



# LWD MEMORY LOG

# Gamma Ray

Scale:		Company: Noble Energy				
1:240 MD		Well: Hullahaloo Y21-775				
Depth Reference:		Field: Weld Country(Noble NAD 83 Grid)				
Driller's Depth		County: Weld		Country: United States		
Status:		State: Colorado		Other Services:		
Final Print		Surface Location:		Latitude: Longitude:		
API No: 05-123-45241-00		SEC: 16 TWN: 2N RGE: 64W		Directional		
Job ID: 8739445		Elevation: 4894.00 ft		Elev. KB: N/A		
Permanent Datum (P.D.): Ground Level		Above P.D. 30.00 ft		Elev. DF: 4924.00 ft		
Log Measured From: Rig Floor				Elev. GL: 4894.00 ft		
Dates		Interval Logged		Magnetic Field Reference		
Date From: 2017-09-16		Top: (ft) 2043.00		Azi Reference North: Grid Dip Angle: (deg) 66.66		
Date To: 2017-09-20		Bottom: (ft) 17203.00		Total Magnetic Field Strength: (nT) 52272		
Spud Date: 2017-09-15				Mag to Reference North Correction: (deg) 7.46 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	2043.00	9.625	36.00	30.00	2033.00
8.500	2043.00	17203.00				
Mud Record						
Type	From (ft)	To (ft)	Hole Size (in)	Interval (ft)	Inc   Az (Start)	Inc   Az (End)
Oil Based Mud	2043.00	17203.00	8.500	15160.00	0.00   7.46	89.94   181.43
Acquisition System						
Baker Hughes Cadence	RT4.1		H&P 517		Other	
Pilot Studio	4.1.7763.3		Rig: Contractor: District:	Helmerich & Payne Drilling Co 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	AutoTrak Curve	2030.65	11630.00	2043.00	11642.35	2017-09-16 18:31	2017-09-18 03:46	30.42
2	2	8.500	PDC	3.00	AutoTrak Curve	11630.00	16361.26	11642.35	16373.61	2017-09-18 14:19	2017-09-19 07:29	16.24
3	2	8.500	PDC	3.00	AutoTrak Curve	16360.71	17190.10	16373.61	17203.00	2017-09-19 21:34	2017-09-20 00:37	4.96

## Crew

Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite
Adam Schlenz	2017-09-15	2017-09-20	Emi Iyalla	2017-09-15	2017-09-20			

## Mud Properties Record

Date / Time	Run	Measured	Mud	Density	Viscosity	pH	Fluid	Oil /	Source	Total	K+
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	No.	Depth (ft)	Type	(ppg)	(cP)		Loss (cm3)	Water		Chlorides (ppm)	(%)
2017-09-16 13:00	1	2043.00	Oil Based Mud	9.2	11	N/A	28.0	84/16	Active Pit	18500	0.00
2017-09-17 03:00	1	4375.00	Oil Based Mud	8.8	9	N/A	17.2	83/17	Active Pit	22000	0.00
2017-09-17 13:00	1	7110.00	Oil Based Mud	8.8	9	N/A	17.2	82/18	Active Pit	23500	0.00
2017-09-18 03:00	1	11425.00	Oil Based Mud	9.0	9	N/A	15.2	84/16	Active Pit	20000	0.00
2017-09-18 13:00	2	11642.00	Oil Based Mud	9.3	10	N/A	16.8	87/13	Active Pit	20000	0.00
2017-09-19 03:00	2	15421.00	Oil Based Mud	9.3	11	N/A	17.6	84/16	Active Pit	22500	0.00
2017-09-19 13:00	2	16370.00	Oil Based Mud	9.3	10	N/A	18.4	85/15	Active Pit	22500	0.00
2017-09-20 03:00	3	17203.00	Oil Based Mud	9.4	10	N/A	18.8	85/15	Active Pit	20000	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	12194650	Near Bit VSS	5.93	6.73	7.000	4.330
1	ATC_SU	12194650	Near Bit Inclination	5.93	6.73	7.000	4.330
1	ATC_MWD	12332940	Gamma (single)	2.21	12.35	7.000	3.250
1	ATC_MWD	12332940	Directional (mag)	12.28	22.42	7.000	3.250
2	ATC_SU	12682276	Near Bit Inclination	5.93	6.73	7.000	4.330
2	ATC_SU	12682276	Near Bit VSS	5.93	6.73	7.000	4.330
2	ATC_MWD	14131212	Gamma (single)	2.21	12.35	7.000	3.250
2	ATC_MWD	14131212	Directional (mag)	12.28	22.42	7.000	3.250
3	ATC_SU	14236901	Near Bit Inclination	5.93	6.73	7.000	4.330
3	ATC_SU	14236901	Near Bit VSS	5.93	6.73	7.000	4.330
3	ATC_MWD	14179564	Gamma (single)	2.75	12.90	7.000	3.250
3	ATC_MWD	14179564	Directional (mag)	12.28	22.43	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 to 3 utilized a 6.75 inch NaviGamma services (Gamma Ray and Directional) services behind a 8.5 inch bit and rotary steerable assembly from 2043 to 17203 feet MD (2035 to 6883 feet TVD).

Remarks

Number	Measured Depth (ft)	Hole Section (in)	Run No.	Remark
1	11630.00	8.500	1	The GRTM curve exceeds the scale in the interval from 11630 to 11642 feet MD (6893 feet TVD) due to the fact that no data was logged for 12 hours after a trip out of hole to replace the AutoTrak Curve tool.
2	16361.00	8.500	2	The GRTM curve exceeds the scale in the interval from 16361 to 16373 feet MD (6885 feet TVD) due to the fact that no data was logged for 12 hours after a trip out of hole to replace the AutoTrak Curve tool.
3	17191.00	8.500	3	The interval from 17191 to 17203 feet MD (6883 feet TVD) was not logged after being drilled due to sensor to bit offset at well TD.

Curve Mnemonics

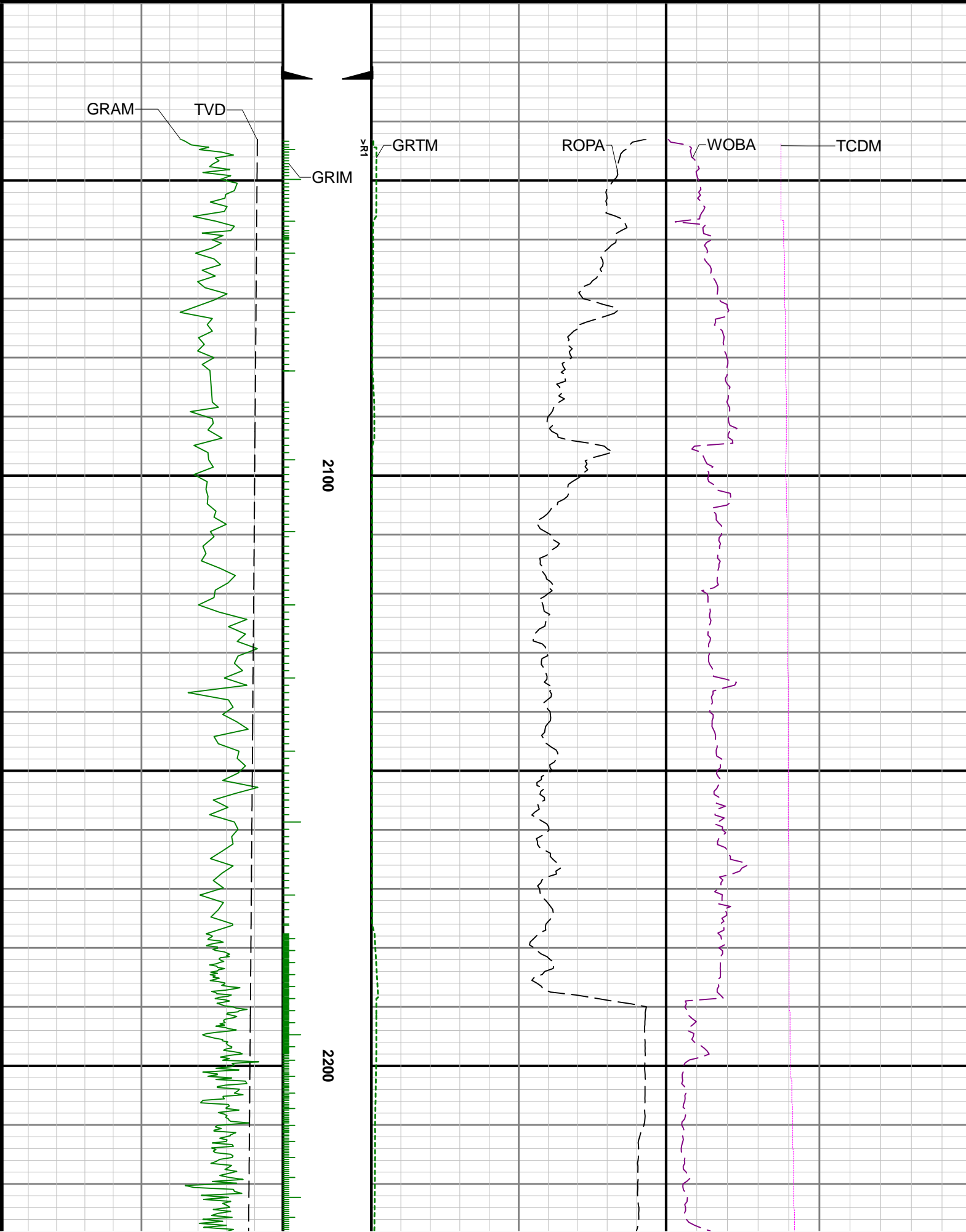
Presented Curves	Description	Units
ROPA	Depth Averaged ROP 3 ft Average	ft/h
TVD	True Vertical Depth	ft
WOBA	Weight On Bit, Average 1 ft Average	klb
GRAM	OnTrak - Gamma Ray - Apparent - Memory 0.5 ft Average	API
GRIM	OnTrak - Gamma Ray - Data Point Indicator - Memory	unitless
GRTM	OnTrak - Gamma Ray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

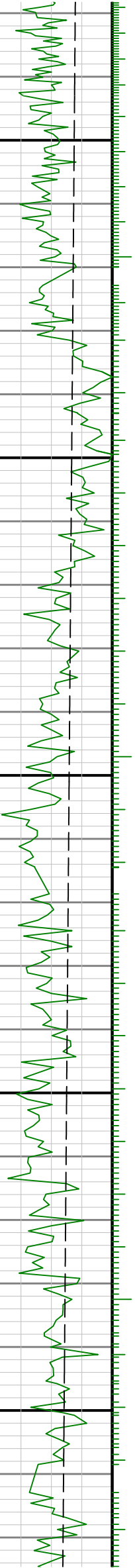
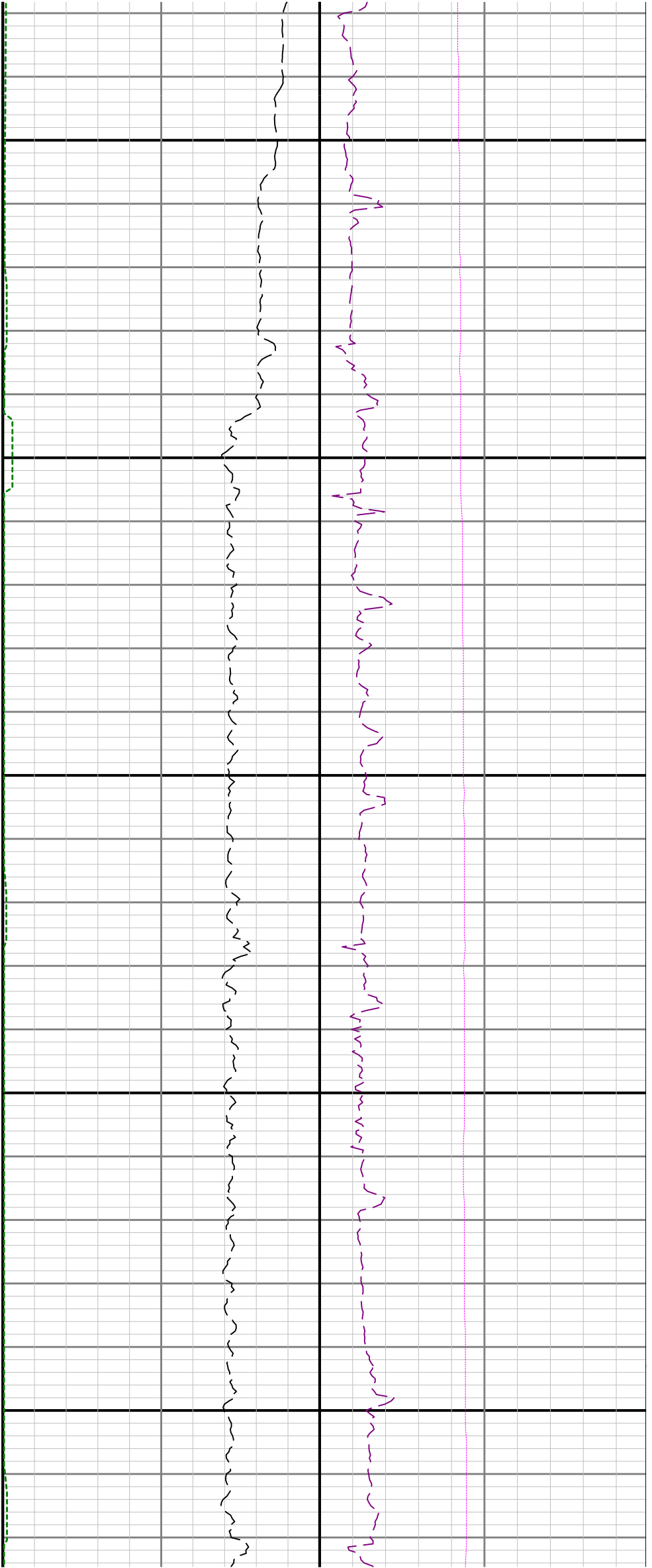


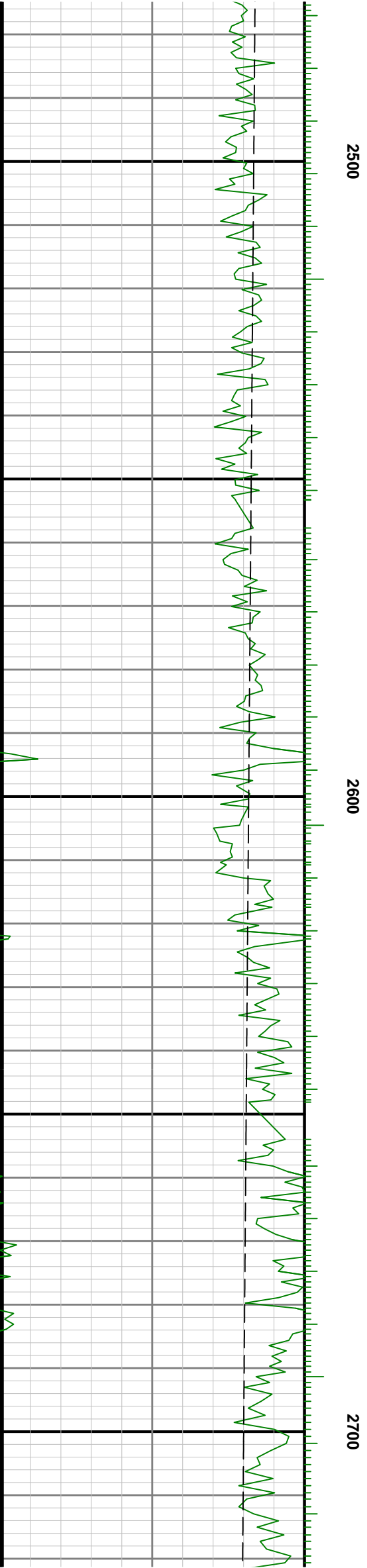
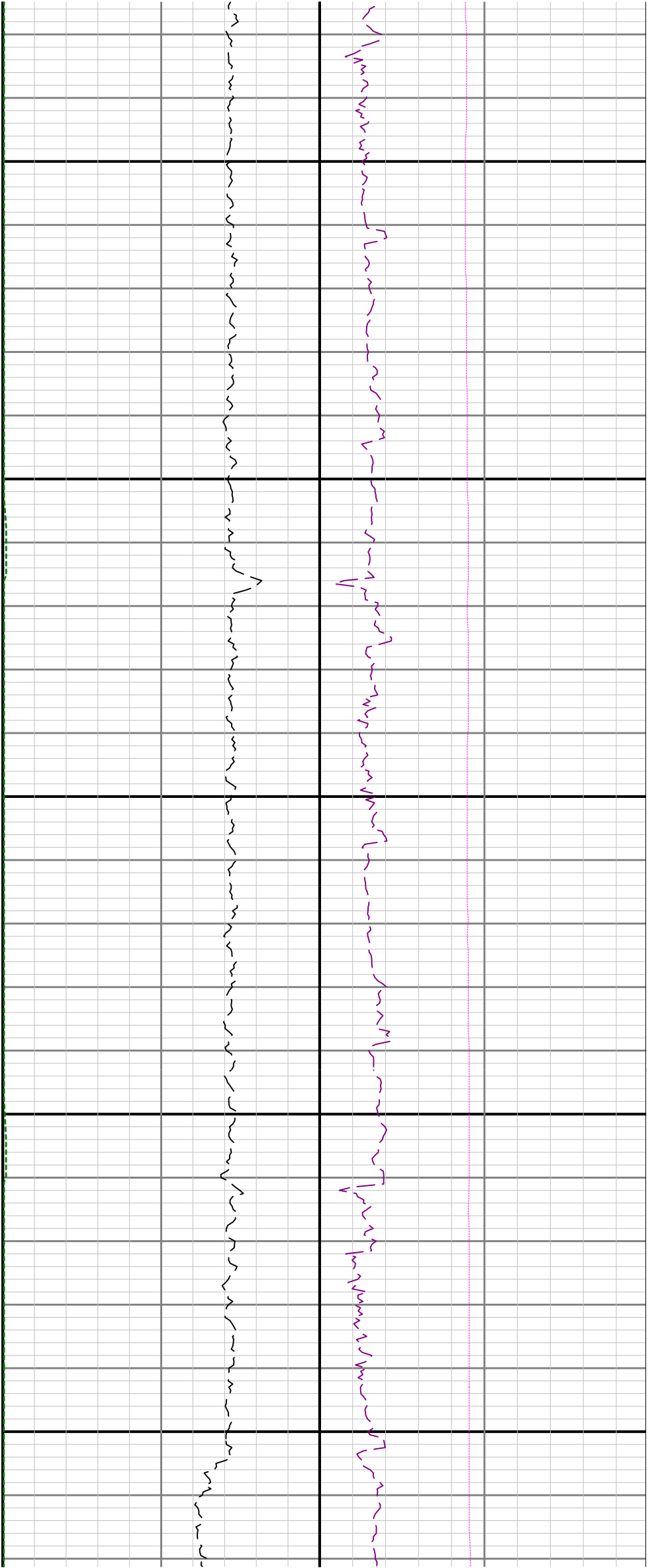
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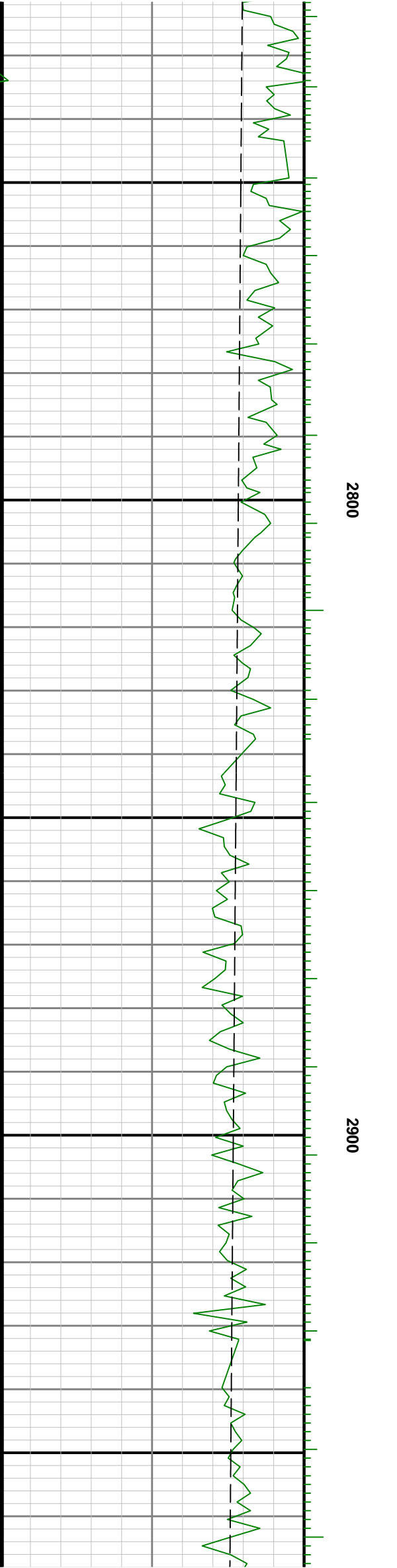
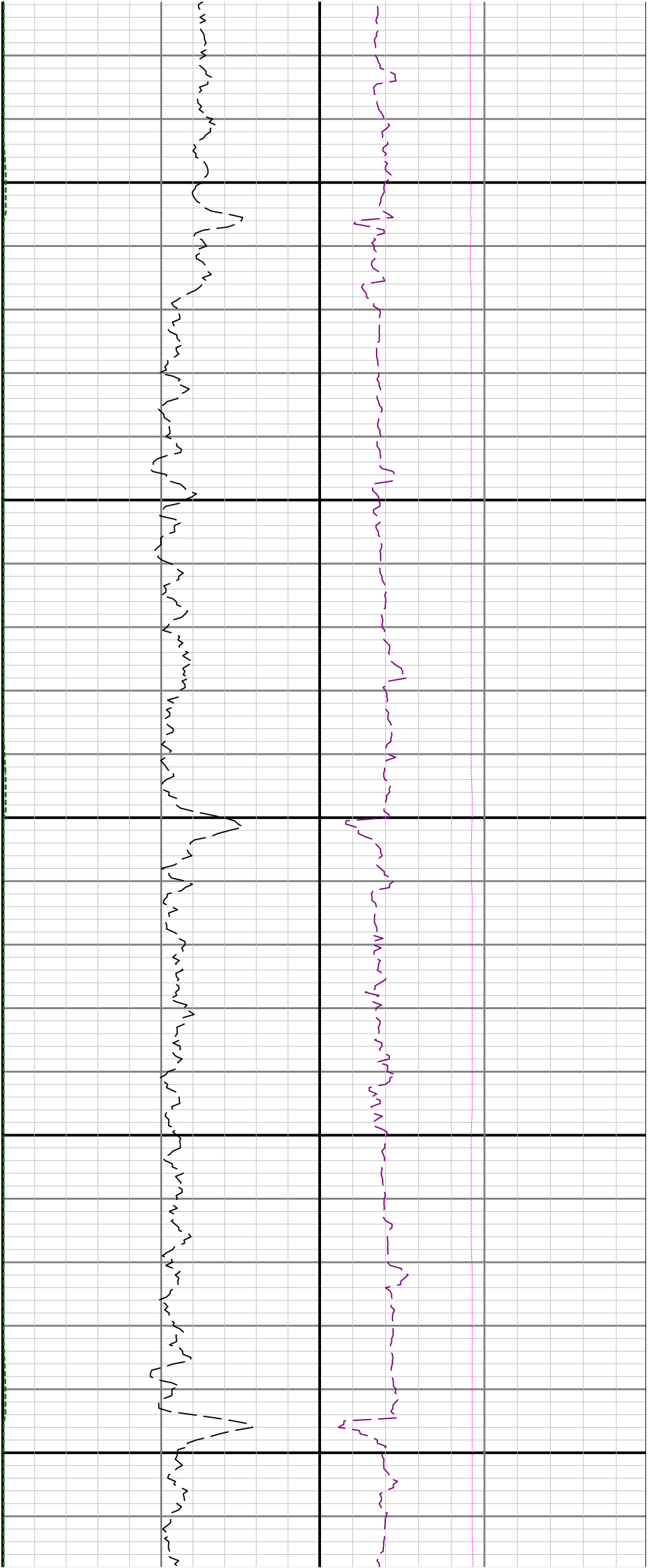
Hullabaloo Y21-775  
Date From: 2017-09-16 18:31:37  
Date To: 2017-09-20 00:36:24  
2017-09-20 09:40:09  
Top: 2043.00  
Bottom: 17203.00

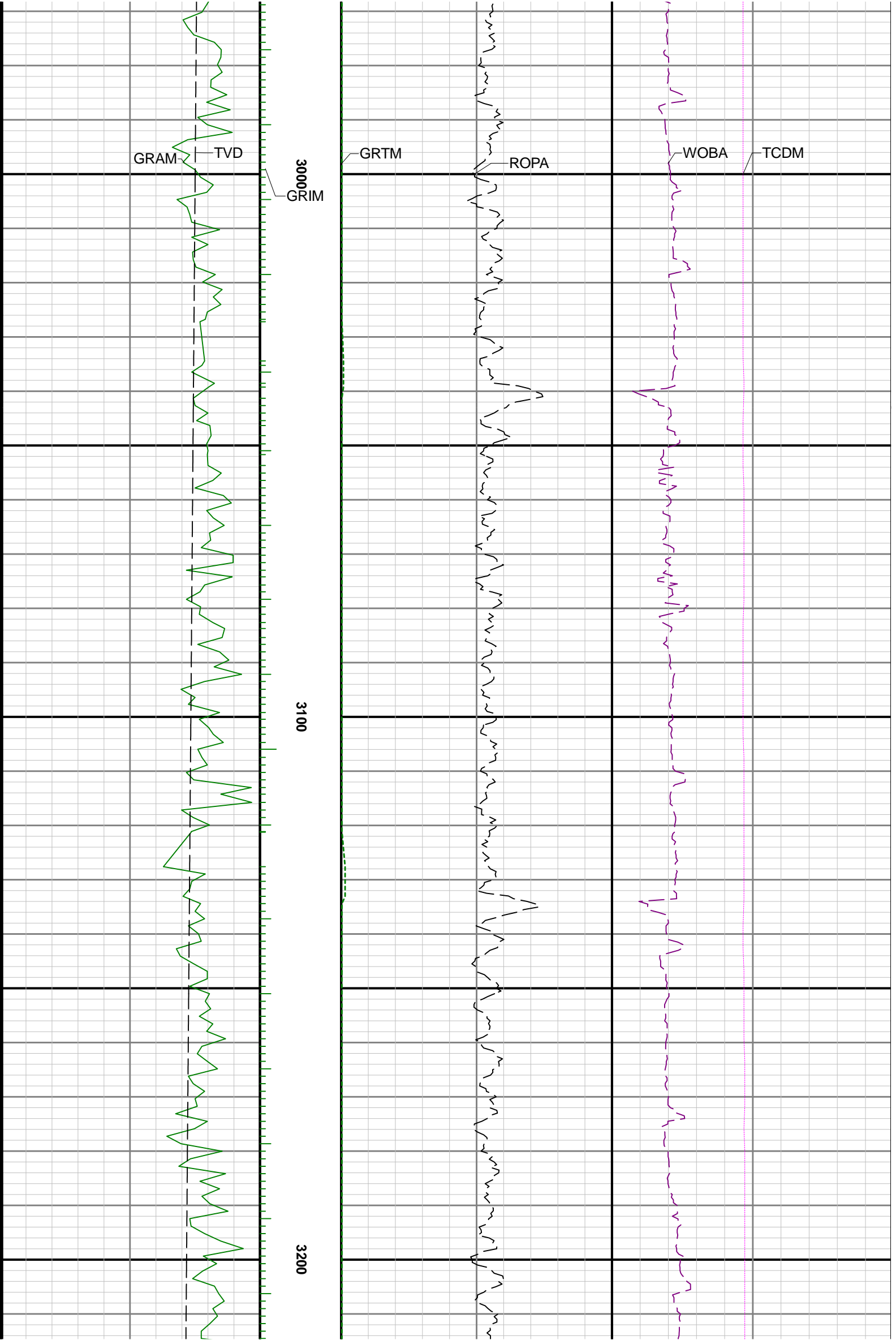
Gamma Ray - Apparent 0.5 ft Average GRAM 0 150	MD 1:240 feet	Gamma Time Since Drilled GRTM 0 600	Weight On Bit, Average 1 ft Average WOBA 0 50
API		min	klb
True Vertical Depth TVD 7500 1500		Depth Averaged ROP 3 ft Average ROPA 1000 0	Downhole Temperature TCDM 0 300
ft		ft/h	degF

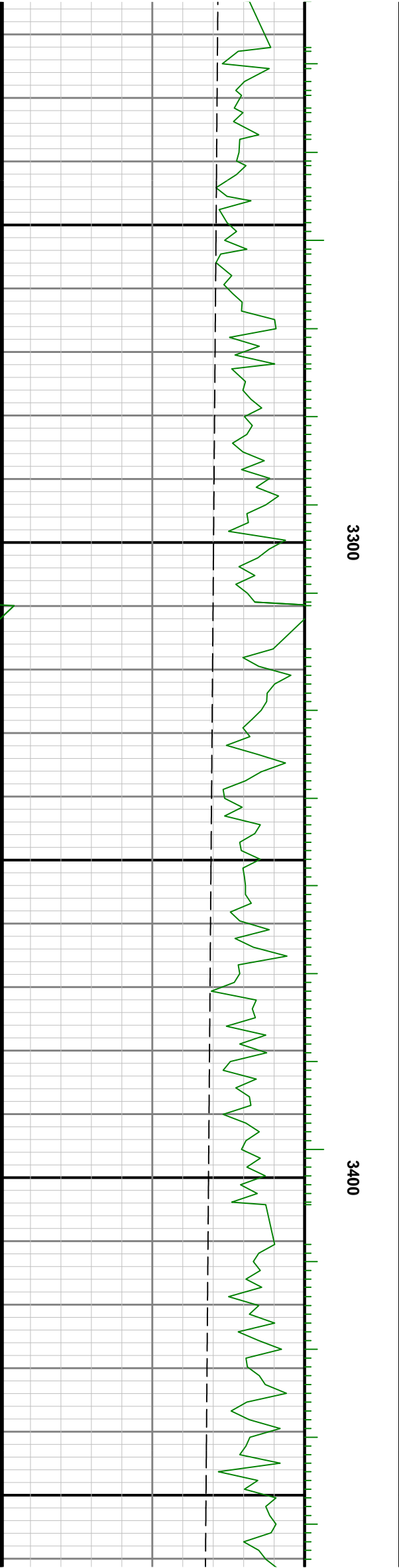
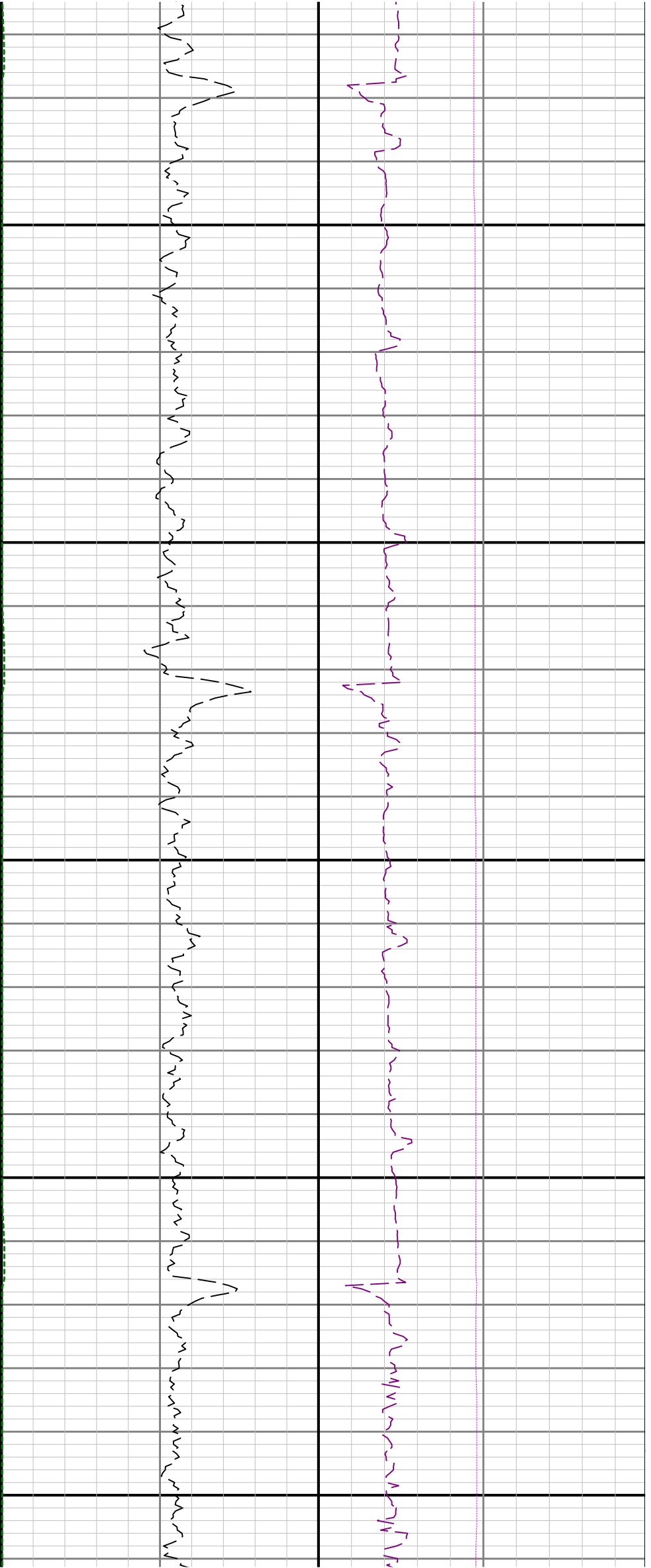




