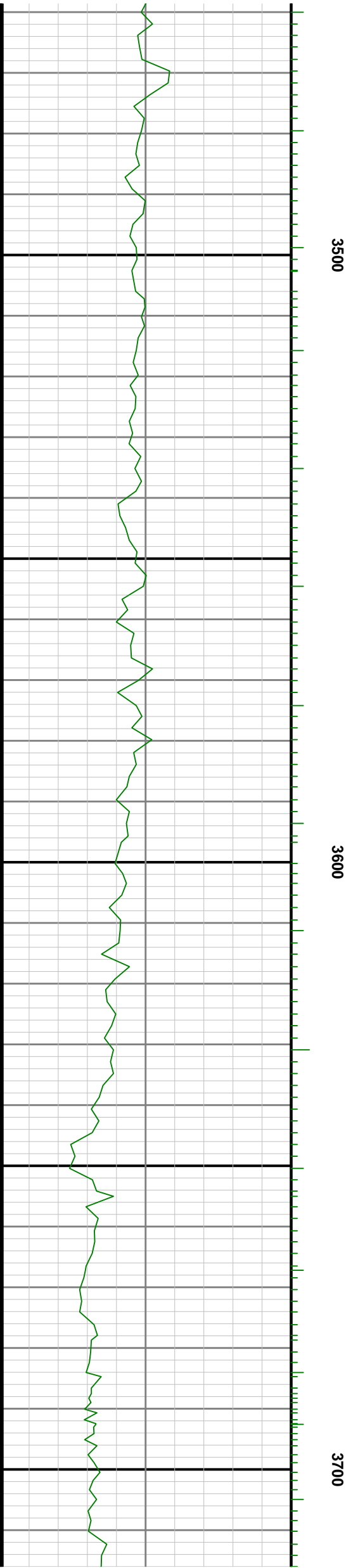
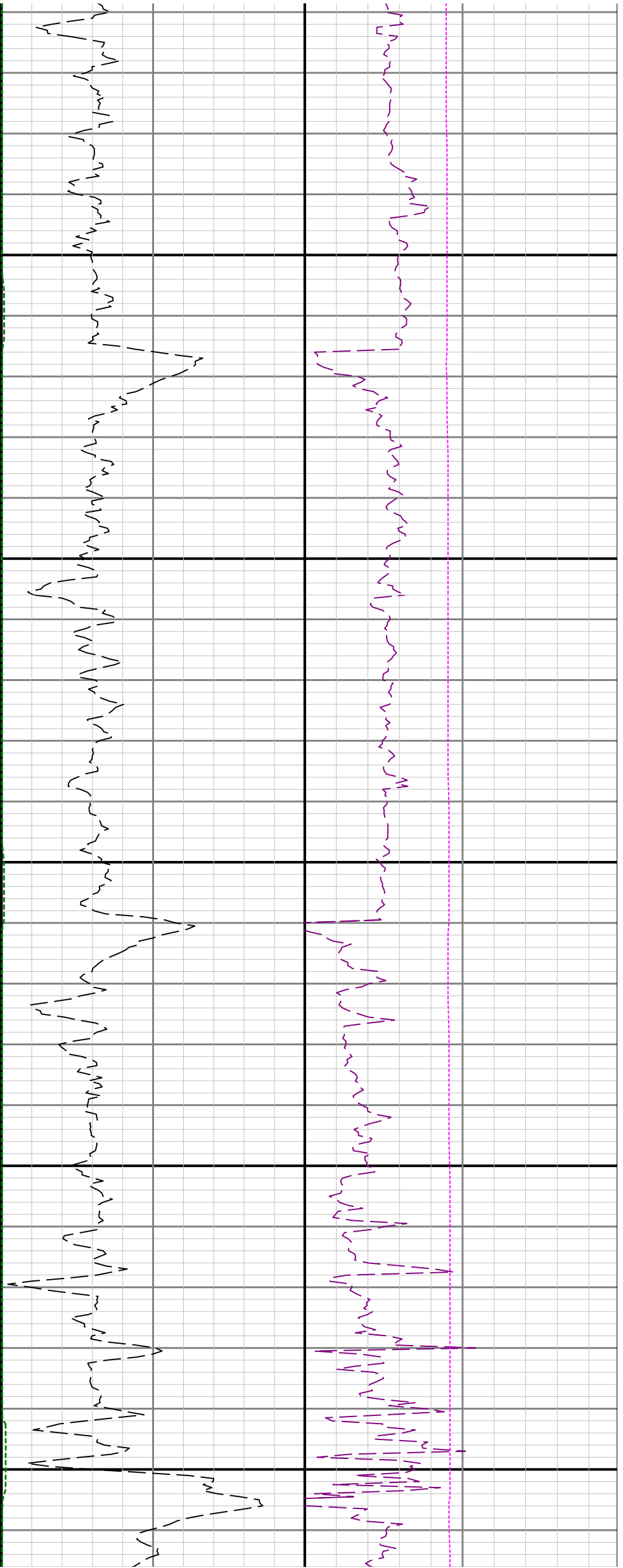


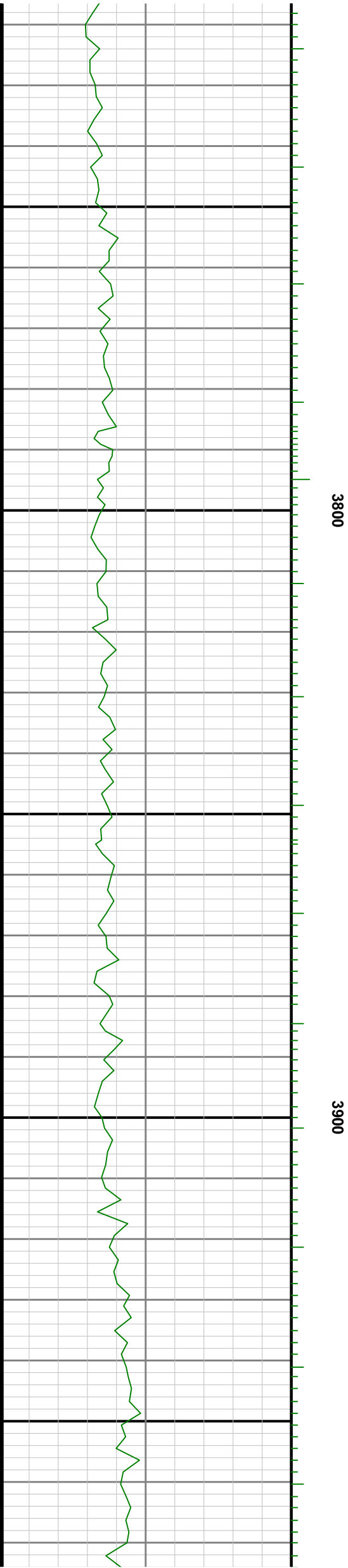
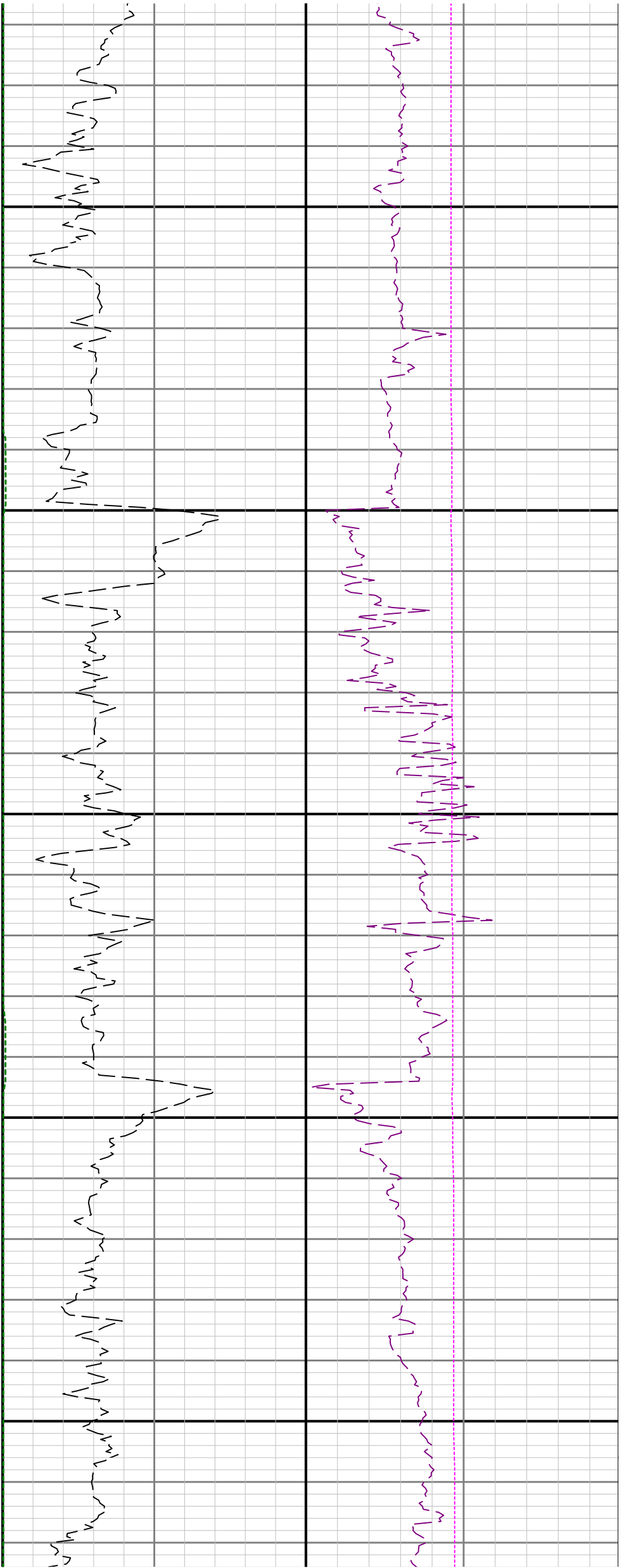


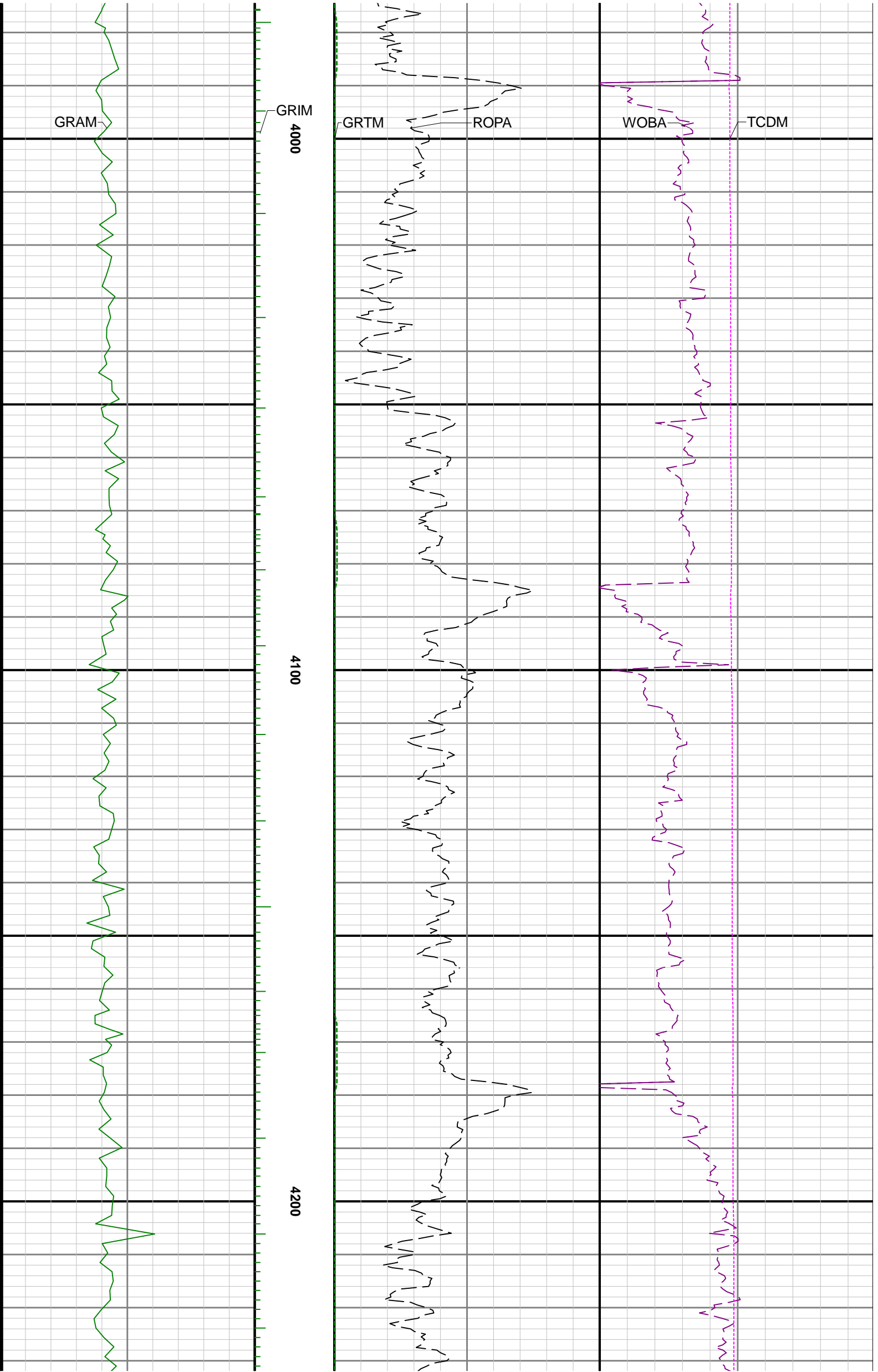


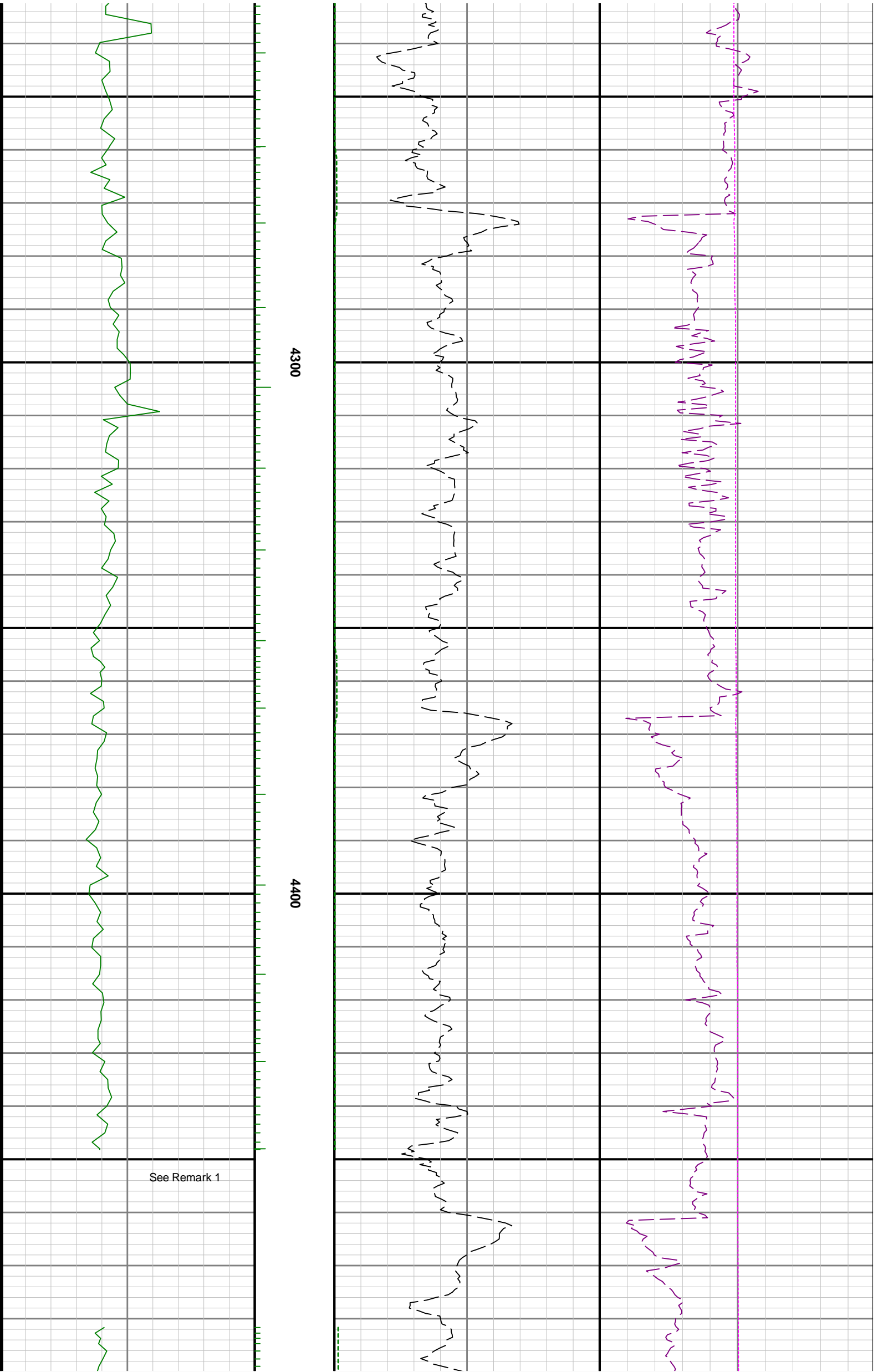
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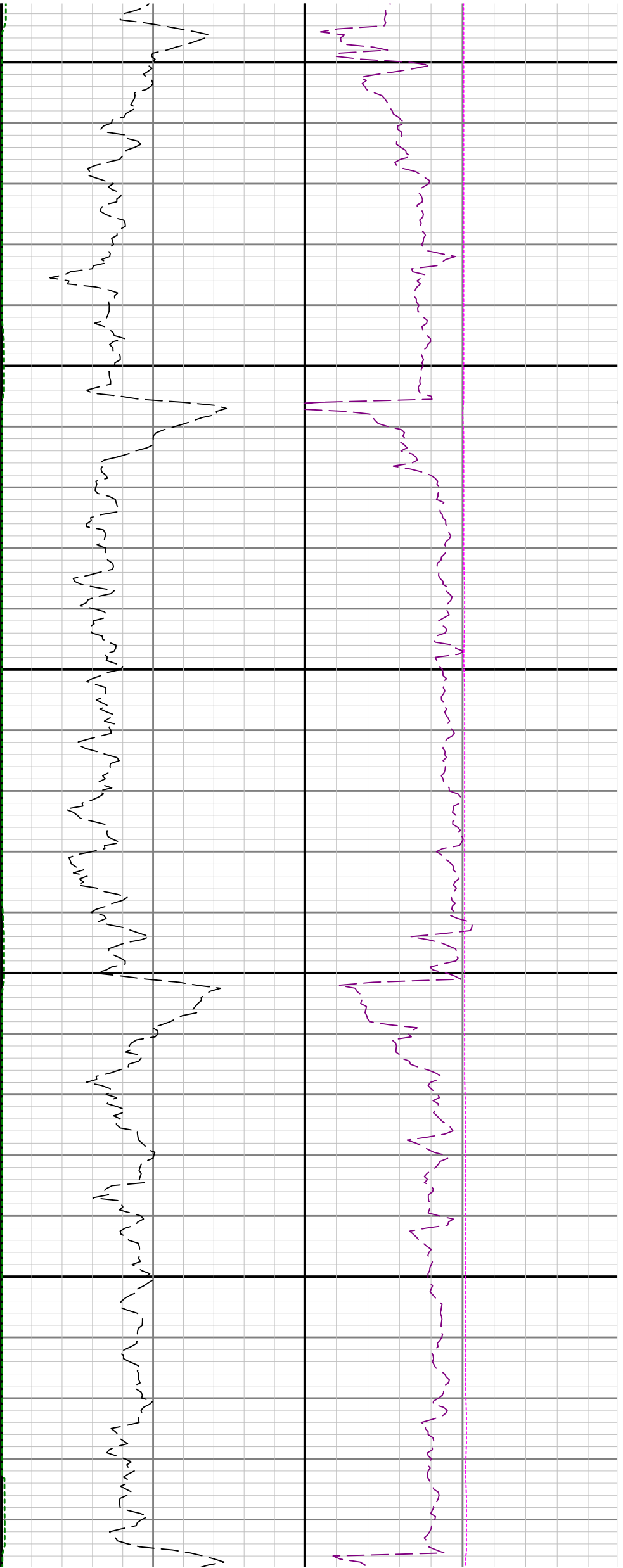








