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TECHNICAL MEMORANDUM

DATE: May 12, 2016 **PROJECT #**: 605.3201

TO: Frank Deal and Pete Moncla, RESOLUTION COPPER MINING LLC

FROM: Matt Shelley, Janis Blainer-Fleming, and Todd Keay

PROJECT: RESOLUTION COPPER MINING LLC, PINAL COUNTY, ARIZONA

SUBJECT: RESULTS OF DRILLING, CONSTRUCTION, AND TESTING AT HYDROLOGIC TEST WELLS HRES-21, DHRES-15, AND DHRES-16

Introduction

In accordance with a request from Mr. Frank Deal, Resolution Copper Mining, LLC (RCM), Montgomery & Associates (M&A) has prepared this Technical Memorandum to summarize results of drilling, construction, and testing at hydrologic test wells HRES-21, DHRES-15 and DHRES-16. These wells were drilled to support additional hydrogeologic characterization of the groundwater system in the vicinity of proposed block-cave mining operations currently planned by RCM east of Superior, Arizona. Results of the drilling program will support ongoing prefeasibility (PFS) studies being conducted by RCM.

Specific goals for each well are summarized below:

Well HRES-21: characterize hydrogeologic conditions in the Apache Leap Tuff (Tal) east of the proposed block-cave mining operation in the area between the west rim of Devils Canyon and the Rancho Rio Fault, and to provide a test well to evaluate the potential influence of the Rancho Rio Fault on groundwater movement within the Apache Leap Tuff (ALT) aquifer.

Well DHRES-15: characterize hydrogeologic conditions in the deep groundwater system south of the Resolution Graben - South Boundary Fault splay, and to provide a test well for long-term hydrologic testing for the deep groundwater system south of the graben.

Well DHRES-16: characterize hydrogeologic conditions within the Superior townsite west of the Concentrator Fault, and provide long-term groundwater monitoring in the townsite to address stakeholder concerns.

Resolution Copper Mining

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June 10, 2016

Mr. Mark Nelson
US Forest Service
Supervisor's Office
2324 East McDowell Road
Phoenix, AZ 85006-2496

Subject: Resolution Copper Mining, LLC – Mine Plan of Operations Baseline Hydrology, Hydrogeology and Geochemical Data Submittal

Dear Mr. Nelson,

Enclosed for your review and consideration, please find two DVD's containing the following hydrologic/hydrogeologic and geochemical information:

- Well construction reports with short term pump test information for wells around the proposed mine area (local hydraulic parameters);
- Long-term pump tests for wells around the proposed mine area to assess storage and anisotropy (regional hydraulic parameters);
- Quarterly well compliance submittals to ADEQ for the West Plant Site Aquifer Protection Permit (APP) including laboratory certificates;
- Geochemical Characterization of Resolution Copper Tailings: 2014-2016 Update; and
- Baseline groundwater and compliance well database (the wells are labelled as HRES-series, DHRES-series, MCC-series) exported from AcQuire in a SQL database. The information included in the database is as follows:
    - Construction details (depth, diameter, casing size/type, perforation information, annular materials, packers, modifications);
    - Location (X, Y and Z in AZ State Plane, NAD 83);
    - Measuring points for calculating groundwater elevations;
    - Data as downloaded from transducers;
    - Digit readouts from nested piezometers; and
    - Lithology of drill holes.

In separate submittals over the next few months, RCML will provide the following:

- Hydrochemistry database for groundwater and compliance wells (the wells are labeled as HRES-series, DHRES-series, MCC-series) including laboratory certificates;

- Baseline water addendum including water chemistry (years 2010 – 2012) and baseline water levels (years 2010 – 2015) with interpretation (hydrographs, diagrams, etc…); and

Any new baseline data collected will be provided in a separate submittal at a later date. For example, an additional round of water chemistry data is being collected (Q4 2015 through Q4 2016) and baseline data for the tailings area will also be collected and submitted once complete. Should you have any questions or require further information please do not hesitate to contact me.

Sincerely,

Vicky Peacey,
Senior Manager, Environmental and External Affairs; Resolution Copper Company, as Manager of Resolution Copper Mining, LLC

Cc: Ms. Mary Morissette; Senior Environmental Specialist; Resolution Copper Company

Enclosure(s): Resolution Copper Mining, LLC – Mine Plan of Operations Supporting Hydrology, Hydrogeology and Geochemistry Data DVD (2)

All three wells have been incorporated into the RCM hydrologic monitoring program. Locations for the three new wells are shown on **Figure 1**. Schematic diagrams of well construction for the wells are shown on **Figures 2 through 4**.

Project Planning and Coordination

The wells were drilled in accordance with technical specifications prepared by RCM. RCM Drilling Services coordinated drilling contractor activities and purchase of well construction materials. Daily drilling reports were prepared by drilling contractor personnel and were submitted to RCM for review. RCM provided daily summaries of drilling progress. Daily summary reports are provided in **Appendix A**.

RCM Hydrology Group were involved in decision making processes during critical phases of drilling operations and well design with input from M&A as needed. M&A personnel described drill cuttings samples and provided on-site monitoring of contractor activities during critical phases of drilling and construction of the wells.

Drilling and Construction Contractors

All three wells were drilled and constructed by National EWP (National) of Gilbert, Arizona, using a Schramm T130XD top-head drive rotary drill rig. Multiple drilling methods were used depending on drilling conditions encountered and goals for each individual well. Drilling methods included:

1. Dual-wall air reverse circulation
2. Dual-wall air-assisted flooded-reverse circulation
3. Direct mud rotary

The surface boreholes for HRES-21, DHRES-15 and DHRES-16 were all drilled using the conventional air rotary drilling method.

Other contractors involved during well construction phases include:

- IDS/COLOG Group (IDS), Lakewood, Colorado: IDS provided borehole geophysical logging services for well HRES-21.

- Baker Hughes, Inc. (BHI), Houston, Texas: BHI provided borehole geophysical logging services for well DHRES-15.

- Southwest Exploration Services, LLC (SWE), Gilbert, Arizona: SWE provided borehole geophysical logging services for wells DHRES-15 and DHRES-16.

- Jonovich Company, Inc., Globe, Arizona: Jonovich provided fluid management services for removal of cuttings and drilling fluids from each drill site.

- Oddonetto Construction Inc., Globe, Arizona: Oddonetto provided water hauling services for drill water supply and dust control.

- Halliburton Company, Farmington, New Mexico: Pressure-grouting services were provided for installation of the intermediate casing string at DHRES-15, and for intermediate and final casing strings at DHRES-16.

- TIW Corporation, Houston, Texas: At well DHRES-15, the 4-1/2-inch production casing was suspended inside the 7-5/8-inch casing using a mechanical casing hanger manufactured by TIW Corporation; installation was supervised by a representative of TIW.

- Shephard-Wesnitzer, Inc. (SWI), Flagstaff, Arizona: SWI conducted final wellhead surveys for the three new wells.

Field Procedures

Monitoring of Drilling Conditions

During drilling operations, drill penetration rate was monitored by National by recording drill start and stop times for each 20-foot drill rod. In addition to drill penetration rate, rotational torque was monitored by drilling personnel, and zones of variable or increasing torque were noted as a potential indicator of fracturing. The technical data sheets (Bit Run Sheets) recorded by National were provided to RCM. Bit Run Sheets for well HRES-21 are provided in **Appendix B**. The original Bit Run Sheets for DHRES-15 and DHRES-16 have not been located.

Borehole deviation surveys were conducted on a regular basis using a Totco mechanical drift recorder.

Monitoring of Lithologic Conditions

Drill cuttings samples were collected at 10-foot intervals and placed in labeled bags. Lithologic descriptions for each sample were prepared in the field by M&A personnel. Splits of each sample were placed in plastic chip trays and were provided to RCM. Bulk cuttings samples have been bagged and are stored by RCM. Detailed lithologic descriptions for each well based on drill cuttings samples are given in **Appendix C**. Lithologic descriptions given in **Appendix C** represent detailed descriptions for each 10-foot sample only. Depths to contacts for principal hydrogeologic units were subsequently refined using these descriptions in combination with borehole geophysical logs and drillers' reports.

Monitoring of Groundwater Conditions

When the dual-wall air reverse circulation drilling method was used at HRES-21 and DHRES-16, it was possible to monitor for the presence of groundwater, and to determine approximately where groundwater inflow zones were encountered. Observations of groundwater production rate were made after drilling out each 20-foot drill rod at depths where groundwater was anticipated. Prior to measurement of production rate, injection water was cut off from the airstream, and air circulation was continued for 10 to 15 minutes. When discharge stabilized, discharge rate was measured using a designated measuring container and stop watch. Water production could not be monitored when drilling with a dual-wall flooded reverse method.

Borehole Geophysical Logging

SWE and IDS standard logging suites generally include: natural gamma ray, caliper, fluid resistivity, temperature, spontaneous potential, E-logs, sonic, acoustic borehole imaging (ABI) or acoustic televiewer (ATV), optical borehole imaging (OBI) or optical televiewer (OTV), borehole video, and borehole deviation. Baker Hughes enhanced logging suite generally includes: natural gamma ray, 4-arm caliper, temperature, spontaneous potential, electrical resistivity logs (E-logs), acoustic porosity, magnetic resonance, resistivity imaging log (STAR), and borehole deviation.

IDS, Baker Hughes, and SWE provided field and final data in digital format to M&A and RCM staff. Final borehole geophysical logs are provided in **Appendix D**.

Log Interpretation

Preliminary borehole geophysical logs were used in the field by M&A in combination with the lithologic descriptions and drillers' daily reports to refine locations for principal lithologic contacts, and to identify suitable placements for vibrating-wire piezometers and perforated intervals. Lithologic logs shown on the schematic diagrams of well construction reflect the adjusted formation and sub-unit contacts. Quantitative analysis of image logs (ABI, OBI, ATV, OTV) for fracture intensity and orientation were not conducted.

Well HRES-21

Well HRES-21 was drilled and constructed during the period May 8 through May 25, 2014. The location for HRES-21 is shown on **Figure 1**. A schematic diagram of well construction for HRES-21 is shown on **Figure 2**. A photograph of the drill site is shown below:

Drill Site Layout at Well HRES-21

Drilling Operations

Drilling operations at HRES-21 began with installation of 16-inch diameter blank steel surface casing. The surface casing was installed to 41 feet below land surface (bls) and cemented in place **(Figure 2)**. The production interval of the borehole for well HRES-21 was drilled to a depth of 1,110 feet bls using the dual-wall air reverse circulation. Only trace amounts of water were produced in the depth interval from land surface to 1,110 feet bls. Drilling method was changed to air-assisted flooded reverse circulation method at 1,110 feet due to circulation problems. As a result, monitoring of groundwater production rate was not feasible below a depth of 1,110 feet. Bit Run Sheets for well HRES-21 are given in **Appendix B**. Depths, drilling methods, and bit types and sizes are summarized below:

Depth Interval (feet, bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 41	conventional air rotary	tricone	19
41 – 1,040	dual-wall, air reverse circulation	hammer	15
1,040 – 1,110	dual-wall, air reverse circulation	tricone	14-¾
1,110 – 1,380	dual-wall, flooded reverse circulation	tricone	14-¾

At HRES-21, borehole deviation was less than 0.2 degrees for the depth interval from land surface to total depth of 1,380 feet bls.

Borehole Geophysical Logging

Borehole geophysical logging was conducted after the borehole had reached total depth. Logging was initiated by IDS on May 25, 2014 after a 2-hour air-lift test was conducted in the open borehole. Logs obtained included: borehole video, OTV, natural gamma ray, 3-arm caliper, temperature, spontaneous potential, E-logs, sonic, and ATV.

A borehole video survey was conducted immediately after the airlift test due to slow water level recovery, which provided the opportunity to maximize video coverage for the open borehole above water level to observe potential water inflows. Water level during the well video was 1,233 feet bls. The video survey, which started at ground surface, was ended at 1,241 feet bls due to poor visibility. During video logging above water level, a small amount of groundwater inflow was observed entering the open borehole at a depth of 934 feet from a small fracture. Larger fractures showing some additional inflow were observed at depths of 977 feet bls and 1,100 feet bls. Groundwater inflow was described as no more than a trickle.

Following the borehole video, the borehole was filled with water to a depth above the water-producing fractures observed in the video, so that these features could be captured with the full suite of geophysical logs. Depth to water in the borehole ranged from 903 to 871 feet bls during subsequent logging runs.

Borehole geophysical logs obtained at HRES-21 and depth intervals for each type of log are summarized as follows:

Logging Tool	Depth Interval(s) (feet bls)
Borehole Video	0 – 1,241
Caliper	0 – 1,380
Temperature	0 – 1,380
Natural Gamma Ray	0 – 1,384
Electric	868 – 1,380
Dual Induction	0 – 1,390
Borehole Imaging	Optical Televiewer 35 – 1,191 Acoustic Televiewer 871 – 1,371
Sonic	884 – 1,380
Spontaneous Potential	871 – 1,375

Finalized borehole geophysical logs from IDS for well HRES-21 are provided in **Appendix D**.

Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well HRES-21 are given in **Appendix C; Table C-1**. A summary log of geologic units encountered at HRES-21 is shown on **Figure 2,** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 120	Apache Leap Tuff – White unit (Talw)
120 – 410	Apache Leap Tuff – Gray unit (Talg)
410 – 1,270	Apache Leap Tuff – Brown unit (Talb)
1,270 – 1,303	Apache Leap Tuff – vitrophyre (Talv)
1,303 – 1,344	Apache Leap Tuff – basal tuff (Talbt)
1,344 – 1,360	Whitetail Conglomerate – channel fill (Tw1)
1,360 – 1,380	Whitetail Conglomerate – lacustrine unit (Tw2)

Depths to principal contacts have been adjusted as necessary based on interpretation of borehole geophysical logs and daily drillers' reports.

Apache Leap Tuff (Tal)

At well HRES-21, Tertiary Apache Leap Tuff (Tal) was encountered from land surface to 1,344 feet. The Tal consists of White unit (Talw) partially welded tuff with pinkish-white groundmass from land surface 120 feet bls; Gray unit (Talg) welded tuff with pinkish-red to reddish-brown groundmass from 120 to 410 feet bls; Brown unit (Talb) densely welded tuff with reddish-brown to orange-brown groundmass from 410 to 1,270 feet bls; vitrophyre (Talv) from 1,270 to 1,303 feet bls; and basal tuff (Talbt) from 1,303 to 1,344 feet bls. The Talw, Talg, and Talb are crystal-rich, dacite porphyry tuff with phenocrysts of potassium and plagioclase feldspars, quartz, biotite, and minor hornblende in an aphanitic to microcrystalline groundmass. The Talv has black glassy groundmass with the same phenocryst assemblage as the other tuff units. At HRES-21 the Talbt is well lithified, crystal-rich, dacite porphyry tuff with a brown, aphanitic groundmass and the same phenocryst assemblage as the other tuff units.

Trace to minor iron oxidation is present throughout the Tal. Trace amounts of calcite and quartz veinlets are also present in many intervals. However, based on inspection of drill cuttings coupled with observed water production rates during drilling, the Tal at HRES-21 appears to be weakly fractured.

Whitetail Conglomerate (Tw)

The borehole at HRES-21 was terminated at 1,380 feet bls after drilling 40 feet into the Tw. The Tw unit was encountered from 1,344 to 1,380 feet bls and consists of poorly sorted, mixed lithology, channel fill conglomerate (Tw1) from 1,344 to 1,360 feet bls, and a silt and clay dominated, lacustrine unit (Tw2) from 1,360 to 1,380 feet bls.

Well Construction

Well HRES-21 was originally designed as a moderate-capacity test well with 8-inch diameter production casing to accommodate a larger submersible test pump. Because groundwater yields from the Tal at this site were much lower than anticipated, RCM decided to install 4-inch production casing for long-term groundwater monitoring.

The production casing string for HRES-21 consists of 4-1/2-inch outside diameter blank and slotted, flush-threaded steel casing **(Figure 2)**. A single interval of perforated casing was installed in the depth interval from 709 to 1,360 feet bls. Perforations are 0.125-inch wide by 2.5-inch long machine-cut slots, four slots per round, four rounds per foot, with each round staggered (16 slots per foot). The bottom joint of perforated steel casing included a welded cap.

The borehole is open in the depth interval from 173 to 1,380 feet bls. A cement basket was installed with the casing string at a depth of 173 feet bls **(Figure 2)**. A bentonite seal consisting of 3/8-inch bentonite chips was installed above the cement basket from 169 to 173 feet bls. Above the bentonite seal, a 2-foot layer of choke sand was installed to stabilize the bentonite. A 4% bentonite, 4% $CaCl_2$ cement was installed from 167 feet bls to 39 feet. The addition of $CaCl_2$ accelerated cement hydration and decreased set time.

Neat cement was installed from 39 feet to land surface. All materials were installed using a tremie pipe. A photograph of the cement basket is shown below:

Cement Basket and Centralizer on 4-1/2-inch OD steel casing installed at HRES-21

Hydraulic Testing

Because little groundwater production was noted during drilling at well HRES-21, an initial air-lift test was conducted in the open borehole prior to geophysical logging to confirm limited production potential and to determine appropriate sizing for final production casing string. The test was conducted from 00:37 to 02:40 on May 24, 2014. The test ended because water production dropped from 200 gpm to 2 gpm after 2 hours of pumping, thus confirming that potential groundwater production rates at well HRES-21 were small. Installation of 4-inch production casing rather than 8-inch casing was therefore considered appropriate for long-term water level monitoring, and potential installation of low-yield pumping equipment.

Following installation if the 4-inch casing string at well HRES-21, airlift pumping was conducted for 4.5 hours to develop the well. The airlift test started at 09:30 and stopped at 14:00 on May 26, 2014. Screened interval is from 709 to 1,360 feet bls in the Tal, although open annulus extends from 173 to 1,380 feet. Depth to pre-pumping water level was about 800 feet bls, and had not recovered completely following drilling and previous air-lift testing. Although data were not suitable for determination of aquifer parameters, results indicate that the Tal at this location has low permeability. Refined estimates of hydraulic parameters at this location could be developed with other testing methods such as a low-flow pumping test or a bail-down test.

Wellhead Completion

Prior to demobilization of the drilling contractor, the wellhead was secured with a surface completion consisting of an extension of the 16-inch steel surface casing to approximately

2.3 feet above land surface. The casing extension is cemented in place and secured with a locking cap.

Well Completion Report

A Well Completion Report for well HRES-21was submitted to Arizona Department of Water Resources (ADWR) by National. Imaged records currently on file with ADWR for HRES-21 are given in **Appendix F.**

Wellhead Survey

A wellhead location and elevation survey was conducted by SWI. Results of the wellhead survey are given in **Appendix G**. Survey results for HRES-21 are summarized below:

	HRES-21
Easting	967381.39
Northing	832967.78
Elevation (ft amsl) Top of Surveyed Point	4109.68
Elevation Land Surface (ft amsl)	4107.38

Datum: U.S. State Plane Coordinate System of 1983

Instrumentation for Long-term Monitoring

Well HRES-21 was not equipped with a dedicated pump due to lower than anticipated water production observed during drilling and airlift testing. An In-Situ Level TROLL 400 (S/N 399249; 100 psi, non-vented) pressure transducer is installed at HRES-21 for water level monitoring. Level Troll and manual water level monitoring data for HRES-21 for 2014 and 2015 are shown on **Figure 5**.

Well DHRES-15

Well DHRES-15 was drilled and constructed during the period May 30, 2014 through July 12, 2014. The location for DHRES-15 is shown on **Figure 1**. A schematic diagram of well construction for DHRES-15 is shown on **Figure 3**. A photograph of the drill site is shown below:

Drill Site Layout at Well DHRES-15

Drilling Operations

Drilling operations at DHRES-15 began with installation of 14-inch diameter blank steel surface casing. The surface casing was installed to 37 feet bls and cemented in place. Well DHRES-15 was then drilled and constructed in two stages. During the first stage, the borehole was drilled to a depth of 2,900 feet, using a dual-wall, flooded reverse circulation drilling method with drilling mud. Then, intermediate casing and a vibrating-wire piezometer array were installed and grouted in place. During the second stage, the borehole was drilled to total depth of 3,920 feet bls using the conventional mud rotary drilling method. Depths, drilling methods, and bit types and sizes are summarized below:

Depth Interval (feet, bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 37	conventional air rotary	tricone	19
37 – 2,900	dual-wall, flooded reverse circulation - mud	tricone	12-¼
2,900 – 3,920	conventional mud rotary	tricone	6-¾

At DHRES-15, borehole deviation was less than 4 degrees for the depth interval from land surface to 1,900 feet bls, and then increased substantially to more than 8 degrees at 3,100 feet bls. Maximum borehole deviation was 10 degrees at a depth of 3,500 feet bls.

Borehole Geophysical Logging

Borehole geophysical logging was conducted in three stages at hydrologic test well DHRES-15. The first stage of logging was conducted approximately midway through drilling of the intermediate borehole. The logging interval was from land surface to 1,548 feet bls. The second stage of logging was conducted after drilling of the intermediate borehole to a depth of 2,886 feet bls. The third stage of logging was conducted after drilling the production borehole to a total depth of 3,920 feet bls.

The first suite of geophysical logs was obtained at DHRES-15 by SWE on June 7, 2014; logs obtained included: borehole deviation, natural gamma ray, 3-arm caliper, temperature, spontaneous potential, E-logs, sonic, and fluid resistivity. The second suite of geophysical logs was obtained by Baker Hughes, Inc. on June 22, 2014; logs obtained included: natural gamma ray, 4-arm caliper, temperature, spontaneous potential, electrical resistivity logs (E-logs), acoustic porosity, magnetic resonance, resistivity imaging log (STAR), and borehole deviation. The STAR tool logged the interval from land surface to 2,886 feet bls. The third suite of geophysical logs was obtained by SWE on July 12, 2014; logs obtained included: natural gamma, 3-arm caliper, temperature, fluid resistivity, spontaneous potential, E-logs, sonic, and ABI.

A summary of logs obtained and depths intervals for each type of log is provided below:

	SWE	**Baker Hughes**	**SWE**
Logging Tools	**Depth Interval(s) (feet bls)**	**Depth Interval(s) (feet bls)**	**Depth Interval(s) (feet bls)**
Caliper	0 – 1,548	1,400 – 2,886	2,700 – 3,920
Temperature	0 – 1,548	1,400 – 2,886	2,700 – 3,920
Fluid resistivity	0 – 1,548	N/A	2,700 – 3,920
Natural Gamma Ray	0 – 1,548	1,400 – 2,886	2,700 – 3,920
Induction / Electric	0 – 1,548	1,400 – 2,886	2,850 – 3,920
Borehole Imaging	N/A	STAR Imager 160 – 2,891	ABI 2,875 – 3,920
Sonic	0 – 1,548	N/A	2,850 – 3,920
Spontaneous Potential	0 – 1,548	1,400 – 2,886	2,850 – 3,920
Borehole Deviation	0 – 1,548	0 – 2,886	2,875 – 3,920
Acoustic Porosity	N/A	1,400 – 2,886	N/A
Magnetic Resonance	N/A	1,000 – 2,400	N/A

N/A= not acquired; ABI = acoustic borehole imaging, STAR Imager = Resistivity Imaging Log

SWE and Baker Hughes provided field and final logs in digital format to M&A and RCM staff **(Appendix D)**.

Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DHRES-15 are given in **Appendix C; Table C-2**. A summary log of geologic units encountered at DHRES-15 is shown on **Figure 3,** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 420	Apache Leap Tuff – Gray Unit (Talg)
420 – 972	Apache Leap Tuff – Brown Unit (Talb)
972 – 1,000	Apache Leap Tuff – Vitrophyre (Talv)
1,000 – 1,020	Apache Leap Tuff – Basal Tuff (Talbt)
1,020 – 1,026	Whitetail Conglomerate – lacustrine unit (Tw2)
1,026 – 1,041	Whitetail Conglomerate – channel fill (Tw1)
1,041 – 1,615	Whitetail Conglomerate – lacustrine unit (Tw2)
1,615 – 2,320	Whitetail Conglomerate – conglomerate (Tw3)
2,320 – 2,890	Naco Limestone (Pnaco)
2,890 – 3,135	Escabrosa Limestone (Me)
3,135 – 3,567	Martin Formation (Dm)
3,567 – 3,603	Bolsa Quartzite (Cb)
3,603 – 3,920	Diabase (pCd)

Depths to principal contacts have been adjusted as necessary based on interpretation of borehole geophysical logs and daily drillers' reports.

Apache Leap Tuff (Tal)

The Tal at DHRES-15 is 1,020 feet thick, and consists of Gray Unit (Talg) welded tuff with pinkish-red to reddish-brown groundmass from land surface to 420 feet bls; Brown Unit (Talb) densely welded tuff with reddish-brown to orange-brown groundmass from 420 to 972 feet bls; vitrophyre (Talv) from 972 to 1,000 feet bls; and basal tuff (Talbt) from 1,000 to 1,020 feet bls. The Talg and Talb are crystal-rich, dacite porphyry tuff with phenocrysts of potassium and plagioclase feldspars, quartz, biotite, and minor hornblende in an aphanitic to microcrystalline groundmass. The Talv has black glassy groundmass with the same phenocryst assemblage as the other tuff units. At DHRES-15 the Talbt is a moderately welded, crystal-rich, dacite porphyry tuff with a yellowish-brown, aphanitic groundmass and the same phenocryst assemblage as the other tuff units.

Whitetail Conglomerate (Tw)

The Tw encountered at DHRES-15 is 1,300 feet thick and consists of lacustrine unit (Tw2) from 1,020 to 1,026 feet bls, channel fill unit (Tw1) from 1,026 to 1,041 feet bls, Tw2 from 1,041 to 1,615 feet bls, and conglomerate unit (Tw3) from 1,615 to 2,320 feet bls. Tw1 consists of a tannish-brown, calcareous matrix with angular clasts of limestone, quartzite and diabase. Tw2 consists of brown and reddish-brown, weakly to moderately lithified, thin-bedded, calcareous mudstones and siltstones, with trace amounts of gray limestone, black and grayish-green ashy clay layers, and gypsum, and very trace clasts of diabase, schist, and quartzite. The clast content increases at the gradational contact between the Tw2 and Tw3 units. The Tw3 consists of a brown sandy calcareous mudstone matrix with clasts of diabase, schist, quartzite, limestone, basalt, vein quartz, occasional porphyry intrusive, and trace chert.

Paleozoic sedimentary rocks (Pz)

At DHRES-15, the Paleozoic sedimentary sequence is 1,247 feet thick and occurs in the depth interval from 2,320 to 3,567 feet bls. Pz units encountered during drilling at DHRES-15 include the Pnaco, Me, Dm, and Cb.

Naco Formation (Pnaco). The Pennsylvanian Naco Formation (Pnaco) is 570 feet thick and was encountered in the depth interval from 2,320 to 2,890 feet bls. The unit consists of moderately to well lithified, interbedded gray, tan, yellow, and white limestone, reddish-brown and brownish-maroon siltstone and calcareous siltstone, and greenish-gray silty limestone, with trace amounts of white, gray, pink and orange chert. Throughout the Pnaco, trace calcite or quartz veining and trace iron oxide staining (limonite and hematite) were present. The Maroon Shale Marker Beds No. 2 and No. 1 were encountered from 2,748 to 2,797 feet bls, and from 2,854 to 2,890 feet bls, respectively.

Escabrosa Limestone (Me). The Mississippian Escabrosa Limestone (Me) is 245 feet thick and was encountered in the depth interval from 2,890 to 3,135 feet bls. The unit consists of well lithified, tan, light brown, white, and gray massive limestone and dolomite, with occasional recrystallized texture and trace to 5 % calcite veining. Very trace pale green talc is present near the contact with the overlying Pnaco. Trace to common iron oxide staining is present throughout the unit.

Martin Formation (Dm). The Devonian Martin Formation (Dm) is 432 feet thick and was encountered in the depth interval from 3,135 to 3,567 feet bls. The Last Black Shale marker bed is located at the top of the unit and was encountered in the depth interval from 3,135 to 3,156 feet bls. The Dm consists of well lithified, interbedded gray and brown, silty limestone, shale and calcareous siltstone and very trace quartz veinlets. The depth interval from 3,250 to 3,420 feet bls contains common to abundant iron oxide staining.

Bolsa Quartzite (Cb). The Cambrian Bolsa Quartzite (Cb) is 36 feet thick and was encountered in the depth interval from 3,537 to 3,603 feet bls. The unit consists of moderately to well lithified, yellowish-tan, medium-grained quartzite, with common iron oxide staining (hematite), trace manganese oxide and trace calcite veinlets. Trace yellow and red shale are also present.

Younger Precambrian units (pCy)

Diabase (pCdiab). Of the five units that are currently recognized in the younger Precambrian rock sequence, only the diabase unit (pCdiab) was encountered during this drilling program. At DHRES-15, the pCdiab was encountered in the depth interval from 3,603 to total drilled depth of 3,920 feet bls (thickness of 317 feet). The pCdiab consists mostly of fine clinopyroxene matrix and white plagioclase laths, with some magnetite, some iron oxide staining, trace pyrite, and trace serpentine alteration.

Well Construction

Intermediate casing was installed from land surface to a depth of 2,875 feet bls, approximately 15 feet above the contact between the Pnaco and the Me. The intermediate casing consists of 7-5/8-inch outside diameter blank, threaded and coupled steel casing. During casing installation, four vibrating-wire pressure transducers (VWPs) manufactured by Geokon of Lebanon, New Hampshire, were attached to the outside of the casing string to measure pore pressures in the Tw, and Pnaco. Locations for VWP installations are shown on **Figure 3**. A summary of details regarding the VWPs installed at DHRES-15 is provided below:

	Identifier*	GEOKON Model 4500-S Serial Number	Installed Depth (feet bls)	Hydrogeologic Unit	Pressure Rating (Mega-Pascals)
1	DHRES-15_710	14-09578	1,662	Tw	10
2	DHRES-15_499[1]	14-09577	2,355	Pnaco	10
3	DHRES-15_398	13-25367	2,685	Pnaco	20
4	DHRES-15_355	13-25366	2,826	Pnaco	20

*Identifier consists of well name and VWP elevation in meters above mean sea level
[1] VWP is no longer functioning

After the casing and VWPs were installed in the borehole, pressure grout was emplaced in the annular space by Halliburton on June 26, 2014. The pressure grout mix consisted of the following ratio by weight: 2.5 parts water: 1 part cement: 0.3 parts bentonite. The lower 25 feet of annular seal material consisted of neat cement to prevent loss of the pressure grout from the bottom of the upper interval during drilling of the lower borehole. The grout and cement were allowed to cure for 72 hours before drilling of the lower borehole commenced. A cementing report was provided to RCM by Halliburton, and is given in **Appendix E.**

The production casing for DHRES-15 consists of 4-1/2-inch outside diameter blank and slotted, threaded and coupled steel casing. A single interval of perforated casing was installed in the depth interval from 2,872 to 3,610 feet bls **(Figure 3)**. Perforations are 0.125-inch wide by 2.5-inch long machine-cut slots, two slots per round, four rounds per foot, and staggered (8 slots per foot). A bullnose end cap was installed at the bottom joint of blank steel casing. The production casing was suspended inside the 7-5/8-inch intermediate casing at a depth of 2,732 bls using a mechanical casing hanger manufactured by TIW (see photograph below). Annular materials were not installed in the production interval of the well.

TIW Casing Hanger at DHRES-15

Well Development

Following casing installation, the production interval at well DHRES-15 was developed by air-lift pumping for one hour. The goal of well development was to remove any residual drilling mud and sediment, and establish a connection to the groundwater system. The air-lift system consisted of 4-1/2-inch dual-wall drill pipe serving as an eductor pipe and BQ drill rod was installed inside the drill pipe to serve as an air line. An In-Situ Level TROLL 500 non-vented pressure transducer was installed in a protective cage on the outside of the drill pipe to monitor water levels in the wellbore during well development and subsequent air-lift testing.

Hydraulic Testing

After well development was complete, groundwater levels were allowed to stabilize for 4 hours and 21 minutes and a 4-hour airlift test was conducted to evaluate pumping capacity of the well and obtain a screening sample for water quality in the deep groundwater system at this location. Discharge volumes and airlift rates were calculated by periodic measurement of storage tank levels. The pressure transducer installed on the outside of the drill pipe was set at a depth of 2,726 feet bls. The discharge head configuration did not provide access for manual sounder measurement of groundwater levels during airlift pumping; however, groundwater level measurements were obtained prior to the test and during the recovery period. During recovery, water level was measured through the open airline (BQ pipe) using an electric water level sounder.

The airlift test started at 20:00 on July 16, and stopped at 00:00 on July 17, 2014. Screened interval is from 2,872 to 3,610 feet bls (accessing Me, Dm, Cb, and pCdiab units). Depth to pre-pumping water level was 749.50 feet bls. The discharge rate ranged from 120 to 150 gallons per minute; average rate was 139 gallons per minute. **Figure 6** is a graph showing water level drawdown and recovery, and air-lift pumping rates observed during the air-lift test. Results of this air-lift test indicate a specific capacity for well DHRES-15 of about one gallon per minute per foot of drawdown.

A sample of the air-lifted groundwater at DHRES-15 was obtained near the end of the pumping period and submitted for routine hydrochemical analyses. Results of analyses for the air-lifted groundwater sample were used to determine appropriate method of discharge for groundwater pumped during the future long-term pumping test, and to support permitting for surface discharge of pumped water from DHRES-15 under an Arizona Pollutant Discharge Elimination System (AZPDES) permit with Arizona Department of Environmental Quality (ADEQ).

A long-term (70-day) pumping test was subsequently conducted at well DHRES-15 during the period December 10, 2014 through February 18, 2015. A comprehensive suite of groundwater samples were obtained during the long-term pumping test. A full description of pumping test set-up and operation, and analysis of pumping test results for well DHRES-15 will be provided to RCM in a separate report prepared by M&A (pending 2016).

Pump Installation and Instrumentation

The dedicated pump assembly for DHRES-15 was installed by Layne Christensen Company, of Chandler, Arizona on October 28, 2014. The well was equipped with a Grundfos Model 150S600-33 pump with a 60-horsepower, 460-volt, three-phase Franklin electric motor. The pump was installed on 3-inch diameter galvanized steel column pipe with galvanized steel couplings; depth to the pump intake was approximately 1,200 feet bls. The well was equipped with two 1-1/4 inch Schedule 80 PVC sounder/transducer access tubes which extended from the wellhead to the top of the pump. The access tubes were capped on the bottom and factory slotted in the lowermost 60 feet.

Instrumentation for Long-Term Monitoring

An In-Situ Level TROLL 500 (S/N 181373; 300 psi, non-vented) integrated datalogger/ pressure transducer was installed to measure and record water levels during testing and long-term groundwater level monitoring.

Long-term Hydraulic Head and Groundwater Level Data

Pore pressures measured at the DHRES-15 grouted-piezometer array have been converted to total hydraulic head in feet above mean sea level (amsl) and are presented along with water level data on the hydrograph on **Figure 7**. The grouted piezometers appear to have equilibrated with pore pressures in the adjacent formations within approximately 2 months following installation, although all piezometers indicate pressure responses to continued drilling, airlifting, and testing at DHRES-15. Pore pressures at the deepest two piezometers, DHRES-15_398 and DHRES-15_355, were affected most during the 70-day constant rate test of the deep aquifer system at DHRES-15 beginning December 10, 2014.

Well Completion Report

A Well Completion Report for well DHRES-15 was submitted to ADWR by National. Image records on file with ADWR for DHRES-15 are given in **Appendix F**.

Wellhead Survey

A wellhead location and elevation survey was conducted by SWI. Results of the wellhead survey are given in **Appendix G**. Survey results for DHRES-15 are summarized below:

	DHRES-15
Easting	964978.32
Northing	831075.50
Elevation (ft amsl) Top of Surveyed Point	3991.78
Elevation Land Surface (ft amsl)	3990.83

Datum: U.S. State Plane Coordinate System of 1983

Well DHRES-16

Well DHRES-16 was drilled and constructed during the period August 25 through September 26, 2014. The location for DHRES-16 is shown on **Figure 1**. A schematic diagram of well construction for DHRES-16 is shown on **Figure 4**. A photograph of the drill site is shown below:

Grouted piezometer installation at DHRES-16

Drilling Operations

Drilling operations at DHRES-16 began with installation of 14-inch diameter blank steel surface casing in a 19-inch borehole. The surface casing was installed to 56 feet bls and cemented in place. Well DHRES-16 was drilled and constructed in two stages. The upper completion of the borehole for well DHRES-16 was drilled using the dual-wall air reverse circulation and dual-wall flooded reverse circulation drilling methods. The lower completion for well DHRES-16 was drilled using the dual-wall air reverse circulation method. Depths, drilling methods, and bit types and sizes are summarized below:

Depth Interval (feet, bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 56	conventional air rotary	tricone	19
56 – 1,145	dual-wall, air reverse circulation	hammer	12-½
1,145 – 1,820	dual-wall, flooded reverse circulation	tricone	12-¼
1,820 – 2,870	dual-wall, air reverse circulation	hammer	6-⅞
2,870 – 3,505	dual-wall, air reverse circulation	hammer	6-¾
3,505 – 4,083	dual-wall, air reverse circulation	tricone	6-½

At DHRES-16, borehole deviation was less than 1 degree for the depth interval from land surface to 2,700 feet bls. Borehole deviation ranged between 1 and 2.3 degrees from 2,700 to the total depth of 4,083 feet bls.

Monitoring of Groundwater Conditions

Results of flow measurements made during drilling operations for well DHRES-16 are summarized on **Figure 4**. At well DHRES-16, water was first encountered at 115 feet bls. Groundwater production rates were between 10 and 55 gallons per minute (gpm) for the interval from 115 to 1,145 feet bls. Groundwater production rates were not measured for the interval from 1,145 to 1,820 feet bls during air-assisted flooded reverse circulation drilling. Groundwater production rate was less than 5 gpm for the interval from 1,820 to 3,305 feet bls, and increased beginning at 3,400 feet bls, and ranged between 10 and 15 gpm for the interval from 3,400 to total depth of 4,083 feet bls.

Borehole Geophysical Logging

Borehole geophysical logging was conducted in two stages at hydrologic test well DHRES-16. The first stage of logging was conducted after drilling of the intermediate borehole to a depth of 1,820 feet bls. The second stage of logging was conducted after drilling the production borehole to a total depth of 4,083 feet bls. At DHRES-16, the first suite of geophysical logs was obtained by SWE on September 3, 2014; logs obtained included: borehole deviation, natural gamma ray, 3-arm caliper, temperature, spontaneous potential, E-logs, sonic, fluid resistivity, and ABI. The second suite of geophysical logs was obtained by SWE on September 23, 2014; logs obtained included: borehole deviation, natural gamma ray, 3-arm caliper, temperature, spontaneous potential, E-logs, sonic, fluid resistivity, and ABI.

A summary of borehole geophysical logs obtained and depth intervals for each type of log are provided below. SWE provided field and final data in digital format to M&A and RCM staff **(Appendix D)**.

Logging Tools	SWE Depth Interval(s) (feet bls)	SWE Depth Interval(s) (feet bls)
Caliper	0 – 1,820	1,800 – 4,083
Temperature	0 – 1,820	1,800 – 4,083
Natural Gamma Ray	0 – 1,820	1,800 – 4,083
Electric	0 – 1,820	1,800 – 4,083
Borehole Imaging	ABI 1,200 – 1,820	ABI 1,800 – 4,083
Sonic	0 – 1,820	1,800 – 4,083
Spontaneous Potential	0 – 1,820	1,800 – 4,083
Borehole deviation	1,200 – 1,820	1,800 – 4,083

ABI = Acoustic borehole imaging

Lithologic Conditions

A summary of geologic units encountered at DHRES-16 is given below; this summary log is also shown on **Figure 4**. Detailed lithologic descriptions based on drill cuttings samples are provided in **Appendix C; Table C-3**.

Depth Interval (feet bls)	Geologic Unit
0 – 60	Undivided Surficial Deposits (Qs)
60 – 777	Conglomerate (Tcg)
777 – 867	Tuff (Tt)
867 – 888	Sandstone (Tss)
888 – 942	Basalt (Tb)
942 – 986	Tuff (Tt)
986 – 998	Basalt (Tb)
998 – 1,041	Tuff (Tt)
1,041 – 1,716	Basalt (Tb)
1,716 – 3,165	Conglomerate (Tcg)
3,165 – 3,280	Apache Leap Tuff – White Unit (Talw)
3,280 – 3,700	Apache Leap Tuff – Gray Unit (Talg)
3,700 – 3,822	Apache Leap Tuff – Brown Unit (Talb)
3,822 – 3,863	Apache Leap Tuff – vitrophyre (Talv)
3,863 – 3,870	Apache Leap Tuff – basal tuff (Talbt)
3,870 – 3,976	Martin Limestone (Dm)
3,976 – 3,995	Intrusive (TKi)
3,995 – 4,083	Martin Limestone (Dm)

Depths to principal contacts have been adjusted as necessary based on interpretation of borehole geophysical logs and daily drillers' reports.

Undivided Surficial Deposits (Qs)

The surficial terrace deposits (Qs) encountered at DHRES-16 is 60 feet thick, from land surface to 60 feet bls, and consists of non- to weakly lithified gravelly silty sand. Subrounded and subangular clasts consist of sandstone, tuff, and quartzite.

Gila Group units (Tcg, Tss, Tt, Tb)

Conglomerate (Tcg). The Gila Conglomerate (Tcg) at DHRES-16 was encountered in two depth intervals. The upper interval is 717 feet thick and was encountered from 60 to 777 feet bls. The Tcg is a mixed lithology conglomerate, moderately lithified, consisting of angular to subrounded clasts of quartzite, limestone, tuff, siltstone, and sandstone. Cement matrix is slightly calcareous. The lower interval of Tcg is 1,449 feet thick and was encountered from 1,716 to 3,165 feet bls. This lower interval of Tcg is a mixed lithology conglomerate, moderately to well lithified, with few interbedded matrix-supported, clayey units. Clasts are subangular to subrounded and comprise siltstone, tuff, quartzite, basalt and schist. The matrix is less calcareous than the upper unit.

Volcanics (Tt and Tb) / Sandstone (Tss). The volcanic and sedimentary units encountered at DHRES-16 consist of alternating layers of tuff (Tt), sandstone (Tss) and basalt flows (Tb). The Tt encountered from 777 to 867 feet bls consists of welded tuff with light grayish-pink groundmass with biotite phenocrysts. The Tss unit from 867 to 888 feet bls consists of well-lithified, weathered tuffaceous sandstone. The depth interval from 888 to 1,041 contains a series of alternating tuff and basalt units. The tuff is welded, brownish-yellow aphanitic groundmass with few phenocrysts of quartz and plagioclase. The basalt is well-lithified, andesitic basalt. Basalt flows and weathered paleosol layers are encountered in the depth interval from 1,041 to 1,716 feet bls.

Apache Leap Tuff (Tal)

The Tal at DHRES-16 is 705 feet thick, and consists of White Unit (Talw) partially welded tuff with pinkish-white groundmass from 3,165 to 3,280 feet bls; Gray Unit (Talg) welded tuff with pinkish-red to reddish-brown groundmass from 3,280 to 3,700 feet bls; Brown Unit (Talb) densely welded tuff with reddish-brown to orange-brown groundmass from 3,700 to 3,830 feet bls; vitrophyre (Talv) from 3,822 to 3,863 feet bls; and basal tuff (Talbt) from 3,863 to 3,870 feet bls. The Talw, Talg, and Talb are crystal-rich, dacite porphyry tuff with phenocrysts of potassium and plagioclase feldspars, quartz, biotite, and minor hornblende in an aphanitic to microcrystalline groundmass. The Talv has black glassy groundmass with the same phenocryst assemblage as the other tuff units. At

DHRES-16 the Talbt is a well lithified, crystal-rich, dacite porphyry tuff with a gray, aphanitic groundmass and the same phenocryst assemblage as the other tuff units.

Paleozoic sedimentary rocks (Pz)

Dm was the only Paleozoic unit encountered during drilling at DHRES-16. The Dm sequence is 215 feet thick and occurs in the depth interval from 3,870 to 4,085 feet bls.

Martin Formation (Dm). The Dm is 215 feet thick and was encountered in the depth interval from 3,870 to total drilling depth of 4,083 feet bls. The Dm consists of well lithified, interbedded gray and pink, silty limestone, shale and trace amounts of chert. Trace amounts of iron oxide staining are present throughout the unit. A mafic dike (TKi) was encountered in the depth interval from 3,976 to 3,995 feet bls. The TKi consists of well lithified, black, andesitic basalt with minor iron oxide staining.

Well Construction

Hydrologic test well DHRES-16 was completed as a fully-grouted piezometer array, and was constructed in two parts. An intermediate casing was installed from land surface to a depth of 1,800 feet bls, approximately 80 feet below the contact between the Tb and the Tcg. The intermediate casing consisted of 7-5/8-inch outside diameter blank, threaded and coupled steel casing. During casing installation, four Geokon VWPs (model #4500S), were attached to the outside of the casing string to measure pore pressures in the Tcg, Tss, and Tb units.

Following casing and instrumentation installation, specialized pressure grout was installed in the annular space by Halliburton on September 5, 2014. The lowermost 40 feet of annular seal material consisted of neat cement to prevent loss of the pressure grout from the bottom of the upper interval when drilling of the lower borehole commenced. Details for the pressure grouting operation for the intermediate casing were provided to RCM by Halliburton and are given in **Appendix E**. Drilling of the lower borehole commenced on September 9, 2014 following a 72-hour cure.

Following drilling of the lower portion of the borehole, casing was installed from land surface to a depth of 4,075 feet bls. The lower casing consisted of 2-3/8-inch outside diameter blank, threaded and coupled EUE steel pipe. During casing installation, two Geokon VWPs (model #4500S) were attached to the outside of the casing string to measure pore pressures at the contact of the Tcg and Tal units and in the Dm, 30 feet below the contact of the Tal and Dm. Following casing and instrumentation installation, specialized pressure grout was installed in the annular space by Halliburton on September 26, 2014. Details for the pressure grouting operation for the lower casing were provided to RCM by Halliburton and are given in **Appendix E.**

Locations for VWP installations at well DHRES-16 are shown on **Figure 4**. Details regarding the VWPs installed at DHRES-16 are given in the table below.

	Identifier*	GEOKON Model 4500S Serial Number	Installed Depth (meters bls)	Hydrogeologic Unit	Pressure Rating (Mega-Pascals)
1	DHRES-16_743	14-17743	198	Tcg	10
2	DHRES-16_577	14-15198	743	Tcg	10
3	DHRES-16_535	13-37861	880	Tss - sandstone	5
4	DHRES-16_287	14-12545	1,695	Tb - basalt	7.5
5	DHRES-16_-157	14-16077	3,151	Tal	5
6	DHRES-16_-387	13-25368	3,904	Dm	20

*Identifier consists of well name and piezometer elevation in meters above mean sea level

Hydraulic Testing

At well DHRES-16, initial characterization of the Tal aquifer was accomplished by conducting airlift tests in the open hole. An In-Situ Level TROLL 500 (S/N 181373); 300 psi, non-vented) pressure transducer was installed 2,214 feet above the bottom of the drill pipe at a depth of 1,600 feet bls. A 6.5-hour open-hole airlift test was conducted from 06:40 to 13:10 on September 20, 2014. Depth to pre-pumping water level was approximately 858 feet bls, but water level was not stable. Discharge volumes and airlift rates were calculated by periodic measurement of storage tank levels. For the first 30 minutes of testing, discharge rates ranged from 50 to 90 gpm. After 30 minutes of testing, discharge rate dropped to between 4 and 10 gpm; average rate was 5 gpm over the duration of the test. Water samples were collected for laboratory chemical and isotopic analyses near the end of testing.

The discharge head configuration did not allow access for manual sounder measurement of groundwater levels during airlift pumping; however, groundwater level measurements were obtained prior to the test and were attempted during the recovery period. During the recovery period, water levels could not be obtained due to excessive pipe dope accumulation inside the drill pipe. Level TROLL data indicated that within 30 minutes of the commencement of airlift testing, water level drew down more than 800 feet, to a depth below the transducer. During recovery, water levels did not recover to the depth of transducer. Test results could not be analyzed.

Hydraulic Head Data

Pore pressures measured at the DHRES-16 grouted-piezometer array have been converted to total hydraulic head in feet amsl and are presented on the hydrograph on **Figure 8**. All piezometers appear to have equilibrated with pore pressures in the adjacent formations by mid-2015.

Well Completion Report

A Well Completion Report for well DHRES-16 was submitted to ADWR by National. Imaged records on file with ADWR for DHRES-16 are shown in **Appendix F**.

Wellhead Survey

A wellhead location and elevation survey was conducted by SWI. Results of the wellhead survey are given in **Appendix G**. Survey results for DHRES-16 are summarized below:

	DHRES-16
Easting	944004.38
Northing	830712.77
Elevation (ft amsl) Top of Surveyed Point	2635.92
Elevation Land Surface (ft amsl)	2634.25

Datum: U.S. State Plane Coordinate System of 1983

References

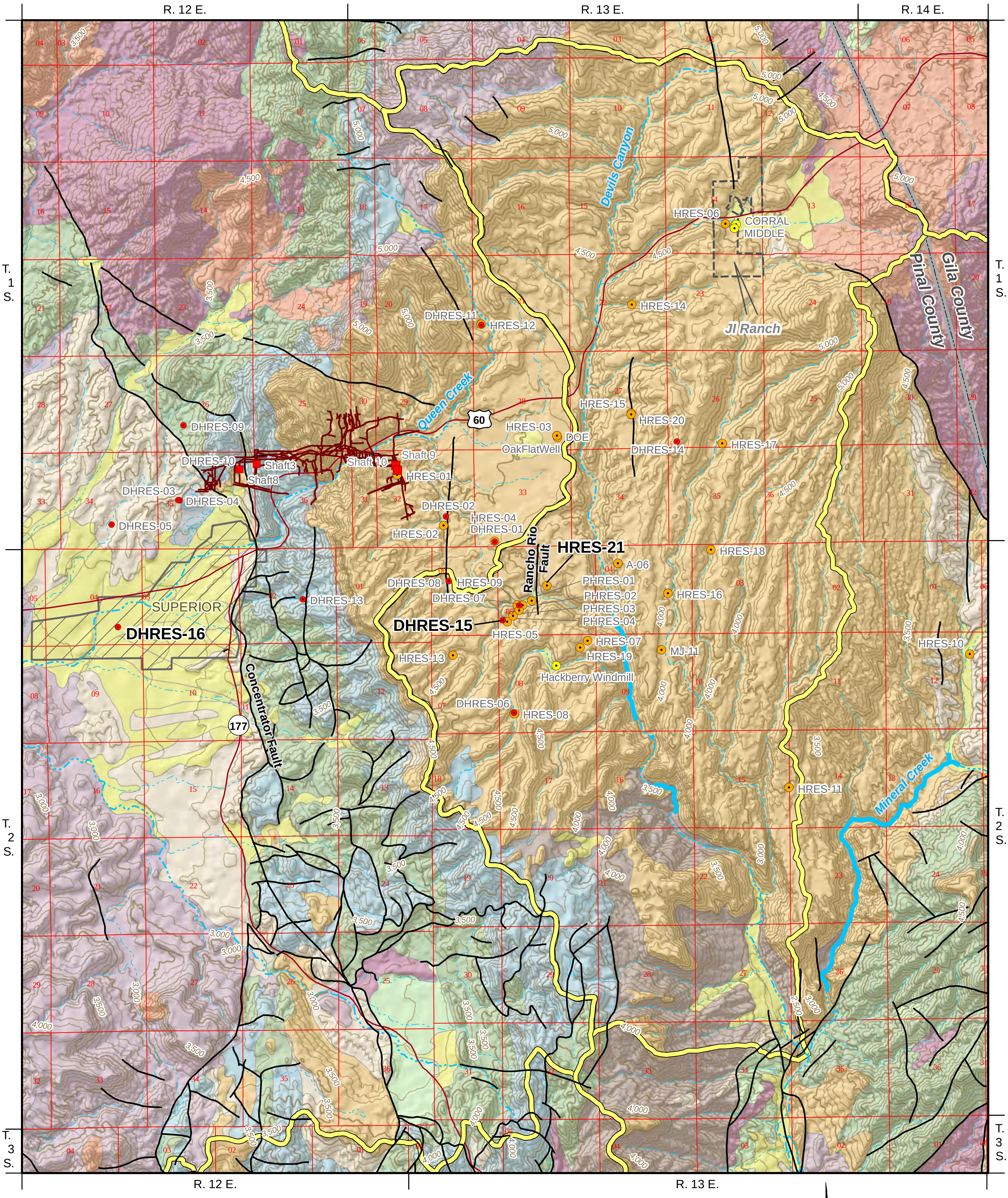
Theis, C.V., 1935, **The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage:** American Geophysical Union Transactions, vol. 16, pp. 519-524.

Table 1. Well Construction Details for Wells HRES-21, DHRES-15, and DHRES-16
Resolution Copper Mining LLC

WELL IDENTIFIER	CADASTRAL LOCATION	WELL REGISTRATION NUMBER	DATE COMPLETED	……….BOREHOLE……….		………………….CASING……………….			GROUTED VIBRATING-WIRE PIEZOMETER IDENTIFIER	OPEN INTERVAL OF WELL or GROUTED DEPTH OF PIEZOMETER (ft, bls)	OPEN INTERVAL OF WELL or GROUTED ELEVATION OF PIEZOMETER (ft, amsl)[b]	HYDROGEOLOGIC UNIT(S) ADJACENT TO OPEN INTERVAL OF WELL or GROUTED LOCATION OF PIEZOMETER	……SURVEY COORDINATES…… (AZSPC, feet)[c]			LAND SURFACE ELEVATION (ft, amsl)
				DIAMETER (inches)	DEPTH (ft, bls)[a]	DIAMETER (inches)	DEPTH (ft, bls)	PERFORATED INTERVAL (ft, bls)					NORTHING (feet)	EASTING (feet)	SURVEYED ELEVATION (ft, amsl)	
HRES-21	(D-02-13) 05ACC	55-916689	26-May-2014	19 15 14-3/4	0 - 41 41 - 1380	16 4	0 - 41 0 - 1,360	--- 709 - 1,360	N/A	N/A	N/A	N/A	832967.78	967381.39	4109.68	4107.38
DHRES-15	(D-02-13) 05CCB	55-916688	12-Jul-2014	19 12-1/4 6	0 - 37 37 - 2,900 2,900 - 3,920	14 7-5/8 4-1/2	0 - 37 37 - 2,872 2,872 - 3,633	--- ---[d] 2,875 - 3,633	DHRES-15_710 DHRES-15_499[e] DHRES-15_398 DHRES-15_355 Perforated Interval	1,662 2,355 2,685 2,826 2,875 - 3,633	3,021 2,328 1,998 1,857 1,808 - 103	Tw3 Pnaco Pnaco Pnaco Pnaco, Me, Dm, Cb, pCdiab	831075.50	964978.32	3991.78	3990.83
DHRES-16	(D-02-12) 04DCA	55-917232	26-Sep-2014	19 12-1/4 6-7/8 6-11/16 6-1/2	0 - 56 56 - 1,820 1,820 - 2,870 2,870 - 3,505 3,505 - 4,085	14 7-5/8 2-3/8	0 - 56 0 - 1,800 0 - 4,075	--- ---[d] ---[d]	DHRES-16_743 DHRES-16_577 DHRES-16_535 DHRES-16_287 DHRES-16_-157 DHRES-16_-387	198 743 880 1,695 3,151 3,904	2,436 1,891 1,754 939 -517 -1,270	Tcg Tcg Tss Tb Tal Dm	830712.77	944004.38	2635.92	2634.25

[a] ft, bls = feet below land surface
[b] ft, amsl = above mean sea level
[c] Datum NAD83 (Epoch NA2011), Arizona State Plane Coordinates, Zone 0202 - NAVD88 (Geoid12A), in feet. Data from Shephard - Wesnitzer, Inc. (Nov. 2014)
[d] grouted-in piezometers attached to pipe
[e] Piezometer was installed and is no longer functioning
N/A = Not Applicable

MONTGOMERY & ASSOCIATES



EXPLANATION

- Watershed Boundary
- Perennial Reach
- Ephemeral or Intermittent Stream
- Fault (Published)
- Magma Mine Workings

Groundwater Monitoring Sites

- Shallow Alluvial Aquifer Monitor Well
- Apache Leap Tuff Aquifer Monitor Well
- Deep Groundwater System Monitor Well
- Shaft

Geologic Units

d	Disturbed Surficial Deposits
Qal	Quaternary Alluvial Deposits
QTg	Quaternary-Tertiary Basin-Fill Deposits
Tal	Tertiary Apache Leap Tuff
Tvu	Tertiary Volcanic Rocks, undifferentiated
Tw	Tertiary Whitetail Conglomerate
TKg	Cretaceous and Tertiary Intrusive Rocks
Pz	Paleozoic Sedimentary Rocks
p€y	Younger Precambrian Sedimentary Rocks, Basalt, and Diabase
p€gu	Undifferentiated Precambrian Intrusive Rocks
p€pi	Older Precambrian Pinal Schist

0 0.5 1 1.5 2
Miles

Resolution Copper Mining

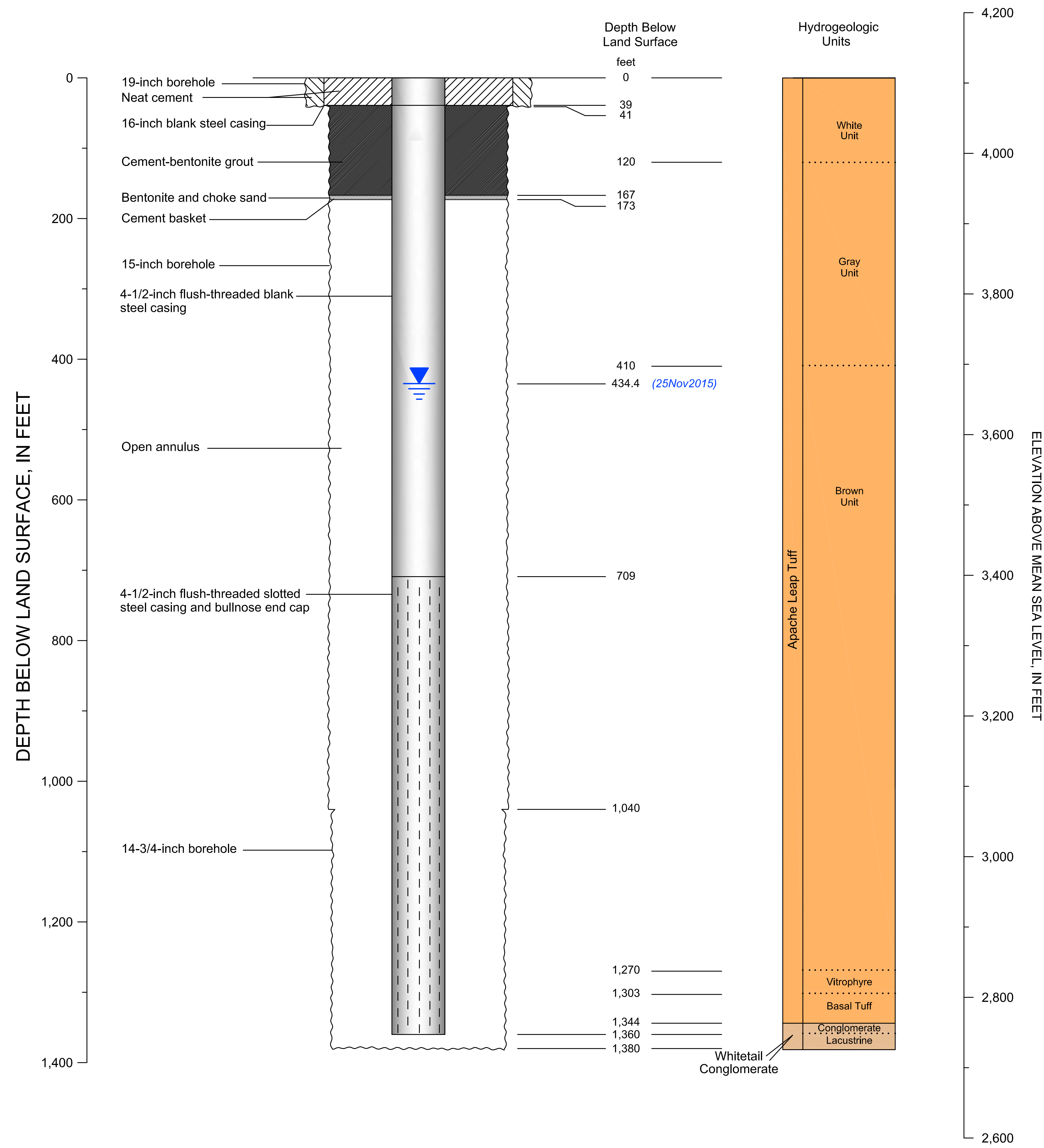
HRES-21, DHRES-15 AND DHRES-16 WELL LOCATIONS

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2016

FIGURE 1

\GIS-Tuc\Projects\605\605.3201\Welloc_Hres21-Dhres15_16_GEOLOGY\11May2016



CADASTRAL: (D-02-13) 05acc	ADWR NO: 55-916689
NORTHING: 832967.78	EASTING: 967381.39
LAND SURFACE ELEVATION: 4107.38 FEET AMSL	
DATUM: U.S. State Plane Coordinate System of 1983 Epoch 2011 (NAD83 NA2011) Arizona Central Zone (0202) North American Datum 1983 North American Vertical Datum of 1983	

EXPLANATION

Non-pumping Water Level

Resolution Copper Mining

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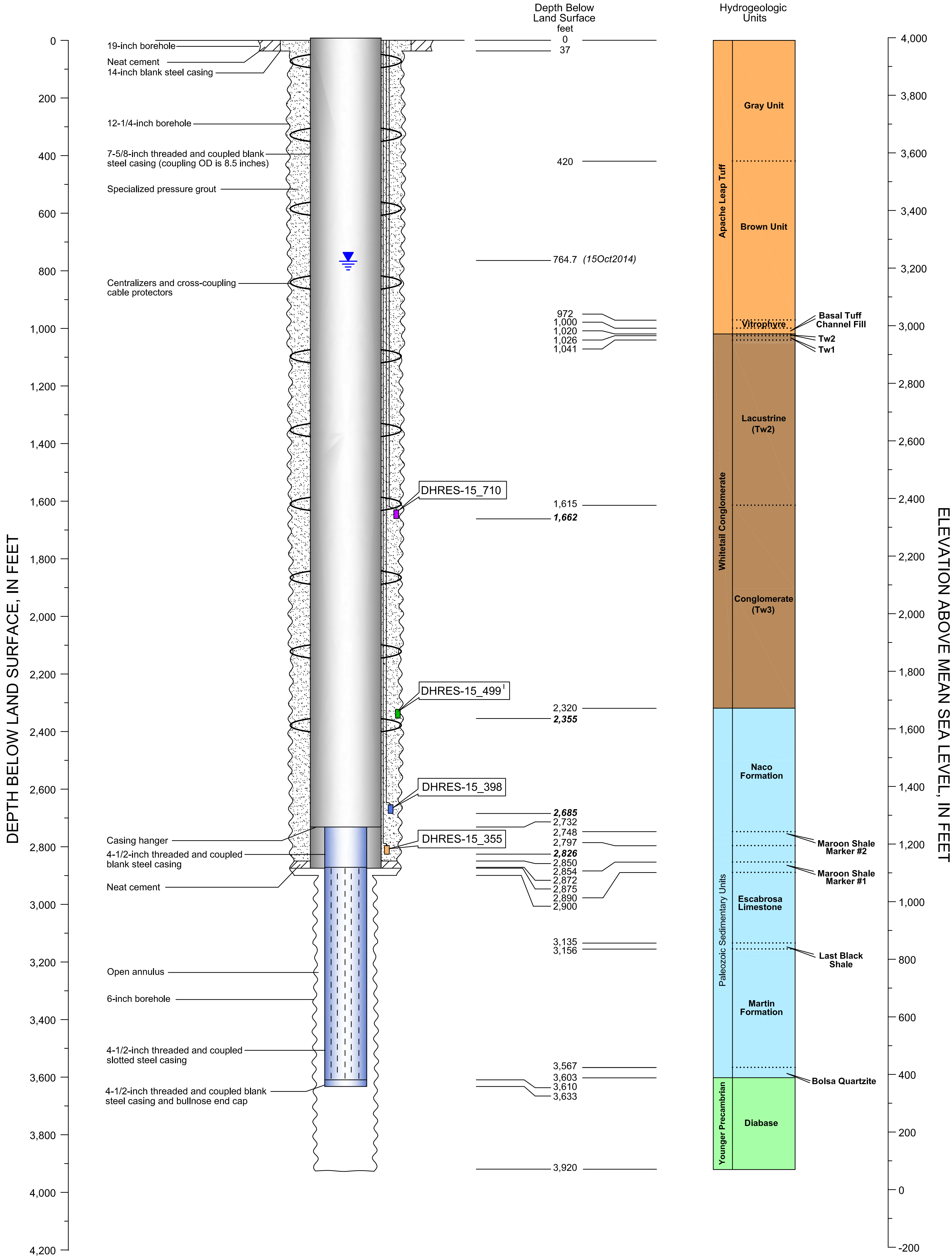
Water Resource Consultants

HRES-21
DIAGRAM OF WELL CONSTRUCTION

Version: February 2016

FIGURE 2

Drafting\605\WellSchematics_2015\HRESwells_SP83\HRES-21-WS_SP83\24March2016



CADASTRAL: (D-02-13)05ccb	ADWR NO: 55-916688
NORTHING: 831075.50	EASTING: 964978.32

LAND SURFACE ELEVATION: 3990.83 FEET AMSL

DATUM: U.S. State Plane Coordinate System of 1983
Epoch 2011 (NAD83 NA2011)
Arizona Central Zone (0202)
North American Datum 1983

North American Vertical Datum of 1983

Non-pumping Water Level

DHRES-15_398
Well Identifier
Piezometer Elevation, in meters amsl

I Piezometer was installed and is not functioning

Resolution Copper Mining

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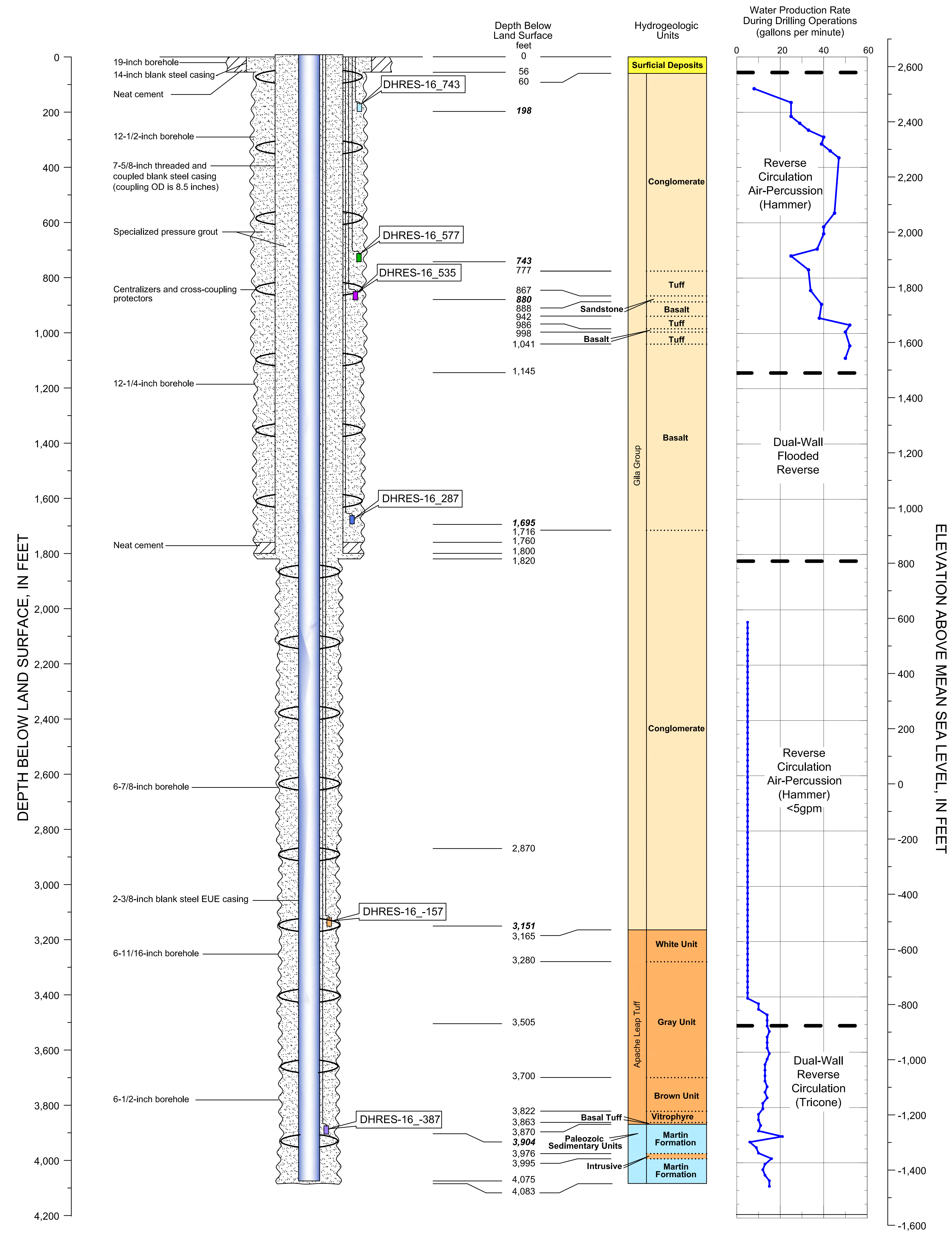
DHRES-15
DIAGRAM OF WELL CONSTRUCTION

Version: May 2016

FIGURE 3

Drafting\605\WellSchematics_2015\DHRES15_Feet\11May2016



CADASTRAL: (D-02-12)04dca	ADWR NO: 55-917232
NORTHING: 830712.77	EASTING: 944004.38

LAND SURFACE ELEVATION: 2634.25 FEET AMSL

DATUM: U.S. State Plane Coordinate System of 1983
Epoch 2011 (NAD83 NA2011)
Arizona Central Zone (0202)
North American Datum 1983

North American Vertical Datum of 1983

DHRES-16_535
Well Identifier
Piezometer Elevation, in meters amsl

Resolution Copper Mining

MONTGOMERY & ASSOCIATES
Water Resource Consultants

DHRES-16
DIAGRAM OF WELL CONSTRUCTION

Version: March 2016

FIGURE 4

Drafting\605\WellSchematics_2015\DHRES16_Feet_LOG\11May2016

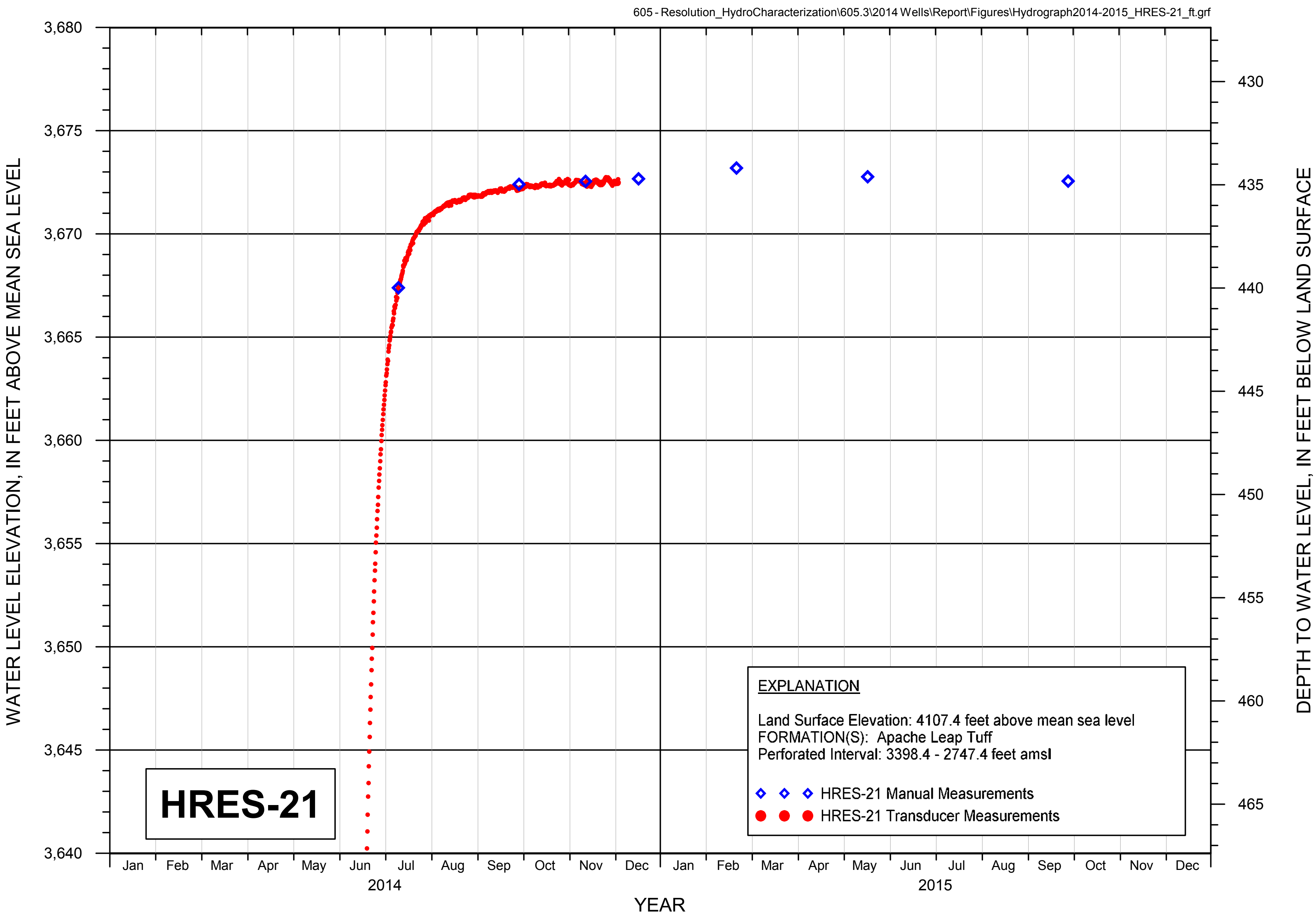


FIGURE 5. WATER LEVEL HYDROGRAPH FOR HYDROLOGIC TEST WELL HRES-21

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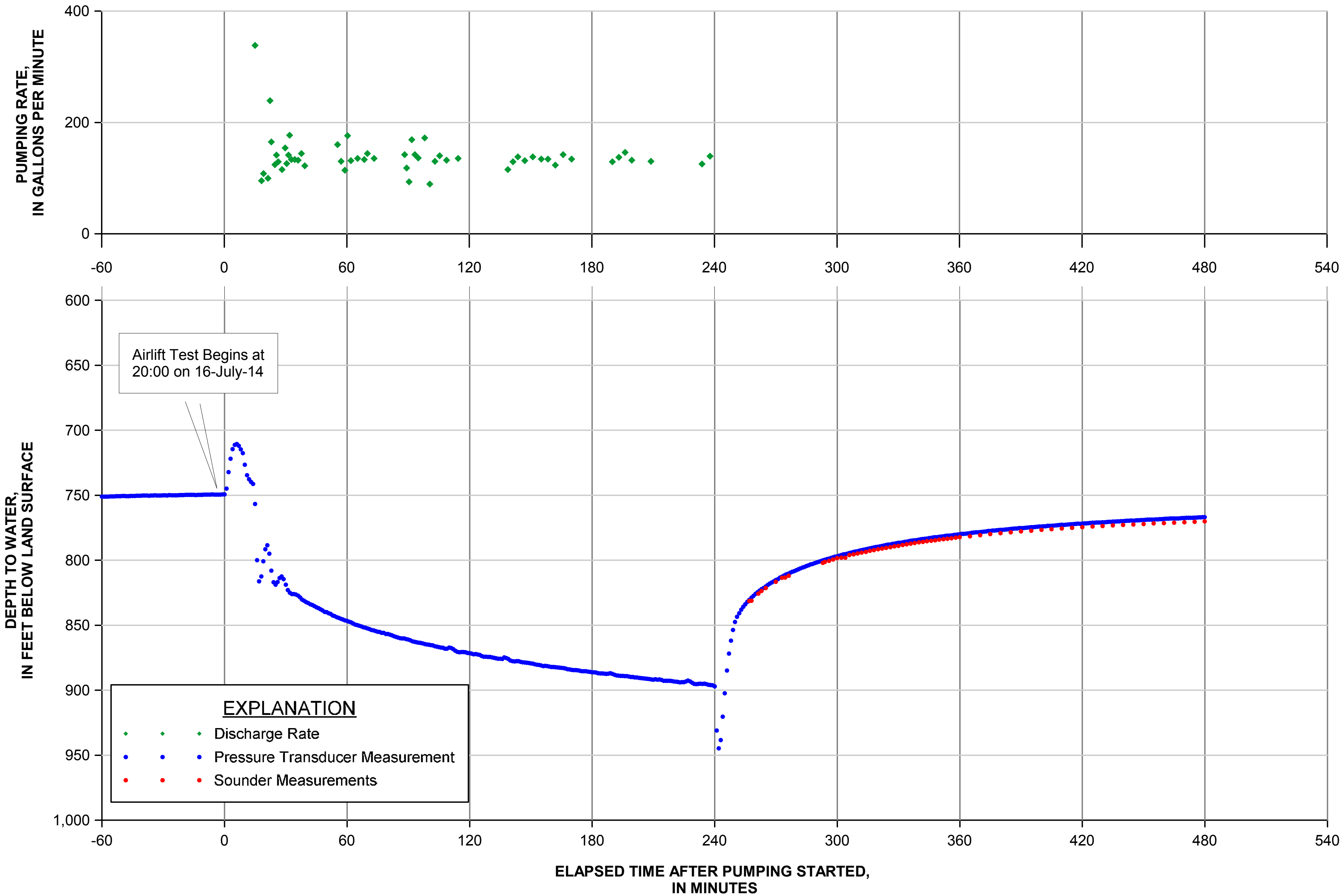

FIGURE 6. DISCHARGE RATE AND DEPTH TO WATER FOR HYDROLOGIC TEST WELL DHRES-15 DURING 4-HOUR CASED AIRLIFT TEST

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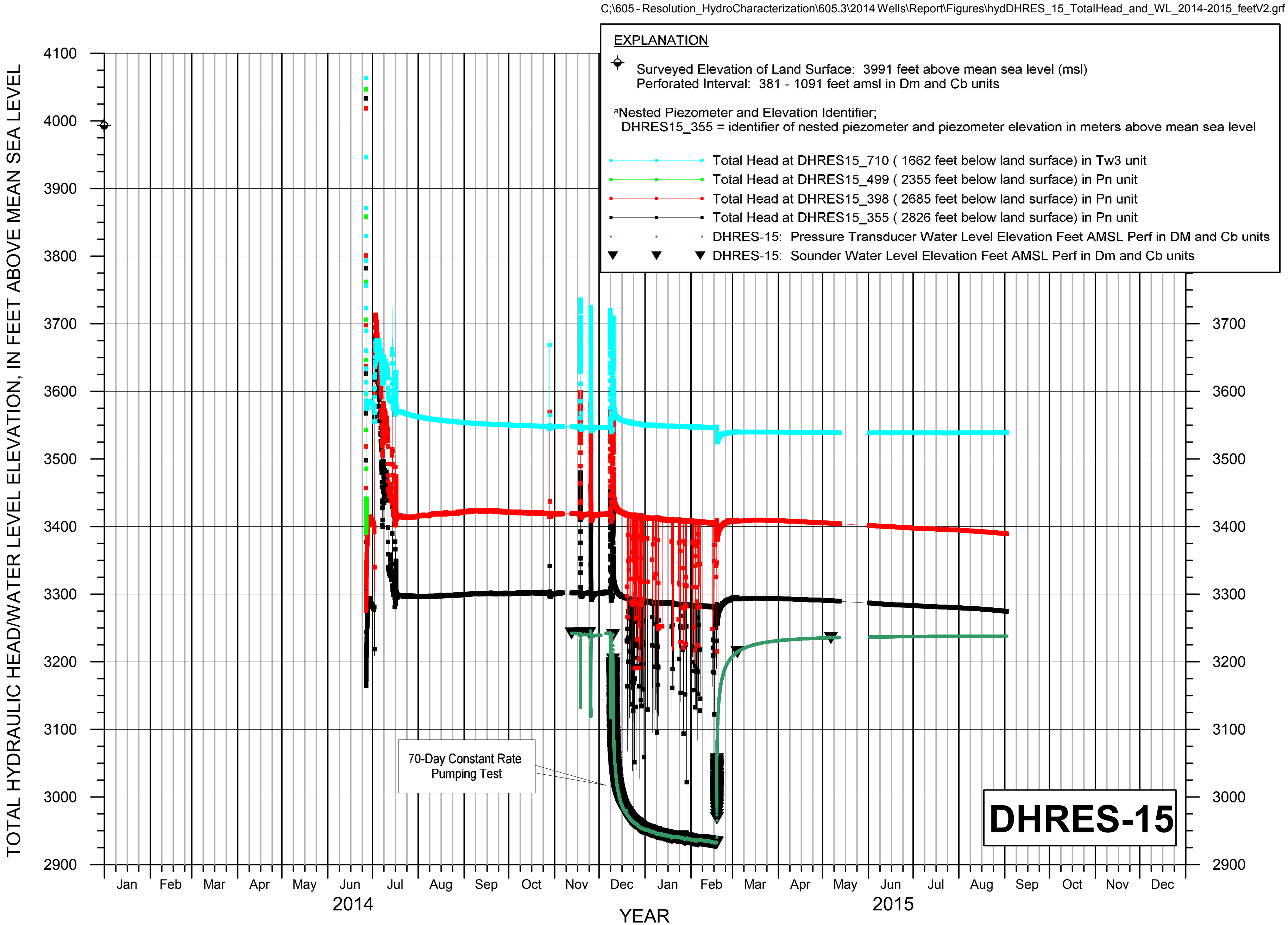

FIGURE 7. HYDROGRAPH OF TOTAL HYDRAULIC HEAD AND WATER LEVEL ELEVATION AT HYDROLOGIC TEST WELL DHRES-15

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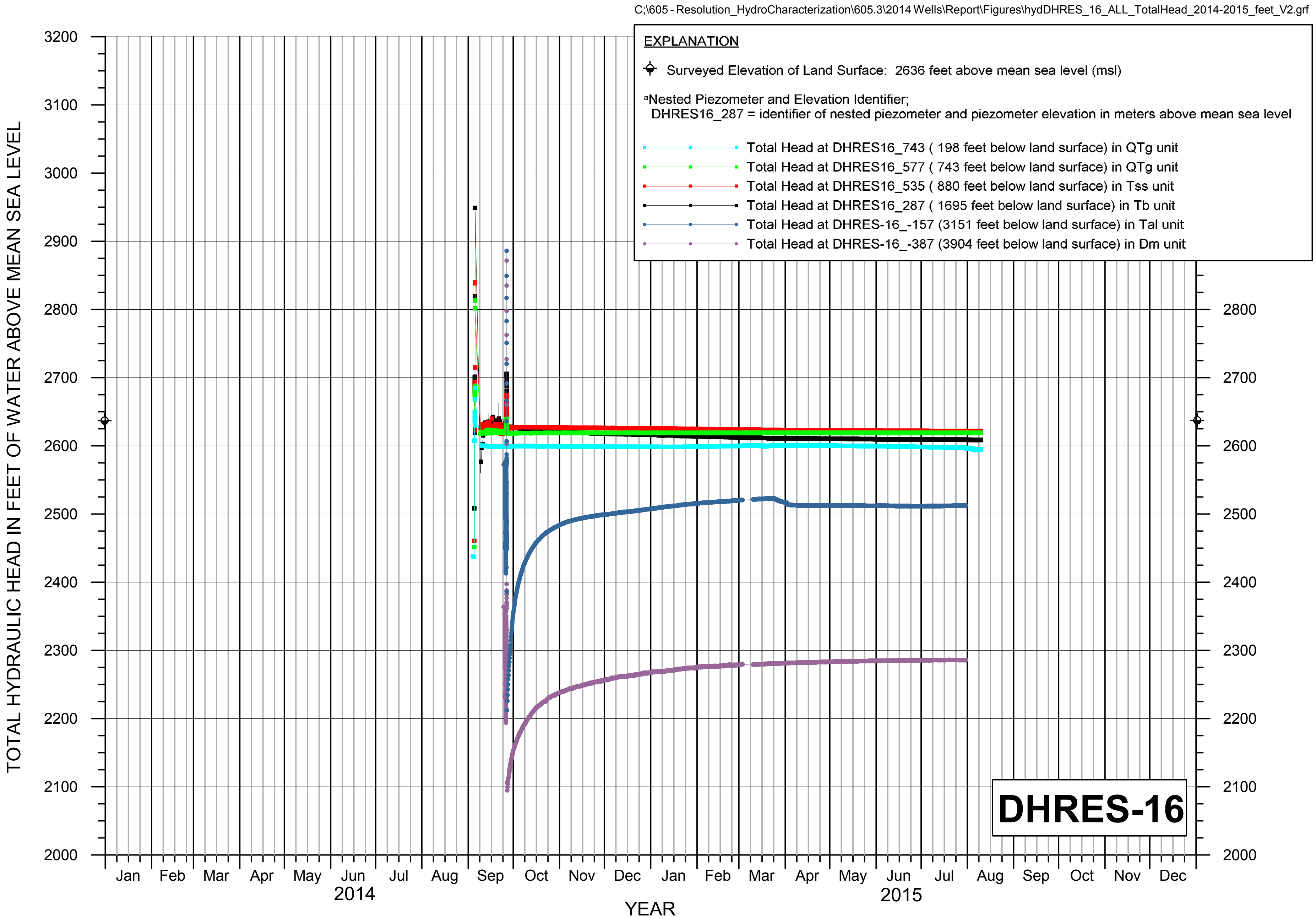

FIGURE 8. HYDROGRAPH OF TOTAL HYDRAULIC HEAD AT HYDROLOGIC TEST WELL DHRES-16

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APPENDIX A

DAILY FIELD PROGRESS REPORTS

TABLE A-1. DAILY FIELD PROGRESS REPORTS DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL HRES-21 (MONTGOMERY ASSOCIATES)

Date	Hole #	Shift Change Depth (feet)	Progress in Last 24 Hours (feet)	Comments	Hole Type/Size	Hydro Data	Geology
28-Apr-14	HRES-21	0.00	0.00	Conducted site safety, isolation officer, permit training for NEWP and M&A crews working on rig #167.	N/A	N/A	N/A
29-Apr-14	HRES-21	0.00	0.00	Rig arrived to EP escorted by AZPDES approximately 1530. Peeks conducting preliminary inspection of rig this evening prior to mobilization of rig to site tomorrow morning. Crews unloaded two trucks in laydown area at EP and began mobilizing ancillary equipment to site. Crews operating daylight hours only.	N/A	N/A	N/A
30-Apr-14	HRES-21	0.00	0.00	Rig failed inspection due to an ABS warning light although all air tests proved okay. NEWP mechanics working on equipment this afternoon with Peeks to reinspect late today or early tomorrow. Water storage tanks are being set up and ancillary equipment is being mobilized to site. Supervisor is optimistically aiming for setting surface on Saturday.	N/A	N/A	N/A
1-May-14	HRES-21	0.00	0.00	6 semi trucks of equipment was unloaded. Rig passed inspection and mobilized to site. Generator, compressor, light plant, mixer, and sub frame were mobilized to site. Additional trucks are scheduled for delivery tomorrow. Surface casing is in laydown, and plumbing into water storage tanks scheduled for Saturday.	N/A	N/A	N/A
2-May-14	HRES-21	0.00	0.00	Continued with mobilization & site setup. Additional tractor trailers received. Water storage tanks placed onsite & filling area, and water line plumbed. Electrical inspection scheduled for early Monday morning. Consultant Rig Geo's notified of tentative start date of Tuesday.	N/A	N/A	N/A

TABLE A-1. DAILY FIELD PROGRESS REPORTS DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL HRES-21 (MONTGOMERY ASSOCIATES)

Date	Hole #	Shift Change Depth (feet)	Progress in Last 24 Hours (feet)	Comments	Hole Type/Size	Hydro Data	Geology
3-May-14	HRES-21	0.00	0.00	Mud Mixer components switched with rig 166; will mob to site in the morning. All bins & crates of supplies have been taken to site. Water storage tanks are approx. 75% full. Site setup will continue tomorrow.	N/A	N/A	N/A
4-May-14	HRES-21	0.00	0.00	Continued with site setup. Mud Mixer mob'ed to site. Water storage tanks are full. Preparing for site inspection and electrical connections tomorrow. Night watchman on duty for security.	N/A	N/A	N/A
5-May-14	HRES-21	0.00	0.00	Site mobilization & setup continued. Water storage tanks filled. Tooling and electrical inspections pushed to tomorrow. Surface casing cement ordered for delivery. 8.625" blank casing delivered.	N/A	N/A	N/A
6-May-14	HRES-21	0.00	0.00	Continuation of site setup. Mud systems repairs conducted. Surface casing, and cement on site. Site Inspection and Electrical Inspection scheduled for tomorrow. Onsite water storage unit full, fire box and Indian pumps onsite.	N/A	N/A	N/A
7-May-14	HRES-21	0.00	0.00	Rig passed inspections. Target to begin drilling surface casing at 6pm this evening. Once surface casing is cemented in place, crews will allow 12 hours to set.	N/A	N/A	N/A
8-May-14	HRES-21	40.00	40.00	Spudded in with 19" bit to a depth of 40 ft. Installed and cemented 16" surface casing. Building BHA w/ 15" bit on hammer. Drilling commencing at this time. Hydrogeologic consultants onsite.	19" diameter hole cut for surface casing; 15" diameter initiating @ 40 ft bgs	N/A	Tal (competent)

TABLE A-1. DAILY FIELD PROGRESS REPORTS DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL HRES-21 (MONTGOMERY ASSOCIATES)

Date	Hole #	Shift Change Depth (feet)	Progress in Last 24 Hours (feet)	Comments	Hole Type/Size	Hydro Data	Geology
9-May-14	HRES-21	175.00	135.00	Drilling commenced around 23:00 after the BHA was set up. The hole was drilled to a depth of 120 ft, bgs before the crew tripped out to add drill collars. Drilling resumed at 13:50. Please note: hydro updates for the past 24 hours from M&A are based on the hydro shift change at 16:00.	15" diameter hole	N/A	Tal
10-May-14	HRES-21	410.00	235.00	Penetration rate over the last 24 hours has ranged between 1.5 to 2 hours per rod. Drilling operations are running smoothly.	15" diameter hole	N/A	Tal (Gray Unit)
11-May-14	HRES-21	585.00	175.00	Drilling operations progressing smoothly and at a steady pace. Drilling ceased for approximately 2 hours due to fuel pump issues. Borehole yet to produce any groundwater.	15" diameter hole	N/A	Tal (Gray Unit)
12-May-14	HRES-21	650.00	65.00	Drillers face some difficulty penetrating Tal at approximate depth of 645 feet. Crew trip out and replace drill bit. Drilling commenced with continued limited progress. Currently assessing whether issues are mechanical or geological. Borehole yet to produce any groundwater. Depth and progress are current as of 4:00pm at hydro shift change. Resolution staff on site mid-day and conduct all-hands safety awareness meeting.	15" diameter hole	N/A	Tal (Gray Unit)

TABLE A-1. DAILY FIELD PROGRESS REPORTS DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL HRES-21 (MONTGOMERY ASSOCIATES)

Date	Hole #	Shift Change Depth (feet)	Progress in Last 24 Hours (feet)	Comments	Hole Type/Size	Hydro Data	Geology
13-May-14	HRES-21	735.00	85.00	The crew tripped back out to assess a foot valve on the hammer bit. They replaced an airline hose on the head and test-fired the hammer at surface. Drilling initially continued with slow penetration in the approximate depth interval of 650 to 675 feet, but began to pick back up to the original pace prior to confronting issues. A new permit to work was authorized for incoming drill crew on hitch rotation. Groundwater has not been encountered yet in borehole.	15" diameter hole	N/A	Tal (Gray Unit)
14-May-14	HRES-21	940.00	205.00	Drilling operations proceeded at a steady pace with minimal interruption. Penetration rates were in the 2 to 2.5 hour range per 25-foot rod. Drilling was down momentarily from approximately 15:15 to 16:00 while the crew repaired a leak on the hydraulic line of the head. Groundwater has not yet been encountered in the borehole.	15" diameter hole	N/A	Tal (Brown Unit)- Gradational contacts between the White, Grey, and Brown units of the Apache Leap Tuff formation have been distinguished. White Unit: 0 to 130 feet. Grey Unit: 130 to 740 feet. Brown Unit: 740 to current depth
15-May-14	HRES-21	1000.00	60.00	Penetration rates gradually decreased and the drillers faced significant difficulty penetrating Tal at an approximate depth of 980 feet, making very limited progress over the subsequent 4 hours of drilling. The crew tripped out and discovered that their crossover tube was ruptured, restricting pressure circulation down to the bit. The part was replaced and drilling operations commenced in the afternoon. Following the repair, progress has returned but with relatively slow penetration rate.	15" diameter hole	N/A - Note: Airlift tests that have been conducted every 25 feet of penetration have provided little indication that the borehole is producing any formation water. After evacuating what appears to be residual injected water, discharge flow reduces to a minimal trickle.	Tal (Brown Unit)

TABLE A-1. DAILY FIELD PROGRESS REPORTS DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL HRES-21 (MONTGOMERY ASSOCIATES)

Date	Hole #	Shift Change Depth (feet)	Progress in Last 24 Hours (feet)	Comments	Hole Type/Size	Hydro Data	Geology
16-May-14	HRES-21	1040.00	40.00	Penetration rates remained slow overnight (5 hrs+/25 ft rod). Onsite compressor capacity was insufficient to ensure reasonable penetration rates with hammer bit. Booster was connected, to negligible effect. At 1040 feet, the crew tripped out to investigate causes slow drilling and for a possible replacement of the hammer bit, which was approaching its standard 50 hr replacement limit. Upon tripping out, National was inclined to switch to flooded-reverse drilling with tricone. After discussion between RCM and National, it was agreed National would not drill flooded reverse, but rather will proceed to drill reverse circulation air-rotary with a 14-3/4" tricone bit in an effort to improve penetration rates. National is currently tripping in with tricone bit.	15" diameter hole	N/A - Note: A static water level of 1024 ft bls was recorded in the 1040 ft deep borehole after the BHA was tripped out. The water level was observed stable and not recovering. Approximately 5.5 hours before this water level was recorded, drillers attempted to evacuate the borehole by airlifting prior to tripping out. The water in the borehole is likely residual water injected during drilling operations.	Tal (Brown Unit)
17-May-14	HRES-21	1040.00	0.00	Tripped back in with tricone to TD (1040 ft). No returns of cuttings to surface upon commencement of drilling. Tripped out to investigate drill pipe and crossovers, and for sundry troubleshooting. National decides to trip back in and drill blind to get better handle on situation. Drilling blind commenced at 16:00 hrs. Currently (19:30 hrs), drilling blind and still no returns of cuttings or water to surface; National continues to troubleshoot.	14-3/4" tricone	N/A	Tal (Brown Unit)

TABLE A-1. DAILY FIELD PROGRESS REPORTS DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL HRES-21 (MONTGOMERY ASSOCIATES)

Date	Hole #	Shift Change Depth (feet)	Progress in Last 24 Hours (feet)	Comments	Hole Type/Size	Hydro Data	Geology
18-May-14	HRES-21	1048.00	8.00	While drilling with no returns, National noticed a torque issue and decided to trip out to troubleshoot. Currently tripping back in without the stabilizer. Mechanic onsite for a repair.	14-3/4" tricone	Measured water level after BHA was tripped out and noted water level was recovering. The last water level measurement was 888.34 ft, bls and recovering at an average rate of 0.02 ft/min. Estimated production based on recovery is 0.2 gpm.	Tal (Brown Unit)
19-May-14	HRES-21	1085.00	37.00	Drillers and mechanic diagnosed an issue involving a sensor that was limiting the amount of power available to the rig. While awaiting a replacement part, National continued drilling while injecting 5-10 gpm and still did not get returns. After approximately one hour of drilling blind, pressure in the borehole increased from about 280 psi to 320 psi, at which point water unloaded with no cuttings. The surge lasted approximately 12-15 minutes and then subsided. Surges continued at intervals of 1-2 hours.	14-3/4" tricone	Well producing minimal amounts of water; surges are mostly injection water.	Tal (Brown Unit)
20-May-14	HRES-21	1110.00	25.00	Using an air drive pump, National increased injection rate to about 50 gpm hoping to improve circulation and get cuttings to the surface. Borehole continued to build pressure as water was injected, and periodically unloaded water with no cuttings larger than sand and silt. After consulting with Resolution, the decision was made to switch to flooded reverse. Currently tripping back in with flooded reverse system.	14-3/4" tricone	Well producing minimal amounts of water; surges are mostly injection water.	Tal (Brown Unit)

TABLE A-1. DAILY FIELD PROGRESS REPORTS DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL HRES-21 (MONTGOMERY ASSOCIATES)

Date	Hole #	Shift Change Depth (feet)	Progress in Last 24 Hours (feet)	Comments	Hole Type/Size	Hydro Data	Geology
21-May-14	HRES-21	1185.00	75.00	Crew commenced drilling last night at 18:25 after switching to flooded reverse circulation drilling method. Crew has been able to maintain circulation and produce returns. Penetration rate with flooded reverse is approximately 5 hours per 25' rod. Mechanic is currently onsite repairing hydraulic leak in head.	14-3/4" tricone	Drillers have noted that they seem to be getting full returns and there is no evidence of loss of injected water to formation.	Tal (Brown Unit)
22-May-14	HRES-21	1285.00	100.00	Crew resumed drilling last night at 21:15. Crew has been able to maintain circulation and produce returns. Penetration rate over the last 100 ft has been gradually increasing from 4 hours per rod to 2.5 hours per rod. Incline in borehole was 0.13 +/- 0.14 at 1000 ft, and 0.13 +/- 0.14 at 1100 (the same). Mechanic is currently onsite again adjusting head position.	14-3/4" tricone	Drillers have noted that they are getting full returns and there is no evidence of loss of injected water to formation.	Tal (Brown Unit); Tal (Vitrophere) encountered at 1269 ft.
24-May-14	HRES-21	1380.00	95.00	Conducted brief airlift test to confirm production rate for well design specs. Currently running geophysical surveys. Due to the low production rate and after reviewing the borehole video log, the planned well design is: 4-1/2" blank casing from 0 to 700 ft and slotted casing from 700 to 1360 ft with a bullnose end cap. Annular material will be 0 to 160 ft cement with a cement basket on bottom and 160 to 1380 ft open annulus.	14-3/4" tricone	Initial water level measured after the airlift test was 1243.15 ft, bls and recovered to 1241.99 ft, bls in 30 minutes. At the end of the borehole video log, the water level had recovered to 1228.83 ft, bls. The borehole was flooded to 913 ft, bls before the next tool in the suite and was still recovering.	Tw2
25-May-14	HRES-21	1380.00	0.00	Geophysical logging concluded at 05:00. National prepared for well construction and began installing casing around 07:00 and currently has less than 5 more joints to trip in.	14-3/4" tricone	Last water level measured with the ABI tool was 872.3 ft, bls.	Tw

TABLE A-1. DAILY FIELD PROGRESS REPORTS DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL HRES-21 (MONTGOMERY ASSOCIATES)

Date	Hole #	Shift Change Depth (feet)	Progress in Last 24 Hours (feet)	Comments	Hole Type/Size	Hydro Data	Geology
26-May-14	HRES-21	1380.00	0.00	Finished installing casing at 17:00 last night. Crew added 6' of bentonite and then proceeded to cement from 167'-ground level. At 06:45 this morning, crew began running 2-1/2" airline to a depth of 1355' bls to evacuate borehole water. Airlifting operations lasted a total of 4 1/2 hours. A transducer was lowered and hung at a depth of 1200' and is recording water level recovery. National crew has welded on the steel well head and secured the well. Crew will begin breaking down site tonight. Mobilization to site DHRES-15 will begin after a few repairs are made to the rig.	14-3/4" tricone 4-1/2" casing	Water level measured at 799.81' bls before airlift test; currently monitoring water level recovery with transducer	Tw

TABLE A-2. DAILY FIELD REPORT DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL DHRES-15 (RESOLUTION COPPER MINING LLC)

Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
5/28/14	DHRES-15	M. Bascopé	Observed crew as they raised the mast and set the outriggers. Crew conducted mast inspection prior to raising. Discussed safety pin placement, and head lowest position (removing gravity hazard) while conducting work. Reviewed TRACK conducted for mobilization.			0.00	0.00	Rig, table, generator, and smaller ancillary equipment onsite and being setup. Sump dug, and rig mast raised and locked. Mechanics onsite reinstalling head motors. National anticipates spudding-in on Saturday.	Set-up
5/29/14	DHRES-15	M. Bascopé	Participated in crews' cross shift meeting, as well as the construction of two TRACKs associated with the installation of the cyclone and Kelly hose. Observed the crew to thoroughly discuss hazards related to gravity and equipment, as well as associated controls.			0.00	0.00	Continuing with Site Setup. Head repair (motor installation) completed. Cyclone installed on mud shaker; Kelly hose installed. Mud tank positioned. ETA for "spudding-in" remains Saturday.	Set-up
5/30/14	DHRES-15	M. Bascopé	New Permit to Work issued to cover "spudding-in" and casing installation. Hazards associated with "tailing-in" process discussed. ERP reviewed with crew.			0.00	0.00	Continuing with site setup. Water lines plumbed; tooling brought onsite. Casing brought onsite as well. Still on target for breaking ground tomorrow.	Set-up
5/31/14	DHRES-15	S. McFadden	Received in depth site induction. Discussed hazards and was provided with a walk around of site. Noted front end loader on site had a tire delaminating and should be corrected. (Odenetto)			80.00	80.00	Casing was set and cemented overnight. At time of visit tooling was being set with drilling estimated to start early evening on Saturday. Water lines were discovered to be shut off during the overnight shift and was turned back on. Site is receiving a consistent water supply now. Drill team was still working on minor setup issue while tooling was being installed.	casing
6/1/14	DHRES-15	A. Henager	The walk up to the rig is lengthy and can be obscured from the view of the driller/helper; discussed how to approach when coming on site and where someone should stand; highlighted the area between the drill and the mud tank as a no go zone, but someone can approach as long as they are site inducted.			80.00	0.00	During the visit they where just about finished running in rods with tooling before running in the air hose.	casing
6/2/14	DHRES-15	M. Bascopé	The walk up to the rig is lengthy and can be obscured from the view of the driller/helper; discussed how to approach when coming on site and where someone should stand; highlighted the area between the drill and the mud tank as a no go zone, but someone can approach as long as they are site inducted.			500.00	420.00	During the visit they were just about finished running in rods with tooling before running in the air hose.	12-1/4" Flooded Reverse
6/3/14	DHRES-15					700.00	200.00		12-1/4" Flooded Reverse
6/4/14	DHRES-15	E. Castleberry	Site induction conducted for first time visit to drill pad. Spoke with helper about use of scorpion wrench and also discussed hazard observations monthly targets.			900.00	200.00	Drilling 12 1/4" flooded reverse - making good progress with no issues to report at this time.	12-1/4" Flooded Reverse

TABLE A-2. DAILY FIELD REPORT DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL DHRES-15 (RESOLUTION COPPER MINING LLC)

Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
6/5/14	DHRES-15	M. Bascopé	Reviewed JSA book; noted a few gaps in coveraged. Discussed with Foreman and Safety Supervisor.			1110.00	210.00	Entered Tw at 1028 ft. Advancing without issue; no issues with: penetration, returns, or formation. Very low amount of Con-Det being used to keep bit clean within Tw. Inclination as high as 2.19° measured at 1000 ft; but trend is lowering since. Bit trip will likely mean transfer to steel tooth for increased penetration in Tw.	12-1/4" Flooded Reverse
6/6/14	DHRES-15	M. Bascopé	Delivered new Rotary Critical Control Posters; and discussed guarding with crew.			1300.00	190.00	Drilling ahead without issue. Steady penetration rate. Approx. 40 hrs left on bit. Steel Tooth being shipped from Elko. No changes to mud recipe. No loss of circulation; only making enough mud to keep up with advancement volume.	12-1/4" Flooded Reverse
6/7/14	DHRES-15	M. Bascopé	Discussed wireline hazards with crew and onsite consultant.			1545.00	245.00	Currently conducting geophysical survey. Tripped out to retrieve fallen TOTCO survey tool and change bit. Used trip to conduct geophysical survey. Steel tooth bit arrived and will be used going back in.	12-1/4" Flooded Reverse
6/8/14	DHRES-15	E. Castleberry	Spoke with crew about completing TRACK / Take 5 specifically when conducting infrequent tasks.			1555.00	10.00	Tripped back in after completion of geophysical logging. Advanced hole 10 ft and ROP slowed significantly. Crew noted increase in clay coming off screen and suspect bit is balling. Currently running gravel down the back side to attempt to advance. If ROP does not increase crew will trip out to inspect bit.	12-1/4" Flooded Reverse
6/9/14	DHRES-15	B. Kiefer	Observed drill crew "tailing-in" drill collars. Held discussion with foreman regarding material safety risks and associated critical controls. Also emphasized importance of discussing effectiveness of critical controls on a daily basis.			1675.00	120.00	Advanced hole 120ft before decision was made to trip out due to slow penetration rate. Replaced steel mill tooth bit with carbide cutting face and currently tripping back in to resume drilling.	12-1/4" Flooded Reverse
6/10/14	DHRES-15	M. Bascopé	Spoke with Driller & Helper about exlusion zone around the cyclone hose when the borehole is pressuring up.			1760.00	85.00	Completed trip in and resumed drilling with carbide bit. No issues to report. Mill tooth bit was observed to be very worn. Analysis of geophysical survey indicates hole is well below DLS requirement.	12-1/4" Flooded Reverse
6/11/14	DHRES-15	M. Bascopé	Spoke with crew about recent safety alert involving metal grating failure. Conducted inspection of mud mixer/shaker grating.			1960.00	200.00	Continuing to drill 12.25" flooded reverse with no issues to report at this time.	12-1/4" Flooded Reverse
6/12/14	DHRES-15	M. Bascopé	Discussed permit to unload procedure for secondary water tanks. Met with supervisor to layout logical tank location and fitting connection.		Flooded Reverse	2160.00	200.00	Drilling ahead - making great progress. No issues to report at this time. ROP remaining at 2hrs per 25 ft.	12-1/4" Flooded Reverse
6/13/14	DHRES-15	M. Bascopé	Quizzed helper on Material Risks and associated Critical Controls. Requested him to dedicate some additional time to reviewing the Risks and Controls.		Flooded Reverse	2350.00	190.00	Drilling ahead without issue. Formation change into limestone encountered at 2,350 ft. Instant decrease in ROP (from 12 to 6 ft/hr). Bit is halfway through life, no intention of early trip at this time. Cuttings are still balled up with signficant amount of clay. Baroid is visiting for analysis.	12-1/4" Flooded Reverse

TABLE A-2. DAILY FIELD REPORT DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL DHRES-15 (RESOLUTION COPPER MINING LLC)

Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
6/14/14	DHRES-15	M. Bascopé	Discussed hazards associated with moving 6,900 gallon poly water tanks.		Flooded Reverse	2470.00	120.00	Drilling ahead without issue. ROP within LS is steadily lower than in previous units (5-6 ft/hr). Cuttings are still balled up with signficant amount of clay. Crew installed new wireline capable of reaching desired survey depths. Surveyed inclinations have been < 6.0°.	12-1/4" Flooded Reverse
6/15/14	DHRES-15	E. Castleberry	Detailed site induction conducted for geology team member new to drill pad. Hazards and areas to avoid were discussed.		Flooded reverse	2550.00	80.00	Continuing to drill flooded reverse at decreased penetration rates. Current ROP reported to still be ~6hrs per rod (25ft).	12-1/4" Flooded Reverse
6/16/14	DHRES-15	E. Castleberry	Returning midnight shift meeting scheduled for tonight. New permit to work will be issued as well during the meeting.			2630.00	80.00	Continuing to drill flooded reverse at ROP of ~6hrs per rod. Anticipating formational contact within next 100 ft or so at which time the hole will be open hole logged and cased off with 9-5/8" casing and piezometers.	12-1/4" Flooded Reverse
6/17/14	DHRES-15	M. Bascopé	Tested the drill pad's fire mitigation setup. Discussed FFP and requested crewmembers to constantly analyze upcoming large tasks and look for critical hazard exposure.			2725.00	95.00	Drilling final rod with 7" string. Rig pullback capability has been reached with this tooling setup and string. Will be switching over to 5" string for deeper advancement. This trip corresponds with the need for a bit replacement, and needed rig maintenance. Estimate for return to drilling is TH night. Drilling will proceed until the Pnaco/Me contact is encountered. The conductor interval will be TD'ed and borehole geophysics will be conducted. Surveyor on notice for ETA of Sat morning.	12-1/4" Flooded Reverse
6/18/14	DHRES-15	M. Bascopé	Spoke with foreman about safety and enviro. Issues observed at Laydown yard.			2790.00	65.00	Switching over to 5.5" rod string and conducting both repairative and preventative maintenance.	12-1/4" Flooded Reverse
6/19/14	DHRES-15	M. Bascopé	Remphasized the importance of starting your shift by contemplating the high energy hazards and associated controls for upcoming tasks. Pointed out that our list of "Material Risks" and "Critical Controls" are based on statistics and interviews, but that crewmembers must look outside of this list and apply the methodology to all tasks - focus on fatality prevention.			2790.00	0.00	Continuing with reparitive maintenece. Currently replacing hydraulic motors within head. Better design (2-speed vs. 3 speed) being installed. Same rpm range as before - no change to operation. Completed 1,000 hr preventative maint. and setup for 5.5" rods. Estimate to be back on bottom drilling @ 02:00 tomorrow morning. Geophysical Surveyor notified to be onsite Sat. morning, as ETA for hitting Pnaco/Me contact (TD) is Sat.	Maintenance
6/20/14	DHRES-15	B. Kiefer	Spoke with crew about vehicle/pedestrian hazards for upcoming geophysical surveys and cementing operations. Crew will be relocating some on-site equipment to accommodate vehicles on site during these operations.			2790	0	Tripped back to bottom and resumed drilling Naco formation. Anticipate formation change in next 12-24 hours which will serve as bace of conductor casing. Next steps will be to open hole survey, run casing and grout casin + peizometers in place.	

TABLE A-2. DAILY FIELD REPORT DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL DHRES-15 (RESOLUTION COPPER MINING LLC)

Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
6/21/14	DHRES-15	M. Bascopé	Ran through detailed setup for piezo installation/ running of casing.			2,900	110	Encountered target contact of Me unit at depth of 2890'. Advanced additional 10 ft to 2900', then TD'ed the conductor interval. Circulated while thinning the mud for an hour to improve geophysical survey results. Currently tripping out. Est. time for string to be out is 23:00. Geophysical contractor notified.	
6/22/14	DHRES-15	E. Castleberry	Spoke with crew and 3rd party logging contractor about safety meeting conducted prior to hanging sheave wheels and running geophysical tooling on wireline. Drill crew advised to stay away from drill decking due to actively operating wireline.			2900.00	0.00	Geophysical logging contractor arrived on site late last night and began logging at 0130 hrs. this morning. Currently running conductivity imager at ~600 ft per hour. Piezometer intervals will be discussed this evening upon completion of geophysical logs. Anticipate running 7-5/8" casing late tonight with pressure grouting to follow.	Logging / Casing
6/23/14	DHRES-15	E. Castleberry	Met with drilling contractor, water well consultants, RCM hydrology and safety team members to conduct risk assessment for running casing and piezometers.			2900.00	0.00	Geophysical logging completed last night. Conducted risk assessment this morning on task of running casing and piezometer tooling. 7-5/8" casing will be ran to 2890 ft depth. Halliburton scheduled to be on-site for pressure grouting of casing and piezometer tooling.	Casing
6/24/14	DHRES-15					2900.00	0.00		Casing
6/25/14	DHRES-15	M. Bascopé	Had discussion with drilling site supervisor about historic incidents involving Eckel Tongs and Elevators.			2900.00	0.00	Completing the installation of casing & piezometers. The final joint should be landed soon. Crew will then prepare site for Halliburton arrival. Cementing to commence at daylight tomorrow morning.	Casing
6/26/14	DHRES-15	E. Castleberry	Participated in site wide safety meeting for cementing process with Halliburton. Halliburton delineated "no go" areas and requested non-essential workers stay off the drill deck during the pumping process.			2900	0	Casing landed at 2890 ft. Steel tabs were welded to casing and casing was set down on 2" steel landing plate. All four piezometers were working after landing casing. Halliburton on site this morning. Began pumping grout at approximately noon today.	Casing
6/27/14	DHRES-15	M. Bascopé	Discussed recent property damage incident involving sky track. Also instructed crew to secure site if leaving site unattended, specifically to not leave any equipment keys.			2900	0	Completed pressurized grouting of conductor casing. All piezo's sucesfully tested and currently monitoring at 10 min interval. Grout will be allowed to cure 72 hrs before initiation of drilling production interval. Crews are currently switching pad layout for convential mud drilling.	
6/28/14	DHRES-15	M. Bascopé	Observed crew as they conducted hot work on table. Hot work permit in place, and correct procedures utilized.			2900	0	WOC. Still waiting for grout cure. Crew continues with site transition to convential drilling. Crew will commence drilling tomorrow at 14:30	
6/29/14	DHRES-15	E. Castleberry	Spoke with driller about weekly permit to work issuance and completing details for JSA's reviewed and critical controls identified for tasks at hand.			2900.00	0.00	Currently working on drill head to set-up for conventional drilling. Crew will trip in to top of float sub inside casing and await arrival of parts for water swivel.	Standby
6/30/14	DHRES-15	E. Castleberry	2 crew members on site busy unloading second pump - no discussion. Returning midnight shift scheduled to meet tonight.			2900.00	0.00	Currently on standby by. Waiting for saver subs to arrive and head hoist cable before tripping to drill out float sub. Second pump arrived this evening and is currently being set-up on site.	Standby

TABLE A-2. DAILY FIELD REPORT DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL DHRES-15 (RESOLUTION COPPER MINING LLC)

Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
7/1/14	DHRES-15					2900.00	0.00	Noted in next days comments.	
7/2/14	DHRES-15	M. Bascopé	Instructed crew members to ensure they walk visitors around during site induction. Reminded crew members to not conduct any tasks for which they have not been formally trained.			2900.00	0.00	Completed repairs to head and downfeed cables. Replacement cables installed and tested. Crew ran in hole this morning and tagged cement. At 12:00, bit had advanced to 2,882 w/ cuttings of cement and rubber from the plug. No issues to report.	Initiating Drill-Out of Production Interval
7/3/14	DHRES-15	M. Bascopé	Observed crew as they conducted preventative maintenece. Had discussion with crew about burn hazards associated with turbo unit on mud pump. Have initiated dialogue with NEWP site safety supervisor about improving access.			3020	120	Drilling Production Interval. Drilling ahead with 6.25" bit, without issue. Rods in the last 24 hrs have advanced with a ROP of approx. 2 hrs, last rod faster at a little over 1 hr. Drillers are conditioning hole longer after runs in response to cave and longer clean up time. However, this improved on last run.	
7/4/14	DHRES-15	M. Bascopé	Spoke to foreman about fatigue management and assessment of crew's level of fatigue.			3130	110	Drilling ahead without issue. Full returns are present. Preparation of production inteval casing has been scheduled for Mon. Liner hanger contractor has been kept up to date on scheduling.	
7/5/14	DHRES-15	M. Bascopé	Reviewed crews' TRACK and BBS forms from past few days. Commended crew for their diligence, and made a few comments/suggestions.			3270.00	140	Drilling ahead without issue. Full returns present. Crew is maintaining mud vis at or below 31s. TOTCO tool bump checked on surface utilizing levels. Acceptable reading of 0.5° achieved. Cuttings this afternoon appeared to have dark shale present. M&A onsite, about to wash cuttings and log.	
7/6/14	DHRES-15	E. Castleberry	Discussed critical controls in place when operating wireline for inclination survey tooling.			3400.00	130.00	Continuing to drill conventional 6-3/4" hole with poly water - making steady progress. No issues to report at this time. Average ROP ~2hrs per 20 ft rod.	6-3/4" conventional rotary
7/7/14	DHRES-15	E. Castleberry	Helper discussed "no-go" areas and current operation. Both driller and lead helper discussed current fatality risk as entanglement in rotating equipment and burst of high pressure lines. Critical controls also discussed.		Full returns	3570	170	Continuing to drill conventional 6-3/4" hole with poly water and full fluid returns - making steady progress. Average ROP ~2hrs per 20 ft rod. Inclination surveys indicating deviation of vertical of ~10 deg at 3500 ft. Bit trip anticipated this afternoon. Discussing options to keep hole closer to vertical. Spoke with casing hanger technician and confirmed that current inclination will not impact ability to run in tooling.	6-3/4" conventional rotary
7/8/14	RES-034	M. Bascopé	Conducted "Return to Shift" meeting with returning crew. Discussed "Copper Group Alerts" involving pinched hand in crane block attachment, utility knife, and haul truck at KUC.			2930	180	Currently drilling without issue. MWD system has provided constant communication since being back on bottom. Azimuth and inclination are on target, and 20 ft DLS are ≤ 2.10. Foreman has been working on site setup for upcoming casing install/cementation.	
7/8/14	DHRES-15	M. Bascopé	Conducted "Return to Shift" meeting with returning crew. Discussed "Copper Group Alerts". Saw that crew completed requested improvement to the access of mud pump with access door.			3610	40	Continuing to drill after replacing bit - same design and hardness. Full fluid returns. Check valve inserted into top of BHA to prevent cuttings back-flow during rod addition.	
7/9/14	DHRES-15	E. Castleberry	Site visit scheduled for this afternoon.		Full returns	3680.00	70.00	Continuing to drill with full fluid returns. Diabase contact noted at 3610 ft. Continuing to advance hole before running casing hanger and 4.5" casing in the production interval.	6-3/4" Conventional Mud Rotary

TABLE A-2. DAILY FIELD REPORT DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL DHRES-15 (RESOLUTION COPPER MINING LLC)

Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
7/10/14	DHRES-15	M. Bascopé	Looked over site for any insufficient guarding. Observed crew to be utilizing shift specific saver sub.			3810.00	130.00	Drilling ahead without issue. ROP within diabase has slowed to approx. 5 hr/rod. Geophysical request has been sent to SWE; DNH tools is ready to mob. Out and casing will be transported to site tomorrow.	6-3/4" Conventional Mud Rotary
7/11/14	DHRES-15	M. Bascopé	Asked helper to ID the most hazardous task for him coming up with running casing.			3920.00	110.00	TD'ed hole this afternoon, at a depth of 3,920 ft. All contractors associated w/ upcoming work have been scheduled for tonight and tomorrow morning.	
7/12/14	DHRES-15	M. Bascopé	Observed crew at they tripped in 4.5' casing. No issues observed.			3920.00	0.00	Hole was conditioned, and drill string trippped out last night by 21:00; shortly followed up with geophysical survey until this morning. DNH tools was onsite, awaiting completion, provided bull-nose shoe for casing which started being run in the hole around 09:30. No issues to report.	
7/13/14	DHRES-15	E. Castleberry	Spoke with drill crew about process of running air lift string. Also spoke with foreman about sites water needs and keeping water available for potential fire fighting while 2" poly lines are worked on.			3920.00	0.00	Completed repairs to drill rig electrical system late last night and completed running of casing. Hung casing at 5:30am this morning with casing hanger at 2723 ft. Tripped out rods used to hang casing by noon today. Currently running in with BQ string to air lift hole for production. Air lifting every 500 ft.	Production of well
7/14/14	DHRES-15	E. Castleberry				3920.00	0.00	See next days comments	Production of well
7/15/14	DHRES-15	M. Bascopé	Observed crew as they switched over the saver sub, utilizing the petol wrench. No HSE issues of concern. Spoke to crew about hands off controls policy and its applicability to multiple activities.			3920.00	0.00	Airlift development with a BQ string was successful at shallow depths: 1,000 and 1,500 ft - drilling fluid reported to be removed from hole. Air lifting was unsuccessful at deeper depths, as the pressure required was too high. Development was terminated and a second approach is currently being initiated. NEWP will be running a string of NQ underneath a string of dual wall 5.5" drill rods. The strings will be connected with an adapter that has a turnaround built in.	Production of well
7/16/14	DHRES-15	M. Bascopé	Spoke with foreman about compressed air hazards associated with unloading holes during development.			3920.00	0.00	At time of visit, crew was still developing the well; two intervals were remaining and production still held around 120 gpm. Air lift testing for production estimates has likely commenced; though mechanical issues were initially reported as being a cause for delay.	Production of well
7/17/14	DHRES-15	M. Bascopé	Site visit currently under way.			3920.00	0.00	Began airlift test at 20:00 last night. Average discharge rate was ~135 gpm. Test concluded at midnight and water chemistry samples were collect at the end of test. Monitored water level recovery from 00:00 to 04:00 this morning. Crew began tripping out pipe at 05:00. Will begin breaking down site after removing rods from hole.	Production of well
7/18/14	DHRES-15	M. Bascopé	Spoke with project manager about hazards associated with upcoming de'mob			3920.00	0.00	Breaking down site for mobilization offsite to KUC.	

TABLE A-2. DAILY FIELD REPORT DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL DHRES-15 (RESOLUTION COPPER MINING LLC)

Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
7/19/14	DHRES-15	M. Bascopé	Conducted incident investigation. Helper was struck in shoulder by falling catwalk. Resulting injury was shoulder dislocation. Helper released by doctor on modified, limited, duty. Tap Root scheduled for Monday morning.			3920.00	0.00	Mobilizing. Work was stopped from 11:00 - 17:00 in response to incident/injury listed to the left. Crews will continue with well completion and mobilization activities and not work on mud tank until completion of Tap Root.	
7/20/14	DHRES-15	E. Castleberry	Discussed confined space classification and requirements for permitted entrance.			3920.00	0.00	De-mobilization continues. Rig and majority of equipment has been staged at EP laydown for arriving trucks. Crew cleaning up remaining materials on drill pad. Anticipate complete de-mobilization by late Wednesday this week.	De-mob
7/21/14	DHRES-15	E. Castleberry	TapRooT conducted for incident that occurred on 7/19. Action items developed with clear deliverable dates.			3920.00	0.00	Continuing with demonization process to SLC. Rig and ancillary equipment mobilized out of east plant laydown today with remaining equipment to follow over the next 2 days. Cement pad poured around well head.	De-mob
7/22/14	DHRES-15	E. Castleberry	Discussions with supervisor and helper on remaining tasks to be completed. Crew observed working under hot work permit when cutting casing and installing well head.			3920.00	0.00	Continuing with demobilization from project. Few remaining items on site. Crew is completing construction of well head cover.	De-mob

TABLE A-3. DAILY FIELD PROGRESS REPORT DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL DHRES-16 (RESOLUTION COPPER MINING LLC)

Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
8/22/14	DHRES-16	M. Bascopé	Worked with crew through the discussion of and usage the SWP associated with rasing the catwalks of the mud tank. Overall, a very good process developed and documented; provided some suggestions and items to consider. Additionally, interacted with crew and RCM Community & Social Performance Manager.			0.00	0.00	Mobilization/ site setup. Additional equipment brought on pad. One-Call/Blue Stake Locators marked utilities, and private contractor swept pad for utilities as additional measure. Will likely "spud-in" Sunday.	
8/23/14	DHRES-16	M. Bascopé	Spoke with NEWP safety supervisor on recent non-compliance item, and requested he check the SWP books onsite for completeness and up to date status.			0.00	0.00	Continuing with site mob. & setup. Rig setup, under-deck sump dug, and generator wired by RCM electrical. Electrical inspection conducted. Third-party inspection initiated; more to follow when crew is ready. ETA to spud-in is tomorrow evening. Fuel delivery lined up; water tank delivery lined up.	
8/24/14	DHRES-16	E. Castleberry	Site visit and detailed rig inspection scheduled for this afternoon.			0.00	0.00	Finalizing setup of site. Detailed rig inspection and final sign off for startup scheduled this afternoon barring any safety critical findings.	Setup
8/25/14	DHRES-16	M. Bascopé	Walked site with RCM Safety Superintendent.			0.00	0.00	RCM drilling inspection completed; 3rd party equipment insptection completed. Onsite kickoff mtg conducted with RCM Hydro, Drilling Ops, and M&A. Crew will be spudding in this afternoon with Air & Tricone.	Surface
8/26/14	DHRES-16	M. Bascopé	Spoke with Contractor Safety Manager about fatigue management, fitness for duty, and return to hitch meetings.			60.00	60.00	Crew advanced 19" borehole to 60 ft and then installed 14" casing with neat cement. Currently preparing & adjusting surface casing diverter. Intend to run BHA to bottom soon. BHA is 12.75" hammer, cob reamer, and stabilizer w/ rods not collars. Collars will be installed around 140ft deep. Noise suppressor was installed on air bypass.	Surface
8/27/14	DHRES-16	M. Bascopé				65.00	65.00		
8/28/14	DHRES-16	M. Bascopé	Site visit conducted with LIF team targeting safety interactions on mechanical lifting and lifting gear.	115 ft	40-45gpm after drilling through water table.	540.00	540.00	12.45" air hammer drilling operations remaining stable. Making great progress. Water encountered at 115 ft with approximately 40-45gpm production. Intersected volcanic unit below conglomerate this morning and are currentl discussing casing and piezo options / locations.	12.45" air hammer
8/29/14	DHRES-16	B. Kiefer	Discussed staying focused as crews nears days of (Sunday) and covered hand safety as related to operating hand/power tools.			1040.00	1040.00	Continued advancement of 12.45" air hammer, with continued production around 40-45 gpm. Encountered basalt and slowed rate of penetration.	

TABLE A-3. DAILY FIELD PROGRESS REPORT DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL DHRES-16 (RESOLUTION COPPER MINING LLC)

Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
8/30/14	DHRES-16	M. Bascopé	Observed crew as they used crane to build bottom hole assembly; no issues identified.			1145.00	1145.00	Switched over from air rotary to flooded reverse. Tripped out hammer when torque increased (bit teeth worn, reamer cutting too much) and ability to advance decreased. Crew had finished running in BHA around shift change today and will be back on bottom drilling soon.	
8/31/14	DHRES-16	E. Castleberry	Detailed induction conducted with drill crew. Further discussions and walk of site conducted with on-site consultant. Spoke with driller about air dump muffler and procedure for operating air bleed off.			1290.00	1230.00	Continuing to drill flooded reverse in search of base of current lithology. Once base of volcanic has been drilled past the hole will be cased off with 7-7/8" LTC casing.	12.25" tricone - flooded reverse
9/1/14	DHRES-16	E. Castleberry	Site visit this afternoon. Met with new crew members and conducted detailed drilling specific site induction along with Part A IO CBT.			1520.00	1455.00	Continuing to drill flooded reverse in search of base of current lithology. Once base of volcanic has been drilled past (100 ft) the hole will be cased off with 7-7/8" LTC casing. Anticipating pressure grouting early Thursday morning if contact is drilled within next 12 hrs.	12.25" tricone - flooded reverse
9/2/14	DHRES-16	M. Bascopé	Talked with crew and found that Tailings/Hydro Manager had already addressed recent hand injury Spoke to site foreman about observation of differen drill crew using a hands free rod loading system and the potential for mis			1665.00	1125.00	Hit lith change this afternoon; will likely TD hole this evening. Attempting to advane borehole 100 ft beyond lith interface so that piezo can be placed there and yet be far enough away from grout shoe to ensure that chase cement does not cover piezo Currently tripping out 300ft to address loss of circulation related to blown O-rings on uppermost drill rods. Will replace rods and insert dog bone turn around. Casing plan in place, M&A provided geophysical surveyor update today, and Halliburton to be notified this evening.	12.25" tricone - flooded reverse
9/3/14	DHRES-16								
9/4/14	DHRES-16								
9/5/14	DHRES-16								
9/6/14	DHRES-16	M. Bascopé	Discussed recent incident from the shaft group concerning severed finger while using jackleg; this was first day back for return to hitch foreman.			1820.00	0.00	Waiting on cement. Halliburton finished grouting conductor interval yesterday afternoon. Procedure was succesful with grout daylighting while being pumped. Communication with piezo transducers maintained throughout process. Conductor casing is landed on surface casing; bowls and slips were removed without disturbing casing. Waiting 72-hrs for grout cure before advancing borehole.	
9/7/14	DHRES-16	E. Castleberry	Site visit scheduled for this afternoon.			1820.00	155.00	Continuing to wait on cement / grout. Will wait full 72 hrs. before tripping in to drill out float sub and collar.	12.25" tricone - flooded reverse

TABLE A-3. DAILY FIELD PROGRESS REPORT DURING MOBILIZATION, DRILLING, AND CONSTRUCTION OPERATIONS AT WELL DHRES-16 (RESOLUTION COPPER MINING LLC)

Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
9/8/14	DHRES-16	E. Castleberry	Site visit scheduled for this afternoon.			1820.00	1820.00	Currently tripping in to drill out float sub and collar 72 hr. grout cure time expires around 2pm today.	12.25" tricone - flooded reverse
9/9/14	DHRES-16	E. Castleberry	Interacted with crew and foreman over the used level winding process; together came up with better solution for worker body position.			1905.00	1905.00	Drilled out float collar and shoe, and then began advancing borehole ith 6-7/8' air-hammer. Drilling away without issue, using approx. 100 gph of water to help lift cuttings. Minmal groundwate observed to collect after each rod.	
9/10/14	DHRES-16								
9/11/14	DHRES-16					2830.00			
9/12/14	DHRES-16	A. Henager	Observed that it was abnormally noisy compared to other rigs; helper explained that they were "airing up" and the hoses were leaking. They are planning to stop to repair the lines as soon as possible.			2865.00	1045.00	Continuing to advance borehole with 6-7/8' air-hammer. Air lines for the air hammer are currentl leaking; crew will be stopping after finishing drillin the current rod to repair the lines.	
9/13/14	DHRES-16	M. Bascopé	Spoke to foreman about MOC process and risk assessments for staffing requirements.			2870.00	1050.00	Pneumatic issues (air leak, hammer misfire) corrected with trip out and choke installation. Back on bottom drilling away without issue.	
9/14/14	DHRES-16	E. Castleberry	Spoke with supervisor and Forman about returning crew refresher inductions and communication of relevant incidents.		making less than 5GPM	3150.00	1245.00	Continuing to drill with no issues to report. Currently averaging about 50 min per 20 ft drill rod.	6-3/4" R/C hammer
9/15/14	DHRES-16	E. Castleberry	Spoke with foreman and driller about recent monthly KPI review and discussions about target BBS, Hazard ID and take fives.		Making 10GPM	3400.00	3400.00	Continuing to drill with 6-3/4" air hammer. Penetration rate slowed to 1.5hrs per 20ft and hol has increased making water to ~10 gal per min at ~3360 ft.	6-3/4" R/C hammer
9/16/14	DHRES-16	M. Bascopé	Site visit scheduled for this afternoon.			3505.00	3505.00	Tripped for bit and switched over to tricone setup. Will continue w/ reverse circ. (no flooding). Tripping-in at this time. Anticipate TD'ing hole early next week.	6-3/4" R/C tri cone.
9/17/14	DHRES-16					3560.00	730.00		6-3/4" R/C tri cone.
9/18/14	DHRES-16	M. Bascopé	Spoke to foreman about definition of grinder cutting; reiterated policy. In addition, spoke about Take-5 triggers.			3665.00	800.00	Drilling away without issue. Utilizing "tube turn-arounds" with 800ft spacing to create/maintain circulation. Two attempts to dial in on turn-around spacing was required.	6-3/4" R/C tri cone.
9/19/14	DHRES-16	M. Bascopé	Observed crew as they utilized powered sounder reel. No issues with procedure.			3865.00	995.00	Tripping out BHA to install temp. piezo on drill string. Will submerge piezo atleast 1,000 ft below static water level and initiate lift test. Estimated to start test at 03:00 tonight. Will then conduct full trip to re-install BHA and advance borehole 100 ft beyond lithologic contact.	
9/20/14	DHRES-16					3865.00	715.00		

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Date	Hole #	Reporter	Daily Safety	Water Table Depth	Hydrology Comments	Shift Change (feet)	Progress in last 24 Hrs	Comments	Hole Type/Size
9/21/14	DHRES-16	E. Castleberry	Spoke with consultant and drillers about most recently conducted take five - consultant noted that safety meeting was held this morning to discuss process of tripping and resuming drilling. Air pressures noted as critical hazard.			3865.00	465.00	Tripped in after completing air lift testing. At time of visit crew was 10 ft off bottom. Will resume drilling operations until whitetail is encountered at which time the hole will TD.	6-3/4" R/C tri cone.
9/22/14	DHRES-16	E. Castleberry				3945.00	440.00	See next days comments.	Logging
9/23/14	DHRES-16	E. Castleberry			producing ~15 gal/min	4085.00	525.00	**TD at 4085 ft.**	Logging
9/24/14	DHRES-16	M. Bascope'	Spoke with foreman about hazards associated with upcoming grouting process.			4085.00	420.00	Installing piezo string of 2-3/8" EUE LTC casing. String should be landed early this evening. Two piezometers were installed onto the casing string and are currently reading successfully. Bottom of casing will be set at 4075 feet bls. Halliburton grouting to initiate Friday morning.	
9/25/14	DHRES-16	M. Bascopé				4085.00	220.00		
9/26/14	DHRES-16	M. Bascopé					-3865.00		
9/27/14	DHRES-16	M. Bascopé					-3865.00		
9/28/14	DHRES-16	E. Castleberry	Spoke with driller about mobilization to and set-up on far west pads. Discussed access to sites during significant rain events.			4085.00	0.00	Cleaning up site and preparing equipment for mobilization to far west. Trucks scheduled to begin hauling equipment tomorrow. Drill rig will mobilize late tomorrow or early Tuesday morning.	Mobilization

APPENDIX B

DRILLING TECHNICAL DATA SHEETS
(National EWP)

APPENDIX B

Drilling Technical Data Sheets
For Well HRES-21

Josh Jonovich 928-701-2290

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 5/8/14
Client: ~~Resolution~~ Rio tinto
Hole/Well No.: HRES-21
Location: Resolution
Serial No.: 204734302

Job #: 402.144
Depth in: 40'
Depth out:
Total hrs:
Bit diam.: 15" Hammer

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
40	50	11:08	11:30	:22	:22	400	30-40			
50	75	2:28	4:23	:38	1:00	300	"			1:15 min putting diverter together
75	100	4:43	5:30	:47	1:47	350	"	1300-1500		
100	125	5:45	6:40	:55	2:42	"	"	1500-1600		
125	150	1:50	2:45	:55	3:37	"	"	"		
150	175	3:00	4:15	1:00	4:37	"	"	"		
175	200	4:35	5:55	1:20	5:57	"	"	"		-15 min bean pump plugged
200	225	6:40	8:15	1:35	7:32	"	"	"		survey
225	250	8:35	10:04	1:29	9:01	"	"	"		
250	275	10:25	11:55	1:30	10:30	"	"	"		
275	300	12:35	2:20	1:45	12:15	"	"	"		Survey
300	325	3:10	4:55	1:45	14:00	"	"	"		
325	350	5:15	7:20	2:05	16:05	"	"	"		
350	375	7:35	10:00	2:25	18:30	"	"	"		Hanging up at 365'
375	400	11:55	2:00	2:05	20:35	"	"	"		Survey
400	425	3:05	5:30	2:25	23:00	"	"	"		
425	450	5:55	10:25	2:35	25:35	"	"	"		shut down 7:25-9:15
450	475	10:40	12:50	2:10	27:45	"	"	"		
475	500	1:20	4:00	2:40	30:25	"	"	"		Survey
500	525	4:45	7:30	2:45	33:10	"	"	"		
525	550	7:55	10:35	2:40	35:50	"	"	"		
550	575	10:50	1:30	2:40	38:30	"	"	"		
575	600	2:15	4:45	2:30	41:00	"	"	"		Survey

National

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Bit Run Sheet

Date:	5/11/14	Job #:	402.144
Client	Rio tinto	Depth in:	40'
Hole/Well No.:	HRES-21	Depth out:	
Location:	Resolution	Total hrs:	
Serial No.:	204734502	Bit diam.:	15"

41:00

Depth		Time		Elapsed	Total	Weight on				
From	To	Start	Stop	Time	Hours	Bit	RPM	Torque	GPM	Comments
600	625	5:[illegible]	8:00	2:25	43:25	350	30-40	1300-1500		
625	645	8:20	11:45	3:25	46:50	"	"	"		645' fractured 5' Left to drill Bit trip
~~650~~ 645	~~655~~ 650	9:55	11:25	1:30	1:30	300	"	"		Bit # 204589001 45 mins off bottom
650	655	11:40	4:00	3:00	4:30	100-350	"	"		Trouble from 645-655
~~655~~	~~700~~									Hole washing [illegible]
655	675	4:35	7:30	2:25	6:55	"	"	"		~30 mins cleaning hole Broke thru bad zone 655
675	700	7:50	9:40	1:50	8:45	300-500	"	16-1700		Survey
700	725	11:30	1:25	1:55	10:40	300-500	"	16-1700		hole got pretty dirty
725	750	3:05	5:15	2:10	12:50	300-500	"	14-1600		
750	775	5:50	7:55	2:05	13:55	300-500	"	14-1600		
775	800	8:25	10:30	2:05	16:00	300-400	"	14-1500		Survey
800	825	12:30	2:45	2:15	18:15	"	"	"		
825	850	3:05	5:15	2:10	20:25	"	"	"		
850	875	5:30	7:50	2:20	22:45	"	"	"		
875	900	8:20	11:05	2:45	25:30	"	"	"		Survey
900	925	11:45	2:40	2:55	28:25	"	"	"		Fix leak on head
925	950	4:10	7:05	2:55	31:20	"	"	"		
950	975	7:30	10:45	3:15	34:35	"	"	"		
975	983	11:30	6:30	4:00	38:35	"	"	"	1:35 start in 980 over 6:30	wasn't drilling pulled to [illegible]
983	1000	1:35	6:30	4:55	43:40					
1000	1013	8:00	10:30	2:30	46:10					
1013	1025	12:10	3:00	2:50	49:00	300-500	"			
1025	1040	3:25	8:30	5:05	54:05					Bit Lost

National

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Bit Run Sheet

Date: 5-17-14

Client: Resolution

Hole/Well No.: HRES21

Location:

Serial No.: J12621R1

Job #: 402.144

Depth in: 1040

Depth out:

Total hrs:

Bit diam.: 14 3/4

Depth		Time		Elapsed Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
1040	1060	1:25	4:40	3:15	3:15	1100	30-40	15-1600		Had fill on Bottom after air[illegible]
1060	1085	5:35	12:15	6:40	10:55	1100	30-40	15-1600		aired up to clean up Hole Surges at 320 psi Stopped 30 mins
1085	1110	12:45	5:35	4:50	15:45	1200	"	"		to get static [illegible]
1110	1135	6:25	11:35	5:10	20:55	1200	25	12-1300		
1135	1160	12:25	6:45	6:20	27:15	"	20-30	1100-1300		
1160	1185	7:15	11:45	4:30	31:45	"	"	"		Rod [illegible]
1185	1210	9:15	1:10	3:55	35:40	1200	30	"		
1210	1235	1:45	4:50	3:05	38:45	"	"	"		585.65 static
1235	1260	5:30	8:45	3:15	42:00	"	"	"		
1260	1285	9:15	11:50	2:35	44:35	"	"	"		fixed hole in screen
1285	1310	6:34	10:05	3:31	48:06	"	"	"		formation change @1269'
1310	1335	10:30	1:00	2:30	50:36	"	"	"		
1335	1360	1:25	3:45	2:20	52:56	"	"	"		
1360	1380	4:01	6:00	1:59	54:55	"	"	"		

MONTGOMERY
& ASSOCIATES

APPENDIX C

LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS
(Montgomery & Associates)

APPENDIX C

Table C-1

Lithologic Descriptions for Drill Cuttings from Well HRES-21

APPENDIX C-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL HRES-21 [*55-916689*] RESOLUTION PINAL COUNTY, ARIZONA

DRILLING COMPANY: National EWP	LOGGED BY: M. Shelley, J. Bell
DEPTH DRILLED / LAND SURFACE ELEVATION: 1380.0 feet	DATE DRILLED: May 7 - 23, 2014
CADASTRAL / U.S. STATE PLANE (NAD83NA2011) : (D-02-13)05acc / 832967.78 N / 967381.391 E	

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - White Unit (Talw)				
0 - 10	**Talw**	Apache Leap Tuff (Tal); moderately to well lithified; crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, black biotite and 40% orangish-pink microcrystalline groundmass; trace greenish-gray pumice; trace lithic fragments; trace magnetite; reaction to acid: none	iron oxide staining (limonite)	subangular chips up to 2.3 cm
10 - 20	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, black biotite and 40% orangish-pink microcrystalline groundmass; trace greenish-gray pumice; trace lithic fragments; trace magnetite; trace eutaxitic texture; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 2.7 cm
20 - 30	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, black biotite and 35% orangish-pink microcrystalline groundmass; trace lithic fragments; trace magnetite; reaction to acid: none	trace iron oxide staining (limonite)	subangular chips up to 2.8 cm
30 - 40	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, black biotite and 35% orangish-pink microcrystalline groundmass; trace greenish-gray pumice; trace lithic fragments; trace magnetite;; trace eutaxitic texture; reaction to acid: none	trace iron oxide staining (hematite and limonite); trace quartz fracture fill	subangular chips up to 4.0 cm
40 - 50	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral bronzy-black biotite and 35% orangish-pink microcrystalline groundmass; trace greenish-gray pumice; trace lithic fragments; trace magn; reaction to acid: none	trace iron oxide staining (hematite and limonite); trace pinkish-brown clay	subangular chips up to 1.5 cm

APPENDIX C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM MONITOR WELL HRES-21 [*55-916689*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
50 - 60	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, bronzy-black biotite and 35% orangish-pink microcrystalline groundmass; trace greenish-gray pumice; trace lithic fragments; trace mag; partially welded; reaction to acid: very weak	minor reddish-brown clay; trace iron oxide staining (hematite)	subangular chips up to 1.2 cm
60 - 70	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 70% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, bronzy-black biotite and 30% grayish-pink microcrystalline groundmass; trace lithic fragments; trace magnetite; trace pumice; partially welded; reaction to acid: none	trace reddish-brown clay	subangular chips up to 0.8 cm
70 - 80	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 70% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, black biotite and 30% grayish-pink microcrystalline groundmass; trace lithic fragments; trace magnetite; trace pumice; partially welded; reaction to acid: none	minor reddish-brown clay; trace iron oxide staining (hematite and limonite)	subangular chips up to 0.8 cm
80 - 90	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 70% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, bronzy-black biotite and 30% grayish-pink microcrystalline groundmass; trace greenish-gray pumice; trace lithic fragments; trace magn; partially welded; reaction to acid: none	trace iron oxide staining (hematite)	subangular chips up to 0.9 cm
90 - 100	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 70% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, bronzy-black biotite and 30% grayish-pink microcrystalline groundmass; trace lithic fragments; trace magnetite; trace pumice; partially welded; reaction to acid: none	trace iron oxide staining (limonite); trace manganese oxide	subangular chips up to 1.8 cm
100 - 110	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 70% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, bronzy-black biotite and 30% orangish-pink microcrystalline groundmass; minor pumice; trace lithic fragments; trace magnetite; partially welded; reaction to acid: none	trace iron oxide staining (limonite); trace manganese oxide	subangular chips up to 1.3 cm

APPENDIX C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM MONITOR WELL HRES-21 [*55-916689*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
110 - 120	**Talw**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 70% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, bronzy-black biotite and 30% orangish-pink microcrystalline groundmass; minor pumice; trace lithic fragments; trace magnetite; partially welded; reaction to acid: none	trace iron oxide staining (limonite); trace manganese oxide	subangular chips up to 1.3 cm
APACHE LEAP TUFF - Gray Unit (Talg)				
120 - 130	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 70% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, bronzy-black biotite and 30% orangish-pink microcrystalline groundmass; minor pumice; trace lithic fragments; trace magnetite; partially welded; reaction to acid: none	trace iron oxide staining (limonite); trace manganese oxide	subrounded to subangular chips up to 2.4 cm
130 - 140	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 70% up to 1 mm sized phenocrysts of anhedral, white feldspar, translucent quartz, euhedral, bronzy-black biotite and 30% orangish-pink microcrystalline groundmass; minor pumice; trace lithic fragments; trace magnetite; partially welded; reaction to acid: none	iron oxide staining (limonite)	subrounded to subangular chips up to 2.9 cm
140 - 150	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; 5% lithic fragments; some pumice; partially welded; reaction to acid: none		subangular chips up to 1.0 cm
150 - 160	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; 5% lithic fragments; trace pumice; partially welded; reaction to acid: none	trace iron oxide on fracture surfaces	subangular chips up to 1.0 cm; chips mostly sand sized
160 - 170	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; partially welded; reaction to acid: none	trace iron oxide	subangular chips up to 0.8 cm; 75% sand sized

APPENDIX C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM MONITOR WELL HRES-21 [*55-916689*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
170 - 180	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; minor lithic fragments; partially welded; reaction to acid: none	trace iron oxide	subangular chips up to 0.4 cm; 75% sand sized
180 - 190	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 0.7 cm; 75% sand sized
190 - 200	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline groundmass; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 1.1 cm; 60% sand sized
200 - 210	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline groundmass; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 1.0 cm; >75% sand sized
210 - 220	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 1.0 cm; >75% sand sized
220 - 230	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 0.8 cm; >75% sand sized
230 - 240	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 1.0 cm; >75% sand sized

APPENDIX C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM MONITOR WELL HRES-21 [*55-916689*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
240 - 250	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; partially welded; reaction to acid: none	trace calcite	subangular chips up to 0.8 cm; >75% sand sized
250 - 260	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; minor pumice; trace lithic fragments; partially welded; reaction to acid: weak	trace iron oxide; trace calcite	subangular chips up to 0.4 cm; >75% sand sized
260 - 270	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 35% pinkish-orange microcrystalline groundmass; minor pumice; trace lithic fragments; partially welded; reaction to acid: weak	trace calcite	subangular chips up to 0.4 cm; >75% sand sized
270 - 280	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; minor pumice; trace lithic fragments; partially welded; reaction to acid: none to very weak	trace calcite	subangular chips up to 0.3 cm; >75% sand sized
280 - 290	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; trace eutaxitic texture; partially welded; reaction to acid: none to very weak	trace iron oxide staining	subangular chips up to 0.9 cm; >75% sand sized
290 - 300	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: none to very weak	trace iron oxide staining	subangular chips up to 0.9 cm; >75% sand sized

APPENDIX C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM MONITOR WELL HRES-21 [*55-916689*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
300 - 310	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: none to very weak	trace iron oxide staining	subangular chips up to 0.7 cm; >75% sand sized
310 - 320	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: none to very weak	trace calcite	subangular chips up to 1.0 cm; >75% sand sized
320 - 330	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; 5% lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.8 cm; >75% sand sized
330 - 340	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: very weak	trace calcite	subangular chips up to 1.1 cm; >75% sand sized
340 - 350	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.5 cm; >75% sand sized
350 - 360	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.9 cm; >75% sand sized

APPENDIX C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM MONITOR WELL HRES-21 [*55-916689*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
360 - 370	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.9 cm; >75% sand sized
370 - 380	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.8 cm; >75% sand sized
380 - 390	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.6 cm; >75% sand sized
390 - 400	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; minor lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: very weak	trace calcite	subangular chips up to 1.0 cm; >75% sand sized
400 - 410	**Talg**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; minor lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: none		subangular chips up to 1.0 cm; >75% sand sized
APACHE LEAP TUFF - Brown Unit (Talb)				
410 - 420	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 65% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black-bronze biotite and 35% pinkish-orange microcrystalline groundmass; trace lithic fragments; trace pumice; trace magnetite; partially welded; reaction to acid: none		subangular chips up to 1.0 cm; >75% sand sized

APPENDIX C-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL HRES-21 [*55-916689*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
420 - 430	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline groundmass; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 0.8 cm; >75% sand sized
430 - 440	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline groundmass; some pumice; minor lithic fragments; trace welded pumice fragments; trace; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.0 cm; >75% sand sized
440 - 450	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline groundmass; some pumice; minor lithic fragments; trace welded pumice fragments; trace; welded; reaction to acid: very weak	trace calcite	subangular chips up to 1.4 cm; >75% sand sized
450 - 460	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline, slightly glassy groundmass; some pumice; minor lithic fragments; trace welded pumice; welded; reaction to acid: weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 1.0 cm; >75% sand sized
460 - 470	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline, slightly glassy groundmass; some pumice; minor lithic fragments; trace welded pumice; welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.9 cm; >75% sand sized
470 - 480	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline, slightly glassy groundmass; some pumice; minor lithic fragments; trace welded pumice; welded; reaction to acid: weak	minor iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 2.2 cm; >75% sand sized

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
480 - 490	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline, slightly glassy groundmass; some pumice; minor lithic fragments; trace welded pumice; welded; reaction to acid: very weak	minor iron oxide staining (hematite and limonite)	subangular chips up to 0.8 cm; >75% sand sized
490 - 500	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline, slightly glassy groundmass; some pumice; minor lithic fragments; trace welded pumice; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.9 cm; >75% sand sized
500 - 510	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline, slightly glassy groundmass; some pumice; minor lithic fragments; minor welded pumice; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.8 cm; >75% sand sized
510 - 520	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% light orange and some pinkish-orange aphanitic to glassy groundmass; some pumice; minor lithic fragments; trace welded; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.5 cm; >75% sand sized
520 - 530	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline, slightly glassy groundmass; some pumice; minor lithic fragments; trace welded pumice; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.4 cm; >75% sand sized
530 - 540	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline, slightly glassy groundmass; some pumice; minor lithic fragments; trace pumice; trace; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 1.0 cm; >75% sand sized

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540 - 550	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline, slightly glassy groundmass; some pumice; minor lithic fragments; minor pumice fragmen; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.9 cm; >75% sand sized
550 - 560	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 1 mm sized phenocrysts of anhedral, white plagioclase, translucent quartz, black biotite and 40% pinkish-orange microcrystalline, slightly glassy groundmass; some pumice; minor lithic fragments; minor pumice fragmen; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.7 cm; >75% sand sized
560 - 570	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-orange aphanitic to microcrystalline groundmass; minor lithic fragments; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.9 cm; >75% sand sized
570 - 580	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-orange aphanitic to microcrystalline groundmass; minor lithic fragments; trace pumice; welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.9 cm; >75% sand sized
580 - 590	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-orange aphanitic to microcrystalline groundmass; minor lithic fragments; trace pumice; welded; reaction to acid: none to very weak	trace calcite	subangular chips up to 1.2 cm; >75% sand sized
590 - 600	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-orange aphanitic to microcrystalline groundmass; minor lithic fragments; trace pumice; welded; reaction to acid: none to very weak	trace calcite	subangular chips up to 1.2 cm; >75% sand sized

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600 - 610	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-brown aphanitic to microcrystalline groundmass; trace glassy texture groundmass; trace lithic fragments; trace pumice; welded; reaction to acid: very weak	minor iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.7 cm; >75% sand sized
610 - 620	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-brown and gray aphanitic to microcrystalline groundmass; trace glassy texture groundmass; trace lithic fragments; trace pumice; welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.8 cm; >75% sand sized
620 - 630	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-brown and gray aphanitic to microcrystalline groundmass; trace glassy texture groundmass; trace lithic fragments; trace welded pumice fragment; trace eutaxitic texture; welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.6 cm; >75% sand sized
630 - 640	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-brown and gray aphanitic to microcrystalline groundmass; trace glassy texture groundmass; trace lithic fragments; trace welded pumice fragments; welded; reaction to acid: very weak	trace calcite	subangular chips up to 0.8 cm; >75% sand sized
640 - 650	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-brown and gray aphanitic to microcrystalline groundmass; trace glassy texture groundmass; some pumice; trace lithic fragments; welded; reaction to acid: very weak to very weak	trace calcite	subangular chips up to 0.9 cm; >75% sand sized
650 - 660	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-brown and gray aphanitic to microcrystalline groundmass; trace glassy texture groundmass; trace lithic fragments; trace pumice; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.0 cm; >75% sand sized

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
660 - 670	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotiteand 50% pinkish-brown and gray aphanitic to microcrystalline groundmass; trace glassy texture groundmass; trace lithic fragments; trace pumice; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.2 cm; >75% sand sized
670 - 680	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-brown and gray aphanitic to microcrystalline groundmass; trace glassy texture groundmass; some pumice; trace lithic fragments; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.1 cm; >75% sand sized
680 - 690	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-brown and gray aphanitic to microcrystalline groundmass; abundant pumice; trace glassy texture groundmass; trace lithic fragments; trace eutaxitic texture; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.2 cm; 40% sand sized
690 - 700	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% phenocrysts of plagioclase, translucent quartz, black biotite and 50% pinkish-brown and gray aphanitic to microcrystalline groundmass; trace glassy texture groundmass; abundant pumice; trace lithic fragments; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.2 cm; 40% sand sized
700 - 710	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; trace lithic fragments; trace pumice; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.8 cm
710 - 720	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; trace lithic fragments; trace pumice; welded; reaction to acid: none		subangular chips up to 0.7 cm

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720 - 730	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; some lithic fragments; trace pumice; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.4 cm
730 - 740	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; trace lithic fragments; trace pumice; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.4 cm
740 - 750	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.5 cm
750 - 760	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; trace lithic fragments; trace pumice; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 1.6 cm; 50% sand size
760 - 770	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; minor lithic fragments; trace pumice; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.0 cm; 75% gravel size
770 - 780	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; minor lithic fragments; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.6 cm; 75% sand size
780 - 790	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; minor lithic fragments; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.6 cm; 75% sand size

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790 - 800	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite;some pumice; trace lithic fragments; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.6 cm; 75% sand size
800 - 810	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.6 cm; 75% sand size
810 - 820	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; minor pumice; trace lithic fragments; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.6 cm; 75% sand size
820 - 830	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; minor pumice; trace lithic fragments; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.6 cm; 75% sand size
830 - 840	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; minor pumice; trace lithic fragments; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.6 cm; 75% sand size
840 - 850	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% pinkish-brown and gray aphanitic to microcrystalline groundmass and 50% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.1 cm; 50% gravel size
850 - 860	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% pinkish-brown and gray aphanitic to microcrystalline groundmass and 50% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.9 cm; 30% gravel size

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860 - 870	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% pinkish-brown and gray aphanitic to microcrystalline groundmass and 50% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.9 cm; 75% gravel size
870 - 880	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% pinkish-brown and gray aphanitic to microcrystalline groundmass and 50% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite); trace calcite	subangular chips up to 0.7 cm; 40% gravel size
880 - 890	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% pinkish-brown and gray aphanitic to microcrystalline groundmass and 50% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.0 cm; 60% gravel size
890 - 900	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% pinkish-brown and gray aphanitic to microcrystalline groundmass and 50% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.6 cm; 35% gravel size
900 - 910	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 55% pinkish-brown and gray aphanitic to microcrystalline groundmass and 45% phenocrysts of plagioclase, translucent quartz, some black biotite; trace lithic fragments; trace pumice; trace magnetite; welded; flow banding; reaction to acid: very weak	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.8 cm; 40% gravel size
910 - 920	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 55% pinkish-brown and gray aphanitic to microcrystalline groundmass and 45% phenocrysts of plagioclase, translucent quartz, some black biotite; trace lithic fragments; trace pumice; trace magnetite; welded; reaction to acid: very weak	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.9 cm; 60% gravel size

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920 - 930	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 55% pinkish-brown and gray aphanitic to microcrystalline groundmass and 45% phenocrysts of plagioclase, translucent quartz, some black biotite; trace lithic fragments; trace pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.2 cm; 75% gravel size
930 - 940	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 55% pinkish-brown and gray aphanitic to microcrystalline groundmass and 45% phenocrysts of plagioclase, translucent quartz, some black biotite; trace lithic fragments; trace pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.0 cm; 75% gravel size
940 - 950	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 55% pinkish-brown and gray aphanitic to microcrystalline groundmass and 45% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; minor lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.0 cm; 75% gravel size
950 - 960	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 55% pinkish-brown and gray aphanitic to microcrystalline groundmass and 45% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	minor iron oxide staining (hematite and limonite)	subangular chips up to 0.9 cm; 75% gravel size
960 - 970	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; minor lithic fragments; trace magnetite; welded; reaction to acid: none	minor iron oxide staining (hematite and limonite)	subangular chips up to 1.2 cm; 75% gravel size
970 - 980	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% pinkish-brown and gray aphanitic to microcrystalline groundmass and 40% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; minor lithic fragments; trace magnetite; welded; reaction to acid: none	minor iron oxide staining (hematite and limonite)	subangular chips up to 1.0 cm; 75% gravel size
980 - 990	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% pinkish-brown and gray aphanitic to microcrystalline groundmass and 50% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.6 cm; 40% gravel size

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990 - 1,000	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% pinkish-brown and gray aphanitic to microcrystalline groundmass and 50% phenocrysts of plagioclase, translucent quartz, some black biotite; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.9 cm; 50% gravel size
1,000 - 1,010	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% phenocrysts of plagioclase, translucent quartz, some black biotite and 40% pinkish-brown and gray aphanitic to microcrystalline groundmass; some pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none to very weak	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.8 cm; 30% gravel size
1,010 - 1,020	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% phenocrysts of plagioclase, translucent quartz, some black biotite and 40% pinkish-brown and gray aphanitic to microcrystalline groundmass; minor pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	minor iron oxide staining (hematite and limonite)	subangular chips up to 1.0 cm; 50% gravel size
1,020 - 1,030	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% pinkish-brown and gray aphanitic to microcrystalline groundmass and 50% phenocrysts of plagioclase, translucent quartz, some black biotite; minor pumice; trace lithic fragments; trace magnetite; trace eutaxitic texture; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 1.0 cm; 50% gravel size
1,030 - 1,040	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 50% pinkish-brown and gray aphanitic to microcrystalline groundmass and 50% phenocrysts of plagioclase, translucent quartz, some black biotite; minor pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips up to 0.8 cm; 40% gravel size
1,040 - 1,050	**Talb**	Apache Leap Tuff (Tal); no sample		
1,050 - 1,060	**Talb**	Apache Leap Tuff (Tal); no sample		
1,060 - 1,070	**Talb**	Apache Leap Tuff (Tal); no sample		
1,070 - 1,080	**Talb**	Apache Leap Tuff (Tal); no sample		
1,080 - 1,090	**Talb**	Apache Leap Tuff (Tal); no sample		

APPENDIX C-1. LITHOLOGIC DESCRIPTIONS FOR
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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
1,090 - 1,100	**Talb**	Apache Leap Tuff (Tal); no sample		
1,100 - 1,110	**Talb**	Apache Leap Tuff (Tal); no sample		
1,110 - 1,120	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-brown and gray aphanitic to glassy groundmass; minor pumice; trace lithic fragments; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite)	subangular to angular up to 2.8 cm
1,120 - 1,130	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 3 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite)	subangular to angular up to 1.5 cm
1,130 - 1,140	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up o 3 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite)	subangular to angular up to 2.5 cm
1,140 - 1,150	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 3 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (limonite)	subangular to angular up to 3.1 cm
1,150 - 1,160	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 3 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite)	subangular to angular up to 1.8 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
1,160 - 1,170	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 4 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite)	subangular to angular up to 2.2 cm
1,170 - 1,180	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 4 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite)	subangular to angular up to 2.3 cm
1,180 - 1,190	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite)	subangular to angular up to 1.5 cm
1,190 - 1,200	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular to angular up to 1.7 cm
1,200 - 1,210	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular to angular up to 1.6 cm
1,210 - 1,220	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular to angular up to 1.5 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
1,220 - 1,230	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular to angular up to 1.8 cm
1,230 - 1,240	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular to angular up to 2.0 cm
1,240 - 1,250	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular to angular up to 2.0 cm
1,250 - 1,260	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, trace black biotite and 40% pinkish-gray aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular to angular up to 2.8 cm
1,260 - 1,270	**Talb**	Apache Leap Tuff (Tal); well lithified; crystal-rich dacite tuff with 60% phenocrysts up to 2mm of milky white plagioclase, translucent quartz, black biotite and 40% pinkish-brown aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; trace black vitrophy; welded; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular to angular up to 1.5 cm
APACHE LEAP TUFF - Vitrophyre (Talv)				
1,270 - 1,280	**Talv**	Apache Leap Tuff (Tal); well lithified; 50% crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, black biotite and 40% pinkish-brown aphanitic to glassy groundmass; trace lithic fragments; trace welded pumice; trace magnetite; 50% black-; welded; reaction to acid: none	trace iron oxide staining on fracture surfaces (hematite and limonite)	subangular to angular up to 2.5 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
1,280 - 1,290	**Talv**	Apache Leap Tuff (Tal); well lithified; 95% black to dark gray vitrophyre; 5% crystal-rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, black biotite and 40% pinkish-brown aphanitic to glassy groundmass; trace lithic fragments; trace welded p; welded; reaction to acid: none	trace iron oxide staining on fracture surfaces (hematite and limonite); trace calcite	subangular to angular up to 1.8 cm
1,290 - 1,300	**Talv**	Apache Leap Tuff (Tal); well lithified; 95% black-dark gray vitrophyre; 5% crystal rich dacite tuff with 60% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, black biotite and 40% pinkish-brown aphanitic to glassy groundmass; trace lithic fragments; trace welded pumi; welded; reaction to acid: none		subangular to angular up to 2.7 cm
APACHE LEAP TUFF - Basal Tuff (Talbt)				
1,300 - 1,310	**Talbt**	Apache Leap Tuff (Tal); well lithified; 80% dacite tuff with 85% brown glassy groundmass and 15% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, black biotite; trace lithic fragments; trace welded pumice; trace magnetite; 20% black to dark gray vitrophyre; welded; reaction to acid: none		subangular to angular up to 1.0 cm
1,310 - 1,320	**Talbt**	Apache Leap Tuff (Tal); well lithified; dacite tuff with 85% brown glassy groundmass and 15% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, black biotite; trace lithic fragments; trace welded pumice; trace magnetite; welded; reaction to acid: none	trace quartz veinlets	subangular to angular up to 1.1 cm; trace contamination of black to dark gray vitrophyre
1,320 - 1,330	**Talbt**	Apache Leap Tuff (Tal); well lithified; dacite tuff with 85% brown glassy groundmass and 15% phenocrysts up to 2mm of milky white plagioclase, translucent quartz, black biotite, trace amphibole; some lithic fragments; trace magnetite; welded; reaction to acid: none	trace quartz veinlets	subangular to angular up to 1.0 cm; trace contamination of black to dark gray vitrophyre
1,330 - 1,340	**Talbt**	Apache Leap Tuff (Tal); well lithified; 85% dacite tuff with 85% brown glassy groundmass and 15% up to 2 mm sized phenocrysts of milky white plagioclase, translucent quartz, black biotite, trace amphibole; some lithic fragments; trace magnetite; welded; reaction to acid: none	trace quartz veinlets	subangular to angular up to 1.0 cm; 15% contamination of black to dark gray vitrophyre

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
WHITETAIL CONGLOMERATE (Tw)				
1,340 - 1,350	**Tw**	Whitetail Conglomerate (Tw); weakly to well lithified; 45% gravel; 25% sand; 35% fines; clasts consist of pale limestone, schist and red sandstone matrix chips; reaction to acid: strong	calcareous cementation	subrounded to angular up to 1.7 cm
1,350 - 1,360	**Tw**	Whitetail Conglomerate (Tw); weakly to well lithified; 45% gravel; 25% sand; 35% fines; clasts consist of pale limestone, schist and red sandstone matrix chips; reaction to acid: strong	calcareous cementation	subrounded to subangular up to 2.0 cm
WHITETAIL CONGLOMERATE - Lacustrine Unit (Tw2)				
1,360 - 1,370	**Tw2**	Whitetail Conglomerate (Tw); weakly lithified; 25% gravel; 30% sand; 45% fines; clasts consist of pale limestone, schist, white quartz and red sandstone matrix chips; reaction to acid: moderate to strong	calcareous cementation; trace iron oxide; trace calcite	subrounded to angular up to 1.0 cm
1,370 - 1,380	**Tw2**	Whitetail Conglomerate (Tw); weakly lithified; 30% gravel; 30% sand; 40% fines; clasts consist of pale limestone, schist, white quartz and red sandstone matrix chips; reaction to acid: moderate to strong	calcareous cementation; trace iron oxide; trace calcite	subrounded to angular up to 1.0 cm

APPENDIX C

Table C-2

Lithologic Descriptions for Drill Cuttings from Well DHRES-15

APPENDIX C-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL DHRES-15 [*55-916688*] RESOLUTION PINAL COUNTY, ARIZONA

DRILLING COMPANY: National EWP	LOGGED BY: M. Shelley, J. Bell; C. Stielstra
DEPTH DRILLED / LAND SURFACE ELEVATION: 3920.0 feet	DATE DRILLED: May 30 - July 11, 2014
CADASTRAL / U.S. STATE PLANE (NAD83NA2011) : (D-02-13)05ccb / 831076.102 N / 964977.715 E	

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Talg)				
0 - 10	**Talg**	Gray Unit; moderately to well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	minor iron oxide staining	subangular chips up to 1.3 cm
10 - 20	**Talg**	Gray Unit; moderately to well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	minor iron oxide staining	subangular chips up to 0.6 cm
20 - 30	**Talg**	Gray Unit; moderately to well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	minor iron oxide staining	subangular chips up to 1.4 cm
30 - 40	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	minor iron oxide staining	subangular chips up to 1.6 cm
40 - 50	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.5 cm

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DRILL CUTTINGS FROM MONITOR WELL DHRES-15 [*55-916688*]
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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
50 - 60	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.6 cm
60 - 70	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.2 cm
70 - 80	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.2 cm
80 - 90	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.3 cm
90 - 100	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 3.0 cm
100 - 110	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; partially welded; reaction to acid: none		subangular chips up to 2.5 cm
110 - 120	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; some lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.3 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
120 - 130	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: weak	trace calcite	subangular chips up to 2.0 cm
130 - 140	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.6 cm
140 - 150	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; minor clay; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.3 cm
150 - 160	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; minor clay; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.3 cm
160 - 170	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; some lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.2 cm
170 - 180	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.6 cm
180 - 190	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	trace chloritic alteration around biotite; trace iron oxide staining	subangular chips up to 2.3 cm

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DRILL CUTTINGS FROM MONITOR WELL DHRES-15 [*55-916688*]
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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
190 - 200	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz, and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.5 cm
200 - 210	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 70% phenocrysts of white plagioclase, translucent quartz and black biotite and 30% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 1.9 cm
210 - 220	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.4 cm
220 - 230	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some lithic fragments; some magnetite; partially welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.6 cm
230 - 240	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some lithic fragments; some magnetite; partially welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.1 cm
240 - 250	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some lithic fragments; some magnetite; partially welded; reaction to acid: none		subangular chips up to 2.3 cm
250 - 260	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some lithic fragments; some magnetite; partially welded; reaction to acid: none		subangular chips up to 2.3 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
260 - 270	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some lithic fragments; some magnetite; partially welded; reaction to acid: none		subangular chips up to 1.8 cm
270 - 280	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some lithic fragments; some magnetite; partially welded; reaction to acid: none		subangular chips up to 2.3 cm
280 - 290	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 1.7 cm
290 - 300	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.5 cm
300 - 310	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some pumice; some magnetite; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.6 cm
310 - 320	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.6 cm
320 - 330	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.6 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
330 - 340	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.0 cm
340 - 350	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; partially welded; reaction to acid: none		subangular chips up to 2.1 cm
350 - 360	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; common medium plasticity clay; some magnetite; trace pumice; trace lithic fragments; partially welded; reaction to acid: none to weak	trace iron oxide staining; trace calcite	subangular chips up to 3.1 cm
360 - 370	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; trace medium plasticity clay; partially welded; reaction to acid: none to weak	trace iron oxide staining; trace calcite	subangular chips up to 2.4 cm
370 - 380	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.1 cm
380 - 390	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.7 cm

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390 - 400	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.2 cm
400 - 410	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.5 cm
410 - 420	**Talg**	Gray Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, and black biotite and 35% pinkish-red, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.6 cm
APACHE LEAP TUFF - Brown Unit (Talb)				
420 - 430	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.4 cm
430 - 440	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.8 cm
440 - 450	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 1.9 cm
450 - 460	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; trace lithic fragments; welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.4 cm

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460 - 470	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; trace lithic fragments; welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.3 cm
470 - 480	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; welded; reaction to acid: none to weak	trace calcite	subangular chips up to 3.0 cm
480 - 490	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; welded; reaction to acid: none to weak	trace calcite	subangular chips up to 2.5 cm
490 - 500	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; welded; reaction to acid: none		subangular chips up to 2.2 cm
500 - 510	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; trace pumice; welded; reaction to acid: none		subangular chips up to 2.1 cm
510 - 520	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; trace pumice; welded; reaction to acid: none		subangular chips up to 2.0 cm
520 - 530	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; trace pumice; welded; reaction to acid: none		subangular chips up to 1.9 cm

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530 - 540	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; trace pumice; welded; reaction to acid: none to very weak		subangular chips up to 2.6 cm
540 - 550	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; some magnetite; some tan clay; trace pumice; welded; reaction to acid: none to weak	trace calcite	subangular chips up to 1.9 cm
550 - 560	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% reddish-pink and gray, aphanitic groundmass; trace pumice; some magnetite; trace tan clay; welded; reaction to acid: none to very weak	trace calcite	subangular chips up to 1.8 cm
560 - 570	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% red and pink, aphanitic groundmass; some magnetite; trace pumice; welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.4 cm
570 - 580	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% red and pink, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 1.6 cm
580 - 590	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% red and pink, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; trace tan clay; welded; reaction to acid: none		subangular chips up to 3.0 cm
590 - 600	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, and black biotite and 40% red and pink, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 1.8 cm

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600 - 610	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% red and pink, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.8 cm
610 - 620	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 40% red and pinkish-gray, aphanitic groundmass; 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.8 cm
620 - 630	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none to weak	trace calcite	subangular chips up to 1.9 cm
630 - 640	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none to weak	trace calcite	subangular chips up to 2.3 cm
640 - 650	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.2 cm
650 - 660	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace high plasticity clay; welded; reaction to acid: none to very strong	large calcite vein; trace iron oxide staining	subangular chips up to 3.1 cm

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660 - 670	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; welded; reaction to acid: none to weak	trace calcite; trace iron oxide staining	subangular chips up to 2.8 cm
670 - 680	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 35% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; welded; reaction to acid: none		subangular chips up to 3.2 cm
680 - 690	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 35% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; trace clay; welded; reaction to acid: none to strong	minor calcite veins; trace iron oxide staining on fracture surfaces	subangular chips up to 2.5 cm
690 - 700	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 35% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; trace clay; welded; reaction to acid: none to strong	minor calcite veins; trace iron oxide staining on fracture surfaces	subangular chips up to 2.4 cm
700 - 710	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 35% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none to weak	trace calcite	subangular chips up to 2.6 cm
710 - 720	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 35% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none to strong	trace iron oxide staining; minor calcite veins	subangular chips up to 3.0 cm

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720 - 730	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 35% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none to weak	trace iron oxide staining; trace calcite	subangular chips up to 2.4 cm
730 - 740	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 35% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none to weak	trace iron oxide staining; trace calcite	subangular chips up to 2.7 cm
740 - 750	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 35% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none to moderate	trace calcite veins	subangular chips up to 2.5 cm
750 - 760	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 65% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 35% red and pinkish-gray, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none to weak	trace iron oxide staining; trace calcite veins	subangular chips up to 2.0 cm
760 - 770	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; trace pumice; some magnetite; trace lithic fragments; welded; reaction to acid: none to moderate	minor calcite veins	subangular chips up to 1.7 cm
770 - 780	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; trace pumice; some magnetite; trace lithic fragments; trace clay; welded; reaction to acid: none to very weak	trace iron oxide staining	subangular chips up to 1.5 cm

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780 - 790	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; common clay; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none to moderate	trace iron oxide staining; minor calcite vein	subangular chips up to 2.8 cm
790 - 800	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none to weak	trace calcite	subangular chips up to 2.2 cm
800 - 810	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.4 cm
810 - 820	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.0 cm
820 - 830	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 1.9 cm
830 - 840	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; some magnetite; trace pumice; trace lithic fragments; welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.5 cm

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840 - 850	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; some magnetite; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 1.8 cm
850 - 860	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; some magnetite; trace lithic fragments; welded; reaction to acid: none to weak	trace iron oxide staining; trace calcite	subangular chips up to 1.8 cm
860 - 870	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; some magnetite; trace lithic fragments; welded; reaction to acid: none		subangular chips up to 2.4 cm
870 - 880	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; some magnetite; welded; reaction to acid: none		subangular chips up to 2.0 cm
880 - 890	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink, aphanitic groundmass; some magnetite; trace clay; welded; reaction to acid: none to very weak	trace calcite	subangular chips up to 1.8 cm
890 - 900	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink and pinkish-orange, aphanitic groundmass; some magnetite; welded; reaction to acid: none	trace iron oxide staining	subangular chips up to 2.1 cm
900 - 910	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink and pinkish-orange, aphanitic groundmass; some magnetite; trace lithic fragments; welded; reaction to acid: none to very weak	trace iron oxide staining; trace calcite	subangular chips up to 2.6 cm

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910 - 920	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink and pinkish-orange, aphanitic groundmass; some magnetite; trace lithic fragments; trace white clay; welded; reaction to acid: none		subangular chips up to 1.7 cm
920 - 930	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-pink and pinkish-orange, aphanitic groundmass; some magnetite; trace lithic fragments; welded; reaction to acid: none to very weak		subangular chips up to 2.5 cm
930 - 940	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 55% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 45% reddish-brown and pink, aphanitic groundmass; some magnetite; welded; reaction to acid: none		subangular chips up to 1.8 cm
940 - 950	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 55% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 45% reddish-brown and pink, aphanitic groundmass; some magnetite; trace white and yellow clay; welded; reaction to acid: none	trace gypsum	subangular chips up to 2.9 cm
950 - 960	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 55% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 45% reddish-brown and pink, aphanitic groundmass; abundant medium plasticity, tan clay; some magnetite; trace lithic; welded; reaction to acid: none		subangular chips up to 1.1 cm
960 - 970	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 55% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 45% reddish-brown and pink, aphanitic groundmass; some magnetite; trace lithic fragments; trace medium plasticity, ta; welded; reaction to acid: none	trace gypsum	subangular chips up to 2.2 cm

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970 - 980	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 55% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 45% reddish-brown and pink, aphanitic groundmass; some magnetite; trace lithic fragments; trace medium plasticity, ta; welded; reaction to acid: none to weak	trace gypsum; trace calcite	subangular chips up to 2.4 cm
980 - 990	**Talb**	Brown Unit; well lithified; crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-brown and pink, aphanitic groundmass; some magnetite; trace lithic fragments; welded; reaction to acid: none to weak	trace iron oxide staining; trace calcite	subangular chips up to 2.4 cm
APACHE LEAP TUFF - Vitrophyre (Talv)				
990 - 1,000	**Talv**	vitrophyre; well lithified; 70% black Vitrophyre; 20% crystal-rich porphyritic tuff consisting of 60% phenocrysts of white plagioclase, translucent quartz, trace <1 mm sized black biotite and 40% reddish-brown and pink, aphanitic groundmass; some magnetite; trace lithic fragments;; partially welded; reaction to acid: none	some iron oxide staining; minor quartz veins	subangular chips up to 2.6 cm
1,000 - 1,010	**Talv**	vitrophyre; well lithified; 90% black Vitrophyre; 5% reddish-orange and brown glassy tuff; 5% tan clay; reaction to acid: none	trace quartz veins	subangular chips up to 1.6 cm
1,010 - 1,020	**Talv**	Vitrophyre and Basal Tuff; moderately to well lithified; 60% black Vitrophyre; 35% light brownish-tan tuff; 5% tan clay; reaction to acid: none	trace quartz veins	subangular chips up to 1.7 cm
APACHE LEAP TUFF - Basal Tuff (Talbt)				
1,020 - 1,030	**Talbt**	Basal Tuff and Tw2; moderately lithified; 70% light brownish-yellow tuff consisting of 60% phenocrysts of plagioclase, quartz and trace biotite and 40% groundmass; 30% light brown clay; trace clasts of limestone and quartzite; reaction to acid: very weak to weak	trace quartz veins	subangular chips up to 1.2 cm
WHITETAIL CONGLOMERATE - Channel Fill Unit (Tw1)				
1,030 - 1,040	**Tw1**	Channel-fill Unit No. 1; moderately lithified; 50% tannish-brown, medium plasticity clay; 40% clasts of limestone, quartzite, and trace diabase; 10% matrix chips of mudstone, siltstone and sandstone; reaction to acid: moderate		subangular chips up to 1.7 cm

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1,040 - 1,050	**Tw1**	Channel-fill Unit No. 1; moderately lithified; 50% tannish-brown, medium plasticity clay; 40% clasts of limestone, quartzite, and trace diabase; 10% matrix chips of mudstone, siltstone and sandstone; reaction to acid: moderate		subangular chips up to 1.4 cm
WHITETAIL CONGLOMERATE - Lacustrine Unit (Tw2)				
1,050 - 1,060	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; mudstone, siltstone and sandstone; 80% medium plasticity, silty clay; 20% matrix chips; trace clasts of limestone; reaction to acid: moderate to strong		subangular chips up to 0.7 cm
1,060 - 1,070	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; mudstone, siltstone and sandstone; 70% medium plasticity, silty clay; 30% matrix chips; reaction to acid: moderate		subrounded to subangular chips up to 0.8 cm
1,070 - 1,080	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; mudstone, siltstone and sandstone; 70% medium plasticity, silty clay; 30% matrix chips; reaction to acid: strong		subrounded to subangular chips up to 0.5 cm
1,080 - 1,090	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; mudstone, siltstone and sandstone; 70% medium plasticity, silty clay; 30% matrix chips; reaction to acid: strong		subrounded to subangular chips up to 0.9 cm
1,090 - 1,100	**Tw2**	Lacustrine Unit no. 2; moderately lithified; mudstone, siltstone and sandstone; 70% medium plasticity, silty clay; 30% matrix chips; reaction to acid: very strong		subrounded to subangular chips up to 0.6 cm
1,100 - 1,110	**Tw2**	Lacustrine Unit no. 2; moderately lithified; mudstone, siltstone and sandstone; 65% medium plasticity, silty clay; 35% matrix chips; reaction to acid: strong		subrounded to subangular chips up to 0.5 cm
1,110 - 1,120	**Tw2**	Lacustrine Unit no. 2; moderately lithified; mudstone, siltstone and sandstone; 65% medium plasticity, silty clay; 35% matrix chips; reaction to acid: strong		subrounded to subangular chips up to 0.6 cm
1,120 - 1,130	**Tw2**	Lacustrine Unit no. 2; moderately lithified; sandstone, siltstone and mudstone; 50% low to medium plasticity, silty clay; 50% matrix chips; reaction to acid: strong		subrounded chips up to 0.6 cm

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1,130 - 1,140	**Tw2**	Lacustrine Unit no. 2; moderately lithified; sandstone, siltstone and mudstone; 70% low to medium plasticity, silty clay; 30% matrix chips; reaction to acid: strong		subrounded to subangular chips up to 1.0 cm
1,140 - 1,150	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium plasticity, silty clay; 20% matrix chips; reaction to acid: strong		subrounded to subangular chips up to 0.7 cm
1,150 - 1,160	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium plasticity, silty clay; 20% matrix chips; trace brown sandstone; reaction to acid: strong	trace gypsum precipitate	subrounded to subangular chips up to 0.6 cm
1,160 - 1,170	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium plasticity, silty clay; 20% matrix chips; trace brown sandstone; reaction to acid: moderate to strong		subrounded to subangular chips up to 1.0 cm
1,170 - 1,180	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium plasticity, silty clay; 20% matrix chips; trace brown sandstone; reaction to acid: very strong		subrounded to subangular chips up to 0.7 cm
1,180 - 1,190	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium plasticity, silty clay; 15% matrix chips; 5% gray clay (ash fall); trace brown sandstone; reaction to acid: moderate to strong	common pink gypsum precipitate	subrounded to subangular chips up to 0.8 cm
1,190 - 1,200	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium to high plasticity, silty clay; 10% matrix chips; reaction to acid: strong		subrounded to subangular chips up to 0.8 cm
1,200 - 1,210	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium to high plasticity, silty clay; 20% matrix chips; reaction to acid: strong		subrounded to subangular chips up to 0.7 cm
1,210 - 1,220	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium to high plasticity, silty clay; 20% matrix chips; reaction to acid: moderate to strong		subrounded to subangular chips up to 0.6 cm
1,220 - 1,230	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium to high plasticity, silty clay; 20% matrix chips; reaction to acid: moderate to strong		subrounded to subangular chips up to 0.5 cm

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1,230 - 1,240	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium to high plasticity, silty clay; 20% matrix chips; reaction to acid: moderate to strong		subrounded to subangular chips up to 0.8 cm
1,240 - 1,250	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 10% matrix chips; reaction to acid: moderate		subrounded chips up to 0.7 cm
1,250 - 1,260	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 10% matrix chips; reaction to acid: moderate to strong		subrounded chips up to 0.5 cm
1,260 - 1,270	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 10% matrix chips; reaction to acid: moderate to strong		subrounded chips up to 0.6 cm
1,270 - 1,280	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 10% matrix chips; reaction to acid: moderate to strong		subrounded chips up to 0.5 cm
1,280 - 1,290	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 10% matrix chips; trace gray ashy clay; reaction to acid: moderate to strong		subrounded chips up to 0.7 cm
1,290 - 1,300	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 10% matrix chips; trace gray ashy clay; reaction to acid: moderate to strong		subrounded chips up to 1.0 cm
1,300 - 1,310	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 10% matrix chips; reaction to acid: moderate to strong		subrounded chips up to 0.8 cm
1,310 - 1,320	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 10% matrix chips; reaction to acid: moderate to strong		subrounded chips up to 0.5 cm
1,320 - 1,330	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 10% matrix chips; reaction to acid: moderate to strong		subrounded chips up to 0.9 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
1,330 - 1,340	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 75% medium plasticity, silty clay; 25% matrix chips; reaction to acid: moderate to strong		subrounded chips up to 0.6 cm
1,340 - 1,350	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium plasticity, silty clay; 20% matrix chips; reaction to acid: weak		subrounded chips up to 0.7 cm
1,350 - 1,360	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 95% medium plasticity, silty clay; 5% matrix chips; reaction to acid: weak		subrounded chips up to 0.5 cm
1,360 - 1,370	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 5% matrix chips; 5% gray-olive ashy clay; reaction to acid: weak		subrounded chips up to 0.5 cm
1,370 - 1,380	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 5% matrix chips; 5% gray-olive ashy clay; reaction to acid: weak		subrounded chips up to 0.9 cm
1,380 - 1,390	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 5% matrix chips; 5% gray-olive ashy clay; reaction to acid: very weak		subrounded chips up to 0.8 cm
1,390 - 1,400	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium plasticity, silty clay; 5% matrix chips; 5% gray-olive ashy clay; reaction to acid: very weak		subrounded chips up to 0.8 cm
1,400 - 1,410	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium to high plasticity, silty clay; 10% matrix chips; reaction to acid: very weak		subangular to subrounded chips up to 0.6 cm
1,410 - 1,420	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium to high plasticity, silty clay; 10% matrix chips; reaction to acid: very weak		subangular chips up to 0.7 cm
1,420 - 1,430	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium to high plasticity, silty clay; 10% matrix chips; reaction to acid: very weak		subrounded to subangular chips up to 0.5 cm

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1,430 - 1,440	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 90% medium to high plasticity, silty clay; 10% matrix chips; reaction to acid: weak to moderate		subrounded to subangular chips up to 0.5 cm
1,440 - 1,450	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium to high plasticity, silty clay; 20% matrix chips; reaction to acid: weak to moderate		subrounded to subangular chips up to 0.6 cm
1,450 - 1,460	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium to high plasticity, silty clay; 20% matrix chips; reaction to acid: weak		subrounded to subangular chips up to 0.7 cm
1,460 - 1,470	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 80% medium to high plasticity, silty clay; 20% matrix chips; reaction to acid: moderate		subrounded to subangular chips up to 0.6 cm
1,470 - 1,480	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; siltstone and mudstone; 70% medium to high plasticity, silty clay; 25% grayish-olive, ashy clay; 5% matrix chips; reaction to acid: moderate		subrounded to subangular chips up to 0.6 cm
1,480 - 1,490	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; siltstone and mudstone; 70% medium to high plasticity, silty clay; 25% grayish-olive, ashy clay; 5% matrix chips; reaction to acid: moderate		subrounded to subangular chips up to 1.0 cm
1,490 - 1,500	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; siltstone and mudstone; 70% medium to high plasticity, silty clay; 25% grayish-olive, ashy clay; 5% matrix chips; reaction to acid: moderate to strong		subrounded to subangular chips up to 0.5 cm
1,500 - 1,510	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; siltstone and mudstone; 70% medium to high plasticity, silty clay; 25% grayish-olive, ashy clay; 5% matrix chips; reaction to acid: moderate		subrounded to subangular chips up to 0.8 cm
1,510 - 1,520	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; siltstone and mudstone; 60% medium to high plasticity, silty clay; 30% grayish-olive, ashy clay; 10% matrix chips; reaction to acid: moderate		subrounded to subangular chips up to 0.8 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
1,520 - 1,530	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; siltstone and mudstone; 60% medium to high plasticity, silty clay; 30% grayish-olive, ashy clay; 10% matrix chips; reaction to acid: moderate to strong		subrounded to subangular chips up to 0.7 cm
1,530 - 1,540	**Tw2**	Lacustrine Unit no. 2; weakly to moderately lithified; siltstone and mudstone; 60% medium to high plasticity, silty clay; 30% grayish-olive, ashy clay; 10% matrix chips; reaction to acid: moderate		subrounded to subangular chips up to 0.8 cm
1,540 - 1,550	**Tw2**	Lacustrine Unit no. 2; moderately to well lithified; siltstone, sandstone, and mudstone; 60% matrix chips; 40% medium plasticity, silty clay; reaction to acid: strong	trace gypsum	subangular to subrounded chips up to 1.4 cm
1,550 - 1,560	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 60% fine to medium-grained sandy, silty clay; 40% matrix chips; reaction to acid: weak		subangular chips up to 0.9 cm
1,560 - 1,570	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 60% fine to medium-grained sandy, silty clay; 40% matrix chips; reaction to acid: weak		subangular chips up to 1.1 cm
1,570 - 1,580	**Tw2**	Lacustrine Unit no. 2; moderately lithified; siltstone and mudstone; 60% fine to medium-grained sandy, silty clay; 40% matrix chips; reaction to acid: weak		subangular to subrounded chips up to 0.8 cm
1,580 - 1,590	**Tw2**	Lacustrine Unit no. 2; moderately lithified; sandstone and siltstone; 40% gray sandy silty clay; 35% medium plasticity, silty clay; 25% matrix chips; trace white-gray clay; trace diabase clasts; reaction to acid: weak	trace gypsum	subangular to subrounded chips up to 0.7 cm
1,590 - 1,600	**Tw2**	Lacustrine Unit no. 2; moderately lithified; sandstone and siltstone; 40% gray sandy silty clay; 35% medium plasticity, silty clay; 25% matrix chips; trace white-gray clay; reaction to acid: weak	trace gypsum	subangular to subrounded chips up to 1.1 cm
1,600 - 1,610	**Tw2**	Lacustrine Unit no. 2; moderately lithified; sandstone and siltstone; 40% gray sandy silty clay; 35% medium plasticity, silty clay; 25% matrix chips; trace white-gray clay; reaction to acid: moderate		subangular chips up to 1.4 cm

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1,610 - 1,620	**Tw2**	Lacustrine Unit no. 2; moderately lithified; sandstone and siltstone; 40% gray sandy silty clay; 35% medium plasticity, silty clay; 25% matrix chips; trace white-gray clay; reaction to acid: strong		subangular chips up to 1.6 cm
1,620 - 1,630	**Tw2**	Lacustrine Unit no. 2 and Conglomerate Unit no. 3; moderately lithified; sandstone, siltstone and mudstone; 50% sandy, silty clay; 30% medium plasticity, silty clay; 10% matrix chips; 10% lithic clasts of schist, quartzite and some diabase, trace magnetite; reaction to acid: moderate	trace iron oxide staining	subangular chips up to 0.9 cm
WHITETAIL CONGLOMERATE - Conglomerate Unit (Tw3)				
1,630 - 1,640	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 60% lithic clasts of schist, quartzite, some diabase and trace limestone, common magnetite; 40% medium plasticity, sandy, silty clay; reaction to acid: moderate	trace iron oxide staining	subangular chips up to 1.4 cm
1,640 - 1,650	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 70% lithic clasts of schist, quartzite, some diabase and trace limestone, common magnetite; 30% medium plasticity, sandy, silty clay; reaction to acid: moderate	trace iron oxide staining	subangular chips up to 1.5 cm
1,650 - 1,660	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 75% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 25% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	subangular chips up to 2.0 cm
1,660 - 1,670	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 75% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 25% medium plasticity, sandy, silty clay; reaction to acid: strong	some iron oxide staining	subangular chips up to 1.8 cm
1,670 - 1,680	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	some iron oxide staining	subangular chips up to 1.6 cm

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1,680 - 1,690	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	subangular chips up to 1.4 cm
1,690 - 1,700	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	subangular chips up to 1.8 cm
1,700 - 1,710	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 70% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 30% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	subangular chips up to 1.7 cm
1,710 - 1,720	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 70% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 30% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	subangular chips up to 1.4 cm
1,720 - 1,730	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 70% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 30% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining; trace epidote	subangular chips up to 1.6 cm
1,730 - 1,740	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 70% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 30% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining; trace epidote	subangular chips up to 1.7 cm
1,740 - 1,750	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining; trace epidote	angular to subangular chips up to 2.2 cm

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1,750 - 1,760	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some quartzite, trace diabase and trace siltstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining; trace epidote; trace quartz vein	angular to subangular chips up to 1.8 cm
1,760 - 1,770	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some quartzite, trace diabase and trace black sandstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining; trace epidote	angular to subangular chips up to 2.0 cm
1,770 - 1,780	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some quartzite, trace diabase and trace black sandstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining; trace epidote	angular to subangular chips up to 1.6 cm
1,780 - 1,790	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some quartzite, trace diabase and trace black sandstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining; trace epidote	angular to subangular chips up to 2.1 cm
1,790 - 1,800	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some quartzite, trace diabase and trace black sandstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	angular to subangular chips up to 1.4 cm
1,800 - 1,810	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some diabase, trace quartzite and trace black sandstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	subangular chips up to 1.6 cm
1,810 - 1,820	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some diabase, trace quartzite and trace black sandstone, common magnetite; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	subangular chips up to 1.8 cm

MONTGOMERY & ASSOCIATES

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1,820 - 1,830	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 85% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite, trace quartz; 15% medium plasticity, sandy, silty clay; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 2.1 cm
1,830 - 1,840	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 85% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite, trace quartz; 15% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining; trace epidote	angular to subangular chips up to 1.8 cm
1,840 - 1,850	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 85% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite, trace quartz; 15% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining; trace epidote	angular to subangular chips up to 1.6 cm
1,850 - 1,860	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite, trace quartz; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining; trace epidote	angular to subangular chips up to 2.3 cm
1,860 - 1,870	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite, common quartz; 20% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	angular to subangular chips up to 1.9 cm
1,870 - 1,880	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite, common quartz; 20% medium plasticity, sandy, silty clay; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 2.0 cm
1,880 - 1,890	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite, common quartz; 20% medium plasticity, sandy, silty clay; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 1.6 cm

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1,890 - 1,900	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 85% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite; 15% medium plasticity, sandy, silty clay; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 1.7 cm
1,900 - 1,910	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 85% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite; 15% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	angular to subangular chips up to 1.4 cm
1,910 - 1,920	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 85% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite; 15% medium plasticity, sandy, silty clay; reaction to acid: strong	trace iron oxide staining	angular to subangular chips up to 2.0 cm
1,920 - 1,930	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 85% lithic clasts of mostly schist, some diabase, trace quartzite, trace siltstone, common magnetite, some quartz; 15% medium plasticity, sandy, silty clay; reaction to acid: very strong	trace iron oxide staining; trace epidote	angular to subangular chips up to 2.3 cm
1,930 - 1,940	**Tw3**	Conglomerate Unit no. 3; weakly to moderately lithified; matrix supported conglomerate; 80% medium to high plasticity, silty clay; 20% lithic clasts of limestone, schist, quartzite, siltstone, quartz; reaction to acid: strong		angular to subangular chips up to 2.1 cm
1,940 - 1,950	**Tw3**	Conglomerate Unit no. 3; weakly to moderately lithified; matrix supported conglomerate; 80% medium to high plasticity, silty clay; 20% lithic clasts of schist, quartzite, siltstone, quartz; reaction to acid: strong	trace iron oxide staining	angular to subangular chips up to 2.0 cm
1,950 - 1,960	**Tw3**	Conglomerate Unit no. 3; weakly to moderately lithified; matrix supported conglomerate; 80% medium to high plasticity, silty clay; 20% lithic clasts of schist, quartzite, siltstone, quartz, trace magnetite; reaction to acid: very strong	trace iron oxide staining; trace epidote	angular to subangular chips up to 0.6 cm

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1,960 - 1,970	**Tw3**	Conglomerate Unit no. 3; weakly to moderately lithified; matrix supported conglomerate; 80% medium to high plasticity, silty clay; 20% lithic clasts of schist, quartzite, trace siltstone, trace quartz, trace magnetite; reaction to acid: strong	trace iron oxide staining; trace epidote	angular to subangular chips up to 0.6 cm
1,970 - 1,980	**Tw3**	Conglomerate Unit no. 3; weakly to moderately lithified; matrix supported conglomerate; 65% medium to high plasticity, silty clay; 35% lithic clasts of schist, quartzite, trace siltstone, trace quartz, trace limestone, trace magnetite; reaction to acid: moderate	trace iron oxide staining; trace epidote	angular to subangular chips up to 1.5 cm
1,980 - 1,990	**Tw3**	Conglomerate Unit no. 3; weakly lithified; matrix supported conglomerate; 85% medium to high plasticity, silty clay; 15% lithic clasts of schist, quartzite, trace siltstone, trace quartz, trace magnetite; gouge; reaction to acid: weak	some iron oxide staining; trace epidote	angular to subangular chips up to 1.3 cm
1,990 - 2,000	**Tw3**	Conglomerate Unit no. 3; weakly to moderately lithified; matrix supported conglomerate; 85% grayish-brown, medium to high plasticity, silty clay; 15% lithic clasts of schist, quartzite, trace siltstone, trace quartz, trace magnetite; reaction to acid: weak	some iron oxide staining; trace epidote	angular to subangular chips up to 0.7 cm
2,000 - 2,010	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 55% lithic clasts of schist, quartzite, trace siltstone, trace quartz, trace limestone, trace magnetite; 45% grayish-brown, medium to high plasticity, silty clay; reaction to acid: weak to moderate	some iron oxide staining; trace epidote	angular to subangular chips up to 2.2 cm
2,010 - 2,020	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 60% lithic clasts of schist, quartzite, trace siltstone, trace quartz, trace limestone, trace magnetite; 40% grayish-brown, medium to high plasticity, silty clay; reaction to acid: strong	some iron oxide staining; trace epidote	angular to subangular chips up to 2.0 cm
2,020 - 2,030	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 60% lithic clasts of schist, quartzite, trace siltstone, trace quartz, trace limestone, trace magnetite; 40% grayish-brown, medium to high plasticity, silty clay; reaction to acid: weak	some iron oxide staining; trace epidote	angular to subangular chips up to 1.9 cm

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2,030 - 2,040	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 60% lithic clasts of schist, quartzite, trace siltstone, trace quartz, trace limestone, trace magnetite; 40% grayish-brown, medium to high plasticity, silty clay; reaction to acid: weak	some iron oxide staining; trace epidote	angular to subangular chips up to 2.2 cm
2,040 - 2,050	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 60% lithic clasts of schist, quartzite, trace siltstone, trace quartz and gypsum, trace limestone, trace magnetite; 40% grayish-brown, medium to high plasticity, silty clay; reaction to acid: weak	common iron oxide staining; trace epidote	angular to subangular chips up to 2.5 cm
2,050 - 2,060	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 60% lithic clasts of schist, quartzite, trace siltstone, trace quartz and gypsum, trace limestone, trace magnetite; 40% grayish-brown, medium to high plasticity, silty clay; reaction to acid: weak	common iron oxide staining; trace epidote	angular to subangular chips up to 2.3 cm
2,060 - 2,070	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 85% lithic clasts of schist, quartzite, trace siltstone, trace quartz and gypsum, trace limestone, trace magnetite; 15% grayish-brown, medium to high plasticity, silty clay; reaction to acid: moderate	common iron oxide staining; trace epidote	angular to subangular chips up to 2.6 cm
2,070 - 2,080	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 85% lithic clasts of schist, quartzite, trace siltstone, trace quartz and gypsum, trace limestone, trace magnetite; 15% grayish-brown, medium to high plasticity, silty clay; reaction to acid: moderate	common iron oxide staining	angular to subangular chips up to 2.0 cm
2,080 - 2,090	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 85% lithic clasts of schist, quartzite, trace siltstone, trace quartz, trace limestone, trace magnetite; 15% grayish-brown, medium to high plasticity, silty clay; reaction to acid: moderate	common iron oxide staining	angular to subangular chips up to 2.0 cm
2,090 - 2,100	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 85% lithic clasts of schist, quartzite, trace siltstone, trace quartz, trace limestone, trace magnetite; 15% grayish-brown, medium to high plasticity, silty clay; reaction to acid: strong	common iron oxide staining	angular to subangular chips up to 2.1 cm

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2,100 - 2,110	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, trace siltstone, trace sandstone, trace quartz, trace limestone, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: strong	common iron oxide staining	angular to subangular chips up to 1.5 cm
2,110 - 2,120	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, trace siltstone, trace sandstone, trace quartz, trace limestone, trace basalt, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: strong	some iron oxide staining	angular to subangular chips up to 1.9 cm
2,120 - 2,130	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, trace siltstone, trace sandstone, trace quartz, trace limestone, trace basalt, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: strong	some iron oxide staining	angular to subangular chips up to 1.7 cm
2,130 - 2,140	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, trace siltstone, trace sandstone, trace quartz, trace limestone, trace basalt, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: strong	some iron oxide staining	angular to subangular chips up to 1.1 cm
2,140 - 2,150	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, trace siltstone, trace sandstone, trace quartz, trace limestone, trace basalt, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: strong	some iron oxide staining	angular to subangular chips up to 1.8 cm
2,150 - 2,160	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 70% lithic clasts of schist, quartzite, trace siltstone, trace sandstone, trace quartz, trace limestone, trace basalt, trace magnetite; 30% brown, medium to high plasticity, silty clay; reaction to acid: strong	some iron oxide staining	angular to subangular chips up to 1.5 cm
2,160 - 2,170	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 70% lithic clasts of schist, quartzite, trace siltstone, trace sandstone, trace quartz, trace limestone, trace basalt, trace chert, trace magnetite; 30% brown, medium to high plasticity, silty clay; reaction to acid: strong	some iron oxide staining	angular to subangular chips up to 1.5 cm

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2,170 - 2,180	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 70% lithic clasts of schist, quartzite, trace siltstone, trace sandstone, trace quartz, trace limestone, trace basalt, trace magnetite; 30% brown, medium to high plasticity, silty clay; reaction to acid: strong	some iron oxide staining	angular to subangular chips up to 1.1 cm
2,180 - 2,190	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 65% lithic clasts of schist, quartzite, trace siltstone, trace sandstone, trace quartz, trace limestone, trace basalt, trace magnetite; 35% brown, high plasticity, silty clay; reaction to acid: strong	trace iron oxide staining	angular to subangular chips up to 1.3 cm
2,190 - 2,200	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 65% lithic clasts of schist, quartzite, trace siltstone, trace sandstone, trace quartz, trace limestone, trace basalt, trace magnetite; 35% brown, high plasticity, silty clay; reaction to acid: strong	trace iron oxide staining	angular to subangular chips up to 1.4 cm
2,200 - 2,210	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, limestone, trace siltstone, trace sandstone, trace quartz, trace chert, trace diabase, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 0.7 cm
2,210 - 2,220	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, limestone, trace siltstone, trace sandstone, trace quartz, trace diabase, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 0.9 cm
2,220 - 2,230	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, limestone, trace siltstone, trace sandstone, trace quartz, trace diabase, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 0.9 cm
2,230 - 2,240	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, limestone, trace siltstone, trace sandstone, trace quartz, trace diabase, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 1.0 cm

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2,240 - 2,250	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, diabase, trace limestone, trace siltstone, trace sandstone, trace quartz, trace basalt, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: strong	trace iron oxide staining	angular to subangular chips up to 1.1 cm; mostly gravel size
2,250 - 2,260	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, diabase, trace limestone, trace siltstone, trace sandstone, trace quartz, trace basalt, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: moderate	trace iron oxide staining	angular to subangular chips up to 0.9 cm
2,260 - 2,270	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, diabase, trace limestone, trace siltstone, trace sandstone, trace quartz, trace basalt, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: moderate	some iron oxide staining; trace epidote	angular to subangular chips up to 1.2 cm
2,270 - 2,280	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 60% lithic clasts of schist, quartzite, diabase, trace limestone, trace siltstone, trace sandstone, common quartz vein, trace basalt, trace magnetite; 40% brown, medium to high plasticity, silty clay; reaction to acid: moderate to strong	gouge, common iron oxide staining	angular to subangular chips up to 1.1 cm
2,280 - 2,290	**Tw3**	Conglomerate Unit no. 3; moderately to well lithified; clast supported conglomerate; 60% lithic clasts of schist, quartzite, diabase, trace limestone, trace siltstone, trace sandstone, common quartz vein, trace basalt, trace magnetite; 40% brown, medium to high plasticity, silty clay; reaction to acid: moderate to strong	common iron oxide staining; trace epidote	angular to subangular chips up to 1.8 cm
2,290 - 2,300	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, diabase, tuff, trace siltstone, trace sandstone, trace quartz, trace basalt, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: moderate to strong	common iron oxide staining; trace epidote	angular to subangular chips up to 2.1 cm

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2,300 - 2,310	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, diabase, tuff, trace siltstone, trace sandstone, trace quartz, trace basalt, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: moderate to strong	common iron oxide staining; trace epidote	angular to subangular chips up to 1.9 cm
2,310 - 2,320	**Tw3**	Conglomerate Unit no. 3; moderately lithified; clast supported conglomerate; 80% lithic clasts of schist, quartzite, diabase, tuff, trace siltstone, trace sandstone, trace quartz, trace basalt, trace magnetite; 20% brown, medium to high plasticity, silty clay; reaction to acid: moderate to strong	common iron oxide staining	angular to subangular chips up to 1.5 cm
2,320 - 2,330	**Tw3**	Conglomerate Unit no. 3; moderately lithified; matrix supported conglomerate; 40% lithic clasts of schist, quartzite, diabase, tuff, trace siltstone, trace sandstone, trace quartz, trace basalt, trace magnetite; 60% brown, medium to high plasticity, silty clay; reaction to acid: strong	common iron oxide staining; trace epidote	angular to subangular chips up to 2.3 cm
NACO FORMATION (Pnaco)				
2,330 - 2,340	**Pnaco**	limestone; moderately to well lithified; 85% gray and olive-brown limestone; 15% clay; clasts of schist, diabase, quartzite, sandstone; reaction to acid: very strong	microfractures; some iron oxide staining	angular to subangular chips up to 1.7 cm
2,340 - 2,350	**Pnaco**	limestone; well lithified; gray, brownish-gray and pinkish-orange limestone; trace green siltstone; reaction to acid: very strong	some iron oxide staining	angular to subangular chips up to 2.3 cm
2,350 - 2,360	**Pnaco**	limestone; well lithified; 55% brownish-gray limestone; 45% medium to high plasticity clay; reaction to acid: very strong	common iron oxide staining	angular to subangular chips up to 1.6 cm; contamination of trace basalt chips
2,360 - 2,370	**Pnaco**	limestone; well lithified; 80% gray limestone; 20% medium to high plasticity, light reddish-brown clay; reaction to acid: very strong	some iron oxide staining	angular to subangular chips up to 1.5 cm
2,370 - 2,380	**Pnaco**	limestone; well lithified; 90% gray to light olive-brown limestone; 10% low to medium plasticity; trace purple limestone; reaction to acid: very strong	some iron oxide staining; light reddish-brown clay	angular to subangular chips up to 1.2 cm
2,380 - 2,390	**Pnaco**	limestone; well lithified; 90% gray to olive brown and light purple limestone; 10% light brown, low to medium plasticity clay; reaction to acid: very strong	some iron oxide staining (hematite)	subangular to angular chips up to 1.2 cm

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2,390 - 2,400	**Pnaco**	limestone; well lithified; gray to light gray limestone; trace light brown clay/mudstone; reaction to acid: very strong	common iron oxide (hematite) in mudstone; some iron oxide in limestone; microfractures	angular to subangular chips up to 2.1 cm; contamination of basalt and diabase chips
2,400 - 2,410	**Pnaco**	limestone; well lithified; 85% gray to grayish purple limestone; 15% light brown to red, medium plasticity clay; reaction to acid: very strong	common iron oxide (hematite); calcite filled microfractures	angular to subangular chips up to 2.1 cm; trace contamination of diabase
2,410 - 2,420	**Pnaco**	limestone; well lithified; 80% gray to grayish-purple limestone; 20% pale brown, medium plasticity clay; reaction to acid: very strong	trace iron oxide (hematite); calcite veins	angular to subangular chips up to 1.8 cm; contamination of diabase chips
2,420 - 2,430	**Pnaco**	limestone; well lithified; 50% gray to grayish-purple limestone; 50% pale brown, medium to high plasticity clay; reaction to acid: very strong	some iron oxide (hematite); calcite veins; trace quartz vein	angular to subangular chips up to 0.5 cm
2,430 - 2,440	**Pnaco**	limestone; well lithified; 80% gray to grayish-purple limestone; 20% pale brown, medium to high plasticity clay; reaction to acid: very strong	common iron oxide (hematite); calcite veins; trace quartz vein	angular to subangular chips up to 2.2 cm
2,440 - 2,450	**Pnaco**	limestone; well lithified; 70% gray to grayish-purple limestone; 30% pale brown, medium to high plasticity clay; reaction to acid: very strong	common iron oxide (hematite); calcite veins; trace quartz vein	angular to subangular chips up to 2.2 cm
2,450 - 2,460	**Pnaco**	limestone; well lithified; 90% medium plasticity clay; 10% gray to grayish-purple limestone; trace siltstone; reaction to acid: very strong	trace iron oxide (hematite)	angular to subangular chips up to 1.9 cm; contamination of diabase chips
2,460 - 2,470	**Pnaco**	limestone; well lithified; 60% pale brown, medium to high plasticity clay; 40% gray to grayish-purple and pale brown limestone; reaction to acid: very strong	trace iron oxide (hematite); calcite veins	angular to subangular chips up to 1.6 cm
2,470 - 2,480	**Pnaco**	limestone; well lithified; 60% pale brown, medium to high plasticity clay; 40% gray to grayish-purple and pale maroon limestone; reaction to acid: very strong		angular to subangular chips up to 1.2 cm
2,480 - 2,490	**Pnaco**	limestone; well lithified; 50% pale brown, medium to high plasticity clay; 50% gray to yellowish-brown limestone; trace siltstone; reaction to acid: very strong	trace iron oxide (hematite)	angular to subangular chips up to 1.9 cm

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2,490 - 2,500	**Pnaco**	limestone; well lithified; 95% gray to dark gray silty limestone; 5% pale brown, medium to high plasticity clay; reaction to acid: very strong	common calcite veins; some iron oxide	angular to subangular chips up to 2.3 cm
2,500 - 2,510	**Pnaco**	limestone; well lithified; light gray crystalline limestone; trace pale brown, medium to high plasticity clay; trace siltstone; reaction to acid: very strong	abundant calcite veins; some iron oxide	angular to subangular chips up to 2.7 cm
2,510 - 2,520	**Pnaco**	limestone; well lithified; gray to brownish-gray limestone; trace pink siltstone; reaction to acid: very strong	some calcite veins; some iron oxide	angular to subangular chips up to 1.7 cm; contamination of basalt chips
2,520 - 2,530	**Pnaco**	limestone; well lithified; gray to purplish-gray limestone; trace yellowish-brown siltstone; trace pale brown, medium to high plasticity clay; reaction to acid: very strong	common calcite veins; some iron oxide; microfractures	angular to subangular chips up to 2.0 cm
2,530 - 2,540	**Pnaco**	limestone; well lithified; gray limestone; trace pinkish-orange recrystallized limestone; trace yellowish-brown silty limestone; reaction to acid: very strong	common calcite veins; common iron oxide (hematite and limonite)	angular to subangular chips up to 1.8 cm
2,540 - 2,550	**Pnaco**	limestone; well lithified; 85% gray, grayish purple and pale maroon limestone; 15% low plasticity clay; trace yellowish-brown silty limestone; reaction to acid: very strong	some calcite veins; some iron oxide (hematite and limonite)	angular to subangular chips up to 1.4 cm
2,550 - 2,560	**Pnaco**	limestone; well lithified; 90% light gray to gray limestone; 10% low plasticity clay; trace yellowish-brown silty limestone; reaction to acid: very strong	common calcite veins; trace iron oxide (hematite and limonite); microfractures	angular to subangular chips up to 1.7 cm
2,560 - 2,570	**Pnaco**	limestone; well lithified; 95% gray to grayish-purple limestone; 5% low plasticity clay; trace maroon limestone; trace red chert; reaction to acid: very strong	common iron oxide (hematite and limonite); common microfractures; trace calcite veins	angular to subangular chips up to 1.9 cm
2,570 - 2,580	**Pnaco**	limestone; well lithified; gray to brownish-gray limestone; trace brown chert; trace yellowish-brown siltstone; reaction to acid: very strong	trace calcite vein; trace iron oxide (hematite and limonite); microfractures	angular to subangular chips up to 2.1 cm
2,580 - 2,590	**Pnaco**	limestone; well lithified; gray to brownish-gray limestone; trace brown chert; trace yellowish-brown siltstone; trace olive chert; reaction to acid: very strong	some iron oxide (hematite and limonite); trace calcite vein	angular to subangular chips up to 1.9 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
2,590 - 2,600	**Pnaco**	limestone; well lithified; gray to brownish-gray limestone; trace yellowish-brown siltstone; trace beige chert; trace reddish-brown shale; reaction to acid: very strong	abundant calcite vein filled microfractures; some iron oxide (hematite and limonite)	angular to subangular chips up to 2.3 cm
2,600 - 2,610	**Pnaco**	limestone; well lithified; dark gray to black limestone; trace pale red silty limestone; trace pale red siltstone; trace pink chert; reaction to acid: very strong	abundant calcite vein filled microfractures; trace iron oxide (hematite and limonite)	angular to subangular chips up to 2.4 cm
2,610 - 2,620	**Pnaco**	limestone; well lithified; gray limestone with maroon silty limestone; trace pale brown and white clay; reaction to acid: very strong		angular to subangular chips up to 1.8 cm
2,620 - 2,630	**Pnaco**	limestone; well lithified; gray limestone and maroon silty, oolitic limestone; reaction to acid: very strong	abundant iron oxide (hematite) on fracture surfaces	angular to subangular chips up to 3.0 cm
2,630 - 2,640	**Pnaco**	limestone; well lithified; 85% gray silty limestone; 15% light brown, red and white, medium plasticity clay; reaction to acid: strong	trace iron oxide staining (hematite and limonite)	angular to subangular chips up to 1.9 cm
2,640 - 2,650	**Pnaco**	limestone; well lithified; olive-brown to gray limestone with some purple limestone; trace light brown, red and white, medium plasticity clay; trace maroon chert; trace yellowish-brown silty limestone; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace calcite veinlets; trace red and white clay	angular to subangular chips up to 2.2 cm
2,650 - 2,660	**Pnaco**	limestone; well lithified; 90% gray to light grayish-purple limestone; 10% white to pale brown clay; trace yellowish-brown silty limestone; reaction to acid: strong	some iron oxide staining (hematite and limonite); trace calcite veinlets	angular to subangular chips up to 2.0 cm
2,660 - 2,670	**Pnaco**	limestone; well lithified; 80% grayish-olive brown limestone; 20% brown clay; trace silty maroon limestone; trace red chert; trace blue-purple siltstone; reaction to acid: none to very strong	some iron oxide staining (hematite and limonite)	angular to subangular chips up to 2.8 cm
2,670 - 2,680	**Pnaco**	limestone; well lithified; 75% dark gray limestone; 25% light brown to white, medium to high plasticity clay; trace purple-brown silty limestone; trace yellowish-brown calcareous siltstone; reaction to acid: very strong		angular to subangular chips up to 2.2 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
2,680 - 2,690	**Pnaco**	limestone; well lithified; 90% light gray to olive-brown limestone; 10% light brown to white, medium to high plasticity clay; trace yellowish-brown silty limestone; trace brown chert; trace pinkish-orange chert; trace dark gray siltstone; reaction to acid: very strong	some calcite veinlets	angular to subangular chips up to 1.8 cm
2,690 - 2,700	**Pnaco**	limestone; moderately to well lithified; 70% light brown, low plasticity clay; 30% light gray to olive-brown limestone; reaction to acid: very strong	trace calcite veinlets; trace iron oxide staining	angular to subangular chips up to 1.7 cm
2,700 - 2,710	**Pnaco**	limestone; moderately to well lithified; 85% medium to dark gray limestone; 15% tan to gray, medium plasticity clay; trace dark gray silty limestone; trace red chert; reaction to acid: very strong		subangular to subrounded chips up to 2.0 cm
2,710 - 2,720	**Pnaco**	limestone; well lithified; 70% pinkish-tan, silty limestone; 25% tan, low plasticity clay; 5% shale; trace chert; trace red and white clay; bedding; reaction to acid: very strong	trace calcite veinlets; trace iron oxide staining; trace red and white clay	subangular chips up to 1.6 cm
2,720 - 2,730	**Pnaco**	limestone; well lithified; 50% light gray to gray and yellow silty limestone; 40% maroon shale; 10% pinkish-tan, low plasticity clay; trace chert; reaction to acid: very strong	trace iron oxide staining	subangular chips up to 2.6 cm
2,730 - 2,740	**Pnaco**	Limestone and siltstone; well lithified; 50% gray to brown, high plasticity clay; 30% gray and yellow silty limestone; 20% maroon shale; trace reddish-orange chert; bedding; reaction to acid: very strong		subangular chips up to 2.0 cm
2,740 - 2,750	**Pnaco**	limestone; well lithified; 50% orangish-brown, medium to high plasticity clay; 50% gray silty limestone; trace yellow limestone; trace maroon shale; reaction to acid: very strong		subangular chips up to 2.6 cm
NACO FORMATION - Maroon Shale Marker #2 (Pnacoms2)				
2,750 - 2,760	**Pnacoms2**	Maroon Shale Shale Marker Bed no. 2; well lithified; 50% orange, medium to high plasticity clay; 30% black fissile shale; 20% black, high plasticity clay; trace white clay; trace reddish-orange chert; bedding; reaction to acid: weak to very strong	trace iron oxide staining on fracture surfaces (hematite); trace white clay	subangular chips up to 1.8 cm
2,760 - 2,770	**Pnacoms2**	Maroon Shale Shale Marker Bed no. 2; weakly to well lithified; black shale and black clay; bedding; reaction to acid: weak to very strong	trace chalcopyrite	subangular chips up to 1.8 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
2,770 - 2,780	**Pnacoms2**	Maroon Shale Shale Marker Bed no. 2; well lithified; 45% medium brown calcareous siltstone; 40% brown, medium plasticity clay; 10% gray-brown bedded siltstone; 5% medium gray shale; trace reddish-brown siltstone; bedding; reaction to acid: strong	trace iron oxide staining (hematite and limonite)	subangular to angular chips up to 1.7 cm; trace contamination of diabase and schist
2,780 - 2,790	**Pnacoms2**	Maroon Shale Shale Marker Bed no. 2; well lithified; 70% purple calcareous shale; 20% light to medium gray, yellowish gray, pinkish-gray limestone; 10% reddish-brown, low plasticity clay; reaction to acid: very strong		subangular to angular chips up to 1.5 cm
NACO FORMATION (Pnaco)				
2,790 - 2,800	**Pnaco**	Limestone and siltstone; well lithified; 60% reddish-brown, low plasticity clay; 15% purple shale; 15% reddish-brown calcareous shale; 10% light to medium gray limestone; reaction to acid: very strong		subangular chips up to 1.6 cm
2,800 - 2,810	**Pnaco**	limestone; well lithified; 80% light to medium gray and light brown silty limestone; 20% purple calcareous shale; trace yellow limestone; trace orange chert; trace red, medium plasticity clay; trace pinkish-white clay; trace black shale; trace brown siltstone; reaction to acid: very strong	trace manganese oxide	subangular chips up to 1.3 cm
2,810 - 2,820	**Pnaco**	limestone; well lithified; 95% light to medium gray and brown silty limestone; 10% purple shale; trace brown clay; trace orange chert; reaction to acid: very strong	trace iron oxide staining (limonite); trace quartz vein	angular to subangular chips up to 2.3 cm
2,820 - 2,830	**Pnaco**	limestone; well lithified; light to medium gray, tan and brown silty limestone; purple and red shale; trace brown clay; trace red and green clay; reaction to acid: strong to very strong	some quartz vein; trace iron oxide staining (limonite); trace calcite; trace red and green clay	angular to subangular chips up to 1.8 cm
2,830 - 2,840	**Pnaco**	limestone; well lithified; 95% light brown and light gray silty limestone; 5% purple calcareous shale; trace white and yellow chert; trace medium gray silty limestone; reaction to acid: very strong	trace iron oxide staining (hematite)	angular to subangular chips up to 1.5 cm
2,840 - 2,850	**Pnaco**	Limestone and siltstone; well lithified; 90% light brown and light gray silty limestone; 10% maroon shale; trace white and yellow chert; trace medium gray and pink silty limestone; reaction to acid: very strong	trace iron oxide staining (hematite and limonite); trace manganese oxide	angular to subangular chips up to 1.7 cm

MONTGOMERY & ASSOCIATES

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NACO FORMATION - Maroon Shale Marker #1 (Pnacoms1)				
2,850 - 2,860	**Pnacoms1**	Maroon Shale Shale Marker Bed no. 1; well lithified; 70% light brown and light gray silty limestone; 20% medium gray and pink silty limestone; 10% brown to tan chert; trace orange chert; trace maroon shale; trace reddish-brown clay; reaction to acid: strong to very strong	trace iron oxide staining (hematite); trace reddish-brown clay	angular to subangular chips up to 1.7 cm
2,860 - 2,870	**Pnacoms1**	Maroon Shale Shale Marker Bed no. 1; well lithified; 55% purple, maroon and pink chert; 45% reddish-brown clay; trace orange chert; trace light gray limestone; reaction to acid: strong		angular to subangular chips up to 1.8 cm
2,870 - 2,880	**Pnacoms1**	Maroon Shale Shale Marker Bed no. 1; well lithified; 45% reddish-brown clay; 30% light pink, white and tan chert; 10% pink chert; 5% purple calcareous shale; reaction to acid: moderate to strong	some iron oxide staining (limonite)	angular to subangular chips up to 1.4 cm
2,880 - 2,890	**Pnacoms1**	Maroon Shale Shale Marker Bed no. 1; well lithified; 60% white and yellow chert; 35% purple, reddish-brown and light brown calcareous, silty shale; 5% light brown silty limestone; trace yellow-orange clay; trace dark gray chert; reaction to acid: moderate to strong	trace yellow-orange clay	angular to subangular chips up to 1.4 cm
ESCABROSA LIMESTONE (Me)				
2,890 - 2,900	**Me**	limestone; well lithified; 85% light to medium gray crystalline limestone; 15% pinkish-brown and brown crystalline limestone; trace light gray silty limestone; trace purple shale; reaction to acid: strong		angular to subangular chips up to 2.3 cm
2,900 - 2,910	**Me**	limestone; well lithified; 85% white and gray limestone; 15% reddish-brown shale; trace pale chert; trace dark gray shale; reaction to acid: very strong	trace iron oxide staining (limonite)	subangular to angular chips up to 0.3 cm
2,910 - 2,920	**Me**	limestone; well lithified; 95% white and light gray silty limestone; 15% brown shale; trace yellow chert; reaction to acid: very strong	trace iron oxide staining (limonite)	subangular to angular chips up to 0.3 cm
2,920 - 2,930	**Me**	limestone; well lithified; 95% light gray, white and pink limestone; 5% light brown dolomite; trace maroon shale; reaction to acid: very strong	trace iron oxide staining (limonite)	subangular to angular chips up to 0.4 cm

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2,930 - 2,940	**Me**	limestone; well lithified; 95% light gray, white and pink limestone; 5% light brown dolomite; trace maroon shale; reaction to acid: very strong	trace iron oxide staining (limonite)	subangular to angular chips up to 0.4 cm
2,940 - 2,950	**Me**	limestone; well lithified; Gray and light yellowish-brown dolomite; trace pale green talc; light gray limestone; reaction to acid: very strong	some iron oxide staining (hematite and limonite)	subangular to angular chips up to 0.3 cm; 90% sand size cuttings
2,950 - 2,960	**Me**	limestone; well lithified; 60% light gray, white and pink limestone; 40% medium dark gray dolomitic shale; trace pale red chert; trace light brown dolomite; reaction to acid: moderate to strong	some iron oxide staining (hematite and limonite)	subangular to angular chips up to 0.3 cm
2,960 - 2,970	**Me**	limestone; well lithified; 60% light gray, white and pink limestone; 40% medium dark gray dolomitic shale; trace pale red chert; trace light brown dolomite; reaction to acid: moderate to strong	common iron oxide staining (hematite and limonite)	subangular to angular chips up to 0.4 cm
2,970 - 2,980	**Me**	limestone; well lithified; 95% grayish-brown dolomitic limestone and shale; 5% white, light gray and pink limestone and shale; reaction to acid: strong	trace iron oxide staining (hematite and limonite)	subangular to angular chips up to 0.3 cm
2,980 - 2,990	**Me**	limestone; well lithified; 50% light medium gray limestone; 50% dark gray dolomitic limestone and shale; trace chert; reaction to acid: very strong	trace iron oxide staining (hematite and limonite)	subangular to angular chips up to 0.3 cm
2,990 - 3,000	**Me**	limestone; well lithified; 75% medium dark gray silty limestone and shale; 25% light gray, white and pink limestone; trace pale green talc; trace chert; reaction to acid: very strong	some iron oxide staining (hematite and limonite)	subangular to angular chips up to 0.3 cm
3,000 - 3,010	**Me**	limestone; well lithified; dark brownish-gray dolomitic shale and gray silty limestone; trace red shale; trace pale milky chert; reaction to acid: very strong	common iron oxide staining (hematite and limonite); some milky quartz veins	subangular to angular chips up to 0.6 cm
3,010 - 3,020	**Me**	limestone; moderately to well lithified; 70% reddish-brown, calcareous shale; 30% dark gray dolomitic shale; trace light gray, white and pink limestone; reaction to acid: very strong	common iron oxide staining (hematite and limonite)	subangular to angular chips up to 0.3 cm
3,020 - 3,030	**Me**	limestone; well to moderately lithified; 70% dark gray and light gray limestone; 25% reddish-brown shale; reaction to acid: very strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.4 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
3,030 - 3,040	**Me**	limestone; well to moderately lithified; 90% dark gray, light gray, yellow and white limestone; 10% red shale; reaction to acid: very strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.3 cm
3,040 - 3,050	**Me**	limestone; well lithified; 50% dark gray, light gray, yellow and white limestone; 25% red shale; 25% black limestone; reaction to acid: very strong	common iron oxide staining (hematite and limonite); trace manganese oxide; faulted zone	subangular chips up to 1.5 cm
3,050 - 3,060	**Me**	limestone; well lithified; 50% dark gray, light gray, yellow and white limestone; 40% tan tuff with magnetite, quartz and biotite; 10% black limestone; reaction to acid: very strong	common iron oxide staining (hematite and limonite); trace manganese oxide; trace quartz veins; faulted zone	subangular chips up to 3.0 cm
3,060 - 3,070	**Me**	limestone; well to moderately lithified; 90% dark gray, light gray, yellow and white limestone; 10% red shale; reaction to acid: very strong	common iron oxide staining (hematite and limonite)	subangular chips up to 0.3 cm
3,070 - 3,080	**Me**	limestone; moderately to well lithified; 90% dark gray, light gray, yellow and white limestone; 10% red shale; reaction to acid: very strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.3 cm
3,080 - 3,090	**Me**	limestone; moderately to well lithified; 90% dark gray, light gray, yellow and white limestone; 10% red shale; reaction to acid: very strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.3 cm
3,090 - 3,100	**Me**	limestone; moderately to well lithified; 90% dark gray, light gray, yellow and white limestone; 10% red shale; reaction to acid: very strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.3 cm
3,100 - 3,110	**Me**	limestone; moderately to well lithified; 95% dark gray, light gray, yellow and white limestone; 5% red shale; reaction to acid: very strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular to subrounded chips up to 0.4 cm
3,110 - 3,120	**Me**	limestone; moderately to well lithified; 95% dark gray, light gray, yellow and white limestone; 5% red shale; reaction to acid: very strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular to subrounded chips up to 0.3 cm
3,120 - 3,130	**Me**	limestone; moderately to well lithified; 95% dark gray, light gray, yellow and white limestone; 5% red shale; reaction to acid: very strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.3 cm

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3,130 - 3,140	**Me**	limestone; moderately to well lithified; dark gray, light gray, yellow and white limestone; trace red shale; trace black limestone; trace oolites; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.4 cm
MARTIN FORMATION - Last Black Shale (Dmlbs)				
3,140 - 3,150	**Dmlbs**	Last Black Shale; moderately to well lithified; 65% dark gray, light gray, yellow and white limestone; 35% black calcareous siltstone/shale; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.3 cm
3,150 - 3,160	**Dmlbs**	Last Black Shale; moderately to well lithified; 80% calcareous siltstone/shale; 20% dark gray, light gray, yellow and white limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.4 cm
MARTIN FORMATION (Dm)				
3,160 - 3,170	**Dm**	limestone; moderately to well lithified; 80% white and light gray limestone; 20% black calcareous siltstone/shale; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.4 cm
3,170 - 3,180	**Dm**	limestone; moderately to well lithified; 90% white and light gray limestone; 10% black calcareous siltstone/shale; trace red shale; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.5 cm
3,180 - 3,190	**Dm**	limestone; moderately to well lithified; 90% white and light gray limestone; 10% black calcareous siltstone/shale; trace red shale; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.4 cm
3,190 - 3,200	**Dm**	limestone; moderately to well lithified; 90% white and light gray limestone; 10% black limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.5 cm
3,200 - 3,210	**Dm**	limestone; moderately to well lithified; 80% white, gray and yellow limestone; 20% black limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.5 cm
3,210 - 3,220	**Dm**	limestone; moderately to well lithified; 80% white, gray and yellow limestone; 20% black limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.5 cm
3,220 - 3,230	**Dm**	limestone; moderately to well lithified; white, dark gray, light gray and yellow limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.5 cm

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3,230 - 3,240	**Dm**	limestone; moderately to well lithified; white, dark gray, light gray and yellow limestone; trace red shale; reaction to acid: strong		subangular chips up to 0.5 cm
3,240 - 3,250	**Dm**	limestone; moderately to well lithified; white, dark gray, light gray and yellow limestone; trace red shale; reaction to acid: strong		subangular chips up to 0.6 cm
3,250 - 3,260	**Dm**	limestone; moderately to well lithified; 90% dark gray limestone; 10% light gray, white and yellow limestone; trace red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces	subangular chips up to 0.4 cm
3,260 - 3,270	**Dm**	limestone; moderately to well lithified; 90% dark gray limestone; 10% light gray, white and yellow limestone; trace red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces	subangular chips up to 0.5 cm
3,270 - 3,280	**Dm**	limestone; moderately to well lithified; 80% medium to light gray, yellow and white limestone; 20% dark gray limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces	subangular chips up to 0.5 cm
3,280 - 3,290	**Dm**	limestone; moderately to well lithified; 80% medium to light gray, yellow and white limestone; 20% dark gray limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces	subangular chips up to 0.5 cm
3,290 - 3,300	**Dm**	limestone; moderately to well lithified; 90% light gray and white limestone; 10% dark gray limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces	subangular chips up to 0.5 cm
3,300 - 3,310	**Dm**	limestone; moderately to well lithified; 90% light gray and white limestone; 10% dark gray limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces	subangular chips up to 0.5 cm
3,310 - 3,320	**Dm**	limestone; moderately to well lithified; dark to light gray, white and yellow limestone; trace yellowish-orange shale; trace red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces	subangular chips up to 0.5 cm
3,320 - 3,330	**Dm**	limestone; moderately to well lithified; 80% dark gray to black shale; 20% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.5 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
3,330 - 3,340	**Dm**	limestone; moderately to well lithified; 60% dark gray to black shale; 40% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.5 cm
3,340 - 3,350	**Dm**	Shale and limestone; moderately to well lithified; 60% dark gray to black shale; 40% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide	subangular chips up to 0.6 cm
3,350 - 3,360	**Dm**	Shale and limestone; moderately to well lithified; 90% dark gray to black shale; 10% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide; trace calcite veins	subangular chips up to 0.6 cm
3,360 - 3,370	**Dm**	Shale and limestone; moderately to well lithified; 90% dark gray to black shale; 10% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide; trace calcite veins	subangular chips up to 0.6 cm
3,370 - 3,380	**Dm**	Shale and limestone; moderately to well lithified; 90% dark gray to black shale; 10% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide; trace calcite veins	subangular chips up to 0.5 cm
3,380 - 3,390	**Dm**	Shale and limestone; moderately to well lithified; 90% dark gray to black shale; 10% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide; trace calcite veins	subangular chips up to 0.5 cm
3,390 - 3,400	**Dm**	Shale and limestone; moderately to well lithified; 90% dark gray to black shale; 10% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide; trace calcite veins	subangular chips up to 0.5 cm
3,400 - 3,410	**Dm**	Shale and limestone; moderately to well lithified; 90% dark gray to black shale; 10% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide; trace calcite veins	subangular chips up to 0.5 cm
3,410 - 3,420	**Dm**	Shale and limestone; moderately to well lithified; 90% dark gray to black shale; 10% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	abundant iron oxide staining (hematite and limonite); trace manganese oxide; trace calcite veins	subangular chips up to 0.5 cm
3,420 - 3,430	**Dm**	Shale and limestone; moderately to well lithified; 95% dark gray to black shale; 5% gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace calcite veins	subangular chips up to 0.5 cm

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3,430 - 3,440	**Dm**	shale; moderately to well lithified; dark gray to black shale; trace gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace calcite veins	subangular chips up to 0.6 cm
3,440 - 3,450	**Dm**	shale; moderately to well lithified; dark gray to black shale; trace gray, white and yellow limestone; trace yellow and red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace calcite veins	subangular chips up to 0.4 cm
3,450 - 3,460	**Dm**	shale; moderately to well lithified; 70% dark gray to black shale; 30% yellowish-tan shale; trace gray, white and yellow limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace calcite veins	subangular chips up to 0.5 cm
3,460 - 3,470	**Dm**	Shale and limestone; moderately to well lithified; 40% yellowish-tan shale; 40% gray limestone; 20% dark gray to black shale; trace red shale; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces	subangular chips up to 0.5 cm
3,470 - 3,480	**Dm**	shale; moderately to well lithified; 90% dark gray to black shale; 5% yellowish-tan shale; 5% gray limestone; trace red shale; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces	subangular chips up to 0.7 cm
3,480 - 3,490	**Dm**	shale; moderately to well lithified; 90% dark gray to black shale; 5% yellowish-tan shale; 5% gray limestone; trace red shale; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces	subangular chips up to 0.5 cm
3,490 - 3,500	**Dm**	shale; moderately to well lithified; 90% dark gray to black shale; 10% gray, white and yellow limestone; trace tan-yellow shale; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets	subangular chips up to 0.6 cm
3,500 - 3,510	**Dm**	Shale and limestone; moderately to well lithified; 90% dark gray to black shale; 10% gray, white and yellow limestone; trace tan-yellow shale; trace red shale; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets	subangular chips up to 0.6 cm
3,510 - 3,520	**Dm**	shale; moderately to well lithified; 95% dark gray to black shale; 5% gray, white and yellow limestone; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets	subangular chips up to 0.5 cm
3,520 - 3,530	**Dm**	shale; moderately to well lithified; 95% dark gray to black shale; 5% gray, white and yellow limestone; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets	subangular chips up to 0.5 cm

APPENDIX C-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL DHRES-15 [*55-916688*]
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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
3,530 - 3,540	**Dm**	shale; moderately to well lithified; 95% dark gray to black shale; 5% gray, white and yellow limestone; reaction to acid: strong	trace iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets	subangular chips up to 0.5 cm
3,540 - 3,550	**Dm**	shale; moderately to well lithified; 95% dark gray to black shale; 5% gray, white and yellow limestone; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace calcite veinlets	subangular chips up to 0.5 cm
3,550 - 3,560	**Dm**	shale; moderately to well lithified; 95% dark gray to black shale; 5% gray, white and yellow limestone; trace reddish-orange shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets	subangular chips up to 0.5 cm
3,560 - 3,570	**Dm**	Shale and limestone; moderately to well lithified; 60% dark gray to black shale; 20% yellowish-tan shale; 10% gray limestone; trace red shale; trace whitish-yellow quartzite; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets	subangular chips up to 0.5 cm
3,570 - 3,580	**Dm**	Limestone and quartzite; moderately to well lithified; 40% dark gray to black shale; 30% whitish-yellow quartzite; 10% yellowish-tan shale; 10% gray limestone; 10% white quartzite; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets; trace slickensides	subangular chips up to 0.5 cm
BOLSA QUARTZITE (Cb)				
3,580 - 3,590	**Cb**	Quartzite; moderately to well lithified; 50% dark gray to black shale; 25% whitish-clear, yellow quartzite; 15% yellowish-tan shale; 10% gray limestone; trace red shale; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets; trace slickensides	subangular chips up to 0.6 cm
3,590 - 3,600	**Cb**	Quartzite; moderately to well lithified; 70% clear, yellow and tan quartzite; 15% dark gray-black shale; 10% gray limestone; trace yellow and red shale; trace white quartz; reaction to acid: strong	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets; trace slickensides	subangular chips up to 0.5 cm
3,600 - 3,610	**Cb**	Quartzite; well lithified; 70% clear, yellow and tan quartzite; 15% dark gray-black shale; 10% gray limestone; trace yellow and red shale; trace white quartz; reaction to acid: weak to moderate	common iron oxide staining (hematite and limonite); trace manganese oxide on fracture surfaces; trace calcite veinlets; trace slickensides	subangular chips up to 0.5 cm
DIABASE (pCdiab)				
3,610 - 3,620	**pCdiab**	diabase; well lithified; 80% black and green diabase; common magnetite; 15% clear, yellow and brown quartzite; 5% light gray and pink limestone; trace talc; reaction to acid: strong	trace iron oxide staining (hematite); some calcite; trace serpentine alteration	subangular to angular chips up to 0.5 cm

APPENDIX C-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL DHRES-15 [*55-916688*] RESOLUTION PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
3,620 - 3,630	**pCdiab**	diabase; well lithified; 90% black and green diabase; common magnetite; 10% clear, yellow and brown quartzite; trace light gray and pink limestone; reaction to acid: moderate to strong	trace iron oxide staining (hematite); some calcite; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,630 - 3,640	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace clear, yellow and brown quartzite; reaction to acid: moderate	trace iron oxide staining (hematite); trace calcite; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,640 - 3,650	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace clear, yellow and brown quartzite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,650 - 3,660	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace clear, yellow and brown quartzite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,660 - 3,670	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,670 - 3,680	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,680 - 3,690	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,690 - 3,700	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,700 - 3,710	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,710 - 3,720	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings

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DRILL CUTTINGS FROM MONITOR WELL DHRES-15 [*55-916688*]
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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
3,720 - 3,730	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,730 - 3,740	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,740 - 3,750	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; reaction to acid: weak	trace iron oxide staining (hematite); trace calcite veins; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,750 - 3,760	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; reaction to acid: weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,760 - 3,770	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,770 - 3,780	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace talc	subangular to angular chips up to 0.3 cm; mostly sand sized cuttings
3,780 - 3,790	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: none to weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.3 cm; mostly sand sized cuttings
3,790 - 3,800	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: none to weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.3 cm; mostly sand sized cuttings
3,800 - 3,810	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: none to weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.3 cm; mostly sand sized cuttings
3,810 - 3,820	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace gray and white clay; reaction to acid: weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.3 cm; mostly sand sized cuttings

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DRILL CUTTINGS FROM MONITOR WELL DHRES-15 [*55-916688*]
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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
3,820 - 3,830	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace gray and white clay; reaction to acid: weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.3 cm; mostly sand sized cuttings
3,830 - 3,840	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: none to weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.3 cm; mostly sand sized cuttings
3,840 - 3,850	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; reaction to acid: none to weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.3 cm; mostly sand sized cuttings
3,850 - 3,860	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; reaction to acid: weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.4 cm; mostly sand sized cuttings
3,860 - 3,870	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; reaction to acid: none to weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.4 cm; mostly sand sized cuttings
3,870 - 3,880	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; reaction to acid: none to weak	some iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.4 cm; mostly sand sized cuttings
3,880 - 3,890	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; reaction to acid: none to weak	some iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite; trace quartz vein	angular chips up to 0.4 cm; mostly sand sized cuttings
3,890 - 3,900	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; some gray clay; reaction to acid: weak to moderate	some iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.4 cm; mostly sand sized cuttings
3,900 - 3,910	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; some gray clay; reaction to acid: weak	some iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.4 cm; mostly sand sized cuttings
3,910 - 3,920	**pCdiab**	diabase; well lithified; black, green and white diabase; common magnetite; trace yellow quartzite; some gray clay; reaction to acid: weak	trace iron oxide staining (hematite); trace weathered diabase; trace serpentine alteration; trace pyrite	angular chips up to 0.4 cm; mostly sand sized cuttings

MONTGOMERY
& ASSOCIATES

APPENDIX C

Table C-3

Lithologic Descriptions for Drill Cuttings from Well DHRES-16

APPENDIX C-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM GROUTED PIEZOMETER DHRES-16 [*55-917232*] RESOLUTION PINAL COUNTY, ARIZONA

DRILLING COMPANY: National EWP	LOGGED BY: M. Shelley, J. Bell
DEPTH DRILLED / LAND SURFACE ELEVATION: 4085.0 feet	DATE DRILLED: Aug 25 - Sept 26, 2014
CADASTRAL / U.S. STATE PLANE (NAD83NA2011) : (D-02-12)04acd / 830712.766 N / 944004.384 E	

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
ALLUVIUM (Qal)				
0 - 10	**Qal**	alluvium; non-lithified to weakly lithified; silty gravelly sand; clasts consist of mostly tuff with schist, quartzite and trace chert; reaction to acid: weak to moderate		subrounded to angular chips up to 1.5 cm
10 - 20	**Qal**	alluvium; non-lithified to weakly lithified; gravelly sand; clasts consist of mostly tuff with quartzite, quartz, schist and basalt; reaction to acid: moderate to strong		subangular to angular chips up to 1.4 cm
20 - 30	**Qal**	alluvium; non-lithified to weakly lithified; silty, clayey, sandy gravel; clasts consist of mostly siltstone with tuff, schist and trace magnetite; reaction to acid: strong		subangular to rounded chips up to 3.5 cm
30 - 40	**Qal**	alluvium; non-lithified to weakly lithified; gravelly sand; clasts consist of mostly sandy siltstone with tuff, schist and trace quartzite; reaction to acid: weak to moderate		subangular chips up to 2.1 cm
40 - 50	**Qal**	alluvium; non-lithified to weakly lithified; gravelly silty sand; clasts consist of mostly sandy siltstone with tuff, schist and trace quartzite; reaction to acid: weak		subangular to subrounded chips up to 1.1 cm
50 - 60	**Qal**	alluvium; non-lithified to weakly lithified; gravelly silty sand; clasts consist of mostly medium-grained quartzite with trace sandstone; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 1.1 cm
GILA CONGLOMERATE (QTg)				
60 - 70	**QTg**	mixed lithology conglomerate; weakly lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with trace sandstone; trace magnetite; reaction to acid: weak		subrounded to subangular chips up to 0.7 cm
70 - 80	**QTg**	mixed lithology conglomerate; weakly lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with trace sandstone; trace magnetite; reaction to acid: very weak		subrounded to subangular chips up to 1.2 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
80 - 90	**QTg**	mixed lithology conglomerate; weakly lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace sandstone and chert; trace magnetite; reaction to acid: very weak		subrounded to subangular chips up to 1.3 cm
90 - 100	**QTg**	mixed lithology conglomerate; weakly lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace sandstone and chert; trace magnetite; reaction to acid: very weak		subrounded to subangular chips up to 0.7 cm
100 - 110	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace sandstone, basalt/diabase, and chert; trace magnetite; reaction to acid: very weak		subrounded to subangular chips up to 1.0 cm
110 - 120	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace sandstone, basalt/diabase and chert; trace magnetite; reaction to acid: very weak		subangular chips up to 0.9 cm
120 - 130	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite and sandstone, trace basalt/diabase and chert; trace magnetite; reaction to acid: very weak		subangular chips up to 1.4 cm
130 - 140	**QTg**	mixed lithology conglomerate; weakly lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace chert and schist; trace magnetite; reaction to acid: weak		subangular chips up to 0.5 cm
140 - 150	**QTg**	mixed lithology conglomerate; weakly lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace pink chert and schist; trace magnetite; reaction to acid: none		subangular chips up to 0.4 cm

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DRILL CUTTINGS FROM GROUTED PIEZOMETER DHRES-16 [*55-917232*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
150 - 160	**QTg**	mixed lithology conglomerate; weakly lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace pink chert and schist; trace magnetite; reaction to acid: none		subangular chips up to 0.7 cm
160 - 170	**QTg**	mixed lithology conglomerate; weakly lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace pink chert and schist; trace magnetite; reaction to acid: very weak		subangular chips up to 0.4 cm
170 - 180	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace pink chert, trace schist; trace magnetite; reaction to acid: very weak		subangular to subrounded chips up to 1.0 cm
180 - 190	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace pink chert, basalt and schist; trace magnetite; reaction to acid: very weak		subangular to subrounded chips up to 0.6 cm
190 - 200	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of weathered, medium-grained quartzite with some medium-grained, white quartzite, trace pink chert, basalt and schist; trace magnetite; reaction to acid: very weak		subangular to subrounded chips up to 0.7 cm
200 - 210	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with trace schist, chert and red, fine-grained quartzite; trace magnetite; reaction to acid: very weak		subangular to subrounded chips up to 0.6 cm
210 - 220	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with trace schist, chert and red, fine-grained quartzite; trace magnetite; reaction to acid: none to very weak		subangular chips up to 0.4 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
220 - 230	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with trace chert and red, fine-grained quartzite; trace magnetite; reaction to acid: none to very weak		subangular chips up to 0.3 cm
230 - 240	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with trace schist, chert and red, fine-grained quartzite; trace magnetite; reaction to acid: none to very weak		subrounded to subangular chips up to 0.6 cm
240 - 250	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with trace schist, chert and red, fine-grained quartzite; trace magnetite; reaction to acid: none		subrounded to subangular chips up to 0.3 cm
250 - 260	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with some chert, trace schist and red, fine-grained quartzite; trace magnetite; reaction to acid: none		subrounded to subangular chips up to 0.5 cm
260 - 270	**QTg**	mixed lithology conglomerate; weakly to moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with some sandstone; trace magnetite; reaction to acid: none		subangular chips up to 0.3 cm
270 - 280	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with some sandstone and some chert; trace magnetite; reaction to acid: none		subrounded to subangular chips up to 0.2 cm
280 - 290	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with some sandstone, chert, and tuff, trace basalt; trace magnetite; reaction to acid: none		subangular to subrounded chips up to 0.3 cm

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290 - 300	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with some sandstone, chert, and tuff; trace magnetite; reaction to acid: none		subrounded chips up to 0.4 cm
300 - 310	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with some limestone, and tuff; trace magnetite; reaction to acid: weak to moderate		subrounded chips up to 0.2 cm
310 - 320	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of tan, medium-grained quartzite with some limestone, trace tuff; trace magnetite; reaction to acid: weak		subrounded chips up to 0.2 cm
320 - 330	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some weathered, medium-grained quartzite; some magnetite; reaction to acid: none		subrounded chips up to 0.9 cm
330 - 340	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some weathered, medium-grained quartzite; some magnetite; reaction to acid: weak		subrounded chips up to 0.4 cm
340 - 350	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some weathered, medium-grained quartzite and red siltstone; some magnetite; reaction to acid: very weak		subangular to subrounded chips up to 0.3 cm
350 - 360	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some weathered, medium-grained quartzite and red siltstone; some magnetite; reaction to acid: very weak		subangular to subrounded chips up to 0.7 cm
360 - 370	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some weathered, medium-grained quartzite and red siltstone; some magnetite; reaction to acid: very weak		subangular to subrounded chips up to 0.5 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
370 - 380	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some weathered, medium-grained quartzite and red siltstone; some magnetite; reaction to acid: very weak		subangular to subrounded chips up to 0.6 cm
380 - 390	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some weathered, medium-grained quartzite and red siltstone; some magnetite; reaction to acid: very weak		subangular chips up to 0.3 cm
390 - 400	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace weathered, medium-grained quartzite, light brown chert and red siltstone; some magnetite; reaction to acid: weak		subangular chips up to 0.5 cm
400 - 410	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace weathered, medium-grained quartzite, light brown chert and red siltstone; some magnetite; reaction to acid: weak		subangular chips up to 0.5 cm
410 - 420	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace weathered, medium-grained quartzite, light brown chert, red siltstone and basalt; some magnetite; reaction to acid: weak to moderate		subangular to subrounded chips up to 0.8 cm
420 - 430	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite, light brown chert, limestone and basalt; some magnetite; reaction to acid: weak to moderate		subangular to subrounded chips up to 1.0 cm
430 - 440	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite, light brown chert, limestone and basalt; some magnetite; reaction to acid: weak to moderate		subangular to subrounded chips up to 1.1 cm

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440 - 450	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite, light brown chert, limestone and basalt; some magnetite; reaction to acid: moderate		subangular to subrounded chips up to 0.6 cm
450 - 460	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite, light brown chert, limestone, tan sandstone and basalt; some magnetite; reaction to acid: weak to moderate		subangular chips up to 0.7 cm
460 - 470	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite, light brown chert, limestone, tan sandstone and basalt; some magnetite; reaction to acid: weak		subangular chips up to 0.8 cm
470 - 480	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite, light brown chert, limestone, tan sandstone and basalt; trace magnetite; reaction to acid: weak to moderate		subangular to subrounded chips up to 0.7 cm
480 - 490	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite, light brown chert, limestone, tan sandstone and basalt; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.7 cm
490 - 500	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite, light brown chert, limestone, tan sandstone and basalt; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.6 cm
500 - 510	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite, light brown chert, limestone, tan sandstone and basalt; trace magnetite; reaction to acid: weak to moderate		subangular to subrounded chips up to 0.6 cm

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510 - 520	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite, light brown chert, limestone, tan sandstone and basalt; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.6 cm
520 - 530	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite and red siltstone, trace light brown chert; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.8 cm
530 - 540	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite and red siltstone, trace light brown chert; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.8 cm
540 - 550	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite and red siltstone, trace light brown chert; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.8 cm
550 - 560	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite and red siltstone, trace light brown chert; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.6 cm
560 - 570	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite and red siltstone, trace light brown chert; trace magnetite; reaction to acid: weak to moderate		subangular to subrounded chips up to 0.9 cm
570 - 580	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite and red siltstone, trace light brown chert; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.9 cm

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580 - 590	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite and red siltstone, trace light brown chert; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.9 cm
590 - 600	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with some red siltstone, trace weathered, medium-grained quartzite and red siltstone, trace light brown chert; trace magnetite; reaction to acid: weak		angular to subrounded chips up to 1.4 cm
600 - 610	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert and brown siltstone; trace magnetite; reaction to acid: weak		angular to subrounded chips up to 0.7 cm
610 - 620	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert and brown siltstone; trace magnetite; reaction to acid: weak		angular to subrounded chips up to 0.5 cm
620 - 630	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone and brown siltstone; trace magnetite; reaction to acid: weak		angular to subrounded chips up to 0.8 cm
630 - 640	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert and brown siltstone; trace magnetite; reaction to acid: weak		angular to subrounded chips up to 0.6 cm
640 - 650	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert and brown siltstone; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.7 cm

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650 - 660	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak to moderate		subangular to subrounded chips up to 0.6 cm
660 - 670	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone, brown siltstone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak to moderate		subangular to subrounded chips up to 0.6 cm
670 - 680	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone, brown siltstone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak to moderate		subangular to subrounded chips up to 0.5 cm
680 - 690	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone, brown siltstone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.7 cm
690 - 700	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone, brown siltstone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.8 cm
700 - 710	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone, brown siltstone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.7 cm
710 - 720	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone, brown siltstone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 1.0 cm

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720 - 730	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone, brown siltstone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.8 cm
730 - 740	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of pink tuff (Tal) with trace tan-gray chert, limestone, brown siltstone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak		subrounded chips up to 0.8 cm
740 - 750	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of pink tuff (Tal) with trace tan-gray chert, limestone, black basalt, brown siltstone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak		subrounded chips up to 0.6 cm
750 - 760	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone, diabase, brown siltstone and orange-red, fine-grained quartzite; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 1.1 cm
760 - 770	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone, diabase, brown siltstone and brown, fine-grained quartzite; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.7 cm
770 - 780	**QTg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace tan-gray chert, limestone, diabase, brown siltstone and brown, fine-grained quartzite; trace magnetite; reaction to acid: weak		subangular to subrounded chips up to 0.9 cm
TUFF (Tt)				
780 - 790	**Tt**	felsic tuff; moderately to well lithified; light gray-pink, felsic tuff with phenocrysts of biotite, some lithic fragments of purple-red basalt, trace red scoria; common magnetite; reaction to acid: none		subrounded to subangular chips up to 1.0 cm

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790 - 800	**Tt**	felsic tuff; moderately to well lithified; light gray-pink, felsic tuff with phenocrysts of biotite, some lithic fragments of purple-red basalt, trace red scoria; common magnetite; reaction to acid: very weak		subrounded to subangular chips up to 0.9 cm
800 - 810	**Tt**	felsic tuff; moderately to well lithified; light gray-pink, felsic tuff with phenocrysts of biotite, some lithic fragments of purple-red basalt, trace red scoria; common magnetite; reaction to acid: very weak		subrounded to subangular chips up to 0.7 cm
810 - 820	**Tt**	felsic tuff; moderately to well lithified; light gray-pink, felsic tuff with phenocrysts of biotite, some lithic fragments of purple-red basalt, trace red scoria; common magnetite; reaction to acid: very weak		subrounded to subangular chips up to 1.1 cm
820 - 830	**Tt**	felsic tuff; moderately to well lithified; light gray-pink, felsic tuff with phenocrysts of biotite, some lithic fragments of purple-red basalt, trace red scoria; common magnetite; reaction to acid: none		subrounded to subangular chips up to 0.9 cm
830 - 840	**Tt**	felsic tuff; moderately to well lithified; light gray-pink, felsic tuff with phenocrysts of biotite, some lithic fragments of purple-red basalt, trace red scoria; common magnetite; some basalt lith fragments; reaction to acid: none		subrounded to subangular chips up to 0.6 cm
840 - 850	**Tt**	felsic tuff; moderately to well lithified; light gray-pink, felsic tuff with phenocrysts of biotite, some lithic fragments of purple-red basalt, trace red scoria; common magnetite; some basalt lith fragments; reaction to acid: none		subrounded to subangular chips up to 0.4 cm
850 - 860	**Tt**	felsic tuff; moderately to well lithified; light gray-pink, felsic tuff with phenocrysts of biotite, some lithic fragments of purple-red basalt, trace red scoria; common magnetite; some basalt lith fragments; reaction to acid: none		subrounded to subangular chips up to 0.6 cm
860 - 870	**Tt**	felsic tuff; moderately to well lithified; 85% light gray-pink, felsic tuff with phenocrysts of biotite, some lithic fragments of purple-red basalt, trace red scoria; common magnetite; 15% basalt lith fragments; reaction to acid: none		subrounded to subangular chips up to 0.5 cm

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SANDSTONE (Ts)				
870 - 880	**Ts**	tuffaceous sandstone; well lithified; 45% light gray-pink, felsic tuff with phenocrysts of biotite, some lithic fragments of purple-red basalt, trace red scoria; common magnetite; trace chert; 40% basalt lith fragments; 5% brown sandstone; reaction to acid: none	trace iron oxide (hematite and limonite)	subrounded to subangular chips up to 0.6 cm
880 - 890	**Ts**	tuffaceous sandstone; well lithified; 95% brownish orange tuffaceous sandstone, trace chert; 5% basalt lithic fragments; reaction to acid: none	some iron oxide (limonite)	subrounded to subangular chips up to 1.3 cm
BASALT (Tb)				
890 - 900	**Tb**	andesitic basalt; well lithified; dark gray to reddish purple andesitic basalt; reaction to acid: none	some iron oxide (hematite)	subrounded to subangular chips up to 0.7 cm
900 - 910	**Tb**	andesitic basalt; well lithified; black to reddish purple basalt, some vessicular basalt with plagioclase laths; common magnetite; reaction to acid: none	common iron oxide (hematite)	subrounded to subangular chips up to 1.3 cm
910 - 920	**Tb**	andesitic basalt; well lithified; black to reddish purple basalt, some vessicular basalt with plagioclase laths; common magnetite; reaction to acid: none	common iron oxide (hematite)	subrounded to subangular chips up to 0.8 cm
920 - 930	**Tb**	andesitic basalt; well lithified; 50% black and purplish red basalt; 50% brownish yellow tuff with quartz, plagioclase, and biotite; trace red weathered basalt; reaction to acid: none	common iron oxide (hematite)	subrounded to subangular chips up to 0.5 cm
930 - 940	**Tb**	andesitic basalt; well lithified; 60% black and purplish red basalt; 40% brownish yellow tuff with quartz, plagioclase, and biotite; trace red weathered basalt; reaction to acid: none	some iron oxide	subangular chips to 1.0 cm
TUFF (Tt)				
940 - 950	**Tt**	tuff; well lithified; 25% black and purplish red basalt; 75% brownish yellow tuff with quartz, plagioclase, and biotite; trace red weathered basalt; reaction to acid: none	trace iron oxide	subangular chips to 1.2 cm
950 - 960	**Tt**	tuff; well lithified; Brownish yellow tuff, almost al groundmass with few phenocrysts of quartz and biotite; trace dark basalt; common magnetite; reaction to acid: none	trace iron oxide	subangular chips to 0.6 cm
960 - 970	**Tt**	tuff; well lithified; Brownish yellow tuff, almost al groundmass with few phenocrysts of quartz and biotite; trace dark basalt; common magnetite; reaction to acid: none	trace iron oxide	subangular chips to 0.9 cm

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970 - 980	**Tt**	tuff; well lithified; Brownish yellow tuff, almost al groundmass with few phenocrysts of quartz and biotite; trace dark basalt; common magnetite; reaction to acid: none	trace iron oxide	subangular chips to 0.8 cm
980 - 990	**Tt**	tuff; well lithified; Brownish yellow tuff, almost al groundmass with few phenocrysts of quartz and biotite; trace dark basalt; common magnetite; reaction to acid: none	trace iron oxide	subangular chips to 0.6 cm
BASALT (Tb)				
990 - 1,000	**Tb**	andesitic basalt; well lithified; black basalt with trace quartz and plagioclase laths; common magnetite; reaction to acid: none		subangular chips to 0.5 cm
TUFF (Tt)				
1,000 - 1,010	**Tt**	tuff; well lithified; 90% brownish yellow tuff consisting of mostly groundmass with few quartz and biotite phenocrysts; 10% basalt; reaction to acid: none		subangular chips to 1.1 cm
1,010 - 1,020	**Tt**	tuff; well lithified; brownish yellow tuff consisting of mostly groundmass with few quartz and biotite phenocrysts; reaction to acid: none	trace crystalline quartz; trace gypsum	subangular chips to 0.9 cm
1,020 - 1,030	**Tt**	tuff; well lithified; brownish yellow tuff consisting of mostly groundmass with few quartz and biotite phenocrysts; reaction to acid: none	5% crystalline quartz; trace gypsum	subangular chips to 1.4 cm
1,030 - 1,040	**Tt**	tuff; well lithified; brownish yellow tuff consisting of mostly groundmass with few quartz and biotite phenocrysts; reaction to acid: none	5% crystalline quartz; trace gypsum	subangular chips to 0.8 cm
BASALT (Tb)				
1,040 - 1,050	**Tb**	andesitic basalt; well lithified; 80% reddish black basalt with quartz and plagioclase laths; 20% brownish yellow tuff consisting of mostly groundmass with few quartz and biotite phenocrysts; reaction to acid: none	5% crystalline quartz; trace gypsum	subangular chips to 0.7 cm
1,050 - 1,060	**Tb**	andesitic basalt; well lithified; reddish black basalt with quartz and plagioclase laths; reaction to acid: none	5% crystalline quartz; trace gypsum	subangular chips to 0.8 cm
1,060 - 1,070	**Tb**	andesitic basalt; well lithified; dark purple vesicular basalt with laths of plagioclse; common magnetite; reaction to acid: none	some iron oxide	subangular chips to 1.4 cm
1,070 - 1,080	**Tb**	andesitic basalt; well lithified; dark purple vesicular basalt with laths of plagioclse; common magnetite; reaction to acid: none	trace iron oxide; some gypsum	subangular chips to 1.0 cm

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1,080 - 1,090	**Tb**	andesitic basalt; well lithified; dark purple vesicular basalt with laths of plagioclse; common magnetite; reaction to acid: none	trace iron oxide; some gypsum	subangular chips to 0.8 cm
1,090 - 1,100	**Tb**	andesitic basalt; well lithified; dark purple vesicular basalt with laths of plagioclse; common magnetite; reaction to acid: none	trace iron oxide; some gypsum	subangular chips to 0.5 cm
1,100 - 1,110	**Tb**	andesitic basalt; well lithified; dark purple vesicular basalt with laths of plagioclse; common magnetite; reaction to acid: none	trace iron oxide; some gypsum	subangular chips to 0.9 cm
1,110 - 1,120	**Tb**	andesitic basalt; well lithified; dark purple vesicular basalt with laths of plagioclse; common magnetite; reaction to acid: none	trace iron oxide; some gypsum	subangular chips to 1.3 cm
1,120 - 1,130	**Tb**	andesitic basalt; well lithified; dark purple vesicular basalt with laths of plagioclse; common magnetite; reaction to acid: none	trace iron oxide; some gypsum	subangular chips to 0.9 cm
1,130 - 1,140	**Tb**	andesitic basalt; well lithified; dark purple vesicular basalt with laths of plagioclse; common magnetite; reaction to acid: none	trace gypsum	subangular chips to 1.2 cm
1,140 - 1,150	**Tb**	andesitic basalt; well lithified; dark purple vesicular basalt with laths of plagioclse; common magnetite; reaction to acid: none		subangular chips to 1.5 cm
1,150 - 1,160	**Tb**	andesitic basalt; well lithified; dark purple basalt with trace vesicles and laths of plagioclse; common magnetite; reaction to acid: none	some vein quartz up to 1.0 cm; trace iron oxide (hematite) filled vesicles	subangular chips to 1.6 cm
1,160 - 1,170	**Tb**	andesitic basalt; well lithified; dark purple basalt with trace vesicles and laths of plagioclse; common magnetite; reaction to acid: none	trace iron oxide (hematite) filled vesicles	subangular chips to 1.5 cm
1,170 - 1,180	**Tb**	andesitic basalt; well lithified; dark purple basalt with trace vesicles and laths of plagioclse; common magnetite; reaction to acid: none	trace iron oxide (hematite) filled vesicles	subangular chips to 2.2 cm
1,180 - 1,190	**Tb**	andesitic basalt; well lithified; dark purple basalt with trace vesicles and laths of plagioclse; common magnetite; reaction to acid: none	trace iron oxide (hematite) filled vesicles	subangular chips to 2.4 cm
1,190 - 1,200	**Tb**	andesitic basalt; well lithified; dark purple basalt with trace vesicles and laths of plagioclse; common magnetite; reaction to acid: none	trace iron oxide (hematite) filled vesicles	subangular chips to 2.1 cm

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1,200 - 1,210	**Tb**	andesitic basalt; well lithified; black basalt with plagioclase filled vesicles; common manetite; reaction to acid: none	trace iron oxide (hematite)	subangular chips to 1.0 cm
1,210 - 1,220	**Tb**	andesitic basalt; well lithified; black basalt with plagioclase filled vesicles; common manetite; reaction to acid: none		subangular chips to 2.1 cm
1,220 - 1,230	**Tb**	andesitic basalt; well lithified; black and reddish black basalt with plagioclase filled vesicles; common manetite; reaction to acid: none	some iron oxide (hematite)	subangular chips to 2.4 cm
1,230 - 1,240	**Tb**	andesitic basalt; well lithified; black and reddish black basalt with plagioclase filled vesicles; common manetite; reaction to acid: none	some iron oxide (hematite)	subangular chips to 1.9 cm
1,240 - 1,250	**Tb**	andesitic basalt; well lithified; black basalt with plagioclase filled vesicles; common manetite; reaction to acid: none	trace iron oxide (hematite)	subangular chips to 1.6 cm
1,250 - 1,260	**Tb**	andesitic basalt; well lithified; black basalt with plagioclase filled vesicles; common manetite; reaction to acid: none	trace iron oxide (hematite)	subangular chips to 3.0 cm
1,260 - 1,270	**Tb**	andesitic basalt; well lithified; black basalt with plagioclase filled vesicles; common manetite; reaction to acid: none		subangular chips to 2.4 cm
1,270 - 1,280	**Tb**	andesitic basalt; well lithified; black basalt with plagioclase filled vesicles; common manetite; reaction to acid: none		subangular chips to 1.2 cm
1,280 - 1,290	**Tb**	paleosol; moderately to well lithified; 50% black basalt; 50% red siltstone and weathered basalt; common magnetite; reaction to acid: none	abunant iron oxide (hematite); trace vein quartz	subangular chips to 1.8 cm
1,290 - 1,300	**Tb**	paleosol; moderately lithified; 80% red siltsone and clay (weathered basalt); 20% black basalt; common magnetite; reaction to acid: none	abunant iron oxide (hematite); some gypsum; common vein quartz (up to 0.8 cm)	subangular chips to 1.7 cm
1,300 - 1,310	**Tb**	andesitic basalt; well lithified; blackish red basalt; common magnetite; reaction to acid: none	some iron oxide (hematite); some gypsum	subangular chips to 1.6 cm
1,310 - 1,320	**Tb**	andesitic basalt; well lithified; blackish red basalt; common magnetite; reaction to acid: none	some iron oxide (hematite); some gypsum	subangular chips to 2.5 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
1,320 - 1,330	**Tb**	paleosol; moderately to well lithified; 75% reddish purple silt and clay; 25% blackish red basalt; common magnetite; reaction to acid: none	abundant iron oxide (hematite); some gypsum	subangular chips to 1.9 cm
1,330 - 1,340	**Tb**	andesitic basalt; well lithified; black slightly red basalt with plagioclase laths; reaction to acid: none	trace iron oxide (hematite); some gypsum	subangular chips to 1.6 cm
1,340 - 1,350	**Tb**	andesitic basalt; well lithified; black slightly red basalt with trace plagioclase laths; trace red silty clay; common magnetite; reaction to acid: none	trace iron oxide filled vesicles; trace gypsum	subangular chips to 3.0 cm
1,350 - 1,360	**Tb**	andesitic basalt; well lithified; black slightly red basalt with trace plagioclase laths; common magnetite; reaction to acid: none	trace iron oxide filled vesicles; trace gypsum	subangular chips to 1.7 cm
1,360 - 1,370	**Tb**	andesitic basalt; well lithified; black slightly red basalt with trace plagioclase laths; common magnetite; reaction to acid: none	trace iron oxide filled vesicles; abundant gypsum (up to 2 cm)	subangular chips to 2.5 cm
1,370 - 1,380	**Tb**	andesitic basalt; well lithified; black slightly red basalt with trace plagioclase laths; common magnetite; reaction to acid: none	trace iron oxide filled vesicles; some gypsum	subangular chips to 2.9 cm
1,380 - 1,390	**Tb**	andesitic basalt; well lithified; black slightly red basalt with trace plagioclase laths; common magnetite; reaction to acid: none	trace gypsum	subangular chips to 2.7 cm
1,390 - 1,400	**Tb**	basalt and paleosol; weakly to well lithified; 85% black slightly red basalt with trace plagioclase laths; 15% red silty clay; common magnetite; reaction to acid: none	common iron oxide (hematite); trace gypsum	subangular chips to 3.1 cm
1,400 - 1,410	**Tb**	basalt and paleosol; moderately to well lithified; 85% black slightly red basalt with trace plagioclase laths; 15% red silty clay; common magnetite; reaction to acid: none	common iron oxide (hematite)	subangular chips to 1.8 cm
1,410 - 1,420	**Tb**	basalt and paleosol; moderately to well lithified; 90% black slightly red basalt with trace plagioclase laths; 10% red silty clay; common magnetite; reaction to acid: none	common iron oxide (hematite)	subangular chips to 1.4 cm
1,420 - 1,430	**Tb**	basalt; well lithified; black slightly red basalt with trace plagioclase laths; common magnetite; reaction to acid: none	common iron oxide (hematite); trace gypsum; trace serpentine alteration	subangular chips to 2.8 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
1,430 - 1,440	**Tb**	basalt; well lithified; black slightly red basalt with trace plagioclase laths; common magnetite; reaction to acid: none	trace iron oxide (hematite)	subangular chips to 3.1 cm
1,440 - 1,450	**Tb**	basalt; well lithified; black slightly red basalt with trace plagioclase laths; common magnetite; reaction to acid: none	some iron oxide (hematite)	subangular chips to 1.5 cm
1,450 - 1,460	**Tb**	basalt; moderately to well lithified; black slightly red basalt with trace plagioclase laths; common magnetite; reaction to acid: none	some iron oxide (hematite)	subangular chips to 1.4 cm
1,460 - 1,470	**Tb**	basalt; well lithified; black slightly red basalt with trace plagioclase laths; some silty red clay; common magnetite; reaction to acid: none	common iron oxide (hematite)	subangular chips to 2.7 cm
1,470 - 1,480	**Tb**	basalt and paleosol; weakly to well lithified; 60% reddish-brown weathered basalt with trace plagioclase laths; 40% silty red clay; common magnetite; reaction to acid: none	major iron oxide (hematite)	subangular chips to 2.0 cm
1,480 - 1,490	**Tb**	basalt and paleosol; moderately to well lithified; 75% reddish-brown weathered basalt with plagioclase laths; 25% sandy red clay; common magnetite; reaction to acid: none	major iron oxide (hematite)	subangular to subrounded chips to 1.6 cm
1,490 - 1,500	**Tb**	basalt and paleosol; moderately to well lithified; reddish-brown slightly weathered basalt with plagioclase laths; trace silty red clay; common magnetite; reaction to acid: none	abundant iron oxide (hematite); trace gypsum	subangular to subrounded chips to 1.0 cm
1,500 - 1,510	**Tb**	basalt; well lithified; blackish purple basalt; common magnetite; reaction to acid: none		subangular chips to 2.1 cm
1,510 - 1,520	**Tb**	basalt; well lithified; blackish purple basalt; common magnetite; reaction to acid: none	trace iron oxide (hematite)	subangular chips to 1.4 cm
1,520 - 1,530	**Tb**	basalt; well lithified; blackish purple basalt; common magnetite; reaction to acid: none		subangular chips to 1.8 cm
1,530 - 1,540	**Tb**	basalt; well lithified; blackish purple basalt; common magnetite; reaction to acid: none	some serpentine alteration	subangular chips to 2.9 cm
1,540 - 1,550	**Tb**	basalt; well lithified; blackish purple basalt; common magnetite; reaction to acid: none	some serpentine alteration	subangular chips to 2.7 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
1,550 - 1,560	**Tb**	basalt; well lithified; blackish purple basalt; common magnetite; reaction to acid: none	some serpentine alteration	subangular chips to 2.2 cm
1,560 - 1,570	**Tb**	basalt; well lithified; blackish purple basalt; common magnetite; reaction to acid: none	some serpentine alteration	subangular chips to 1.8 cm
1,570 - 1,580	**Tb**	basalt; well lithified; blackish purple basalt; common magnetite; reaction to acid: none	some serpentine alteration	subangular chips to 3.1 cm
1,580 - 1,590	**Tb**	basalt; well lithified; blackish purple basalt; common magnetite; reaction to acid: none	some serpentine alteration	subangular chips to 3.5 cm
1,590 - 1,600	**Tb**	basalt and paleosol; weakly to well lithified; 80% blackish purple basalt; 20% reddish brown sandy clay; common magnetite; reaction to acid: none	abundant iron oxide (hematite); some serpentine alteration	subangular chips to 3.3 cm
1,600 - 1,610	**Tb**	basalt and paleosol; weakly to well lithified; 75% blackish purple basalt; 25% reddish brown sandy clay; common magnetite; reaction to acid: none	major iron oxide (hematite)	subangular chips to 2.9 cm
1,610 - 1,620	**Tb**	basalt and paleosol; weakly to well lithified; 90% blackish purple basalt; 10% reddish brown sandy clay; common magnetite; reaction to acid: none	major iron oxide (hematite)	subangular chips to 3.2 cm
1,620 - 1,630	**Tb**	basalt and paleosol; moderately to well lithified; 95% weathered reddish-brown basalt with quartz and plagioclase laths; 5% reddish brown sandy clay; common magnetite; reaction to acid: none	abundant iron oxide (hematite)	subangular chips to 3.0 cm
1,630 - 1,640	**Tb**	basalt and paleosol; moderately to well lithified; 95% weathered reddish-brown basalt with quartz and plagioclase laths; 5% reddish brown sandy clay; common magnetite; reaction to acid: none	abundant iron oxide (hematite)	subangular chips to 3.1 cm
1,640 - 1,650	**Tb**	basalt and paleosol; moderately to well lithified; 95% weathered reddish-brown basalt with quartz and plagioclase laths; 5% reddish brown sandy clay; common magnetite; reaction to acid: none	abundant iron oxide (hematite)	subangular chips to 2.3 cm
1,650 - 1,660	**Tb**	basalt; well lithified; dark reddish-brown basalt; common magnetite; reaction to acid: none	trace iron oxide (hematite)	subangular chips to 2.7 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
1,660 - 1,670	**Tb**	basalt and paleosol; well lithified; weathered reddish-brown basalt with quartz and plagioclase laths; common magnetite; reaction to acid: none	abundant iron oxide (hematite)	subangular chips to 2.8 cm
1,670 - 1,680	**Tb**	basalt and paleosol; moderately to well lithified; weathered reddish-brown basalt with quartz and plagioclase laths; common magnetite; reaction to acid: none	abundant iron oxide (hematite)	subangular chips to 2.1 cm
1,680 - 1,690	**Tb**	basalt; well lithified; weathered reddish-brown basalt with quartz and plagioclase laths; common magnetite; reaction to acid: none	some iron oxide (hematite)	subangular chips to 2.4 cm
1,690 - 1,700	**Tb**	basalt; well lithified; weathered reddish-brown basalt with quartz and plagioclase laths; common magnetite; reaction to acid: none	some iron oxide (hematite)	subangular chips to 1.9 cm
1,700 - 1,710	**Tb**	basalt; well lithified; weathered reddish-brown basalt with quartz and plagioclase laths; common magnetite; reaction to acid: none	some iron oxide (hematite)	subangular chips to 3.0 cm
1,710 - 1,720	**Tb**	basalt; well lithified; weathered reddish-brown basalt with quartz and plagioclase laths; common magnetite; reaction to acid: none	some iron oxide (hematite)	subangular chips to 3.4 cm
GILA CONGLOMERATE (Tg)				
1,720 - 1,730	**Tg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace basalt; trace magnetite; reaction to acid: none		subangular to subrounded chips to 2.2 cm
1,730 - 1,740	**Tg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with 10% basalt; trace magnetite; reaction to acid: none		subangular to subrounded chips to 2.4 cm
1,740 - 1,750	**Tg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace basalt and brown siltstone; trace magnetite; reaction to acid: none		subangular to subrounded chips to 3.8 cm
1,750 - 1,760	**Tg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace basalt and brown siltstone; trace magnetite; 10% sandy clay; reaction to acid: none	major iron oxide (hematite)	subangular to subrounded chips to 2.3 cm

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1,760 - 1,770	**Tg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of brown tuff (Tal) with trace basalt and red siltstone; trace magnetite; 50% sandy silty clay; reaction to acid: none	weathering on clasts; abundant iron oxide (hematite and limonite)	subrounded to subangular chips to 1.8cm
1,770 - 1,780	**Tg**	matrix supported conglomerate; weakly lithified; conglomerate consisting of 80% red, medium to high plasticity clay; 20% clasts of limestone and tuff (Tal); reaction to acid: strong	major iron oxide (hematite)	subangular chips to 1.1 cm
1,780 - 1,790	**Tg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of limestone with trace brown sitlstone and white clay; reaction to acid: very strong		subangular chips to 2.8 cm
1,790 - 1,800	**Tg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of limestone with trace brown sitlstone and white clay; reaction to acid: very strong	some iron oxide (hematite)	subangular chips to 2.1 cm
1,800 - 1,810	**Tg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting mostly of clasts of limestone with trace brown sitlstone, basalt and tuff (Tal); trace white clay; reaction to acid: very strong		subangular chips to 1.6 cm
1,810 - 1,820	**Tg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting of 50% brown, sandy clay; 50% clasts of limestone, schist, diabase, quartz and quartzite; reaction to acid: moderate to strong		subangular chips to 1.1 cm
1,820 - 1,830	**Tg**	mixed lithology conglomerate; moderately lithified; conglomerate consisting of clasts of tuff (Tal), brown siltstone, schist, quartz vein and fine-grained quartzite; trace magnetite; 10% silt; reaction to acid: weak	trace iron oxide (hematite and limonite)	subangular chips to 0.5 cm
1,830 - 1,840	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting of clasts of tuff (Tal), brown siltstone, schist, quartz vein and fine-grained quartzite; trace magnetite; 10% silt; reaction to acid: weak	trace iron oxide (hematite and limonite)	subangular chips to 0.6 cm

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1,840 - 1,850	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some quartz vein; trace magnetite; reaction to acid: very weak	trace iron oxide (hematite and limonite)	subangular chips to 0.8 cm
1,850 - 1,860	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some quartz vein; trace magnetite; reaction to acid: very weak		subangular chips to 0.8 cm
1,860 - 1,870	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some quartz vein; trace magnetite; 5% silt; reaction to acid: weak	trace iron oxide (hematite and limonite)	subangular chips to 0.7 cm
1,870 - 1,880	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some quartz vein; trace magnetite; reaction to acid: very weak	trace iron oxide (hematite and limonite)	subangular chips to 0.8 cm
1,880 - 1,890	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some quartz vein; trace magnetite; reaction to acid: very weak	trace iron oxide (hematite and limonite)	subangular chips to 0.7 cm
1,890 - 1,900	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some quartz vein; trace magnetite; reaction to acid: very weak	trace iron oxide (hematite and limonite)	subangular chips to 1.0 cm
1,900 - 1,910	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting of clasts of quartzite, quartz vein, schist, brown siltstone and tuff (Tal); reaction to acid: very weak	trace iron oxide (hematite)	subangular to angular chips to 0.5 cm
1,910 - 1,920	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting of clasts of quartzite, quartz vein, schist, brown siltstone and tuff (Tal); reaction to acid: none to very weak	trace iron oxide (hematite)	subangular to angular chips to 0.6 cm
1,920 - 1,930	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting of clasts of quartzite, quartz vein, schist, brown siltstone and tuff (Tal); reaction to acid: none to very weak	trace iron oxide (hematite)	subangular to angular chips to 0.4 cm

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1,930 - 1,940	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting of clasts of quartzite, quartz vein, schist, brown siltstone and tuff (Tal), trace basalt; 15% silt; reaction to acid: none	trace iron oxide (hematite)	subangular to angular chips to 1.4 cm
1,940 - 1,950	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting of clasts of quartzite, quartz vein, schist, brown siltstone and tuff (Tal); trace pink tuff and basalt; reaction to acid: none	trace iron oxide (hematite)	subangular to angular chips to 1.2 cm
1,950 - 1,960	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some schist, quartzite and quartz vein; reaction to acid: very weak		subangular to angular chips to 0.6 cm
1,960 - 1,970	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some siltstone, quartzite and quartz vein, trace tuff (Tal); reaction to acid: weak		subangular to angular chips to 1.0 cm
1,970 - 1,980	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some siltstone, quartzite and quartz vein, trace tuff (Tal); reaction to acid: weak		subangular to angular chips to 1.2 cm
1,980 - 1,990	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some siltstone, quartzite and quartz vein, trace tuff (Tal); reaction to acid: weak	major weathering on schist	subangular to angular chips to 0.8 cm
1,990 - 2,000	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some siltstone, quartzite and quartz vein, trace tuff (Tal); reaction to acid: weak	major weathering on schist	subangular to angular chips to 0.7 cm
2,000 - 2,010	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and quartzite with trace siltstone and quartz vein; reaction to acid: weak	major weathering on schist	subangular to angular chips to 0.7 cm

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2,010 - 2,020	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and quartzite with some basalt and quartz vein, trace tuff (Tal); reaction to acid: weak	major weathering on schist	subangular to angular chips to 0.4 cm
2,020 - 2,030	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some basalt and quartz vein, trace tuff (Tal); reaction to acid: weak		subangular to angular chips to 0.6 cm
2,030 - 2,040	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some basalt, tuff (Tal) and quartz vein, trace brown siltstone; reaction to acid: weak		subangular to angular chips to 1.1 cm
2,040 - 2,050	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some schist; trace quartzite and quartz vein; reaction to acid: weak	trace iron oxide staining (hematite)	subangular chips to 0.8 cm
2,050 - 2,060	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some schist; trace quartzite and quartz vein; reaction to acid: weak	trace iron oxide staining (hematite)	subangular chips to 1.7 cm
2,060 - 2,070	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace quartzite and quartz vein; reaction to acid: weak	trace iron oxide staining (hematite)	subangular chips to 0.6 cm
2,070 - 2,080	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace quartzite and quartz vein; reaction to acid: weak		subangular chips to 0.8 cm
2,080 - 2,090	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace quartzite and quartz vein; reaction to acid: weak	weathering on schist	subangular chips to 0.7 cm

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2,090 - 2,100	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace quartzite and quartz vein; reaction to acid: weak	weathering on schist	subangular chips to 0.9 cm
2,100 - 2,110	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace quartzite and quartz vein; reaction to acid: weak	weathering on schist	subangular chips to 0.8 cm
2,110 - 2,120	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace silstone, quartzite, chert and quartz vein; reaction to acid: very weak	trace iron oxide staining (hematite)	subangular chips to 1.1 cm
2,120 - 2,130	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace silstone, quartzite and quartz vein; reaction to acid: very weak	common weathered schist; common iron oxide staining (hematite)	subangular chips to 1.4 cm
2,130 - 2,140	**Tg**	mixed lithology conglomerate; well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace matrix chips, silstone, quartzite and quartz vein; reaction to acid: very weak	some weathered schist; common iron oxide staining (hematite)	subangular chips to 1.0 cm
2,140 - 2,150	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace matrix chips, silstone, quartzite and quartz vein; reaction to acid: very weak	some weathered schist; some iron oxide staining (hematite)	subangular chips to 0.9 cm
2,150 - 2,160	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace matrix chips, silstone, quartzite and quartz vein; reaction to acid: very weak	some weathered schist; some iron oxide staining (hematite)	subangular chips to 0.7 cm
2,160 - 2,170	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and some tuff (Tal); trace matrix chips, silstone, quartzite and quartz vein; reaction to acid: very weak	some weathered schist; some iron oxide staining (hematite)	subangular chips to 1.1 cm

MONTGOMERY & ASSOCIATES

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2,170 - 2,180	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and tuff (Tal); trace matrix chips, silstone, quartzite and quartz vein; reaction to acid: very weak	trace weathered schist; trace iron oxide staining (hematite)	subangular chips to 0.8 cm
2,180 - 2,190	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) and schist with some medium-grained quartzite; trace silstone and quartz vein; reaction to acid: weak	trace weathered schist; trace iron oxide staining (hematite)	subangular chips to 1.0 cm
2,190 - 2,200	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) and schist with some medium-grained quartzite; trace silstone and quartz vein; reaction to acid: very weak	trace weathered schist; trace iron oxide staining (hematite)	subangular chips to 0.6 cm
2,200 - 2,210	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) and schist with some medium-grained quartzite and silstone; trace quartz vein; reaction to acid: very weak	trace weathered schist; trace iron oxide staining (hematite)	subangular chips to 0.6 cm
2,210 - 2,220	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) and schist with some medium-grained quartzite and silstone; trace quartz vein; reaction to acid: very weak	trace weathered schist; trace iron oxide staining (hematite)	subangular chips to 0.8 cm
2,220 - 2,230	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) and schist with some medium-grained quartzite and silstone; trace basalt, diabase and quartz vein; reaction to acid: very weak	trace weathered schist; trace iron oxide staining (hematite)	subangular chips to 0.4 cm
2,230 - 2,240	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) and schist with some medium-grained quartzite and silstone; trace basalt, diabase and quartz vein; reaction to acid: very weak	trace weathered schist; trace iron oxide staining (hematite)	subangular chips to 0.4 cm
2,240 - 2,250	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) and schist with some medium-grained quartzite and silstone; trace basalt, diabase and quartz vein; reaction to acid: very weak	trace weathered schist; trace iron oxide staining (hematite)	subangular chips to 0.4 cm

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2,250 - 2,260	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) and schist with some medium-grained quartzite and silstone; trace basalt, diabase and quartz vein; 5% silt; reaction to acid: weak to moderate	trace weathered schist; trace iron oxide staining (hematite)	subangular chips to 0.5 cm
2,260 - 2,270	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some tuff (Tal) medium-grained quartzite, diabase and silstone; trace basalt and quartz vein; reaction to acid: weak	trace weathered schist	subangular chips to 0.4 cm
2,270 - 2,280	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some tuff (Tal) medium-grained quartzite, diabase and silstone; trace basalt and quartz vein; reaction to acid: very weak	trace weathered schist	subangular chips to 0.3 cm
2,280 - 2,290	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some tuff (Tal) medium-grained quartzite, diabase and silstone; trace basalt and quartz vein; reaction to acid: very weak	trace weathered schist	subangular chips to 0.6 cm
2,290 - 2,300	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some medium-grained quartzite, diabase and silstone; trace tuff (Tal), basalt, chert and quartz vein; reaction to acid: very weak	trace weathered schist; trace epidote	subangular chips to 0.7 cm
2,300 - 2,310	**Tg**	mixed lithology conglomerate; well lithified; conglomerate consisting mostly of clasts of schist with some medium-grained quartzite, diabase and silstone; trace tuff (Tal), basalt, chert and quartz vein; reaction to acid: none to very weak	trace weathered schist; trace epidote	subangular chips to 0.5 cm
2,310 - 2,320	**Tg**	mixed lithology conglomerate; well lithified; conglomerate consisting mostly of clasts of schist with some medium-grained quartzite, diabase and silstone; trace tuff (Tal), basalt, chert and quartz vein; reaction to acid: none to very weak	trace epidote	subangular chips to 0.4 cm

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2,320 - 2,330	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some medium-grained quartzite; trace brown silstone, tuff (Tal), chert and quartz vein; reaction to acid: very weak	trace weathering on schist	subangular chips to 0.4 cm
2,330 - 2,340	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some medium-grained quartzite; trace brown silstone, tuff (Tal), chert and quartz vein; reaction to acid: very weak	trace weathering on schist	subangular chips to 0.6 cm
2,340 - 2,350	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some medium-grained quartzite; trace brown silstone, tuff (Tal), basalt, chert and quartz vein; reaction to acid: very weak	trace weathering on schist	subangular chips to 0.5 cm
2,350 - 2,360	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some medium-grained quartzite; trace brown silstone, tuff (Tal), basalt, chert and quartz vein; reaction to acid: very weak	trace weathering on schist	subangular chips to 0.5 cm
2,360 - 2,370	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some medium-grained quartzite; trace brown silstone, tuff (Tal), basalt, chert and quartz vein; reaction to acid: very weak	trace weathering on schist	subangular chips to 0.6 cm
2,370 - 2,380	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some medium-grained quartzite; trace brown silstone, tuff (Tal), basalt, diabase, chert and quartz vein; reaction to acid: very weak	trace weathering on schist	subangular chips to 1.0 cm
2,380 - 2,390	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some medium-grained quartzite; trace brown silstone, tuff (Tal), diabase, chert and quartz vein; reaction to acid: none	trace weathering on schist	subangular chips to 0.7 cm
2,390 - 2,400	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some tuff (Tal) and medium-grained quartzite; trace brown silstone, diabase, chert and quartz vein; reaction to acid: very weak	trace weathering on schist	subangular chips to 0.6 cm

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2,400 - 2,410	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some tuff (Tal) and medium-grained quartzite; trace brown silstone, diabase, chert and quartz vein; reaction to acid: none to very weak	some weathering on schist	subangular chips to 0.7 cm
2,410 - 2,420	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some tuff (Tal) and medium-grained quartzite; trace brown silstone, diabase, chert and quartz vein; reaction to acid: none to very weak	some weathering on schist	subangular chips to 0.6 cm
2,420 - 2,430	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some tuff (Tal) and medium-grained quartzite; trace brown silstone, diabase, chert and quartz vein; reaction to acid: very weak	trace weathering on schist; trace epidite	subangular chips to 0.9 cm
2,430 - 2,440	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some tuff (Tal), diabase and medium-grained quartzite; trace brown silstone, chert and quartz vein; reaction to acid: very weak	trace weathering on schist; trace epidite	subangular chips to 0.7 cm
2,440 - 2,450	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with trace tuff (Tal) and quartzite; reaction to acid: very weak	trace epidite	subangular chips to 0.8 cm
2,450 - 2,460	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some quartzite; trace tuff (Tal); reaction to acid: very weak	trace epidite	subangular chips to 1.1 cm
2,460 - 2,470	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some quartzite; trace tuff (Tal), diabase and basalt; reaction to acid: very weak	some weathering on schist	subangular chips to 1.0 cm
2,470 - 2,480	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some quartzite and tuff (Tal); trace diabase and basalt; reaction to acid: very weak	some weathering on schist	subangular chips to 1.4 cm

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2,480 - 2,490	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some quartzite and tuff (Tal); trace diabase, quartz vein fragments and basalt; reaction to acid: very weak	some weathering on schist	subangular chips to 0.7 cm
2,490 - 2,500	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some quartzite and tuff (Tal); trace diabase, quartz vein fragments and basalt; reaction to acid: very weak	some weathering on schist	subangular chips to 0.6 cm
2,500 - 2,510	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist with some quartzite and tuff (Tal); trace diabase, quartz vein fragments, gray tuff and basalt; reaction to acid: very weak	some weathering on schist	subangular chips to 1.1 cm
2,510 - 2,520	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some schist; trace diabase, quartz vein fragments, gray tuff and basalt; reaction to acid: very weak	some weathering on schist; trace iron oxide staining (hematite)	subangular chips to 1.3 cm
2,520 - 2,530	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some schist and diabase; trace quartz vein fragments, gray tuff and basalt; reaction to acid: very weak	some weathering on schist; trace iron oxide staining (hematite)	subangular chips to 0.7 cm
2,530 - 2,540	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and diabase; trace tuff (Tal), quartz vein fragments, gray tuff and basalt; reaction to acid: weak	some weathering on schist; trace iron oxide staining (hematite)	subangular chips to 1.2 cm
2,540 - 2,550	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and diabase; trace tuff (Tal), quartz vein fragments, gray tuff and basalt; reaction to acid: weak	some weathering on schist; trace iron oxide staining (hematite)	subangular chips to 0.9 cm
2,550 - 2,560	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of schist and diabase with some red siltstone; trace tuff (Tal), quartz vein fragments, gray tuff and basalt; reaction to acid: very weak	some weathering on schist; trace iron oxide staining (hematite)	subangular chips to 1.0 cm

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2,560 - 2,570	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of red siltstone and some schist and diabase; trace tuff (Tal), quartz vein fragments, gray tuff and basalt; reaction to acid: weak to moderate	some weathering on schist; trace iron oxide staining (hematite)	subangular chips to 0.8 cm
2,570 - 2,580	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of red siltstone and some schist and diabase; trace tuff (Tal), quartz vein fragments, gray tuff and basalt; reaction to acid: weak	some weathering on schist; trace iron oxide staining (hematite)	subangular chips to 0.9 cm
2,580 - 2,590	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of red siltstone and quartzite with some schist and diabase; trace tuff (Tal), quartz vein fragments, gray tuff and basalt; reaction to acid: very weak	some weathering on schist; trace iron oxide staining (hematite)	subangular chips to 1.3 cm
2,590 - 2,600	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of red siltstone and quartzite with some schist and diabase; trace tuff (Tal), quartz vein fragments, gray tuff and basalt; reaction to acid: very weak	some weathering on schist; trace iron oxide staining (hematite)	subangular chips to 1.1 cm
2,600 - 2,610	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of siltstone, quartzite, diabase and schist; trace quartz vein fragments and red chert; reaction to acid: very weak	some weathered clasts; trace iron oxide staining (hematite)	subangular chips to 1.0 cm
2,610 - 2,620	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of siltstone, quartzite, diabase and schist; trace quartz vein fragments, basalt and red chert; reaction to acid: weak to moderate	some weathered clasts; trace iron oxide staining (hematite)	subangular chips to 0.8 cm
2,620 - 2,630	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of siltstone, quartzite and diabase; trace quartz vein fragments, schist, basalt and red chert; reaction to acid: weak	some weathered clasts; trace iron oxide staining (hematite)	subangular chips to 0.7 cm

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2,630 - 2,640	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of siltstone, quartzite, basalt and diabase; trace quartz vein fragments, schist and red chert; reaction to acid: very weak	some weathered clasts	subangular chips to 1.1 cm
2,640 - 2,650	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of siltstone, quartzite, basalt and diabase; trace quartz vein fragments, schist and red chert; reaction to acid: very weak	some weathered clasts	subangular chips to 1.2 cm
2,650 - 2,660	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of siltstone, quartzite, basalt and diabase; trace quartz vein fragments, schist and red chert; reaction to acid: very weak	some weathered clasts	subangular chips to 0.9 cm
2,660 - 2,670	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of siltstone, quartzite, basalt and diabase; trace quartz vein fragments, schist and red chert; reaction to acid: very weak	some weathered clasts	subangular chips to 0.9 cm
2,670 - 2,680	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of siltstone, quartzite, basalt and diabase; trace quartz vein fragments, schist and red chert; reaction to acid: weak to moderate	some weathered clasts; trace gypsum	subangular chips to 0.7 cm
2,680 - 2,690	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of siltstone, quartzite, basalt and diabase; trace quartz vein fragments, schist and red chert; reaction to acid: weak	some weathered clasts	subangular chips to 0.5 cm
2,690 - 2,700	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of quartzite with some basalt and diabase; trace quartz vein fragments, schist and red chert; reaction to acid: very weak	some weathered clasts	subangular chips to 0.8 cm
2,700 - 2,710	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of quartzite with some basalt and diabase; trace quartz vein fragments, schist and red chert; reaction to acid: very weak	some weathered clasts	subangular chips to 1.2 cm

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2,710 - 2,720	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some quartzite; trace quartz vein fragments and basalt; reaction to acid: very weak	some weathered clasts	subangular chips to 1.3 cm
2,720 - 2,730	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some quartzite; trace quartz vein fragments and basalt; reaction to acid: very weak	some weathered clasts	subangular chips to 1.0 cm
2,730 - 2,740	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some quartzite; trace quartz vein fragments and basalt; reaction to acid: very weak	some weathered clasts	subangular chips to 0.8 cm
2,740 - 2,750	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone and quartzite; trace diabase and schist; reaction to acid: weak	trace weathered clasts	subangular chips to 1.1 cm
2,750 - 2,760	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone and quartzite; trace diabase and schist; reaction to acid: weak	trace weathered clasts	subangular chips to 0.8 cm
2,760 - 2,770	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone and quartzite; trace diabase and schist; reaction to acid: weak	trace weathered clasts; trace iron oxide staining (hematite)	subangular chips to 0.7 cm
2,770 - 2,780	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone, schist and quartzite; trace diabase and orange chert; reaction to acid: weak	trace weathered clasts; trace iron oxide staining (hematite)	subangular chips to 1.1 cm
2,780 - 2,790	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone, schist and quartzite; trace diabase and orange chert; reaction to acid: weak	trace weathered clasts; trace iron oxide staining (hematite)	subangular chips to 1.3 cm

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2,790 - 2,800	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone, schist and quartzite; trace diabase, tan limestone and orange chert; reaction to acid: weak to moderate	trace weathered clasts	subangular chips to 0.9 cm
2,800 - 2,810	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone, schist and quartzite; trace diabase, white tuff, tan limestone and orange chert; reaction to acid: very weak	trace weathered clasts	subangular chips to 1.0 cm
2,810 - 2,820	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone, basalt, schist and quartzite; trace diabase, white tuff, tan limestone and orange chert; reaction to acid: very weak	trace weathered clasts	subangular chips to 1.1 cm
2,820 - 2,830	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone, basalt, schist and quartzite; trace diabase, white tuff, tan limestone and orange chert; reaction to acid: very weak	trace weathered clasts	subangular chips to 1.9 cm
2,830 - 2,840	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone and basalt; trace schist, quartzite and diabase; reaction to acid: very weak	trace weathered clasts	subangular chips to 1.7 cm
2,840 - 2,850	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone and basalt; trace quartzite and diabase; reaction to acid: very weak	trace weathered clasts	subangular chips to 0.8 cm
2,850 - 2,860	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone and basalt; trace quartzite and diabase; reaction to acid: weak	trace weathered clasts	subangular chips to 0.9 cm

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2,860 - 2,870	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with some reddish-brown siltstone and basalt; trace quartzite and diabase; reaction to acid: weak	trace weathered clasts	subangular chips to 1.0 cm
2,870 - 2,880	**Tg**	mixed lithology conglomerate; moderately to well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with trace reddish-brown siltstone, basalt and diabase; reaction to acid: very weak	trace weathered clasts	subangular chips to 0.6 cm
2,880 - 2,890	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: very weak		subangular to subrounded chips to 0.8 cm
2,890 - 2,900	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: very weak		subangular to subrounded chips to 0.9 cm
2,900 - 2,910	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: none		subangular to subrounded chips to 1.1 cm
2,910 - 2,920	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: none		subangular to subrounded chips to 0.8 cm
2,920 - 2,930	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: none		subangular to subrounded chips to 0.6 cm
2,930 - 2,940	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: none		subangular to subrounded chips to 0.8 cm

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2,940 - 2,950	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: none		subangular to subrounded chips to 0.5 cm
2,950 - 2,960	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: none		subangular to subrounded chips to 0.5 cm
2,960 - 2,970	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: none		subangular to subrounded chips to 0.7 cm
2,970 - 2,980	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: none	very weathered clasts of tuff	subangular to subrounded chips to 1.3 cm
2,980 - 2,990	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: none	very weathered clasts of tuff	subangular to subrounded chips to 1.1 cm
2,990 - 3,000	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: none	very weathered clasts of tuff	subangular to subrounded chips to 1.4 cm
3,000 - 3,010	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: weak to moderate	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 1.6 cm
3,010 - 3,020	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with trace grayish-brown siltstone; trace magnetite; reaction to acid: moderate	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 1.1 cm

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3,020 - 3,030	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some gray chert; trace magnetite; reaction to acid: moderate	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 1.4 cm
3,030 - 3,040	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some grayish-green pumice and gray chert; trace magnetite; reaction to acid: weak to moderate	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 0.9 cm
3,040 - 3,050	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some grayish-green pumice and gray chert; trace magnetite; reaction to acid: weak to moderate	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 1.6 cm
3,050 - 3,060	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some grayish-green pumice and gray/orange chert; trace magnetite; reaction to acid: weak	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 1.4 cm
3,060 - 3,070	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some grayish-green pumice, light gray tuff and gray/orange chert; trace magnetite; reaction to acid: none to weak	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 1.7 cm
3,070 - 3,080	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some light gray tuff and gray/orange chert; trace pumice and magnetite; reaction to acid: none to weak	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 1.3 cm
3,080 - 3,090	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some light gray tuff and gray/orange chert; trace pumice and magnetite; reaction to acid: weak	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 1.4 cm
3,090 - 3,100	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some light gray tuff and gray/orange chert; trace pumice and magnetite; reaction to acid: weak	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 1.1 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
3,100 - 3,110	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some light gray tuff and gray/orange chert; trace pumice and magnetite; reaction to acid: weak	very weathered clasts of tuff; trace iron oxide staining (hematite)	subangular to subrounded chips to 0.9 cm
3,110 - 3,120	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some gray/orange chert; trace pumice and magnetite; reaction to acid: weak	trace weathered clasts of tuff; trace iron oxide staining (hematite)	subrounded chips to 1.3 cm
3,120 - 3,130	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some brown-gray siltstone; trace magnetite; reaction to acid: very weak	trace weathered clasts of tuff; trace iron oxide staining (hematite)	subrounded chips to 1.5 cm
3,130 - 3,140	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some brown-gray siltstone; trace magnetite; reaction to acid: very weak	trace weathered clasts of tuff; trace iron oxide staining (hematite)	subrounded chips to 1.1 cm
3,140 - 3,150	**Tg**	tuff (Tal) dominated conglomerate; well lithified; conglomerate consisting mostly of clasts of reddish-brown tuff (Tal) with some brown-gray siltstone; trace magnetite; reaction to acid: none	trace weathered clasts of tuff; trace iron oxide staining (hematite)	subrounded chips to 1.0 cm
APACHE LEAP TUFF - White Unit (Talw)				
3,150 - 3,160	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic to crystalline groundmass containing 70% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); non-welded; reaction to acid: none		subrounded chips to 1.5 cm
3,160 - 3,170	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); non-welded; reaction to acid: none		subrounded chips to 1.2 cm
3,170 - 3,180	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); non-welded; reaction to acid: none		subrounded chips to 1.4 cm

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3,180 - 3,190	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); non-welded; reaction to acid: none		subrounded chips to 1.3 cm
3,190 - 3,200	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); non-welded; reaction to acid: none		subrounded chips to 1.1 cm
3,200 - 3,210	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown sandstone and gray siltstone; non-welded; reaction to acid: none		subrounded chips to 1.3 cm
3,210 - 3,220	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); some lithic fragments of brown sandstone and gray siltstone; non-welded; reaction to acid: none		subangular to subrounded chips to 0.8 cm
3,220 - 3,230	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); some lithic fragments of brown sandstone and gray siltstone; non-welded; reaction to acid: none		subangular to subrounded chips to 1.3 cm
3,230 - 3,240	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); some lithic fragments of brown sandstone and gray siltstone; non-welded; reaction to acid: none	trace iron oxide staining (hematite)	subangular to subrounded chips to 1.0 cm
3,240 - 3,250	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); some lithic fragments of brown sandstone and gray siltstone; non-welded; reaction to acid: none		subangular to subrounded chips to 0.7 cm

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3,250 - 3,260	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); non-welded; reaction to acid: none		subangular to subrounded chips to 0.9 cm
3,260 - 3,270	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice and lithic fragments of brown sandstone and gray siltstone; non-welded; reaction to acid: none		subangular to subrounded chips to 1.1 cm
3,270 - 3,280	**Talw**	White Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic, pinkish-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); some lithic fragments of brown sandstone; trace pumice; non-welded; reaction to acid: none		subangular to subrounded chips to 1.5 cm
APACHE LEAP TUFF - Gray Unit (Talg)				
3,280 - 3,290	**Talg**	Gray Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic to micrcrystalline, light brown-pink groundmass containing 70% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; reaction to acid: none		subangular to subrounded chips to 2.0 cm
3,290 - 3,300	**Talg**	Gray Unit; moderately to well lithified; Crystal rich dacite tuff with aphanitic to micrcrystalline, light brown-pink groundmass containing 70% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; reaction to acid: none		subangular to subrounded chips to 1.8 cm
3,300 - 3,310	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 70% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown siltstone and pumice; reaction to acid: none to moderate	trace calcite on fracture surfaces	subangular to subrounded chips to 1.6 cm
3,310 - 3,320	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 70% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown siltstone and pumice; reaction to acid: none		subangular chips to 1.0 cm

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3,320 - 3,330	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 70% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown siltstone and pumice; reaction to acid: none	trace iron oxide staining (hematite)	subangular chips to 1.1 cm
3,330 - 3,340	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 70% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown siltstone and pumice; reaction to acid: none		subangular chips to 1.1 cm
3,340 - 3,350	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown siltstone and pumice; reaction to acid: none		subangular chips to 1.3 cm
3,350 - 3,360	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown siltstone and pumice; reaction to acid: none		subangular chips to 1.0 cm
3,360 - 3,370	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); some pumice; trace lithic fragments of brown siltstone; reaction to acid: none		subangular chips to 0.8 cm
3,370 - 3,380	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); some pumice; trace lithic fragments of brown siltstone; reaction to acid: none		subangular chips to 0.9 cm
3,380 - 3,390	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of brown siltstone; reaction to acid: none		subangular chips to 0.8 cm

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DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
3,390 - 3,400	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (<1 mm); trace pumice; trace lithic fragments of brown siltstone; reaction to acid: none		subangular chips to 1.0 cm
3,400 - 3,410	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (<1 mm); trace pumice; trace lithic fragments of black sandstone; reaction to acid: none		subangular chips to 1.4 cm
3,410 - 3,420	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (<1 mm); trace pumice; trace lithic fragments of black sandstone; reaction to acid: none		subangular chips to 0.8 cm
3,420 - 3,430	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (<1 mm); trace pumice; trace lithic fragments of reddish-brown siltstone; reaction to acid: none	trace iron oxide staining (hematite and limonite)	subangular chips to 1.1 cm
3,430 - 3,440	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with aphanitic, brown-pink groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (<1 mm); trace pumice; trace lithic fragments of reddish-brown siltstone; reaction to acid: none		subangular chips to 1.0 cm
3,440 - 3,450	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray and red-brown groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (1 mm); trace pumice; trace lithic fragments of grayish-brown siltstone; reaction to acid: none	trace iron oxide staining (limonite)	subangular chips to 0.9 cm
3,450 - 3,460	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray and red-brown groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (1 mm); trace pumice; trace lithic fragments of grayish-brown siltstone; reaction to acid: none		subangular chips to 0.7 cm

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3,460 - 3,470	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (1 mm); trace pumice; trace lithic fragments of grayish-brown siltstone; reaction to acid: none	trace iron oxide staining (limonite)	subangular chips to 0.8 cm
3,470 - 3,480	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (1 mm); trace pumice; trace lithic fragments of grayish-brown siltstone; reaction to acid: none		subangular chips to 1.2 cm
3,480 - 3,490	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (1 mm); trace pumice; trace lithic fragments of grayish-brown siltstone; reaction to acid: none		subangular chips to 1.0 cm
3,490 - 3,500	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (1 mm); trace pumice; trace lithic fragments of grayish-brown siltstone; reaction to acid: none		subangular chips to 1.1 cm
3,500 - 3,510	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone; reaction to acid: none		subangular chips to 0.9 cm
3,510 - 3,520	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone; reaction to acid: none		subangular chips to 1.1 cm
3,520 - 3,530	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; reaction to acid: none		subangular chips to 1.3 cm

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3,530 - 3,540	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; reaction to acid: none		subangular chips to 0.8 cm
3,540 - 3,550	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; reaction to acid: none		subangular chips to 0.8 cm
3,550 - 3,560	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 65% phenocrysts of plagioclase, quartz and biotite (up to 2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; reaction to acid: none		subangular chips to 0.7 cm
3,560 - 3,570	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; reaction to acid: none		subangular chips to 1.0 cm
3,570 - 3,580	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-gray groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; reaction to acid: none		subangular chips to 1.0 cm
3,580 - 3,590	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; common magnetite; reaction to acid: none		subangular chips to 1.3 cm
3,590 - 3,600	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; common magnetite; reaction to acid: none		subangular chips to 1.0 cm

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3,600 - 3,610	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; common magnetite; trace tuff with white-gray groundmass; reaction to acid: none		subangular chips to 1.4 cm
3,610 - 3,620	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; common magnetite; trace tuff with white-gray groundmass; reaction to acid: none		subangular chips to 0.9 cm
3,620 - 3,630	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; common magnetite; trace tuff with white-gray groundmass; reaction to acid: none		subangular chips to 0.9 cm
3,630 - 3,640	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; common magnetite; reaction to acid: none		subangular chips to 0.7 cm
3,640 - 3,650	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; common magnetite; reaction to acid: none		subangular chips to 0.7 cm
3,650 - 3,660	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of grayish-brown siltstone and dark red tuff; common magnetite; reaction to acid: none to weak	trace calcite	subangular chips to 0.9 cm

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3,660 - 3,670	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of brown siltstone; common magnetite; reaction to acid: none		subangular chips to 1.0 cm
3,670 - 3,680	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of brown siltstone; common magnetite; reaction to acid: none		subangular chips to 0.8 cm
3,680 - 3,690	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of brown siltstone; common magnetite; reaction to acid: none		subangular chips to 0.7 cm
3,690 - 3,700	**Talg**	Gray Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of brown siltstone; common magnetite; reaction to acid: none		subangular chips to 0.7 cm
APACHE LEAP TUFF - Brown Unit (Talb)				
3,700 - 3,710	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of brown siltstone; common magnetite; reaction to acid: none		subangular chips to 0.9 cm
3,710 - 3,720	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with microcrystalline, pink-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace pumice; trace lithic fragments of black sandstone; common magnetite; reaction to acid: none to weak	trace calcite	subangular chips to 0.6 cm
3,720 - 3,730	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with microcrystalline, reddish-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; common magnetite; reaction to acid: none		subangular chips to 0.8 cm

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3,730 - 3,740	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with microcrystalline, reddish-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; common magnetite; reaction to acid: none		subangular chips to 0.7 cm
3,740 - 3,750	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with microcrystalline, reddish-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; some magnetite; trace pumice; reaction to acid: none	trace iron oxide staining	subangular chips to 0.8 cm
3,750 - 3,760	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with microcrystalline, reddish-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; some magnetite; trace pumice; reaction to acid: none	trace iron oxide staining	subangular chips to 0.9 cm
3,760 - 3,770	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with aphanitic to glassy, reddish-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; some magnetite; trace pumice; reaction to acid: none to very weak	trace calcite	subangular chips to 1.5 cm
3,770 - 3,780	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with aphanitic to glassy, reddish-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; trace magnetite; trace pumice; reaction to acid: none to very weak		subangular chips to 0.7 cm
3,780 - 3,790	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with aphanitic to glassy, orange-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; trace magnetite; trace pumice; reaction to acid: very weak	trace calcite	subangular chips to 0.4 cm
3,790 - 3,800	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with aphanitic to glassy, orange-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; trace magnetite; some pumice; reaction to acid: none	trace iron oxide staining (hematite); trace quartz vein	subangular chips to 0.8 cm

APPENDIX C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM GROUTED PIEZOMETER DHRES-16 [*55-917232*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
3,800 - 3,810	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with aphanitic to glassy, orange-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; trace magnetite; some pumice; reaction to acid: none	trace quartz vein	subangular chips to 1.9 cm
3,810 - 3,820	**Talb**	Brown Unit; well lithified; Crystal rich dacite tuff with aphanitic to glassy, orange-brown groundmass containing 60% phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; trace magnetite; some pumice; reaction to acid: none	trace quartz vein	subangular chips to 0.7 cm
3,820 - 3,830	**Talb**	Brown Unit / Vitrphyre; well lithified; 65% crystal rich dacite tuff with glassy, orange-brown groundmass containing phenocrysts of plagioclase, quartz and biotite (up to 1-2 mm); trace lithic fragments of brown and yellow siltstone; trace magnetite; some pumice; 35% black, glassy vitrophyre; reaction to acid: very weak	trace calcite	subangular chips to 0.8 cm
APACHE LEAP TUFF - Vitrophyre (Talv)				
3,830 - 3,840	**Talv**	Vitrphyre; well lithified; black, glassy vitrophyre with biotite phenocrysts; trace orange glassy tuff; reaction to acid: none	trace quartz vein	subangular chips to 0.8 cm
3,840 - 3,850	**Talv**	Vitrphyre; well lithified; 80% black, glassy vitrophyre with biotite phenocrysts; 20% reddish-brown and orange glassy tuff; some magnetite; reaction to acid: none	trace quartz vein	subangular chips to 0.9 cm
3,850 - 3,860	**Talv**	Vitrphyre; well lithified; black, glassy vitrophyre with biotite phenocrysts; trace reddish-brown and orange glassy tuff; some magnetite; reaction to acid: none		subangular chips to 0.6 cm
APACHE LEAP TUFF - Basal Tuff (Talbt)				
3,860 - 3,870	**Talbt**	Vitrphyre / Basal Tuff; well lithified; 60% basal tuff with 70% gray, aphanitic groundmass and 30% phenocrysts of biotite, plagioclase and quartz; 30% black, glassy vitrophyre; 10% dacite tuff with orange, glassy groundmass; reaction to acid: none	trace clear quartz vein; trace iron oxide staining (hematite)	subangular chips to 1.5 cm
MARTIN FORMATION (Dm)				
3,870 - 3,880	**Dm**	limestone; well lithified; 65% light-dark gray silty limestone; 30% white silty limestone; 5% reddish-brown siltstone; trace basal tuff; reaction to acid: very strong	trace clear quartz vein; trace iron oxide staining (hematite)	angular chips to 0.3 cm

APPENDIX C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM GROUTED PIEZOMETER DHRES-16 [*55-917232*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
3,880 - 3,890	**Dm**	limestone; well lithified; 70% medium-dark gray and brownish-gray silty limestone; 30% white silty limestone; trace brown siltstone; reaction to acid: very strong	some iron oxide staining (hematite)	angular chips to 0.9 cm
3,890 - 3,900	**Dm**	limestone; well lithified; 95% light grayish-white silty limestone; 5% medium gray silty limestone; trace dark gray limestone; trace pinkish-gray limestone; reaction to acid: very strong	trace iron oxide staining (hematite)	angular chips to 1.0 cm
3,900 - 3,910	**Dm**	limestone; well lithified; medium-dark gray and brownish-gray silty limestone; trace light grayish-white silty limestone; trace red siltstone; reaction to acid: very strong	trace clear quartz vein; trace iron oxide staining (hematite)	angular chips to 0.8 cm
3,910 - 3,920	**Dm**	limestone; well lithified; 75% medium-dark gray and brownish-gray silty limestone; 25% light grayish-white silty limestone; trace brown siltstone; reaction to acid: very strong	trace iron oxide staining (hematite)	angular chips to 0.4 cm
3,920 - 3,930	**Dm**	limestone; well lithified; 70% medium-dark gray and brownish-gray, fine-grained limestone; 30% trace reddish-brown siltstone; reaction to acid: strong	trace iron oxide staining (hematite)	angular chips to 1.3 cm
3,930 - 3,940	**Dm**	limestone; well lithified; 95% medium-dark gray and brownish-gray, fine-grained limestone; 5% trace reddish-brown siltstone; reaction to acid: very strong	trace clear quartz vein; trace iron oxide staining (hematite)	angular to subangular chips to 1.2 cm
3,940 - 3,950	**Dm**	limestone; well lithified; 95% medium gray, fine-grained limestone; 5% purplish-brown chert; trace white chert; reaction to acid: very strong	trace clear quartz vein; trace iron oxide veins (hematite)	angular chips to 1.4 cm
3,950 - 3,960	**Dm**	limestone; well lithified; 70% medium gray, fine-grained limestone; 30% reddish-brown siltstone (non-calcareous); reaction to acid: very strong	trace iron oxide veins (hematite)	angular chips to 1.0 cm
3,960 - 3,970	**Dm**	limestone; well lithified; 98% medium gray, fine-grained limestone; pinkish-white chert; reaction to acid: very strong	trace iron oxide (hematite)	angular to subangular chips to 1.4 cm
3,970 - 3,980	**Dm**	limestone; well lithified; 55% grayish-white, fine-grained limestone; 35% medium gray, fine-grained limestone; 10% reddish-brown siltstone; trace white chert; reaction to acid: very strong	minor iron oxide (hematite)	angular to subangular chips to 1.0 cm

APPENDIX C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM GROUTED PIEZOMETER DHRES-16 [*55-917232*]
RESOLUTION
PINAL COUNTY, ARIZONA

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
INTRUSIVE (TKg)				
3,980 - 3,990	**TKg**	dike; well lithified; black volcanic intrusive with 80% microcrystalline groundmass; 20% phenocrysts of quartz and plagioclase (up to 2 mm); reaction to acid: moderate	minor iron oxide (hematite)	angular chips to 1.0 cm
MARTIN FORMATION (Dm)				
3,990 - 4,000	**Dm**	limestone; well lithified; light gray and pink, silty limestone; trace black volcanic intrusive chips; trace black shale; trace pinkish-white chert; trace medium gray limestone; reaction to acid: strong	trace calcite	angular to subangular chips to 0.5 cm
4,000 - 4,010	**Dm**	limestone; well lithified; 60% light gray, silty limestone; 40% light pink, silty limestone; trace black shale; trace black volcanic intrusive chips; reaction to acid: very strong		angular to subangular chips to 1.0 cm
4,010 - 4,020	**Dm**	limestone; well lithified; 95% light gray, silty limestone; 5% light pink, silty limestone; trace orange chert; reaction to acid: very strong		angular chips to 0.8 cm
4,020 - 4,030	**Dm**	limestone; well lithified; 95% light medium gray, silty limestone; 3% white, gray and pink chert; 2% brown siltstone; trace dark gray limestone; reaction to acid: very strong	trace iron oxide staining (hematite)	angular to subangular chips to 0.8 cm
4,030 - 4,040	**Dm**	limestone; well lithified; 70% brown, well-lithified limestone; 30% medium gray, silty limestone; reaction to acid: very strong		angular chips to 0.5 cm
4,040 - 4,050	**Dm**	limestone; well lithified; 80% light medium gray, silty limestone; 20% brown, well-lithified siltstone; reaction to acid: very strong	trace calcite	angular chips to 0.5 cm
4,050 - 4,060	**Dm**	limestone; well lithified; 95% medium gray, silty limestone; 5% brown, well-lithified siltstone; reaction to acid: very strong	trace iron oxide staining (hematite)	angular chips to 0.6 cm
4,060 - 4,070	**Dm**	limestone; well lithified; light medium gray, silty limestone; trace brown, well-lithified siltstone; reaction to acid: very strong	trace quartz vein; trace iron oxide staining (hematite)	angular chips to 0.4 cm
4,070 - 4,080	**Dm**	limestone; well lithified; medium gray, fine-grained limestone; reaction to acid: very strong	trace iron oxide staining (hematite)	angular chips to 0.4 cm
4,080 - 4,085	**Dm**	limestone; well lithified; medium gray, fine-grained limestone; reaction to acid: very strong		angular chips to 0.3 cm

APPENDIX D

BOREHOLE GEOPHYSICAL LOGS
(IDS, SWE, BHI)

(SENT AS SEPERATE FILE)

APPENDIX D

BOREHOLE GEOPHYSICAL LOGS
(IDS, SWE, BHI)

APPENDIX D

Borehole Geophysical Logs from Well HRES-21
Conducted by IDS; interval 0 – 1,380 feet

Layne Christensen Co.