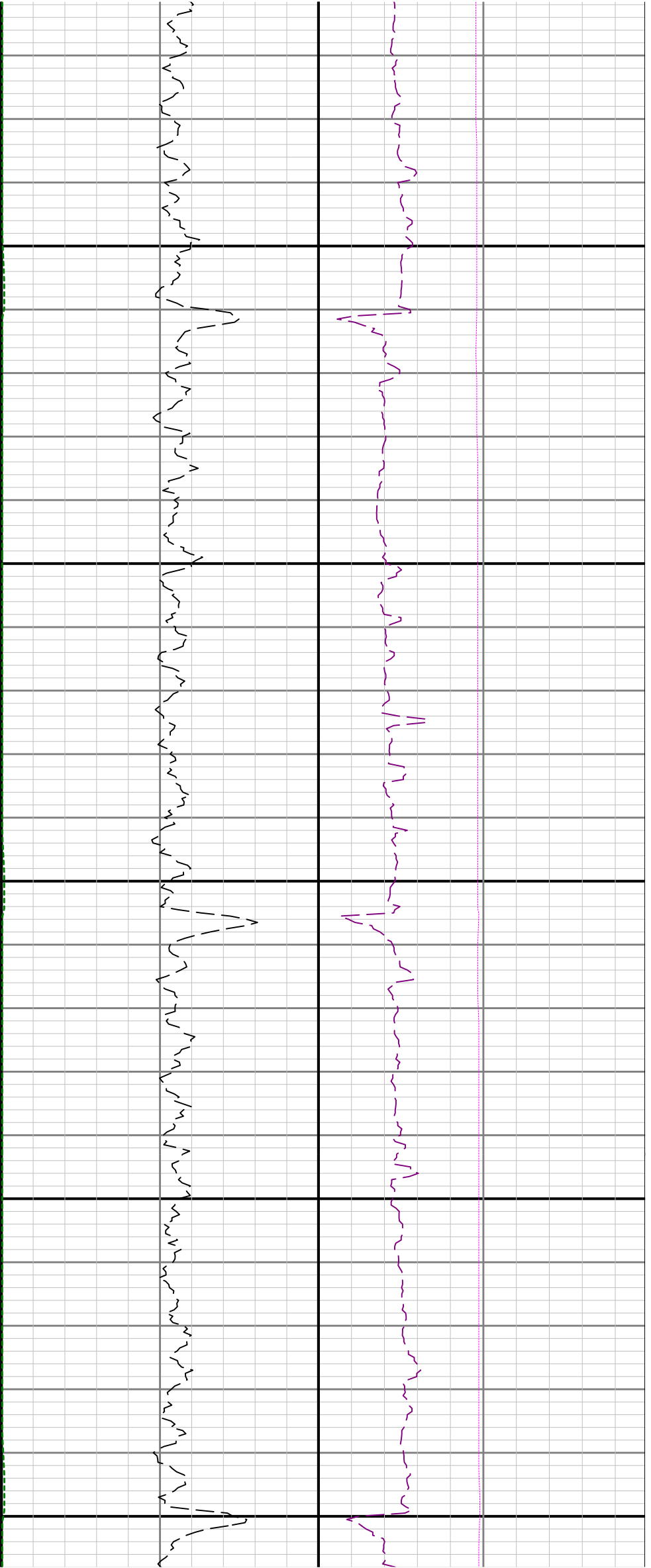








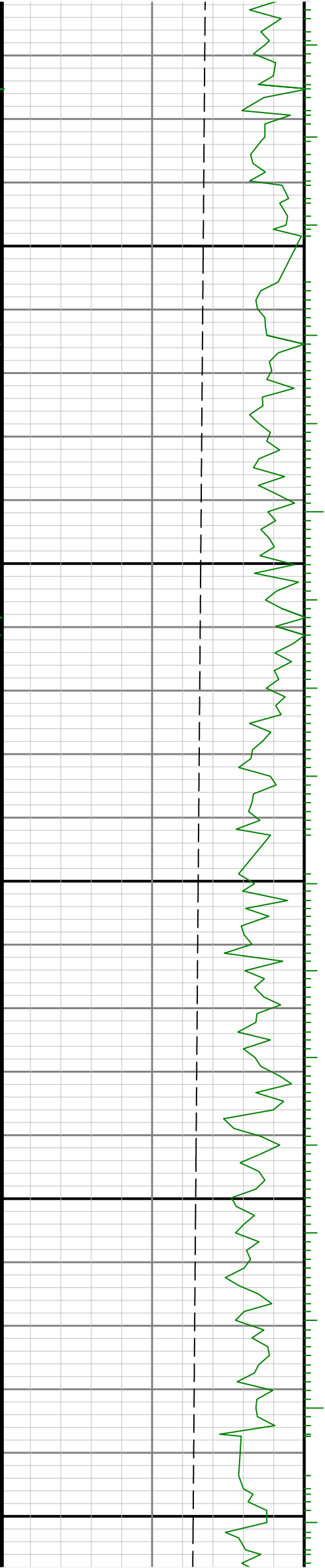


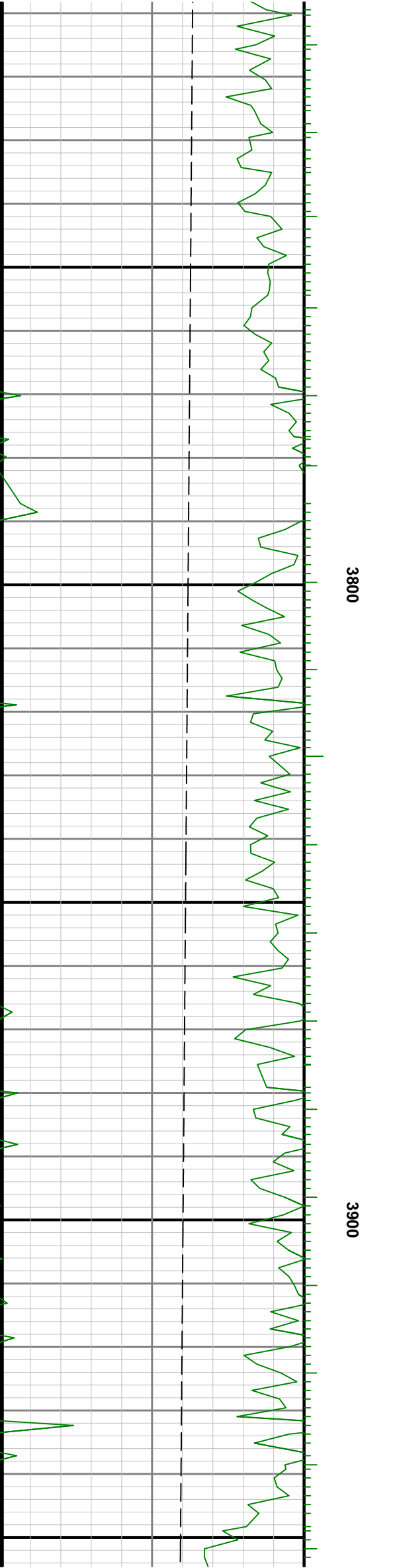
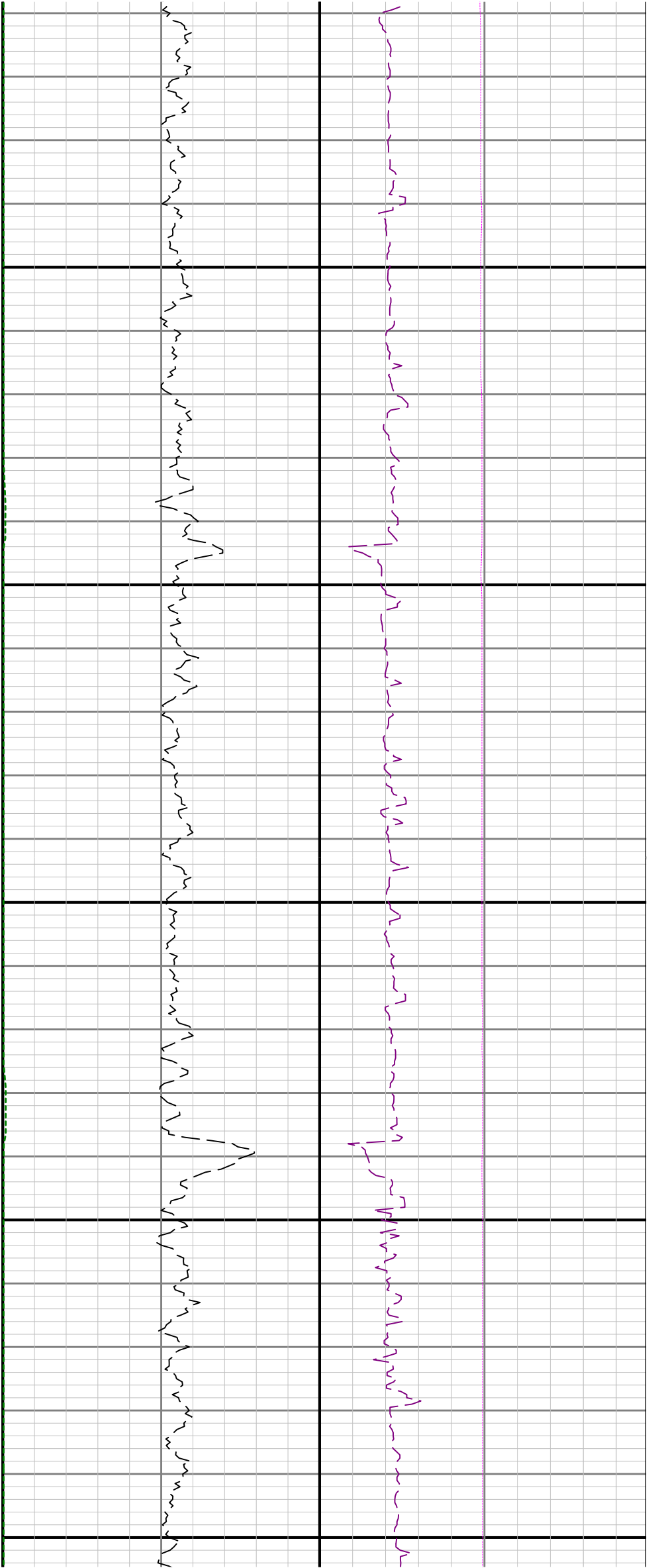


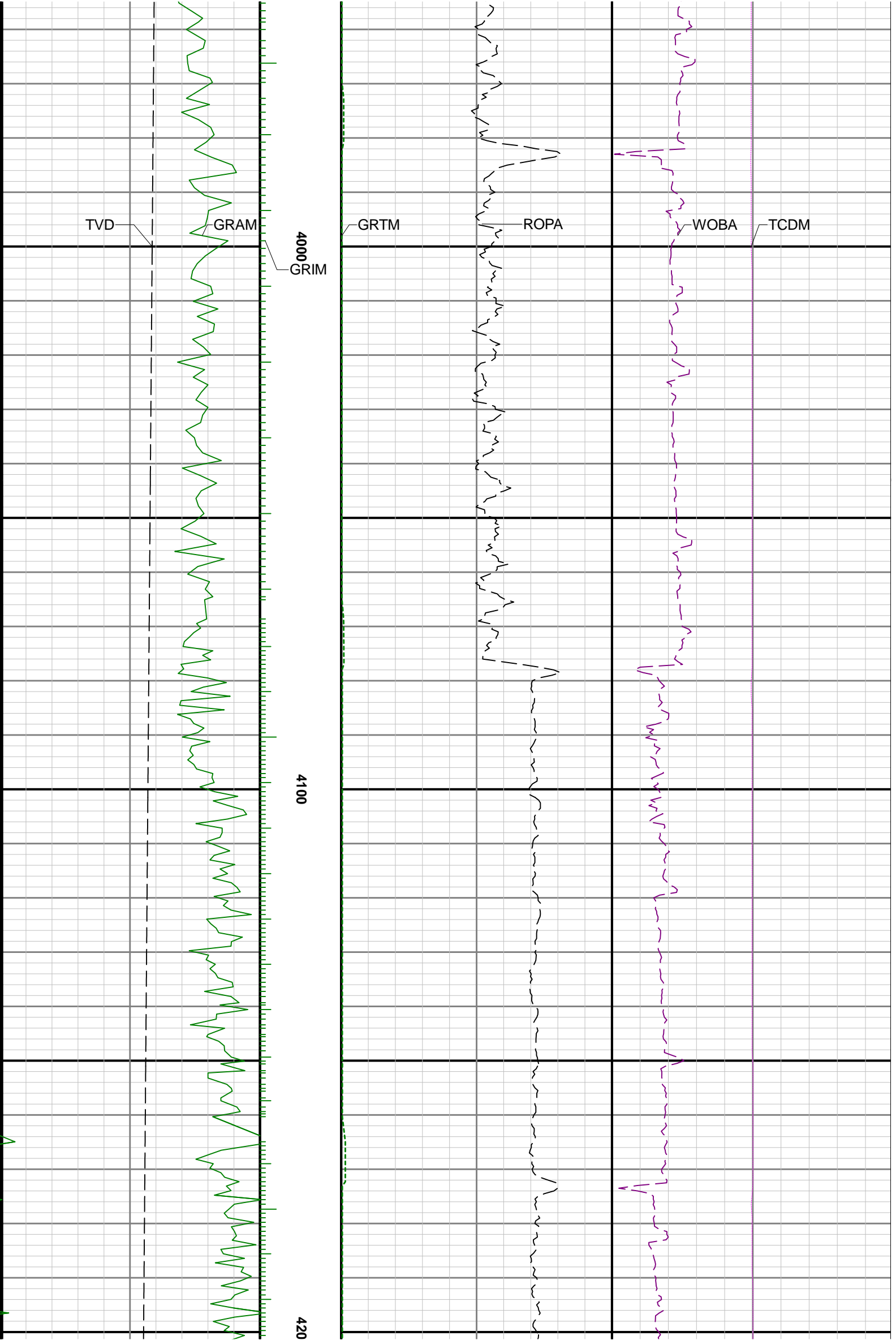
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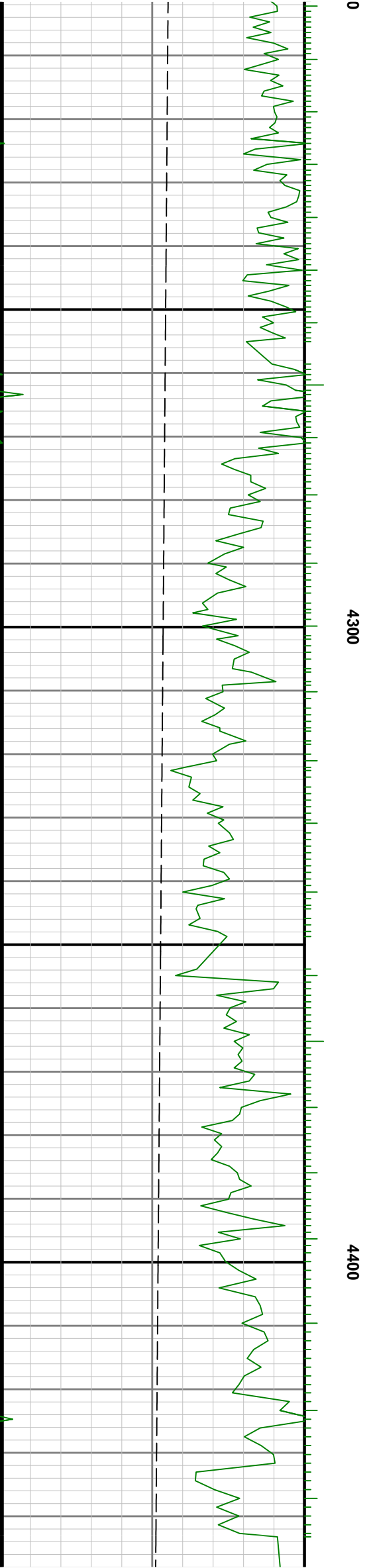
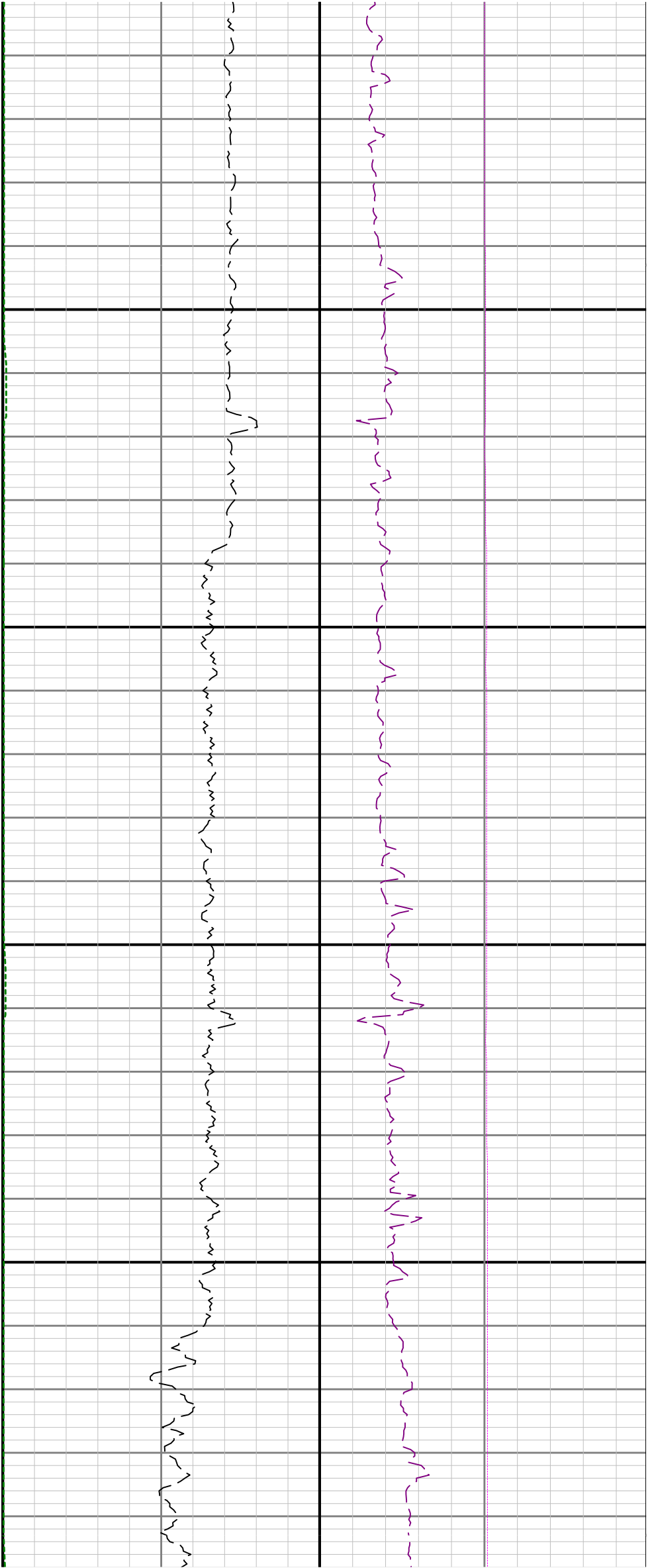
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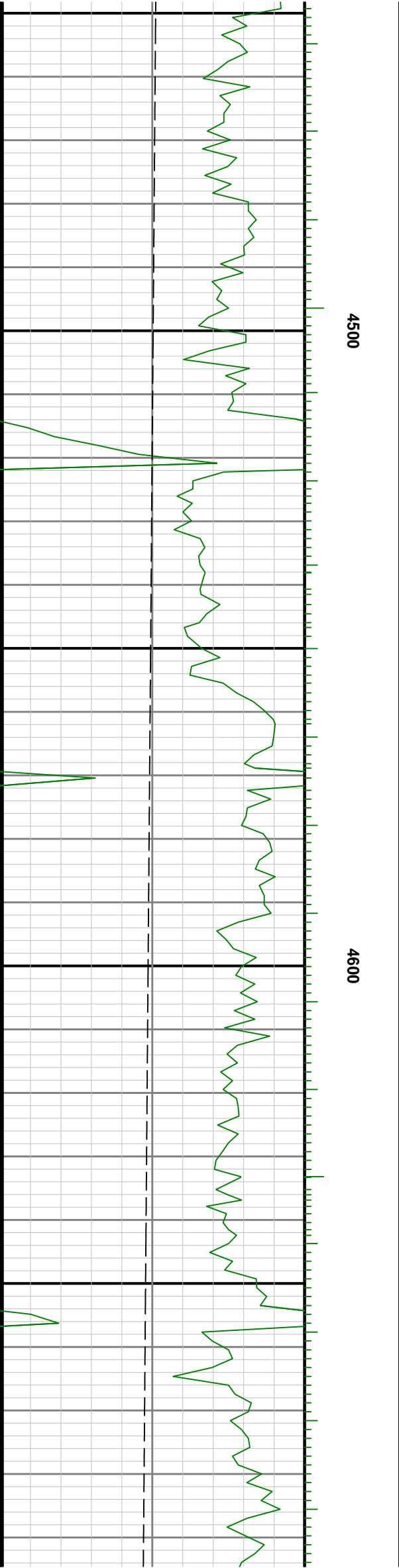
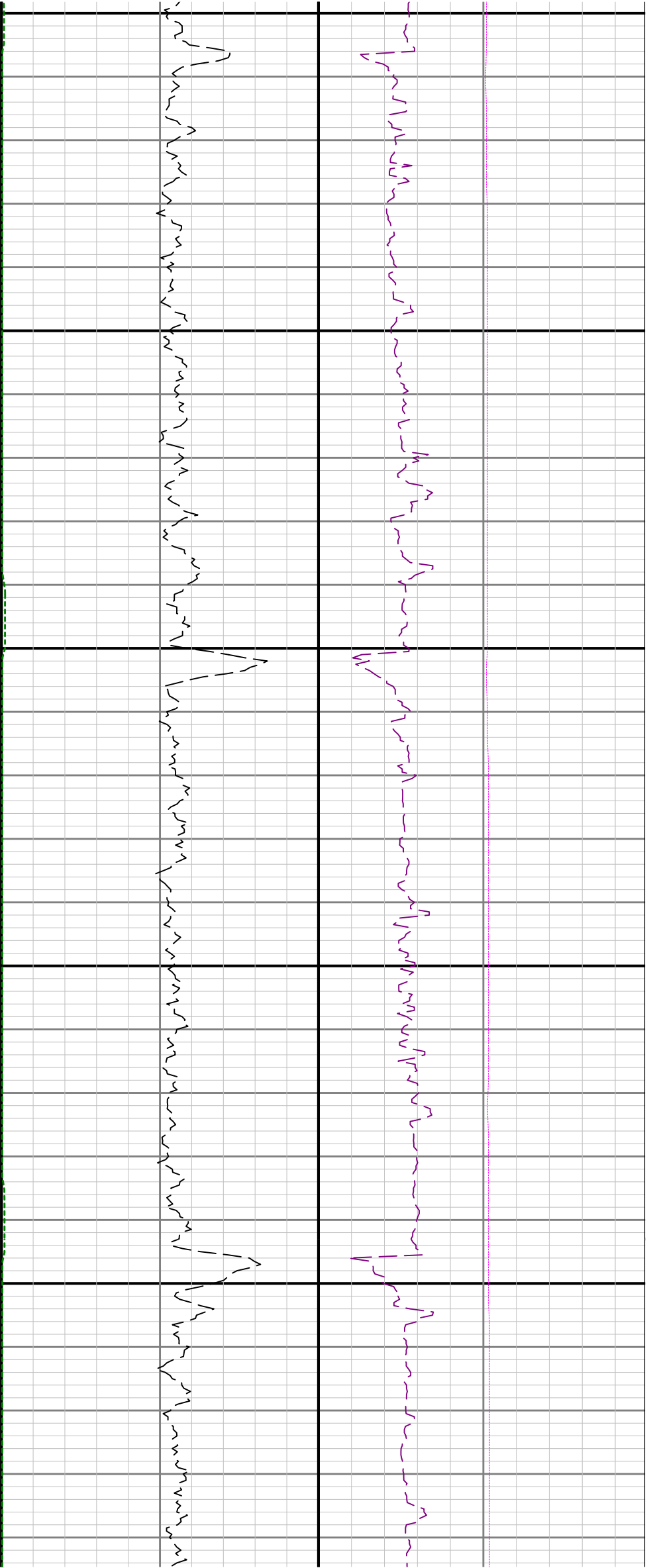
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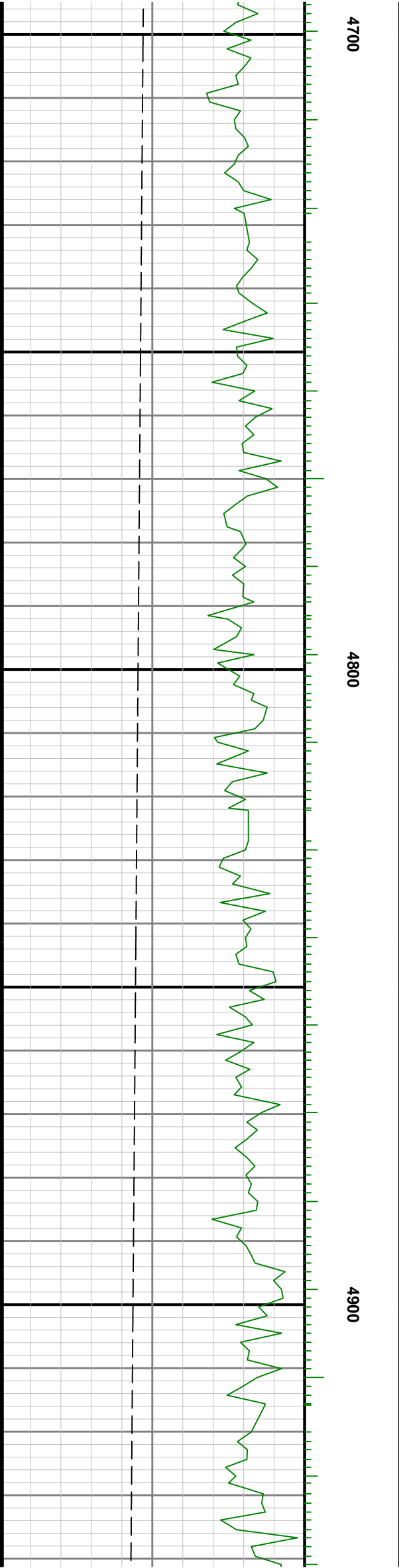
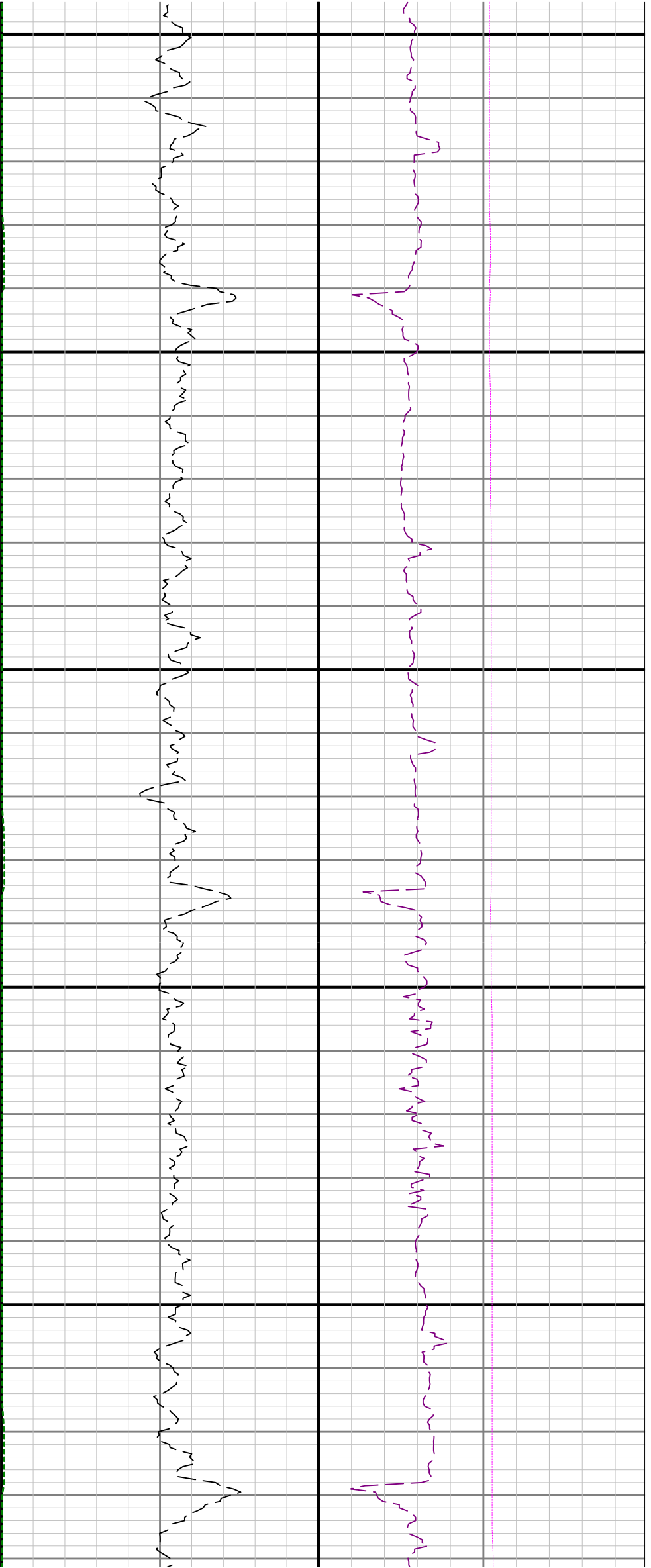