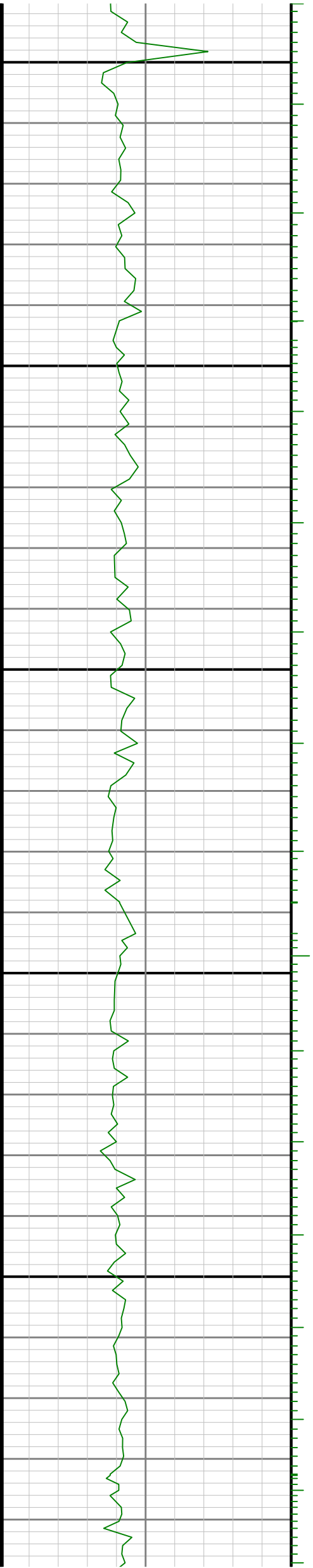


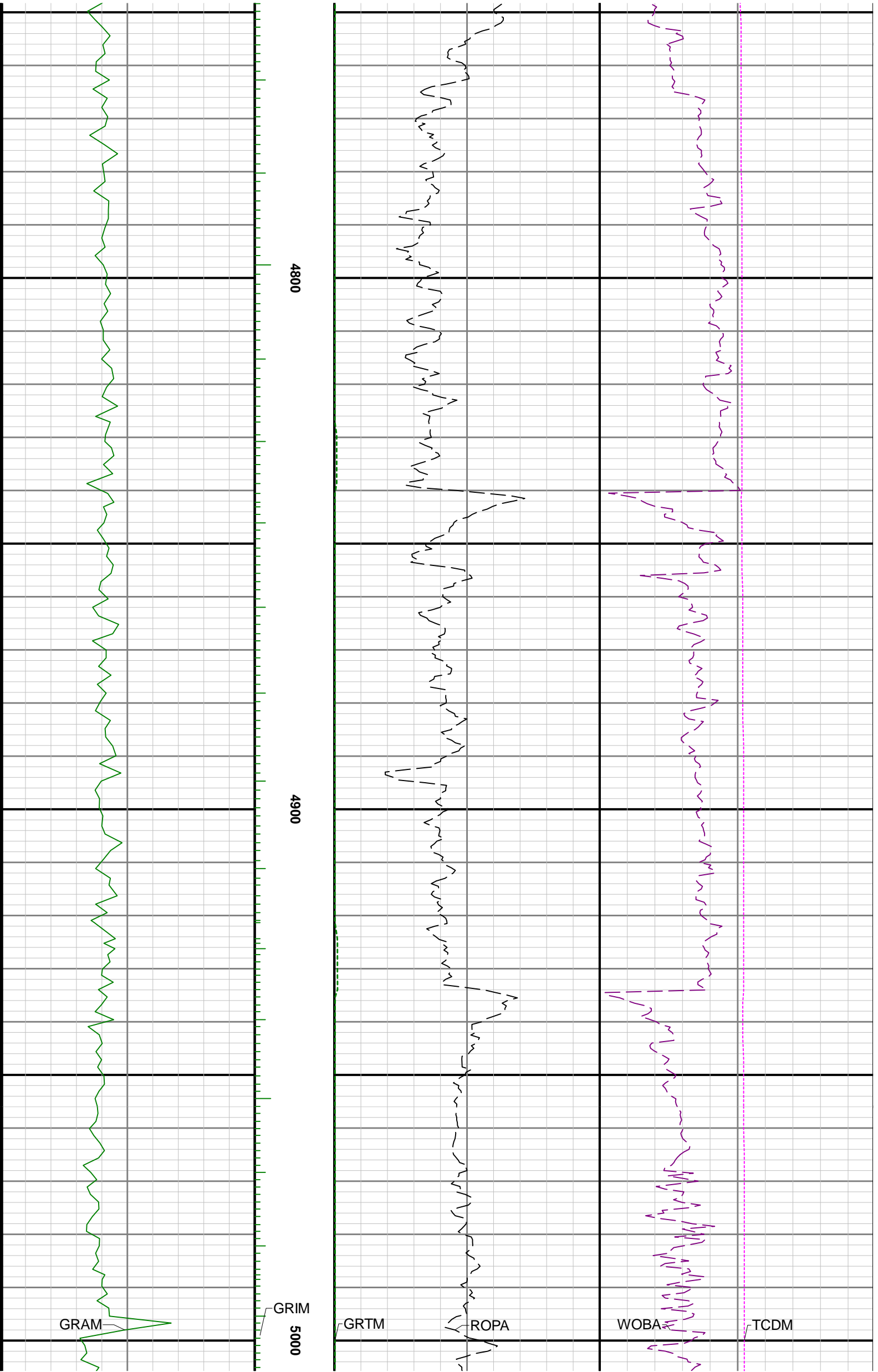


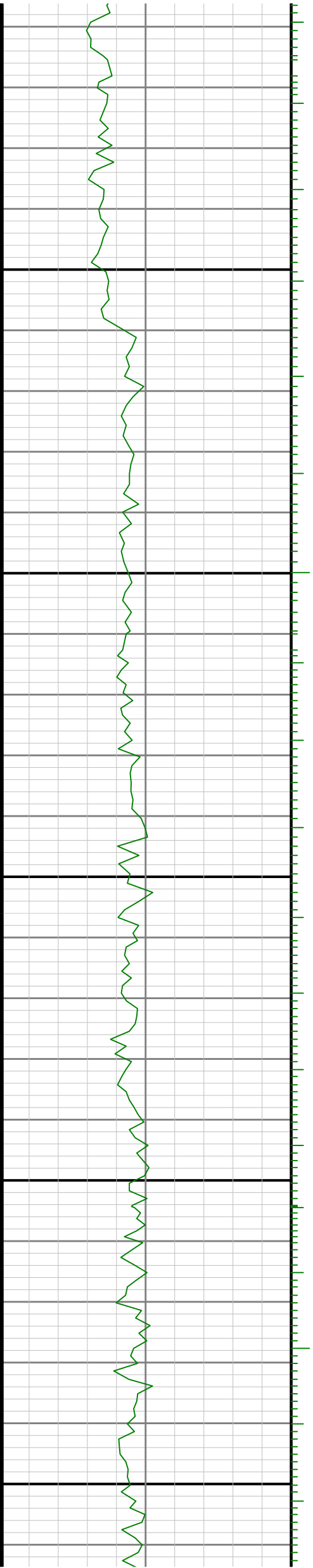
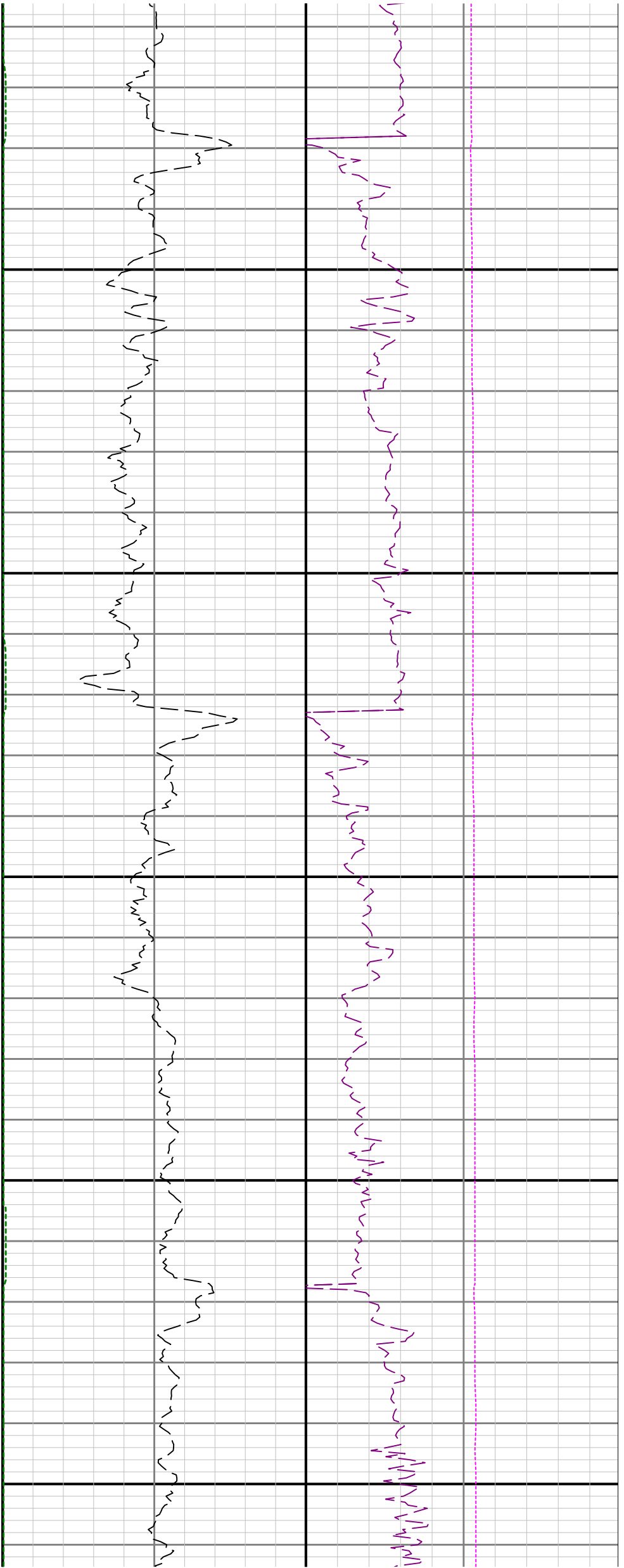
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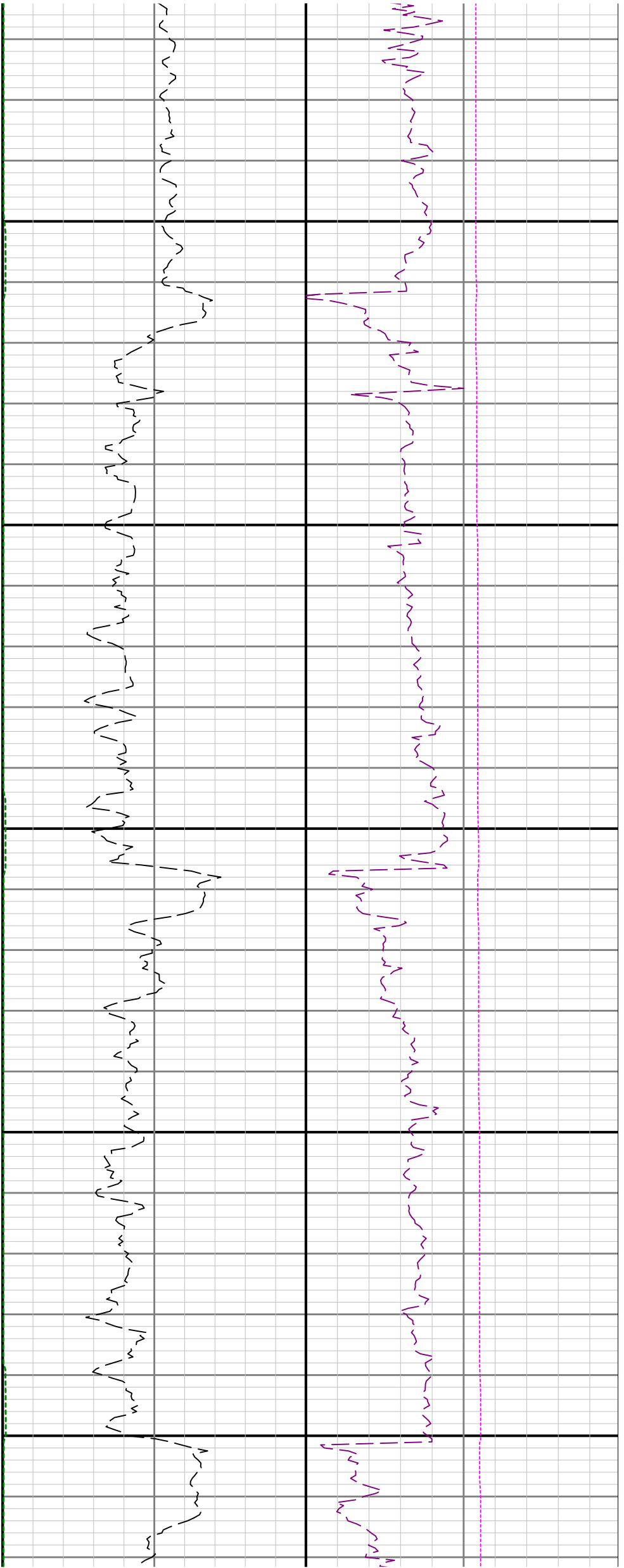
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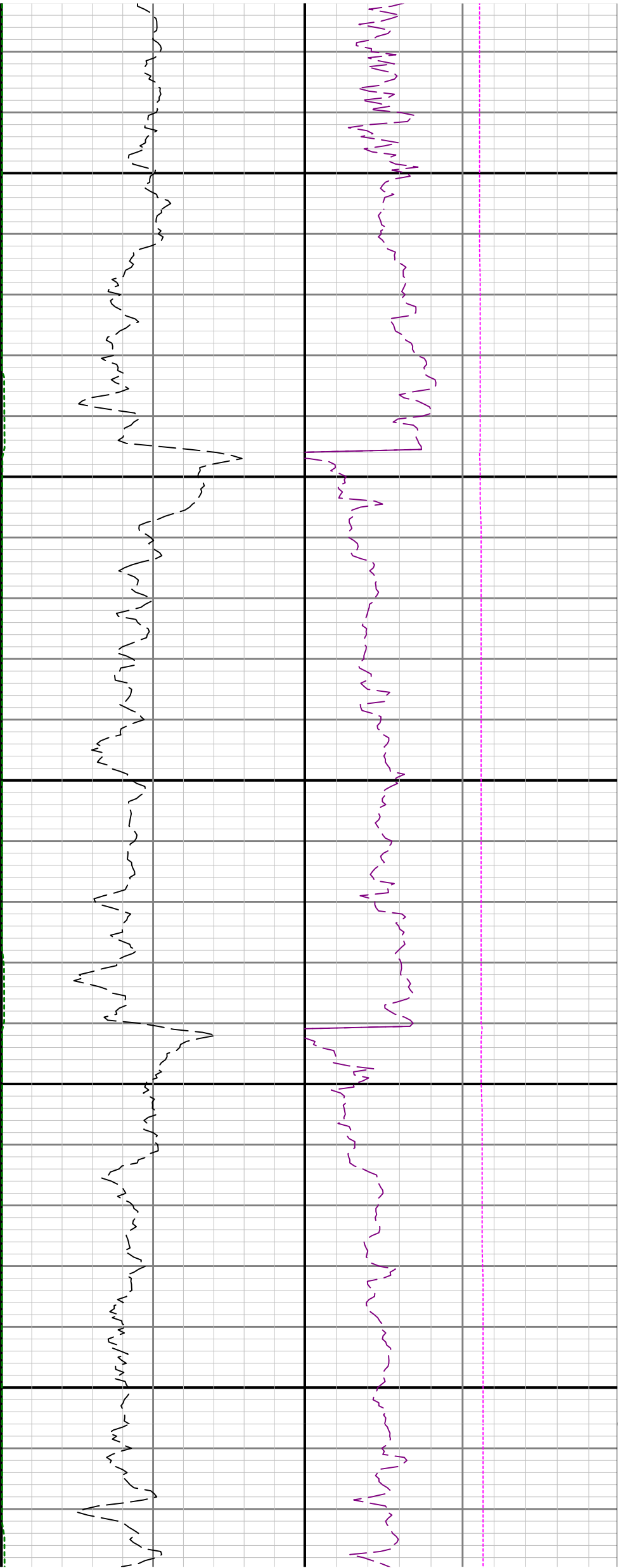
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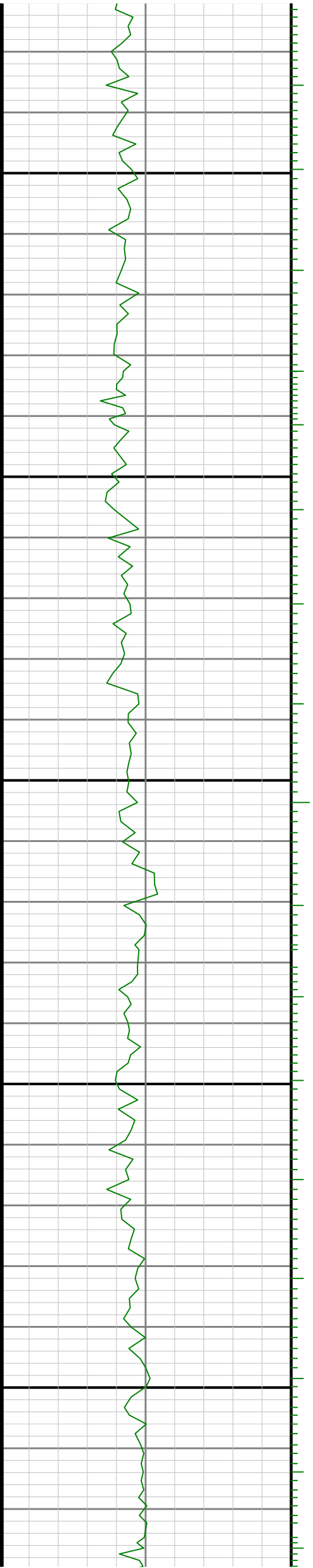
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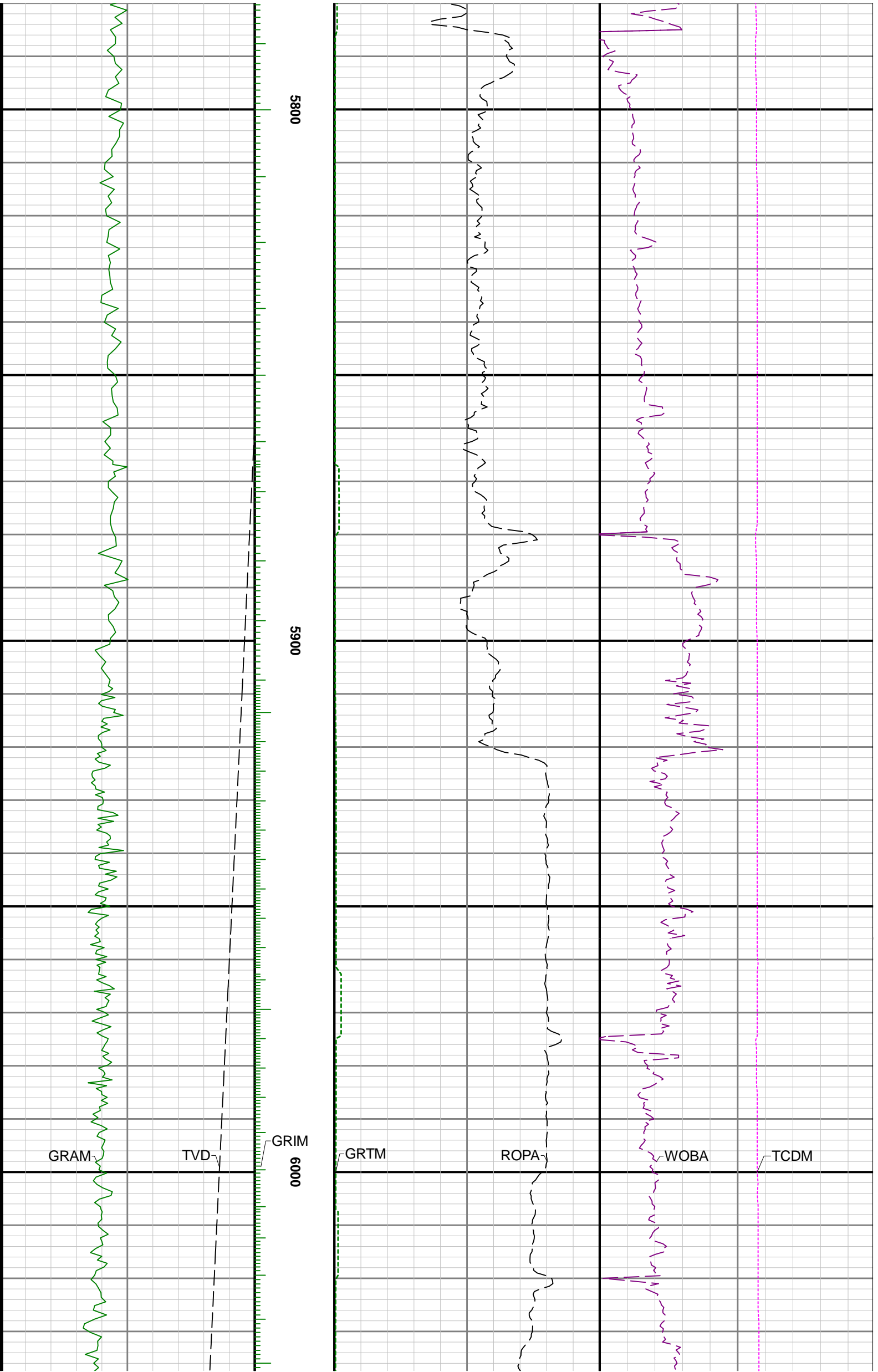
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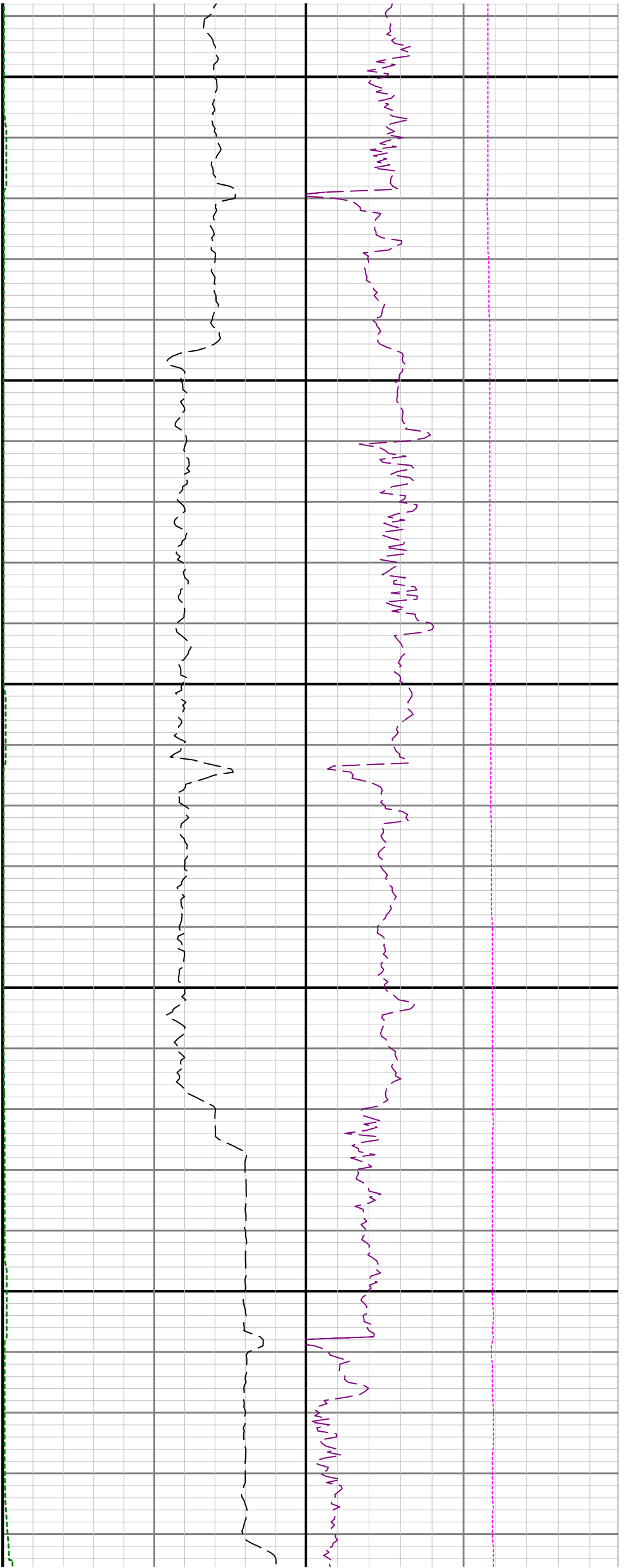


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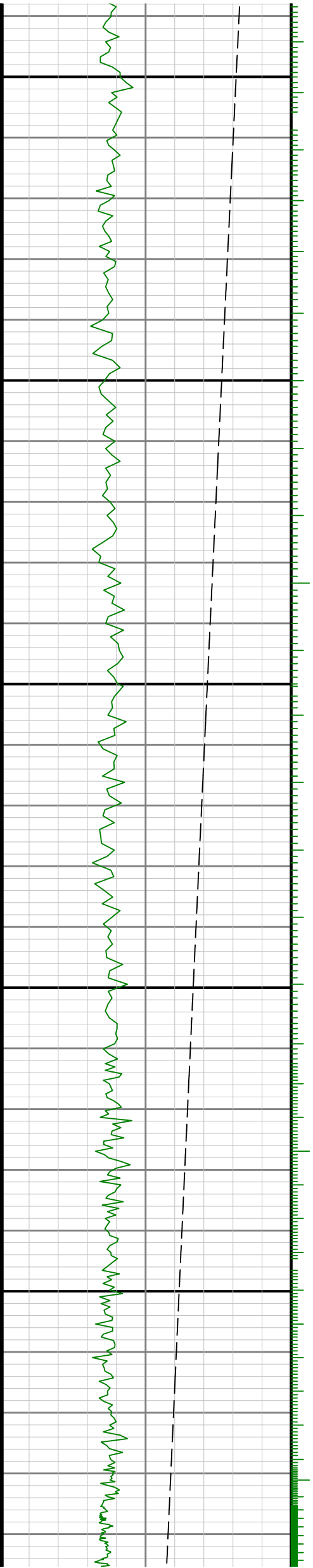


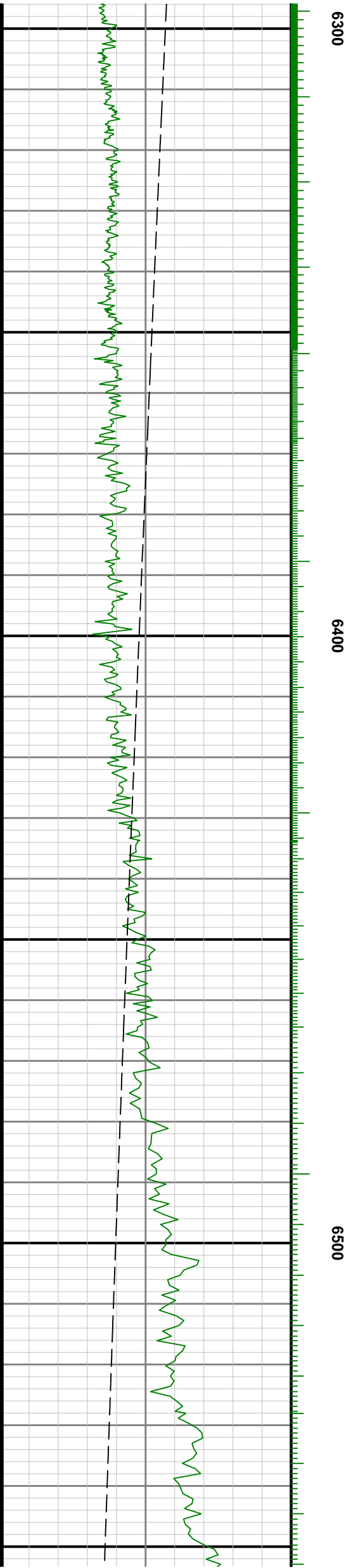
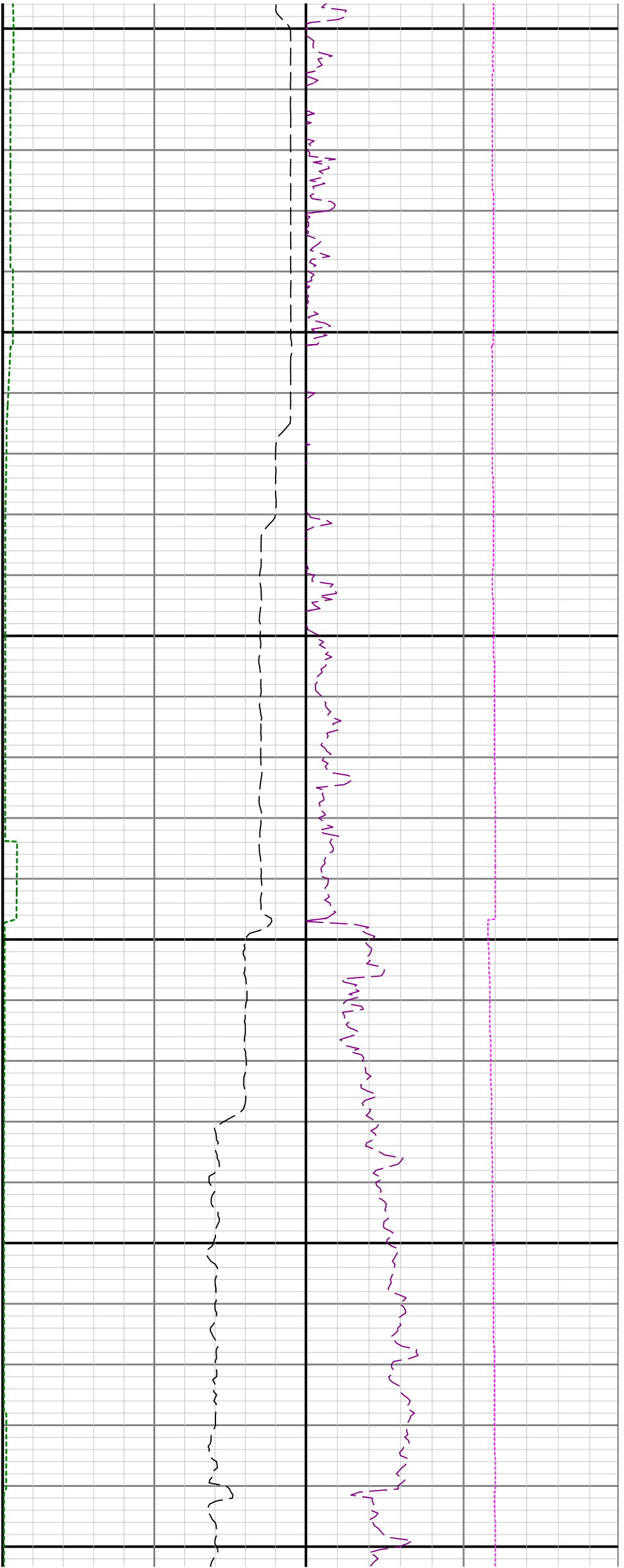


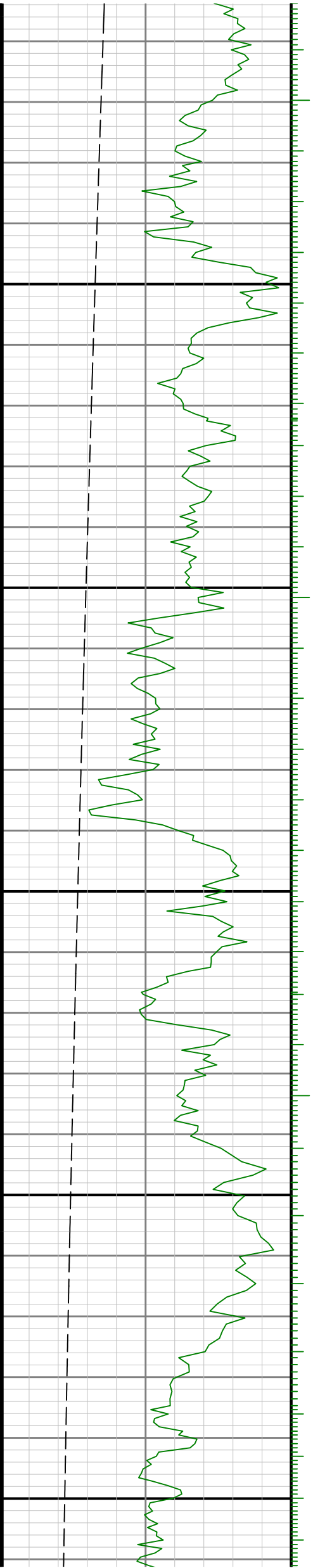


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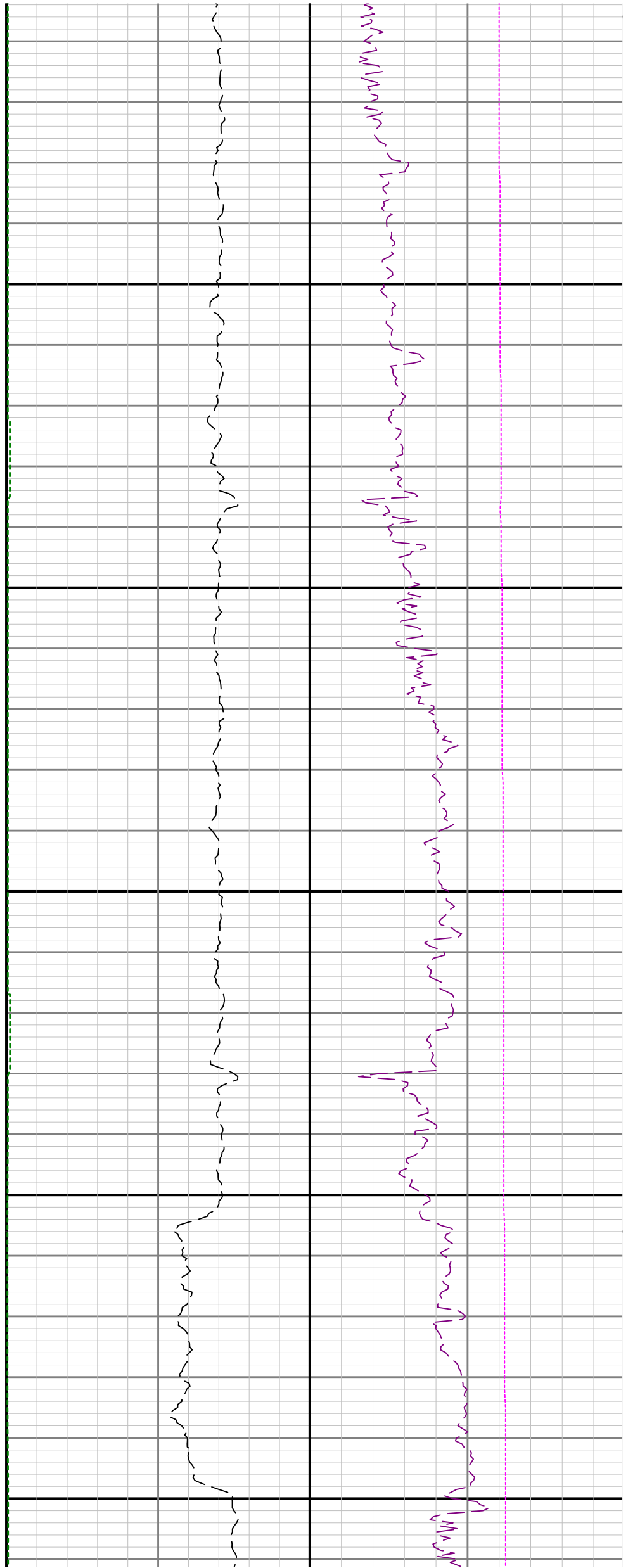