12030 E. Riggs Rd.
Chandler, AZ. 85249
Phone: (480) 895-9404

Well Inspection Report

CLIENT: Montgomery & Associates
ADDRESS:
CONTACT: Megan Zivic
JOB LOCATION: Resolution Copper

WELL NUMBER: HRES-21 | **JOB NUMBER:** IDS/Colog

SURVEYED BY: Wes Van Allen | **DATE:** 24-May-14

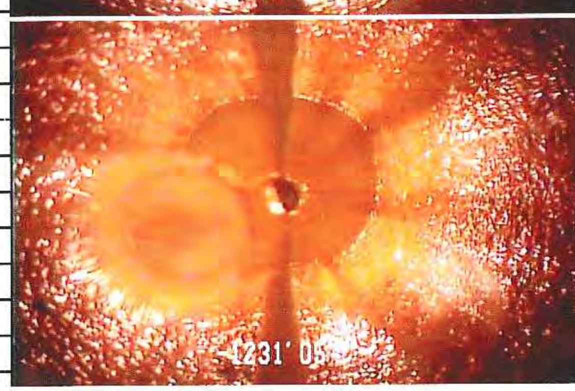
REVIEWED BY: | **WATER LEVEL:** 1233'10"

WATER CONDITION: Very cloudy | **TOTAL DEPTH:** 1380'

CASING DIAMETER: Borehole 15" | **SURVEY DEPTH:** 1241'01"

NOTES:Zero was at top of the drill table. Drill table is 5'00" above ground level.

DEPTH	REMARKS
0-	Zero at top of table
46'01"	Bottom of surface casing
935'03"	Water entering borehole
965'05"	Water entering borehole
977'00"	Water entering from fracture
1046'09"	Borehole changes diameter to 14"3/4"
1233'10"	Static water level (dirty water)
1241'01"	End survey due to no visibility



COLOG Group - Borehole Geophysics

810 Quail Street
Suite E
Lakewood, Colorado
80215
Office: 303.279.0171
Fax: 303.278.0135
www.idsdrill.com

Natural Gamma
16" & 64" Normal Resistivities
Spontaneous Potential
Single Point Resistance
Caliper

Company Rio Tinto
Well HRES21
Field Resolution Copper
County Pinal
State AZ

COMPANY Rio Tinto
WELL HRES21
FIELD Resolution Copper
COUNTY Pinal **STATE** AZ

LOCATION

QTR **SEC** **TWP** **RGE**

OTHER SERVICES
Optical Televiewer
Acoustic Televiewer
Full Waveform Sonic
Dual Induction

PERMANENT DATUM **ELEVATION**

LOG MEAS. FROM 0.0 ft **ABOVE PERMANENT DATUM**

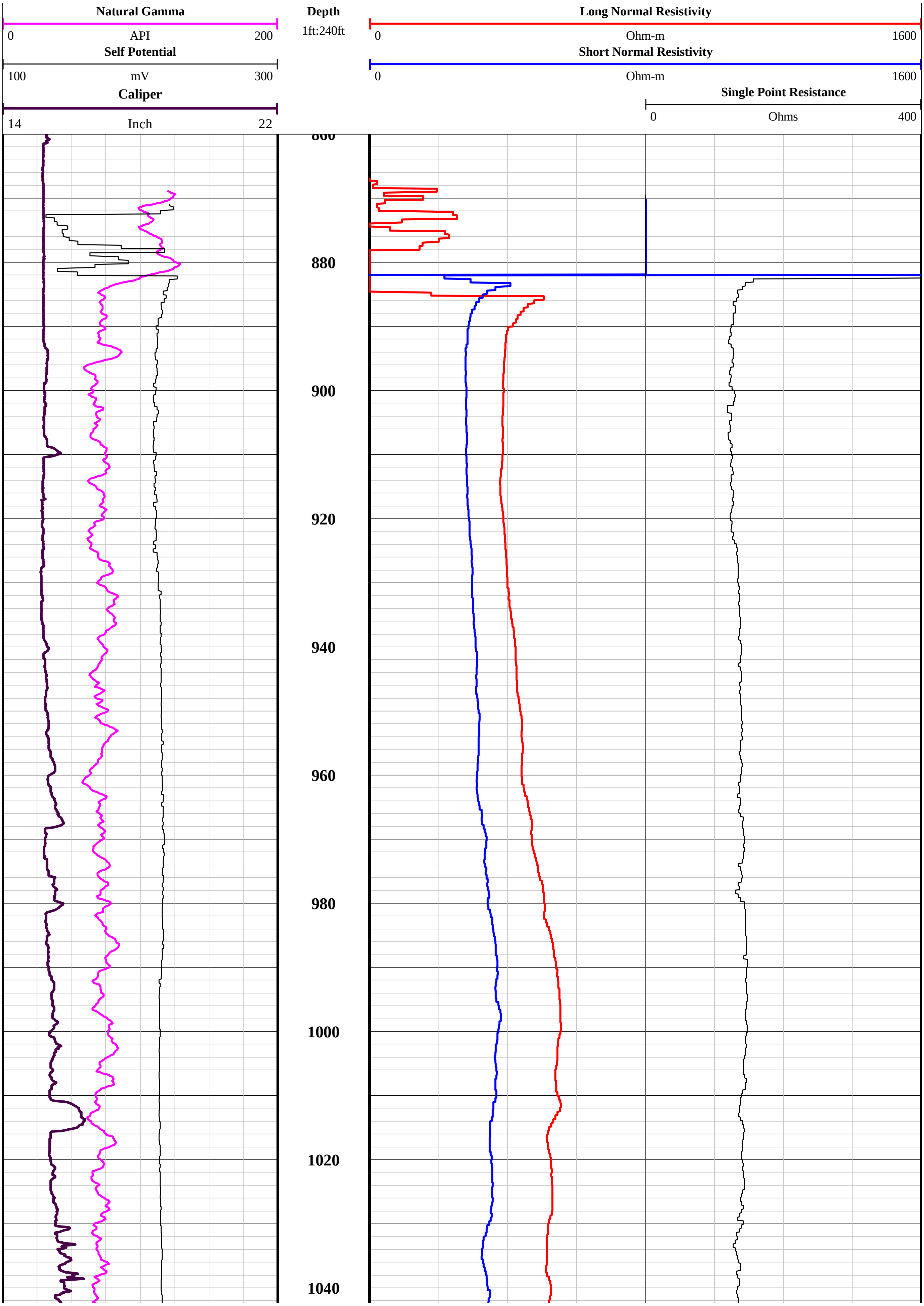
DRILLING MEAS. FROM

DATE ACQUIRED	5/24/2014	5/24/2014		
RUN NUMBER	8	6		
LOG TYPE	Electric Log	3-Arm Caliper		
DEPTH-DRILLER	1380ft	1380 ft		
DEPTH-LOGGER	1375ft	1375 ft		
BTM LOG INTERVAL	1375ft	1373 ft		
TOP LOG INTERVAL	871ft	1.2 ft		
RECORDED BY	C.ONeil	C. ONeil		
WITNESSED BY	M.Shelley	M. Shelly		
PROBE TYPE, S/N	ELXG	QL40-CAL 6601		
LOGGING SPEED	40 ft/min	18 ft/min		
A.S.D.E. / Sample Interval	0.3' / 0.25'	0.5', 0.01'		
Fluid Level / Fluid Type	882 ft	882 ft		

BOREHOLE RECORD				CASING RECORD			
RUN No.	**BIT**	**FROM**	**TO**	**SIZE**	**WGT.**	**FROM**	**TO**

COMMENTS

NA - Not Available, N/A - Not Applicable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API
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Self Potential
100
mV
300
Caliper
14
Inch
22
Depth
1ft:240ft
Long Normal Resistivity
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Ohm-m
1600
Short Normal Resistivity
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Ohm-m
1600
Single Point Resistance
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Ohms
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980
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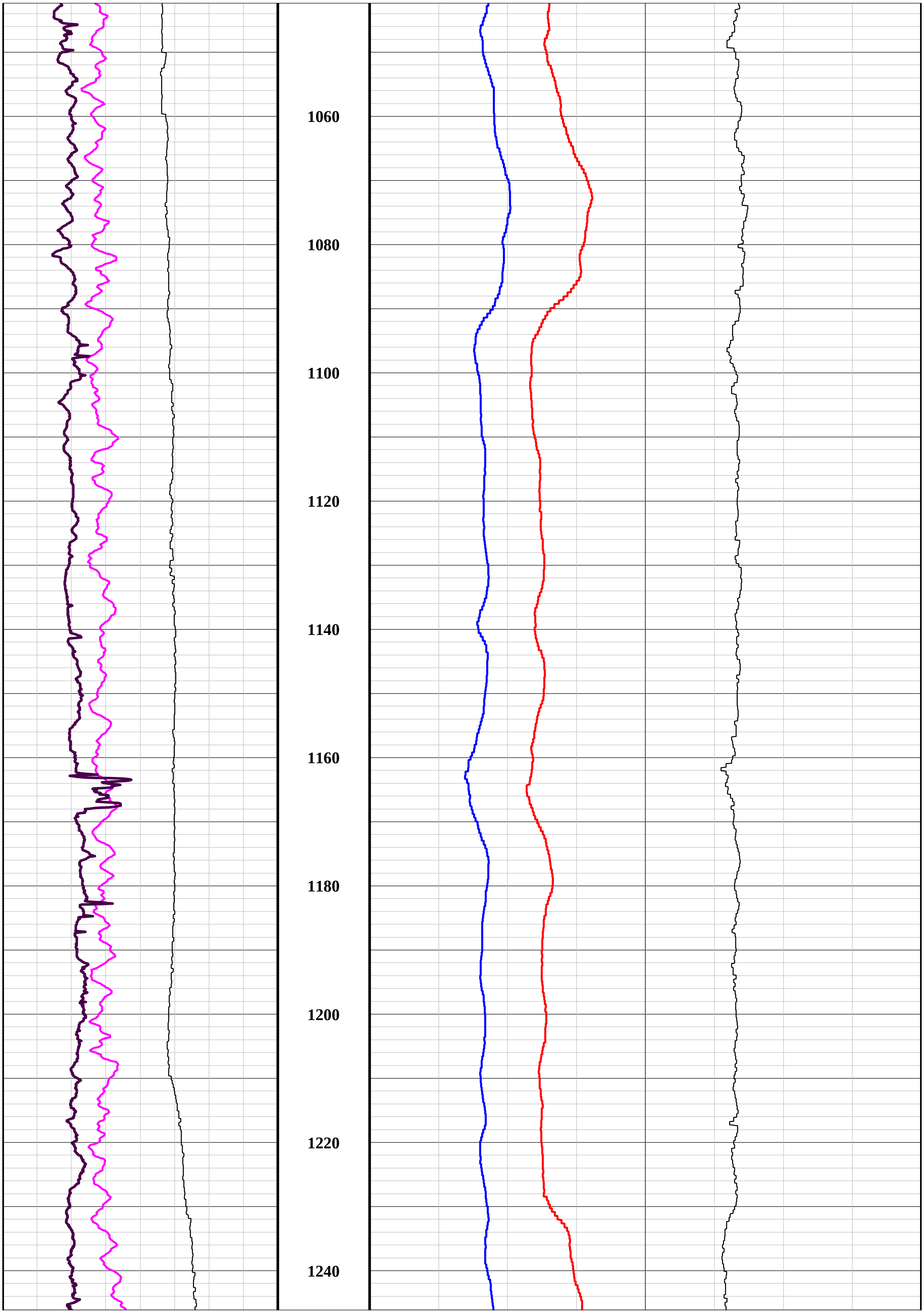
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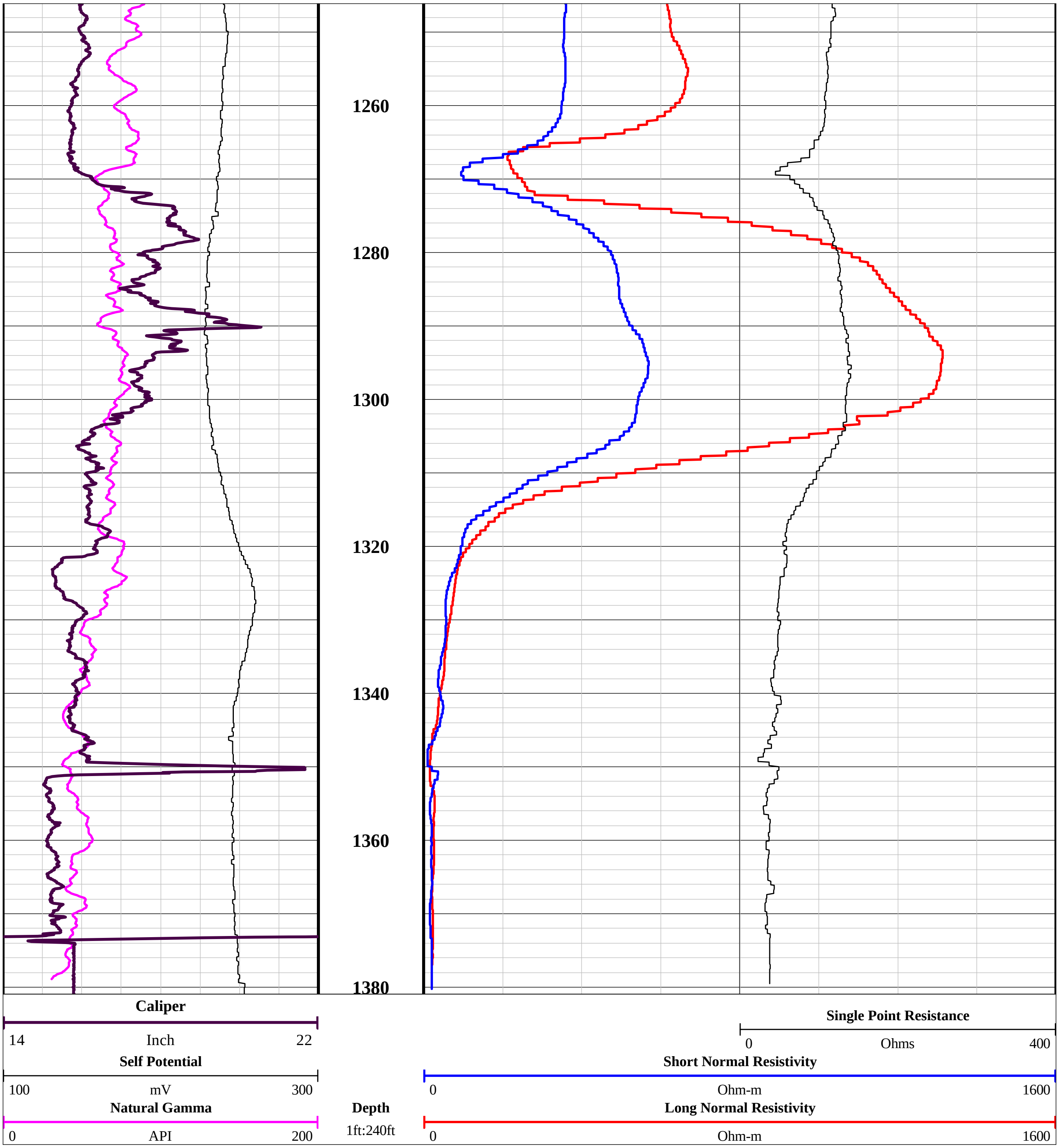
1240



1260
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1320
1340
1360
1380
Caliper
14
Inch
22
Self Potential
100
mV
300
Natural Gamma
0
API
200
Depth
1ft:240ft
Single Point Resistance
0
Ohms
400
Short Normal Resistivity
0
Ohm-m
1600
Long Normal Resistivity
0
Ohm-m
1600

IDS COLOG Group - Borehole Geophysics	Dual Induction		COLOG Main Office 810 Quail Street, Suite E, Lakewood, CO 80215 Phone: (303) 279-0171, Fax: (303) 278-0135 E-mail: colog@colog.com
	COMPANY: Resolution Copper	PROJECT: Cased Comparison	
	DATE LOGGED: 24 May 2014	WELL: HRES21	

Natural Gamma
0 CPS 200

Caliper
14 Inch 22

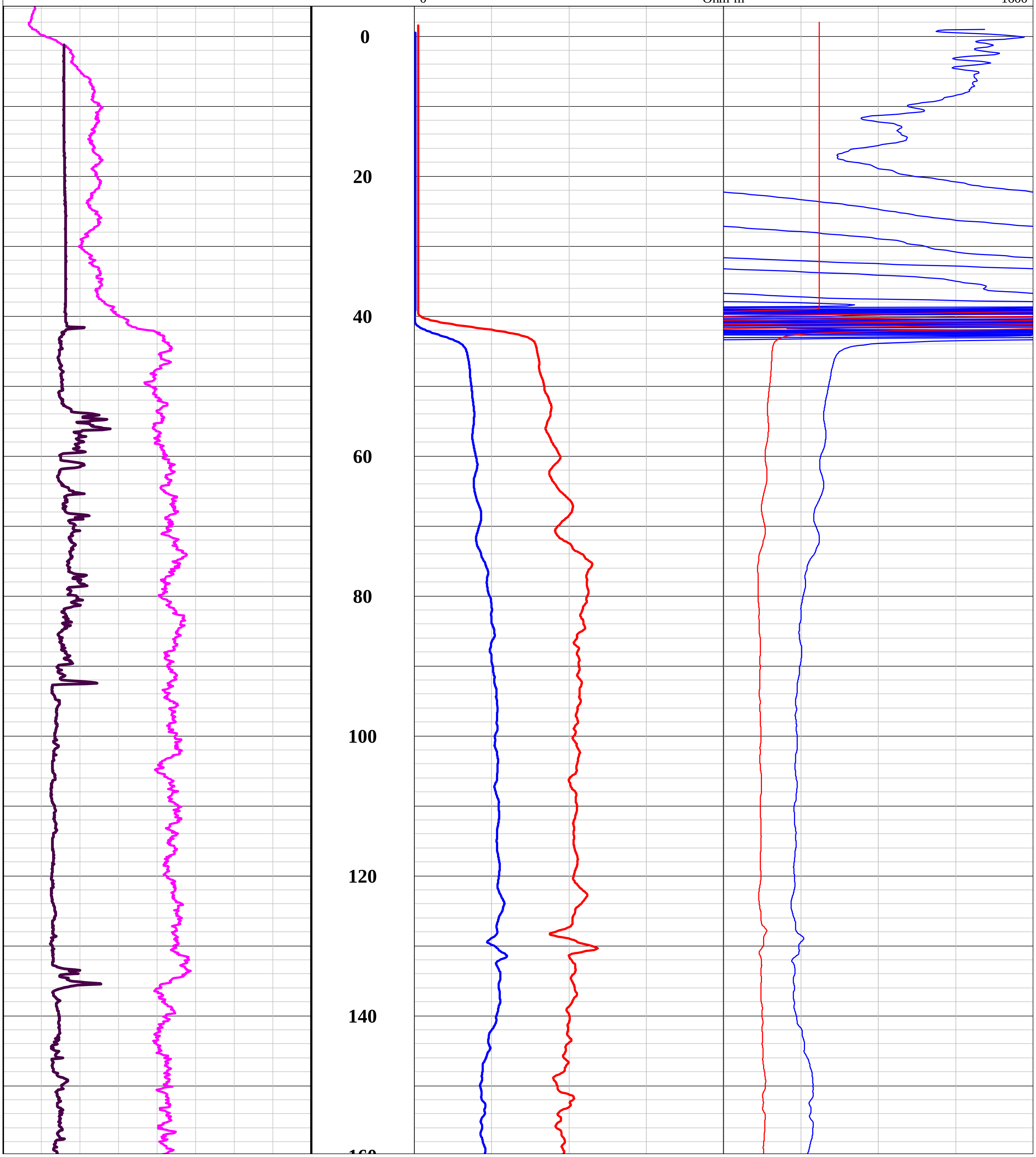
Depth
1ft:240ft

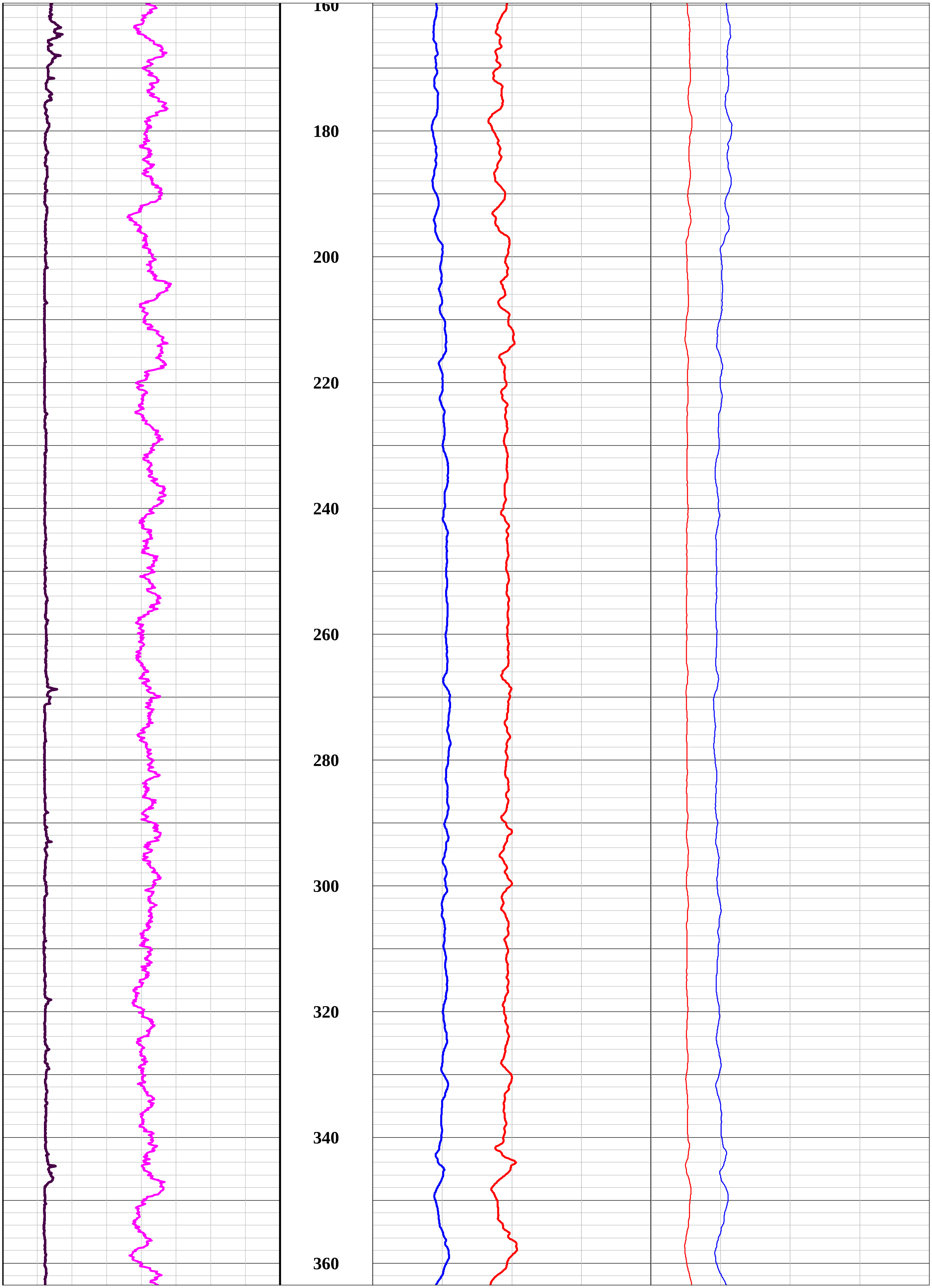
Short Induction Conductivity
0 mS/m 20

Long Induction Conductivity
0 mS/m 20

Long Induction Resistivity
0 Ohm-m 1600

Short Induction Resistivity
0 Ohm-m 1600

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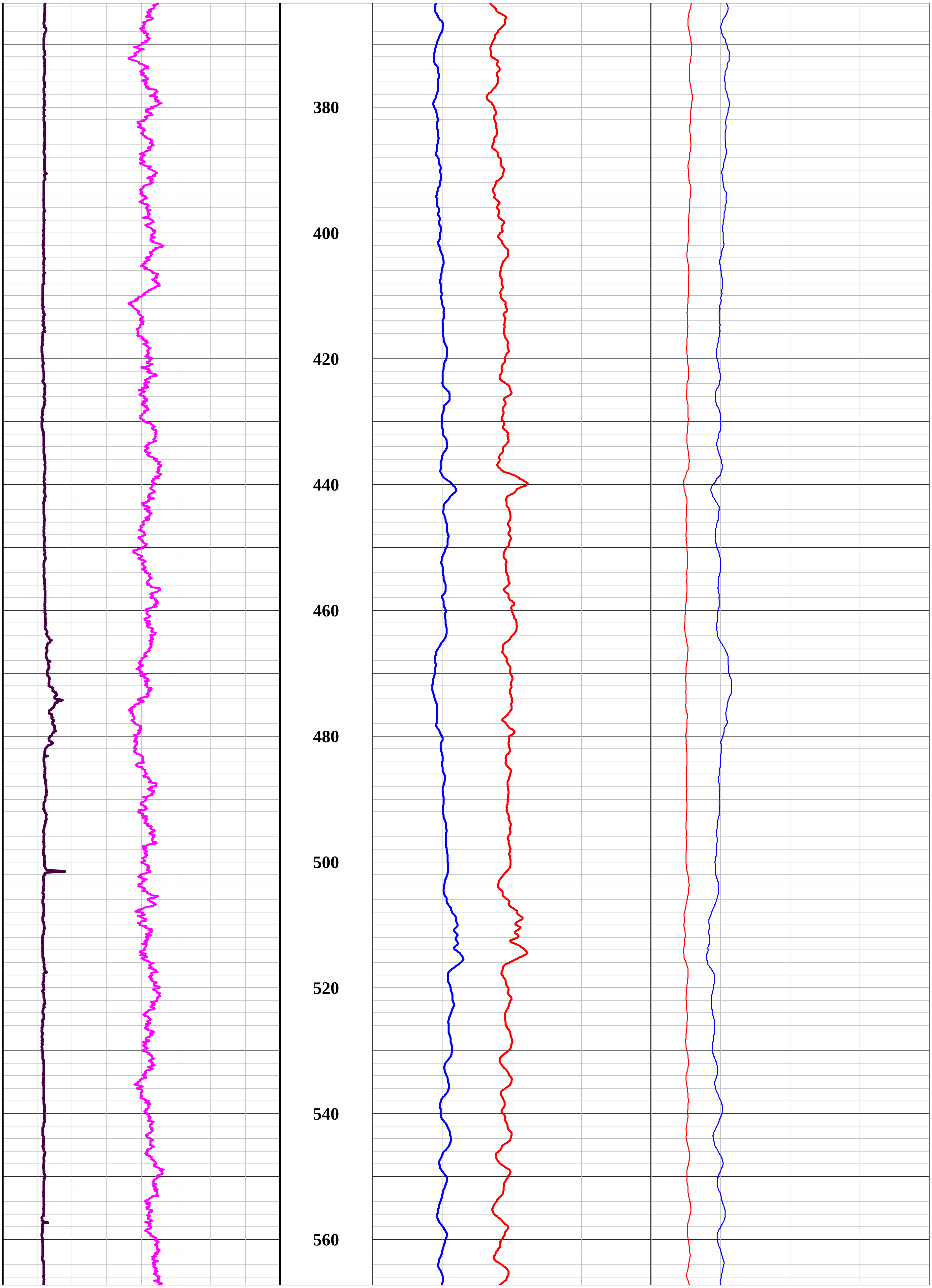
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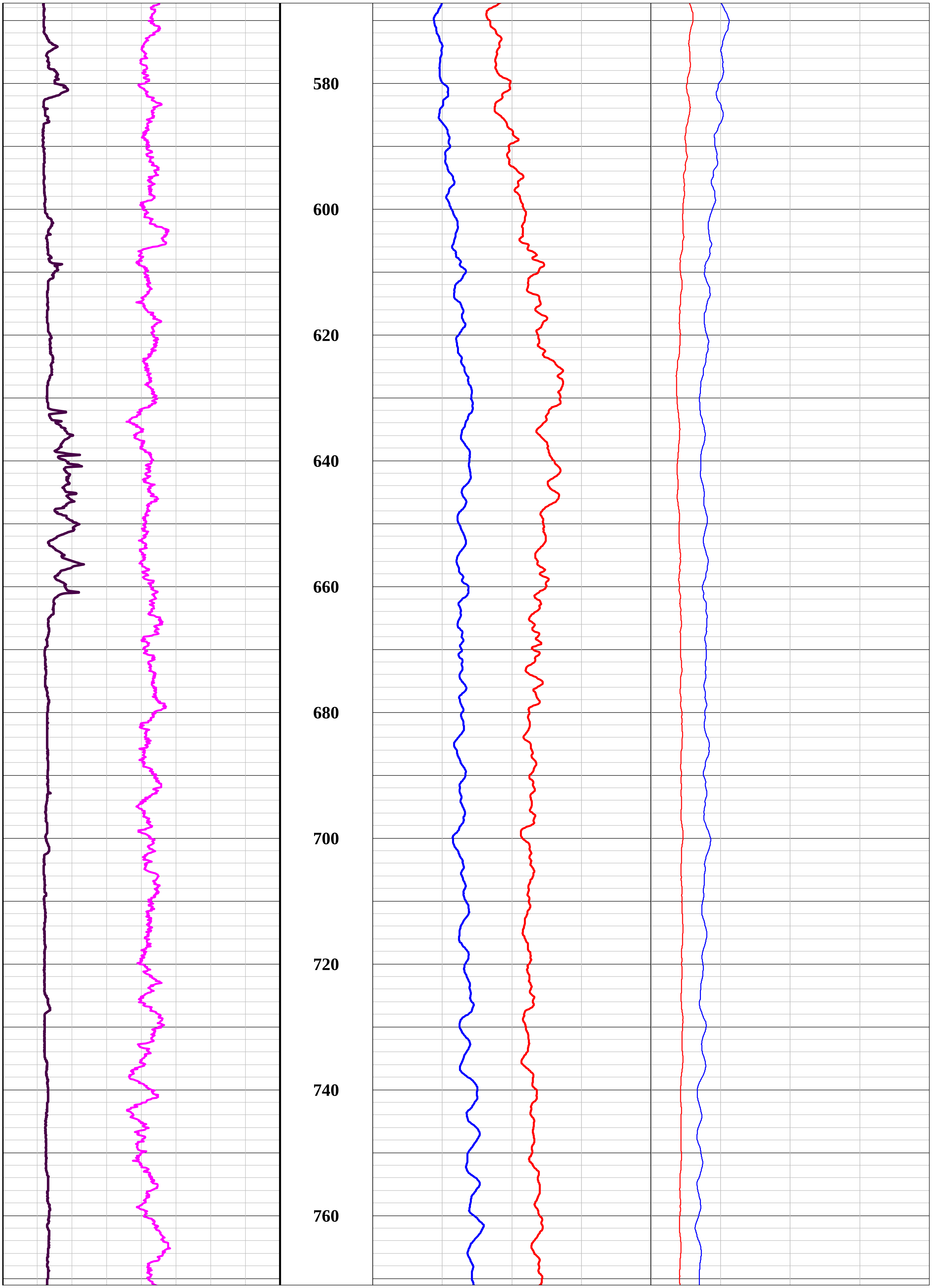
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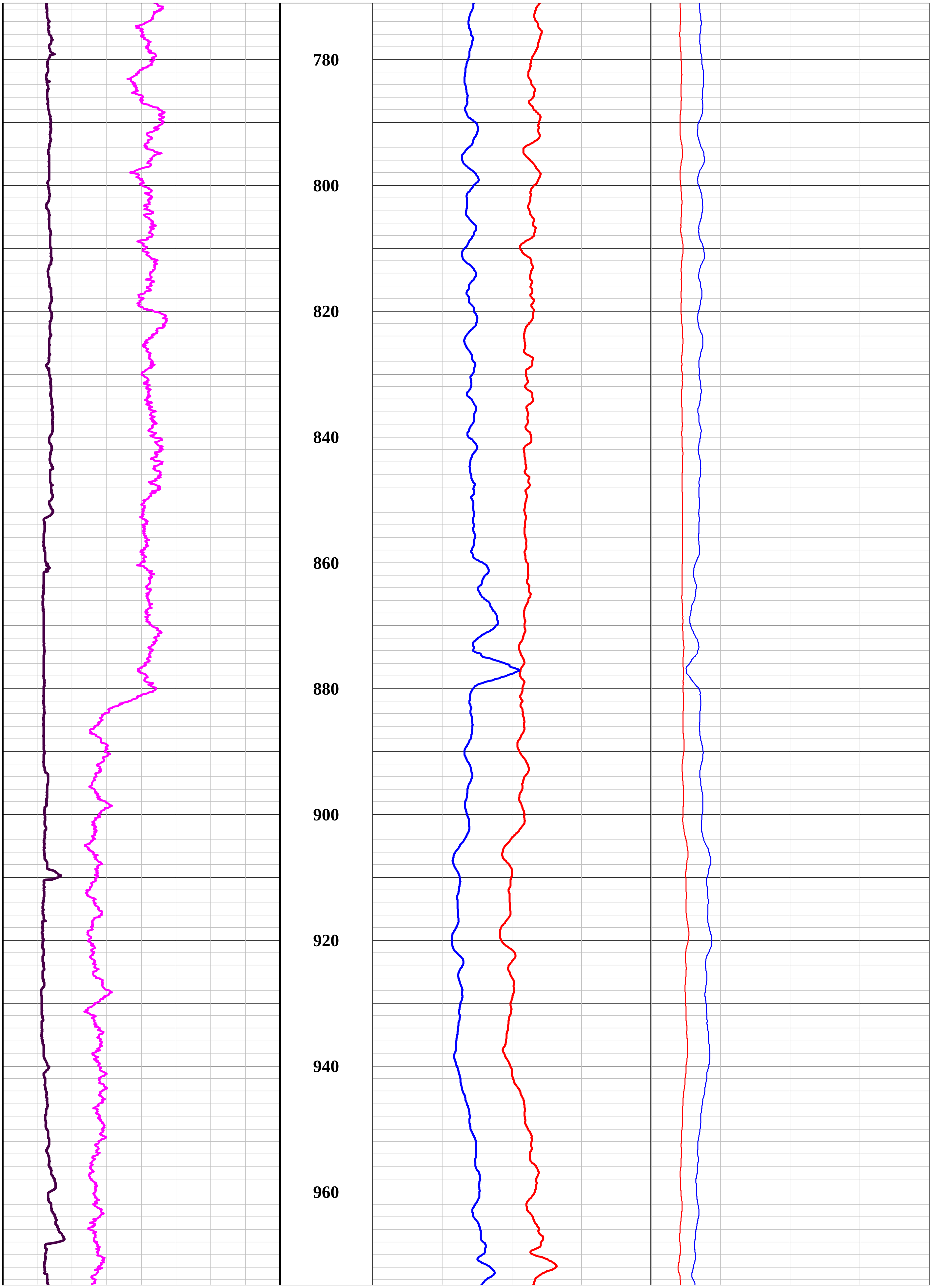
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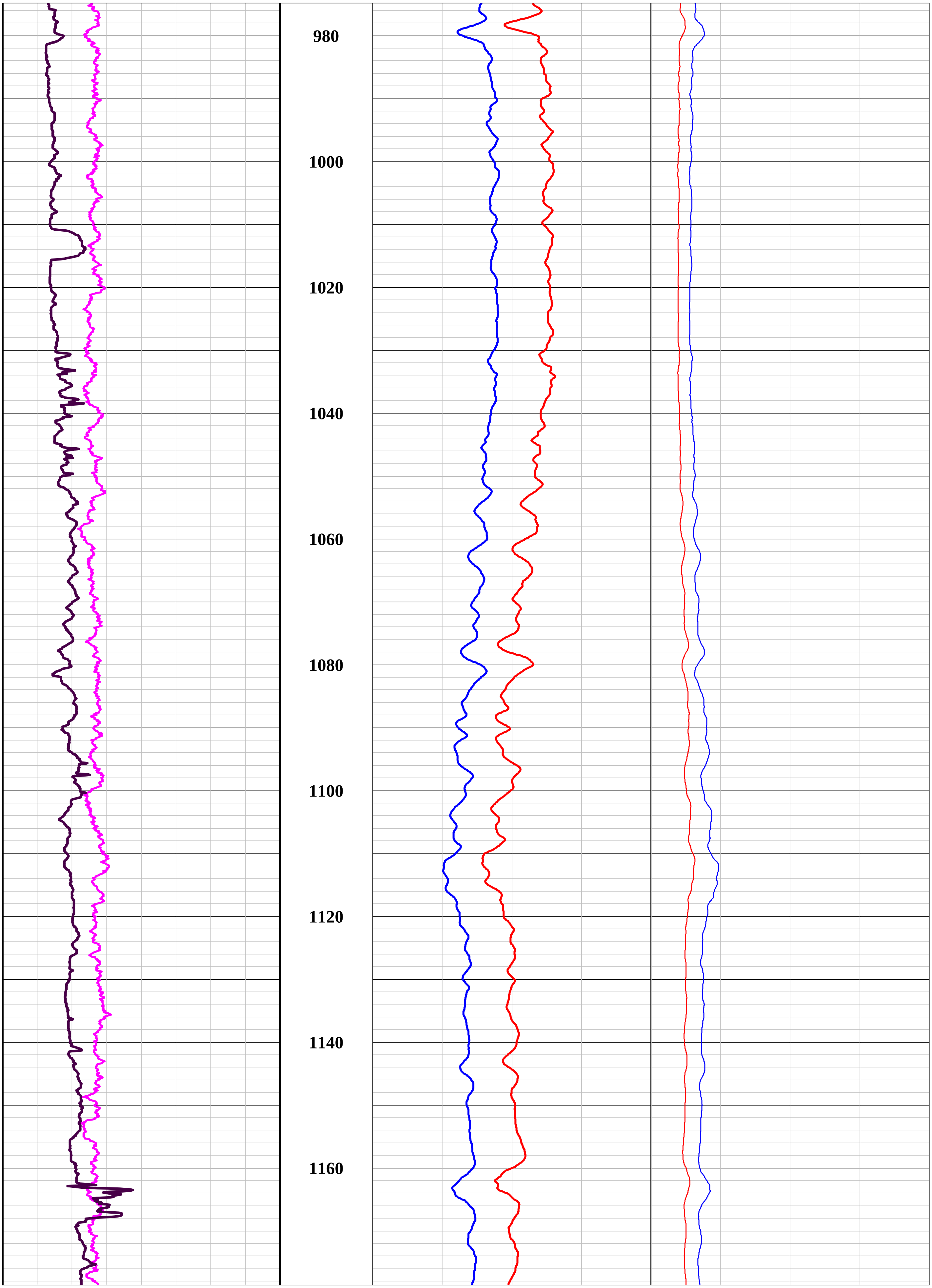

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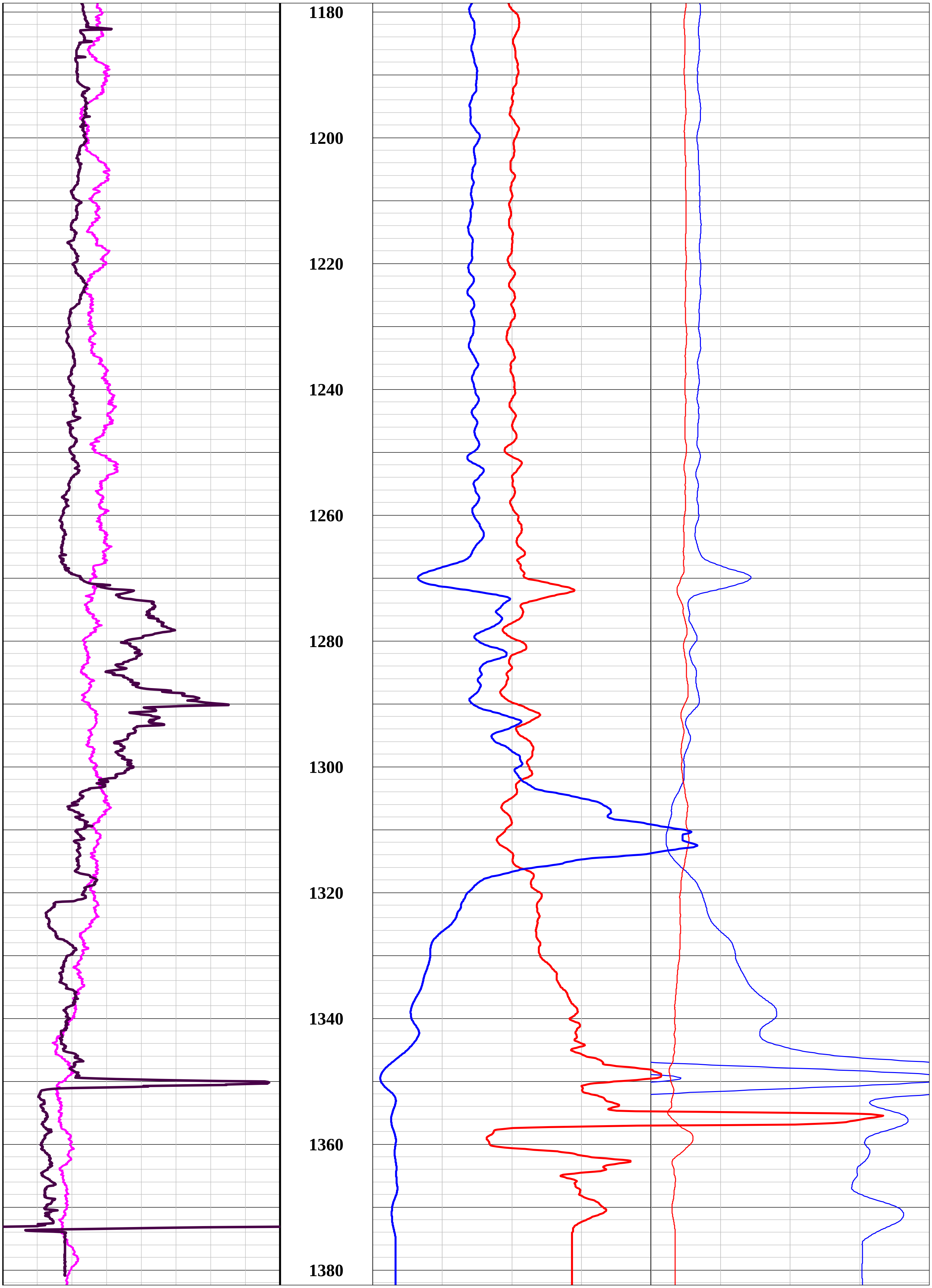
1140
1160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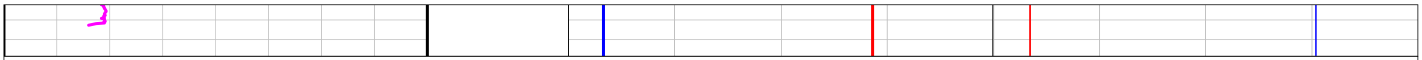

Short Induction Resistivity
0 Ohm-m 1600

Long Induction Resistivity
0 Ohm-m 1600

Caliper
14 Inch 22

Long Induction Conductivity
0 mS/m 20

Natural Gamma
0 CPS 200

Depth
1ft:240ft

Short Induction Conductivity
0 mS/m 20

COLOG Group - Borehole Geophysics

810 Quail Street
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80215
Office: 303.279.0171
Fax: 303.278.0135
www.idsdrill.com

Full Wave Form Sonic

Company Rio Tinto
Well HRES21
Field Resolution Copper
County Pinal
State AZ

COMPANY	Rio Tinto		
WELL	HRES21		
FIELD	Resolution Copper		
COUNTY	Pinal	**STATE**	AZ

LOCATION

QTR **SEC** **TWP** **RGE**

OTHER SERVICES
Optical Televiewer
Acoustic Televiewer
3-Arm Caliper
Spontaneous Potential
Single Point Resistivity
Natural Gamma
Dual Induction

PERMANENT DATUM **ELEVATION**

LOG MEAS. FROM 0.0 ft **ABOVE PERMANENT DATUM**

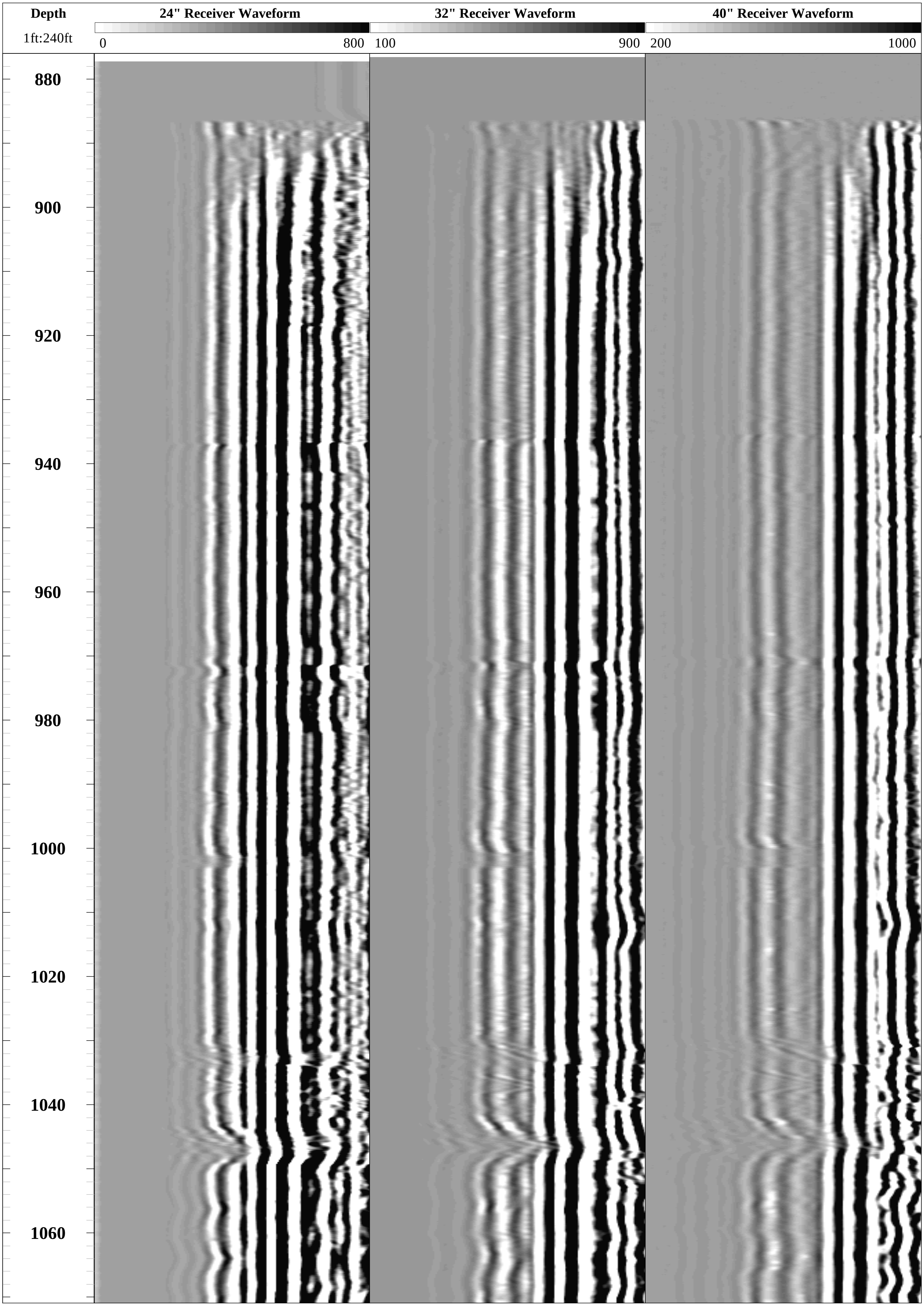
DRILLING MEAS. FROM

DATE ACQUIRED	5/24/2014			
RUN NUMBER	7			
LOG TYPE	Full Waveform Sonic			
DEPTH-DRILLER	1380 ft			
DEPTH-LOGGER	1375 ft			
BTM LOG INTERVAL	1373 ft			
TOP LOG INTERVAL	886 ft			
RECORDED BY	C.ONeil			
WITNESSED BY	M.Shelley			
PROBE TYPE, S/N	TRSS 8896			
LOGGING SPEED	12.2ft/min			
A.S.D.E. / Sample Interval	0.2' / 0.1'			
Fluid Level / Fluid Type	886 ft			

BOREHOLE RECORD				CASING RECORD			
RUN No.	**BIT**	**FROM**	**TO**	**SIZE**	**WGT.**	**FROM**	**TO**

COMMENTS

NA - Not Available, N/A - Not Applicable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1ft:240ft
24" Receiver Waveform
0
800
32" Receiver Waveform
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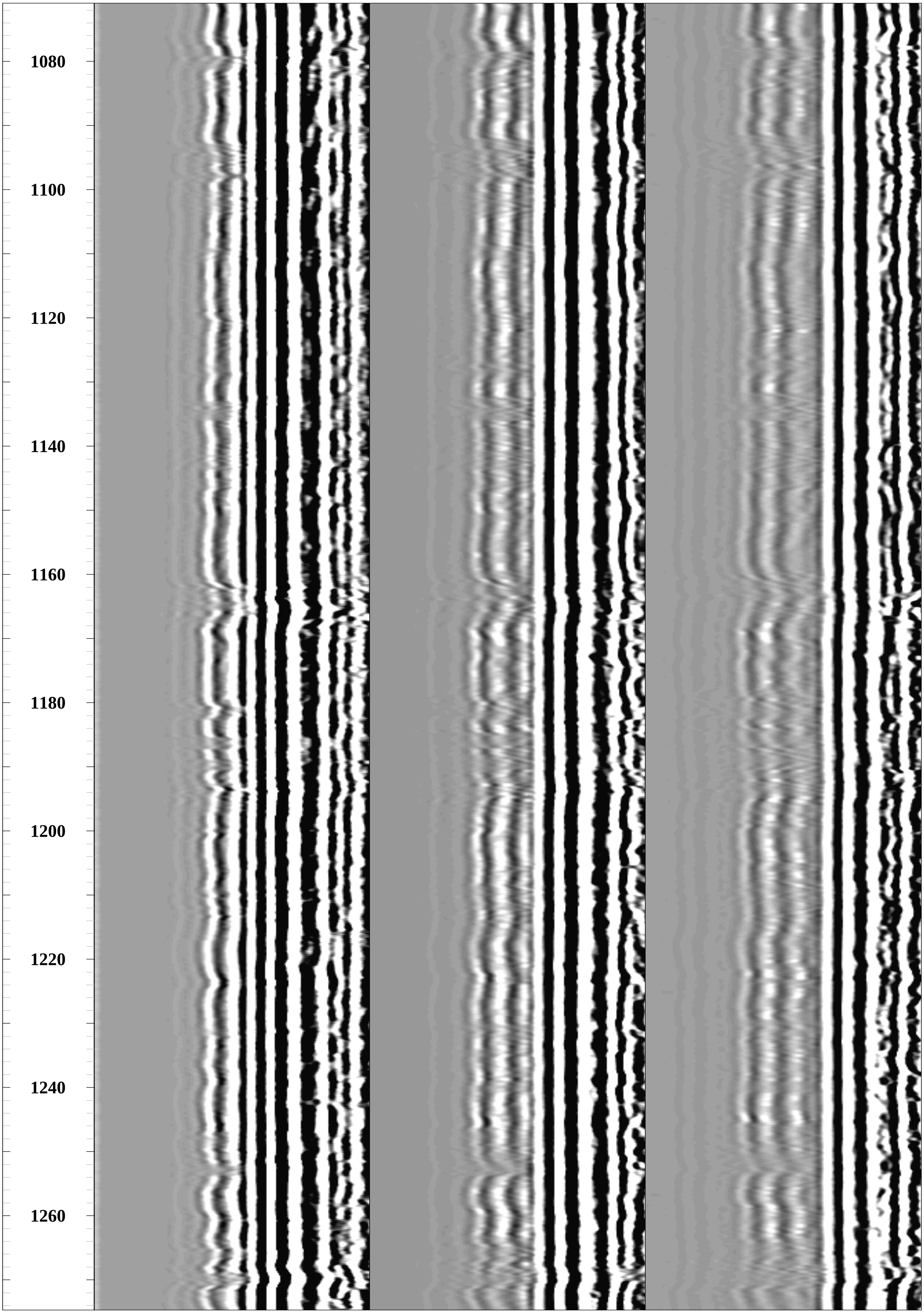
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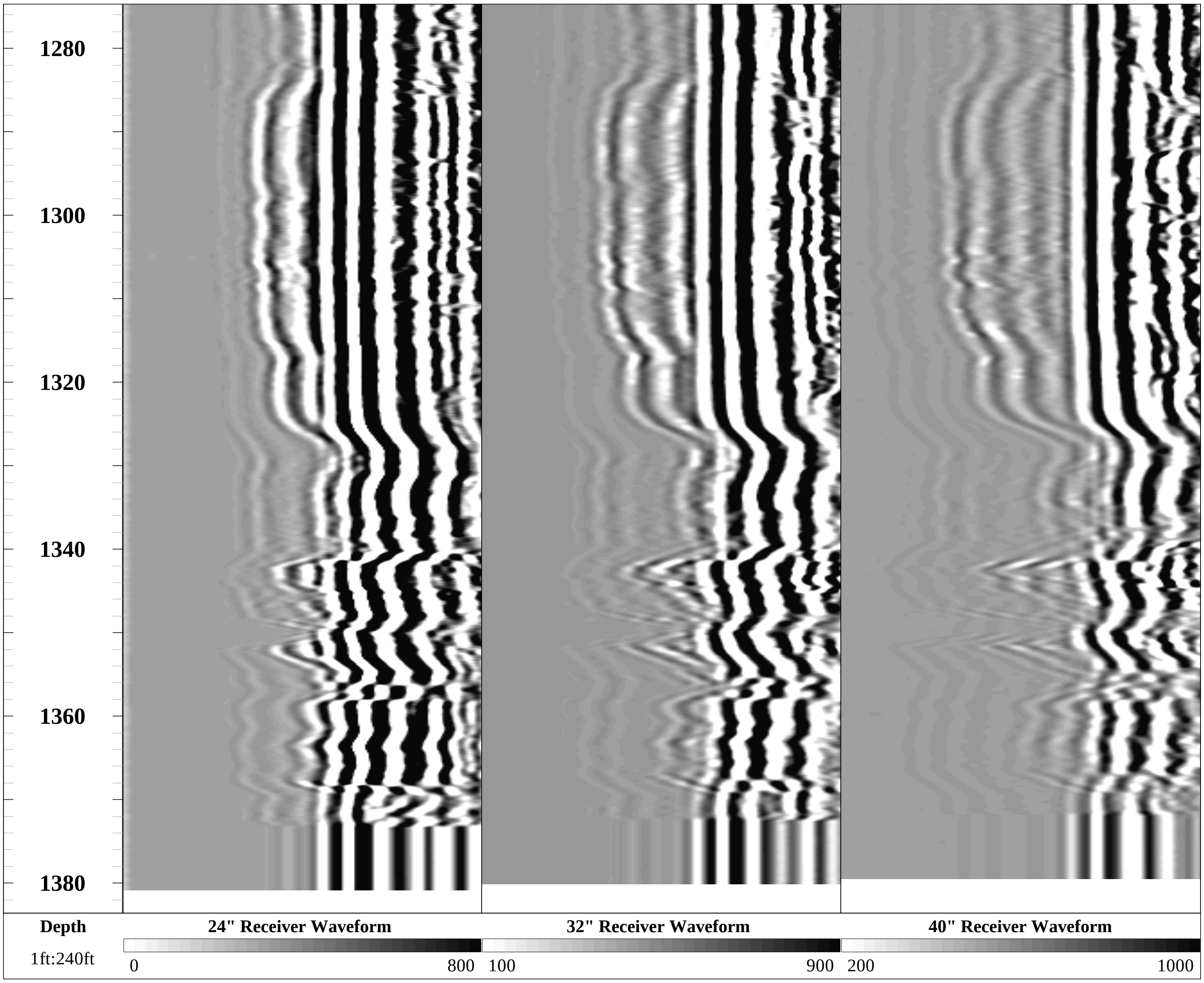
1280
1300
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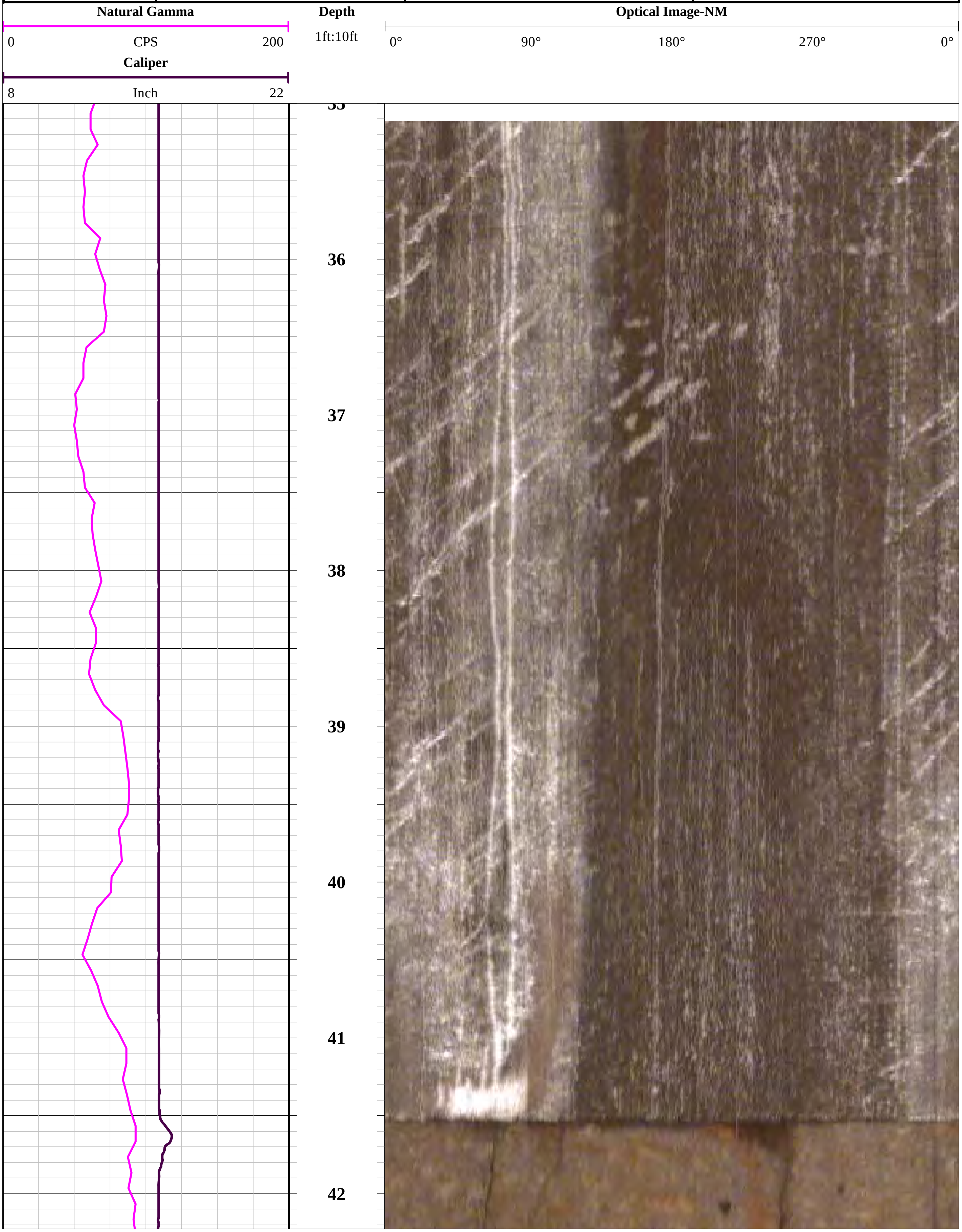
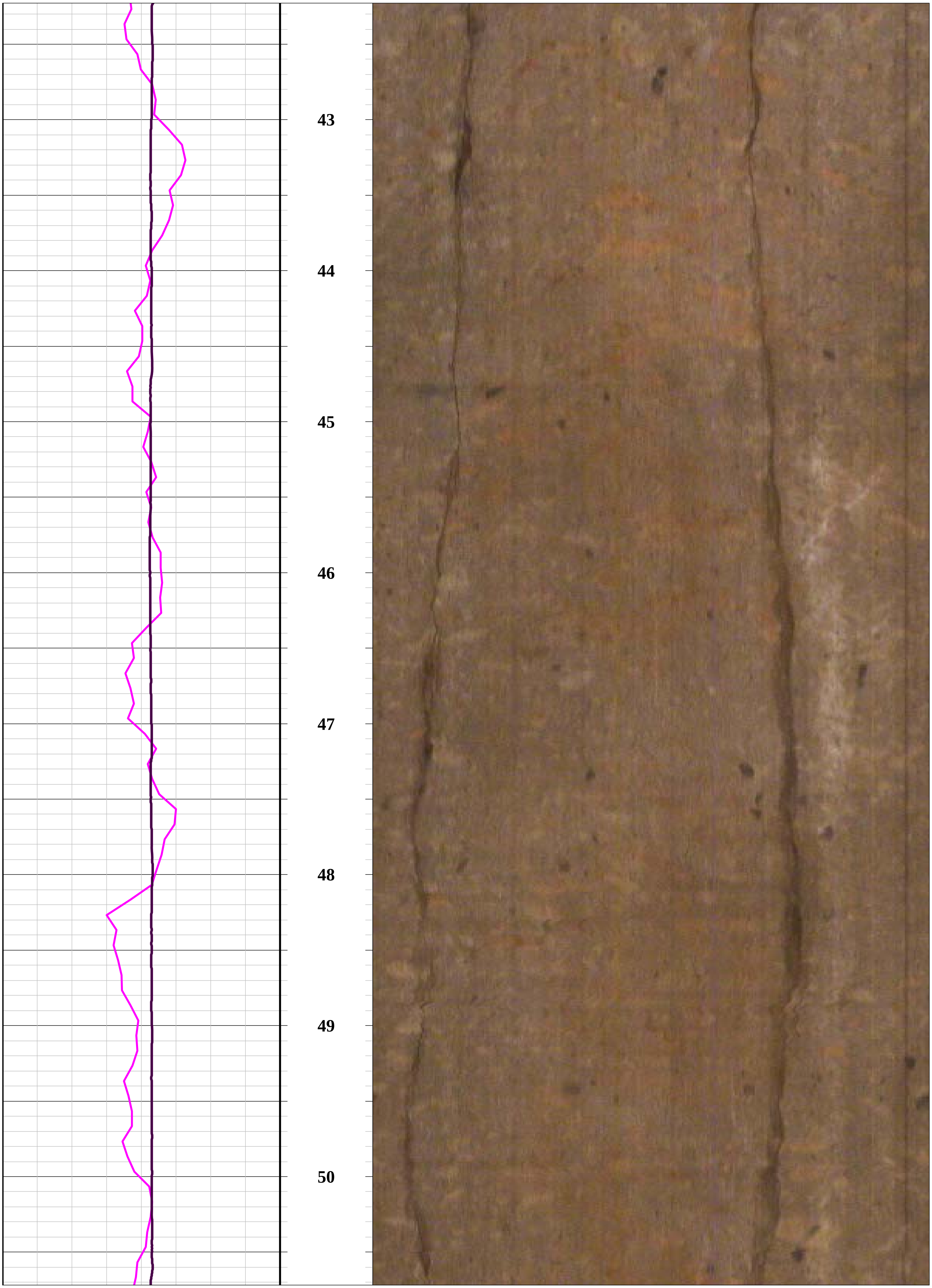
Depth
1ft:240ft
24" Receiver Waveform
0
800
32" Receiver Waveform
100
900
40" Receiver Waveform
200
1000

IDS COLOG Group - Borehole Geophysics	**Optical Televiewer Summary Plot**	**IDS - Colog Group**
	COMPANY: Rio Tinto / **PROJECT: Resolution Copper**	810 Quail Street, Suite E, Lakewood, CO 80215
	DATE LOGGED: 24 May 2014 / **WELL: HRES21**	Phone: (303) 279-0171, Fax: (303) 278-0135 www.idsdrill.com

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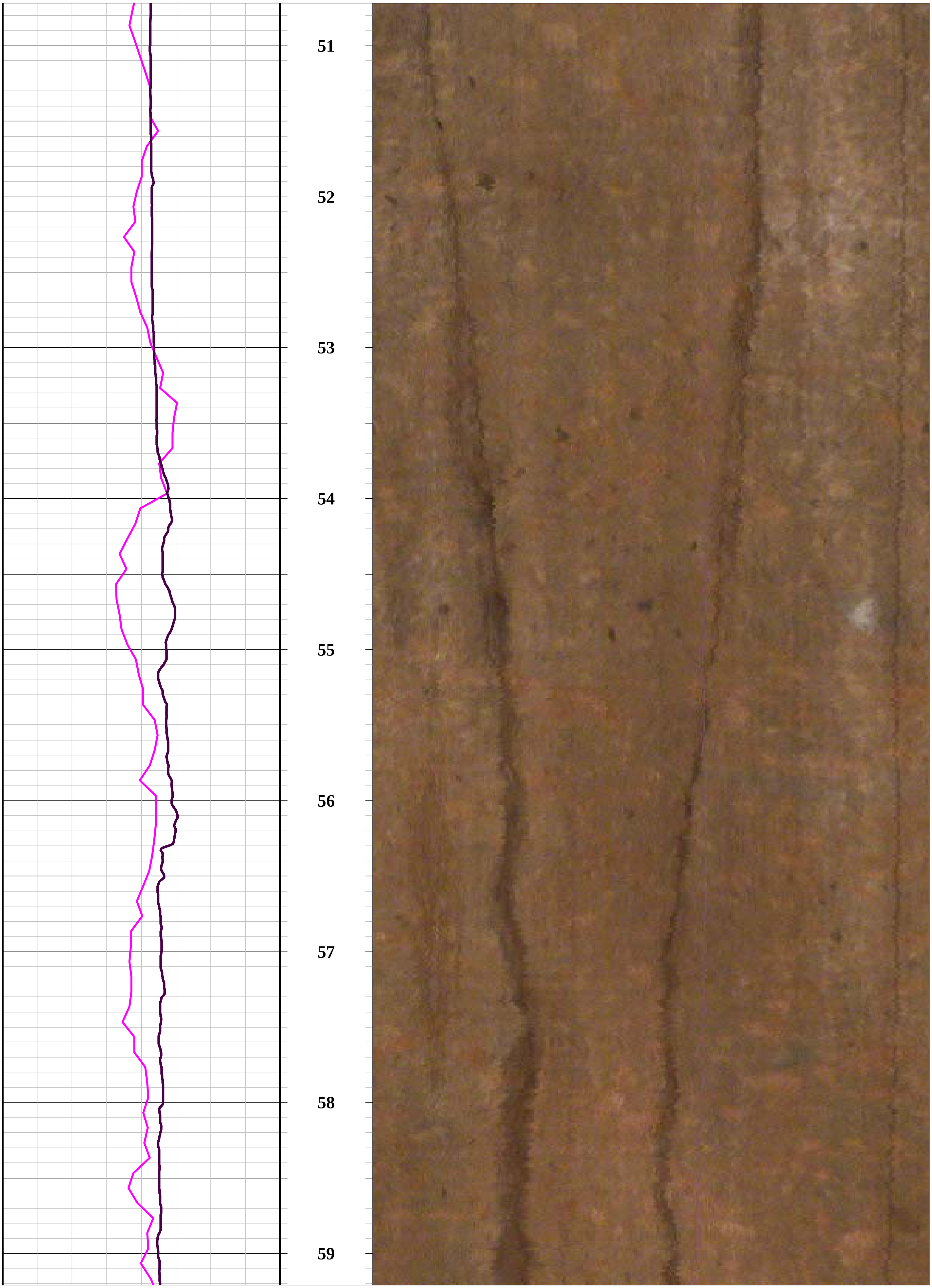
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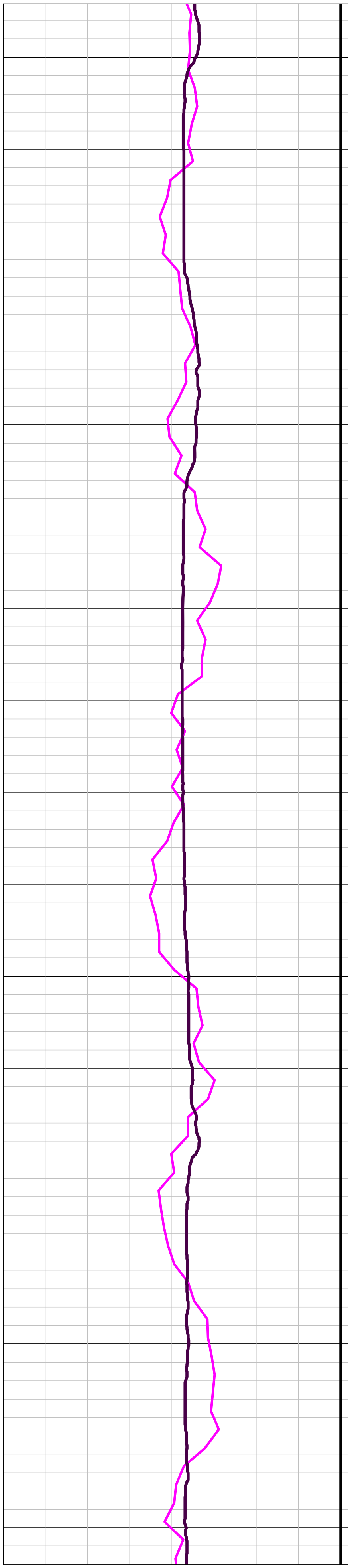

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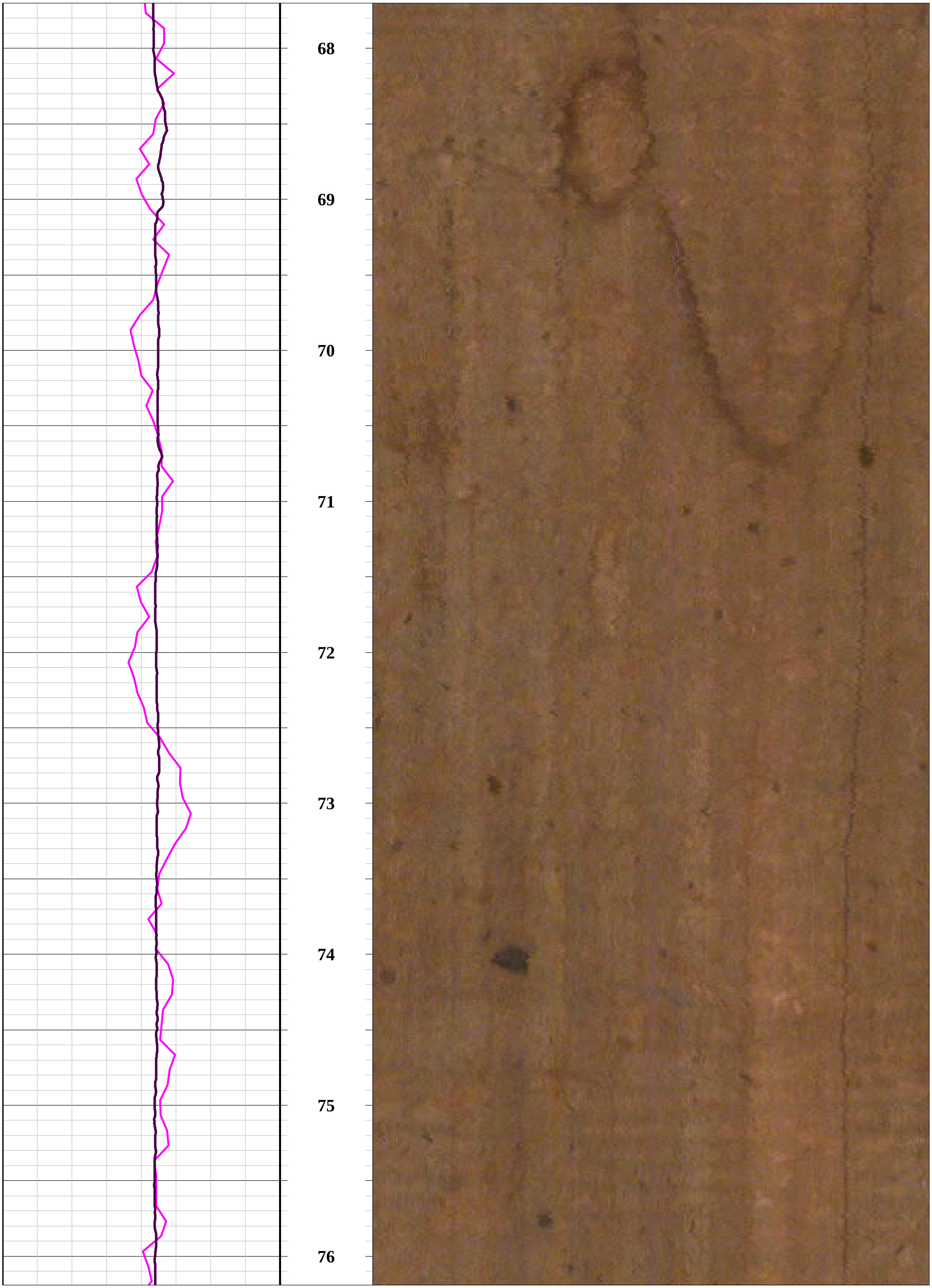
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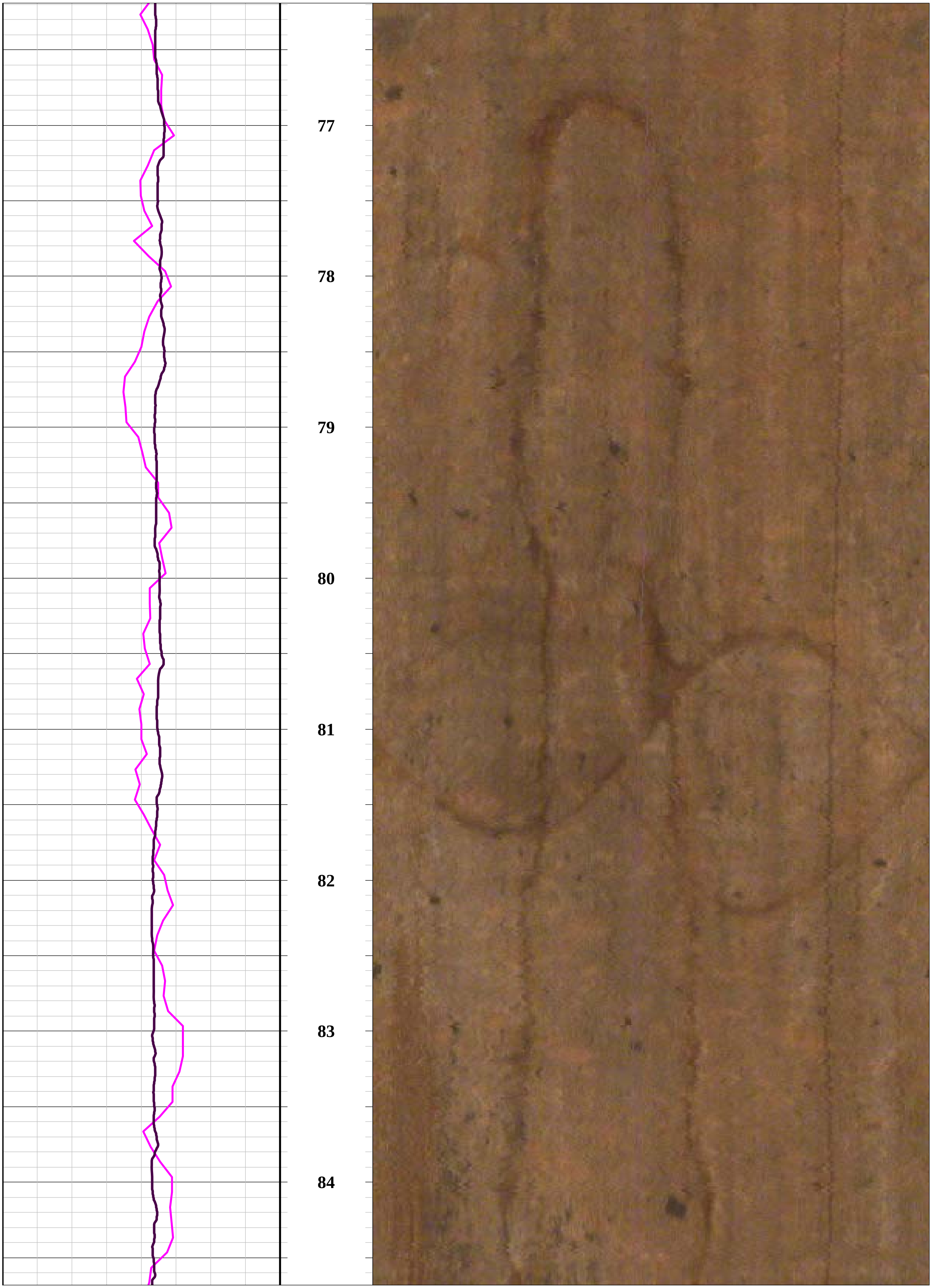
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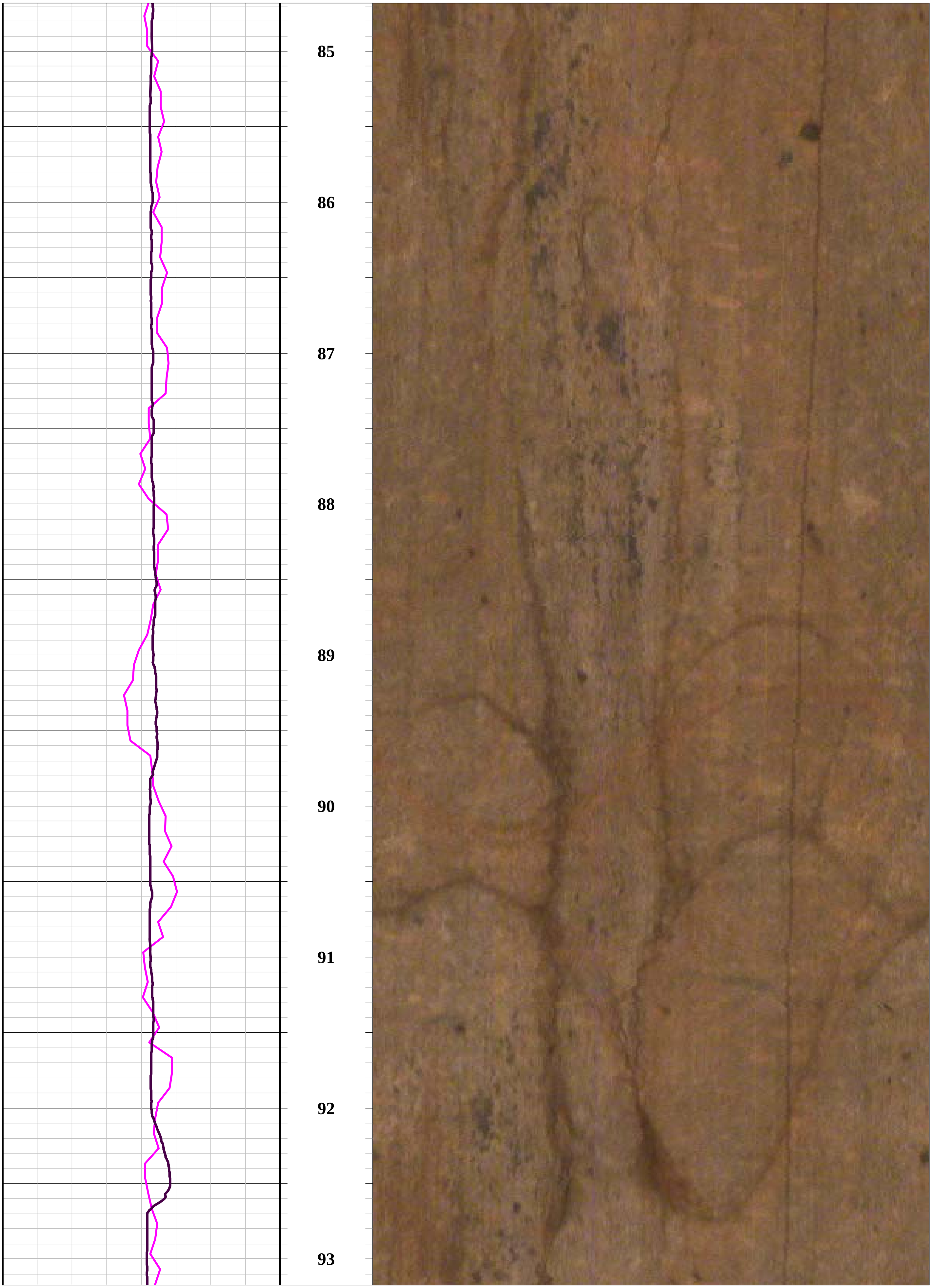
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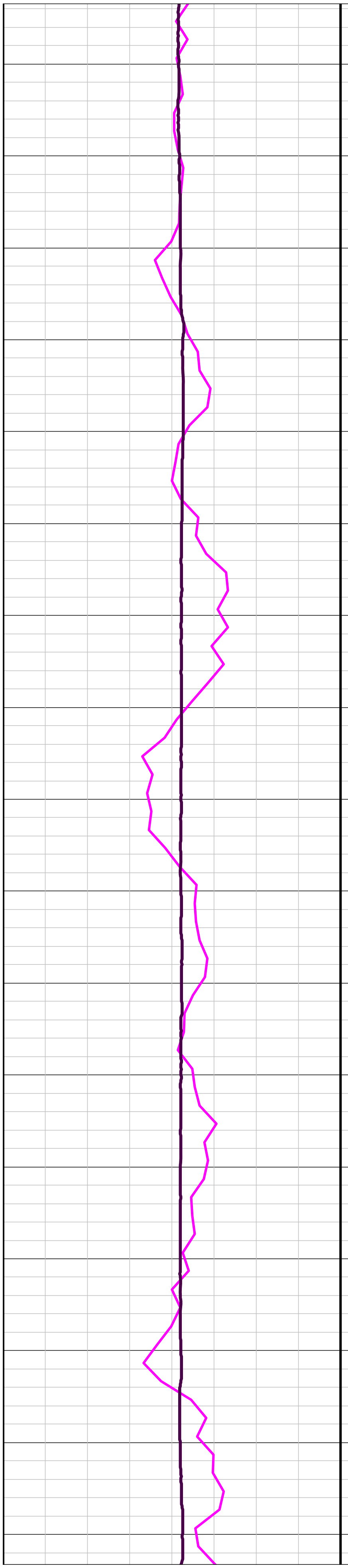

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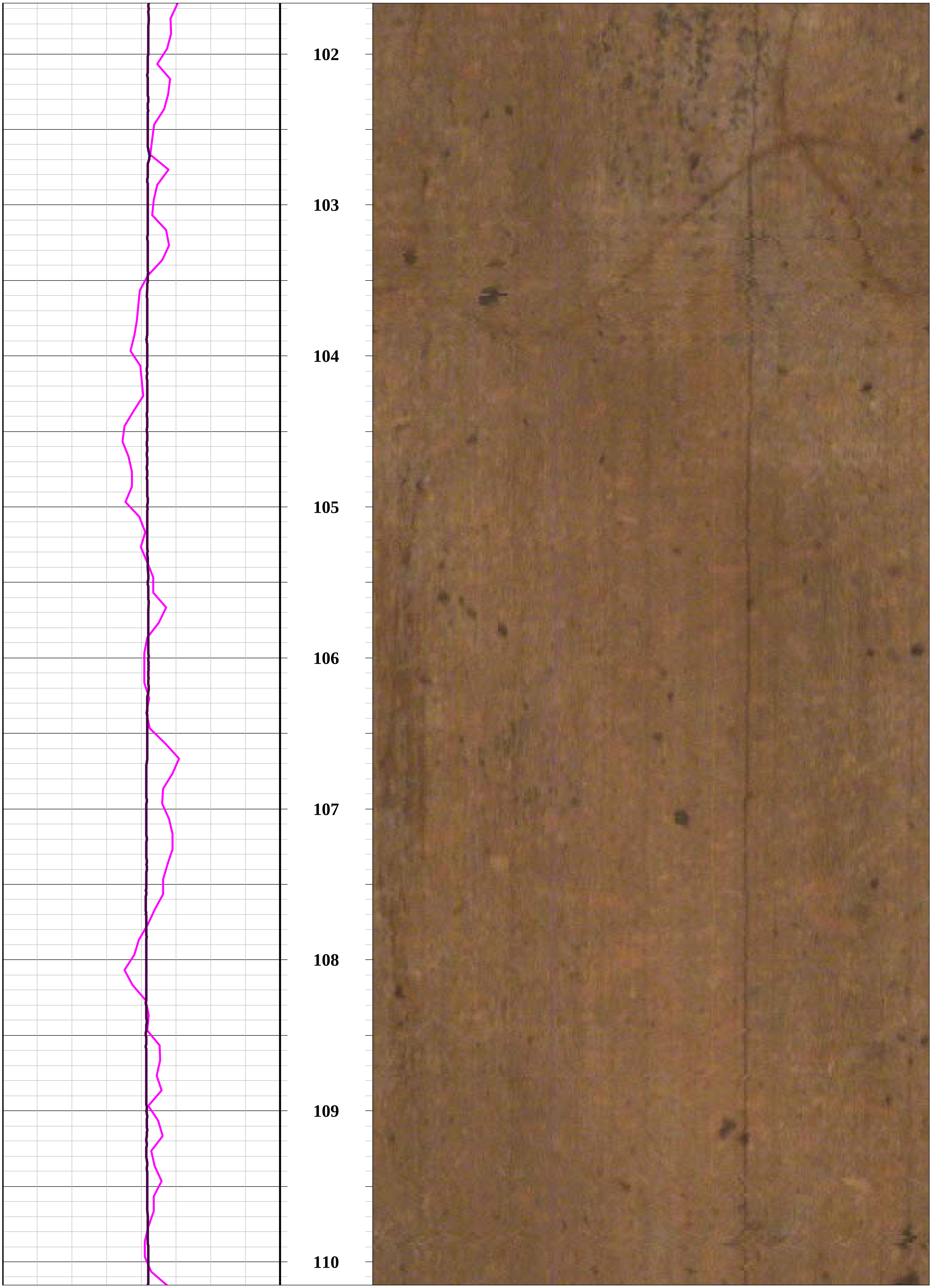
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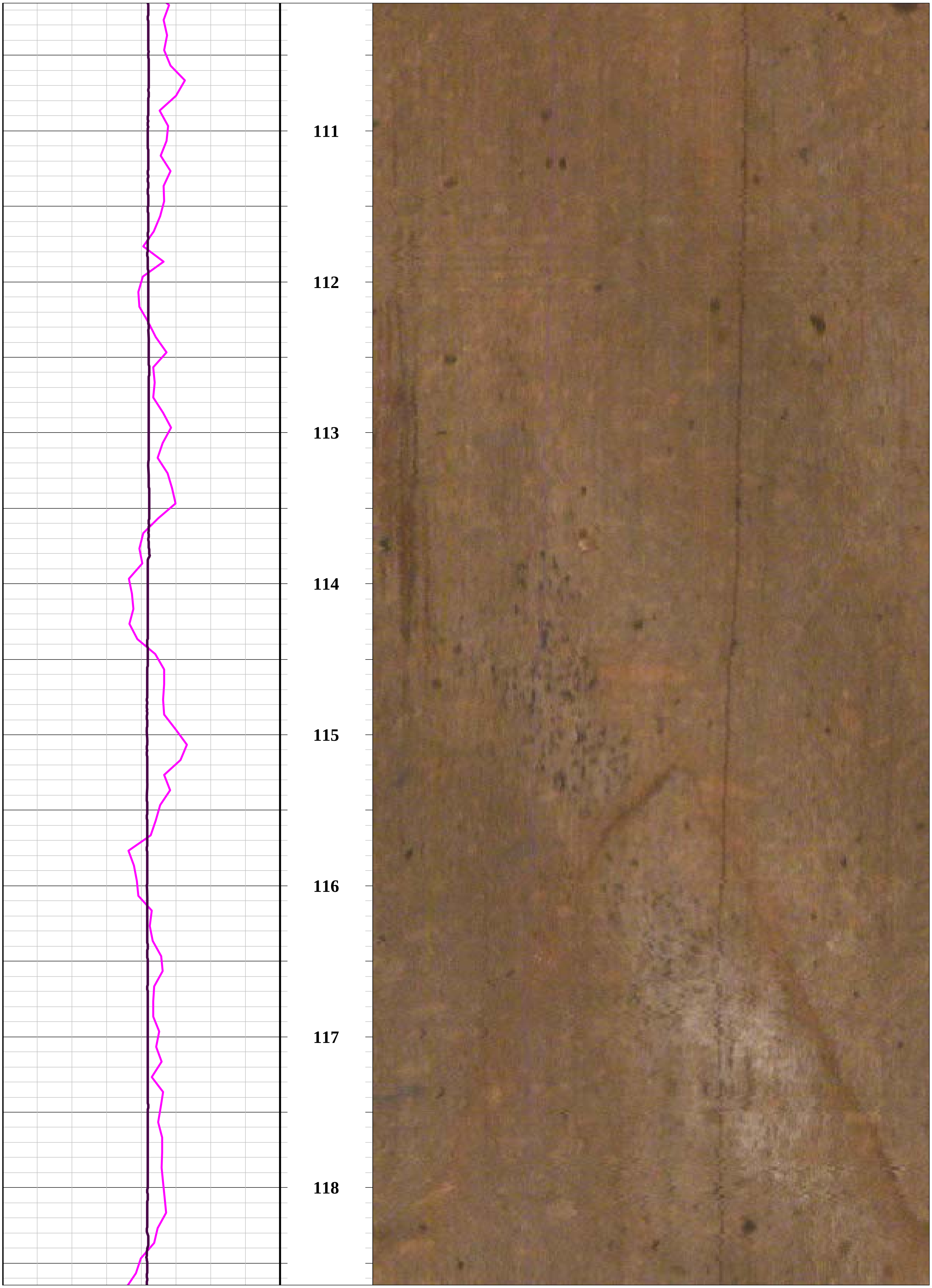
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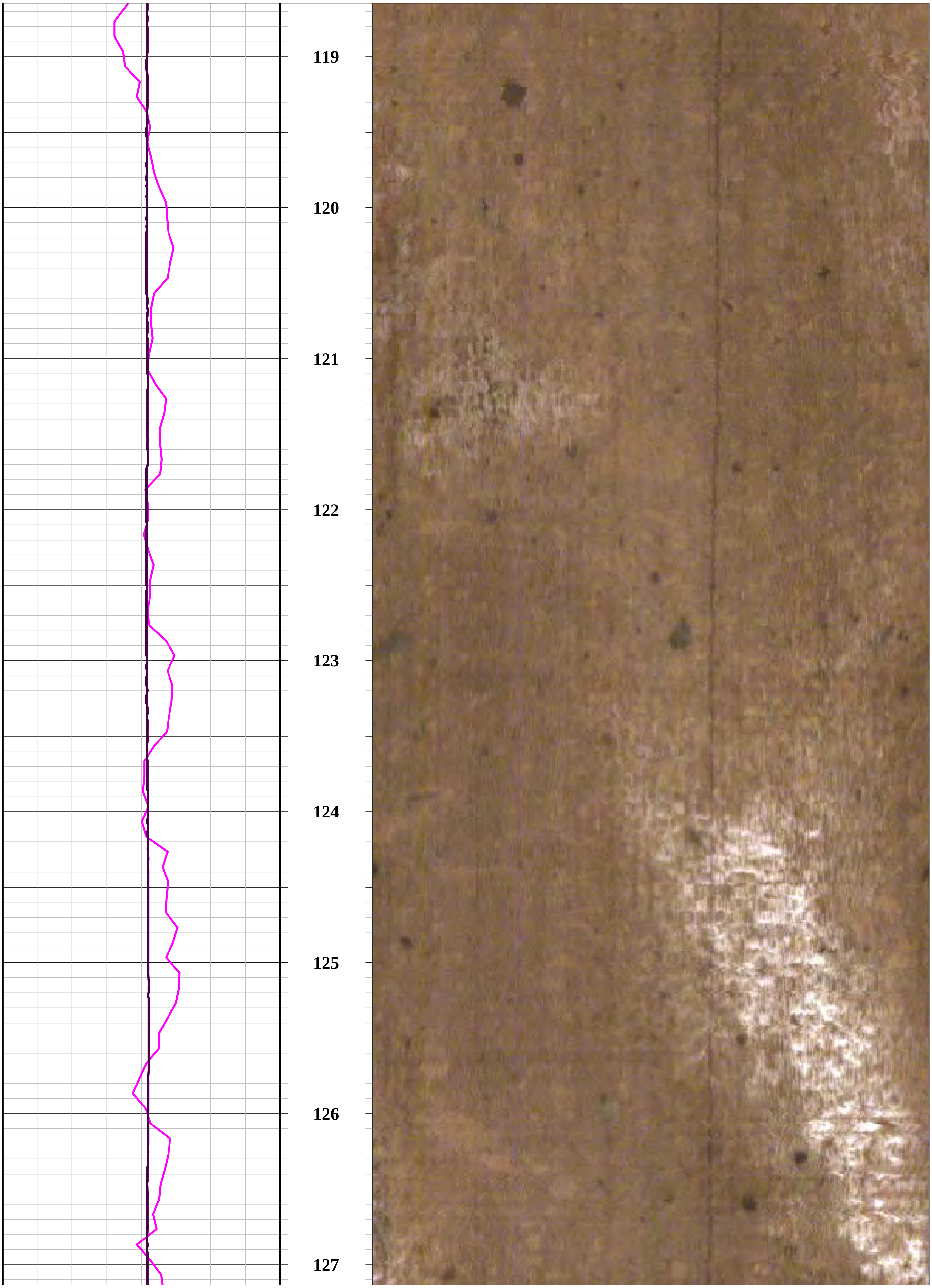
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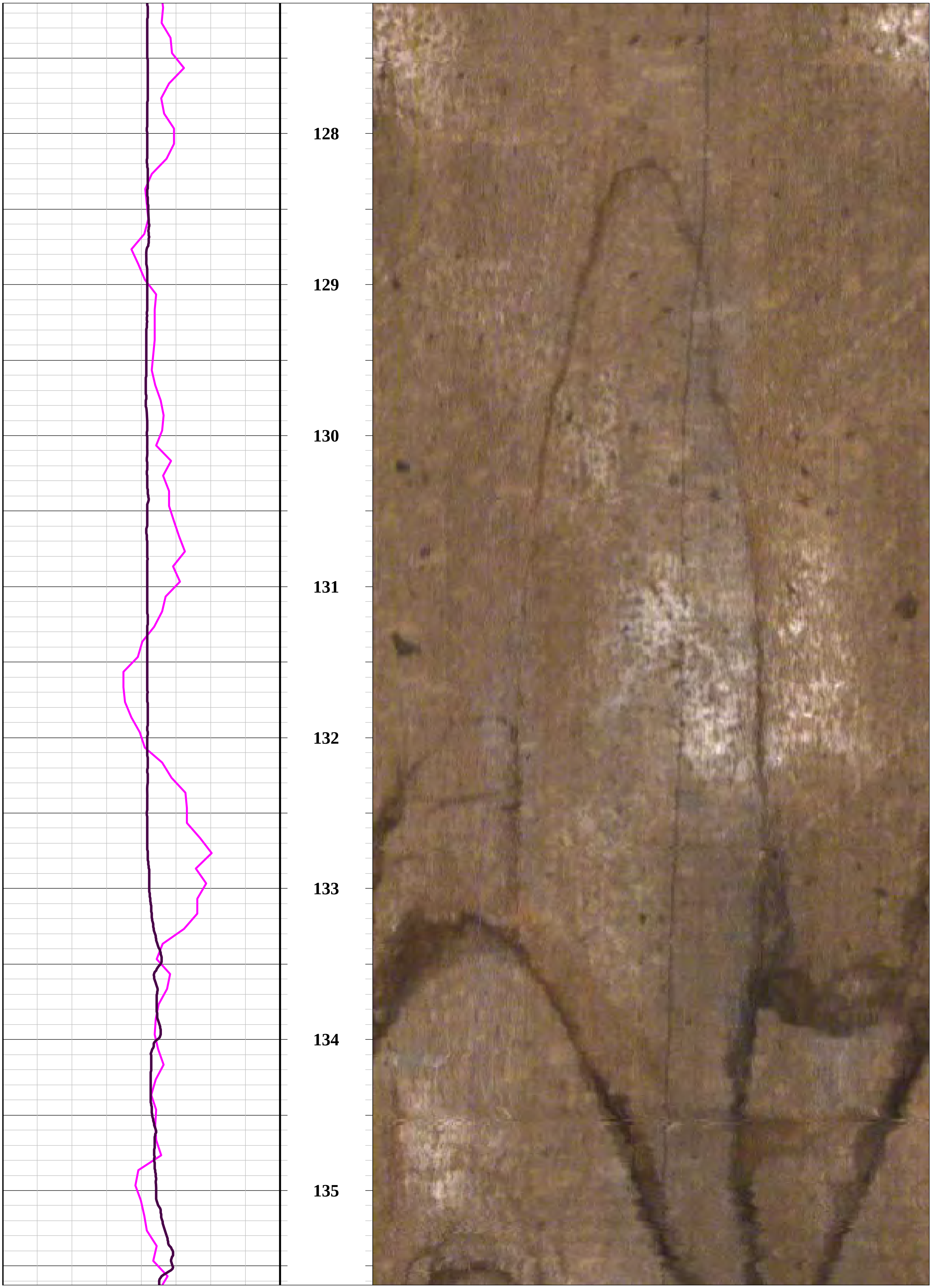
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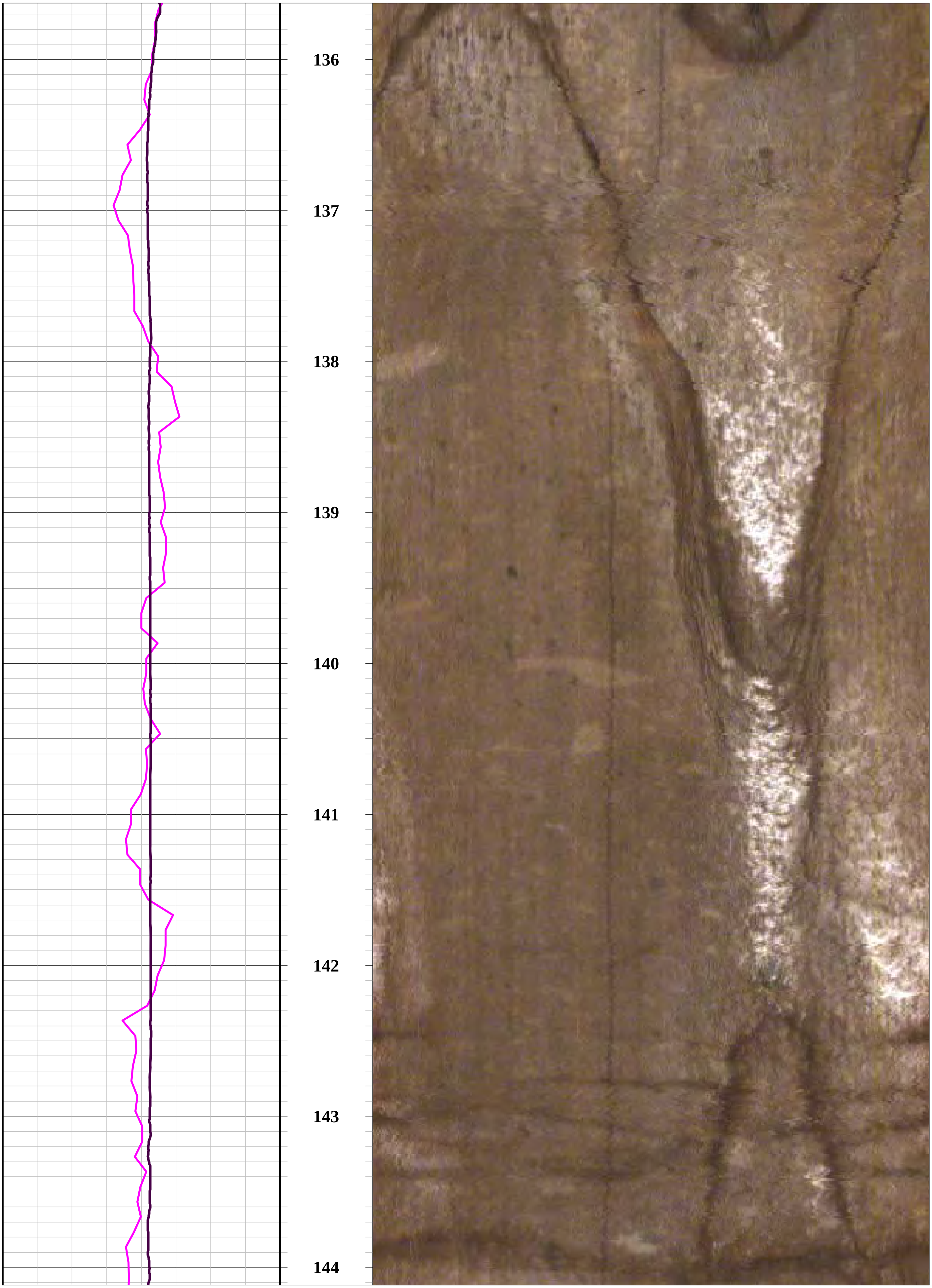
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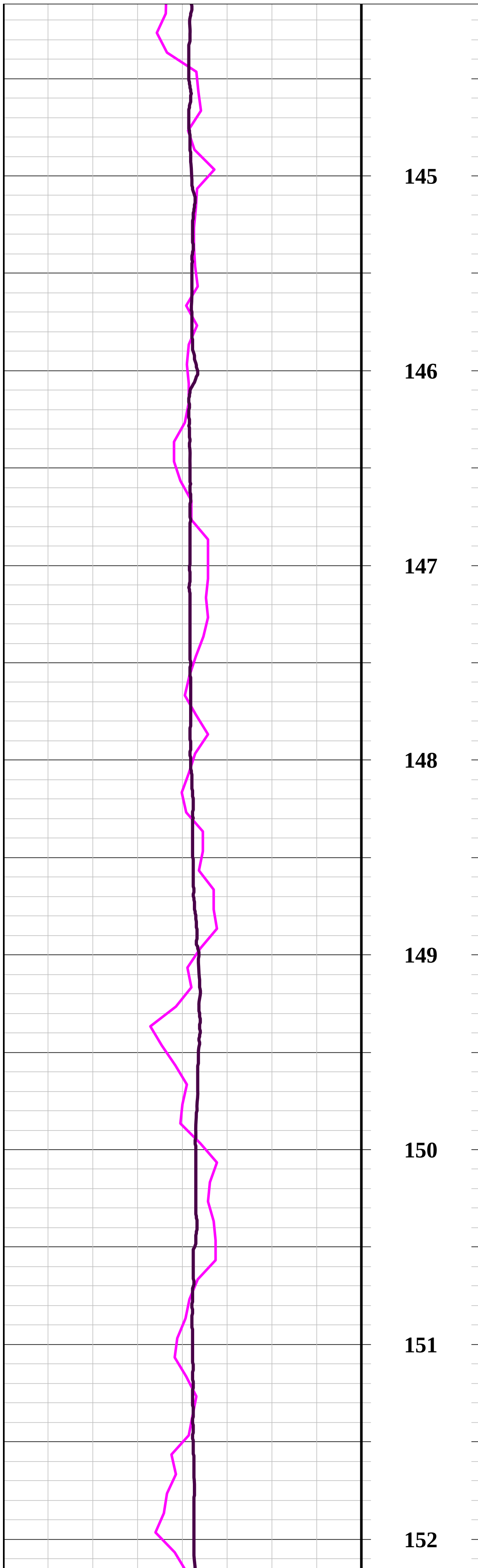
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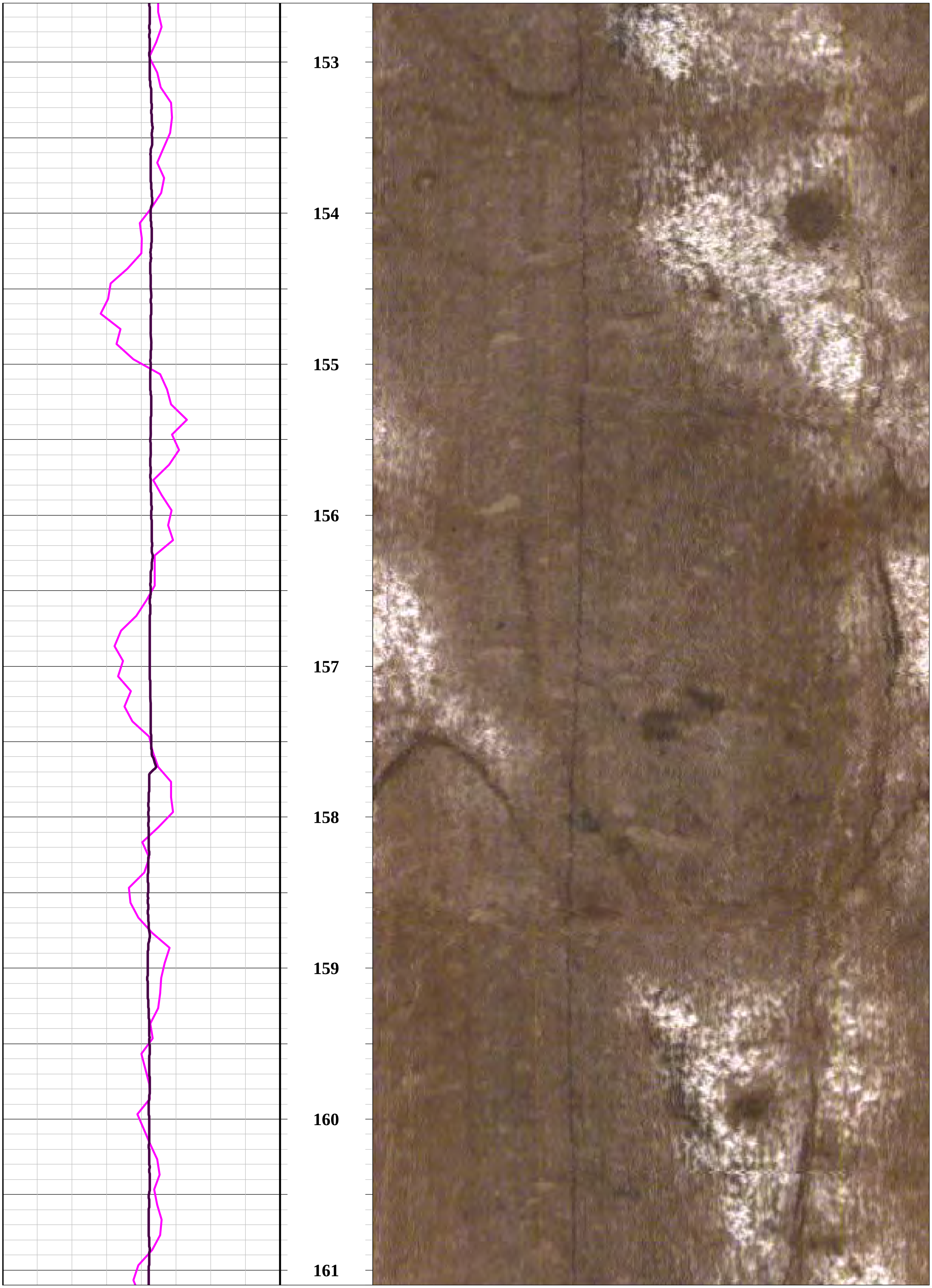
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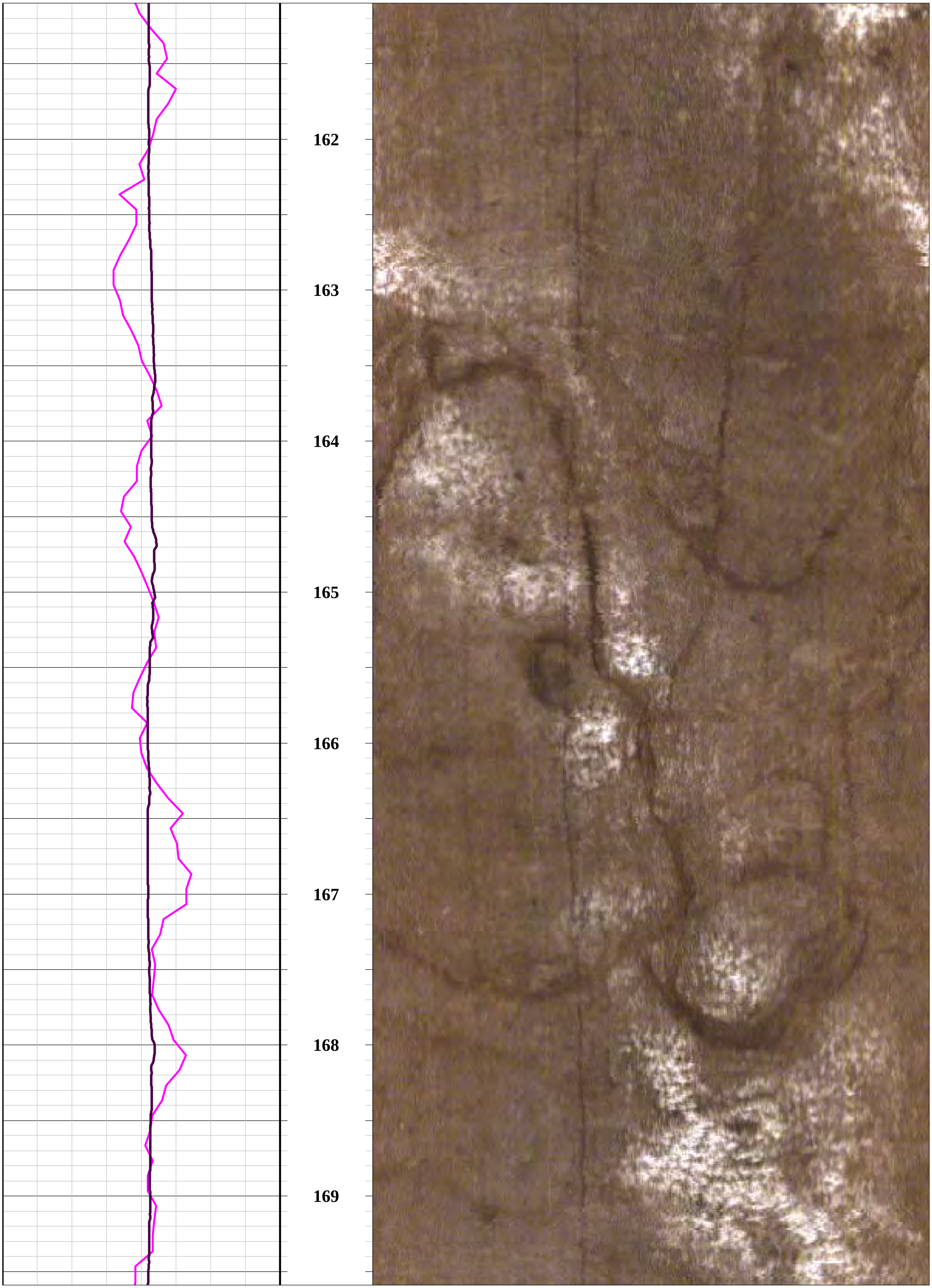
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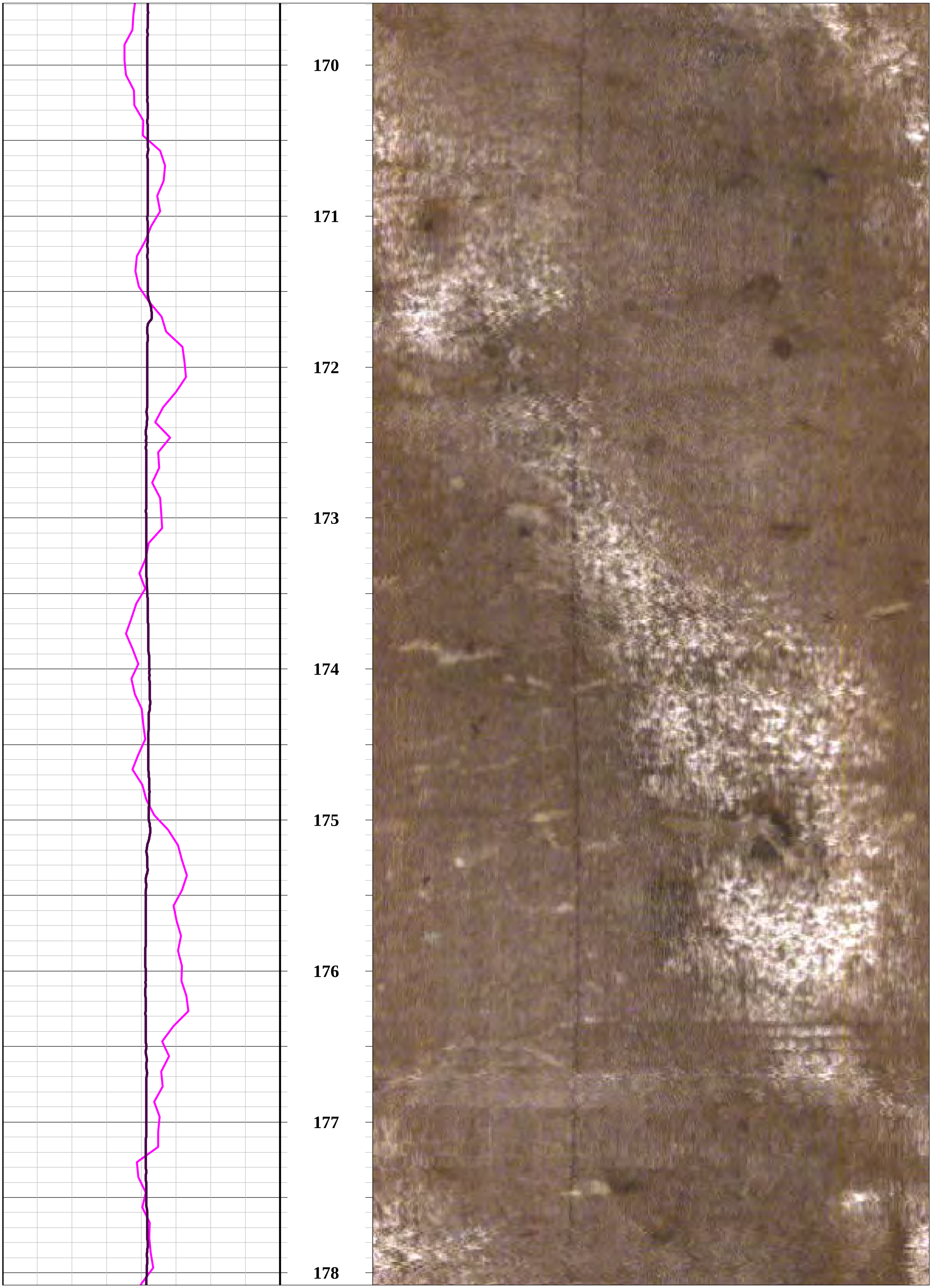
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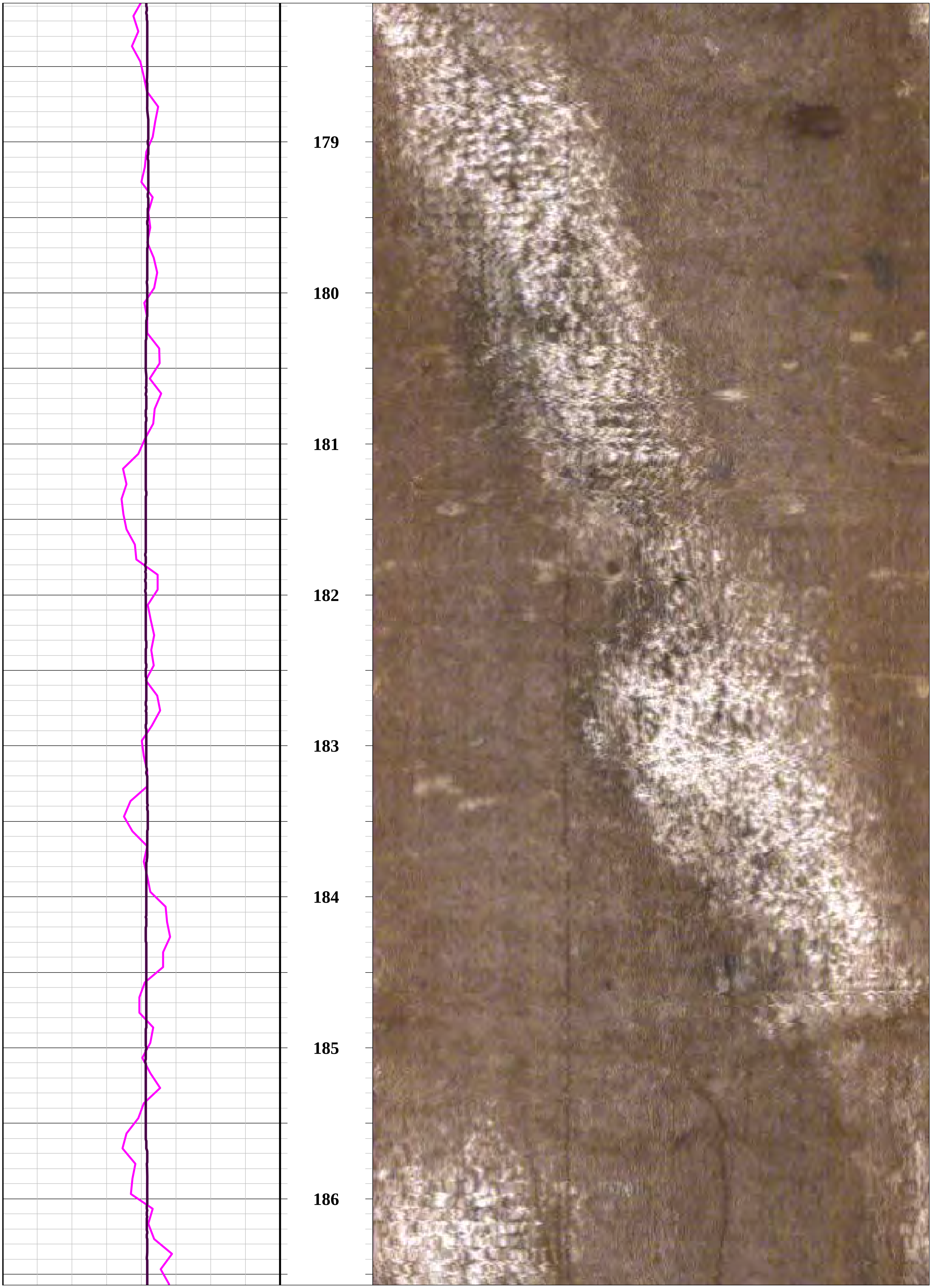
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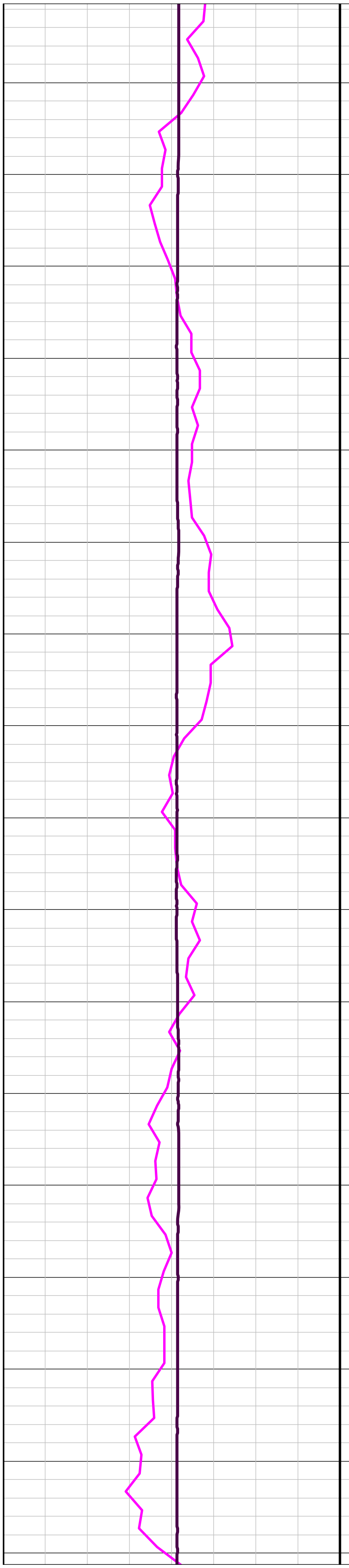

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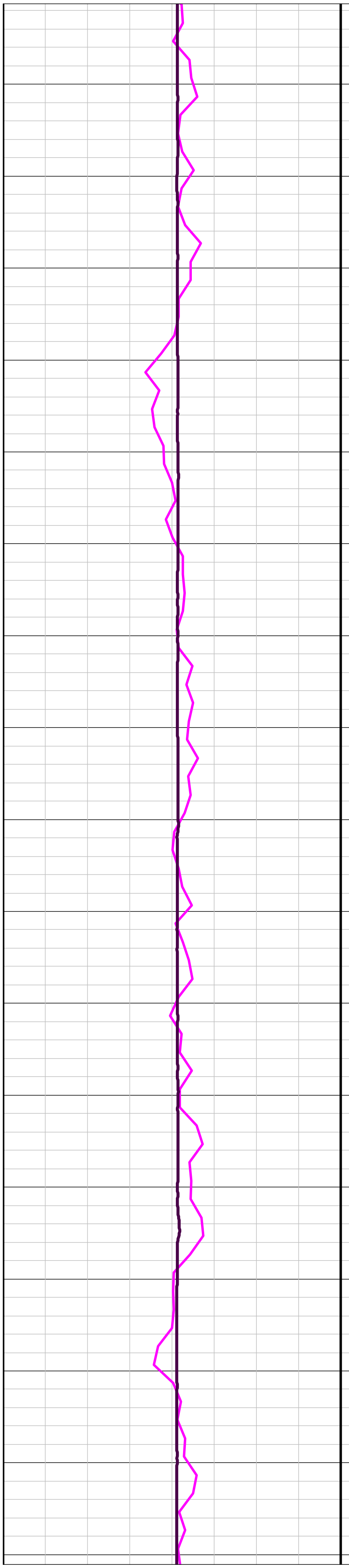

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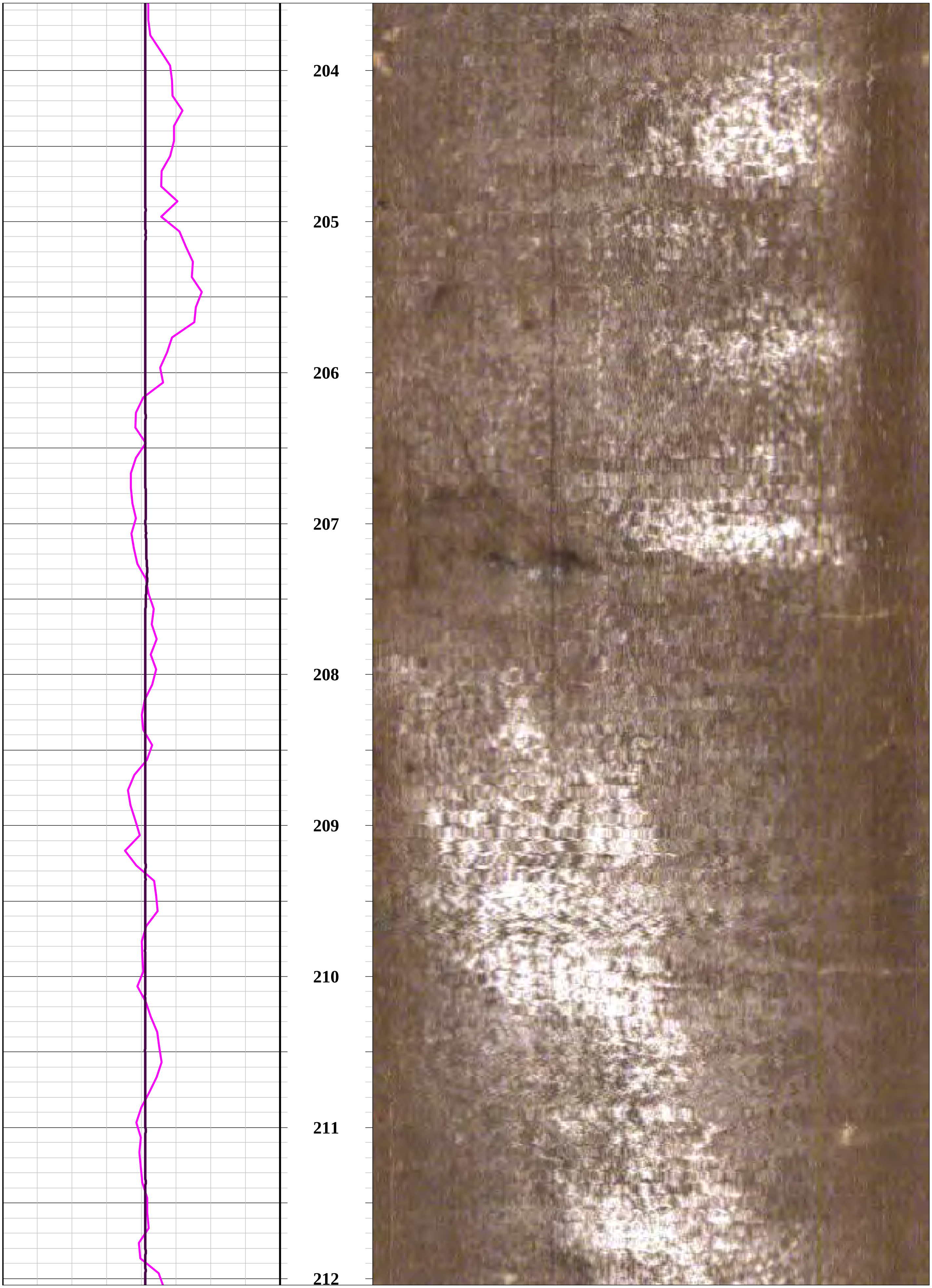
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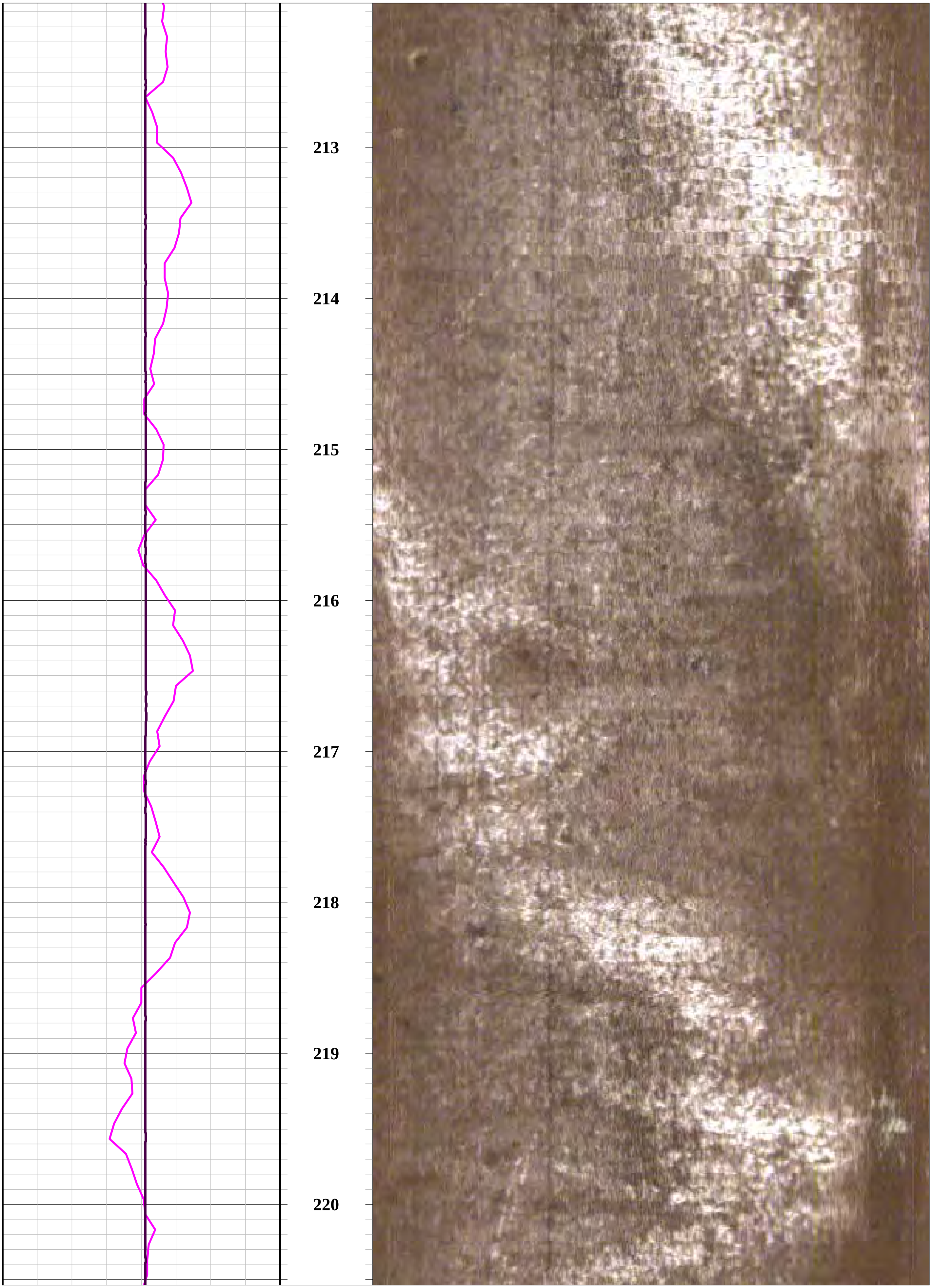
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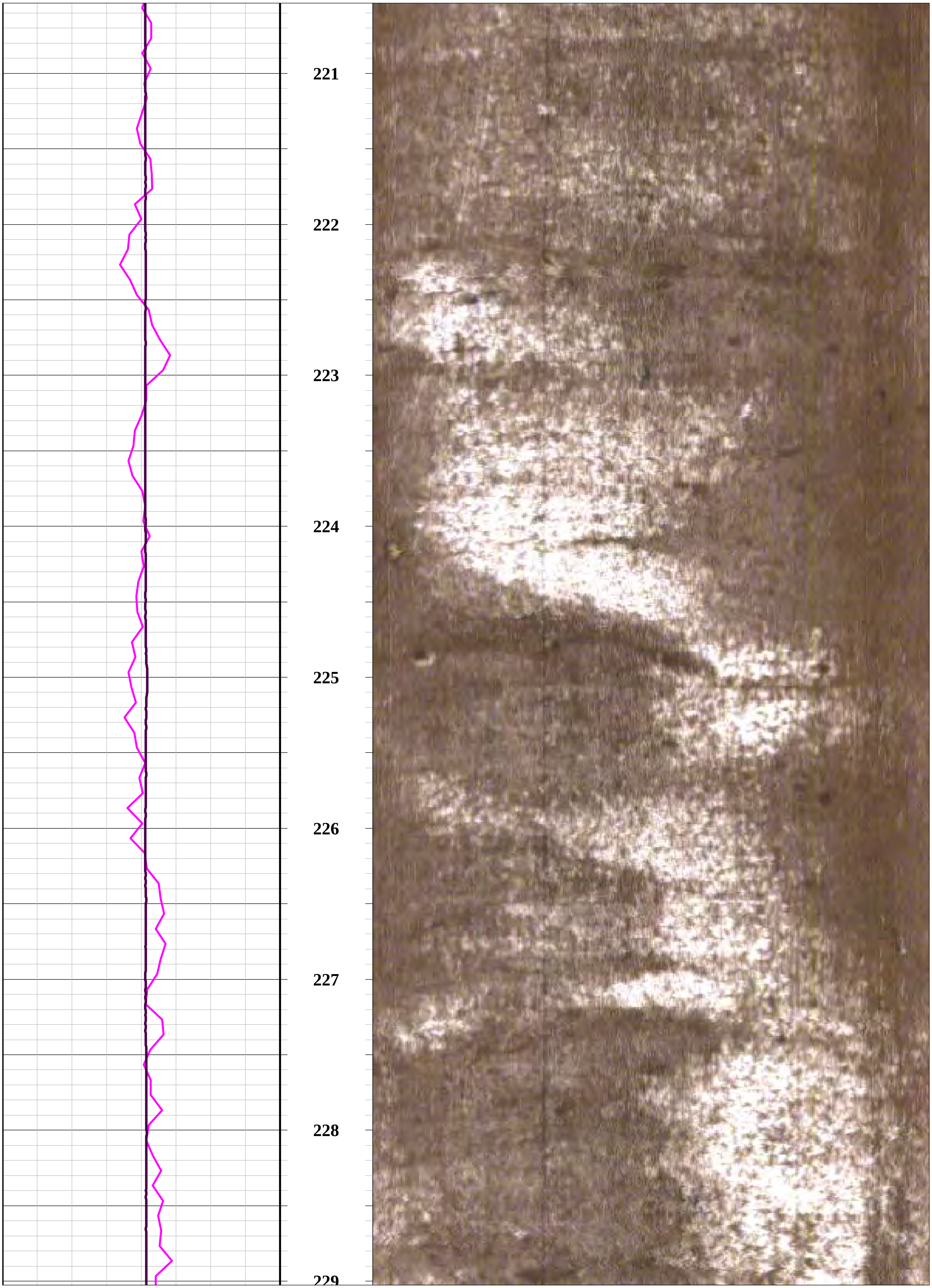
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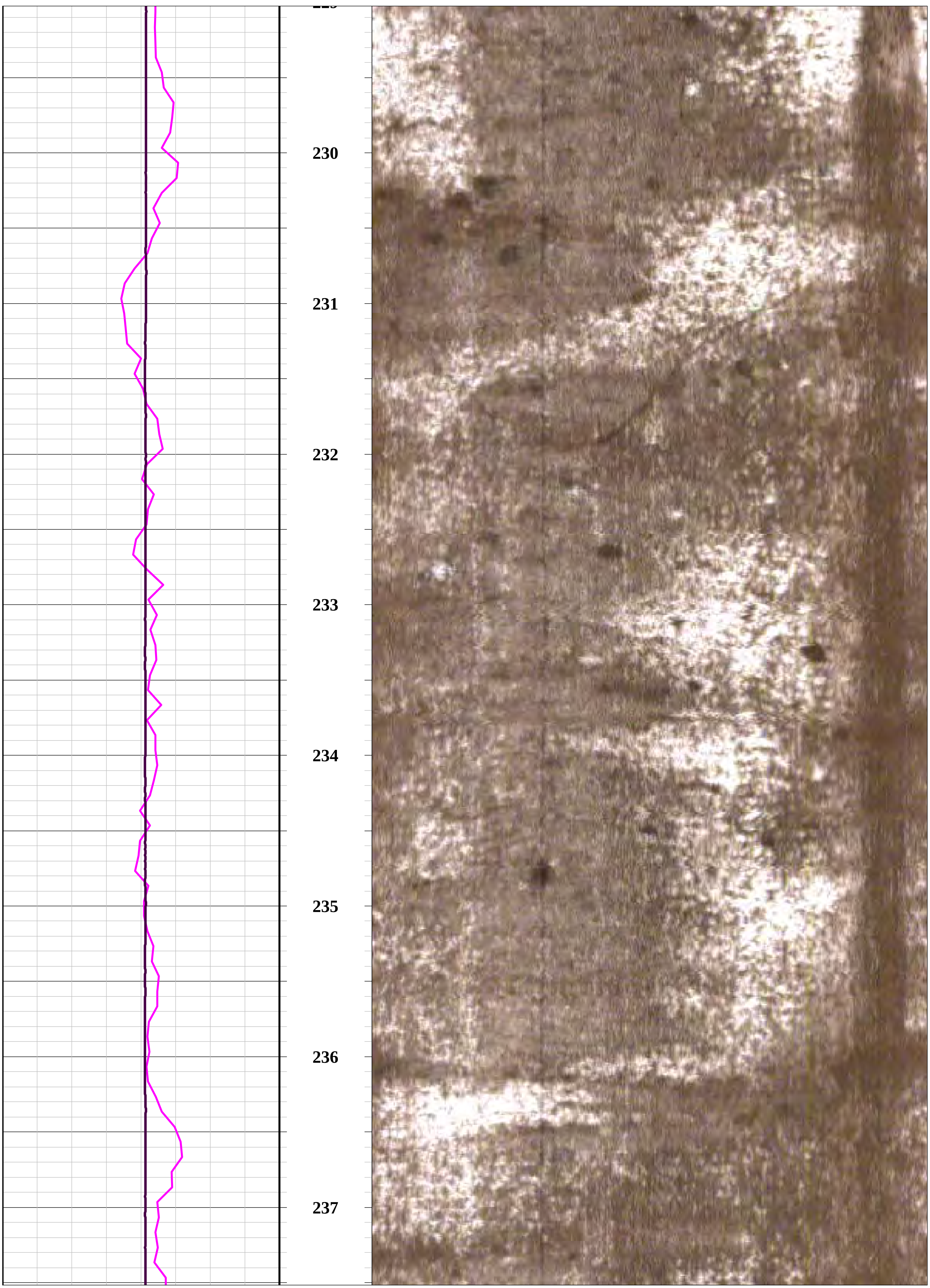
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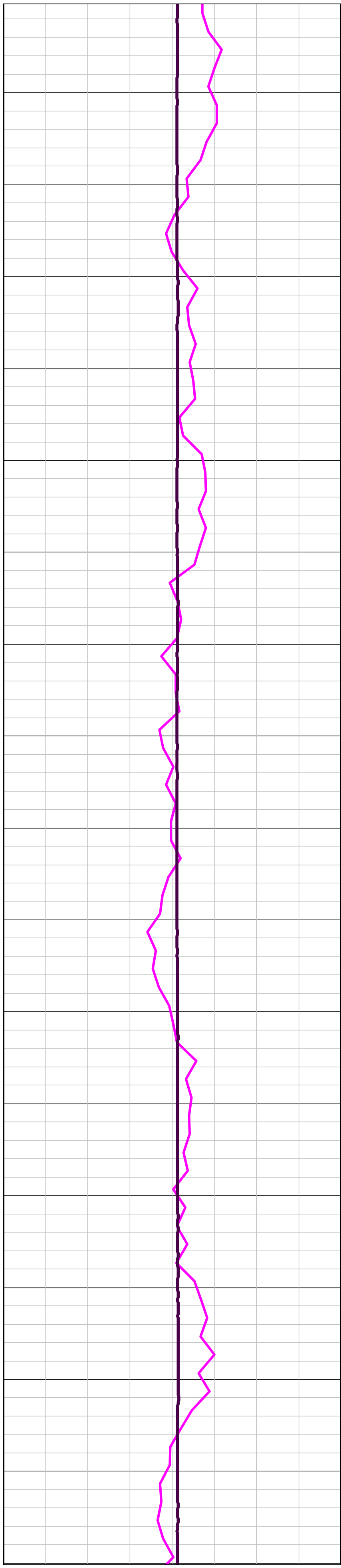

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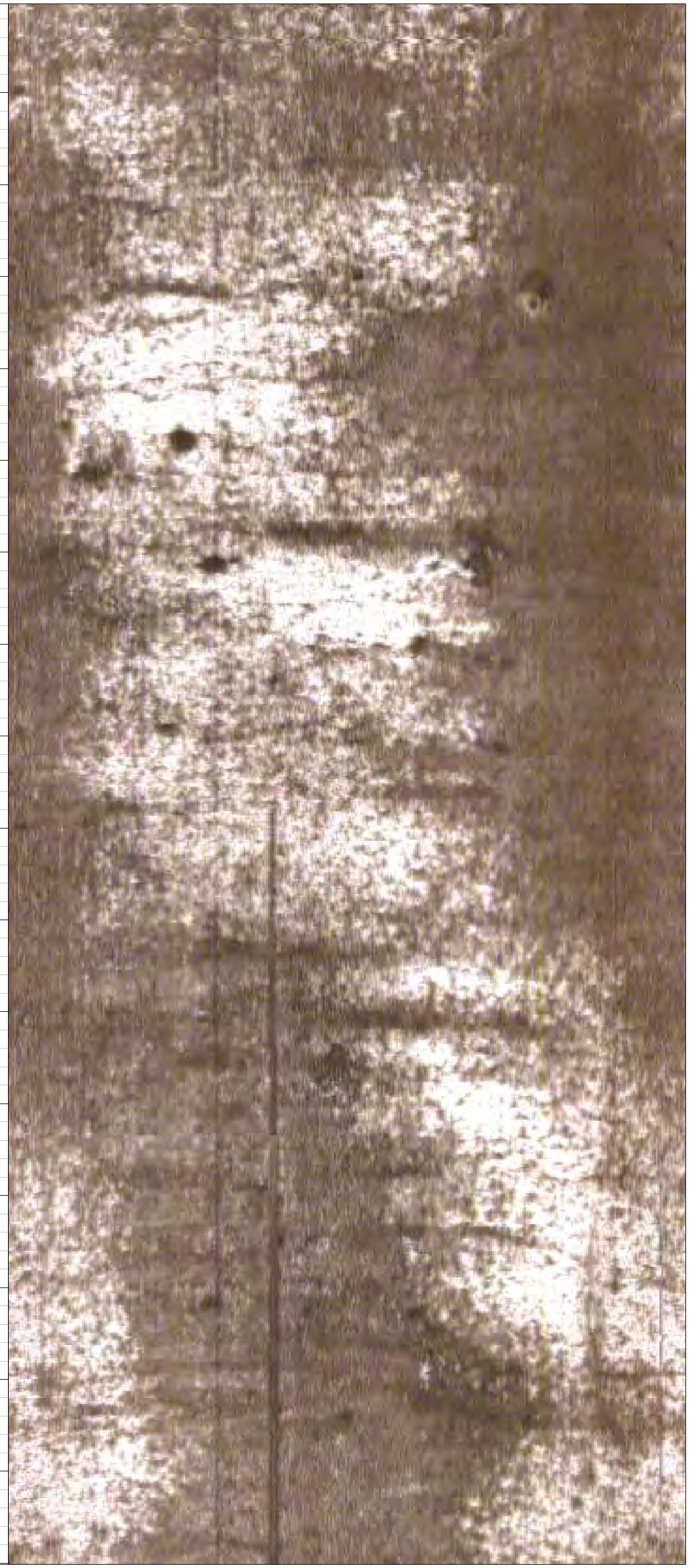

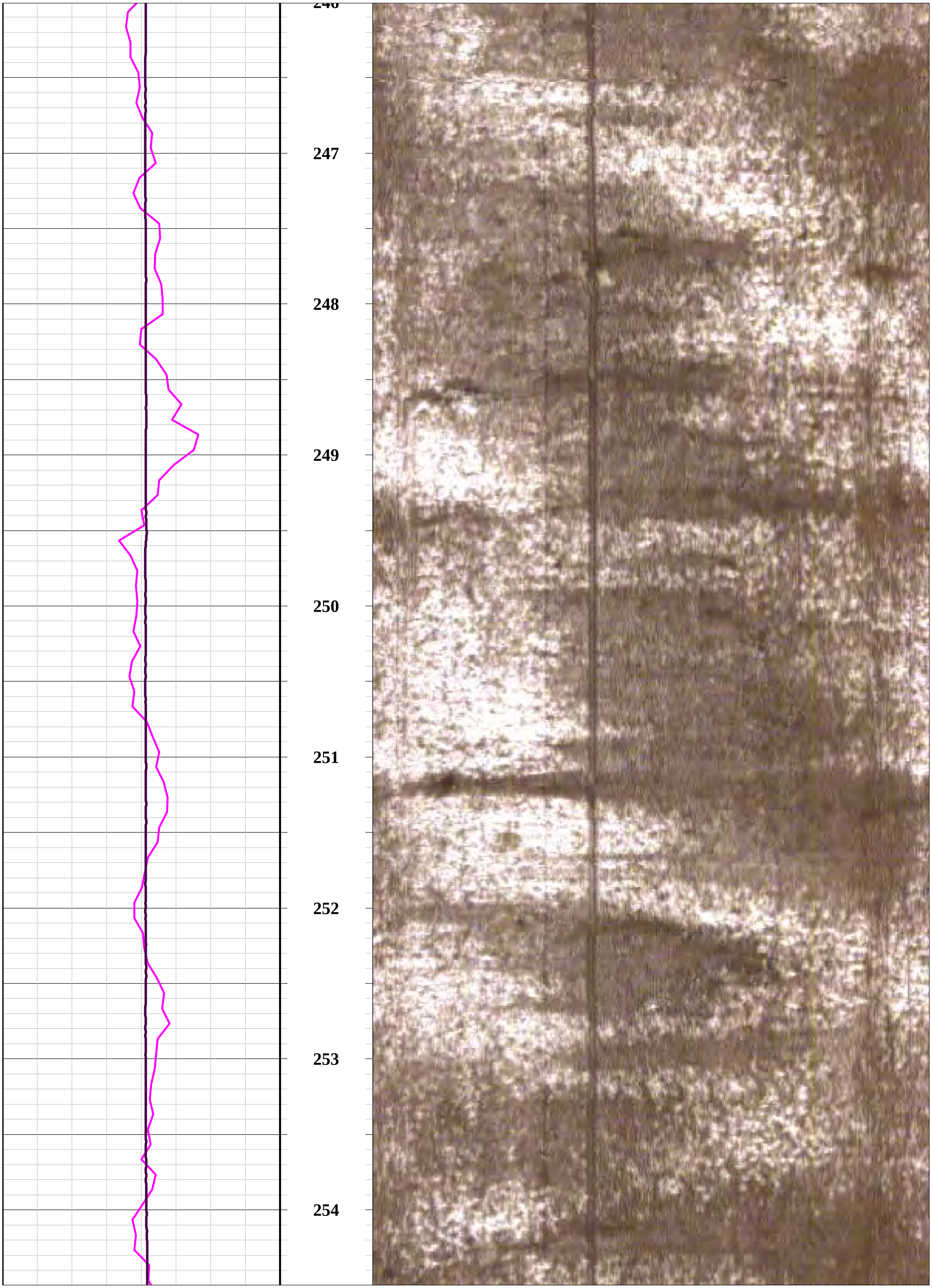
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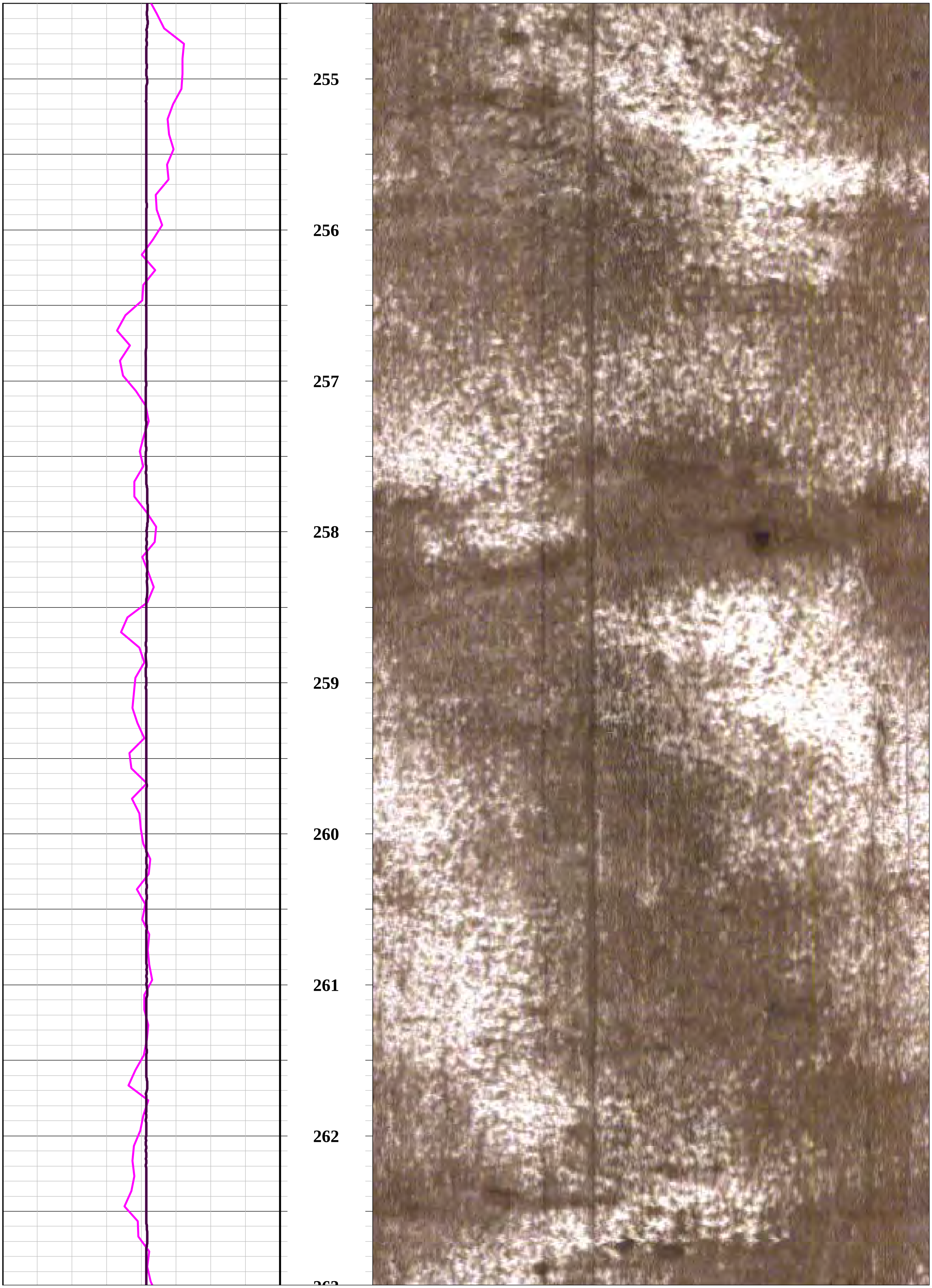
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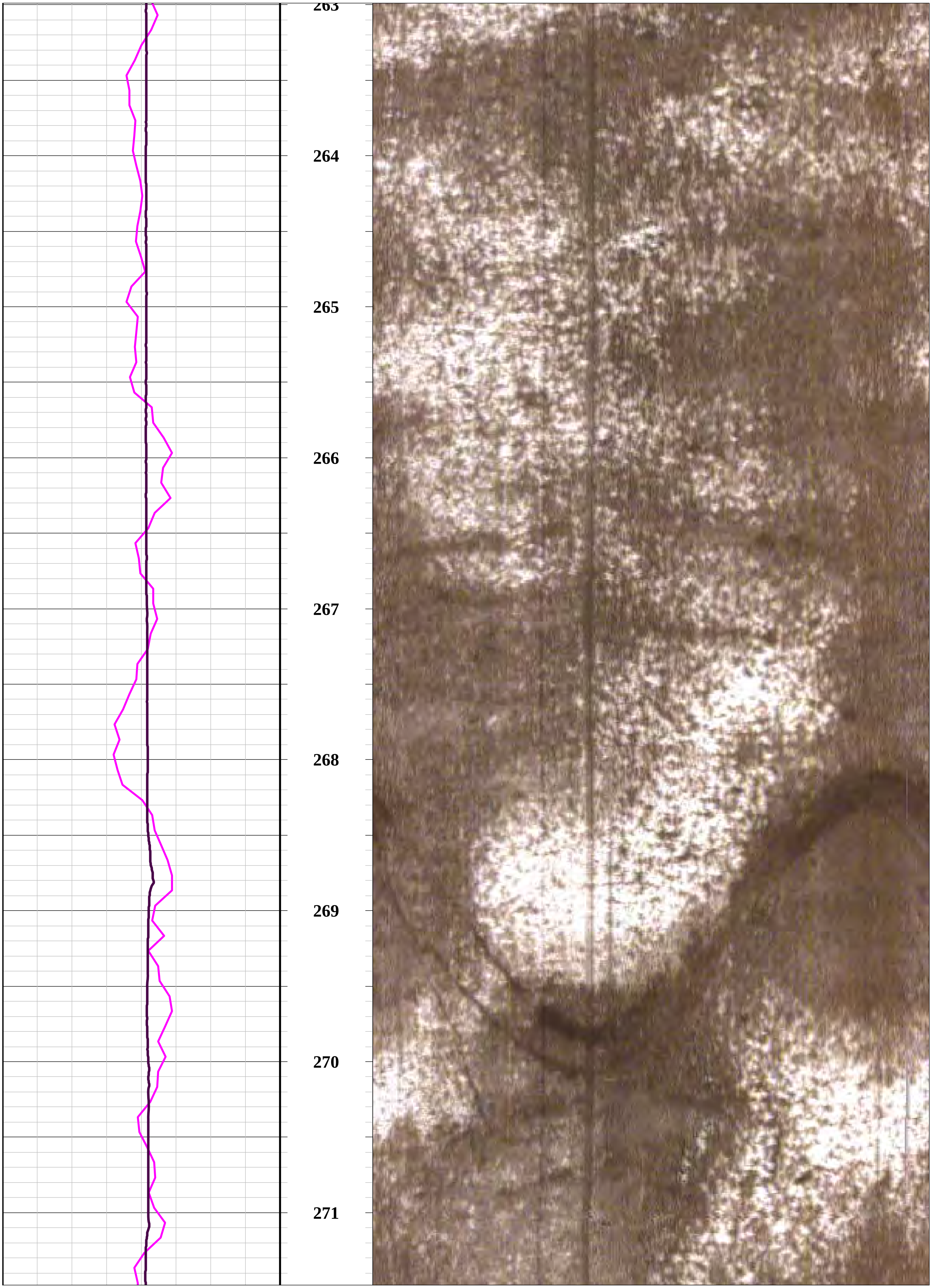
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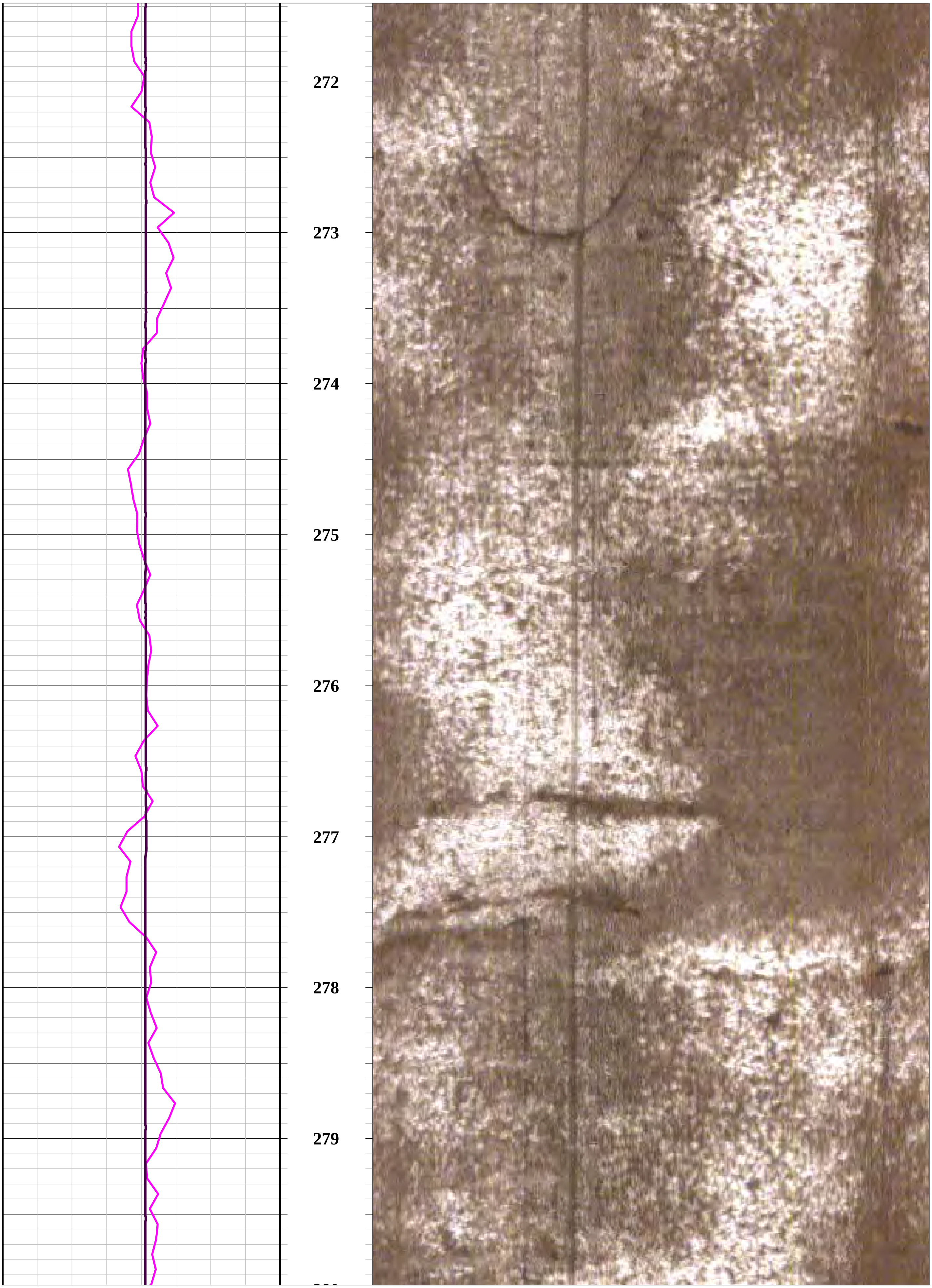
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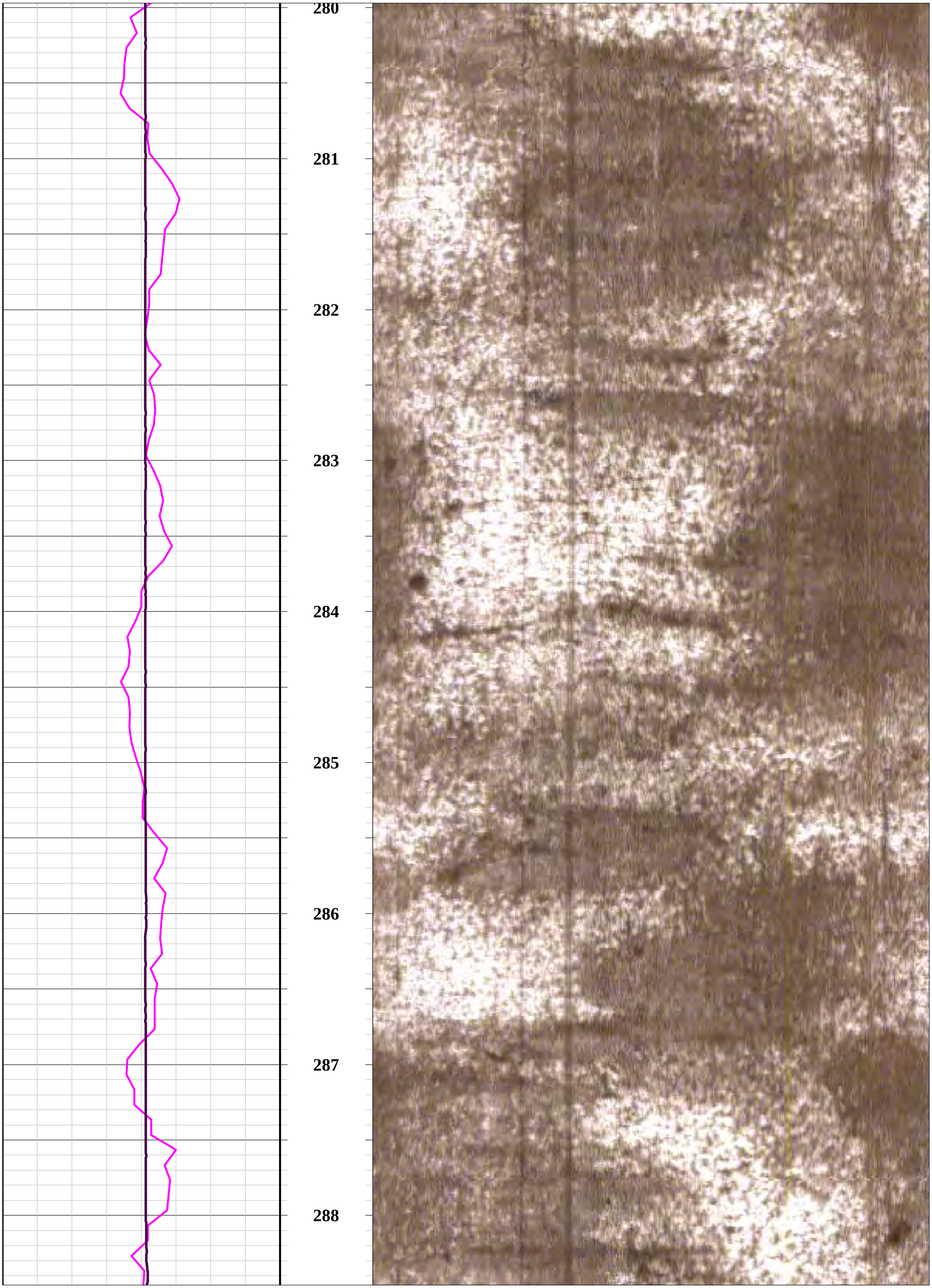
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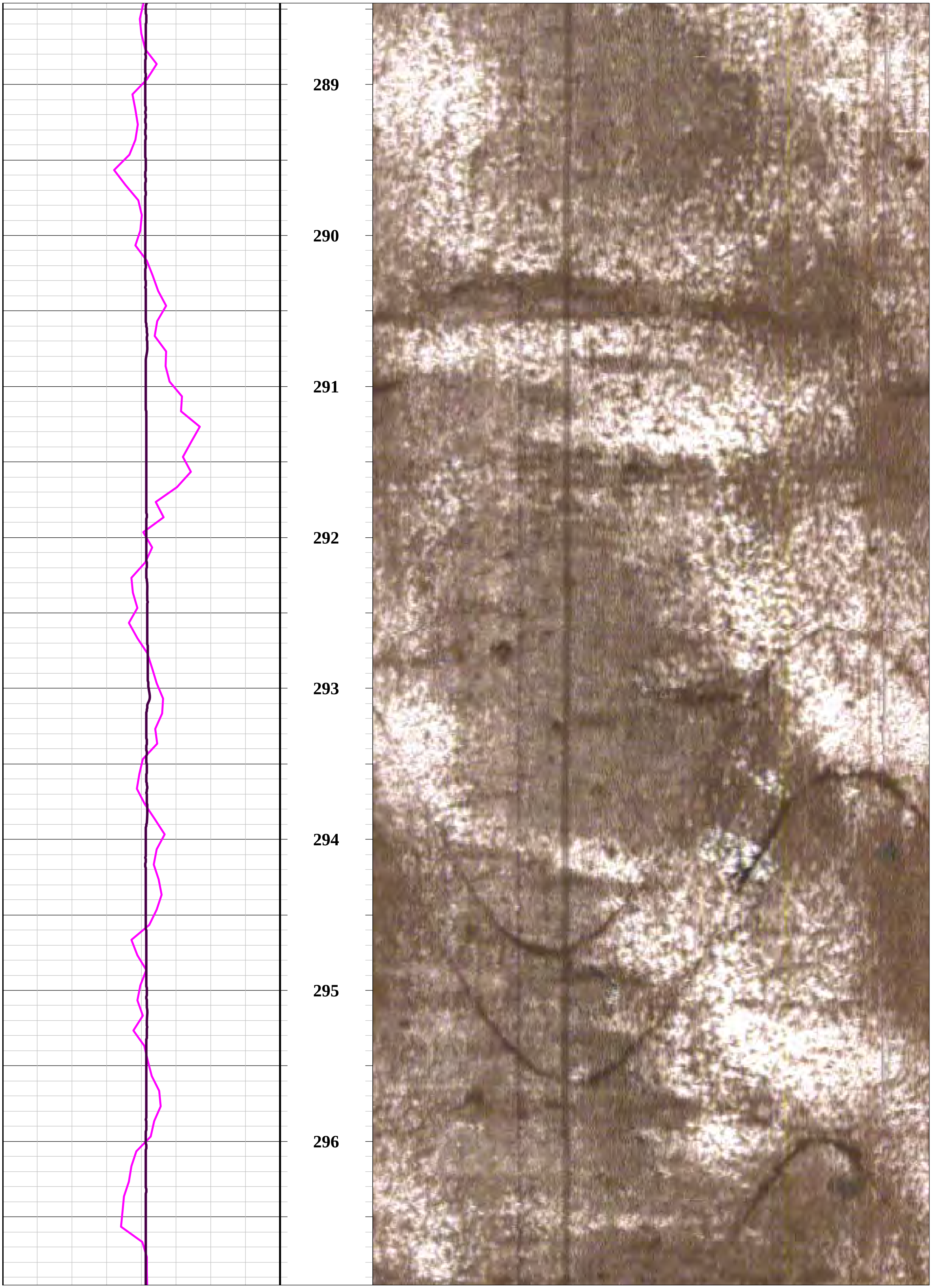
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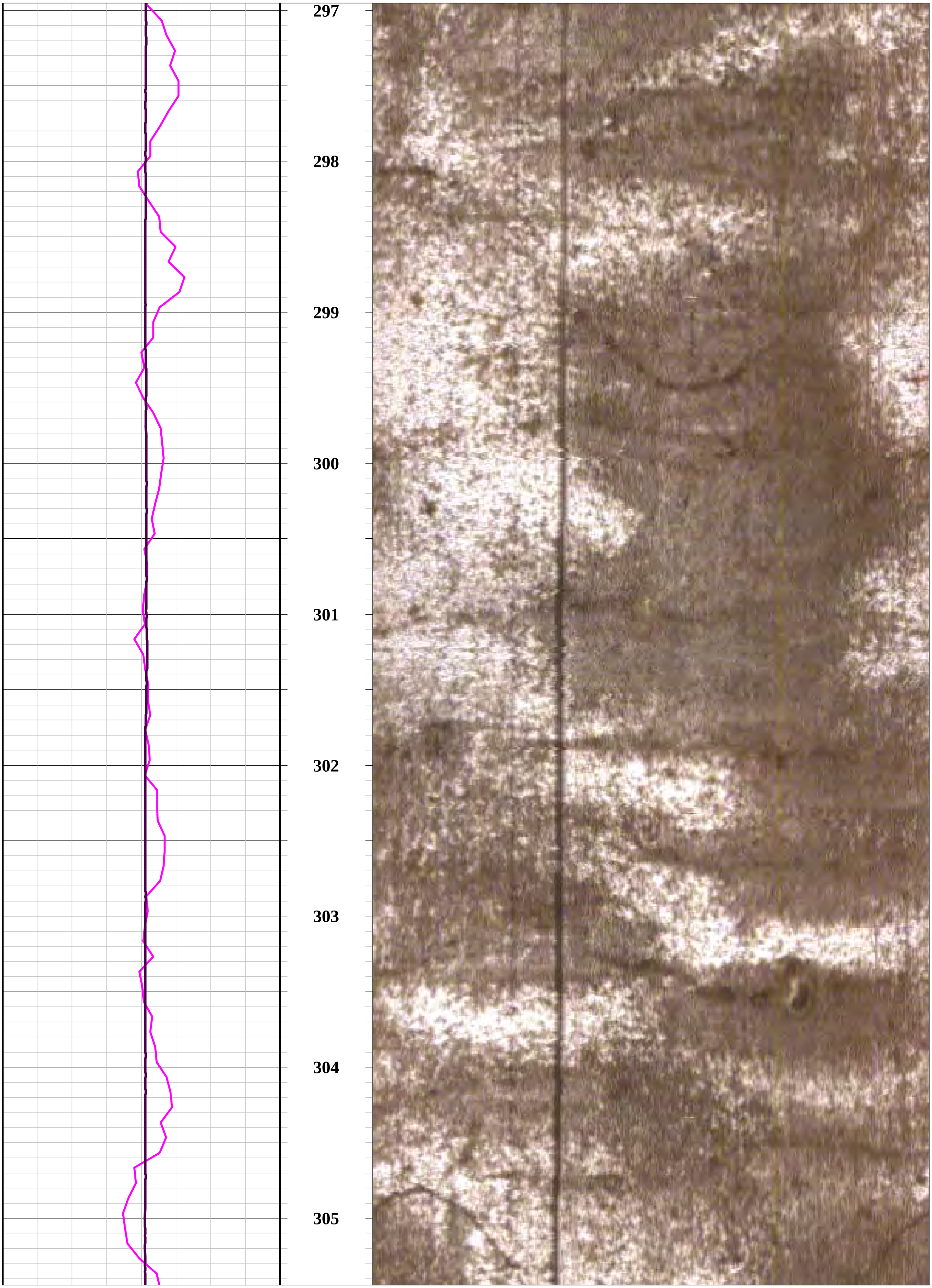
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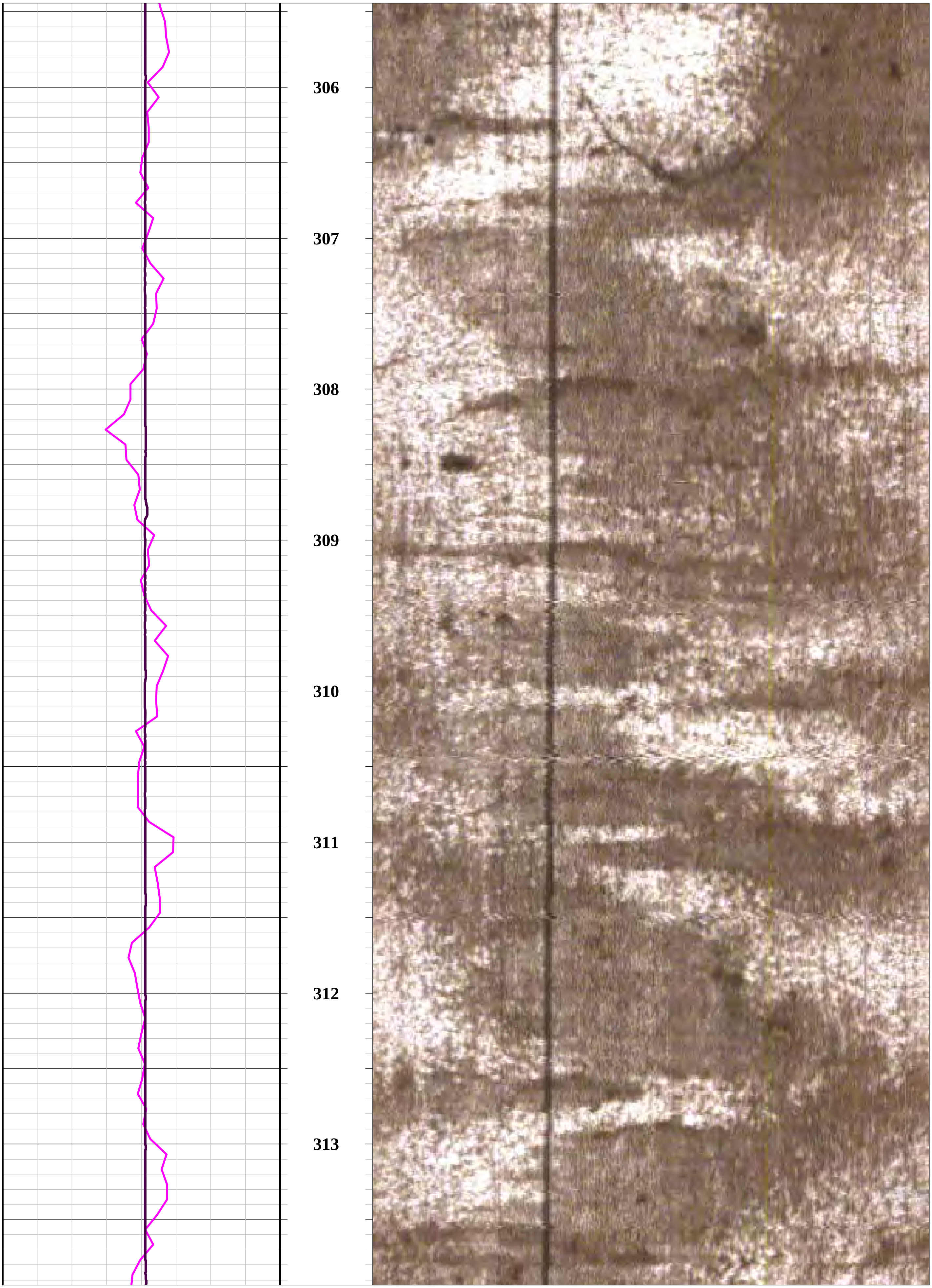
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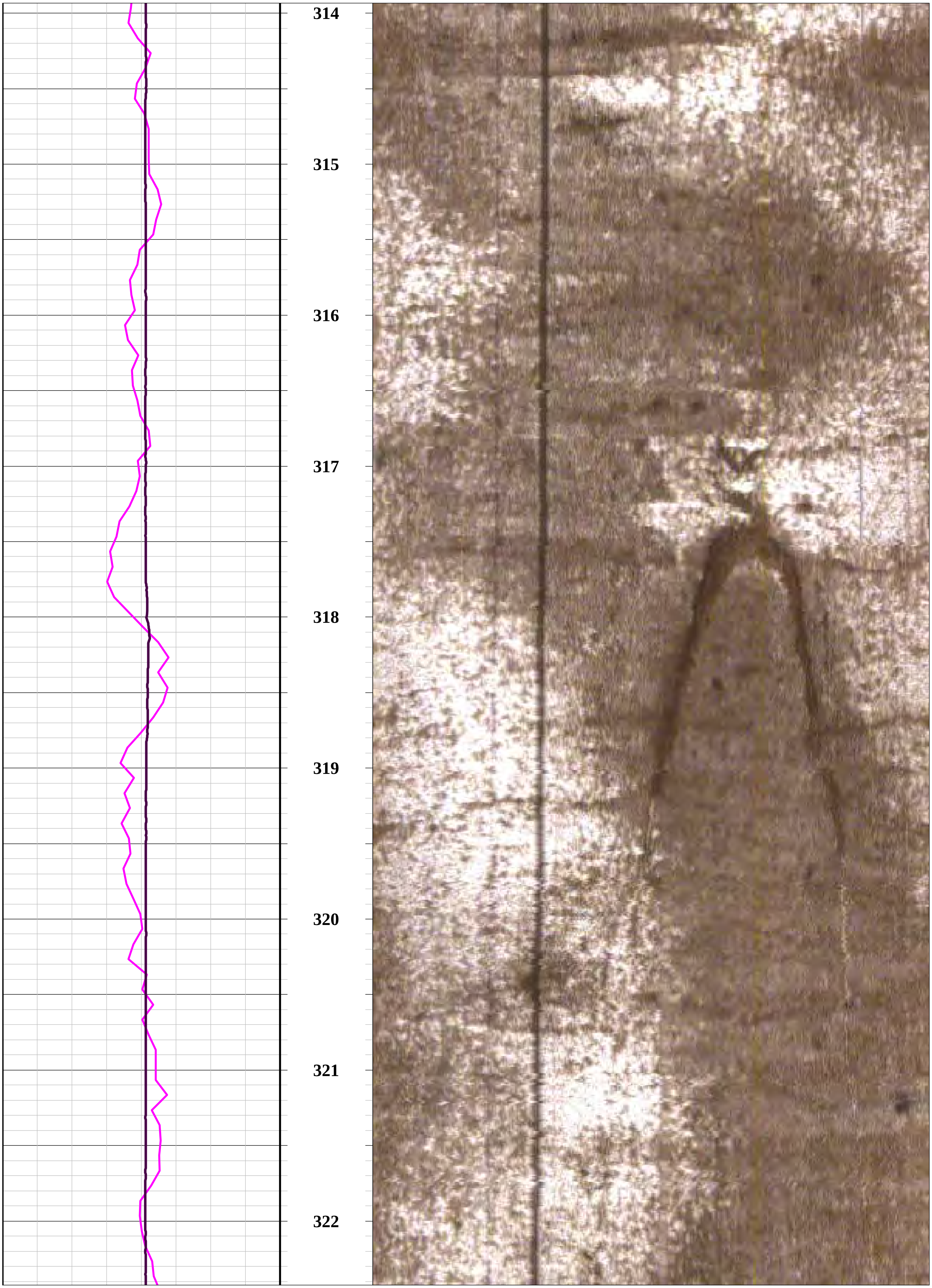
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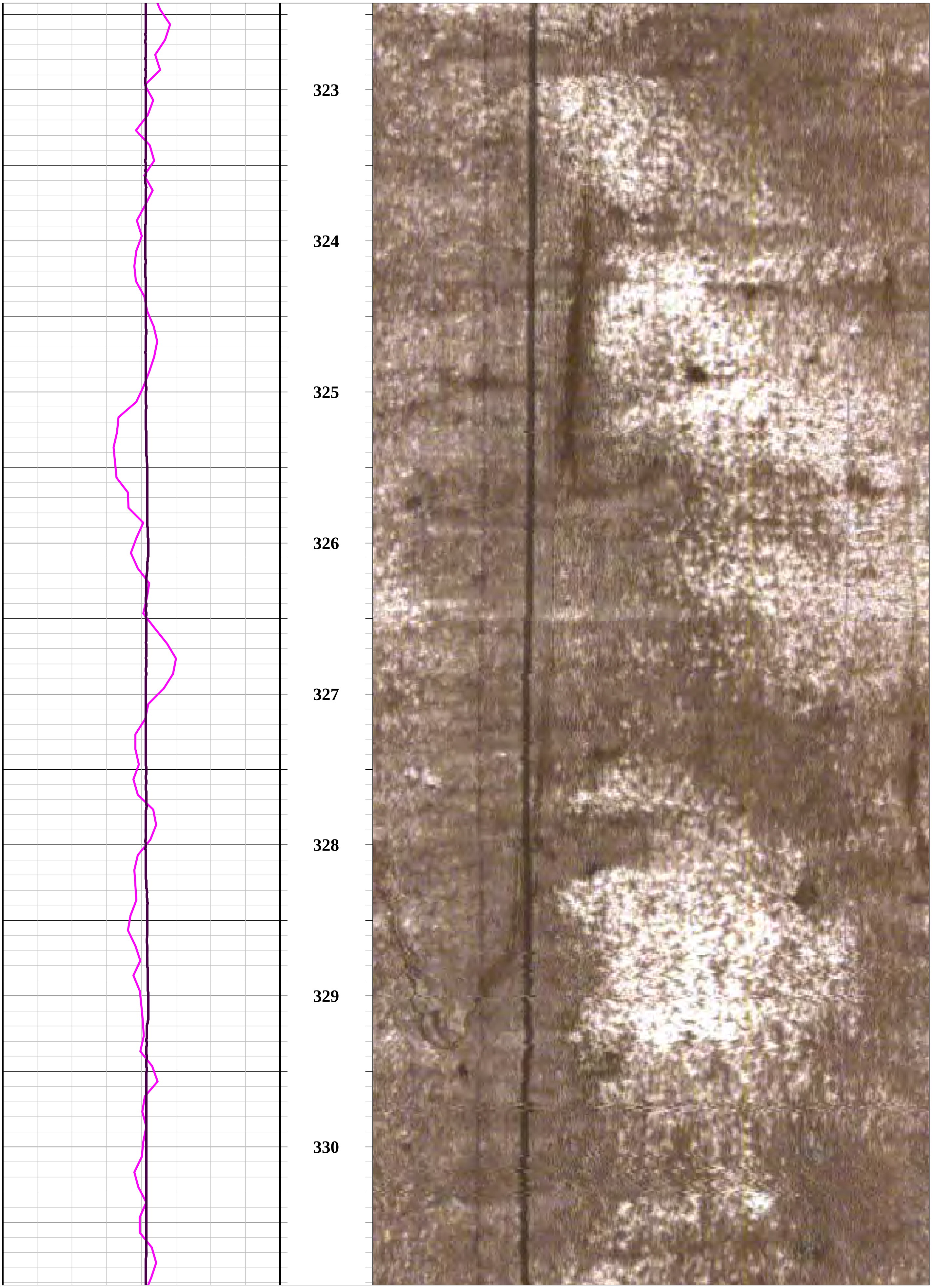
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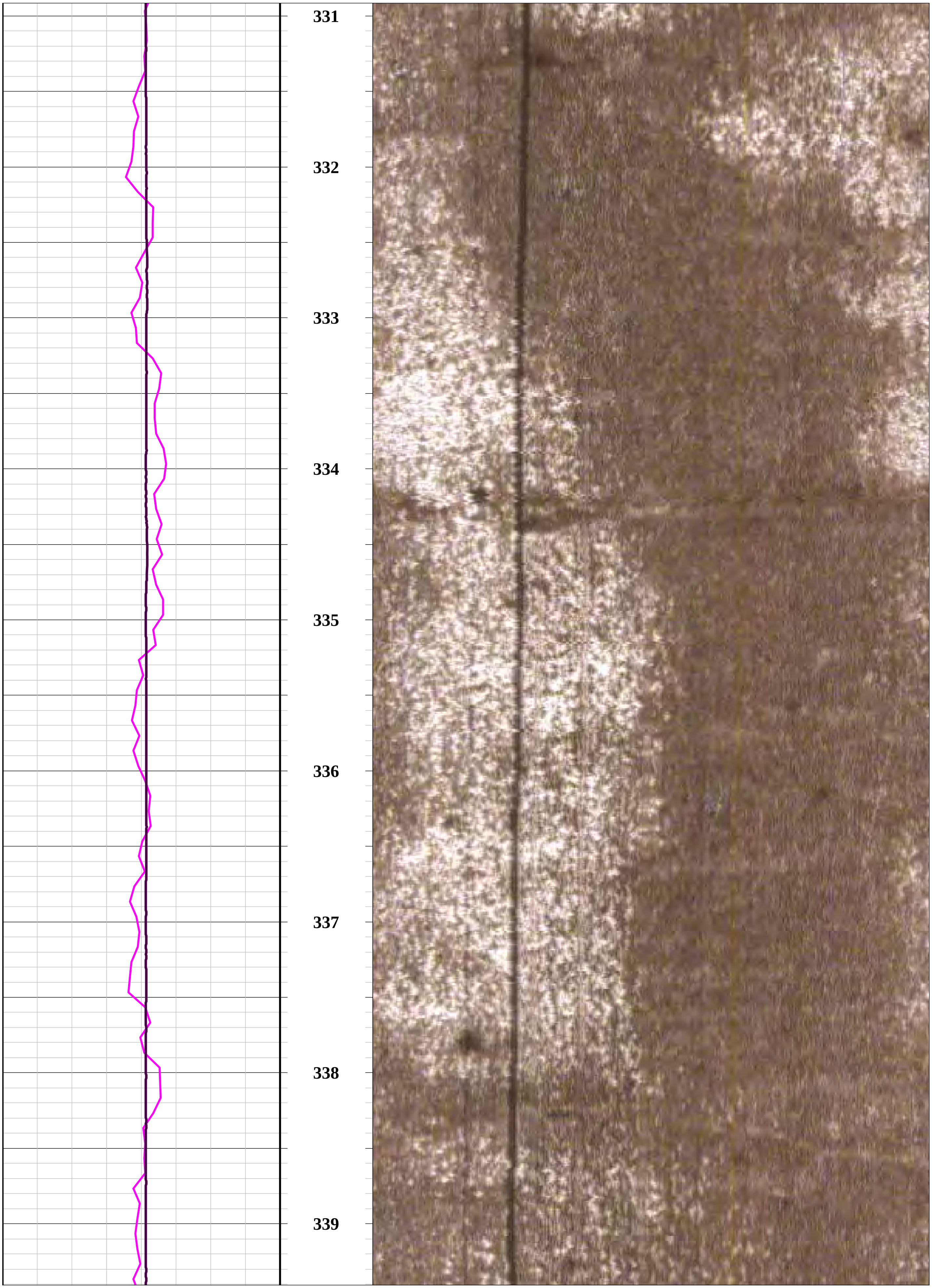
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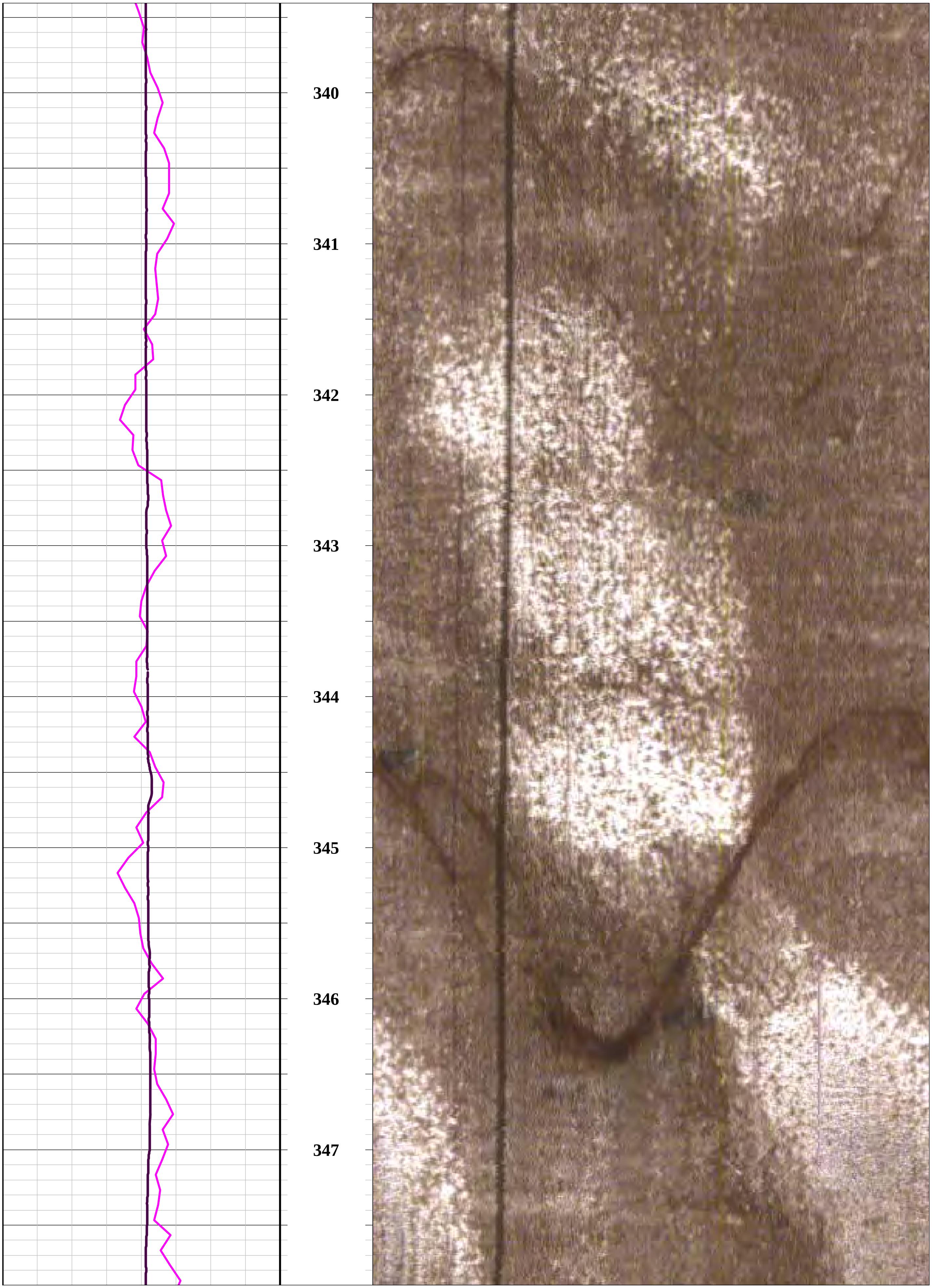
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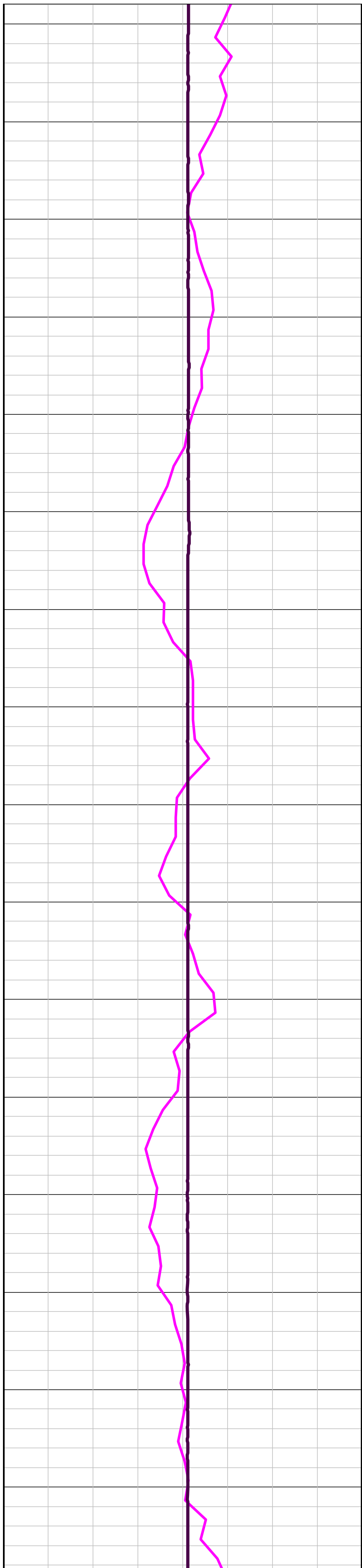

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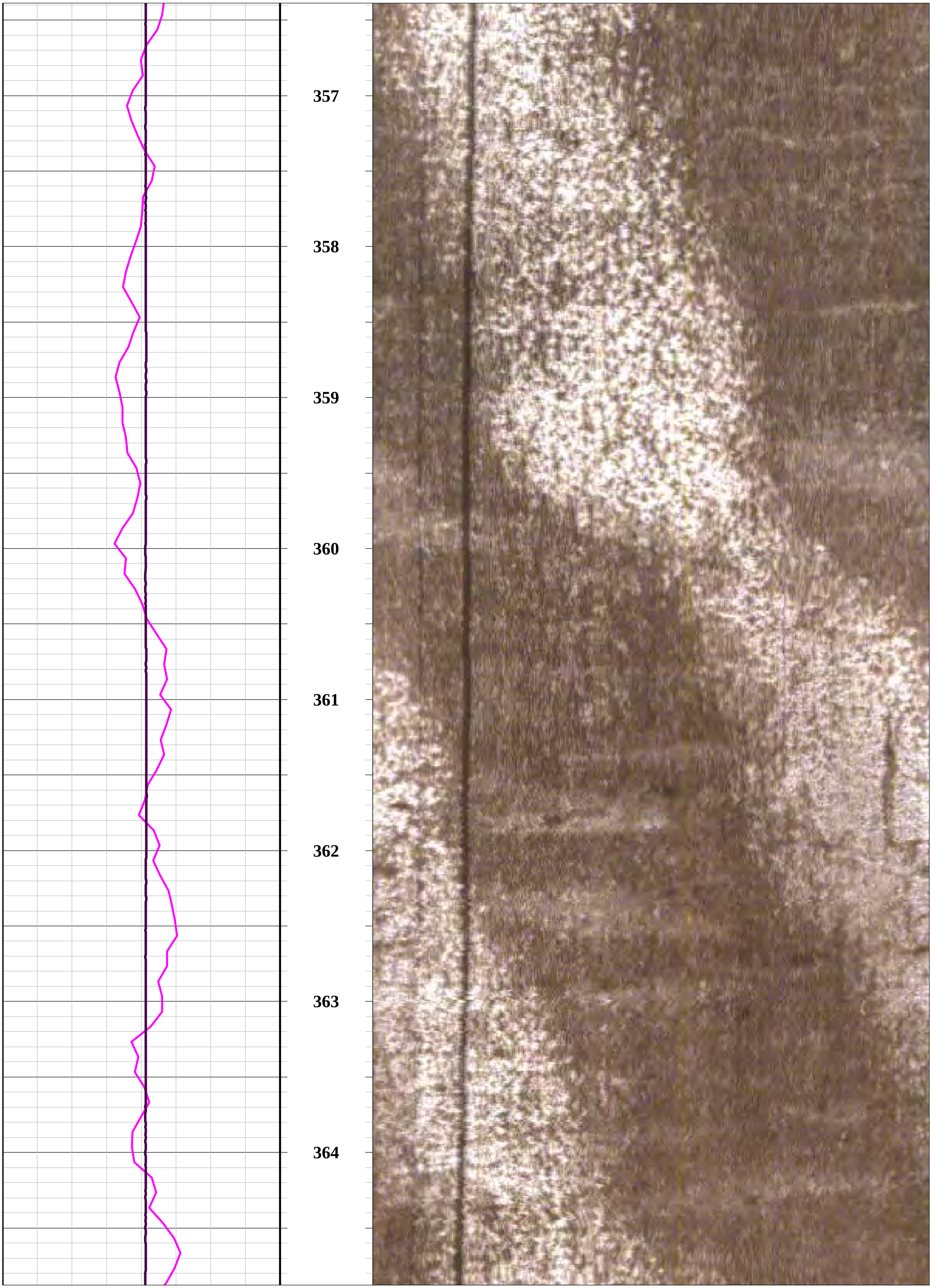
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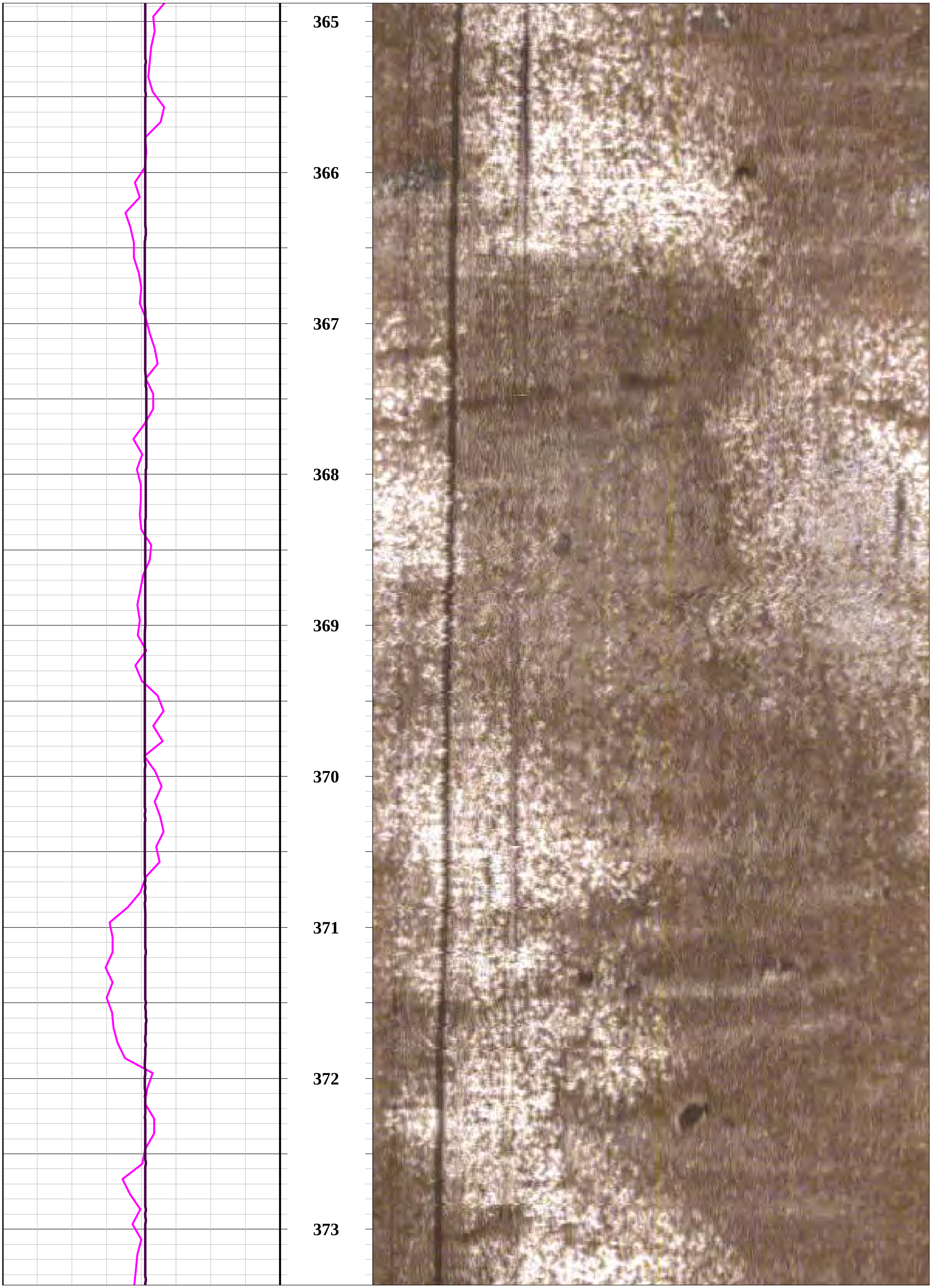
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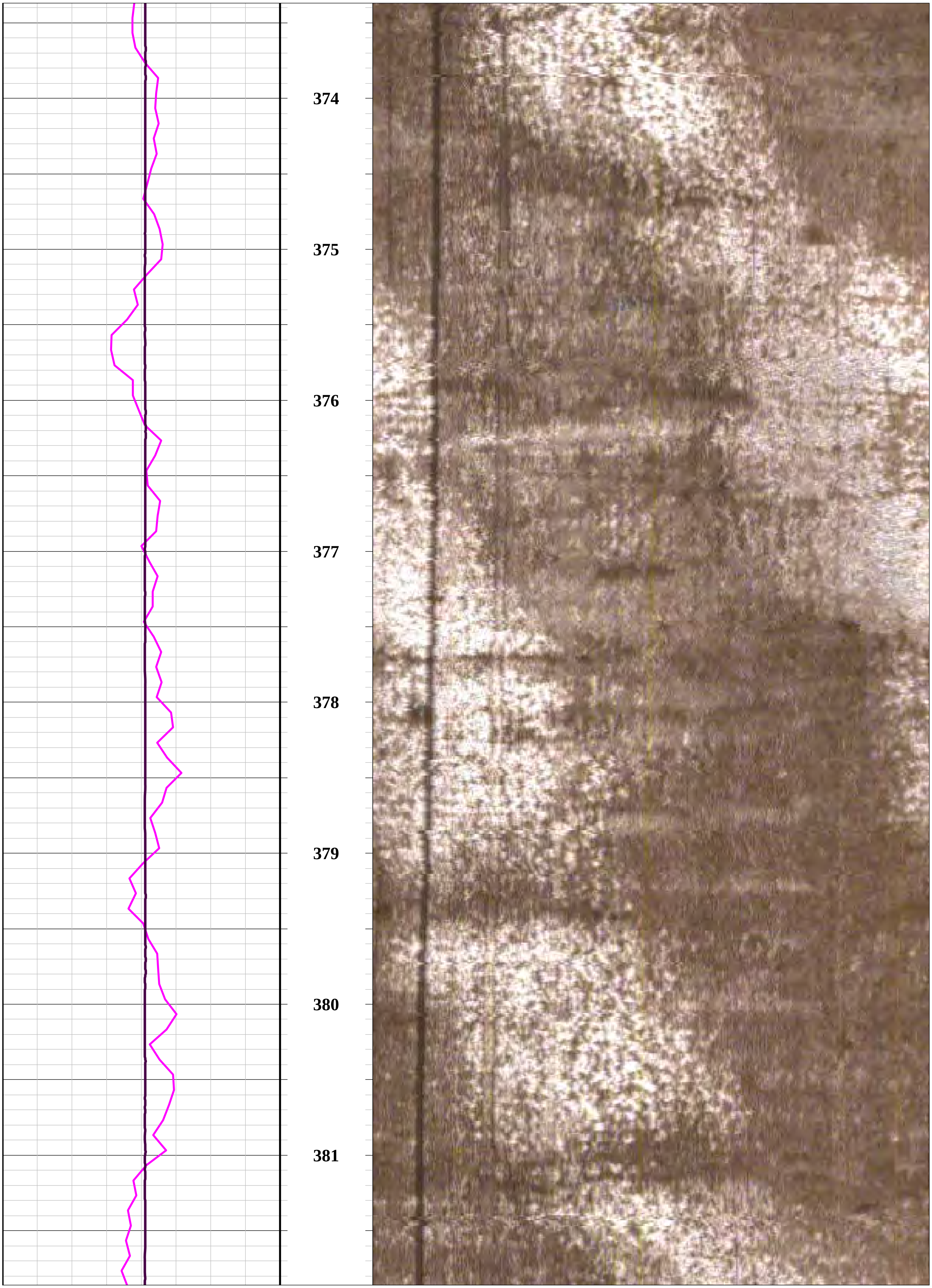
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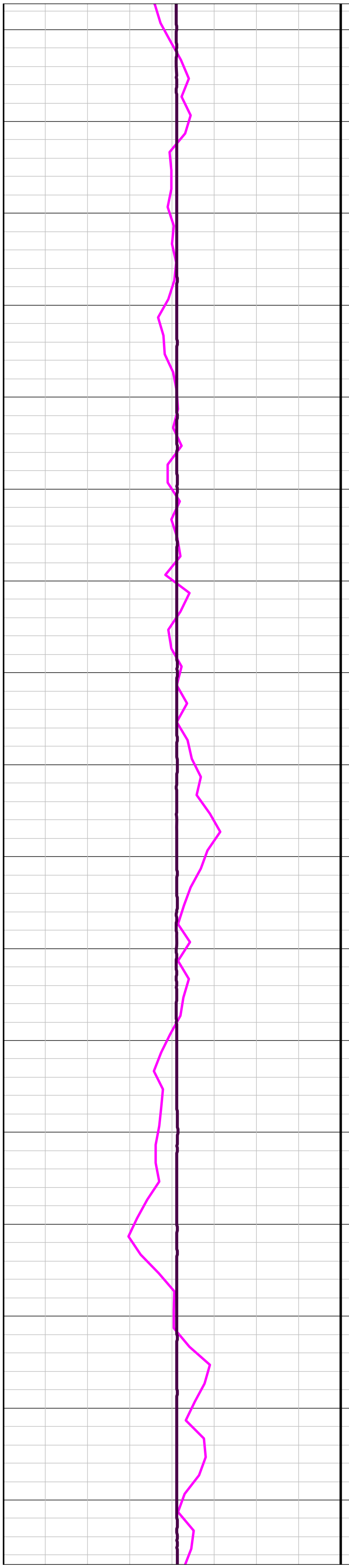

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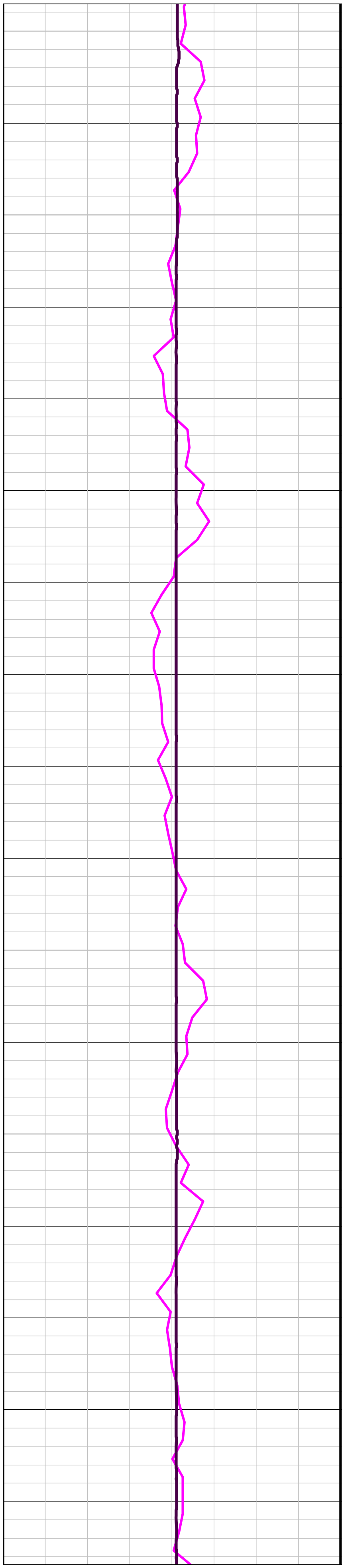

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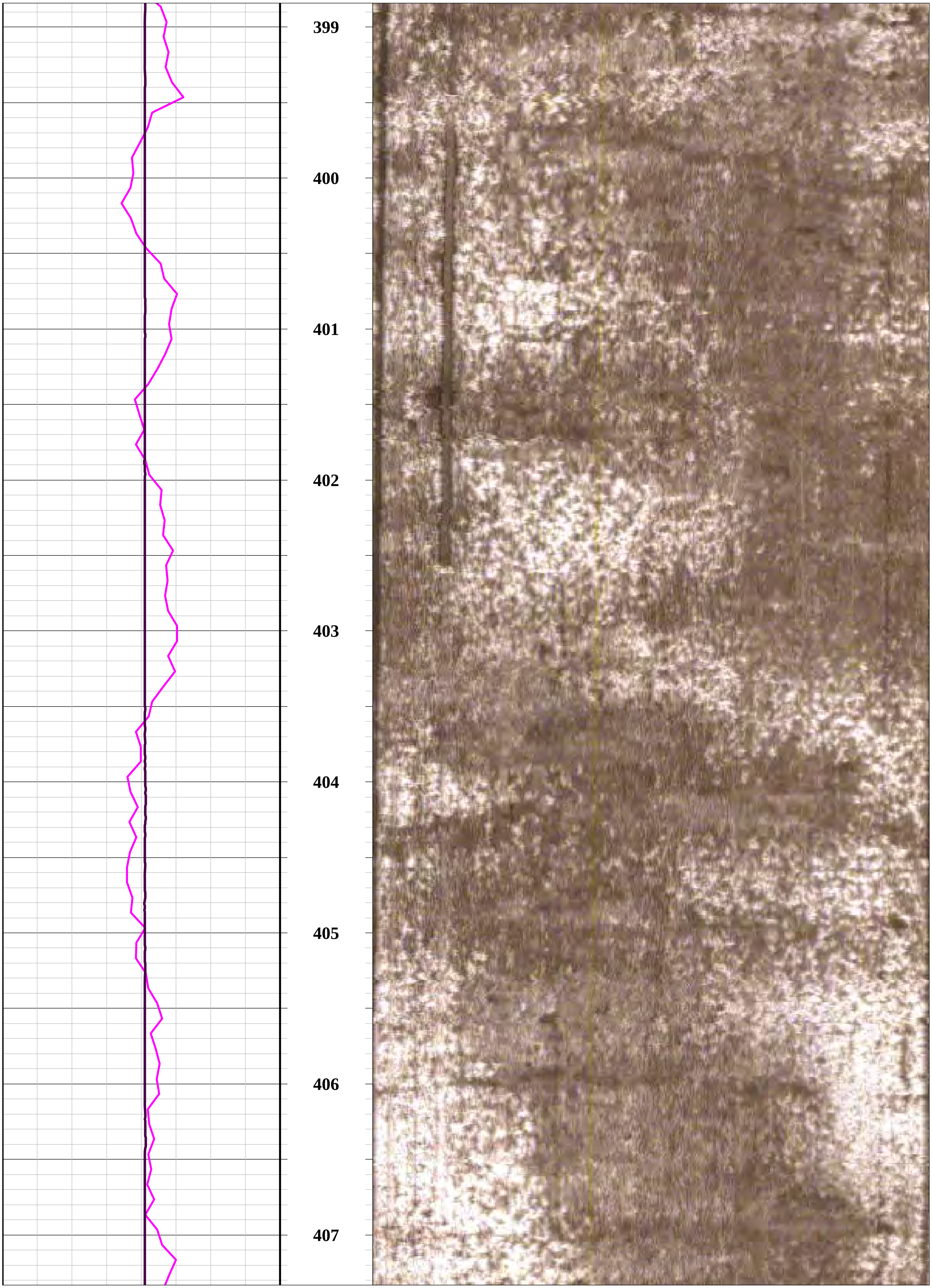
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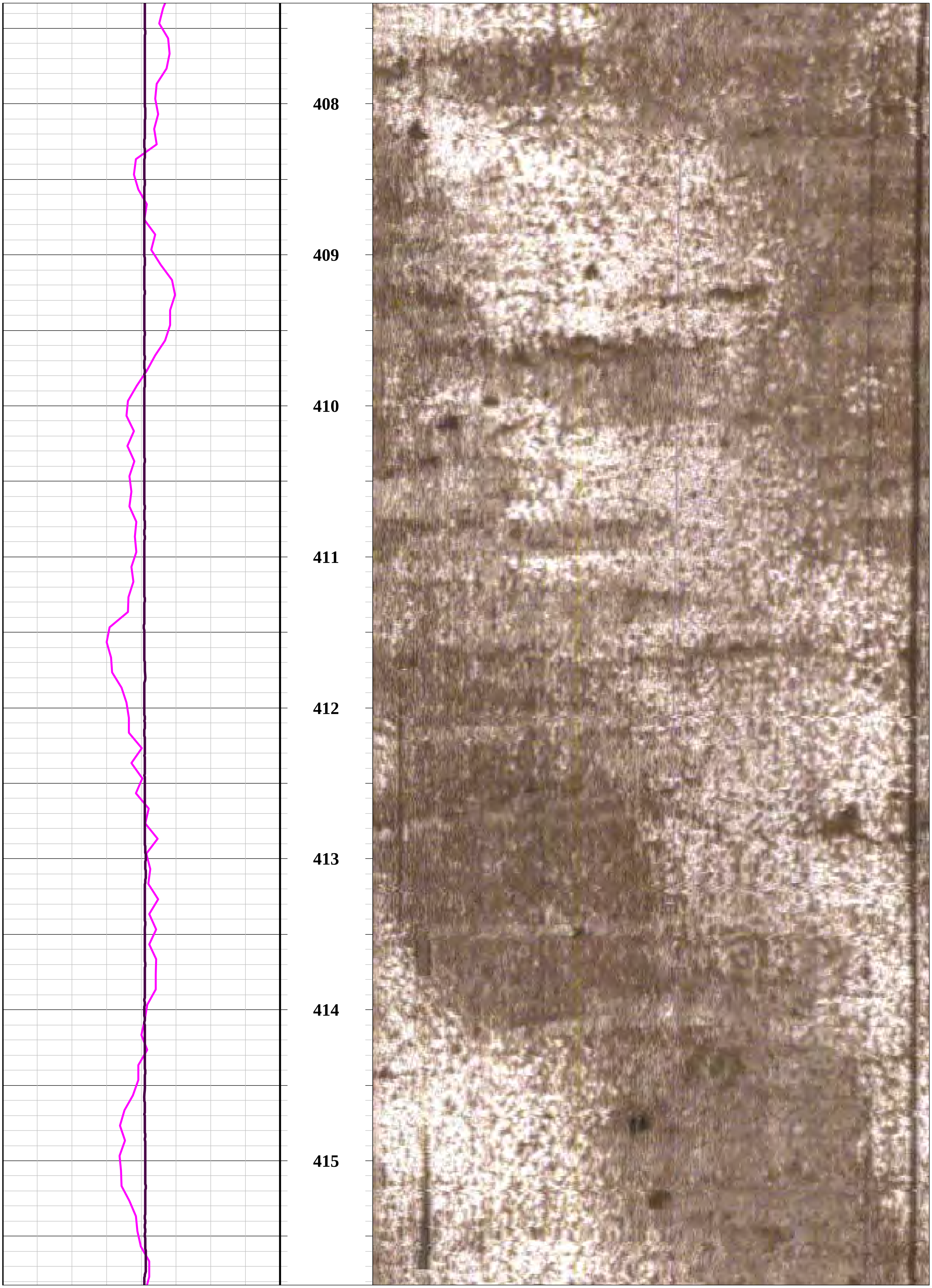
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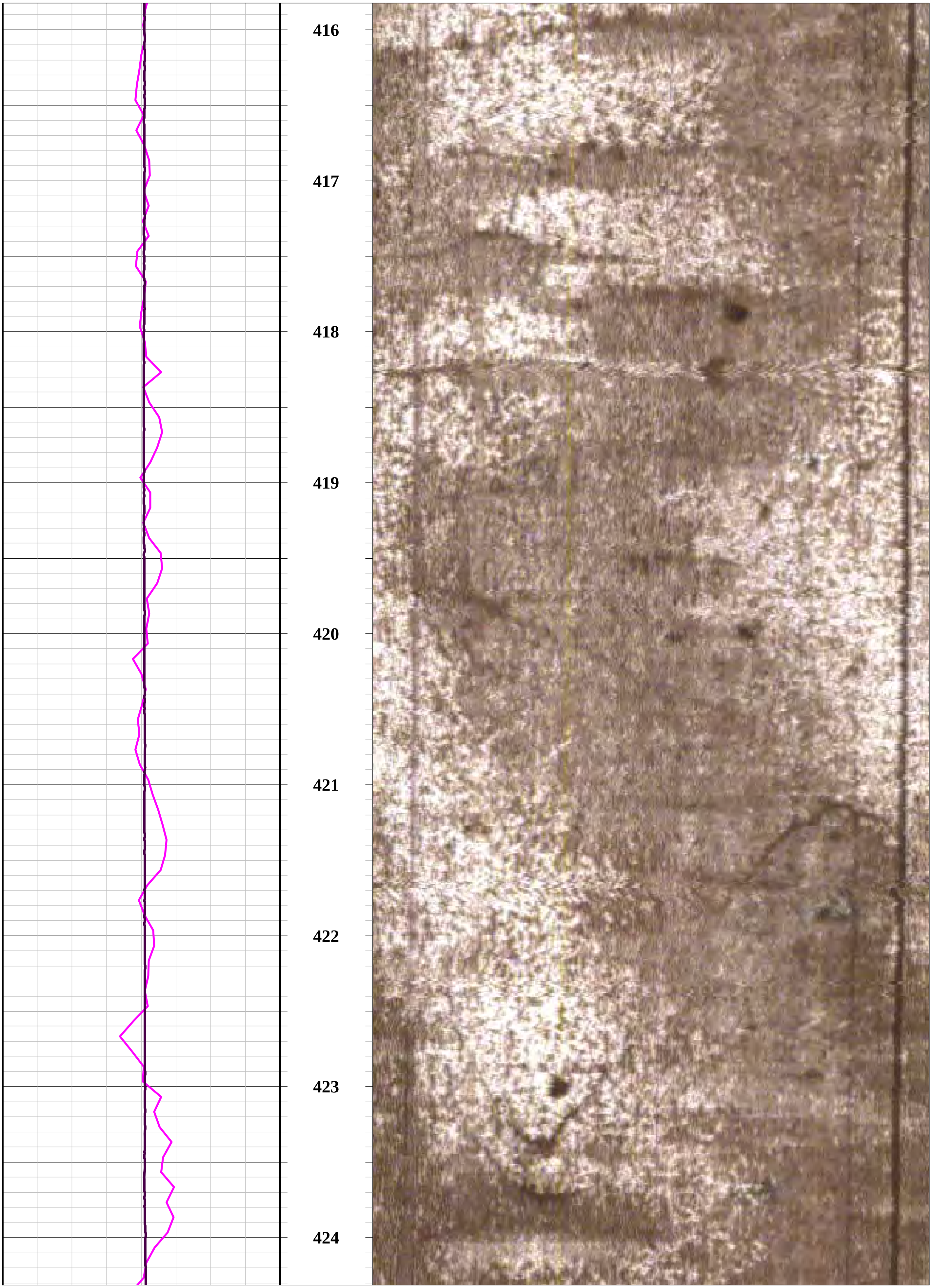

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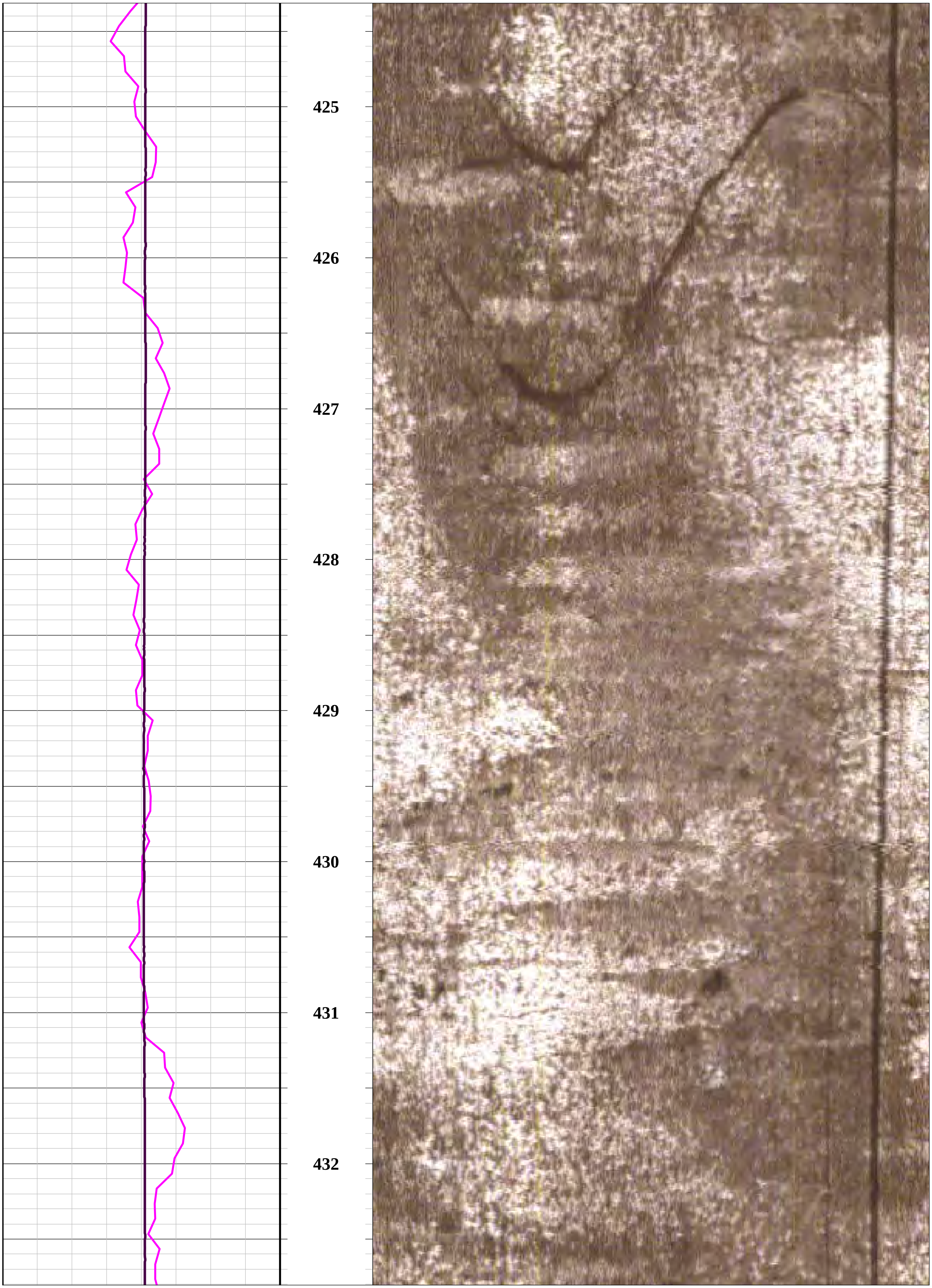
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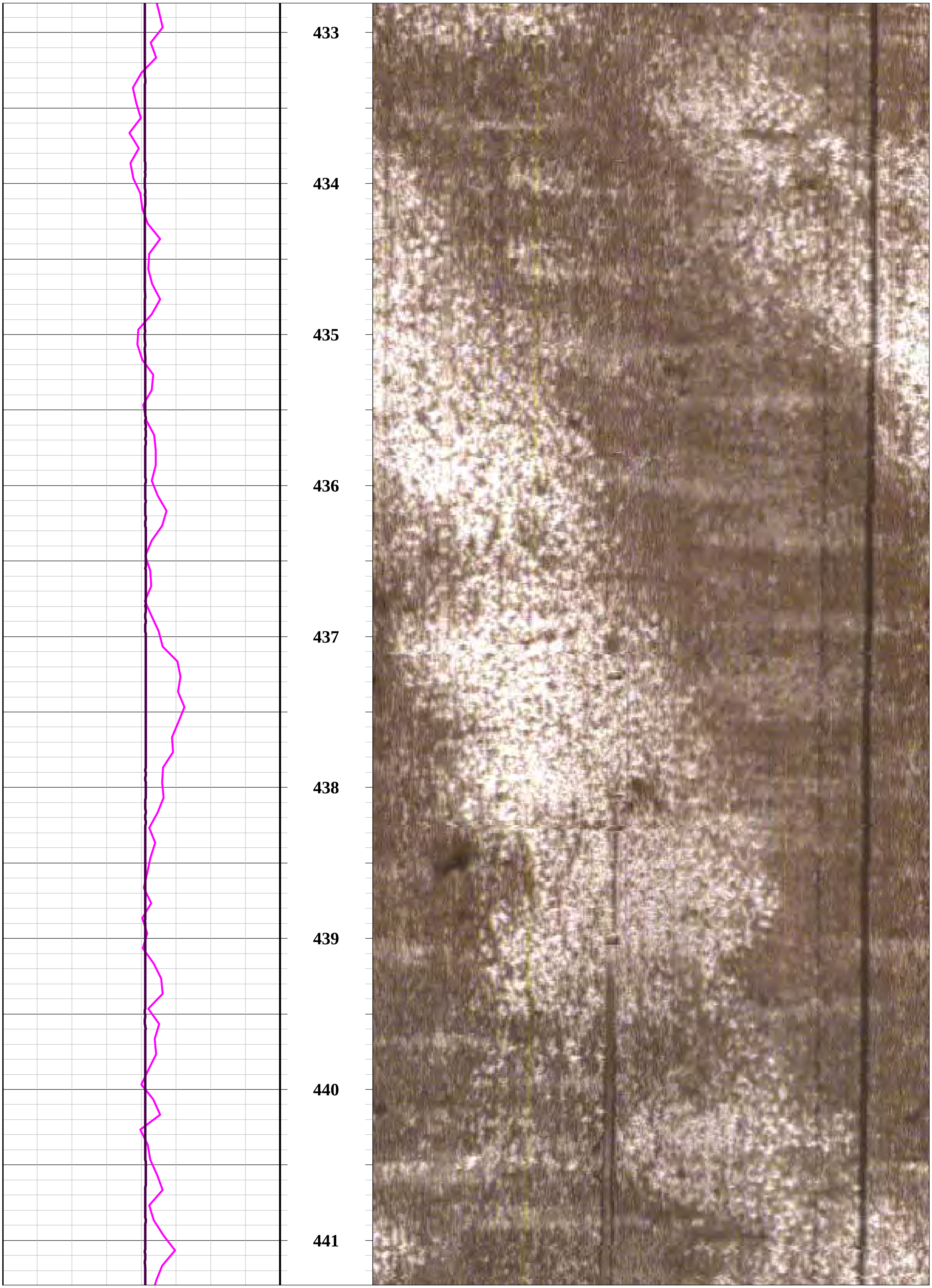
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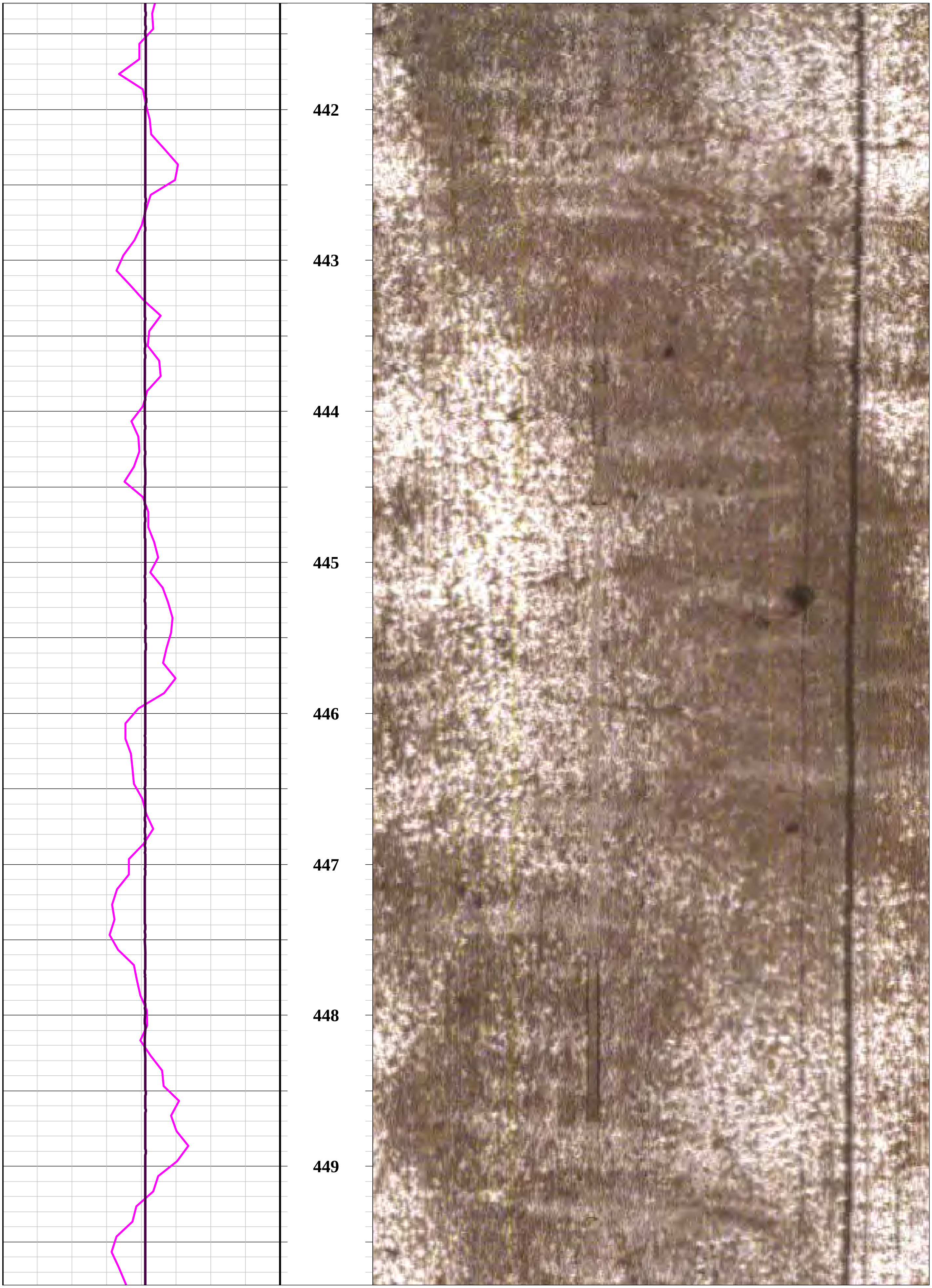
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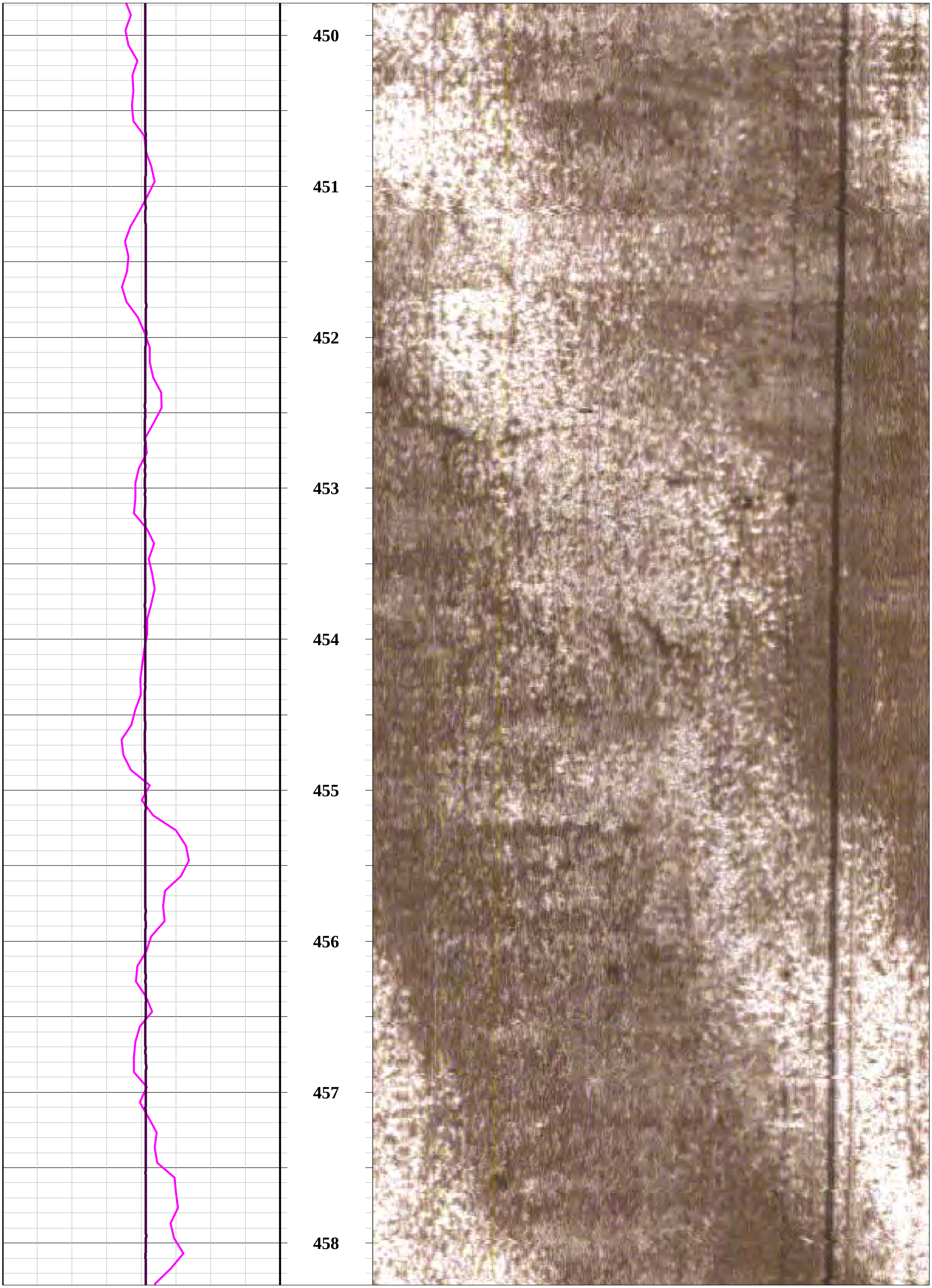
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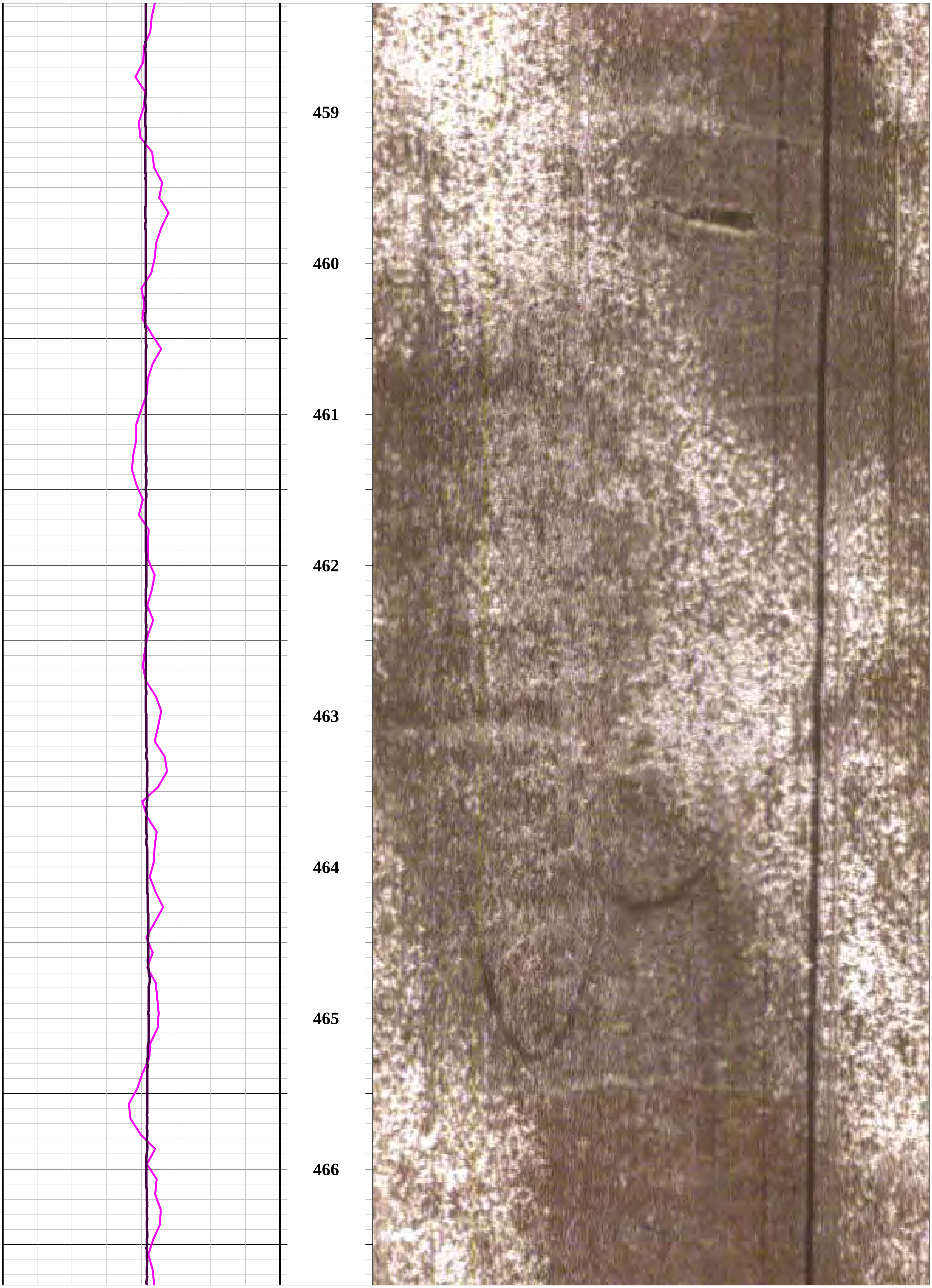
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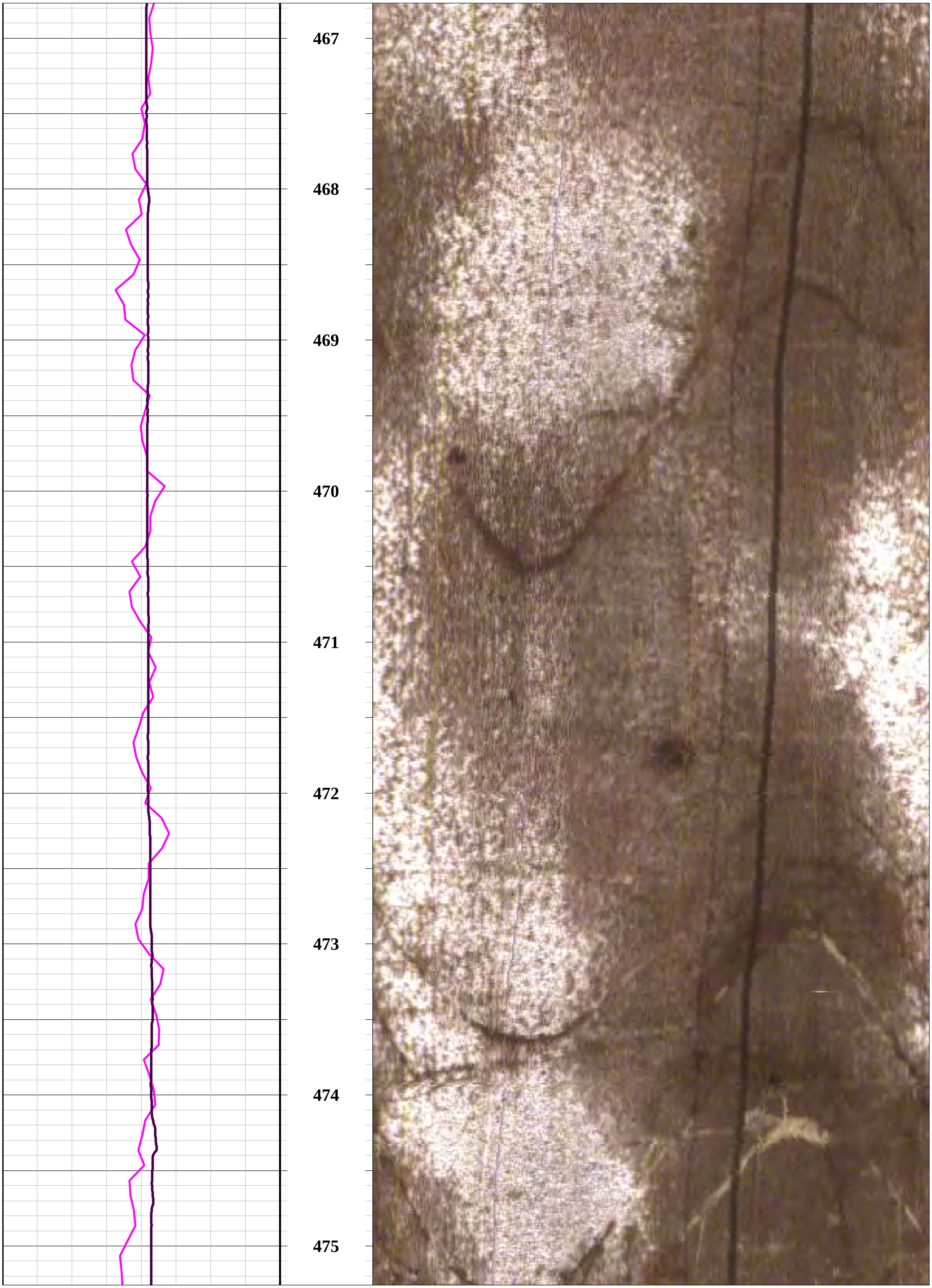
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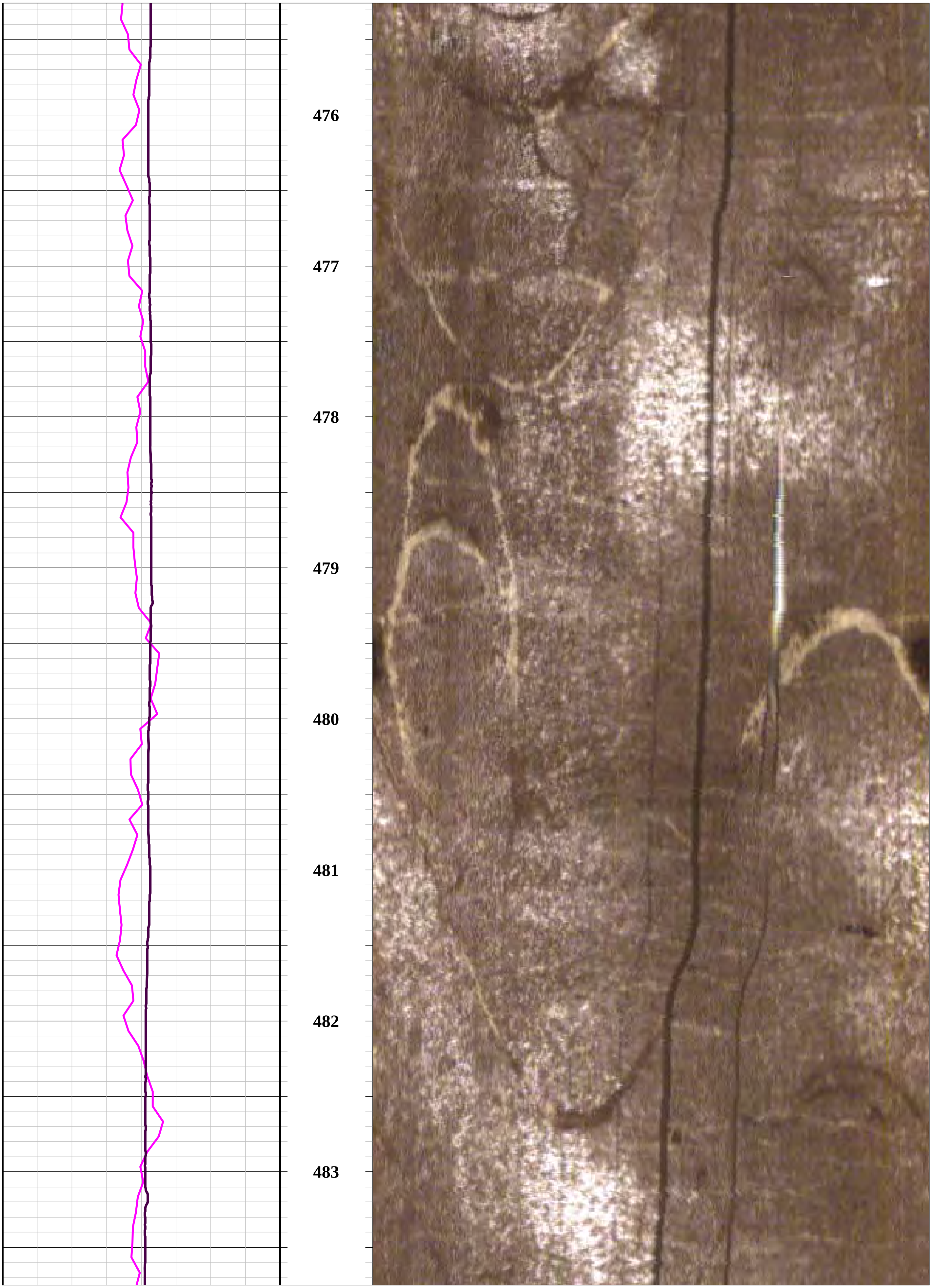
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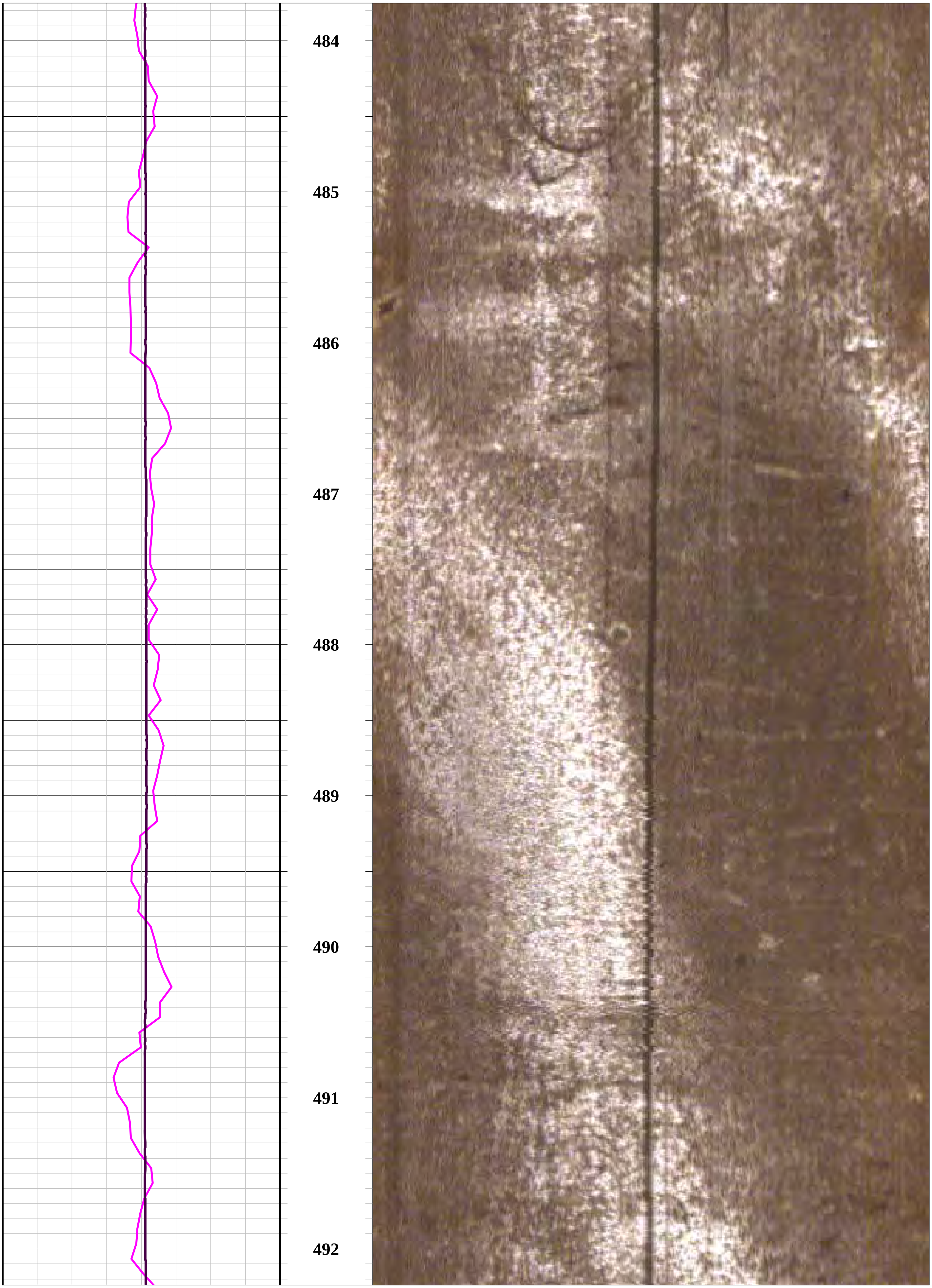
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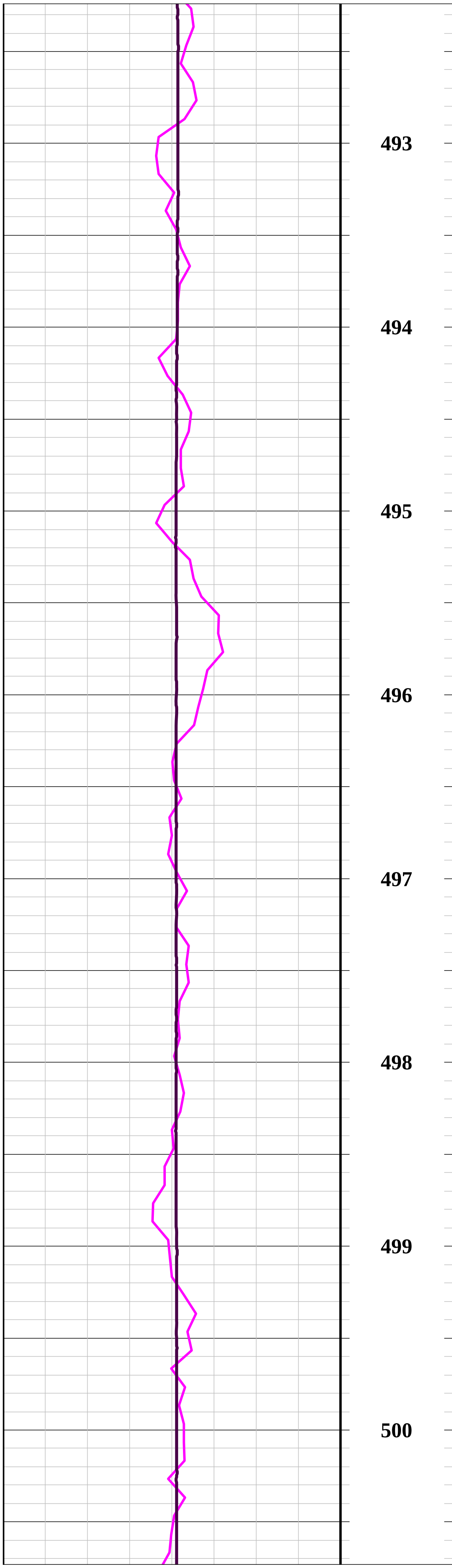

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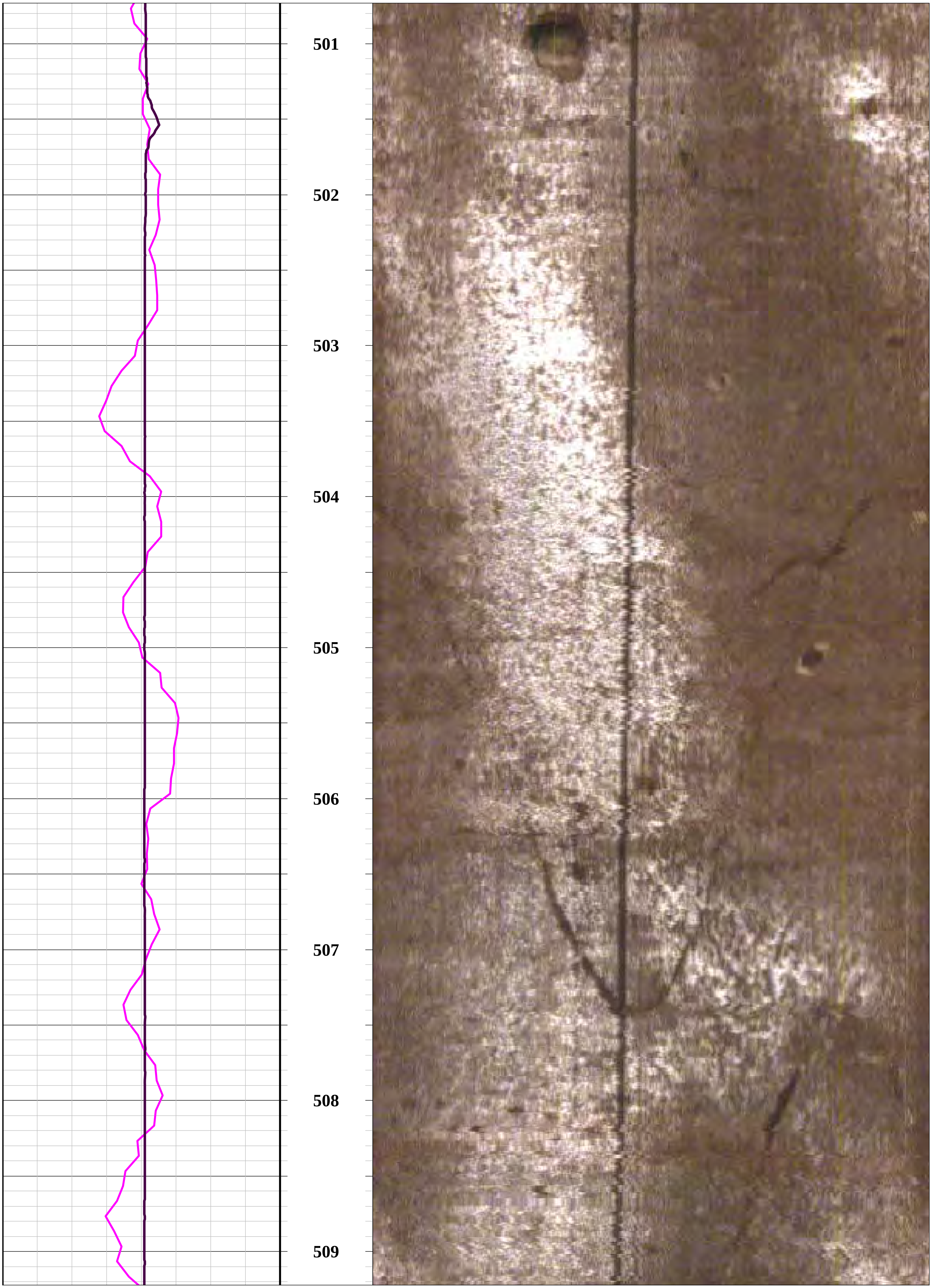
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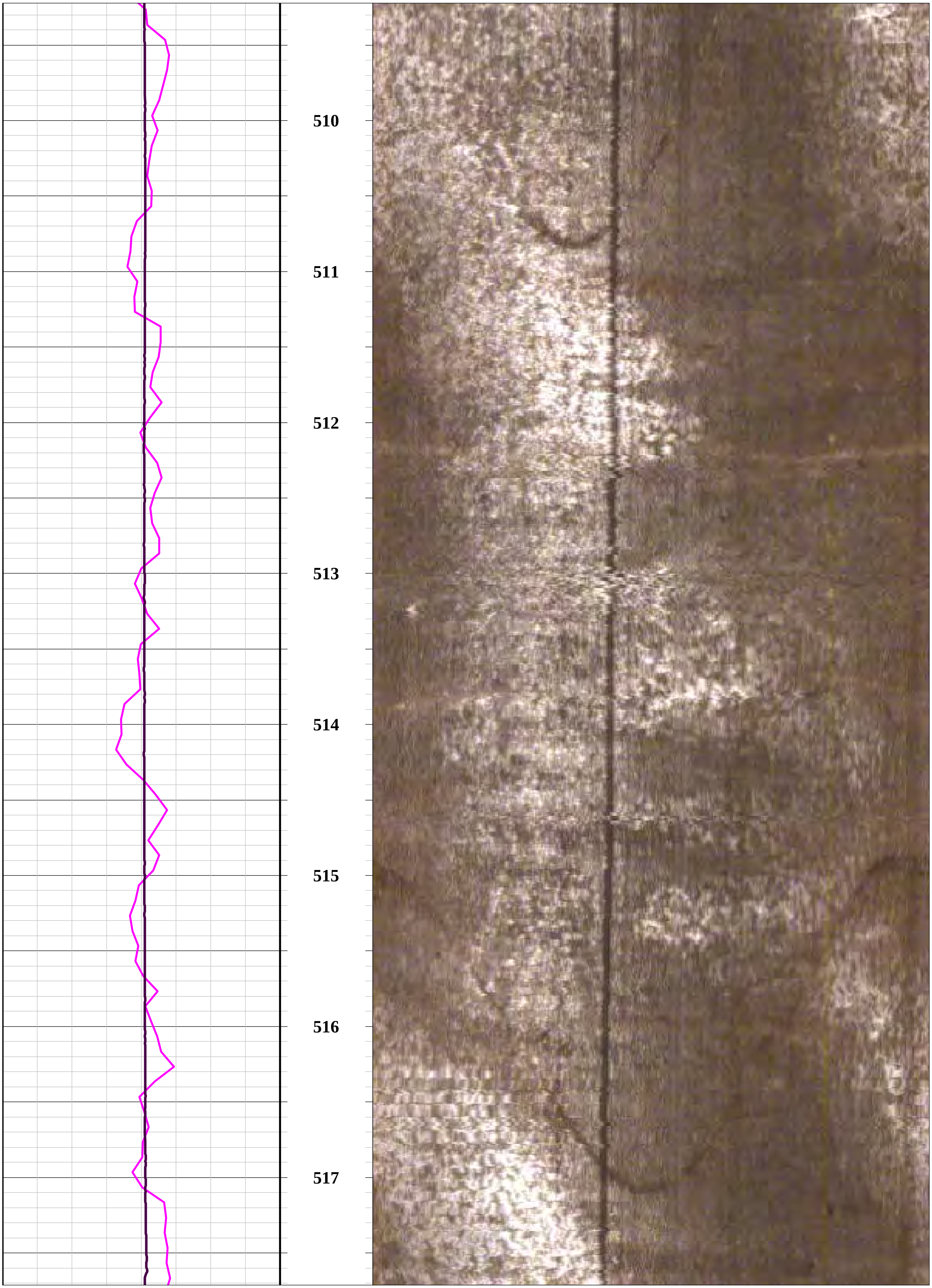
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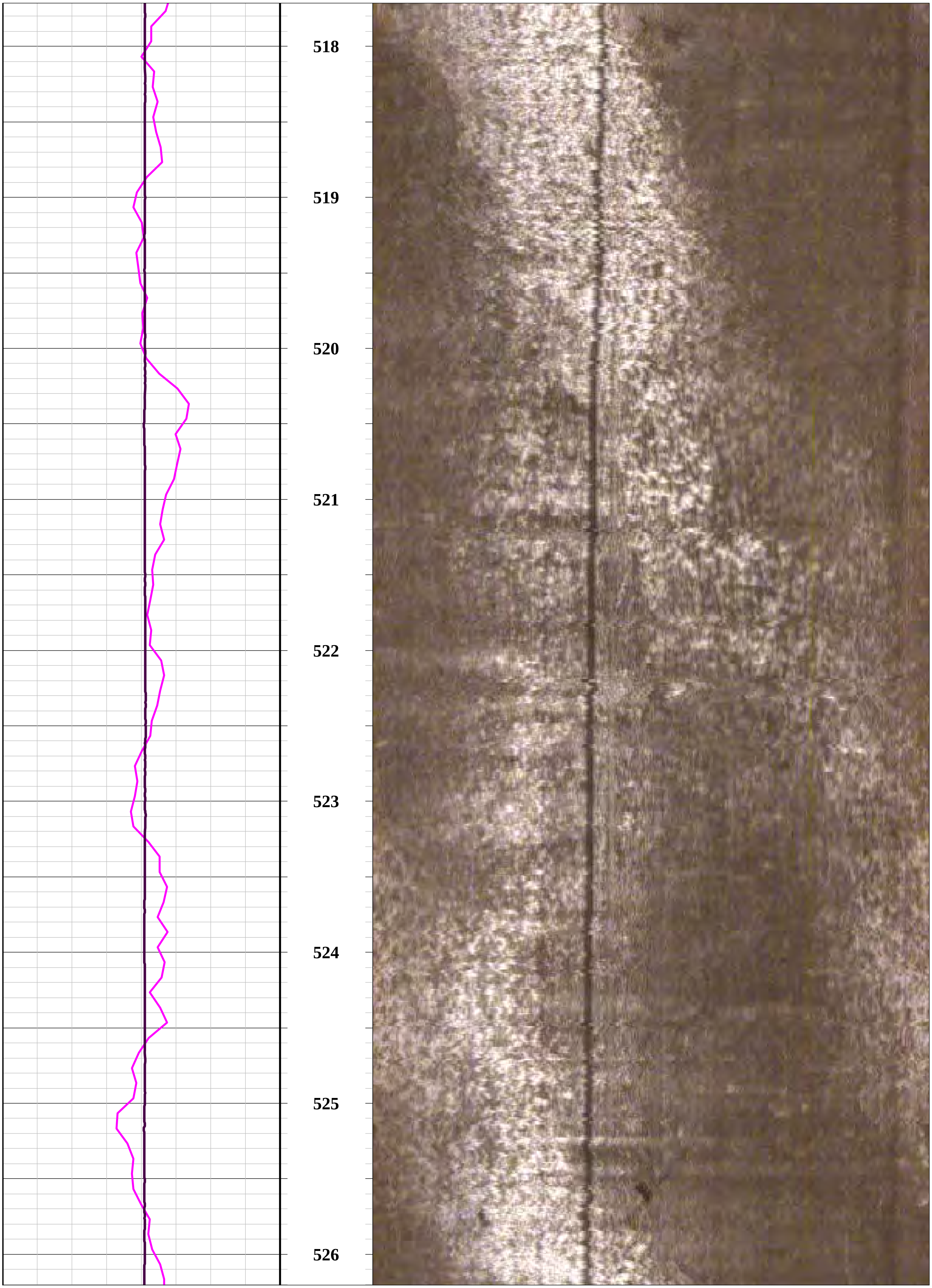
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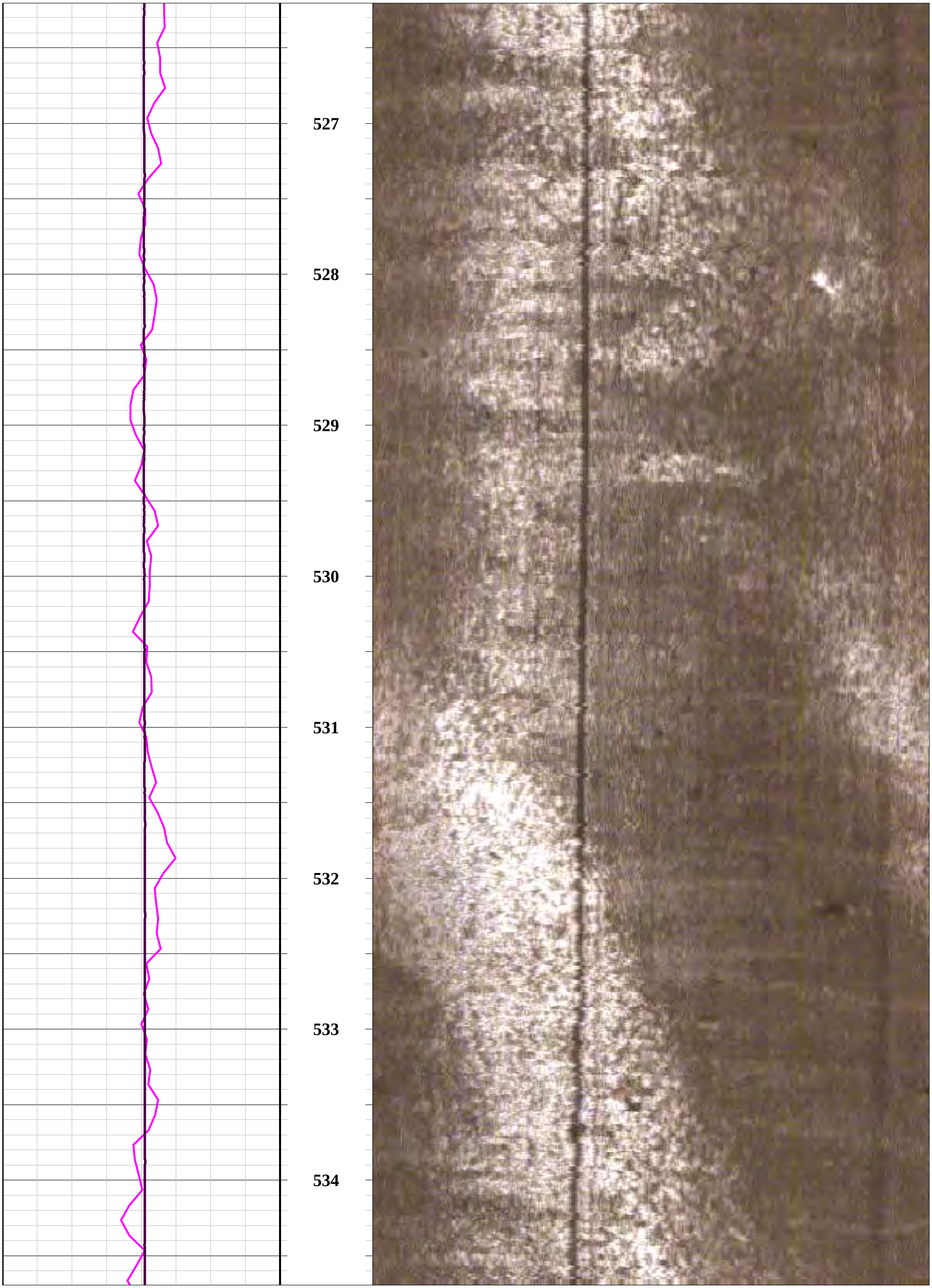
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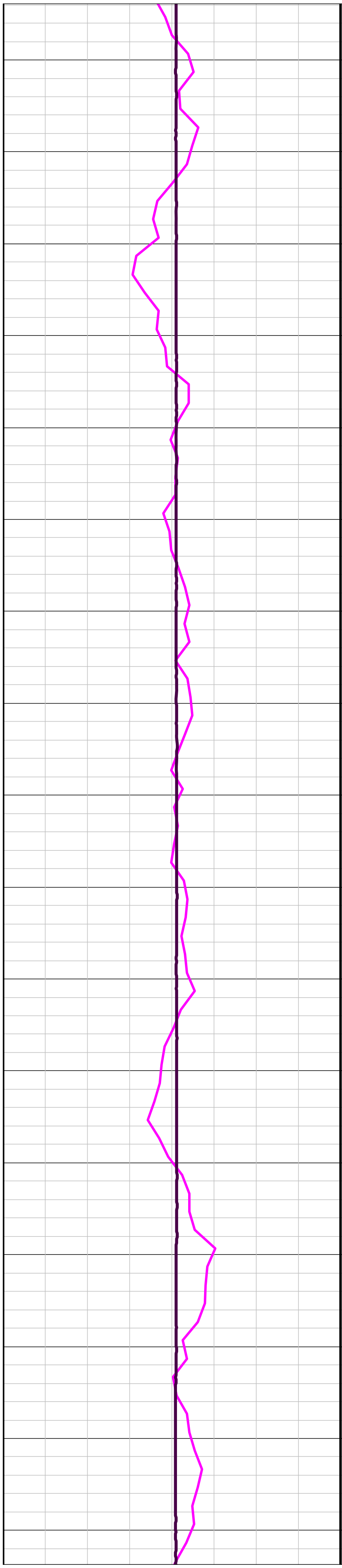

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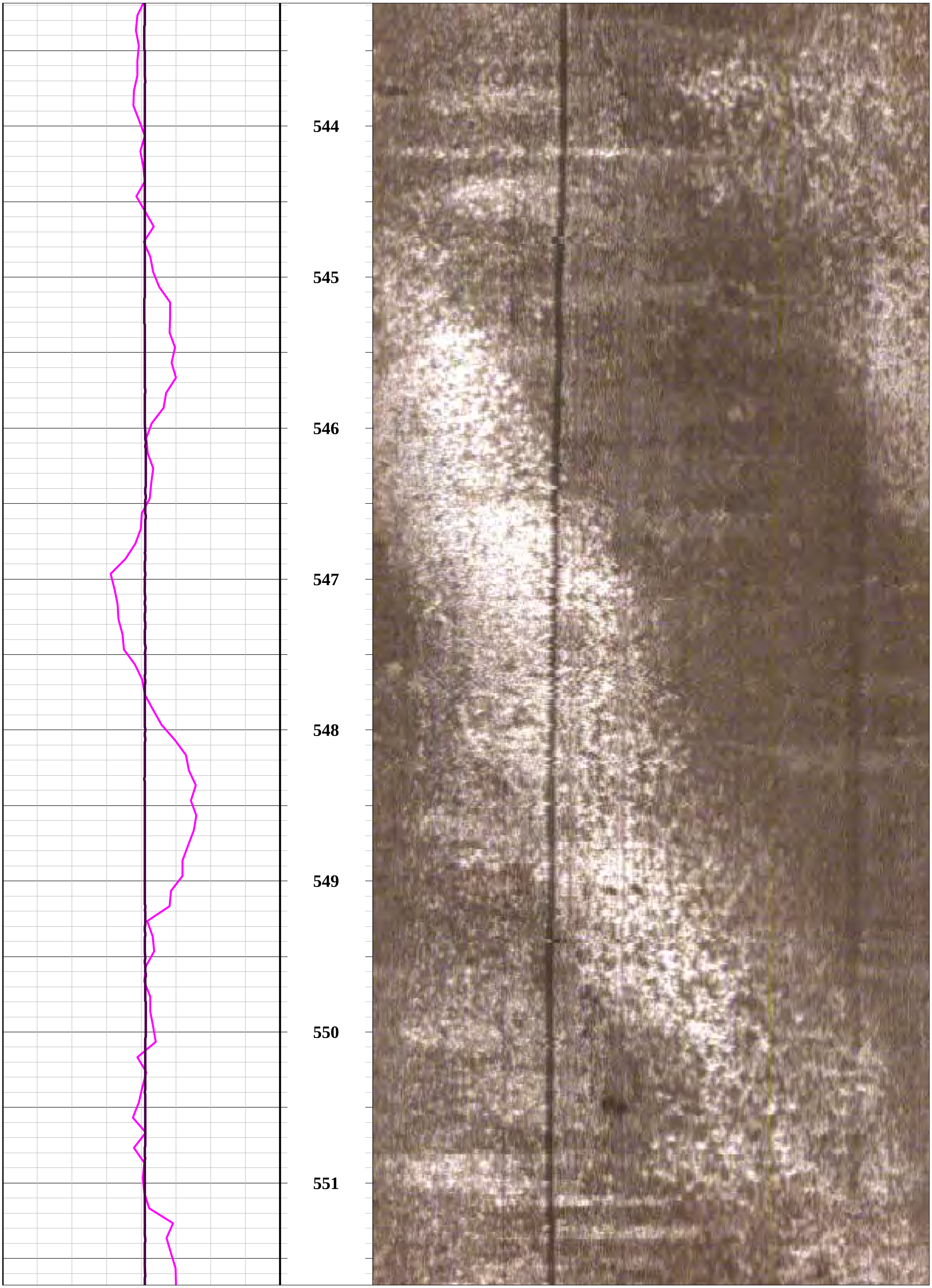
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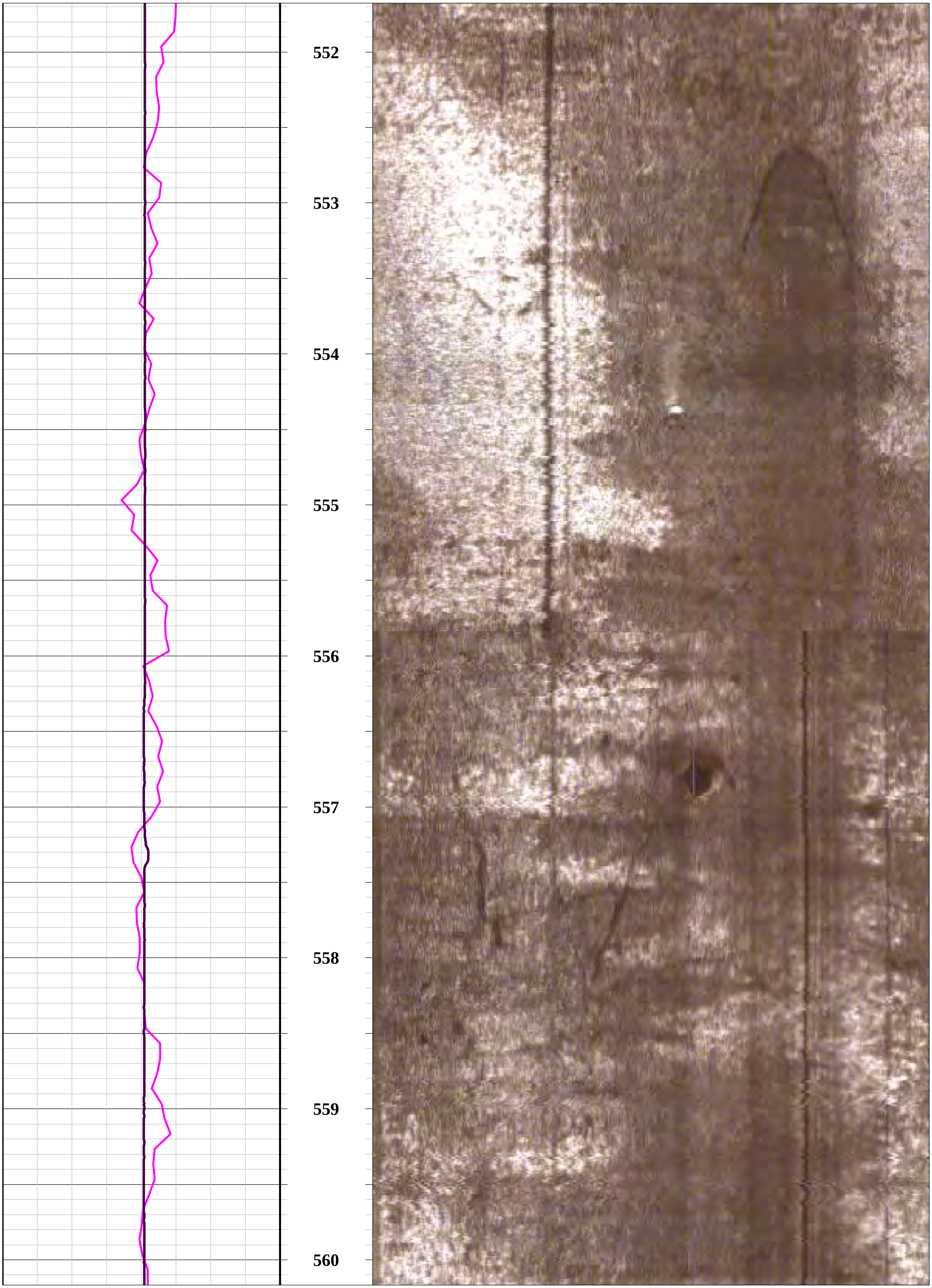
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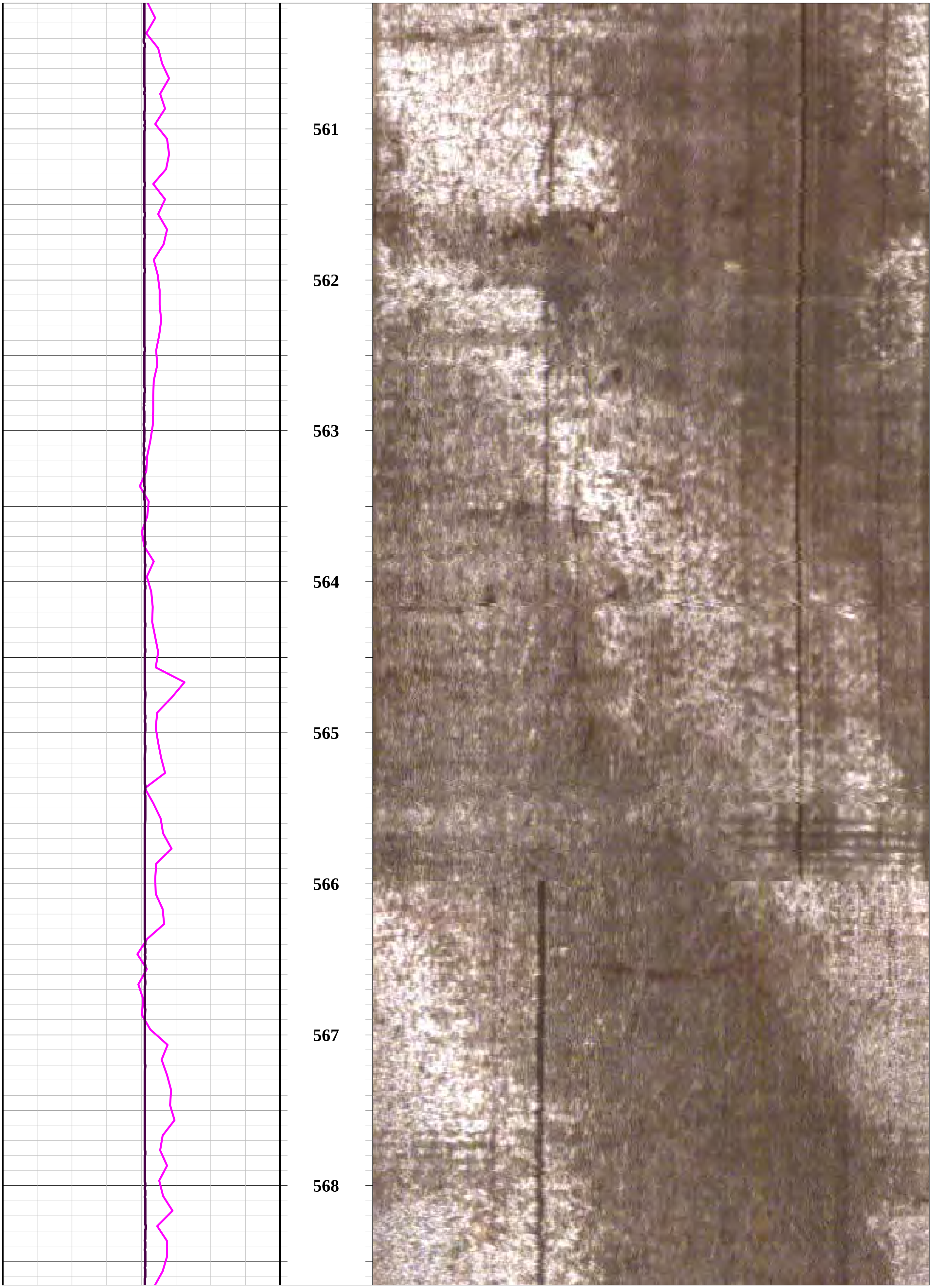
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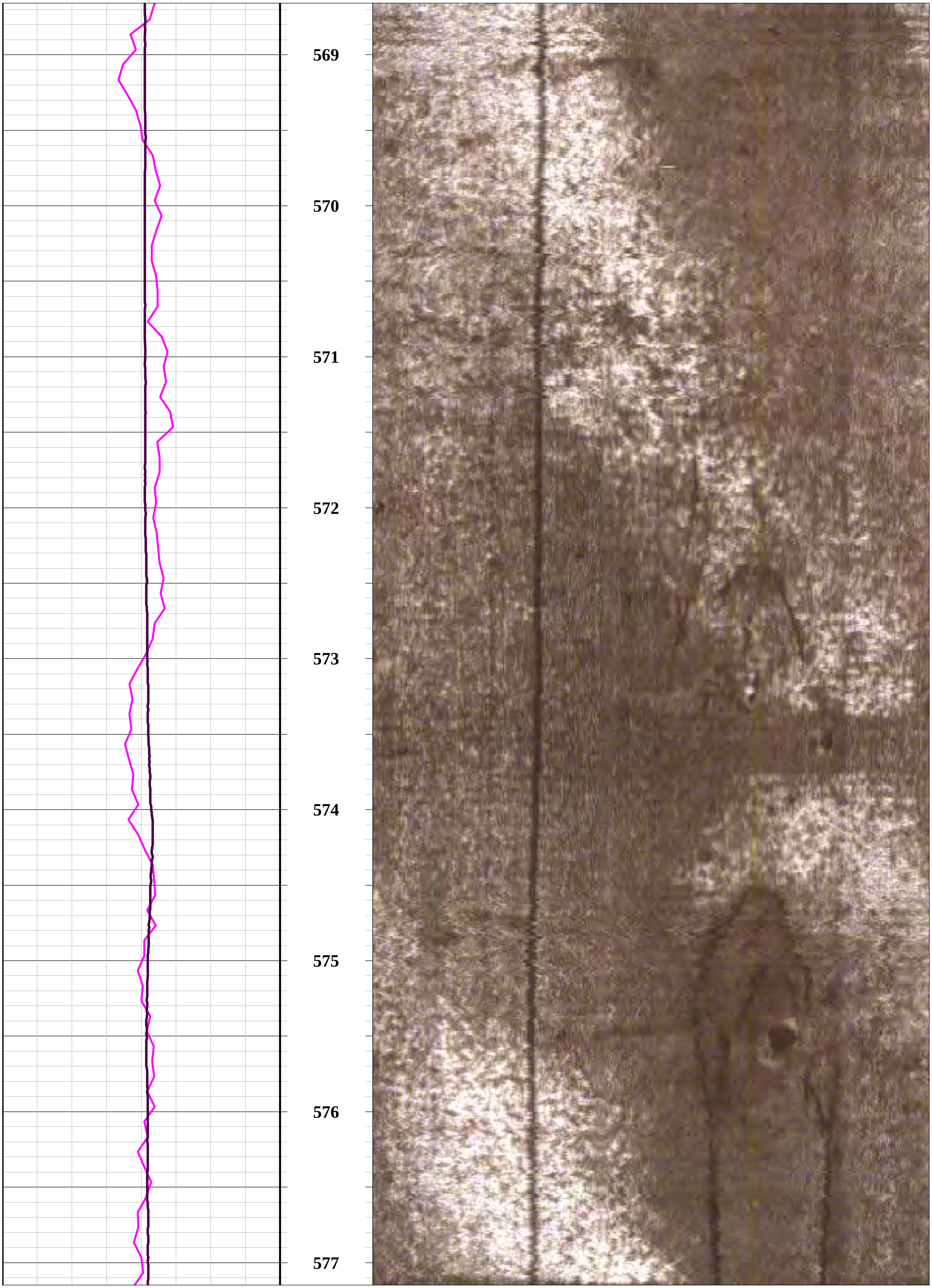
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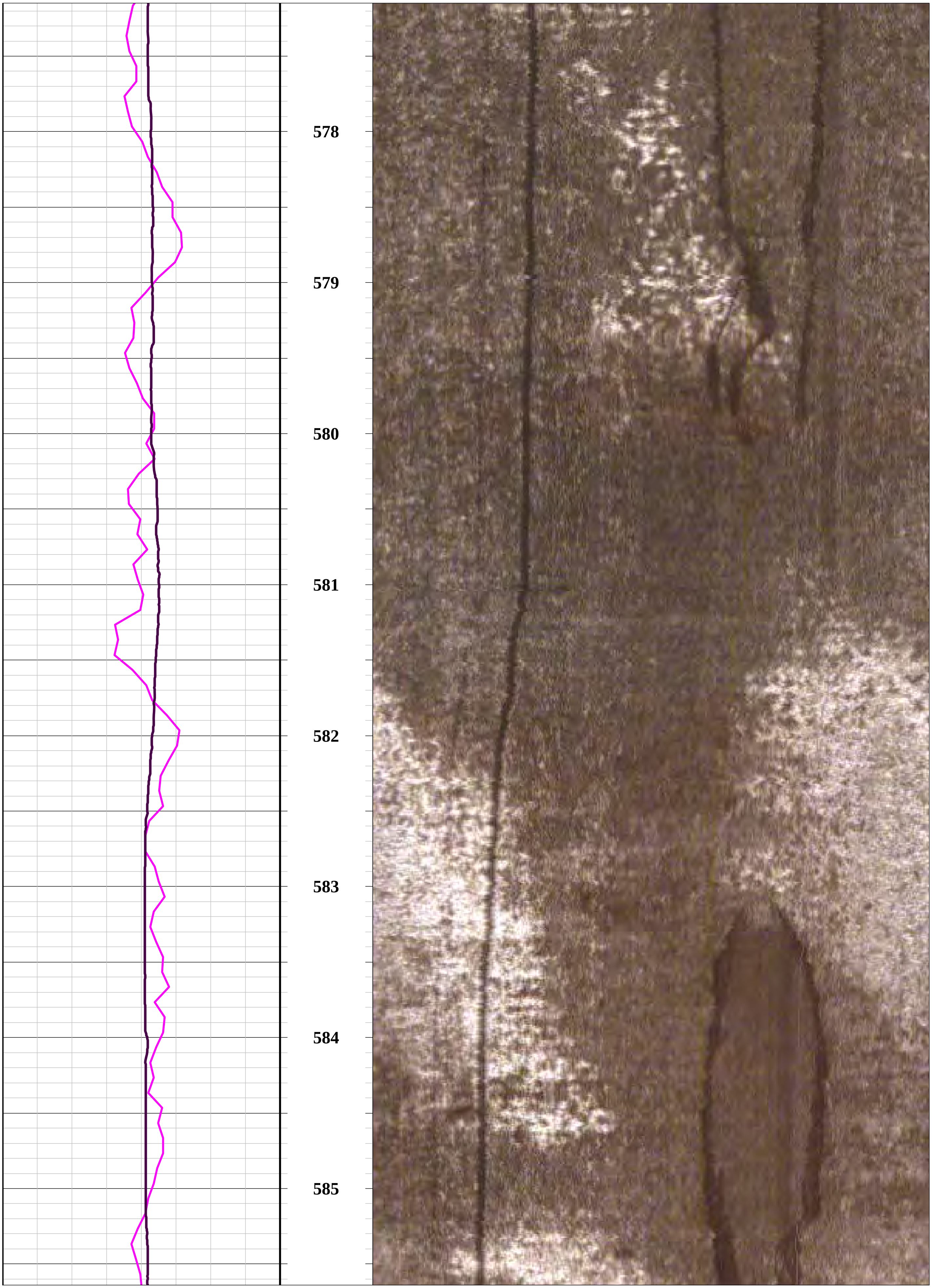
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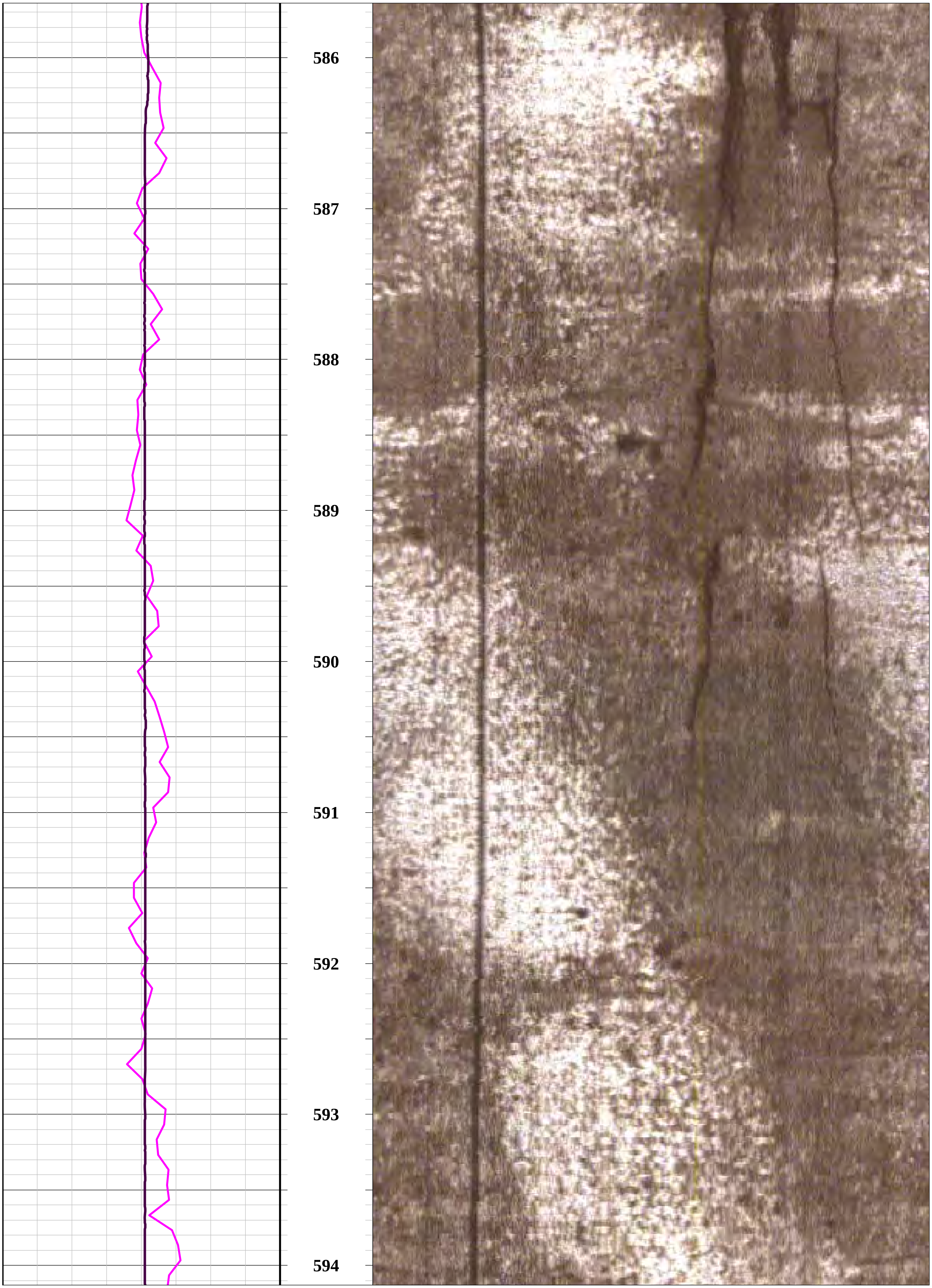
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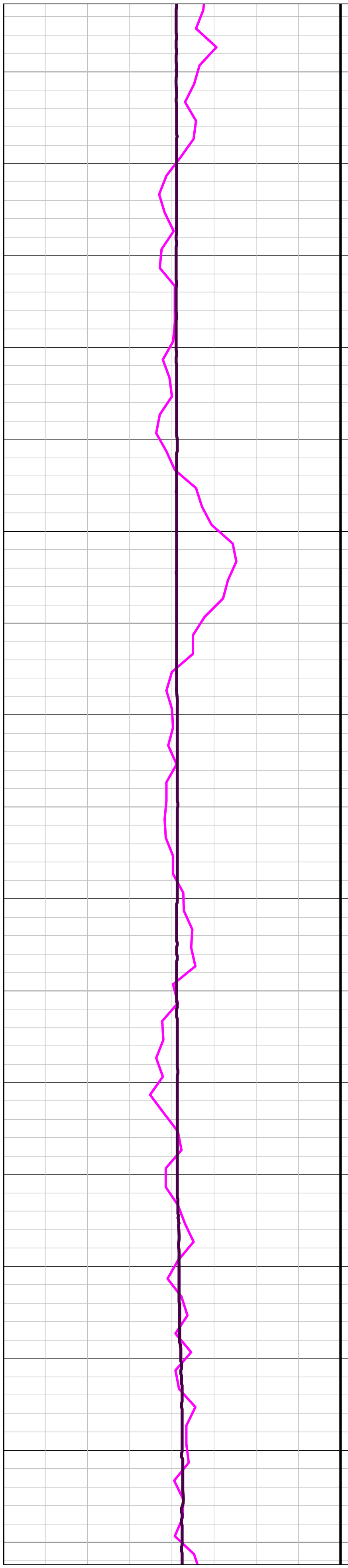

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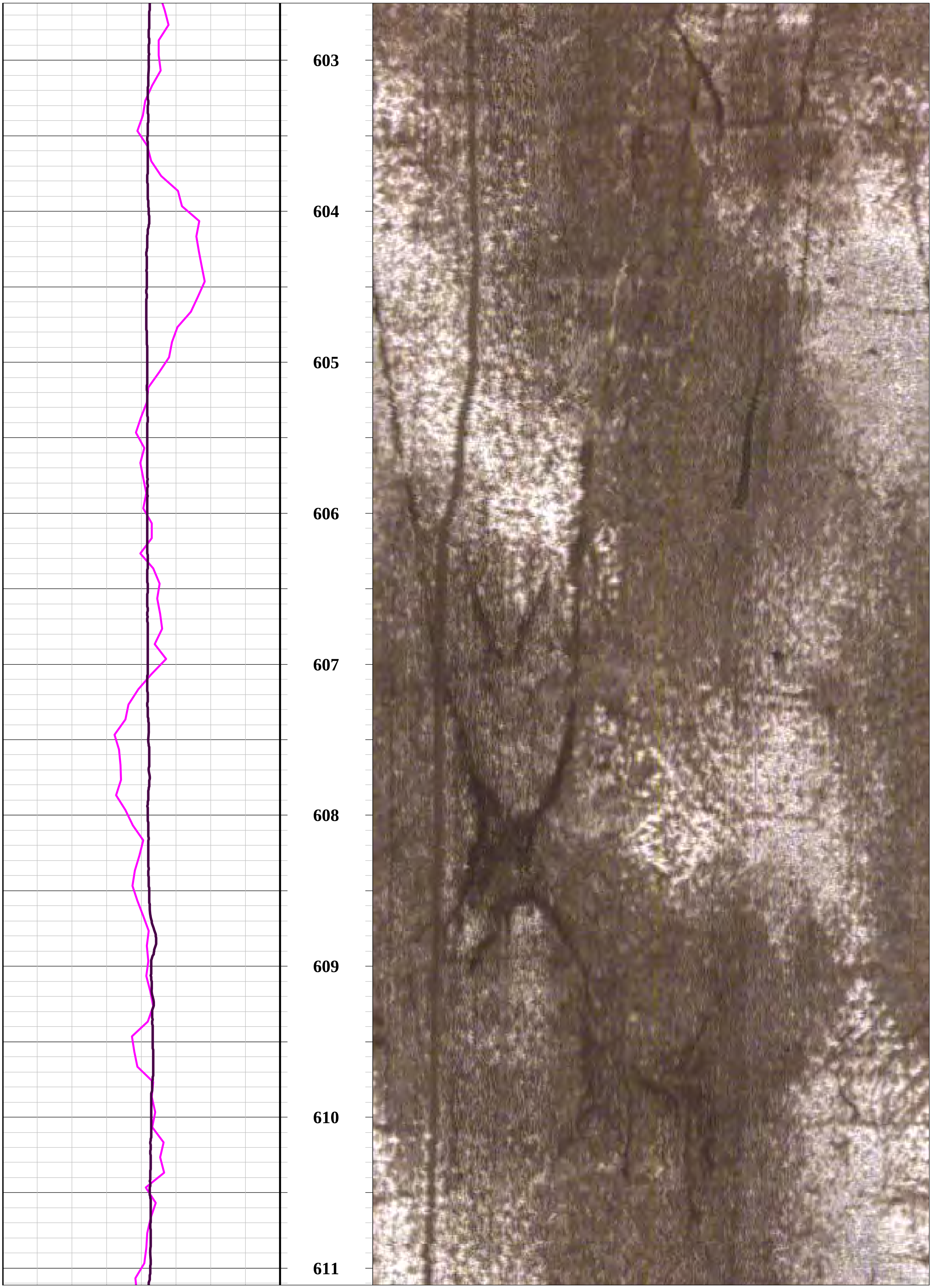
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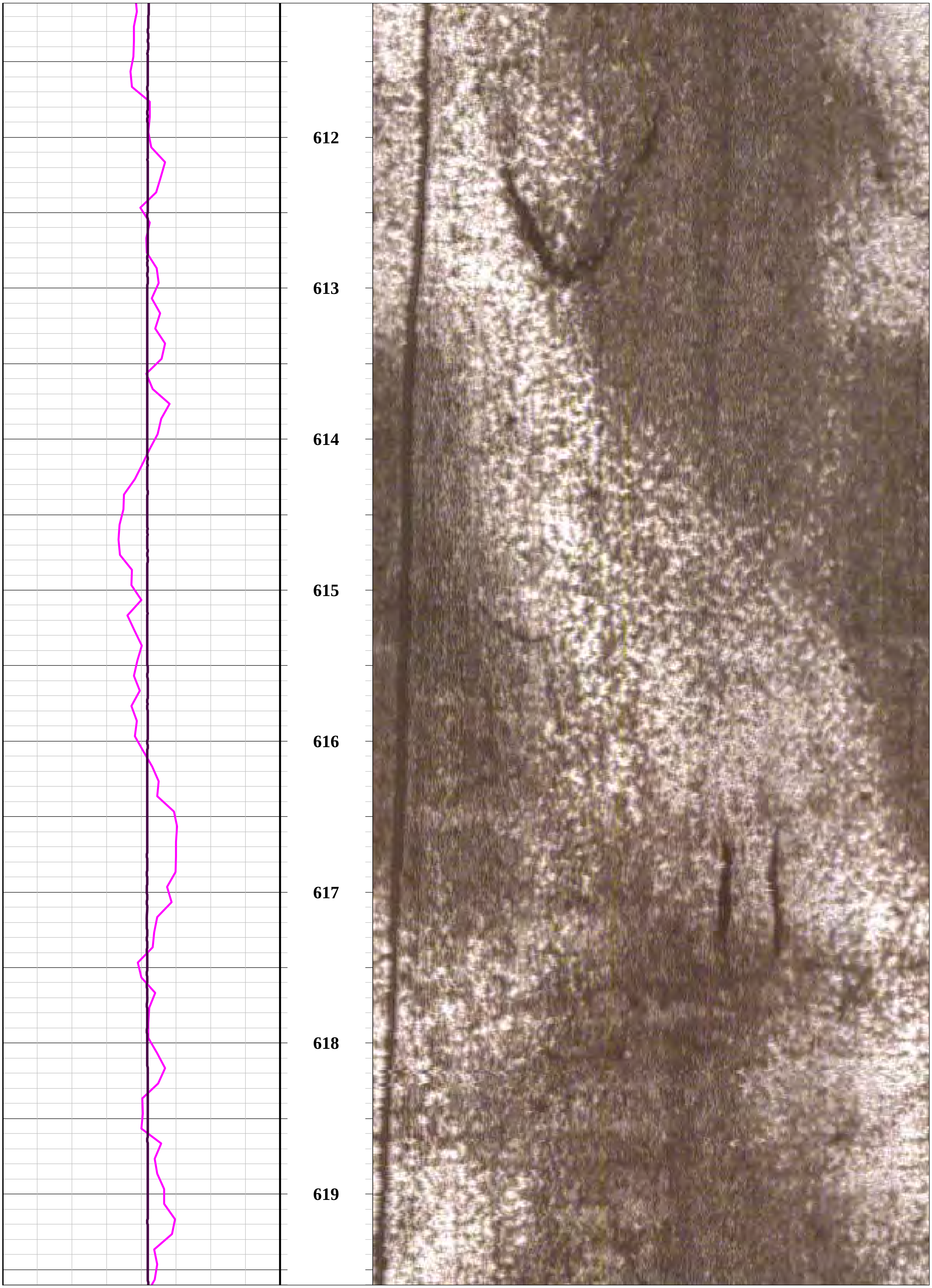
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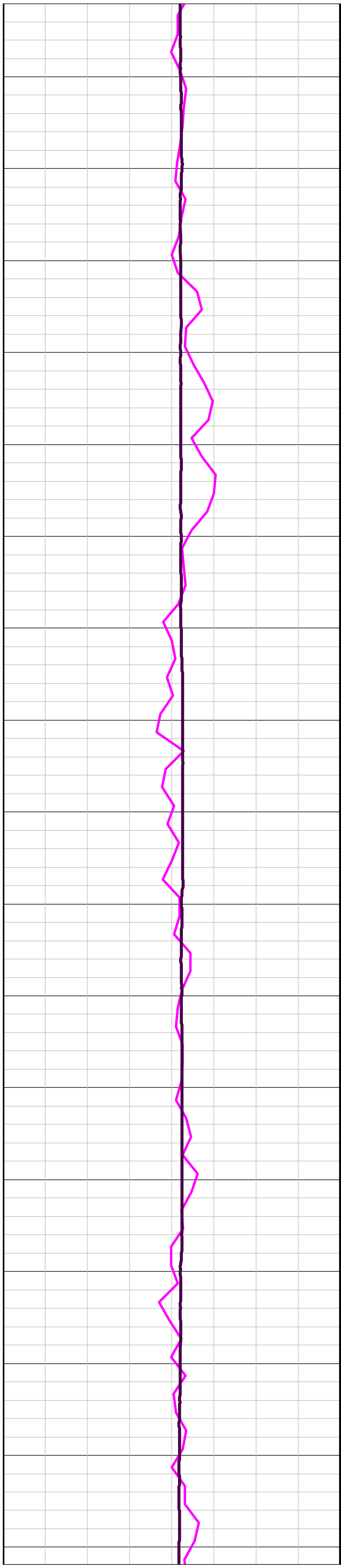

