



| LWD MEMORY LOG | | | | | | | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|
| <div> <div>  <div> <div>BAKER</div> <div>HUGHES</div> <div>a GE company</div> </div> </div> <div>  </div> </div> <div>Gamma Ray</div> | | | | <div> <div>Scale:</div> <div>1:240</div> </div> <div> <div>Company: Noble Energy</div> <div>Well: Vogler State D21-790</div> <div>Field: Wattenberg</div> </div> <div> <div>Depth Reference:</div> <div>County: Weld</div> <div>State: Colorado</div> </div> <div> <div>Driller's Depth</div> <div>Country: United States</div> </div> | | | | | | | |
| <div> <div>Status:</div> <div>Final Print</div> </div> <div> <div>API No:</div> <div>05-123-48561-00</div> </div> <div> <div>Job ID:</div> <div>109752805</div> </div> | | | | <div> <div>Surface Location:</div> <div>Latitude: 040° 12' 21.600" N</div> <div>Longitude: 104° 32' 55.932" W</div> </div> <div> <div>Other Services:</div> <div>Directional</div> </div> | | | | | | | |
| <div> <div>Permanent Datum (P.D.):</div> <div>Ground Level</div> </div> <div> <div>Elevation:</div> <div>4820.00 ft</div> </div> <div> <div>Log Measured From:</div> <div>Rig Floor</div> </div> <div> <div>Above P.D.:</div> <div>30.00 ft</div> </div> | | | | <div> <div>Elev. KB:</div> <div>4850.00 ft</div> </div> <div> <div>Elev. DF:</div> <div>4820.00 ft</div> </div> <div> <div>Elev. GL:</div> <div></div> </div> | | | | | | | |
| <div> <div>Dates</div> <div> <div>From: 2019-04-19</div> <div>To: 2019-04-22</div> <div>Spud: 2019-04-13</div> </div> </div> <div> <div>Interval</div> <div> <div>Drilled (ft)</div> <div>1973.00</div> <div>Top: 1973.00</div> <div>Bottom: 17660.00</div> </div> </div> | | | | <div> <div>Magnetic Field Reference</div> <div> <div>Azi Reference North:</div> <div>1973.00</div> <div>Total Magnetic Field Strength: (nT)</div> <div>17647.00</div> </div> </div> <div> <div>Grid Dip Angle: (deg)</div> <div>66.67</div> </div> <div> <div>Mag to Reference North Correction: (deg)</div> <div>52060</div> </div> | | | | | | | |
| <div> <div>Borehole Record</div> <div> <div>Hole Size (in)</div> <div>From (ft)</div> <div>To (ft)</div> <div>Size (in)</div> <div>Weight (lb/ft)</div> <div>From (ft)</div> <div>To (ft)</div> </div> </div> <div> <div>Casing Record</div> <div> <div>13.500</div> <div>30.00</div> <div>1973.00</div> <div>9.625</div> <div>36.00</div> <div>30.00</div> <div>1963.00</div> </div> </div> | | | | <div> <div>Mud Record</div> <div> <div>Type</div> <div>From (ft)</div> <div>To (ft)</div> <div>Hole Size (in)</div> <div>Interval (ft)</div> <div>Inc Az (Start)</div> <div>Inc Az (End)</div> </div> </div> <div> <div>Deviation Record</div> <div> <div>Oil Based Mud</div> <div>1973.00</div> <div>17660.00</div> <div>8.500</div> <div>15687.00</div> <div>0.53 182.27</div> <div>90.15 359.32</div> </div> </div> | | | | | | | |
| <div> <div>Acquisition System</div> <div> <div>Cadence</div> <div>Plot Studio</div> </div> </div> <div> <div>Software Version</div> <div> <div>RT 5.2</div> <div>5.2.8472.1</div> </div> </div> | | | | <div> <div>Other</div> <div> <div>Rig: H&P 517</div> <div>Contractor: Helmerich & Payne Drilling Co</div> <div>District: RMA</div> </div> </div> <div> <div>Unit: D&E</div> </div> | | | | | | | |

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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 | AutoTrak Curve | 1973.00 | 13177.00 | 1973.00 | 13190.00 | 2019-04-19 02:45 | 2019-04-20 20:40 | 37.03 |
| 2 | 2 | 8.500 | PDC | 3.00 | AutoTrak Curve | 13177.00 | 17647.00 | 13190.00 | 17660.00 | 2019-04-21 10:00 | 2019-04-22 05:10 | 20.21 |

Crew

| Name | Arrive Wellsite | Depart Wellsite | Name | Arrive Wellsite | Depart Wellsite | Name | Arrive Wellsite | Depart Wellsite |
|--------------|-----------------|-----------------|-------------|-----------------|-----------------|------|-----------------|-----------------|
| Adam Schlenz | 2019-04-18 | 2019-04-22 | Andrew Hays | 2019-04-22 | 2019-04-23 | | | |

Mud Properties Record

| Date / Time | Run No. | Depth (ft) | Mud Type | Density (ppg) | Viscosity (cP) | pH | Fluid Loss (cm3) | Oil / Water | Source | Total Chlorides (ppm) | K+ (%) |
|-------------|---------|------------|----------|---------------|----------------|----|------------------|-------------|--------|-----------------------|--------|
|-------------|---------|------------|----------|---------------|----------------|----|------------------|-------------|--------|-----------------------|--------|

| | | | | | | | | | | | |
|------------------|---|----------|---------------|-----|----|-----|------|---------|------------|-------|------|
| 2019-04-19 01:00 | 1 | 1973.00 | Oil Based Mud | 9.3 | 16 | N/A | 22.8 | 74/14 | Active Pit | 24295 | 0.00 |
| 2019-04-19 13:00 | 1 | 5423.00 | Oil Based Mud | 9.1 | 16 | N/A | 15.0 | 72.5/15 | Active Pit | 25267 | 0.00 |
| 2019-04-20 01:00 | 1 | 7941.00 | Oil Based Mud | 9.5 | 12 | N/A | 15.0 | 73/16 | Active Pit | 24295 | 0.00 |
| 2019-04-20 12:30 | 1 | 11034.51 | Oil Based Mud | 9.4 | 12 | N/A | 16.0 | 72.5/16 | Active Pit | 23810 | 0.00 |
| 2019-04-21 04:45 | 2 | 13194.35 | Oil Based Mud | 9.6 | 14 | N/A | 18.0 | 72/15.5 | Active Pit | 23324 | 0.00 |
| 2019-04-21 12:30 | 2 | 13747.00 | Oil Based Mud | 9.7 | 13 | N/A | 21.4 | 71/16 | Active Pit | 23810 | 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 | AutoTrak Curve Steering Unit | 12124244 | Near Bit Inclination | 5.93 | 6.73 | 7.000 | 4.330 |
| 1 | AutoTrak Curve Steering Unit | 12124244 | Near Bit VSS | 5.93 | 6.73 | 7.000 | 4.330 |
| 1 | AutoTrak Curve MWD | 12332940 | Gamma (single) | 2.75 | 12.90 | 7.000 | 3.250 |
| 1 | AutoTrak Curve MWD | 12332940 | Directional (mag) | 12.27 | 22.42 | 7.000 | 3.250 |

| | | | | | | | |
|---|------------------------------|----------|----------------------|-------|-------|-------|-------|
| 2 | AutoTrak Curve Steering Unit | 14709049 | Near Bit VSS | 5.93 | 6.73 | 7.000 | 4.330 |
| 2 | AutoTrak Curve Steering Unit | 14709049 | Near Bit Inclination | 5.93 | 6.73 | 7.000 | 4.330 |
| 2 | AutoTrak Curve MWD | 14381954 | Gamma (single) | 2.78 | 12.90 | 7.000 | 3.250 |
| 2 | AutoTrak Curve MWD | 14381954 | Directional (mag) | 12.27 | 22.39 | 7.000 | 3.250 |

Service and Tool Mnemonics

| Mnemonic | Name | Description |
|----------|---------------------|-------------------------------|
| ATC SU | AutoTrak Curve SU | Auto Trak Curve Steering Unit |
| ATC MWD | AutoTrak Curve MWD | Auto Trak Curve MWD |
| ATC LCPM | AutoTrak Curve 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 1973 to 17660 feet MD (1973 to 6794 feet TVD).
- 3

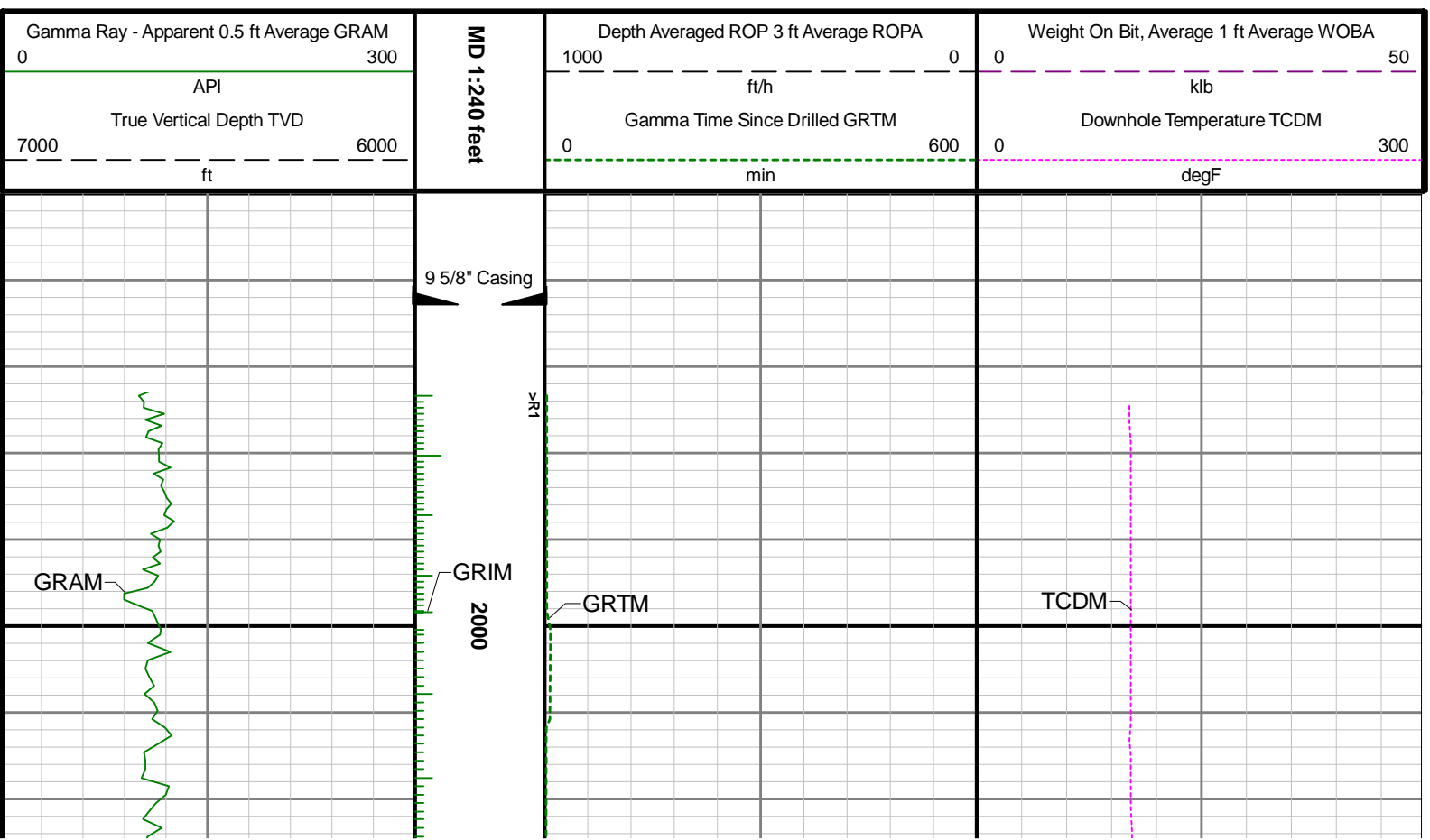
The Gamma Ray Apparent (GRAM) data is presented 0 to 300 API, per the customer's request.

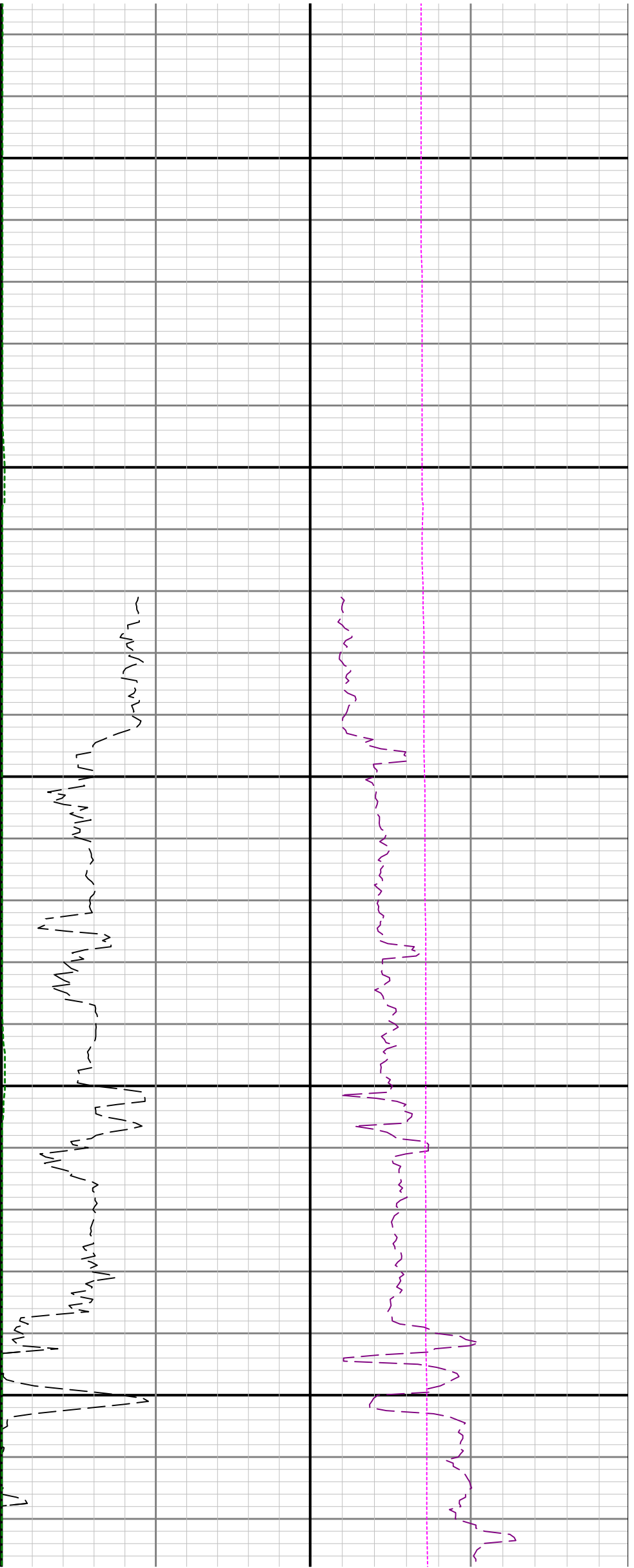
Remarks

| Number | Depth (ft) | Hole Section (in) | Run No. | Remark |
|--------|---------------|-------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | 2395.00 | 8.500 | 1 | The interval from 2351 to 2382 feet MD (2351 to 2382 feet TVD) has gaps in gamma ray data, due to a downlinking while drilling ahead and terminating power to LWD tool. |
| 2 | 3815.00 | 8.500 | 1 | The interval from 3753 to 3802 feet MD (3709 to 3754 feet TVD) has gaps in gamma ray data, due to a downlinking while drilling ahead and terminating power to LWD tool. |
| 3 | 5668.00 | 8.500 | 1 | The interval from 5618 to 5655 feet MD (5389 to 5422 feet TVD) has gaps in gamma ray data, due to a downlinking while drilling ahead and terminating power to LWD tool. |
| 4 | 6841.00 | 8.500 | 1 | The interval from 6841 to 6853feet MD (6527 to 6537 feet TVD) has gaps in gamma ray data, due to a downlinking while drilling ahead and terminating power to LWD tool. |
| 5 | 8879.00 | 8.500 | 1 | The interval from 8834 to 8866 feet MD (6800 feet TVD) has gaps in gamma ray data, due to a downlinking while drilling ahead and terminating power to LWD tool. |
| 6 | 13190.00 | 8.500 | 1 | The interval from 13177 to 13190 feet MD (6796 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. |
| 7 | 17660.00 | 8.500 | 2 | The interval from 17647 to 17660 feet MD (6794 feet TVD) was not logged after being drilled due to sensor to bit offset at well TD. |

Curve Mnemonics

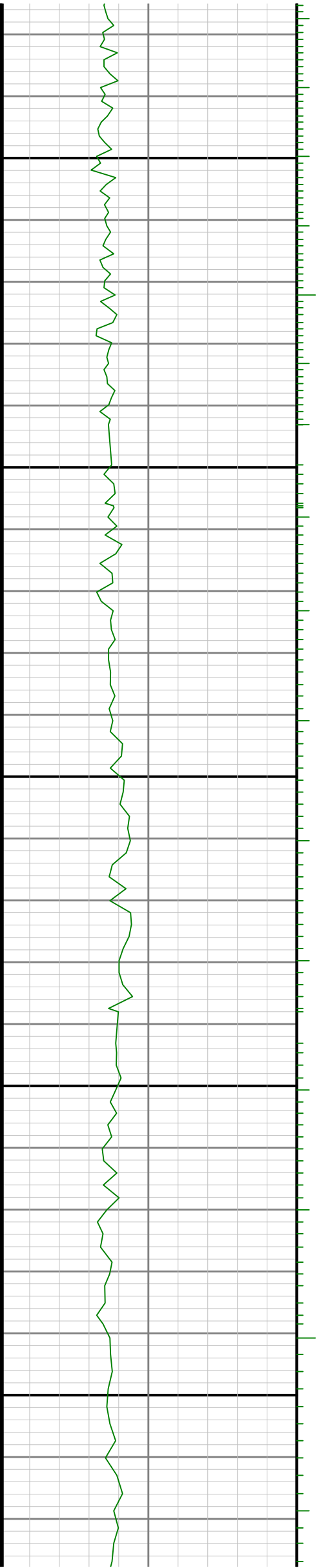
| Presented Curves | Description | Units |
|------------------|----------------------------------------------|----------|
| ROPA | Depth Averaged ROP 3 ft Average | ft/h |
| TVD | True Vertical Depth | ft |
| WOBA | Weight On Bit, Average 1 ft Average | klb |
| GRAM | Gamma Ray - Apparent - Memory 0.5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

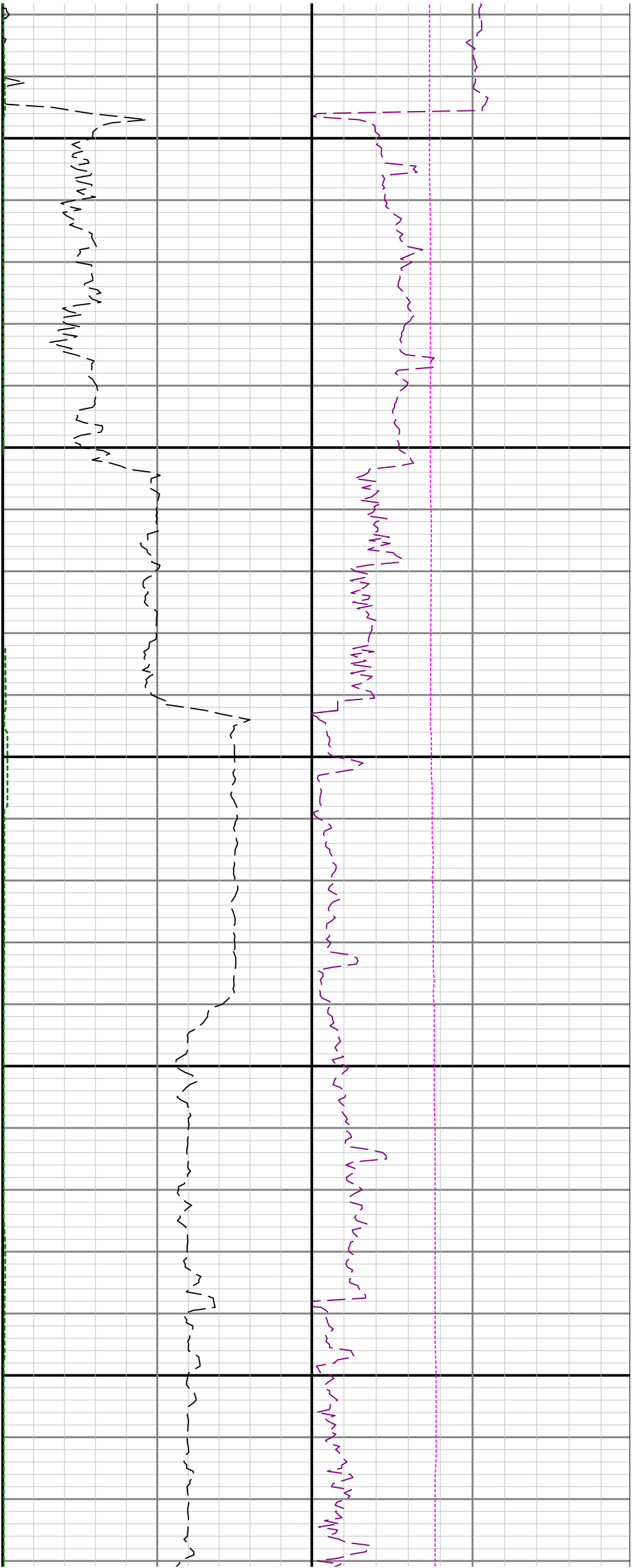




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2200



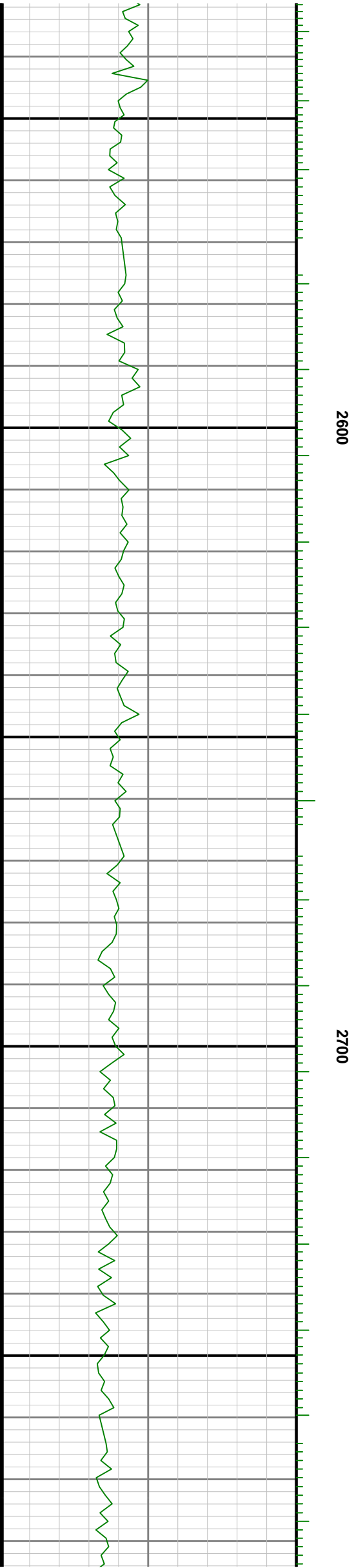


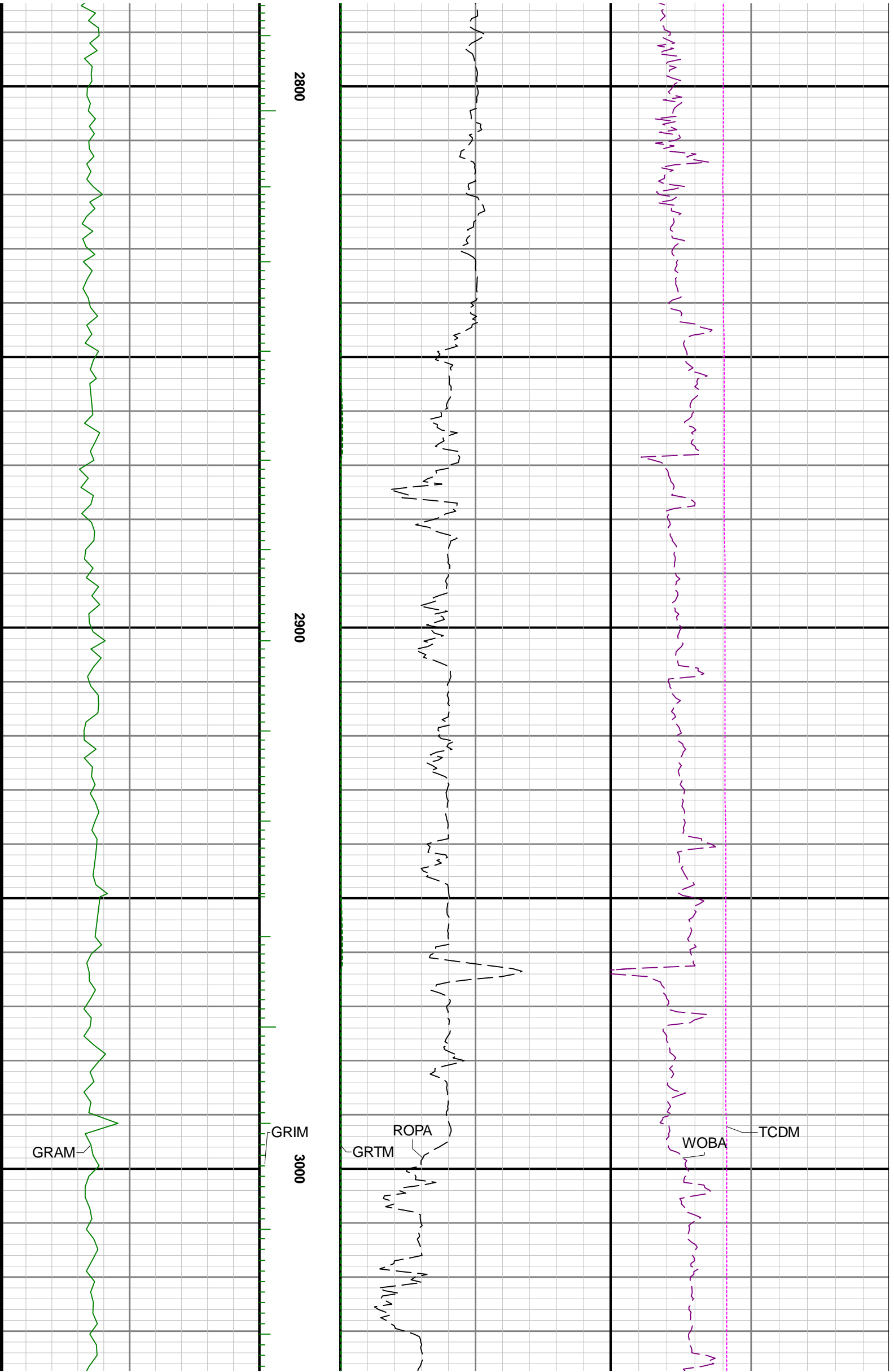
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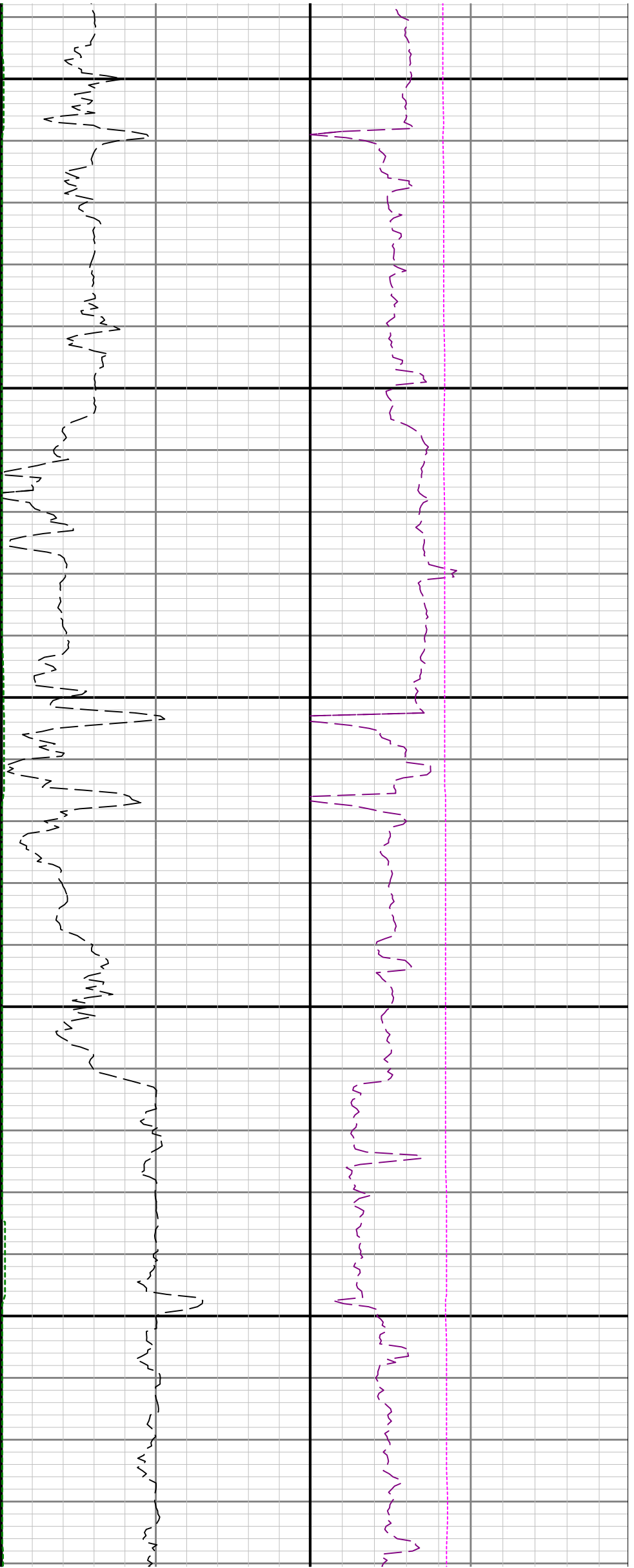
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See Remark 1

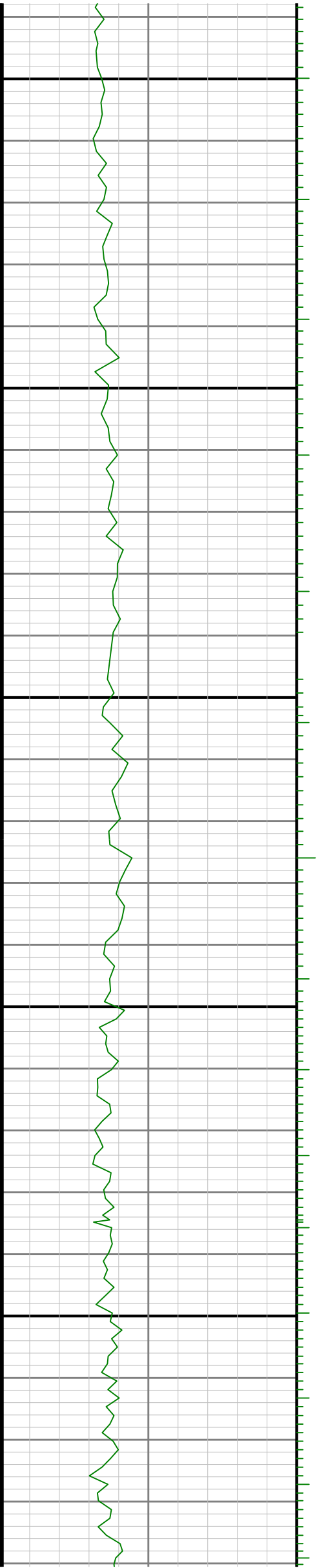


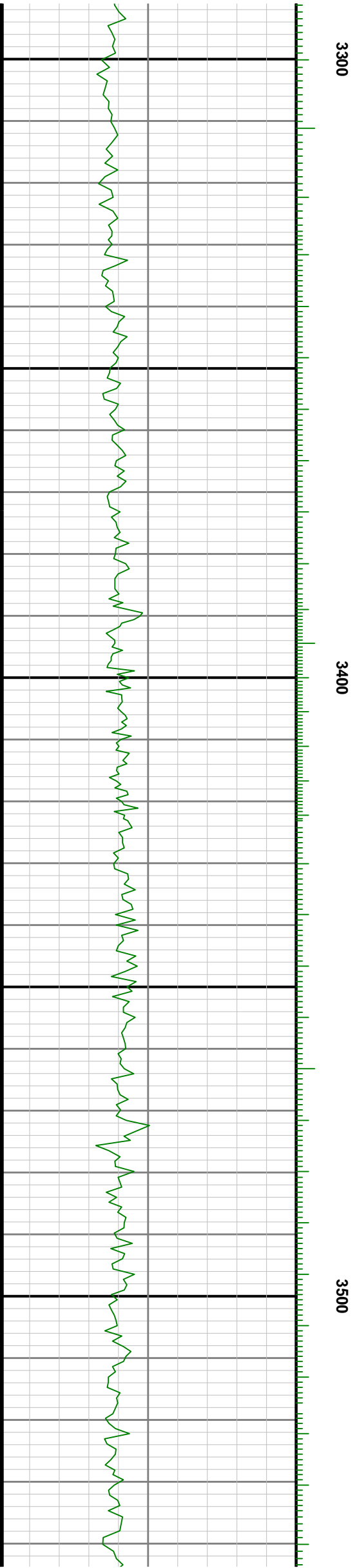
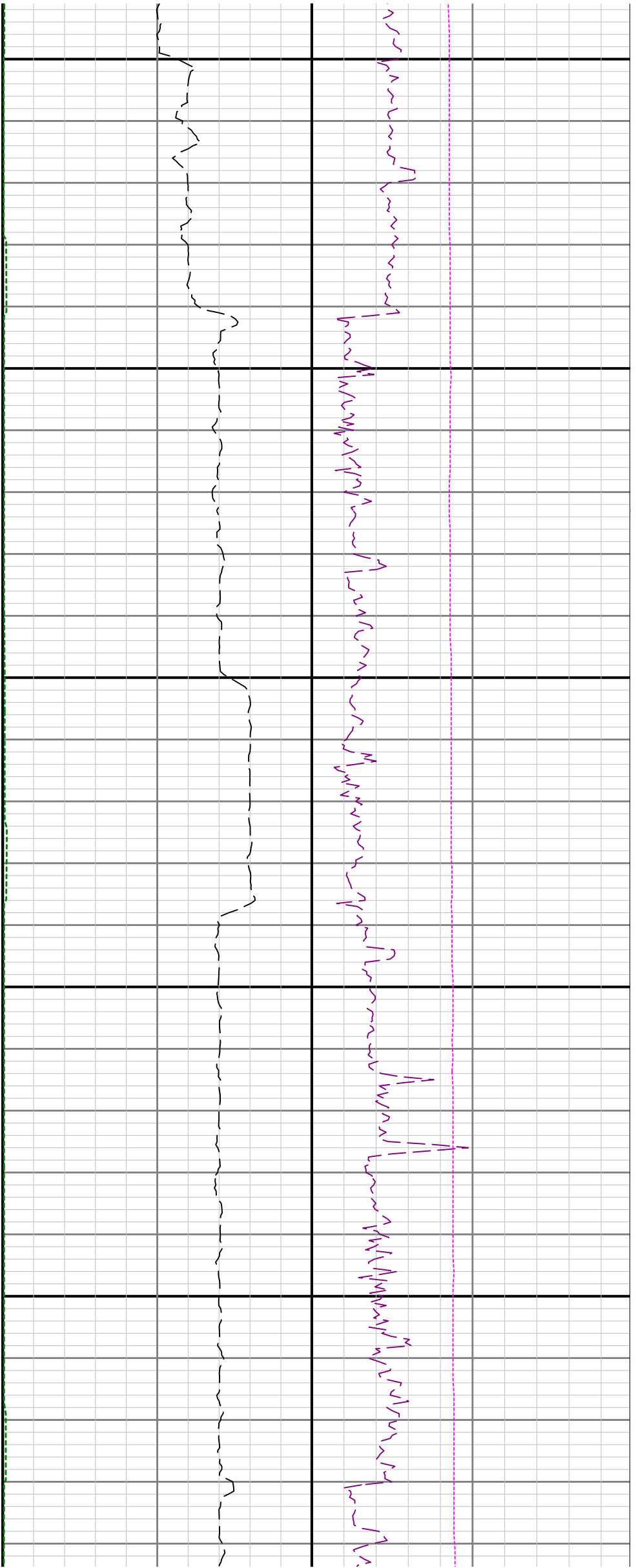