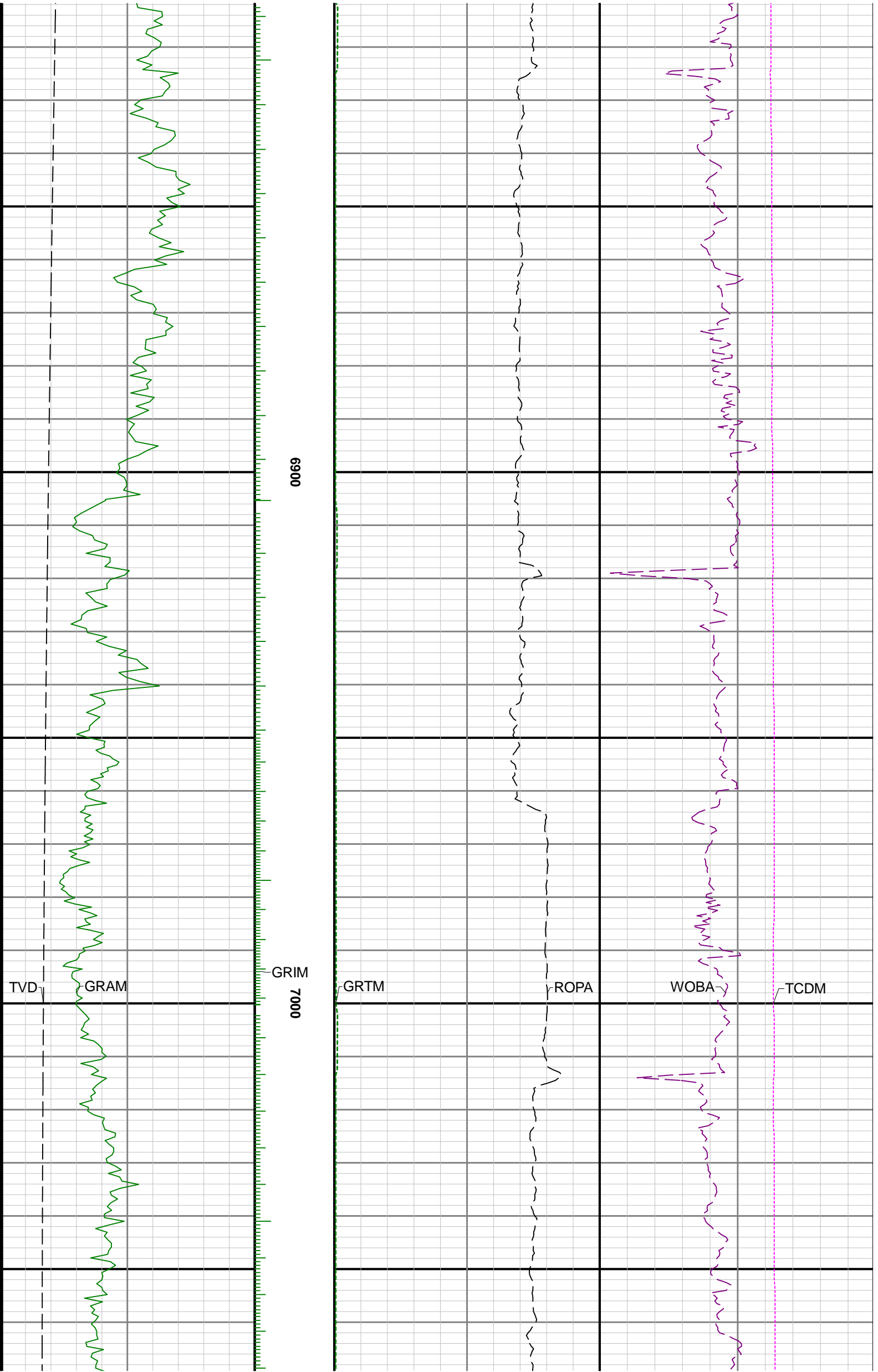


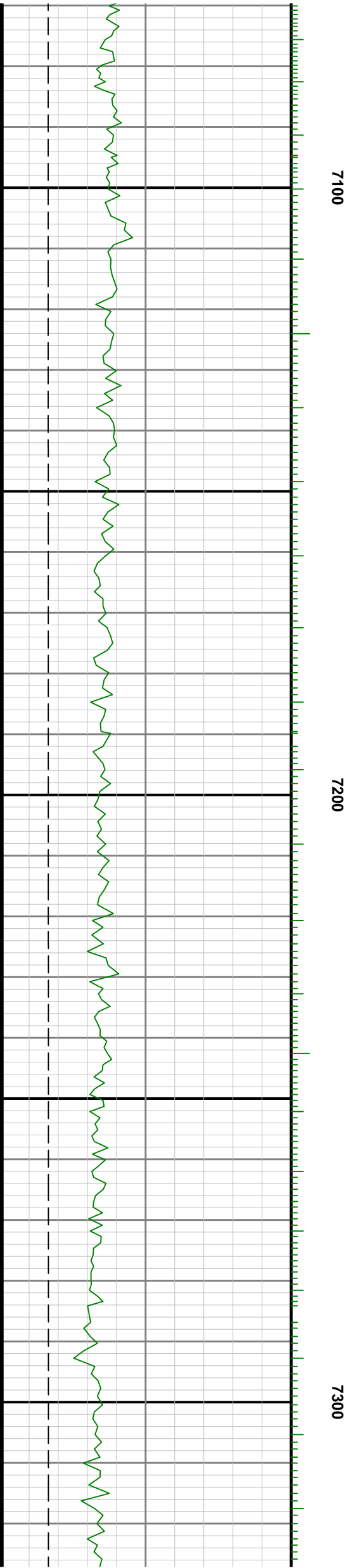
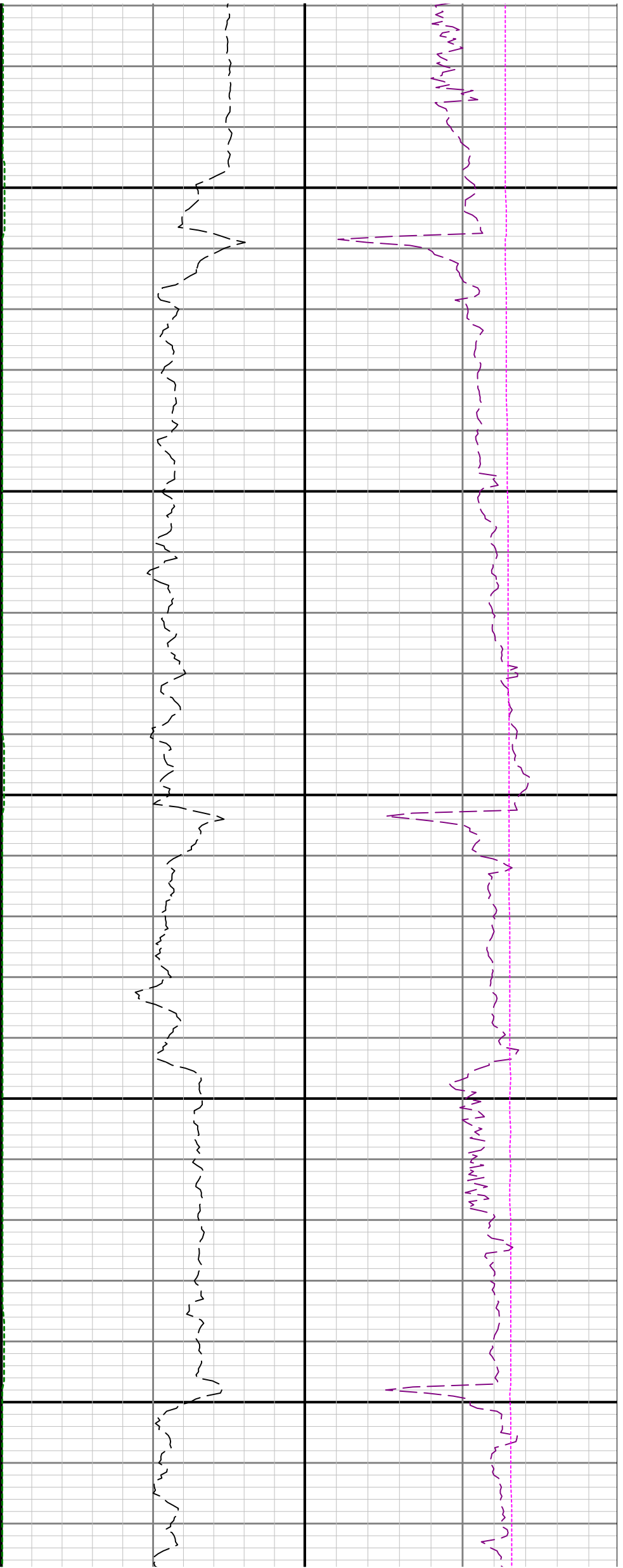
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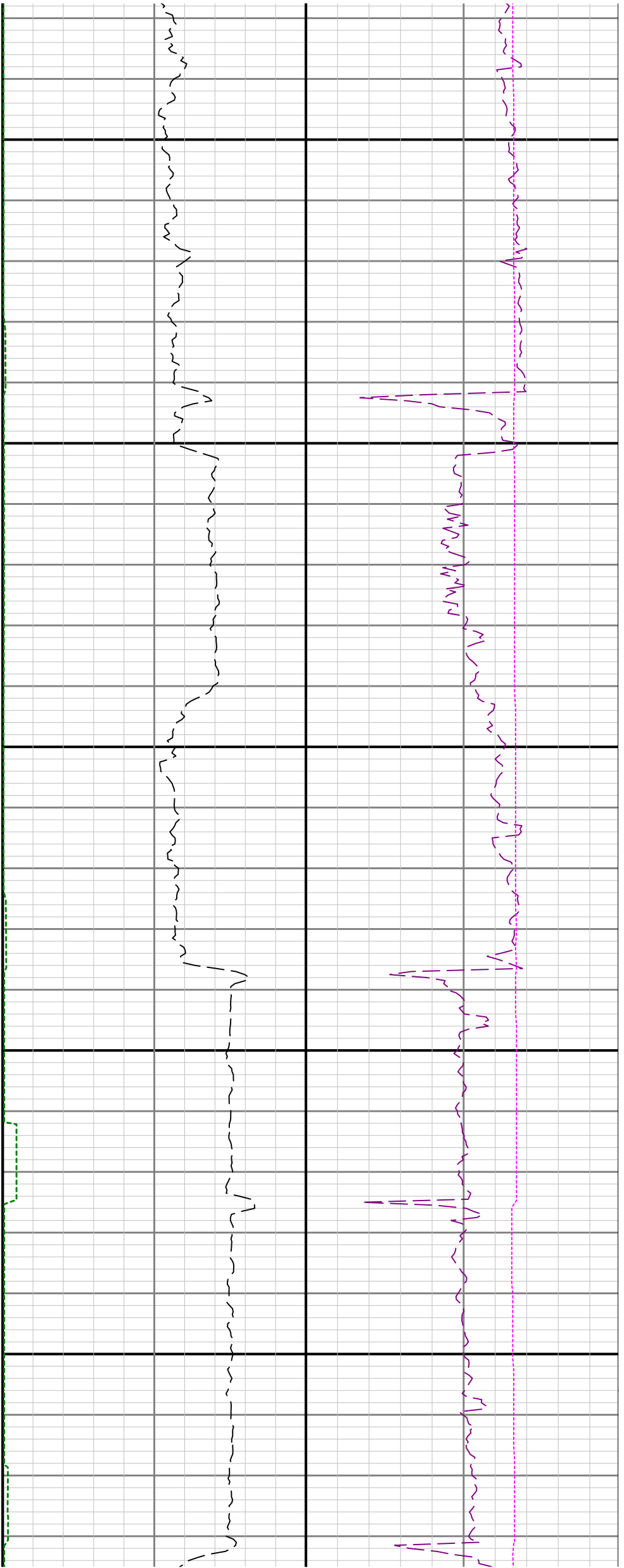
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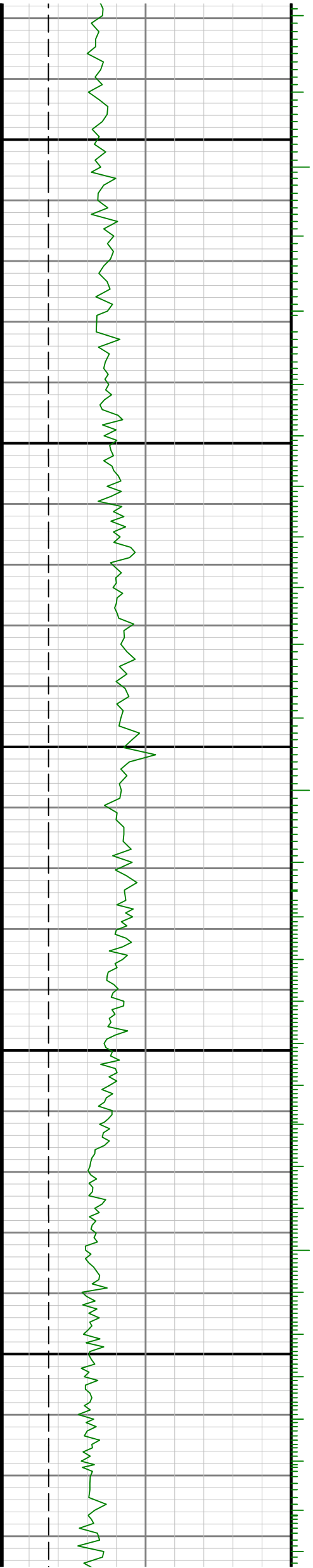


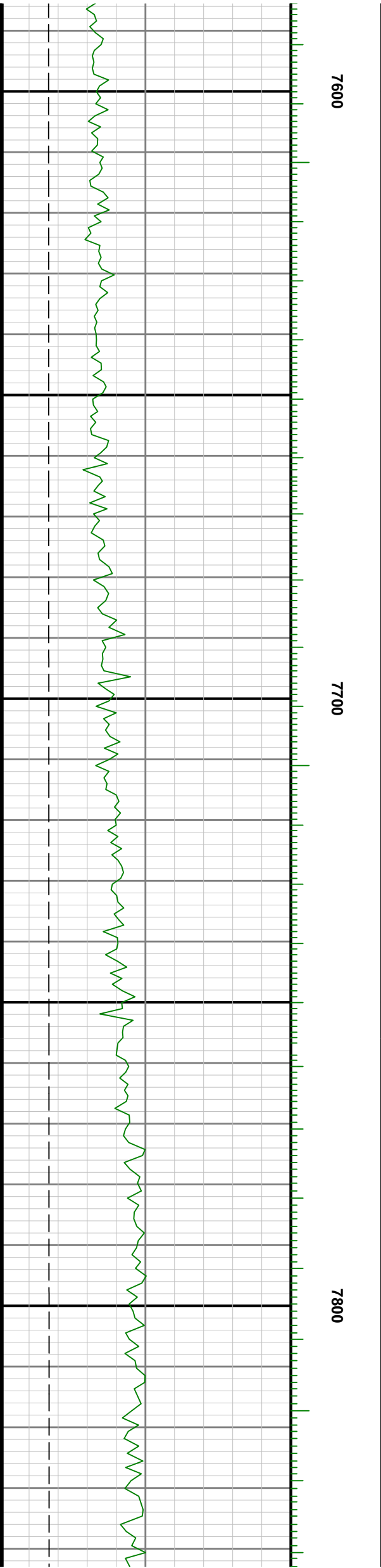
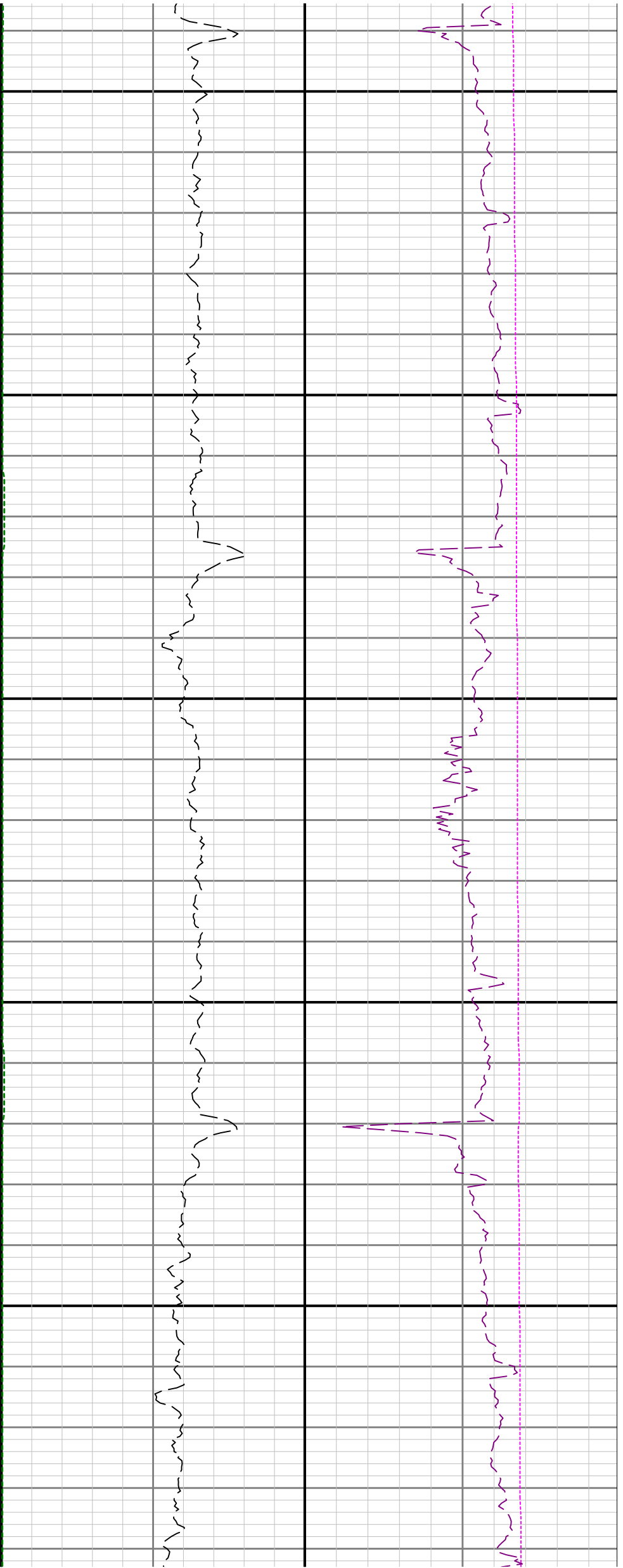


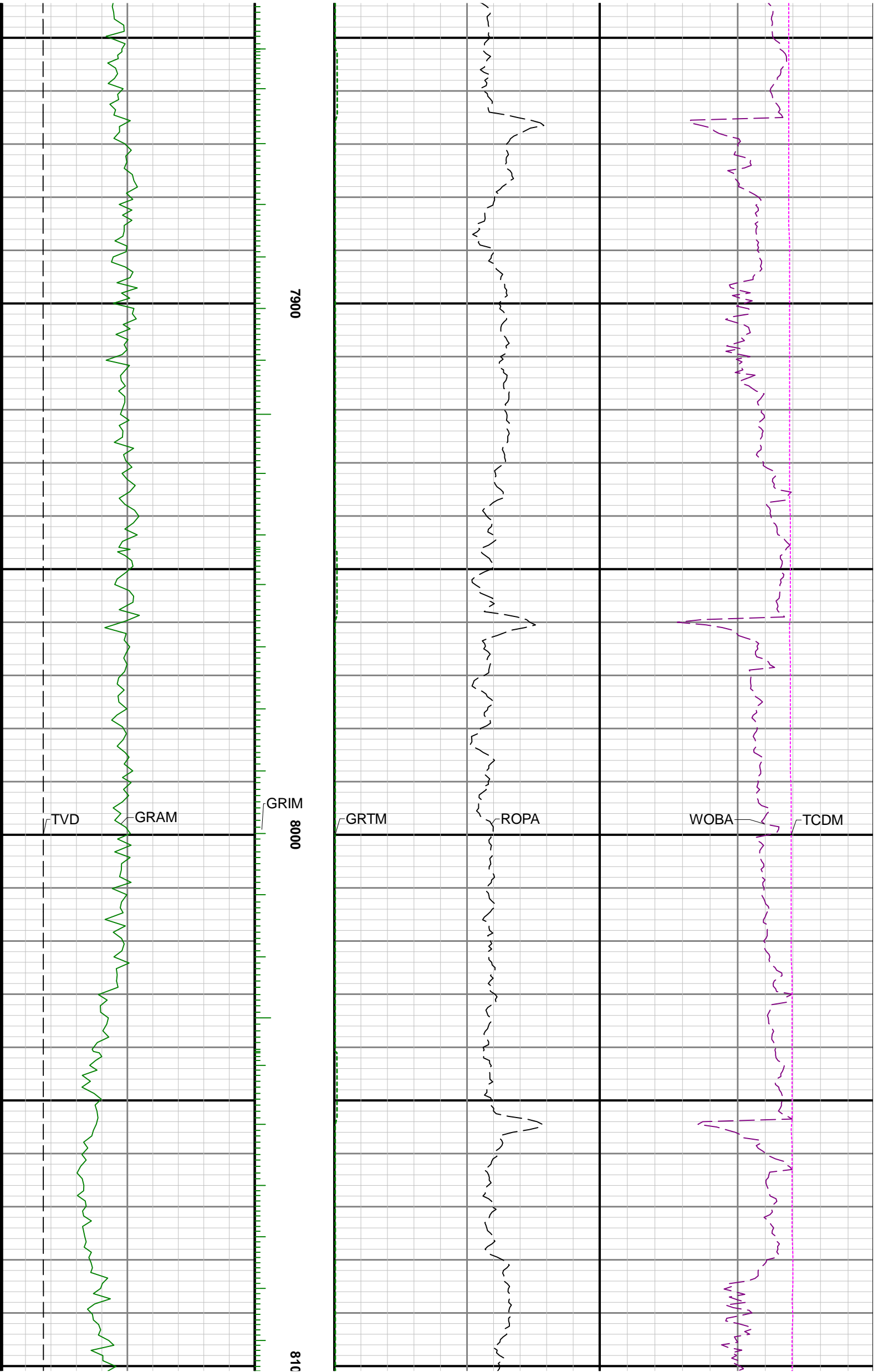


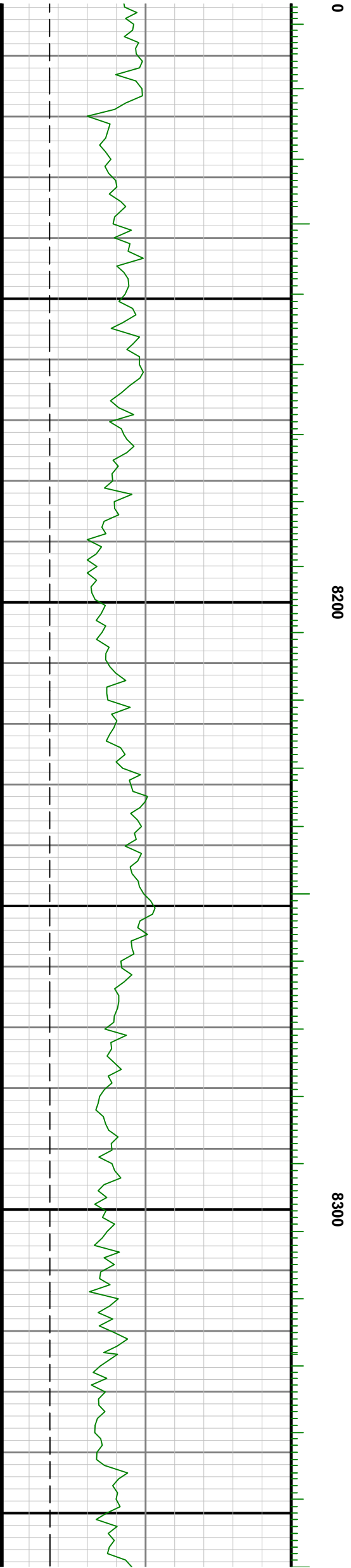
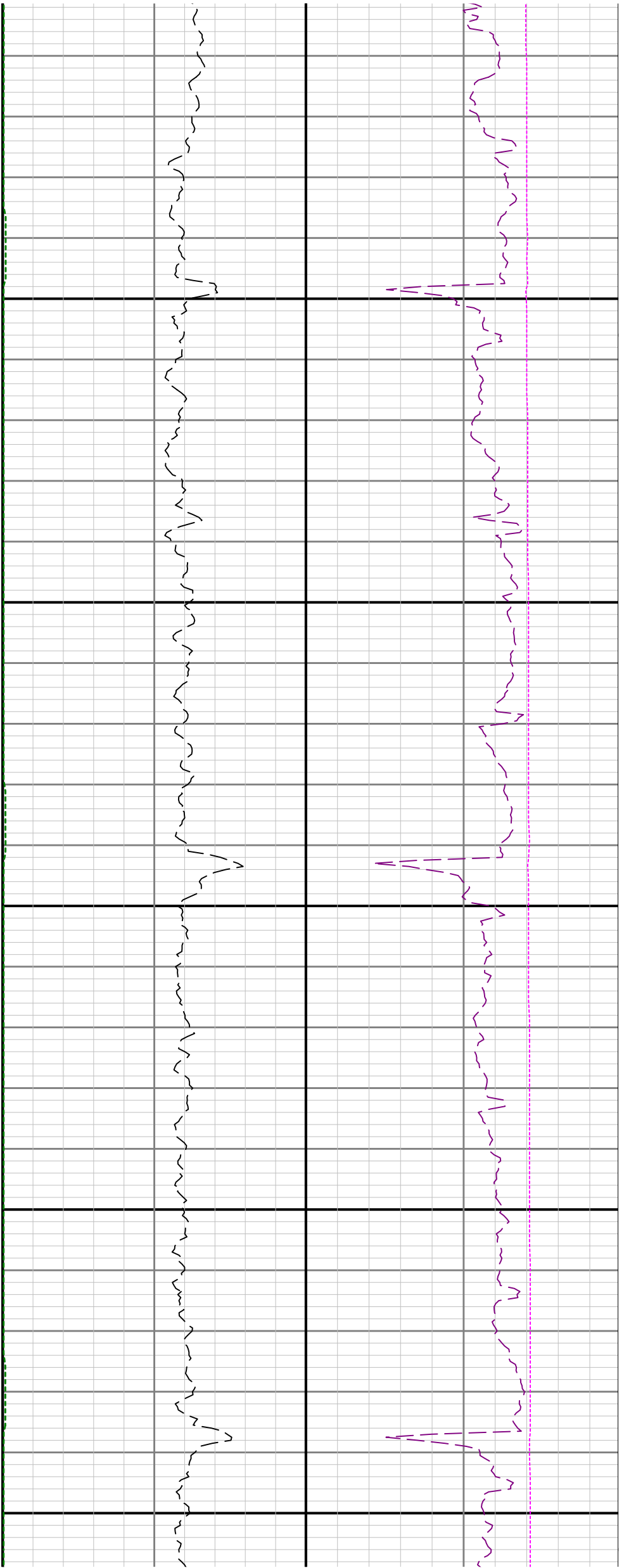
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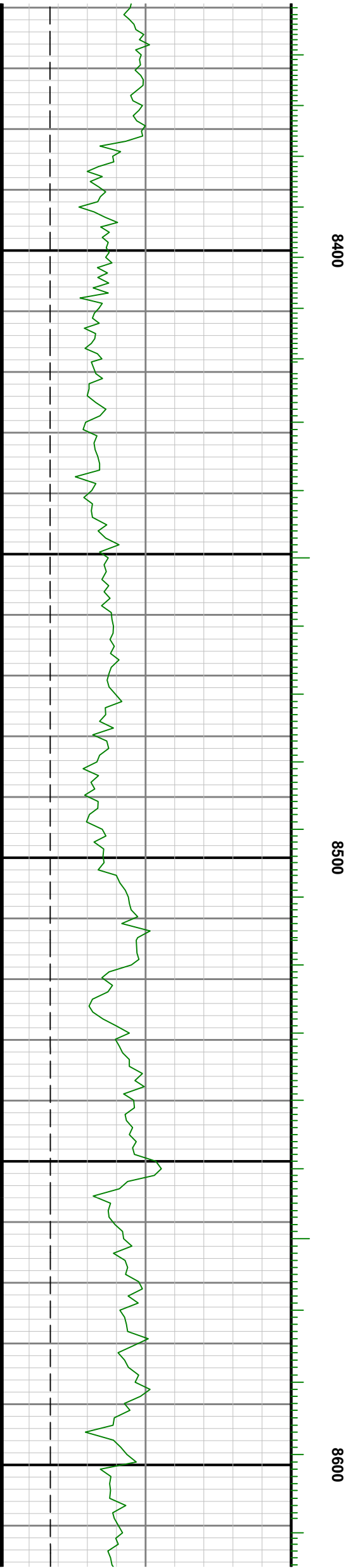
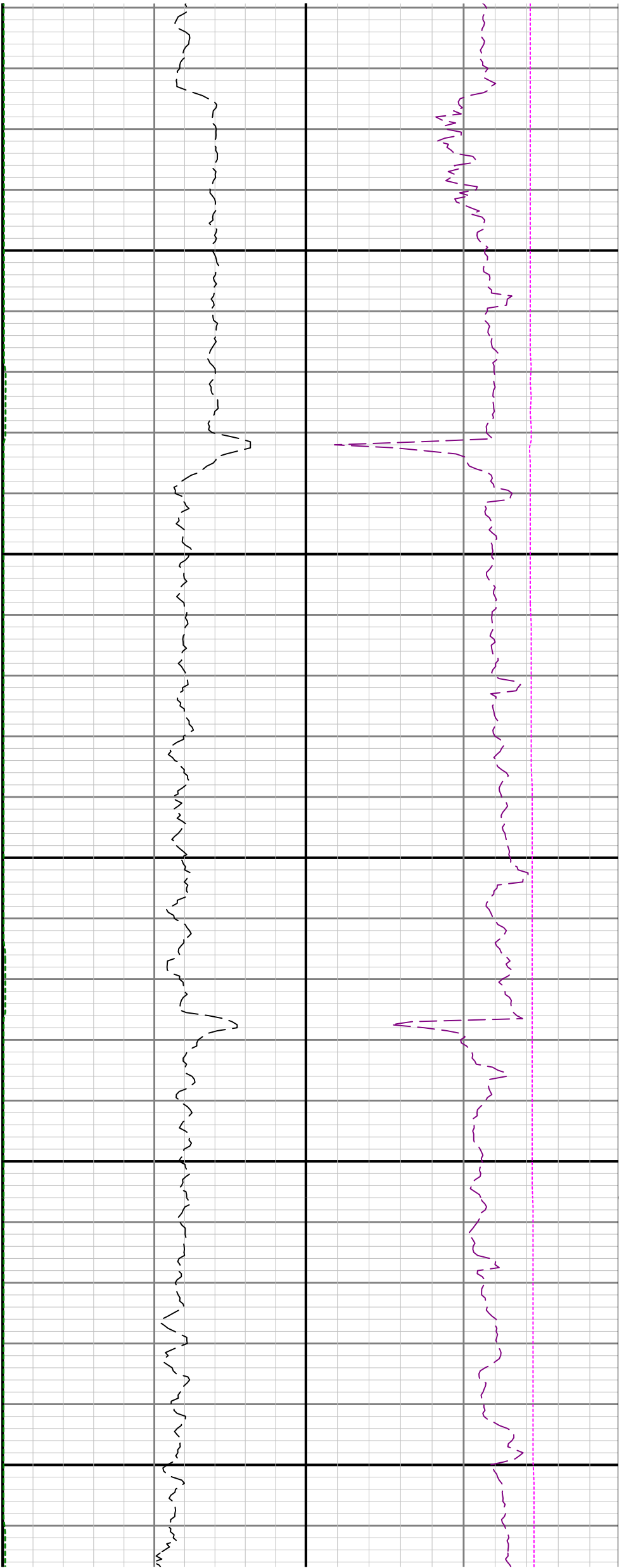
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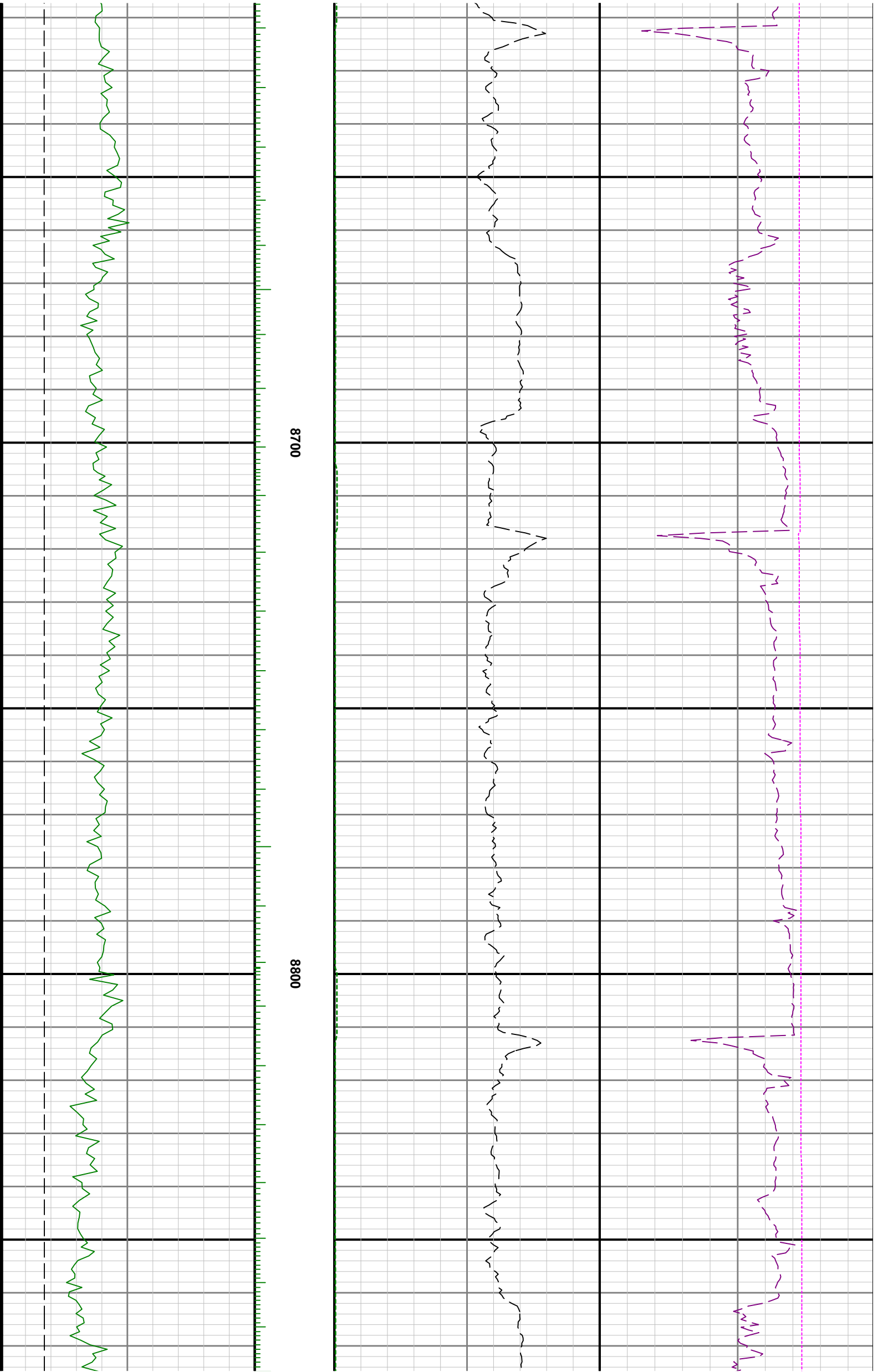