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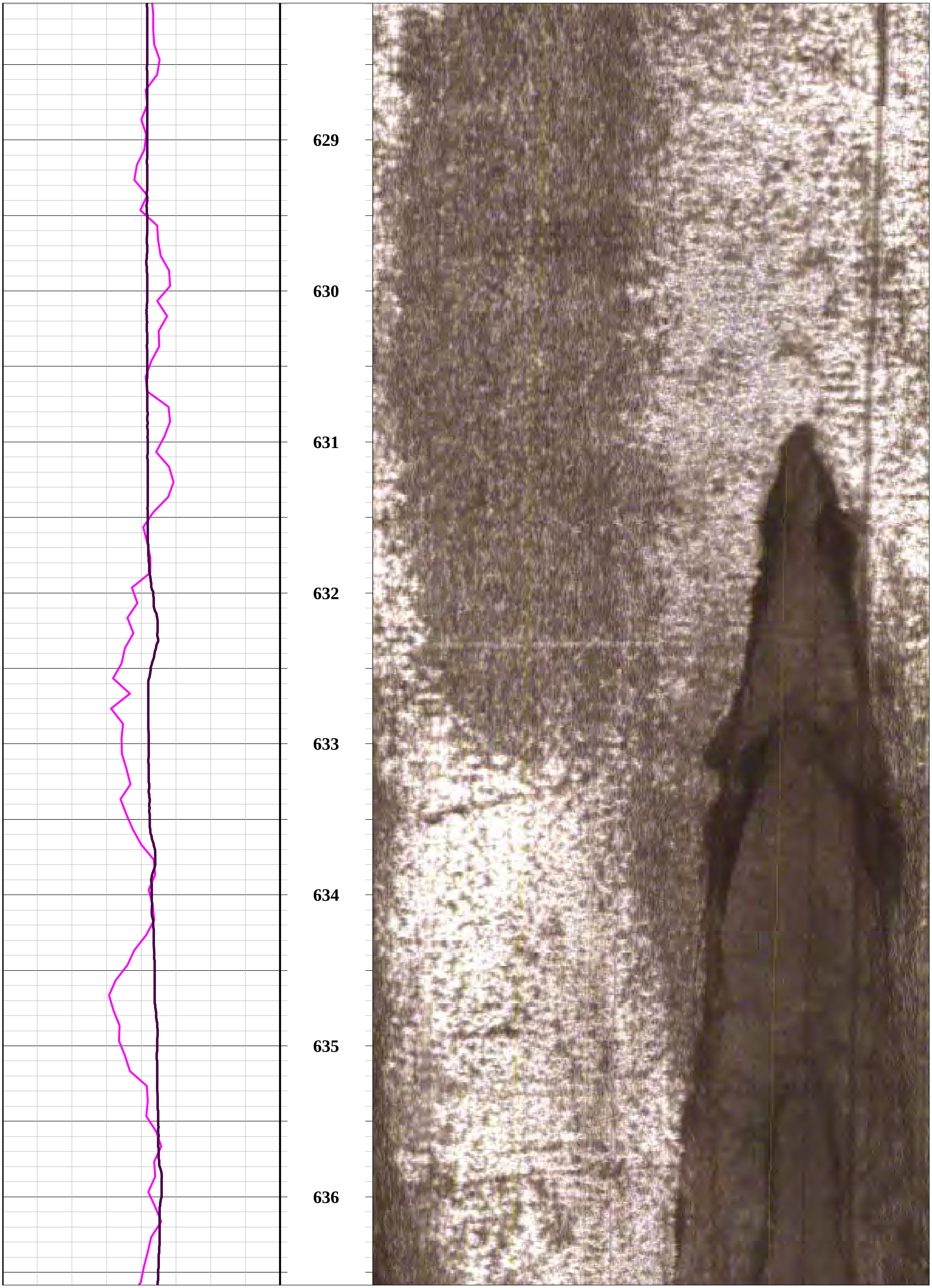
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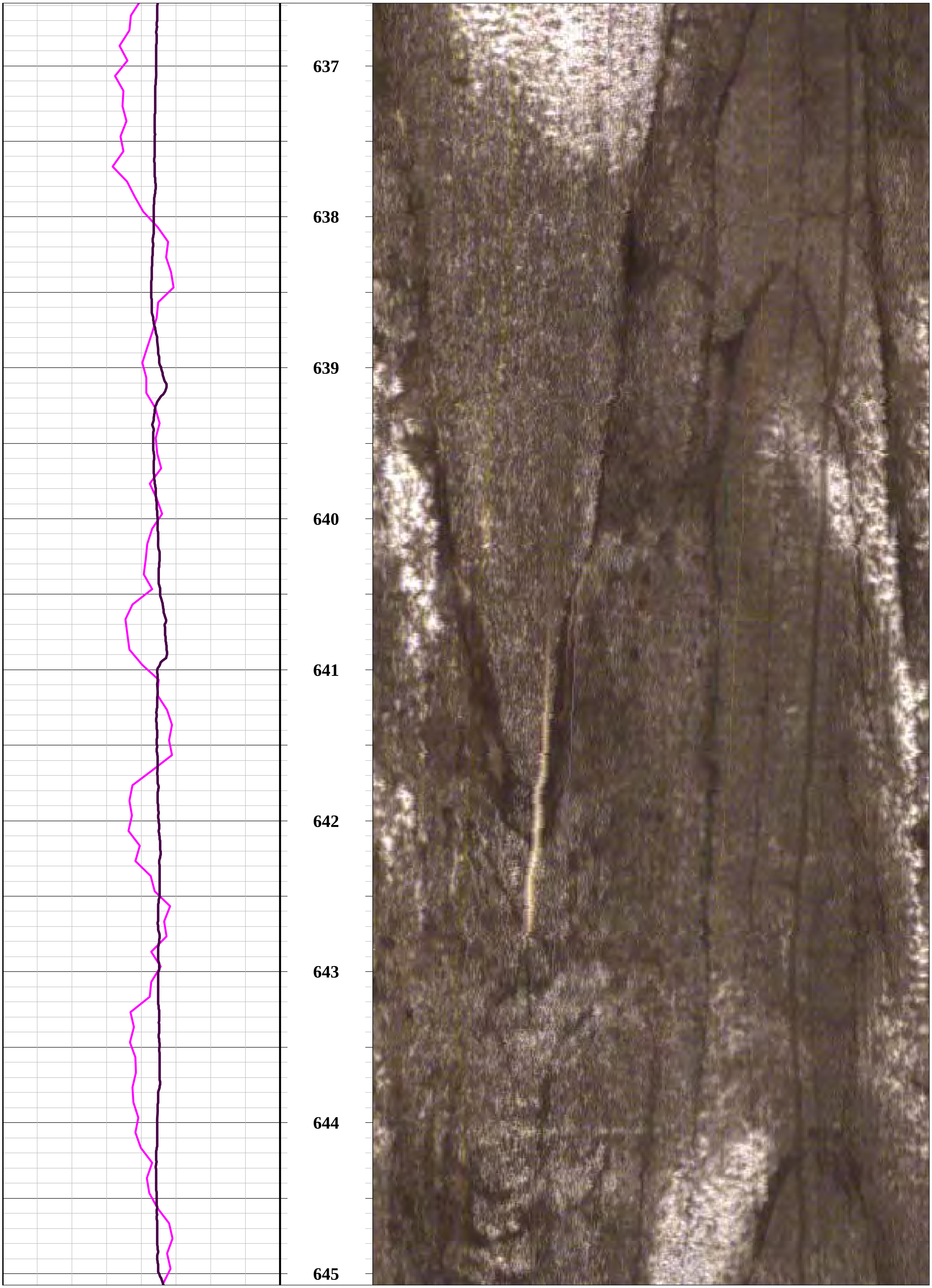
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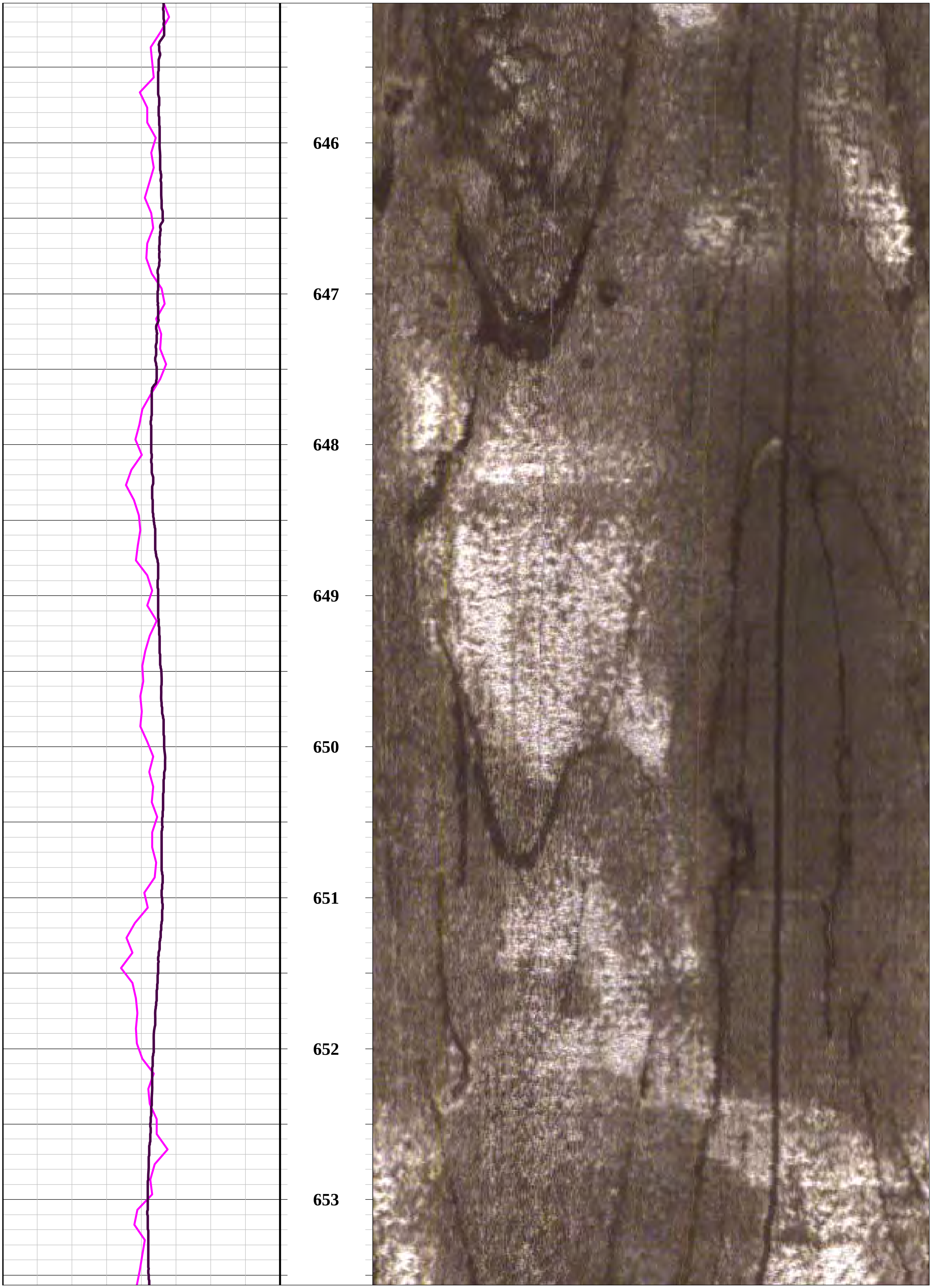
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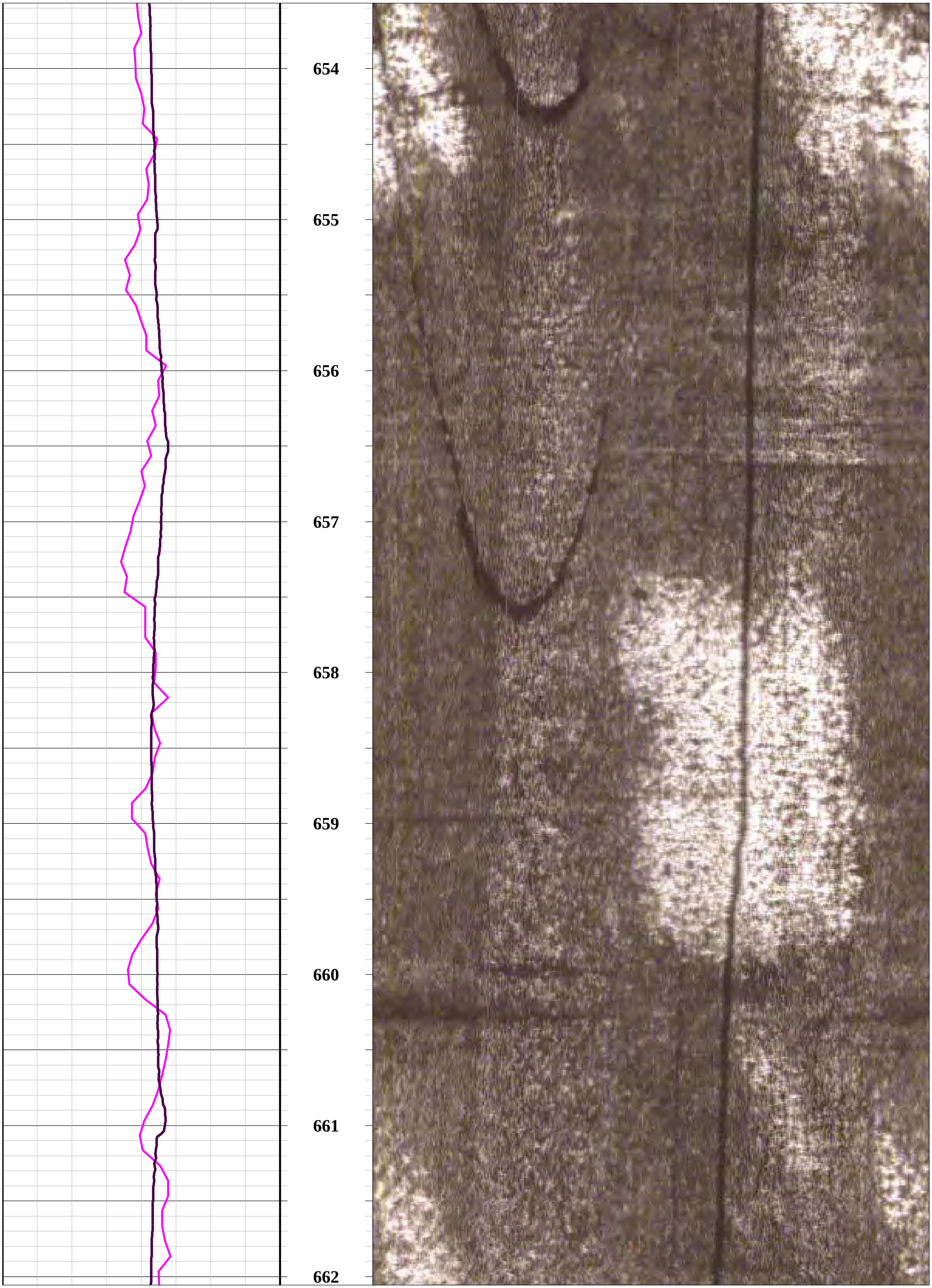
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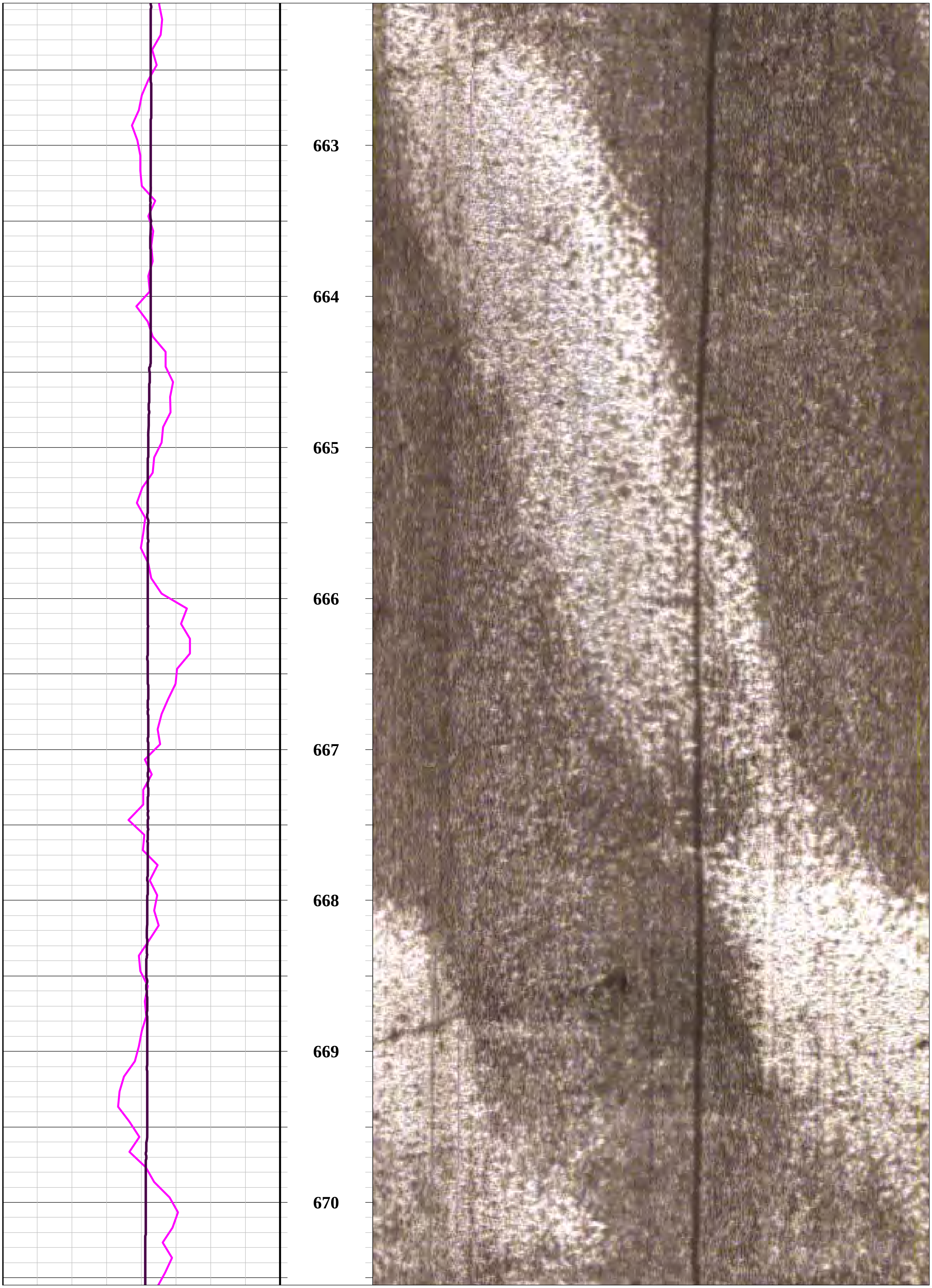
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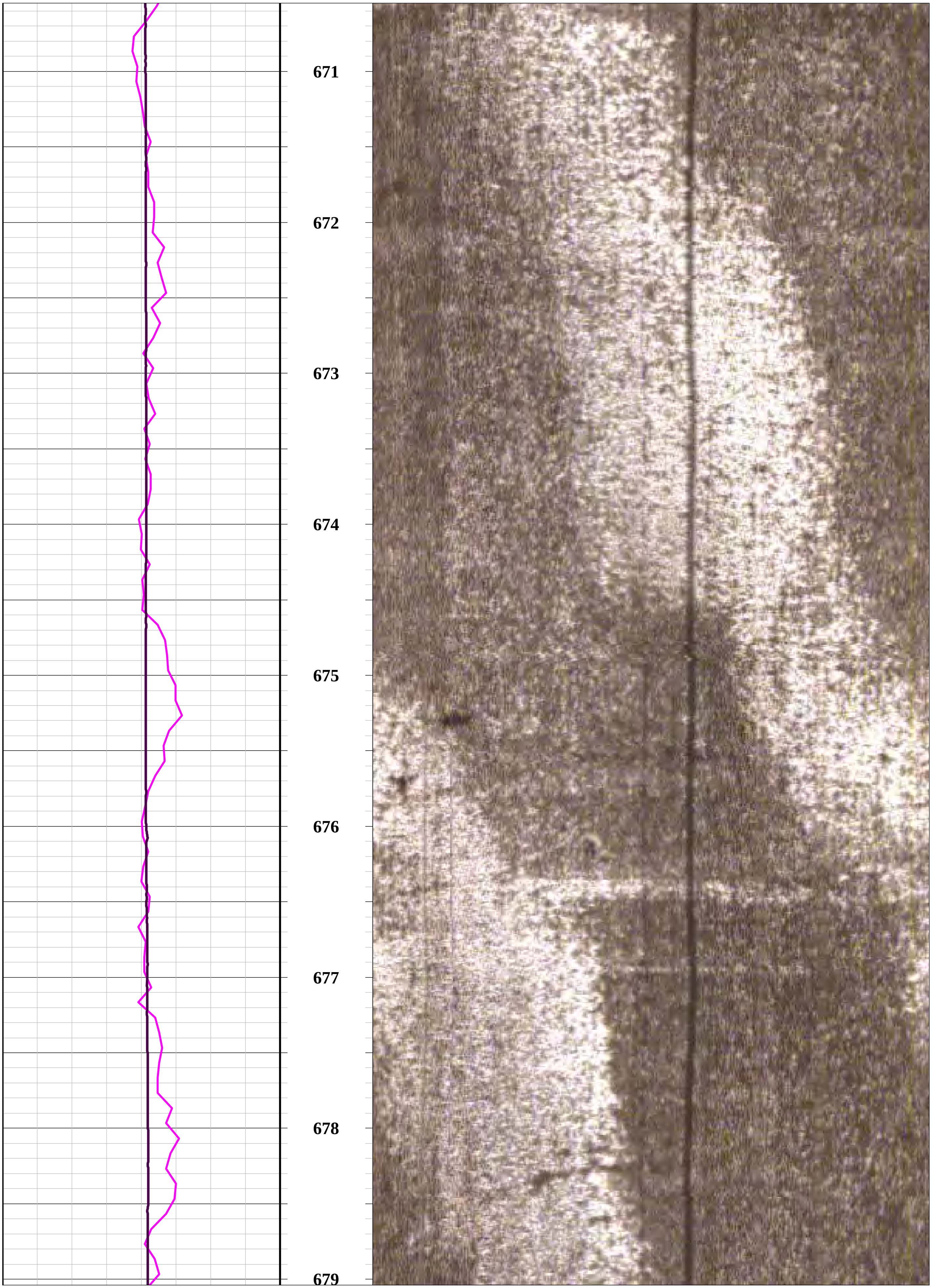
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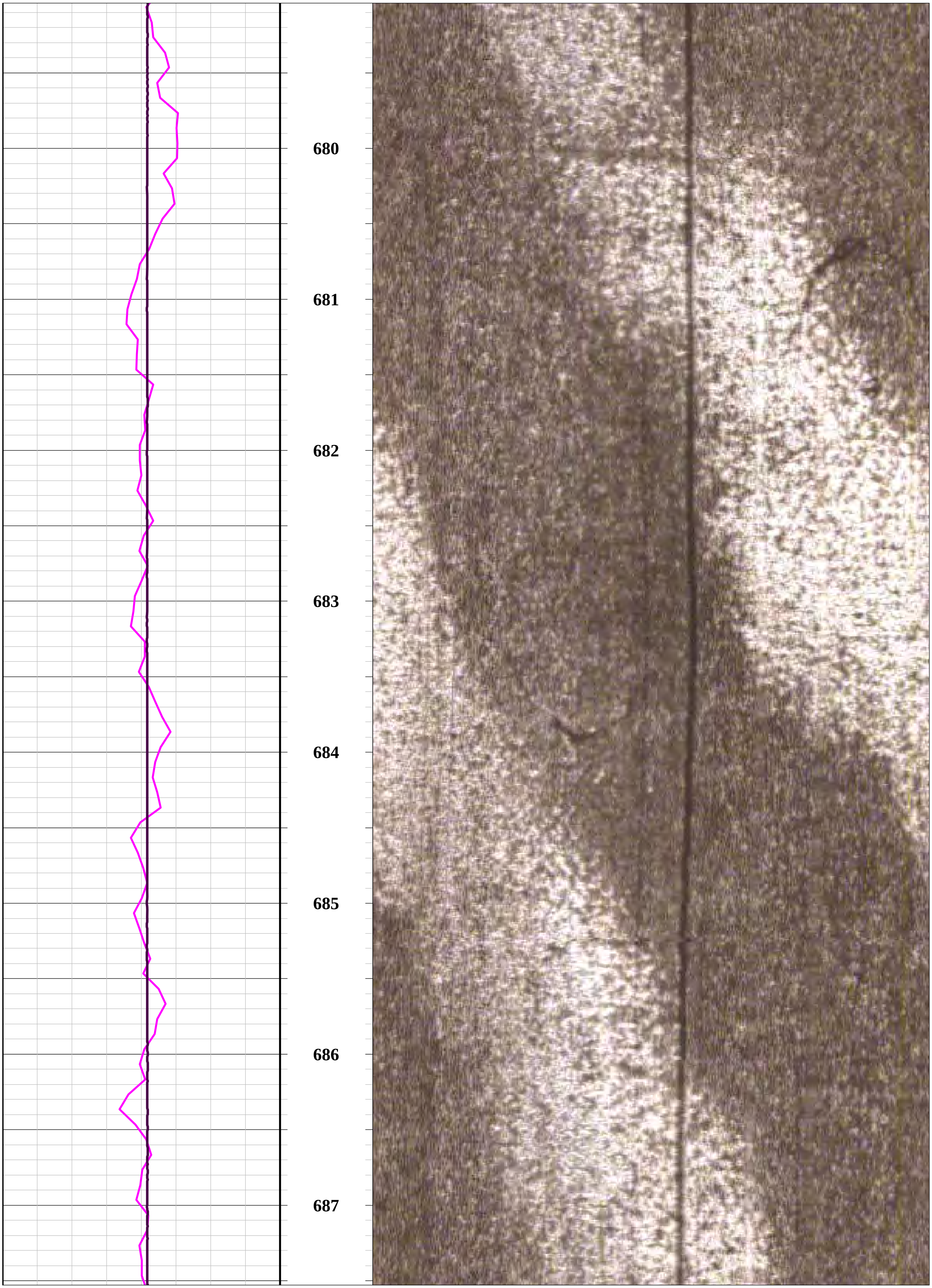
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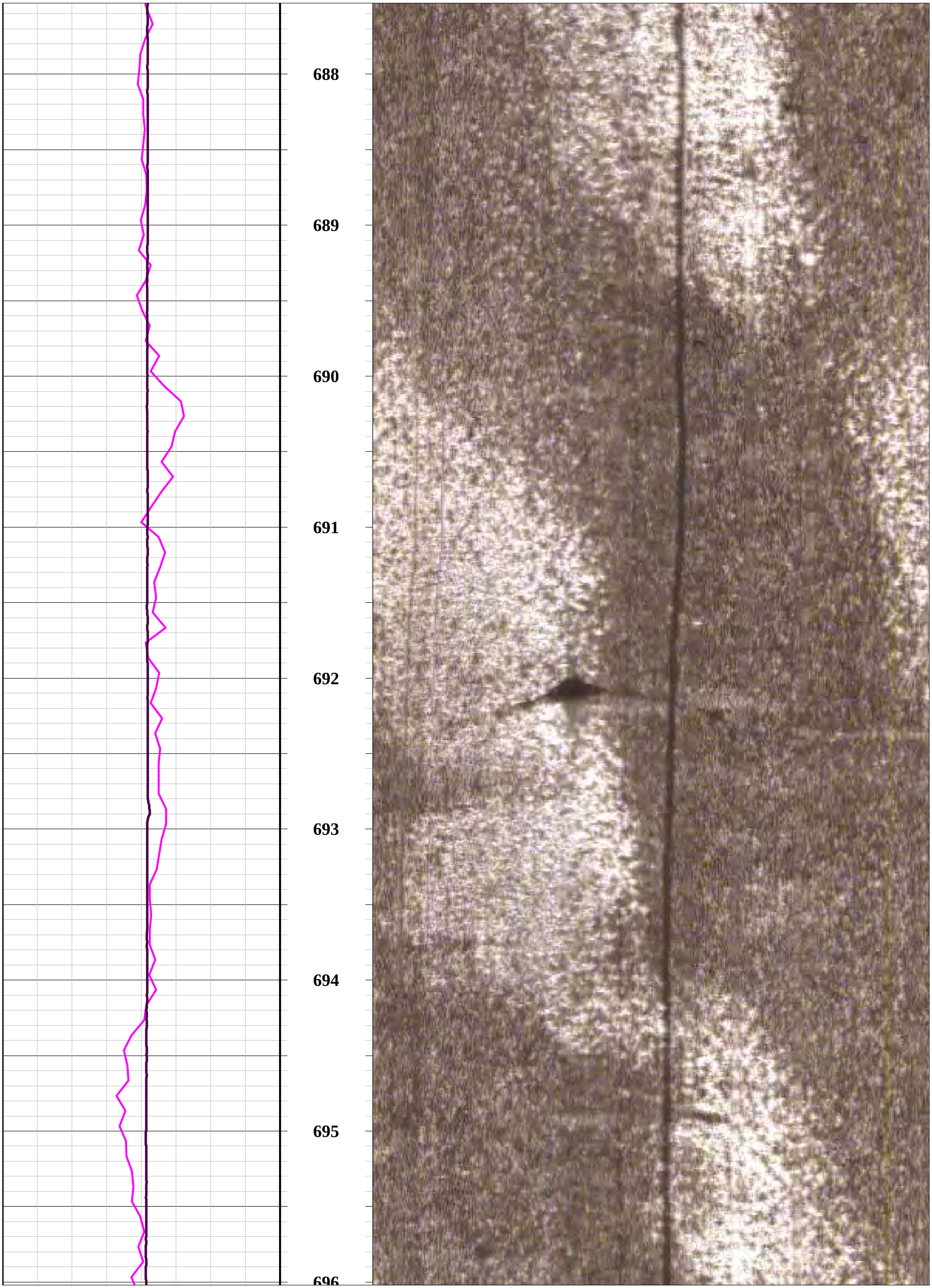
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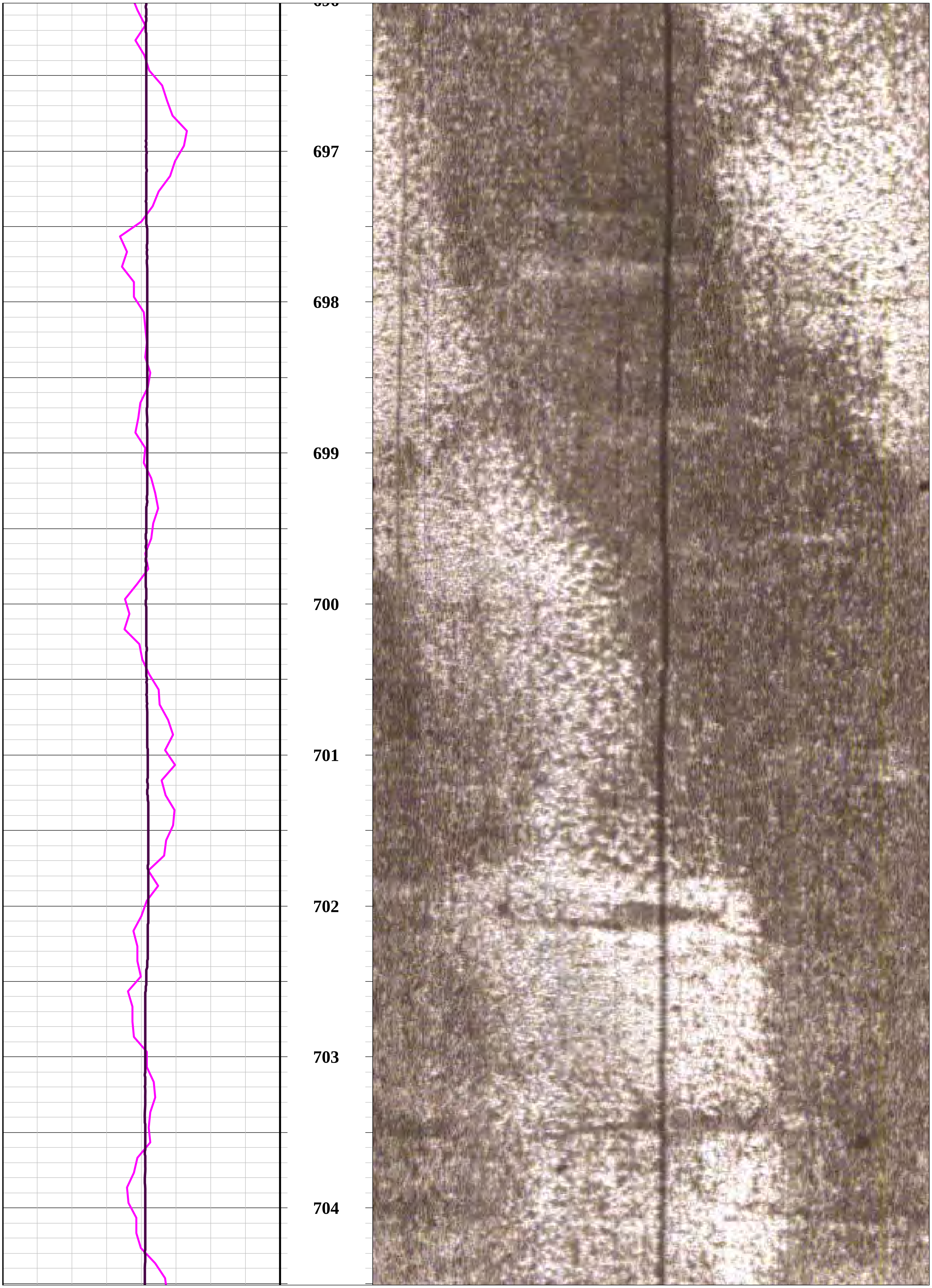
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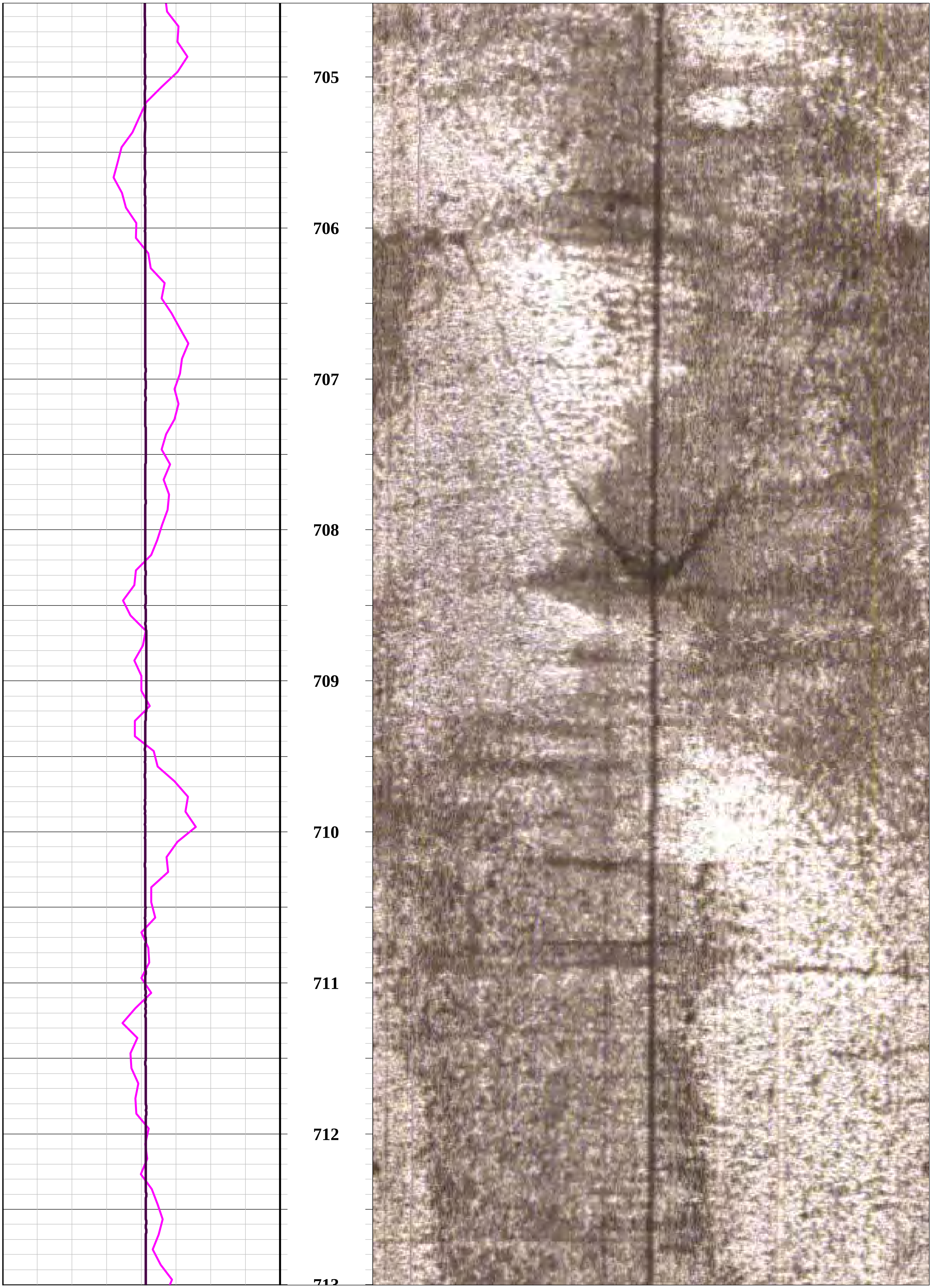
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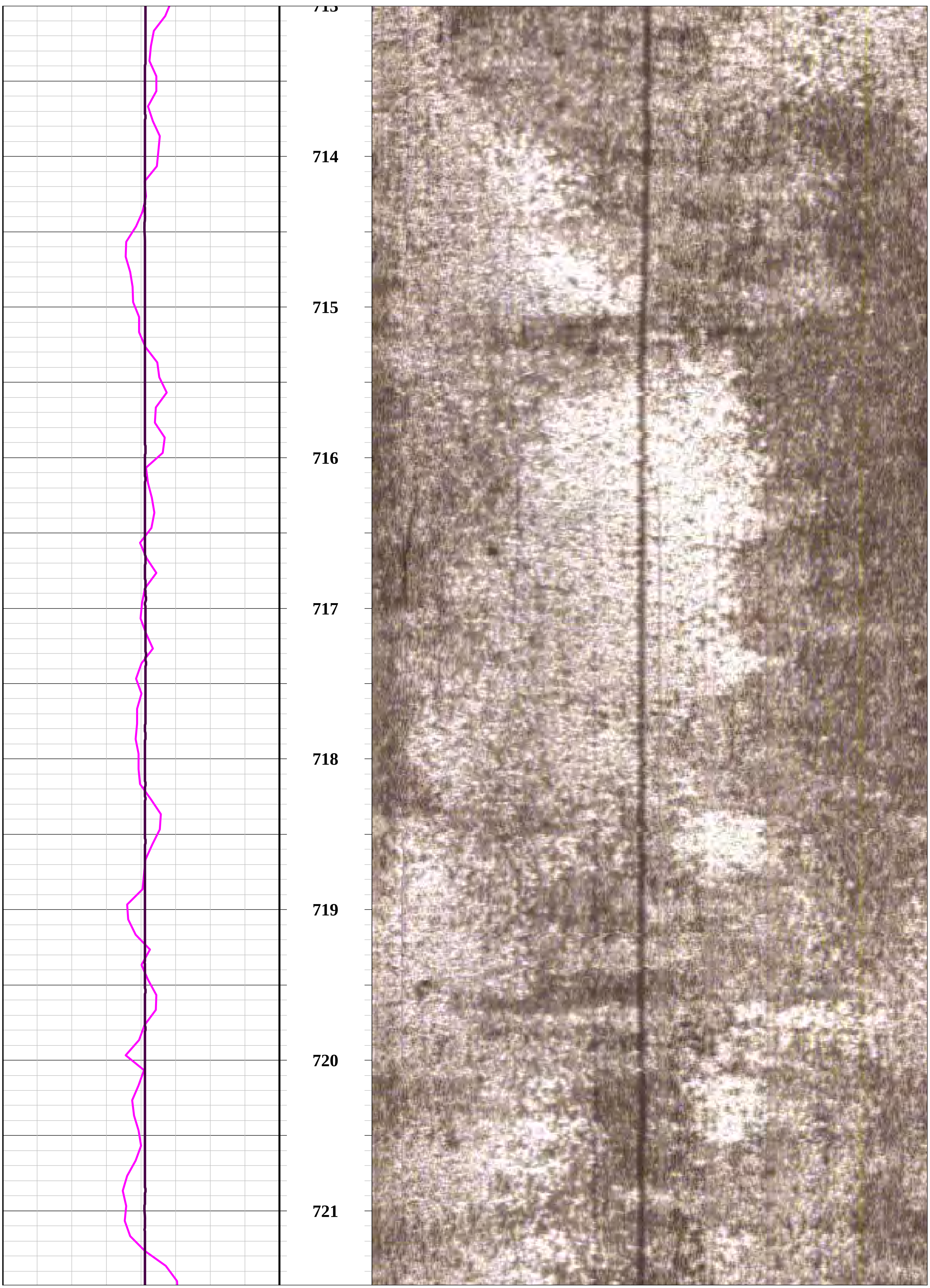
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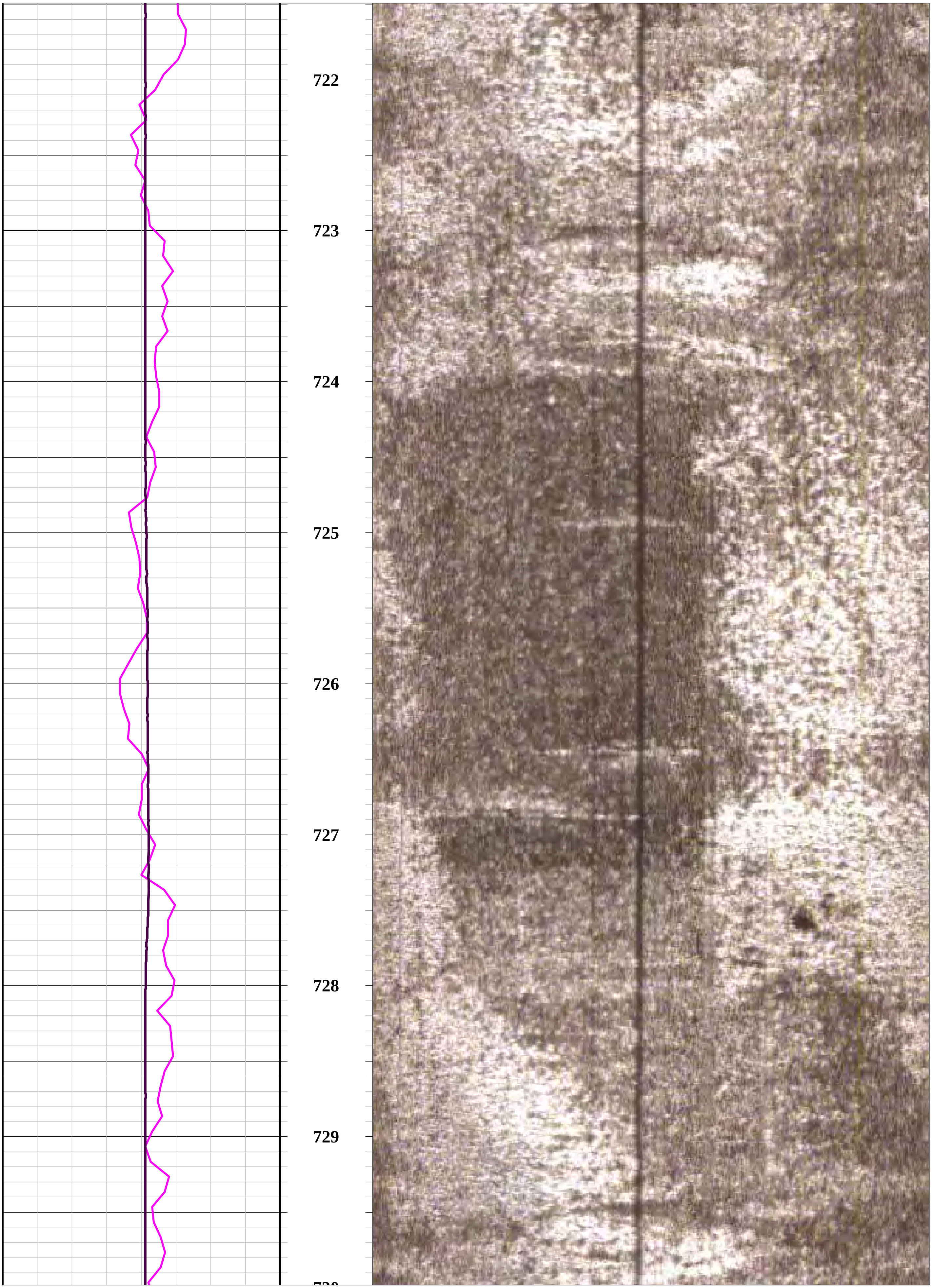
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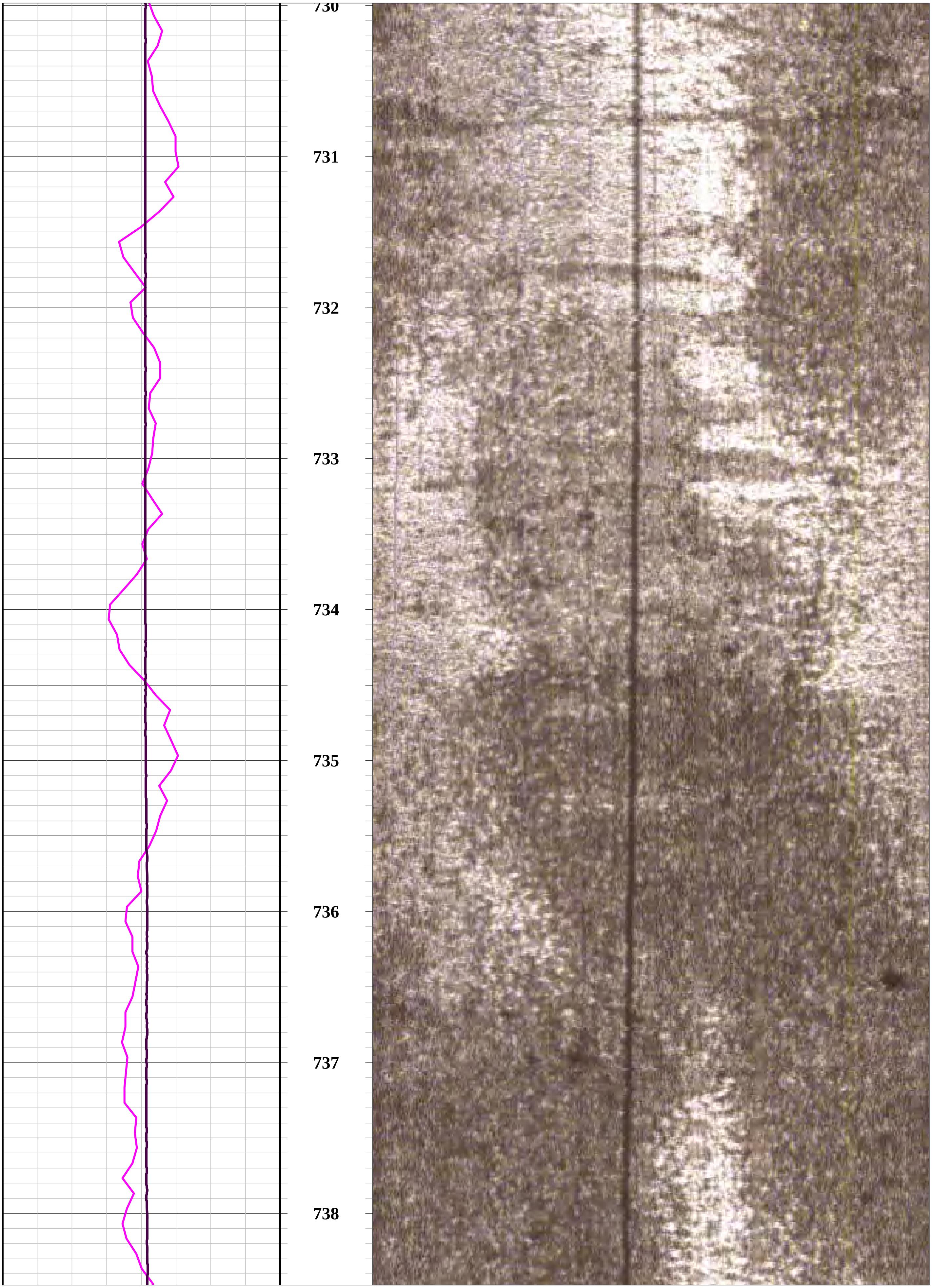
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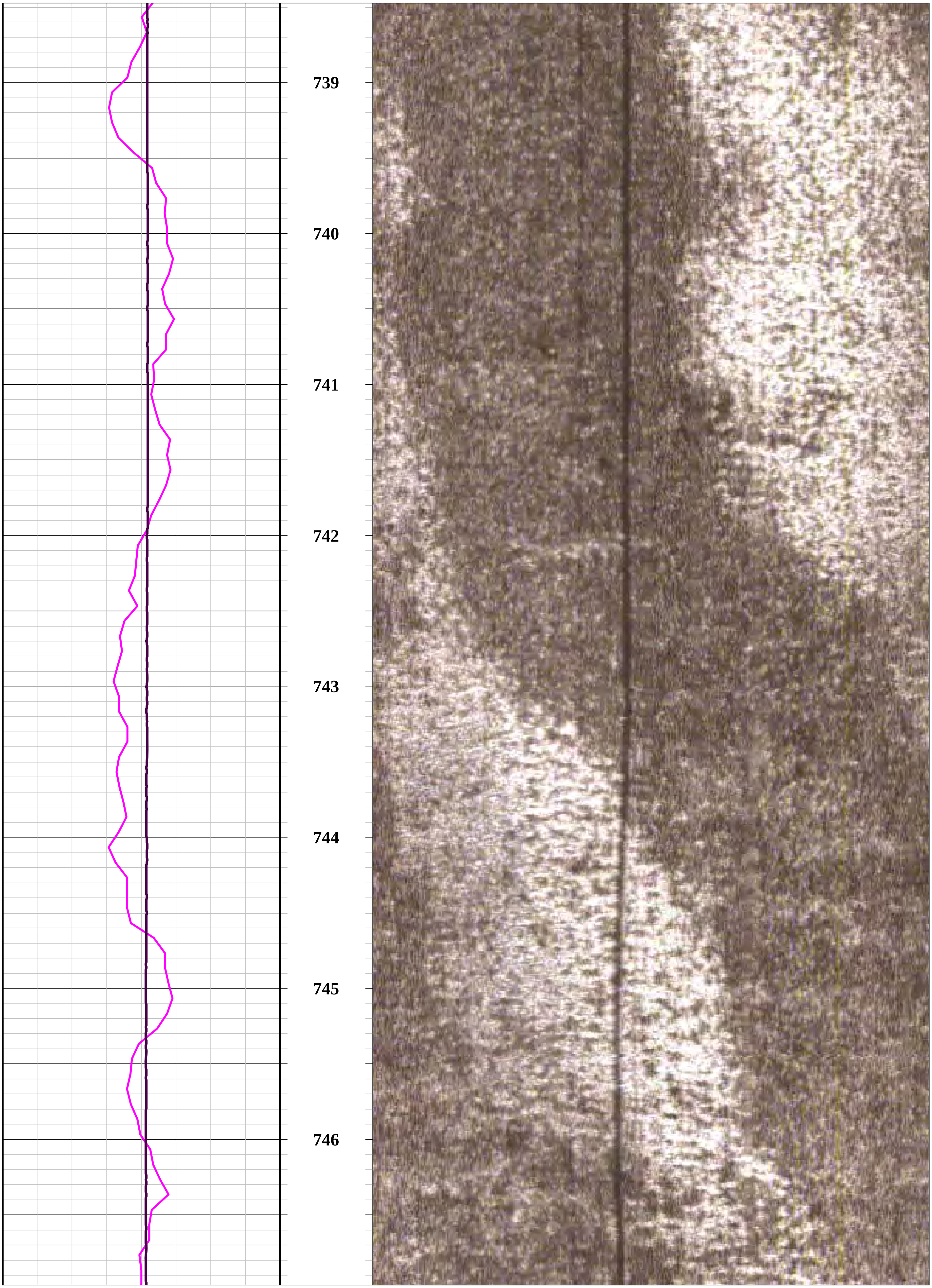
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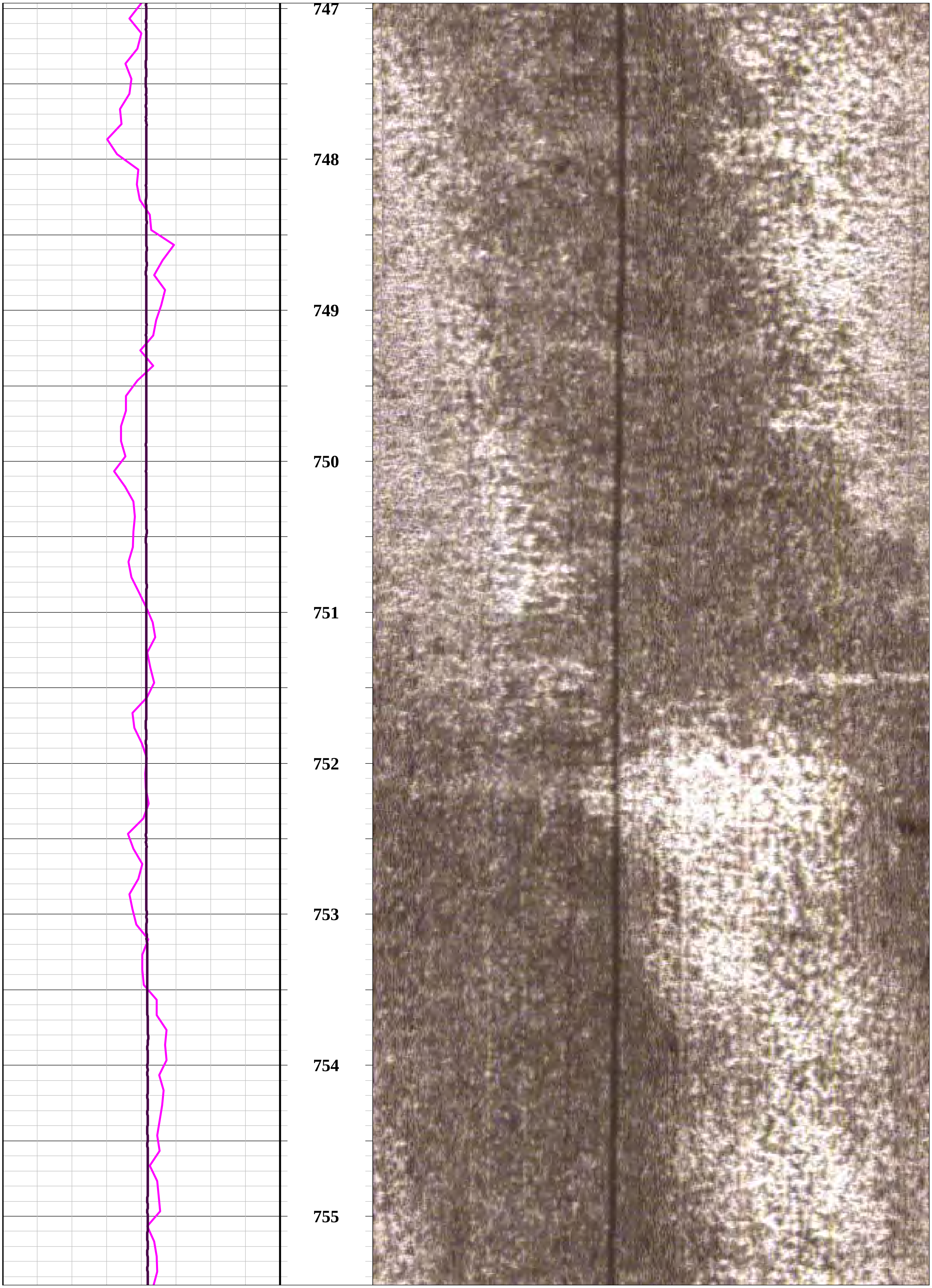
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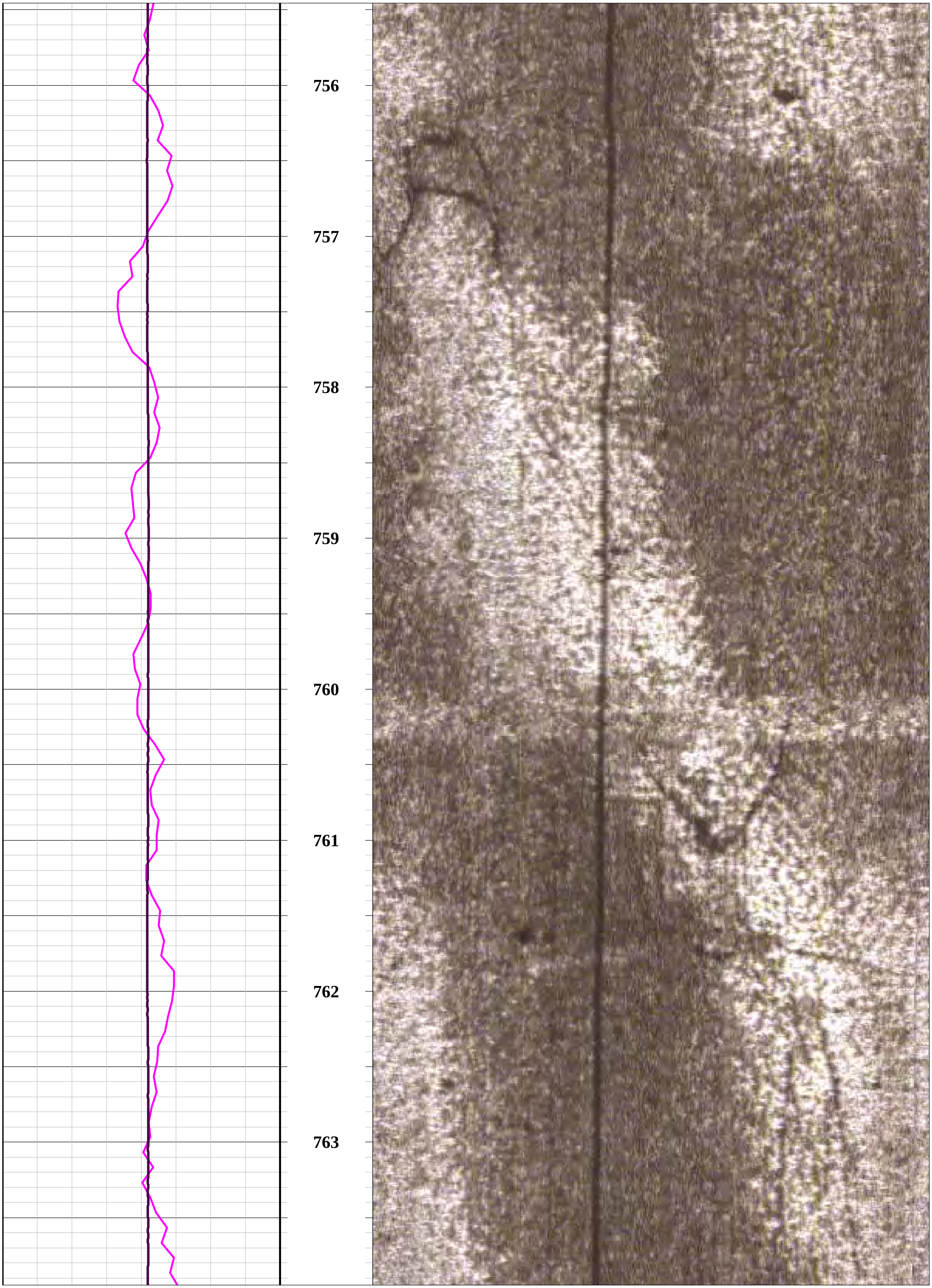
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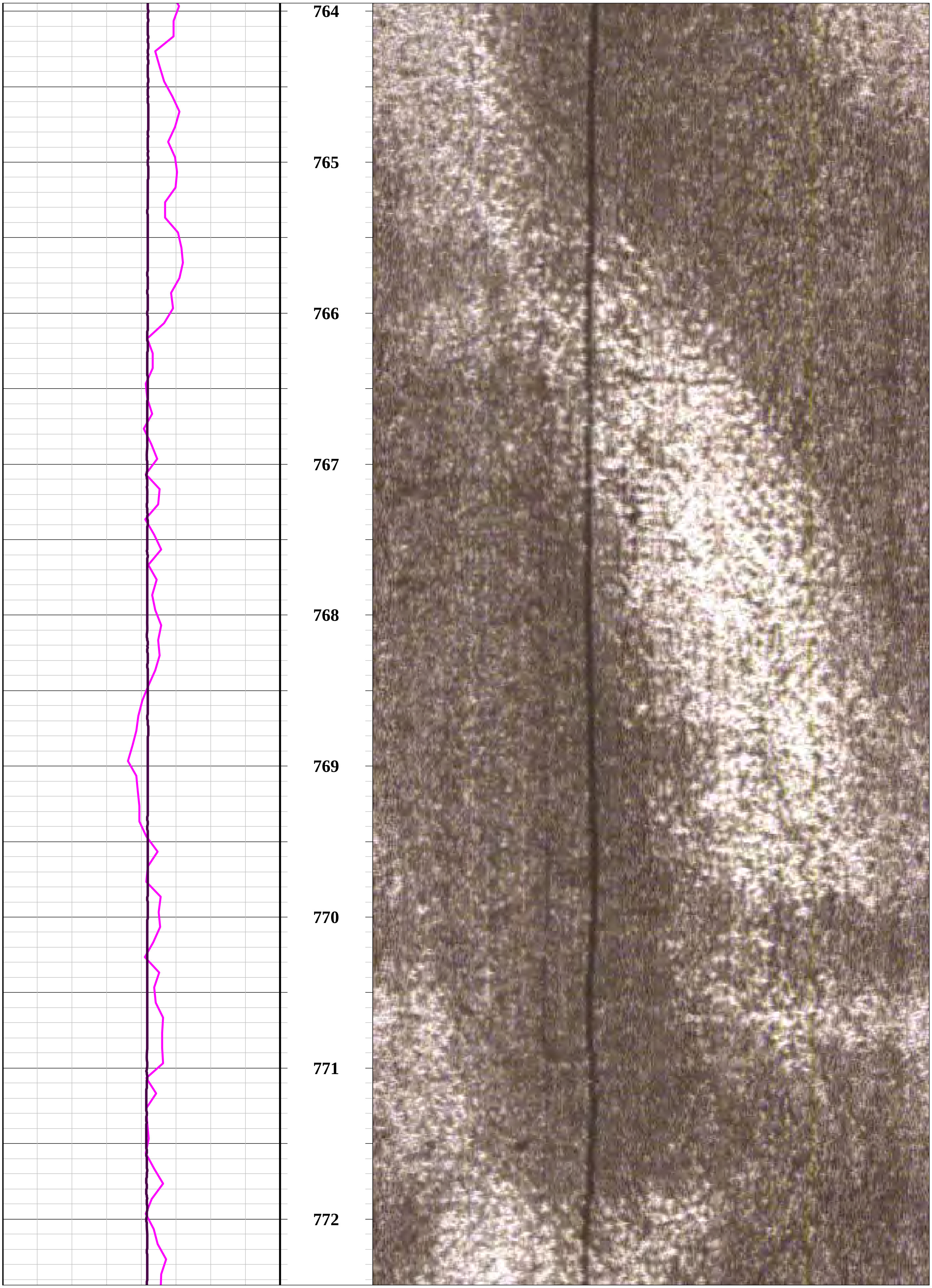
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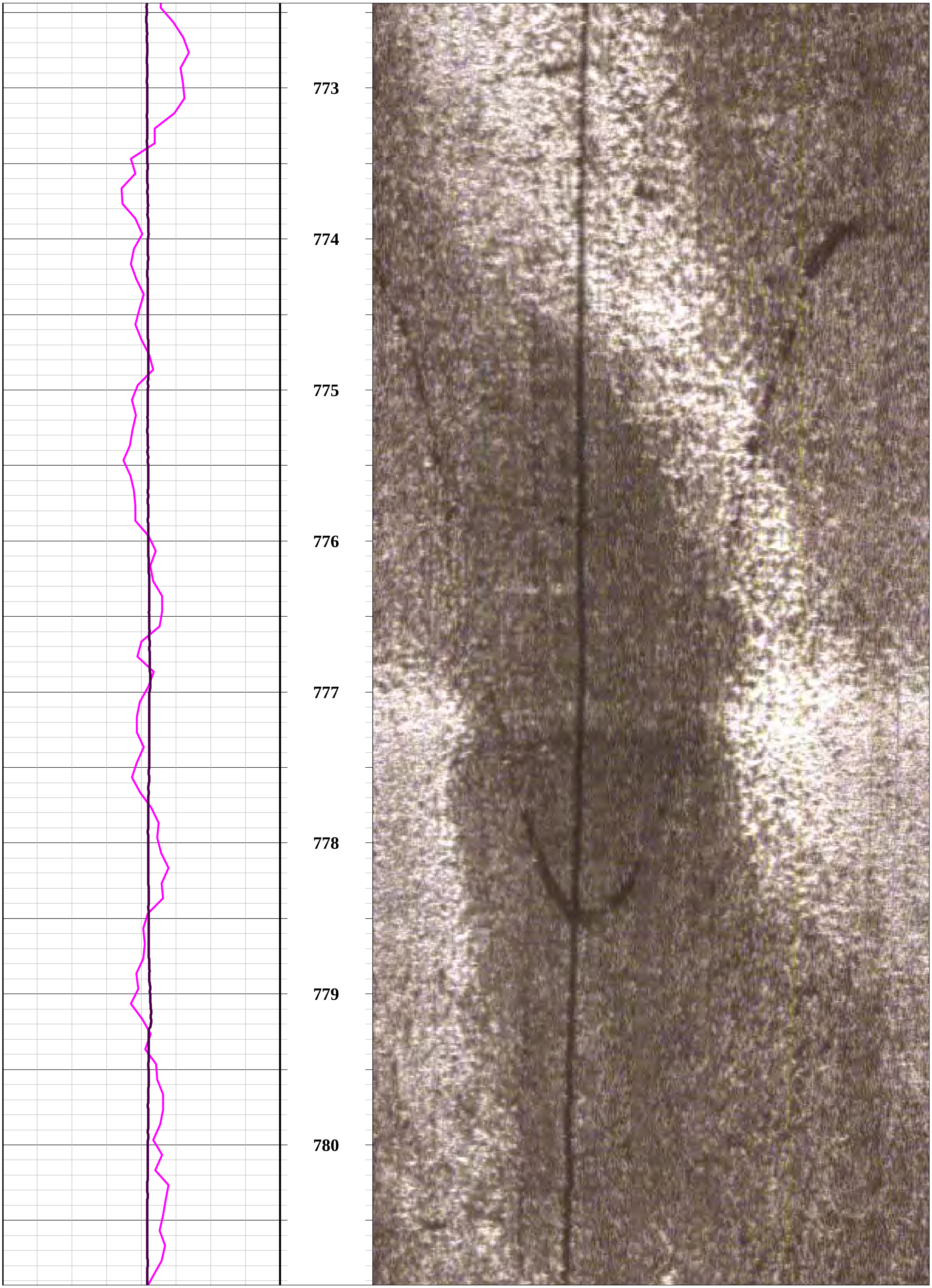
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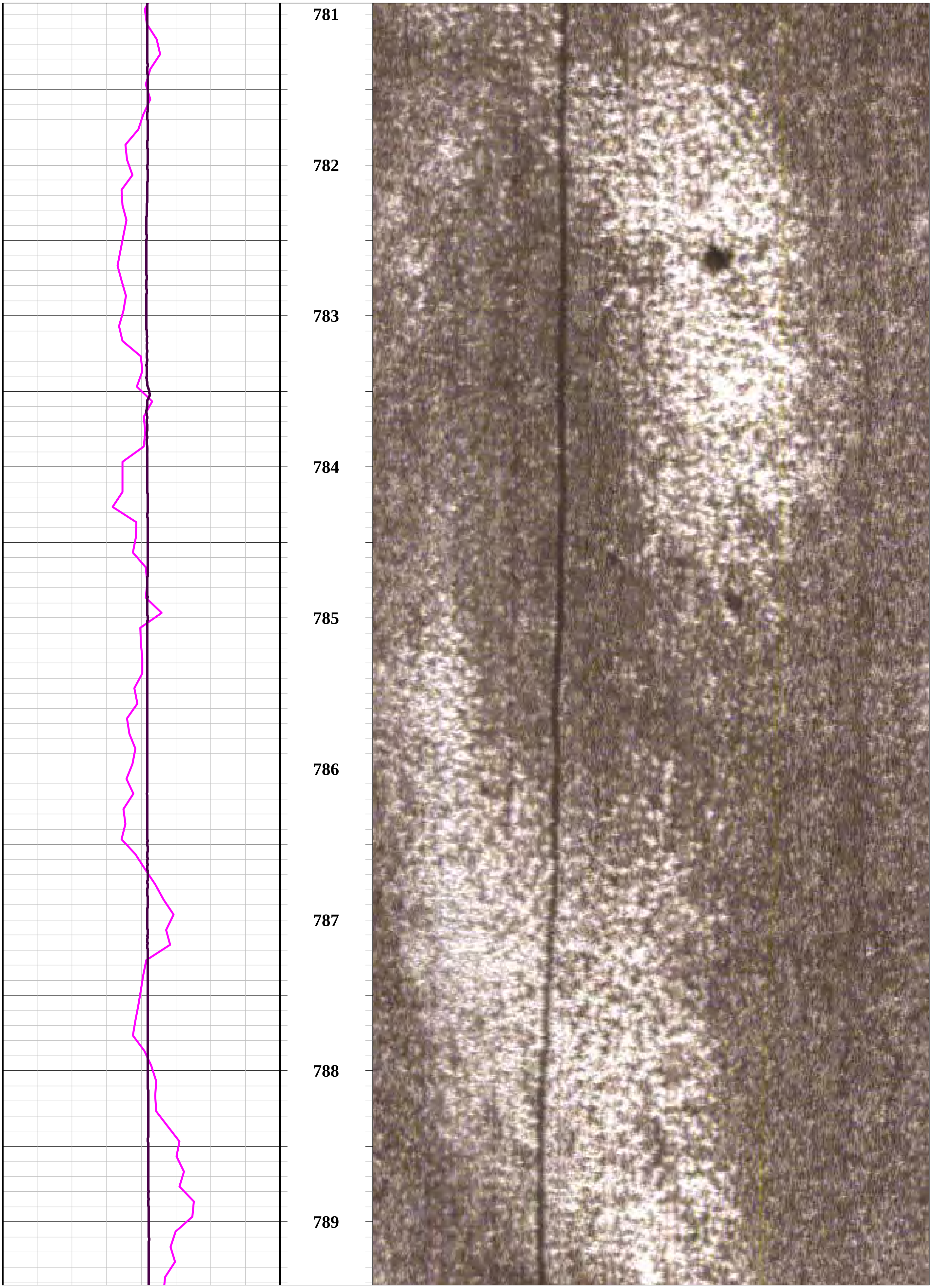
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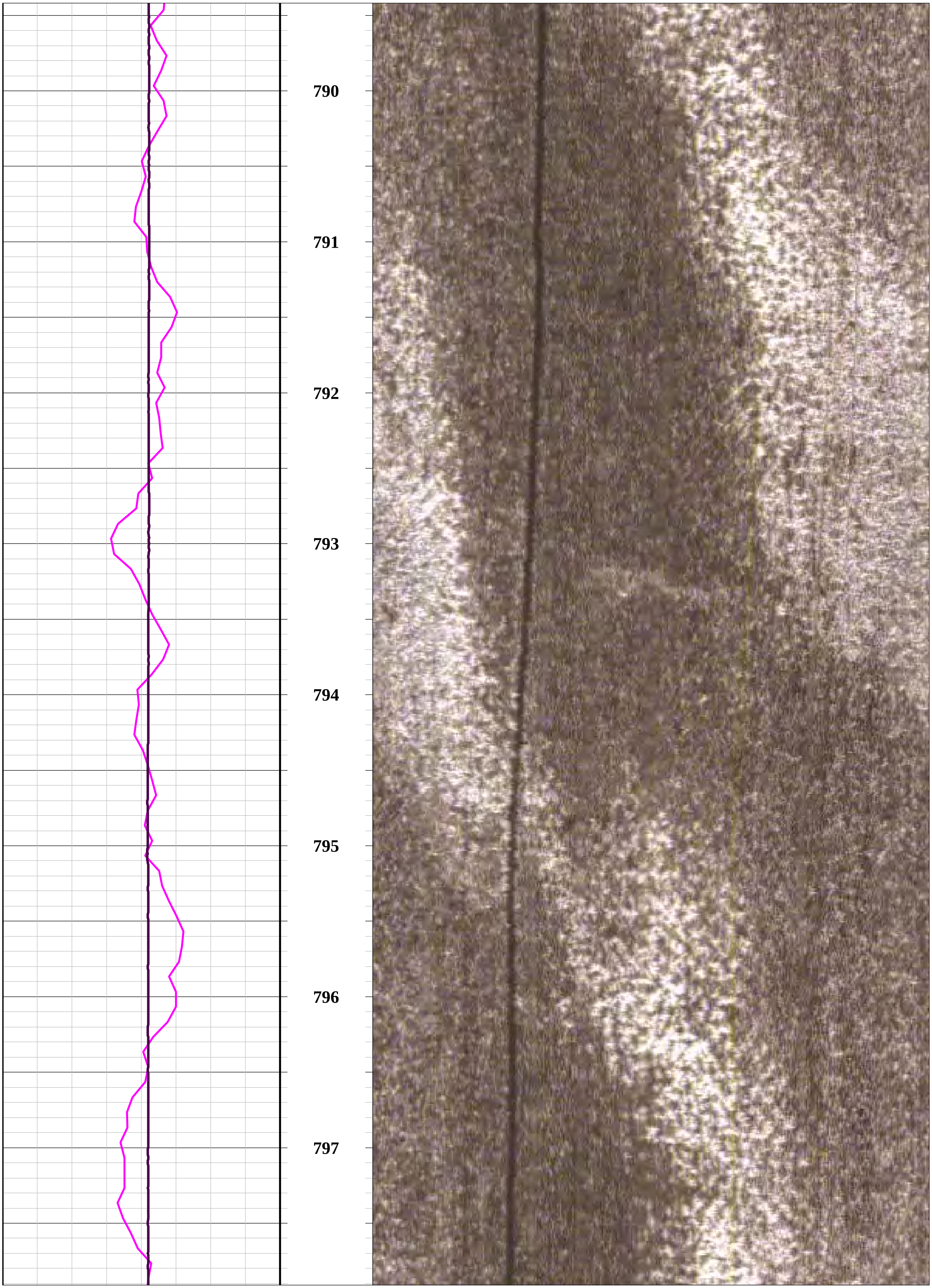
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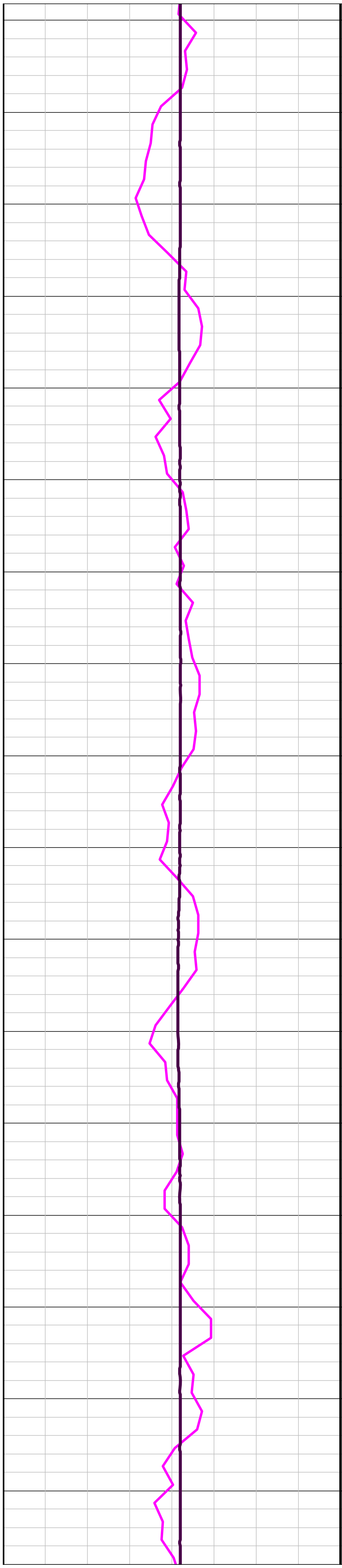

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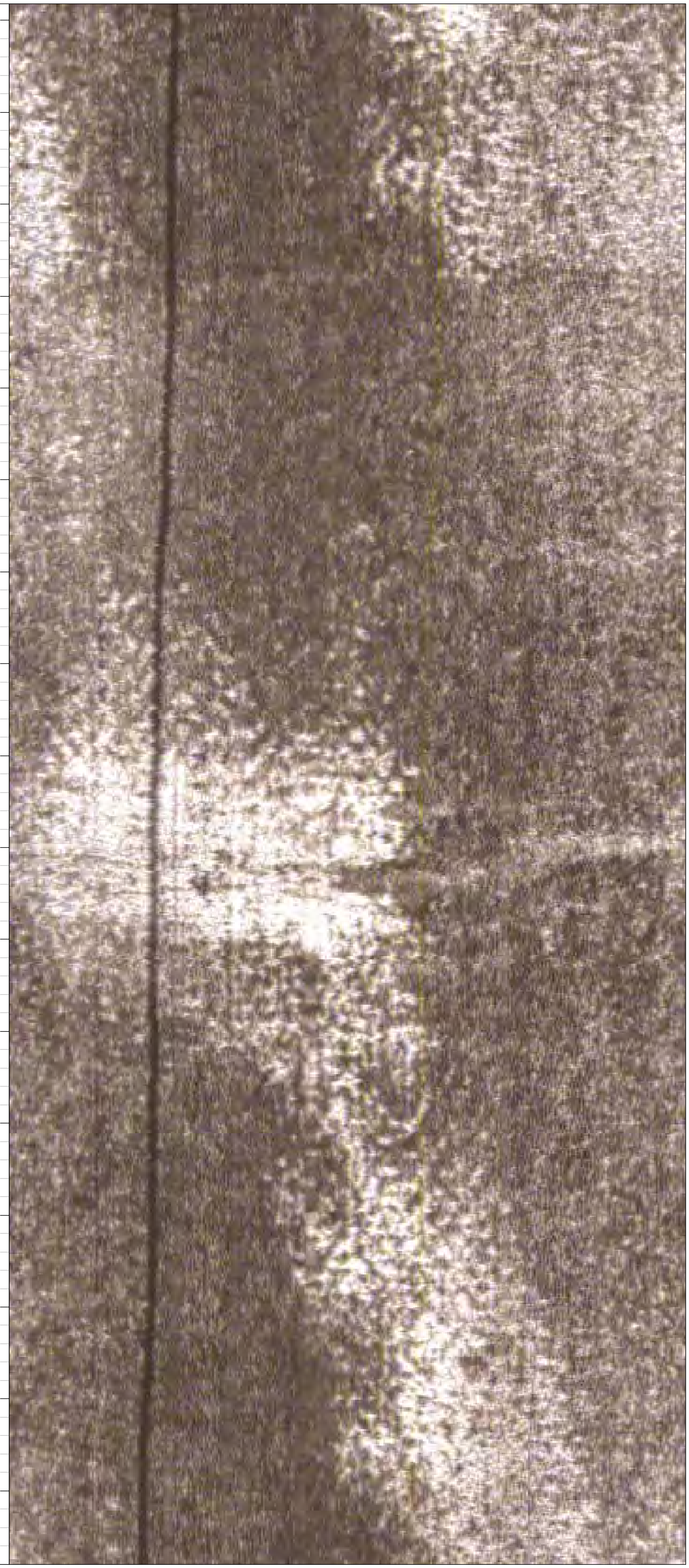

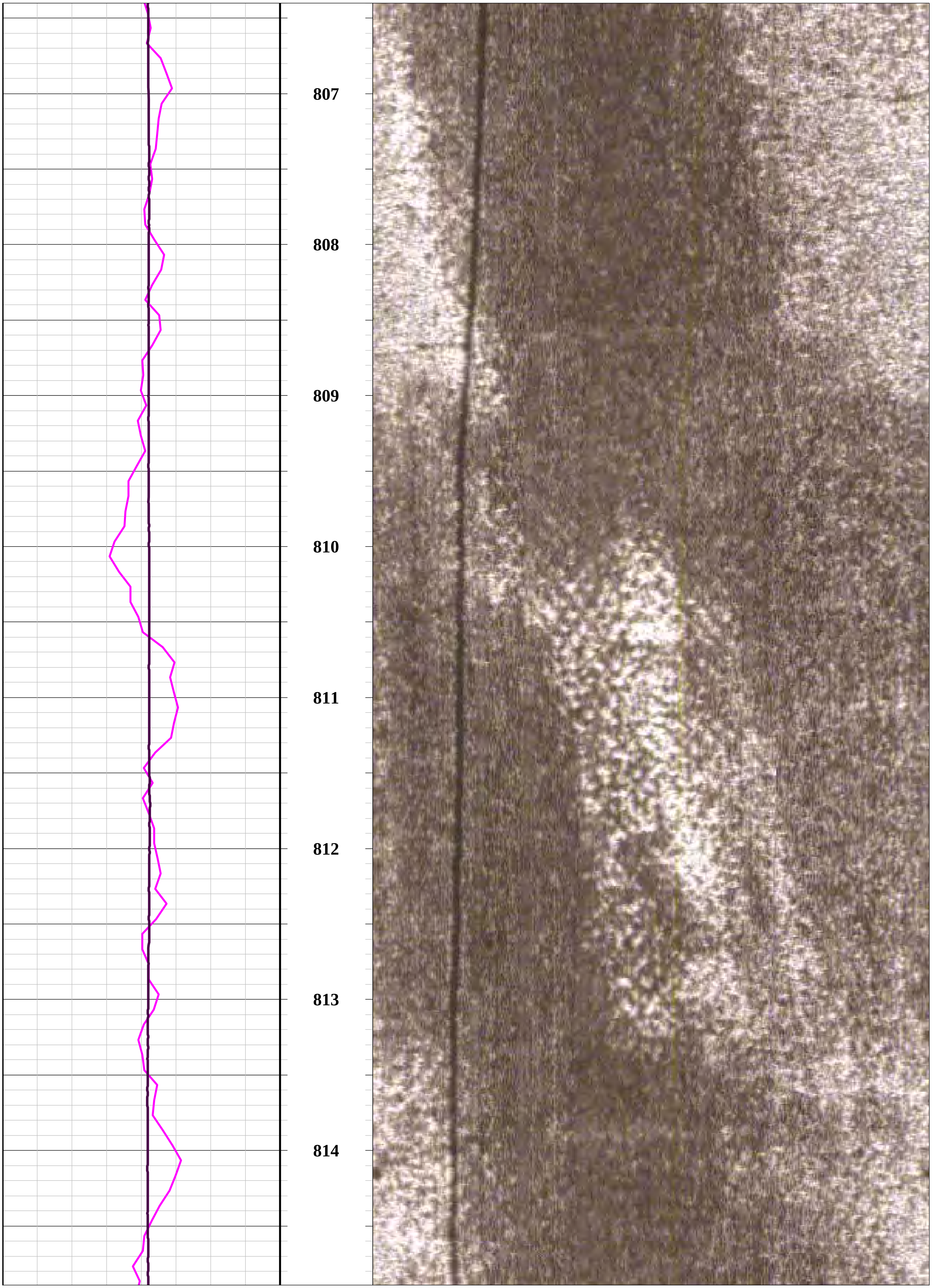
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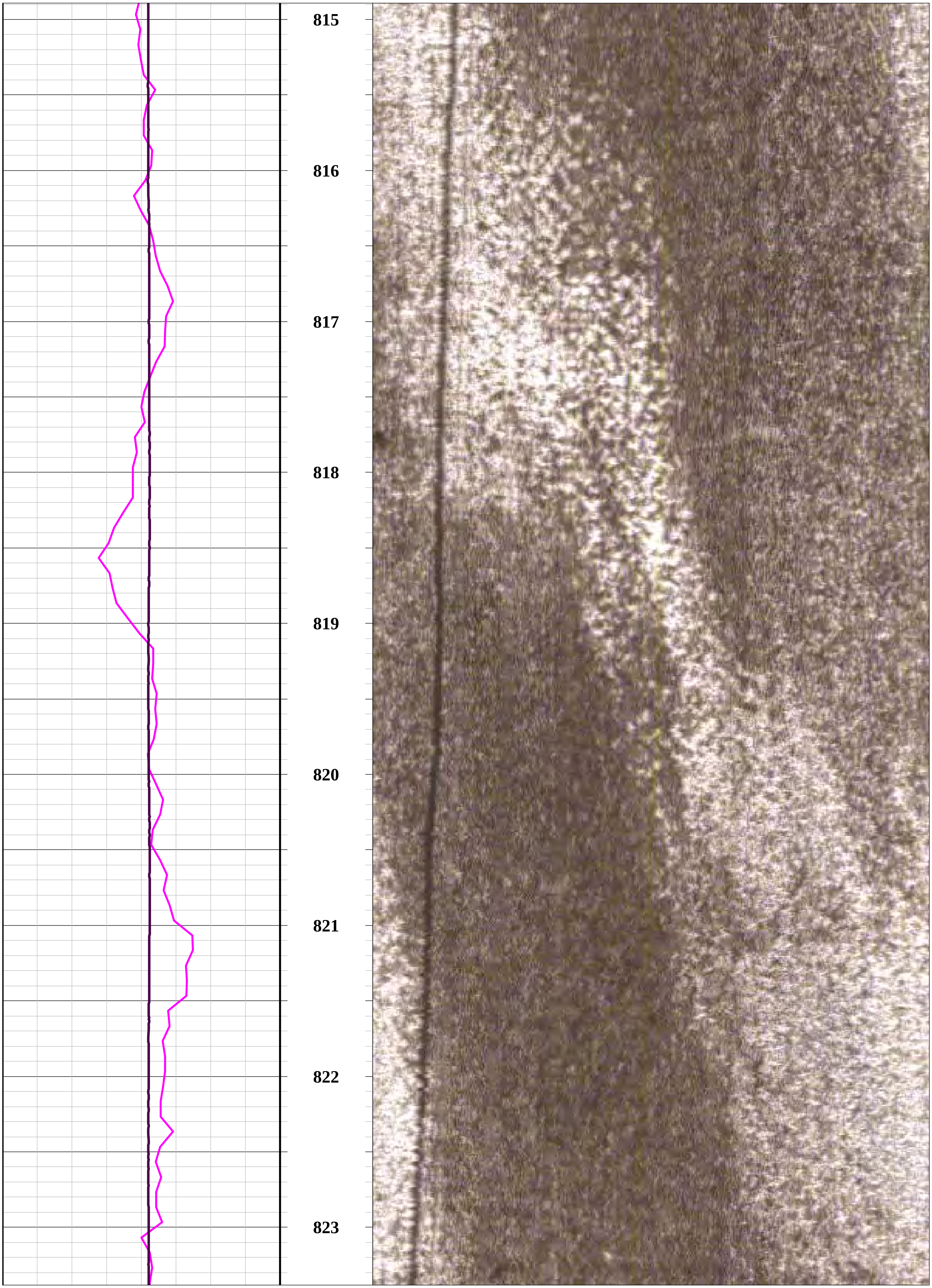
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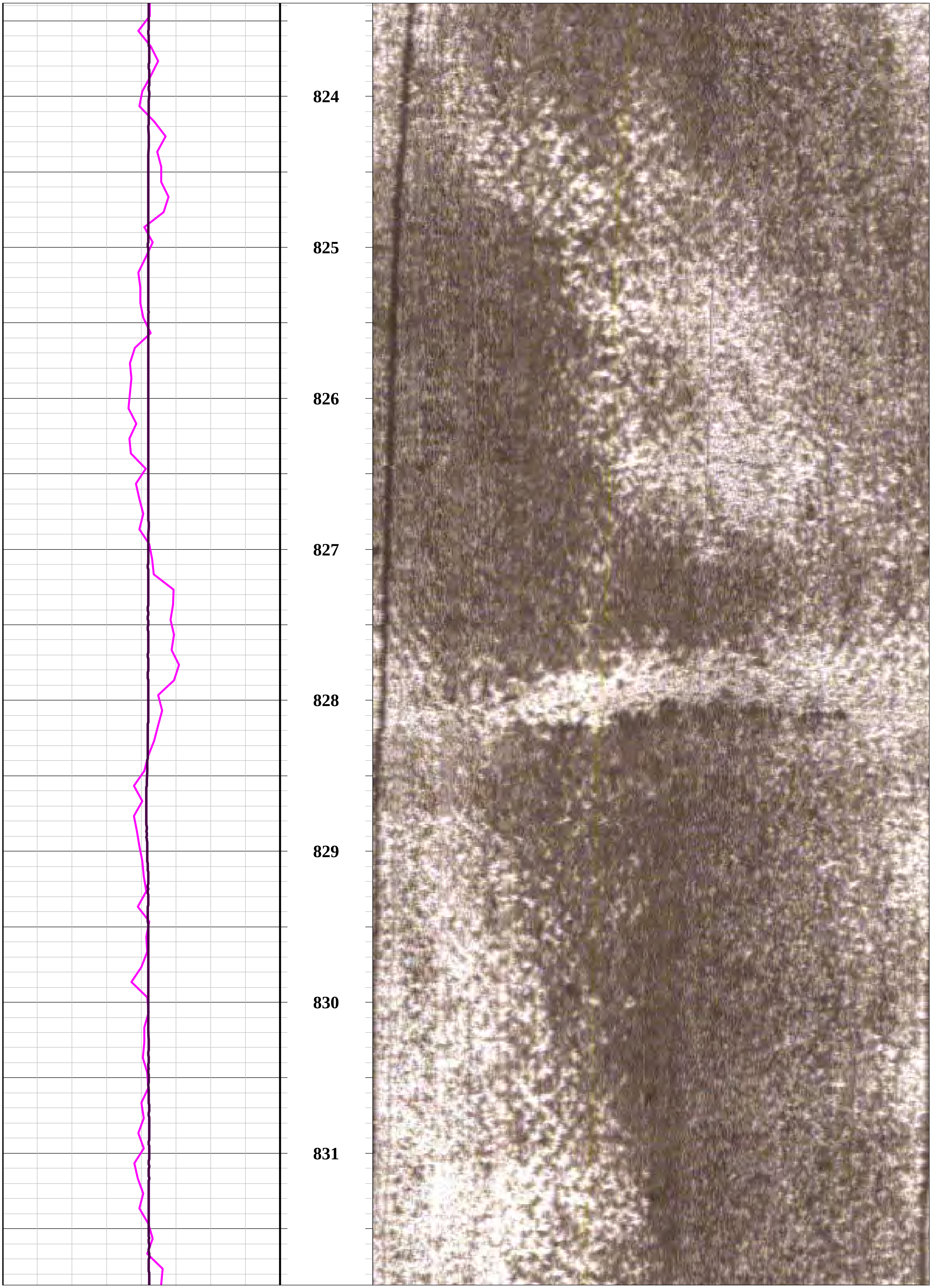
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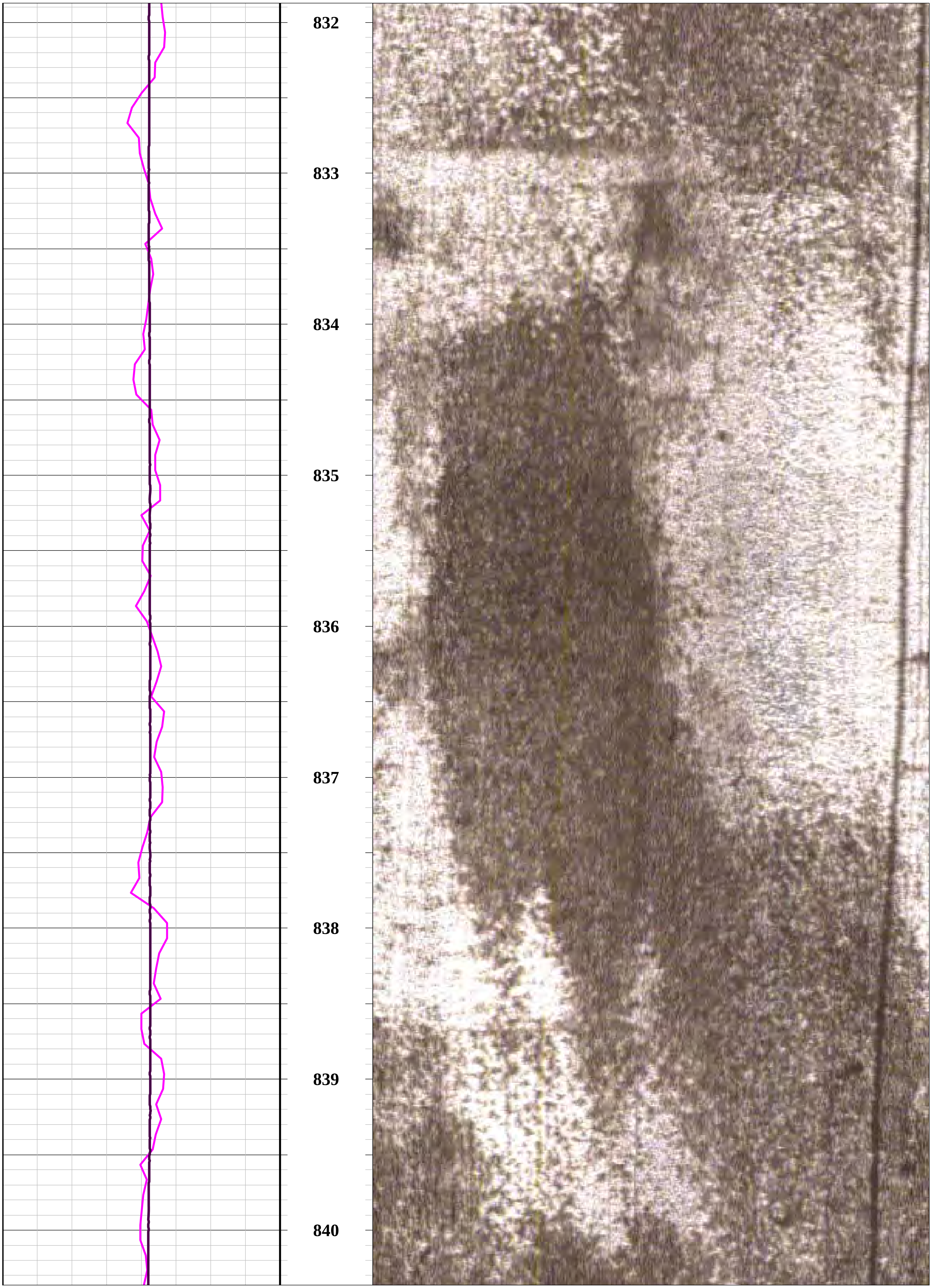
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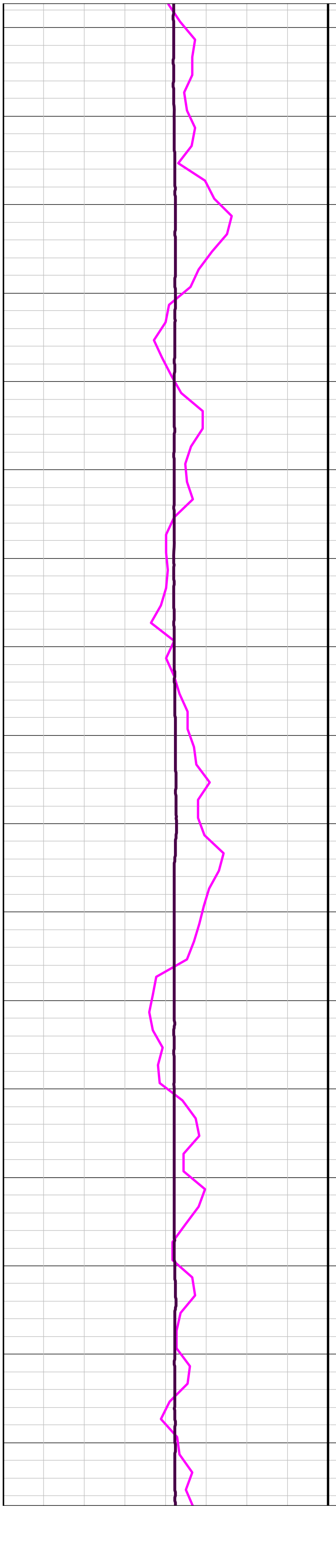

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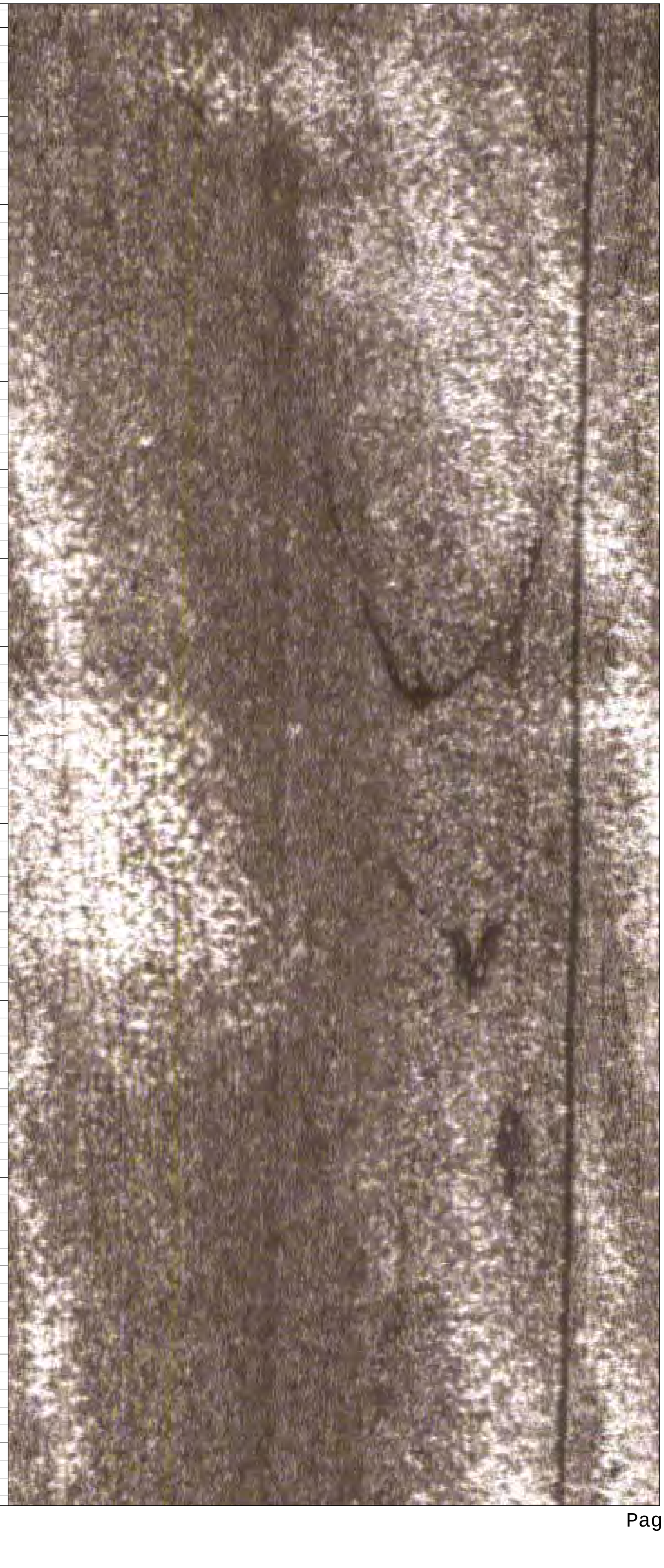

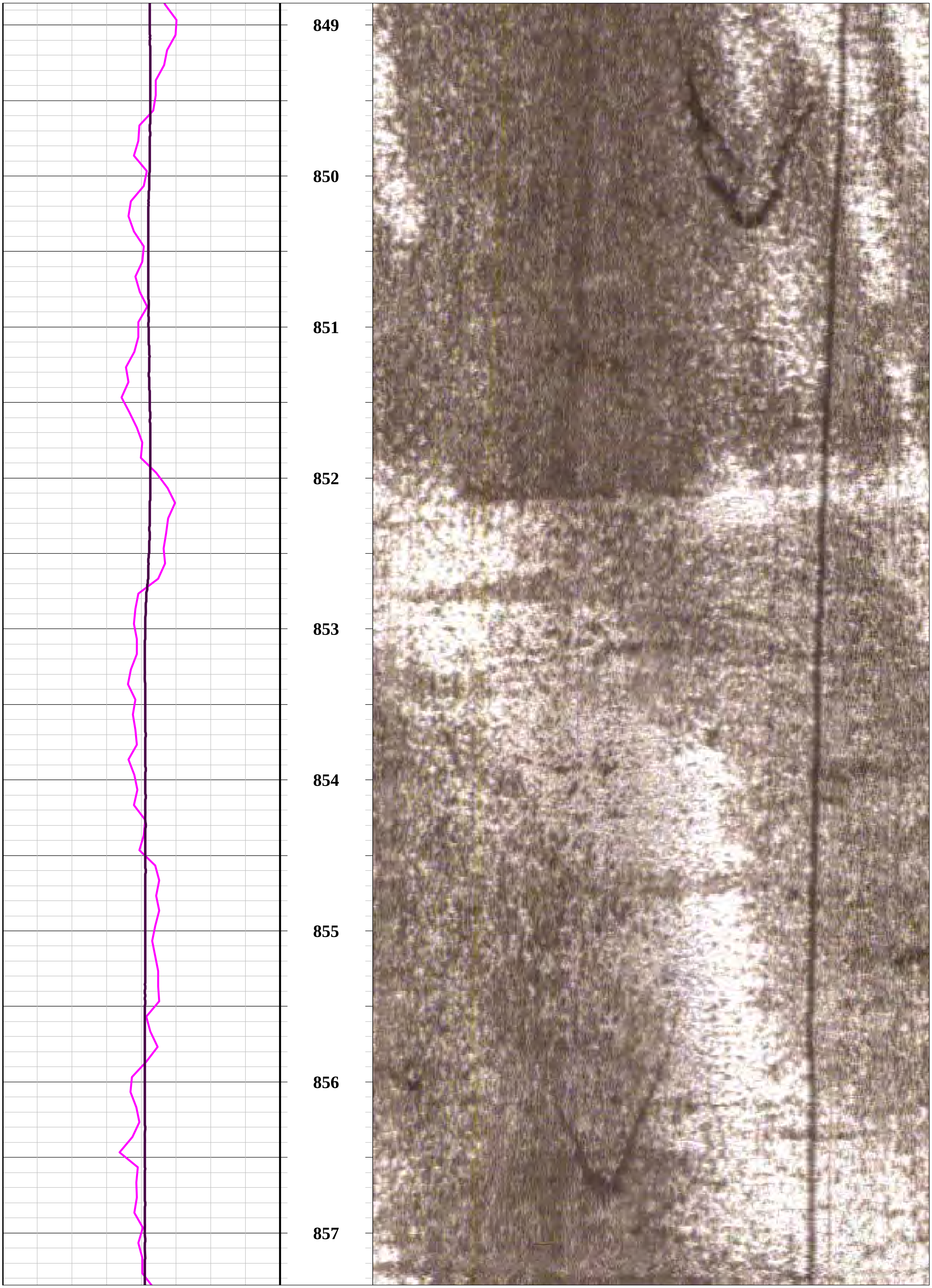
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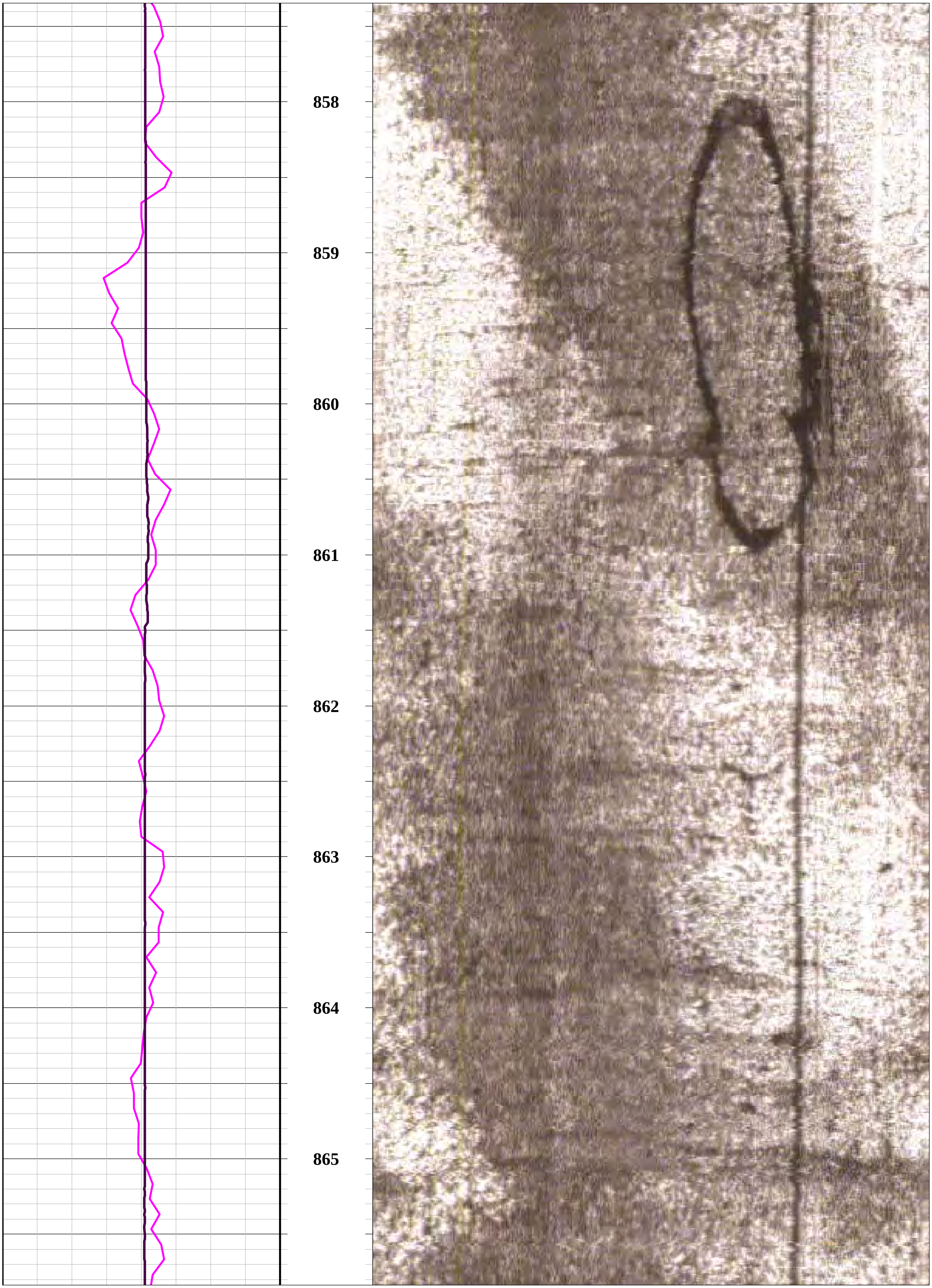
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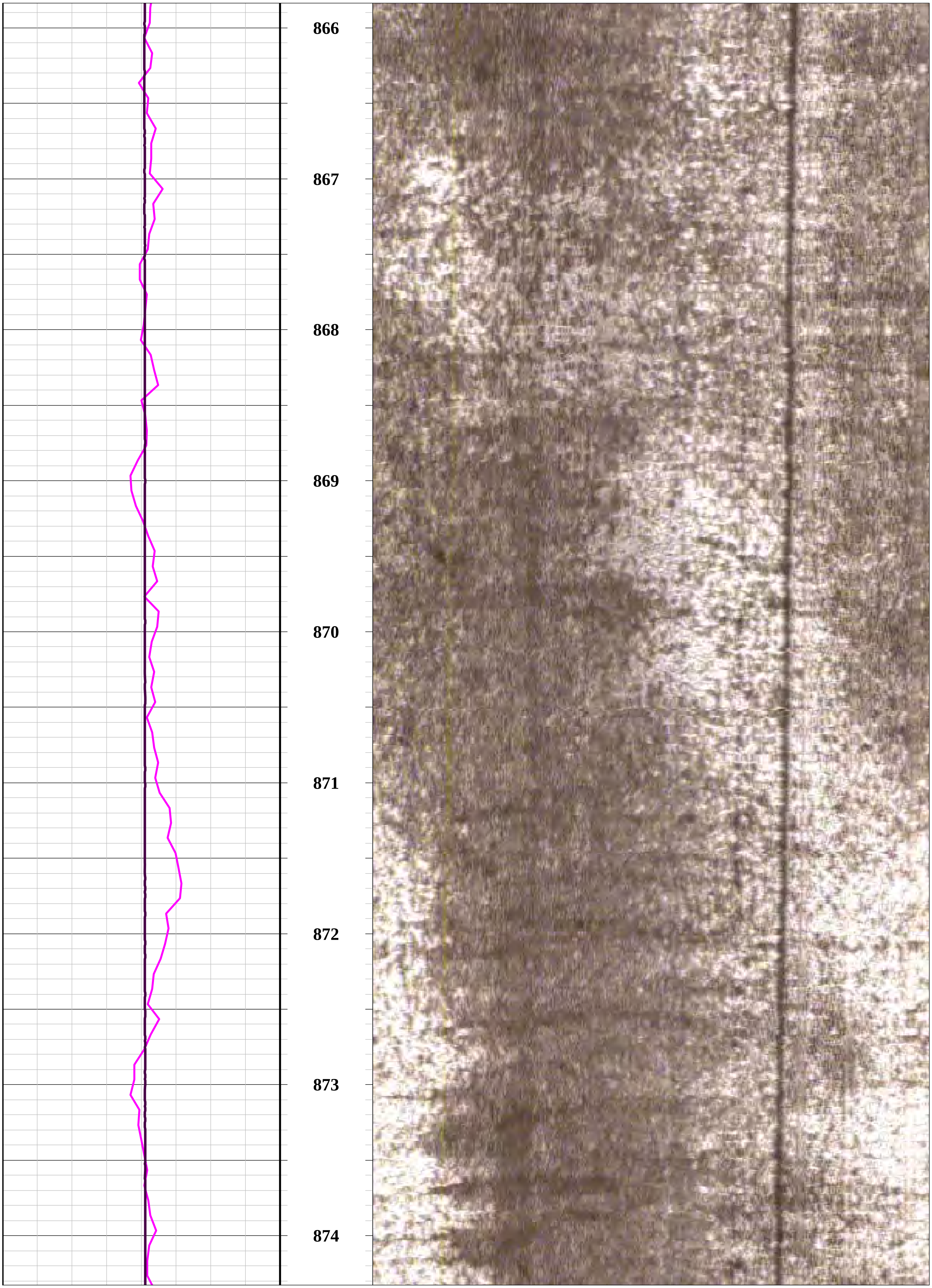
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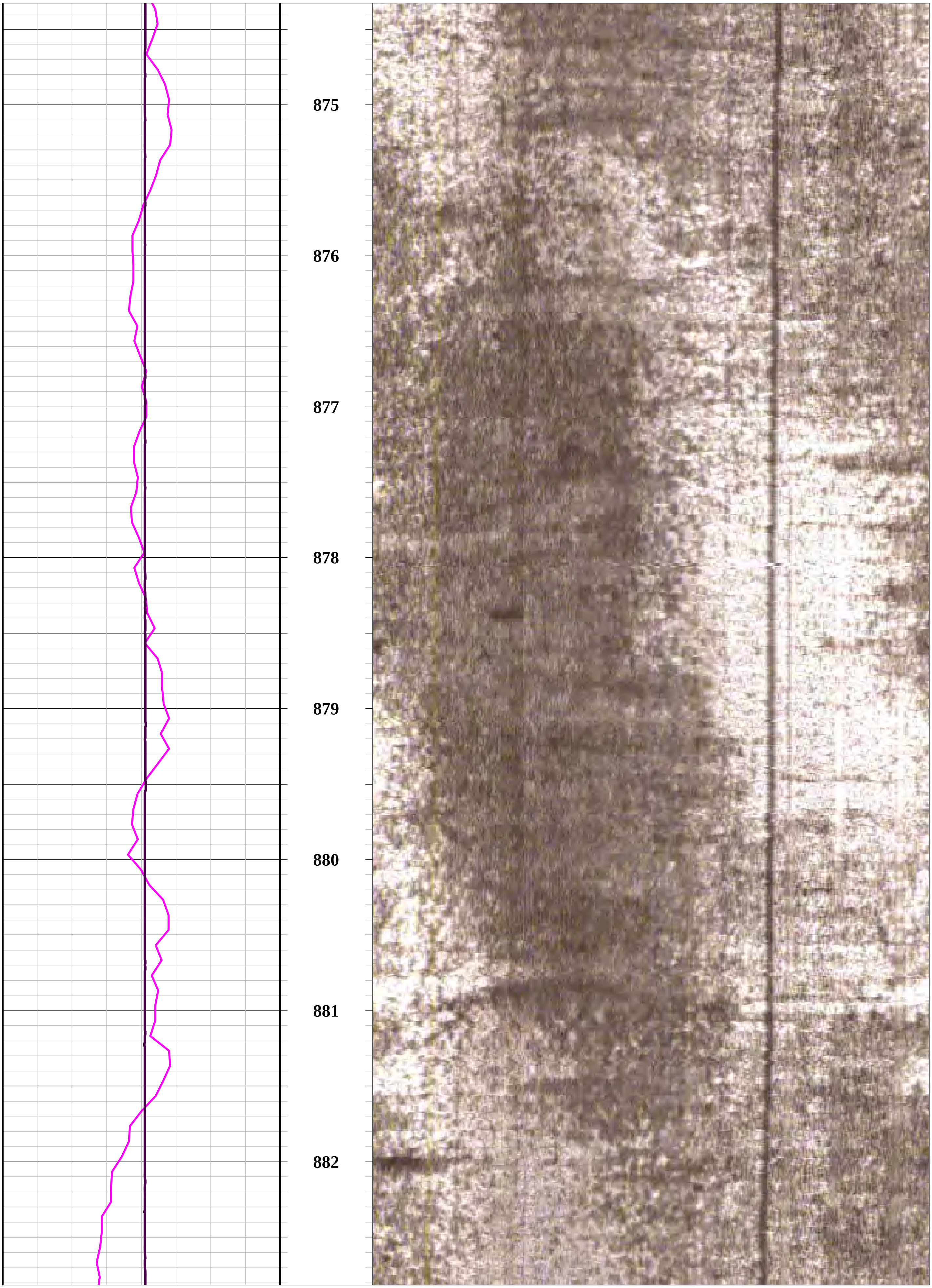
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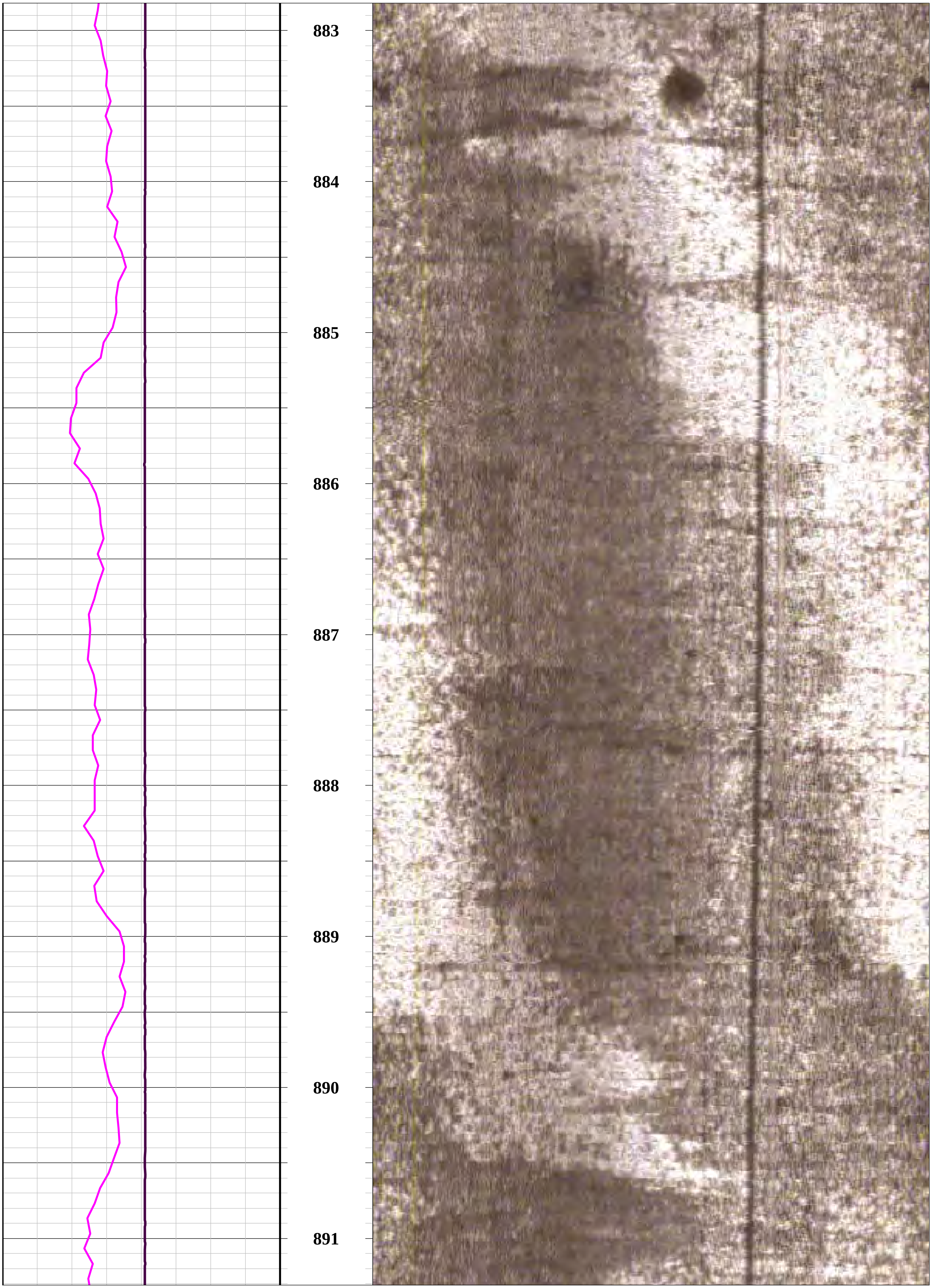
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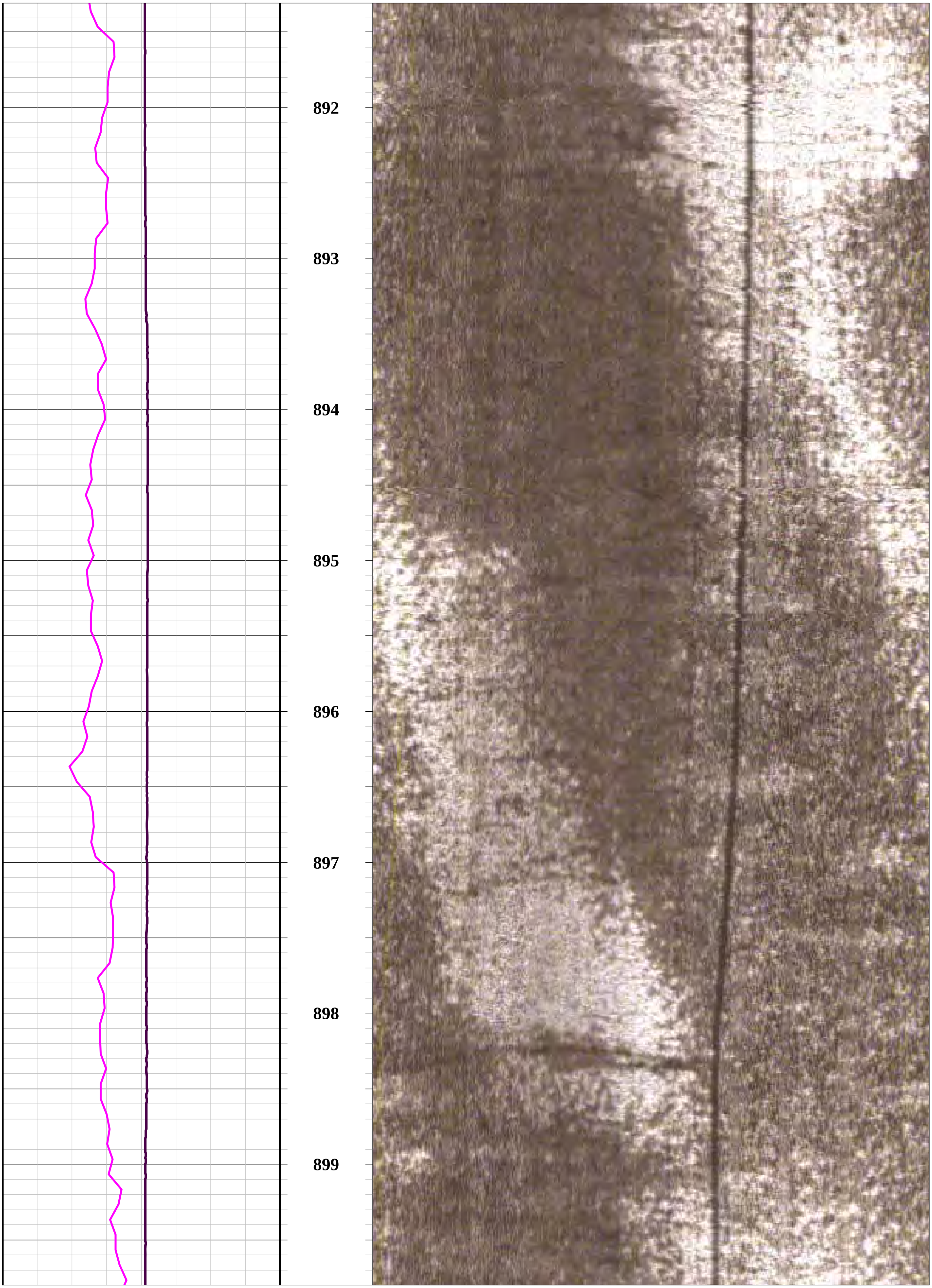
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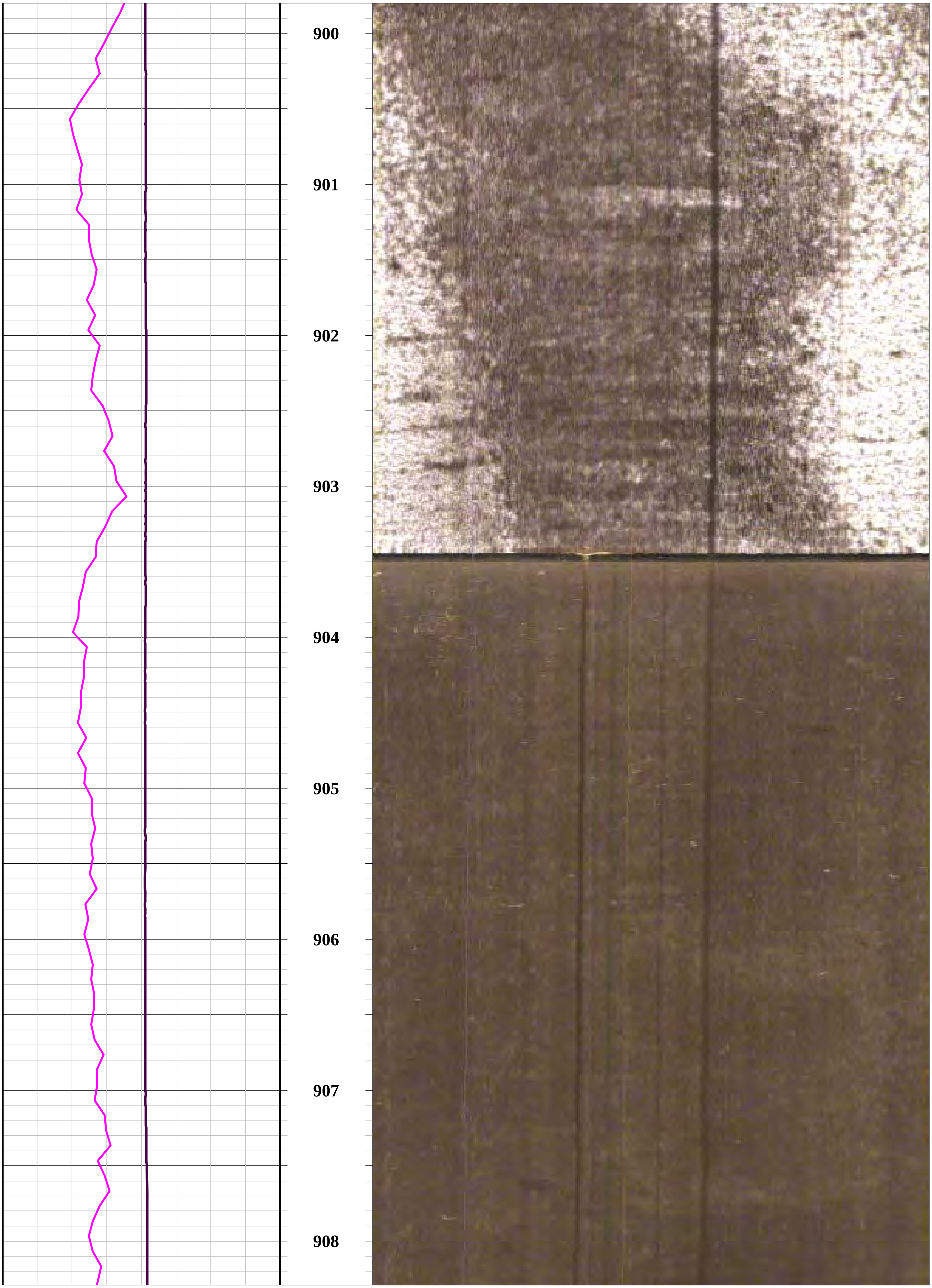
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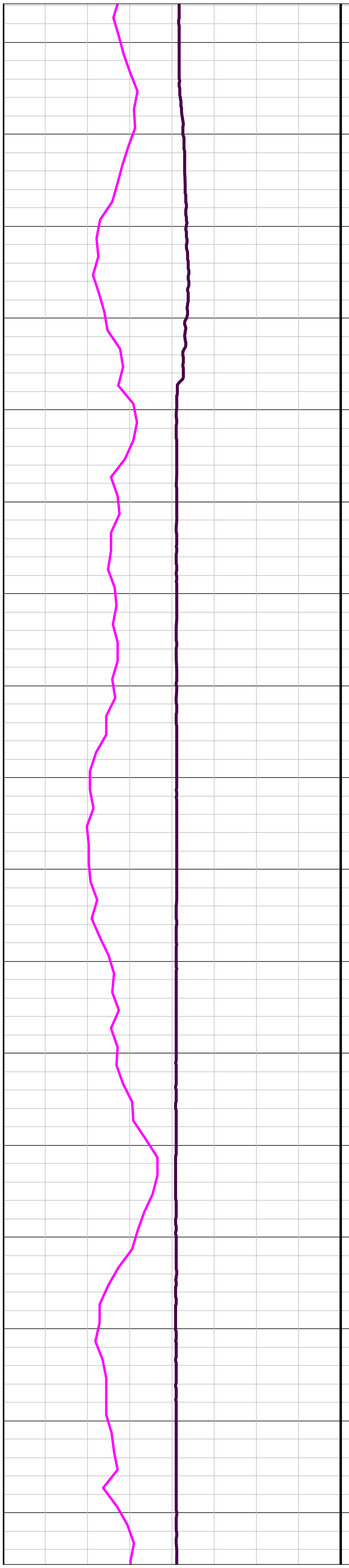

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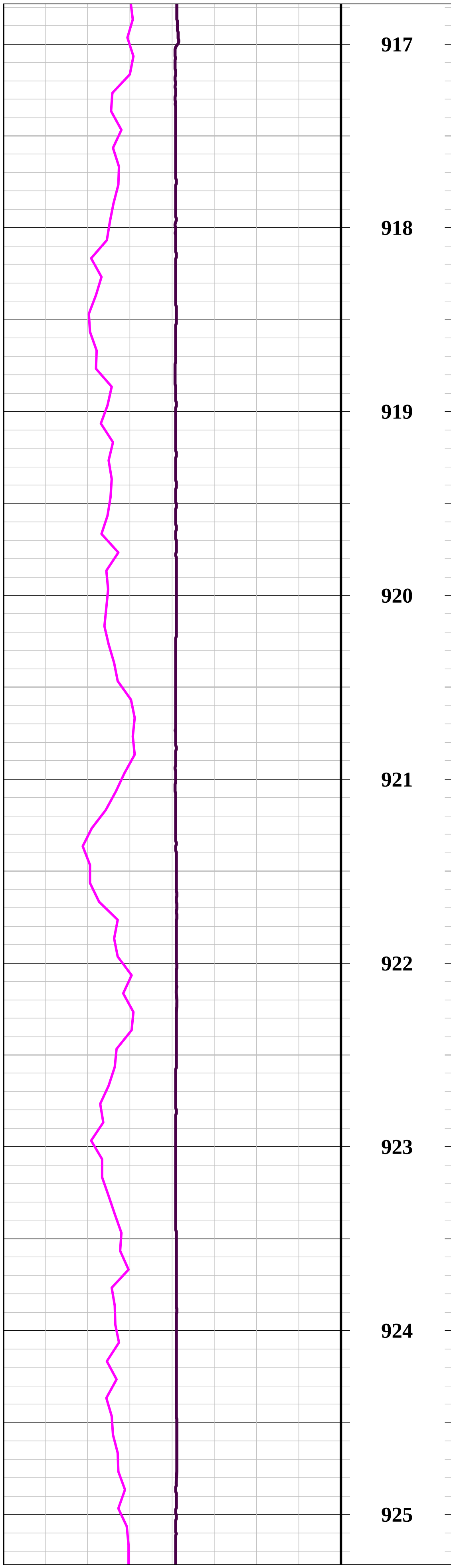
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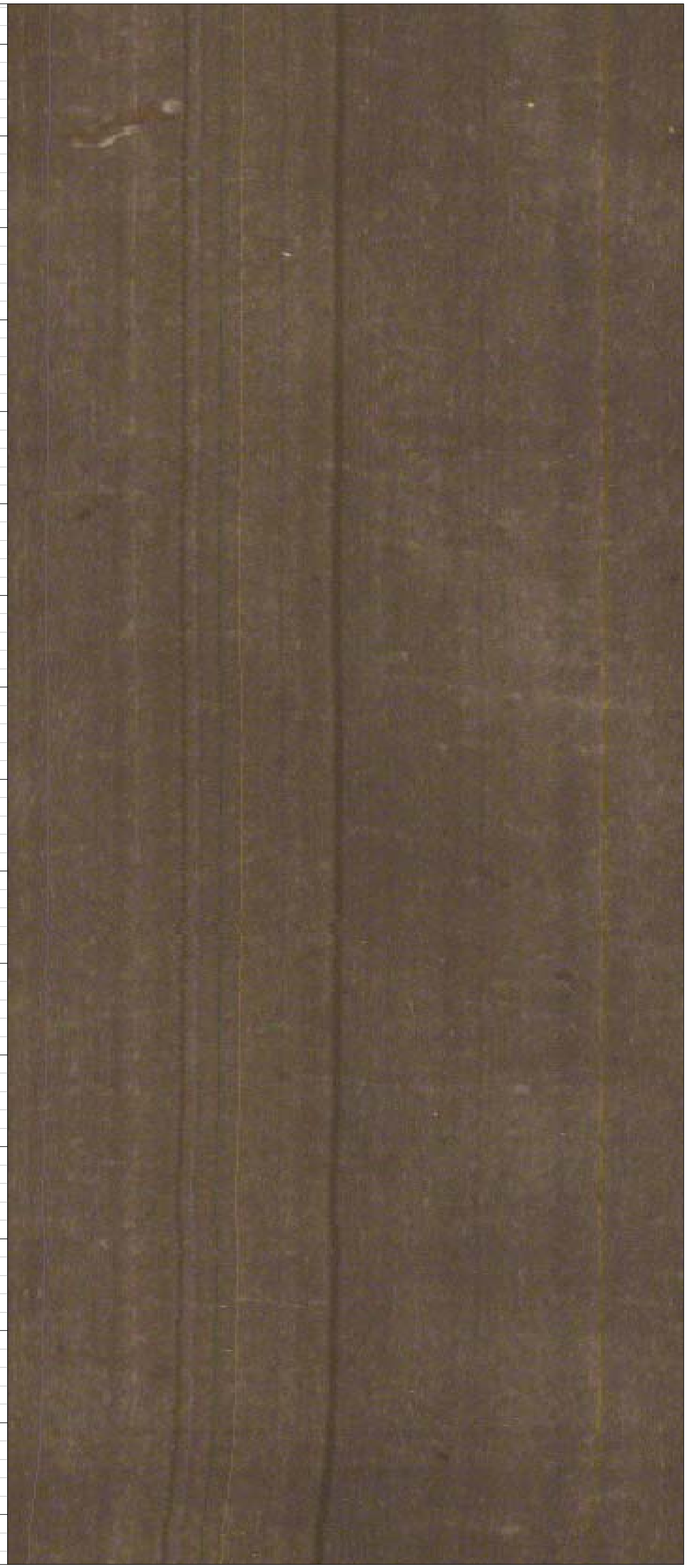

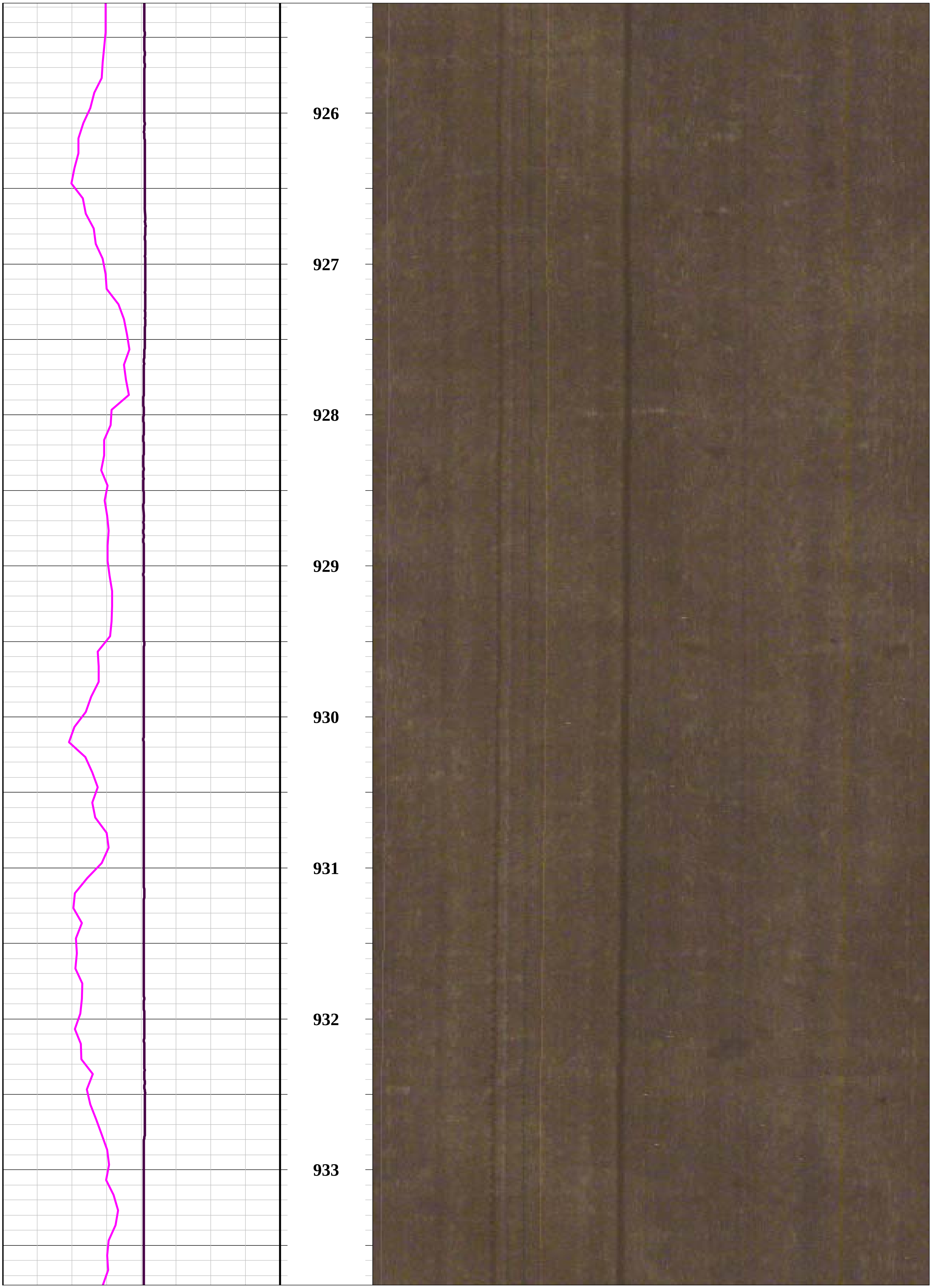
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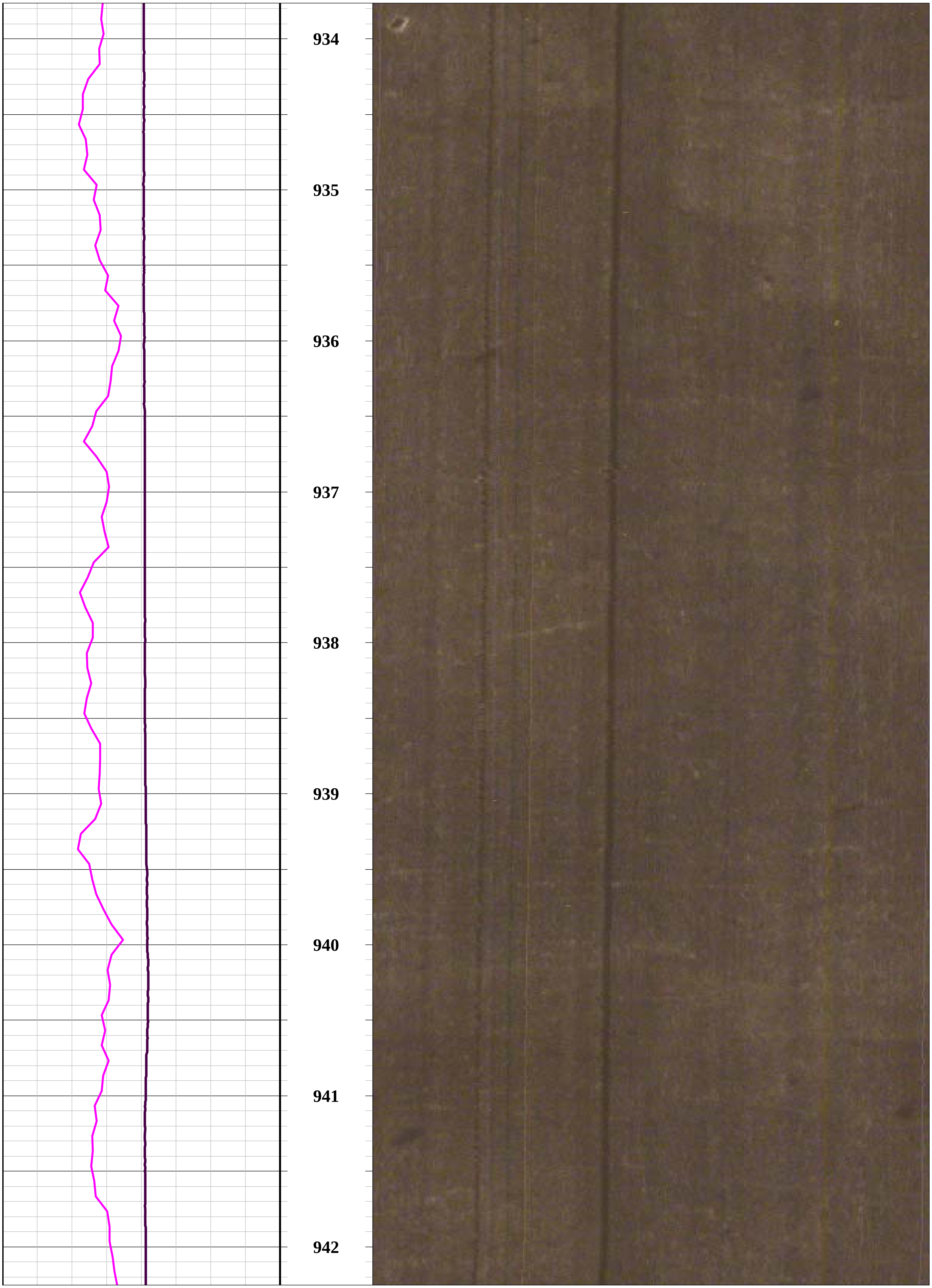
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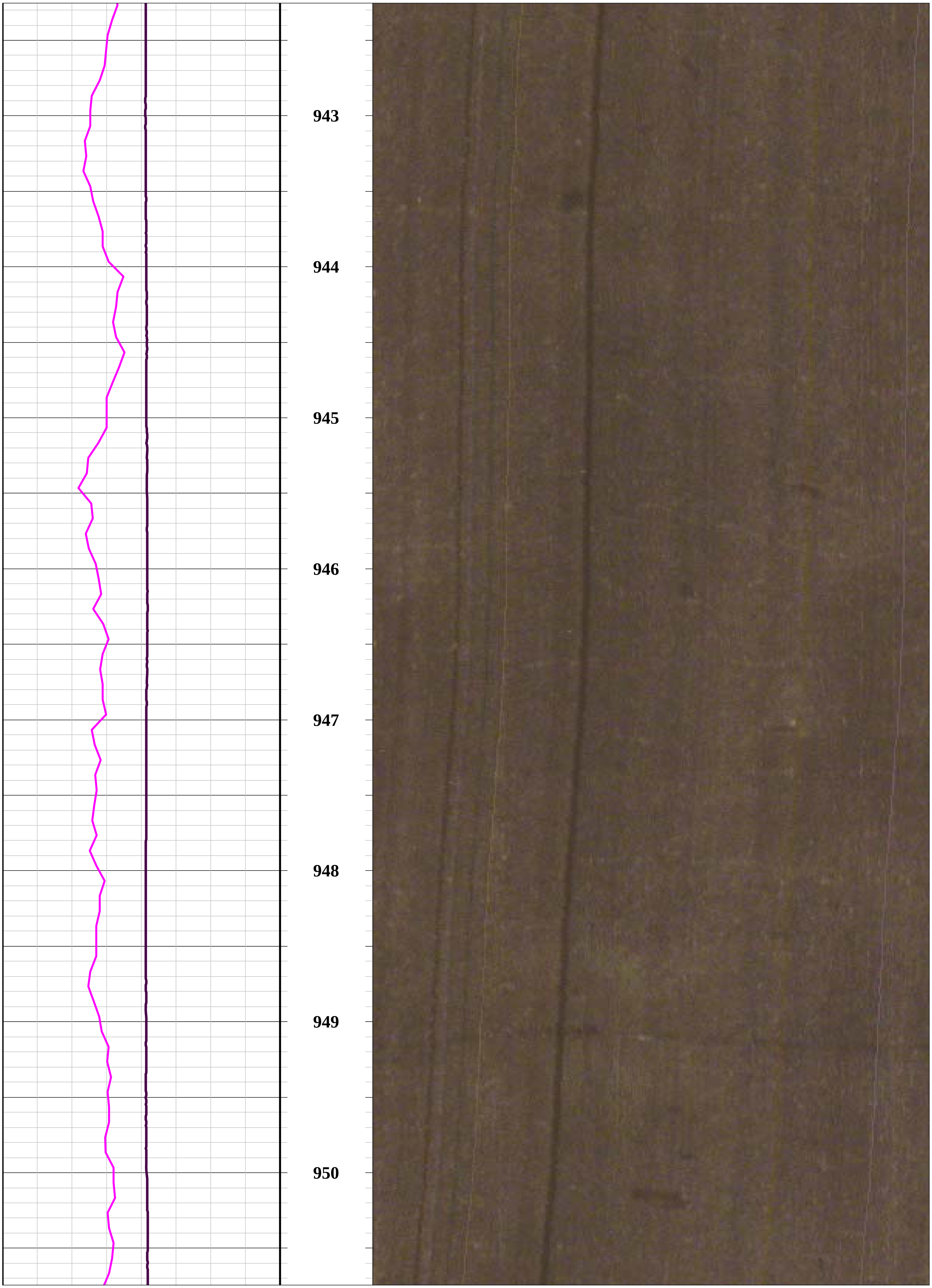
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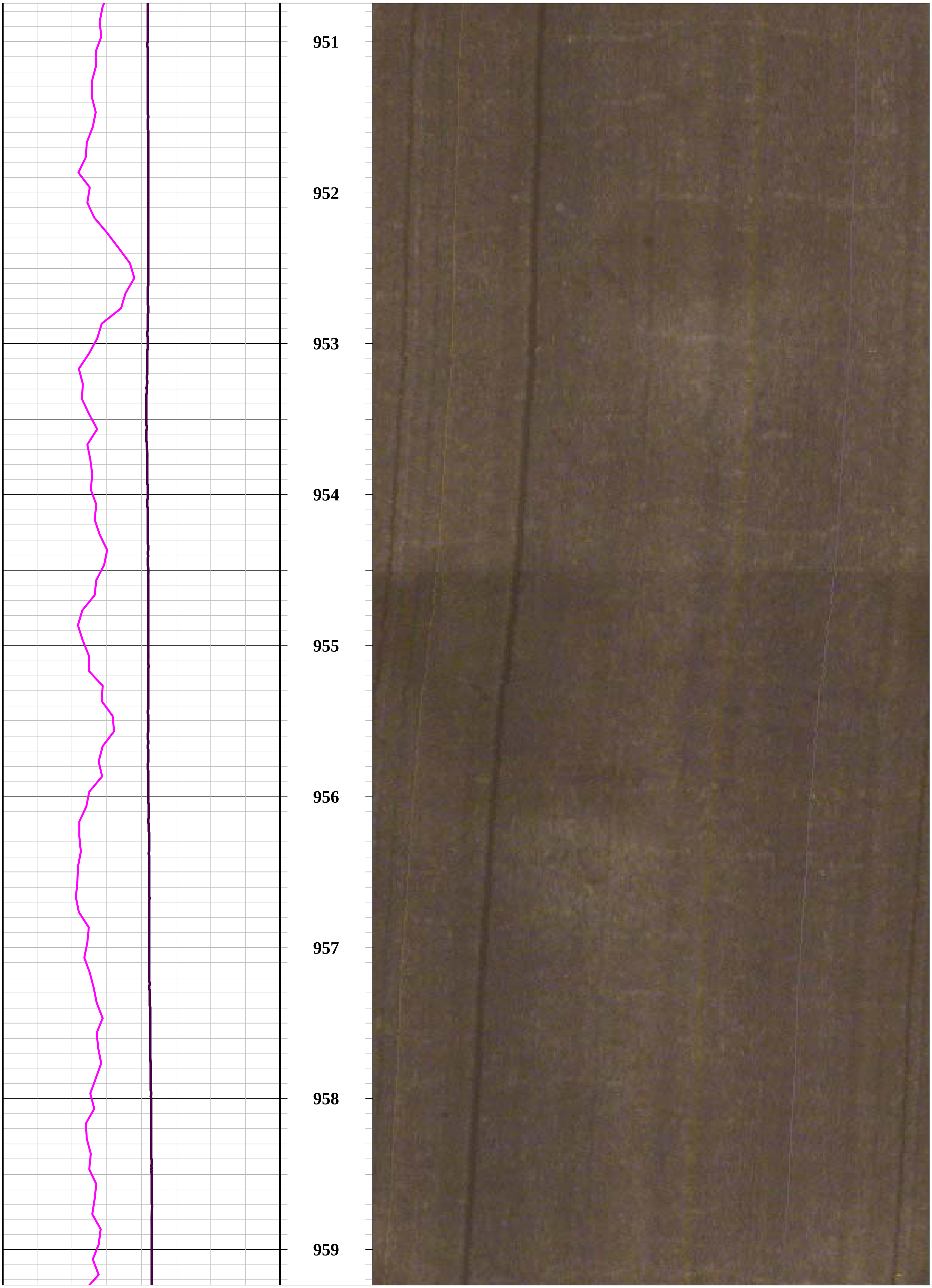
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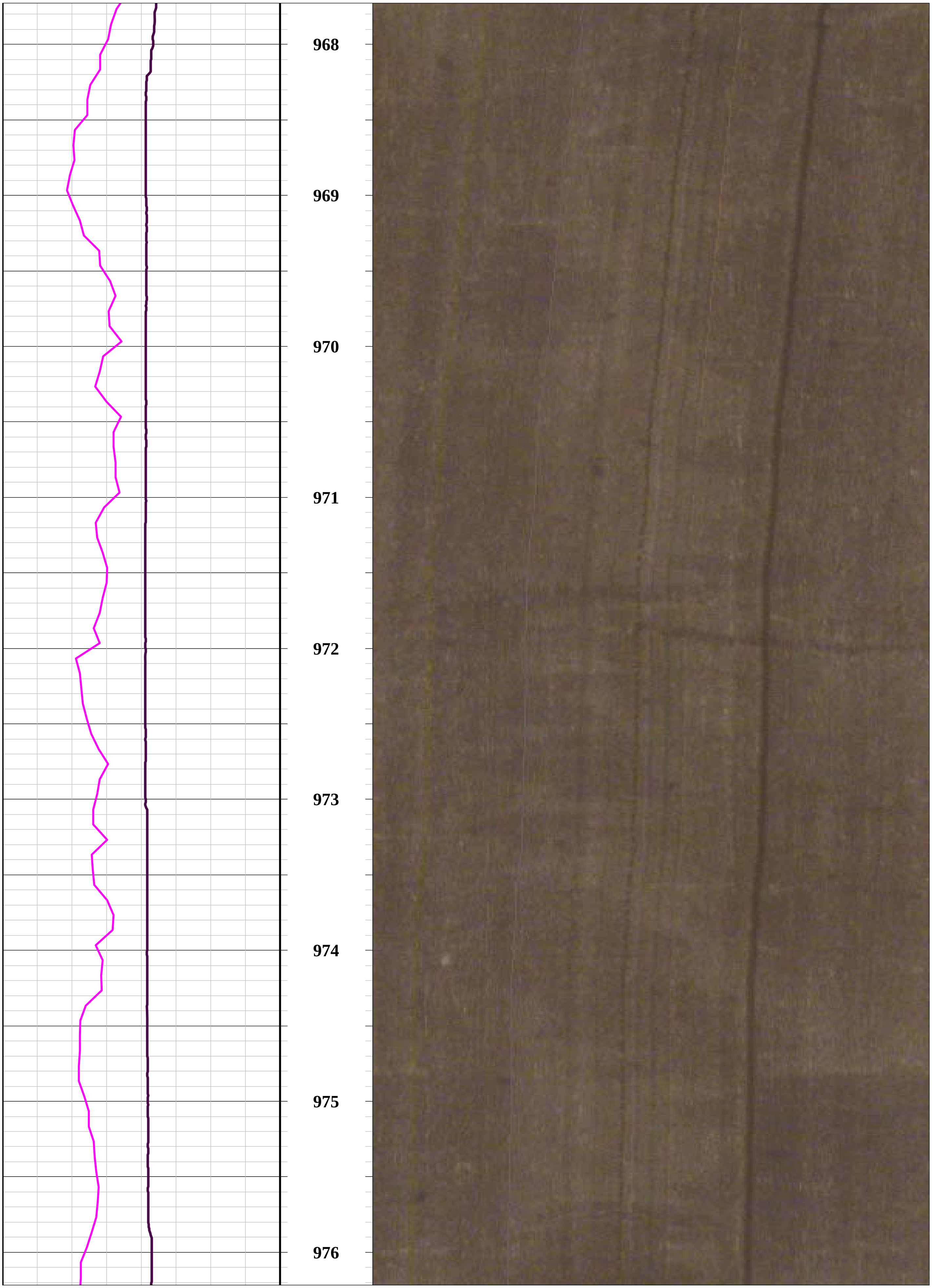
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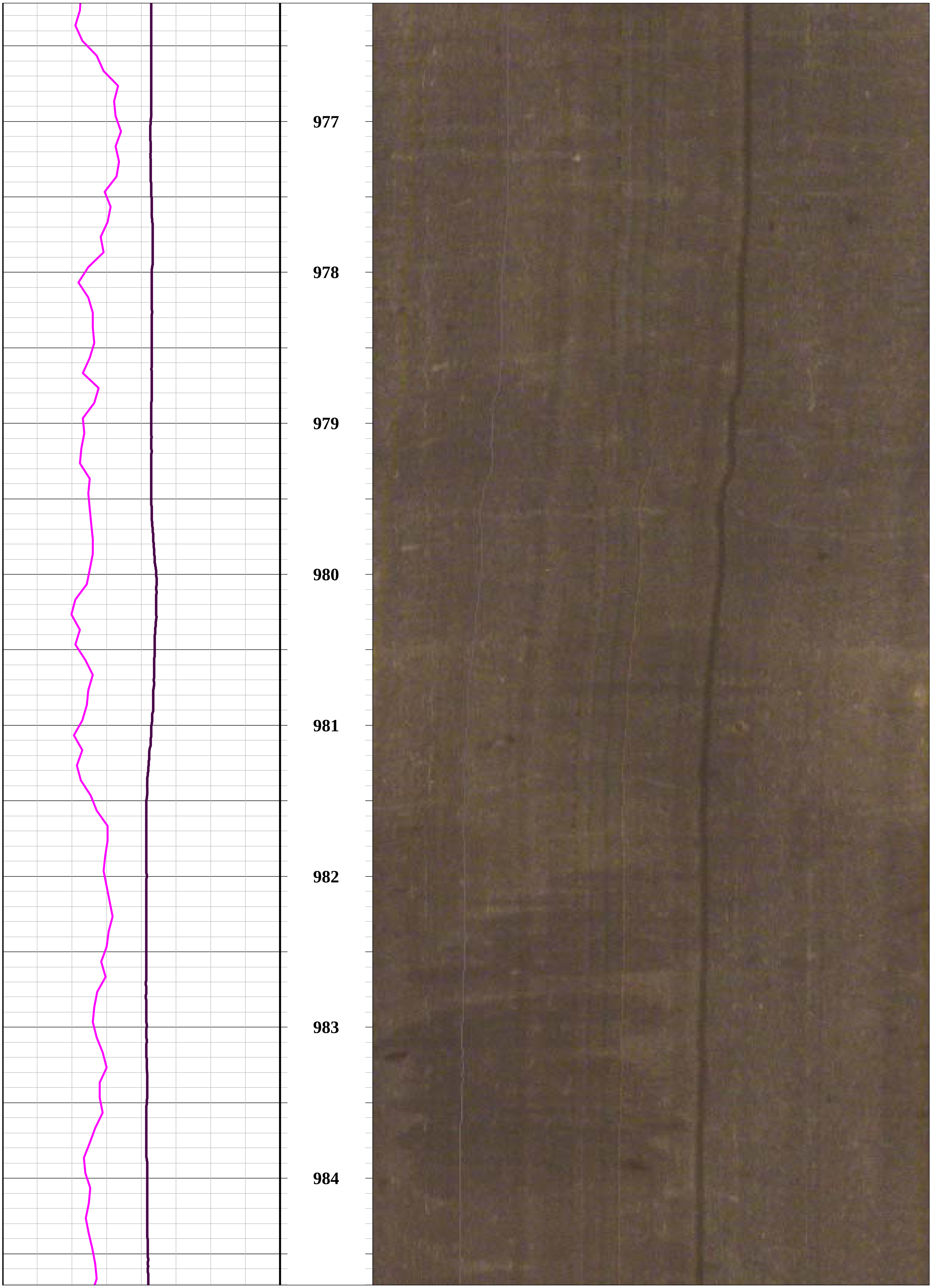
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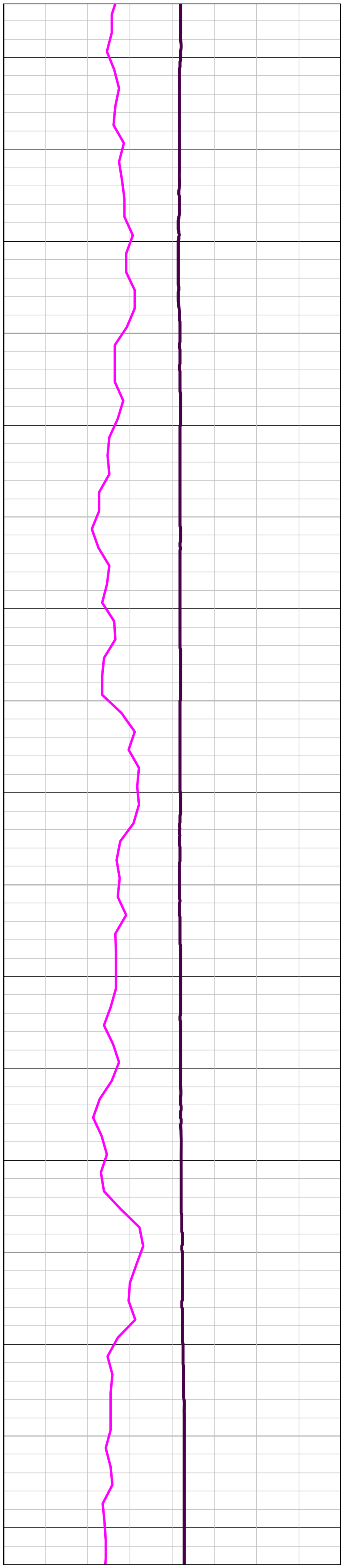

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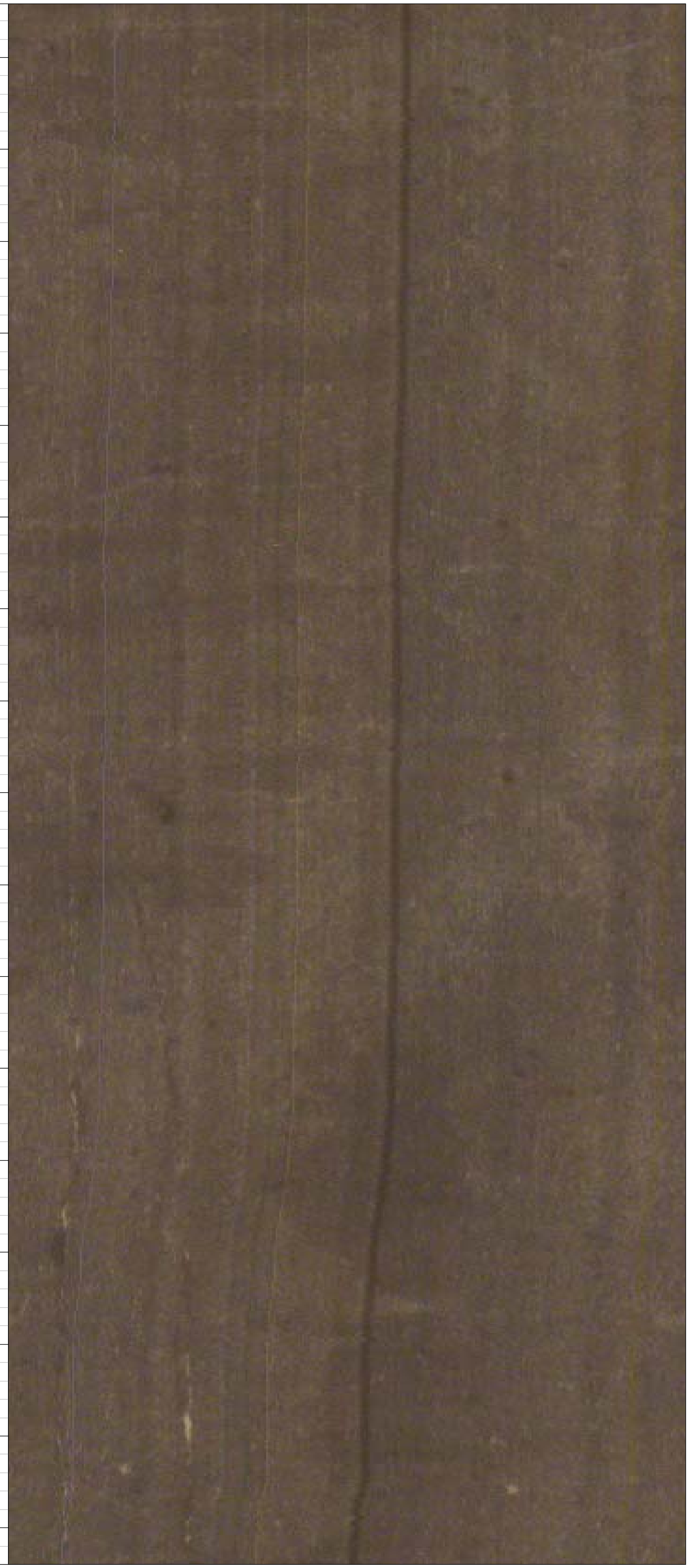

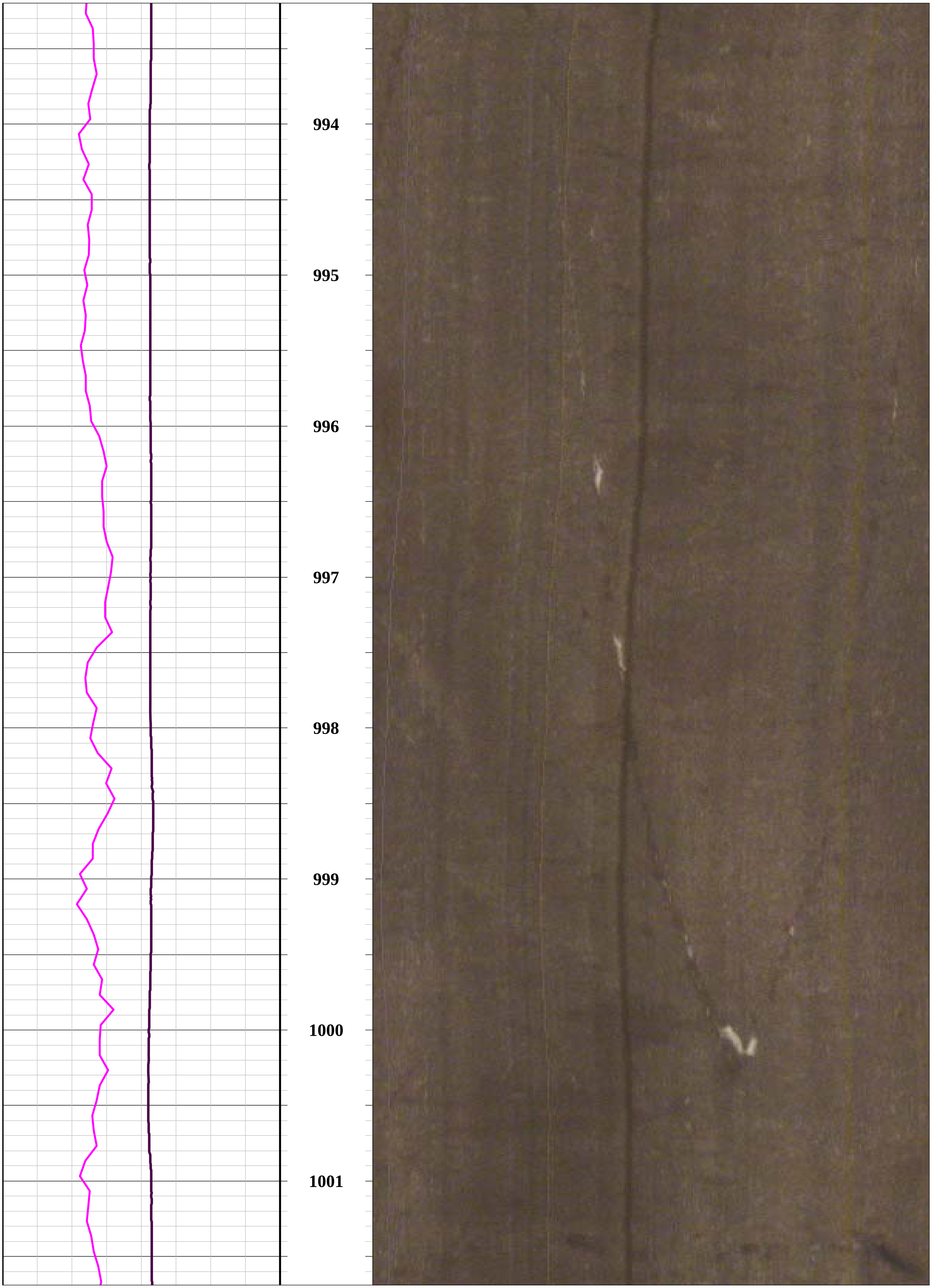
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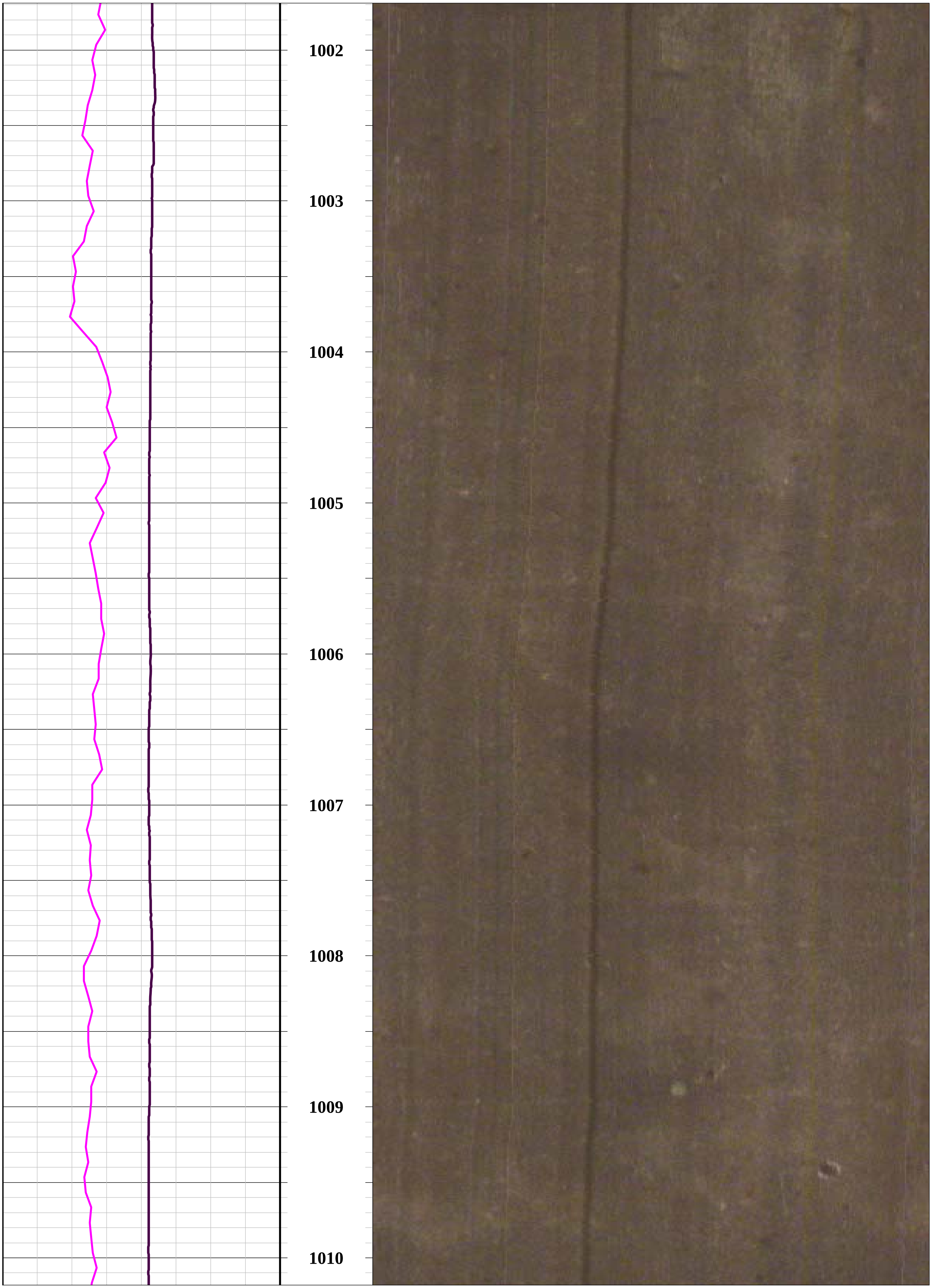
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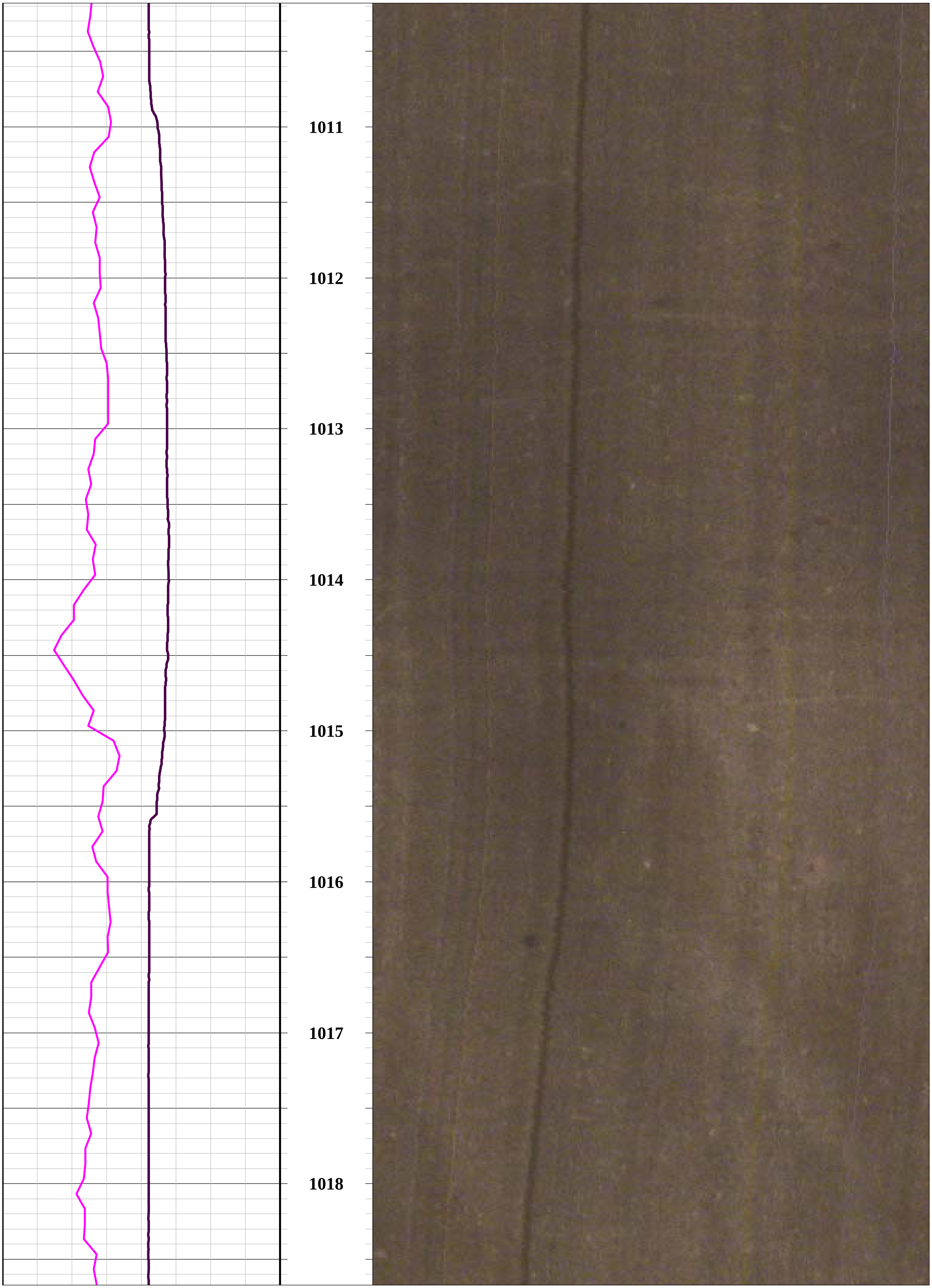
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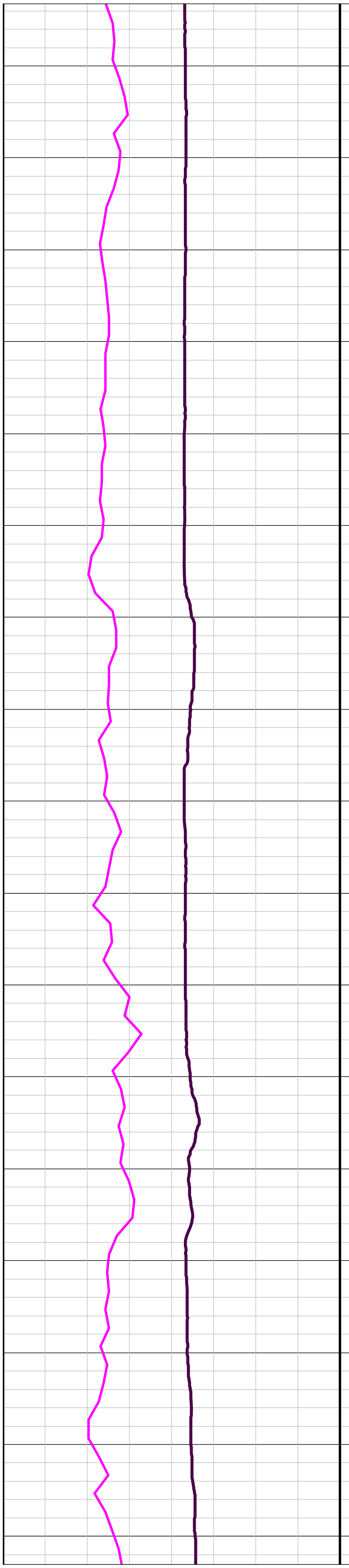

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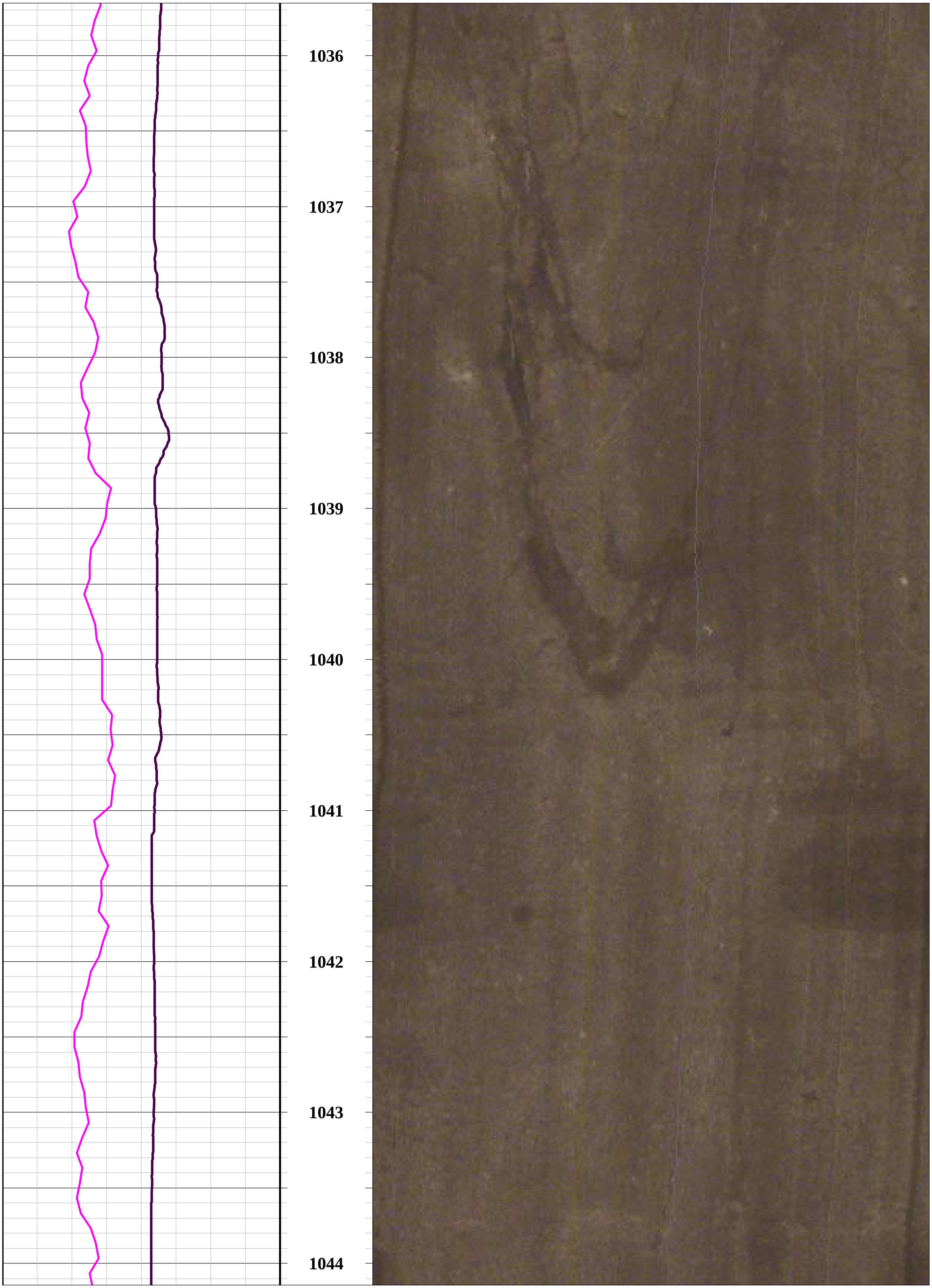
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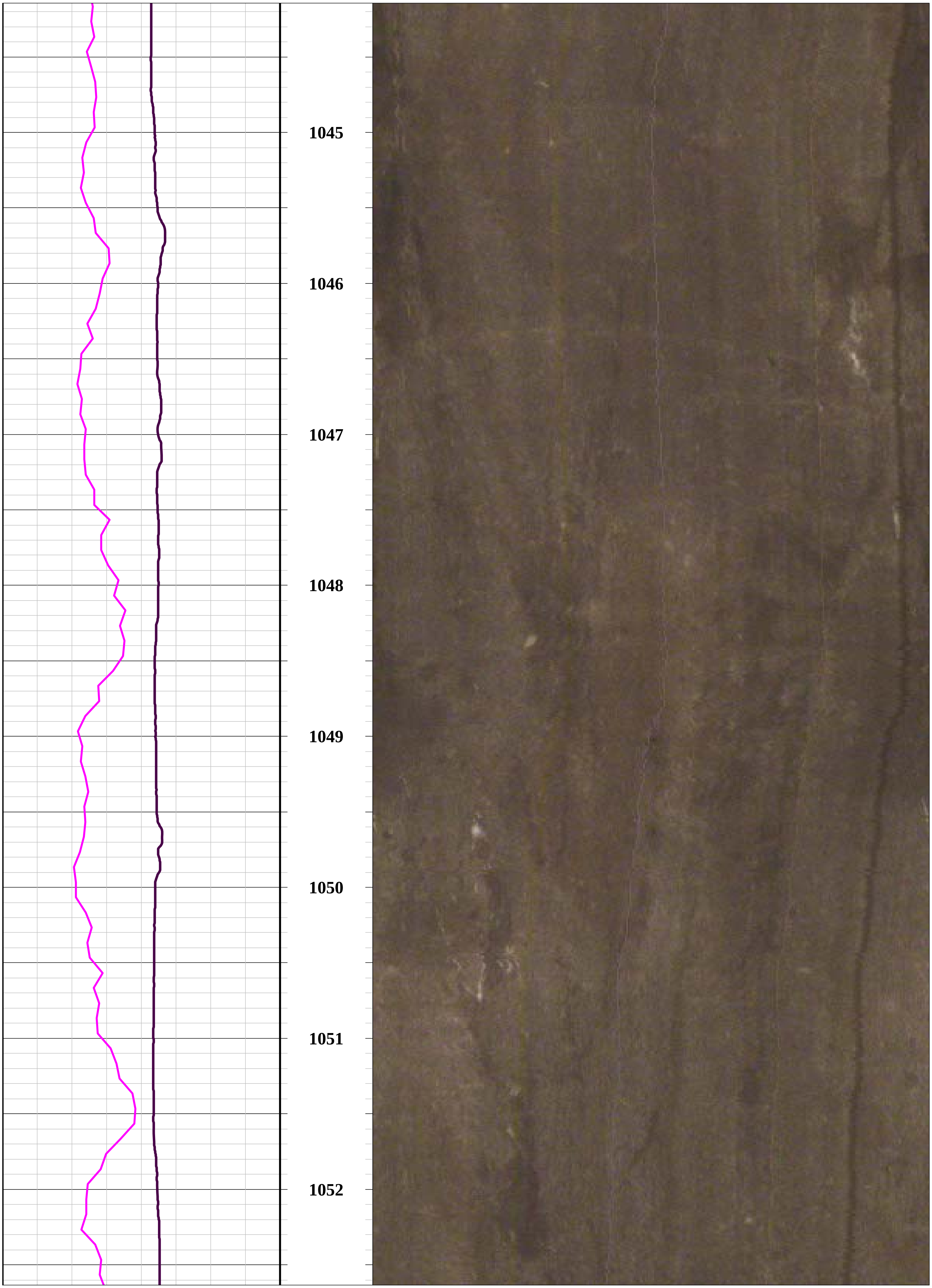
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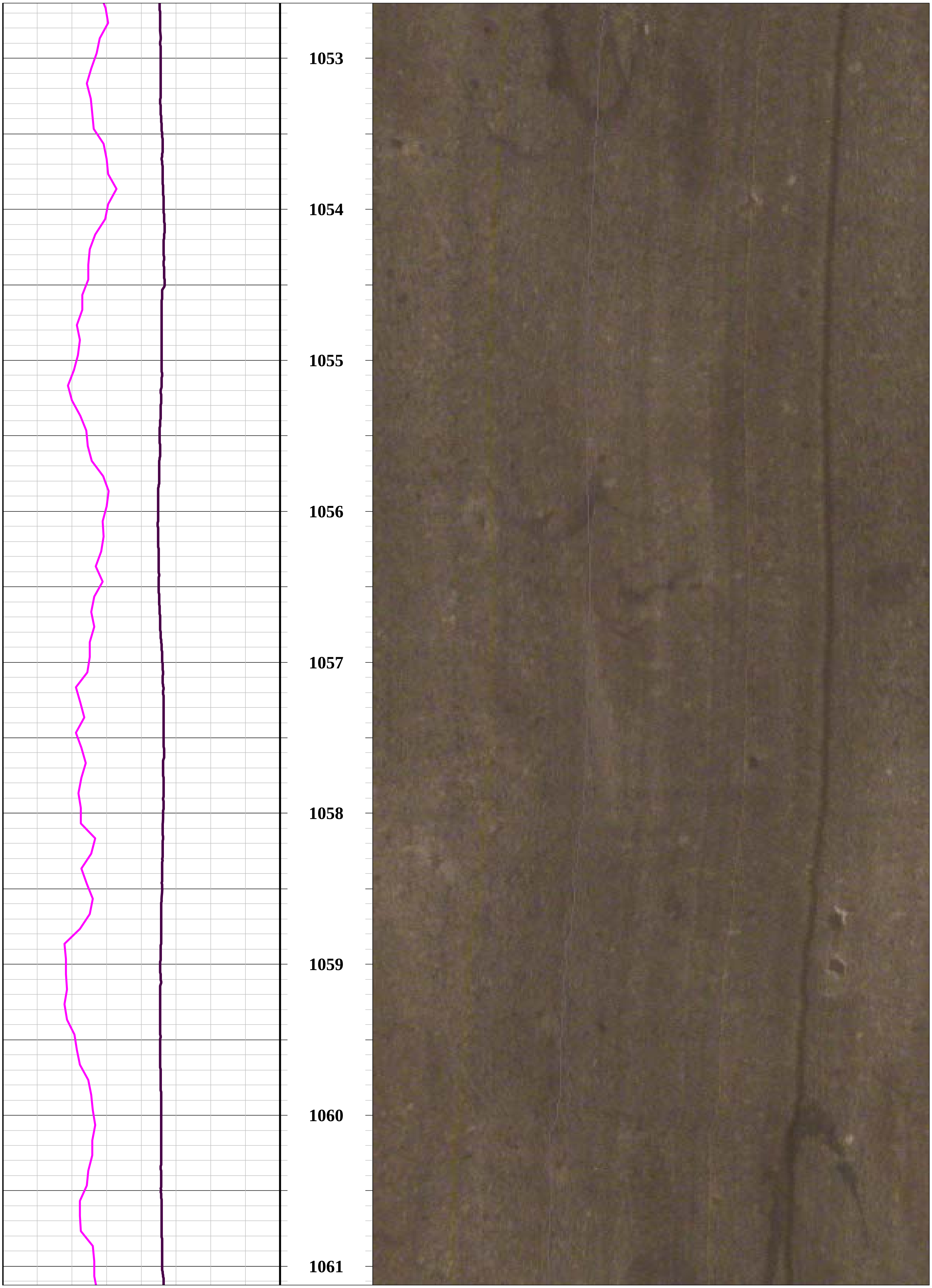
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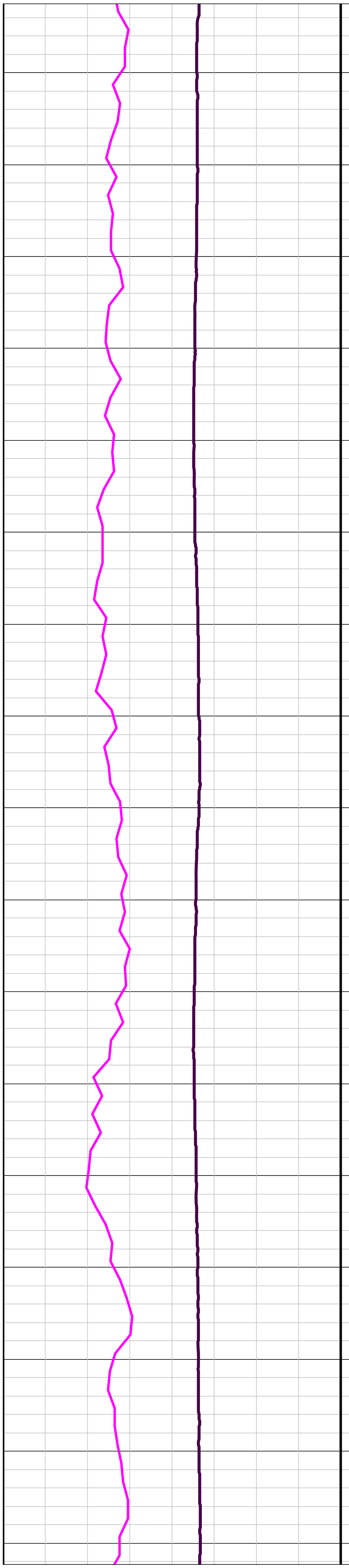

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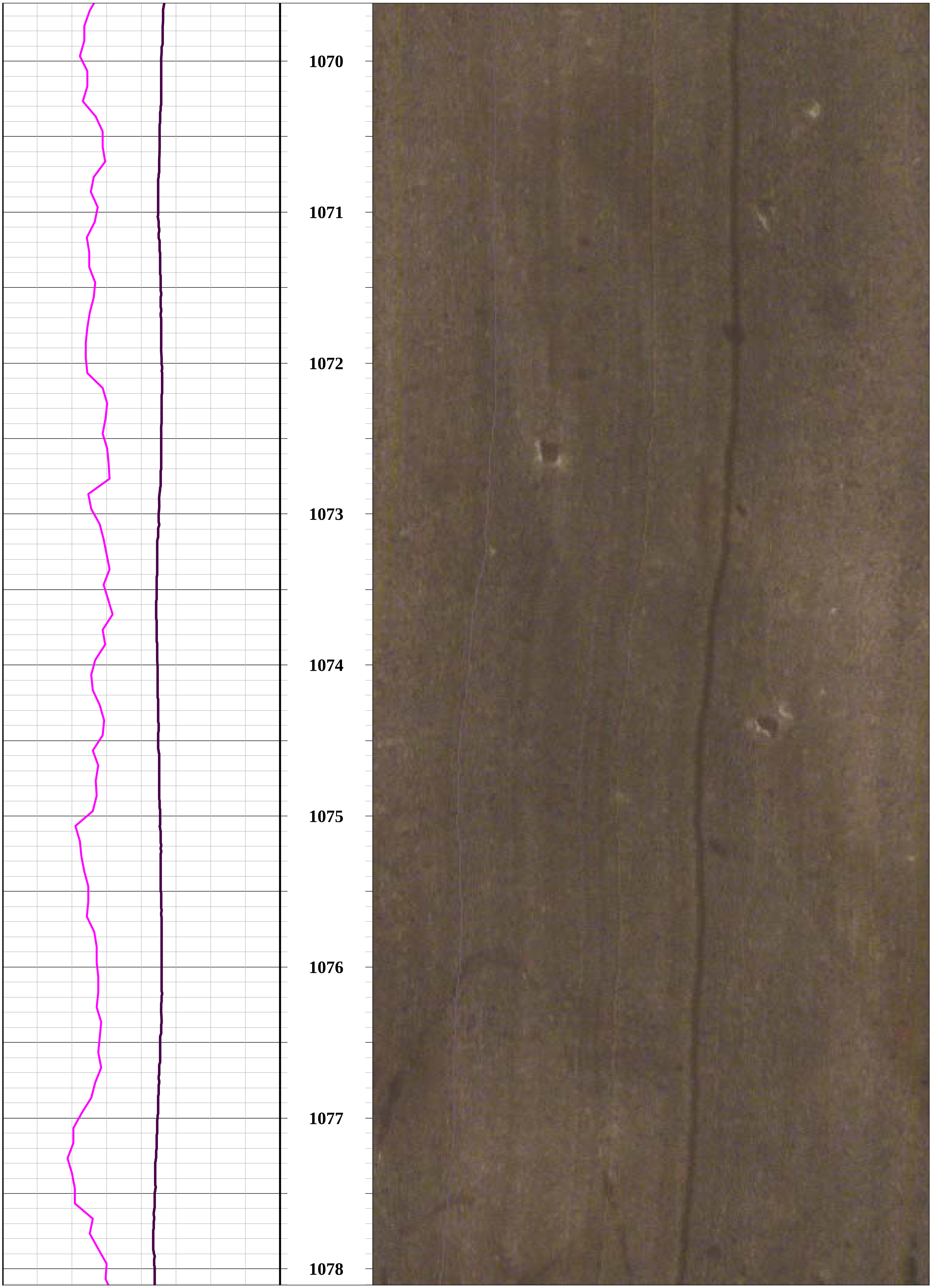
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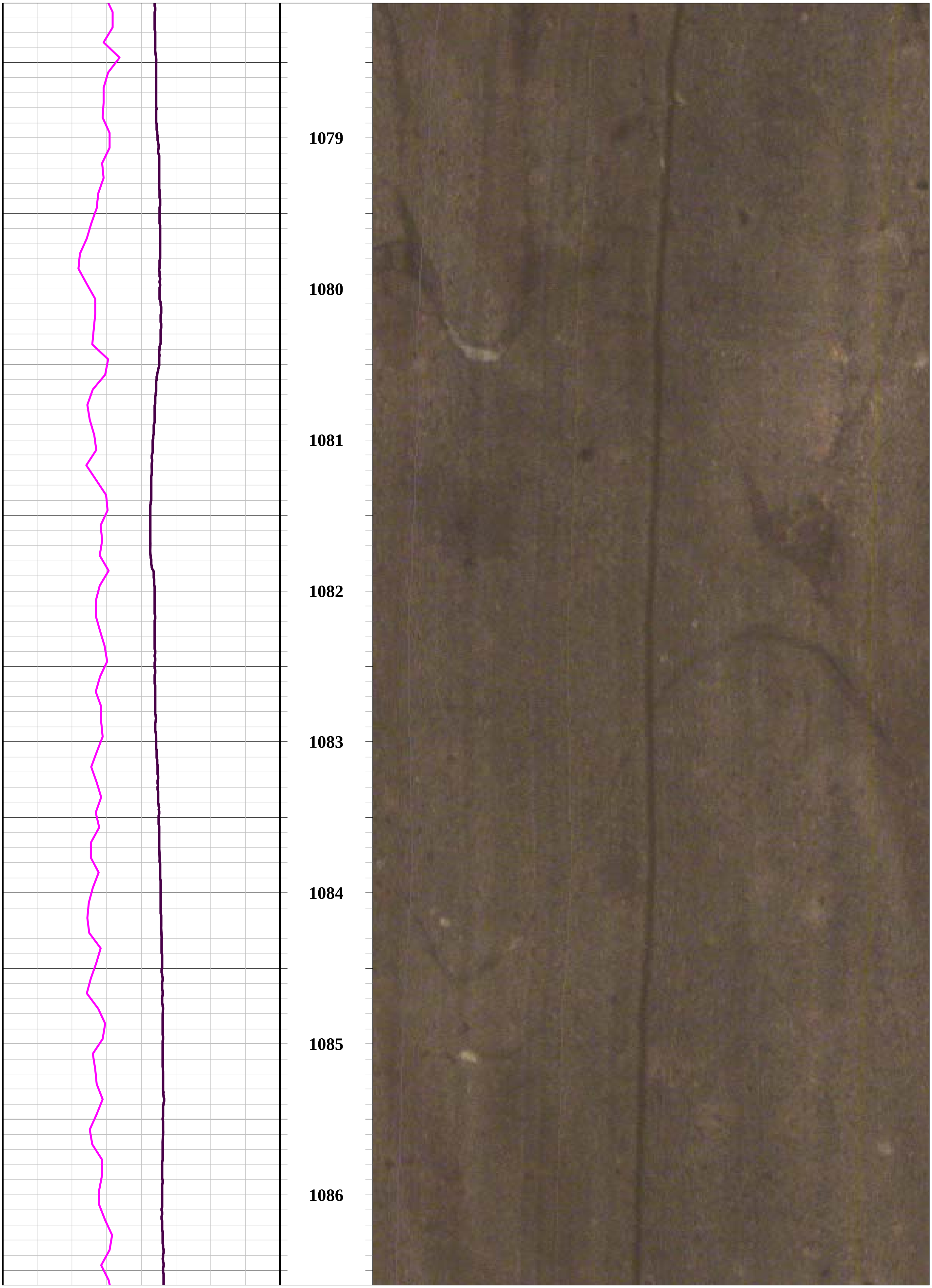
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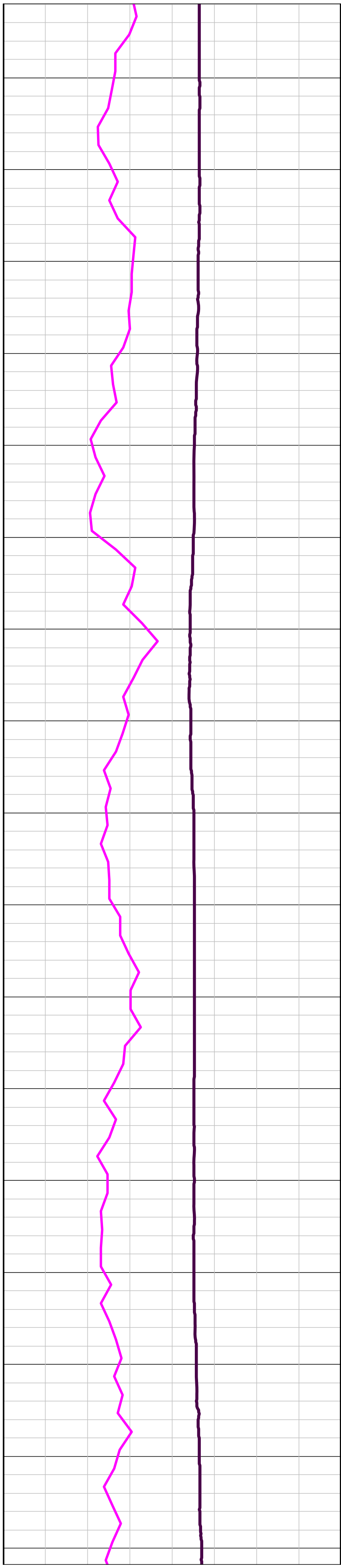

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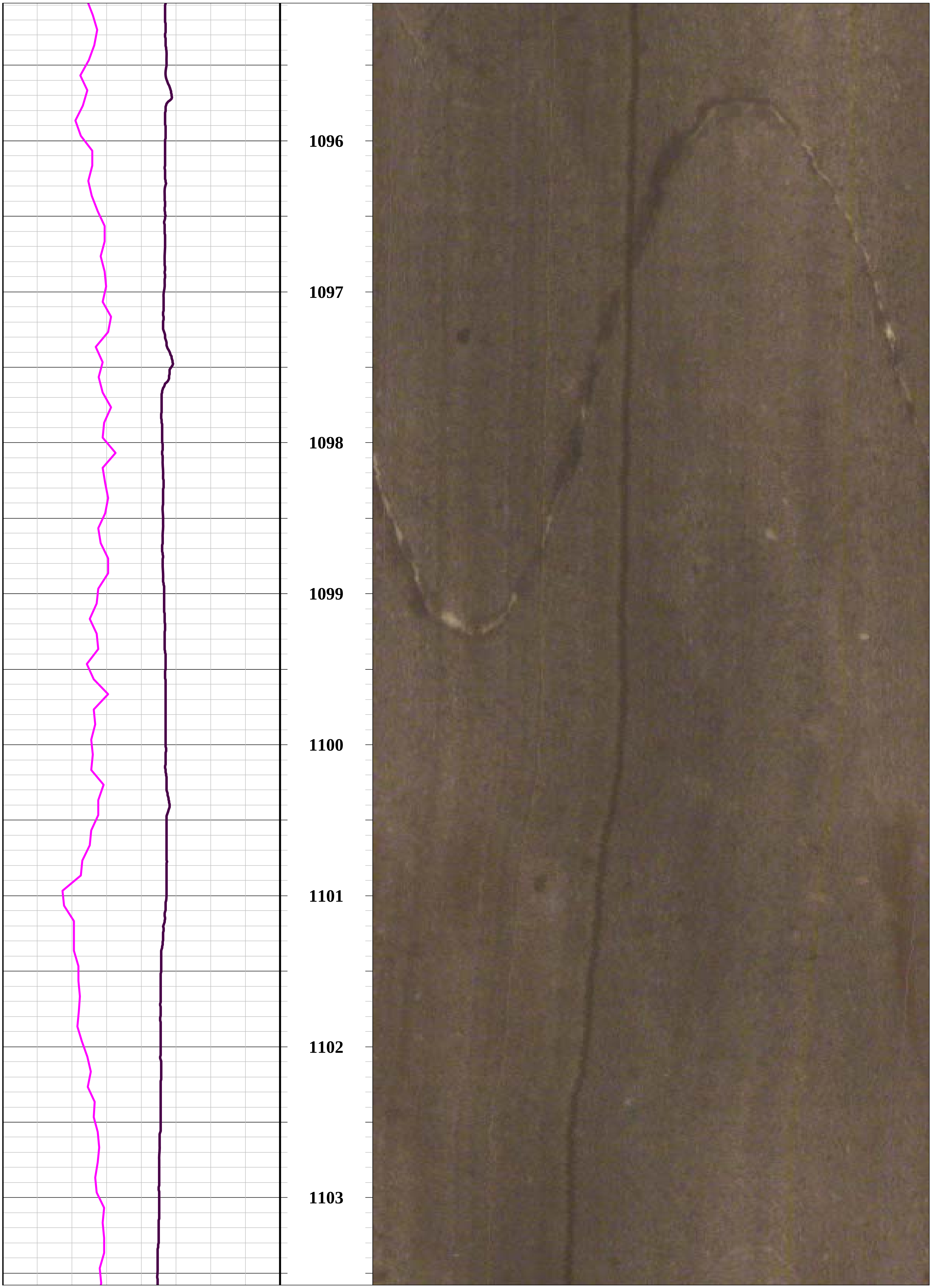
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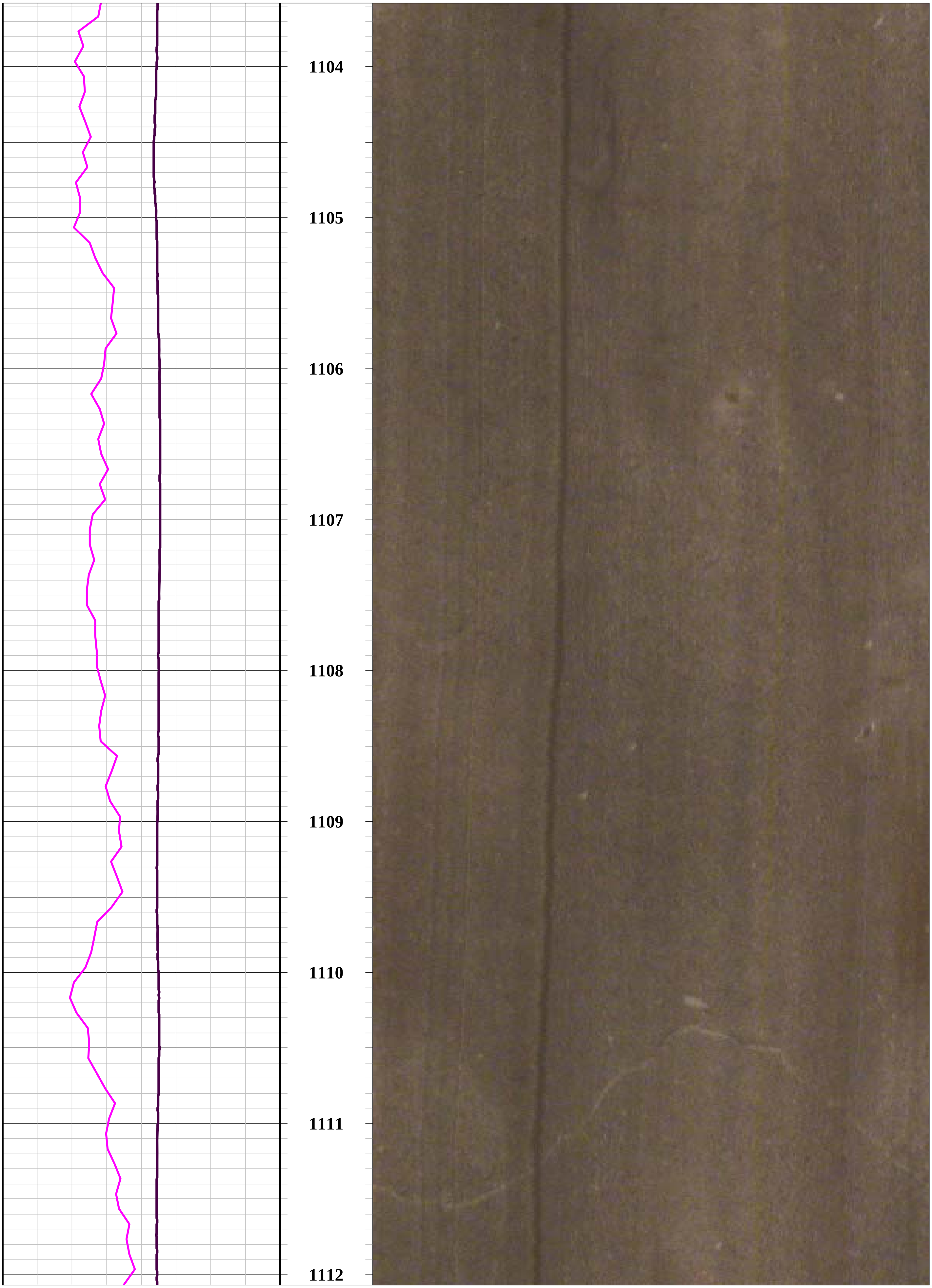
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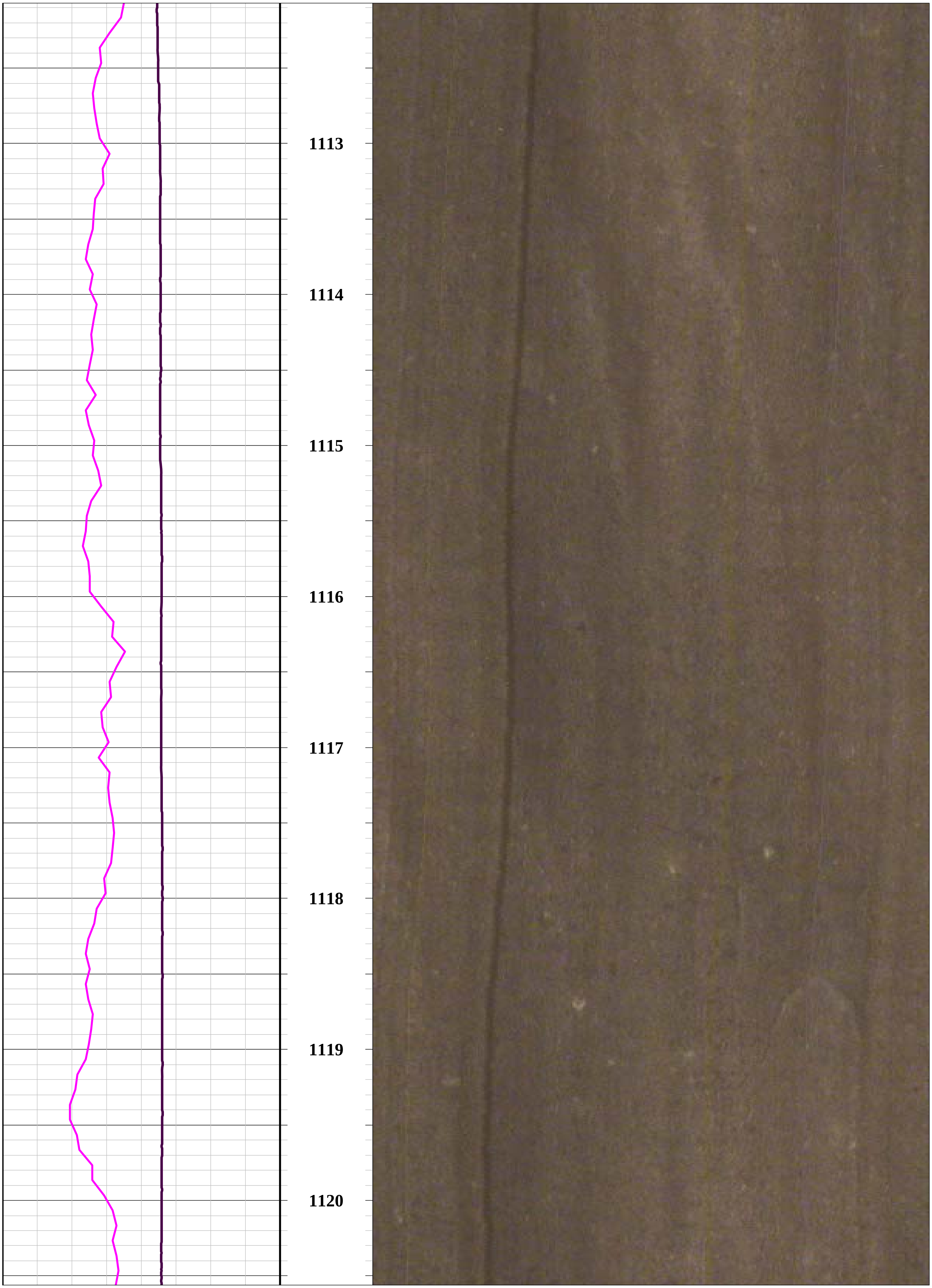
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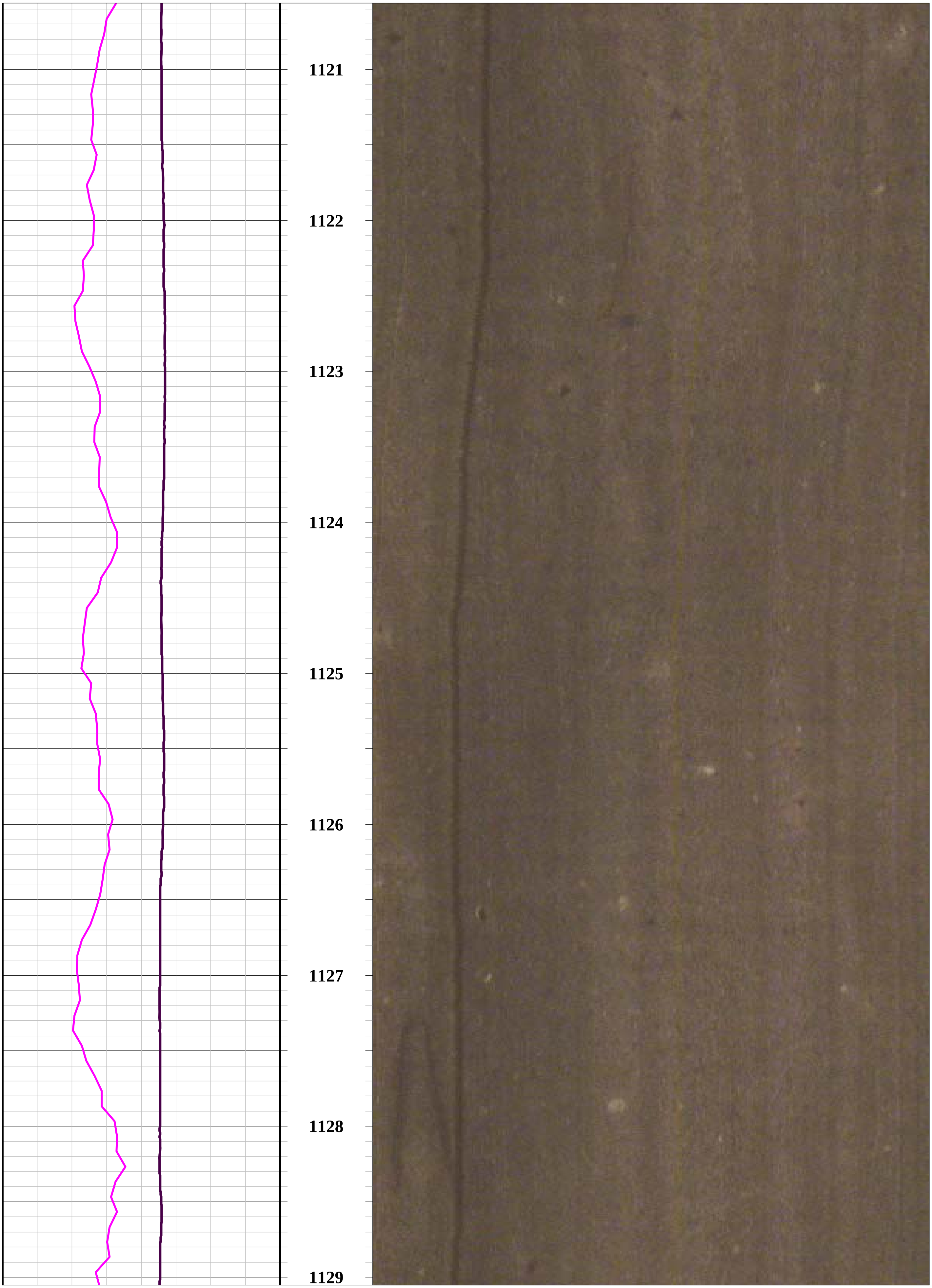
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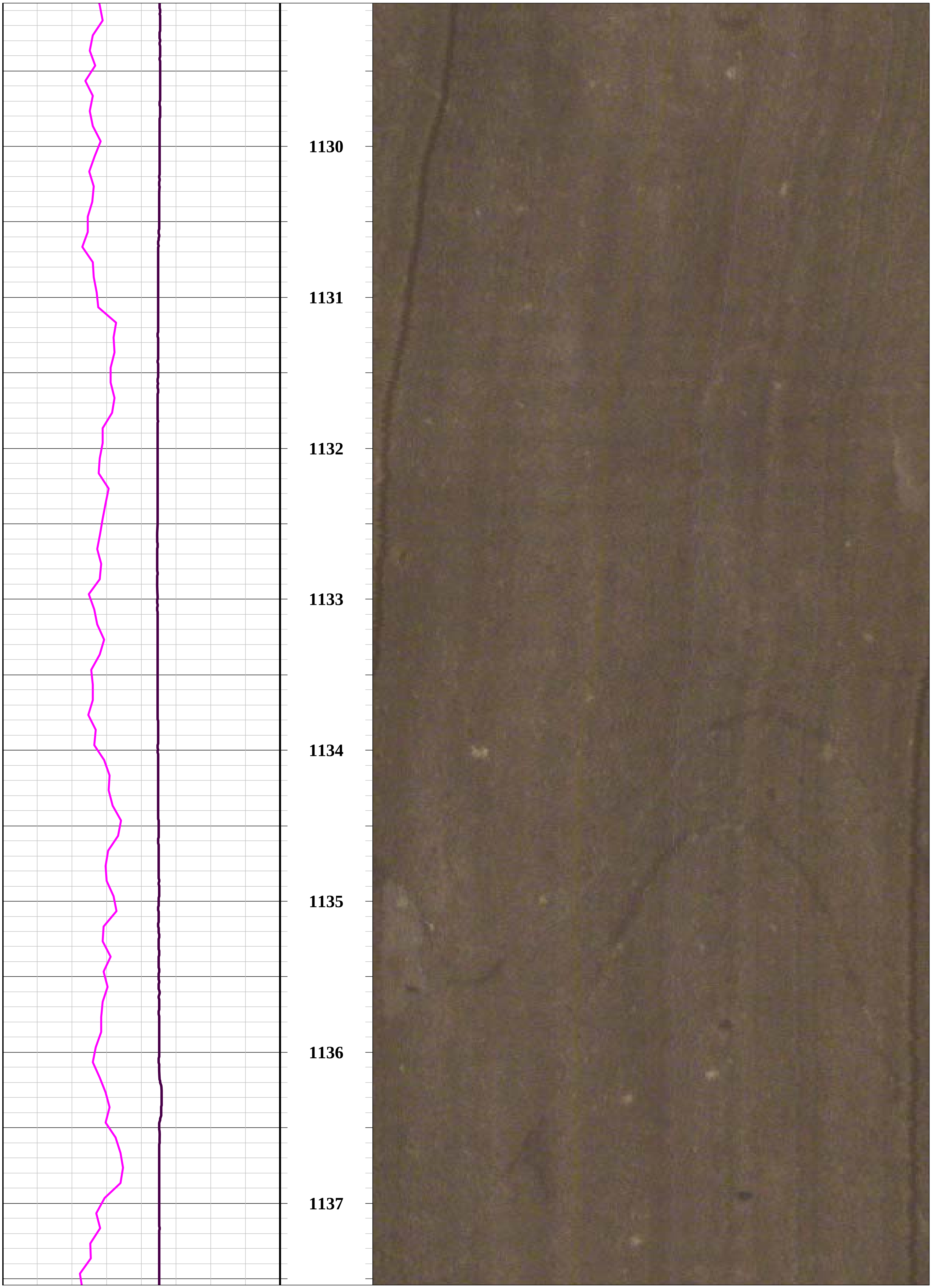
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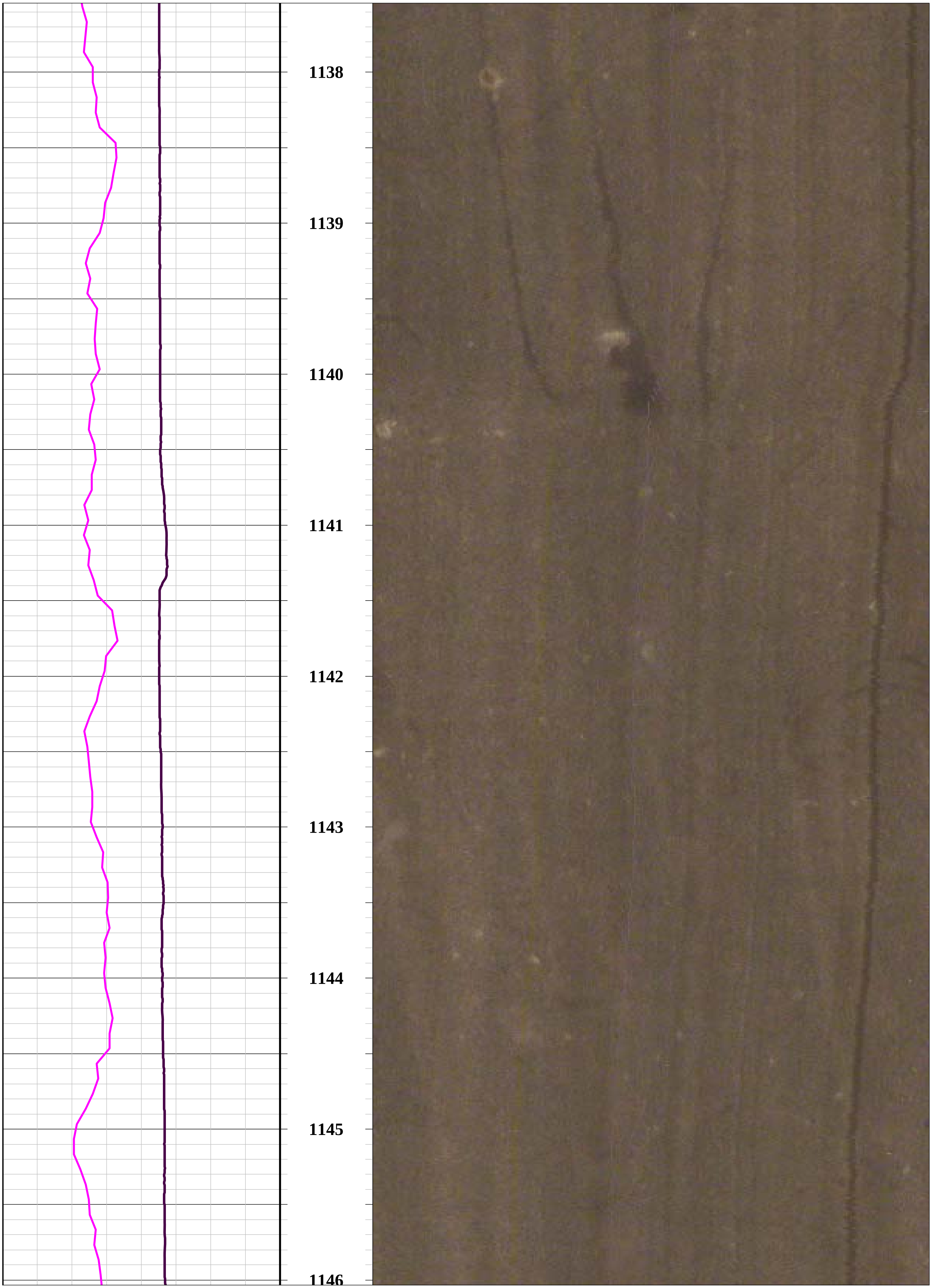
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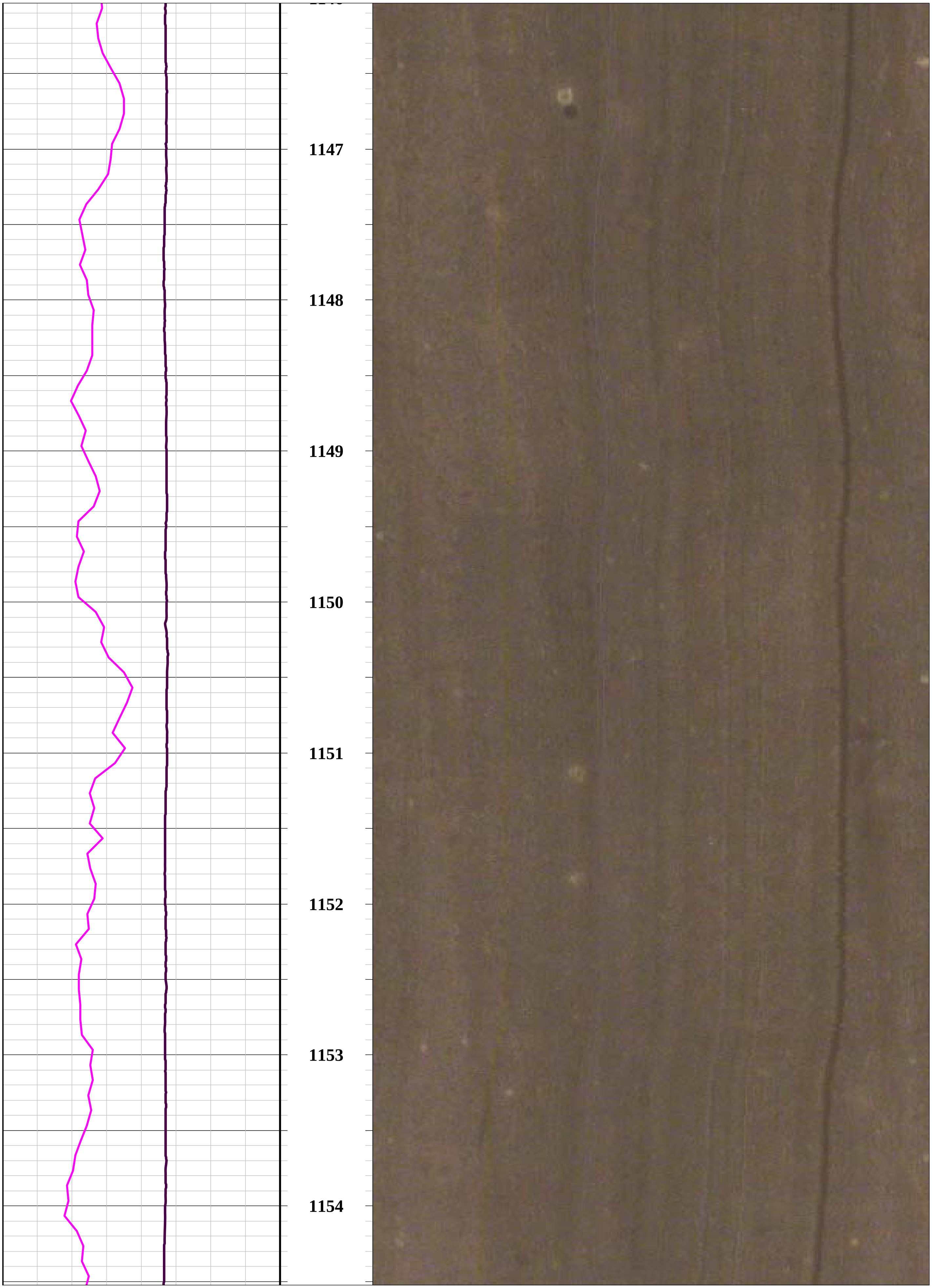
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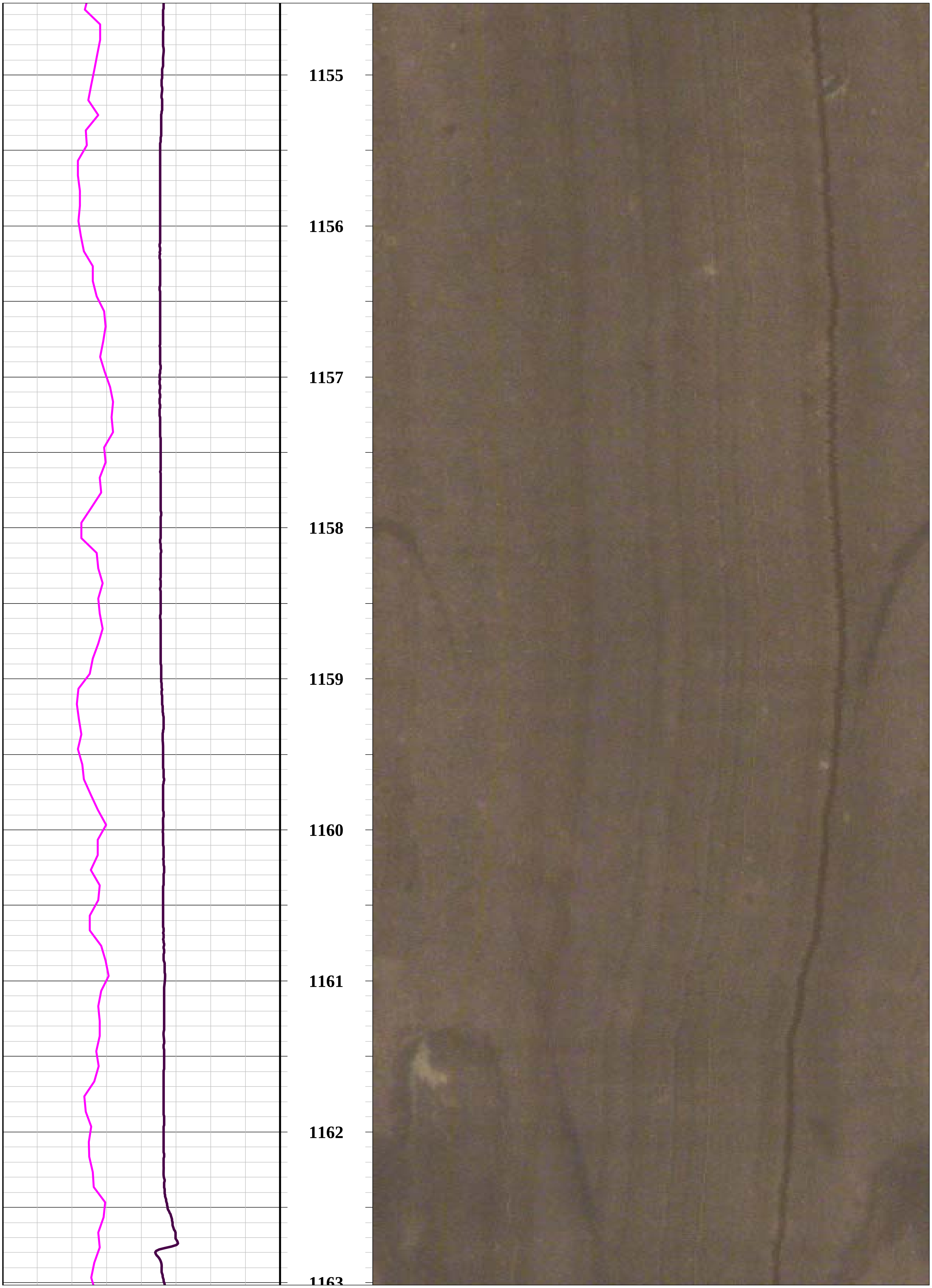
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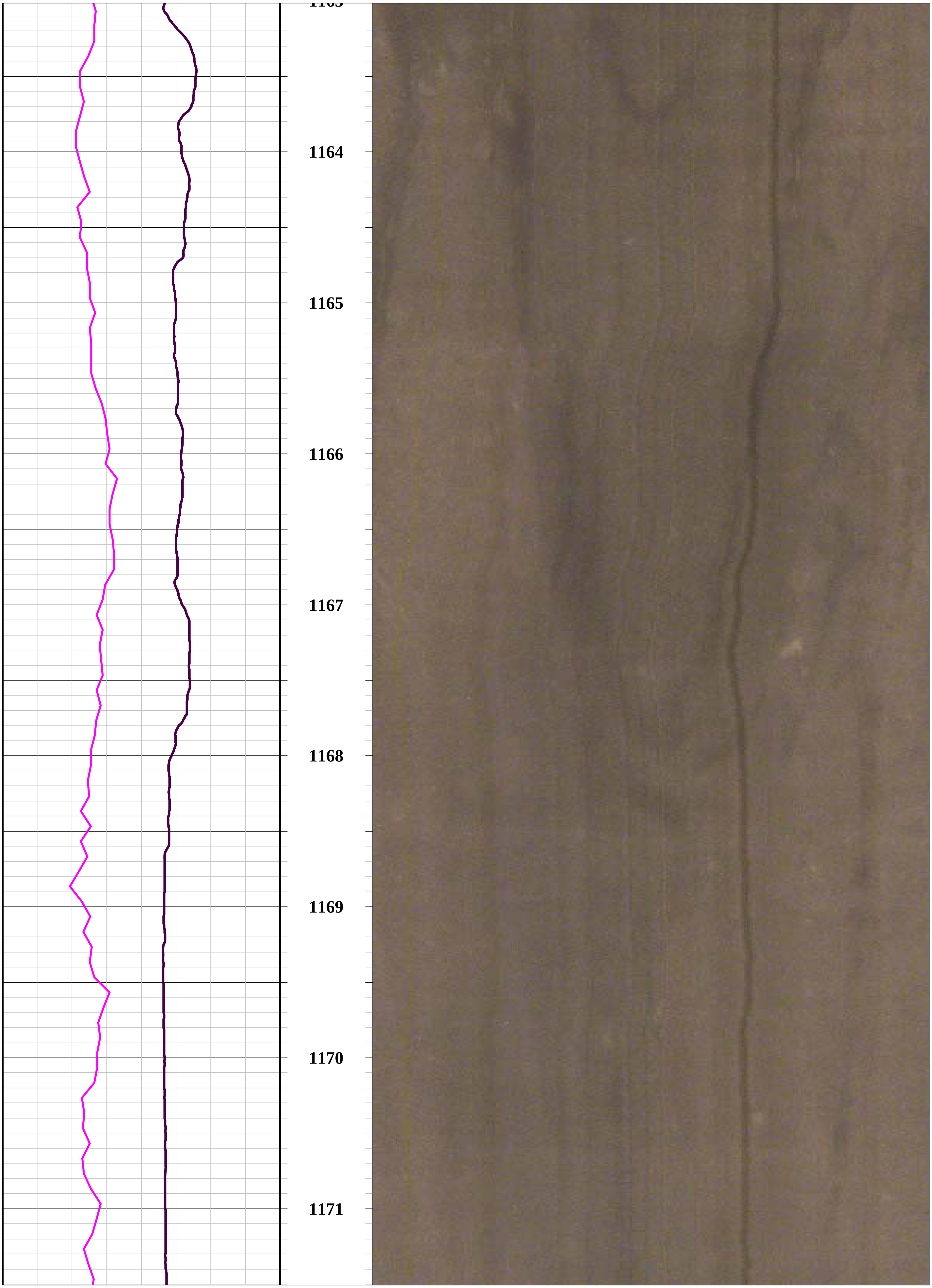
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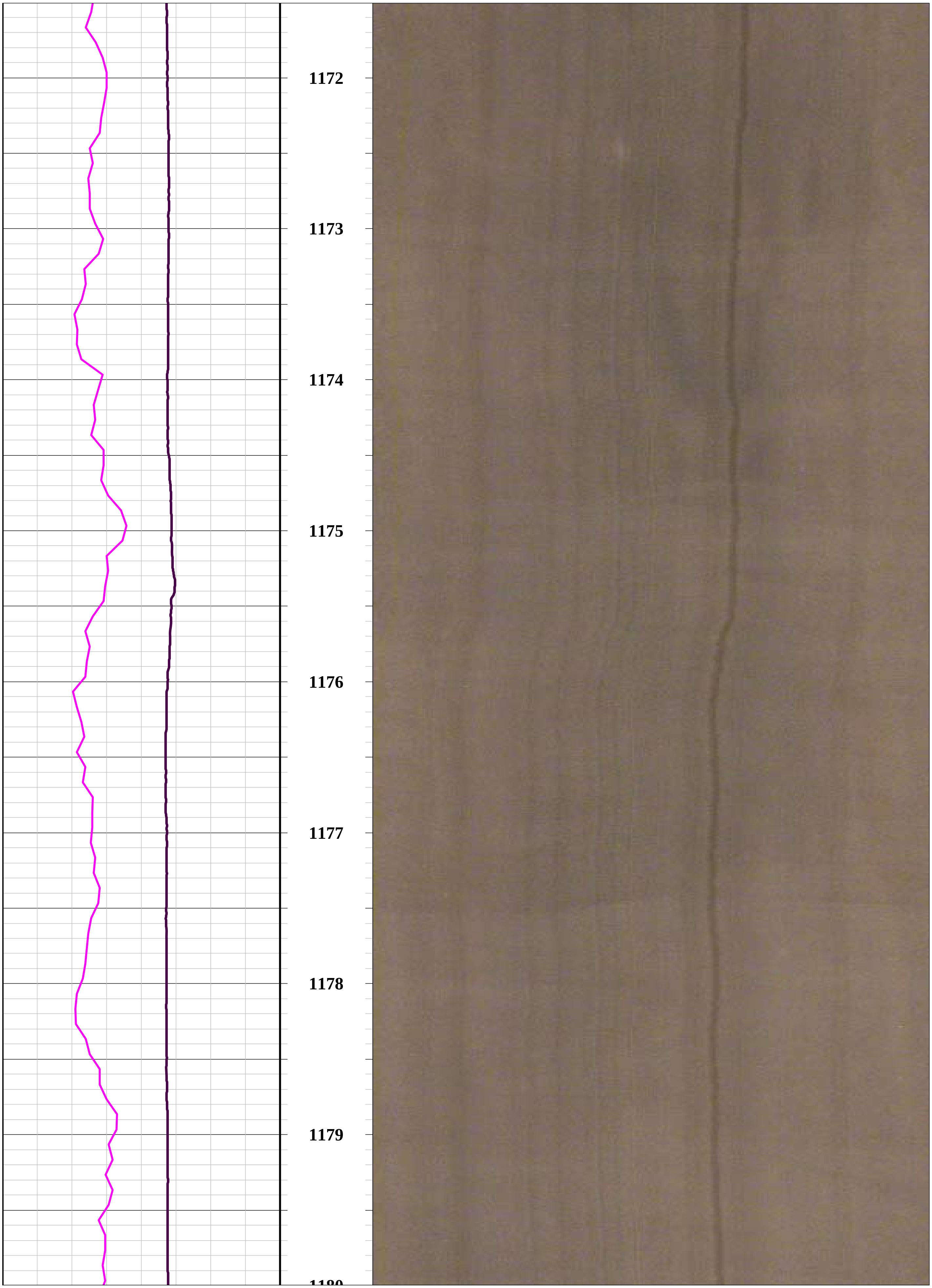
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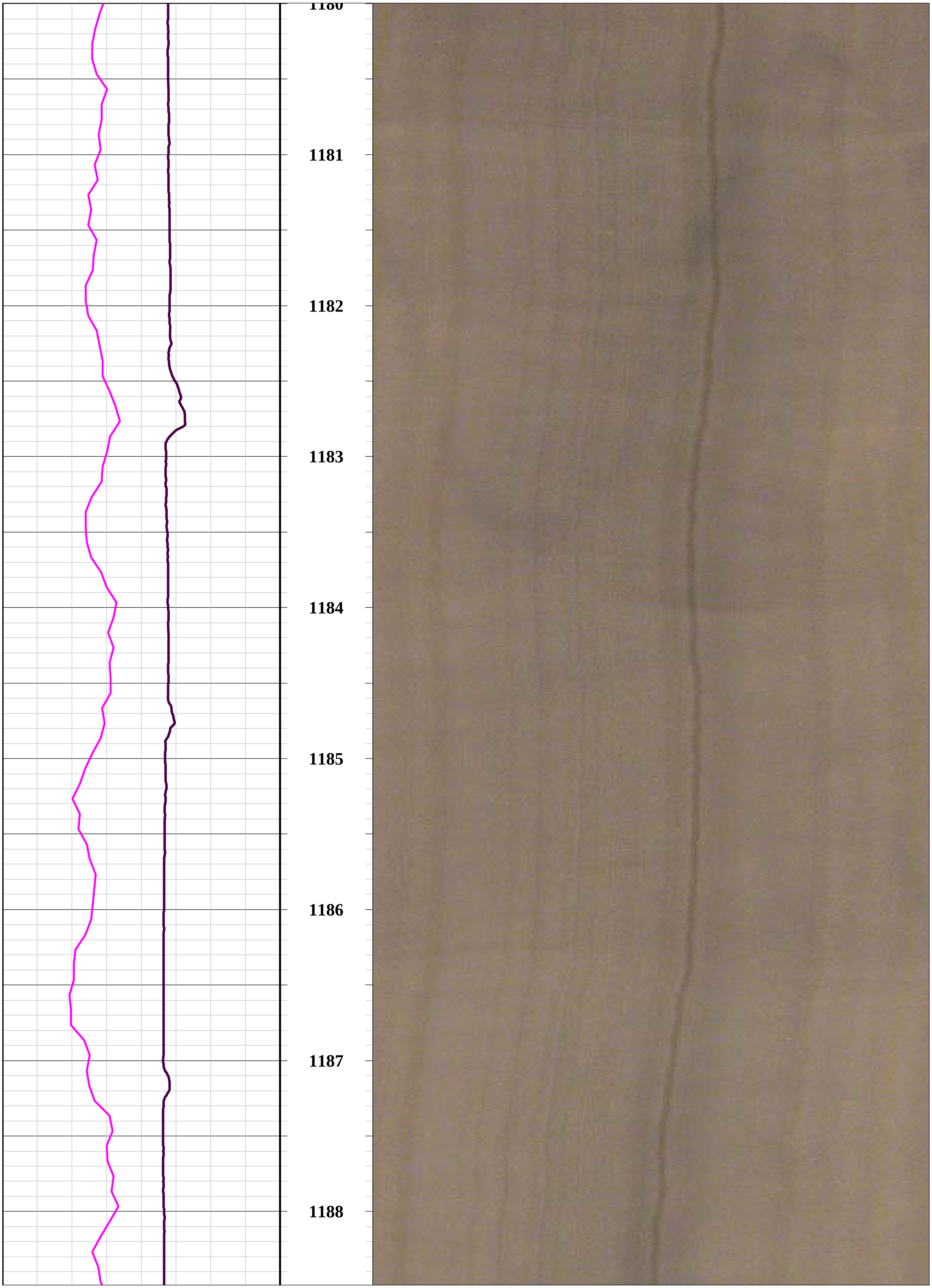
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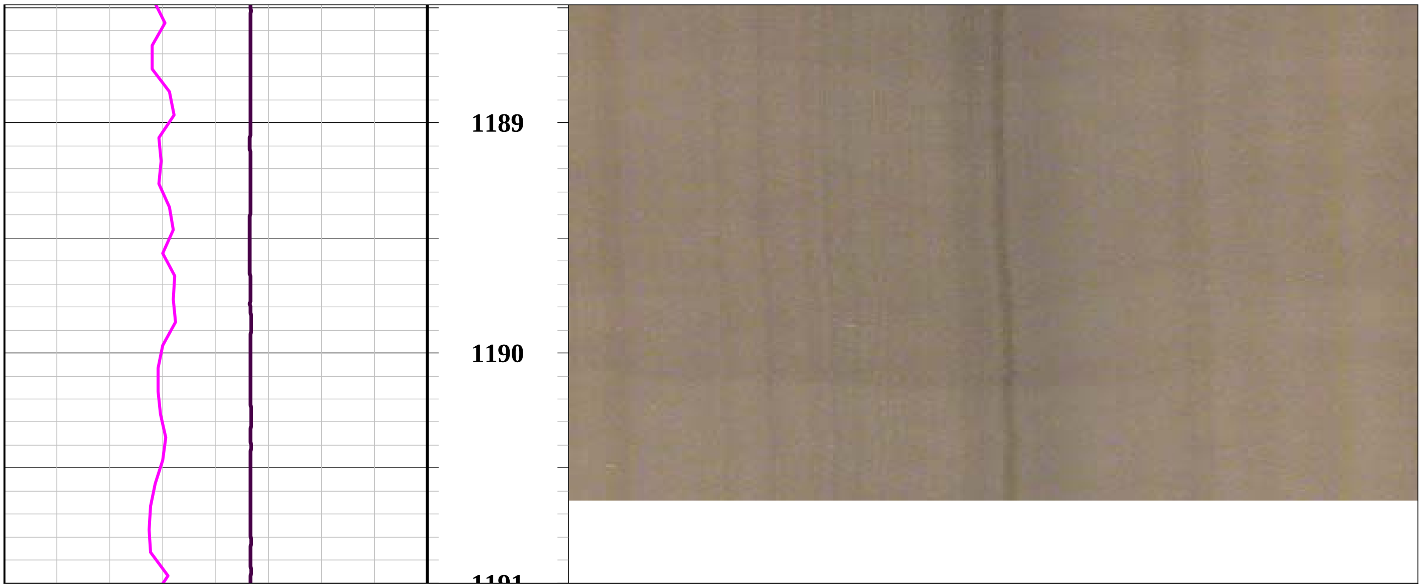

Caliper	Depth	Optical Image-NM
8 Inch 22		
Natural Gamma	Depth	Optical Image-NM
0 CPS 200	1ft:10ft	0° 90° 180° 270° 0°

COLOG Group - Borehole Geophysics

810 Quail Street
Suite E
Lakewood, Colorado
80215
Office: 303.279.0171
Fax: 303.278.0135
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Acoustic Televiewer

Company Rio Tinto
Well HRES21
Field Resolution Copper
County Pinal
State Arizona

COMPANY Rio Tinto
WELL HRES21
FIELD Resolution Copper
COUNTY Pinal **STATE** Arizona

LOCATION

QTR **SEC** **TWP** **RGE**

OTHER SERVICES
Full Wave Form Sonic
3-Arm Caliper
Natural Gamma
16in and 64 in Resistivity
Single Point Resistivity
Spontaneous Potential

PERMANENT DATUM GROUND LEVEL **ELEVATION** NA

LOG MEAS. FROM GROUND LEVEL 0.0 ft **ABOVE PERMANENT DATUM**

DRILLING MEAS. FROM GROUND LEVEL

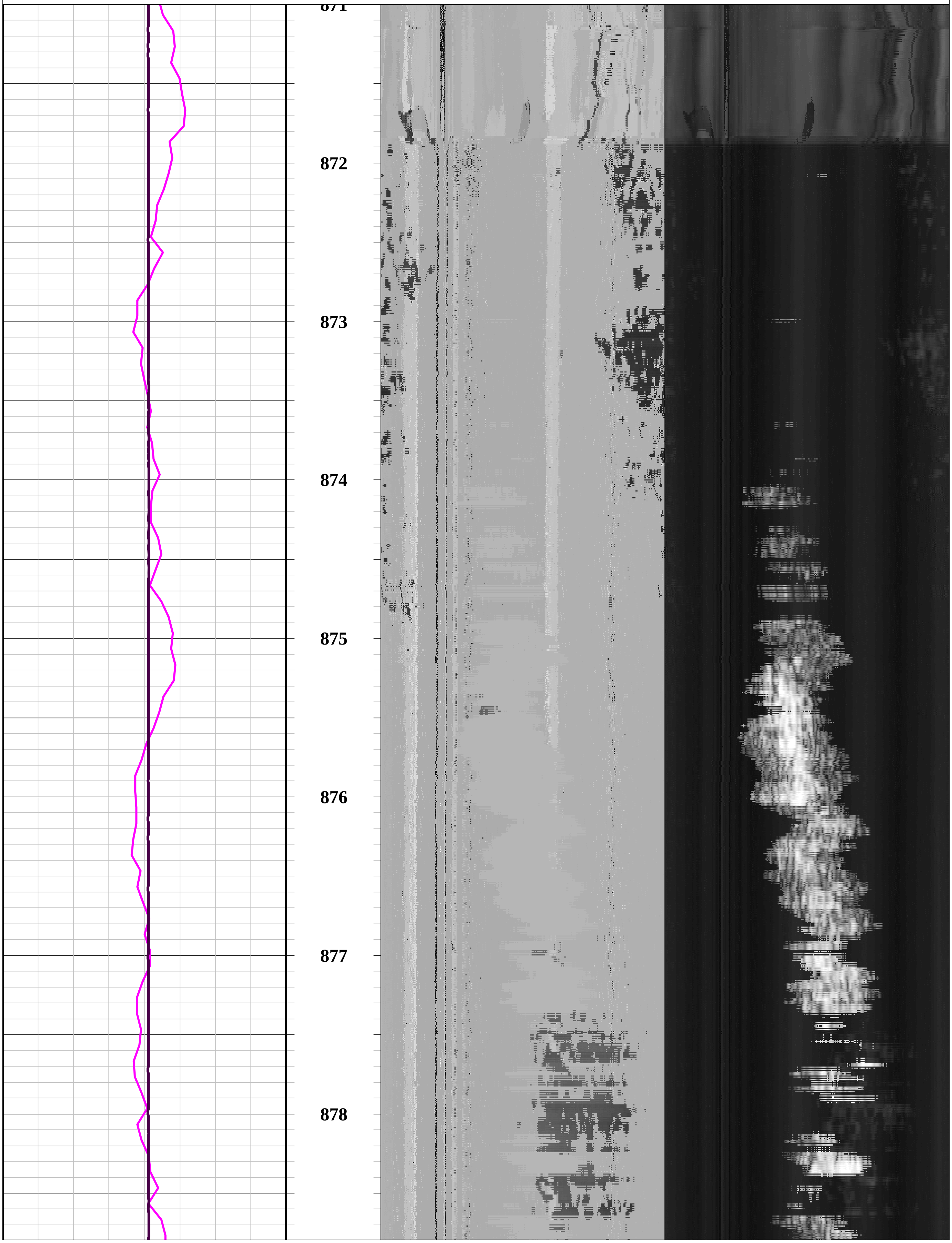
DATE ACQUIRED	5/25/2014			
RUN NUMBER	1			
LOG TYPE	Acoustic Televiewer			
DEPTH-DRILLER	1380 ft			
DEPTH-LOGGER	1375 ft			
BTM LOG INTERVAL	1375 ft			
TOP LOG INTERVAL	872 ft			
RECORDED BY	H. York			
WITNESSED BY	M. Shelley			
PROBE TYPE, S/N	ABI			
LOGGING SPEED	6 ft/min			
A.S.D.E. / Sample Interval	0.2' / 0.006'			
Fluid Level / Fluid Type	871 ft			

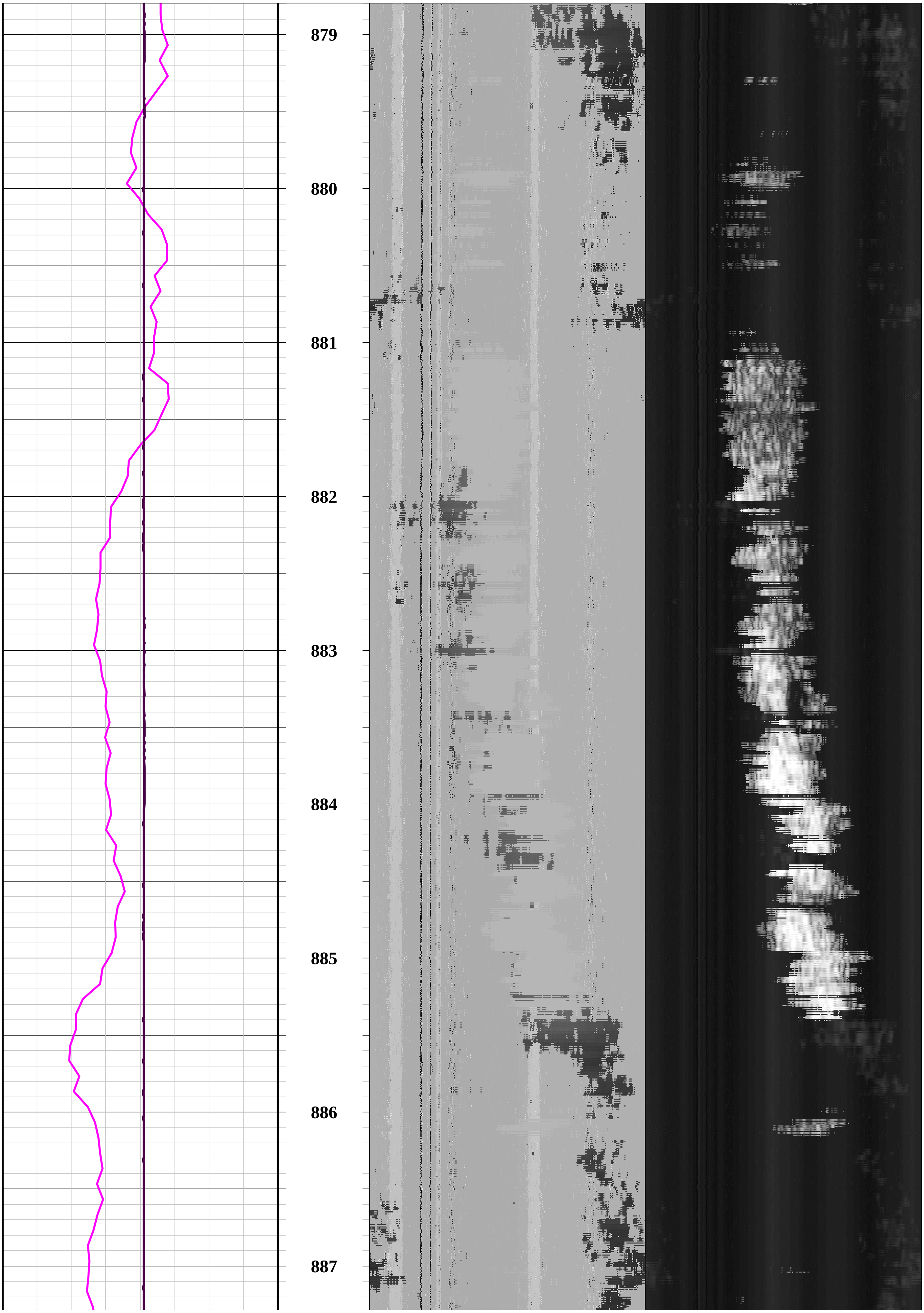
BOREHOLE RECORD				CASING RECORD			
RUN No.	**BIT**	**FROM**	**TO**	**SIZE**	**WGT.**	**FROM**	**TO**

COMMENTS

NA - Not Available, N/A - Not Applicable

Natural Gamma	Depth	TravelTime-NM	Amplitude-NM
0 CPS 200	1ft:10ft	0° 90° 180° 270° 0°	0° 90° 180° 270° 0°
Caliper			
8 Inch 22			

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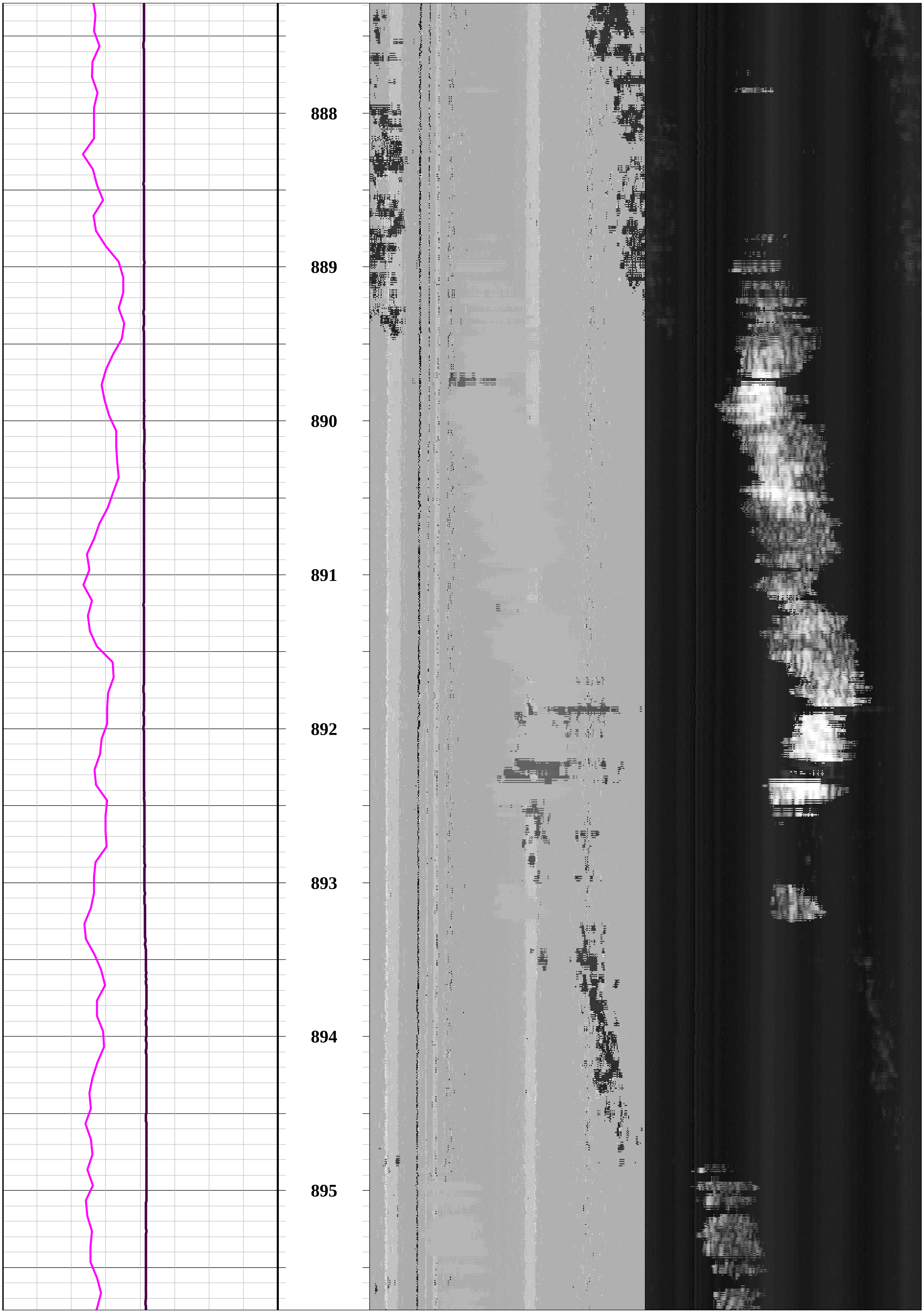
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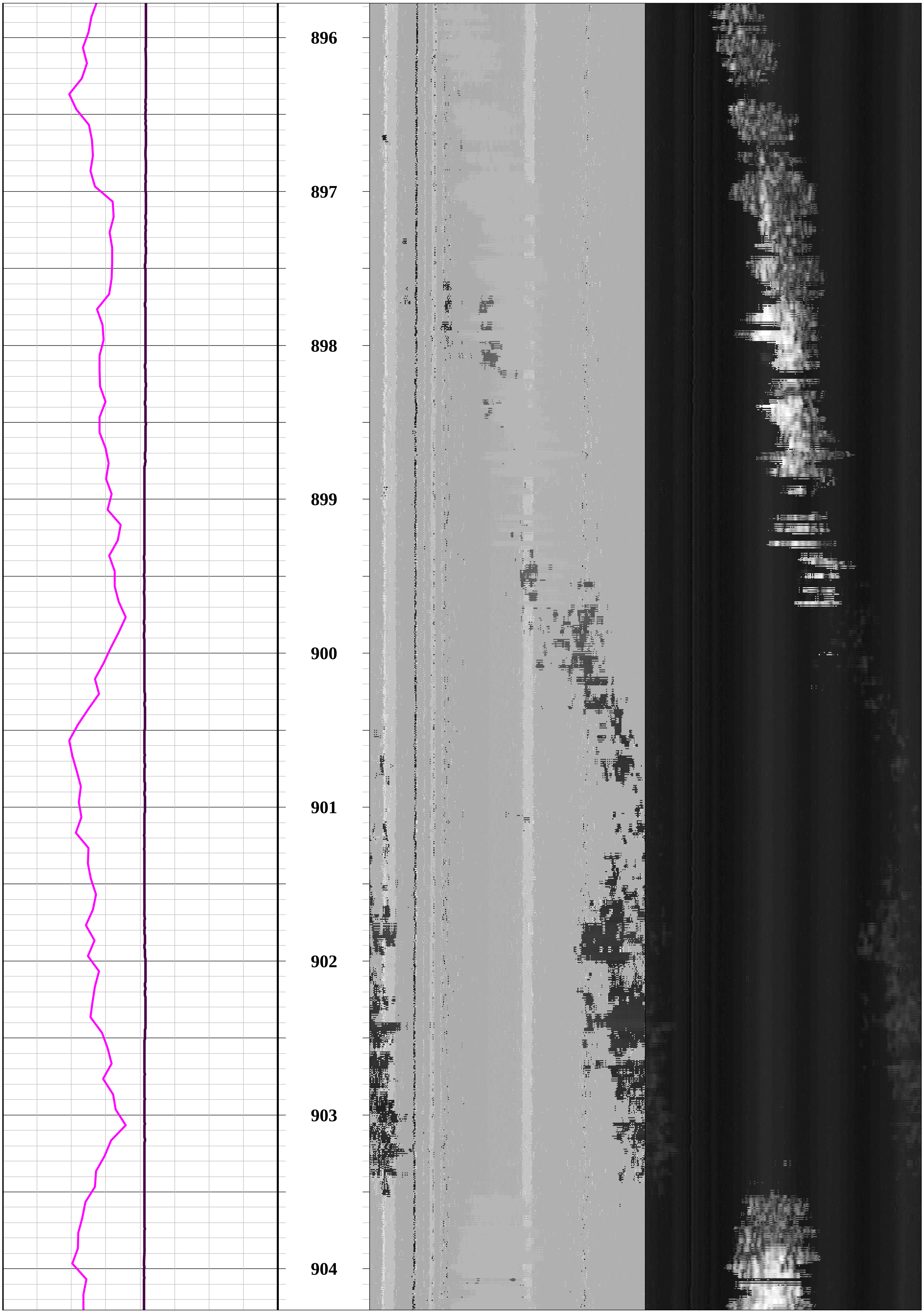
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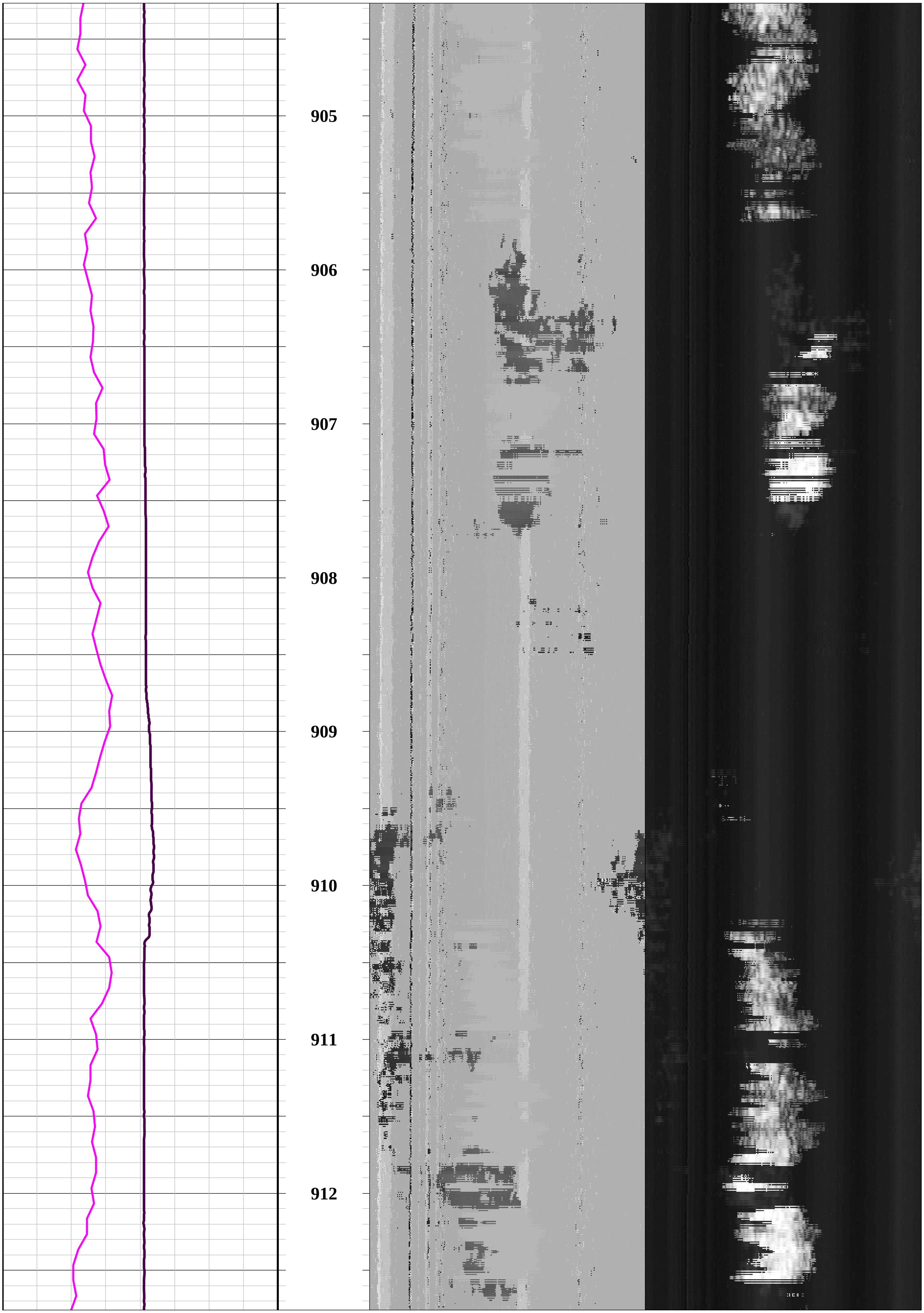
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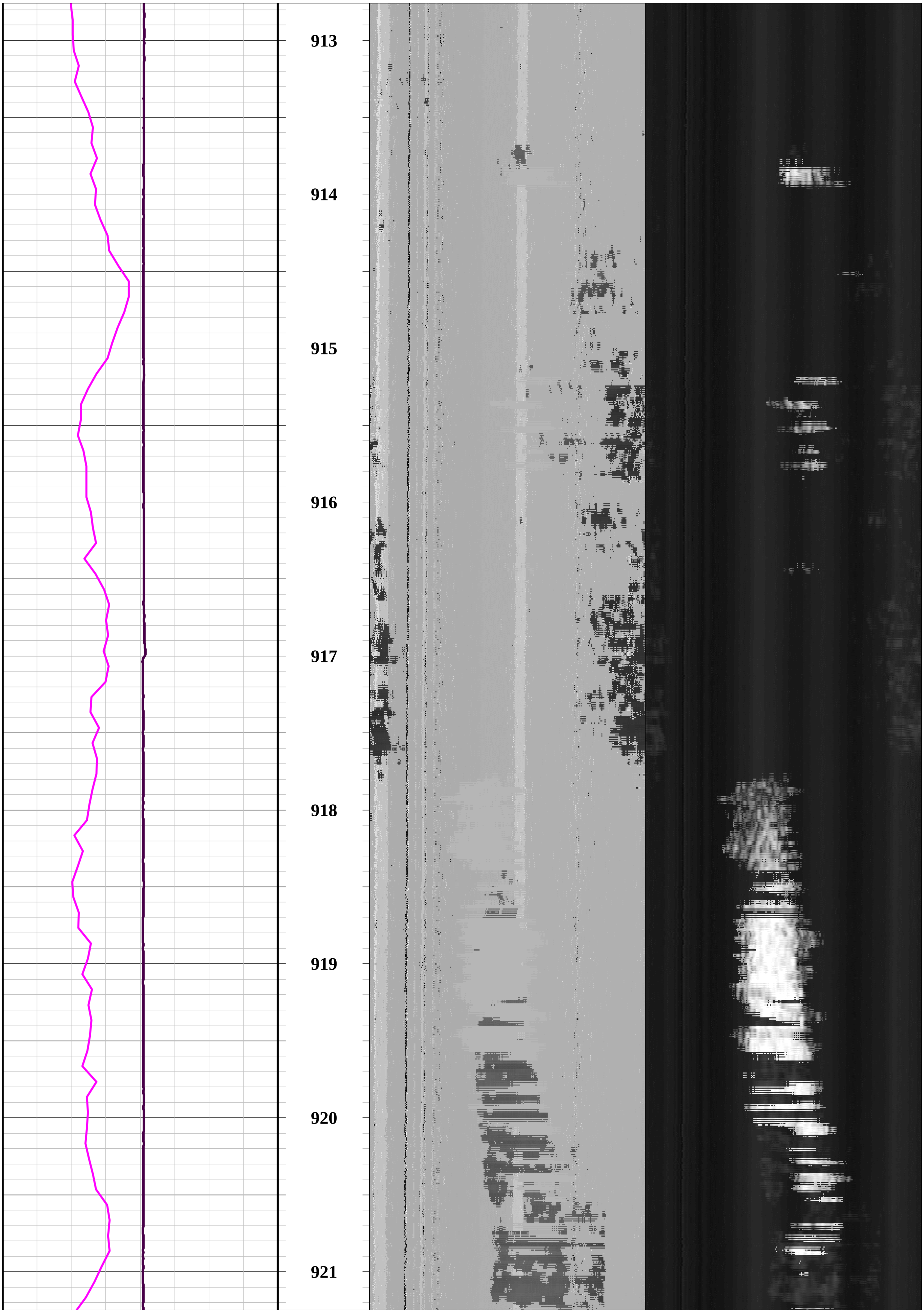
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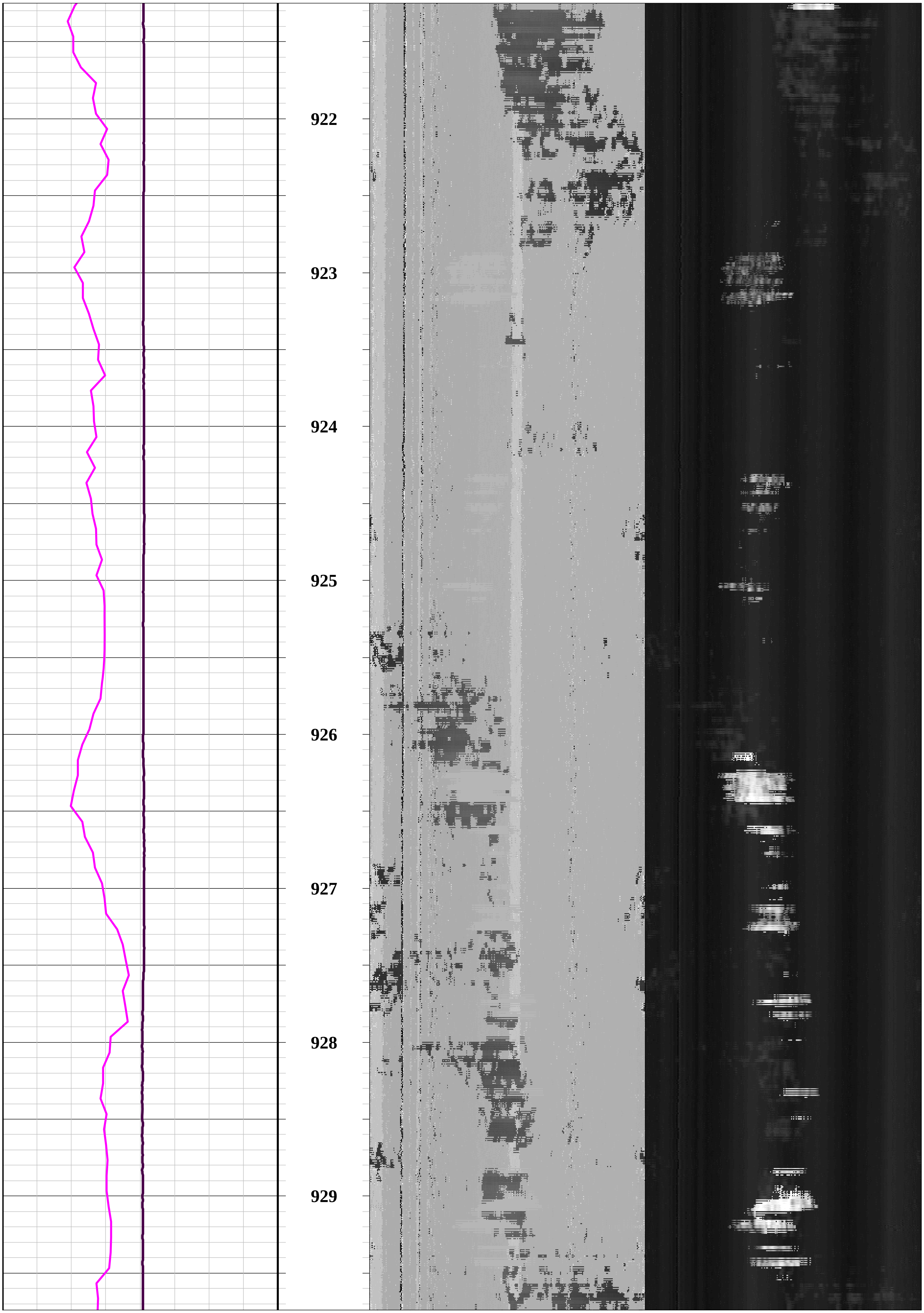
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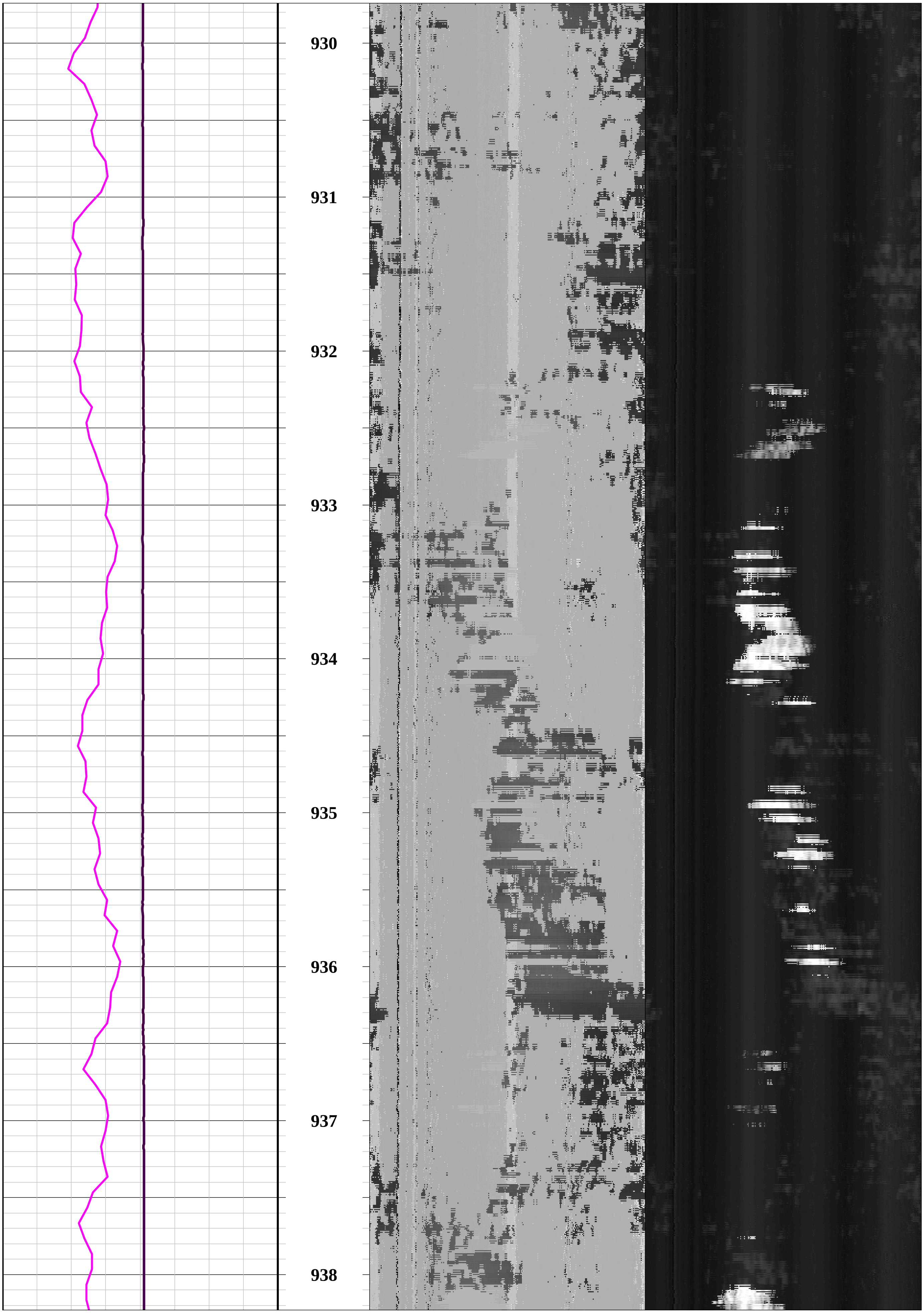
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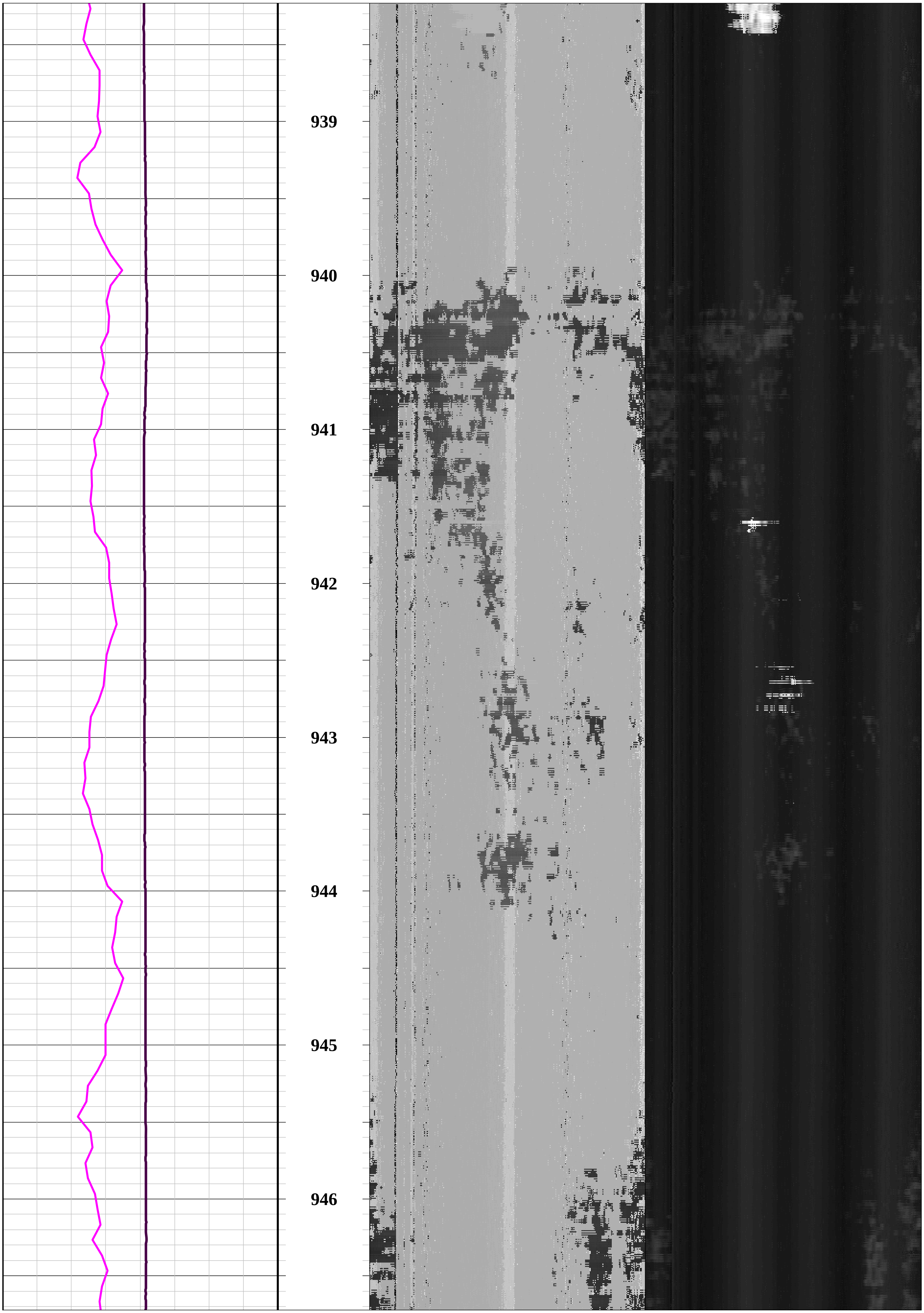
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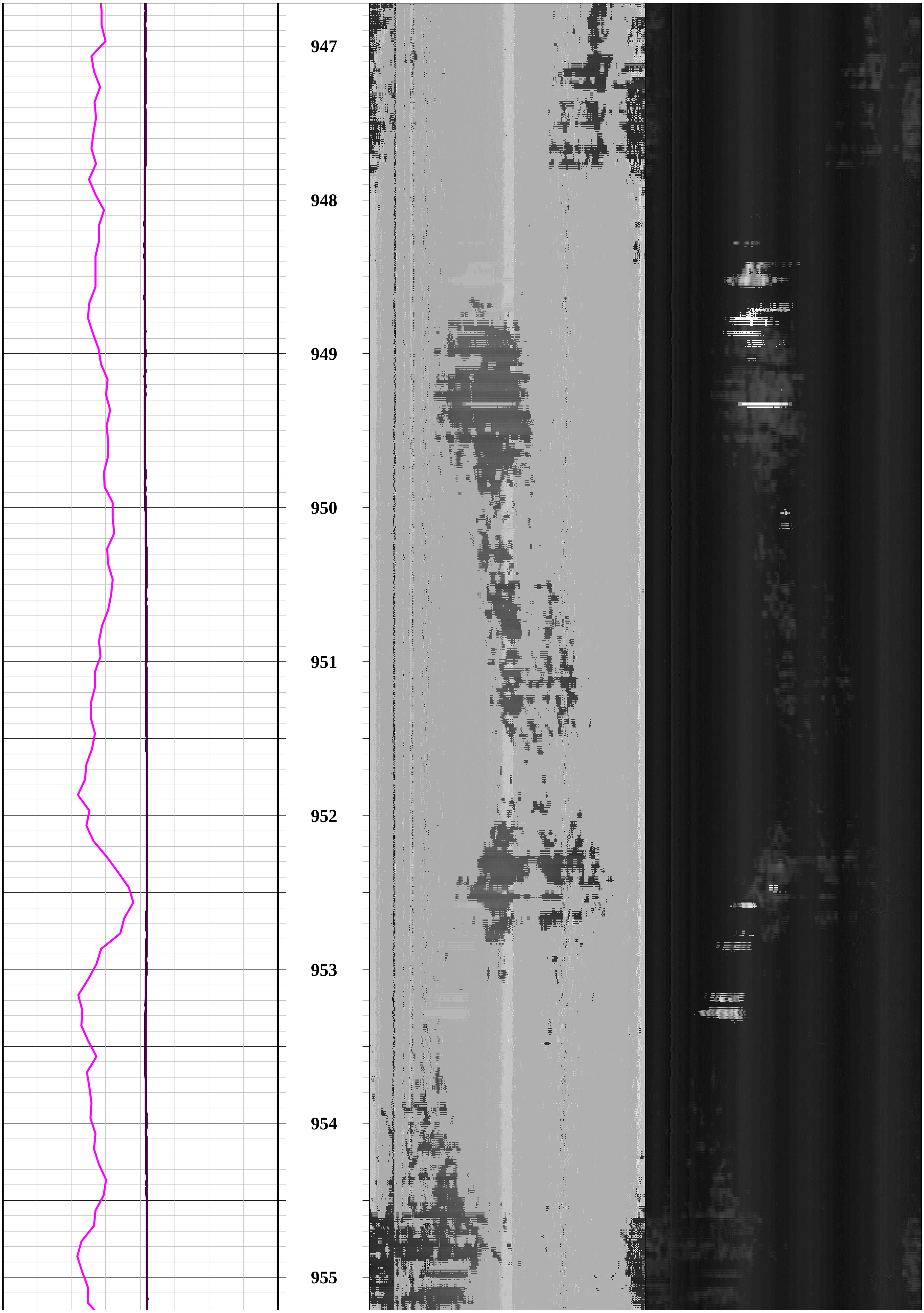
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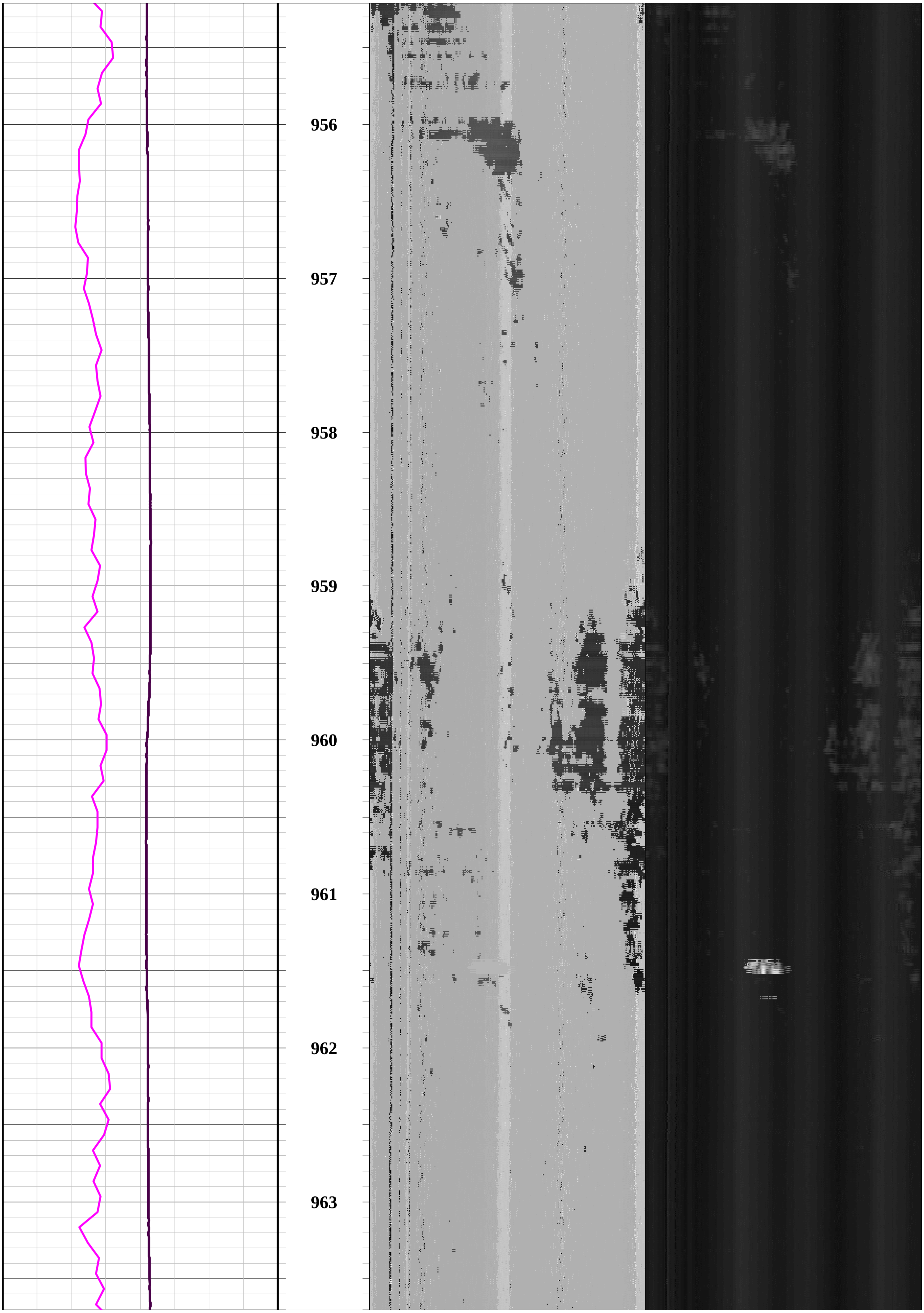
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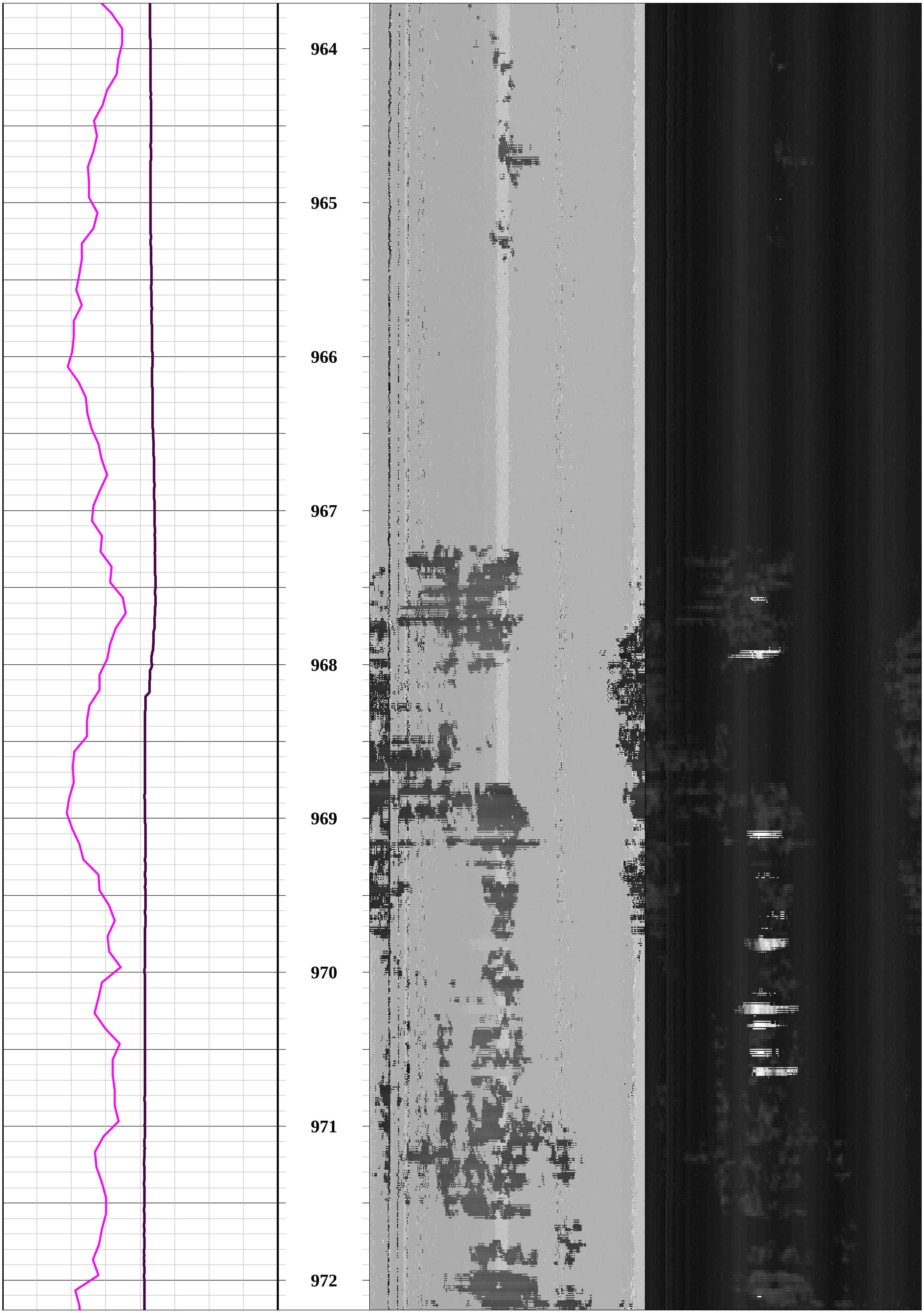
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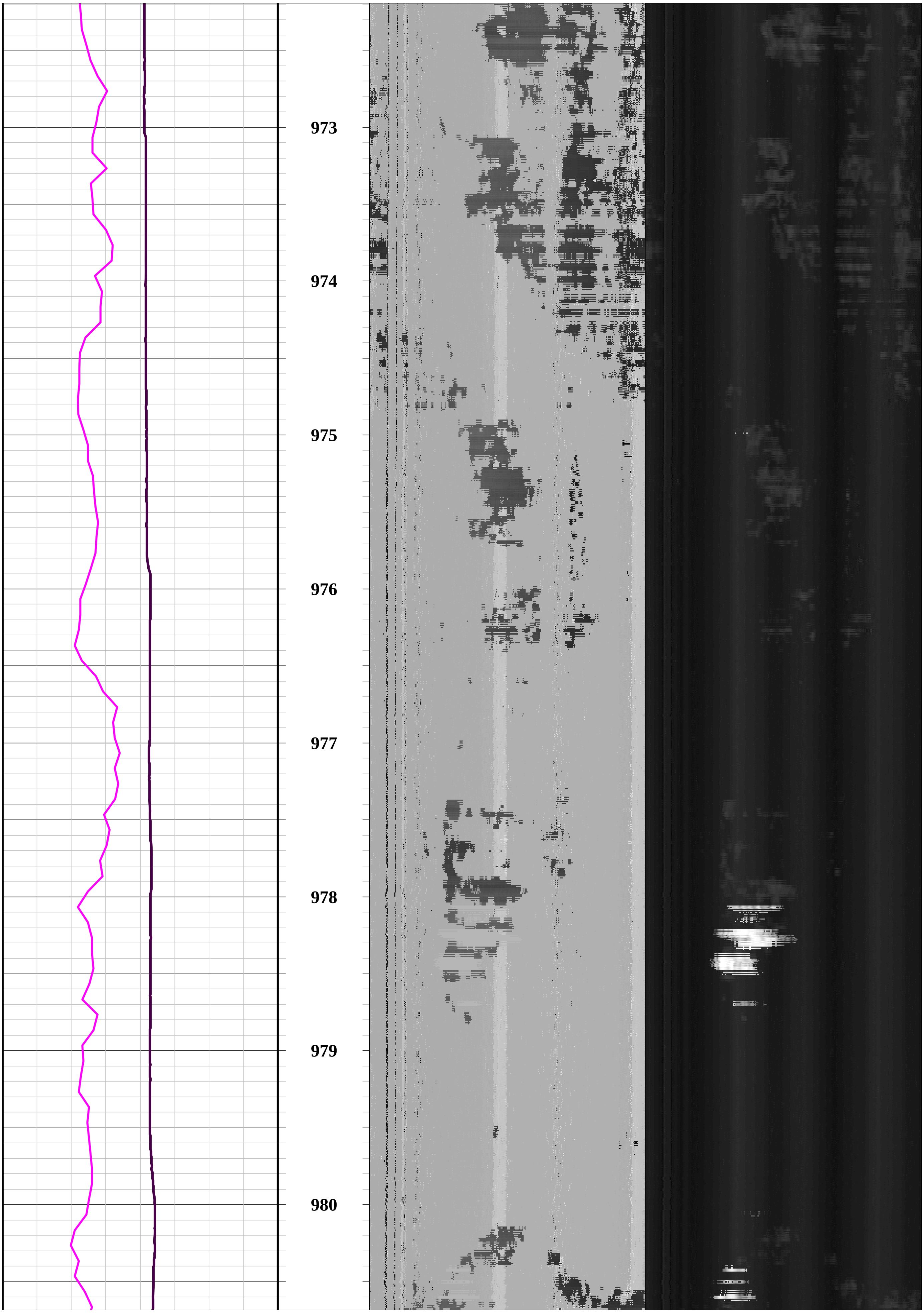
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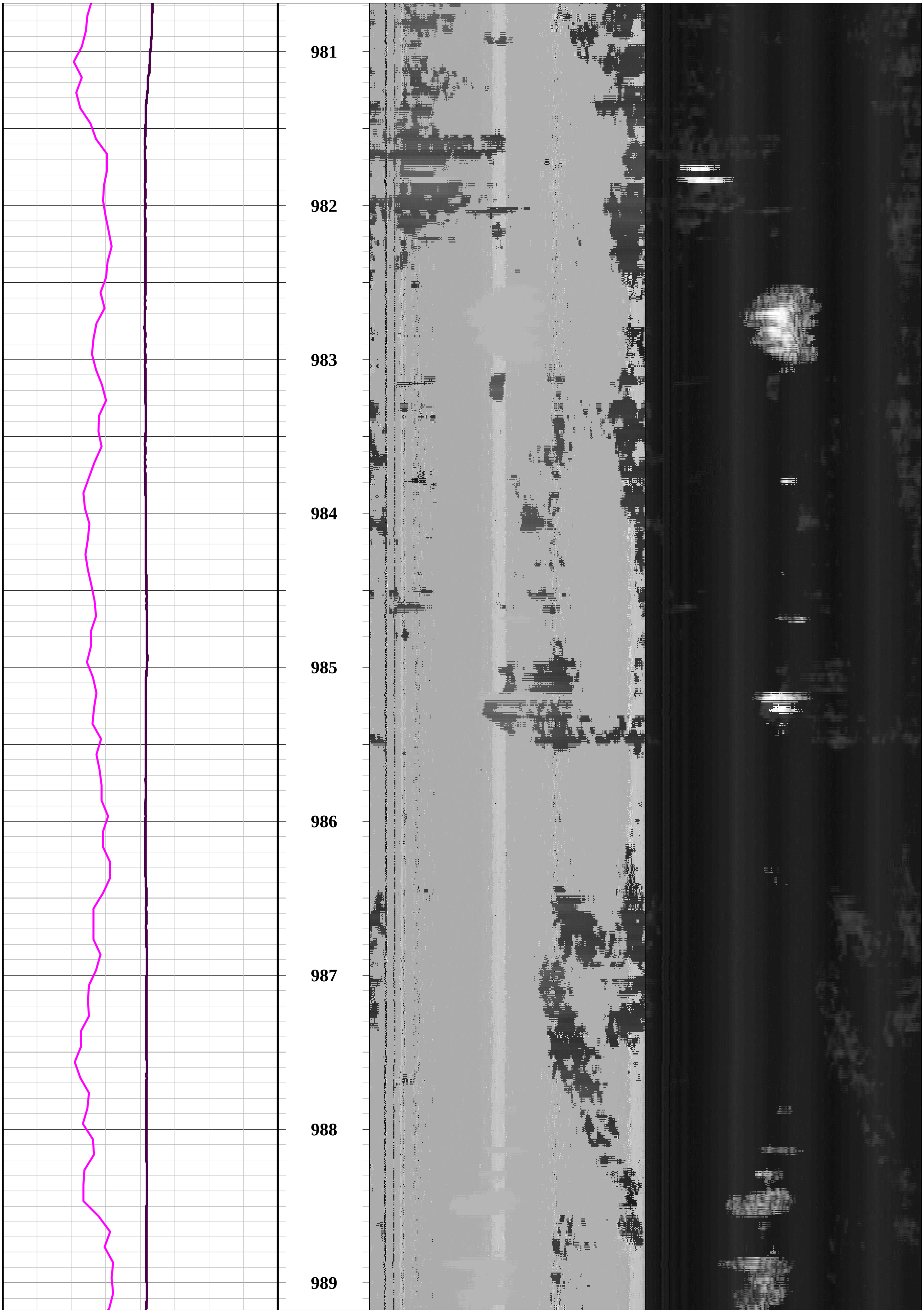
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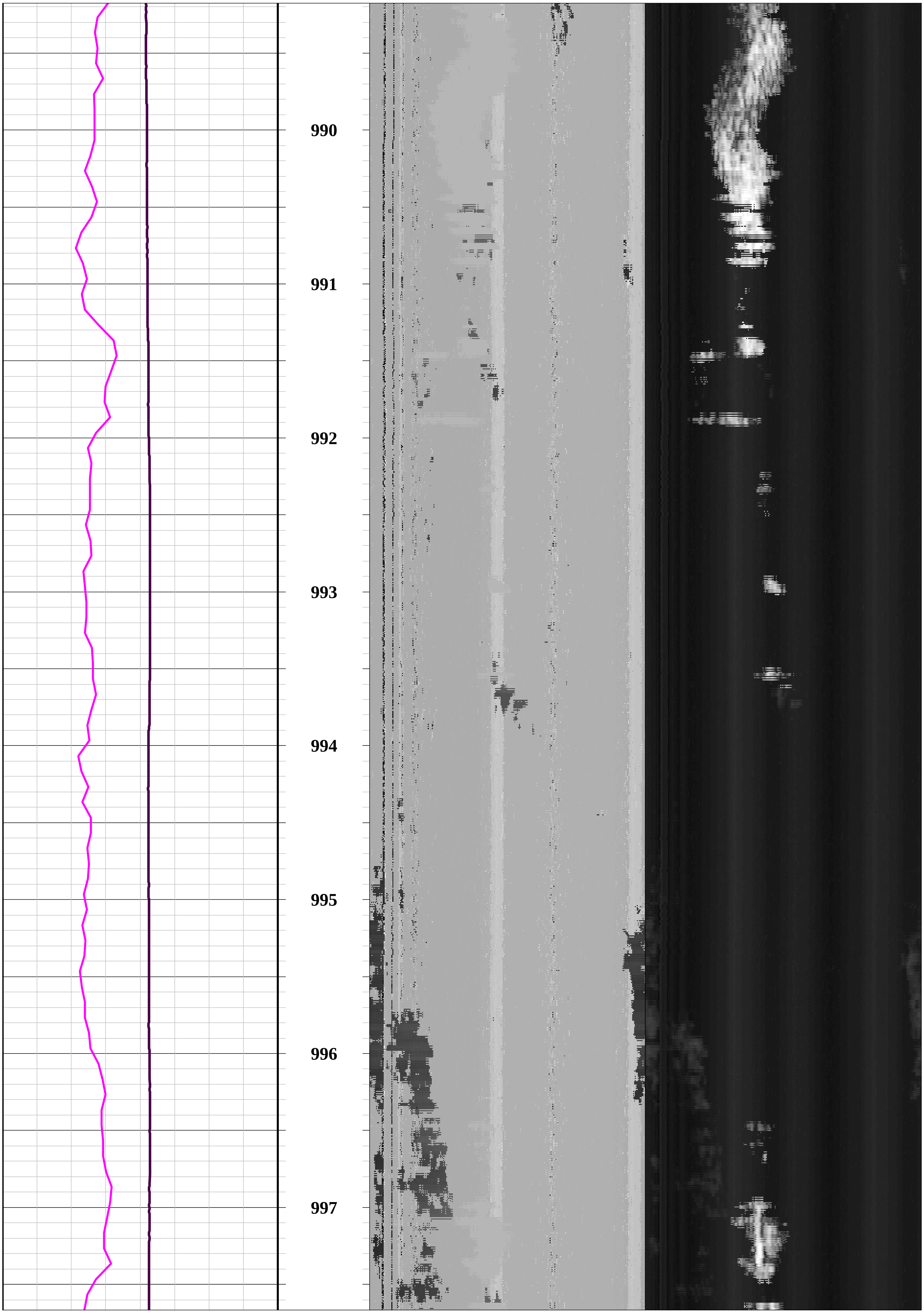
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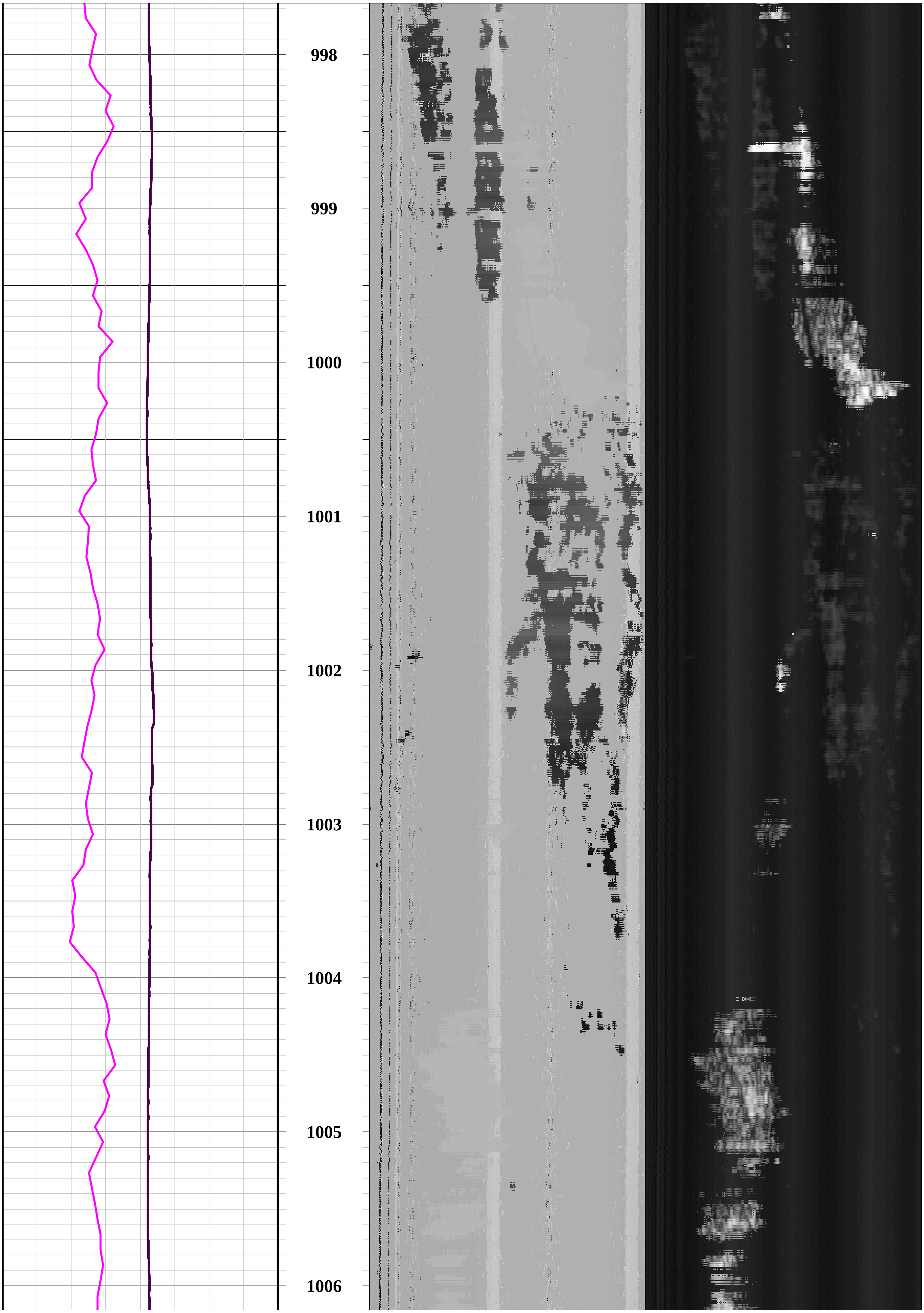
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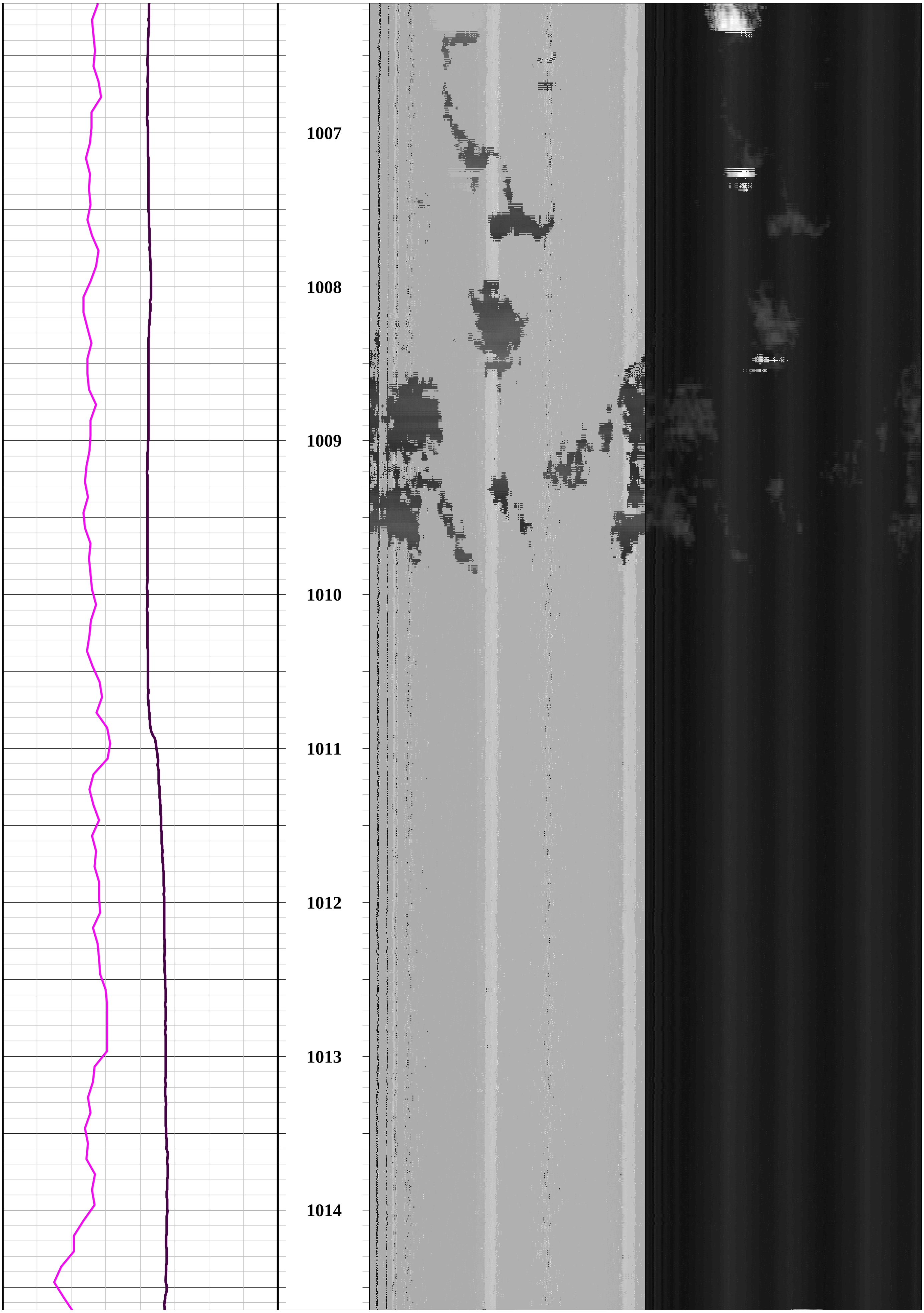
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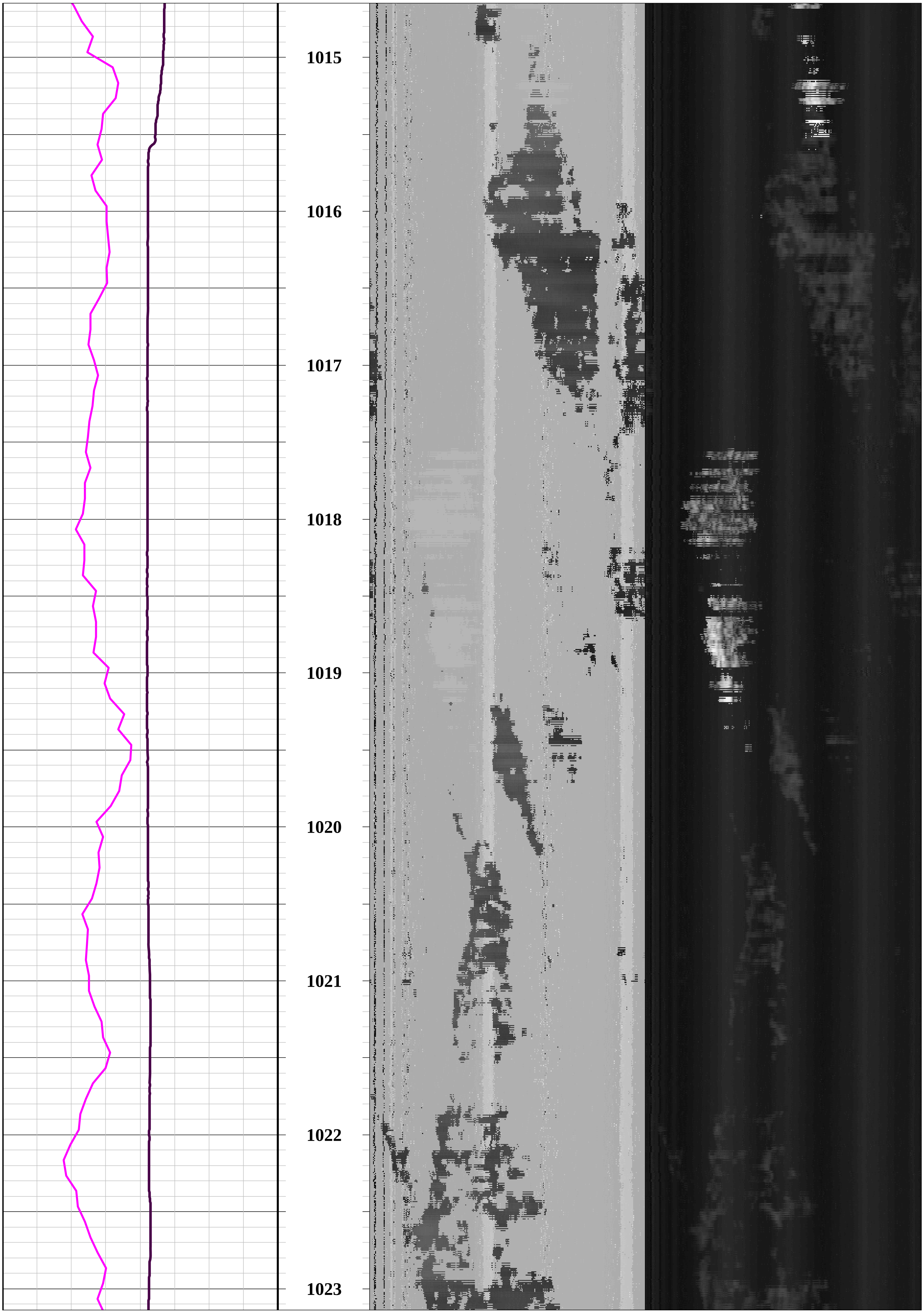
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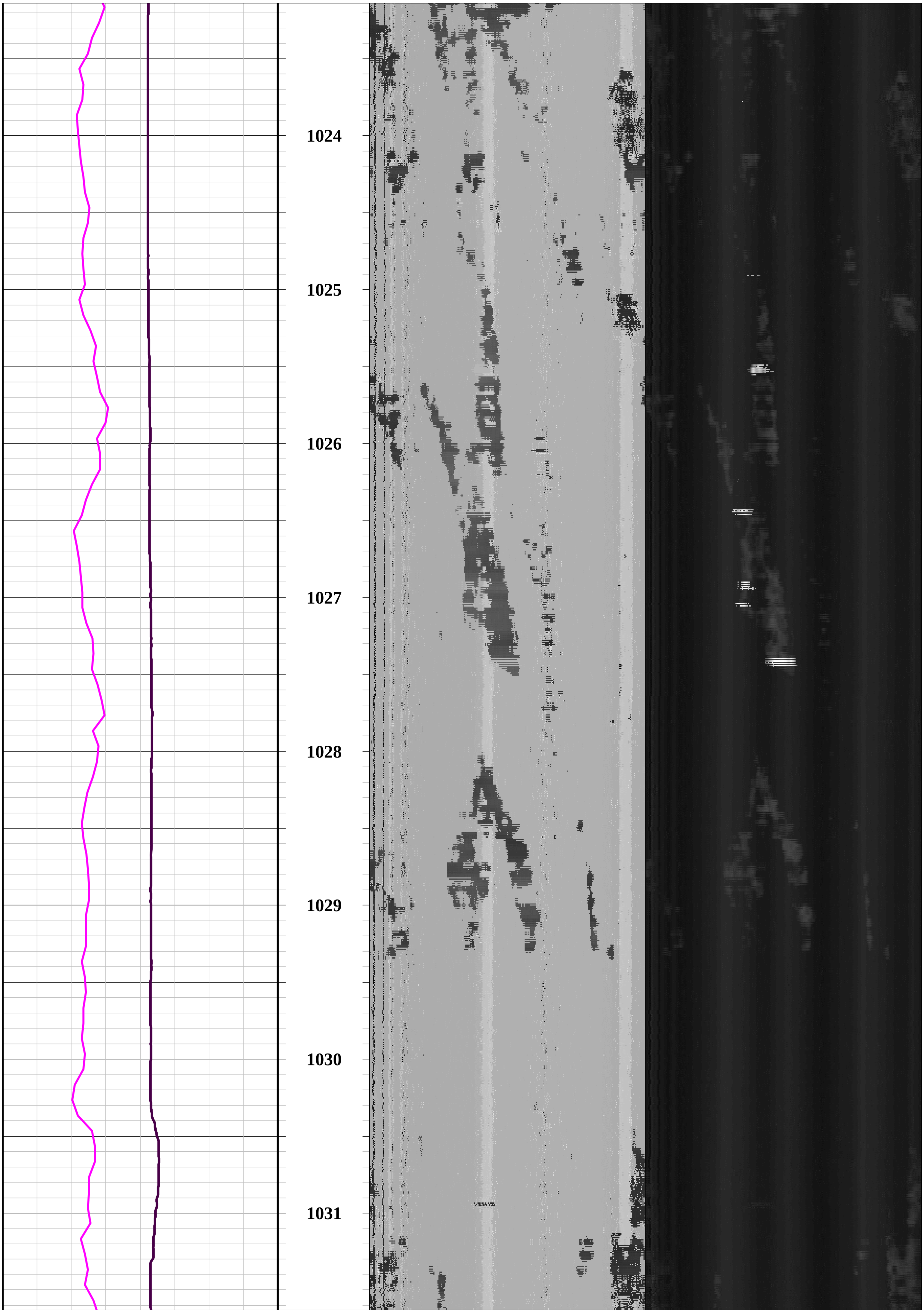
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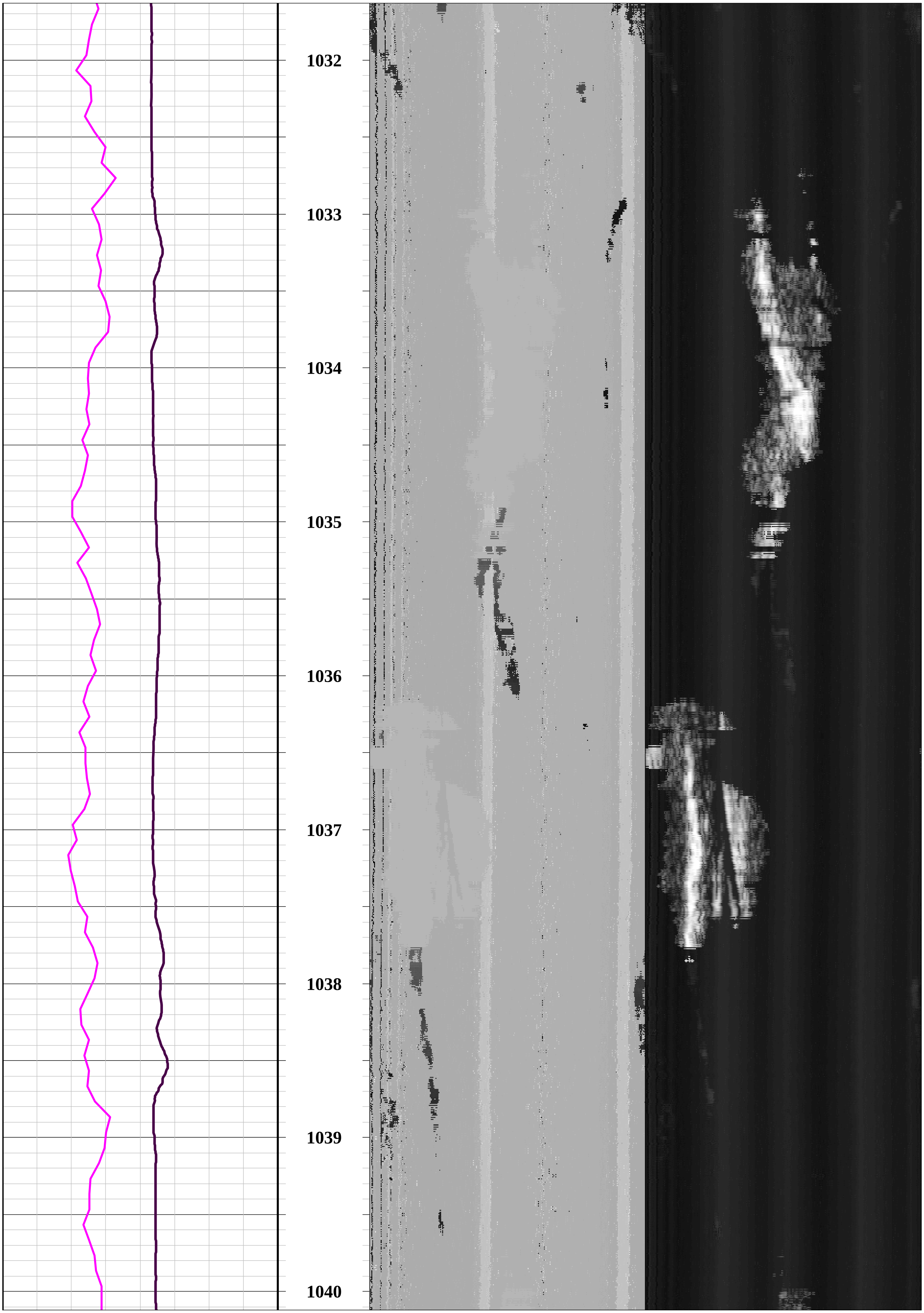
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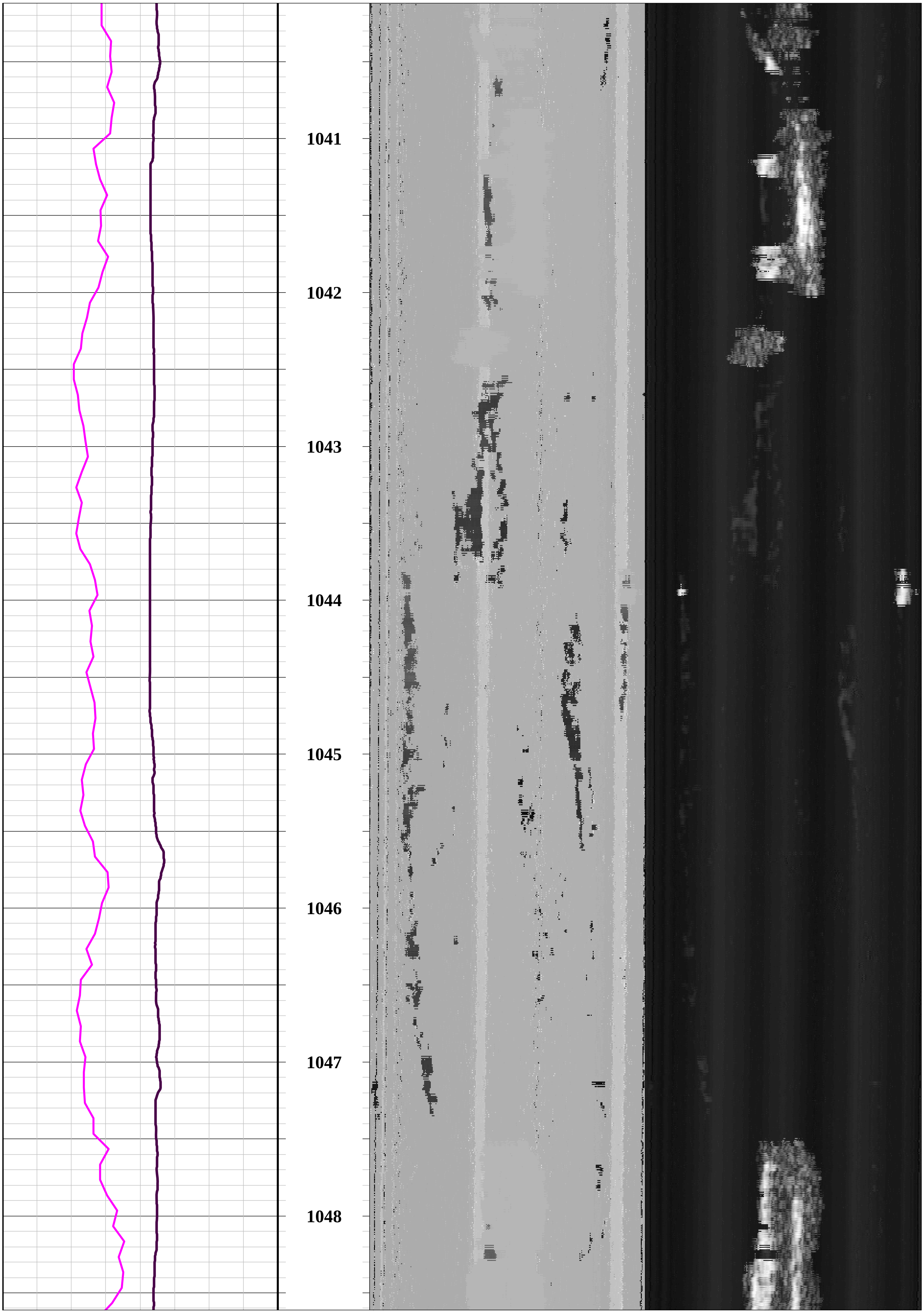
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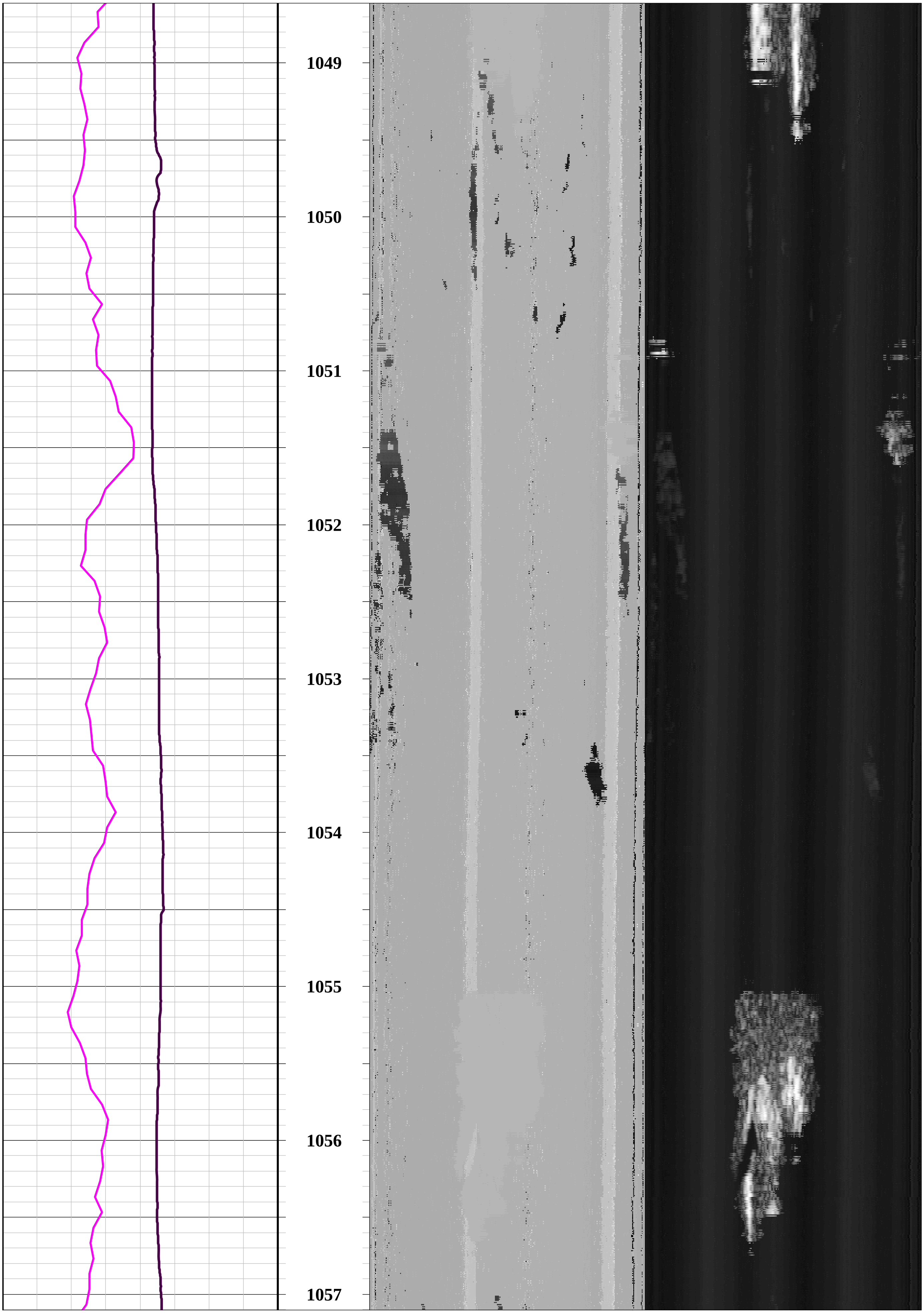

