



## LWD REALTIME/MEMORY LOG

# Gamma Ray

Company: Noble Energy

**Well:** Guttersten State D23-721

Field: **Wattenberg**

|         |      |         |               |
|---------|------|---------|---------------|
| County: | Weld | County: | United States |
|---------|------|---------|---------------|

**Driller's Depth** **State:** **Colorado**

|         |                   |                 |
|---------|-------------------|-----------------|
| Status: | Surface Location: | Other Services: |
|---------|-------------------|-----------------|

Latitude: 040° 12' 20.484" N

PI No: 05-123-48621-00

|      |           |      |    |      |    |      |     |
|------|-----------|------|----|------|----|------|-----|
| bID: | 109870273 | SEC: | 23 | TWN: | 3N | RGE: | 64W |
|------|-----------|------|----|------|----|------|-----|

|                         |                |            |         |           |     |
|-------------------------|----------------|------------|---------|-----------|-----|
| Permanent Datum (P.D.): | Mean Sea Level | Elevation: | 0.00 ft | Elev. KB: | N/A |
|-------------------------|----------------|------------|---------|-----------|-----|

|                  |           |             |            |         |            |
|------------------|-----------|-------------|------------|---------|------------|
| g Measured From: | Rig Floor | Above P.D.: | 4839.00 ft | Elev G: | 4809.00 ft |
|------------------|-----------|-------------|------------|---------|------------|

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|                      |            |
|----------------------|------------|
| Drilled (ft)         | 2019-06-28 |
| Logged (ft)          |            |
| Azi Reference North: |            |
| Grid                 |            |
| Dip Angle: (deg)     | 66.65      |

|            |         |         |                                     |       |
|------------|---------|---------|-------------------------------------|-------|
| 2019-0/-02 | 1966.00 | 1966.00 | Total Magnetic Field Strength: (nT) | 52085 |
| 10p:       | 1966.00 | 1966.00 |                                     |       |

|                 |                  |                  |  |      |
|-----------------|------------------|------------------|--|------|
| Wed: 2019-06-15 | Bottom: 17545.00 | Bottom: 17532.00 | Mag to Reference North Correction: (deg) | 7.44 |
|-----------------|------------------|------------------|--|------|

## Borehole Reco

## Casing Record

| Hole Size (in) | From (ft) | To (ft) | Size (in) | Weight (lb/ft) | From (ft) | To (ft) |
|----------------|-----------|---------|-----------|----------------|-----------|---------|
|----------------|-----------|---------|-----------|----------------|-----------|---------|

|        |       |         |       |       |       |         |
|--------|-------|---------|-------|-------|-------|---------|
| 13.500 | 30.00 | 1966.00 | 9.625 | 36.00 | 30.00 | 1956.00 |
|        |       |         |       |       |       |         |

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|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

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## Record

## Deviation Record

| Type | From (ft) | To (ft) | Hole Size (in) | Interval (ft) | Inc   Az (Start) | Inc   Az (End) |
|------|-----------|---------|----------------|---------------|------------------|----------------|
|------|-----------|---------|----------------|---------------|------------------|----------------|

|           |         |          |       |          |      |        |       |        |
|-----------|---------|----------|-------|----------|------|--------|-------|--------|
| Based Mud | 1966.00 | 17545.00 | 8.500 | 15579.00 | 0.96 | 315.62 | 90.09 | 354.09 |
|-----------|---------|----------|-------|----------|------|--------|-------|--------|

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## Acquisition System

## Software Version

RT 5.2 Rlg: H&P 517

|                 |            |           |     |                               |             |
|-----------------|------------|-----------|-----|-------------------------------|-------------|
|                 | 1.0.0720.1 | Cornwall. | BMA | Helmreich & Layle Printing Co | Leitch, D&C |
| University Cell |            | Dickson.  |     |                               |             |

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## Log Run Summary

| Run No | Bit Run No. | Bit Size<br>(in) | Bit Type | Bit Gauge Length<br>(in) | Assembly Type    | Logged Interval |          | Bit Depth Interval |          | Date / Time      |                  | Circ. Hours |
|--------|-------------|------------------|----------|--------------------------|------------------|-----------------|----------|--------------------|----------|------------------|------------------|-------------|
|        |             |                  |          |                          |                  | Top             | Bottom   | From               | To       | Start Logging    | End Logging      |             |
|        |             |                  |          |                          |                  | (ft)            | (ft)     | (ft)               | (ft)     |                  |                  |             |
| 1      | 1           | 8.500            | PDC      | 3.00                     | Rotary Steerable | 1966.00         | 17099.00 | 1966.00            | 17112.00 | 2019-06-28 21:15 | 2019-07-01 23:05 | 66.93       |
| 2      | 2           | 8.500            | PDC      | 3.00                     | Rotary Steerable | 17099.00        | 17532.00 | 17112.00           | 17545.00 | 2019-07-02 17:40 | 2019-07-02 19:45 | 5.16        |

| Crew   |     |
|--------|-----|
| Member | Age |
| 1      | 25  |
| 2      | 28  |
| 3      | 30  |
| 4      | 32  |
| 5      | 35  |
| 6      | 38  |
| 7      | 40  |
| 8      | 42  |
| 9      | 45  |
| 10     | 48  |
| 11     | 50  |
| 12     | 52  |
| 13     | 55  |
| 14     | 58  |
| 15     | 60  |
| 16     | 62  |
| 17     | 65  |
| 18     | 68  |
| 19     | 70  |
| 20     | 72  |
| 21     | 75  |
| 22     | 78  |
| 23     | 80  |
| 24     | 82  |
| 25     | 85  |
| 26     | 88  |
| 27     | 90  |
| 28     | 92  |
| 29     | 95  |
| 30     | 98  |
| 31     | 100 |
| 32     | 102 |
| 33     | 105 |
| 34     | 108 |
| 35     | 110 |
| 36     | 112 |
| 37     | 115 |
| 38     | 118 |
| 39     | 120 |
| 40     | 122 |
| 41     | 125 |
| 42     | 128 |
| 43     | 130 |
| 44     | 132 |
| 45     | 135 |
| 46     | 138 |
| 47     | 140 |
| 48     | 142 |
| 49     | 145 |
| 50     | 148 |
| 51     | 150 |
| 52     | 152 |
| 53     | 155 |
| 54     | 158 |
| 55     | 160 |
| 56     | 162 |
| 57     | 165 |
| 58     | 168 |
| 59     | 170 |
| 60     | 172 |
| 61     | 175 |
| 62     | 178 |
| 63     | 180 |
| 64     | 182 |
| 65     | 185 |
| 66     | 188 |
| 67     | 190 |
| 68     | 192 |
| 69     | 195 |
| 70     | 198 |
| 71     | 200 |
| 72     | 202 |
| 73     | 205 |
| 74     | 208 |
| 75     | 210 |
| 76     | 212 |
| 77     | 215 |
| 78     | 218 |
| 79     | 220 |
| 80     | 222 |
| 81     | 225 |
| 82     | 228 |
| 83     | 230 |
| 84     | 232 |
| 85     | 235 |
| 86     | 238 |
| 87     | 240 |
| 88     | 242 |
| 89     | 245 |
| 90     | 248 |
| 91     | 250 |
| 92     | 252 |
| 93     | 255 |
| 94     | 258 |
| 95     | 260 |
| 96     | 262 |
| 97     | 265 |
| 98     | 268 |
| 99     | 270 |
| 100    | 272 |
| 101    | 275 |
| 102    | 278 |
| 103    | 280 |
| 104    | 282 |
| 105    | 285 |
| 106    | 288 |
| 107    | 290 |
| 108    | 292 |
| 109    | 295 |
| 110    | 298 |
| 111    | 300 |
| 112    | 302 |
| 113    | 305 |
| 114    | 308 |
| 115    | 310 |
| 116    | 312 |
| 117    | 315 |
| 118    | 318 |
| 119    | 320 |
| 120    | 322 |
| 121    | 325 |
| 122    | 328 |
| 123    | 330 |
| 124    | 332 |
| 125    | 335 |
| 126    | 338 |
| 127    | 340 |
| 128    | 342 |
| 129    | 345 |
| 130    | 348 |
| 131    | 350 |
| 132    | 352 |
| 133    | 355 |
| 134    | 358 |
| 135    | 360 |
| 136    | 362 |
| 137    | 365 |
| 138    | 368 |
| 139    | 370 |
| 140    | 372 |
| 141    | 375 |
| 142    | 378 |
| 143    | 380 |
| 144    | 382 |
| 145    | 385 |
| 146    | 388 |
| 147    | 390 |
| 148    | 392 |
| 149    | 395 |
| 150    | 398 |
| 151    | 400 |
| 152    | 402 |
| 153    | 405 |
| 154    | 408 |
| 155    | 410 |
| 156    | 412 |
| 157    | 415 |
| 158    | 418 |
| 159    | 420 |
| 160    | 422 |
| 161    | 425 |
| 162    | 428 |
| 163    | 430 |
| 164    | 432 |
| 165    | 435 |
| 166    | 438 |
| 167    | 440 |
|        |     |

| Name        | Arrive<br>Wellsite | Depart<br>Wellsite | Name         | Arrive<br>Wellsite | Depart<br>Wellsite | Name | Arrive<br>Wellsite | Depart<br>Wellsite |
|-------------|--------------------|--------------------|--------------|--------------------|--------------------|------|--------------------|--------------------|
| Andrew Hays | 2019-06-28         | 2019-07-01         | Adam Schlenz | 2019-07-01         | 2019-07-03         |      |                    |                    |

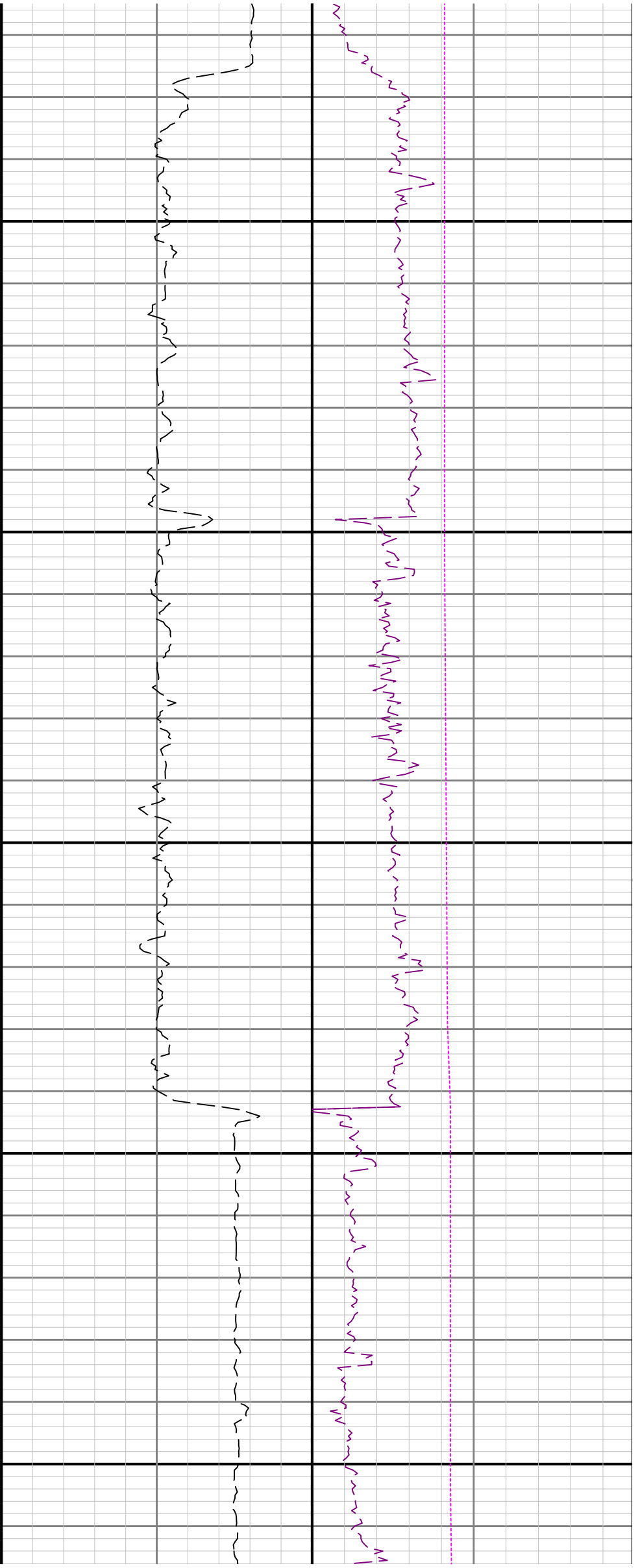
### Mud Properties Record

| Date / Time      | Run No. | Depth<br>(ft) | Mud Type      | Density<br>(ppg) | viscosity<br>(cP) | pH  | Fluid Loss<br>(cm3) | Oil / Water | Source     | Total Chlorides<br>(ppm) | K+<br>(%) |
|------------------|---------|---------------|---------------|------------------|-------------------|-----|---------------------|-------------|------------|--------------------------|-----------|
| 2019-06-28 15:00 | 1       | 1966.00       | Oil Based Mud | 9.3              | 14                | N/A | 24.0                | 72/15.5     | Active Pit | 21380                    | 0.00      |
| 2019-06-29 15:00 | 1       | 6650.00       | Oil Based Mud | 9.2              | 11                | N/A | 16.0                | 69/20.5     | Active Pit | 24295                    | 0.00      |
| 2019-06-30 15:00 | 1       | 11050.00      | Oil Based Mud | 9.5              | 12                | N/A | 16.0                | 69/19       | Active Pit | 25753                    | 0.00      |
| 2019-07-01 12:30 | 1       | 14882.00      | Oil Based Mud | 9.5              | 14                | N/A | 16.0                | 68/20       | Active Pit | 26239                    | 0.00      |
| 2019-07-02 15:00 | 2       | 17112.00      | Oil Based Mud | 9.5              | 15                | N/A | 18.0                | 68.5/19     | Active Pit | 25753                    | 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 | 14502006      | Near Bit Inclination | 5.93               | 6.73            | 7.000         | 4.330         |
| 1       | AutoTrak Curve Steering Unit | 14502006      | Near Bit VSS         | 5.93               | 6.73            | 7.000         | 4.330         |
| 1       | AutoTrak Curve MWD           | 14270075      | Gamma (single)       | 2.75               | 12.90           | 6.875         | 3.250         |
| 1       | AutoTrak Curve MWD           | 14270075      | Directional (mag)    | 12.27              | 22.42           | 6.875         | 3.250         |
| 2       | AutoTrak Curve Steering Unit | 14891521      | Near Bit Inclination | 5.93               | 6.73            | 7.000         | 4.330         |

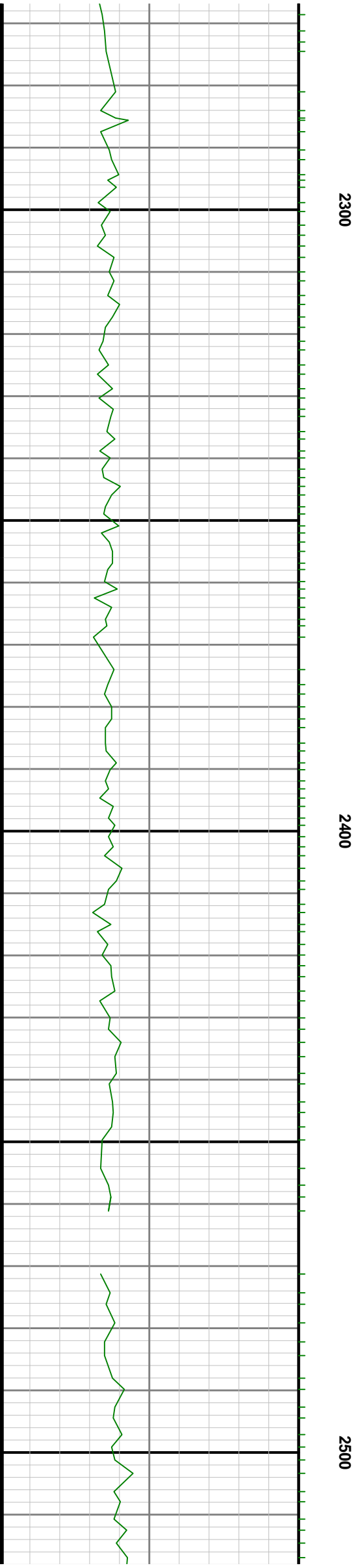
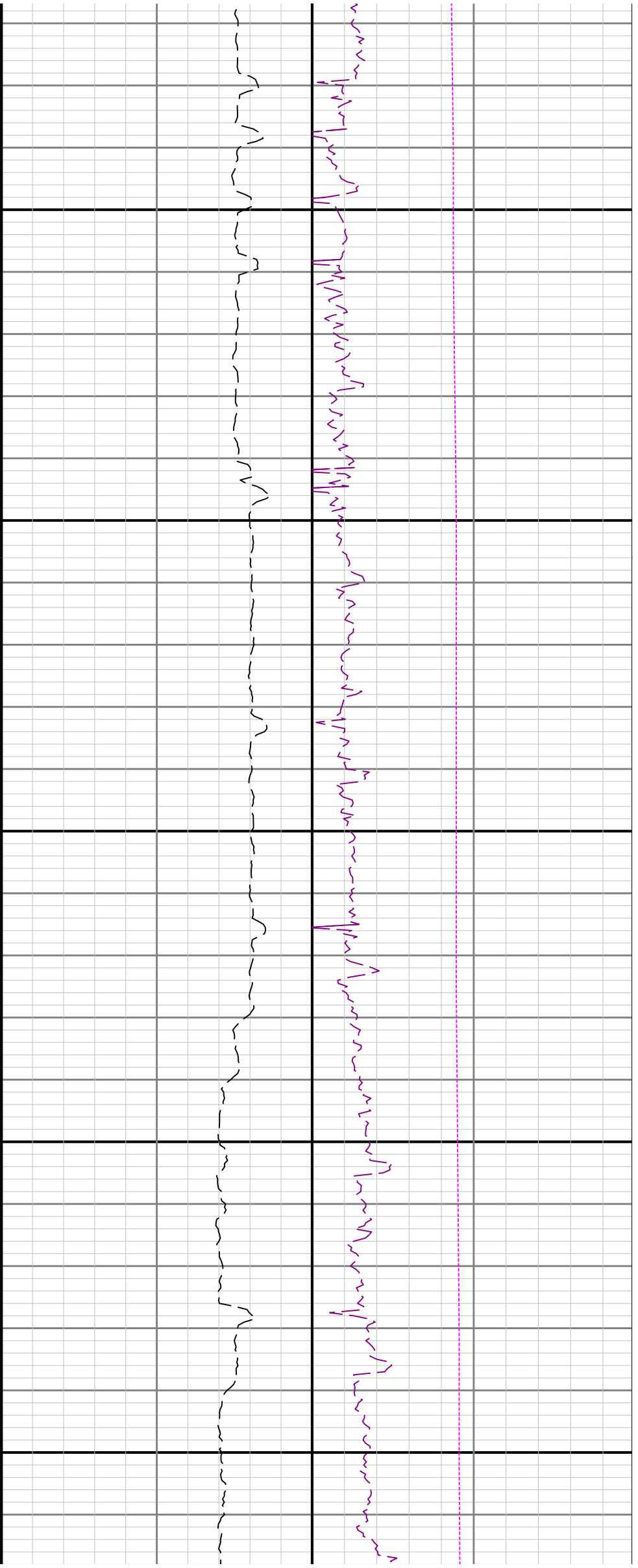


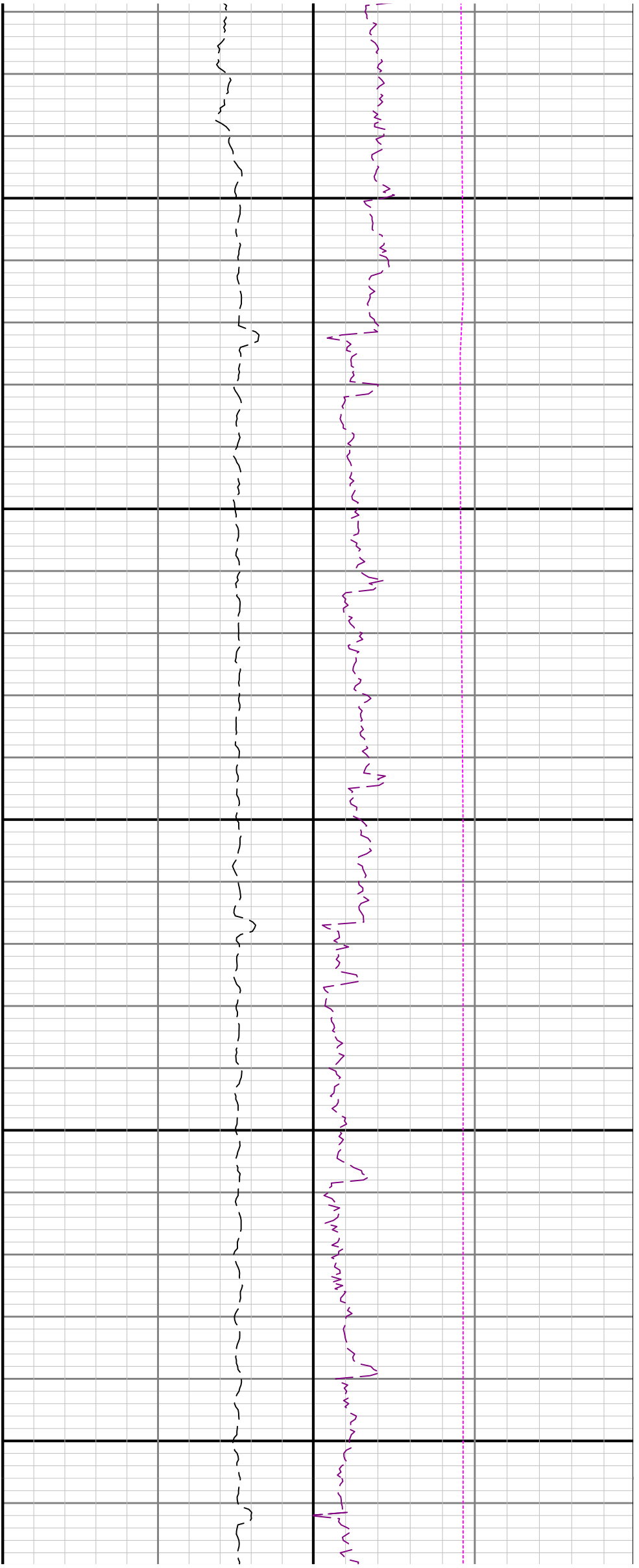


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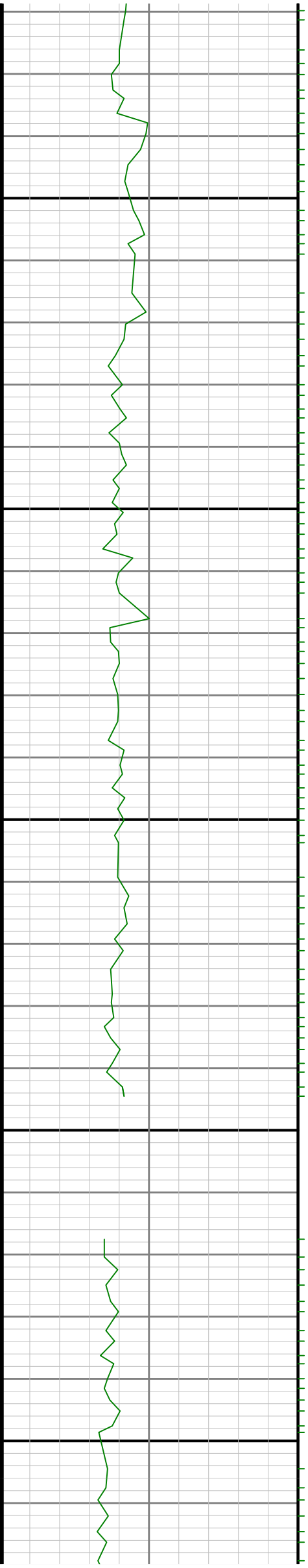


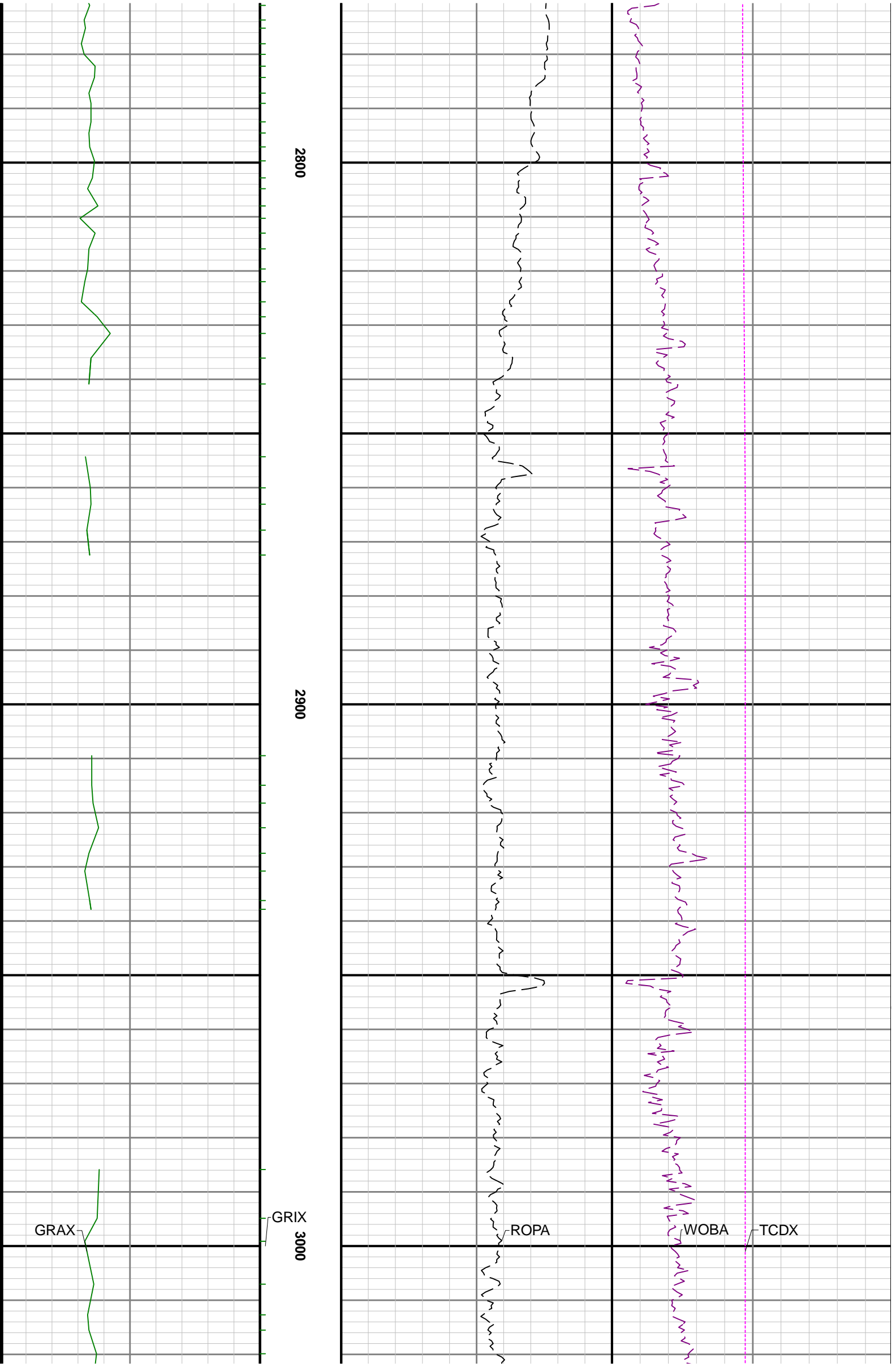


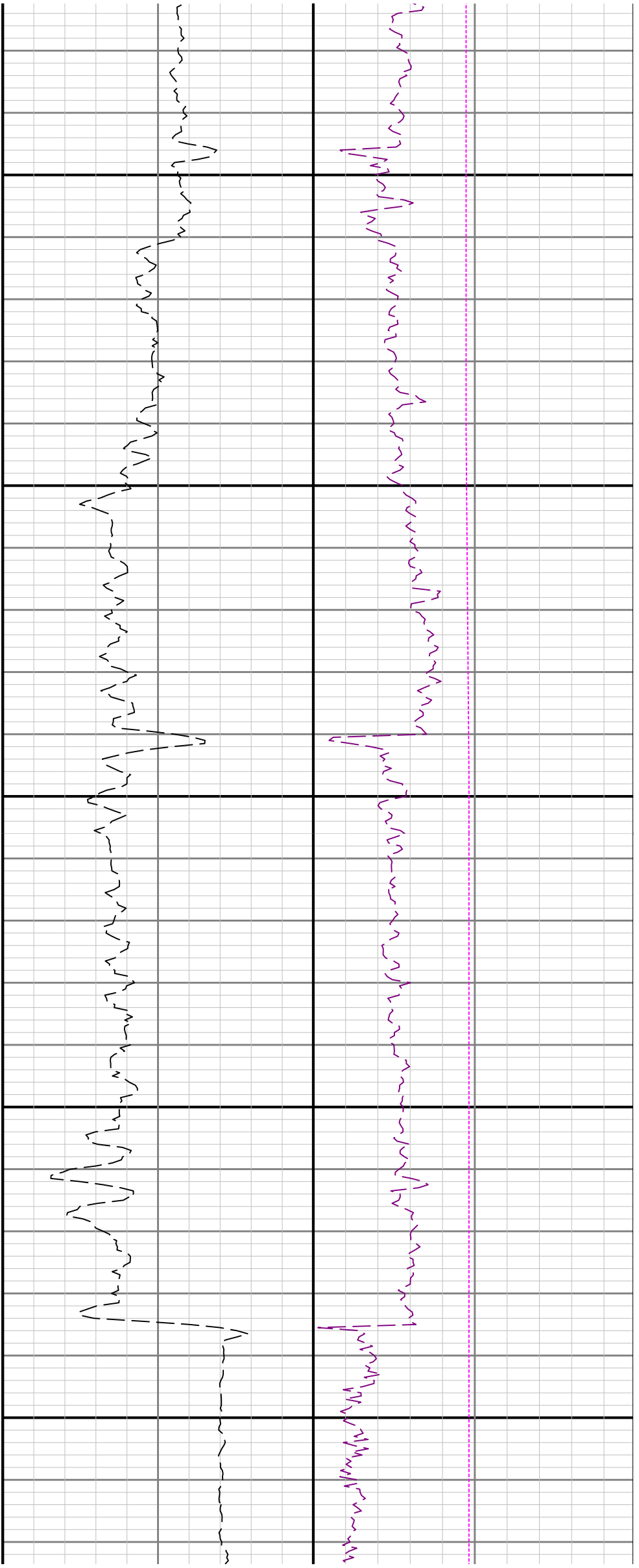


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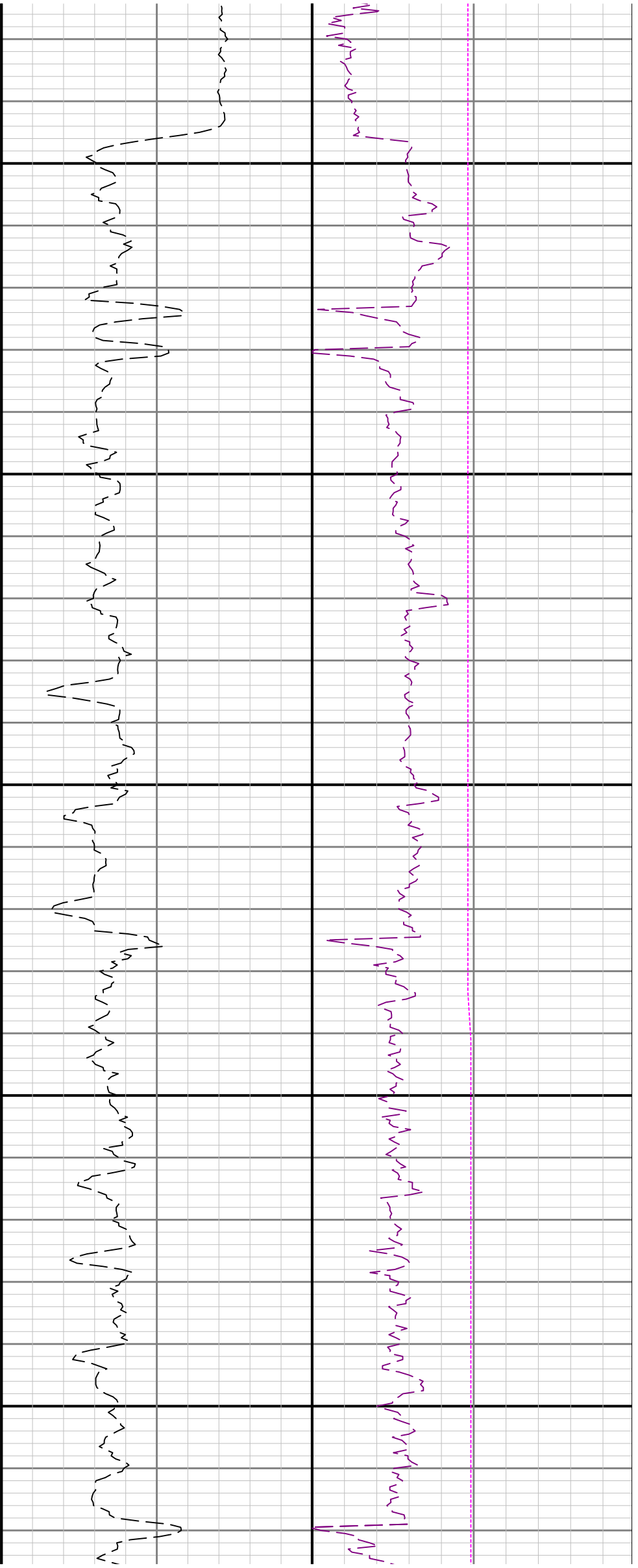