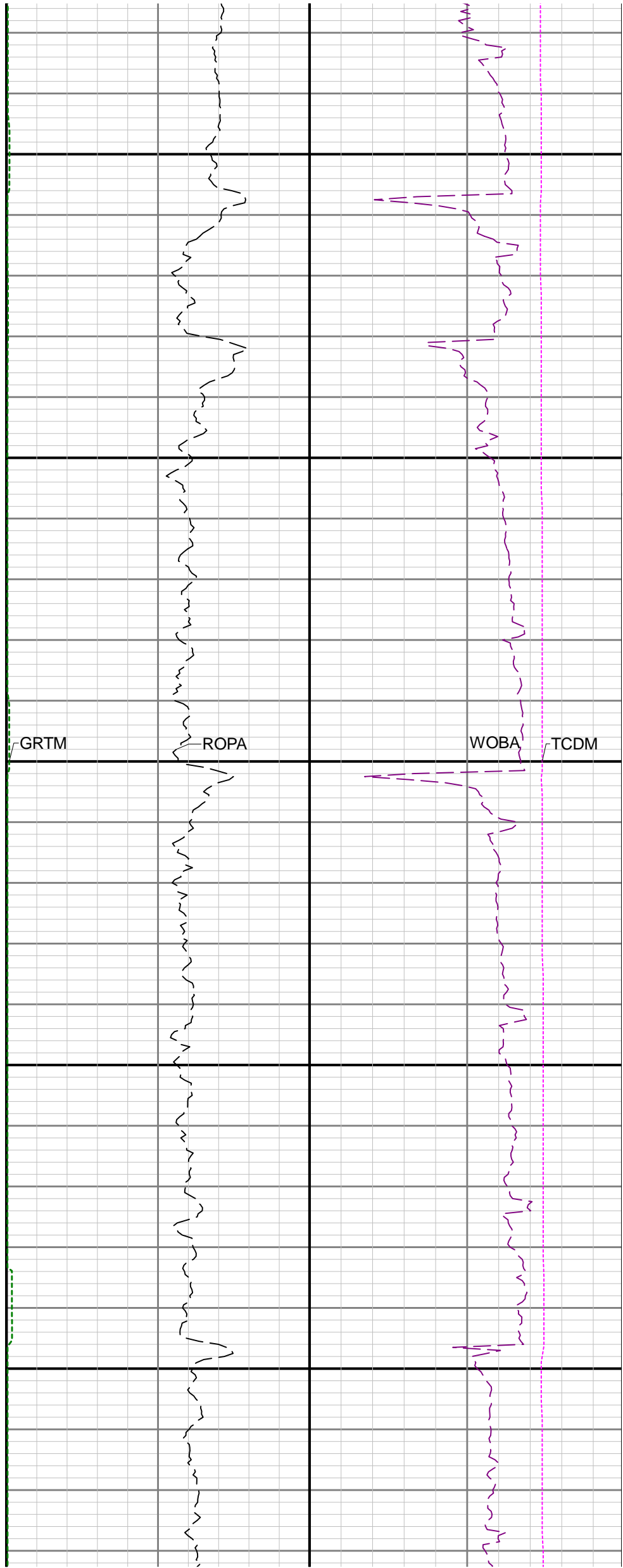
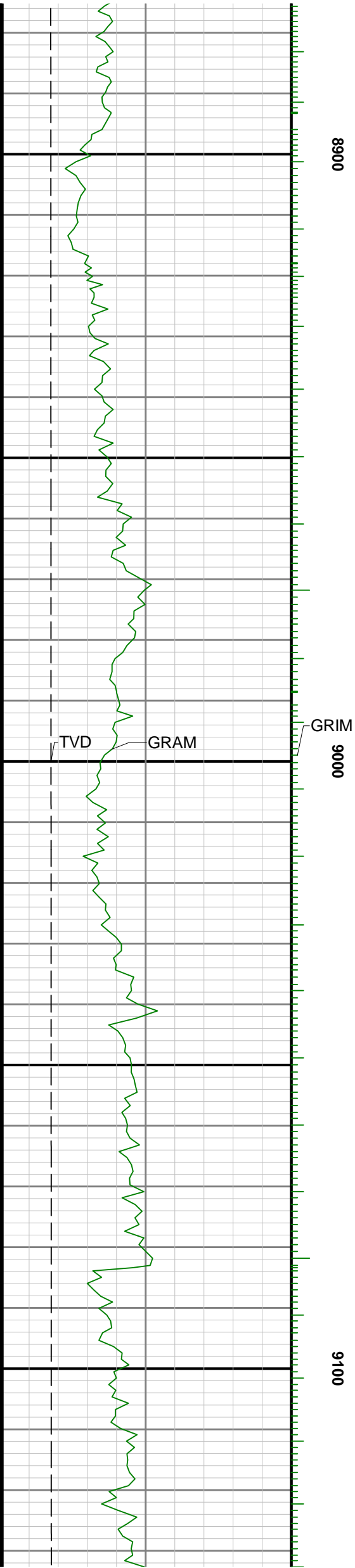


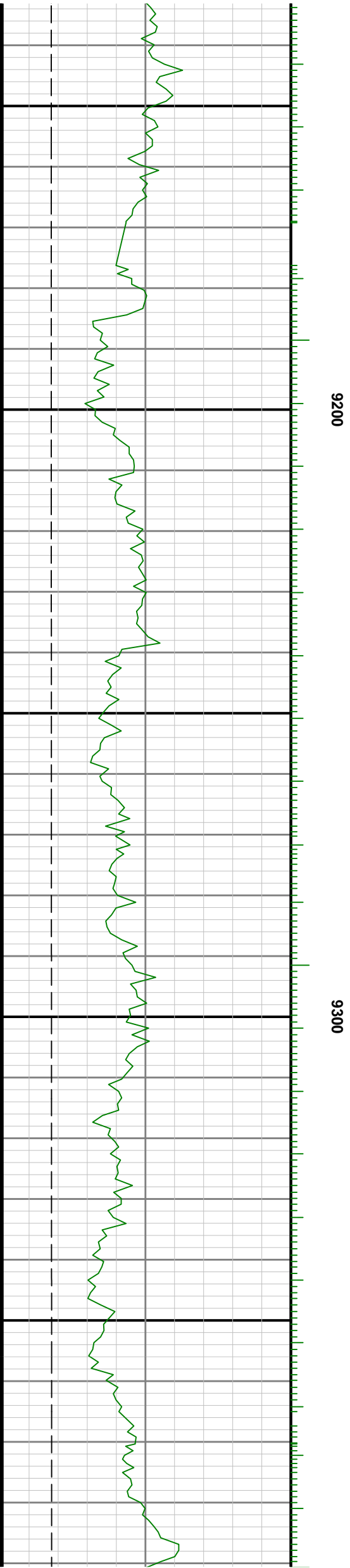
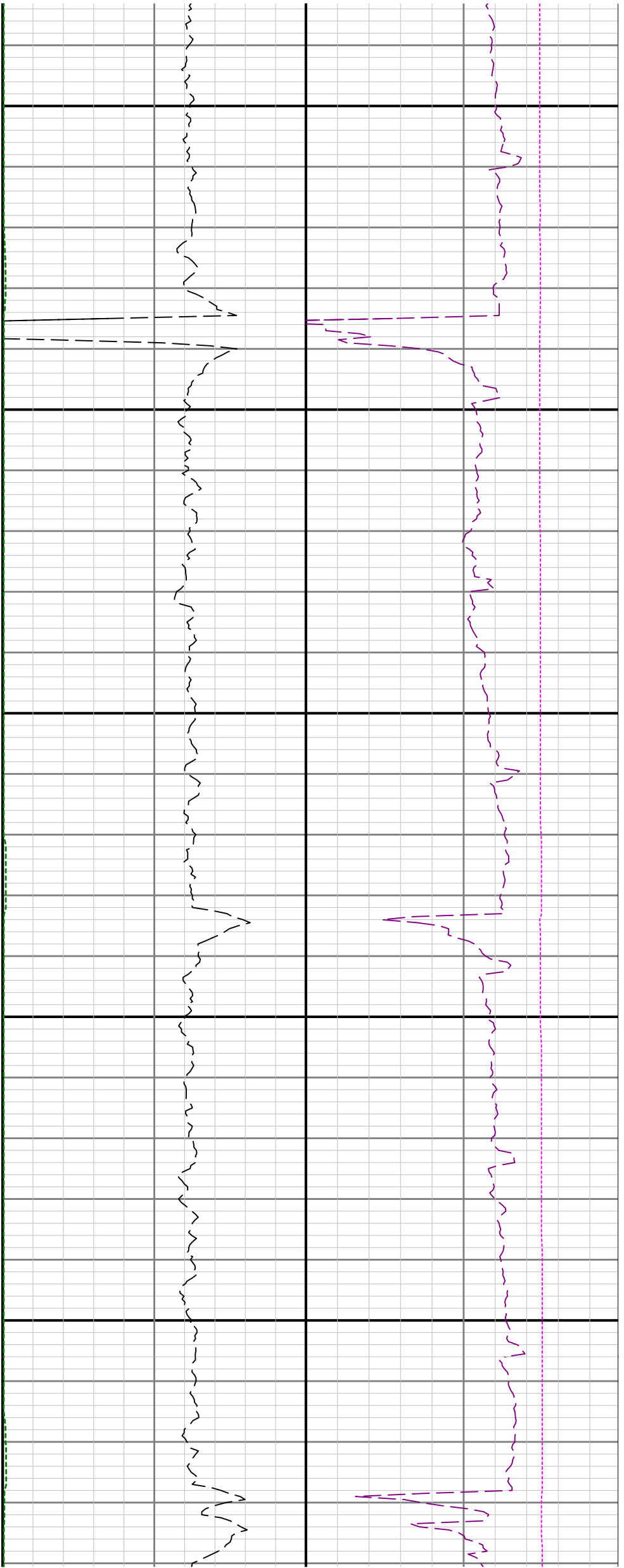


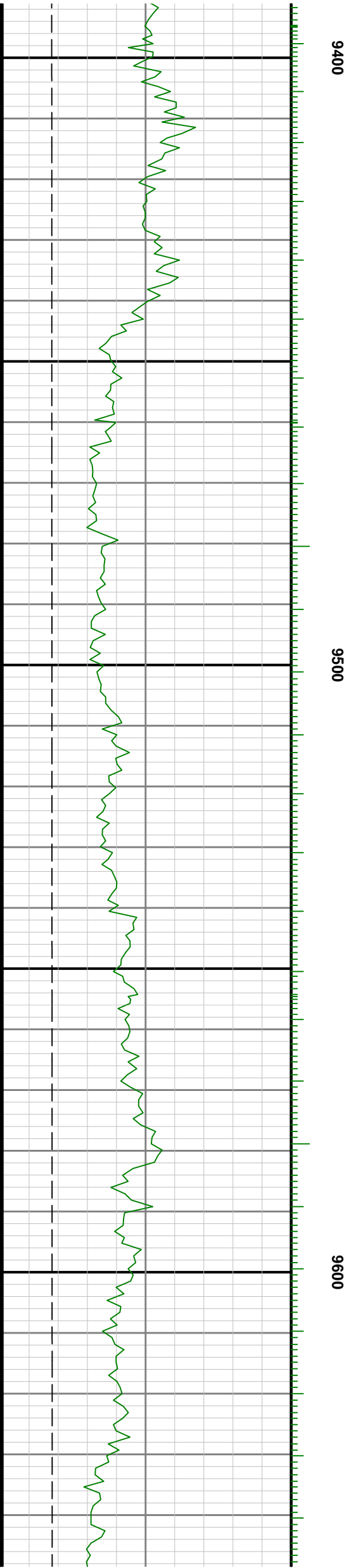
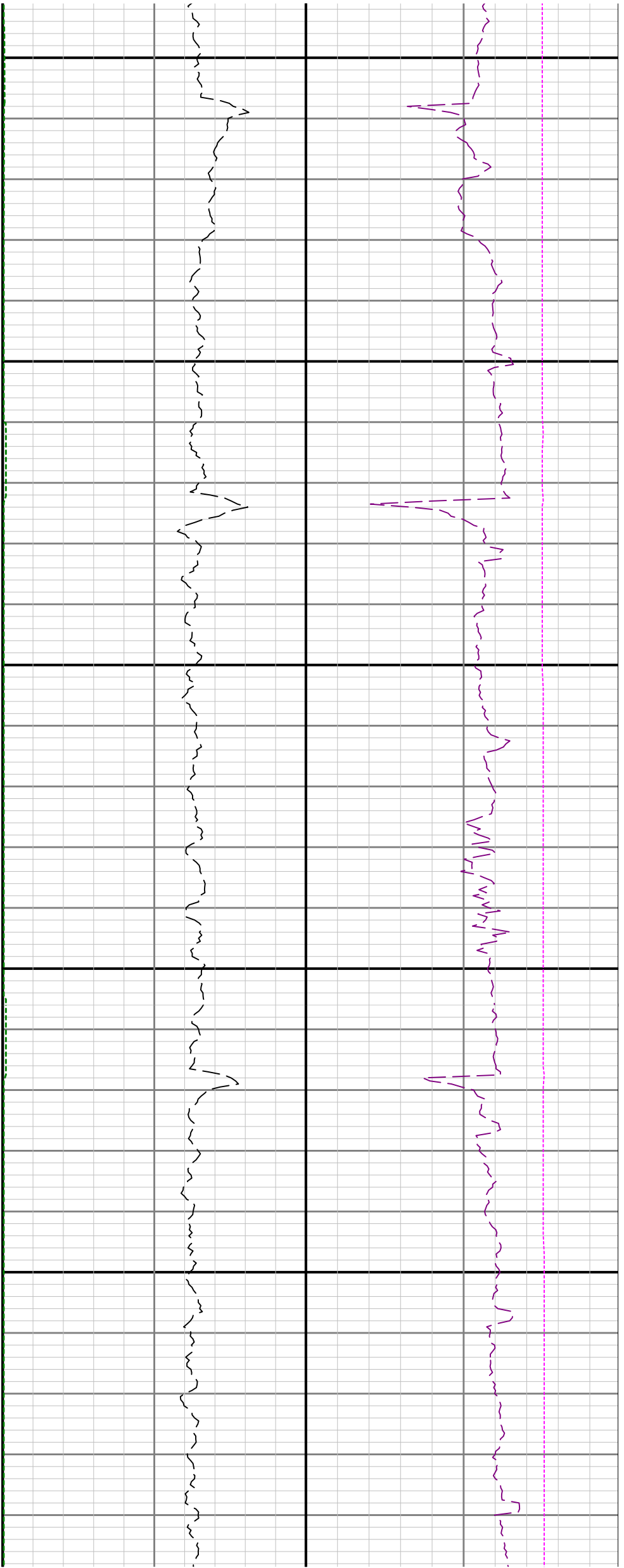