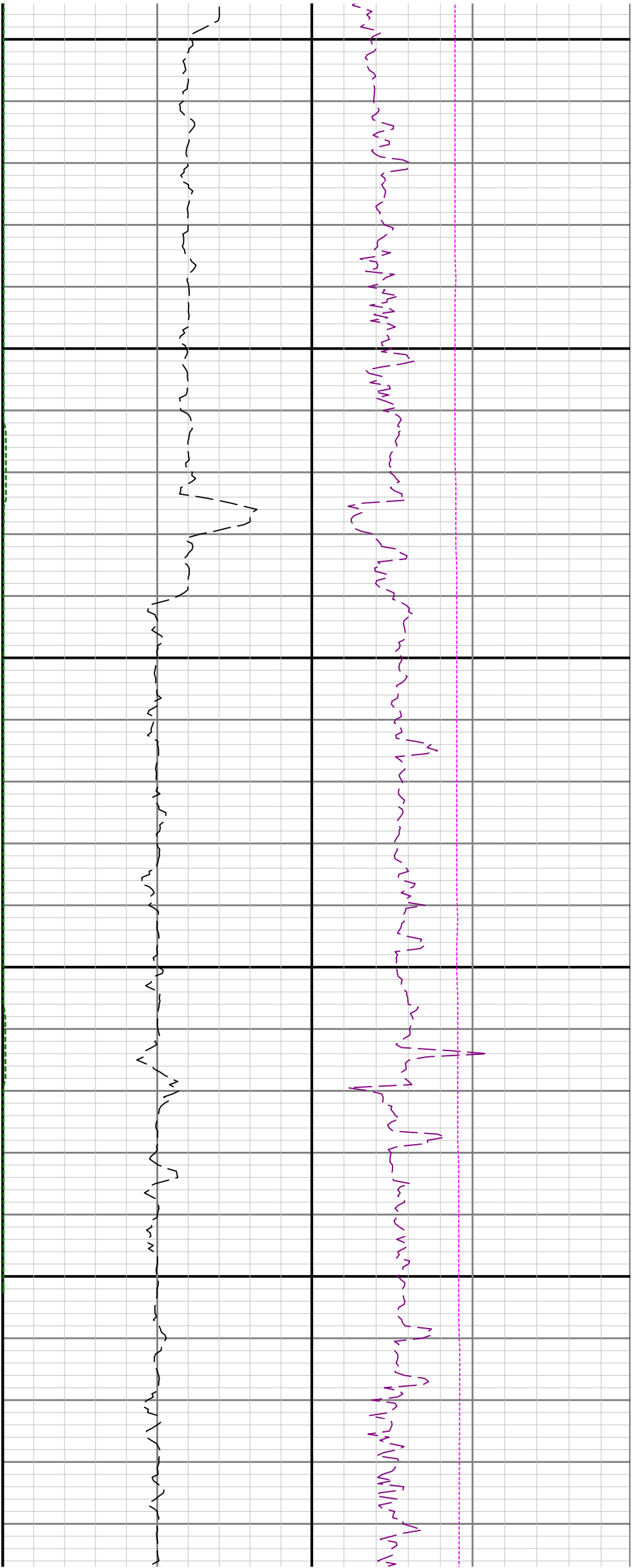


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3200



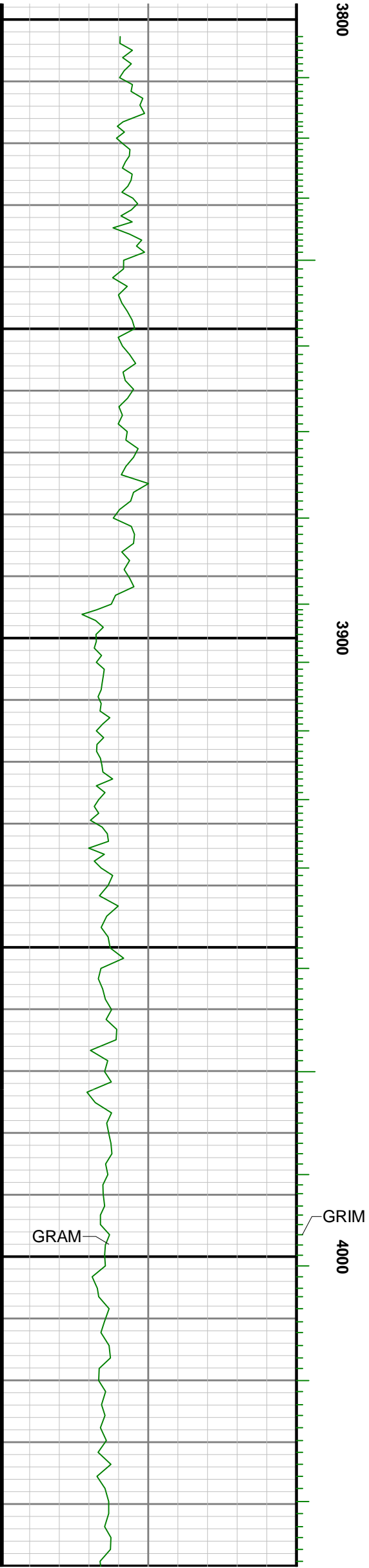
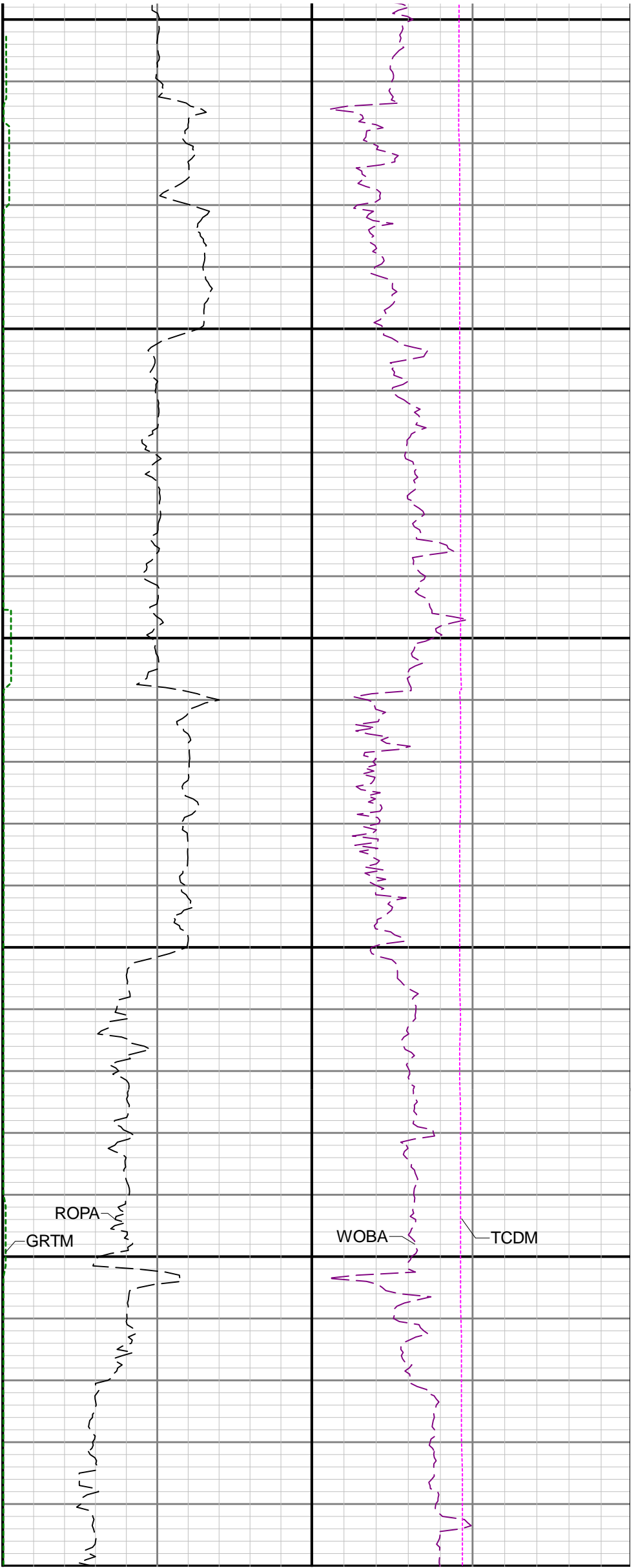


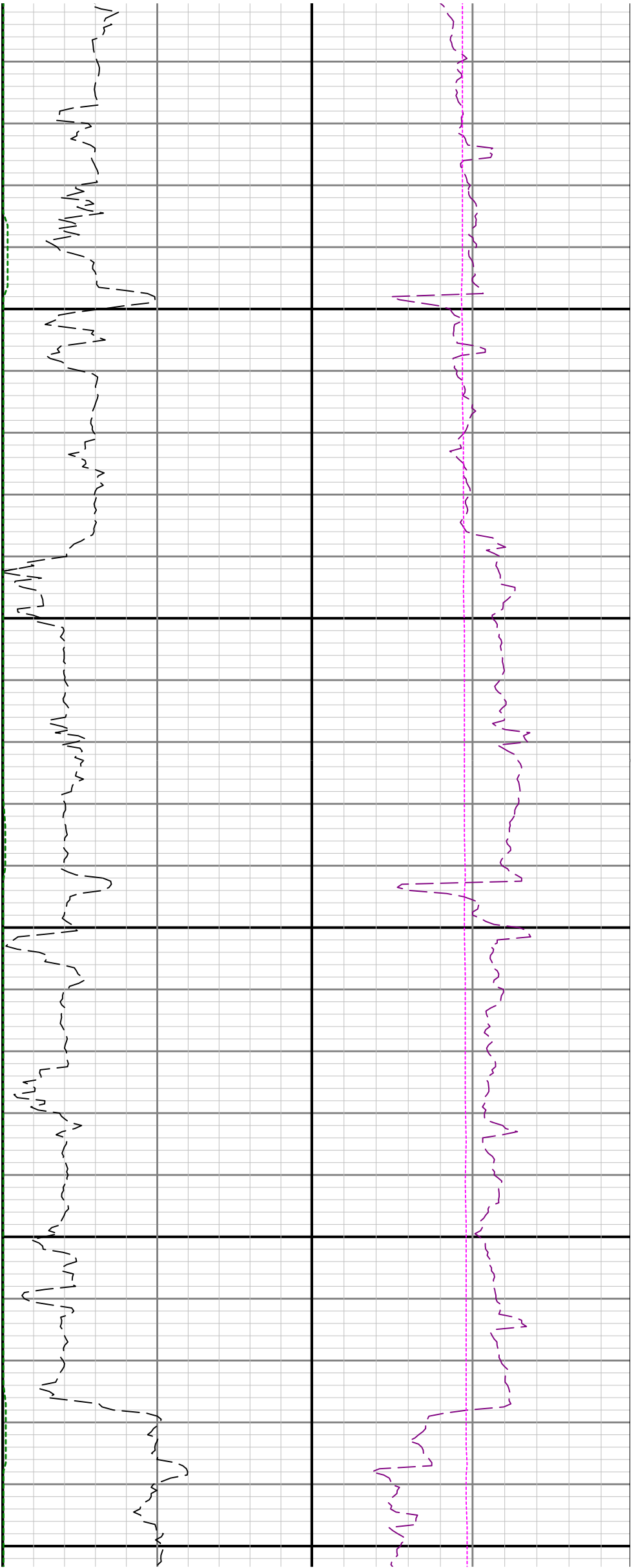


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3700

See Remark 2

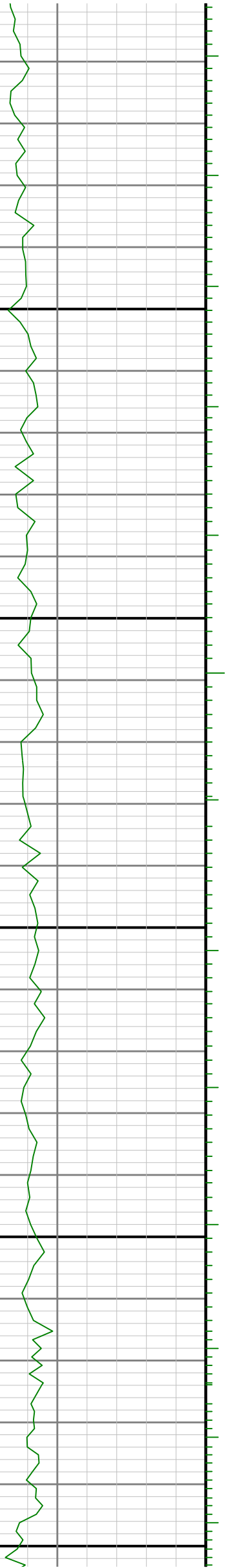
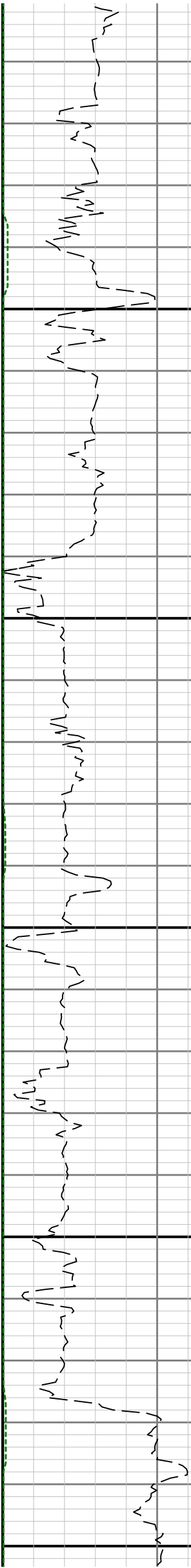


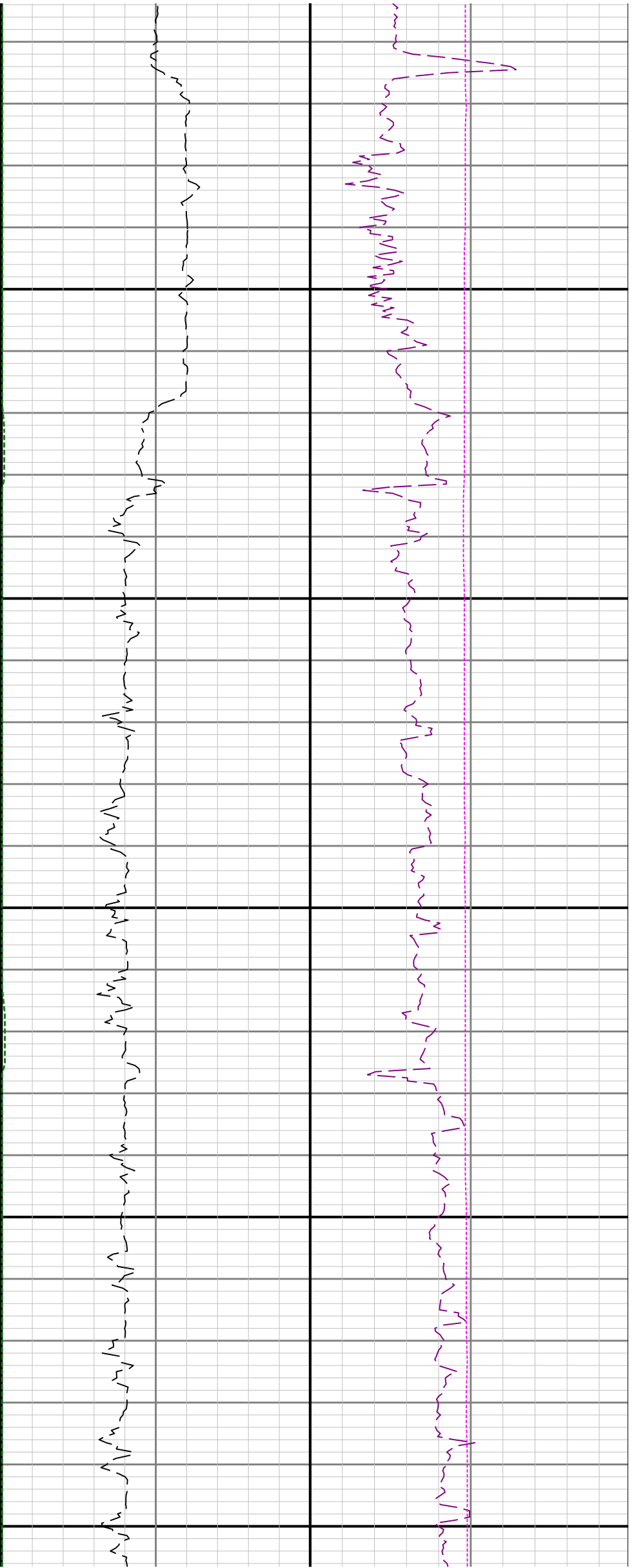


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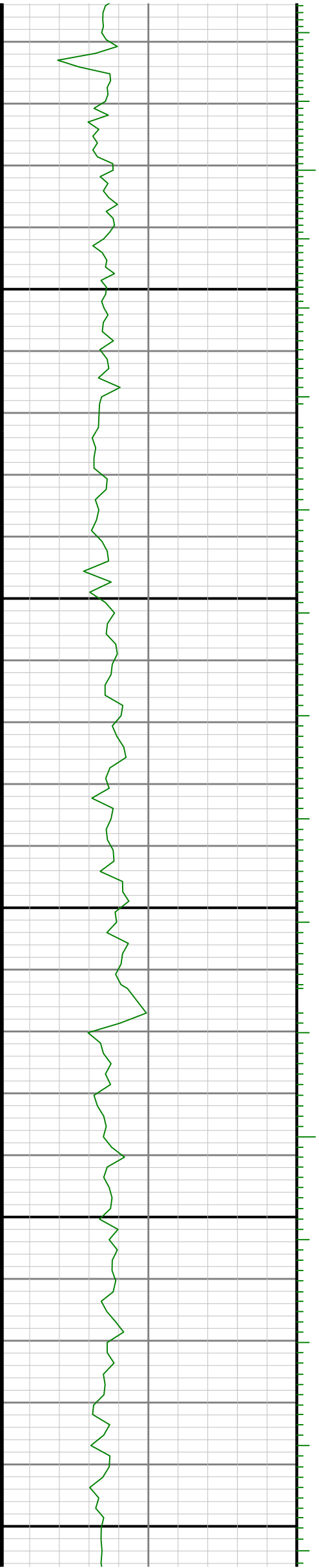
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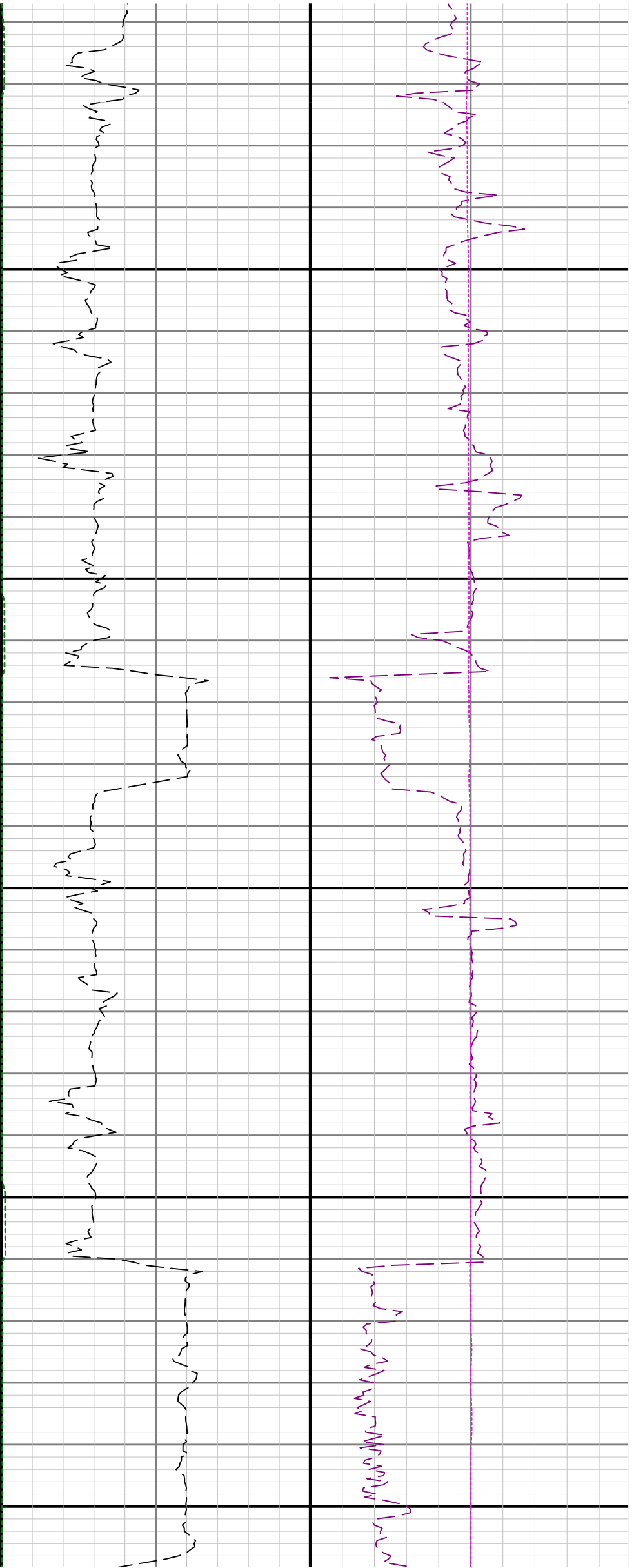




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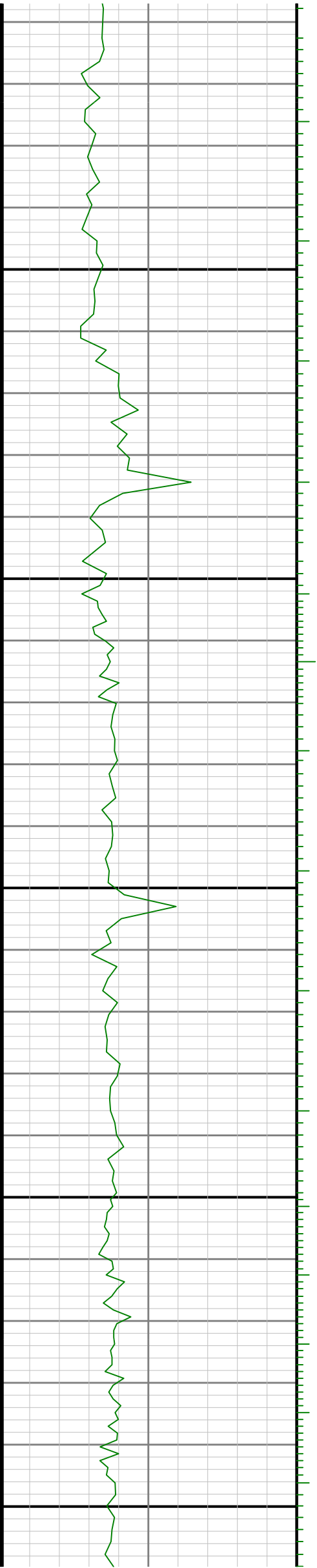