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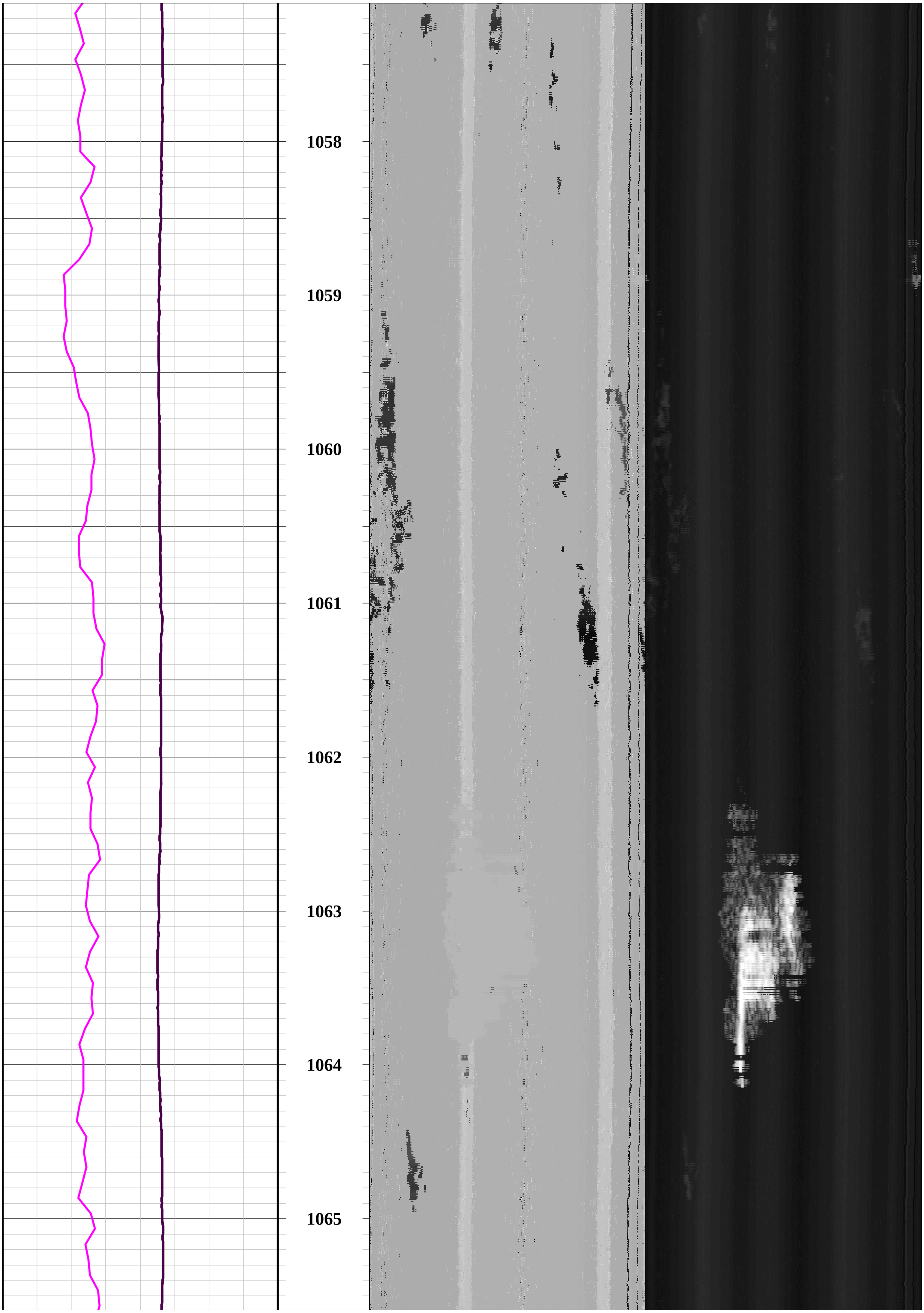
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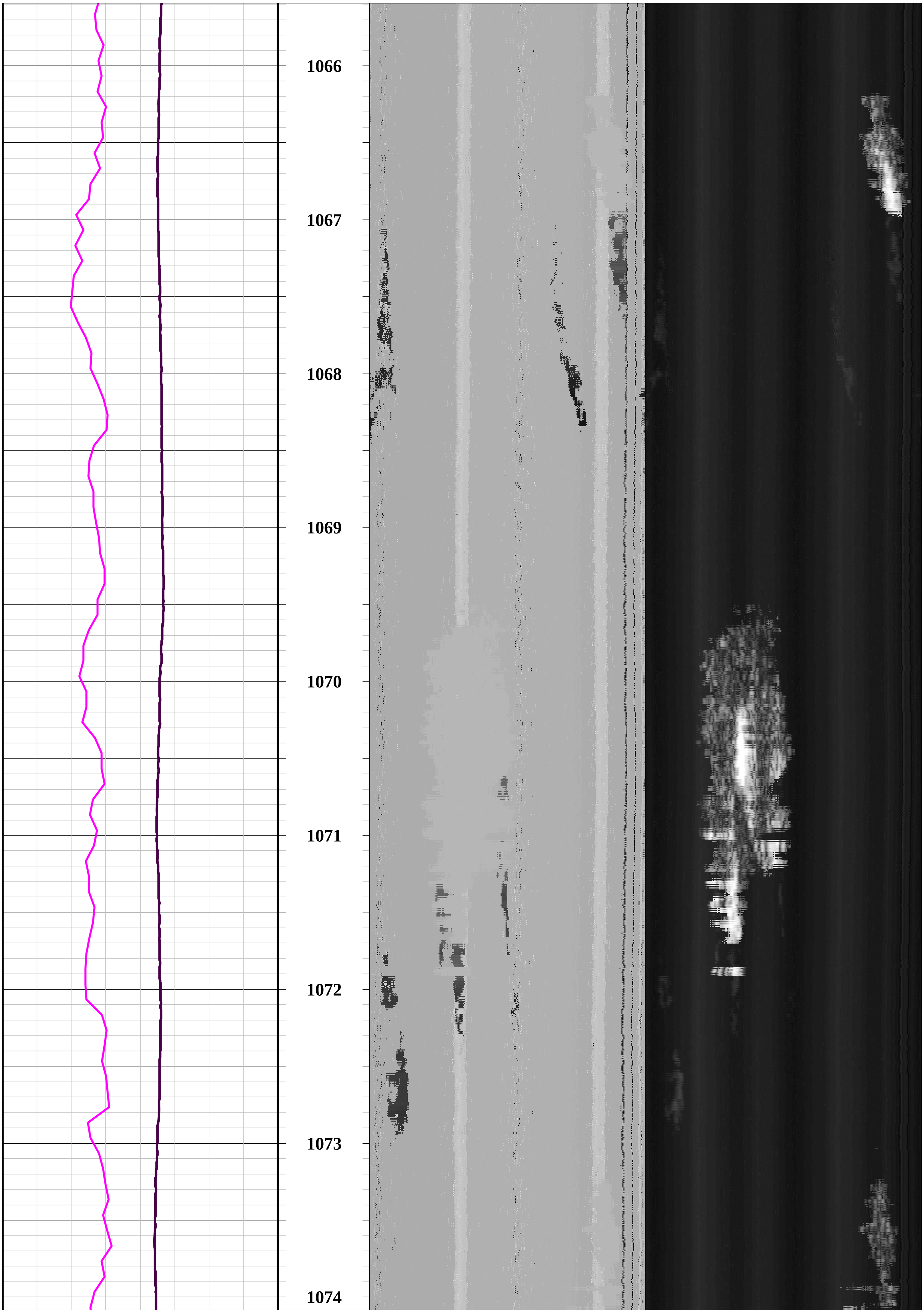
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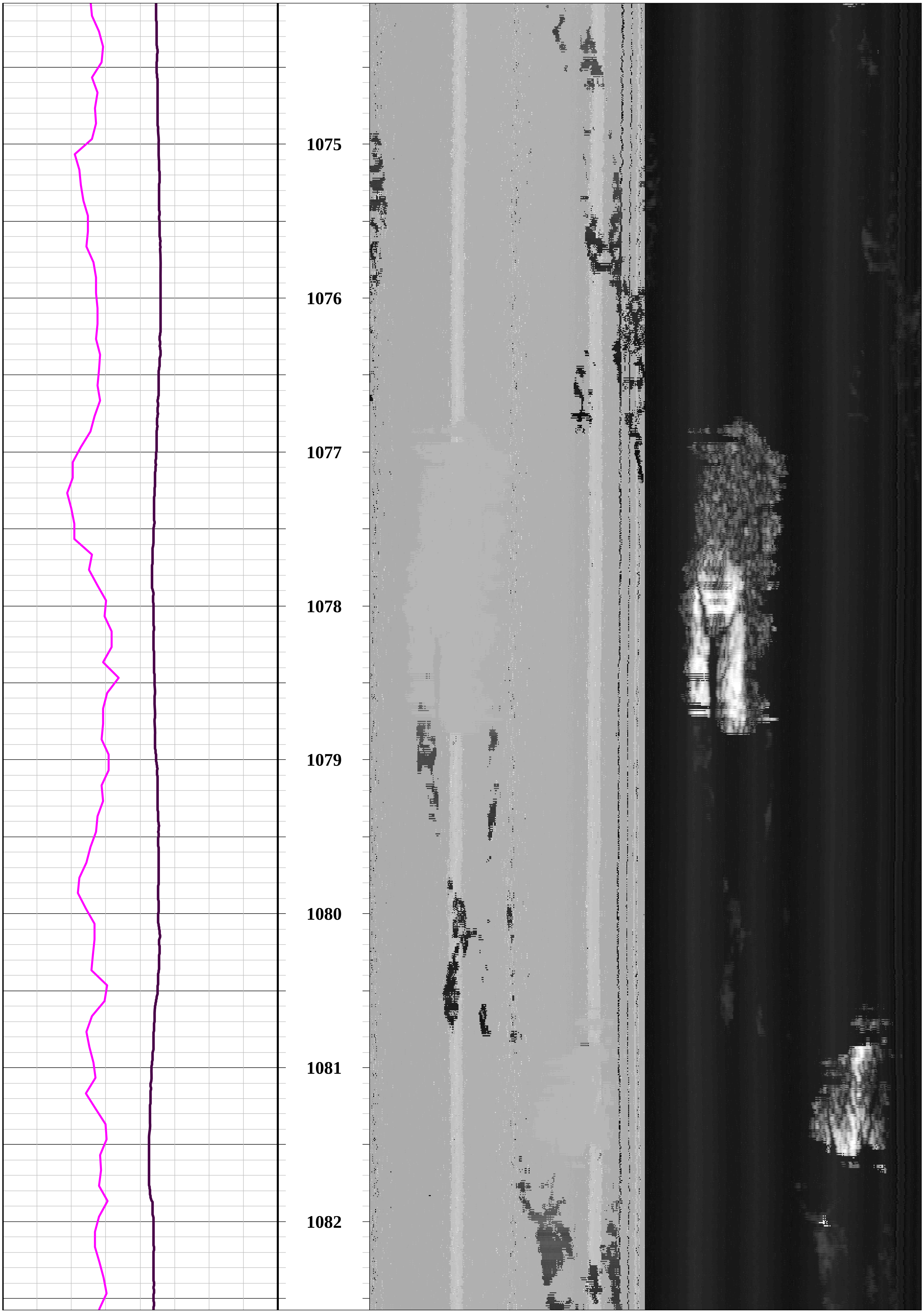
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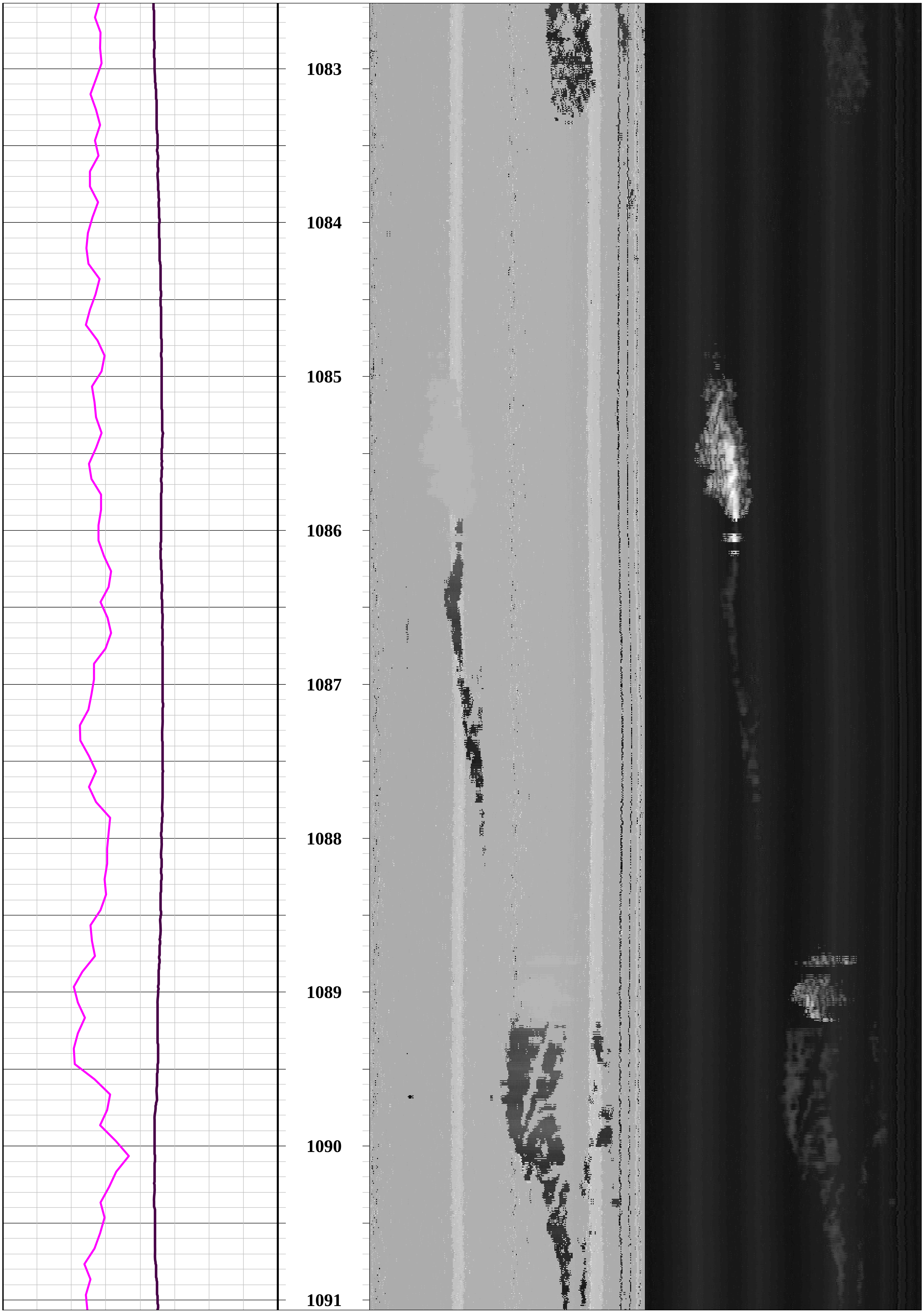
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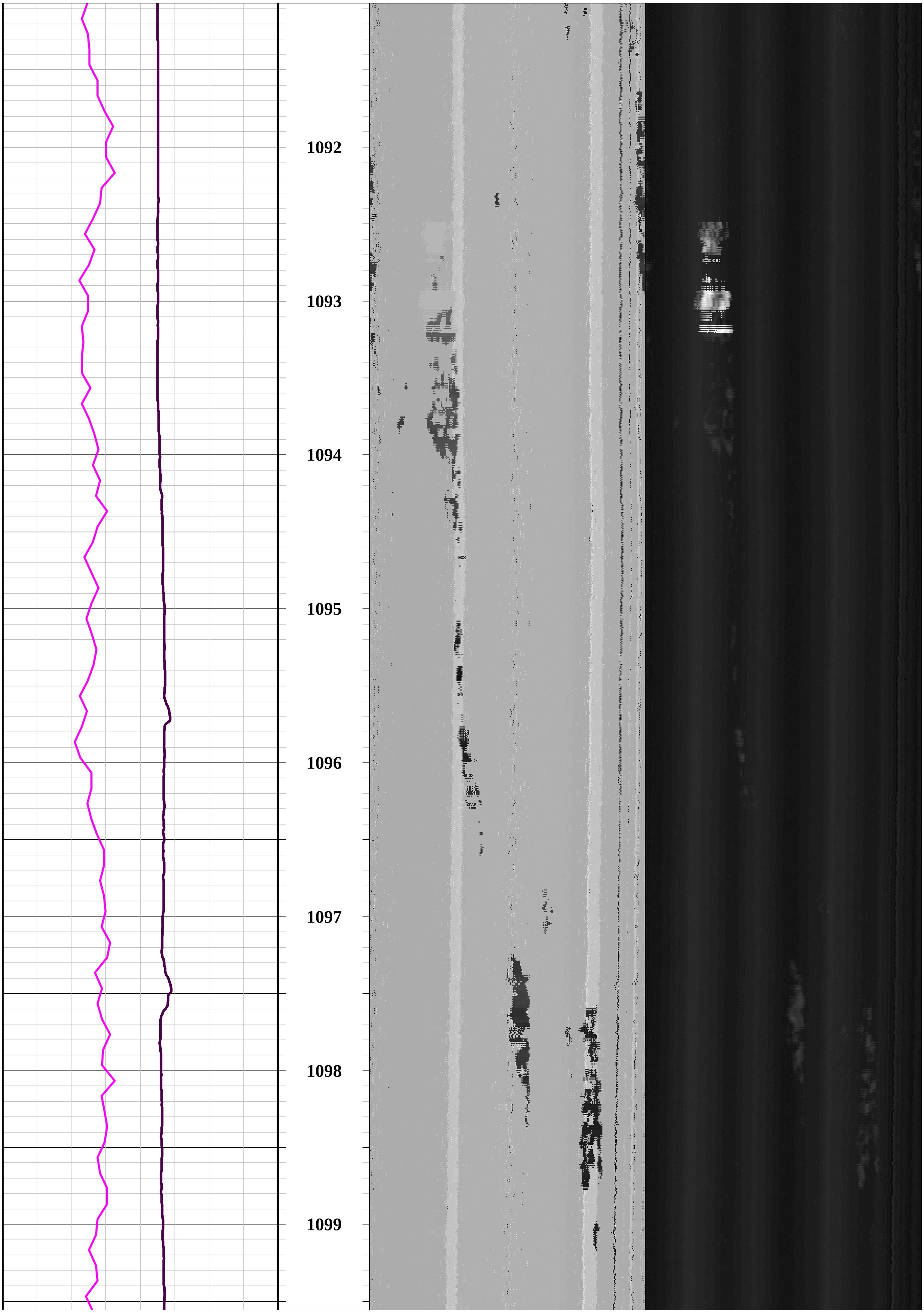
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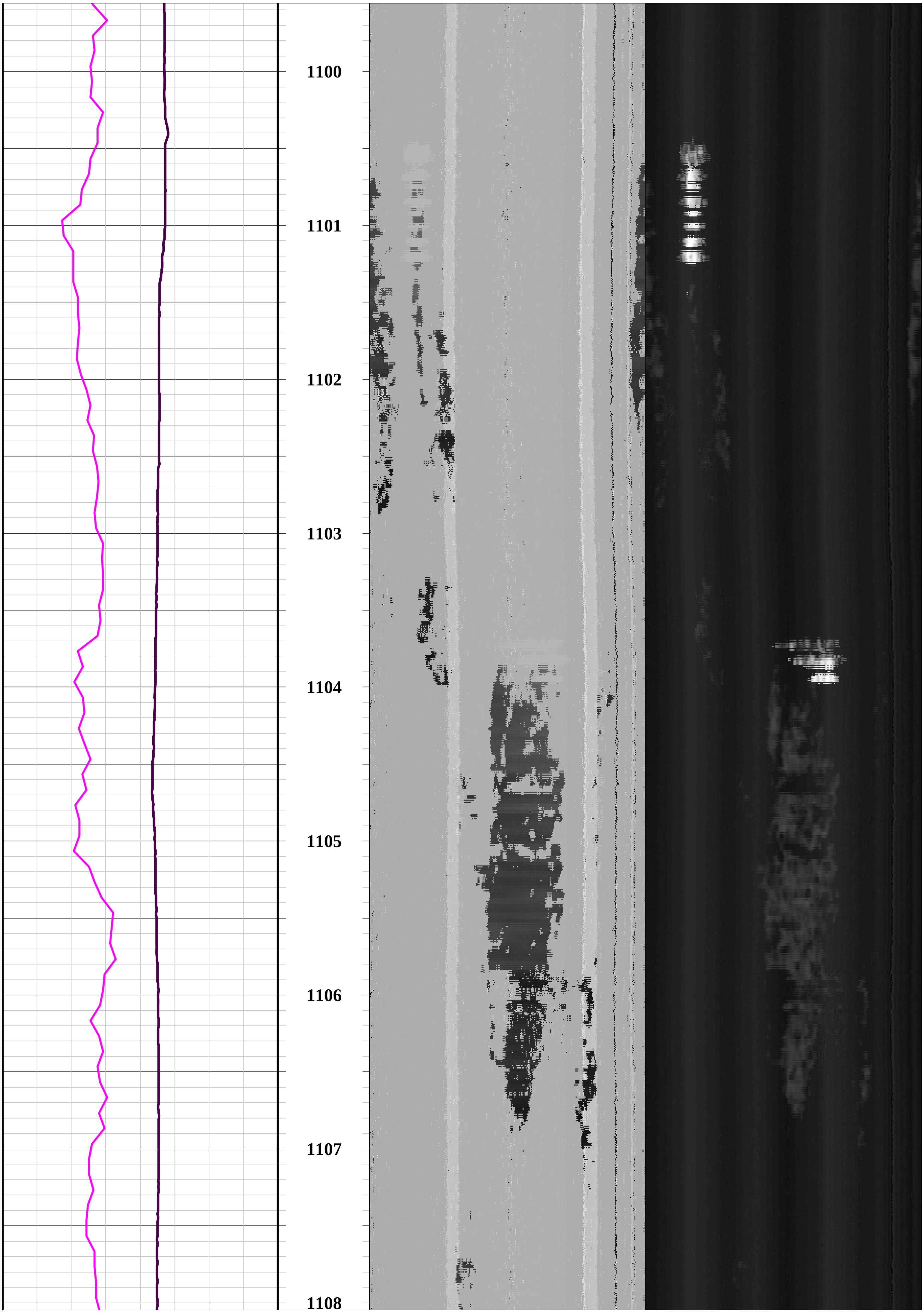
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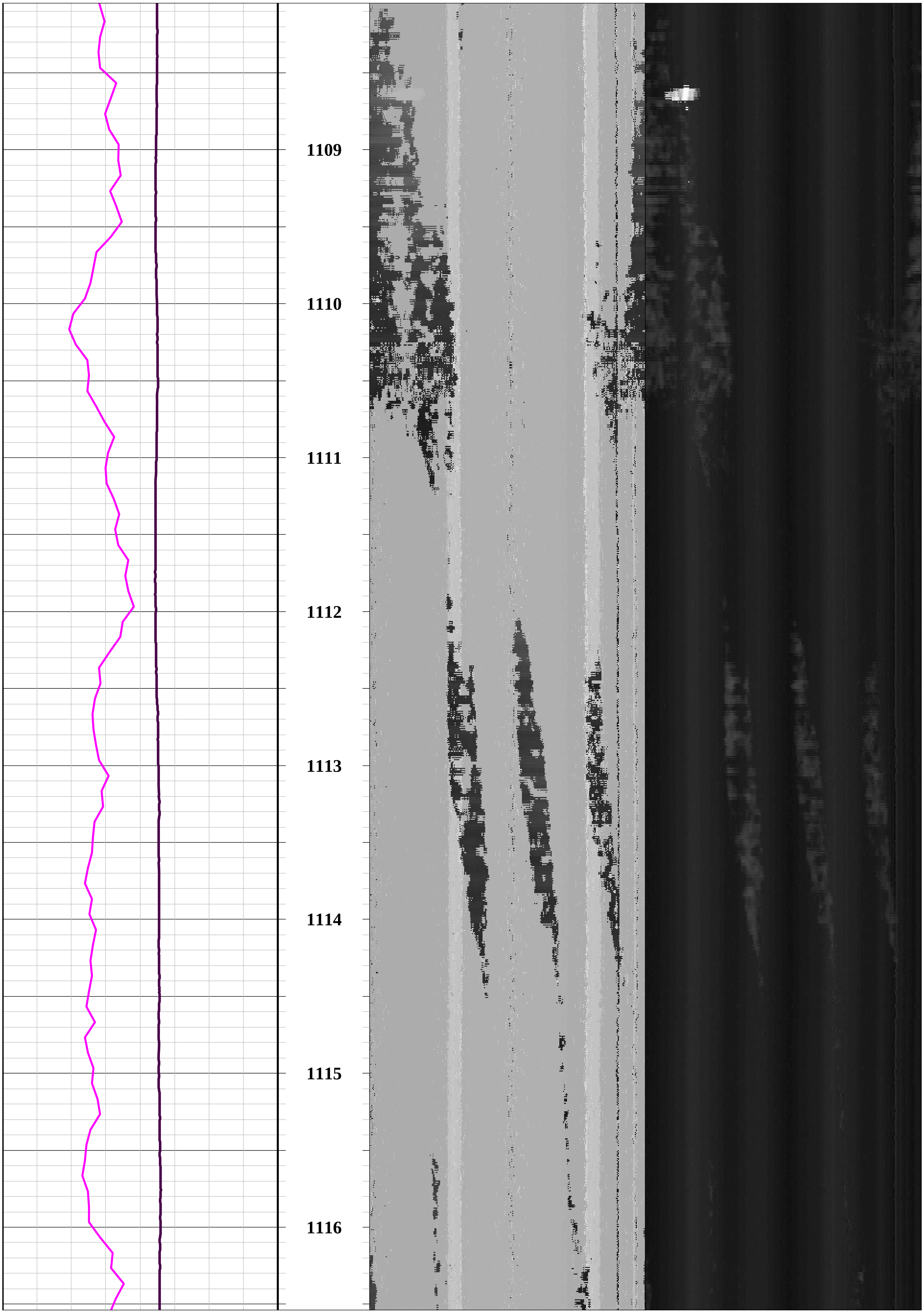
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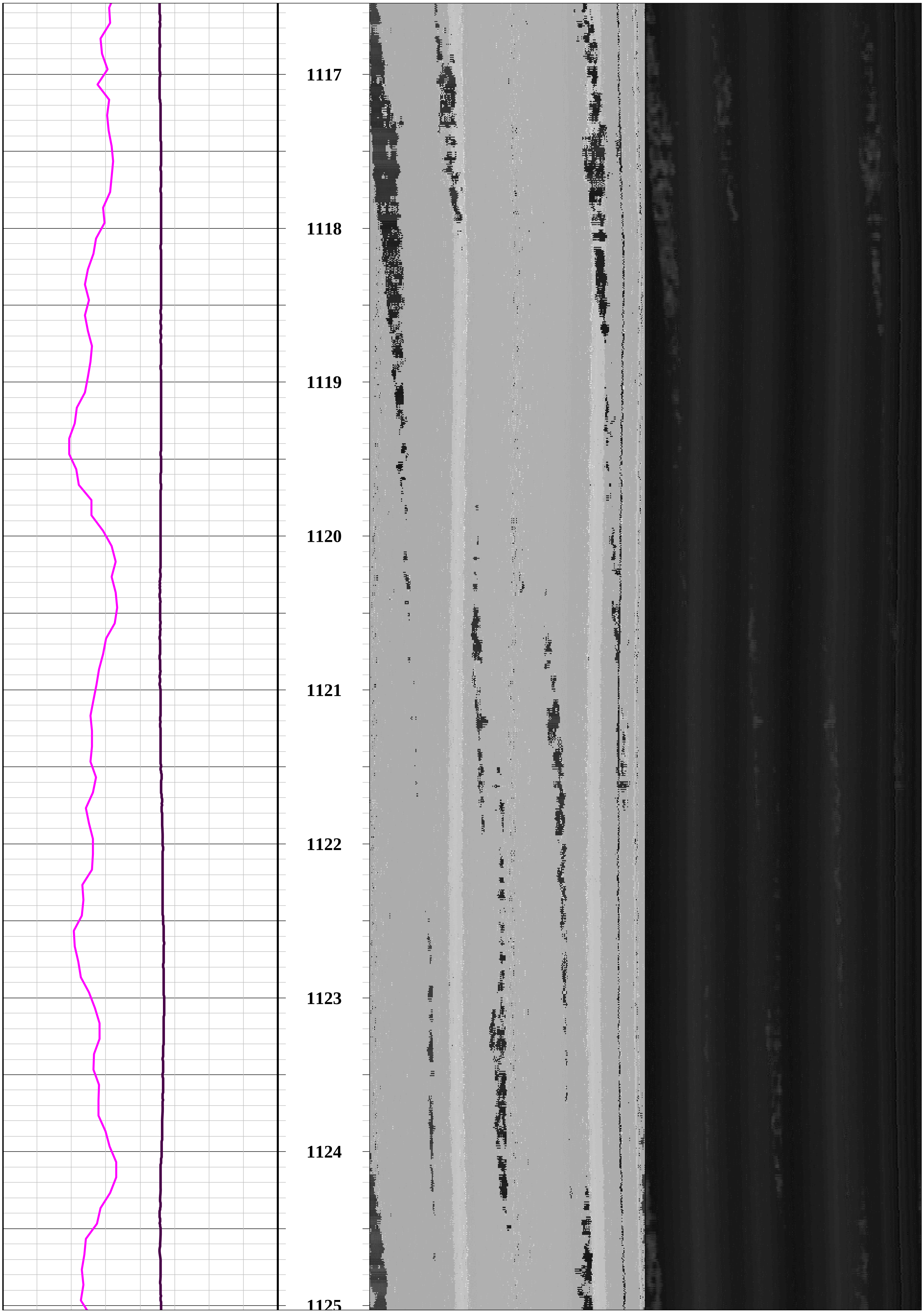

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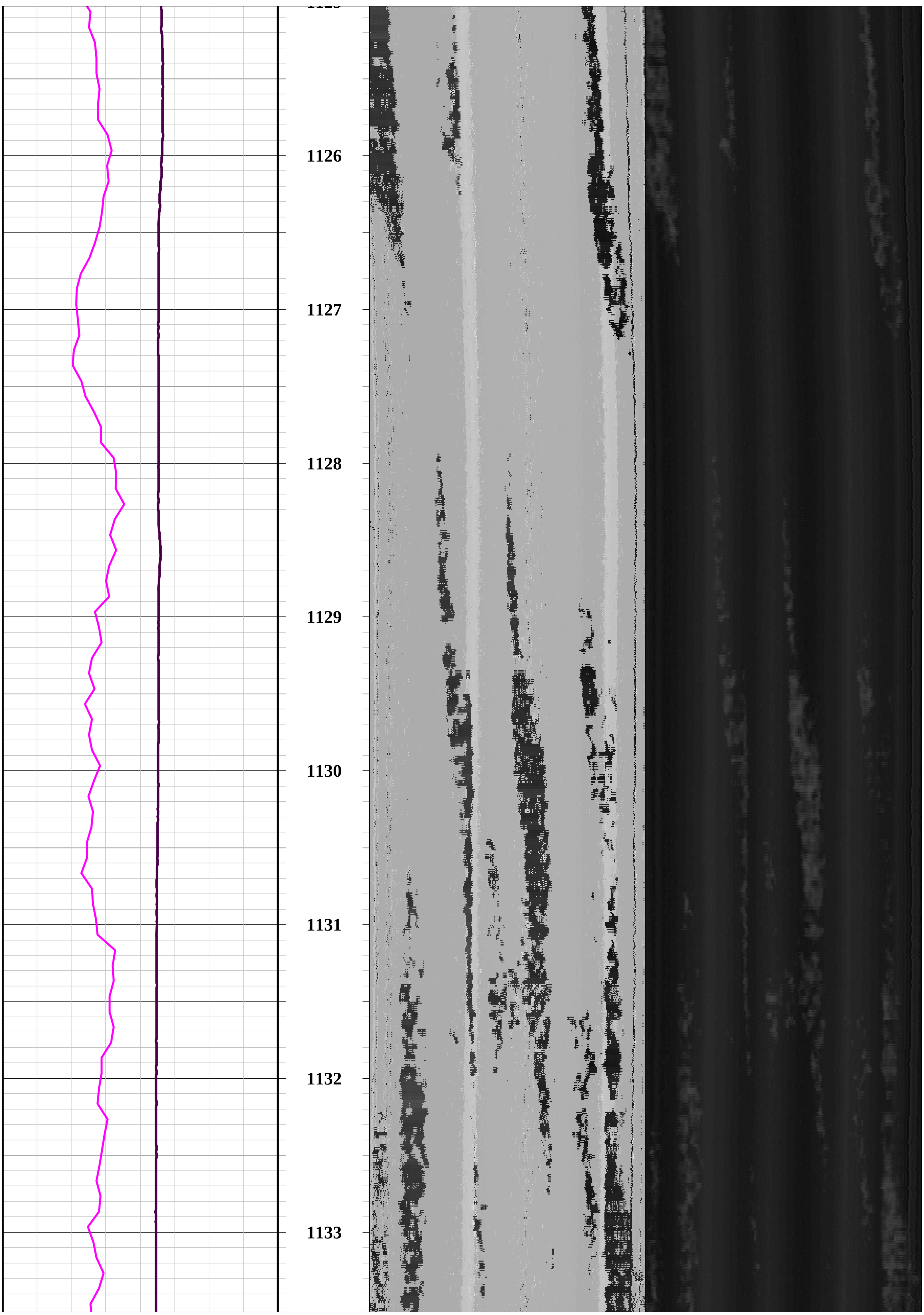
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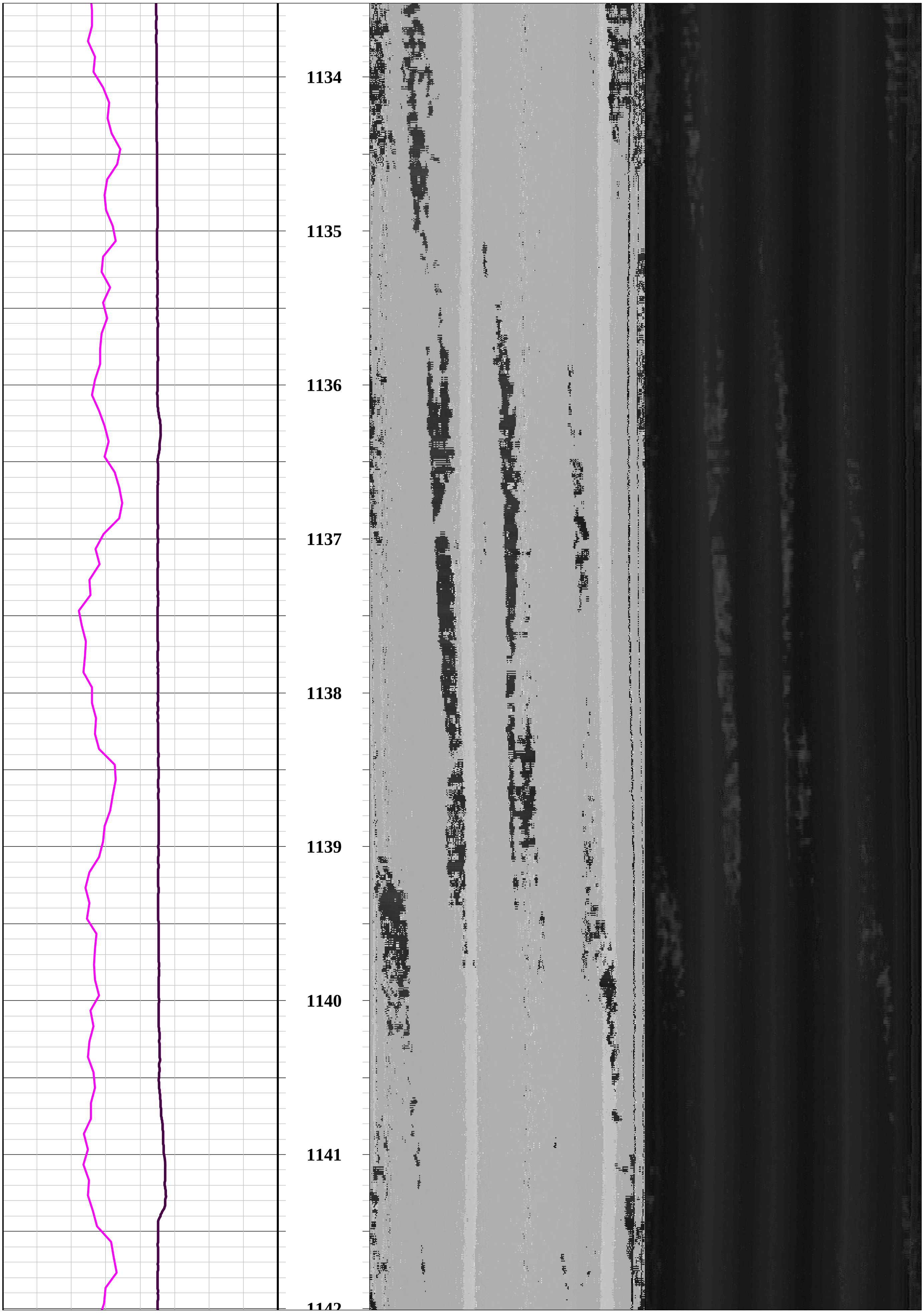
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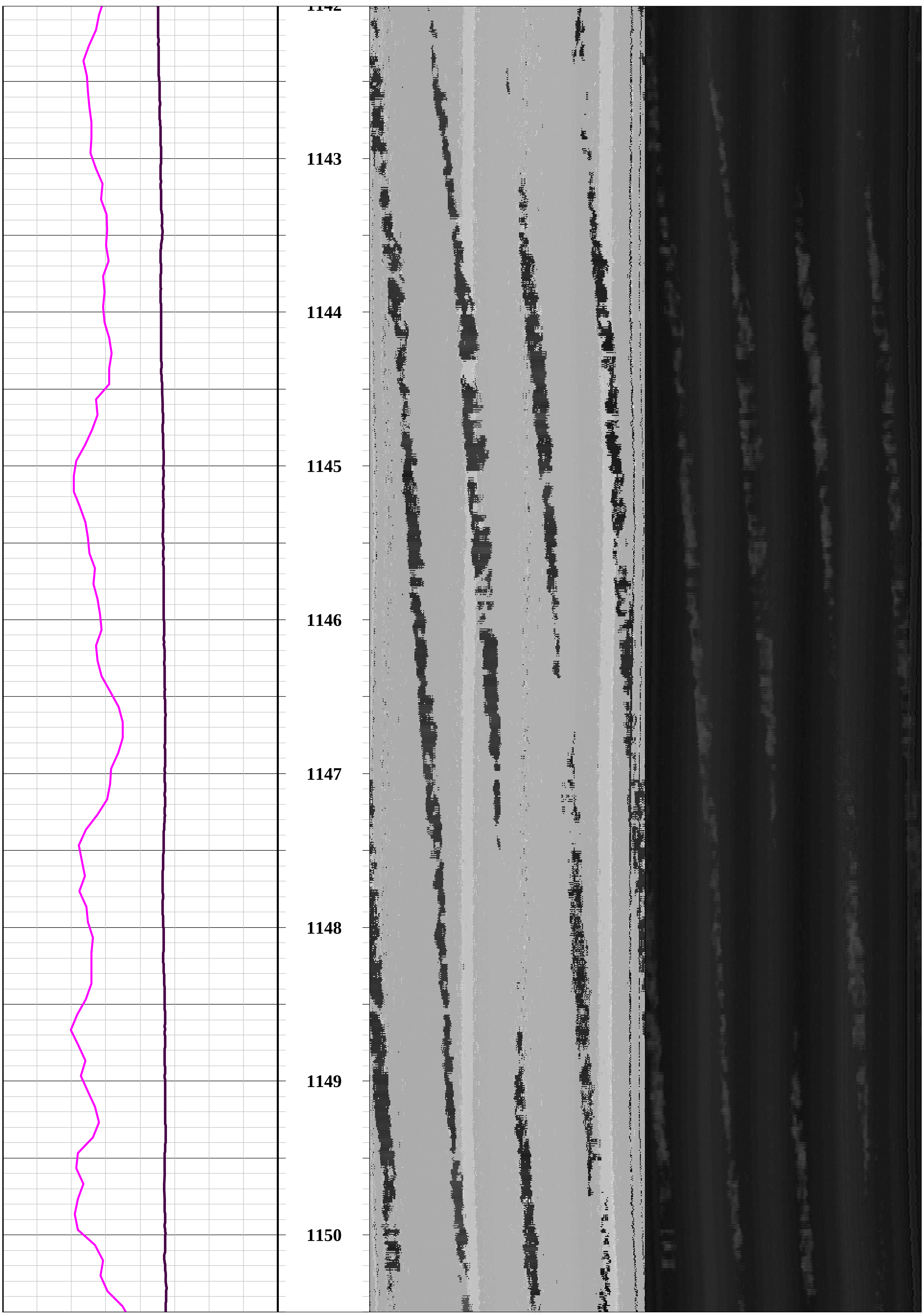
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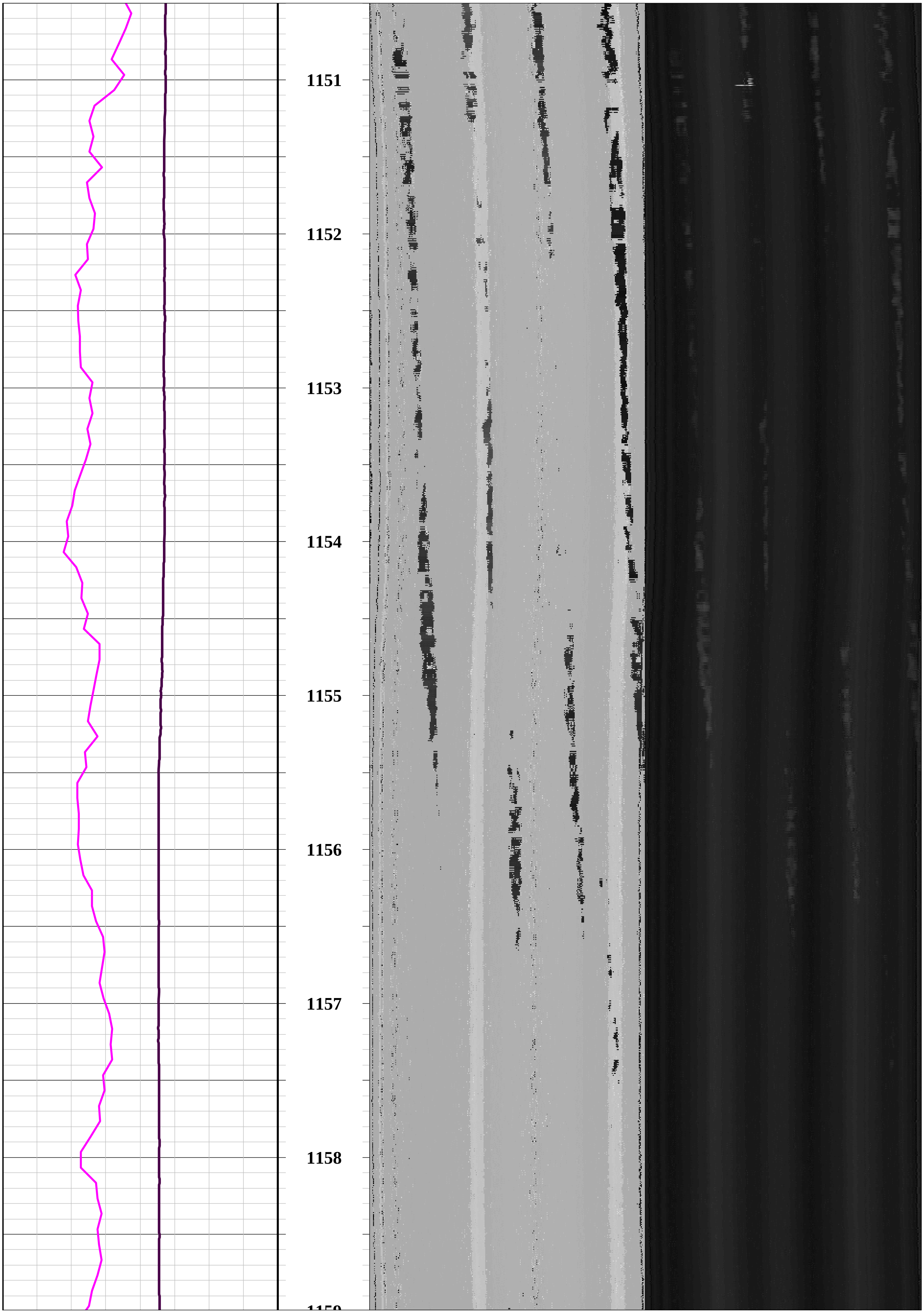
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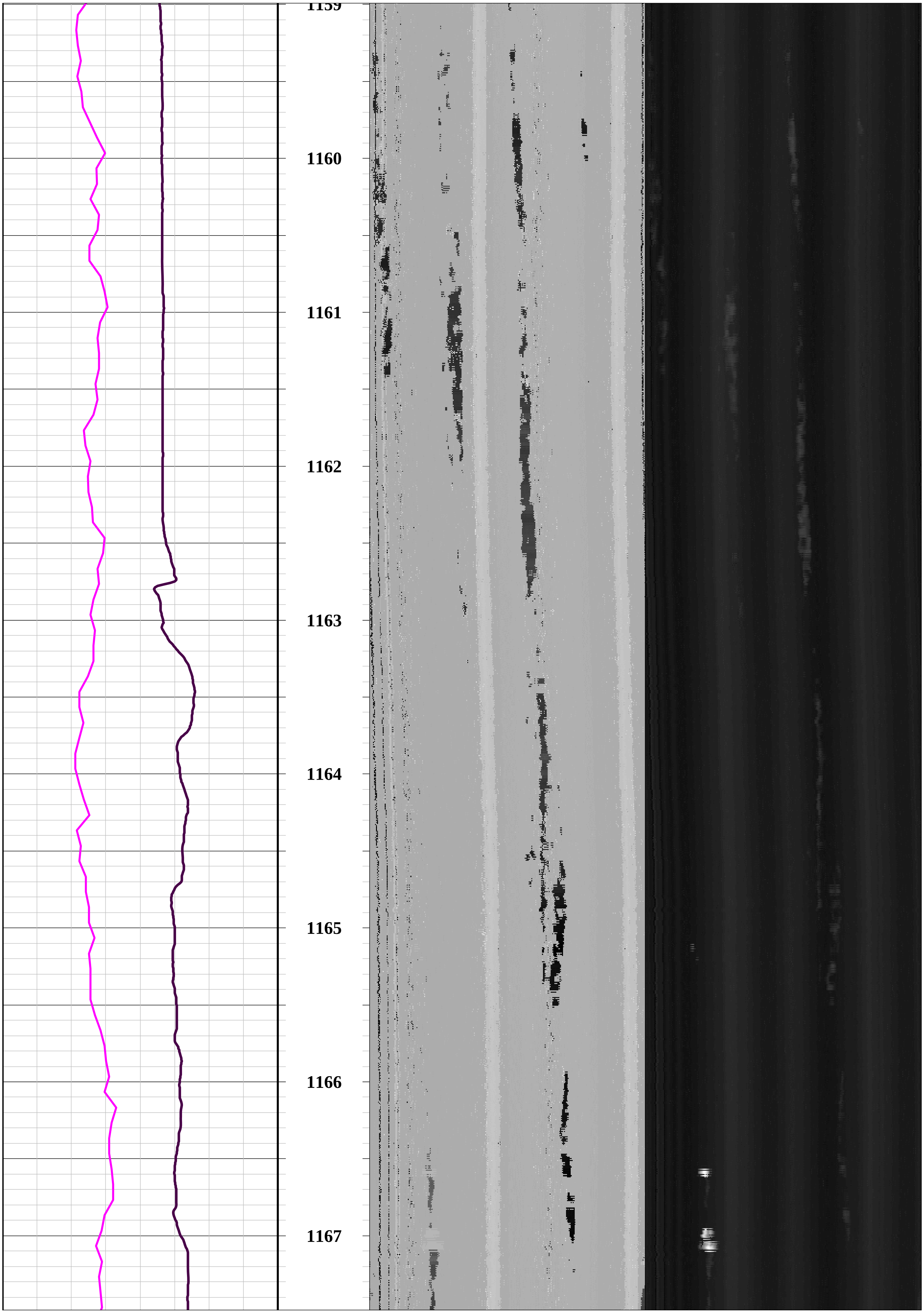
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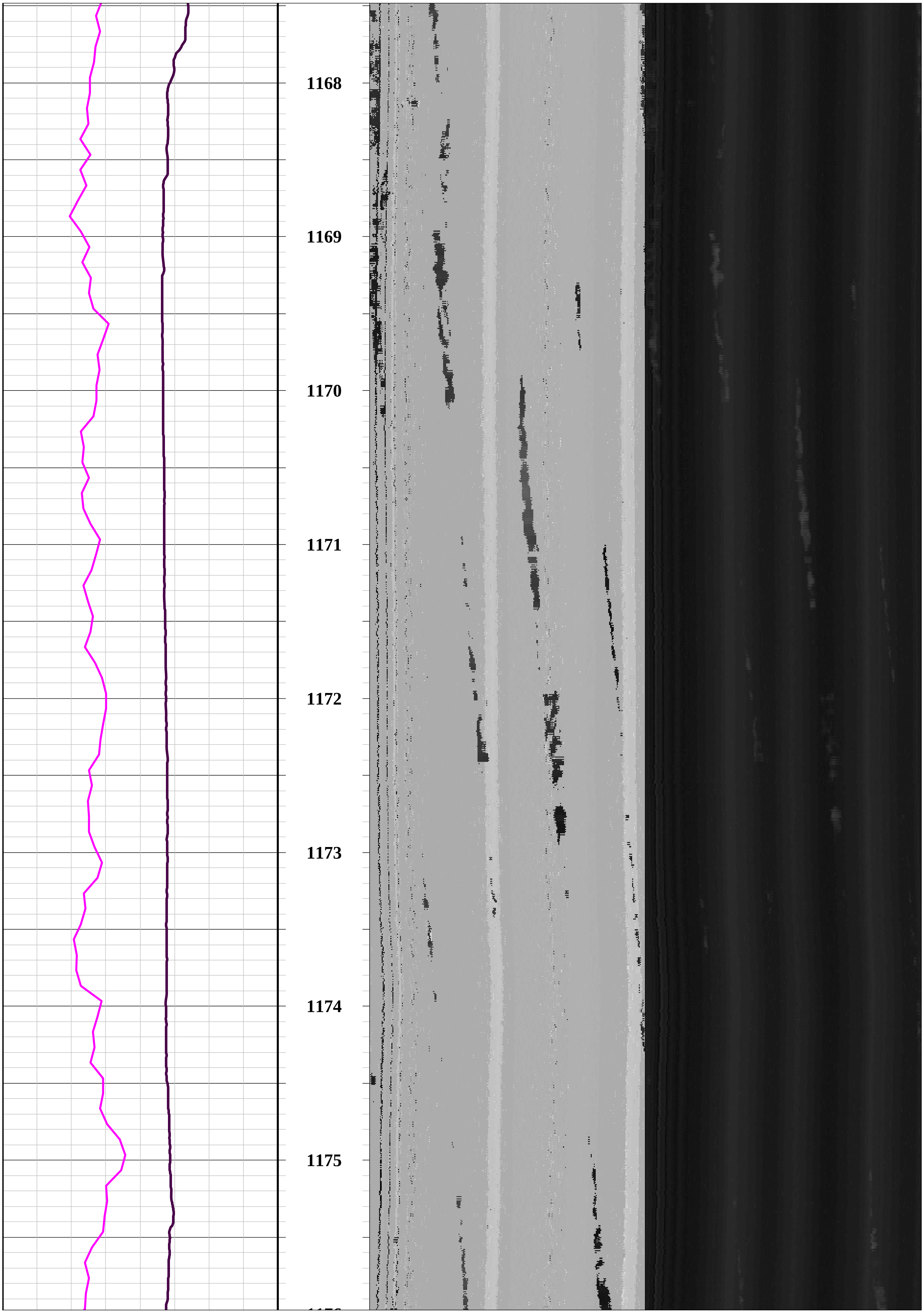
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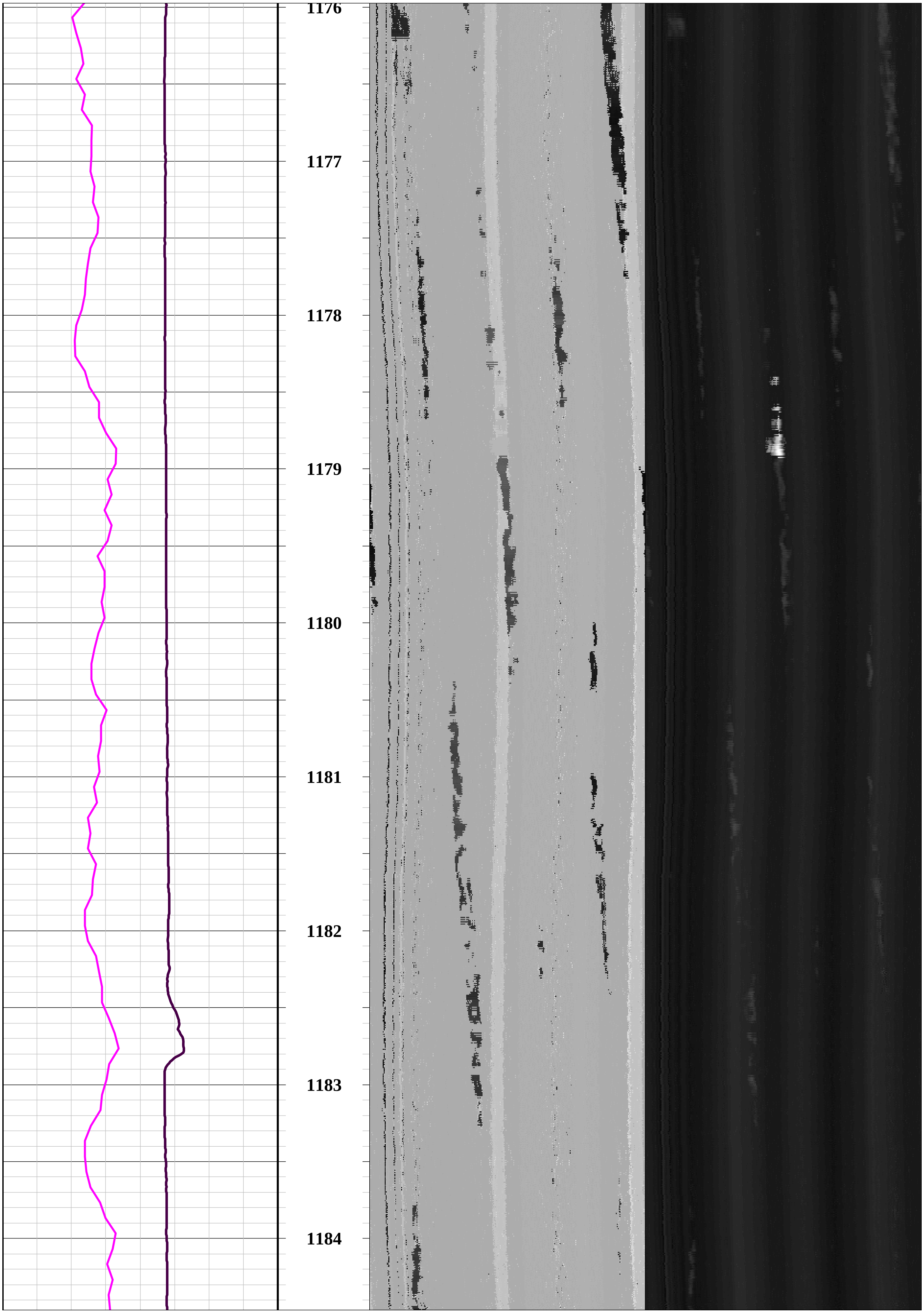
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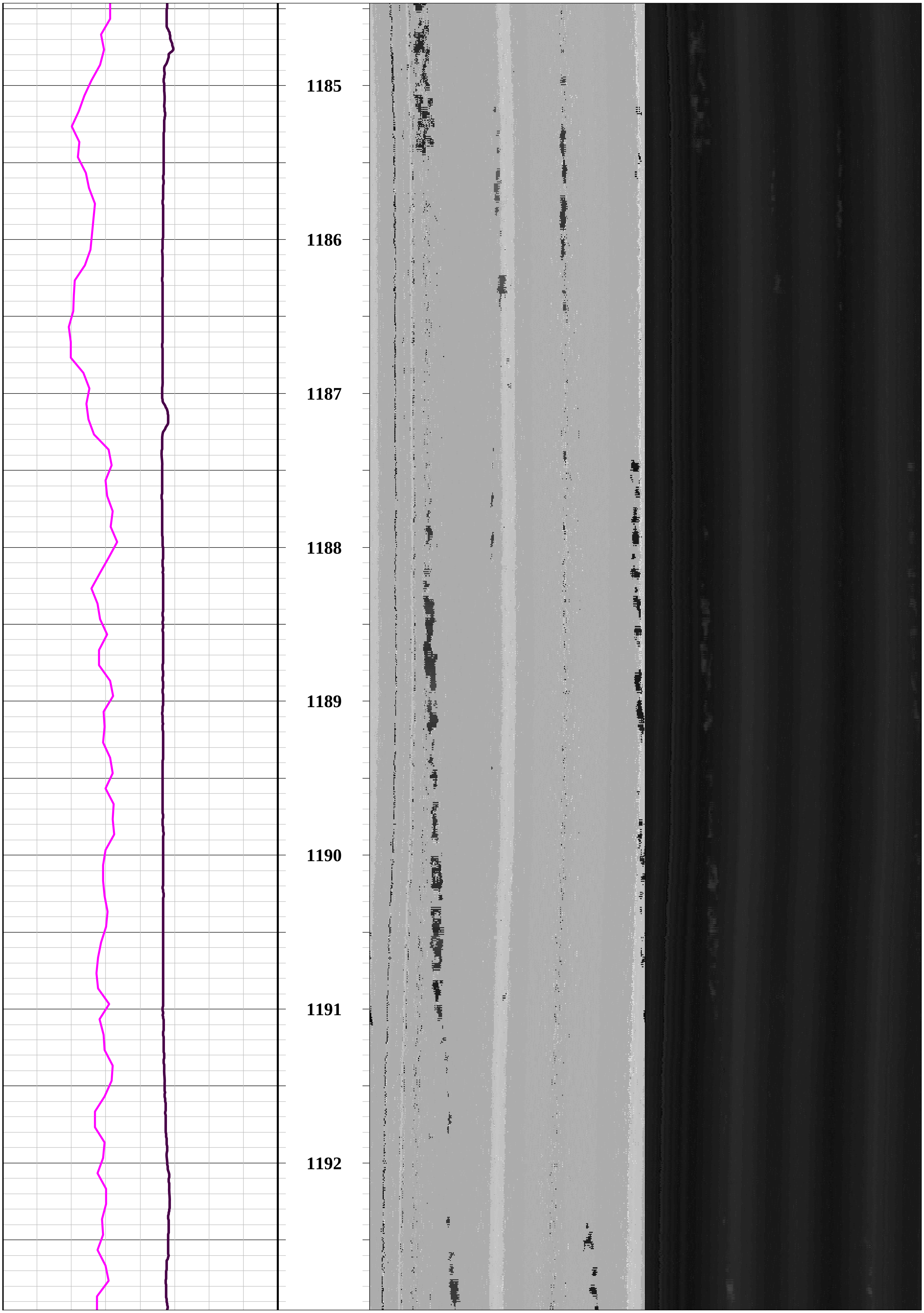
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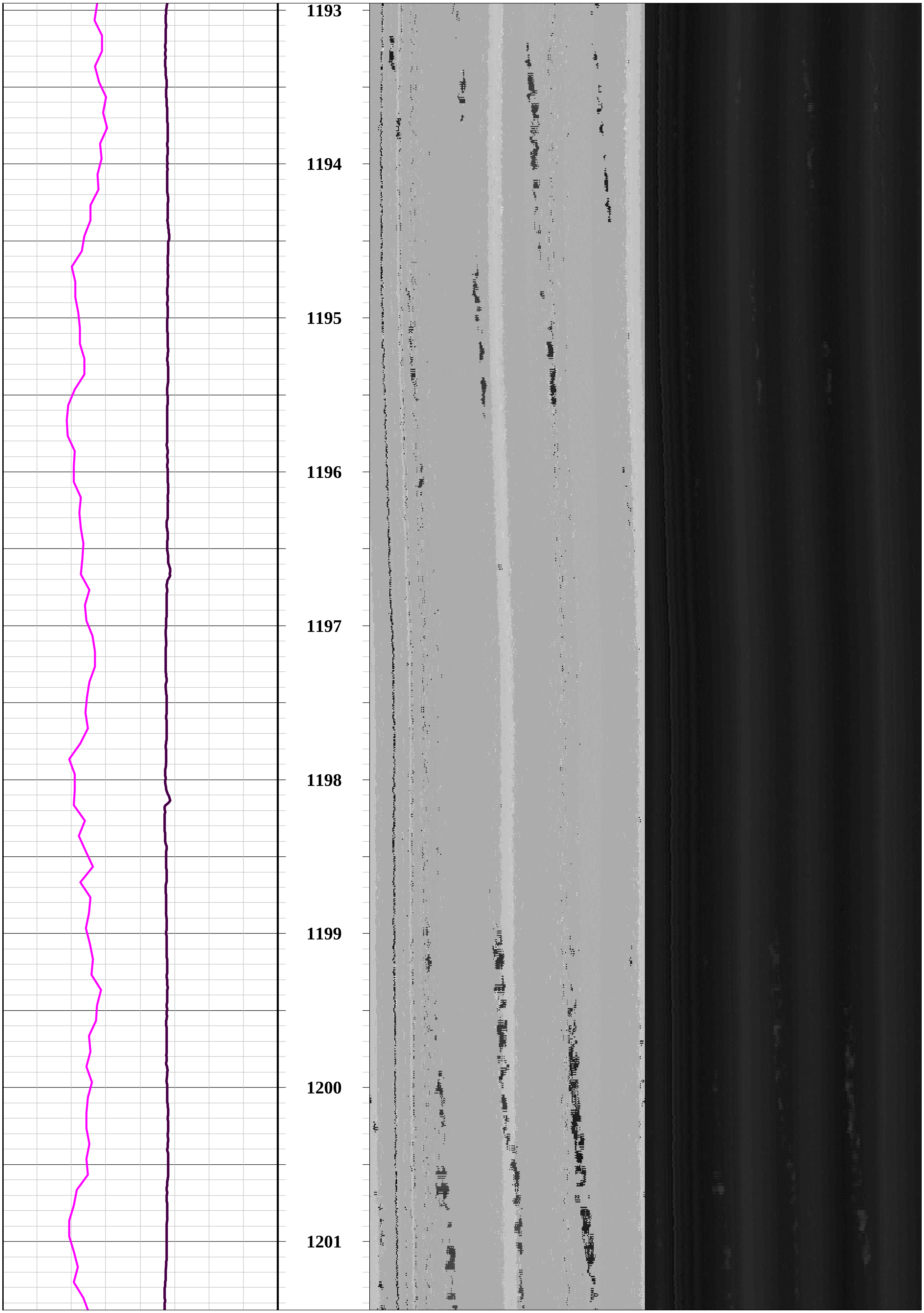
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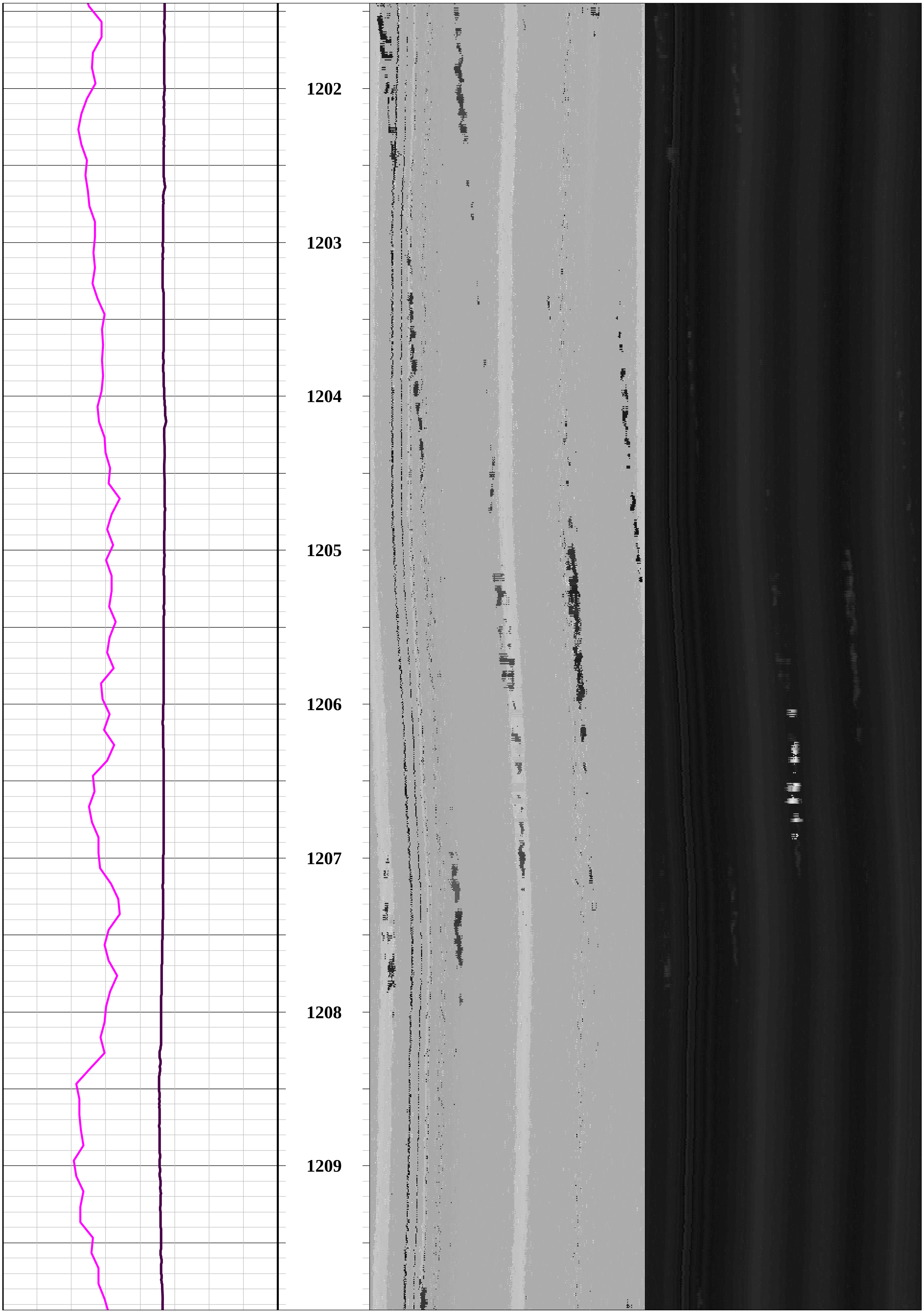
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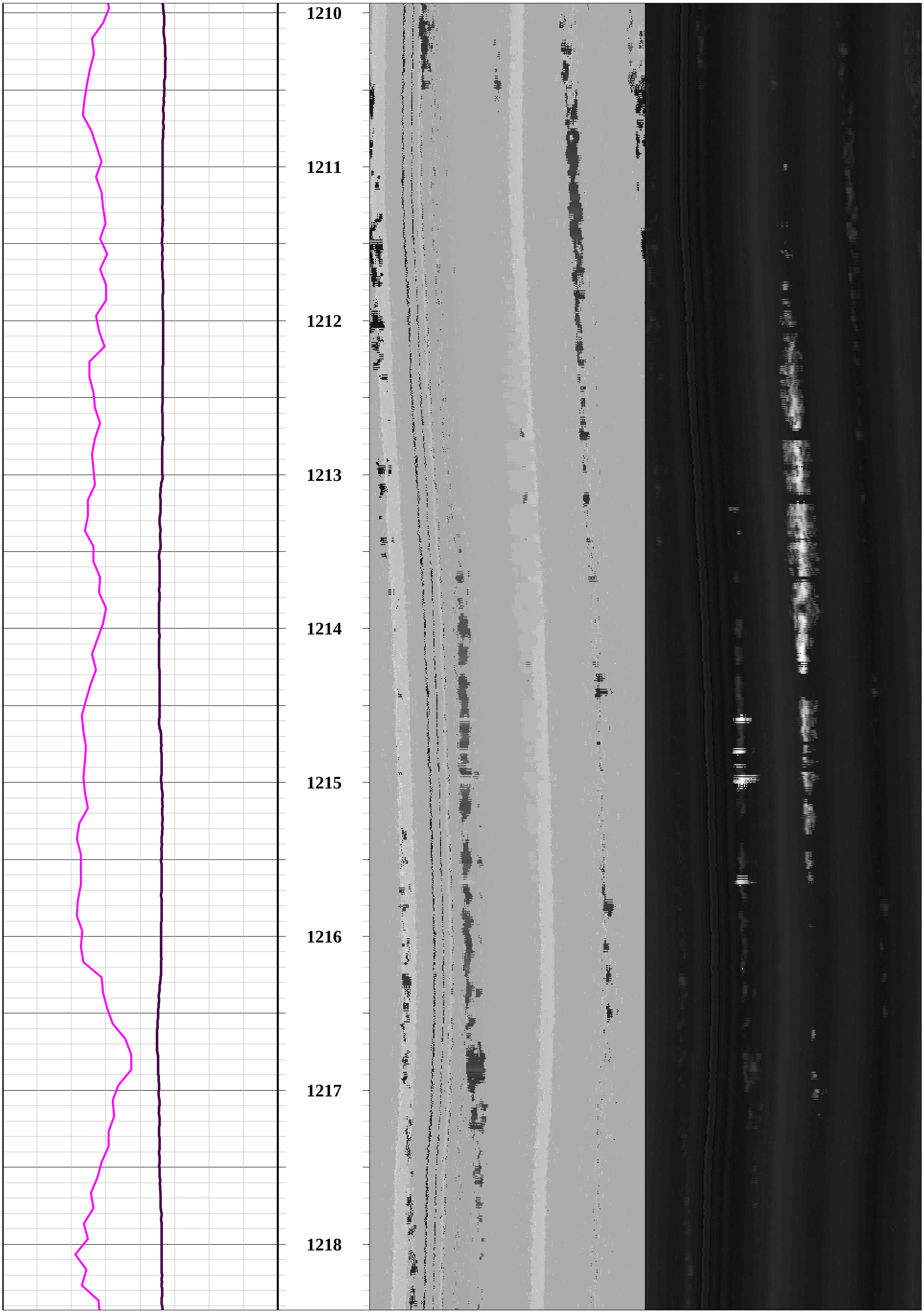
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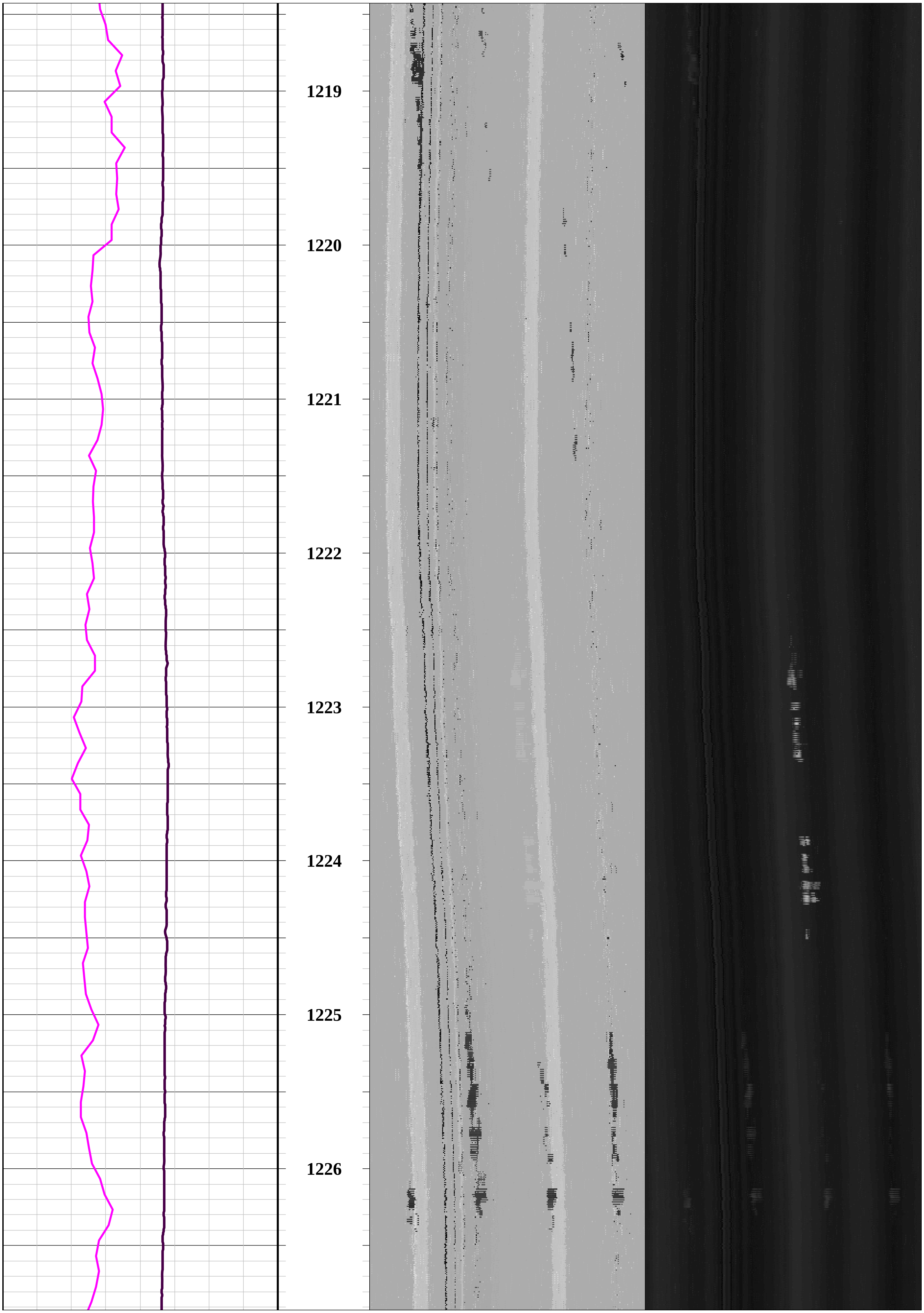
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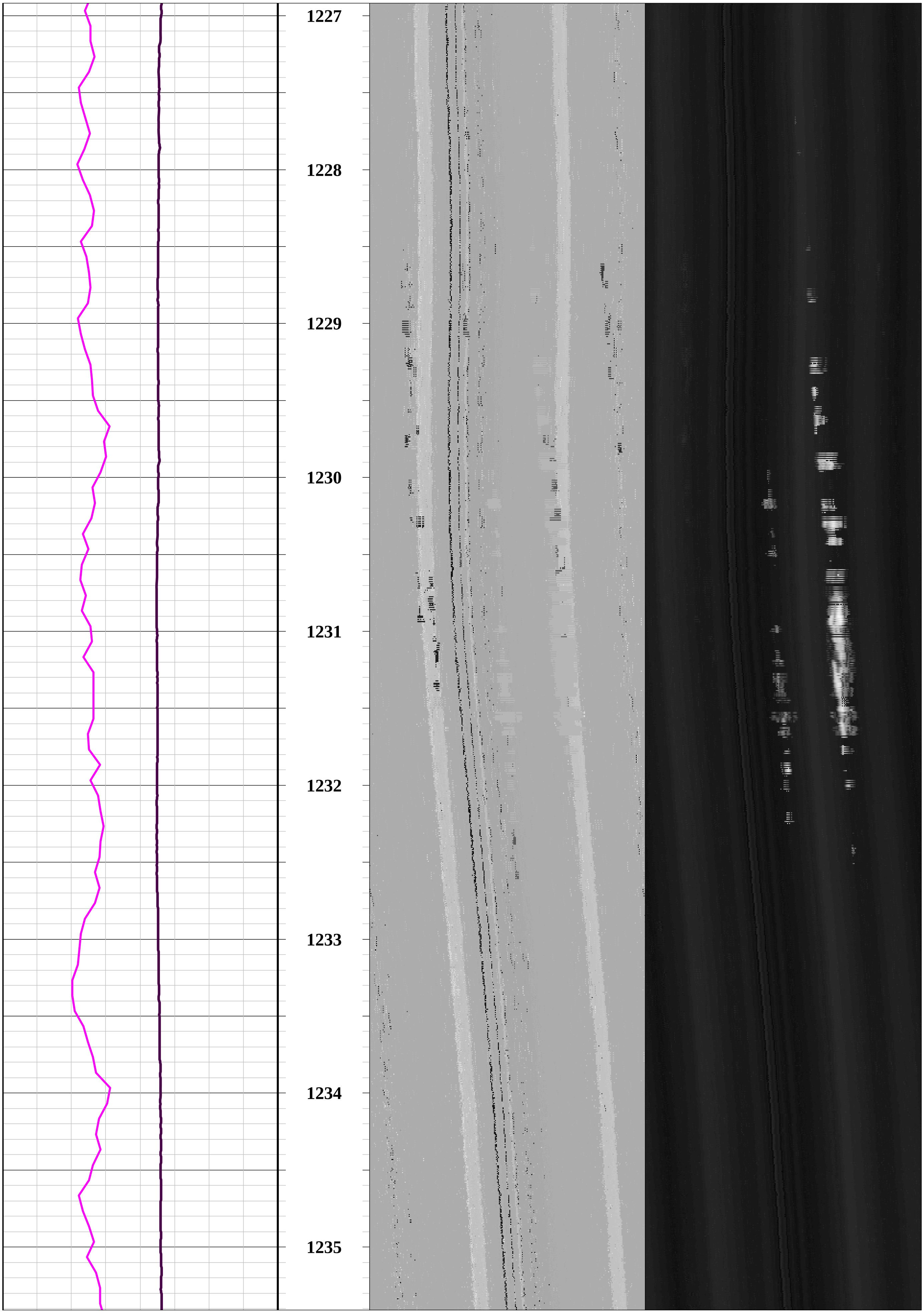
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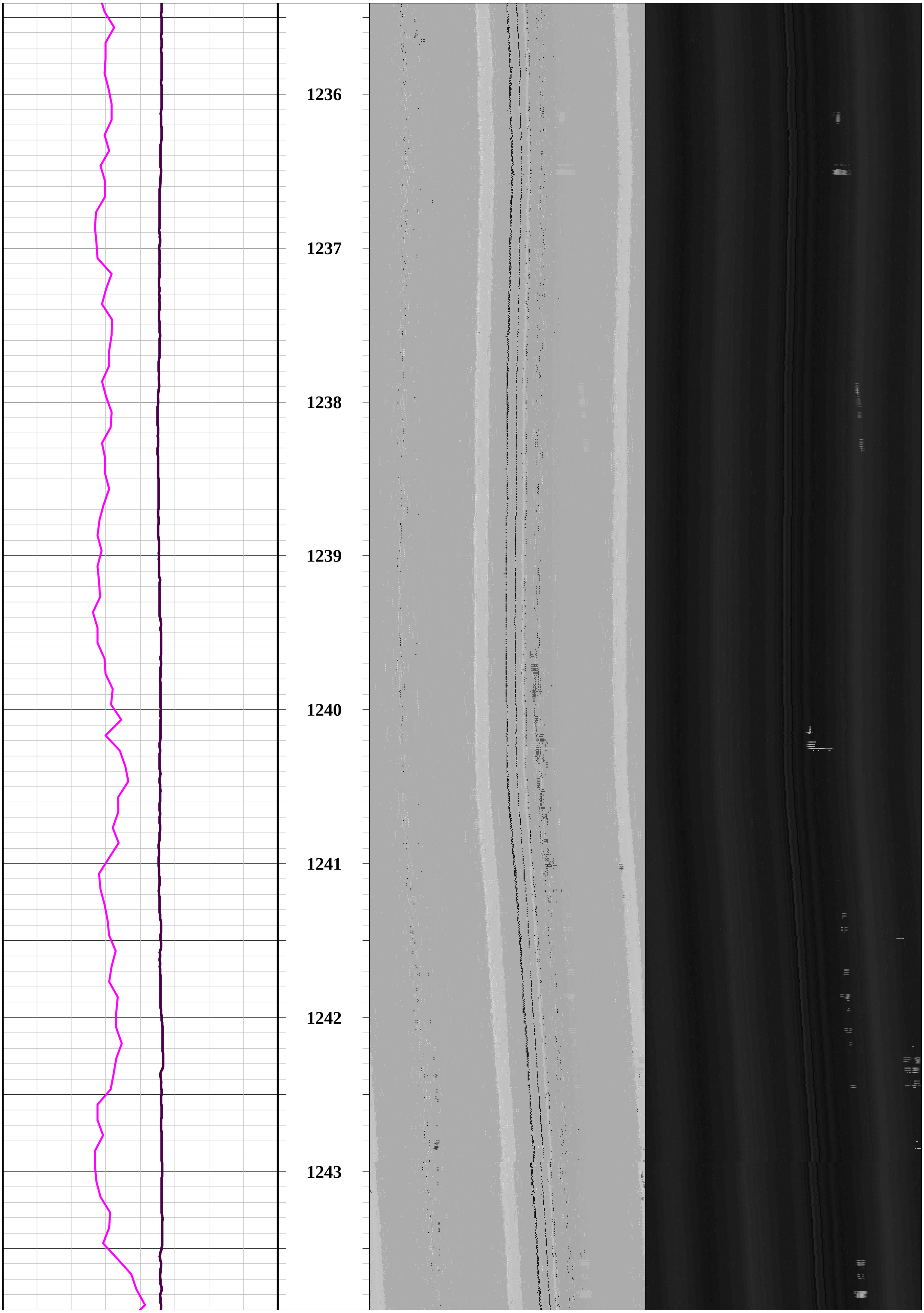
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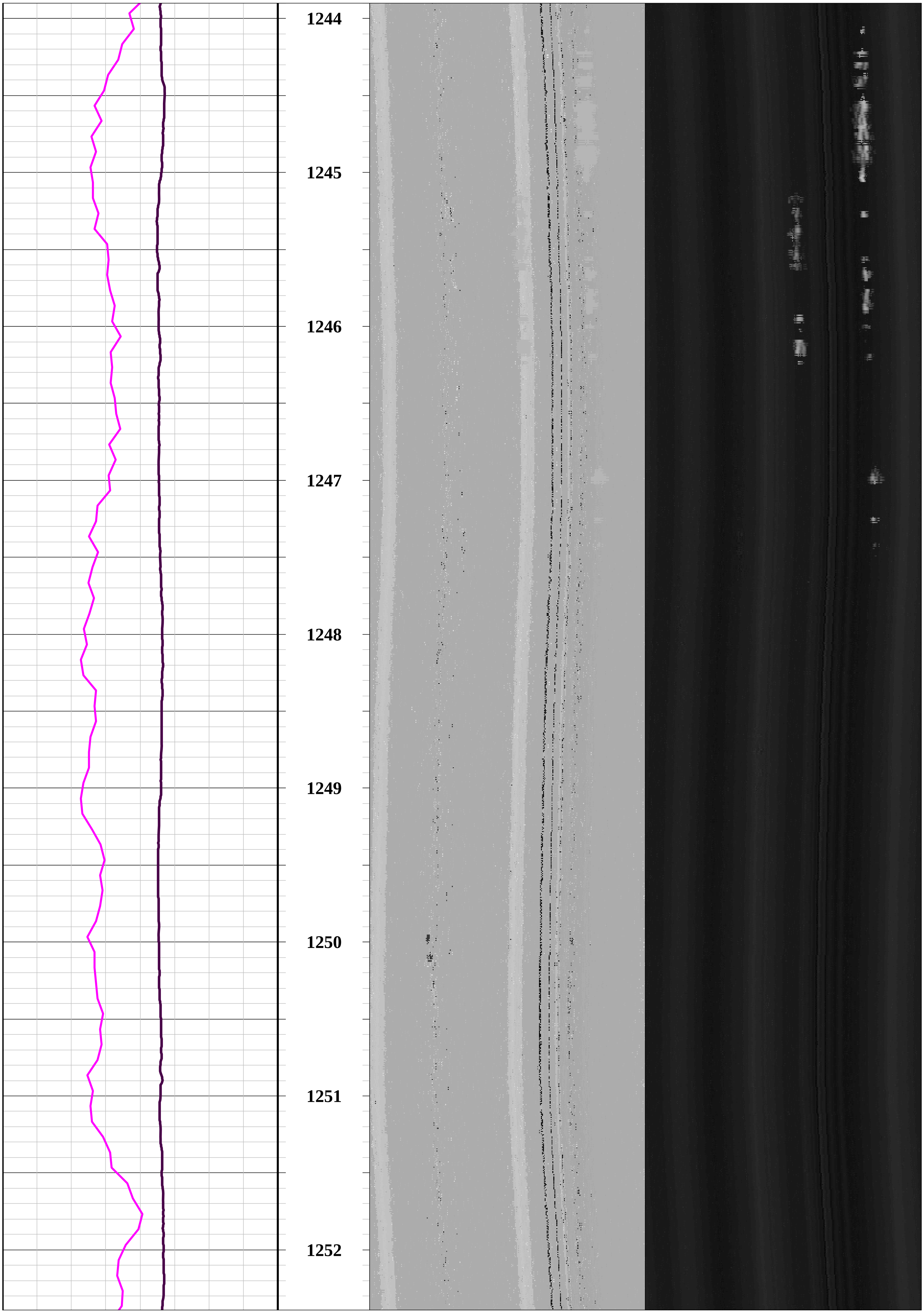
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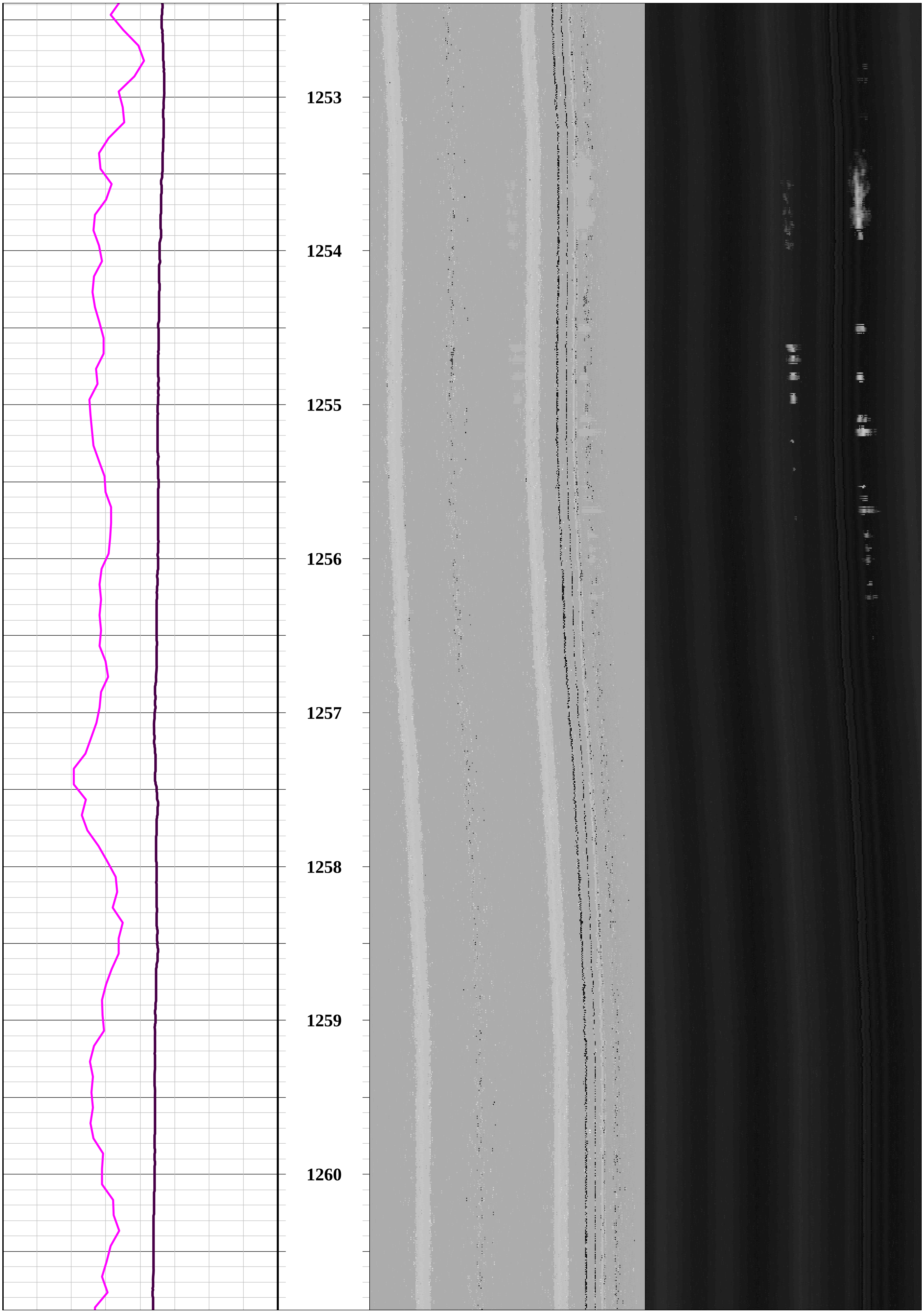

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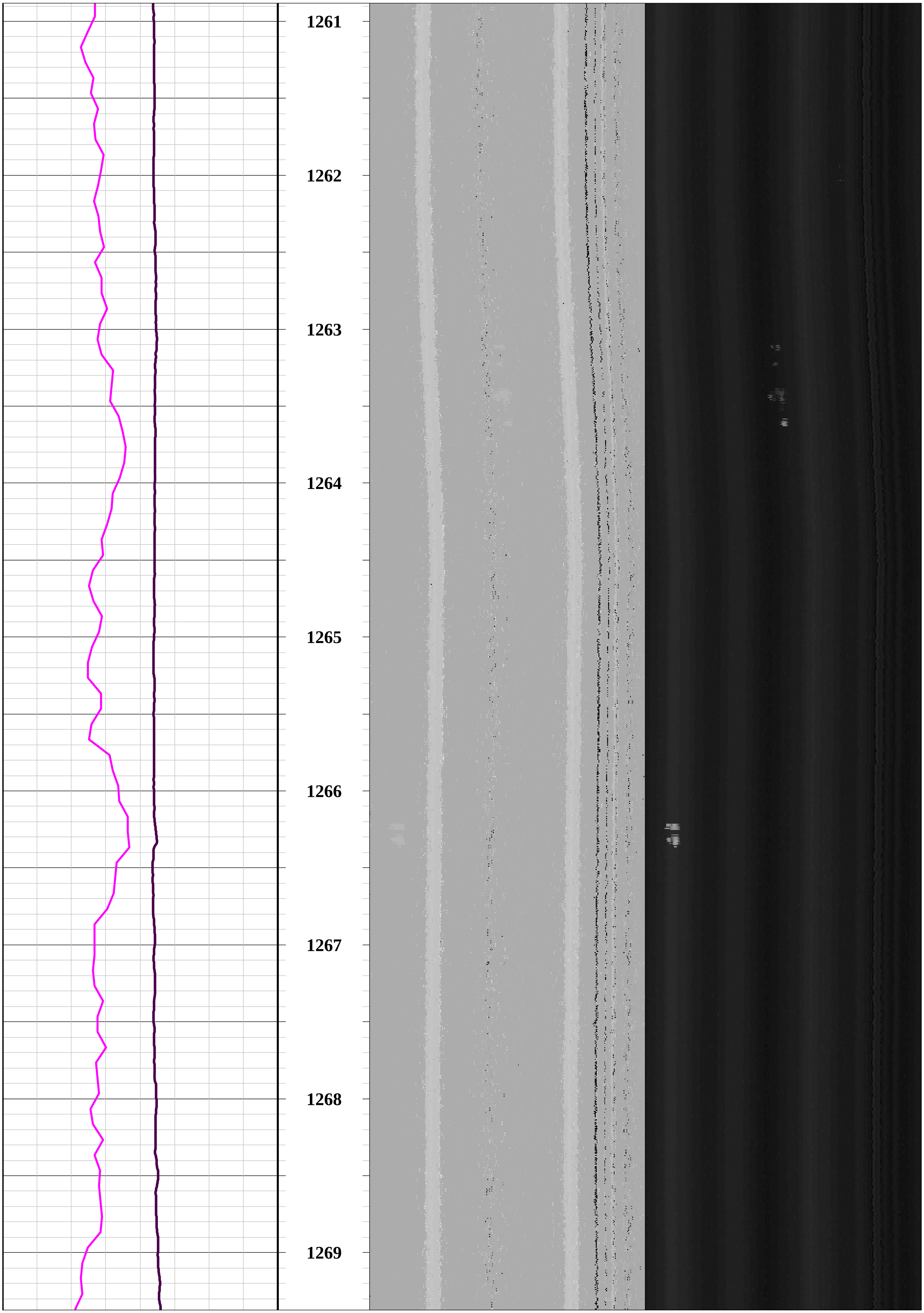
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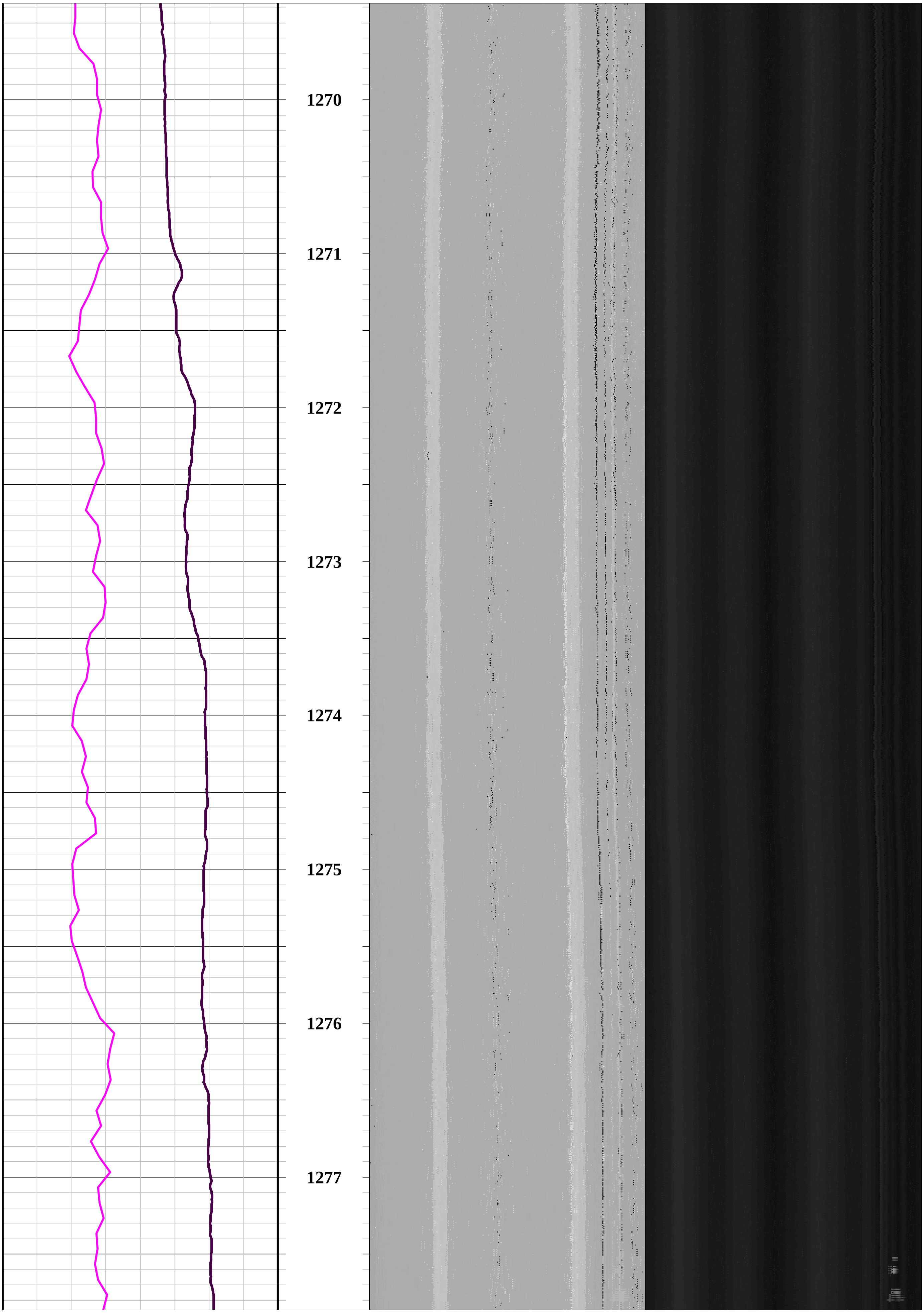
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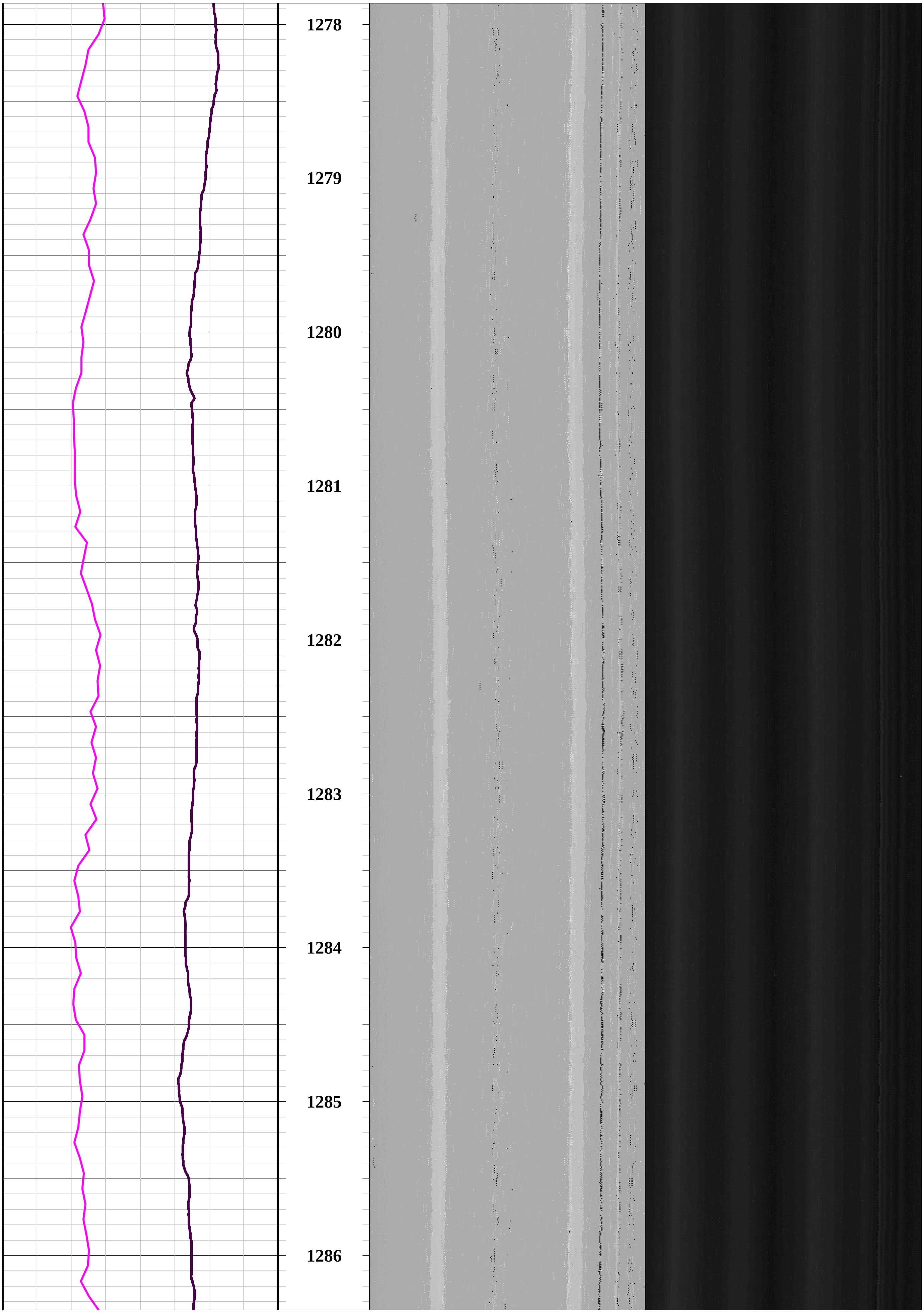
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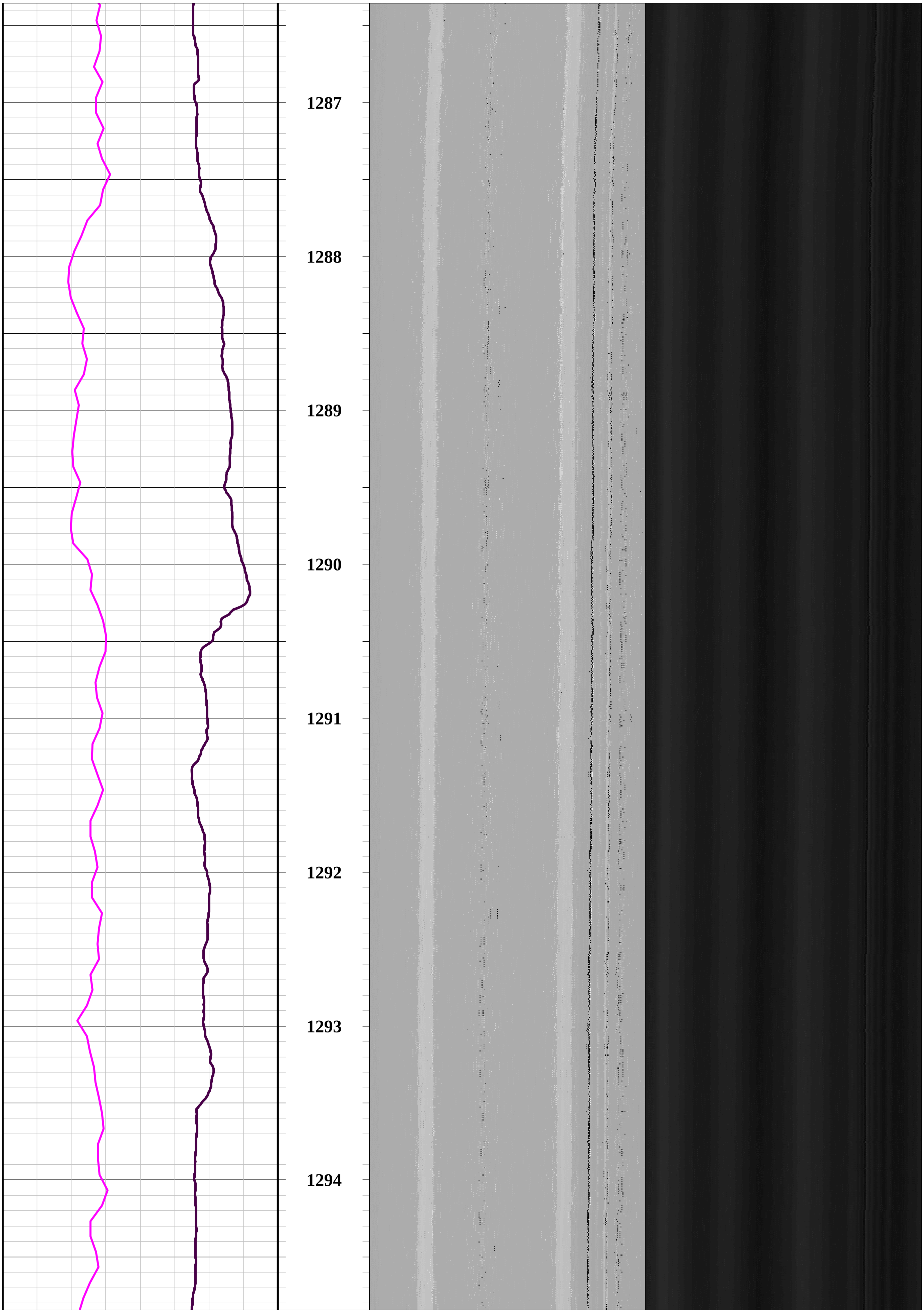
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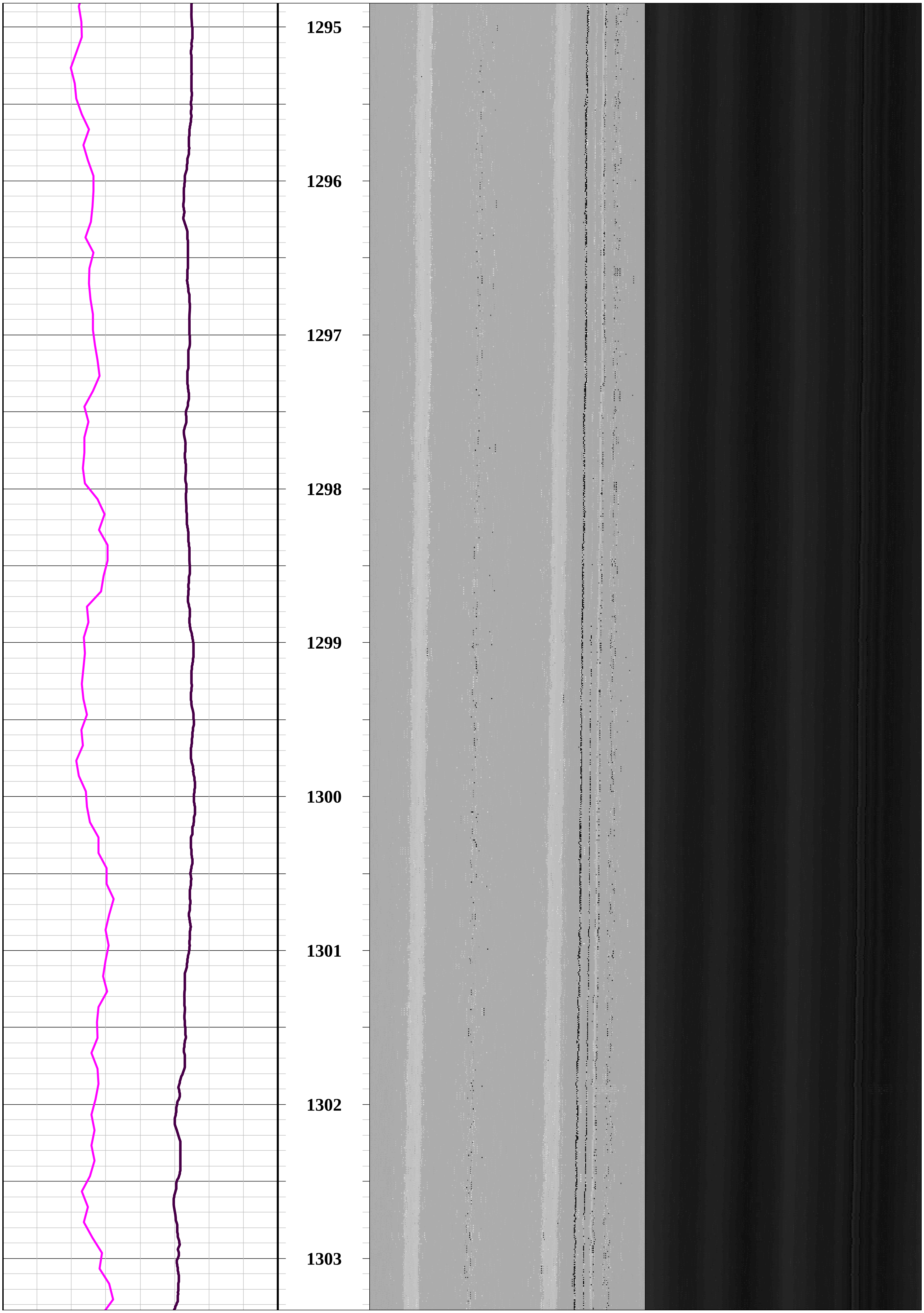
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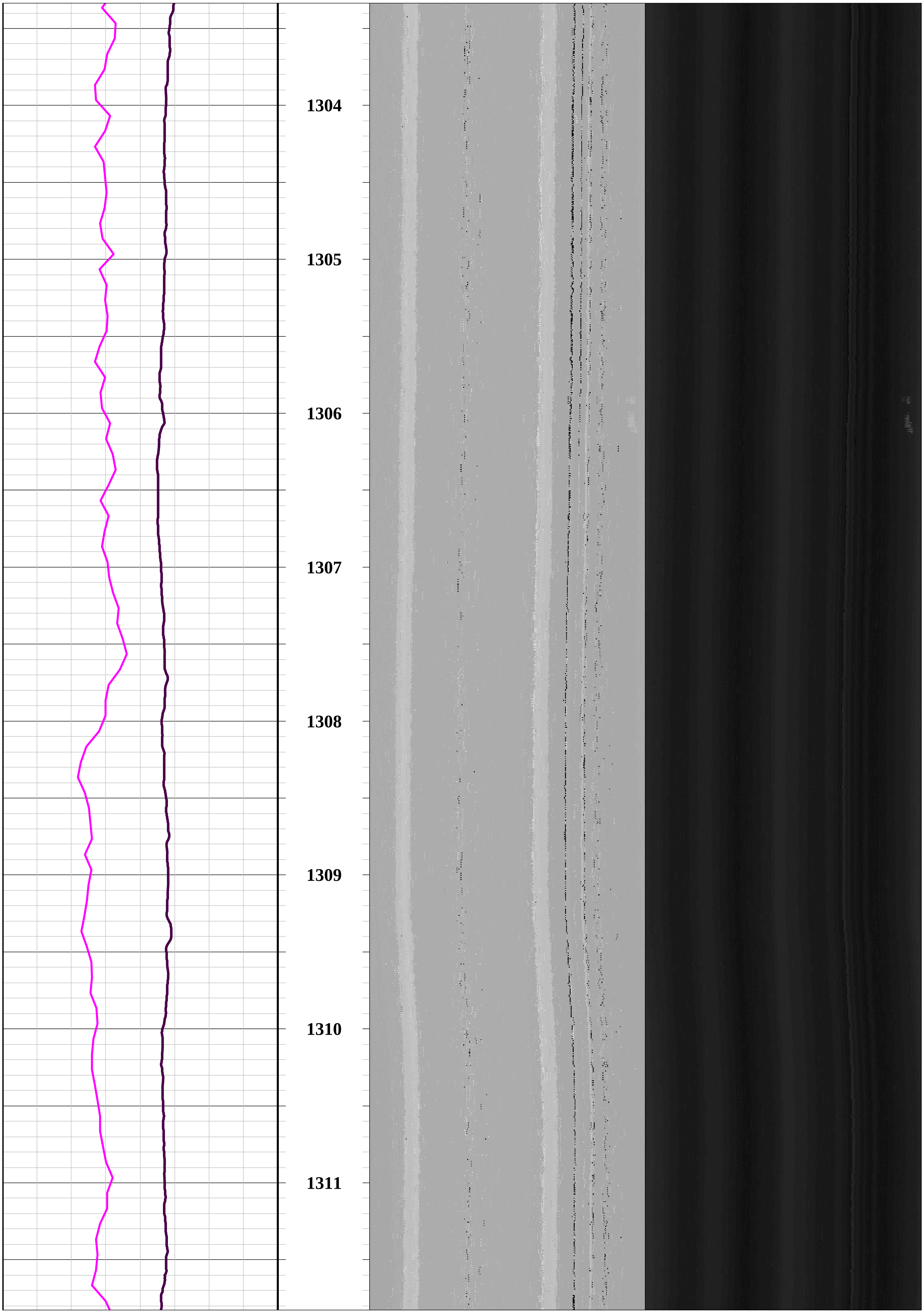
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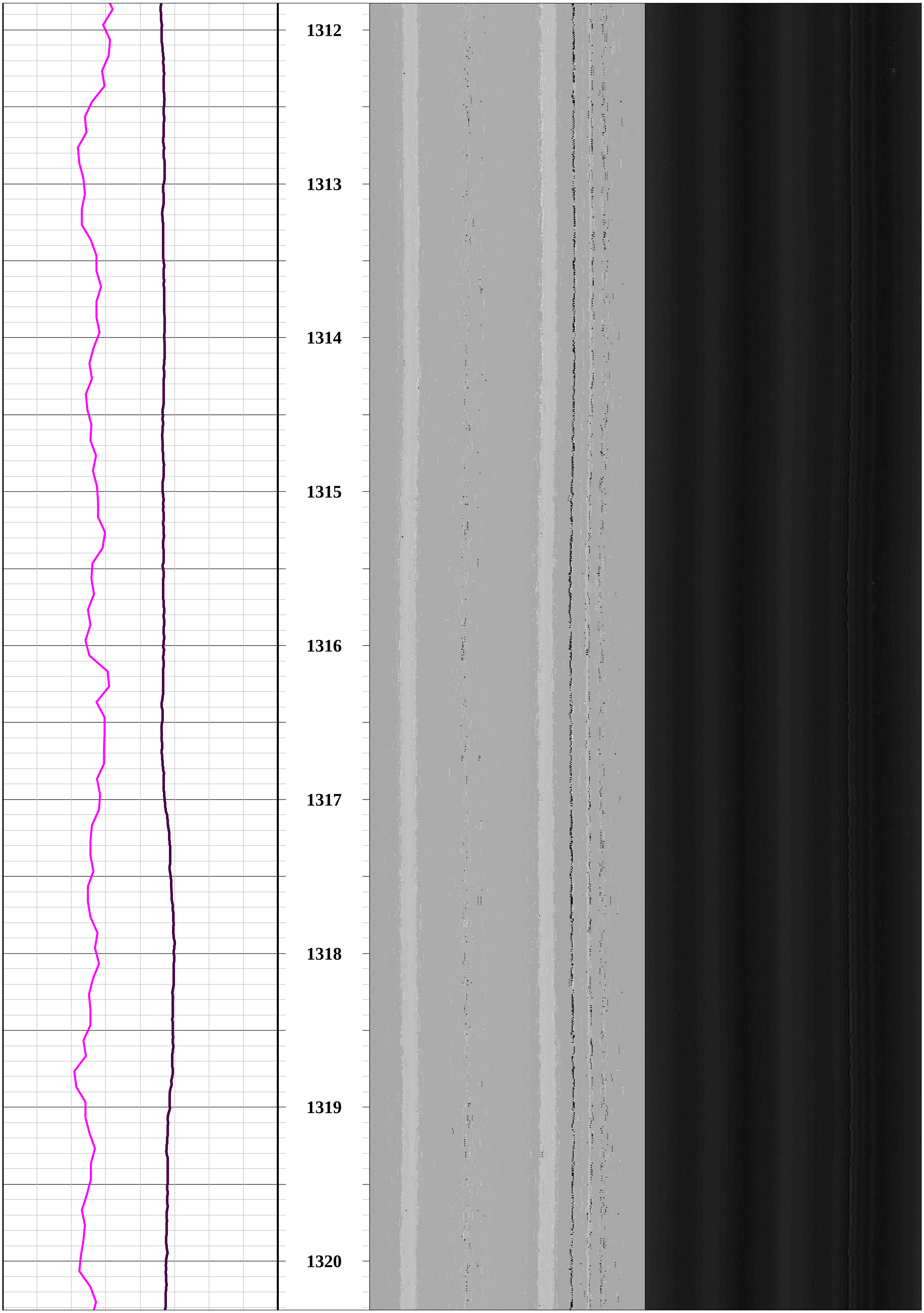
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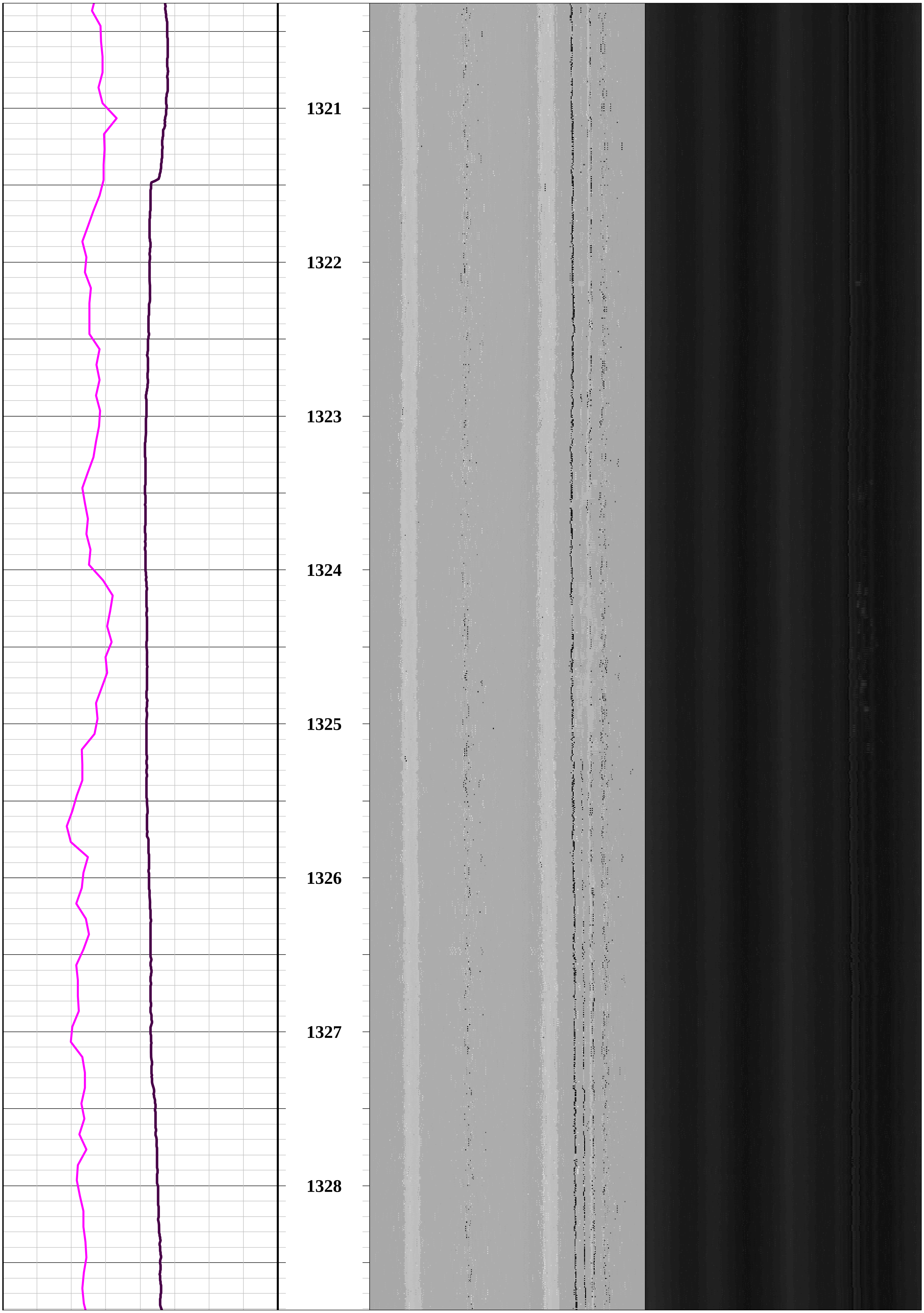
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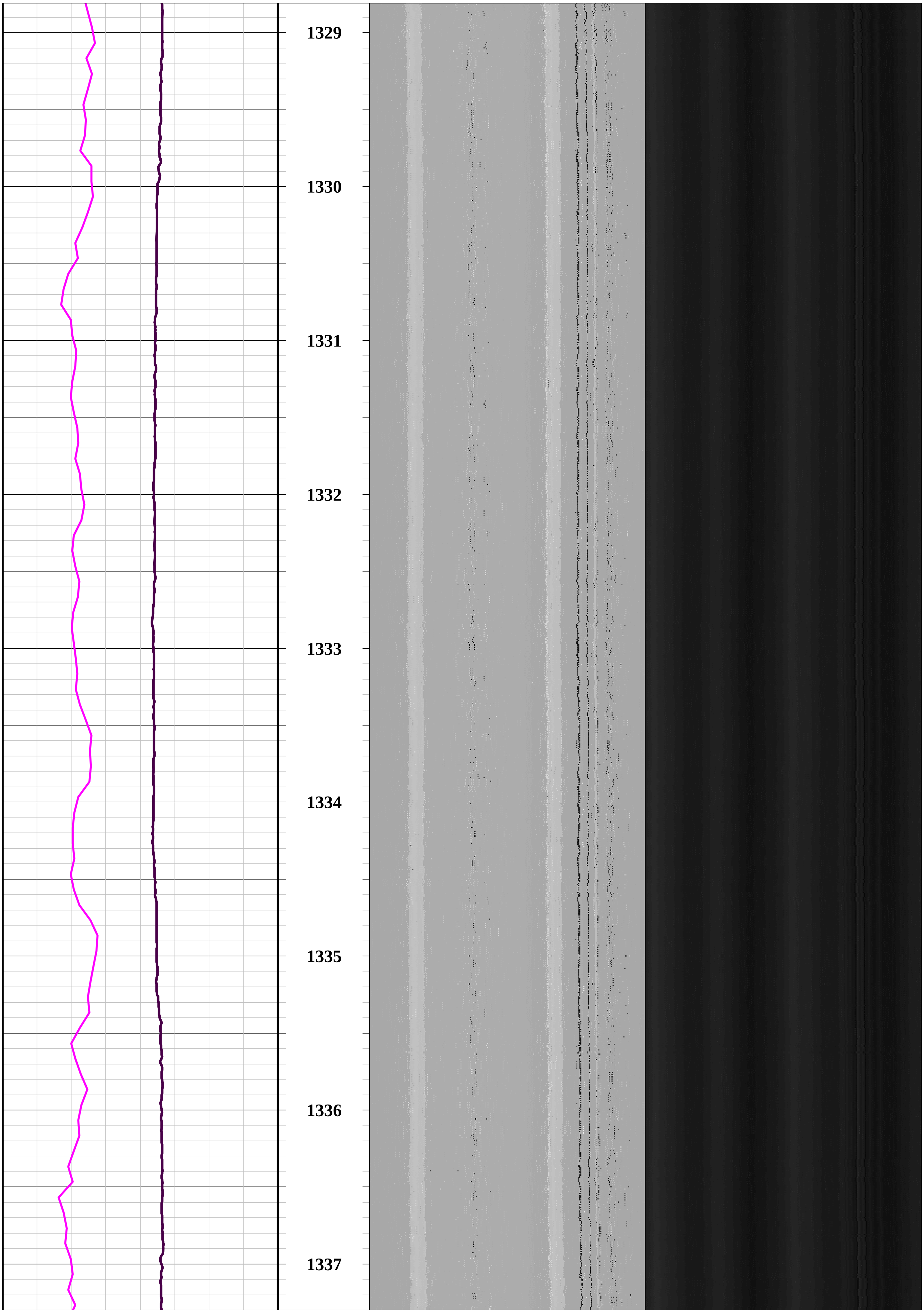
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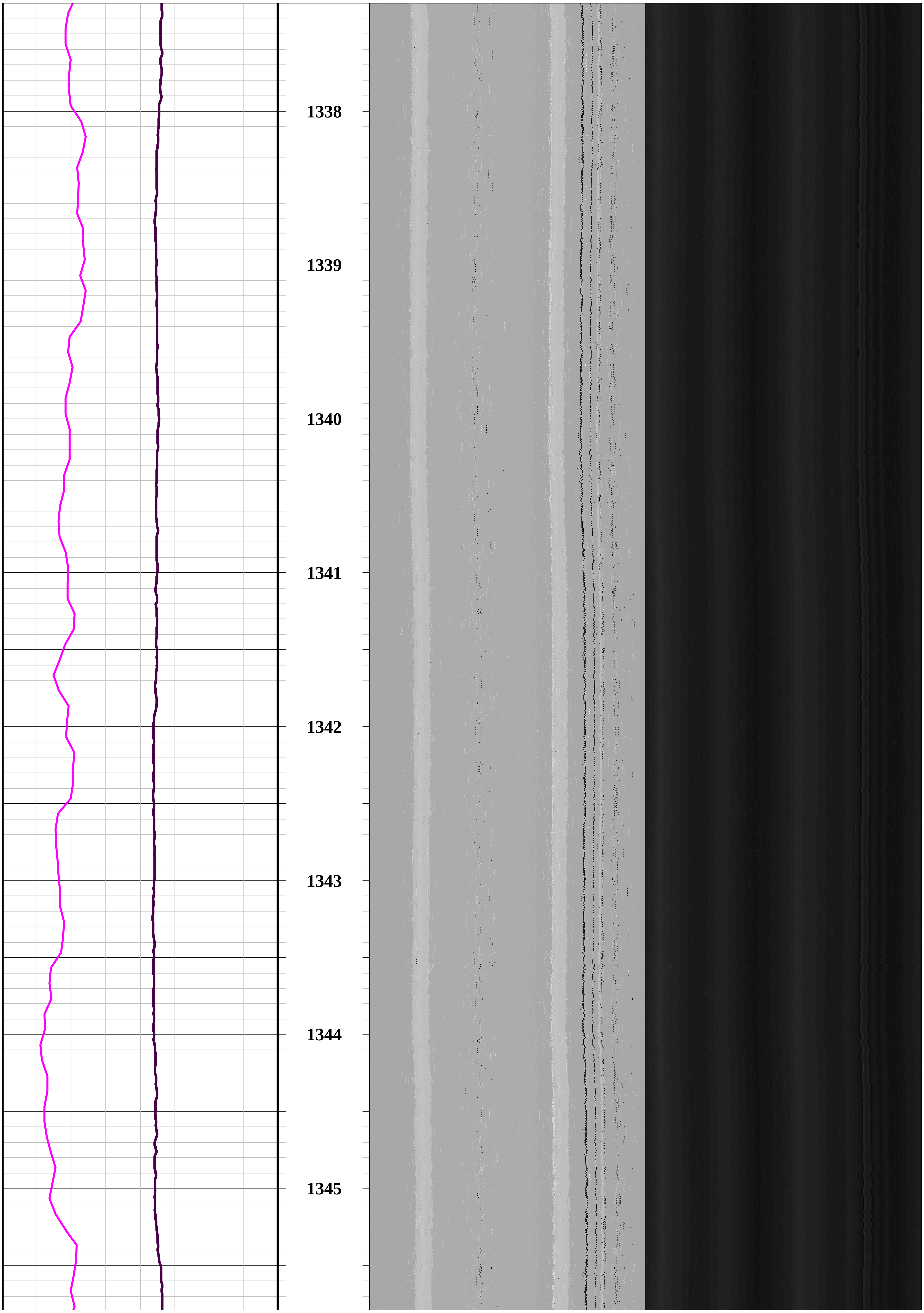
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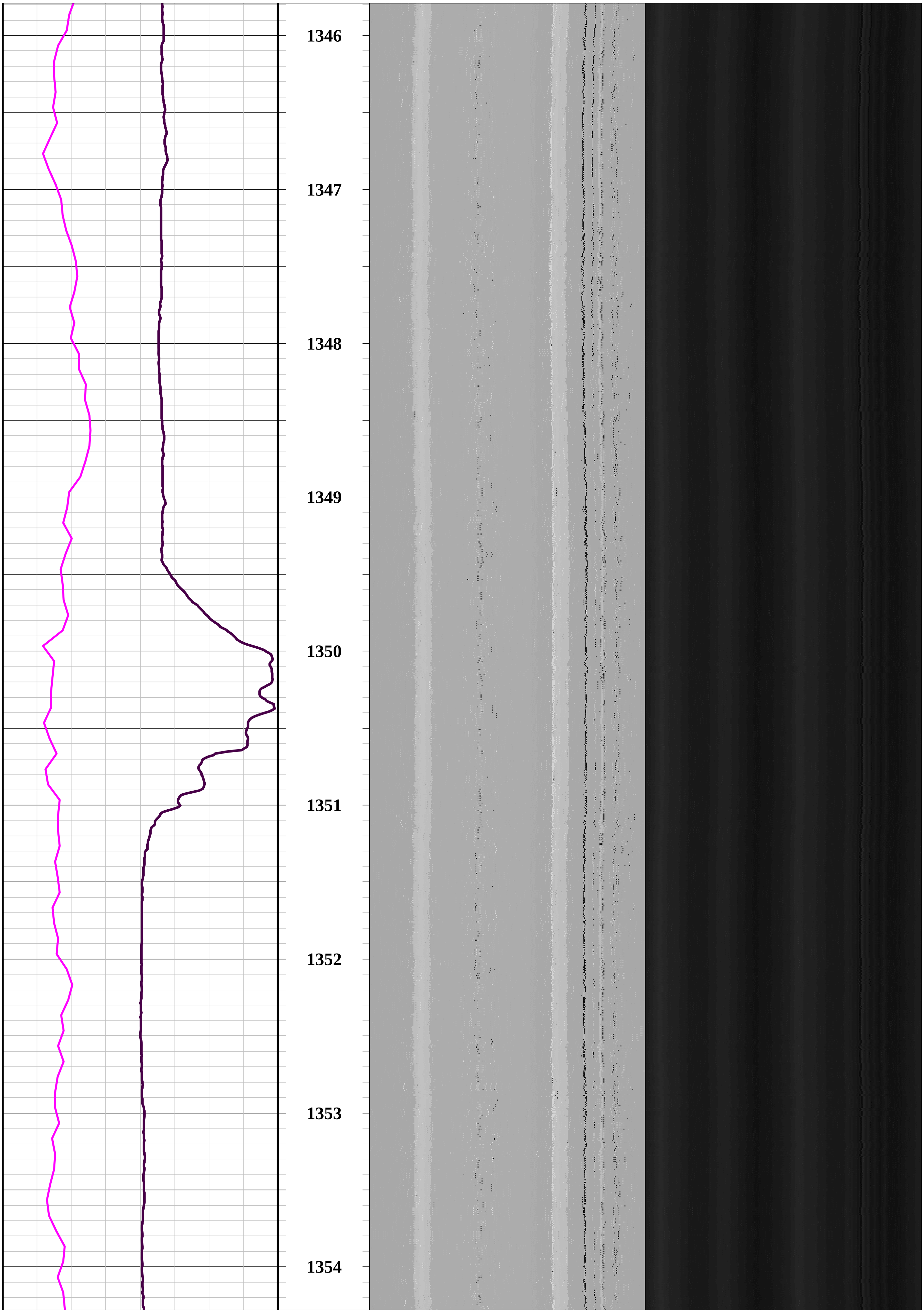
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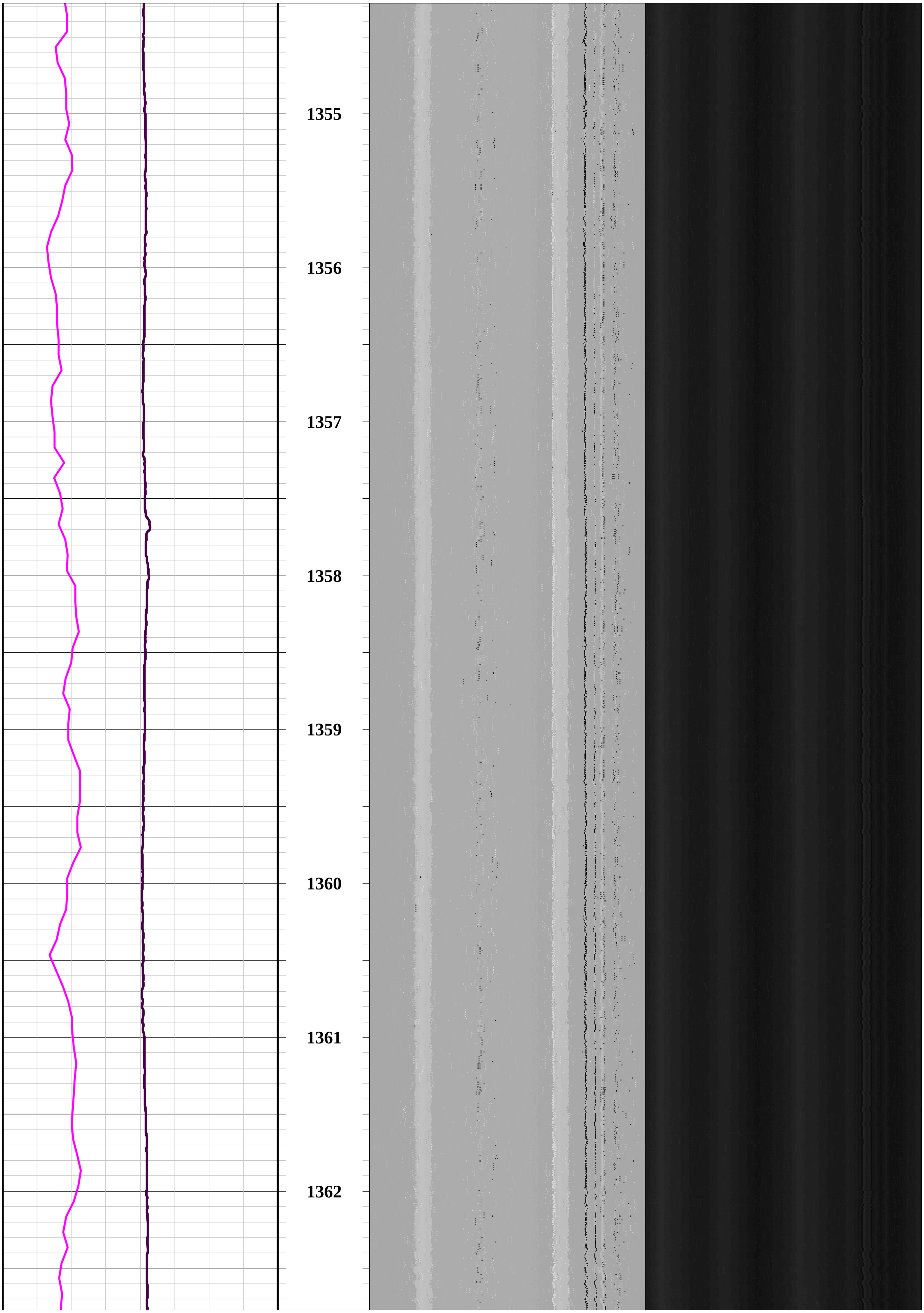
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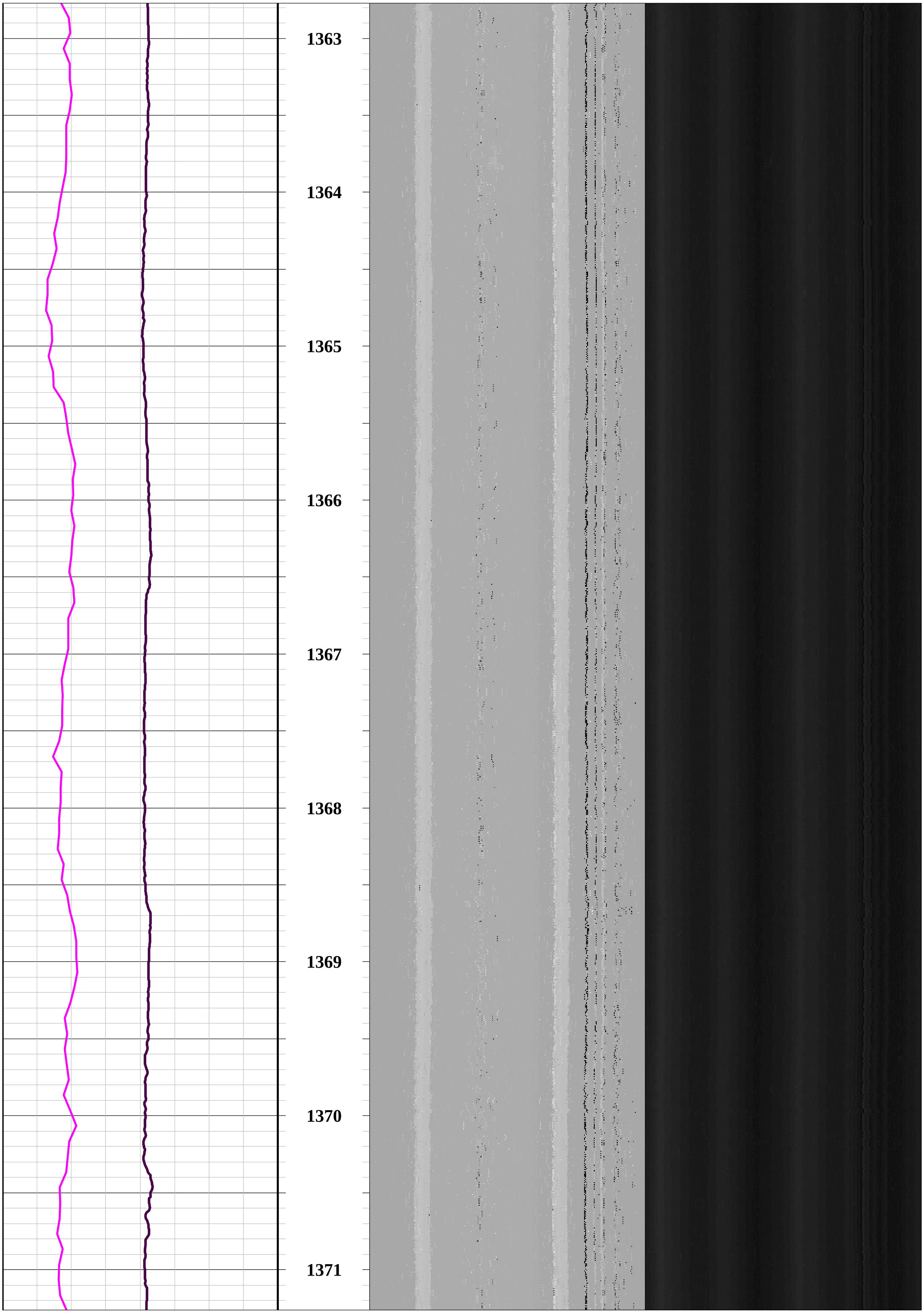
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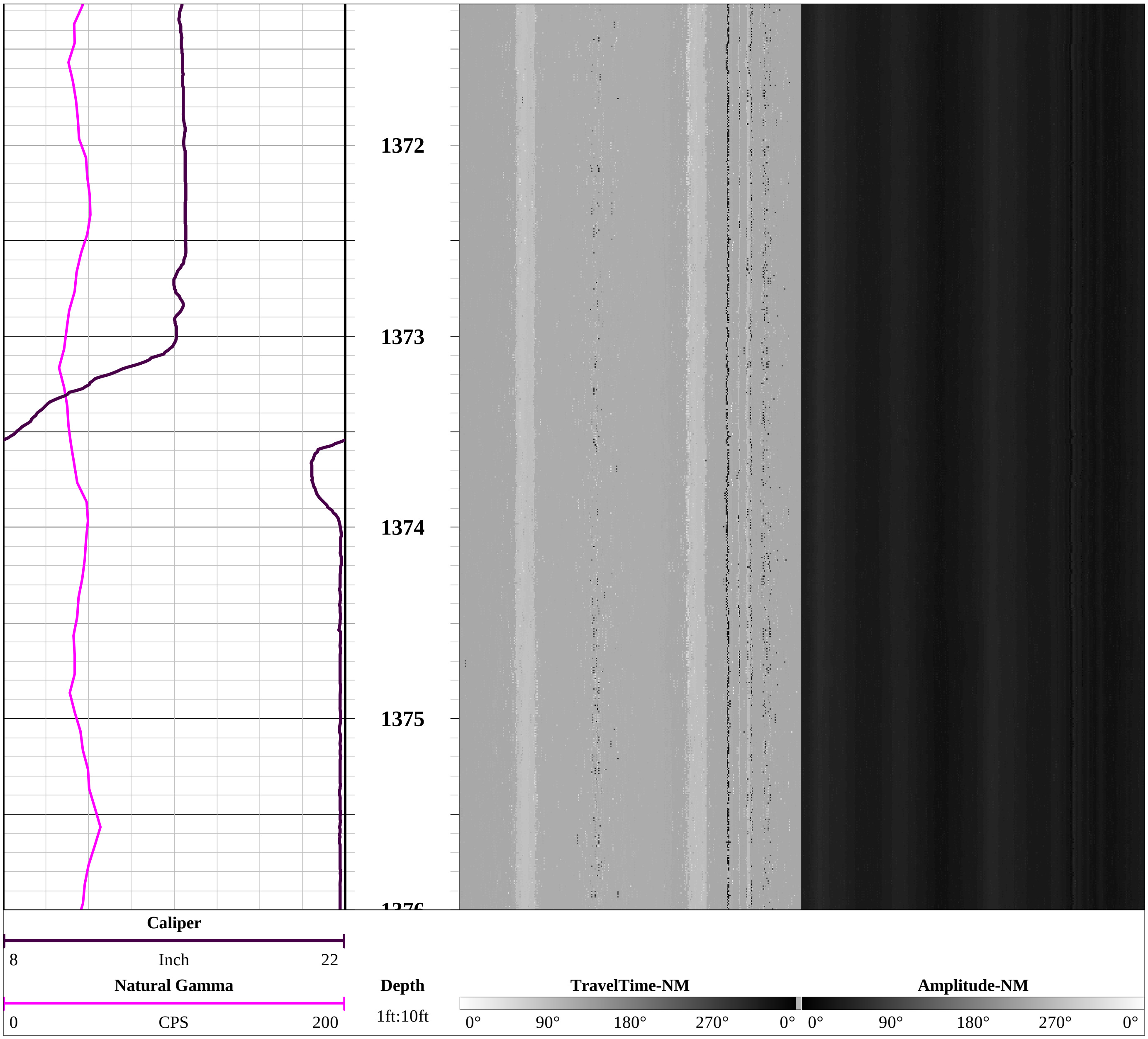


1372
1373
1374
1375
Caliper
8
Inch
22
Natural Gamma
0
CPS
200
Depth
1ft:10ft
TravelTime-NM
0°
90°
180°
270°
0°
Amplitude-NM
0°
90°
180°
270°
0°

APPENDIX D

Borehole Geophysical Logs from Well DHRES-15
Conducted by SWE; interval 0-1,548 feet

DHRES-15 Geophysical Log Summary

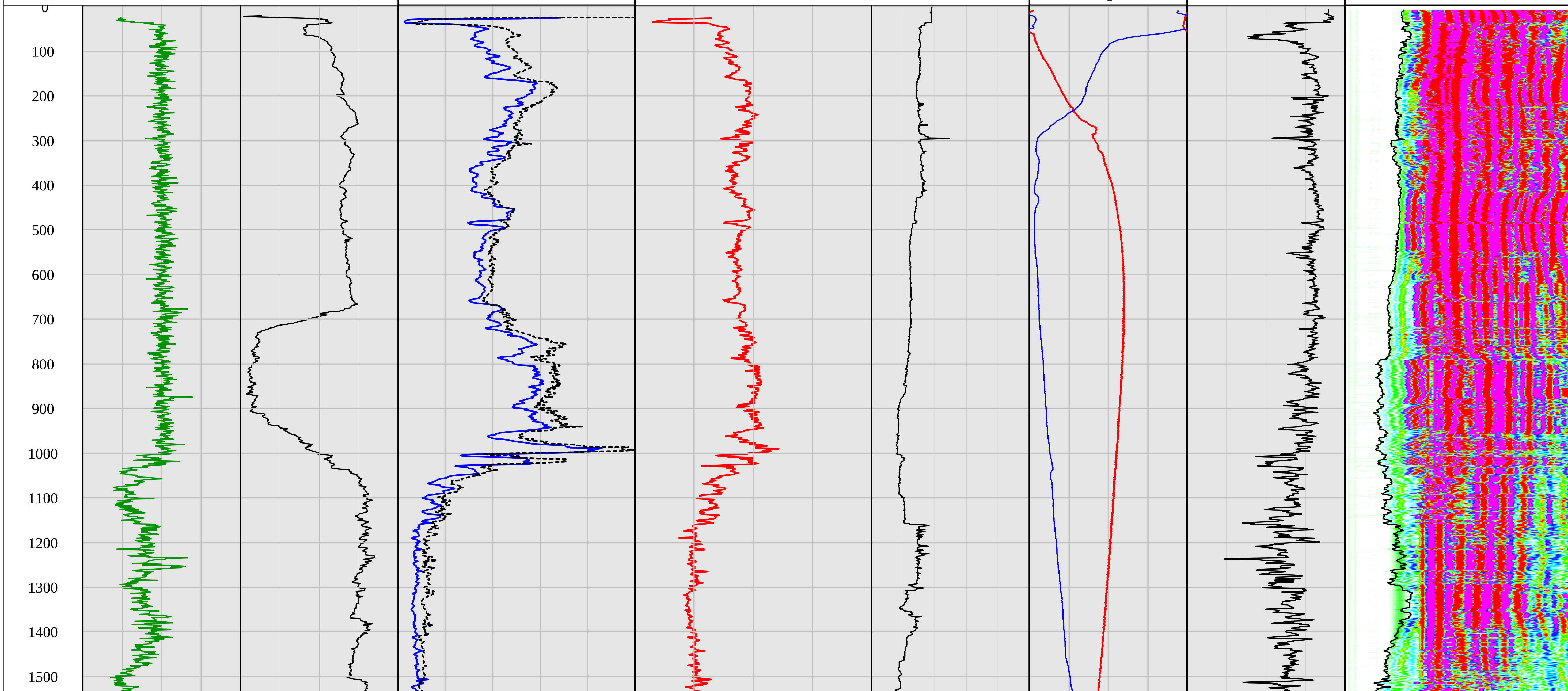
Southwest Exploration Services, LLC
borehole geophysics & video services

MONTGOMERY & ASSOCIATES

COMPANY: E. L. MONTGOMERY & ASSOCIATES
FIELD: RESOLUTION COPPER
WELL ID: DHRES-15
COUNTY: PINAL STATE: ARIZONA

Logging Engineer: K. MITCHELL
Date Logged: 6-07-14
Processed By: K. MITCHELL
Date Processed: 3-16-16

Depth	Nat. Gamma	SP	16" NRes	Single Point Resistance	3-Arm Caliper	Fluid Resistivity	Delta T	RX1 - VDL
1in:230ft	0 API 200	400 mV 1200	0 Ohm-m 100	0 Ohms 80	10 Inches 20	0 Ohm-m 10	240 uSec/ft 40	100 uSec 1020
			64" NRes			Temperature		RX1 - Travel Time
			0 Ohm-m 100			30 Deg C 50		100 uSec 1020



			0 Ohm-m 100			30 Deg C 50		100 uSec 1020
			64" NRes			Temperature		RX1 - Travel Time
1in:230ft	0 API 200	400 mV 1200	0 Ohm-m 100	0 Ohms 80	10 Inches 20	0 Ohm-m 10	240 uSec/ft 40	100 uSec 1020
Depth	Nat. Gamma	SP	16" NRes	Single Point Resistance	3-Arm Caliper	Fluid Resistivity	Delta T	RX1 - VDL

Southwest Exploration Services, LLC
borehole geophysics & video services

COMPANY	RESOLUTION COPPER
WELL ID	DHRES-015 (55-916688)
FIELD	RESOLUTION
COUNTY	PINAL
STATE	ARIZONA

TYPE OF LOGS: GAMMA-CALIPER
MORE: FLUID TEMP-RES

LOCATION
NW 1/4 OF SW 1/4 OF SW 1/4
964978 e, 831076 N

SEC 05 TWP 02 S RGE 13 E

OTHER SERVICES
40 GRP-ELOGS
4 RX SONIC
ABI-43

PERMANENT DATUM	AZ SPC, feet	ELEVATION 3991 ft	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM	D.F.
DRILLING MEAS. FROM	GROUND LEVEL		G.L.

DATE	06-07-14	TYPE FLUID IN HOLE	MUD
RUN No	1	MUD WEIGHT	9.3 LB
TYPE LOG	GAMMA-CALIPER-TFR	VISCOSITY	38 SEC
DEPTH-DRILLER	1548 FT	LEVEL	FULL
DEPTH-LOGGER	1548 FT	MAX. REC. TEMP.	50.8 DEG C
BTM LOGGED INTERVAL	1548 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	SURFACE	SAMPLE INTERVAL	0.1 FT
DRILLER / RIG#	NATIONA RIG # 167	LOGGING TRUCK	TRUCK #300
RECORDED BY / Logging Eng.	K. MITCHELL	TOOL STRING/SN	MSI COMBO SN 4953
WITNESSED BY	M&A MATT SHELLY	LOG TIME:ON SITE/OFF SITE	1201 PM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	37 ft	14"	STEEL	SURFACE	36 FT
2	12 1/4 "	37 ft	1548 ft				
3							

COMMENTS: 5 FT STICKUP ON CASING

.

Tool Summary:

Date	06-07-14	**Date**	06-07-14	**Date**	06-07-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	COMBO TOOL	**Tool Model**	MSI 40 GRP	**Tool Model**	ALT 4 RX SONIC
Tool SN	4953	**Tool SN**	5513	**Tool SN**	5185
From	SURFACE	**From**	SURFACE	**From**	SURFACE
To	1548 FT	**To**	1548 FT	**To**	1548 FT
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	K. MITCHELL
Truck No	300	**Truck No**	300	**Truck No**	300
Operation Check	06-07-14	**Operation Check**	06-07-14	**Operation Check**	06-07-14
Calibration Check	06-06-14	**Calibration Check**	06-01-14	**Calibration Check**	N/A
Time Logged	12:45 PM	**Time Logged**	2:00 PM	**Time Logged**	

Date	06-07-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT ABI-43	**Tool Model**		**Tool Model**	
Tool SN	90601	**Tool SN**		**Tool SN**	
From	SURACE	**From**		**From**	
To	1548 FT	**To**		**To**	
Recorded By	K. MITCHELL	**Recorded By**		**Recorded By**	
Truck No	300	**Truck No**		**Truck No**	
Operation Check	06-07-14	**Operation Check**		**Operation Check**	
Calibration Check	N/A	**Calibration Check**		**Calibration Check**	
Time Logged	5:30	**Time Logged**		**Time Logged**	

Additional Comments:

Caliper Arms Used: 9" **Calibration Points:** 6 & 12"

Disclaimer:

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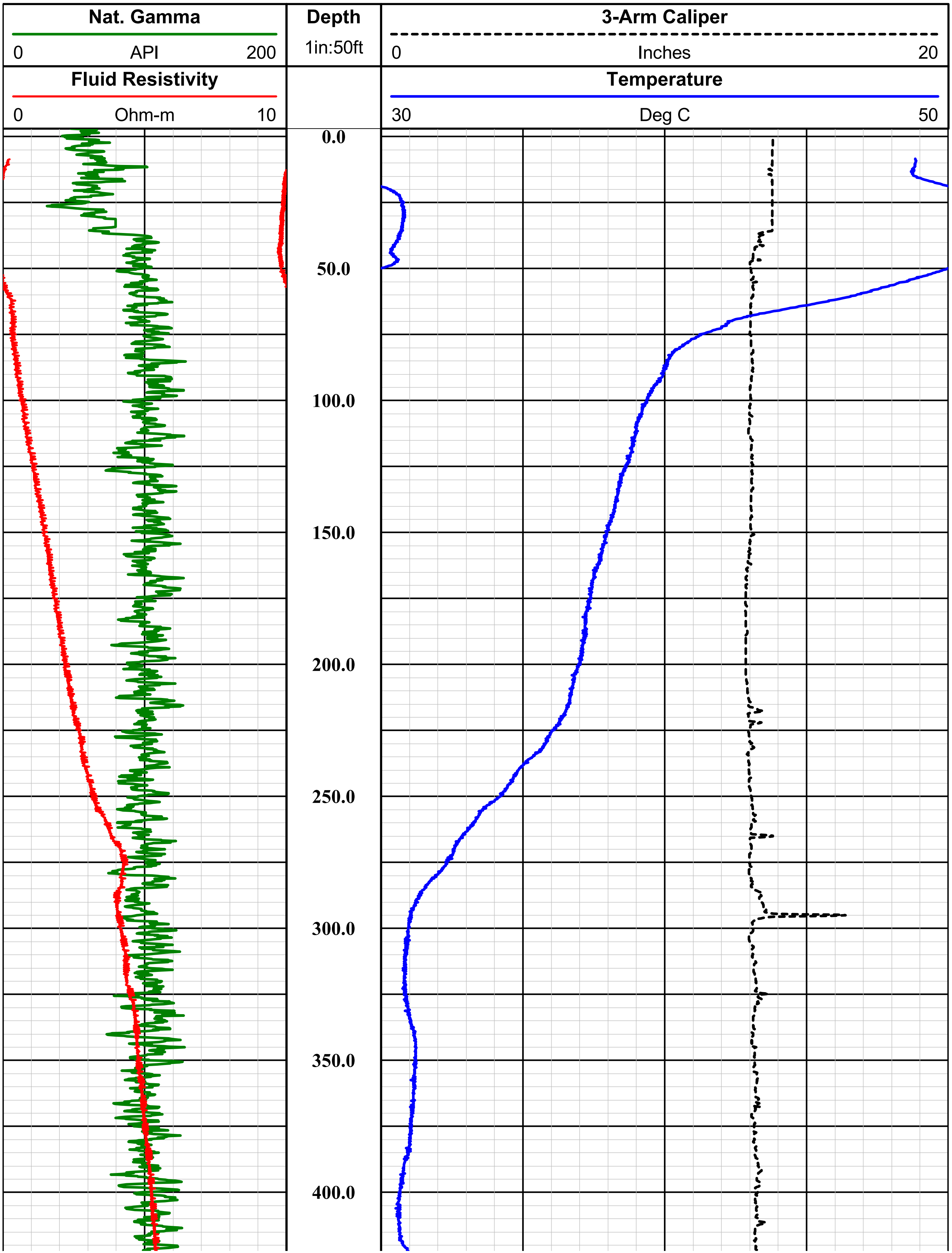

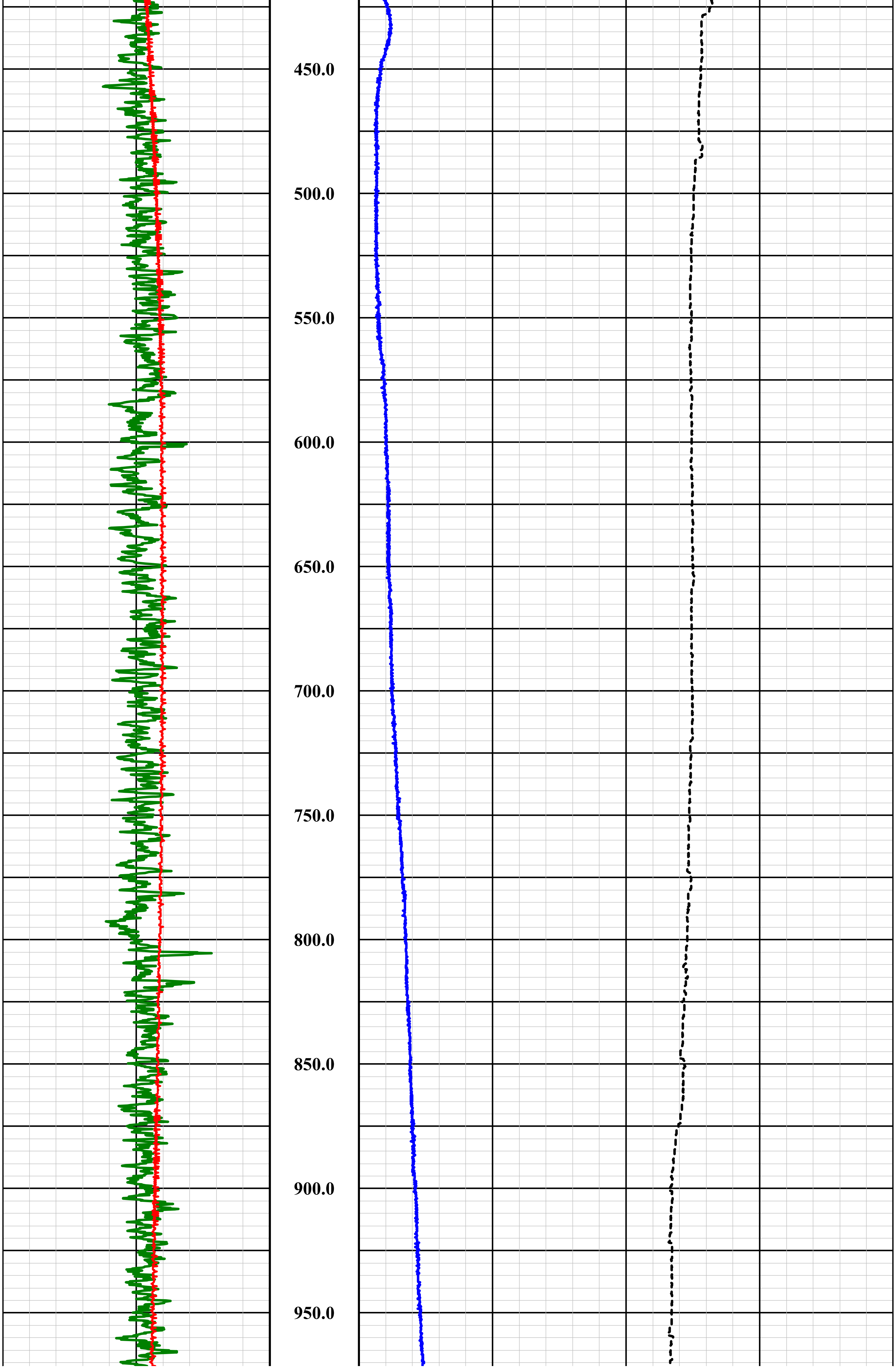
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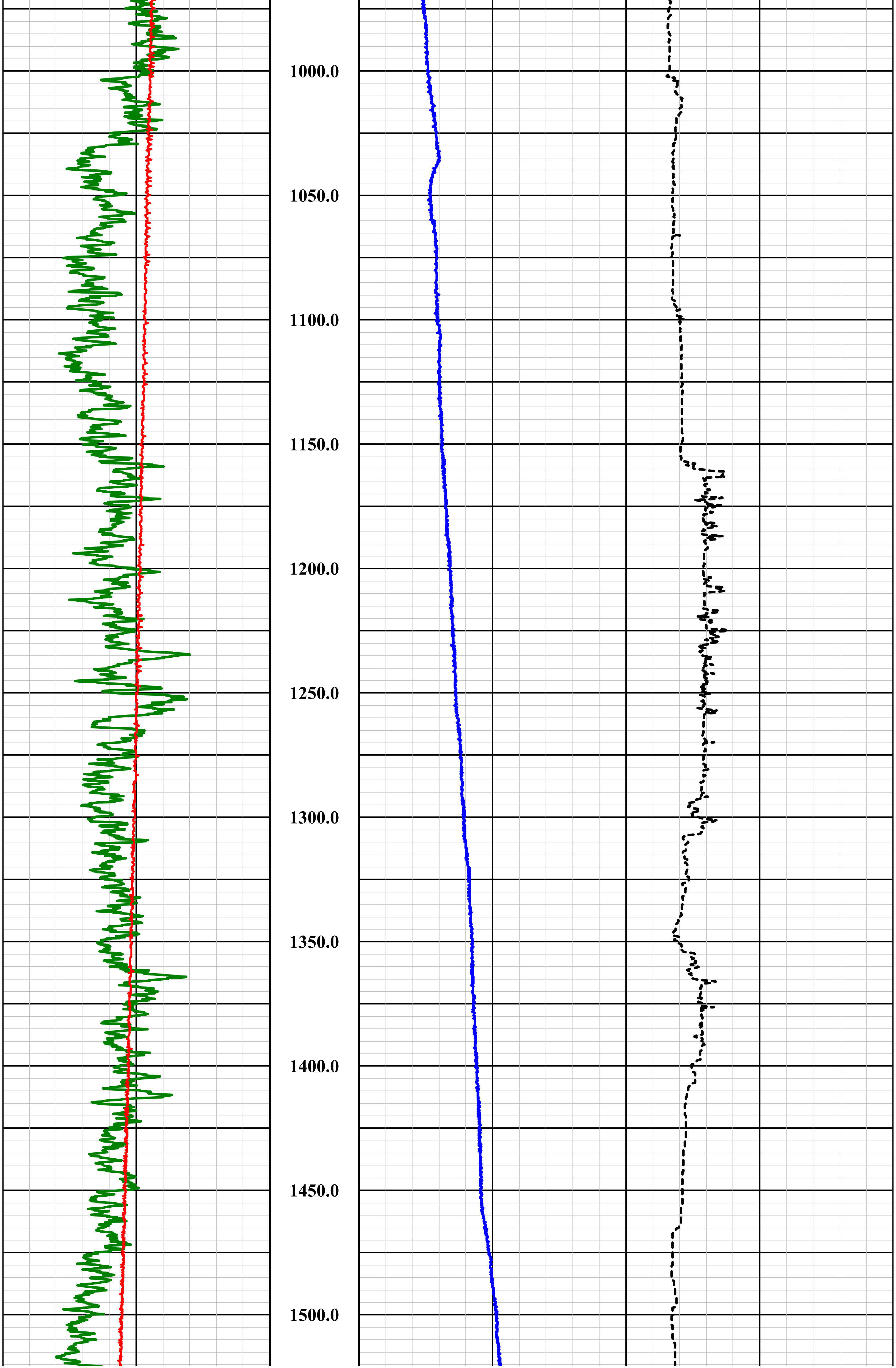
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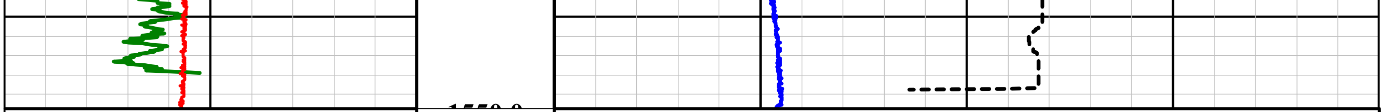


0 Ohm-m 10 **Fluid Resistivity**		30 Deg C 50 **Temperature**
0 API 200 **Nat. Gamma**	1in:50ft **Depth**	0 Inches 20 **3-Arm Caliper**

MSI Gamma-Caliper-Temperature-Fluid Resistivity SN 4953

Probe Top = Depth Ref.

Single Conductor MSI Probe Top

Probe Length = 2.59 m or 8.5 ft
Probe Weight = 6.80 kg or 15.0 lbs

Natural Gamma and Caliper can only be collected logging up hole.

Fluid Temperature/Resistivity can only be collected logging down hole.

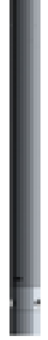
Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)

Natural Gamma Ray = 0.76 m (29.75 in)

3-Arm Caliper = 1.44 m (56.75 in)

Distance from tool top: 2.20 m (86.5 in)

Available Arm Sizes: 3", 9", and 15"



1.375" or 34.9 mm Diameter

Southwest Exploration Services, LLC
borehole geophysics & video services

Company	RESOLUTION COPPER
Well	DHRES-14
Field	RESOLUTION
County	PINAL
State	ARIZONA

Preliminary GCT SUMMARY

Southwest Exploration Services, LLC
borehole geophysics & video services

COMPANY	RESOLUTION COPPER		
WELL ID	DHRES-015 (55-916688)		
FIELD	RESOLUTION		
COUNTY	PINAL	STATE	ARIZONA

TYPE OF LOGS: E-LOGS
MORE: NAT. GAMMA

LOCATION
NW 1/4 OF SW 1/4 OF SW 1/4
964978 E, 831076 N

SEC 05 TWP 02 S RGE 13 E

OTHER SERVICES
CALIPER
FLUID TEMP/RES
4 RX SONIC
ABI-43

PERMANENT DATUM	AZ SPC, feet	ELEVATION	3991 ft	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND LEVEL			G.L.

DATE	06-07-14	TYPE FLUID IN HOLE	MUD
RUN No	1	MUD WEIGHT	9.3 LB
TYPE LOG	E-LOGS	VISCOSITY	38
DEPTH-DRILLER	1548 FT	LEVEL	FULL
DEPTH-LOGGER	1548 FT	MAX. REC. TEMP.	50.8 DEG C
BTM LOGGED INTERVAL	1548 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	SURFACE	SAMPLE INTERVAL	0.2 FT
DRILLER / RIG#	NATIONAL EW&P	LOGGING TRUCK	TRUCK # 300
RECORDED BY / Logging Eng.	K. MITCHELL	TOOL STRING/SN	MSI-40GRP SN 5513
WITNESSED BY	M&A MATT SHELLY	LOG TIME:ON SITE/OFF SITE	1201 PM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	37 ft	14"	STEEL	SURFACE	36 FT
2	12 1/4 IN	37 ft	1548 FT				
3							

COMMENTS: 5 FT STICKUP ON CASING

.

Tool Summary:

Date	06-07-14	**Date**	06-07-14	**Date**	06-07-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	COMBO TOOL	**Tool Model**	MSI 40 GRP	**Tool Model**	ALT 4 RX SONIC
Tool SN	4953	**Tool SN**	5513	**Tool SN**	5185
From	SURFACE	**From**	SURFACE	**From**	SURFACE
To	1548 FT	**To**	1548 FT	**To**	1548 FT
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	K. MITCHELL
Truck No	300	**Truck No**	300	**Truck No**	300
Operation Check	06-07-14	**Operation Check**	06-07-14	**Operation Check**	06-07-14
Calibration Check	06-06-14	**Calibration Check**	06-01-14	**Calibration Check**	N/A
Time Logged	12:45 PM	**Time Logged**	2:00 PM	**Time Logged**	3:20 PM

Date	06-07-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT ABI-43	**Tool Model**		**Tool Model**	
Tool SN	90601	**Tool SN**		**Tool SN**	
From	SURACE	**From**		**From**	
To	1548 FT	**To**		**To**	
Recorded By	K. MITCHELL	**Recorded By**		**Recorded By**	
Truck No	300	**Truck No**		**Truck No**	
Operation Check	06-07-14	**Operation Check**		**Operation Check**	
Calibration Check	N/A	**Calibration Check**		**Calibration Check**	
Time Logged	5:30 PM	**Time Logged**		**Time Logged**	

Additional Comments:

Caliper Arms Used: 9"　　**Calibration Points:** 6 & 12"

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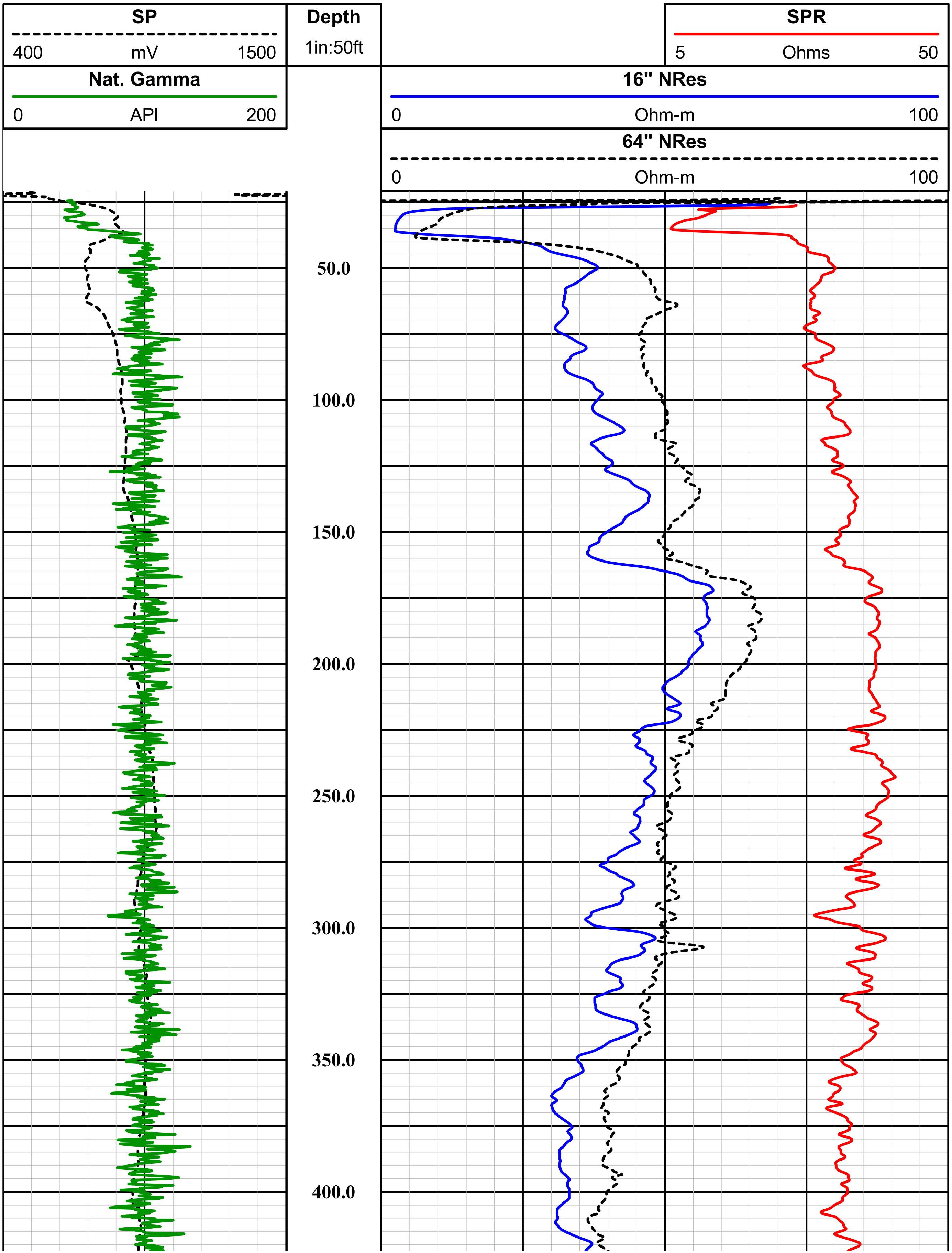

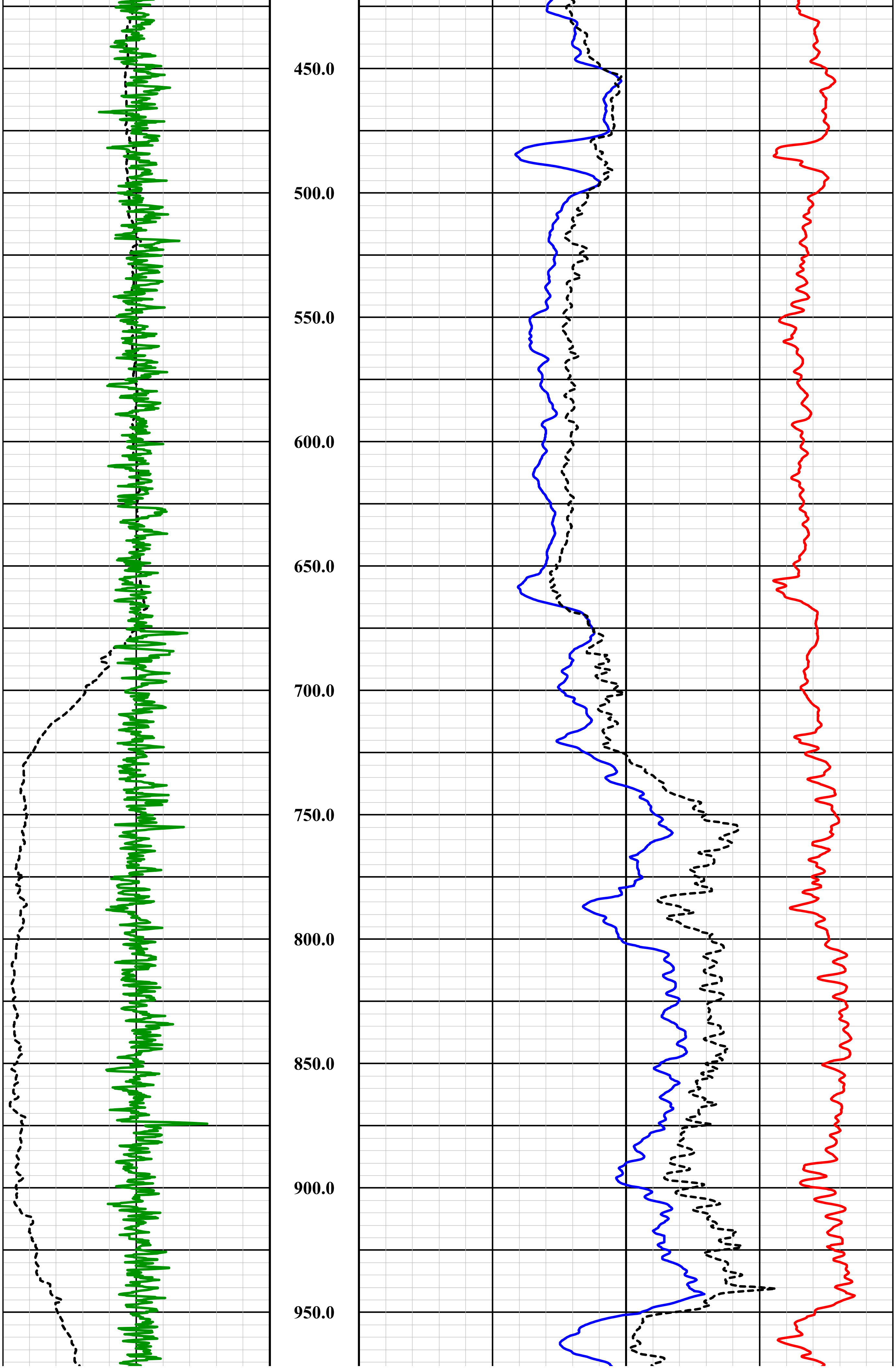
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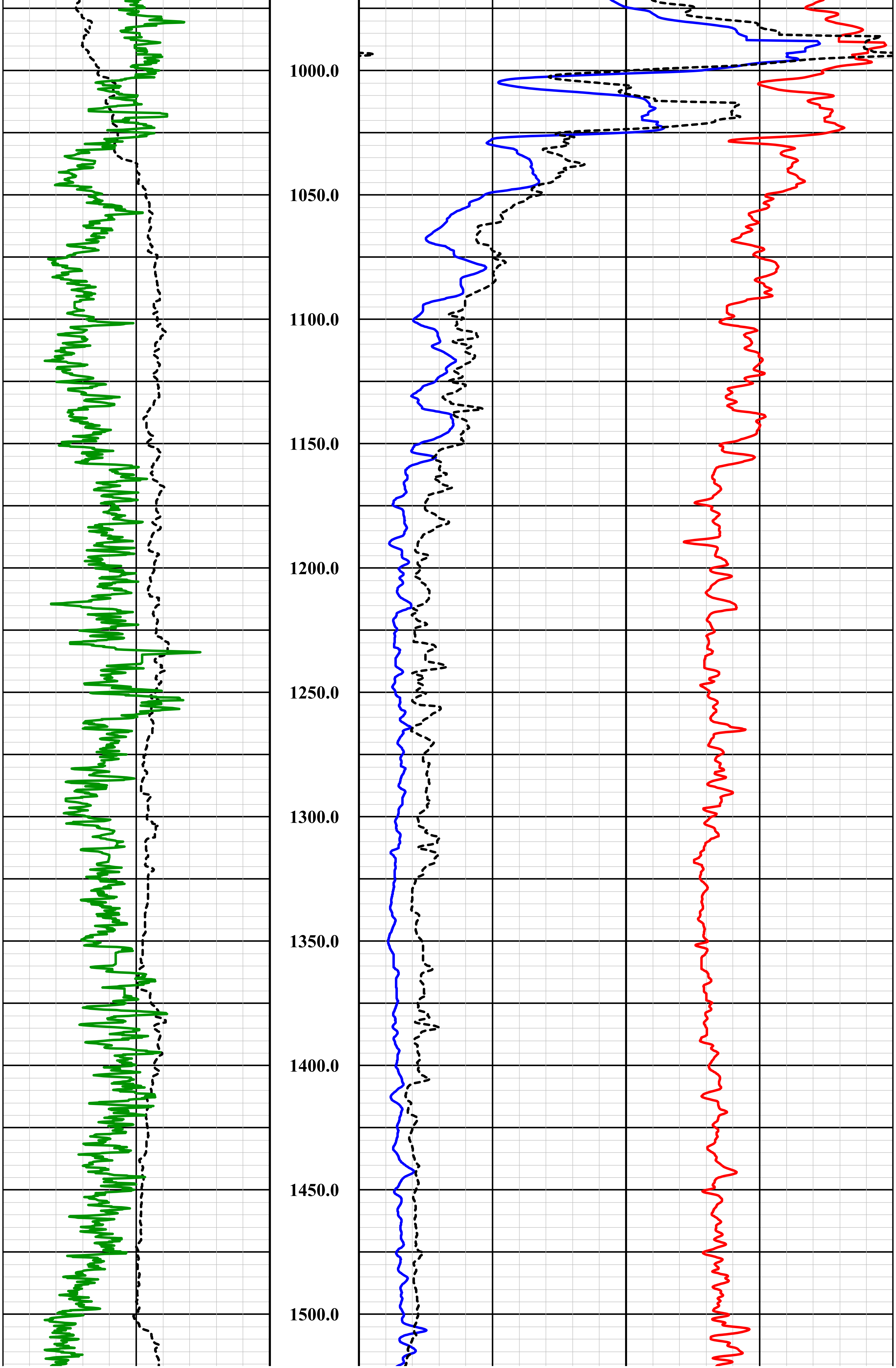
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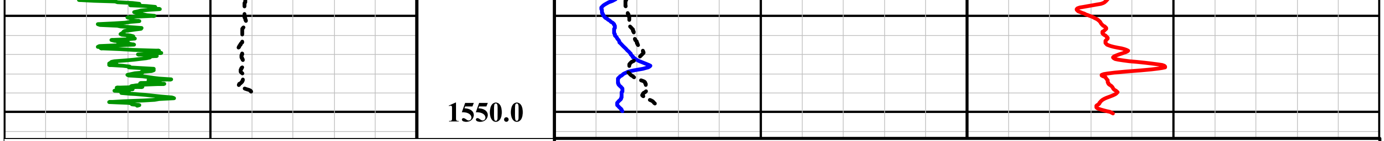


SP	Nat. Gamma	Depth	16" NRes	64" NRes	SPR
400 mV 1500	0 API 200	1in:50ft	0 Ohm-m 100	0 Ohm-m 100	5 Ohms 50

MSI 40 GRP E-Log Tool

Probe Top = Depth Ref.

Tool SN: 5019, 5513, & 5514

Bridle connects to wireline cablehead: Wireline armor is the B Electrode.

Bridle Electrode (N Electrode)

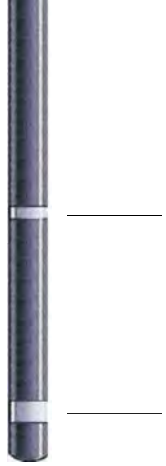
Probe Length = 1.98 m or 6.5 ft
Bridle Length = 7.88 m or 25.86 ft

Probe Weight = 7.3 kg or 16.0 lbs

Can only be collected in fluid

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)

Electrode Measuring Points (from bottom of probe)
- **Spontaneous Potential (SP): 1.777 m or 5.81 ft**
- **16" Normal Resistivity (16" NRes): 0.3548 m or 1.16 ft**
- **64" Normal Resistivity (64" NRes): 0.9644 m or 3.16 ft**
- **Single Point Resistance (SPR): 0.152 m or 0.50 ft**
- **Natural Gamma Ray (Nat. Gamma): 0.73 m or 2.39 ft**



1.63" or 40 mm Diameter (41.4 mm with neoprene heat shrink and electrical tape)

Southwest Exploration Services, LLC
borehole geophysics & video services

Company	RESOLUTION COPPER
Well	DHRES-14
Field	RESOLUTION
County	PINAL
State	ARIZONA

Preliminary E-LOG SUMMARY

Southwest Exploration Services, LLC

borehole geophysics & video services

COMPANY	RESOLUTION COPPER		
WELL ID	DHRES-015 (55-916688)		
FIELD	RESOLUTION		
COUNTY	PINAL	STATE	ARIZONA

TYPE OF LOGS: 4 RX SONIC

MORE: GAMMA-CALIPER

LOCATION
NW 1/4 OF DW 1/4 OF SW 14
964978 E, 831076 N

SEC 05 TWP 02 S RGE 13 E

OTHER SERVICES
40 GRP-ELOGS
FLUID TEMP/RES
ABI-43

PERMANENT DATUM	AZ SPC, feet	ELEVATION	3991 ft	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND LEVEL			G.L.

DATE	06-07-14	TYPE FLUID IN HOLE	MUD
RUN No	1	MUD WEIGHT	9.3 LB
TYPE LOG	4 RX SONIC	VISCOSITY	38 SEC
DEPTH-DRILLER	1548 FT	LEVEL	FULL
DEPTH-LOGGER	1548 FT	MAX. REC. TEMP.	50.8 DEG C
BTM LOGGED INTERVAL	1548 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	SURFACE	SAMPLE INTERVAL	0.25 FT
DRILLER / RIG#	NATIONA RIG # 167	LOGGING TRUCK	TRUCK # 300
RECORDED BY / Logging Eng.	K. MITCHELL	TOOL STRING/SN	ALT 4 RX SONIC SN 5185
WITNESSED BY	M&A MATT SHELLY	LOG TIME:ON SITE/OFF SITE	1201 PM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	37 ft	14"	STEEL	SURFACE	36 FT
2	12 1/4"	37 ft	1548 FT				
3							

COMMENTS: 5 FT STICKUP ON CASING

Tool Summary:

Date	06-07-14	**Date**	06-07-14	**Date**	06-07-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	COMBO TOOL	**Tool Model**	MSI 40 GRP	**Tool Model**	ALT 4 RX SONIC
Tool SN	4953	**Tool SN**	5513	**Tool SN**	5185
From	SURFACE	**From**	SURFACE	**From**	SURFACE
To	1548 FT	**To**	1548 FT	**To**	1548 FT
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	K. MITCHELL
Truck No	300	**Truck No**	300	**Truck No**	300
Operation Check	06-07-14	**Operation Check**	06-07-14	**Operation Check**	06-07-14
Calibration Check	06-06-14	**Calibration Check**	06-01-14	**Calibration Check**	N/A
Time Logged	12:45 PM	**Time Logged**	2:00 PM	**Time Logged**	3:20 PM

Date	06-07-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT ABI-43	**Tool Model**		**Tool Model**	
Tool SN	90601	**Tool SN**		**Tool SN**	
From	SURACE	**From**		**From**	
To	1548 FT	**To**		**To**	
Recorded By	K. MITCHELL	**Recorded By**		**Recorded By**	
Truck No	300	**Truck No**		**Truck No**	
Operation Check	06-07-14	**Operation Check**		**Operation Check**	
Calibration Check	N/A	**Calibration Check**		**Calibration Check**	
Time Logged	5:30 PM	**Time Logged**		**Time Logged**	

Additional Comments:

Caliper Arms Used: 9" **Calibration Points:** 6 & 12"

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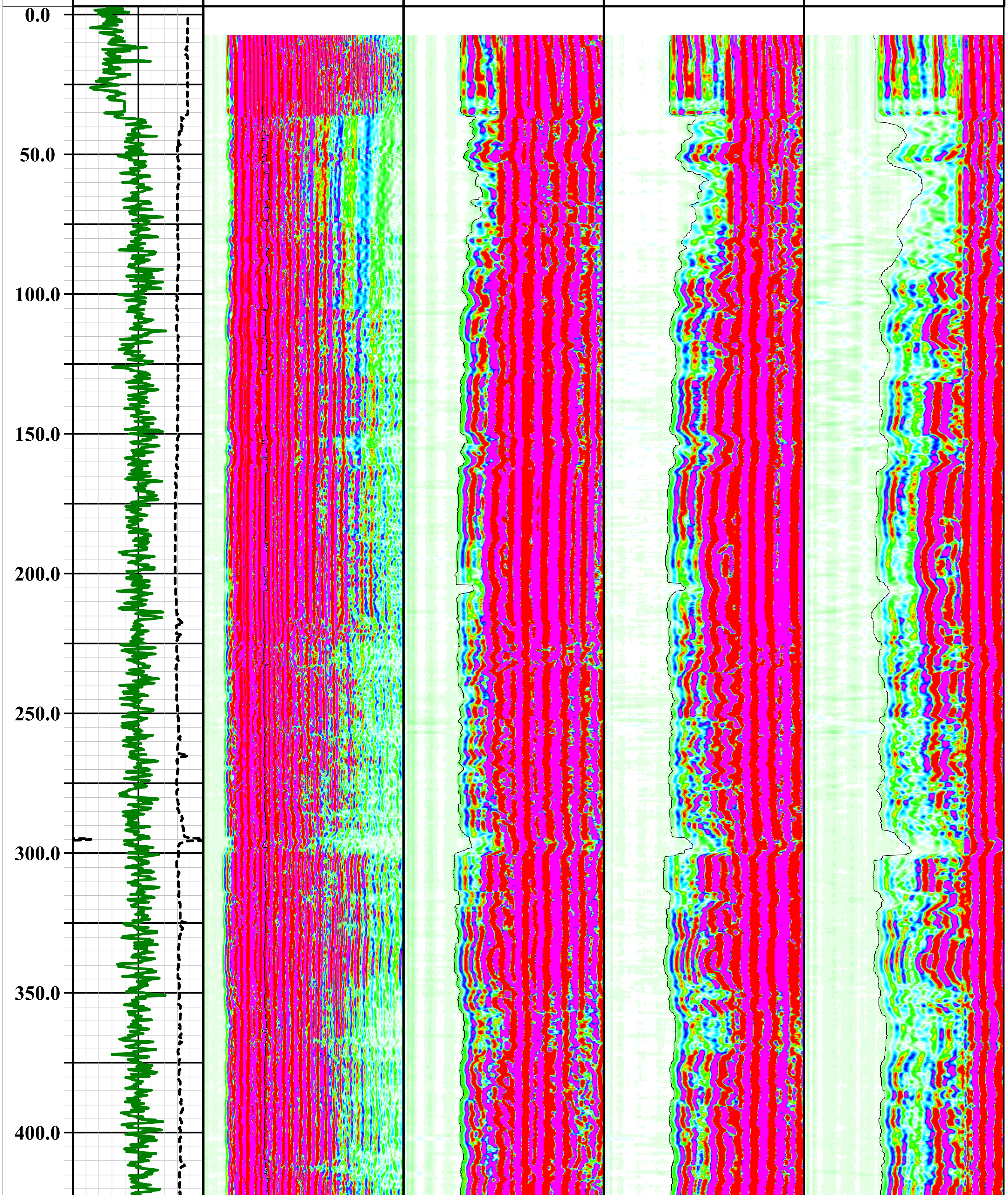
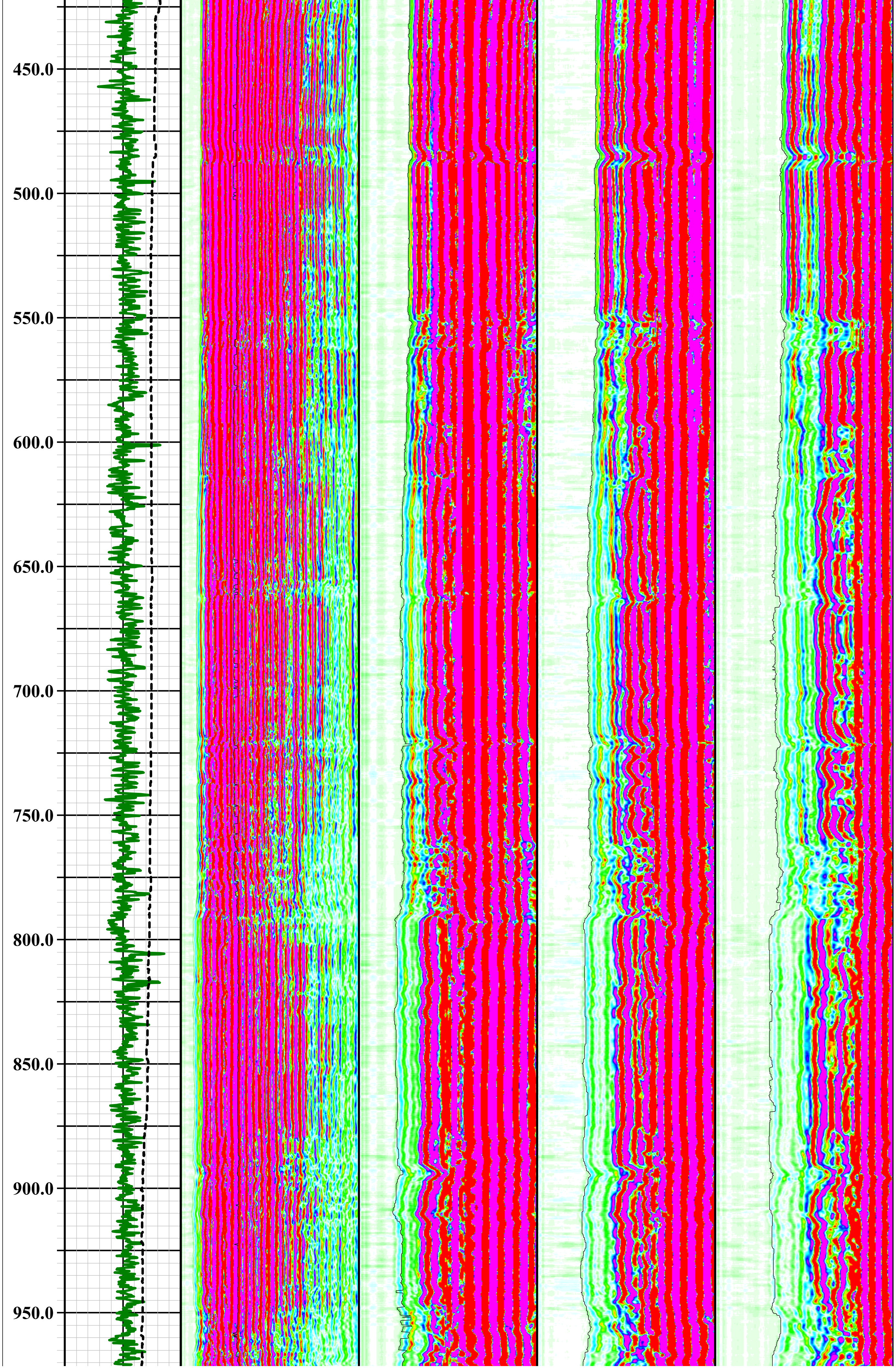
Depth	Nat. Gamma	RX1 -Travel Time ST	RX2 - Travel Time ST	RX3 - Travel Time ST	RX4 -Travel Time ST
1in:50ft	0 API 200	100 uSec 2040	100 uSec 1020	100 uSec 1020	100 uSec 1020
	3-Arm Caliper	RX1 - VDL - stacked	RX2 - VDL - stacked	RX3 - VDL - stacked	RX4 - VDL - stacked
	5 Inches 15	100 uSec 2040	100 uSec 1020	100 uSec 1020	100 uSec 1020





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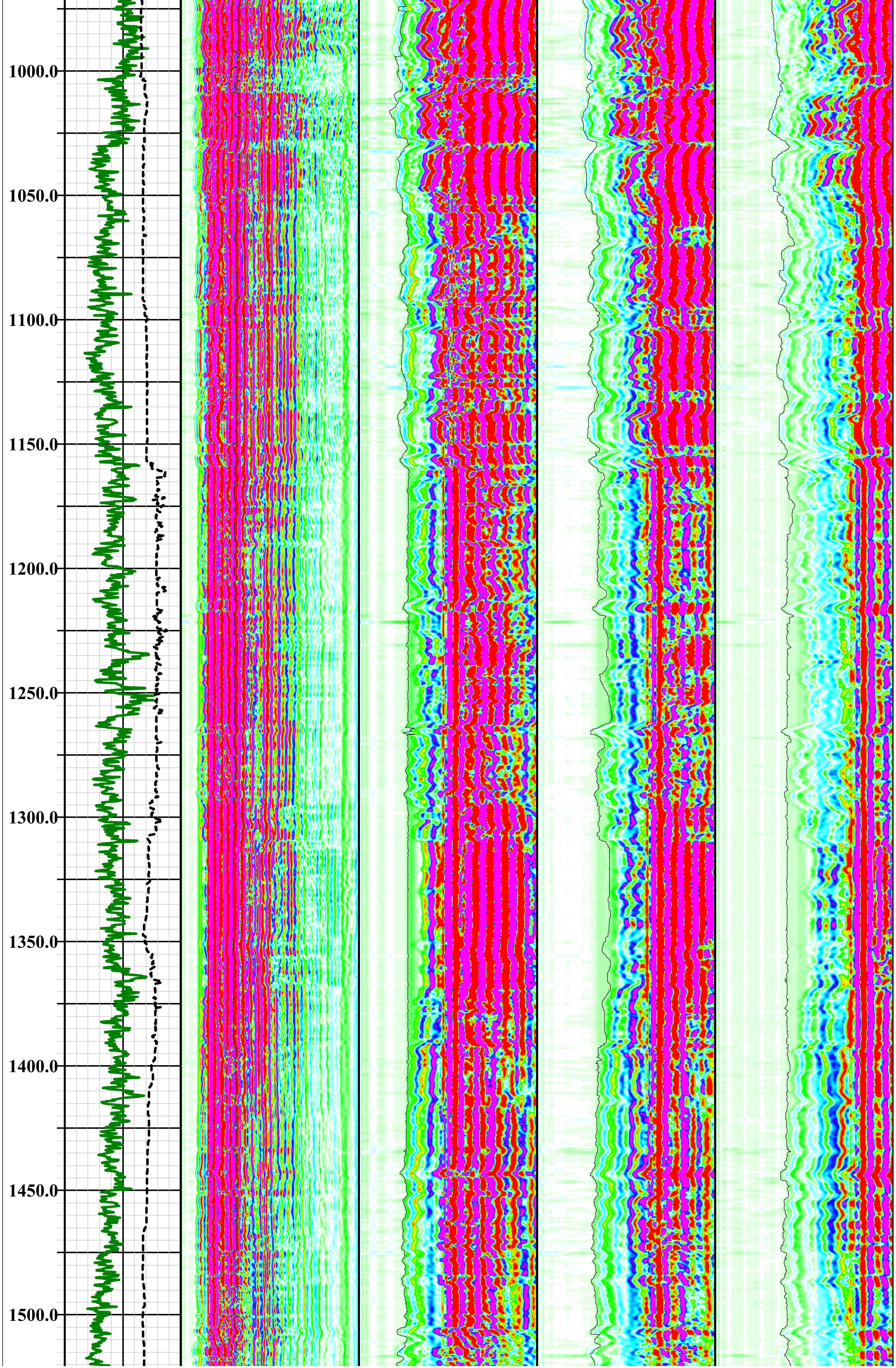
500.0
550.0
600.0
650.0
700.0
750.0
800.0
850.0
900.0
950.0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1150.0
1200.0
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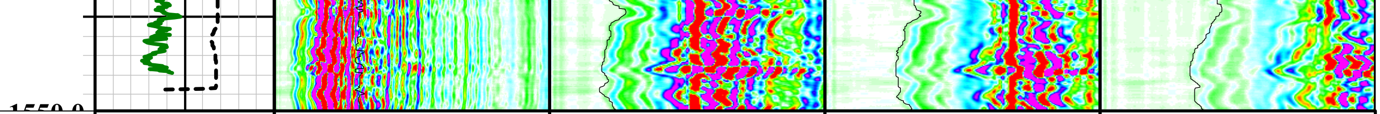
1300.0
1350.0
1400.0
1450.0
1500.0



	5 Inches 15 3-Arm Caliper	100 uSec 2040 RX1 - VDL - stacked	100 uSec 1020 RX2 - VDL - stacked	100 uSec 1020 RX3 - VDL - stacked	100 uSec 1020 RX4 - VDL - stacked
1in:50ft Depth	0 API 200 Nat. Gamma	100 uSec 2040 RX1 -Travel Time ST	100 uSec 1020 RX2 - Travel Time ST	100 uSec 1020 RX3 - Travel Time ST	100 uSec 1020 RX4 -Travel Time ST

FWS50-4Rx Full Waveform Sonic Tool SN 5185

Probe Top = Depth Ref.

Four Conductor MSI Probe Top

Probe Length = 2.71 m or 8.9 ft
Probe Weight = ~18.0 kg or 39.6 lbs

Sensors: Ceramic Piezoelectric in Polyurethane potting

Transmitter Frequency: ~20 kHz resonant frequency

Rx - Rx Spacing: 0.2 m (7.9 in)

Typically ran centralized with external bow spring centralizers.

Can only be collected in fluid.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)

Rx-4 Tx - Rx4 Spacing = 1.2 m (47.2 in)

Rx-3 Tx - Rx3 Spacing = 1.0 m (39.4 in)

Rx-2 Tx - Rx2 Spacing = 0.8 m (31.5 in)

Rx-1 Tx - Rx1 Spacing = 0.6 m (23.6 in)

Acoustic Isolater

Tx = Acoustic Transmitter

0.155 m or 6.25 in. - End of tool to center of Tx

1.97" or 50 mm Diameter

MSI Gamma-Caliper-Temperature-Fluid Resistivity SN 4953

Probe Top = Depth Ref.

Single Conductor MSI Probe Top

Probe Length = 2.59 m or 8.5 ft
Probe Weight = 6.80 kg or 15.0 lbs

Natural Gamma and Caliper can only be collected logging up hole.

Fluid Temperature/Resistivity can only be collected logging down hole.

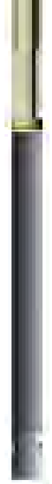
Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)

Natural Gamma Ray = 0.76 m (29.75 in)

3-Arm Caliper = 1.44 m (56.75 in)

Distance from tool top: 2.20 m (86.5 in)

Available Arm Sizes: 3", 9", and 15"



TFR (Temperature/Fluid Resistivity) = 0.39 m (15.5 in)

1.375" or 34.9 mm Diameter

Southwest Exploration Services, LLC

borehole geophysics & video services

Company	RESOLUTION COPPER
Well	DHRES-14
Field	RESOLUTION
County	PINAL
State	ARIZONA

Preliminary SONIC SUMMARY

APPENDIX D

Borehole Geophysical Logs from Well DHRES-15
Conducted by BHI; interval 1,400 – 2,886 feet

BAKER HUGHES

GAMMA RAY LOG TEMPERATURE

FILE NO:	US087602
API NO:	
Ver. 3.87	
RIG: NATIONAL 16	

COMPANY	RESOLUTION COPPER COMPANY
WELL	DHRES-15
FIELD	RESOLUTION COPPER
COUNTY	PINAL
STATE	AZ

LOCATION:

SEC 5 TWP 2S RGE 13E

OTHER SERVICES
GRWGI/HDIL
STAR
MREX
ACCOUSTIC

PERMANENT DATUM	GL	ELEVATION	NA	
LOG MEASURED FROM	GL	0 FT	ABOVE P.D.	
DRILL. MEAS. FROM	GL			

ELEVATIONS:

KB	NA
DF	
GL	NA

DATE		22-Jun-2014				
RUN	TRIP	1	1			
SERVICE ORDER		US087602				
DEPTH DRILLER		2900 FT				
DEPTH LOGGER		2894 FT				
BOTTOM LOGGED INTERVAL		2886 FT				
TOP LOGGED INTERVAL		1400 FT				
CASING DRILLER		14 IN	@ 40 FT		@	
CASING LOGGER		36 FT				
BIT SIZE		12.25 IN				
TYPE OF FLUID IN HOLE		WBM				
DENSITY	VISCOSITY	9.7 LB/G	40 CP			
PH	FLUID LOSS	8.0	6.0 C3			
SOURCE OF SAMPLE		FLOWLINE				
RM AT MEAS. TEMP.		3.7 OHMM	@ 75 DEGF		@	
RMF AT MEAS. TEMP.		5.6 OHMM	@ 74 DEGF		@	
RMC AT MEAS. TEMP.		3.05 OHMM	@ 71 DEGF		@	
SOURCE OF RMF	RMC	MEASURED	MEASURED			
RM AT BHT		2.59 OHMM	@ 117 DEGF		@	
TIME SINCE CIRCULATION		12 HR				
MAX. RECORDED TEMP.		118 DEGF				
EQUIP. NO.	LOCATION	6670	GRAND JCT			
RECORDED BY		D SMITH/T VERCIMAK				
WITNESSED BY		M SHELLEY				

IN MAKING INTERPRETATIONS OF LOGS OUR EMPLOYEES WILL GIVE THE CUSTOMER THE BENEFIT OF THEIR BEST JUDGEMENT. BUT SINCE ALL INTERPRETATIONS ARE OPINIONS BASED ON INFERENCES FROM ELECTRICAL OR OTHER MEASUREMENTS, WE CANNOT, AND WE DO NOT GUARANTEE THE ACCURACY OR CORRECTNESS OF ANY INTERPRETATION. WE SHALL NOT BE LIABLE OR RESPONSIBLE FOR ANY LOSS, COST, DAMAGES, OR EXPENSES WHATSOEVER INCURRED OR SUSTAINED BY THE CUSTOMER RESULTING FROM ANY INTERPRETATION MADE BY ANY OF OUR EMPLOYEES.

BOREHOLE RECORD

BIT SIZE	FROM	TO
12.25 IN	40 FT	2900 FT

CASING RECORD

SIZE	WEIGHT	GRADE	FROM	TO
14 IN			0 FT	40 FT

REMARKS

RUN 1 TRIP 1: TEMPERATURE_GR LOGGED GOING DOWN IN WELL

LOGGING DOWN CAN CAUSE DEPTH DIFFERENCES WITH STANDARD UP LOGS DUE TO FLOATING AND LESS CABLE TENSION

DOWN LOG DEPTH ADJUSTED TO HDIL_DAL_WGI_GR LOG RUN TO CORRECT FOR DEPTH DIFFERENCES

FLUID LEVEL ESTIMATED USING TEMPERATURE SHIFT AND SPIKE IN DIFF TEMP

THANK YOU FOR CHOOSING BAKER HUGHES WIRELINE SERVICES

CREW: VERCIMAK/SMITH/HOLLER/BAUGHMAN

EQUIPMENT DATA					
RUN	TRIP	TOOL	SERIES NO.	SERIAL NO.	POSITION
1	1	ELEC	8250EA	10314363	FREE
1	1	TELE	8248ED	Z120493	FREE
1	1	GR	8262XA	10317216	FREE
1	1	TEMP	8255XA	11774568	FREE

MAIN LOG 5"/100FT SCALE

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 14:54:15 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n353h01.prm
LOGGING MODE: DEPTH DIRECTION: DOWN
TOP DEPTH: -1.692 ft BOTTOM DEPTH: 2913.750 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
GR	FILTER ()	medium (1)		TOP	BOTTOM
TEMP	FILTER ()	medium (1)		"	"

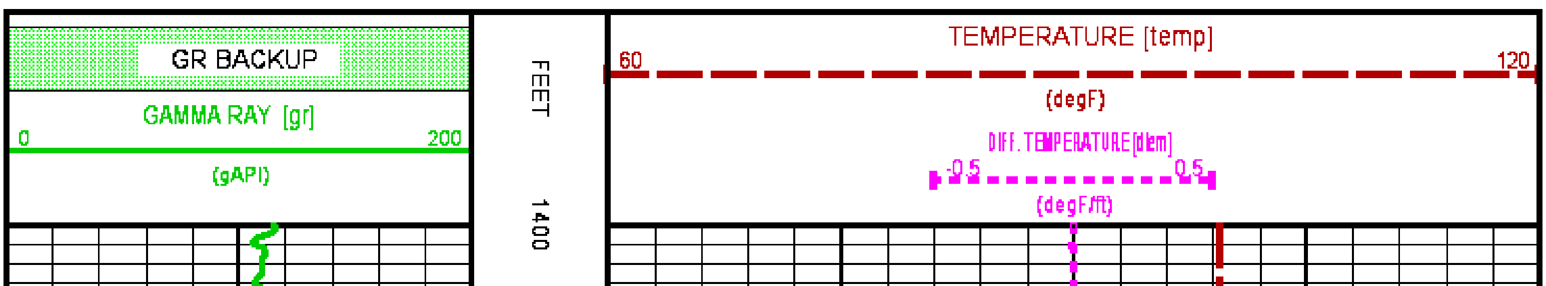
CURVE DESCRIPTION REPORT

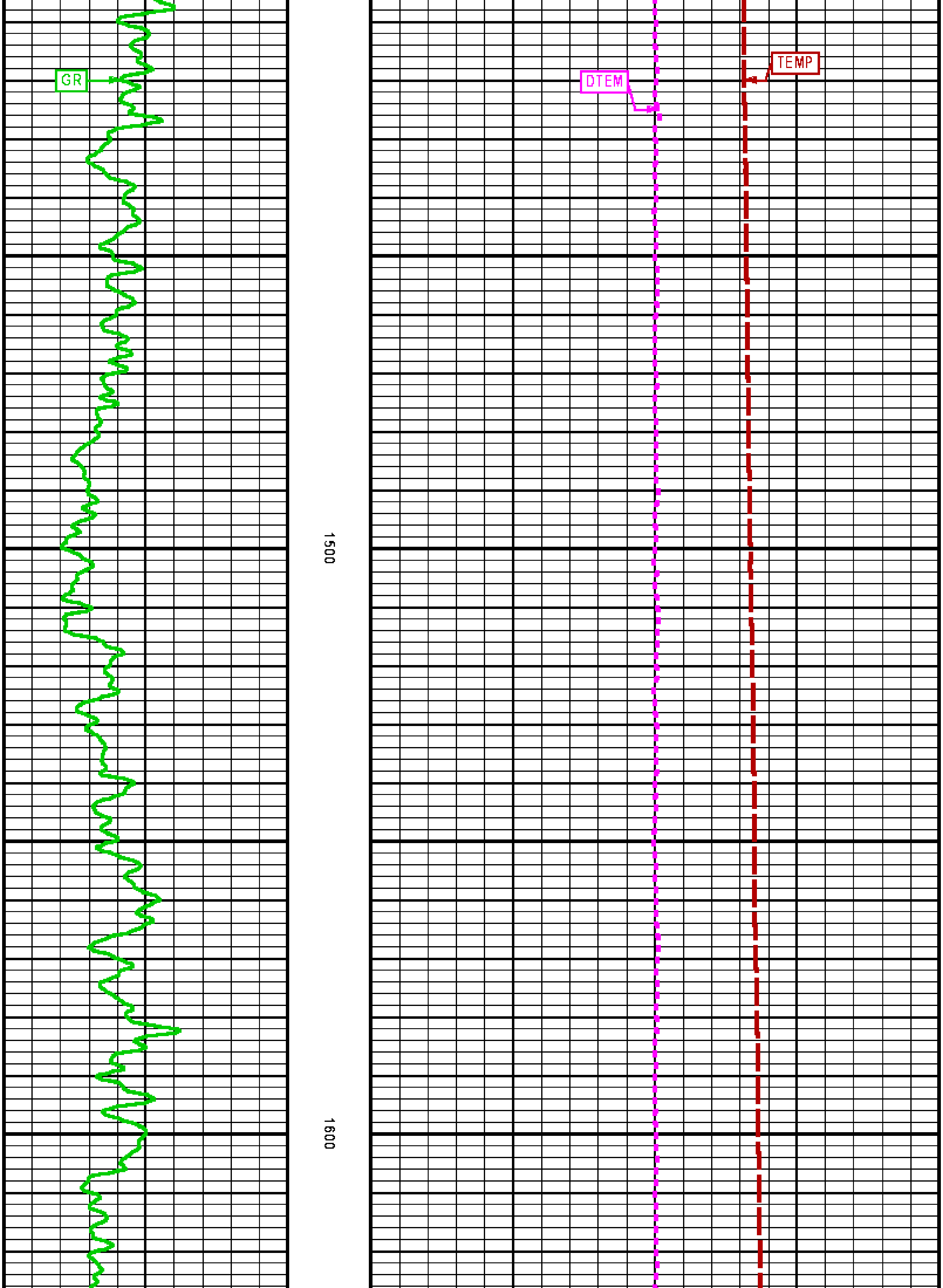
CURVE NAME	CREATION DATE	CURVE DESCRIPTION
F1:DTEM	Jun 22 02:29:56 2014	DIFFERENTIAL TEMPERATURE
F1:GR	Jun 22 02:29:56 2014	GAMMA RAY
F1:TEMP	Jun 22 02:29:56 2014	TEMPERATURE

CURVE MEASURE POINT OFFSET

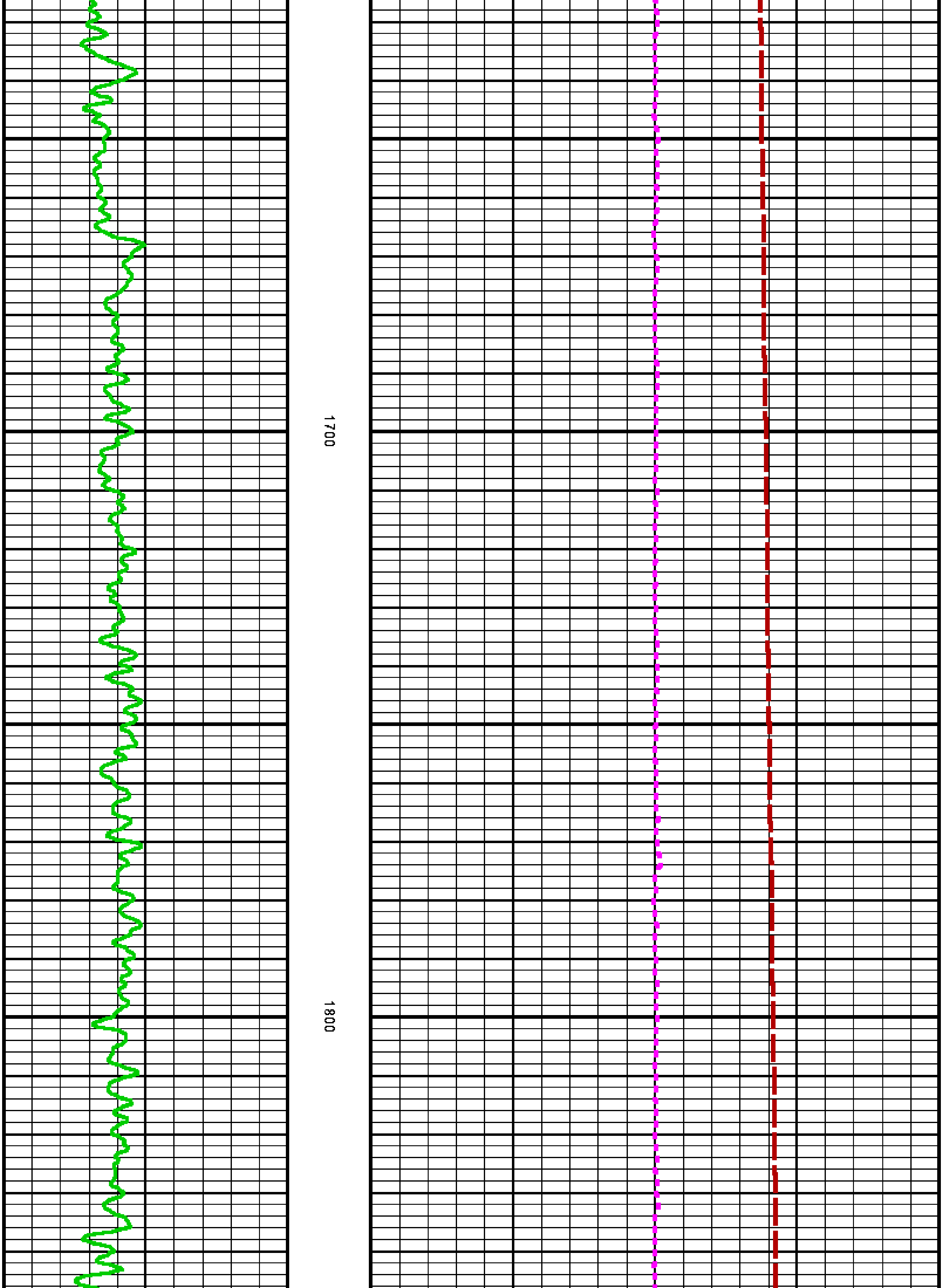
CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
DTEM	0.75	GR	4.25	TEMP	0.75		

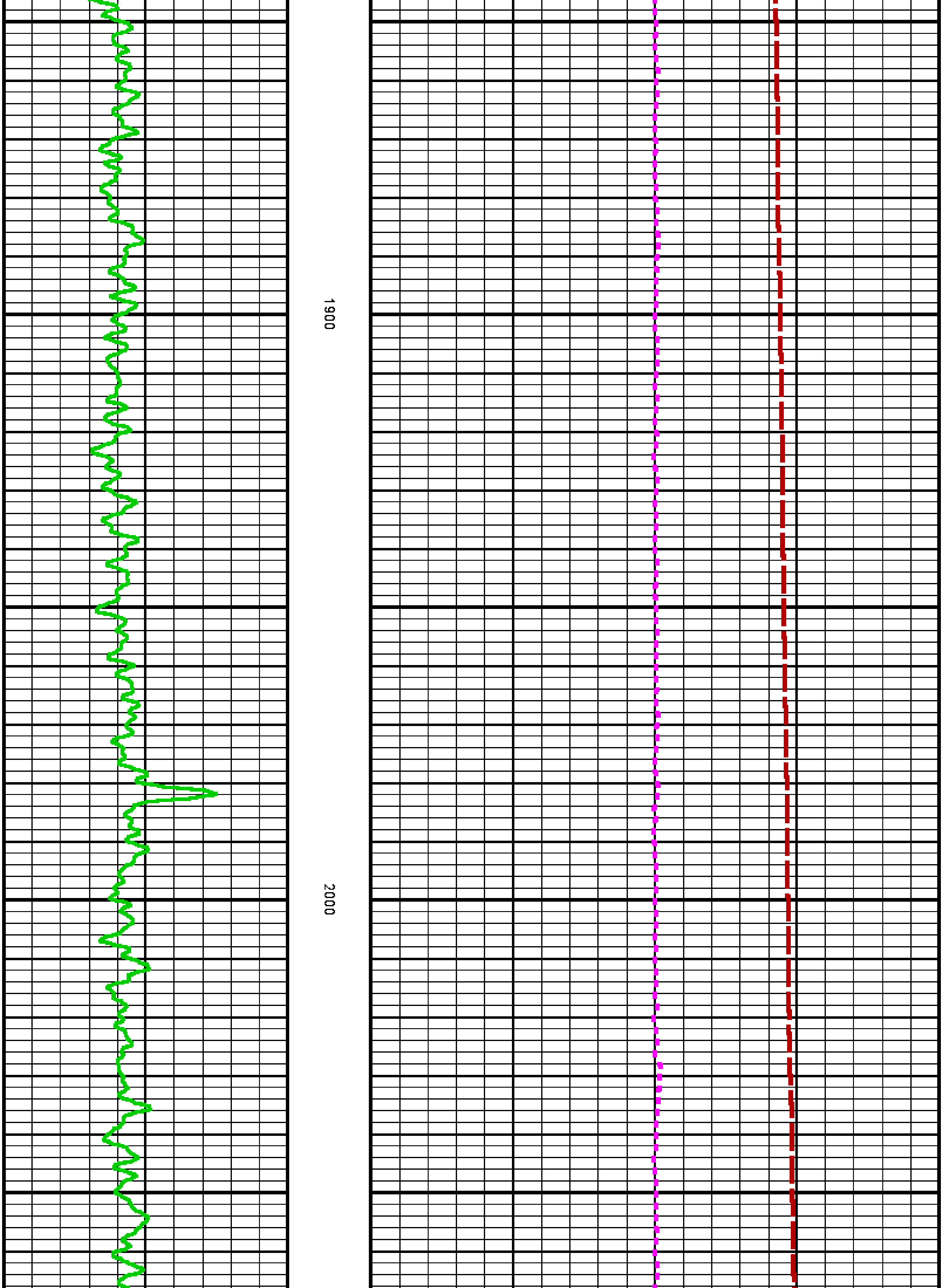
Presentation	**: HL6670:TEMP.fvpdf [5"/100' Scale]**
Plot Interval	**: 1400 - 2916.25 Feet**
Data File 1	**: F1 : HL6670:/dat1a/OH087602/TEMP_1.xtf**
Created On	**: Jun 22 08:42:16 2014**
Company	**: RESOLUTION COPPER COMPANY**
Well	**: DHRES-15**
Field	**: RESOLUTION COPPER**
File Interval	**: -4.5 - 2916.25 Feet**
OCT	**: n353h**

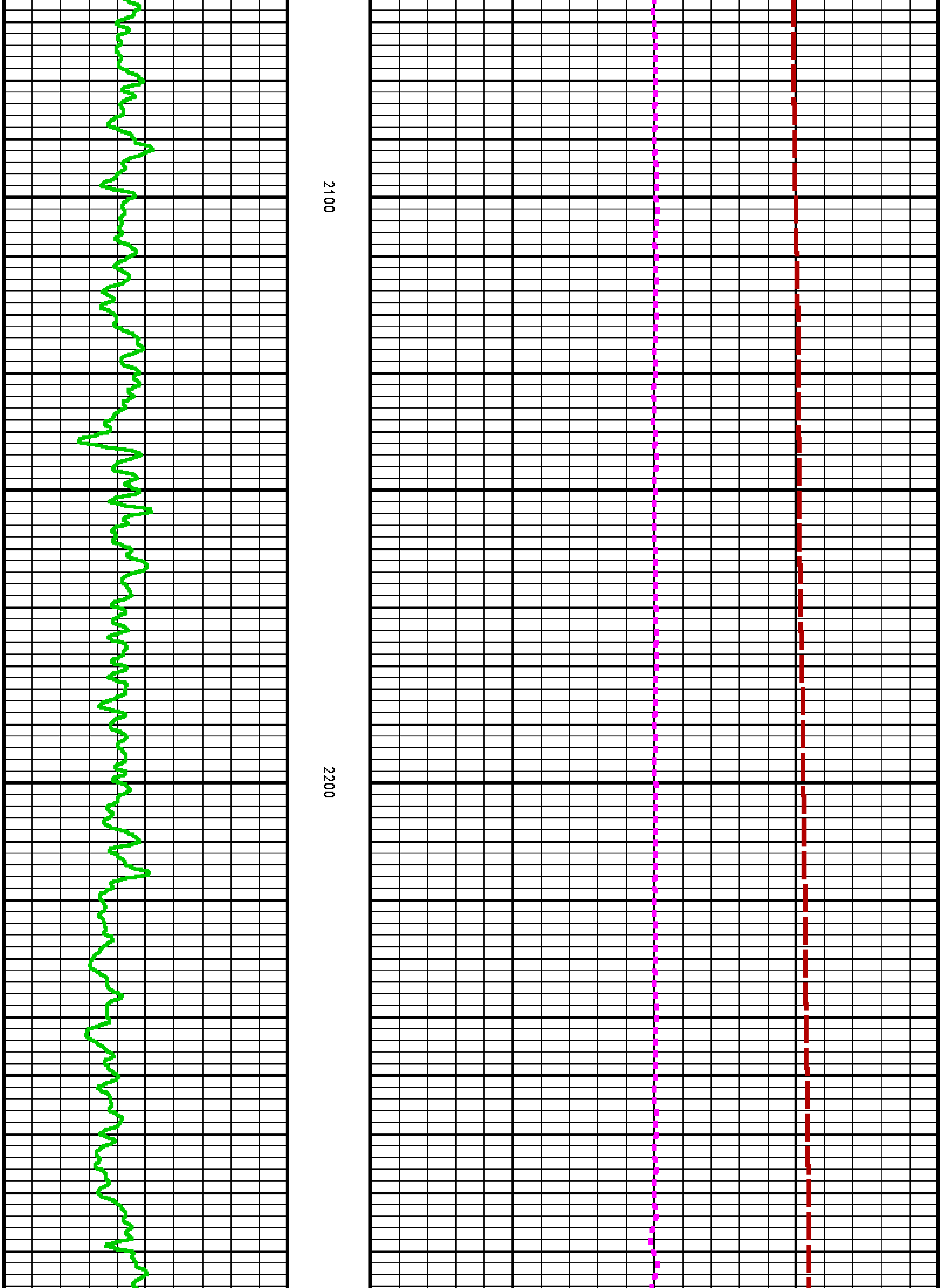




GR
DTEM
TEMP
1500
1600


1700
1800


1900
2000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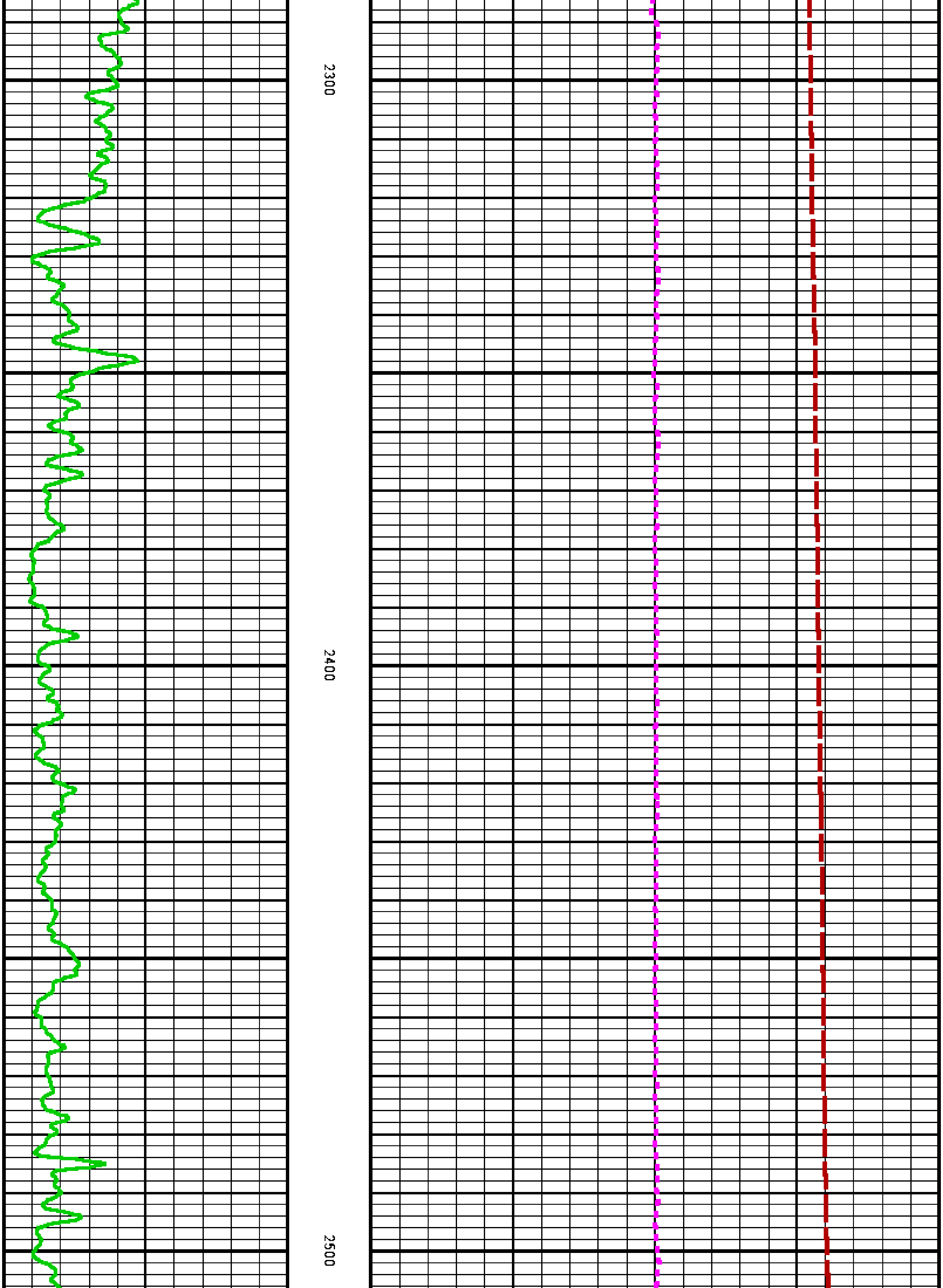
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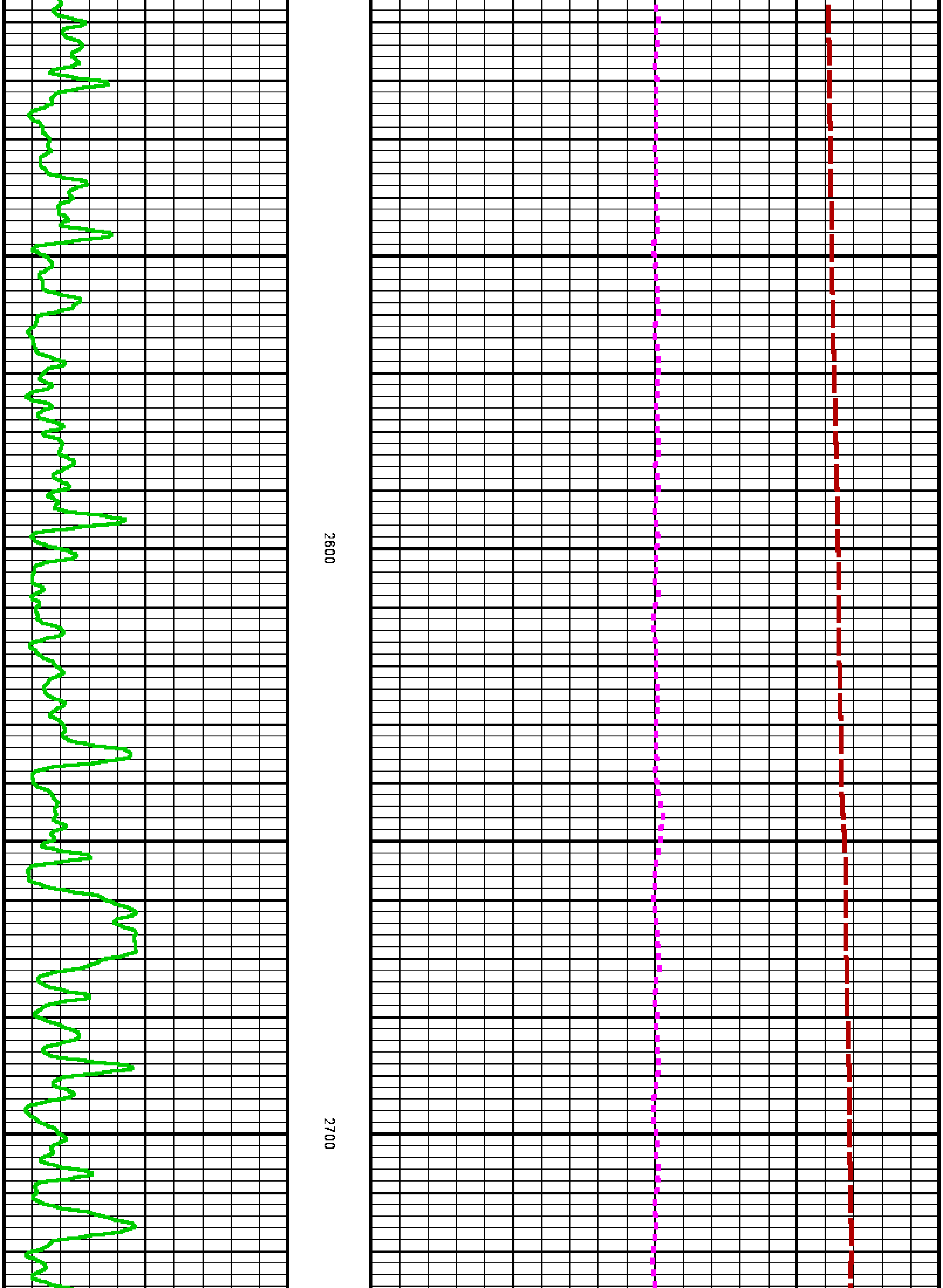
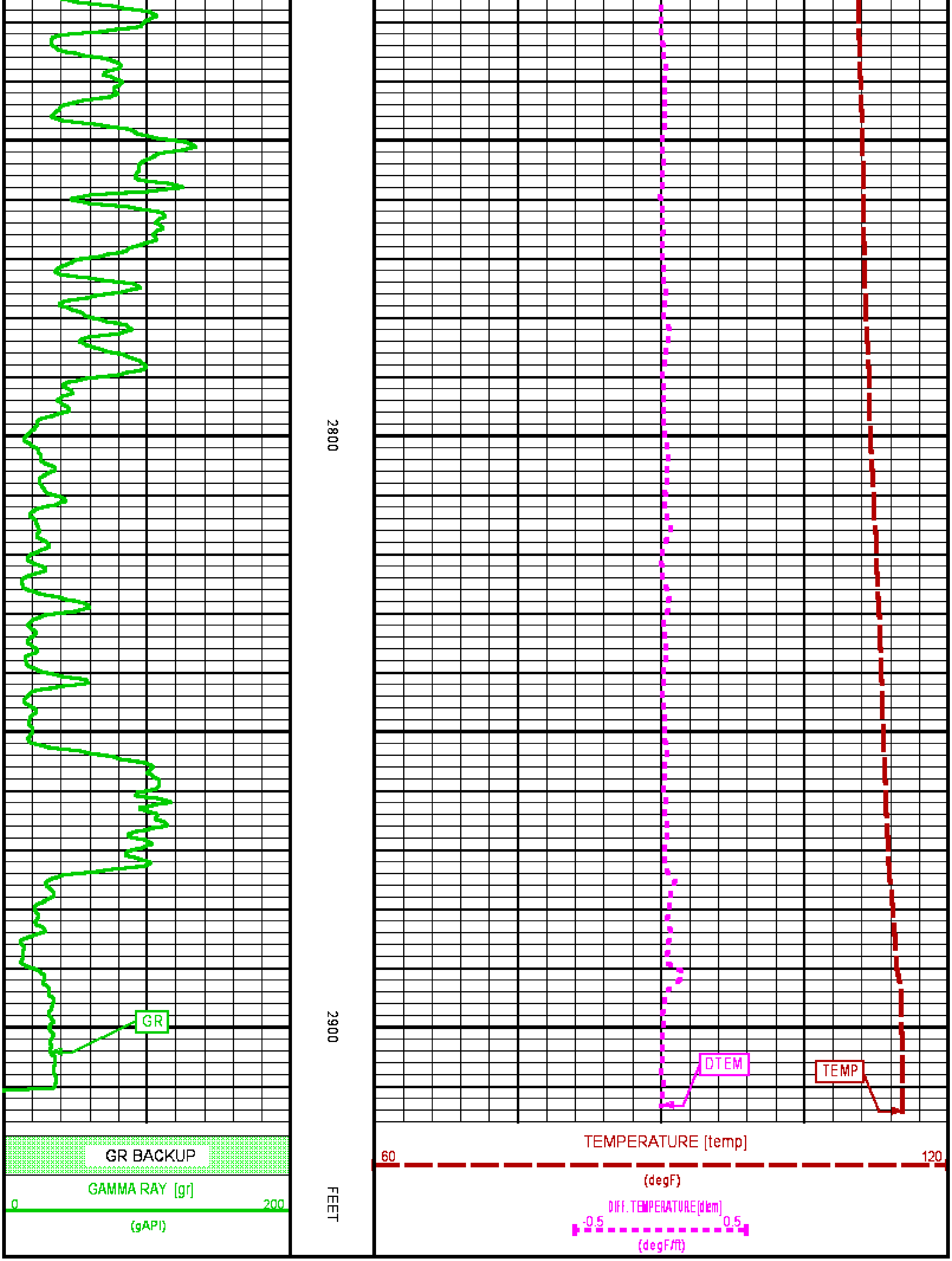
2400
2500


2600
2700



2800
2900
GR
DTEM
TEMP
GR BACKUP
GAMMA RAY [gr]
0
200
(gAPI)
FEET
TEMPERATURE [temp]
60
120
(degF)
DIFF. TEMPERATURE [dtem]
-0.5
0.5
(degF/ft)

CALIBRATION / VERIFICATION SUMMARY

Source File: /dat1a/OH087602/TEMP.tp1

GR PRIMARY CALIBRATION SUMMARY

TOOL #: 8262XA 10317216 DATE/TIME PERFORMED: Thu Jun 19 10:07:10 2014

UNIT #: 3880TA HL6670 CALB JIG #: 4702NK DA-041

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	CR DIFF (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	CALBRTR (gAPI)
GR	101.51	427.00	325.5	0.553	56.14	236.14	180

GR BEFORE LOG VERIFICATION SUMMARY

TOOL #: 8262XA 10317216 DATE/TIME PERFORMED: Sun Jun 22 02:26:30 2014 DAYS SINCE CAL: 2

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK DA-041

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	65.38	384.53	0.553	36.15	212.65	176.50 170.00 190.00

GR AFTER LOG VERIFICATION SUMMARY

TOOL #: 8262XA 10317216 DATE/TIME PERFORMED: Sun Jun 22 04:03:02 2014 DAYS SINCE CAL: 2

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK DA-041

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	58.62	384.58	0.553	32.42	212.68	180.26 166.50 186.50

TPSETEMP PRIMARY CALIBRATION SUMMARY

TOOL #: 8255XA 11774568 DATE/TIME PERFORMED: Wed May 14 12:39:45 2014

UNIT #: 3880TA HL6670

	T(0)	T(1)	T(2)	T(3)
Corr Coeff for Temp	-9.274653E+00	1.055639E-01	2.143764E-06	-2.782846E-10

INSTRUMENT CONFIGURATION

Source File: /dat1a/OH087602/GR_TEMP-tdg

15.50'

A3 CABLEHEAD
Diameter : 1.37"

PCM POWER SUPPLY
Diameter : 1.70"
Length : 3.86'
Weight : 18 lbs

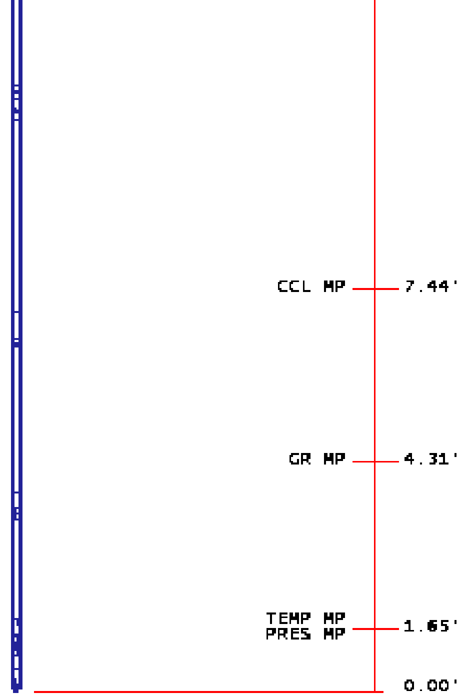
Series : B250EA
Mnemonic : PCM

TELEMETRY / CCL
Diameter : 1.70"
Length : 4.46'
Weight : 20 lbs
Series : B248ED
Mnemonic : PCM
Measure Point: 1.00': CCL MP

GAMMA RAY
Diameter : 1.70"
Length : 3.02'
Weight : 15 lbs
Series : B263XA
Mnemonic : GR
Measure Point: 0.89': GR MP

TEMPERATURE / PRESSURE
Diameter : 1.70"
Length : 3.30'
Weight : 13 lbs
Series : B255XA
Mnemonic : SRPL
Measure Point: 1.53': TEMP MP

BULL PLUG 1 11/16



TOTAL LENGTH: 15.50'
TOTAL WEIGHT: 69 lbs
MAX DIAMETER: 0'1.70"

BAKER HUGHES
EOLIPS

COMPANY	RESOLUTION COPPER COMPANY		FILE NO: US087602
WELL	DHRES-15		API NO:
FIELD	RESOLUTION COPPER		
COUNTY	PINAL	STATE AZ	

LOCATION:	ELEVATIONS: KB NA DF GL NA	RIG: NATIONAL 16
SEC 5 TWP 2S RGE 13E	DATE 22-Jun-2014	

BAKER HUGHES

HIGH DEFINITION INDUCTION LOG
GAMMA RAY LOG
CALIPER LOG

FILE NO: US087602

API NO:

COMPANY	RESOLUTION COPPER COMPANY
WELL	DHRES-15
FIELD	RESOLUTION COPPER
COUNTY	PINAL — STATE AZ

Ver. 3.87

RIG: NATIONAL 16

LOCATION:

SEC 5 TWP 2S RGE 13E

OTHER SERVICES
STAR
MREX
TEMP/GR
ACCOUSTIC
WGI

PERMANENT DATUM GL ELEVATION NA
LOG MEASURED FROM GL 0 FT ABOVE P.D.
DRILL. MEAS. FROM GL

ELEVATIONS:
KB NA
DF
GL NA

DATE		22-Jun-2014			
RUN	TRIP	1	1		
SERVICE ORDER		US087602			
DEPTH DRILLER		2900 FT			
DEPTH LOGGER		2894 FT			
BOTTOM LOGGED INTERVAL		2886 FT			
TOP LOGGED INTERVAL		1400 FT			
CASING DRILLER		14 IN	@ 40 FT		@
CASING LOGGER		36 FT			
BIT SIZE		12.25 IN			
TYPE OF FLUID IN HOLE		WBM			
DENSITY	VISCOSITY	9.7 LB/G	40 CP		
PH	FLUID LOSS	8.0	6.0 C3		
SOURCE OF SAMPLE		FLOWLINE			
RM AT MEAS. TEMP.		3.7 OHMM	@ 75 DEGF		@
RMF AT MEAS. TEMP.		5.6 OHMM	@ 74 DEGF		@
RMC AT MEAS. TEMP.		3.05 OHMM	@ 71 DEGF		@
SOURCE OF RMF	RMC	MEASURED	MEASURED		
RM AT BHT		2.59 OHMM	@ 117 DEGF		@
TIME SINCE CIRCULATION		12 HR			
MAX. RECORDED TEMP.		118 DEGF			
EQUIP. NO.	LOCATION	6670	GRAND JCT		
RECORDED BY		D SMITH/T VERCIMAK			
WITNESSED BY		M SHELLEY			

BOREHOLE RECORD		
BIT SIZE	FROM	TO
12.25 IN	40 FT	2900 FT

CASING RECORD				
SIZE	WEIGHT	GRADE	FROM	TO
14 IN			0 FT	40 FT

REMARKS

RUN 1 TRIP 1: HDIL_DAL_WGI_GR RUN IN COMBINATION

WGI/CAL VERIFIED DURING BEFORE LOG CALIBRATION
BVOL/CVOL CALCULATED IN CUBIC FT
CVOL CALCULATED FOR 7.625 IN CASING

DT MATRIX = 51.3

HDIL RAN CENTRALIZED
ABC CALCULATED = HOLE SIZE

THANK YOU FOR CHOOSING BAKER HUGHES WIRELINE SERVICES

CREW: VERCIMAK/SMITH/HOLLER/BAUGHMAN

EQUIPMENT DATA

RUN	TRIP	TOOL	SERIES NO.	SERIAL NO.	POSITION
1FRE	21	PWRADPT2	4430XB	1244777	FREE
1	2	SWVL	3944XD	10158308	FREE
1	2	TTRM	3981XA	10516527	FREE
1	2	WTS	3514XB	10240730	FREE
1	2	DSL	1329XA	10196895	FREE
1	2	ORIENT	4401XB	10304309	CENTRALIZED
1	2	CALIPER	4253XA	10189872	CENTRALIZED
1	2	DAL EA	1677EA	10076613	CENTRALIZED
1	2	DAL MA	1680MA	Z154423	CENTRALIZED
1	2	CENTRALIZER	4341XA	10202020	CENTRALIZED
1	2	HDIL EA	1515EA	10318637	CENTRALIZED
1	2	HDIL MA	1515MA	10037719	CENTRALIZED

MAIN LOG 2"/100FT SCALE

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 13:41:19 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n777l_WGI_DAL03.prm
LOGGING MODE: DEPTH DIRECTION: UP
TOP DEPTH: 58.625 ft BOTTOM DEPTH: 2899.755 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft) TOP	BOTTOM
TTRM	FILTER ()	medium (1)		TOP	BOTTOM
	FILTER (.h)	medium (1)		"	"
	FILTER (.i)	medium (1)		"	"
TENSION	FILTER ()	medium (1)		"	"
GR	FILTER ()	medium (1)		"	"
	FILTER (.h)	medium (1)		"	"
CALIPER	FILTER	medium (1)		"	"
SP-SPDH	FILTER ()	heavy (3)		"	"
	FILTER (.h)	heavy (3)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft) TOP	BOTTOM
CASING - BOREHOLE & CEMENT VOLUME	CASING O.D.	7.625	in	TOP	BOTTOM
BIT SIZE	BIT SIZE	12.250	in	"	"
MUD SAMPLE RESISTIVITY	MUD SAMPLE TEMP	75.0	degF	"	"
	MUD SAMPLE RES	3.700	ohm.m	"	"
BOREHOLE TEMP from GRADIENT	Known BH REF TEMP	77.0	degF	"	"
	at BH REF DEPTH	0.0	ft	"	"
	with TEMP GRADIENT	1.200	0.01 degF/ft	"	"
BOREHOLE CORR DIAMETER SOURCE	CALIPER/FIXED DIA. (mbh*)	USE CALIPER		"	"
BOREHOLE CORR DIAMETER	FIXED DIAMETER (mbh*)	12.250	in	"	"
BH MUD RESISTIVITY SOURCE	RMUD SOURCE (HDIL)	TOOL MEASURED		"	"

HDIL PROCESSING

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft) TOP	BOTTOM
HDIL TEMPERATURE CORRECTION	TEMP CORR SOURCE	USE RXTEMP		TOP	BOTTOM
ADAPTIVE BOREHOLE CORRECTION	ABC PROCESSING	ON		"	"

ADAPTIVE BOREHOLE CORRECTION	ABC PROCESSING	ON			
	ABC to CALCULATE	BOREHOLE SIZE		"	"
	STANDOFF	1.50	in	"	"
	TOOL POSITION	CENTRALIZED		"	"
	Rmud MULTIPLIER	1.000		"	"

CURVE DESCRIPTION REPORT

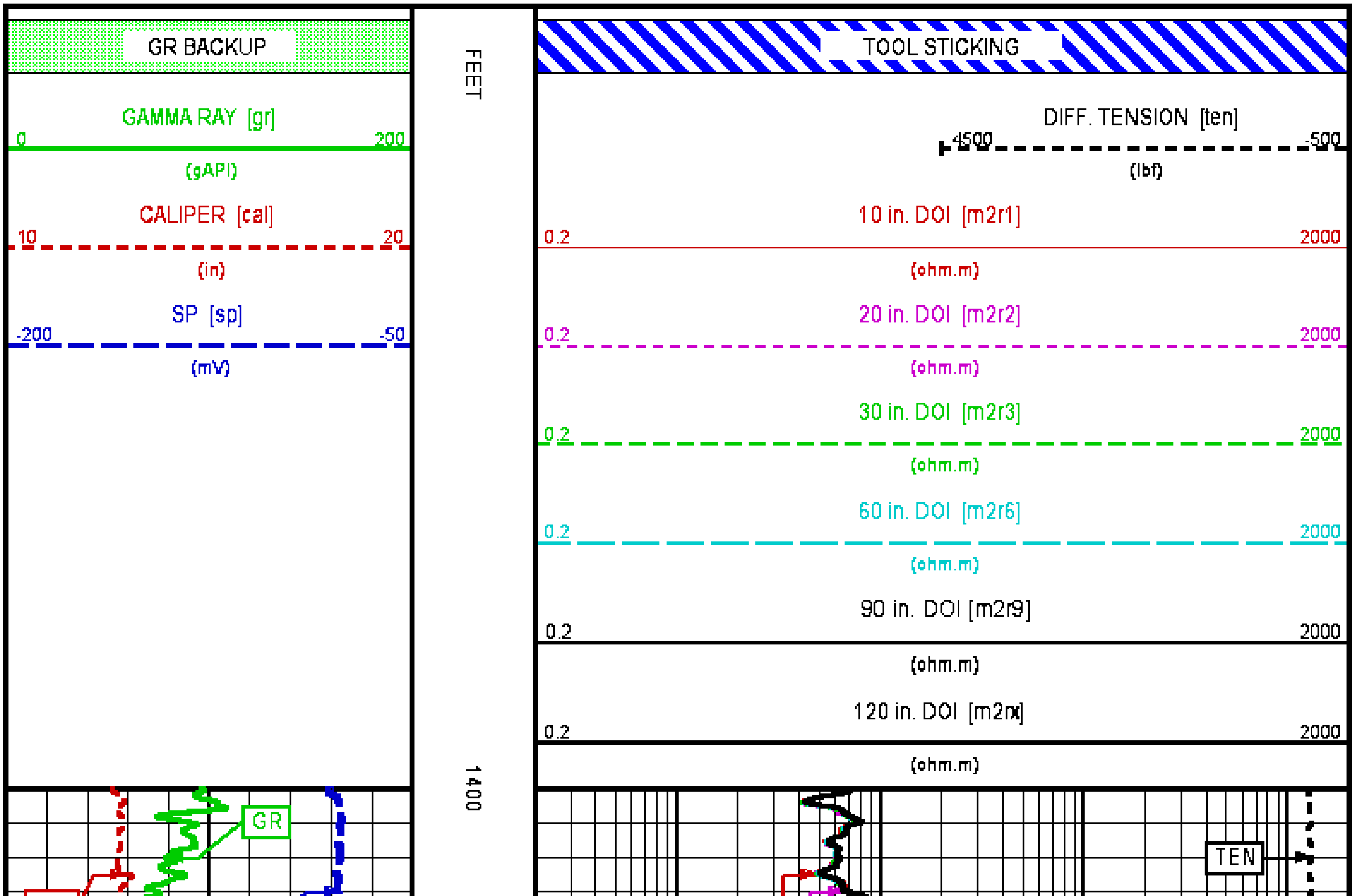
CURVE NAME	CREATION DATE	CURVE DESCRIPTION
F1:CAL	Jun 22 06:16:28 2014	CALIPER
F1:GR	Jun 22 06:16:28 2014	GAMMA RAY
F1:M2R1	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 10-INCH DOI
F1:M2R2	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 20-INCH DOI
F1:M2R3	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 30-INCH DOI
F1:M2R6	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 60-INCH DOI
F1:M2R9	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 90-INCH DOI
F1:M2RX	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 120-INCH DOI
F1:SP	Jun 22 06:16:28 2014	SPONTANEOUS POTENTIAL
F1:TEN	Jun 22 06:16:28 2014	DIFFERENTIAL TENSION

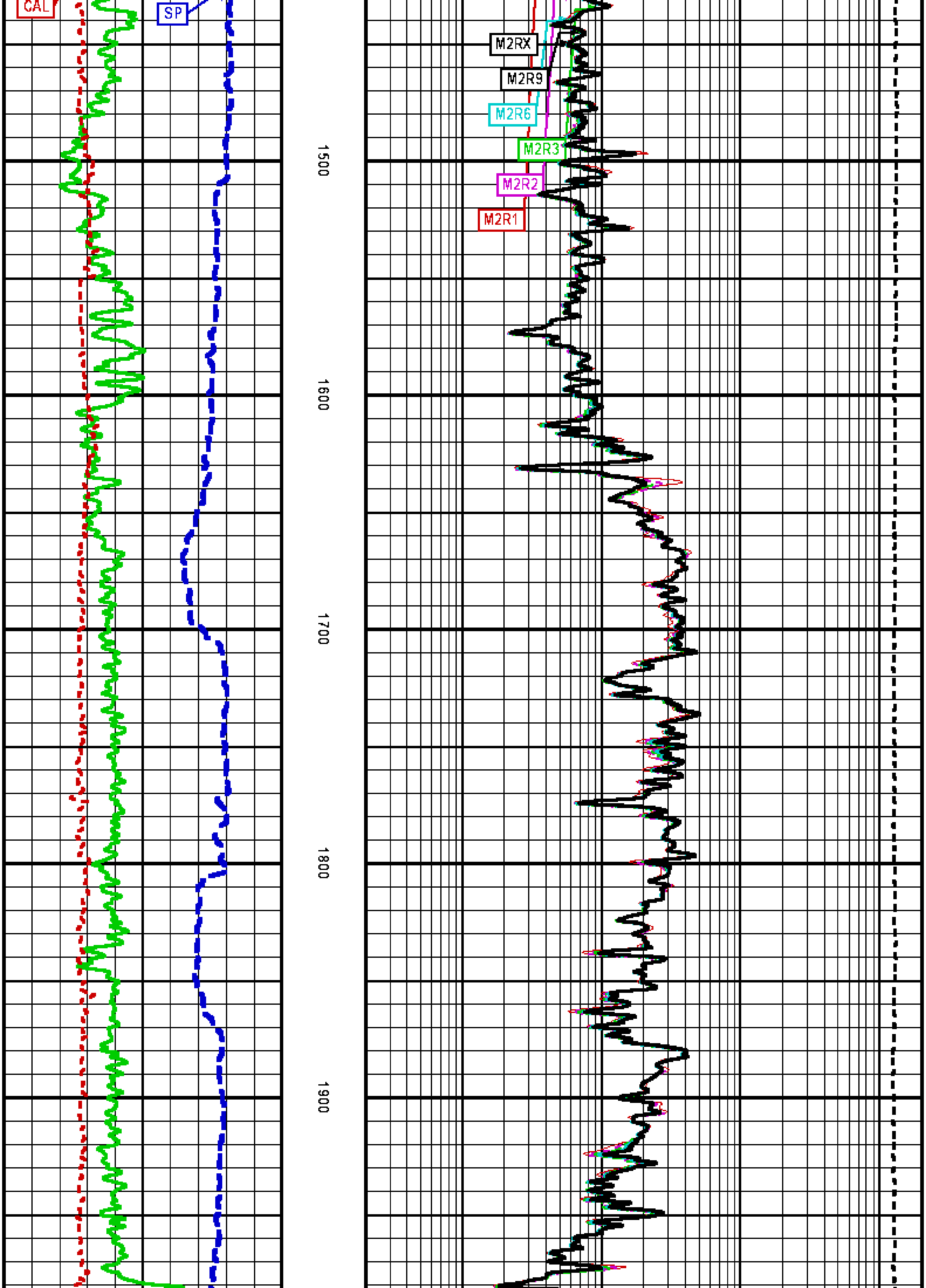
CURVE MEASURE POINT OFFSET

CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
CAL	54.50	M2R2	8.00	M2R9	8.00	TEN	0.00
GR	71.75	M2R3	8.00	M2RX	8.00		
M2R1	8.00	M2R6	8.00	SP	14.00		

Presentation : HL6670:HDIL-2IN.fvpdf [2"/100' Scale]
Plot Interval : 1400 - 2904.75 Feet

Data File 1 : F1 : HL6670:/dat1a/OH087602/MAIN_WGI_DAL.xtf
Created On : Jun 22 06:16:28 2014
Company : RESOLUTION COPPER COMPANY
Well : DHRES-15
Field : RESOLUTION COPPER
File Interval : -25.75 - 2904.88 Feet
OCT : n777I_WG

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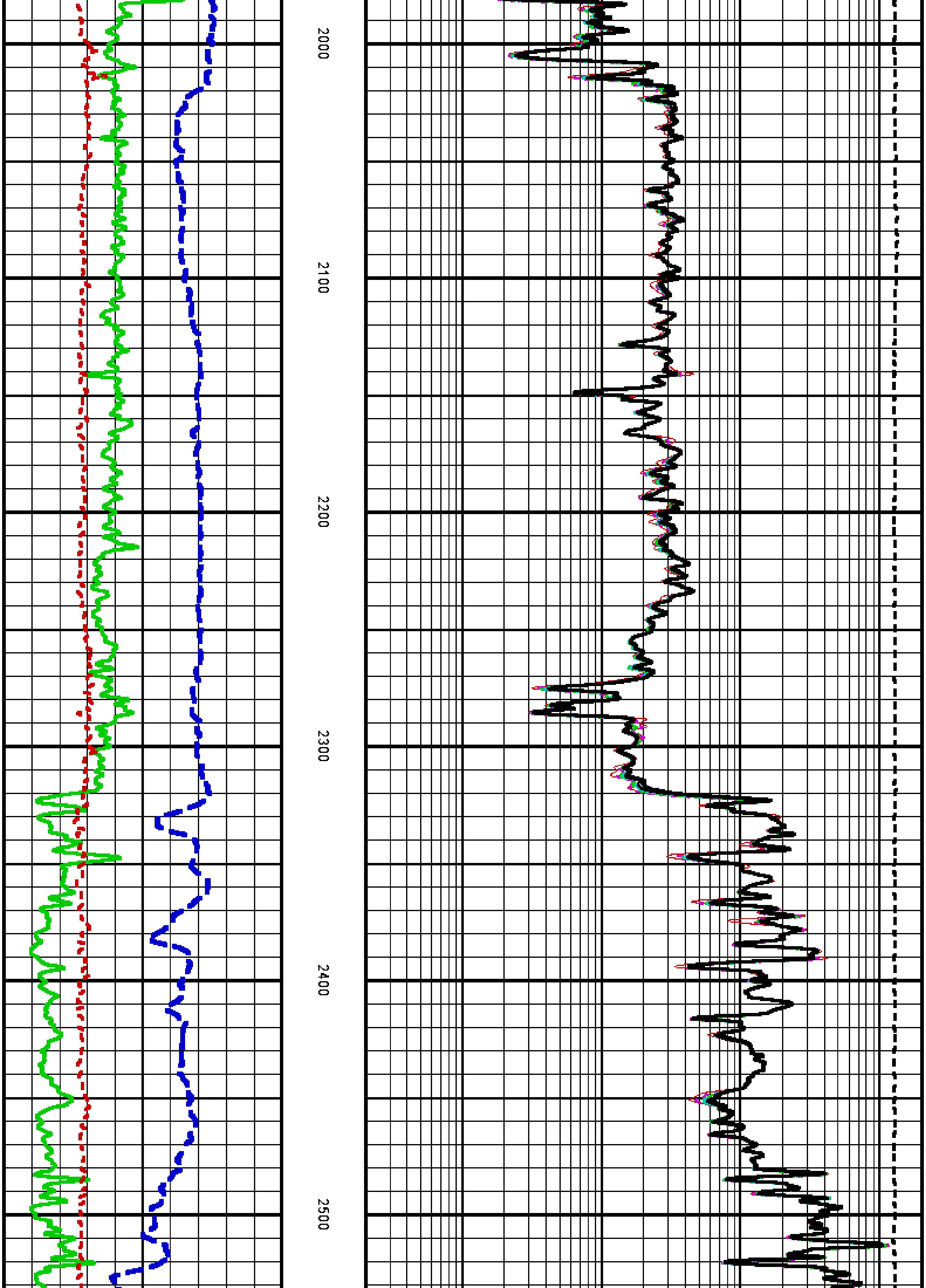
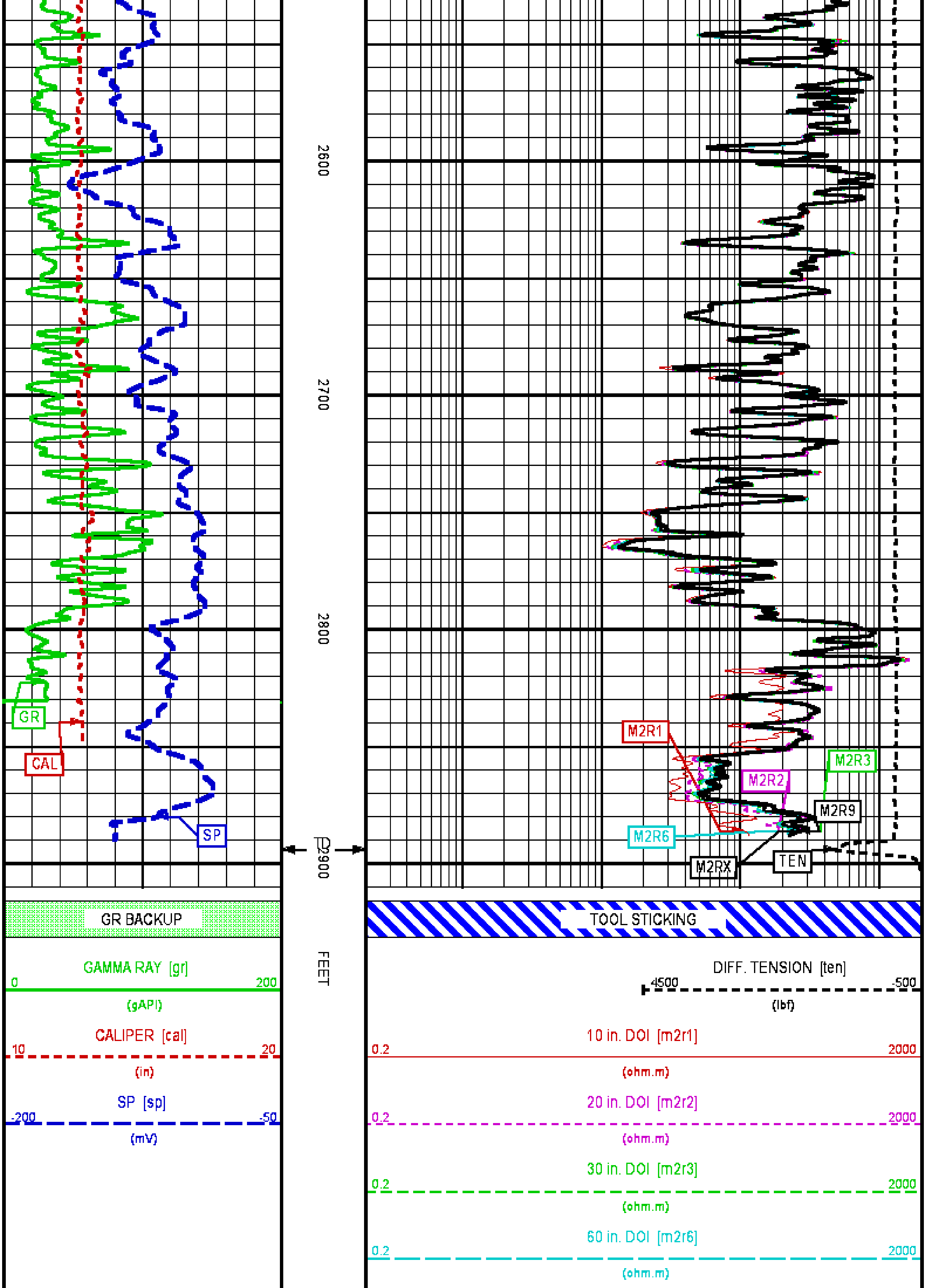
SP
M2RX
M2R9
M2R6
M2R3
M2R2
M2R1
1500
1600
1700
1800
1900


2000
2100
2200
2300
2400
2500



2600
2700
2800
2900
GR
CAL
SP
M2R1
M2R2
M2R3
M2R9
M2R6
M2RX
TEN
GR BACKUP
TOOL STICKING
FEET
GAMMA RAY [gr]
0
200
(gAPI)
CALIPER [cal]
10
20
(in)
SP [sp]
-200
-50
(mV)
DIFF. TENSION [ten]
4500
-500
(lbf)
10 in. DOI [m2r1]
0.2
2000
(ohm.m)
20 in. DOI [m2r2]
0.2
2000
(ohm.m)
30 in. DOI [m2r3]
0.2
2000
(ohm.m)
60 in. DOI [m2r6]
0.2
2000
(ohm.m)

		90 in. DOI [m2r9] 0.2 2000
		(ohm.m)
		120 in. DOI [m2rx] 0.2 2000
		(ohm.m)

MAIN 5"/100FT SCALE

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 13:39:51 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n777I_WGI_DAL03.prm
LOGGING MODE: DEPTH DIRECTION: UP
TOP DEPTH: 58.625 ft BOTTOM DEPTH: 2899.755 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft) TOP	BOTTOM
TTRM	FILTER ()	medium (1)		TOP	BOTTOM
	FILTER (.h)	medium (1)		"	"
	FILTER (.i)	medium (1)		"	"
TENSION	FILTER ()	medium (1)		"	"
GR	FILTER ()	medium (1)		"	"
	FILTER (.h)	medium (1)		"	"
CALIPER	FILTER	medium (1)		"	"
SP-SPDH	FILTER ()	heavy (3)		"	"
	FILTER (.h)	heavy (3)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft) TOP	BOTTOM
CASING - BOREHOLE & CEMENT VOLUME	CASING O.D.	7.625	in	TOP	BOTTOM
BIT SIZE	BIT SIZE	12.250	in	"	"
MUD SAMPLE RESISTIVITY	MUD SAMPLE TEMP	75.0	degF	"	"
	MUD SAMPLE RES	3.700	ohm.m	"	"
BOREHOLE TEMP from GRADIENT	Known BH REF TEMP	77.0	degF	"	"
	at BH REF DEPTH	0.0	ft	"	"
	with TEMP GRADIENT	1.200	0.01 degF/ft	"	"
BOREHOLE CORR DIAMETER SOURCE	CALIPER/FIXED DIA. (mbh*)	USE CALIPER		"	"
BOREHOLE CORR DIAMETER	FIXED DIAMETER (mbh*)	12.250	in	"	"
BH MUD RESISTIVITY SOURCE	RMUD SOURCE (HDIL)	TOOL MEASURED		"	"

HDIL PROCESSING

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft) TOP	BOTTOM
HDIL TEMPERATURE CORRECTION	TEMP CORR SOURCE	USE RXTEMP		TOP	BOTTOM
ADAPTIVE BOREHOLE CORRECTION	ABC PROCESSING	ON		"	"
	ABC to CALCULATE	BOREHOLE SIZE		"	"
	STANDOFF	1.50	in	"	"
	TOOL POSITION	CENTRALIZED		"	"
	Rmud MULTIPLIER	1.000		"	"

CURVE DESCRIPTION REPORT

CURVE NAME	CREATION DATE	CURVE DESCRIPTION

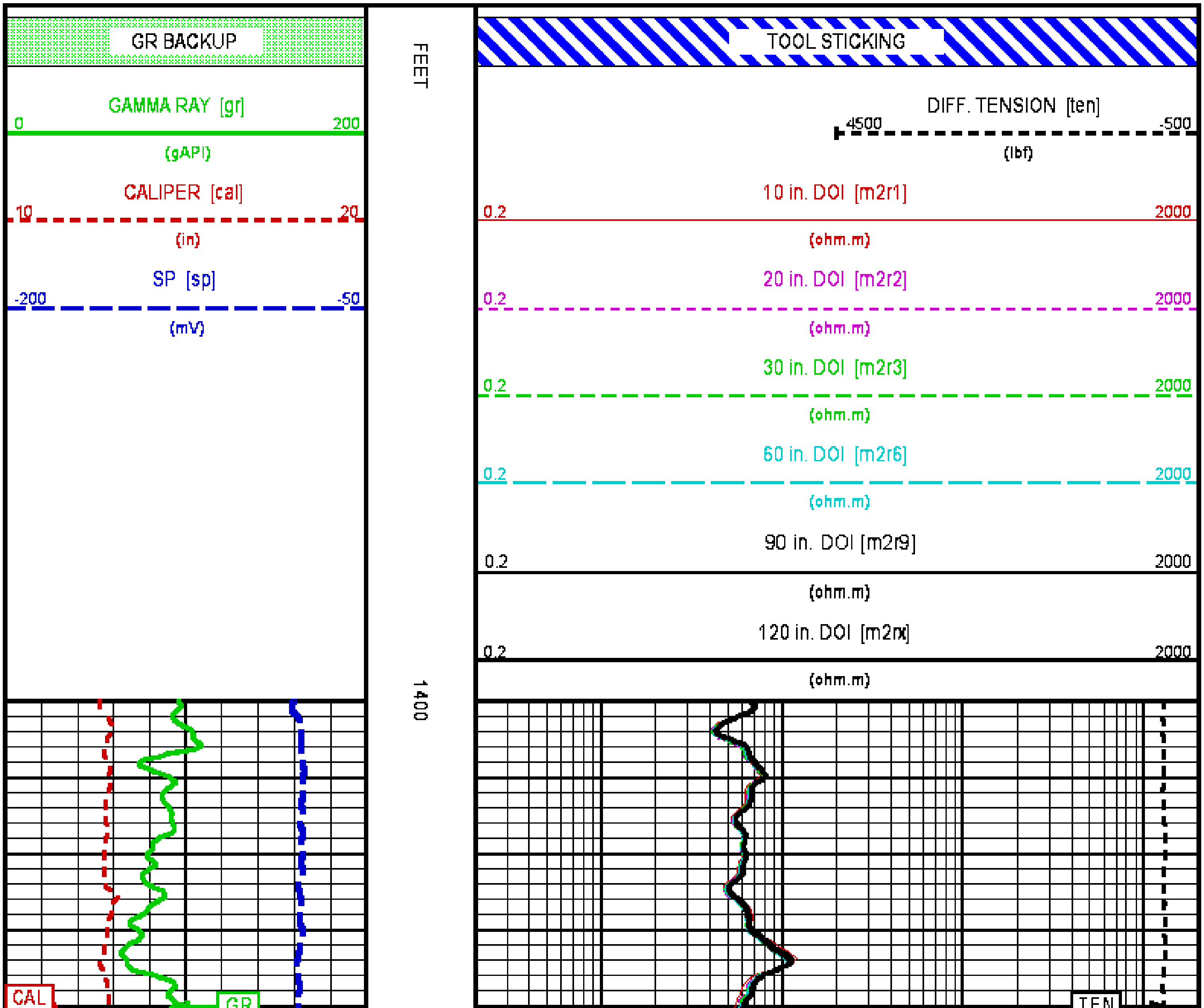
F1:CAL	Jun 22 06:16:28 2014	CALIPER
F1:GR	Jun 22 06:16:28 2014	GAMMA RAY
F1:M2R1	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 10-INCH DOI
F1:M2R2	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 20-INCH DOI
F1:M2R3	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 30-INCH DOI
F1:M2R6	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 60-INCH DOI
F1:M2R9	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 90-INCH DOI
F1:M2RX	Jun 22 06:16:28 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 120-INCH DOI
F1:SP	Jun 22 06:16:28 2014	SPONTANEOUS POTENTIAL
F1:TEN	Jun 22 06:16:28 2014	DIFFERENTIAL TENSION

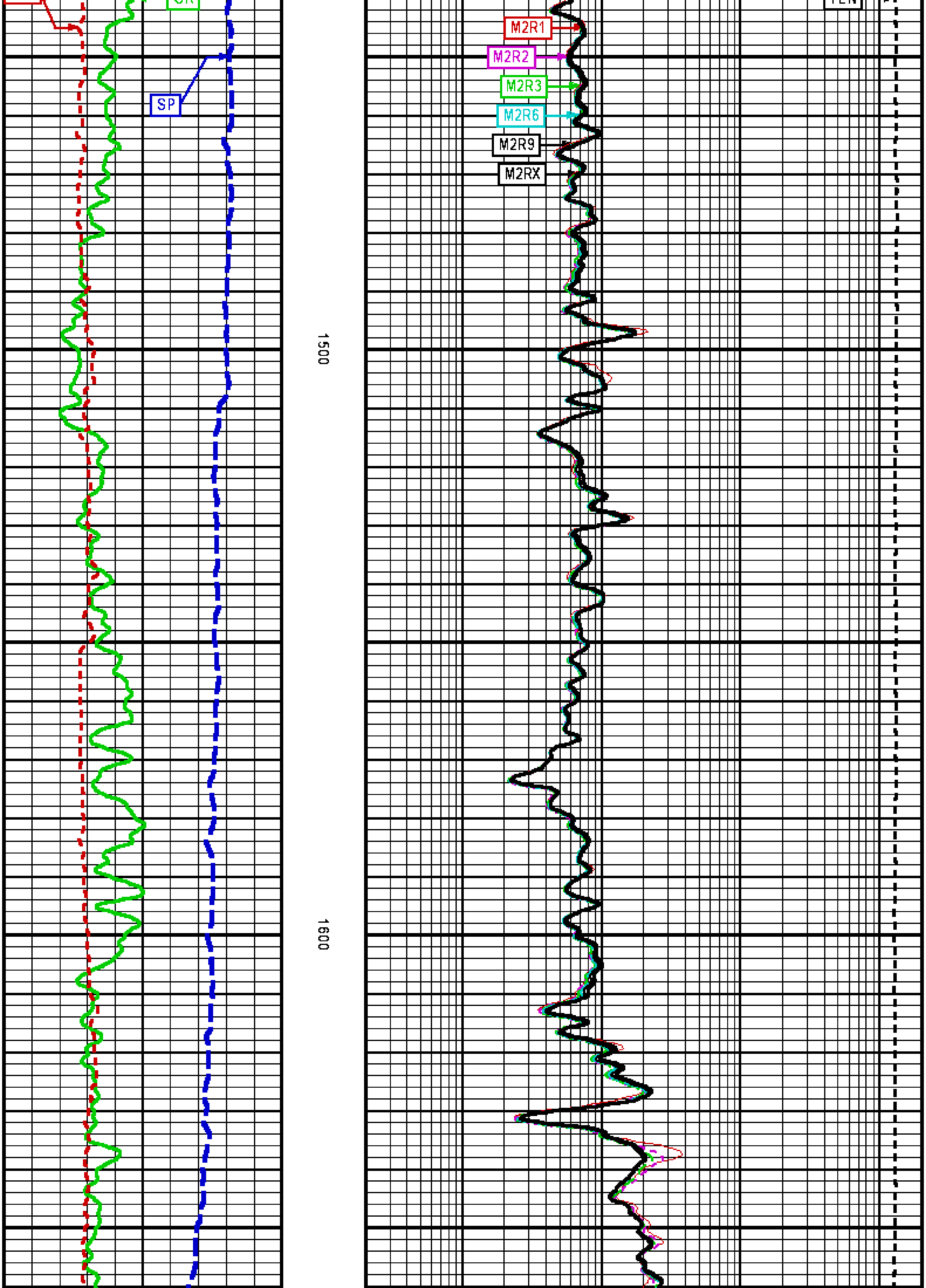
CURVE MEASURE POINT OFFSET

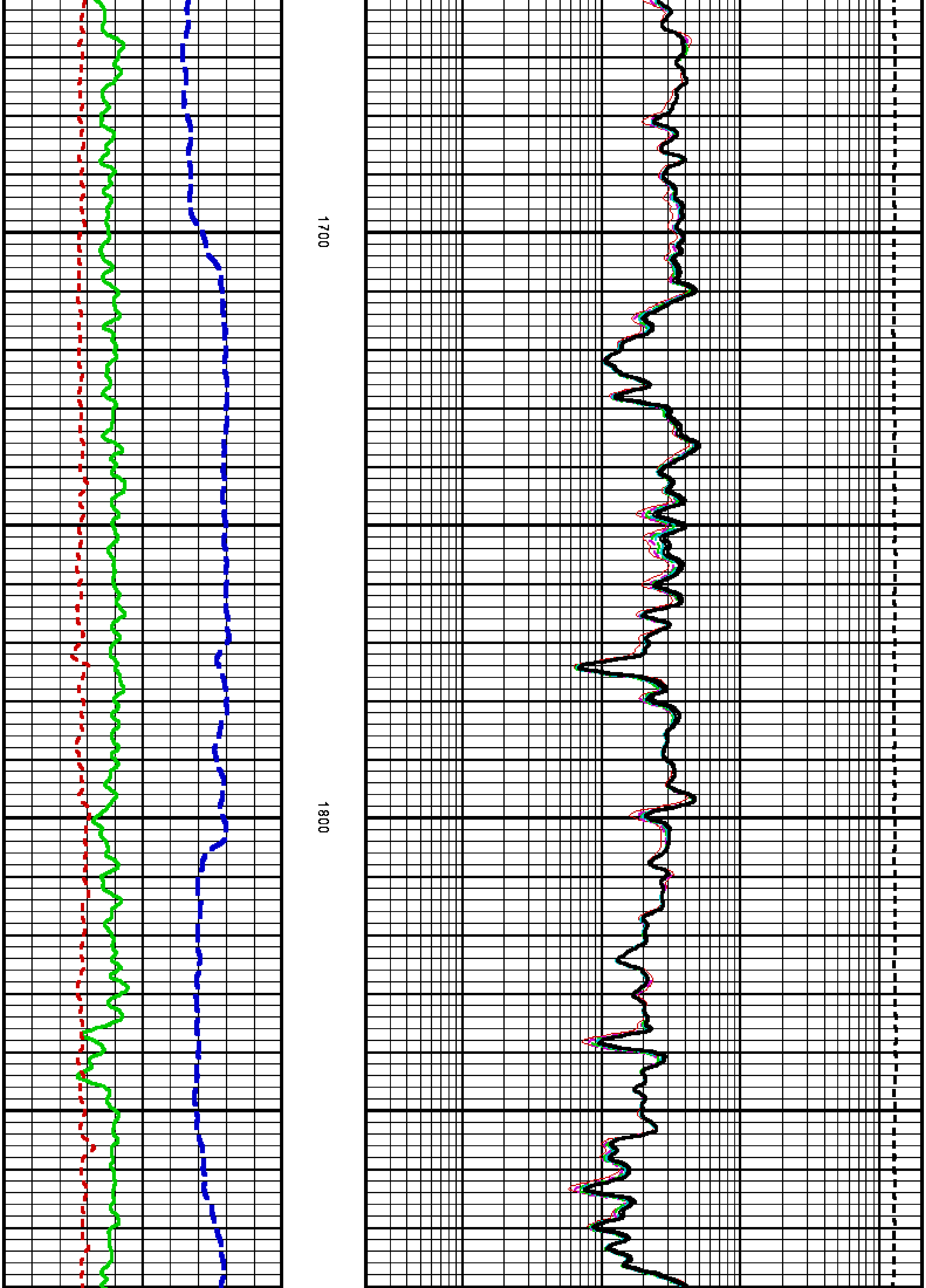
CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
CAL	54.50	M2R2	8.00	M2R9	8.00	TEN	0.00
GR	71.75	M2R3	8.00	M2RX	8.00		
M2R1	8.00	M2R6	8.00	SP	14.00		

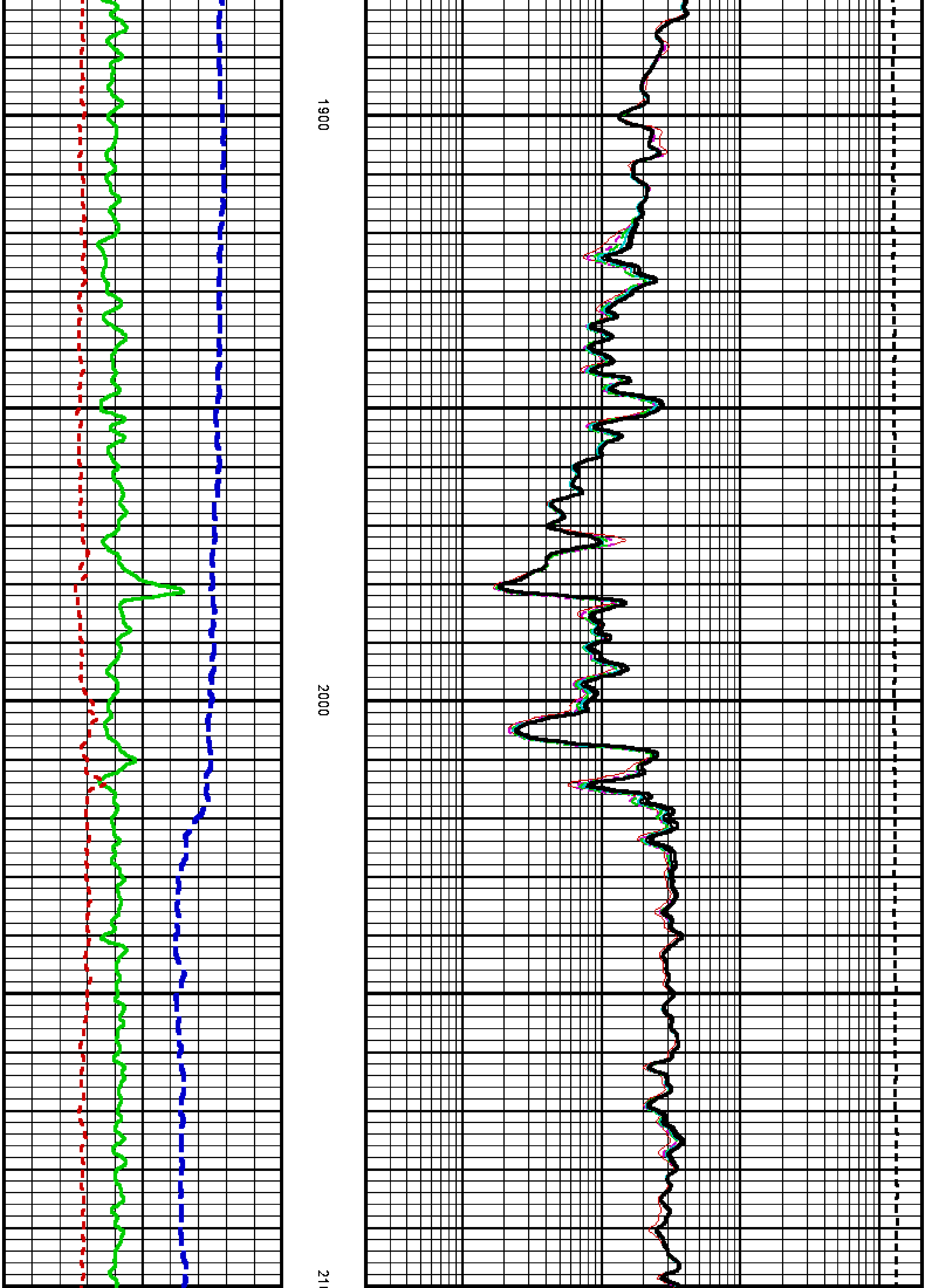
Presentation : HL6670:HDIL-5IN.fvpdf [5"/100' Scale]
Plot Interval : 1400 - 2904.75 Feet

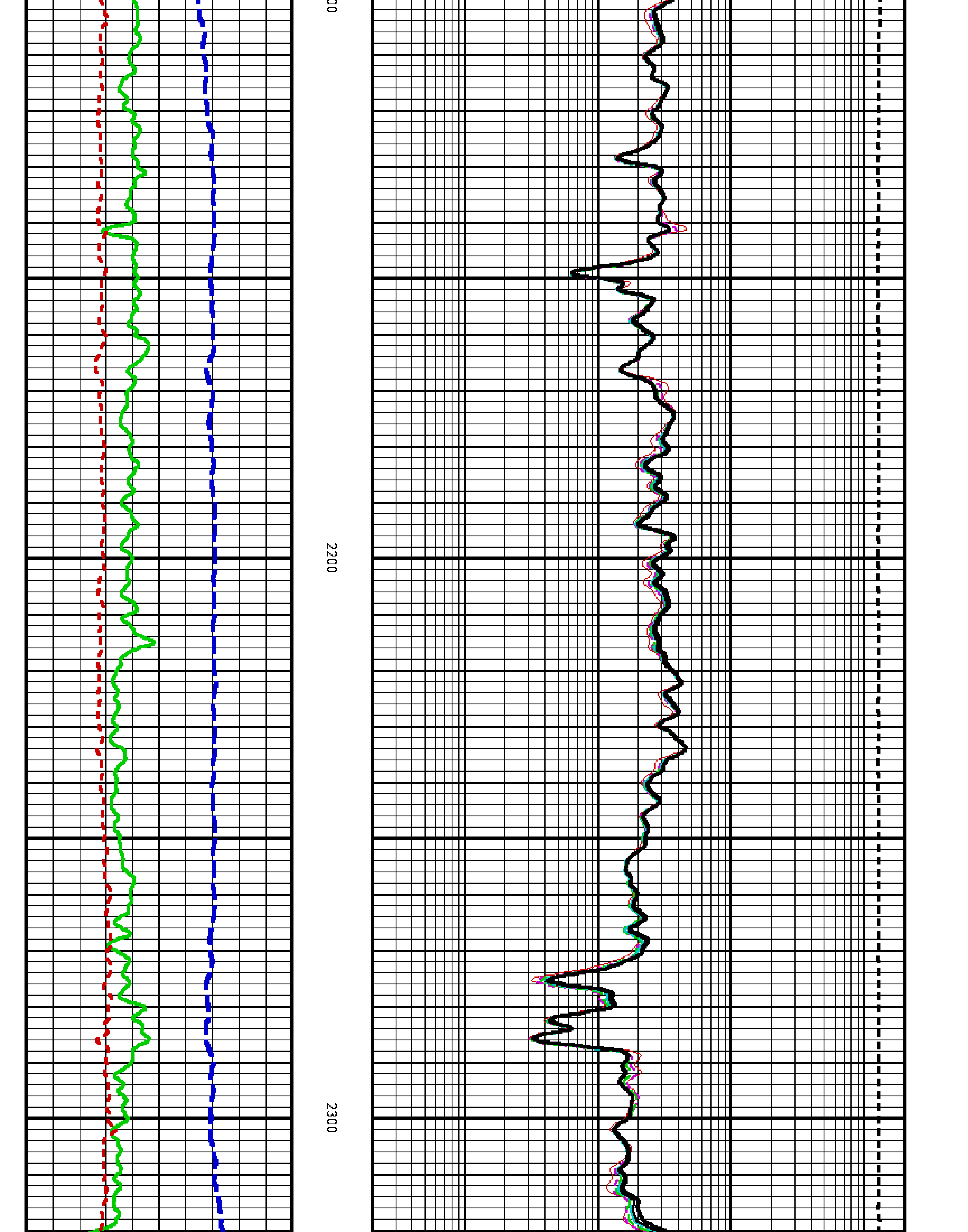
Data File 1 : F1 : HL6670:/dat1a/OH087602/MAIN_WGI_DAL.xtf
Created On : Jun 22 06:16:28 2014
Company : RESOLUTION COPPER COMPANY
Well : DHRES-15
Field : RESOLUTION COPPER
File Interval : -25.75 - 2904.88 Feet
OCT : n777l_WG

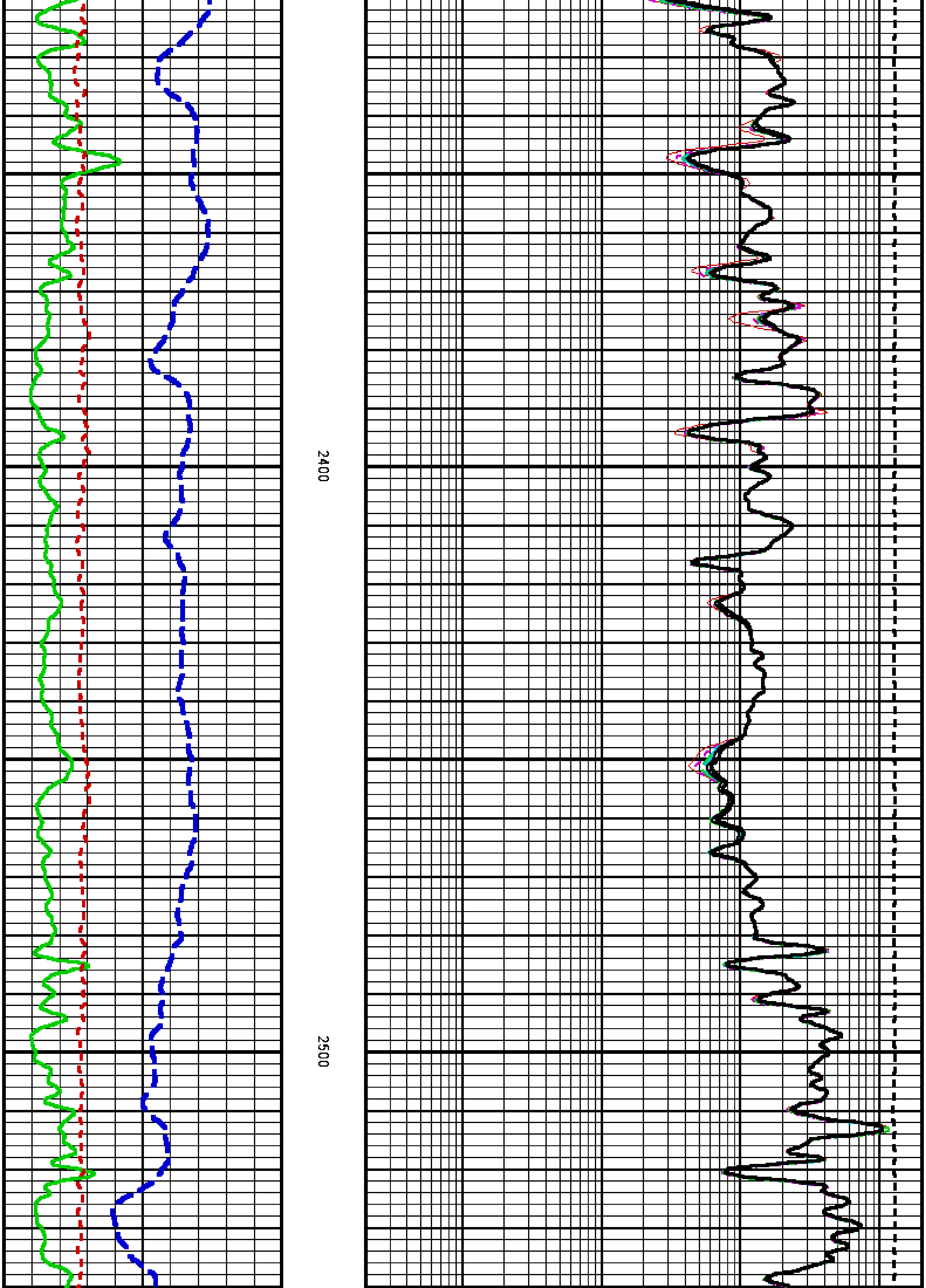


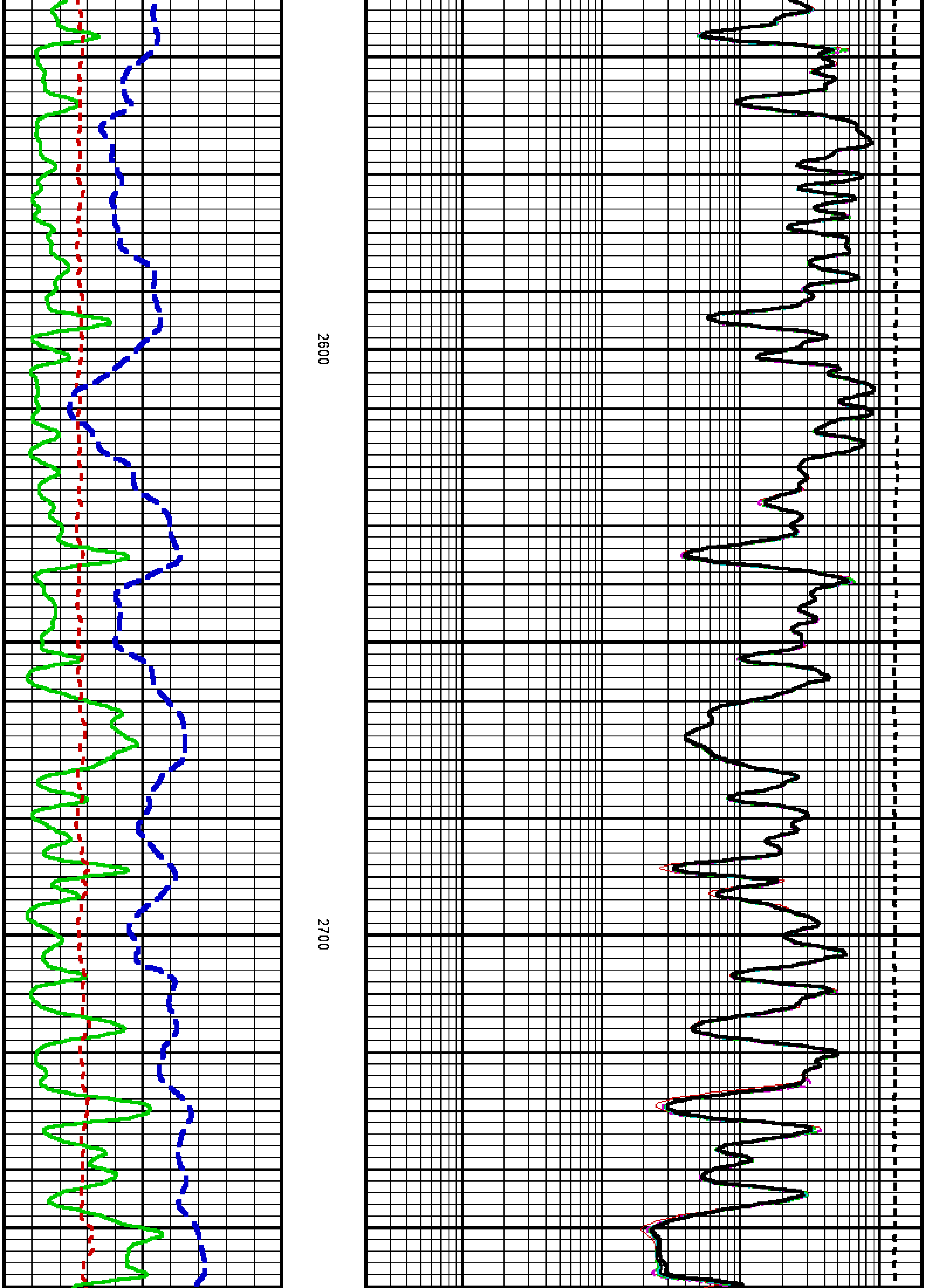

SP
M2R1
M2R2
M2R3
M2R6
M2R9
M2RX
1500
1600

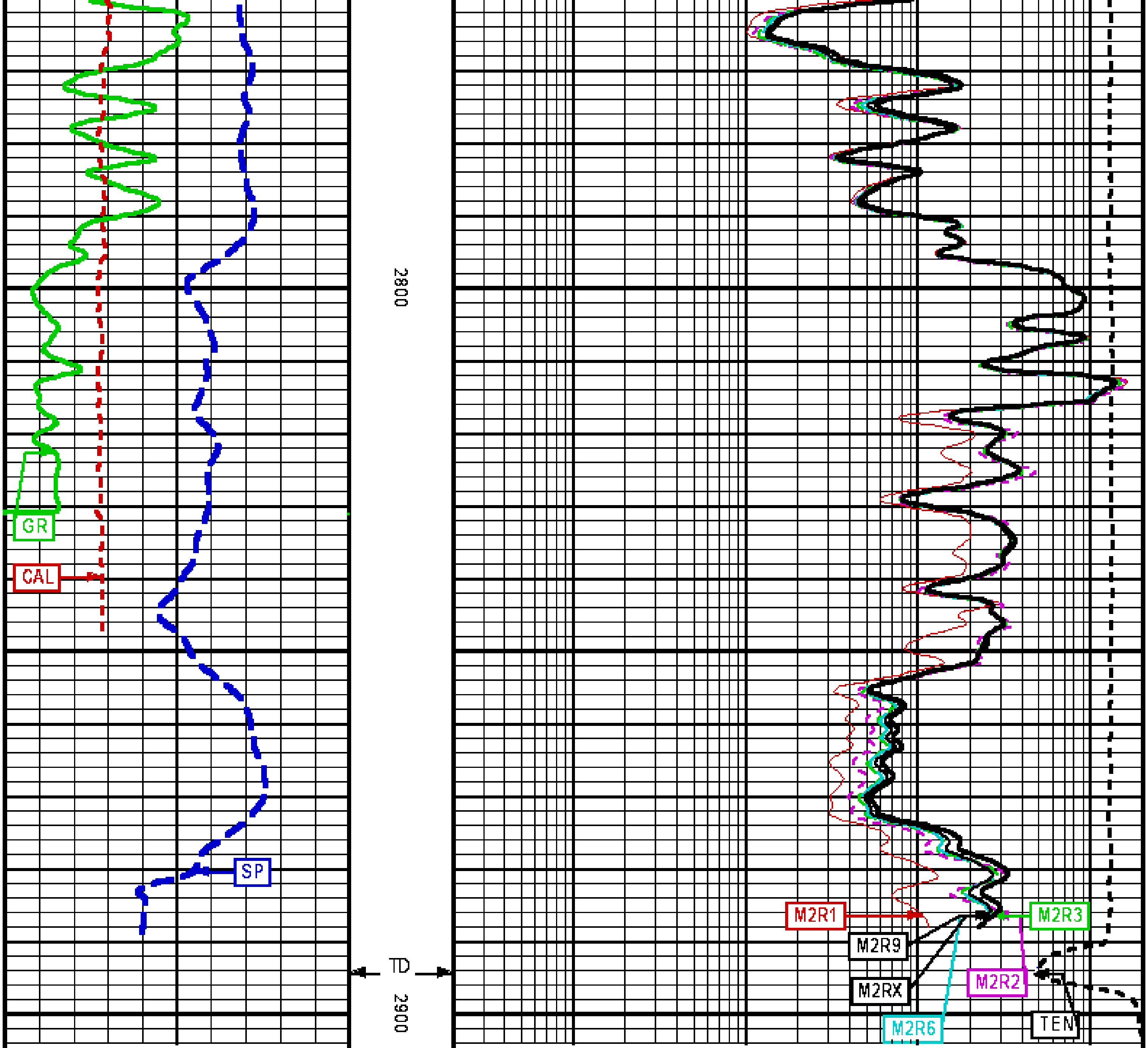

1700
1800


1900
2000


2200
2300


2400
2500


2600
2700



GR BACKUP

TOOL STICKING

FEET

GAMMA RAY [gr]
0 200
(gAPI)

CALIPER [cal]
10 20
(in)

SP [sp]
-200 -50
(mV)

DIFF. TENSION [ten]
4500 -500
(lbf)

10 in. DOI [m2r1]
0.2 2000
(ohm.m)

20 in. DOI [m2r2]
0.2 2000
(ohm.m)

30 in. DOI [m2r3]
0.2 2000
(ohm.m)

60 in. DOI [m2r6]
0.2 2000
(ohm.m)

90 in. DOI [m2r9]
0.2 2000

		(ohm.m)
		120 in. DOI [m2rx] 0.2 2000
		(ohm.m)

REPEAT LOG

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 10:54:59 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n777I_WGI_DAL02.prm
LOGGING MODE: DEPTH DIRECTION: UP
TOP DEPTH: 2575.625 ft BOTTOM DEPTH: 2900.696 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft) TOP	BOTTOM
TTRM	FILTER ()	medium (1)		TOP	BOTTOM
	FILTER (.h)	medium (1)		"	"
	FILTER (.i)	medium (1)		"	"
TENSION	FILTER ()	medium (1)		"	"
GR	FILTER ()	medium (1)		"	"
	FILTER (.h)	medium (1)		"	"
CALIPER	FILTER	medium (1)		"	"
SP-SPDH	FILTER ()	heavy (3)		"	"
	FILTER (.h)	heavy (3)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft) TOP	BOTTOM
CASING - BOREHOLE & CEMENT VOLUME	CASING O.D.	7.625	in	TOP	BOTTOM
BIT SIZE	BIT SIZE	12.250	in	"	"
MUD SAMPLE RESISTIVITY	MUD SAMPLE TEMP	75.0	degF	"	"
	MUD SAMPLE RES	3.700	ohm.m	"	"
BOREHOLE TEMP from GRADIENT	Known BH REF TEMP	77.0	degF	"	"
	at BH REF DEPTH	0.0	ft	"	"
	with TEMP GRADIENT	1.200	0.01 degF/ft	"	"
BOREHOLE CORR DIAMETER SOURCE	CALIPER/FIXED DIA. (mbh*)	USE CALIPER		"	"
BOREHOLE CORR DIAMETER	FIXED DIAMETER (mbh*)	12.250	in	"	"
BH MUD RESISTIVITY SOURCE	RMUD SOURCE (HDIL)	TOOL MEASURED		"	"

HDIL PROCESSING

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft) TOP	BOTTOM
HDIL TEMPERATURE CORRECTION	TEMP CORR SOURCE	USE RXTEMP		TOP	BOTTOM
ADAPTIVE BOREHOLE CORRECTION	ABC PROCESSING	ON		"	"
	ABC to CALCULATE	BOREHOLE SIZE		"	"
	STANDOFF	1.50	in	"	"
	TOOL POSITION	CENTRALIZED		"	"
	Rmud MULTIPLIER	1.000		"	"

CURVE DESCRIPTION REPORT

CURVE NAME	CREATION DATE	CURVE DESCRIPTION
F1:CAL	Jun 22 05:53:39 2014	CALIPER
F1:GR	Jun 22 05:53:39 2014	GAMMA RAY

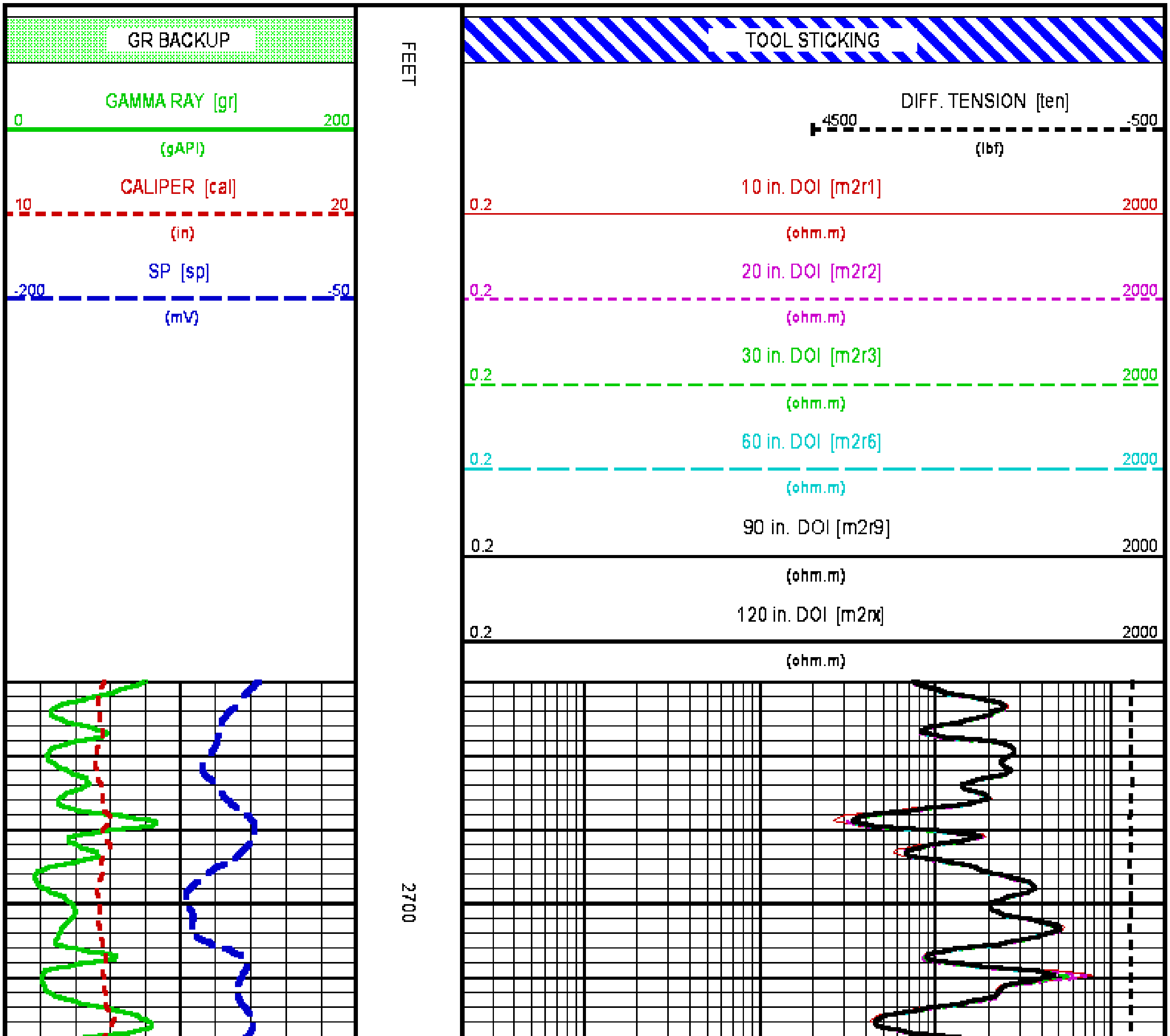
F1:M2R1	Jun 22 05:53:39 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 10-INCH DOI
F1:M2R2	Jun 22 05:53:39 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 20-INCH DOI
F1:M2R3	Jun 22 05:53:39 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 30-INCH DOI
F1:M2R6	Jun 22 05:53:39 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 60-INCH DOI
F1:M2R9	Jun 22 05:53:39 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 90-INCH DOI
F1:M2RX	Jun 22 05:53:39 2014	VERTICAL 2-FOOT RESOLUTION MATCHED RESISTIVITY, 120-INCH DOI
F1:SP	Jun 22 05:53:39 2014	SPONTANEOUS POTENTIAL
F1:TEN	Jun 22 05:53:39 2014	DIFFERENTIAL TENSION

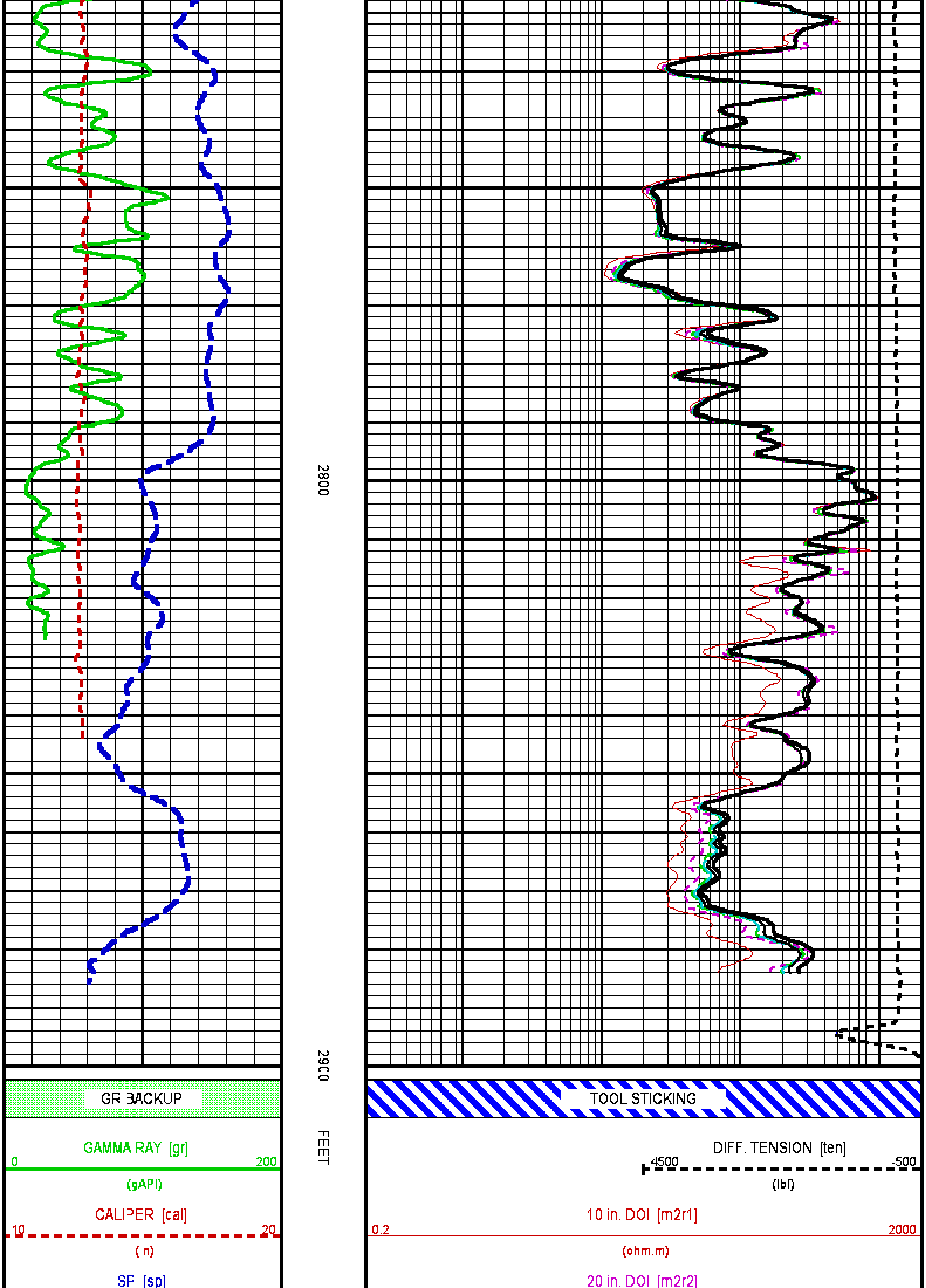
CURVE MEASURE POINT OFFSET

CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
CAL	54.50	M2R2	8.00	M2R9	8.00	TEN	0.00
GR	71.75	M2R3	8.00	M2RX	8.00		
M2R1	8.00	M2R6	8.00	SP	14.00		