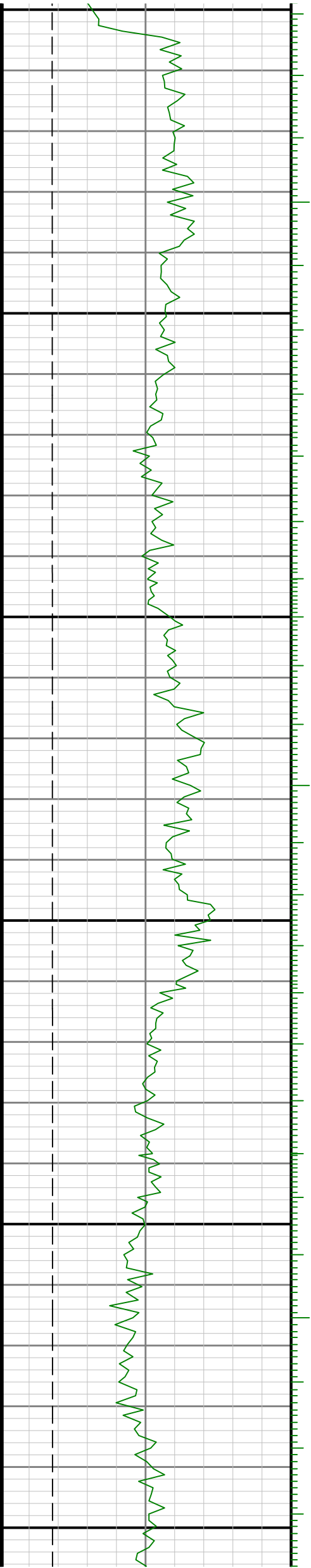








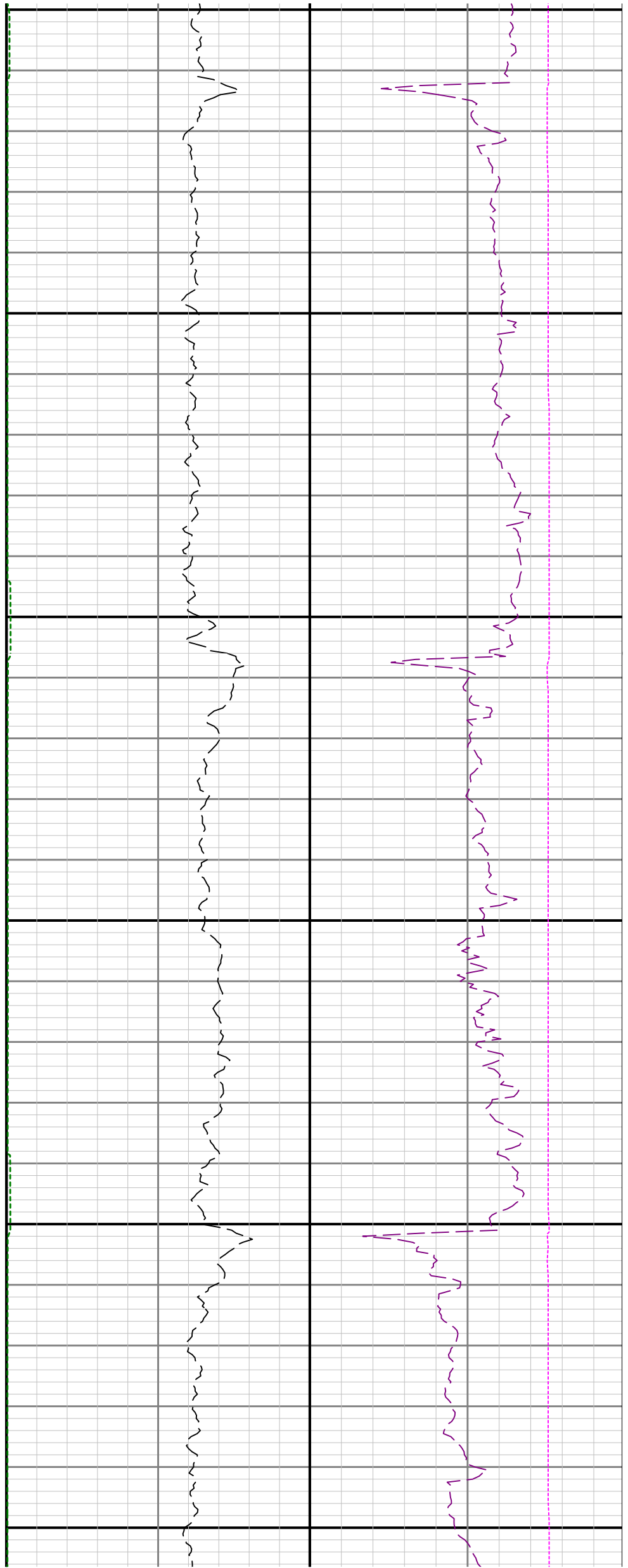


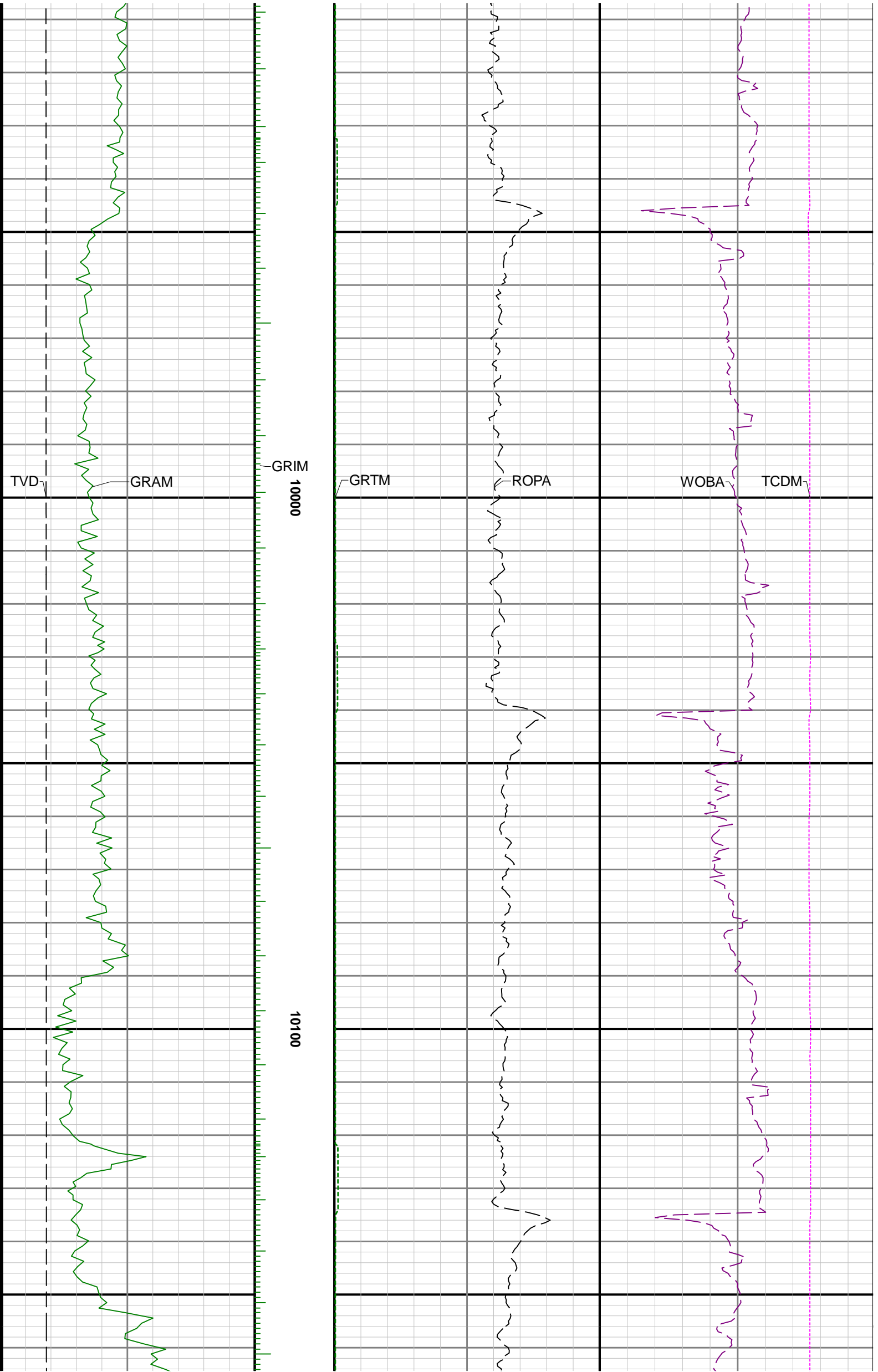


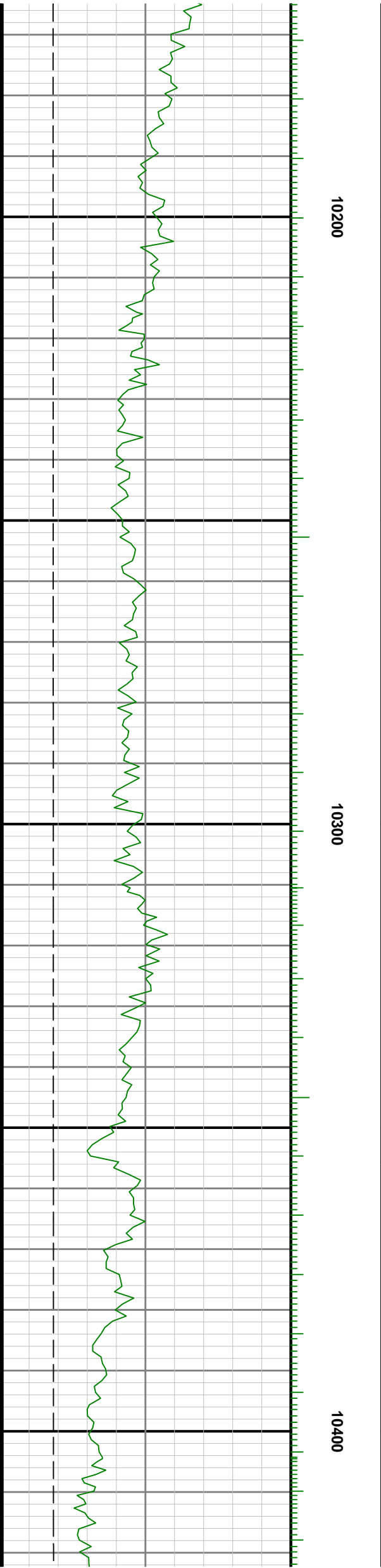
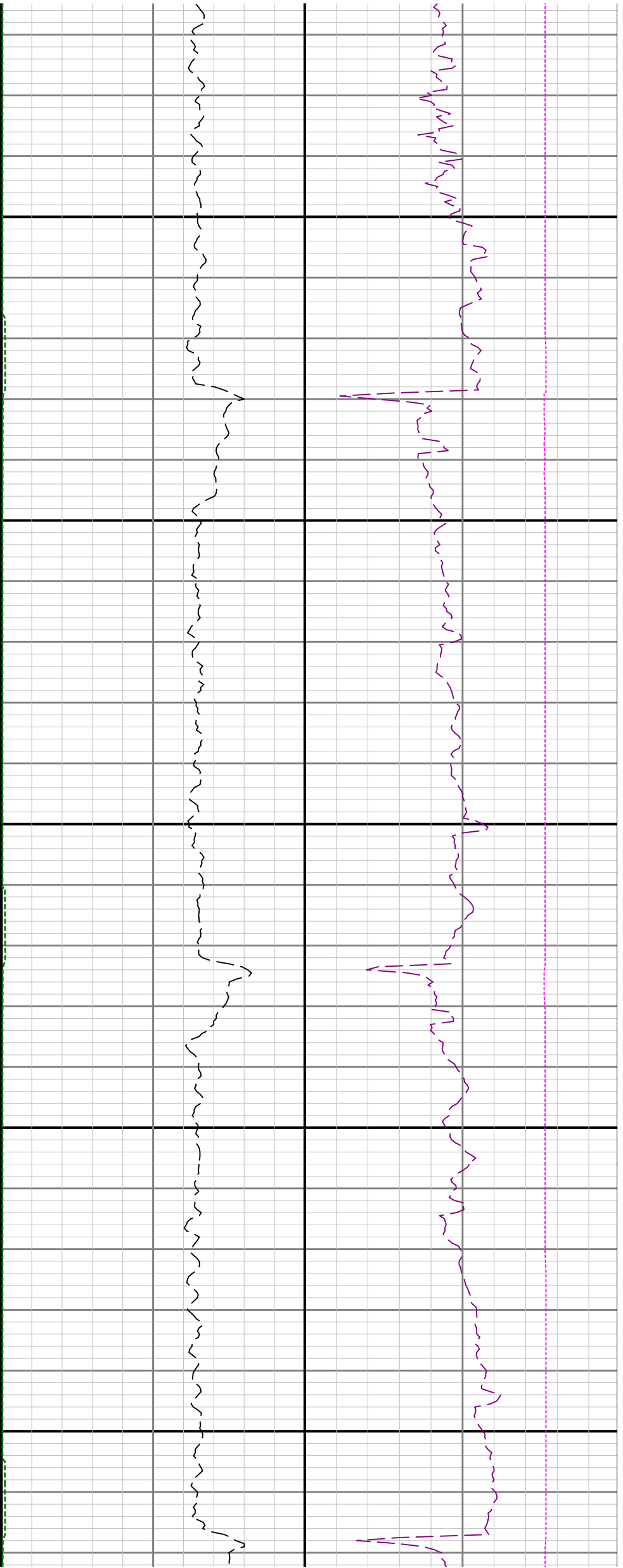
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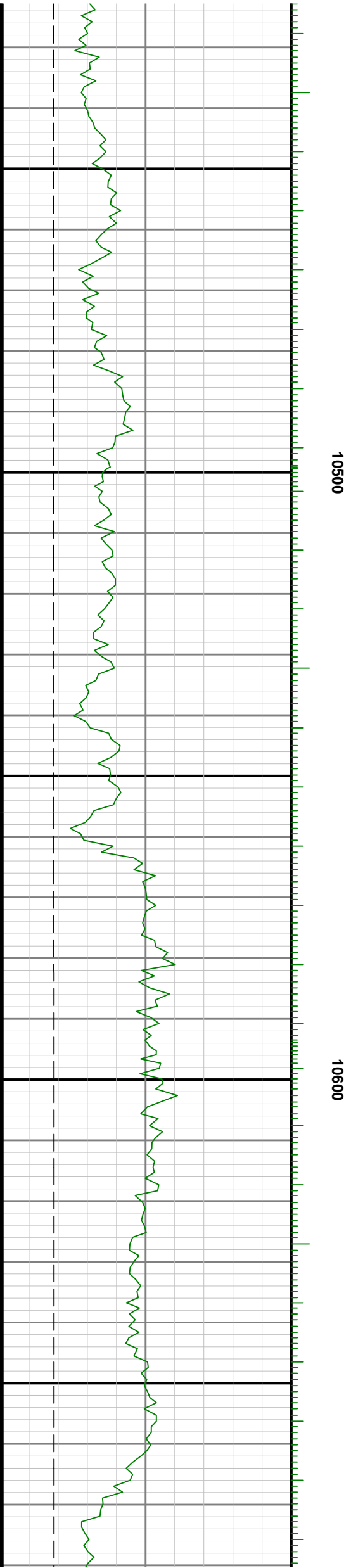
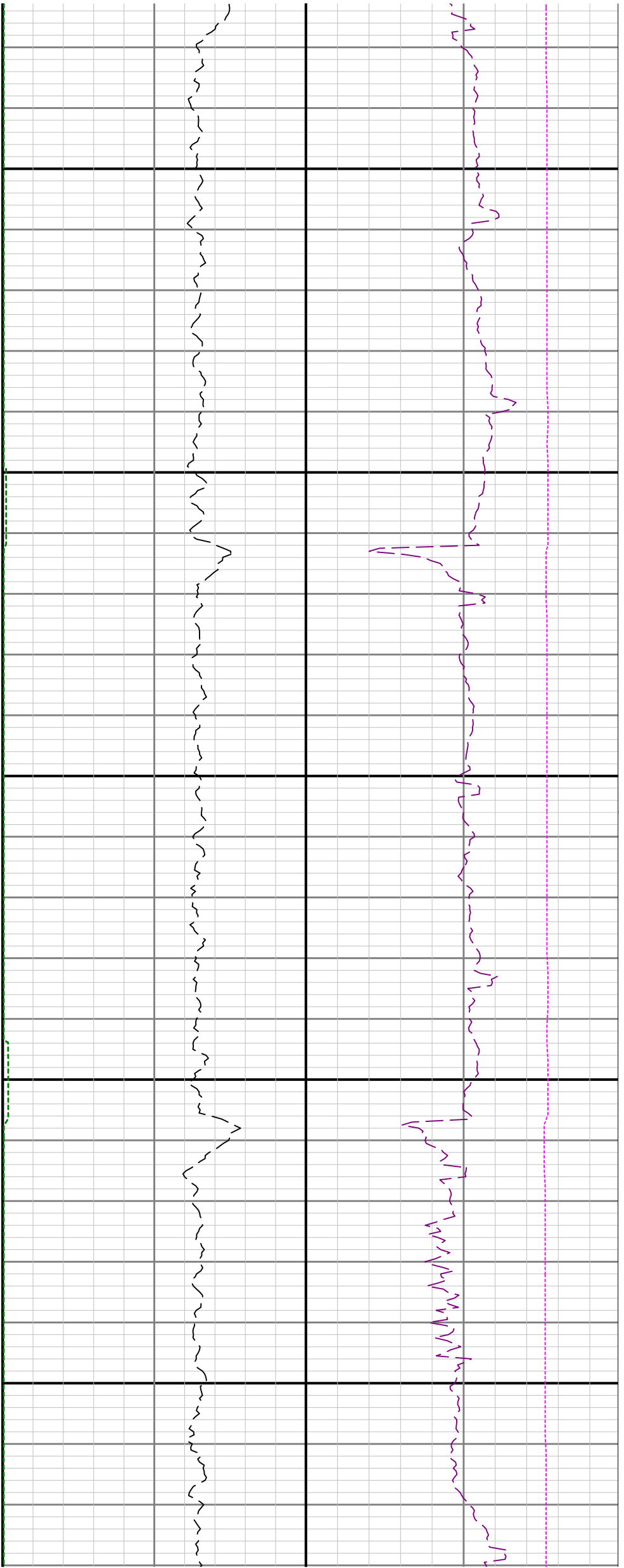
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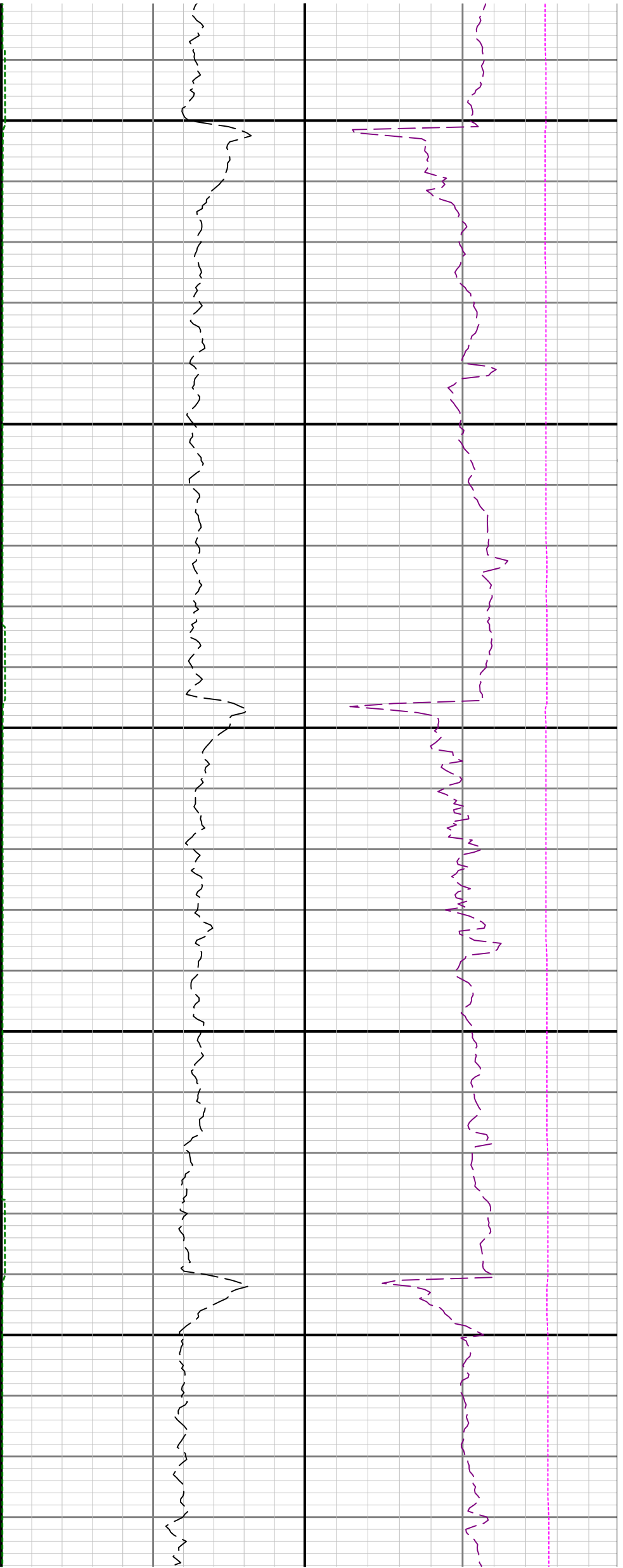
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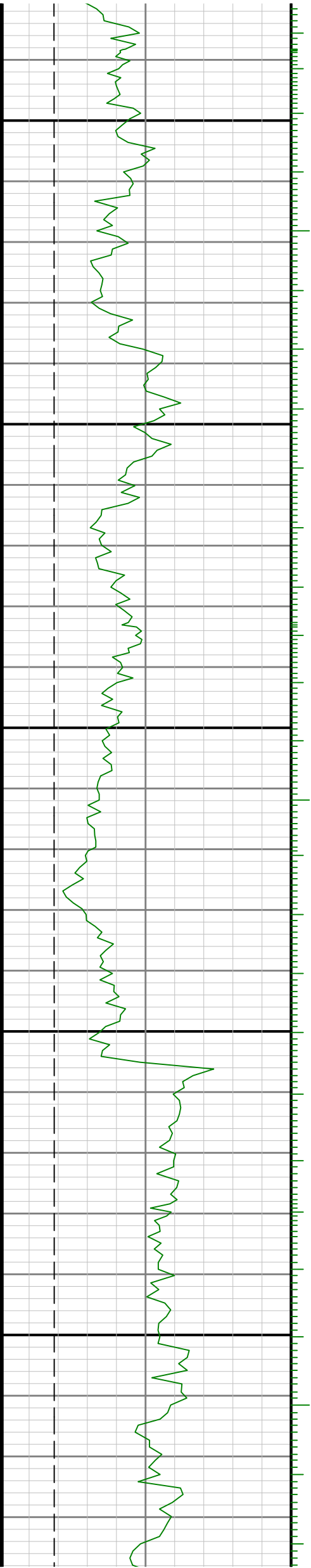


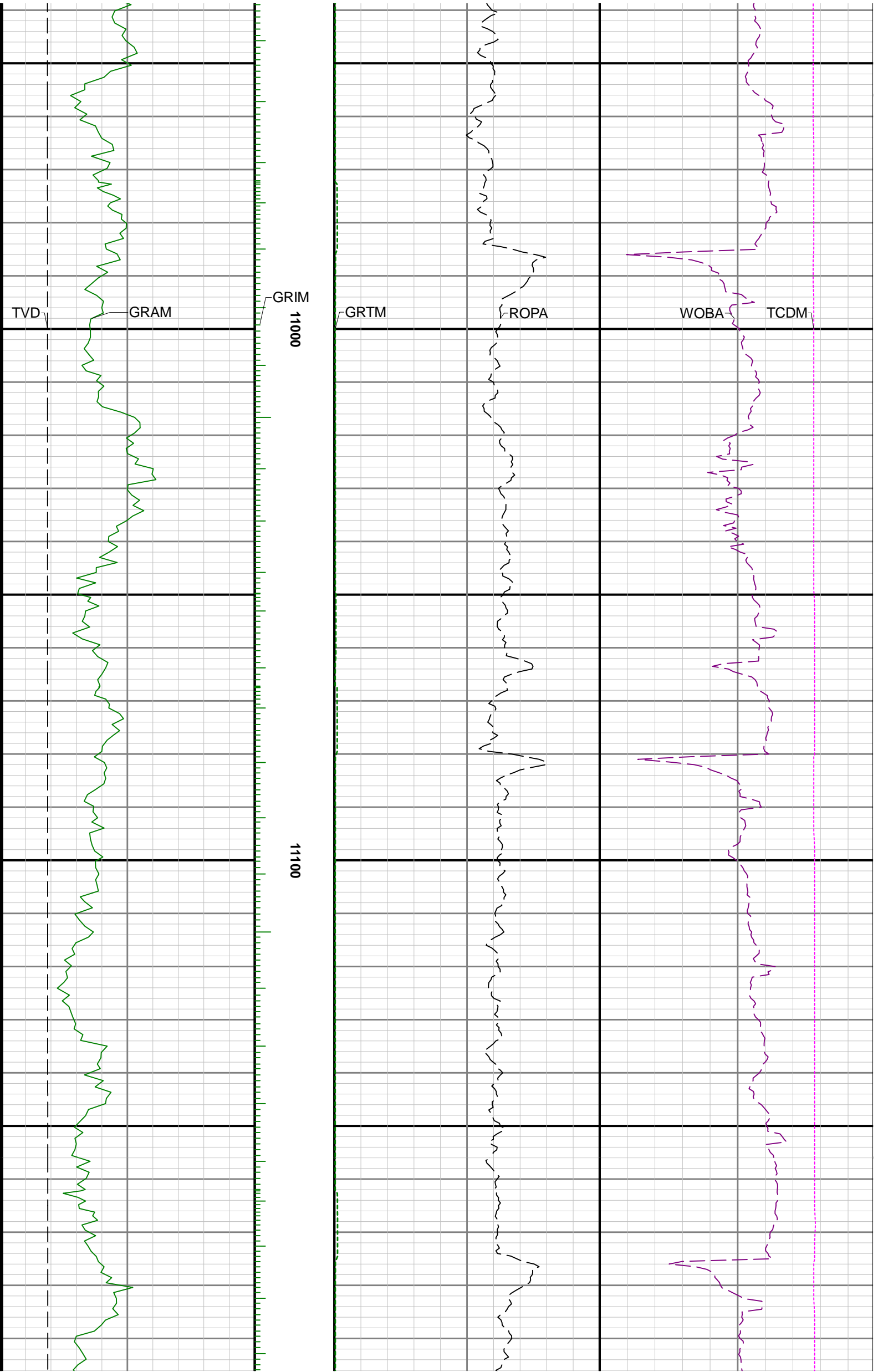


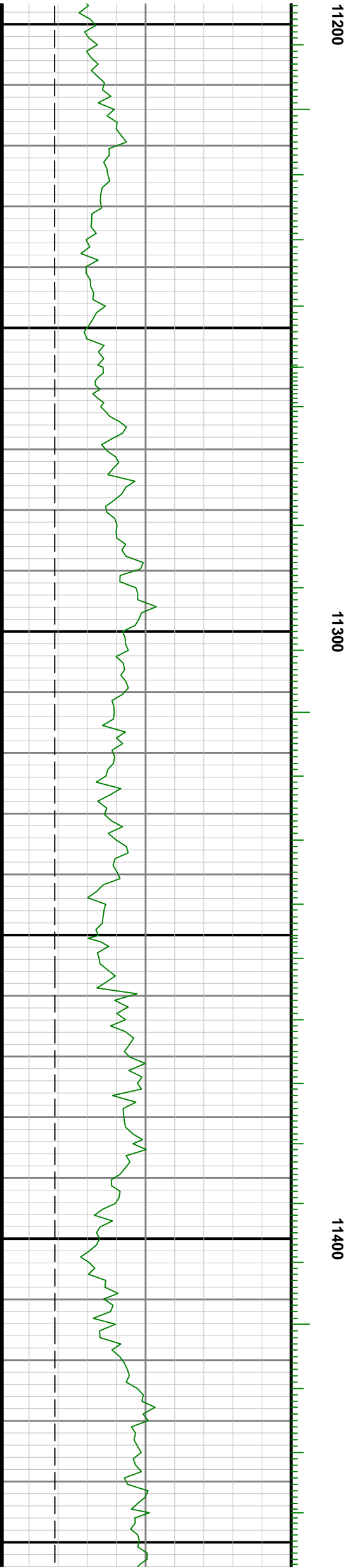
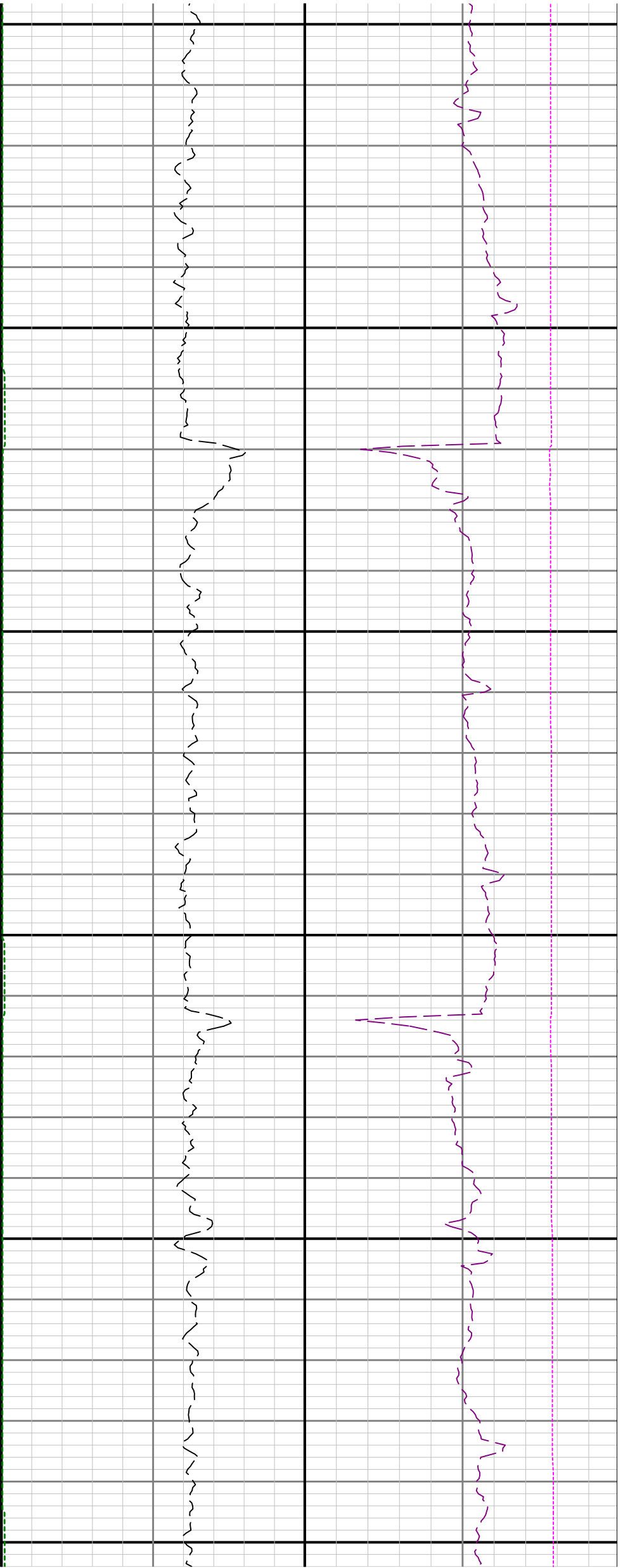
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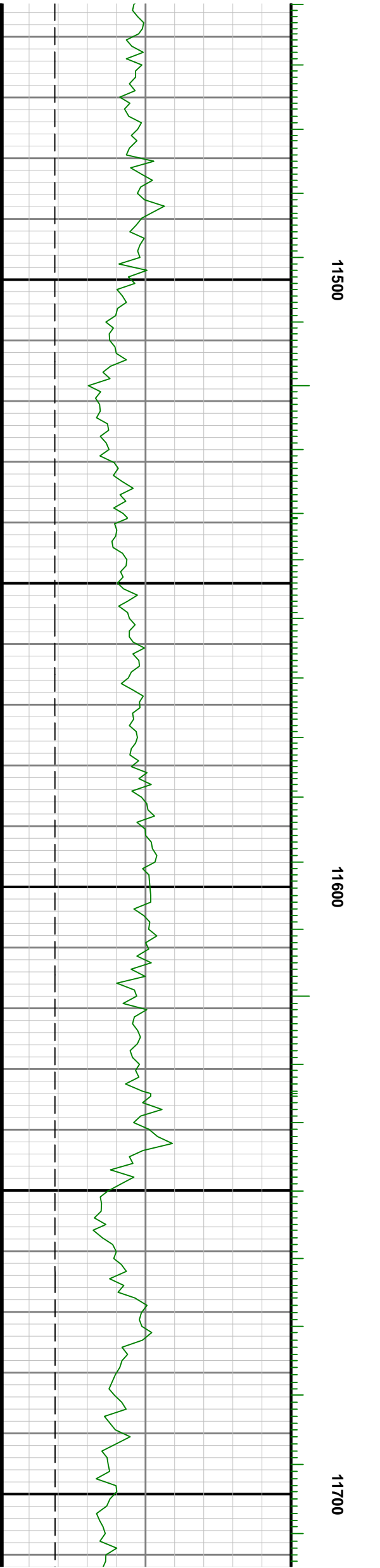
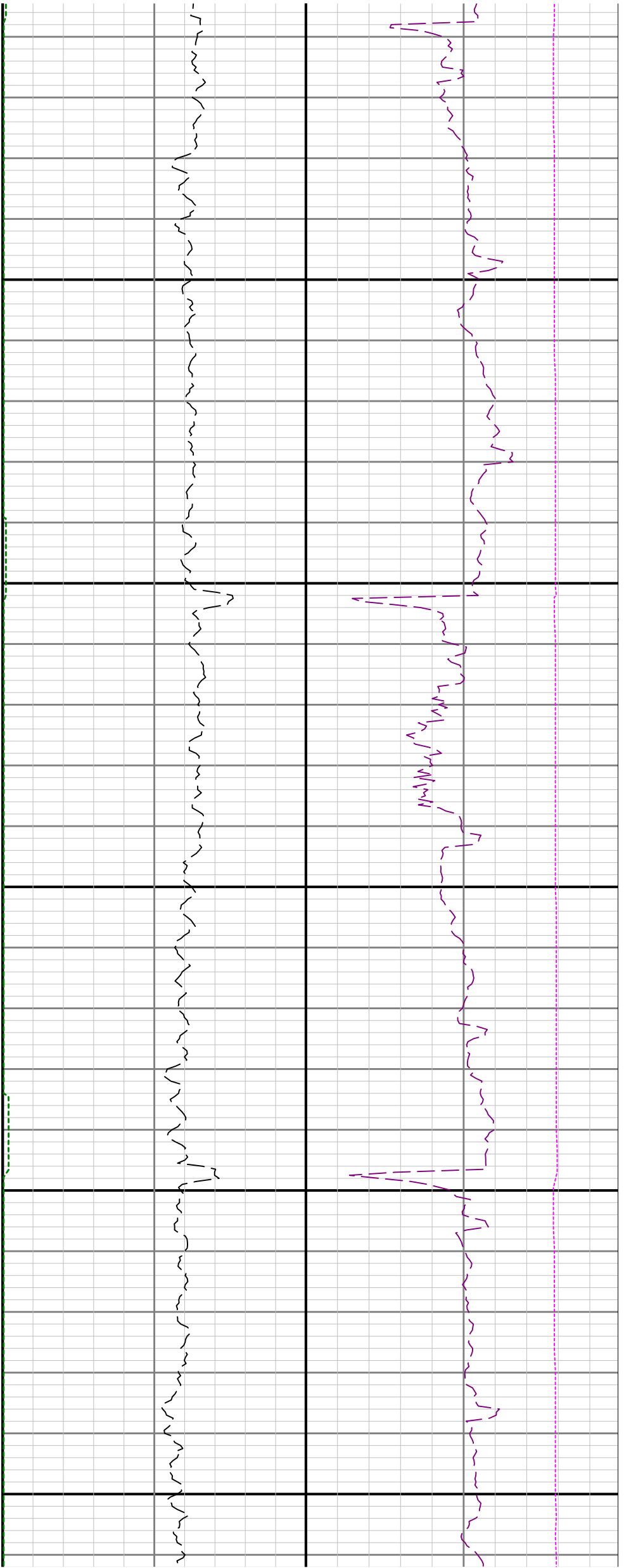
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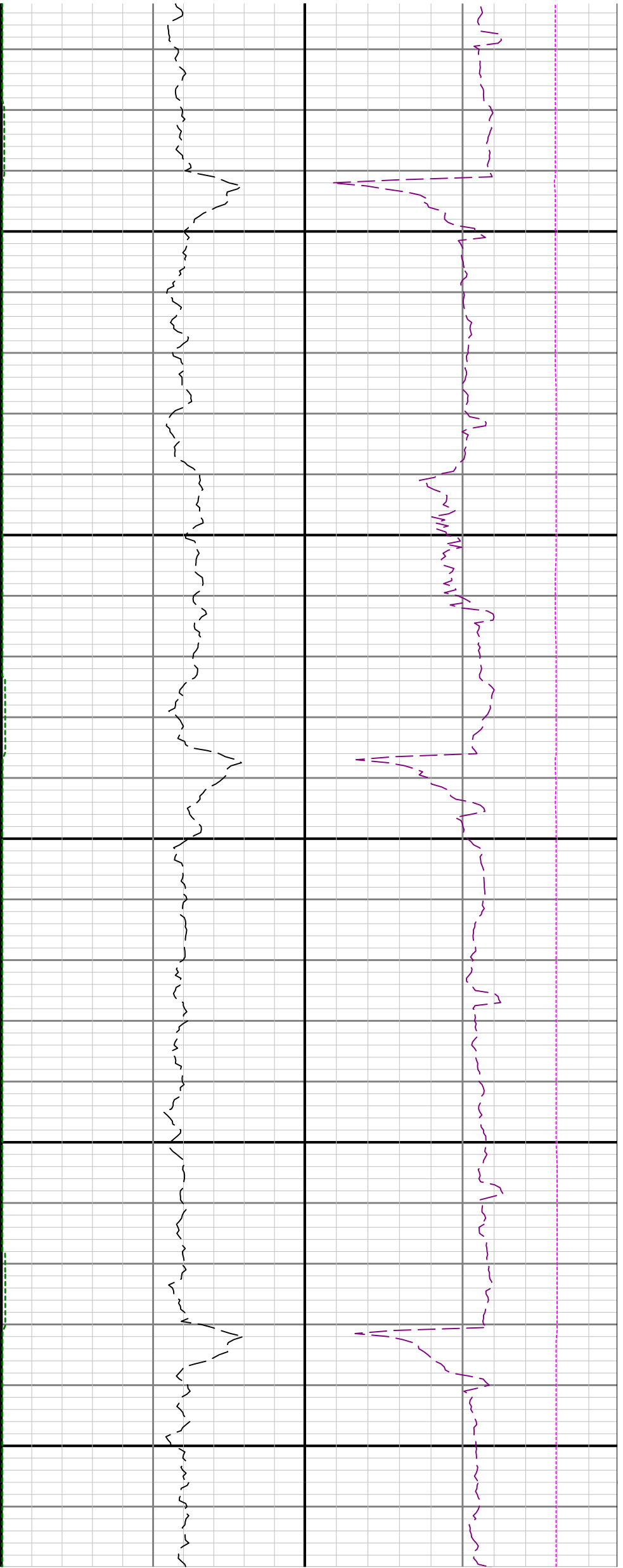
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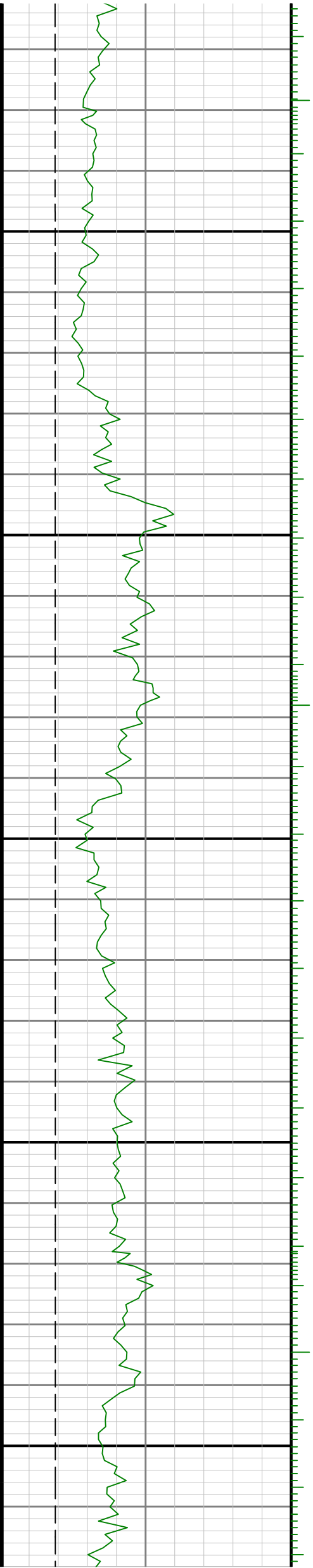