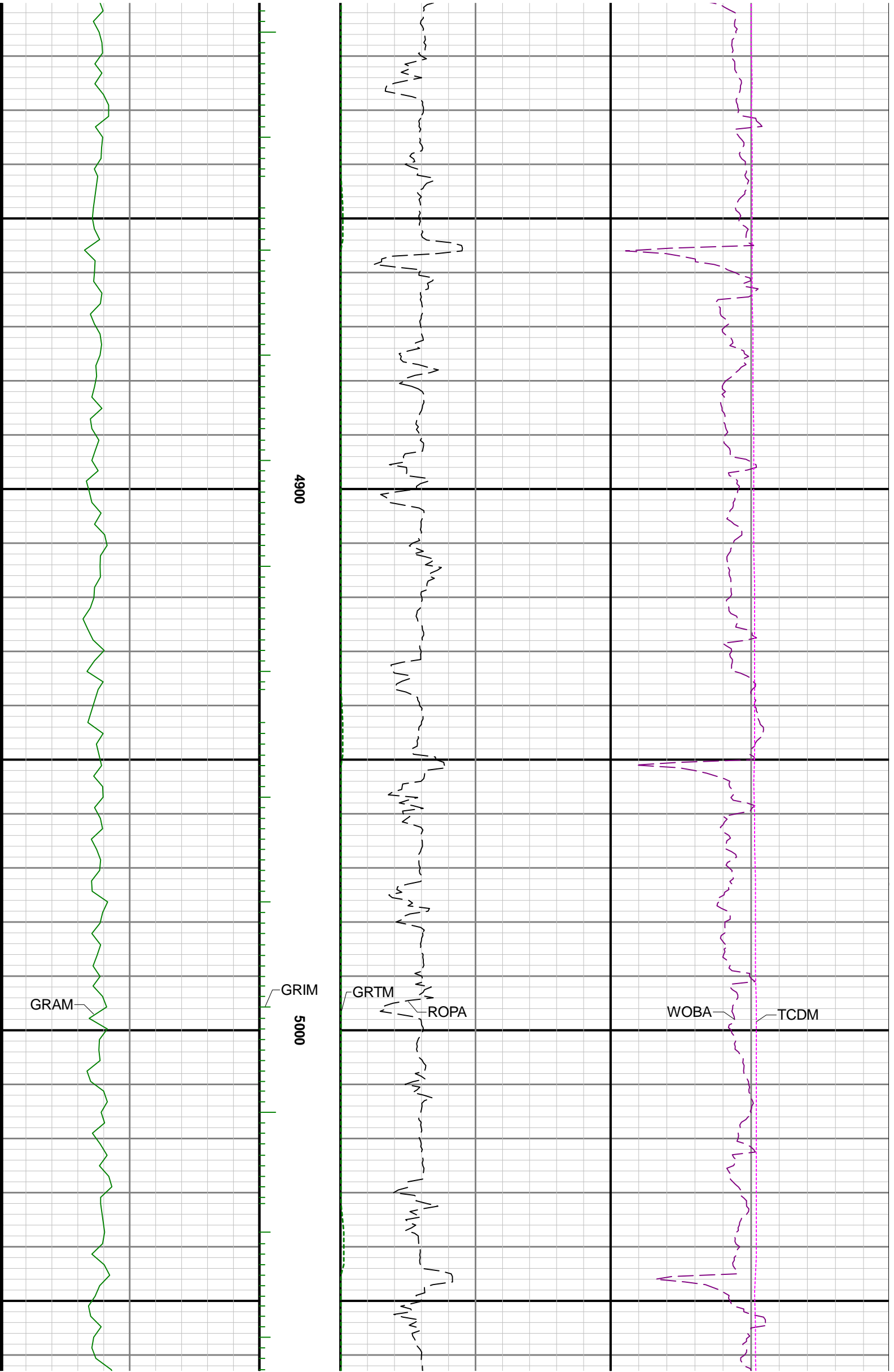


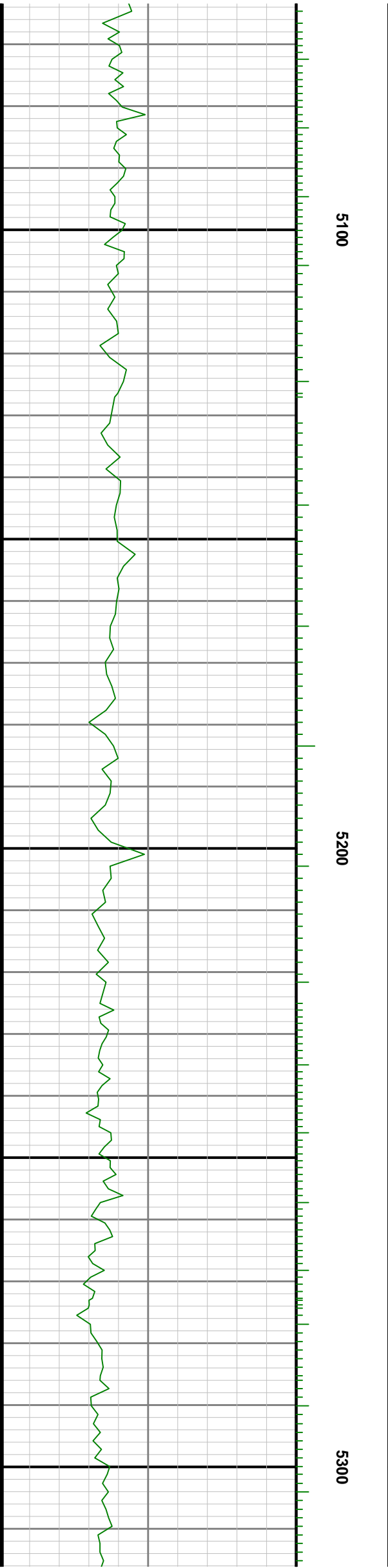
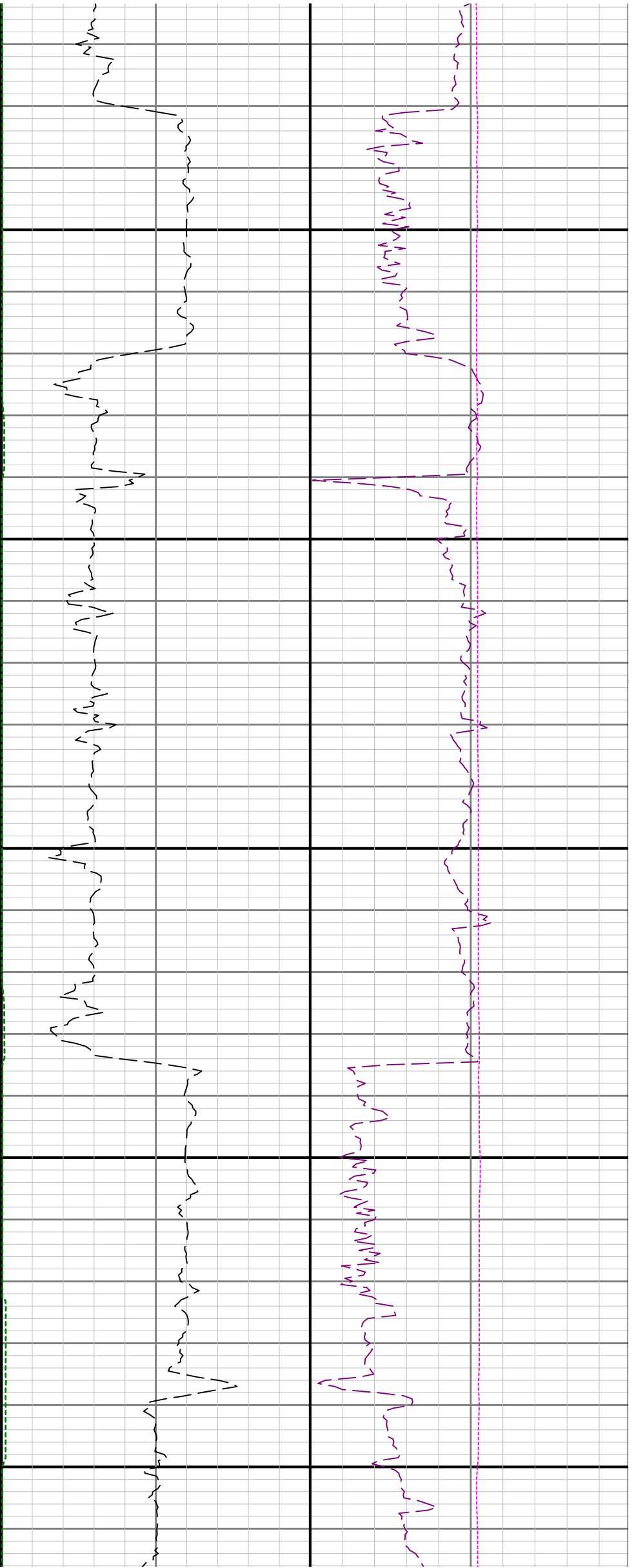
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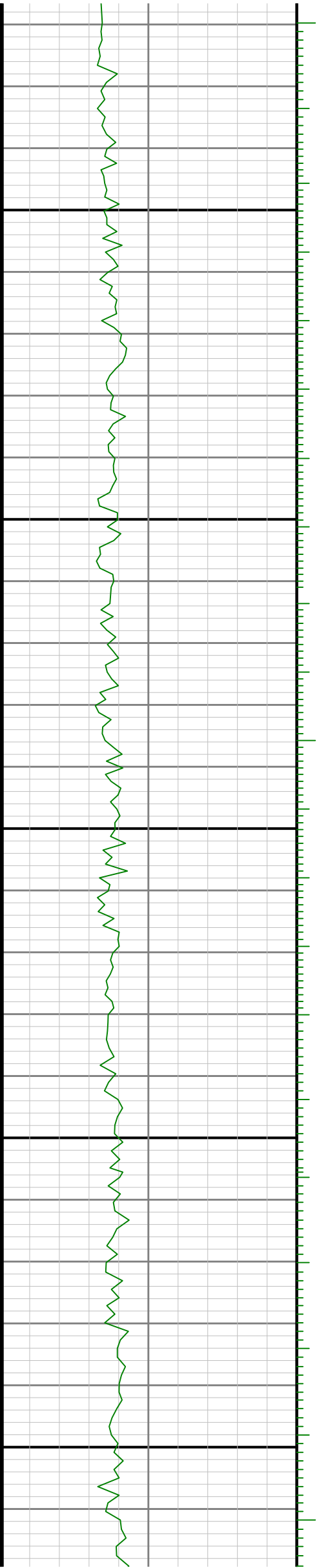
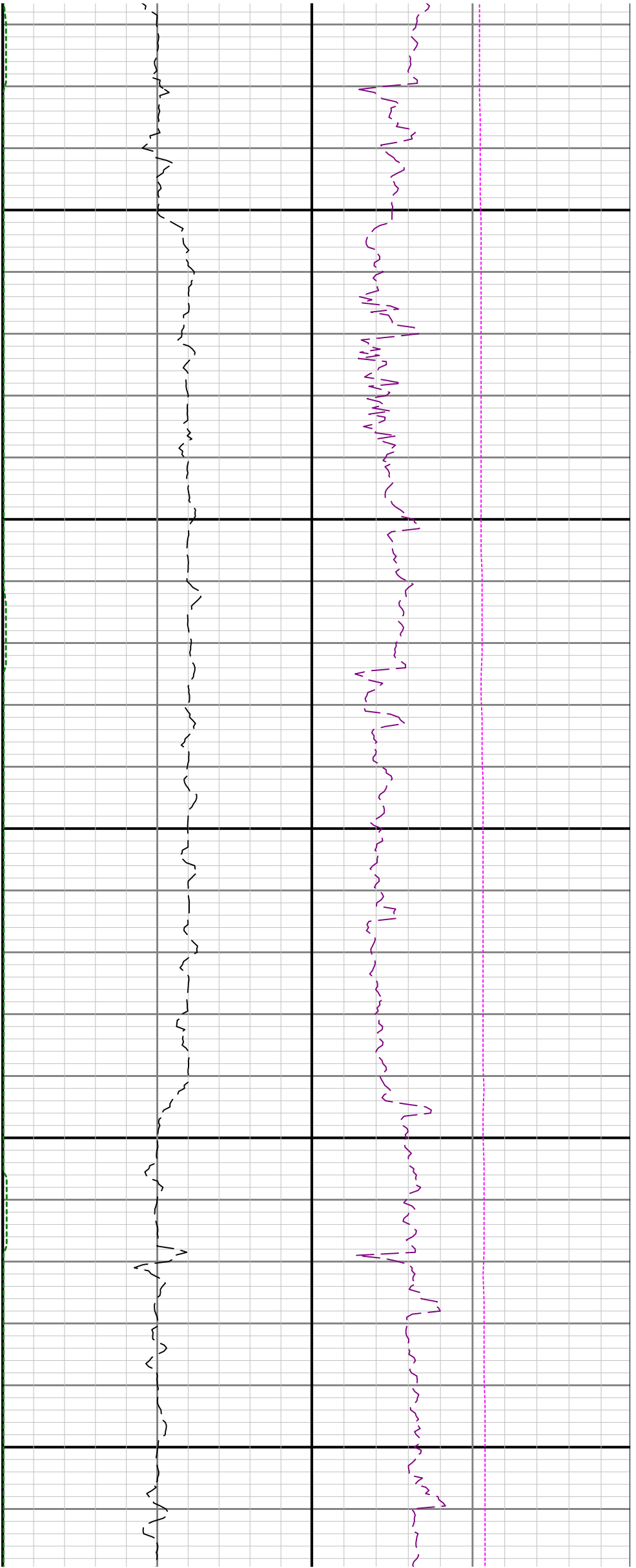
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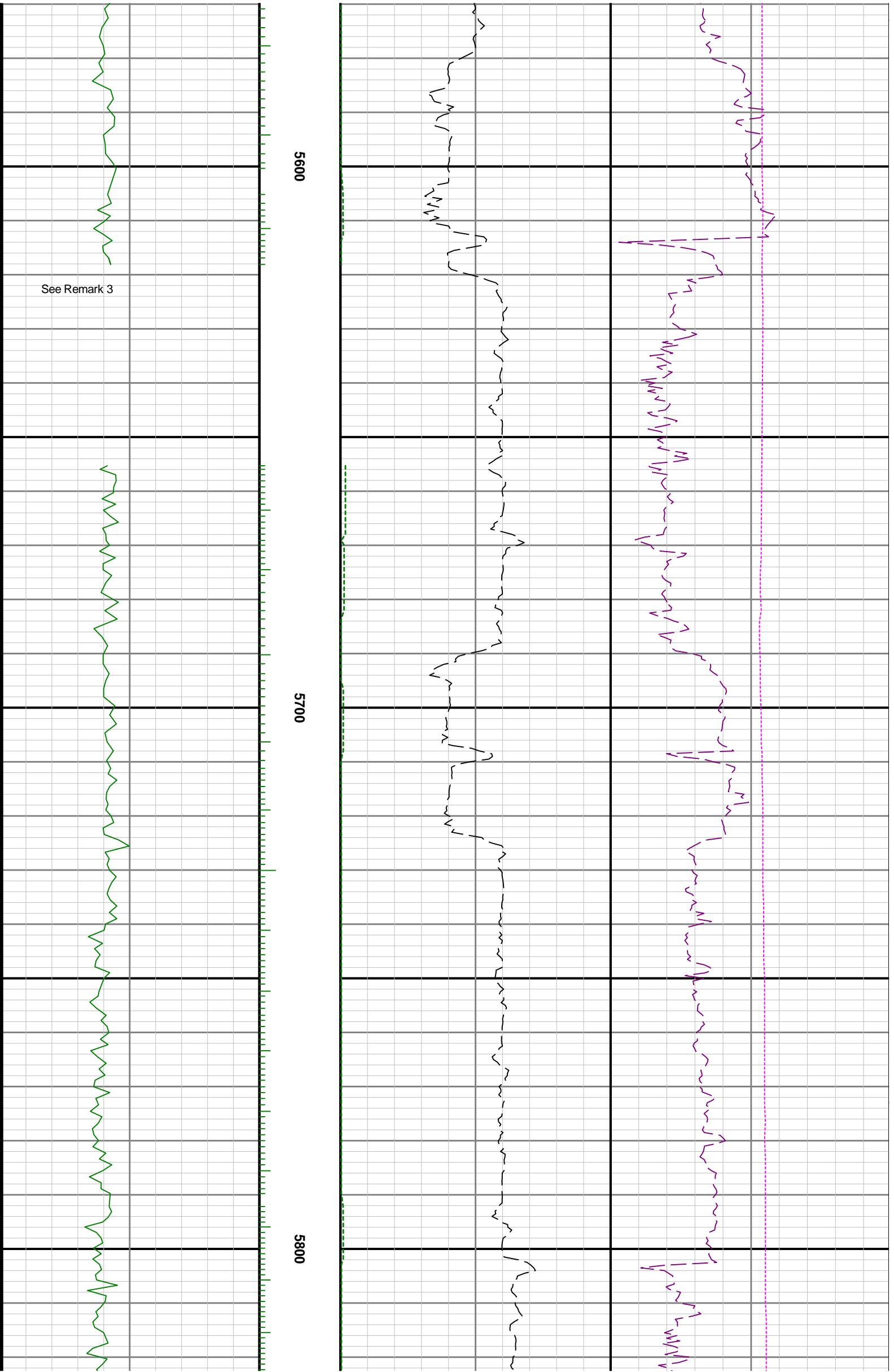
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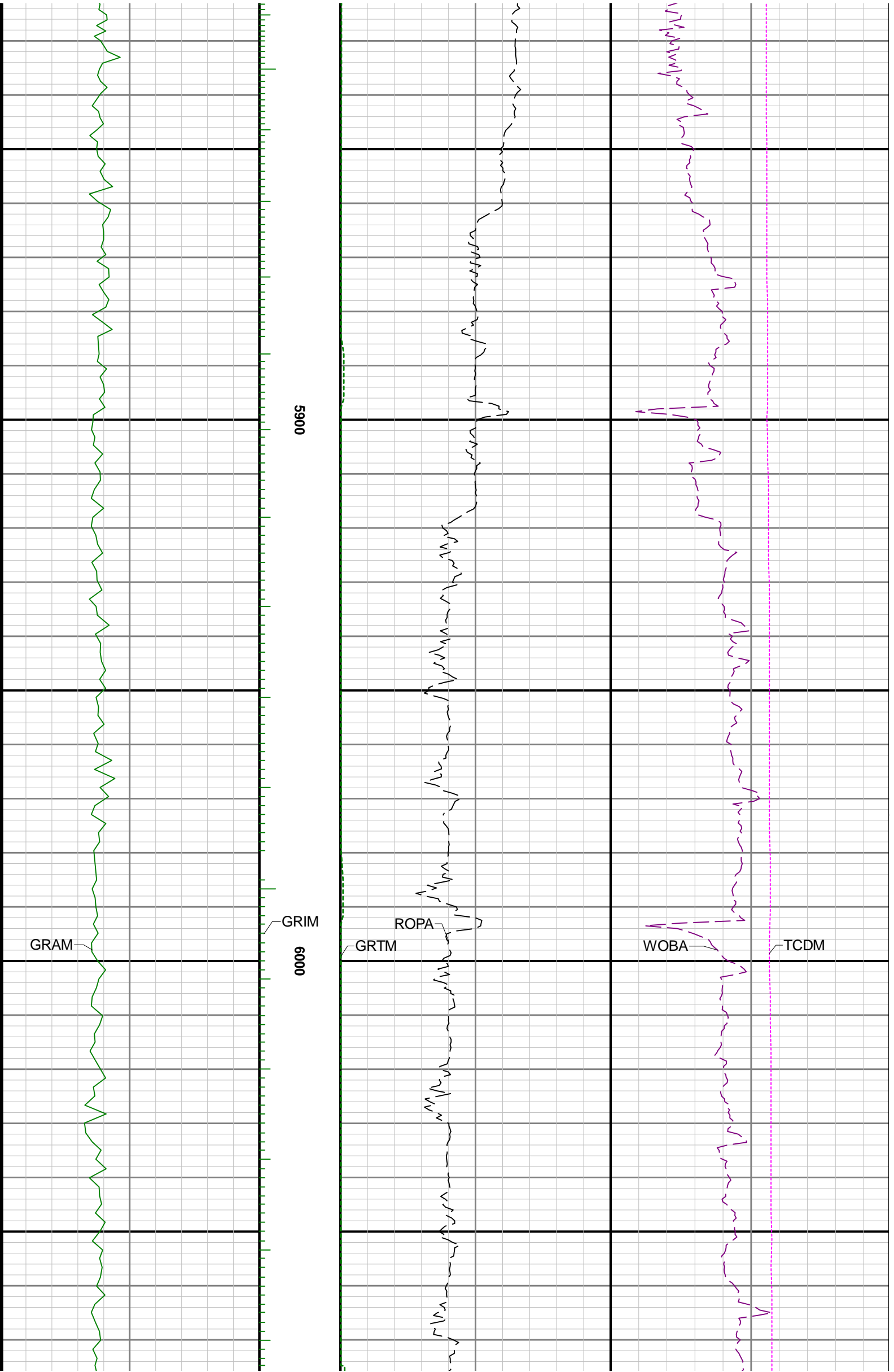


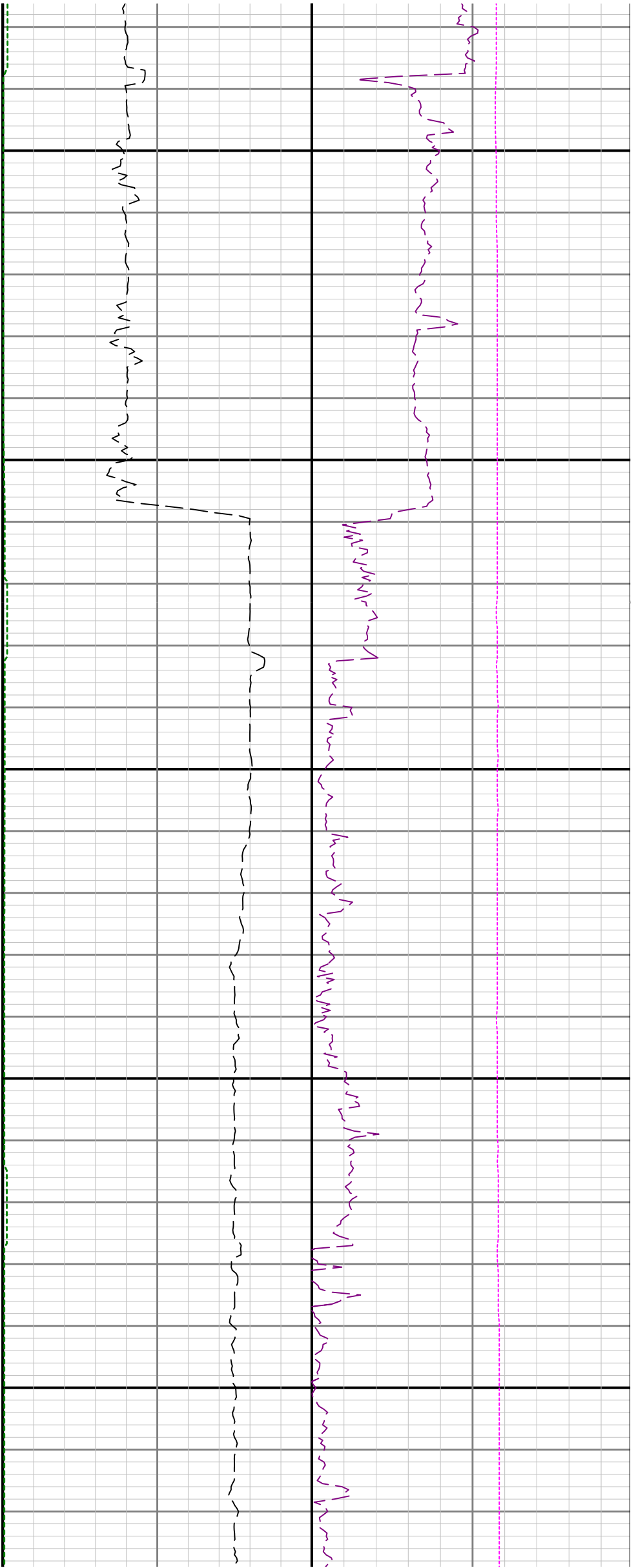
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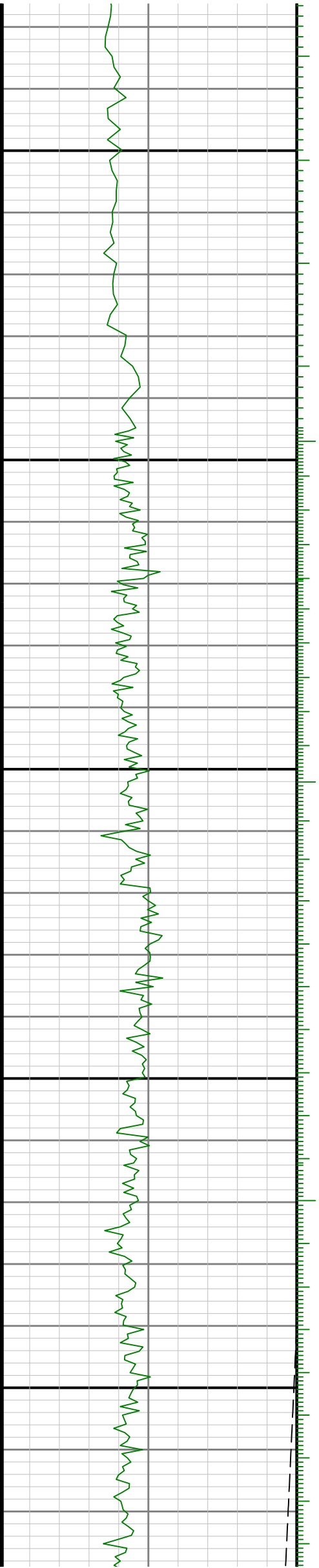


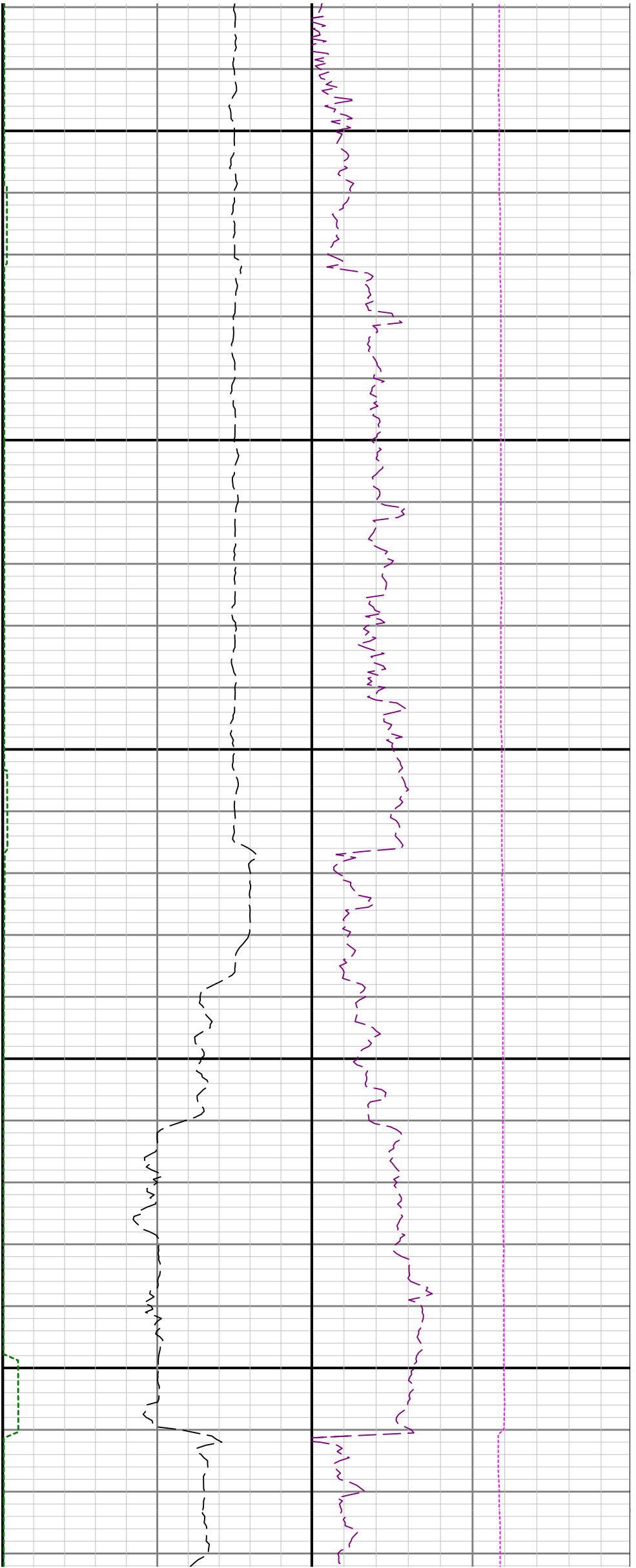


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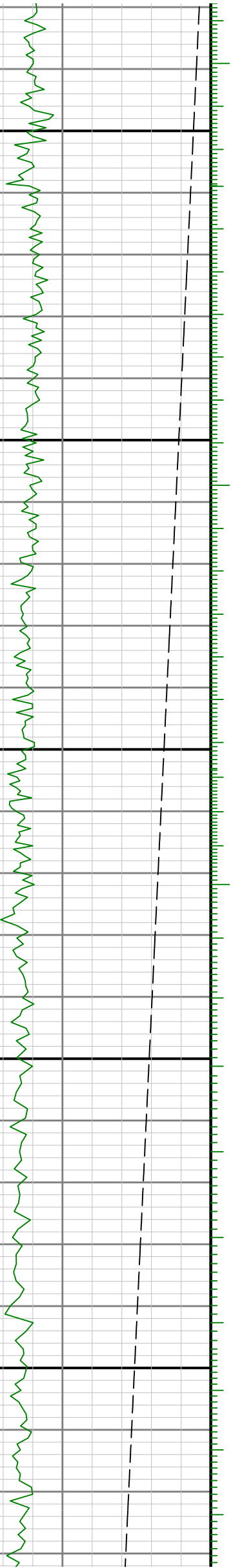
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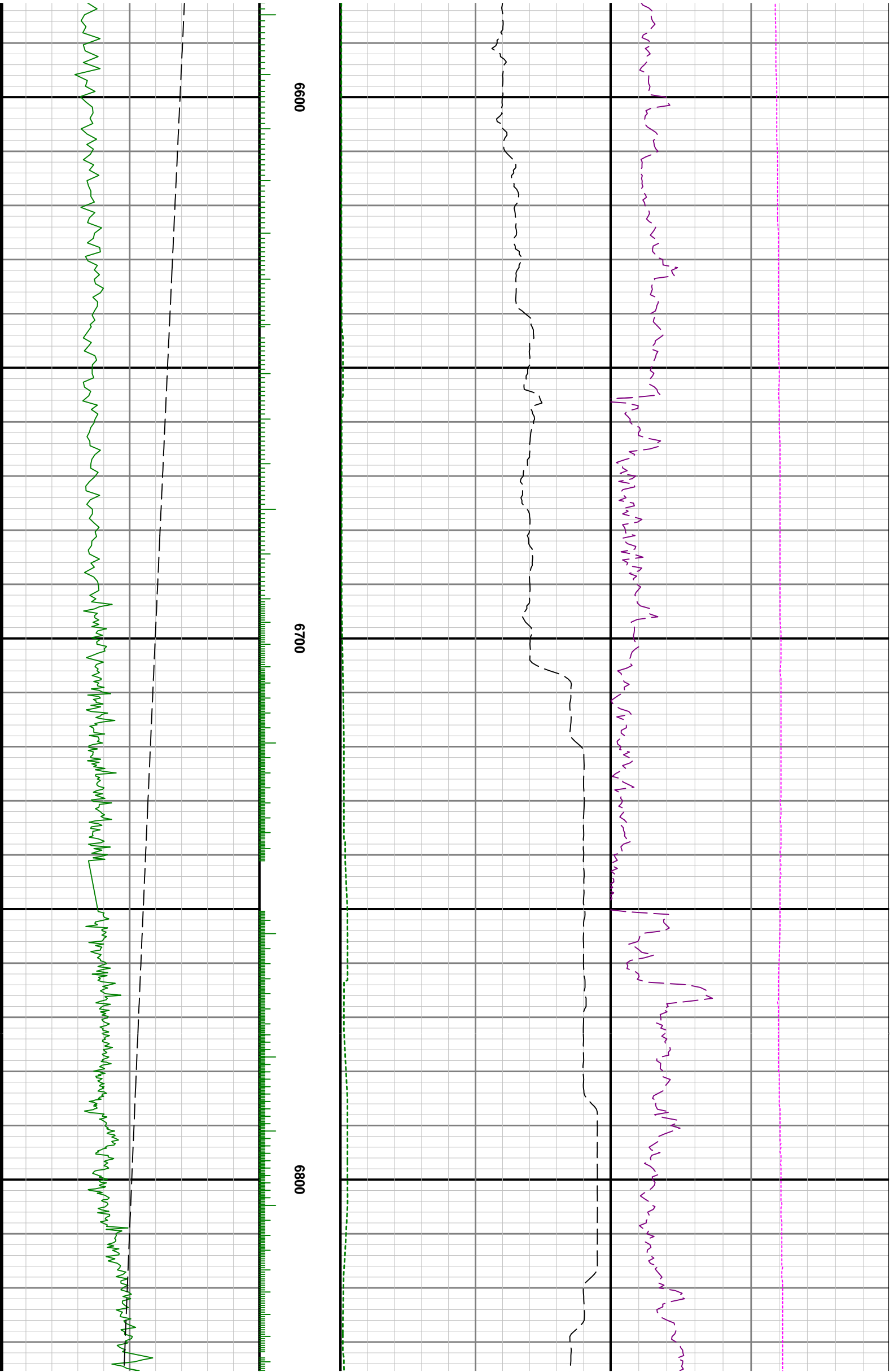


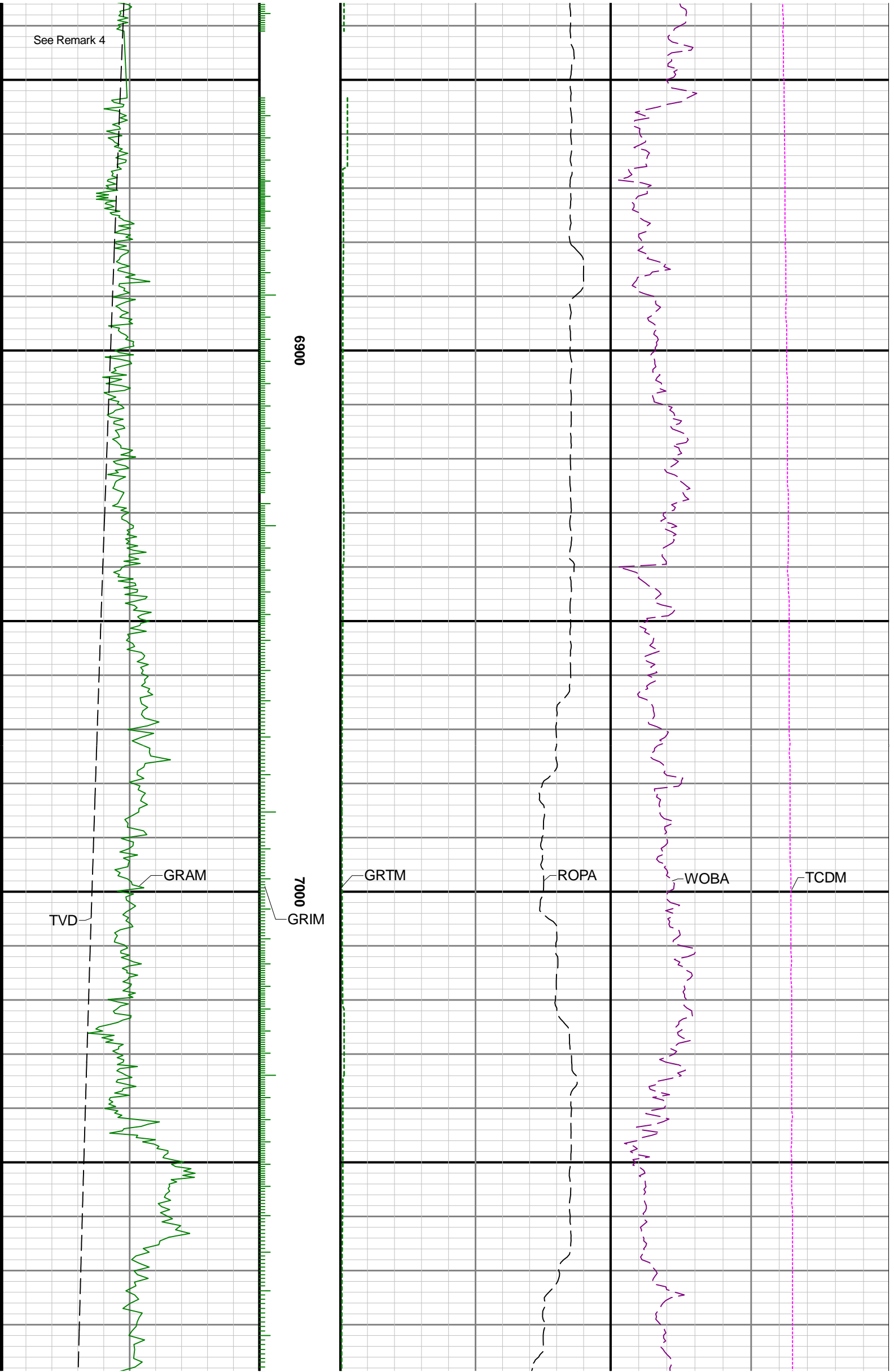


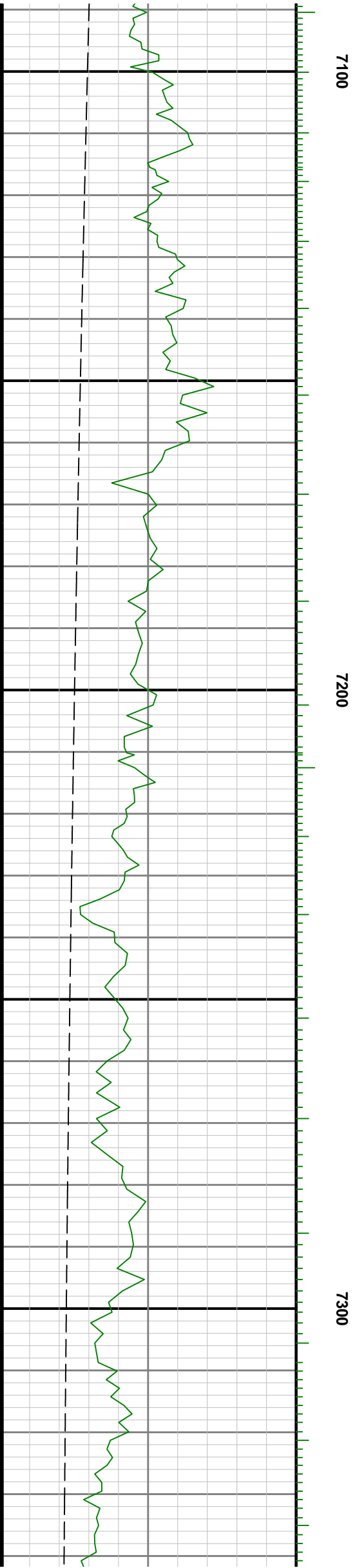
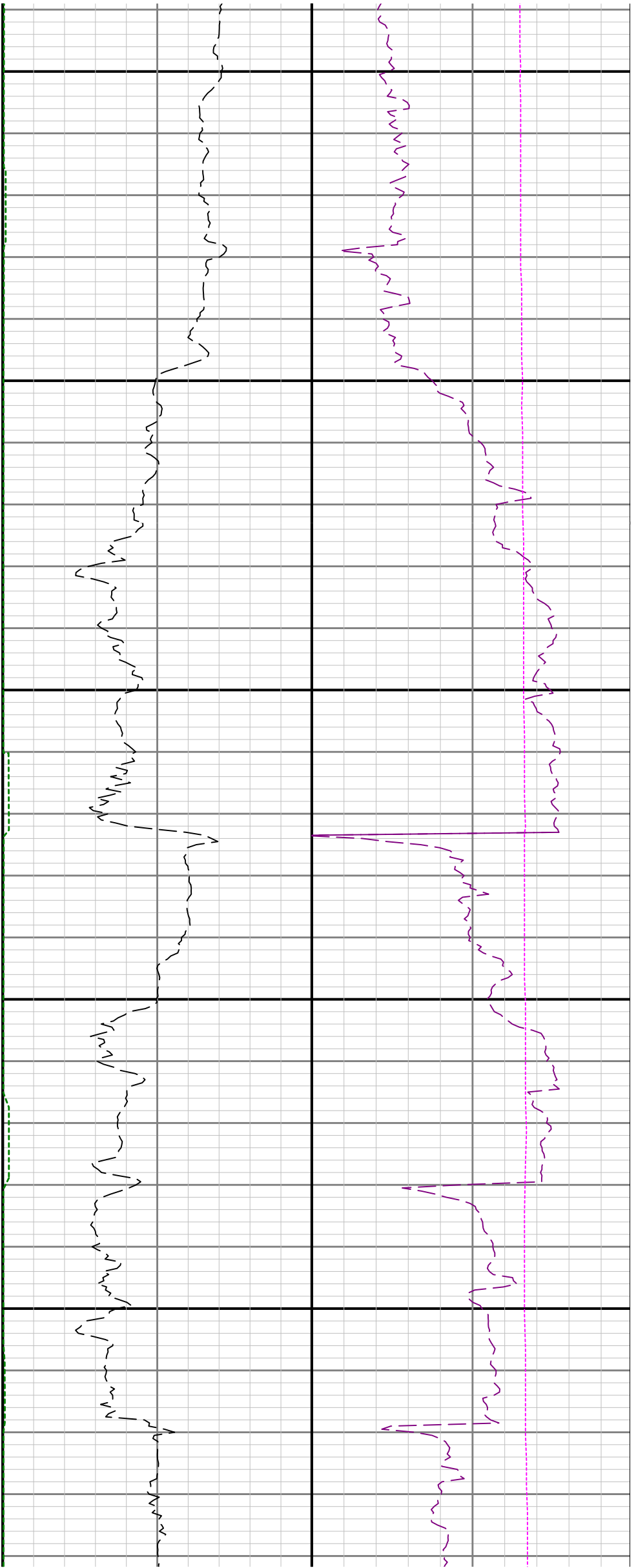
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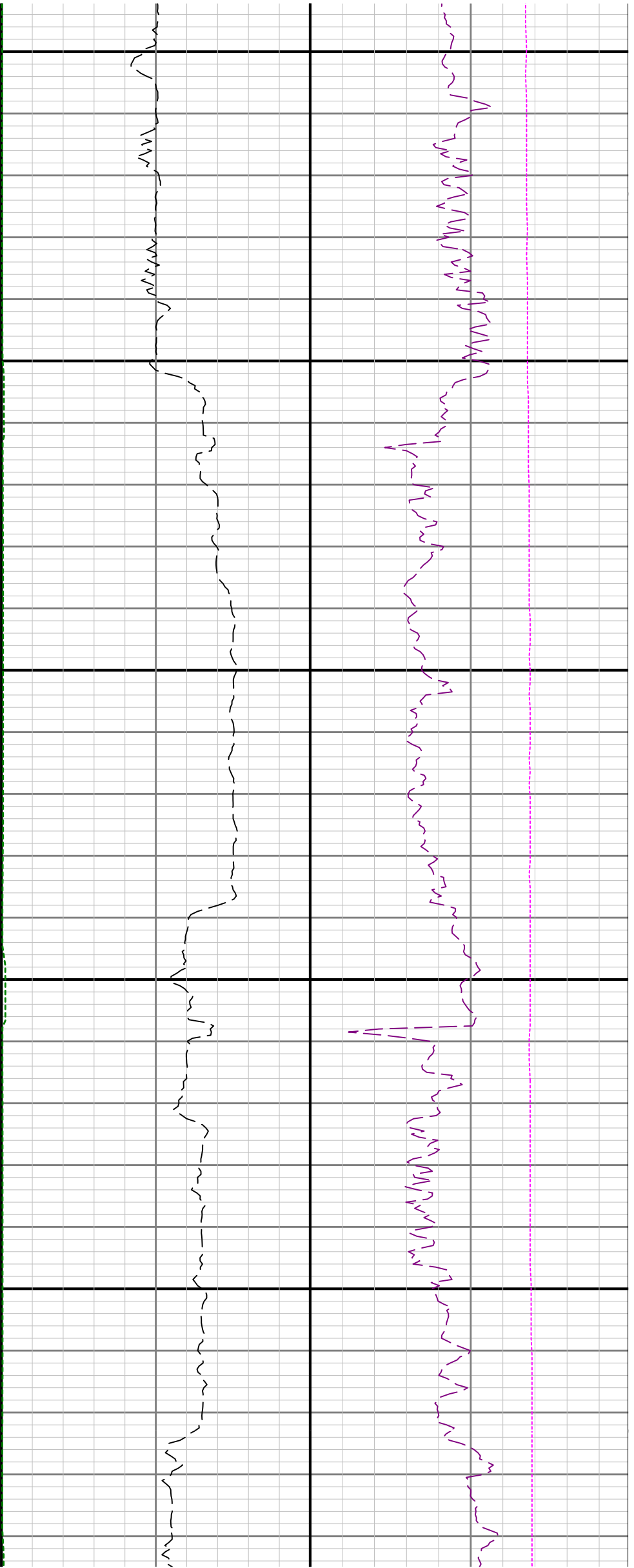
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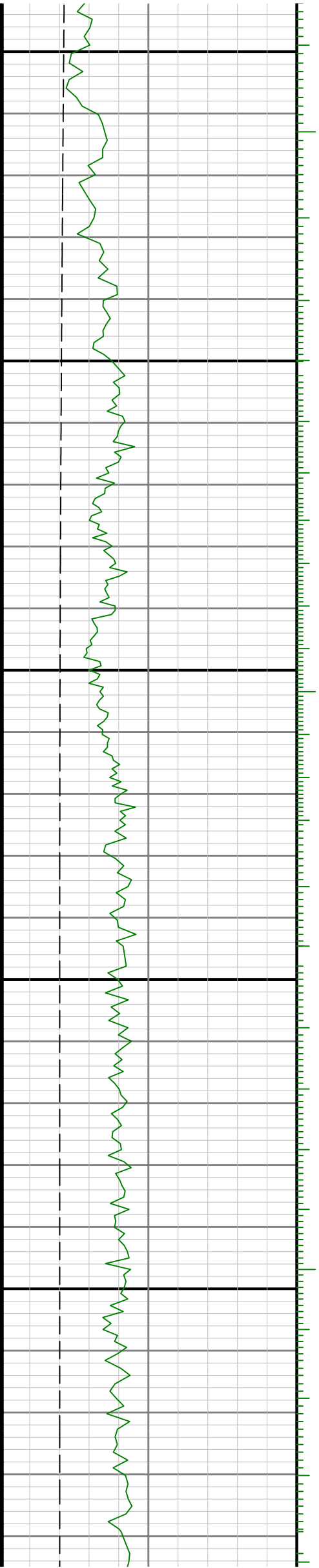