Presentation : HL6670:REPEAT_HDIL-5IN.fvpdf [5"/100' Scale]
Plot Interval : 2670 - 2900.75 Feet

Data File 1 : F1 : HL6670:/dat1a/OH087602/REPEAT_WGI_DAL02.xtf
Created On : Jun 22 08:22:10 2014
Company : RESOLUTION COPPER COMPANY
Well : DHRES-15
Field : RESOLUTION COPPER
File Interval : 2491.25 - 2900.88 Feet
OCT : n777I_WG





2800
2900
FEET
GR BACKUP
TOOL STICKING
GAMMA RAY [gr]
0
200
(gAPI)
CALIPER [cal]
10
20
(in)
SP [sp]
DIFF. TENSION [ten]
4500
-500
(lbf)
10 in. DOI [m2r1]
0.2
2000
(ohm.m)
20 in. DOI [m2r2]

-200 (mV) -50	0.2 (ohm.m) 2000
	30 in. DOI [m2r3] 0.2 (ohm.m) 2000
	60 in. DOI [m2r6] 0.2 (ohm.m) 2000
	90 in. DOI [m2r9] 0.2 (ohm.m) 2000
	120 in. DOI [m2rx] 0.2 (ohm.m) 2000

CALIBRATION / VERIFICATION SUMMARY

Source File: /dat1a/OH087602/PLOT_WGI_DAL.tp1

CHT PRIMARY CALIBRATION SUMMARY

TOOL #: 3981XA 10516527 DATE/TIME PERFORMED: Fri Jun 13 11:47:01 2014

UNIT #: 3885TC 6685

	Signal Low (raw)	Signal High (raw)	Scale Mult	Scale Add	Engr Low (lbf)	Engr High (lbf)
CHT	-104.19	379.56	3.10	123.06	-200.00	1300.00

GR PRIMARY CALIBRATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Tue Jun 3 11:41:15 2014

UNIT #: 3880TA HL6670 CALB JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	CR DIFF (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	CALBRTR (gAPI)
GR	331.93	1231.27	899.3 830.0 960.0	0.167	55.36	205.36	150

GR PRIMARY VERIFICATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Tue Jun 3 11:52:52 2014

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	326.98	1207.64	0.167	54.54	201.42	146.89 140.00 160.00

GR BEFORE LOG VERIFICATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Sun Jun 22 04:37:52 2014 DAYS SINCE CAL: 18

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK VBA-905

BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	193.98	1068.84	0.167	32.35	178.27	145.92 (135.89 – 155.89)

GR AFTER LOG VERIFICATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Sun Jun 22 07:57:23 2014 DAYS SINCE CAL: 18

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	195.57	1064.44	0.167	32.62	177.54	144.92 (135.92 – 155.92)

WGI PRIMARY CALIBRATION SUMMARY

TOOL #: 4253XA 10189872 DATE/TIME PERFORMED: Wed Jun 18 16:21:47 2014

UNIT #: 3880TA HL6670

DIAMETER	SM RING (in)	LG RING (in)	TEMPERATURE (degF)
	7.000	21.800	81.735

COS/SIN/ ANGLE DATA	SM RING COS (mV)	SM RING SIN (mV)	LG RING COS (mV)	LG RING SIN (mV)	OFFSET COS (mV)	OFFSET SIN (mV)	OFFSET ANG (deg)
ARM 1 LOWER	1150.8	-1095.9	-989.6	1239.9	80.6 (-500.0 – 500.0)	72.0 (-500.0 – 500.0)	9.334
ARM 1 UPPER	1421.7	728.4	-1346.1	-616.2	37.8 (-500.0 – 500.0)	56.1 (-500.0 – 500.0)	1.993
ARM 2 LOWER	1224.1	-946.4	-1105.5	1115.8	59.3 (-500.0 – 500.0)	84.7 (-500.0 – 500.0)	8.736
ARM 2 UPPER	-1201.8	-1001.8	1186.8	1154.3	-7.5 (-500.0 – 500.0)	76.3 (-500.0 – 500.0)	18.377
ARM 3 LOWER	1351.6	-247.4	-1742.9	-63.7	-195.7 (-500.0 – 500.0)	-155.5 (-500.0 – 500.0)	4.924
ARM 3 UPPER	1005.3	-1243.9	-931.2	1328.4	37.1 (-500.0 – 500.0)	42.3 (-500.0 – 500.0)	9.887
ARM 4 LOWER	1042.6	-1220.9	-1111.3	1191.0	-34.3 (-500.0 – 500.0)	-14.9 (-500.0 – 500.0)	9.407
ARM 4 UPPER	-840.7	-1097.1	1232.6	965.9	195.9 (-500.0 – 500.0)	-65.6 (-500.0 – 500.0)	18.098
ARM 5 LOWER	1535.8	-438.0	-1348.6	572.3	93.6 (-500.0 – 500.0)	67.1 (-500.0 – 500.0)	6.514
ARM 5 UPPER	610.2	-1591.8	-716.9	1547.5	-53.3 (-500.0 – 500.0)	-22.2 (-500.0 – 500.0)	11.292
ARM 6 LOWER	1383.7	-612.0	-1398.7	569.3	-7.5 (-500.0 – 500.0)	-21.4 (-500.0 – 500.0)	6.885
ARM 6 UPPER	863.7	-1212.4	-854.2	1277.2	4.7 (-500.0 – 500.0)	32.4 (-500.0 – 500.0)	10.123

WGI BEFORE LOG VERIFICATION SUMMARY

TOOL #: 4253XA 10189872 DATE/TIME PERFORMED: Sun Jun 22 04:35:07 2014 DAYS SINCE CAL: 3

UNIT #: 3880TA HL6670

DIAMETER	TRUE ID (in)	CHAD (in)	MIND (in)	MAXD (in)	TEMPERATURE (degF)
	21.800	21.760 (21.600 – 22.000)	21.668	21.867	72.945

	RADIUS (in)	RADIUS (in)	DIAMETER (in)
ARM 1 & 4	10.930	10.937	21.867
ARM 2 & 5	10.772	10.919	21.692
ARM 3 & 6	10.836	10.886	21.722

HDIL PRIMARY CALIBRATION SUMMARY

TOOL #: 1515MA 10037719 | DATE/TIME PERFORMED: Mon Jan 20 14:47:06 2014

UNIT #: 3880TA HL6670 | GRCOND ID & DATE: 126 083096

ZERO DATA(mv)	10 KHz	30 KHz	50 KHz	70 KHz	90 KHz	110 KHz	130 KHz	150 KHz
Coil 0 R	0.002	0.002	0.002	0.000	-0.001	0.001	-0.000	-0.001
	-0.200 0.200	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100
Coil 0 Q	0.007	0.009	0.002	0.003	0.004	0.002	-0.000	-0.000
	-1.000 1.000	-0.200 0.200	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100
Coil 1 R	-0.004	-0.002	0.000	0.005	0.004	0.001	-0.001	-0.002
	-0.200 0.200	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100
Coil 1 Q	-0.008	-0.009	-0.006	-0.002	0.000	0.003	0.003	0.001
	-1.000 1.000	-0.200 0.200	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100
Coil 2 R	0.004	0.006	0.006	0.004	0.004	0.006	0.009	0.010
	-0.200 0.200	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100
Coil 2 Q	-0.002	0.001	0.000	-0.000	-0.004	-0.004	-0.004	-0.002
	-1.000 1.000	-0.200 0.200	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100
Coil 3 R	0.006	0.007	0.008	0.006	0.006	0.003	0.004	0.002
	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100
Coil 3 Q	-0.008	-0.004	0.002	0.002	-0.001	0.001	-0.002	-0.001
	-0.500 0.500	-0.200 0.200	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100
Coil 4 R	-0.004	-0.003	0.000	-0.000	0.005	0.006	0.005	0.007
	-0.200 0.200	-0.200 0.200	-0.200 0.200	-0.200 0.200	-0.200 0.200	-0.200 0.200	-0.200 0.200	-0.200 0.200
Coil 4 Q	-0.008	-0.001	-0.001	0.000	-0.007	-0.004	-0.003	0.000
	-1.000 1.000	-0.400 0.400	-0.200 0.200	-0.200 0.200	-0.200 0.200	-0.200 0.200	-0.200 0.200	-0.200 0.200
Coil 5 R	0.005	0.003	0.009	0.009	-0.002	0.004	0.005	0.004
	-0.400 0.400	-0.400 0.400	-0.400 0.400	-0.400 0.400	-0.400 0.400	-0.400 0.400	-0.400 0.400	-0.400 0.400
Coil 5 Q	-0.005	0.002	0.006	0.008	0.003	0.012	-0.000	-0.005
	-2.000 2.000	-0.800 0.800	-0.400 0.400	-0.400 0.400	-0.400 0.400	-0.400 0.400	-0.400 0.400	-0.400 0.400
Coil 6 R	-0.013	0.016	-0.019	-0.002	-0.008	0.002	0.001	0.032
	-1.000 1.000	-1.000 1.000	-1.000 1.000	-1.000 1.000	-1.000 1.000	-1.000 1.000	-1.000 1.000	-1.000 1.000
Coil 6 Q	0.010	-0.003	0.006	-0.003	-0.005	-0.017	-0.012	-0.005
	-5.000 5.000	-2.000 2.000	-1.000 1.000	-1.000 1.000	-1.000 1.000	-1.000 1.000	-1.000 1.000	-1.000 1.000

ELEC. GAINS	10 KHz	30 KHz	50 KHz	70 KHz	90 KHz	110 KHz	130 KHz	150 KHz
Coil 0 M	125.56	124.07	121.17	116.96	111.53	105.14	97.64	89.46
	100.00 150.00	100.00 150.00	98.00 150.00	96.00 140.00	92.00 140.00	87.00 130.00	82.00 120.00	76.00 110.00
Coil 0 P	7.720	24.297	40.614	56.846	73.005	89.211	105.261	121.397
	6.000 9.000	19.000 28.000	32.000 47.000	44.000 66.000	57.000 85.000	70.000 100.000	82.000 120.000	95.000 140.000
Coil 1 M	217.91	215.29	210.30	202.98	193.60	182.50	169.46	155.27
	180.00 270.00	180.00 270.00	170.00 260.00	170.00 250.00	160.00 250.00	160.00 230.00	150.00 220.00	140.00 200.00
Coil 1 P	7.696	24.246	40.521	56.735	72.881	89.012	105.062	121.231
	6.000 9.000	19.000 28.000	32.000 48.000	45.000 67.000	57.000 86.000	70.000 110.000	83.000 120.000	96.000 140.000
Coil 2 M	436.05	430.98	421.26	407.00	388.43	366.45	340.70	312.16
	360.00 540.00	360.00 540.00	350.00 530.00	340.00 510.00	330.00 500.00	310.00 470.00	300.00 440.00	270.00 410.00
Coil 2 P	7.883	24.793	41.460	58.064	74.574	91.207	107.653	124.246
	6.000 9.000	19.000 29.000	32.000 48.000	45.000 67.000	58.000 87.000	71.000 110.000	84.000 130.000	96.000 140.000
Coil 3 M	707.25	698.26	681.02	655.98	624.05	586.83	544.23	498.72
	550.00 880.00	560.00 870.00	570.00 850.00	550.00 830.00	530.00 800.00	500.00 760.00	470.00 710.00	440.00 650.00
Coil 3 P	7.849	24.750	41.335	57.794	74.101	90.378	106.417	122.488
	6.000 10.000	20.000 29.000	33.000 49.000	46.000 69.000	59.000 89.000	72.000 110.000	85.000 130.000	98.000 150.000
Coil 4 M	1138.1	1121.1	1089.1	1043.5	986.7	922.7	851.5	777.1
	900.0 1400.0	900.0 1300.0	900.0 1300.0	850.0 1300.0	800.0 1200.0	800.0 1200.0	750.0 1100.0	700.0 1000.0
Coil 4 P	8.082	25.375	42.288	59.012	75.437	91.687	107.650	123.478
	6.000 10.000	20.000 30.000	33.000 50.000	46.000 70.000	60.000 90.000	73.000 110.000	86.000 130.000	99.000 150.000
Coil 5 M	2364.9	2334.3	2275.3	2190.0	2080.7	1953.9	1808.5	1653.5
	1900.0 2800.0	1800.0 2800.0	1800.0 2700.0	1800.0 2600.0	1700.0 2500.0	1600.0 2400.0	1500.0 2200.0	1400.0 2100.0
Coil 5 P	8.215	25.787	43.065	60.223	77.222	94.151	110.852	127.528
	6.000 10.000	20.000 31.000	34.000 51.000	48.000 72.000	62.000 93.000	76.000 110.000	89.000 130.000	100.000 150.000
Coil 6 M	6019.4	5941.0	5788.5	5570.2	5290.0	4963.2	4587.5	4184.2
	4700.0 7100.0	4700.0 7000.0	4600.0 6900.0	4400.0 6600.0	4200.0 6400.0	4000.0 6000.0	3700.0 5600.0	3400.0 5100.0
Coil 6 P	8.163	25.893	43.275	60.549	77.668	94.722	111.567	128.365
	7.000 10.000	22.000 32.000	36.000 54.000	51.000 76.000	65.000 98.000	80.000 120.000	94.000 140.000	110.000 160.000

AM Factor	10 KHz	30 KHz	50 KHz	70 KHz	90 KHz	110 KHz	130 KHz	150 KHz
Coil 0 R	483	-87	-144	-156	-157	-155	-153	-150
	-300 800	-500 200	-600 100	-600 50	-500 20	-500 20	-500 20	-500 20
Coil 0 Q	2334	826	459	286	182	109	53	7
	-3000 6000	-1000 2000	-1000 1200	-500 900	-400 700	-400 600	-400 500	-400 400
Coil 1 R	568	87	22	1	-10	-16	-20	-23
	450 650	20 130	-30 60	-50 40	-55 30	-60 20	-60 10	-60 10
Coil 1 Q	1327	526	327	236	184	146	121	100
	0 2500	0 900	0 600	0 450	0 350	0 300	0 250	0 250
Coil 2 R	186.9	27.5	7.0	0.6	-2.9	-4.5	-5.8	-6.8

	(14.0 / 23.0)	(0.0 / 51.0)	(-10.0 / 25.0)	(-15.0 / 15.0)	(-16.0 / 10.0)	(-16.0 / 7.0)	(-16.0 / 5.0)	(-16.0 / 3.0)
Coil 2 Q	442.6 (-200.0 / 1000.0)	177.0 (0.0 / 350.0)	113.2 (0.0 / 220.0)	85.0 (0.0 / 160.0)	69.9 (0.0 / 130.0)	60.3 (0.0 / 110.0)	53.5 (0.0 / 100.0)	49.4 (0.0 / 90.0)
Coil 3 R	49.6 (37.0 / 62.0)	7.2 (0.0 / 12.0)	2.0 (-3.0 / 6.0)	0.5 (-4.0 / 4.0)	-0.4 (-5.0 / 2.0)	-0.9 (-5.0 / 1.0)	-1.5 (-6.0 / 1.0)	-2.1 (-6.0 / 1.0)
Coil 3 Q	83.4 (-140.0 / 280.0)	37.1 (-40.0 / 100.0)	26.8 (-20.0 / 70.0)	23.1 (-10.0 / 60.0)	22.0 (-10.0 / 50.0)	22.1 (-10.0 / 50.0)	22.6 (-10.0 / 50.0)	23.4 (-10.0 / 50.0)
Coil 4 R	11.61 (2.00 / 18.00)	1.33 (-3.00 / 6.00)	-0.19 (-3.50 / 3.00)	-0.74 (-3.50 / 2.00)	-1.01 (-4.20 / 2.00)	-1.24 (-4.50 / 2.00)	-1.43 (-4.70 / 2.00)	-1.41 (-5.00 / 2.00)
Coil 4 Q	21.84 (-100.00 / 100.00)	12.42 (-30.00 / 50.00)	11.77 (-20.00 / 40.00)	12.79 (-10.00 / 40.00)	14.35 (-10.00 / 40.00)	16.30 (-10.00 / 45.00)	18.31 (-10.00 / 50.00)	20.31 (-10.00 / 60.00)
Coil 5 R	2.57 (-2.00 / 5.80)	0.12 (-3.20 / 2.40)	-0.24 (-4.50 / 3.10)	-0.30 (-4.70 / 3.20)	-0.36 (-4.80 / 3.20)	-0.62 (-5.00 / 3.30)	-0.48 (-5.20 / 3.40)	-0.50 (-5.40 / 3.50)
Coil 5 Q	16.74 (-60.00 / 70.00)	8.87 (-20.00 / 30.00)	9.13 (-20.00 / 30.00)	10.52 (-20.00 / 35.00)	12.26 (-20.00 / 45.00)	14.38 (-20.00 / 50.00)	16.33 (-20.00 / 60.00)	18.50 (-30.00 / 70.00)
Coil 6 R	-2.45 (-4.80 / 1.00)	-0.38 (-5.70 / 3.80)	-0.16 (-6.50 / 4.90)	-0.16 (-6.90 / 5.40)	-0.21 (-7.30 / 5.80)	-0.22 (-7.50 / 6.00)	-0.30 (-7.70 / 6.10)	-0.34 (-7.90 / 6.30)
Coil 6 Q	2.55 (-30.00 / 30.00)	3.41 (-20.00 / 25.00)	5.61 (-20.00 / 35.00)	7.98 (-30.00 / 50.00)	10.23 (-35.00 / 60.00)	12.54 (-40.00 / 70.00)	14.73 (-50.00 / 80.00)	17.02 (-60.00 / 100.00)

MM Factor	10 KHz	30 KHz	50 KHz	70 KHz	90 KHz	110 KHz	130 KHz	150 KHz
Coil 0 M	1.005 (0.500 / 1.100)	1.000 (0.500 / 1.100)	0.994 (0.500 / 1.100)	0.993 (0.500 / 1.100)	0.991 (0.500 / 1.100)	0.990 (0.500 / 1.100)	0.990 (0.500 / 1.100)	0.990 (0.500 / 1.100)
Coil 0 P	0.340 (-2.000 / 2.000)	0.477 (-2.000 / 2.000)	0.518 (-2.000 / 2.000)	0.444 (-2.000 / 2.000)	0.381 (-2.000 / 2.000)	0.301 (-2.000 / 2.000)	0.250 (-2.000 / 2.000)	0.214 (-2.000 / 2.000)
Coil 1 M	0.986 (0.500 / 1.100)	0.983 (0.500 / 1.100)	0.978 (0.500 / 1.100)	0.977 (0.500 / 1.100)	0.975 (0.500 / 1.100)	0.974 (0.500 / 1.100)	0.973 (0.500 / 1.100)	0.973 (0.500 / 1.100)
Coil 1 P	0.188 (-2.000 / 2.000)	0.359 (-2.000 / 2.000)	0.431 (-2.000 / 2.000)	0.447 (-2.000 / 2.000)	0.416 (-2.000 / 2.000)	0.344 (-2.000 / 2.000)	0.298 (-2.000 / 2.000)	0.280 (-2.000 / 2.000)
Coil 2 M	1.010 (0.500 / 1.100)	1.007 (0.500 / 1.100)	1.006 (0.500 / 1.100)	1.005 (0.500 / 1.100)	1.004 (0.500 / 1.100)	1.003 (0.500 / 1.100)	1.003 (0.500 / 1.100)	1.001 (0.500 / 1.100)
Coil 2 P	0.091 (-2.000 / 2.000)	0.101 (-2.000 / 2.000)	0.155 (-2.000 / 2.000)	0.193 (-2.000 / 2.000)	0.175 (-2.000 / 2.000)	0.202 (-2.000 / 2.000)	0.170 (-2.000 / 2.000)	0.202 (-2.000 / 2.000)
Coil 3 M	1.000 (0.500 / 1.100)	0.999 (0.500 / 1.100)	0.998 (0.500 / 1.100)	0.997 (0.500 / 1.100)	0.996 (0.500 / 1.100)	0.995 (0.500 / 1.100)	0.996 (0.500 / 1.100)	0.998 (0.500 / 1.100)
Coil 3 P	0.078 (-2.000 / 2.000)	0.117 (-2.000 / 2.000)	0.193 (-2.000 / 2.000)	0.220 (-2.000 / 2.000)	0.220 (-2.000 / 2.000)	0.201 (-2.000 / 2.000)	0.152 (-2.000 / 2.000)	0.217 (-2.000 / 2.000)
Coil 4 M	1.009 (0.500 / 1.100)	1.008 (0.500 / 1.100)	1.008 (0.500 / 1.100)	1.007 (0.500 / 1.100)	1.006 (0.500 / 1.100)	1.005 (0.500 / 1.100)	1.004 (0.500 / 1.100)	1.003 (0.500 / 1.100)
Coil 4 P	0.082 (-2.000 / 2.000)	0.127 (-2.000 / 2.000)	0.159 (-2.000 / 2.000)	0.244 (-2.000 / 2.000)	0.248 (-2.000 / 2.000)	0.255 (-2.000 / 2.000)	0.256 (-2.000 / 2.000)	0.221 (-2.000 / 2.000)
Coil 5 M	1.018 (0.500 / 1.100)	1.018 (0.500 / 1.100)	1.018 (0.500 / 1.100)	1.017 (0.500 / 1.100)	1.015 (0.500 / 1.100)	1.016 (0.500 / 1.100)	1.014 (0.500 / 1.100)	1.013 (0.500 / 1.100)
Coil 5 P	0.072 (-2.000 / 2.000)	0.010 (-2.000 / 2.000)	0.089 (-2.000 / 2.000)	0.115 (-2.000 / 2.000)	0.074 (-2.000 / 2.000)	0.027 (-2.000 / 2.000)	0.032 (-2.000 / 2.000)	0.025 (-2.000 / 2.000)
Coil 6 M	1.011 (0.500 / 1.100)	1.013 (0.500 / 1.100)	1.012 (0.500 / 1.100)	1.011 (0.500 / 1.100)	1.010 (0.500 / 1.100)	1.016 (0.500 / 1.100)	1.015 (0.500 / 1.100)	1.013 (0.500 / 1.100)
Coil 6 P	0.004 (-2.000 / 2.000)	0.087 (-2.000 / 2.000)	0.037 (-2.000 / 2.000)	0.132 (-2.000 / 2.000)	0.034 (-2.000 / 2.000)	-0.055 (-2.000 / 2.000)	-0.066 (-2.000 / 2.000)	-0.194 (-2.000 / 2.000)

PARMS	TCID 0	TCID 1	Cal Temp (degF)	T Factor
IDs	1.617	0.832	61.0	1.04

HDIL BEFORE LOG VERIFICATION SUMMARY

TOOL #: 1515MA 10037719 DATE/TIME PERFORMED: Sun Jun 22 05:29:07 2014 DAYS SINCE CAL: 152

UNIT #: 3880TA HL6670

ZERO DATA(mv)	10 KHz	30 KHz	50 KHz	70 KHz	90 KHz	110 KHz	130 KHz	150 KHz
Coil 0 R	-0.012 (-0.200 / 0.200)	-0.005 (-0.100 / 0.100)	-0.004 (-0.100 / 0.100)	-0.005 (-0.100 / 0.100)	-0.007 (-0.100 / 0.100)	-0.003 (-0.100 / 0.100)	-0.005 (-0.100 / 0.100)	-0.006 (-0.100 / 0.100)
Coil 0 Q	0.006 (-1.000 / 1.000)	0.010 (-0.200 / 0.200)	0.002 (-0.100 / 0.100)	0.001 (-0.100 / 0.100)	0.003 (-0.100 / 0.100)	0.001 (-0.100 / 0.100)	-0.001 (-0.100 / 0.100)	0.001 (-0.100 / 0.100)
Coil 1 R	0.005 (-0.200 / 0.200)	0.000 (-0.100 / 0.100)	-0.002 (-0.100 / 0.100)	0.001 (-0.100 / 0.100)	0.000 (-0.100 / 0.100)	-0.003 (-0.100 / 0.100)	-0.004 (-0.100 / 0.100)	-0.007 (-0.100 / 0.100)
Coil 1 Q	-0.004 (-1.000 / 1.000)	-0.003 (-0.200 / 0.200)	-0.001 (-0.100 / 0.100)	0.003 (-0.100 / 0.100)	0.003 (-0.100 / 0.100)	0.002 (-0.100 / 0.100)	0.002 (-0.100 / 0.100)	0.001 (-0.100 / 0.100)
Coil 2 R	-0.002 (-0.200 / 0.200)	0.004 (-0.100 / 0.100)	0.006 (-0.100 / 0.100)	0.002 (-0.100 / 0.100)	0.003 (-0.100 / 0.100)	0.005 (-0.100 / 0.100)	0.008 (-0.100 / 0.100)	0.010 (-0.100 / 0.100)
Coil 2 Q	0.003 (-1.000 / 1.000)	0.001 (-0.200 / 0.200)	0.003 (-0.100 / 0.100)	-0.000 (-0.100 / 0.100)	-0.003 (-0.100 / 0.100)	-0.003 (-0.100 / 0.100)	-0.004 (-0.100 / 0.100)	-0.005 (-0.100 / 0.100)
Coil 3 R	0.011 (-0.100 / 0.100)	0.006 (-0.100 / 0.100)	-0.001 (-0.100 / 0.100)	0.005 (-0.100 / 0.100)	0.002 (-0.100 / 0.100)	0.001 (-0.100 / 0.100)	0.002 (-0.100 / 0.100)	0.003 (-0.100 / 0.100)
Coil 3 Q	-0.007	-0.006	-0.000	0.002	0.000	0.000	0.001	0.001

	10 KHz	30 KHz	50 KHz	70 KHz	90 KHz	110 KHz	130 KHz	150 KHz
	-0.500 0.500	-0.200 0.200	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100	-0.100 0.100
Coil 4 R	-0.013 -0.200 0.200	-0.008 -0.200 0.200	-0.007 -0.200 0.200	-0.009 -0.200 0.200	-0.004 -0.200 0.200	-0.001 -0.200 0.200	-0.002 -0.200 0.200	-0.002 -0.200 0.200
Coil 4 Q	-0.009 -1.000 1.000	0.005 -0.400 0.400	-0.000 -0.200 0.200	-0.002 -0.200 0.200	-0.005 -0.200 0.200	-0.002 -0.200 0.200	-0.002 -0.200 0.200	-0.001 -0.200 0.200
Coil 5 R	-0.002 -0.400 0.400	0.009 -0.400 0.400	0.008 -0.400 0.400	0.011 -0.400 0.400	-0.001 -0.400 0.400	-0.006 -0.400 0.400	-0.001 -0.400 0.400	-0.000 -0.400 0.400
Coil 5 Q	-0.001 -2.000 2.000	0.005 -0.800 0.800	-0.001 -0.400 0.400	0.004 -0.400 0.400	0.004 -0.400 0.400	0.012 -0.400 0.400	0.005 -0.400 0.400	0.000 -0.400 0.400
Coil 6 R	-0.028 -1.000 1.000	-0.005 -1.000 1.000	-0.007 -1.000 1.000	-0.023 -1.000 1.000	-0.001 -1.000 1.000	-0.007 -1.000 1.000	-0.003 -1.000 1.000	0.005 -1.000 1.000
Coil 6 Q	-0.024 -5.000 5.000	0.003 -2.000 2.000	0.004 -1.000 1.000	-0.004 -1.000 1.000	0.008 -1.000 1.000	-0.021 -1.000 1.000	-0.010 -1.000 1.000	-0.018 -1.000 1.000

ELEC. GAINS	10 KHz	30 KHz	50 KHz	70 KHz	90 KHz	110 KHz	130 KHz	150 KHz
Coil 0 M	125.98 100.00 150.00	124.49 100.00 150.00	121.58 98.00 150.00	117.35 96.00 140.00	112.04 92.00 140.00	105.60 87.00 130.00	98.20 82.00 120.00	89.94 76.00 110.00
Coil 0 P	7.582 6.000 9.000	23.872 19.000 28.000	39.871 32.000 47.000	55.843 44.000 66.000	71.694 57.000 85.000	87.637 70.000 100.000	103.449 82.000 120.000	119.386 95.000 140.000
Coil 1 M	218.11 180.00 270.00	215.56 180.00 270.00	210.49 170.00 260.00	203.20 170.00 250.00	194.06 160.00 250.00	182.96 160.00 230.00	170.08 150.00 220.00	155.77 140.00 200.00
Coil 1 P	7.679 6.000 9.000	24.179 19.000 28.000	40.407 32.000 48.000	56.607 45.000 67.000	72.665 57.000 86.000	88.836 70.000 110.000	104.895 83.000 120.000	121.087 96.000 140.000
Coil 2 M	439.46 360.00 540.00	434.41 360.00 540.00	424.57 350.00 530.00	410.23 340.00 510.00	392.11 330.00 500.00	369.78 310.00 470.00	344.14 300.00 440.00	315.68 270.00 410.00
Coil 2 P	7.855 6.000 9.000	24.677 19.000 29.000	41.269 32.000 48.000	57.817 45.000 67.000	74.262 58.000 87.000	90.831 71.000 110.000	107.243 84.000 130.000	123.841 96.000 140.000
Coil 3 M	710.97 590.00 880.00	702.12 580.00 870.00	684.84 570.00 850.00	659.69 550.00 830.00	627.94 530.00 800.00	590.82 500.00 760.00	547.90 470.00 710.00	502.37 440.00 650.00
Coil 3 P	7.721 6.000 10.000	24.312 20.000 29.000	40.597 33.000 49.000	56.804 46.000 69.000	72.814 59.000 89.000	88.873 72.000 110.000	104.642 85.000 130.000	120.436 98.000 150.000
Coil 4 M	1138.5 900.0 1400.0	1122.0 900.0 1300.0	1089.9 900.0 1300.0	1044.6 850.0 1300.0	988.8 800.0 1200.0	924.7 800.0 1200.0	854.7 750.0 1100.0	780.6 700.0 1000.0
Coil 4 P	7.963 6.000 10.000	25.046 20.000 30.000	41.713 33.000 50.000	58.225 46.000 70.000	74.415 60.000 90.000	90.515 73.000 110.000	106.238 86.000 130.000	121.950 99.000 150.000
Coil 5 M	2365.1 1900.0 2800.0	2335.0 1800.0 2800.0	2275.9 1800.0 2700.0	2191.0 1800.0 2600.0	2083.7 1700.0 2500.0	1957.2 1600.0 2400.0	1813.2 1500.0 2200.0	1659.0 1400.0 2100.0
Coil 5 P	8.220 6.000 10.000	25.809 20.000 31.000	43.083 34.000 51.000	60.287 48.000 72.000	77.281 62.000 93.000	94.288 76.000 110.000	111.026 89.000 130.000	127.775 100.000 150.000
Coil 6 M	6029.1 4700.0 7100.0	5951.8 4700.0 7000.0	5800.2 4600.0 6900.0	5581.6 4400.0 6600.0	5308.6 4200.0 6400.0	4980.3 4000.0 6000.0	4610.2 3700.0 5600.0	4210.1 3400.0 5100.0
Coil 6 P	8.141 7.000 10.000	25.830 22.000 32.000	43.157 36.000 54.000	60.419 51.000 76.000	77.469 65.000 98.000	94.560 80.000 120.000	111.373 94.000 140.000	128.235 110.000 160.000

HDIL AFTER LOG VERIFICATION SUMMARY

TOOL #: 1515MA 10037719 DATE/TIME PERFORMED: Sun Jun 22 07:56:48 2014 DAYS SINCE CAL: 152

UNIT #: 3880TA HL6670

ZERO DATA(mv)	10 KHz	30 KHz	50 KHz	70 KHz	90 KHz	110 KHz	130 KHz	150 KHz
Coil 0 R	-0.010 -0.052 0.068	-0.002 -0.065 0.055	-0.002 -0.034 0.026	-0.002 -0.035 0.025	-0.006 -0.037 0.023	-0.003 -0.033 0.027	-0.003 -0.035 0.025	-0.006 -0.036 0.024
Coil 0 Q	0.007 -0.034 0.046	0.010 -0.110 0.130	0.003 -0.028 0.032	0.001 -0.029 0.031	0.004 -0.027 0.033	0.001 -0.029 0.031	-0.000 -0.031 0.029	0.000 -0.029 0.031
Coil 1 R	0.006 -0.075 0.085	0.003 -0.050 0.050	0.001 -0.032 0.028	0.003 -0.029 0.031	0.002 -0.030 0.030	-0.002 -0.033 0.027	-0.004 -0.034 0.026	-0.005 -0.037 0.023
Coil 1 Q	-0.004 -0.404 0.396	-0.002 -0.103 0.097	-0.001 -0.031 0.029	0.002 -0.027 0.033	0.003 -0.027 0.033	0.003 -0.028 0.032	0.003 -0.028 0.032	0.001 -0.029 0.031
Coil 2 R	-0.006 -0.072 0.068	0.004 -0.026 0.034	0.006 -0.024 0.036	0.007 -0.028 0.032	0.007 -0.027 0.033	0.011 -0.025 0.035	0.010 -0.022 0.038	0.012 -0.020 0.040
Coil 2 Q	-0.003 -0.347 0.353	-0.002 -0.099 0.101	0.000 -0.027 0.033	-0.003 -0.030 0.030	-0.003 -0.033 0.027	-0.004 -0.033 0.027	-0.006 -0.034 0.026	-0.003 -0.035 0.025
Coil 3 R	0.010 -0.029 0.051	0.006 -0.034 0.046	0.003 -0.041 0.039	0.009 -0.035 0.045	0.007 -0.038 0.042	0.003 -0.039 0.041	0.003 -0.038 0.042	0.004 -0.037 0.043
Coil 3 Q	-0.006 -0.207 0.193	-0.009 -0.086 0.074	-0.002 -0.040 0.040	-0.001 -0.038 0.042	-0.002 -0.040 0.040	0.000 -0.040 0.040	0.002 -0.039 0.041	-0.002 -0.039 0.041
Coil 4 R	-0.013 -0.073 0.047	-0.004 -0.068 0.052	-0.008 -0.067 0.053	-0.006 -0.069 0.051	-0.007 -0.064 0.056	-0.002 -0.061 0.059	0.005 -0.062 0.058	-0.001 -0.062 0.058
Coil 4 Q	-0.002 -0.309 0.291	0.003 -0.095 0.105	-0.004 -0.060 0.060	-0.001 -0.062 0.058	0.001 -0.065 0.055	-0.002 -0.062 0.058	-0.006 -0.062 0.058	0.001 -0.061 0.059
Coil 5 R	0.002 -0.122 0.118	0.009 -0.111 0.129	0.007 -0.112 0.128	0.006 -0.109 0.131	0.004 -0.121 0.119	0.005 -0.126 0.114	0.002 -0.121 0.119	-0.001 -0.120 0.120
Coil 5 Q	0.004 -0.601 0.599	0.003 -0.245 0.255	-0.003 -0.121 0.119	0.003 -0.116 0.124	0.004 -0.116 0.124	0.004 -0.108 0.132	0.007 -0.115 0.125	-0.009 -0.120 0.120
Coil 6 R	-0.022 -0.328 0.272	0.006 -0.305 0.295	-0.026 -0.307 0.293	-0.023 -0.323 0.277	-0.010 -0.301 0.299	0.001 -0.307 0.293	0.022 -0.303 0.297	0.020 -0.295 0.305

	10 KHz	30 KHz	50 KHz	70 KHz	90 KHz	110 KHz	130 KHz	150 KHz
Coil 6 Q	-0.037 -1.524 1.476	0.001 -0.597 0.603	0.013 -0.296 0.304	-0.008 -0.304 0.296	-0.027 -0.292 0.308	0.004 -0.321 0.279	-0.022 -0.310 0.290	-0.013 -0.318 0.282

ELEC. GAINS	10 KHz	30 KHz	50 KHz	70 KHz	90 KHz	110 KHz	130 KHz	150 KHz
Coil 0 M	126.03 123.46 128.50	124.53 122.00 126.98	121.65 119.14 124.01	117.43 115.00 119.69	112.05 109.80 114.28	105.70 103.49 107.72	98.25 96.24 100.16	89.99 88.14 91.74
Coil 0 P	7.578 4.582 10.582	23.874 20.872 26.872	39.874 36.871 42.871	55.849 52.843 58.843	71.708 68.694 74.694	87.676 84.637 90.637	103.498 100.449 106.449	119.463 116.386 122.386
Coil 1 M	218.09 213.75 222.48	215.53 211.25 219.88	210.50 206.28 214.70	203.24 199.14 207.27	194.02 190.18 197.94	182.85 179.30 186.62	170.12 166.67 173.48	155.89 152.65 158.88
Coil 1 P	7.678 4.679 10.679	24.182 21.179 27.179	40.420 37.407 43.407	56.616 53.607 59.607	72.700 69.665 75.665	88.869 85.836 91.836	104.956 101.895 107.895	121.137 118.087 124.087
Coil 2 M	439.65 430.67 448.25	434.60 425.72 443.10	424.86 416.08 433.07	410.55 402.02 418.43	392.27 384.27 399.96	370.06 362.39 377.18	344.51 337.25 351.02	315.85 309.37 322.00
Coil 2 P	7.851 4.856 10.856	24.679 21.677 27.677	41.261 38.269 44.269	57.824 54.817 60.817	74.271 71.262 77.262	90.857 87.831 93.831	107.303 104.243 110.243	123.942 120.841 126.841
Coil 3 M	711.45 696.75 725.19	702.64 688.07 716.16	685.45 671.14 698.53	660.29 646.49 672.88	628.47 615.38 640.50	591.33 579.01 602.64	548.57 536.95 558.86	502.93 492.32 512.41
Coil 3 P	7.717 4.721 10.721	24.315 21.312 27.312	40.605 37.597 43.597	56.811 53.804 59.804	72.830 69.814 75.814	88.907 85.873 91.873	104.715 101.642 107.642	120.547 117.436 123.436
Coil 4 M	1139.3 1115.8 1161.3	1122.7 1099.5 1144.4	1090.7 1068.1 1111.7	1045.4 1023.7 1065.5	989.4 969.1 1008.6	925.5 906.2 943.2	855.4 837.6 871.8	781.6 765.0 796.2
Coil 4 P	7.962 4.963 10.963	25.052 22.046 28.046	41.720 38.713 44.713	58.236 55.225 61.225	74.444 71.415 77.415	90.549 87.515 93.515	106.305 103.238 109.238	122.035 118.950 124.950
Coil 5 M	2366.0 2317.8 2412.4	2335.9 2288.3 2381.7	2277.1 2230.4 2321.4	2192.4 2147.2 2234.8	2084.6 2042.0 2125.3	1958.4 1918.0 1996.3	1815.0 1777.0 1849.5	1660.5 1625.8 1692.2
Coil 5 P	8.215 5.220 11.220	25.806 22.809 28.809	43.084 40.083 46.083	60.283 57.287 63.287	77.286 74.281 80.281	94.290 91.288 97.288	111.059 108.026 114.026	127.871 124.775 130.775
Coil 6 M	6031.1 5908.5 6149.7	5953.4 5832.7 6070.8	5802.6 5684.2 5916.2	5585.0 5469.9 5693.2	5309.5 5202.5 5414.8	4984.7 4880.7 5079.9	4612.1 4518.0 4702.4	4214.5 4125.9 4294.3
Coil 6 P	8.134 5.141 11.141	25.830 22.830 28.830	43.156 40.157 46.157	60.406 57.419 63.419	77.466 74.469 80.469	94.552 91.560 97.560	111.414 108.373 114.373	128.301 125.236 131.236

INSTRUMENT CONFIGURATION

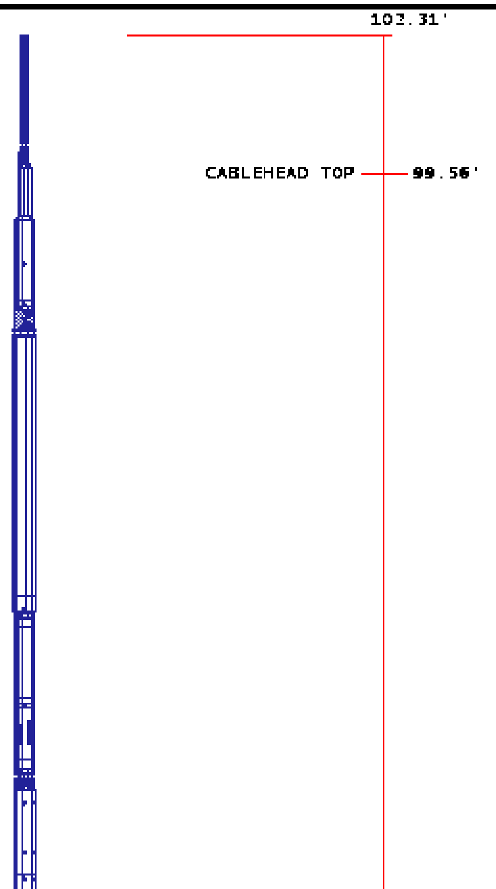
Source File: /dat1a/OH087602AWGI_DAL~-tdg

CABLEHEAD
Diameter : 3.38"
Length : 5.50'
Weight : 24 lbs
Series : CABL33B
Mnemonic : CBLH
Measure Point: 2.75': CABLEHEAD TOP

DOWNHOLE POWER ADAPTER
Diameter : 3.62"
Length : 5.27'
Weight : 86 lbs
Series : 4430XB
Mnemonic : DHPA

SWIVEL
Diameter : 3.38"
Length : 3.50'
Weight : 68 lbs
Series : 3944XD
Mnemonic : SWVL

TTRM SUB
Diameter : 3.63"
Length : 3.83'



Series : 3981XA
Mnemonic : TTRM
Measure Point: 1.38': TEMP MP
Measure Point: 1.13': RM MP

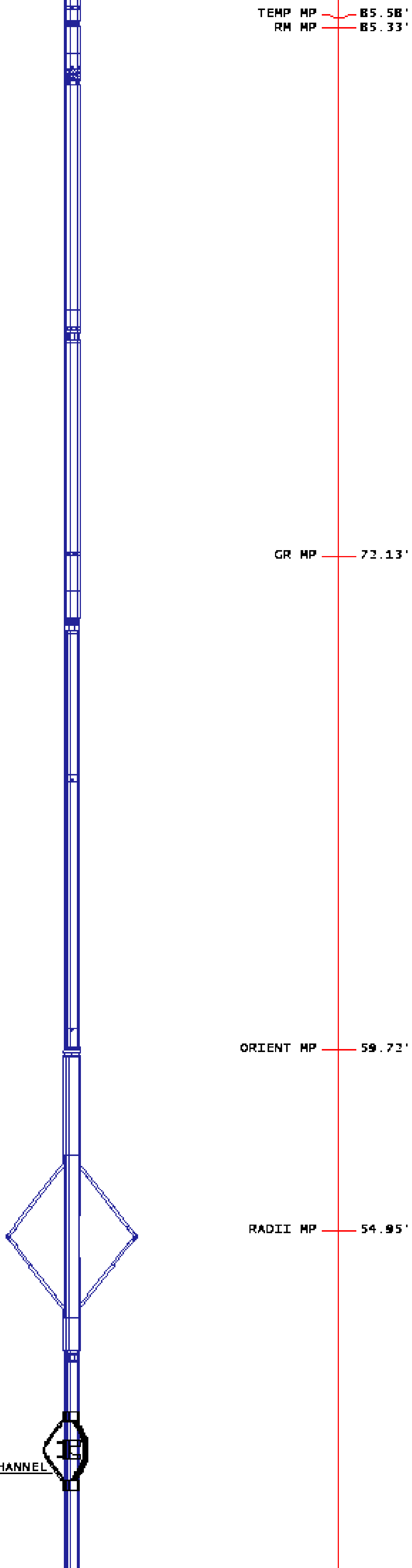
WTS COMMON REMOTE
Diameter : 3.63"
Length : 6.36'
Weight : 126 lbs
Series : 3514XB
Mnemonic : WTS

DIGITAL SPECTRALOG
Diameter : 3.63"
Length : 7.31'
Weight : 130 lbs
Series : 1329XA
Mnemonic : DSL
Measure Point: 1.60': GR MP

DIGITAL ORIENTATION
Diameter : 3.38"
Length : 10.81'
Weight : 110 lbs
Series : 4401XB
Mnemonic : ORIT
Measure Point: 0.00': ORIENT MP

WELL GEOMETRY INSTRUMENT
Diameter : 3.62"
Length : 7.61'
Weight : 100 lbs
Series : 4353XA
Mnemonic : WGI
Measure Point: 3.85': RADII MP

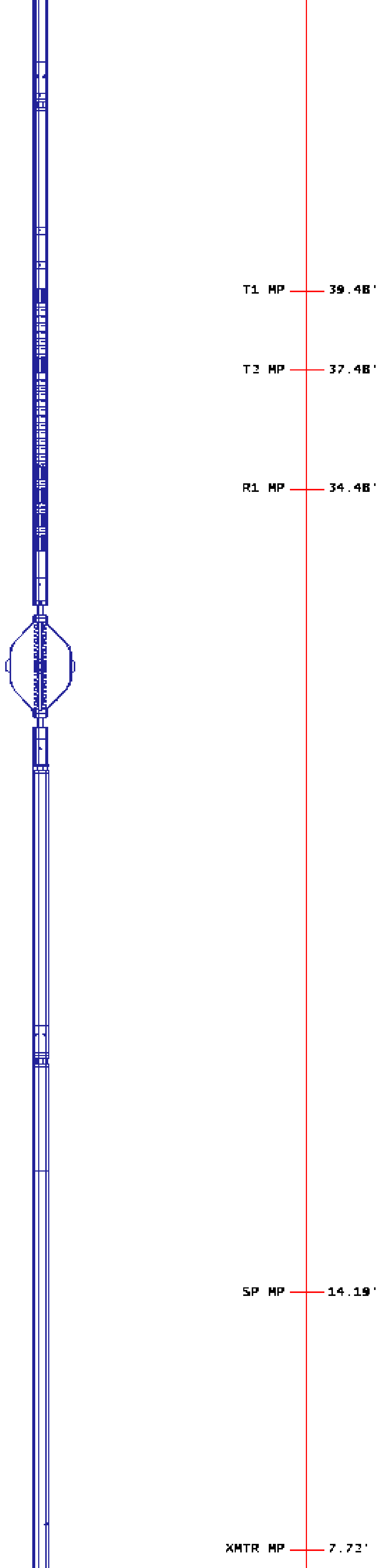
ARRAY ACOUSTILOG ELECTRONICS, 8 CHANNEL
Diameter : 3.38"
Length : 7.82'
Weight : 102 lbs
Series : 1677EA
Mnemonic : XMAC

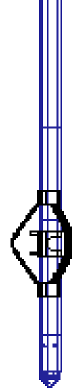


DIGITAL ACOUSTILOG
Diameter : 3.38"
Length : 12.76'
Weight : 145 lbs
Series : 1680MA
Mnemonic : DAL
Measure Point: 7.95': T1 MP
Measure Point: 5.95': T2 MP
Measure Point: 2.95': R1 MP

4 ARM BOW SPRING CENTRALIZER
Diameter : 3.38"
Length : 4.13'
Weight : 73 lbs
Series : 4341XA
Mnemonic : CENT

HIGH DEFINITION INDUCTION TOOL
Diameter : 3.63"
Length : 37.13'
Weight : 415 lbs
Series : 1515XA
Mnemonic : HDIL
Measure Point: 13.91': SP MP
Measure Point: 7.44': XMTR MP





TOTAL LENGTH: 103.31'
TOTAL WEIGHT: 1456 lbs
MAX DIAMETER: 0'4.00"

BAKER HUGHES

COMPANY	RESOLUTION COPPER COMPANY		FILE NO: US087602
WELL	DHRES-15		API NO:
FIELD	RESOLUTION COPPER		
COUNTY	PINAL	STATE AZ	
LOCATION:		ELEVATIONS: KB NA DF	RIG: NATIONAL 16

	SEC 5 TWP 2S RGE 13E	GL NA	
		DATE 22-Jun-2014	

BAKER HUGHES

WELLBORE GEOMETRY LOG
GAMMA RAY LOG

FILE NO: US087602

API NO:

COMPANY	RESOLUTION COPPER COMPANY
WELL	DHRES-15
FIELD	RESOLUTION COPPER
COUNTY	PINAL STATE AZ

Ver. 3.87

RIG: NATIONAL 16

LOCATION:

SEC 5 TWP 2S RGE 13E

OTHER SERVICES
STAR
MREX
TEMP/GR
HDIL

PERMANENT DATUM GL ELEVATION NA
LOG MEASURED FROM GL 0 FT ABOVE P.D.
DRILL. MEAS. FROM GL

ELEVATIONS:
KB NA
DF
GL NA

DATE		22-Jun-2014			
RUN	TRIP	1	1		
SERVICE ORDER		US087602			
DEPTH DRILLER		2900 FT			
DEPTH LOGGER		2894 FT			
BOTTOM LOGGED INTERVAL		2886 FT			
TOP LOGGED INTERVAL		0 FT			
CASING DRILLER		14 IN	@ 40 FT		@
CASING LOGGER		36 FT			
BIT SIZE		12.25 IN			
TYPE OF FLUID IN HOLE		WBM			
DENSITY	VISCOSITY	9.7 LB/G	40 CP		
PH	FLUID LOSS	8.0	6.0 C3		
SOURCE OF SAMPLE		FLOWLINE			
RM AT MEAS. TEMP.		3.7 OHMM	@ 75 DEGF		@
RMF AT MEAS. TEMP.		5.6 OHMM	@ 74 DEGF		@
RMC AT MEAS. TEMP.		3.05 OHMM	@ 71 DEGF		@
SOURCE OF RMF	RMC	MEASURED	MEASURED		
RM AT BHT		2.59 OHMM	@ 117 DEGF		@
TIME SINCE CIRCULATION		12 HR			
MAX. RECORDED TEMP.		118 DEGF			
EQUIP. NO.	LOCATION	6670	GRAND JCT		
RECORDED BY		D SMITH/T VERCIMAK			
WITNESSED BY		M SHELLEY			

BOREHOLE RECORD

BIT SIZE	FROM	TO
12.25 IN	40 FT	2900 FT

CASING RECORD

SIZE	WEIGHT	GRADE	FROM	TO
14 IN			0 FT	40 FT

REMARKS

RUN 1 TRIP 1: HDIL_DAL_WGI_GR RUN IN COMBINATION

WGI/CAL VERIFIED DURING BEFORE LOG CALIBRATION
BVOL/CVOL CALCULATED IN CUBIC FT
CVOL CALCULATED FOR 7.625 IN CASING

DT MATRIX = 51.3

HDIL RAN CENTRALIZED
ABC CALCULATED = HOLE SIZE

THANK YOU FOR CHOOSING BAKER HUGHES WIRELINE SERVICES

CREW: VERCIMAK/SMITH/HOLLER/BAUGHMAN

EQUIPMENT DATA

RUN	TRIP	TOOL	SERIES NO.	SERIAL NO.	POSITION
1FRE	21	PWRADPT2	4430XB	1244777	FREE
1	2	SWVL	3944XD	10158308	FREE
1	2	TTRM	3981XA	10516527	FREE
1	2	WTS	3514XB	10240730	FREE
1	2	DSL	1329XA	10196895	FREE
1	2	ORIENT	4401XB	10304309	CENTRALIZED
1	2	CALIPER	4253XA	10189872	CENTRALIZED
1	2	DAL EA	1677EA	10076613	CENTRALIZED
1	2	DAL MA	1680MA	Z154423	CENTRALIZED
1	2	CENTRALIZER	4341XA	10202020	CENTRALIZED
1	2	HDIL EA	1515EA	10318637	CENTRALIZED
1	2	HDIL MA	1515MA	10037719	CENTRALIZED

MAIN LOG 5"/100FT SCALE

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 08:21:22 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n777l_WGI_DAL03.prm
LOGGING MODE: DEPTH DIRECTION: UP
TOP DEPTH: 58.625 ft BOTTOM DEPTH: 2899.755 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
TENSION	FILTER ()	medium (1)		TOP	BOTTOM
GR	FILTER ()	medium (1)		"	"
	FILTER (.h)	medium (1)		"	"
	FILTER (.i)	medium (1)		"	"
CALIPER	FILTER	medium (1)		"	"
SP-SPDH	FILTER ()	heavy (3)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
CASING - BOREHOLE & CEMENT VOLUME	CASING O.D.	7.625	in	TOP	BOTTOM
BIT SIZE	BIT SIZE	12.250	in	"	"

CURVE DESCRIPTION REPORT

CURVE NAME	CREATION DATE	CURVE DESCRIPTION
F1:BCVO	Jun 22 08:05:03 2014	BOREHOLE CUMULATIVE VOLUME
F1:BRADW	Jun 22 06:16:28 2014	BIT RADIUS
F1:CCVO	Jun 22 08:05:03 2014	CEMENT CUMULATIVE VOLUME
F1:CRADW	Jun 22 06:16:28 2014	CASING RADIUS
F1:DEVWQH	Jun 22 06:16:28 2014	DEVIATION AT WGI POSITION
F1:DFLGW	Jun 22 06:16:28 2014	DEAD CROSS-SECTIONAL AREA FLAG
F1:GR	Jun 22 06:16:28 2014	GAMMA RAY
F1:MAXD	Jun 22 08:05:03 2014	MAXIMUM CALIPER DIAMETER
F1:MIND	Jun 22 08:05:03 2014	MINIMUM CALIPER DIAMETER
F1:MNR1W	Jun 22 06:16:28 2014	MINIMUM RADIUS 1
F1:MNR2W	Jun 22 06:16:28 2014	MINIMUM RADIUS 2
F1:MXR1W	Jun 22 06:16:28 2014	MAXIMUM RADIUS 1

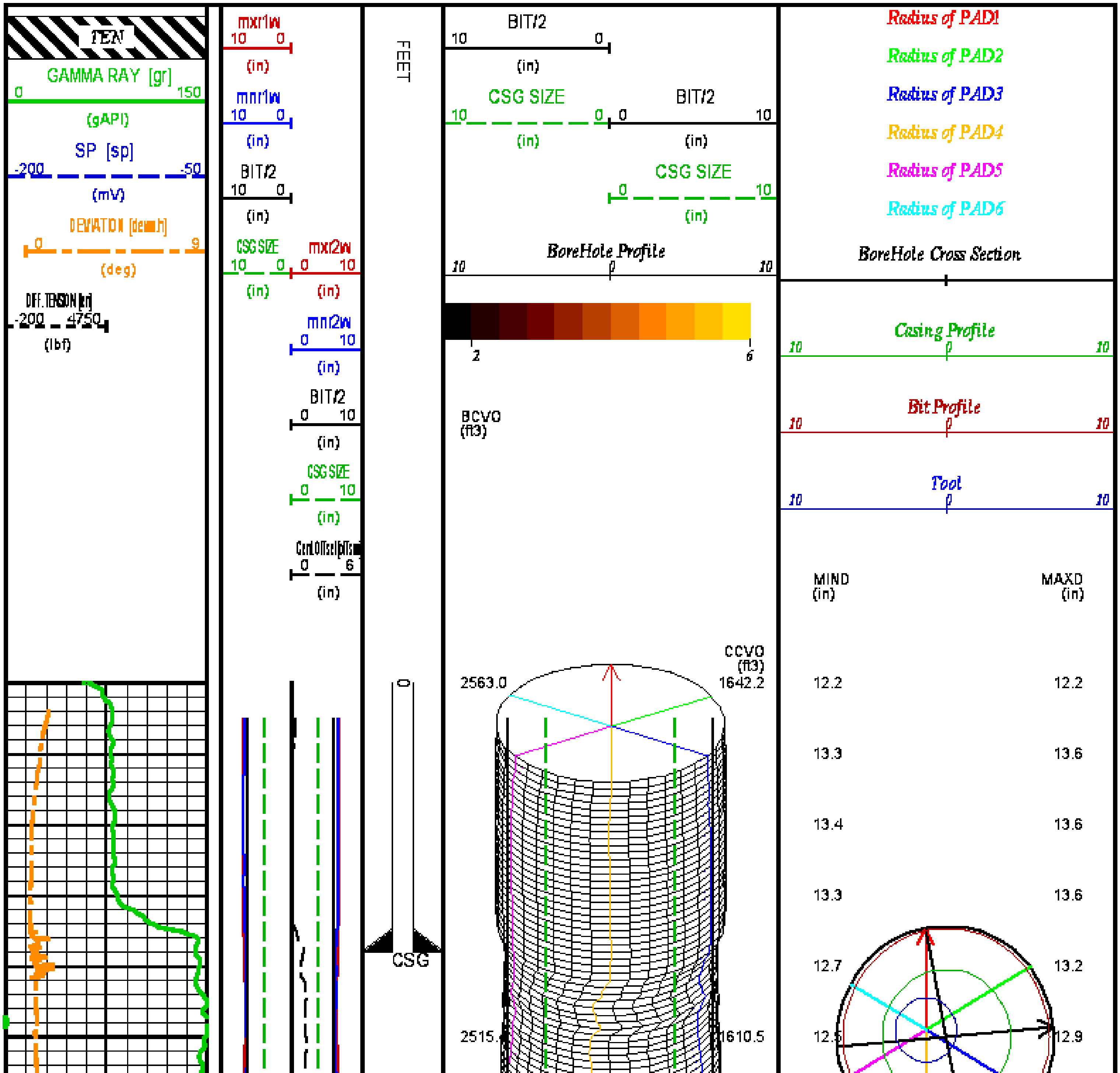
F1:MXR2W	Jun 22 06:16:28 2014	MAXIMUM RADIUS 2
F1:OFFSW	Jun 22 06:16:28 2014	TOOL-TO-CENTROID RADIUS
F1:SP	Jun 22 06:16:28 2014	SPONTANEOUS POTENTIAL
F1:TEN	Jun 22 06:16:28 2014	DIFFERENTIAL TENSION

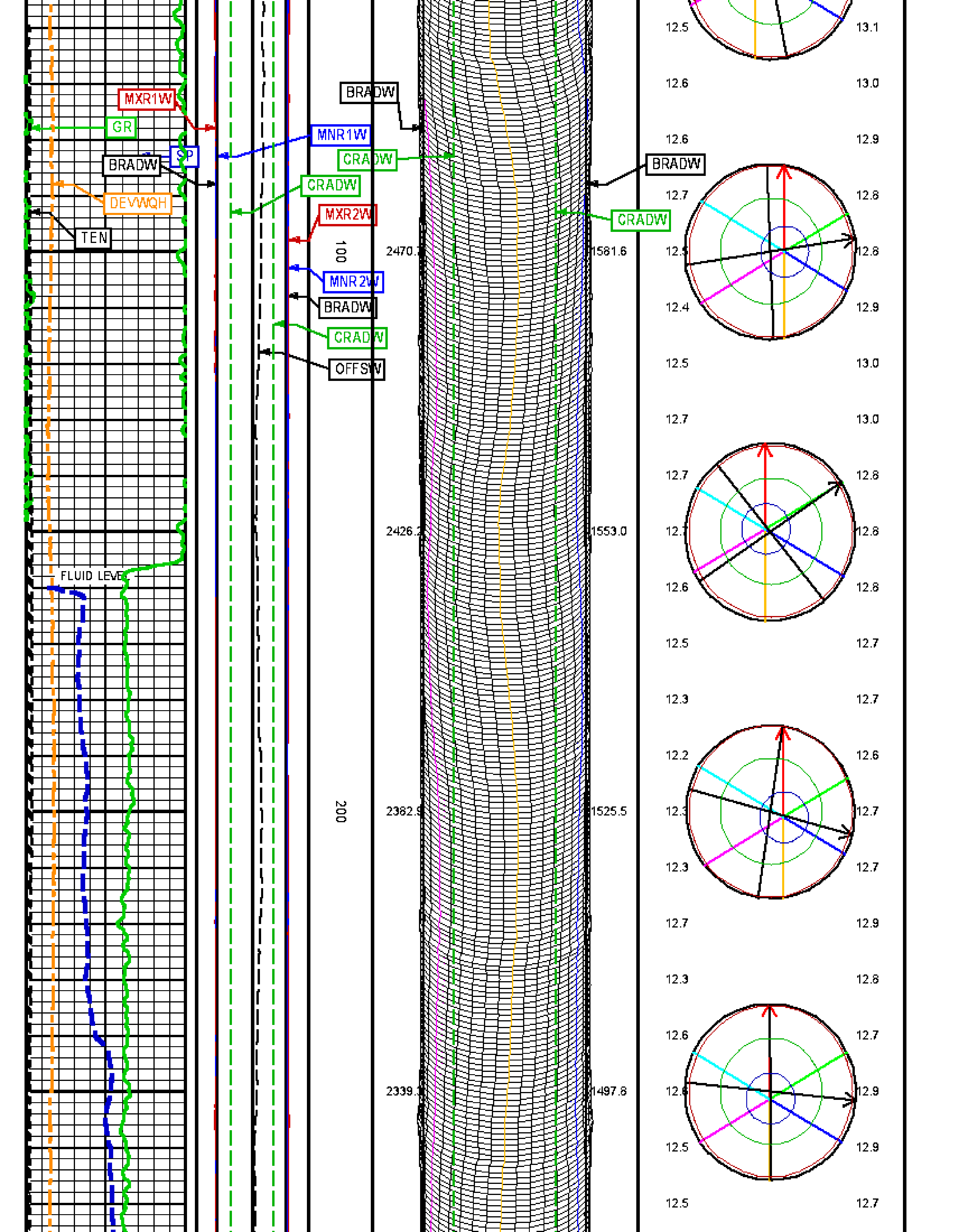
CURVE MEASURE POINT OFFSET

CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
BRADW	54.75	DFLGW	54.75	MNR2W	54.75	OFFSW	54.75
CRADW	54.75	GR	71.75	MXR1W	54.75	SP	14.00
DEVWOH	54.62	MNR1W	54.75	MXR2W	54.75	TEN	0.00

Presentation : HL6670:MAIN_WGI.fvpdf [5"/100' Scale]
Plot Interval : 0 - 2904.75 Feet

Data File 1 : F1 : HL6670:/dat1a/OH087602/MAIN_WGI_DAL.xtf
Created On : Jun 22 06:16:28 2014
Company : RESOLUTION COPPER COMPANY
Well : DHRES-15
Field : RESOLUTION COPPER
File Interval : -25.75 - 2904.88 Feet
OCT : n777l_WG





MXR1W
GR
BRADW
SP
DEVWQH
TEN
FLUID LEVE
MNR1W
CRADW
MXR2W
MNR2W
BRADW
CRADW
OFFSW
100
200
BRADW
CRADW
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2426.2
1553.0
1525.5
1497.8
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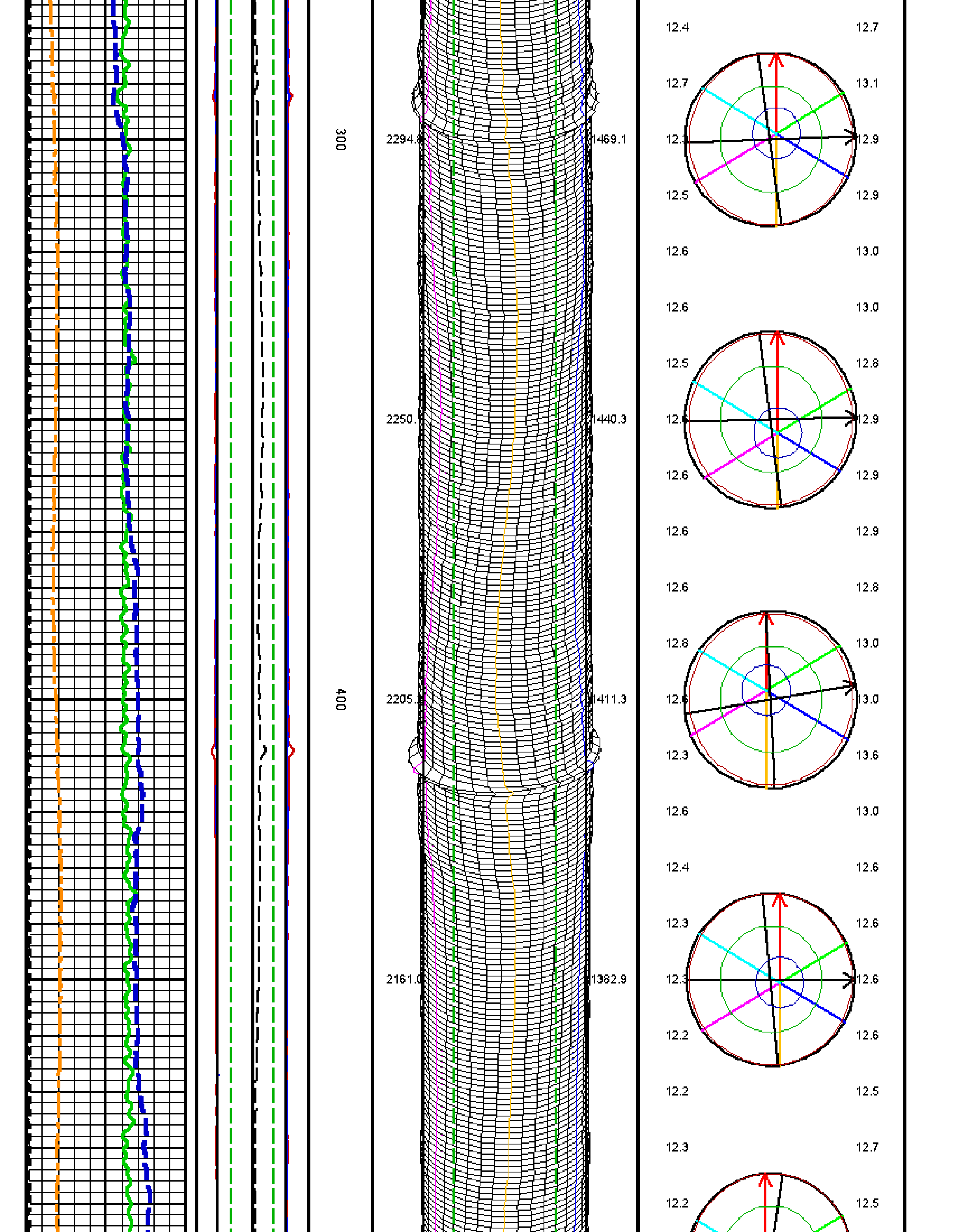

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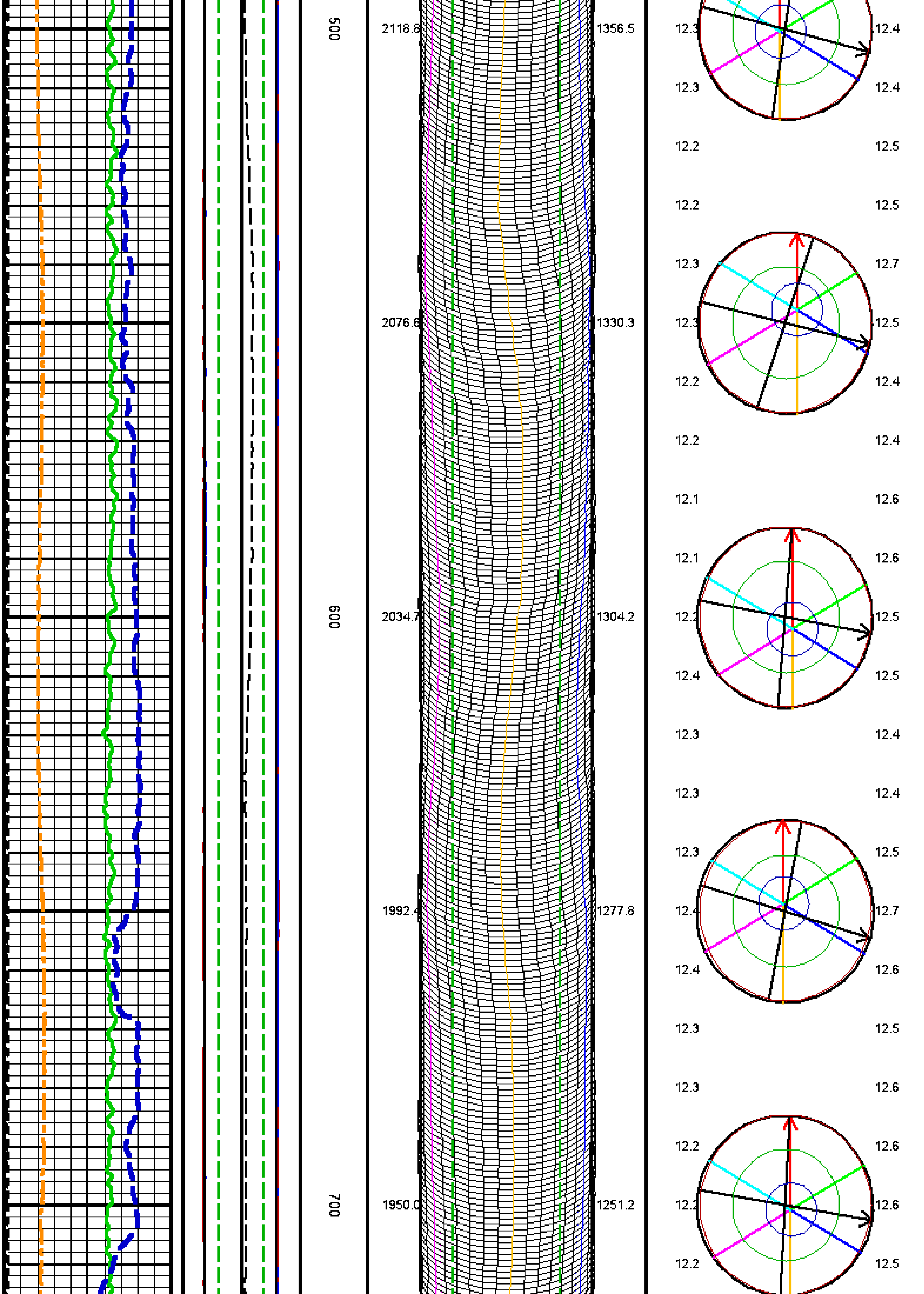

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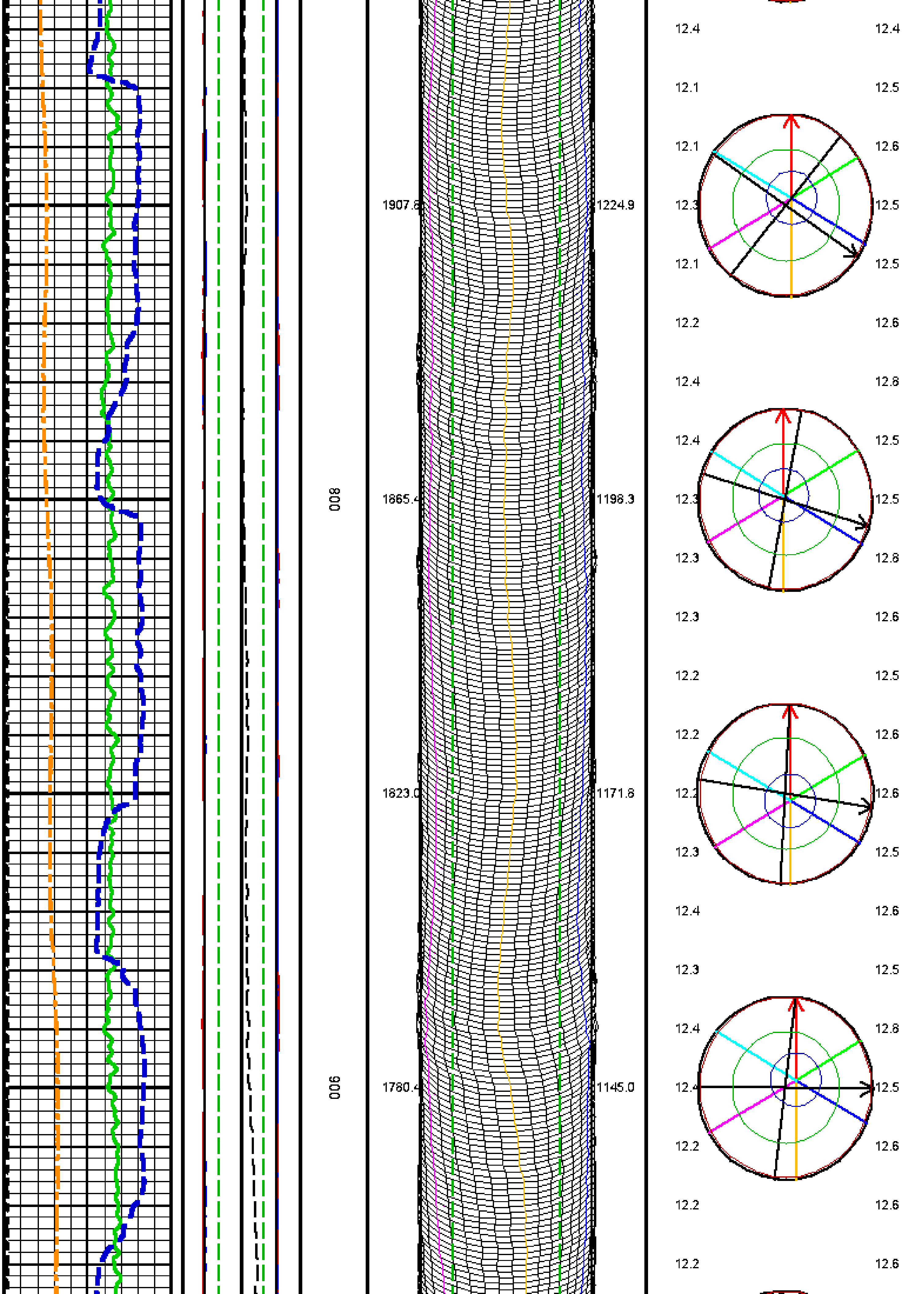

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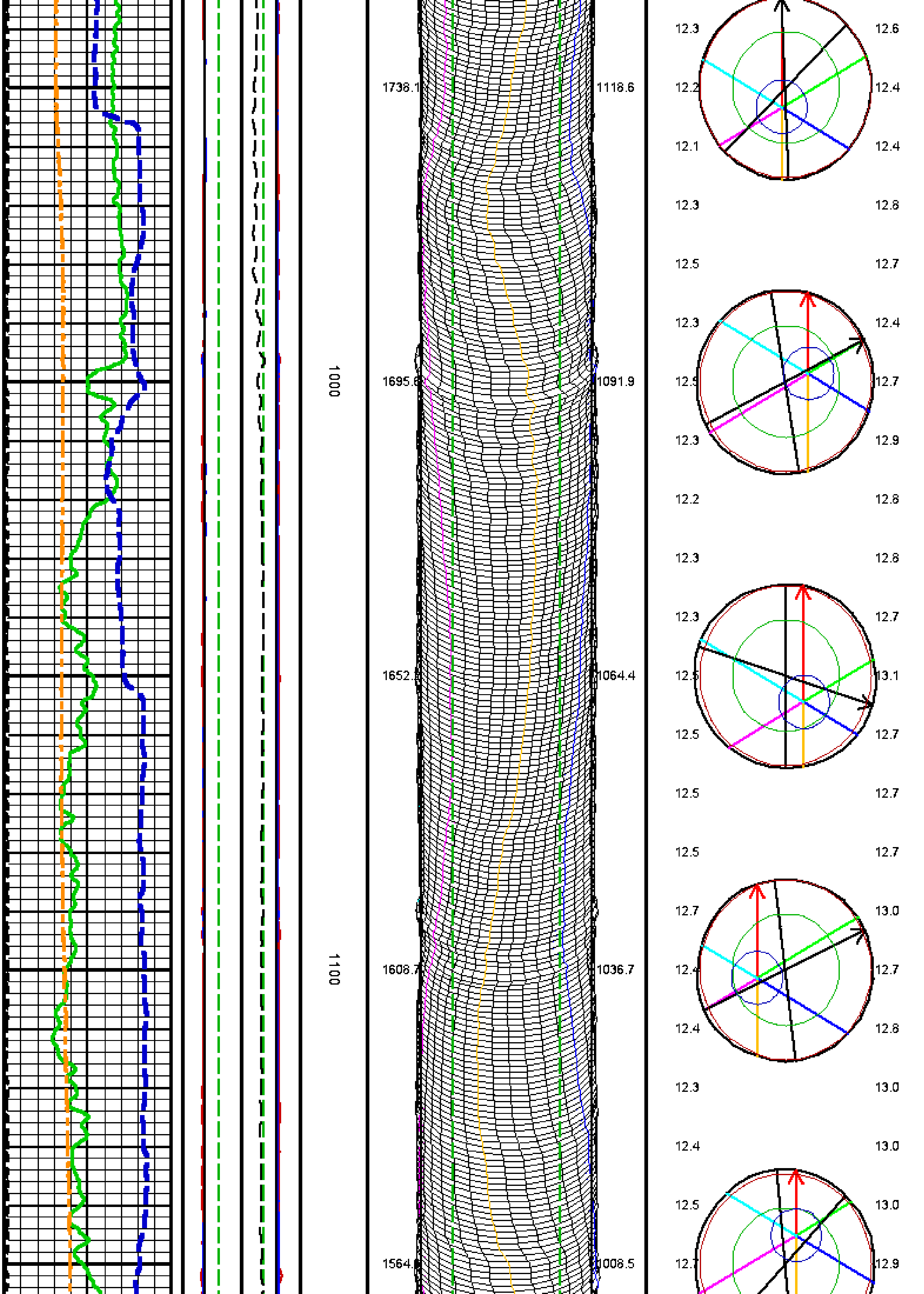

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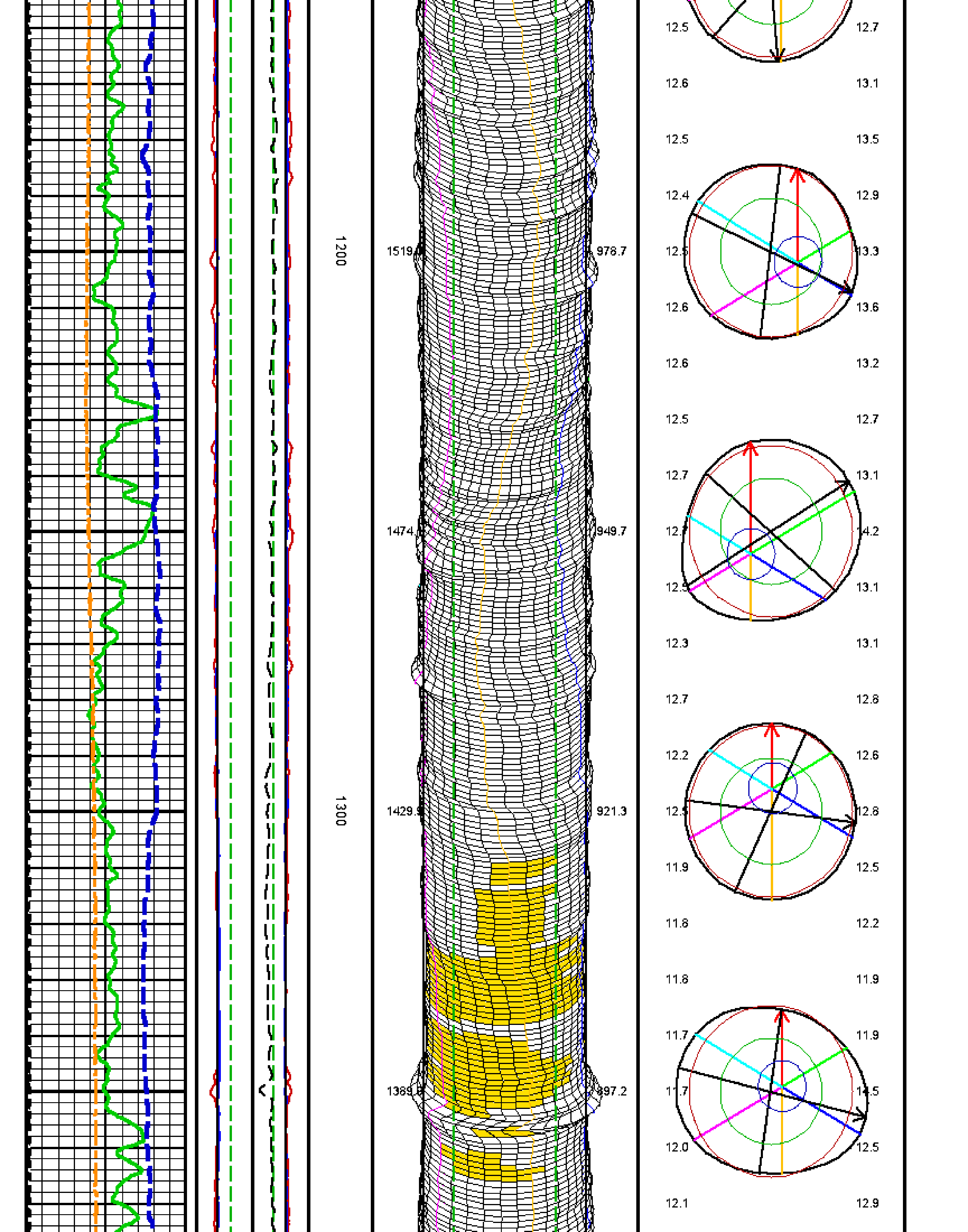

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12.7
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11.8
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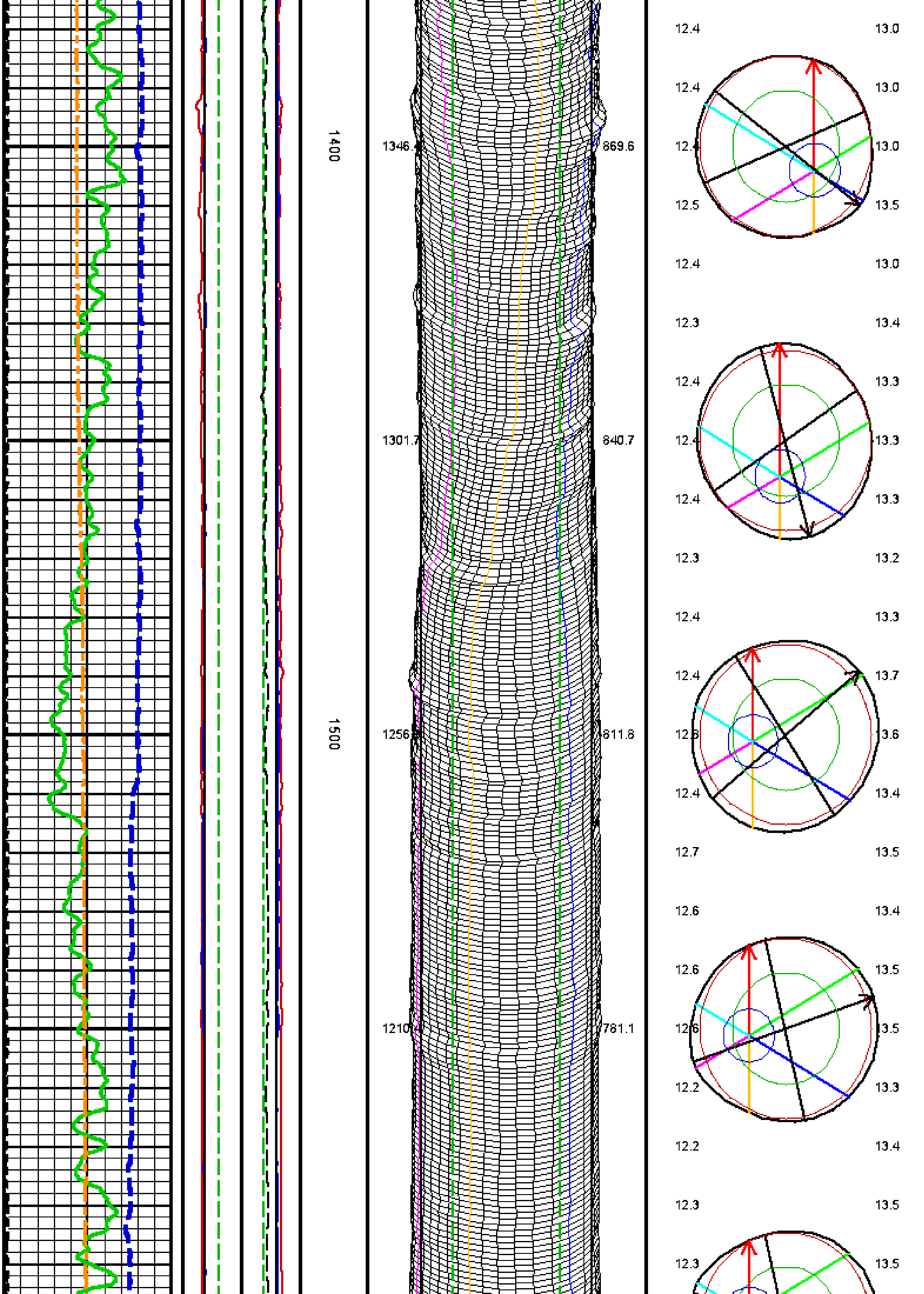

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869.6
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781.1
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13.0
12.5 13.5
12.4 13.0
12.3 13.4
12.4 13.3
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12.4 13.3
12.3 13.2
12.4 13.3
12.4 13.7
13.6
12.4 13.4
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12.6 13.5
13.5
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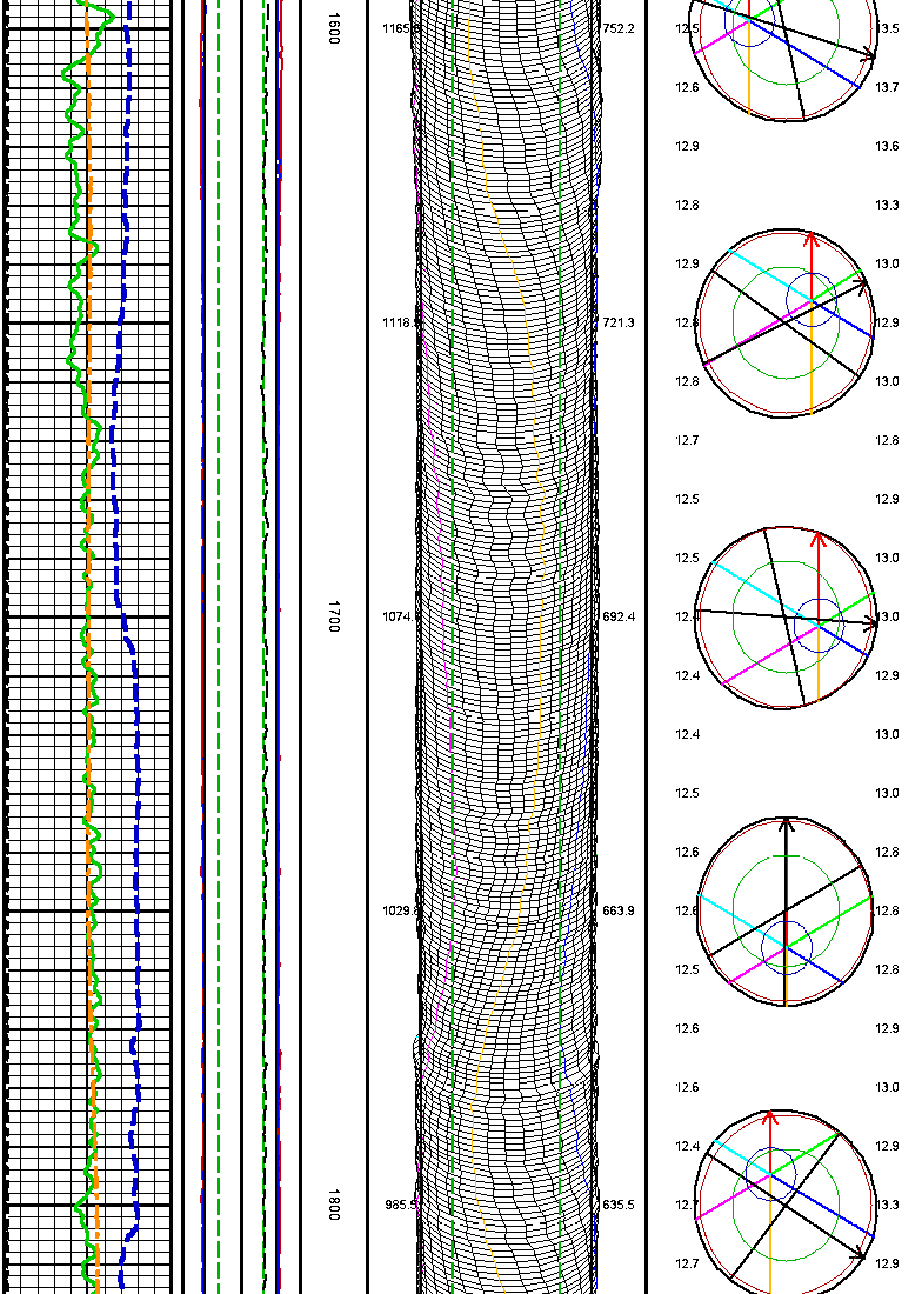
12.2 13.4
12.3 13.5
12.3 13.5



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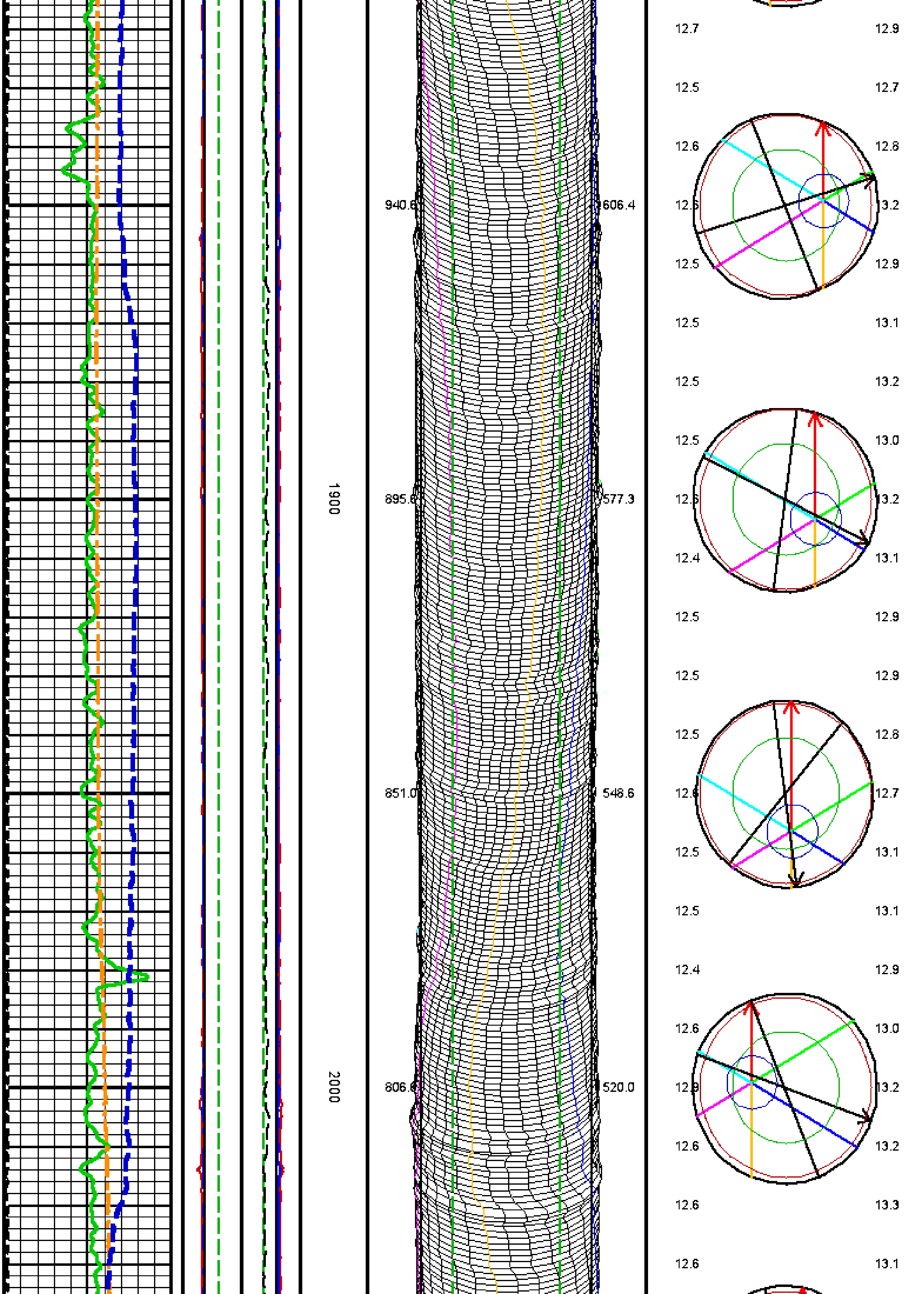
12.9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1900
895.6 577.3
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12.5 12.8
851.0 548.6
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12.5 13.1
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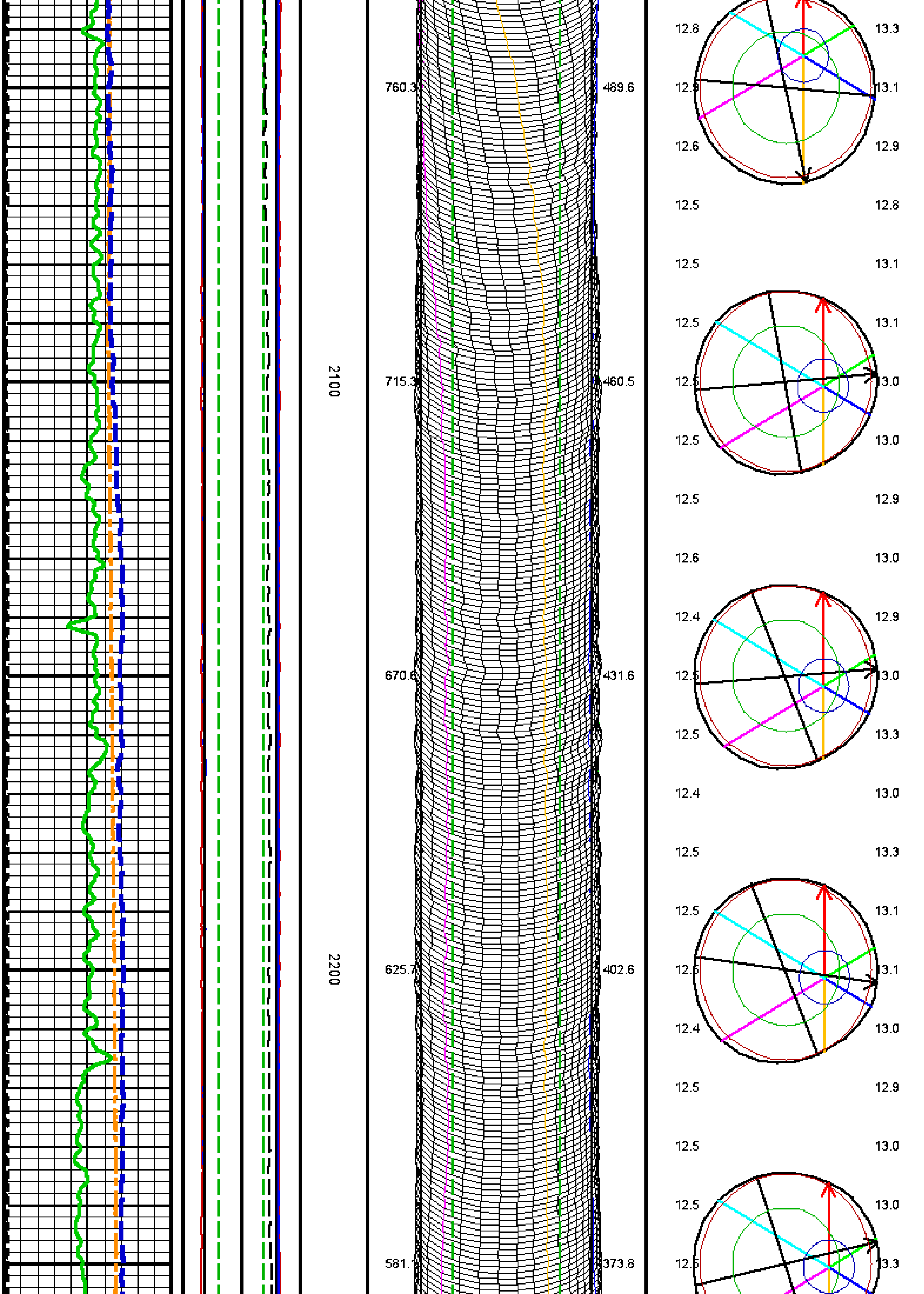
12.6 13.1



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2100
715.3
460.5
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12.9
670.6
431.6
12.5
13.0
12.5
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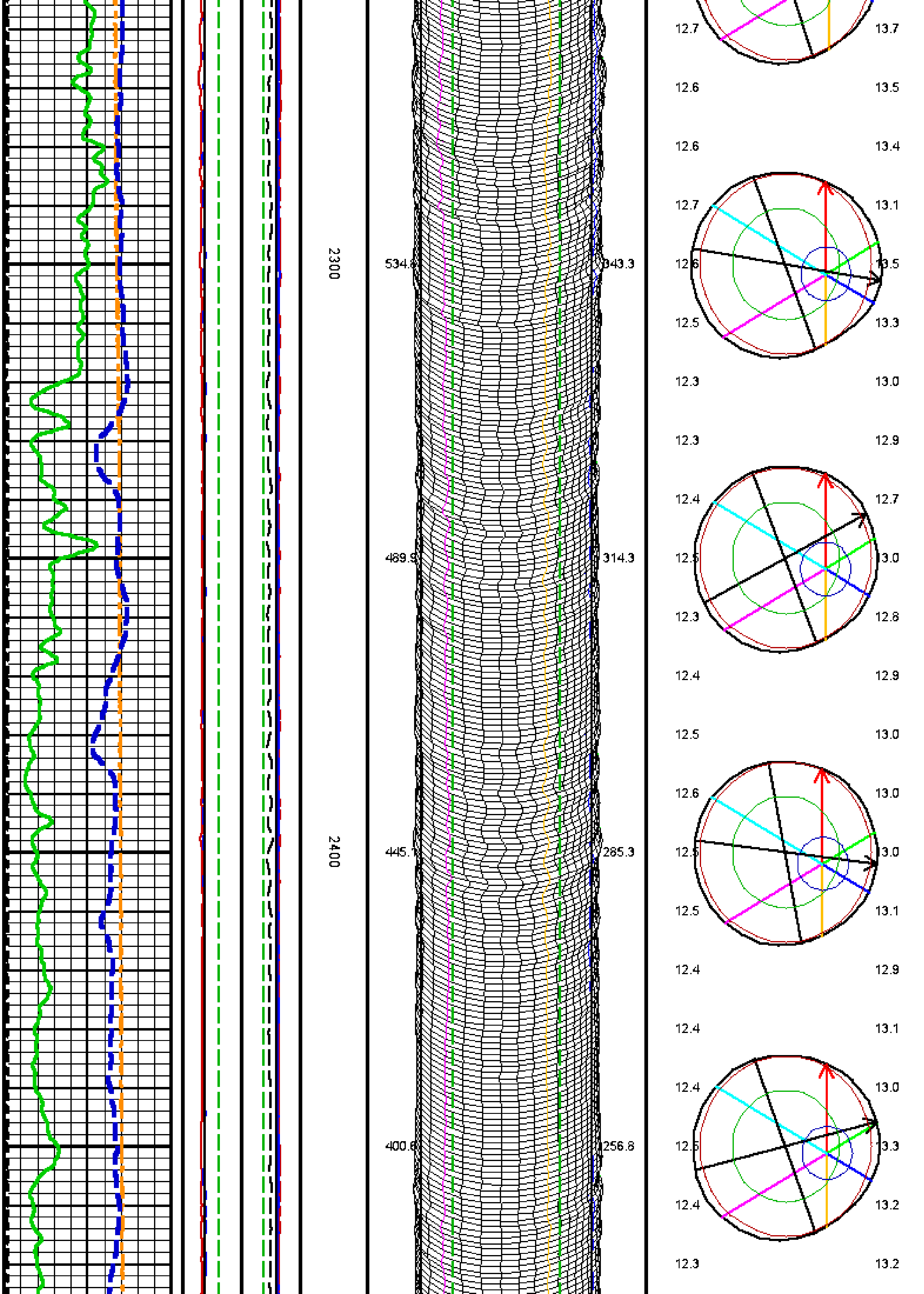
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13.0
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12.9
12.4
12.7
489.9
314.3
12.5
13.0
12.3
12.8
12.4
12.9
12.5
13.0
12.6
13.0
2400
445.1
285.3
12.5
13.0
12.5
13.1
12.4
12.9
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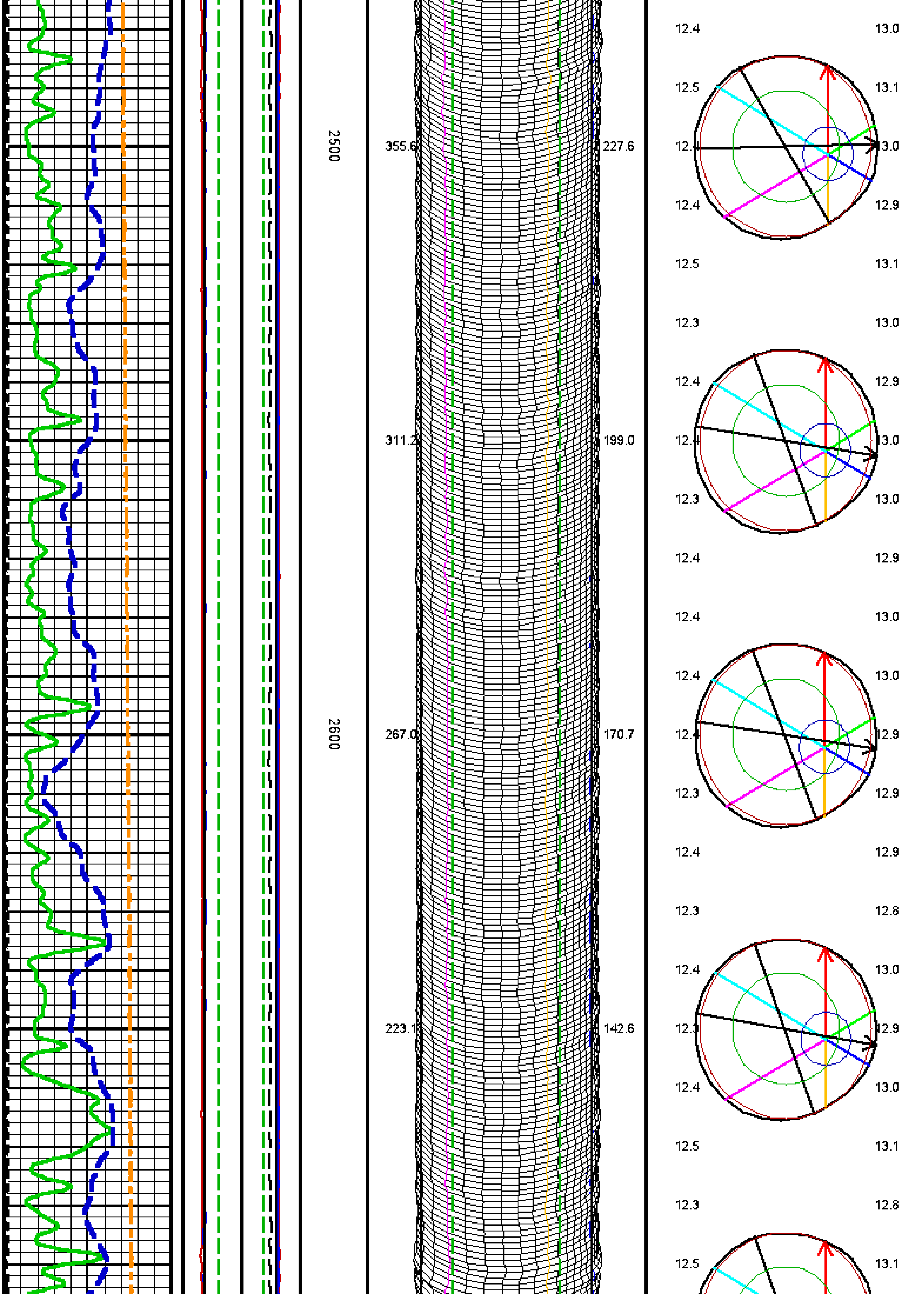
13.2



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2600
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227.6
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267.0
170.7
223.1
142.6
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12.5
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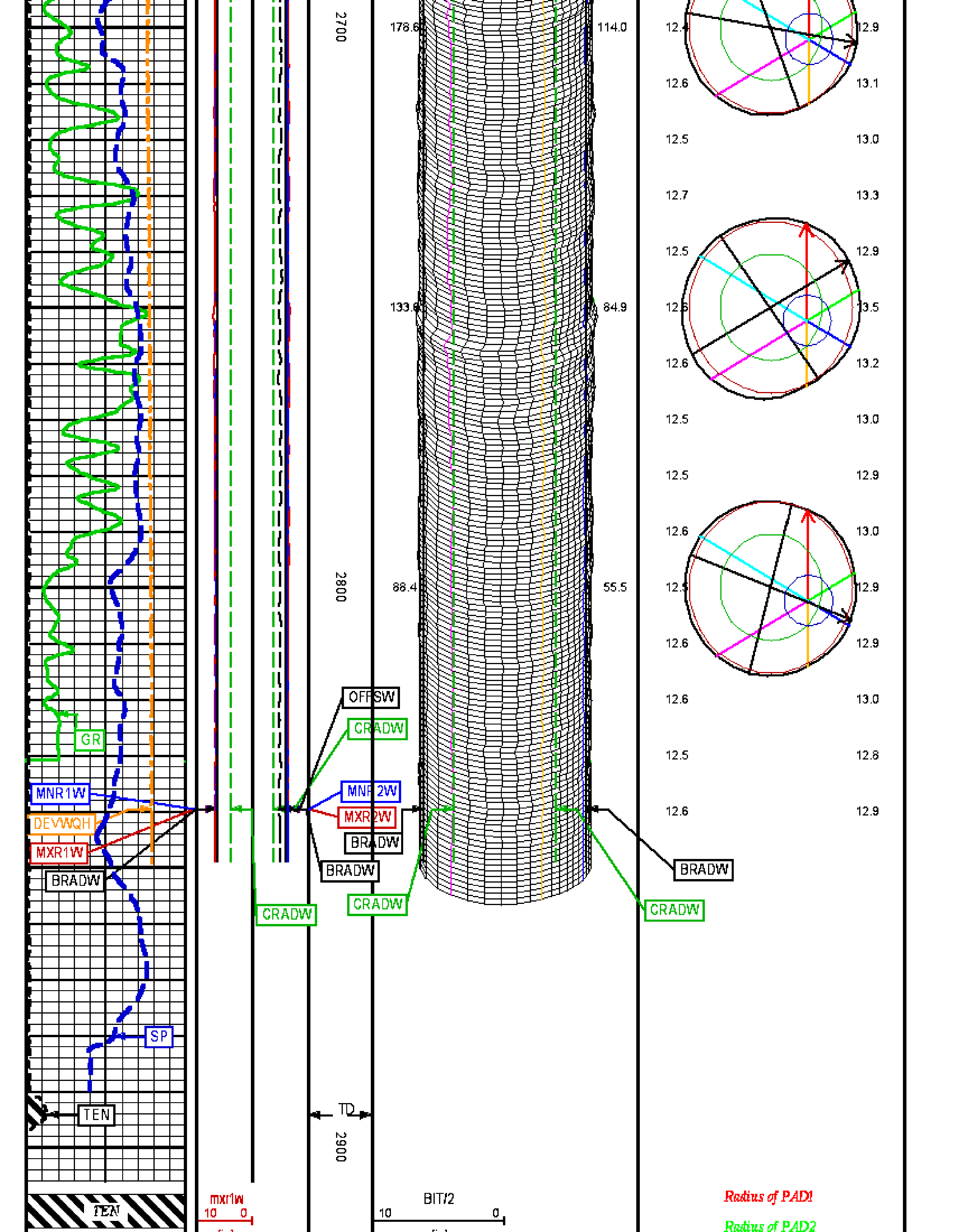
12.9
12.3
12.8



GR
MNR1W
DEVWQH
MXR1W
BRADW
SP
TEN
TEN
mxr1w
10 0
CRADW
2700
2800
TD
2900
OFFSW
CRADW
MNR2W
MXR2W
BRADW
BRADW
CRADW
176.6
114.0
133.6
84.9
86.4
55.5
BIT/2
10 0
BRADW
CRADW
12.4
12.9
12.6
13.1
12.5
13.0
12.7
13.3
12.5
12.9
12.6
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12.6
13.2
12.5
13.0
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12.6
13.0
12.5
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12.9
12.6
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12.5
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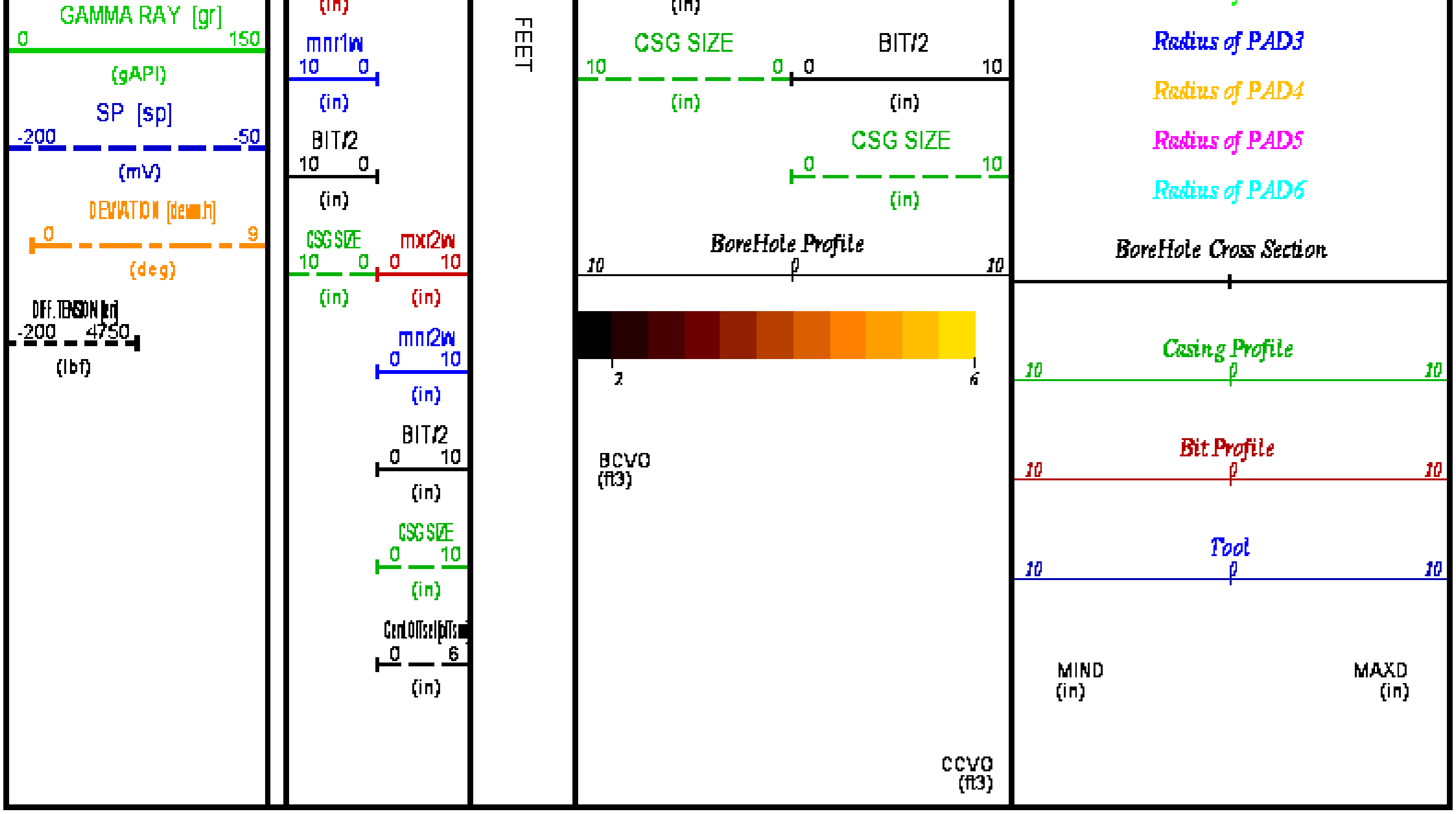
12.6
12.9
Radius of PAD1
Radius of PAD2



REPEAT LOG

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 08:48:31 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n777l_WGI_DAL02.prm
LOGGING MODE: DEPTH DIRECTION: UP
TOP DEPTH: 2575.625 ft BOTTOM DEPTH: 2900.696 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
TENSION	FILTER ()	medium (1)		TOP	BOTTOM
GR	FILTER ()	medium (1)		"	"
	FILTER (.h)	medium (1)		"	"
	FILTER (.i)	medium (1)		"	"
CALIPER	FILTER	medium (1)		"	"
SP-SPDH	FILTER ()	heavy (3)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
CASING - BOREHOLE & CEMENT VOLUME	CASING O.D.	7.625	in	TOP	BOTTOM
BIT SIZE	BIT SIZE	12.250	in	"	"

CURVE DESCRIPTION REPORT

CURVE NAME	CREATION DATE	CURVE DESCRIPTION

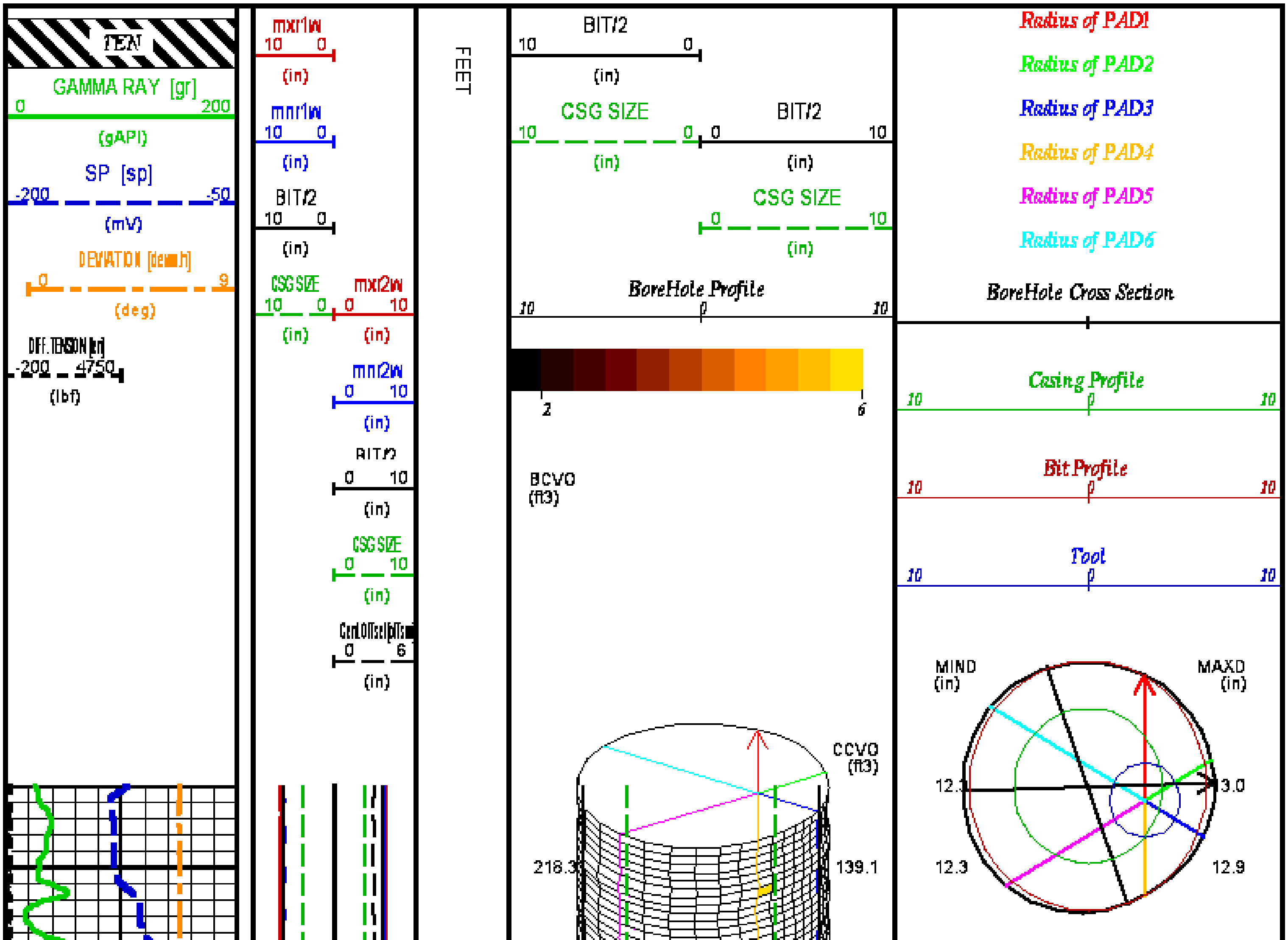
F1:BCVO	Jun 22 08:22:10 2014	BOREHOLE CUMULATIVE VOLUME
F1:BRADW	Jun 22 05:53:39 2014	BIT RADIUS
F1:CCVO	Jun 22 08:22:10 2014	CEMENT CUMULATIVE VOLUME
F1:CRADW	Jun 22 05:53:39 2014	CASING RADIUS
F1:DEVWQH	Jun 22 05:53:39 2014	DEVIATION AT WGI POSITION
F1:DFLGW	Jun 22 05:53:39 2014	DEAD CROSS-SECTIONAL AREA FLAG
F1:GR	Jun 22 05:53:39 2014	GAMMA RAY
F1:MAXD	Jun 22 08:22:10 2014	MAXIMUM CALIPER DIAMETER
F1:MIND	Jun 22 08:22:10 2014	MINIMUM CALIPER DIAMETER
F1:MNR1W	Jun 22 05:53:39 2014	MINIMUM RADIUS 1
F1:MNR2W	Jun 22 05:53:39 2014	MINIMUM RADIUS 2
F1:MXR1W	Jun 22 05:53:39 2014	MAXIMUM RADIUS 1
F1:MXR2W	Jun 22 05:53:39 2014	MAXIMUM RADIUS 2
F1:OFFSW	Jun 22 05:53:39 2014	TOOL-TO-CENTROID RADIUS
F1:SP	Jun 22 05:53:39 2014	SPONTANEOUS POTENTIAL
F1:TEN	Jun 22 05:53:39 2014	DIFFERENTIAL TENSION

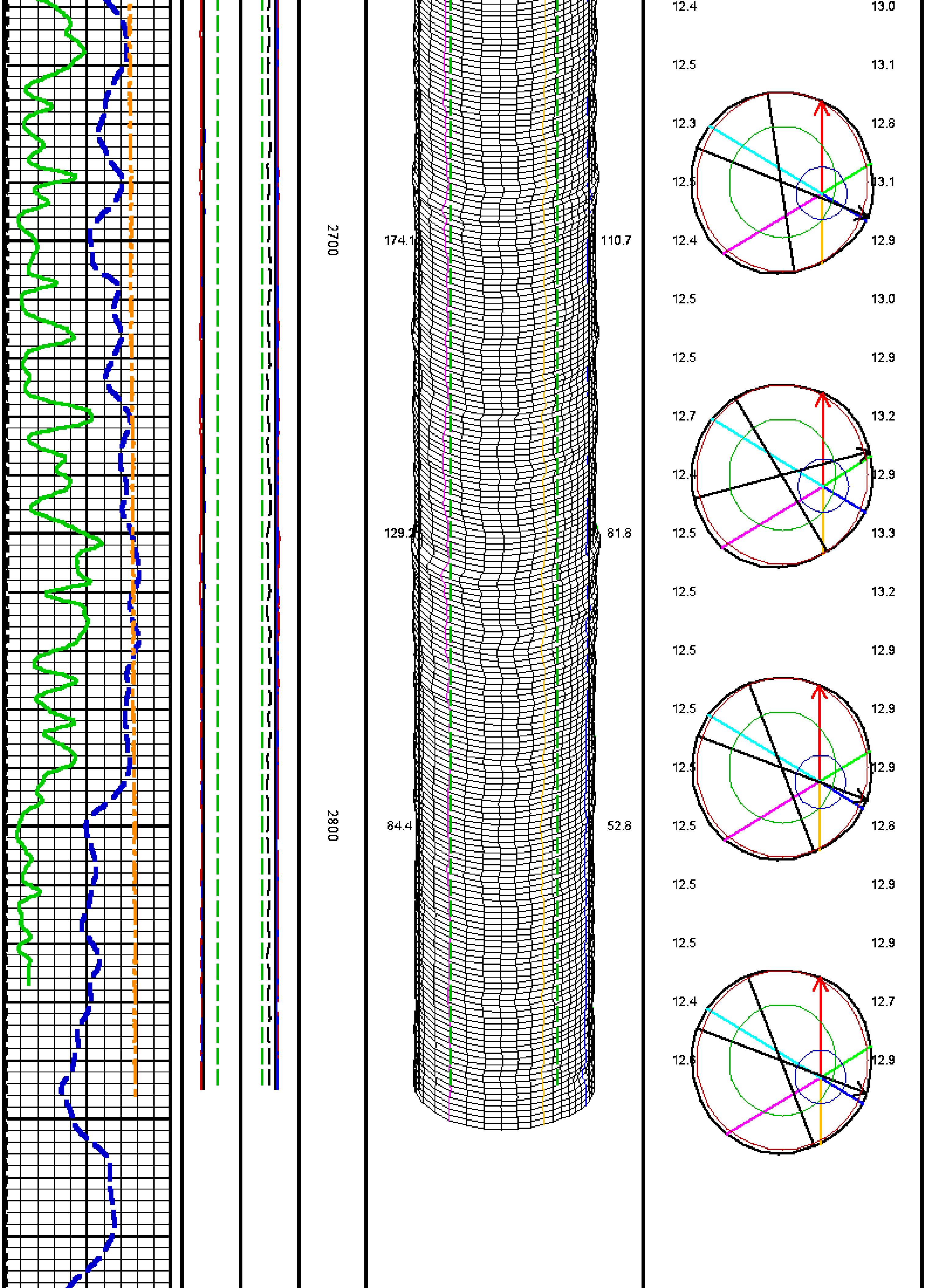
CURVE MEASURE POINT OFFSET

CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
BRADW	54.75	DFLGW	54.75	MNR2W	54.75	OFFSW	54.75
CRADW	54.75	GR	71.75	MXR1W	54.75	SP	14.00
DEVWQH	54.62	MNR1W	54.75	MXR2W	54.75	TEN	0.00

Presentation : HL6670:REPEAT_WGI.fvpdf [5"/100' Scale]
Plot Interval : 2640 - 2904 Feet

Data File 1 : F1 : HL6670:/dat1a/OH087602/REPEAT_WGI_DAL02.xtf
Created On : Jun 22 08:22:10 2014
Company : RESOLUTION COPPER COMPANY
Well : DHRES-15
Field : RESOLUTION COPPER
File Interval : 2491.25 - 2900.88 Feet
OCT : n777l_WG





12.4 13.0
12.5 13.1
12.3 12.8
12.5 13.1
2700
174.1 110.7
12.4 12.9
12.5 13.0
12.5 12.9
12.7 13.2
12.4 12.9
129.2 81.6
12.5 13.3
12.5 13.2
12.5 12.9
12.5 12.9
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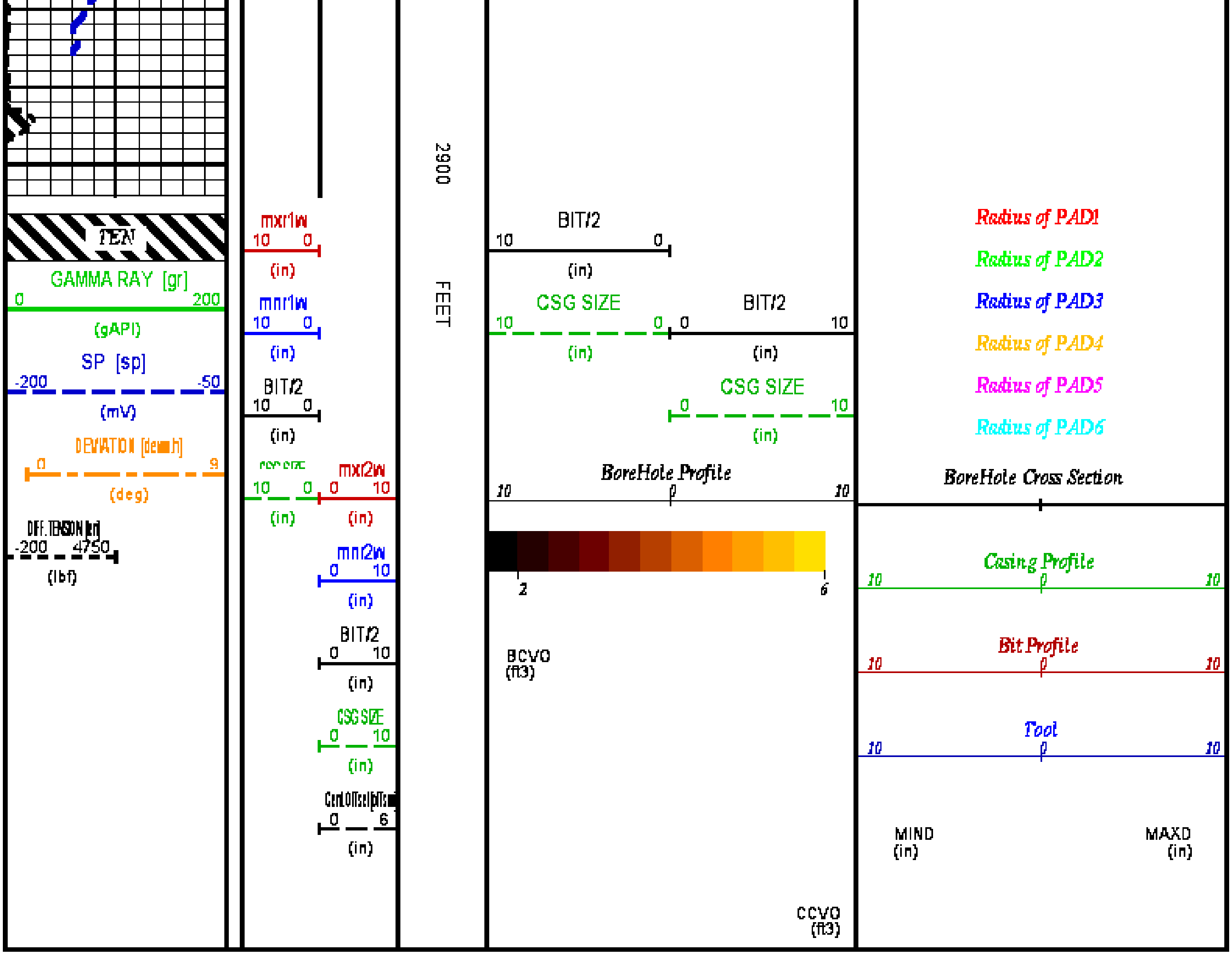
12.4 12.7
12.6 12.9



CALIBRATION / VERIFICATION SUMMARY

Source File: /dat1a/OH087602/PLOT_WGI_DAL.tp1

CHT PRIMARY CALIBRATION SUMMARY

TOOL #: 3981XA 10516527

DATE/TIME PERFORMED: Fri Jun 13 11:47:01 2014

UNIT #: 3885TC 6685

	Signal Low (raw)	Signal High (raw)	Scale Mult	Scale Add	Engr Low (lbf)	Engr High (lbf)
CHT	-104.19	379.56	3.10	123.06	-200.00	1300.00

GR PRIMARY CALIBRATION SUMMARY

TOOL #: 1329XA 10196895

DATE/TIME PERFORMED: Tue Jun 3 11:41:15 2014

UNIT #: 3880TA HL6670

CALB JIG #: 4702NK VBA-905

BACKGROUND (cts/s)	CALBRTR ON (cts/s)	CR DIFF (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	CALBRTR (gAPI)

GR	331.93	1231.27	899.3 (880.0 – 960.0)	0.167	55.36	205.36	150

GR PRIMARY VERIFICATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Tue Jun 3 11:52:52 2014

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	326.98	1207.64	0.167	54.54	201.42	146.89 (140.00 – 160.00)

GR BEFORE LOG VERIFICATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Sun Jun 22 04:37:52 2014 DAYS SINCE CAL: 18

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	193.98	1068.84	0.167	32.35	178.27	145.92 (136.89 – 156.89)

GR AFTER LOG VERIFICATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Sun Jun 22 07:57:23 2014 DAYS SINCE CAL: 18

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	195.57	1064.44	0.167	32.62	177.54	144.92 (135.92 – 155.92)

WGI PRIMARY CALIBRATION SUMMARY

TOOL #: 4253XA 10189872 DATE/TIME PERFORMED: Wed Jun 18 16:21:47 2014

UNIT #: 3880TA HL6670

DIAMETER	SM RING (in)	LG RING (in)	TEMPERATURE (degF)
	7.000	21.800	81.735

COS/SIN/ ANGLE DATA	SM RING COS (mV)	SM RING SIN (mV)	LG RING COS (mV)	LG RING SIN (mV)	OFFSET COS (mV)	OFFSET SIN (mV)	OFFSET ANG (deg)
ARM 1 LOWER	1150.8	-1095.9	-989.6	1239.9	80.6 (-500.0 – 500.0)	72.0 (-500.0 – 500.0)	9.334
ARM 1 UPPER	1421.7	728.4	-1346.1	-616.2	37.8 (-500.0 – 500.0)	56.1 (-500.0 – 500.0)	1.993
ARM 2 LOWER	1224.1	-946.4	-1105.5	1115.8	59.3 (-500.0 – 500.0)	84.7 (-500.0 – 500.0)	8.736
ARM 2 UPPER	-1201.8	-1001.8	1186.8	1154.3	-7.5 (-500.0 – 500.0)	76.3 (-500.0 – 500.0)	18.377
ARM 3 LOWER	1351.6	-247.4	-1742.9	-63.7	-195.7 (-500.0 – 500.0)	-155.5 (-500.0 – 500.0)	4.924
ARM 3 UPPER	1005.3	-1243.9	-931.2	1328.4	37.1 (-500.0 – 500.0)	42.3 (-500.0 – 500.0)	9.887
ARM 4 LOWER	1042.6	-1220.9	-1111.3	1191.0	-34.3 (-500.0 – 500.0)	-14.9 (-500.0 – 500.0)	9.407
ARM 4 UPPER	-840.7	-1097.1	1232.6	965.9	195.9 (-500.0 – 500.0)	-65.6 (-500.0 – 500.0)	18.098
ARM 5 LOWER	1535.8	-438.0	-1348.6	572.3	93.6 (-500.0 – 500.0)	67.1 (-500.0 – 500.0)	6.514
ARM 5 UPPER	610.2	-1591.8	-716.9	1547.5	-53.3 (-500.0 – 500.0)	-22.2 (-500.0 – 500.0)	11.292
ARM 6 LOWER	1383.7	-612.0	-1398.7	569.3	-7.5 (-500.0 – 500.0)	-21.4 (-500.0 – 500.0)	6.885
ARM 6 UPPER	863.7	-1212.4	-854.2	1277.2	4.7 (-500.0 – 500.0)	32.4 (-500.0 – 500.0)	10.123

WGI BEFORE LOG VERIFICATION SUMMARY

TOOL #: 4253XA 10189872 DATE/TIME PERFORMED: Sun Jun 22 04:35:07 2014 DAYS SINCE CAL: 3

UNIT #: 3880TA HL6670

DIAMETER	TRUE ID (in)	CHAD (in)	MIND (in)	MAXD (in)	TEMPERATURE (degF)
	21.800	21.760 (21.600 – 22.000)	21.668	21.867	72.945

	RADIUS (in)	RADIUS (in)	DIAMETER (in)
ARM 1 & 4	10.930	10.937	21.867
ARM 2 & 5	10.772	10.919	21.692
ARM 3 & 6	10.836	10.886	21.722

WGI_OR PRIMARY CALIBRATION SUMMARY

TOOL #: 4253XA 10189872 DATE/TIME PERFORMED: Thu Jun 19 08:17:50 2014

UNIT #: 3880TA HL6670 ORIENTATION #: 4401XB 10304309

	DEV (deg)	QA (mG)	MEAS RB (deg)	RB OFFSET (deg)	ROTATED RB (deg)
ORIT TBM CHECK	90.0	999.4 (990.0 – 1010.0)	359.3 (357.5 – 2.5)		
WGI ORIENTATION			349.8	349.8	0.0

WGI_OR BEFORE LOG VERIFICATION SUMMARY

TOOL #: 4253XA 10189872 DATE/TIME PERFORMED: Thu Jun 19 08:18:26 2014 DAYS SINCE CAL: 0

UNIT #: 3880TA HL6670

	DEV (deg)	QA (mG)	ROTATED RB (deg)
WGI ORIENTATION	90.0	999.6 (990.0 – 1010.0)	0.0 (-1.5 – 1.5)

INSTRUMENT CONFIGURATION

Source File: /dat1a/OH087602/WGI_DAL~-tdg

102.31'

CABLEHEAD
Diameter : 3.38"
Length : 5.50'
Weight : 24 lbs
Series : CABL338
Mnemonic : CBLH
Measure Point: 2.75' : CABLEHEAD TOP

CABLEHEAD TOP 99.56'

DOWNHOLE POWER ADAPTER
Diameter : 3.62"
Length : 5.27'
Weight : 86 lbs
Series : 4430XB
Mnemonic : DHPA

SWIVEL
Diameter : 3.38"
Length : 3.50'
Weight : 68 lbs
Series : 3944XD
Mnemonic : SWVL

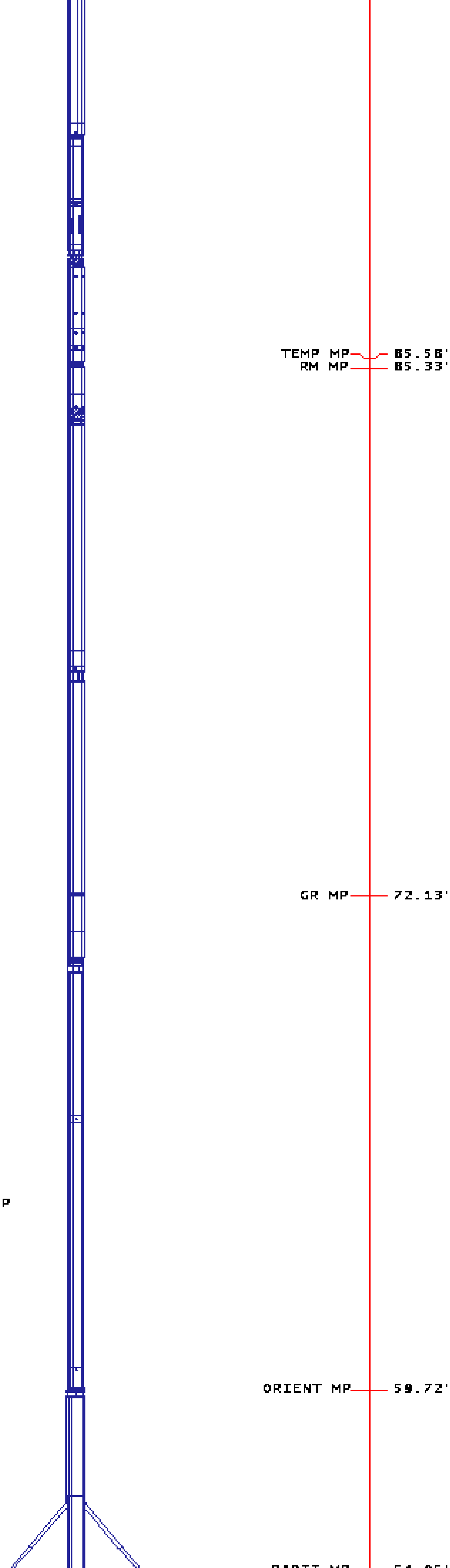
TTRM SUB
Diameter : 3.63"
Length : 3.83'
Weight : 62 lbs
Series : 3981XA
Mnemonic : TTRM
Measure Point: 1.38': TEMP MP
Measure Point: 1.13': RM MP

WTS COMMON REMOTE
Diameter : 3.63"
Length : 6.36'
Weight : 126 lbs
Series : 3514XB
Mnemonic : WTS

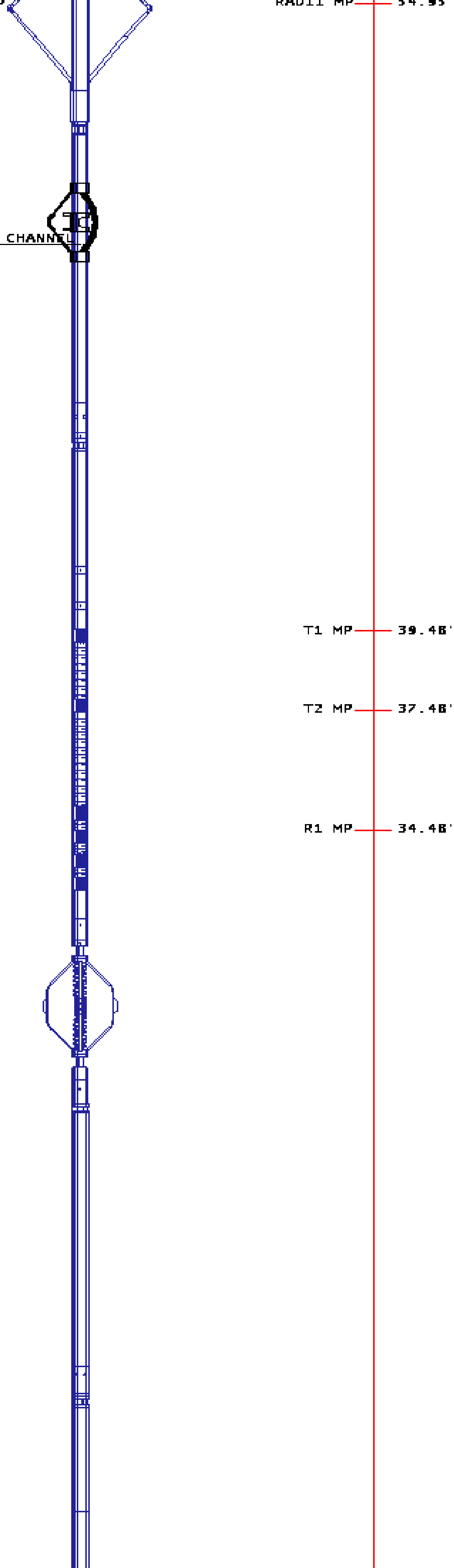
DIGITAL SPECTRALOG
Diameter : 3.63"
Length : 7.31'
Weight : 130 lbs
Series : 1329XA
Mnemonic : DSL
Measure Point: 1.60': GR MP

DIGITAL ORIENTATION
Diameter : 3.38"
Length : 10.81'
Weight : 110 lbs
Series : 4401XB
Mnemonic : ORIT
Measure Point: 0.00': ORIENT MP

WELL GEOMETRY INSTRUMENT
Diameter : 3.62"
Length : 7.61'
Weight : 100 lbs
Series : 4253XA
Mnemonic : WGI



Measure Point: 2.85': RADII MP



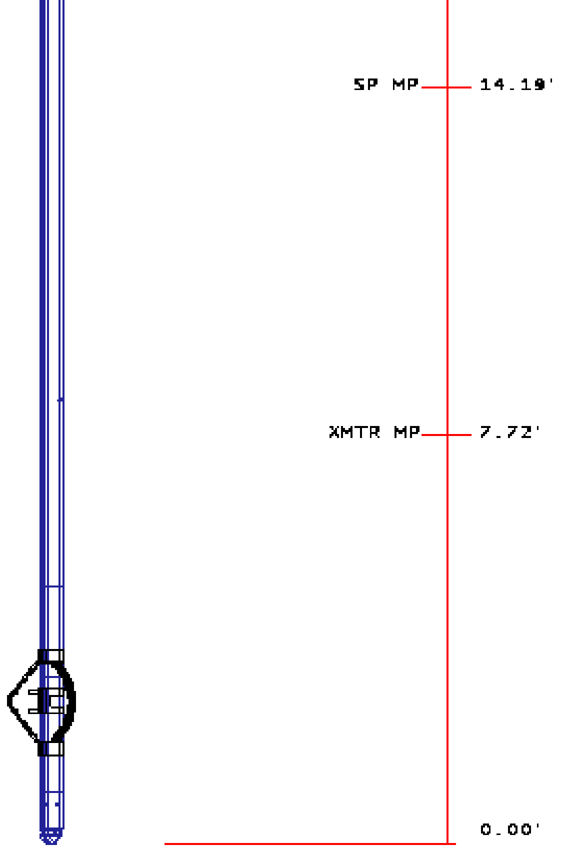
ARRAY ACOUSTILOG ELECTRONICS, 8 CHANNEL
Diameter : 3.38"
Length : 7.82'
Weight : 102 lbs
Series : 1677EA
Mnemonic : XMAC

DIGITAL ACOUSTILOG
Diameter : 3.38"
Length : 12.76'
Weight : 145 lbs
Series : 1680MA
Mnemonic : DAL
Measure Point: 7.95': T1 MP
Measure Point: 5.95': T2 MP
Measure Point: 2.95': R1 MP

4 ARM BOW SPRING CENTRALIZER
Diameter : 3.38"
Length : 4.12'
Weight : 72 lbs
Series : 4341XA
Mnemonic : CENT

HIGH DEFINITION INDUCTION TOOL

Diameter	:	3.62"
Length	:	27.13'
Weight	:	415 lbs
Series	:	1515XA
Mnemonic	:	HDIL
Measure Point	:	13.91': SP MP
Measure Point	:	7.44': XMTR MP



BULL PLUG 3 3/8

TOTAL LENGTH: 102.31'
TOTAL WEIGHT: 1456 lbs
MAX DIAMETER: 0'4.00"

BAKER HUGHES EOLIPS	COMPANY	RESOLUTION COPPER COMPANY	FILE NO: US087602
	WELL	DHRES-15	API NO:
	FIELD	RESOLUTION COPPER	
	COUNTY	PINAL STATE AZ	

LOCATION:	ELEVATIONS: KB NA DF GL NA	RIG: NATIONAL 16
SEC 5 TWP 2S RGE 13E	DATE 22-Jun-2014	

BAKER HUGHES

GAMMA RAY LOG
CALIPER LOG
DIGITAL ACOUSTILOG

FILE NO: US087602

API NO:

Ver. 3.87

RIG: NATIONAL 16

COMPANY	RESOLUTION COPPER COMPANY
WELL	DHRES-15
FIELD	RESOLUTION COPPER
COUNTY	PINAL
STATE	AZ

LOCATION:

SEC 5 TWP 2S RGE 13E

OTHER SERVICES:
STAR
MREX
TEMP/GR
HDIL
WGI

PERMANENT DATUM GL ELEVATION NA

LOG MEASURED FROM GL 0 FT ABOVE P.D.

DRILL. MEAS. FROM GL

ELEVATIONS:
KB NA
DF
GL NA

DATE	22-Jun-2014	
RUN / TRIP	1 / 1	
SERVICE ORDER	US087602	
DEPTH DRILLER	2900 FT	
DEPTH LOGGER	2894 FT	
BOTTOM LOGGED INTERVAL	2886 FT	
TOP LOGGED INTERVAL	1400 FT	
CASING DRILLER	14 IN @ 40 FT	@
CASING LOGGER	36 FT	
BIT SIZE	12.25 IN	
TYPE OF FLUID IN HOLE	WBM	
DENSITY / VISCOSITY	9.7 LB/G / 40 CP	
PH / FLUID LOSS	8.0 / 6.0 C3	
SOURCE OF SAMPLE	FLOWLINE	
RM AT MEAS. TEMP.	3.7 OHMM @ 75 DEGF	@
RMF AT MEAS. TEMP.	5.6 OHMM @ 74 DEGF	@
RMC AT MEAS. TEMP.	3.05 OHMM @ 71 DEGF	@
SOURCE OF RMF / RMC	MEASURED / MEASURED	
RM AT BHT	2.59 OHMM @ 117 DEGF	@
TIME SINCE CIRCULATION	12 HR	
MAX. RECORDED TEMP.	118 DEGF	
EQUIP. NO. / LOCATION	6670 / GRAND JCT	
RECORDED BY	D SMITH/T VERCIMAK	
WITNESSED BY	M SHELLEY	

BOREHOLE RECORD

BIT SIZE	FROM	TO
12.25 IN	40 FT	2900 FT

CASING RECORD

SIZE	WEIGHT	GRADE	FROM	TO
14 IN			0 FT	40 FT

REMARKS

RUN 1 TRIP 1: HDIL_DAL_WGI_GR RUN IN COMBINATION

WGI/CAL VERIFIED DURING BEFORE LOG CALIBRATION
BVOL/CVOL CALCULATED IN CUBIC FT
CVOL CALCULATED FOR 7.625 IN CASING

DT MATRIX = 51.3

HDIL RAN CENTRALIZED
ABC CALCULATED = HOLE SIZE

THANK YOU FOR CHOOSING BAKER HUGHES WIRELINE SERVICES

CREW: VERCIMAK/SMITH/HOLLER/BAUGHMAN

EQUIPMENT DATA					
RUN	TRIP	TOOL	SERIES NO.	SERIAL NO.	POSITION
1FRE	21	PWRADPT2	4430XB	1244777	FREE
1	2	SWVL	3944XD	10158308	FREE
1	2	TTRM	3981XA	10516527	FREE
1	2	WTS	3514XB	10240730	FREE
1	2	DSL	1329XA	10196895	FREE
1	2	ORIENT	4401XB	10304309	CENTRALIZED
1	2	CALIPER	4253XA	10189872	CENTRALIZED
1	2	DAL EA	1677EA	10076613	CENTRALIZED
1	2	DAL MA	1680MA	Z154423	CENTRALIZED
1	2	CENTRALIZER	4341XA	10202020	CENTRALIZED
1	2	HDIL EA	1515EA	10318637	CENTRALIZED
1	2	HDIL MA	1515MA	10037719	CENTRALIZED

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 13:37:57 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n777l_WGI_DAL03.prm
LOGGING MODE: DEPTH DIRECTION: UP
TOP DEPTH: 58.625 ft BOTTOM DEPTH: 2899.755 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
TENSION	FILTER ()	medium (1)		TOP	BOTTOM
GR	FILTER ()	medium (1)		"	"
CALIPER	FILTER	medium (1)		"	"
DT24	FILTER ()	light (2)		"	"
	FILTER (.i)	light (2)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
CASING - BOREHOLE & CEMENT VOLUME	CASING O.D.	7.625	in	TOP	BOTTOM
BIT SIZE	BIT SIZE	12.250	in	"	"

ACOUSTIC POROSITY

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
ACOUSTIC POROSITY	POROSITY TYPE	WYLLIE		TOP	BOTTOM
	DTmatrix	51.30	us/ft	"	"
	DTfluid	190.00	us/ft	"	"
	DTshale	100.00	us/ft	"	"
	MOD. WYLLIE PARM	2.25		"	"
	MOD. R-H-G PARM	2.00		"	"
DELTA T CURVE SELECTION	DT24 SOURCE	FIRST ARRIVAL DT24		"	"

ACOUSTIC PICK CONTROL

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
DELTA-T REJECTION RANGE	REJECTION DTmin	40	us/ft	TOP	BOTTOM
	REJECTION DTmax	180	us/ft	"	"
FIRST ARRIVAL PICK (3 FT)	SEARCH START OFFSET (sfan1*)	0	us	"	"
	SEARCH START OFFSET (sfan2*)	0	us	"	"
	SEARCH START OFFSET (sfan3*)	0	us	"	"
	SEARCH START OFFSET (sfan4*)	0	us	"	"
	SEARCH WINDOW LENGTH	1700	us	"	"
	THRESHOLD FACTOR	0.32		"	"
	THRESHOLD MINIMUM (sfan1*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfan2*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfan3*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfan4*)	1.8	pct	"	"
	F3 THRESHOLD	OFF		"	"

	E3 THRESHOLD	OFF			
FIRST ARRIVAL PICK (5 FT)	SEARCH START OFFSET (sfsf1*)	49	us	"	"
	SEARCH START OFFSET (sfsf2*)	49	us	"	"
	SEARCH START OFFSET (sfsf3*)	49	us	"	"
	SEARCH START OFFSET (sfsf4*)	49	us	"	"
	SEARCH WINDOW LENGTH	1200	us	"	"
	THRESHOLD FACTOR	0.32		"	"
	THRESHOLD MINIMUM (sfsf1*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfsf2*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfsf3*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfsf4*)	1.8	pct	"	"
	E3 THRESHOLD	OFF		"	"

ACOUSTIC QUALITY CONTROL

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
CYCLE SKIP LIMIT	CYCLE SKIP LIMIT	100	us	TOP	BOTTOM

ACOUSTIC WAVEFORM FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
WAVEFORM FILTER - DELTA T	SURFACE WAVE FILTER	ON		TOP	BOTTOM
	LOW FREQ CUTOFF	4000	Hz	"	"
	HIGH FREQ CUTOFF	30000	Hz	"	"

ACOUSTIC TCC CONTROL PARAMETERS

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
GENERAL TCC PARAMETERS	AGC	ON		TOP	BOTTOM
	SUBCYCLE LENGTH	50		"	"
	STACK LEVEL	1		"	"
	DSP FILTER	ON		"	"
	SUBSET	2		"	"
DELTA T TCC PARAMETERS	ACG WINDOW	0	us	"	"
	MOVEOUT	16	us/ft	"	"
	SAMPLE PERIOD	16		"	"
	RX DELAY	192	us	"	"

CURVE DESCRIPTION REPORT

CURVE NAME	CREATION DATE	CURVE DESCRIPTION
F1:BIT	Jun 22 06:16:28 2014	BIT SIZE
F1:CAL	Jun 22 06:16:28 2014	CALIPER
F1:DT24	Jun 22 06:16:28 2014	SLOWNESS OVER 24-INCH INTERVAL
F1:GR	Jun 22 06:16:28 2014	GAMMA RAY
F1:PORA	Jun 22 06:16:28 2014	ACOUSTIC POROSITY
F1:TEN	Jun 22 06:16:28 2014	DIFFERENTIAL TENSION
F1:TT	Jun 22 06:16:28 2014	INTEGRATED TRAVELTIME FROM ACOUSTIC SLOWNESS

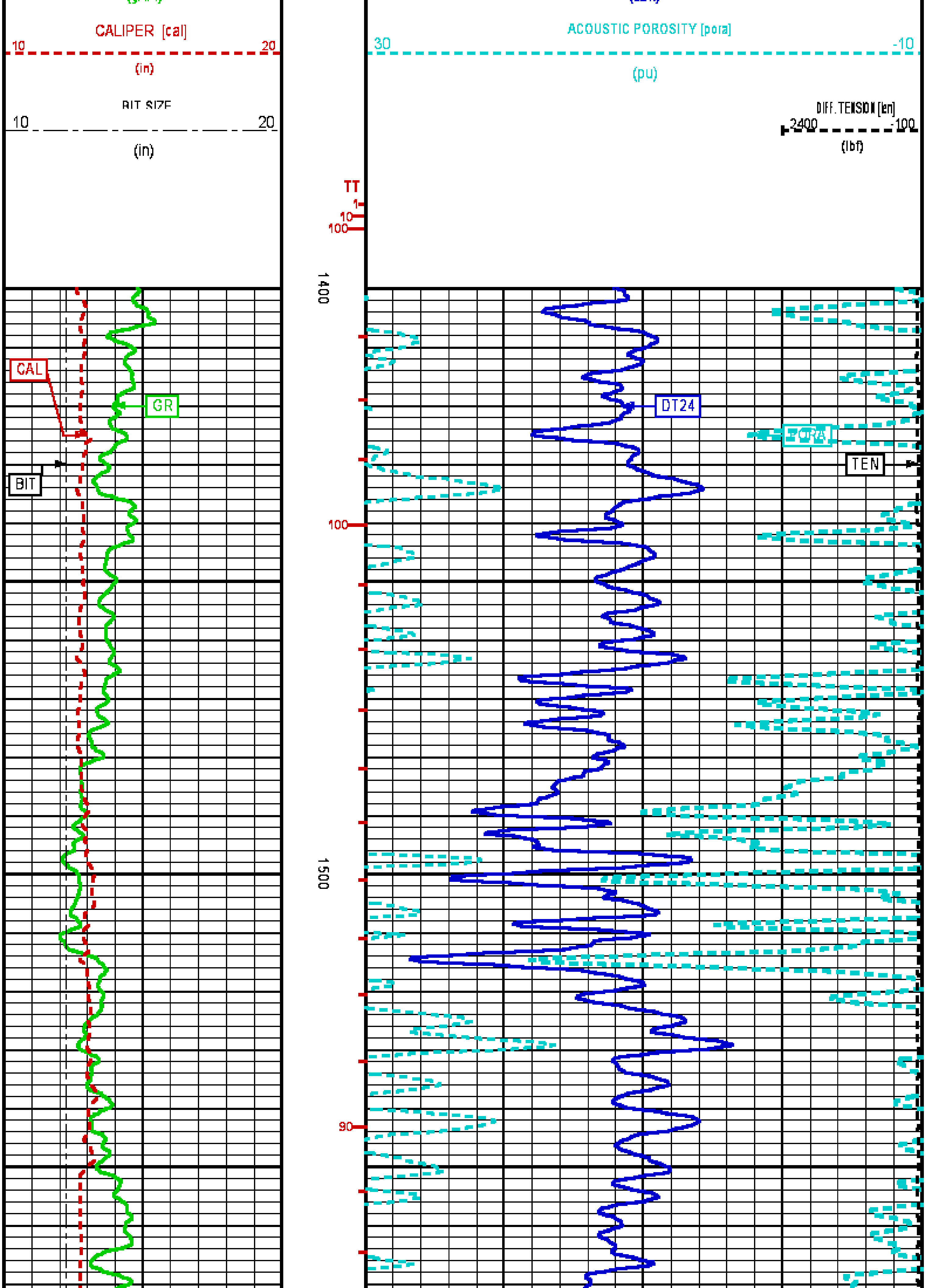
CURVE MEASURE POINT OFFSET

CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
BIT	0.00	DT24	33.50	PORA	33.50		
CAL	54.50	GR	71.75	TEN	0.00		

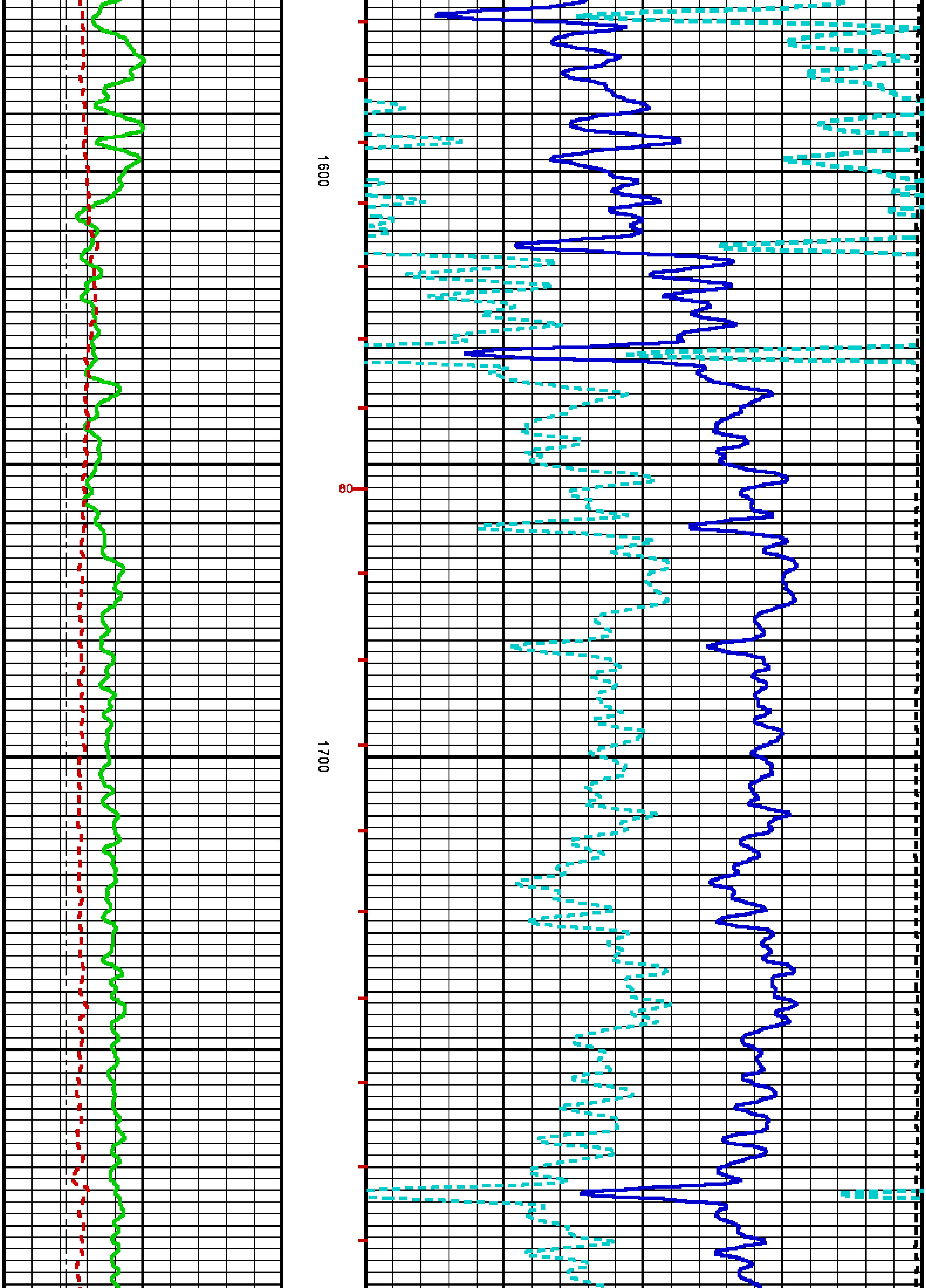
Presentation : HL6670:MAIN_Acoustic.fvpdf [5"/100' Scale]
Plot Interval : 1400 - 2904.75 Feet

Data File 1 : F1 : HL6670:/dat1a/OH087602/n777l_WGI_DAL03.aff
Created On : Jun 22 06:16:28 2014
Company : RESOLUTION COPPER COMPANY
Well : DHRES-15
Field : RESOLUTION COPPER
File Interval : -26.75 - 2904.88 Feet
OCT : n777l_WG

GR BACKUP	FEET	TOOL STICKING
GAMMA RAY [gr] 0 — 200 (gAPI)		2FT. DELTA-T [dt24] 140 — 40 (us/ft)



CALIPER [cal]
10
20
(in)
BIT SIZE
10
20
(in)
ACOUSTIC POROSITY [pora]
30
-10
(pu)
DIFF. TENSION [en]
2400
-100
(lbf)
TT
1
10
100
1400
CAL
GR
DT24
PORA
BIT
TEN
100
1500
90



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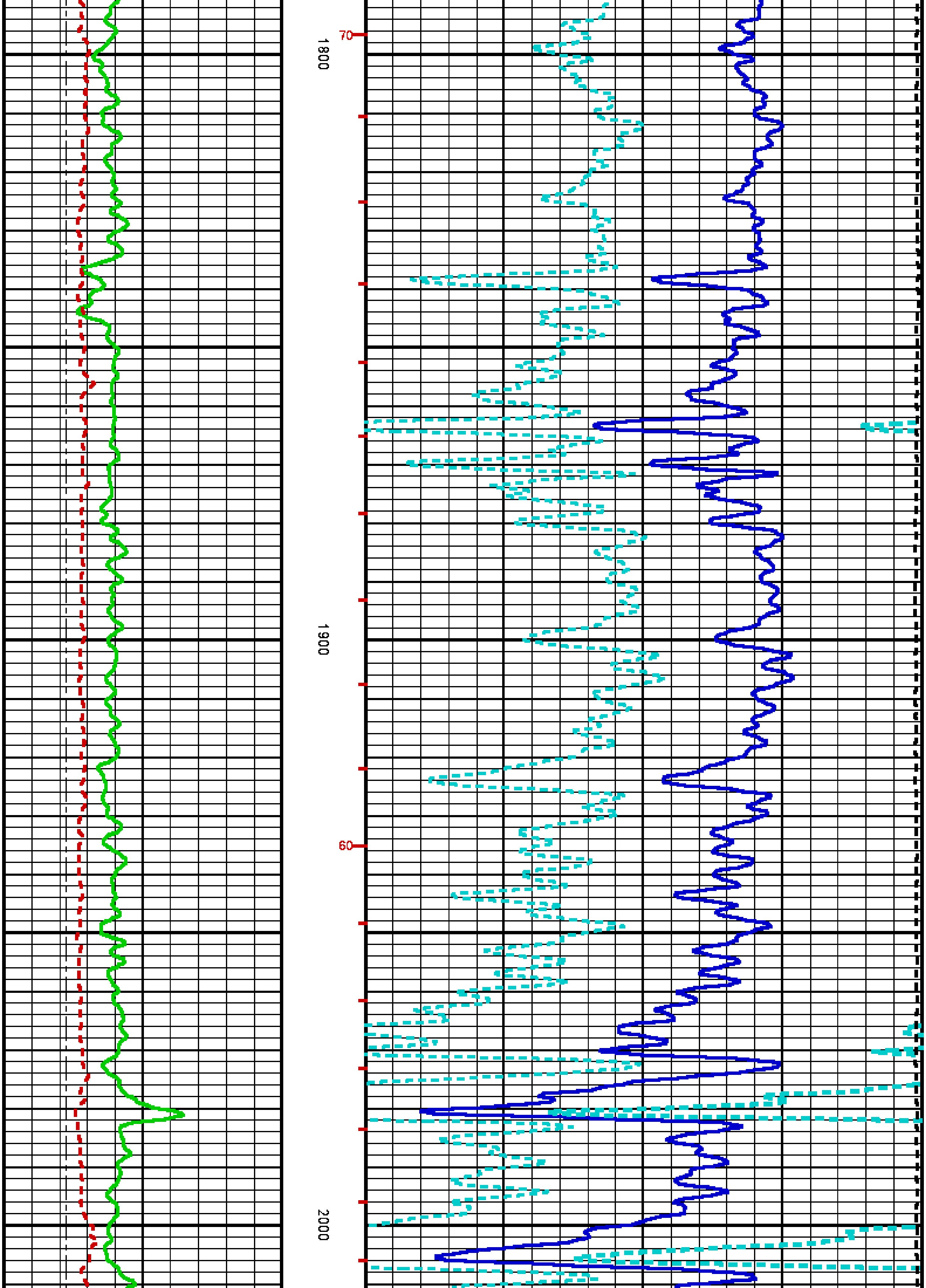
60
1700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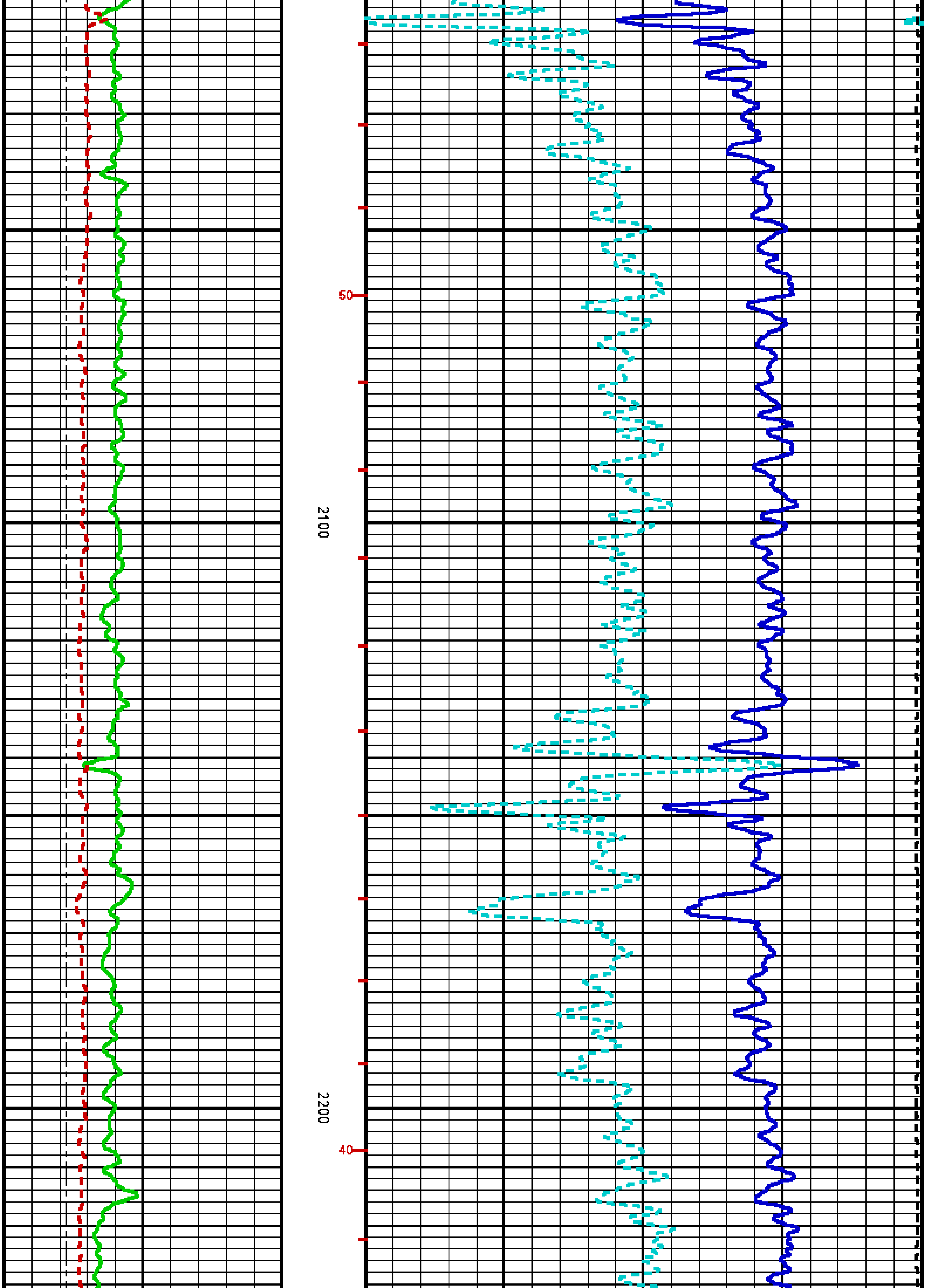
2000


50
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2200
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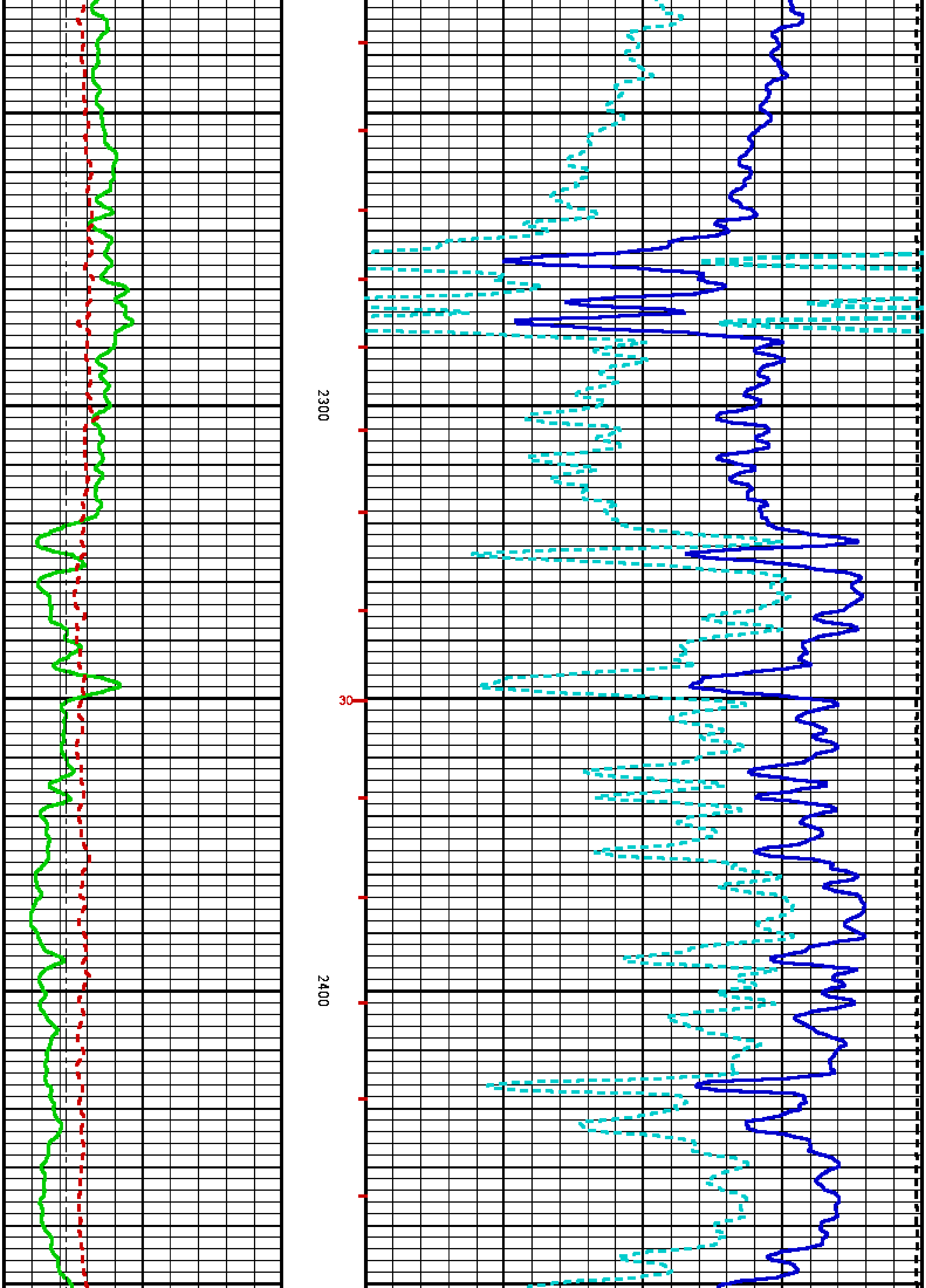

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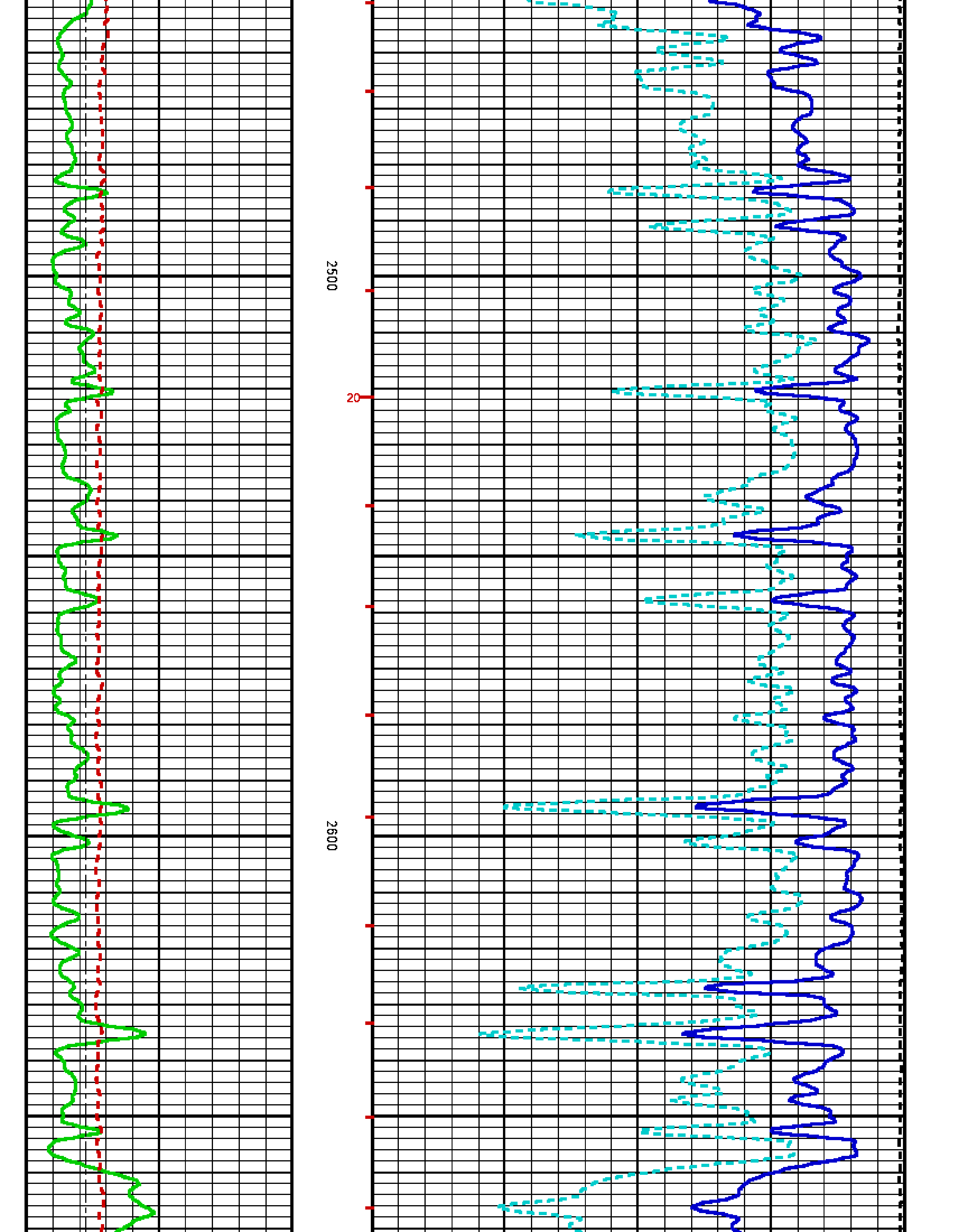
2400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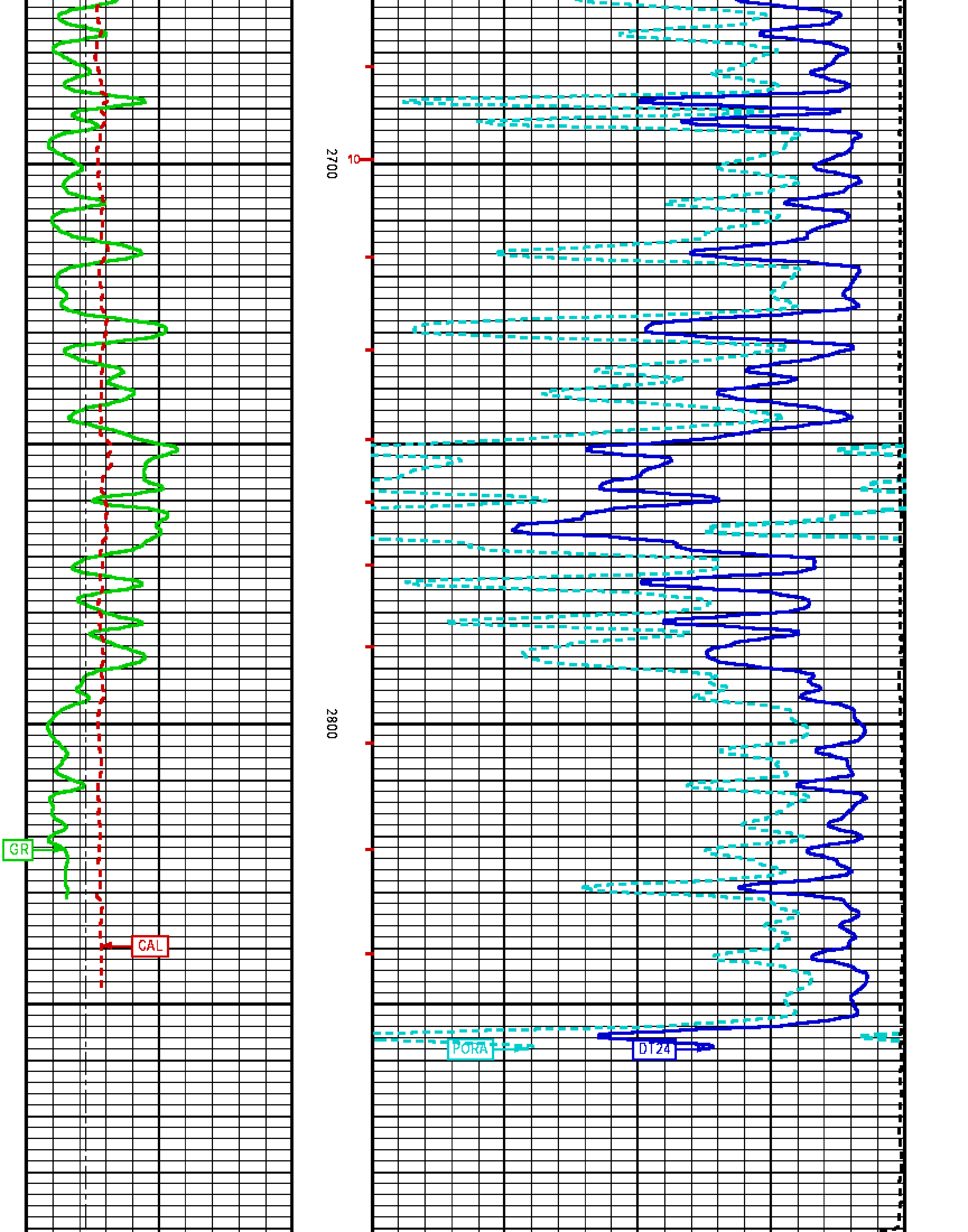
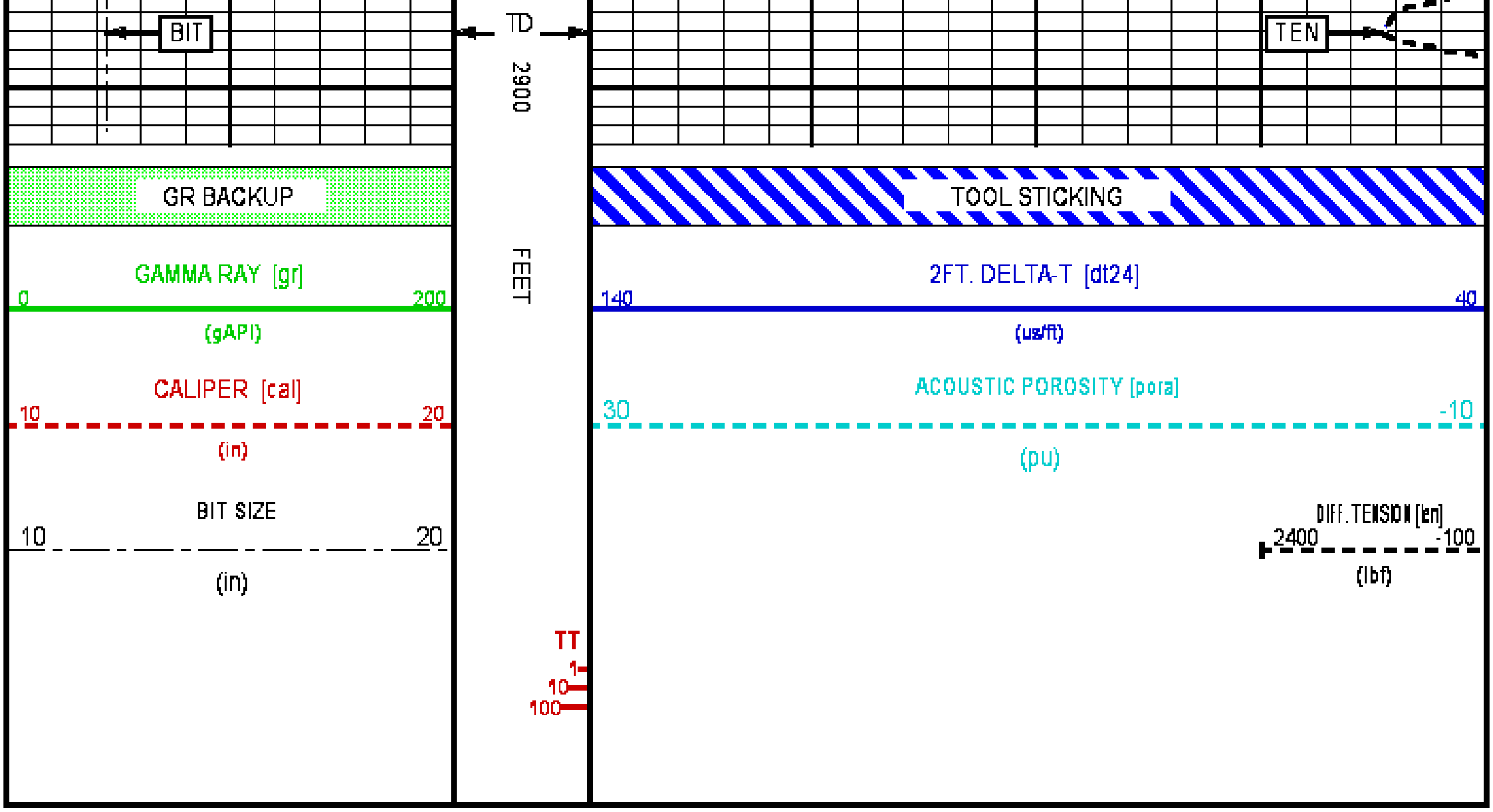
2600


2700
10
2800
GR
CAL
PORA
DT24



REPEAT LOG

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 09:19:41 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n777l_WGI_DAL02.prm
LOGGING MODE: DEPTH DIRECTION: UP
TOP DEPTH: 2575.625 ft BOTTOM DEPTH: 2900.696 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
TENSION	FILTER ()	medium (1)		TOP	BOTTOM
GR	FILTER ()	medium (1)		"	"
CALIPER	FILTER	medium (1)		"	"
DT24	FILTER ()	light (2)		"	"
	FILTER (.i)	light (2)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
CASING - BOREHOLE & CEMENT VOLUME	CASING O.D.	7.625	in	TOP	BOTTOM
BIT SIZE	BIT SIZE	12.250	in	"	"

ACOUSTIC POROSITY

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
ACOUSTIC POROSITY	POROSITY TYPE	WYLLIE		TOP	BOTTOM
	DTmatrix	51.30	us/ft	"	"
	DTfluid	190.00	us/ft	"	"

	DTshale	100.00	us/ft	"	"
	MOD. WYLLIE PARM	2.25		"	"
	MOD. R-H-G PARM	2.00		"	"
DELTA T CURVE SELECTION	DT24 SOURCE	FIRST ARRIVAL DT24		"	"

ACOUSTIC PICK CONTROL

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
DELTA-T REJECTION RANGE	REJECTION DTmin	40	us/ft	TOP	BOTTOM
	REJECTION DTmax	160	us/ft	"	"
FIRST ARRIVAL PICK (3 FT)	SEARCH START OFFSET (sfan1*)	0	us	"	"
	SEARCH START OFFSET (sfan2*)	0	us	"	"
	SEARCH START OFFSET (sfan3*)	0	us	"	"
	SEARCH START OFFSET (sfan4*)	0	us	"	"
	SEARCH WINDOW LENGTH	1700	us	"	"
	THRESHOLD FACTOR	0.32		"	"
	THRESHOLD MINIMUM (sfan1*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfan2*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfan3*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfan4*)	1.8	pct	"	"
	E3 THRESHOLD	OFF		"	"
FIRST ARRIVAL PICK (5 FT)	SEARCH START OFFSET (sfaf1*)	49	us	"	"
	SEARCH START OFFSET (sfaf2*)	49	us	"	"
	SEARCH START OFFSET (sfaf3*)	49	us	"	"
	SEARCH START OFFSET (sfaf4*)	49	us	"	"
	SEARCH WINDOW LENGTH	1200	us	"	"
	THRESHOLD FACTOR	0.32		"	"
	THRESHOLD MINIMUM (sfaf1*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfaf2*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfaf3*)	1.8	pct	"	"
	THRESHOLD MINIMUM (sfaf4*)	1.8	pct	"	"
	E3 THRESHOLD	OFF		"	"

ACOUSTIC QUALITY CONTROL

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
CYCLE SKIP LIMIT	CYCLE SKIP LIMIT	100	us	TOP	BOTTOM

ACOUSTIC WAVEFORM FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
WAVEFORM FILTER - DELTA T	SURFACE WAVE FILTER	ON		TOP	BOTTOM
	LOW FREQ CUTOFF	4000	Hz	"	"
	HIGH FREQ CUTOFF	30000	Hz	"	"

ACOUSTIC TCC CONTROL PARAMETERS

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
GENERAL TCC PARAMETERS	AGC	ON		TOP	BOTTOM
	SUBCYCLE LENGTH	50		"	"
	STACK LEVEL	1		"	"
	DSP FILTER	ON		"	"
	SUBSET	2		"	"
DELTA T TCC PARAMETERS	ACG WINDOW	0	us	"	"
	MOVEOUT	16	us/ft	"	"
	SAMPLE PERIOD	16		"	"
	RX DELAY	192	us	"	"

CURVE DESCRIPTION REPORT

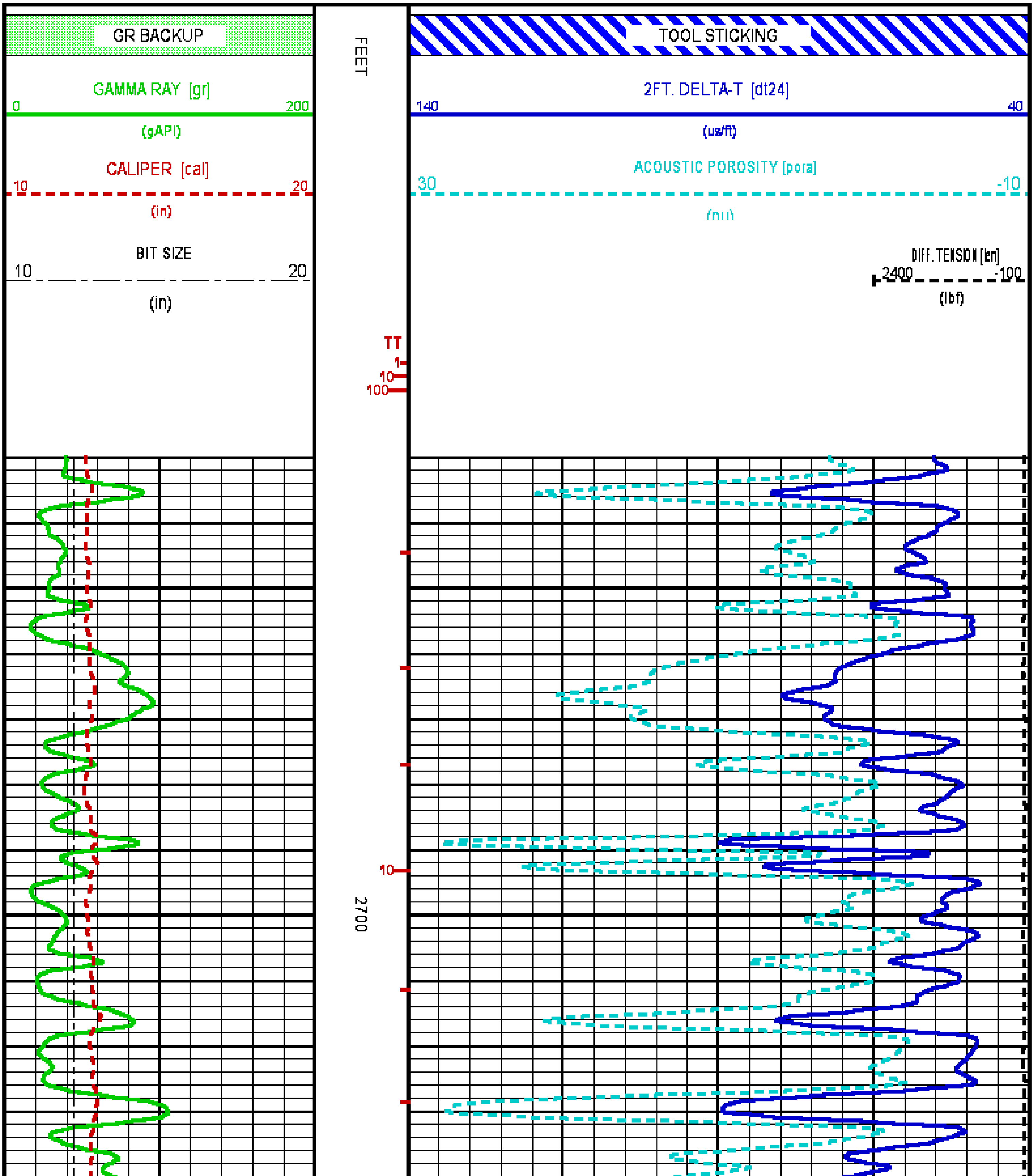
CURVE NAME	CREATION DATE	CURVE DESCRIPTION
F1:BIT	Jun 22 05:53:39 2014	BIT SIZE
F1:CAL	Jun 22 05:53:39 2014	CALIPER
F1:DT24	Jun 22 05:53:39 2014	SLOWNESS OVER 24-INCH INTERVAL
F1:GR	Jun 22 05:53:39 2014	GAMMA RAY
F1:PORA	Jun 22 05:53:39 2014	ACOUSTIC POROSITY
F1:TEN	Jun 22 05:53:39 2014	DIFFERENTIAL TENSION
F1:TT	Jun 22 05:53:39 2014	INTEGRATED TRAVELTIME FROM ACOUSTIC SLOWNESS

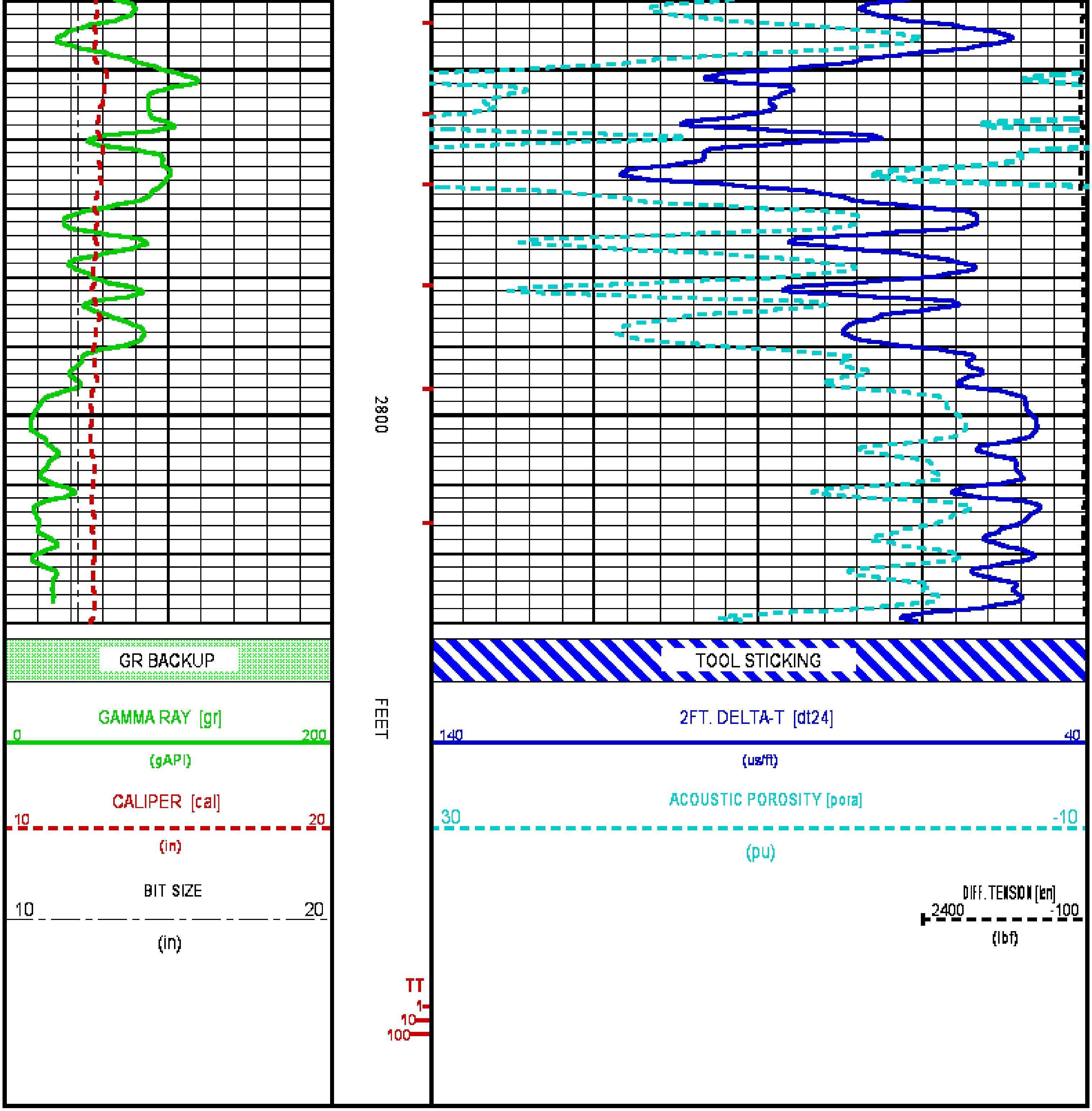
CURVE MEASURE POINT OFFSET

CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)

BIT	0.00	DT24	33.50	PORA	33.50
CAL	54.50	GR	71.75	TEN	0.00

Presentation	**: HL6670:REPEAT_Acoustic.fvpdf [5"/100' Scale]**
Plot Interval	**: 2630 - 2830 Feet**
Data File 1	**: F1 : HL6670:/dat1a/OH087602/REPEAT_WGI_DAL02.xtf**
Created On	**: Jun 22 08:22:10 2014**
Company	**: RESOLUTION COPPER COMPANY**
Well	**: DHRES-15**
Field	**: RESOLUTION COPPER**
File Interval	**: 2491.25 - 2900.88 Feet**
OCT	**: n777l_WG**





CALIBRATION / VERIFICATION SUMMARY

Source File: /dat1a/OH087602/PLOT_WGI_DAL.tp1

CHT PRIMARY CALIBRATION SUMMARY

TOOL #: 3981XA 10516527 DATE/TIME PERFORMED: Fri Jun 13 11:47:01 2014

UNIT #: 3885TC 6685

	Signal Low (raw)	Signal High (raw)	Scale Mult	Scale Add	Engr Low (lbf)	Engr High (lbf)
CHT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CHT	-104.19	379.56	3.10	123.06	-200.00	1300.00

GR PRIMARY CALIBRATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Tue Jun 3 11:41:15 2014

UNIT #: 3880TA HL6670 CALB JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	CR DIFF (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	CALBRTR (gAPI)
GR	331.93	1231.27	899.3 (830.0 – 960.0)	0.167	55.36	205.36	150

GR PRIMARY VERIFICATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Tue Jun 3 11:52:52 2014

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	326.98	1207.64	0.167	54.54	201.42	146.89 (140.00 – 160.00)

GR BEFORE LOG VERIFICATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Sun Jun 22 04:37:52 2014 DAYS SINCE CAL: 18

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	193.98	1068.84	0.167	32.35	178.27	145.92 (135.89 – 155.89)

GR AFTER LOG VERIFICATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Sun Jun 22 07:57:23 2014 DAYS SINCE CAL: 18

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	195.57	1064.44	0.167	32.62	177.54	144.92 (135.92 – 155.92)

WGI PRIMARY CALIBRATION SUMMARY

TOOL #: 4253XA 10189872 DATE/TIME PERFORMED: Wed Jun 18 16:21:47 2014

UNIT #: 3880TA HL6670

DIAMETER	SM RING (in)	LG RING (in)	TEMPERATURE (degF)
	7.000	21.800	81.735

COS/SIN/ ANGLE DATA	SM RING COS (mV)	SM RING SIN (mV)	LG RING COS (mV)	LG RING SIN (mV)	OFFSET COS (mV)	OFFSET SIN (mV)	OFFSET ANG (deg)
ARM 1 LOWER	1150.8	-1095.9	-989.6	1239.9	80.6 (-500.0 – 500.0)	72.0 (-500.0 – 500.0)	9.334
ARM 1 UPPER	1421.7	728.4	-1346.1	-616.2	37.8 (-500.0 – 500.0)	56.1 (-500.0 – 500.0)	1.993
ARM 2 LOWER	1224.1	-946.4	-1105.5	1115.8	59.3 (-500.0 – 500.0)	84.7 (-500.0 – 500.0)	8.736
ARM 2 UPPER	-1201.8	-1001.8	1186.8	1154.3	-7.5 (-500.0 – 500.0)	76.3 (-500.0 – 500.0)	18.377
ARM 3 LOWER	1351.6	-247.4	-1742.9	-63.7	-195.7 (-500.0 – 500.0)	-155.5 (-500.0 – 500.0)	4.924

ARM 3 UPPER	1005.3	-1243.9	-931.2	1328.4	37.1 (-500.0 – 500.0)	42.3 (-500.0 – 500.0)	9.887
ARM 4 LOWER	1042.6	-1220.9	-1111.3	1191.0	-34.3 (-500.0 – 500.0)	-14.9 (-500.0 – 500.0)	9.407
ARM 4 UPPER	-840.7	-1097.1	1232.6	965.9	195.9 (-500.0 – 500.0)	-65.6 (-500.0 – 500.0)	18.098
ARM 5 LOWER	1535.8	-438.0	-1348.6	572.3	93.6 (-500.0 – 500.0)	67.1 (-500.0 – 500.0)	6.514
ARM 5 UPPER	610.2	-1591.8	-716.9	1547.5	-53.3 (-500.0 – 500.0)	-22.2 (-500.0 – 500.0)	11.292
ARM 6 LOWER	1383.7	-612.0	-1398.7	569.3	-7.5 (-500.0 – 500.0)	-21.4 (-500.0 – 500.0)	6.885
ARM 6 UPPER	863.7	-1212.4	-854.2	1277.2	4.7 (-500.0 – 500.0)	32.4 (-500.0 – 500.0)	10.123

WGI BEFORE LOG VERIFICATION SUMMARY

TOOL #: 4253XA 10189872 DATE/TIME PERFORMED: Sun Jun 22 04:35:07 2014 DAYS SINCE CAL: 3

UNIT #: 3880TA HL6670

DIAMETER	TRUE ID (in)	CHAD (in)	MIND (in)	MAXD (in)	TEMPERATURE (degF)
	21.800	21.760 (21.600 – 22.000)	21.668	21.867	72.945

	RADIUS (in)	RADIUS (in)	DIAMETER (in)
ARM 1 & 4	10.930	10.937	21.867
ARM 2 & 5	10.772	10.919	21.692
ARM 3 & 6	10.836	10.886	21.722

WGI_OR PRIMARY CALIBRATION SUMMARY

TOOL #: 4253XA 10189872 DATE/TIME PERFORMED: Thu Jun 19 08:17:50 2014

UNIT #: 3880TA HL6670 ORIENTATION #: 4401XB 10304309

	DEV (deg)	QA (mG)	MEAS RB (deg)	RB OFFSET (deg)	ROTATED RB (deg)
ORIT TBM CHECK	90.0	999.4 (990.0 – 1010.0)	359.3 (357.5 – 2.5)		
WGI ORIENTATION			349.8	349.8	0.0

WGI_OR BEFORE LOG VERIFICATION SUMMARY

TOOL #: 4253XA 10189872 DATE/TIME PERFORMED: Thu Jun 19 08:18:28 2014 DAYS SINCE CAL: 0

UNIT #: 3880TA HL6670

	DEV (deg)	QA (mG)	ROTATED RB (deg)
WGI ORIENTATION	90.0	999.6 (990.0 – 1010.0)	0.0 (-1.5 – 1.5)

INSTRUMENT CONFIGURATION

Source File: /dat1a/OH087602/WGI_DAL~tdg

102.31'

CABLEHEAD
Diameter : 3.38"
Length : 5.50'
Weight : 24 lbs
Series : CABL33B
Mnemonic : CBLH
Measure Point: 2.75': CABLEHEAD TOP

DOWNHOLE POWER ADAPTER
Diameter : 3.63"
Length : 5.37'
Weight : 86 lbs
Series : 4430XB
Mnemonic : DHPA

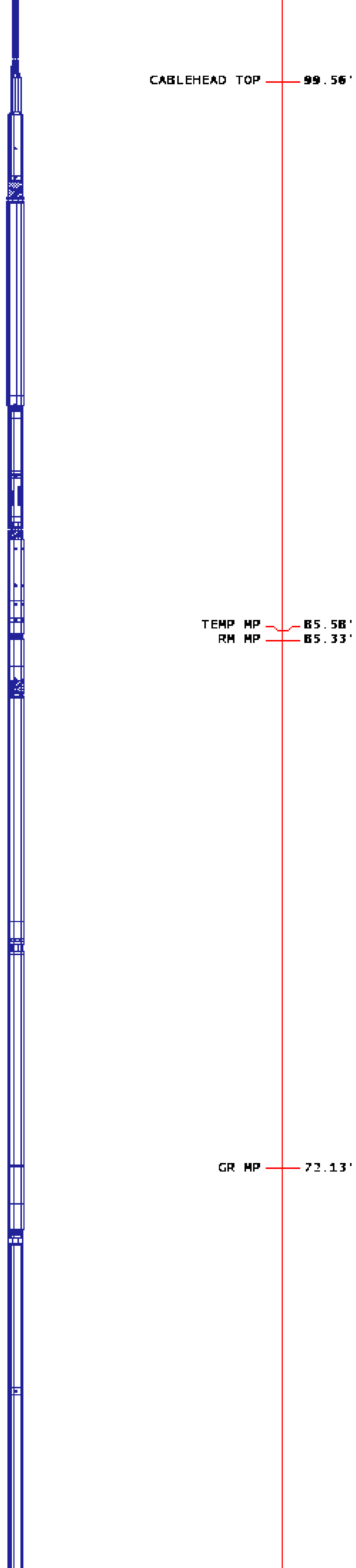
SWIVEL
Diameter : 3.38"
Length : 3.50'
Weight : 68 lbs
Series : 3944XD
Mnemonic : SWVL

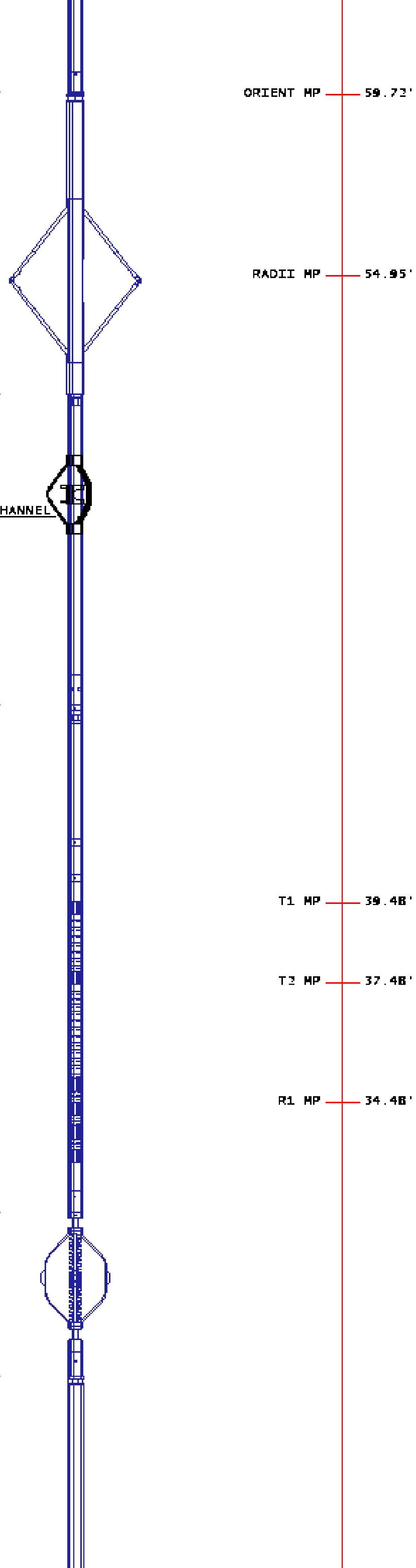
TTRM SUB
Diameter : 3.63"
Length : 3.83'
Weight : 63 lbs
Series : 3981XA
Mnemonic : TTRM
Measure Point: 1.38': TEMP MP
Measure Point: 1.13': RM MP

WTS COMMON REMOTE
Diameter : 3.63"
Length : 6.36'
Weight : 126 lbs
Series : 3514XB
Mnemonic : WTS

DIGITAL SPECTRALOG
Diameter : 3.63"
Length : 7.31'
Weight : 130 lbs
Series : 1329XA
Mnemonic : DSL
Measure Point: 1.60': GR MP

DIGITAL ORIENTATION
Diameter : 3.38"
Length : 10.81'
Weight : 110 lbs
Series : 4401XB
Mnemonic : ORIT
Measure Point: 0.00': ORIENT MP





WELL GEOMETRY INSTRUMENT

Diameter : 3.63"
Length : 7.61'
Weight : 100 lbs
Series : 4253XA
Mnemonic : WGI
Measure Point: 2.85': RADII MP

ARRAY ACOUSTILOG ELECTRONICS, 8 CHANNEL

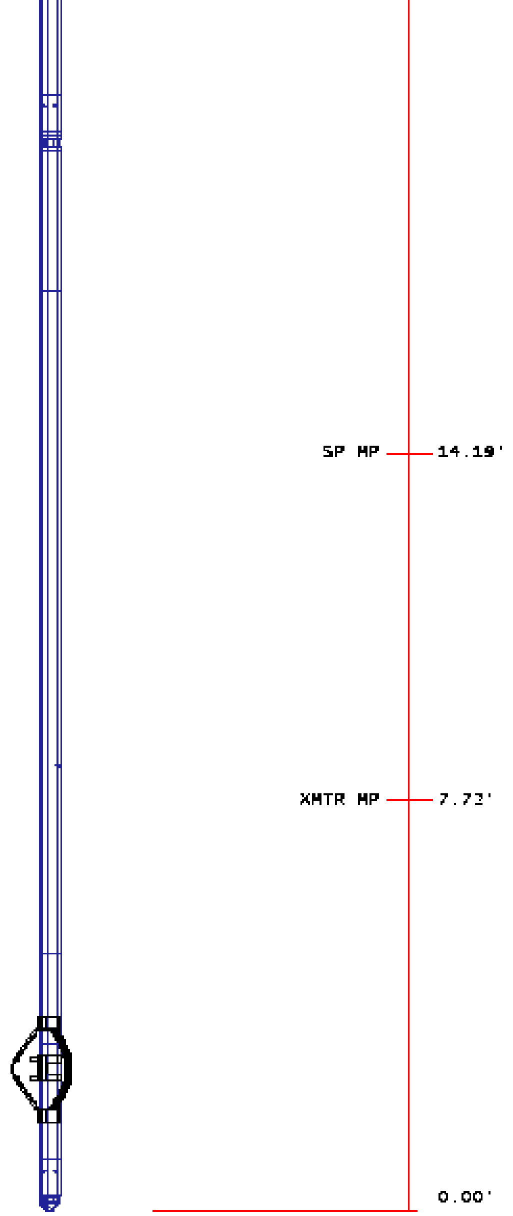
Diameter : 3.38"
Length : 7.83'
Weight : 103 lbs
Series : 1677EA
Mnemonic : XMAC

DIGITAL ACOUSTILOG

Diameter : 3.38"
Length : 13.76'
Weight : 145 lbs
Series : 1680MA
Mnemonic : DAL
Measure Point: 7.95': T1 MP
Measure Point: 5.95': T3 MP
Measure Point: 2.95': R1 MP

4 ARM BOW SPRING CENTRALIZER

Diameter : 3.38"
Length : 4.13'
Weight : 72 lbs
Series : 4341XA
Mnemonic : CENT



HIGH DEFINITION INDUCTION TOOL
Diameter : 3.63"
Length : 37.13'
Weight : 415 lbs
Series : 1515XA
Mnemonic : HDIL
Measure Point: 13.91': SP MP
Measure Point: 7.44': XMTR MP

BULL PLUG 3 3/8

TOTAL LENGTH: 103.31'
TOTAL WEIGHT: 1456 lbs
MAX DIAMETER: 0'4.00"

BAKER HUGHES ECLIPS	COMPANY	RESOLUTION COPPER COMPANY	FILE NO: US087602
	WELL	DHRES-15	API NO:
	FIELD	RESOLUTION COPPER	
	COUNTY	PINAL STATE AZ	
	LOCATION: SEC 5 TWP 2S RGE 13E	ELEVATIONS: KB NA DF GL NA	RIG: NATIONAL 16
		DATE 22-Jun-2014	

BAKER HUGHES

RESISTIVITY IMAGING LOG
GAMMA RAY LOG
(PRELIMINARY RESULTS)

FILE NO: US087602

API NO:

COMPANY	RESOLUTION COPPER COMPANY
WELL	DHRES-15
FIELD	RESOLUTION COPPER
COUNTY	PINAL STATE AZ

Ver. 3.87

RIG: NATIONAL 16

LOCATION:

NW SW SW

SEC 5 TWP 2S RGE 13E

OTHER SERVICES

HDIL
MREX
TEMP/GR
DAL
WGI

PERMANENT DATUM GL ELEVATION NA

LOG MEASURED FROM GL 0 FT ABOVE P.D.

DRILL. MEAS. FROM GL

ELEVATIONS:

KB NA
DF
GL NA

DATE		22-Jun-2014			
RUN	TRIP	1	3		
SERVICE ORDER		US087602			
DEPTH DRILLER		2900 FT			
DEPTH LOGGER		2894 FT			
BOTTOM LOGGED INTERVAL		2891 FT			
TOP LOGGED INTERVAL		160 FT			
CASING DRILLER		14 IN	@ 40 FT	@	
CASING LOGGER		NOT LOGGED			
BIT SIZE		12.25 IN			
TYPE OF FLUID IN HOLE		WBM			
DENSITY	VISCOSITY	9.7 LB/G	40 CP		
PH	FLUID LOSS	8.0	6.0 C3		
SOURCE OF SAMPLE		FLOWLINE			
RM AT MEAS. TEMP.		3.7 OHMM	@ 75 DEGF	@	
RMF AT MEAS. TEMP.		5.6 OHMM	@ 74 DEGF	@	
RMC AT MEAS. TEMP.		3.05 OHMM	@ 71 DEGF	@	
SOURCE OF RMF	RMC	MEASURED	MEASURED		
RM AT BHT		2.59 OHMM	@ 117 DEGF	@	
TIME SINCE CIRCULATION		12 HR			
MAX. RECORDED TEMP.		118 DEGF			
EQUIP. NO.	LOCATION	6670	GRAND JCT		
RECORDED BY		D SMITH/T VERCIMAK			
WITNESSED BY		M SHELLEY			

BOREHOLE RECORD

BIT SIZE	FROM	TO
12.25 IN	40 FT	2900 FT

CASING RECORD

SIZE	WEIGHT	GRADE	FROM	TO
14 IN			0 FT	40 FT

REMARKS

RUN 1 TRIP 3: BVOL/CVOL CALCULATED IN CUBIC FT
CVOL CALCULATED FOR 7.625 IN CASING

THANK YOU FOR CHOOSING BAKER HUGHES WIRELINE SERVICES

CREW: VERCIMAK/SMITH/HOLLER/BAUGHMAN

EQUIPMENT DATA

RUN	TRIP	TOOL	SERIES NO.	SERIAL NO.	POSITION
1	3	PWR ADPT	4430XB	1244777	FREE

1	3	SWVL	3944XD	10158308	FREE
1	3	TTRM	3981XA	10516527	FREE
1	3	WTS	3514XB	10240730	FREE
1	3	DSL	1329XA	10196895	FREE
1	3	ORIENT	4401XB	10304309	FREE
1	3	CAP SUB	1022PB	10565895	FREE
1	3	STAR	1036EB / 4236MB	10402331 / 10370498	CENT

MAIN LOG

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 14:38:35 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n837g02.prm
LOGGING MODE: DEPTH   DIRECTION: UP
TOP DEPTH: 148.017 ft   BOTTOM DEPTH: 2910.254 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
SPEED	FILTER ()	medium (1)		TOP	BOTTOM
	FILTER (.h)	medium (1)		"	"
	FILTER (.i)	medium (1)		"	"
GR	FILTER ()	medium (1)		"	"
	FILTER (.h)	medium (1)		"	"
	FILTER (.i)	medium (1)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
BIT SIZE	BIT SIZE	12.250	in	TOP	BOTTOM

ORIENTATION

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
GEOMAG PARAMETERS	MAG Inclination	0.000	deg	TOP	BOTTOM
	MAG Field - TOTAL	0	nT	"	"

STAR/EART PROCESSING

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
GUARD VOLTAGE QUAL CURVE	PAD SELECTION	PAD 1		TOP	BOTTOM

CURVE DESCRIPTION REPORT

CURVE NAME	CREATION DATE	CURVE DESCRIPTION
F1:AZSTQH	Jun 22 09:55:30 2014	AZIMUTH OF REFERENCE PAD FOR STAR
F1:BKRGQH	Jun 22 09:55:30 2014	BUCKER DRIVER VALUE
F1:DEVSTQH	Jun 22 09:55:30 2014	DEVIATION FOR STAR
F1:GR	Jun 22 09:55:30 2014	GAMMA RAY
F1:GVRATQH	Jun 22 09:55:30 2014	ACTUAL GUARD VOLTAGE, IDEAL GUARD VOLTAGE RATIO
F1:P1BTNQH	Jun 22 09:55:30 2014	PACKED PAD 1 BLOCK (BUTTONS 1-24)
F1:P2BTNQH	Jun 22 09:55:30 2014	PACKED PAD 2 BLOCK (BUTTONS 1-24)
F1:P3BTNQH	Jun 22 09:55:30 2014	PACKED PAD 3 BLOCK (BUTTONS 1-24)
F1:P4BTNQH	Jun 22 09:55:30 2014	PACKED PAD 4 BLOCK (BUTTONS 1-24)
F1:P5BTNQH	Jun 22 09:55:30 2014	PACKED PAD 5 BLOCK (BUTTONS 1-24)
F1:P6BTNQH	Jun 22 09:55:30 2014	PACKED PAD 6 BLOCK (BUTTONS 1-24)
F1:PADFQH	Jun 22 09:55:30 2014	PAD FORCE
F1:PADGQH	Jun 22 09:55:30 2014	PAD GAIN CODE
F1:QCKOSTQH	Jun 22 09:55:30 2014	COMPOSITE QUALITY OF MAGNETOMETER REF STAR

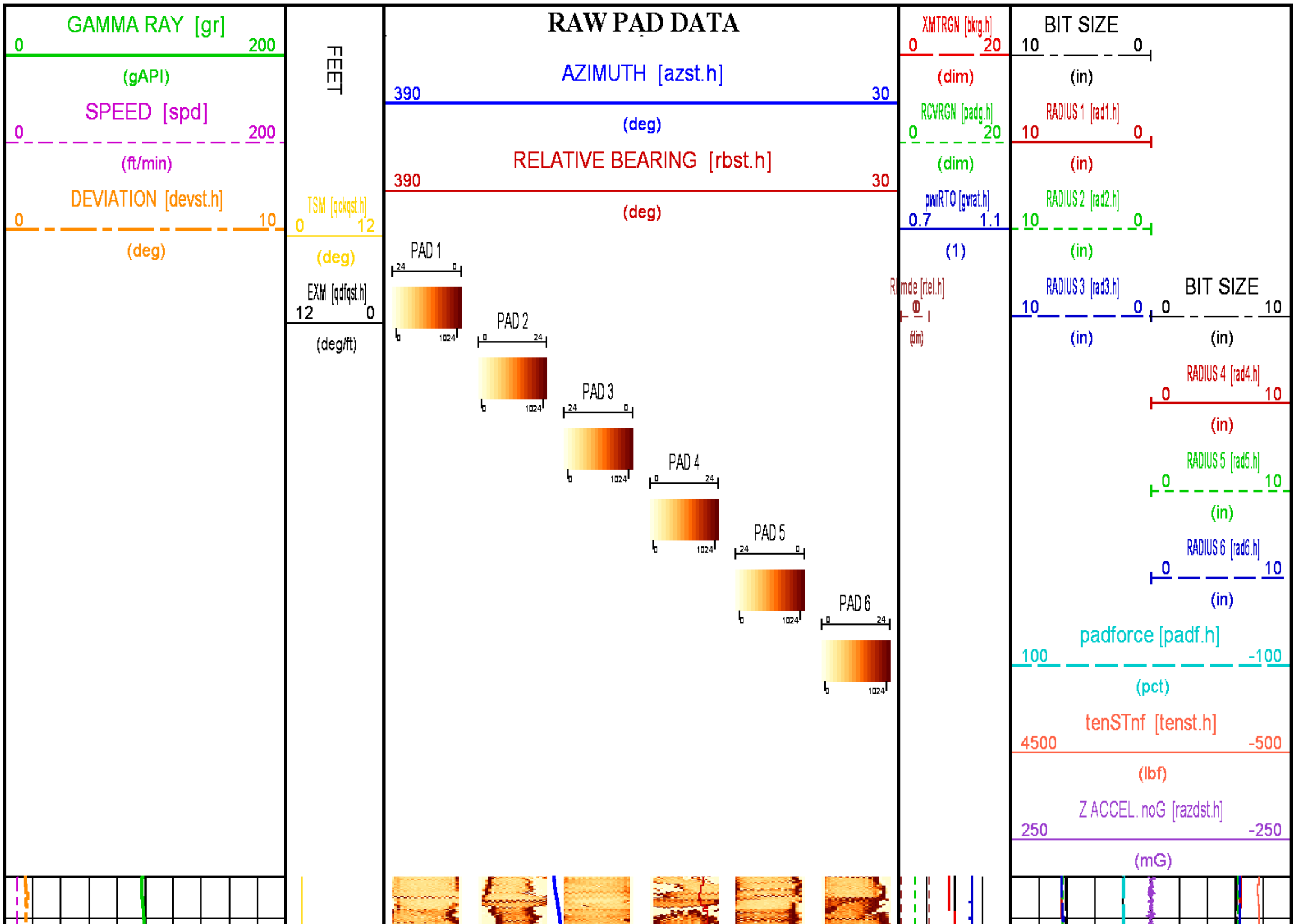
F1:QCKQSTQH	Jun 22 09:55:30 2014	COMPOSITE QUALITY OF MAGNETOMETER REF STAR
F1:QDFQSTQH	Jun 22 09:55:30 2014	COMPOSITE QUALITY OF DIFF OF MAGNETOMETER REF STAR
F1:RAD1QH	Jun 22 09:55:30 2014	RADIUS, TOOL AXIS TO PAD 1 FACE
F1:RAD2QH	Jun 22 09:55:30 2014	RADIUS, TOOL AXIS TO PAD 2 FACE
F1:RAD3QH	Jun 22 09:55:30 2014	RADIUS, TOOL AXIS TO PAD 3 FACE
F1:RAD4QH	Jun 22 09:55:30 2014	RADIUS, TOOL AXIS TO PAD 4 FACE
F1:RAD5QH	Jun 22 09:55:30 2014	RADIUS, TOOL AXIS TO PAD 5 FACE
F1:RAD6QH	Jun 22 09:55:30 2014	RADIUS, TOOL AXIS TO PAD 6 FACE
F1:RAZDSTQH	Jun 22 09:55:30 2014	DIFFERENTIAL Z-AXIS ACCELEROMETER SHIFTED TO STAR
F1:RBIT1	Jun 22 09:55:30 2014	BIT RADIUS 1
F1:RBIT4	Jun 22 09:55:30 2014	BIT RADIUS 4
F1:RBSTQH	Jun 22 09:55:30 2014	RELATIVE BEARING (RELATIVE TO BOREHOLE HIGH SIDE) FOR STAR
F1:RTELQH	Jun 22 09:55:30 2014	RETURN ELECTRODE
F1:SPD	Jun 22 09:55:30 2014	SPEED
F1:TENSTQH	Jun 22 09:55:30 2014	DIFFERENTIAL TENSION REFERENCED TO STAR PAD 1

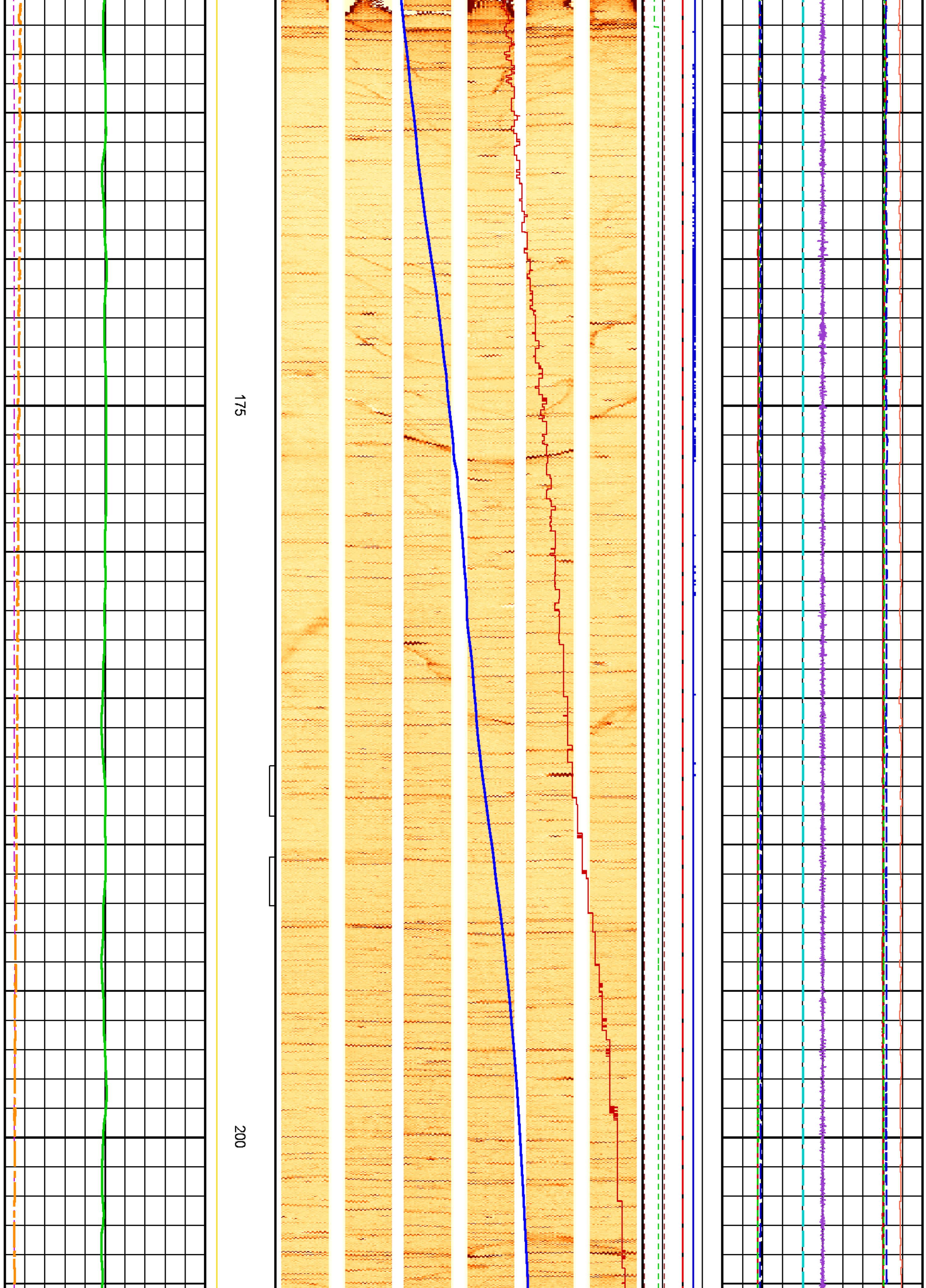
CURVE MEASURE POINT OFFSET

CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
AZSTQH	3.32	PADGQH	3.32	RAD4QH	3.32	RBSTQH	3.32
BKRGQH	3.32	QCKQSTQH	3.32	RAD5QH	3.32	RTELQH	3.32
DEVSTQH	3.32	QDFQSTQH	3.32	RAD6QH	3.32	SPD	0.00
GR	43.00	RAD1QH	3.32	RAZDSTQH	3.32	TENSTQH	3.32
GVRATQH	3.32	RAD2QH	3.32	RBIT1	3.25		
PADFQH	3.32	RAD3QH	3.32	RBIT4	3.25		

Presentation : HL6670:/dat1a/OH087602/star_image_MAIN.fvpdf [25''/100' Scale]
Plot Interval : 160 - 2913.5 Feet

Data File 1 : F1 : HL6670:/dat1a/OH087602/n837g02.aff
Created On : Jun 22 09:55:30 2014
Company : RESOLUTION COPPER COMPANY
Well : DHRES-15
Field : RESOLUTION COPPER
File Interval : 91.5 - 2913.5 Feet
OCT : n837g

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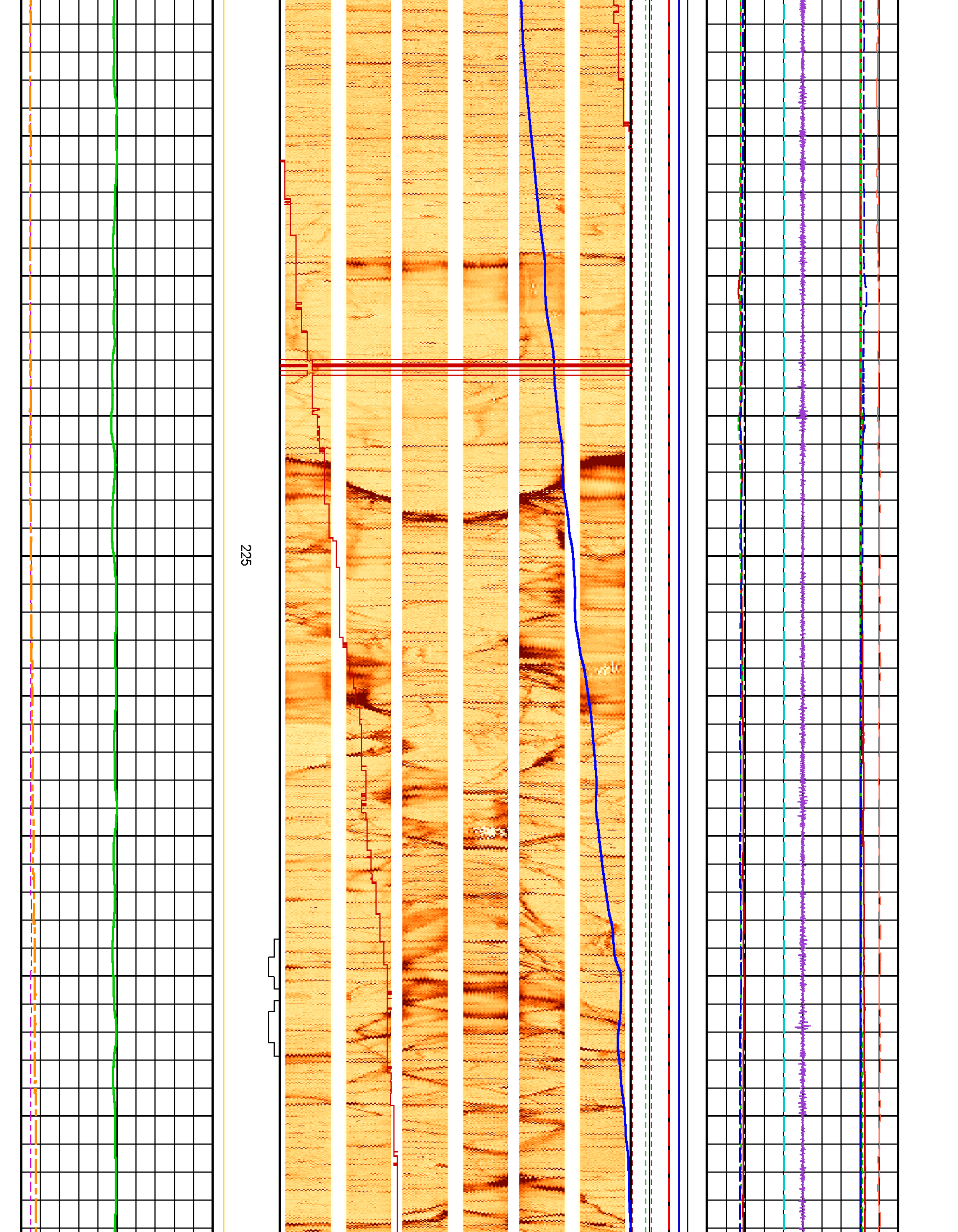
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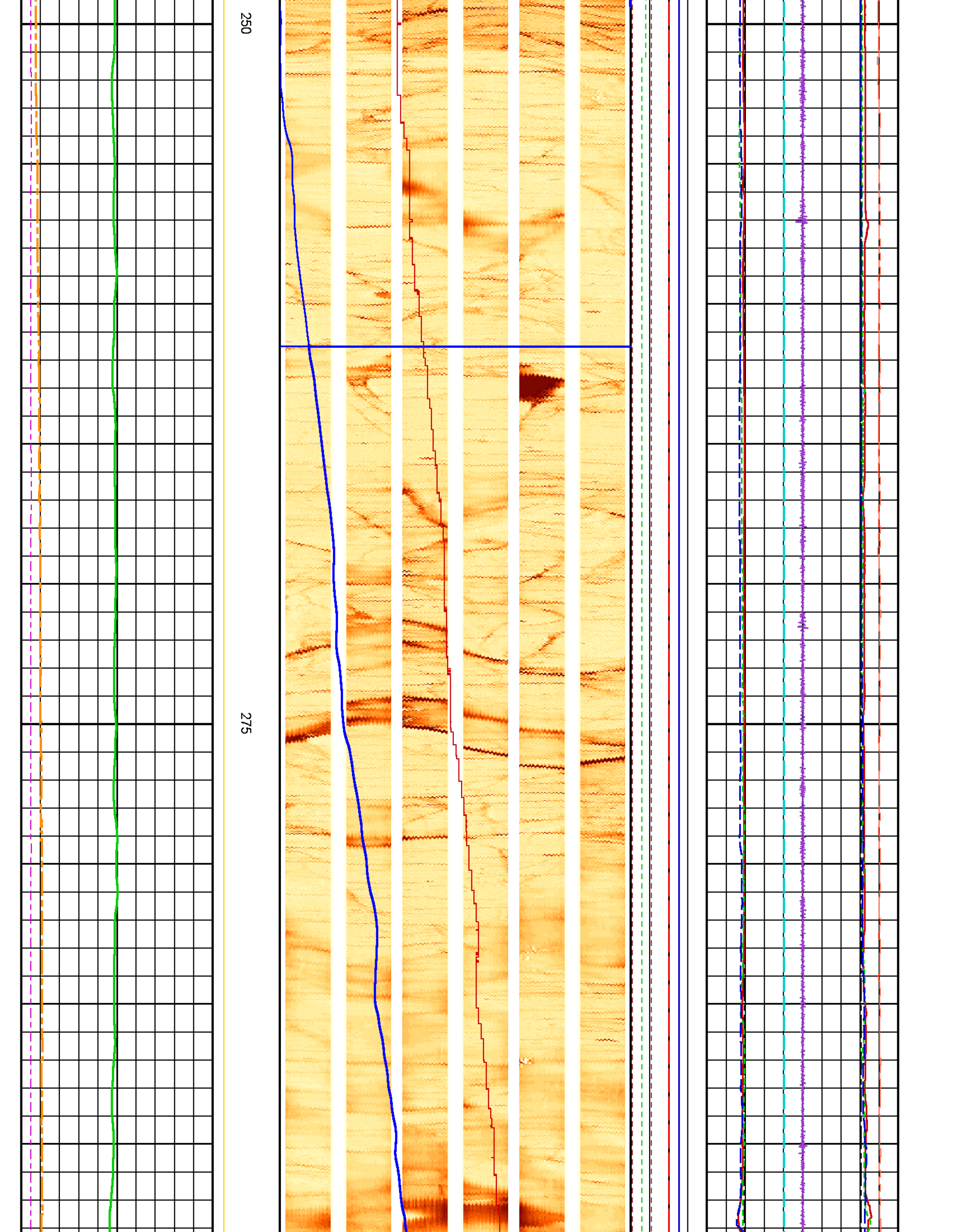
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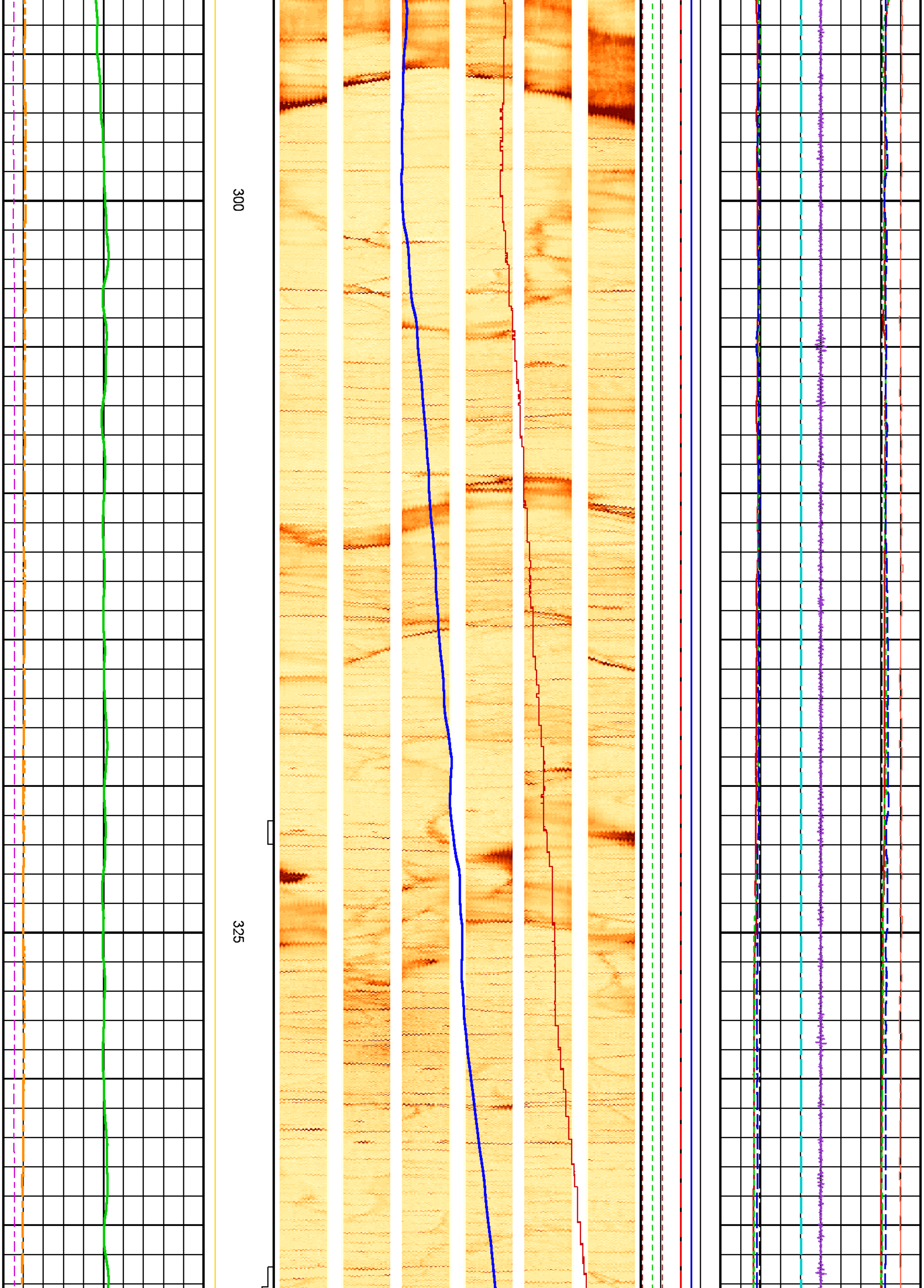
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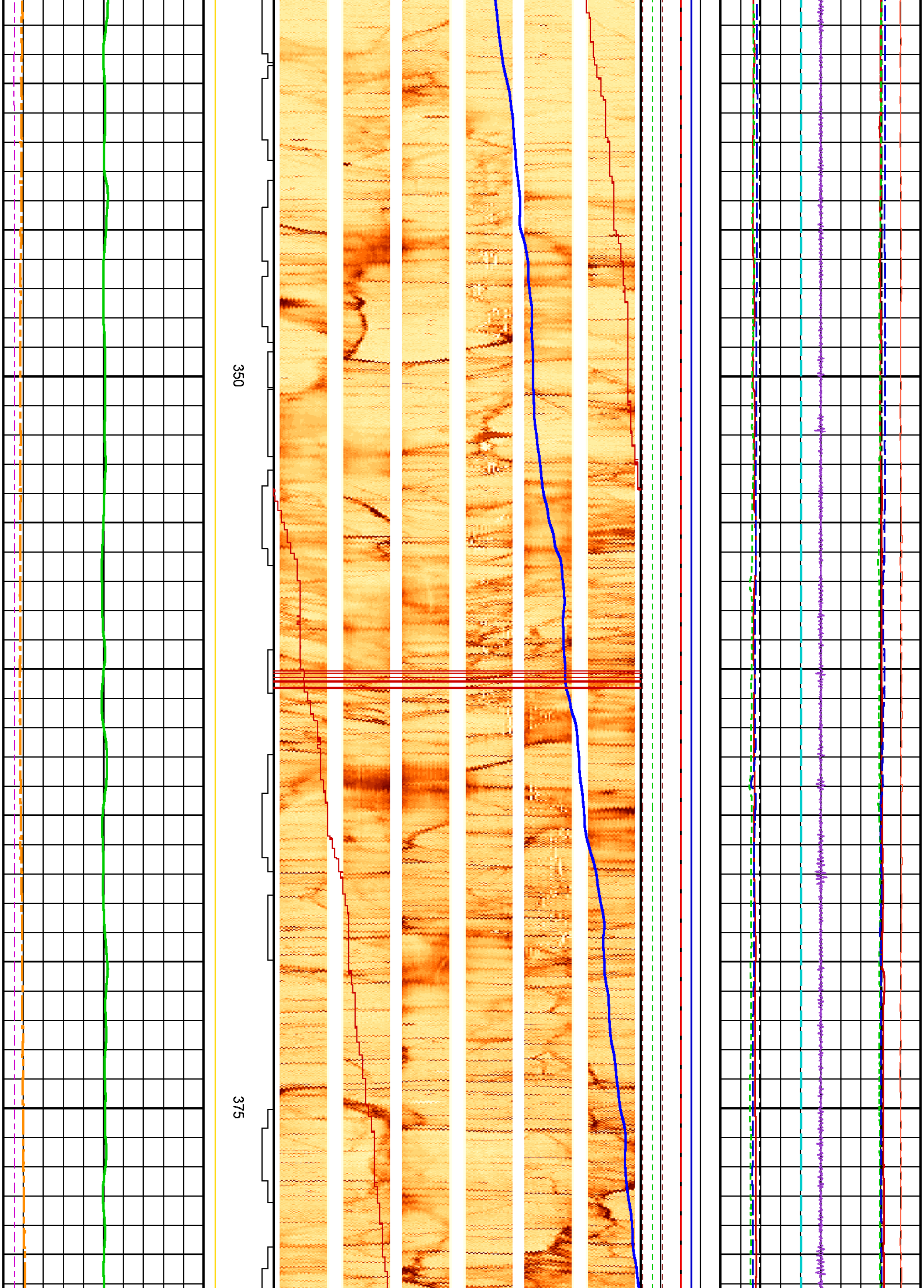
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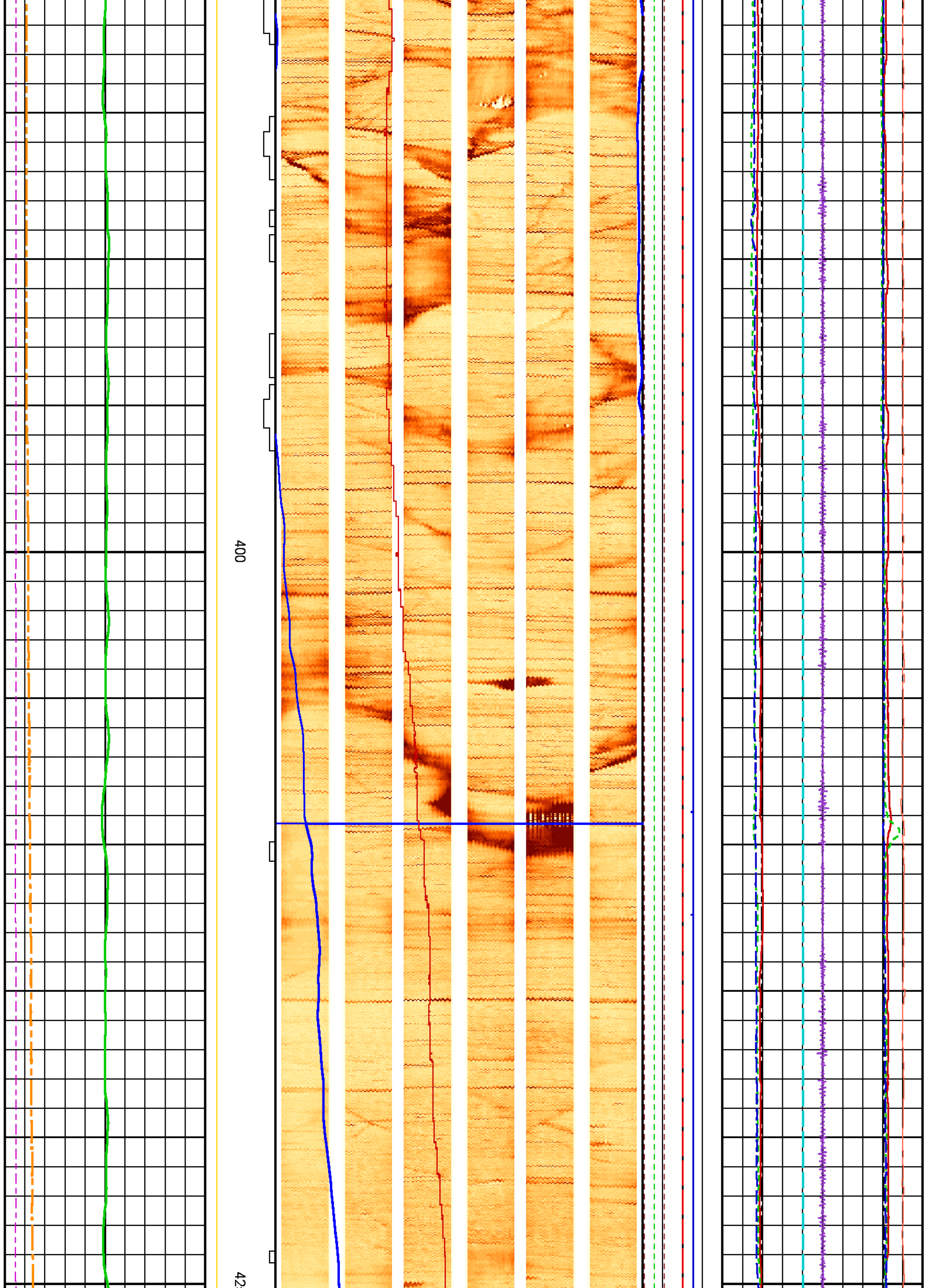
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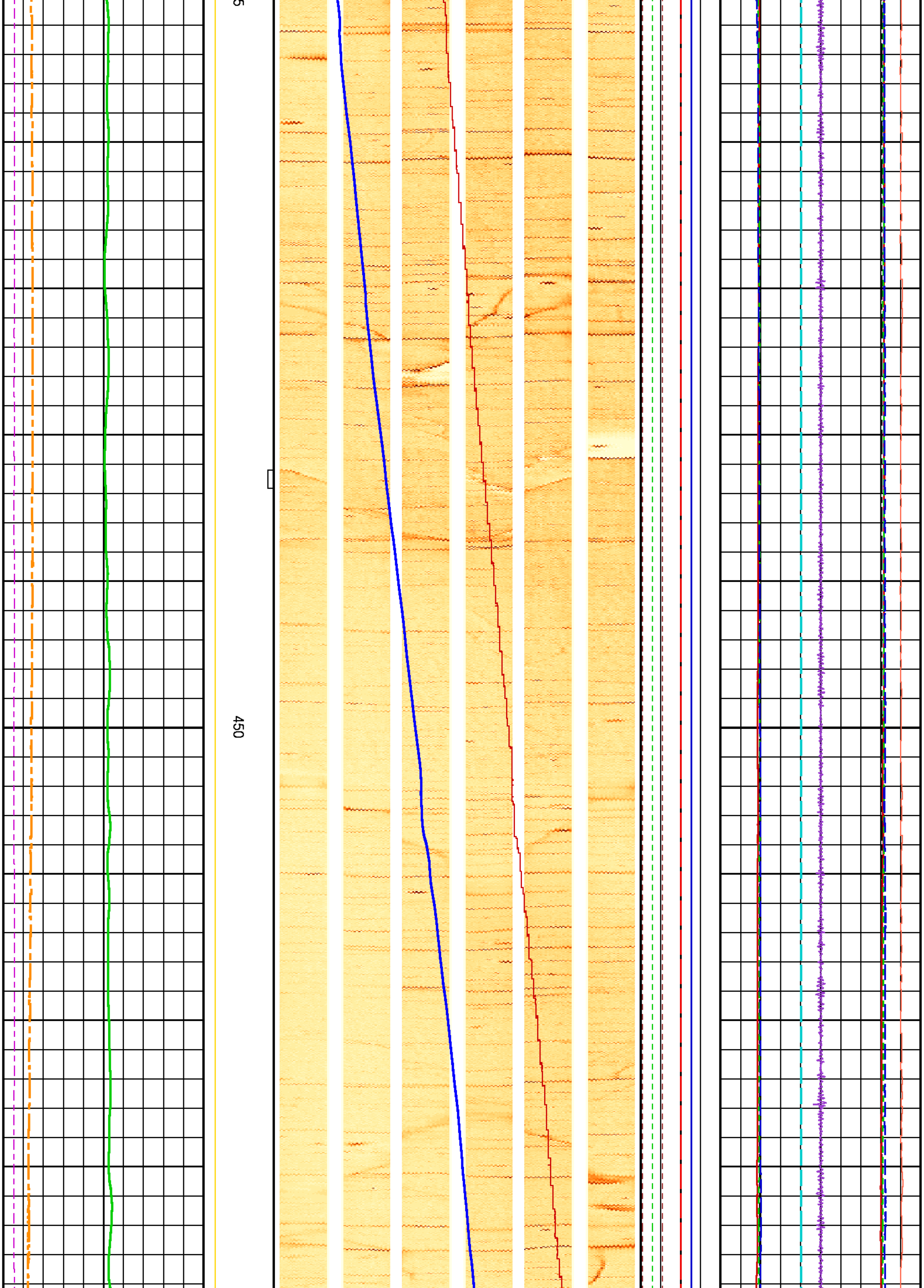
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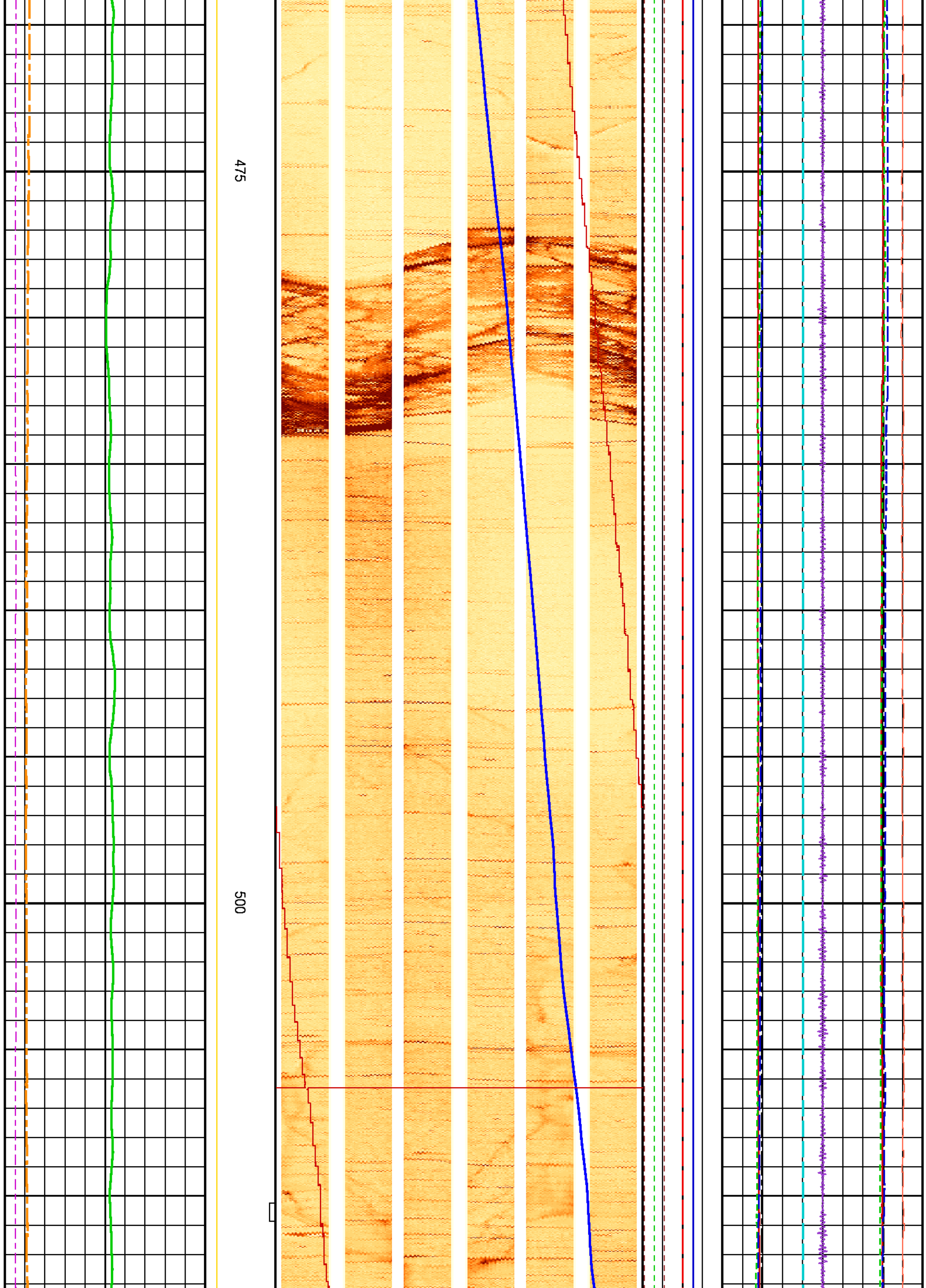
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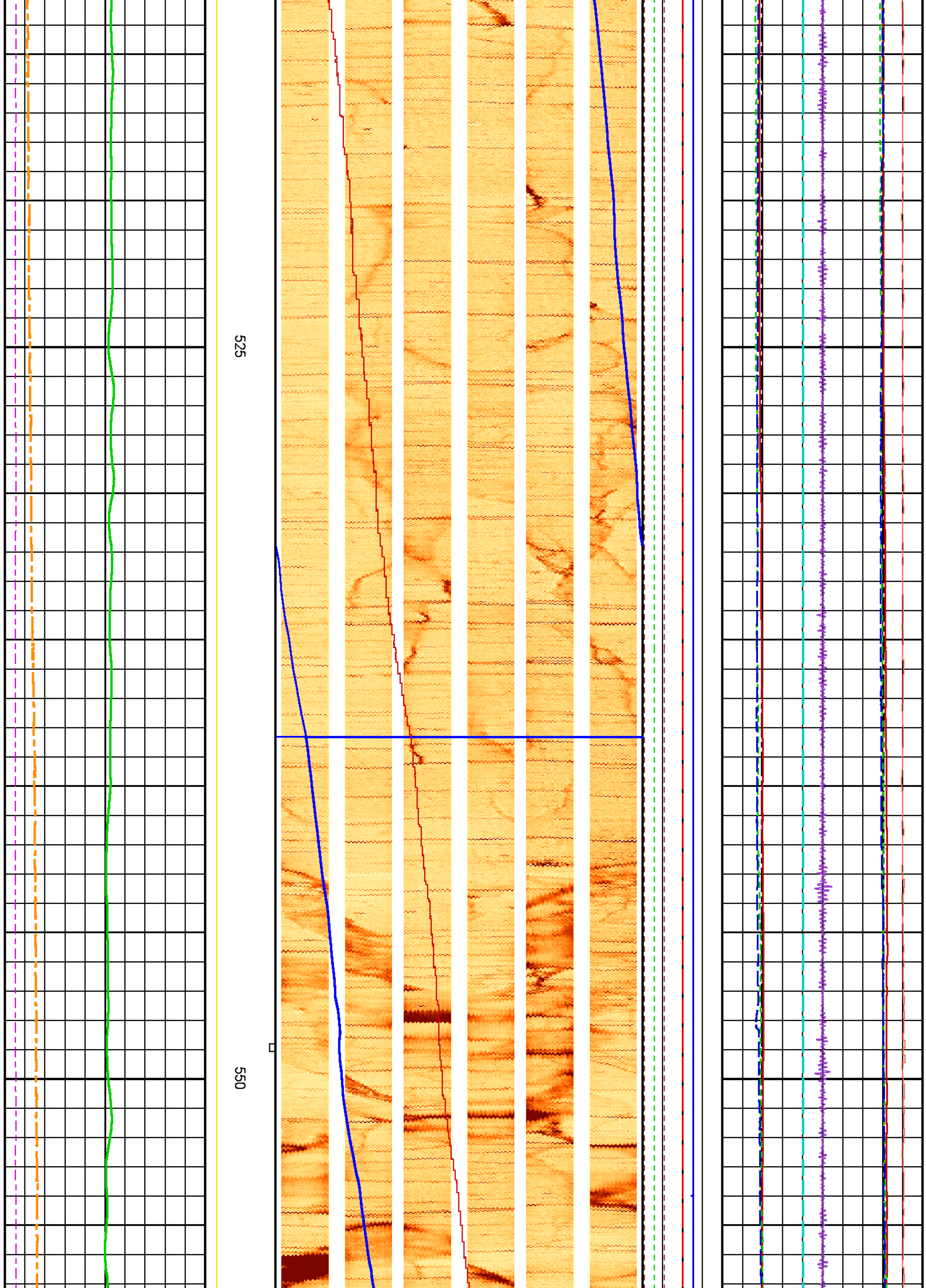
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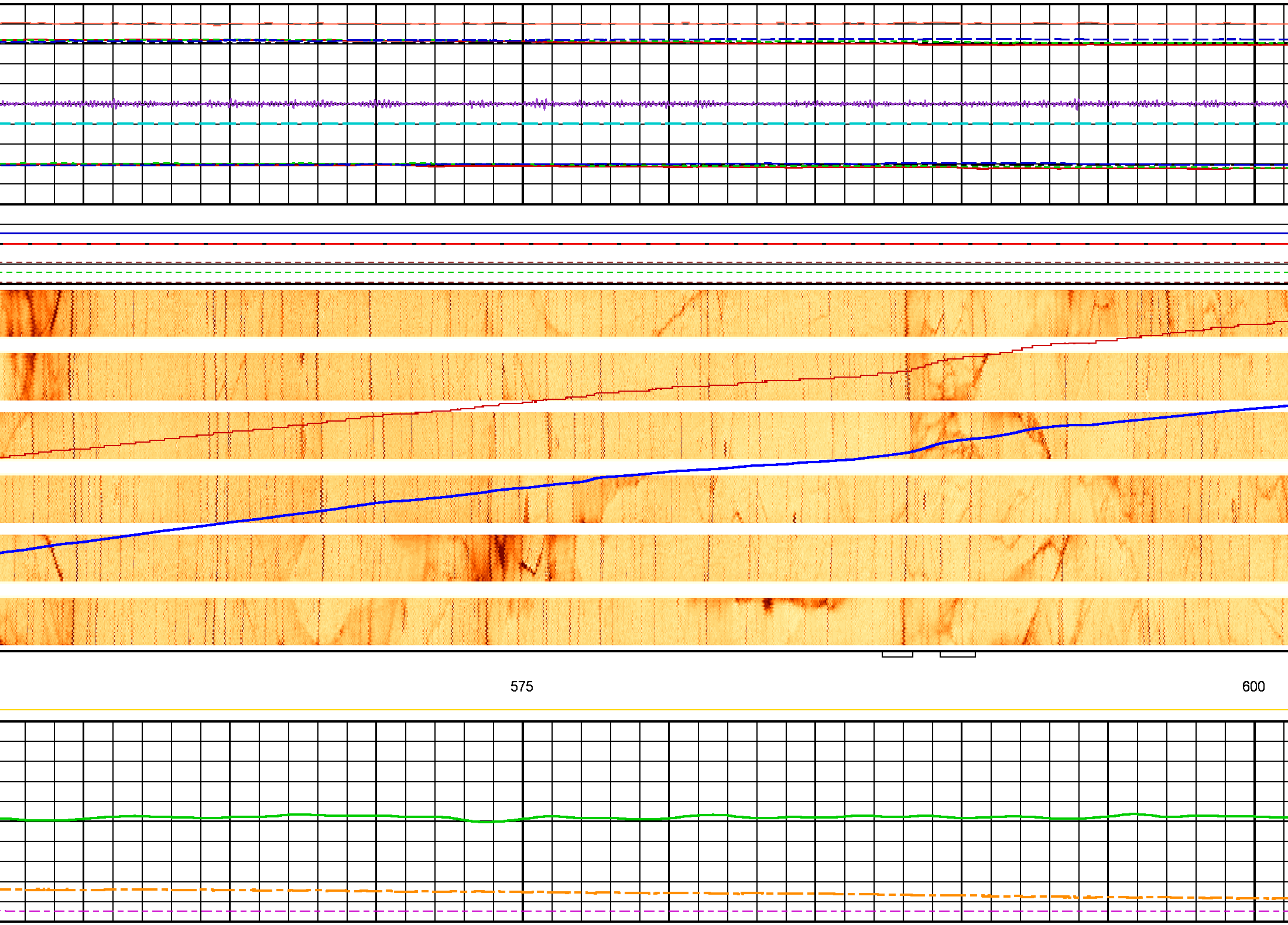
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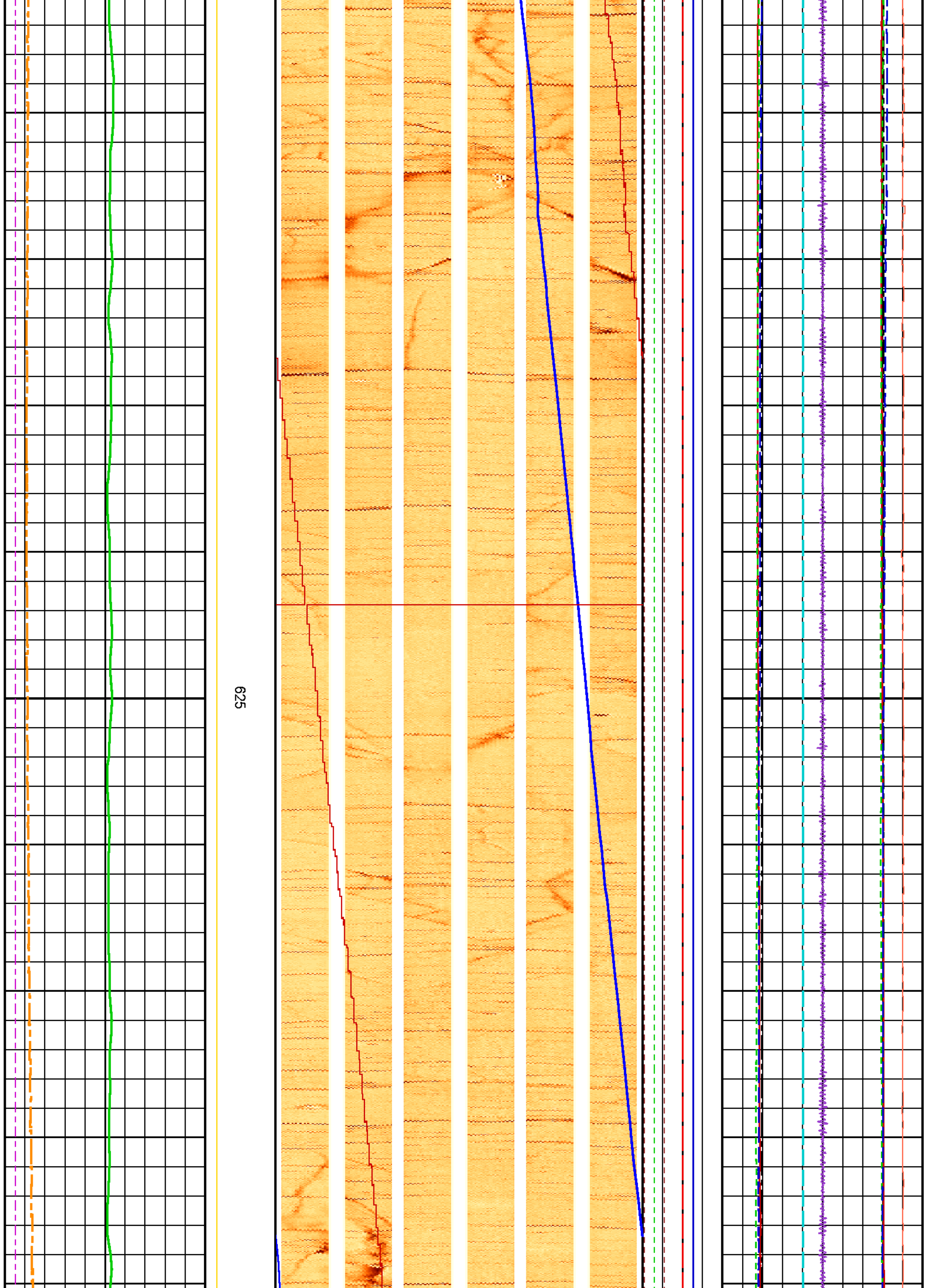
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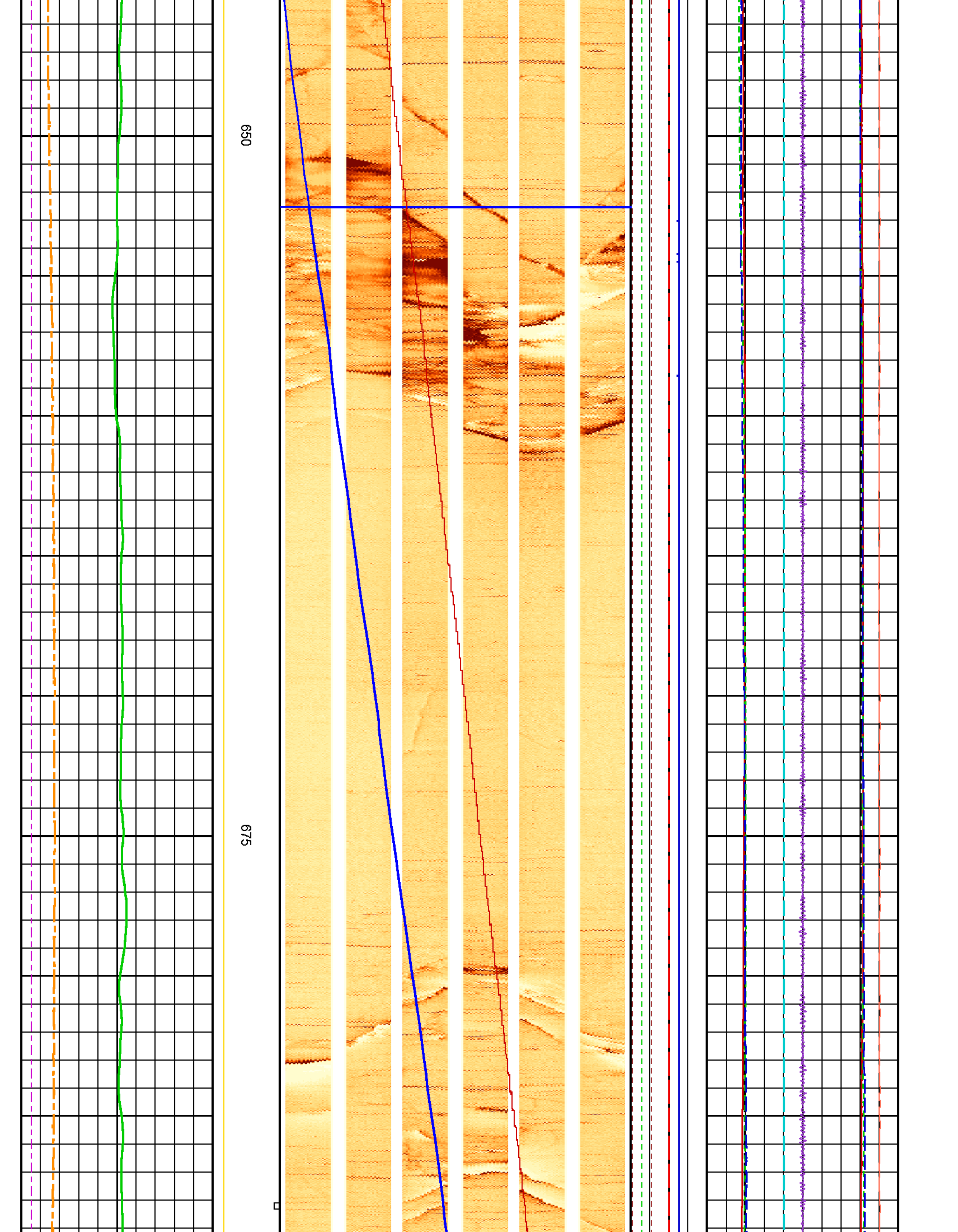

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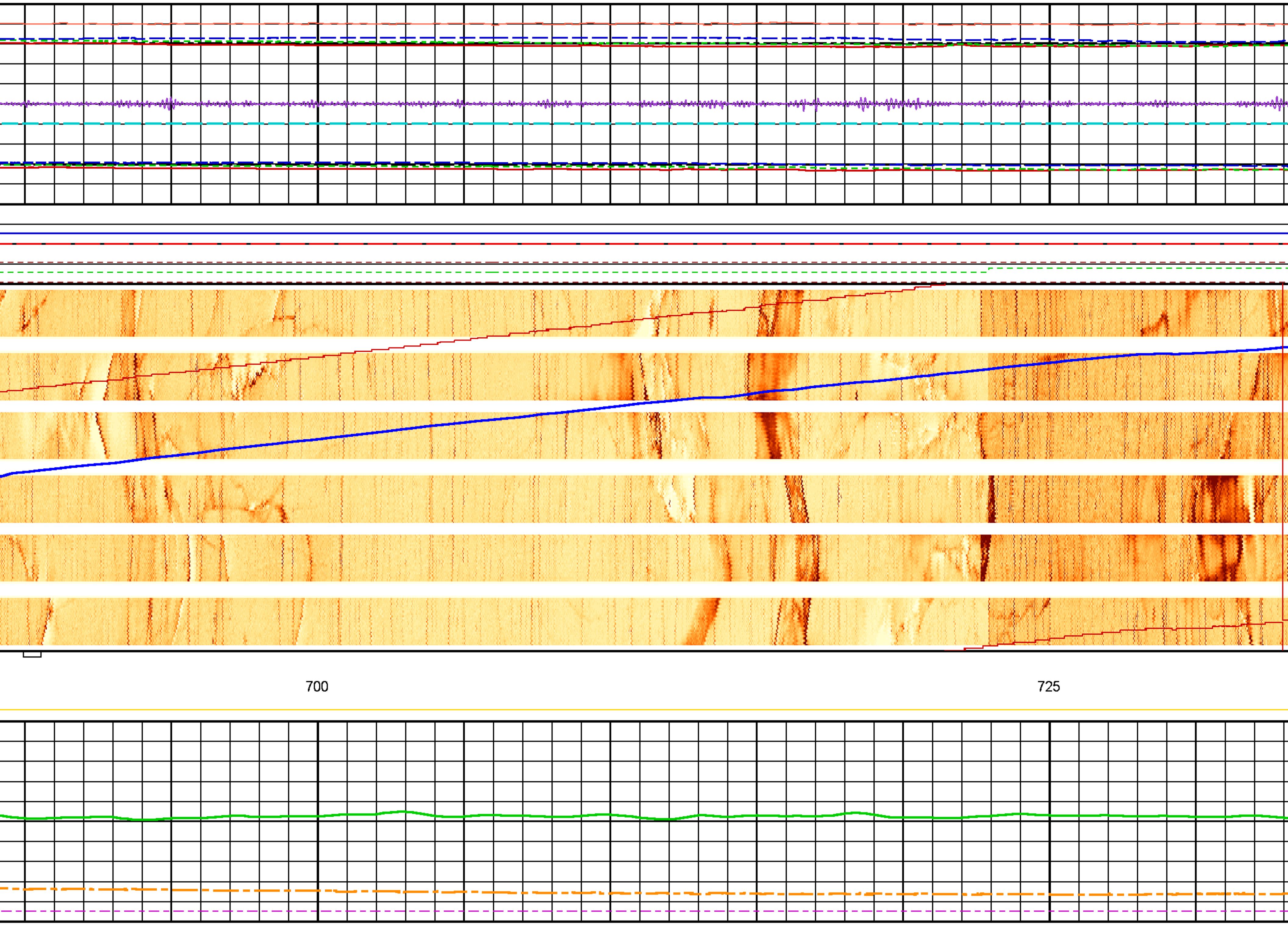
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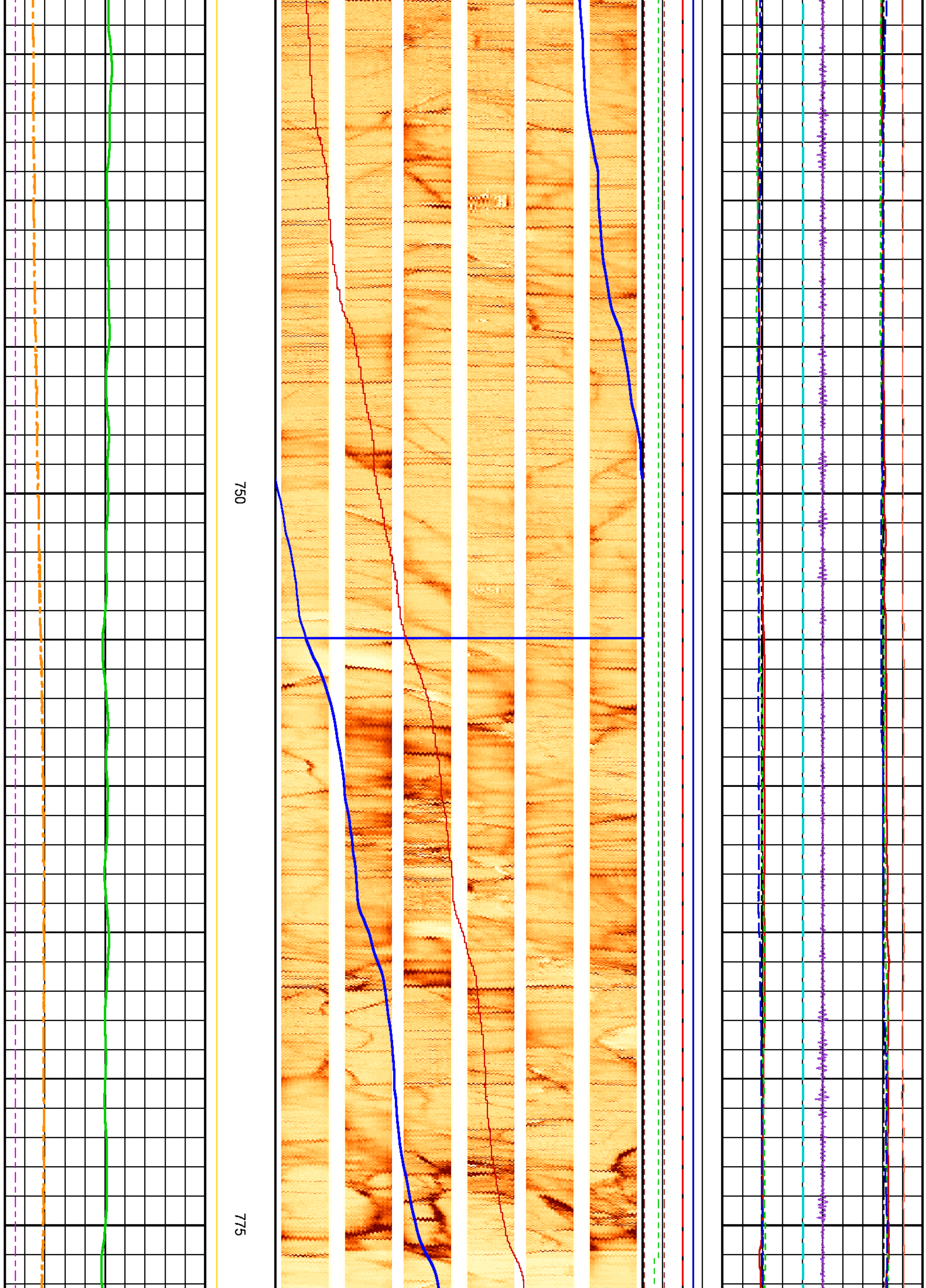
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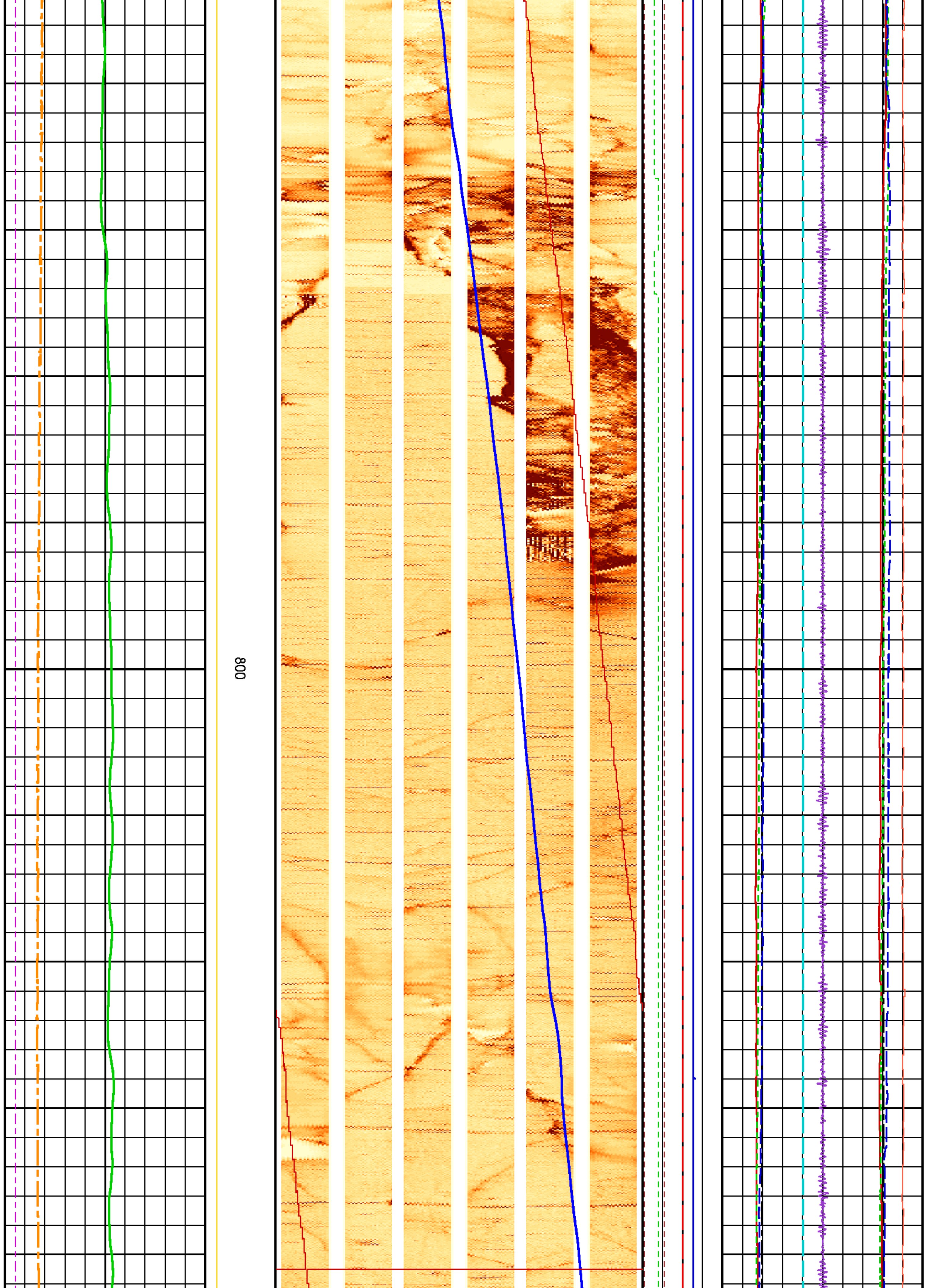
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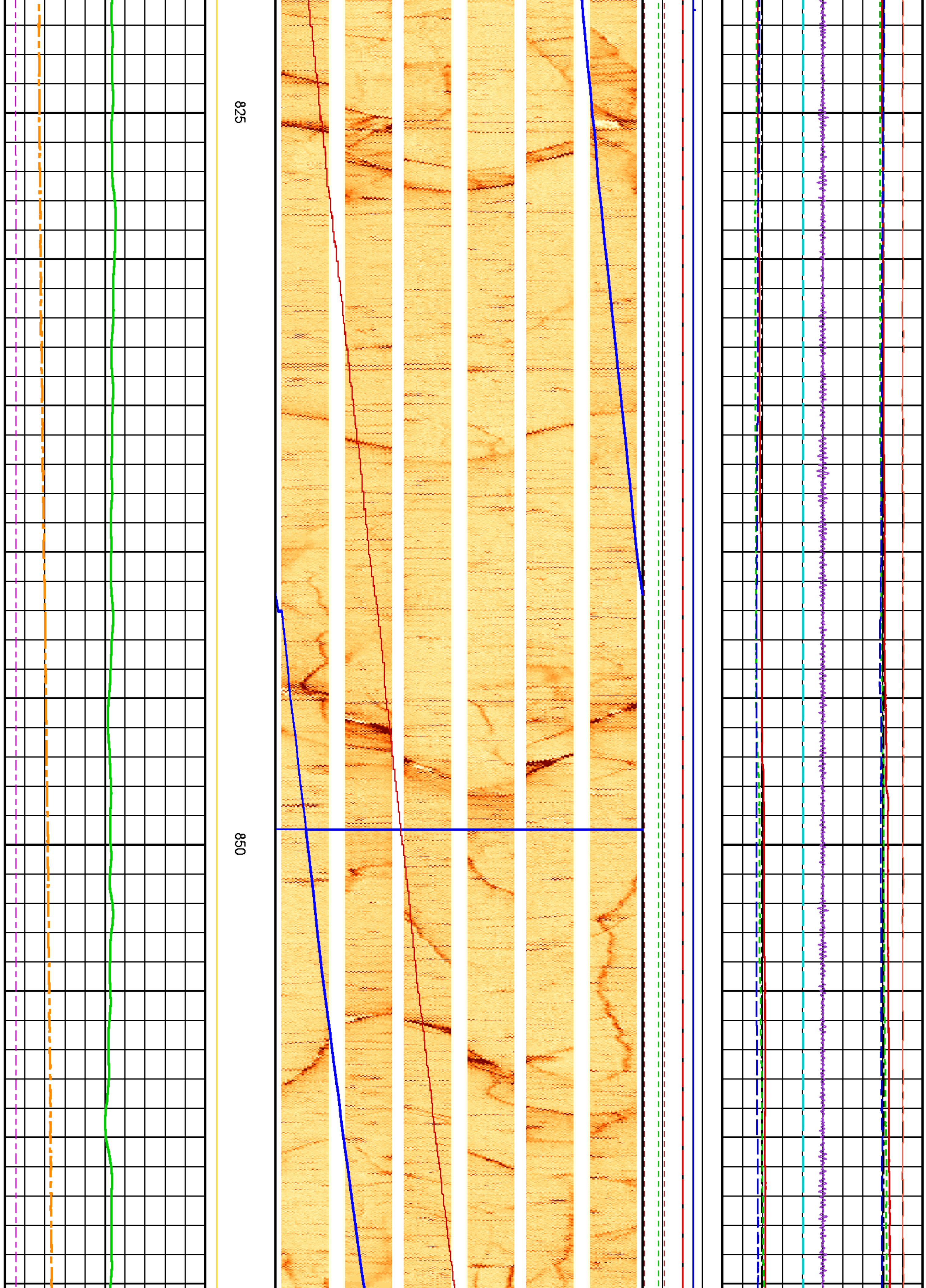
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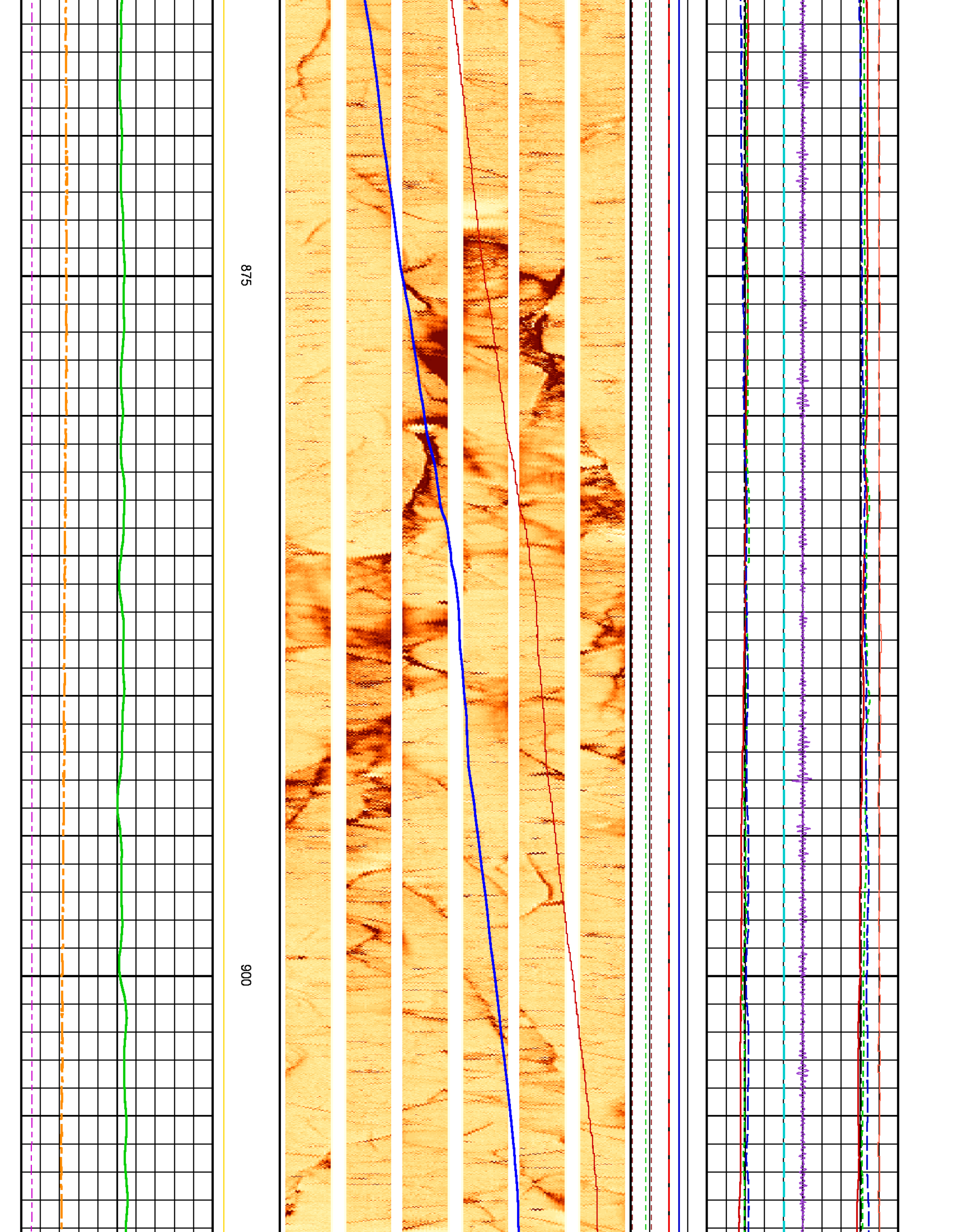

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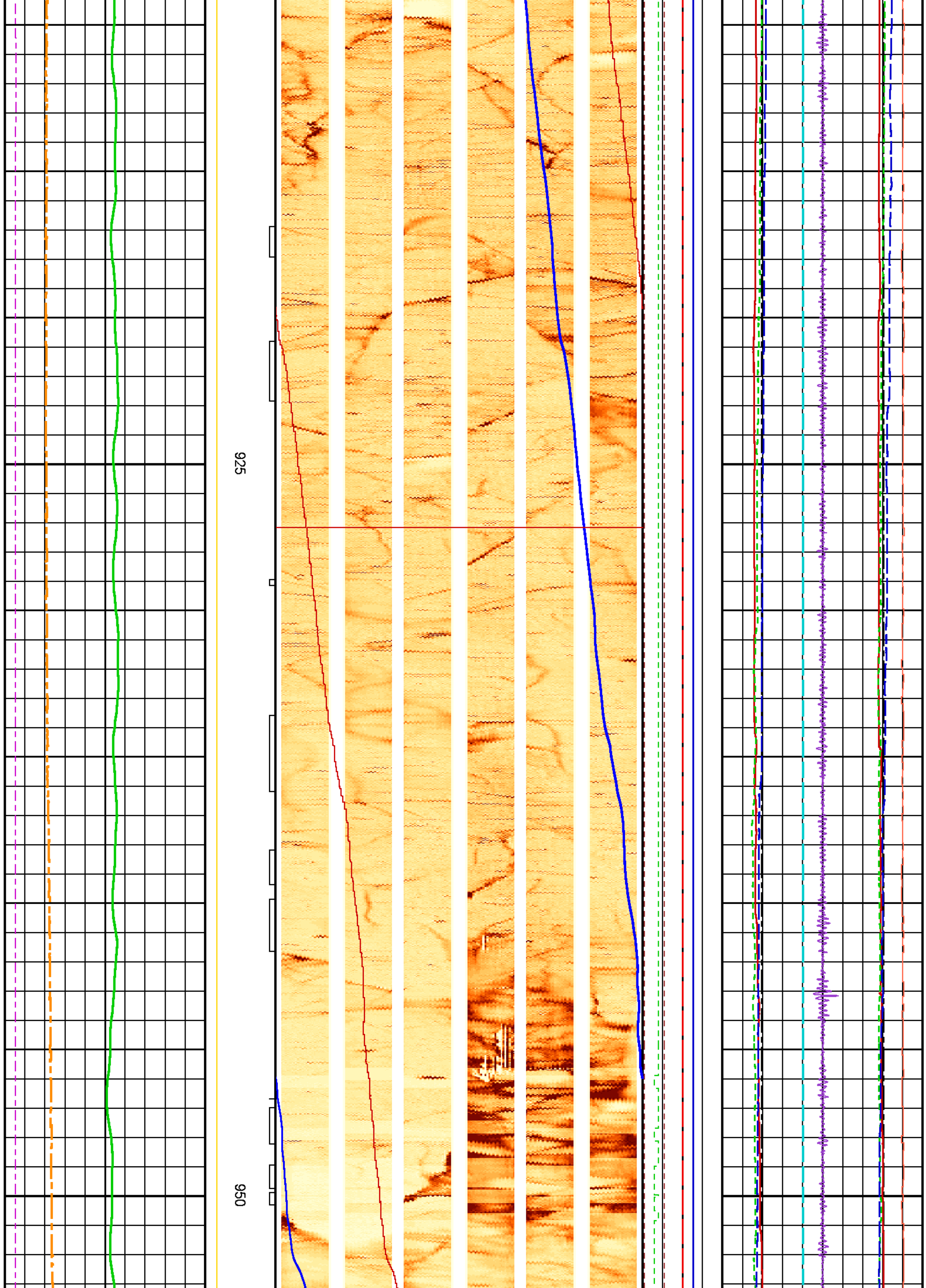

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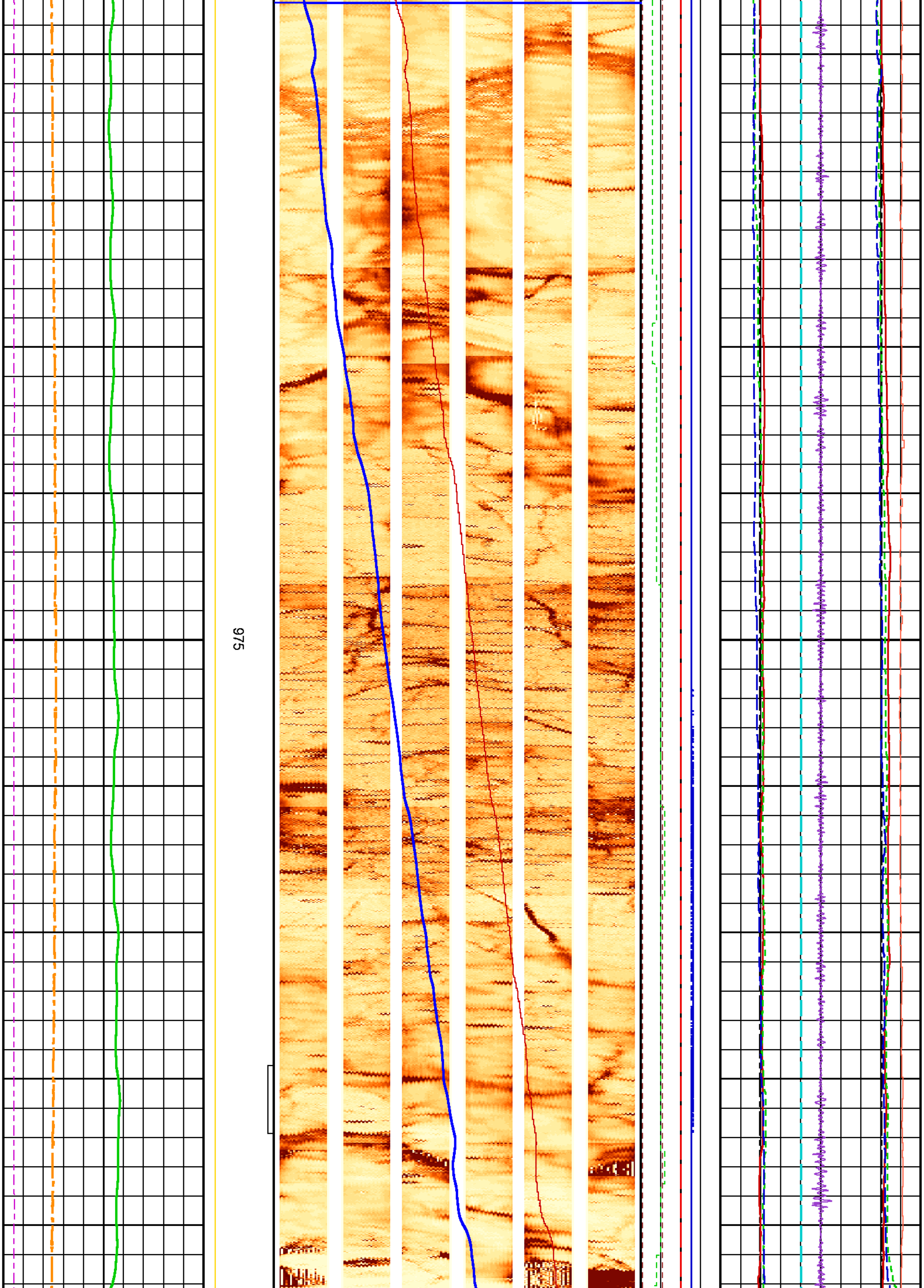
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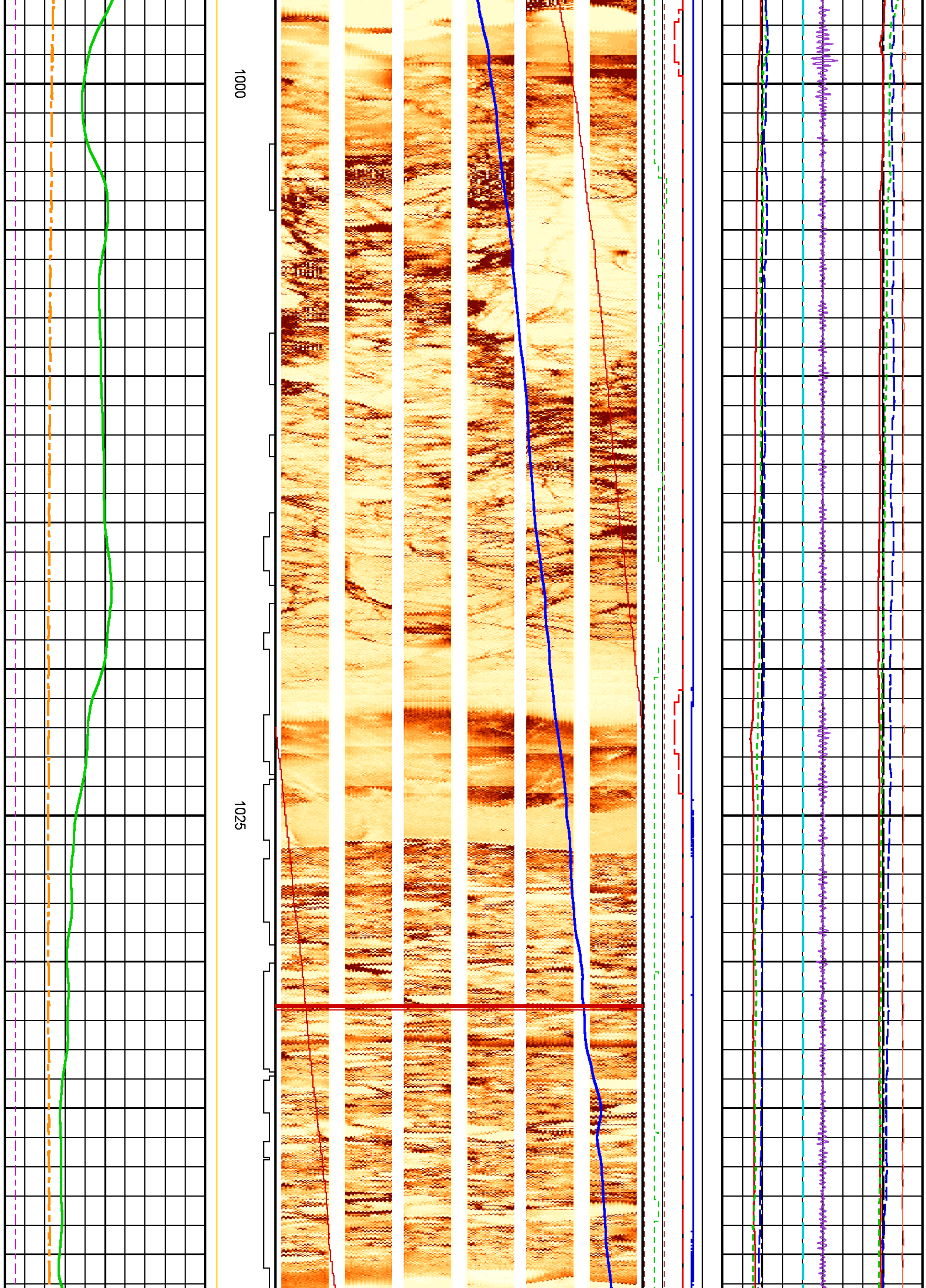

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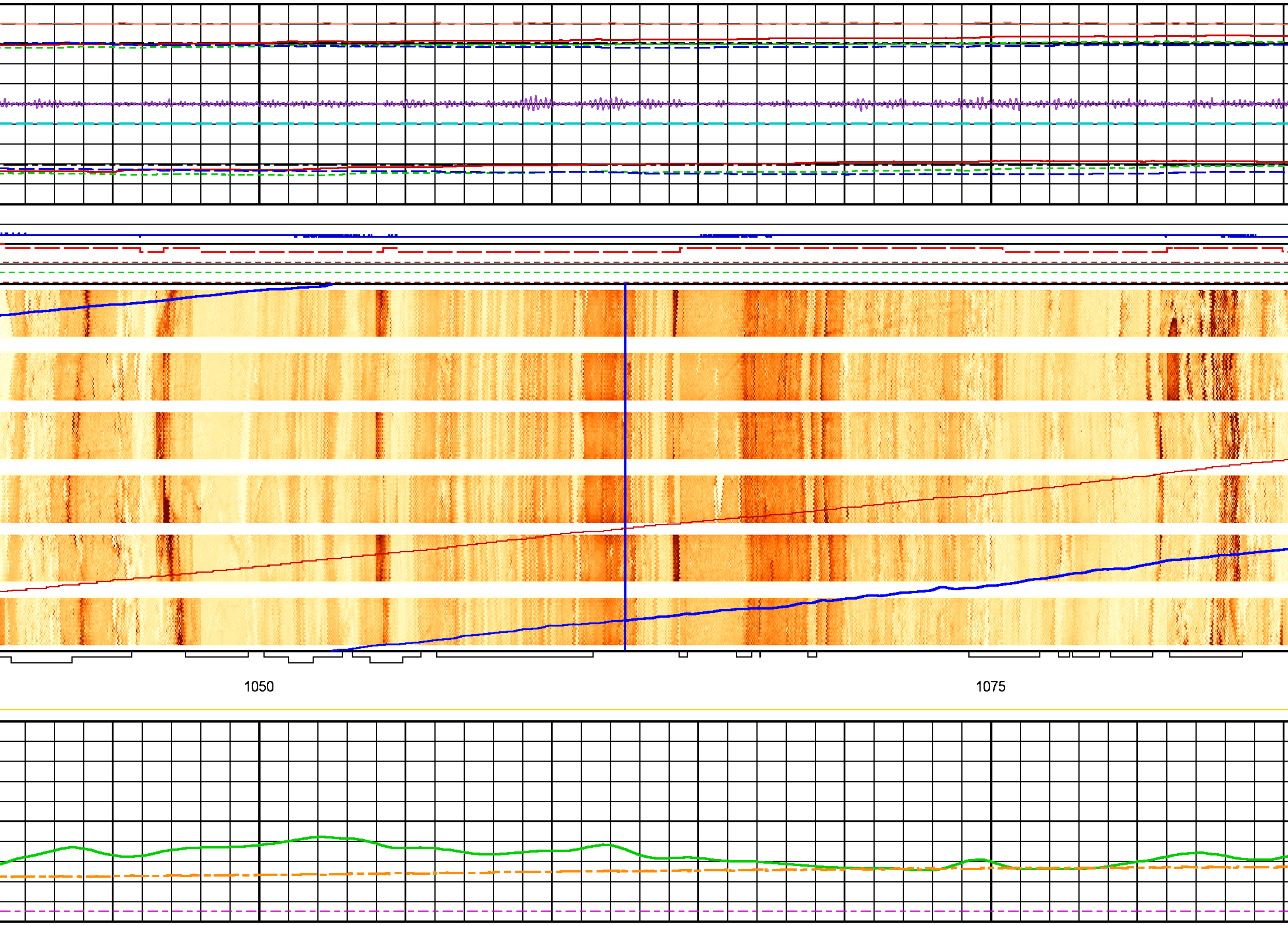
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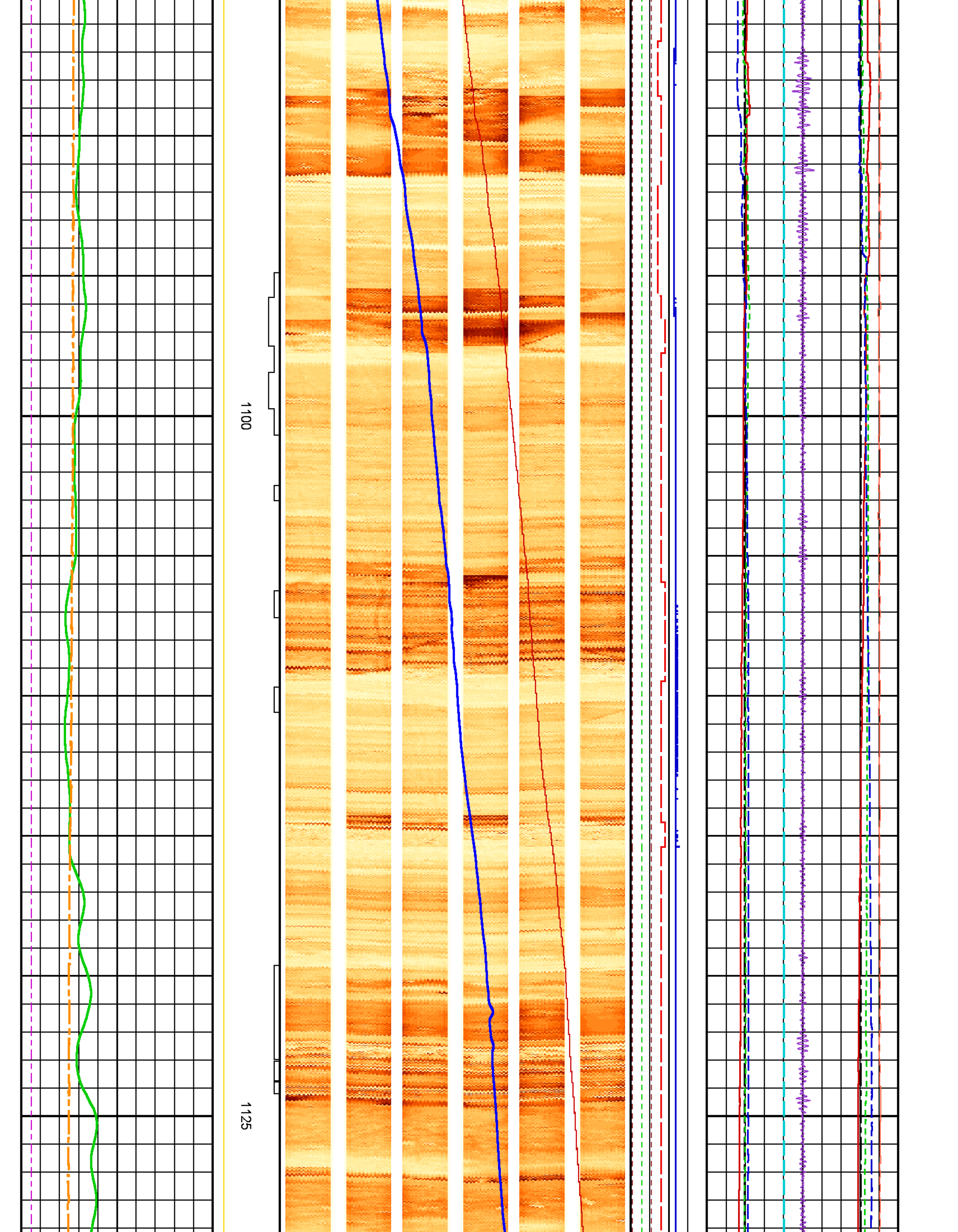
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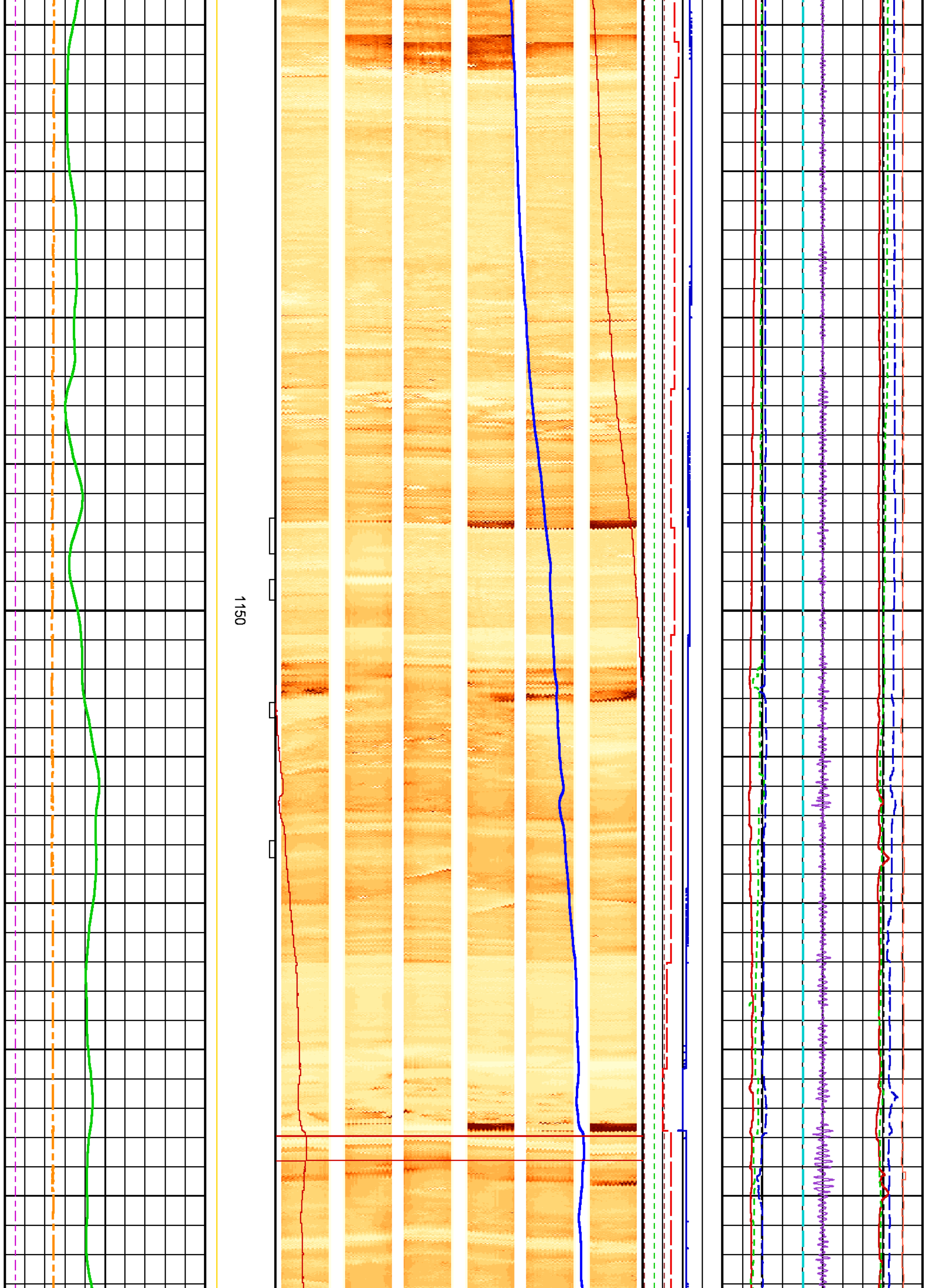
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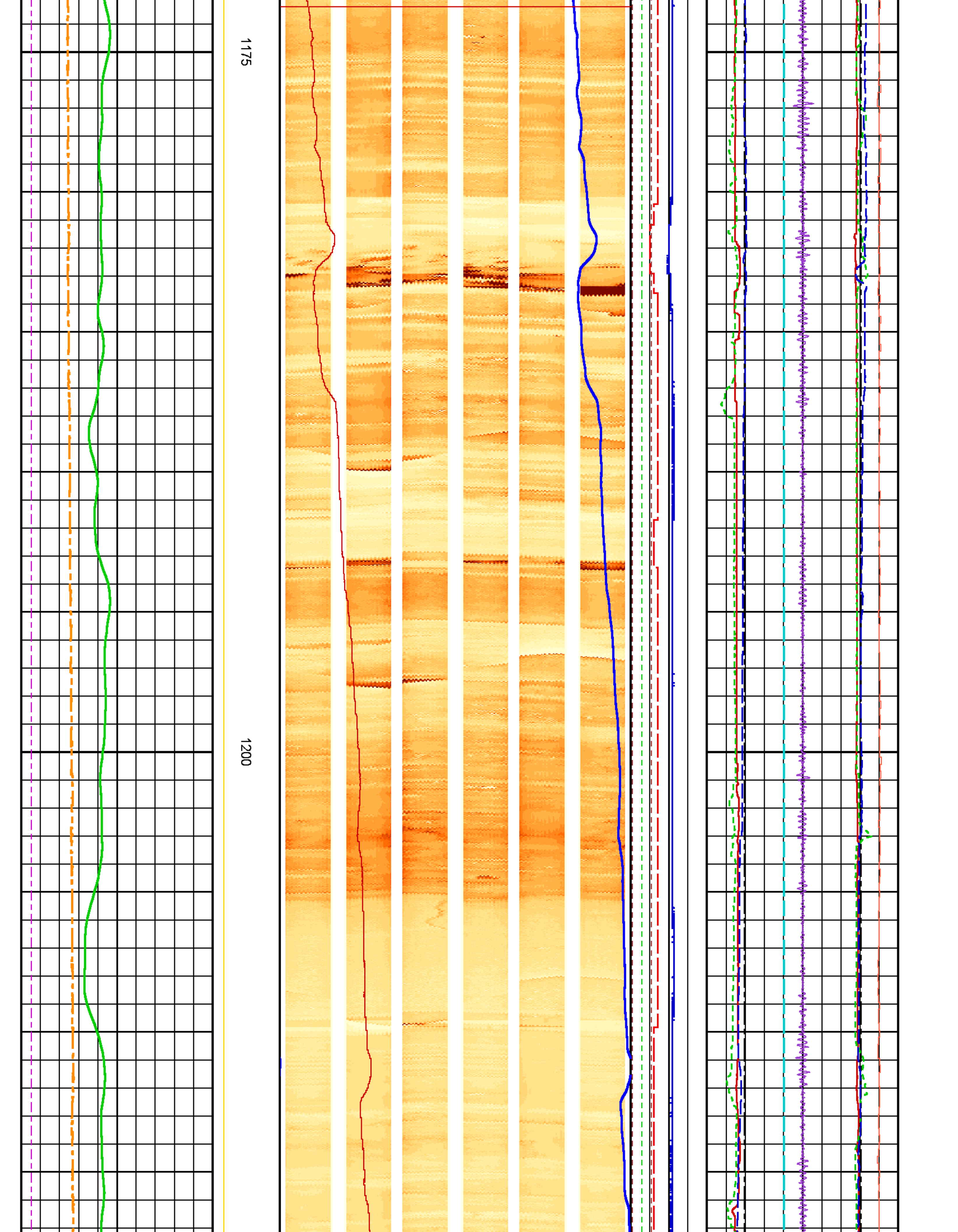