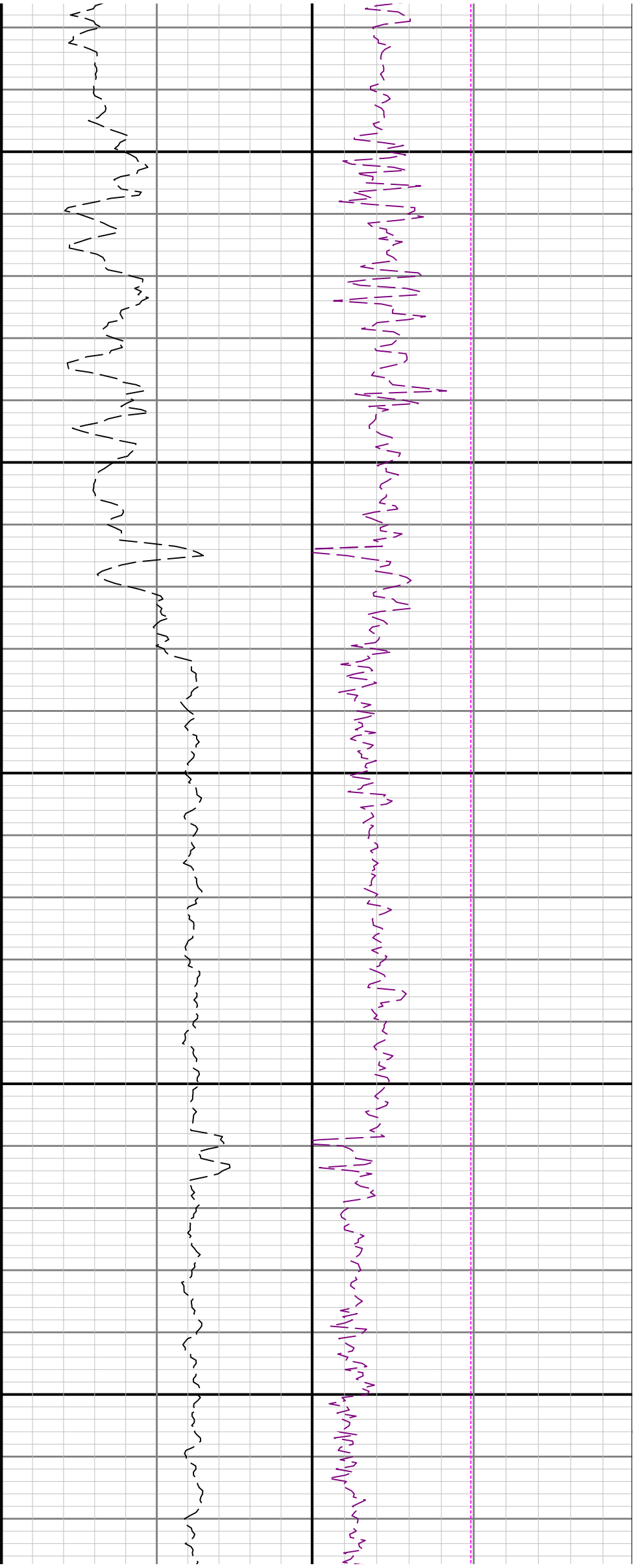
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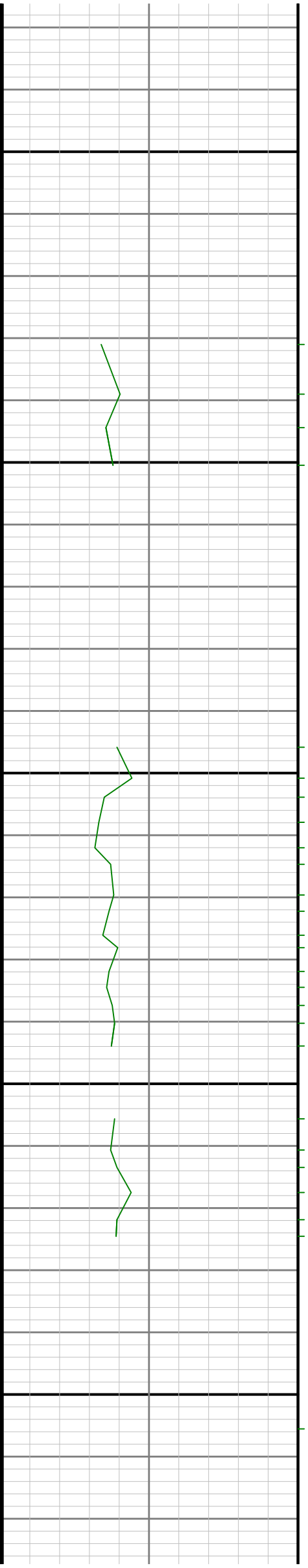


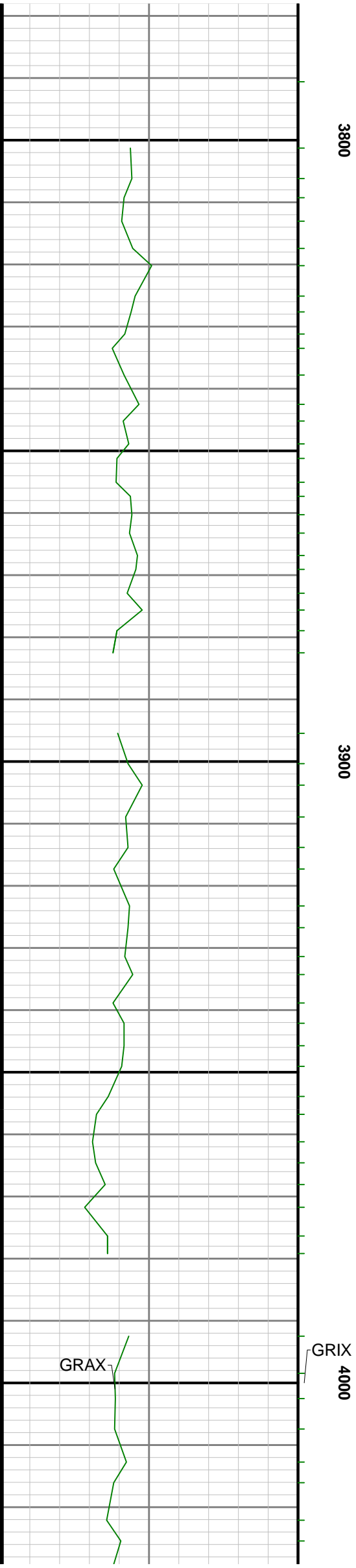
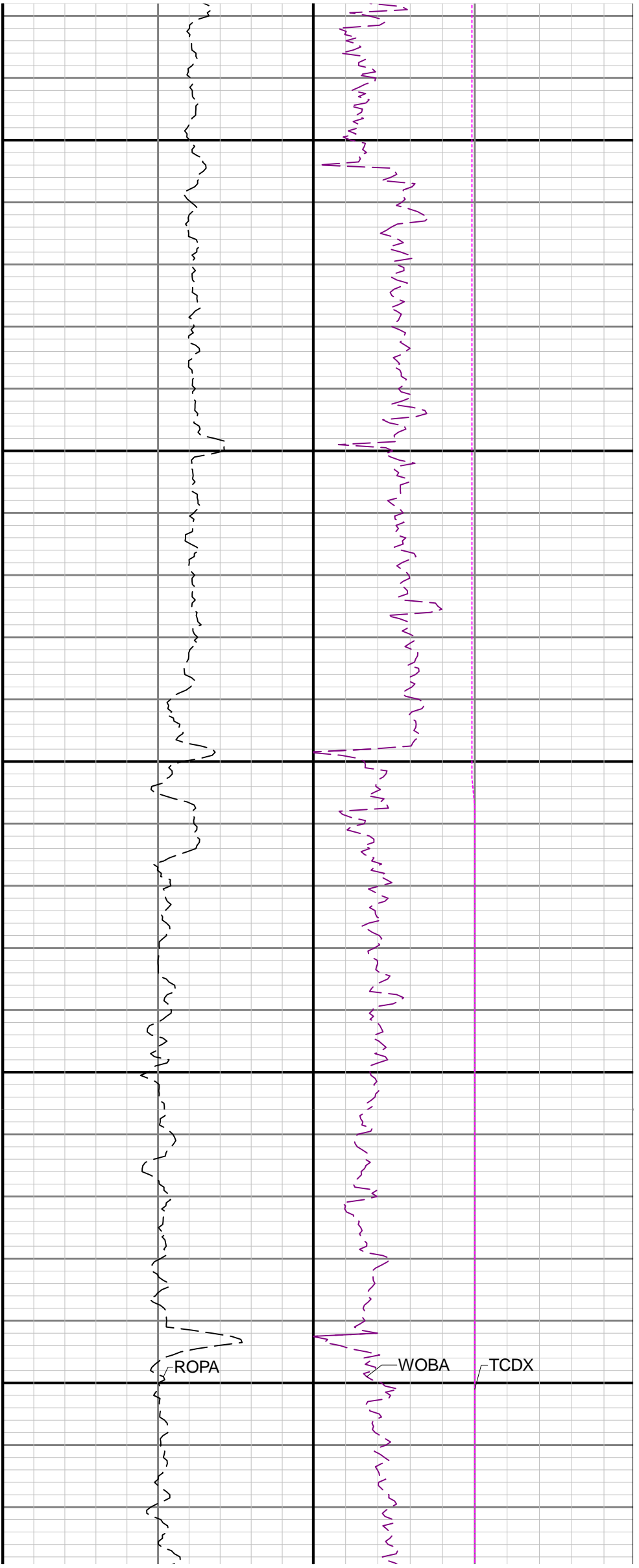


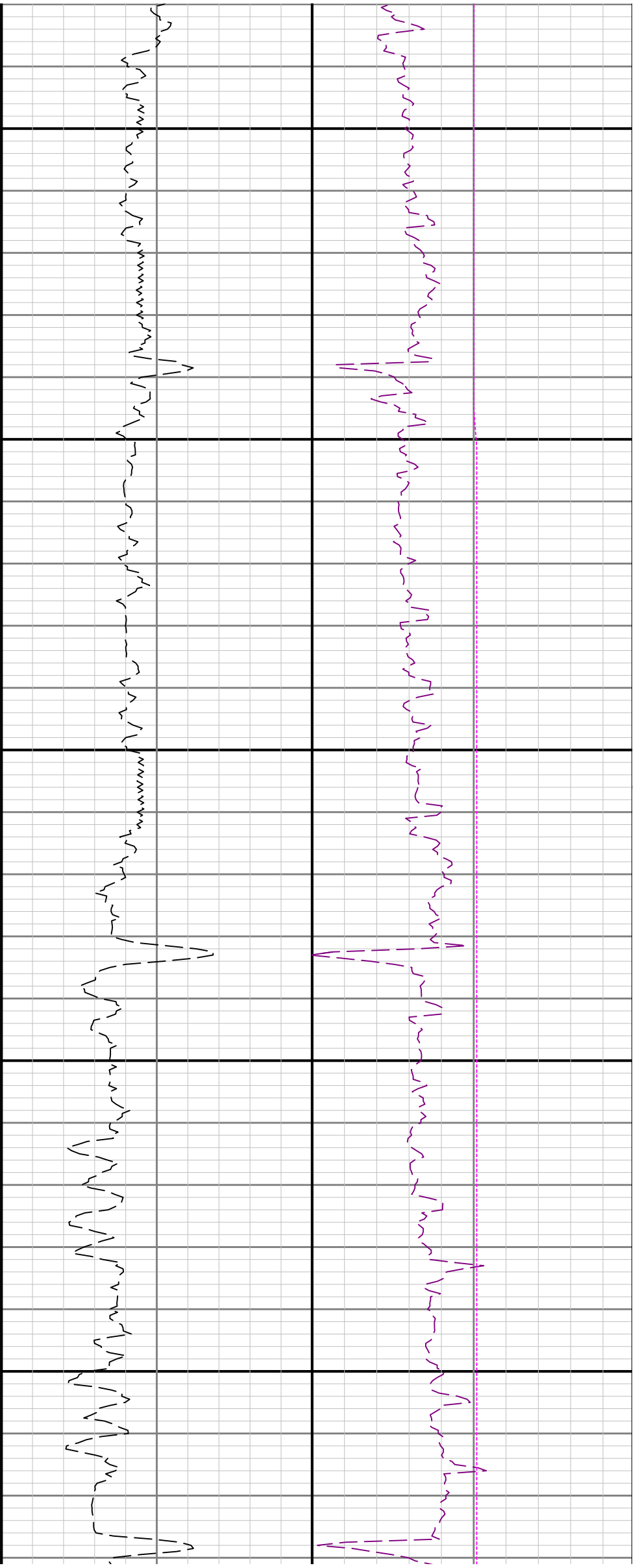


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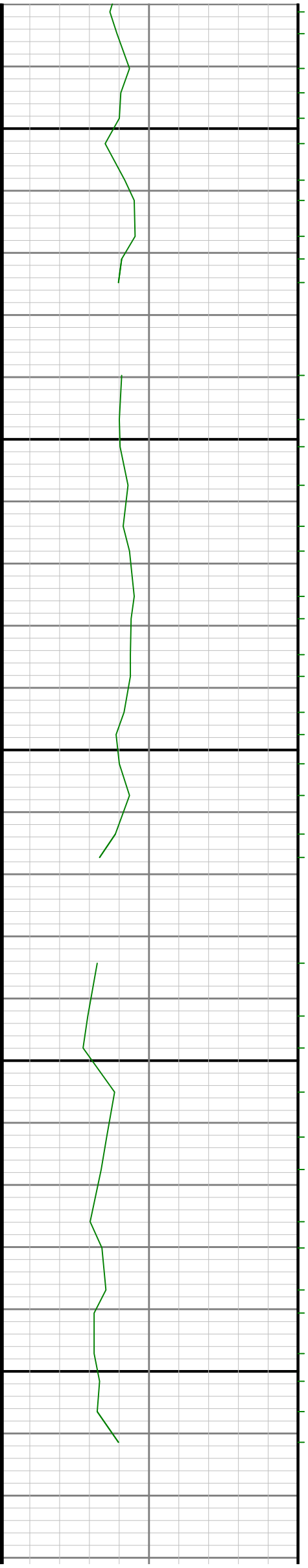


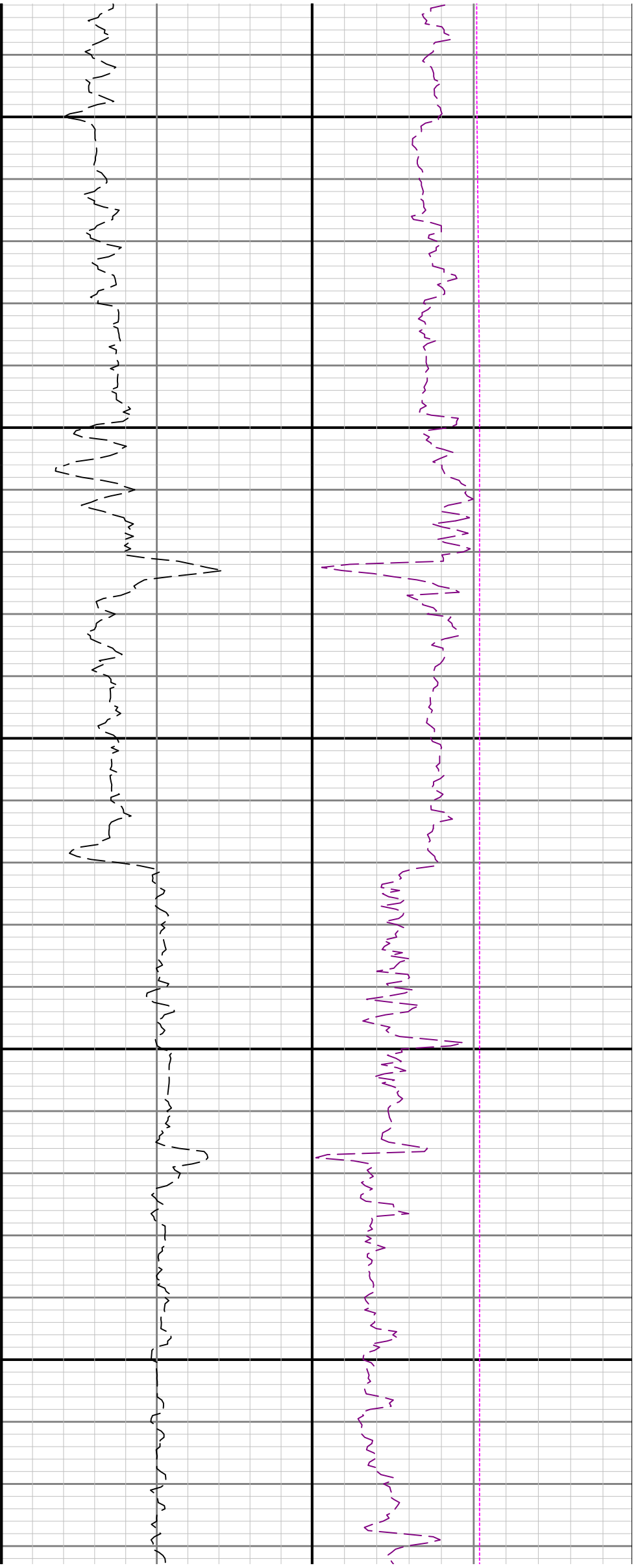




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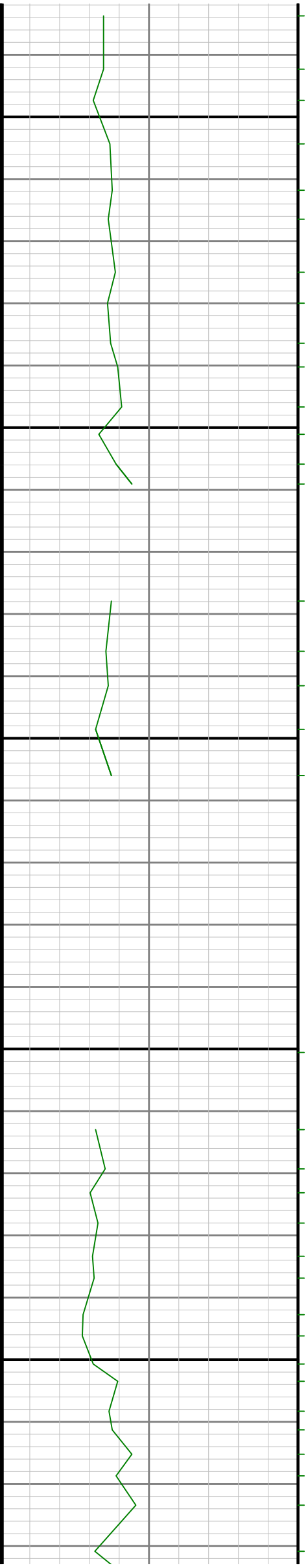


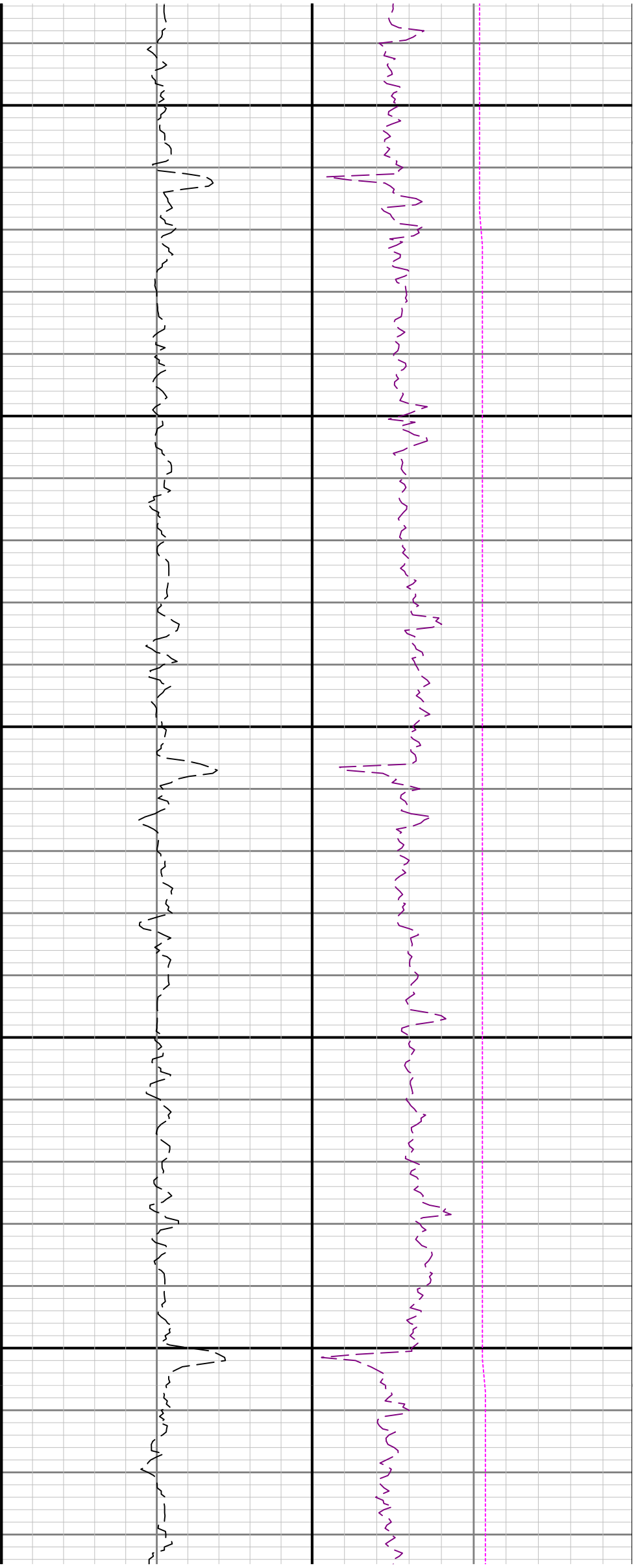


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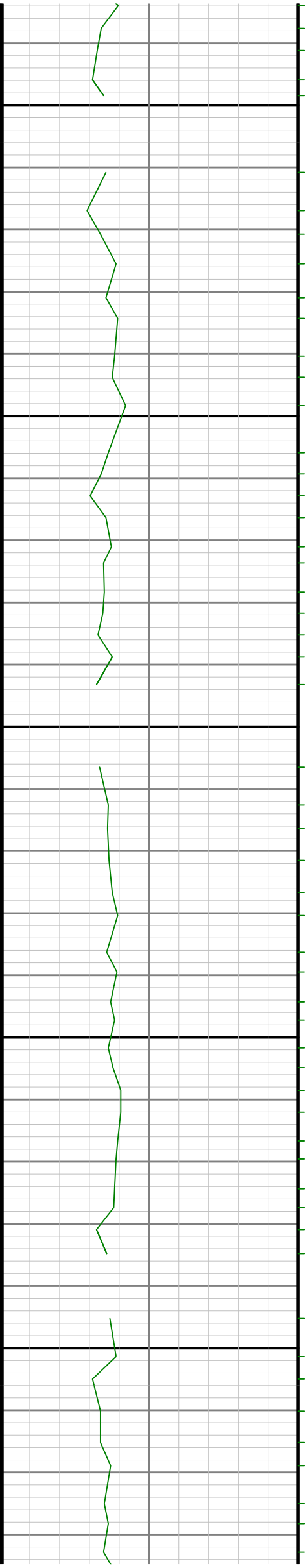
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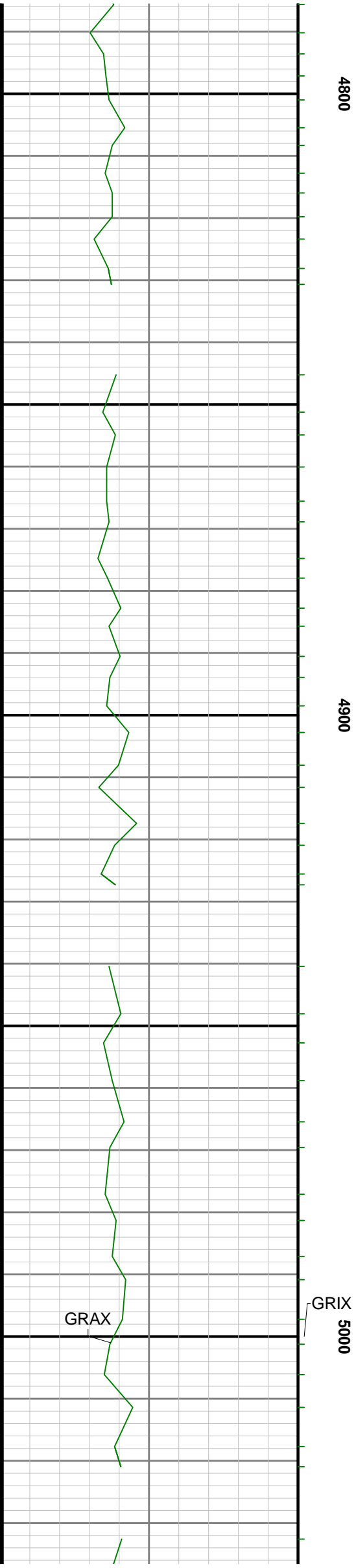
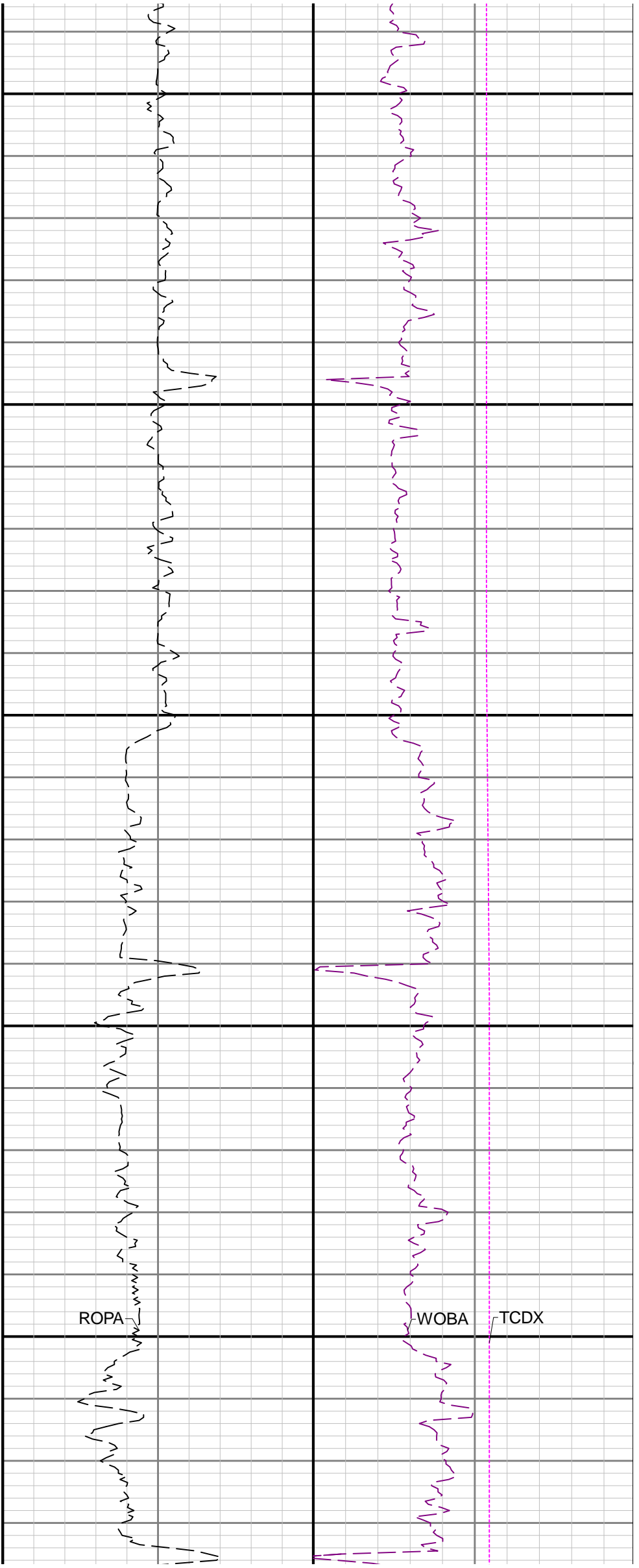


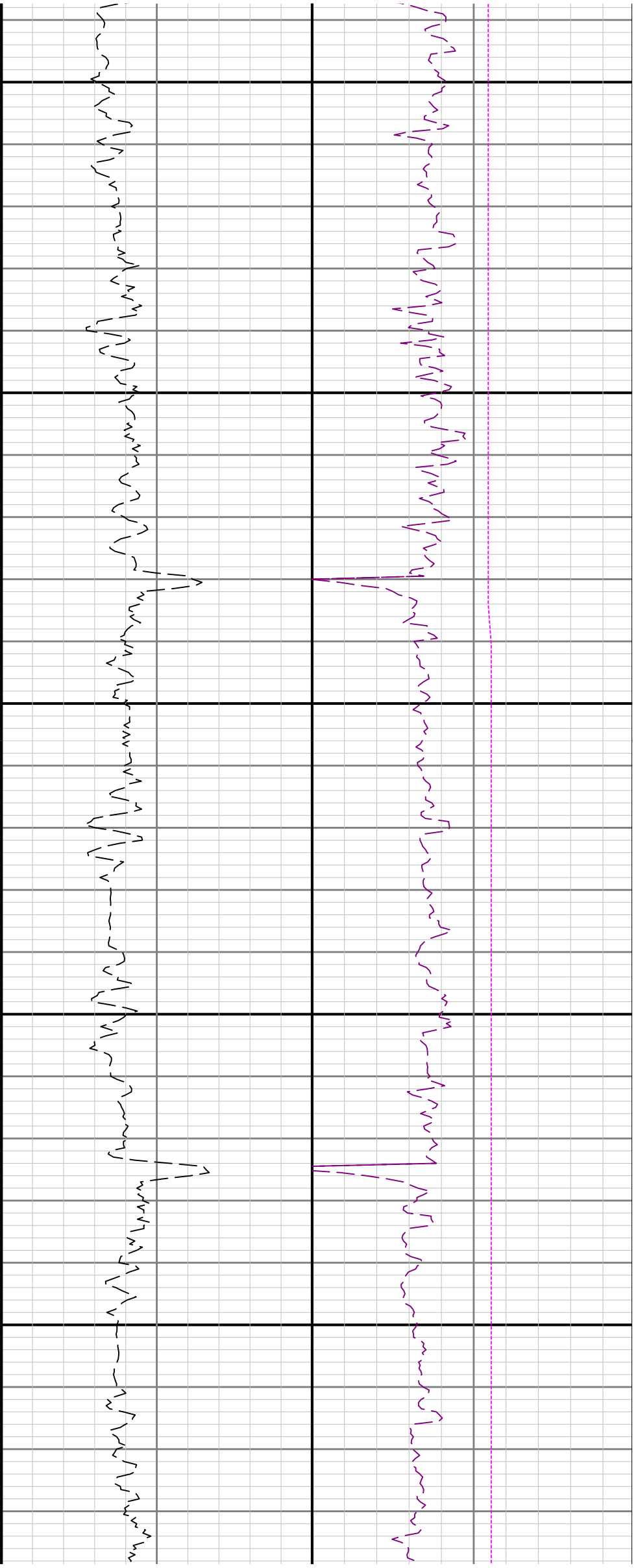


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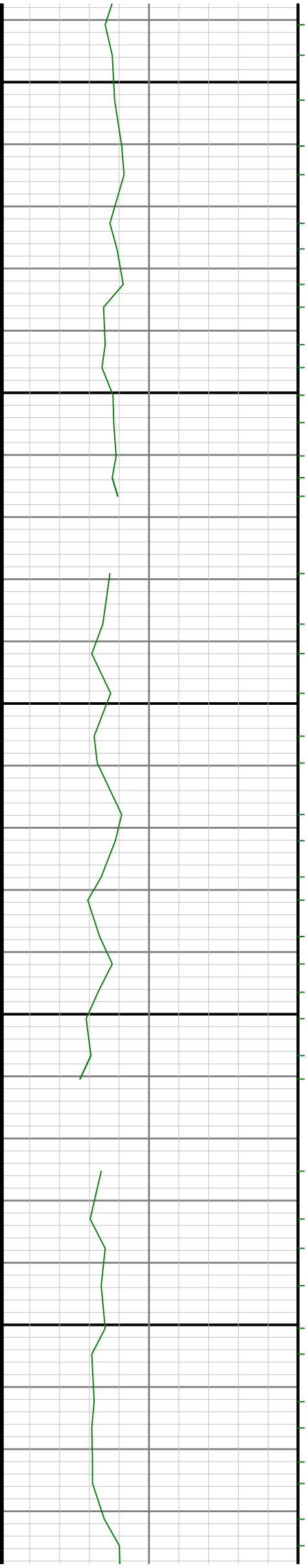