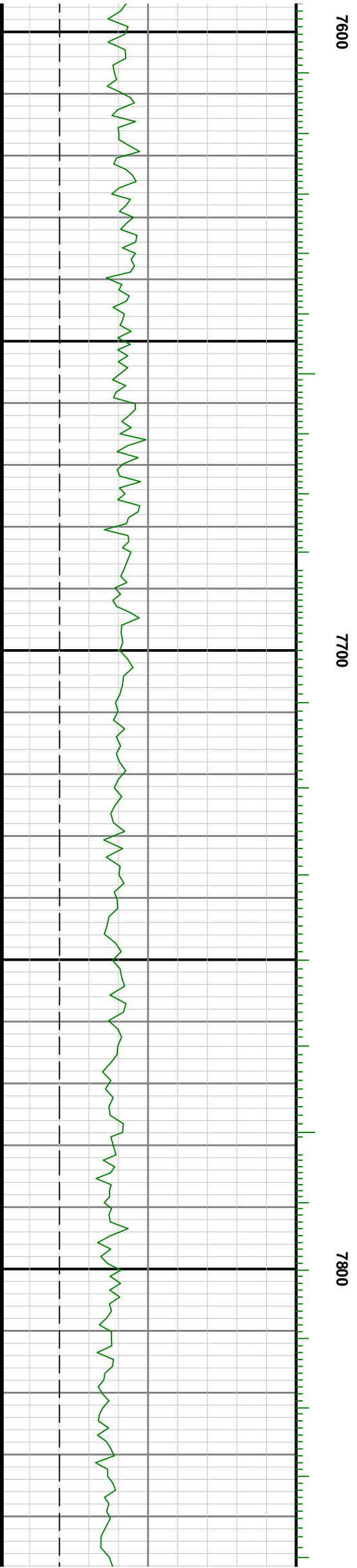
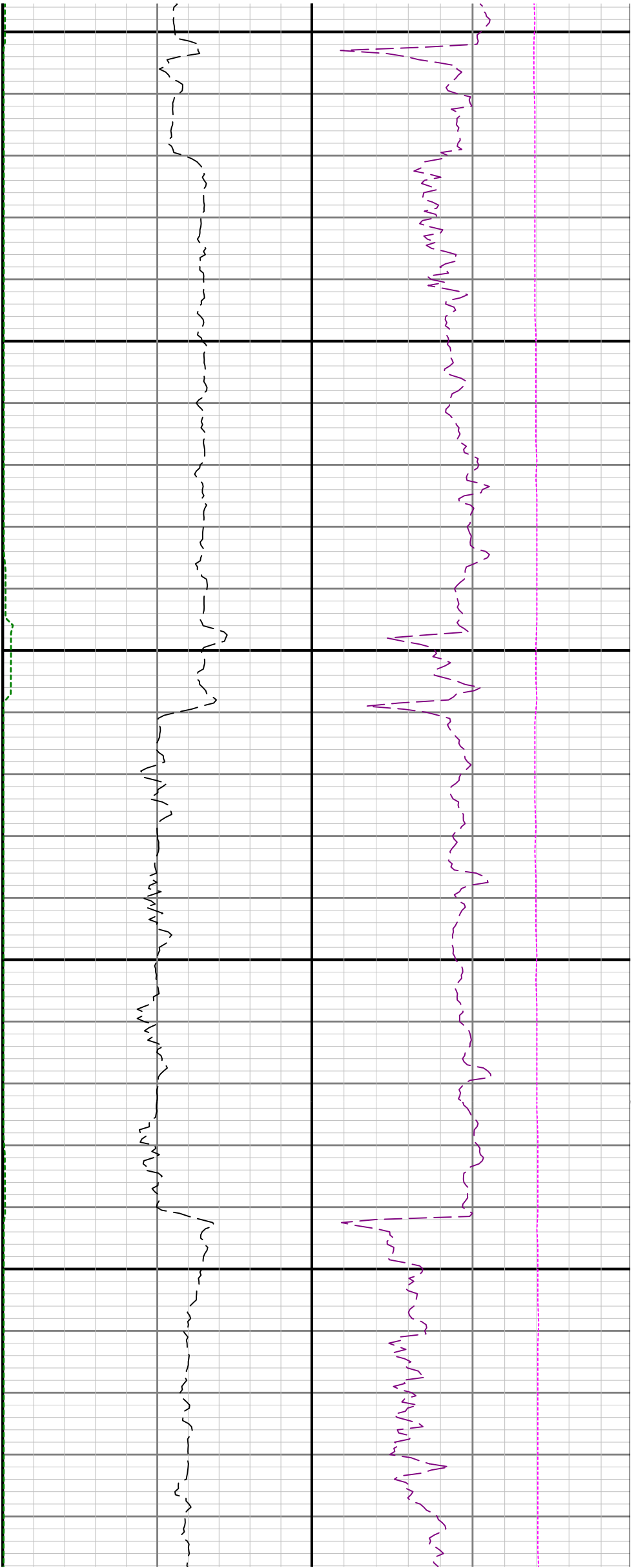


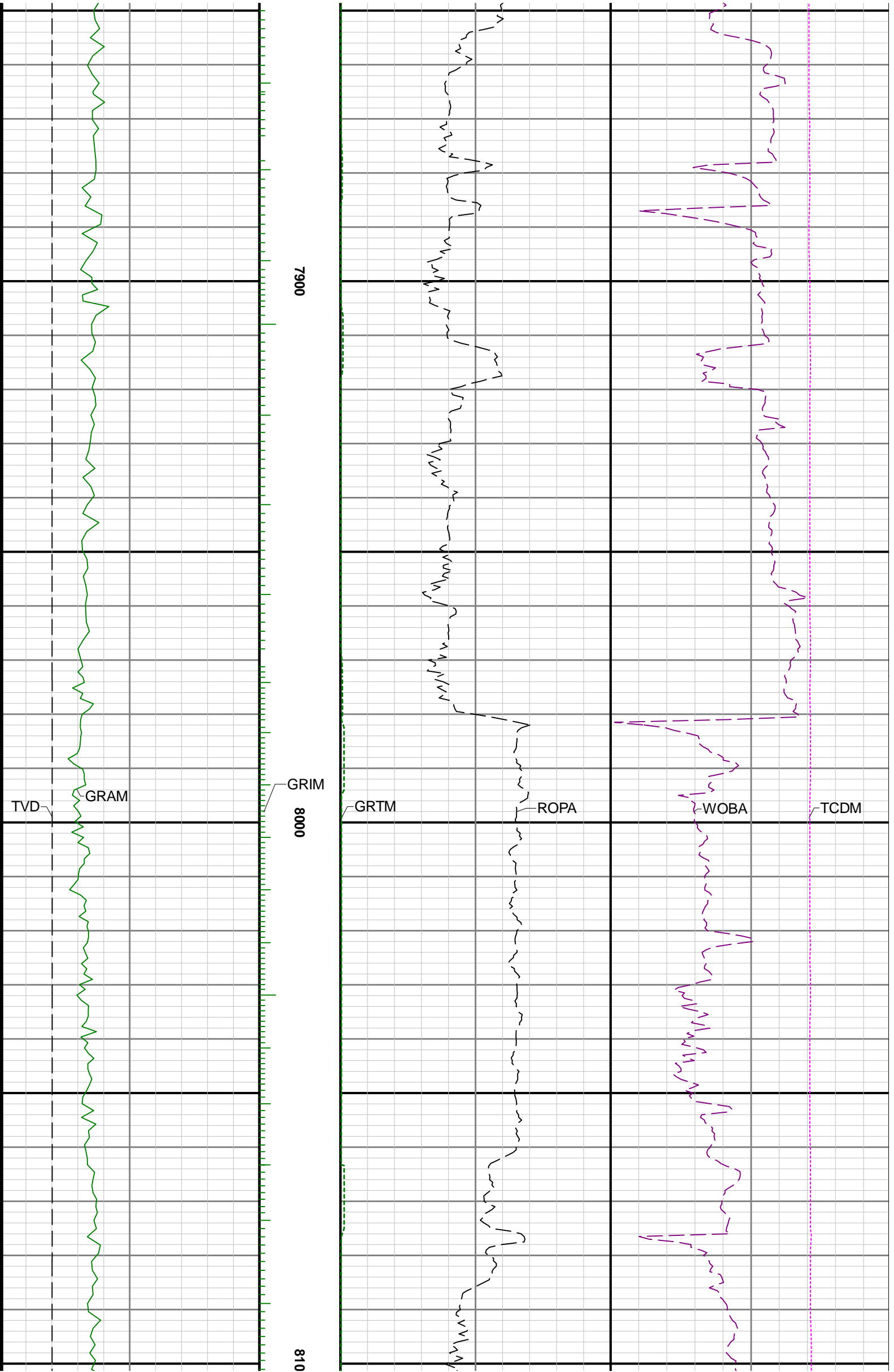


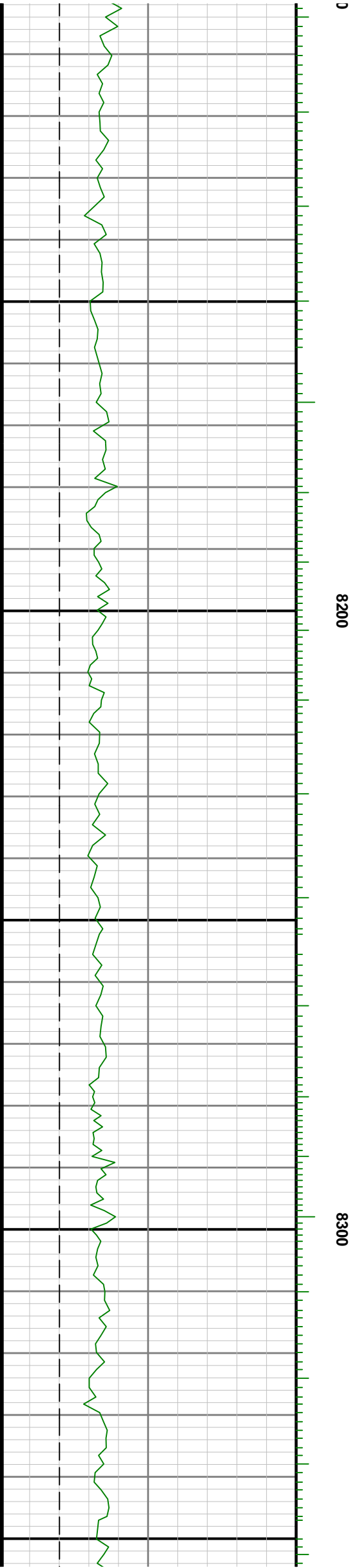
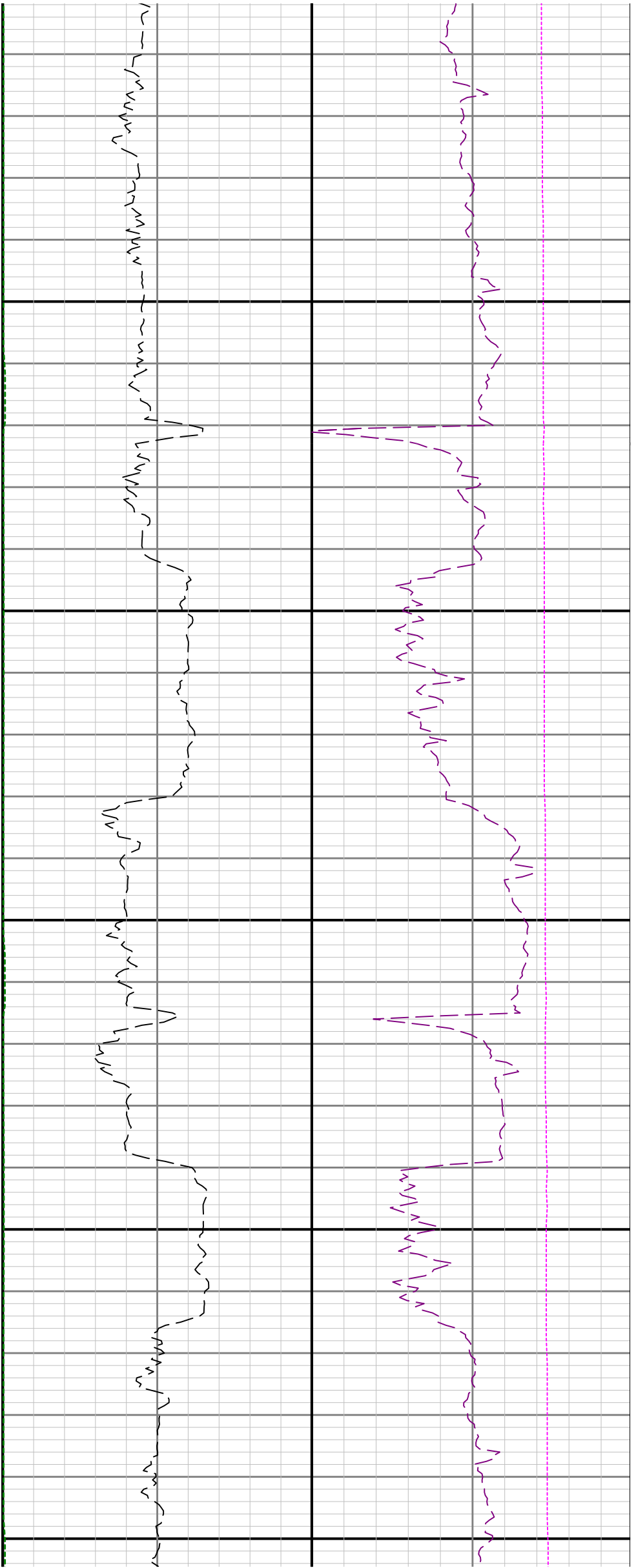
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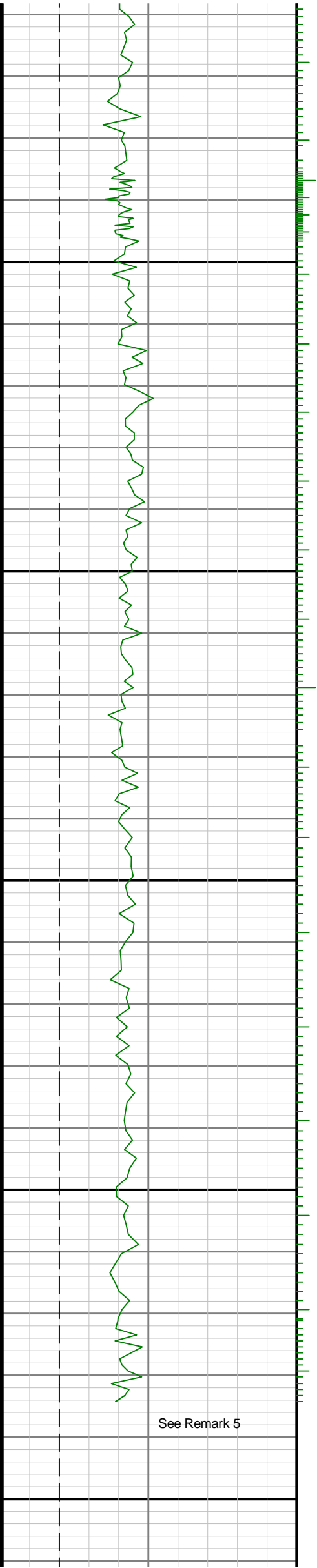
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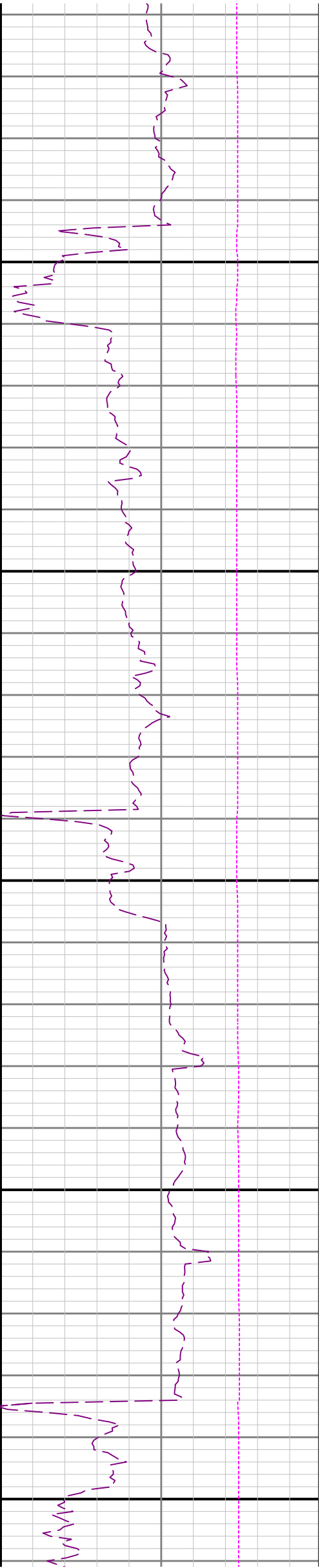
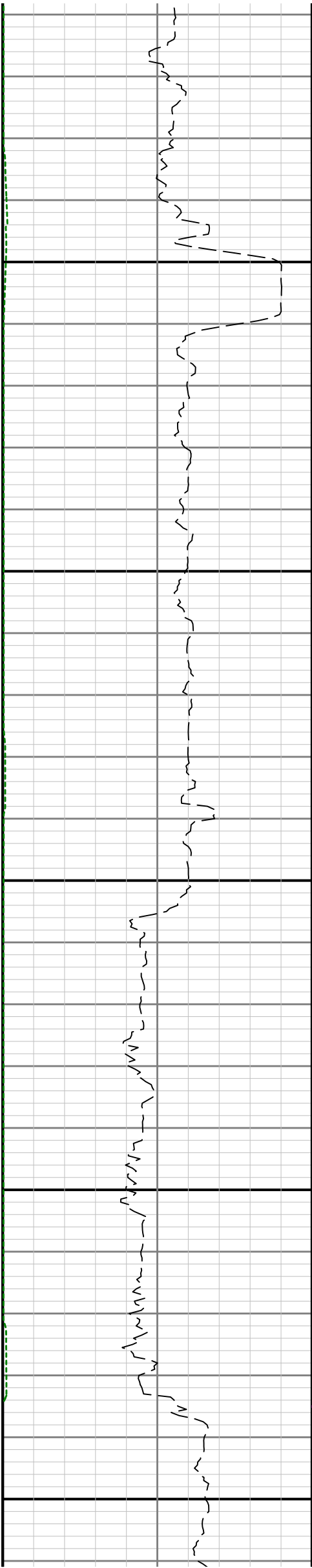


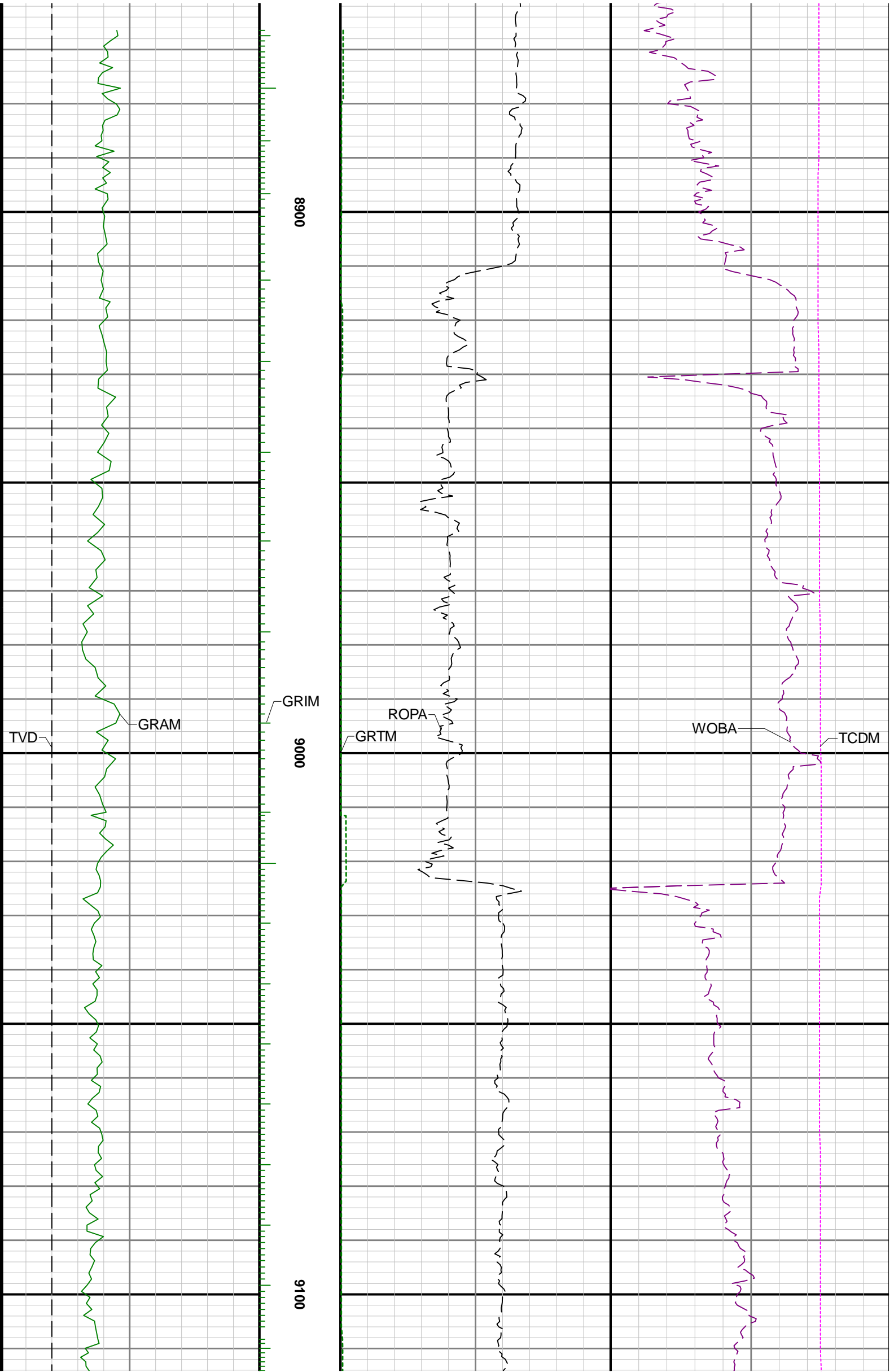


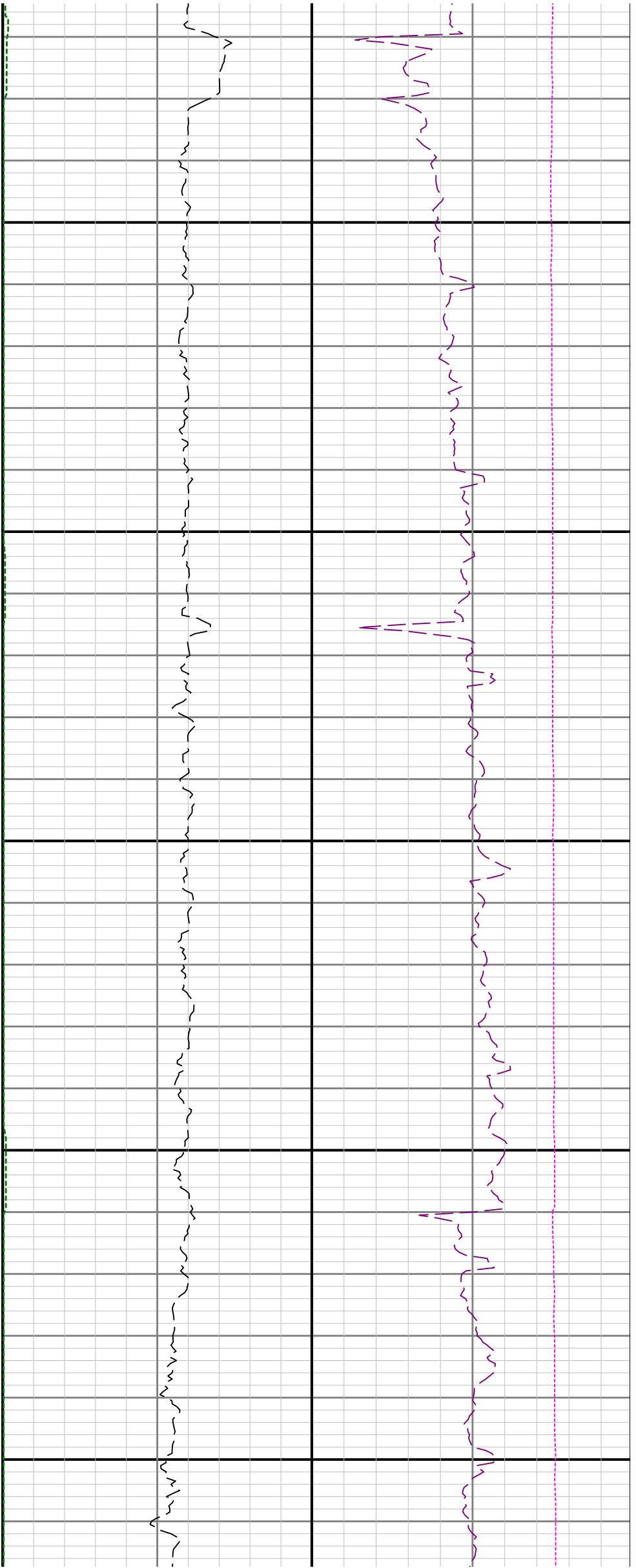
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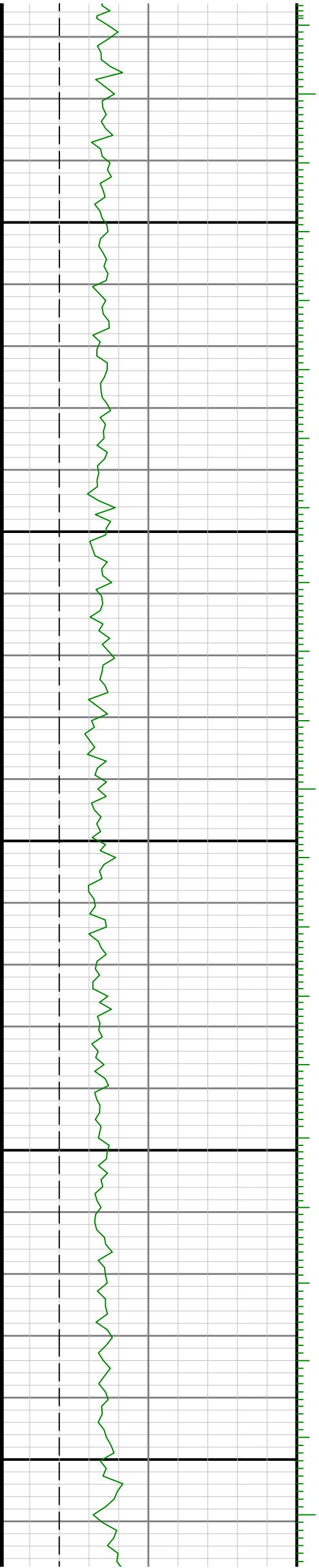


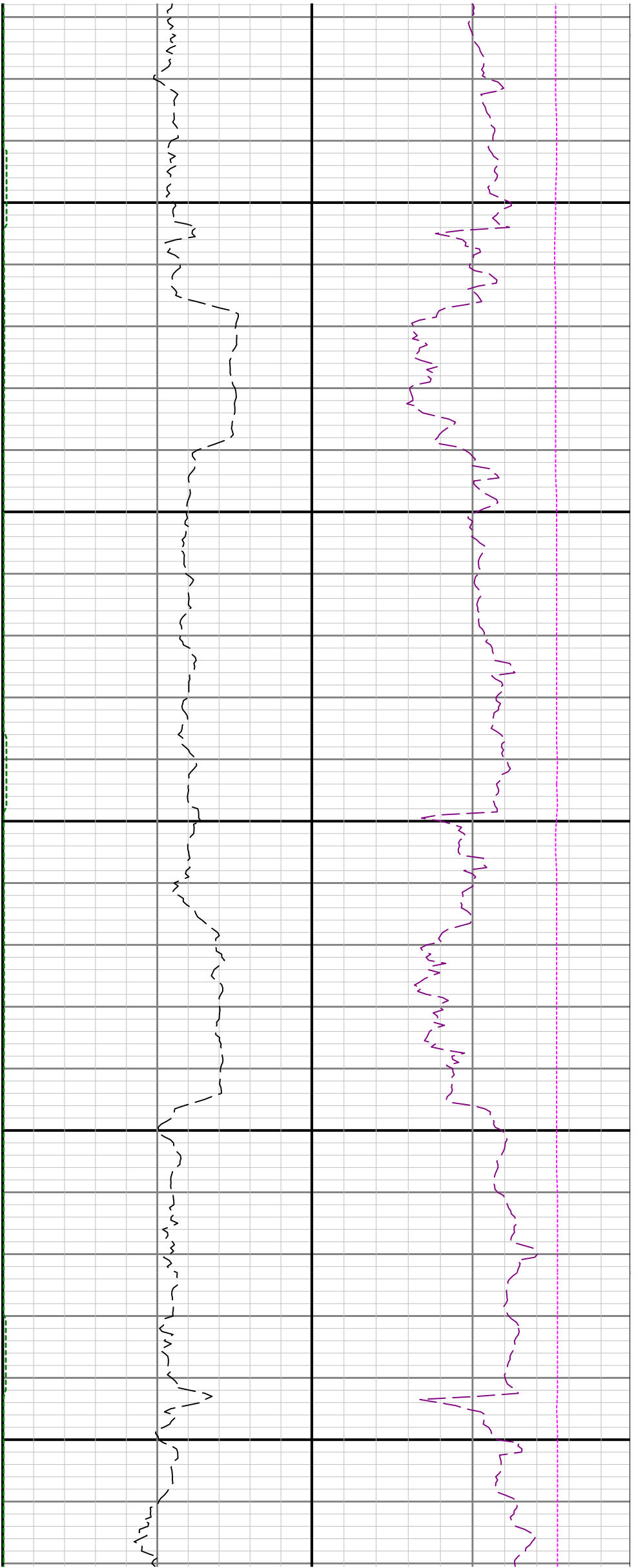




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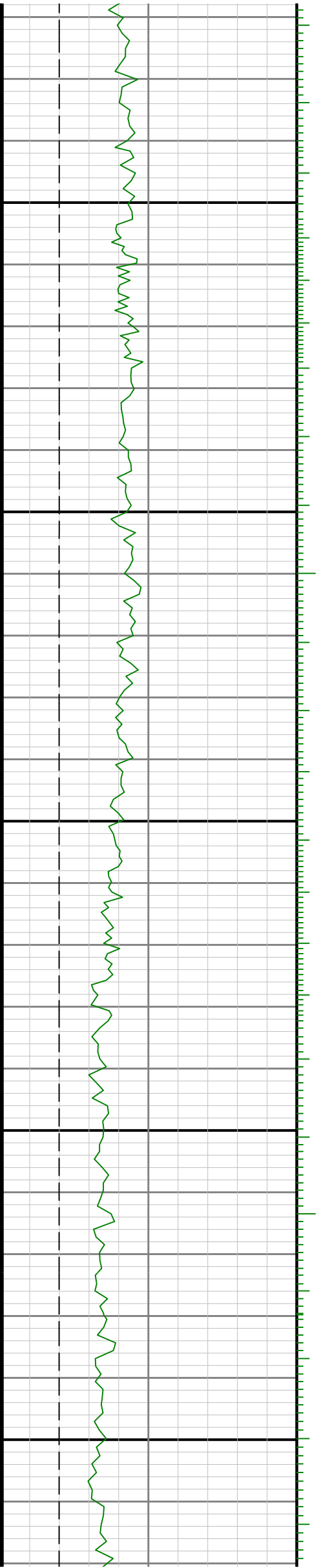