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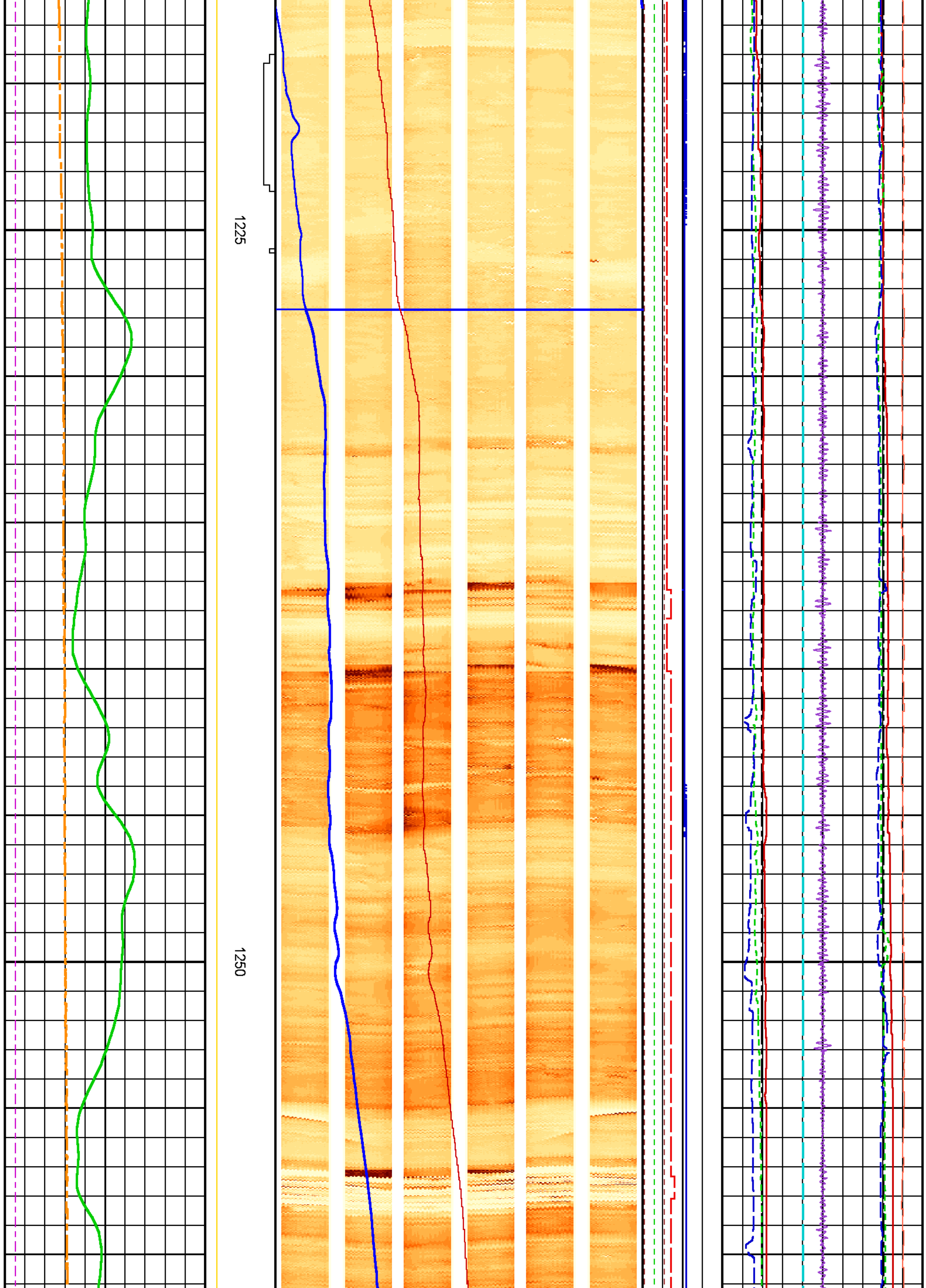

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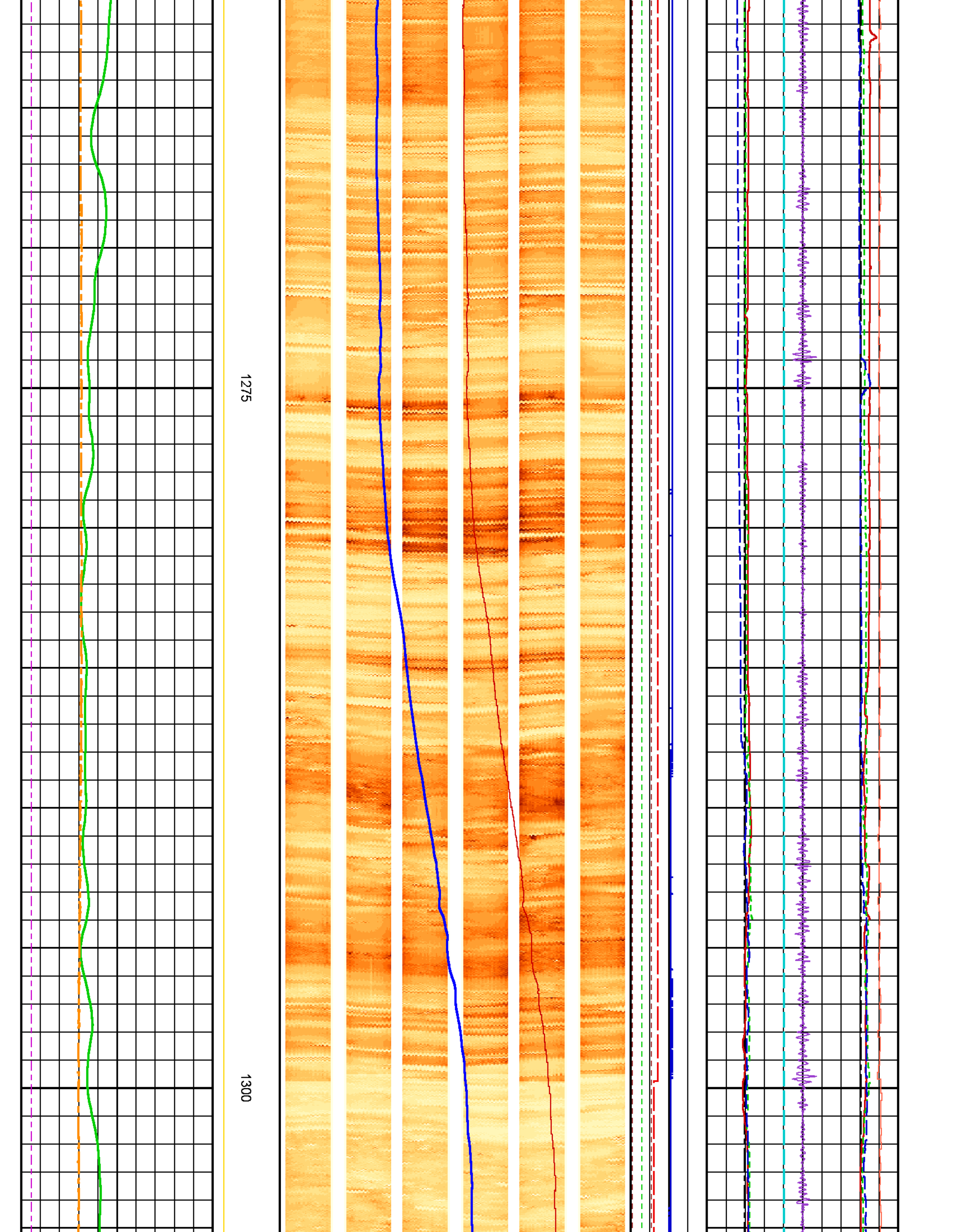
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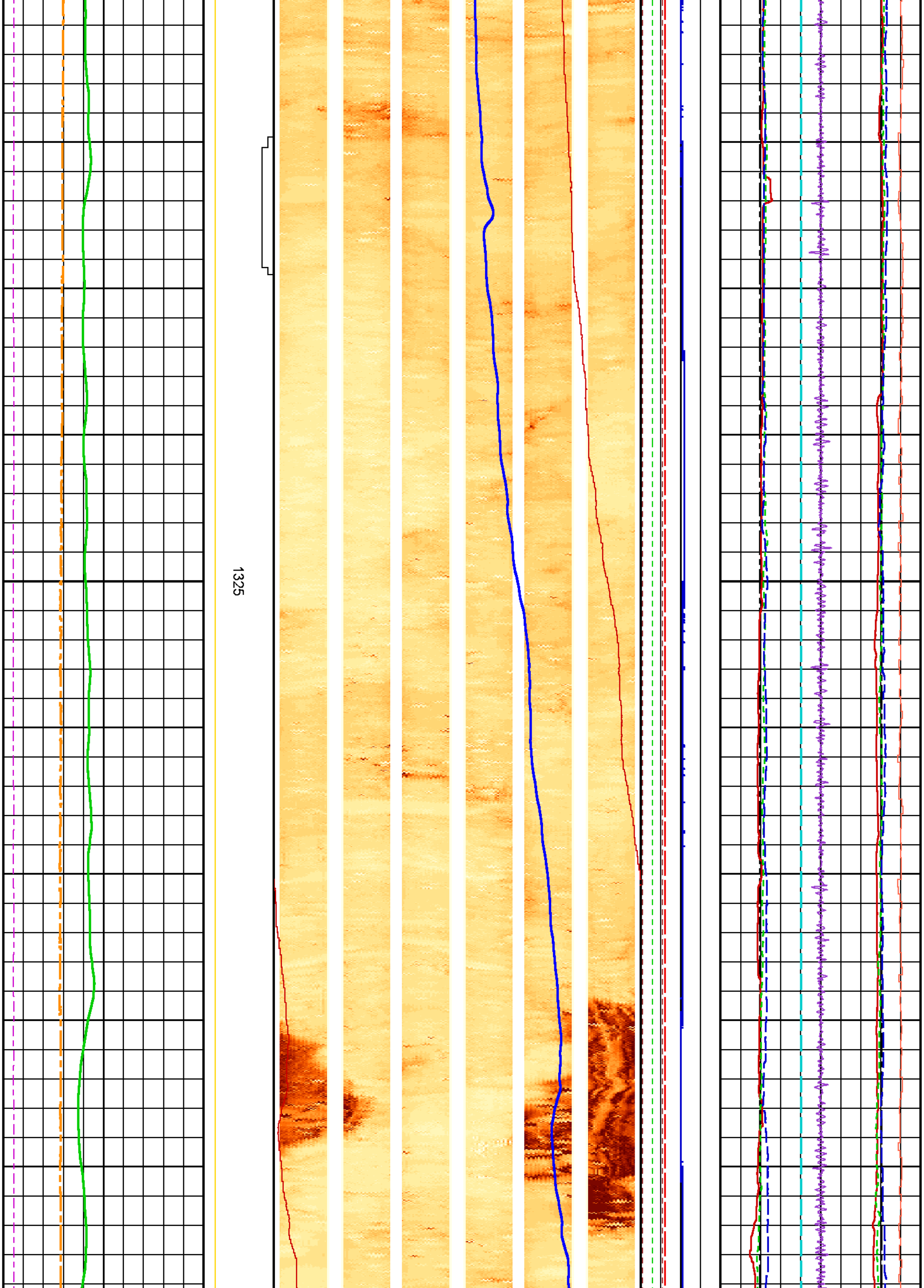
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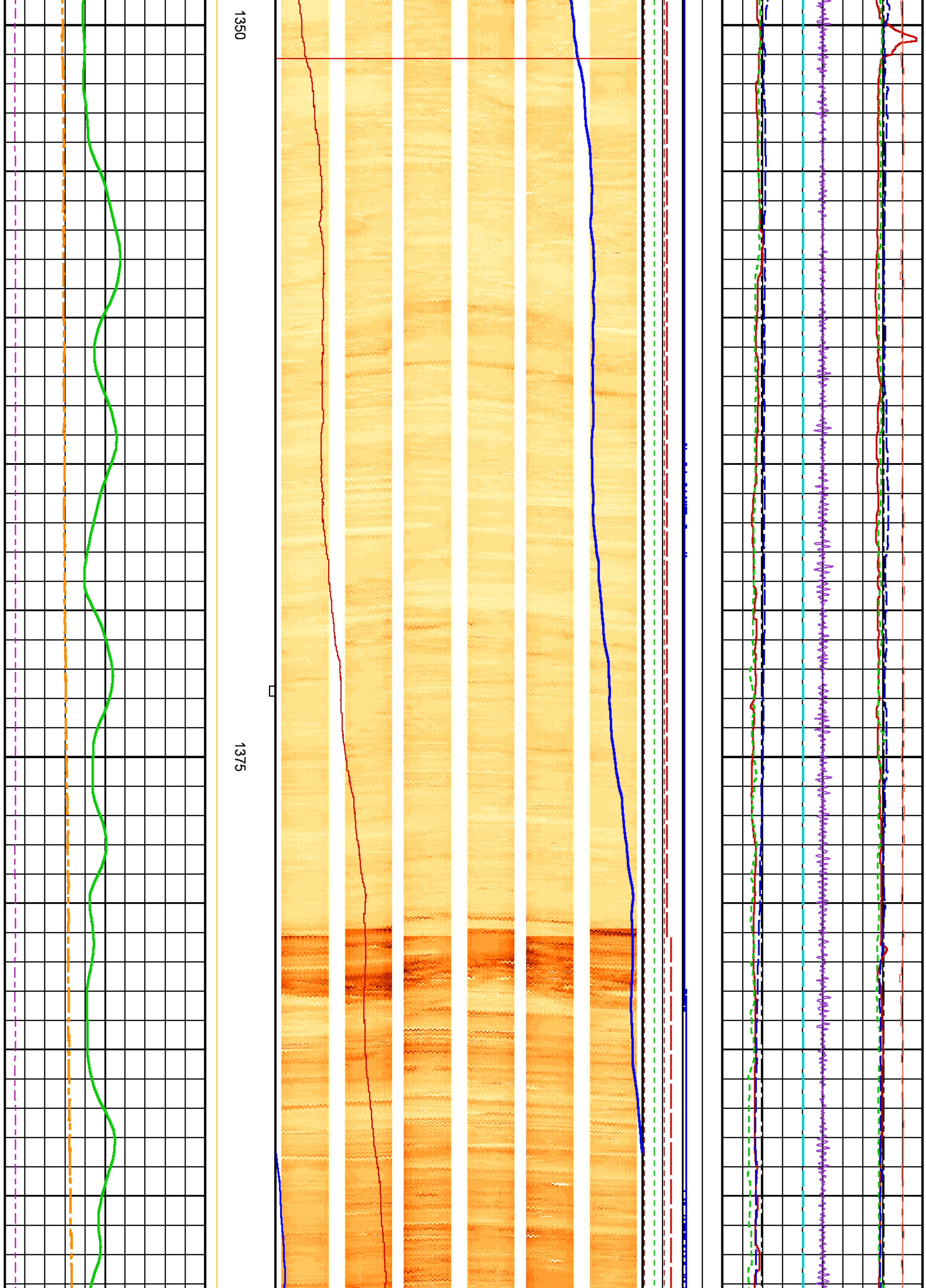

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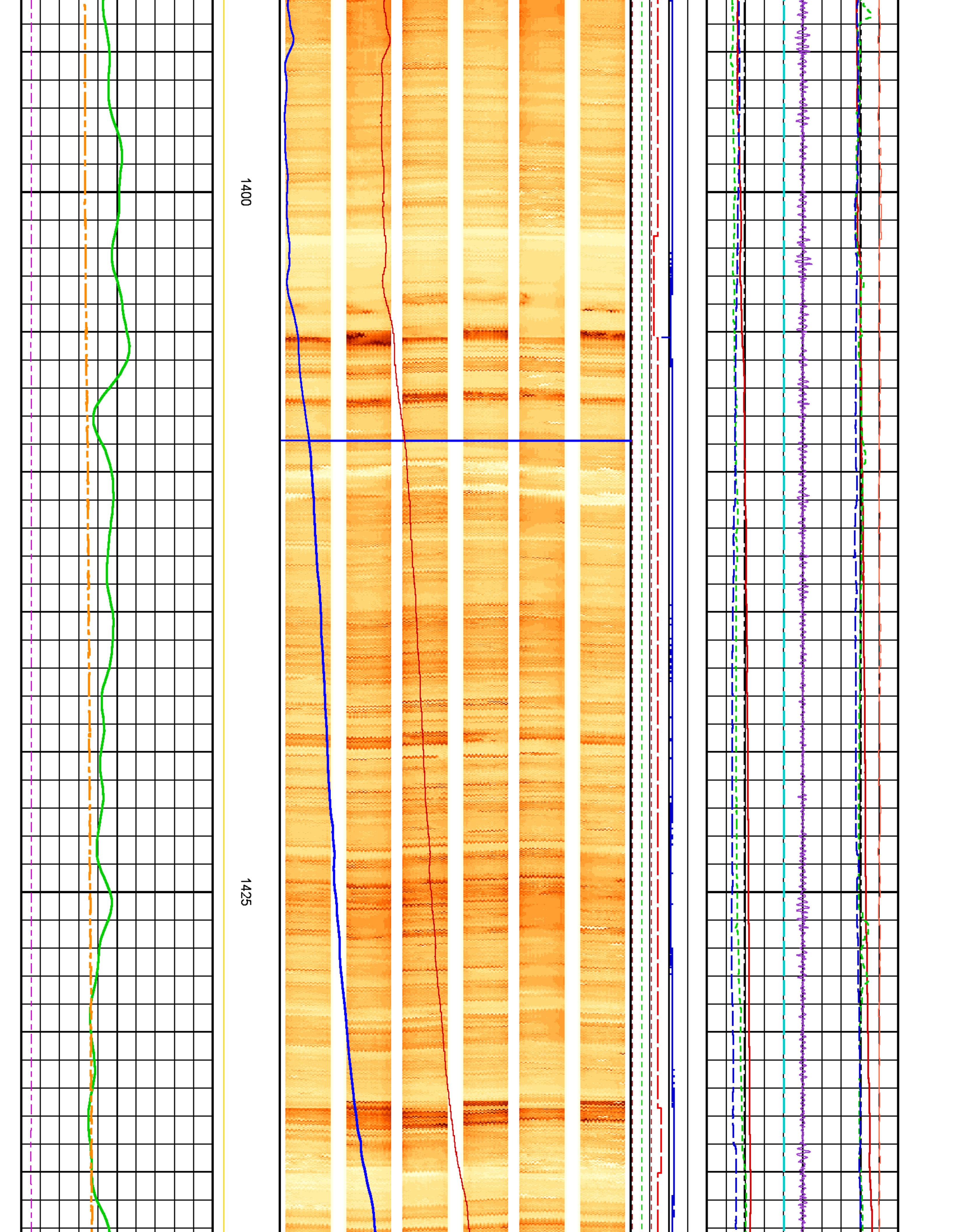
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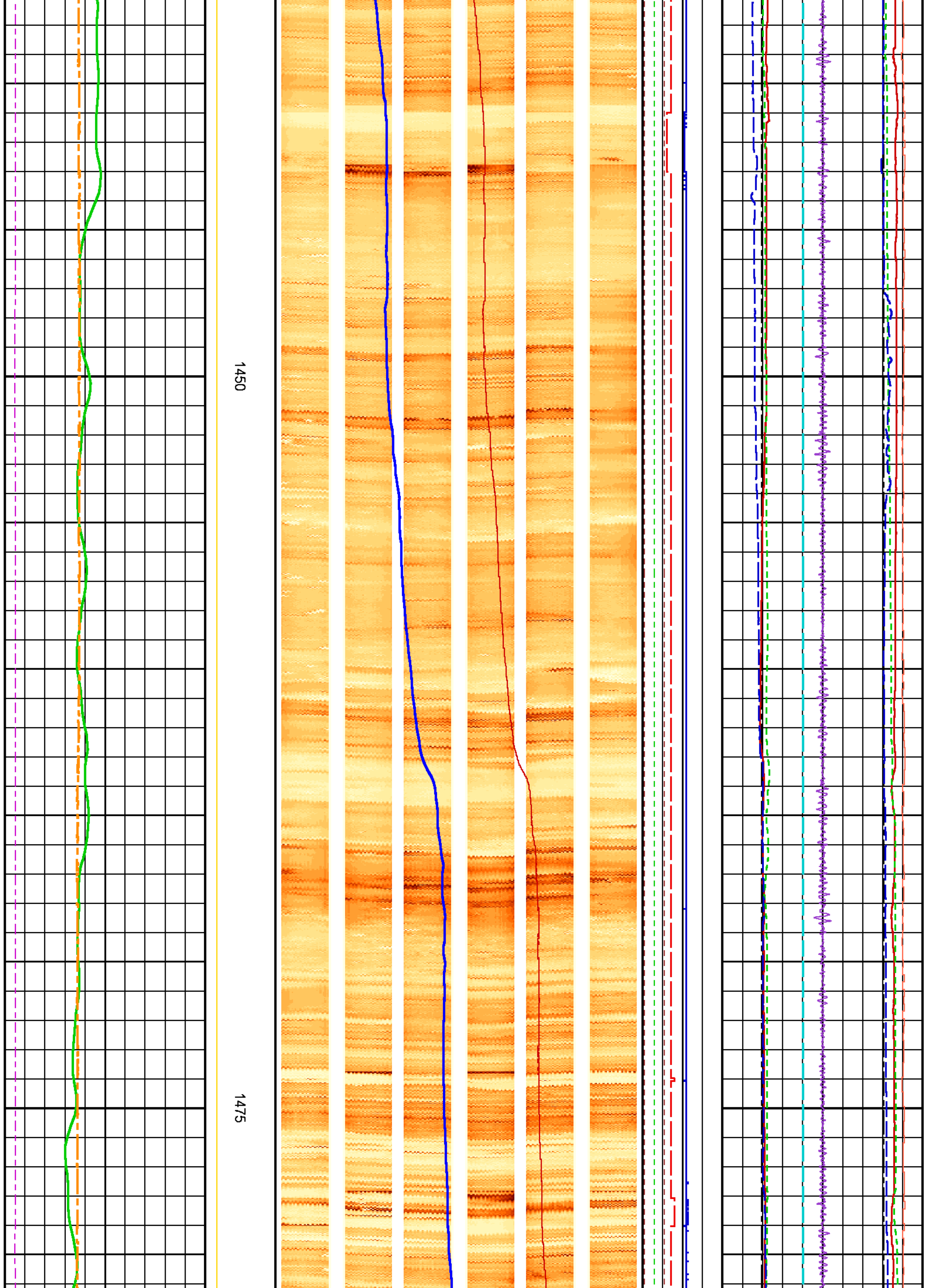
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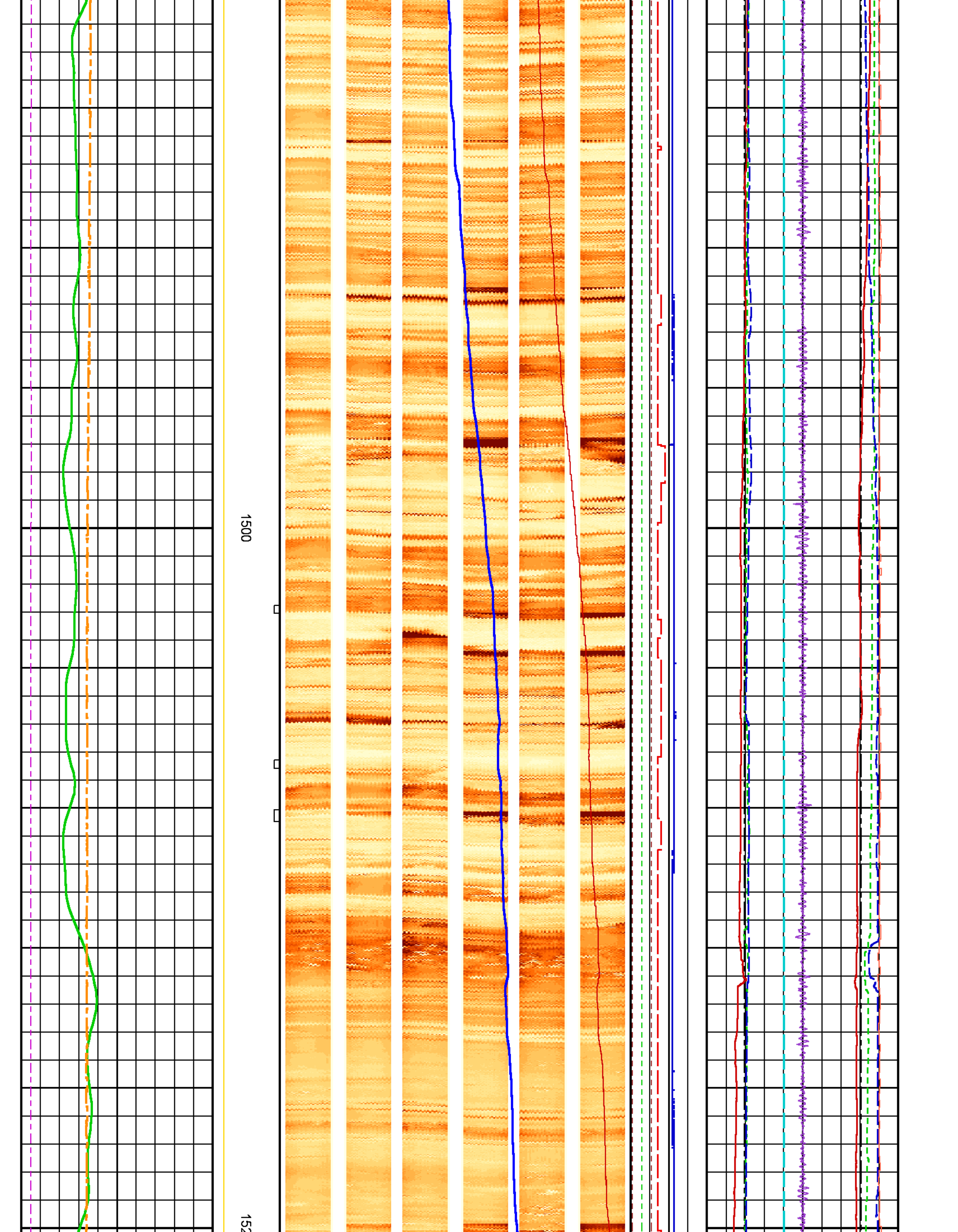
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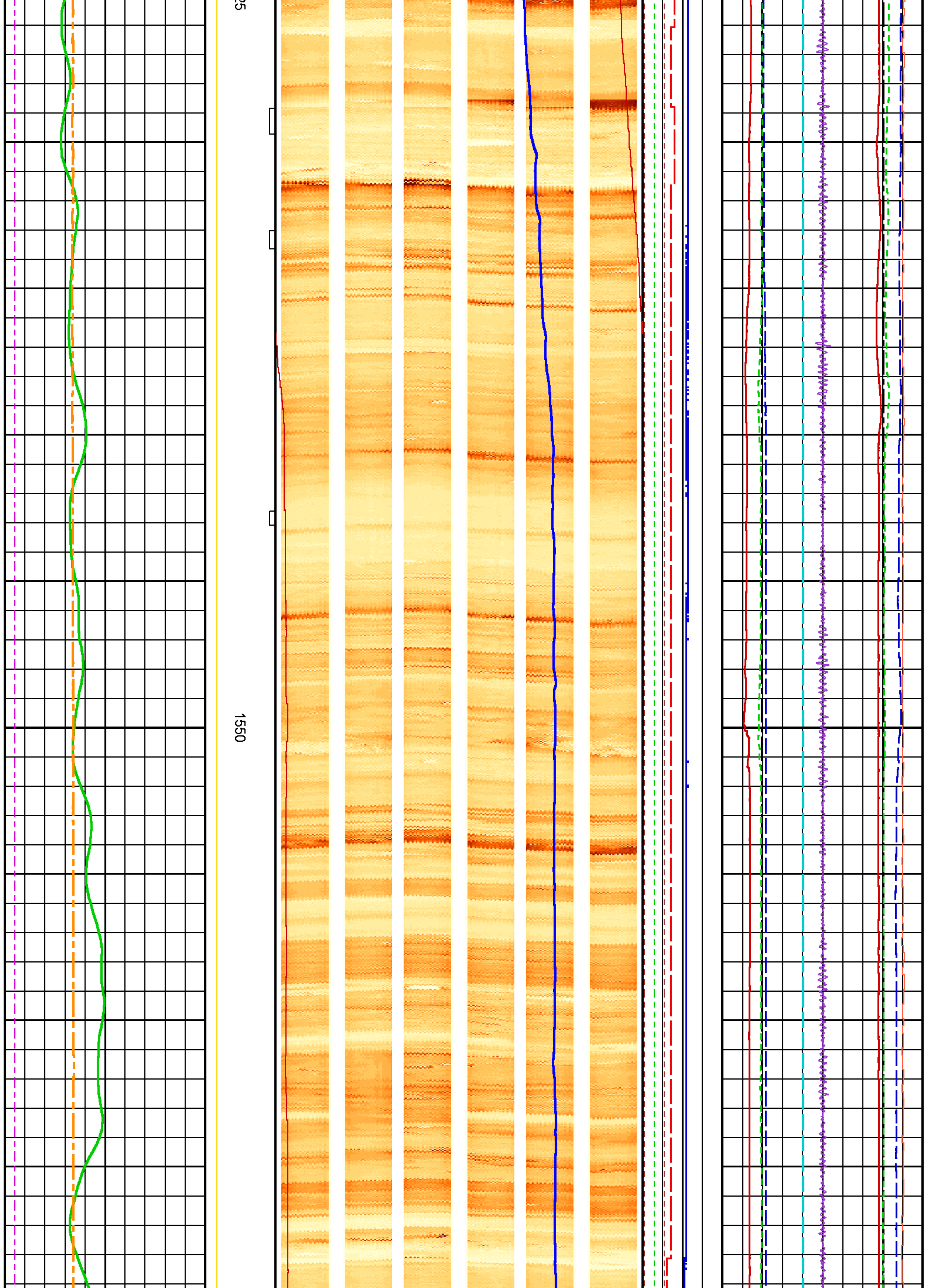
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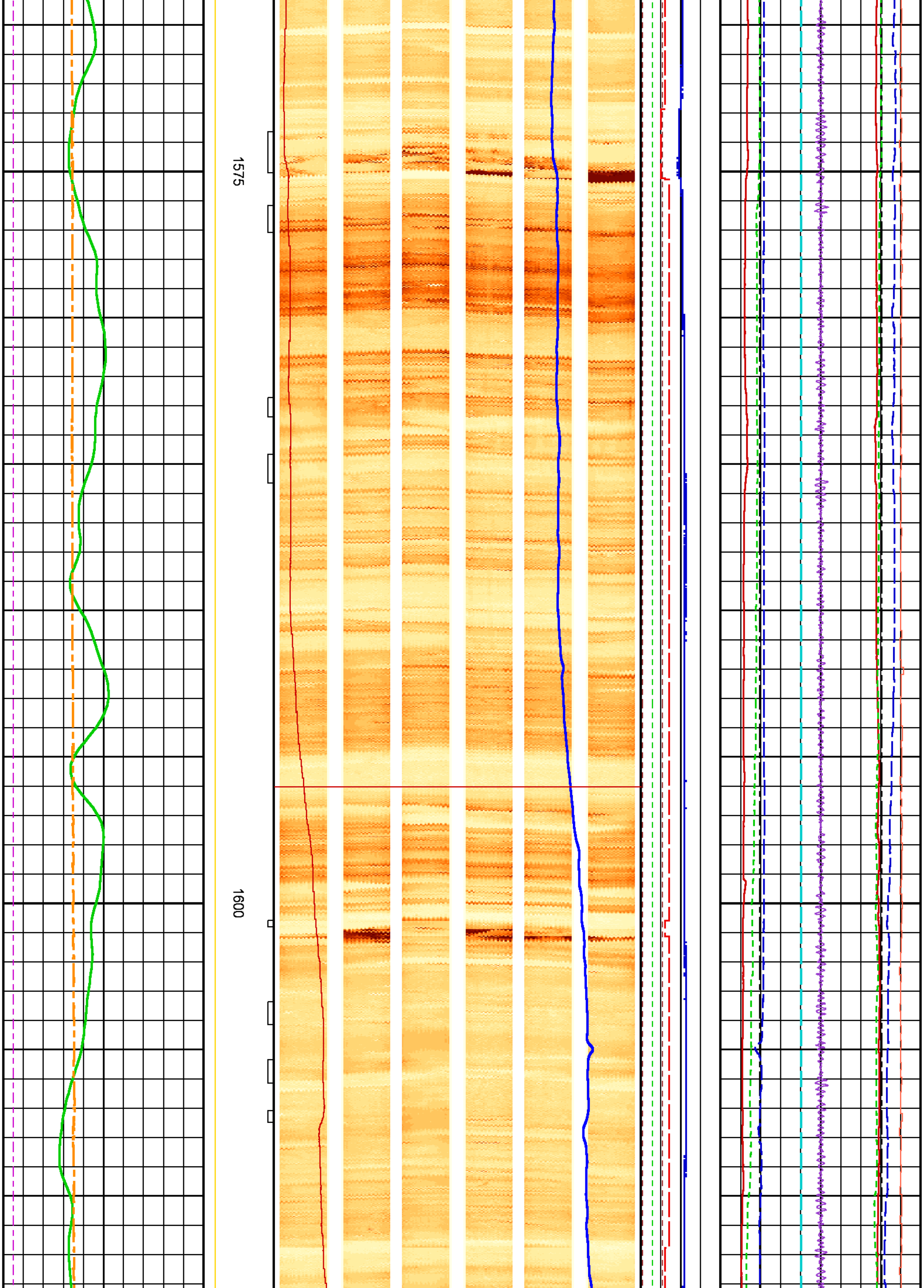
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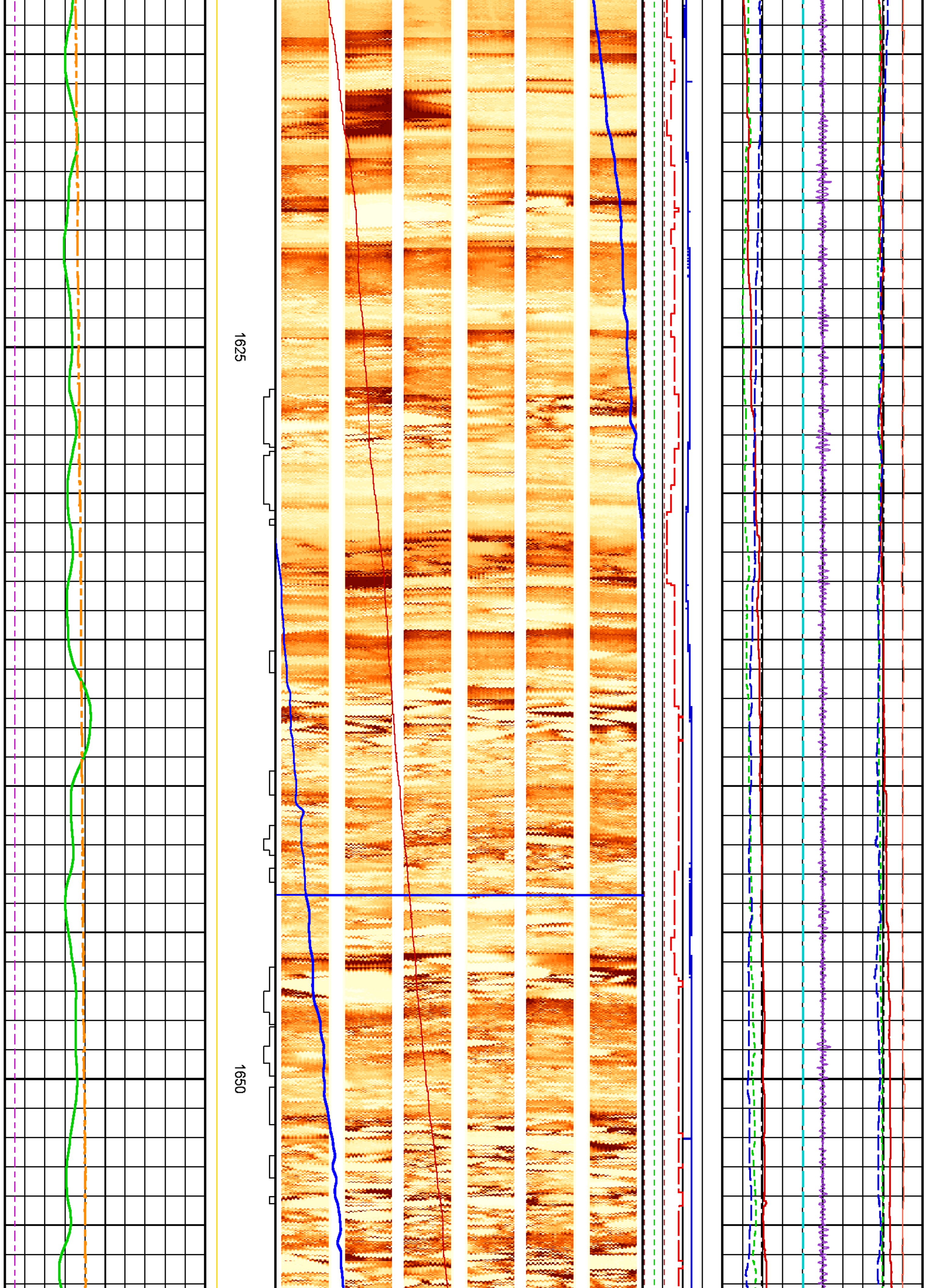
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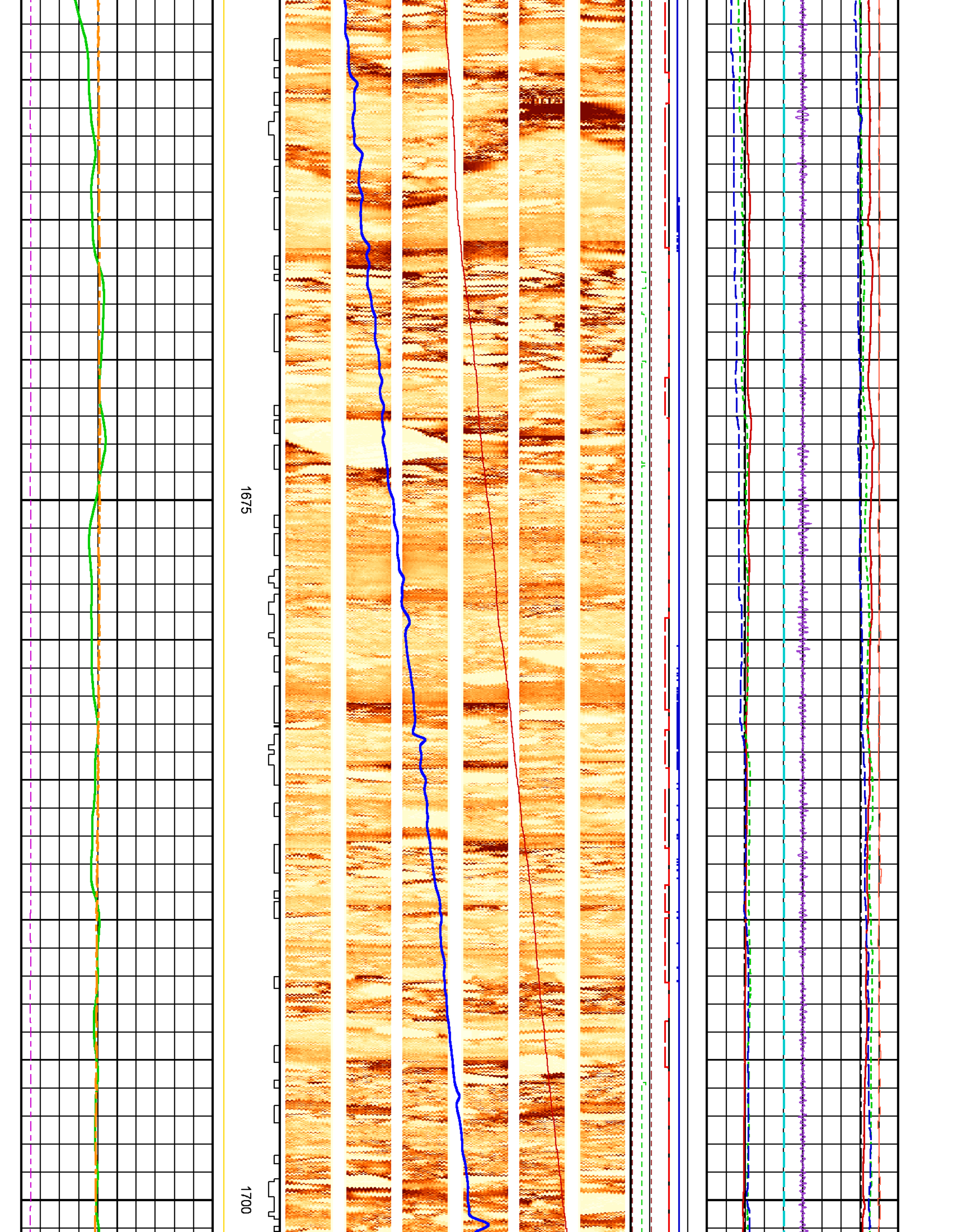
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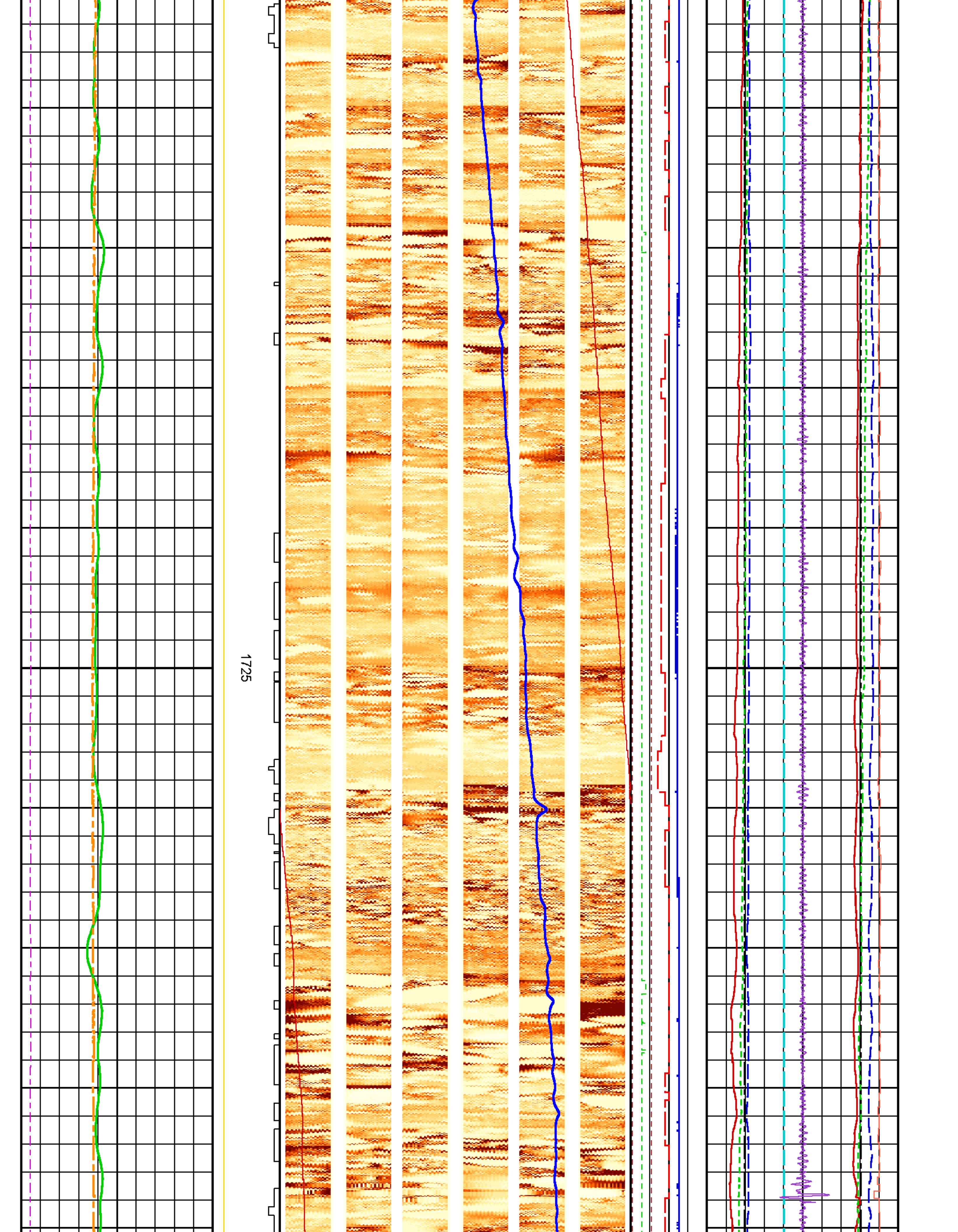
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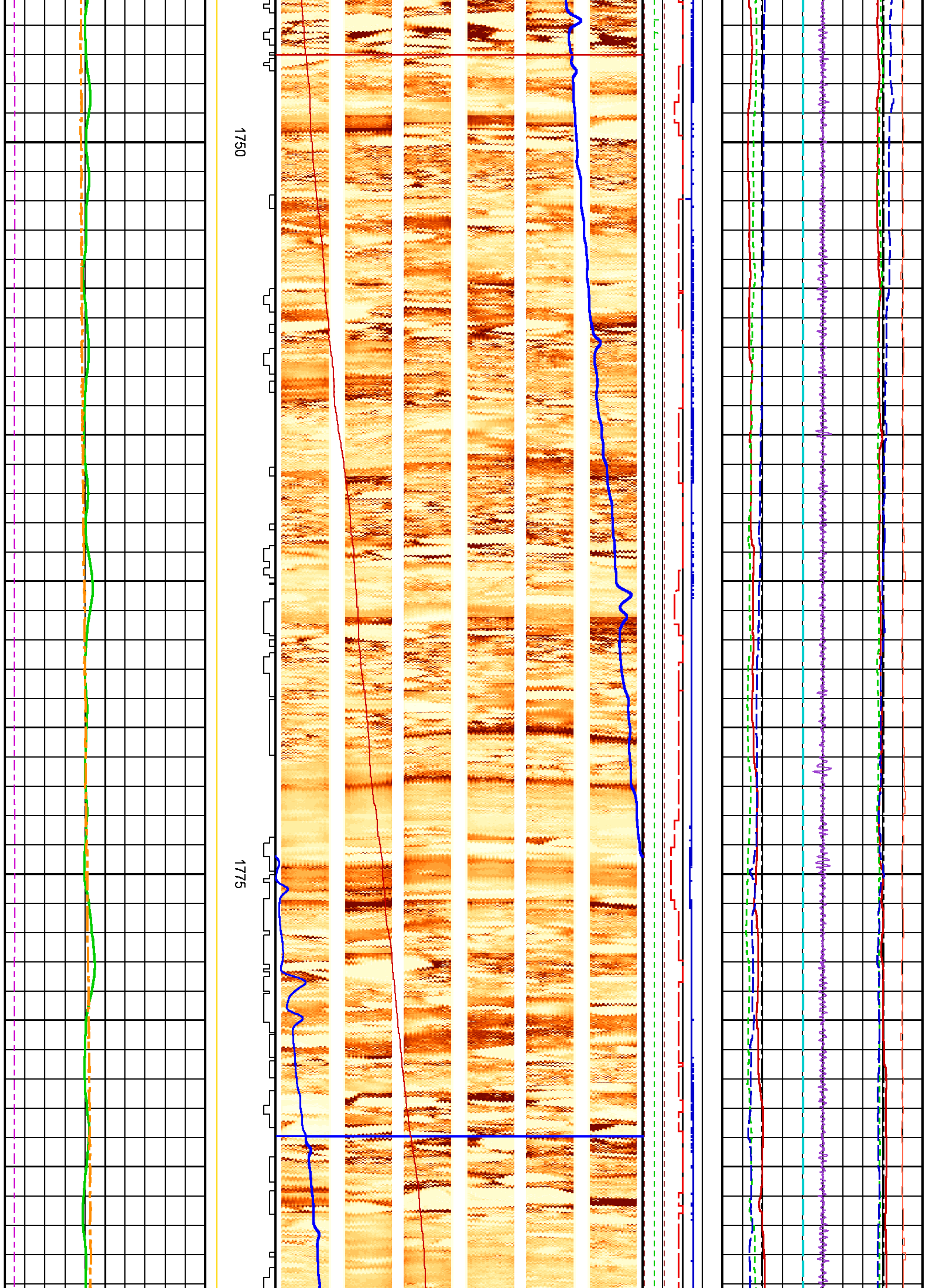
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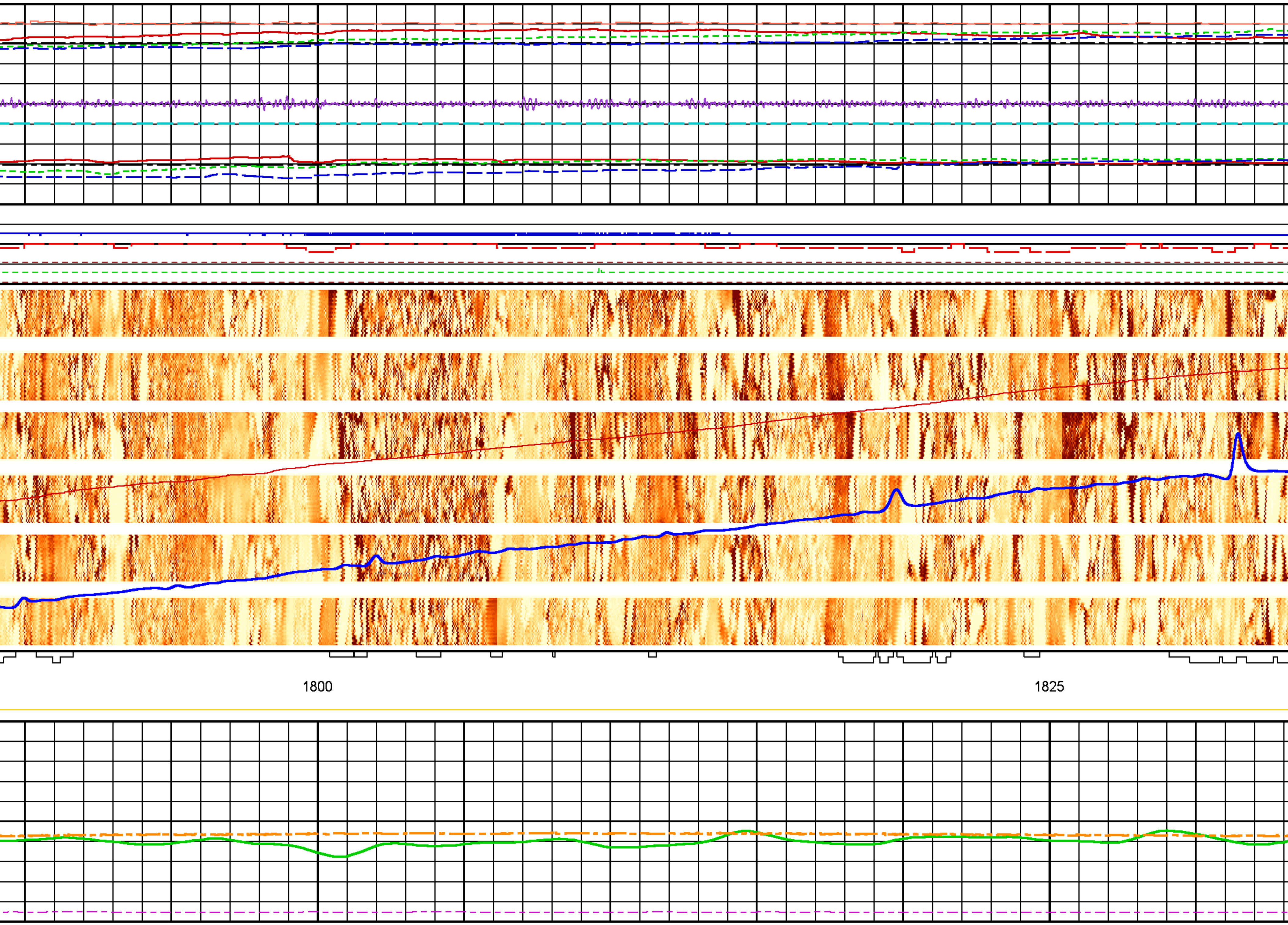
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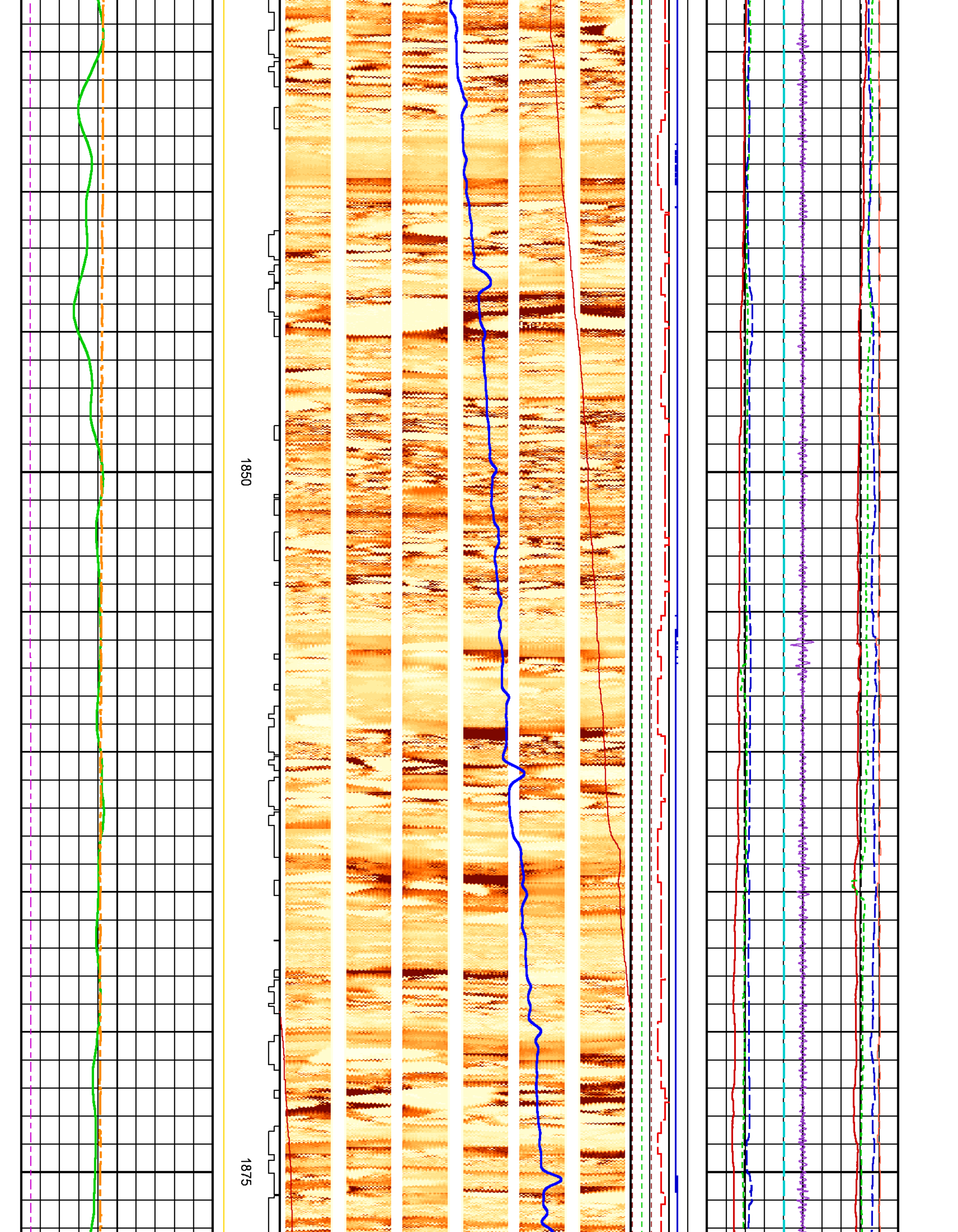
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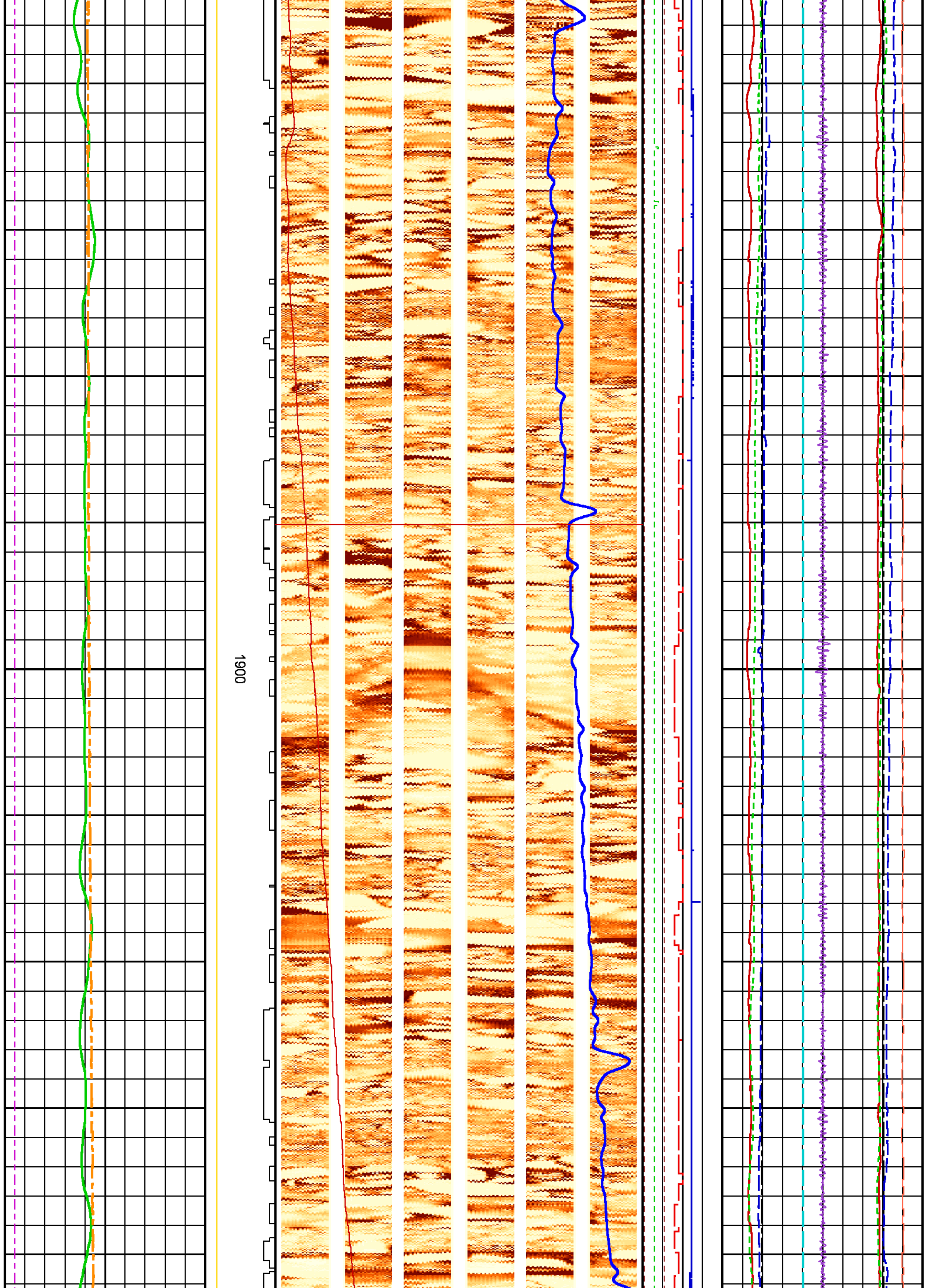
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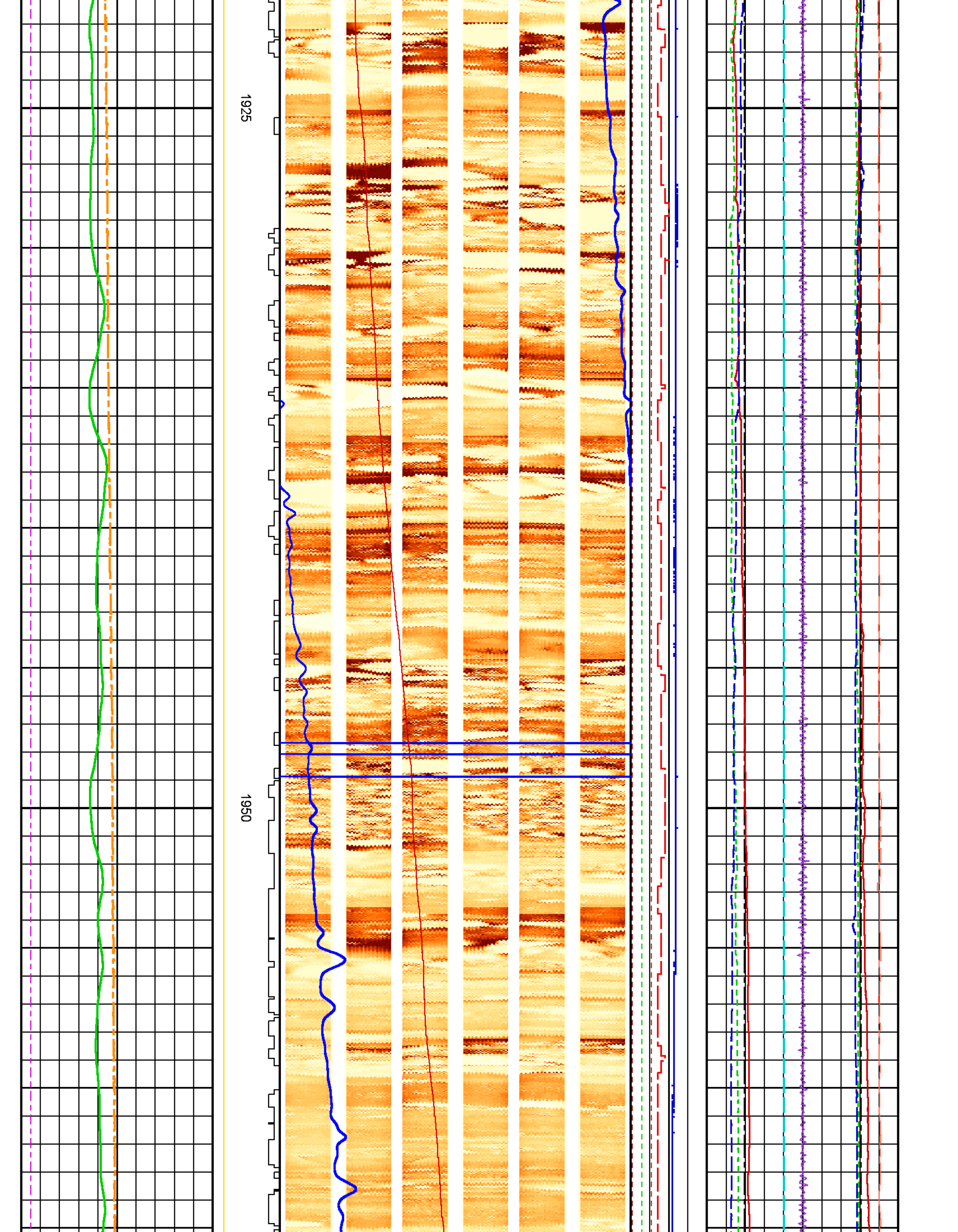
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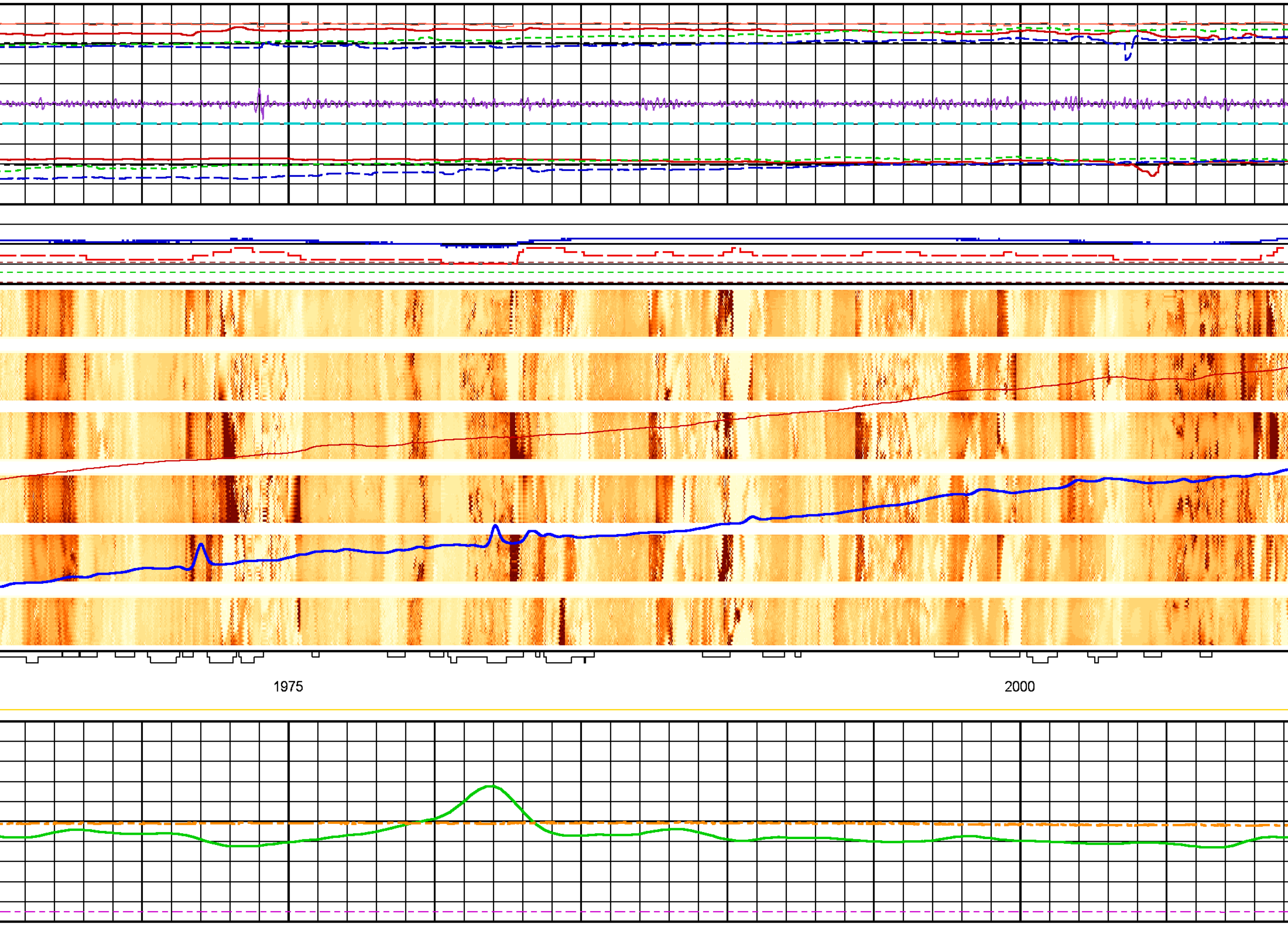
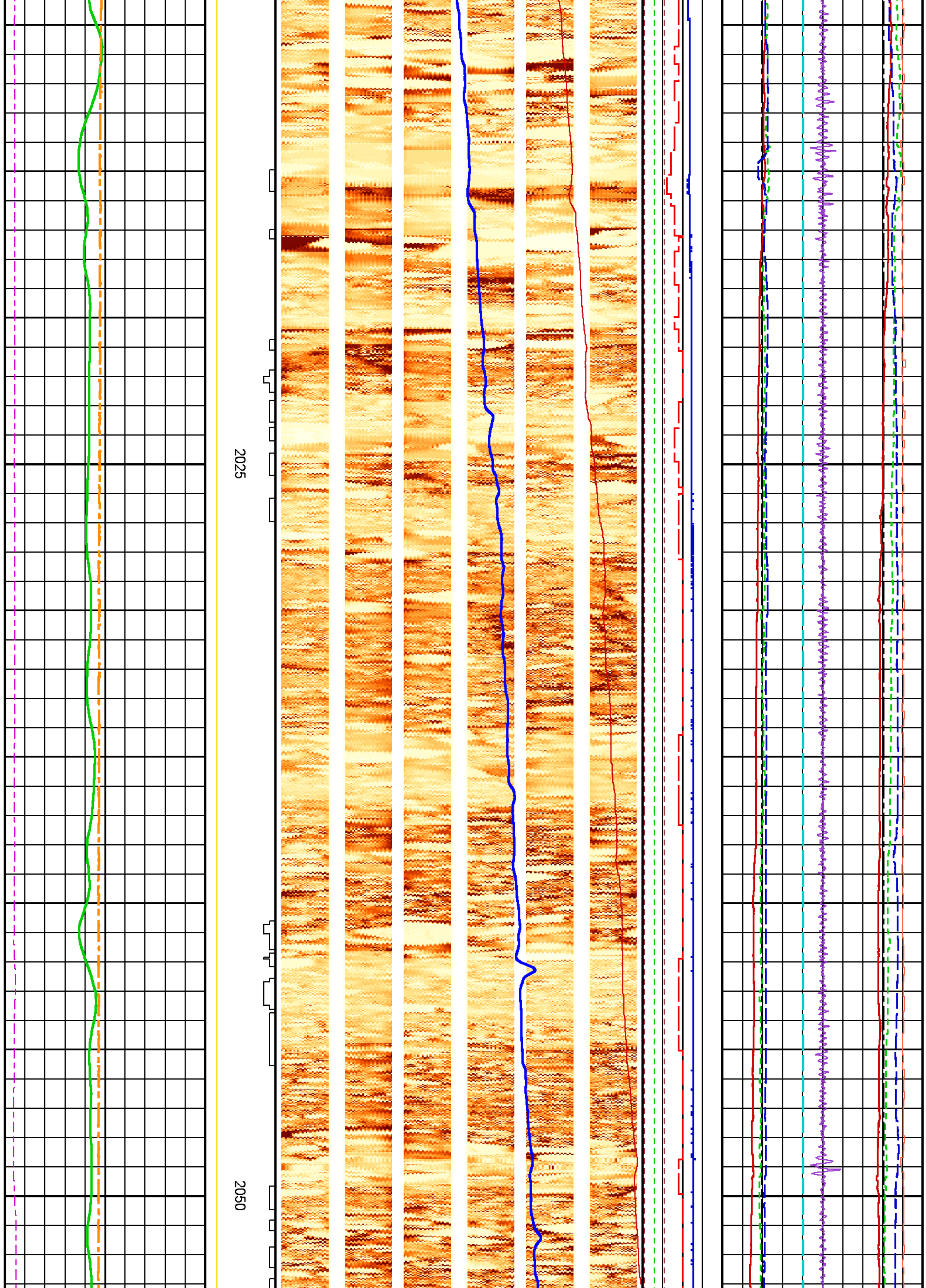
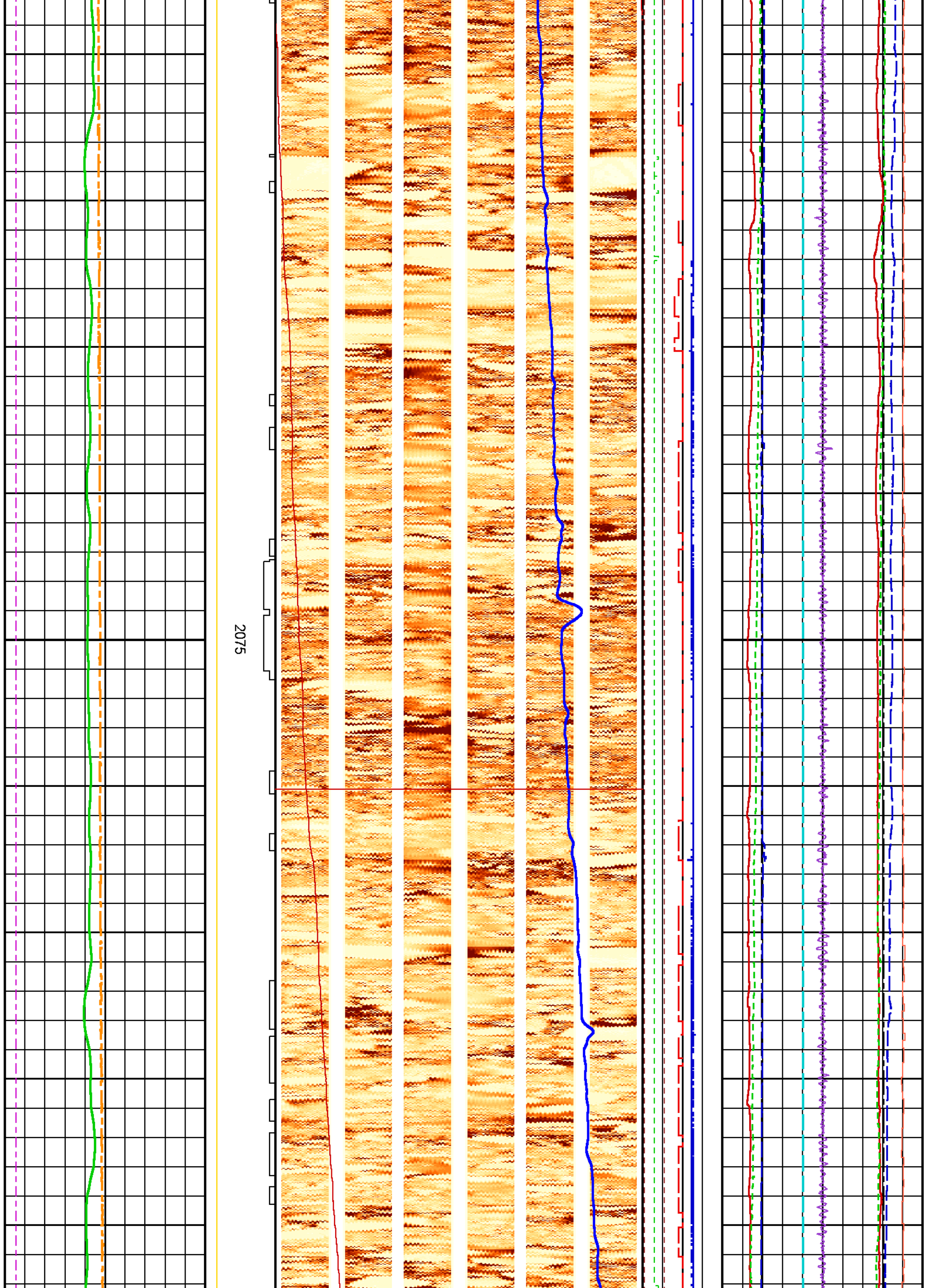


1975
2000



2025
2050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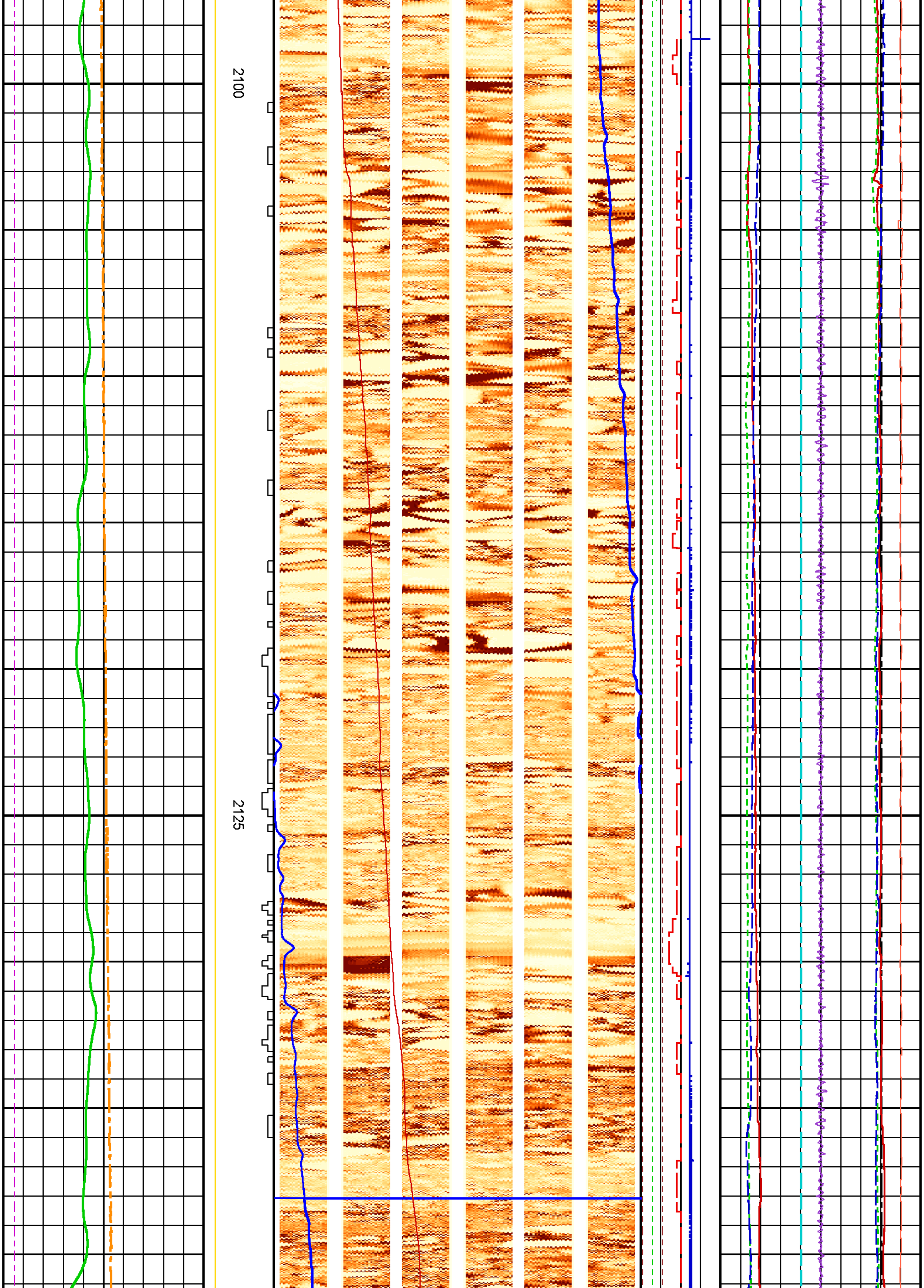
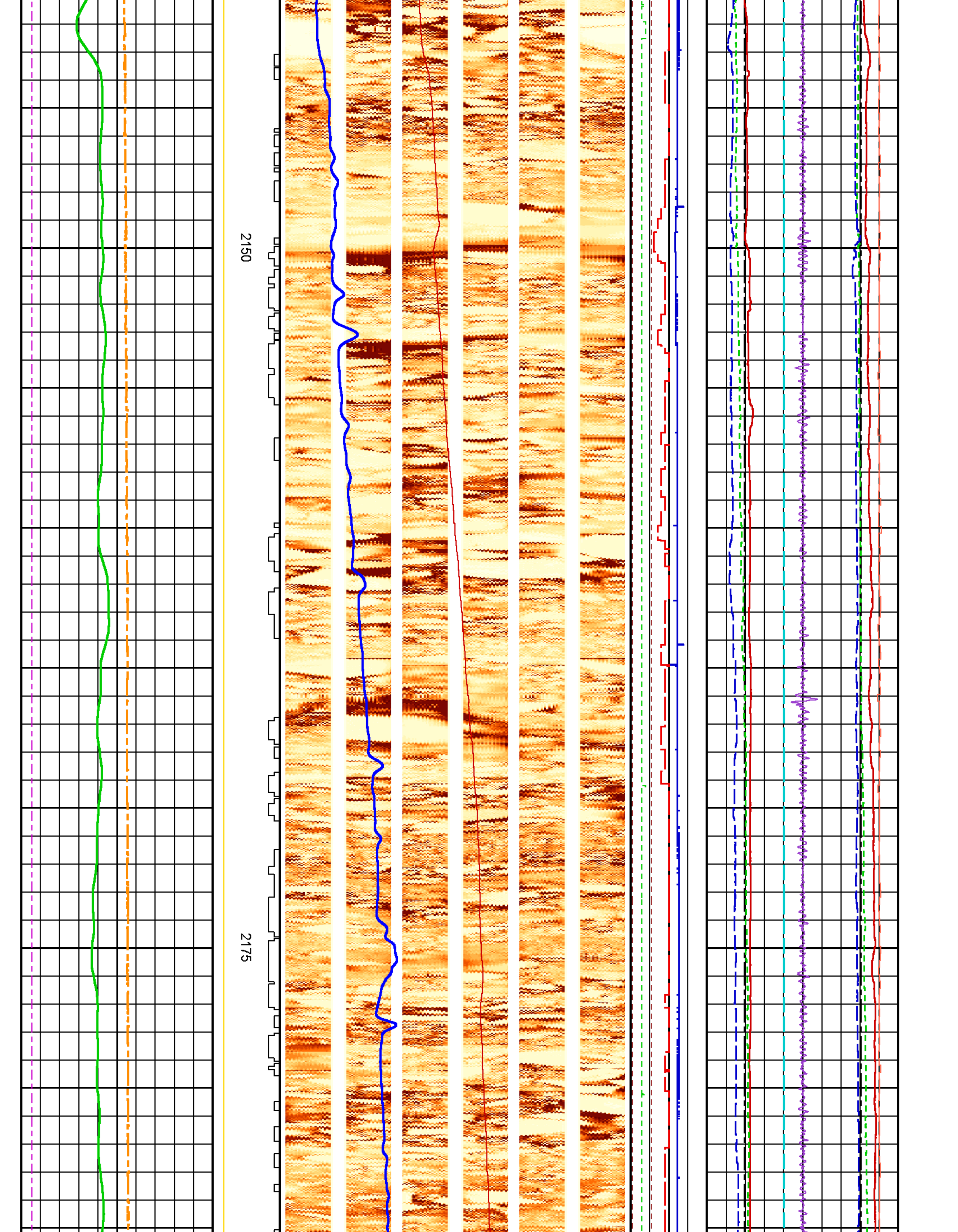
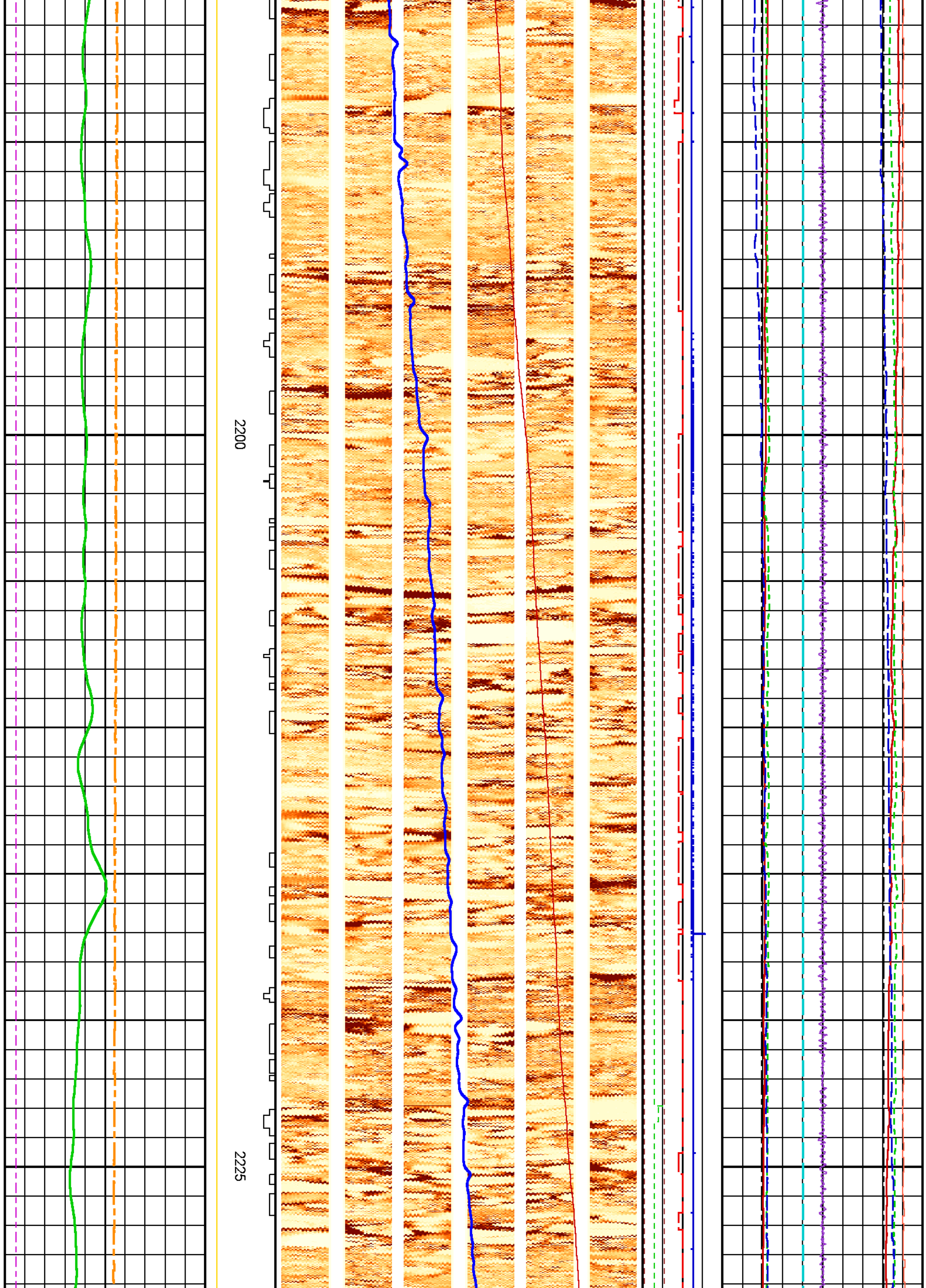

2100
2125



2150
2175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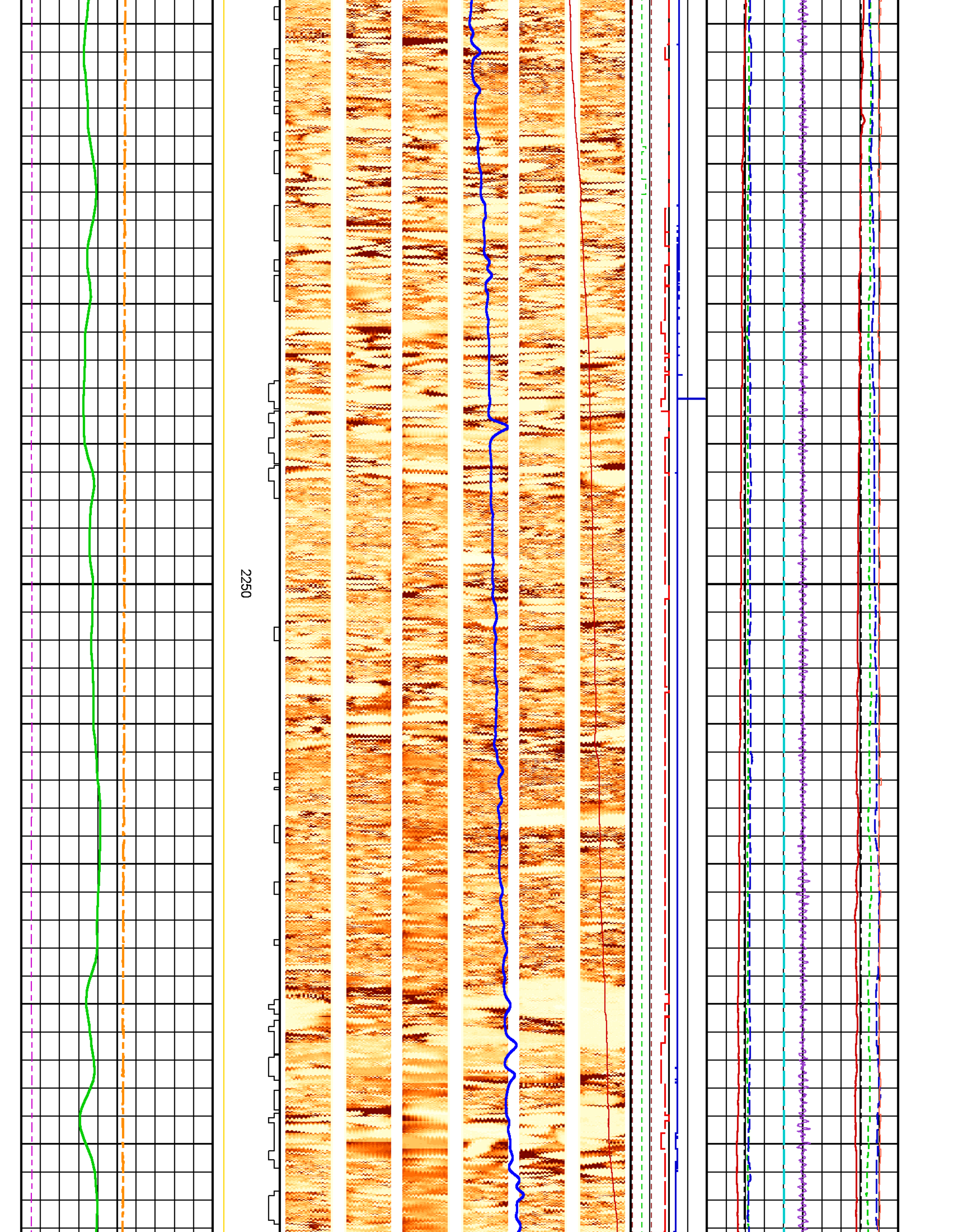
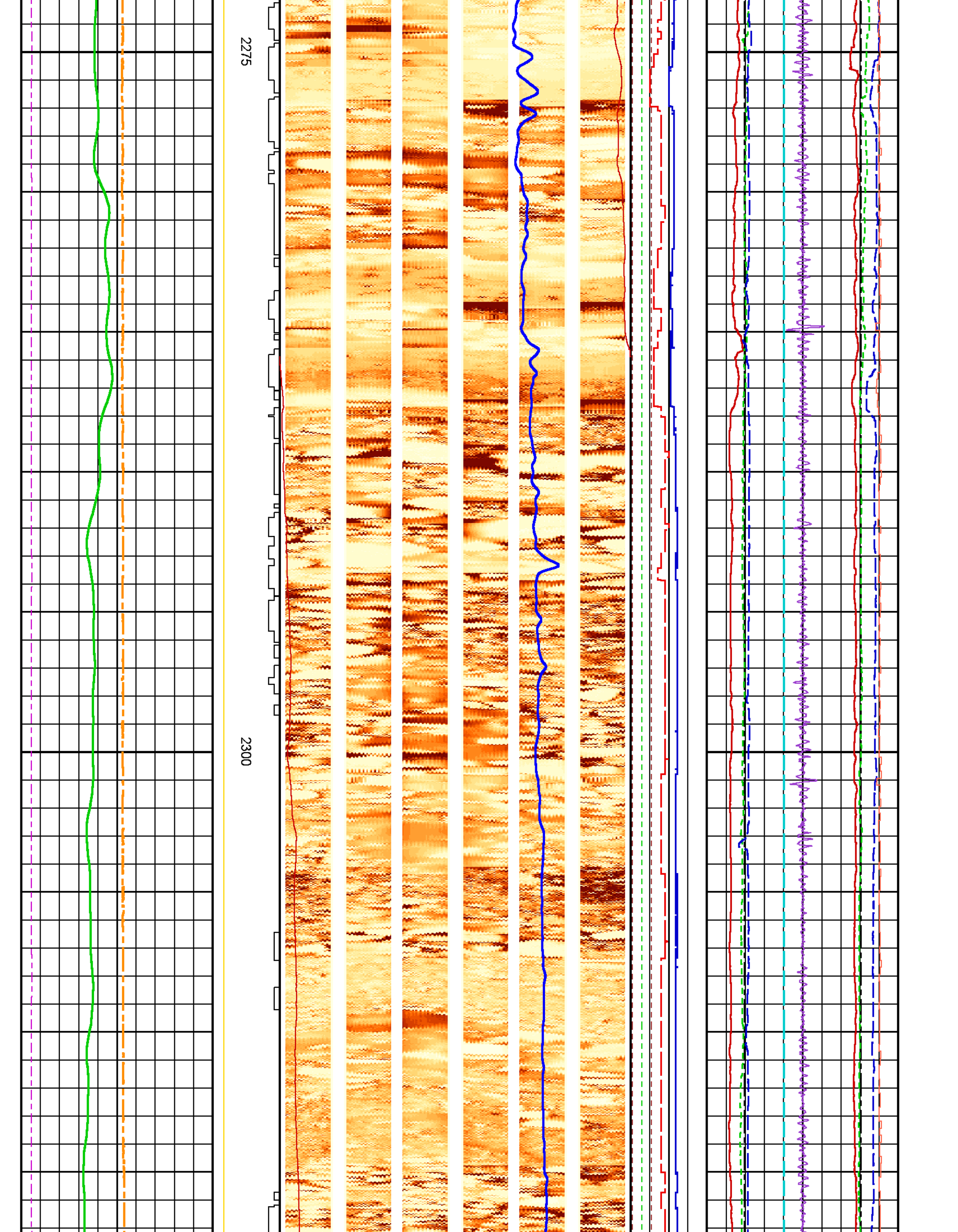
2225



2250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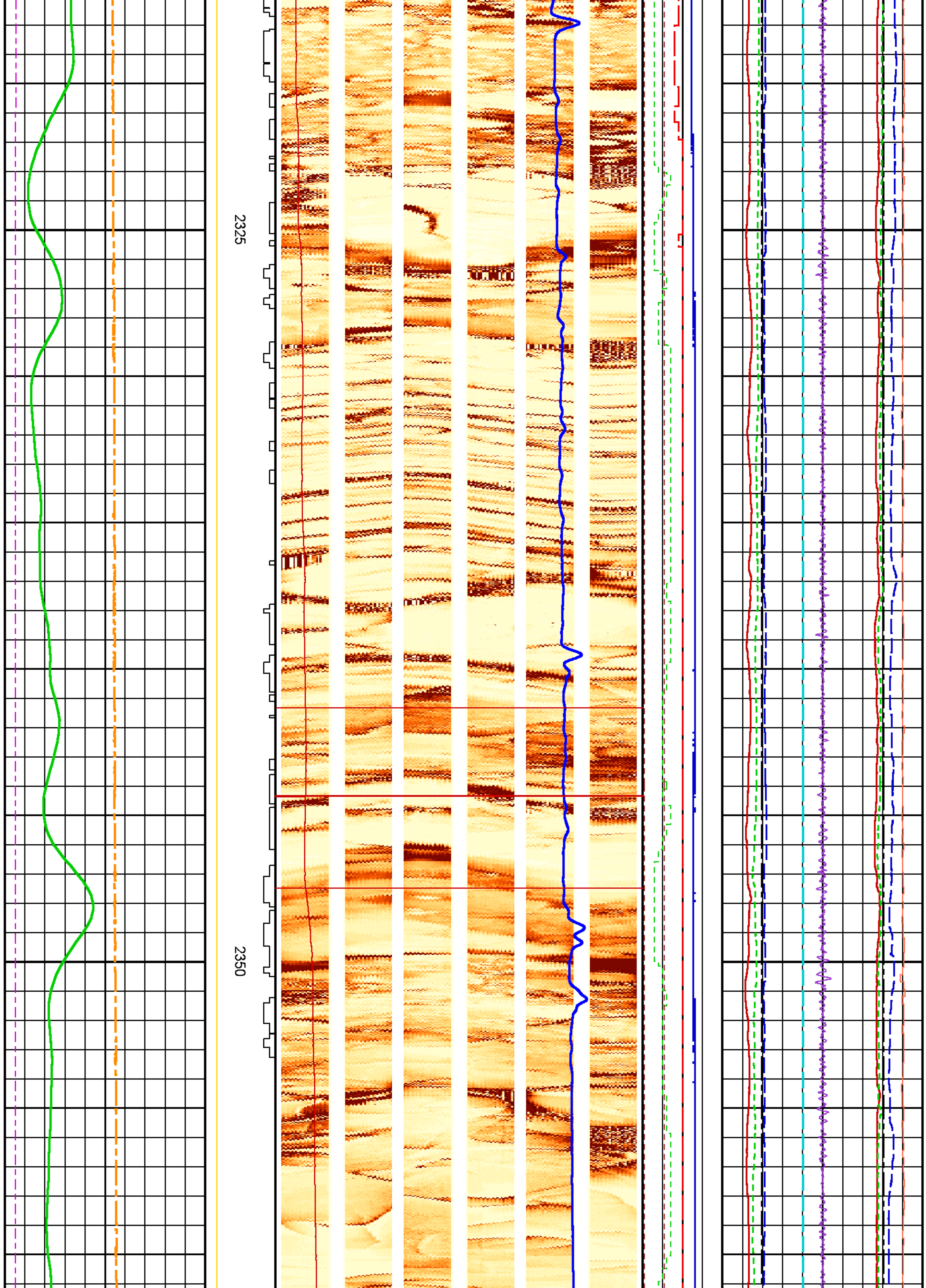
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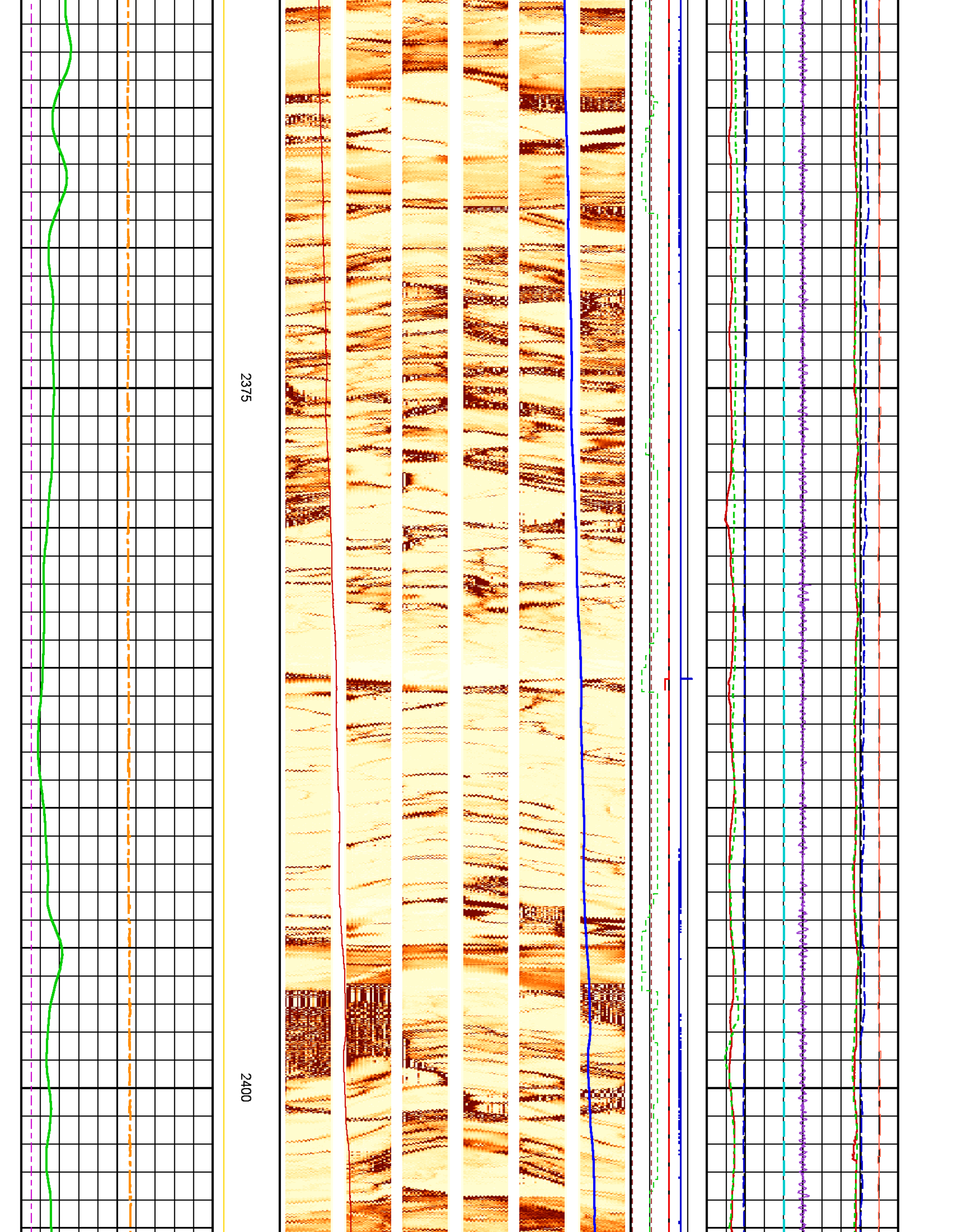
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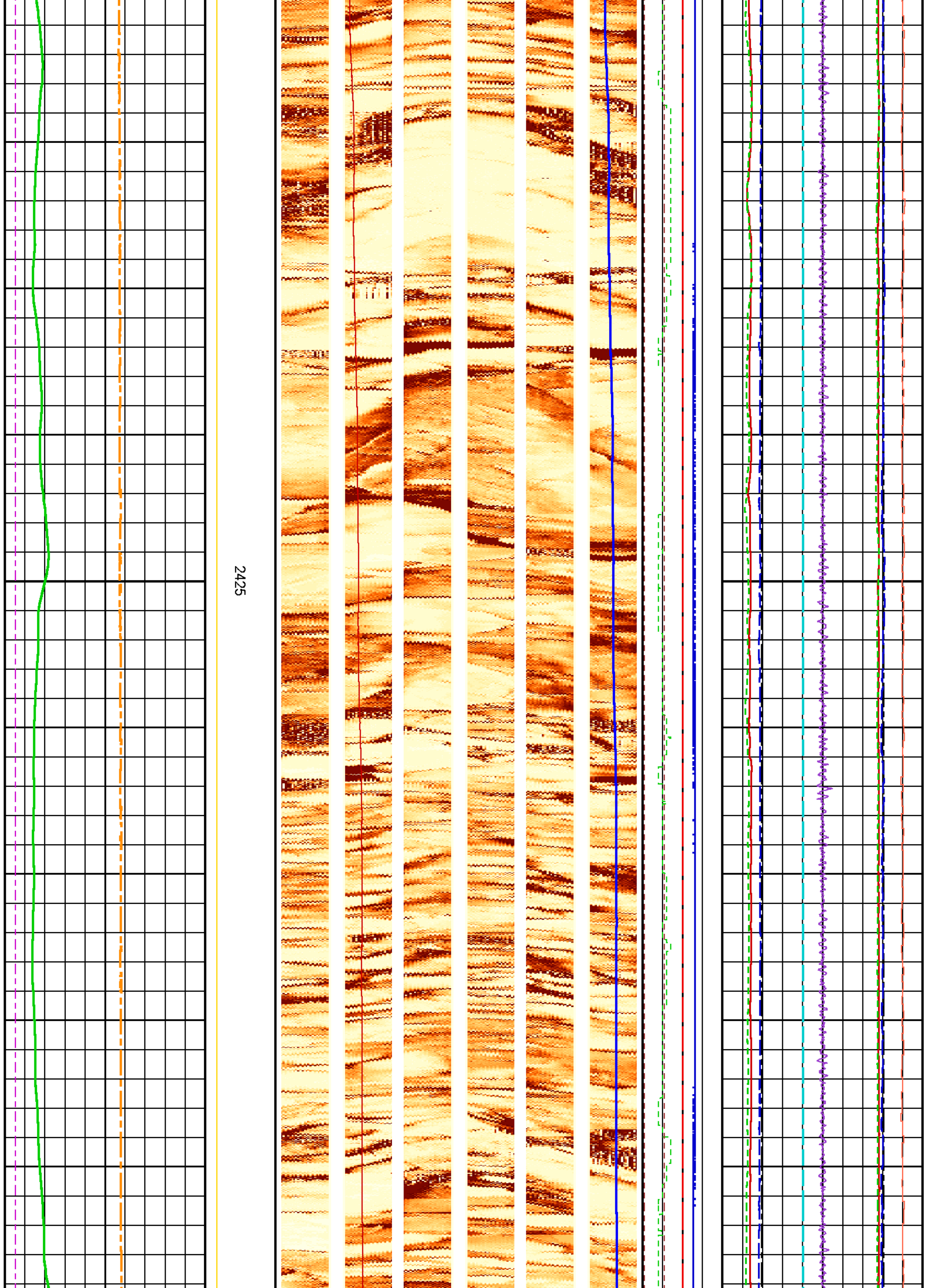
2400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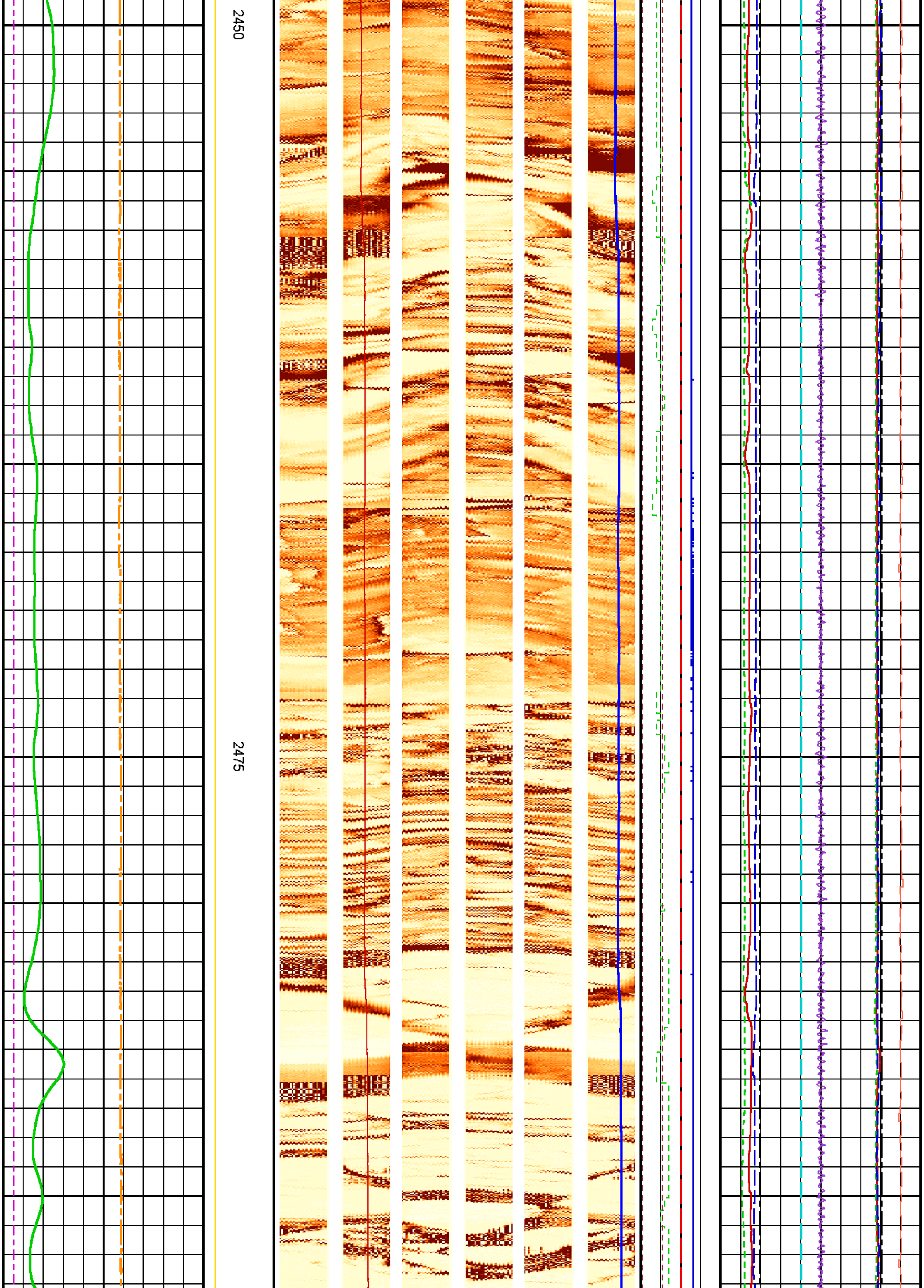
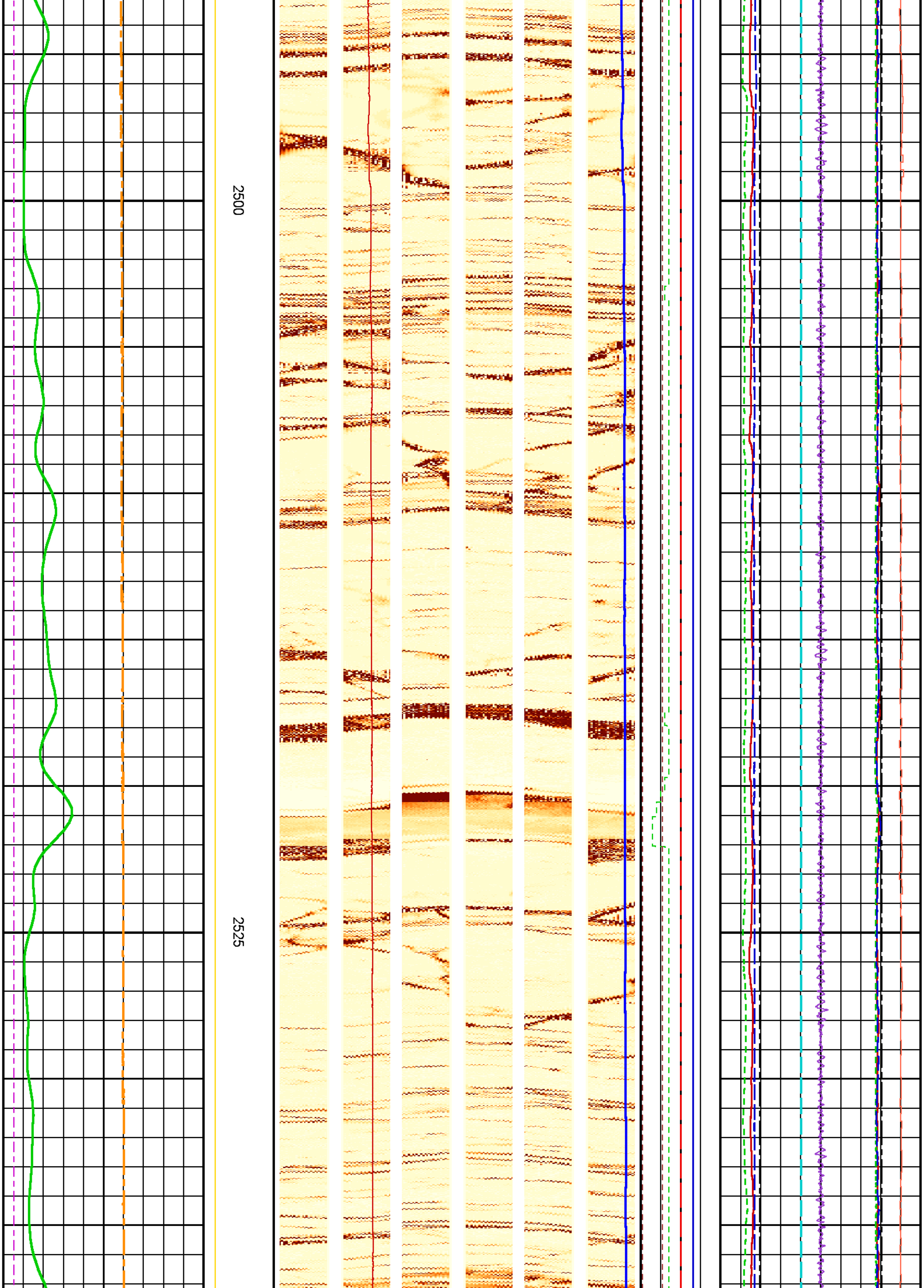

2450
2475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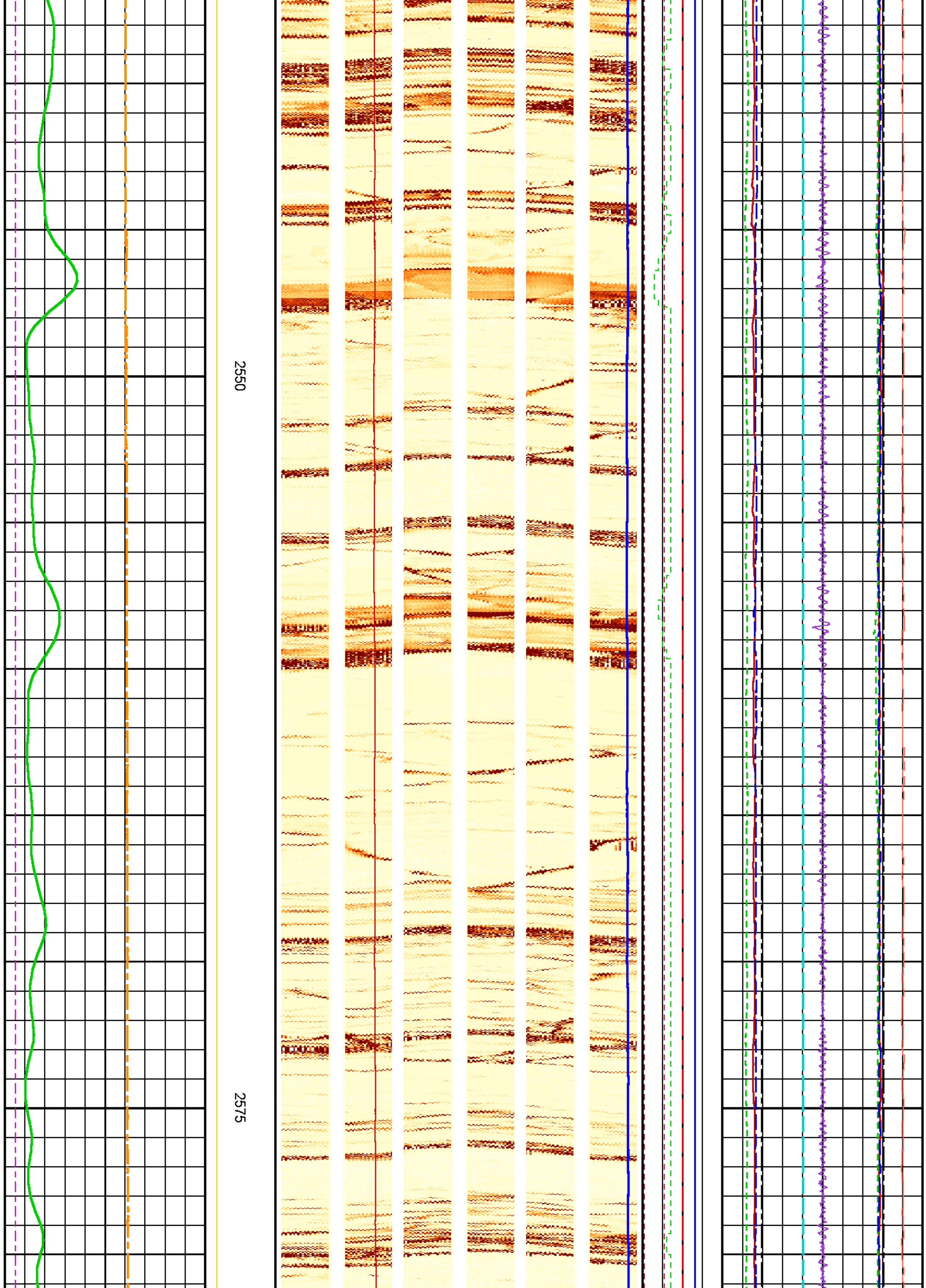
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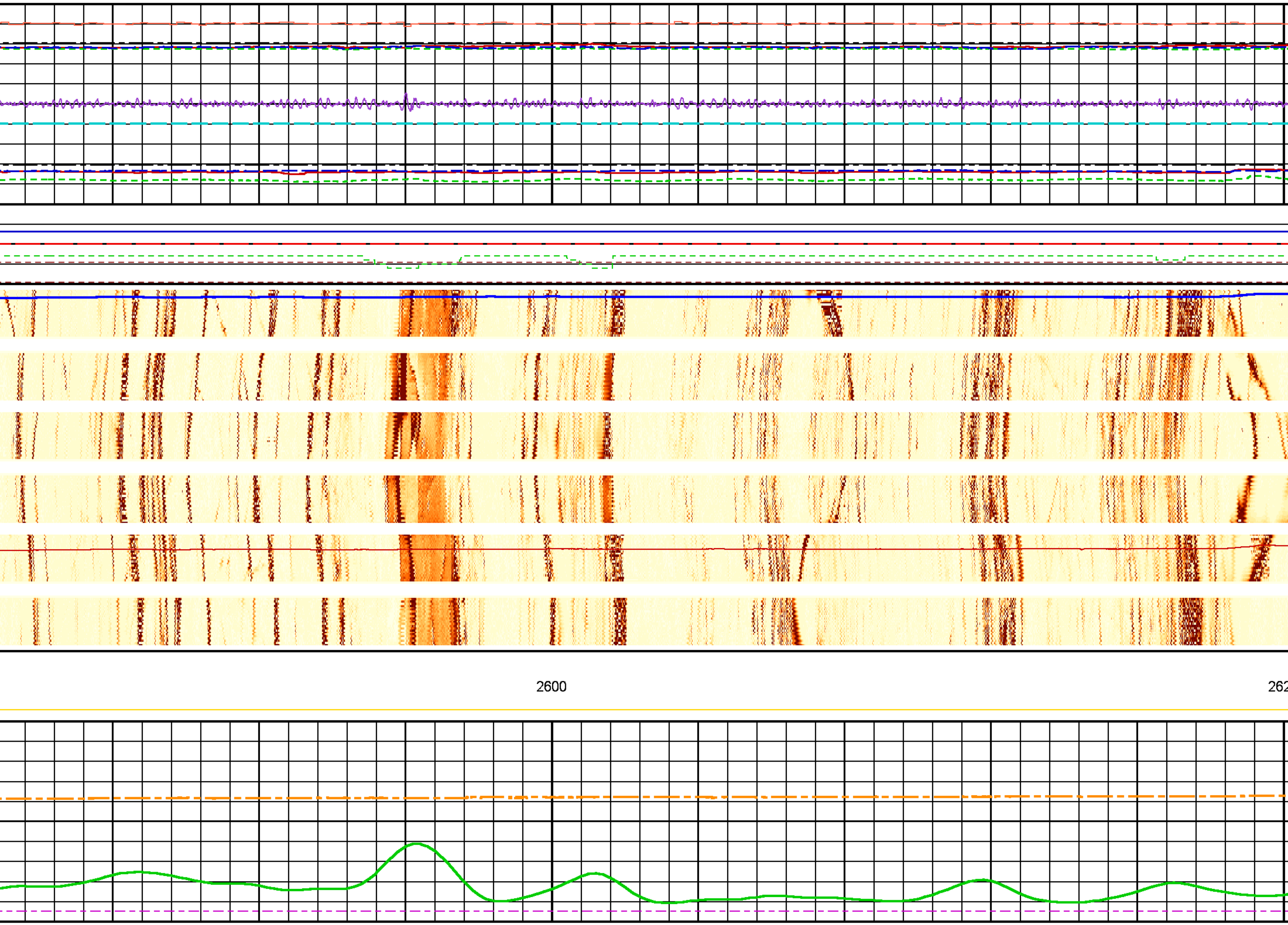
2575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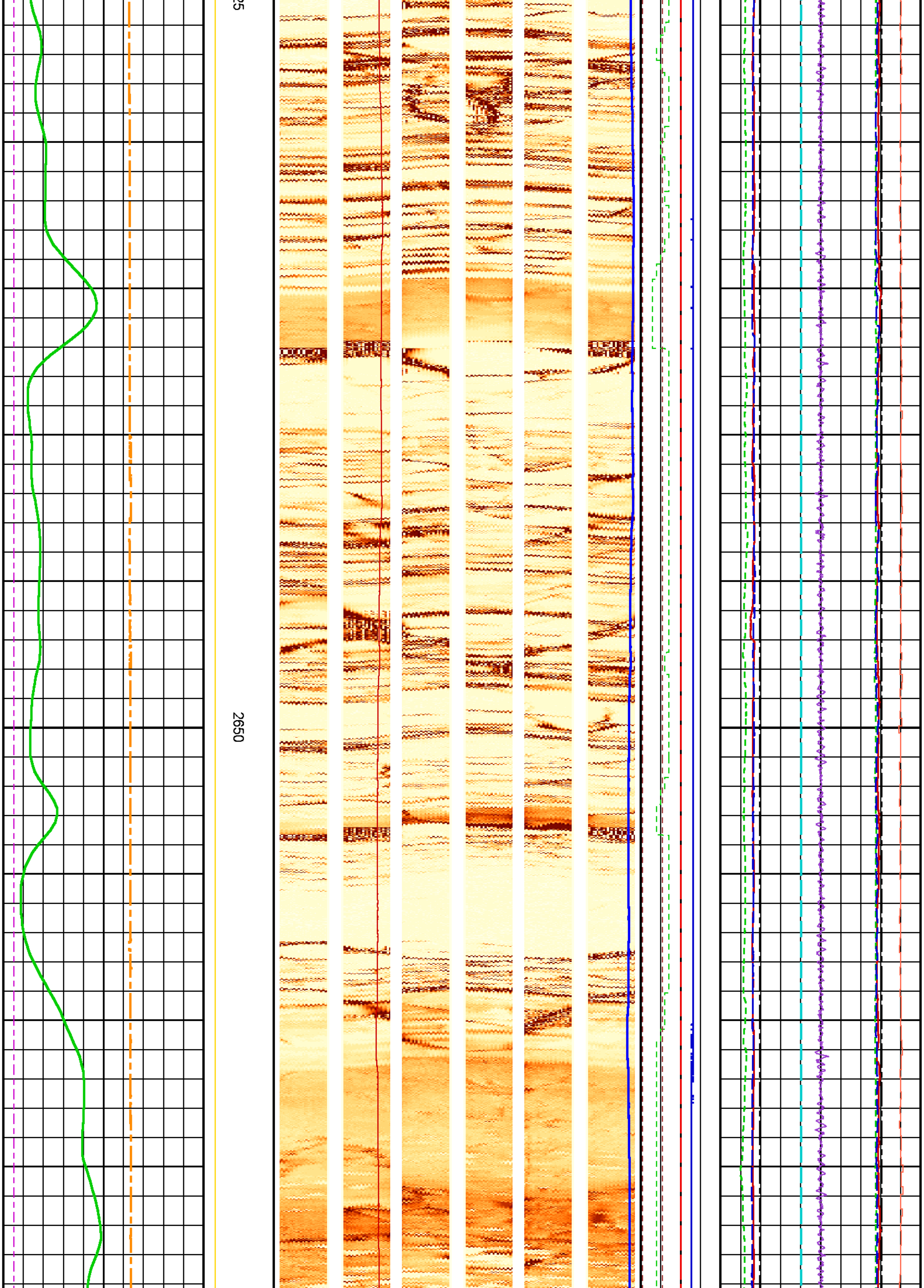
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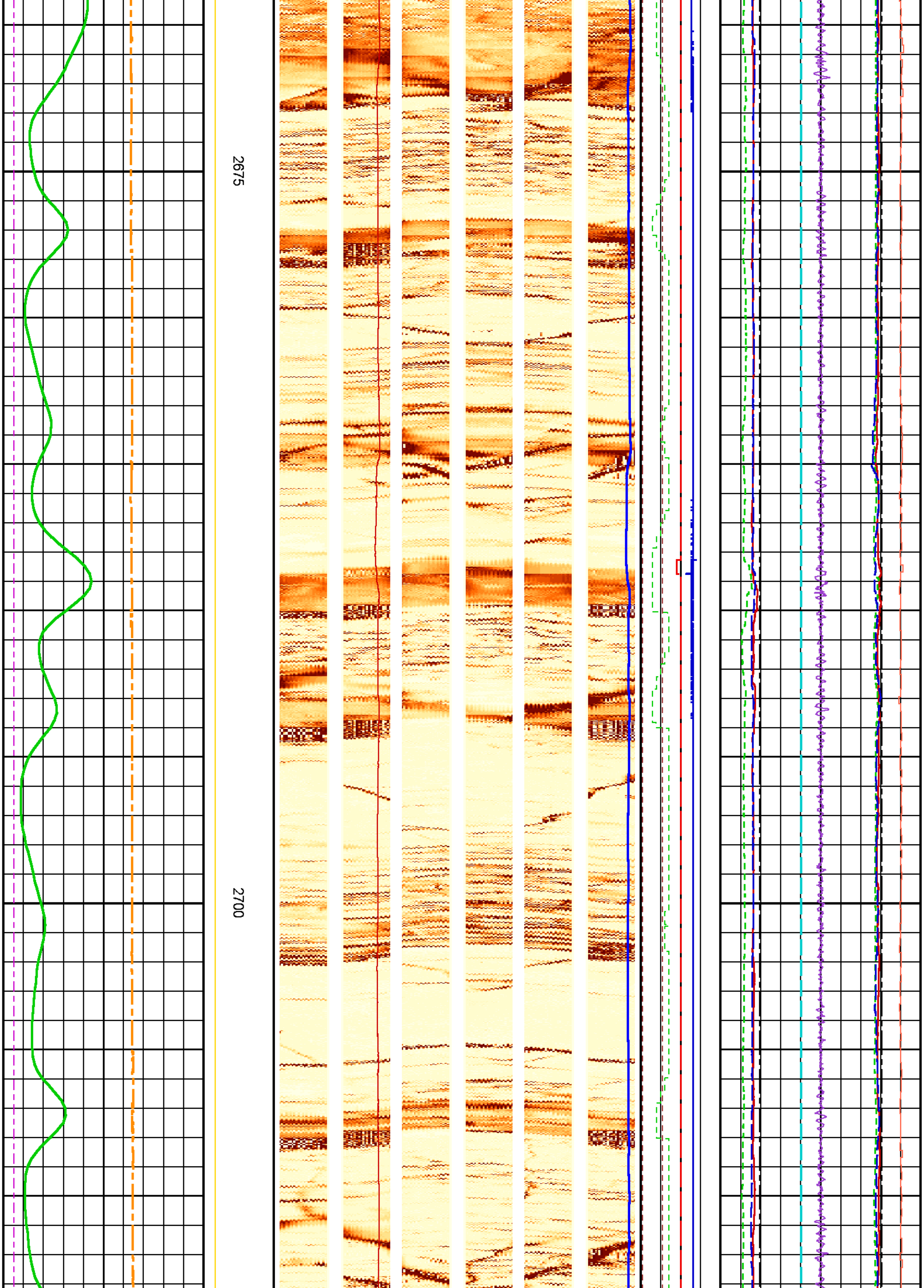
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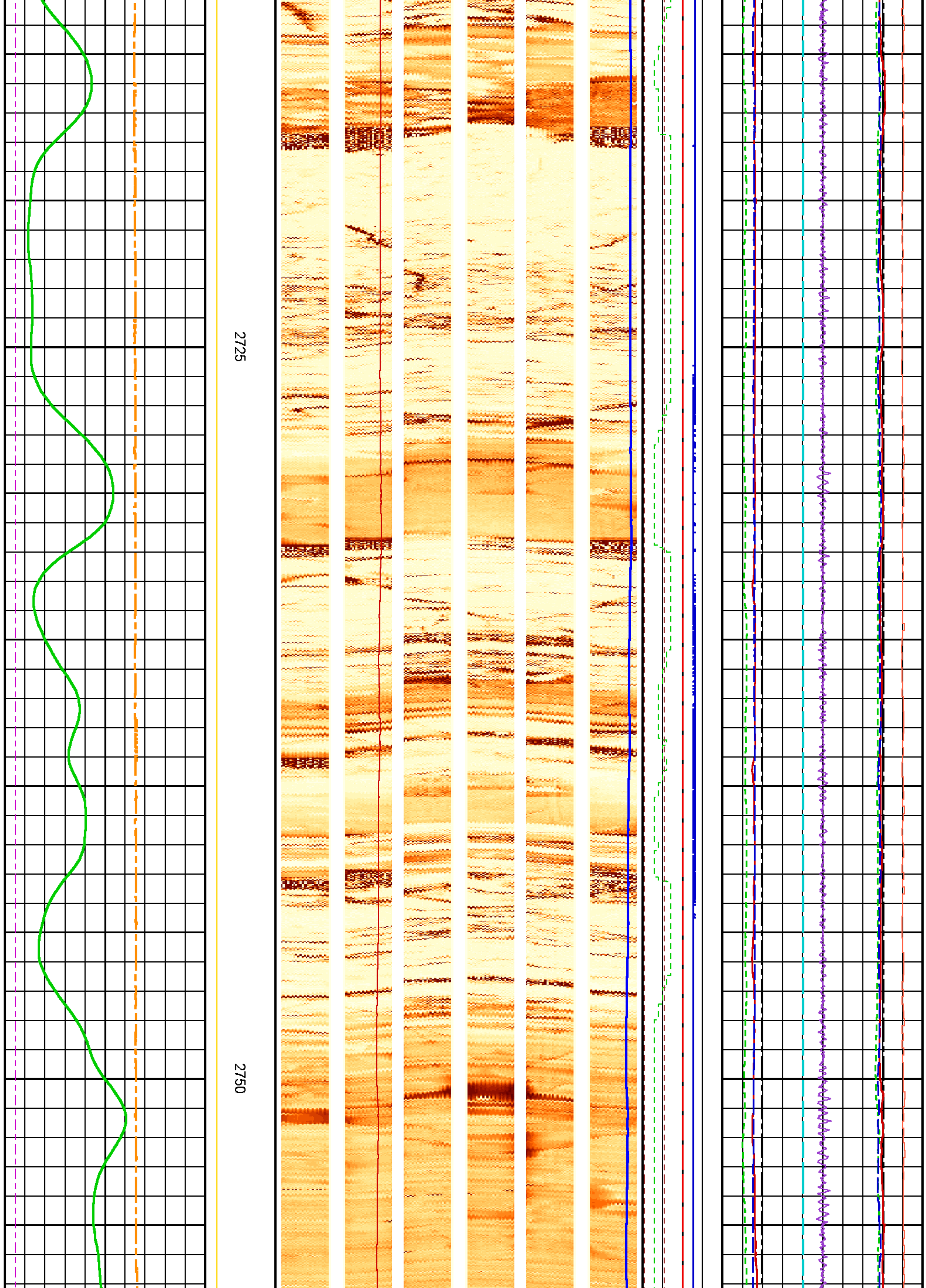
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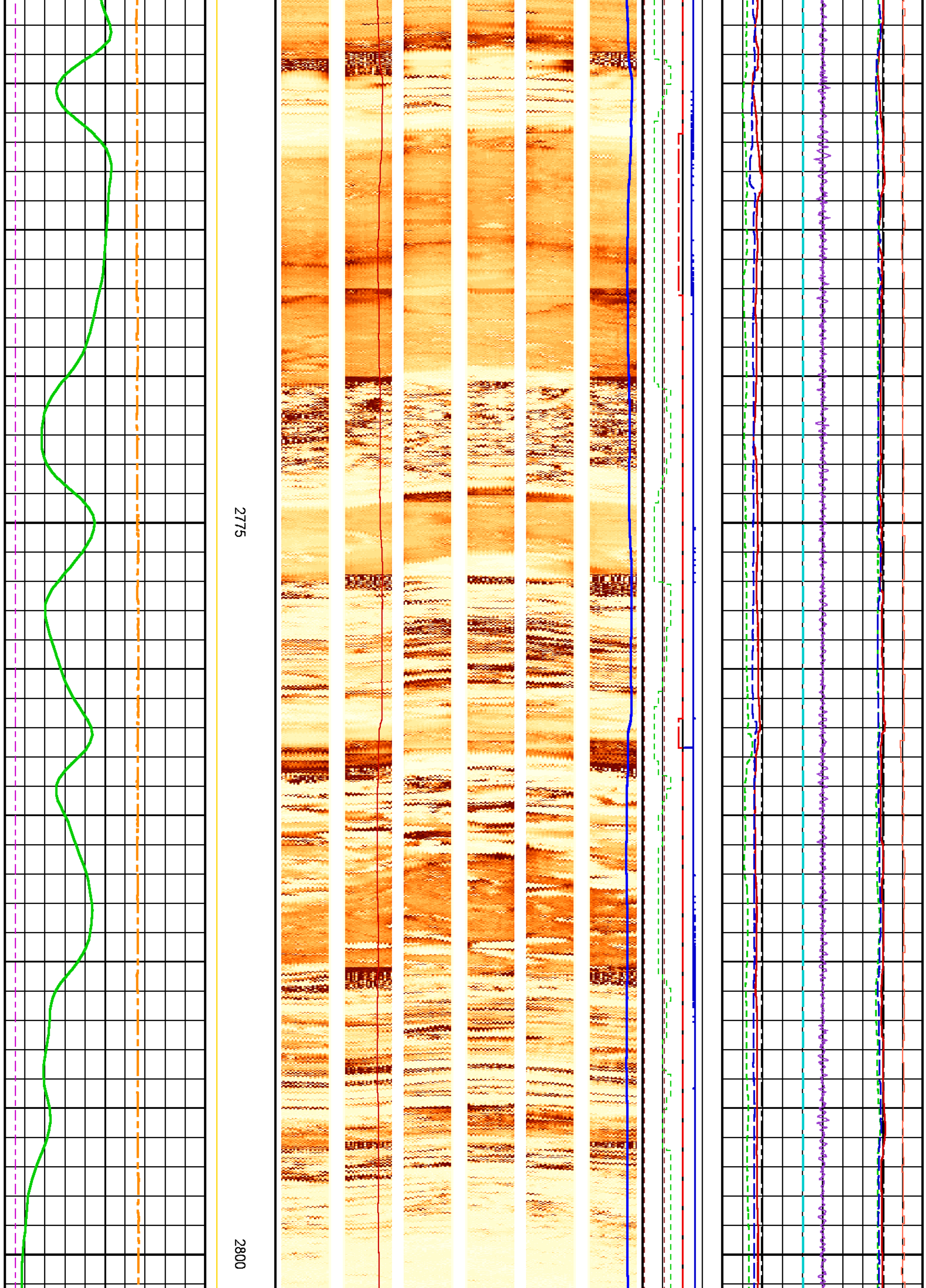

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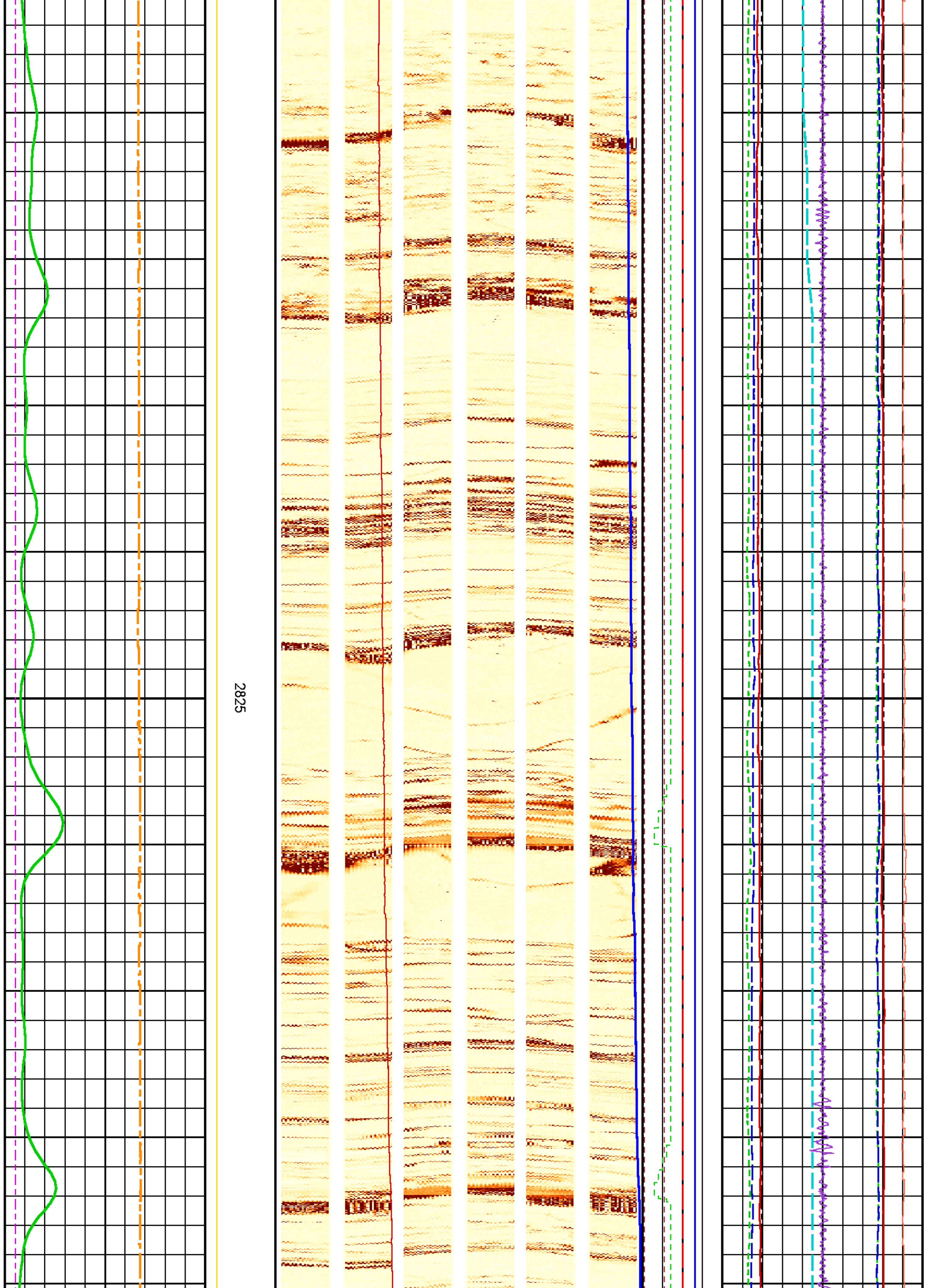
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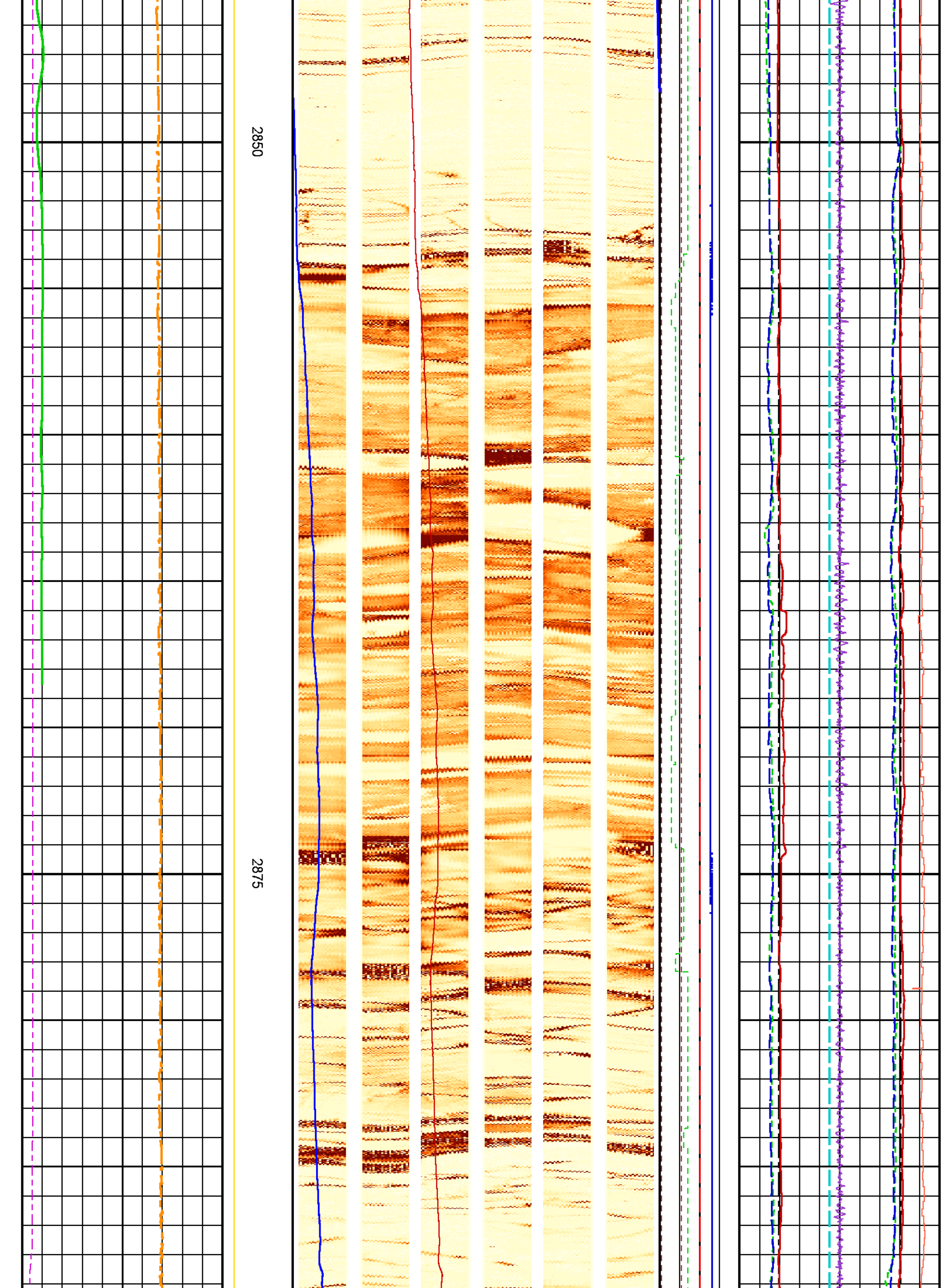
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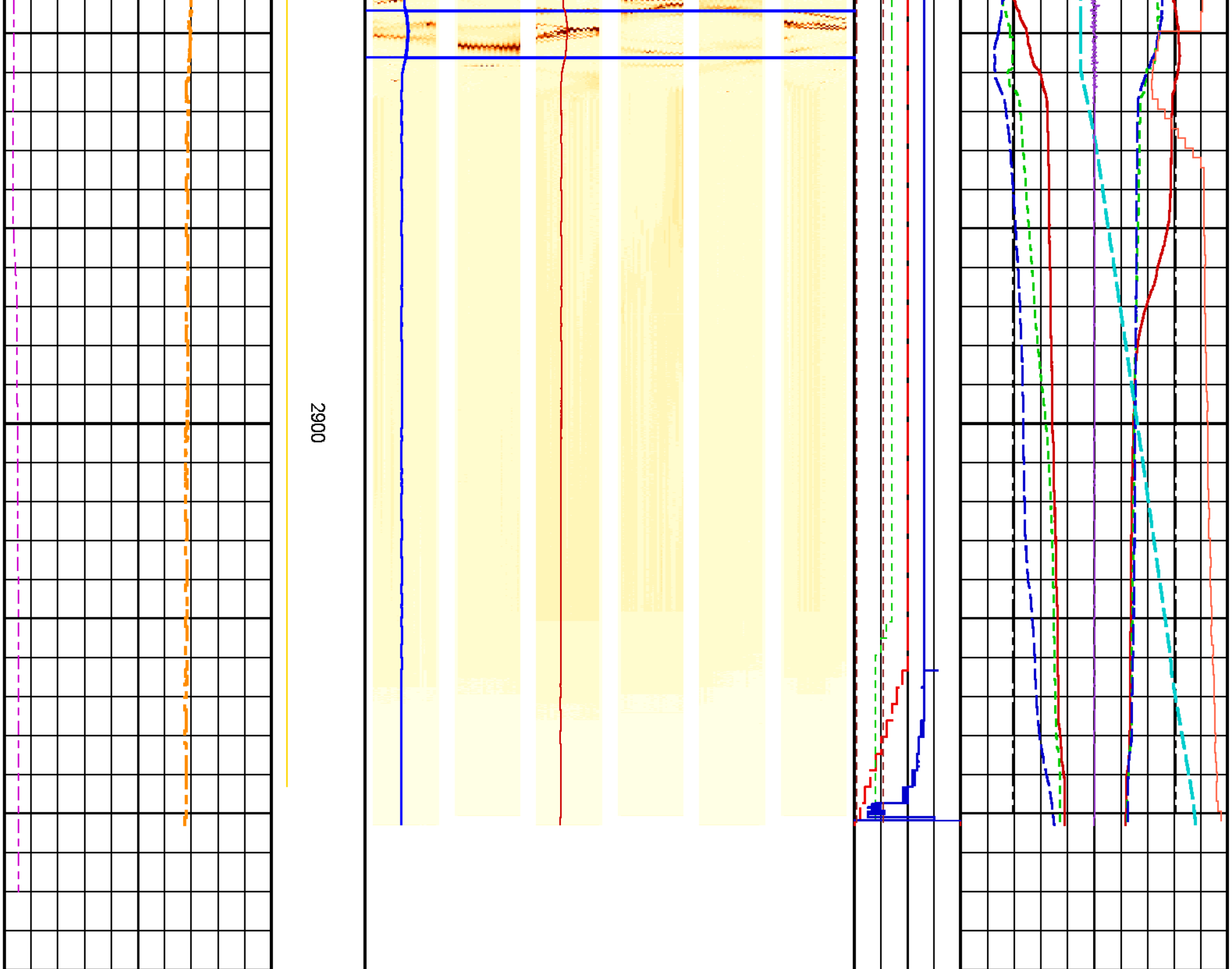
2875



GAMMA RAY [gr]
0 200
(gAPI)
SPEED [spd]
0 200
(ft/min)
DEVIATION [devst.h]
0 10
(deg)

FEET
TSM [qckqst.h]
0 12
(deg)
EXM [qdfqst.h]
12 0
(deg/ft)

RAW PAD DATA
AZIMUTH [azst.h]
390 30
(deg)
RELATIVE BEARING [rbst.h]
390 30
(deg)

PAD 1
24 0
0 1024

PAD 2
0 24
0 1024

PAD 3
24 0
0 1024

PAD 4
0 24
0 1024

PAD 5
24 0
0 1024

PAD 6
0 24
0 1024

XMTRGN [bkrg.h]
0 20
(dim)
RCVRGN [padg.h]
0 20
(dim)
pwrRTO [gvrat.h]
0.7 1.1
(1)
RTmde [rtel.h]
0
(dim)

BIT SIZE
10 0
(in)
RADIUS 1 [rad1.h]
10 0
(in)
RADIUS 2 [rad2.h]
10 0
(in)
RADIUS 3 [rad3.h]
10 0
(in)

BIT SIZE
0 10
(in)
RADIUS 4 [rad4.h]
0 10
(in)
RADIUS 5 [rad5.h]
0 10
(in)
RADIUS 6 [rad6.h]
0 10
(in)

padforce [padf.h]
100 -100
(pct)
tenSTnf [tenst.h]
4500 -500
(lbf)

				Z ACCEL. noG [razdst.h] 250 -250 (mG)

REPEAT LOG

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 14:40:20 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n837g01.prm
LOGGING MODE: DEPTH DIRECTION: UP
TOP DEPTH: 2645.833 ft BOTTOM DEPTH: 2895.492 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
SPEED	FILTER ()	medium (1)		TOP	BOTTOM
	FILTER (.h)	medium (1)		"	"
	FILTER (.i)	medium (1)		"	"
GR	FILTER ()	medium (1)		"	"
	FILTER (.h)	medium (1)		"	"
	FILTER (.i)	medium (1)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
BIT SIZE	BIT SIZE	12.250	in	TOP	2890.922
		7.875	in	2890.922	BOTTOM

ORIENTATION

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
GEOMAG PARAMETERS	MAG Inclination	0.000	deg	TOP	BOTTOM
	MAG Field - TOTAL	0	nT	"	"

STAR/EART PROCESSING

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
GUARD VOLTAGE QUAL CURVE	PAD SELECTION	PAD 1		TOP	BOTTOM

CURVE DESCRIPTION REPORT

CURVE NAME	CREATION DATE	CURVE DESCRIPTION
F1:AZSTQH	Jun 22 09:26:22 2014	AZIMUTH OF REFERENCE PAD FOR STAR
F1:BKRGQH	Jun 22 09:26:22 2014	BUCKER DRIVER VALUE
F1:DEVSTQH	Jun 22 09:26:22 2014	DEVIATION FOR STAR
F1:GR	Jun 22 09:26:22 2014	GAMMA RAY
F1:GVRATQH	Jun 22 09:26:22 2014	ACTUAL GUARD VOLTAGE, IDEAL GUARD VOLTAGE RATIO
F1:P1BTNQH	Jun 22 09:26:22 2014	PACKED PAD 1 BLOCK (BUTTONS 1-24)
F1:P2BTNQH	Jun 22 09:26:22 2014	PACKED PAD 2 BLOCK (BUTTONS 1-24)
F1:P3BTNQH	Jun 22 09:26:22 2014	PACKED PAD 3 BLOCK (BUTTONS 1-24)
F1:P4BTNQH	Jun 22 09:26:22 2014	PACKED PAD 4 BLOCK (BUTTONS 1-24)
F1:P5BTNQH	Jun 22 09:26:22 2014	PACKED PAD 5 BLOCK (BUTTONS 1-24)
F1:P6BTNQH	Jun 22 09:26:22 2014	PACKED PAD 6 BLOCK (BUTTONS 1-24)
F1:PADFQH	Jun 22 09:26:22 2014	PAD FORCE
F1:PADGQH	Jun 22 09:26:22 2014	PAD GAIN CODE
F1:QCKQSTQH	Jun 22 09:26:22 2014	COMPOSITE QUALITY OF MAGNETOMETER REF STAR
F1:QDFQSTQH	Jun 22 09:26:22 2014	COMPOSITE QUALITY OF DIFF OF MAGNETOMETER REF STAR

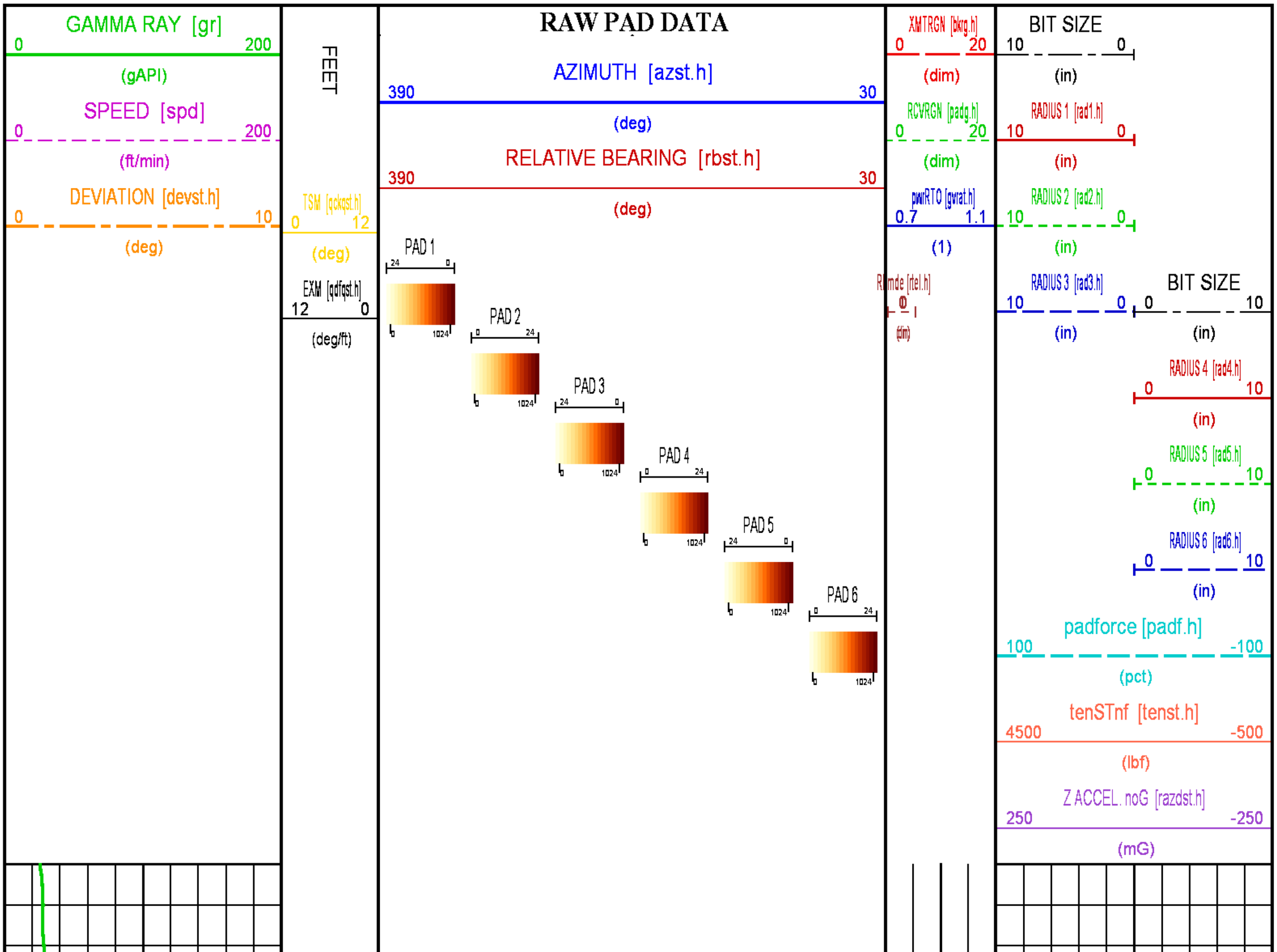
F1:RAD1QH	Jun 22 09:26:22 2014	RADIUS, TOOL AXIS TO PAD 1 FACE
F1:RAD2QH	Jun 22 09:26:22 2014	RADIUS, TOOL AXIS TO PAD 2 FACE
F1:RAD3QH	Jun 22 09:26:22 2014	RADIUS, TOOL AXIS TO PAD 3 FACE
F1:RAD4QH	Jun 22 09:26:22 2014	RADIUS, TOOL AXIS TO PAD 4 FACE
F1:RAD5QH	Jun 22 09:26:22 2014	RADIUS, TOOL AXIS TO PAD 5 FACE
F1:RAD6QH	Jun 22 09:26:22 2014	RADIUS, TOOL AXIS TO PAD 6 FACE
F1:RAZDSTQH	Jun 22 09:26:22 2014	DIFFERENTIAL Z-AXIS ACCELEROMETER SHIFTED TO STAR
F1:RBIT1	Jun 22 09:26:22 2014	BIT RADIUS 1
F1:RBIT4	Jun 22 09:26:22 2014	BIT RADIUS 4
F1:RBSTQH	Jun 22 09:26:22 2014	RELATIVE BEARING (RELATIVE TO BOREHOLE HIGH SIDE) FOR STAR
F1:RTELQH	Jun 22 09:26:22 2014	RETURN ELECTRODE
F1:SPD	Jun 22 09:26:22 2014	SPEED
F1:TENSTQH	Jun 22 09:26:22 2014	DIFFERENTIAL TENSION REFERENCED TO STAR PAD 1

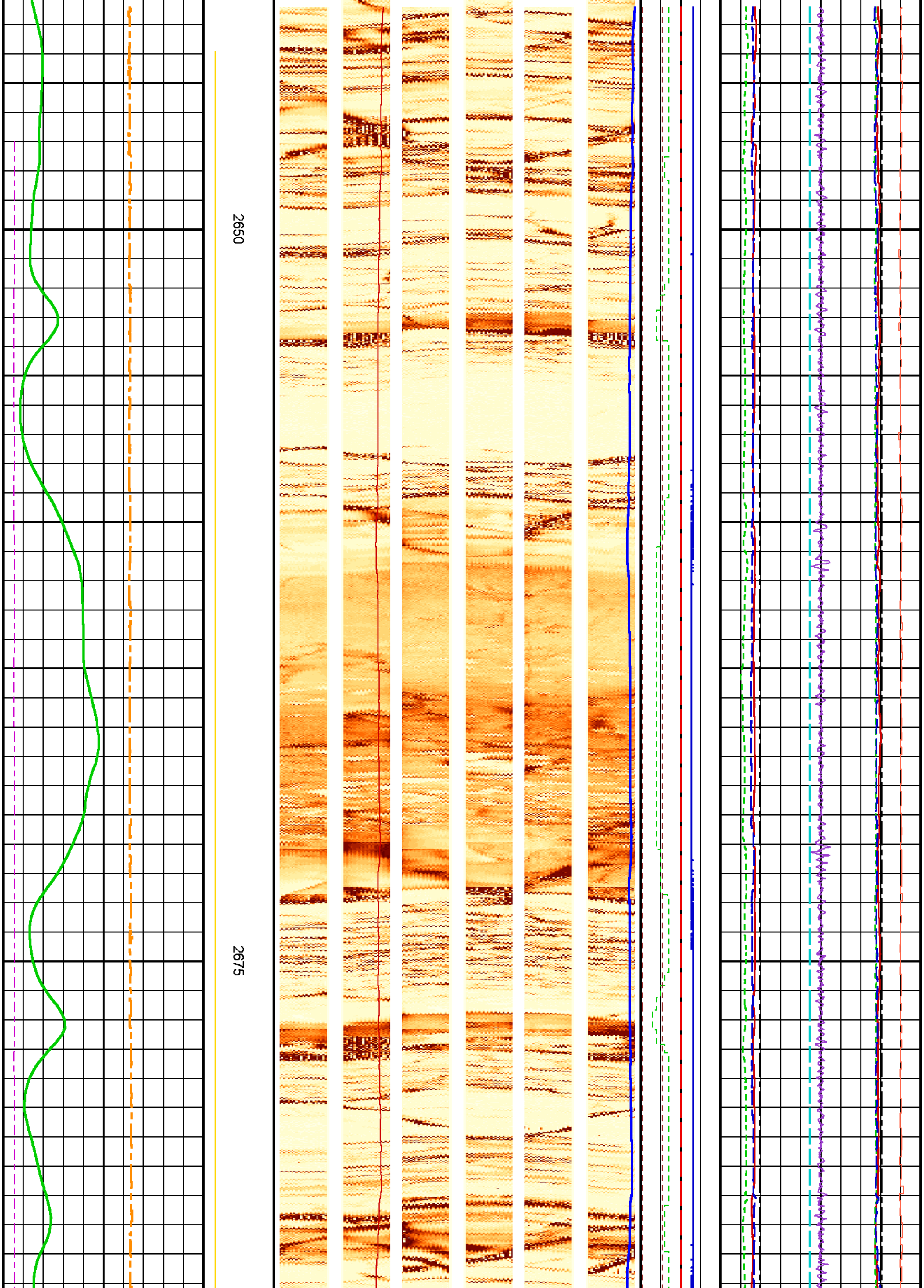
CURVE MEASURE POINT OFFSET

CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
AZSTQH	3.32	PADGQH	3.32	RAD4QH	3.32	RBSTQH	3.32
BKRGQH	3.32	QCKQSTQH	3.32	RAD5QH	3.32	RTELQH	3.32
DEVSTQH	3.32	QDFQSTQH	3.32	RAD6QH	3.32	SPD	0.00
GR	43.00	RAD1QH	3.32	RAZDSTQH	3.32	TENSTQH	3.32
GVRATQH	3.32	RAD2QH	3.32	RBIT1	3.25		
PADFQH	3.32	RAD3QH	3.32	RBIT4	3.25		

Presentation : HL6670:/dat1a/OH087602/star_image_REPEAT.fvpdf [25''/100' Scale]
Plot Interval : 2640 - 2893.5 Feet

Data File 1 : F1 : HL6670:/dat1a/OH087602/n837g01.aff
Created On : Jun 22 09:26:22 2014
Company : RESOLUTION COPPER COMPANY
Well : DHRES-15
Field : RESOLUTION COPPER
File Interval : 2589.25 - 2893.5 Feet
OCT : n837g

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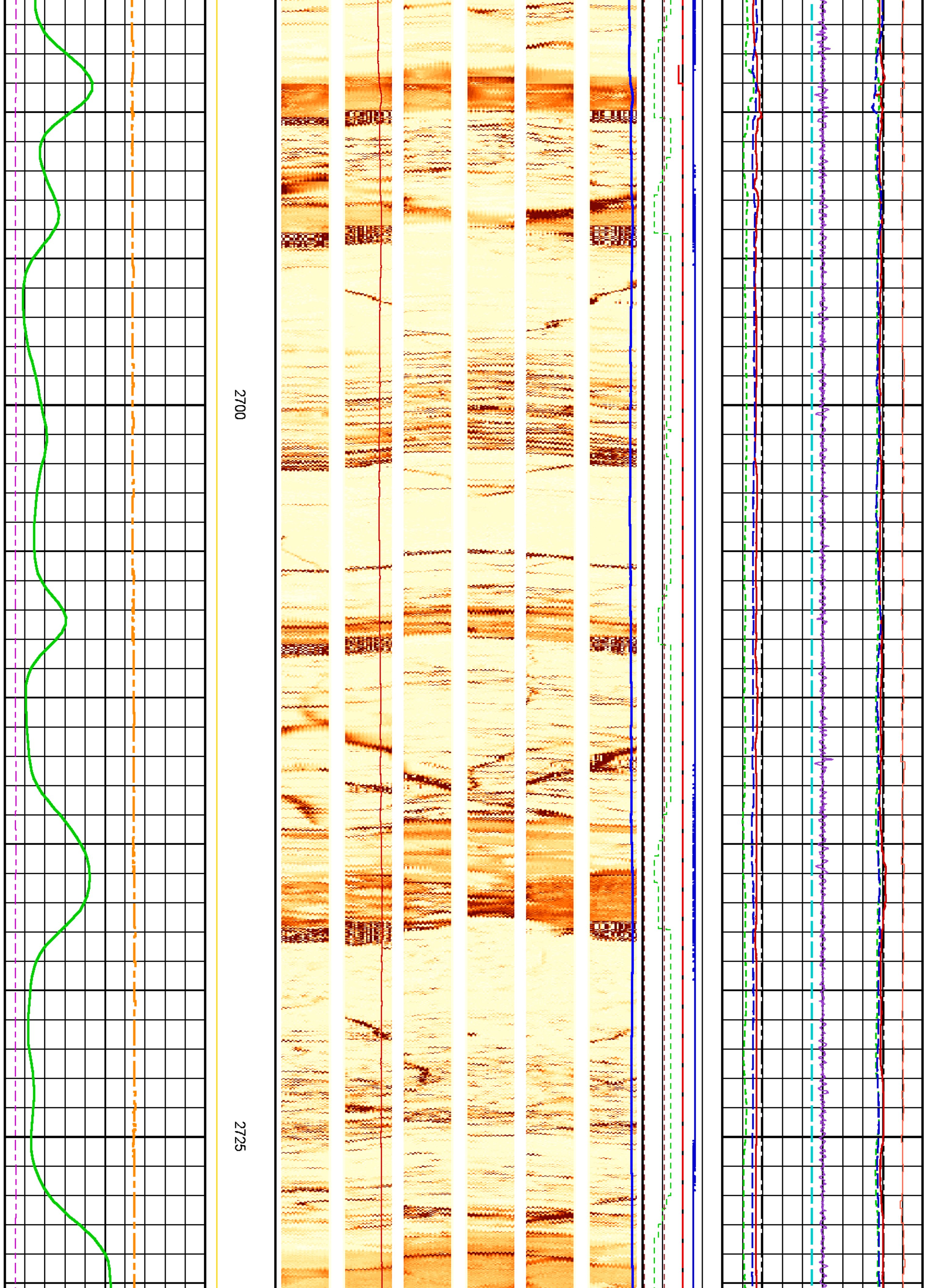
2675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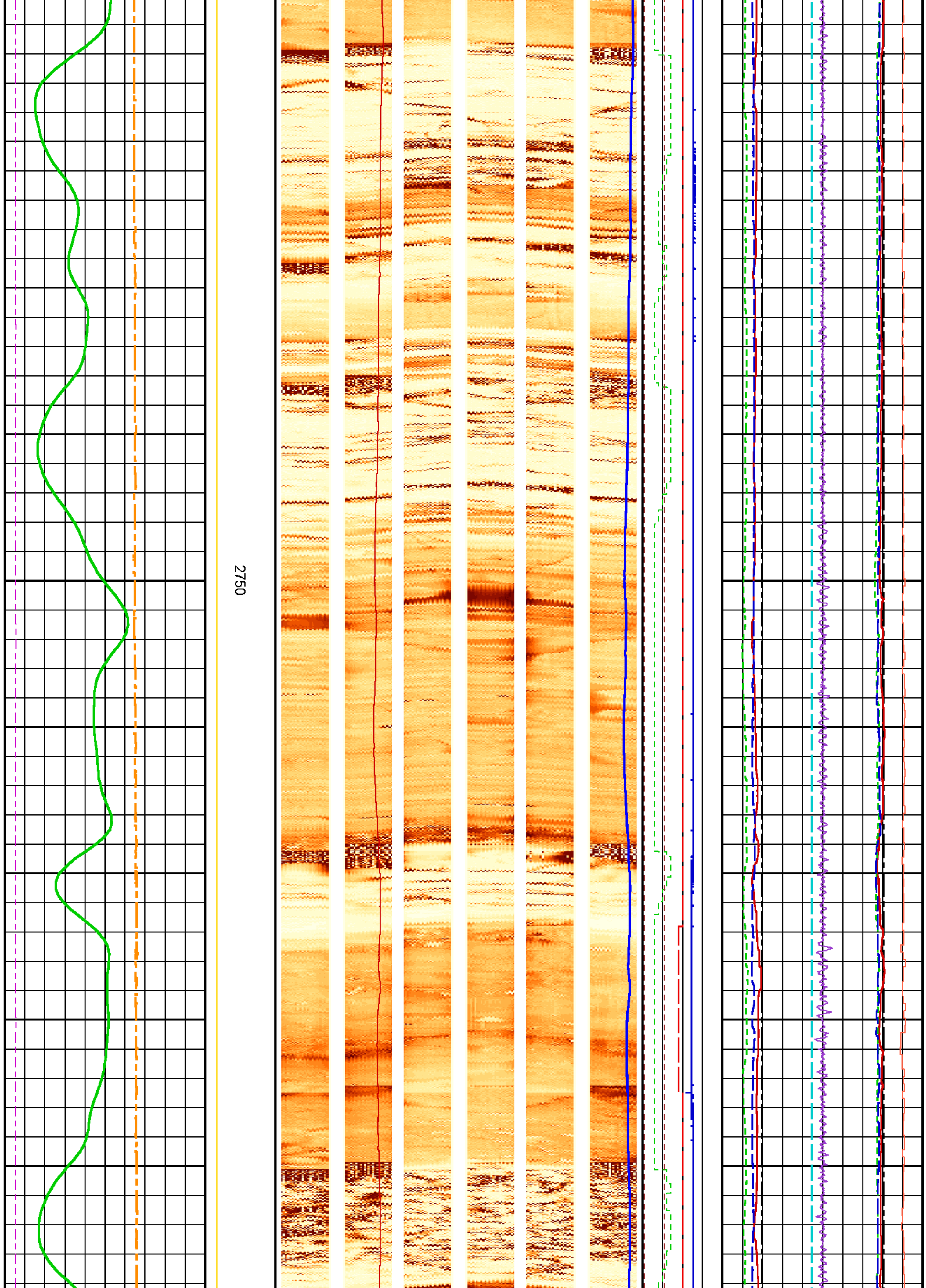
2725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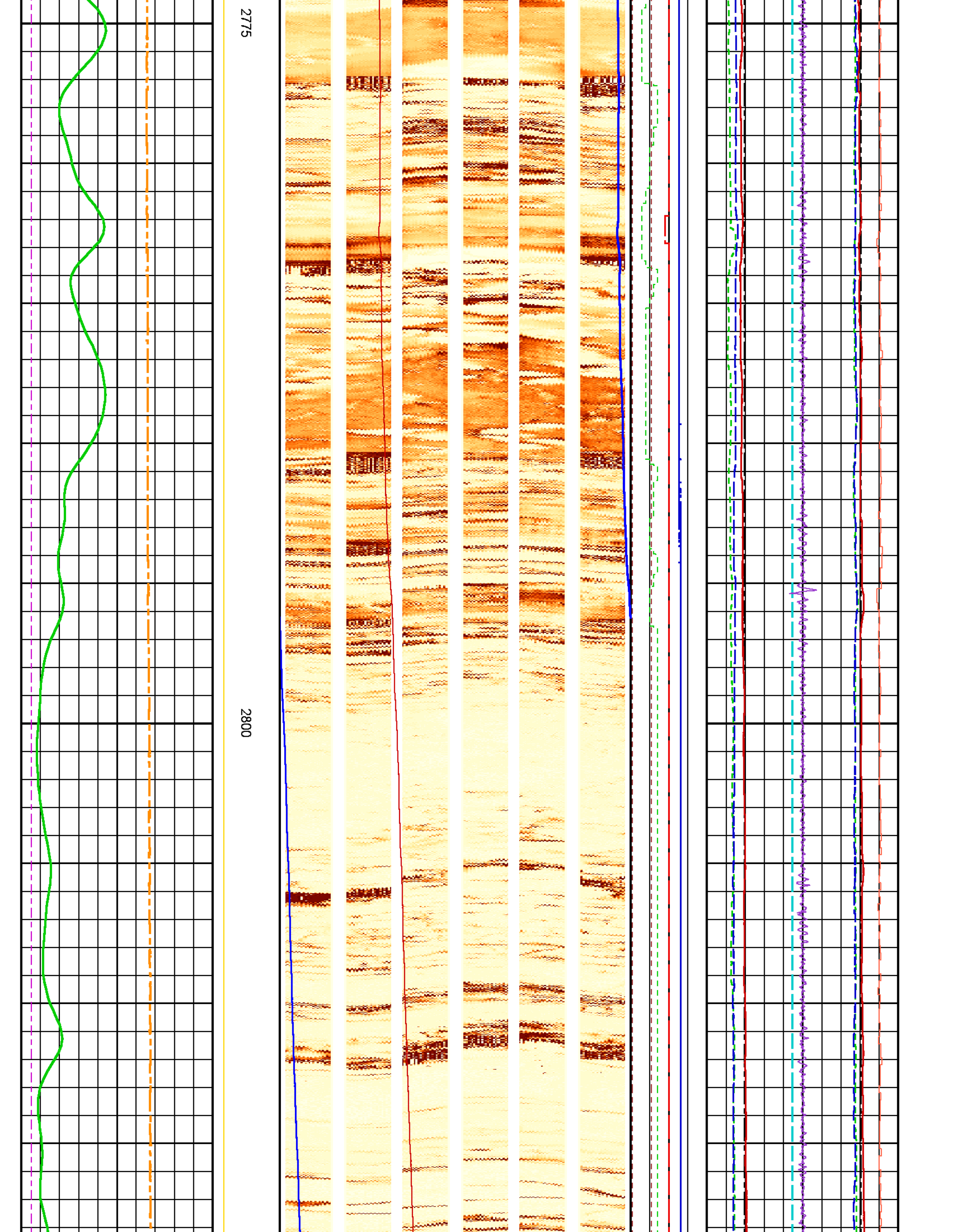
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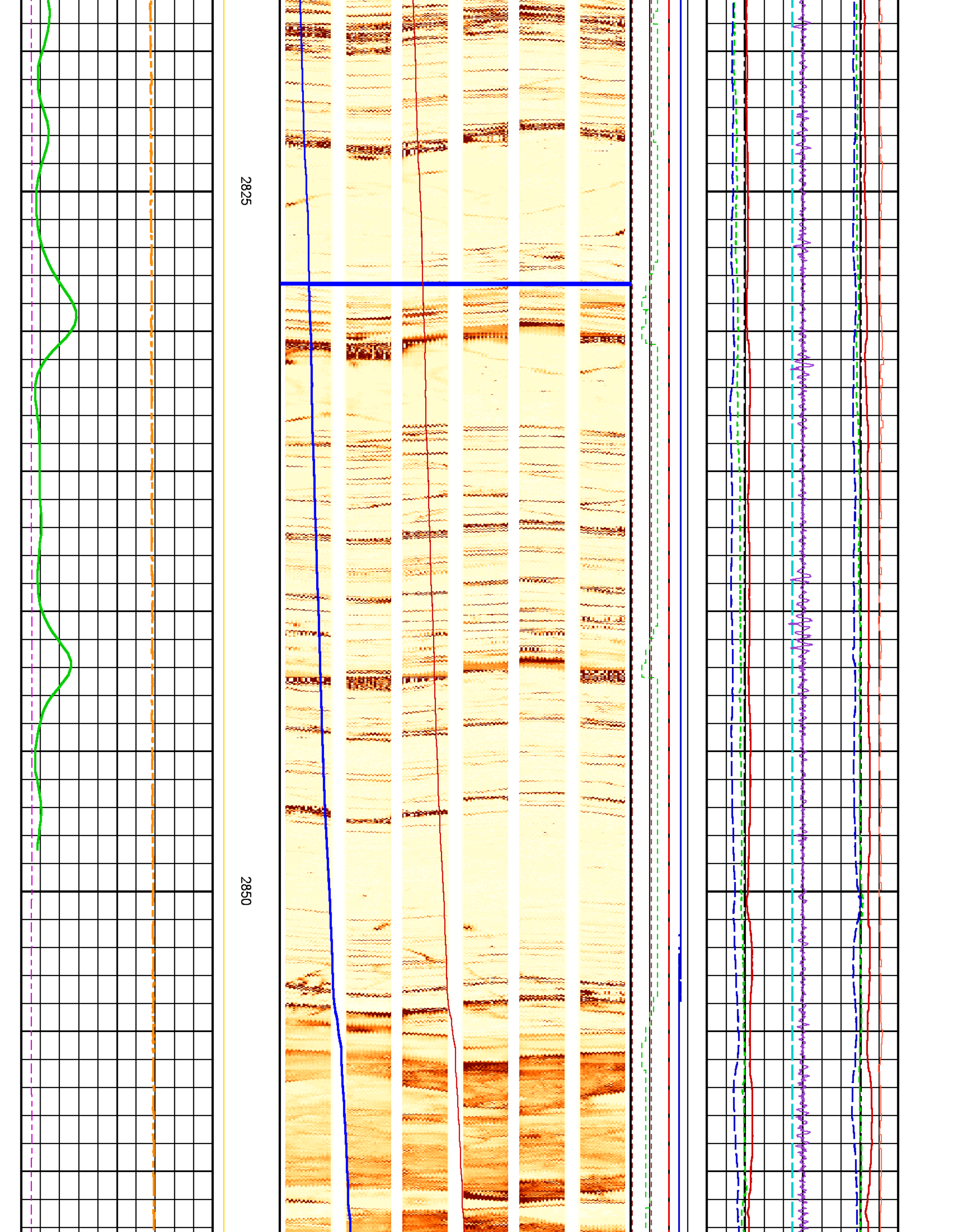
2800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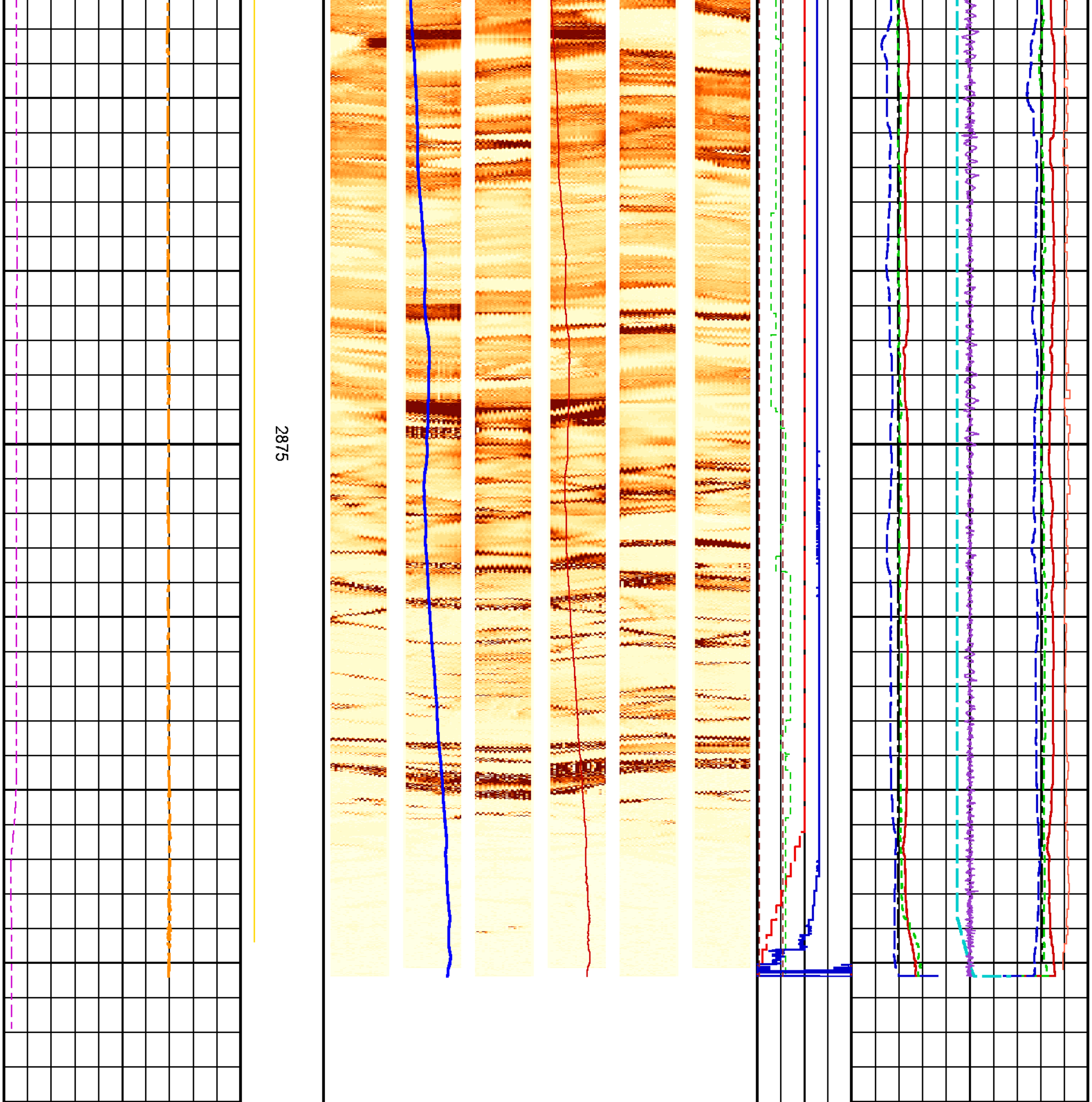
2850



GAMMA RAY [gr]
0 200
(gAPI)
SPEED [spd]
0 200
(ft/min)
DEVIATION [devst.h]
0 10
(deg)

FEET

TSM [qckqst.h]
0 12
(deg)
EXM [qdfqst.h]
12 0
(deg/ft)

RAW PAD DATA

AZIMUTH [azst.h]
390 30
(deg)
RELATIVE BEARING [rbst.h]
390 30
(deg)

PAD 1
24 0
0 1024
PAD 2
0 24
0 1024
PAD 3
24 0
0 1024
PAD 4
0 24

XMTRGN [bkrg.h]
0 20
(dim)
RCVRGN [padg.h]
0 20
(dim)
pwRTO [gvrat.h]
0.7 1.1
(1)
Rmde [rtel.h]
0
(dim)

BIT SIZE
10 0
(in)
RADIUS 1 [rad1.h]
10 0
(in)
RADIUS 2 [rad2.h]
10 0
(in)
RADIUS 3 [rad3.h]
10 0
(in)

BIT SIZE
0 10
(in)
RADIUS 4 [rad4.h]
0 10
(in)
RADIUS 5 [rad5.h]
0 10

(in)

PAD 5
24 0
0 1024

RADIUS 6 [rad6.h]
0 10
(in)

PAD 6
0 24
0 1024

0 1024

padforce [padf.h]
100 -100
(pct)

tenSTnf [tenst.h]
4500 -500
(lbf)

Z ACCEL. noG [razdst.h]
250 -250
(mG)

BAKER HUGHES

COMPANY	RESOLUTION COPPER COMPANY		FILE NO: US087602
WELL	DHRES-15		API NO:
FIELD	RESOLUTION COPPER		
COUNTY	PINAL	STATE AZ	

LOCATION:

NW SW SW

ELEVATIONS:

KB NA

DF

GL NA

RIG: NATIONAL 16

SEC 5 TWP 2S RGE 13E

DATE 22-Jun-2014

BAKER HUGHES

MAGNETIC RESONANCE EXPLORER LOG
GAMMA RAY LOG
(PRELIMINARY RESULTS)

FILE NO: US087602
API NO:

COMPANY	RESOLUTION COPPER COMPANY
WELL	DHRES-15
FIELD	RESOLUTION COPPER
COUNTY	PINAL STATE AZ

Ver. 3.87
RIG: NATIONAL 16

LOCATION:

SEC 5   TWP 2S   RGE 13E

OTHER SERVICES
STAR
DAL
TEMP
HDIL
WGI

PERMANENT DATUM GL   ELEVATION NA
LOG MEASURED FROM GL   0 FT   ABOVE P.D.
DRILL. MEAS. FROM GL

ELEVATIONS:
KB NA
DF
GL NA

DATE		22-Jun-2014			
RUN	TRIP	1	4		
SERVICE ORDER		US087602			
DEPTH DRILLER		2900 FT			
DEPTH LOGGER		NOT TAGGED			
BOTTOM LOGGED INTERVAL		2400 FT			
TOP LOGGED INTERVAL		1000 FT			
CASING DRILLER		14 IN	@ 40 FT		@
CASING LOGGER		NOT LOGGED			
BIT SIZE		12.25 IN			
TYPE OF FLUID IN HOLE		WBM			
DENSITY	VISCOSITY	9.7 LB/G	40 CP		
PH	FLUID LOSS	8.0	6.0 C3		
SOURCE OF SAMPLE		FLOWLINE			
RM AT MEAS. TEMP.		3.7 OHMM	@ 75 DEGF		@
RMF AT MEAS. TEMP.		5.6 OHMM	@ 74 DEGF		@
RMC AT MEAS. TEMP.		3.05 OHMM	@ 71 DEGF		@
SOURCE OF RMF	RMC	MEASURED	MEASURED		
RM AT BHT		2.59 OHMM	@ 117 DEGF		@
TIME SINCE CIRCULATION		23 HRS			
MAX. RECORDED TEMP.		113 DEGF			
EQUIP. NO.	LOCATION	6670	GRAND JCT		
RECORDED BY		D SMITH / T VERCIMAK			
WITNESSED BY		M SHELLEY			

BOREHOLE RECORD

BIT SIZE	FROM	TO
12.25 IN	40 FT	2900 FT

CASING RECORD

SIZE	WEIGHT	GRADE	FROM	TO
14 IN			0 FT	40 FT

REMARKS

RUN 1 TRIP 4: MREX-GR RAN DECENTRALIZED

MREX LOGGED IN PORO PERM MODE WITH TW = 6.434 SEC
CALIPER PRESENTED FROM LOG RUN 2: HDIL/DAL/WGI/GR

THANK YOU FOR CHOOSING BAKER HUGHES WIRELINE SERVICES

CREW: VERCIMAK/SMITH/HOLLER/BAUGHMAN

EQUIPMENT DATA

RUN	TRIP	TOOL	SERIES NO.	SERIAL NO.	POSITION
1	4	PWRADPT2	4430XB	1244777	FREE
1	4	SWVL	3944XD	10158308	FREE
1	4	TTRM	3981XA	10516527	FREE
1	4	WTS	3514XB	10240730	FREE
1	4	DSL	1329XA	10196895	FREE
1	4	CAP SUB	1022PB	10379396	DECENTRALIZED
1	4	MREX	1036EC / 3218MB	12514556 / 10161143	DECENTRALIZED

MAIN LOG 5"/100FT SCALE

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 19:02:26 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n857d03.prm
LOGGING MODE: DEPTH   DIRECTION: UP
TOP DEPTH: 979.750 ft   BOTTOM DEPTH: 2427.729 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
TTRM	FILTER (.td)	medium (1)		TOP	BOTTOM
SPEED	FILTER ()	medium (1)		"	"
TENSION	FILTER ()	medium (1)		"	"
GR	FILTER ()	medium (1)		"	"
	FILTER (.h)	medium (1)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
BIT SIZE	BIT SIZE	12.250	in	TOP	BOTTOM

MREX GENERAL

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
MREX TCC	ACM NAME	PoroPerm		TOP	BOTTOM

MREX ACQUISITION PARAMETERS

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
MREX TCC	SUBSET 0 INTERVAL	8.000	s	TOP	BOTTOM
	NUM FREQ GROUPS	2		"	"
	1ST FREQ	INDEX 12, 961.5 kHz		"	"
	2ND FREQ	INDEX 4, 612.7 kHz		"	"
	3RD FREQ	INDEX 8, 763.4 kHz		"	"
	4TH FREQ	INDEX 10, 857.2 kHz		"	"
	5TH FREQ	INDEX 2, 553.2 kHz		"	"
	6TH FREQ	INDEX 6, 686.3 kHz		"	"
	NOMINAL TIP ANG (B)	135	deg	"	"
	PULSE SHAPE	SOFT		"	"
	1ST T2 TE	0.60	ms	"	"
	1ST T2 ECHOES	833		"	"
	1ST T2 TW	6.434	s	"	"
	1ST T2 TRAIN LENGTH	500	ms	"	"
	1ST BVI TE	0.60	ms	"	"
	1ST BVI ECHOES	50		"	"
	1ST BVI TW	0.100		"	"
	1ST BVI TRAIN LEN	30	ms	"	"
	CBW TE	0.40	ms	"	"
	CBW ECHOES/PACKET	24		"	"
	CBW TRAIN LENGTH	10	ms	"	"

	1ST CBW PACKETS	68		"	"
	CBW TW	0.020	s	"	"

MREX PROCESSING

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
NOISE & CAL PULSE SELECTION	FREQ DISPLAY SELECT	FREQUENCY A		TOP	BOTTOM
POROSITY	MBVI/MBVM BOUNDARY	CARBONATE (92 ms)		"	"
	USER MBVI/MBVM	92	ms	"	"
	CBW CUTOFF	3.30	ms	"	"
PERMEABILITY	Coates M exponent	4.000		"	"
	Coates N exponent	2.000		"	"
	Coates Constant	10.000		"	"
AVERAGING LENGTH (SAMPLES)	ET Averaging Length	4 samples		"	"
INVERSION (FITTING) PARAMETERS	T2 FIRST BIN	4.00	ms	"	"
	T2 LAST BIN	2048.00	ms	"	"
	T2 BINS USED	19		"	"
	BVI FIRST BIN	4.00	ms	"	"
	BVI LAST BIN	1024.00	ms	"	"
	BVI BINS USED	13		"	"
	CBW FIRST BIN	0.35	ms	"	"
	CBW LAST BIN	1024.00	ms	"	"
	CBW BINS USED	16		"	"
	TPOR FIRST BIN	0.35	ms	"	"
	TPOR LAST BIN	2048.00	ms	"	"
	TPOR BINS USED	26		"	"
RESET PHASE ROTATION ANGLE	RESET ACCUM. PHASE	RESET ACCUM PHASE		"	"
MREX FORMATION/BOREHOLE TEMP	BOREHOLE TEMP SRC	MEASURED (3981/3980)		"	"

CURVE DESCRIPTION REPORT

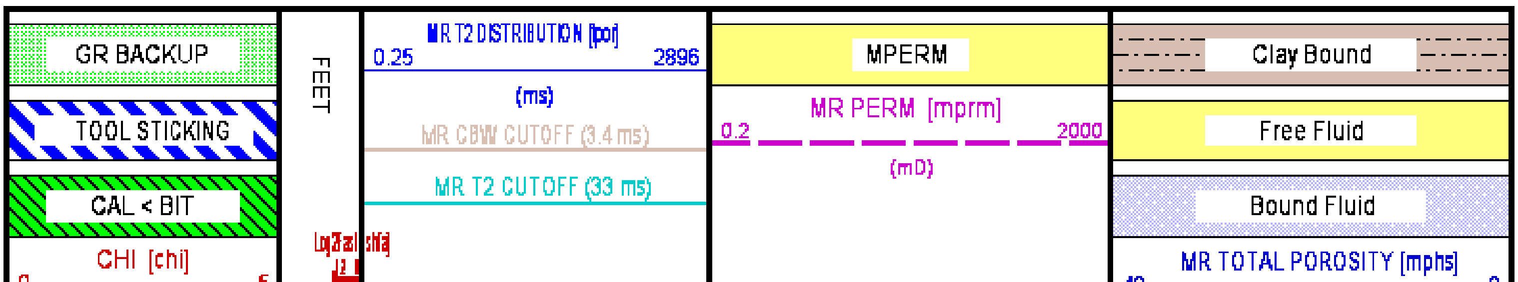
CURVE NAME	CREATION DATE	CURVE DESCRIPTION
F1:BIT	Jun 22 17:13:11 2014	BIT SIZE
F1:CAL	Jun 22 17:13:11 2014	CALIPER
F1:CHI	Jun 22 17:13:11 2014	GOODNESS OF FIT OF EACH ECHO DATA PACKET
F1:GR	Jun 22 17:13:11 2014	GAMMA RAY
F1:MBVI	Jun 22 17:13:11 2014	MR IRREDUCIBLE FLUIDS
F1:MPHE	Jun 22 17:13:11 2014	MR EFFECTIVE POROSITY
F1:MPHS	Jun 22 17:13:11 2014	MR TOTAL POROSITY
F1:MPRM	Jun 22 17:13:11 2014	MR PERMEABILITY
F1:QSHFA	Jun 22 17:13:11 2014	QUALITY OF SHIFTED DATA OF 1ST T2
F1:SPD	Jun 22 17:13:11 2014	SPEED
F1:TEN	Jun 22 17:13:11 2014	DIFFERENTIAL TENSION
F1:TPOR	Jun 22 17:13:11 2014	TOTAL POROSITY (CBW + T2 BIN ARRAY)

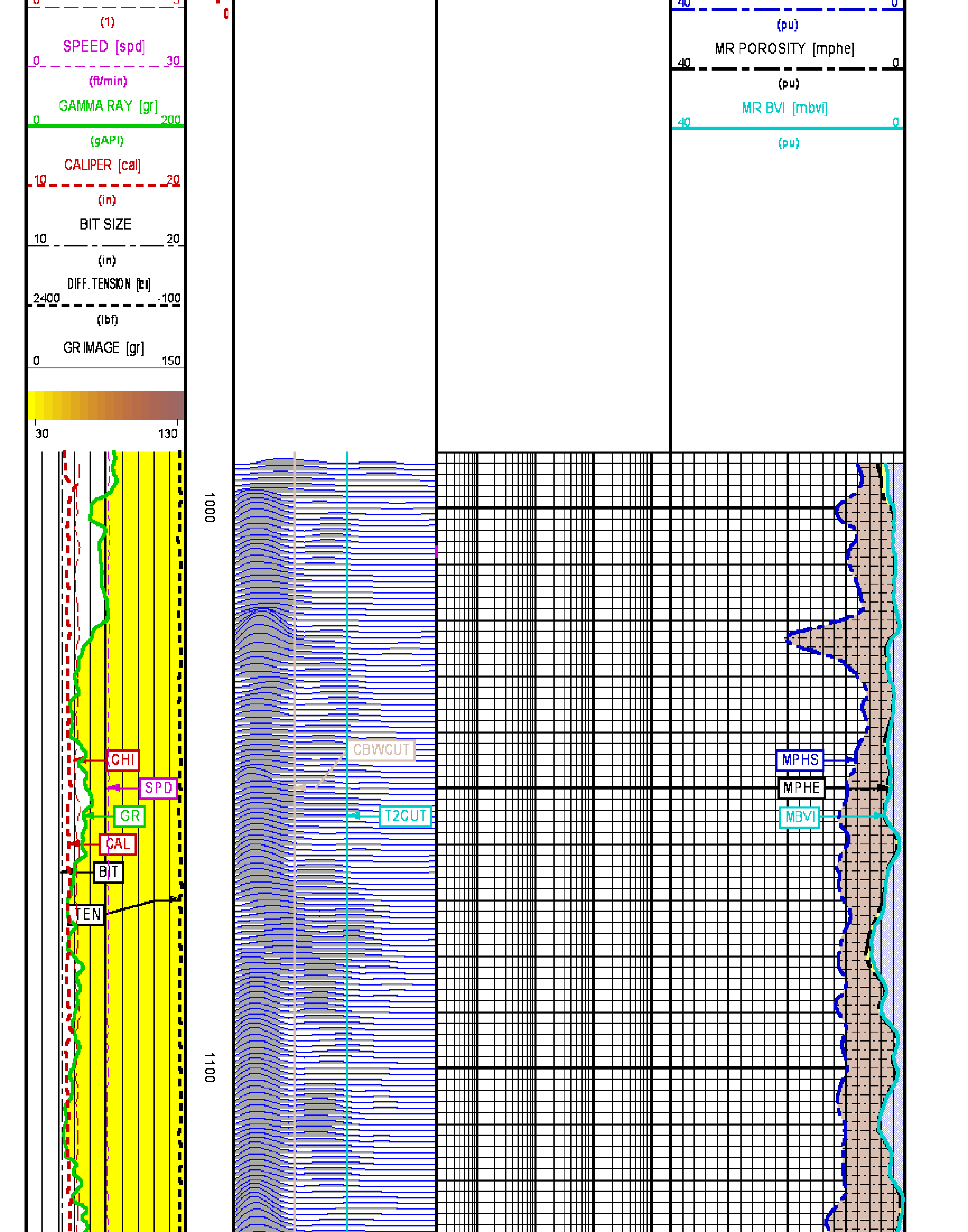
CURVE MEASURE POINT OFFSET

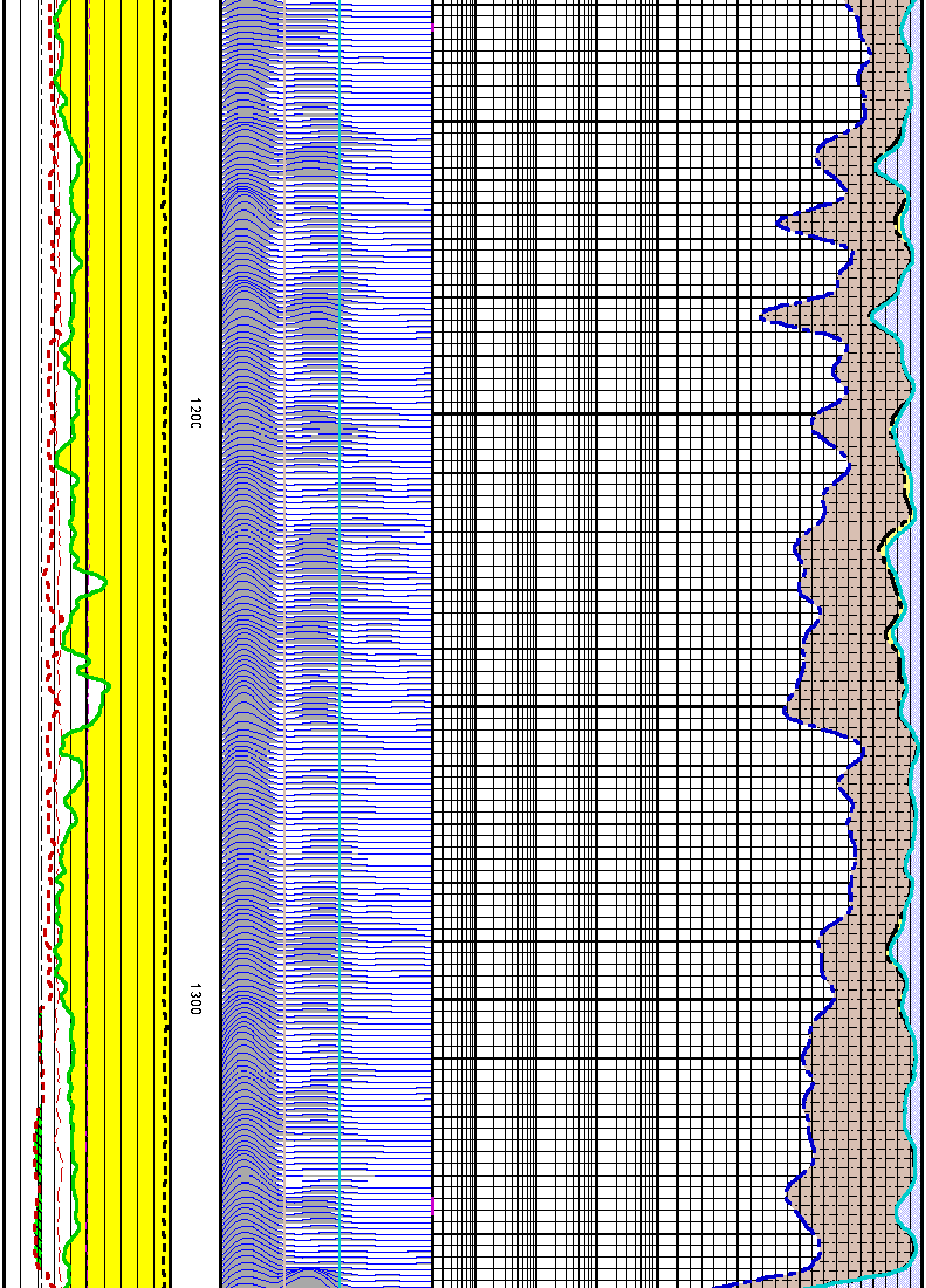
CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
BIT	0.00	GR	26.00	MPHS	5.00	SPD	0.00
CAL	31.75	MBVI	5.00	MPRM	5.00	TEN	0.00
CHI	5.00	MPHE	5.00	QSHFA	5.00	TPOR	5.00

Presentation : HL6670:/dat1a/OH087602/mrex_pp_std_4lg_MAIN.fvpdf [5"/100' Scale]
Plot Interval : 990 - 2424.5 Feet

Data File 1 : F1 : HL6670:/dat1a/OH087602/MREX_MAIN.xtf
Created On : Jun 22 17:13:11 2014
Company : RESOLUTION COPPER COMPANY
Well : DHRES-15
Field : RESOLUTION COPPER
File Interval : 32 - 5744 Feet
OCT : n857d




(1)
SPEED [spd]
0 30
(ft/min)
GAMMA RAY [gr]
0 200
(gAPI)
CALIPER [cal]
10 20
(in)
BIT SIZE
10 20
(in)
DIFF. TENSION [lbf]
2400 -100
(lbf)
GR IMAGE [gr]
0 150
30 130
(pu)
MR POROSITY [mphe]
40 0
(pu)
MR BVI [mbvi]
40 0
(pu)
1000
1100
CHI
SPD
GR
CAL
BIT
TEN
CBWCUT
T2CUT
MPHS
MPHE
MBVI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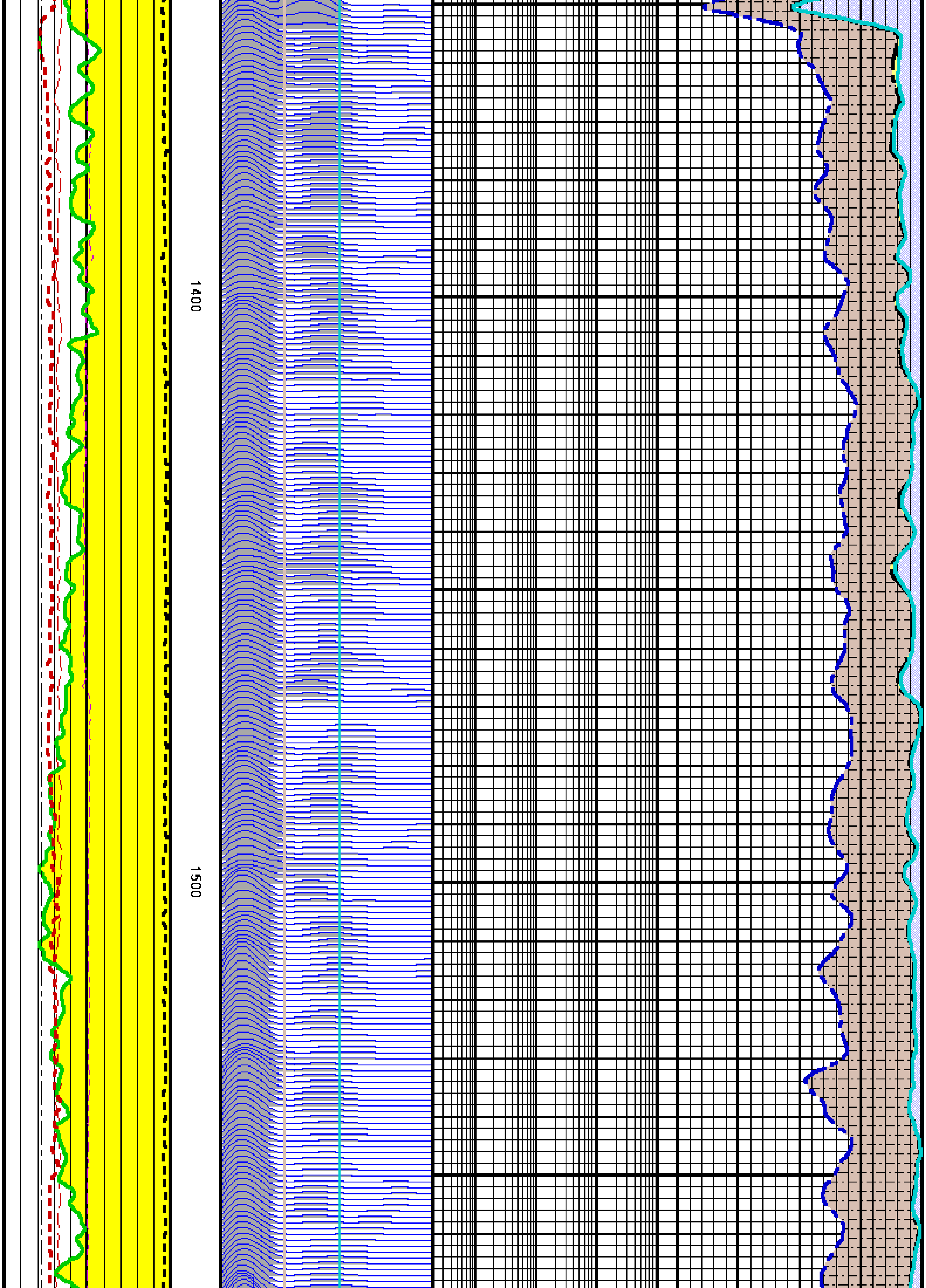
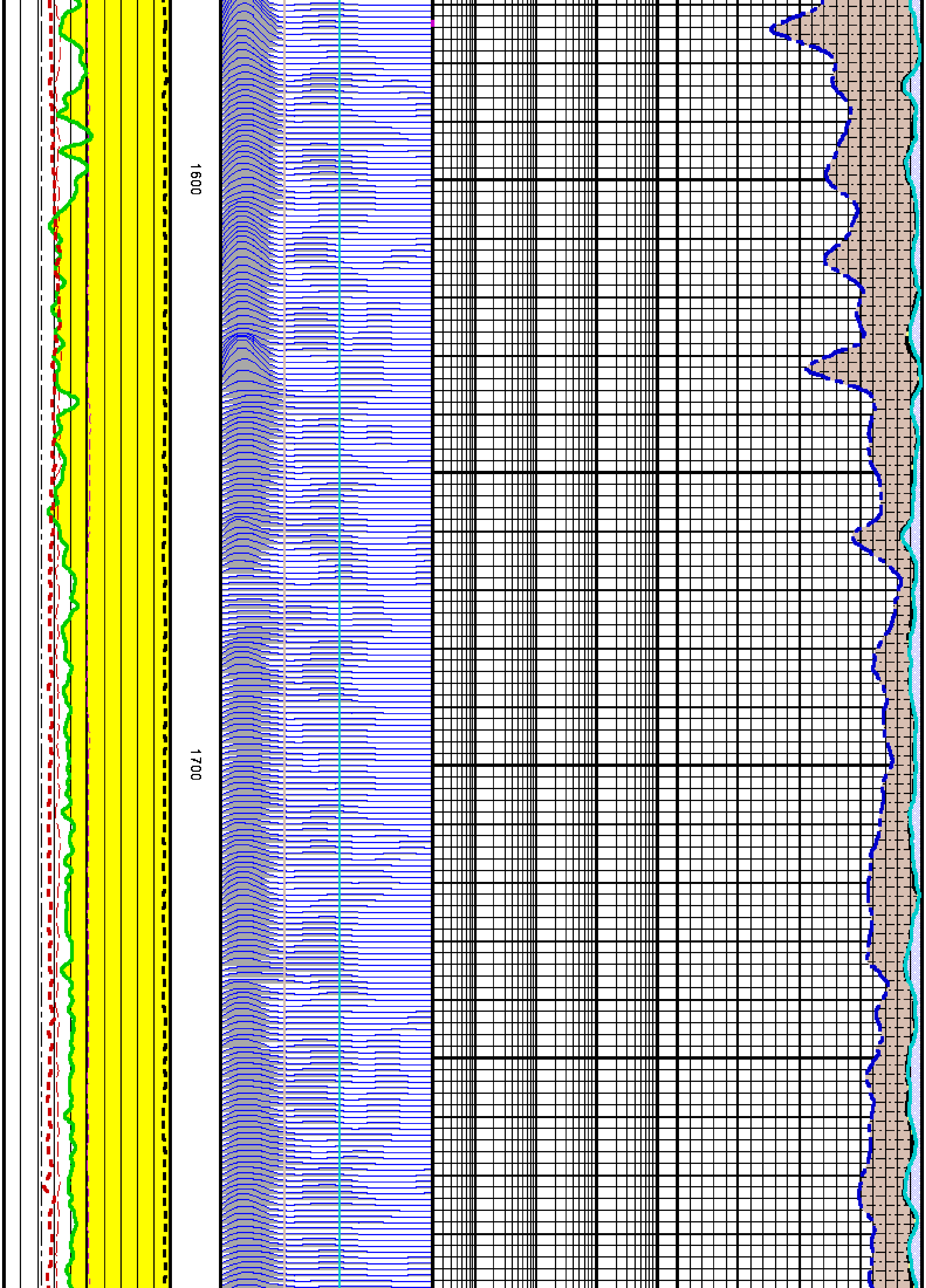
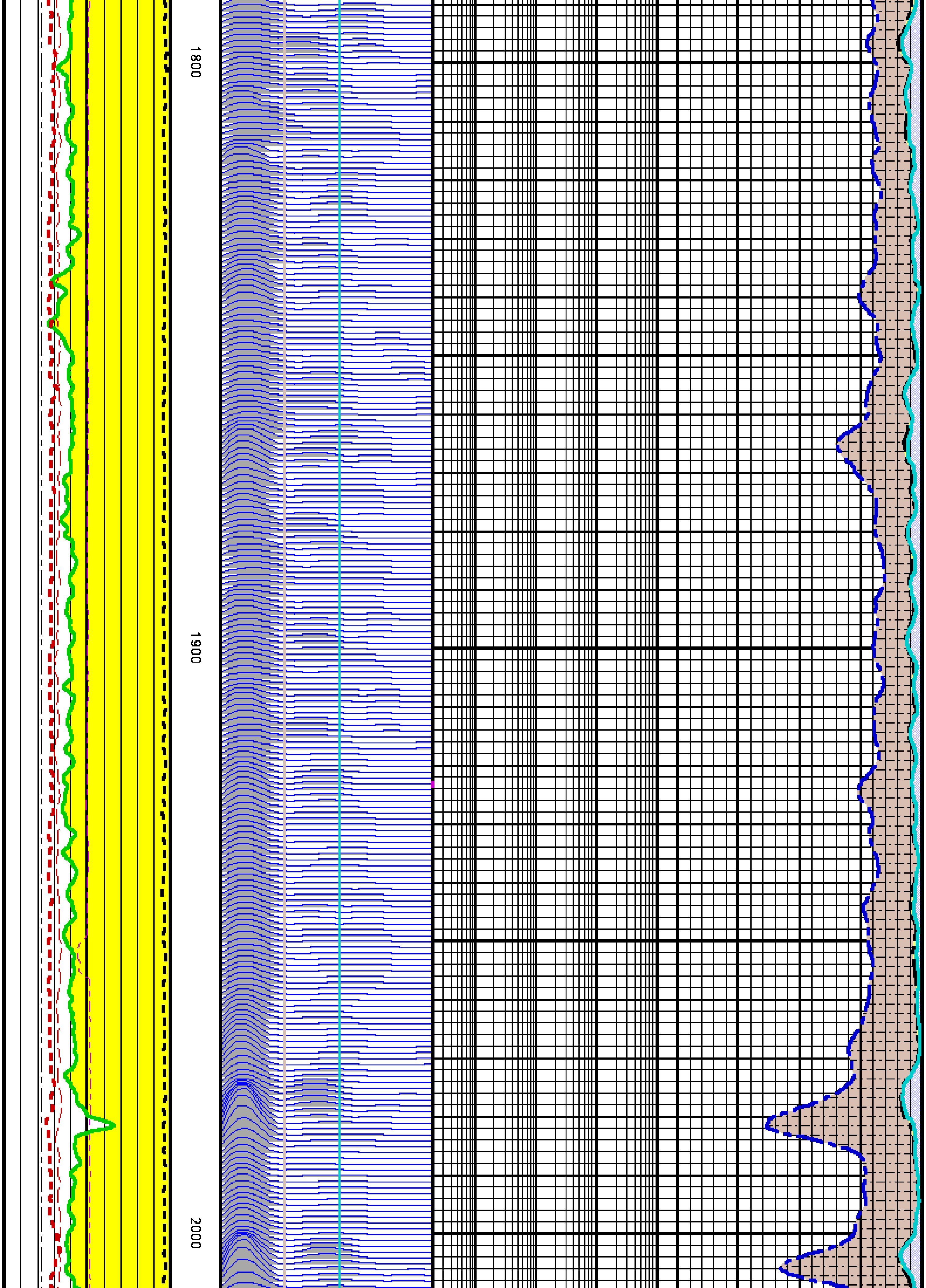
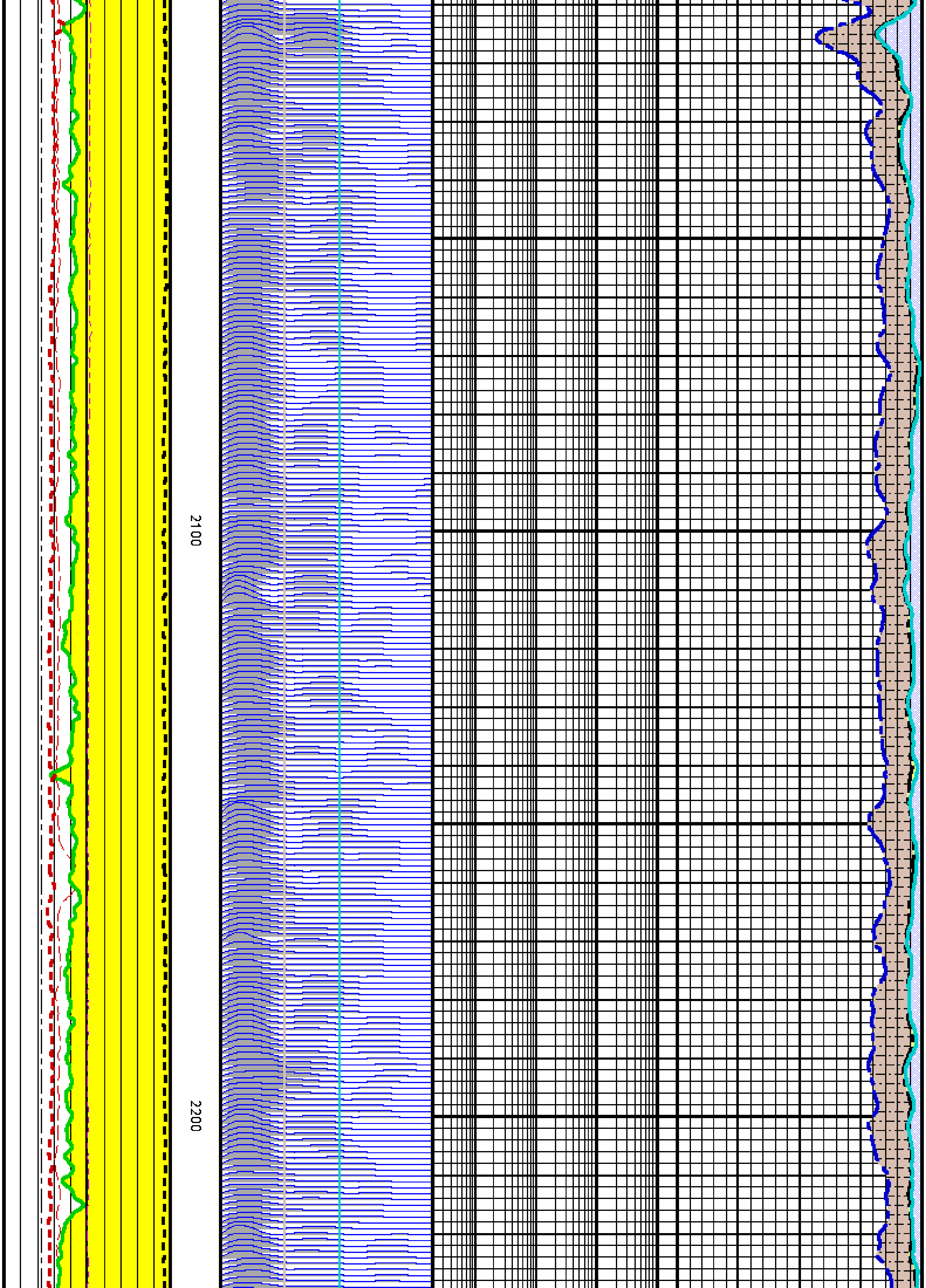
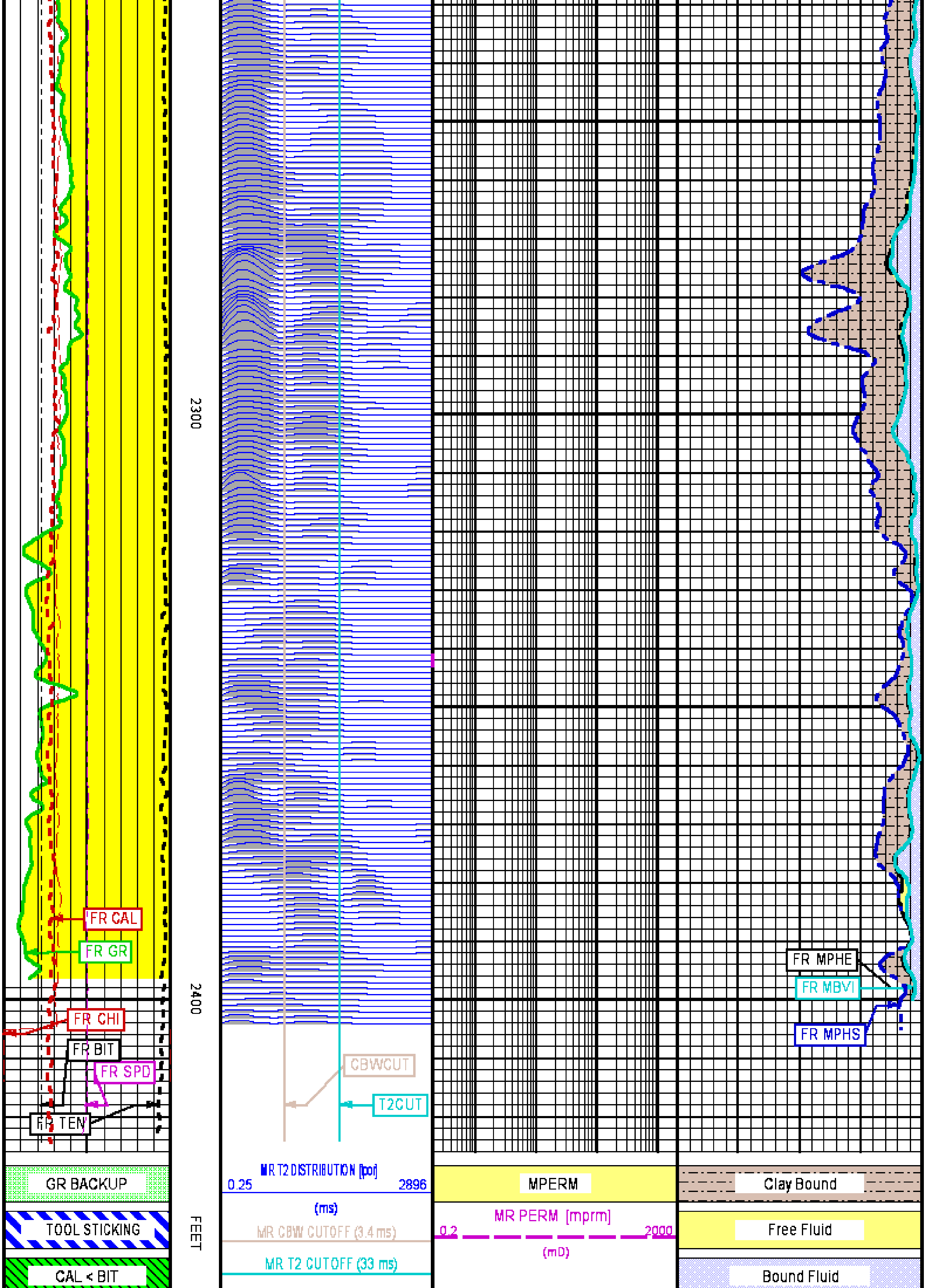
1300


1400
1500

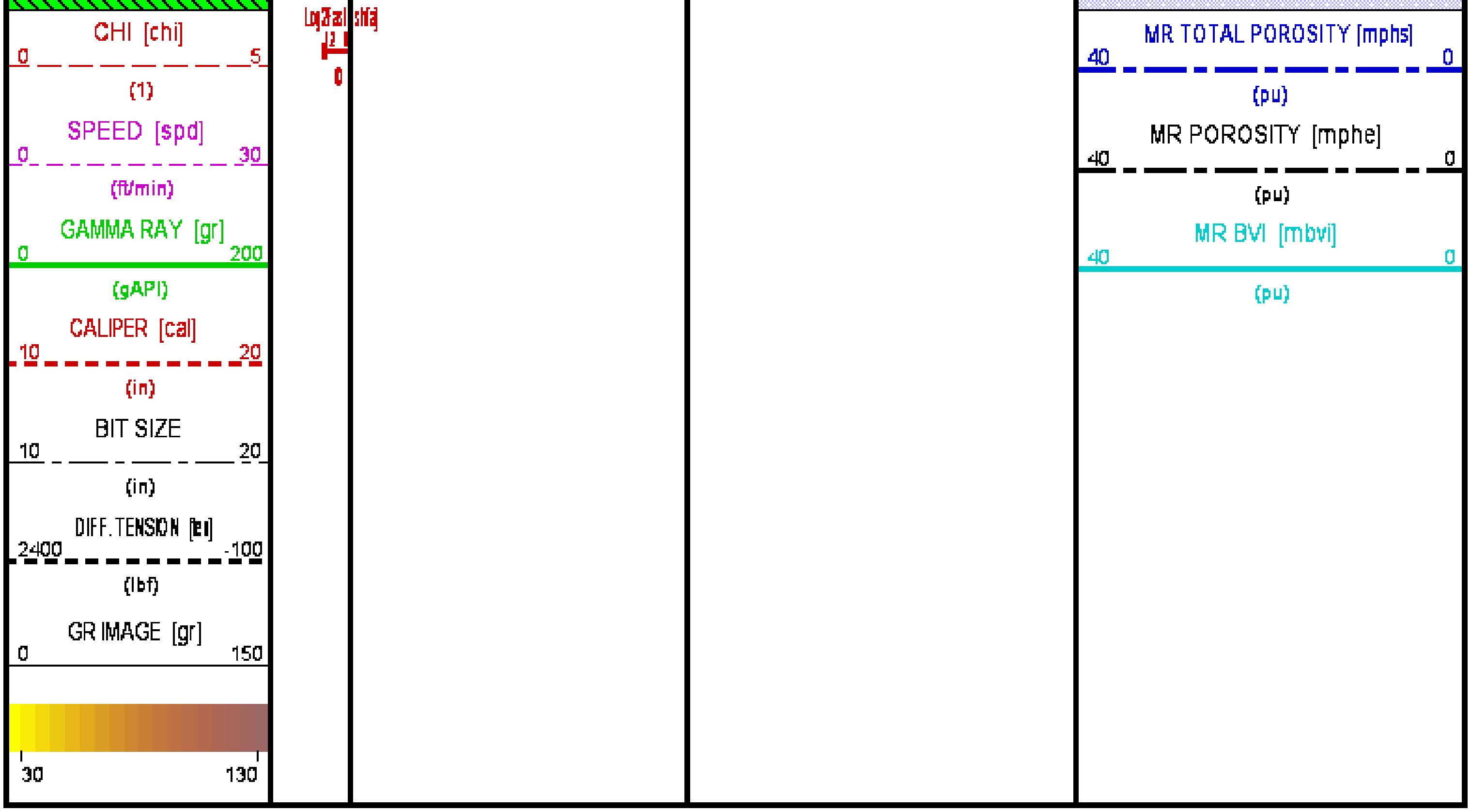

1600
1700


1800
1900
2000


2100
2200



2300
2400
FEET
FR CAL
FR GR
FR CHI
FR BIT
FR SPD
FR TEN
GR BACKUP
TOOL STICKING
CAL < BIT
CBWCUT
T2CUT
MR T2 DISTRIBUTION [pof]
0.25
2896
(ms)
MR CBW CUTOFF (3.4 ms)
MR T2 CUTOFF (33 ms)
MPERM
MR PERM [mprm]
0.2
2000
(mD)
FR MPHE
FR MBVI
FR MPHS
Clay Bound
Free Fluid
Bound Fluid



REPEAT LOG

ECLIPS 6.2i ECLIPS General Release Rel 6.2i Wed Jun 12 12:21:40 CDT 2013
Updates: 1

Plotted: Sun Jun 22 18:14:19 2014

PARAMETER AND FILTER SUMMARY REPORT

FILE: /dat1a/OH087602/n857d02.prm
LOGGING MODE: DEPTH DIRECTION: UP
TOP DEPTH: 2186.750 ft BOTTOM DEPTH: 2437.984 ft

SYMMETRIC FILTER

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
TTRM	FILTER (.td)	medium (1)		TOP	BOTTOM
SPEED	FILTER ()	medium (1)		"	"
TENSION	FILTER ()	medium (1)		"	"
GR	FILTER ()	medium (1)		"	"
	FILTER (.h)	medium (1)		"	"

BOREHOLE & CEMENT

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
BIT SIZE	BIT SIZE	12.250	in	TOP	BOTTOM

MREX GENERAL

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
MREX TCC	ACM NAME	PoroPerm		TOP	BOTTOM

MREX ACQUISITION PARAMETERS

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
MREX TCC	SUBSET 0 INTERVAL	8.000	s	TOP	BOTTOM
	NUM FREQ GROUPS	2		"	"
	1ST FREQ	INDEX 12, 961.5 kHz		"	"
	2ND FREQ	INDEX 4, 612.7 kHz		"	"
	3RD FREQ	INDEX 8, 763.4 kHz		"	"
	4TH FREQ	INDEX 10, 857.2 kHz		"	"
	5TH FREQ	INDEX 2, 553.2 kHz		"	"
	6TH FREQ	INDEX 6, 686.3 kHz		"	"
	NOMINAL TIP ANG (B)	135	deg	"	"
	PULSE SHAPE	SOFT		"	"
	1ST T2 TE	0.60	ms	"	"
	1ST T2 ECHOES	833		"	"
	1ST T2 TW	6.434	s	"	"
	1ST T2 TRAIN LENGTH	500	ms	"	"
	1ST BVI TE	0.60	ms	"	"
	1ST BVI ECHOES	50		"	"
	1ST BVI TW	0.100		"	"
	1ST BVI TRAIN LEN	30	ms	"	"
	CBW TE	0.40	ms	"	"
	CBW ECHOES/PACKET	24		"	"
	CBW TRAIN LENGTH	10	ms	"	"
	1ST CBW PACKETS	68		"	"
	CBW TW	0.020	s	"	"

MREX PROCESSING

MEASUREMENT TYPE	PARAMETER	VALUE	UNITS	INTERVAL (ft)	
NOISE & CAL PULSE SELECTION	FREQ DISPLAY SELECT	FREQUENCY A		TOP	BOTTOM
POROSITY	MBVI/MBVM BOUNDARY	CARBONATE (92 ms)		"	"
	USER MBVI/MBVM	92	ms	"	"
	CBW CUTOFF	3.30	ms	"	"
PERMEABILITY	Coates M exponent	4.000		"	"
	Coates N exponent	2.000		"	"
	Coates Constant	10.000		"	"
AVERAGING LENGTH (SAMPLES)	ET Averaging Length	4 samples		"	"
INVERSION (FITTING) PARAMETERS	T2 FIRST BIN	4.00	ms	"	"
	T2 LAST BIN	2048.00	ms	"	"
	T2 BINS USED	19		"	"
	BVI FIRST BIN	4.00	ms	"	"
	BVI LAST BIN	1024.00	ms	"	"
	BVI BINS USED	13		"	"
	CBW FIRST BIN	0.35	ms	"	"
	CBW LAST BIN	1024.00	ms	"	"
	CBW BINS USED	16		"	"
	TPOR FIRST BIN	0.35	ms	"	"
	TPOR LAST BIN	2048.00	ms	"	"
	TPOR BINS USED	26		"	"
RESET PHASE ROTATION ANGLE	RESET ACCUM. PHASE	RESET ACCUM PHASE		"	"
MREX FORMATION/BOREHOLE TEMP	BOREHOLE TEMP SRC	MEASURED (3981/3980)		"	"

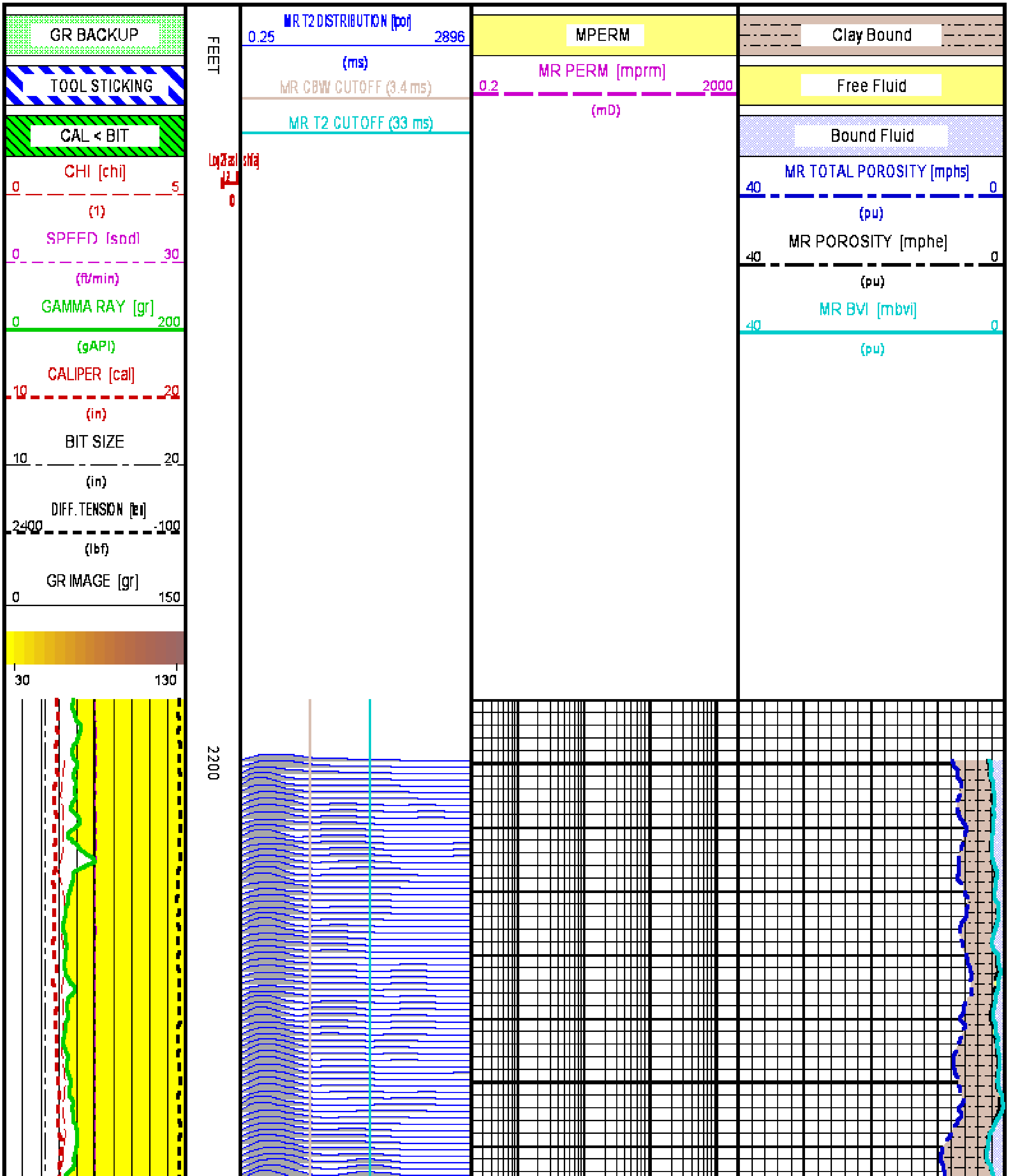
CURVE DESCRIPTION REPORT

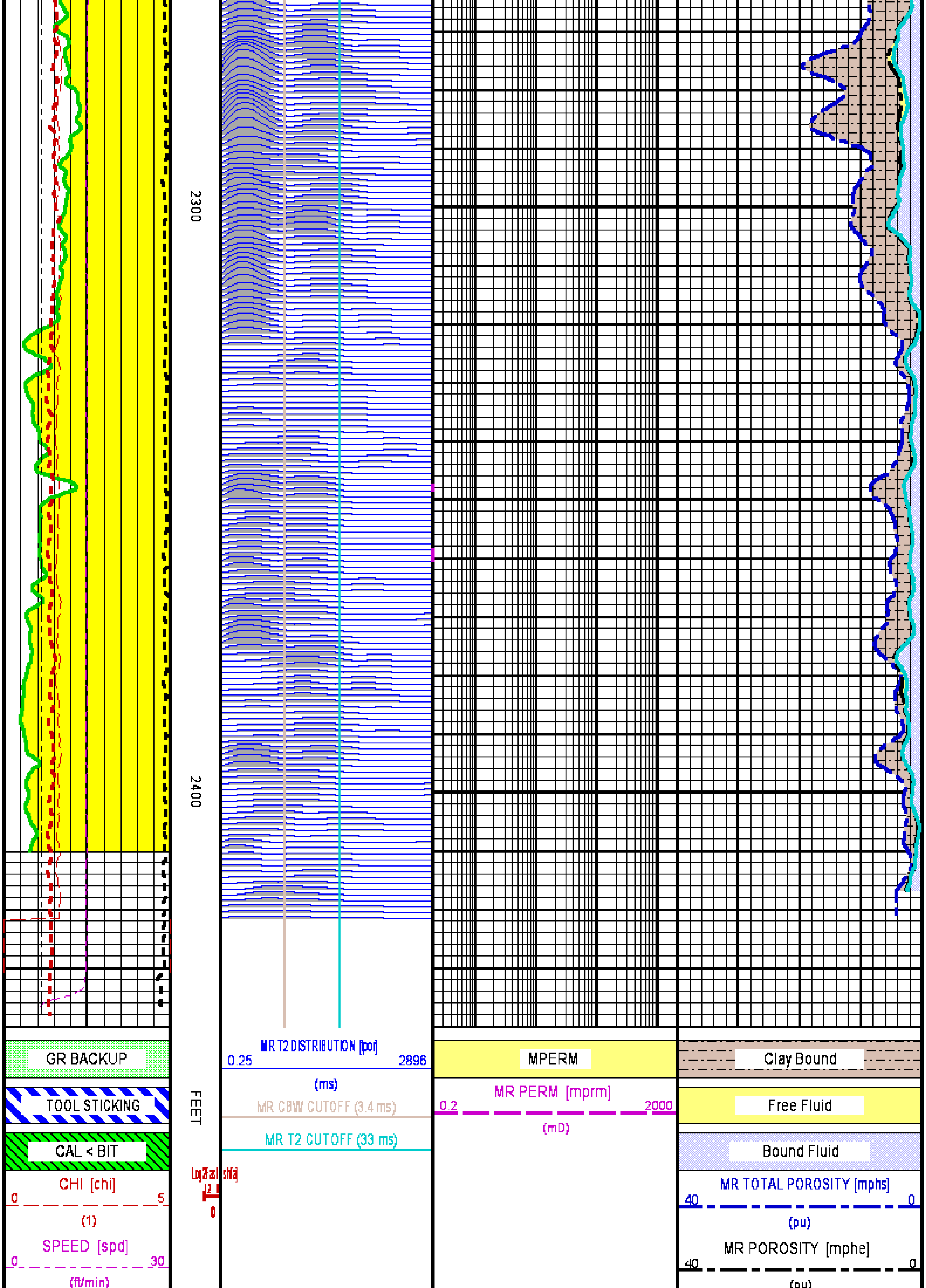
CURVE NAME	CREATION DATE	CURVE DESCRIPTION
F1:BIT	Jun 22 16:50:43 2014	BIT SIZE
F1:CAL	Jun 22 16:50:43 2014	CALIPER
F1:CHI	Jun 22 16:50:43 2014	GOODNESS OF FIT OF EACH ECHO DATA PACKET
F1:GR	Jun 22 16:50:43 2014	GAMMA RAY
F1:MBVI	Jun 22 16:50:43 2014	MR IRREDUCIBLE FLUIDS
F1:MPHE	Jun 22 16:50:43 2014	MR EFFECTIVE POROSITY
F1:MPHS	Jun 22 16:50:43 2014	MR TOTAL POROSITY
F1:MPRM	Jun 22 16:50:43 2014	MR PERMEABILITY
F1:QSHFA	Jun 22 16:50:43 2014	QUALITY OF SHIFTED DATA OF 1ST T2
F1:SPD	Jun 22 16:50:43 2014	SPEED
F1:TEN	Jun 22 16:50:43 2014	DIFFERENTIAL TENSION
F1:TPOR	Jun 22 16:50:43 2014	TOTAL POROSITY (CBW + T2 BIN ARRAY)

CURVE MEASURE POINT OFFSET

CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)	CURVE	OFFSET (ft)
BIT	0.00	GR	26.00	MPHS	5.00	SPD	0.00
CAL	31.75	MBVI	5.00	MPRM	5.00	TEN	0.00
CHI	6.00	MPHE	6.00	QSHFA	6.00	TPOR	6.00

Presentation	**: HL6670:/dat1a/OH087602/mrex_pp_std_4lg_REPEAT.fvpdf [5"/100' Scale]**
Plot Interval	**: 2190 - 2440 Feet**
Data File 1	**: F1 : HL6670:/dat1a/OH087602/MREX_REPEAT.xdf**
Created On	**: Jun 22 16:50:43 2014**
Company	**: RESOLUTION COPPER COMPANY**
Well	**: DHRES-15**
Field	**: RESOLUTION COPPER**
File Interval	**: 6.5 - 2847.75 Feet**
OCT	**: n857d**




2300
2400
GR BACKUP
TOOL STICKING
CAL < BIT
CHI [chi]
0
5
(1)
SPEED [spd]
0
30
(ft/min)
FEET
MR T2 DISTRIBUTION [por]
0.25
2896
(ms)
MR CBW CUTOFF (3.4 ms)
MR T2 CUTOFF (33 ms)
MPERM
MR PERM [mprm]
0.2
2000
(mD)
Clay Bound
Free Fluid
Bound Fluid
MR TOTAL POROSITY [mphs]
40
0
(pu)
MR POROSITY [mphe]
40
0
(pu)

GAMMA RAY [gr]
0 200
(gAPI)
CALIPER [cal]
10 20
(in)
BIT SIZE
10 20
(in)
DIFF. TENSION [ten]
2400 -100
(lbf)
GR IMAGE [gr]
0 150
30 130

MR BVI [mbvi]
40 0
(pu)

CALIBRATION / VERIFICATION SUMMARY

Source File: /dat1a/OH087602/n857d.tp1

GR PRIMARY CALIBRATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Tue Jun 3 11:41:15 2014

UNIT #: 3880TA HL6670 CALB JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	CR DIFF (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	CALBRTR (gAPI)
GR	331.93	1231.27	899.3 830.0 960.0	0.167	55.36	205.36	150

GR PRIMARY VERIFICATION SUMMARY

TOOL #: 1329XA 10196895 DATE/TIME PERFORMED: Tue Jun 3 11:52:52 2014

UNIT #: 3880TA HL6670 VERI JIG #: 4702NK VBA-905

	BACKGROUND (cts/s)	CALBRTR ON (cts/s)	MULT	BACKGROUND (gAPI)	CALBRTR ON (gAPI)	DIFF. (gAPI)
GR	326.98	1207.64	0.167	54.54	201.42	146.89 140.00 160.00

MREX_1FSWP PRIMARY CALIBRATION SUMMARY

TOOL #: 3218MB 556143 DATE/TIME PERFORMED: Sat May 10 15:40:20 2014

UNIT #: 3882TD HL6690 ELECTRONICS #:

FREQ No.	1	2	3	4	5	6	7	8	9	10	11	12
PRIMARY kHz	495 491 505	554 550 566	580 576 593	614 609 628	646 640 659	688 683 701	728 721 738	765 760 781	812 805 828	859 852 874	913 904 928	964 955 980
Q ANT.	47.6 31.0 61.0	51.7 34.0 64.0	53.5 36.0 66.0	54.9 38.0 68.0	56.2 40.0 70.0	61.1 42.0 72.0	62.5 44.0 74.0	64.8 46.0 76.0	64.1 47.0 78.0	69.0 49.0 80.0	72.9 50.0 82.0	74.3 51.0 84.0
NOISE mV	3.0 0.0 10.0	3.1 0.0 10.0	3.6 0.0 10.0	3.0 0.0 10.0	3.0 0.0 10.0	3.6 0.0 10.0	4.0 0.0 10.0	5.7 0.0 10.0	43.3 0.0 10.0	6.4 0.0 10.0	6.1 0.0 10.0	5.7 0.0 10.0
CAL mV	291 200 540	361 240 640	387 260 690	426 290 740	463 310 800	524 340 870	568 370 940	620 400 1010	696 440 1080	808 480 1170	911 450 1250	877 420 1340

MREX_1FSWP BEFORE LOG VERIFICATION SUMMARY

TOOL #: 3218MB 556143 DATE/TIME PERFORMED: Sun Jun 22 15:30:33 2014 DAYS SINCE CAL: 42

UNIT #: 3880TA HL6670

FREQ No.	1	2	3	4	5	6	7	8	9	10	11	12
BEFORE kHz	494	553	578	613	644	686	726	763	810	857	911	961
	486 / 505	544 / 566	570 / 593	599 / 628	633 / 659	676 / 701	714 / 738	752 / 781	796 / 826	843 / 874	895 / 928	946 / 980
Q	44.9	46.1	44.9	47.6	50.2	49.7	49.5	51.9	52.4	54.2	55.3	56.9
	8.0 / 61.0	8.0 / 64.0	8.0 / 66.0	8.0 / 68.0	8.0 / 70.0	8.0 / 72.0	8.0 / 74.0	8.0 / 76.0	8.0 / 78.0	8.0 / 80.0	8.0 / 82.0	8.0 / 84.0
NOISE mV	3.1	3.7	3.5	4.5	4.9	5.4	4.7	4.6	6.0	6.6	7.8	7.0
	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0
CAL mV	285	347	365	398	443	477	515	569	634	730	819	788

MREX_1FSWP AFTER LOG VERIFICATION SUMMARY

TOOL #: 3218MB 556143 DATE/TIME PERFORMED: Sun Jun 22 18:53:30 2014 DAYS SINCE CAL: 43

UNIT #: 3880TA HL6670

FREQ No.	1	2	3	4	5	6	7	8	9	10	11	12
AFTER kHz	494	553	579	613	644	686	726	763	810	857	911	961
	486 / 505	544 / 566	570 / 593	599 / 628	633 / 659	676 / 701	714 / 738	752 / 781	796 / 826	843 / 874	895 / 928	946 / 980
DELTA F %	0.0	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0
	-1.0 / 1.0	-1.0 / 1.0	-1.0 / 1.0	-1.0 / 1.0	-1.0 / 1.0	-1.0 / 1.0	-1.0 / 1.0	-1.0 / 1.0	-1.0 / 1.0	-1.0 / 1.0	-1.0 / 1.0	-1.0 / 1.0
Q	44.6	47.4	46.0	49.3	50.4	50.6	50.1	52.1	53.3	55.6	56.9	57.5
	8.0 / 61.0	8.0 / 64.0	8.0 / 66.0	8.0 / 68.0	8.0 / 70.0	8.0 / 72.0	8.0 / 74.0	8.0 / 76.0	8.0 / 78.0	8.0 / 80.0	8.0 / 82.0	8.0 / 84.0
NOISE mV	3.8	3.5	3.7	4.3	4.3	5.0	5.0	6.1	5.0	6.5	7.1	7.6
	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0	0.0 / 15.0
CAL mV	288	356	373	411	450	488	524	579	647	751	847	804

MREX_2TGN PRIMARY CALIBRATION SUMMARY

TOOL #: 3218MB 556143 DATE/TIME PERFORMED: Sat May 10 15:46:20 2014

UNIT #: 3882TD HL6690

FREQ No.	1	2	3	4	5	6	7	8	9	10	11	12
TX FREQ kHz	495	554	580	614	646	688	728	765	812	859	913	964
Vtx kV	1.03	1.11	1.11	1.15	1.12	1.16	1.17	1.16	1.18	1.18	1.20	1.17
	0.80 / 1.60	0.90 / 1.60	0.90 / 1.60	1.00 / 1.60	1.00 / 1.60	1.00 / 1.60	1.00 / 1.60	1.00 / 1.60	1.00 / 1.60	1.00 / 1.60	0.90 / 1.60	0.90 / 1.60
TAU 90 us	53.1	48.7	47.9	45.6	45.8	42.8	42.3	41.9	40.6	40.0	39.3	39.0
	43.0 / 59.0	39.0 / 54.0	38.0 / 53.0	36.0 / 50.0	35.0 / 49.0	34.0 / 48.0	33.0 / 47.0	32.0 / 46.0	32.0 / 46.0	32.0 / 46.0	31.0 / 45.0	30.0 / 44.0

MREX_3RGN PRIMARY CALIBRATION SUMMARY

TOOL #: 3218MB 556143 DATE/TIME PERFORMED: Sat May 10 15:49:57 2014

UNIT #: 3882TD HL6690

CAL TEMP
(degF)
60.0

FREQ No.	1	2	3	4	5	6	7	8	9	10	11	12
Gr	0.89	0.98	1.01	1.08	1.06	1.16	1.18	1.22	1.32	1.29	1.36	1.40
T2LM ms	111	110	110	110	111	112	111	110	110	110	109	107
	100 / 200	100 / 200	100 / 200	100 / 200	100 / 200	100 / 200	100 / 200	100 / 200	100 / 200	100 / 200	100 / 200	100 / 200

MREX_3RGN PRIMARY VERIFICATION SUMMARY

TOOL #: 3218MB 556143

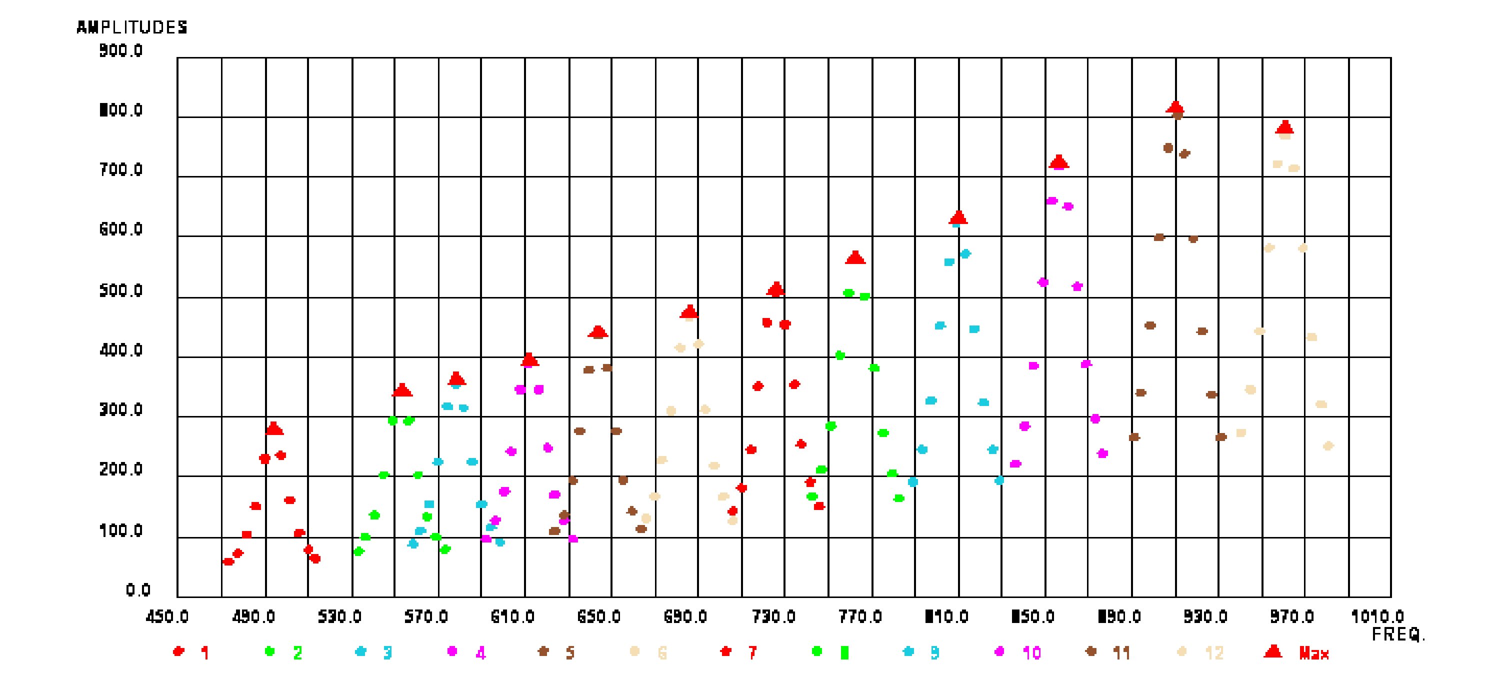
DATE/TIME PERFORMED: Sat May 10 15:55:56 2014

UNIT #: 3882TD HL6690

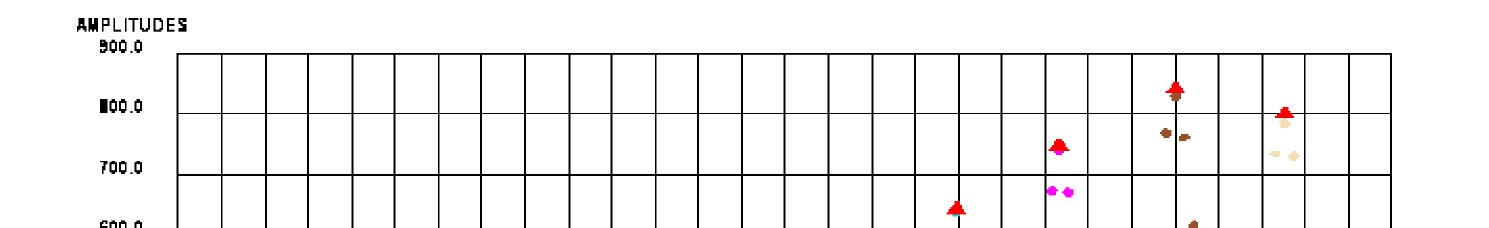
CAL TEMP (degF): 60.0

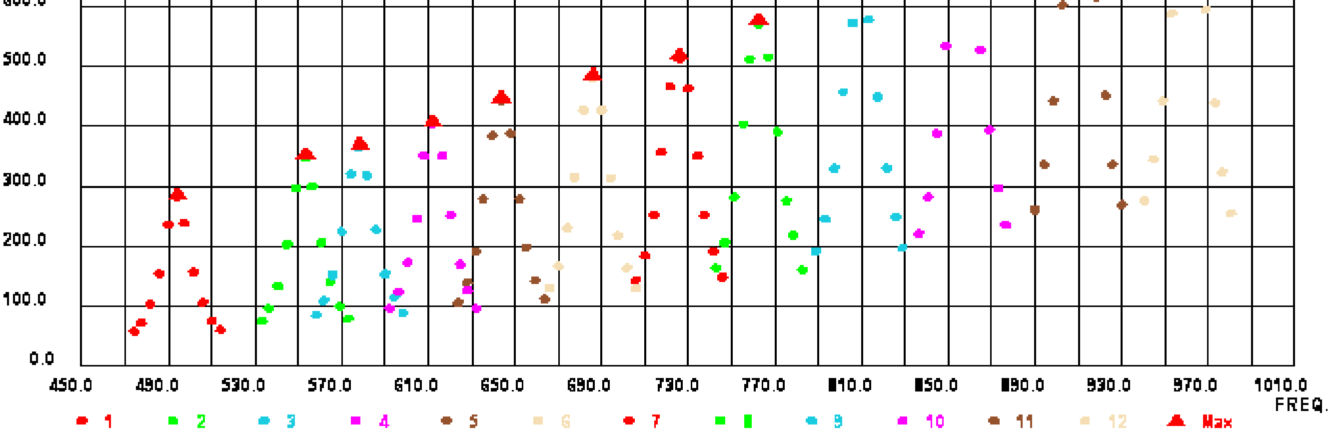
FREQ No.	1	2	3	4	5	6	7	8	9	10	11	12
TE ms	0.40											
POROSITY pu	99.5	100.0	99.4	100.2	99.5	100.2	99.9	99.3	100.7	100.0	99.9	99.0
(limits)	97.0 103.0	97.0 103.0	97.0 103.0	97.0 103.0	97.0 103.0	97.0 103.0	97.0 103.0	97.0 103.0	97.0 103.0	97.0 103.0	97.0 103.0	97.0 103.0
NOISE pu	5.17	4.52	4.16	4.03	3.88	3.49	3.41	3.18	3.47	3.04	2.76	2.70
(limits)	0.00 8.40	0.00 7.00	0.00 6.50	0.00 6.40	0.00 6.20	0.00 5.80	0.00 5.60	0.00 5.10	0.00 4.80	0.00 4.50	0.00 4.50	0.00 4.30
RINGING pu	2.9	4.2	5.8	4.5	1.8	3.0	1.5	1.3	1.7	1.0	1.0	1.1
(limits)	0.0 30.0	0.0 30.0	0.0 30.0	0.0 30.0	0.0 30.0	0.0 30.0	0.0 30.0	0.0 30.0	0.0 30.0	0.0 30.0	0.0 30.0	0.0 30.0
TE ms	0.30											
POR2 pu	101.1	97.2	96.2	97.0	97.5	98.7	100.5	99.4	100.8	100.5	99.5	99.1
NOISE pu	6.07	4.69	4.31	3.92	3.82	3.55	3.55	3.71	5.17	4.65	2.98	2.95
RINGING pu	3.6	1.7	2.9	4.5	1.2	4.0	2.9	2.9	2.1	1.6	1.0	1.2

FREQUENCY SWEEP For MAGNET #556143 □



FREQUENCY SWEEP For MAGNET #556143 □





INSTRUMENT CONFIGURATION

Source File: /dat1a/OH087602/n857d1~PP-tdg

52.96'

CABLEHEAD 3 3/8 WITH SP
Diameter : 3.38"
Length : 2.00'
Weight : 35 lbs
Series : 3069ZZ
Mnemonic : CH
Measure Point: 0.83': SP

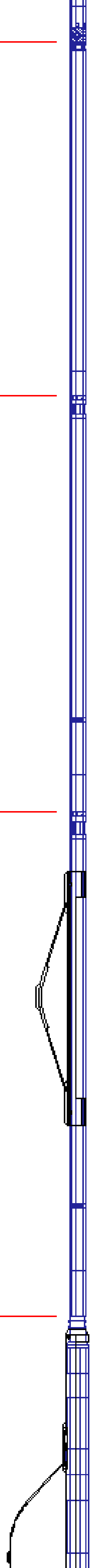
SP — 51.80'

DOWNHOLE POWER ADAPTER
Diameter : 3.62"
Length : 5.27'
Weight : 86 lbs
Series : 4430XB
Mnemonic : DHPA

SWIVEL
Diameter : 3.38"
Length : 3.50'
Weight : 68 lbs
Series : 3944XD
Mnemonic : SWVL

TTRM SUB
Diameter : 3.63"
Length : 3.83'
Weight : 62 lbs
Series : 3981XA
Mnemonic : TTRM
Measure Point: 1.38': TEMP MP
Measure Point: 1.13': RM MP

TEMP MP — 39.74'
RM MP — 39.49'



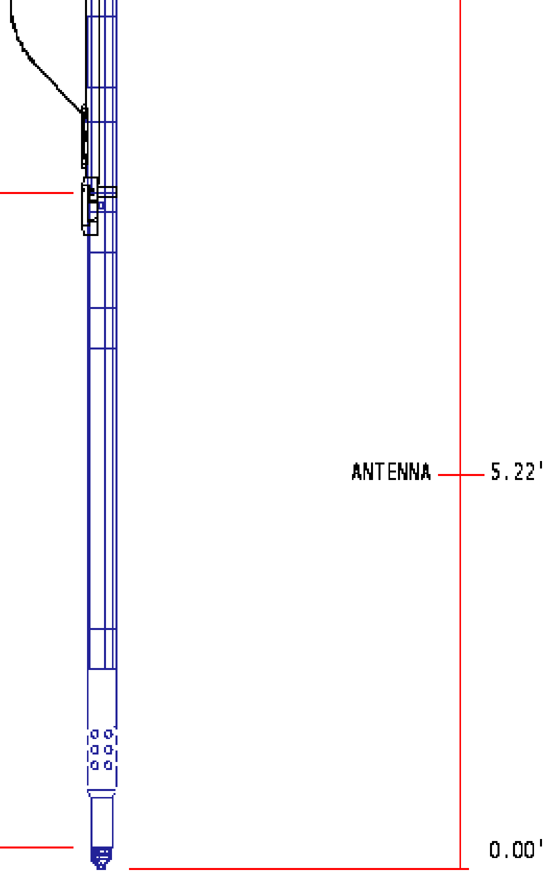
WTS COMMON REMOTE
Diameter : 3.63"
Length : 6.36'
Weight : 126 lbs
Series : 3514XB
Mnemonic : WTS

DIGITAL SPECTRALOG
Diameter : 3.63"
Length : 7.31'
Weight : 130 lbs
Series : 1329XA
Mnemonic : DSL
Measure Point: 1.60': GR MP

GR MP 26.28'

MREX CAPACITOR CHARGER SUB
Diameter : 3.62"
Length : 8.90'
Weight : 176 lbs
Series : 3218QA
Mnemonic : MREX

MREX ELECTRONICS
Diameter : 5.00"
Length : 6.95'
Weight : 178 lbs
Series : 3218EB
Mnemonic : MREX



MREX MAGNET
  Diameter   : 5.00"
  Length   : 8.56'
  Weight   : 310 lbs
  Series   : 3218MB
  Mnemonic   : MREX
  Measure Point: 4.93': ANTENNA

BULL PLUG 3 3/8

TOTAL LENGTH: 52.96'
TOTAL WEIGHT: 1203 lbs
MAX DIAMETER: 0'5.00"

BAKER HUGHES EOLIPS	COMPANY RESOLUTION COPPER COMPANY WELL DHRES-15 FIELD RESOLUTION COPPER COUNTY PINAL STATE AZ	FILE NO: US087602 API NO:
	LOCATION: SEC 5 TWP 2S RGE 13E	ELEVATIONS: KB NA DF GL NA
		RIG: NATIONAL 16
		DATE 22-Jun-2014

APPENDIX D

Borehole Geophysical Logs from Well DHRES-15
Conducted by SWE; interval 2,700 – 3,920 feet

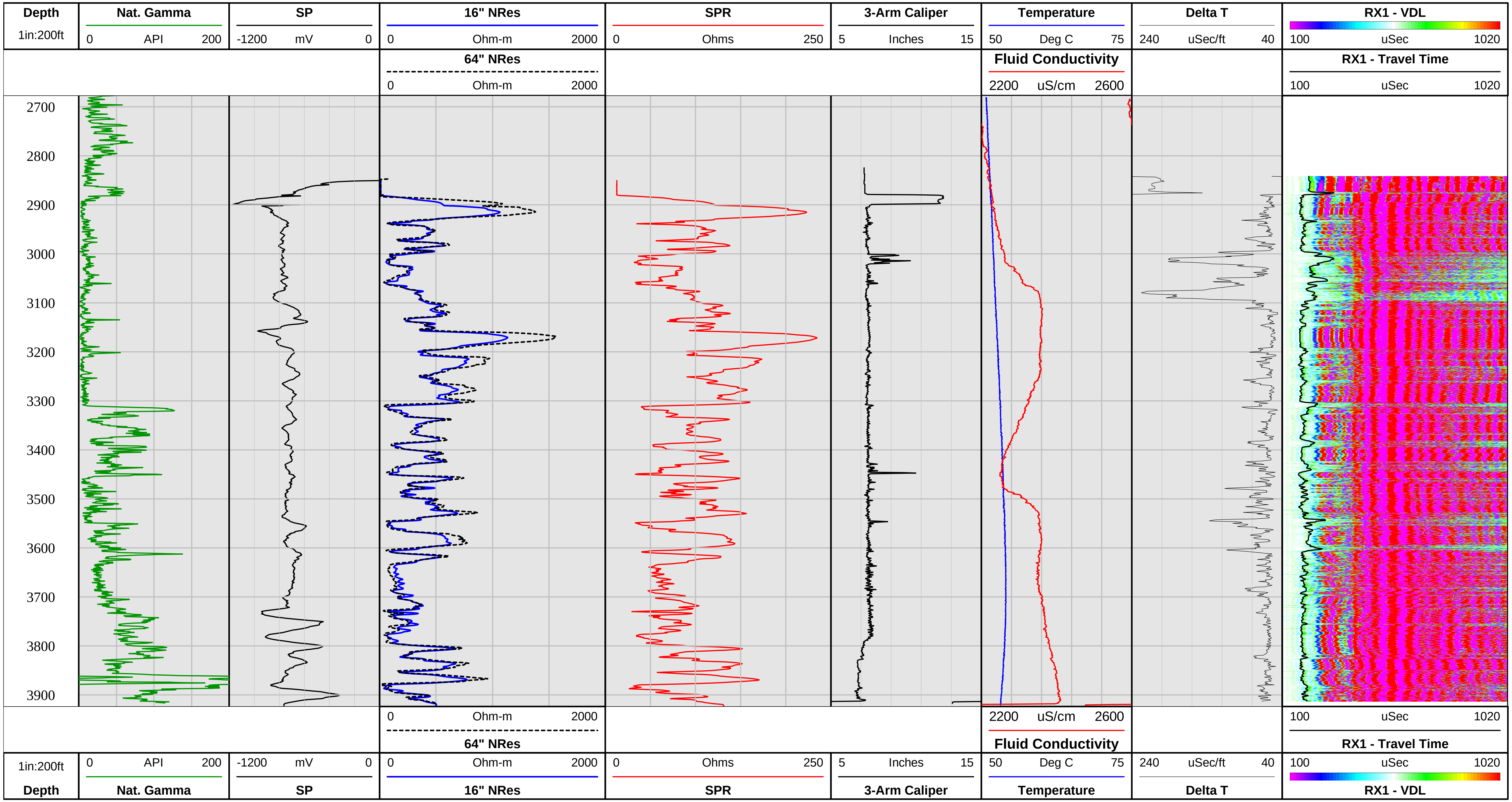
DHRES-15 Geophysical Log Summary

Southwest Exploration Services, LLC
borehole geophysics & video services

MONTGOMERY & ASSOCIATES

COMPANY: E. L. MONTGOMERY & ASSOCIATES
FIELD: RESOLUTION COPPER
WELL ID: DHRES-15
COUNTY: PINAL STATE: ARIZONA

Logging Engineer: K. MITCHELL
Date Logged: 07-11-14
Processed By: K. MITCHELL
Date Processed: 3-16-16



Southwest Exploration Services, LLC
borehole geophysics & video services

COMPANY	RESOLUTION COPPER CO
WELL ID	DHRES-15 (15-91668)
FIELD	RESOLUTION
COUNTY	PINAL
STATE	ARIZONA

TYPE OF LOGS: GAMMA-CALIPER
MORE: TEMP-CONDUCTIVITY

OTHER SERVICES
DUAL INDUCTION
E-LOGS
SONIC
ABI-43

LOCATION
NW 1/4 OF SW 1/4 OF SW 1/4
9644978 E, 831076 N

SEC 05 TWP 02 S RGE 13 E

PERMANENT DATUM	AZ SPC, FEET	ELEVATION	3991 FT	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND LEVEL			G.L.

DATE	07-11-14	TYPE FLUID IN HOLE	POLY WATER
RUN No	1	MUD WEIGHT	N/A
TYPE LOG	GAMMA-CALIPER-TEMP	VISCOSITY	N/A
DEPTH-DRILLER	3920 FT	LEVEL	~ 640 FT
DEPTH-LOGGER	3920 FT	MAX. REC. TEMP.	54 DEG C
BTM LOGGED INTERVAL	3920 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	2700 FT	SAMPLE INTERVAL	0.2 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	K. MITCHELL	TOOL STRING/SN	QL-COMBO-SN 5613
WITNESSED BY	MATT SHELLY - M&A	LOG TIME:ON SITE/OFF SITE	10:15 PM

BOREHOLE RECORD				CASING RECORD			
RUN NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	37 FT	14"	STEEL	SURFACE	37 FT
2	12 1/4"	37 FT	2900 FT	7 5/8"	STEEL	SURFACE	2890 FT
3	6"	2900 FT	TD				

COMMENTS:

.

Tool Summary:

Date	07-11-14	**Date**	07-11-14	**Date**	07-12-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	ELOG	**Tool Model**	QL-COMBO TOOL	**Tool Model**	QL-DUAL INDUCTION
Tool SN	4790	**Tool SN**	5613	**Tool SN**	5911
From	2850 FT	**From**	2700 FT	**From**	2700 FT
To	3920 FT	**To**	3920 FT	**To**	3920 FT
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	K. MITCHELL
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	07-11-14	**Operation Check**	07-11-14	**Operation Check**	07-11-14
Calibration Check	07-11-14	**Calibration Check**	07-11-14	**Calibration Check**	07-11-14
Time Logged	10:30 PM	**Time Logged**	11:50 PM	**Time Logged**	1:10 AM

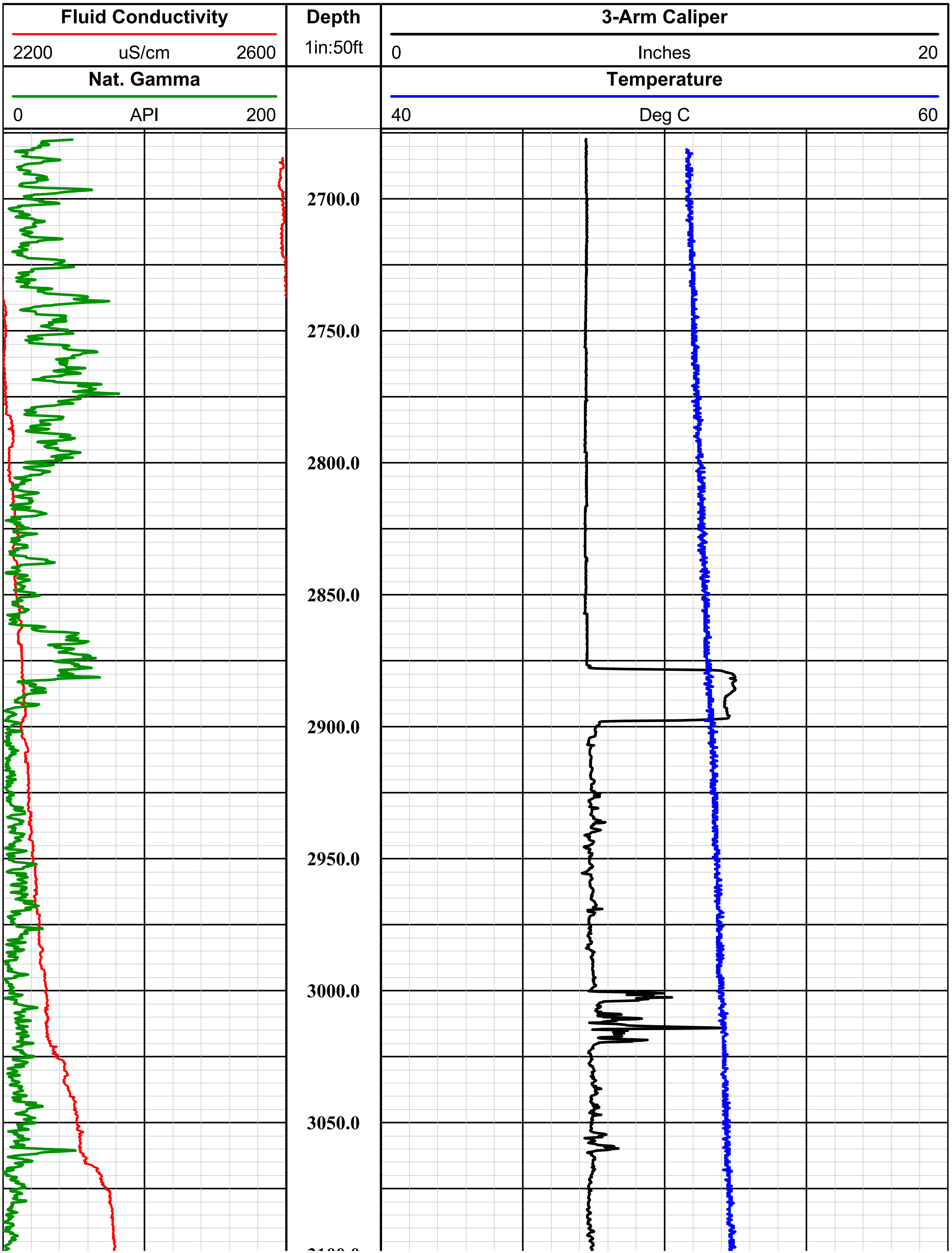
Date	07-12-14	**Date**	07-12-14	**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT 4RX SONIC	**Tool Model**	ABI-43	**Tool Model**	
Tool SN	110208	**Tool SN**	091601	**Tool SN**	
From	2850 FT	**From**	2890 FT	**From**	
To	3920 FT	**To**	3915 FT	**To**	
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	
Truck No	500	**Truck No**	500	**Truck No**	
Operation Check	07-11-14	**Operation Check**	07-11-14	**Operation Check**	
Calibration Check	N/A	**Calibration Check**	N/A	**Calibration Check**	
Time Logged	2:20 AM	**Time Logged**	3:45 AM	**Time Logged**	

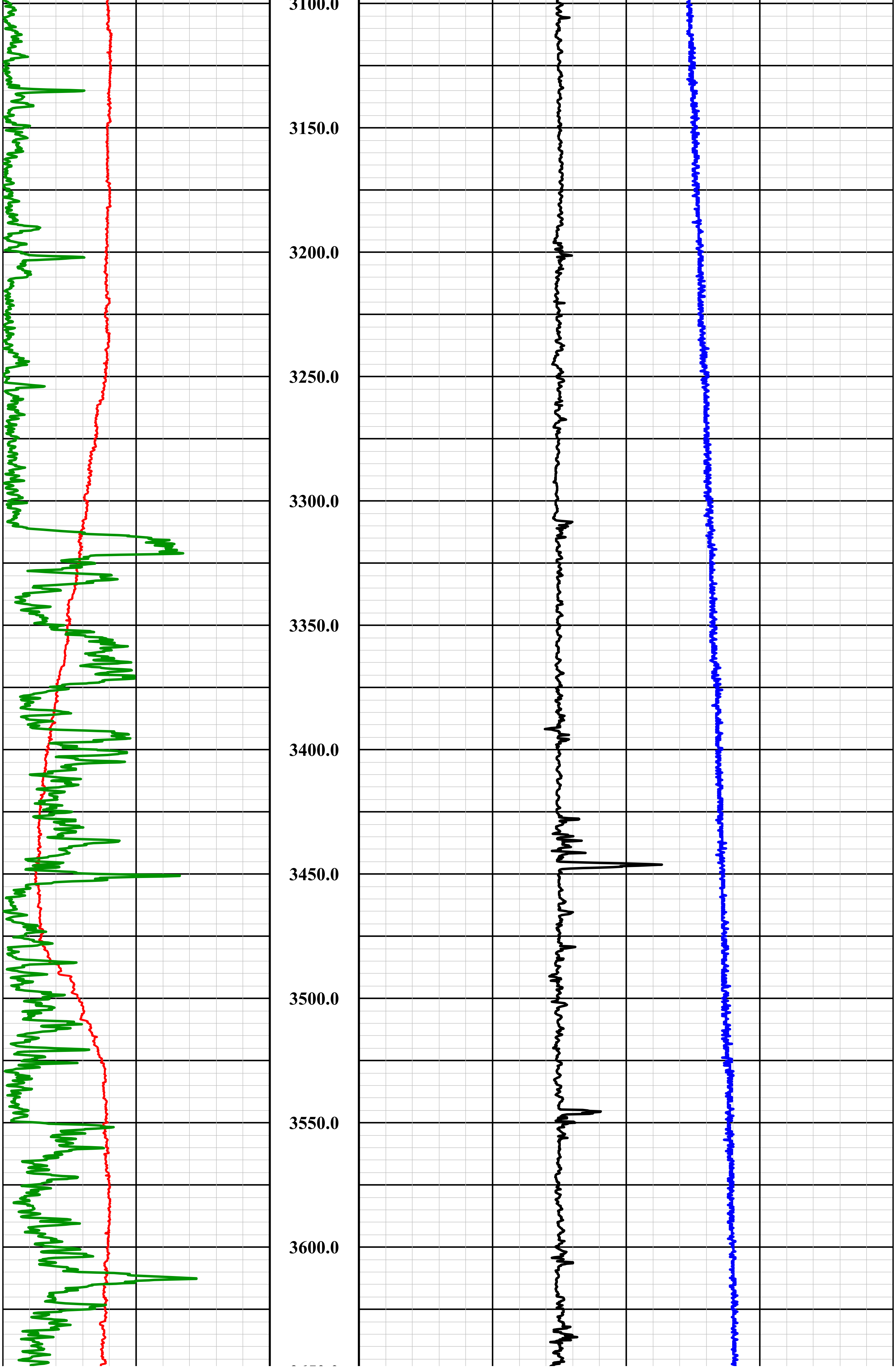
Additional Comments:

Caliper Arms Used: 9" **Calibration Points:** 4" & 12"

Disclaimer:

All interpretations of log data are opinions based on inferences from electrical or other measurements. We do not guarantee the accuracy or correctness of any interpretations or recommendations and shall not be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our employees or agents. These interpretations are also subject to our general terms and conditions set out in our current Service Invoice.

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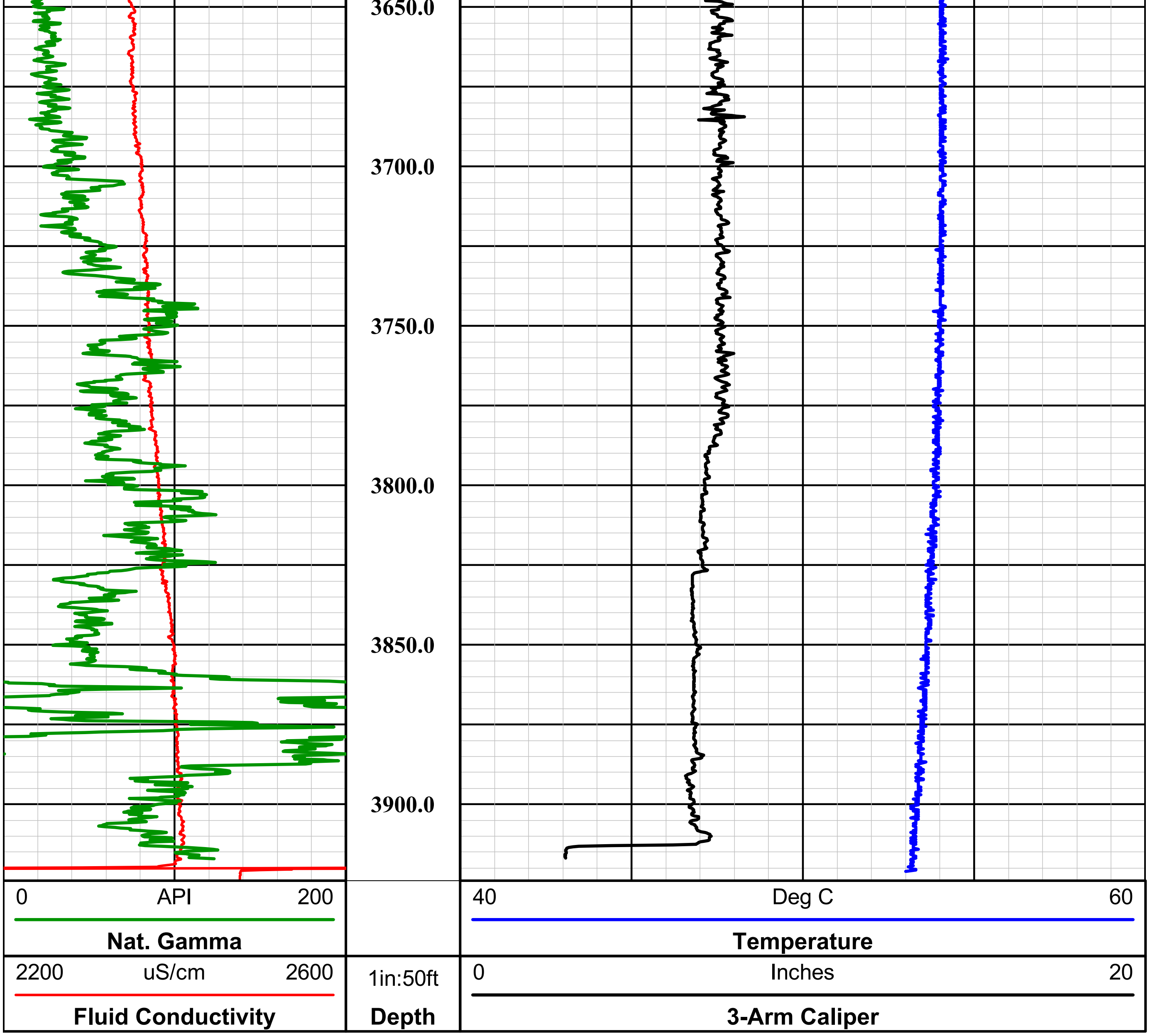


QL40 Gamma-Caliper-Temperature-Fluid Conductivity SN 5613

Probe Top = Depth Ref.

Four Conductor MSI Probe Top

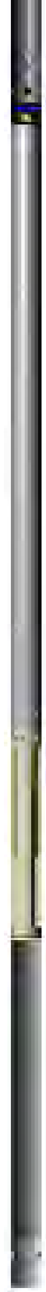
Probe Length = 3.69 m or 12.12 ft
Probe Weight = 18.195 kg or 40.11 lbs

Caliper arms can only collect data logging up hole

Fluid Temperature/Conductivity and Natural Gamma can be collected logging up and down hole

Temperature Rating: 80 Deg C (176 Deg F)
Presure Rating: 200 bar (2900 psi)

Natural Gamma Ray = 1.07 m (42.12 in)



3-Arm Caliper = 1.78 m (70.27 in)

Available Arm Sizes: 3", 9", and 15"

FTC (Fluid Temperature/Conductivity) = 0.78 m (30.71 in)

1.57" or 40.0 mm Diameter

Southwest Exploration Services, LLC

borehole geophysics & video services

Company	RESOLUTION COPPER
Well	DHRES-15
Field	RESOLUTION
County	PINAL
State	ARIZONA

Preliminary GAMMA-CALIPER-TEMP SUMMARY

Southwest Exploration Services, LLC
borehole geophysics & video services

COMPANY	RESOLUTION COPPER CO		
WELL ID	DHRES-15 (55-91668)		
FIELD	RESOLUTION		
COUNTY	PINAL	STATE	ARIZONA

TYPE OF LOGS: E-LOGS
MORE: GAMMA

LOCATION NW 1/4 OF SW 1/4 OF SW 1/4 964978 E, 831076 N	OTHER SERVICES DUAL INDUCTION COMBO TOOL SONIC ABI-43
SEC 05 TWP 02 S RGE 13 E	

PERMANENT DATUM	AZ SPC FEET	ELEVATION 3991	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM	D.F.
DRILLING MEAS. FROM			G.L.

DATE	07-11-14	TYPE FLUID IN HOLE	POLY WATER
RUN No	1	MUD WEIGHT	N/A
TYPE LOG	E-LOGS - GAMMA	VISCOSITY	N/A
DEPTH-DRILLER	3920 FT	LEVEL	~ 640 FT
DEPTH-LOGGER	3920 FT	MAX. REC. TEMP.	54 DEG C
BTM LOGGED INTERVAL	3920 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	2850 FT	SAMPLE INTERVAL	0.2 FT
DRILLER / RIG#	NATIONAL E & P	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	K. MITCHELL	TOOL STRING/SN	GEOVISTA ELOG SN-4790
WITNESSED BY	MATT SHELLY M&A	LOG TIME:ON SITE/OFF SITE	10:15 PM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	37 FT	14"	STEEL	SURFACE	37 FT
2	12 1/4"	37 FT	2900 FT	7 5/8"	STEEL	SURFACE	2890 FT
3	6"	2900 FT	TD				

COMMENTS:

.

Tool Summary:

Date	07-11-14	**Date**	07-11-14	**Date**	07-12-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	ELOG	**Tool Model**	QL-COMBO TOOL	**Tool Model**	QL-DUAL INDUCTION
Tool SN	4790	**Tool SN**	5613	**Tool SN**	5911
From	2850 FT	**From**	2700 FT	**From**	2750 FT
To	3920 FT	**To**	3920 FT	**To**	3920 FT
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	K. MITCHELL
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	07-11-14	**Operation Check**	07-11-14	**Operation Check**	07-11-14
Calibration Check	07-11-14	**Calibration Check**	07-11-14	**Calibration Check**	07-11-14
Time Logged	10:30 PM	**Time Logged**	11:50 PM	**Time Logged**	1:10 AM

Date	07-12-14	**Date**	07-12-14	**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT 4RX SONIC	**Tool Model**	ALT ABI-43	**Tool Model**	
Tool SN	110208	**Tool SN**	091601	**Tool SN**	
From	2850 FT	**From**	2890 FT	**From**	
To	3920 FT	**To**	3915 FT	**To**	
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	
Truck No	500	**Truck No**	500	**Truck No**	
Operation Check	07-11-14	**Operation Check**	07-11-14	**Operation Check**	
Calibration Check	N/A	**Calibration Check**	N/A	**Calibration Check**	
Time Logged	2:20 AM	**Time Logged**	3:45 AM	**Time Logged**	

Additional Comments:

Caliper Arms Used: 9" **Calibration Points:** 4" & 12"

Disclaimer:

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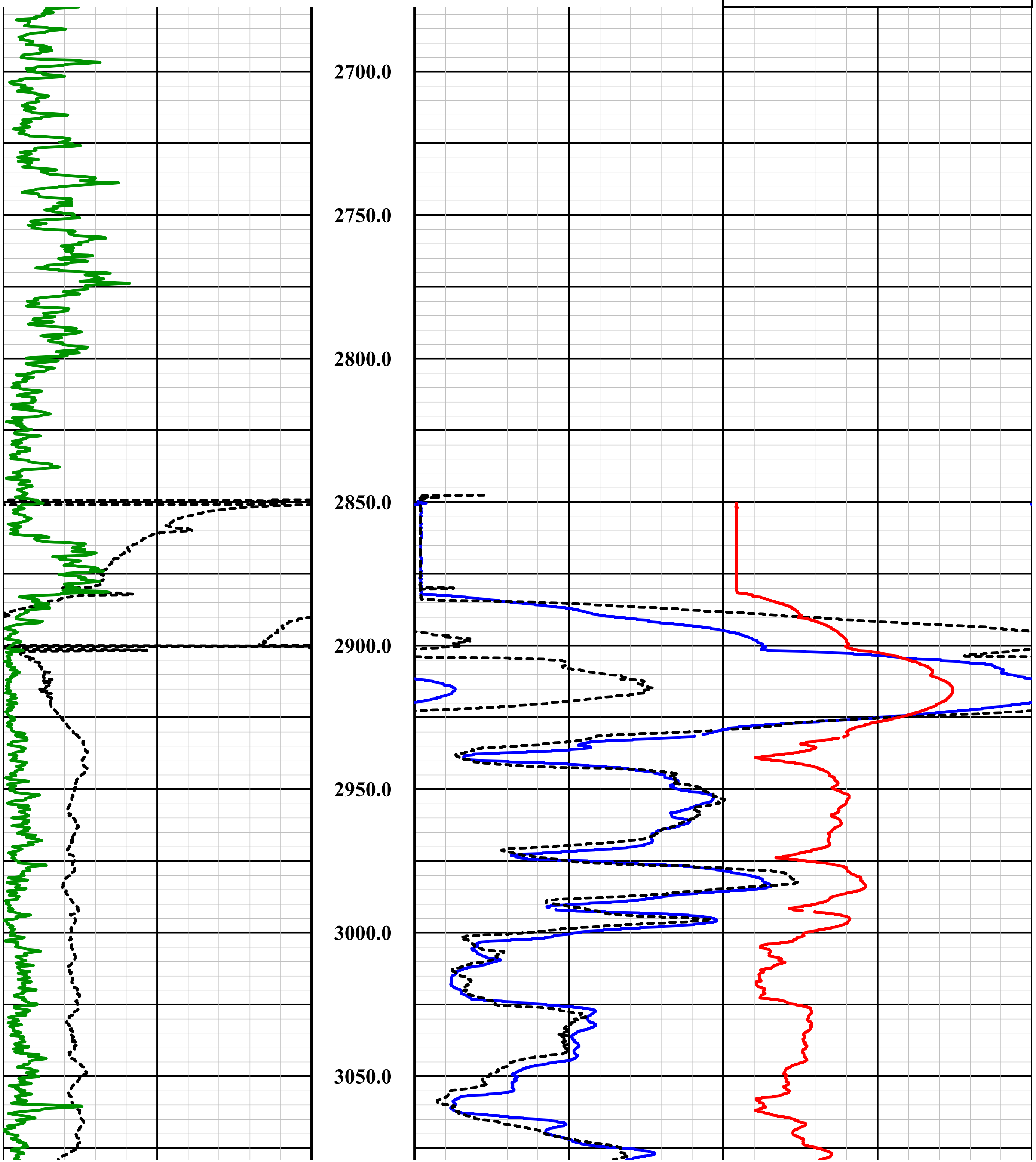
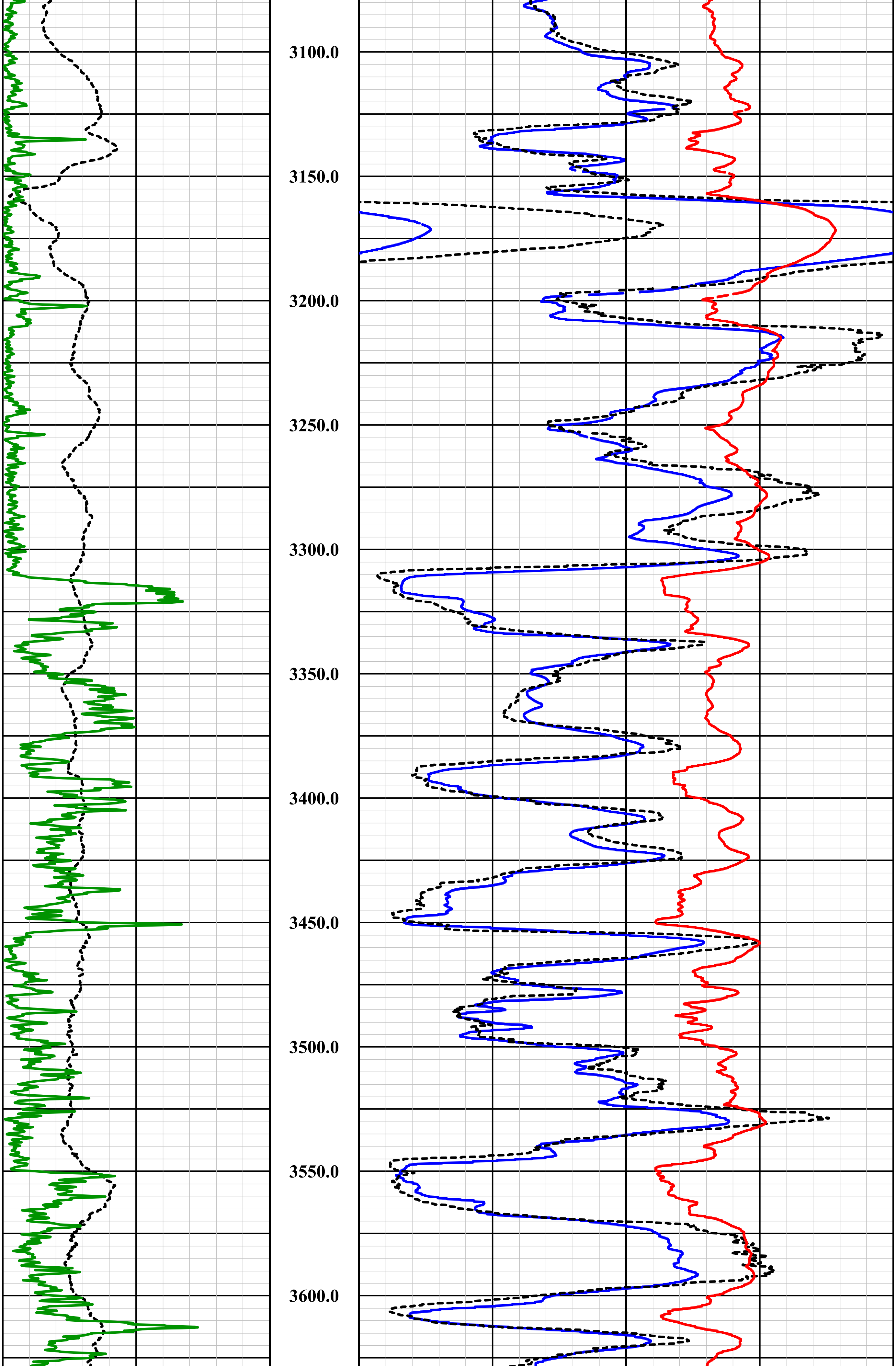
SP	Depth	16" NRes
-1000 mV 0	1in:50ft	0 Ohm-m 1000
Nat. Gamma		**64" NRes**
0 API 200		0 Ohm-m 1000
		SPR
		0 Ohms 300

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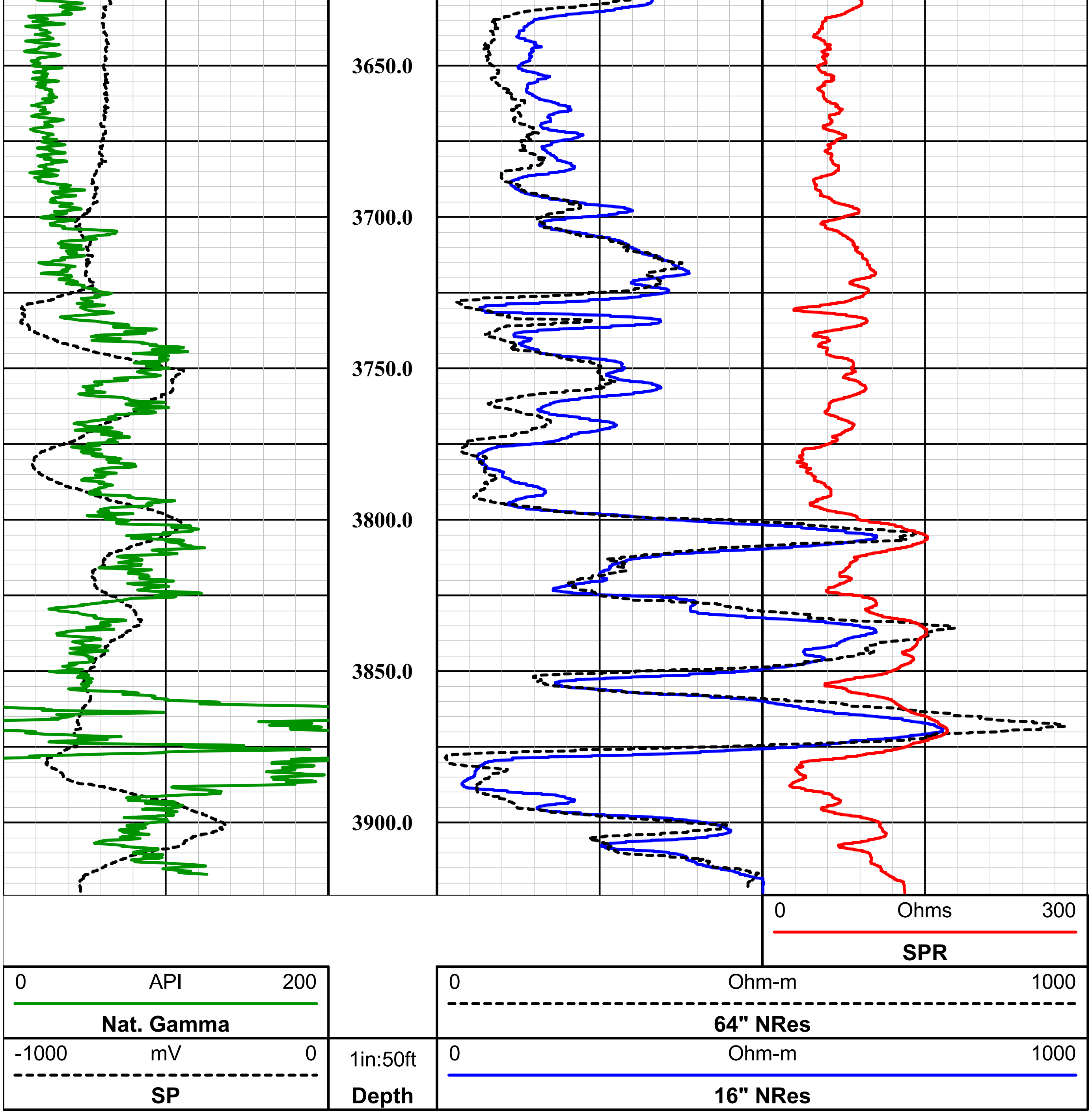

GeoVista E-Log Tool

Probe Top = Depth Ref.

Tool SN: 4035 & 4790

Bridle connects to wireline cablehead: Wireline armor is the B Electrode.

Four Conductor MSI Probe Top

Bridle Electrode (N Electrode)

64" Normal Resistivity Electrode/Spontaneous Potential Electrode (M Electrode)

Probe Length = 2.3 m or 7.55 ft
Bridle Length = 10.0 m or 32.81 ft

Probe Weight = 7.0 kg or 15.4 lbs

Can only be collected in fluid

Isolation Bridle - Not shown in diagram but is necessary for operation

Electrode Measuring Points (from bottom of probe)
- Spontaneous Potential (SP): 0.65 m or 2.13 ft
- 16" Normal Resistivity (16" NRes): 0.50 m or 1.64 ft
- 64" Normal Resistivity (64" NRes): 1.10 m or 3.61 ft
- Single Point Resistance (SPR): 0.25 m or 0.82 ft

Temperature Rating: 80 Deg C (176 Deg F)
Presure Rating: 200 bar (2900 psi)

16" Normal Resistivity Electrode (M Electrode)

Current Electrode/Single Point Resistance
(A Electrode)

1.65" or 42 mm Diameter

Southwest Exploration Services, LLC
borehole geophysics & video services

Company	RESOLUTION COPPER
Well	DHRES-15
Field	RESOLUTION
County	PINAL
State	ARIZONA

Preliminary **ELOG SUMMARY**

Southwest Exploration Services, LLC
borehole geophysics & video services

COMPANY	RESOLUTION COPPER CO
WELL ID	DHRES-15 (15-91668)
FIELD	RESOLUTION
COUNTY	PINAL
STATE	ARIZONA

TYPE OF LOGS: 4 RX SONIC
MORE: GAMMA-CALIPER

LOCATION
NW 1/4 OF SW 1/4 OF SW 1/4
964978 E, 831076 N

SEC 05 TWP 02S RGE 13E

OTHER SERVICES
DUAL INDUCTION
COMBO TOOL
E-LOGS
ABI-43

PERMANENT DATUM	AZ SPC, feet	ELEVATION	3991 ft	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND LEVEL			G.L.

DATE	07-11-14	TYPE FLUID IN HOLE	POLY WATER
RUN No	1	MUD WEIGHT	N/A
TYPE LOG	4 RX SONIC	VISCOSITY	N/A
DEPTH-DRILLER	3920 FT	LEVEL	~ 640 FT
DEPTH-LOGGER	3920 FT	MAX. REC. TEMP.	54 DEG C
BTM LOGGED INTERVAL	3920 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	2850 FT	SAMPLE INTERVAL	0.2 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	K. MITCHELL	TOOL STRING/SN	ALT 4 RX SONIC - SN 110208
WITNESSED BY	MATT SHELLY M&A	LOG TIME:ON SITE/OFF SITE	10:15 PM

BOREHOLE RECORD				CASING RECORD			
RUN NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	Surface	37 ft	14"	STEEL	SURFACE	37 ft
2	12 1/4"	37 ft	2900 ft	7 5/8"	STEEL	SURFACE	2890 ft
3	6"	2900 ft	TD				

COMMENTS:

.

Tool Summary:

Date	07-11-14	**Date**	07-11-14	**Date**	07-12-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	ELOG	**Tool Model**	QL-COMBO TOOL	**Tool Model**	QL-DUAL INDUCTION
Tool SN	4790	**Tool SN**	5613	**Tool SN**	5911
From	2850 FT	**From**	2700 FT	**From**	2700 FT
To	3920 FT	**To**	3920 FT	**To**	3920 FT
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	K. MITCHELL
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	07-11-14	**Operation Check**	07-11-14	**Operation Check**	07-11-14
Calibration Check	07-11-14	**Calibration Check**	07-11-14	**Calibration Check**	07-11-14
Time Logged	10:30 PM	**Time Logged**	11:50 PM	**Time Logged**	1:10 AM

Date	07-12-14	**Date**	07-12-14	**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT 4RX SONIC	**Tool Model**	ALT ABI-43	**Tool Model**	
Tool SN	110208	**Tool SN**	091601	**Tool SN**	
From	2850 FT	**From**	2890 FT	**From**	
To	3920 FT	**To**	3915 FT	**To**	
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	
Truck No	500	**Truck No**	500	**Truck No**	
Operation Check	07-11-14	**Operation Check**	07-11-14	**Operation Check**	
Calibration Check	N/A	**Calibration Check**	N/A	**Calibration Check**	
Time Logged	1:30 AM	**Time Logged**	2:45 AM	**Time Logged**	

Additional Comments:

Caliper Arms Used: 9" **Calibration Points:** 4" & 12"

Disclaimer:

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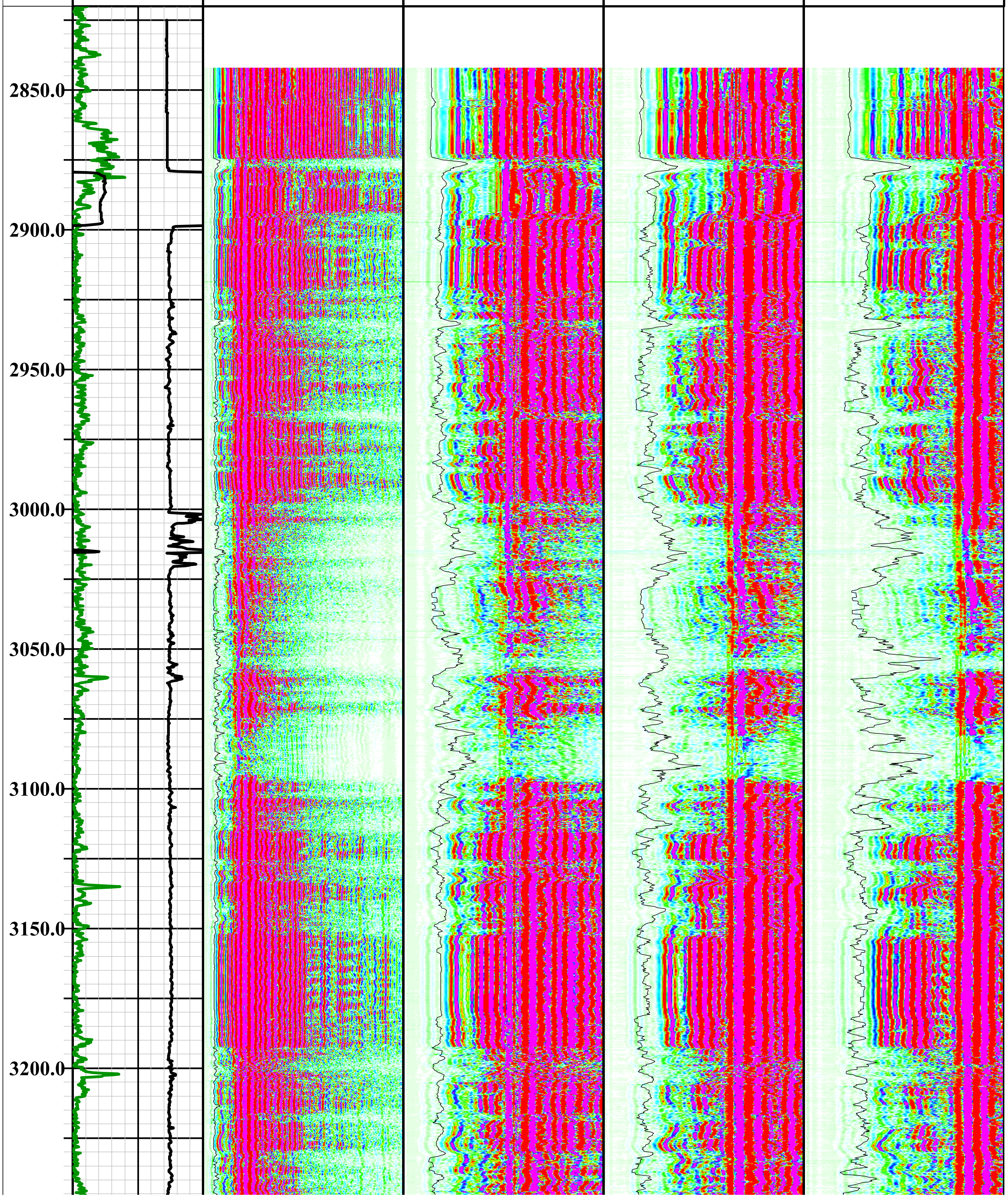
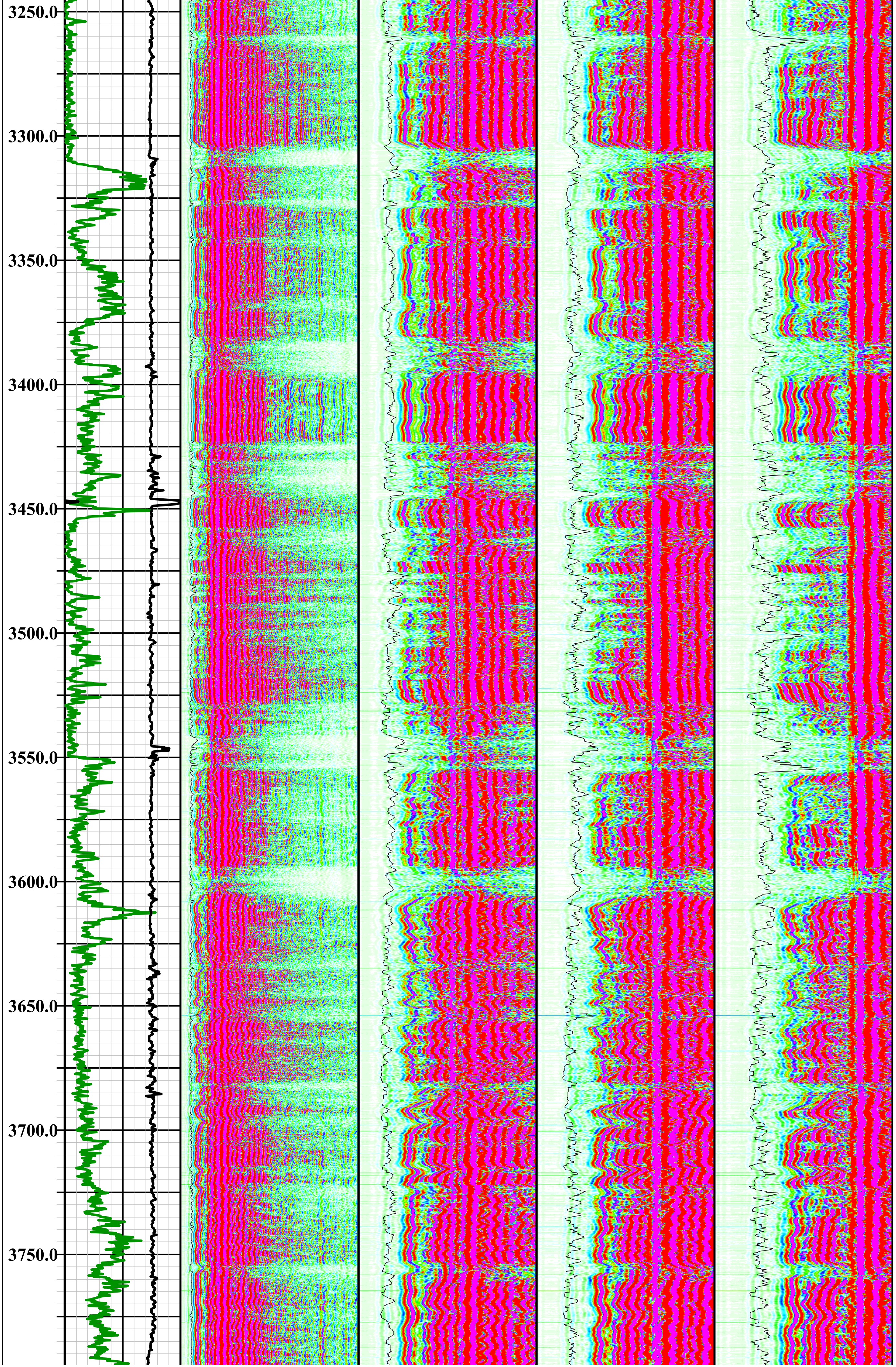
Depth	Nat. Gamma	RX1 - Travel Time	RX2 - Travel Time	RX3 - Travel Time	RX4 - Travel Time
1in:50ft	0 API 200	100 uSec 2040	100 uSec 1020	100 uSec 1020	100 uSec 1020
	3-Arm Caliper	RX1 - VDL	RX2 - VDL	RX3 - VDL	RX4 - VDL
	0 Inches 10	100 uSec 2040	100 uSec 1020	100 uSec 1020	100 uSec 1020

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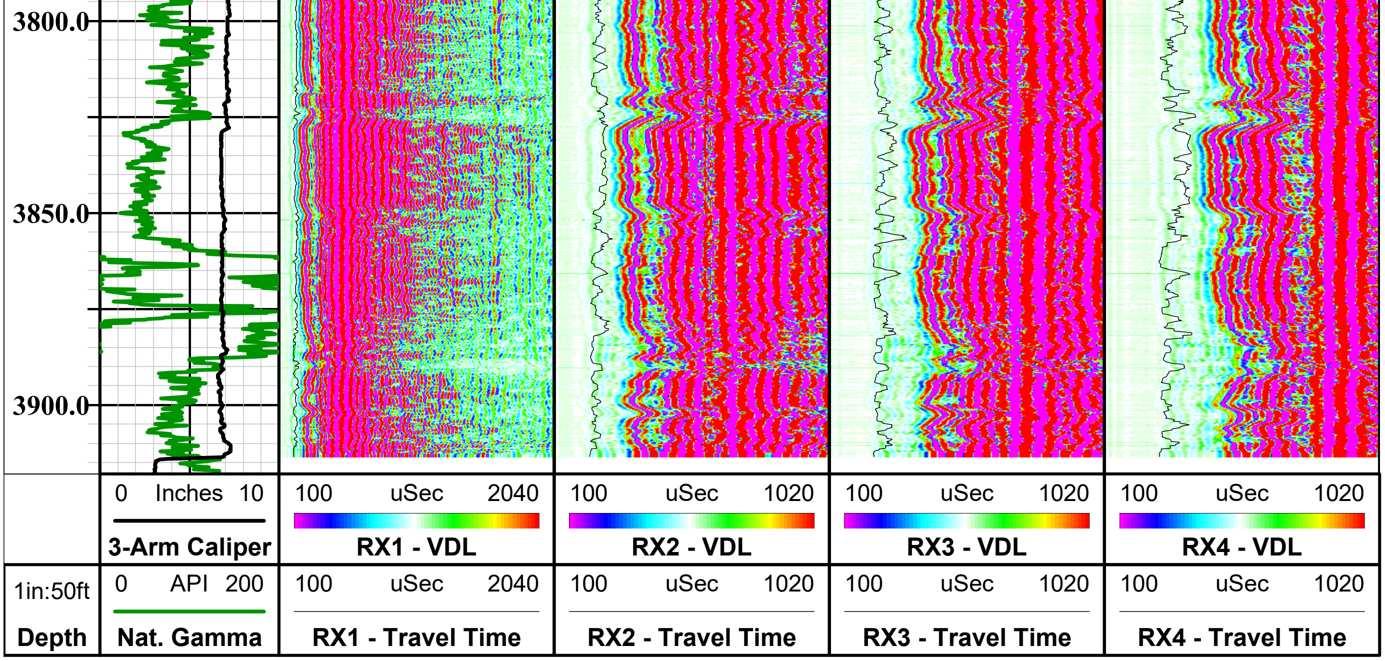


FWS50-4Rx Full Waveform Sonic Tool SN 5185

Probe Top = Depth Ref.

Four Conductor MSI Probe Top

Probe Length = 2.71 m or 8.9 ft
Probe Weight = ~18.0 kg or 39.6 lbs

Sensors: Ceramic Piezoelectric in Polyurethane potting

Transmitter Frequency: ~20 kHz resonant frequency

Rx - Rx Spacing: 0.2 m (7.9 in)

Typically ran centralized with external bow spring centralizers.

Can only be collected in fluid.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)

Rx-4 Tx - Rx4 Spacing = 1.2 m (47.2 in)

Rx-3 Tx - Rx3 Spacing = 1.0 m (39.4 in)

Rx-2 Tx - Rx2 Spacing = 0.8 m (31.5 in)

Rx-1 Tx - Rx1 Spacing = 0.6 m (23.6 in)

Acoustic Isolater

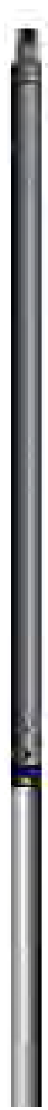
Tx = Acoustic Transmitter

0.155 m or 6.25 in. - End of tool to center of Tx

1.97" or 50 mm Diameter

QL40 Gamma-Caliper-Temperature-Fluid Conductivity SN 5613

Probe Top = Depth Ref.



Four Conductor MSI Probe Top

Probe Length = 3.69 m or 12.12 ft
Probe Weight = 18.195 kg or 40.11 lbs

Caliper arms can only collect data logging up hole

Fluid Temperature/Conductivity and Natural Gamma
can be collected logging up and down hole

Temperature Rating: 80 Deg C (176 Deg F)
Presure Rating: 200 bar (2900 psi)

Natural Gamma Ray = 1.07 m (42.12 in)

Southwest Exploration Services, LLC
borehole geophysics & video services

Company	RESOLUTION COPPER
Well	DHRES-15
Field	RESOLUTION
County	PINAL
State	ARIZONA

Preliminary 4 RX SONIC SUMMARY

Southwest Exploration Services, LLC
borehole geophysics & video services

COMPANY	RESOLUTION COPPER CO		
WELL ID	DHRES-15 (55-91668)		
FIELD	RESOLUTION		
COUNTY	PINAL	STATE	ARIZONA

TYPE OF LOGS: ACOUSTIC TELEVIEWER
MORE: CALIPER

LOCATION
NW 1/4 OF SW 1/4 OF SW 1/4
964978 E, 831076 N

SEC 05 TWP 02 S RGE 13 E

OTHER SERVICES
DUAL INDUCTION
COMBO TOOL
SONIC
E-LOGS

PERMANENT DATUM	AZ SPC, feet	ELEVATION 3991 ft	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM	D.F.
DRILLING MEAS. FROM			G.L.