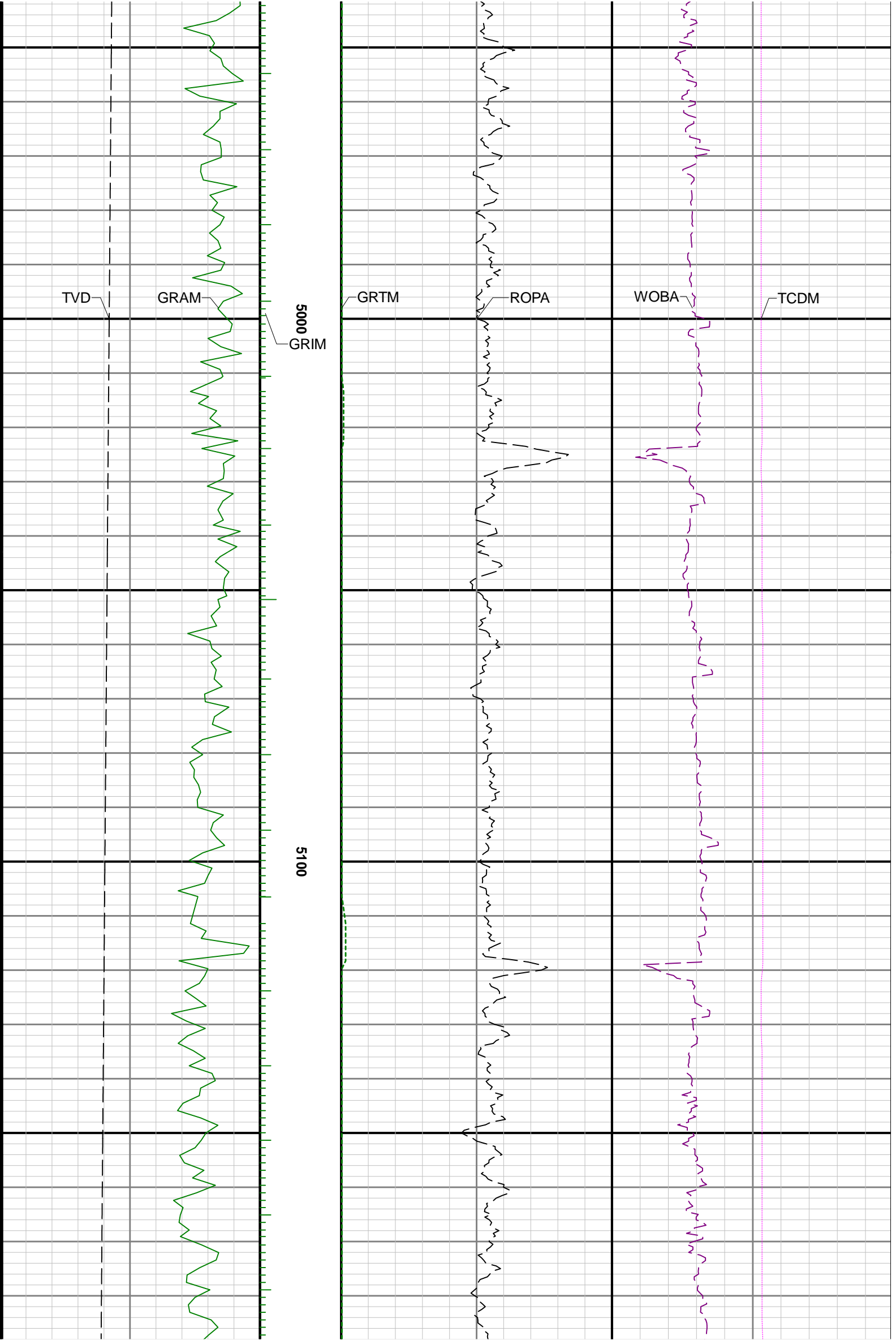


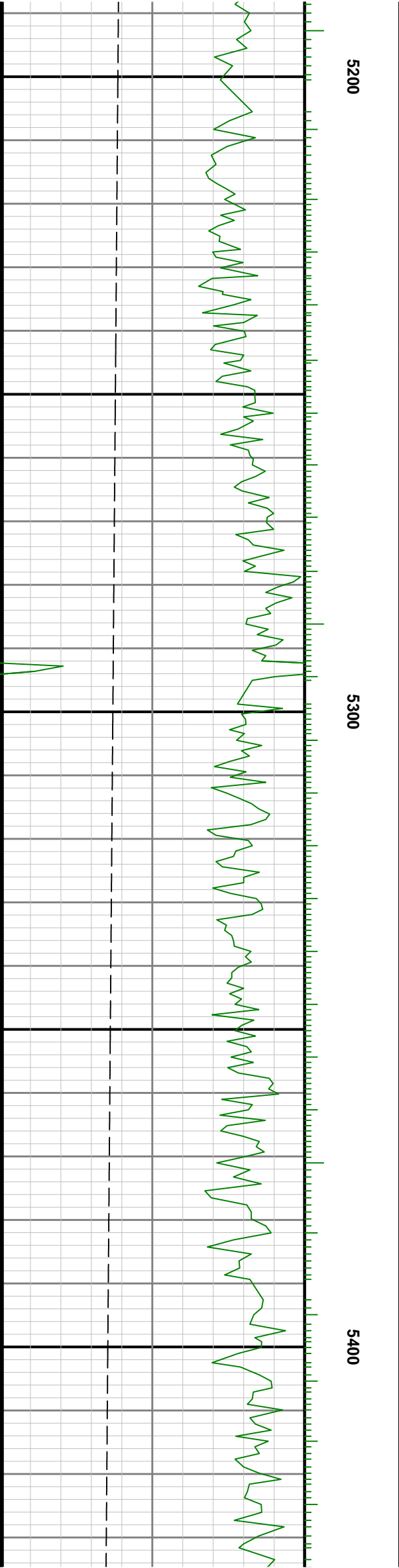
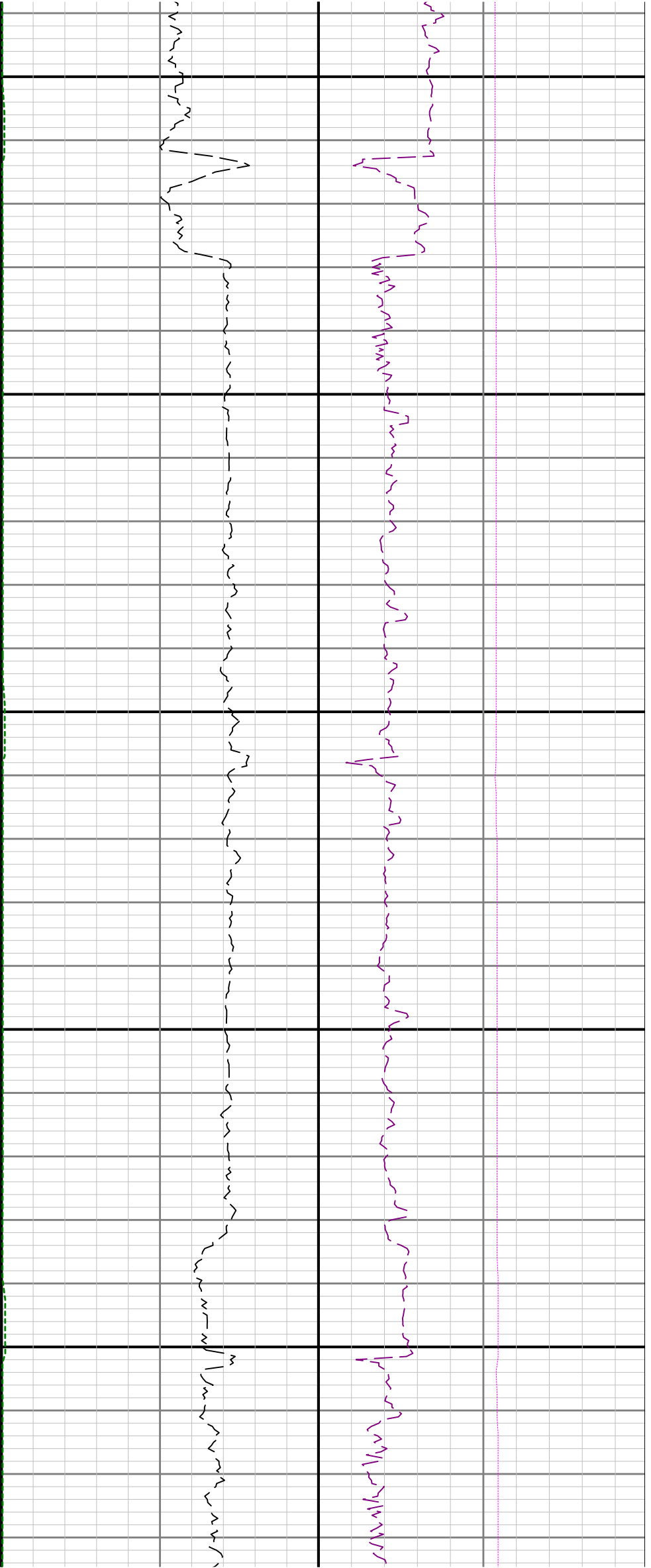




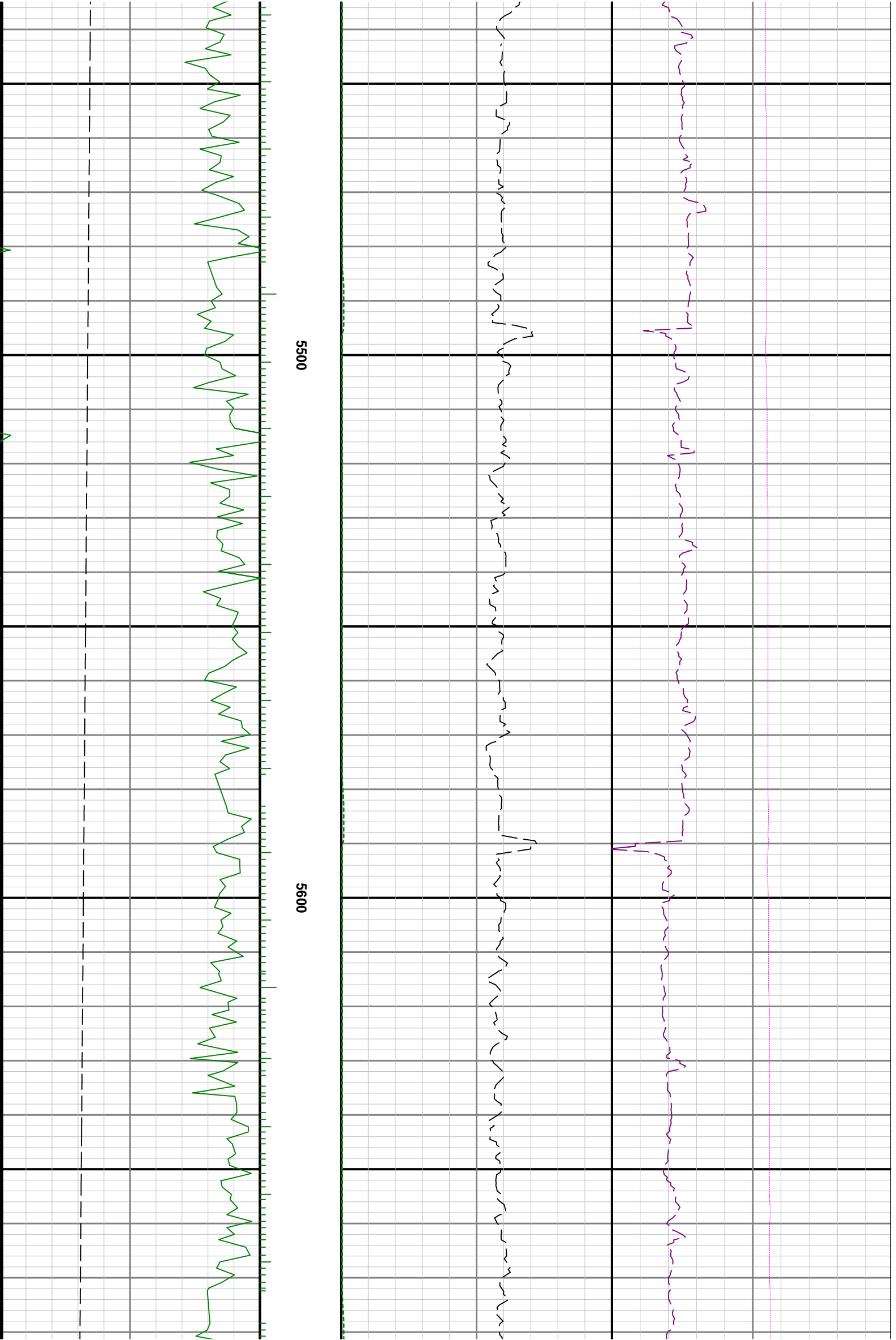


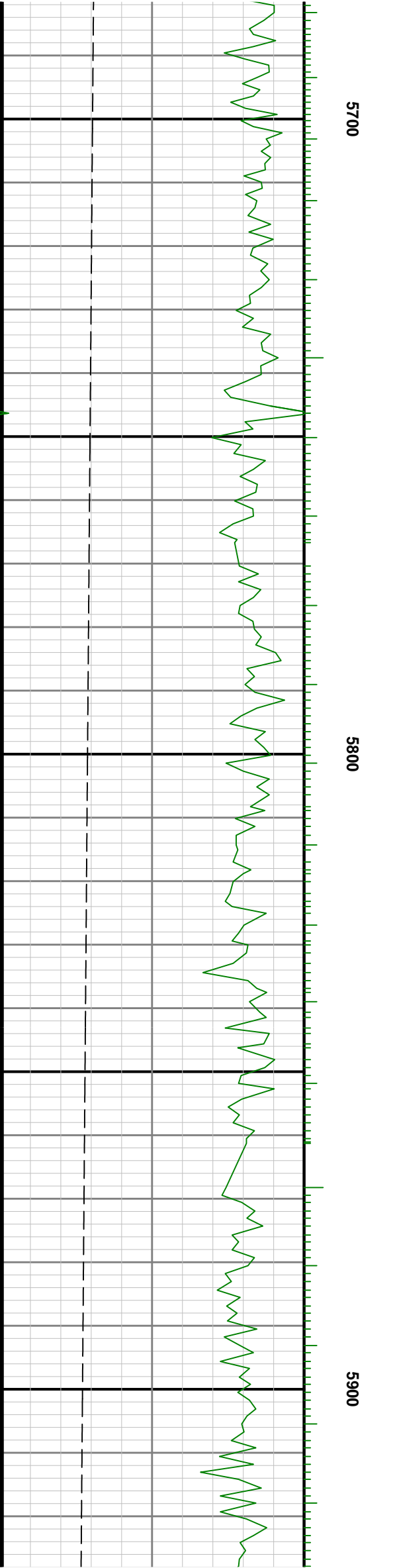
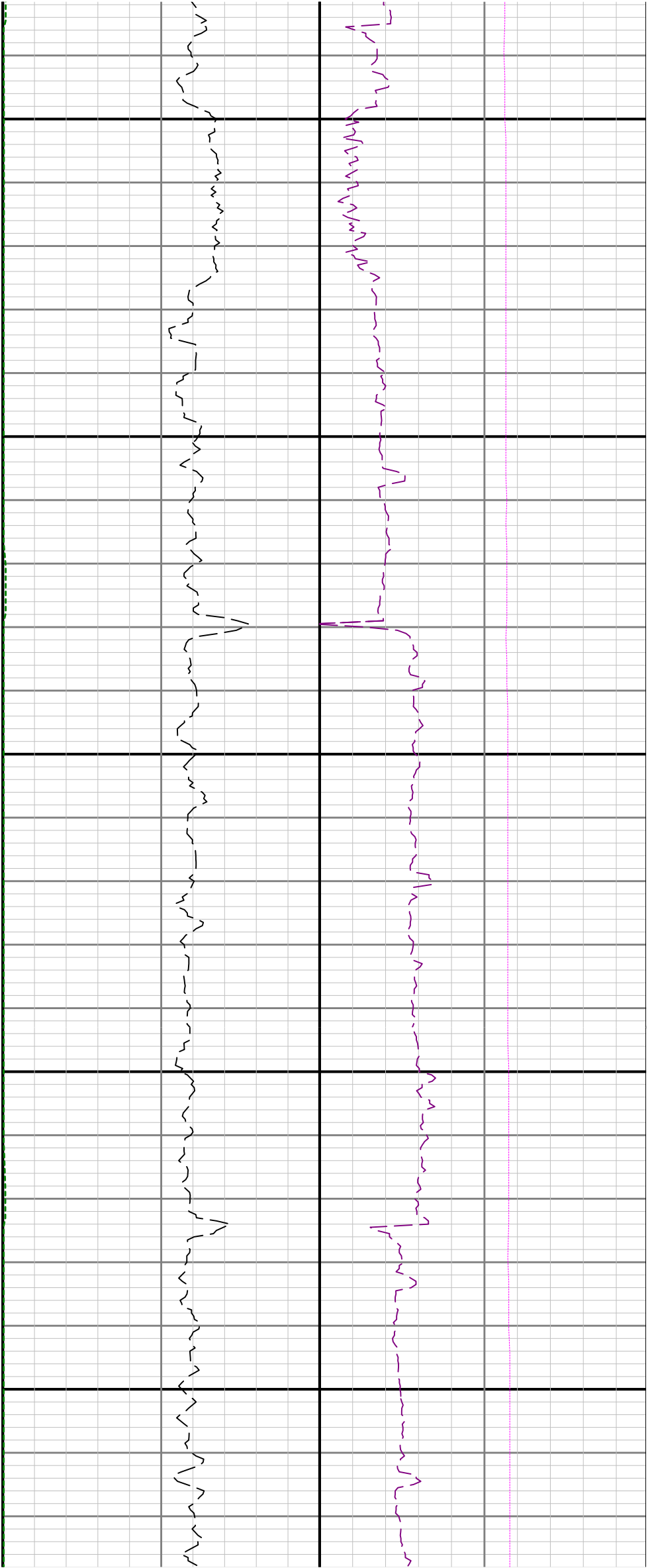