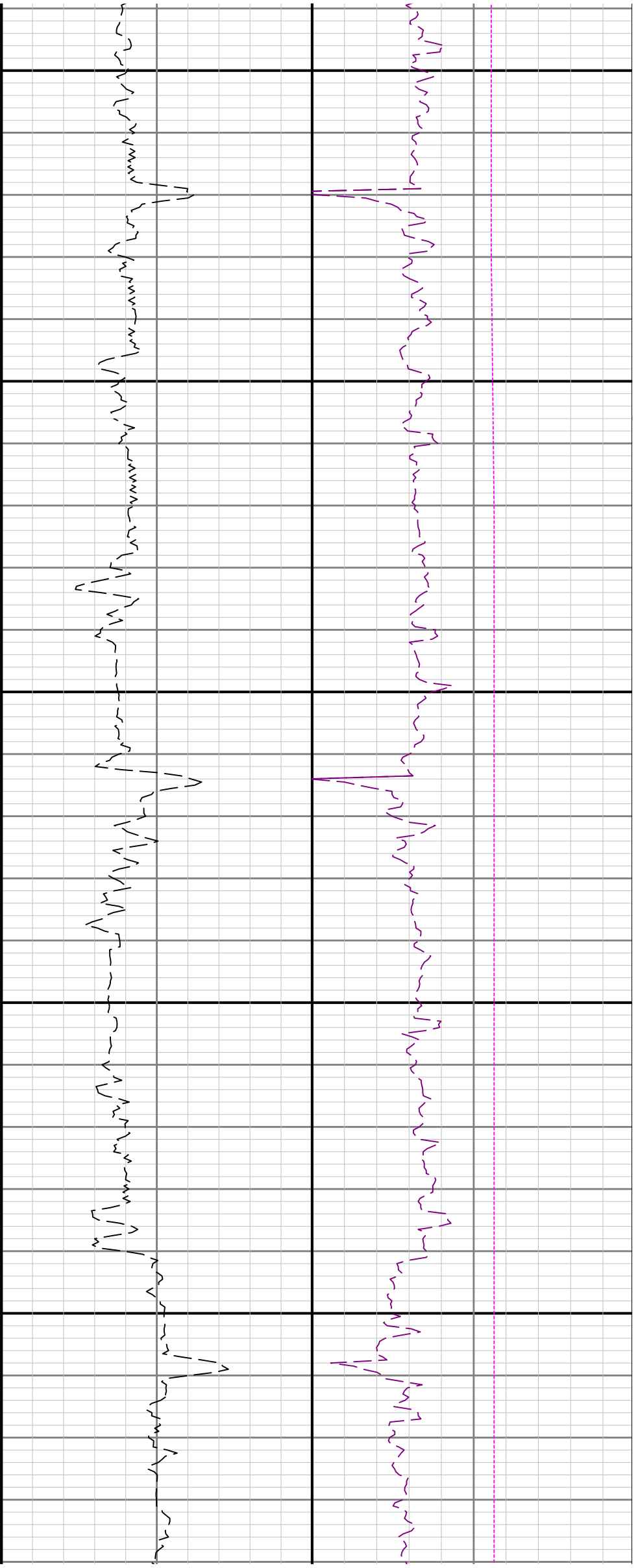




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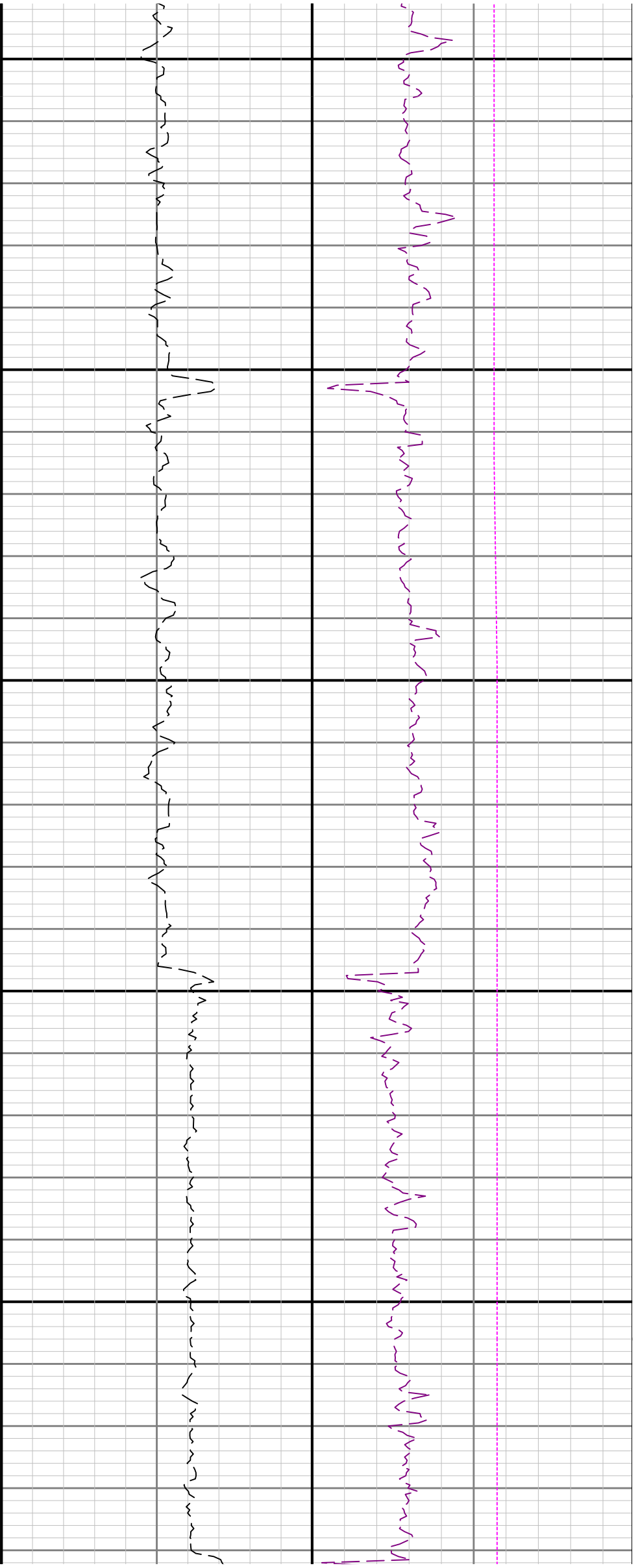
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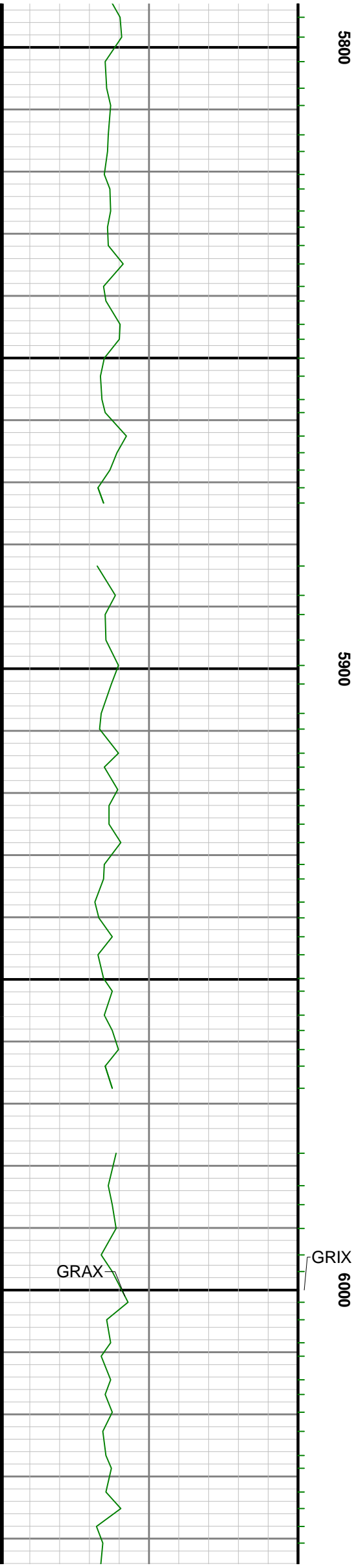
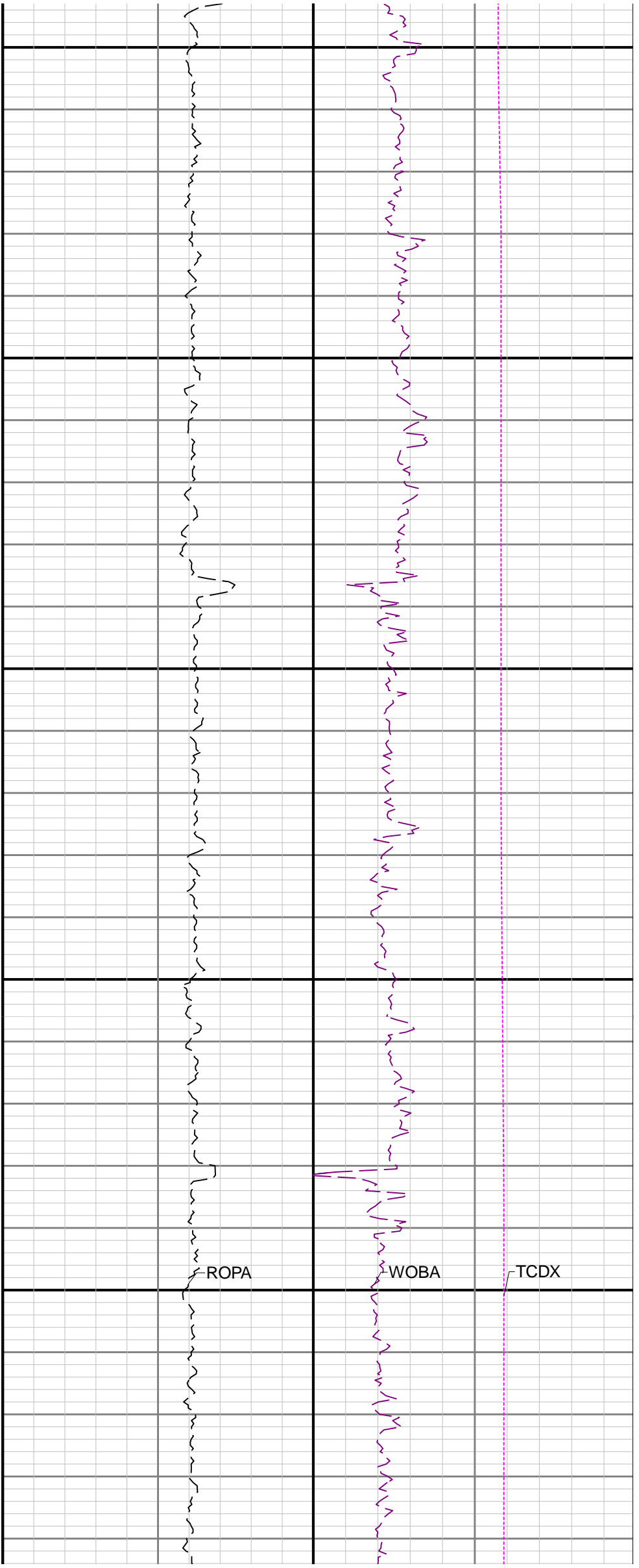


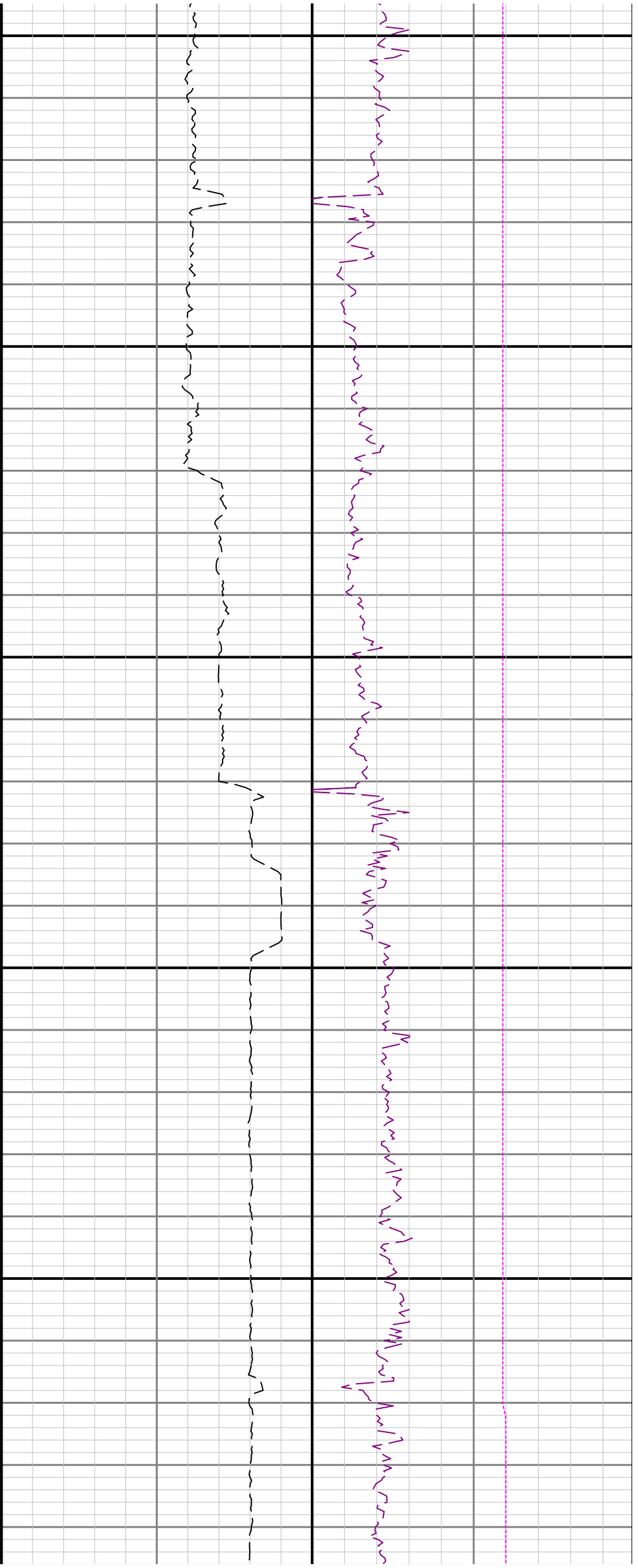


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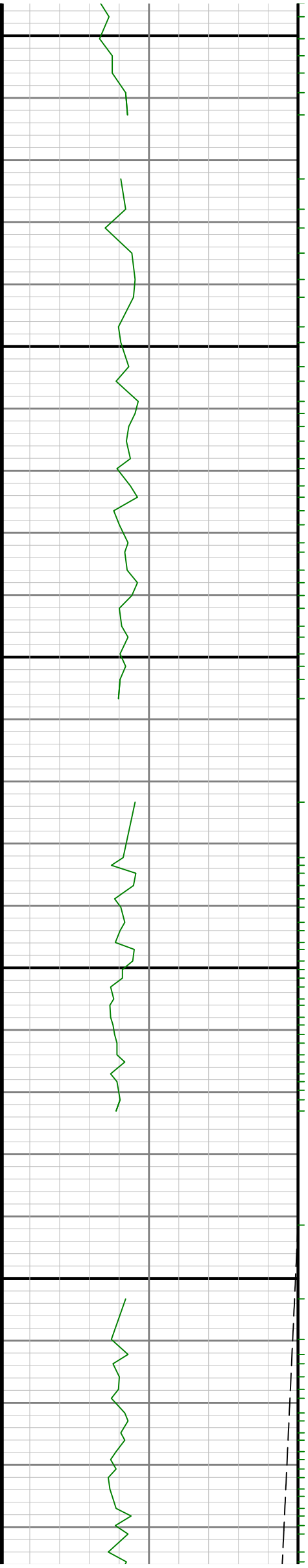


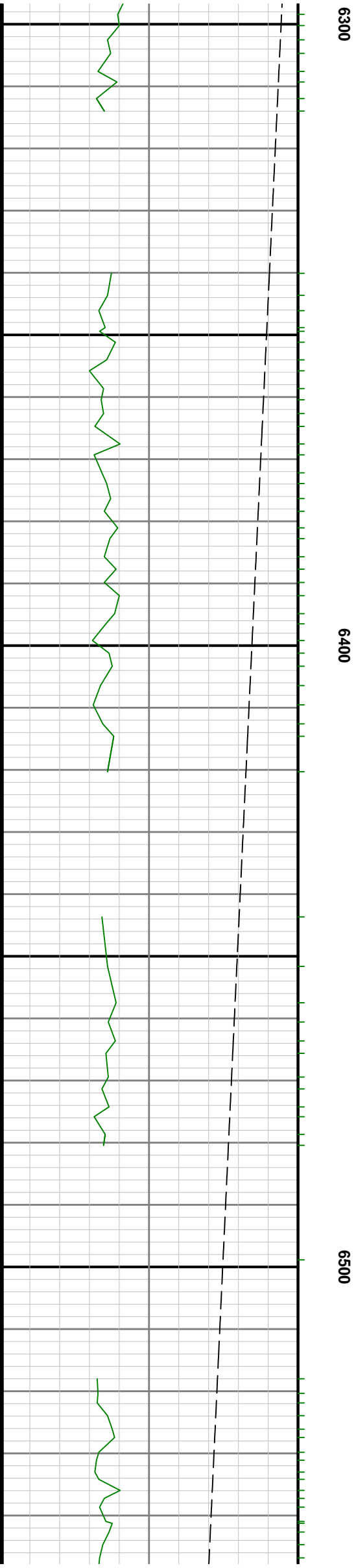
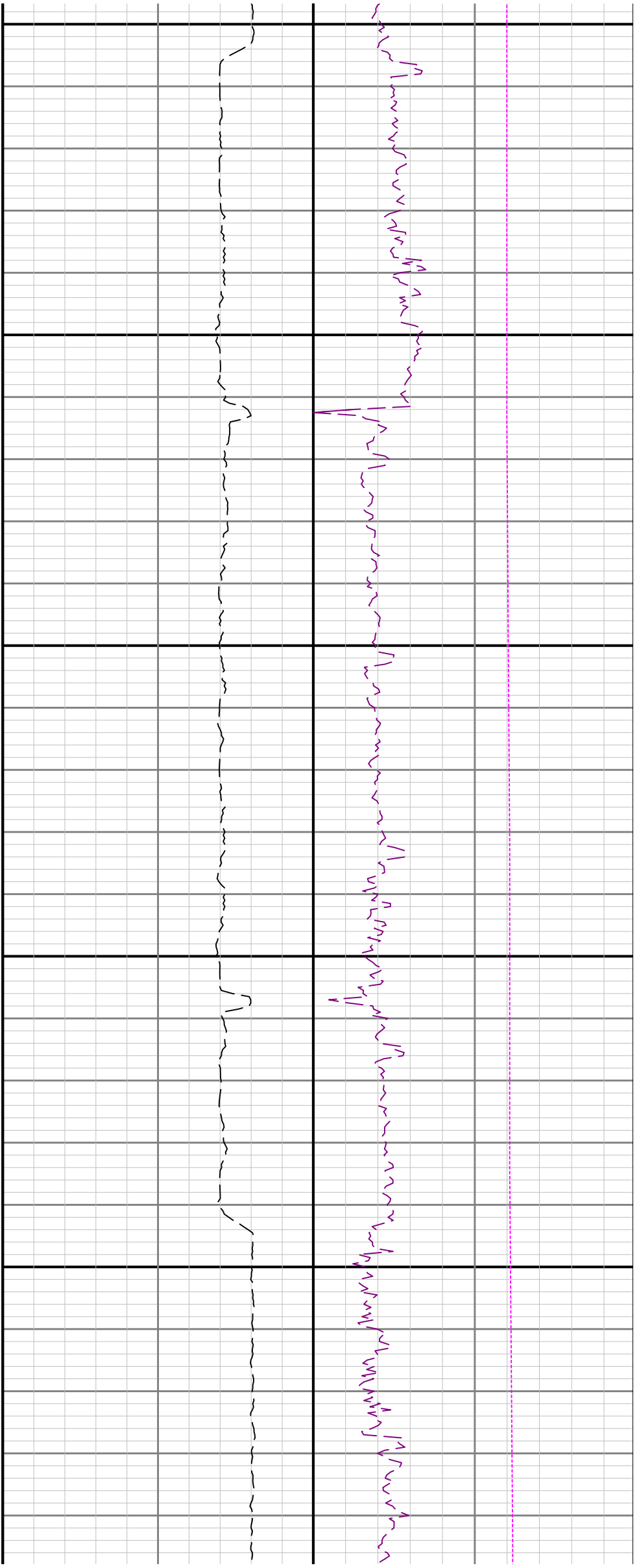


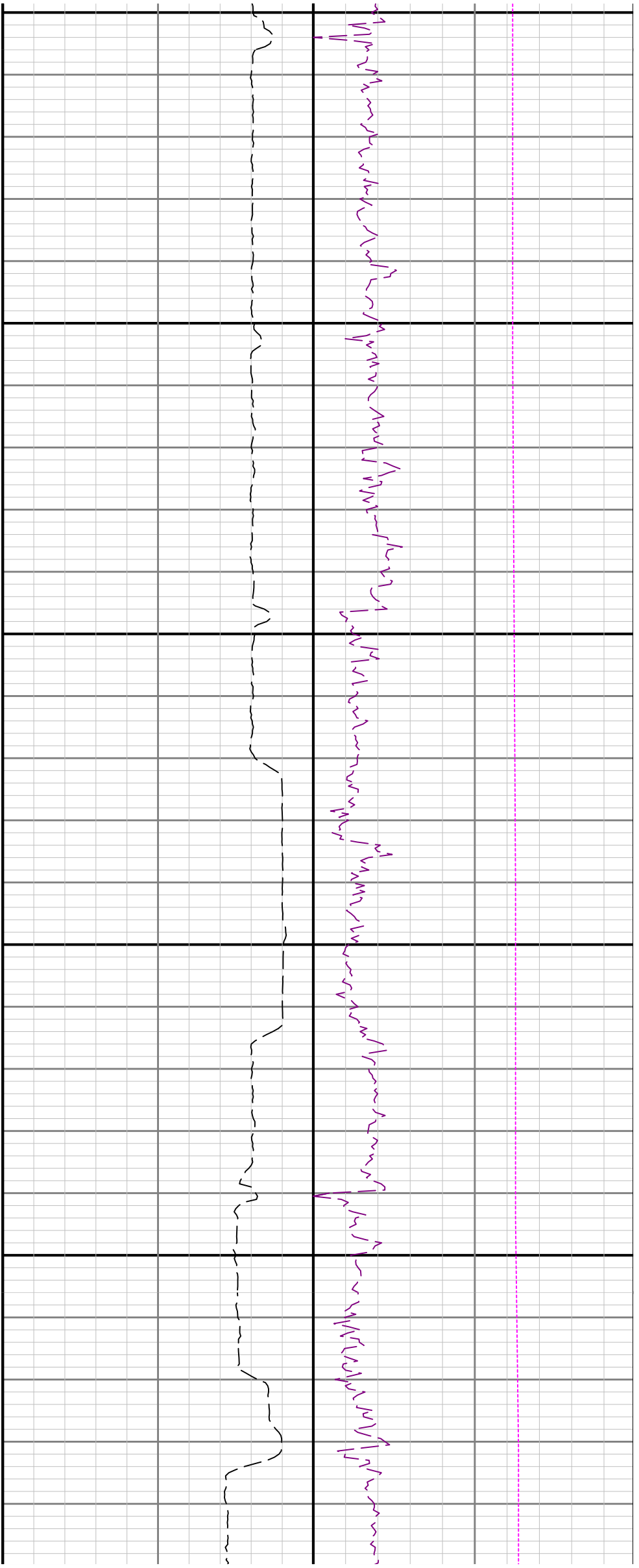


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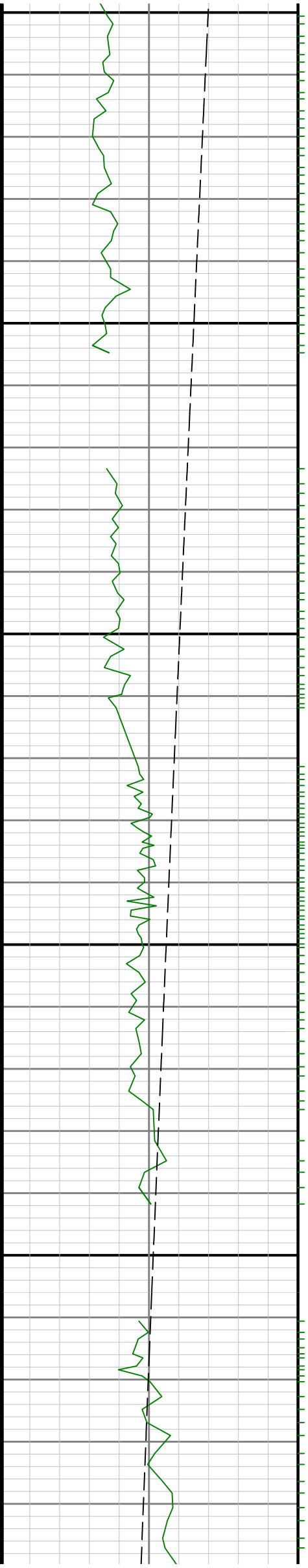


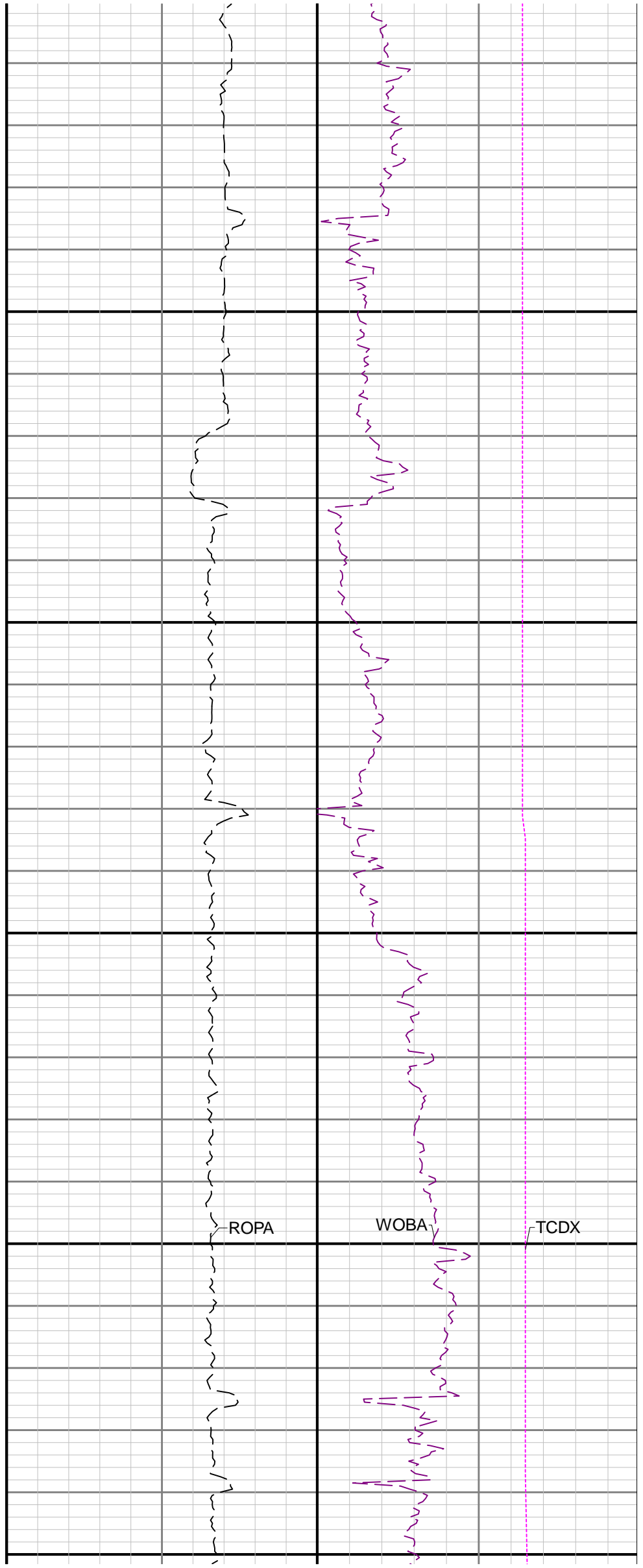


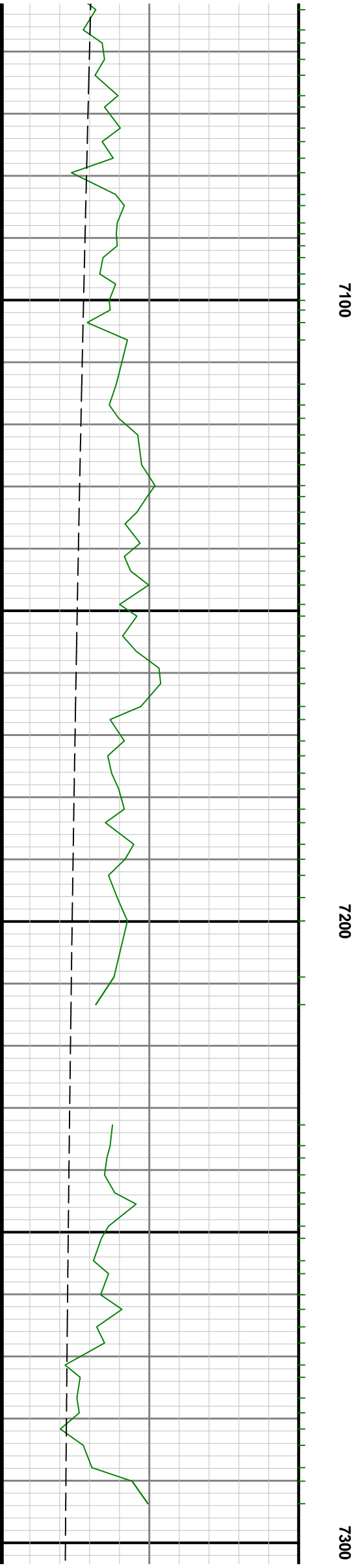
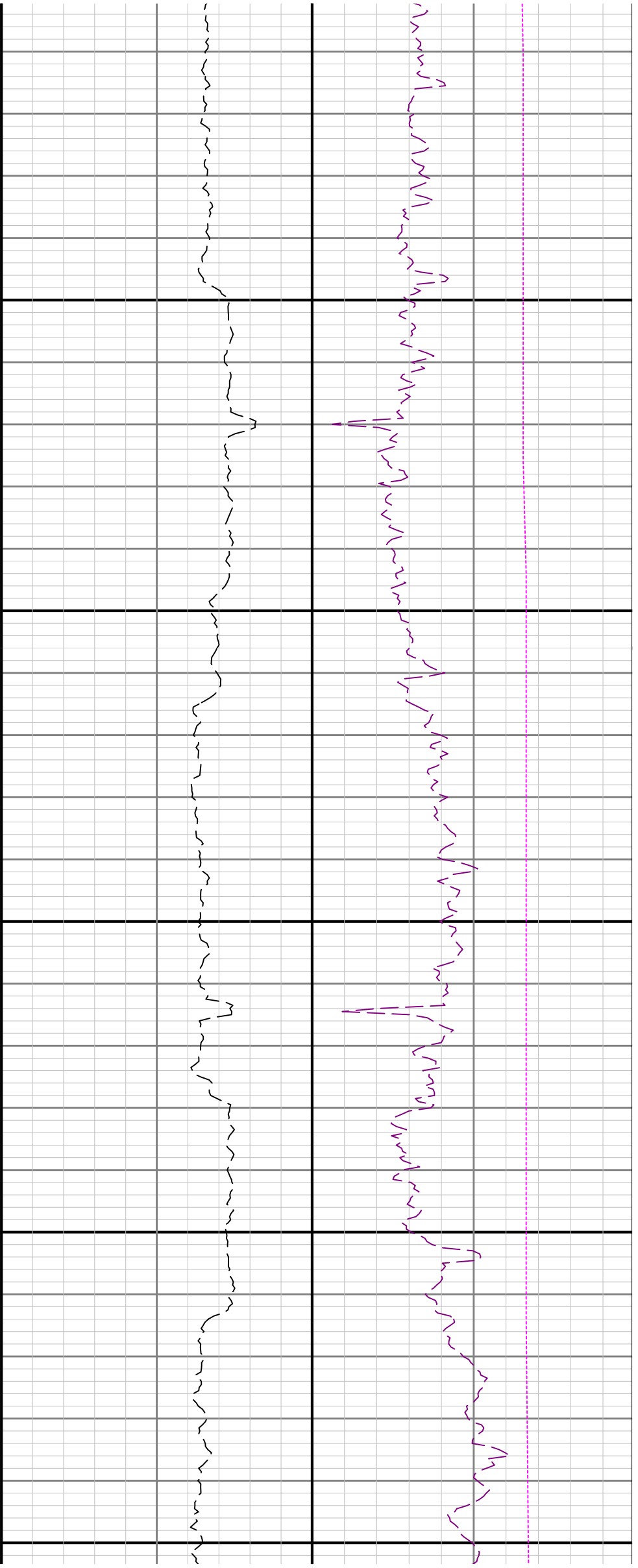
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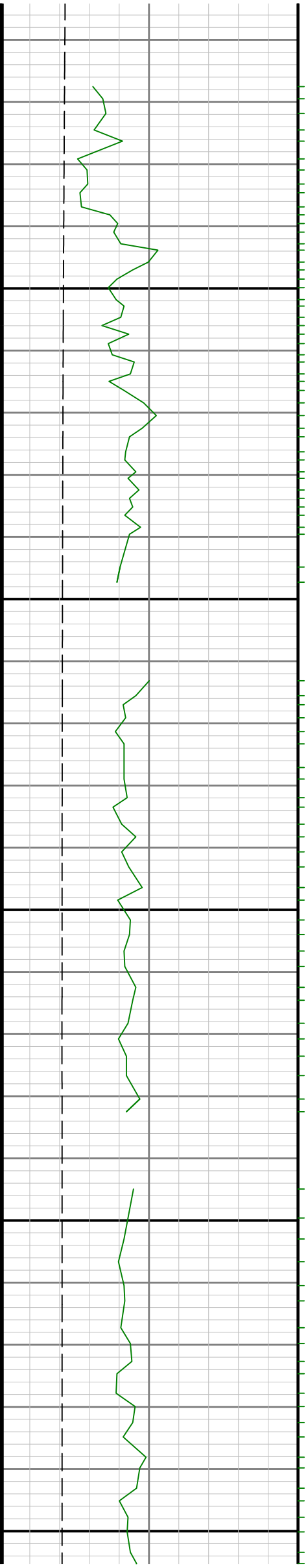
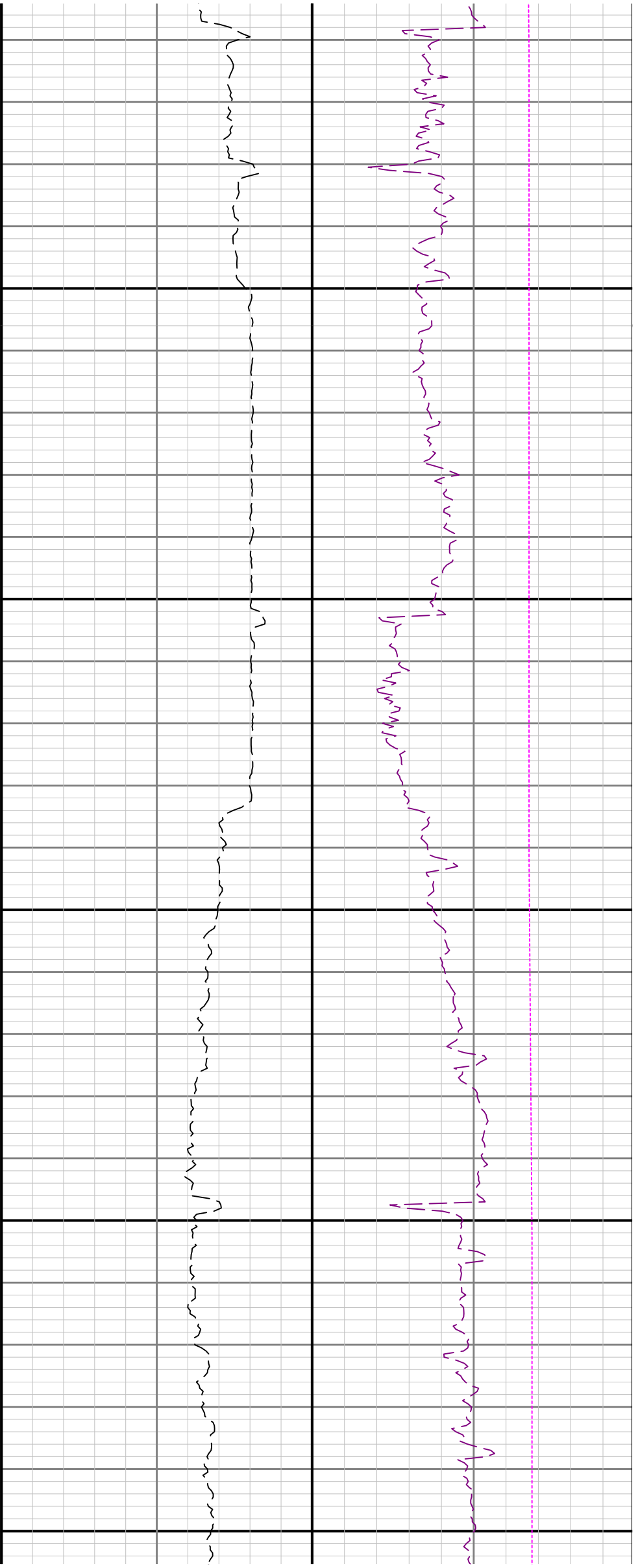
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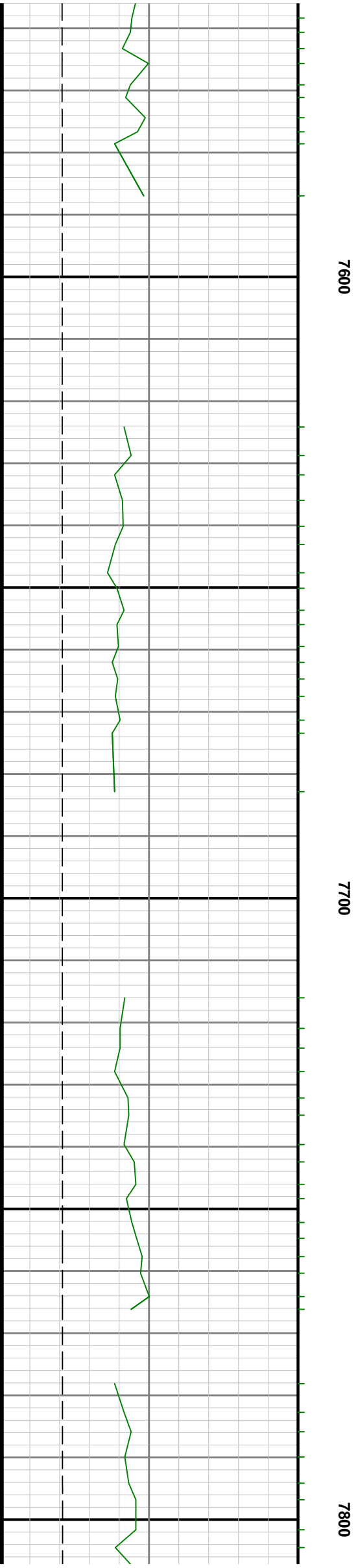
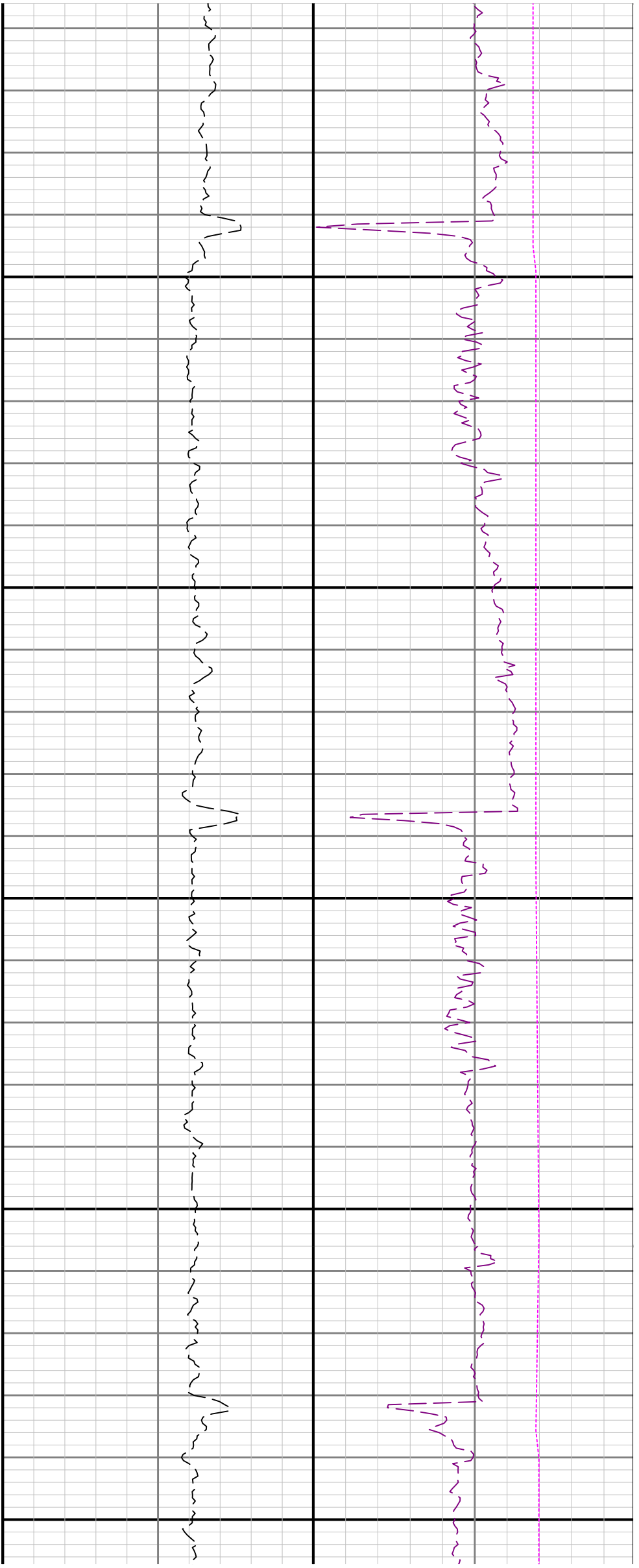