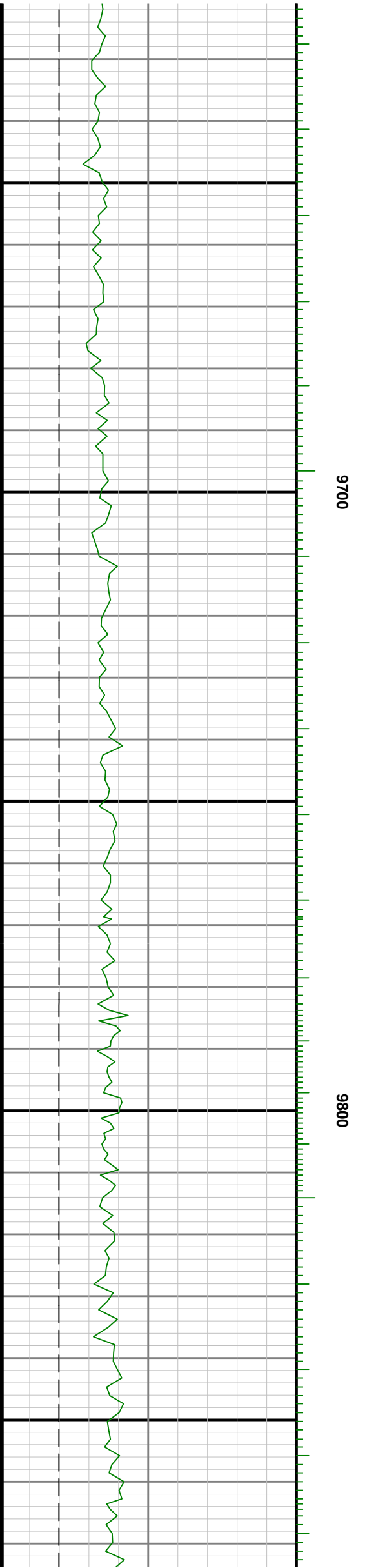
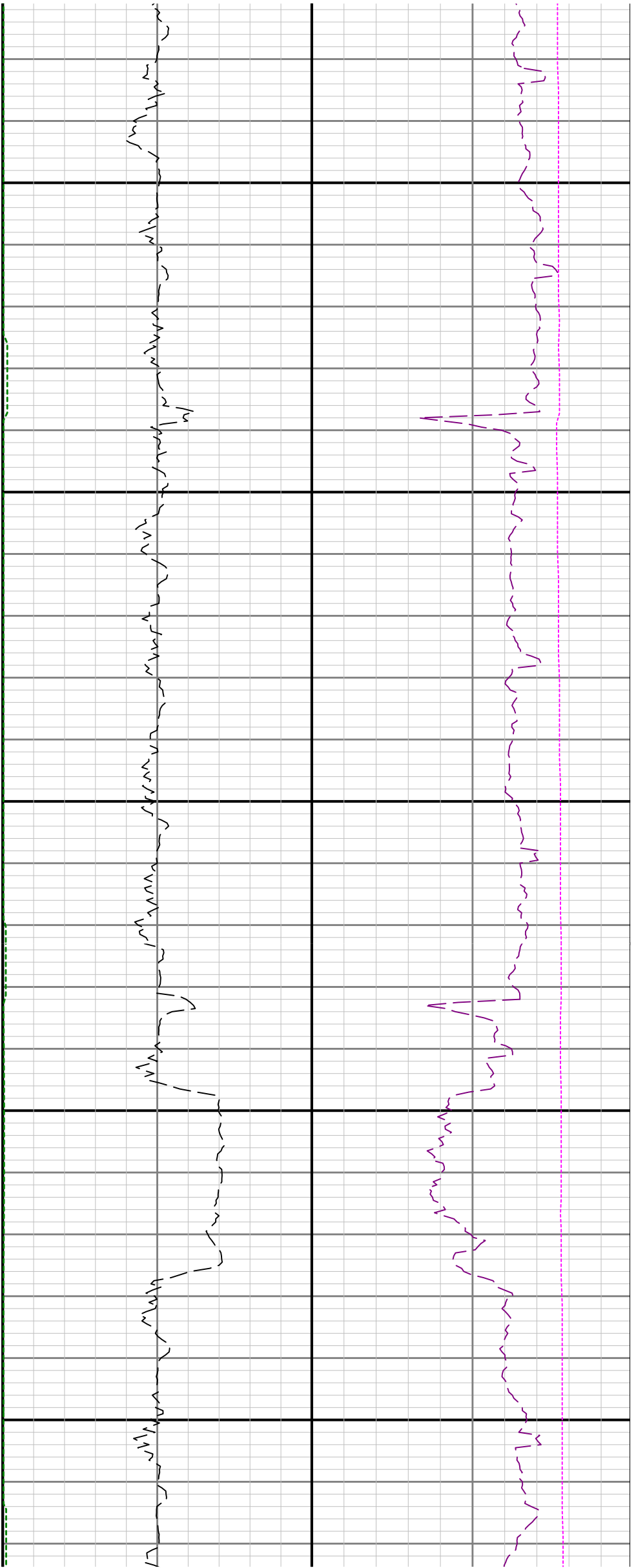


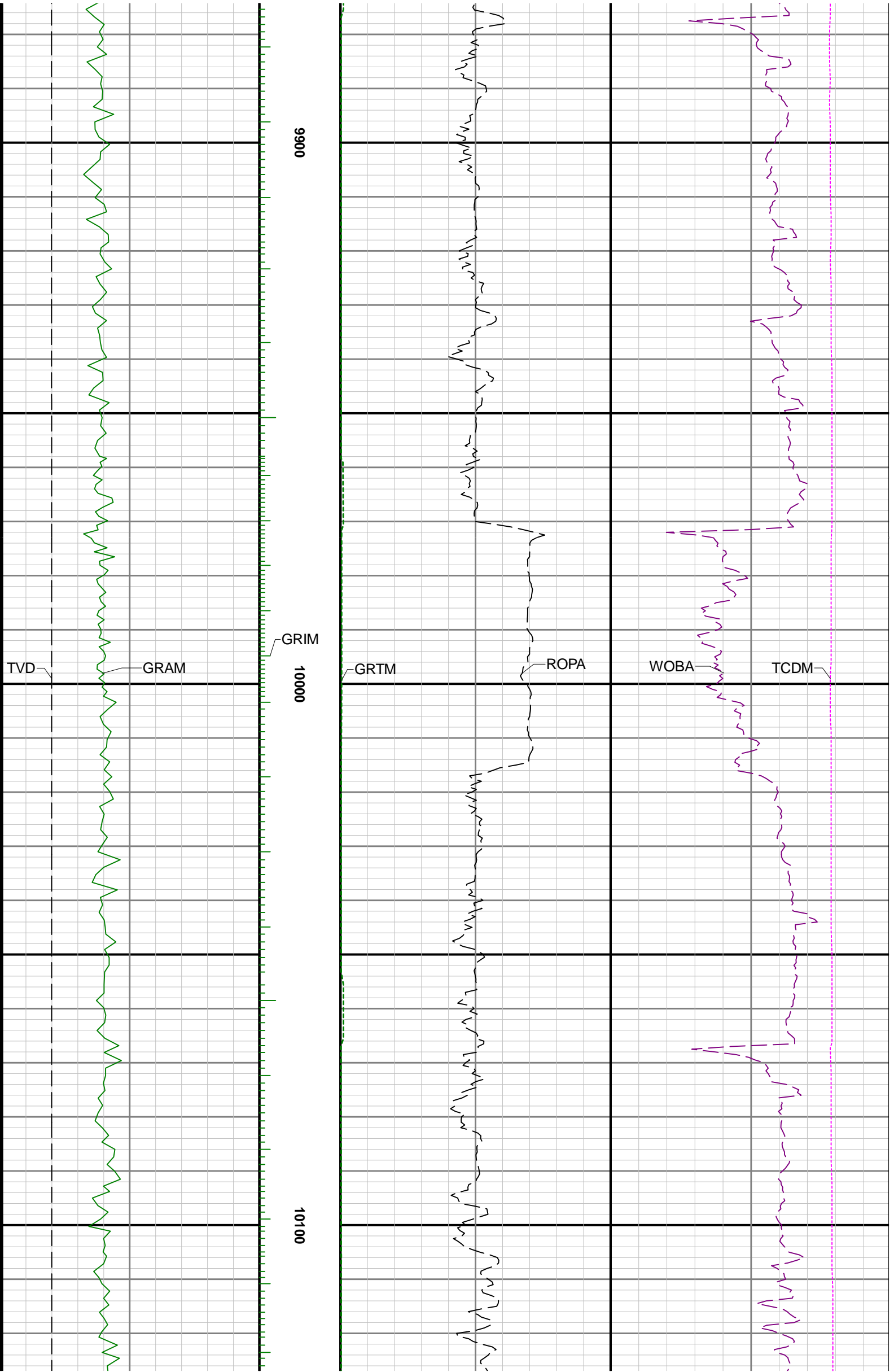
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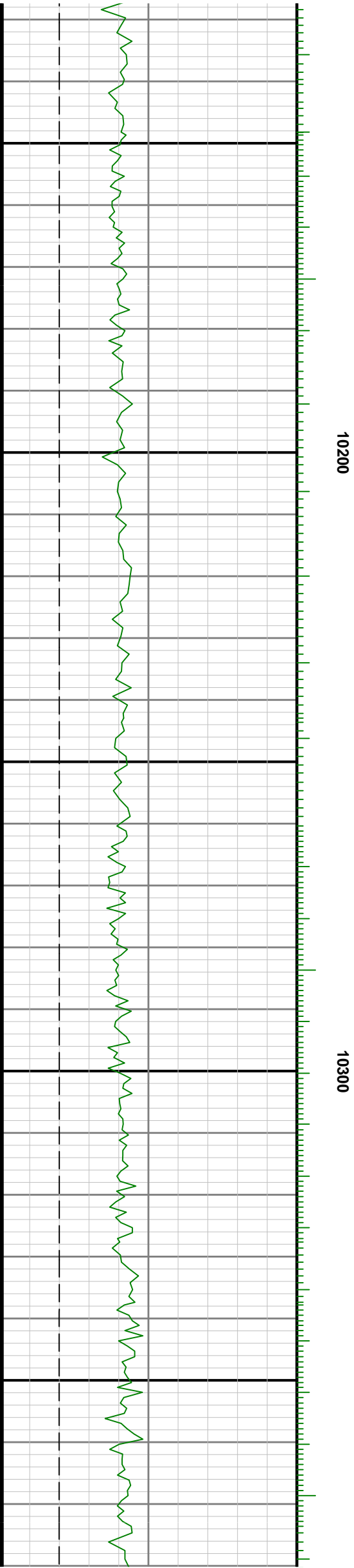
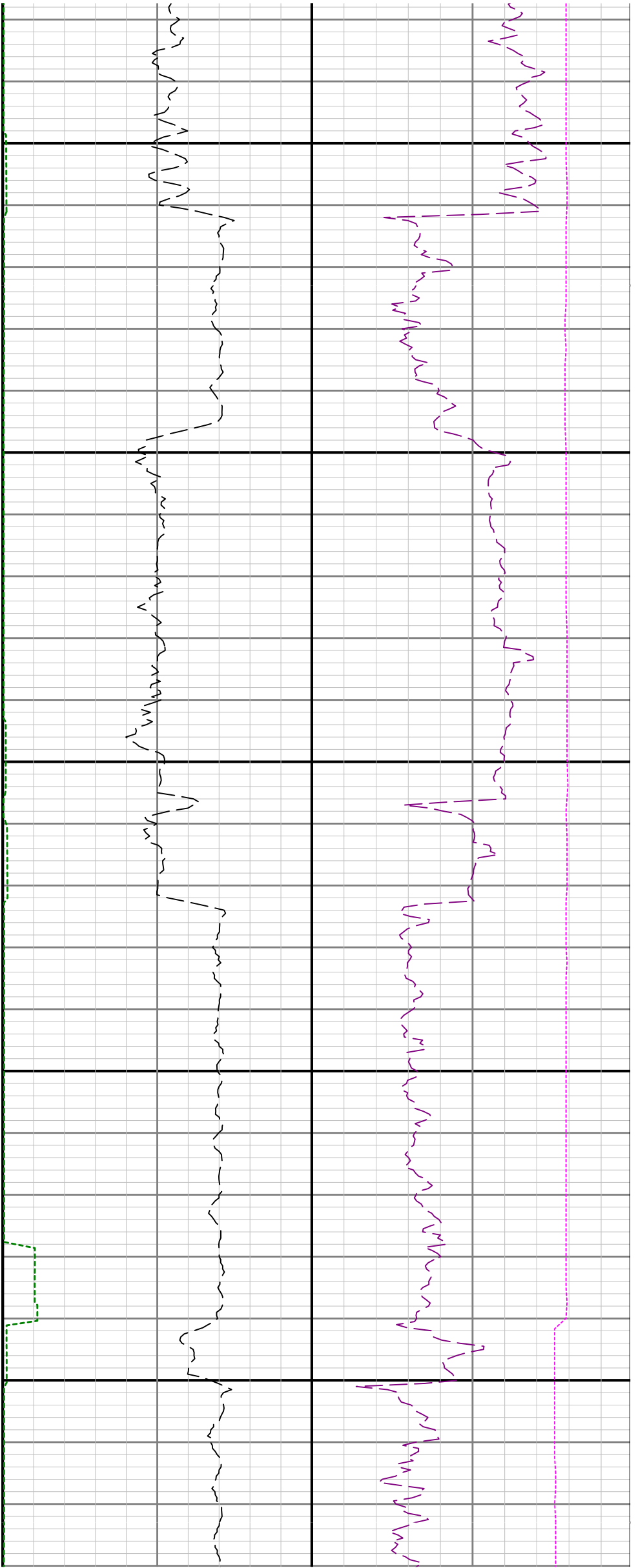
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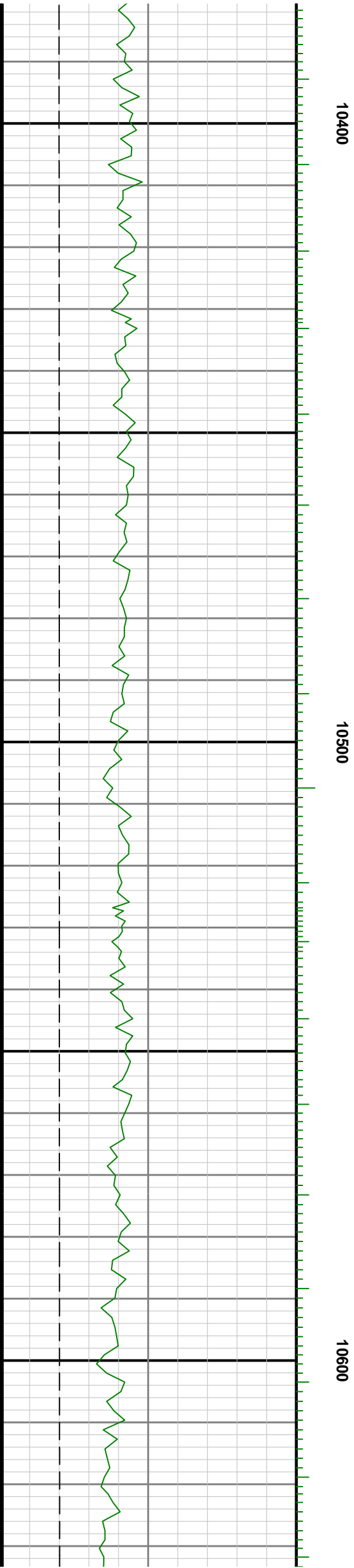
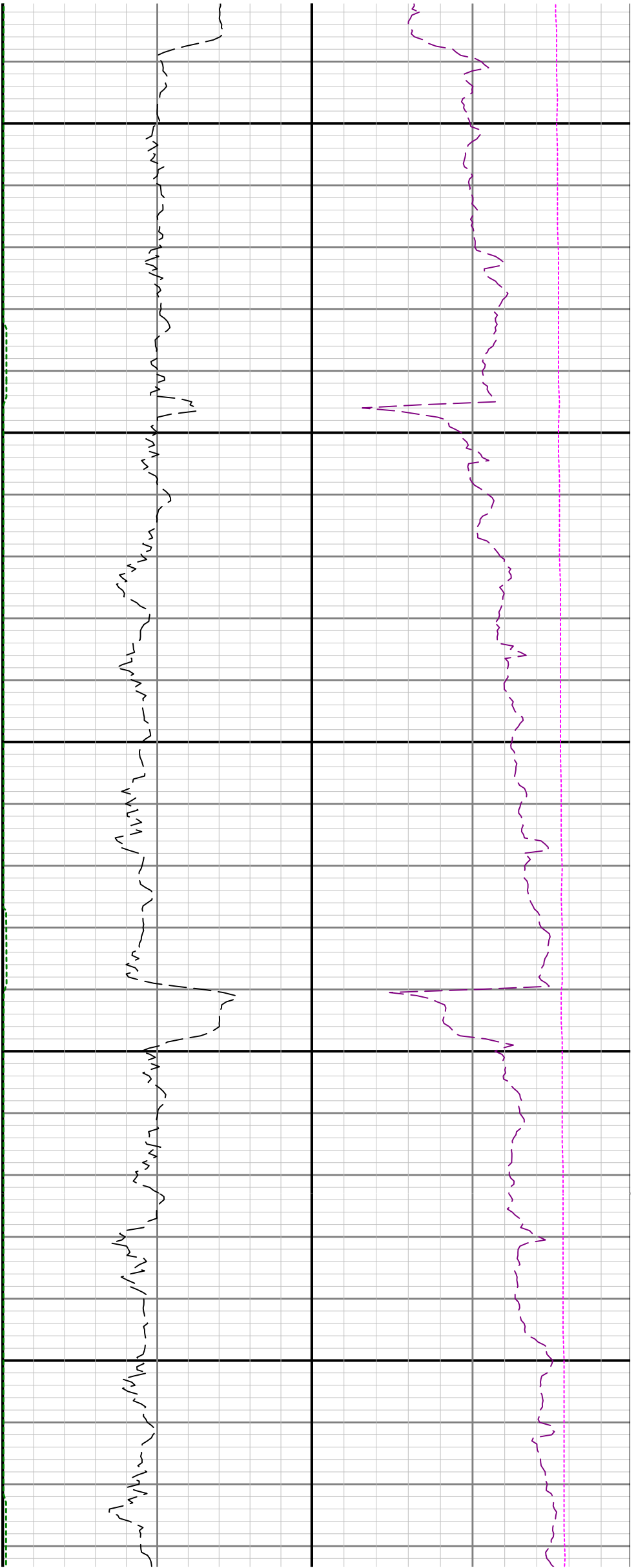
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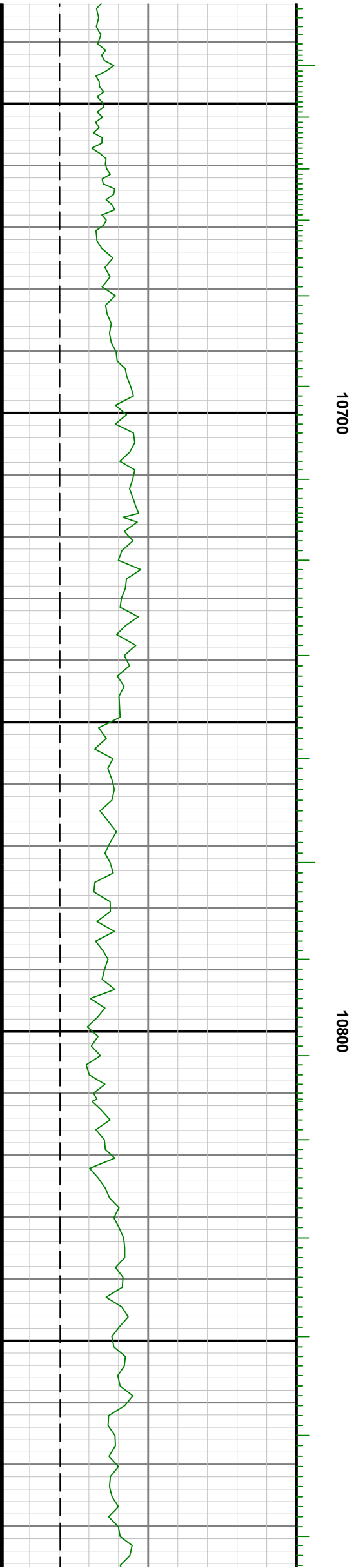
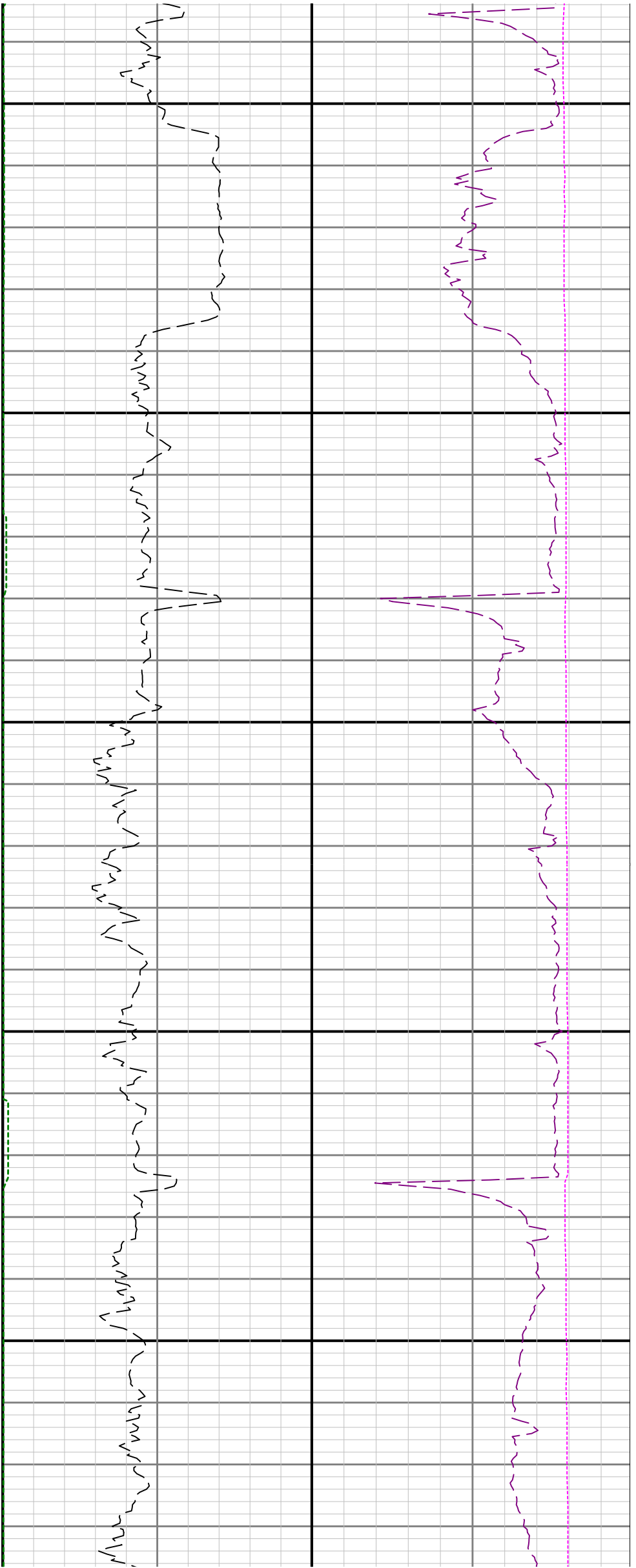


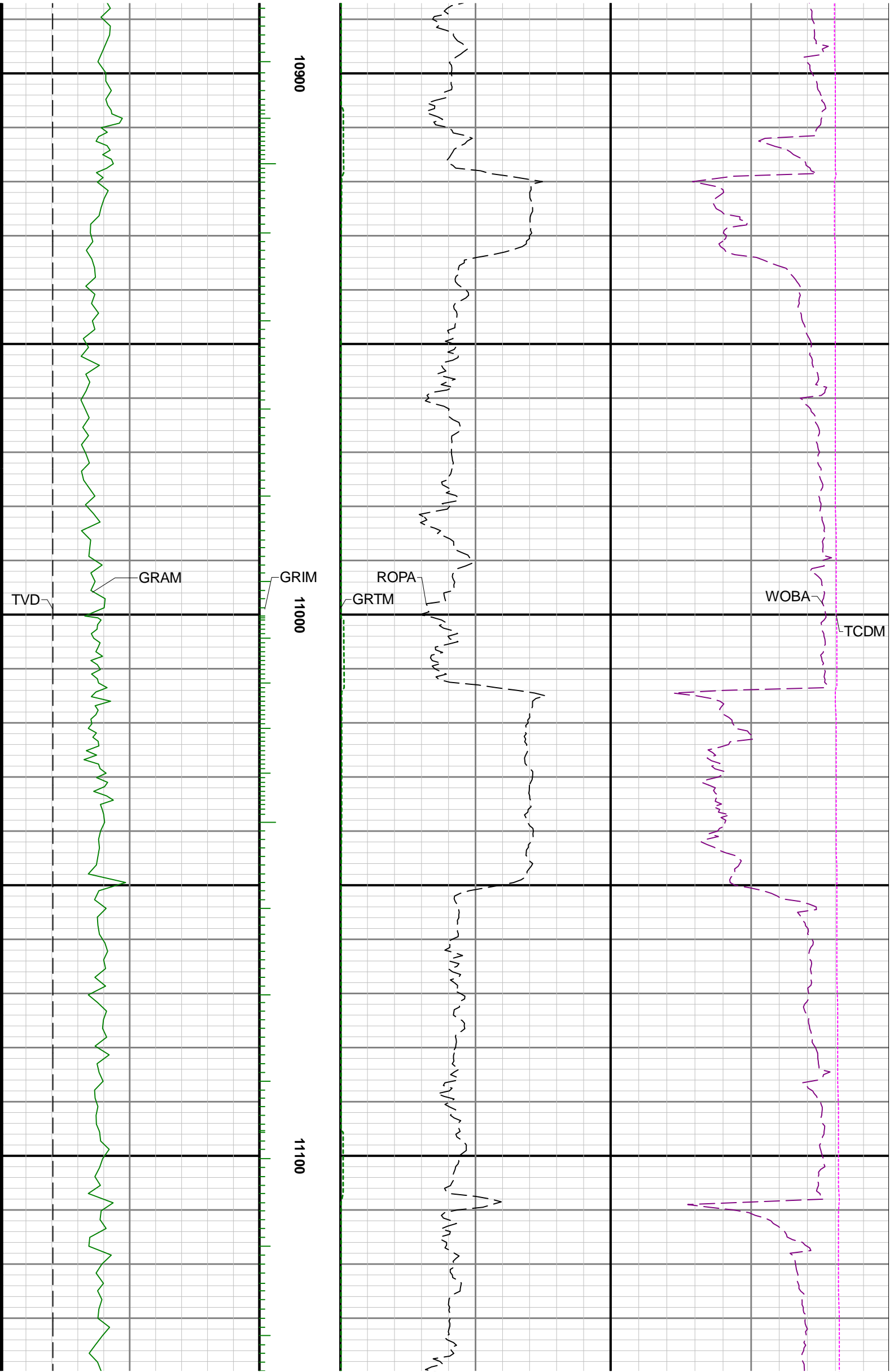








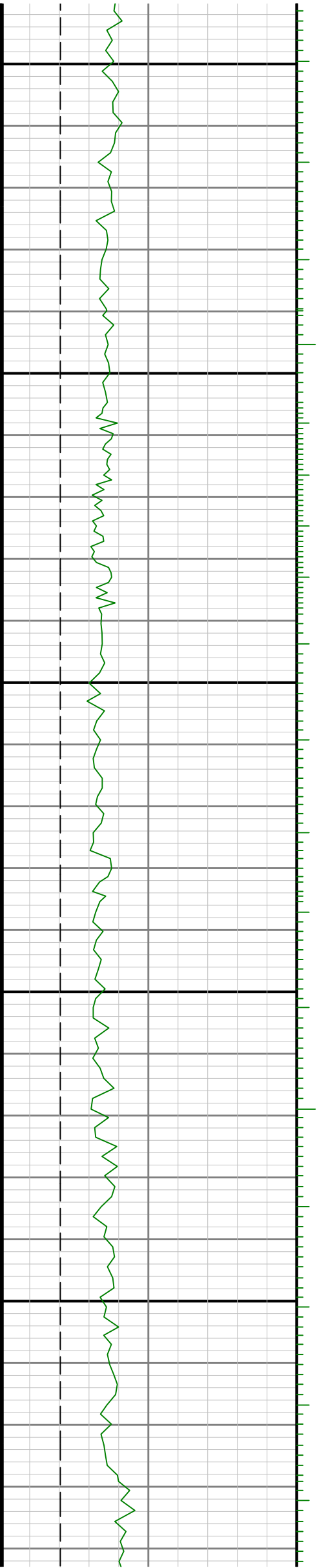


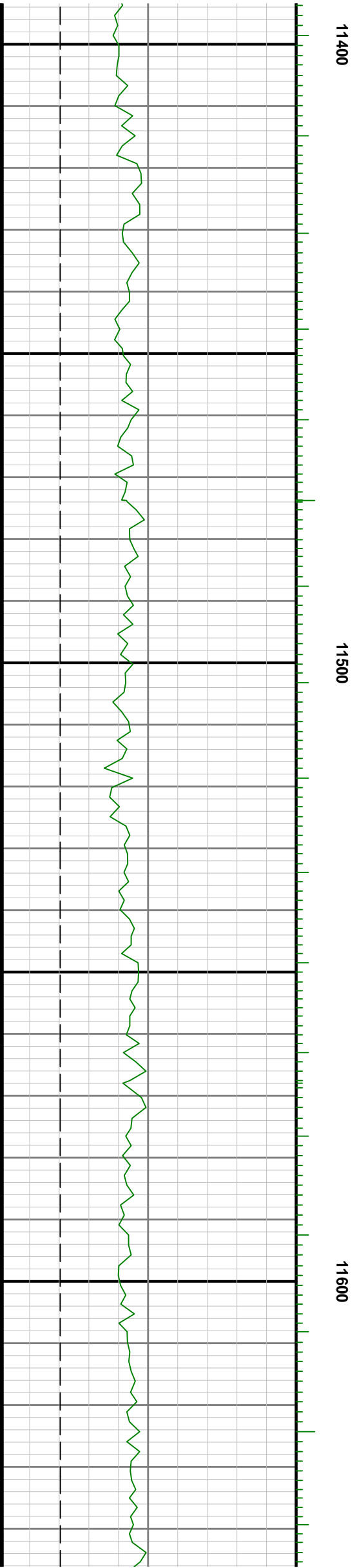
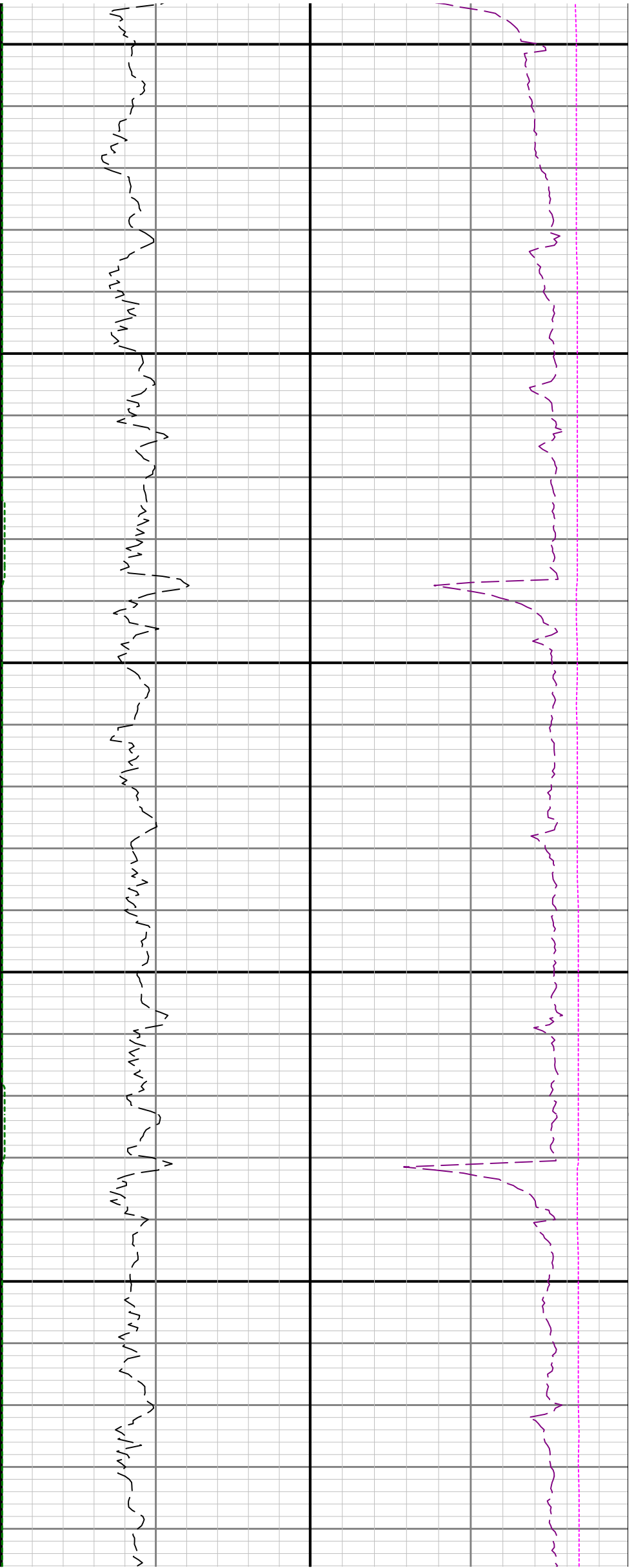