DATE	07-12-14	TYPE FLUID IN HOLE	POLY WATER
RUN No	1	MUD WEIGHT	N/A
TYPE LOG	ACOUSTIC TELEVIEWER	VISCOSITY	N/A
DEPTH-DRILLER	3920 FT	LEVEL	~ 640 FT
DEPTH-LOGGER	3920 FT	MAX. REC. TEMP.	54 DEG C
BTM LOGGED INTERVAL	3920 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	2875 FT	SAMPLE INTERVAL	0.2 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	K. MITCHELL	TOOL STRING/SN	ALT ABI-43 SN - 90601
WITNESSED BY	MATT SHELLY - M&A	LOG TIME:ON SITE/OFF SITE	10:15 PM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	37 FT	14"	STEEL	SURFACE	37 FT
2	12 1/4"	37 FT	2900 FT	7 7/8"	STEEL	SURFACE	2890 FT
3	6"	2900 FT	TOTAL DEPTH				

COMMENTS:

Tool Summary:

Date	07-11-14	**Date**	07-11-14	**Date**	07-12-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	ELOG	**Tool Model**	QL-COMBO TOOL	**Tool Model**	QL-DUAL INDUCTION
Tool SN	4790	**Tool SN**	5613	**Tool SN**	5911
From	2850 FT	**From**	2700 FT	**From**	2700 FT
To	3920 FT	**To**	3920 FT	**To**	3920 FT
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	K. MITCHELL
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	07-11-14	**Operation Check**	07-11-14	**Operation Check**	07-11-14
Calibration Check	07-11-14	**Calibration Check**	07-11-14	**Calibration Check**	07-11-14
Time Logged	10:30 PM	**Time Logged**	11:50 PM	**Time Logged**	1:10 AM

Date	07-12-14	**Date**	07-12-14	**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT 4RX SONIC	**Tool Model**	ABI-43	**Tool Model**	
Tool SN	110208	**Tool SN**	091601	**Tool SN**	
From	2850 FT	**From**	2890 FT	**From**	
To	3920 FT	**To**	3915 FT	**To**	
Recorded By	K. MITCHELL	**Recorded By**	K. MITCHELL	**Recorded By**	
Truck No	500	**Truck No**	500	**Truck No**	
Operation Check	07-11-14	**Operation Check**	07-11-14	**Operation Check**	
Calibration Check	N/A	**Calibration Check**	N/A	**Calibration Check**	
Time Logged	2:20 AM	**Time Logged**	3:45 AM	**Time Logged**	

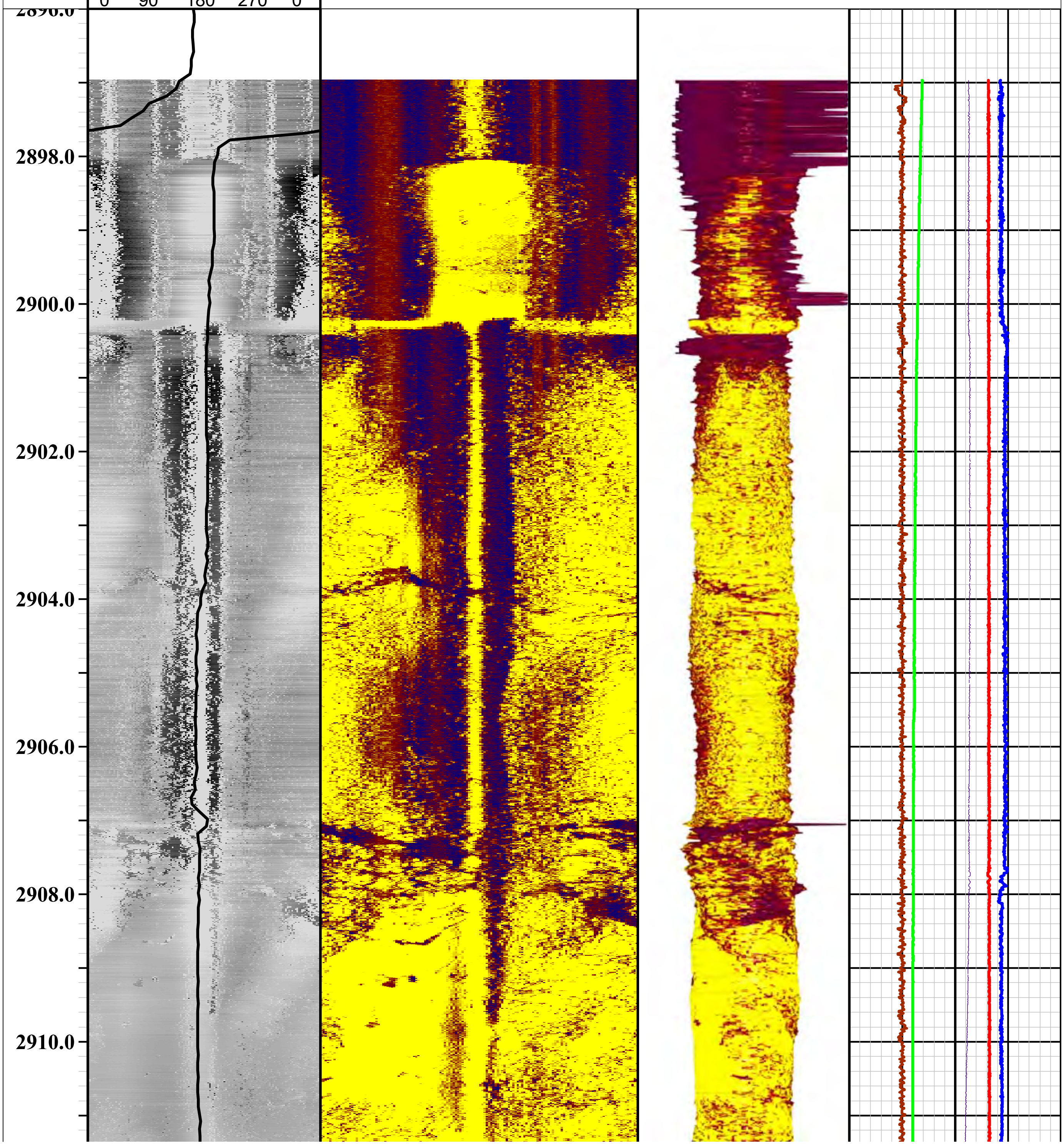
Additional Comments:

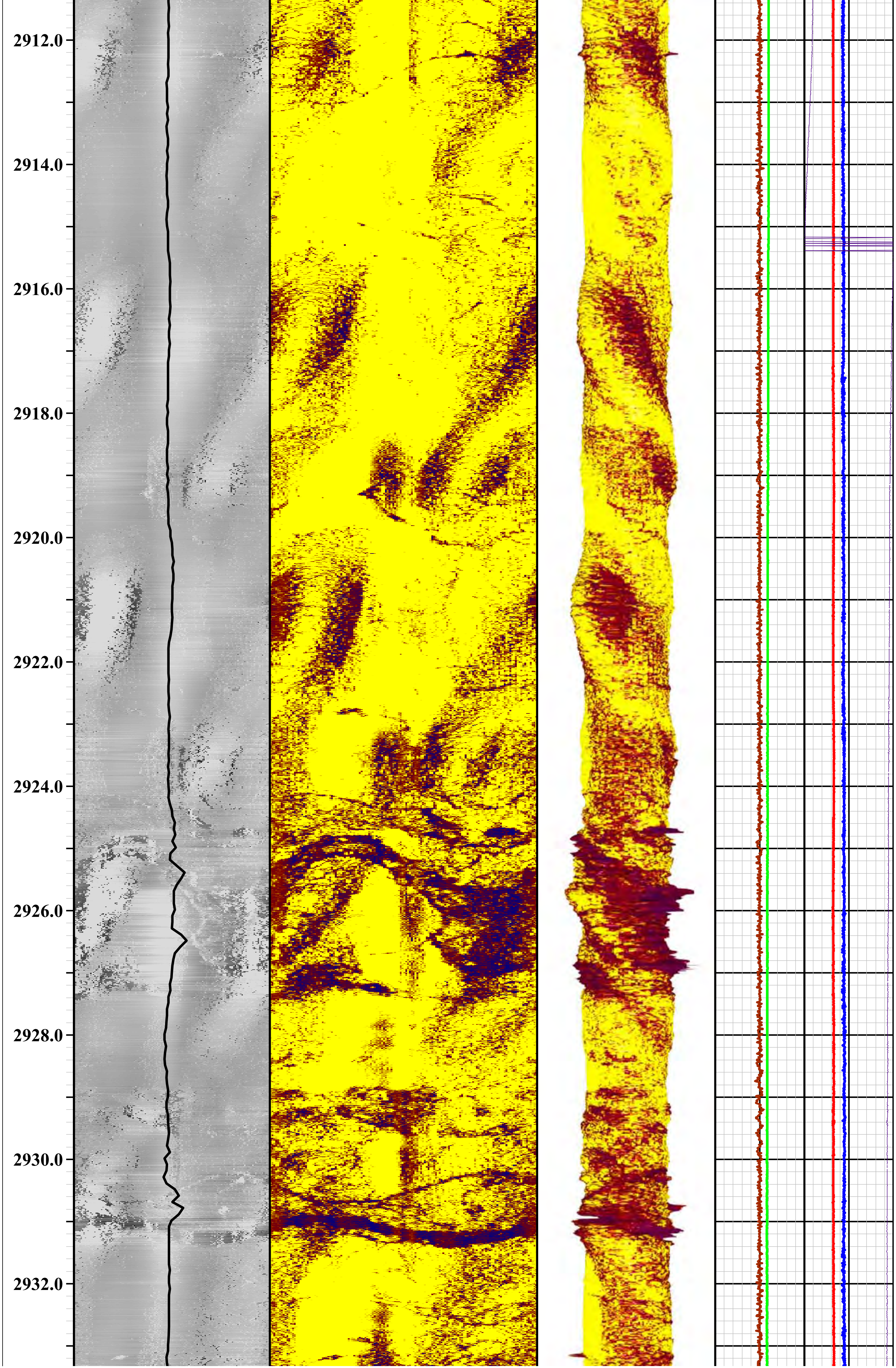
Caliper Arms Used: 9" **Calibration Points:** 4" & 12"

Disclaimer:

All interpretations of log data are opinions based on inferences from electrical or other measurements. We do not guarantee the accuracy or correctness of any interpretations or recommendations and shall not be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our employees or agents. These interpretations are also subject to our general terms and conditions set out in our current Service Invoice.

Depth	TravelTime-HS	Amplitude-HS	3-D View	Mag Field	Tilt
1in:2ft	Oriented High Side 0° 90° 180° 270° 0°	Oriented High Side 0° 90° 180° 270° 0°	-0°	40 uT 60	0 Deg 16
	3-Arm Caliper 5 Inches 10	Amplitude-Static Oriented High Side 0° 90° 180° 270° 0°		Gravity 0.8 G 1.2	Azimuth 0 360
	Centralized TT Oriented High Side 0° 90° 180° 270° 0°				RBR -90 270

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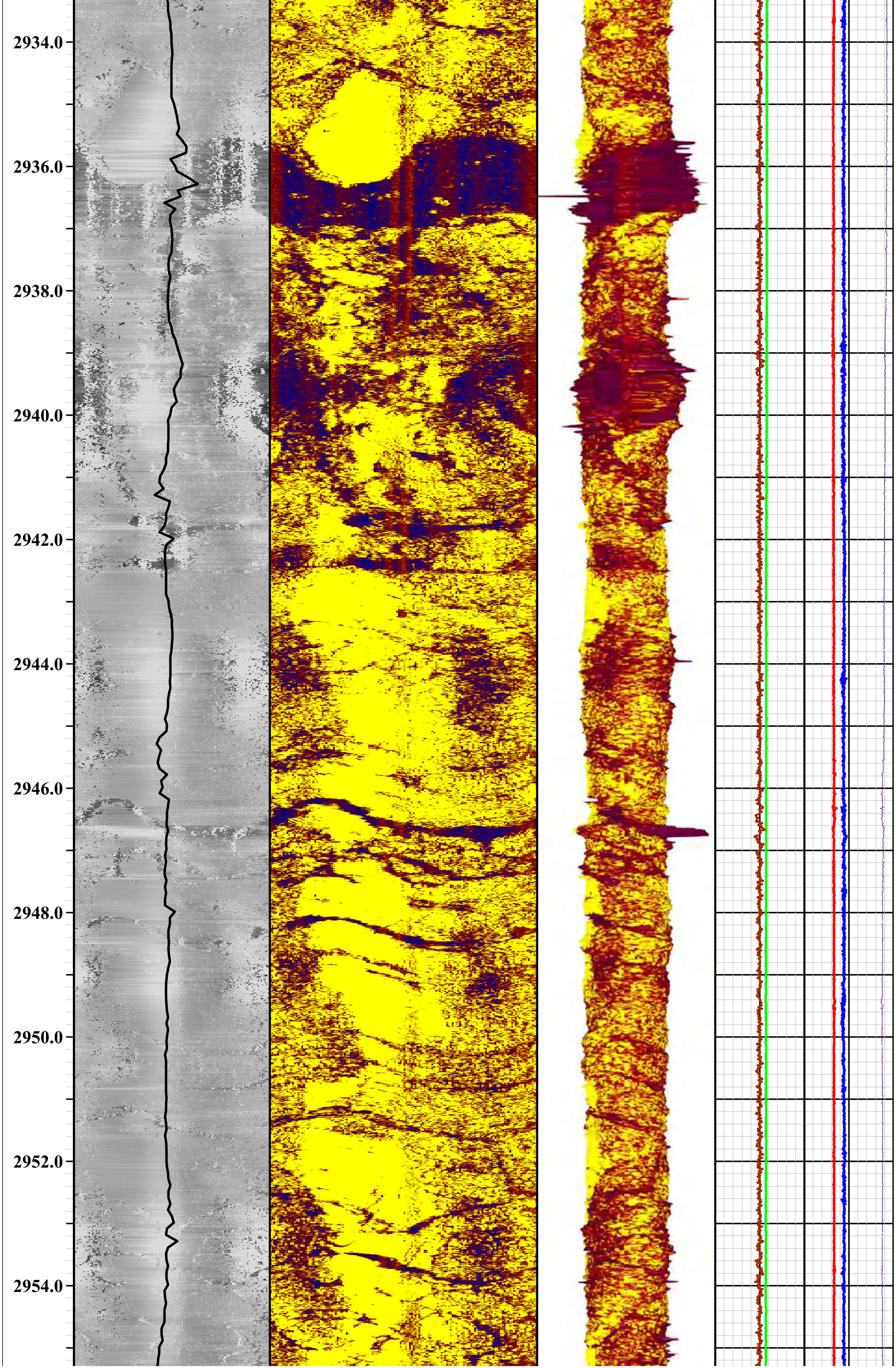
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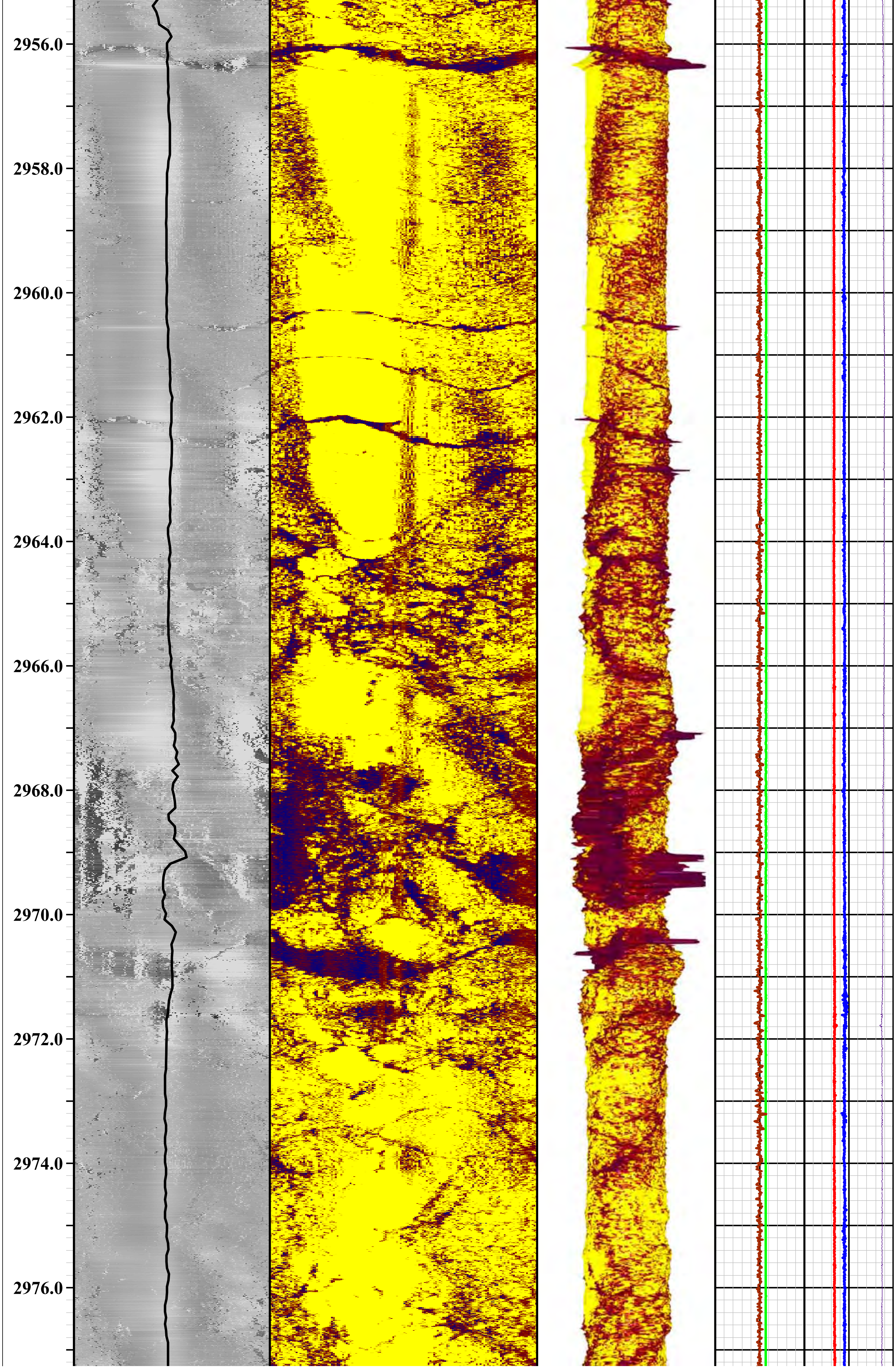
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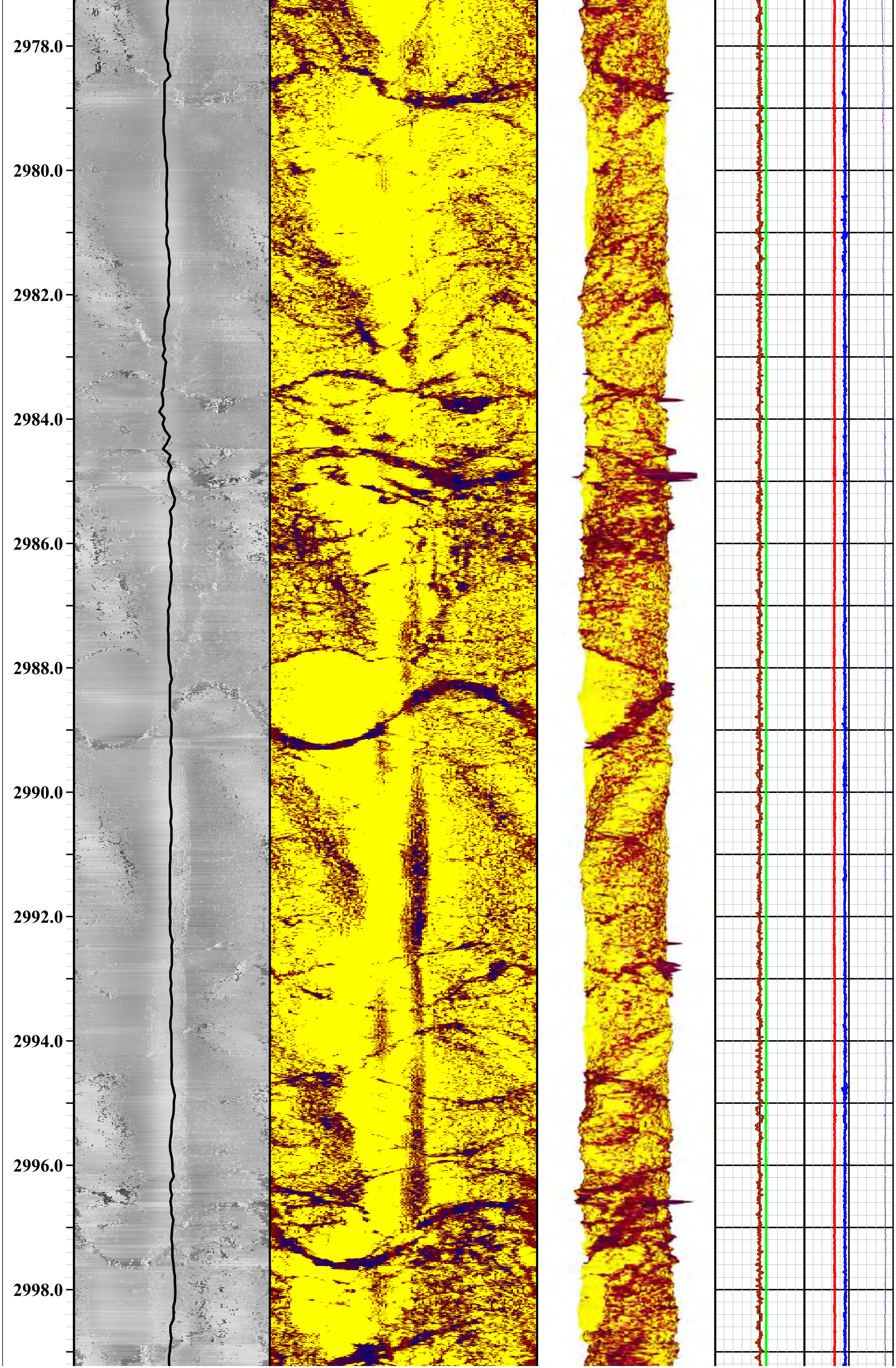

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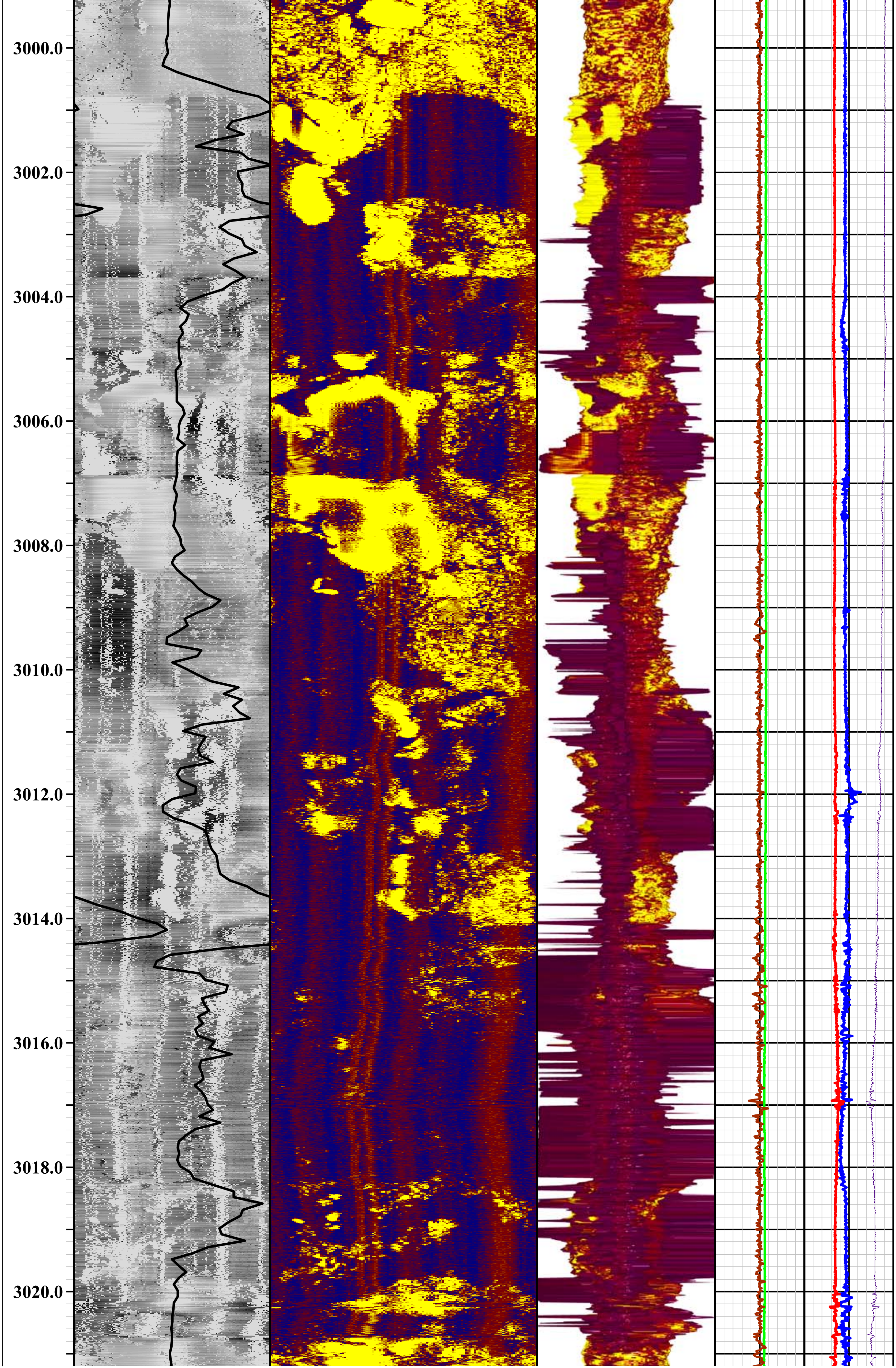
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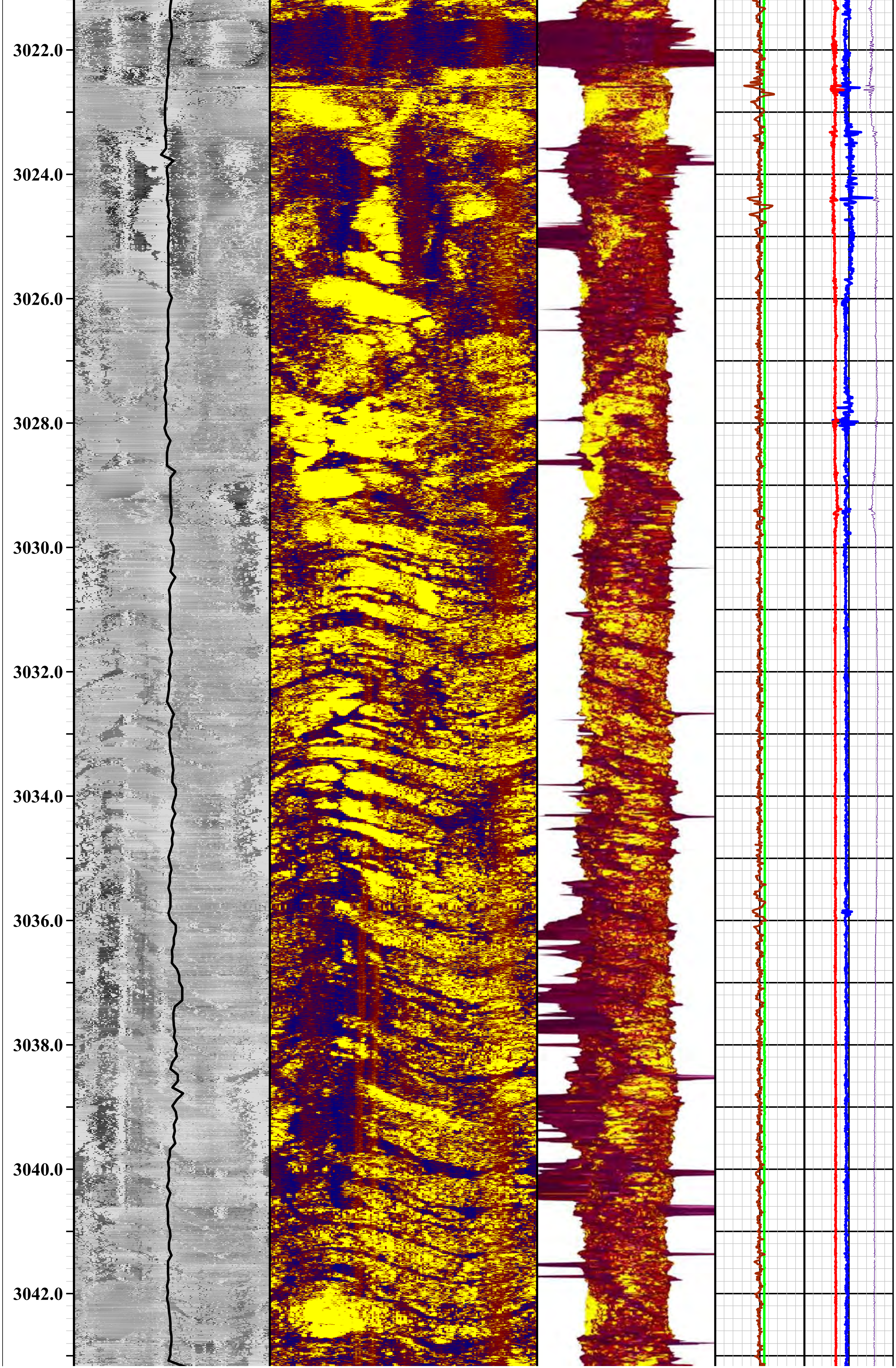
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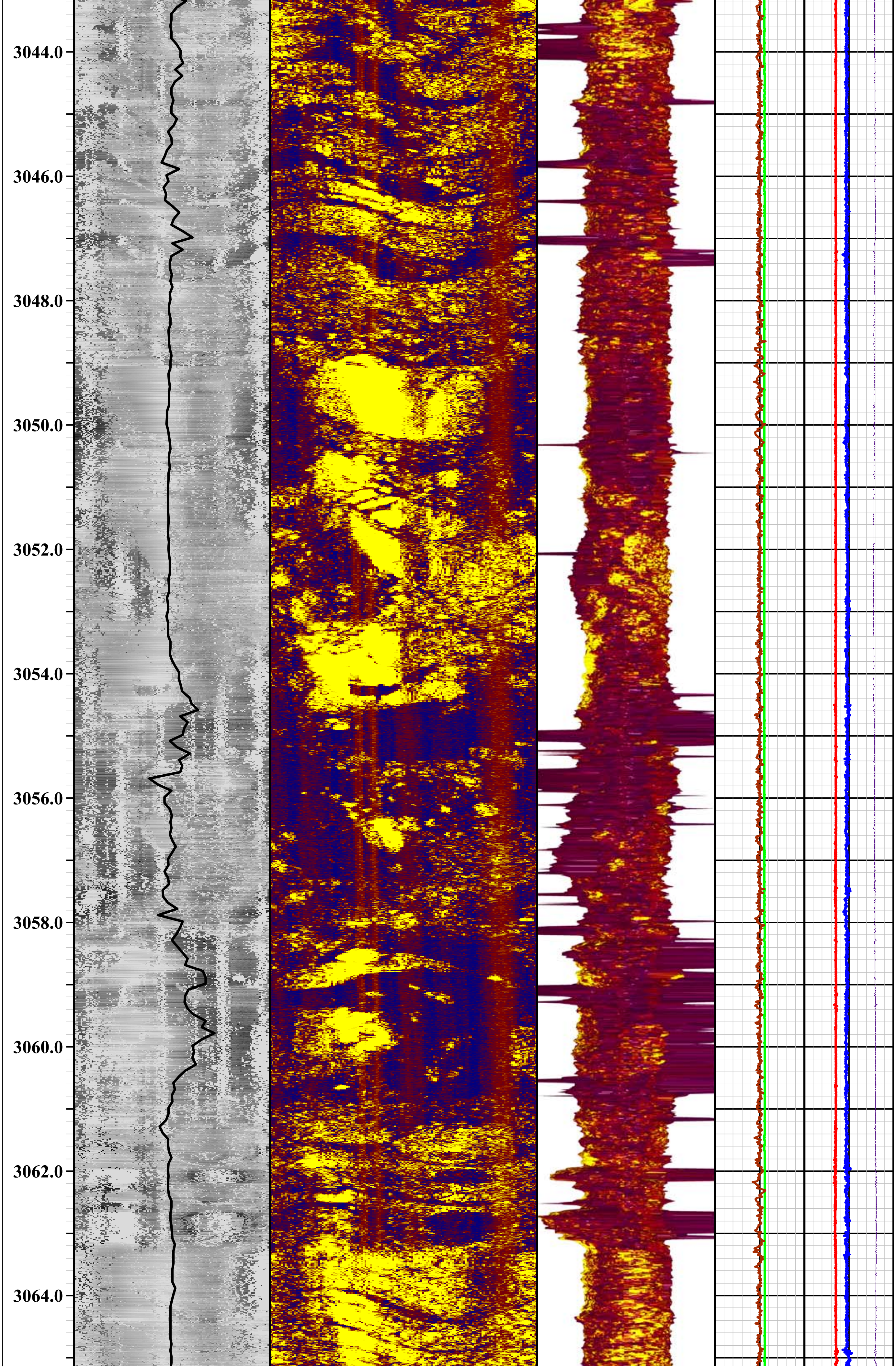
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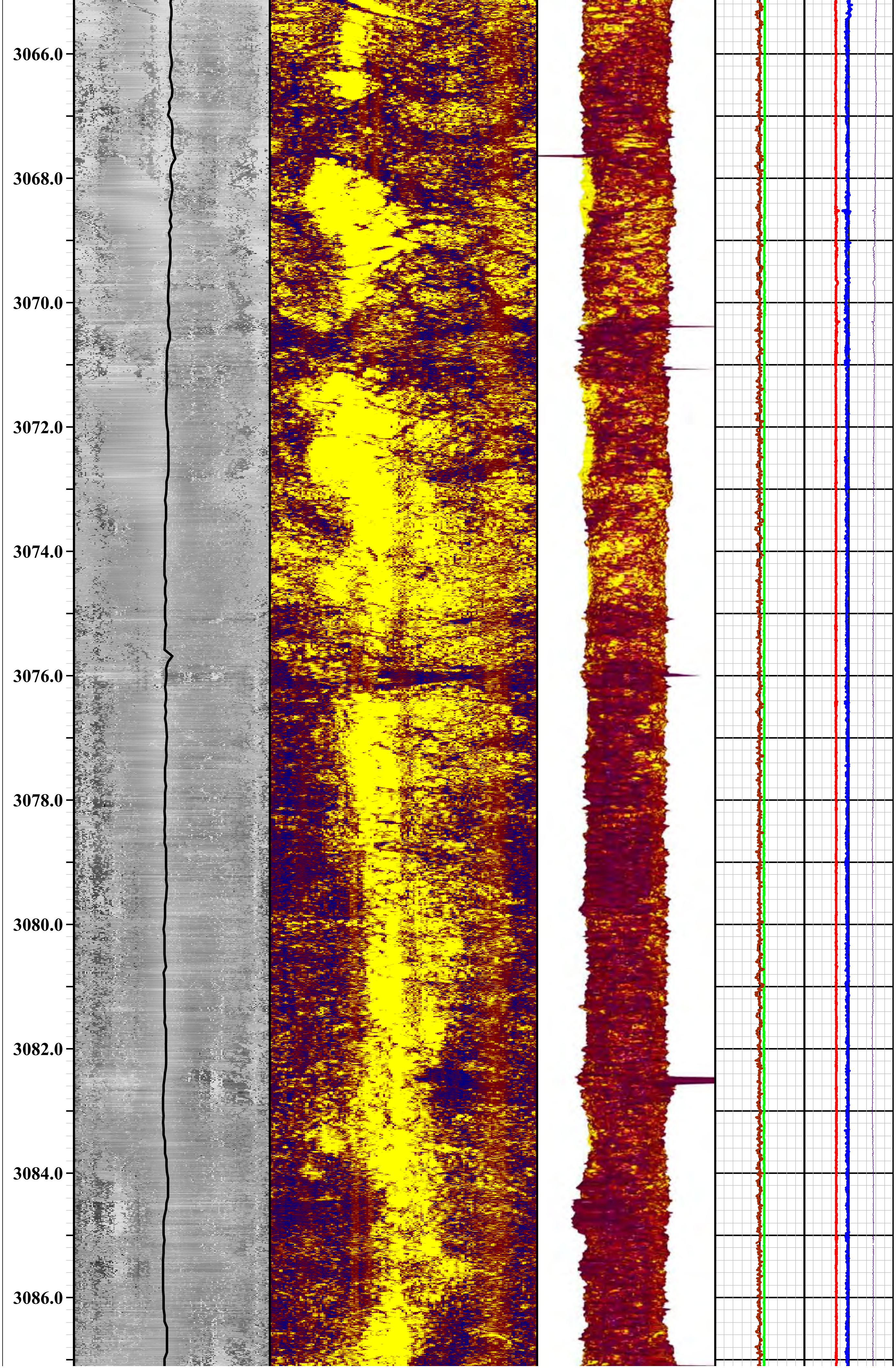
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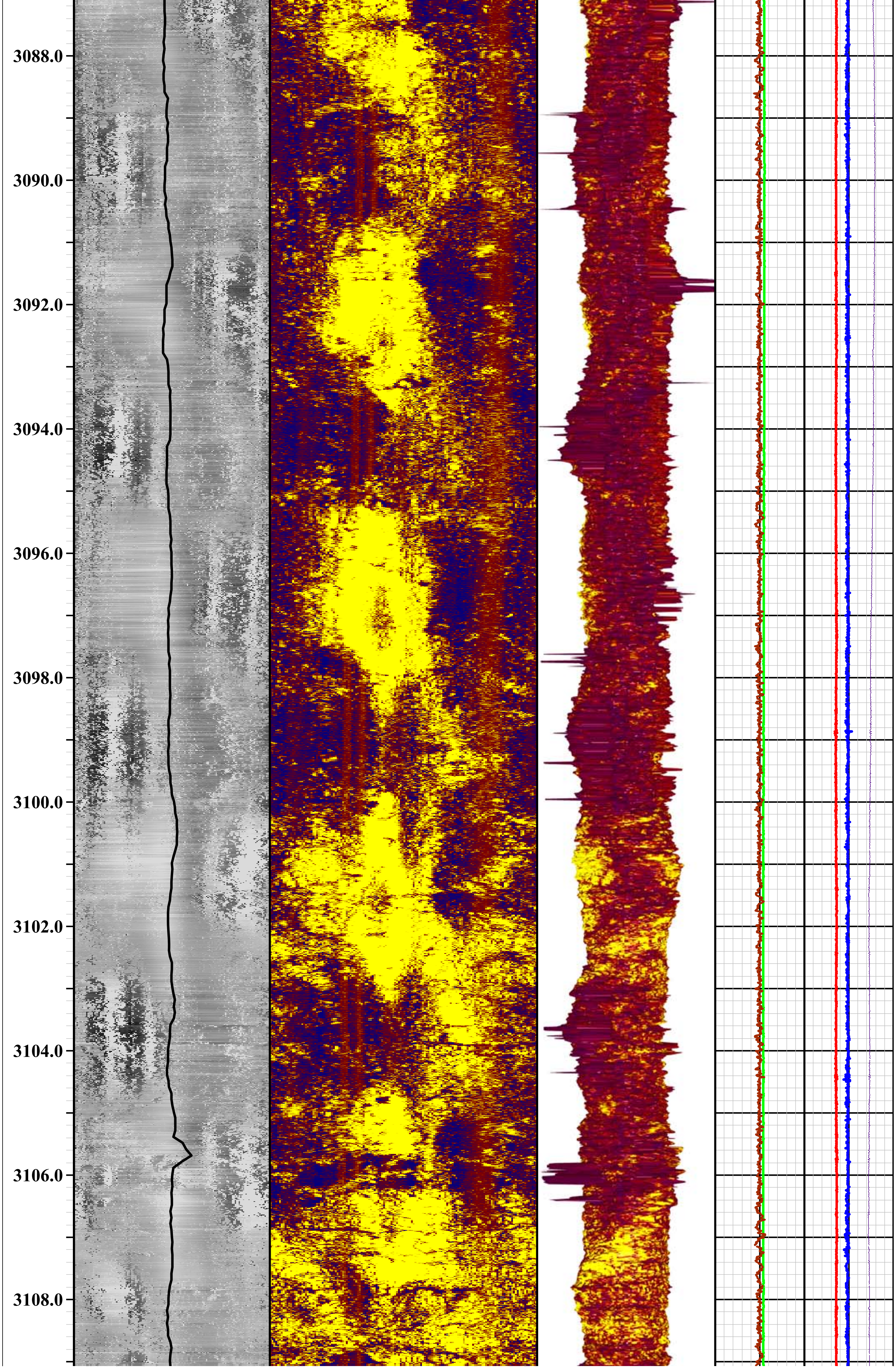
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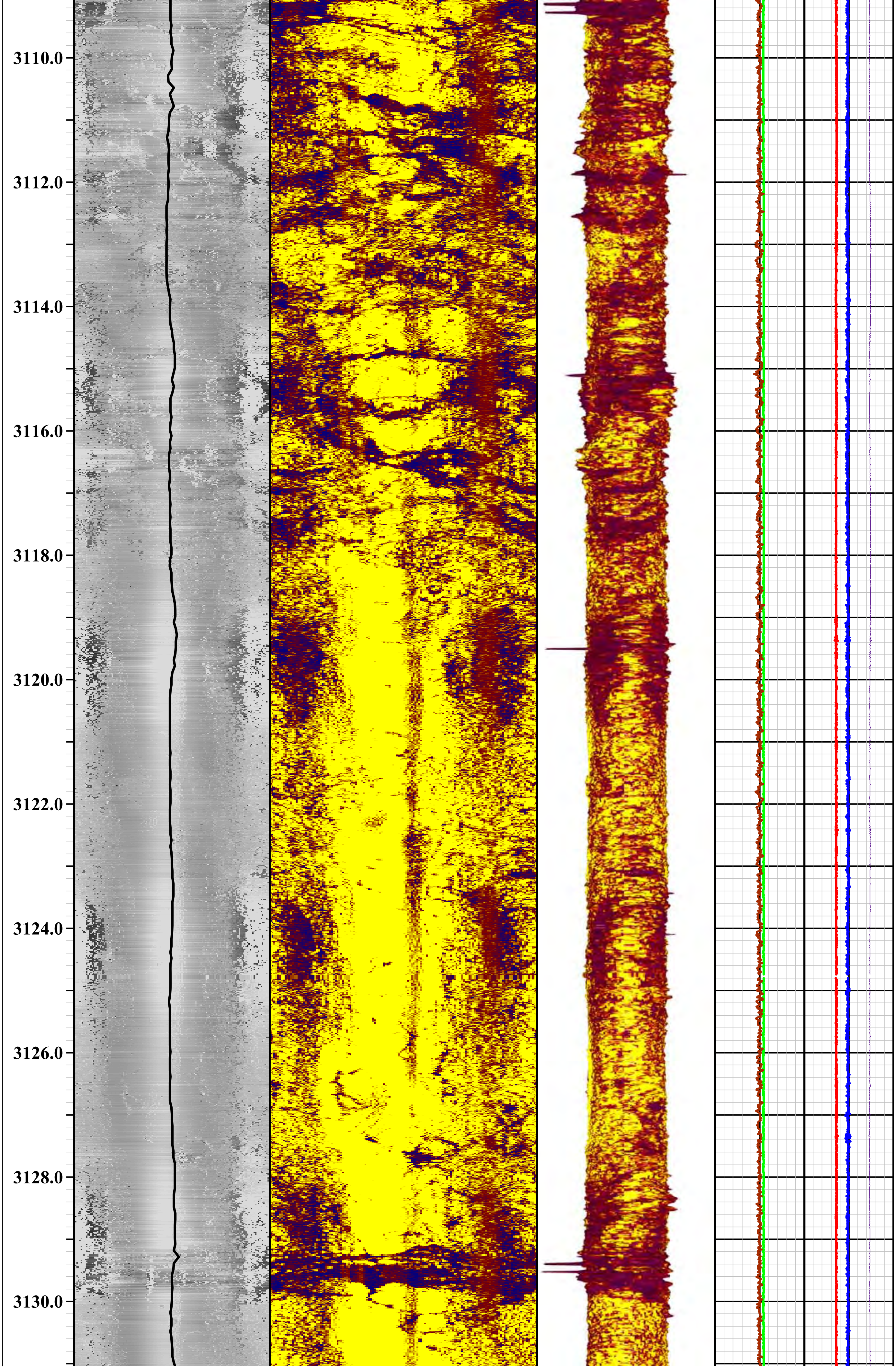
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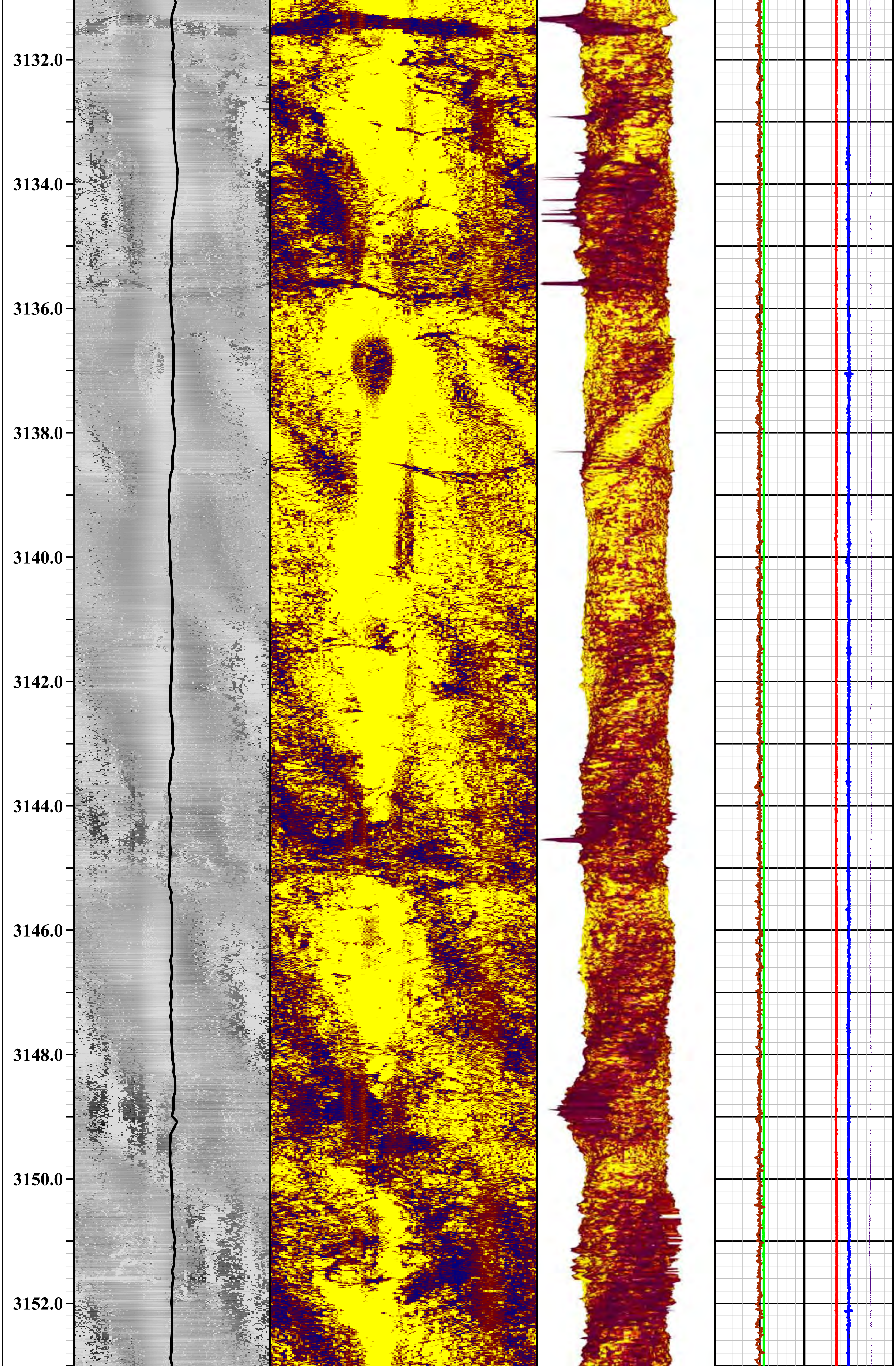
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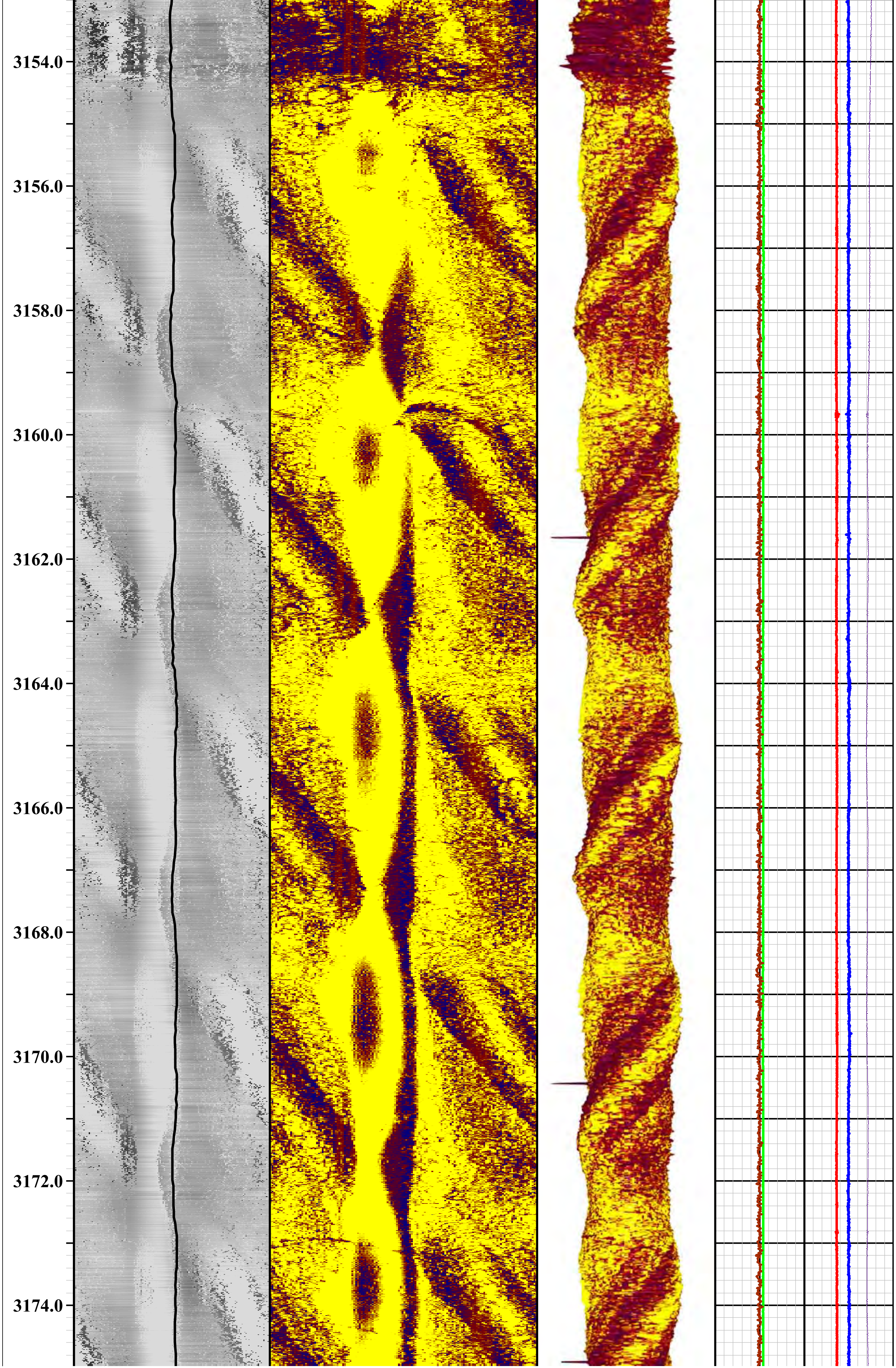
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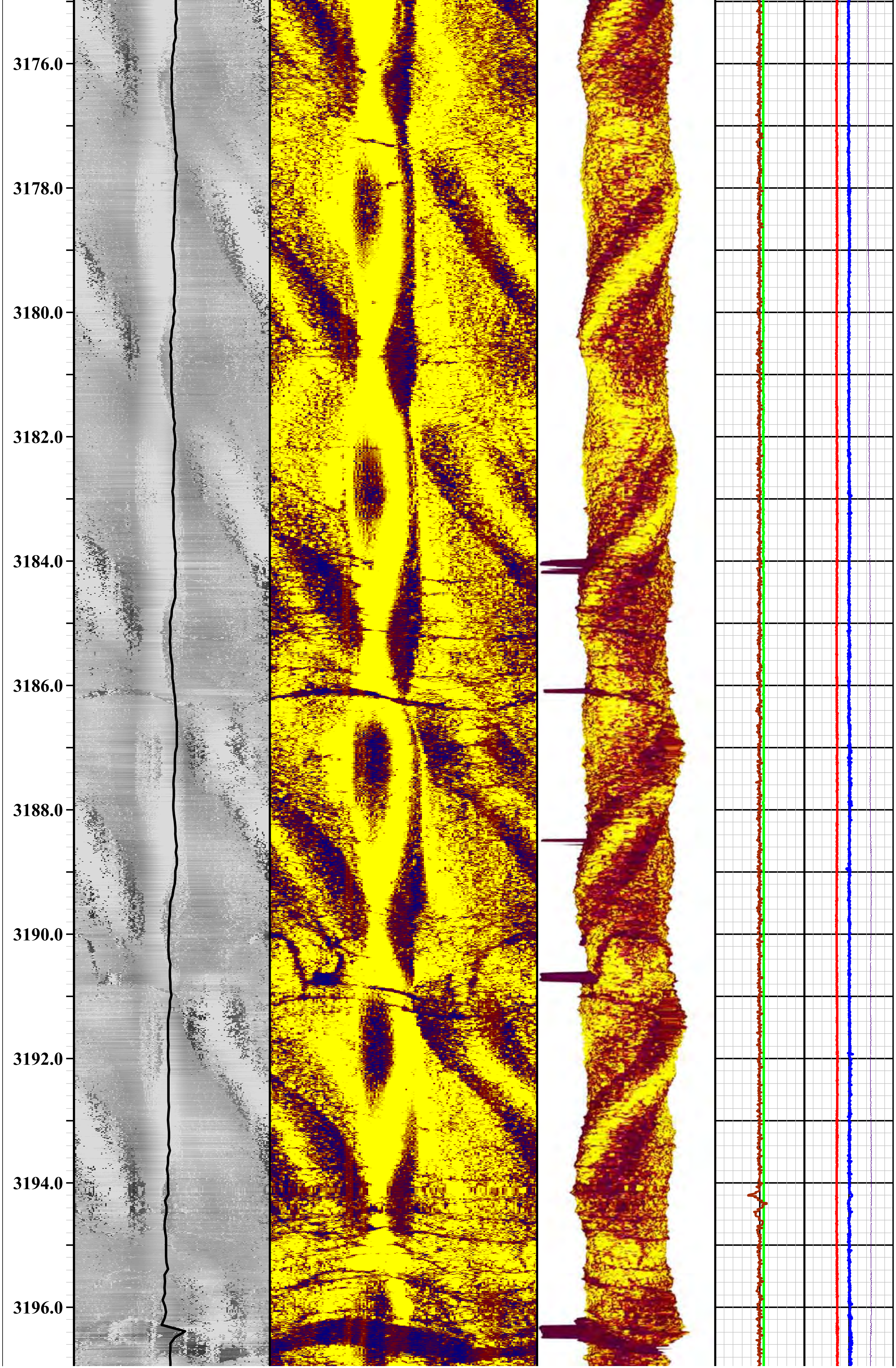
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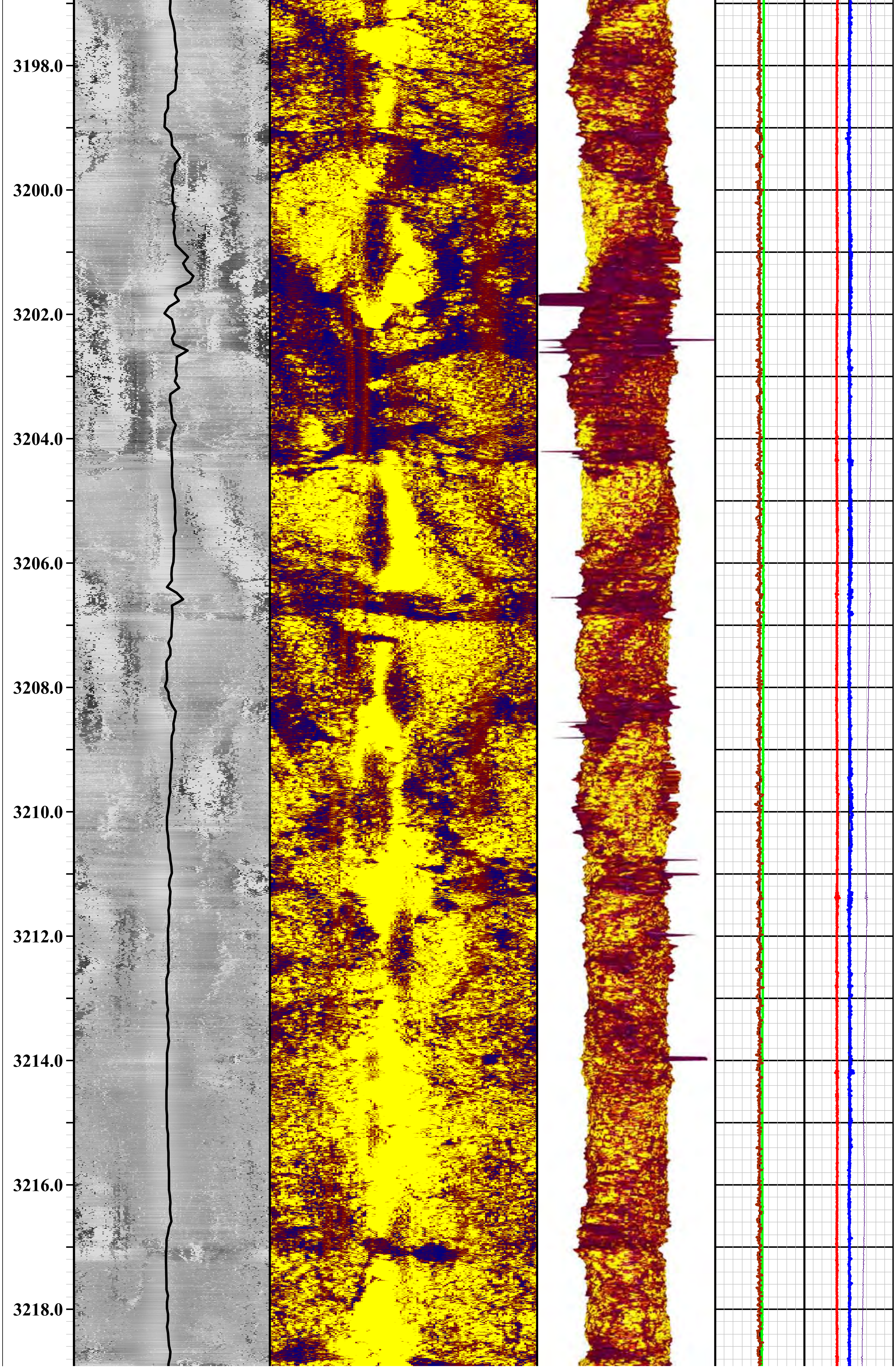
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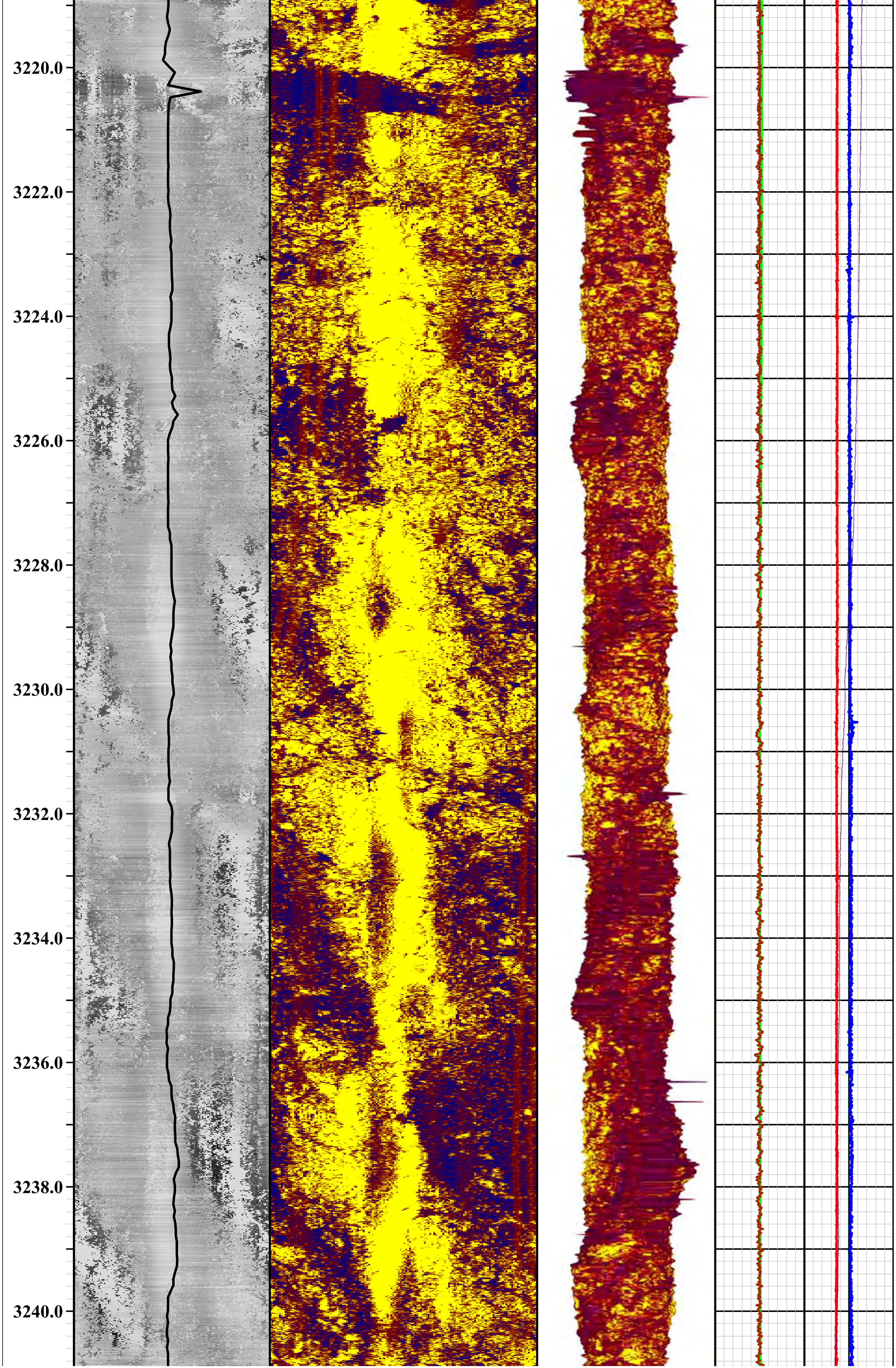

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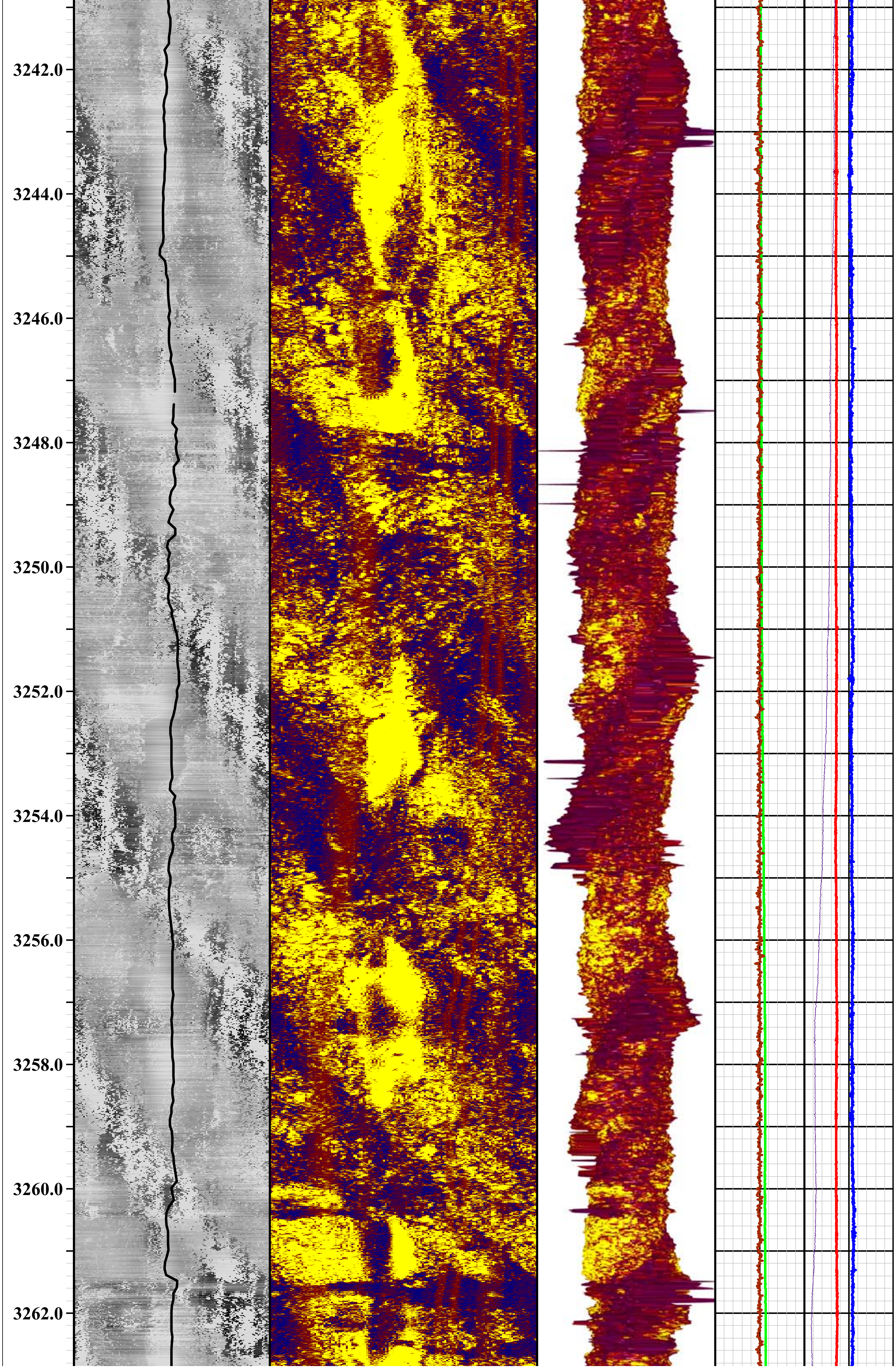
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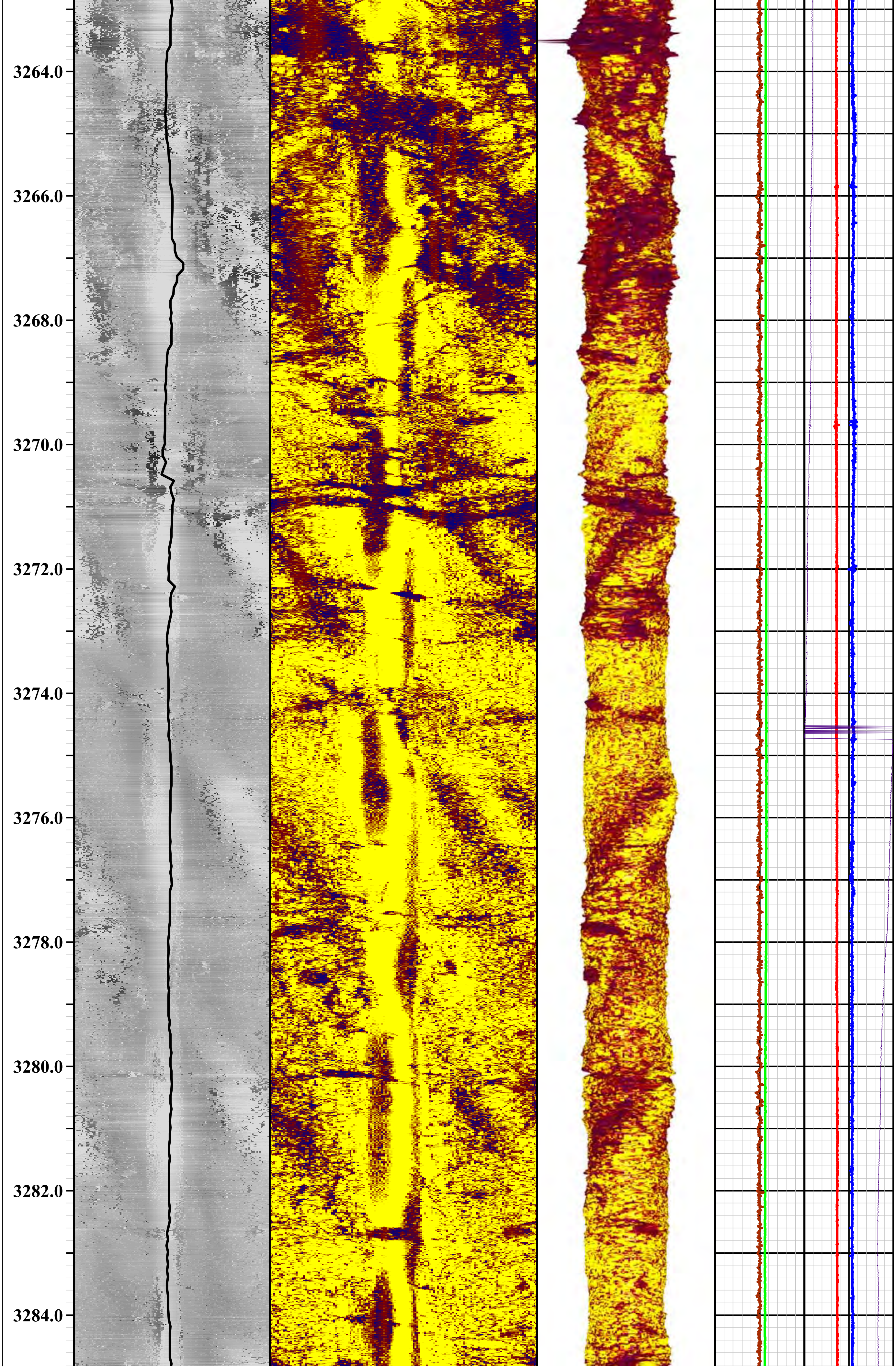
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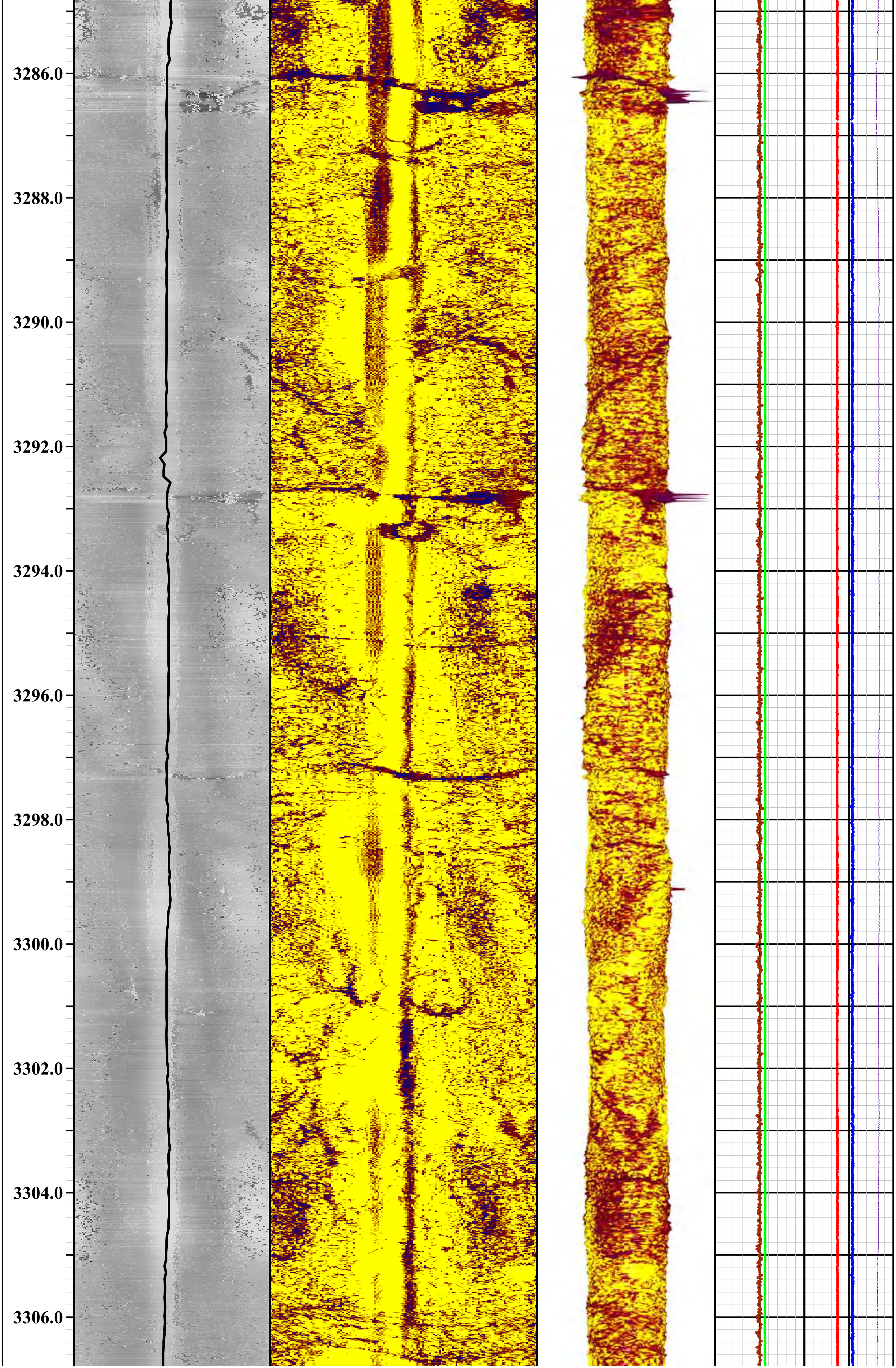
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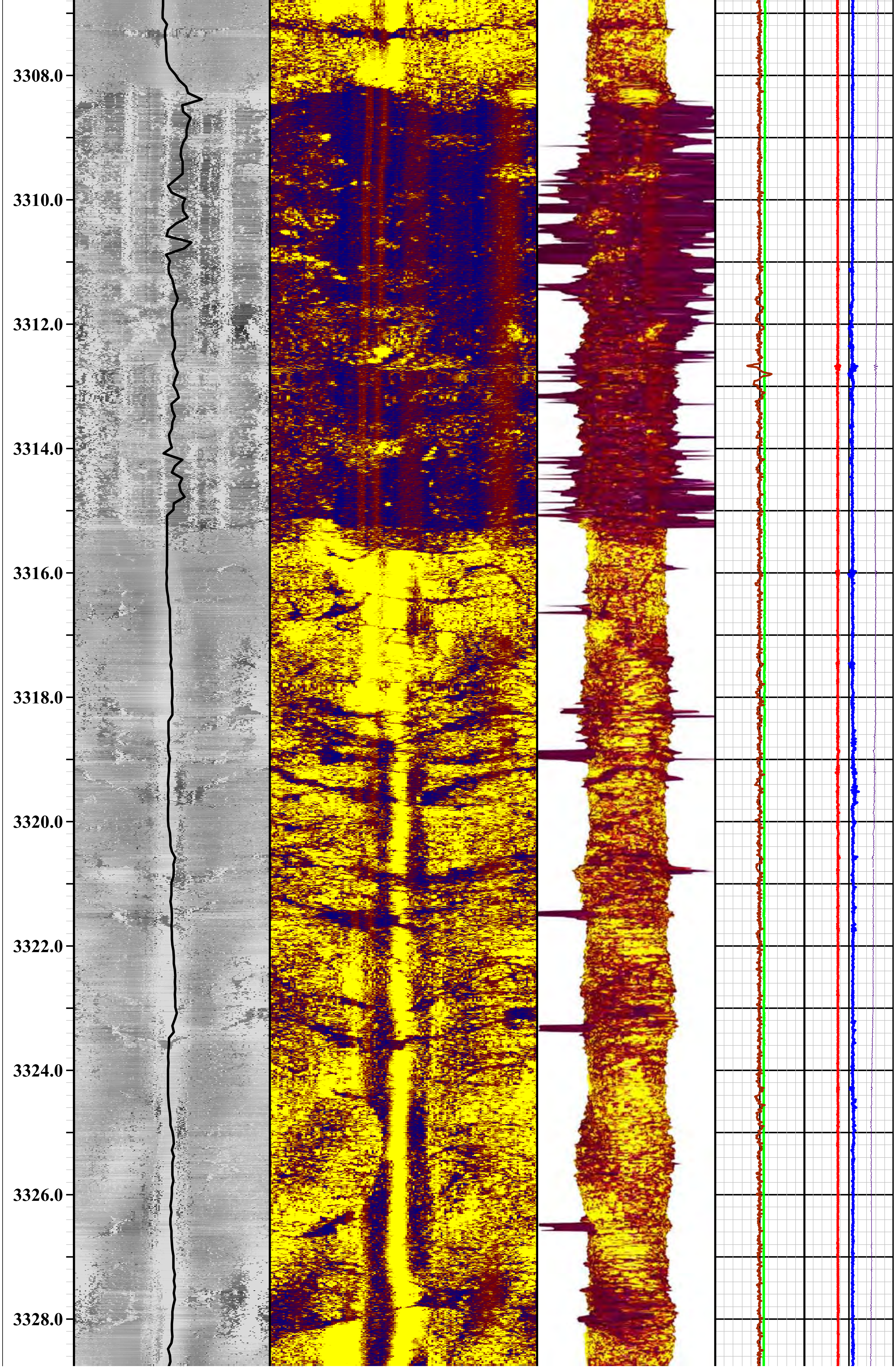
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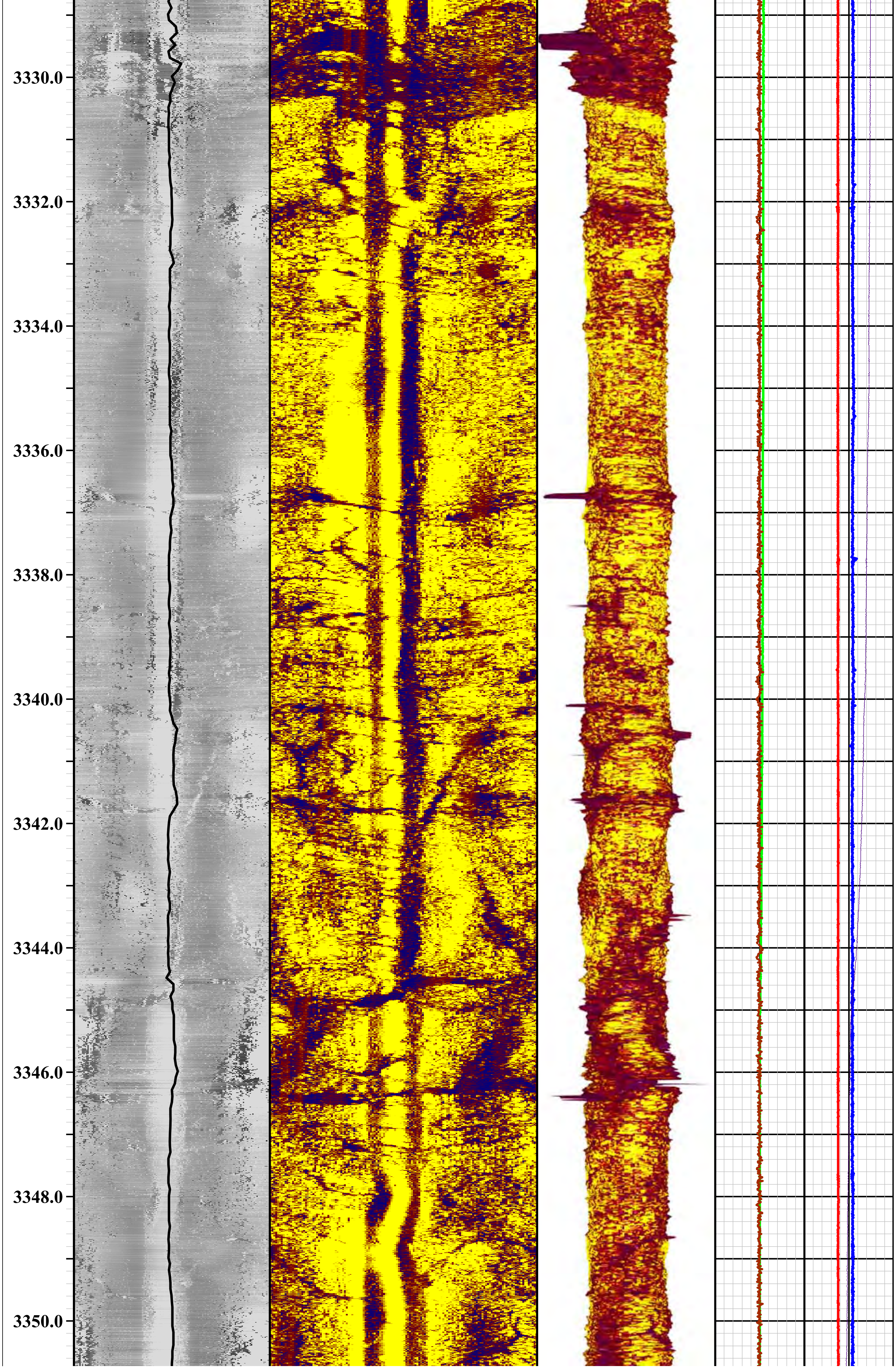
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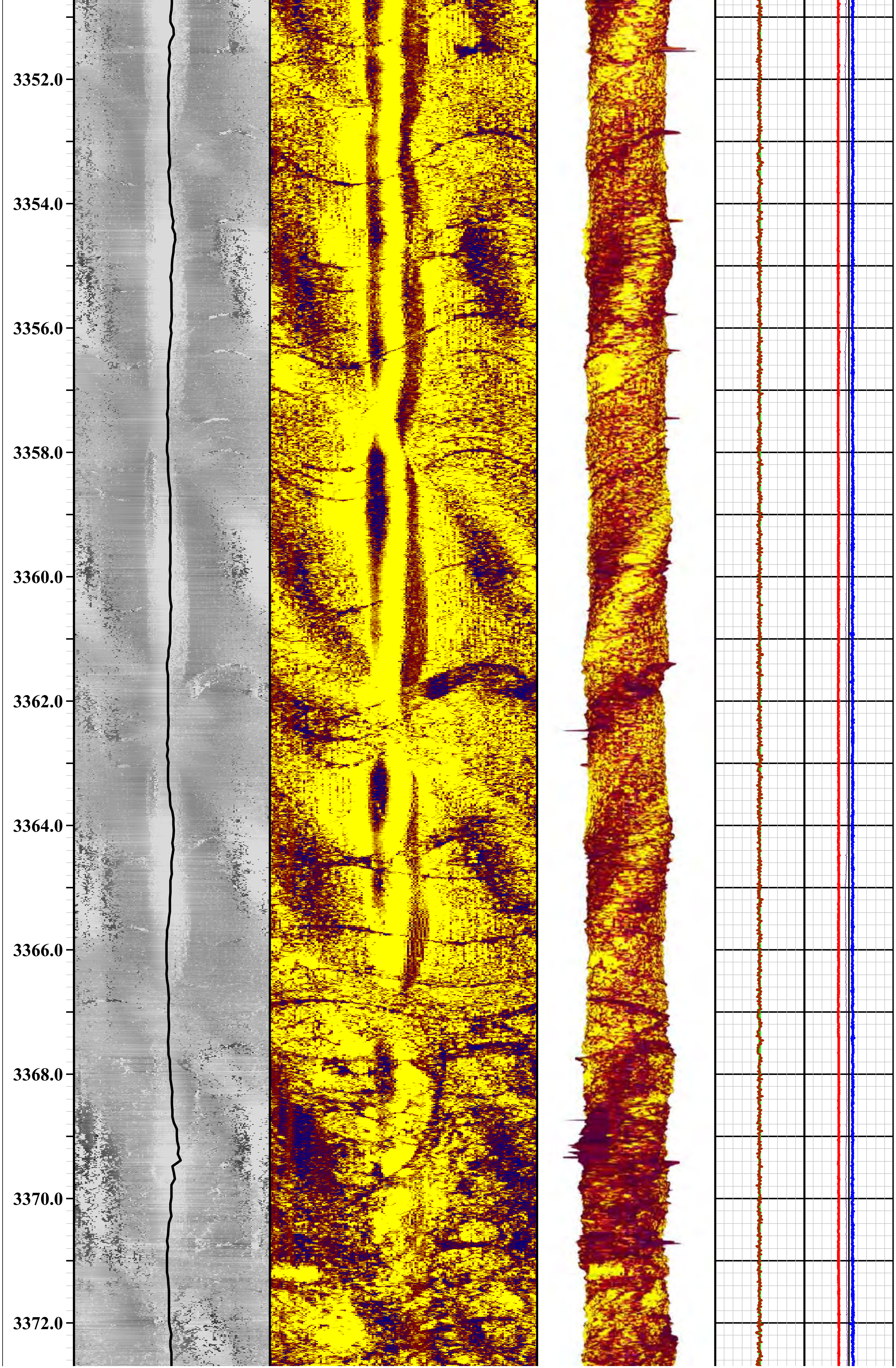
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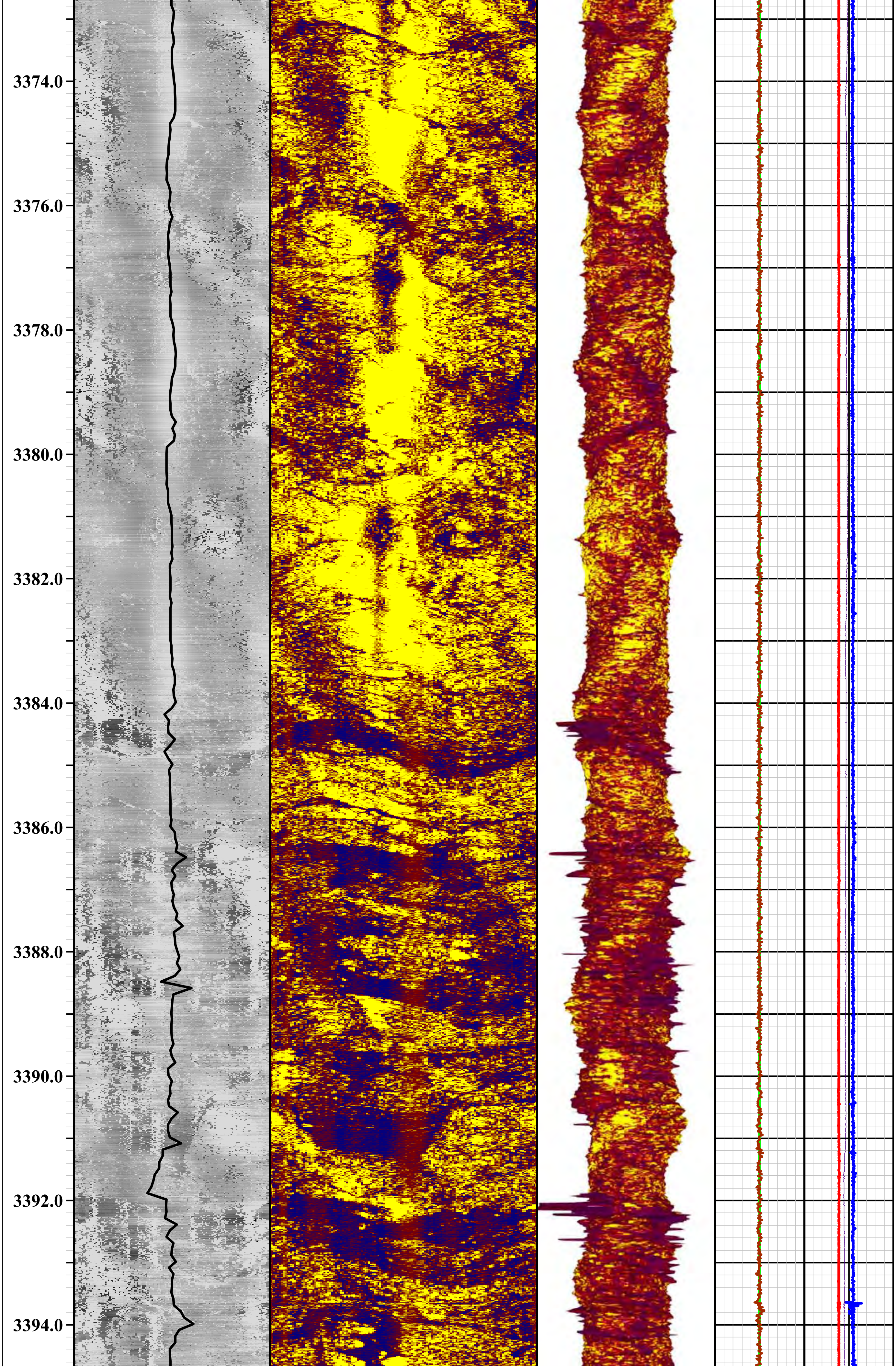

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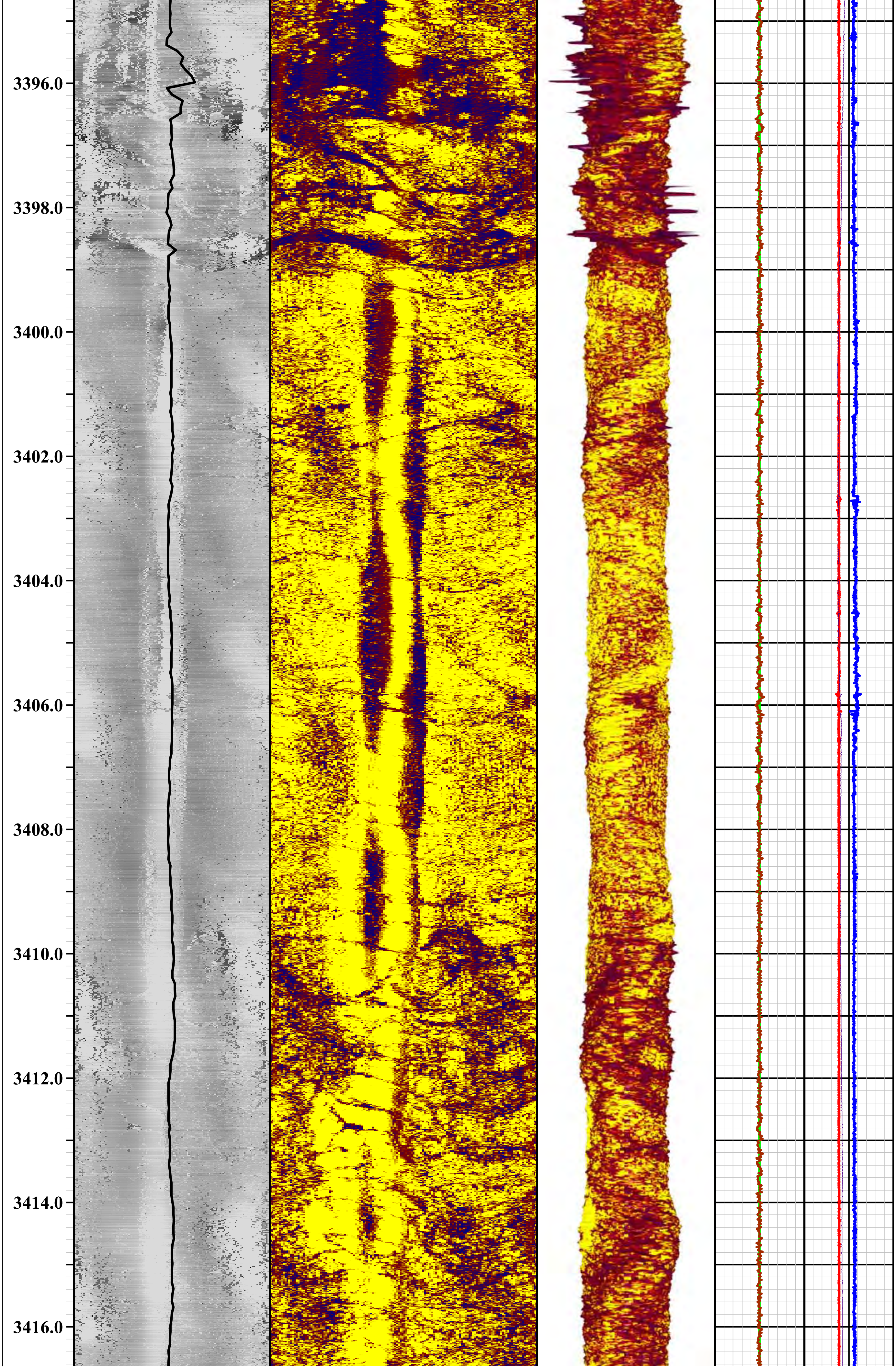

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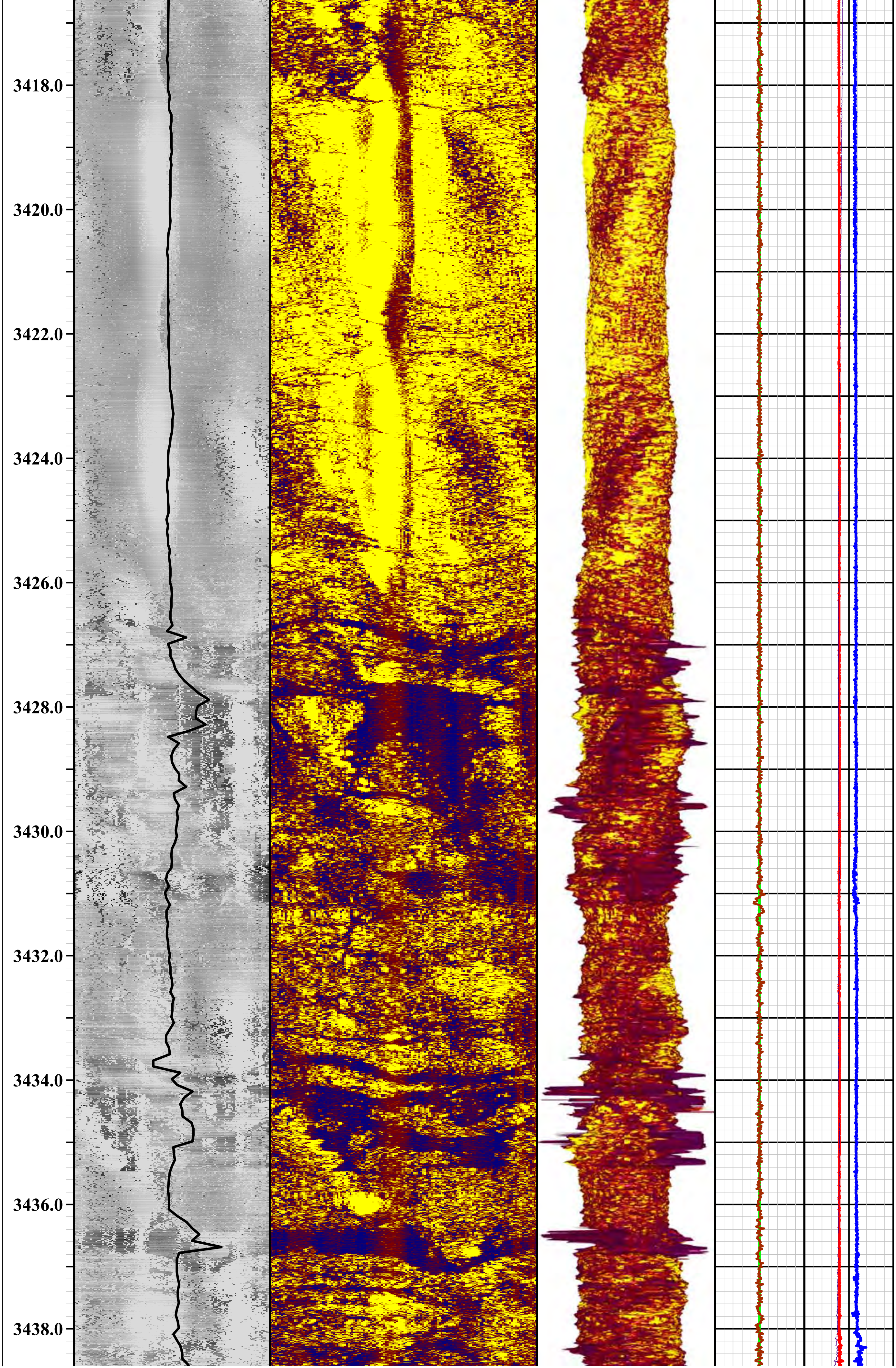
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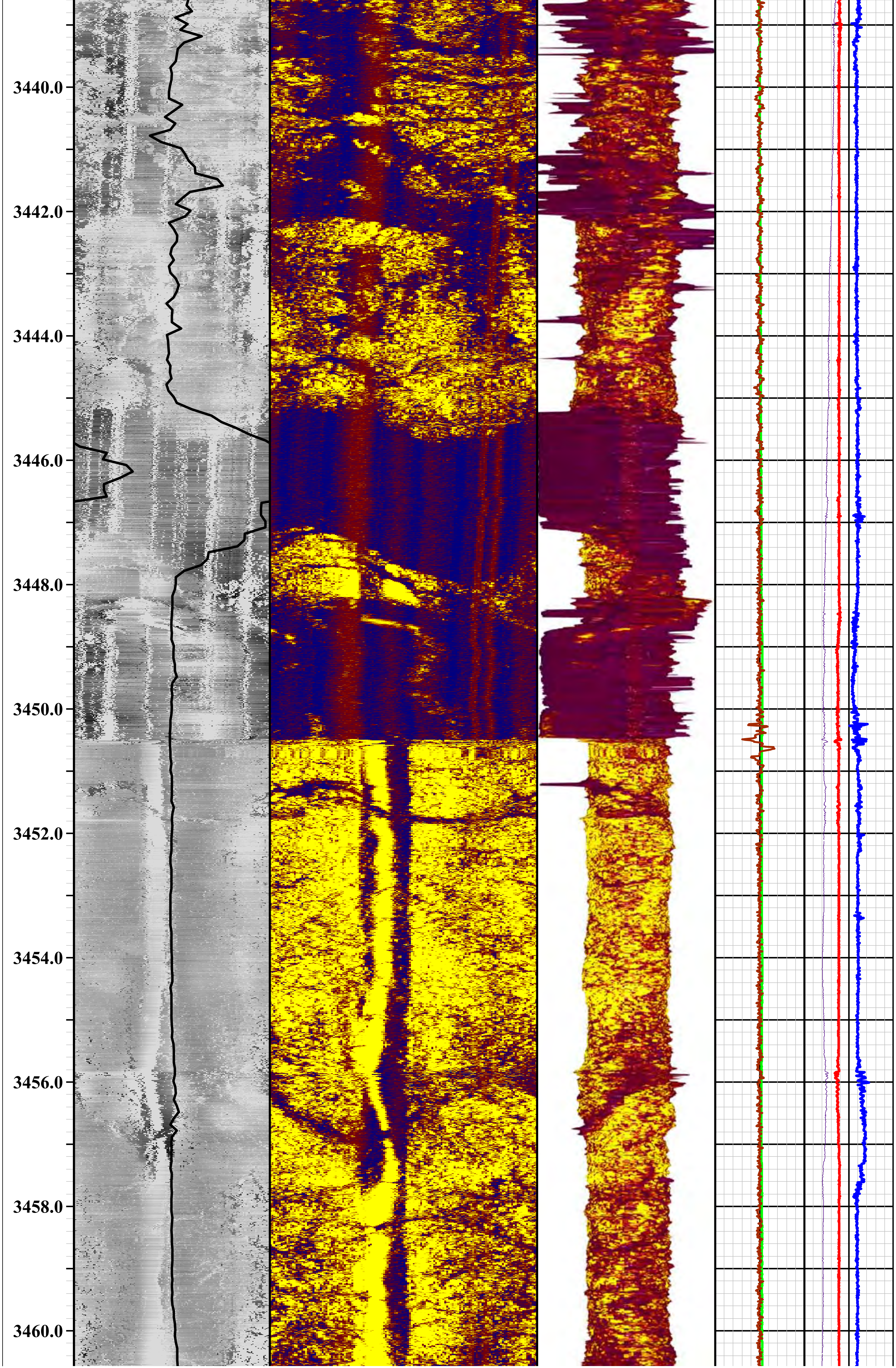
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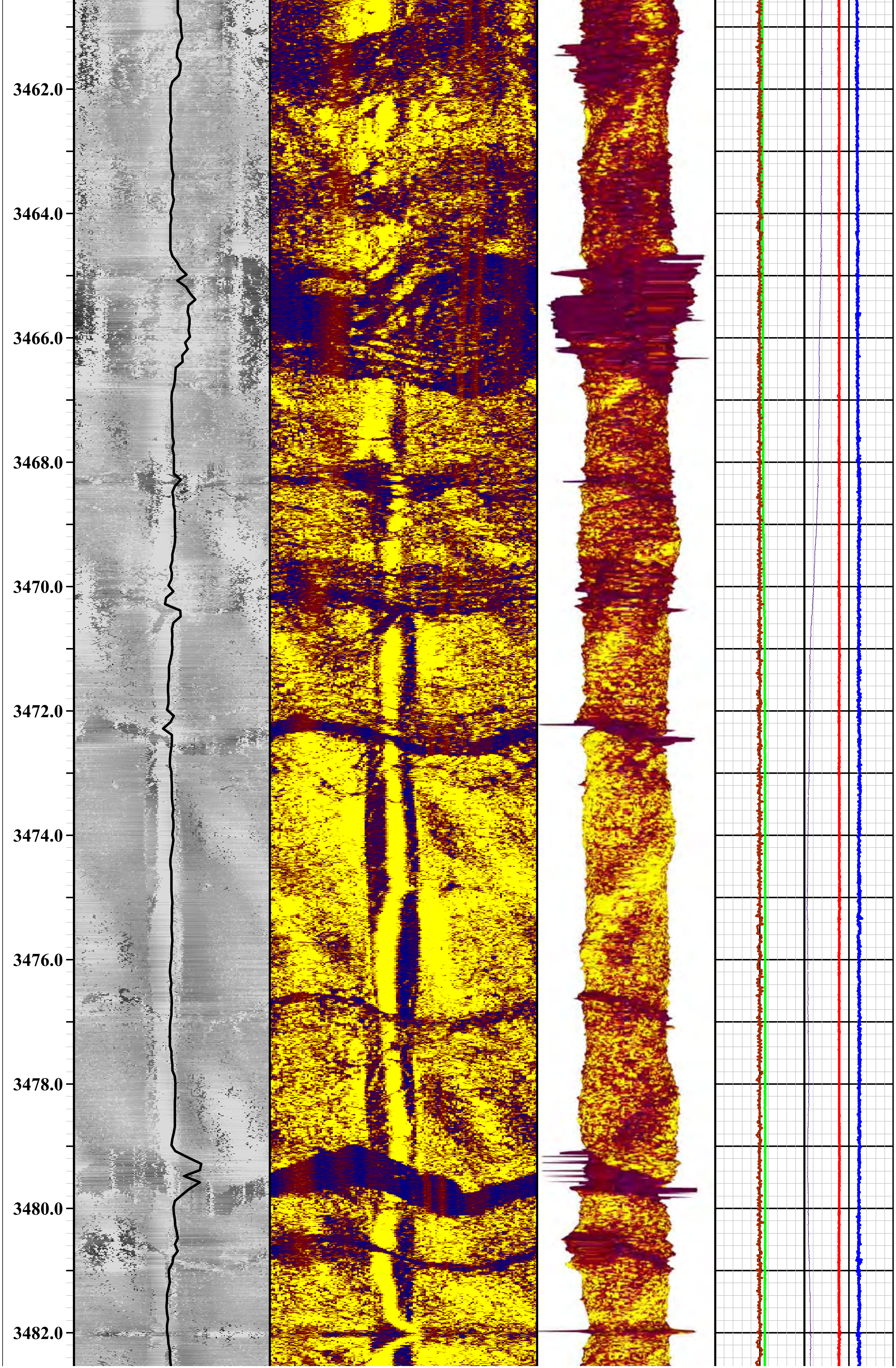
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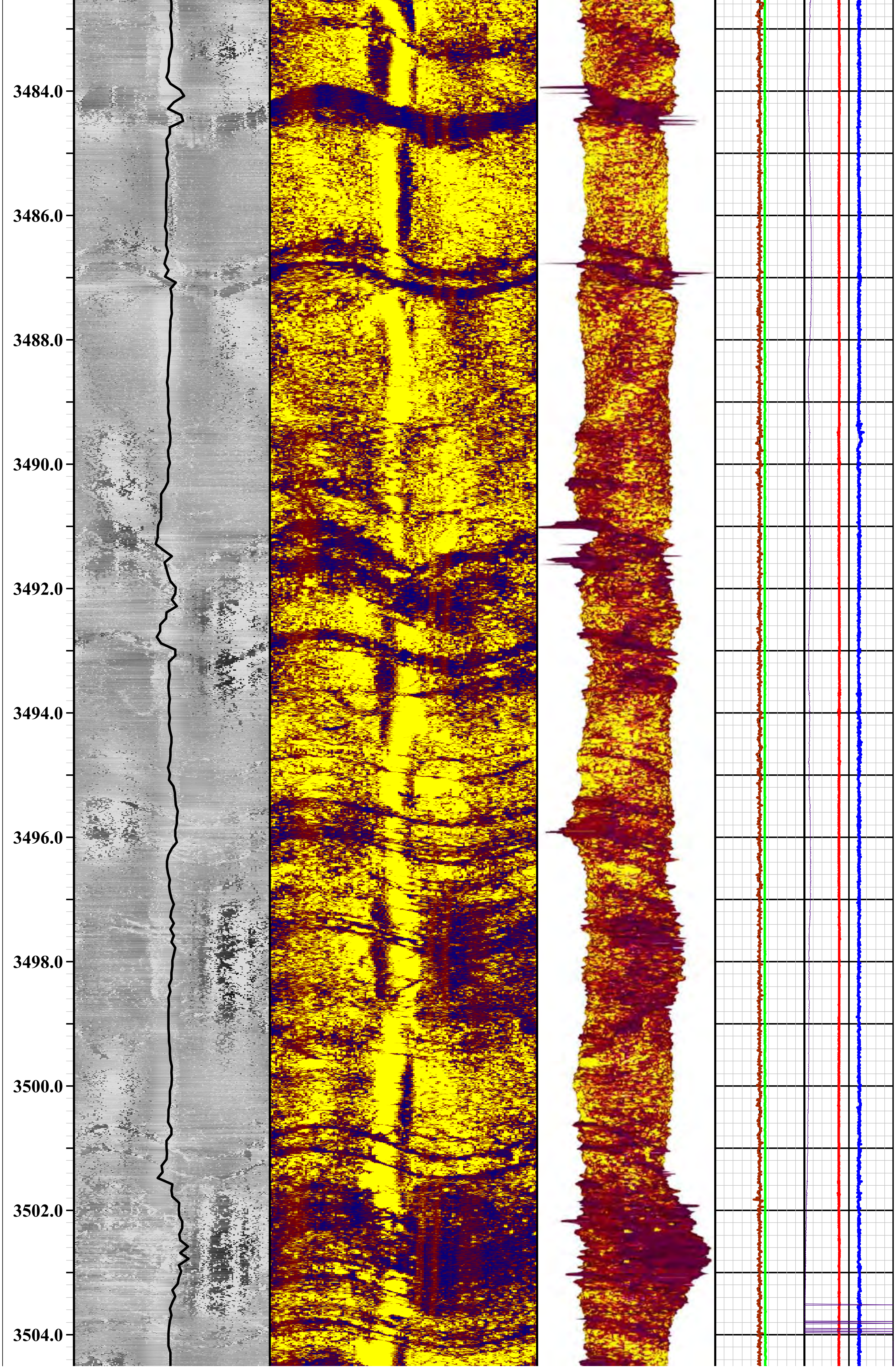

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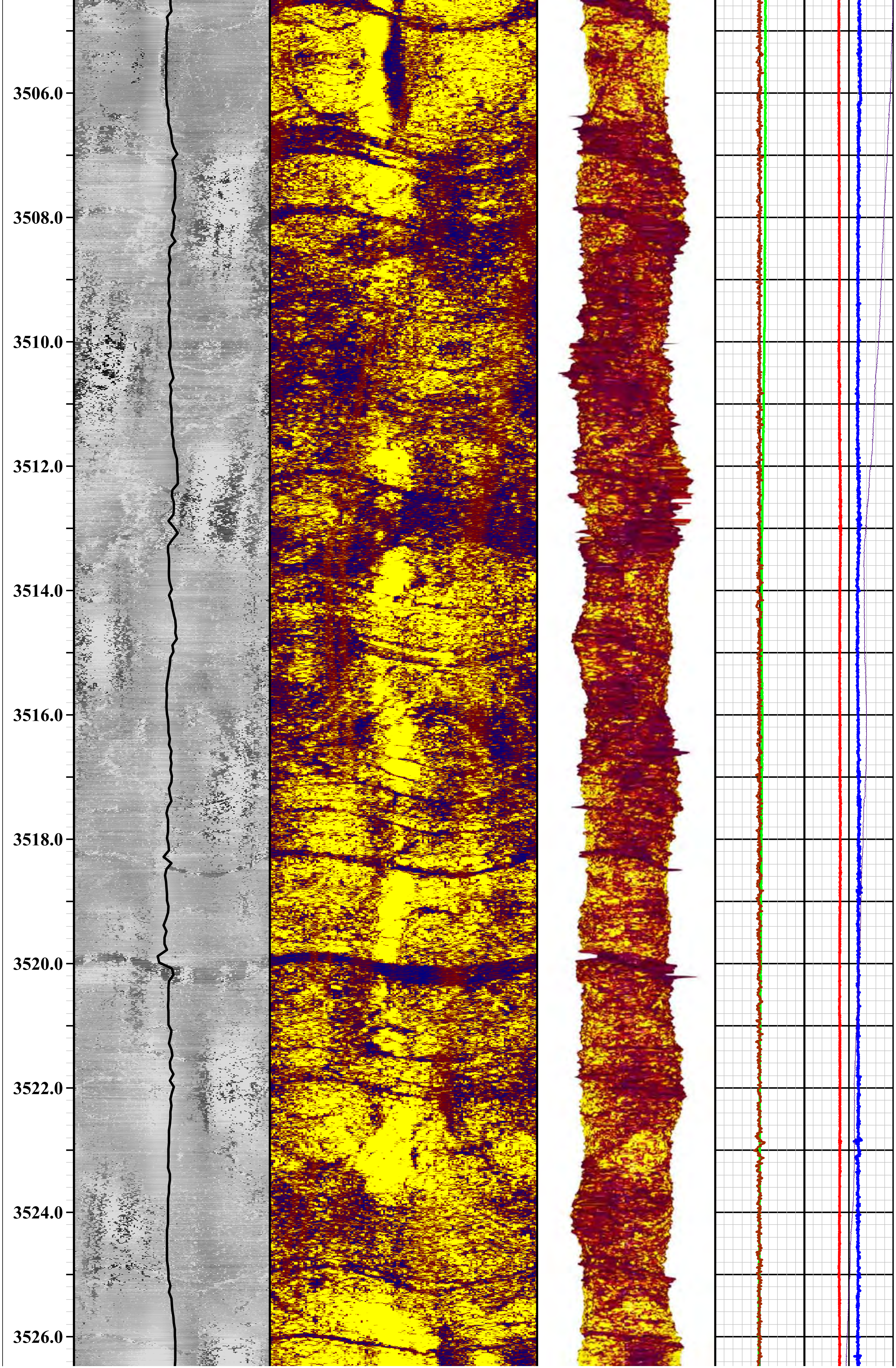

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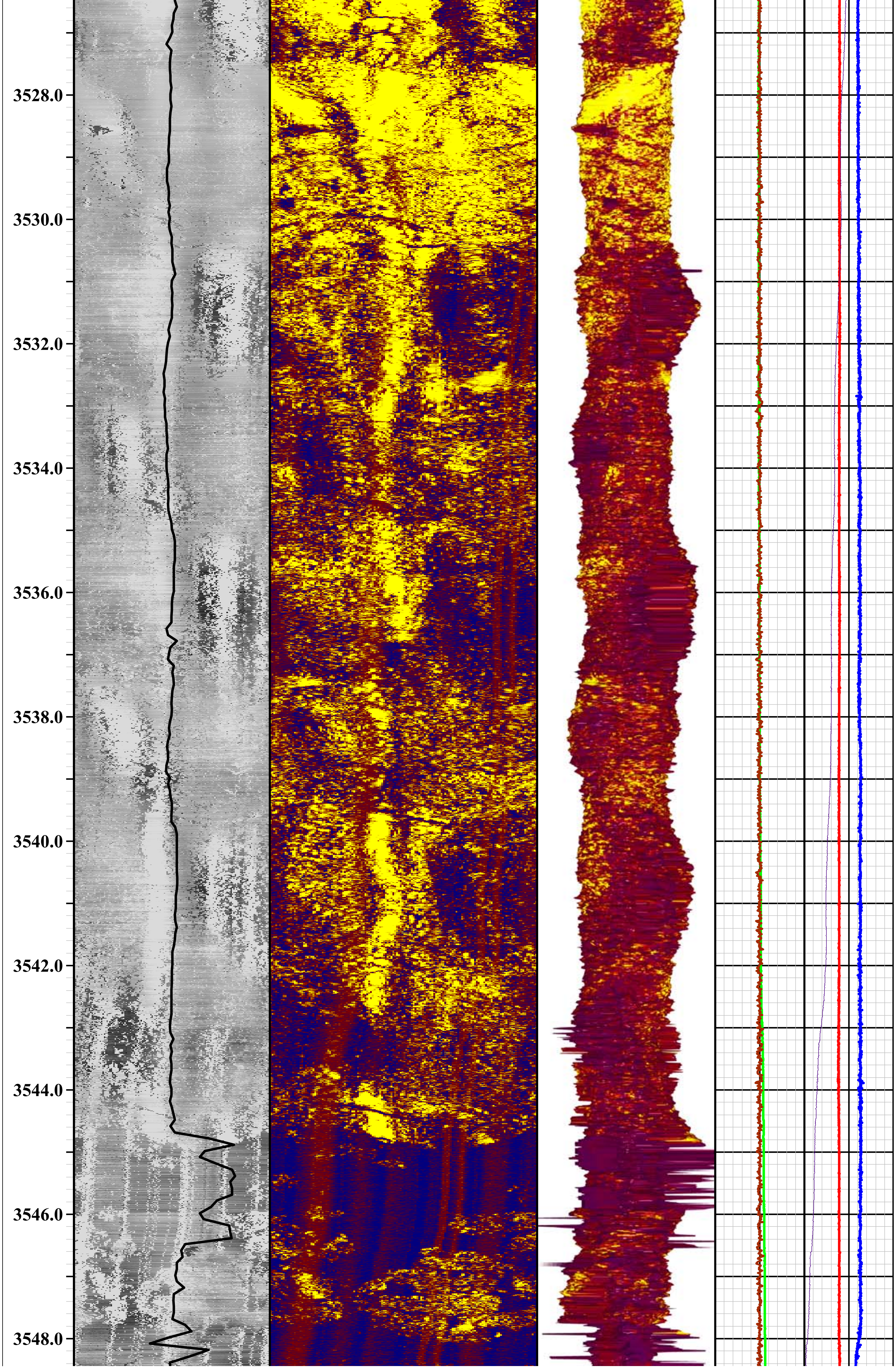
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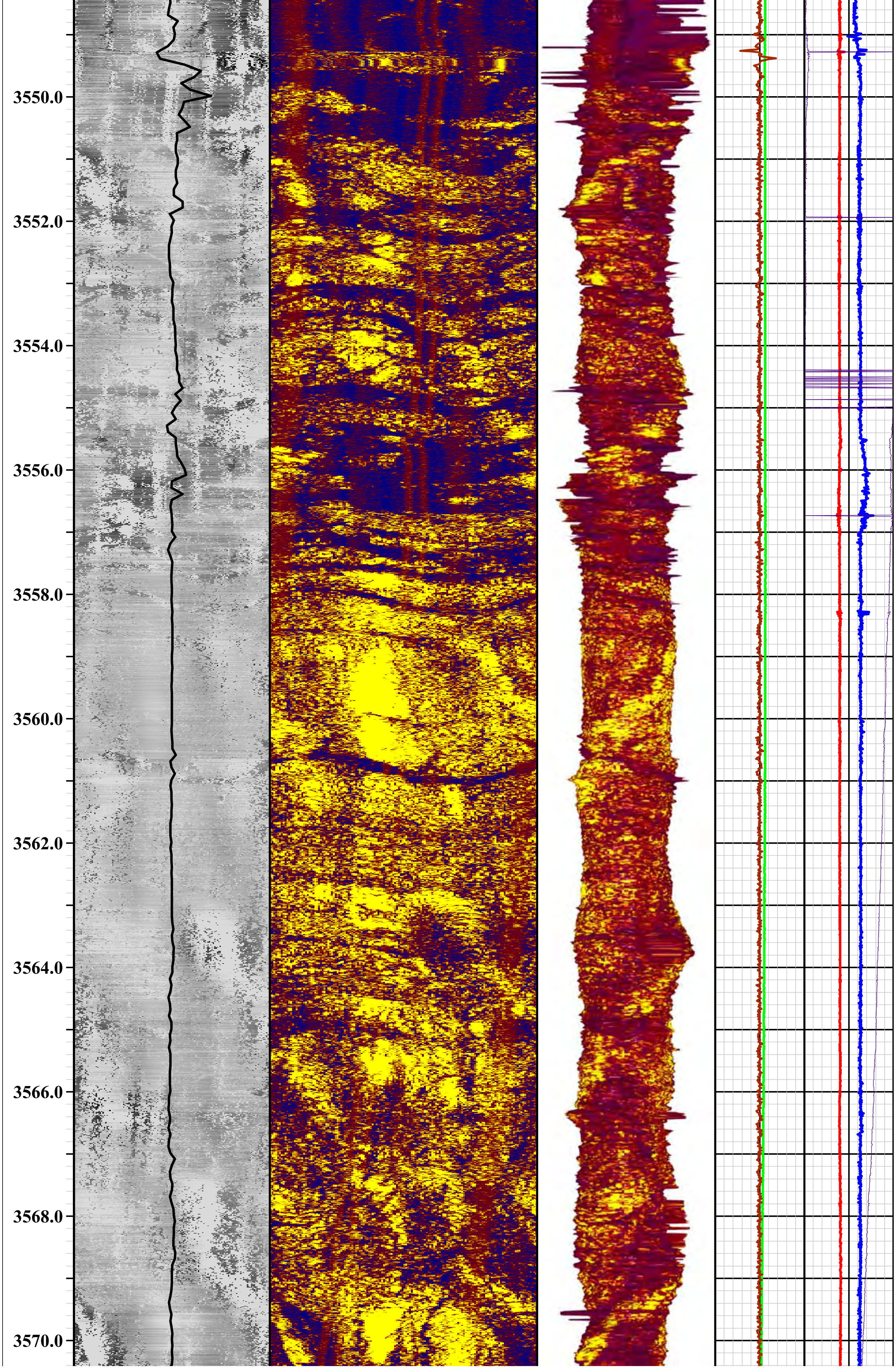
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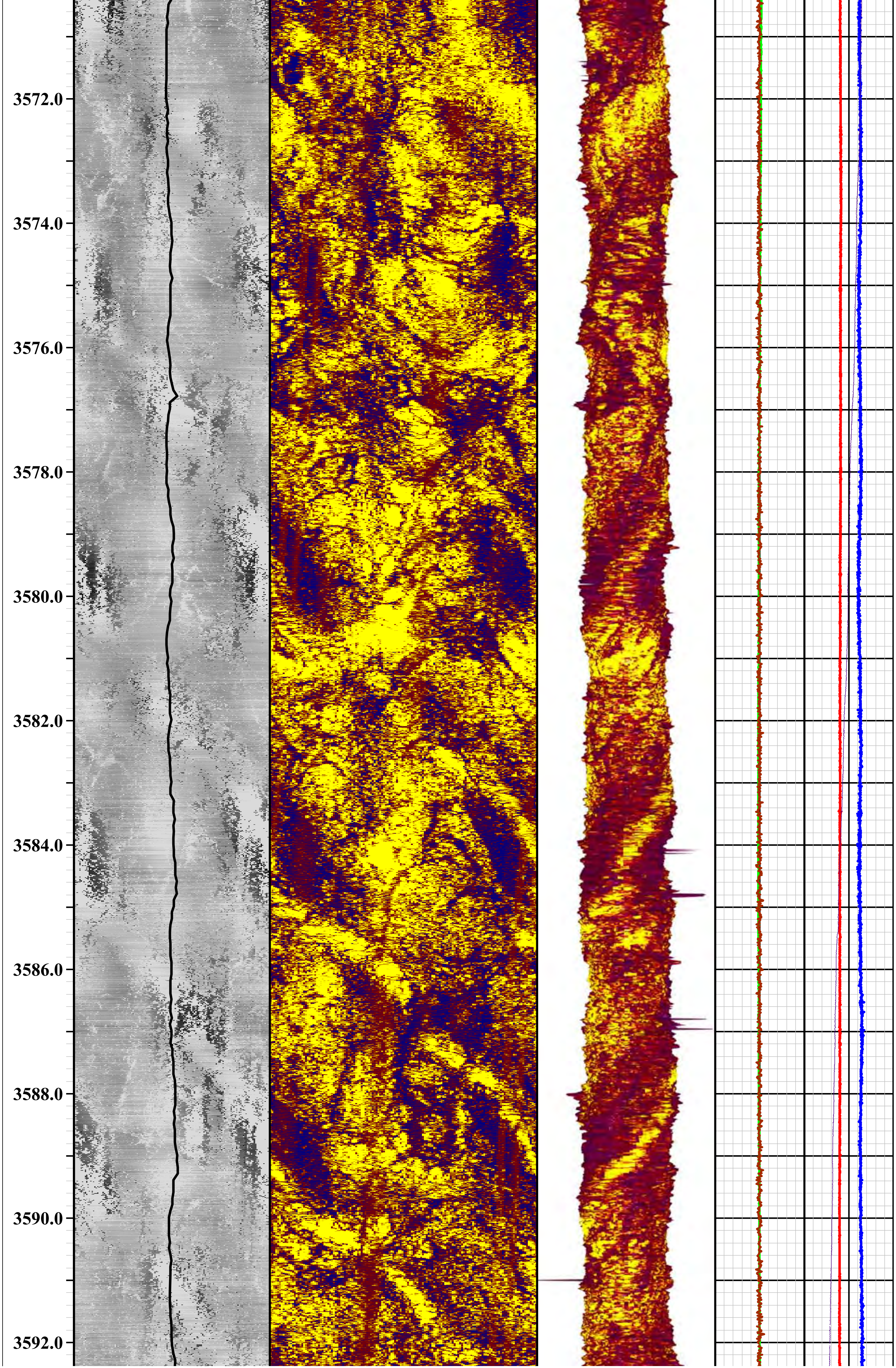
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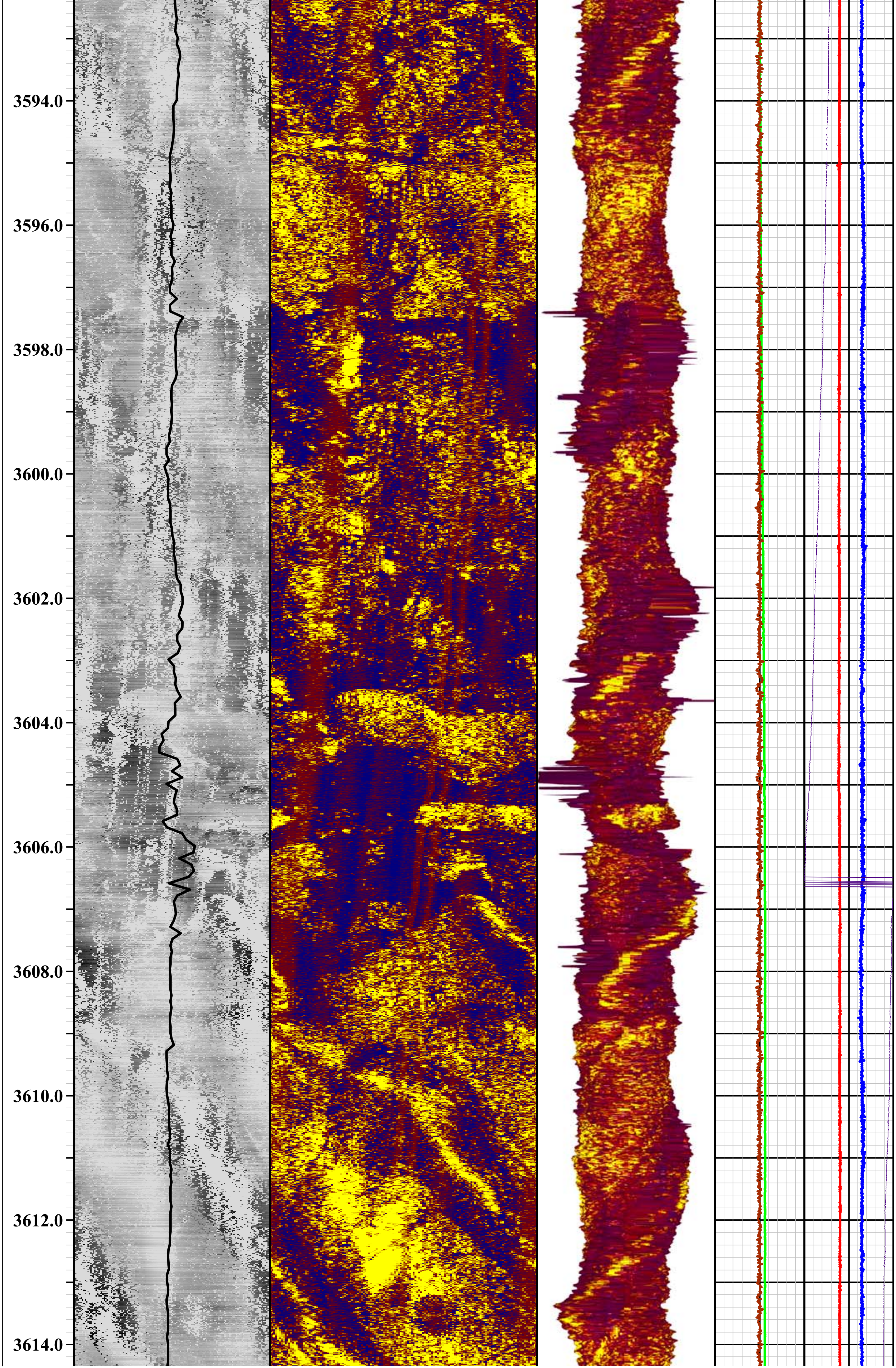
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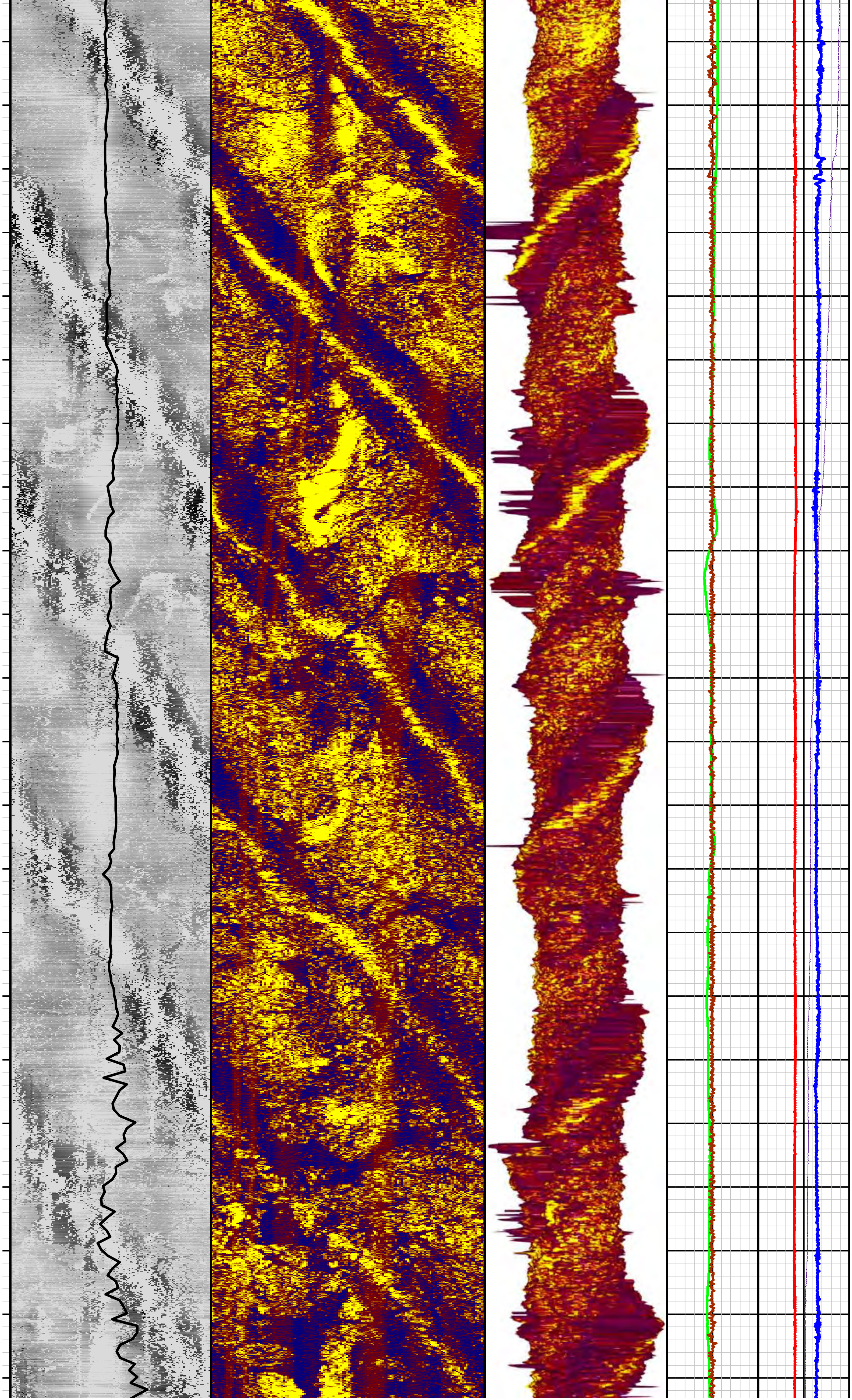

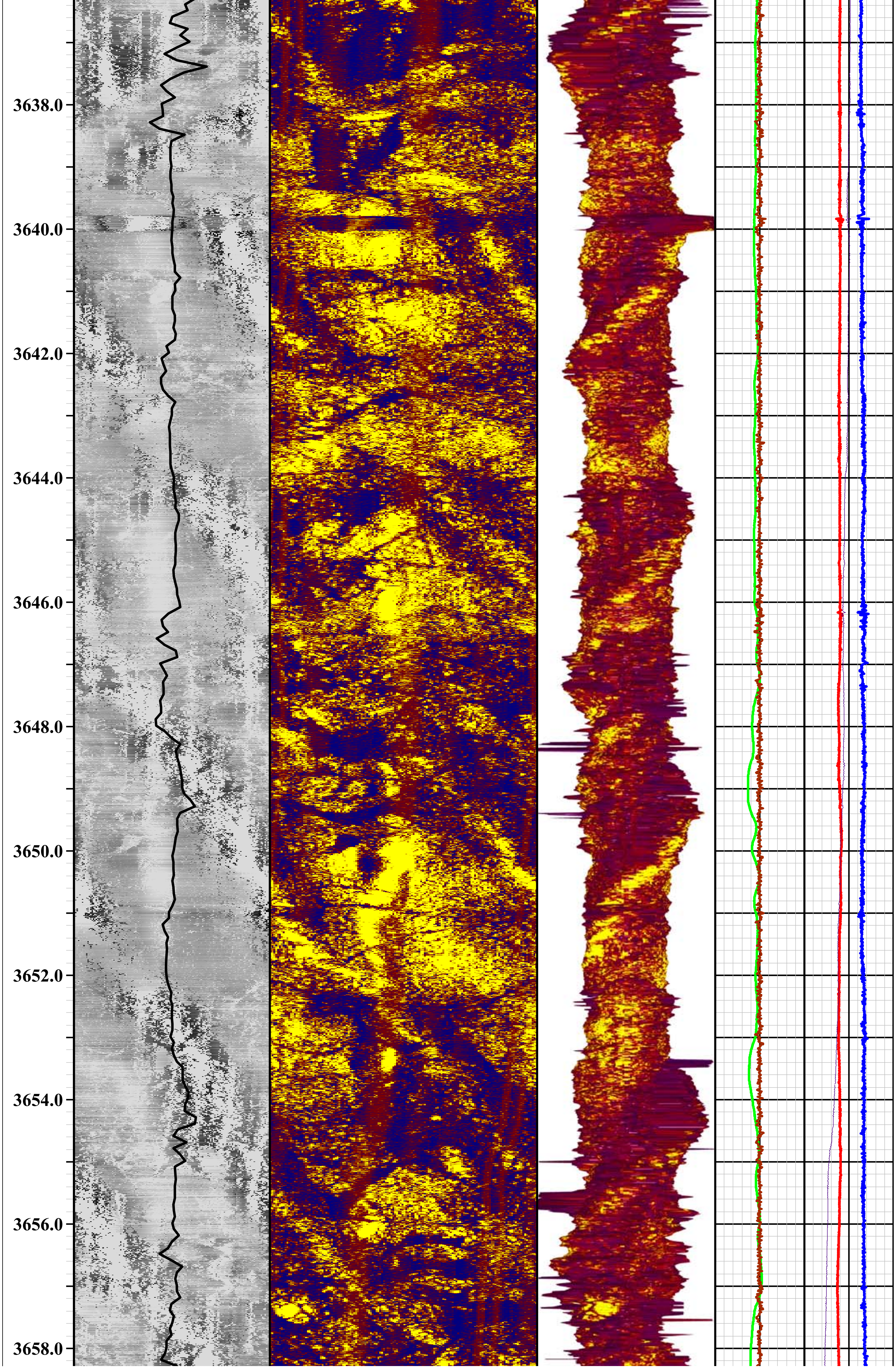
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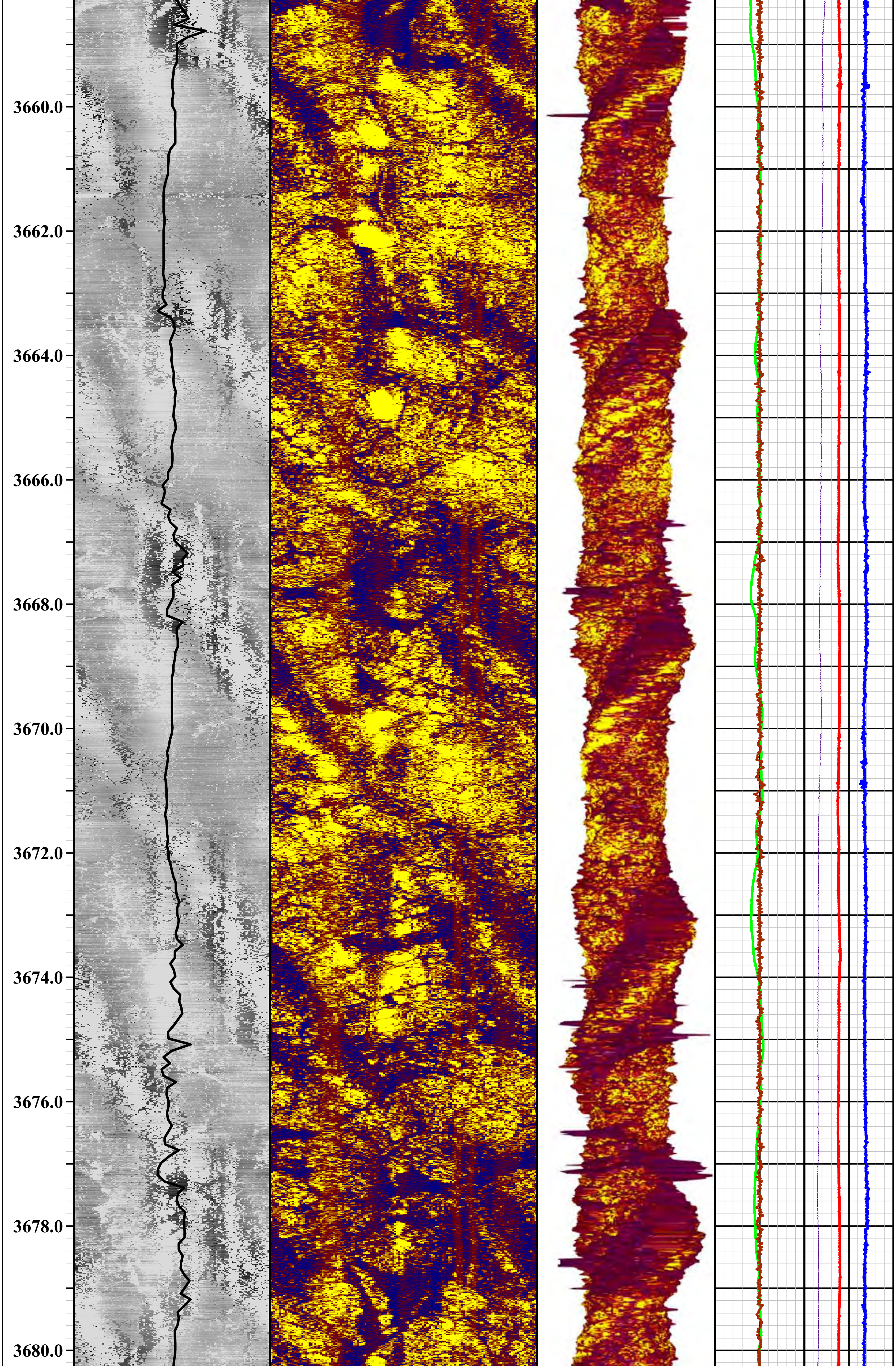
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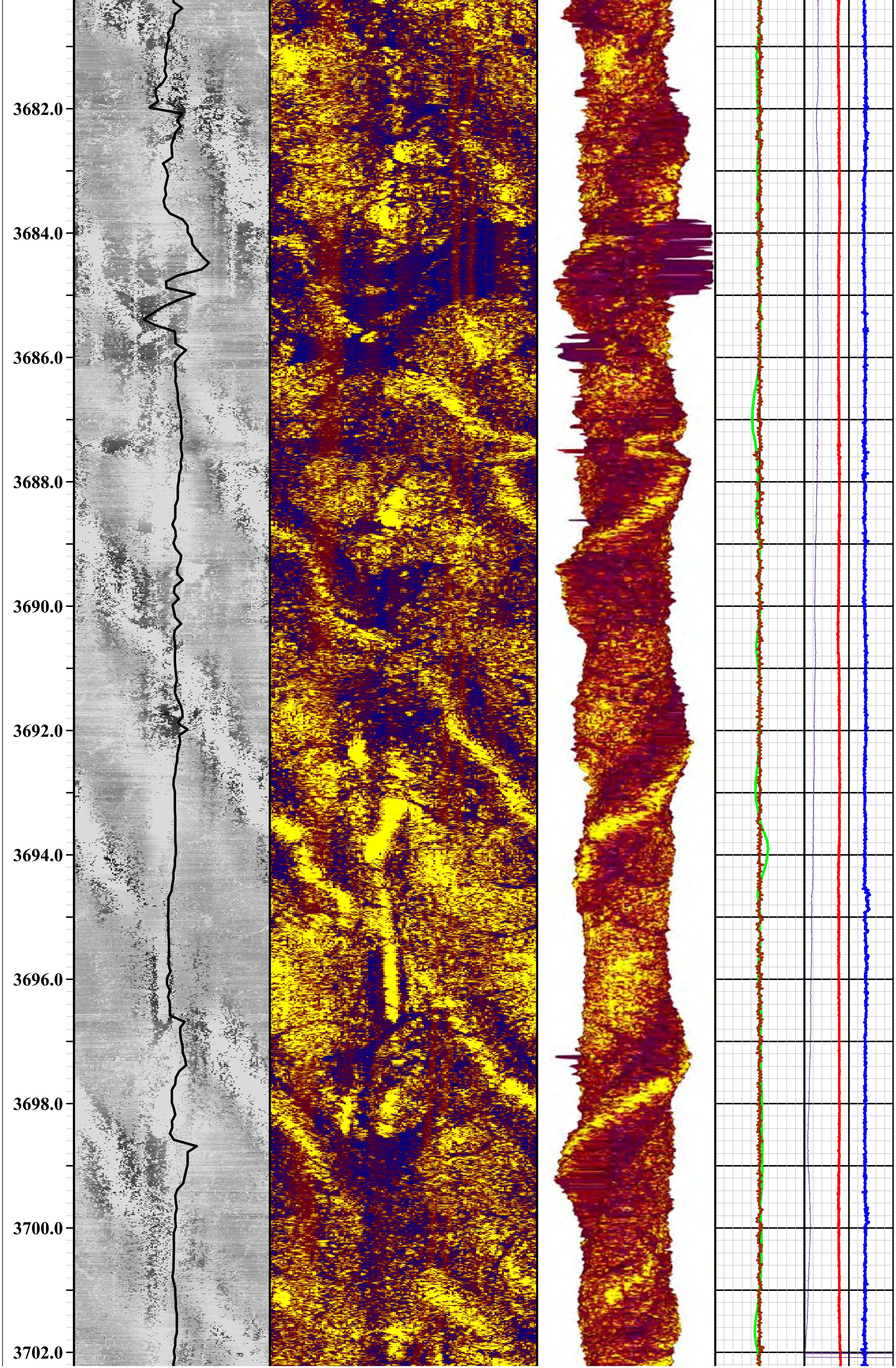
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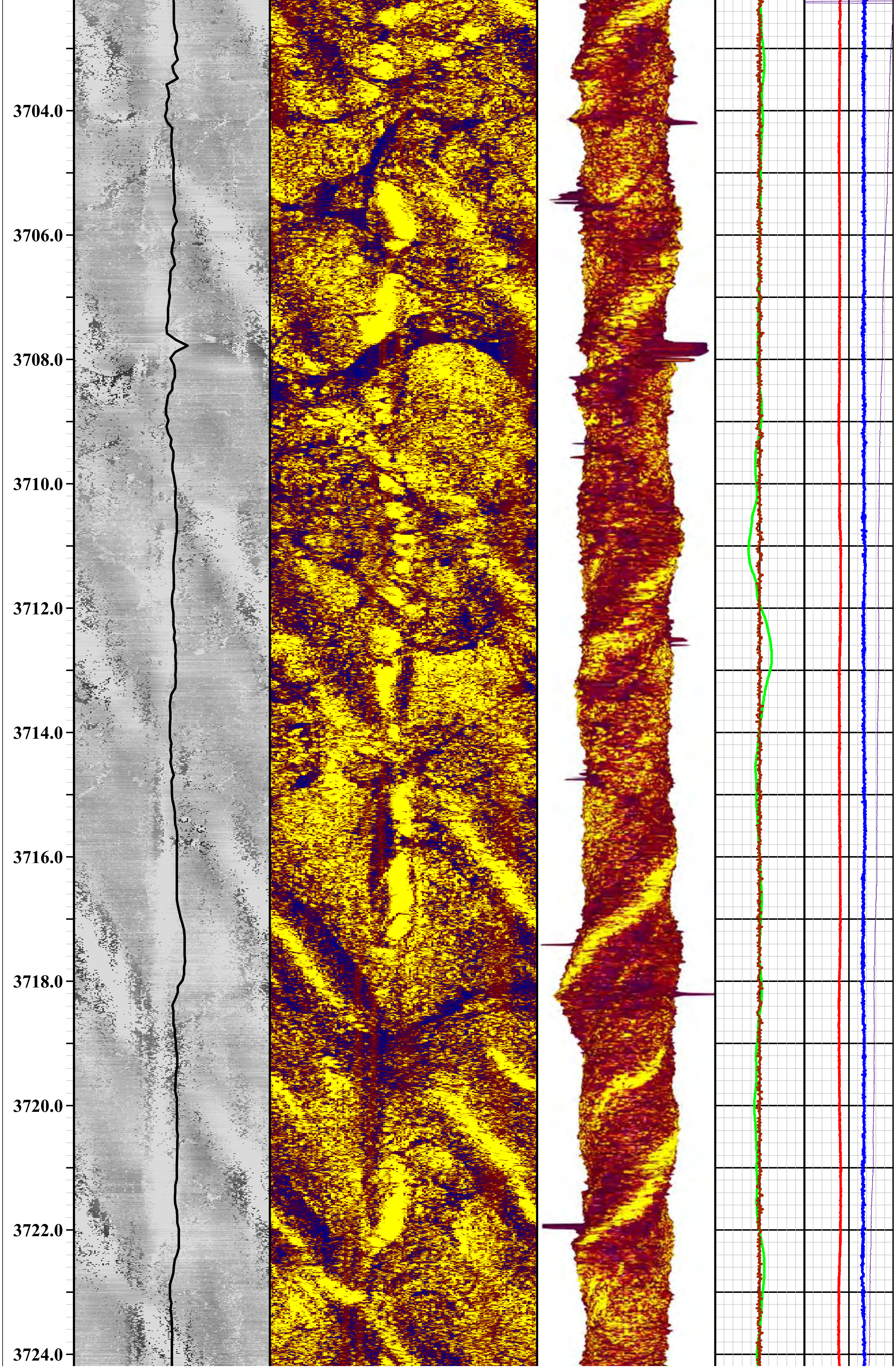
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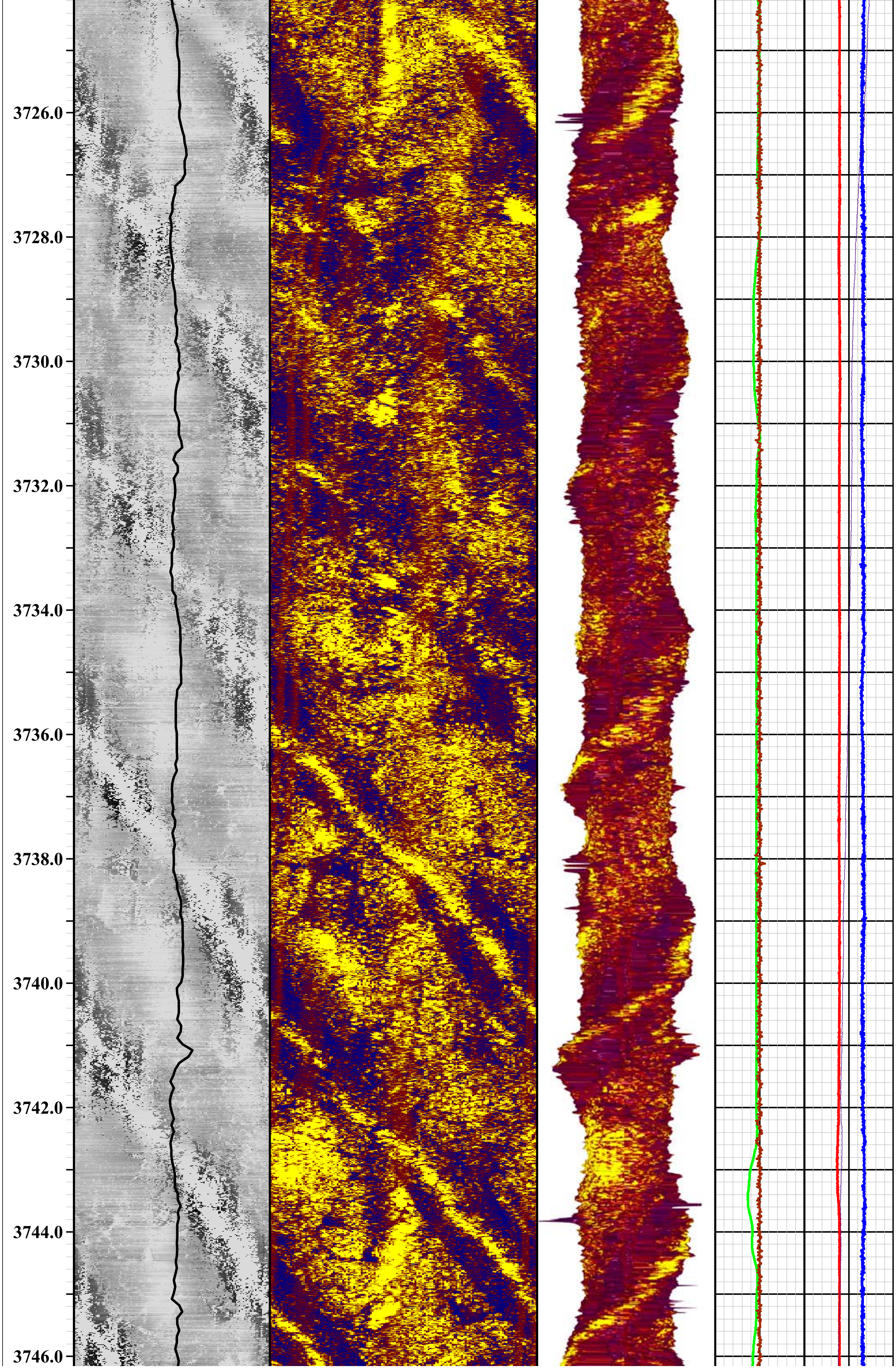
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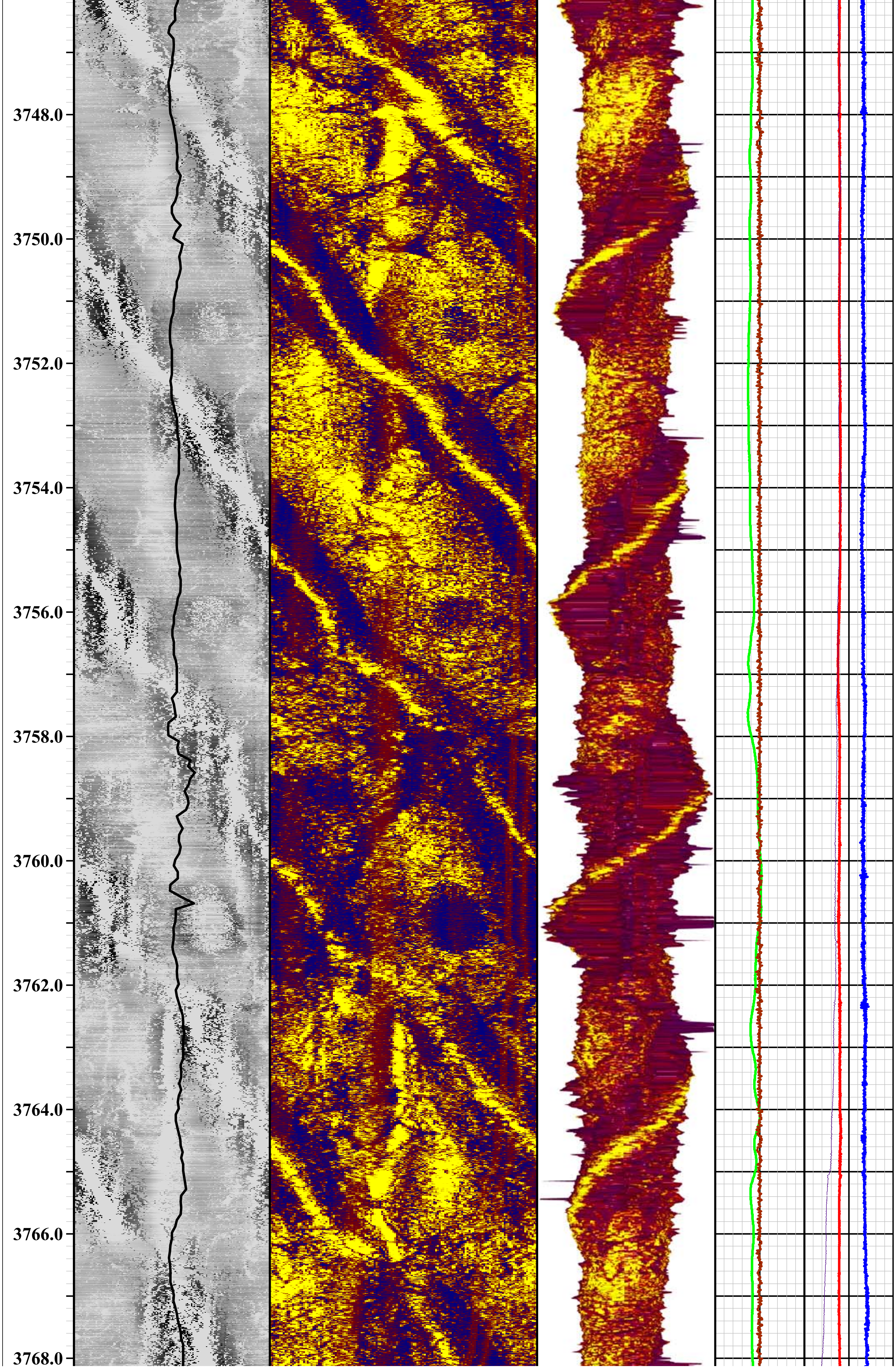
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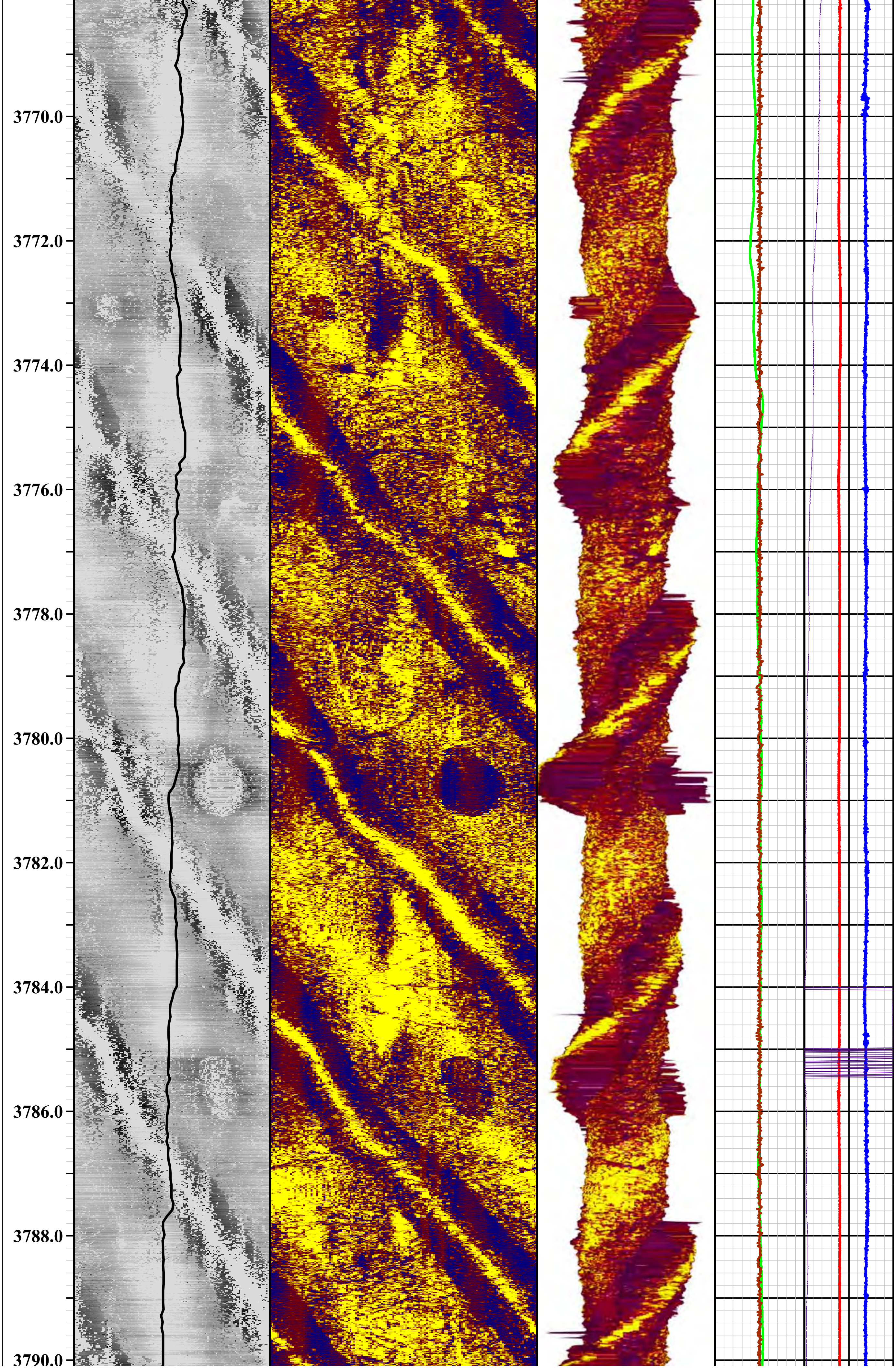
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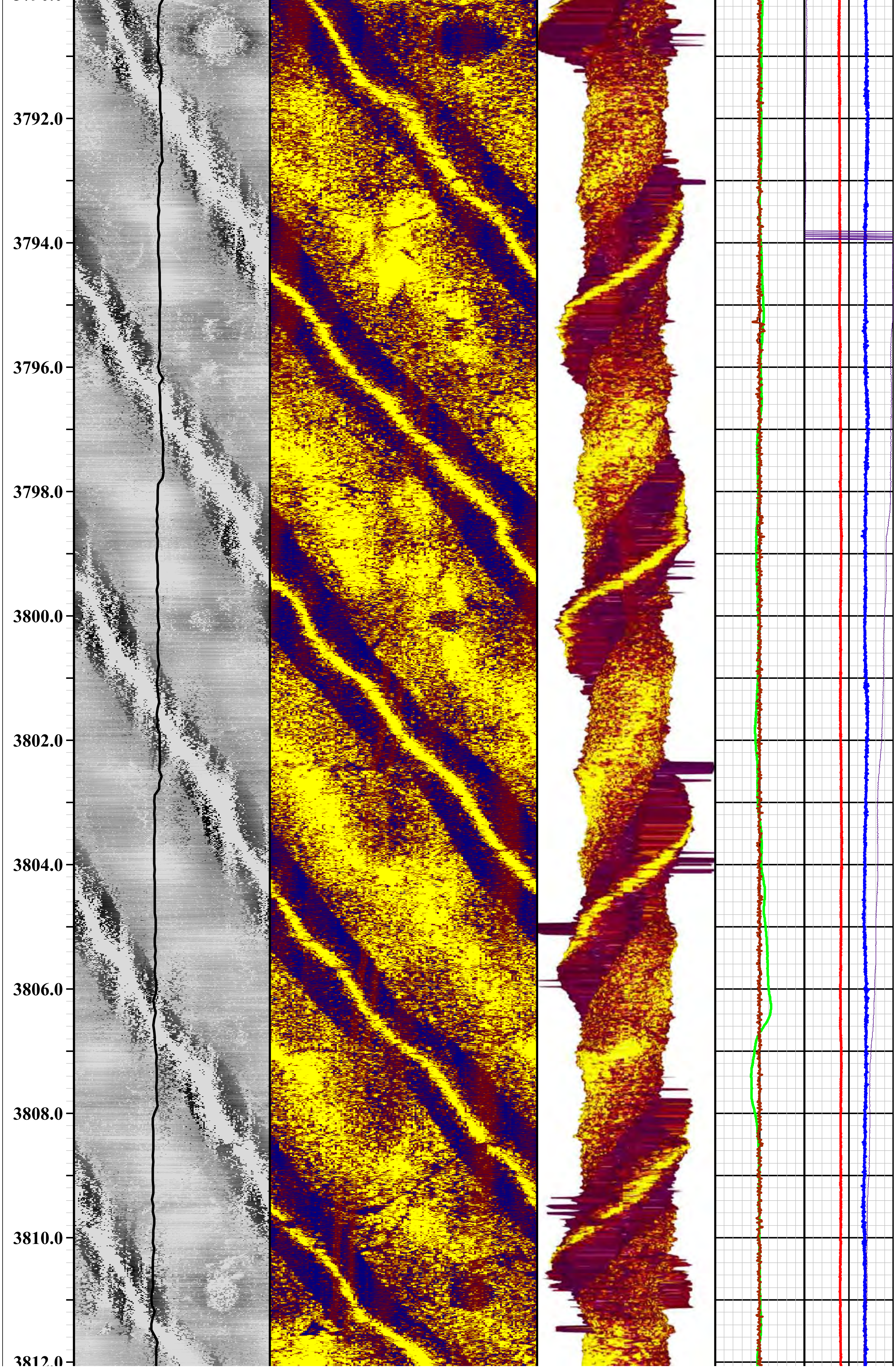
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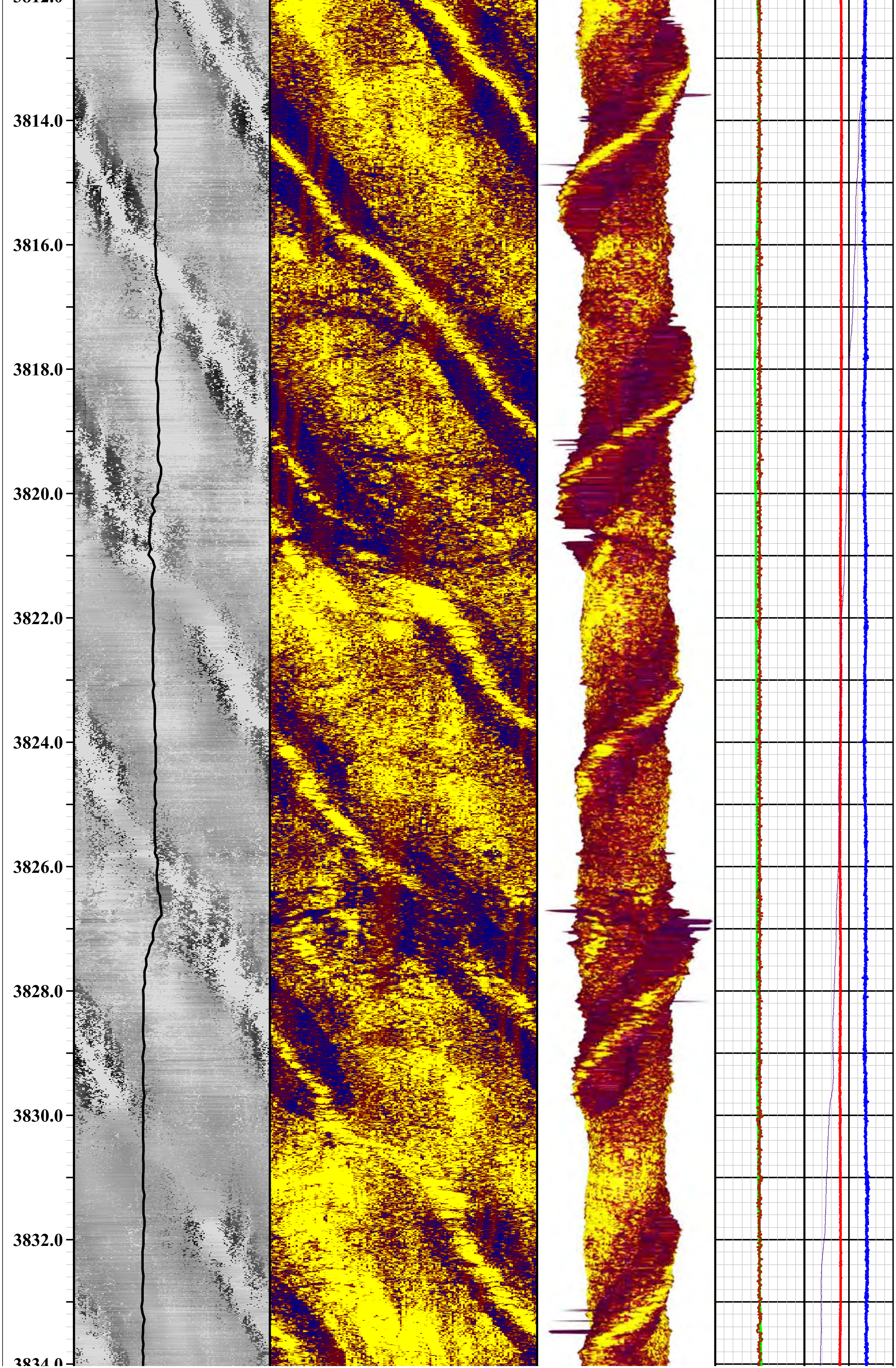
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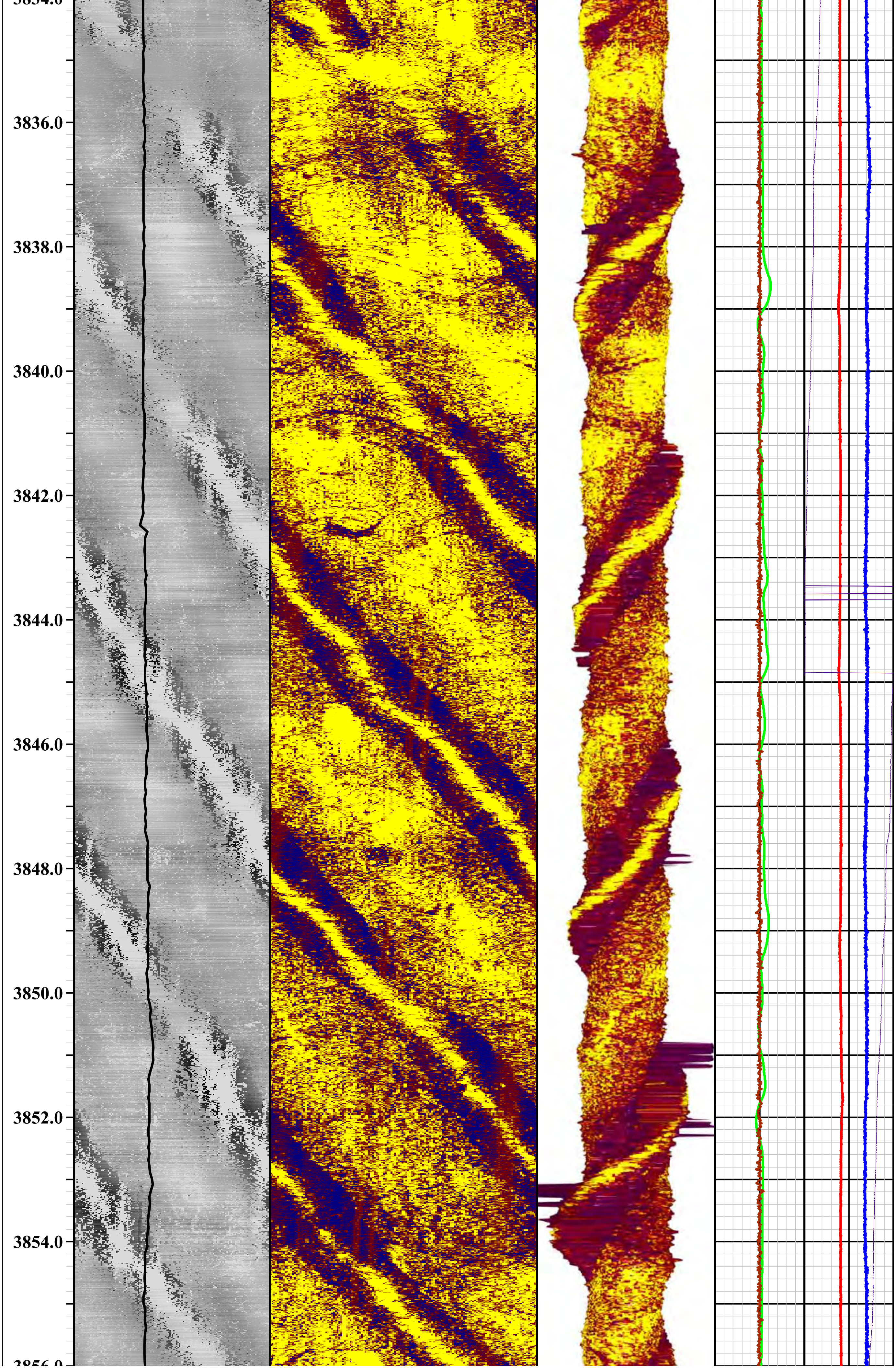
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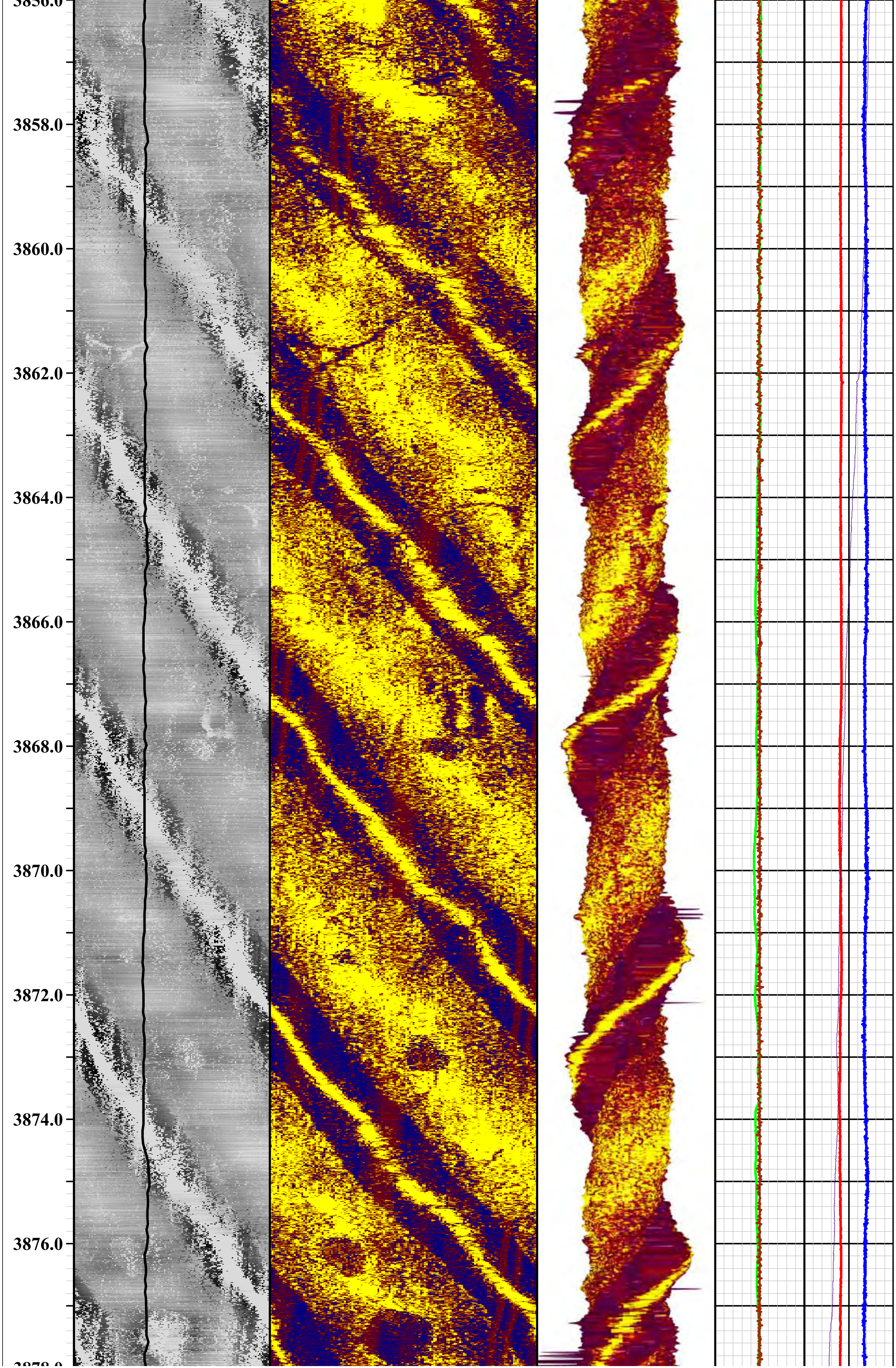
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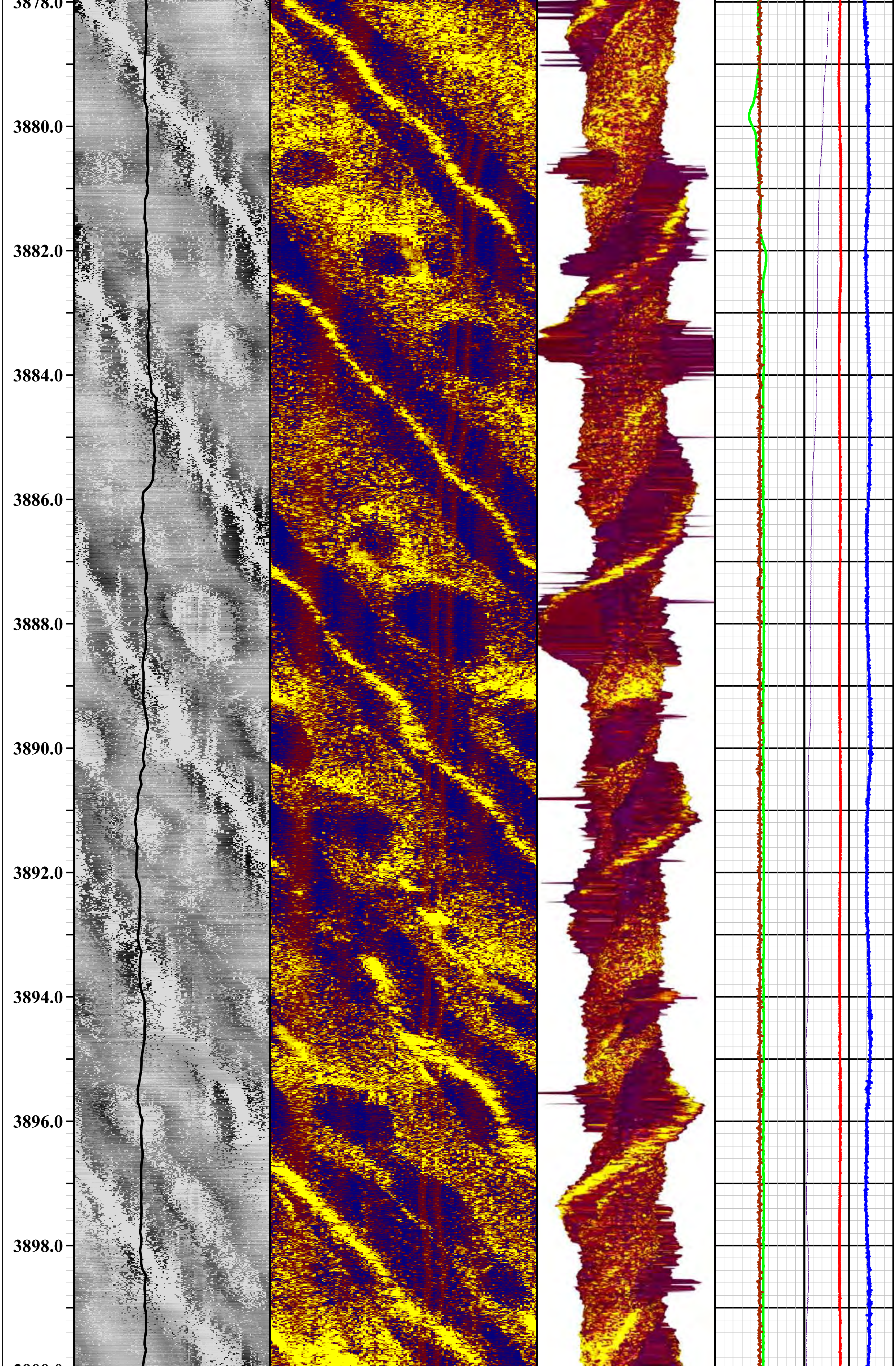
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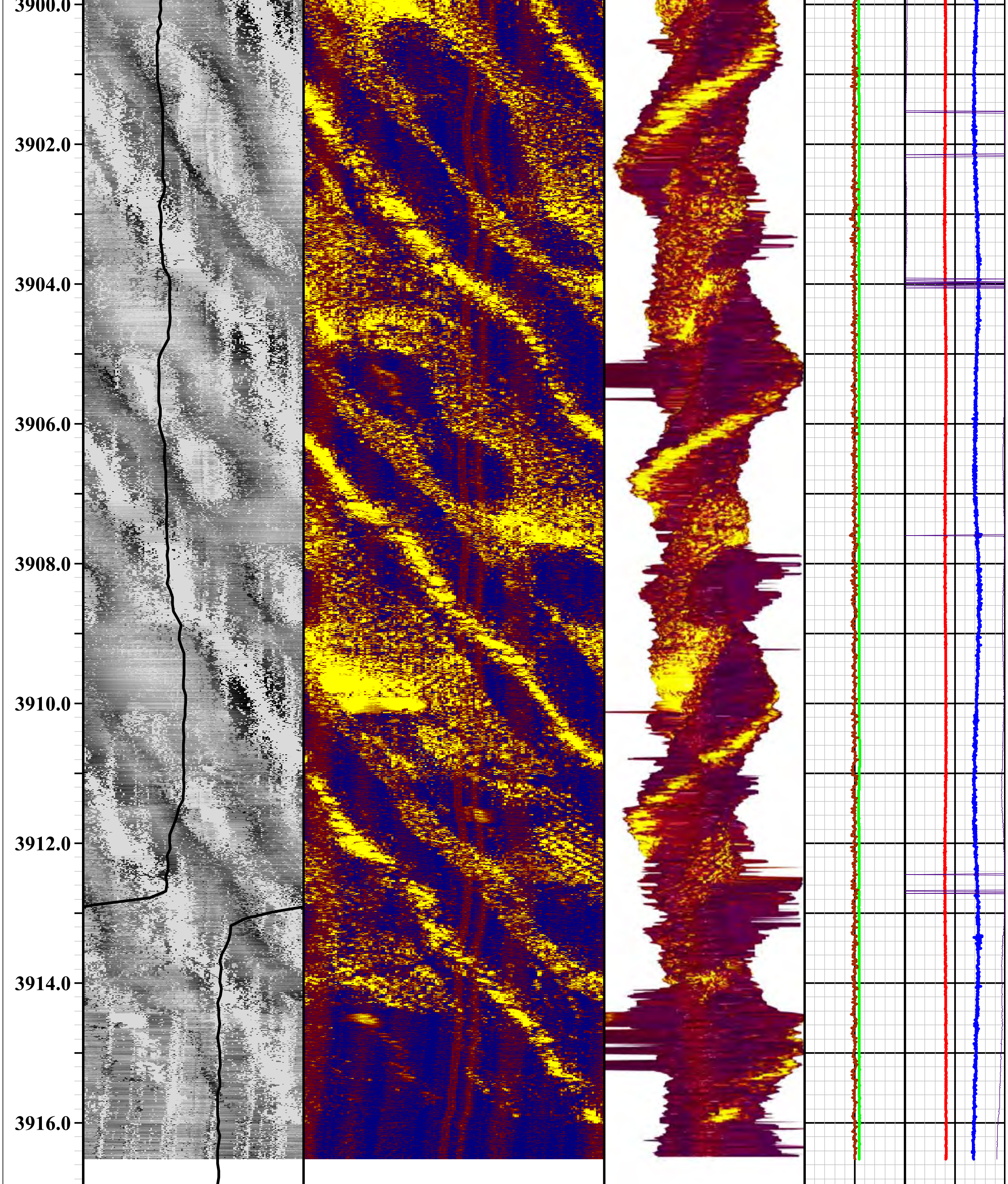


0° 90° 180° 270° 0°
Oriented High Side
Centralized TT

5 Inches 10
3-Arm Caliper

0° 90° 180° 270° 0°
Oriented High Side
Amplitude-Static

-90 270
RBR

0.8 G 1.2
Gravity

0 360
Azimuth

1in:2ft
Depth

0° 90° 180° 270° 0°
Oriented High Side
TravelTime-HS

0° 90° 180° 270° 0°
Oriented High Side
Amplitude-HS

-0°
3-D View

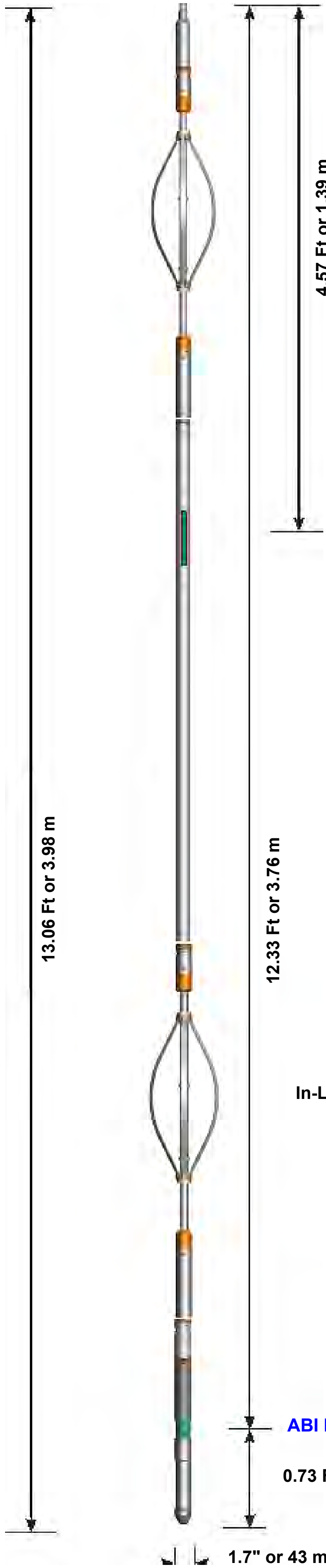
40 uT 60
Mag Field

0 Deg 16
Tilt

ABI-43 Acoustic Borehole Imager

Tool SN: 111801 & 091601

Probe Top = Depth Ref.



APS544 Probe Orientation Sensor
3-Axis Magnetometer
3 Accellerometers

Probe Length = 2.01 m or 6.59 ft

Probe Weight = 20.4 kg or 45.0 lbs

Distance from Acoustic Image Window to Orientation Sensor = 1.6 m or 5.1 ft

Inclination Accuracy = +/- 0.5 Deg

Azimuth Accuracy = +/- 1.2 Deg

Beam Width = 3.0 mm

Frequency: 1.2 mHz

Temperature Rating = 125.0 Deg C (257.0 Deg F)

Pressure Rating = 700 bar (10153 psi)

In-Line Centralizers - 3-6 band Titanium Bow Springs

ABI Imaging Window

0.73 Ft or 0.22 m

1.7" or 43 mm Diameter

Southwest Exploration Services, LLC
borehole geophysics & video services

Company	RESOLUTION COPPER
Well	DHRES-15
Field	RESOLUTION
County	PINAL
State	ARIZONA

Preliminary ACOUSTIC TELEVIEWER SUMMARY

APPENDIX D

Borehole Geophysical Logs from Well DHRES-16
Conducted by SWE; interval 0 – 1,820 feet

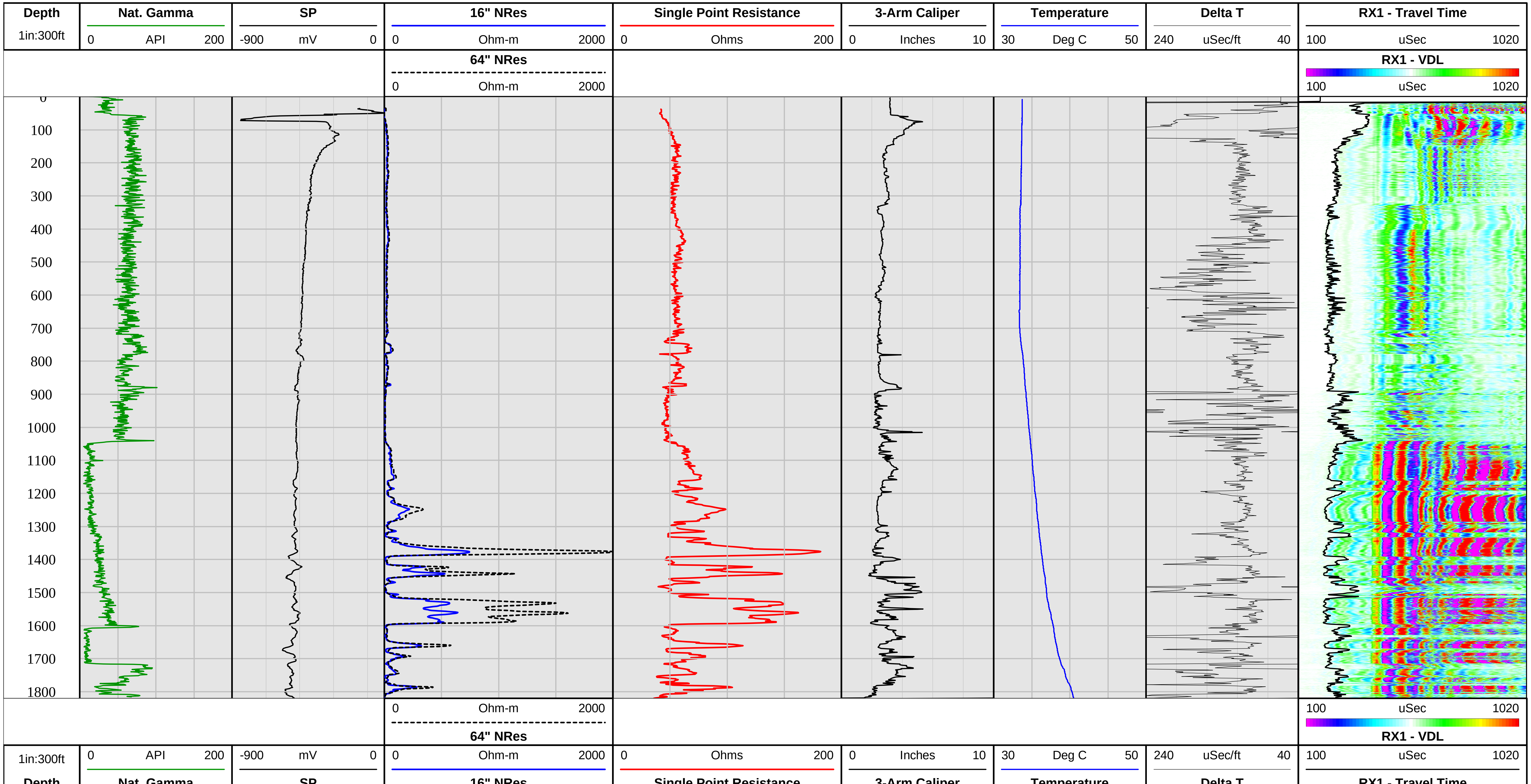
DHRES-16 Geophysical Log Summary

Southwest Exploration Services, LLC
borehole geophysics & video services

MONTGOMERY & ASSOCIATES

COMPANY: E. L. MONTGOMERY & ASSOCIATES
FIELD: RESOLUTION COPPER
WELL ID: DHRES-16
COUNTY: PINAL STATE: ARIZONA

Logging Engineer: E. TURNER
Date Logged: 9-03-14
Processed By: K. MITCHELL
Date Processed: 3-16-16



Southwest Exploration Services, LLC

borehole geophysics & video services

COMPANY	RESOLUTION COPPER
WELL ID	DHRES-16 (55-917232)
FIELD	RESOLUTION
COUNTY	PINAL
STATE	ARIZONA

TYPE OF LOGS: NAT. GAMMA-CALIPER
MORE: TEMPERATURE

LOCATION
SE 1/4 OF SW 1/4, NE 1/4
944004 E, 830713 N

SEC 04 TWP 02 S RGE 12 E

OTHER SERVICES
E-LOG
SONIC
ABI-43

PERMANENT DATUM	AZ SPC, FEET	ELEVATION	2634 FT	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND LEVEL			G.L.

DATE	09-03-14	TYPE FLUID IN HOLE	FORMATION WATER
RUN No	1	MUD WEIGHT	N/A
TYPE LOG	GAMMA-CAL-TEMP	VISCOSITY	N/A
DEPTH-DRILLER	1820 FT	LEVEL	FULL
DEPTH-LOGGER	1820 FT	MAX. REC. TEMP.	40.74 DEG C
BTM LOGGED INTERVAL	1820 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	SURFACE	SAMPLE INTERVAL	0.1 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	E. TURNER	TOOL STRING/SN	COMBO 5446
WITNESSED BY	MATT - M&A	LOG TIME:ON SITE/OFF SITE	11:40 AM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	55 FT	14"		SURFACE	55 FT
2	12.25"	55 FT	TOTAL DEPTH				
3							

COMMENTS:

.

Tool Summary:

Date	09-03-14	**Date**	09-03-14	**Date**	09-03-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	MSI COMBO	**Tool Model**	GEOVISTA ELOG	**Tool Model**	ALT FWS50
Tool SN	5446	**Tool SN**	4035	**Tool SN**	3564
From	SURFACE	**From**	SURFACE	**From**	SURFACE
To	1820 FT	**To**	1820 FT	**To**	1820 FT
Recorded By	E. TURNER	**Recorded By**	E. TURNER	**Recorded By**	E. TURNER
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	8-28-14	**Operation Check**	8-28-14	**Operation Check**	8-28-14
Calibration Check	8-28-14	**Calibration Check**	8-28-14	**Calibration Check**	N/A
Time Logged	12:15 PM	**Time Logged**	1:45 PM	**Time Logged**	2:45 PM

Date	09-03-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT ABI43	**Tool Model**		**Tool Model**	
Tool SN	91601	**Tool SN**		**Tool SN**	
From	1200 FT	**From**		**From**	
To	1820 FT	**To**		**To**	
Recorded By	E. TURNER	**Recorded By**		**Recorded By**	
Truck No	500	**Truck No**		**Truck No**	
Operation Check	8-28-14	**Operation Check**		**Operation Check**	
Calibration Check	N/A	**Calibration Check**		**Calibration Check**	
Time Logged	4:25 PM	**Time Logged**		**Time Logged**	

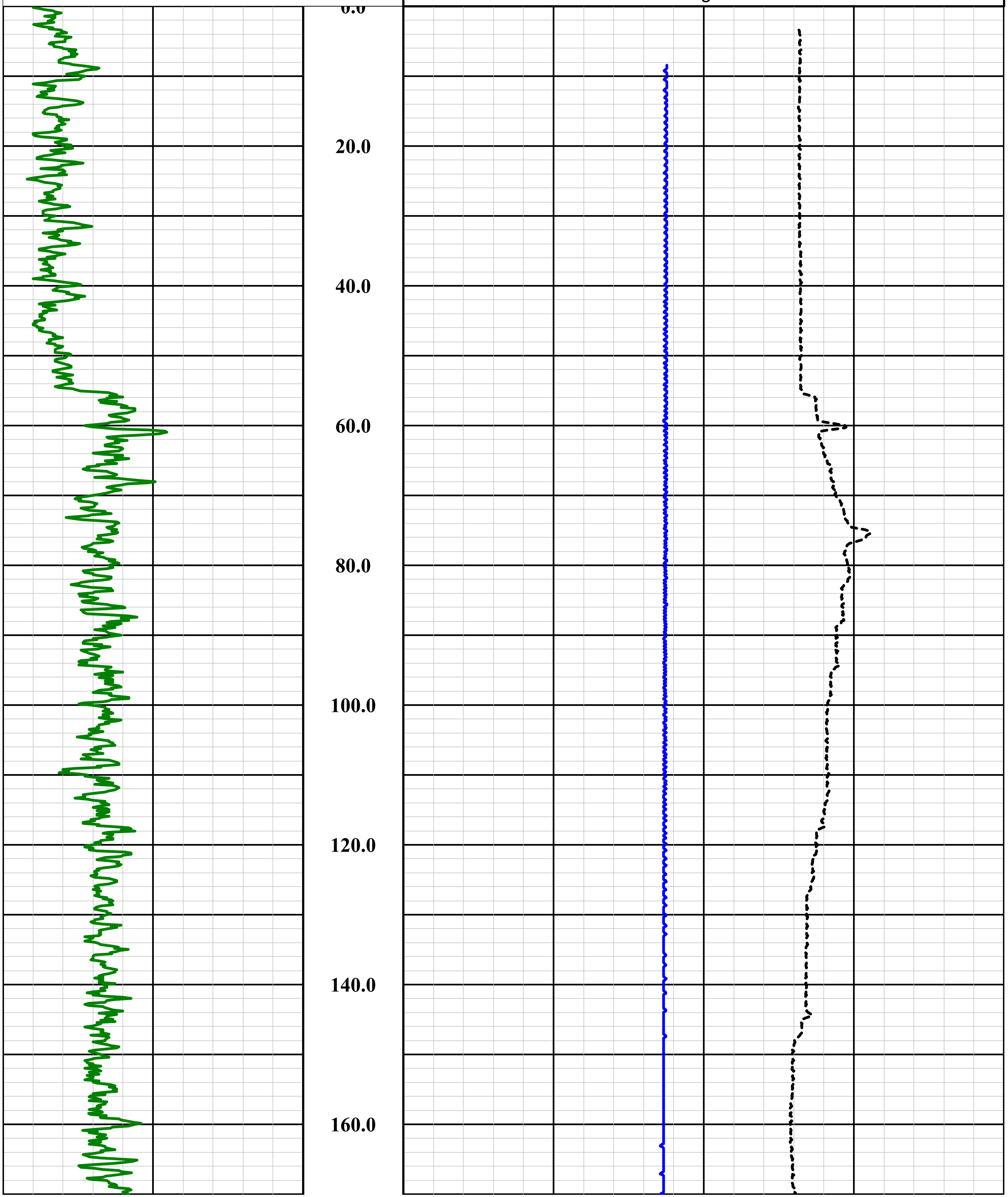
Additional Comments:

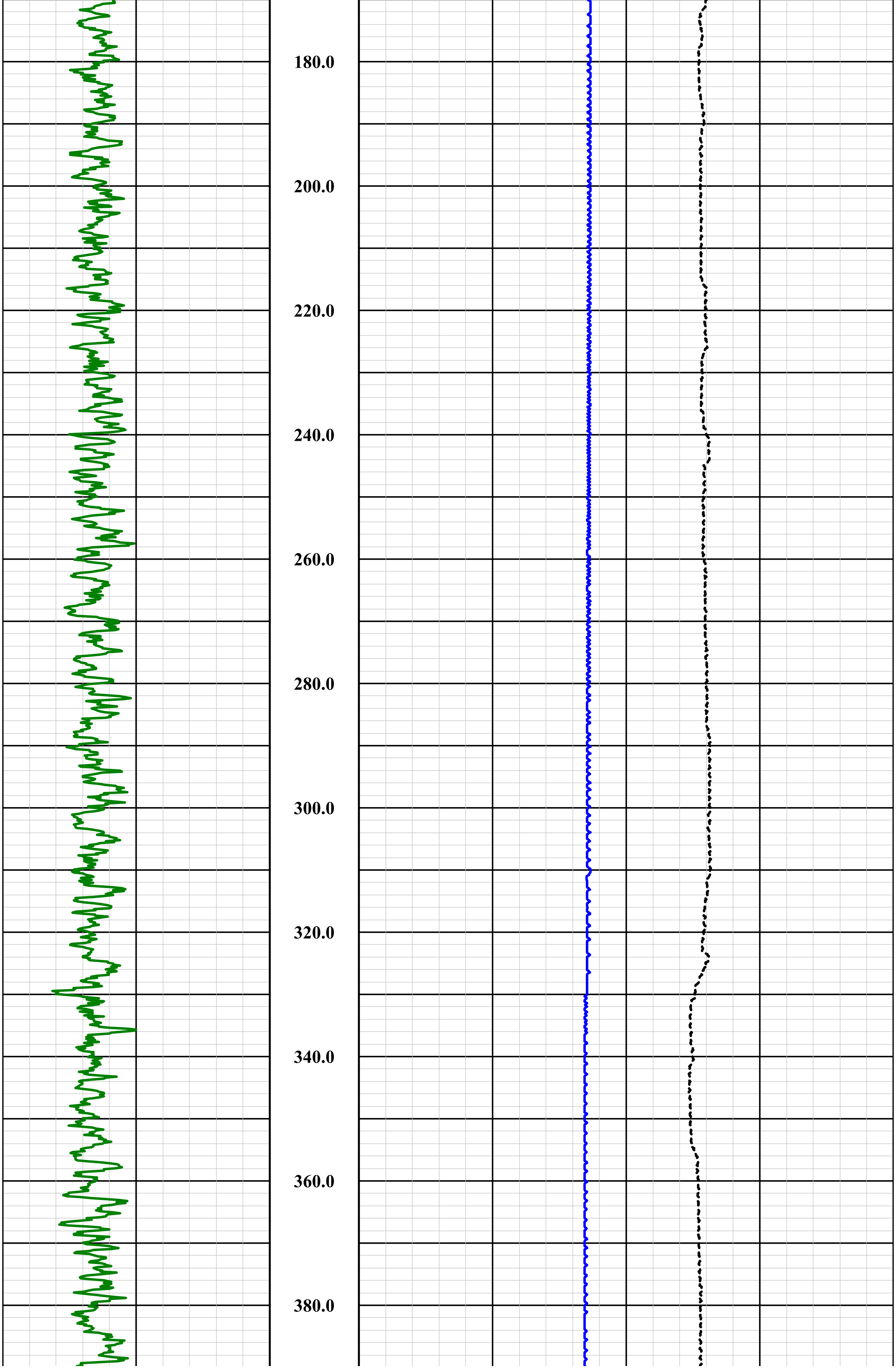
Caliper Arms Used: 15" **Calibration Points:** 10.2" - 24"

Disclaimer:

All interpretations of log data are opinions based on inferences from electrical or other measurements. We do not guarantee the accuracy or correctness of any interpretations or recommendations and shall not be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our employees or agents. These interpretations are also subject to our general terms and conditions set out in our current Service Invoice.

Nat. Gamma	Depth	3-arm Caliper
0 API 200	1in:20ft	0 inches 20
		Temperature
		25 Deg C 45

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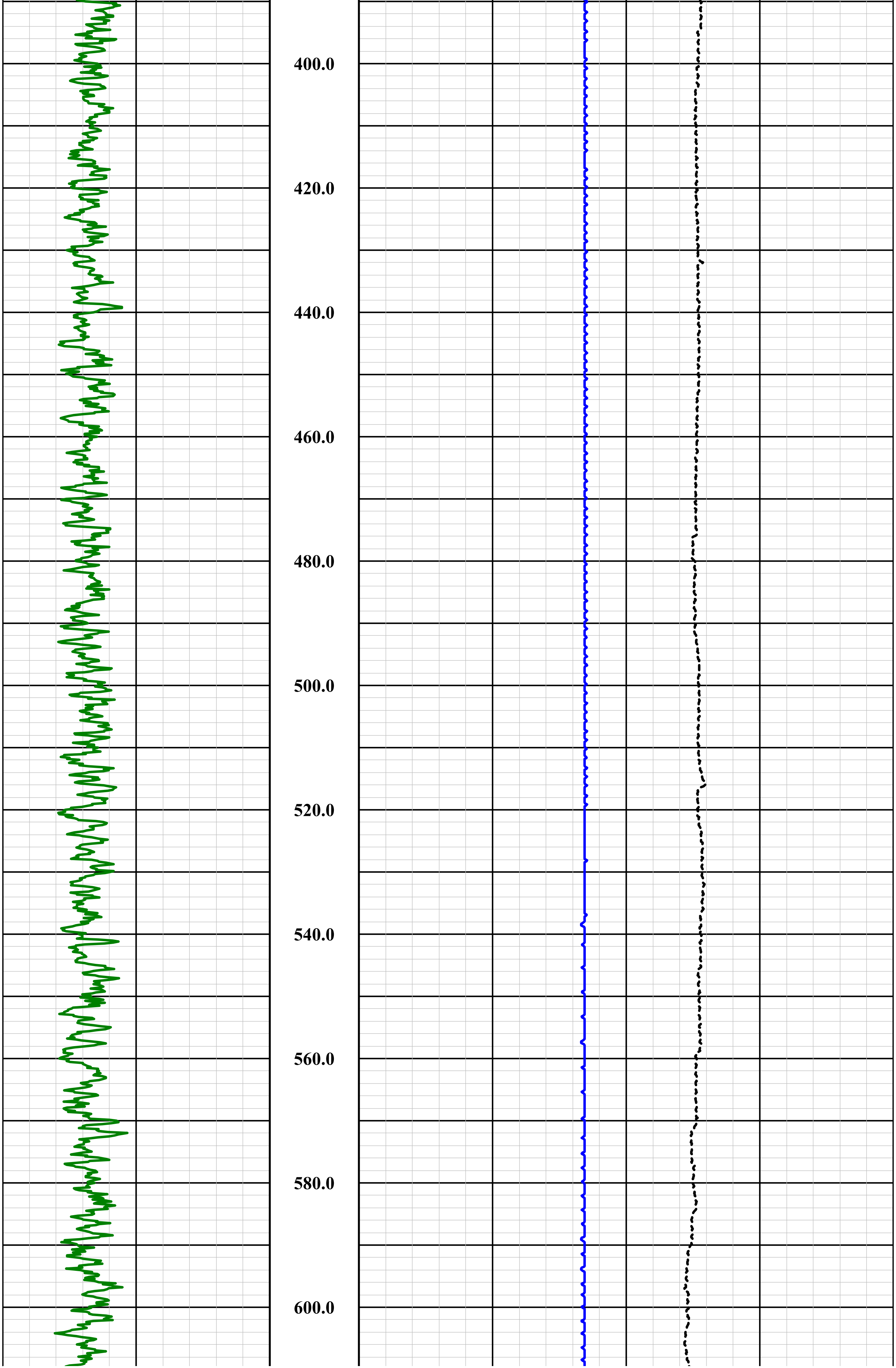
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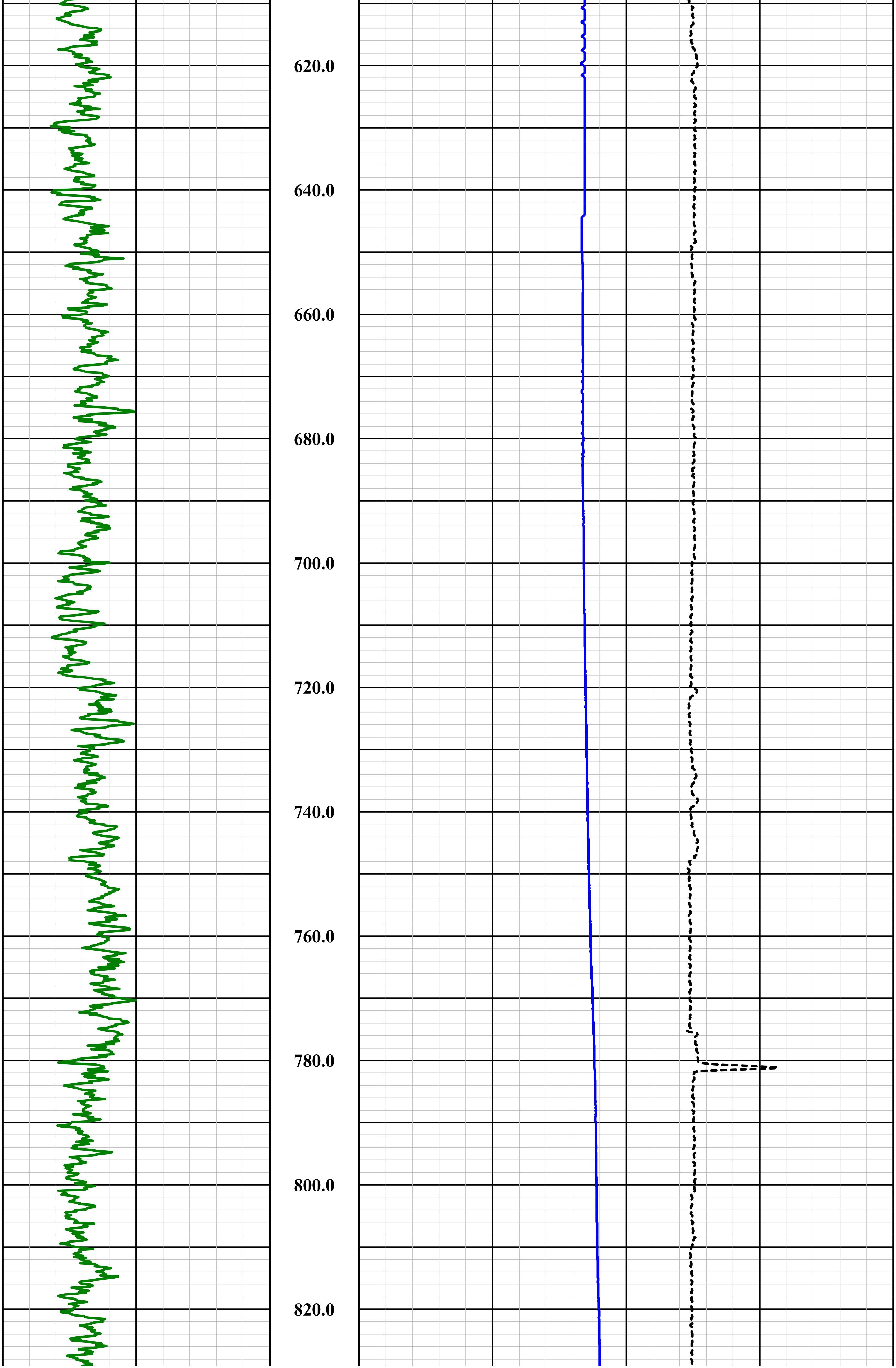
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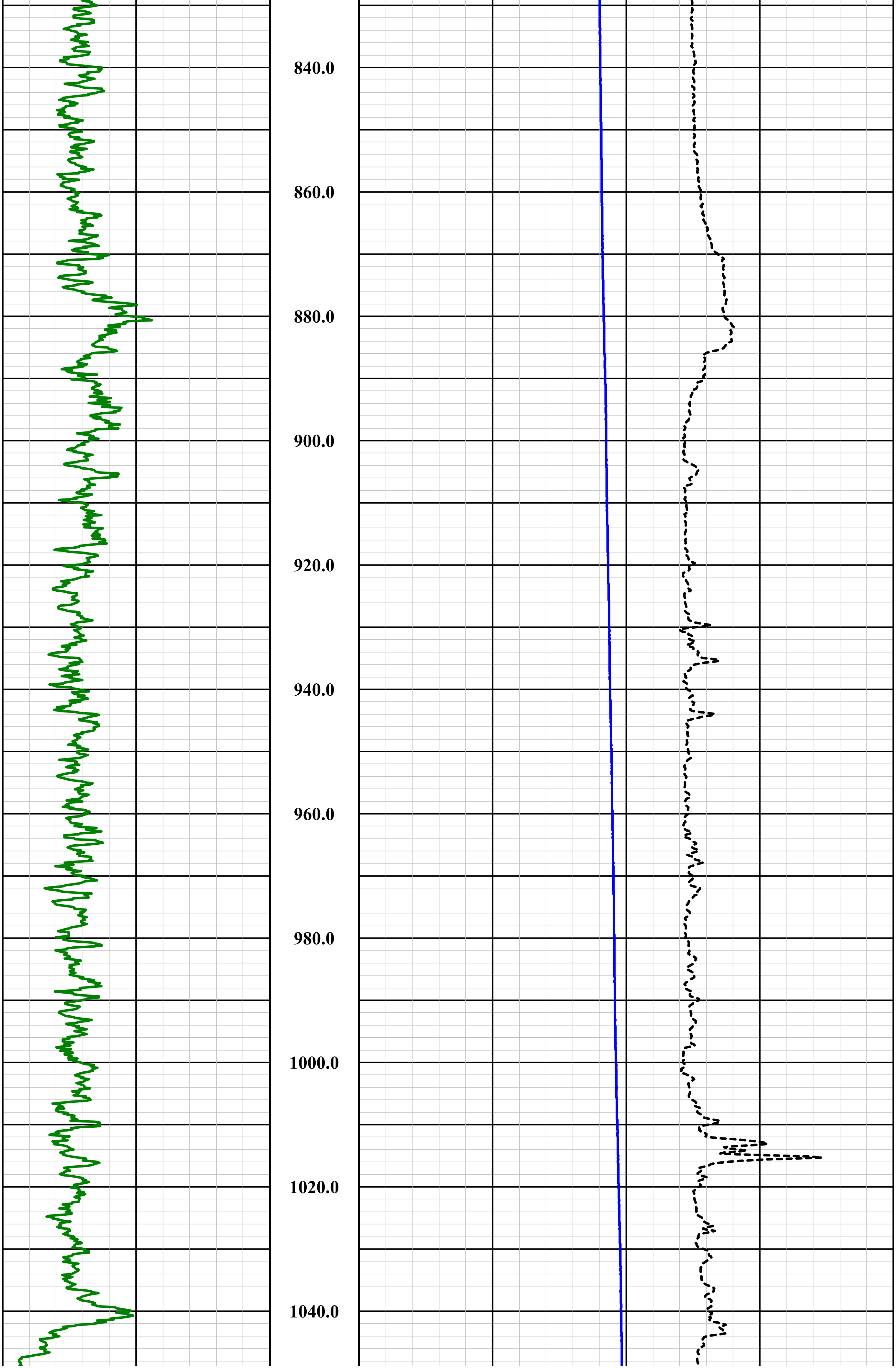
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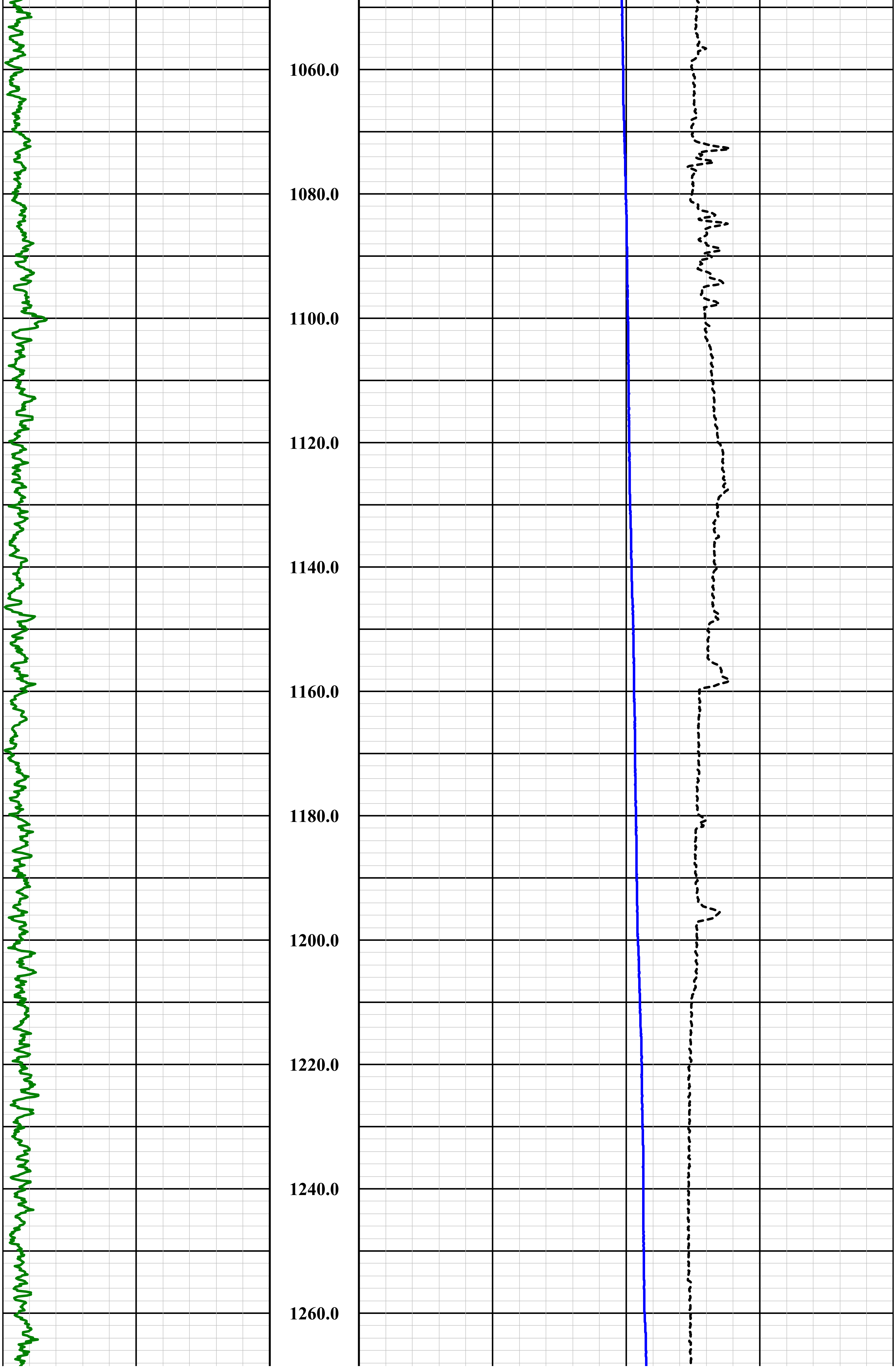
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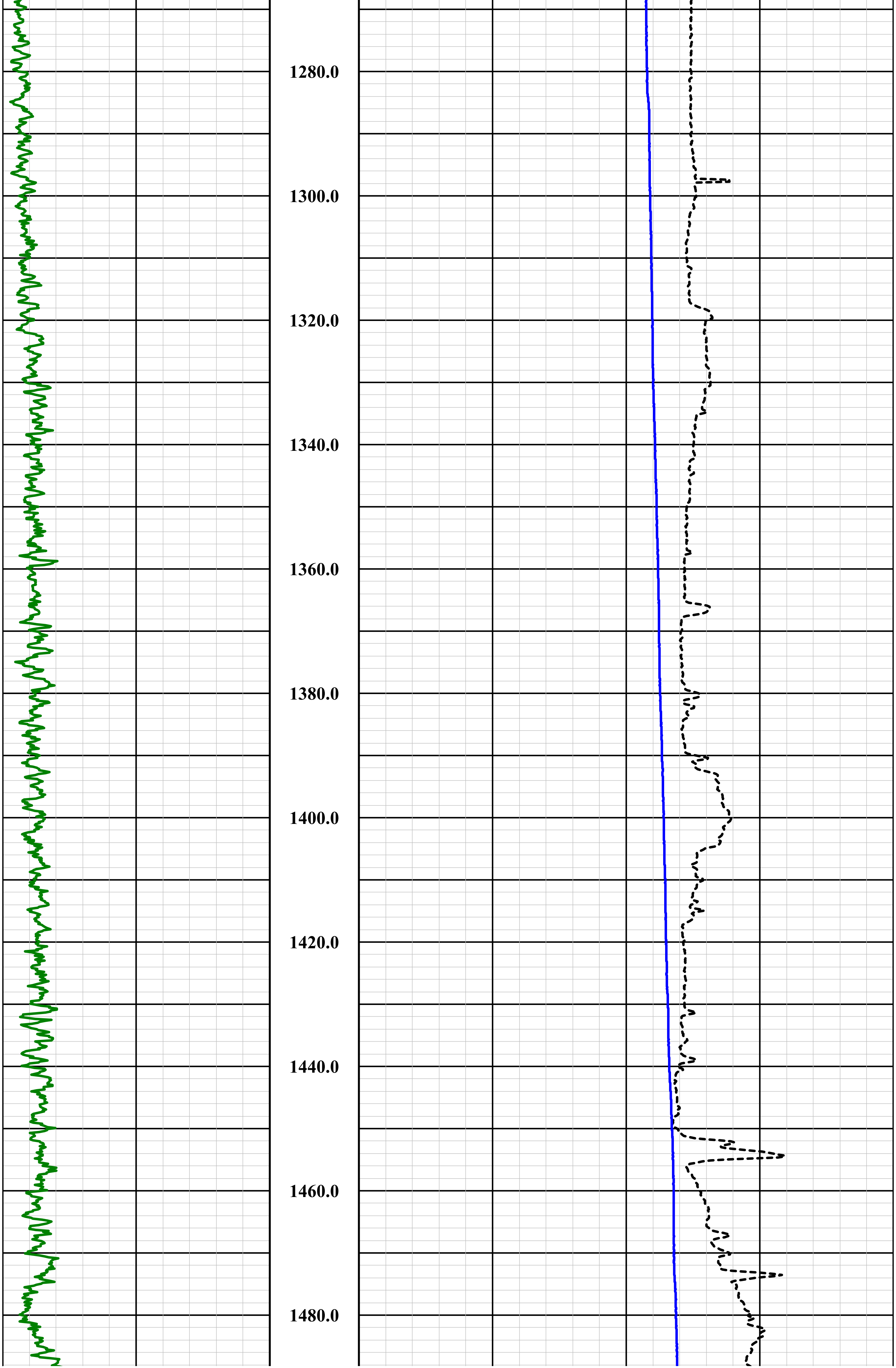
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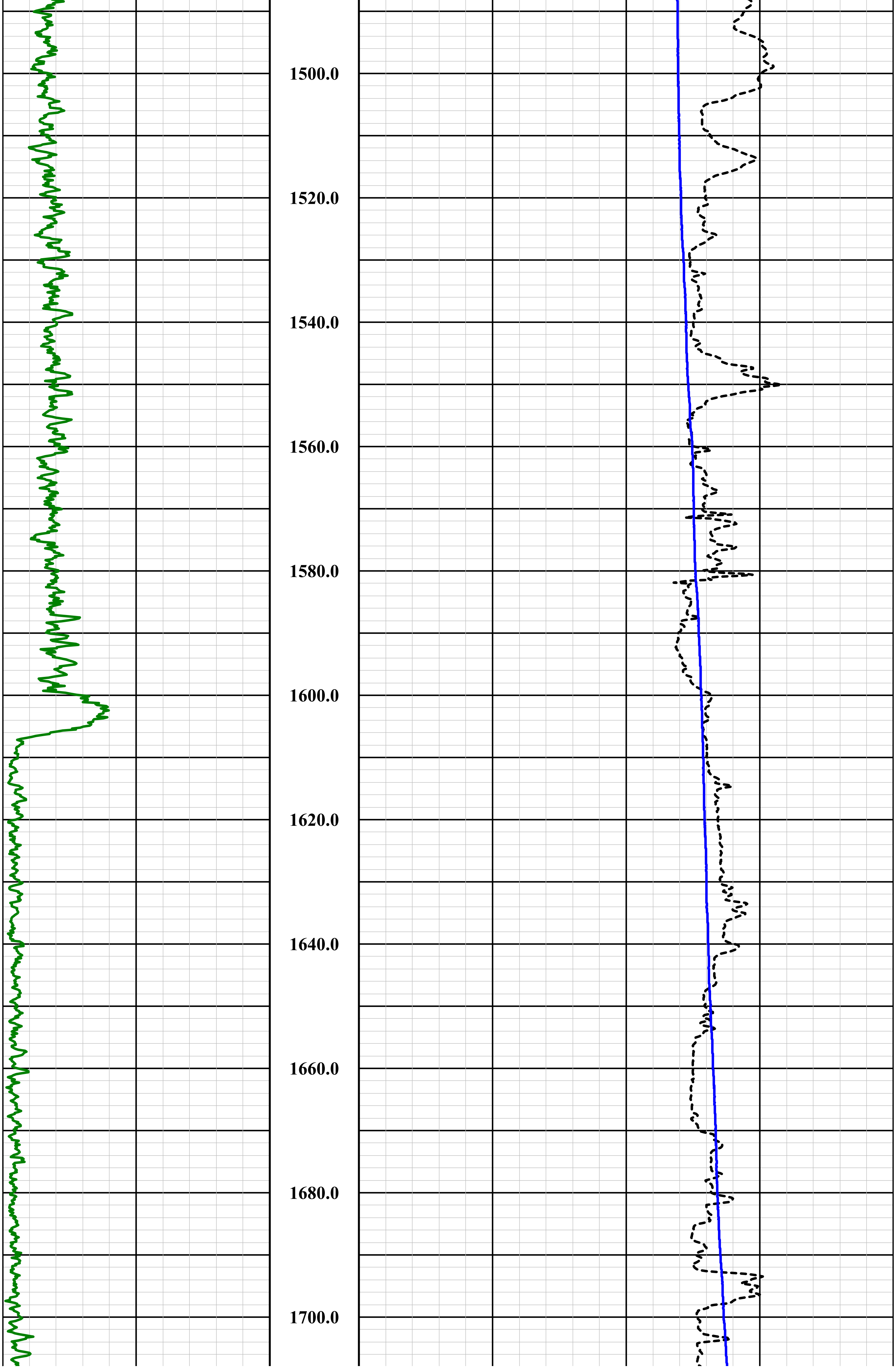
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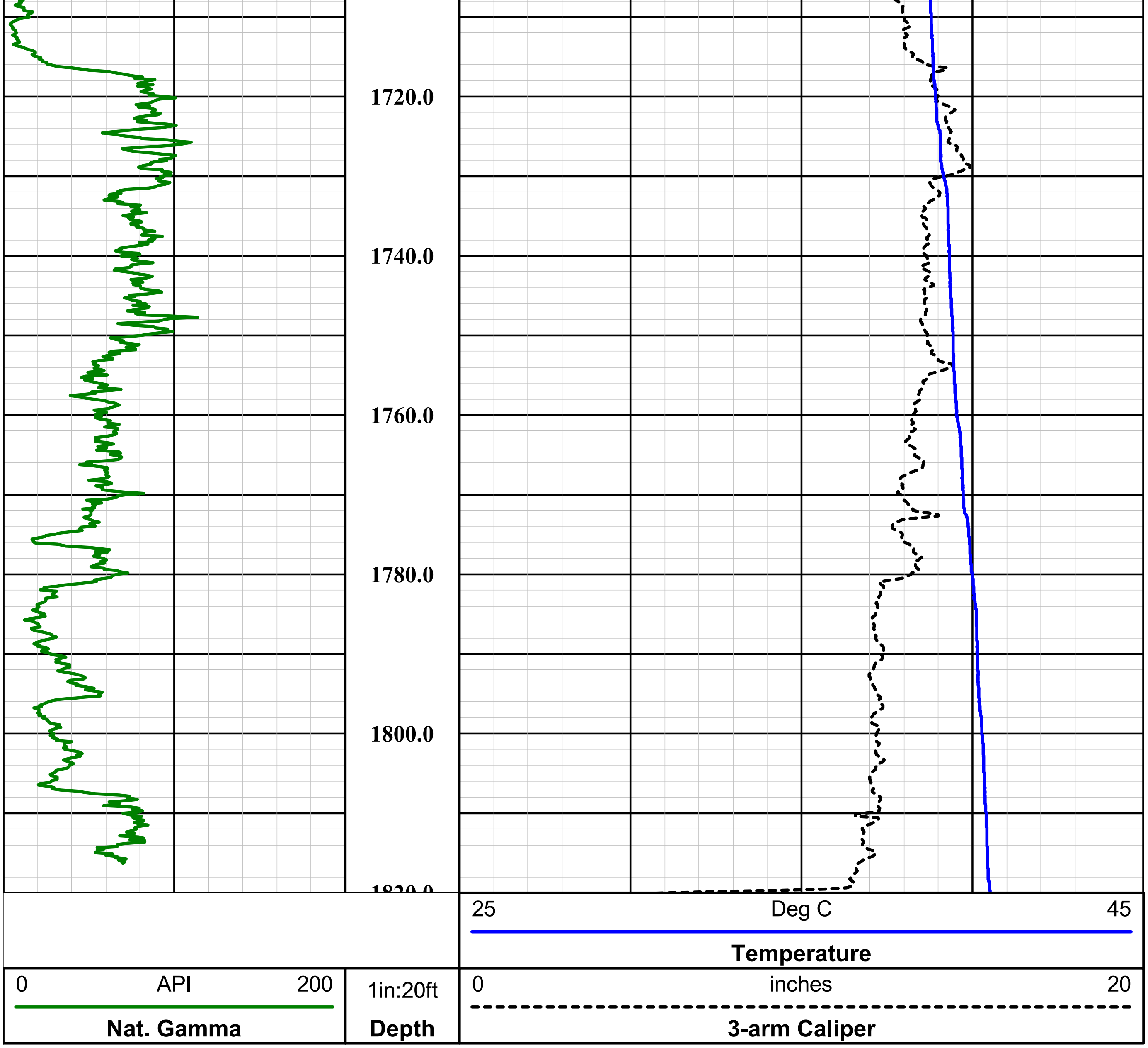
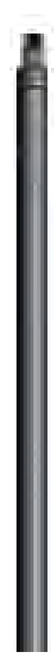


MSI Gamma-Caliper-Temperature-Fluid Resistivity

Probe Top = Depth Ref.

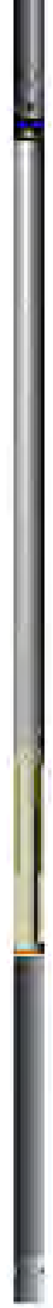


Probe Length = 2.59 m or 8.5 ft
Probe Weight = 6.80 kg or 15.0 lbs

Natural Gamma and Caliper can only be collected logging up hole.

Fluid Temperature/Resistivity can only be collected logging down hole.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)



NOTE: Lengths on a particular tool may vary from those listed on this document due to probe sizes and styles utilizedl

3-Arm Caliper = 1.44 m (56.75 in)

Distance from tool top: 2.20 m (86.5 in)

Available Arm Sizes: 3", 9", and 15"

TFR (Temperature/Fluid Resistivity) = 0.39 m (15.5 in)

1.375" or 34.9 mm Diameter

Southwest Exploration Services, LLC
borehole geophysics & video services

Company	RESOLUTION COPPER MINING
Well	DHRES-16
Field	SUPERIOR
County	PINAL
State	ARIZONA

Preliminary GCT SUMMARY

Southwest Exploration Services, LLC
borehole geophysics & video services

COMPANY	RESOLUTION COPPER		
WELL ID	DHRES-16 (55-917232)		
FIELD	RESOLUTION		
COUNTY	PINAL	STATE	ARIZONA

TYPE OF LOGS: E-LOGS
MORE: NAT. GAMMA

LOCATION
SE 1/4 OF SW 1/4 OF NE 1/4
944004 E, 830713 N

SEC 04 TWP 02 S RGE 12 E

OTHER SERVICES
COMBO
SONIC
ABI-43

PERMANENT DATUM	AZ SPC, FEET	ELEVATION	2634 FT	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND LEVEL			G.L.

DATE	09-03-14	TYPE FLUID IN HOLE	FORMATION WATER
RUN No	1/2	MUD WEIGHT	N/A
TYPE LOG	ELOG-GAM	VISCOSITY	N/A
DEPTH-DRILLER	1820 FT	LEVEL	FULL
DEPTH-LOGGER	1820 FT	MAX. REC. TEMP.	40.74 DEG C
BTM LOGGED INTERVAL	1820 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	SURFACE	SAMPLE INTERVAL	0.2 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	E. TURNER	TOOL STRING/SN	GEOVISTA ELOG S/N 4035
WITNESSED BY	MATT - M&A	LOG TIME:ON SITE/OFF SITE	11:40 AM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	55 FT	14"		SURFACE	56 FT
2	12.25"	55 FT	TOTAL DEPTH				
3							

COMMENTS:

.

Tool Summary:

Date	09-03-14	**Date**	09-03-14	**Date**	09-03-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	MSI COMBO	**Tool Model**	GEOVISTA ELOG	**Tool Model**	ALT FWS50
Tool SN	5446	**Tool SN**	4035	**Tool SN**	3564
From	SURFACE	**From**	SURFACE	**From**	SURFACE
To	1820 FT	**To**	1820 FT	**To**	1820 FT
Recorded By	E. TURNER	**Recorded By**	E. TURNER	**Recorded By**	E. TURNER
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	8-28-14	**Operation Check**	8-28-14	**Operation Check**	8-28-14
Calibration Check	8-28-14	**Calibration Check**	8-28-14	**Calibration Check**	N/A
Time Logged	12:15 PM	**Time Logged**	1:45 PM	**Time Logged**	2:45 PM

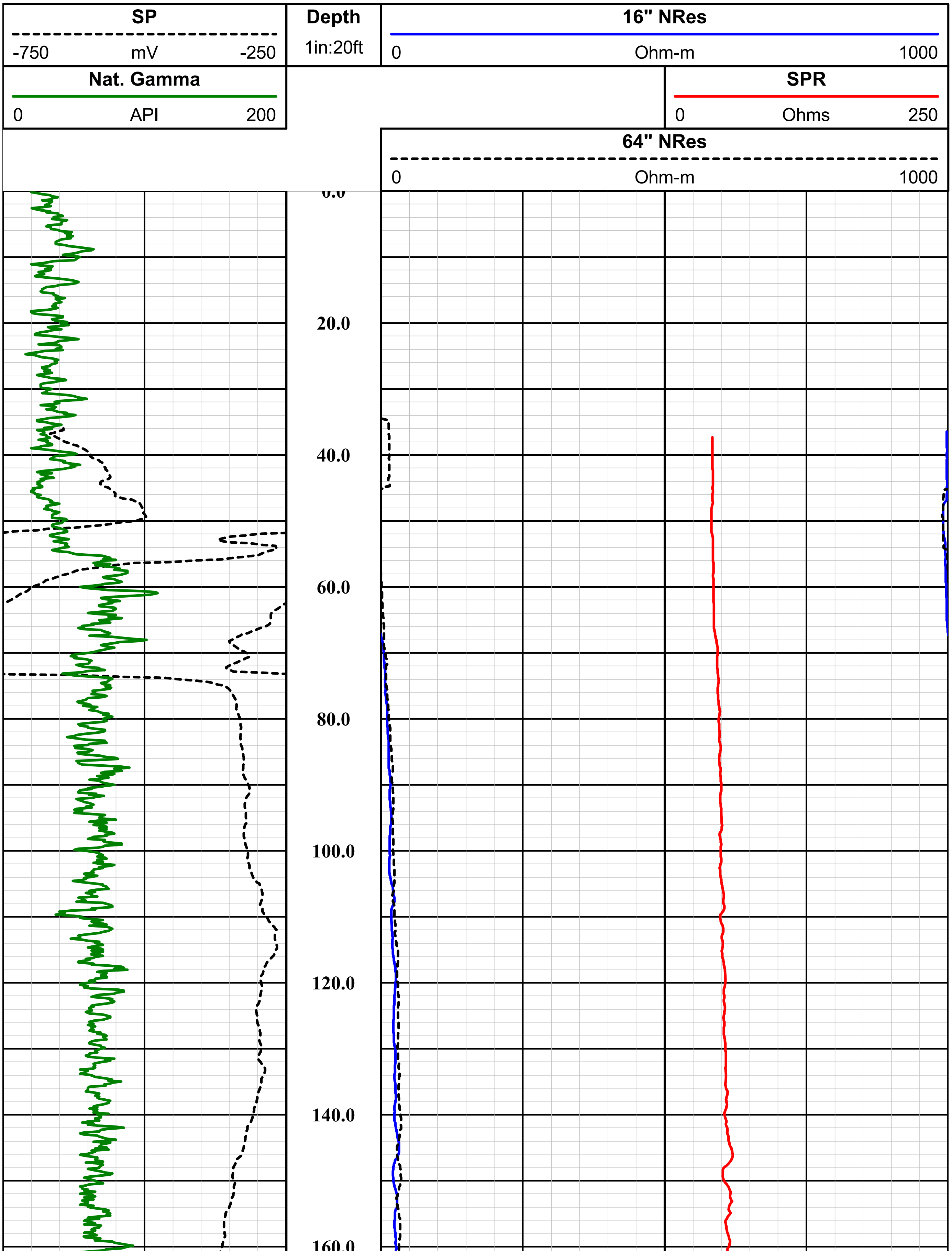
Date	09-03-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT ABI43	**Tool Model**		**Tool Model**	
Tool SN	91601	**Tool SN**		**Tool SN**	
From	1200 FT	**From**		**From**	
To	1820 FT	**To**		**To**	
Recorded By	E. TURNER	**Recorded By**		**Recorded By**	
Truck No	500	**Truck No**		**Truck No**	
Operation Check	8-28-14	**Operation Check**		**Operation Check**	
Calibration Check	N/A	**Calibration Check**		**Calibration Check**	
Time Logged	4:25 PM	**Time Logged**		**Time Logged**	

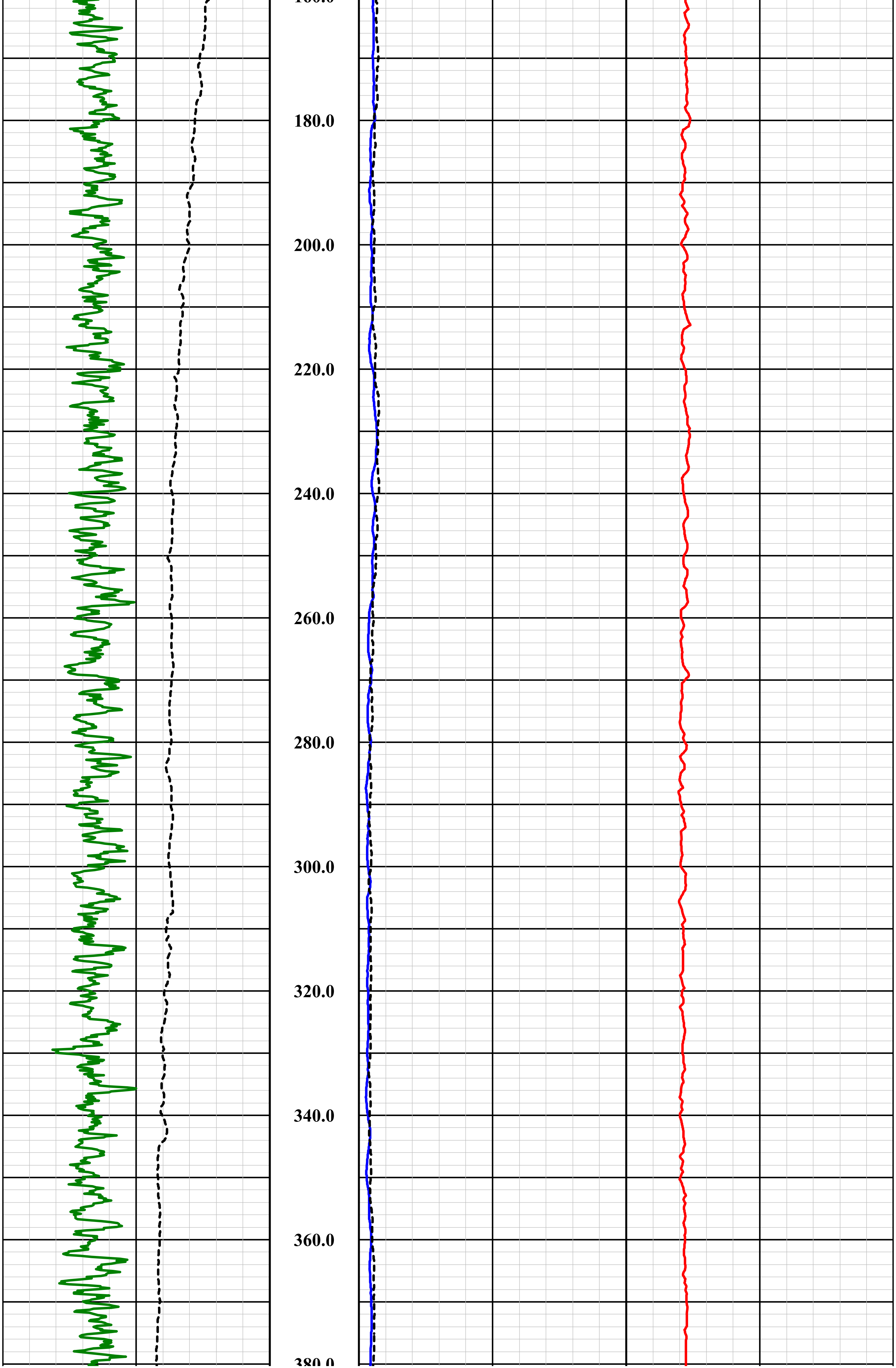
Additional Comments:

Caliper Arms Used: 15" **Calibration Points:** 10.2" - 24"

Disclaimer:

All interpretations of log data are opinions based on inferences from electrical or other measurements. We do not guarantee the accuracy or correctness of any interpretations or recommendations and shall not be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our employees or agents. These interpretations are also subject to our general terms and conditions set out in our current Service Invoice.

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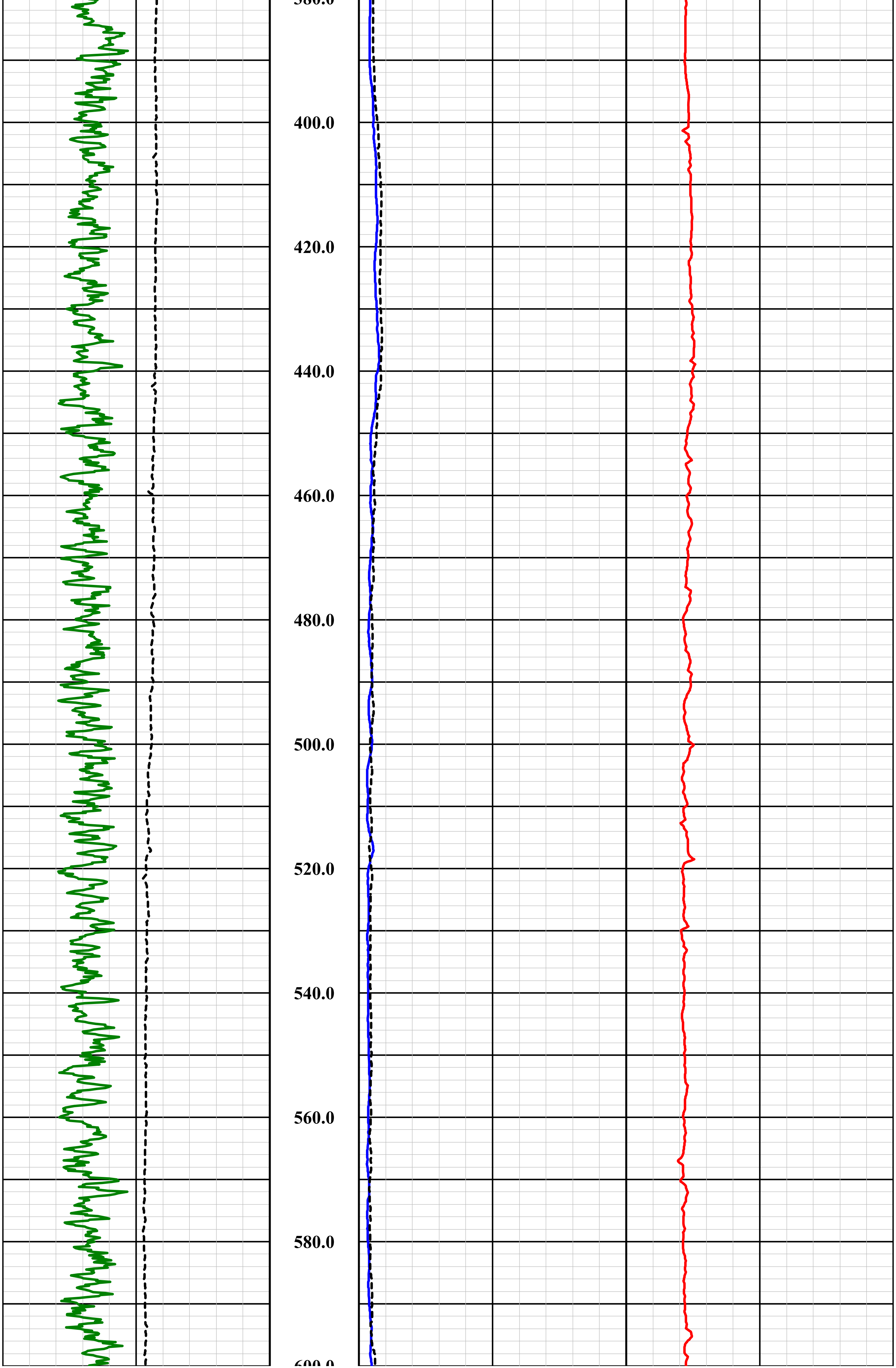
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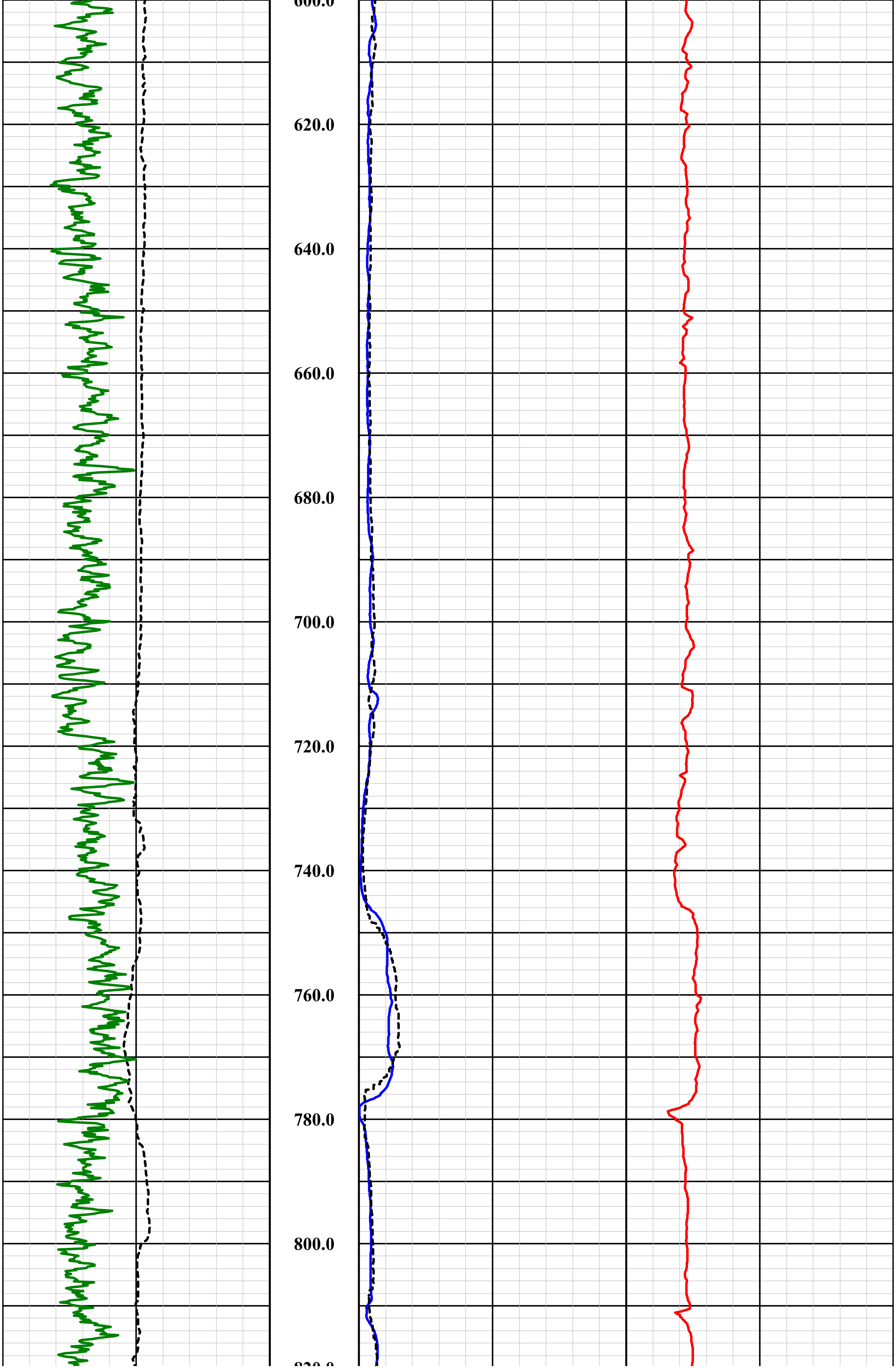
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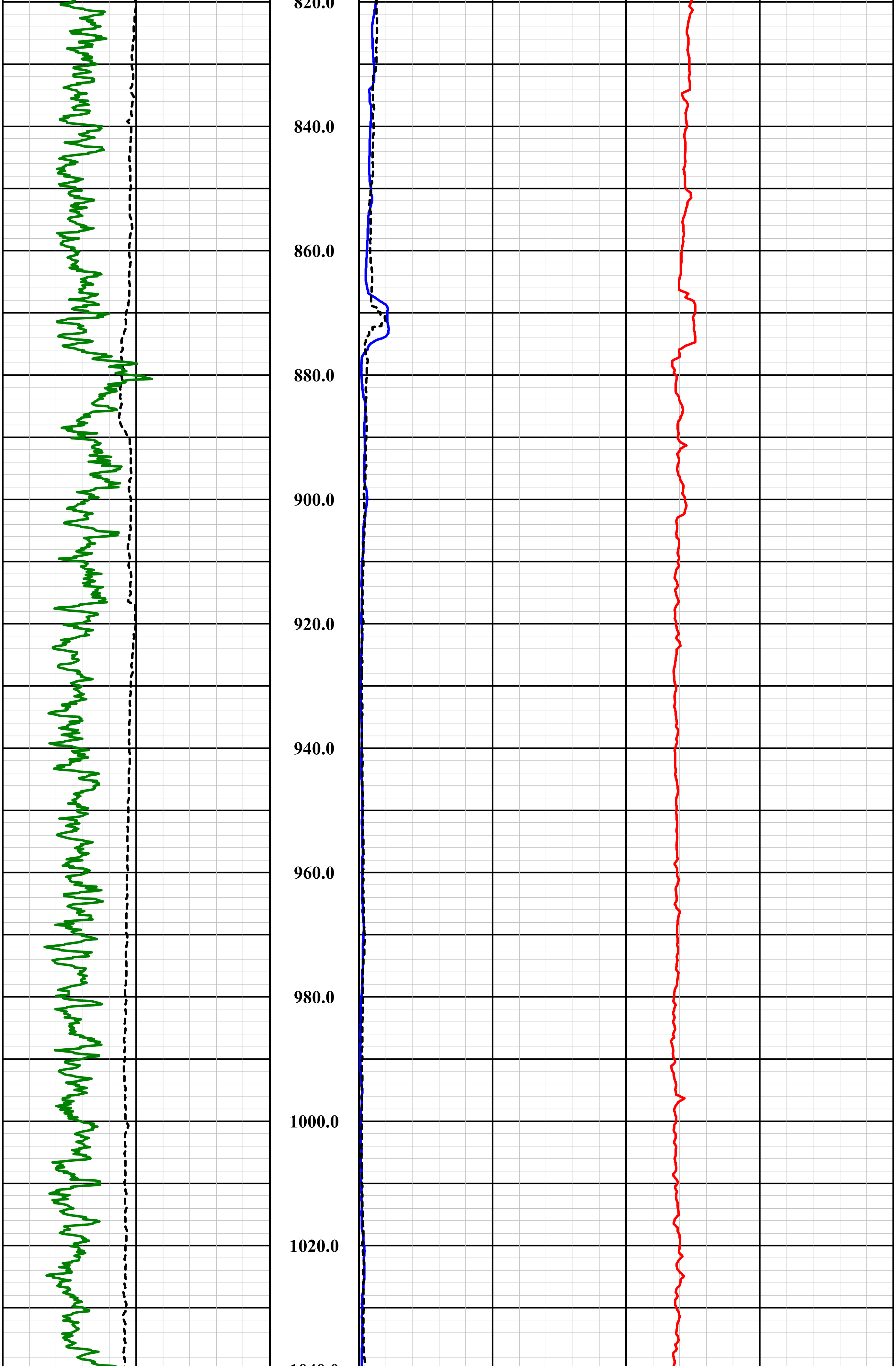
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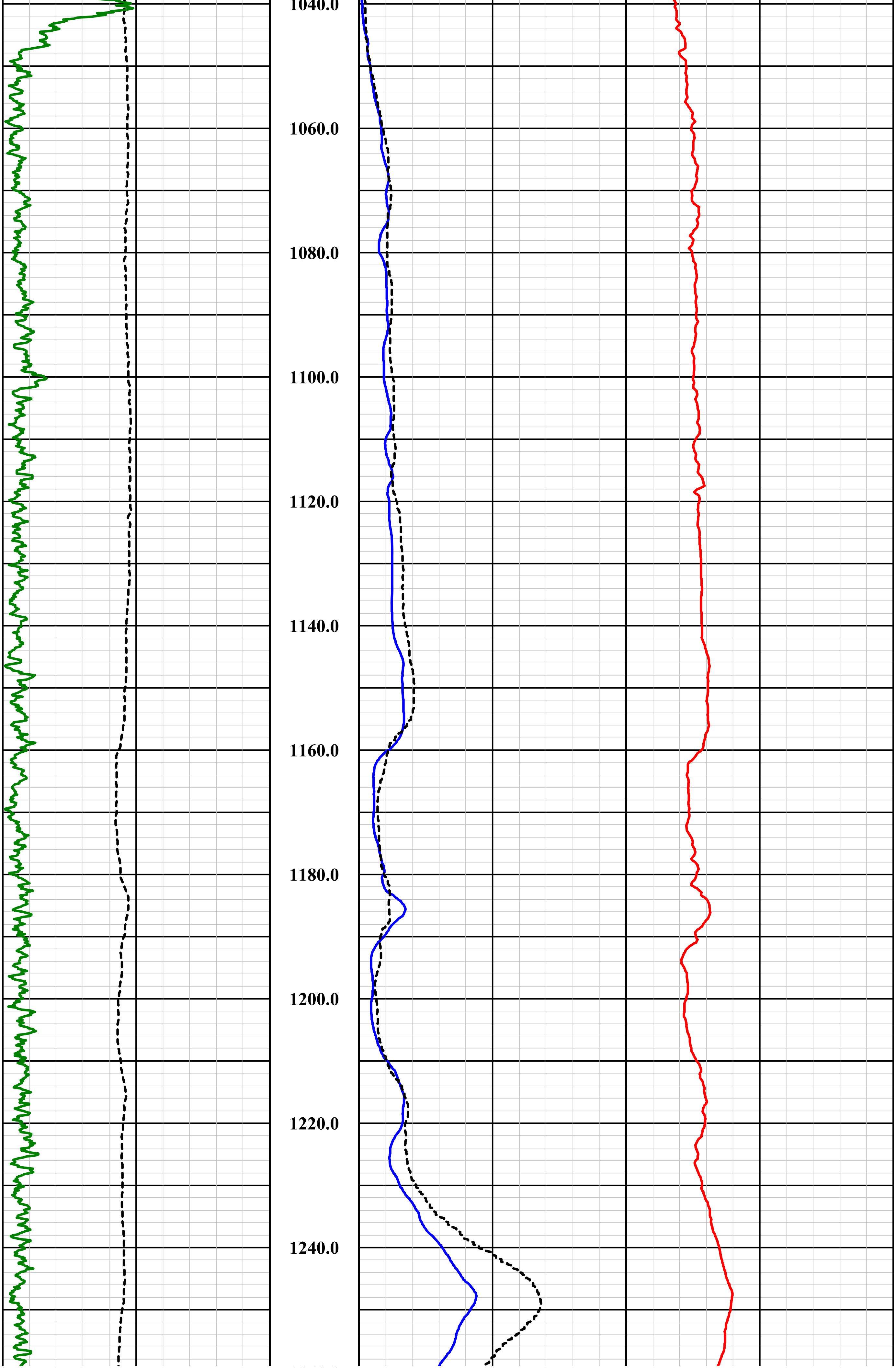
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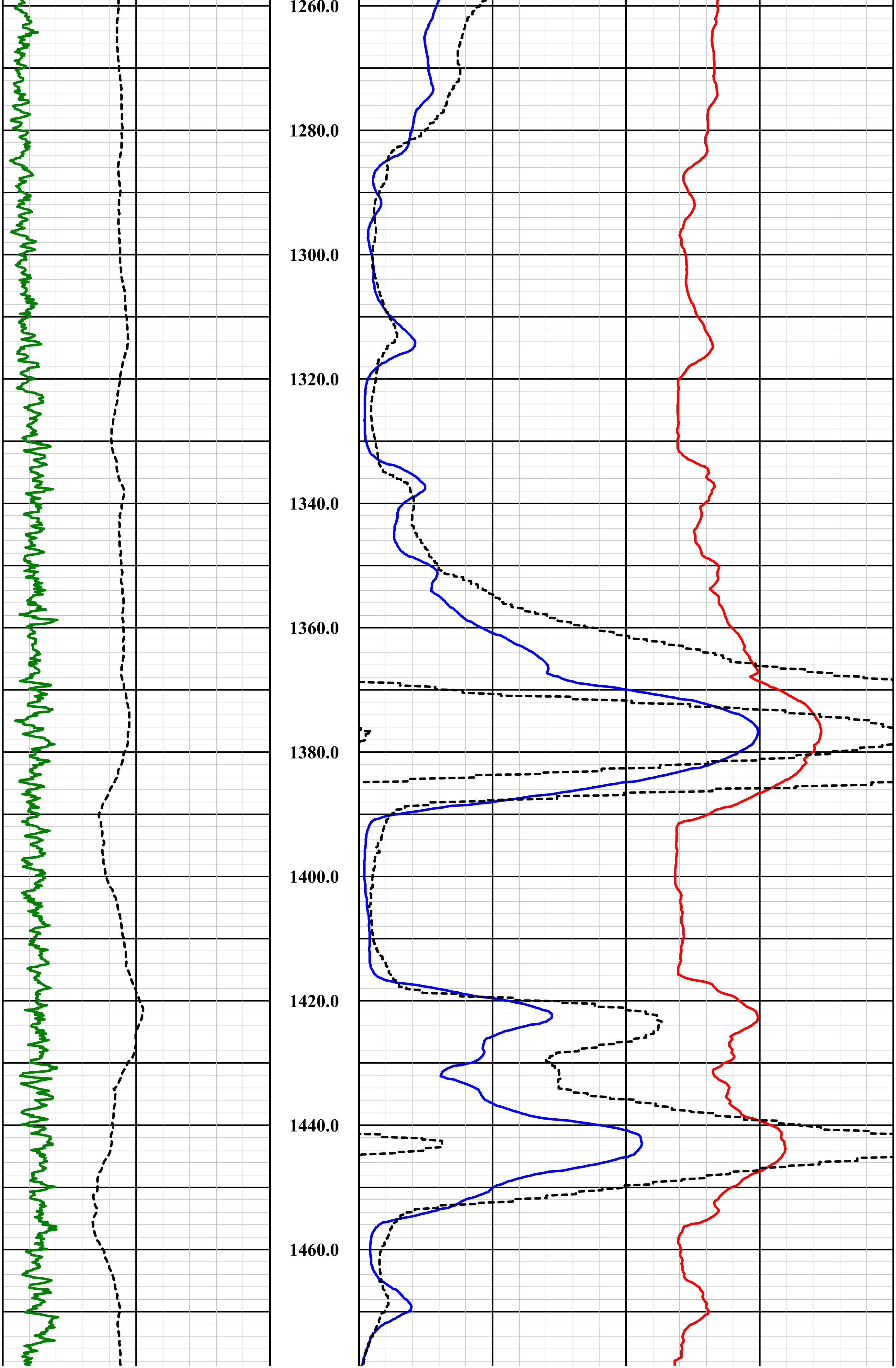
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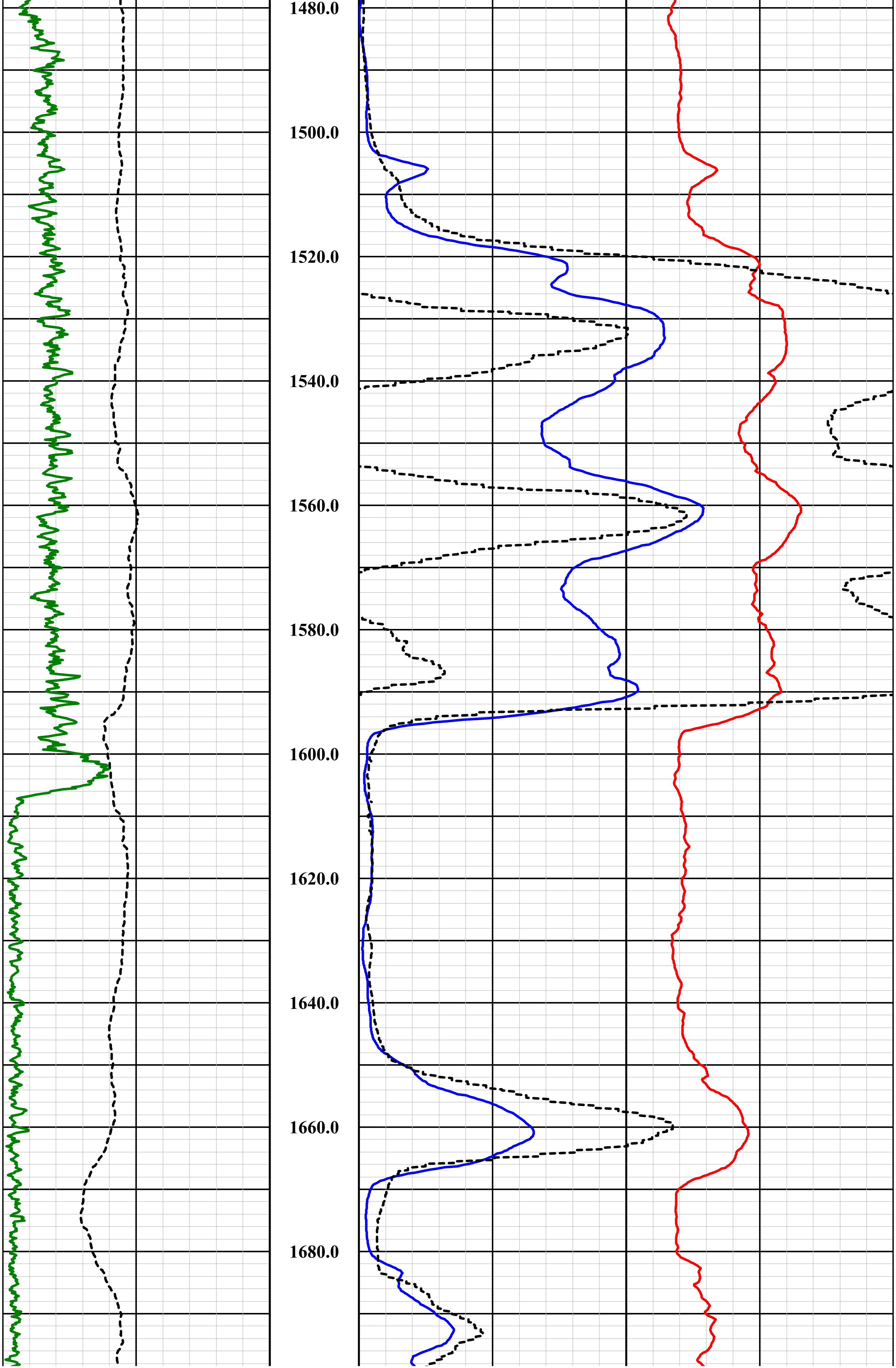

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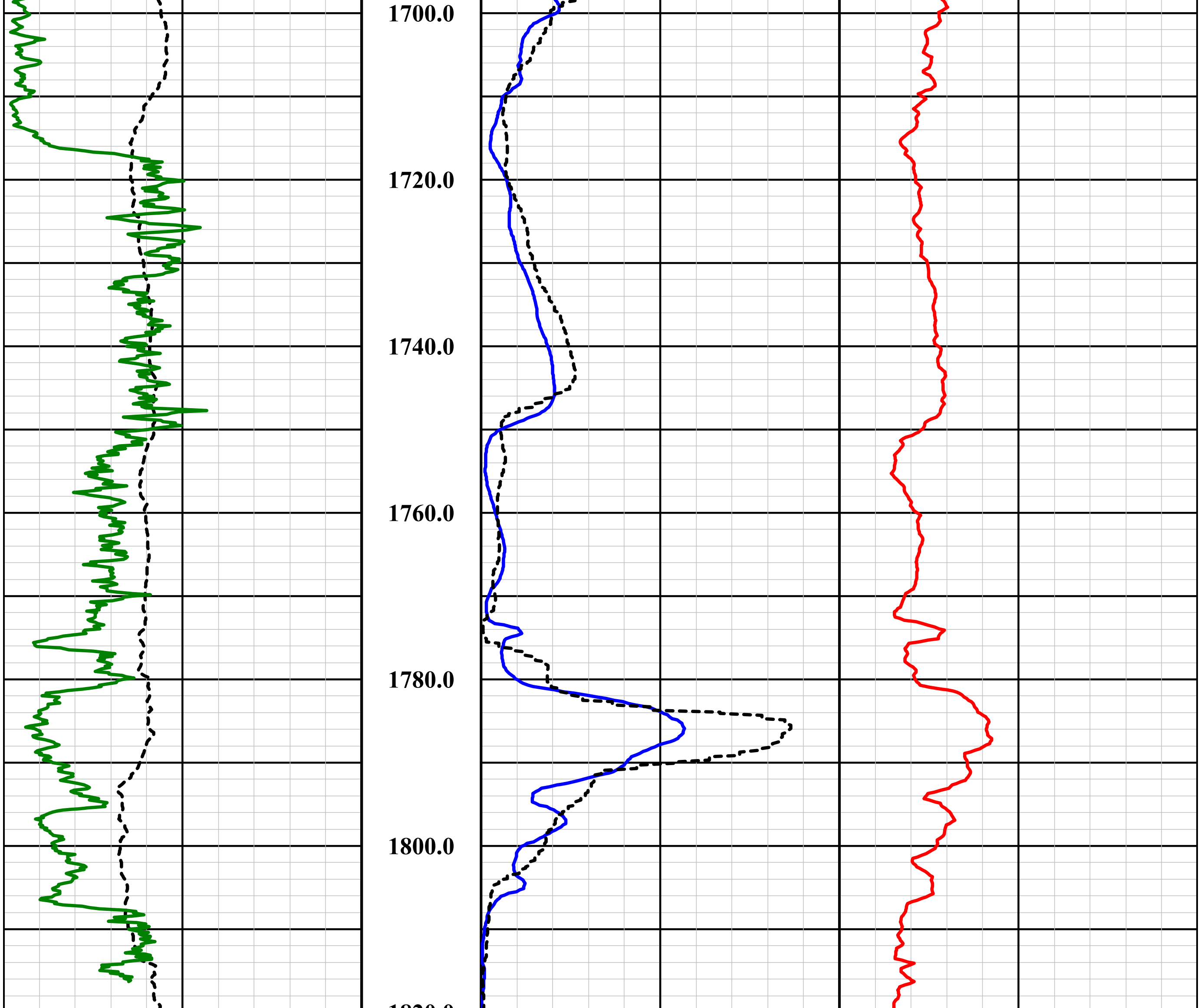


Curve	Scale left	Units	Scale right
64" NRes (dashed)	0	Ohm-m	1000
Nat. Gamma	0	API	200
SPR	0	Ohms	250
SP (dashed)	-750	mV	-250
Depth		1in:20ft	
16" NRes	0	Ohm-m	1000

GeoVista E-Log Tool

Probe Top = Depth Ref.

Tool SN: 4035 & 4790

Bridle connects to wireline cablehead: Wireline armor is the B Electrode.

Four Conductor MSI Probe Top

Bridle Electrode (N Electrode)

64" Normal Resistivity Electrode/Spontaneous Potential Electrode (M Electrode)

Probe Length = 2.3 m or 7.55 ft
Bridle Length = 10.0 m or 32.81 ft

Probe Weight = 7.0 kg or 15.4 lbs

Can only be collected in fluid

Isolation Bridle - Not shown in diagram but is necessary for operation

Electrode Measuring Points (from bottom of probe)
- Spontaneous Potential (SP): 0.65 m or 2.13 ft
- 16" Normal Resistivity (16" NRes): 0.50 m or 1.64 ft
- 64" Normal Resistivity (64" NRes): 1.10 m or 3.61 ft
- Single Point Resistance (SPR): 0.25 m or 0.82 ft

Temperature Rating: 80 Deg C (176 Deg F)
Presure Rating: 200 bar (2900 psi)

16" Normal Resistivity Electrode (M Electrode)

Current Electrode/Single Point Resistance
(A Electrode)

1.65" or 42 mm Diameter

MSI Gamma-Caliper-Temperature-Fluid Resistivity

Probe Top = Depth Ref.

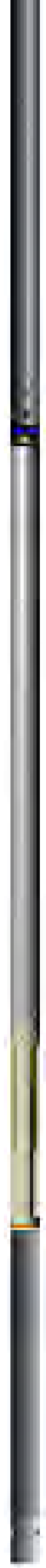
Single Conductor MSI Probe Top

Probe Length = 2.59 m or 8.5 ft
Probe Weight = 6.80 kg or 15.0 lbs

Natural Gamma and Caliper can only be collected logging up hole.

Fluid Temperature/Resistivity can only be collected logging down hole.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)



Natural Gamma Ray = 0.76 m (29.75 in)

NOTE: Lengths on a particular tool may vary from those listed on this document due to probe sizes and styles utilizedl

3-Arm Caliper = 1.44 m (56.75 in)

Distance from tool top: 2.20 m (86.5 in)

Available Arm Sizes: 3", 9", and 15"

TFR (Temperature/Fluid Resistivity) = 0.39 m (15.5 in)

1.375" or 34.9 mm Diameter

Southwest Exploration Services, LLC
borehole geophysics & video services

Company	RESOLUTION COPPER MINING
Well	DHRES-16
Field	SUPERIOR
County	PINAL
State	ARIZONA

Preliminary ELOG SUMMARY

Southwest Exploration Services, LLC
borehole geophysics & video services

COMPANY	RESOLUTION COPPER
WELL ID	DHRES-16 955-917232)
FIELD	RESOLUTION
COUNTY	PINAL
STATE	ARIZONA

TYPE OF LOGS: 4 RX SONIC
MORE: NAT. GAMMA-CALIPER

LOCATION
SE 1/4 OF SW 1/4 OF NE 1/4
944004 E, 830713 N

SEC 04 TWP 02 S RGE 12 E

OTHER SERVICES
E-LOG
COMBO
ABI-43

PERMANENT DATUM	AZ SPC, FEET	ELEVATION	2634 FT	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM				G.L.

DATE	09-03-14	TYPE FLUID IN HOLE	FORMATION WATER
RUN No	1/3	MUD WEIGHT	N/A
TYPE LOG	SONIC-GAM-CAL	VISCOSITY	N/A
DEPTH-DRILLER	1820 FT	LEVEL	FULL
DEPTH-LOGGER	1820 FT	MAX. REC. TEMP.	40.74 DEG C
BTM LOGGED INTERVAL	1820 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	SURFACE	SAMPLE INTERVAL	0.25 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	E. TURNER	TOOL STRING/SN	50MM SONIC S/N 3564
WITNESSED BY	MATT - M&A	LOG TIME:ON SITE/OFF SITE	11:40 AM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	55 FT	14"		SURFACE	56 FT
2	12.25"	55 FT	TOTAL DEPTH				
3							

COMMENTS:

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Tool Summary:

Date	09-03-14	**Date**	09-03-14	**Date**	09-03-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	MSI COMBO	**Tool Model**	GEOVISTA ELOG	**Tool Model**	ALT FWS50
Tool SN	5446	**Tool SN**	4035	**Tool SN**	3564
From	SURFACE	**From**	SURFACE	**From**	SURFACE
To	1820 FT	**To**	1820 FT	**To**	1820 FT
Recorded By	E. TURNER	**Recorded By**	E. TURNER	**Recorded By**	E. TURNER
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	8-28-14	**Operation Check**	8-28-14	**Operation Check**	8-28-14
Calibration Check	8-28-14	**Calibration Check**	8-28-14	**Calibration Check**	N/A
Time Logged	12:15 PM	**Time Logged**	1:45 PM	**Time Logged**	2:45 PM

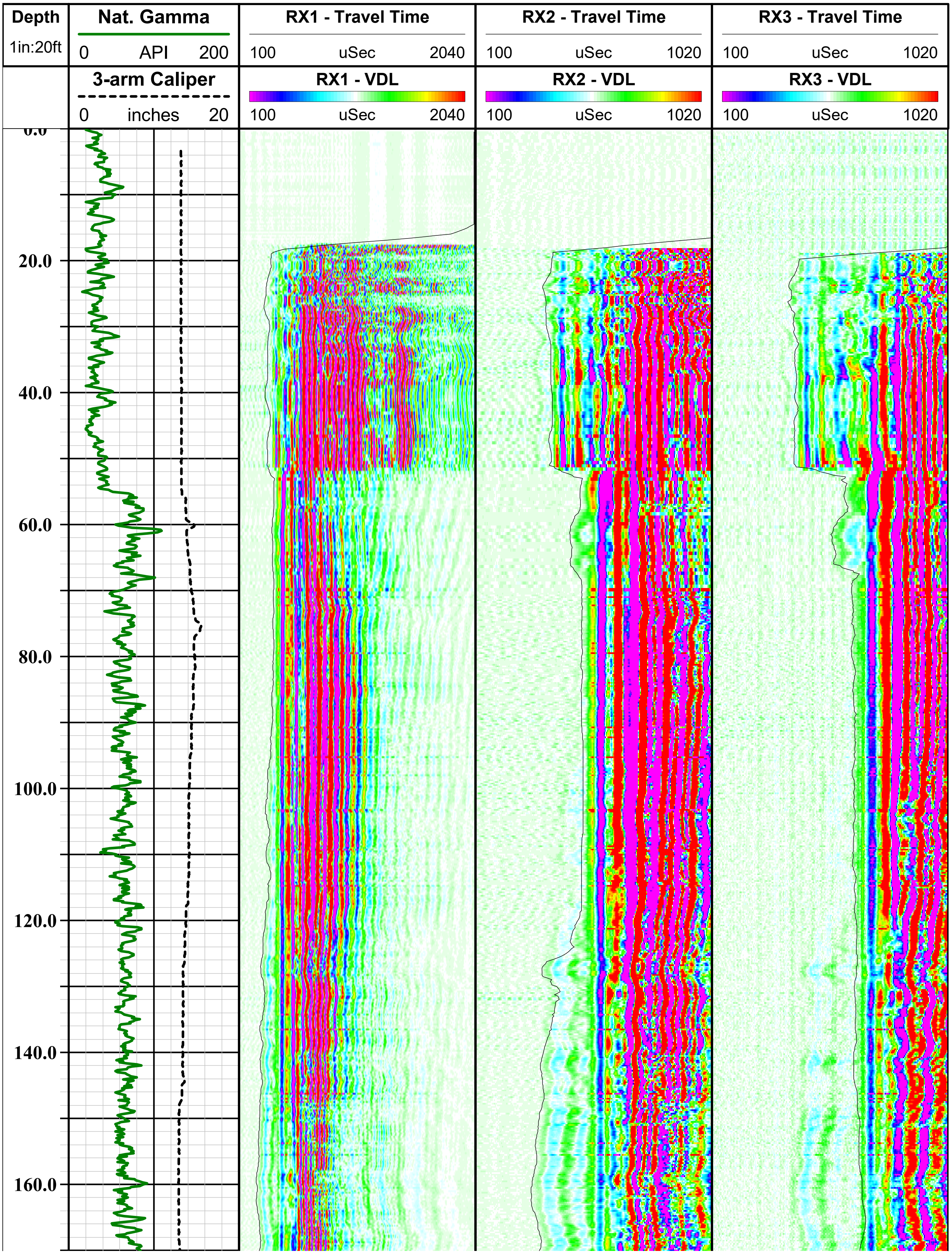
Date	09-03-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT ABI43	**Tool Model**		**Tool Model**	
Tool SN	91601	**Tool SN**		**Tool SN**	
From	1200 FT	**From**		**From**	
To	1820 FT	**To**		**To**	
Recorded By	E. TURNER	**Recorded By**		**Recorded By**	
Truck No	500	**Truck No**		**Truck No**	
Operation Check	8-28-14	**Operation Check**		**Operation Check**	
Calibration Check	N/A	**Calibration Check**		**Calibration Check**	
Time Logged	4:25 PM	**Time Logged**		**Time Logged**	

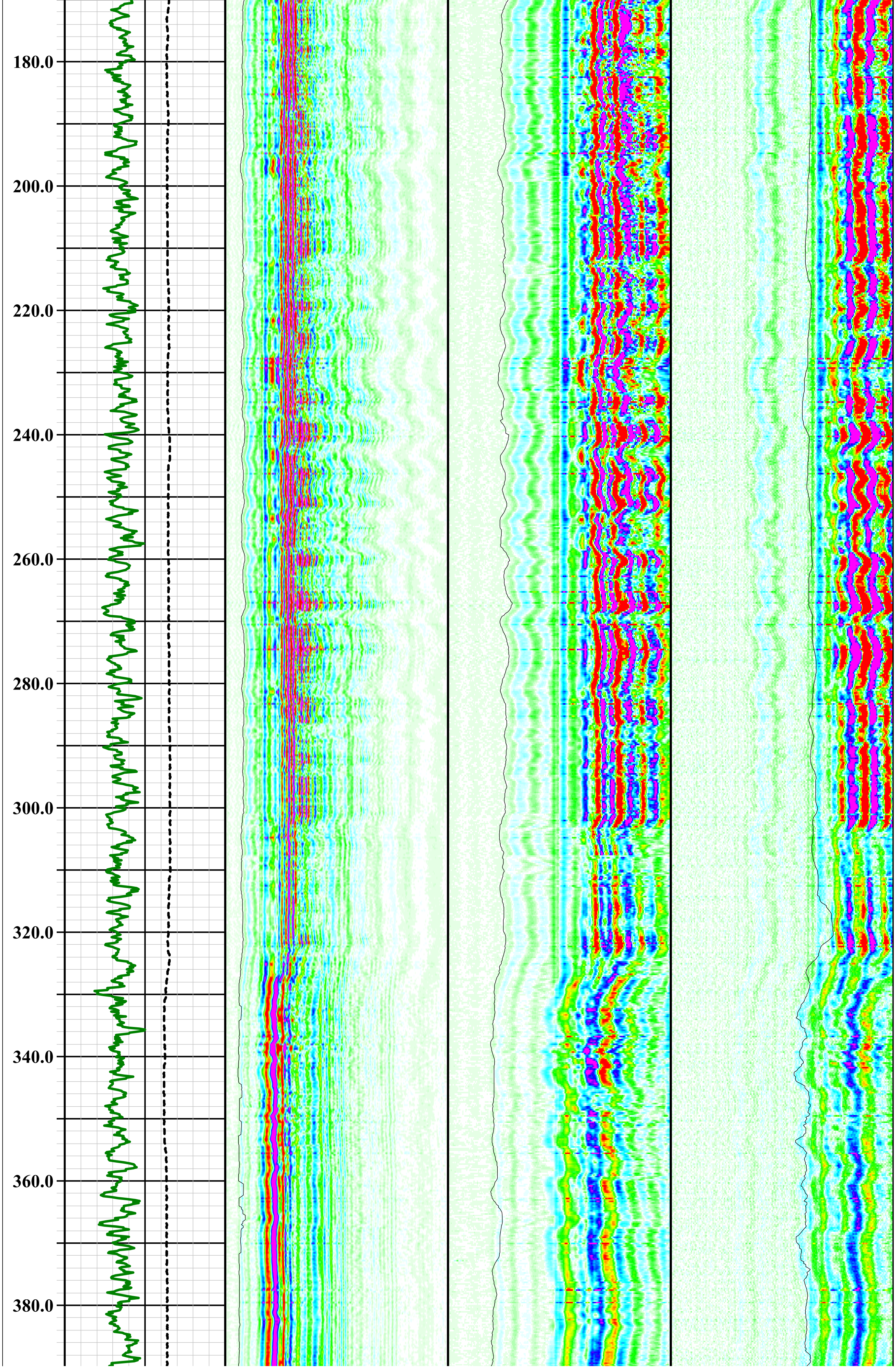
Additional Comments:

Caliper Arms Used: 15" **Calibration Points:** 10.2" - 24"

Disclaimer:

All interpretations of log data are opinions based on inferences from electrical or other measurements. We do not guarantee the accuracy or correctness of any interpretations or recommendations and shall not be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our employees or agents. These interpretations are also subject to our general terms and conditions set out in our current Service Invoice.

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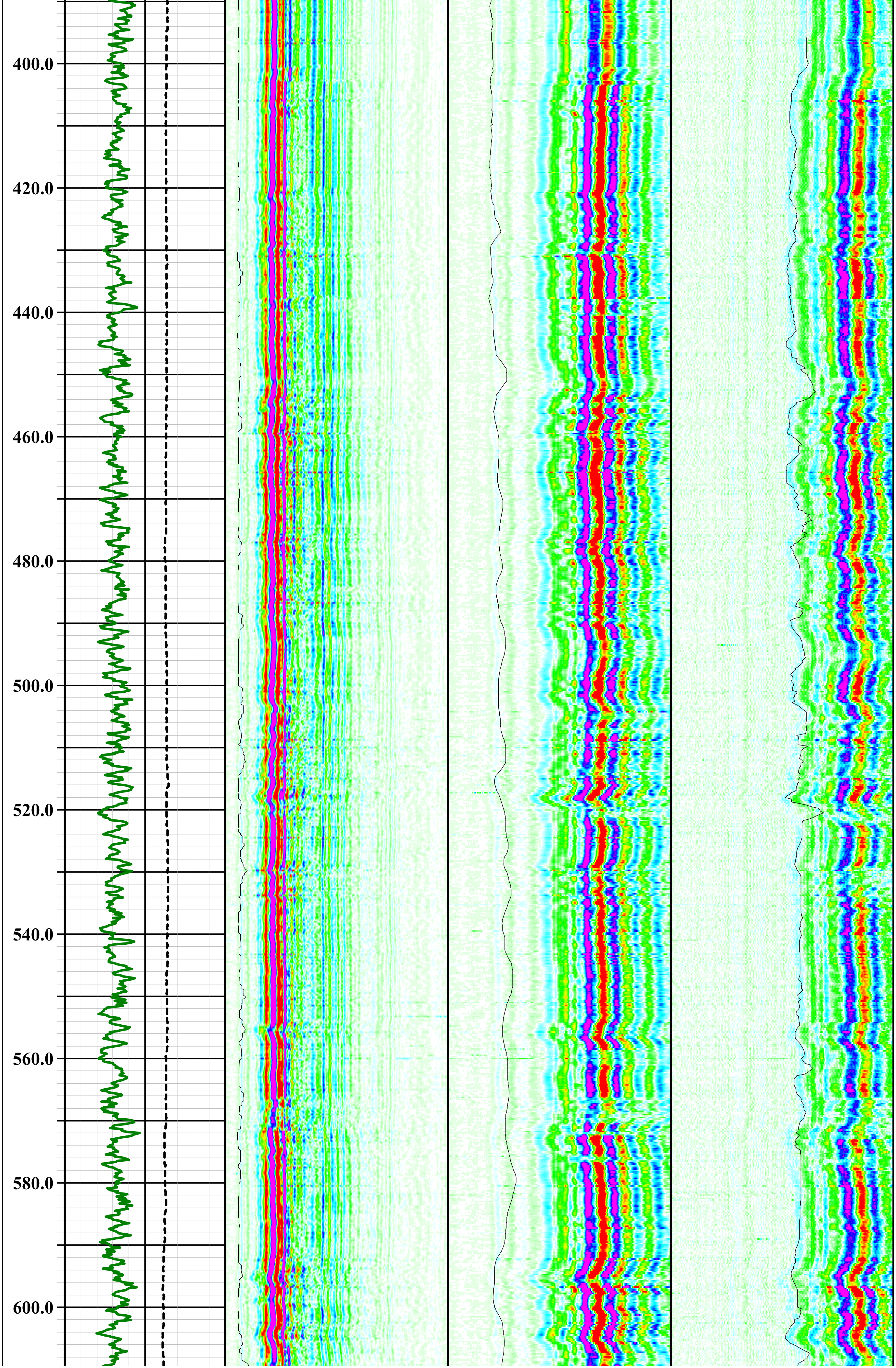
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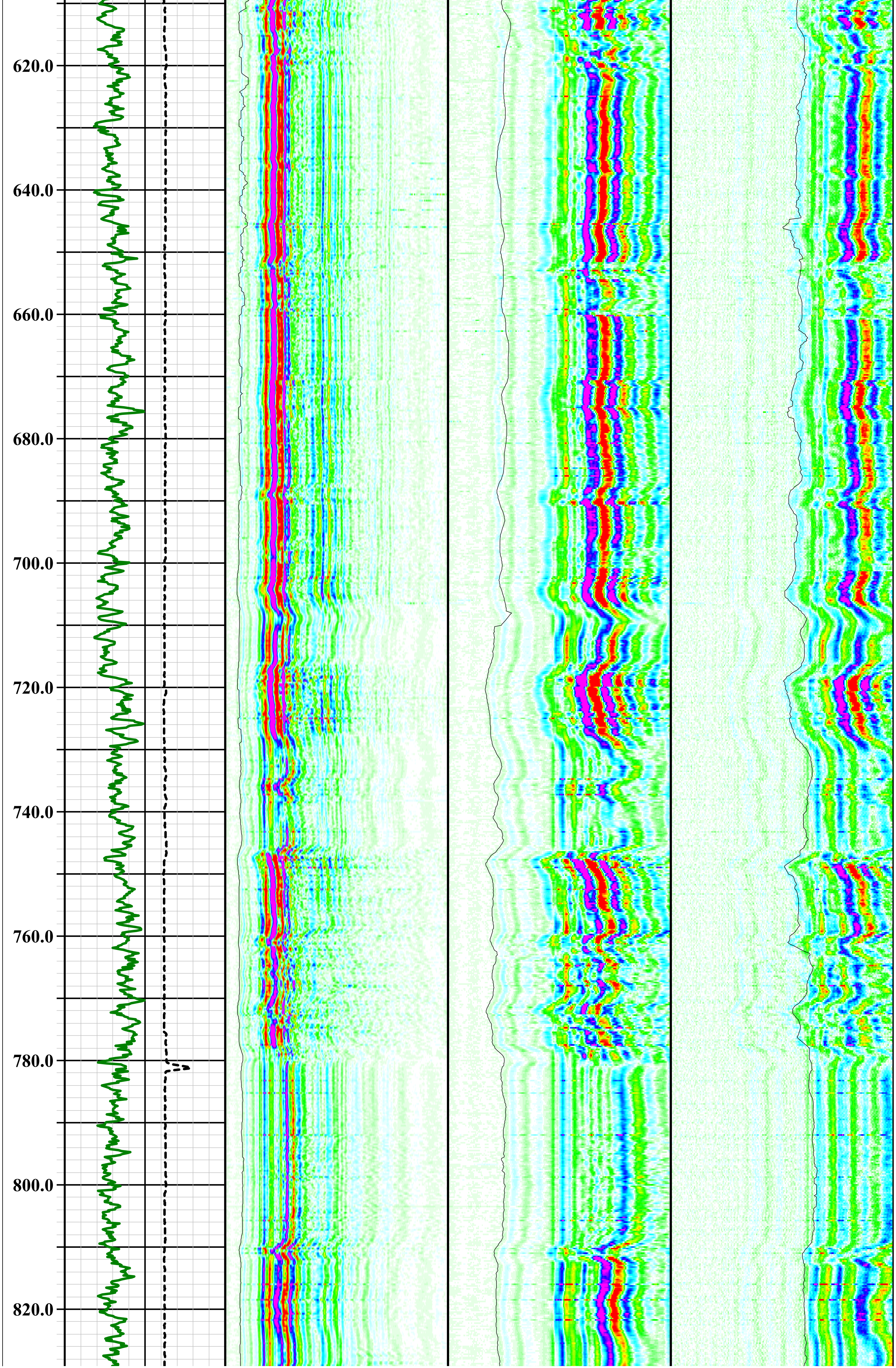
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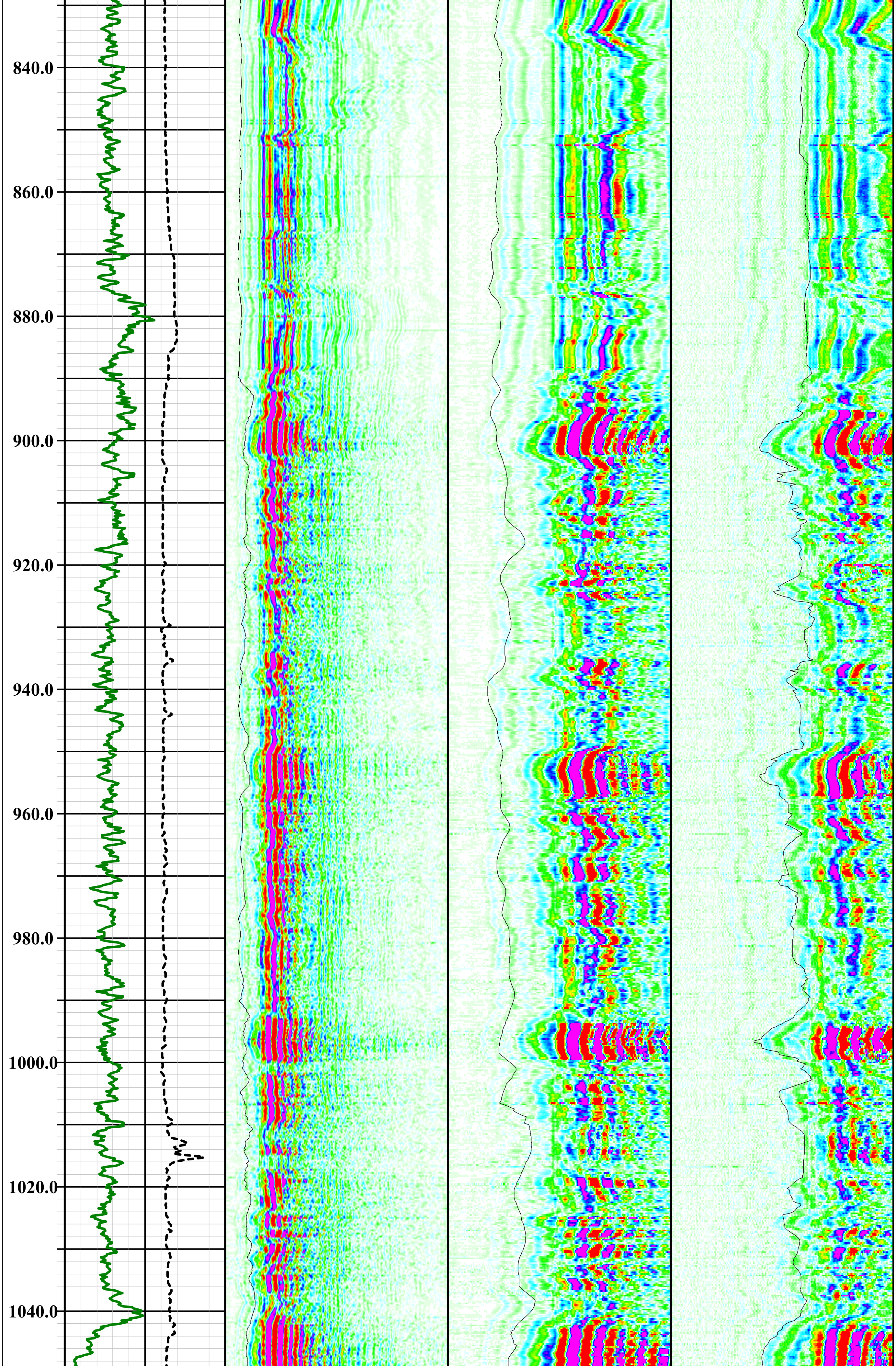
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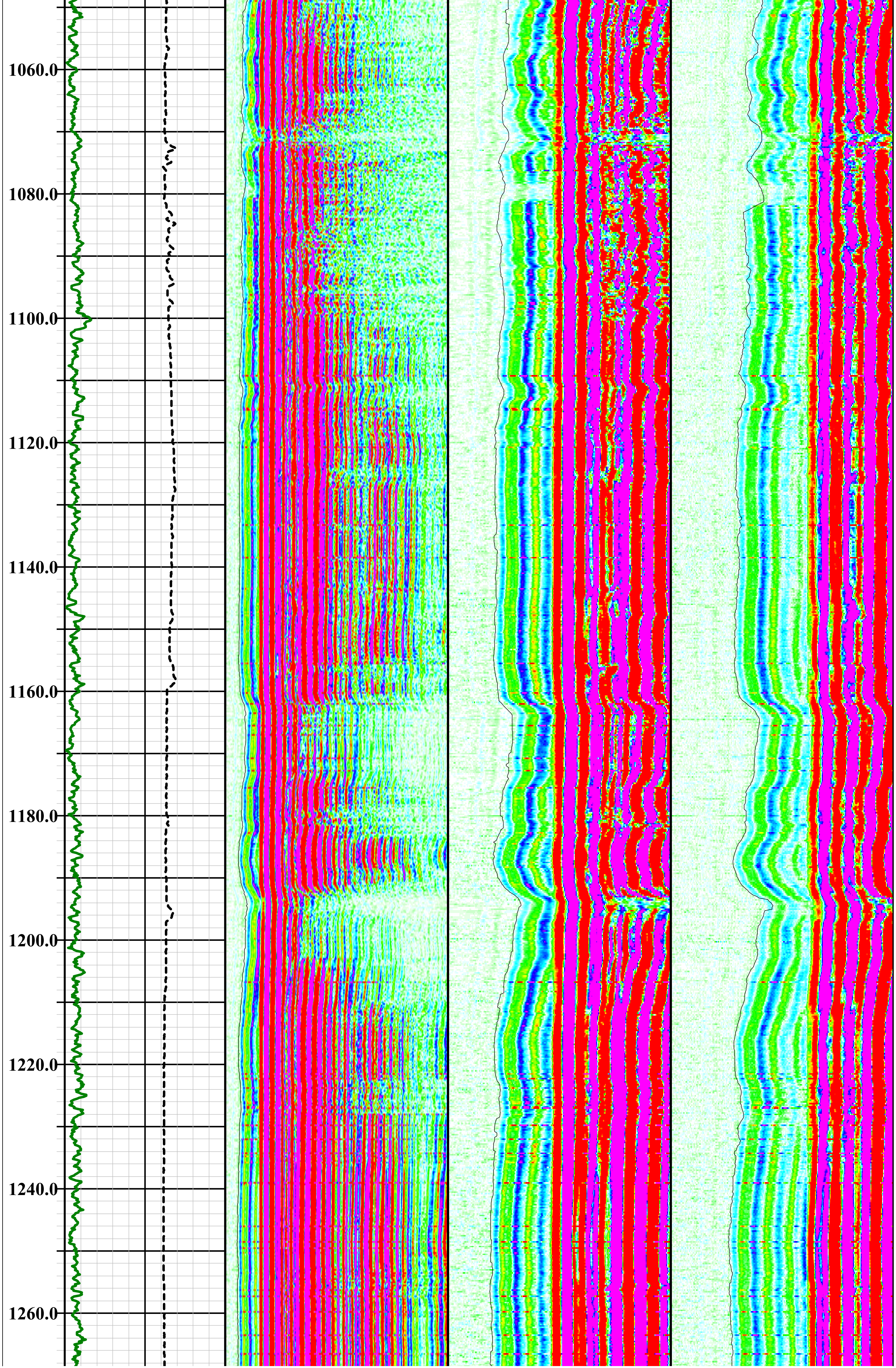
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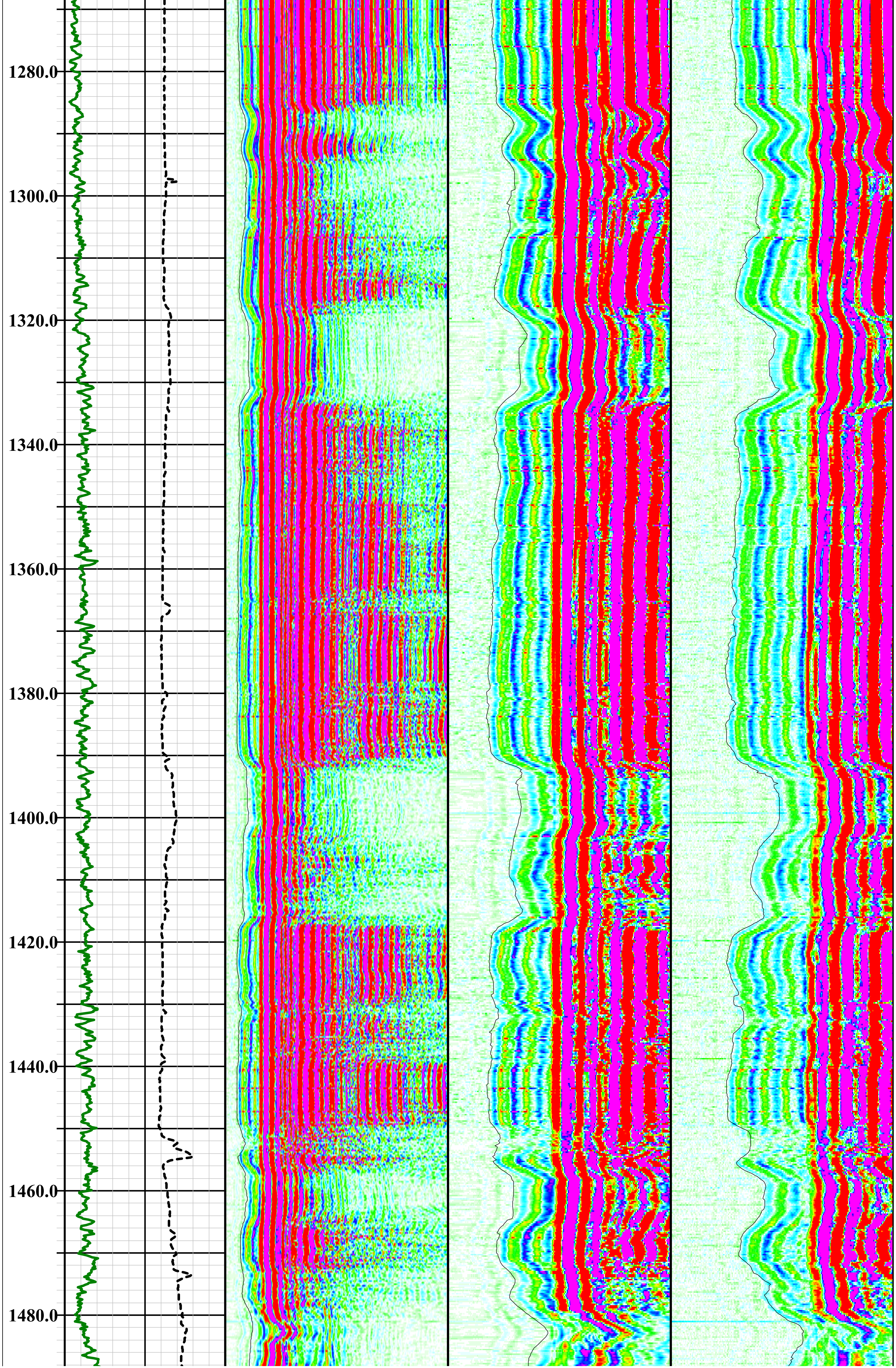
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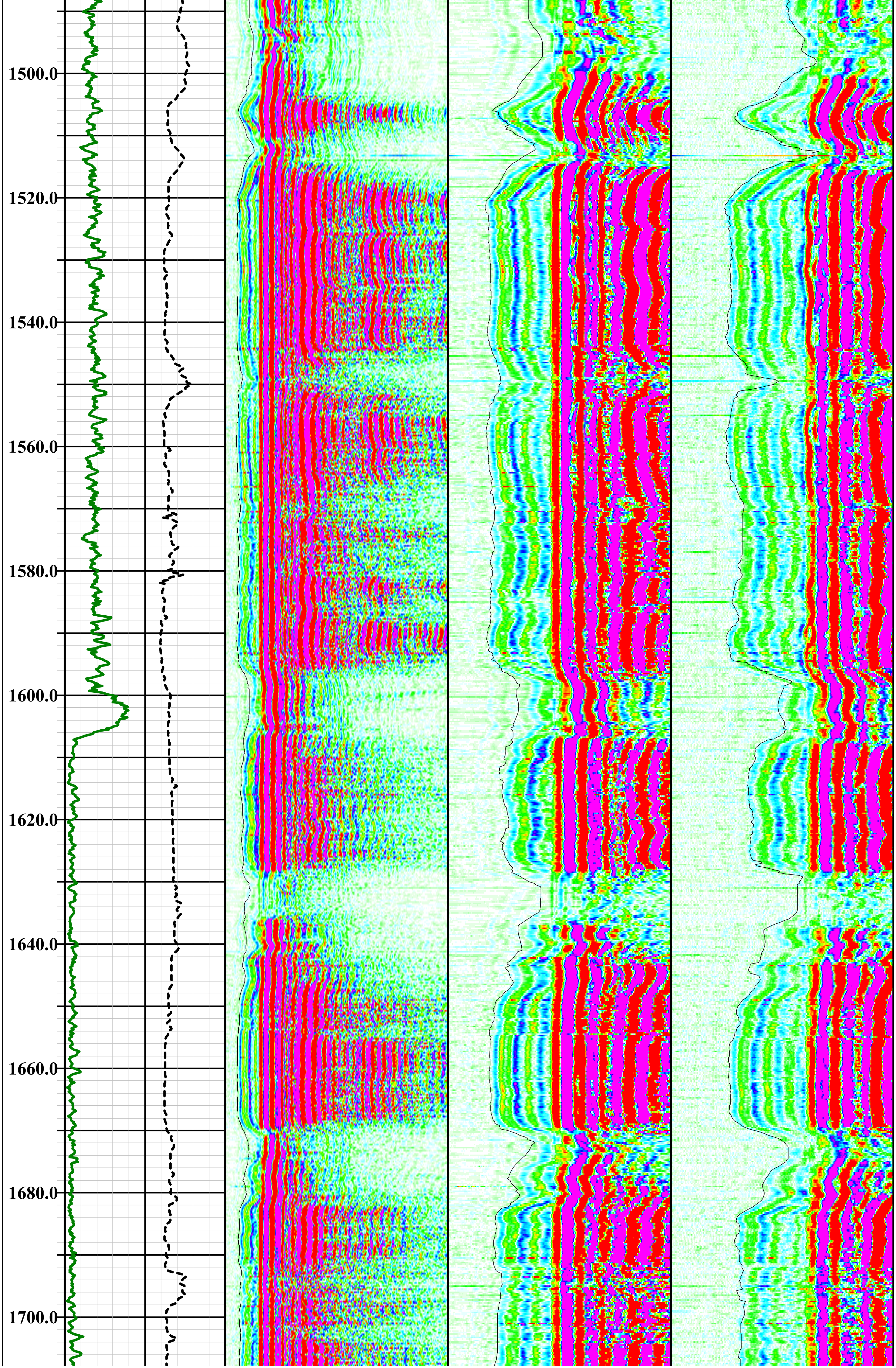
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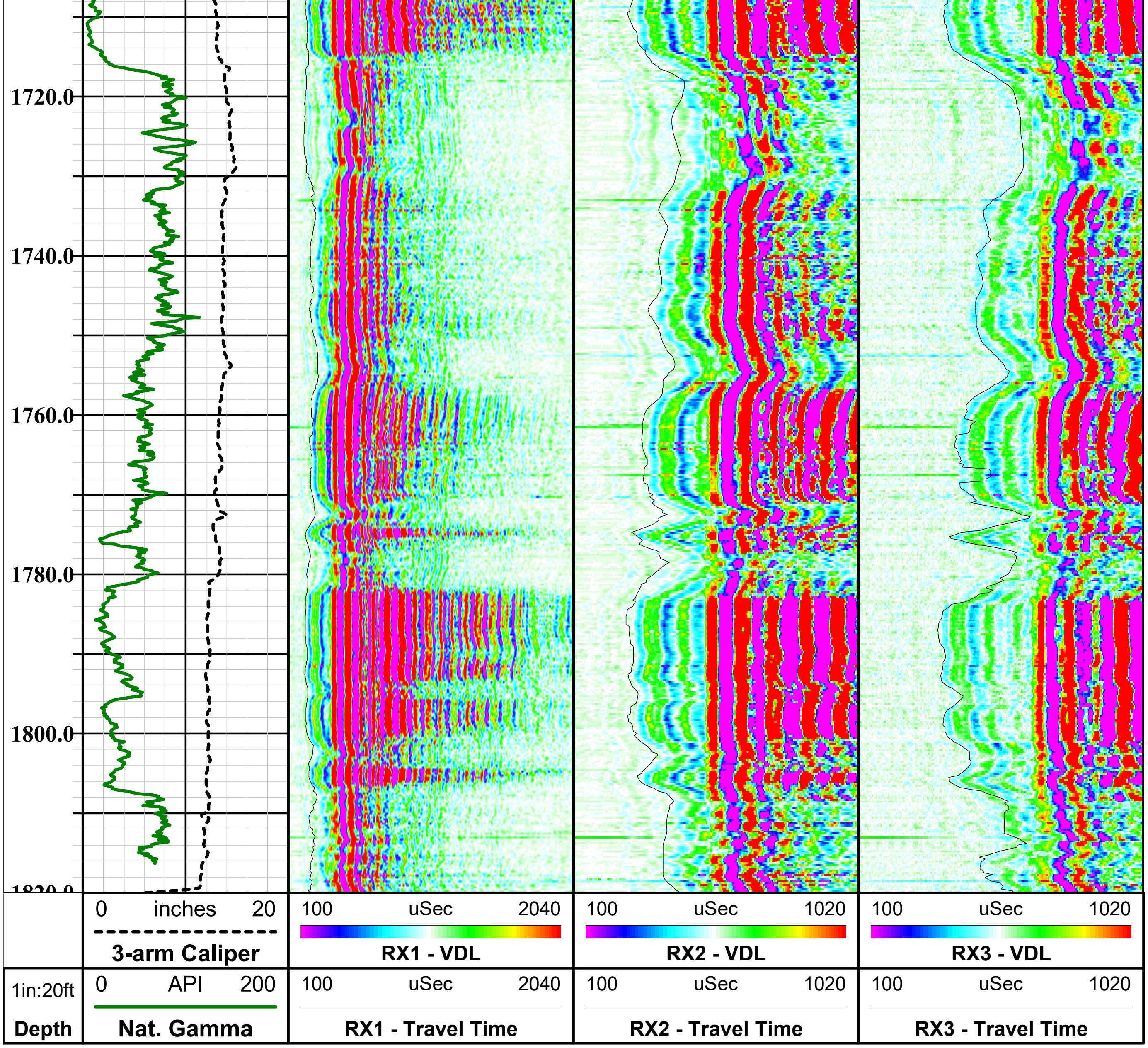


FWS50-3Rx Full Waveform Sonic Tool SN 3564

Probe Top = Depth Ref.

Single Conductor MSI Probe Top

Probe Length = 2.88 m or 9.46 ft
Probe Weight = ~18.0 kg or 39.6 lbs

Sensors: Ceramic Piezoelectric in Polyurethane potting

Transmitter Frequency: ~20 kHz resonant frequency

Rx - Rx Spacing: 0.2 m (7.9 in)

Typically ran centralized with external bow spring centralizers.

Can only be collected in fluid.

Temperature Rating: 70 Deg C (158 Deg F)

Presure Rating: 200 bar (2900 psi)

Rx-3 Tx - Rx3 Spacing = 1.0 m (39.4 in)

Rx-2 Tx - Rx2 Spacing = 0.8 m (31.5 in)

Rx-1 Tx - Rx1 Spacing = 0.6 m (23.6 in)

Acoustic Isolater

Tx = Acoustic Transmitter

0.235 m or 9.25 in. - End of tool to center of Tx

1.97" or 50 mm Diameter

MSI Gamma-Caliper-Temperature-Fluid Resistivity

Probe Top = Depth Ref.

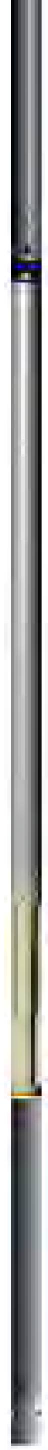
Single Conductor MSI Probe Top

Probe Length = 2.59 m or 8.5 ft
Probe Weight = 6.80 kg or 15.0 lbs

Natural Gamma and Caliper can only be collected logging up hole.

Fluid Temperature/Resistivity can only be collected logging down hole.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)



Natural Gamma Ray = 0.76 m (29.75 in)

NOTE: Lengths on a particular tool may vary from those listed on this document due to probe sizes and styles utilizedl

3-Arm Caliper = 1.44 m (56.75 in)

Distance from tool top: 2.20 m (86.5 in)

Available Arm Sizes: 3", 9", and 15"

TFR (Temperature/Fluid Resistivity) = 0.39 m (15.5 in)

1.375" or 34.9 mm Diameter

Southwest Exploration Services, LLC

borehole geophysics & video services

Company	RESOLUTION COPPER MINING
Well	DHRES-16
Field	SUPERIOR
County	PINAL
State	ARIZONA

Preliminary SONIC SUMMARY

Southwest Exploration Services, LLC
borehole geophysics & video services

COMPANY	RESOLUTION COPPER		
WELL ID	DHRES-16 (55-917232)		
FIELD	RESOLUTION		
COUNTY	PINAL	STATE	ARIZONA

TYPE OF LOGS: ABI TELEVIEWER
MORE: 3-ARM CALIPER

LOCATION
SE 1/4 OF SW 1/4 OF NE 1/4
944004 E, 830713 N

OTHER SERVICES
E-LOG
SONIC
COMBO

SEC 04 TWP 02 S RGE 12 E

PERMANENT DATUM	AZ SPC. FEET	ELEVATION	2634 FT	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND LEVEL			G.L.

DATE	09-03-14	TYPE FLUID IN HOLE	FORMATION WATER
RUN No	1/4	MUD WEIGHT	N/A
TYPE LOG	ABI-CAL	VISCOSITY	N/A
DEPTH-DRILLER	1820 FT	LEVEL	FULL
DEPTH-LOGGER	1820 FT	MAX. REC. TEMP.	40.74 DEG C
BTM LOGGED INTERVAL	1820 FT	IMAGE ORIENTED TO:	MAG NORTH
TOP LOGGED INTERVAL	1200 FT	SAMPLE INTERVAL	0.0096 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	E. TURNER	TOOL STRING/SN	ALT ABI43 S/N 91601
WITNESSED BY	MATT - M&A	LOG TIME:ON SITE/OFF SITE	11:40 AM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	56 FT	14"		SURFACE	56 FT
2	12.25"	56 FT	TOTAL DEPTH				
3							

COMMENTS:

.