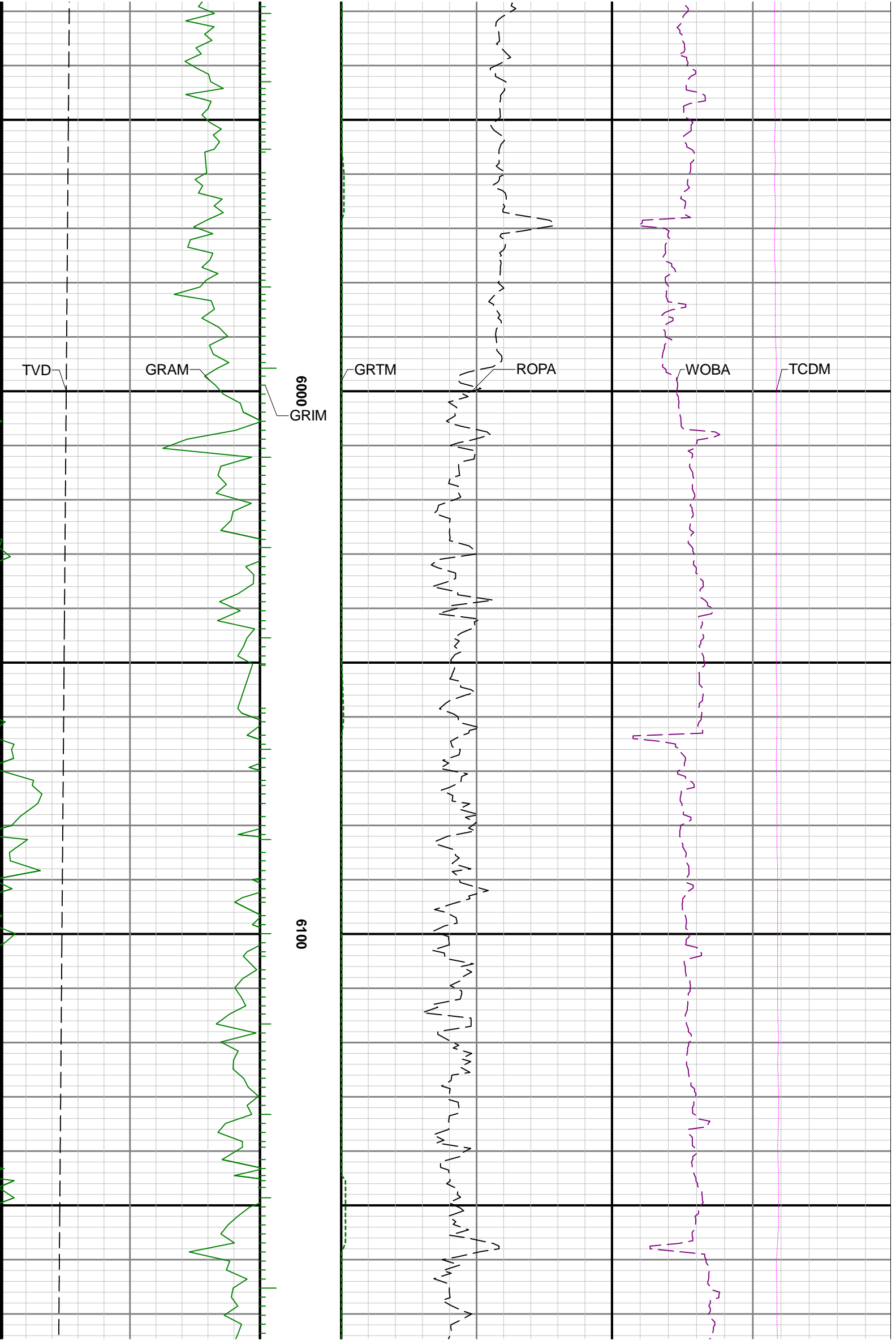


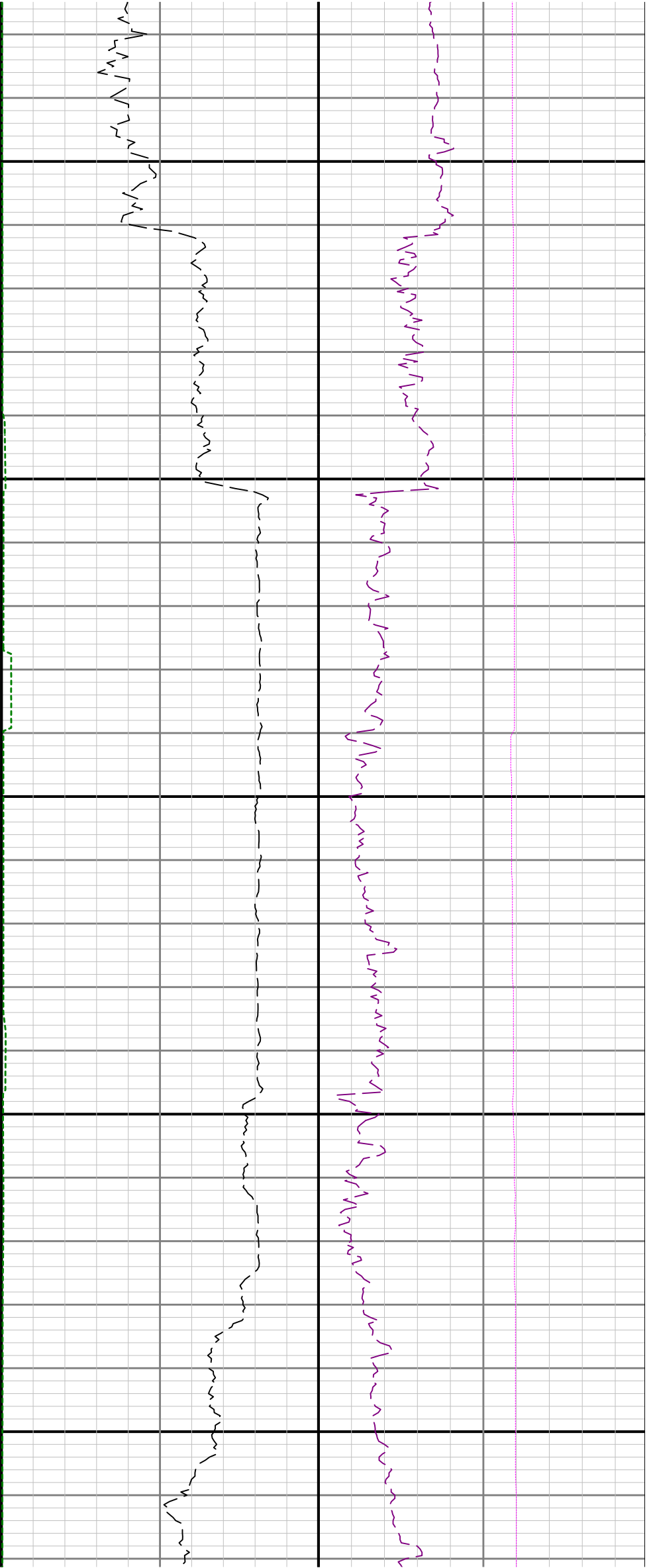








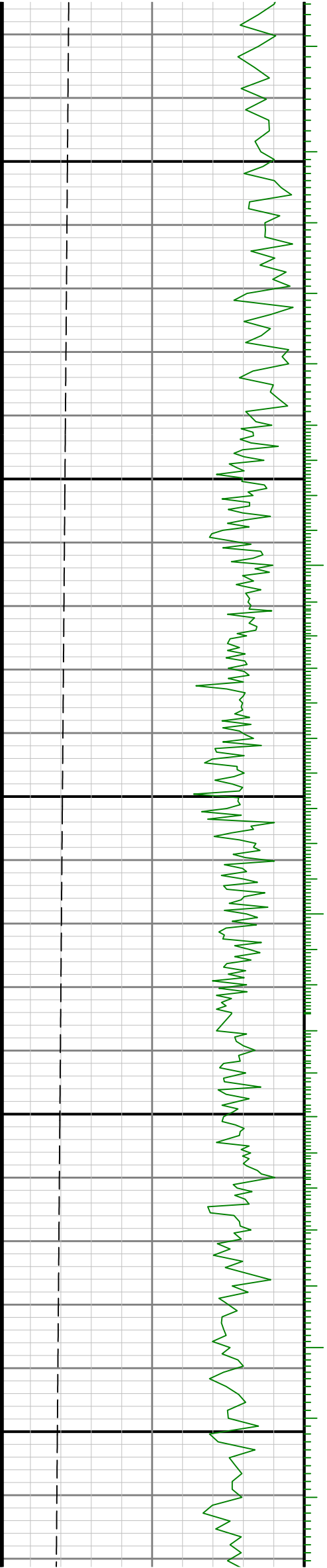


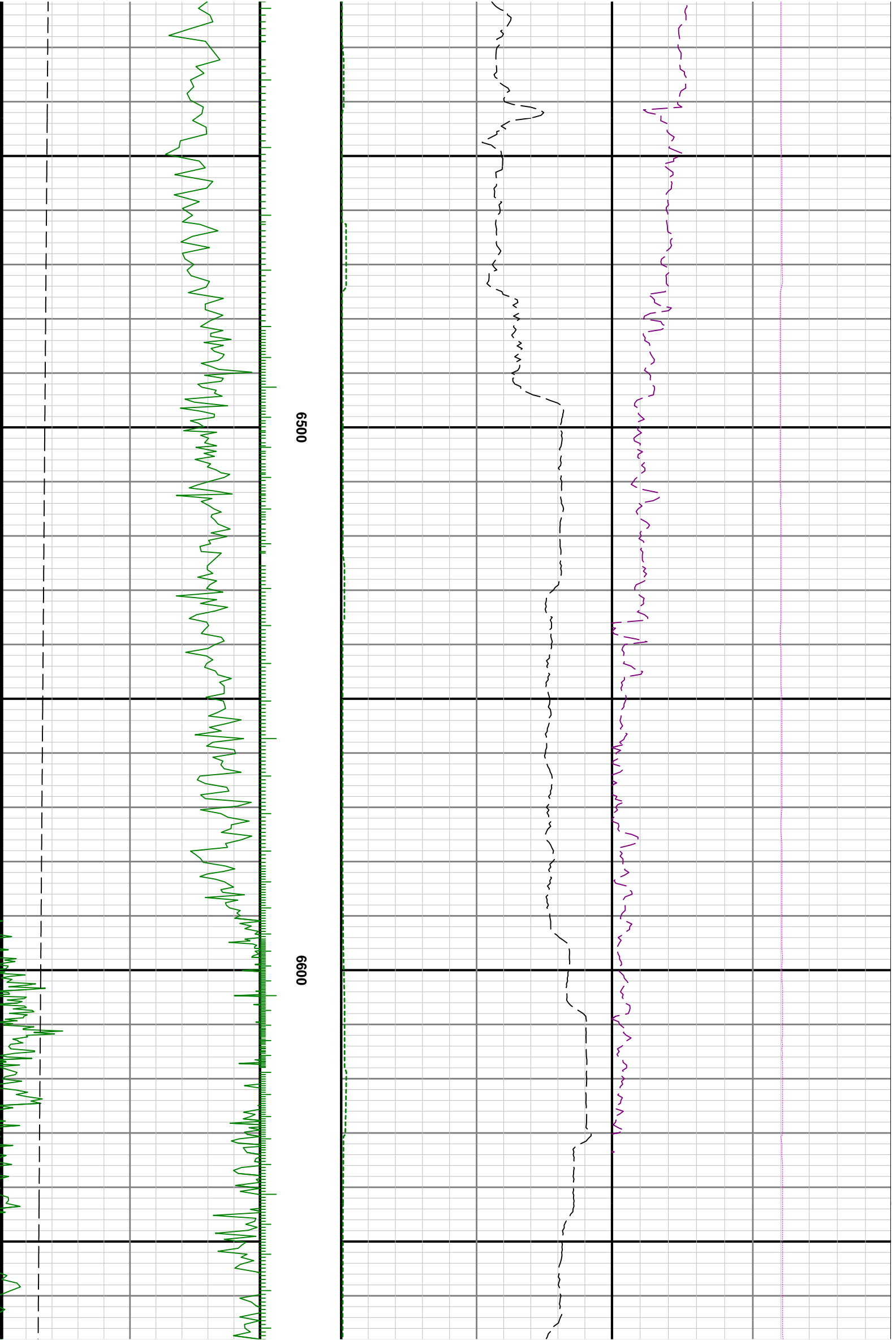


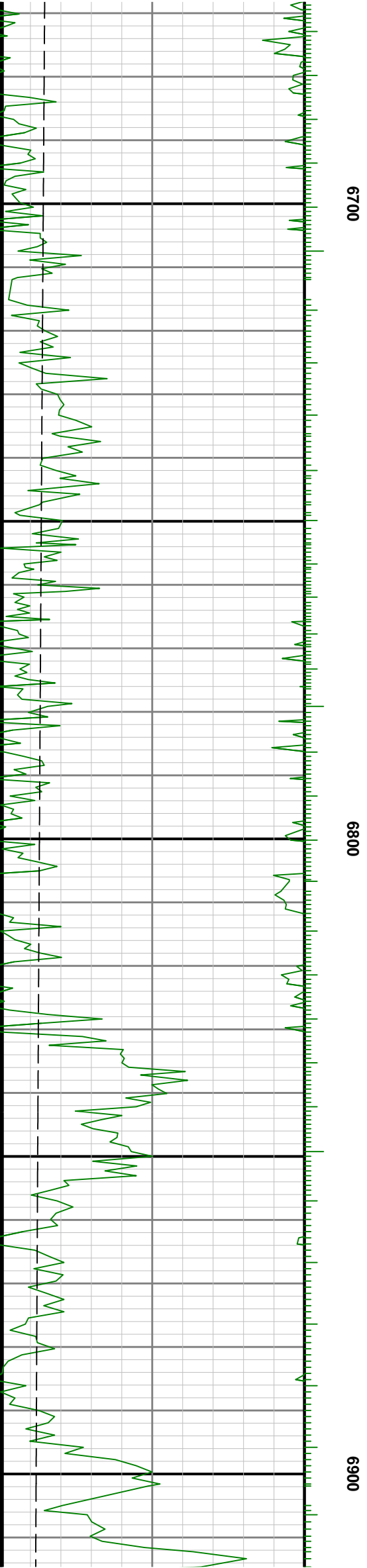
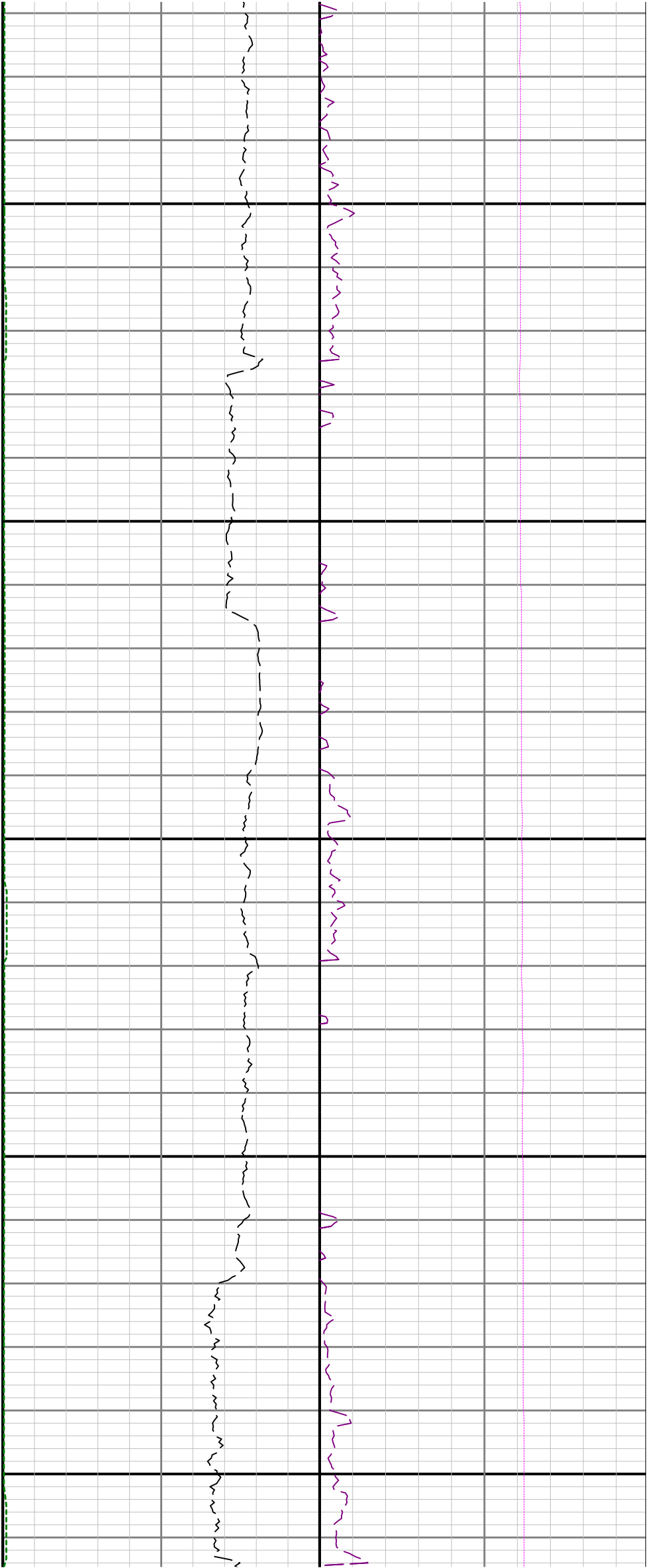
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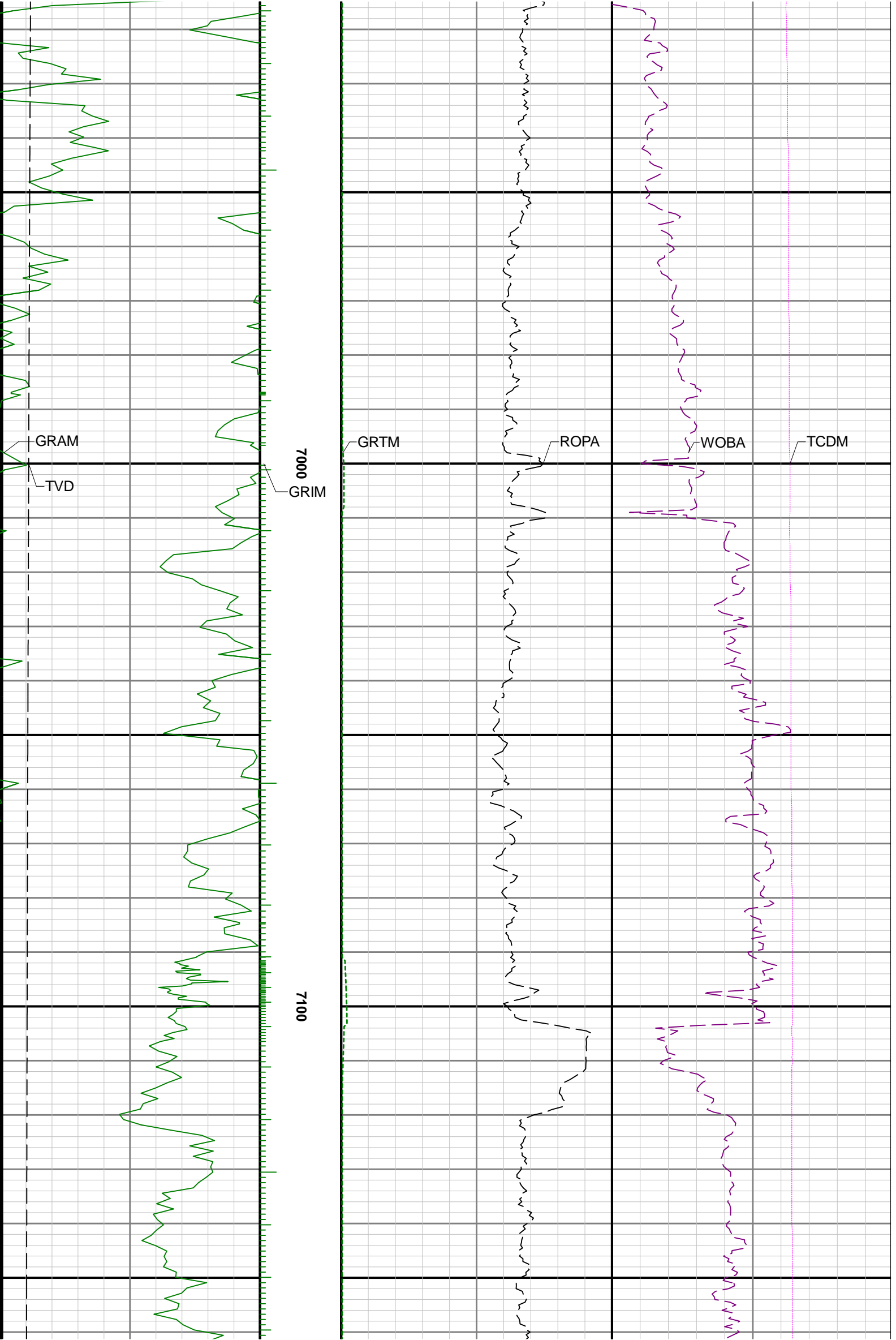
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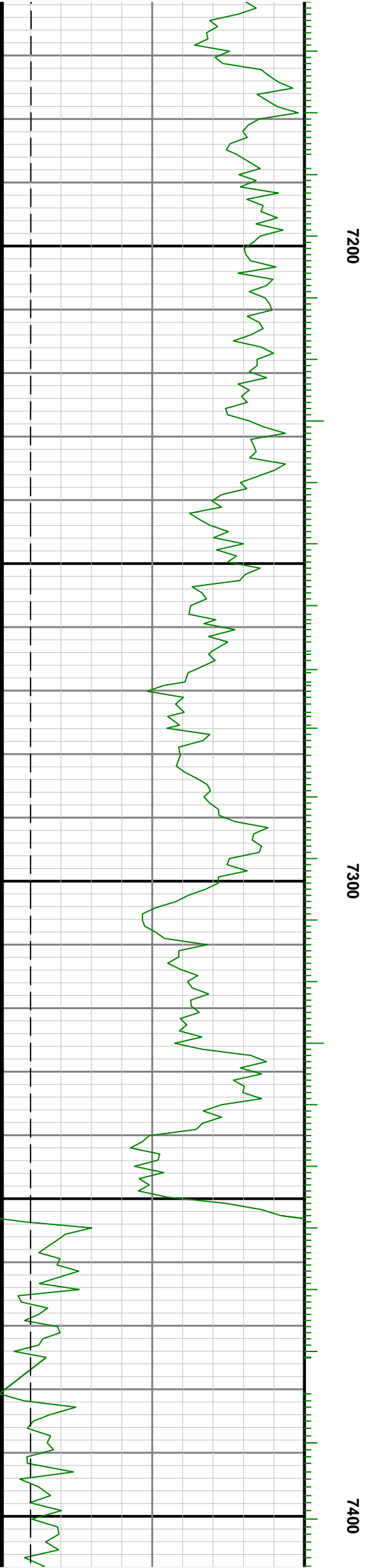
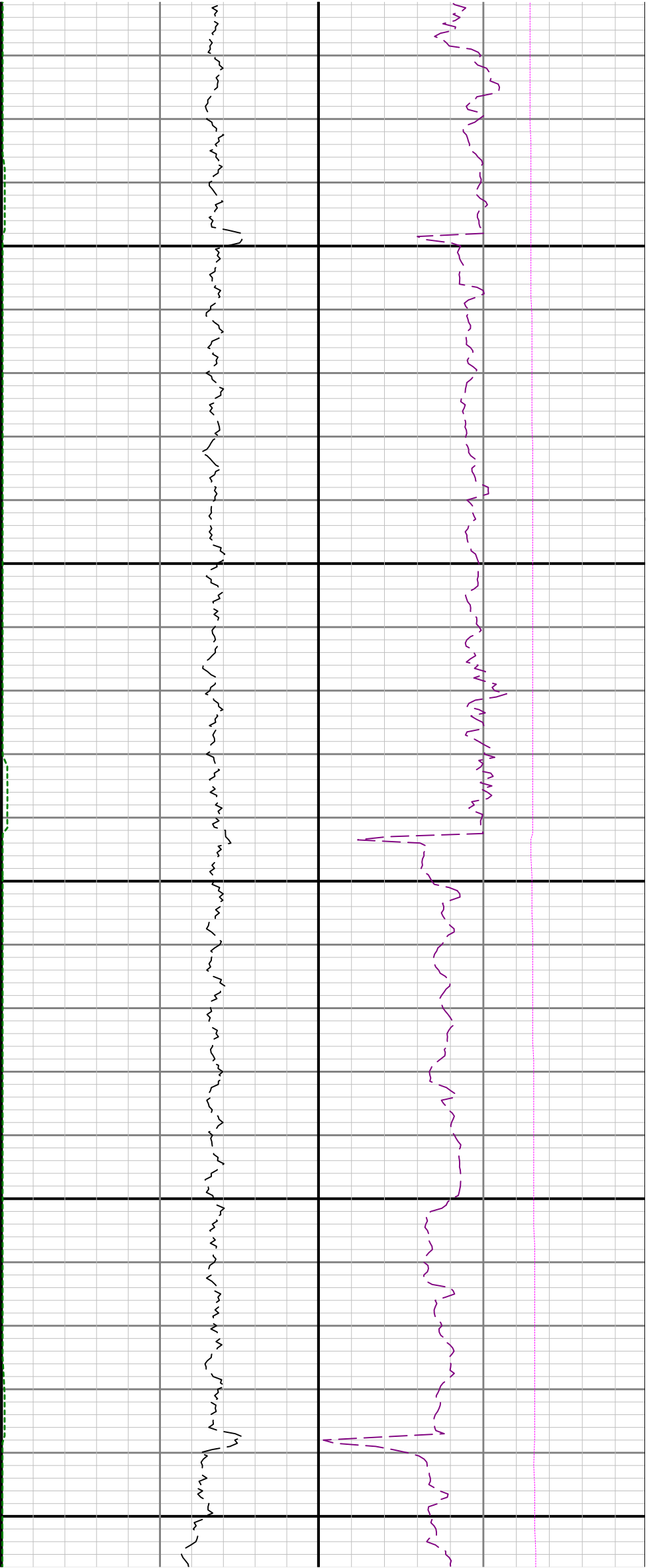
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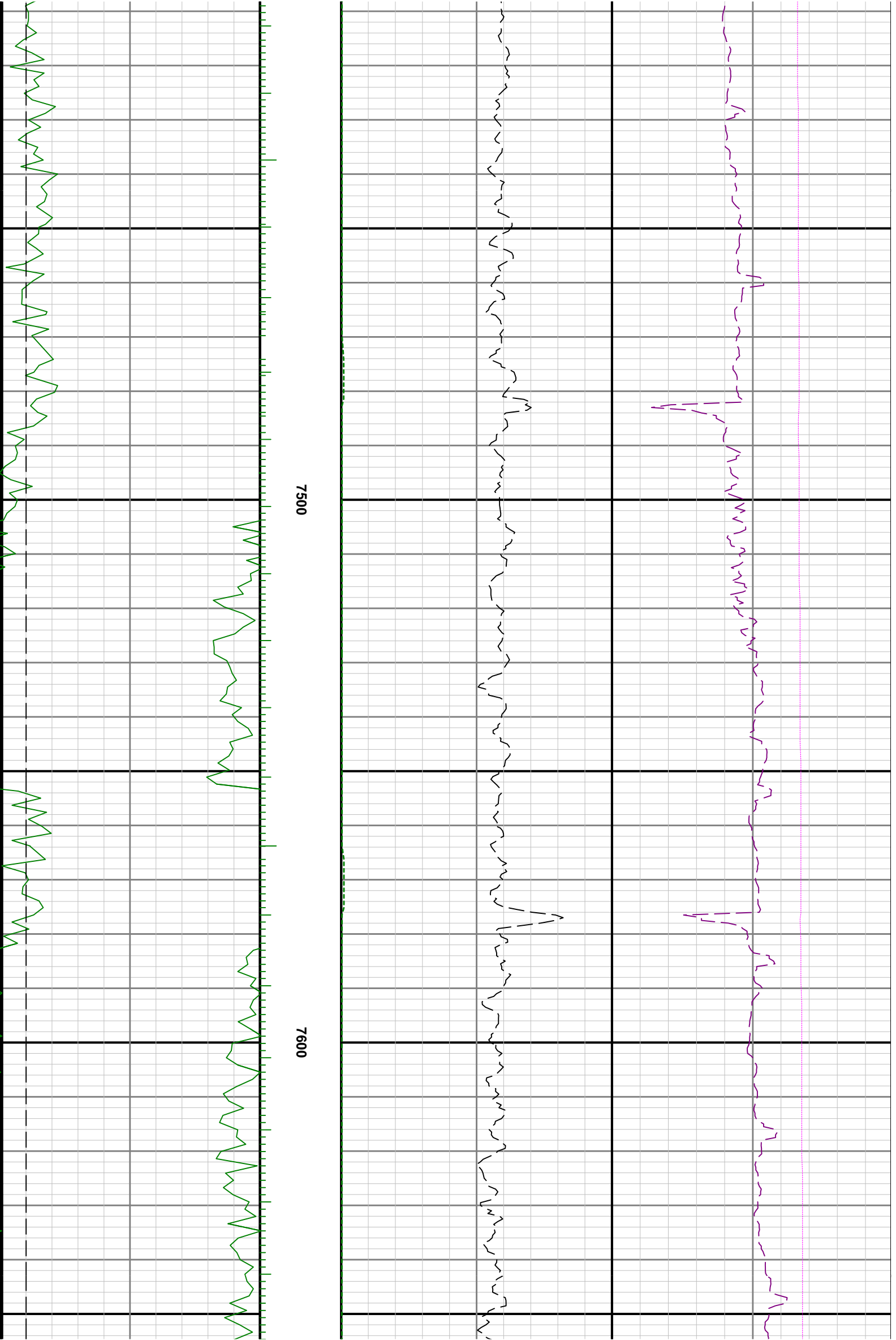


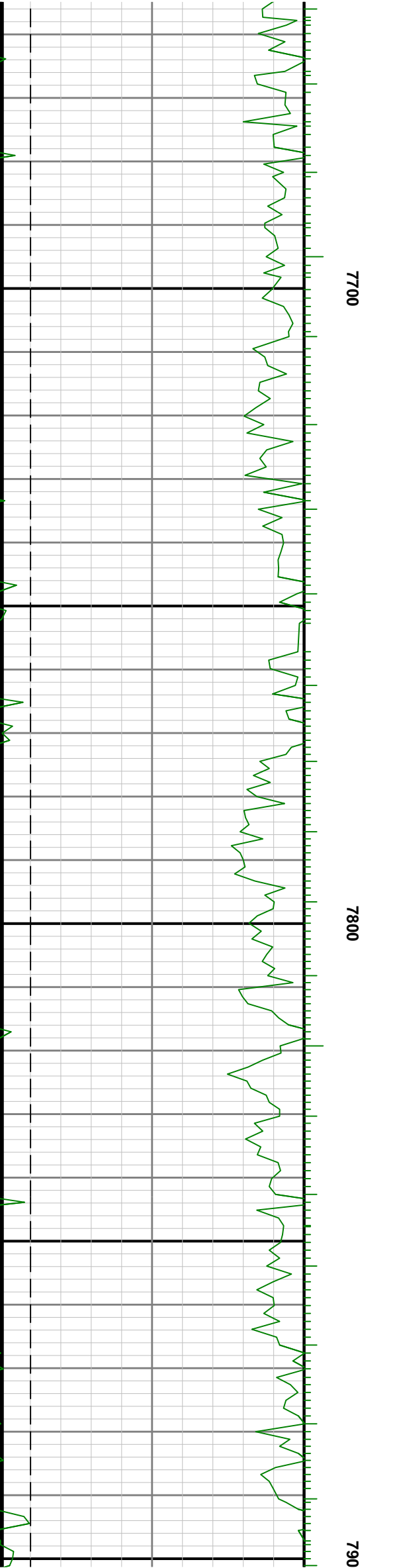
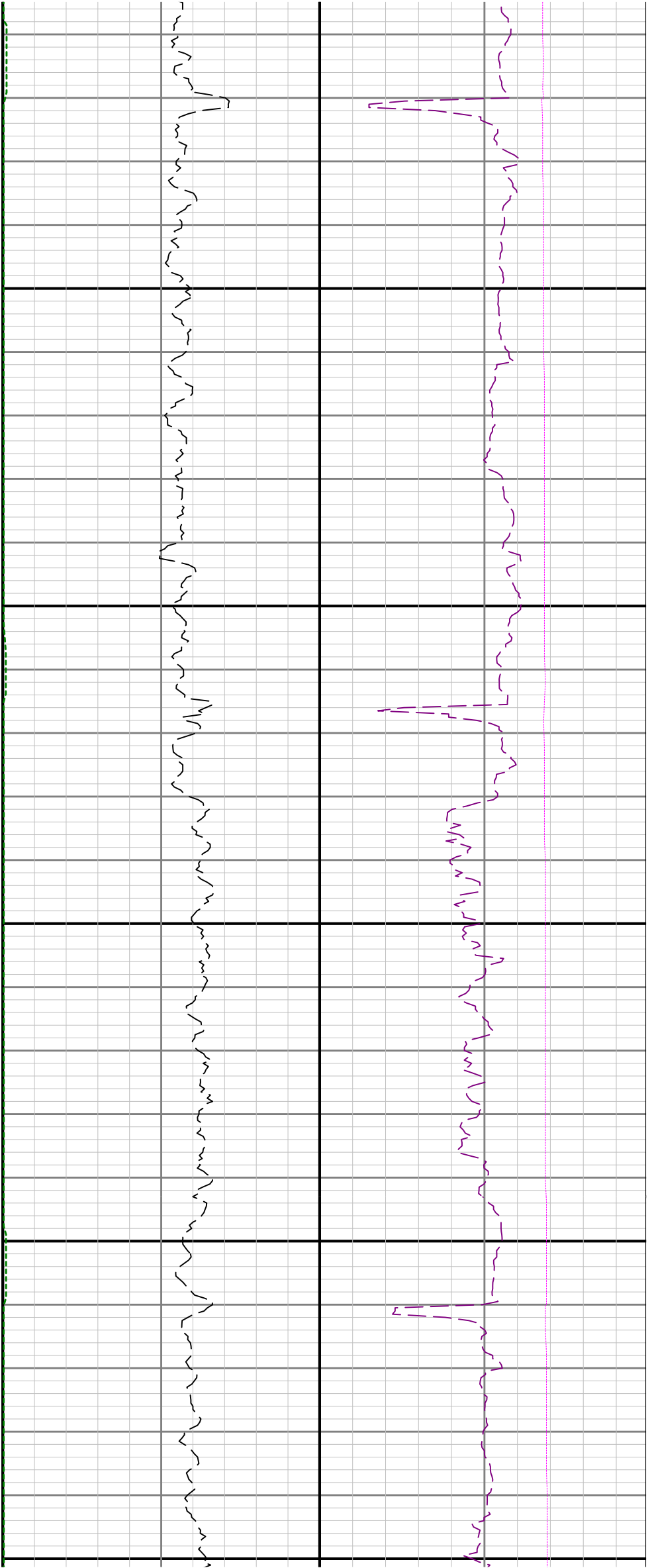


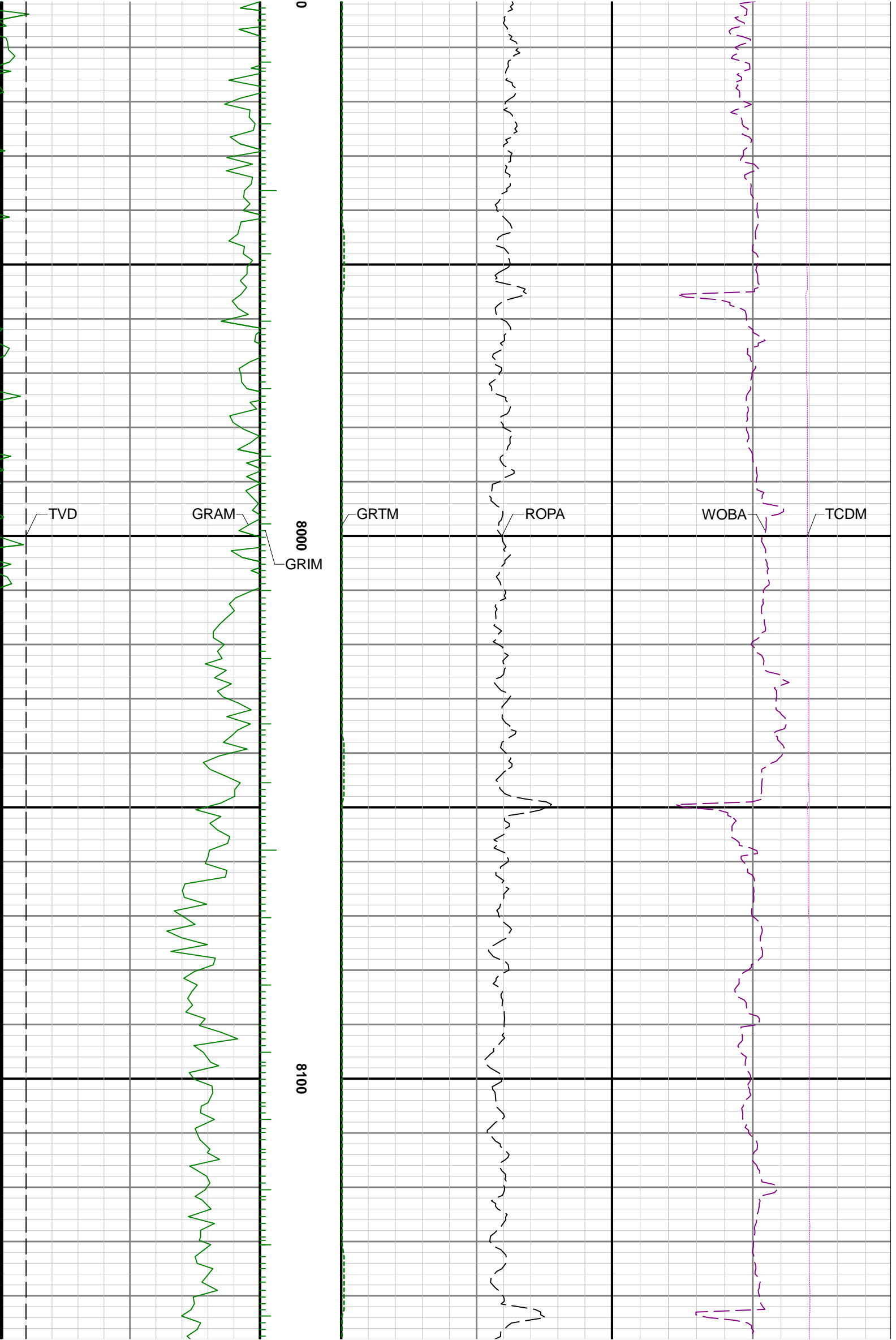


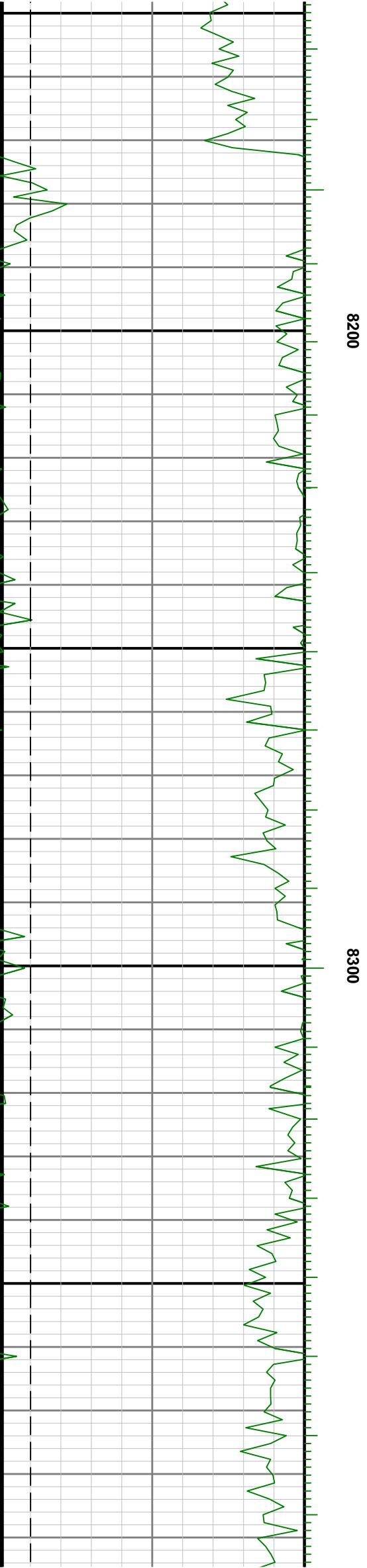
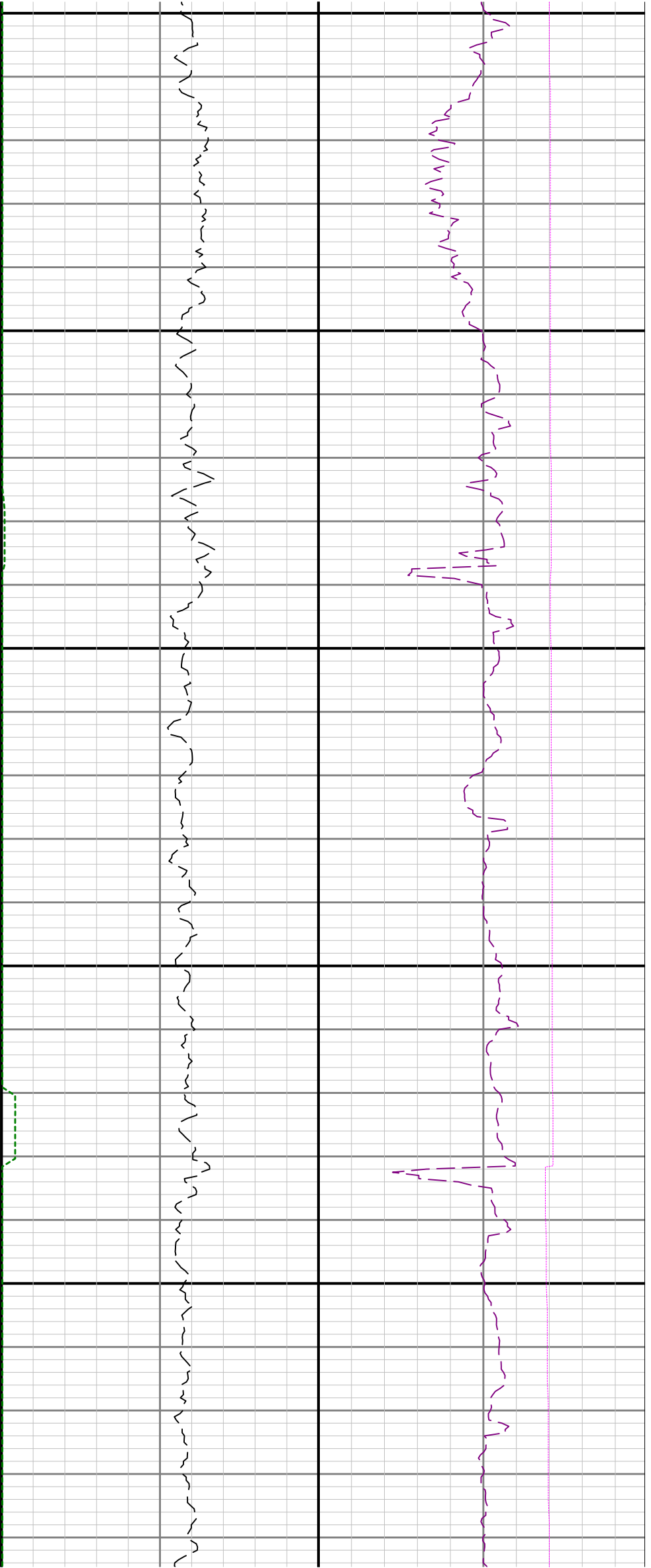


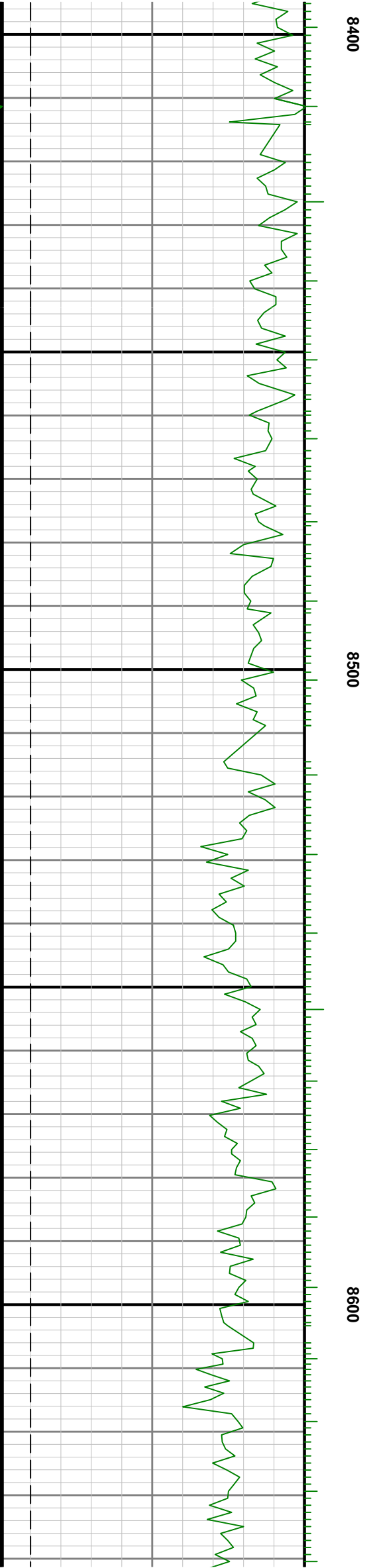
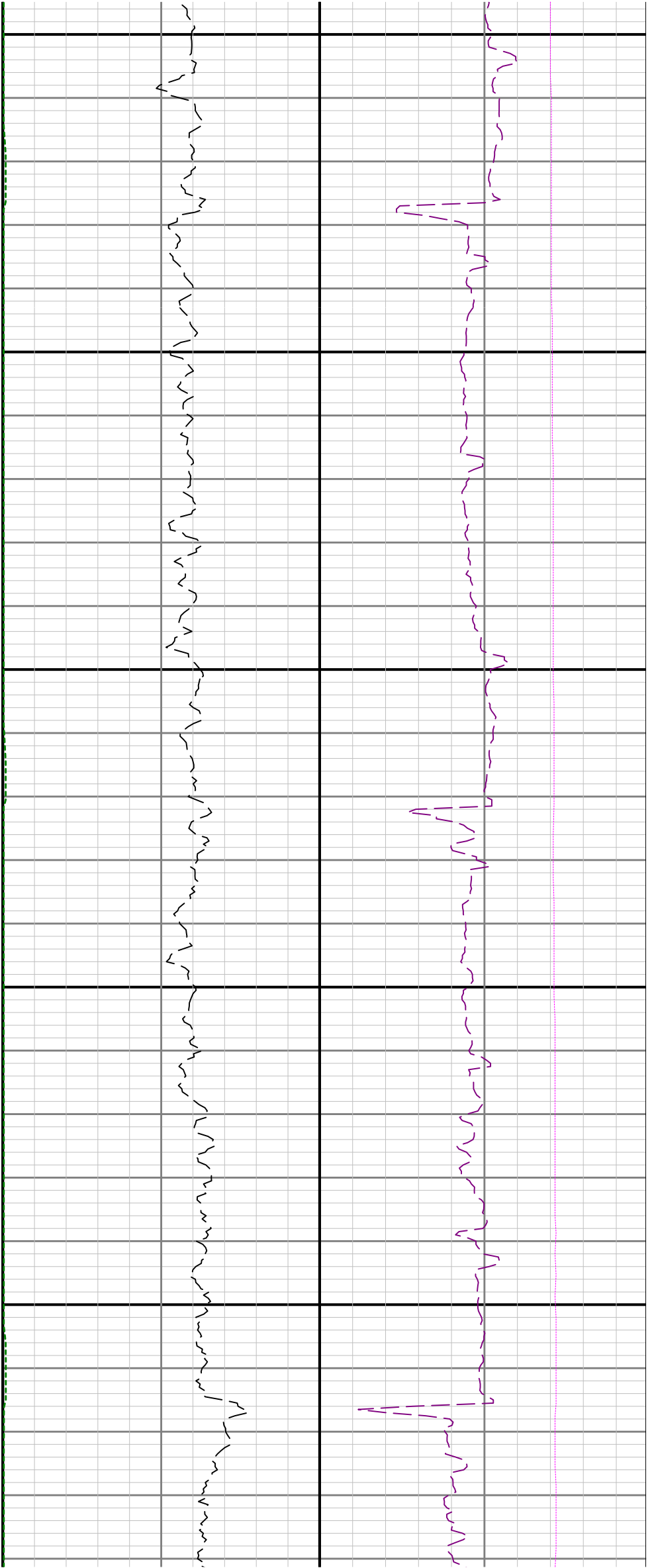