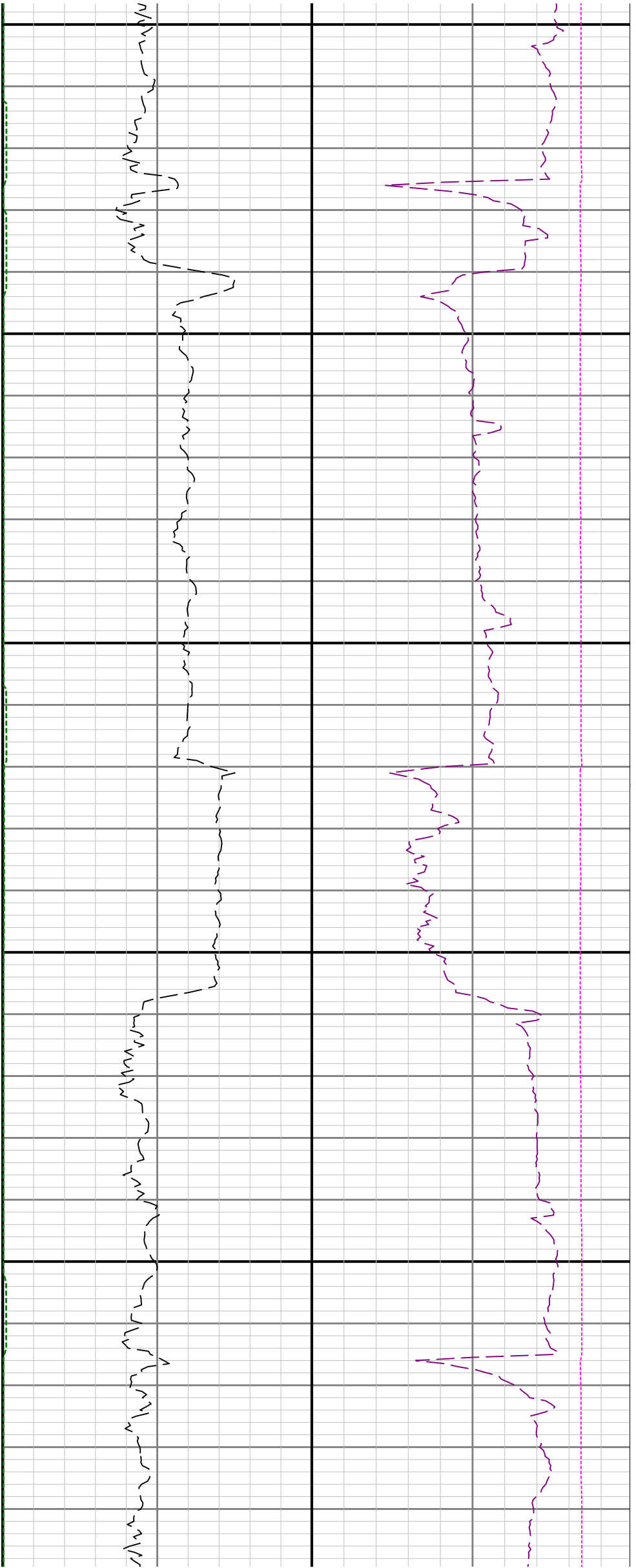


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11300



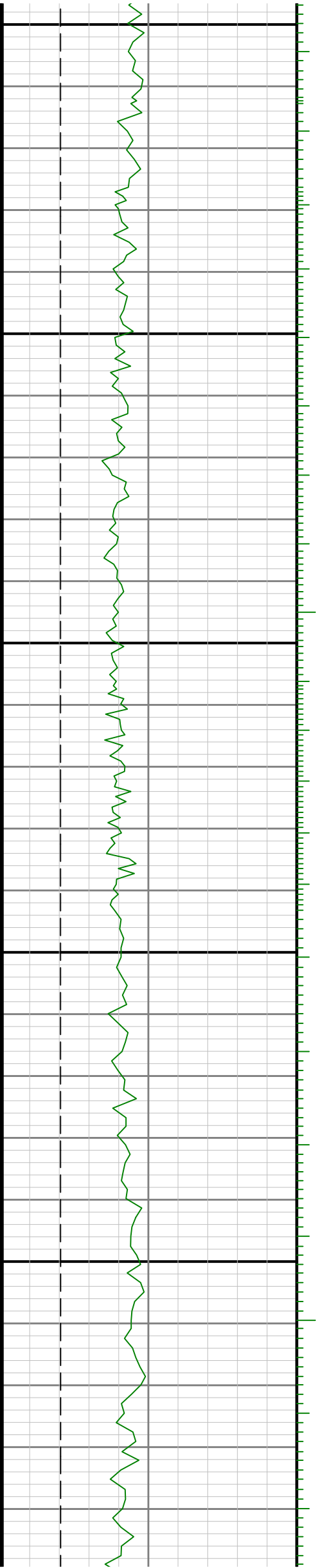


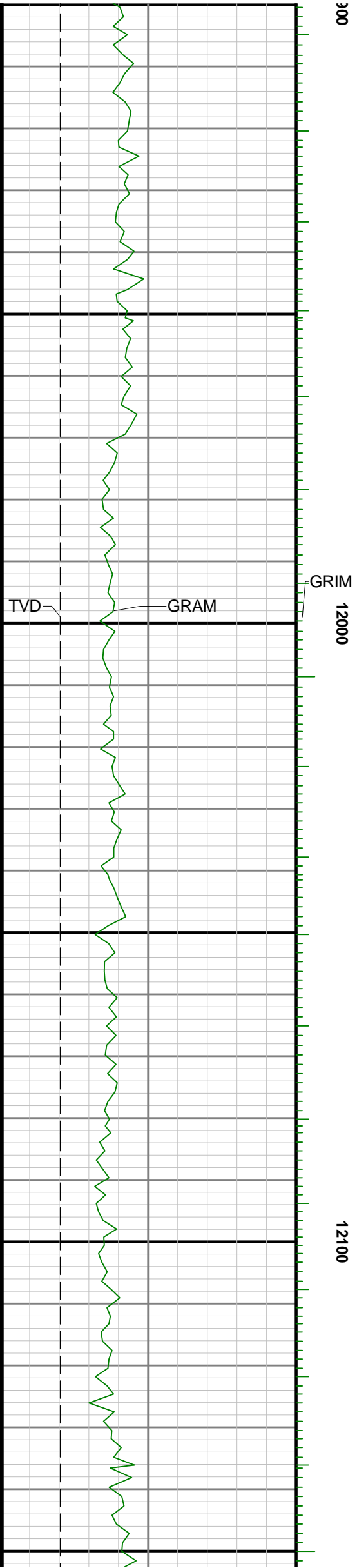
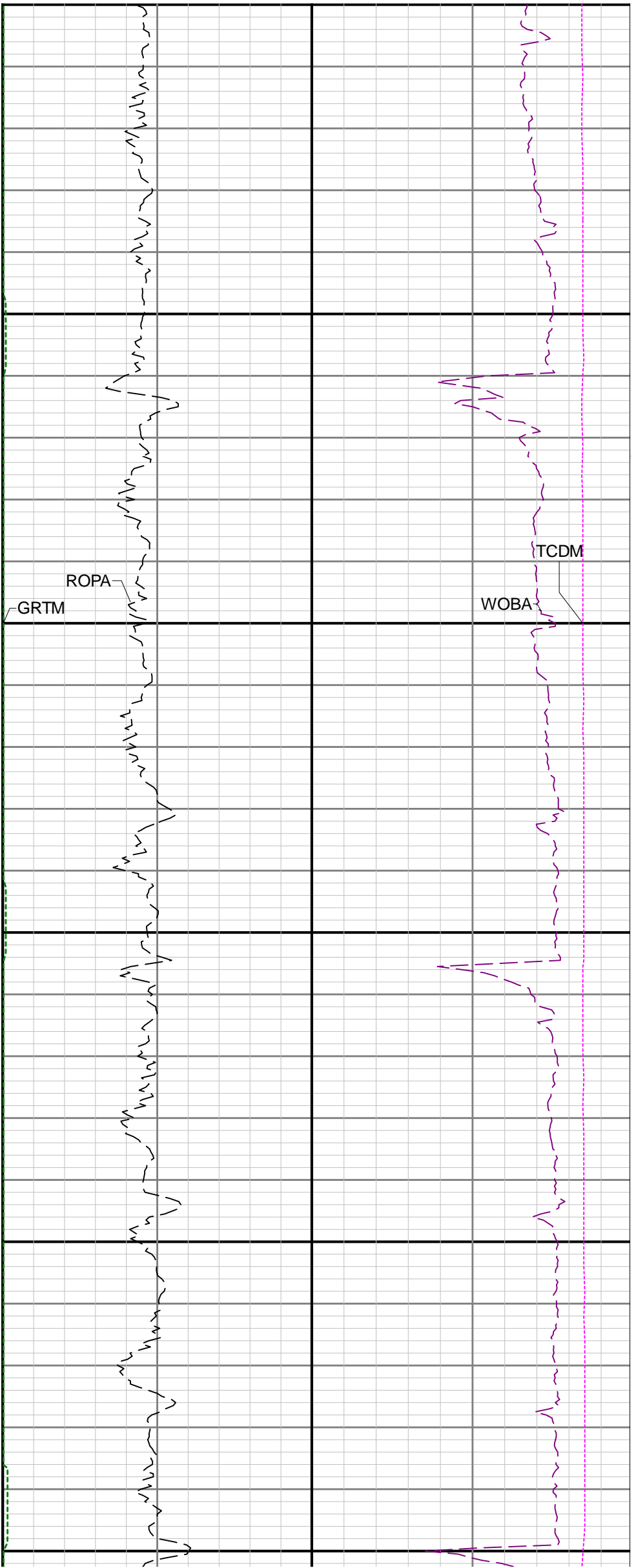


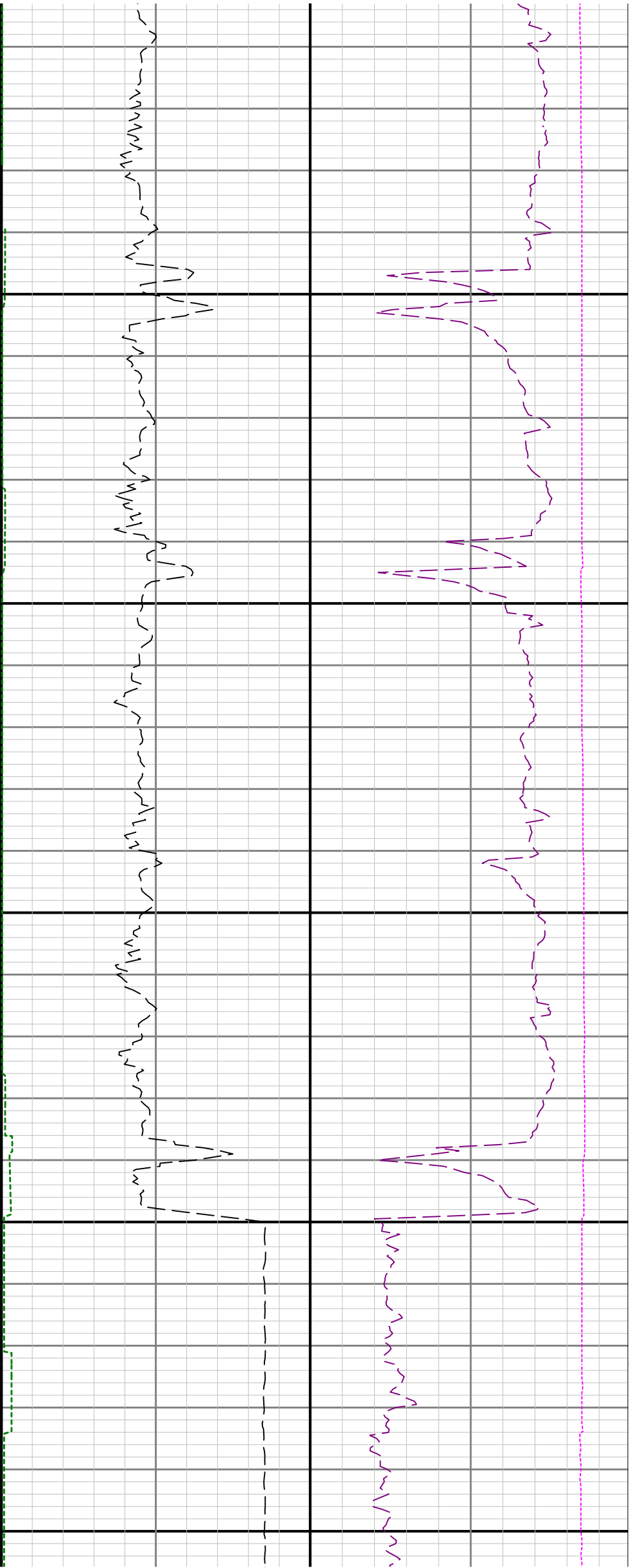
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11800

11



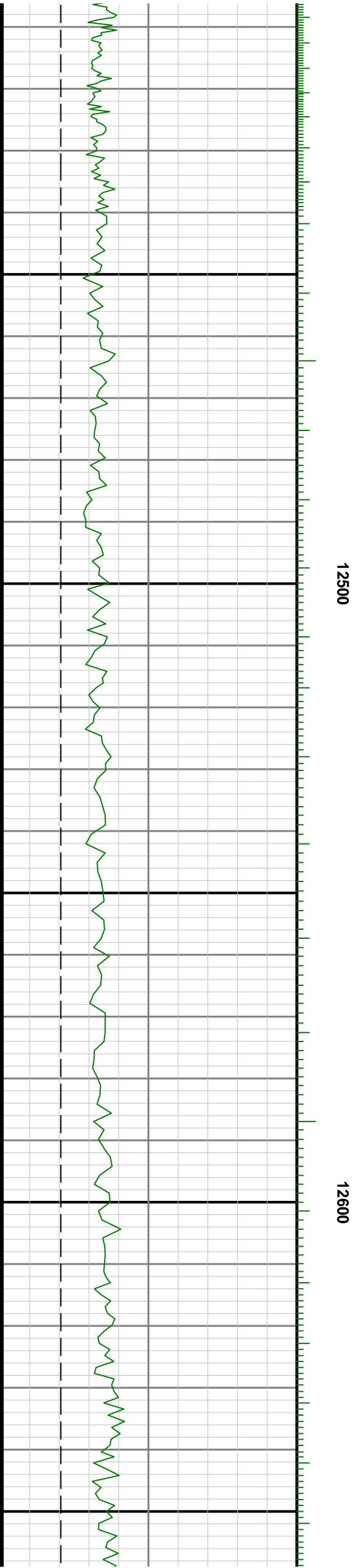
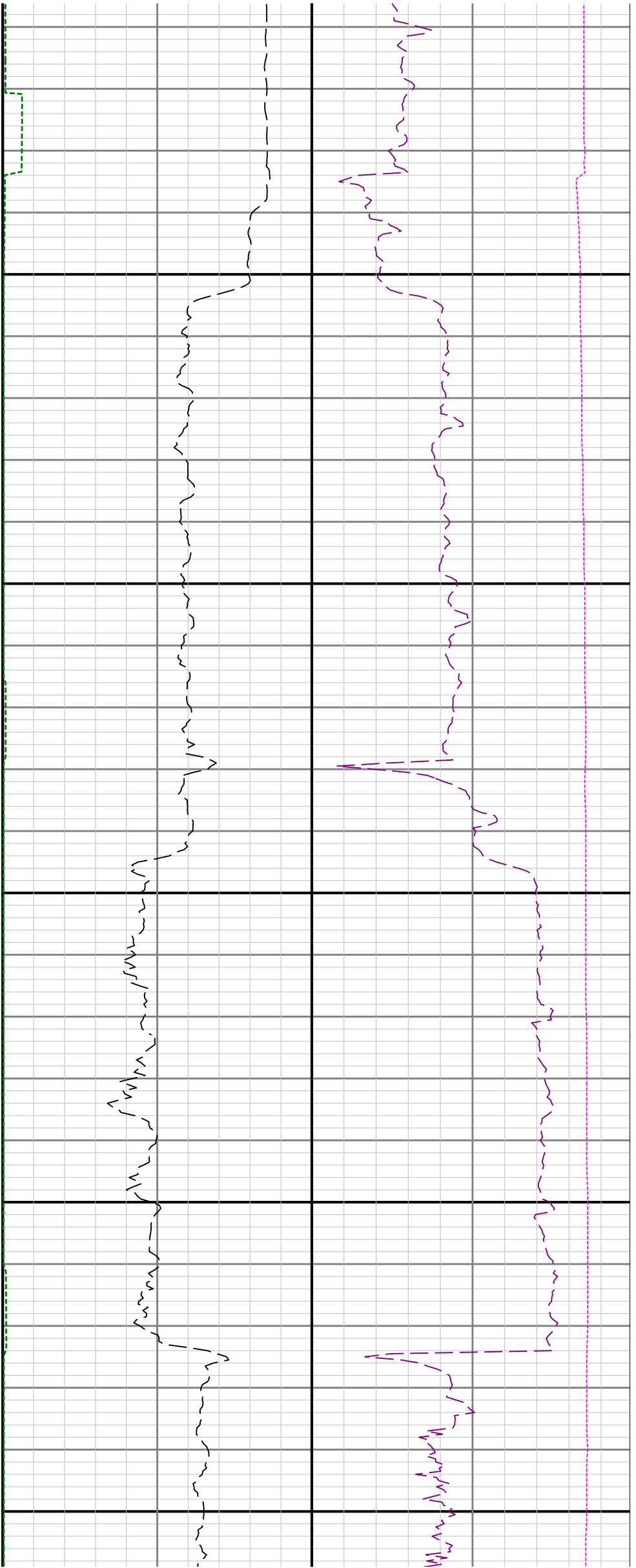


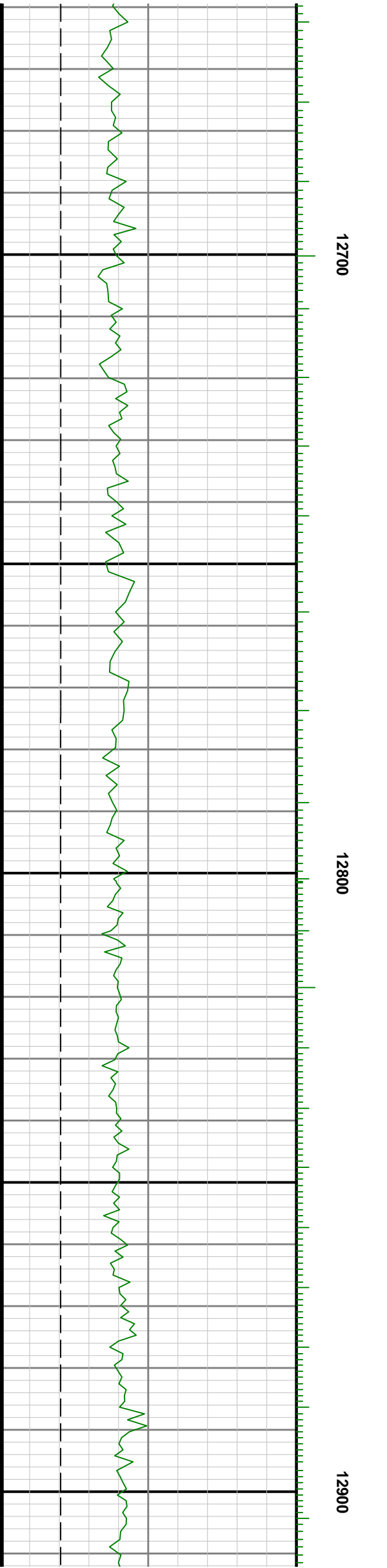
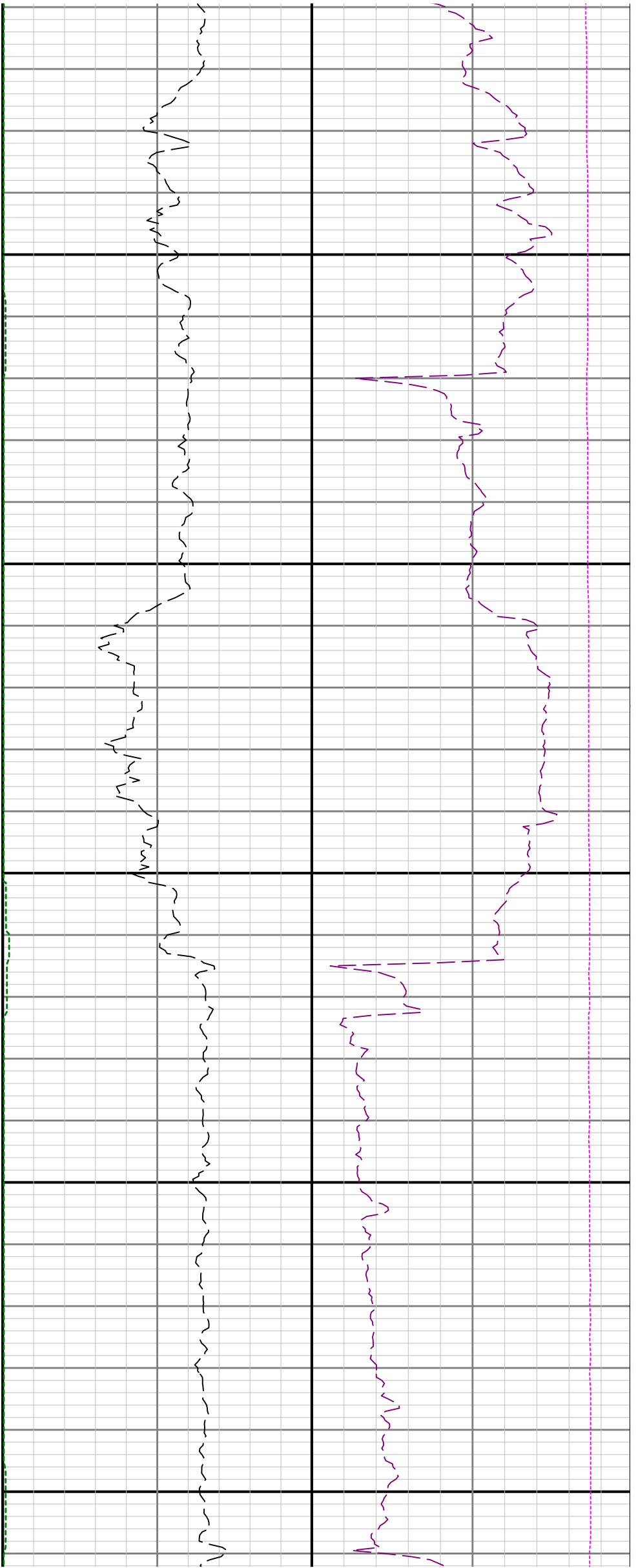


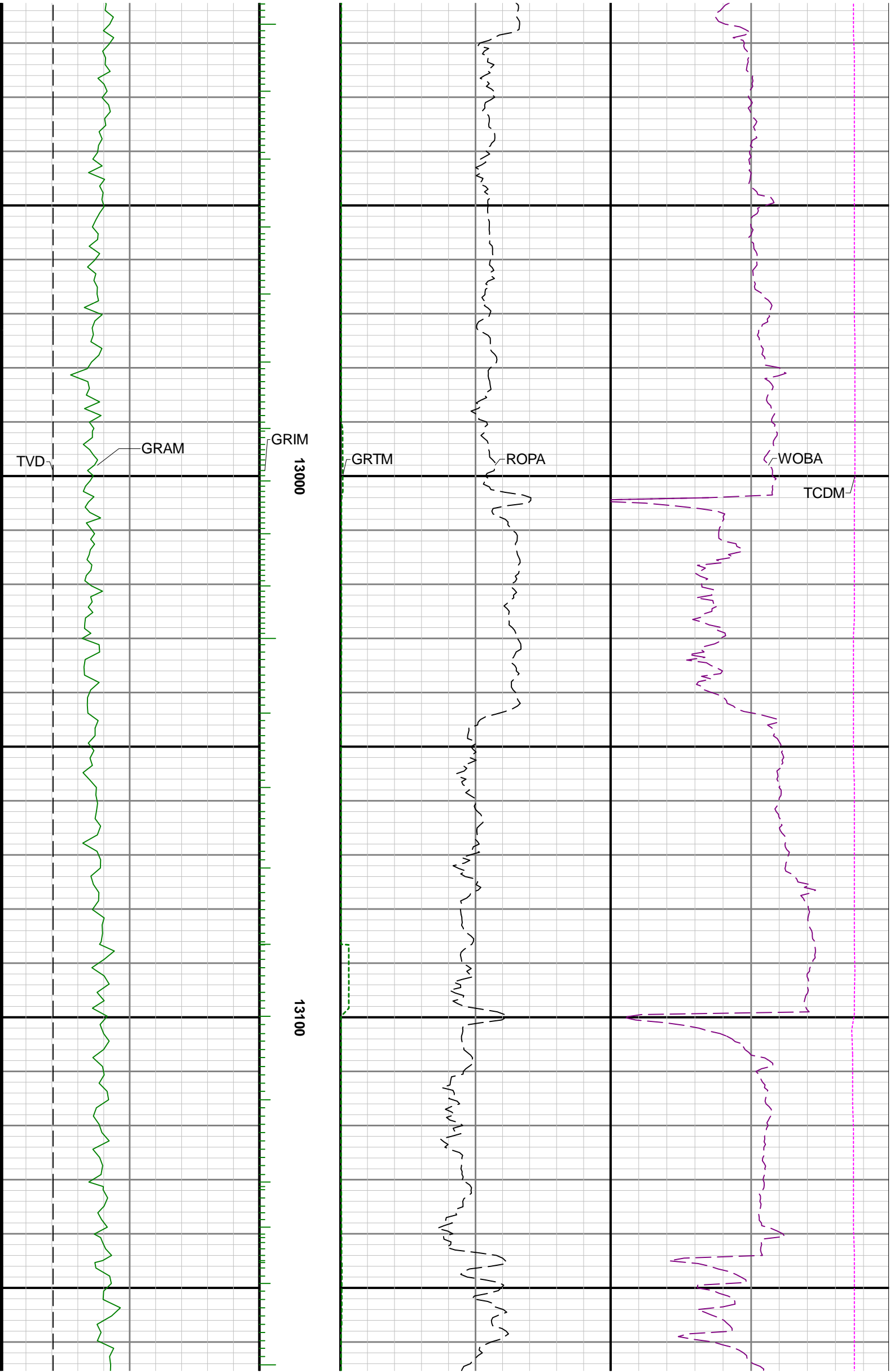
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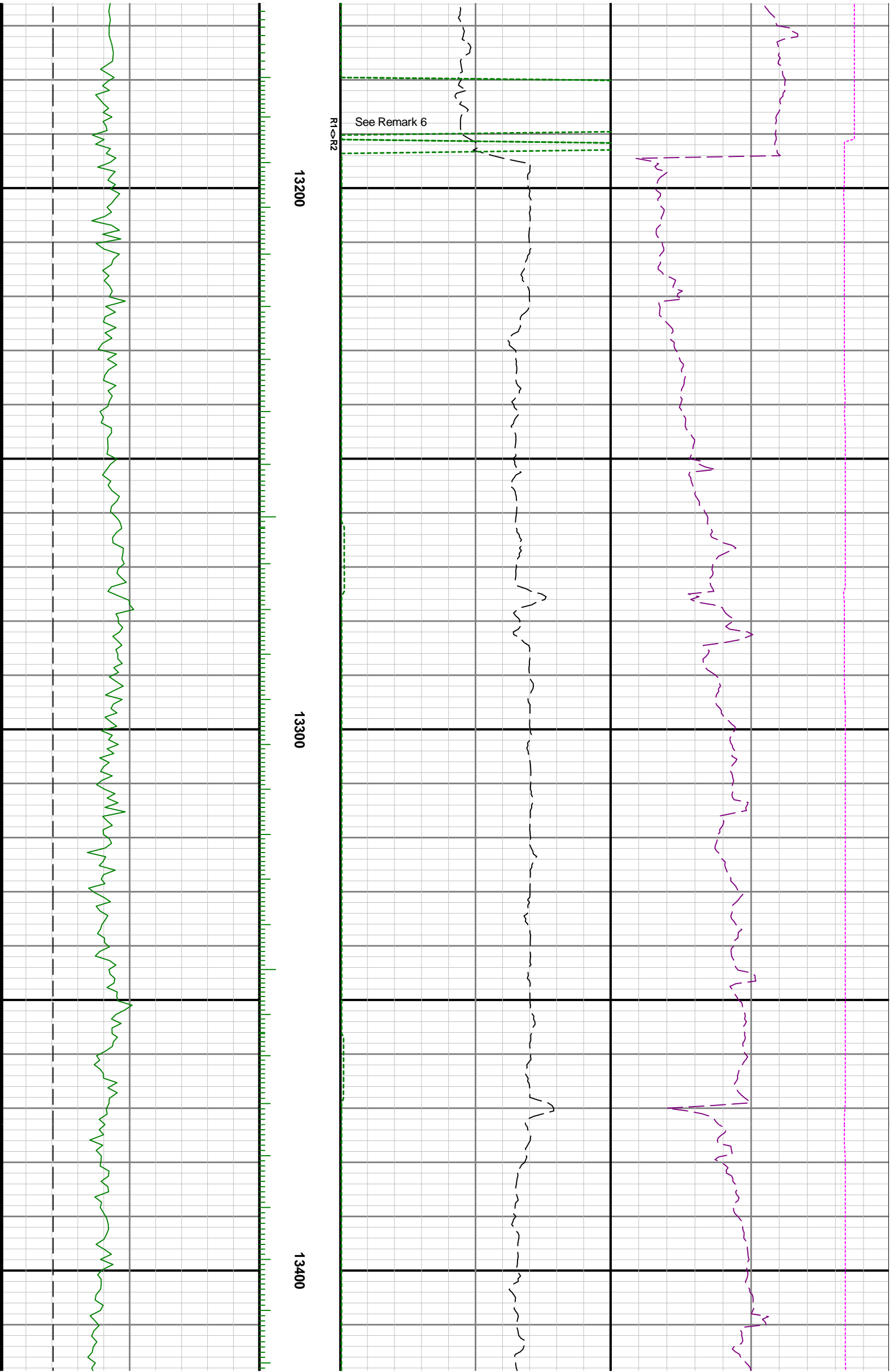
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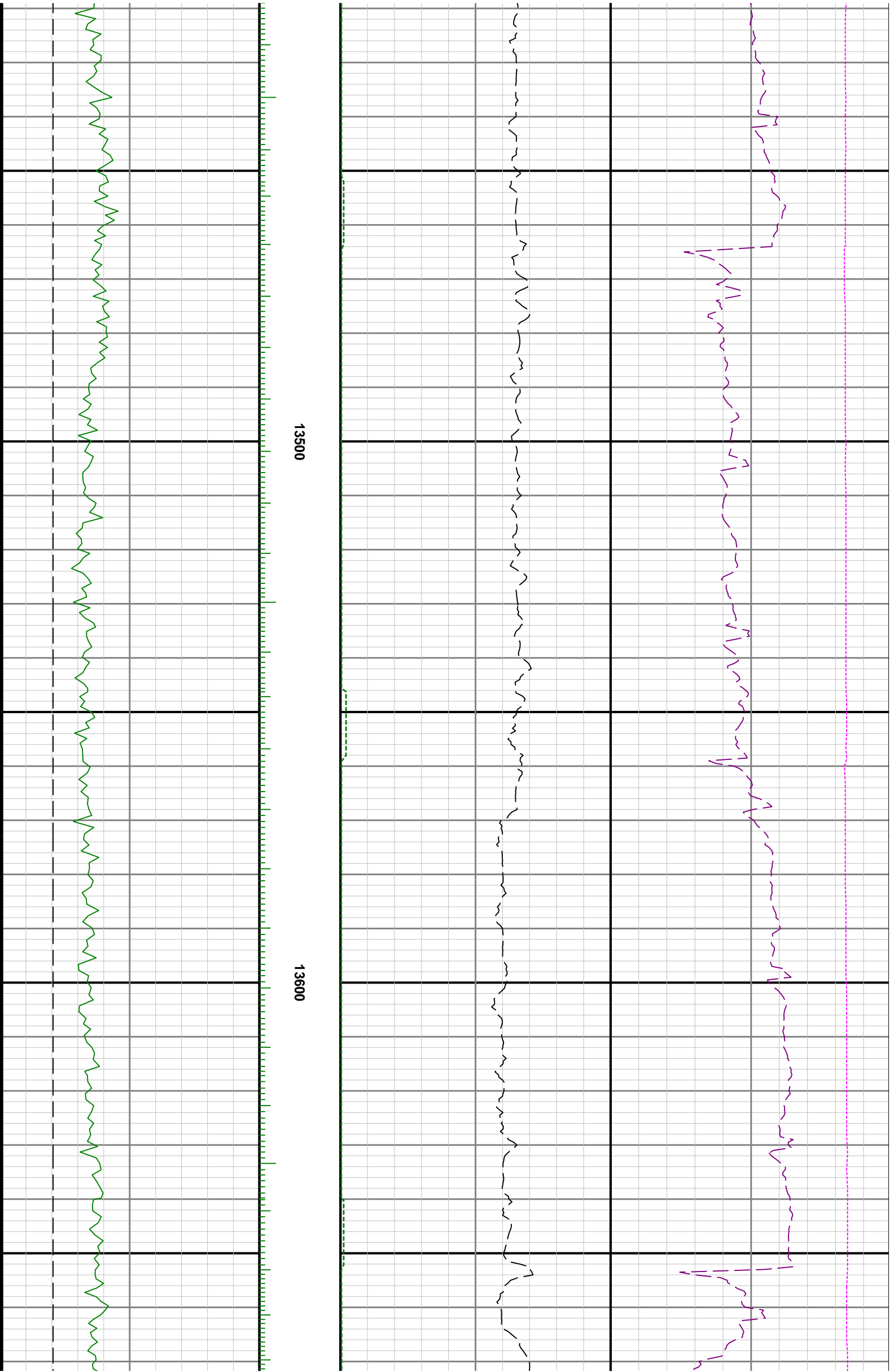
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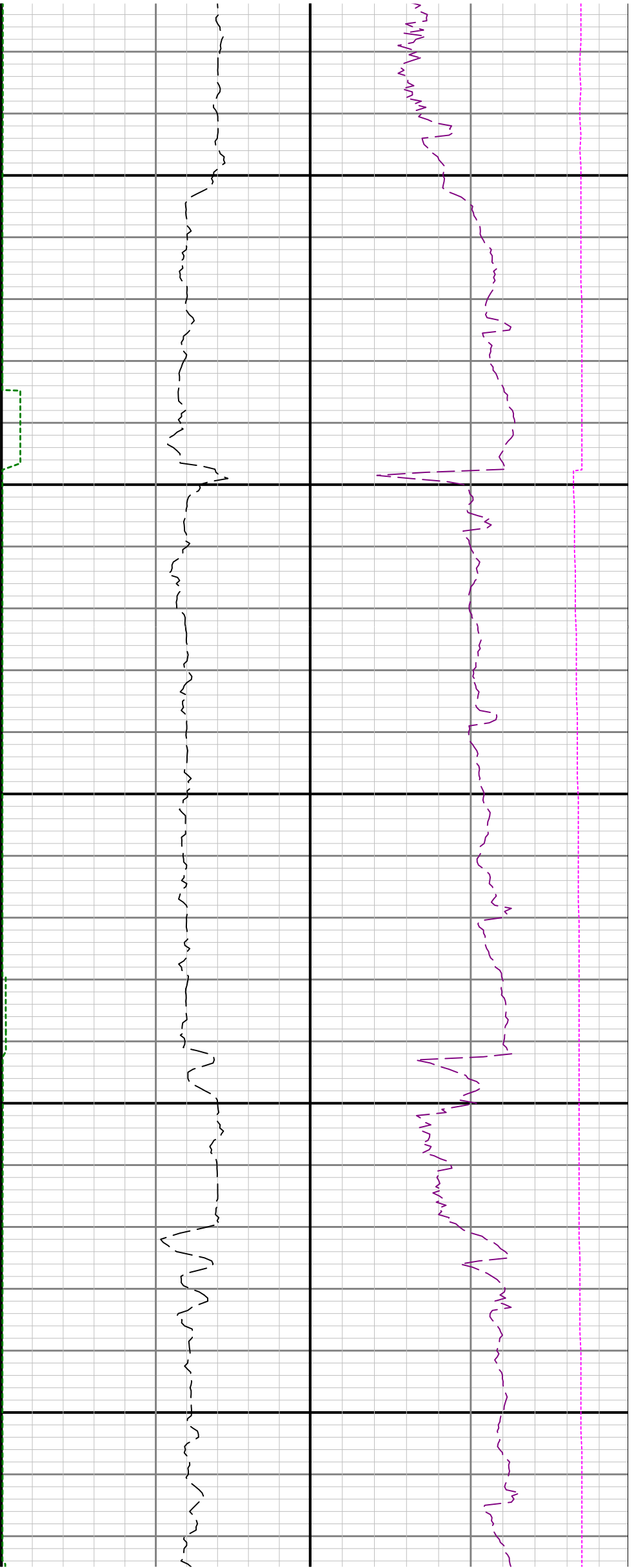