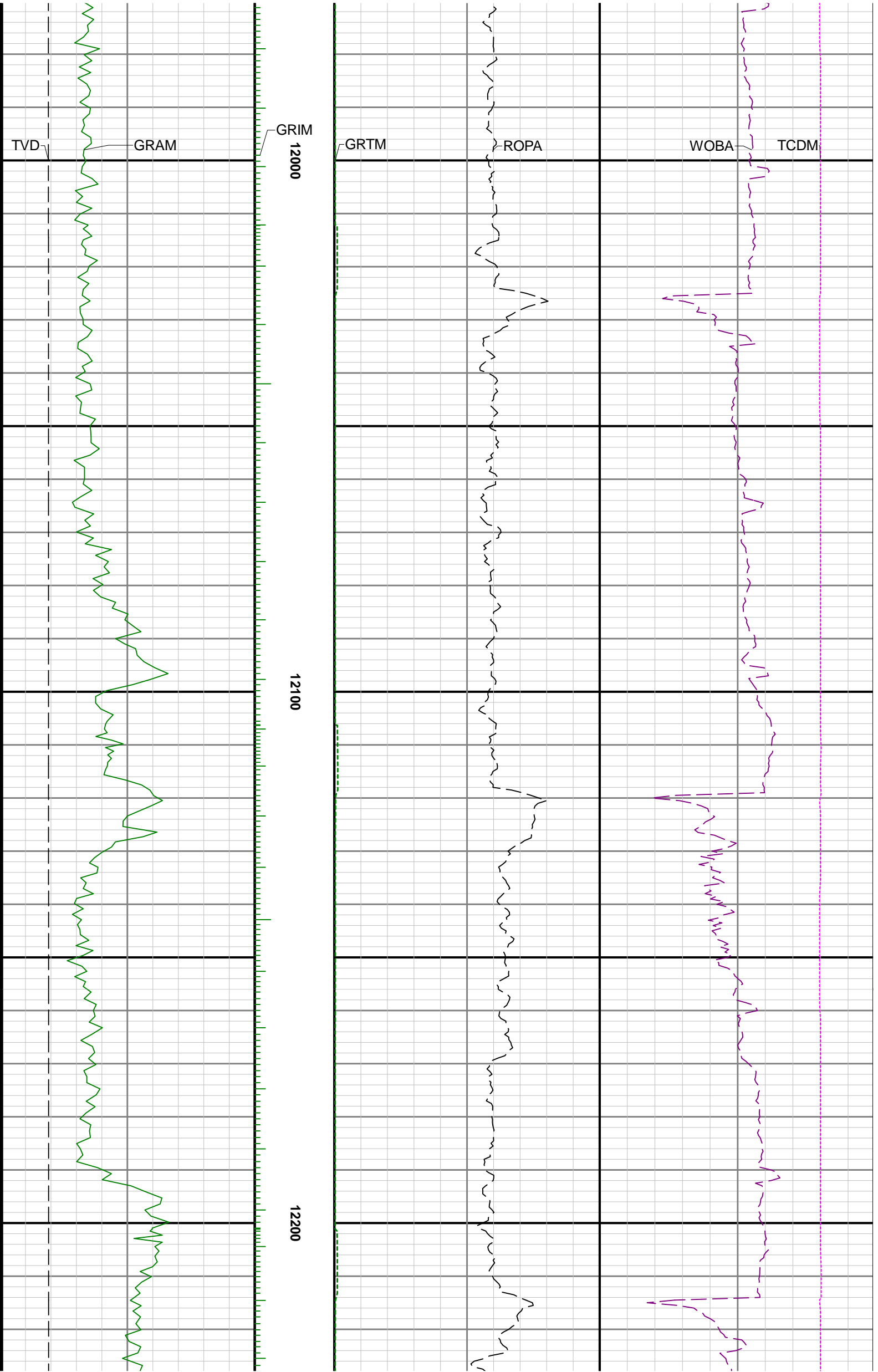


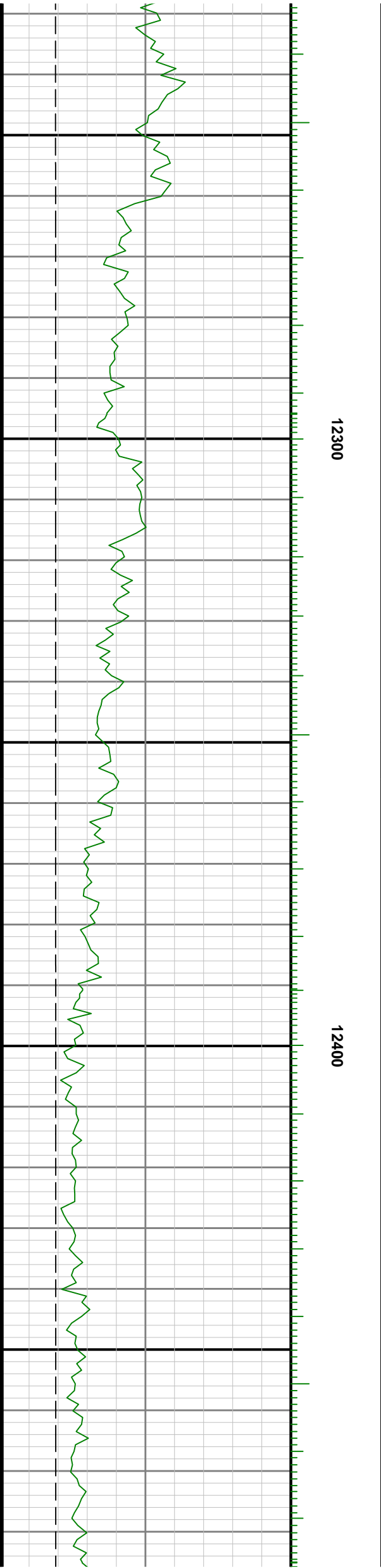
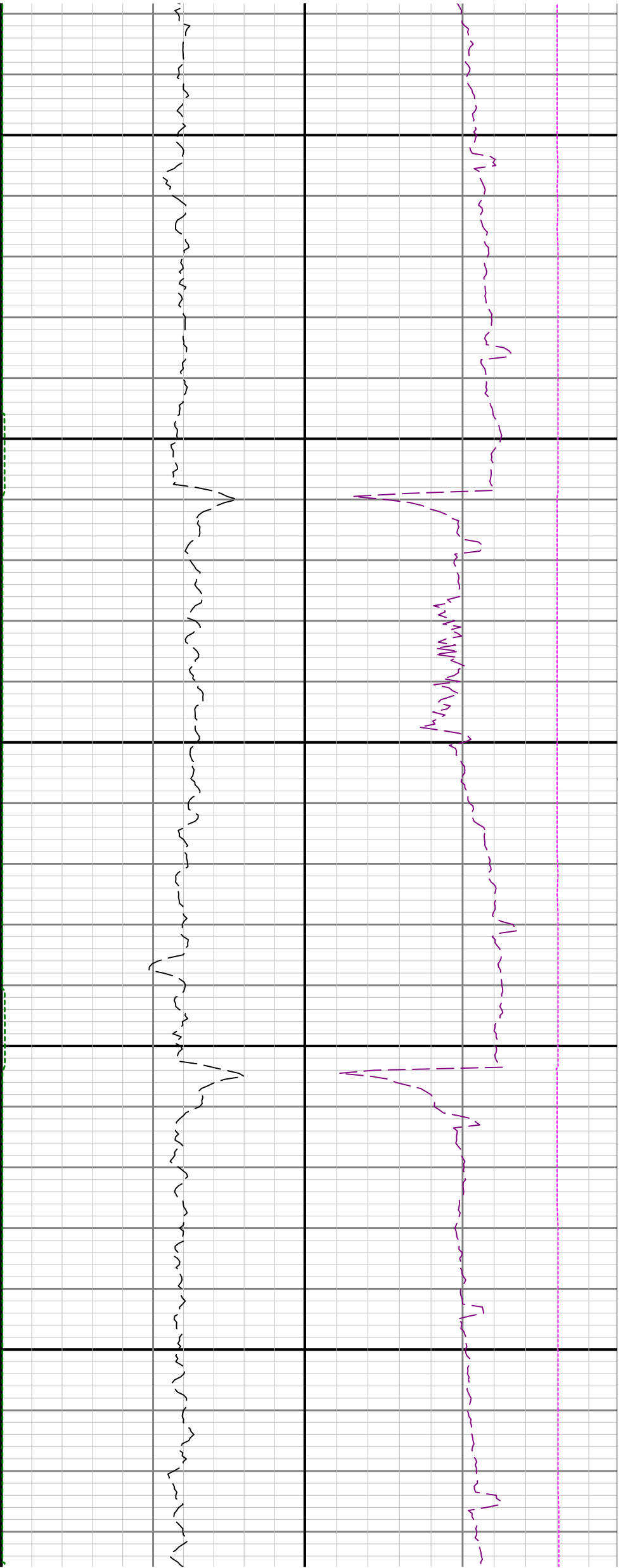


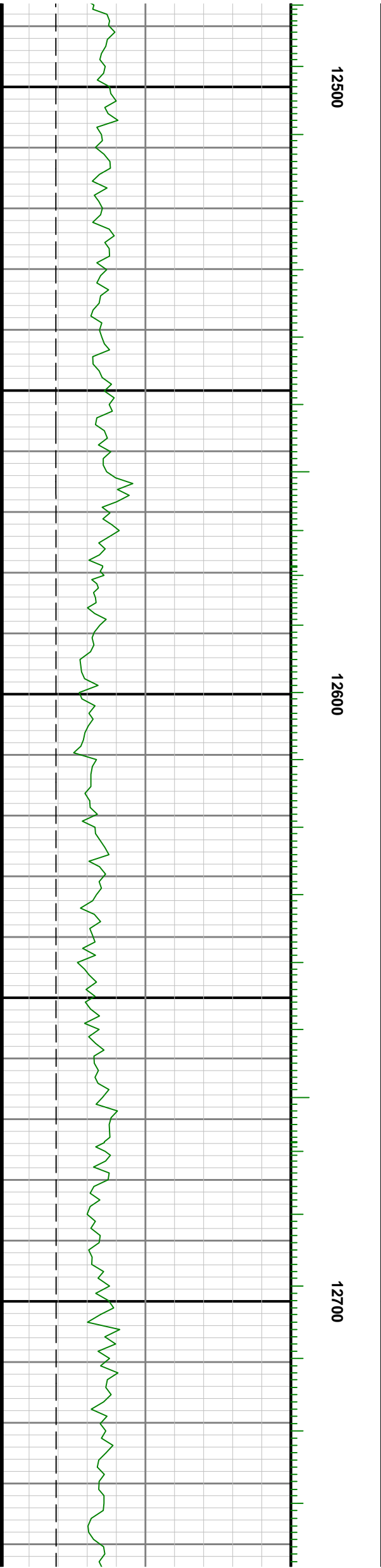
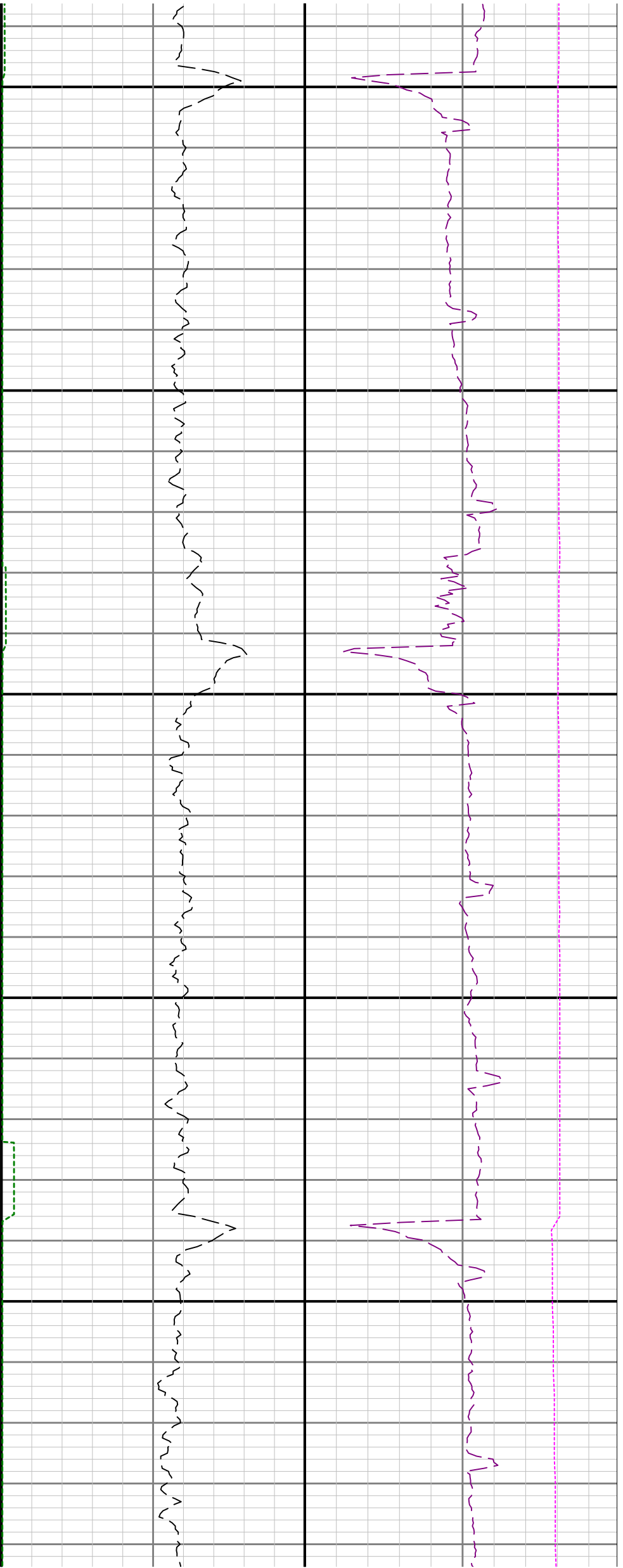
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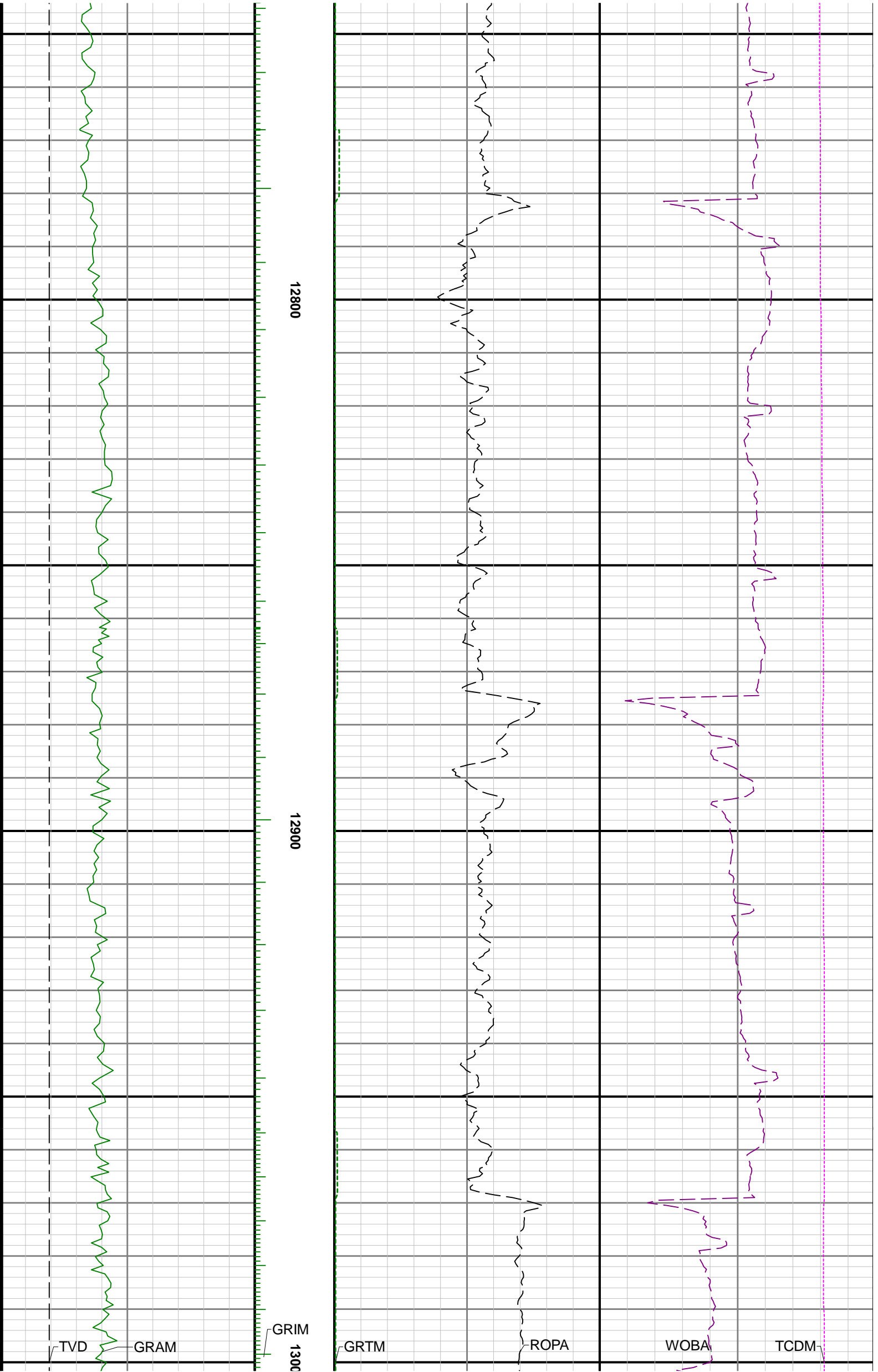
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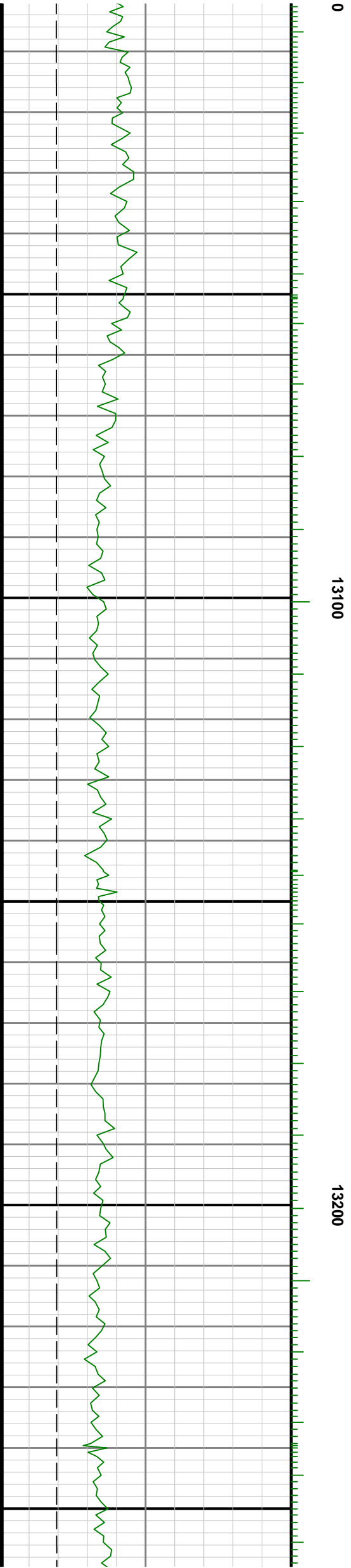


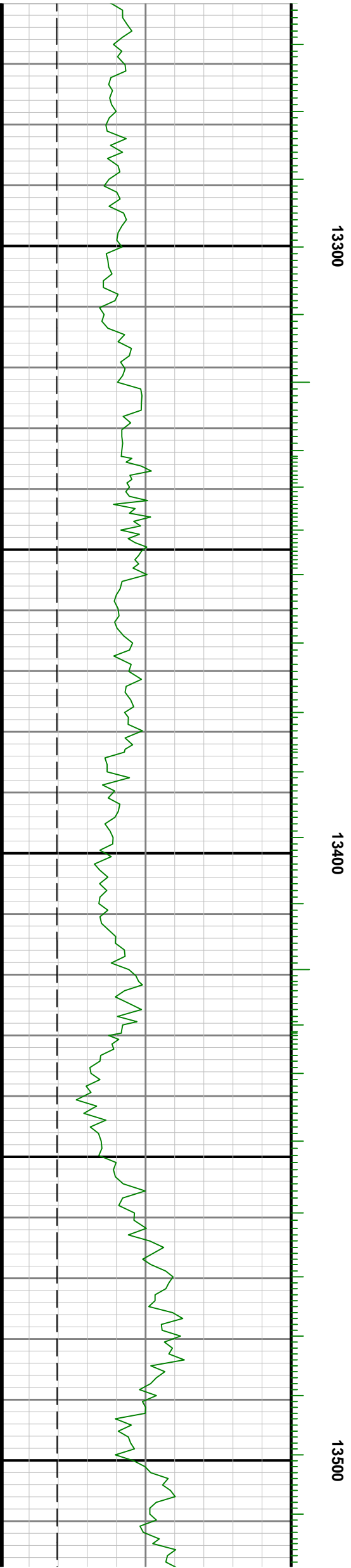
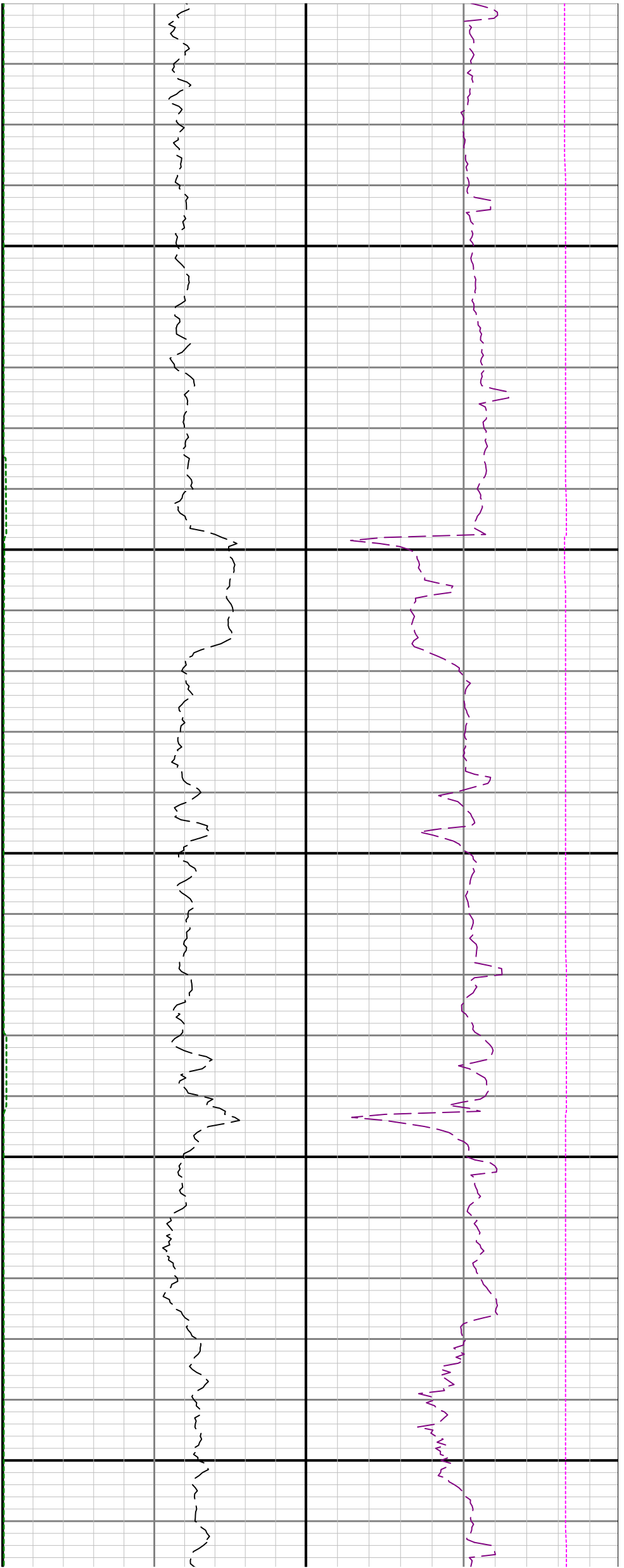