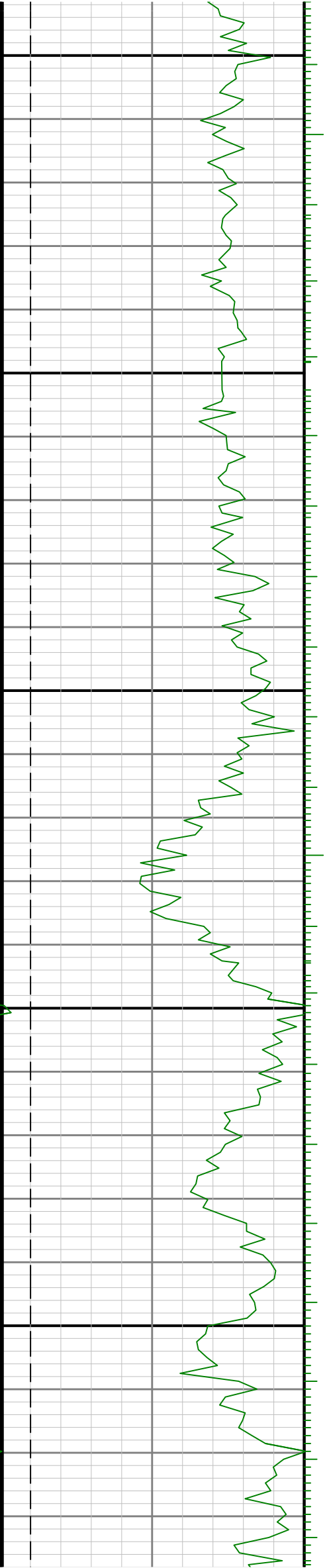






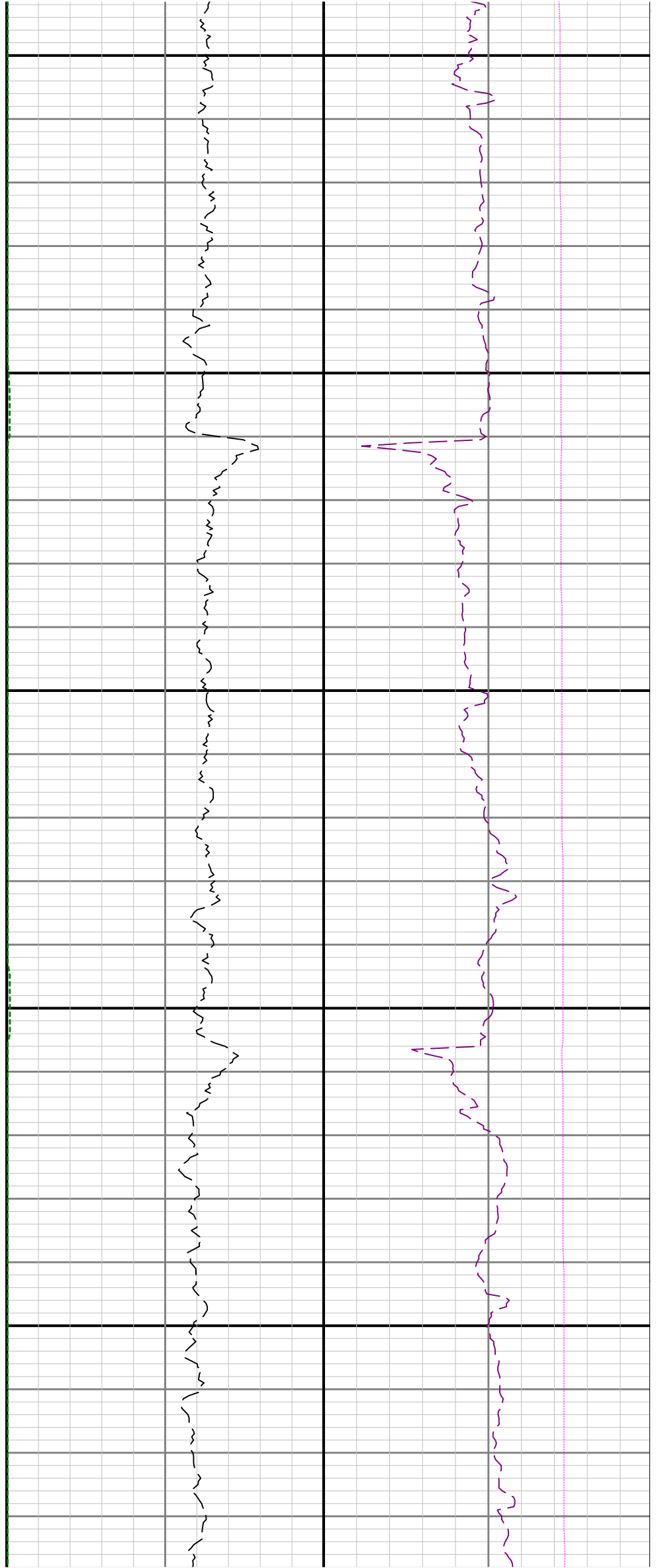


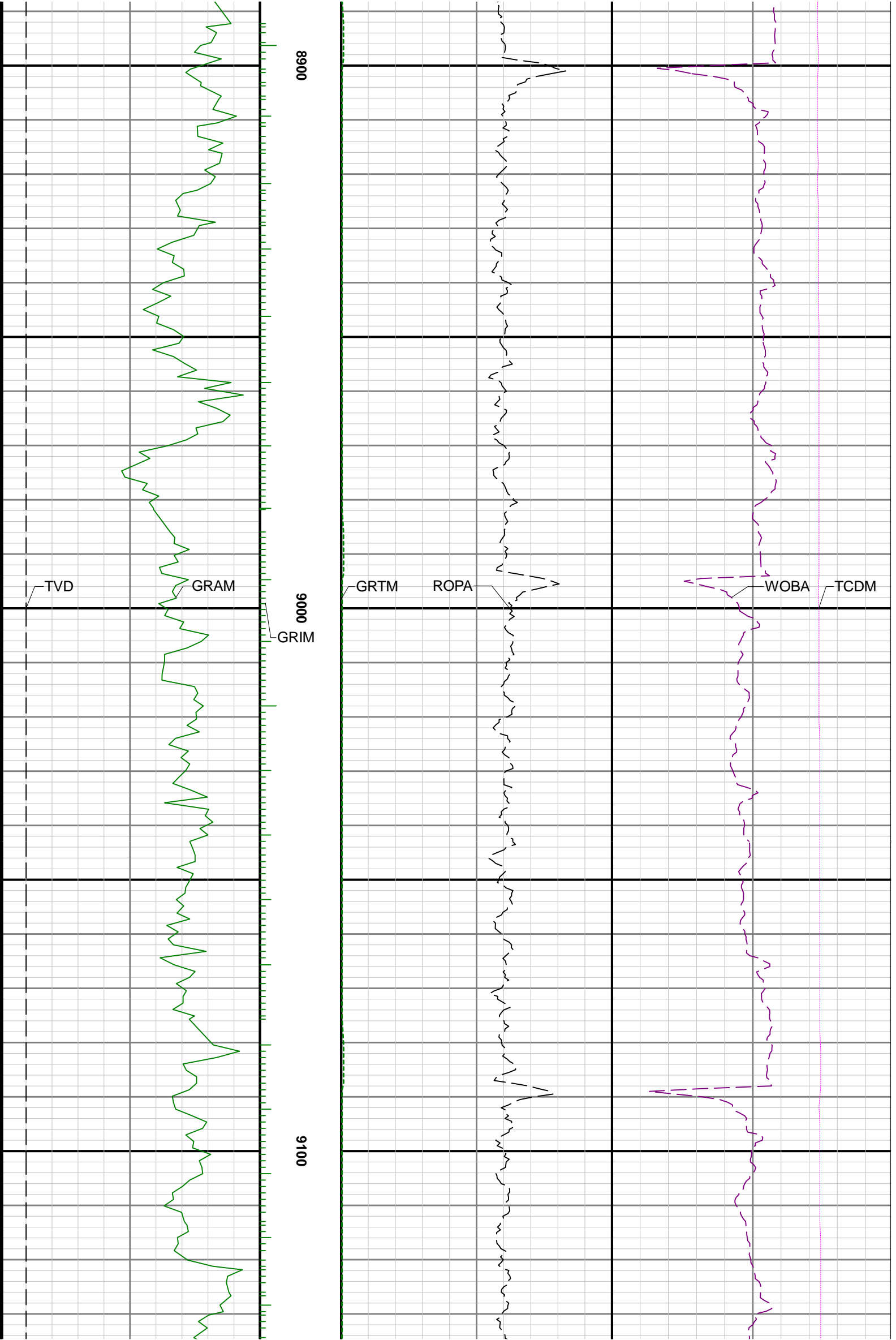


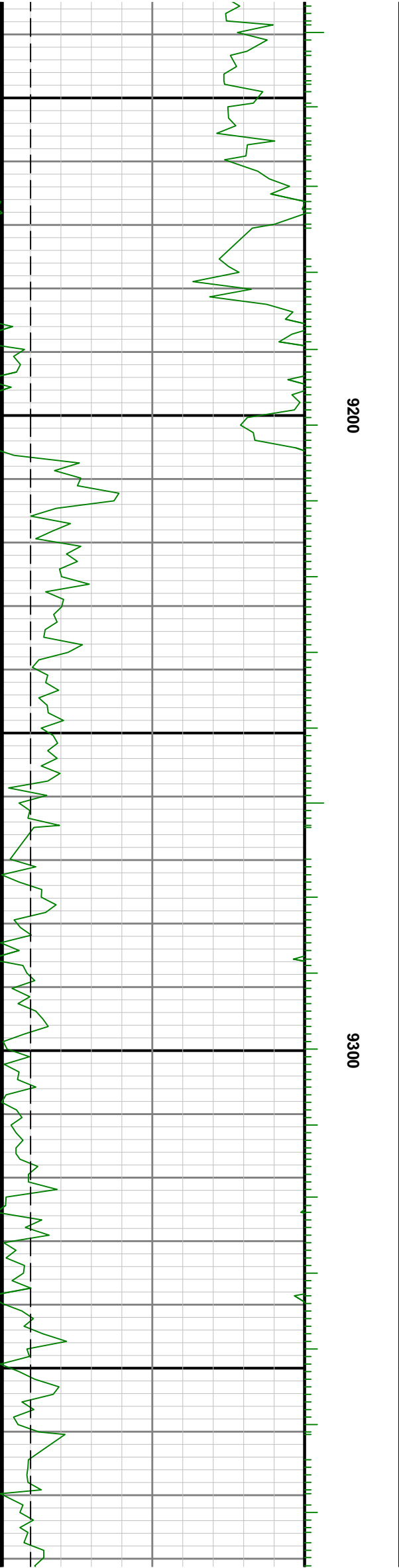
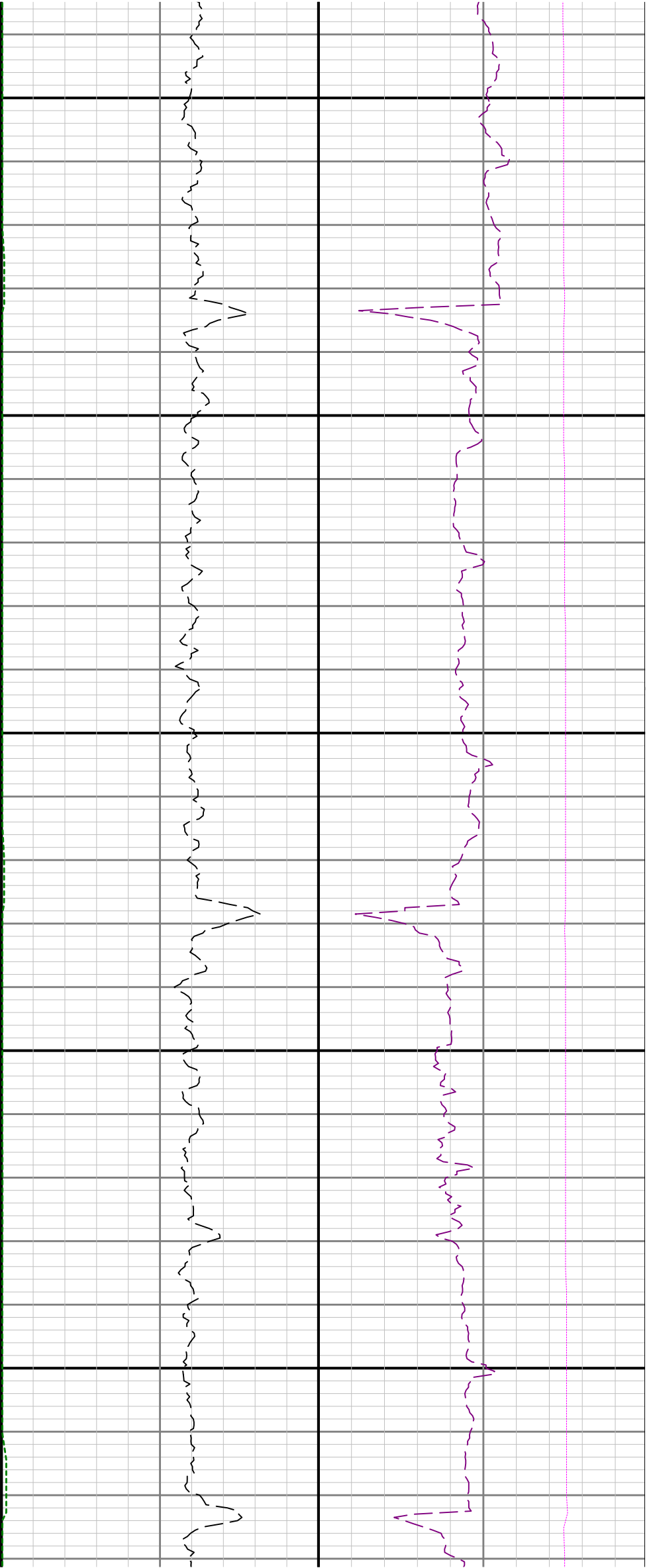


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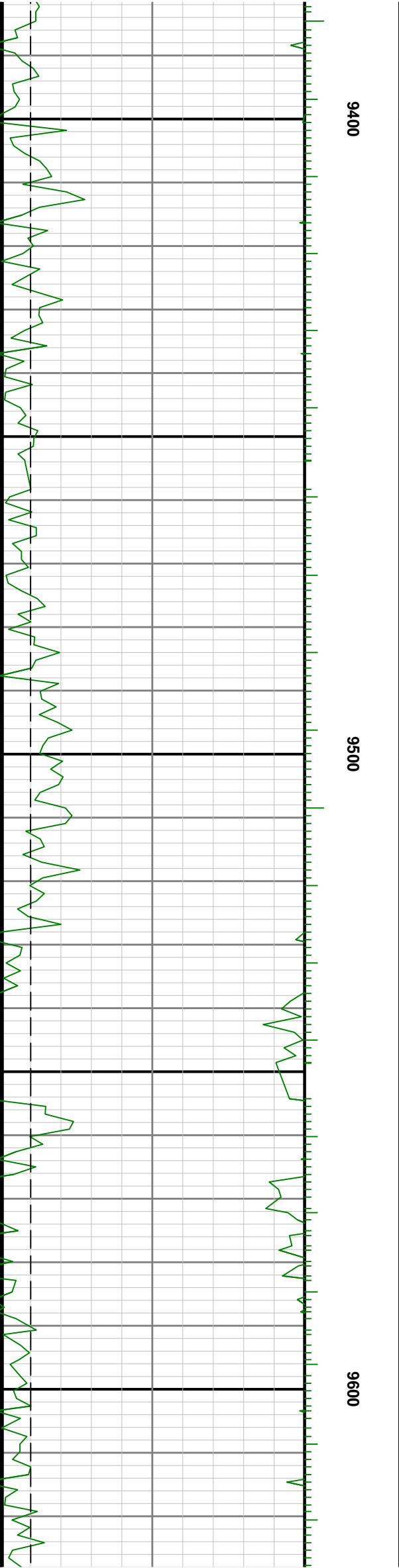
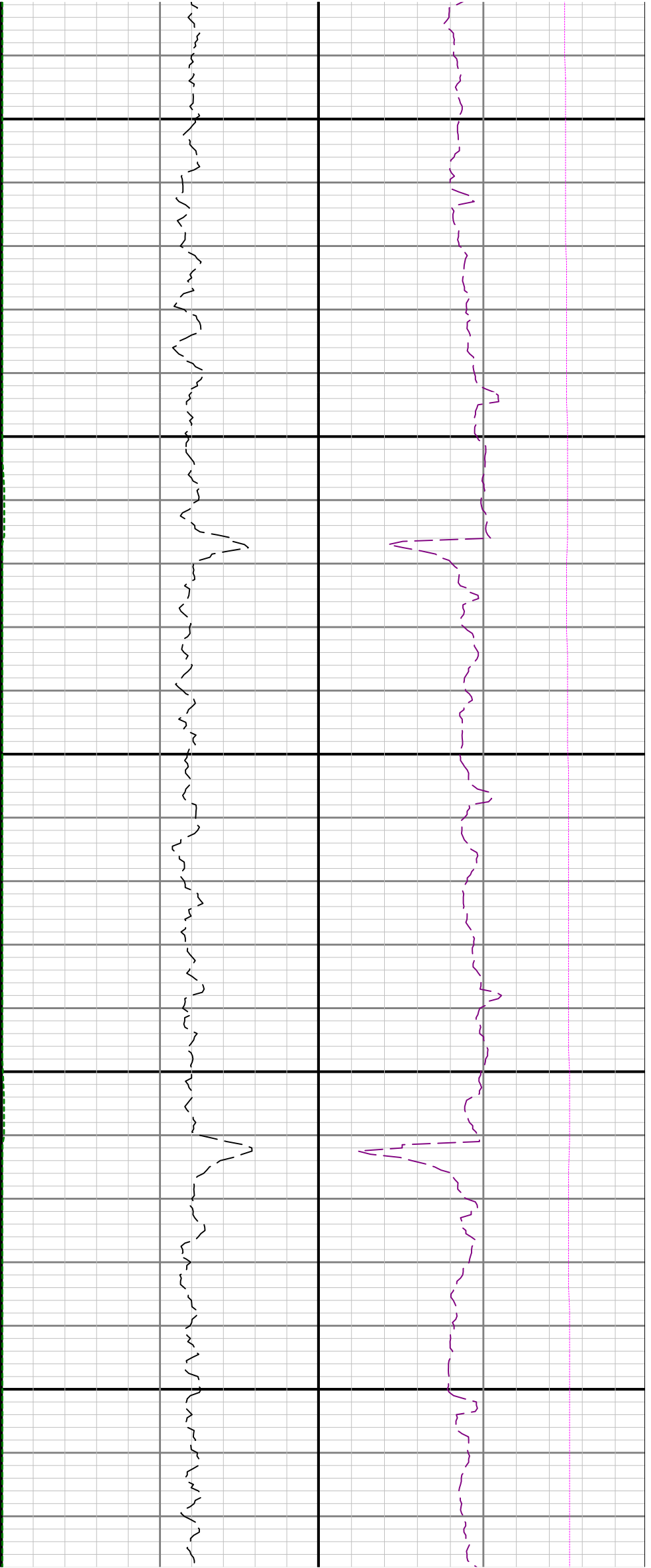
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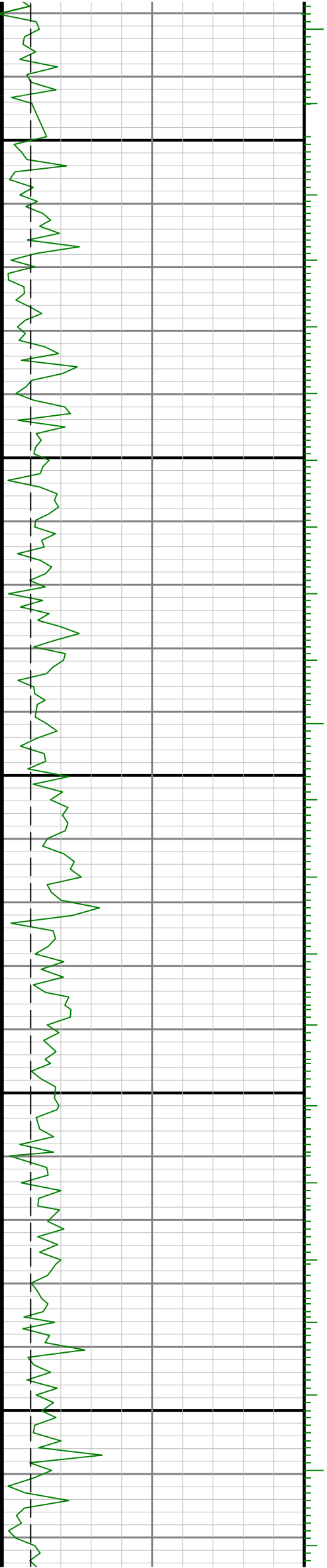






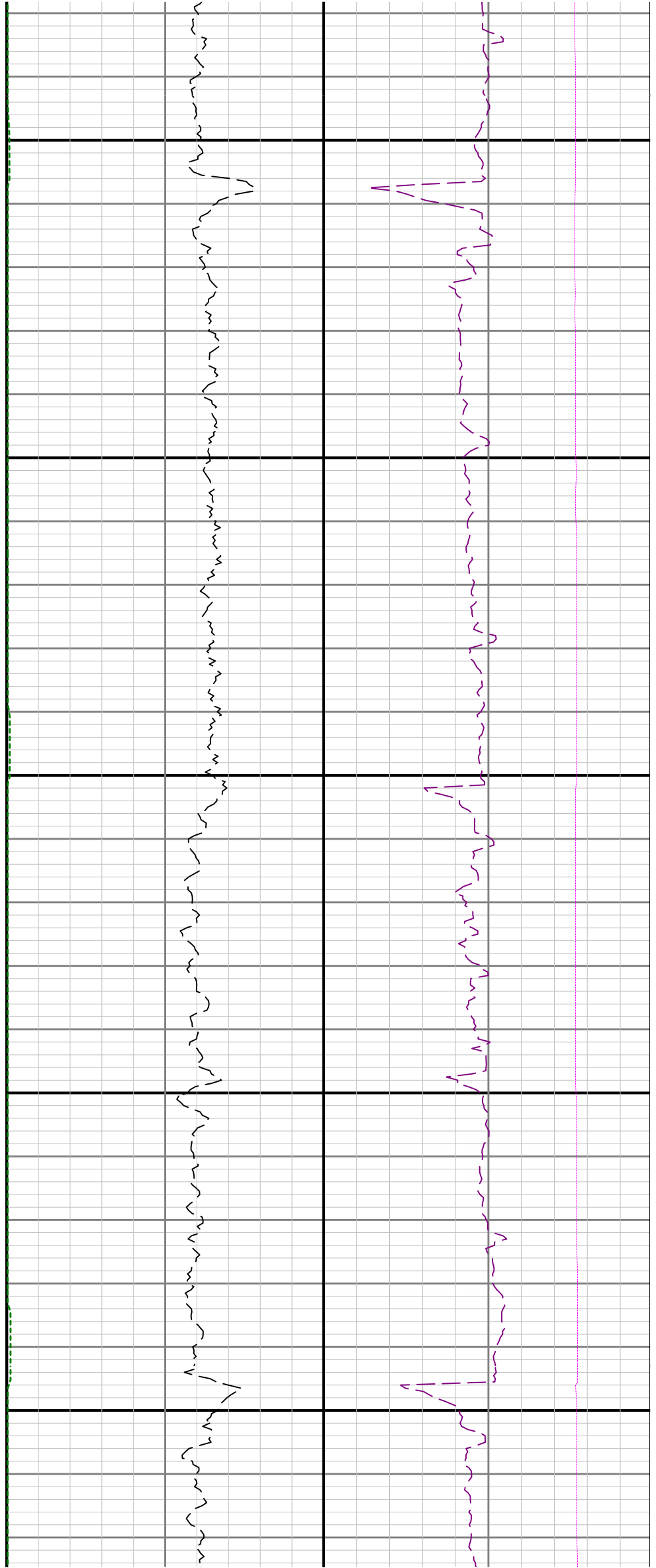


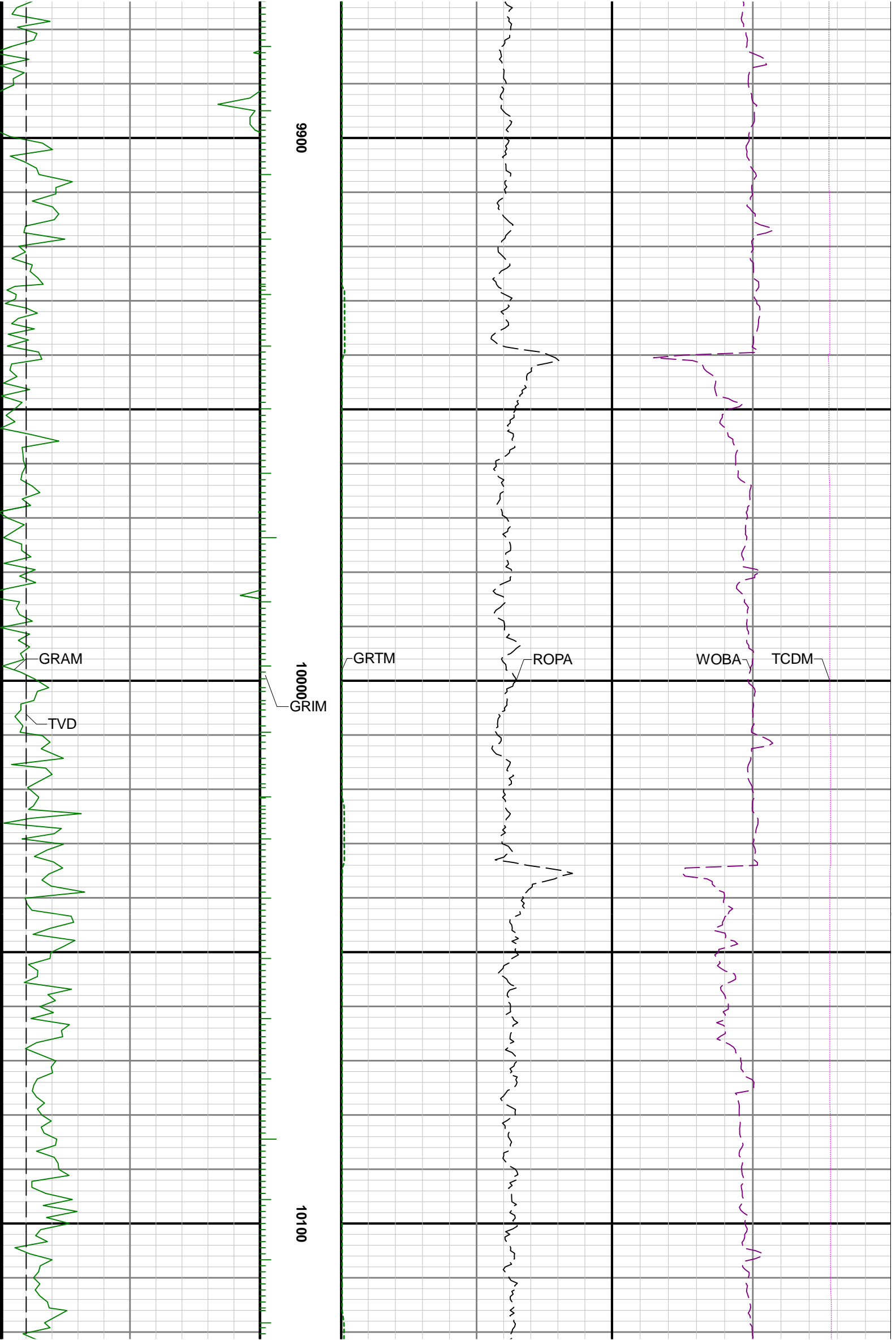


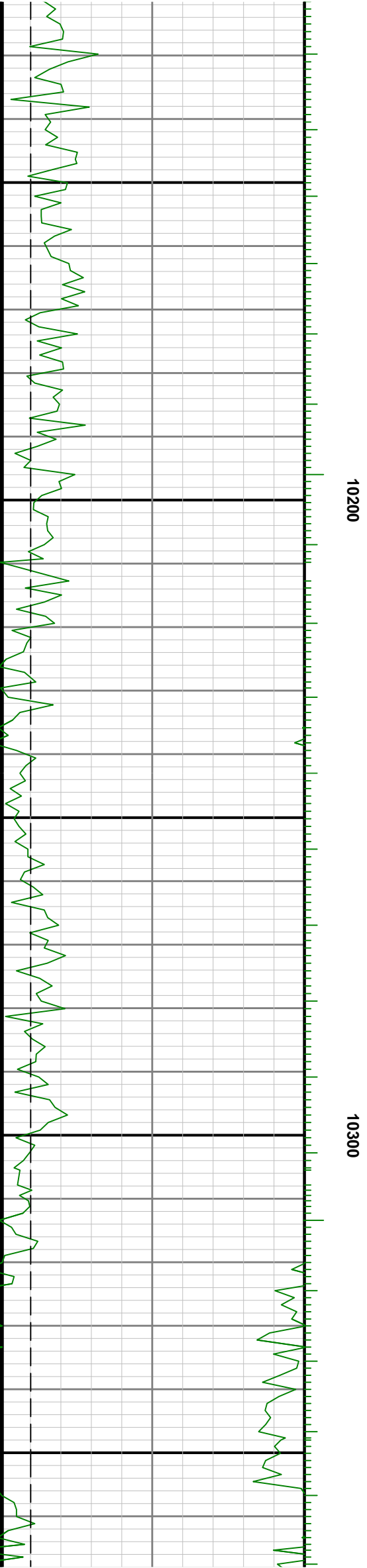
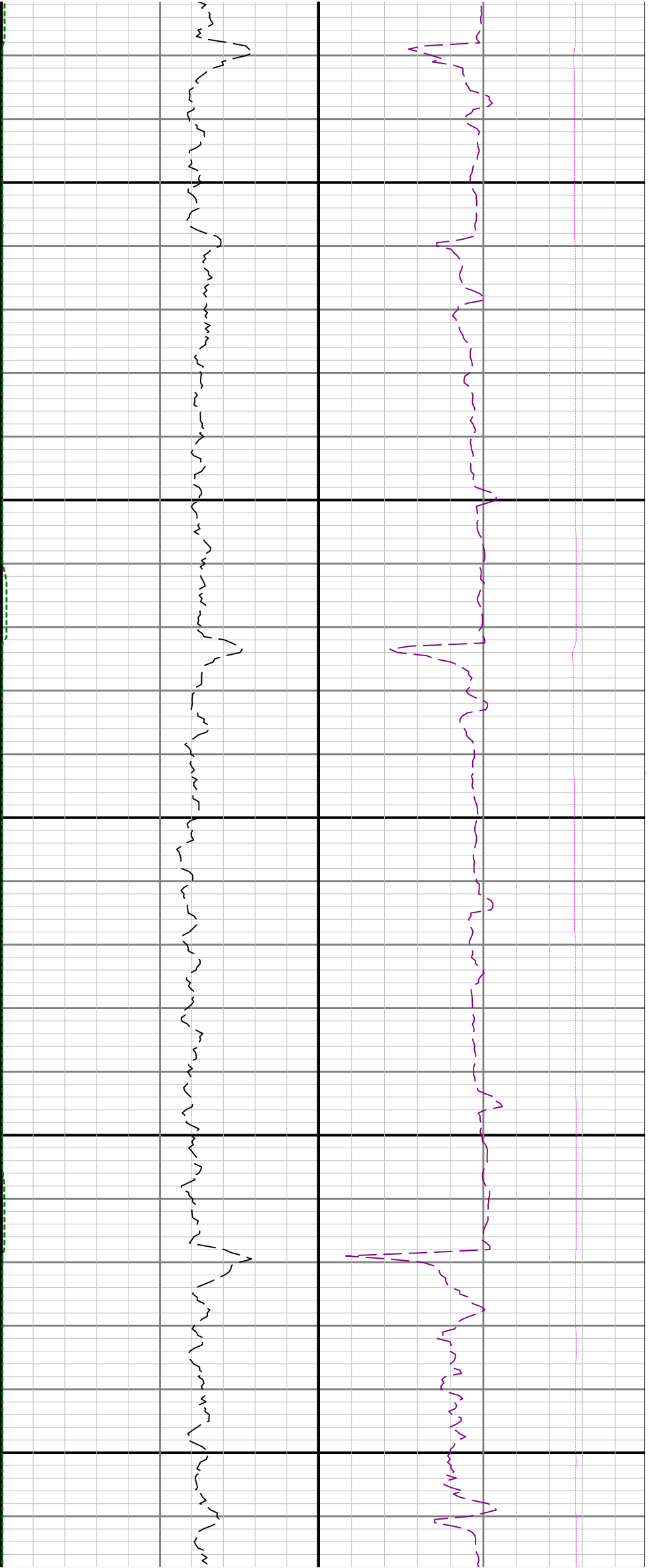


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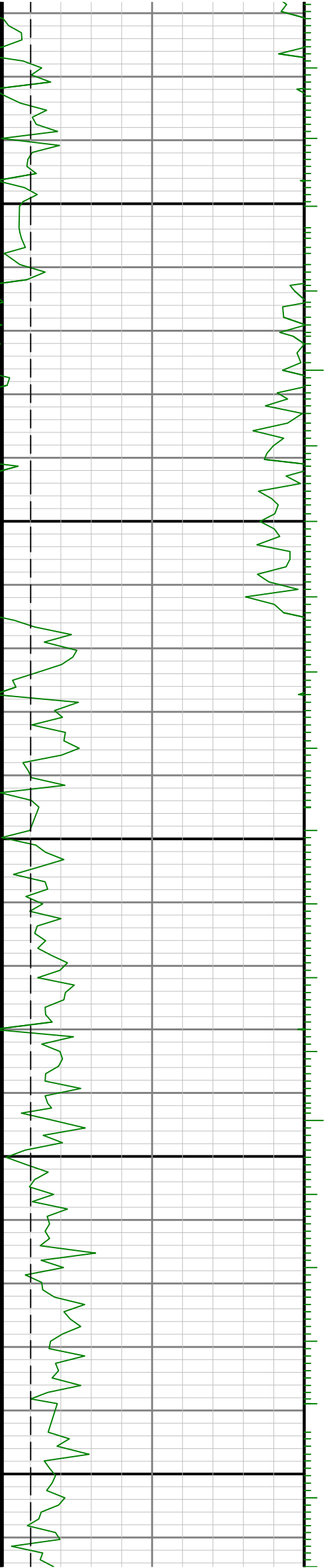