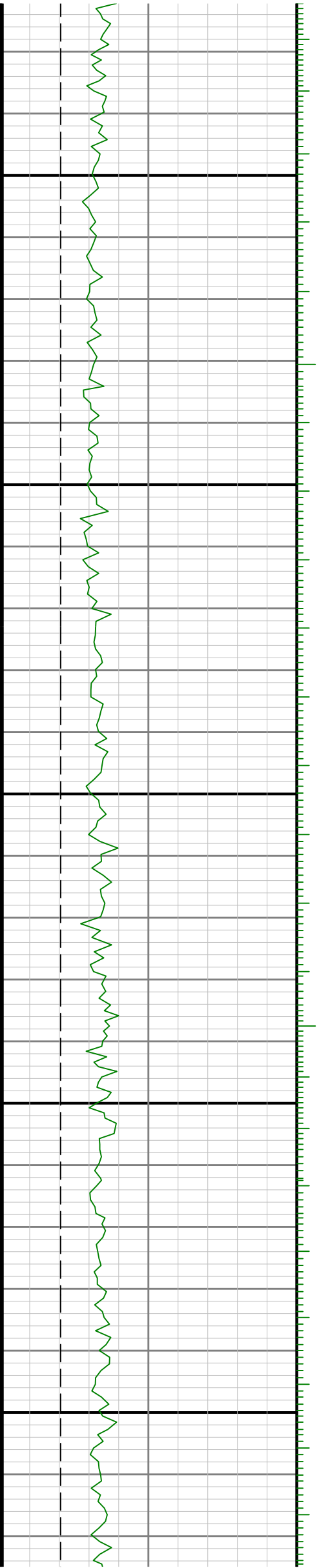


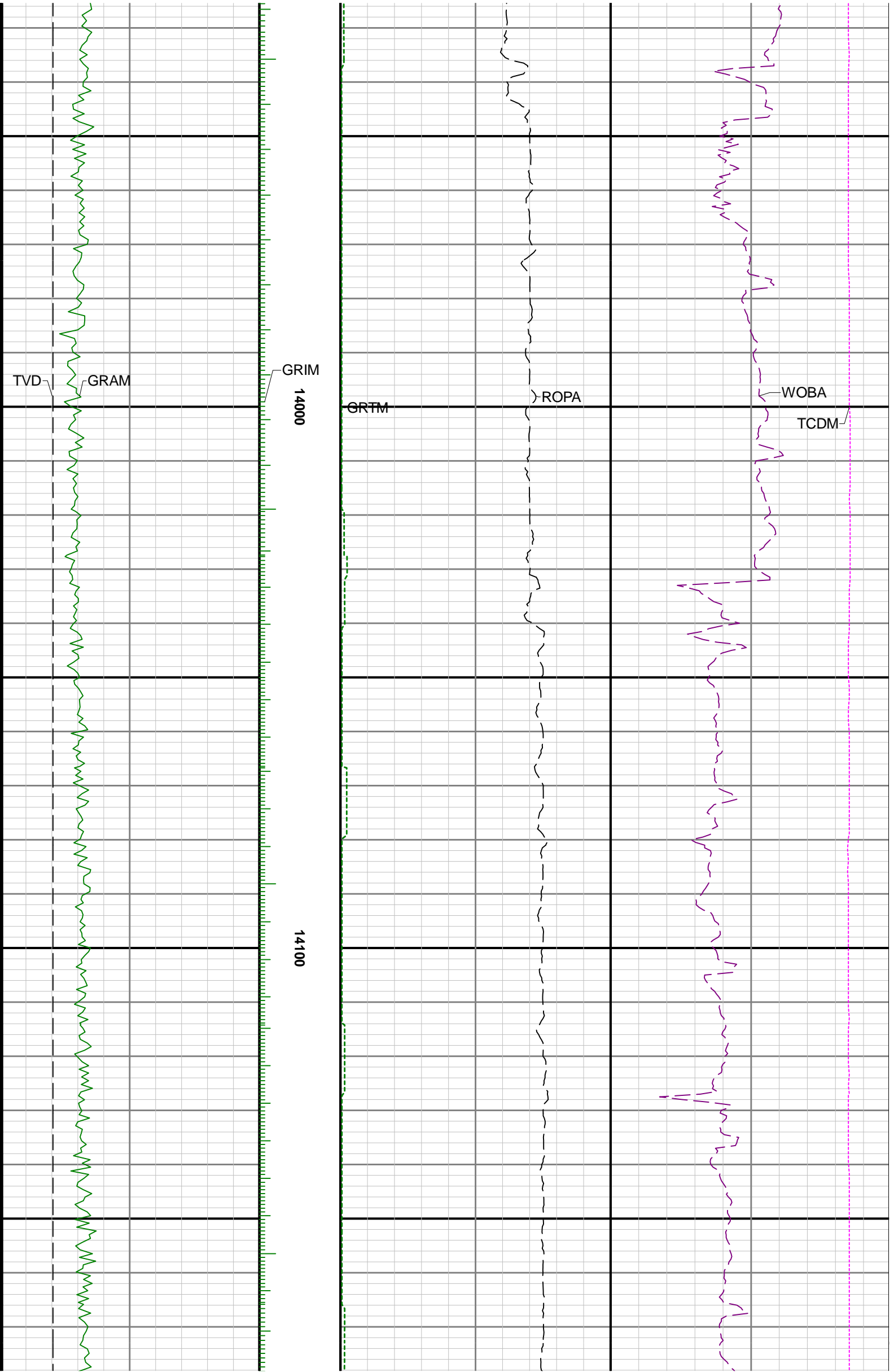


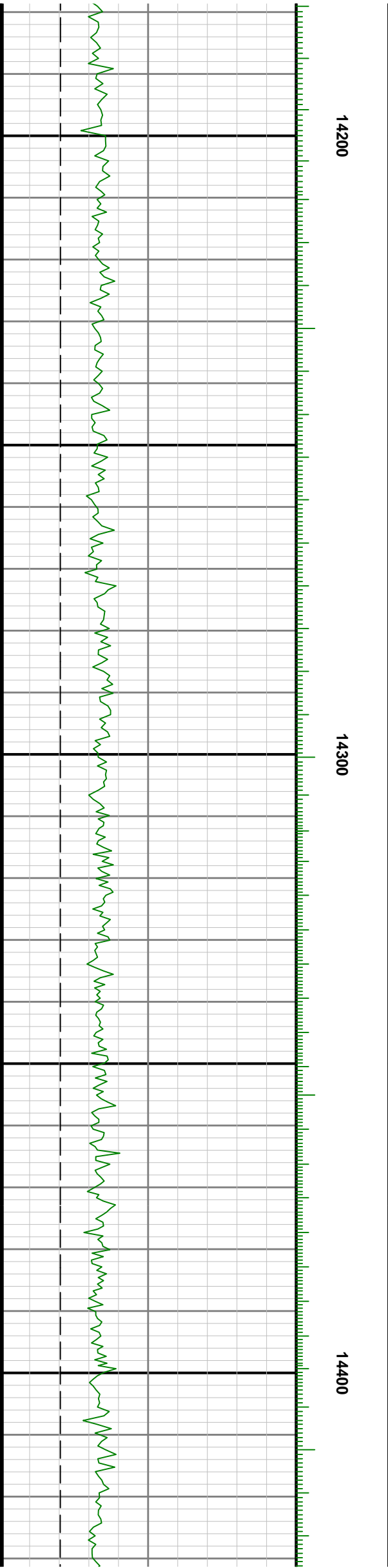
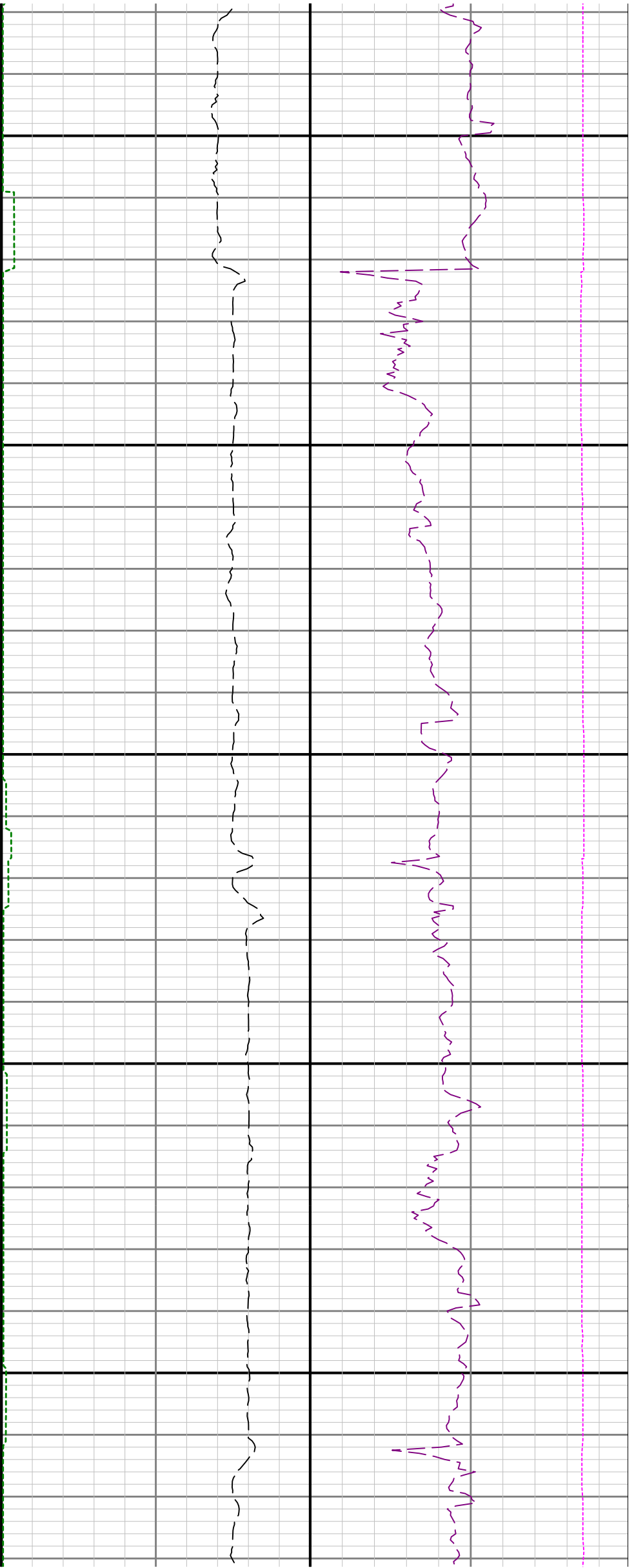
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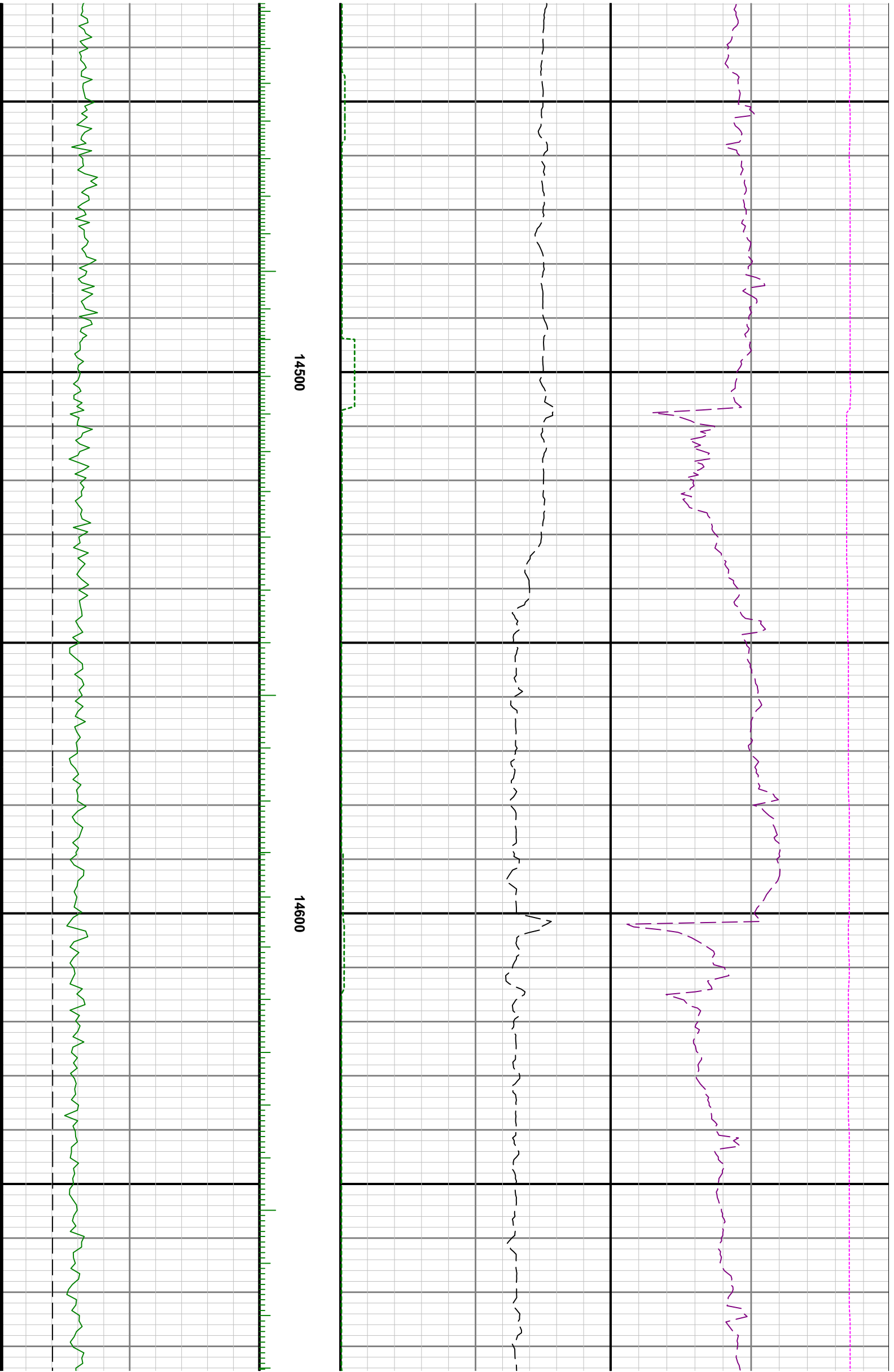
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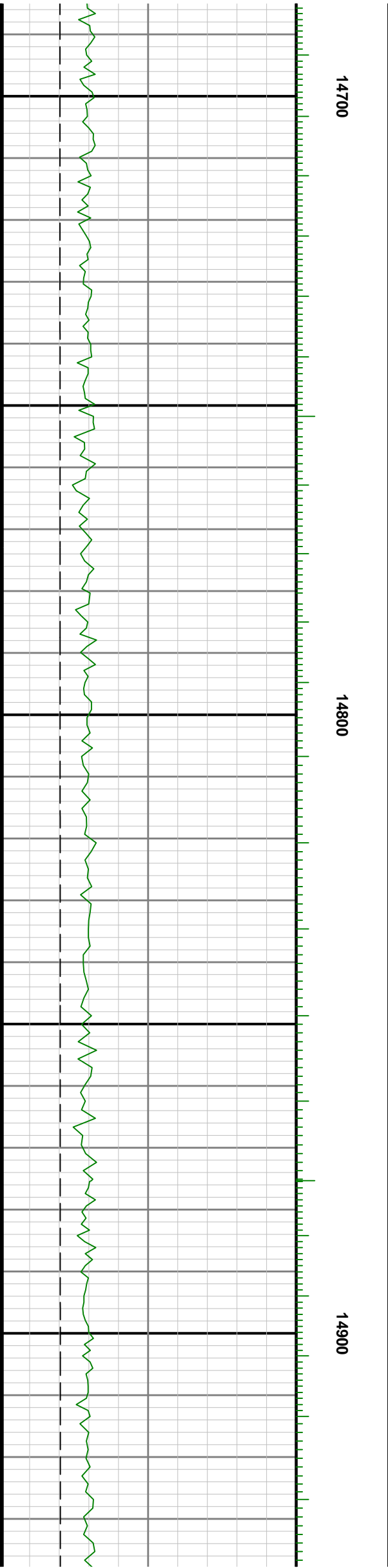
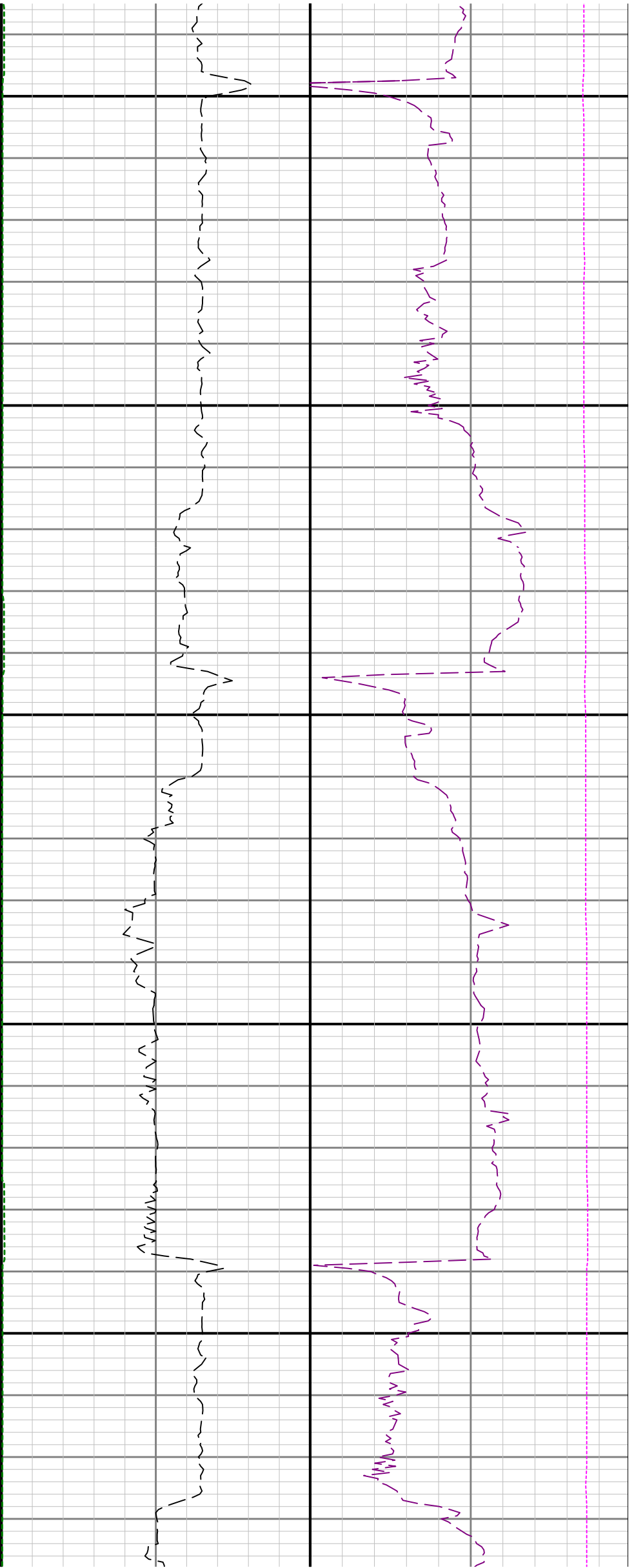
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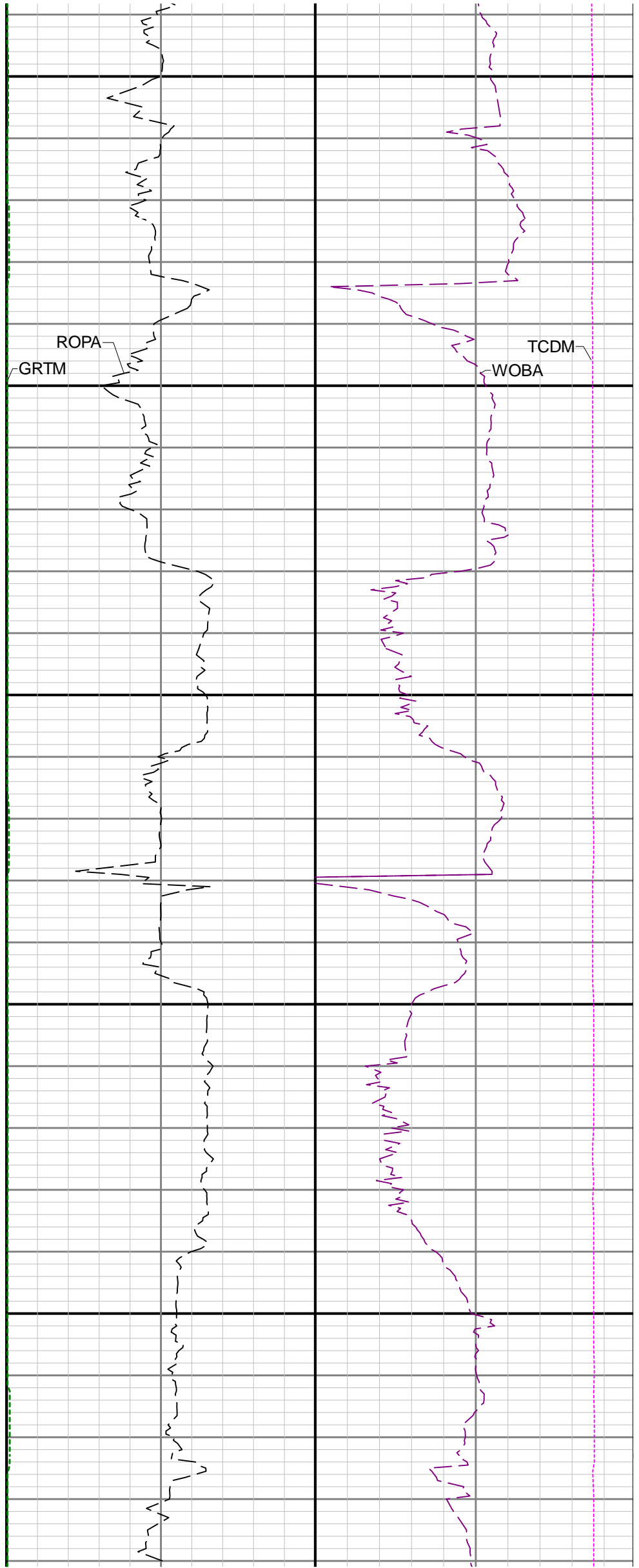
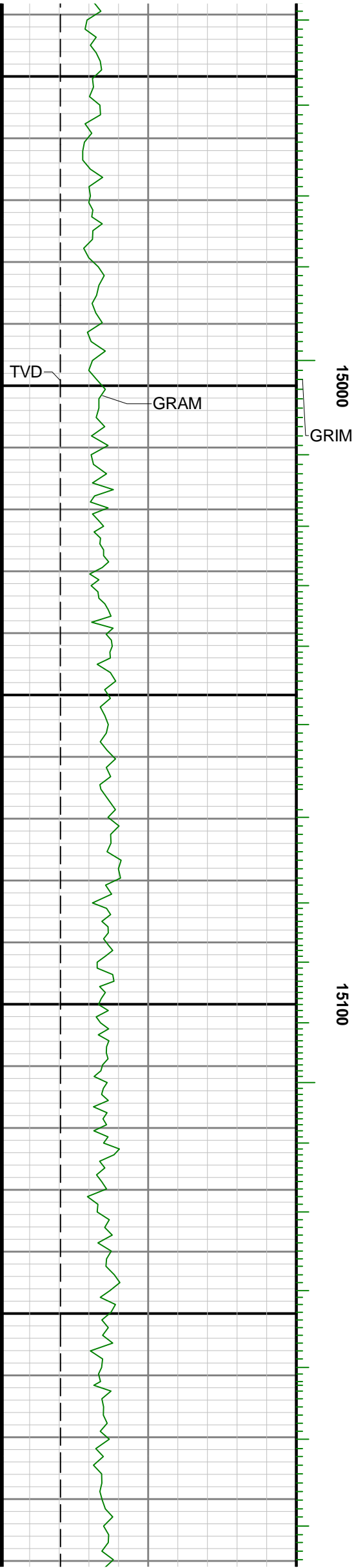


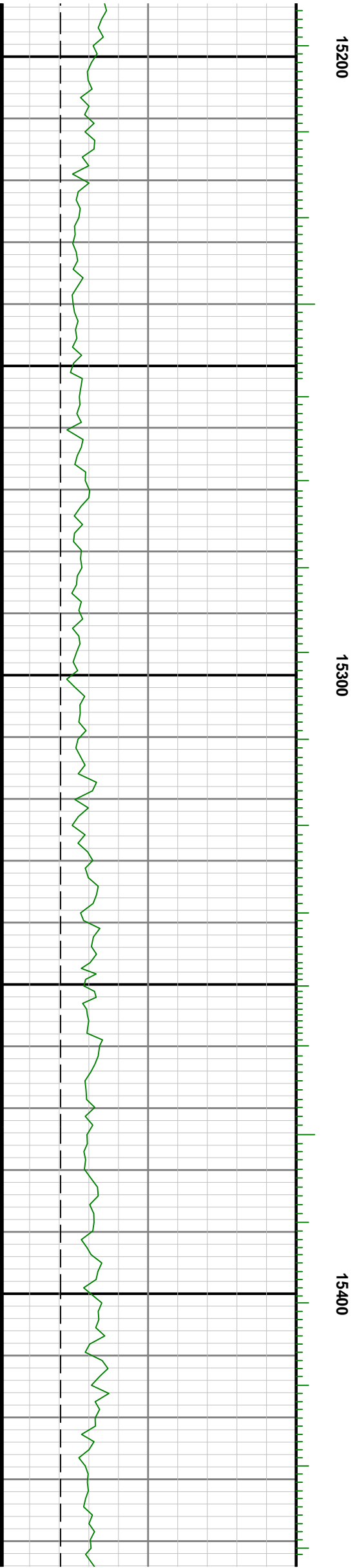
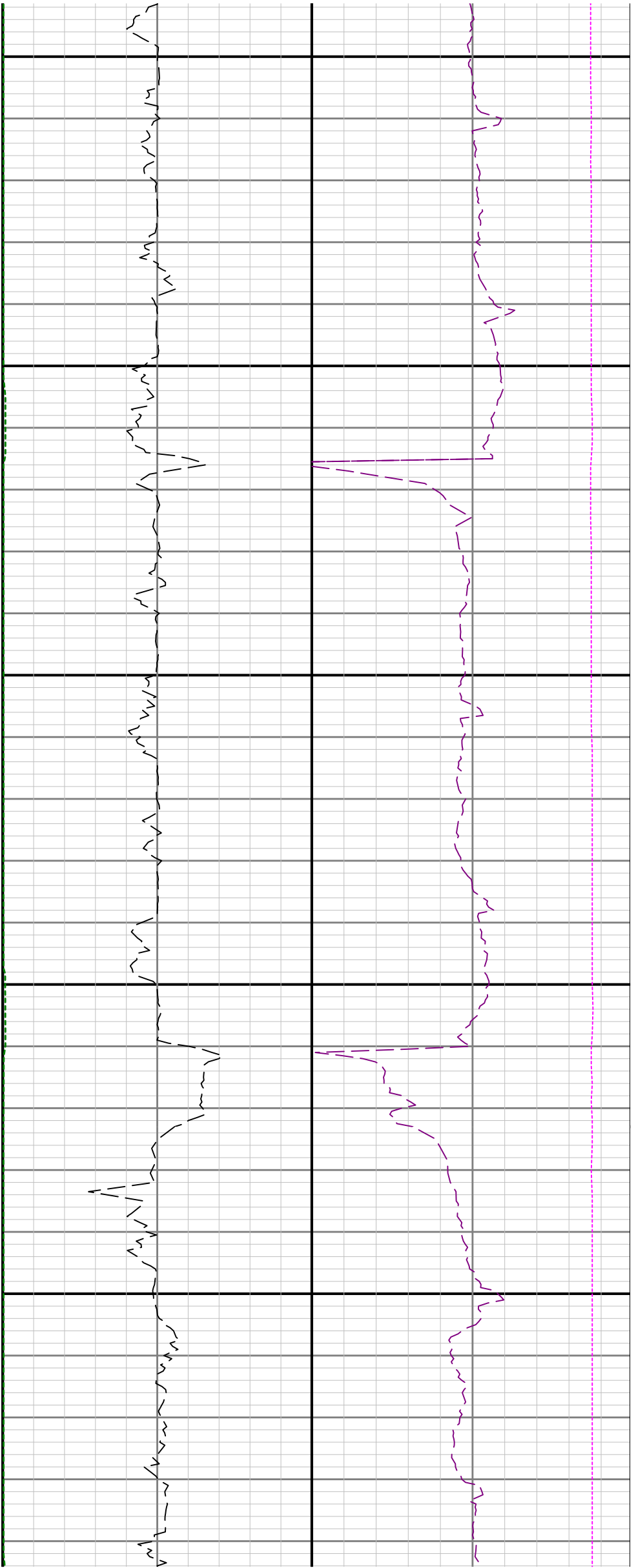