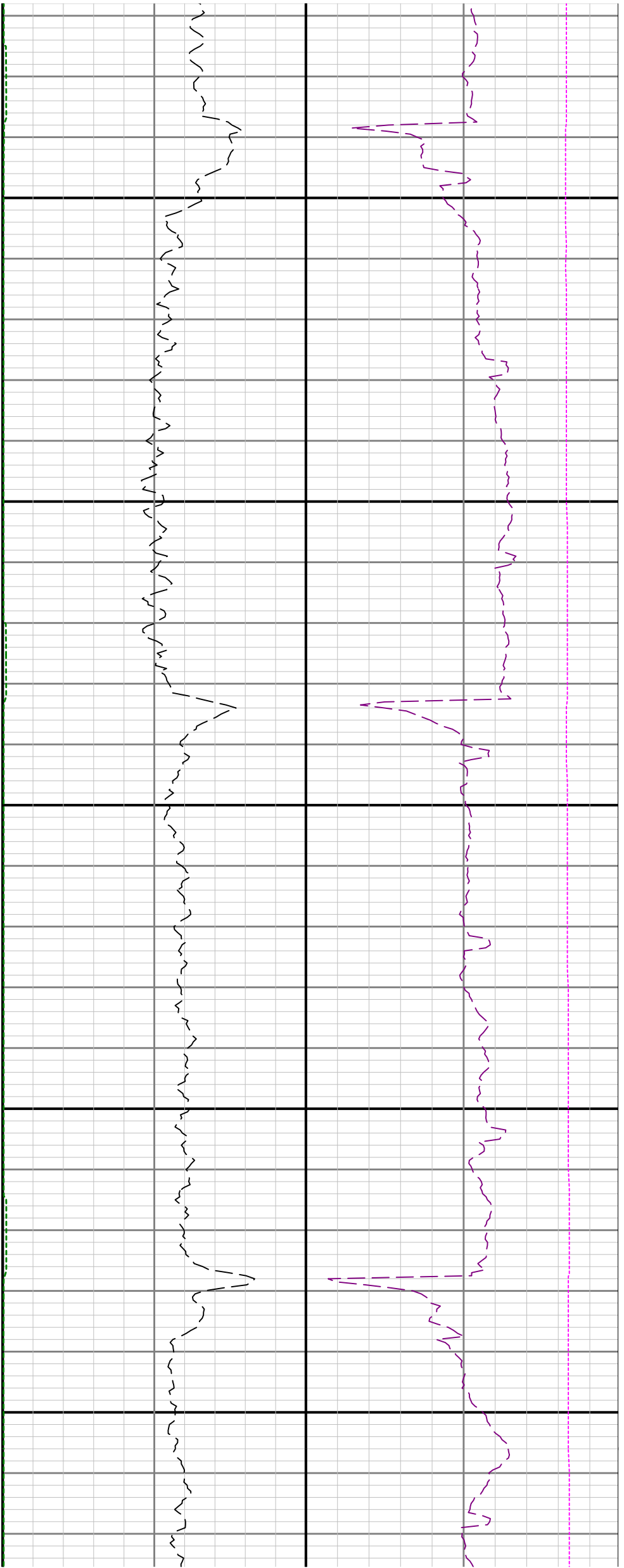






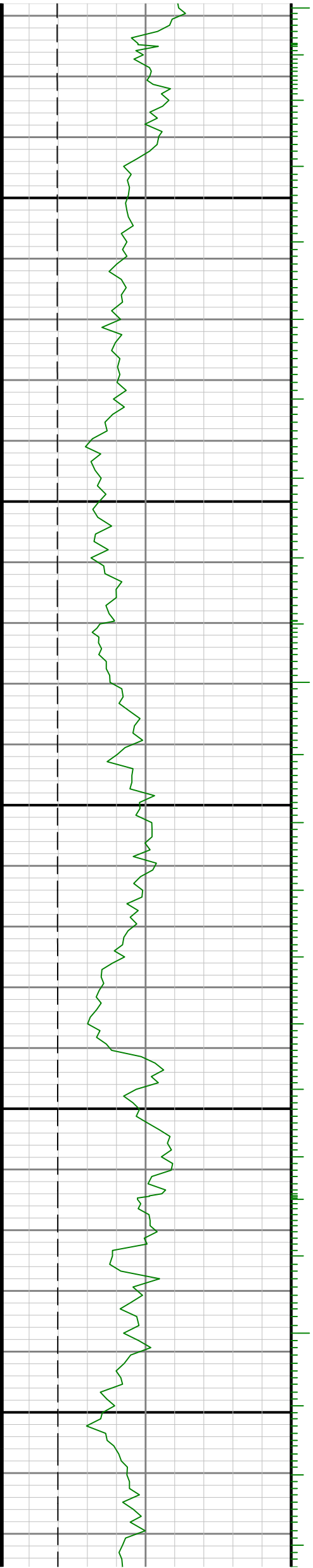


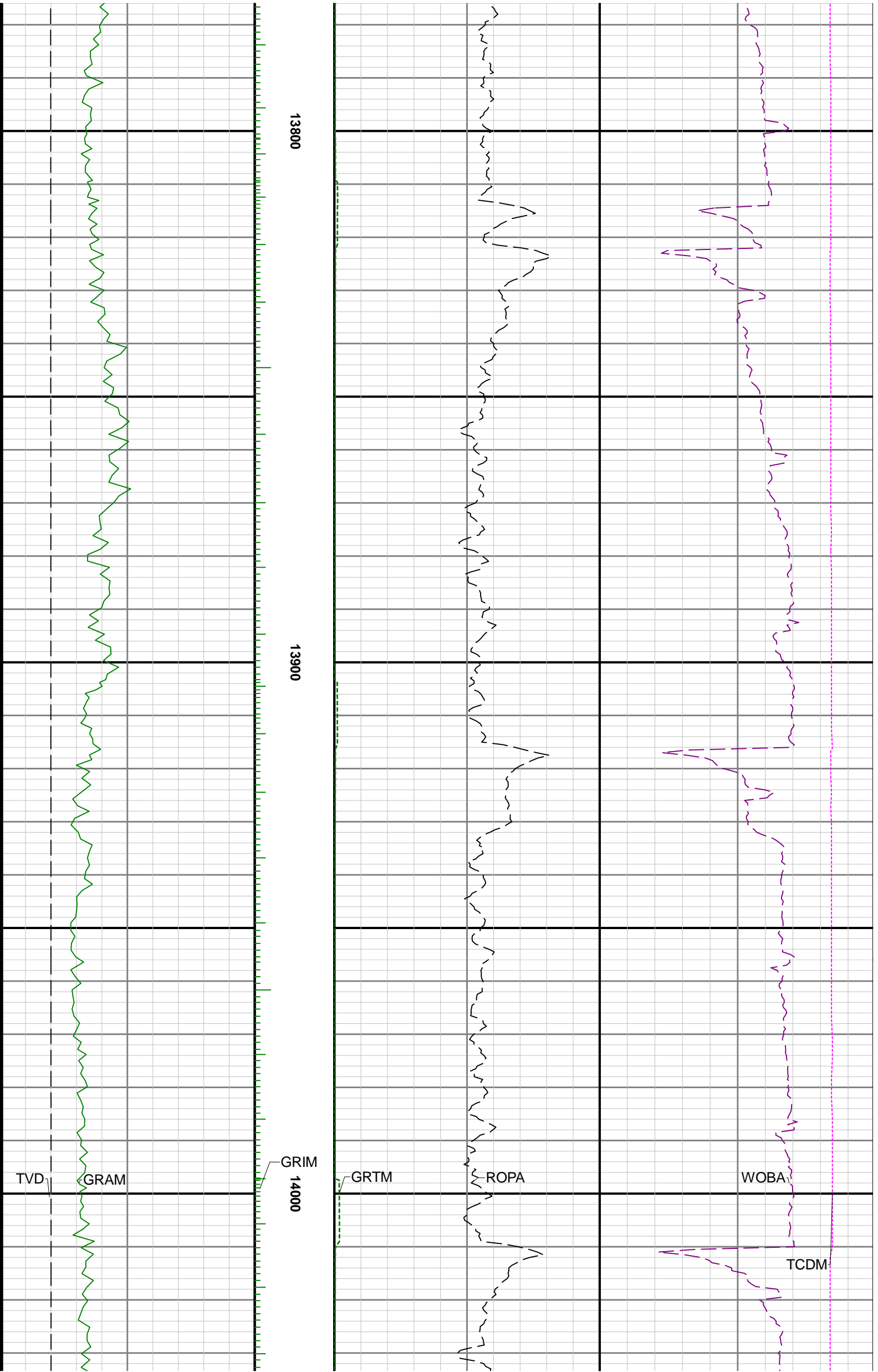


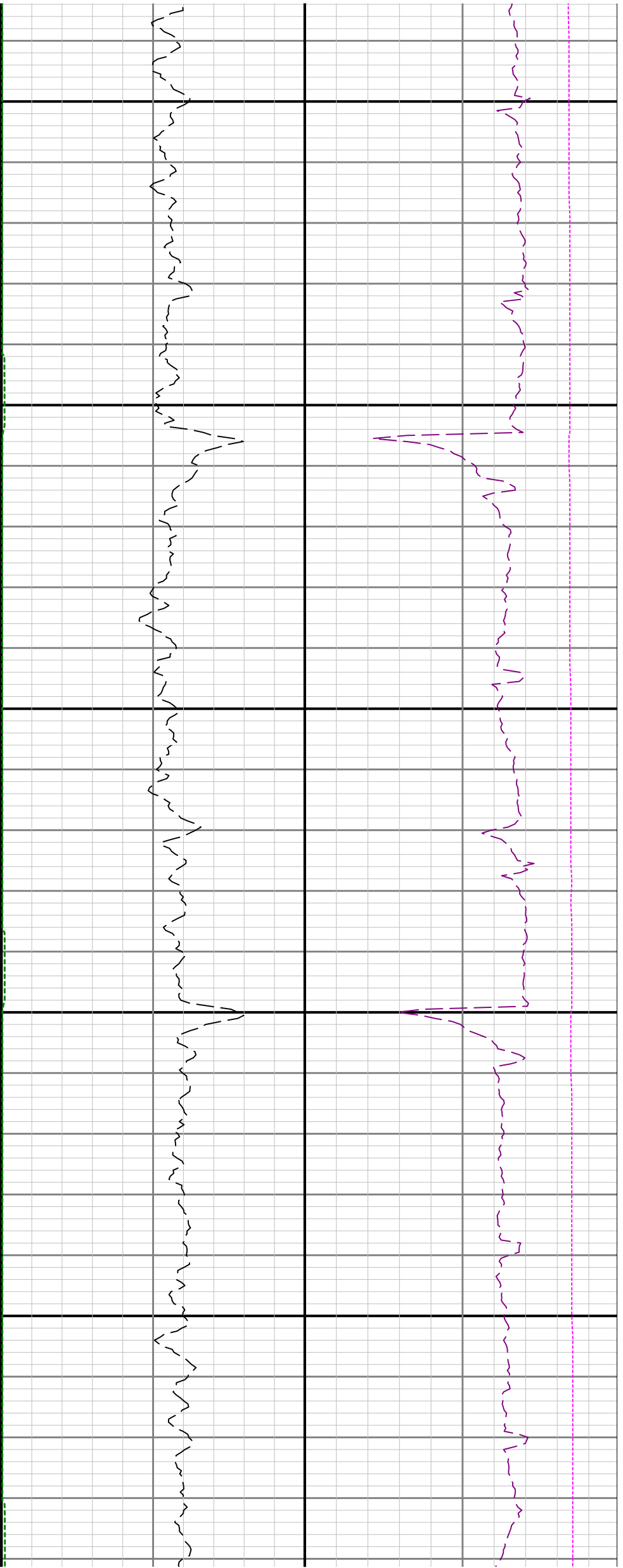


13600

13700

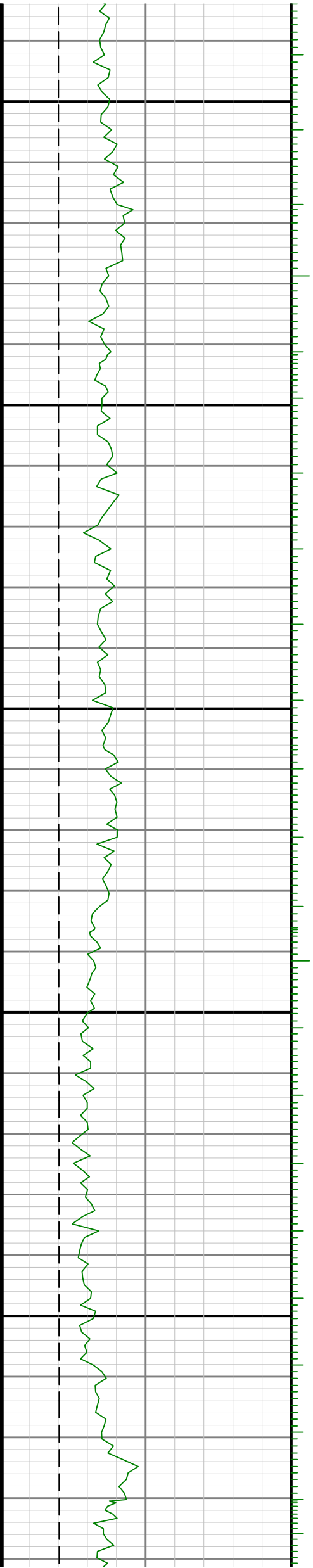






14100

14200

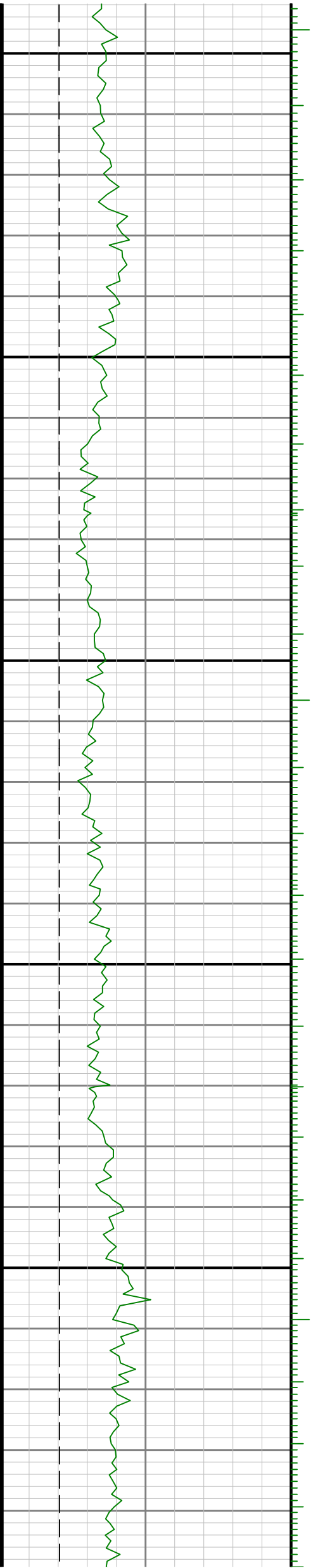


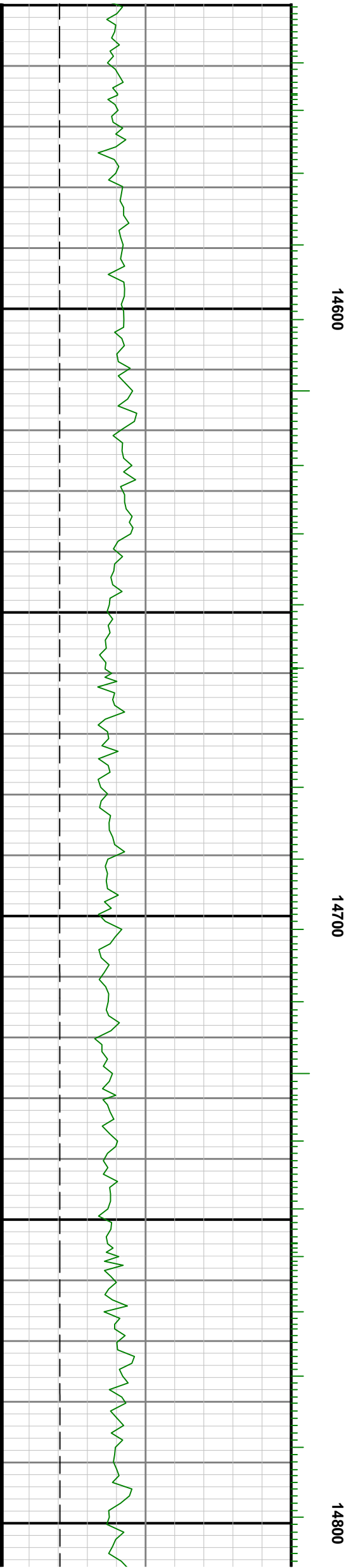
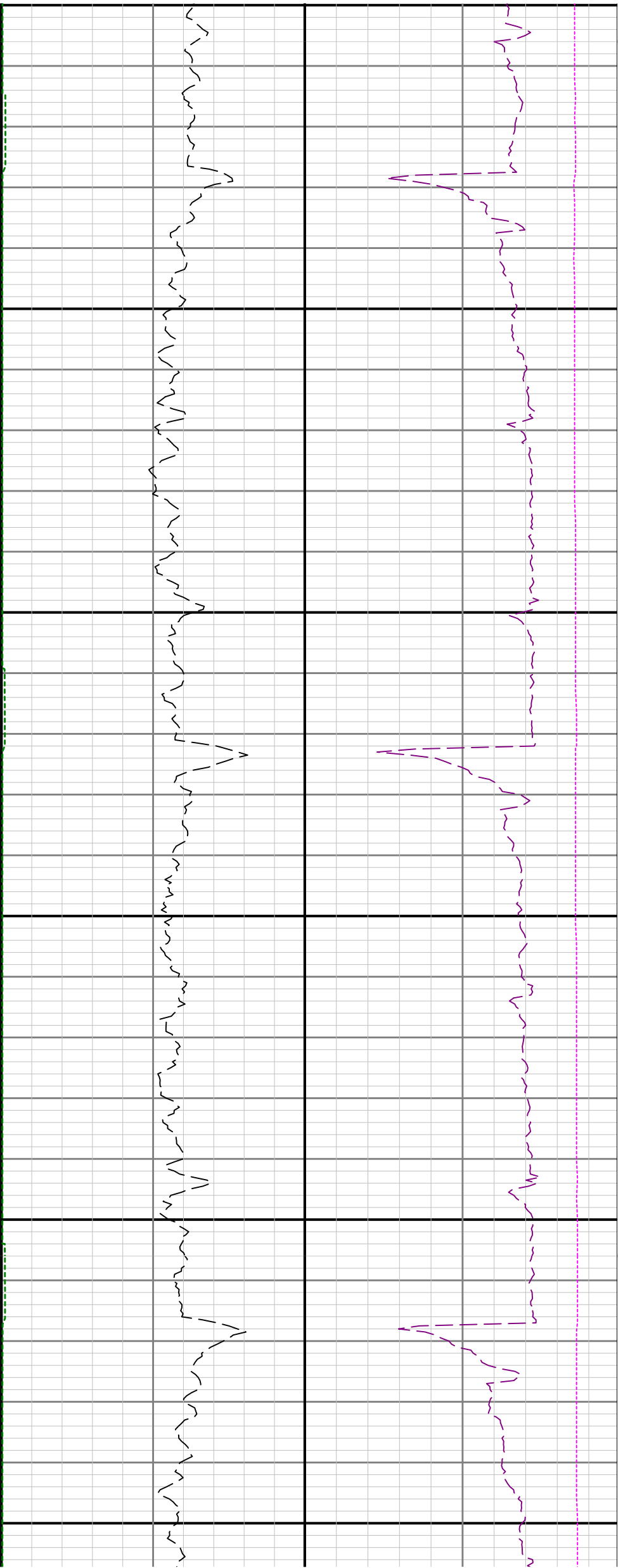


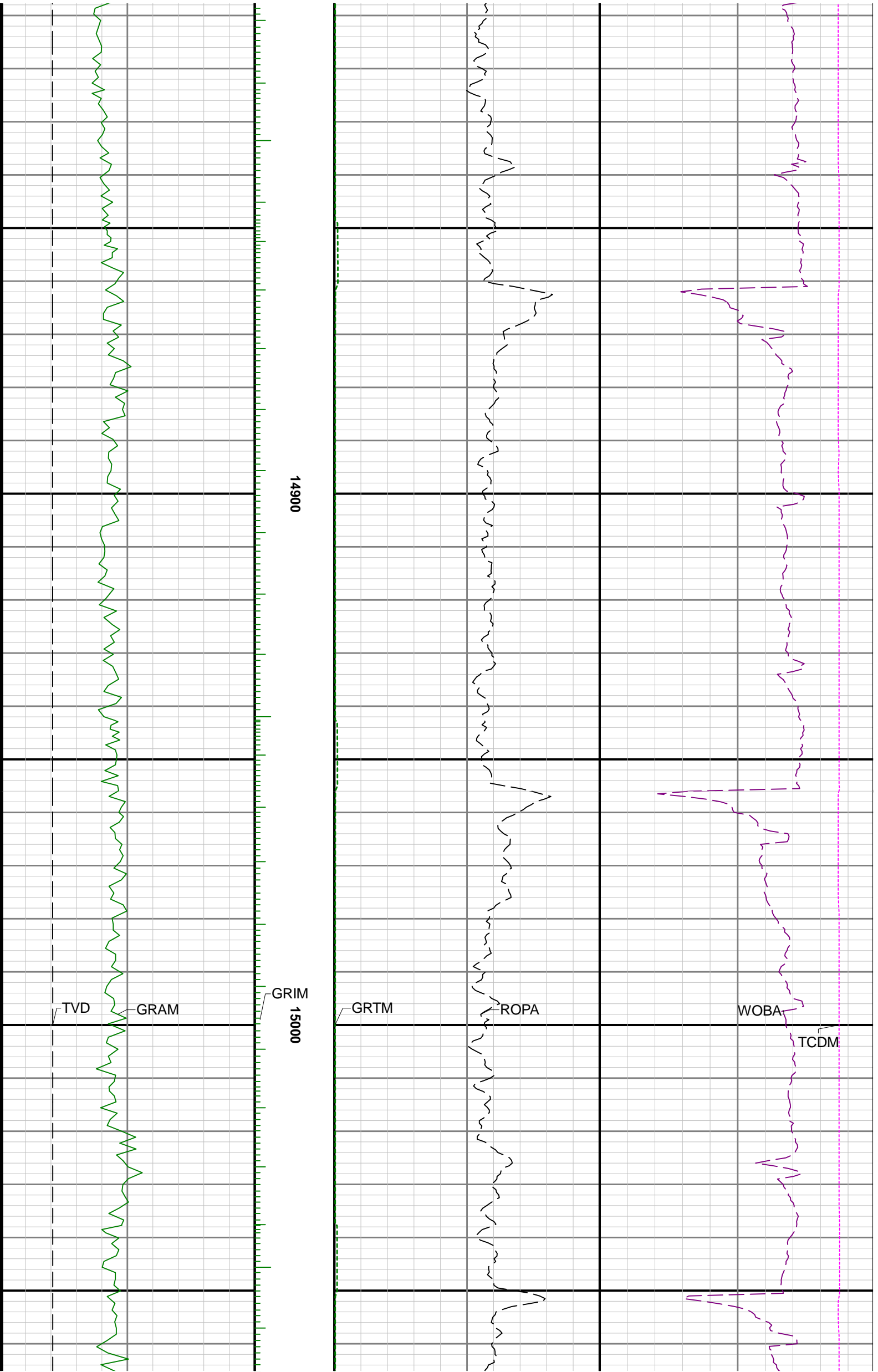
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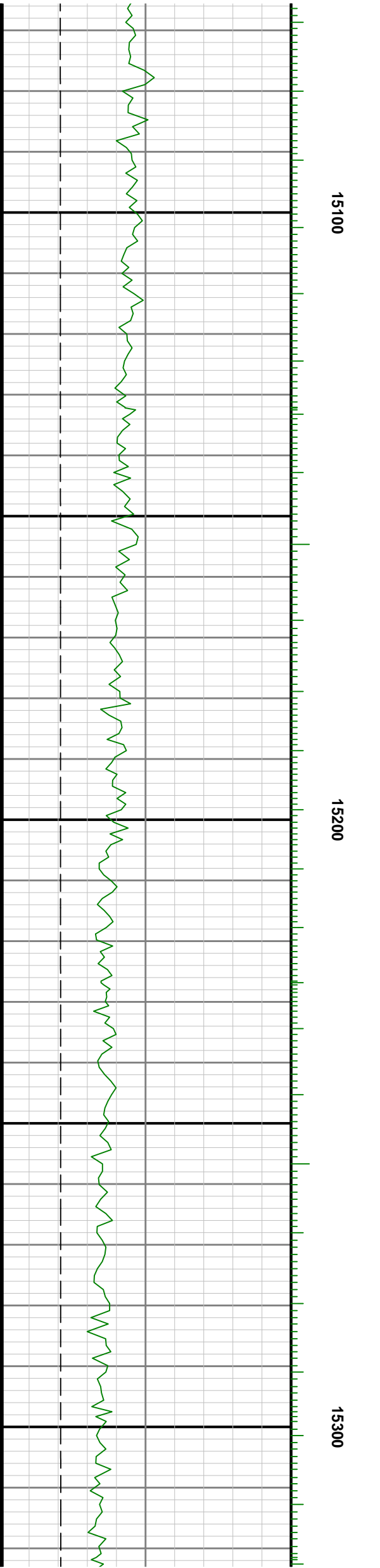
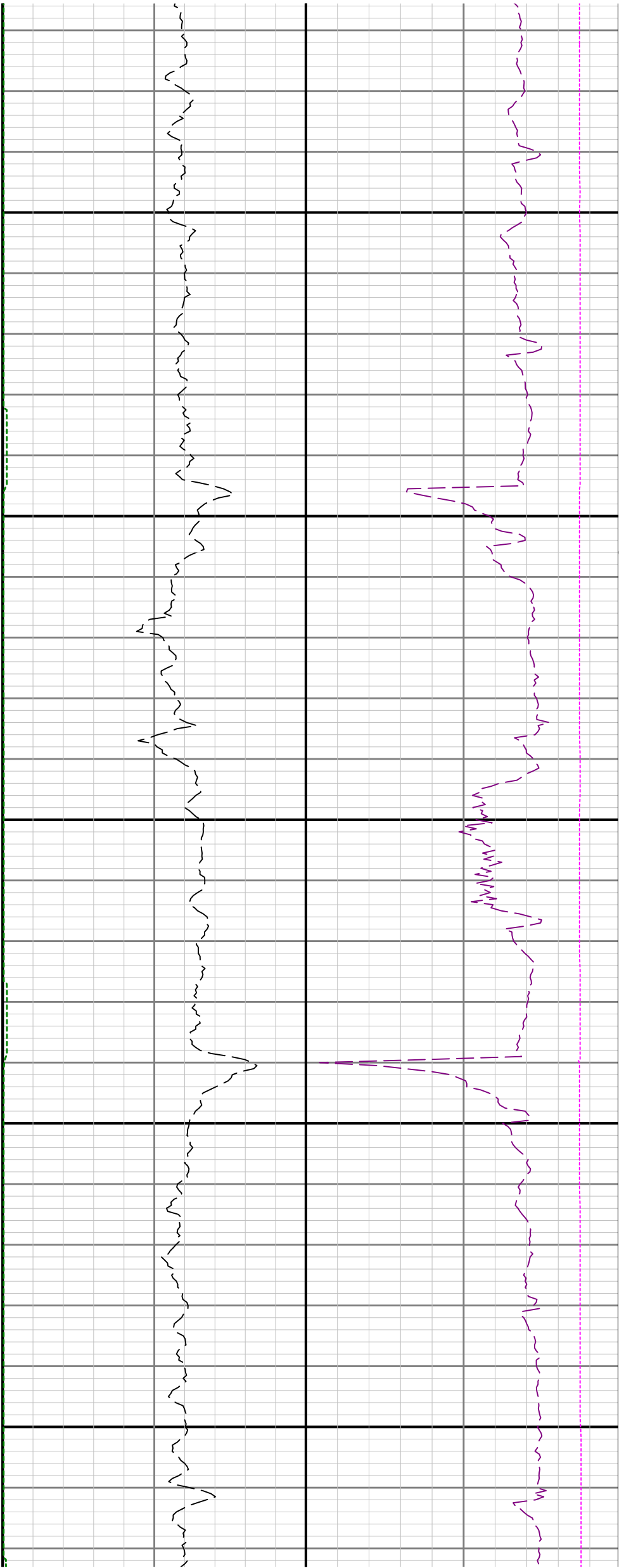
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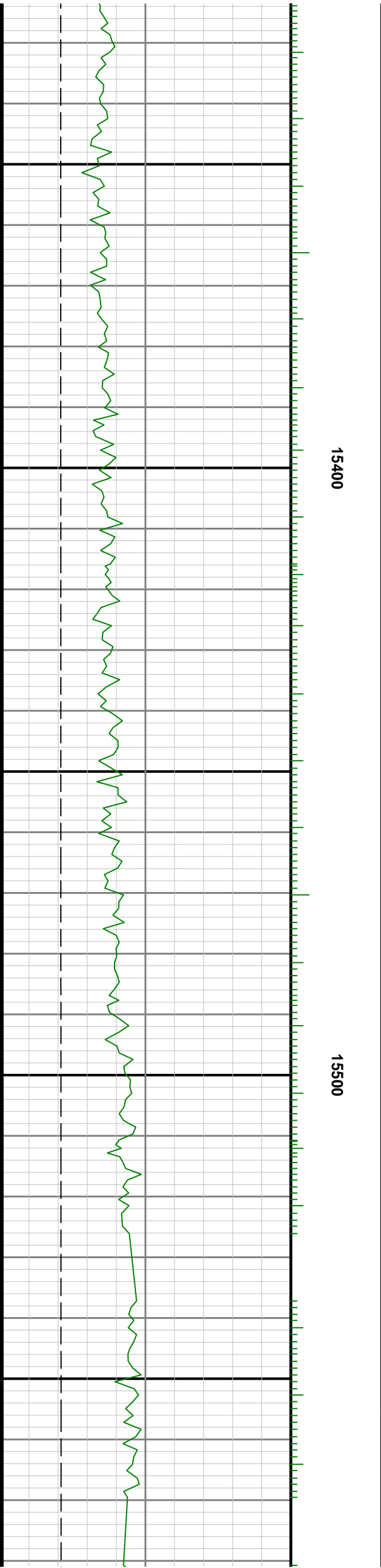
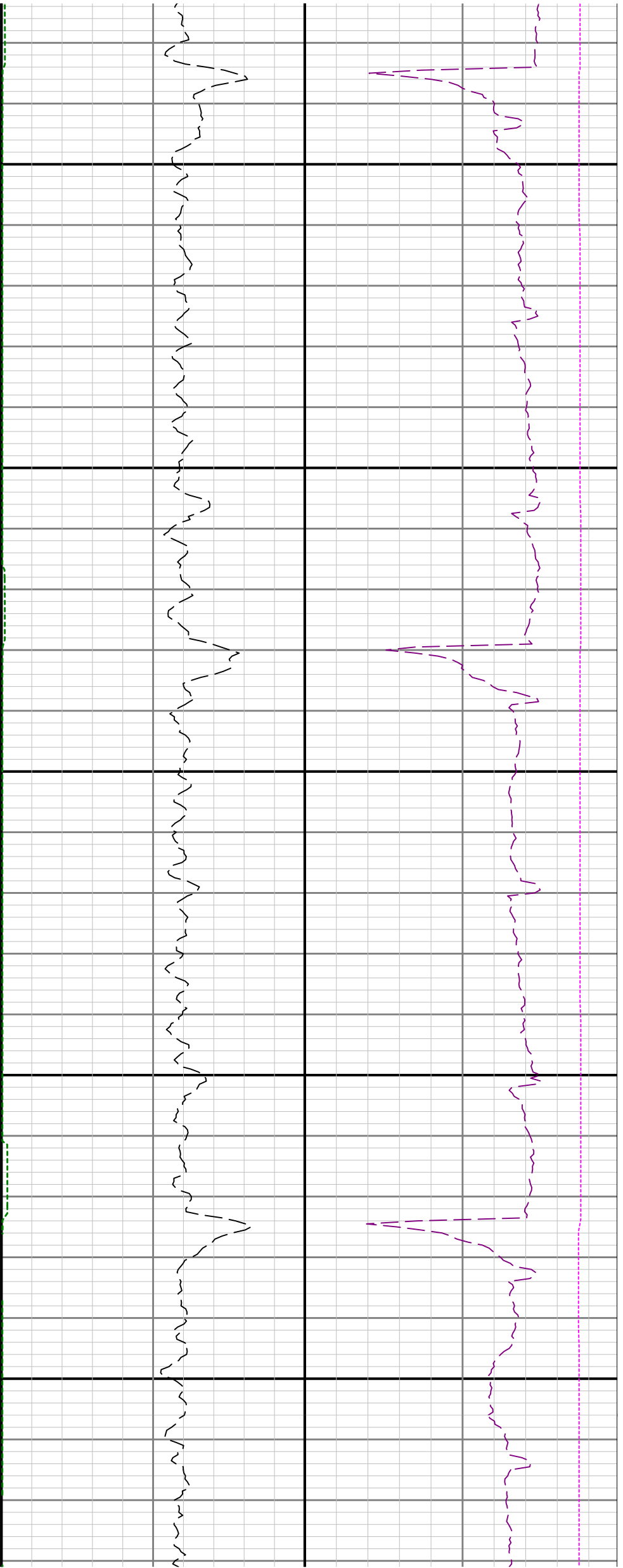
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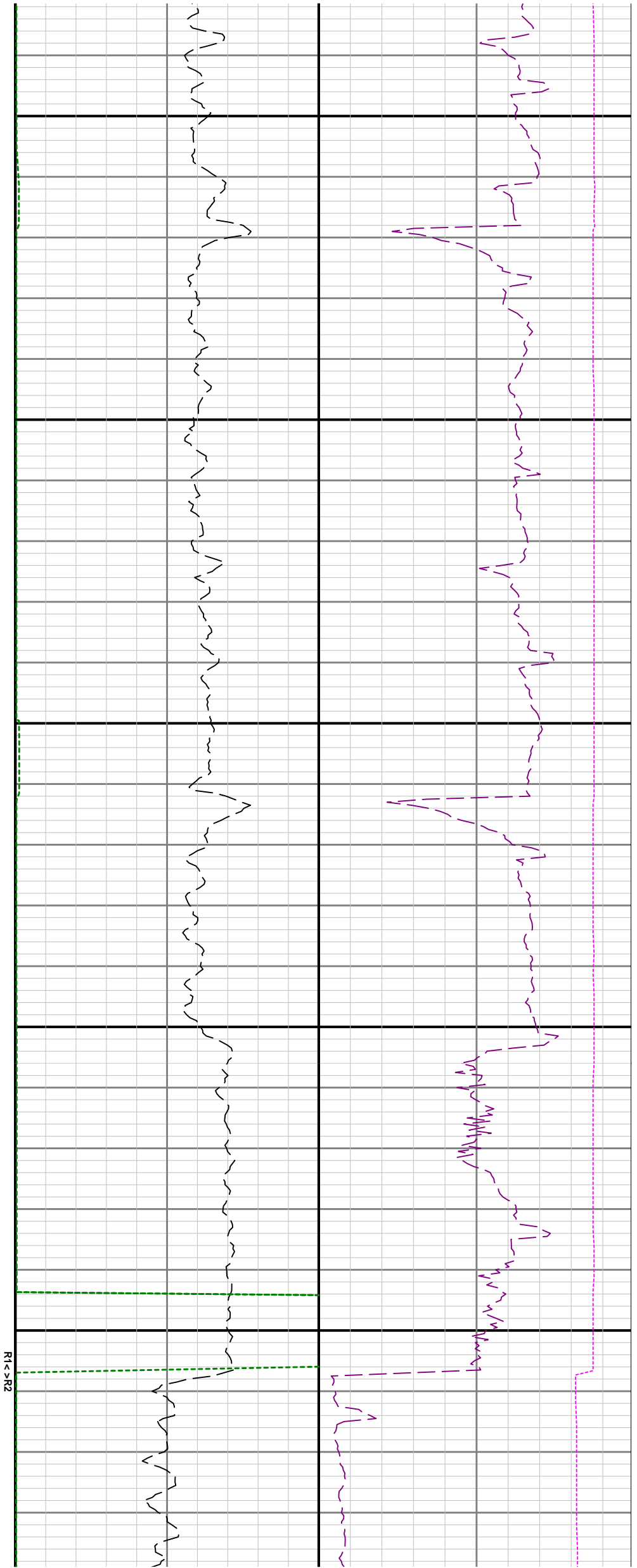