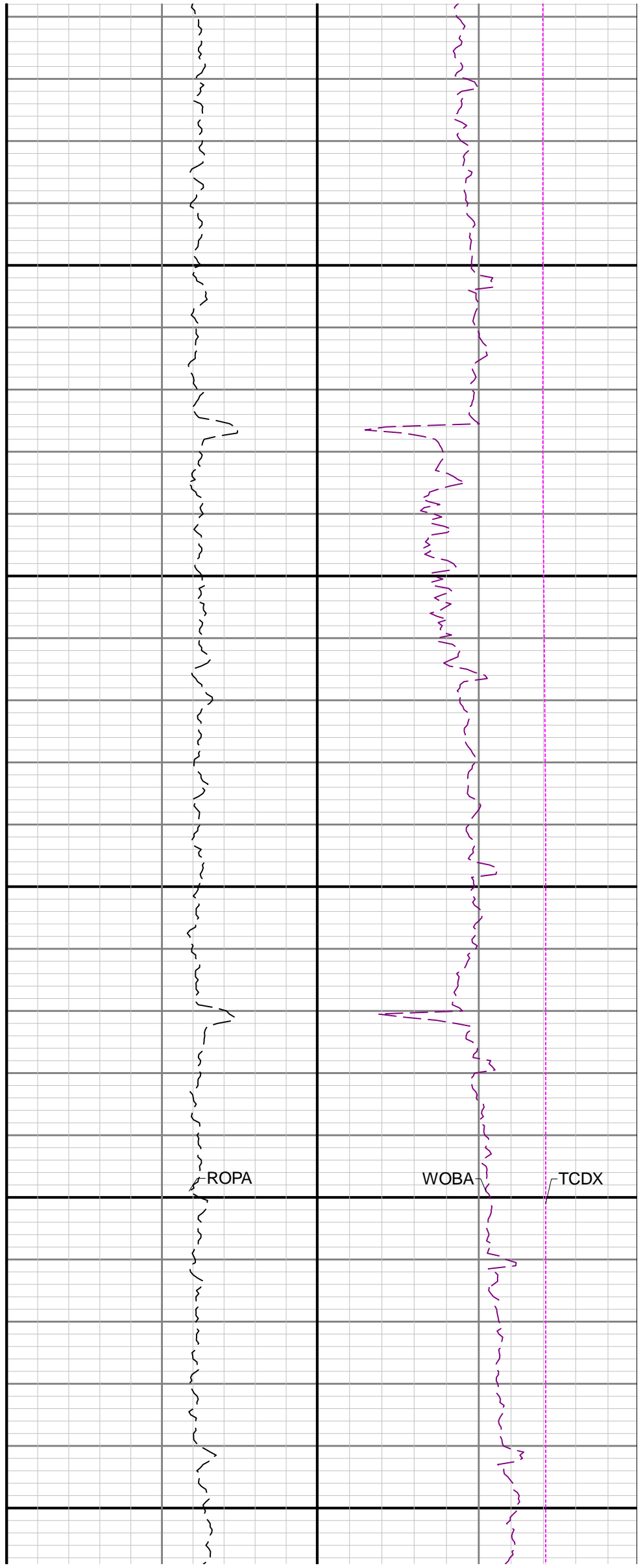
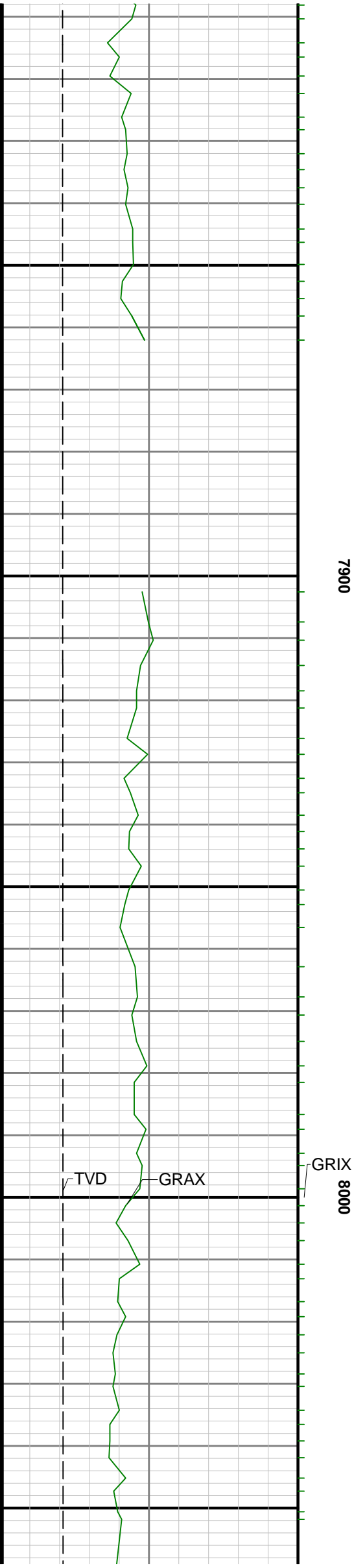


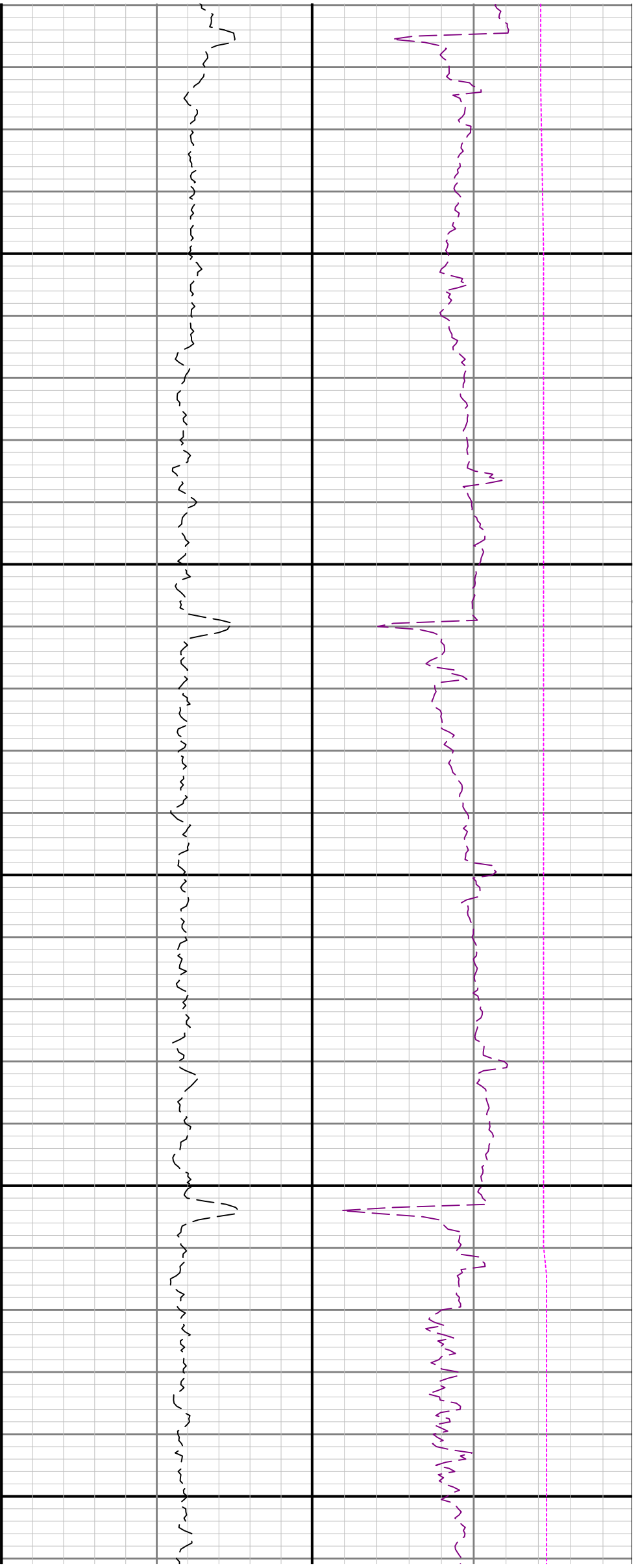








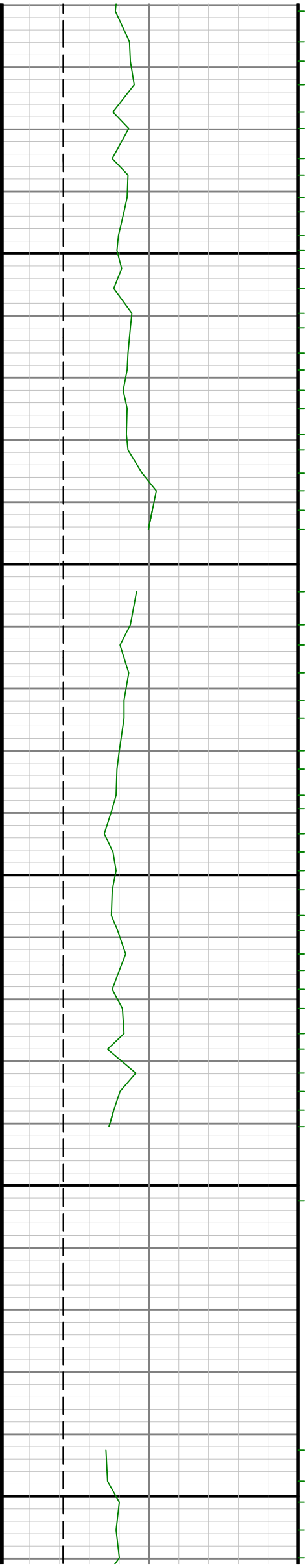


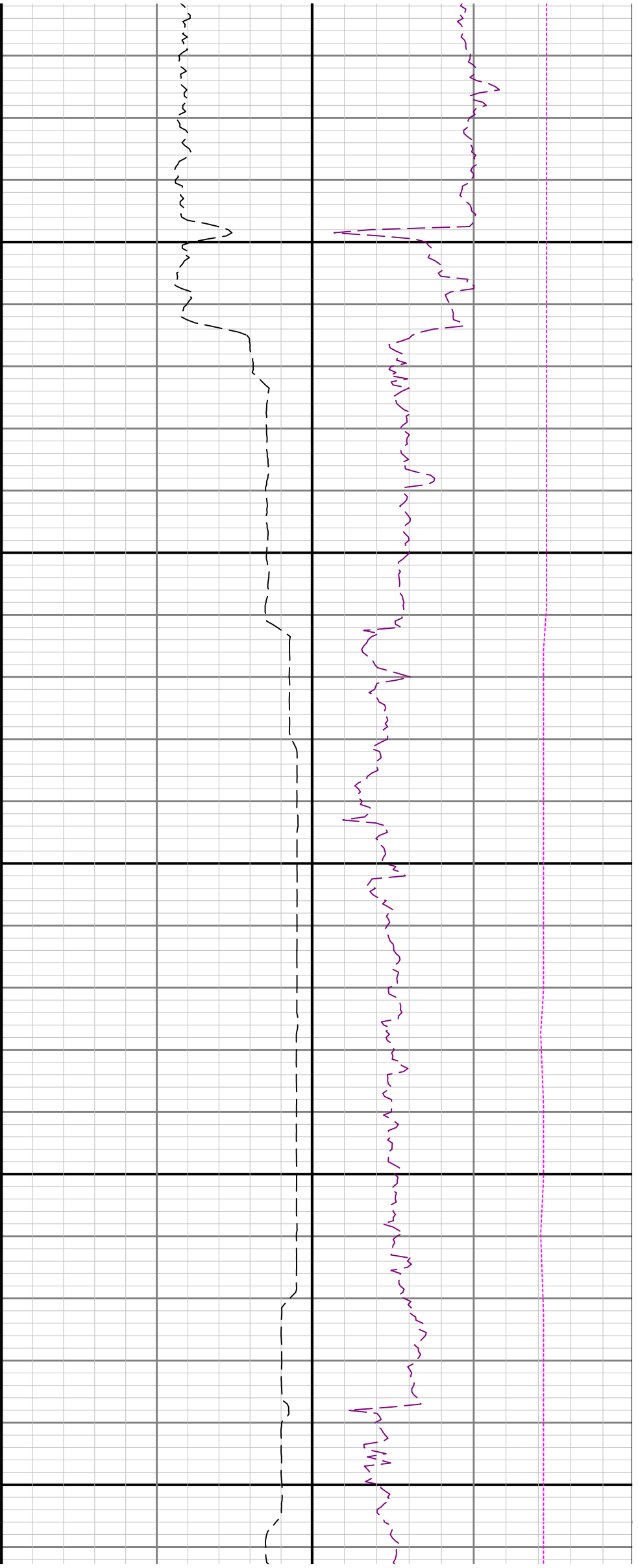


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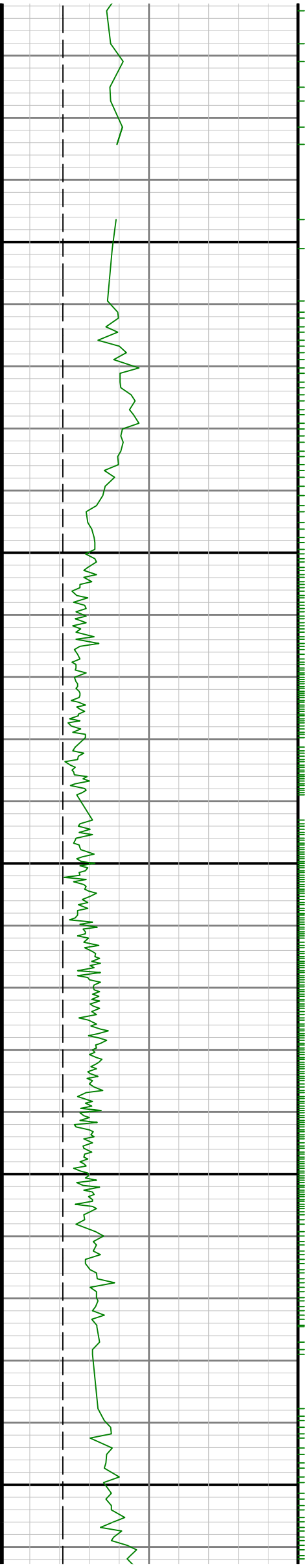
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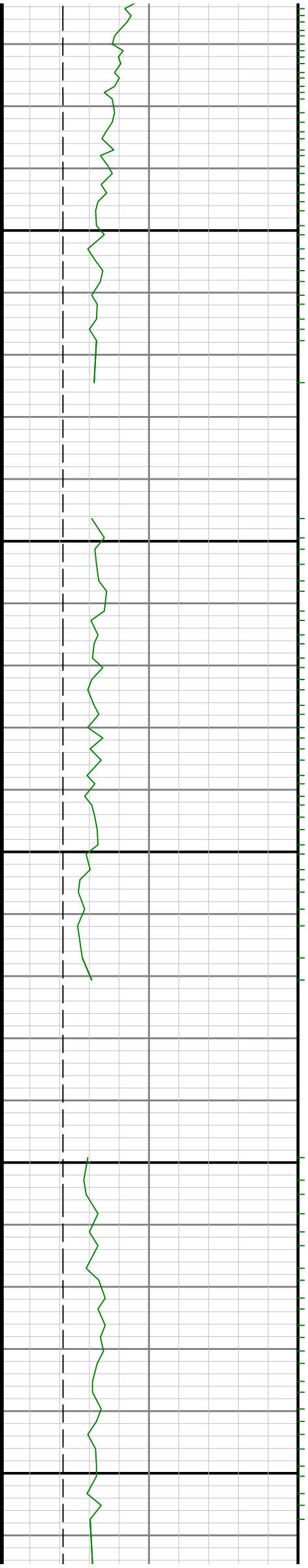




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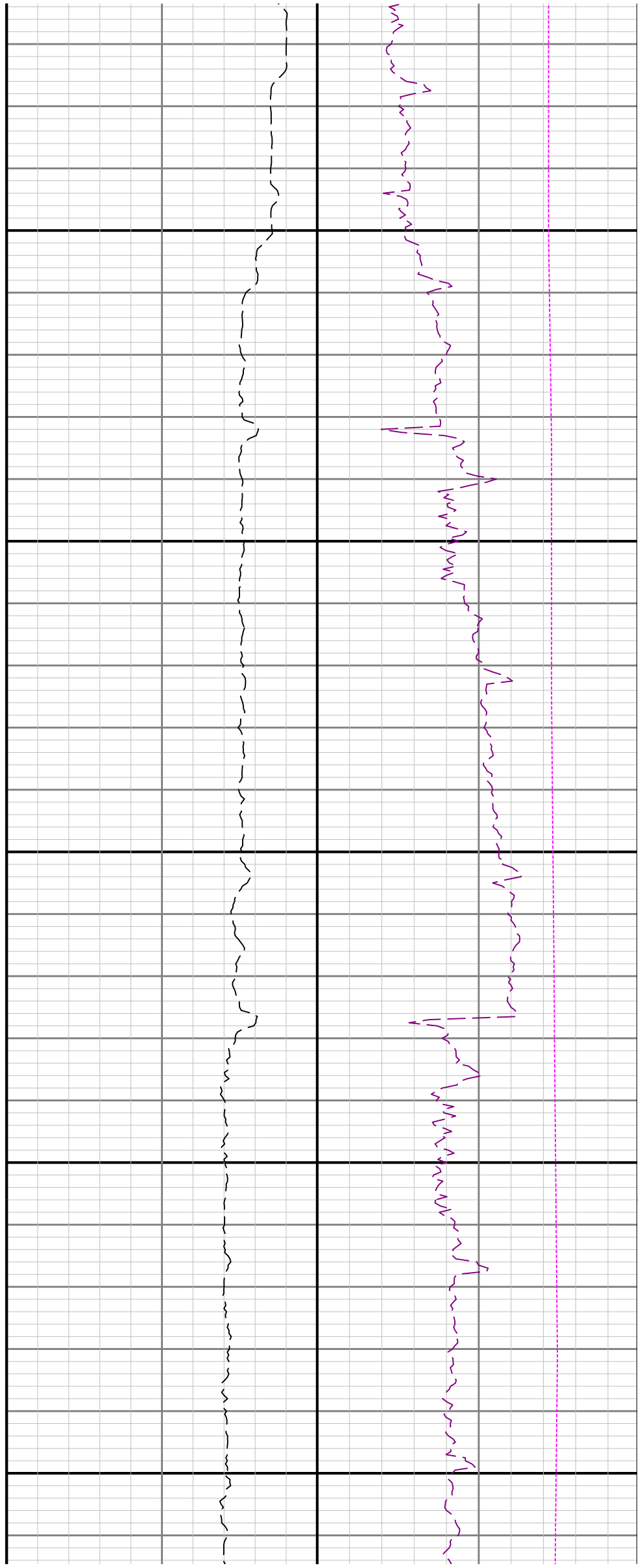


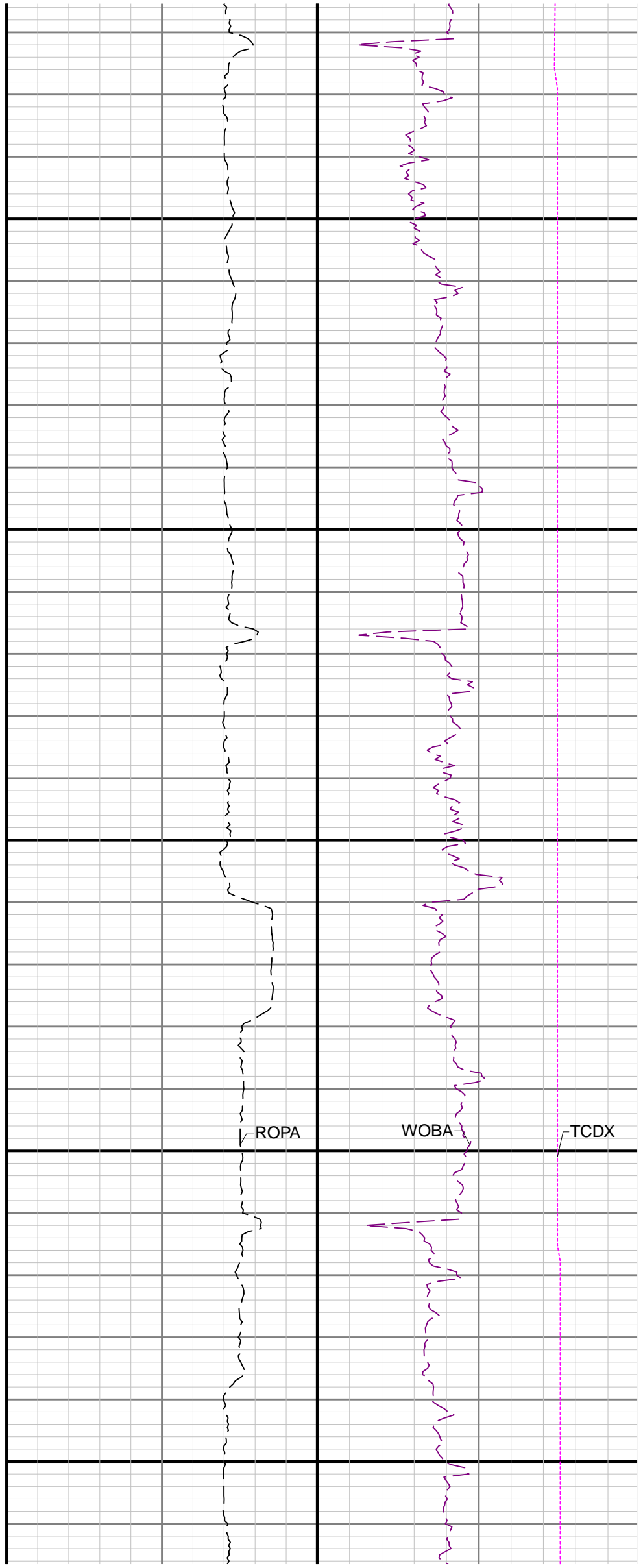
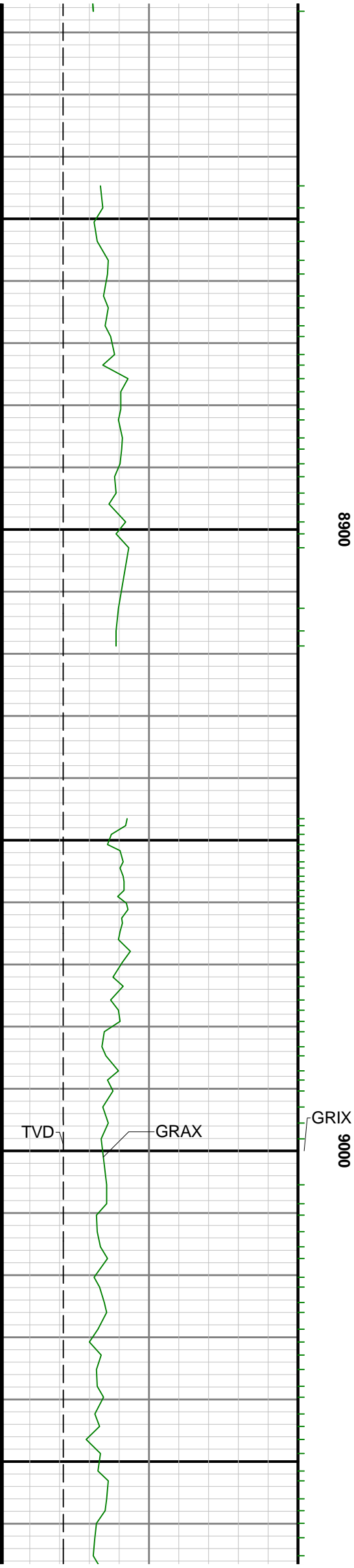


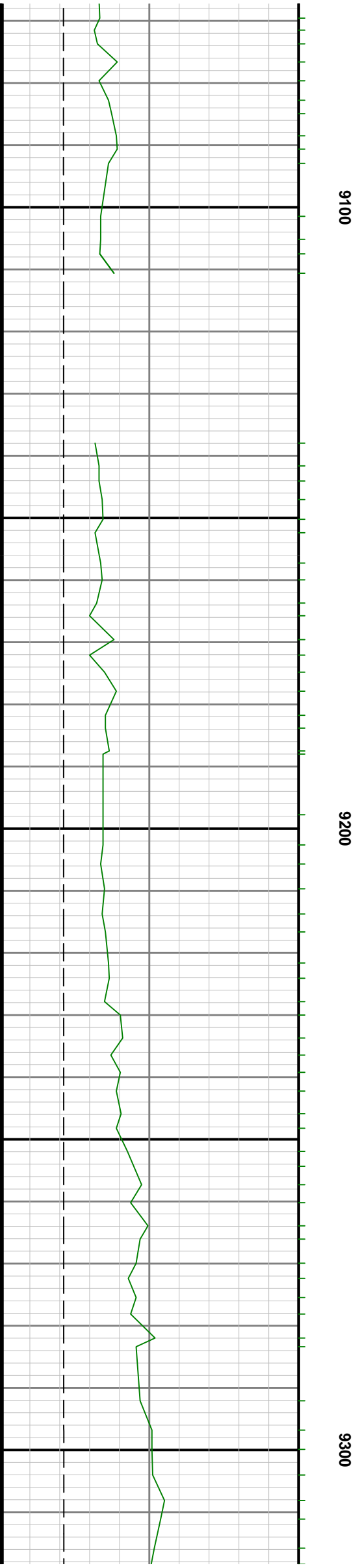
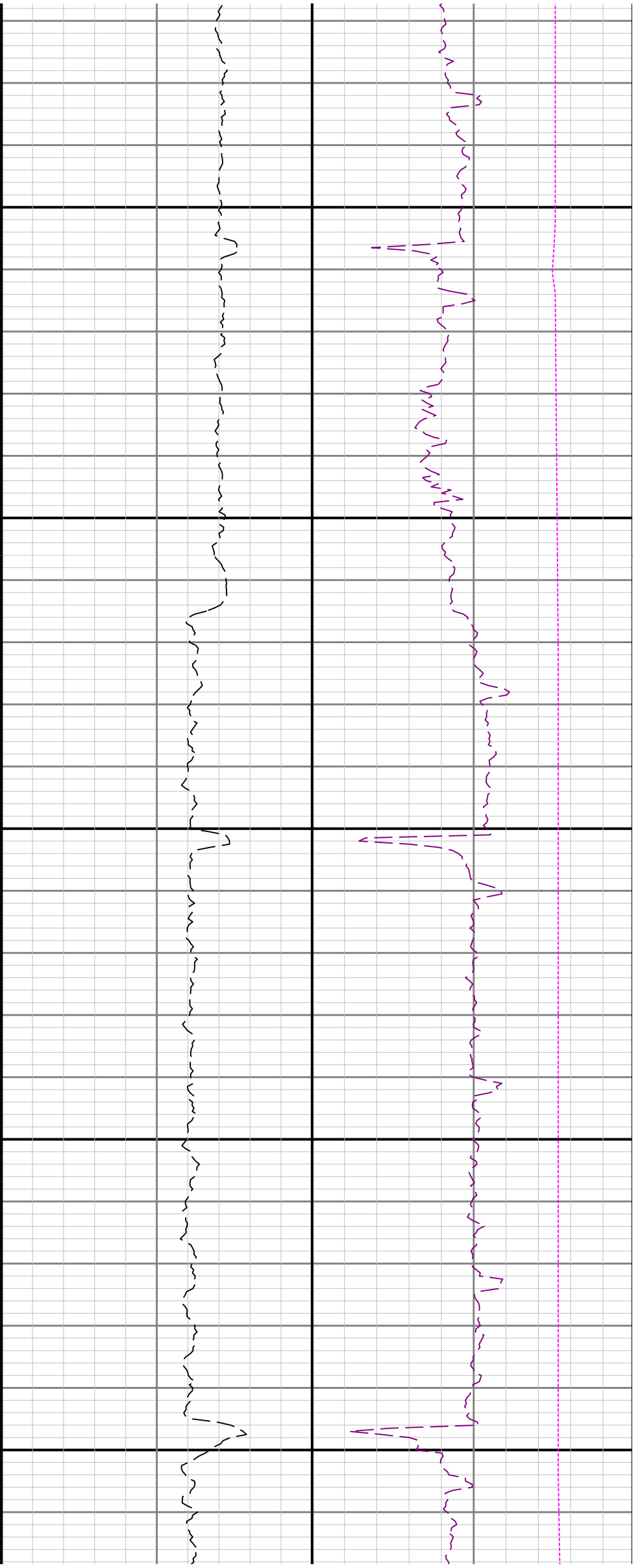
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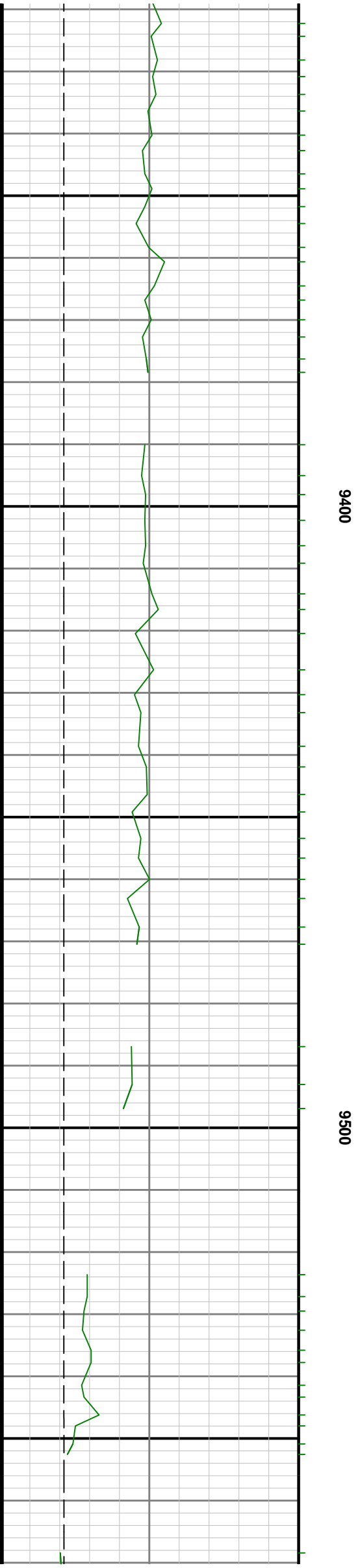
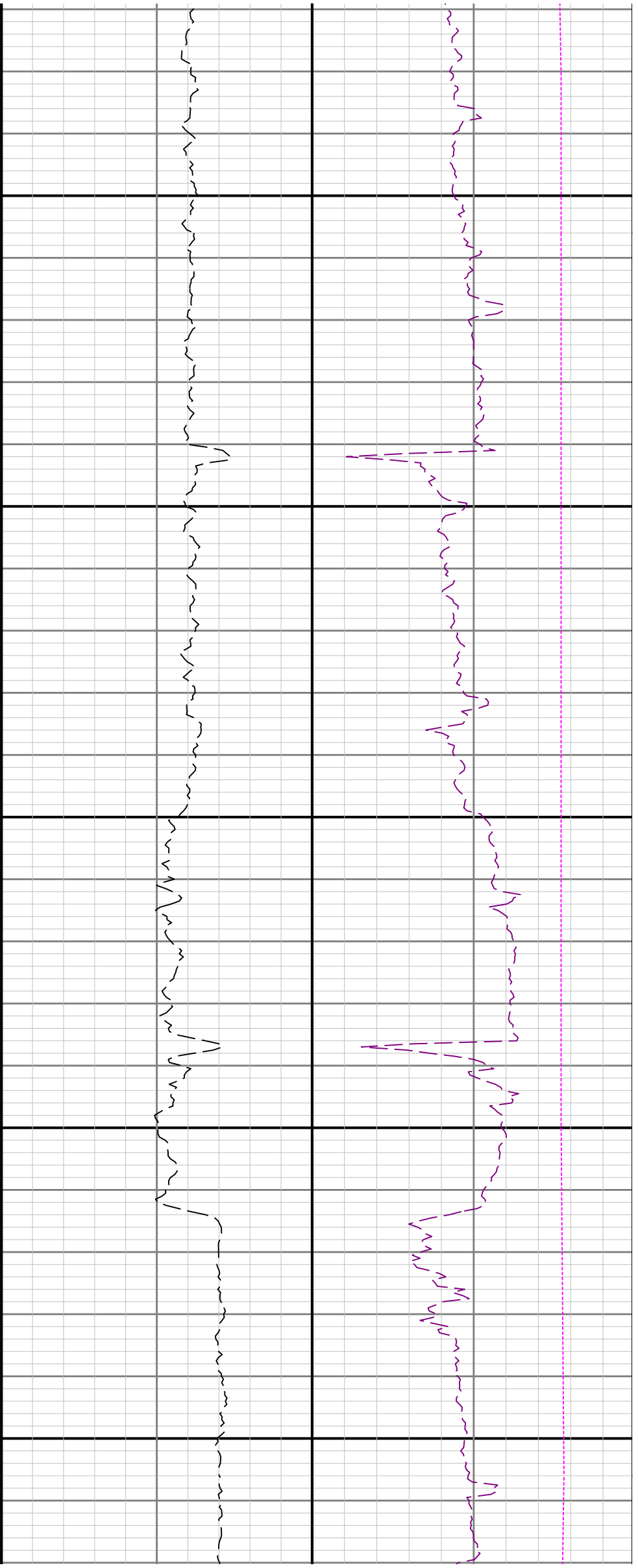
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8800