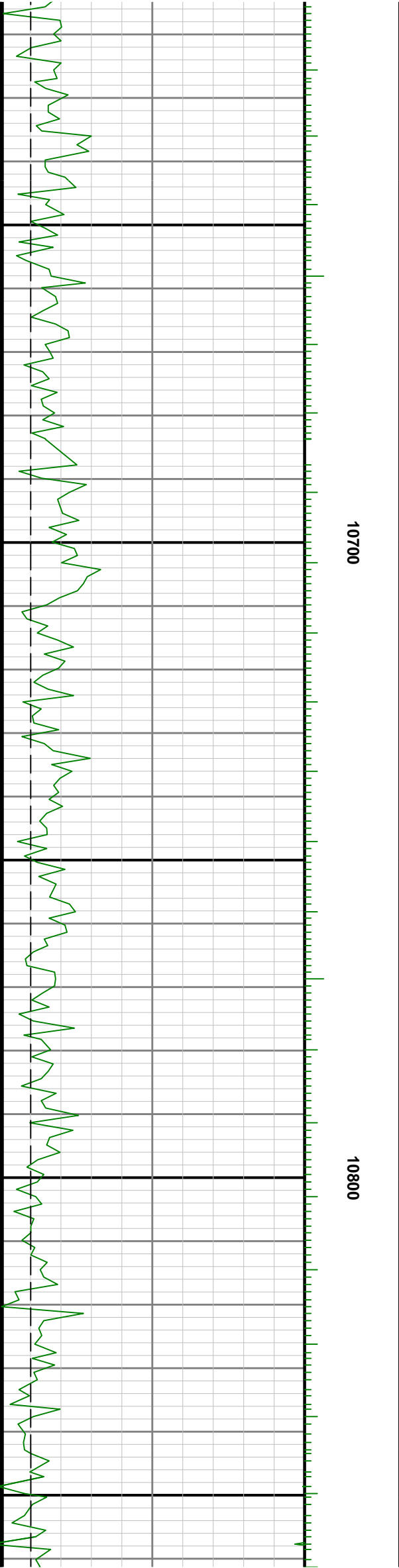
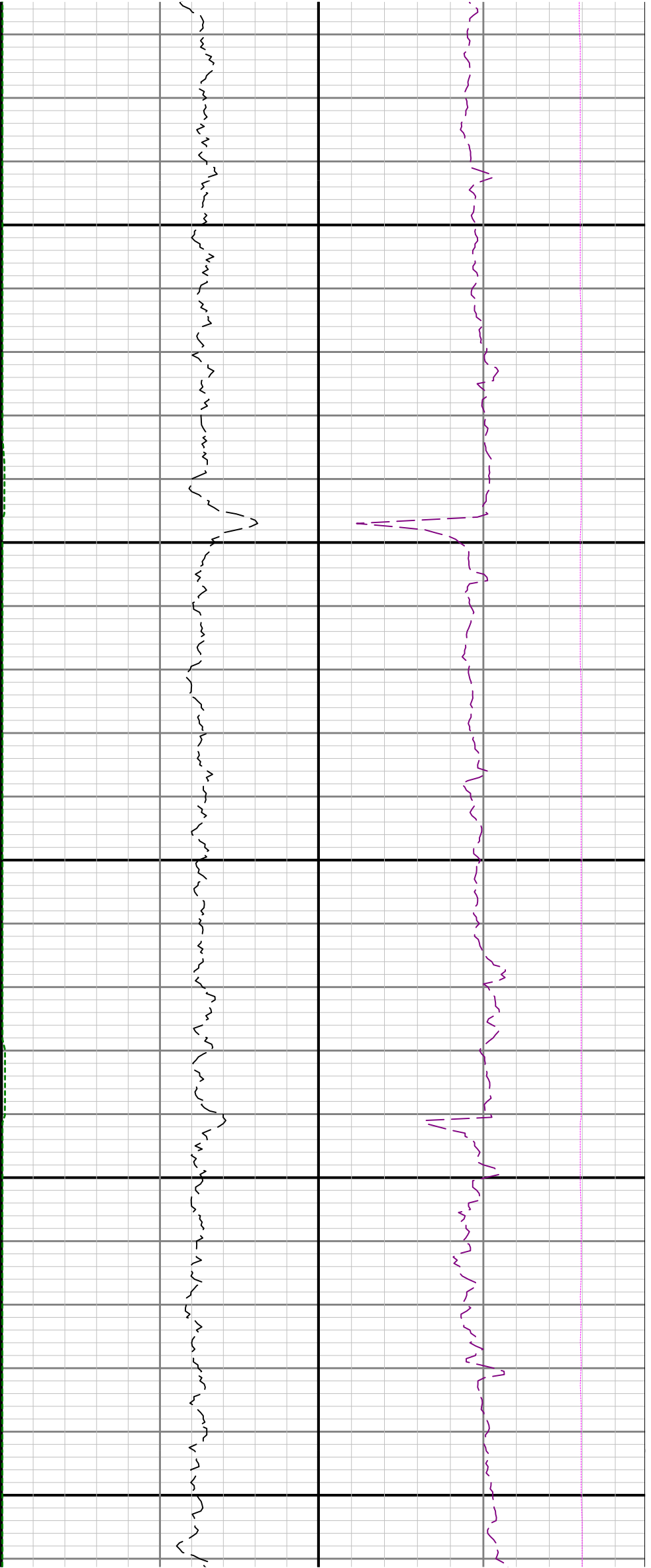


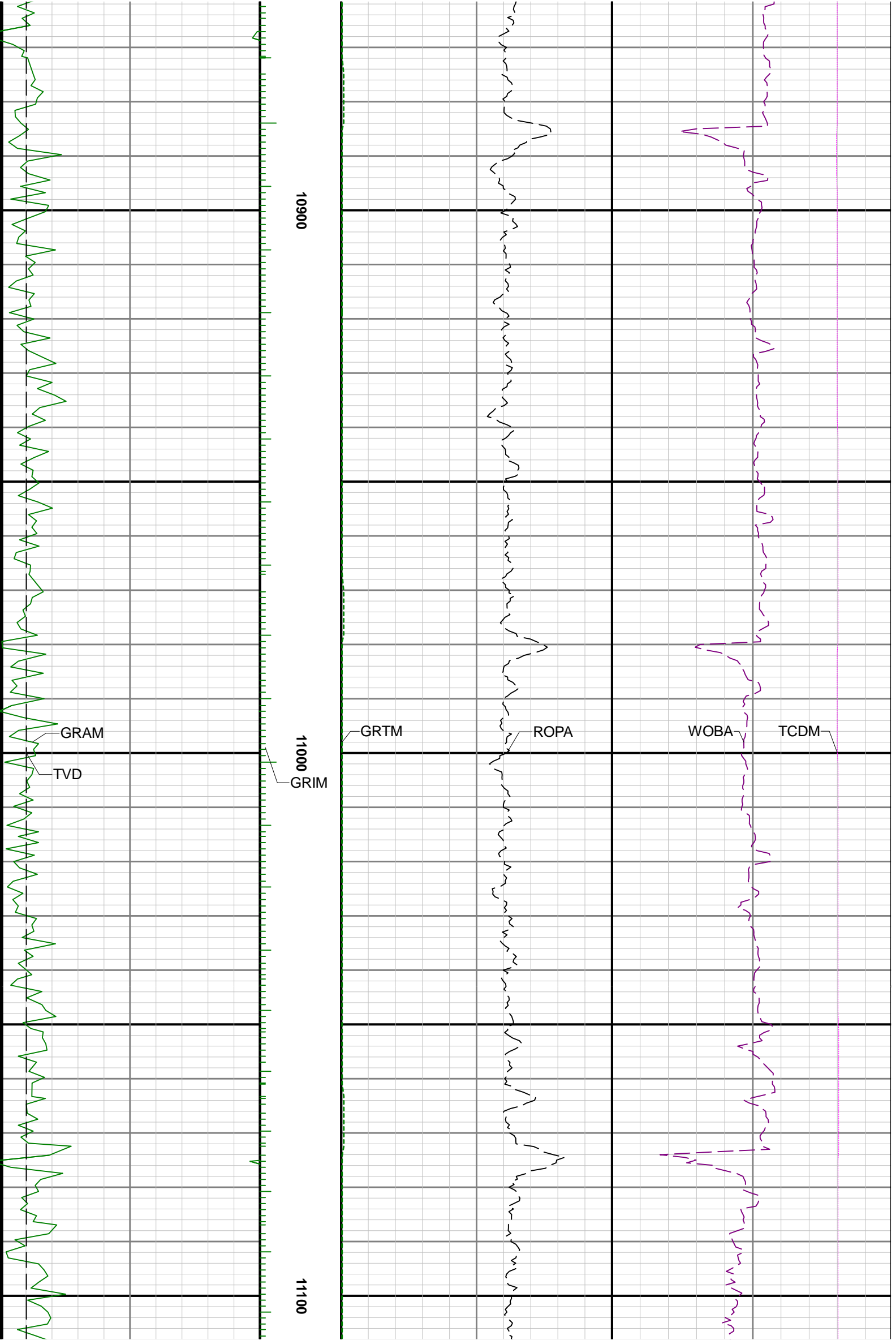
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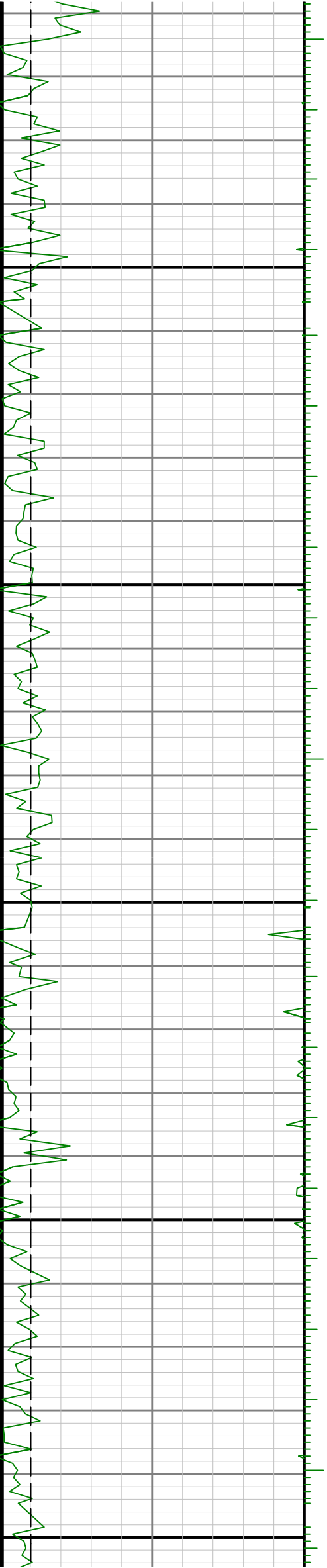




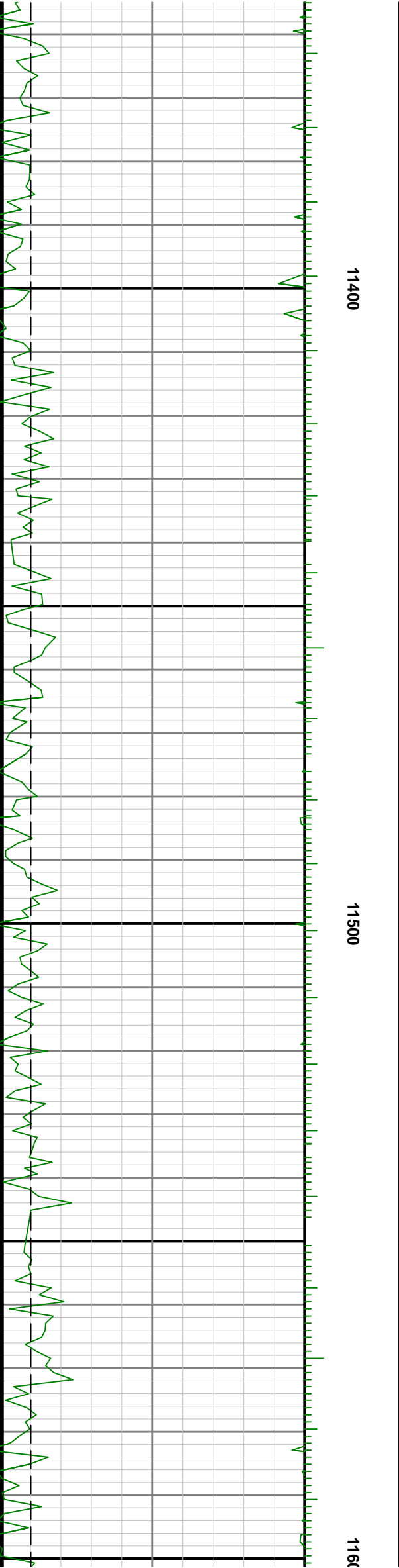
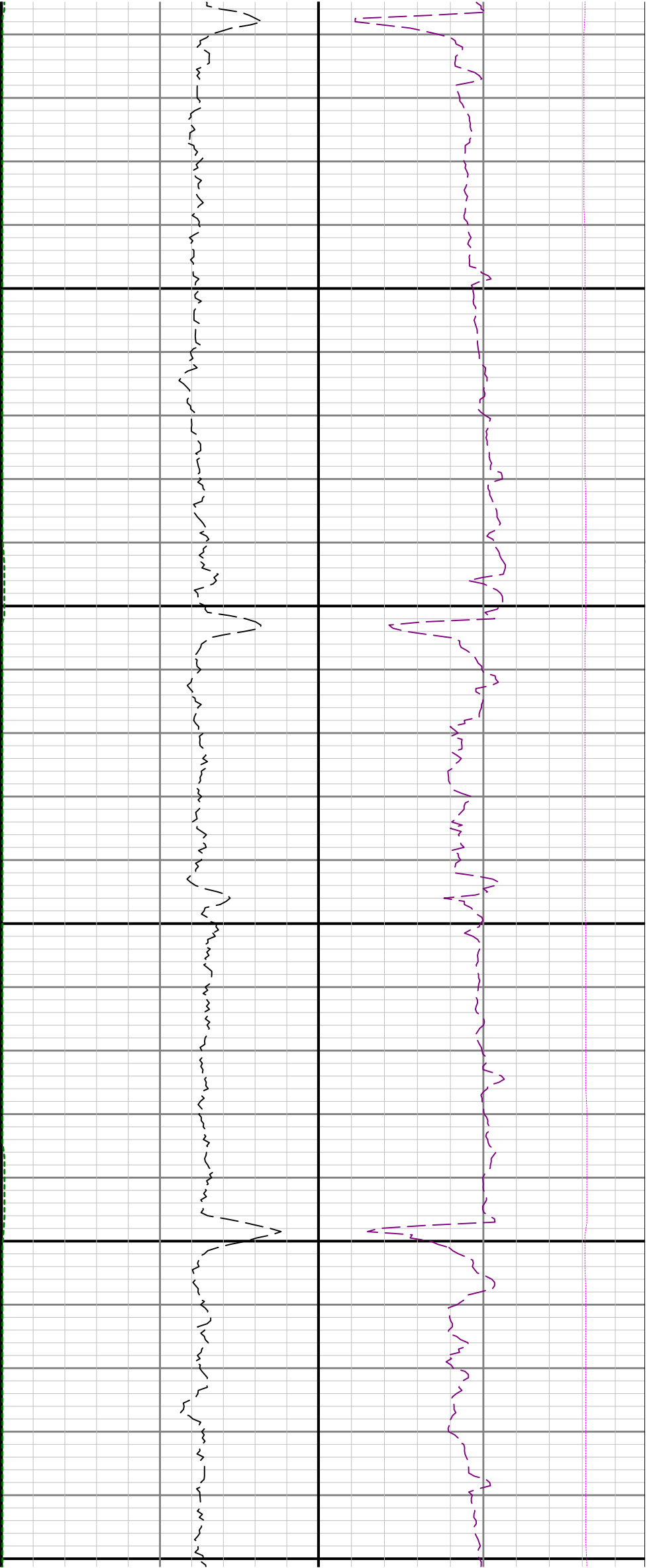


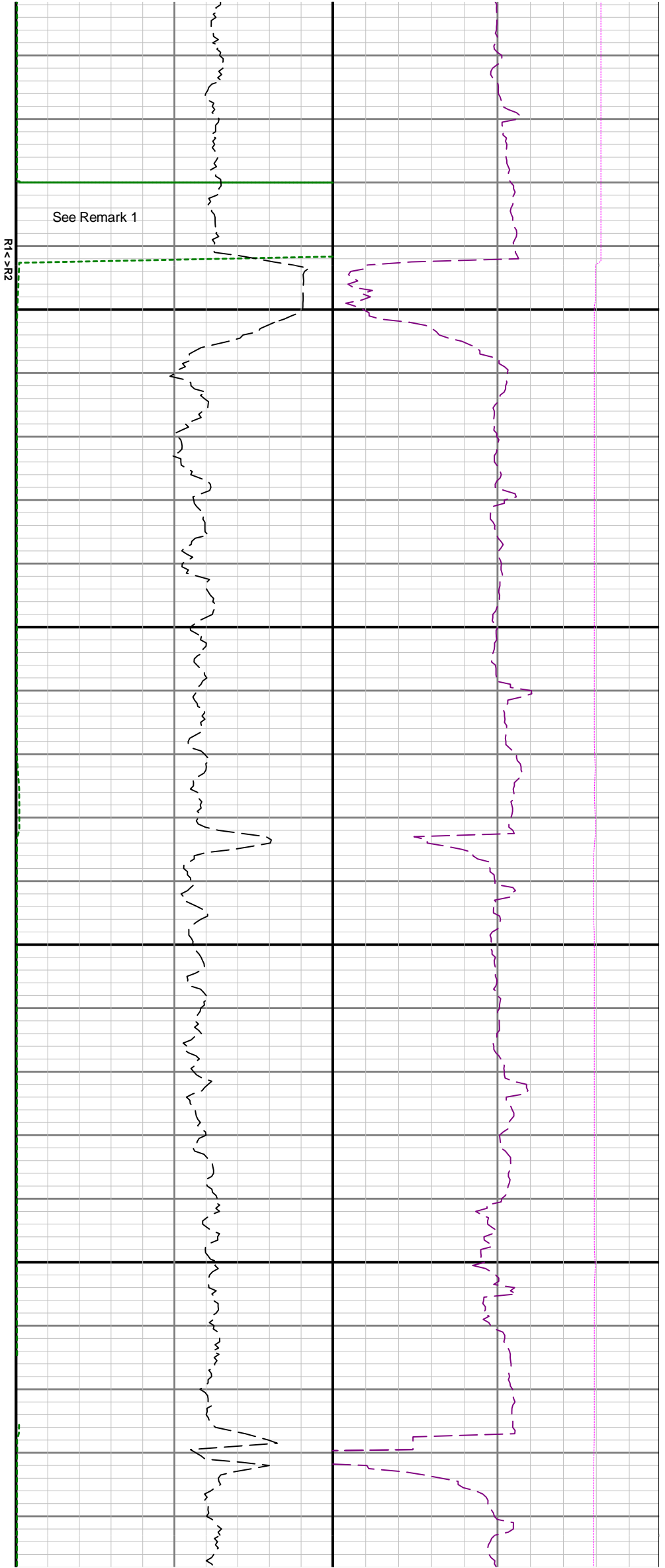
11200

11300





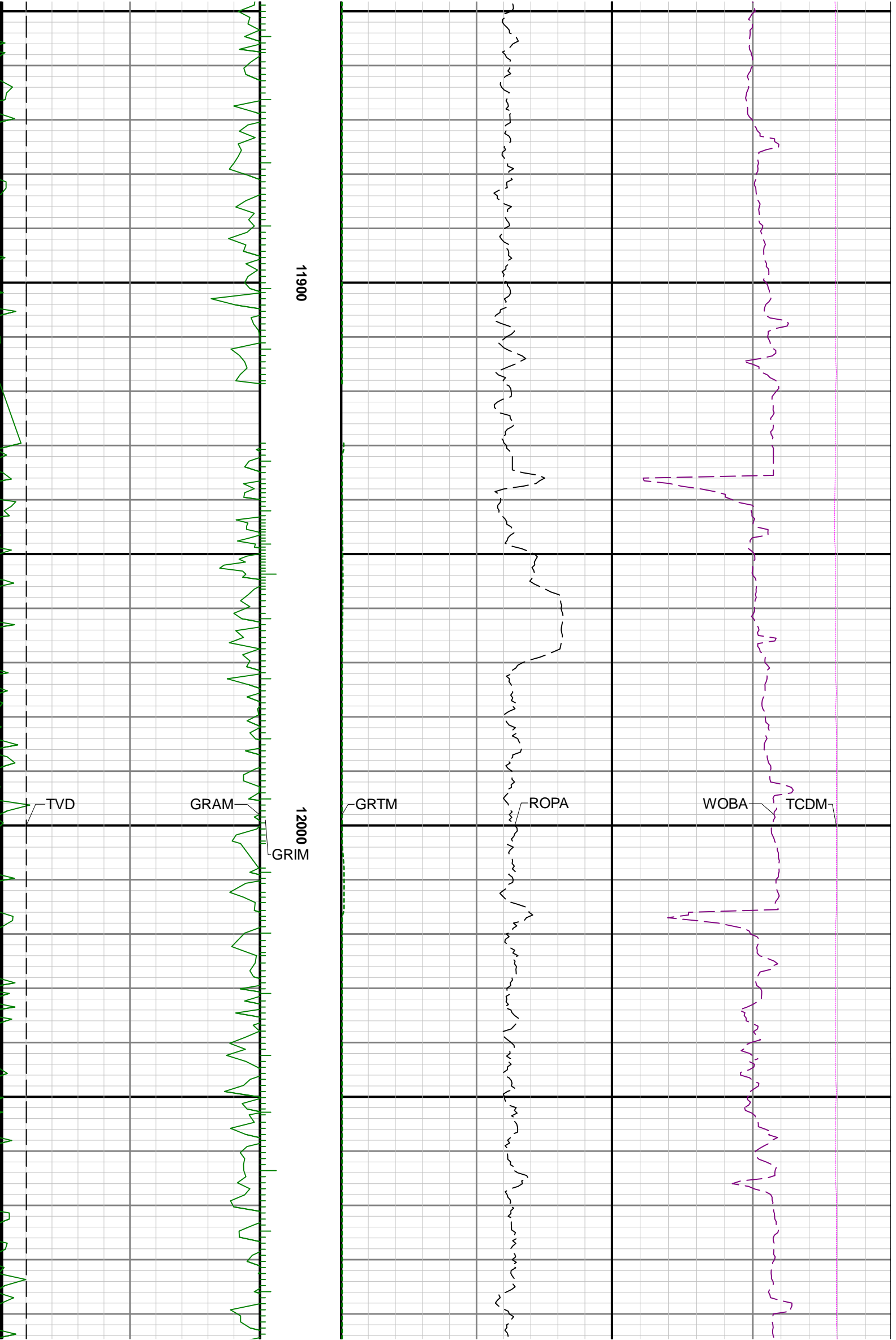


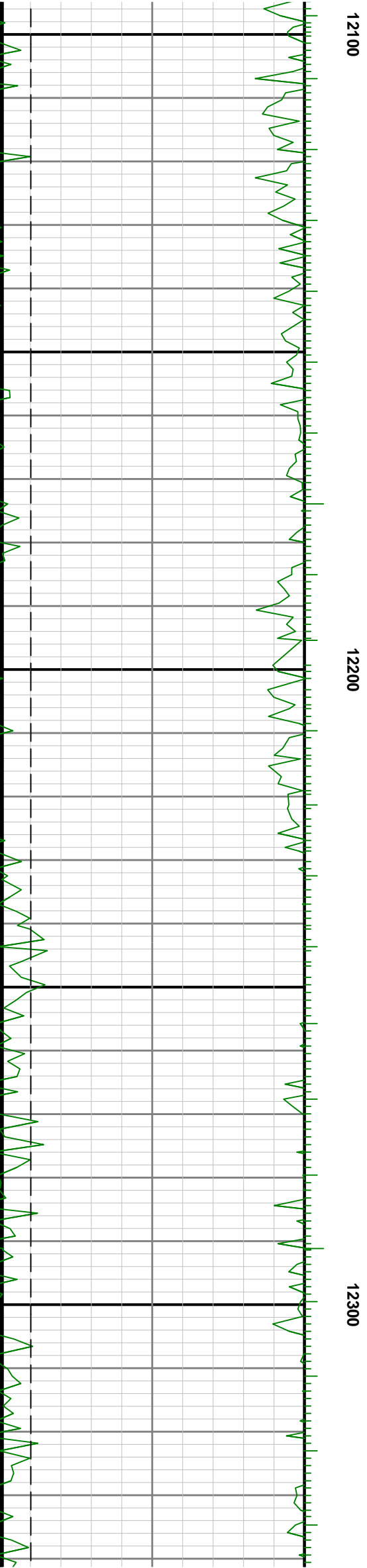
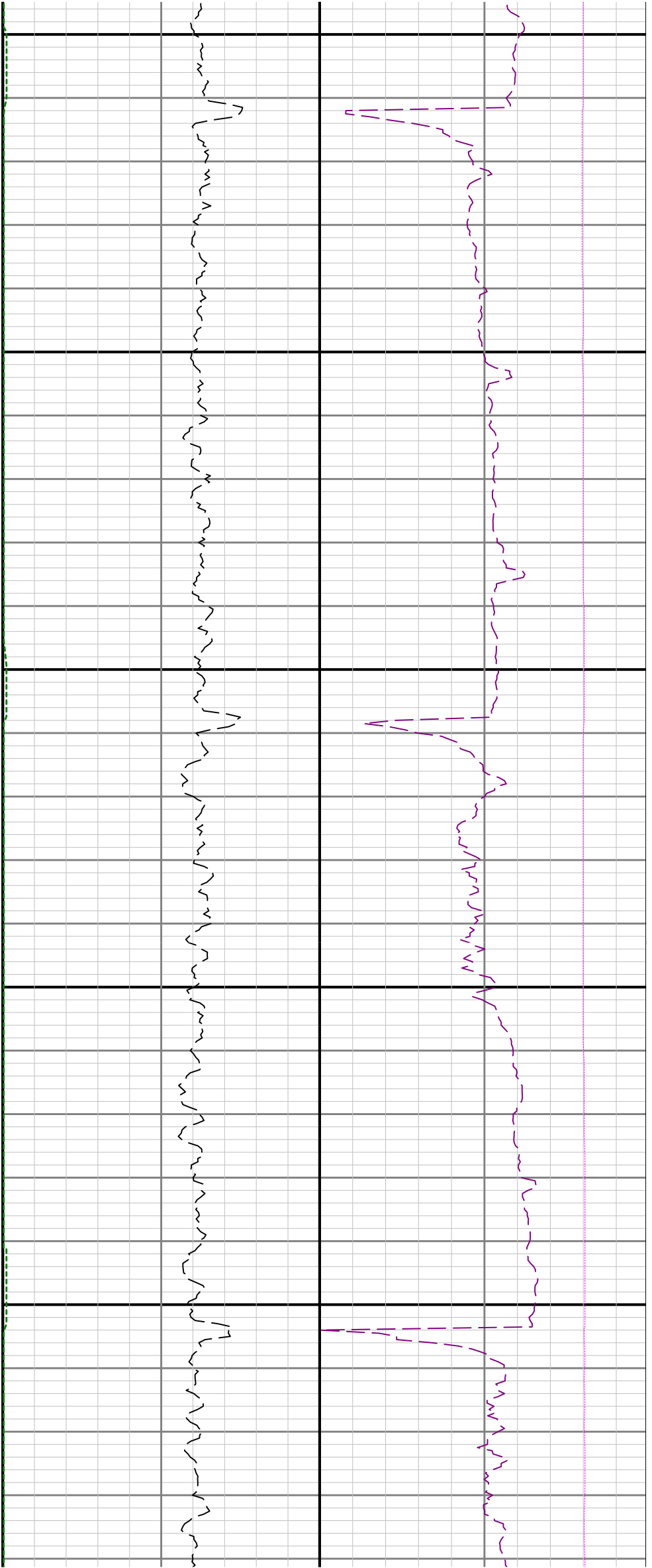


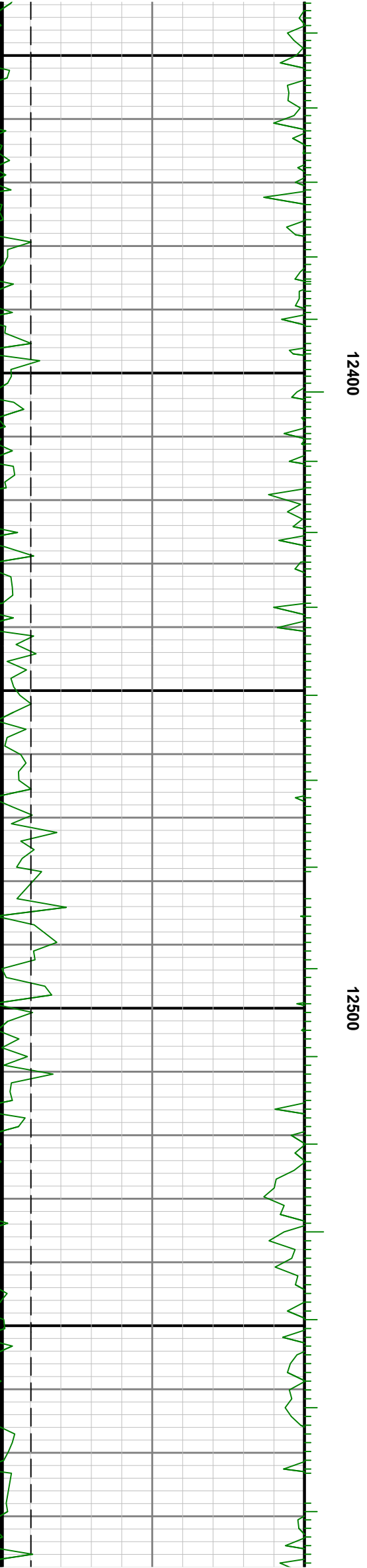
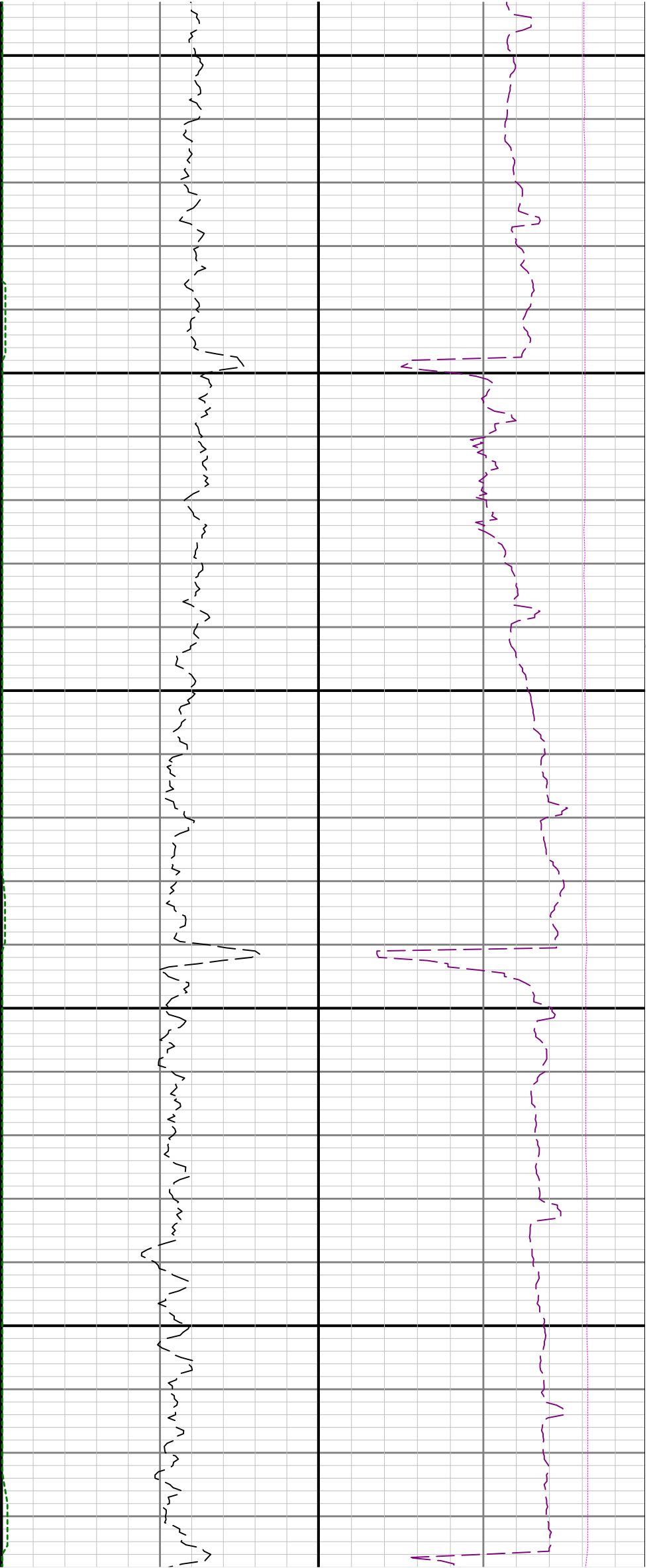
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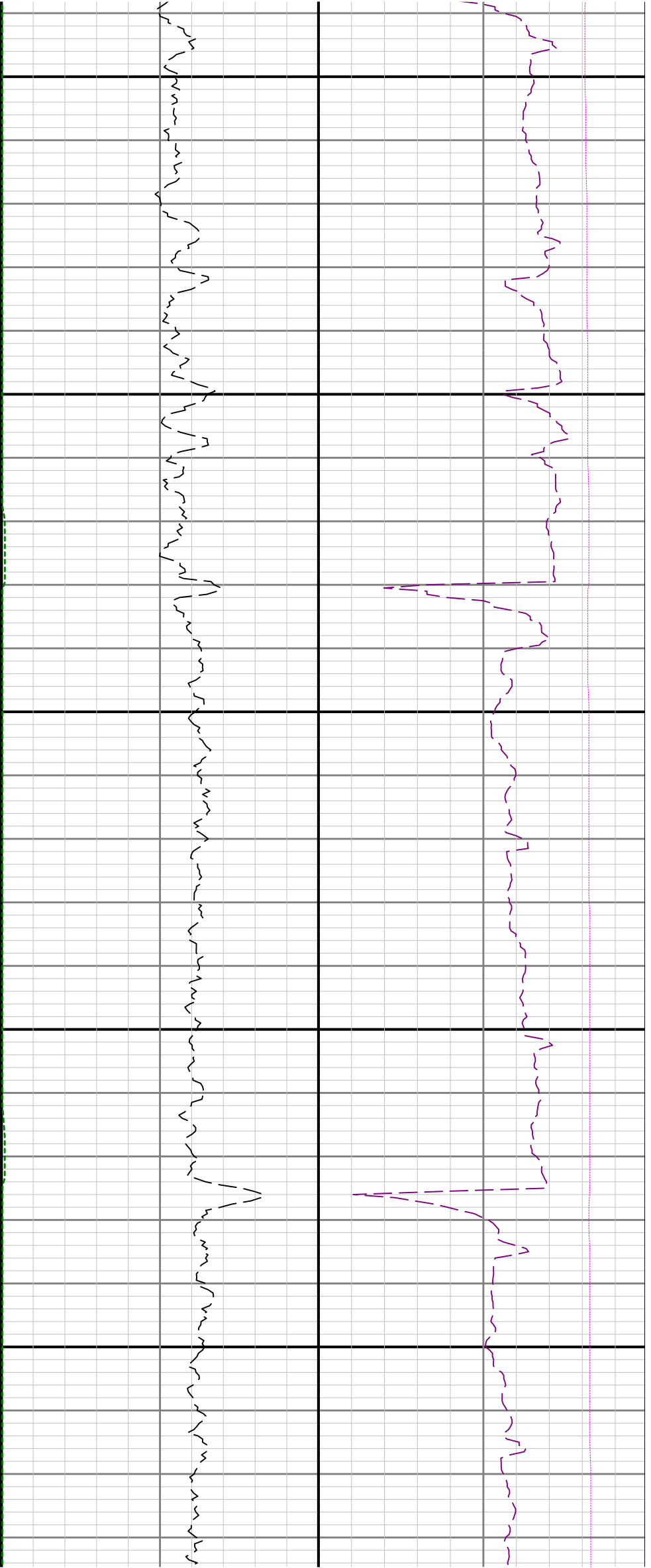
11700