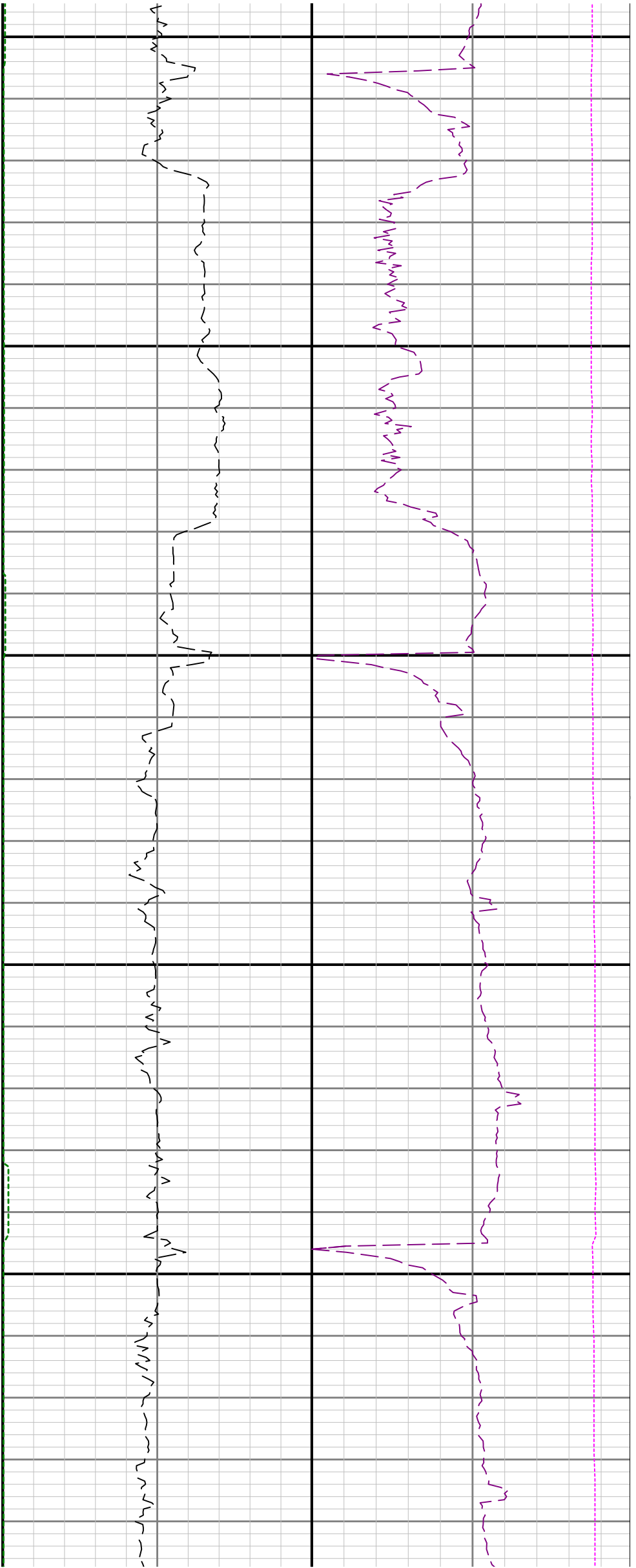








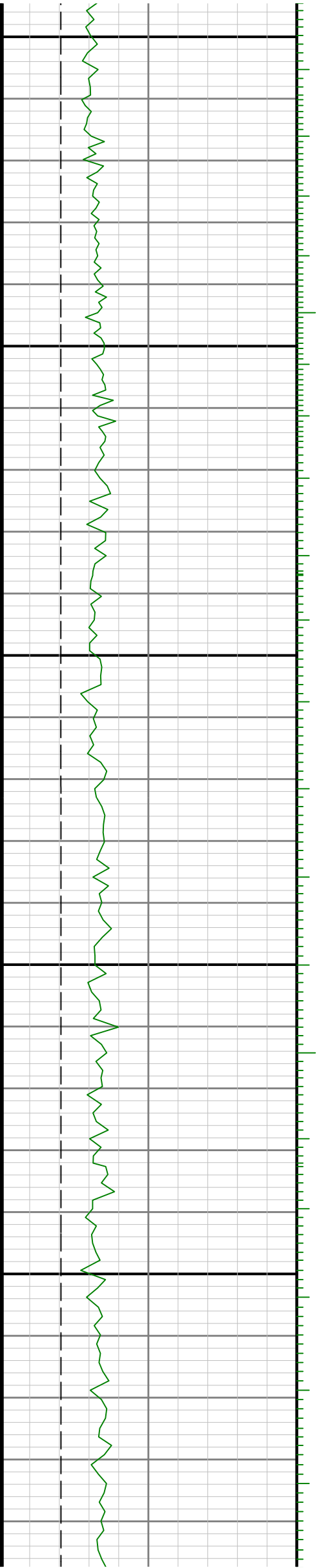


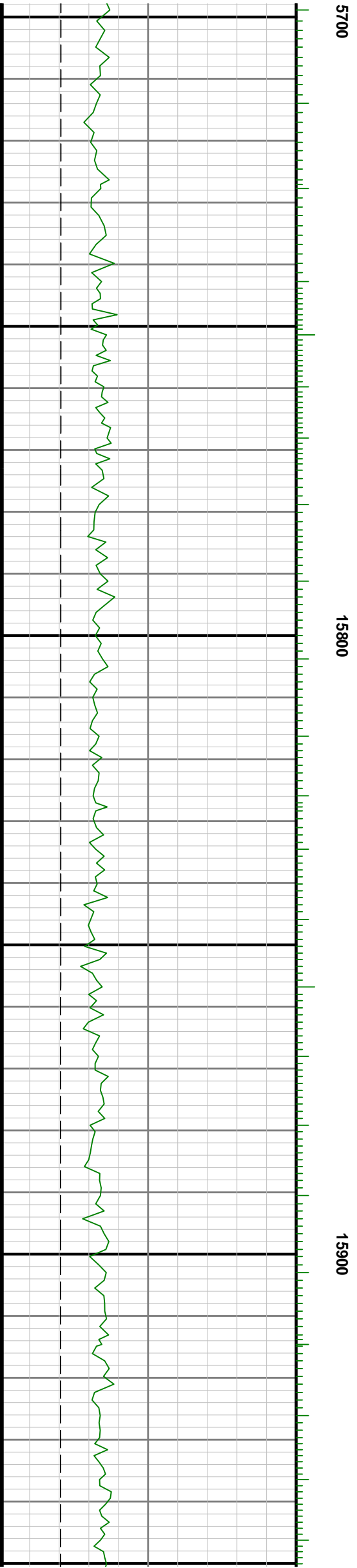
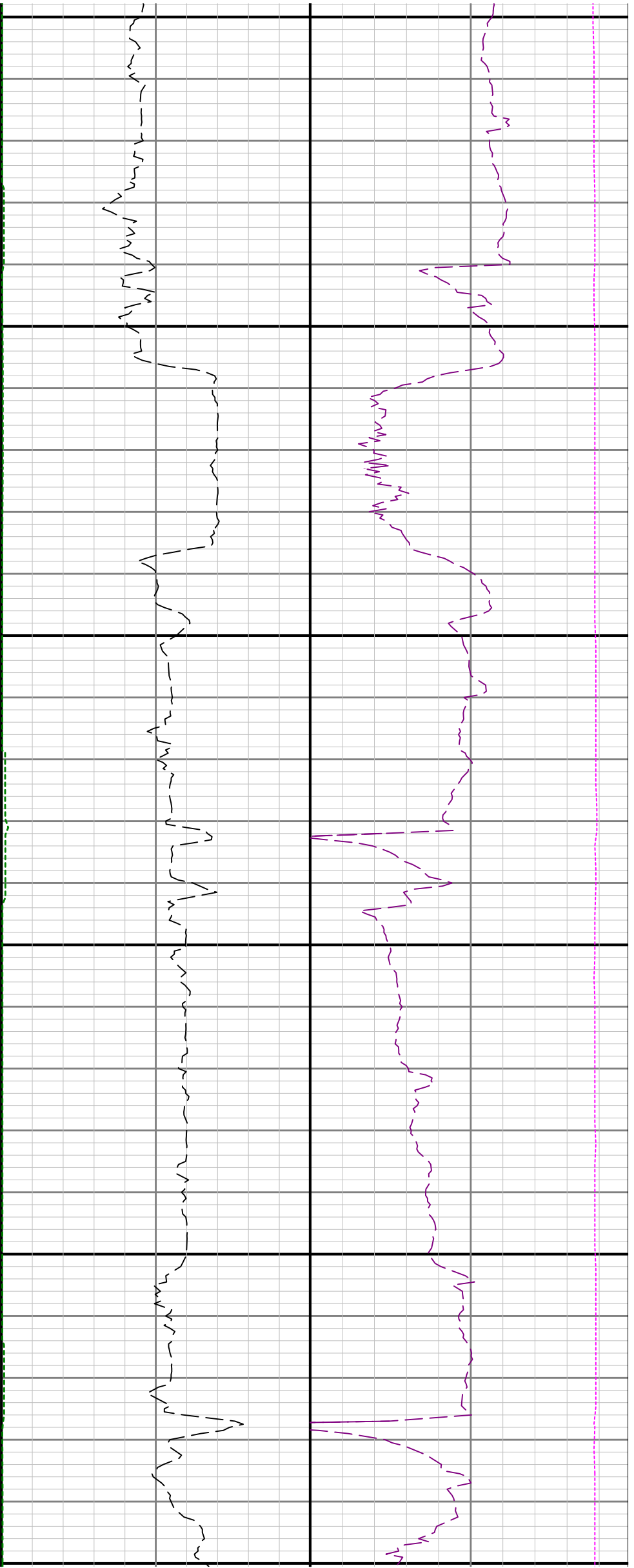


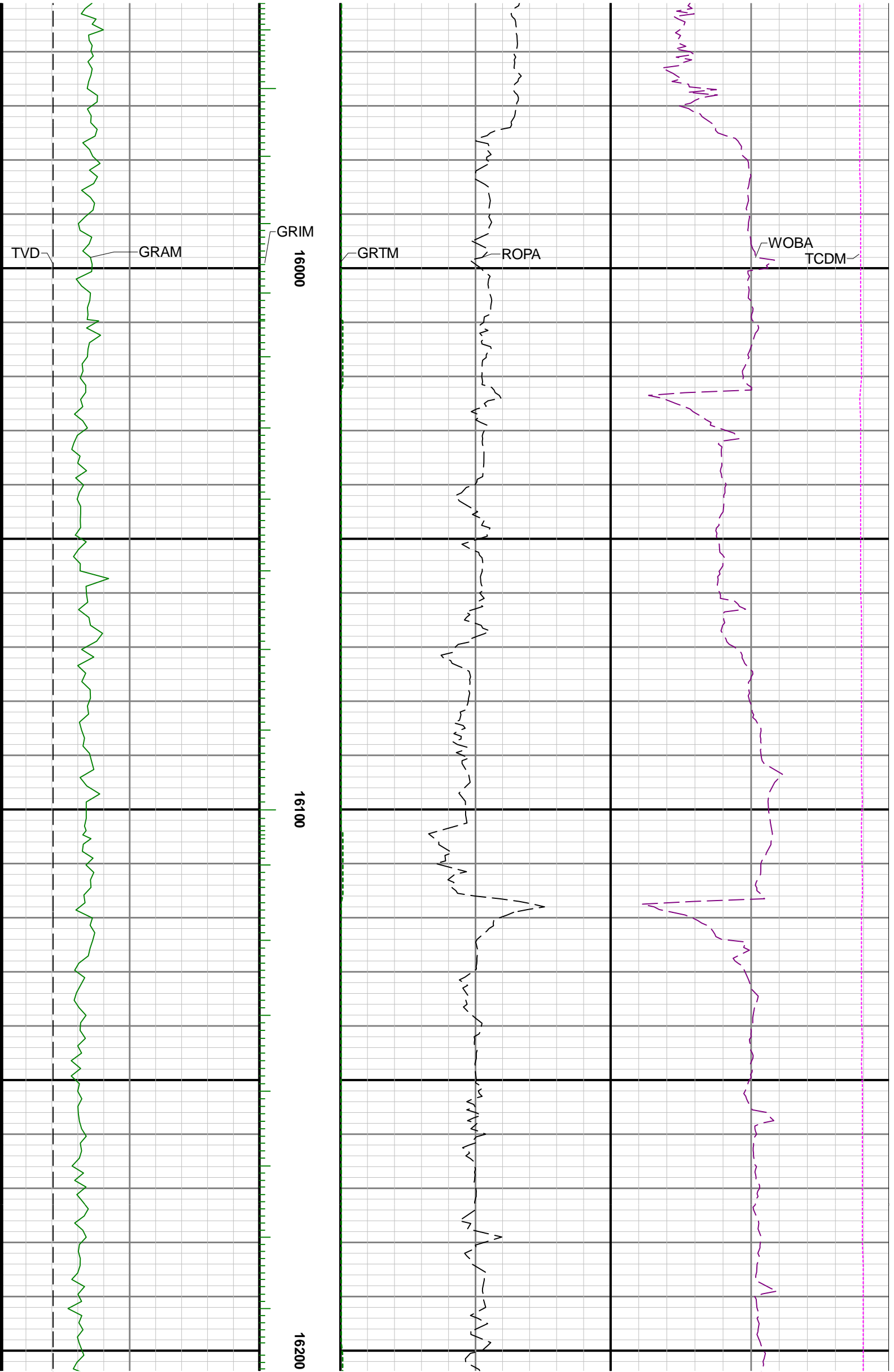
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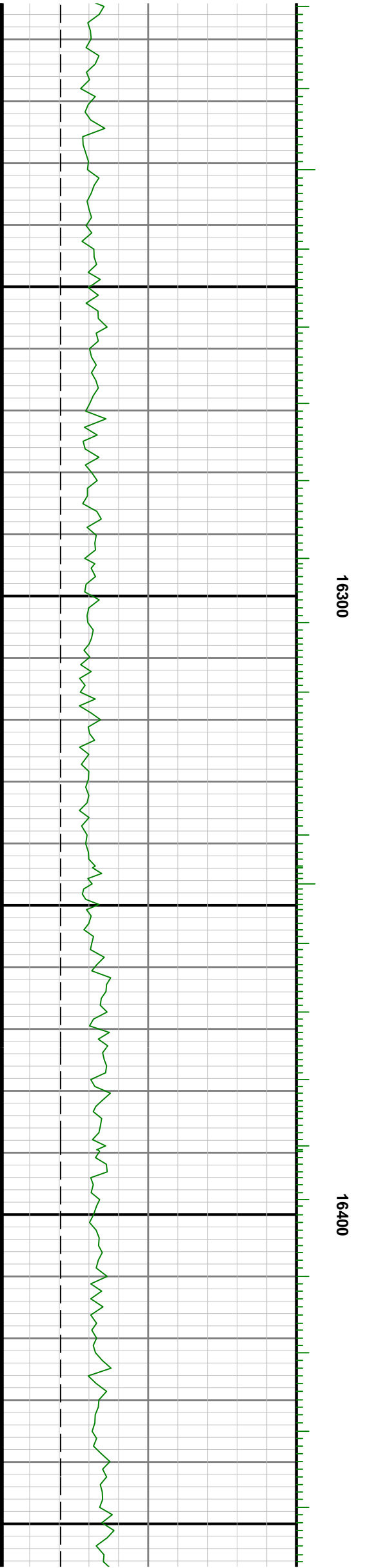
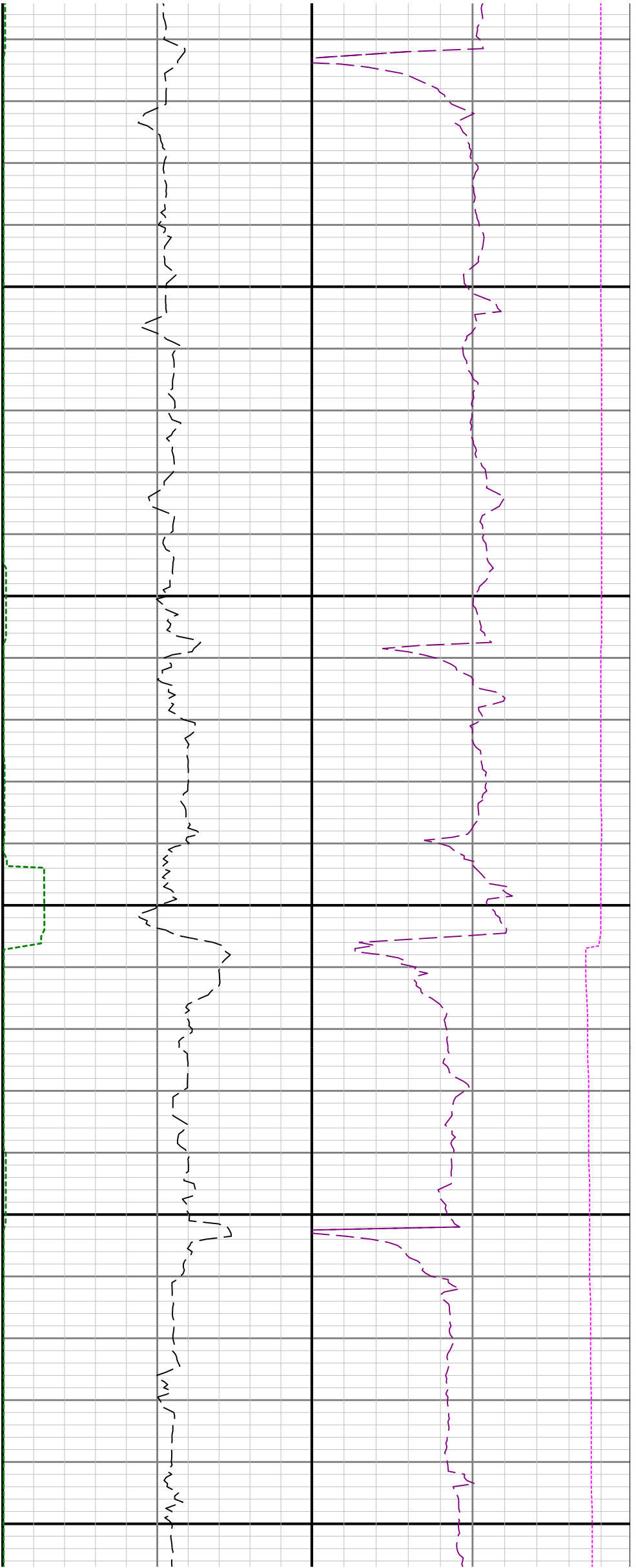
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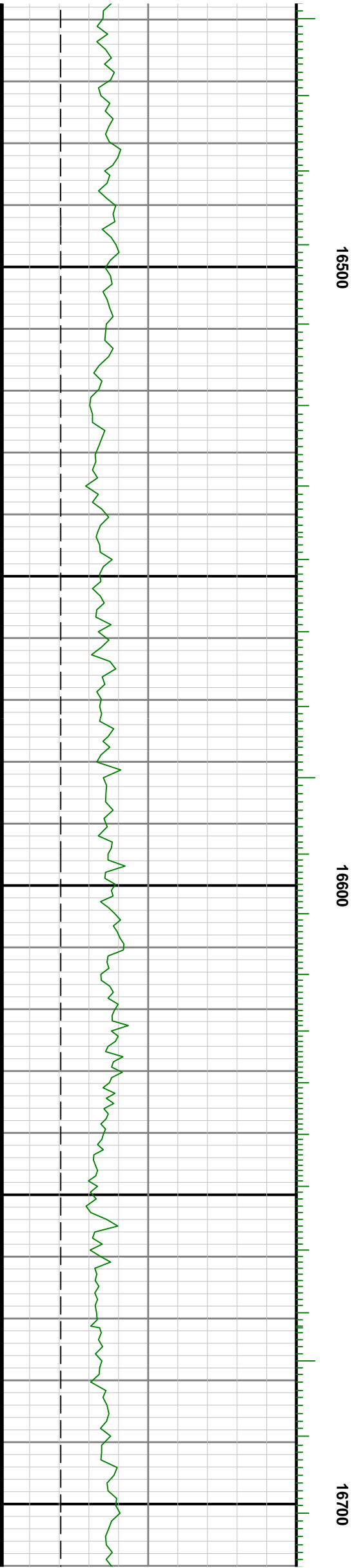
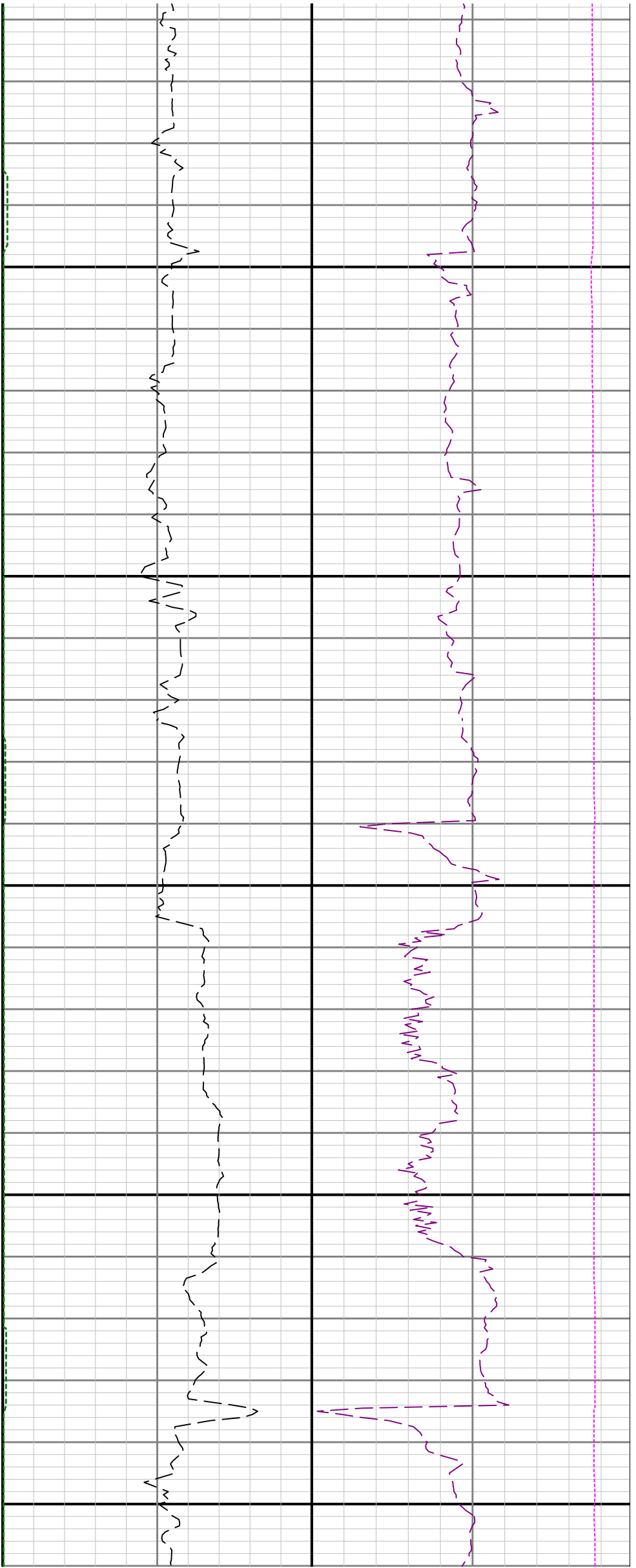
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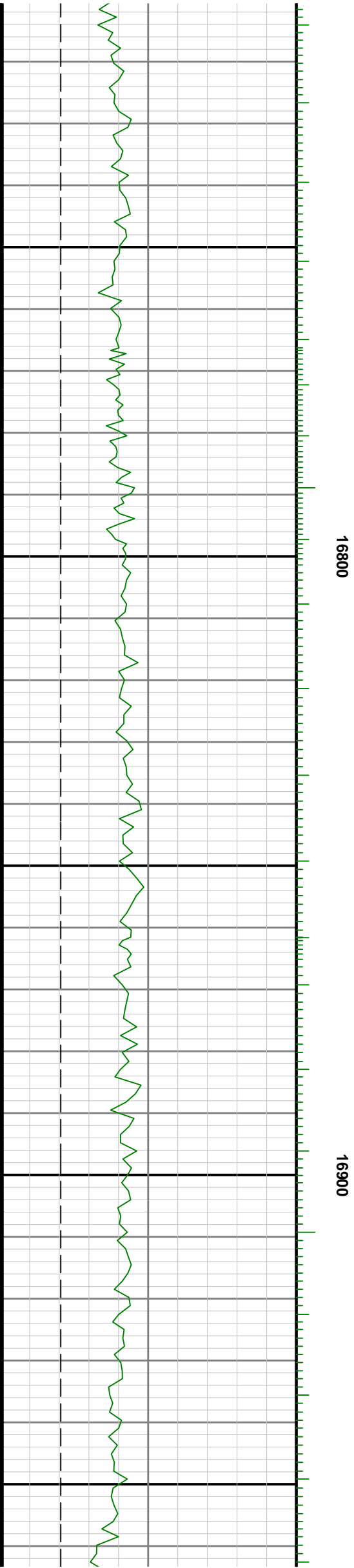
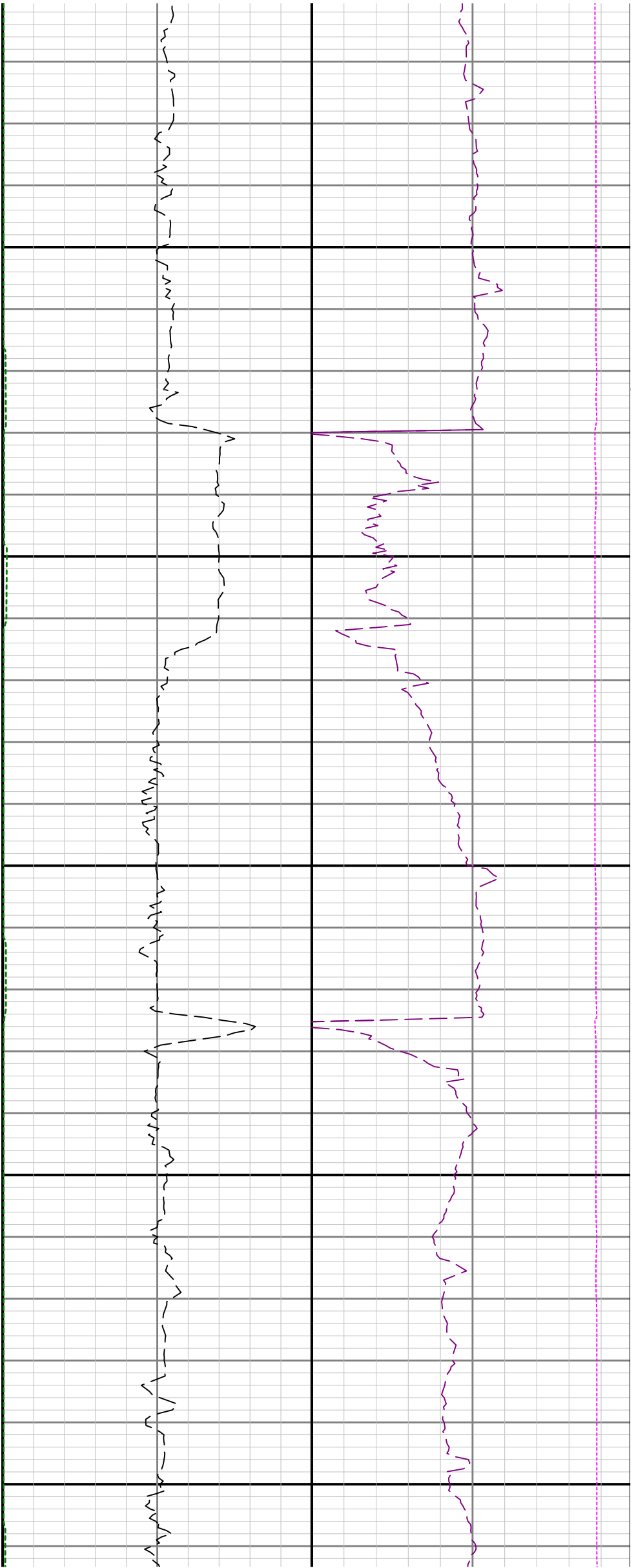


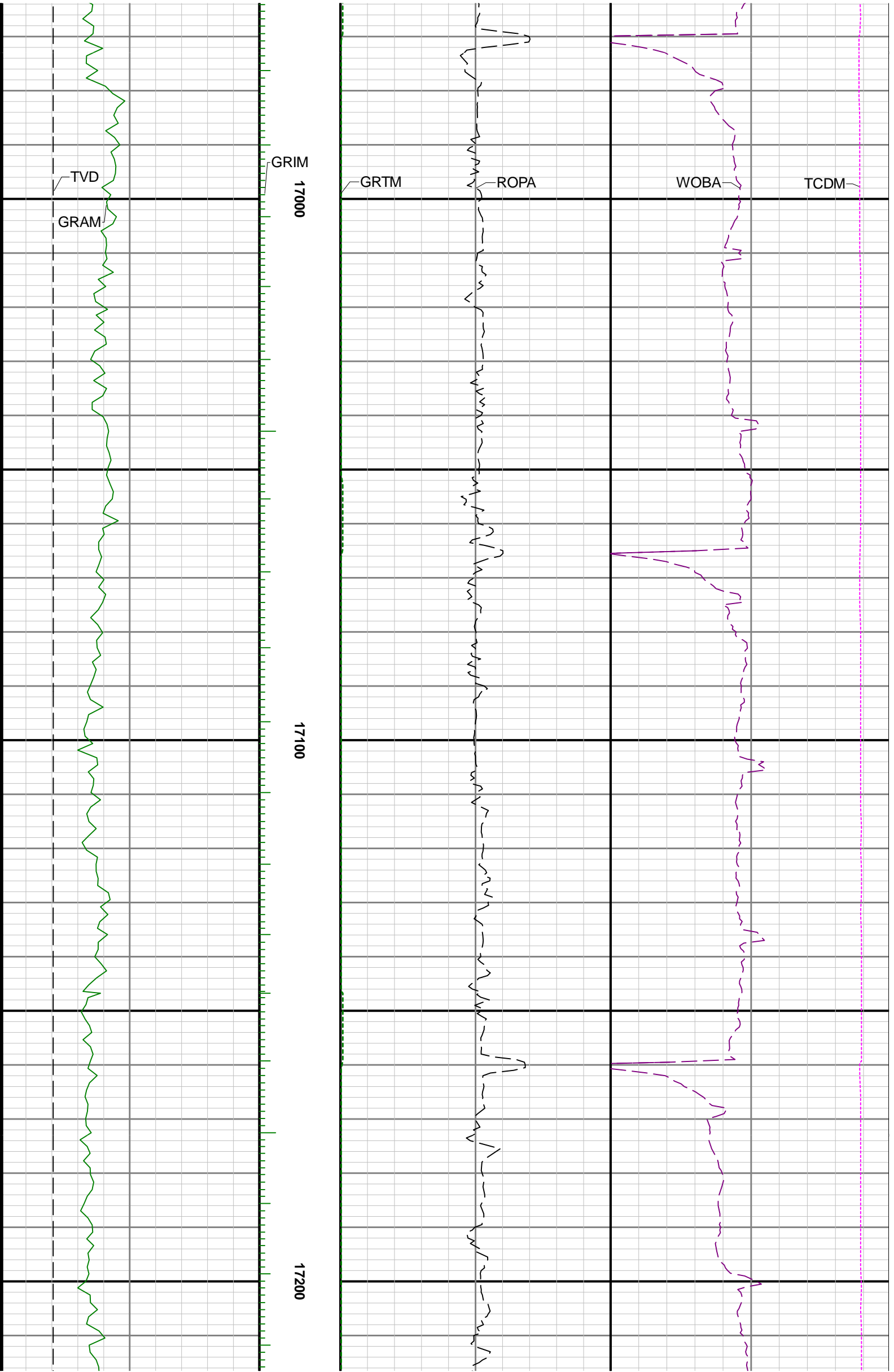


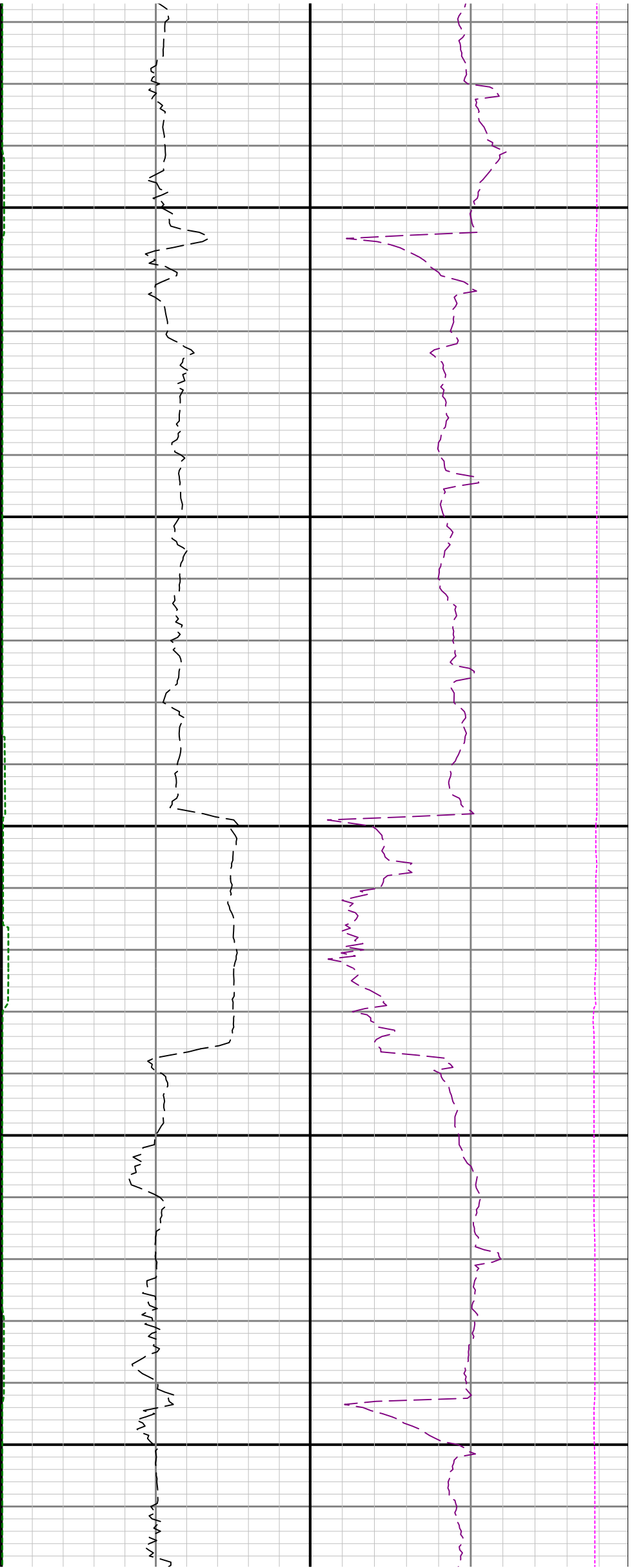












17300

17400