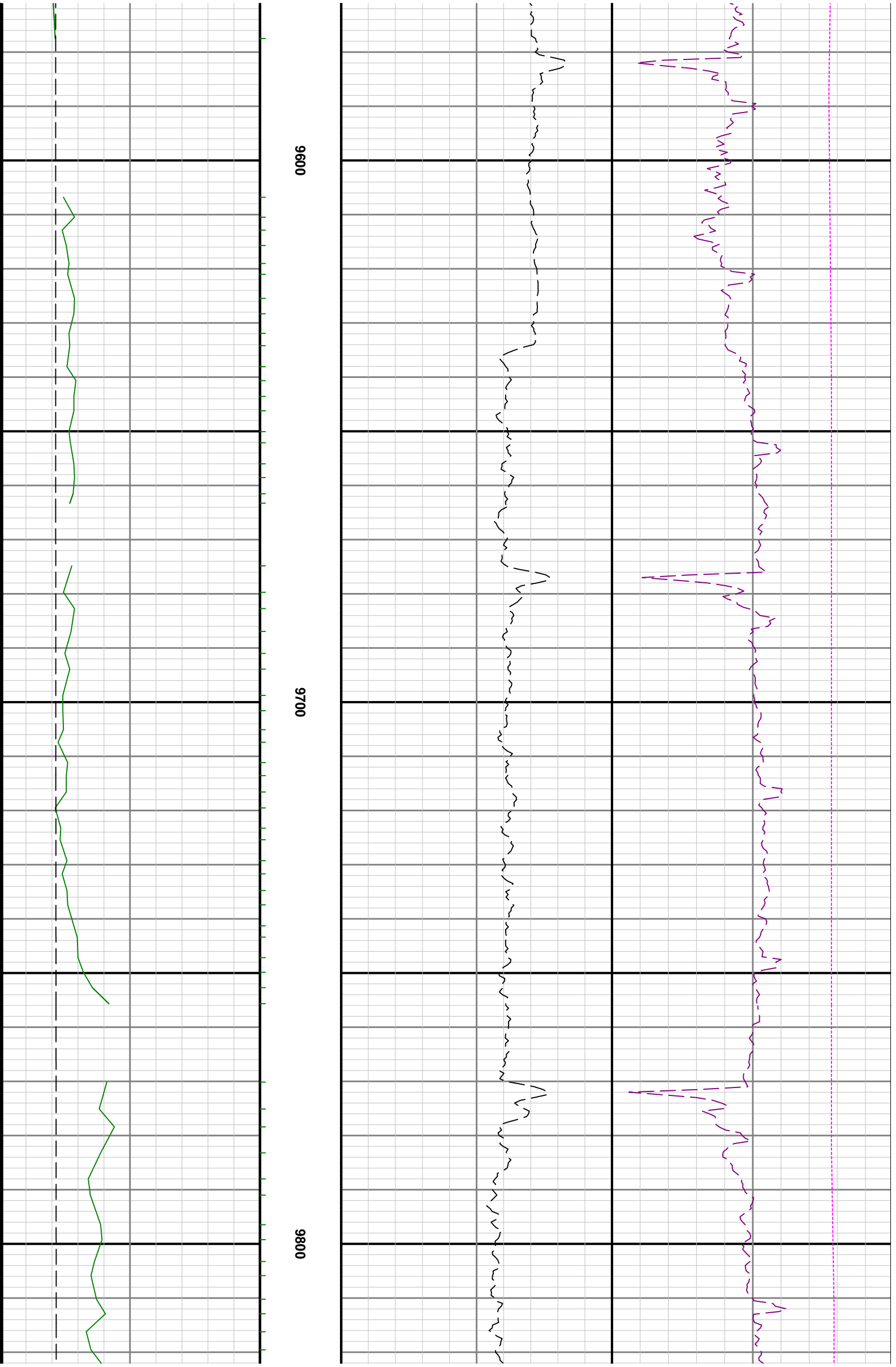


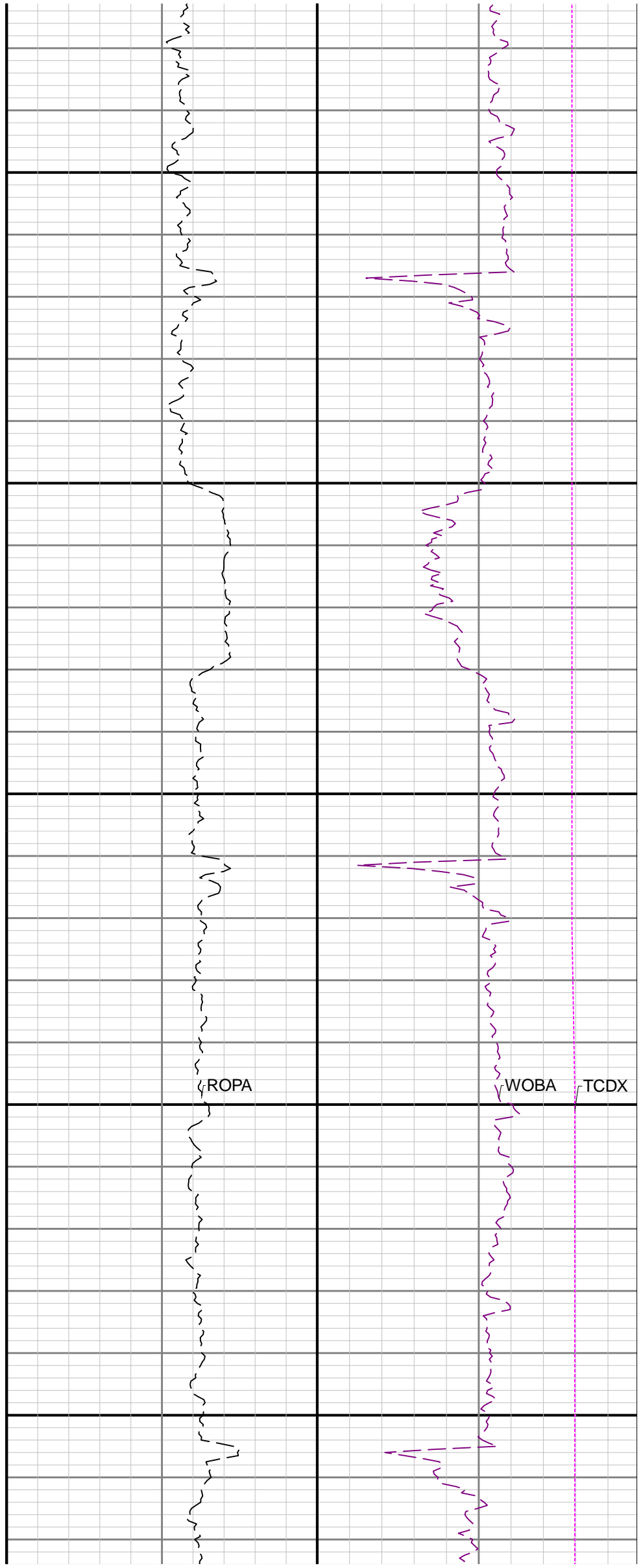
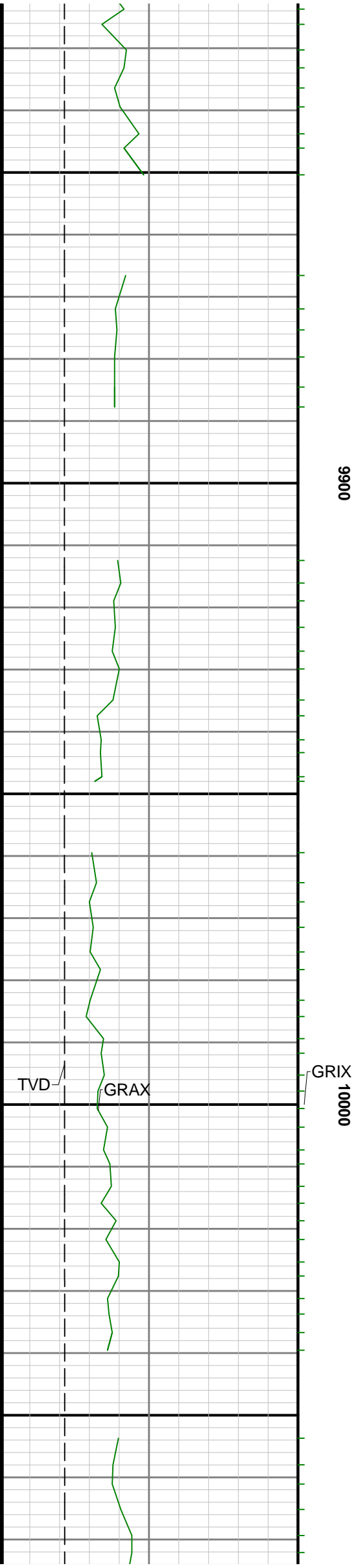


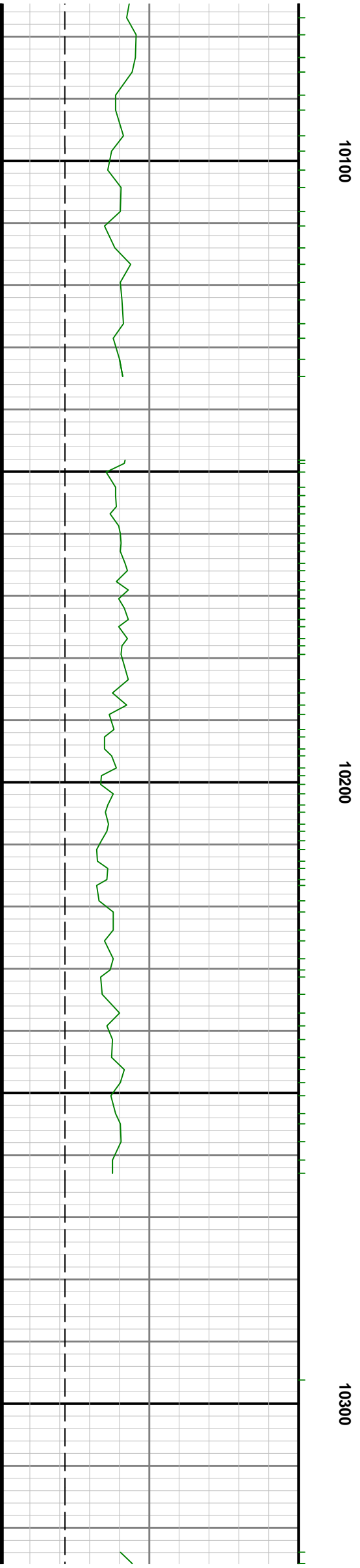
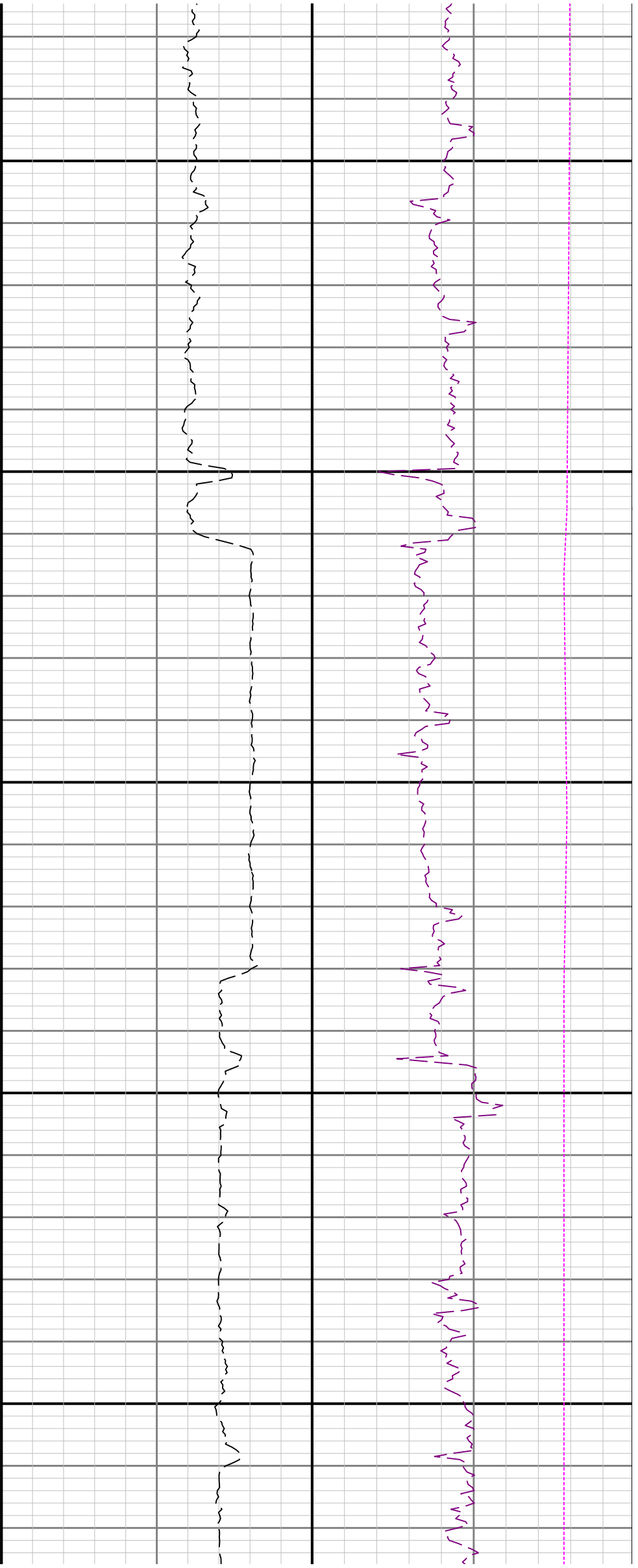


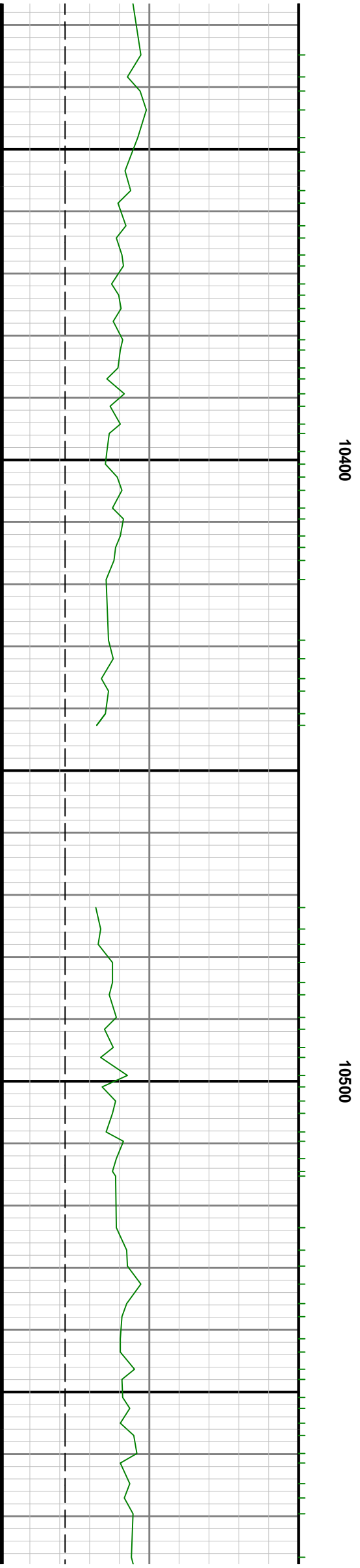
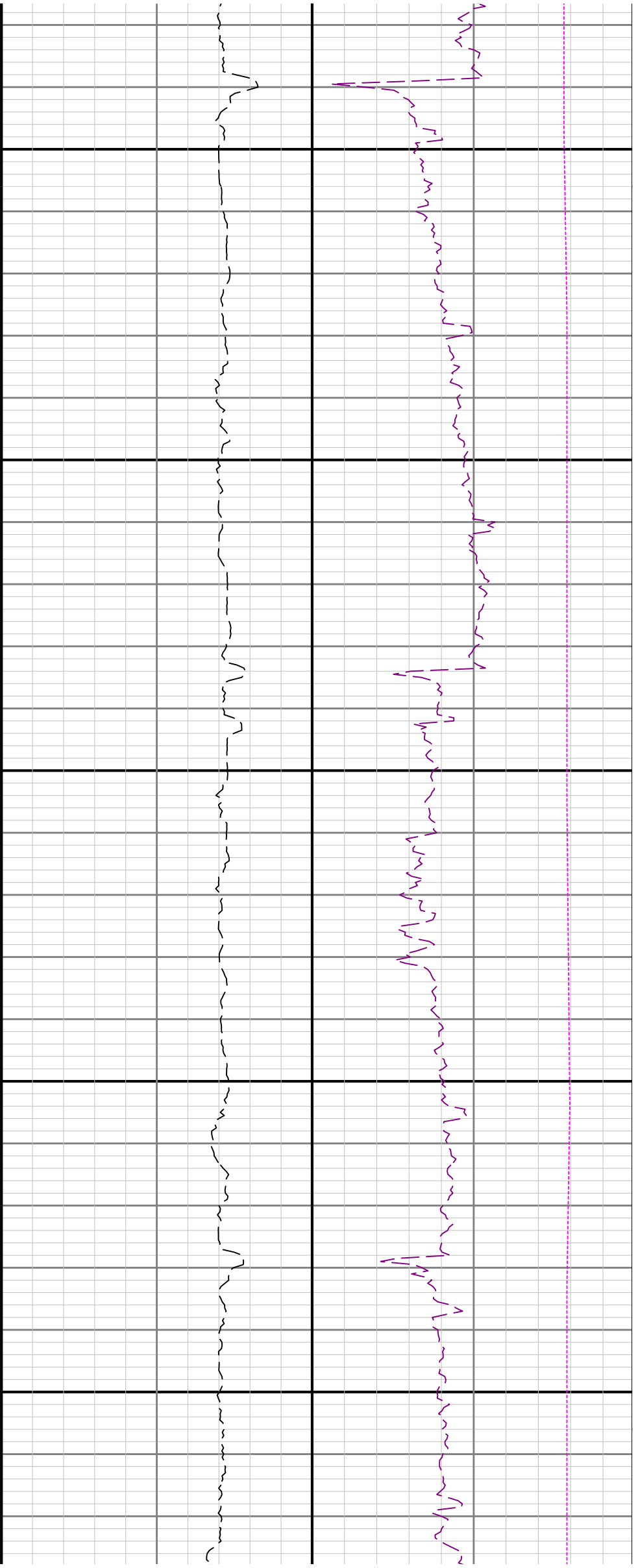


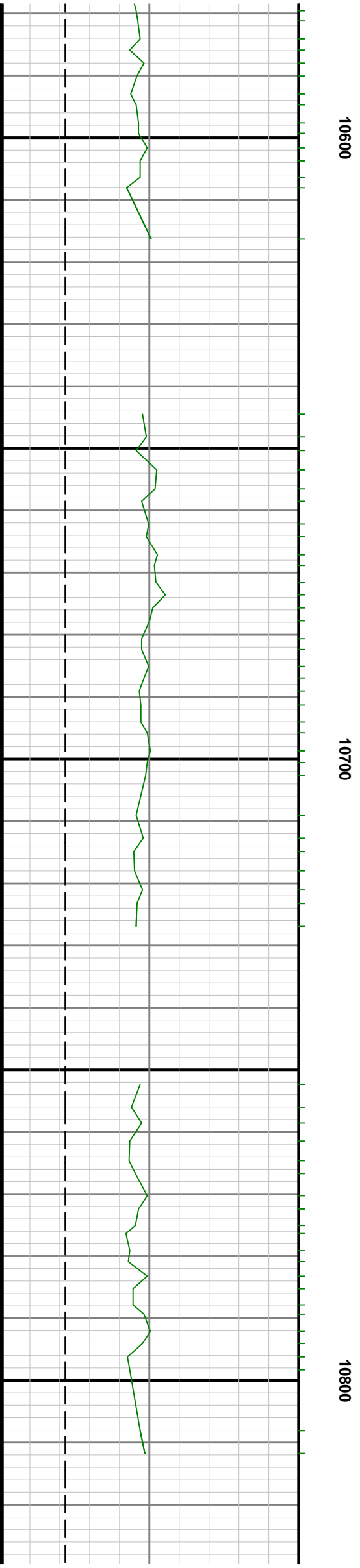
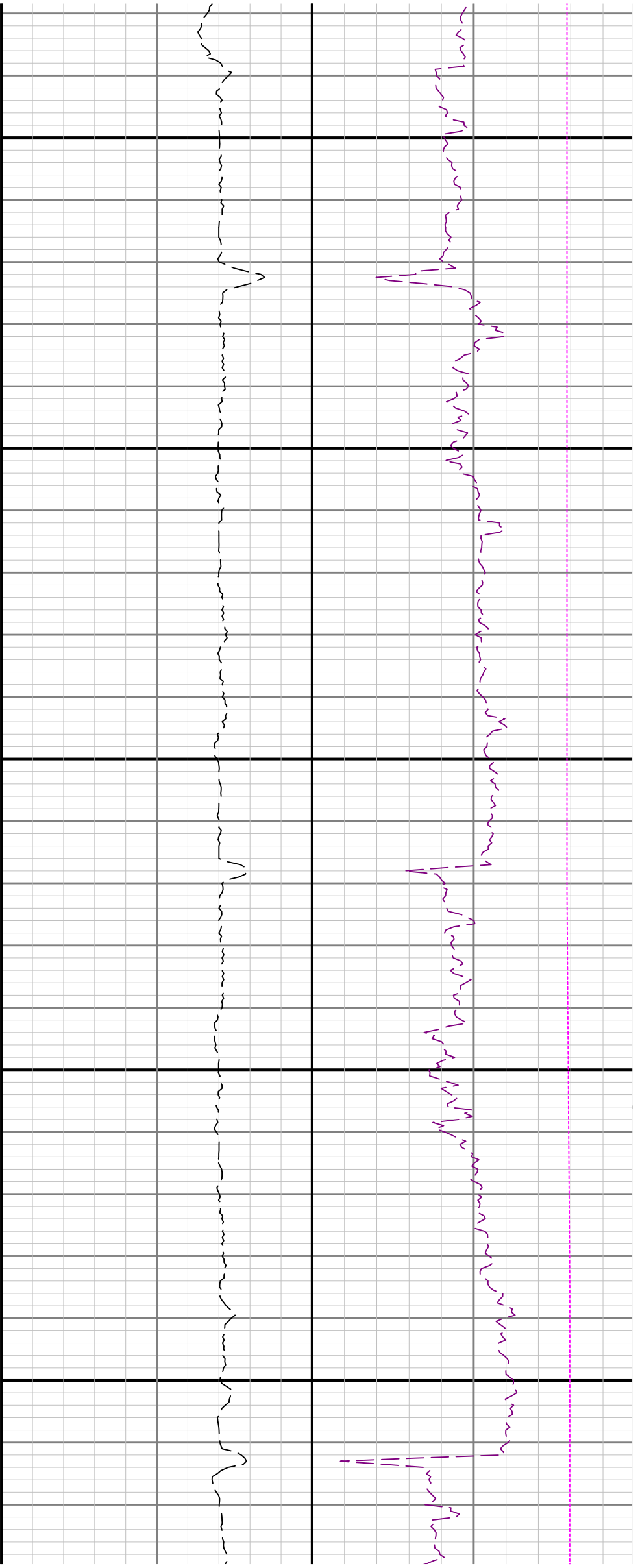