**11800**





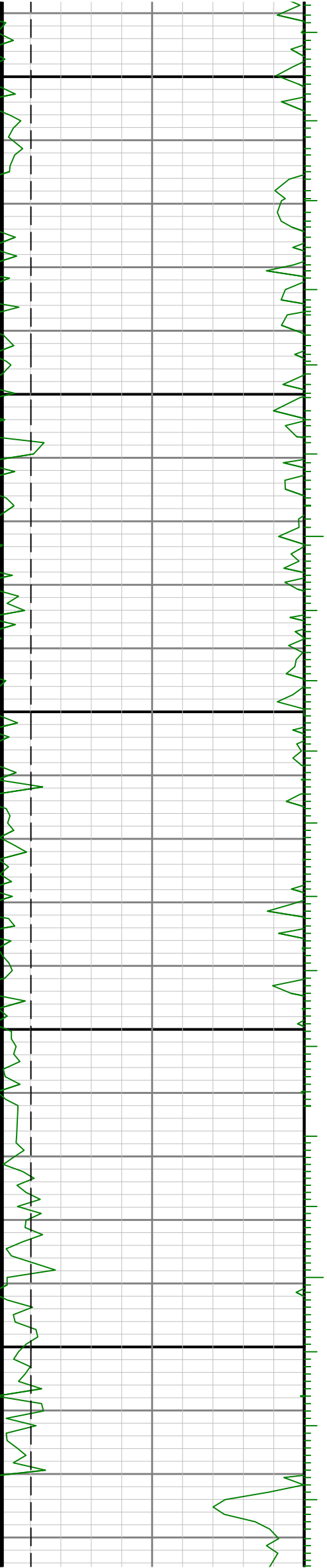


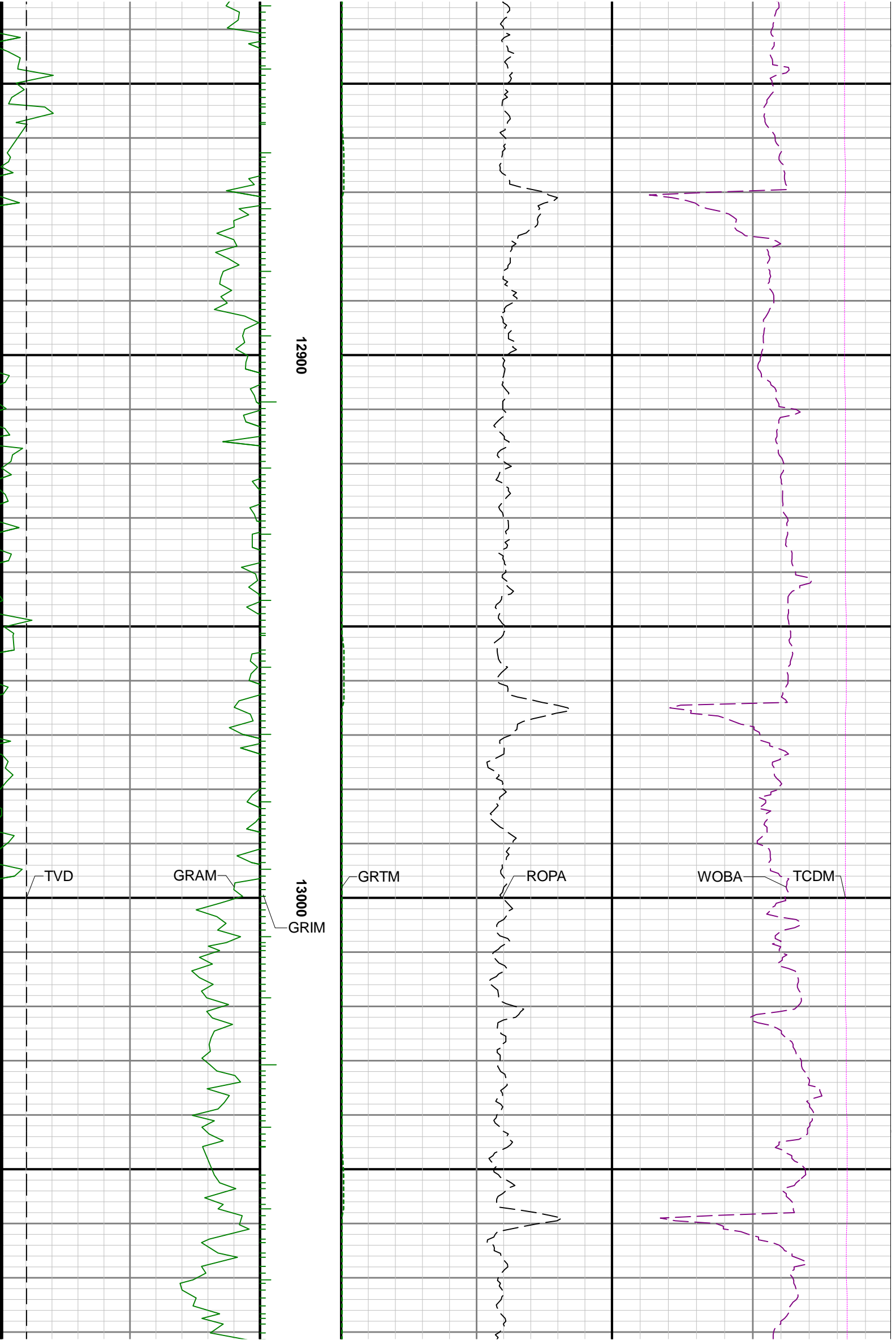


12600

12700

12800



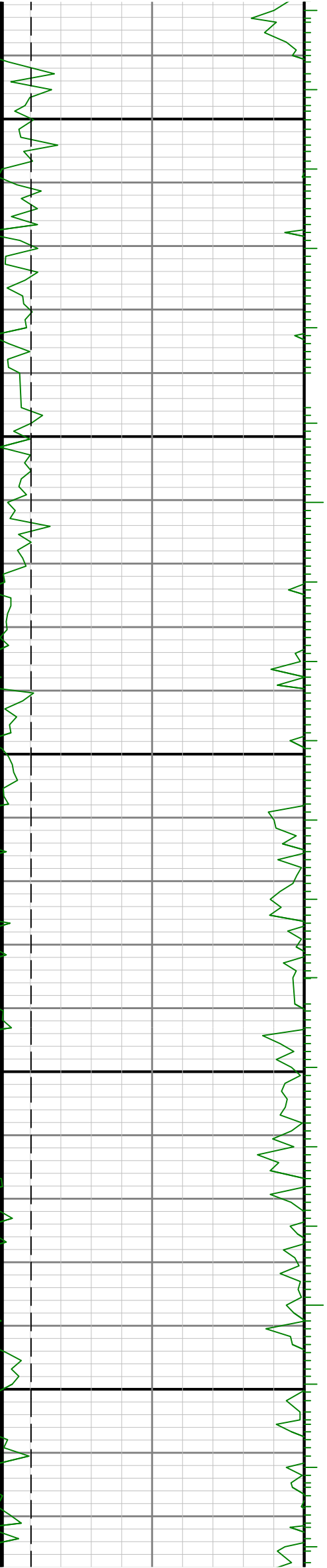




13100

13200

13300

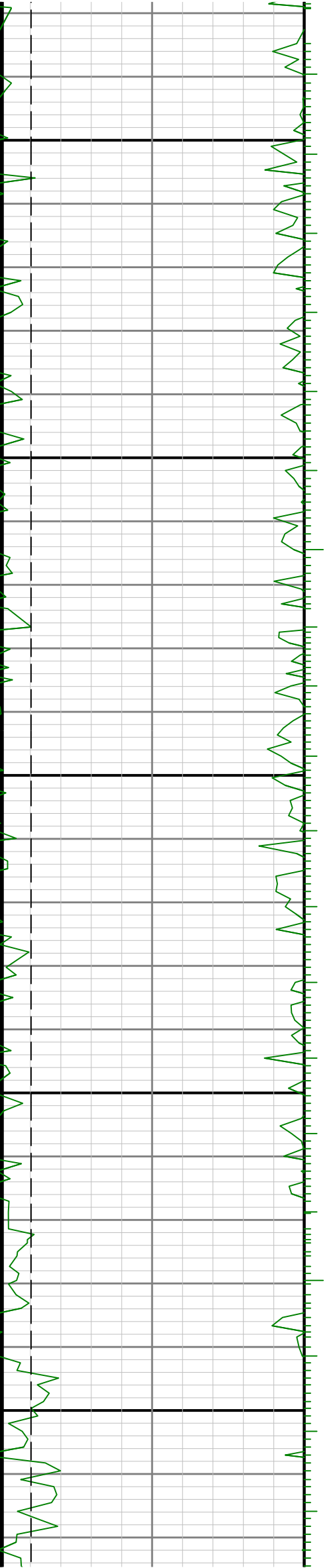


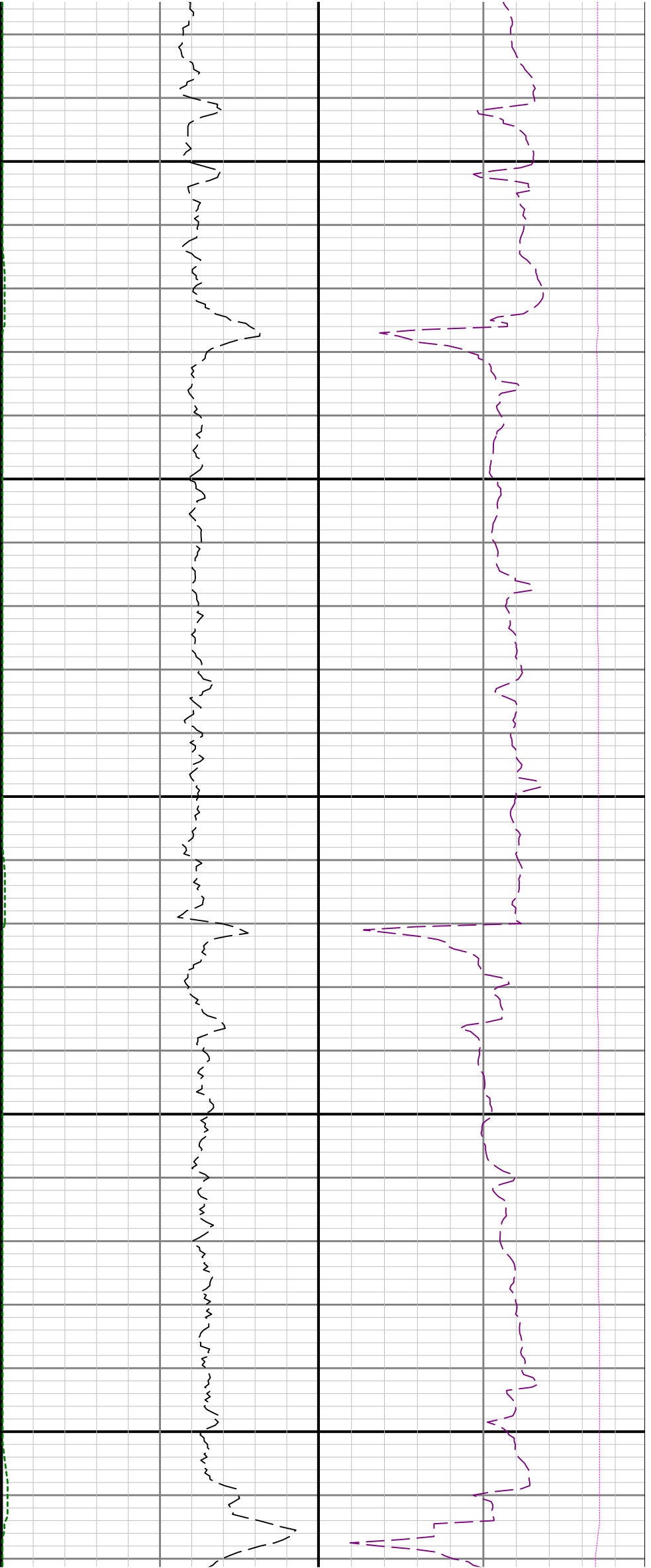




13400

13500

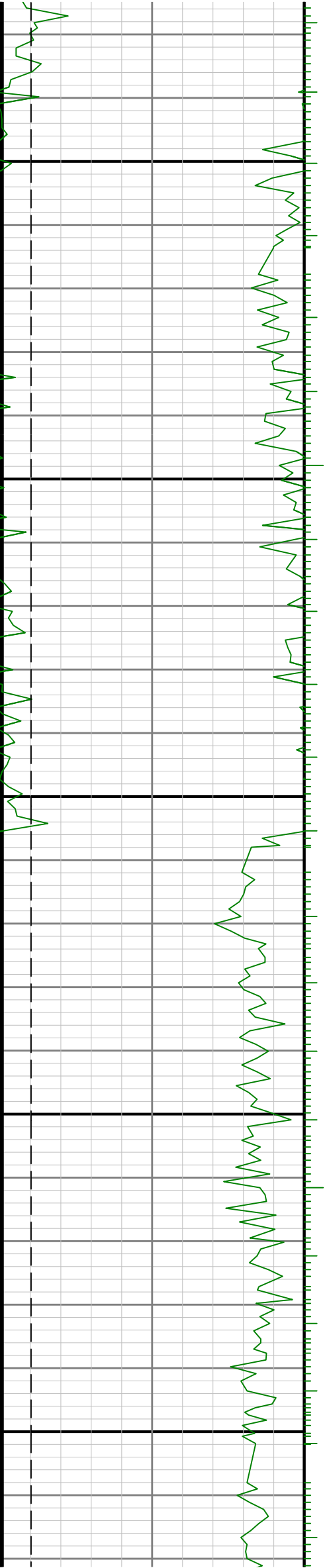


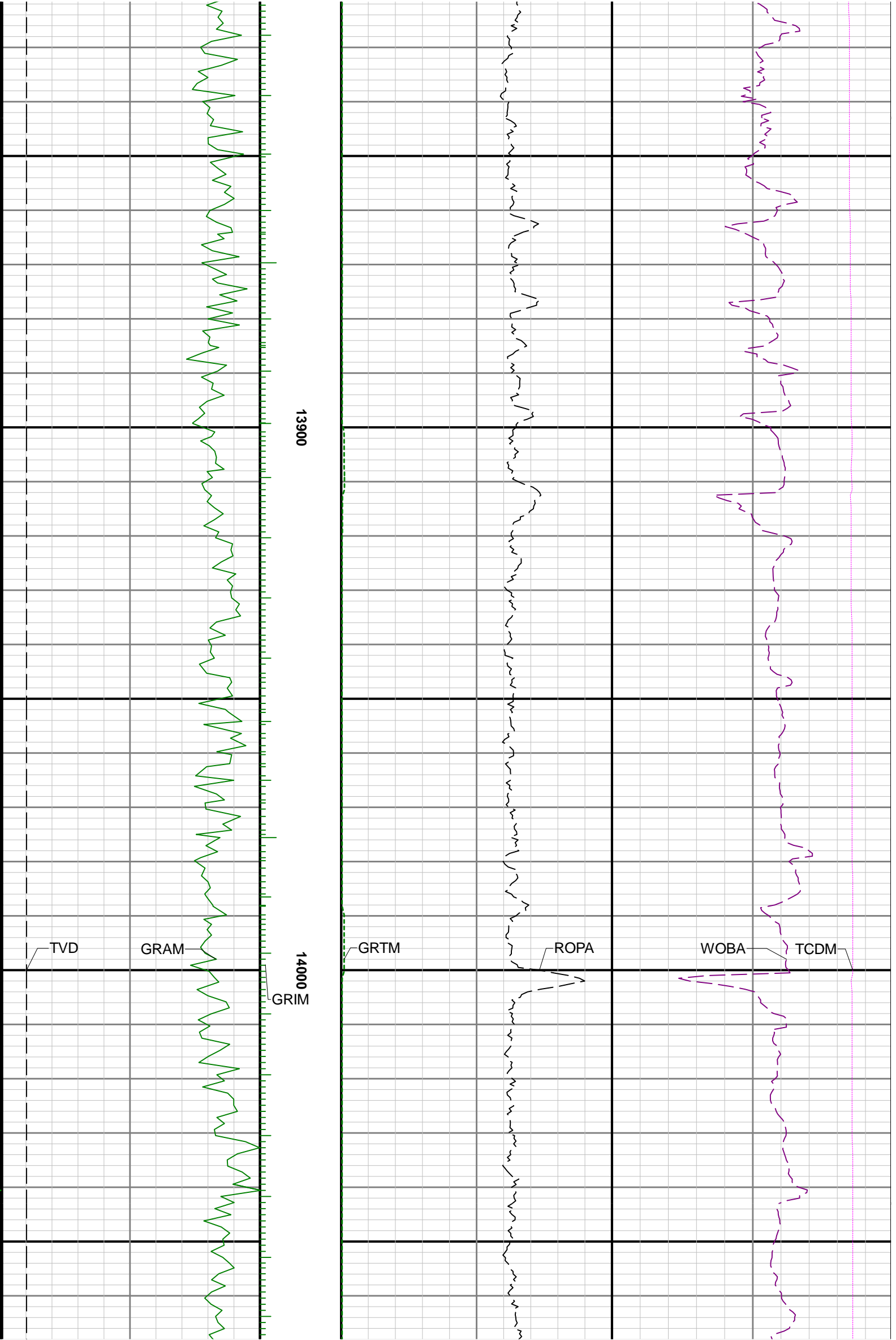


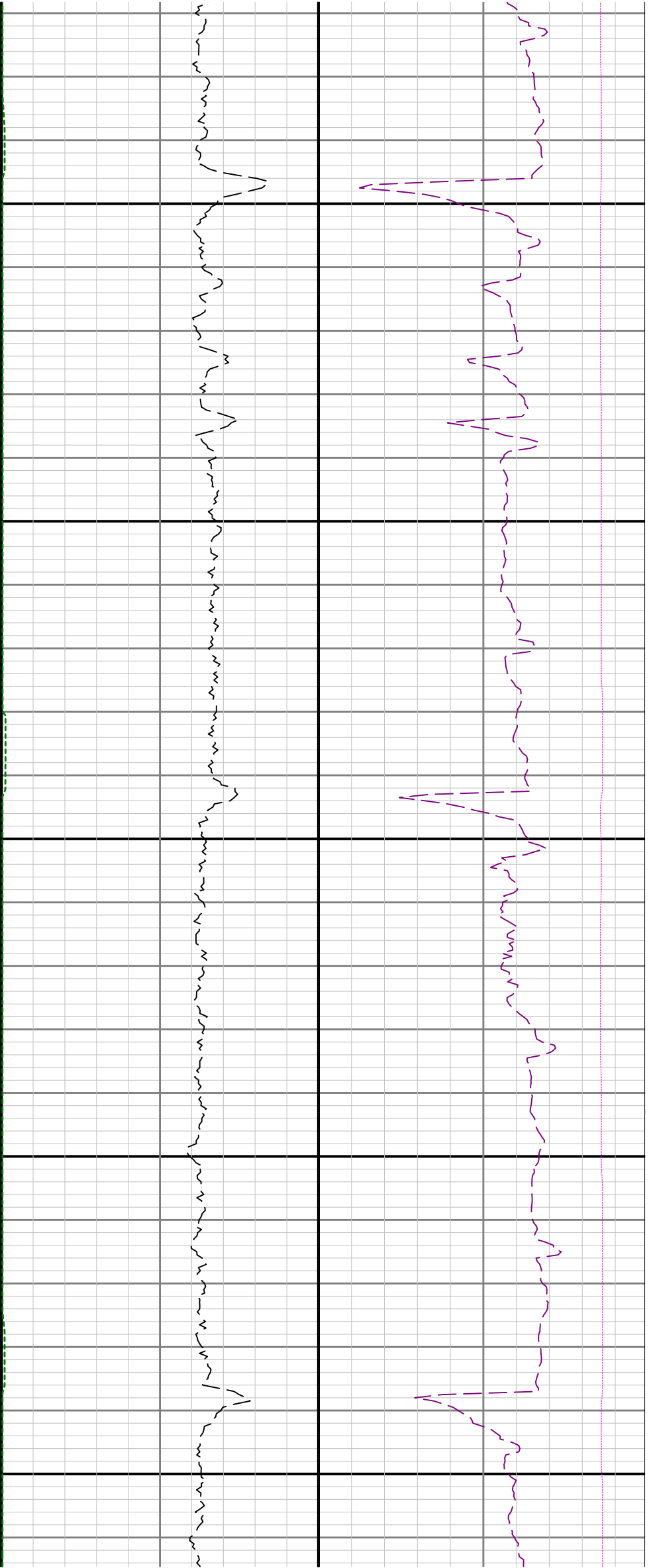
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13700