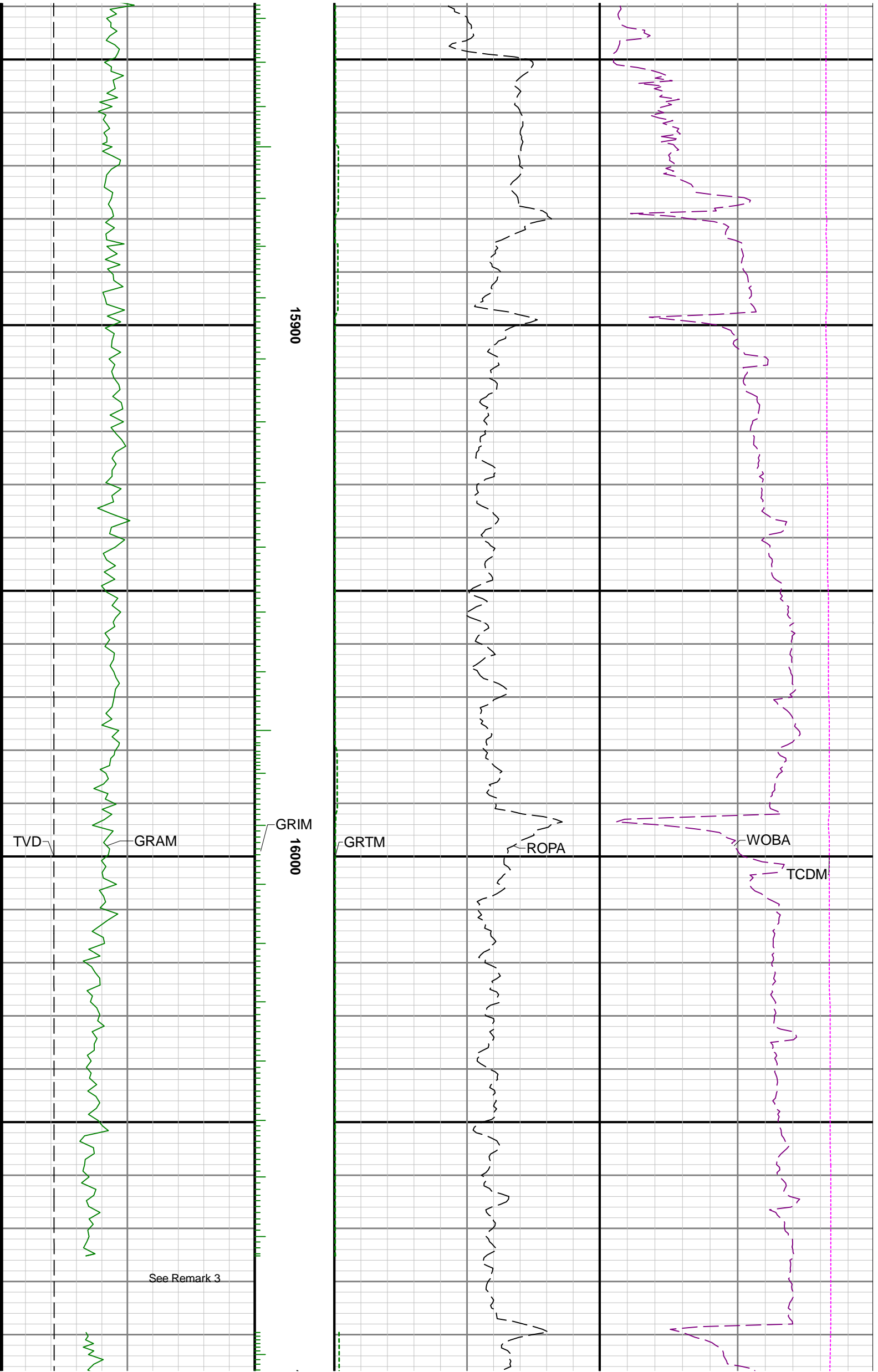


15600

15700

15800

See Remark 2



TVD

GRAM

GRIM

16000

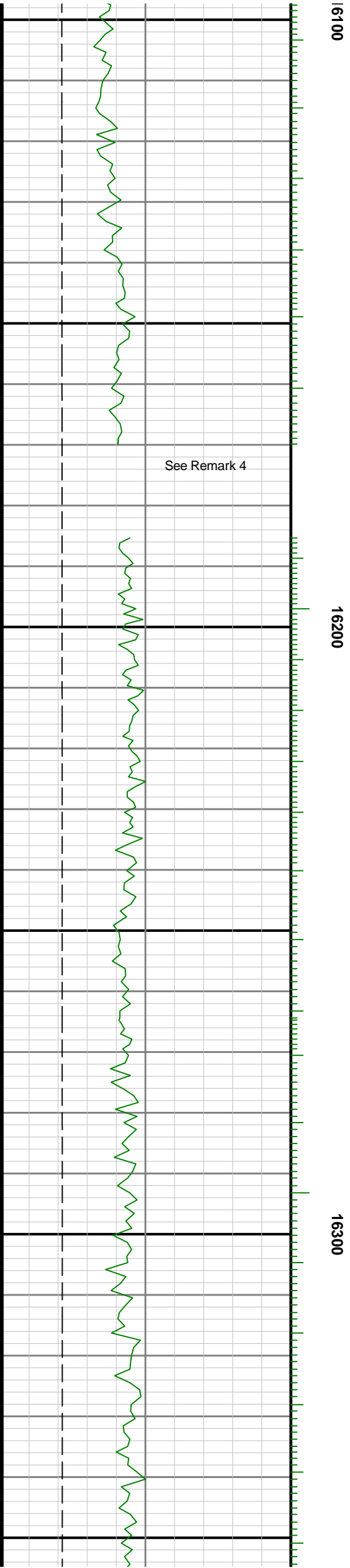
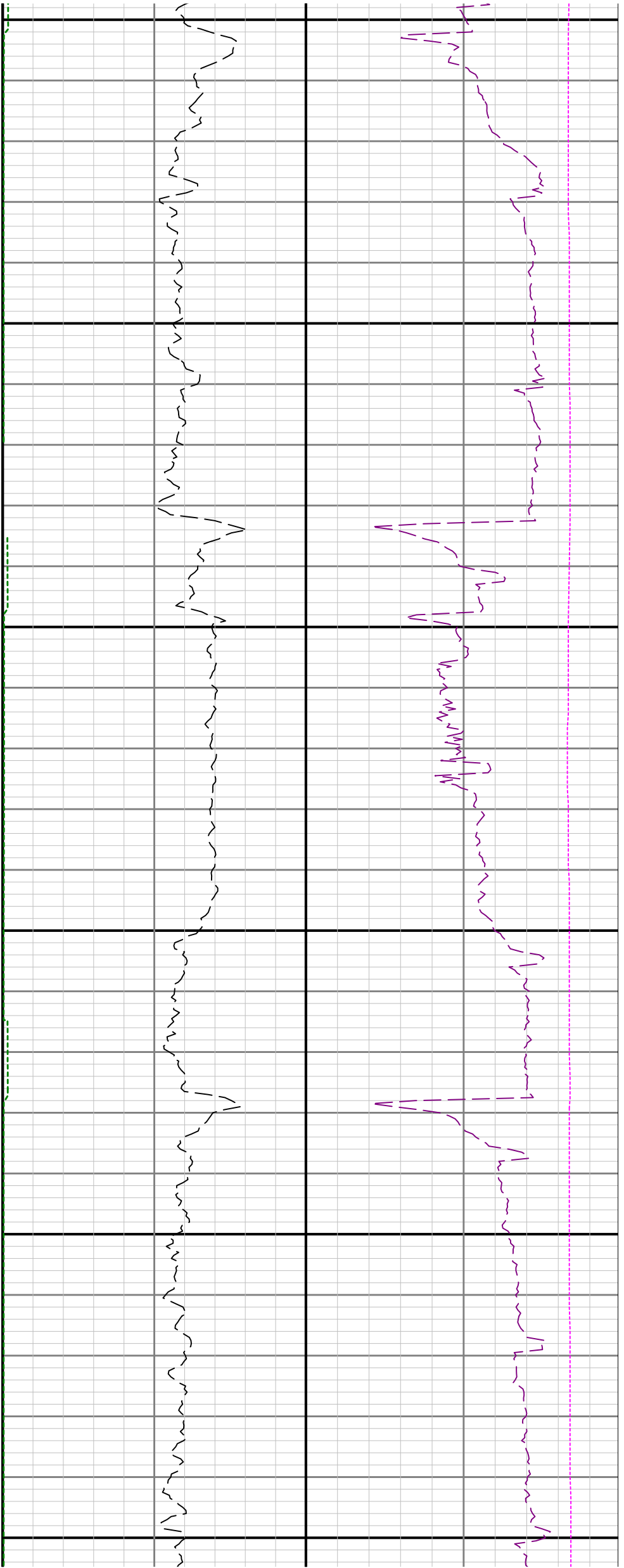
GRTM

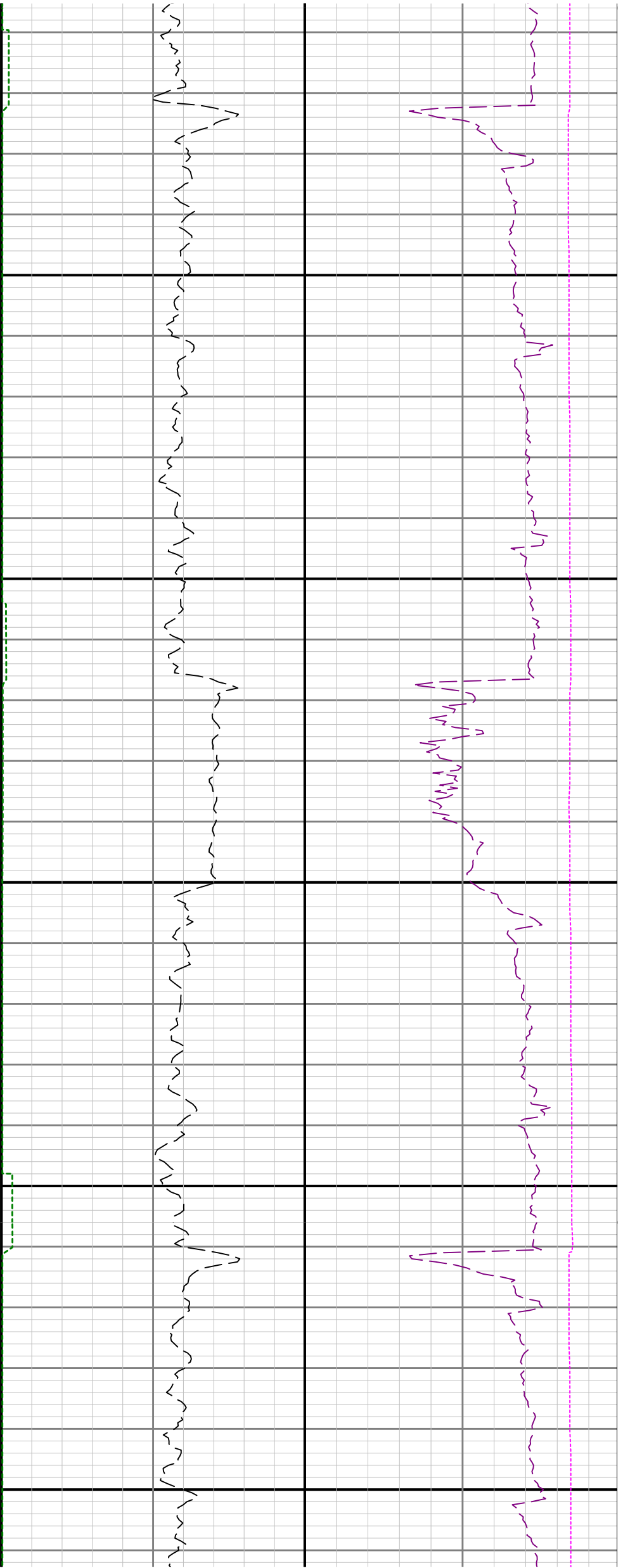
ROPA

WOBA

TCDM

See Remark 3

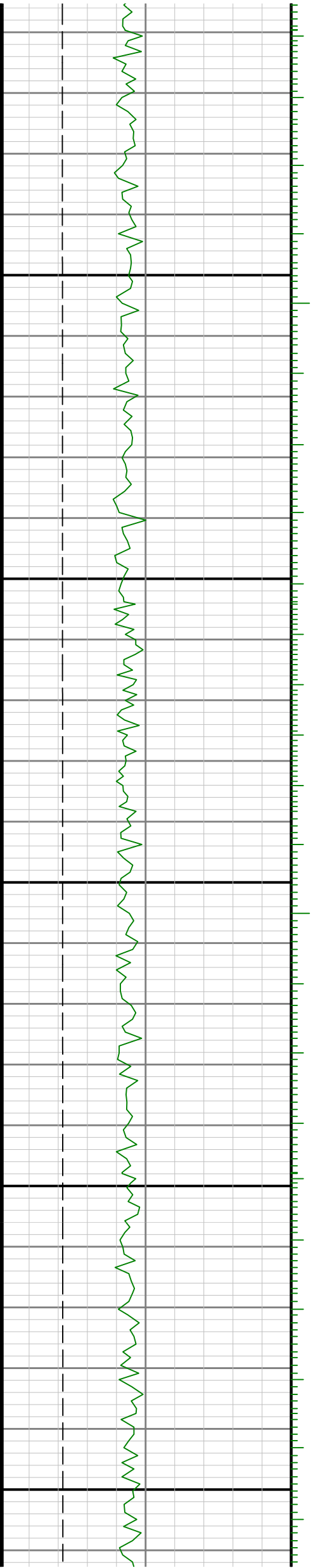


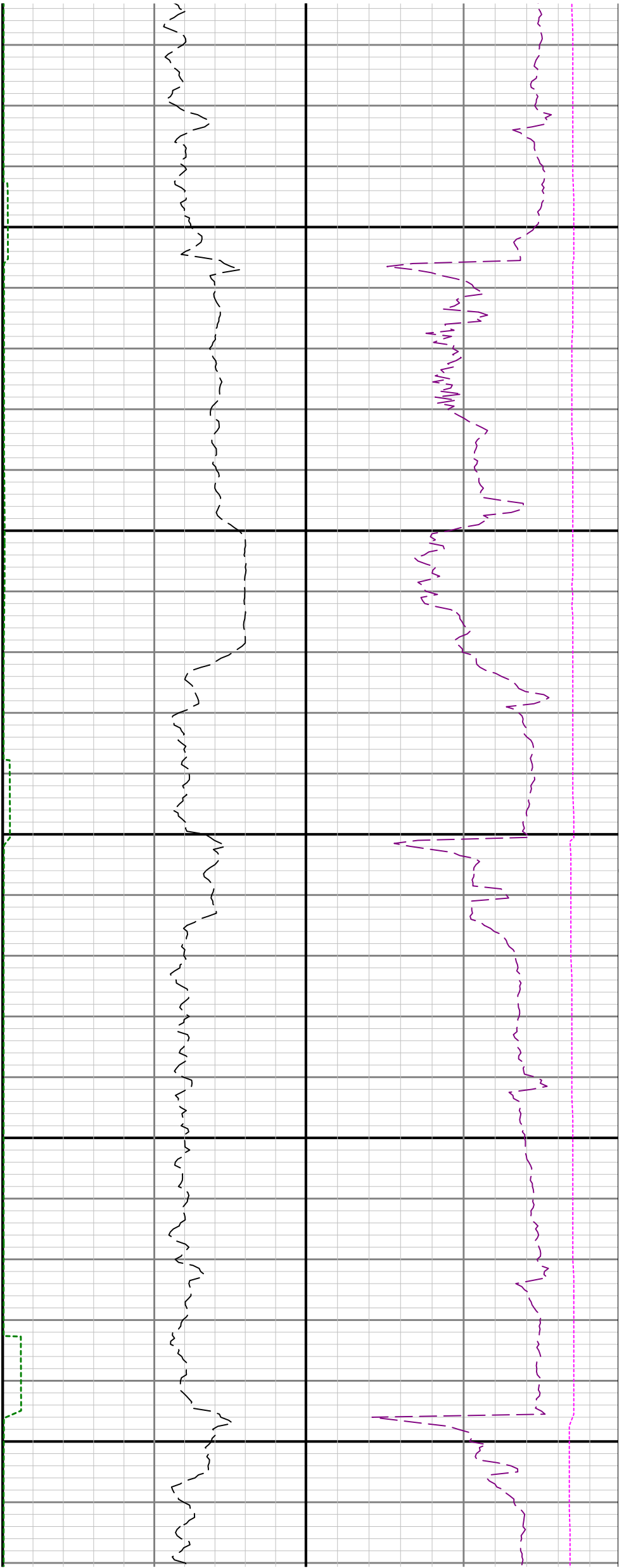


16400

16500

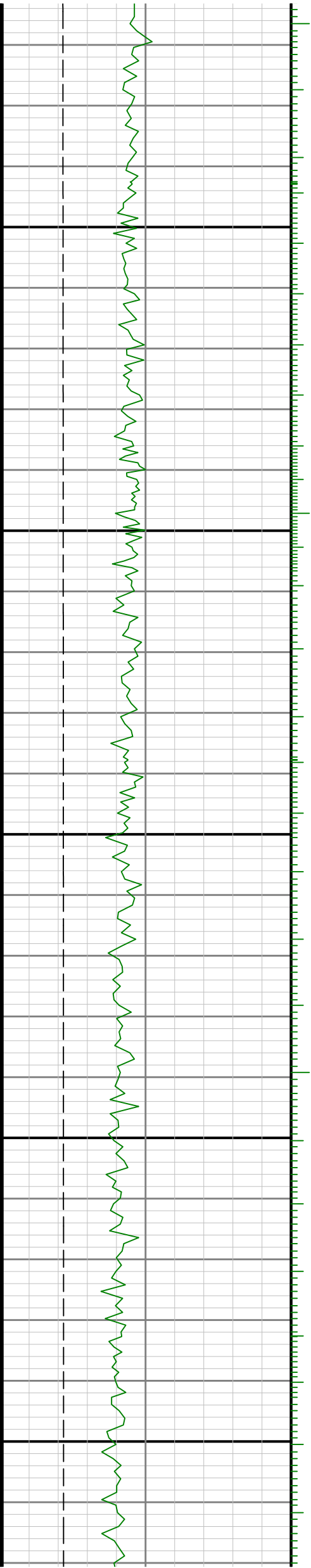
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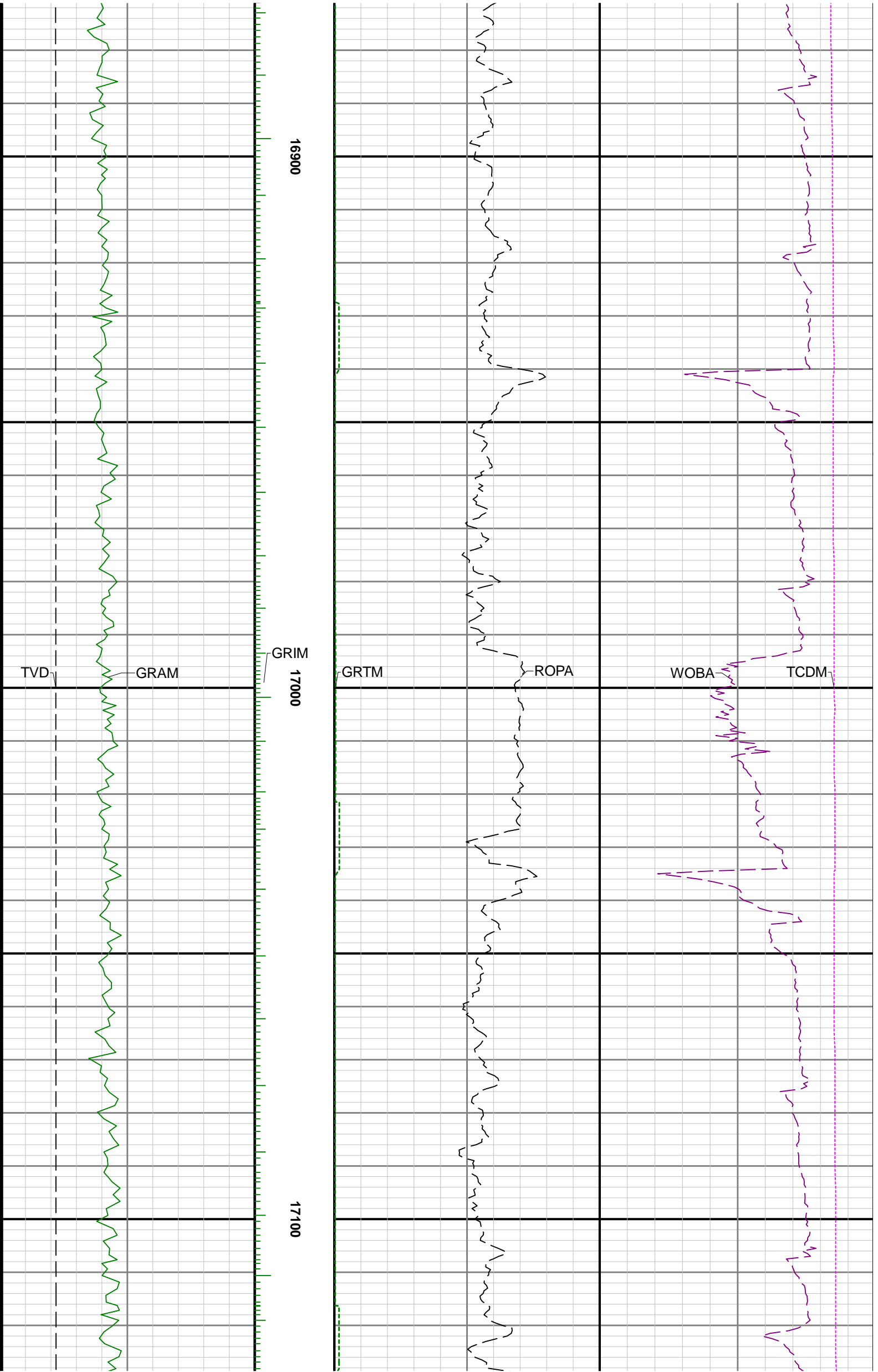


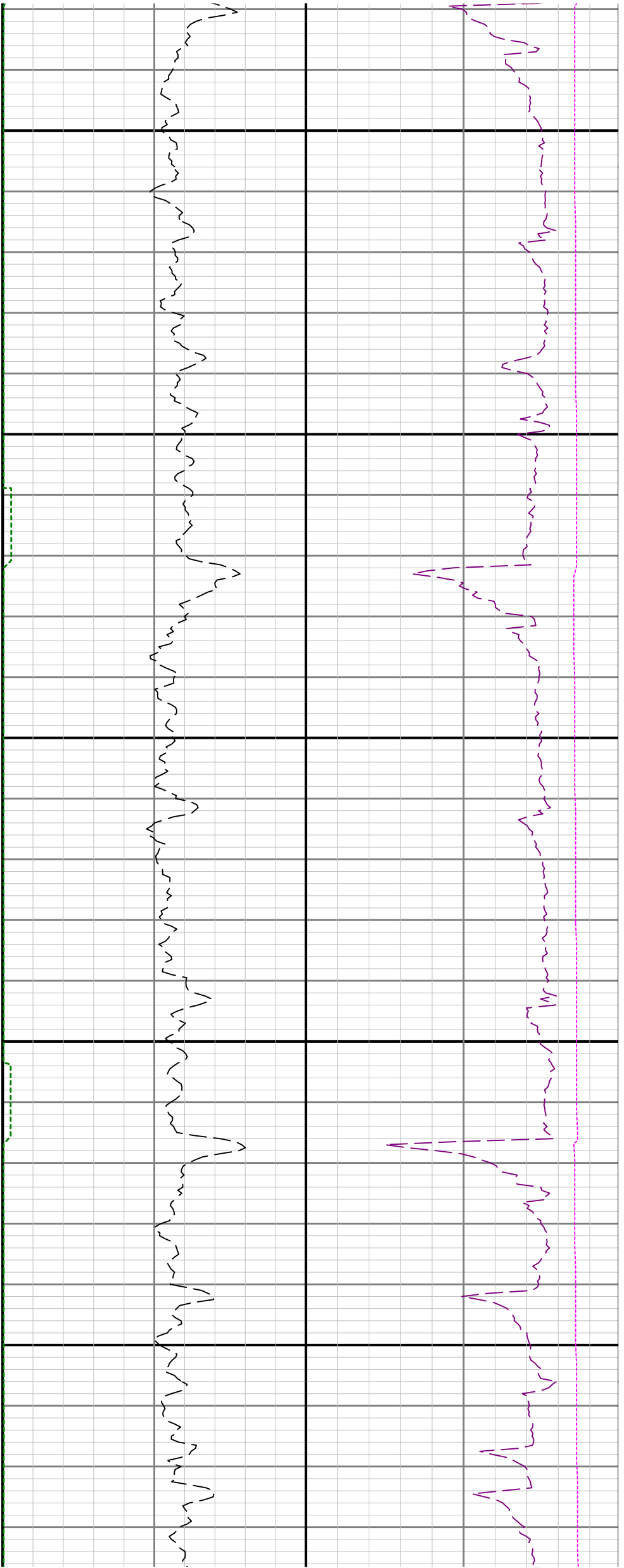


16700

16800







17200

17300