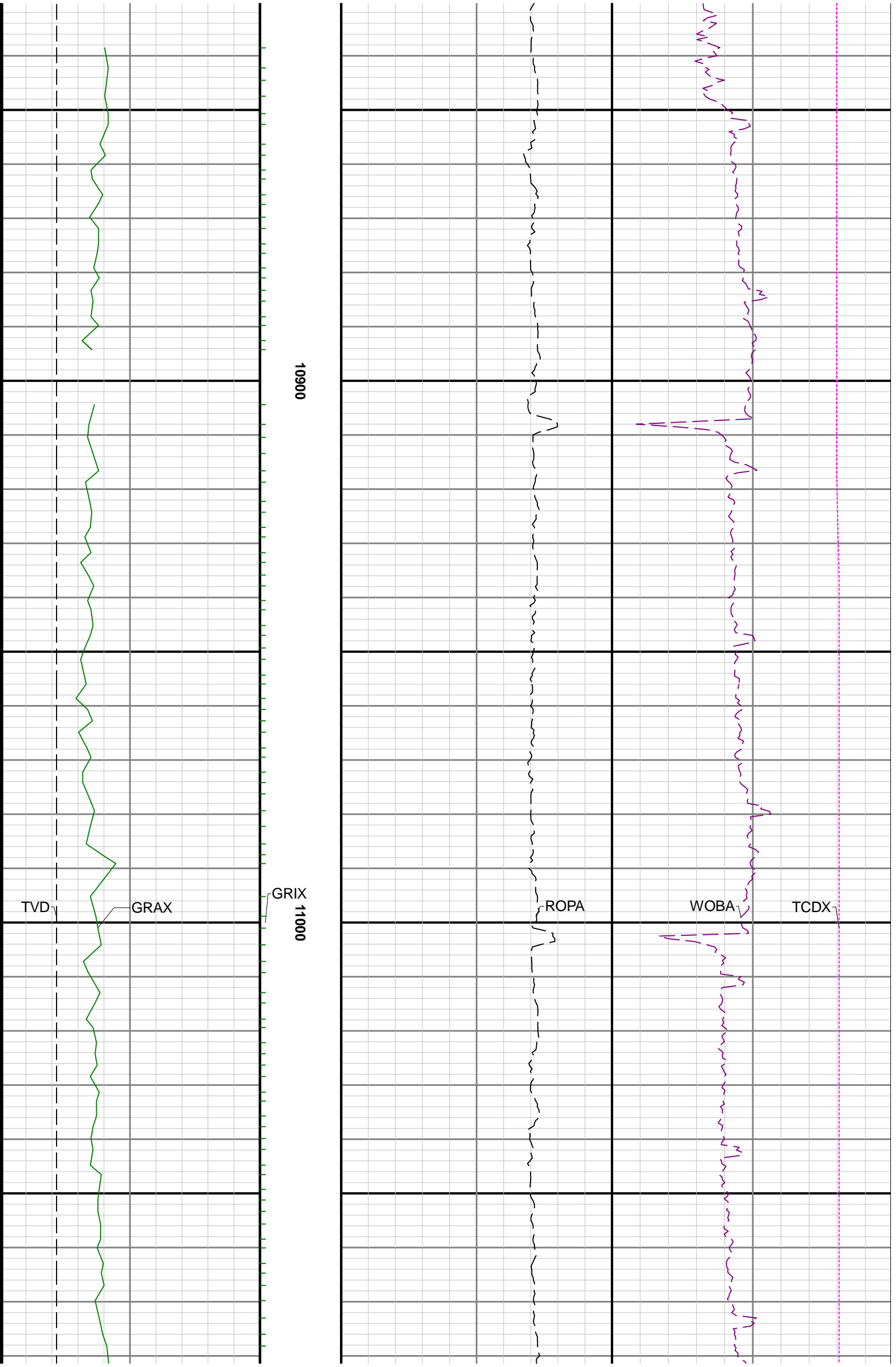


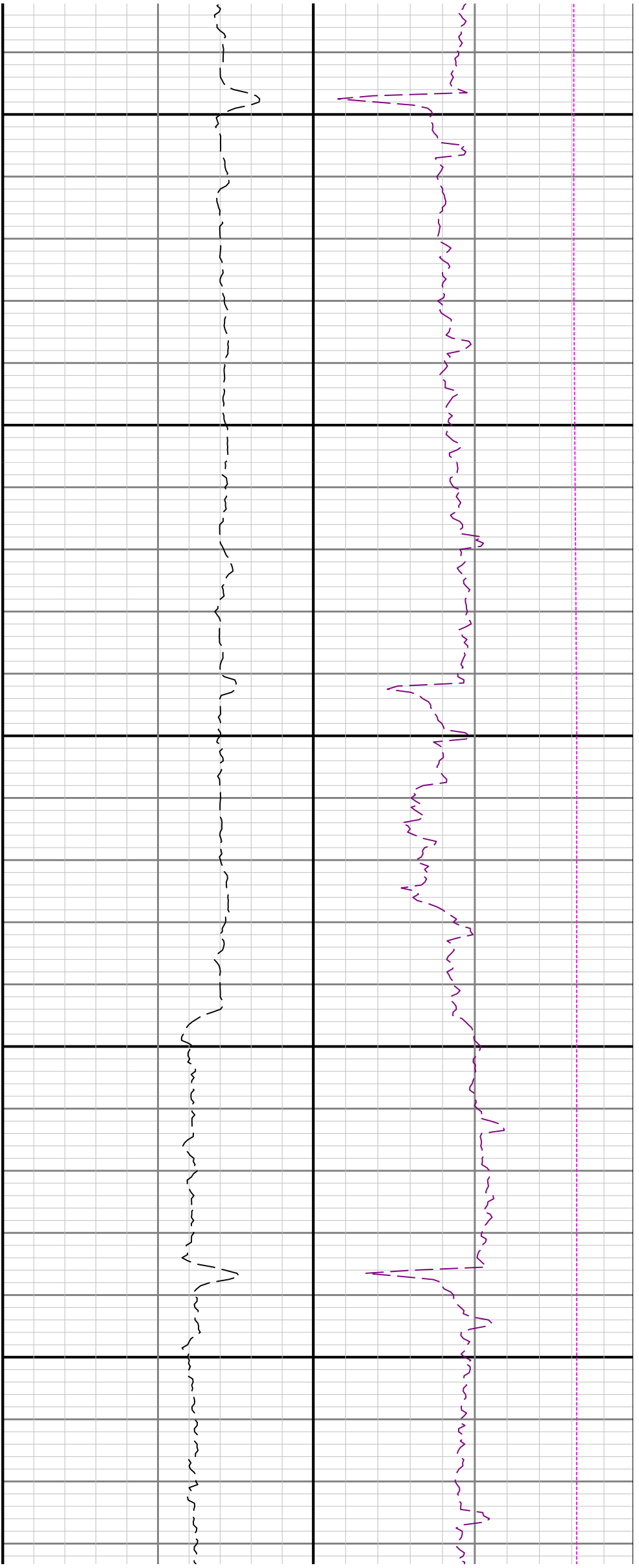








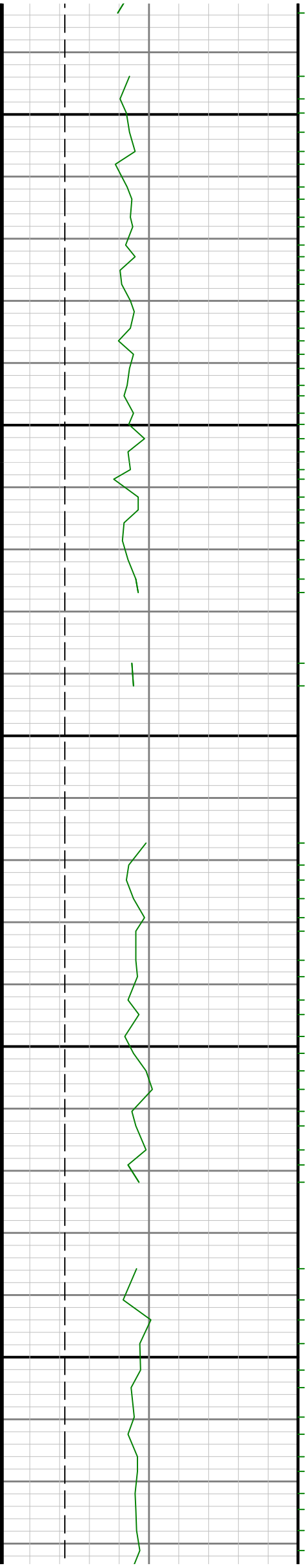


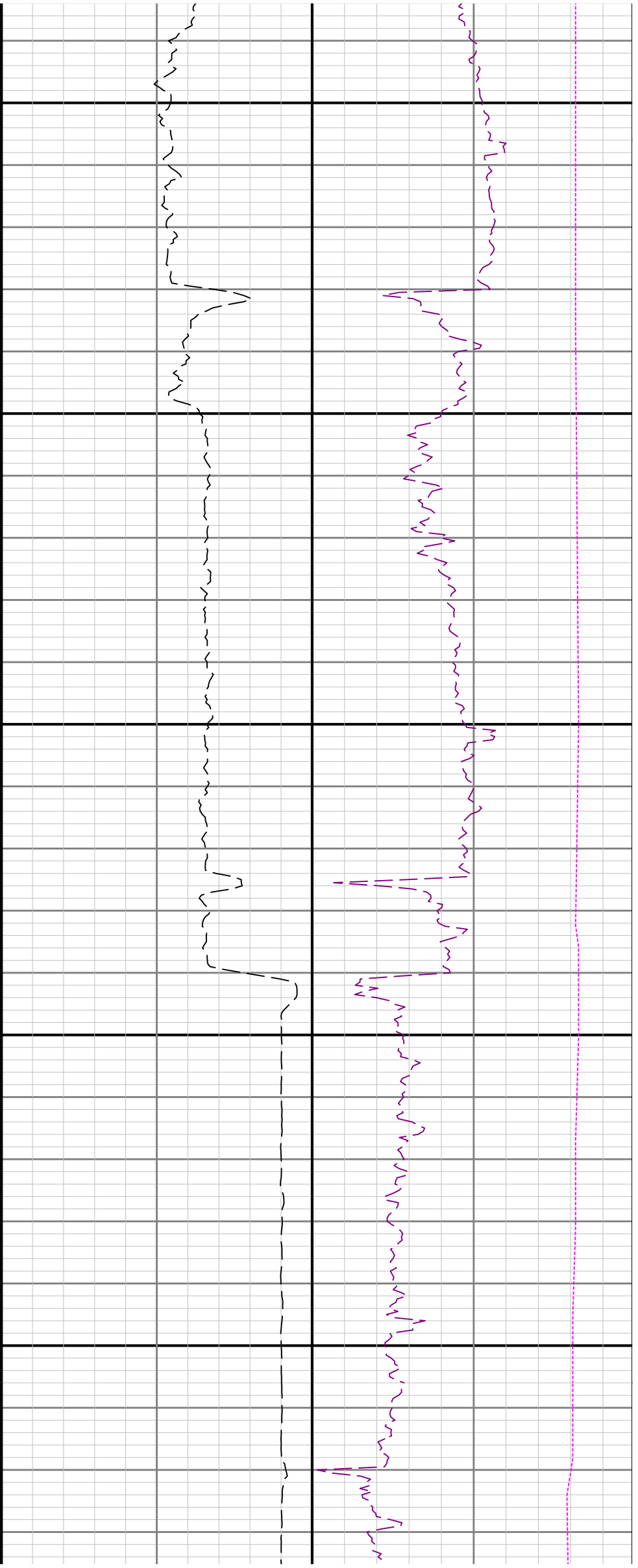


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11200

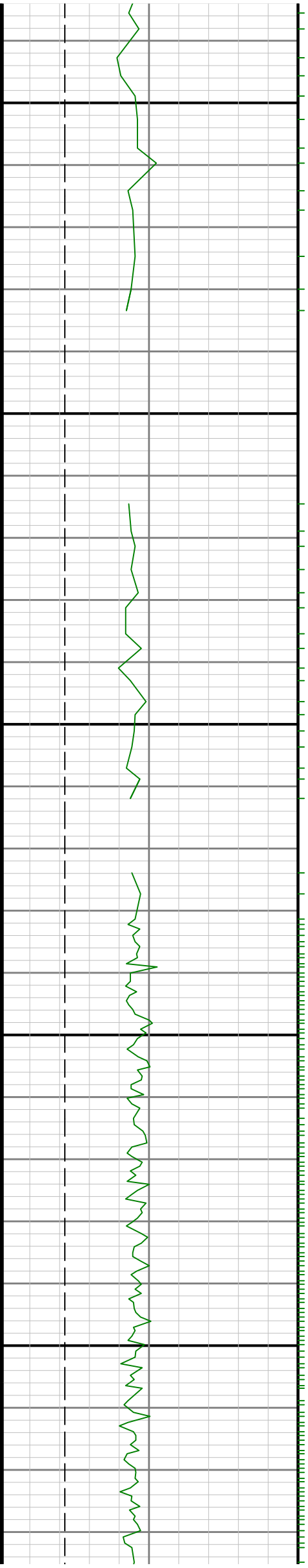
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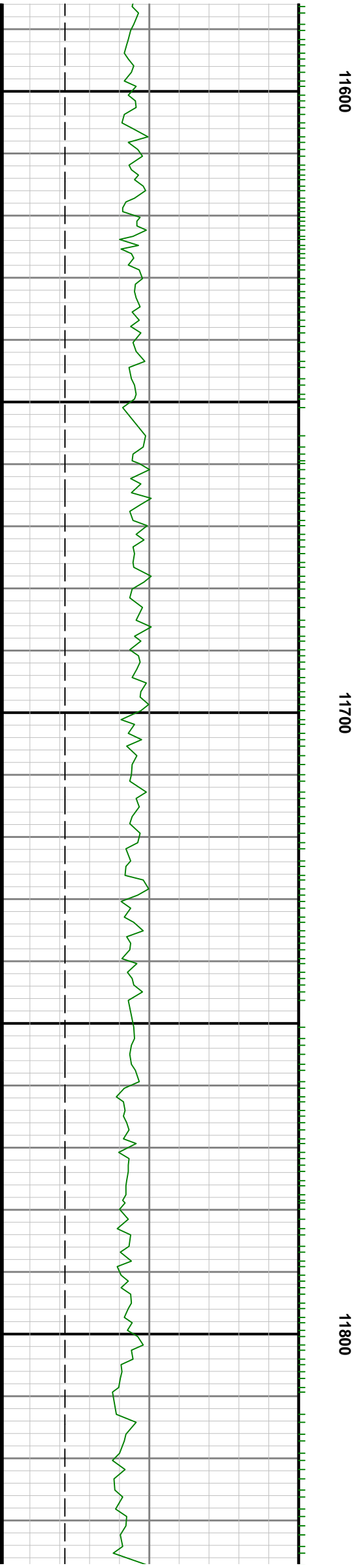
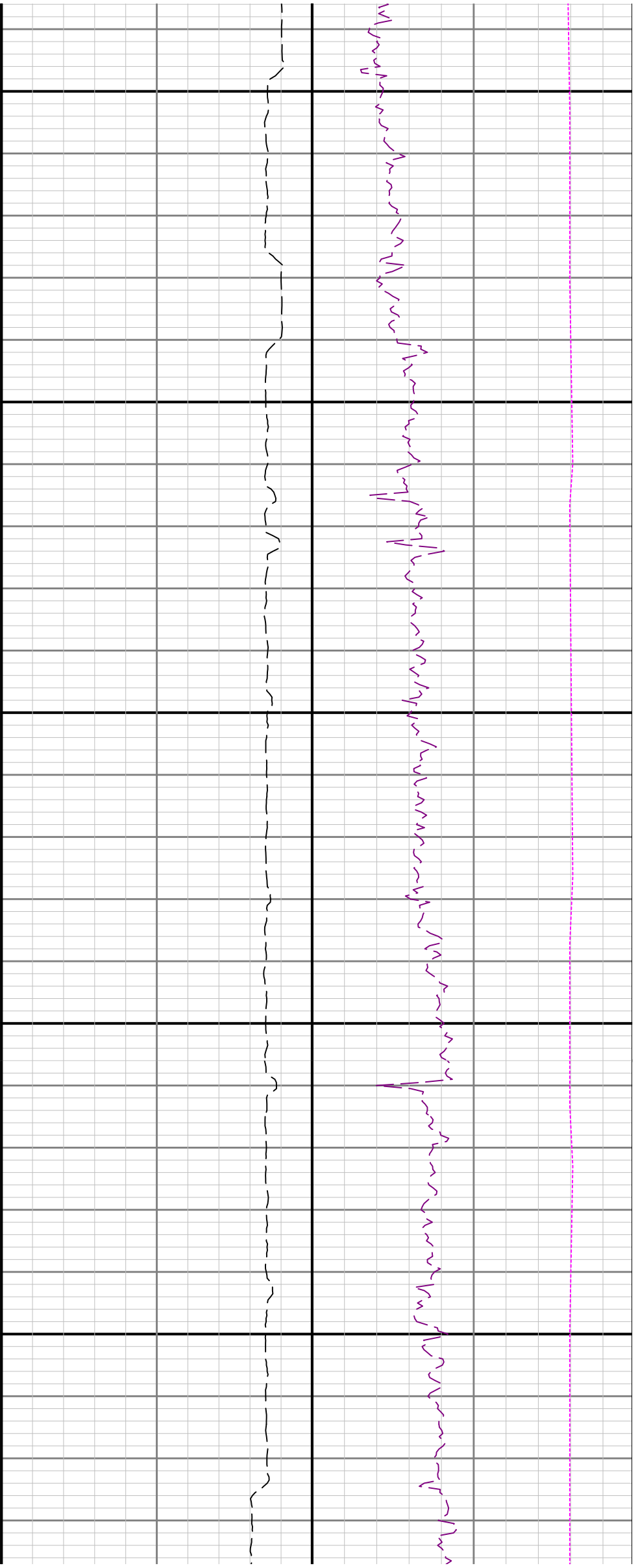


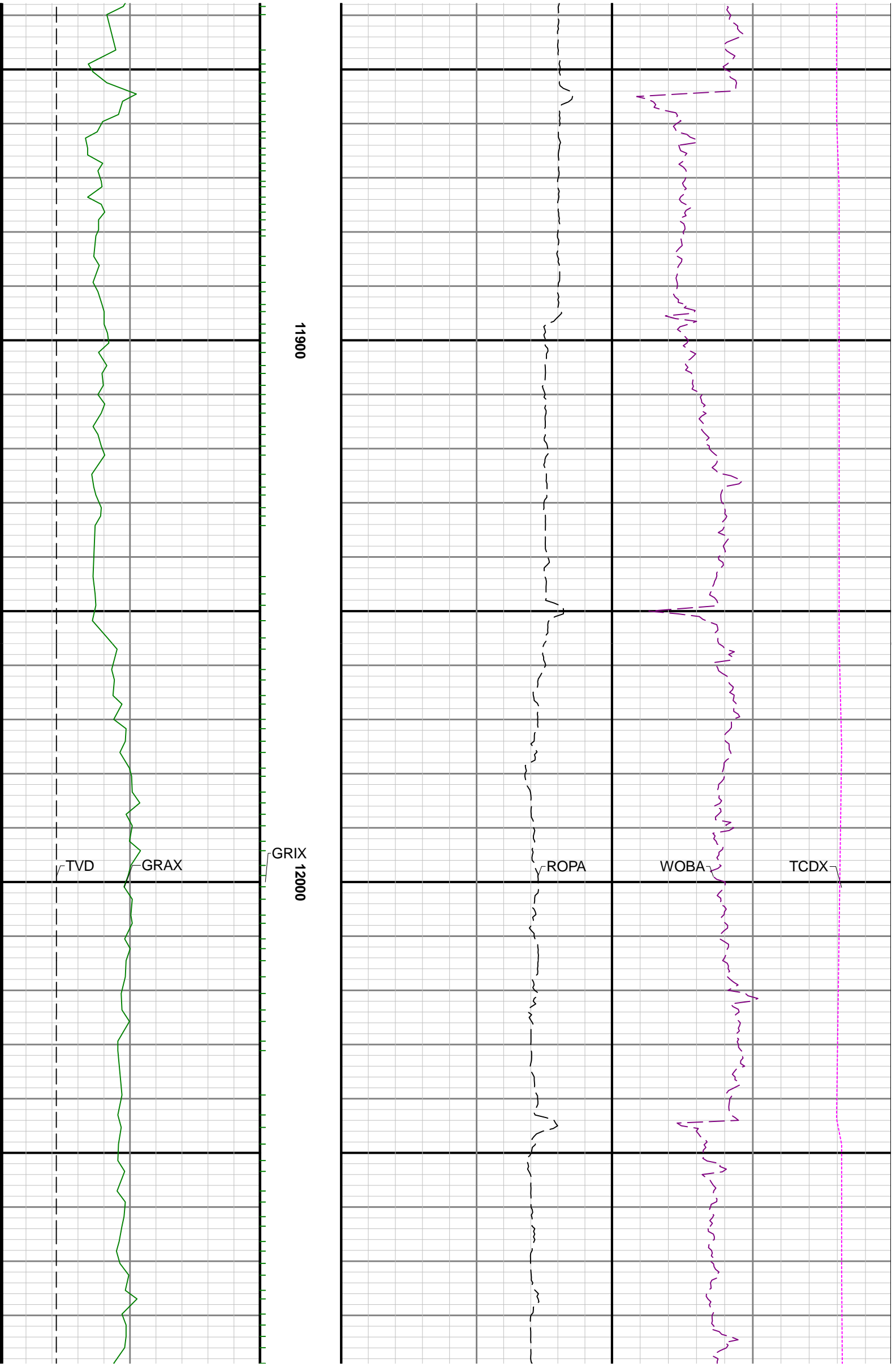
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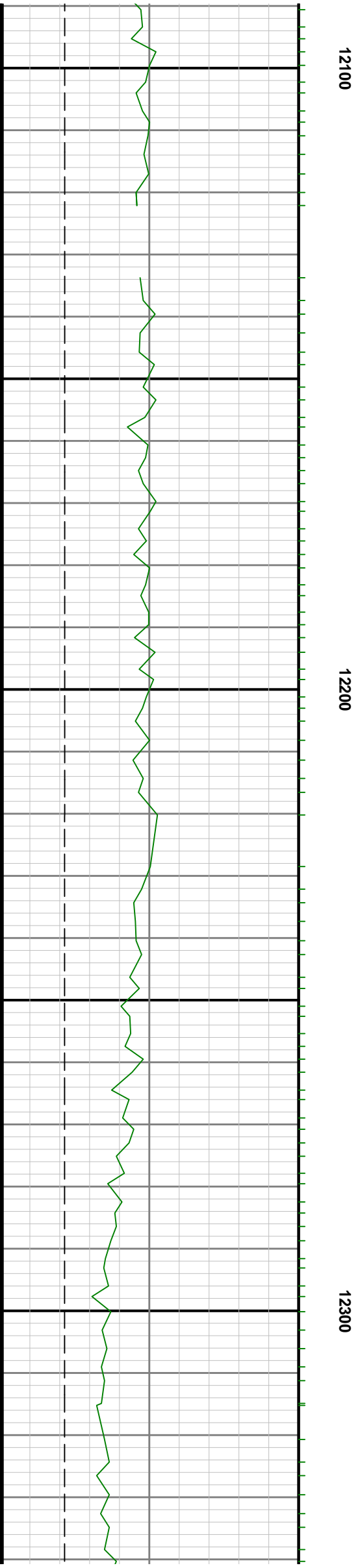
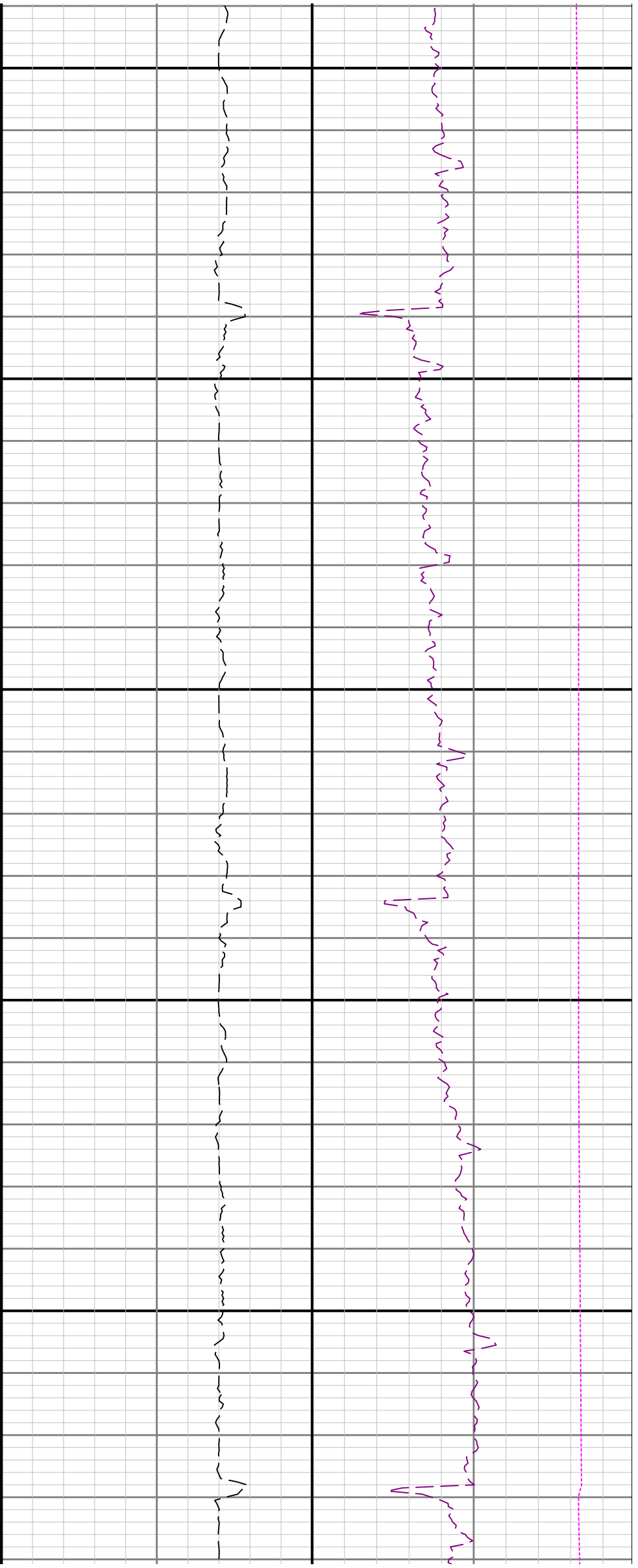
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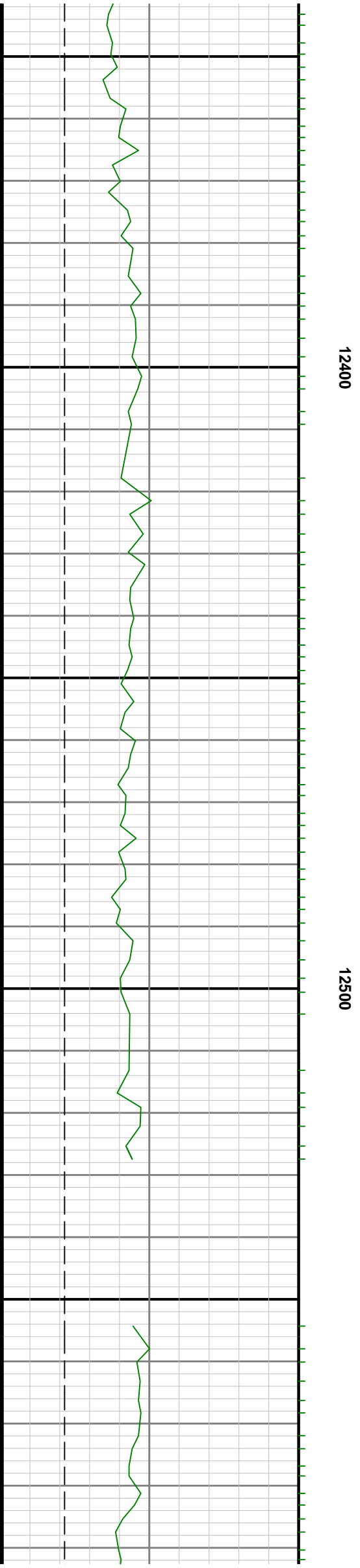
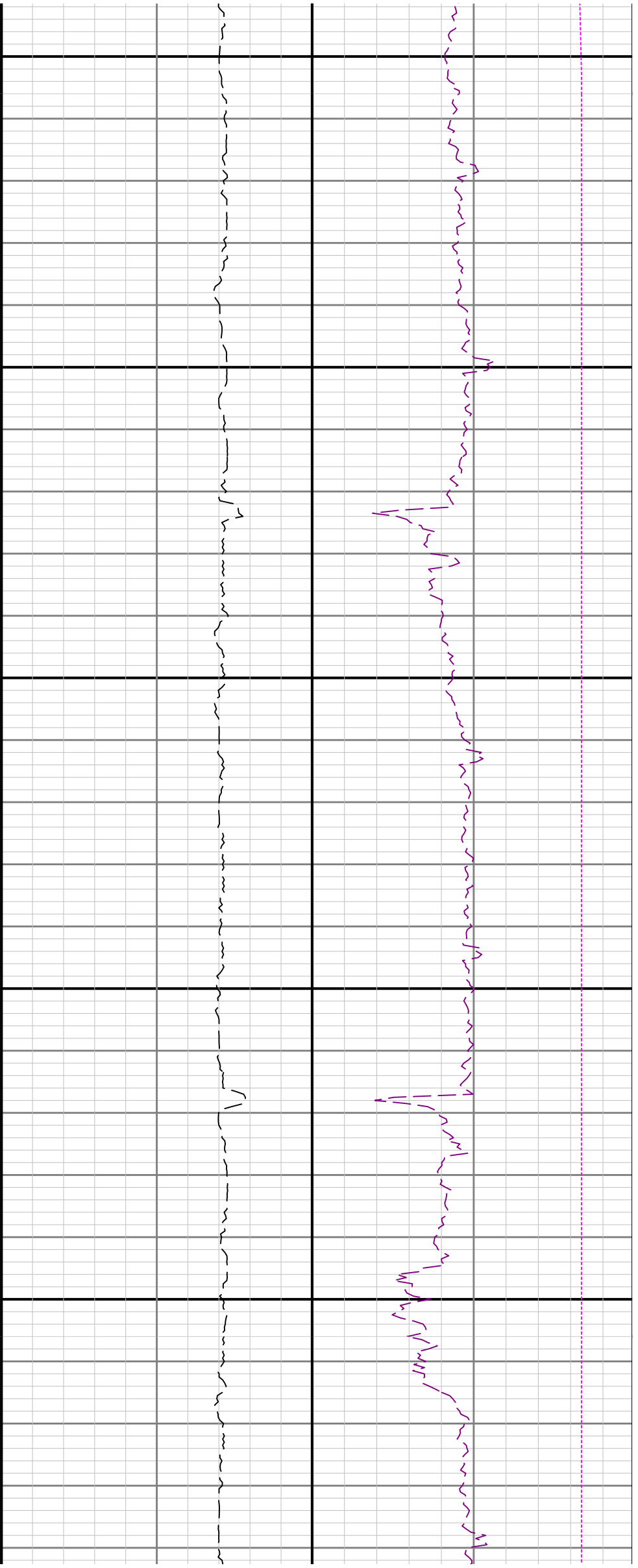


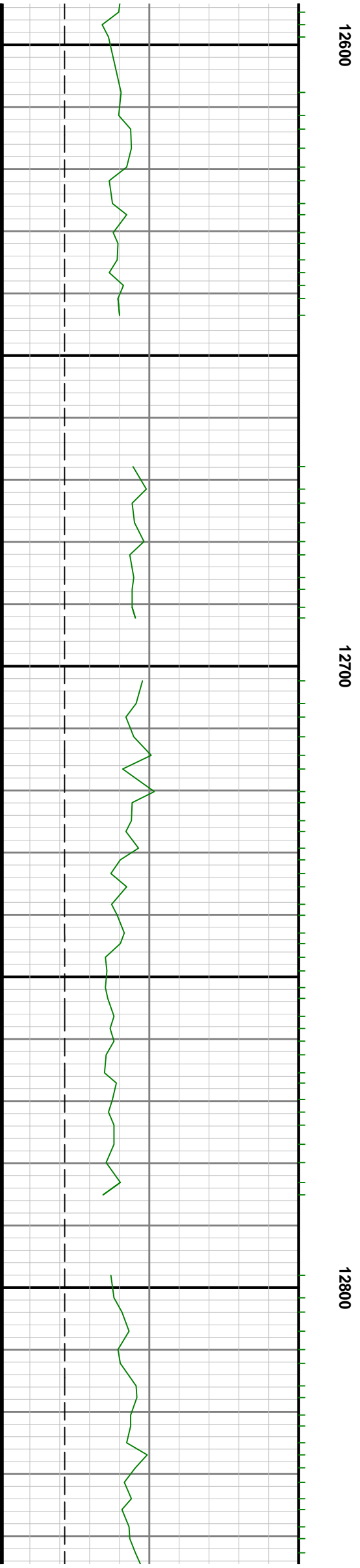
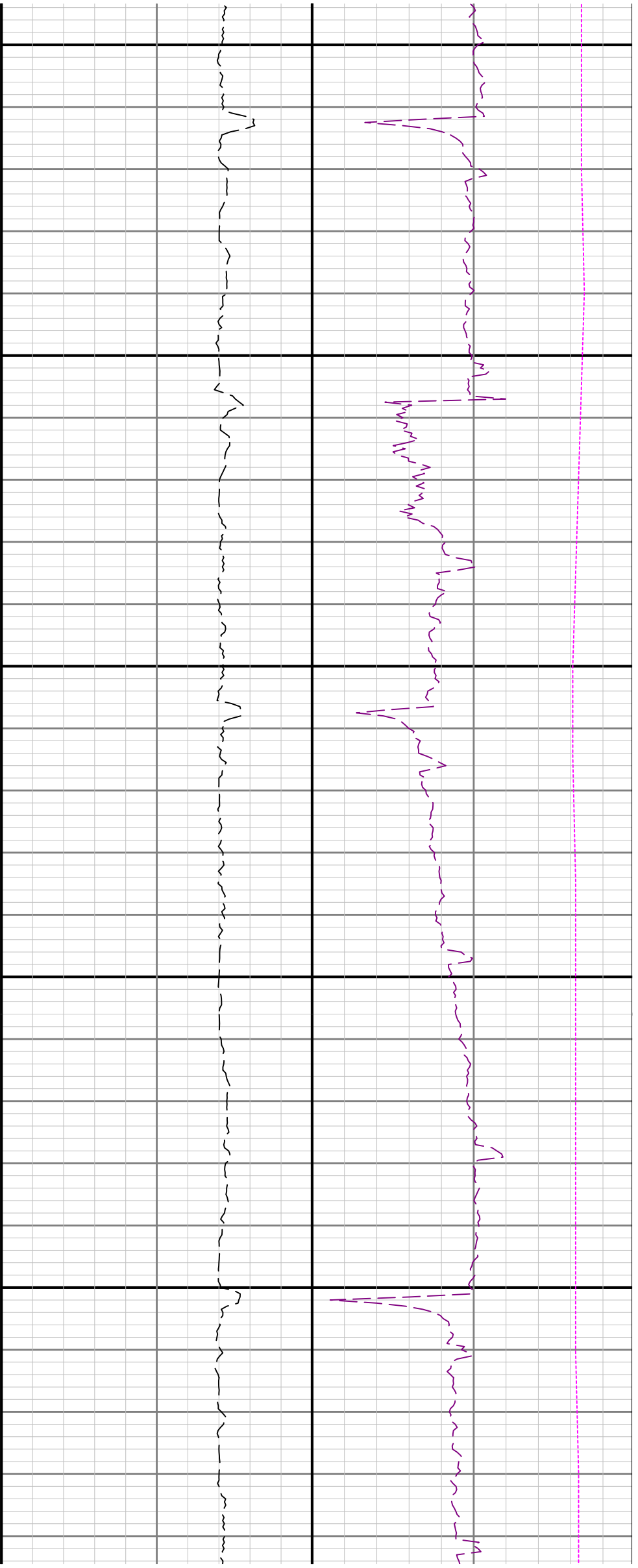