13800



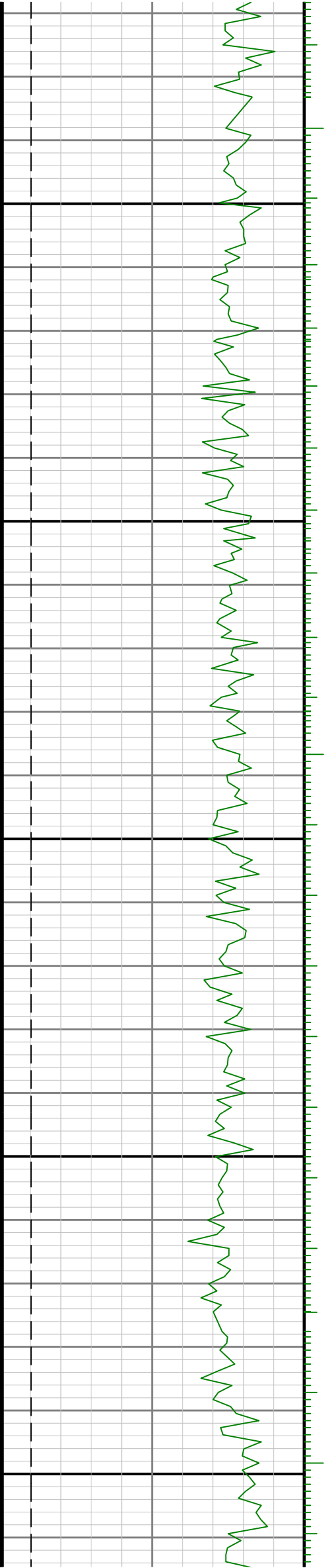


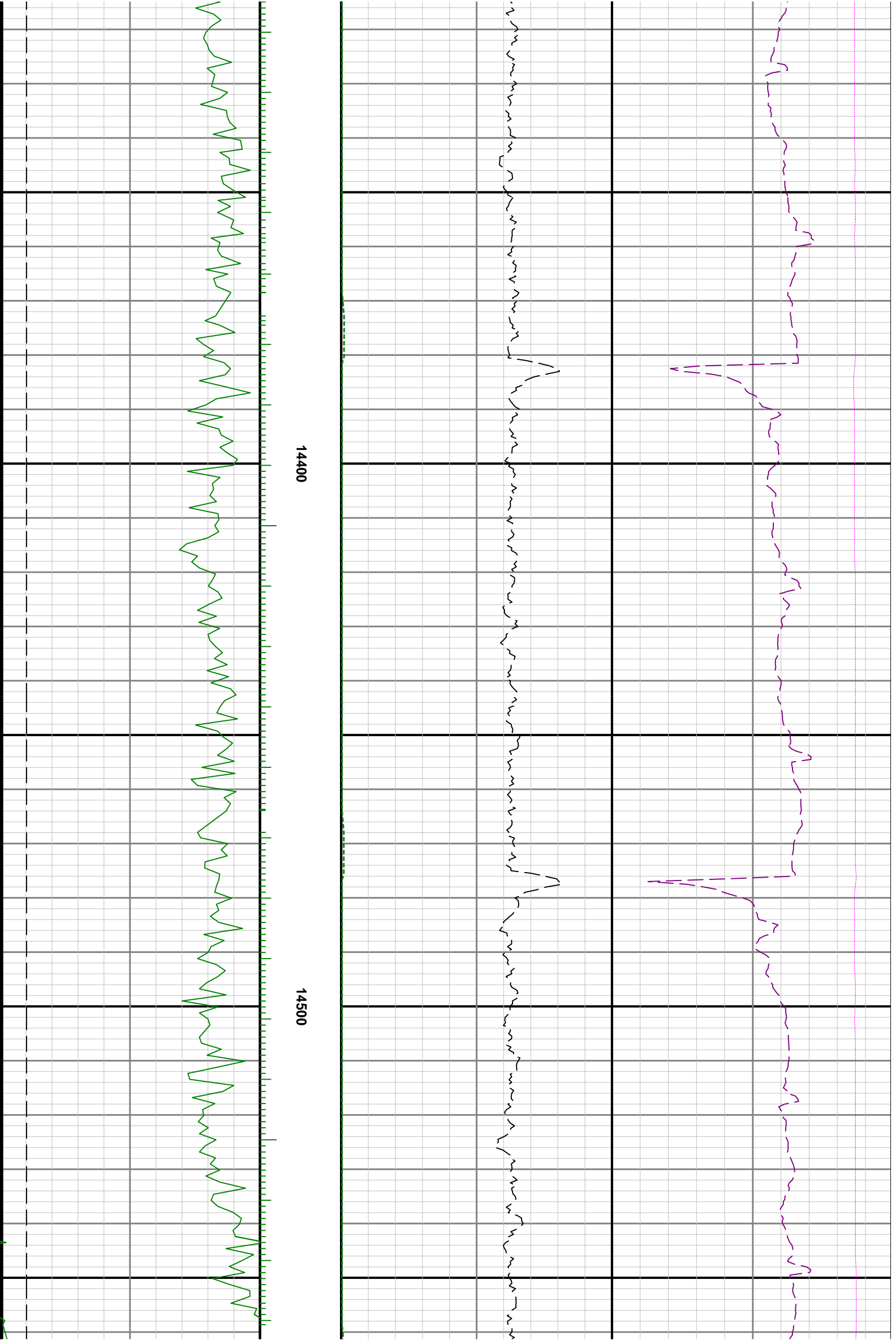


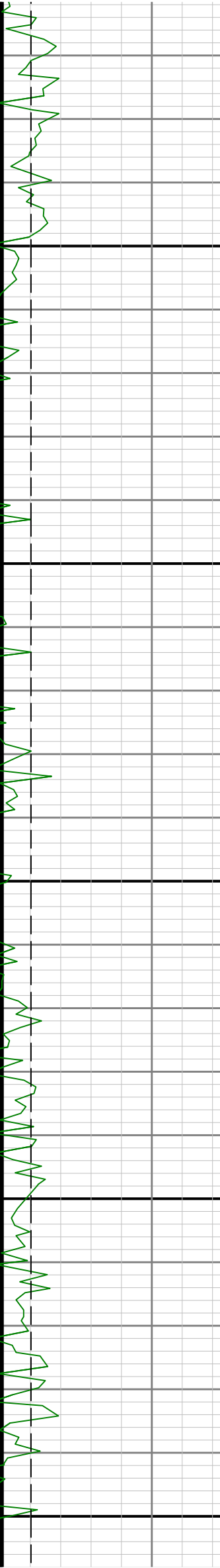
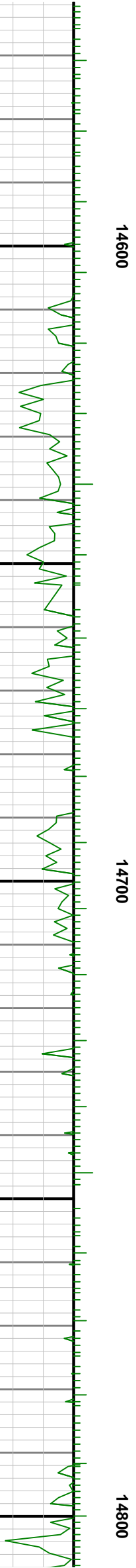
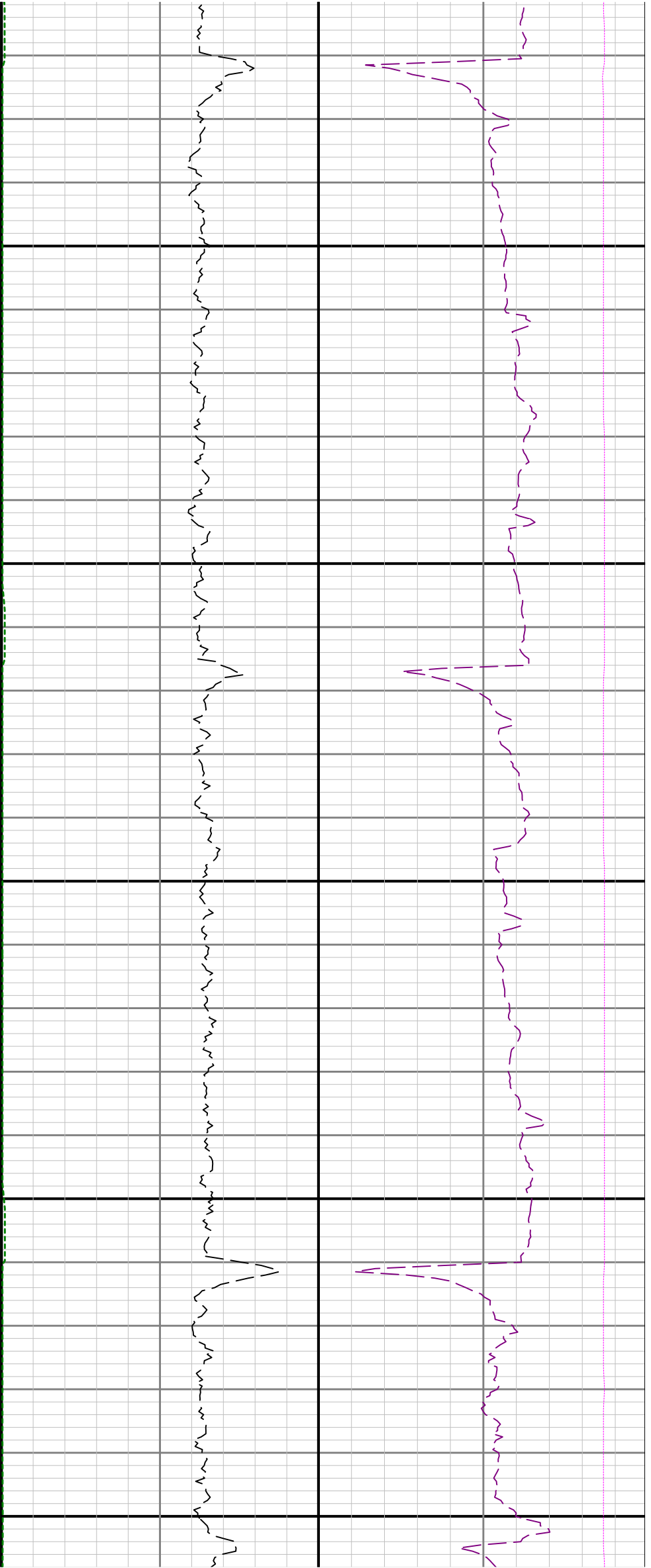
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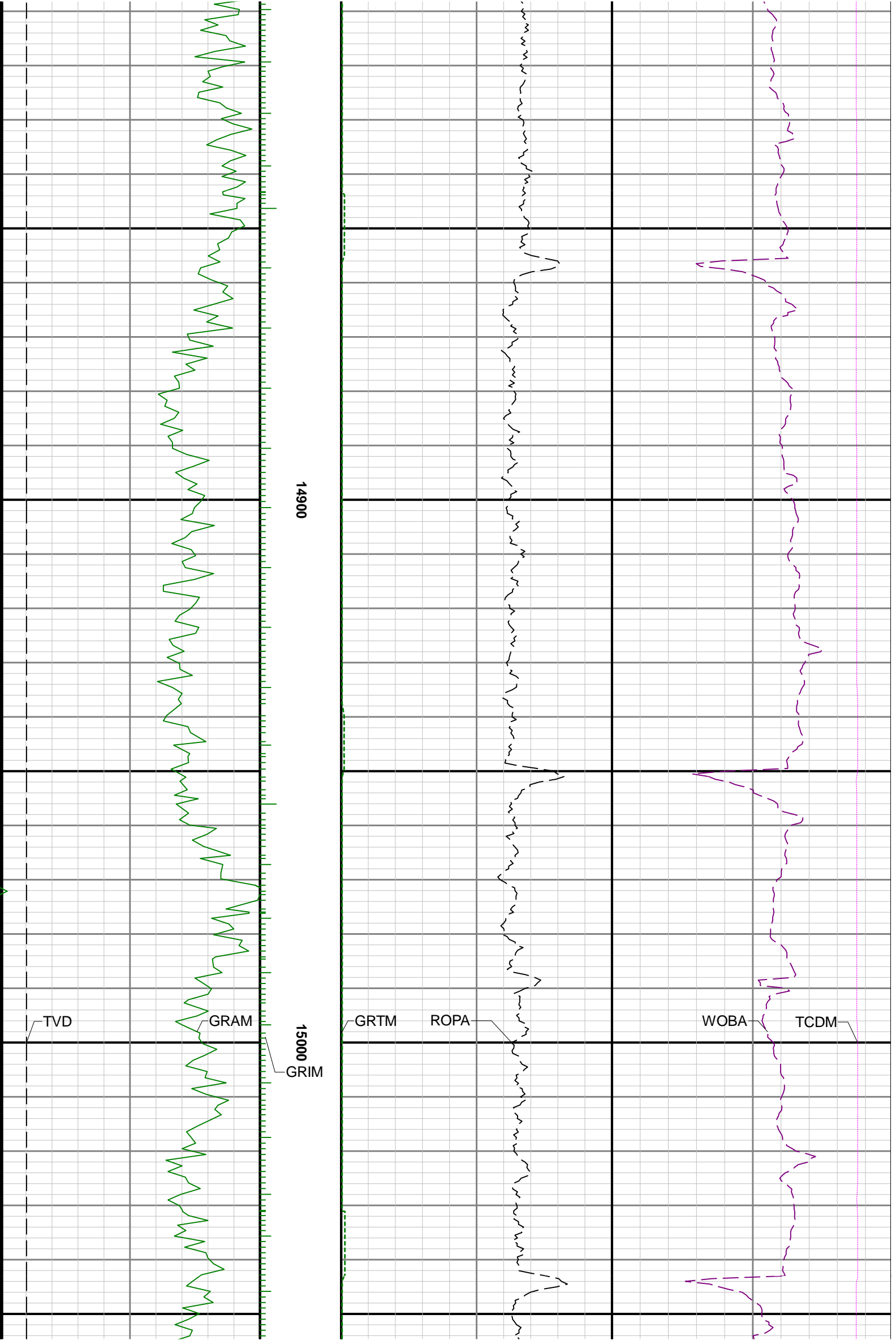
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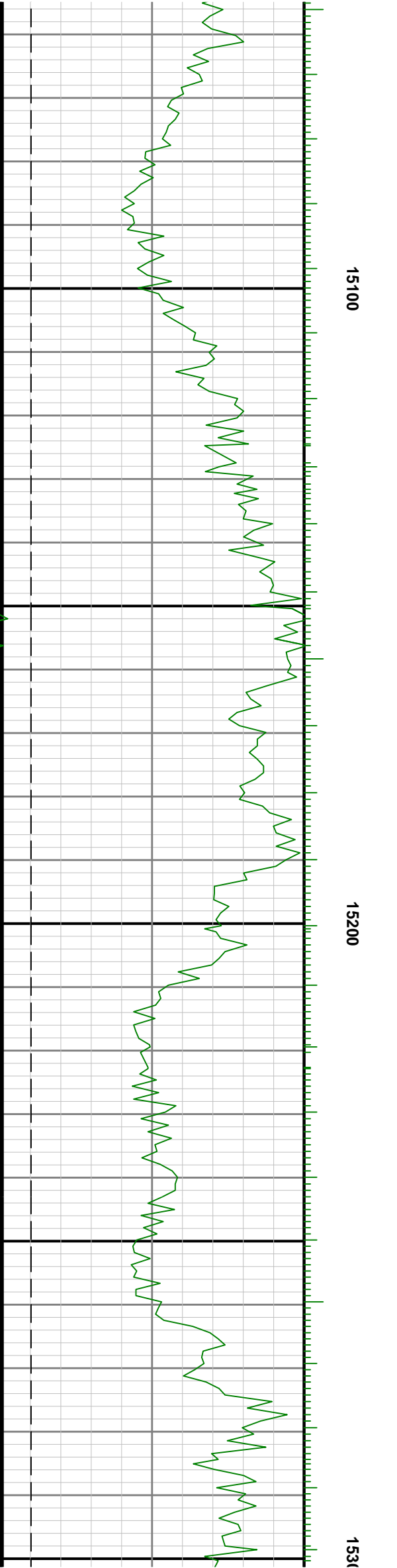
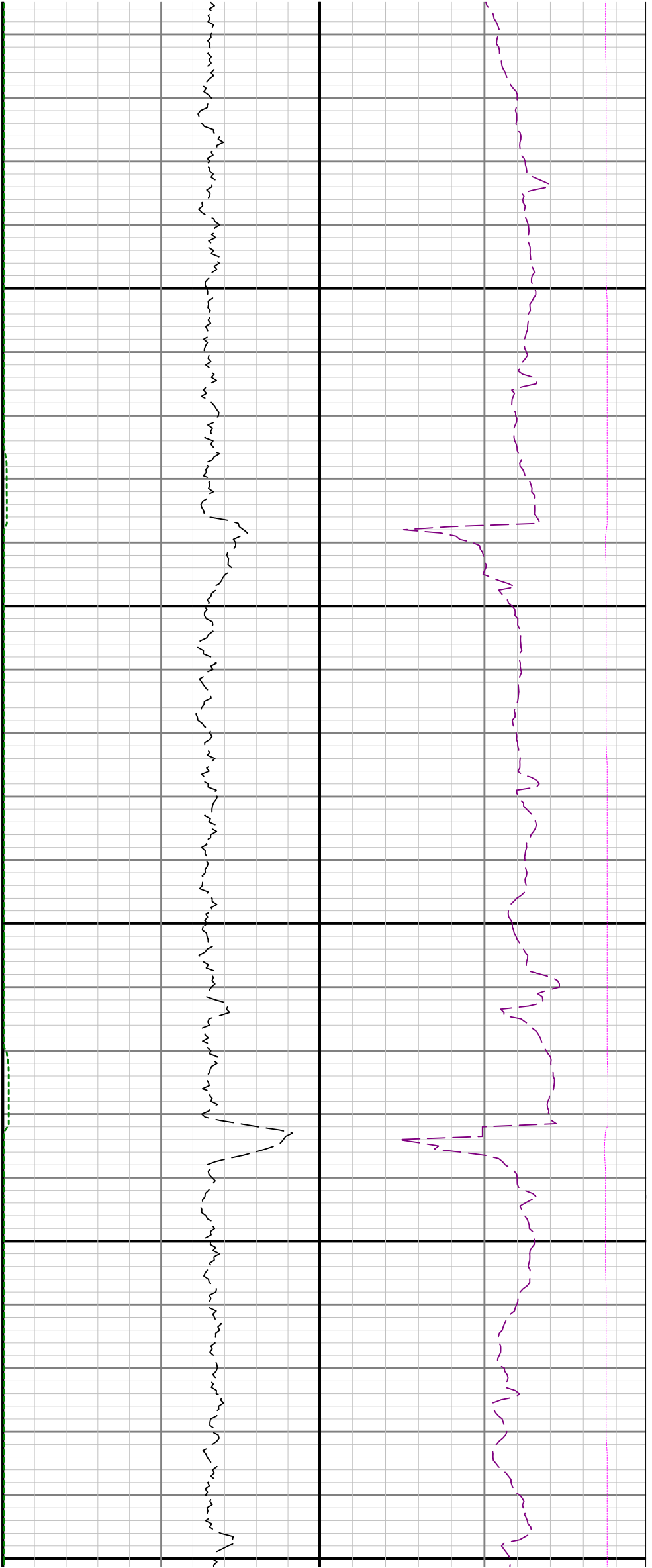
14300



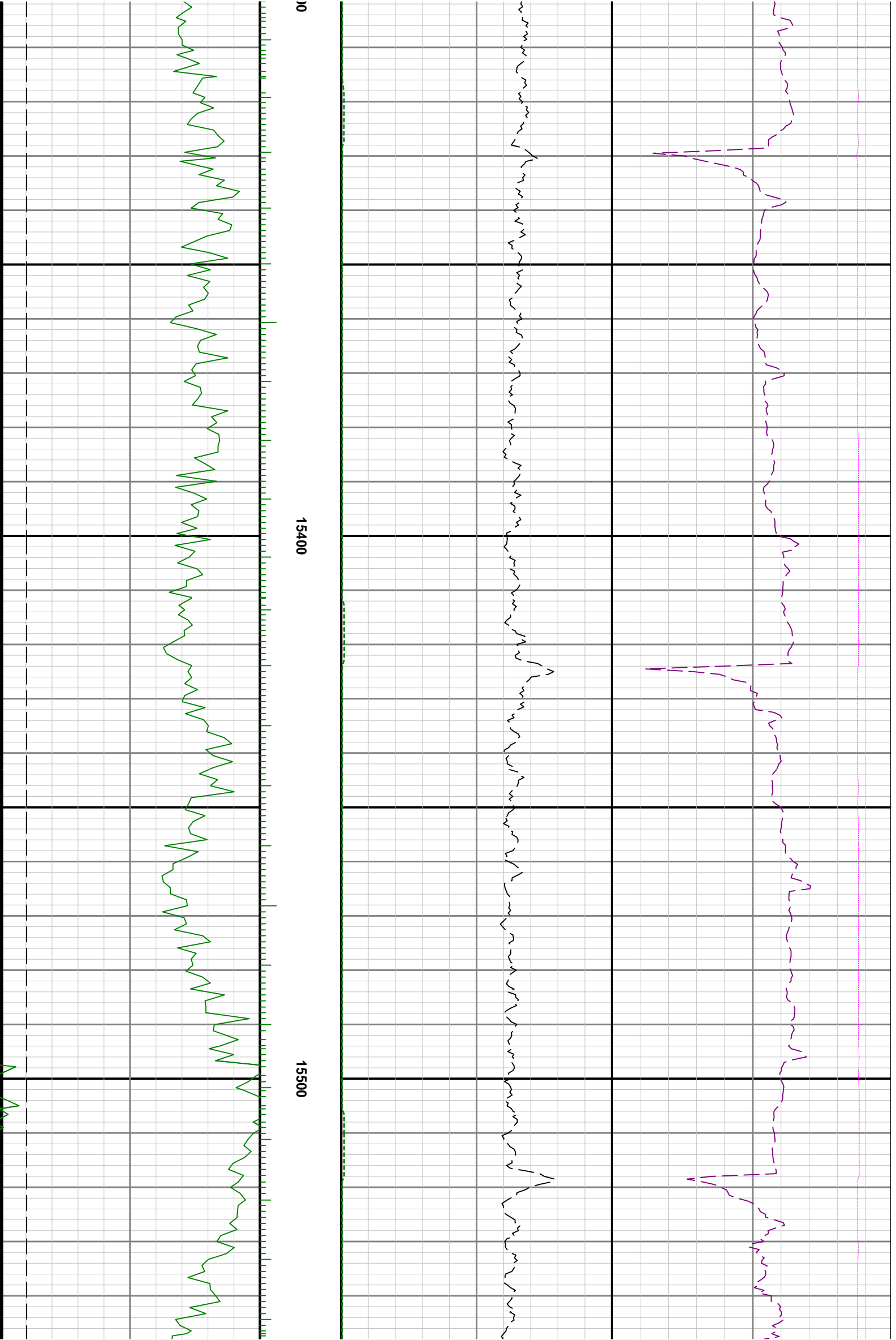


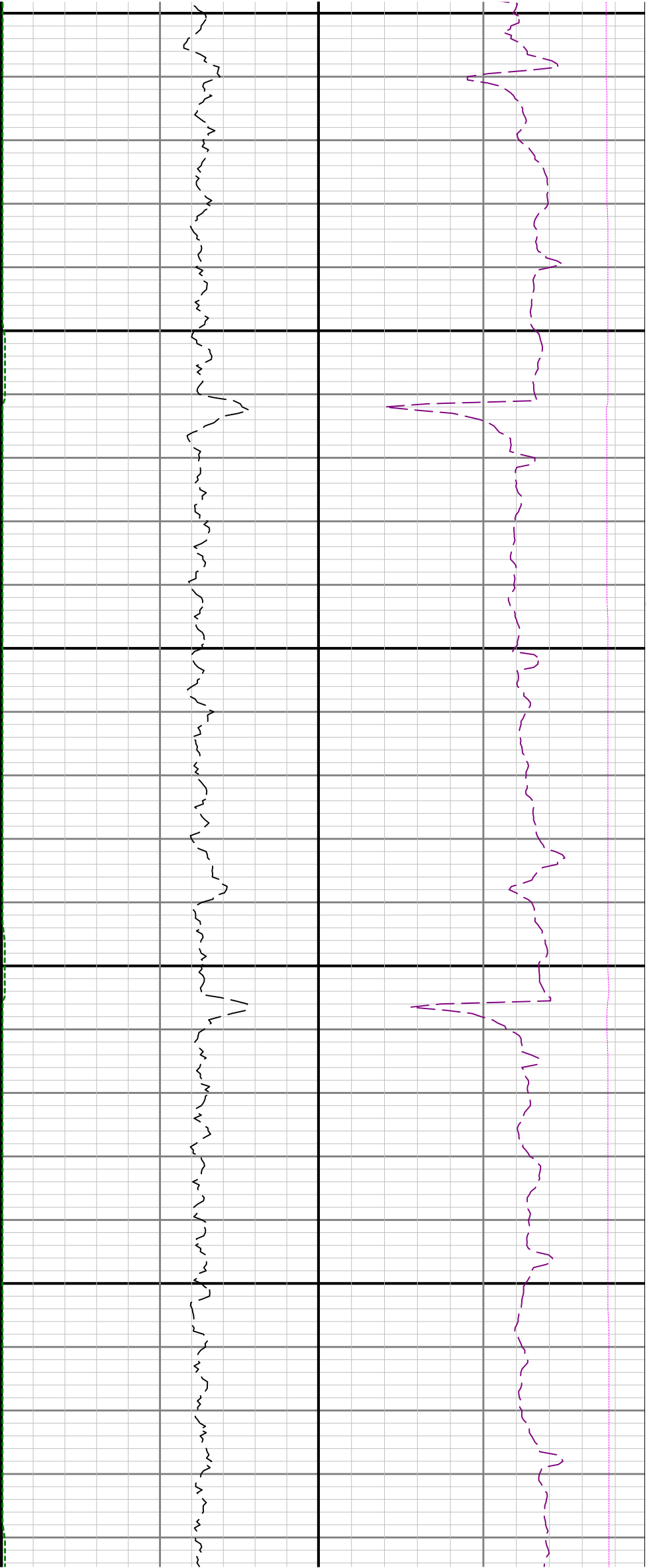






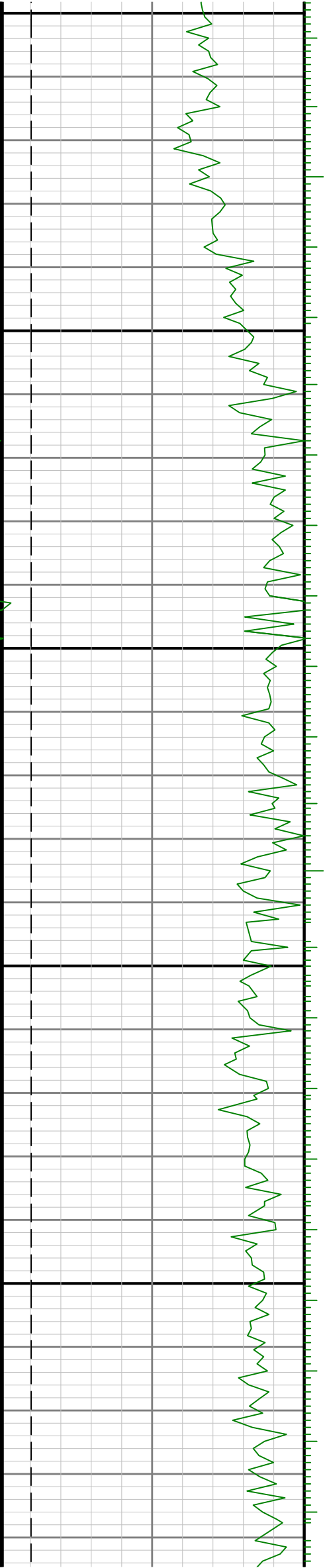


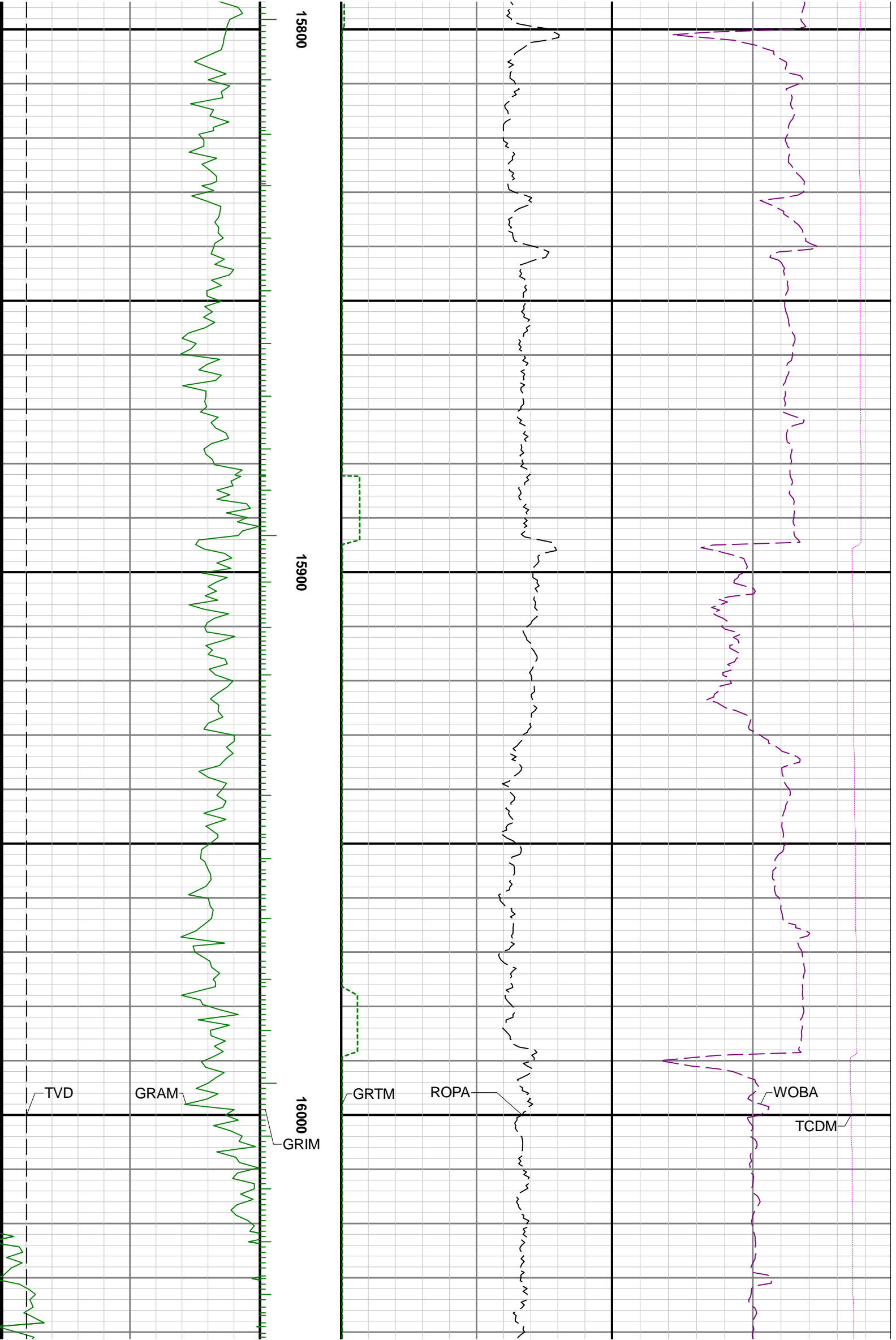


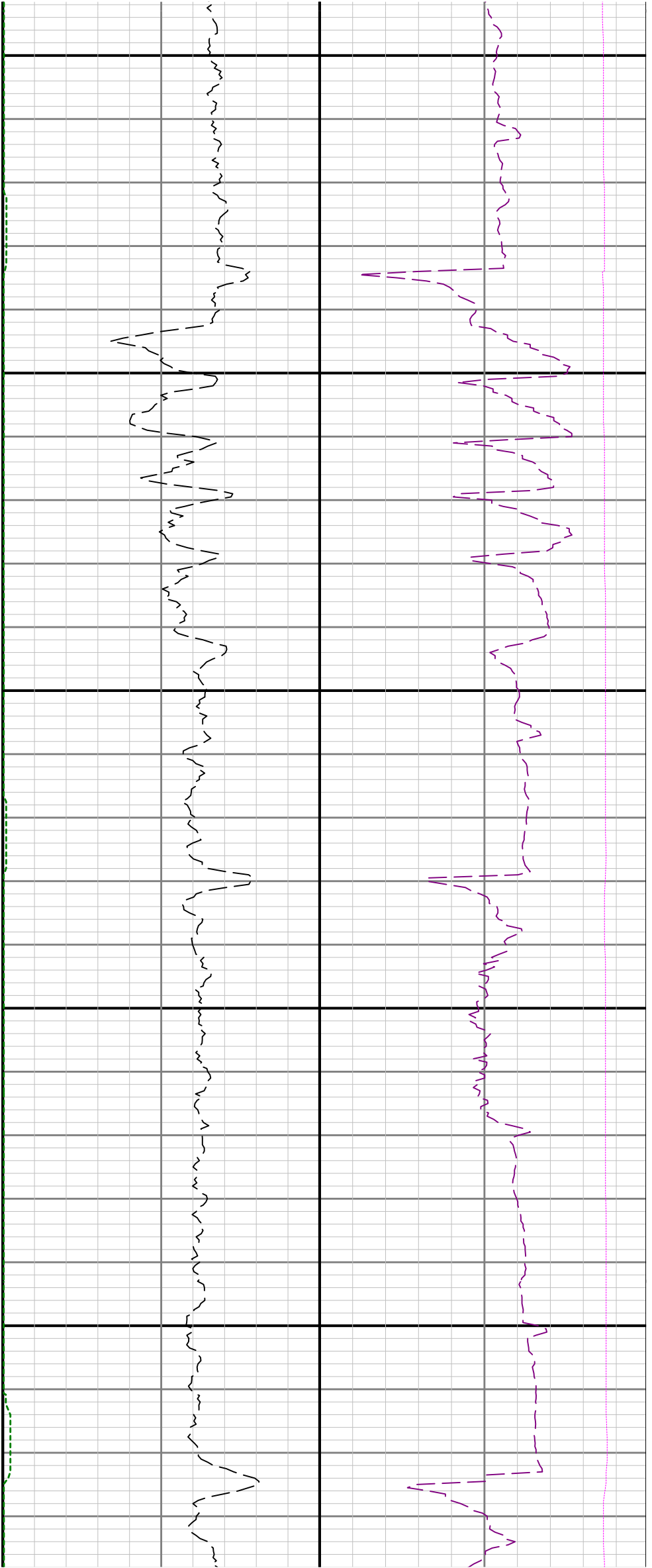


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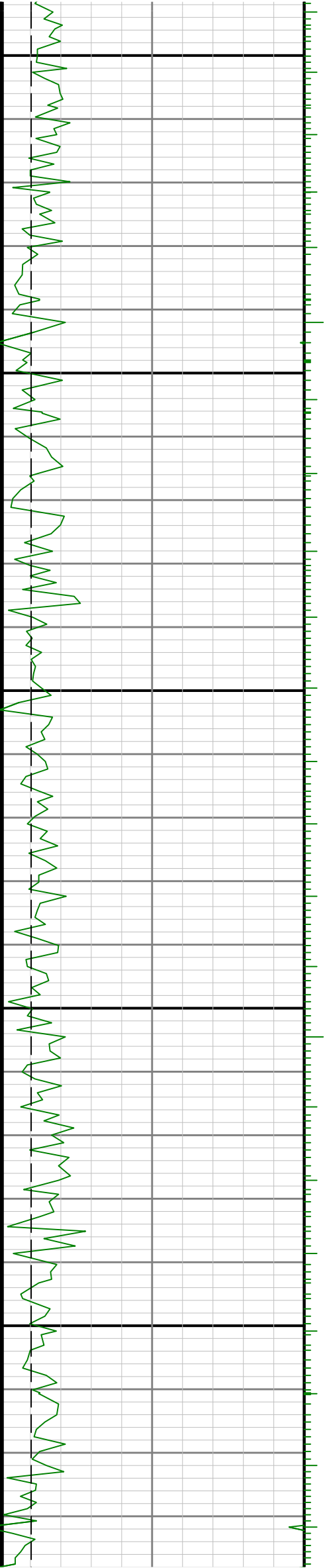


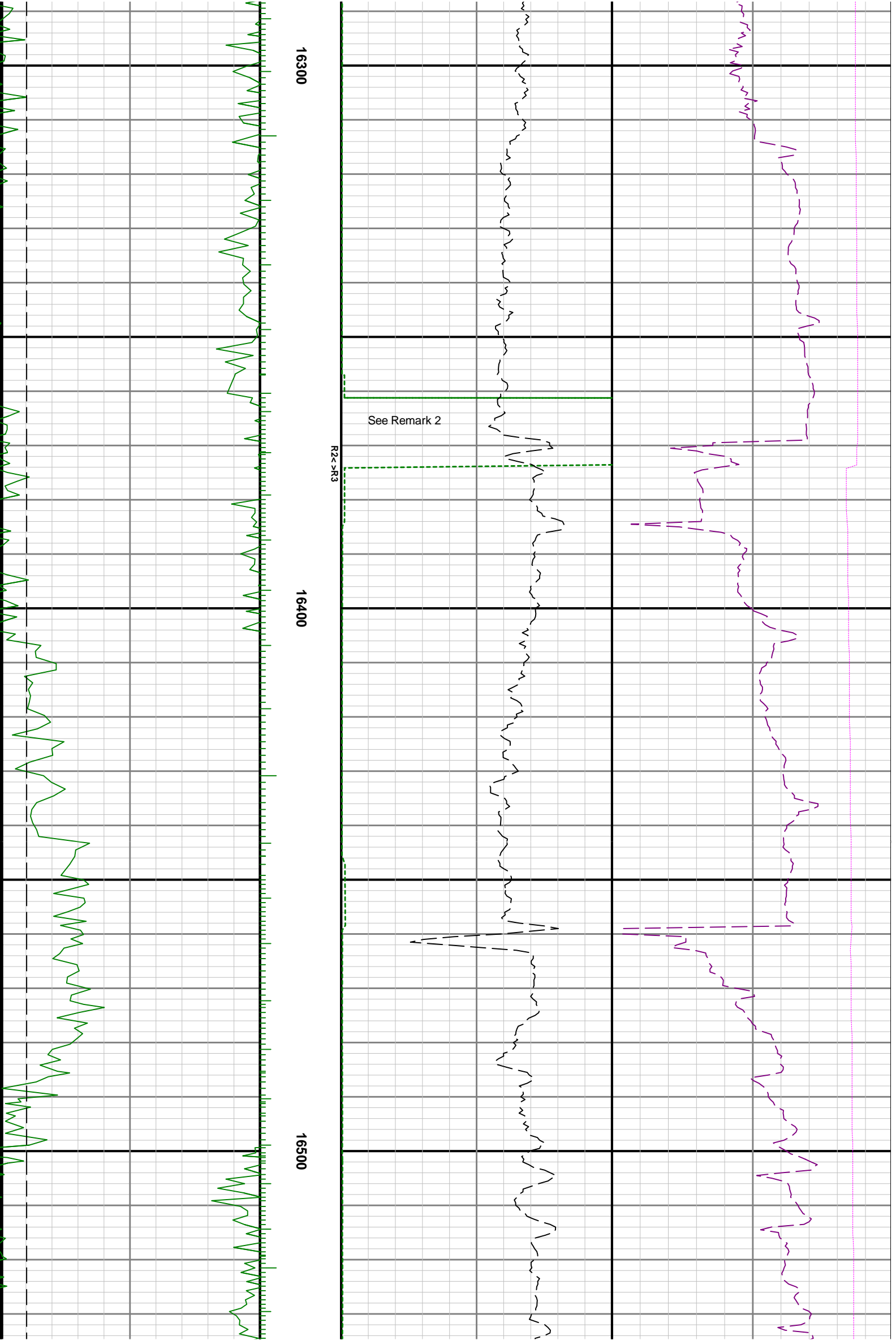


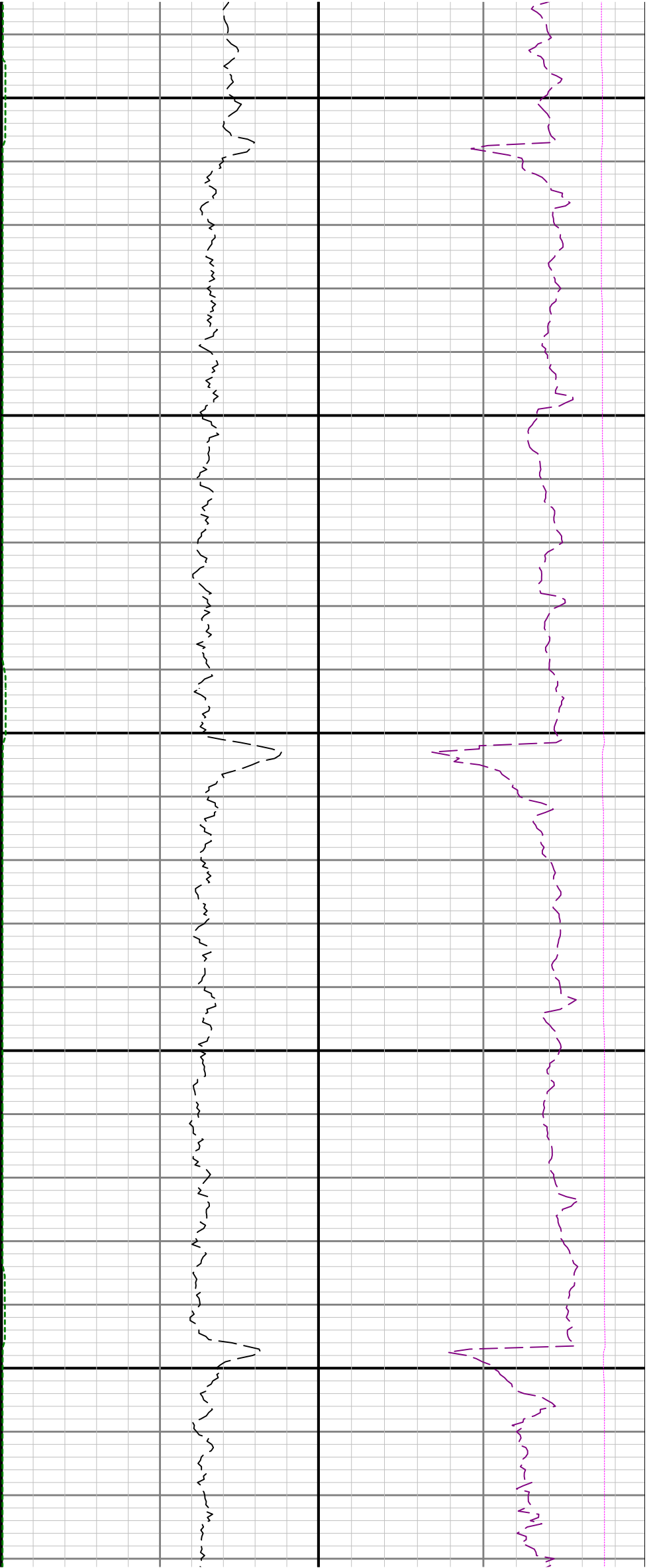


16100

16200







16600

16700