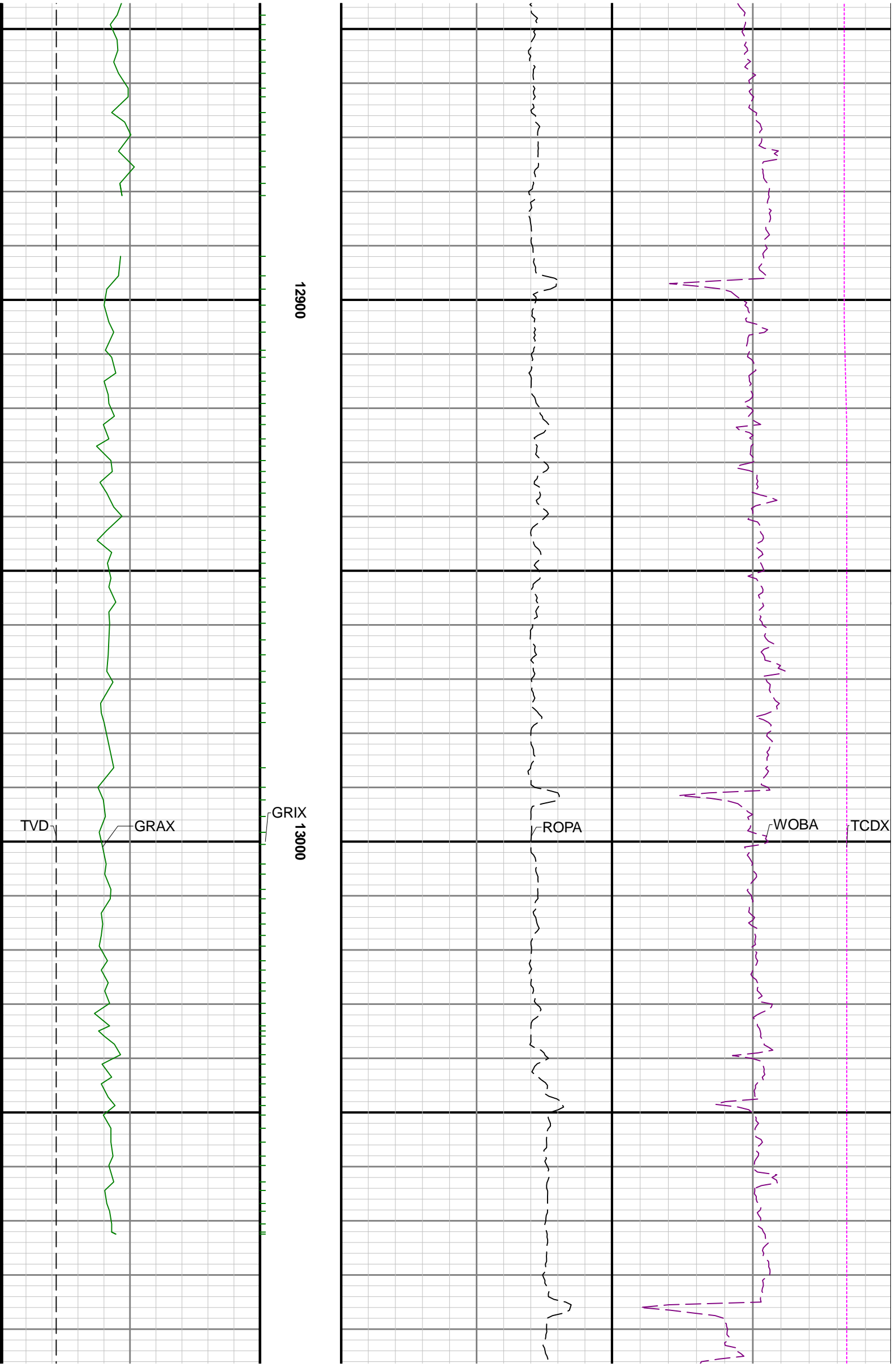


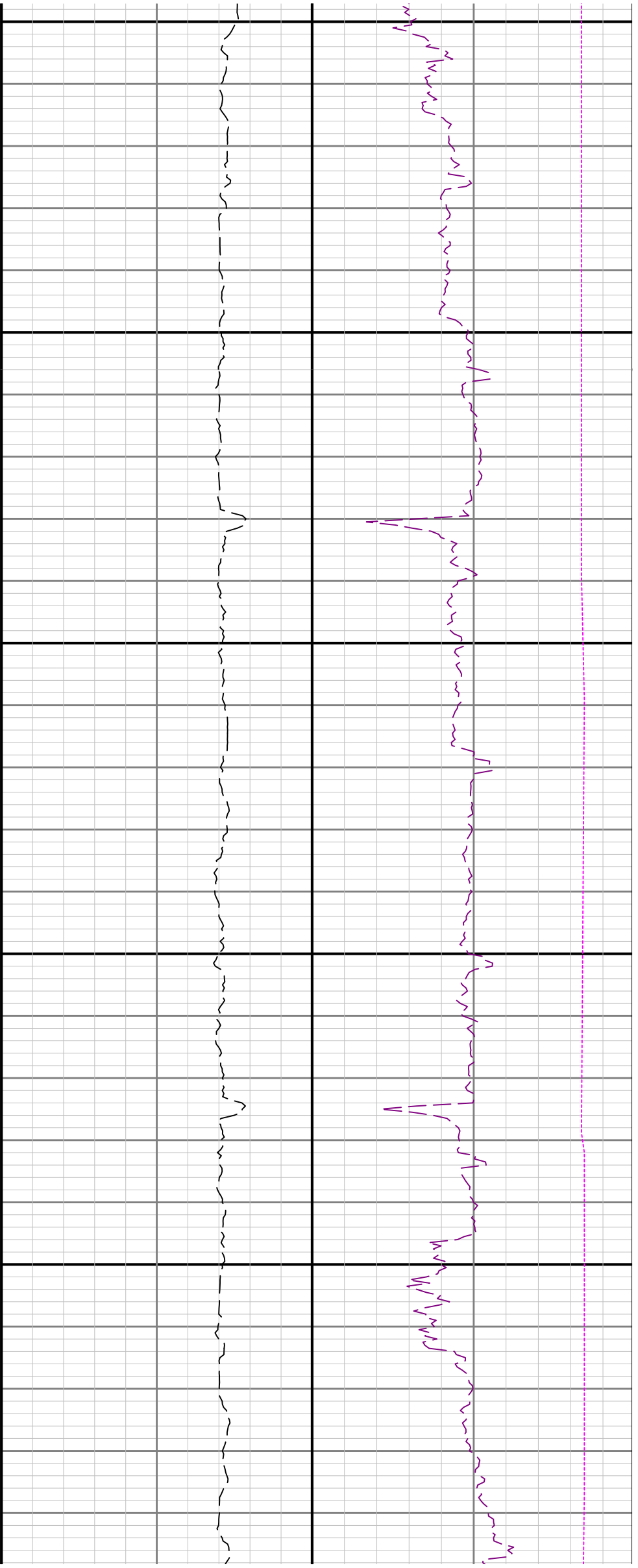








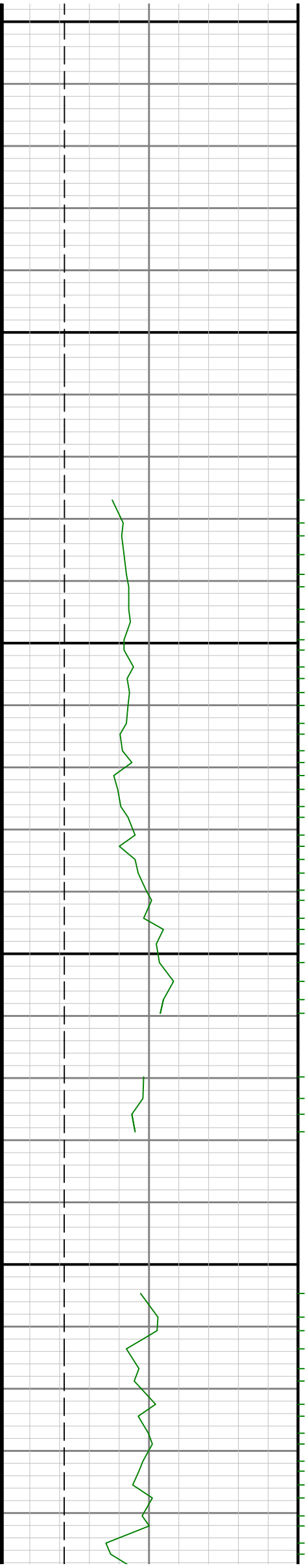


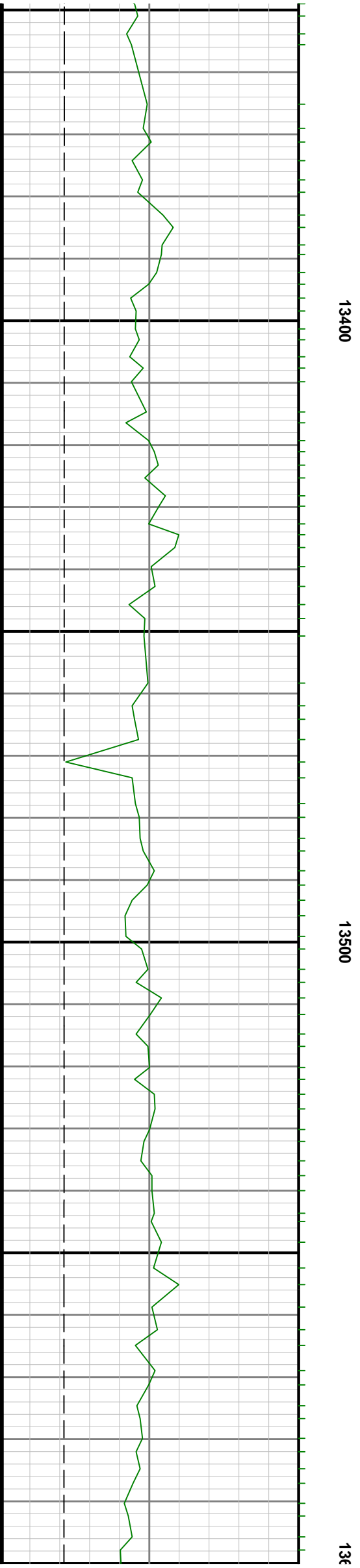
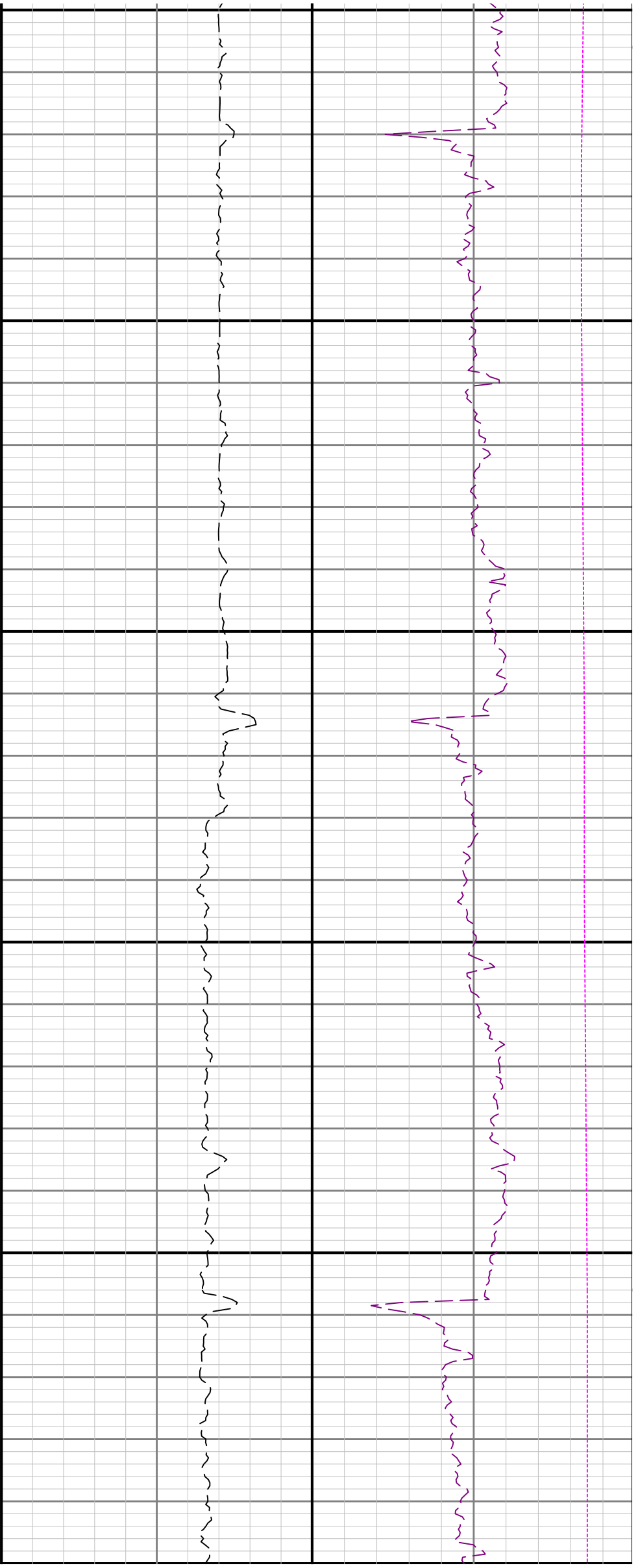


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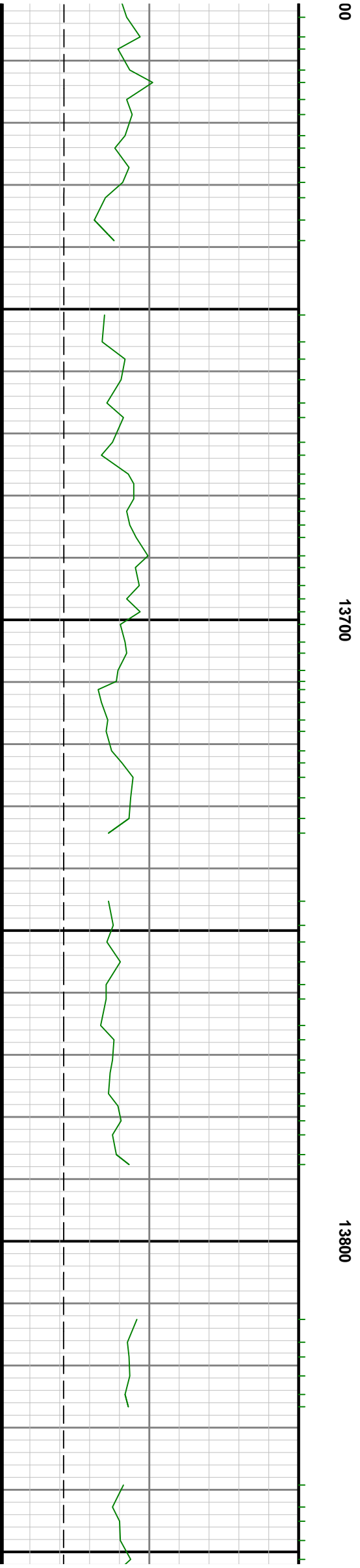
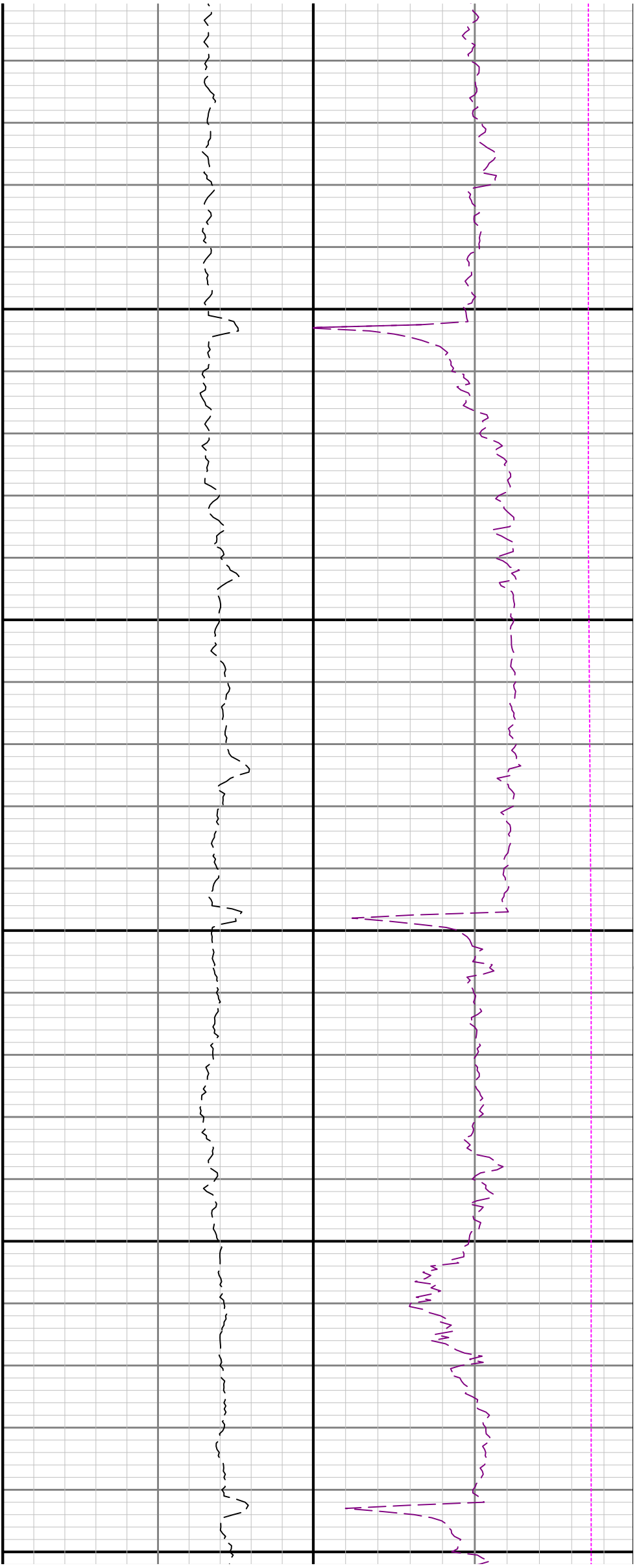
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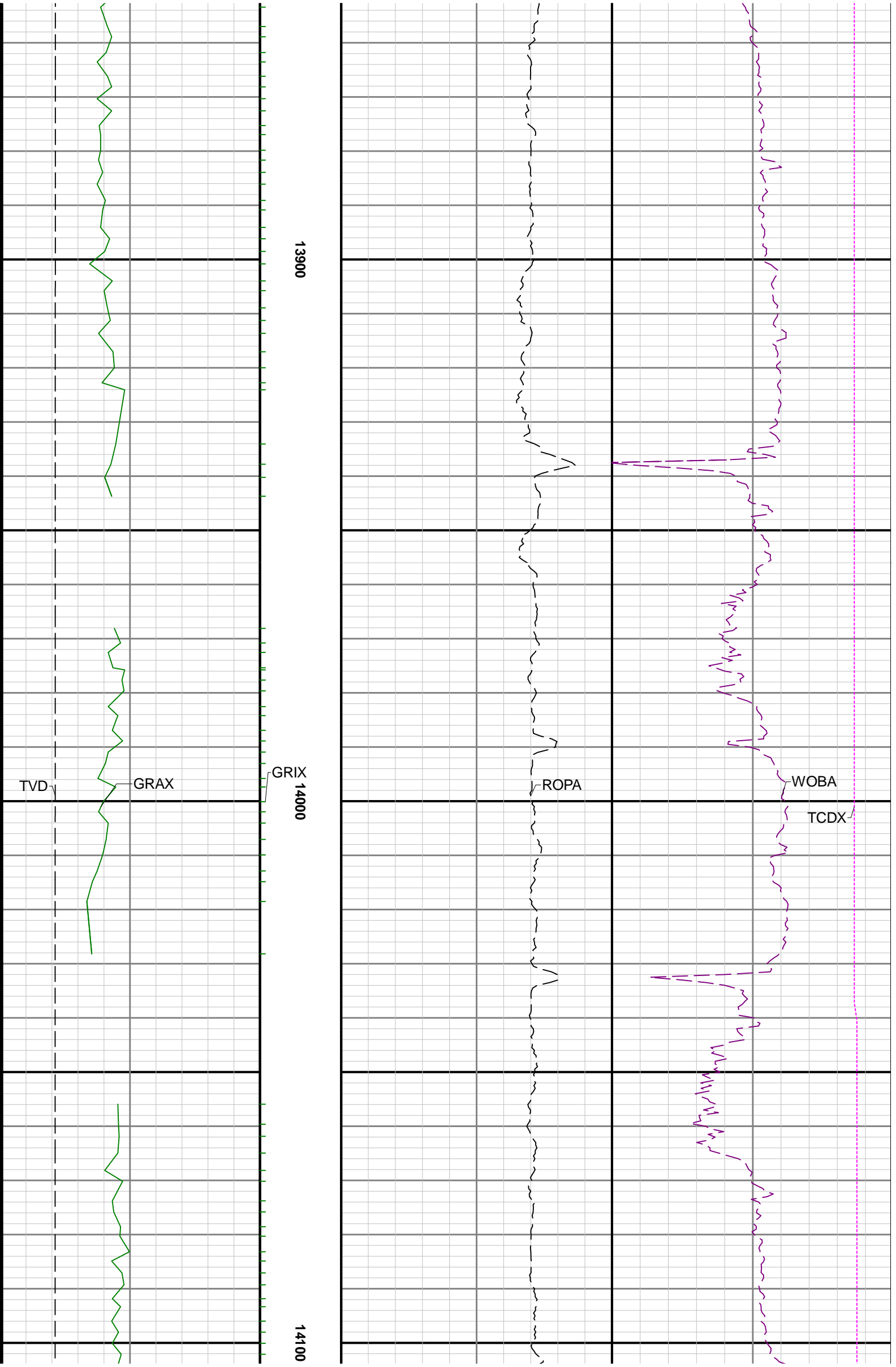
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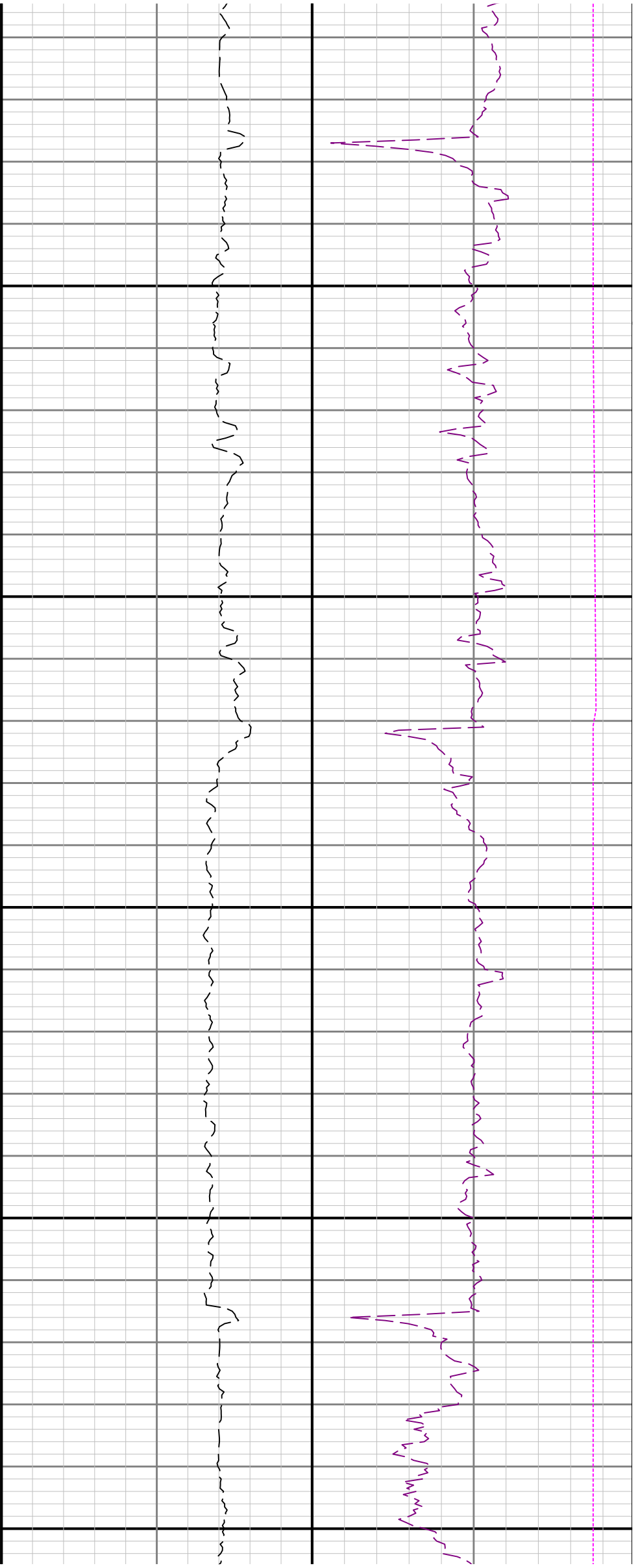






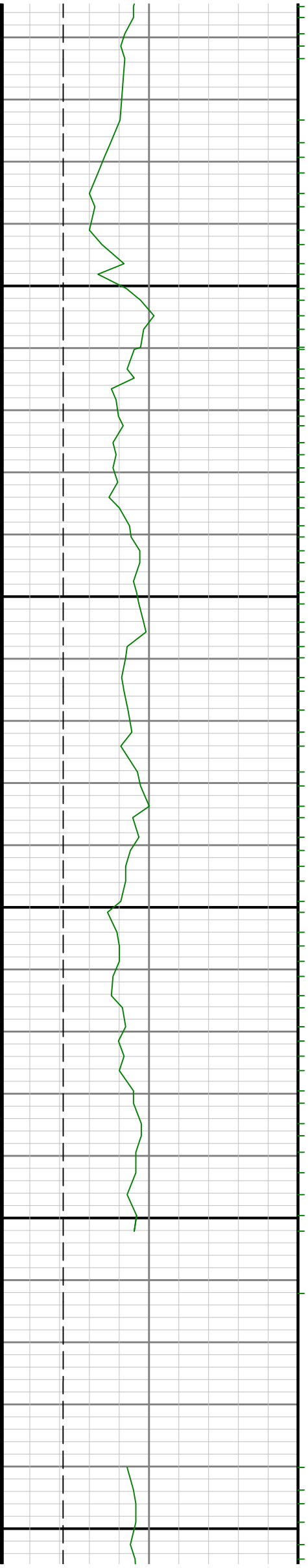


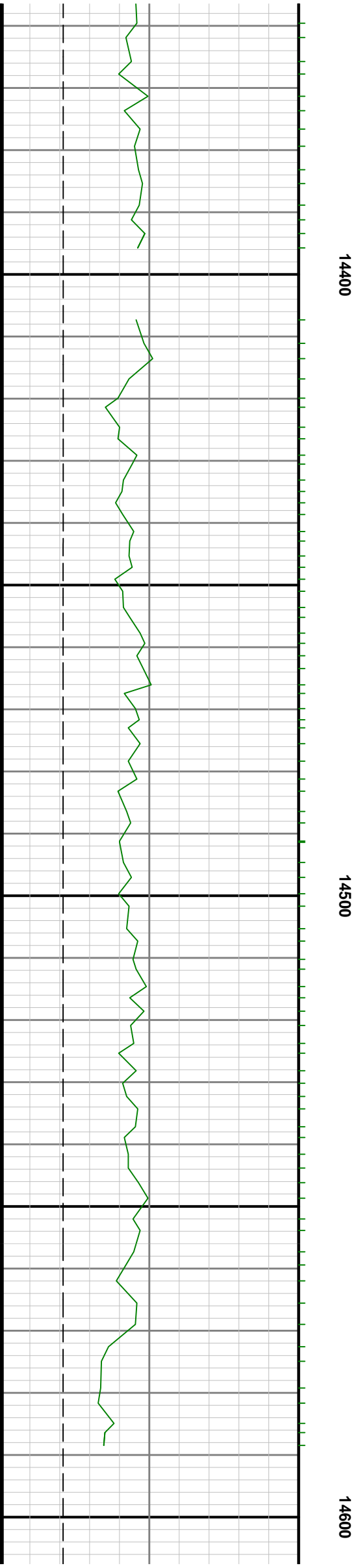
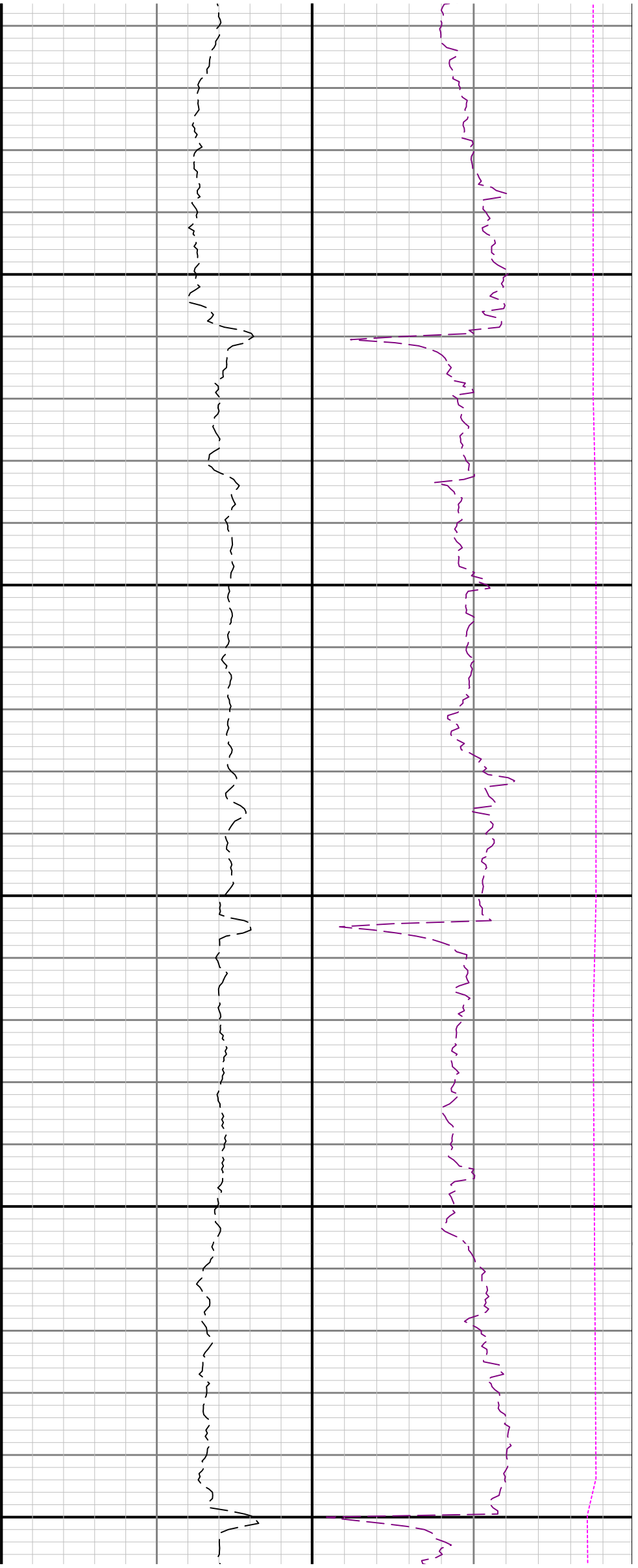


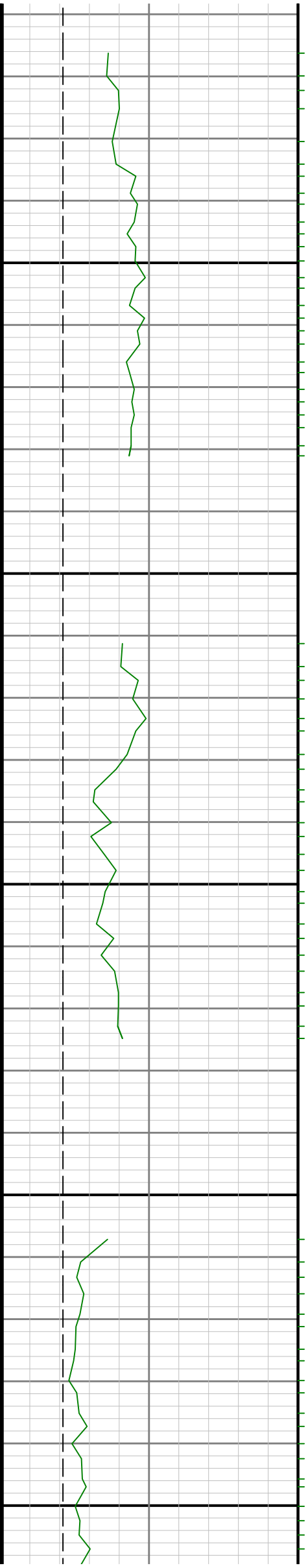
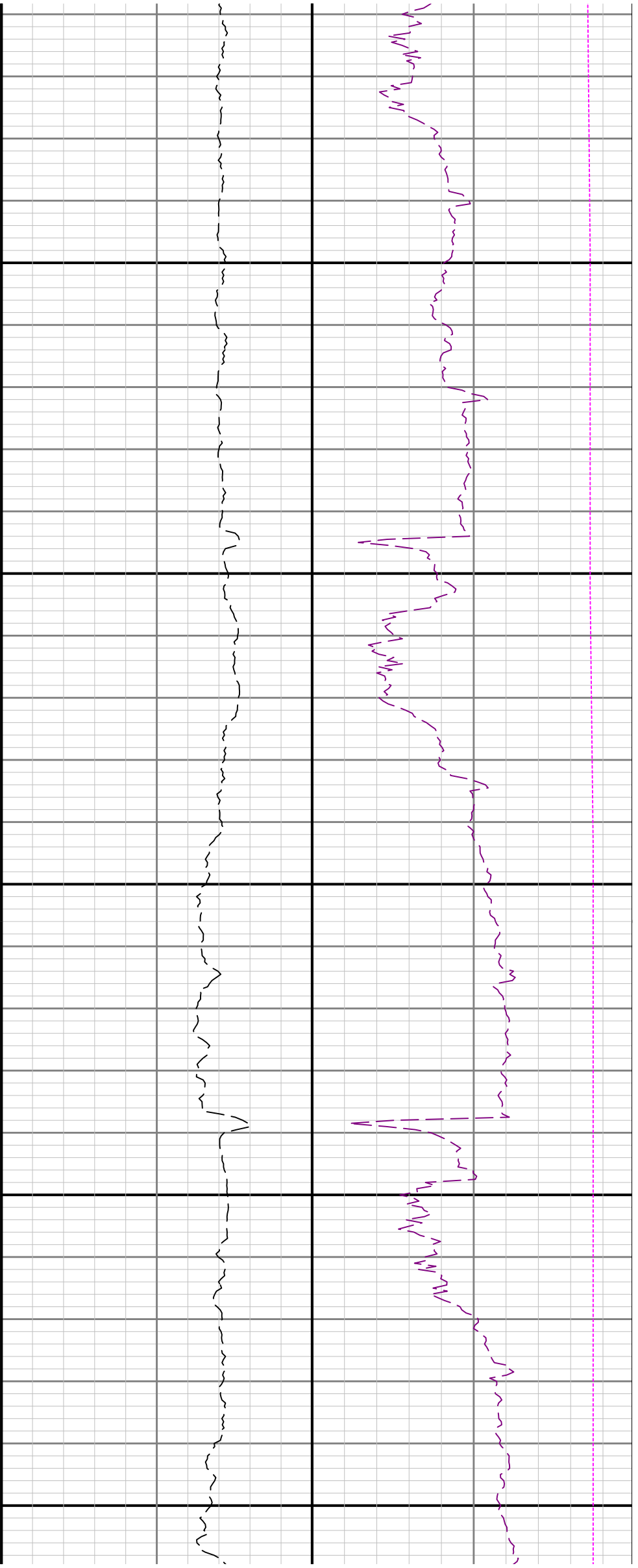


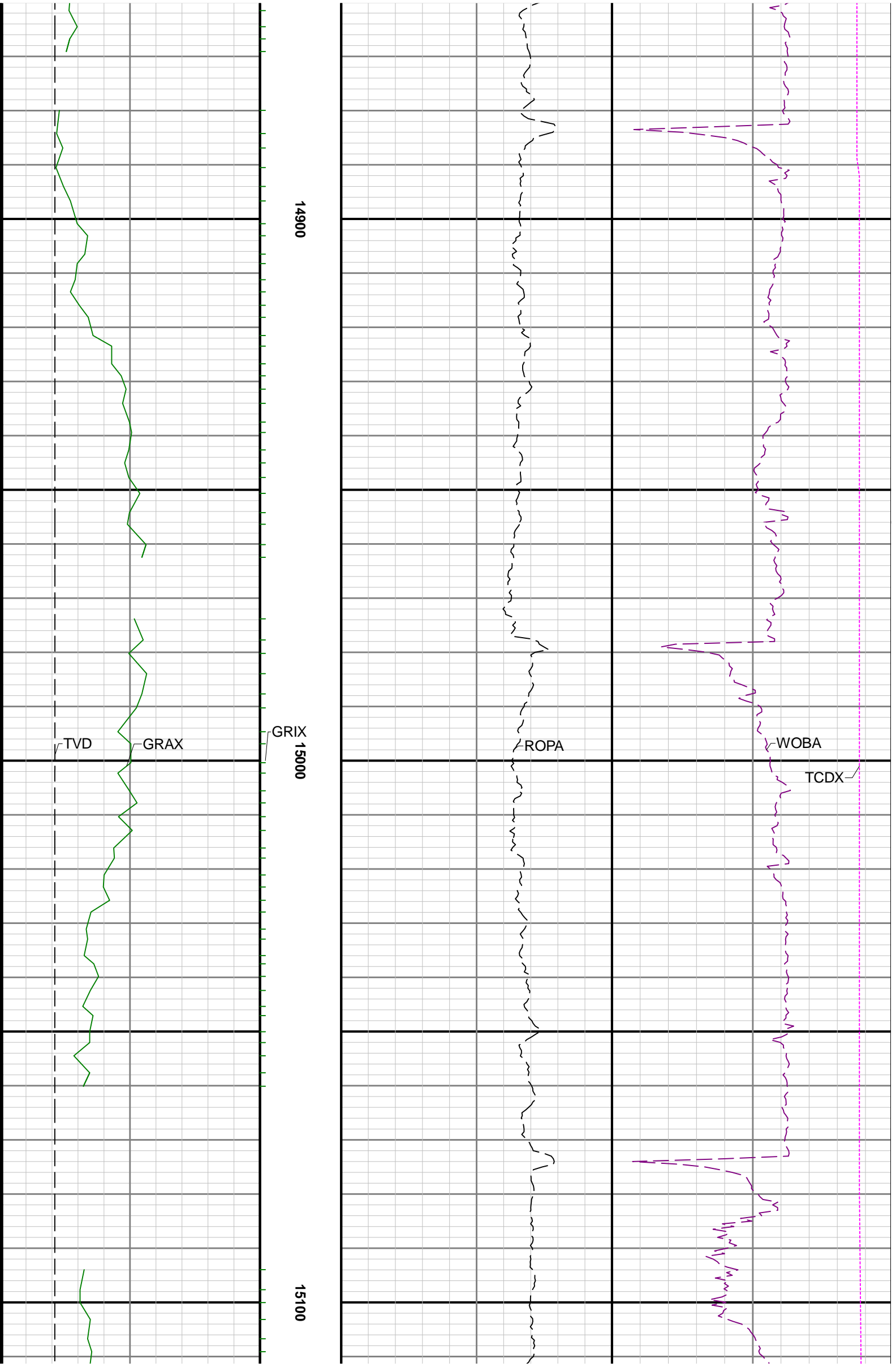
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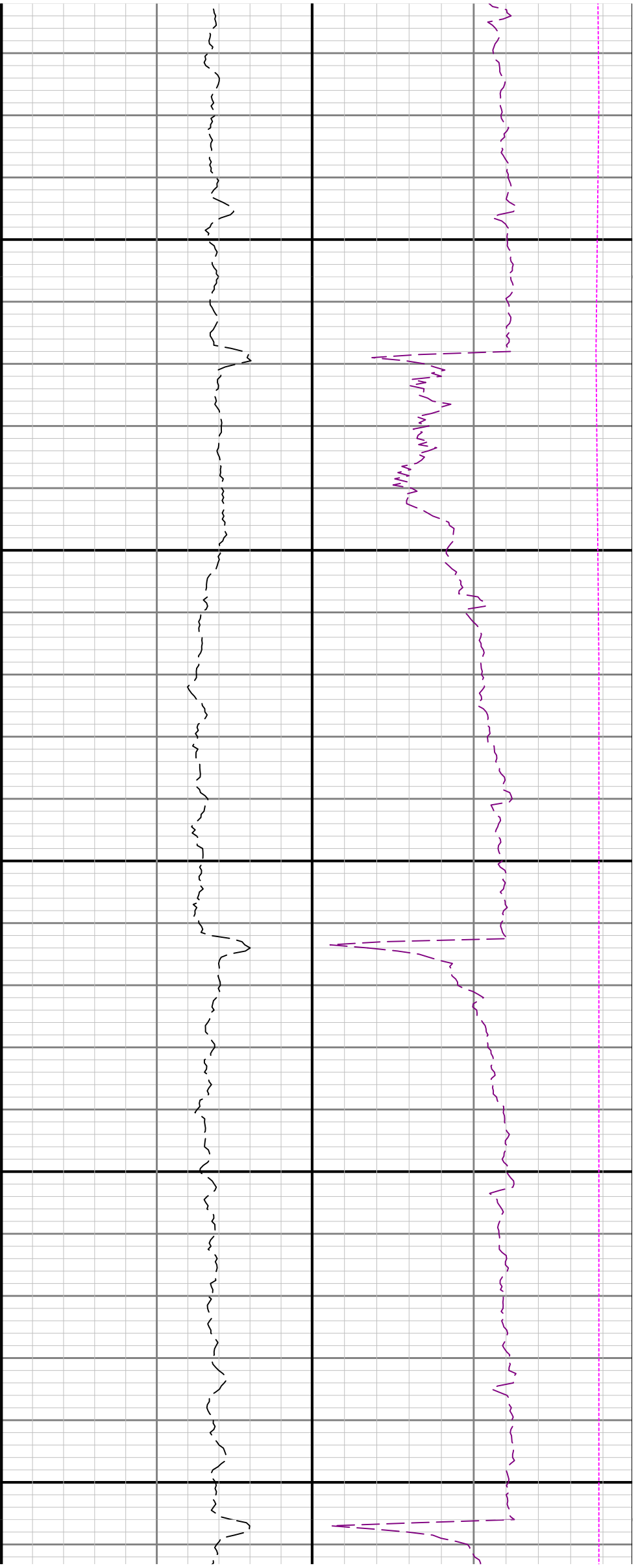
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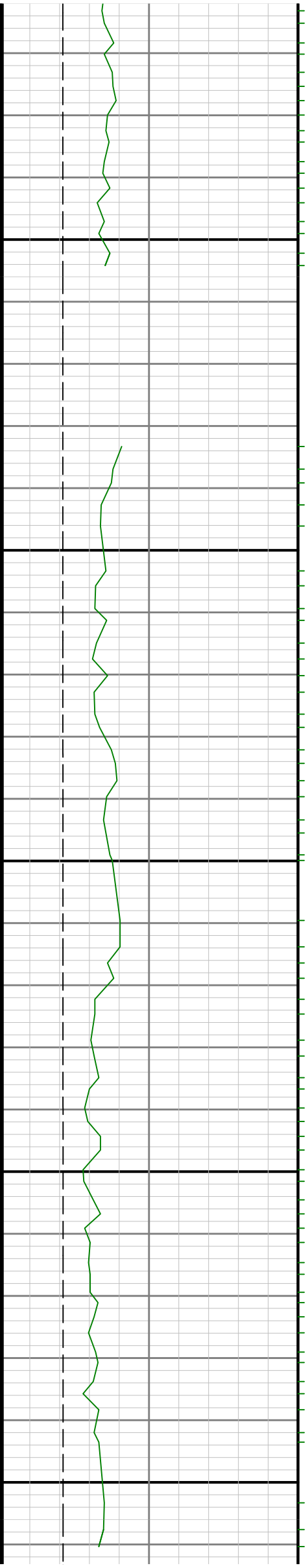


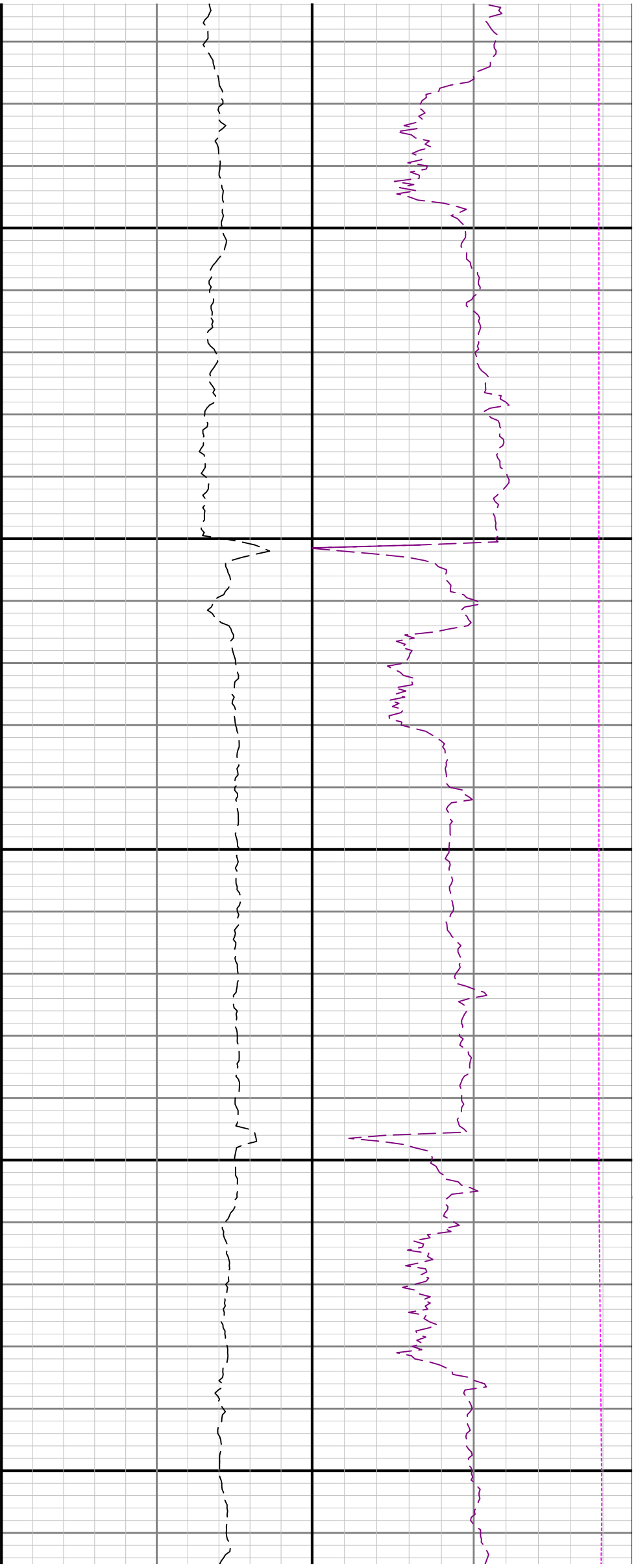




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15300

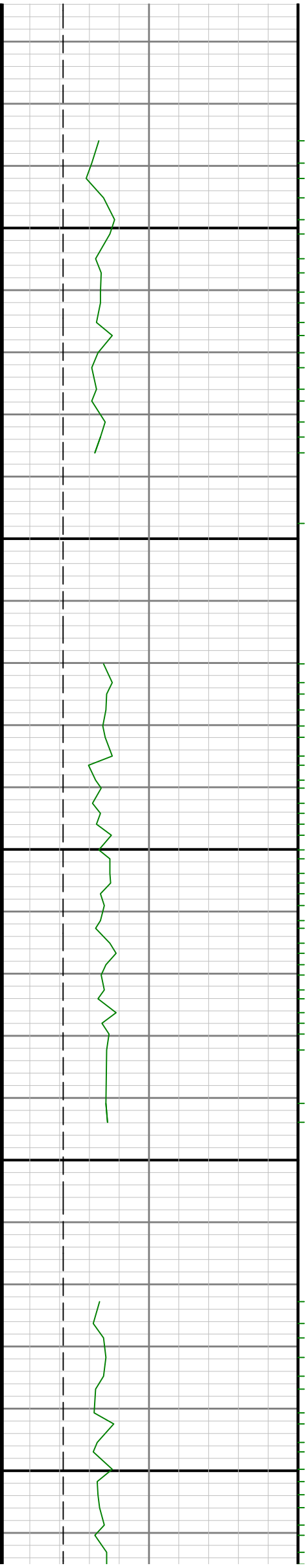




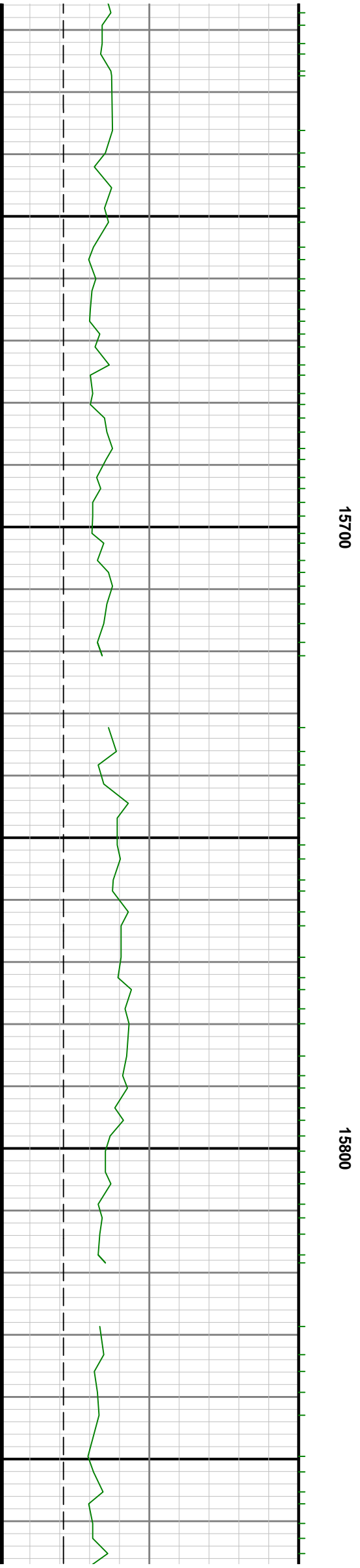
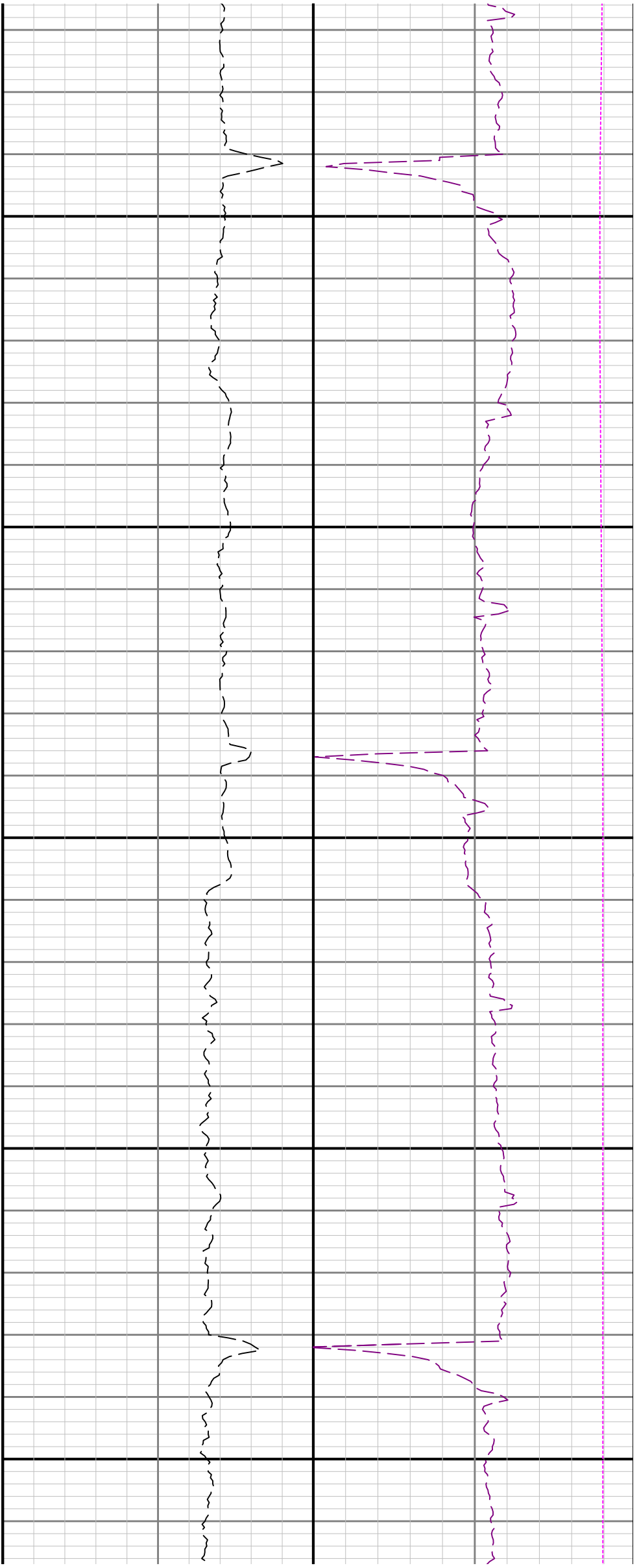
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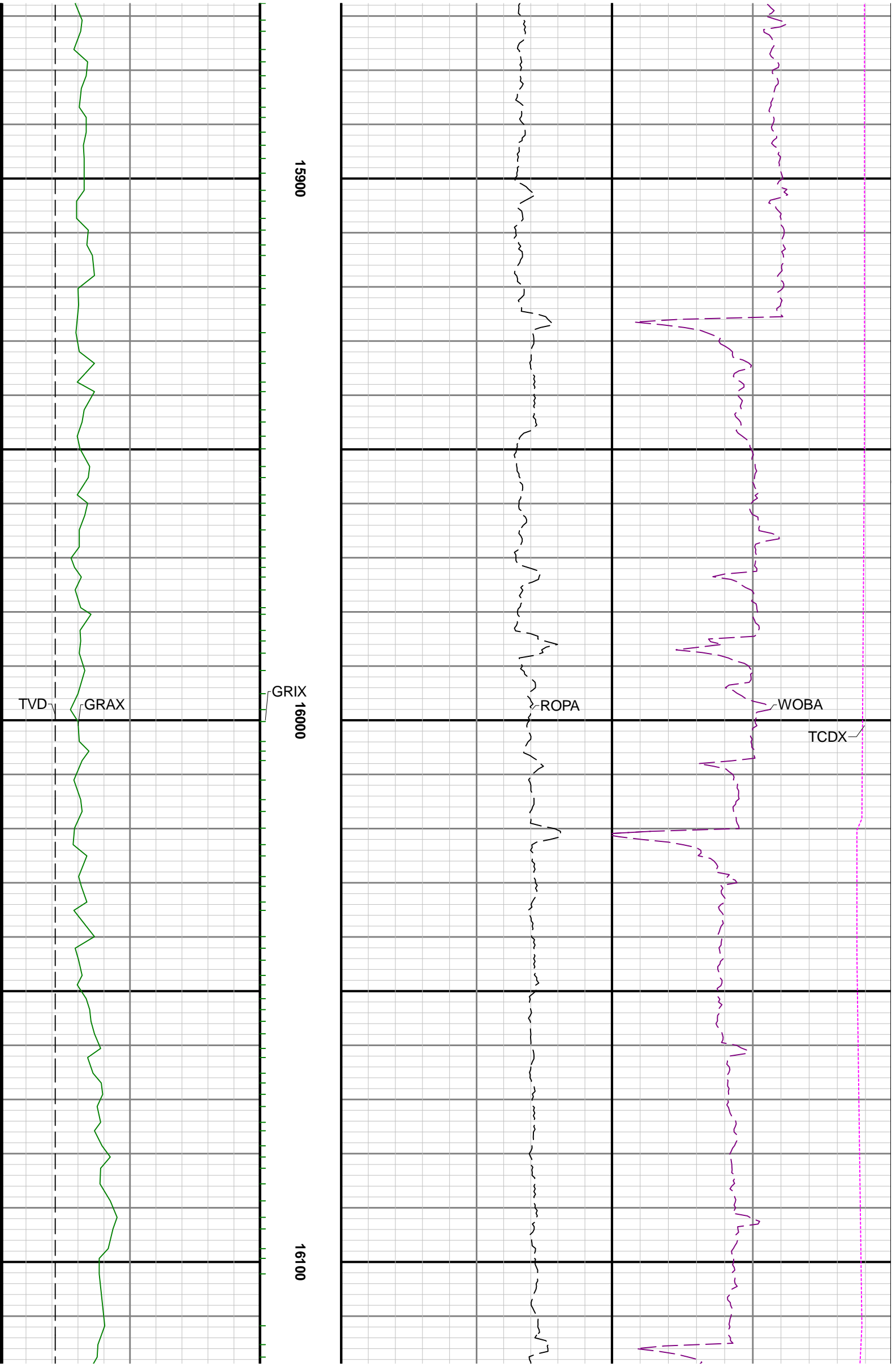
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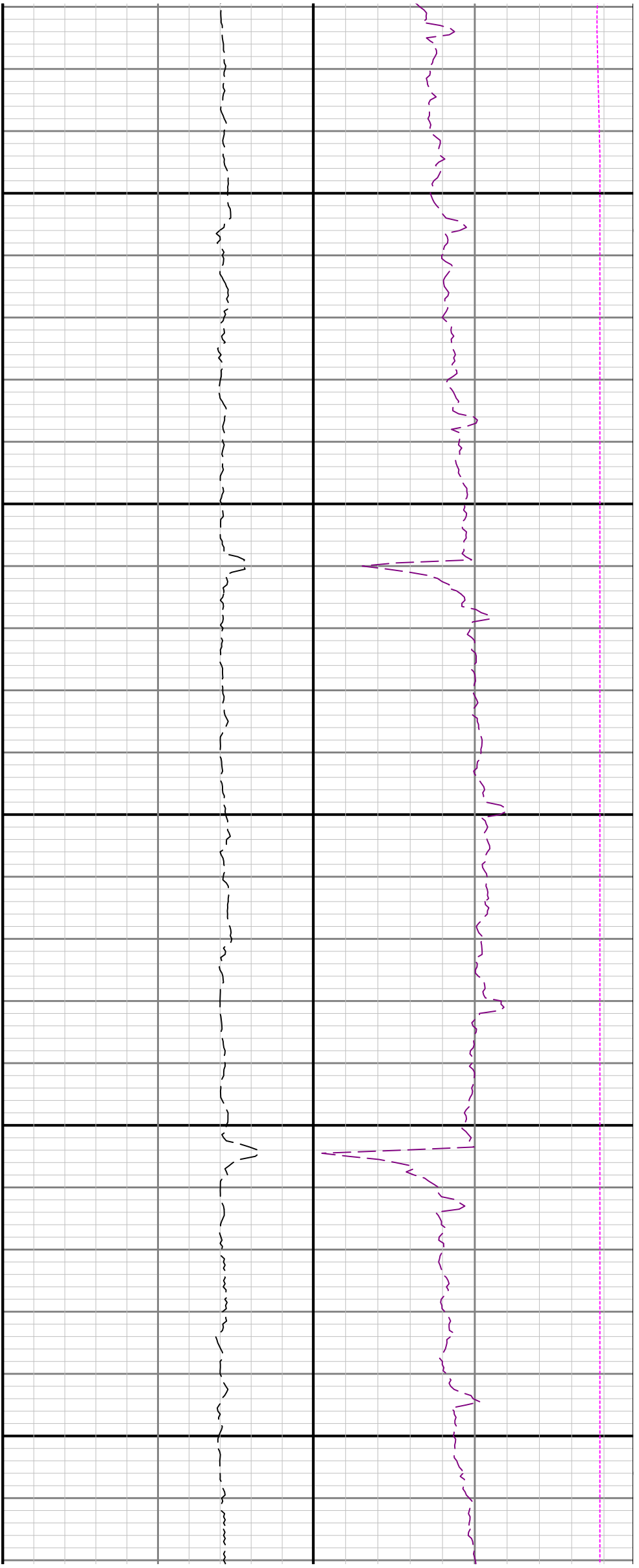
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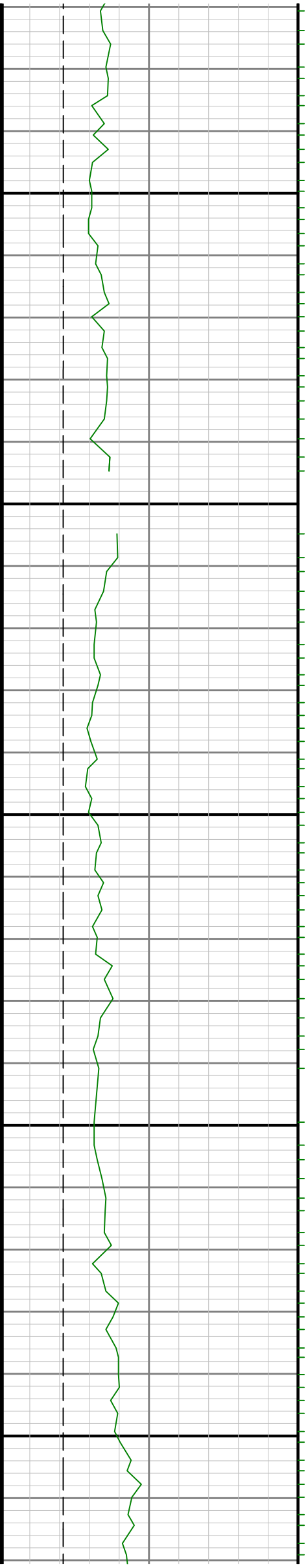


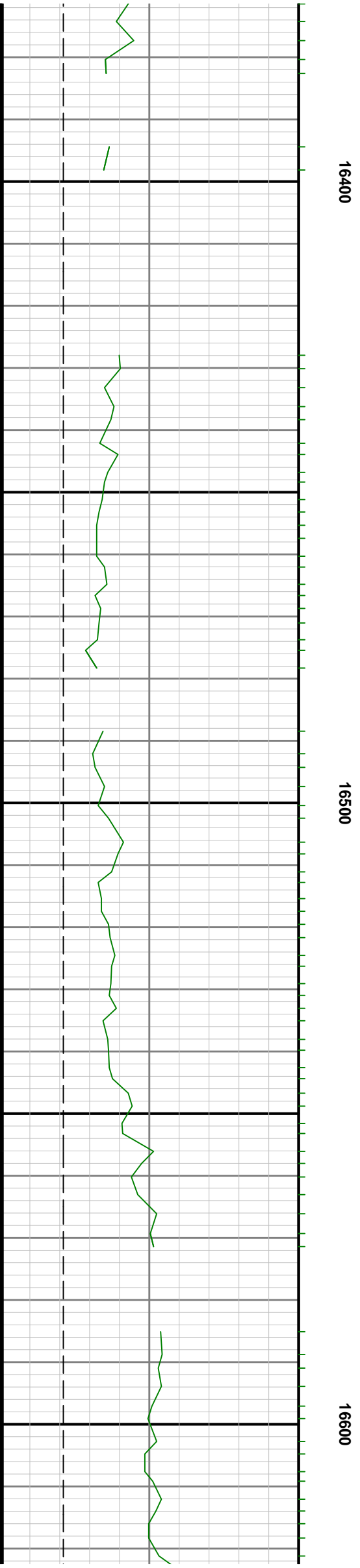


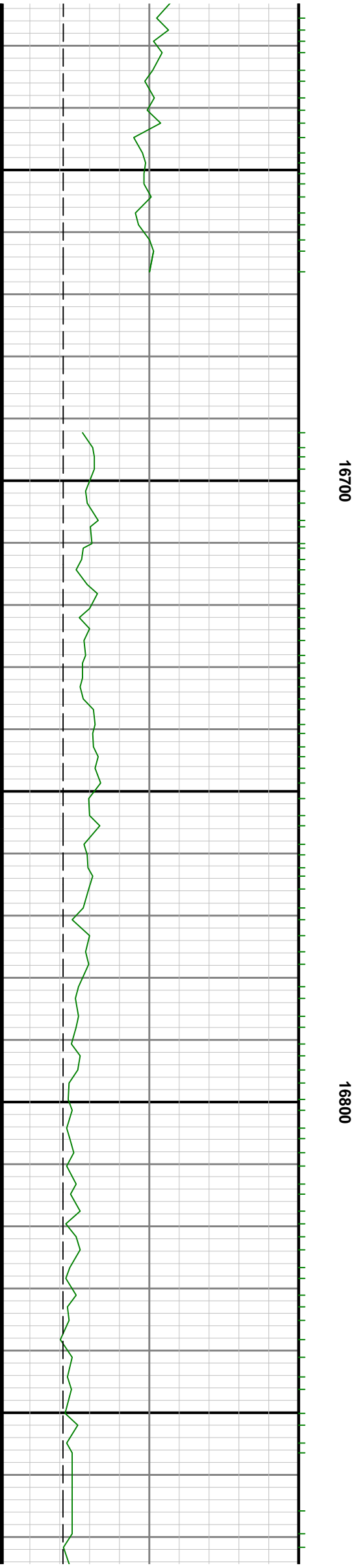
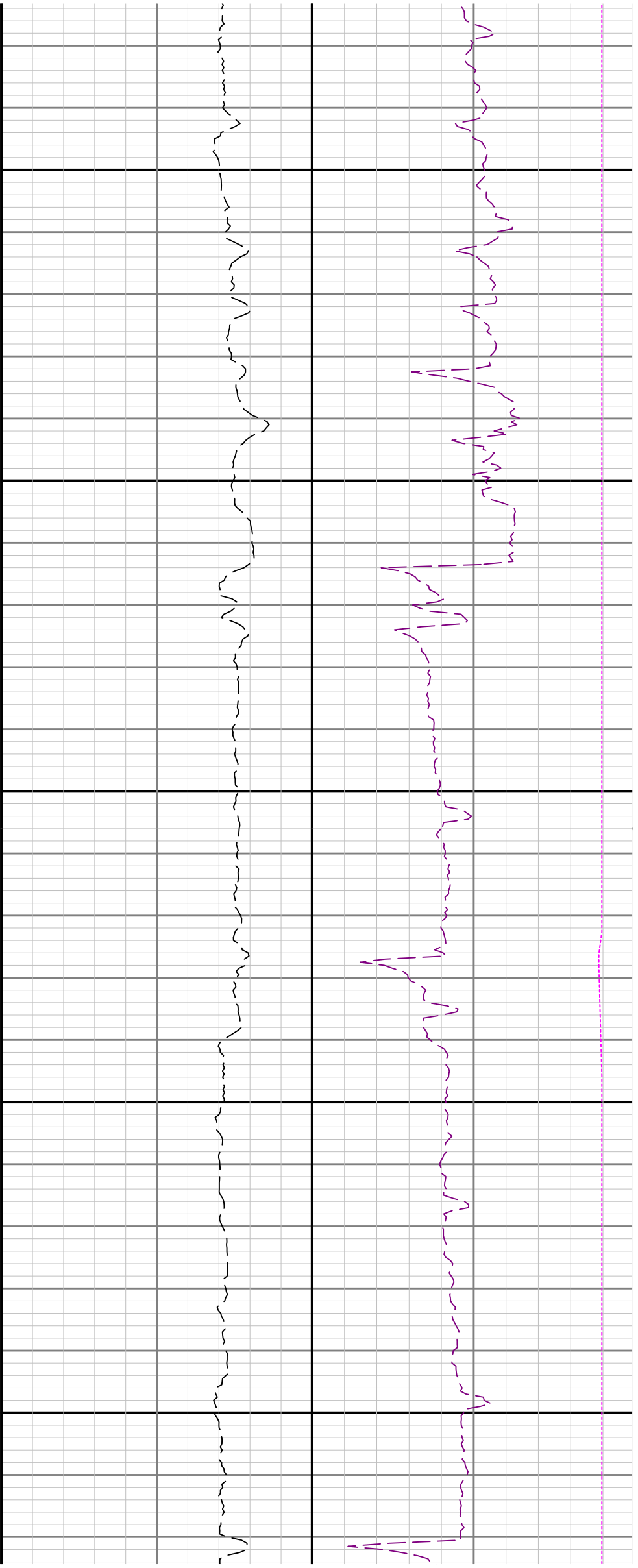


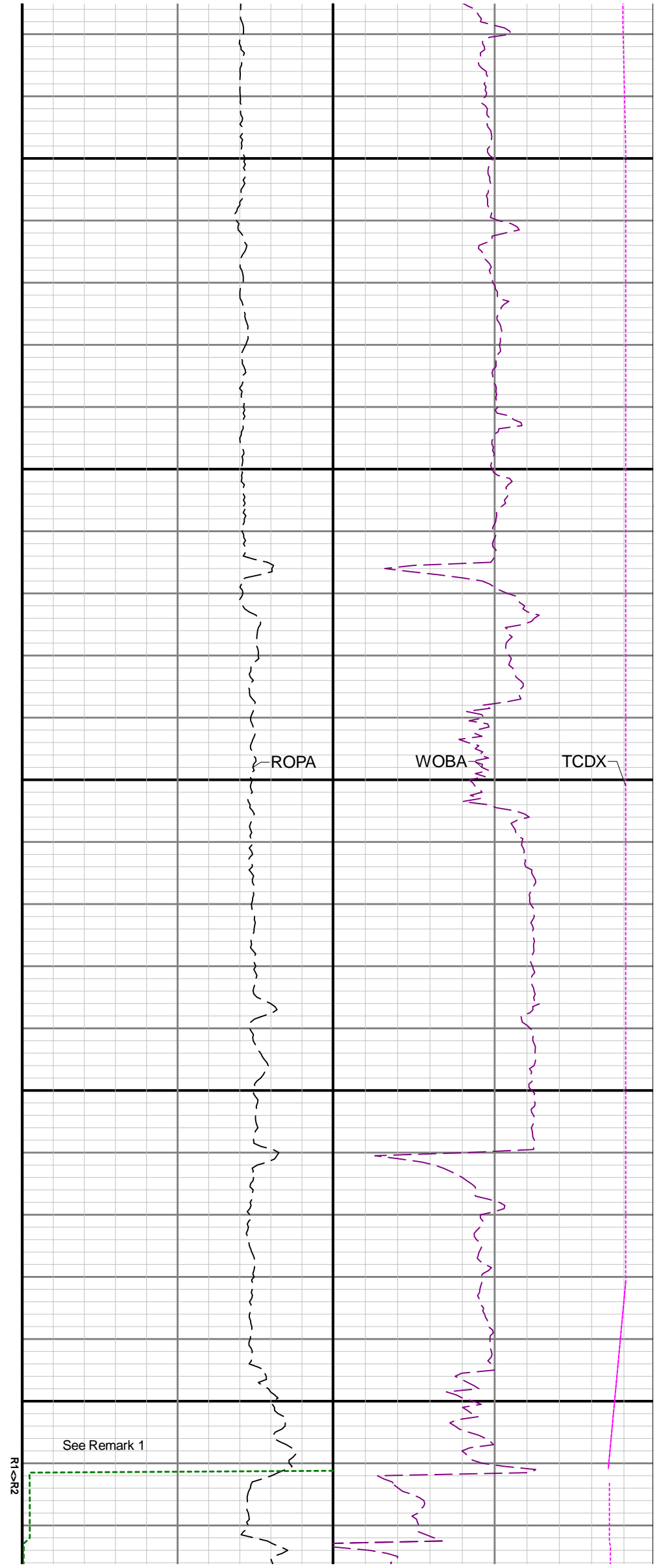
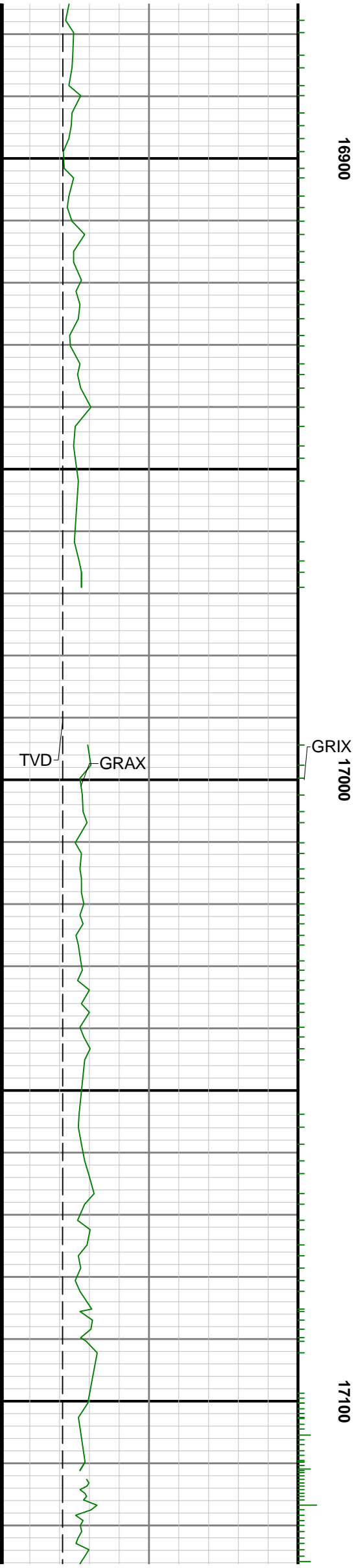
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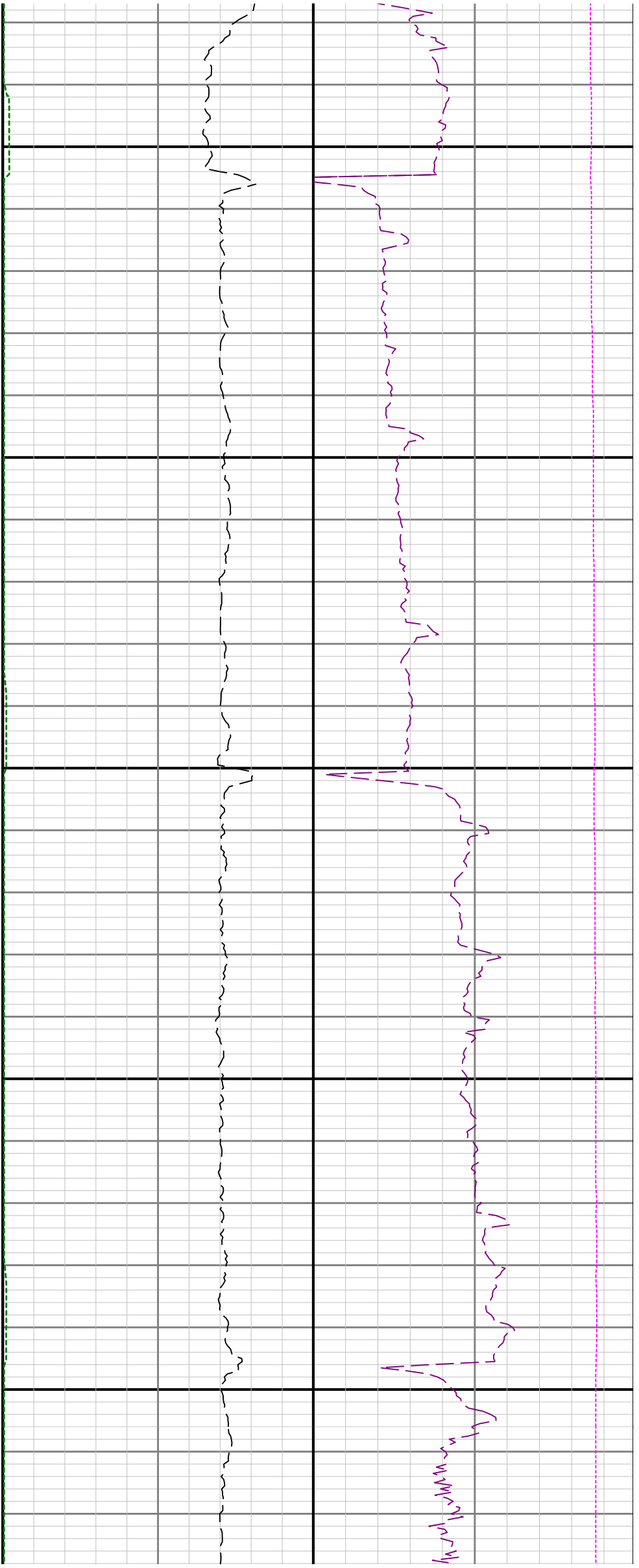
16300











17200

17300