Tool Summary:

Date	09-03-14	**Date**	09-03-14	**Date**	09-03-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	MSI COMBO	**Tool Model**	GEOVISTA ELOG	**Tool Model**	ALT FWS50
Tool SN	5446	**Tool SN**	4035	**Tool SN**	3564
From	SURFACE	**From**	SURFACE	**From**	SURFACE
To	1820 FT	**To**	1820 FT	**To**	1820 FT
Recorded By	E. TURNER	**Recorded By**	E. TURNER	**Recorded By**	E. TURNER
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	8-28-14	**Operation Check**	8-28-14	**Operation Check**	8-28-14
Calibration Check	8-28-14	**Calibration Check**	8-28-14	**Calibration Check**	N/A
Time Logged	12:15 PM	**Time Logged**	1:45 PM	**Time Logged**	2:45 PM

Date	09-03-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	ALT ABI43	**Tool Model**		**Tool Model**	
Tool SN	91601	**Tool SN**		**Tool SN**	
From	1200 FT	**From**		**From**	
To	1820 FT	**To**		**To**	
Recorded By	E. TURNER	**Recorded By**		**Recorded By**	
Truck No	500	**Truck No**		**Truck No**	
Operation Check	8-28-14	**Operation Check**		**Operation Check**	
Calibration Check	N/A	**Calibration Check**		**Calibration Check**	
Time Logged	4:25 PM	**Time Logged**		**Time Logged**	

Additional Comments:

Caliper Arms Used: 15" **Calibration Points:** 10.2" - 24"

Disclaimer:

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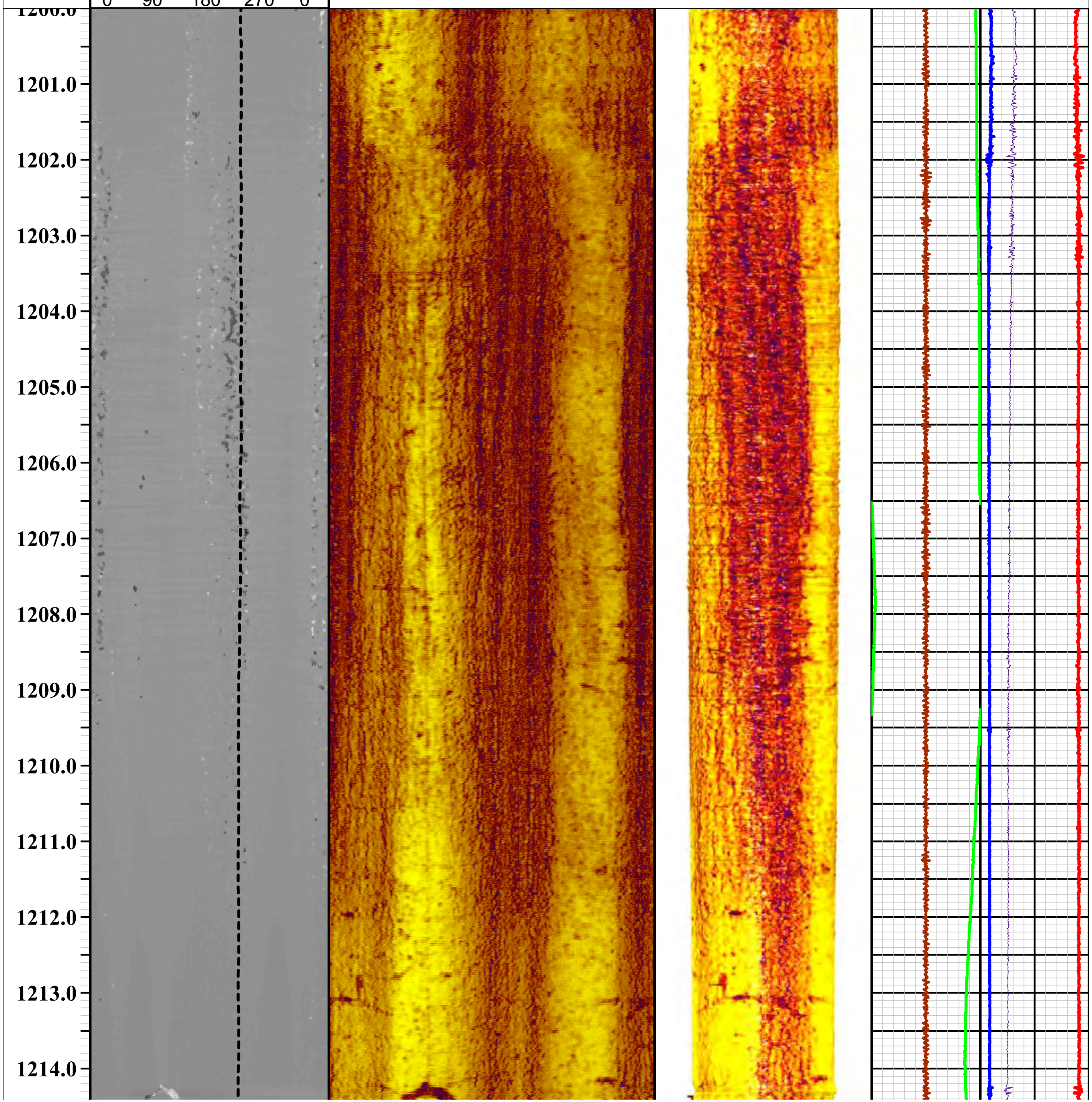
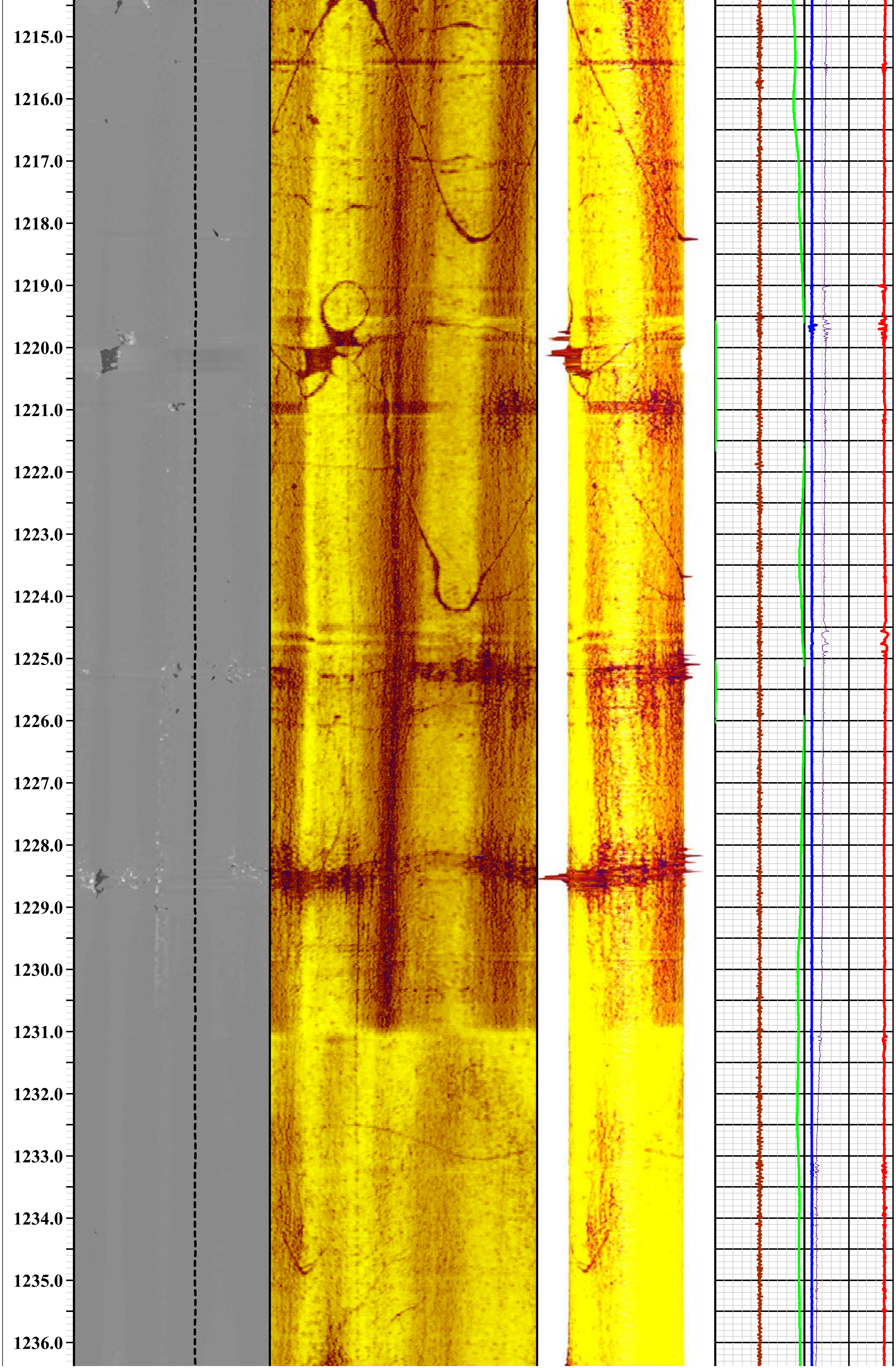
Depth	TravelTime-NM	Amplitude-NM	3-D View	Mag Field	Tilt
1in:2ft	Oriented High Side 0° 90° 180° 270° 0°	Oriented High Side 0° 90° 180° 270° 0°	-0°	40 uT 60	0 Deg 16
	3-arm Caliper 0 inches 20	Amplitude-STATIC Oriented High Side 0° 90° 180° 270° 0°		Gravity 0.8 G 1.2	Azimuth 0 360
	avelTime-NM - Median Filt Oriented High Side 0° 90° 180° 270° 0°				RBR -90 270
	Centralized TT Oriented High Side 0° 90° 180° 270° 0°				





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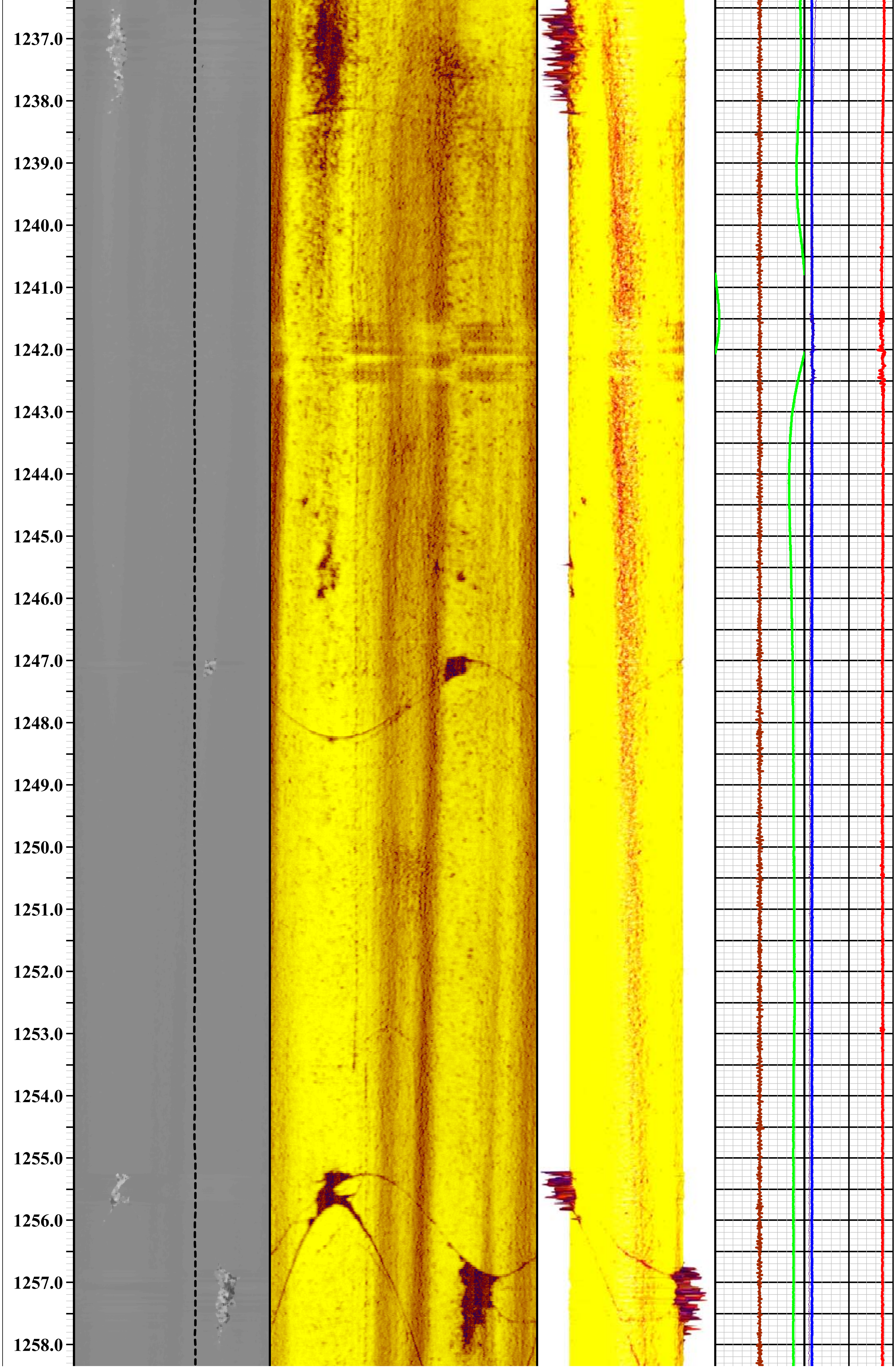
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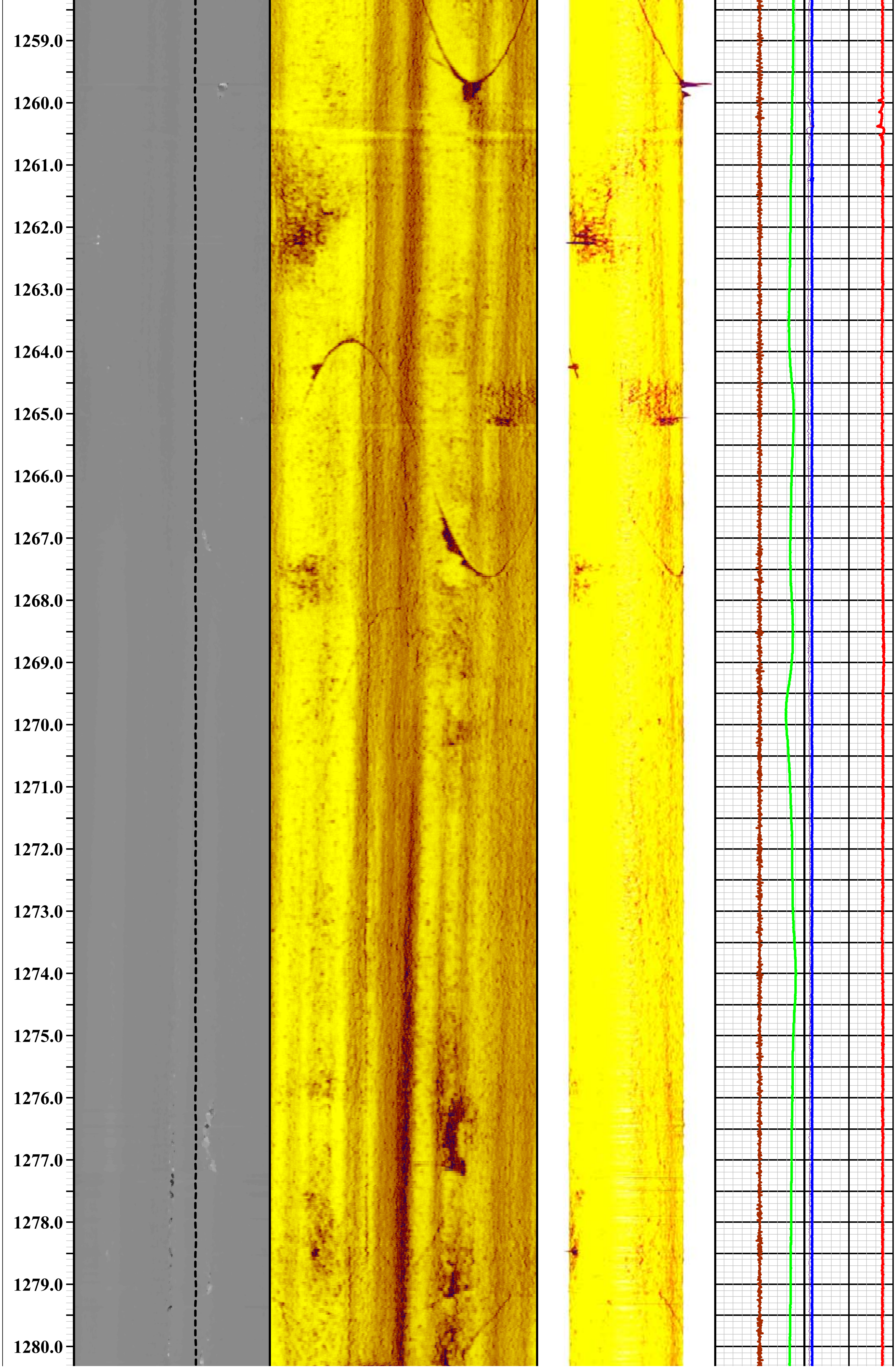
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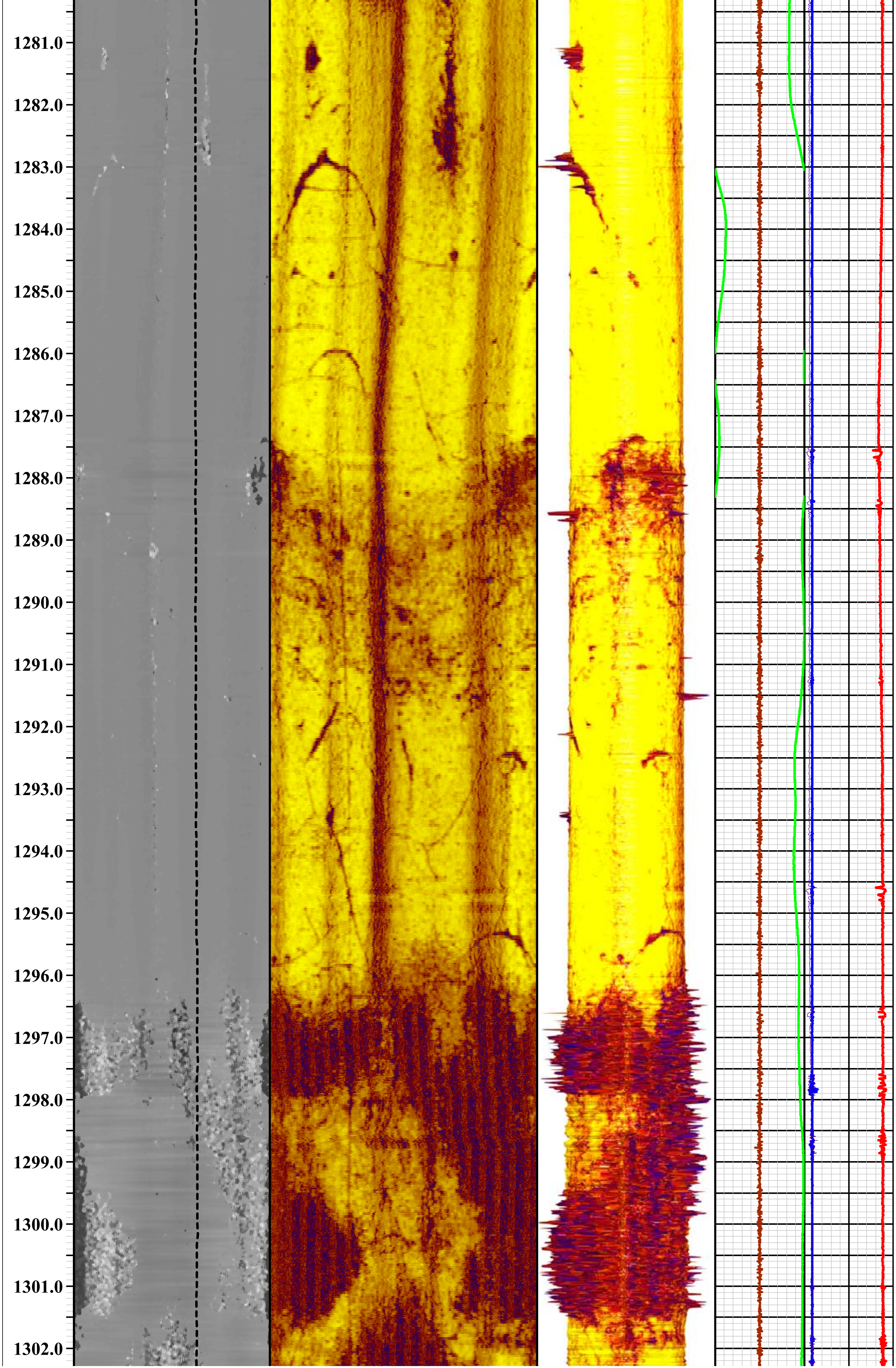
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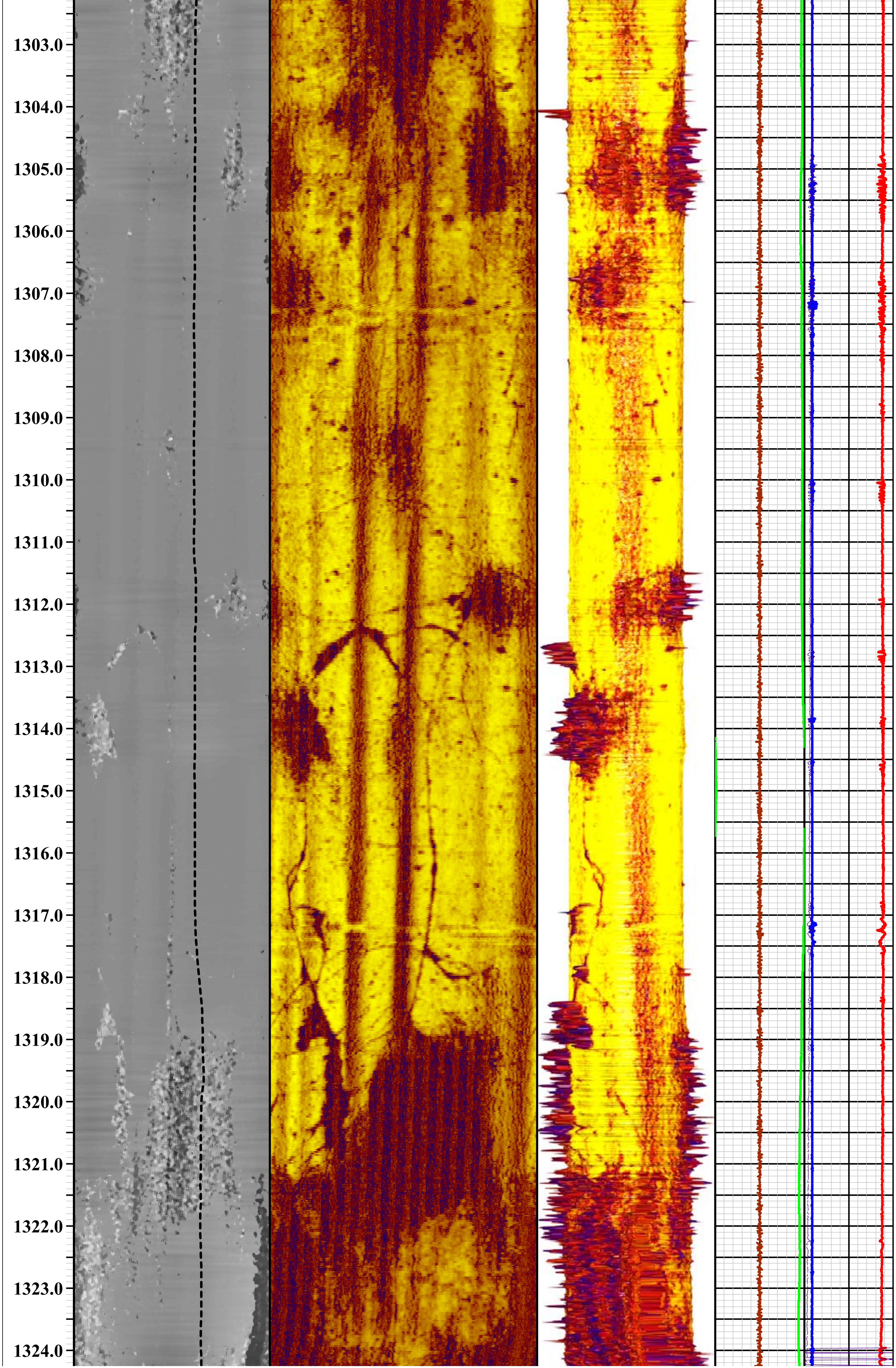
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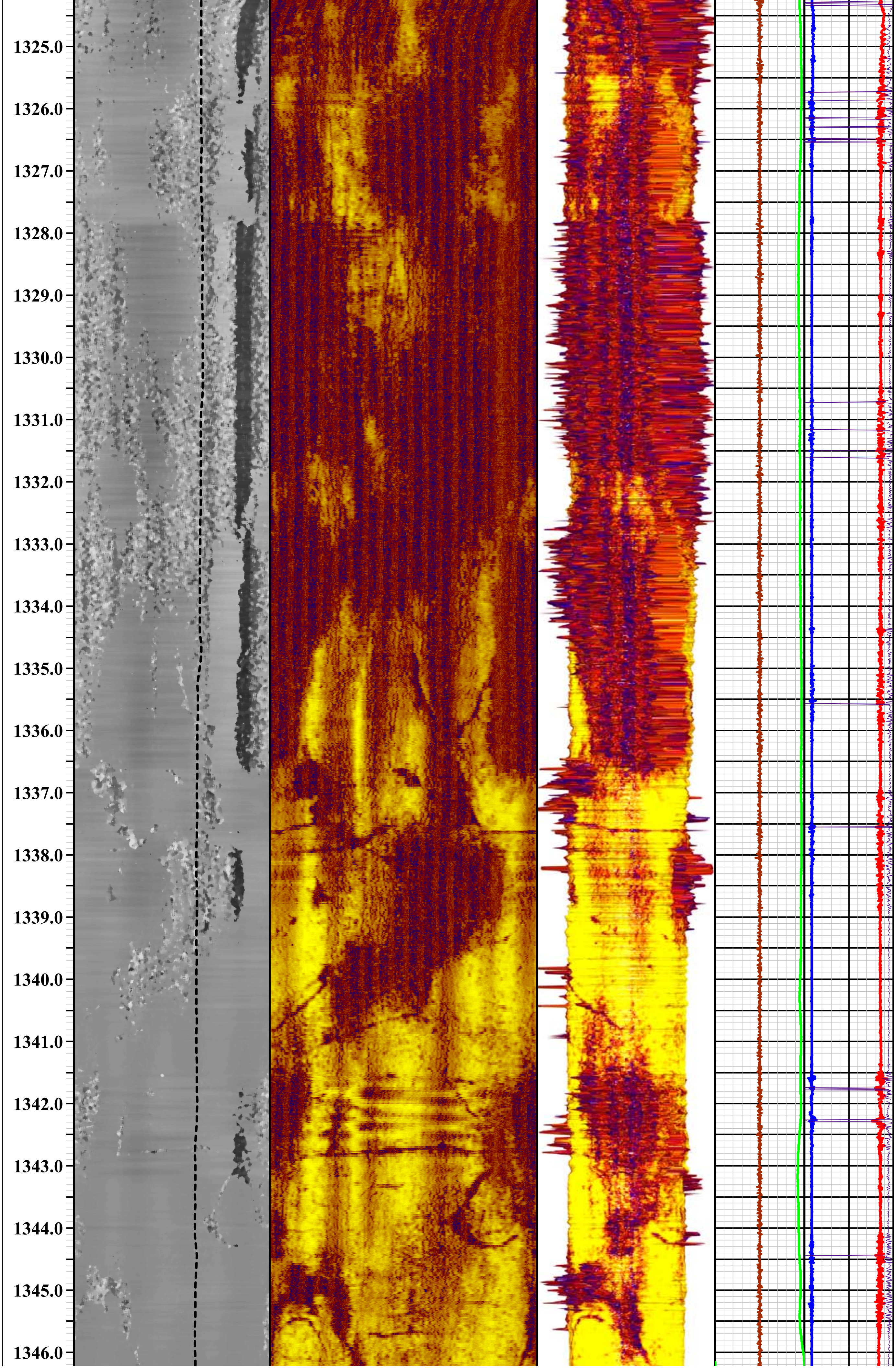
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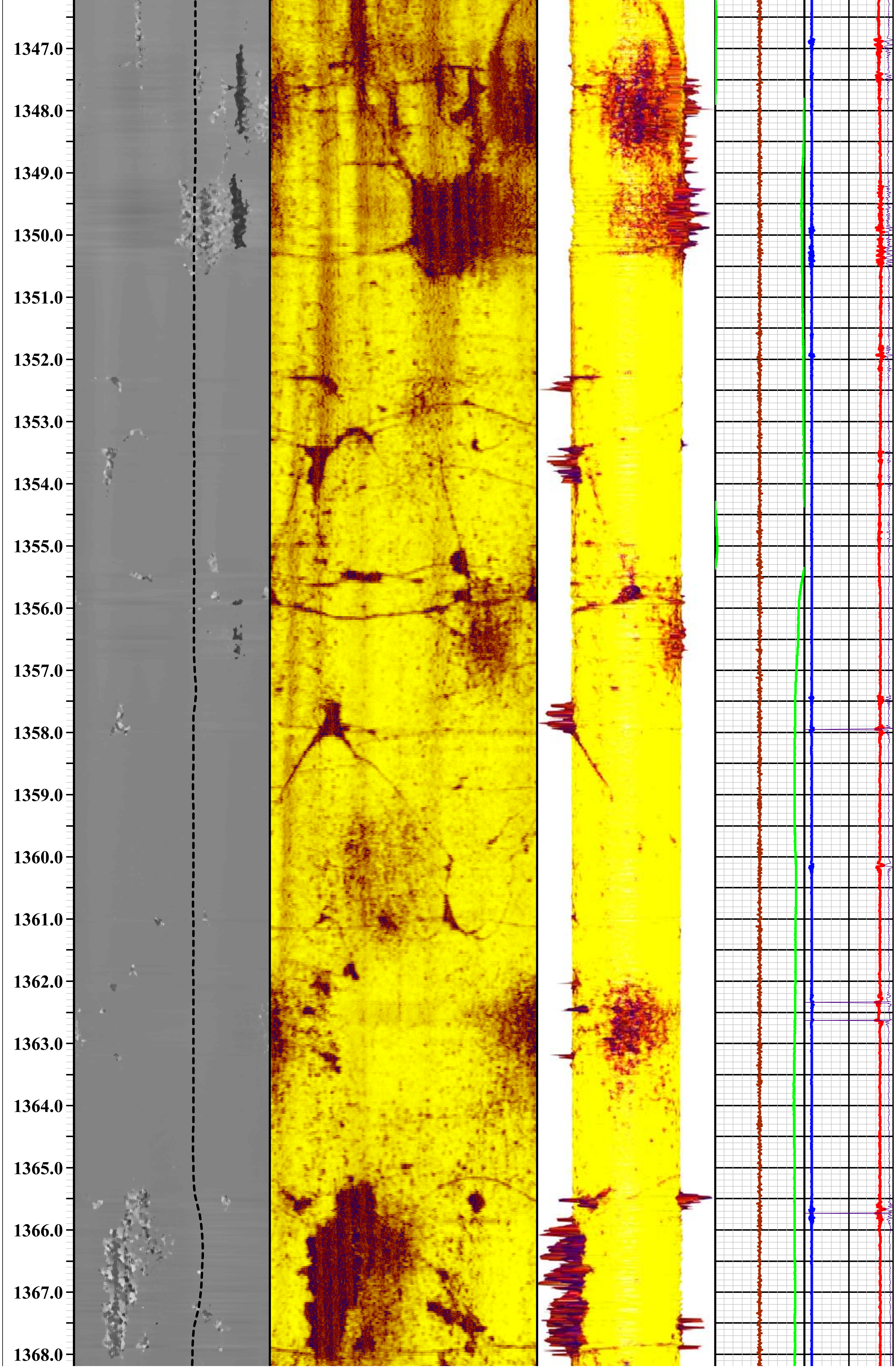
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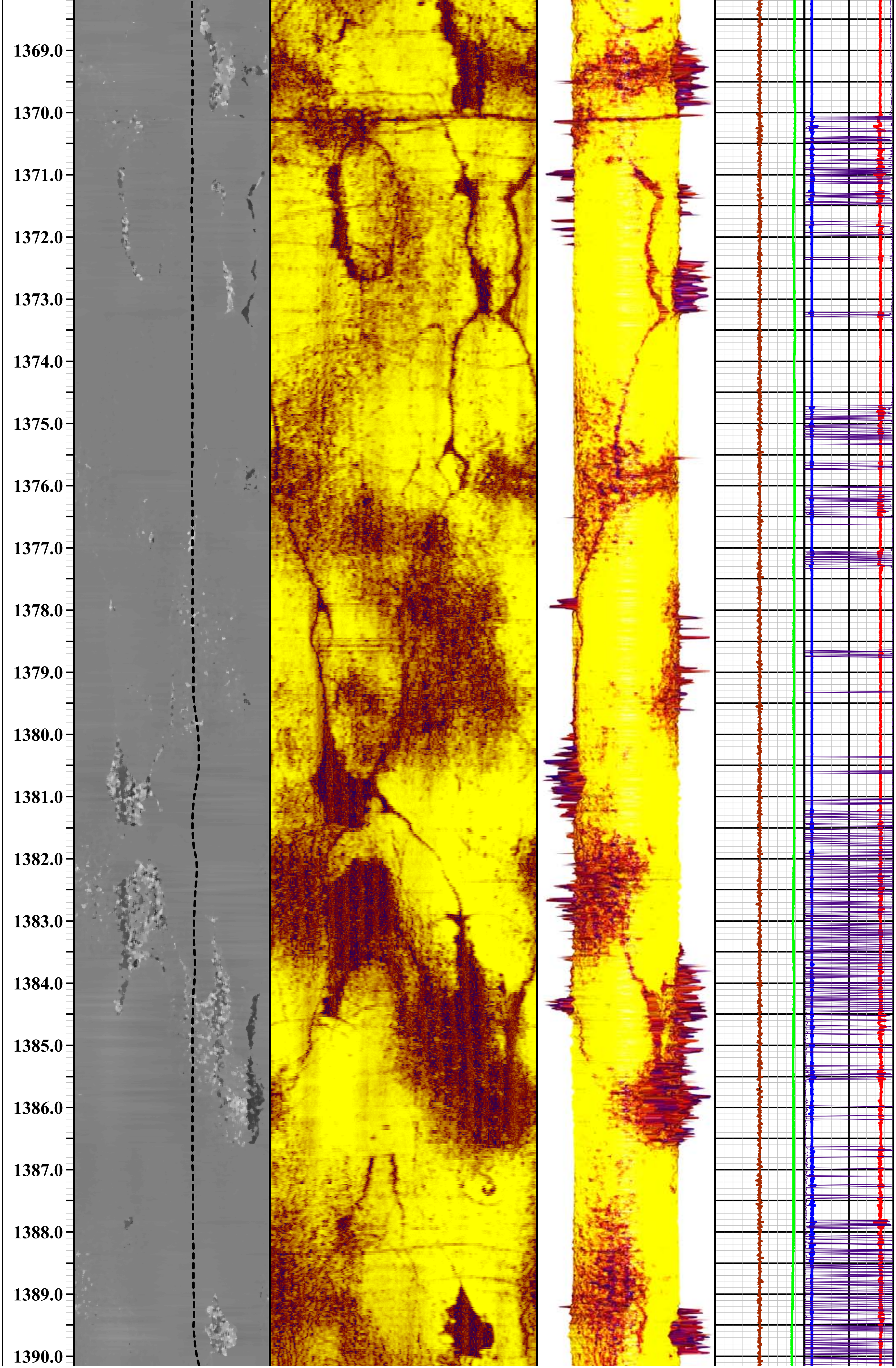
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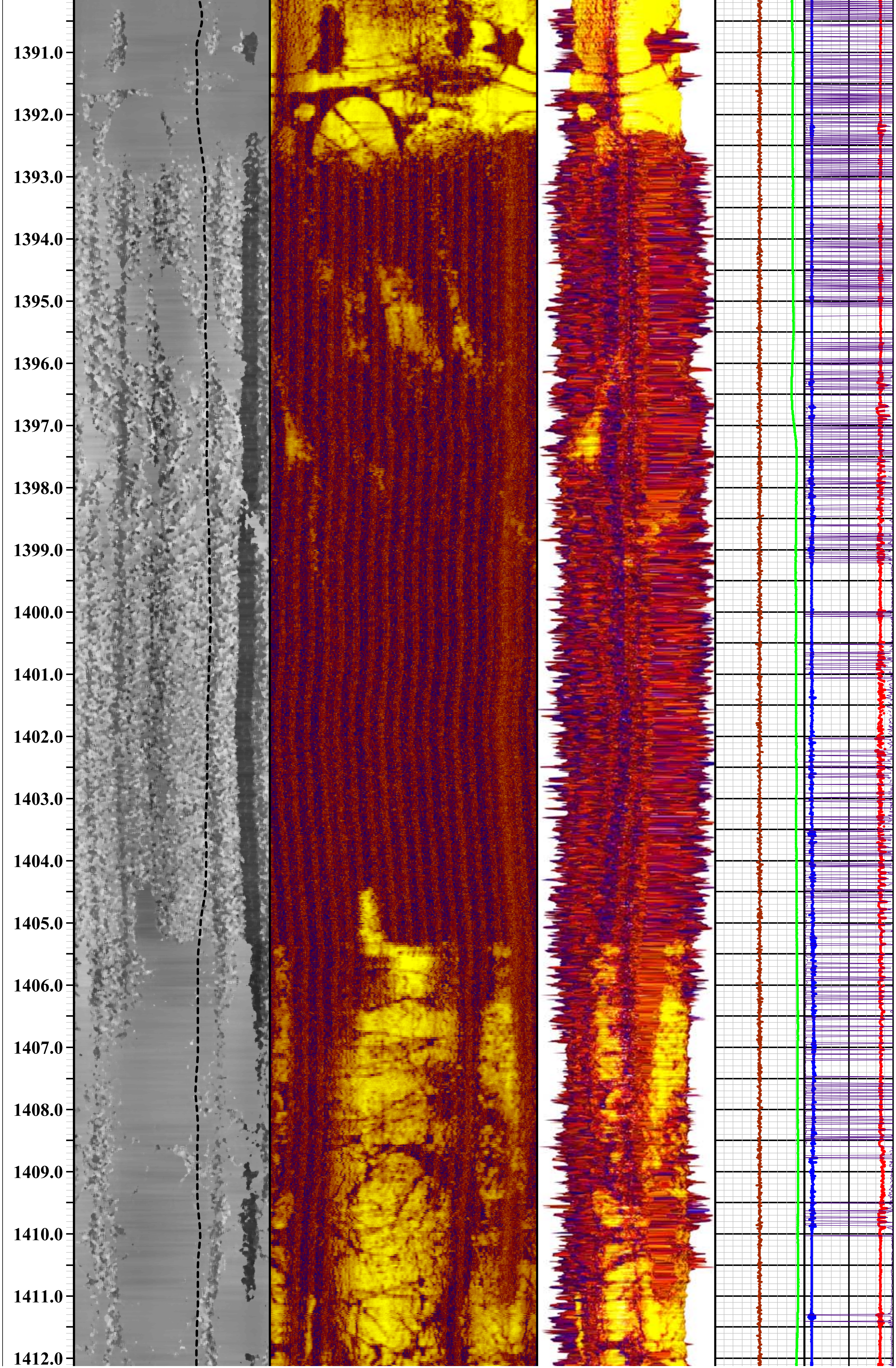
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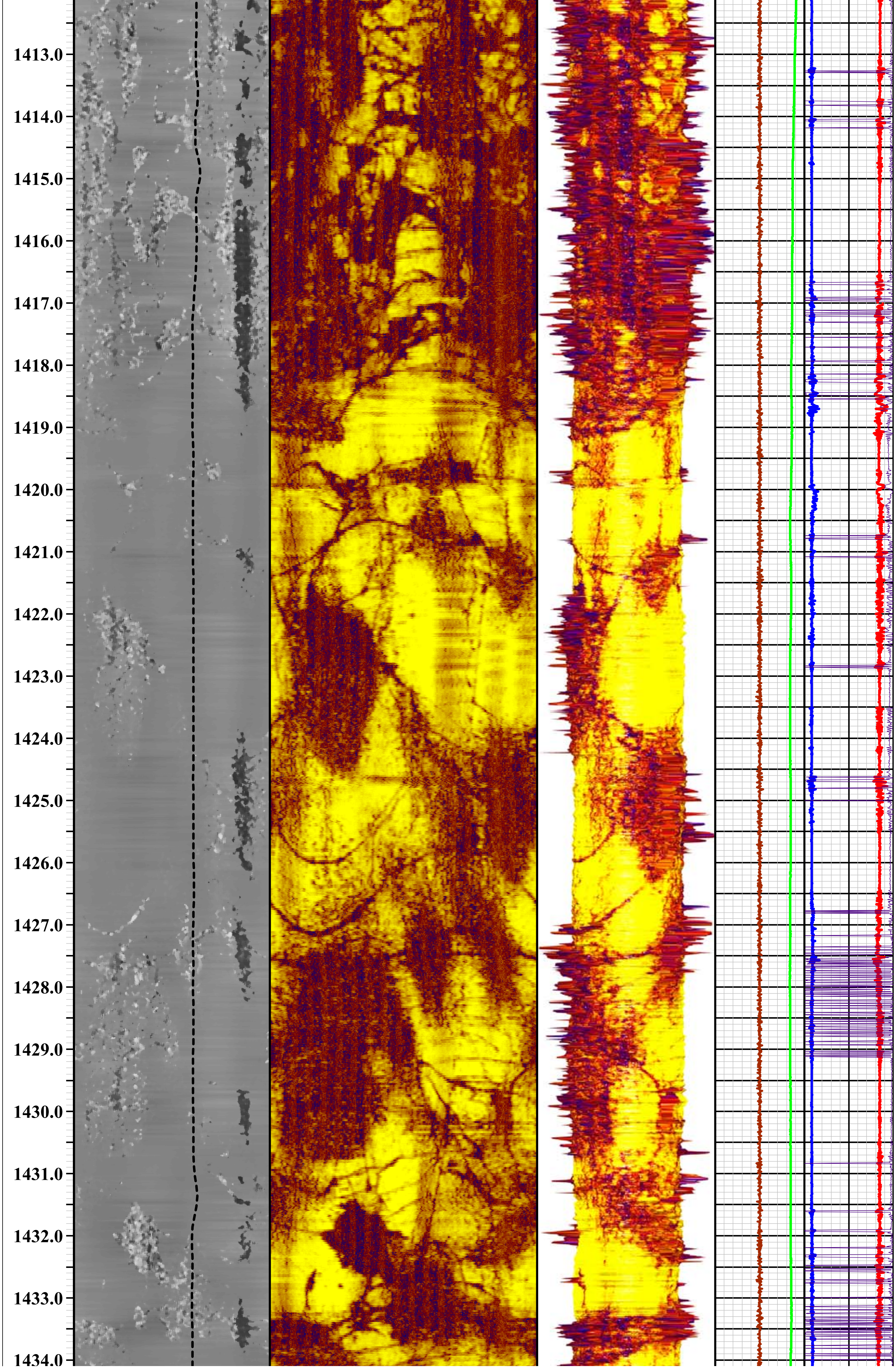
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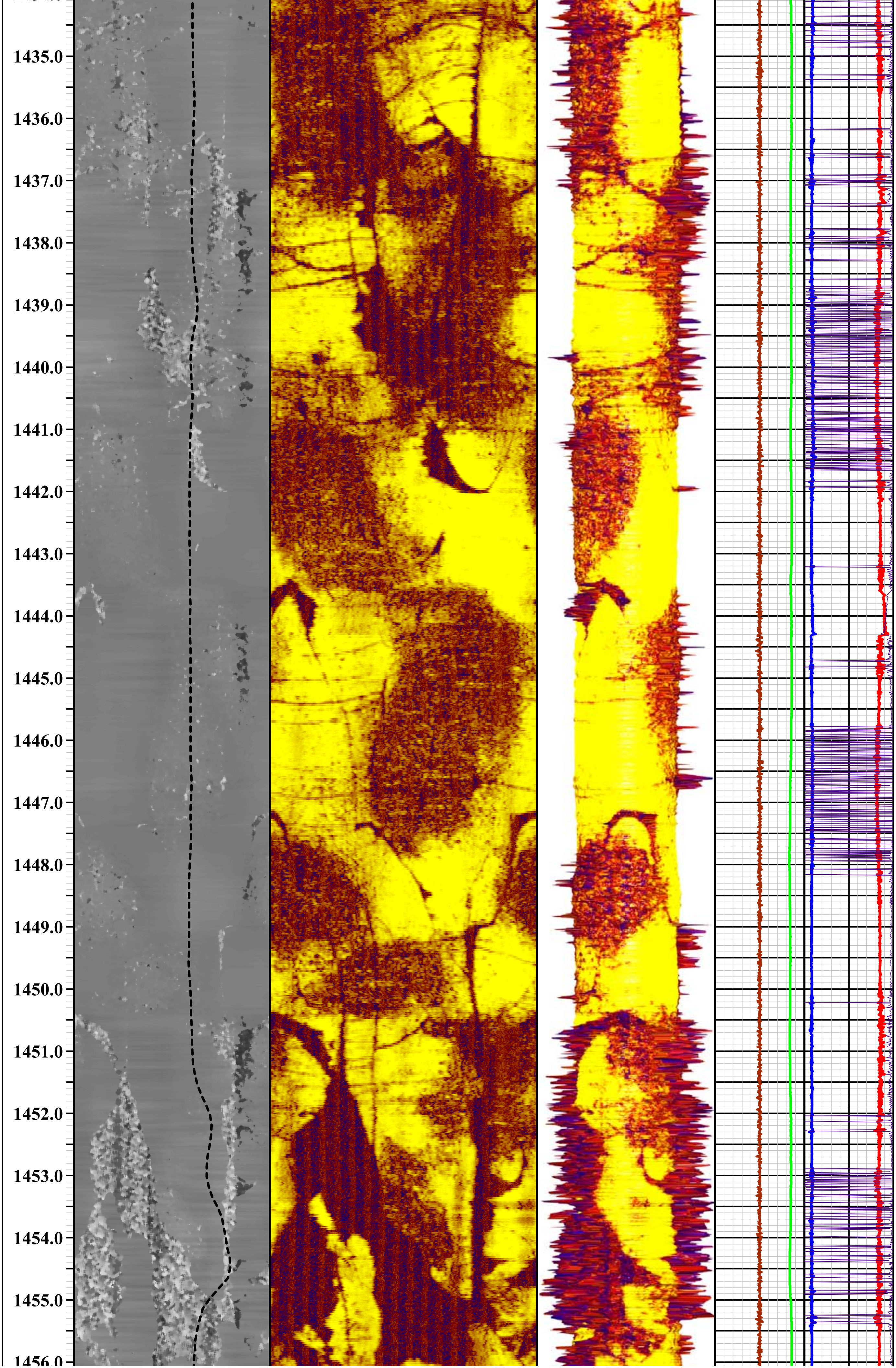
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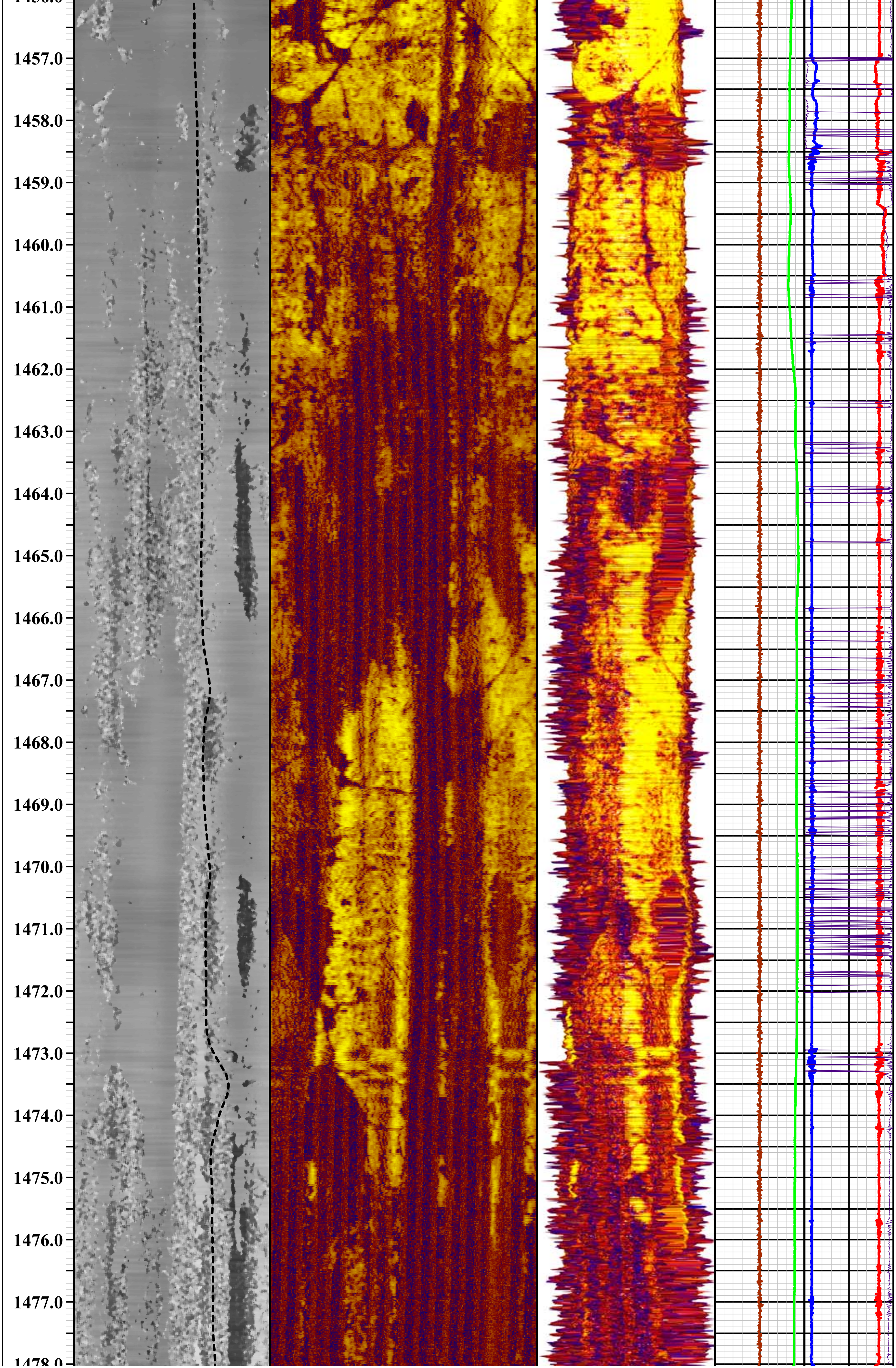
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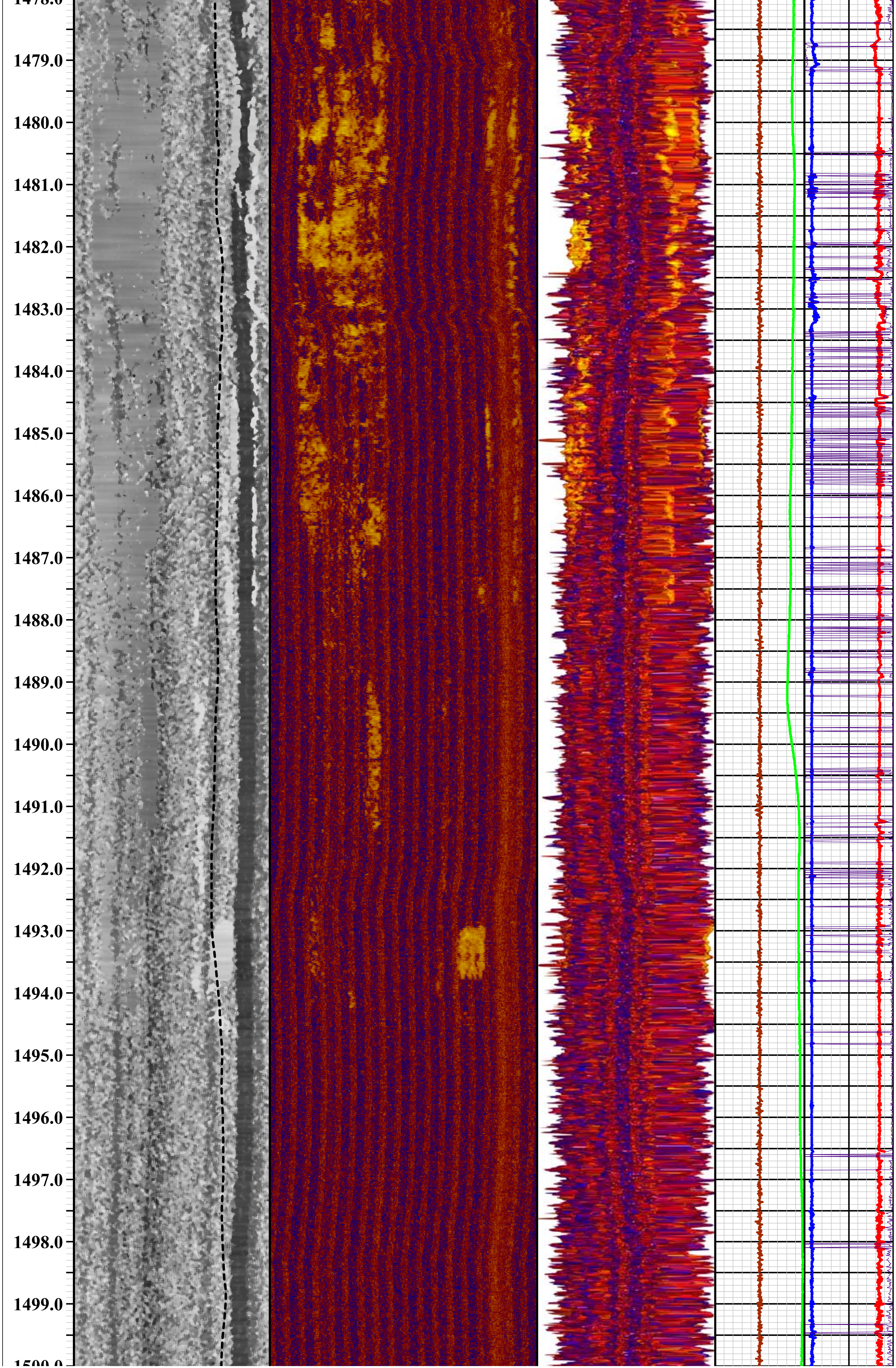
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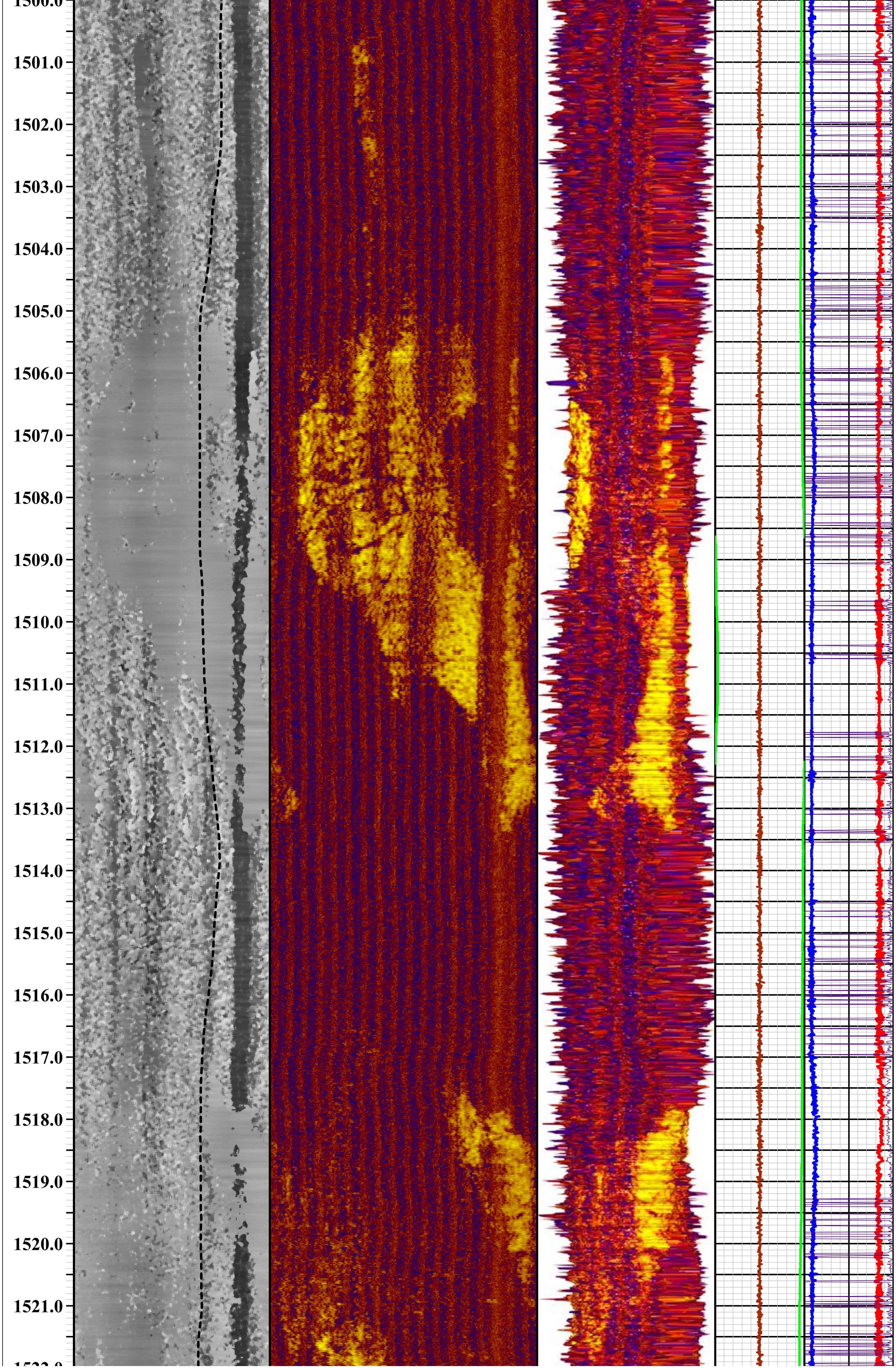
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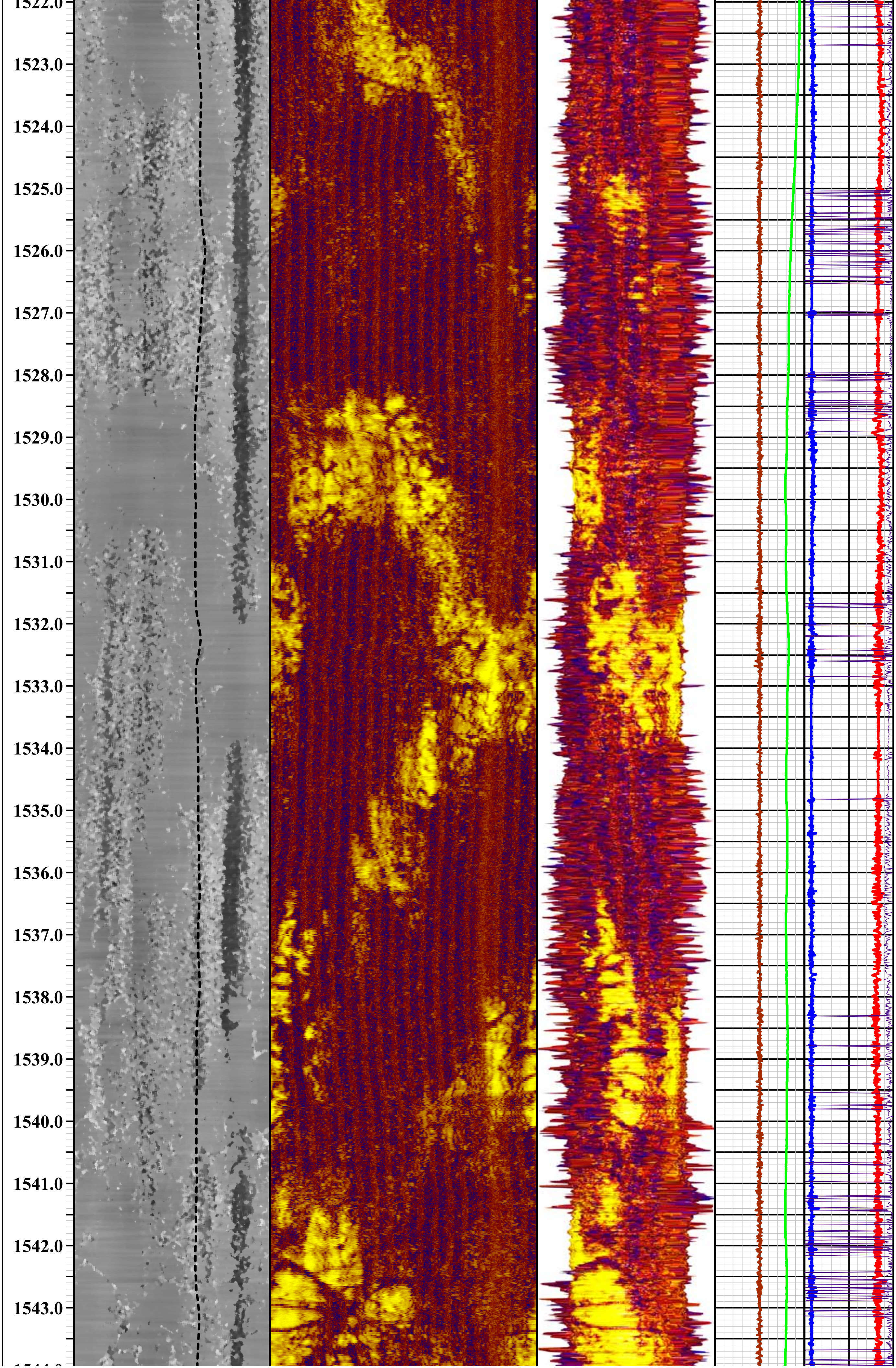
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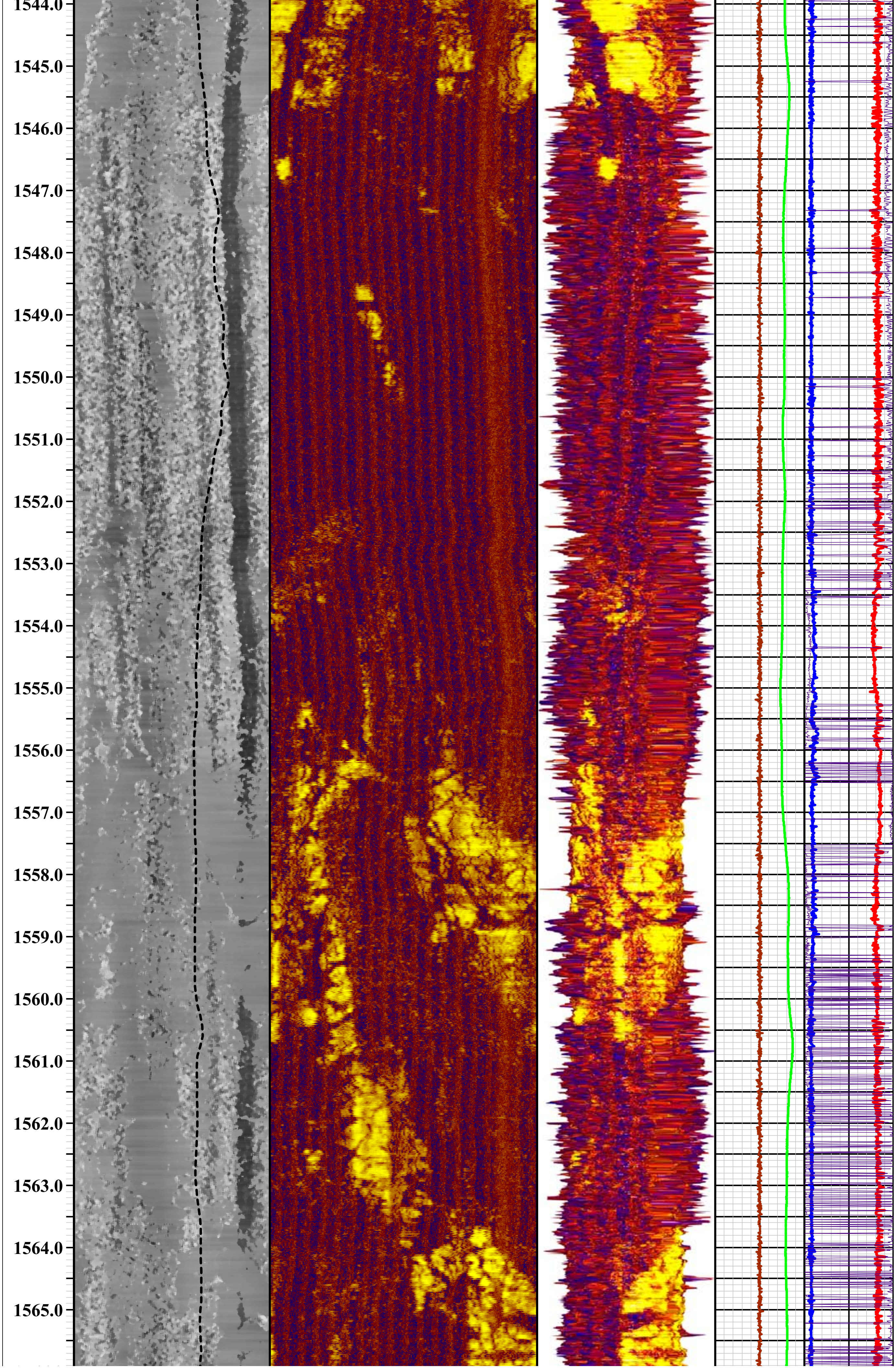
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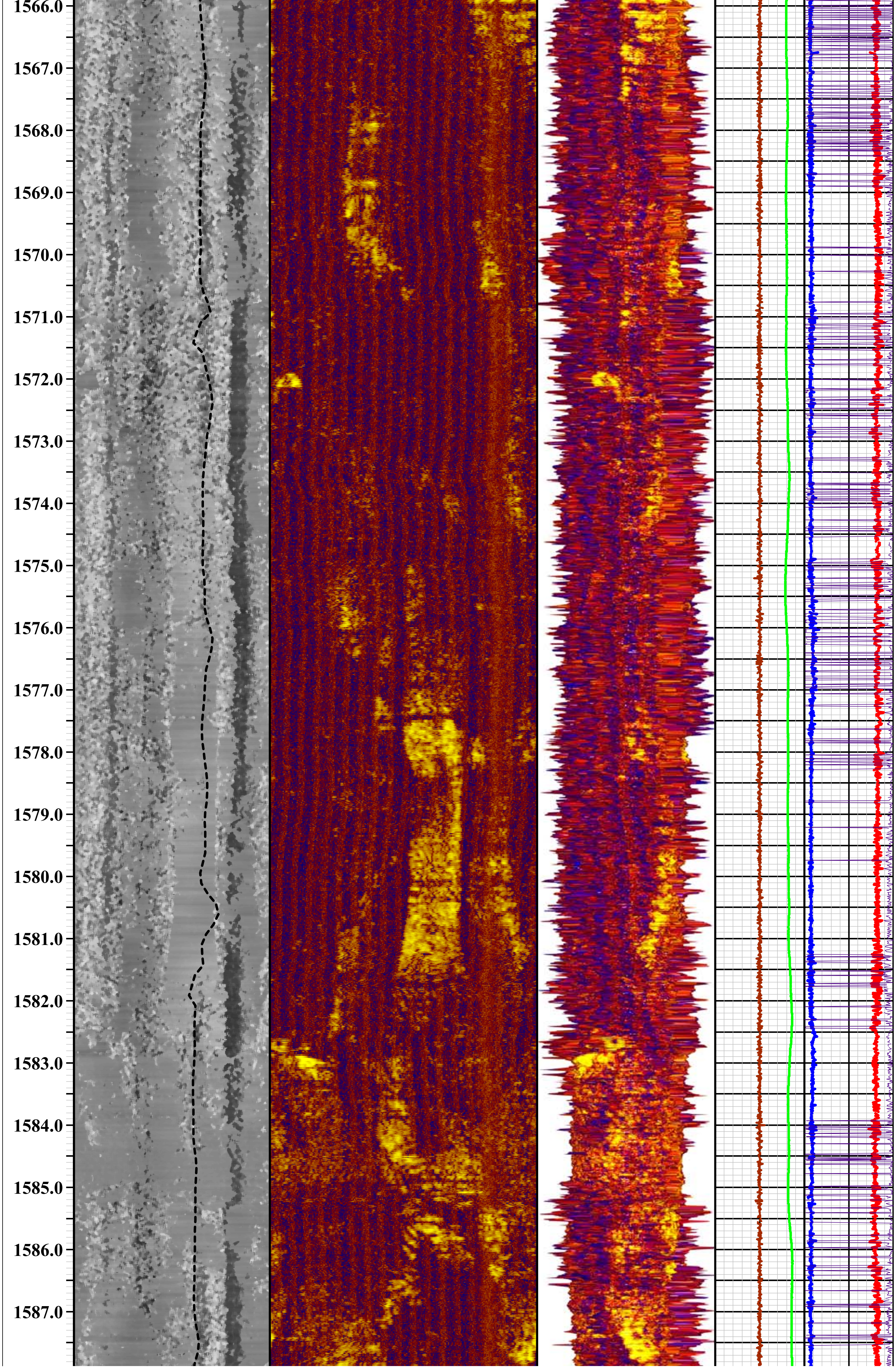
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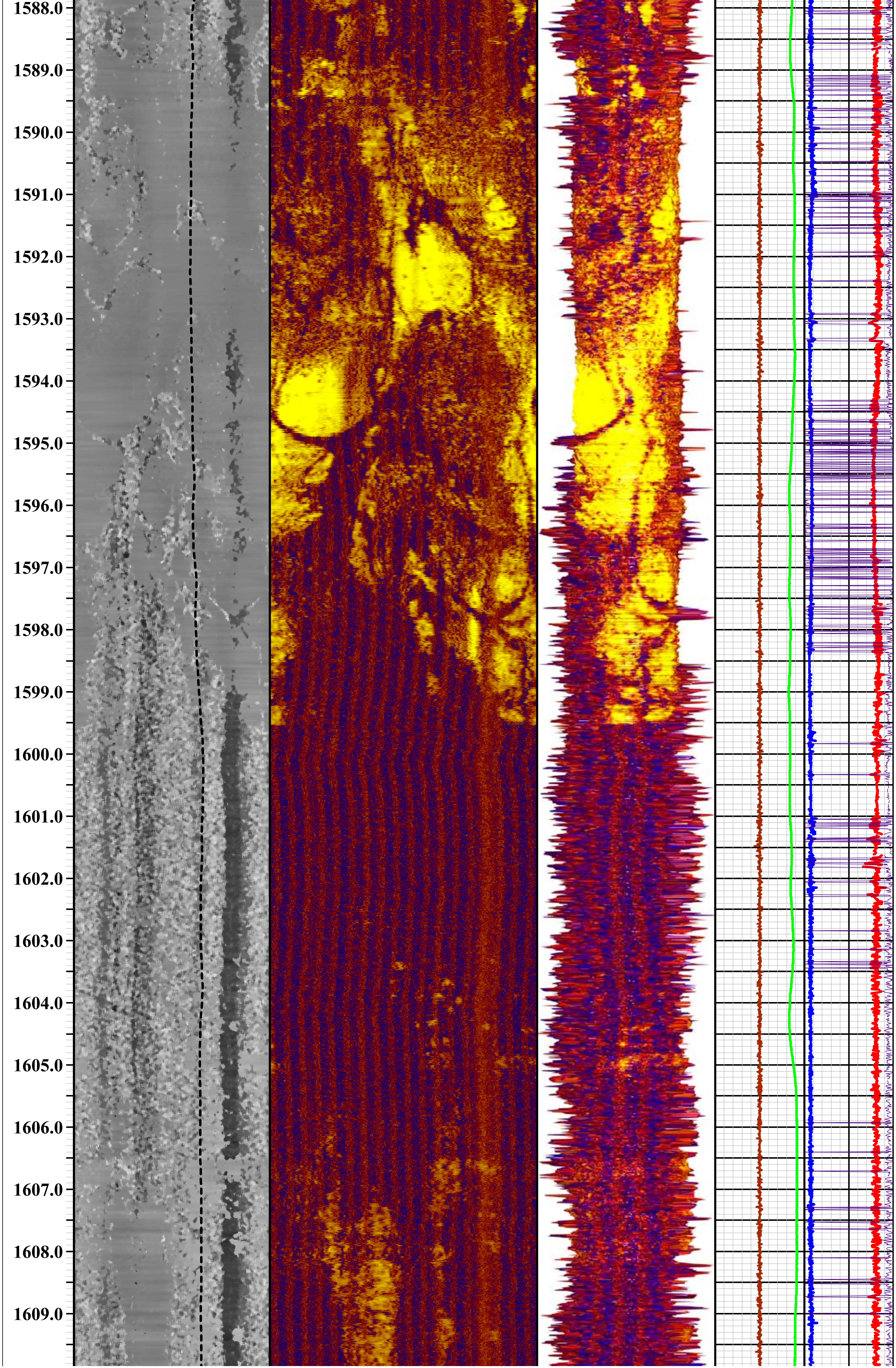

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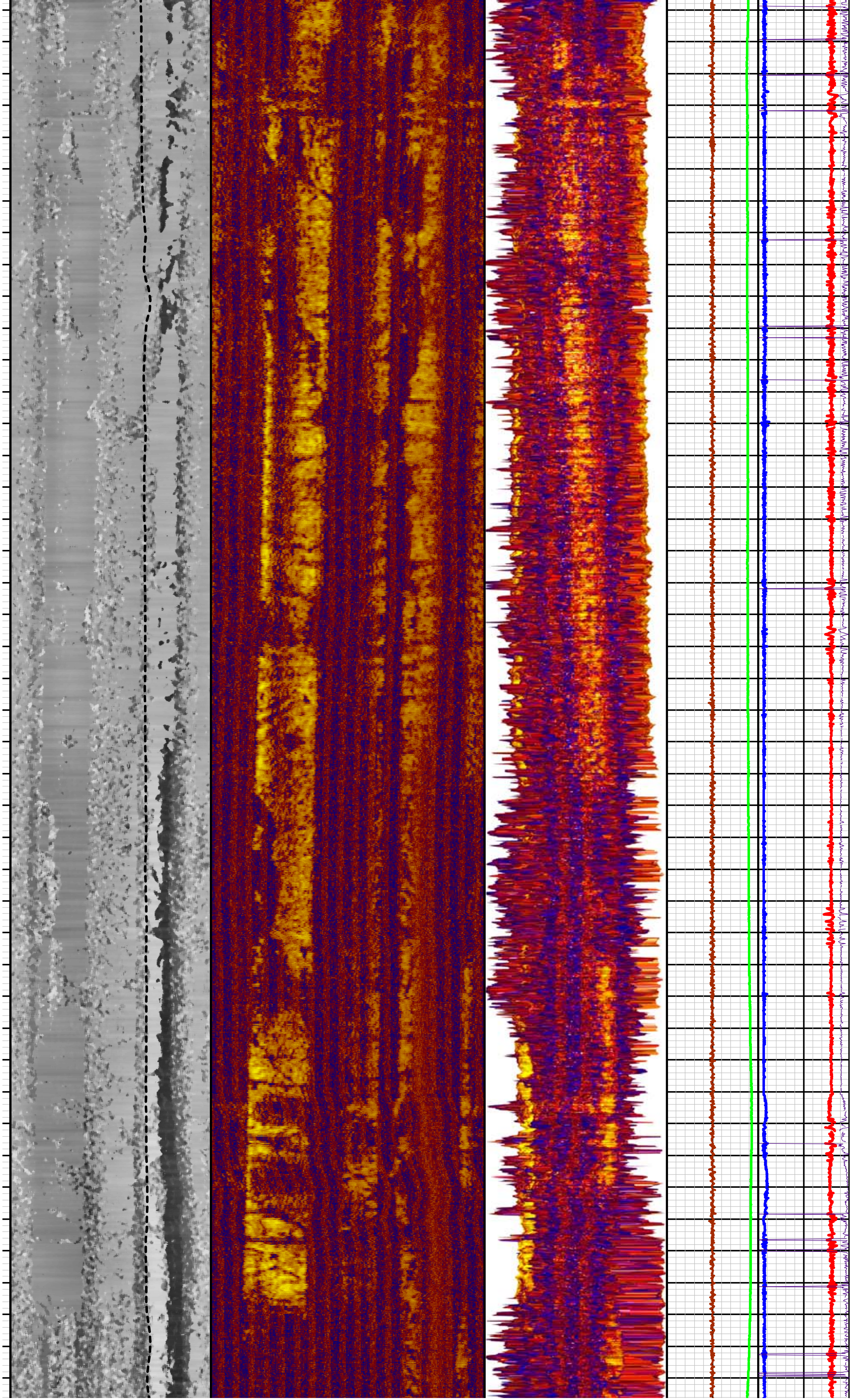

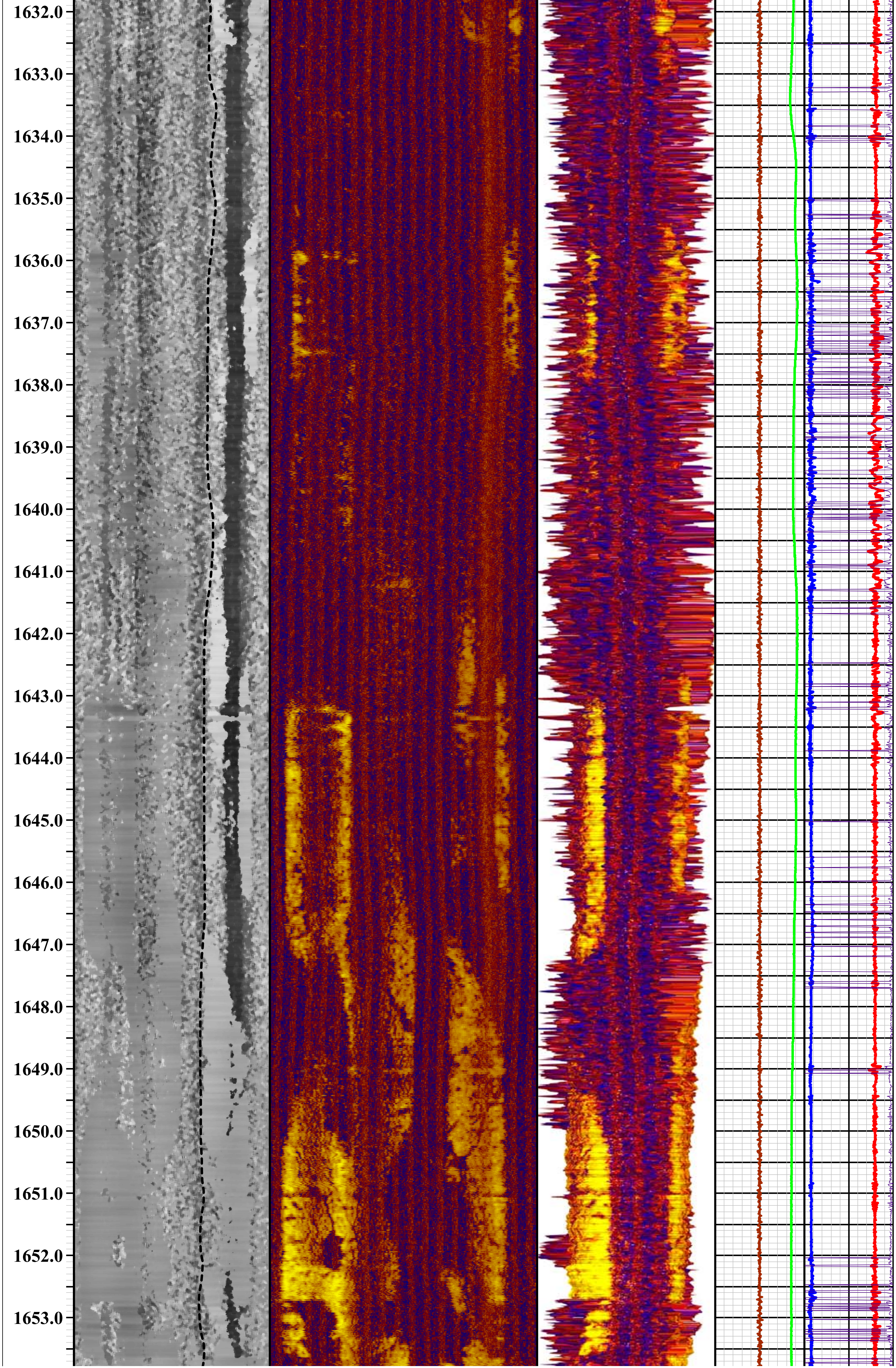
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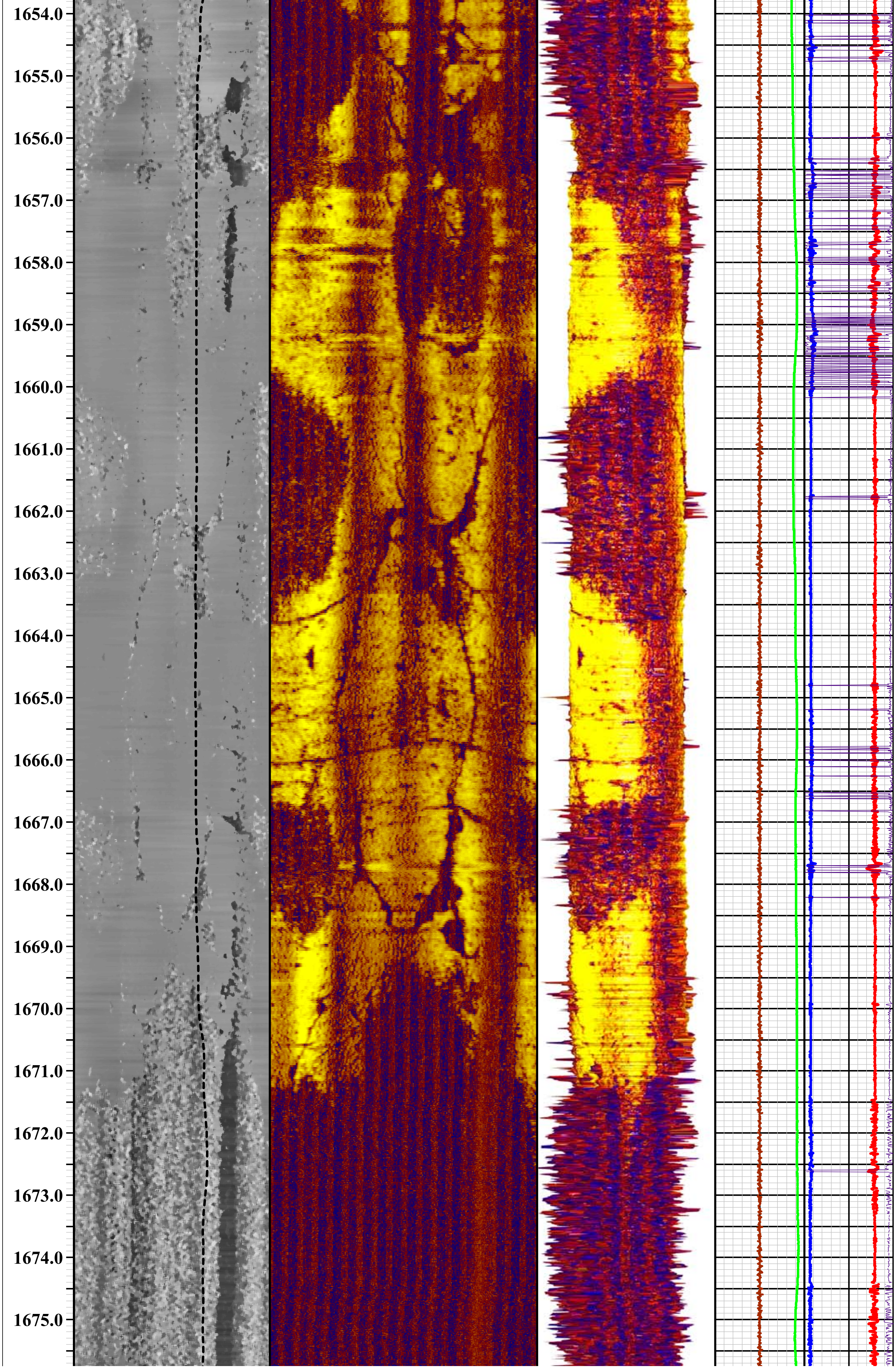
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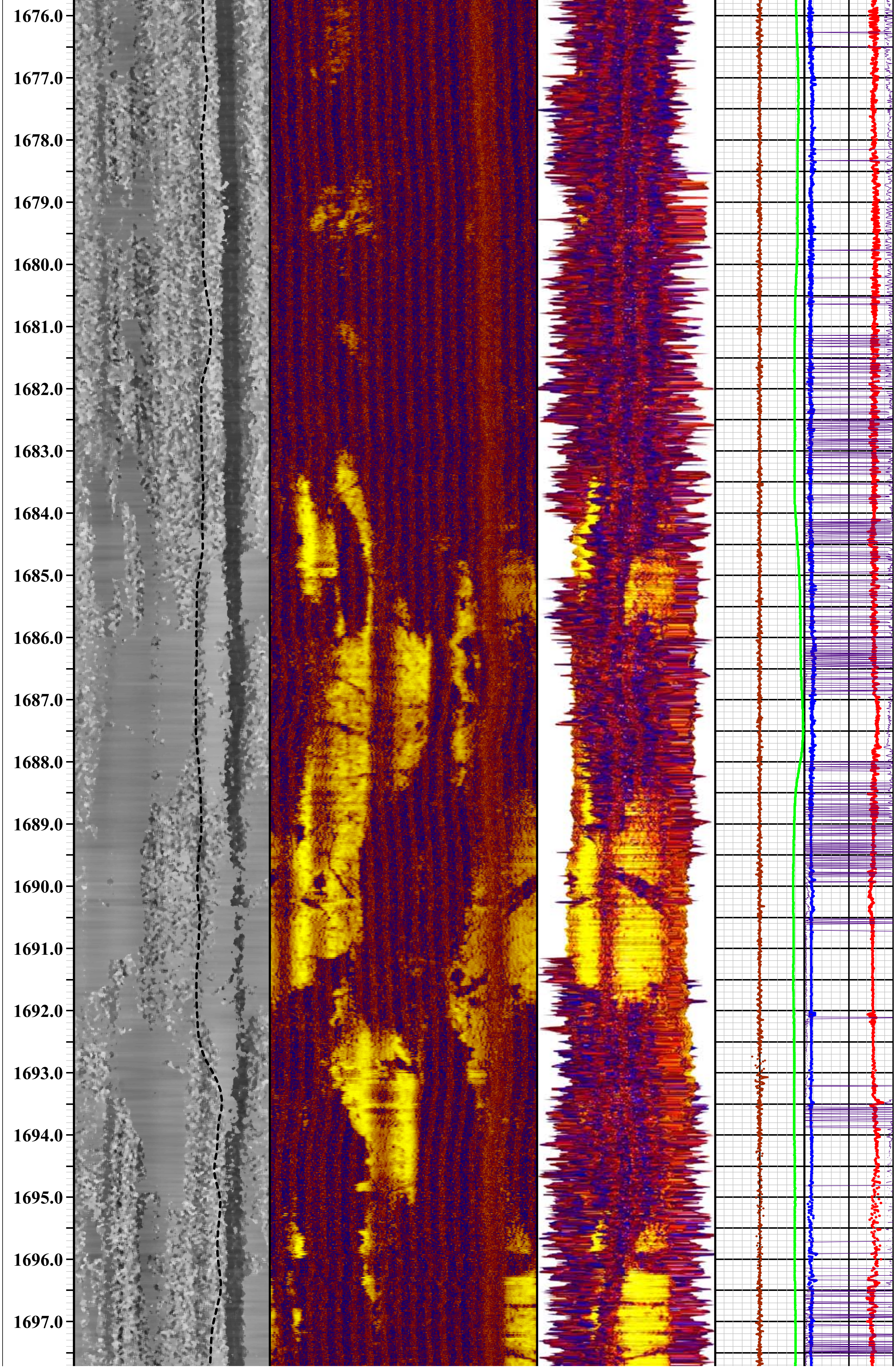
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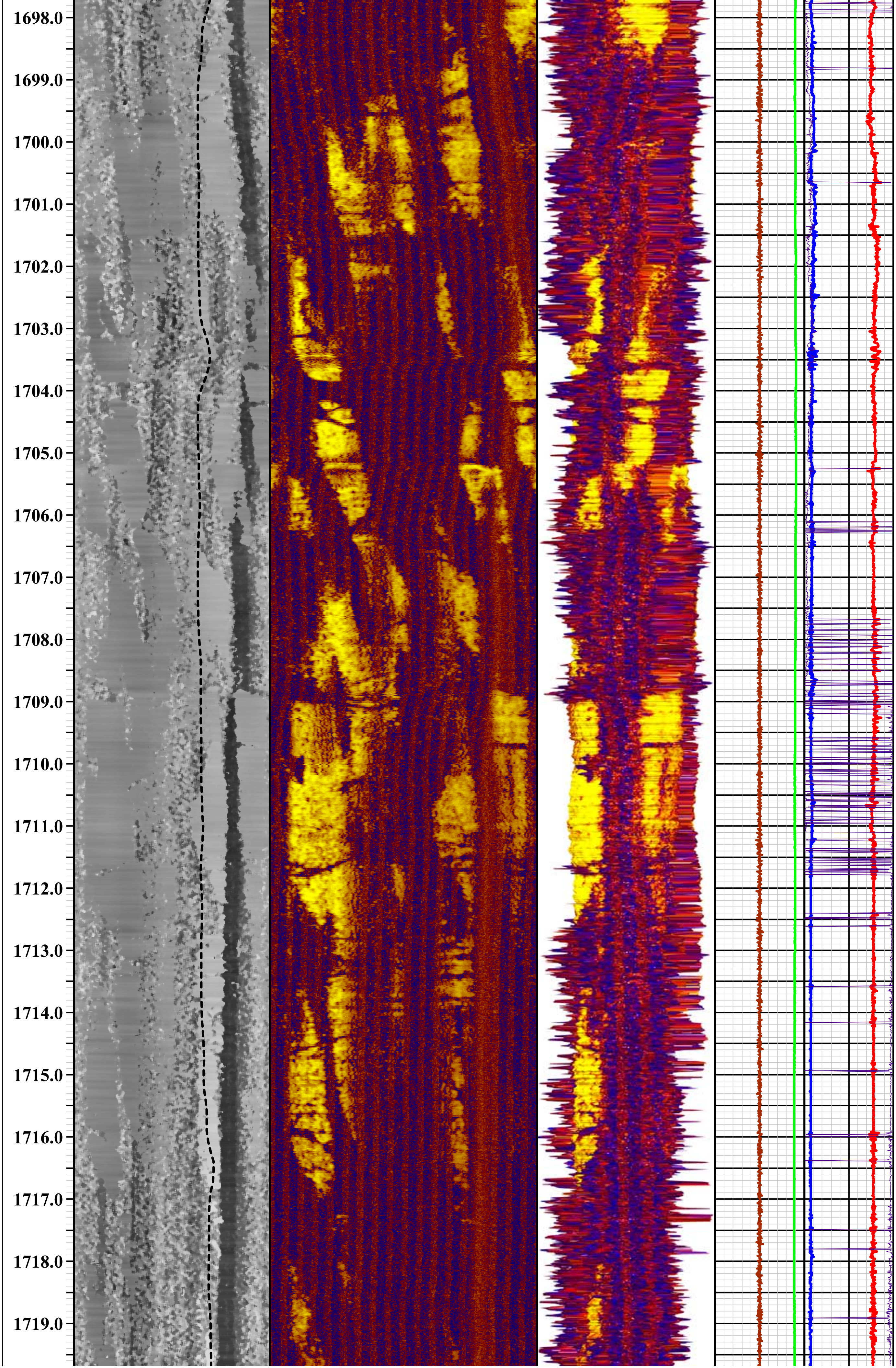
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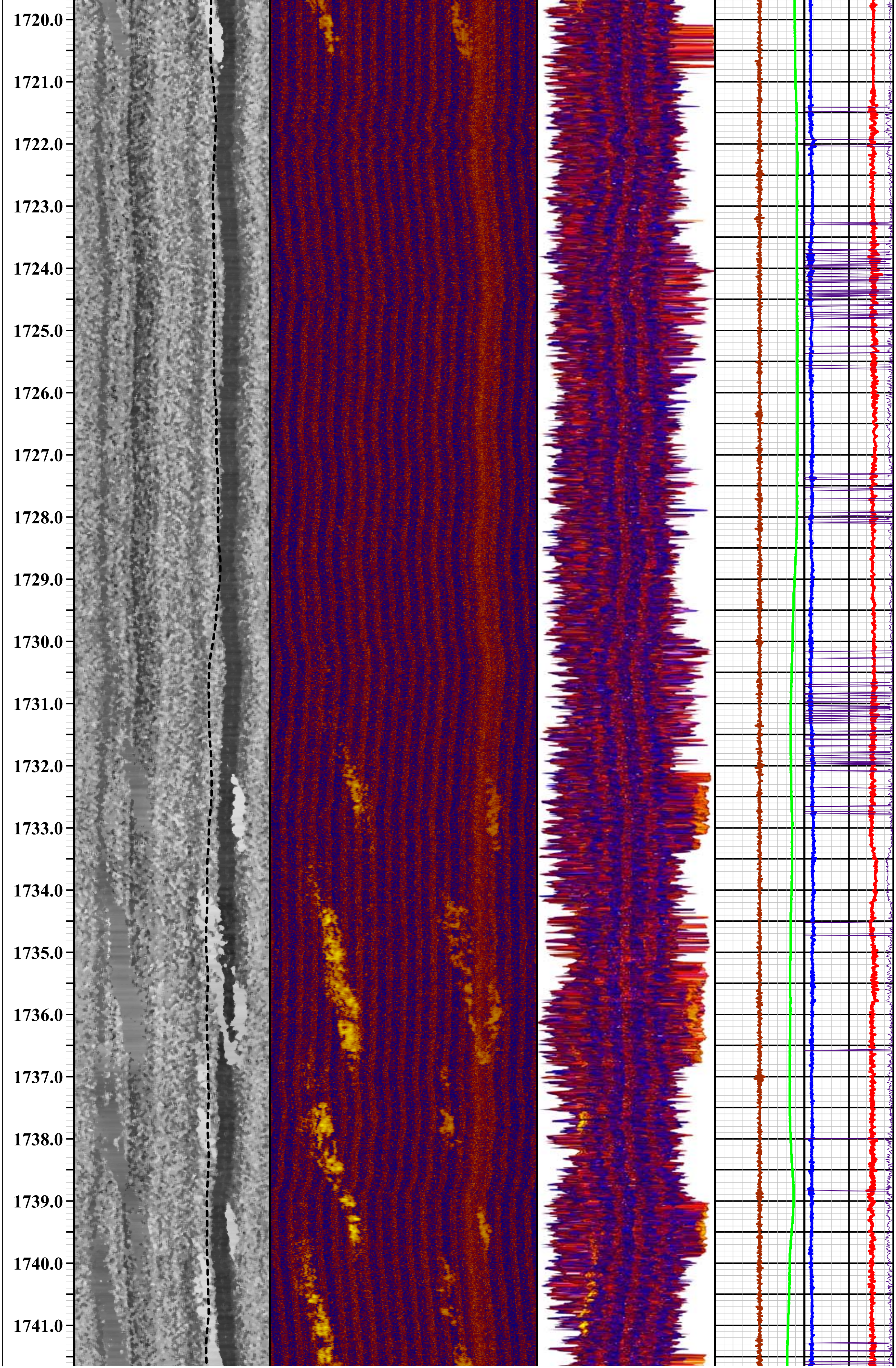
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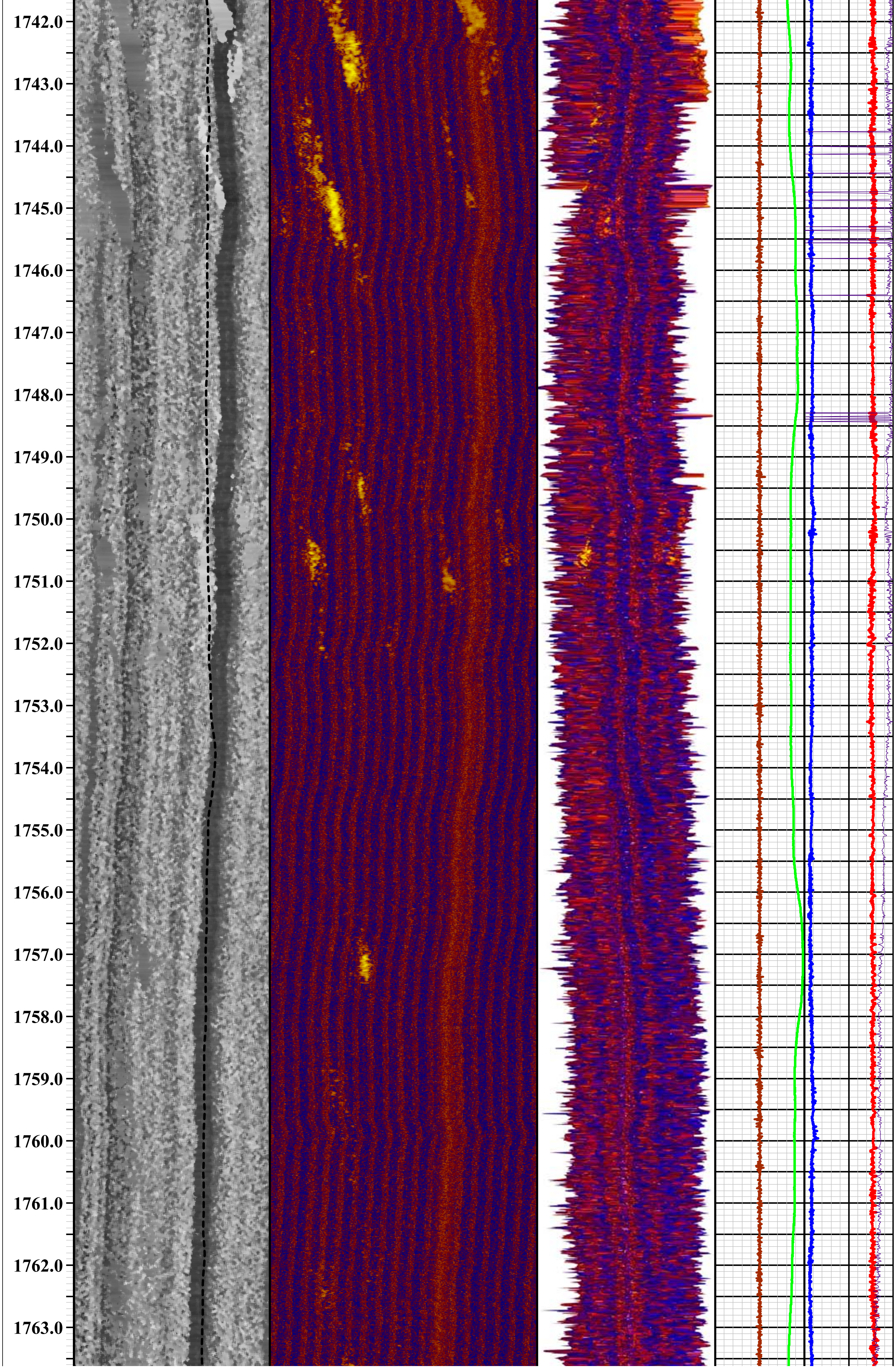
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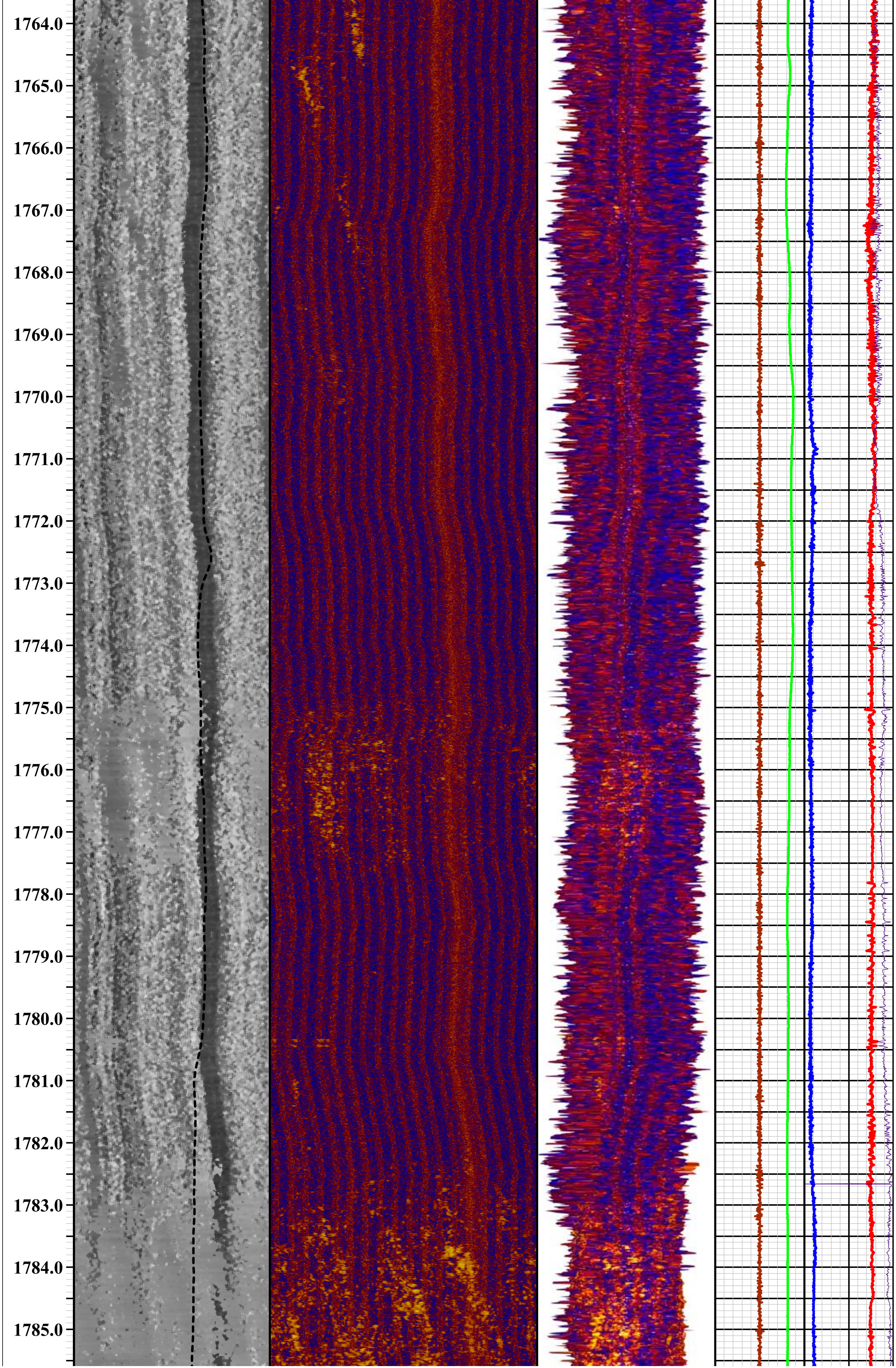
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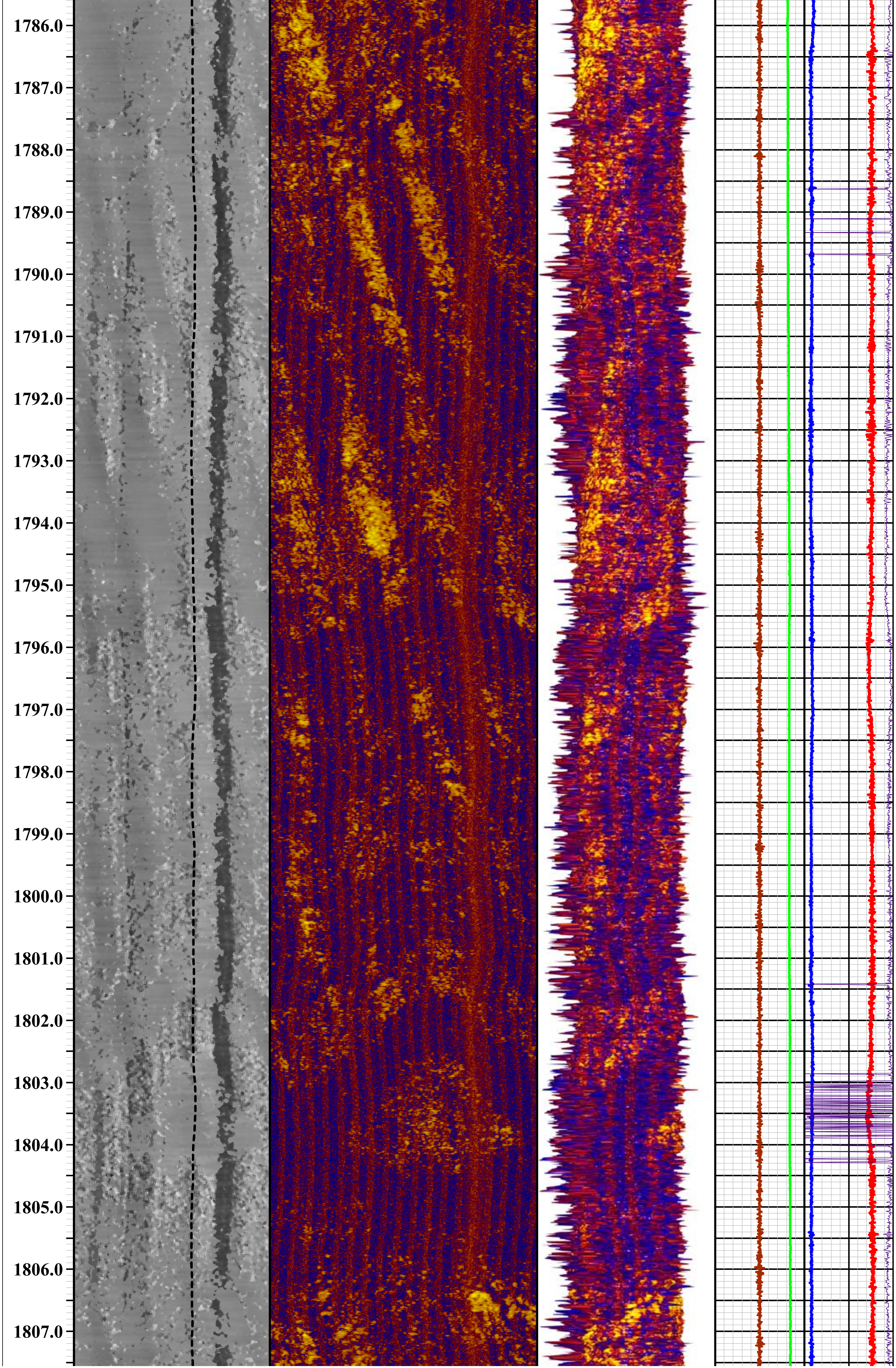
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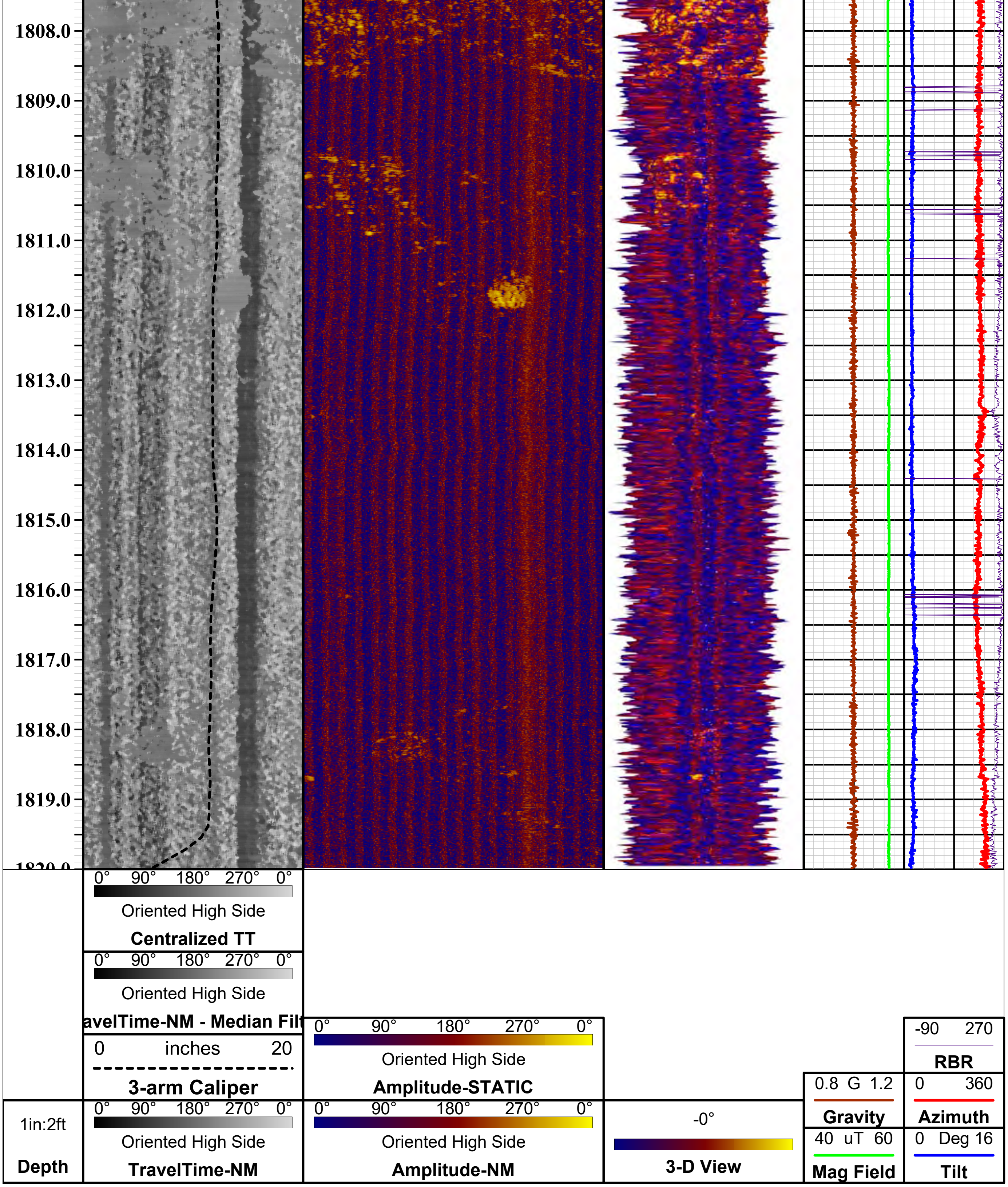
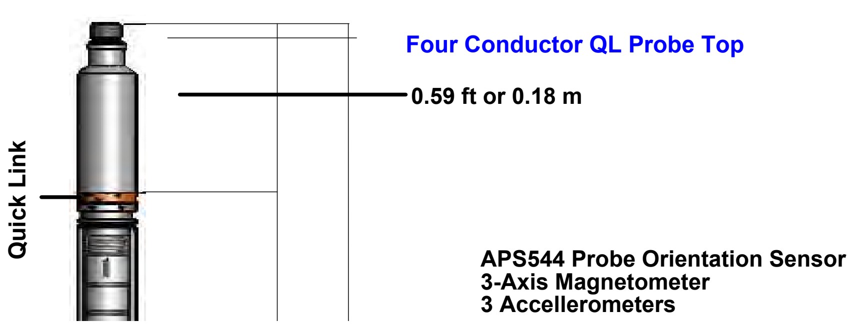
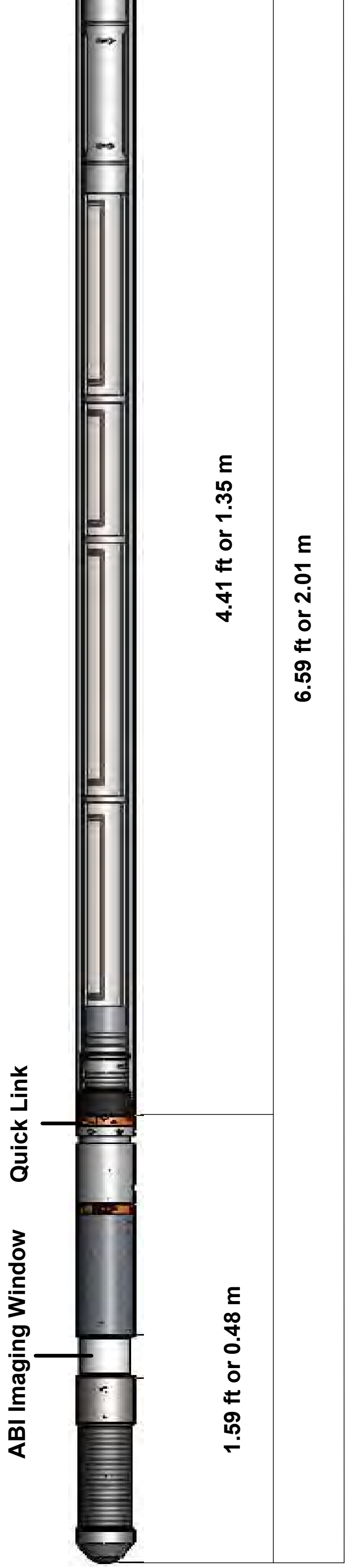


QL ABI-43 Acoustic Borehole Imager

Probe Top = Depth Reference

Tool SN: 111801 & 091601





1.7 in or 43 mm Tool Diameter

Probe Length = 2.01 m or 6.59 ft

Probe Weight = 10.0 kg or 22.0 lbs

Distance from Acoustic Image Window to Orientation Sensor = 1.6 m or 5.1 ft

Inclination Accuracy = +/- 0.5 Deg

Azimuth Accuracy = +/- 1.2 Deg

Beam Width = 3.0 mm

Frequency: 1.2 mHz

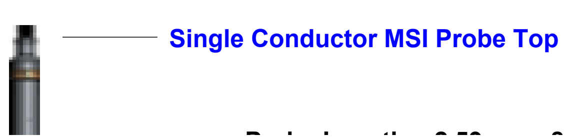
Temperature Rating = 125.0 Deg C (257.0 Deg F)

Pressure Rating = 700 bar (10153 psi)

Slip-Over Centralizers - 3 Band Phosphor Bronze Bow Springs with Aluminum Collars

MSI Gamma-Caliper-Temperature-Fluid Resistivity

Probe Top = Depth Ref.

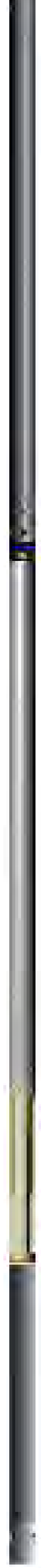


Probe Length = 2.59 m or 8.5 ft
Probe Weight = 6.80 kg or 15.0 lbs

Natural Gamma and Caliper can only be collected logging up hole.

Fluid Temperature/Resistivity can only be collected logging down hole.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)



Natural Gamma Ray = 0.76 m (29.75 in)

NOTE: Lengths on a particular tool may vary from those listed on this document due to probe sizes and styles utilizedl

3-Arm Caliper = 1.44 m (56.75 in)

Distance from tool top: 2.20 m (86.5 in)

Available Arm Sizes: 3", 9", and 15"

TFR (Temperature/Fluid Resistivity) = 0.39 m (15.5 in)

1.375" or 34.9 mm Diameter

Southwest Exploration Services, LLC
borehole geophysics & video services

Company	RESOLUTION COPPER MINING
Well	DHRES-16
Field	SUPERIOR
County	PINAL
State	ARIZONA

State ARIZONA

Preliminary **ABI SUMMARY**

APPENDIX D

Borehole Geophysical Logs from Well DHRES-16
Conducted by SWE; interval 1,800 – 4,083 feet

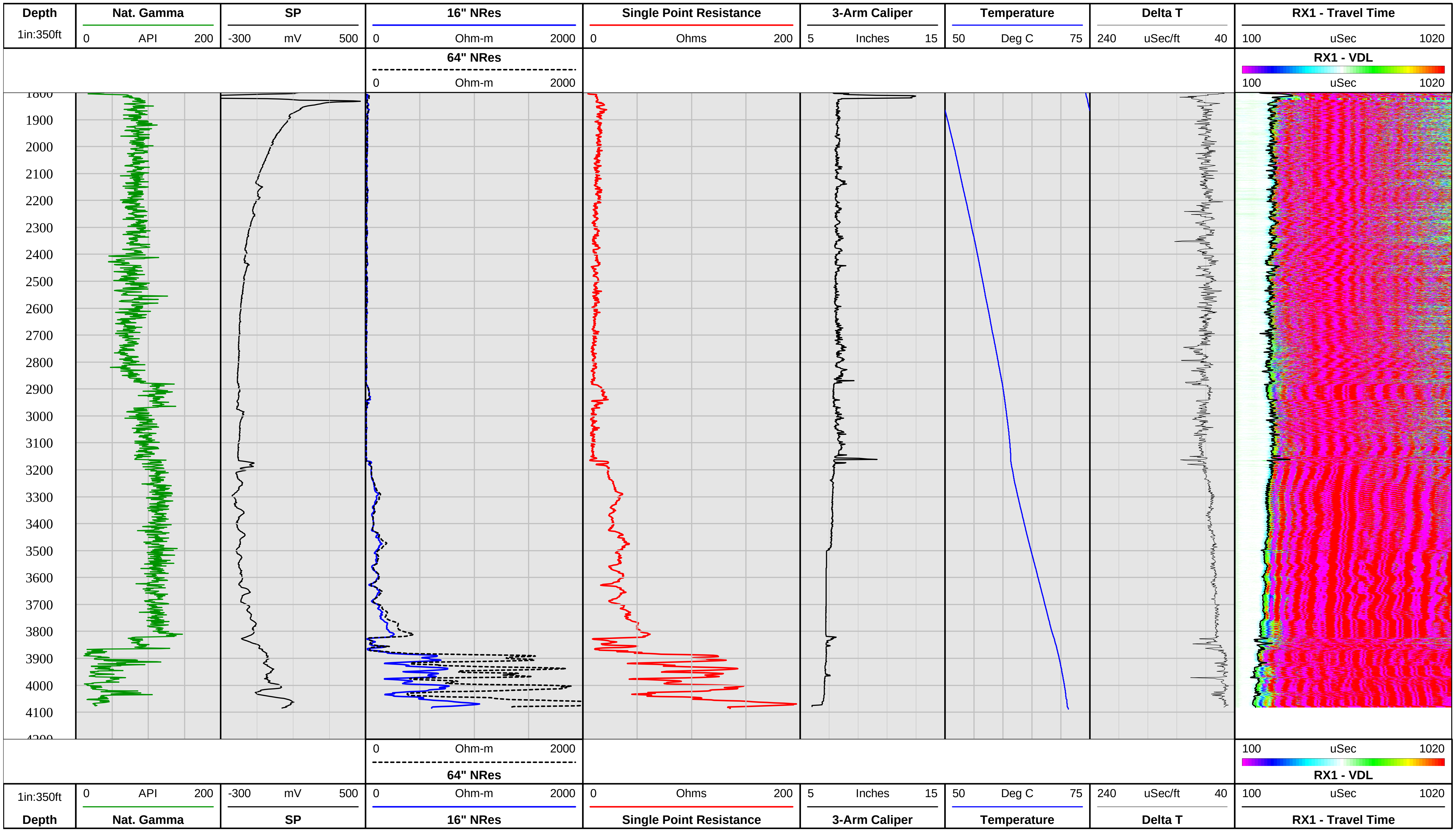
DHRES-16 Geophysical Log Summary

Southwest Exploration Services, LLC
borehole geophysics & video services

MONTGOMERY
& ASSOCIATES

COMPANY: E. L. MONTGOMERY & ASSOCIATES
FIELD: RESOLUTION COPPER
WELL ID: DHRES-16
COUNTY: PINAL STATE: ARIZONA

Logging Engineer: E. TURNER
Date Logged: 9-23-14
Processed By: K. MITCHELL
Date Processed: 3-16-16



Southwest Exploration Services, LLC
borehole geophysics & video services

COMPANY	RESOLUTION COPPER		
WELL ID	DHRES-16 (55-917232)		
FIELD	RESOLUTION		
COUNTY	PINAL	STATE	ARIZONA

TYPE OF LOGS: NAT. GAMMA-CALIPER
MORE: TEMPERATURE

LOCATION	SE 1/4 OF SW 1/4 OF NE 1/4 944004 E 830713 N	OTHER SERVICES	E-LOG SONIC ABI-43
SEC 04	TWP 02 S	RGE 12 E	
PERMANENT DATUM	AZSPC, FEET	ELEVATION 2634 FEET	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM	D.F.
DRILLING MEAS. FROM			G.L.
DATE	09-23-14	TYPE FLUID IN HOLE	FORMATION WATER
RUN No	1	MUD WEIGHT	N/A
TYPE LOG	GAM-CAL-TEMP	VISCOSITY	N/A
DEPTH-DRILLER	4085 FT	LEVEL	1280 FT
DEPTH-LOGGER	4083 FT	MAX. REC. TEMP.	71.29 DEG C
BTM LOGGED INTERVAL	4083 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	1800 FT	SAMPLE INTERVAL	0.1 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	E. TURNER	TOOL STRING/SN	COMBO 5446
WITNESSED BY	MATT - M&A	LOG TIME:ON SITE/OFF SITE	10:40 AM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	?	SURFACE	56 FT	14"		SURFACE	56 FT
2	12.25"	56 FT	1820 FT	7 5/8"		SURFACE	1805 FT
3	6.5"	1820 FT	TOTAL DEPTH				

COMMENTS:

Tool Summary:

Date	09-23-14	**Date**	09-23-14	**Date**	09-23-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	MSI COMBO	**Tool Model**	ALT ABI43	**Tool Model**	ALT FWS50
Tool SN	5446	**Tool SN**	91601	**Tool SN**	4572
From	1800 FT	**From**	1800 FT	**From**	1800 FT
To	4083 FT	**To**	4083 FT	**To**	4083 FT
Recorded By	E. TURNER	**Recorded By**	E. TURNER	**Recorded By**	E. TURNER
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	9-19-14	**Operation Check**	9-19-14	**Operation Check**	9-19-14
Calibration Check	9-19-14	**Calibration Check**	N/A	**Calibration Check**	N/A
Time Logged	11:00 AM	**Time Logged**	1:45 PM	**Time Logged**	6:30 PM

Date	09-23-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	GEOVISTA ELOG	**Tool Model**		**Tool Model**	
Tool SN	4097	**Tool SN**		**Tool SN**	
From	1800 FT	**From**		**From**	
To	4083 FT	**To**		**To**	
Recorded By	E. TURNER	**Recorded By**		**Recorded By**	
Truck No	500	**Truck No**		**Truck No**	
Operation Check	9-19-14	**Operation Check**		**Operation Check**	
Calibration Check	9-19-14	**Calibration Check**		**Calibration Check**	
Time Logged	8:10 PM	**Time Logged**		**Time Logged**	

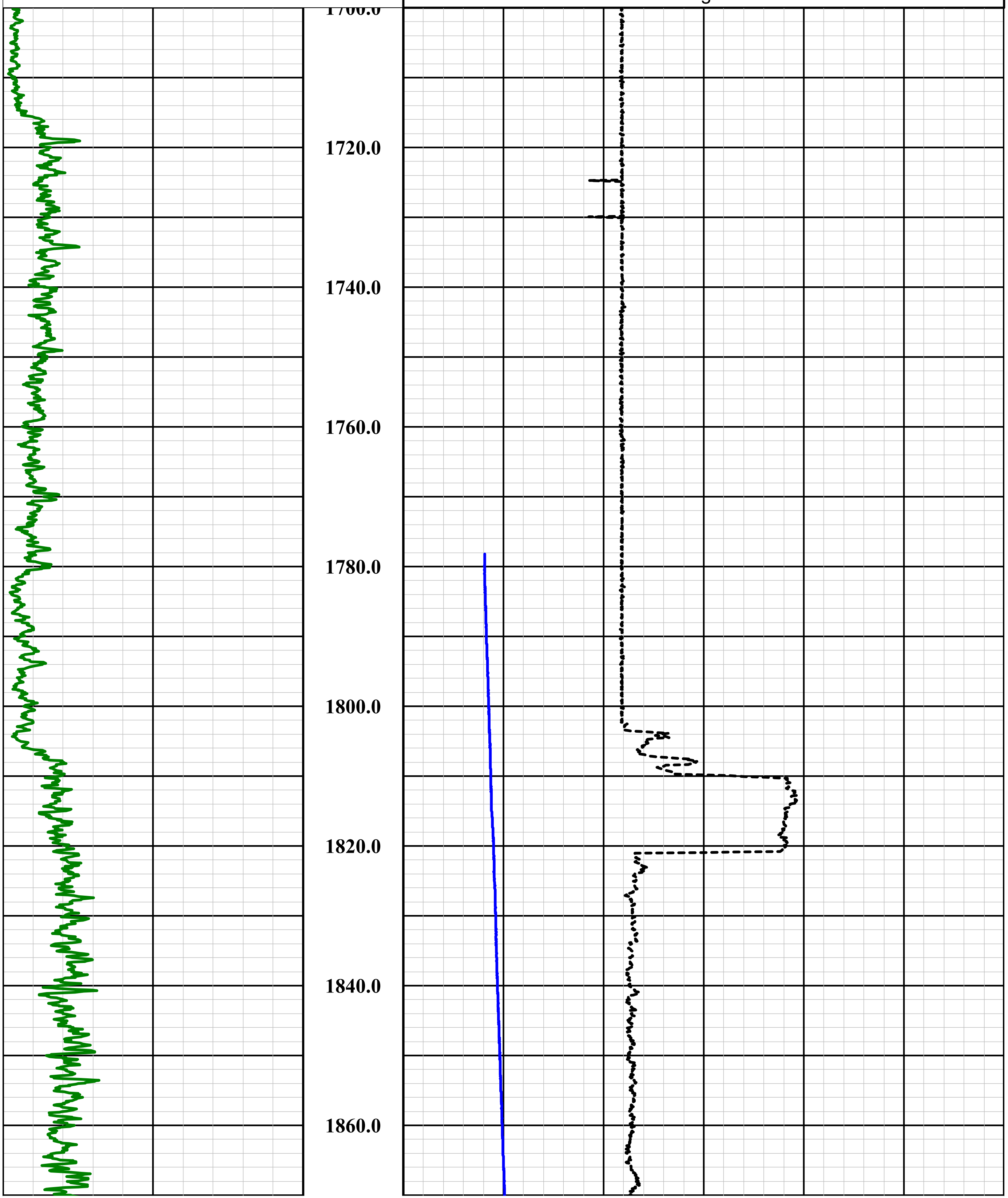
Additional Comments:

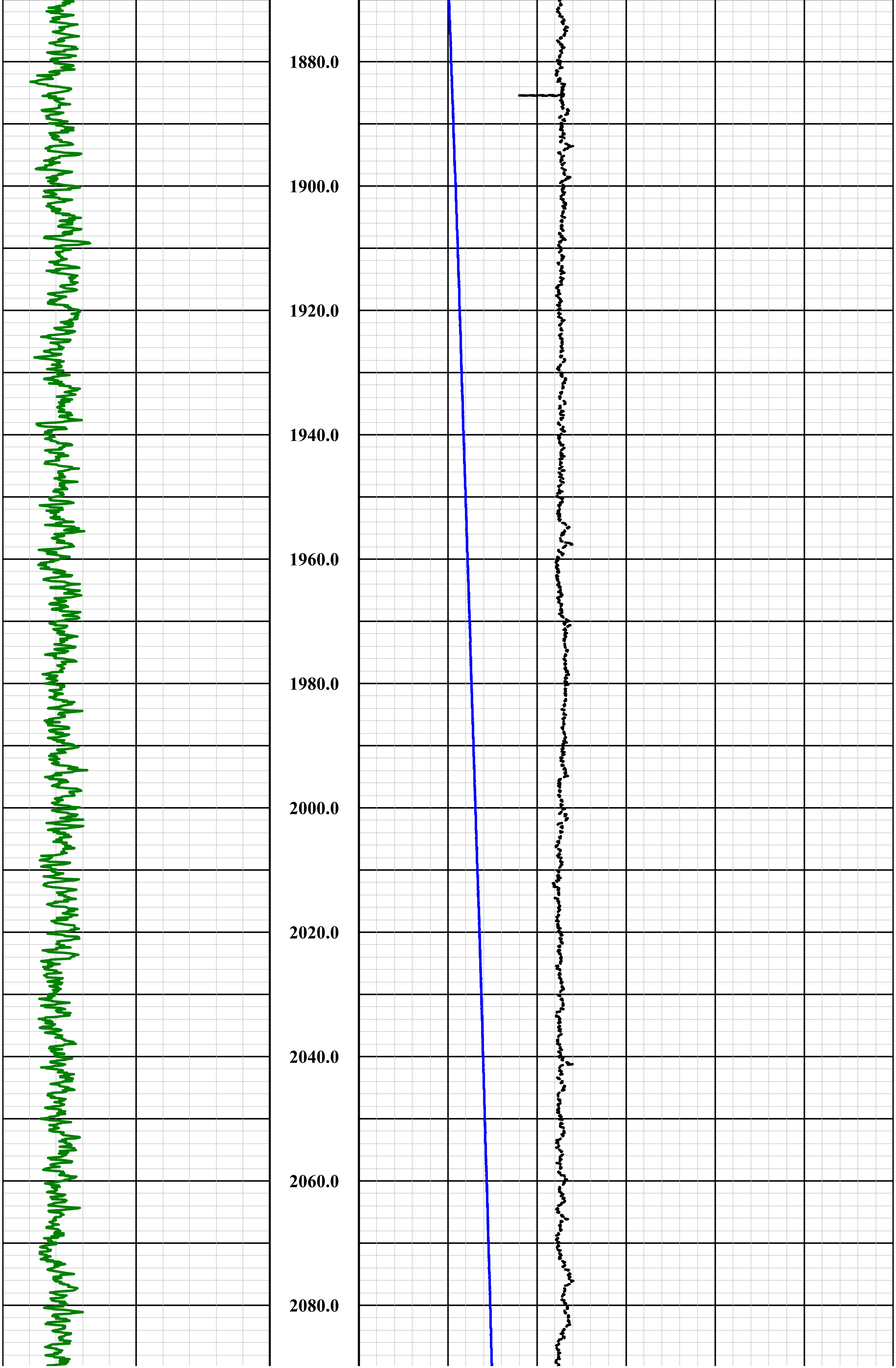
Caliper Arms Used: 9" **Calibration Points:** 4.75" - 14"

Disclaimer:

All interpretations of log data are opinions based on inferences from electrical or other measurements. We do not guarantee the accuracy or correctness of any interpretations or recommendations and shall not be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our employees or agents. These interpretations are also subject to our general terms and conditions set out in our current Service Invoice.

Nat. Gamma	Depth	3-Arm Caliper
0 API 400	1in:20ft	0 Inches 20
		Temperature
		45 Deg C 75

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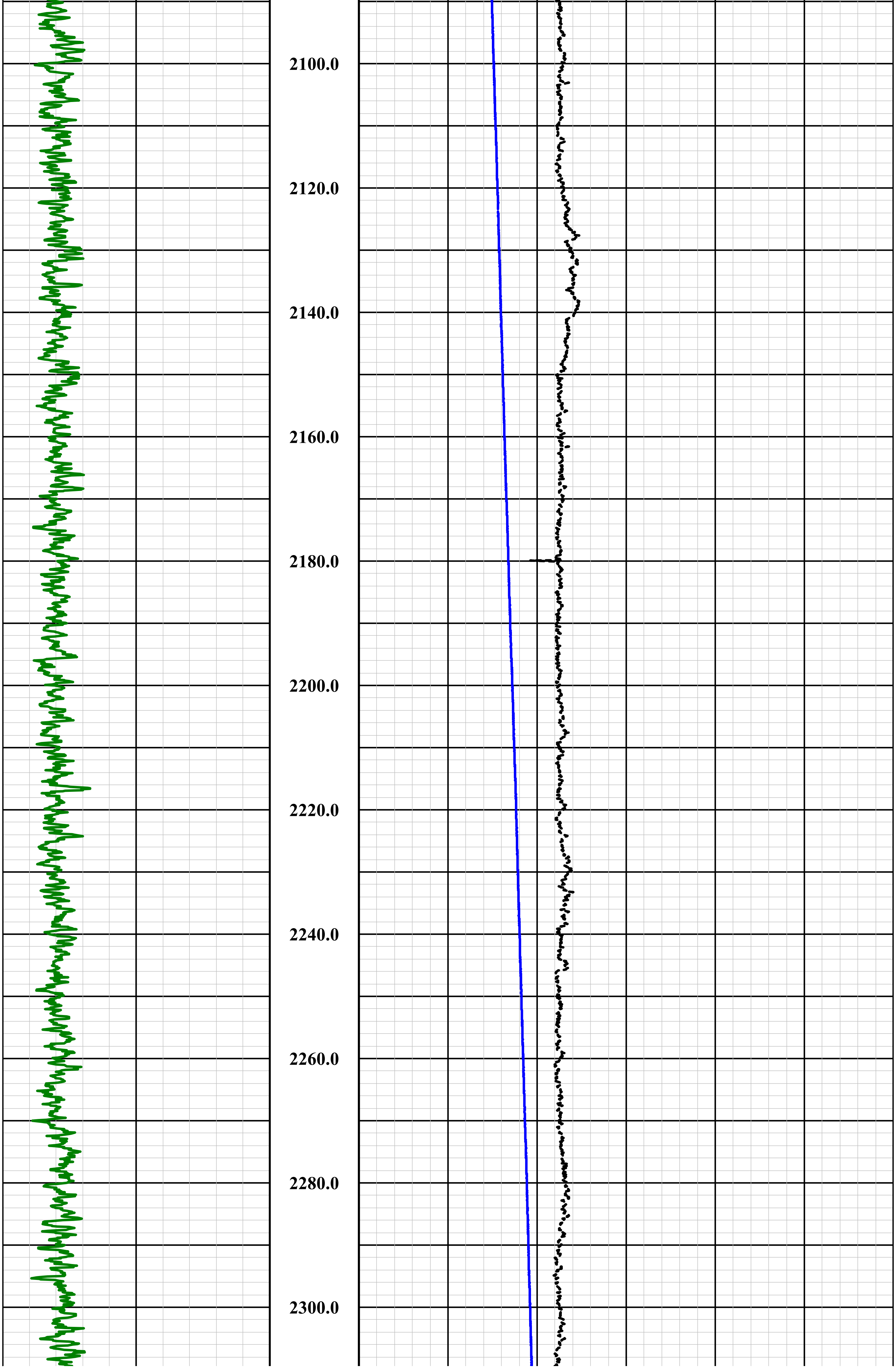
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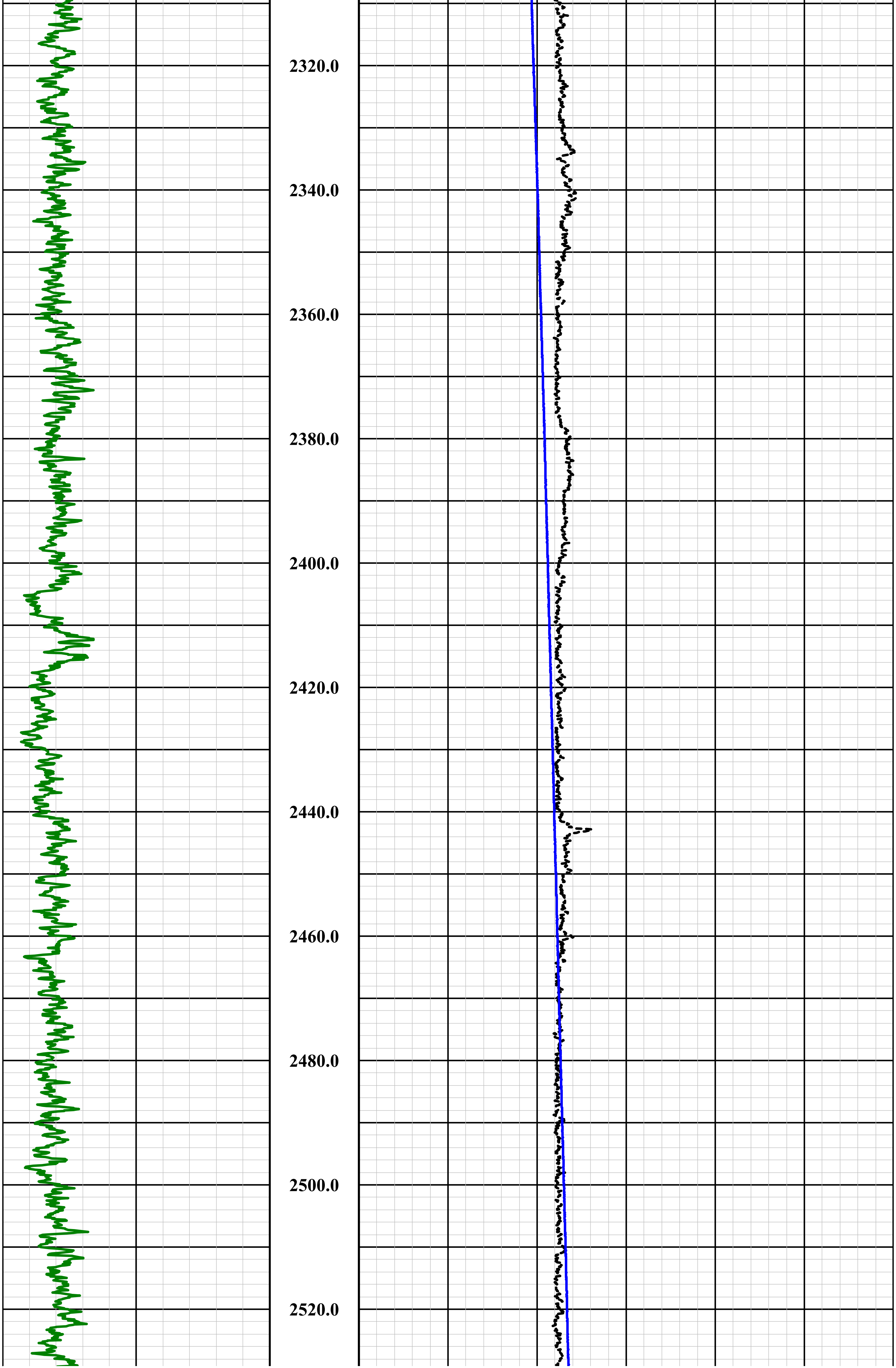
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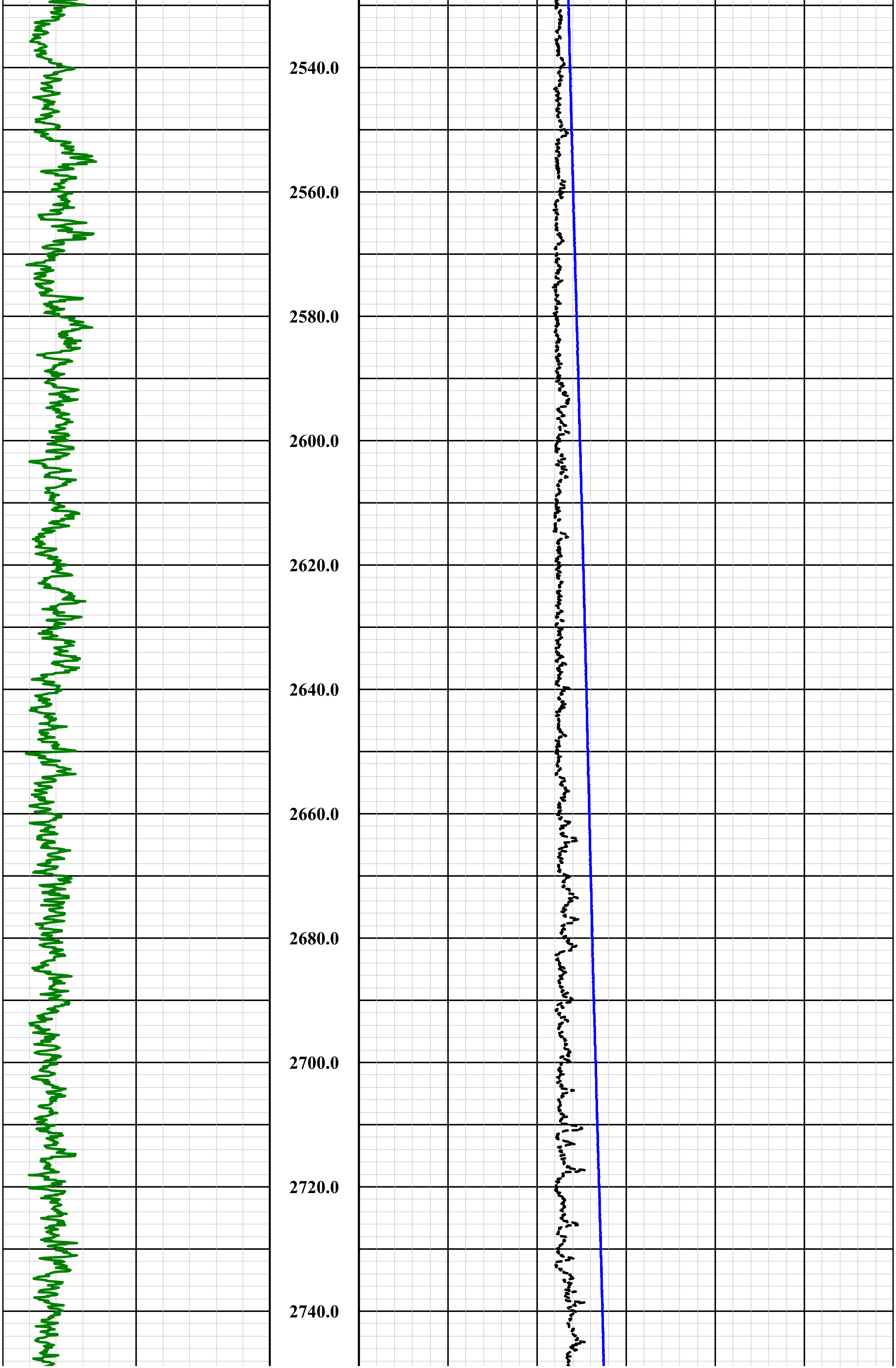
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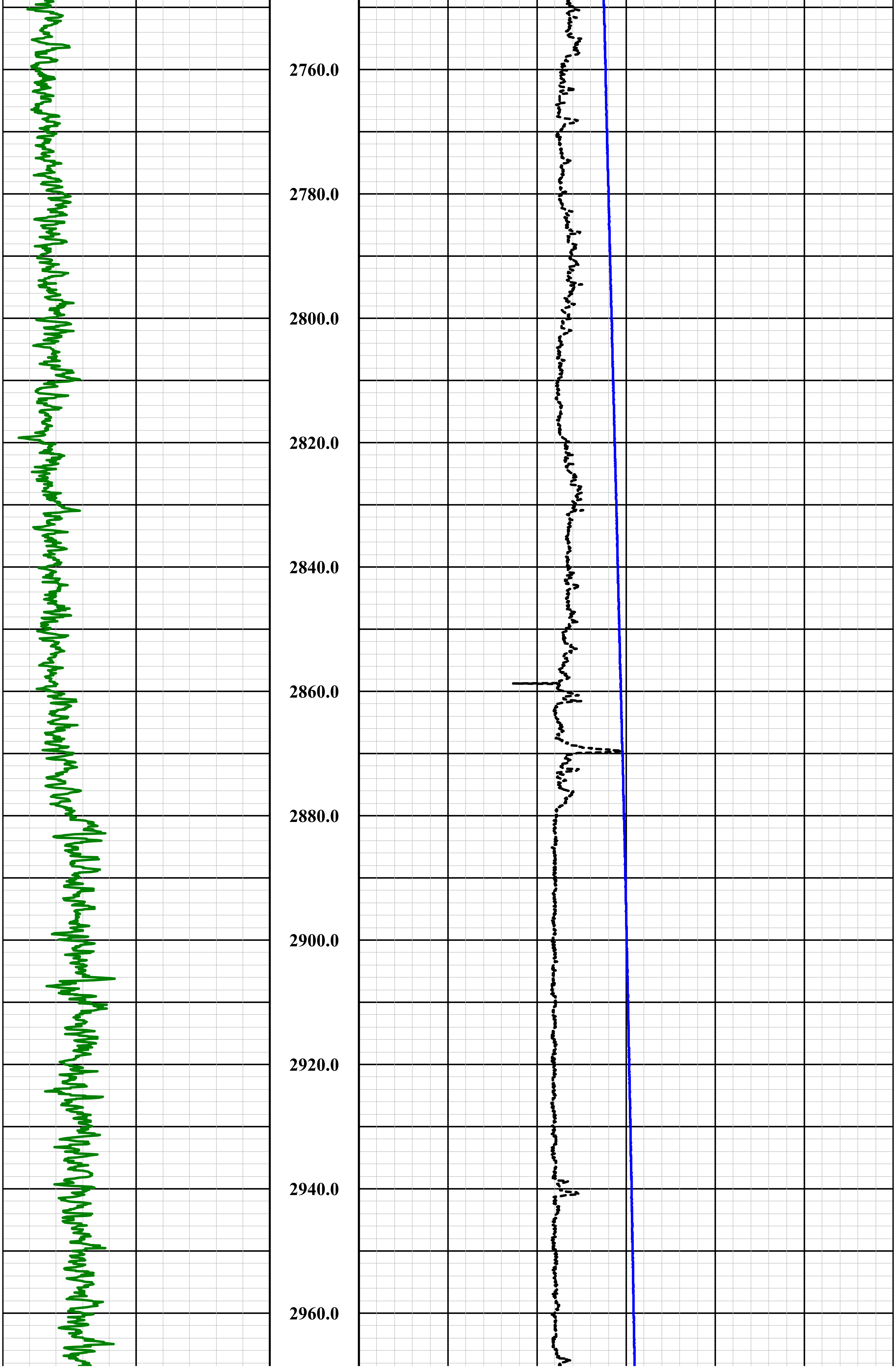
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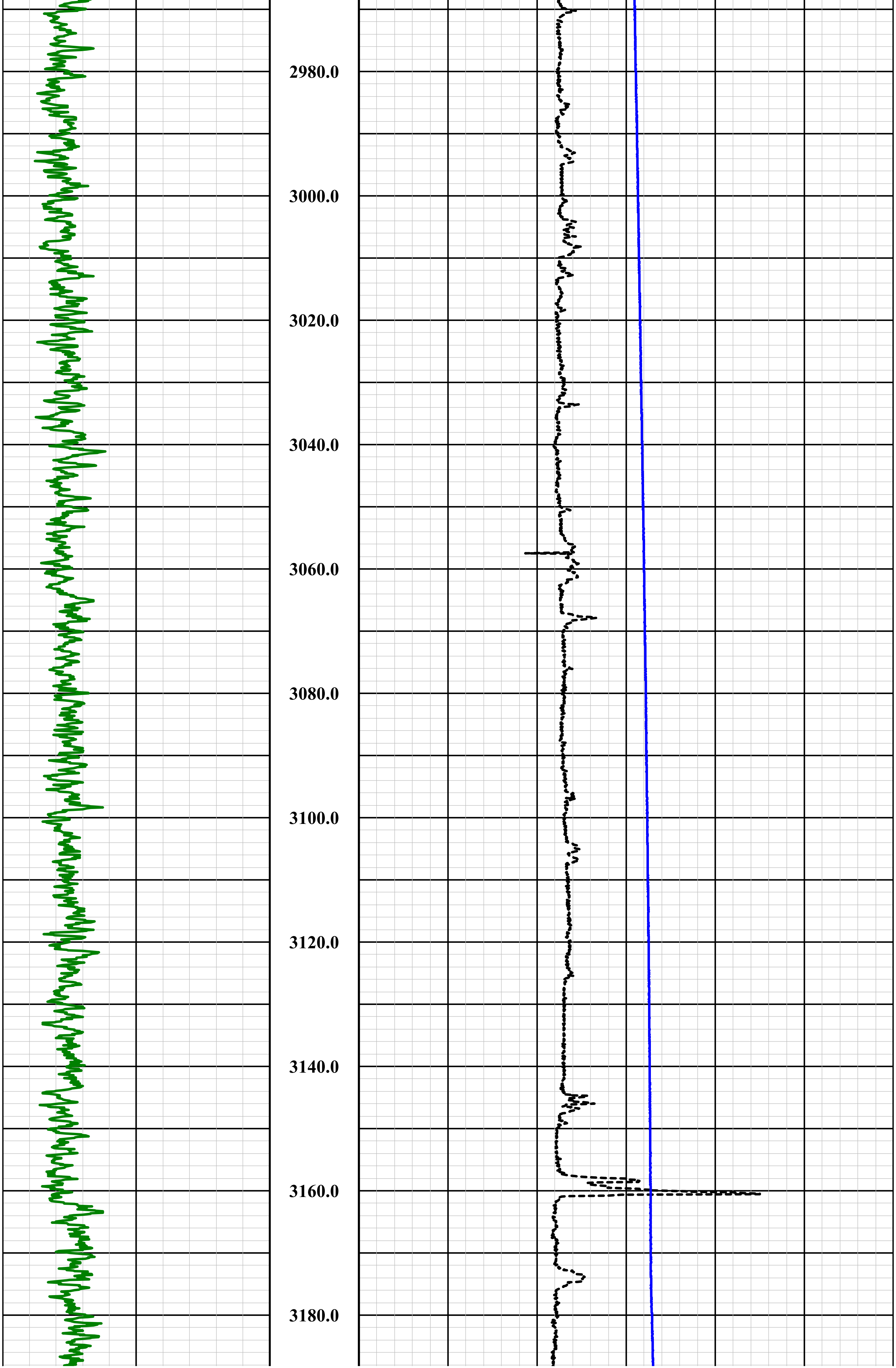
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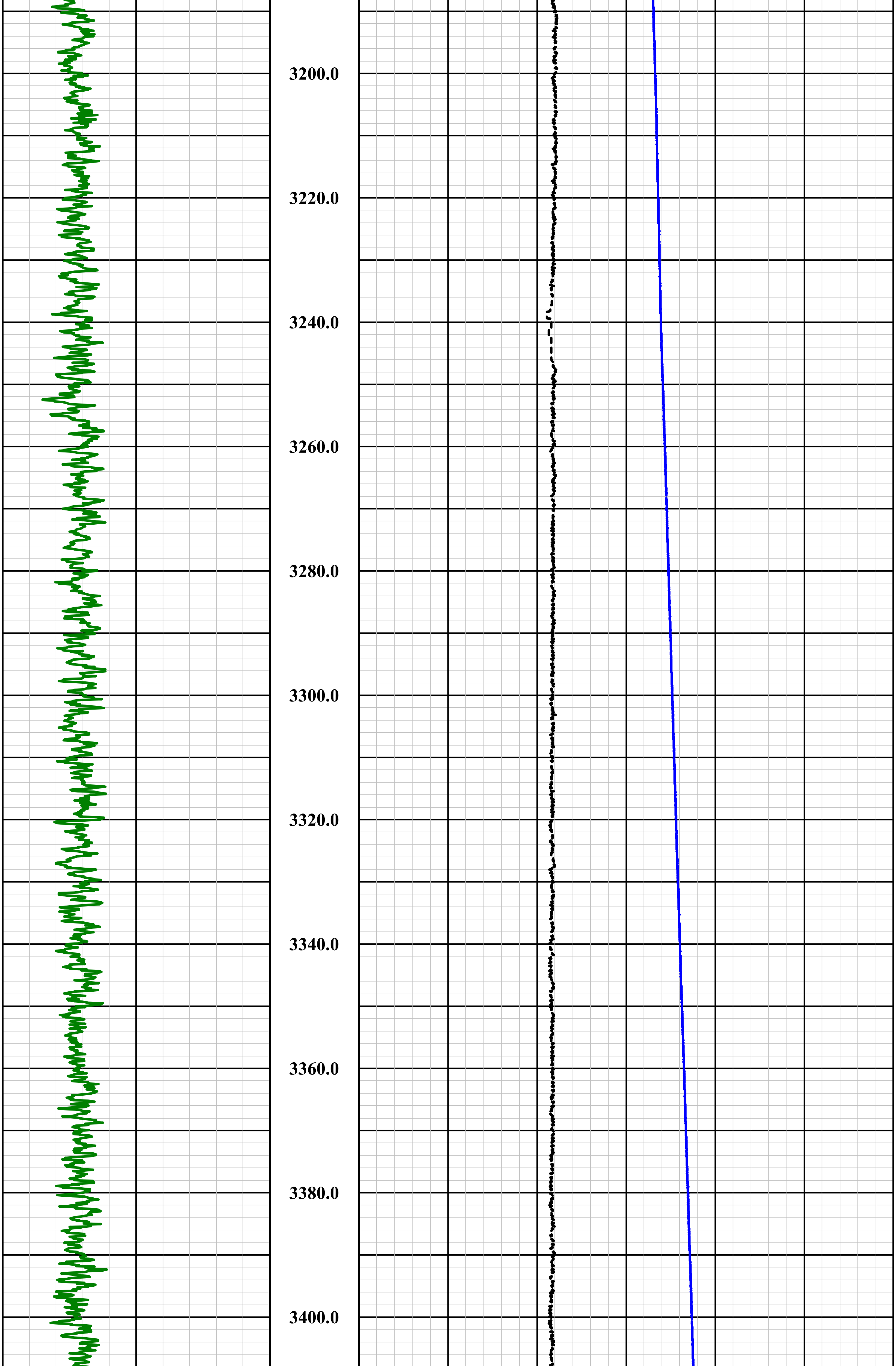

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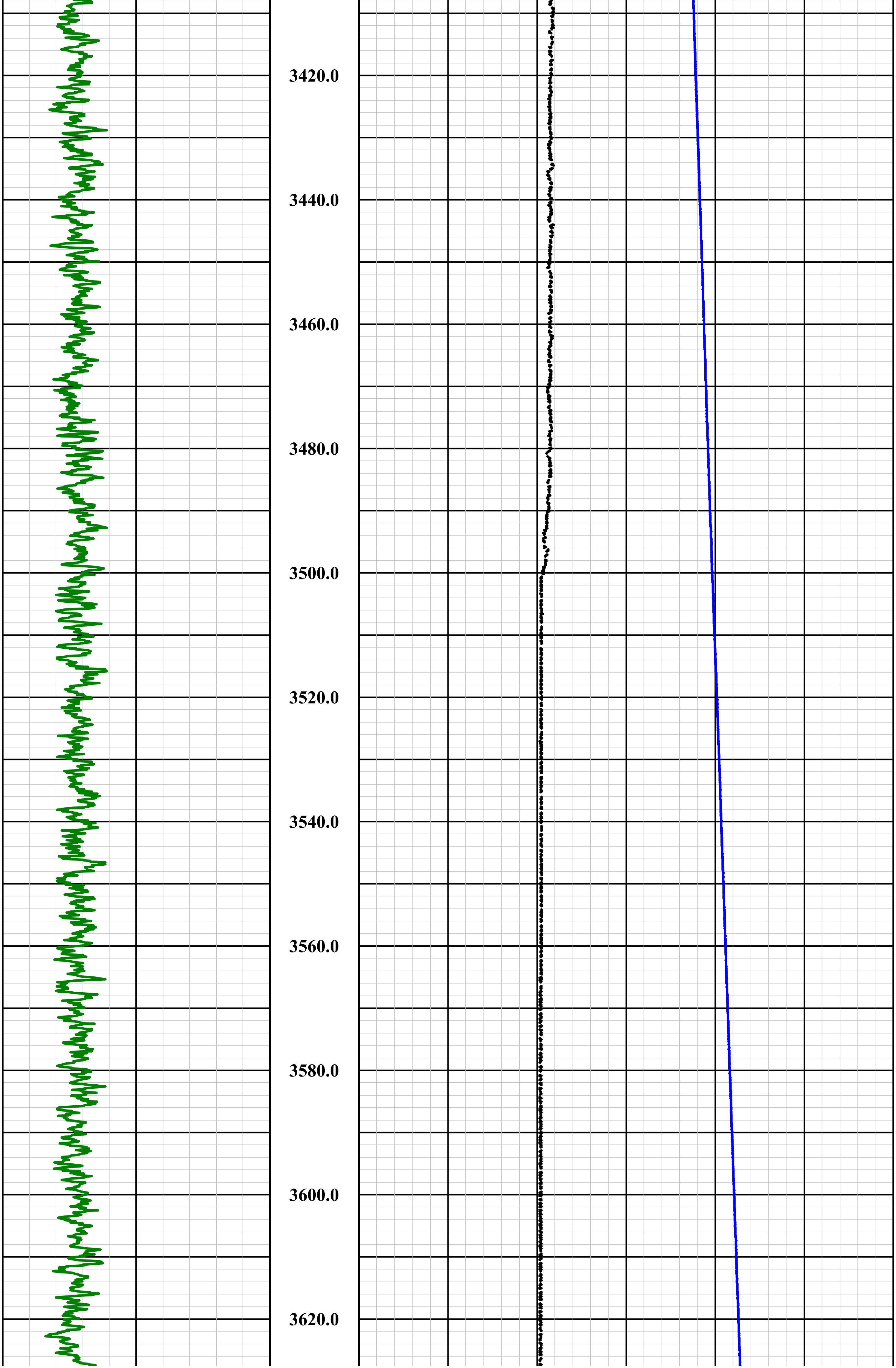
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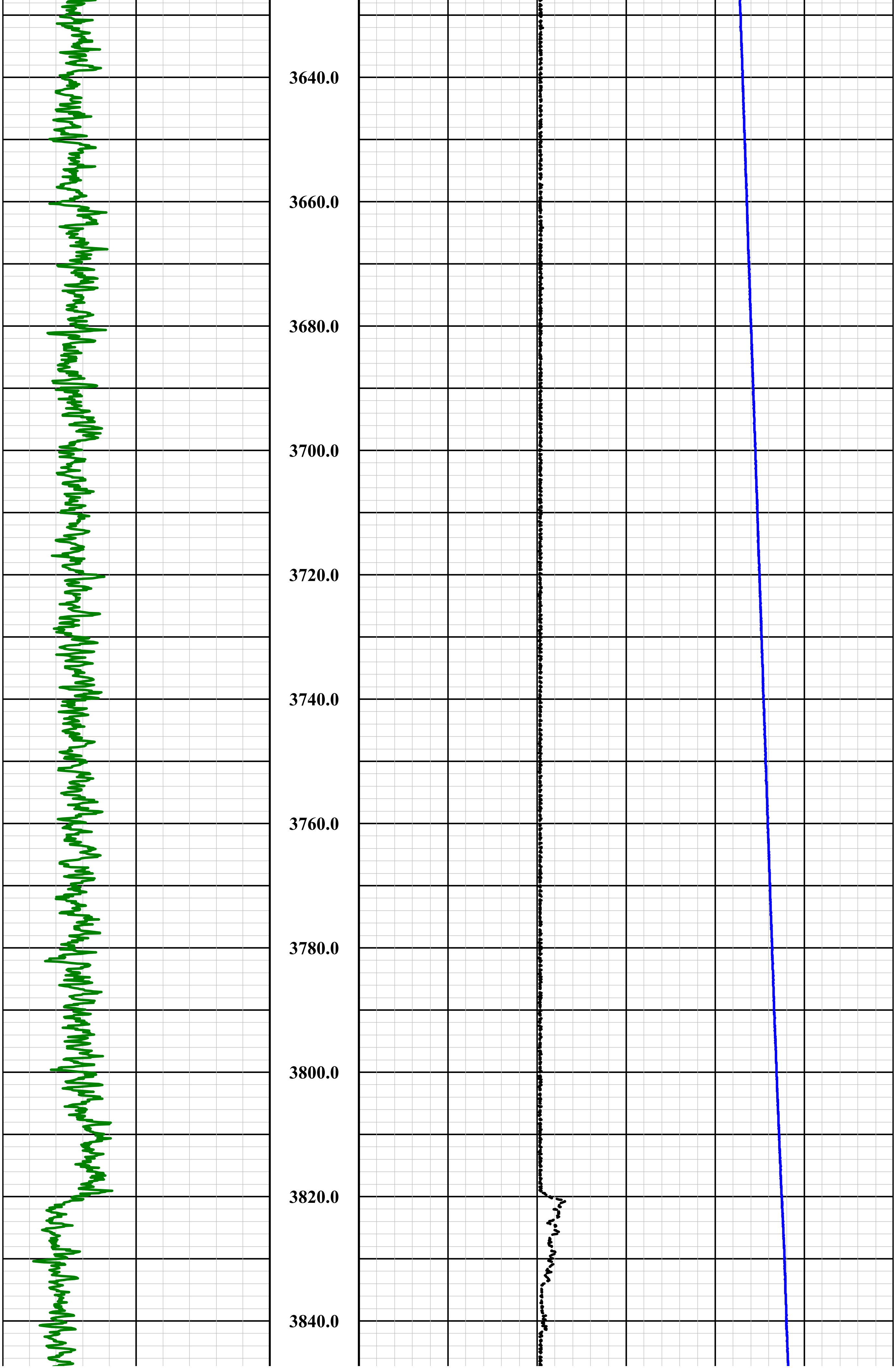
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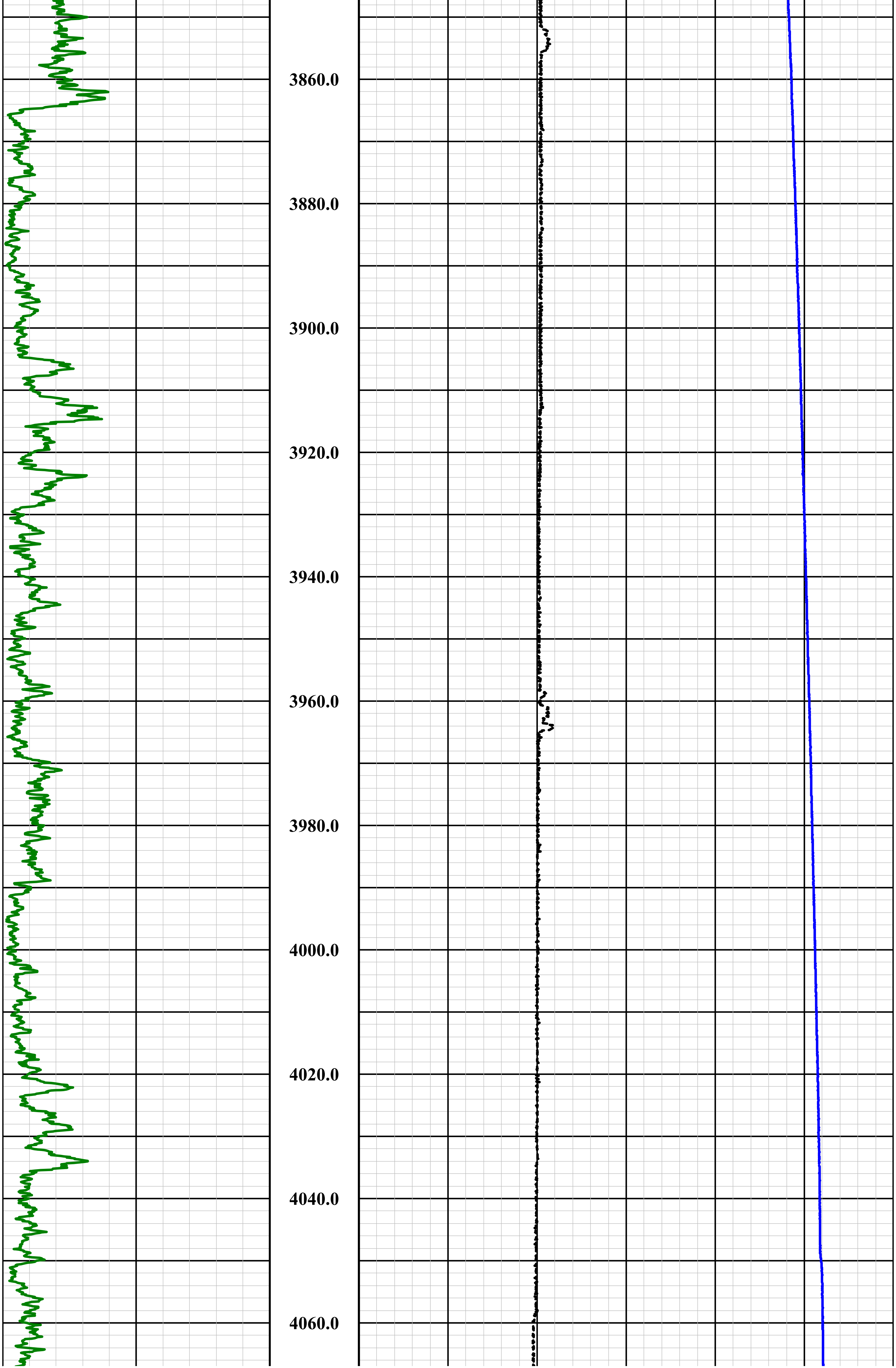
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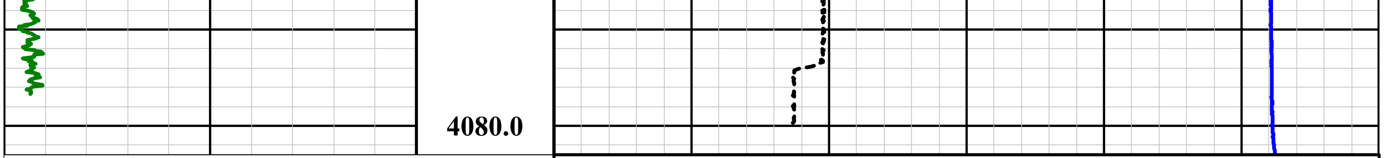


		45 Deg C 75 **Temperature**
0 API 400 **Nat. Gamma**	1in:20ft **Depth**	0 Inches 20 **3-Arm Caliper**

MSI Gamma-Caliper-Temperature-Fluid Resistivity

Probe Top = Depth Ref.

Single Conductor MSI Probe Top

Probe Length = 2.59 m or 8.5 ft
Probe Weight = 6.80 kg or 15.0 lbs

Natural Gamma and Caliper can only be collected logging up hole.

Fluid Temperature/Resistivity can only be collected logging down hole.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)

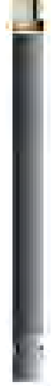
Natural Gamma Ray = 0.76 m (29.75 in)

NOTE: Lengths on a particular tool may vary from those listed on this document due to probe sizes and styles utilizedl

3-Arm Caliper = 1.44 m (56.75 in)

Distance from tool top: 2.20 m (86.5 in)

Available Arm Sizes: 3", 9", and 15"



TFR (Temperature/Fluid Resistivity) = 0.39 m (15.5 in)

1.375" or 34.9 mm Diameter

Southwest Exploration Services, LLC

borehole geophysics & video services

Company	RESOLUTION COPPER MINING
Well	DHRES-16
Field	SUPERIOR
County	PINAL
State	ARIZONA

Preliminary GCT SUMMARY

Southwest Exploration Services, LLC

borehole geophysics & video services

COMPANY	RESOLUTION COPPER		
WELL ID	DHRES-16 (55-917232)		
FIELD	RESOLUTION		
COUNTY	PINAL	STATE	ARIZONA

TYPE OF LOGS: E-LOGS
MORE: NAT. GAMMA

LOCATION
SE 1/4 OF SW 1/4 OF NE 1/4
944004 E, 830713 N

SEC 04 TWP 02 S RGE 12 E

OTHER SERVICES
COMBO
SONIC
ABI-43

PERMANENT DATUM	AZSPC, FEET	ELEVATION	2634 FT	K.B.	
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.	
DRILLING MEAS. FROM	GROUND LEVEL			G.L.	

DATE	09-23-14	TYPE FLUID IN HOLE	FORMATION WATER
RUN No	1/4	MUD WEIGHT	N/A
TYPE LOG	ELOGS-GAMMA	VISCOSITY	N/A
DEPTH-DRILLER	4085 FT	LEVEL	1280 FT
DEPTH-LOGGER	4083 FT	MAX. REC. TEMP.	71.29 DEG C
BTM LOGGED INTERVAL	4083 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	1800 FT	SAMPLE INTERVAL	0.2 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	E. TURNER	TOOL STRING/SN	GEOVISTA #4790
WITNESSED BY	MATT - M&A	LOG TIME:ON SITE/OFF SITE	10:40 AM 10:30 PM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	56 FT	14"		SURFACE	56 FT
2	12.25"	56 FT	1820 FT	7 5/8"		SURFACE	1805 FT
3	6.5"	1820 FT	TOTAL DEPTH				

COMMENTS:

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Tool Summary:

Date	09-23-14	**Date**	09-23-14	**Date**	09-23-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	MSI COMBO	**Tool Model**	ALT ABI43	**Tool Model**	ALT FWS50
Tool SN	5446	**Tool SN**	91601	**Tool SN**	4572
From	1800 FT	**From**	1800 FT	**From**	1800 FT
To	4083 FT	**To**	4083 FT	**To**	4083 FT
Recorded By	E. TURNER	**Recorded By**	E. TURNER	**Recorded By**	E. TURNER
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	9-19-14	**Operation Check**	9-19-14	**Operation Check**	9-19-14
Calibration Check	9-19-14	**Calibration Check**	N/A	**Calibration Check**	N/A
Time Logged	11:00 AM	**Time Logged**	1:45 PM	**Time Logged**	6:30 PM

Date	09-23-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	GEOVISTA ELOG	**Tool Model**		**Tool Model**	
Tool SN	4097	**Tool SN**		**Tool SN**	
From	1800 FT	**From**		**From**	
To	4083 FT	**To**		**To**	
Recorded By	E. TURNER	**Recorded By**		**Recorded By**	
Truck No	500	**Truck No**		**Truck No**	
Operation Check	9-19-14	**Operation Check**		**Operation Check**	
Calibration Check	9-19-14	**Calibration Check**		**Calibration Check**	
Time Logged	8:10 PM	**Time Logged**		**Time Logged**	

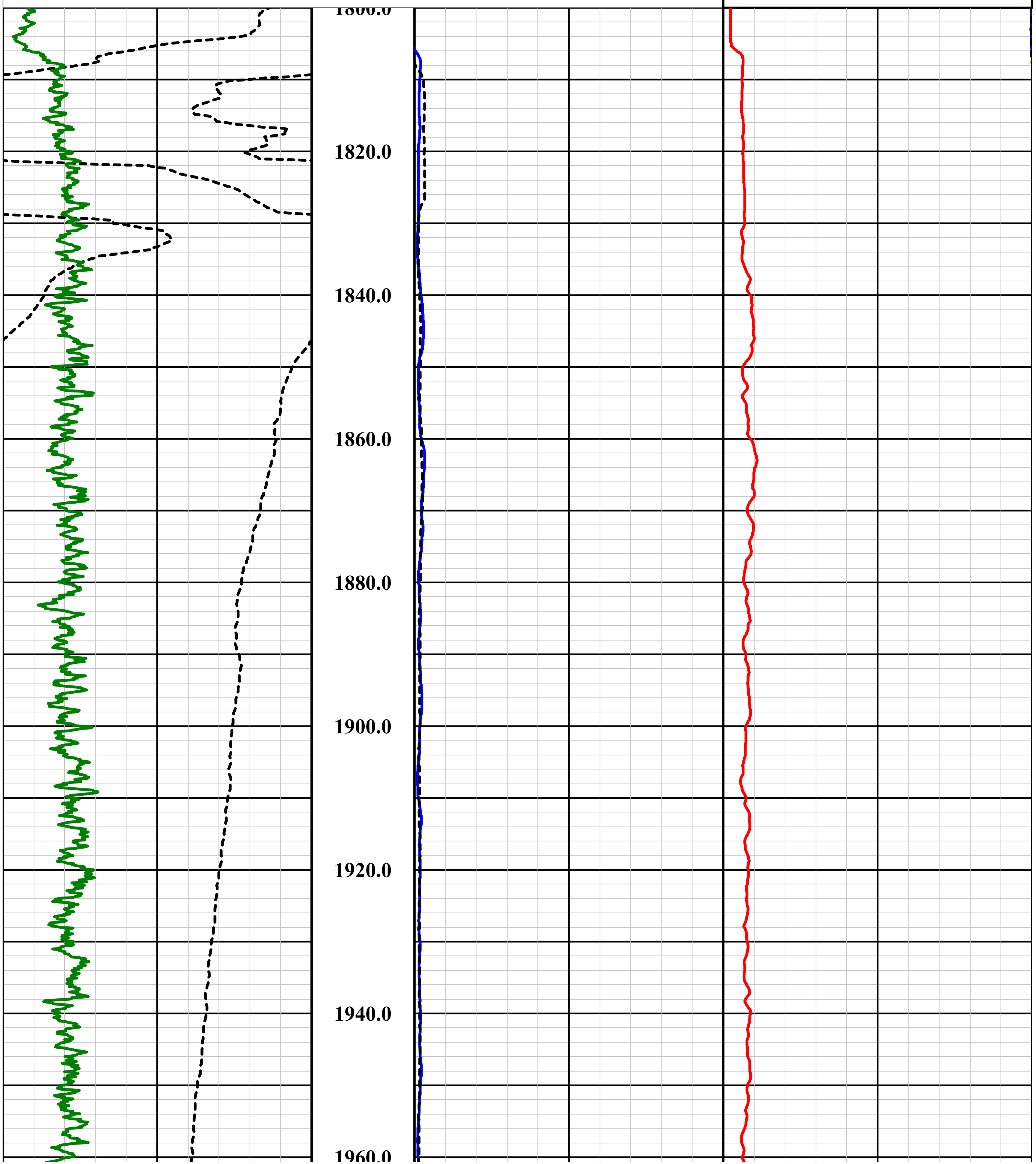
Additional Comments:

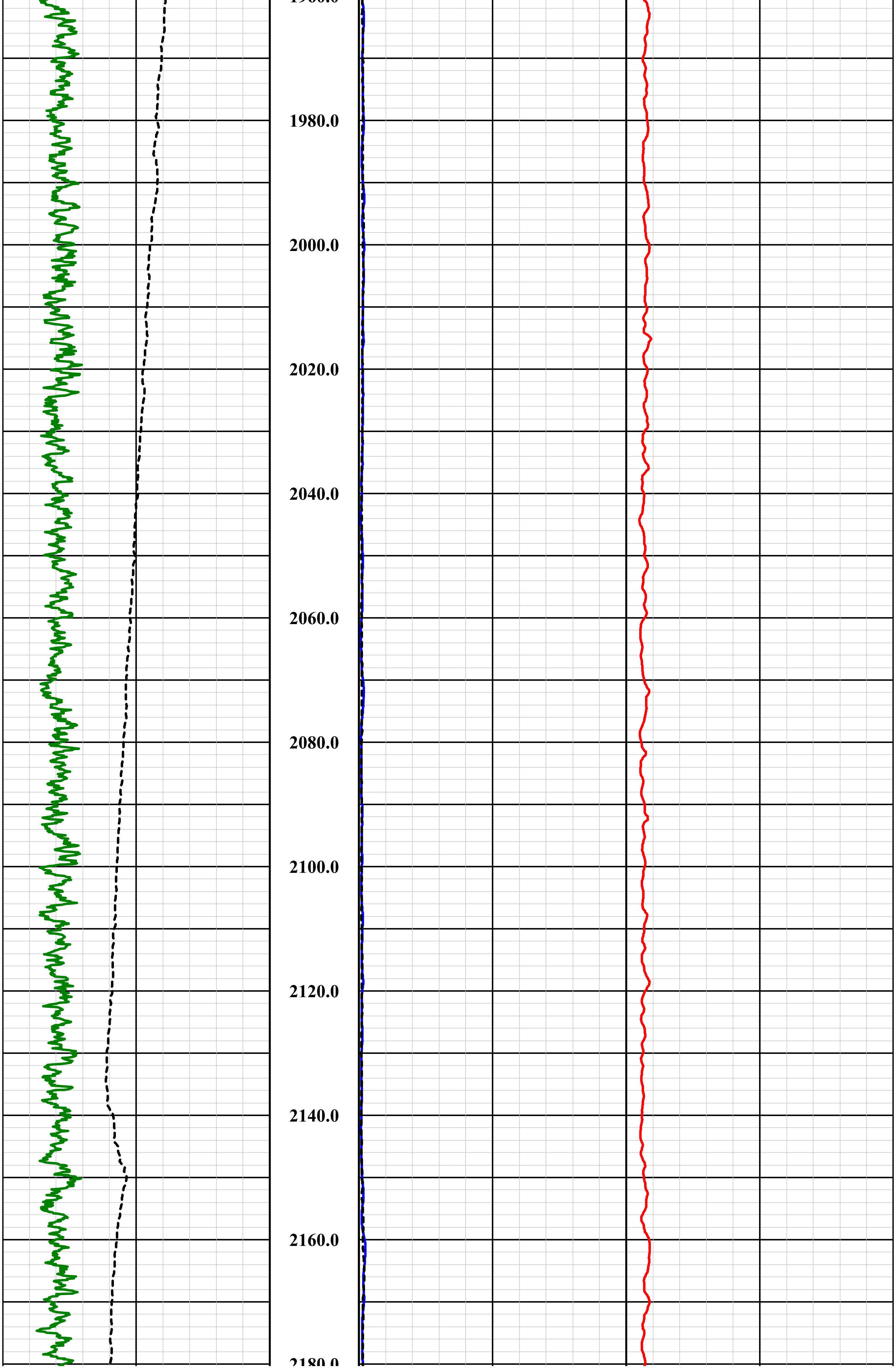
Caliper Arms Used: 9"   **Calibration Points:** 4.75" - 14"

Disclaimer:

All interpretations of log data are opinions based on inferences from electrical or other measurements. We do not guarantee the accuracy or correctness of any interpretations or recommendations and shall not be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our employees or agents. These interpretations are also subject to our general terms and conditions set out in our current Service Invoice.

SP	Depth	16" NRes
-300 mV 200	1in:20ft	0 Ohm-m 2000
Nat. Gamma		**64" NRes**
0 API 400		0 Ohm-m 2000
		SPR
		0 Ohms 200

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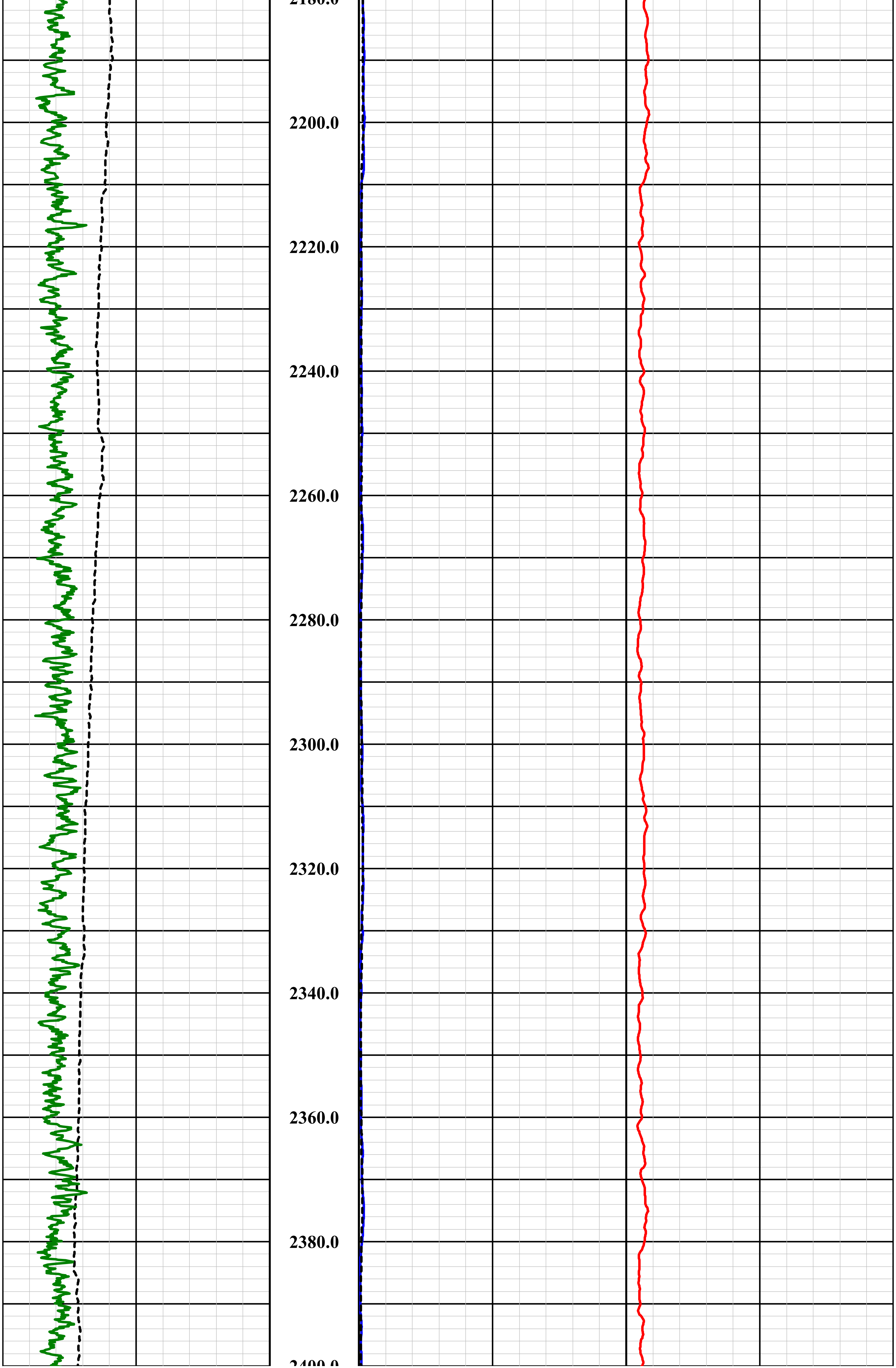
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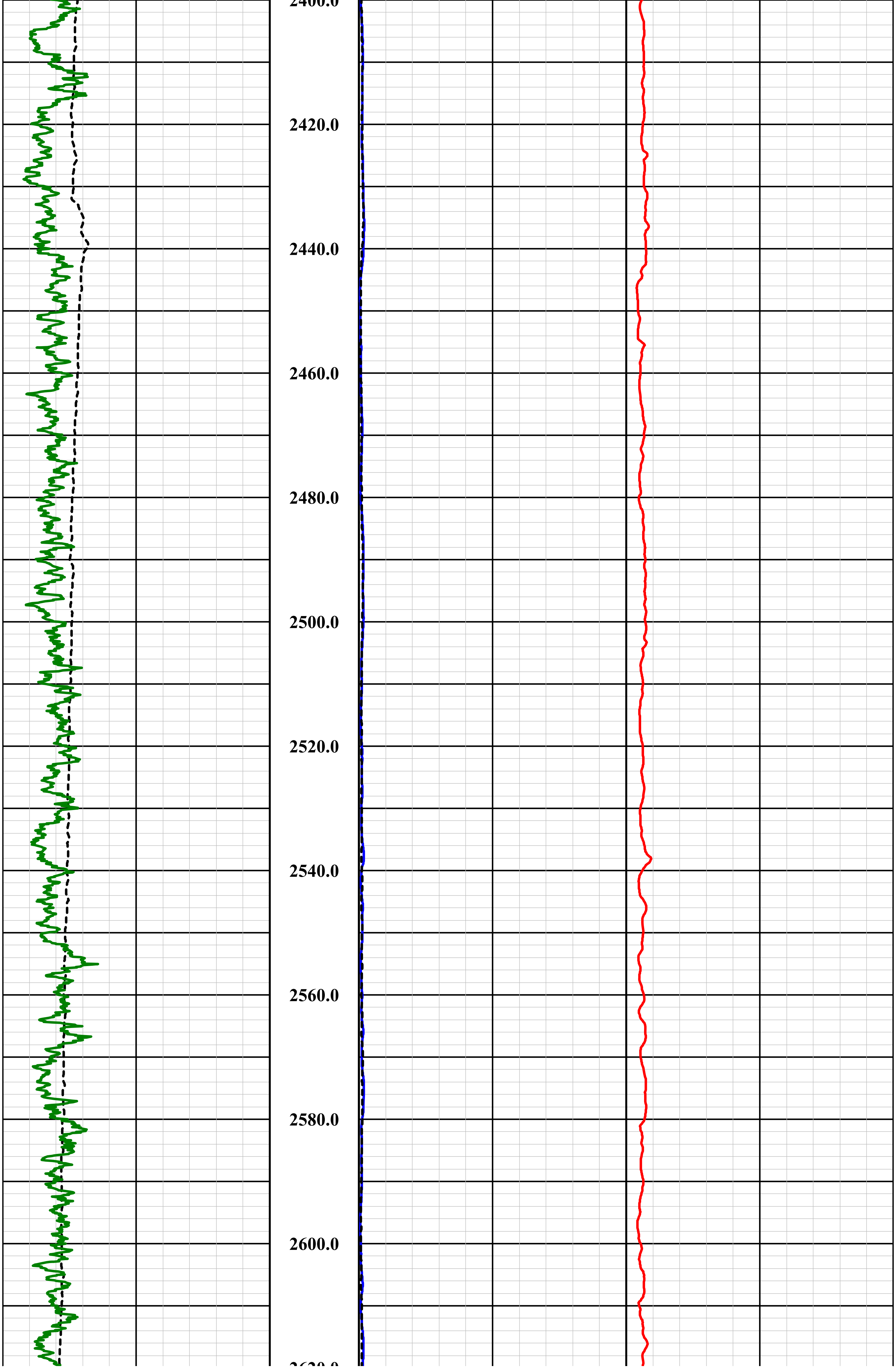
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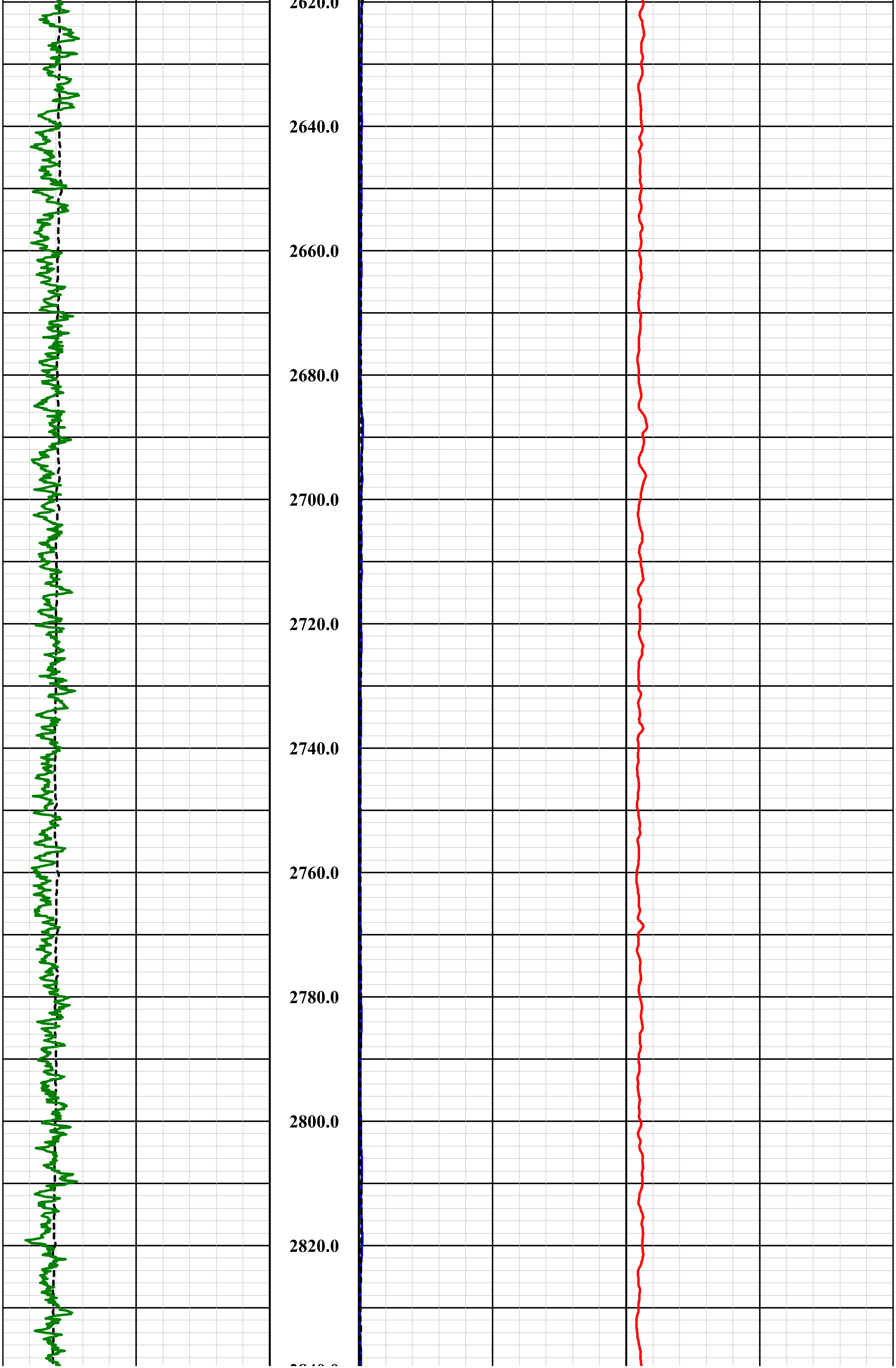
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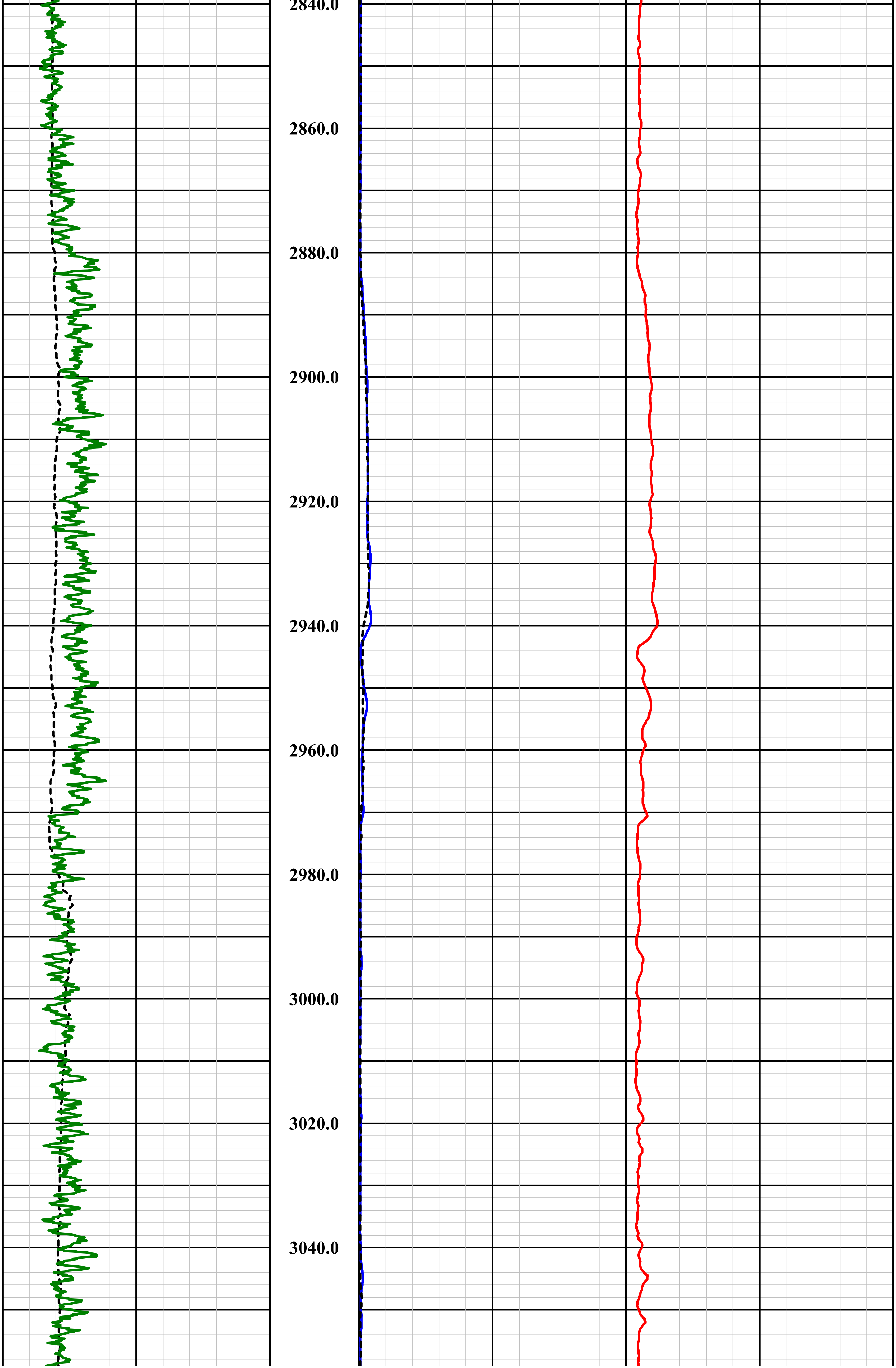
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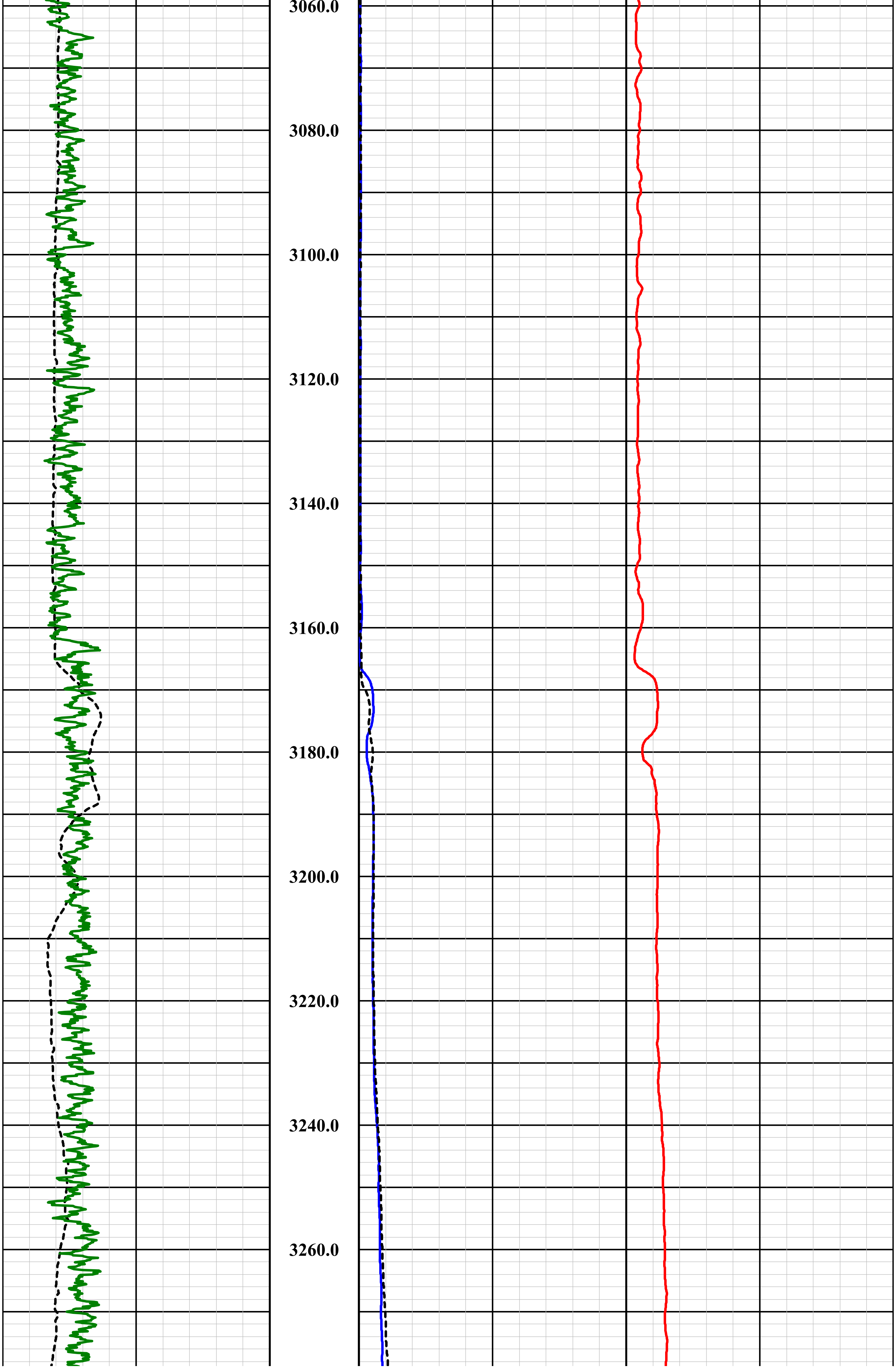
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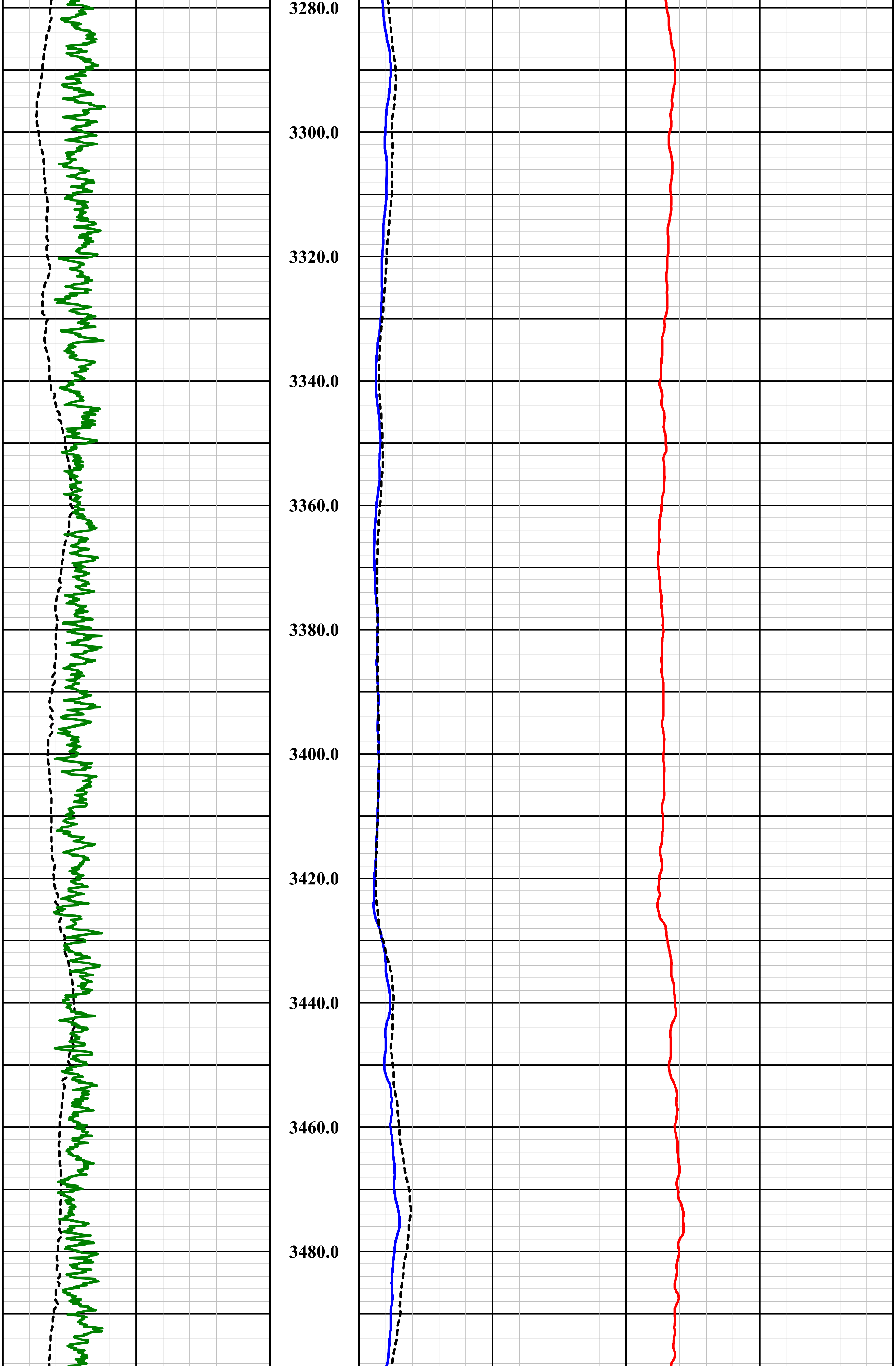
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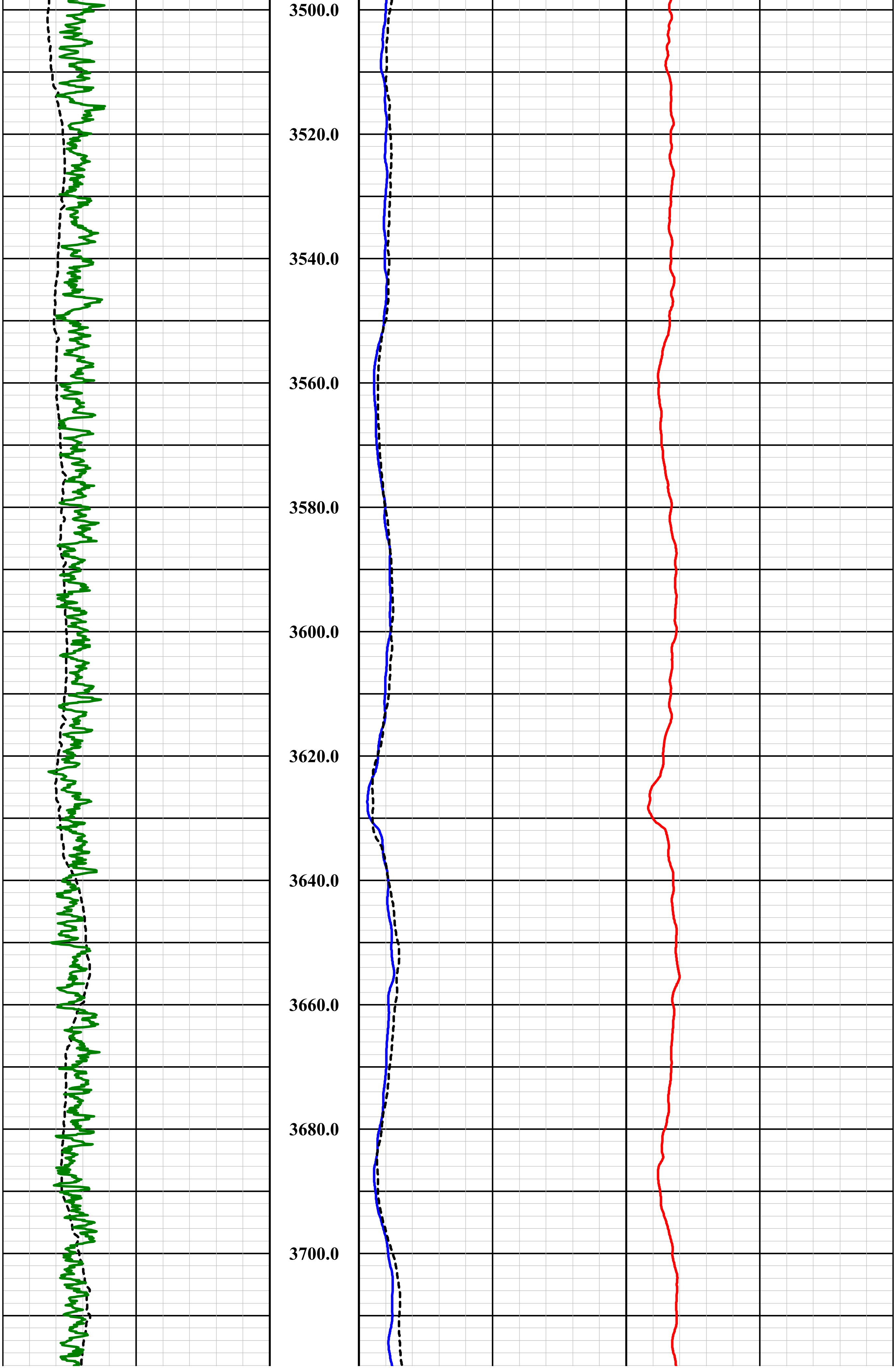
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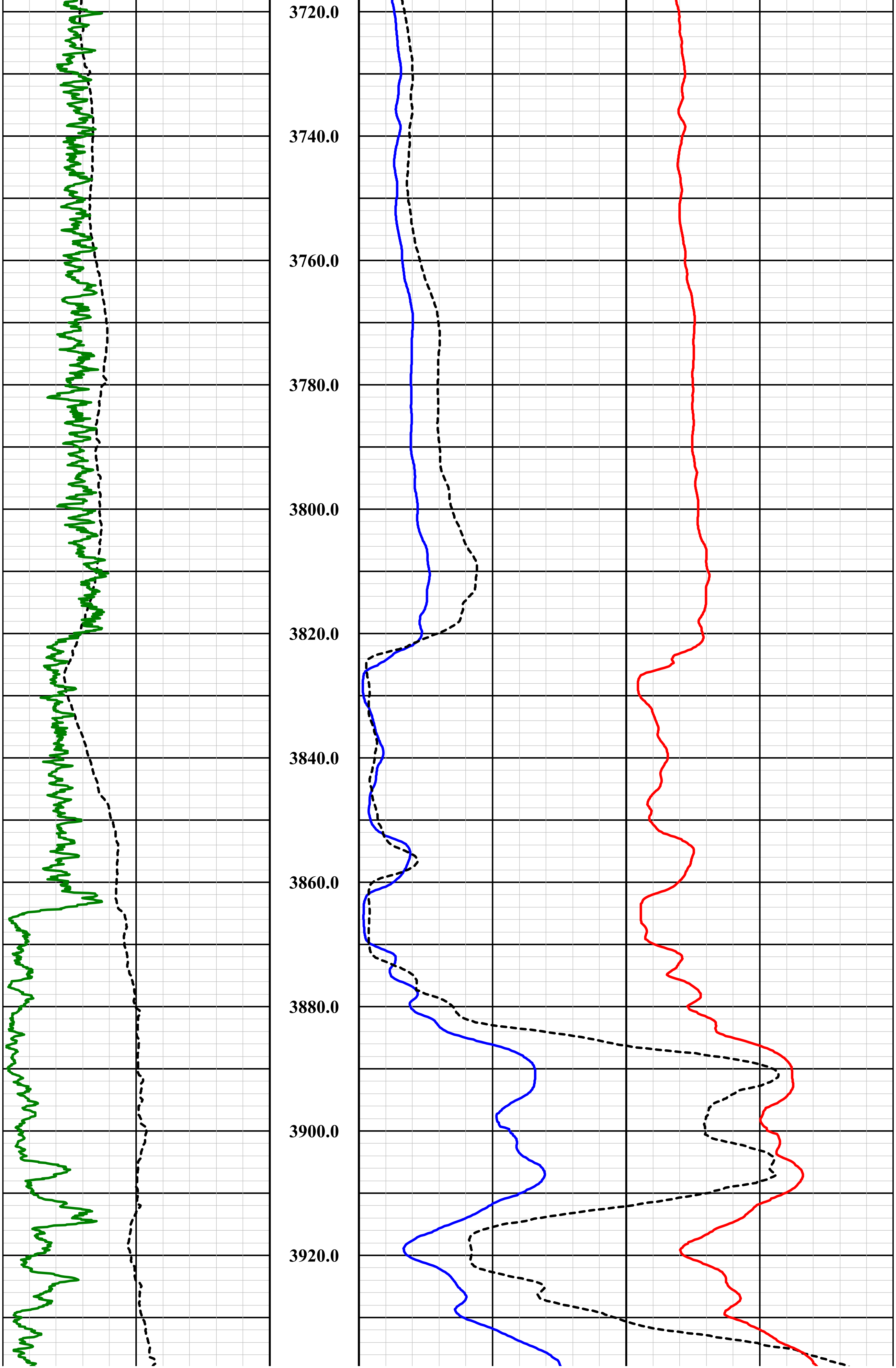
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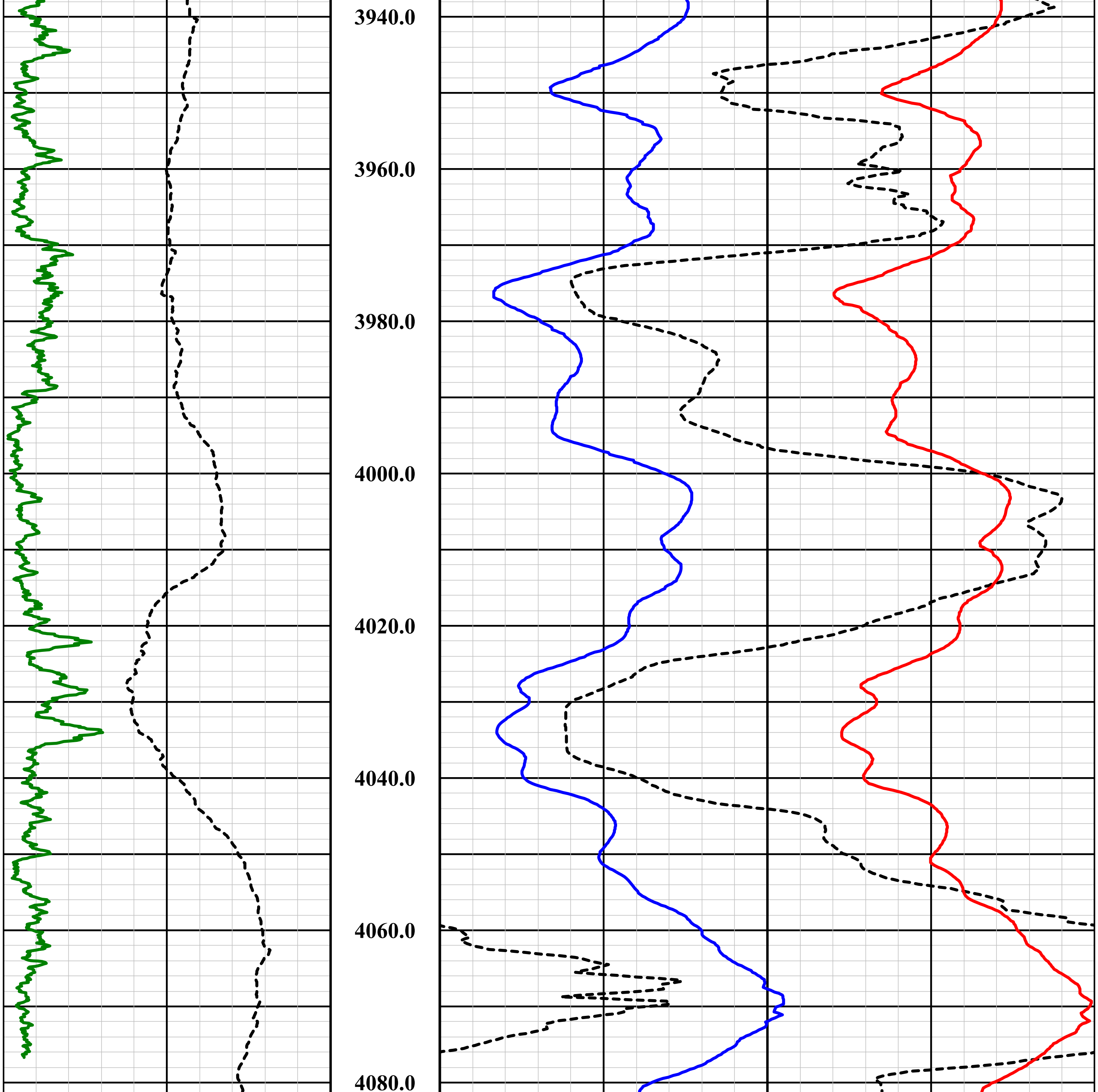


			0 Ohms 200 **SPR**
0 API 400 **Nat. Gamma**		0 Ohm-m 2000 **64" NRes**	
-300 mV 200 **SP**	1in:20ft **Depth**	0 Ohm-m 2000 **16" NRes**	

GeoVista E-Log Tool

Probe Top = Depth Ref.

Tool SN: 4035 & 4790

Bridle connects to wireline cablehead: Wireline armor is the B Electrode.

Four Conductor MSI Probe Top

Bridle Electrode (N Electrode)

64" Normal Resistivity Electrode/Spontaneous Potential Electrode
(M Electrode)

Probe Length = 2.3 m or 7.55 ft
Bridle Length = 10.0 m or 32.81 ft

Probe Weight = 7.0 kg or 15.4 lbs

Can only be collected in fluid

Isolation Bridle - Not shown in diagram but is necessary for operation

Electrode Measuring Points (from bottom of probe)
- Spontaneous Potential (SP): 0.65 m or 2.13 ft
- 16" Normal Resistivity (16" NRes): 0.50 m or 1.64 ft
- 64" Normal Resistivity (64" NRes): 1.10 m or 3.61 ft
- Single Point Resistance (SPR): 0.25 m or 0.82 ft

Temperature Rating: 80 Deg C (176 Deg F)
Presure Rating: 200 bar (2900 psi)

16" Normal Resistivity Electrode (M Electrode)

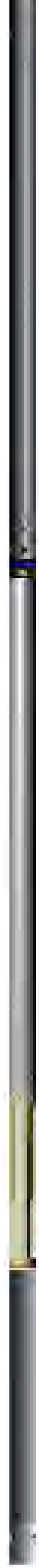
Current Electrode/Single Point Resistance
(A Electrode)

1.65" or 42 mm Diameter

MSI Gamma-Caliper-Temperature-Fluid Resistivity

Probe Top = Depth Ref.

Single Conductor MSI Probe Top



Probe Length = 2.59 m or 8.5 ft
Probe Weight = 6.80 kg or 15.0 lbs

Natural Gamma and Caliper can only be collected logging up hole.

Fluid Temperature/Resistivity can only be collected logging down hole.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)

Natural Gamma Ray = 0.76 m (29.75 in)

NOTE: Lengths on a particular tool may vary from those listed on this document due to probe sizes and styles utilizedl

3-Arm Caliper = 1.44 m (56.75 in)

Distance from tool top: 2.20 m (86.5 in)

Available Arm Sizes: 3", 9", and 15"

TFR (Temperature/Fluid Resistivity) = 0.39 m (15.5 in)

1.375" or 34.9 mm Diameter

Southwest Exploration Services, LLC

Company	RESOLUTION COPPER MINING
Well	DHRES-16
Field	SUPERIOR
County	PINAL

borehole geophysics & video services

County	PINAL
State	ARIZONA

Preliminary **ELOG SUMMARY**

Southwest Exploration Services, LLC

borehole geophysics & video services

COMPANY	RESOLUTION COPPER
WELL ID	DHRES-16 (55-917232)
FIELD	RESOLUTION
COUNTY	PINAL
STATE	ARIZONA

TYPE OF LOGS: 4 RX SONIC

MORE: GAMMA-CALIPER

LOCATION
SE 1/4 OF SW 1/4 OF NE 1/4
944004 E, 830713 N

SEC 04 TWP 02 S RGE 12 E

OTHER SERVICES
E-LOG
COMBO
ABI-43

PERMANENT DATUM	AZ SPC, FEET	ELEVATION	2634 FT	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND LEVEL			G.L.

DATE	09-23-14	TYPE FLUID IN HOLE	FORMATION WATER
RUN No	1/3	MUD WEIGHT	N/A
TYPE LOG	SONIC-GAM-CAL	VISCOSITY	N/A
DEPTH-DRILLER	4085 FT	LEVEL	1280 FT
DEPTH-LOGGER	4083 FT	MAX. REC. TEMP.	71.29 DEG C
BTM LOGGED INTERVAL	4083 FT	IMAGE ORIENTED TO:	N/A
TOP LOGGED INTERVAL	1800 FT	SAMPLE INTERVAL	0.25 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	E. TURNER	TOOL STRING/SN	ALT FWS50-4RX #4572
WITNESSED BY	MATT - M&A	LOG TIME:ON SITE/OFF SITE	10:40 AM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	?	SURFACE	55 FT	14"		SURFACE	55 FT
2	12.25"	55 FT	1820 FT	7 5/8"		SURFACE	1805 FT
3	6.5"	1820 FT	TOTAL DEPTH				

COMMENTS:

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Tool Summary:

Date	09-23-14	**Date**	09-23-14	**Date**	09-23-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	MSI COMBO	**Tool Model**	ALT ABI43	**Tool Model**	ALT FWS50
Tool SN	5446	**Tool SN**	91601	**Tool SN**	4572
From	1800 FT	**From**	1800 FT	**From**	1800 FT
To	4083 FT	**To**	4083 FT	**To**	4083 FT
Recorded By	E. TURNER	**Recorded By**	E. TURNER	**Recorded By**	E. TURNER
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	9-19-14	**Operation Check**	9-19-14	**Operation Check**	9-19-14
Calibration Check	9-19-14	**Calibration Check**	N/A	**Calibration Check**	N/A
Time Logged	11:00 AM	**Time Logged**	1:45 PM	**Time Logged**	6:30 PM

Date	09-23-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	GEOVISTA ELOG	**Tool Model**		**Tool Model**	
Tool SN	4097	**Tool SN**		**Tool SN**	
From	1800 FT	**From**		**From**	
To	4083 FT	**To**		**To**	
Recorded By	E. TURNER	**Recorded By**		**Recorded By**	
Truck No	500	**Truck No**		**Truck No**	
Operation Check	9-19-14	**Operation Check**		**Operation Check**	
Calibration Check	9-19-14	**Calibration Check**		**Calibration Check**	
Time Logged	8:10 PM	**Time Logged**		**Time Logged**	

Additional Comments:

Caliper Arms Used: 9" **Calibration Points:** 4.75" - 14"

Disclaimer:

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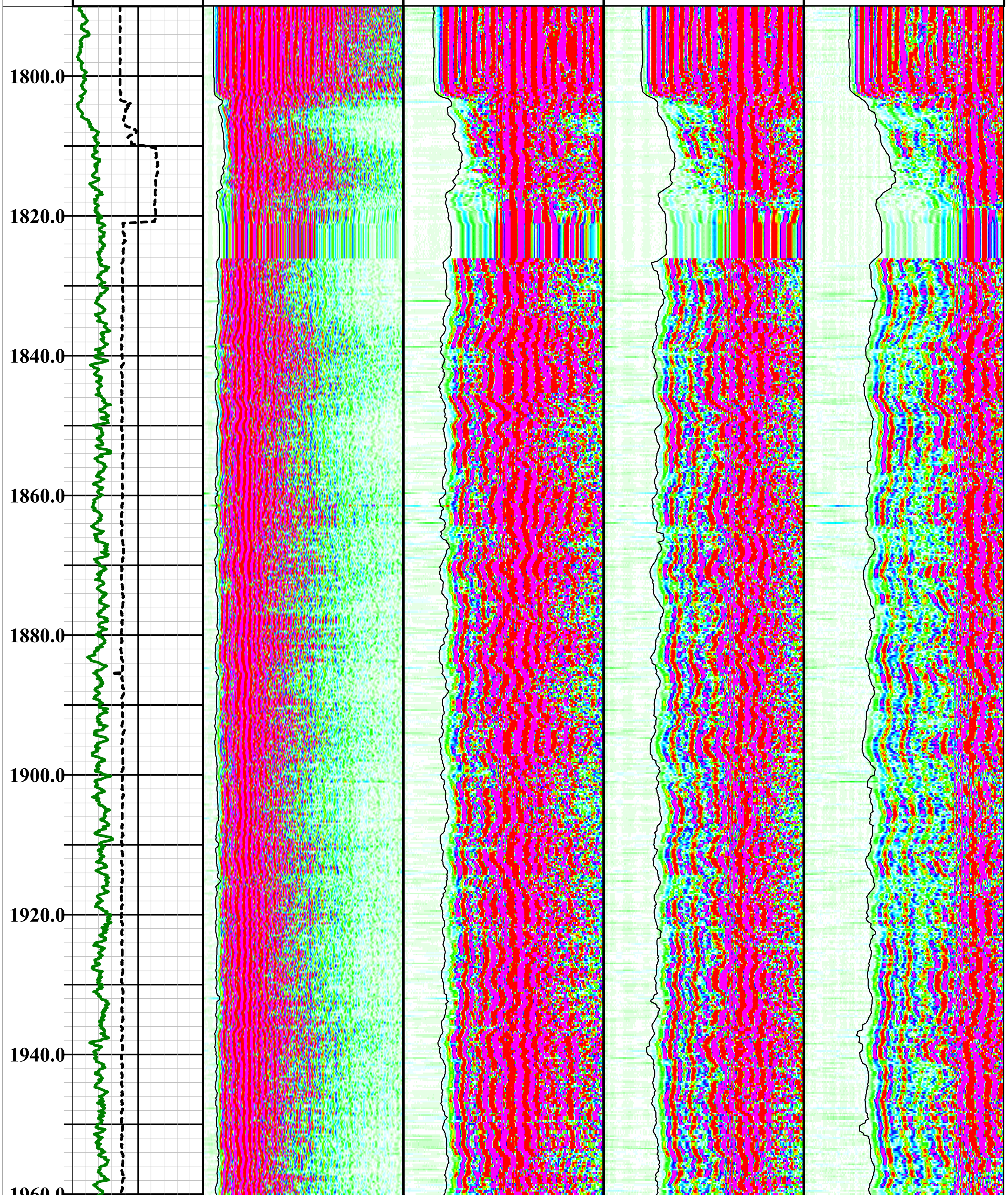
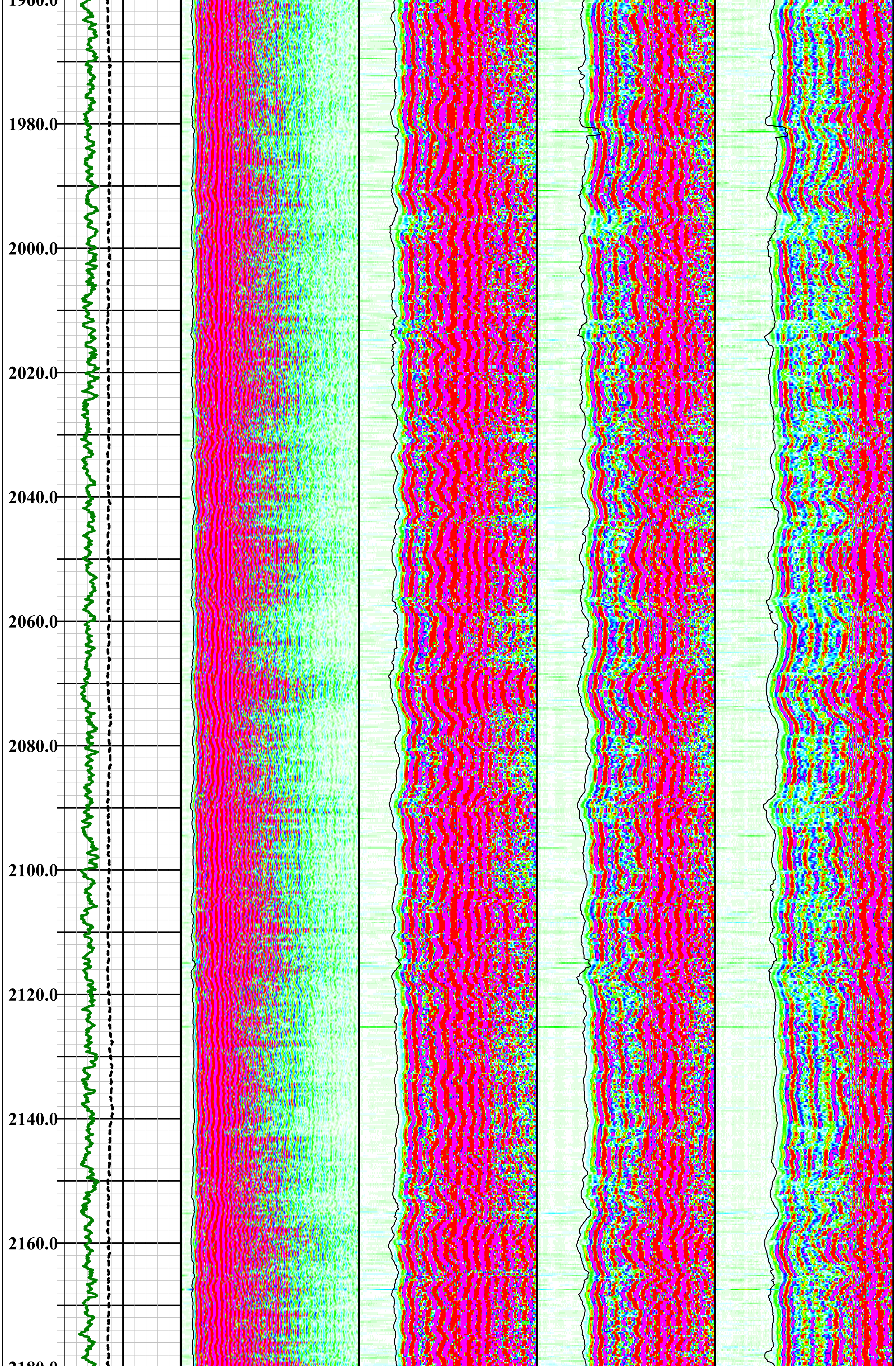
Depth	3-Arm Caliper	RX1 - Travel Time	RX2 - Travel Time	RX3 - Travel Time	RX4 - Travel Time
1in:20ft	0 Inches 20	100 uSec 2040	100 uSec 1020	100 uSec 1020	100 uSec 1020
	Nat. Gamma	RX1 - VDL	RX2 - VDL	RX3 - VDL	RX4 - VDL
	0 API 400	100 uSec 2040	100 uSec 1020	100 uSec 1020	100 uSec 1020

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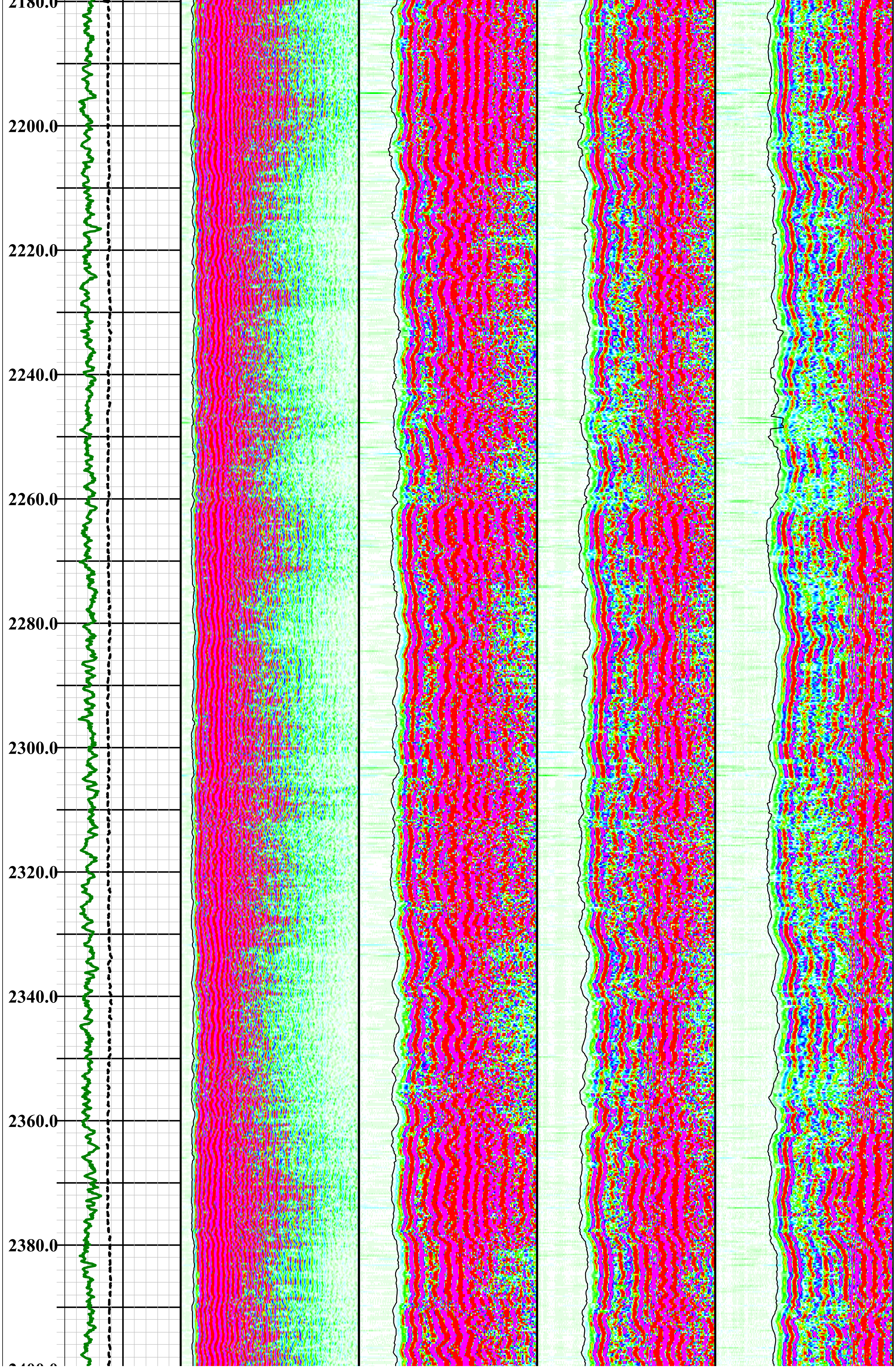
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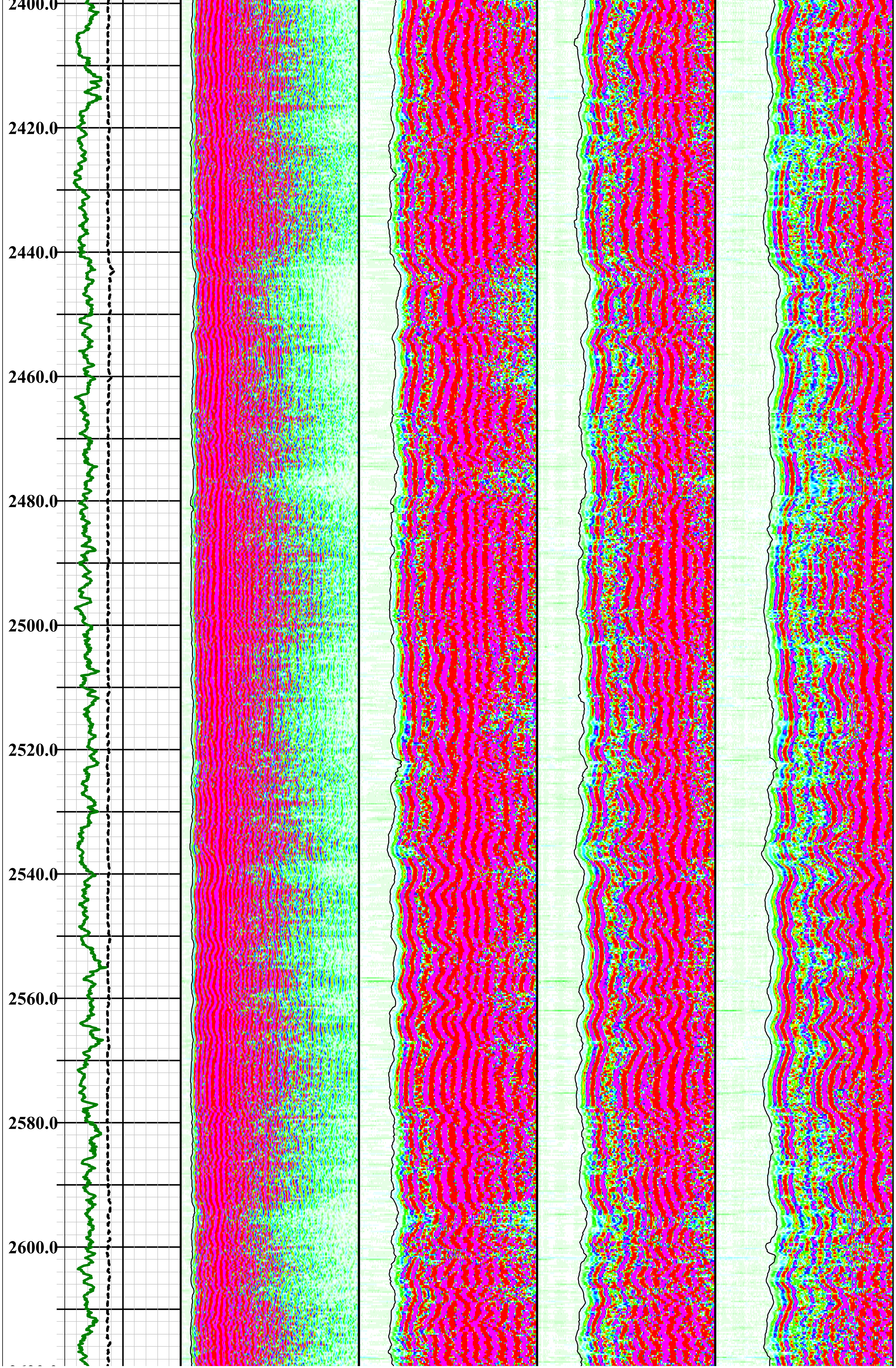
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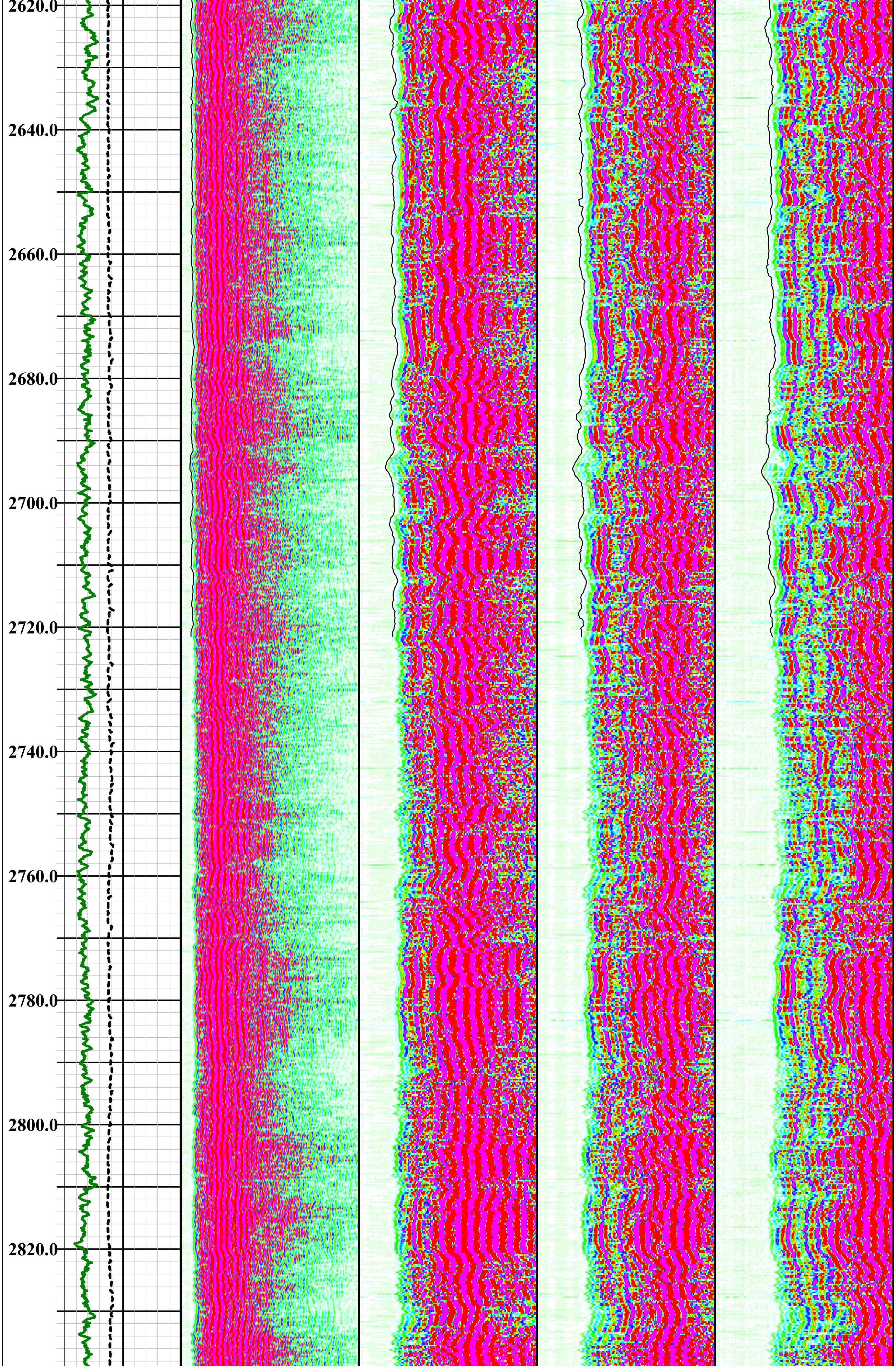
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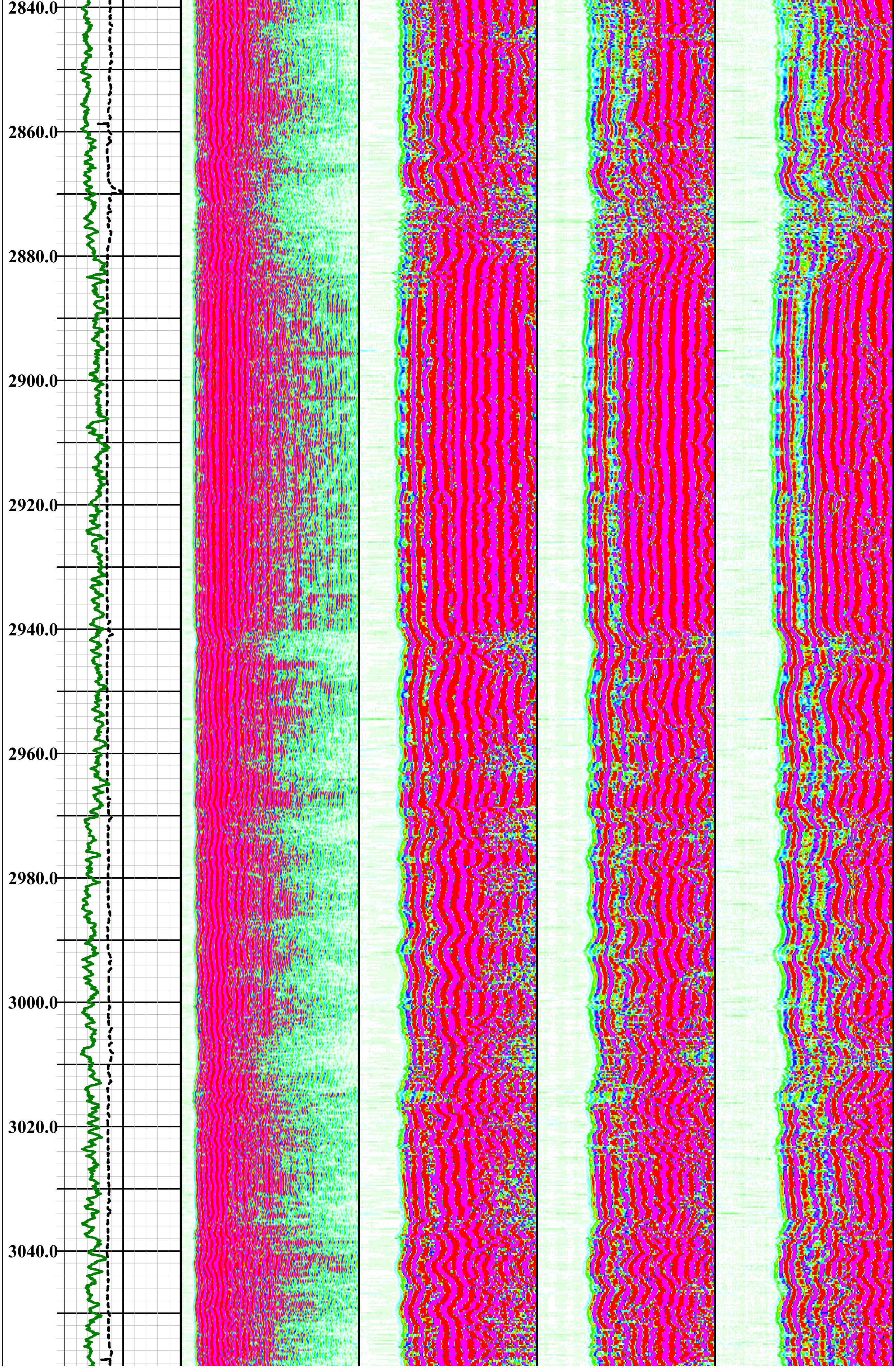
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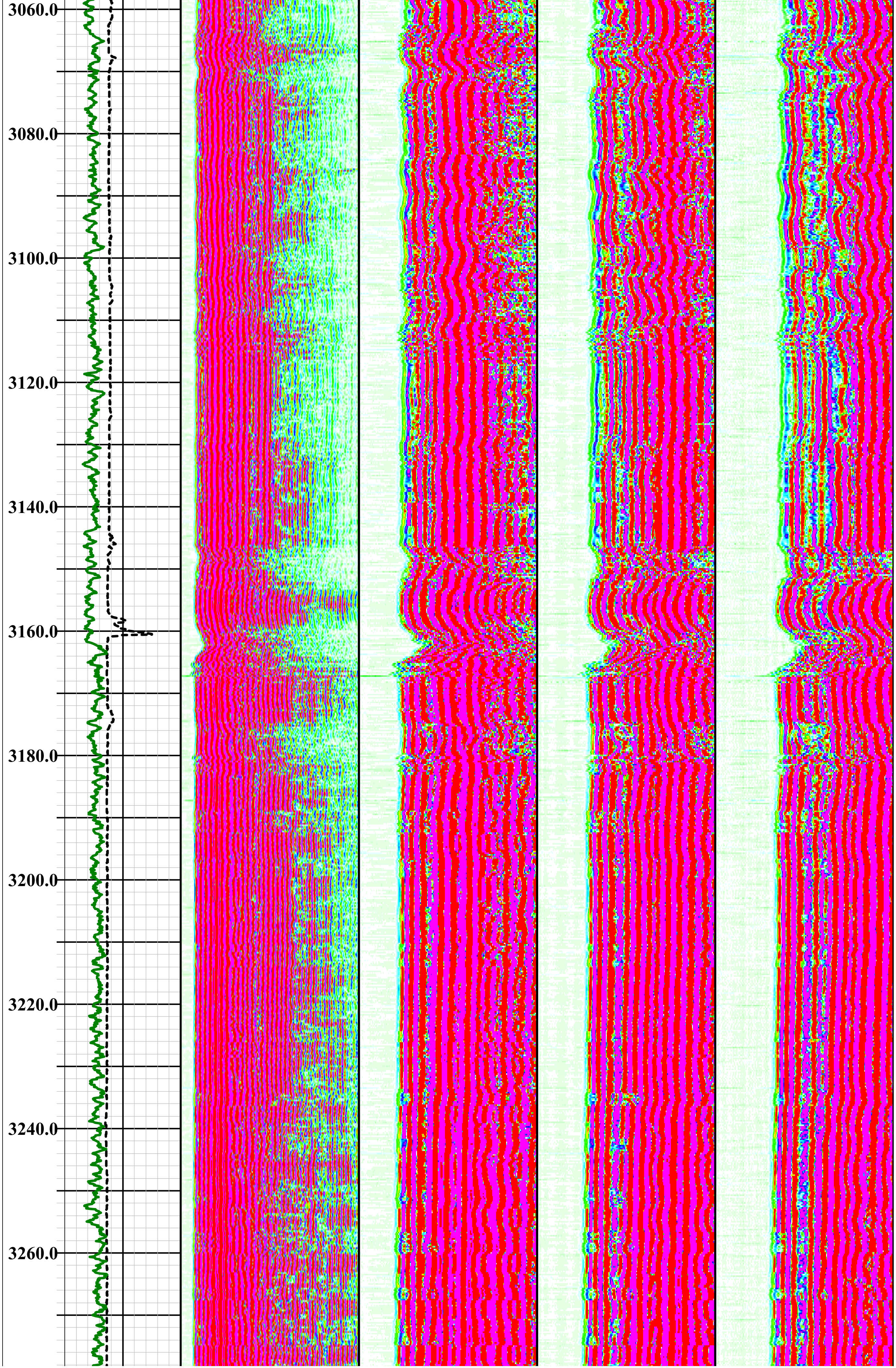
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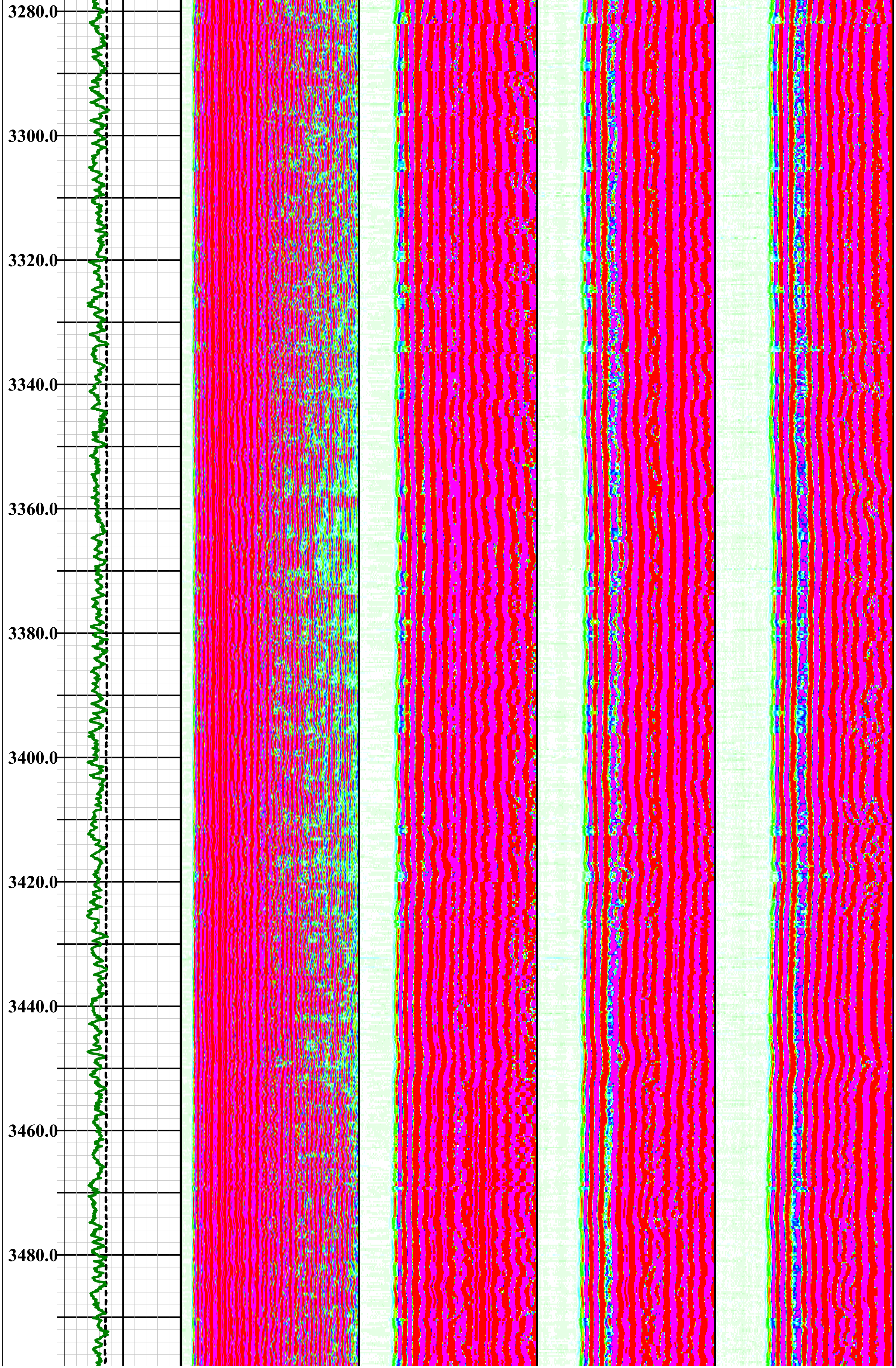
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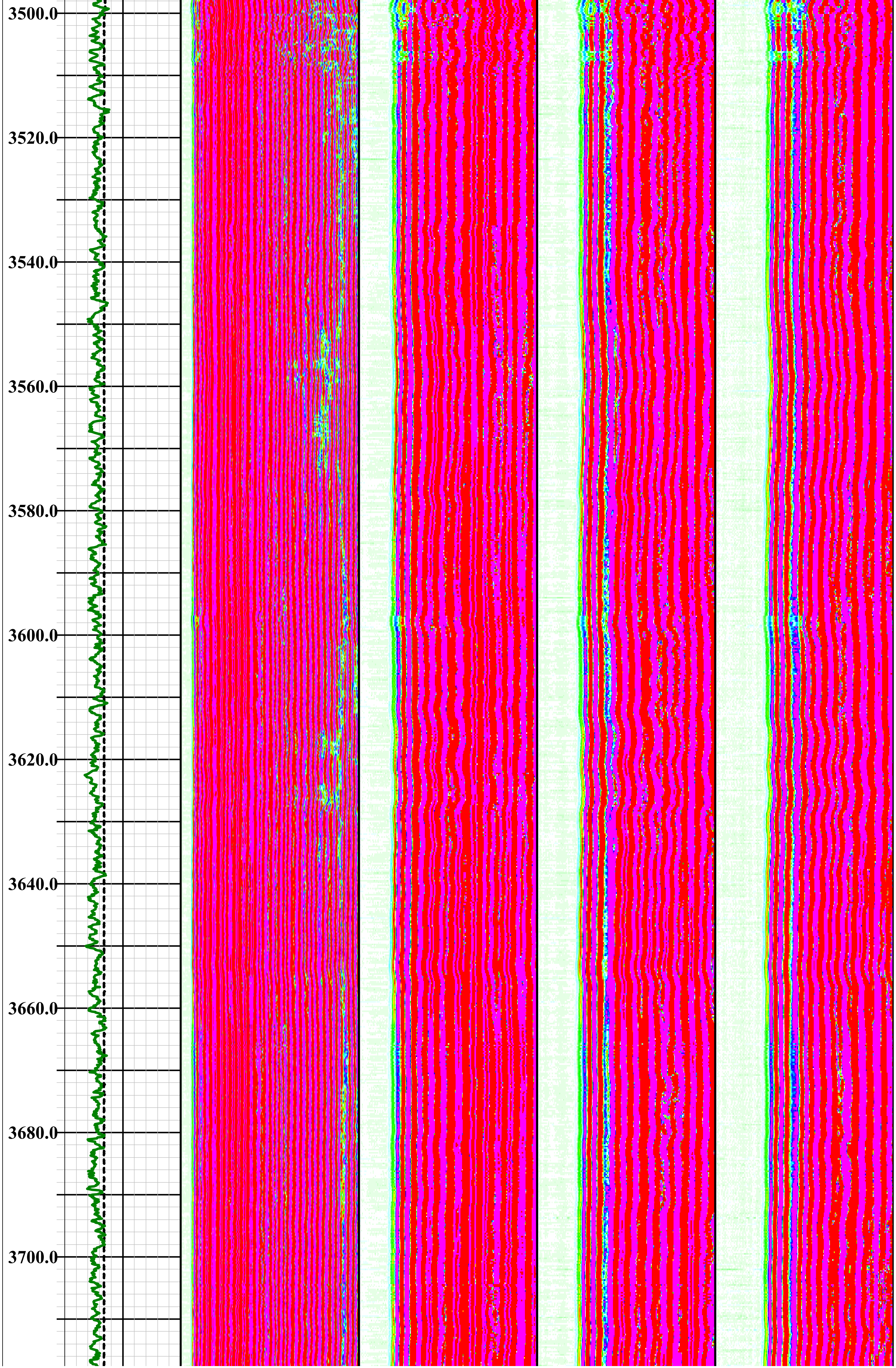
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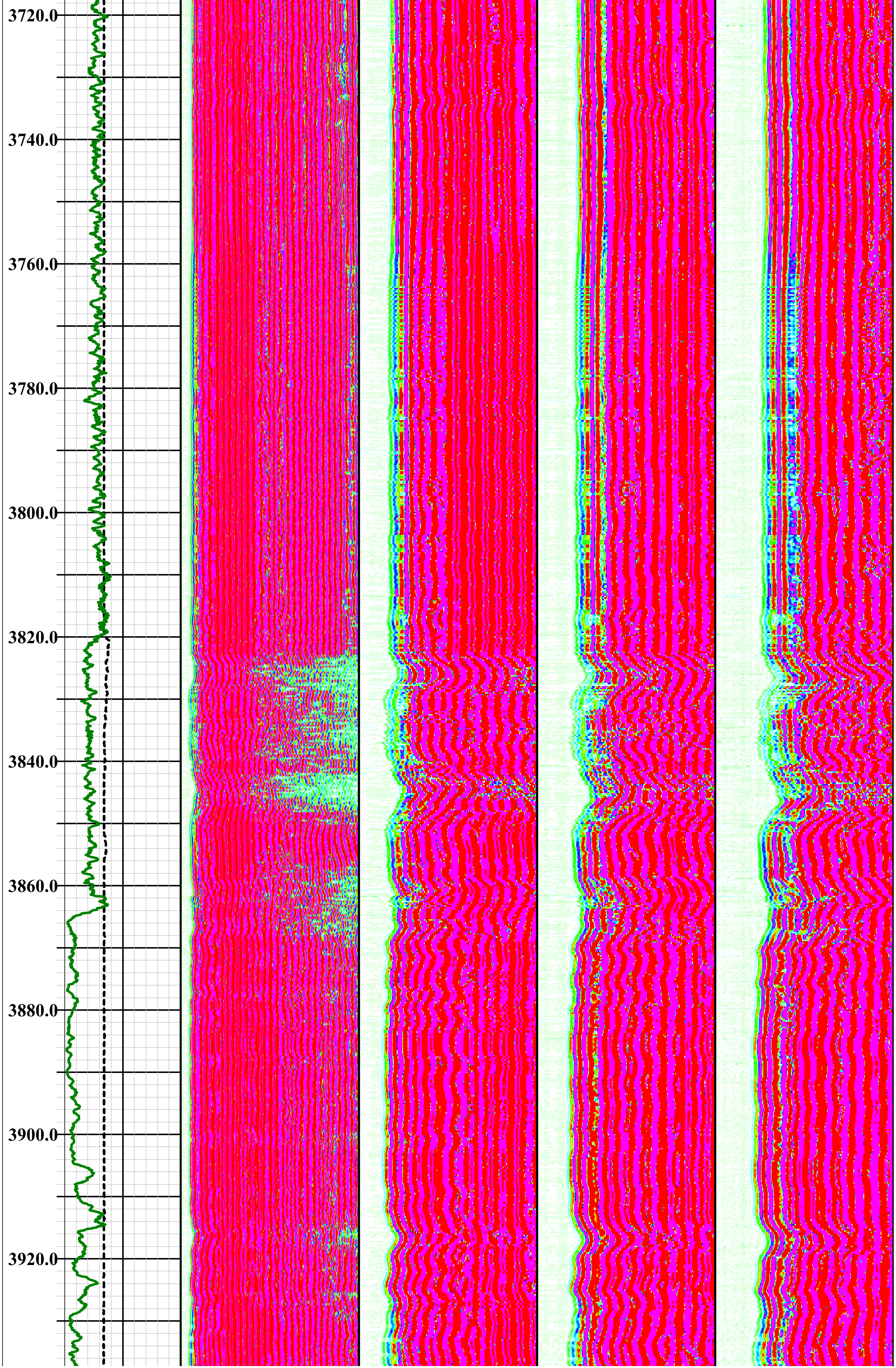
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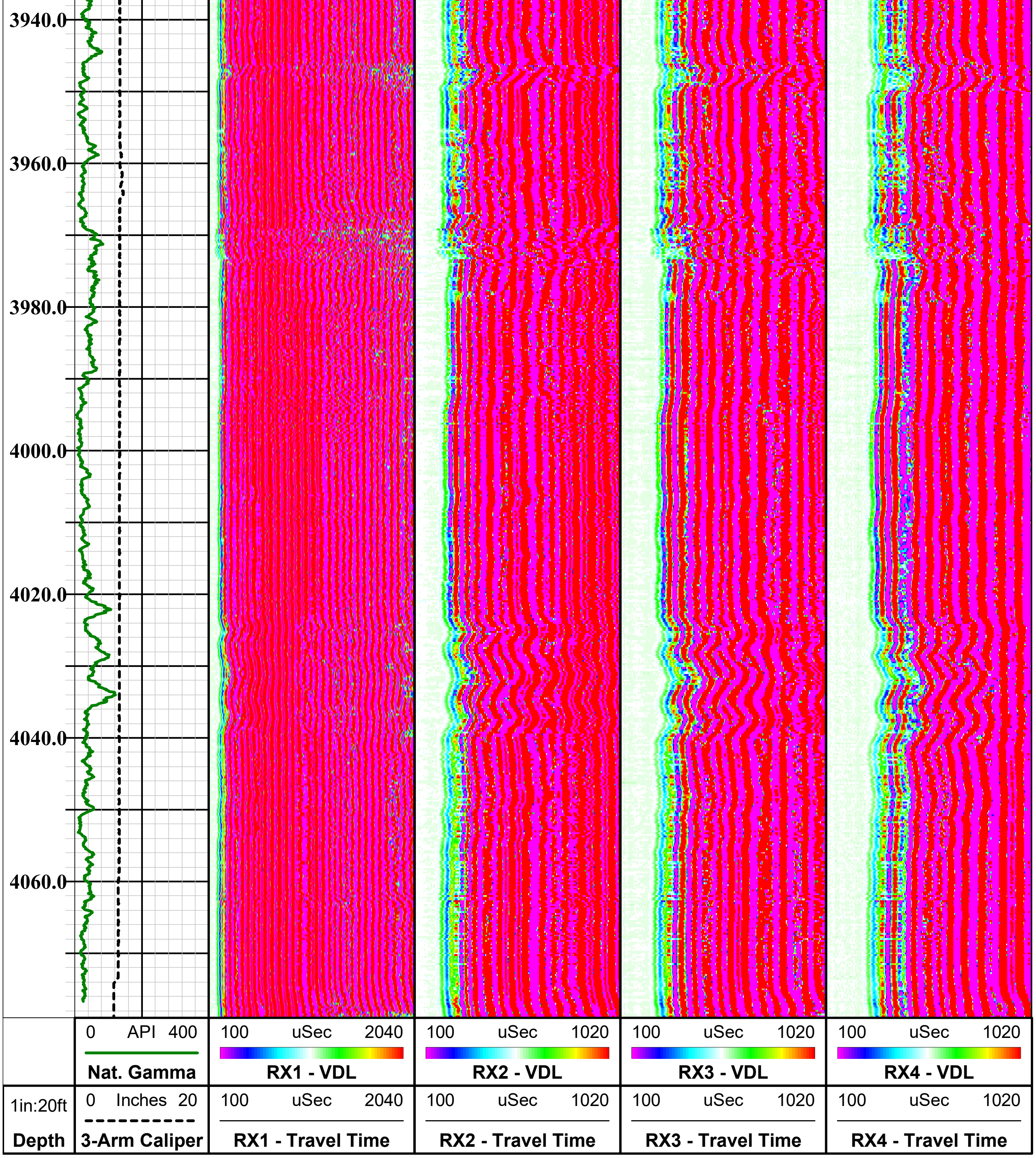


FWS50-4Rx Full Waveform Sonic Tool SN 4572

Probe Top = Depth Ref.

Probe Length = 2.78 m or 9.13 ft
Probe Weight = ~18.0 kg or 39.6 lbs

Sensors: Ceramic Piezoelectric in Polyurethane potting

Transmitter Frequency: ~20 kHz resonant frequency

Rx - Rx Spacing: 0.2 m (7.9 in)

Typically ran centralized with external bow spring centralizers.

Can only be collected in fluid.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)

Rx-4 Tx - Rx4 Spacing = 1.2 m (47.2 in)

Rx-3 Tx - Rx3 Spacing = 1.0 m (39.4 in)

Rx-2 Tx - Rx2 Spacing = 0.8 m (31.5 in)

Rx-1 Tx - Rx1 Spacing = 0.6 m (23.6 in)

Acoustic Isolater

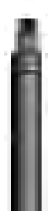
Tx = Acoustic Transmitter

0.235 m or 9.25 in. - End of tool to center of Tx

1.97" or 50 mm Diameter

MSI Gamma-Caliper-Temperature-Fluid Resistivity

Probe Top = Depth Ref.



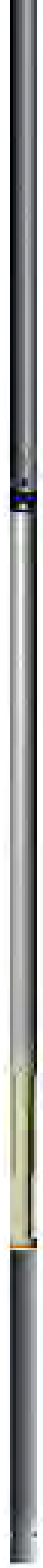
Single Conductor MSI Probe Top

Probe Length = 2.59 m or 8.5 ft
Probe Weight = 6.80 kg or 15.0 lbs

Natural Gamma and Caliper can only be collected logging up hole.

Fluid Temperature/Resistivity can only be collected logging down hole.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)



Natural Gamma Ray = 0.76 m (29.75 in)

NOTE: Lengths on a particular tool may vary from those listed on this document due to probe sizes and styles utilizedl

3-Arm Caliper = 1.44 m (56.75 in)

Distance from tool top: 2.20 m (86.5 in)

Available Arm Sizes: 3", 9", and 15"

TFR (Temperature/Fluid Resistivity) = 0.39 m (15.5 in)

1.375" or 34.9 mm Diameter

Southwest Exploration Services, LLC
borehole geophysics & video services

Company	RESOLUTION COPPER MINING
Well	DHRES-16
Field	SUPERIOR
County	PINAL
State	ARIZONA

Southwest Exploration Services, LLC

borehole geophysics & video services

COMPANY	RESOLUTION COPPER
WELL ID	DHRES-16 (55-917232)
FIELD	RESOLUTION
COUNTY	PINAL — STATE ARIZONA

TYPE OF LOGS: ACOUSTIC TELEVIEWER
MORE: 3-ARM CALIPER

OTHER SERVICES
E-LOG
SONIC
COMBO

LOCATION
SE 1/4 OF SW 1/4 OF NE 1/4
944004 E, 830713 N

SEC 04 TWP 02 S RGE 12 E

PERMANENT DATUM	AZSPC, FEET	ELEVATION	2634 FT	K.B.
LOG MEAS. FROM	GROUND LEVEL	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND LEVEL			G.L.

DATE	09-23-14	TYPE FLUID IN HOLE	FORMATION WATER
RUN No	1/2	MUD WEIGHT	N/A
TYPE LOG	ACOUSTIC TELEVIEWER	VISCOSITY	N/A
DEPTH-DRILLER	4085 FT	LEVEL	1280 FT
DEPTH-LOGGER	4083 FT	MAX. REC. TEMP.	71.29 DEG C
BTM LOGGED INTERVAL	4083 FT	IMAGE ORIENTED TO:	MAG NORTH
TOP LOGGED INTERVAL	1800 FT	SAMPLE INTERVAL	0.0125 FT
DRILLER / RIG#	NATIONAL	LOGGING TRUCK	TRUCK #500
RECORDED BY / Logging Eng.	E. TURNER	TOOL STRING/SN	ALT ABI-43 SN- 91601
WITNESSED BY	MATT - M&A	LOG TIME:ON SITE/OFF SITE	10:40 AM

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	19"	SURFACE	56 FT	14"		SURFACE	56 FT
2	12.25"	56 FT	1820 FT	7 5/8"		SURFACE	1805 FT
3	6.5"	1820 FT	TOTAL DEPTH				

COMMENTS:

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Tool Summary:

Date	09-23-14	**Date**	09-23-14	**Date**	09-23-14
Run No.	1	**Run No.**	2	**Run No.**	3
Tool Model	MSI COMBO	**Tool Model**	ALT ABI43	**Tool Model**	ALT FWS50
Tool SN	5446	**Tool SN**	91601	**Tool SN**	4572
From	1800 FT	**From**	1800 FT	**From**	1800 FT
To	4083 FT	**To**	4083 FT	**To**	4083 FT
Recorded By	E. TURNER	**Recorded By**	E. TURNER	**Recorded By**	E. TURNER
Truck No	500	**Truck No**	500	**Truck No**	500
Operation Check	9-19-14	**Operation Check**	9-19-14	**Operation Check**	9-19-14
Calibration Check	9-19-14	**Calibration Check**	N/A	**Calibration Check**	N/A
Time Logged	11:00 AM	**Time Logged**	1:45 PM	**Time Logged**	6:30 PM

Date	09-23-14	**Date**		**Date**	
Run No.	4	**Run No.**	5	**Run No.**	6
Tool Model	GEOVISTA ELOG	**Tool Model**		**Tool Model**	
Tool SN	4097	**Tool SN**		**Tool SN**	
From	1800 FT	**From**		**From**	
To	4083 FT	**To**		**To**	
Recorded By	E. TURNER	**Recorded By**		**Recorded By**	
Truck No	500	**Truck No**		**Truck No**	
Operation Check	9-19-14	**Operation Check**		**Operation Check**	
Calibration Check	9-19-14	**Calibration Check**		**Calibration Check**	
Time Logged	8:10 PM	**Time Logged**		**Time Logged**	

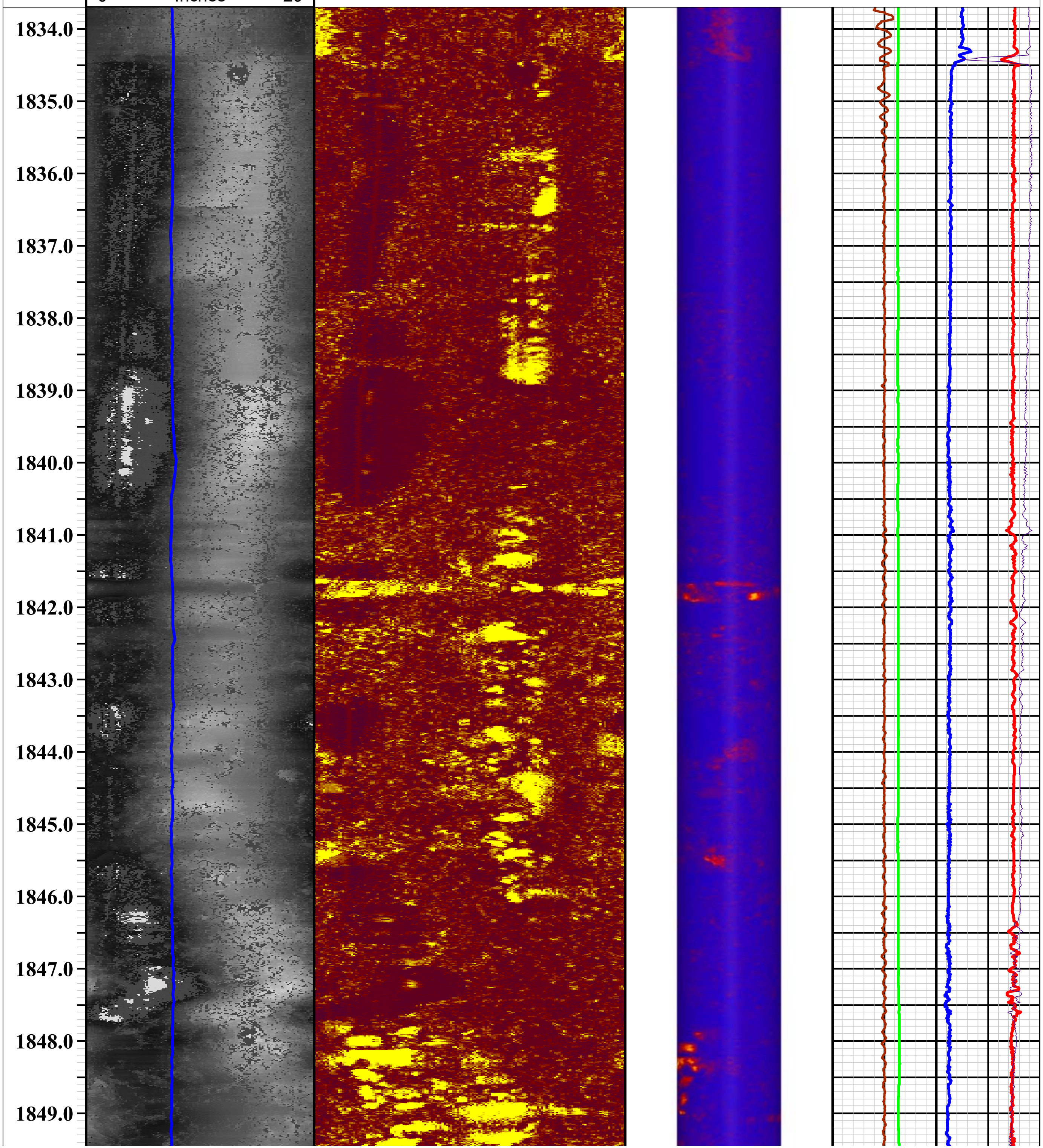
Additional Comments:

Caliper Arms Used: 9" **Calibration Points:** 4.75" - 14"

Disclaimer:

All interpretations of log data are opinions based on inferences from electrical or other measurements. We do not guarantee the accuracy or correctness of any interpretations or recommendations and shall not be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our employees or agents. These interpretations are also subject to our general terms and conditions set out in our current Service Invoice.

Depth	TravelTime-NM-Upper	Amplitude-NM-Upper	3-D View	Mag Field	Tilt
1in:2ft	Oriented Mag North 0° 90° 180° 270° 0°	Oriented Mag North 0° 90° 180° 270° 0°	-0°	40 uT 60	0 Deg 8
				Gravity 0.8 G 1.2	Azimuth 0 360
	TravelTime-NM-Lower Oriented Mag North 0° 90° 180° 270° 0°	Amplitude-NM-Lower Oriented Mag North 0° 90° 180° 270° 0°			RBR -90 270
	3-Arm Caliper 0 Inches 20				



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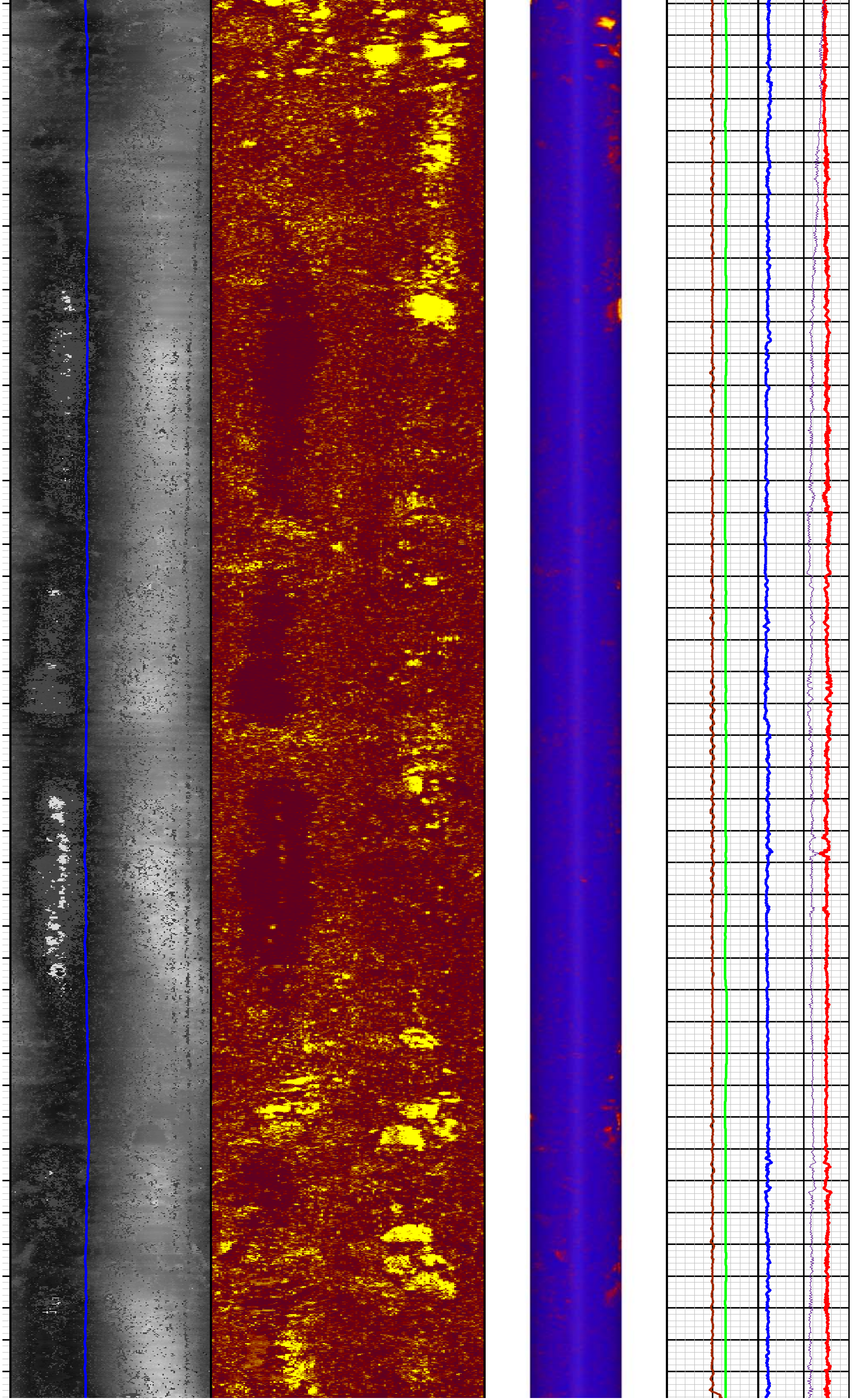

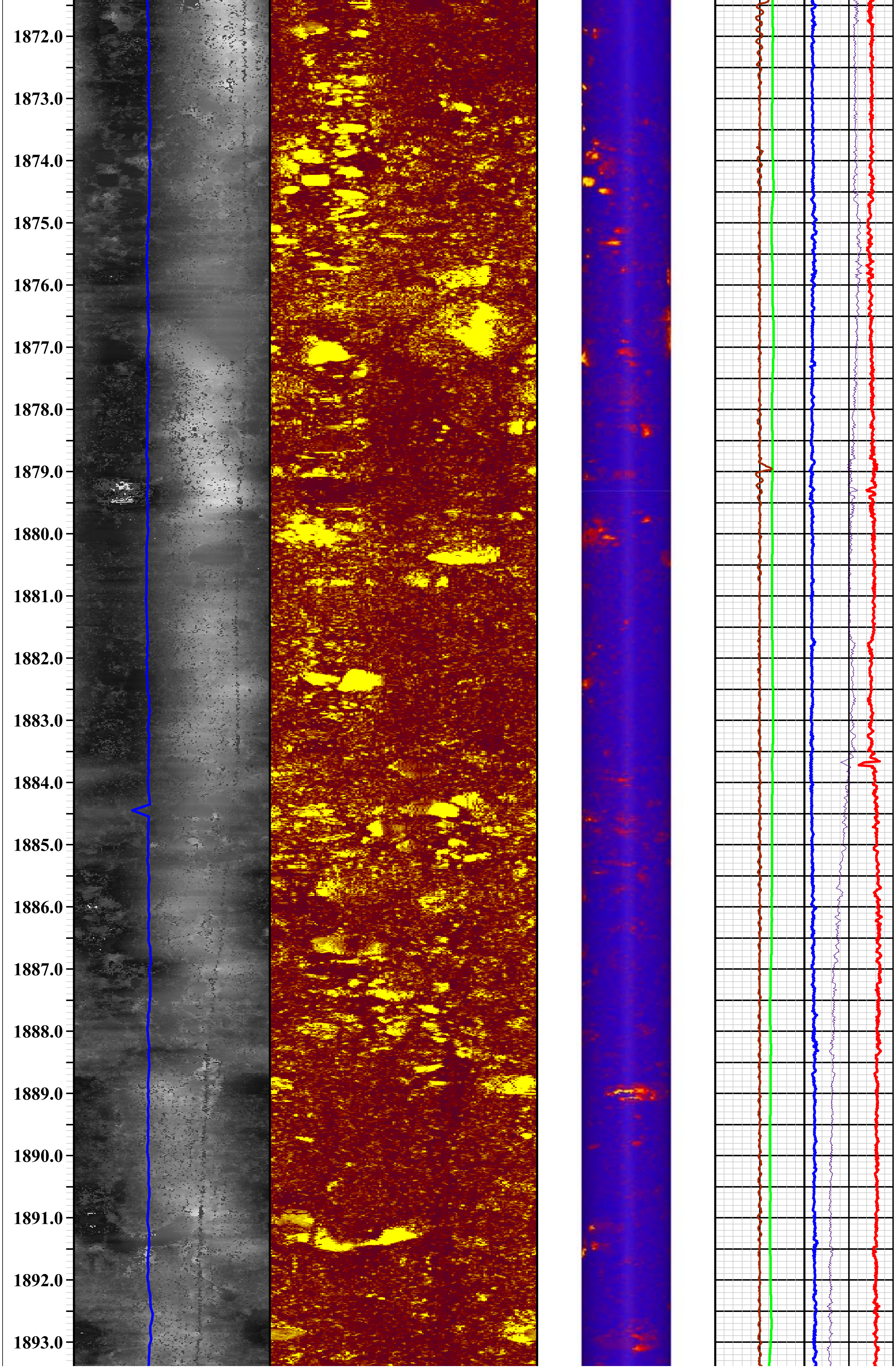
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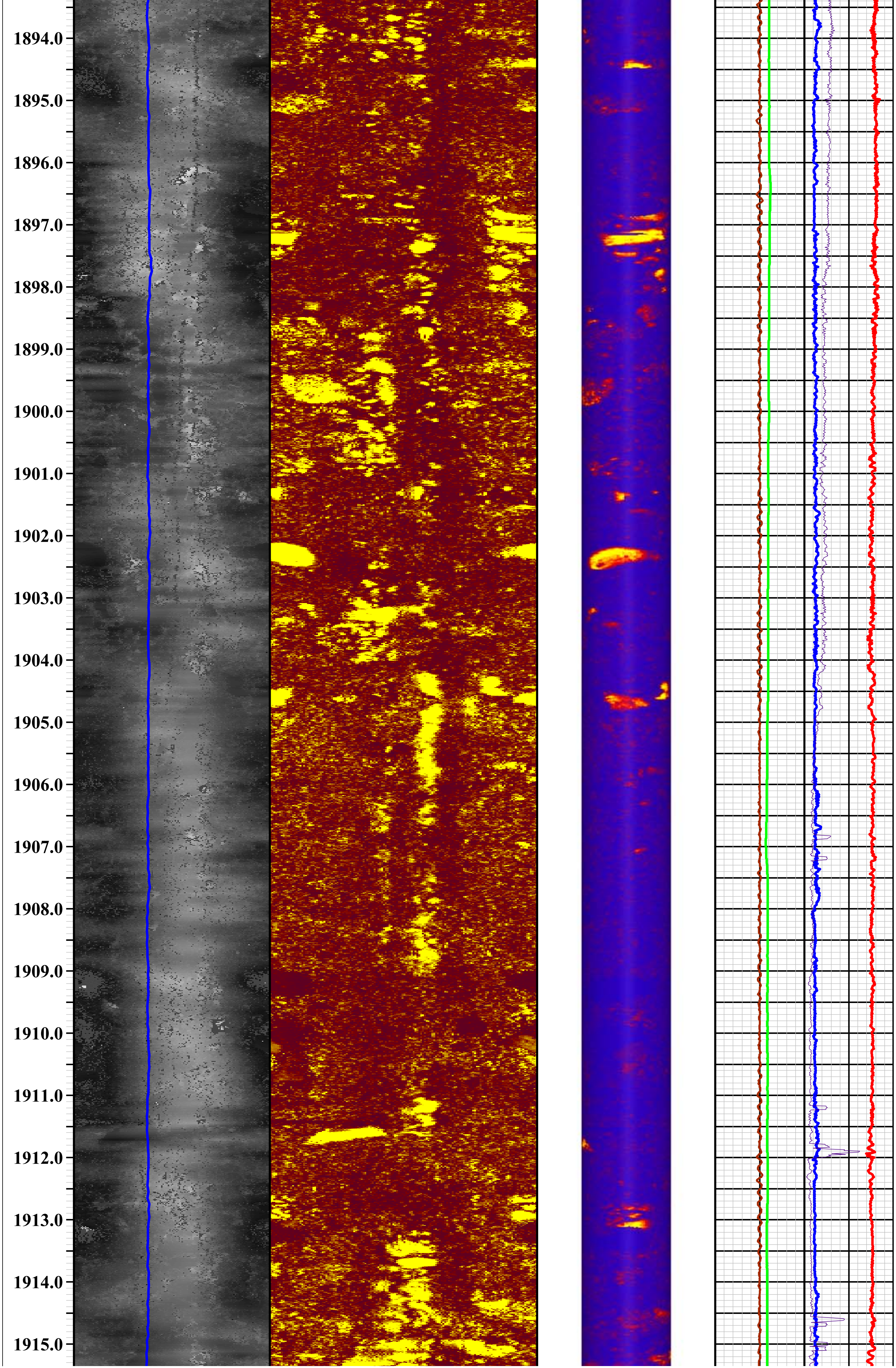
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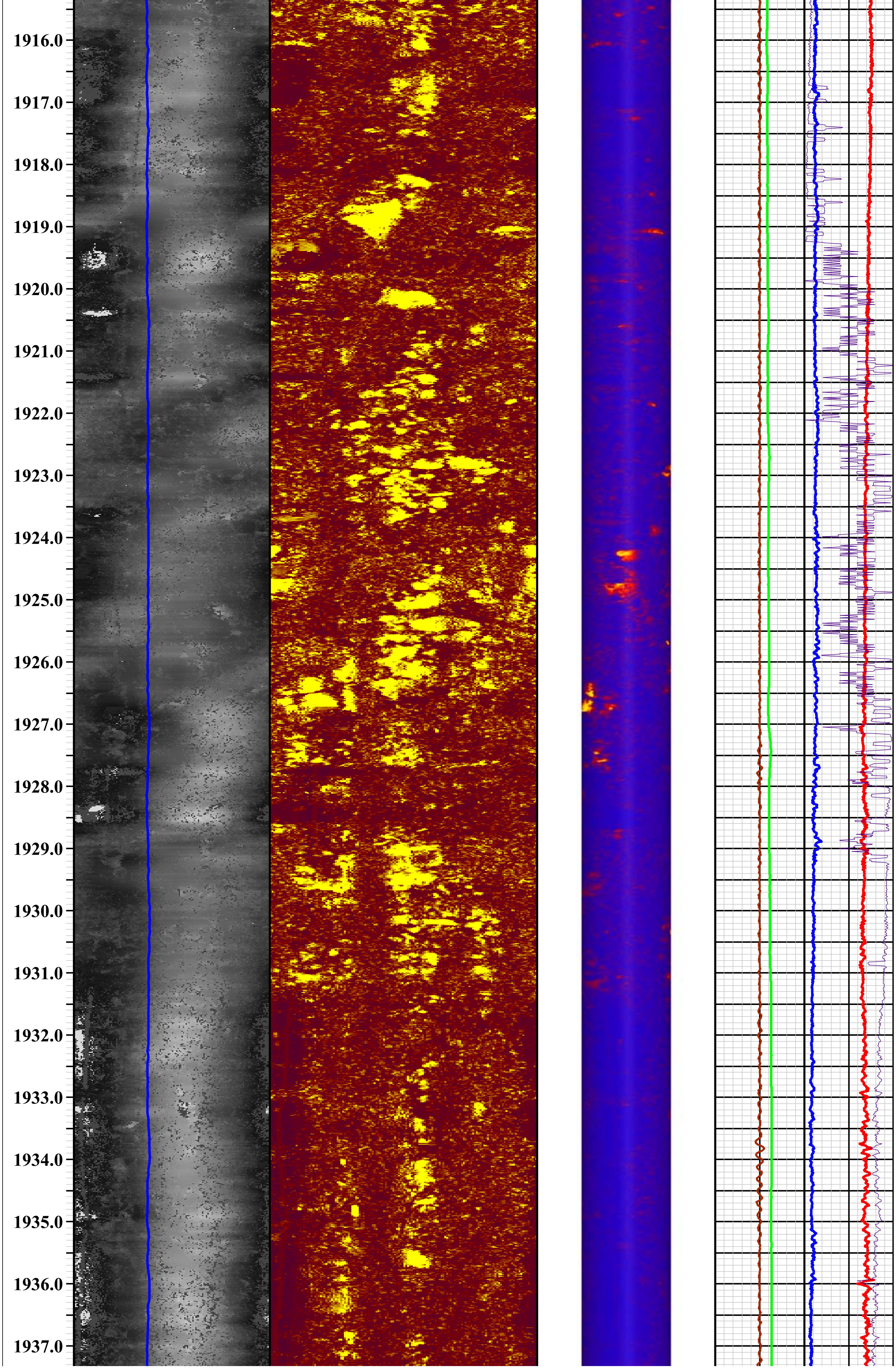
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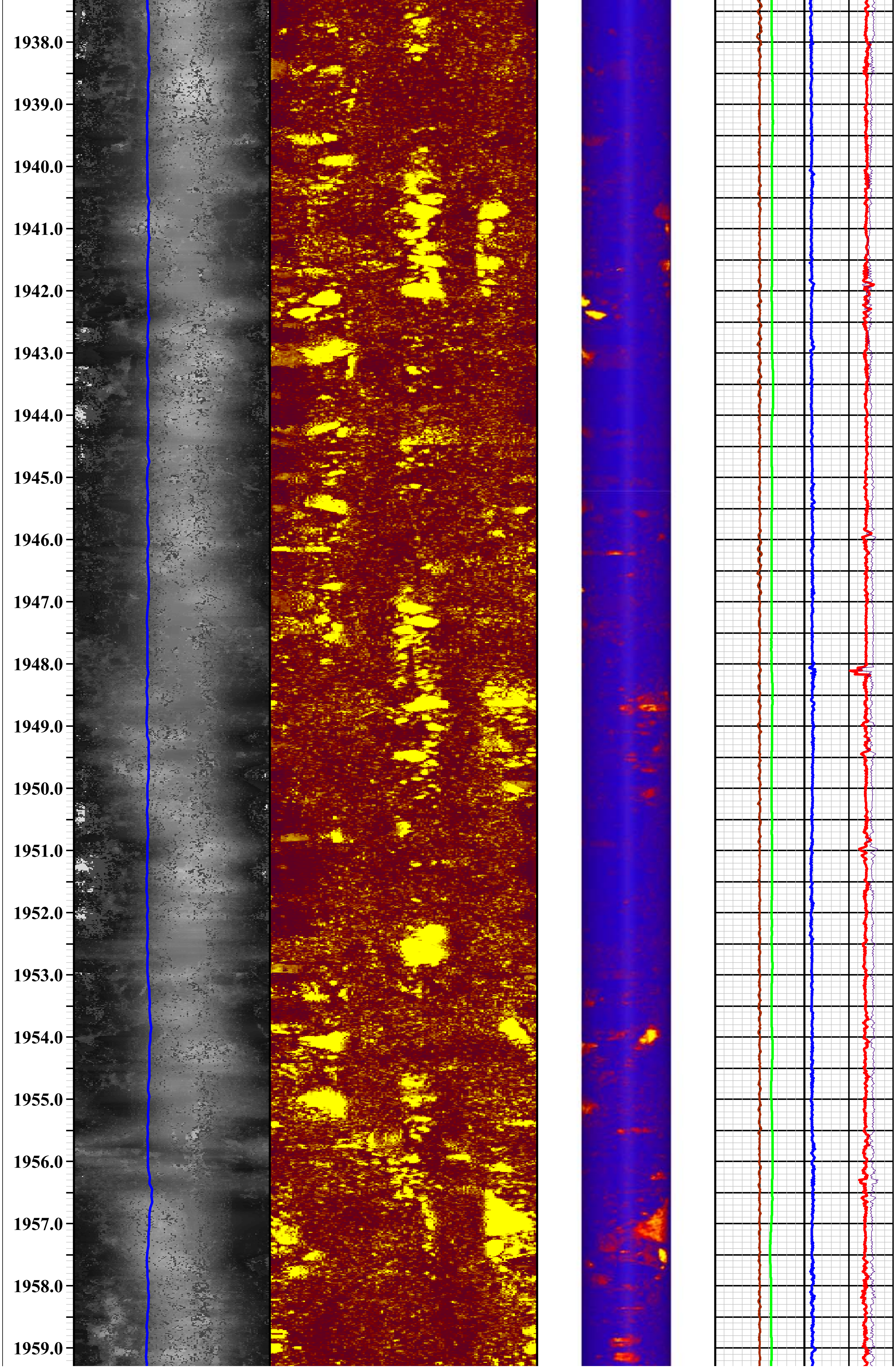
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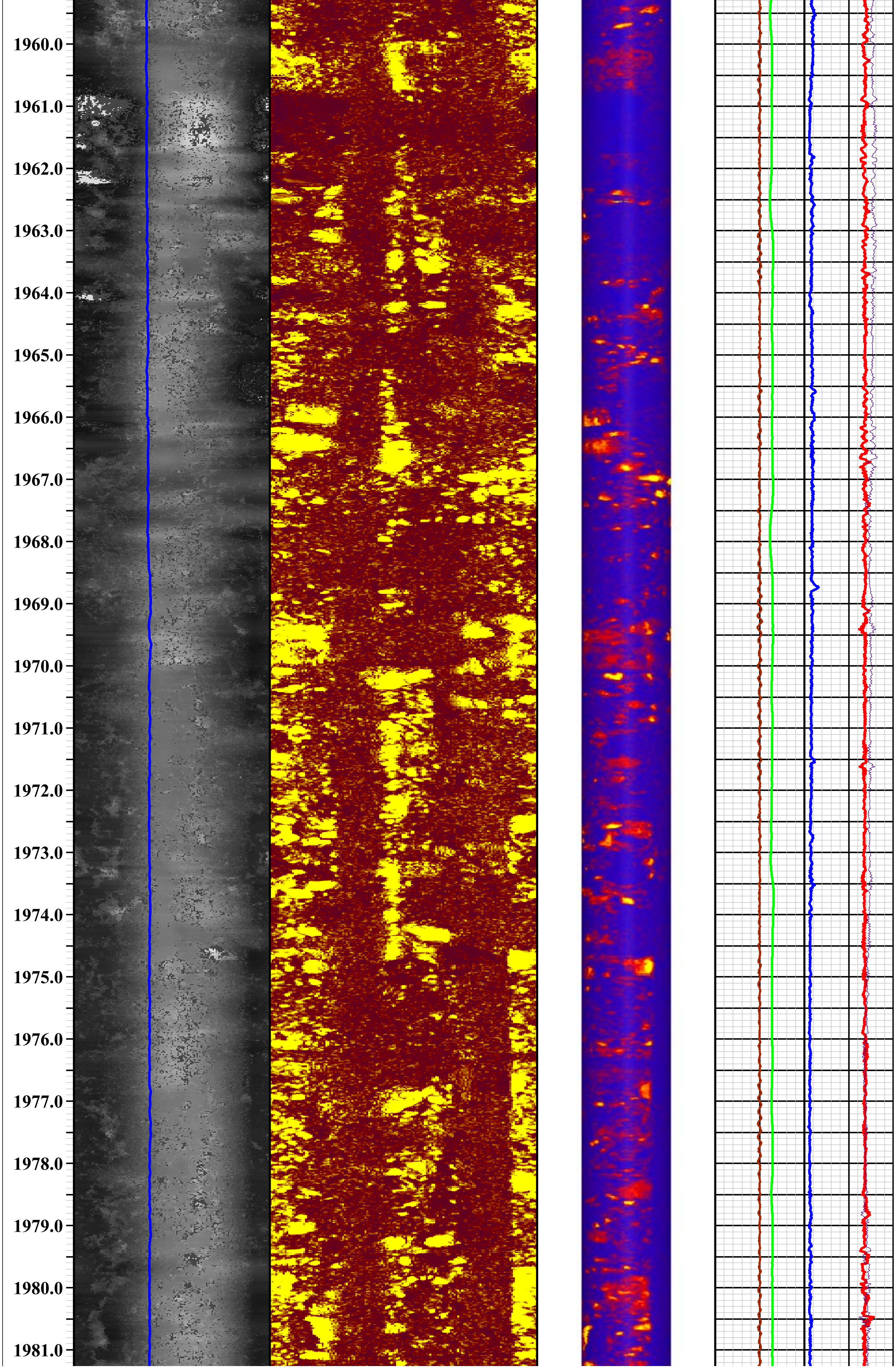
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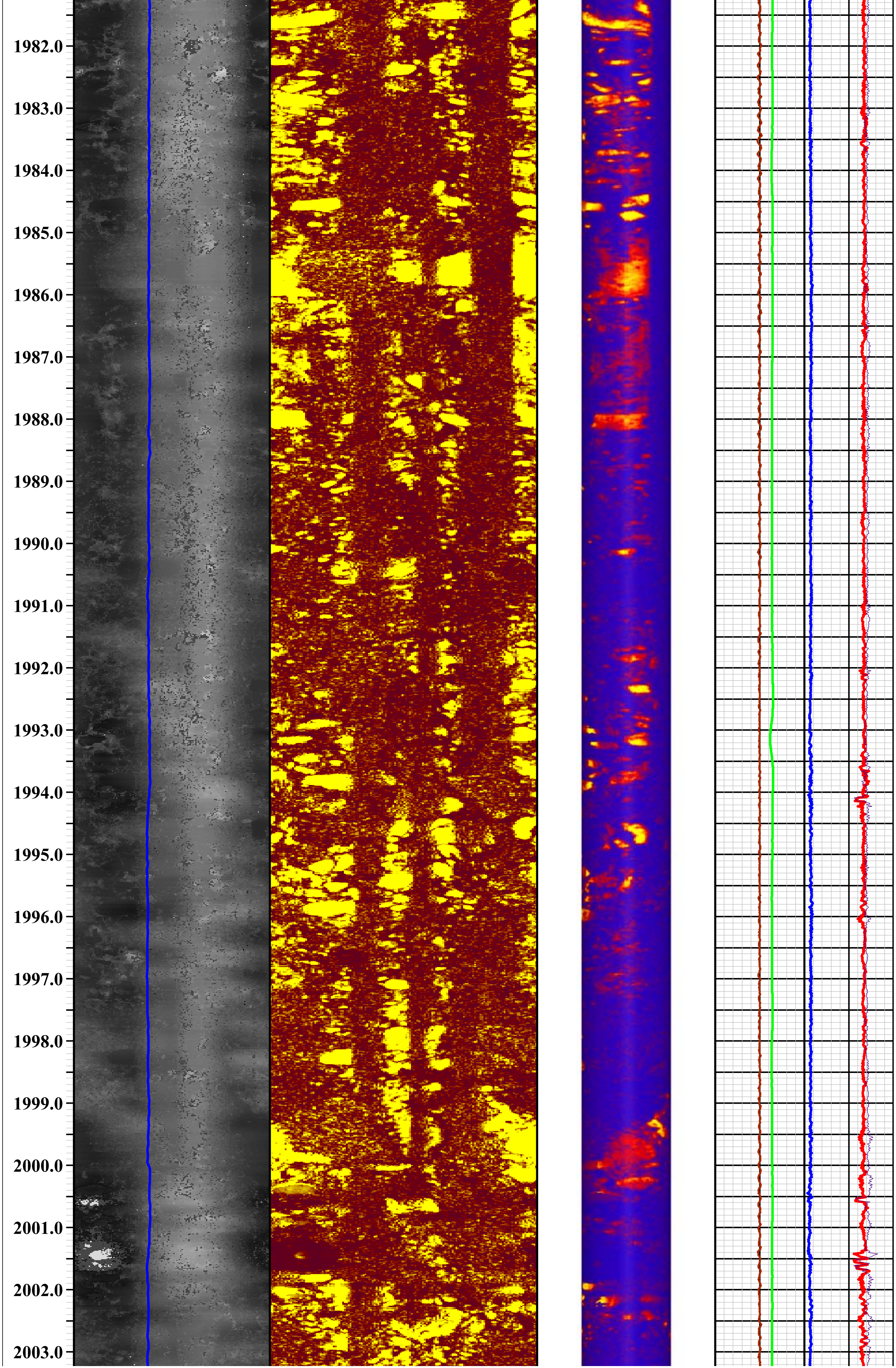
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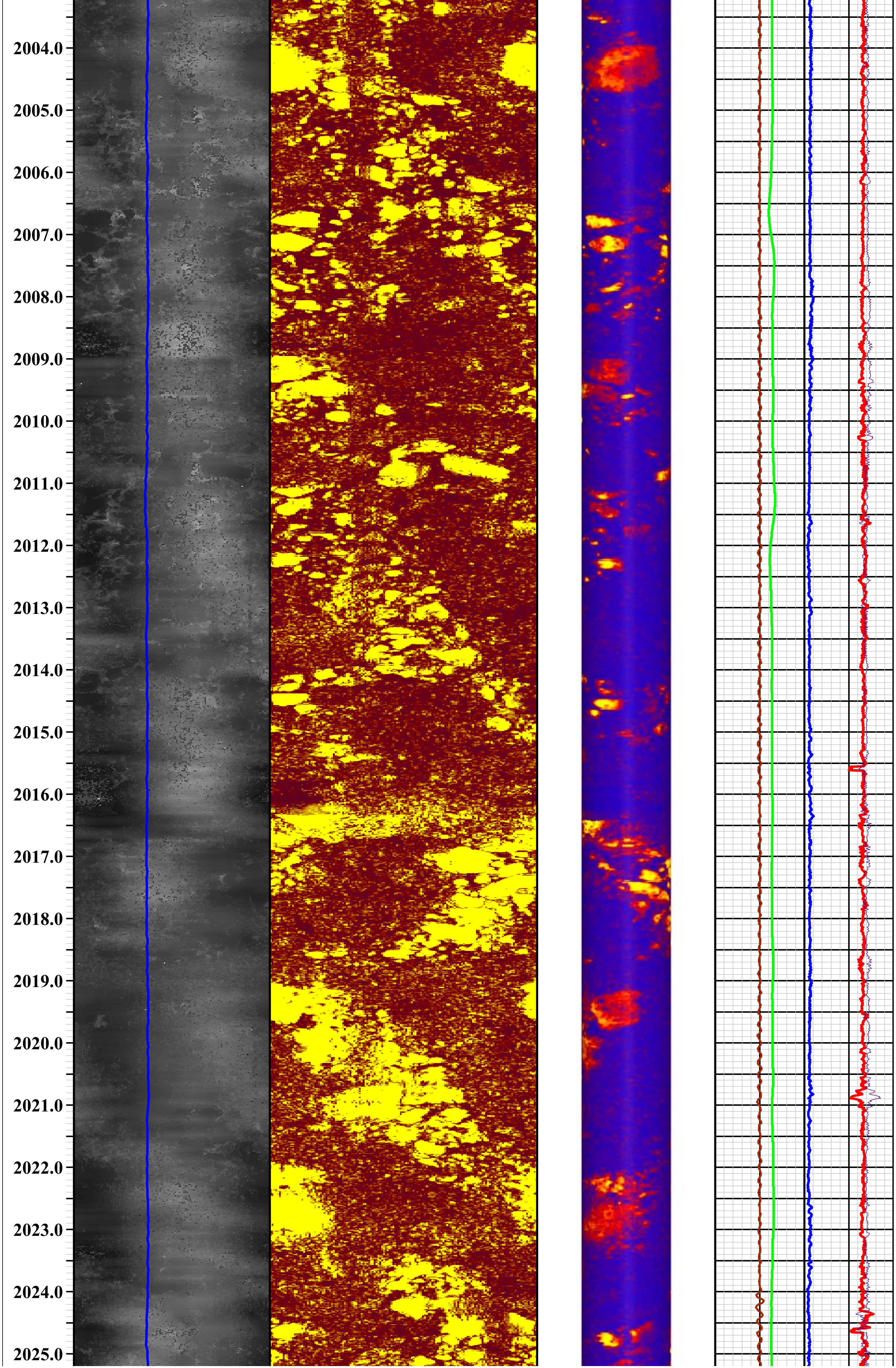
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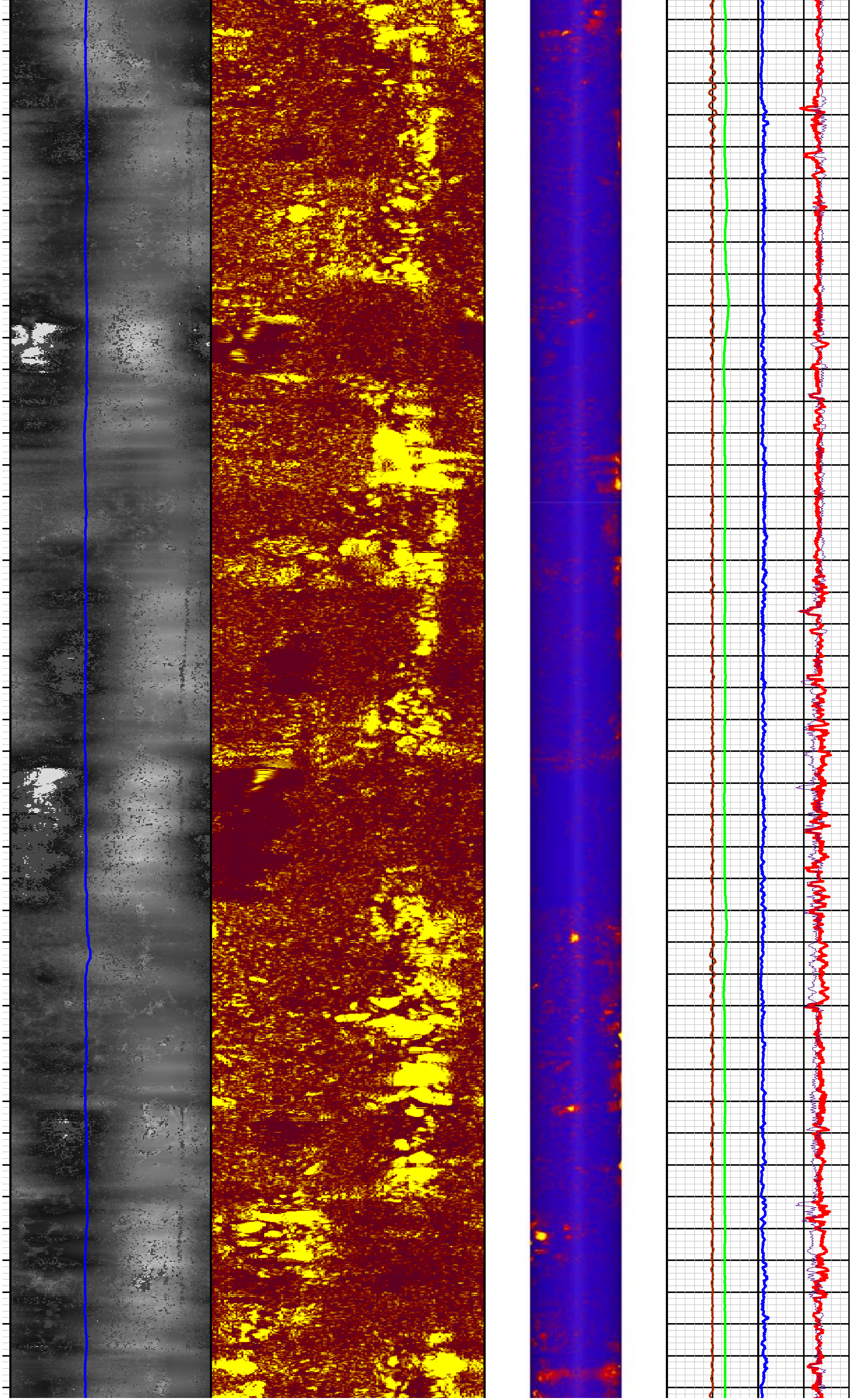

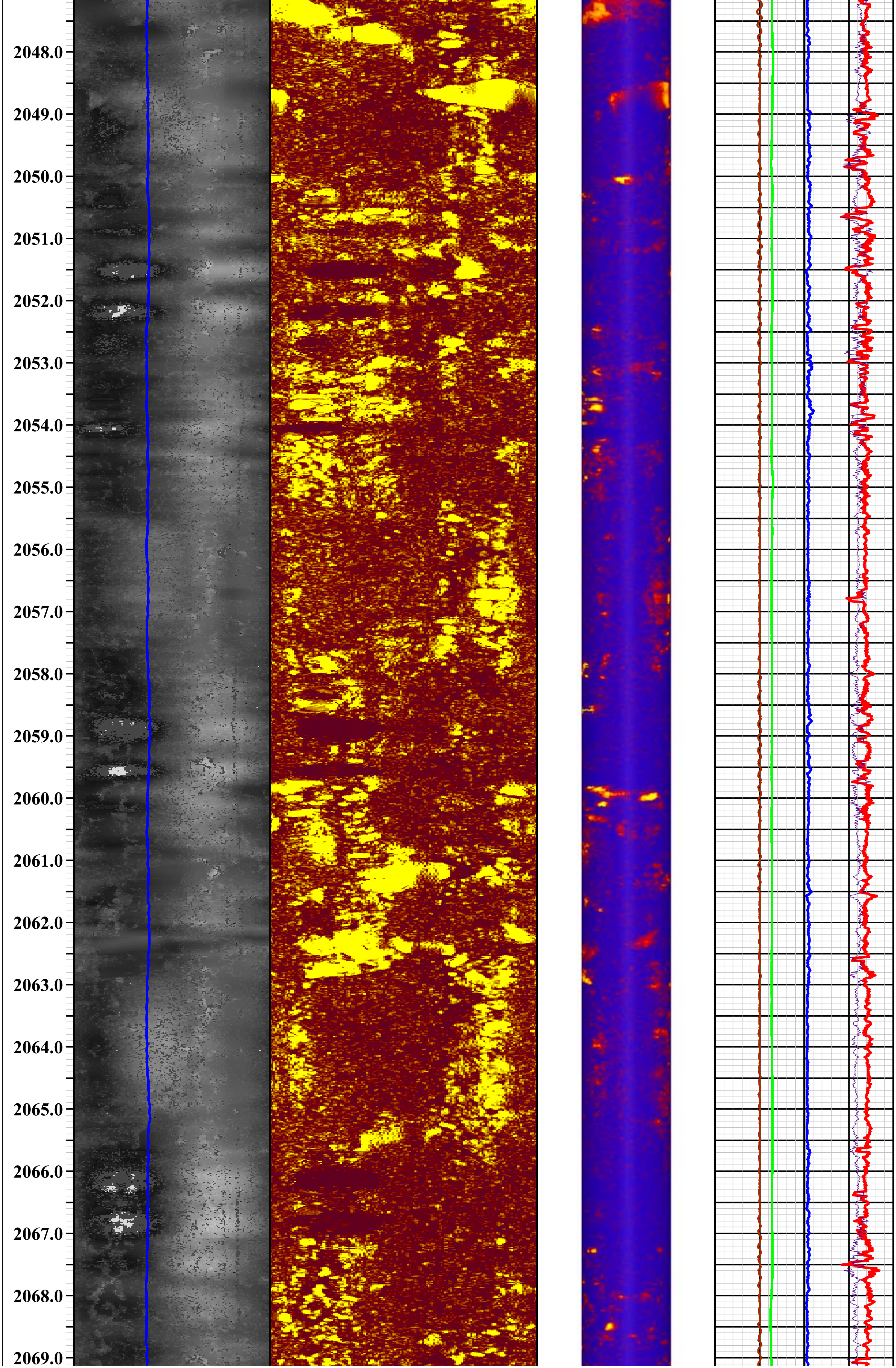
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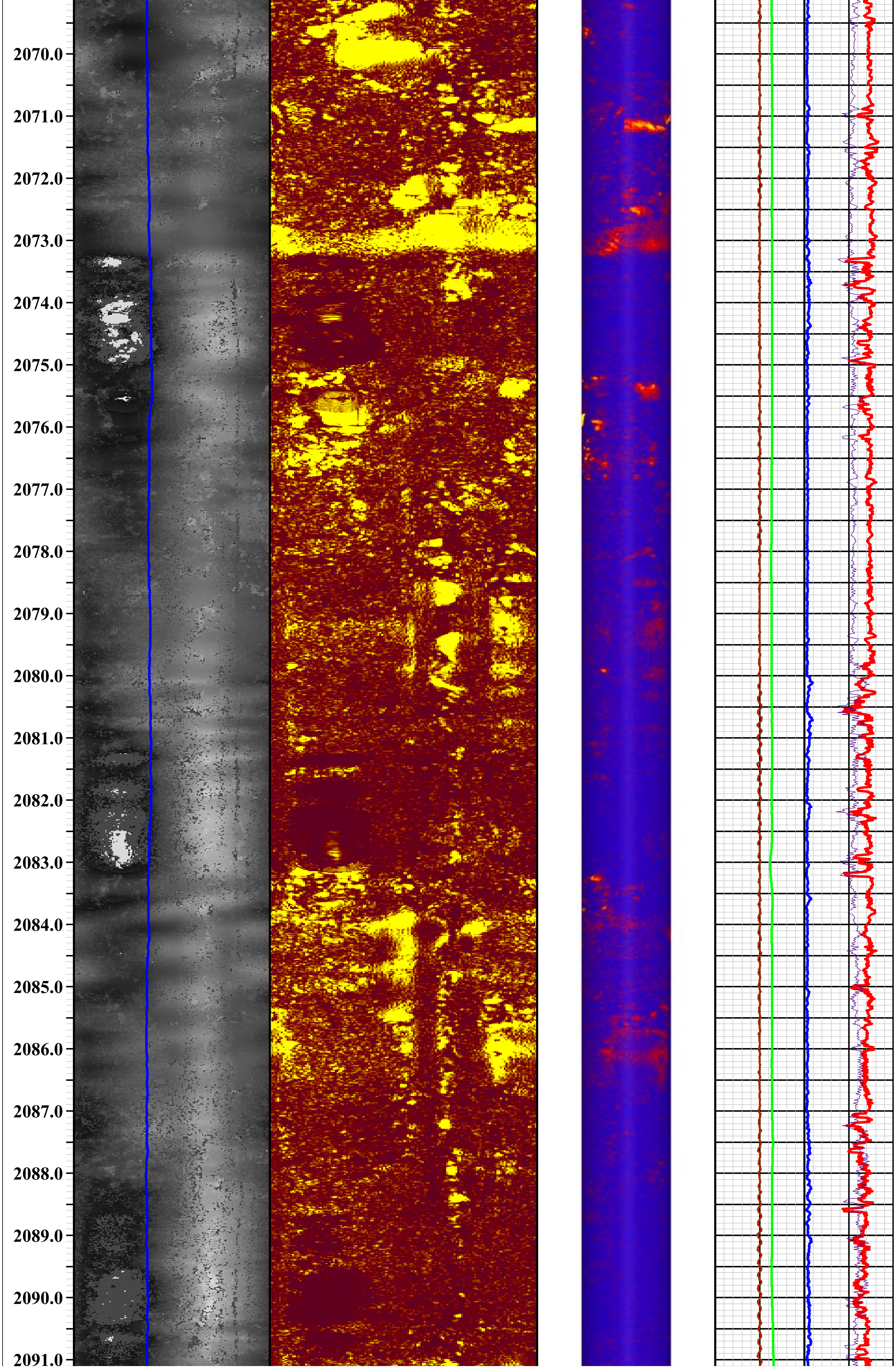
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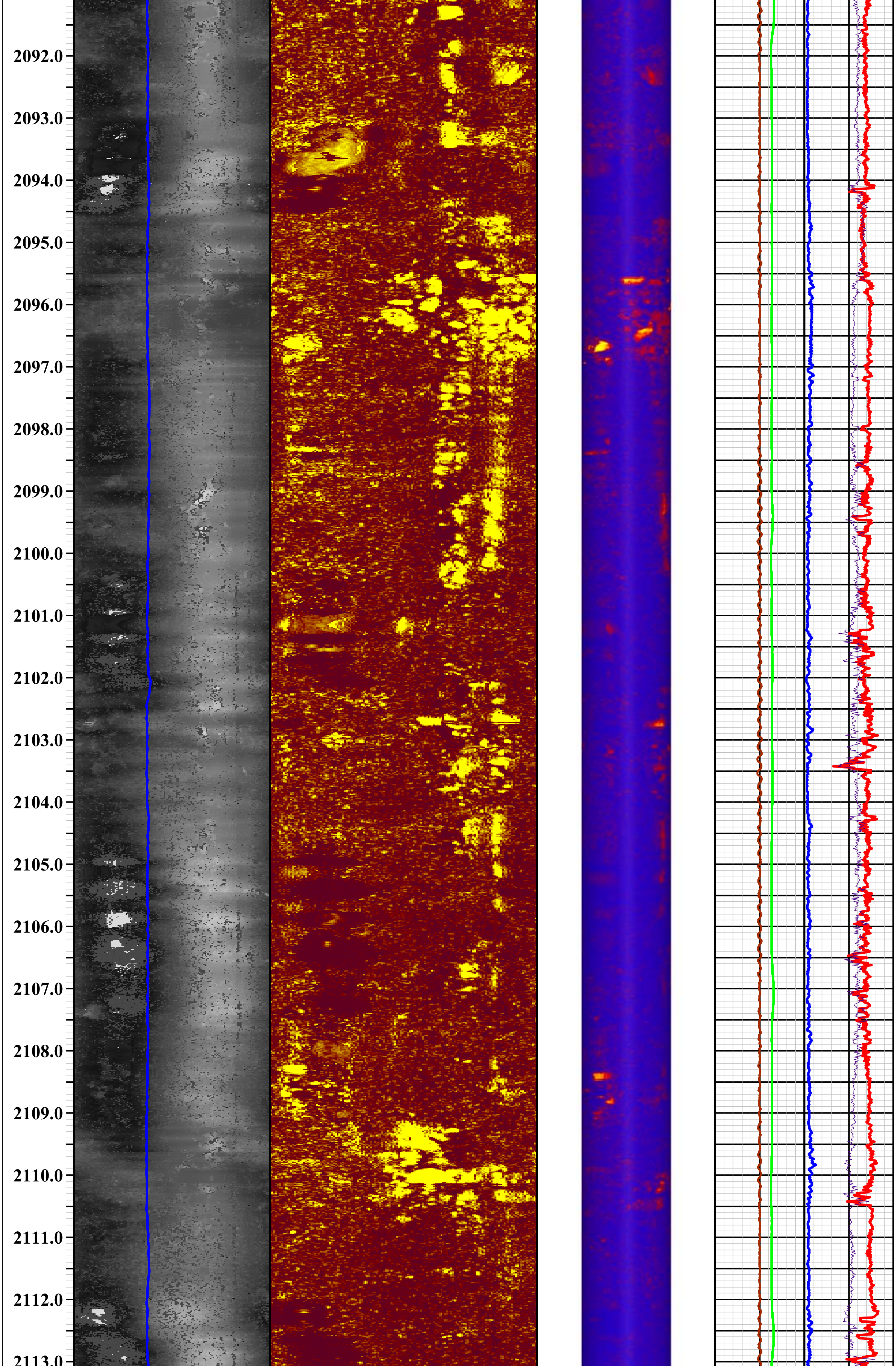
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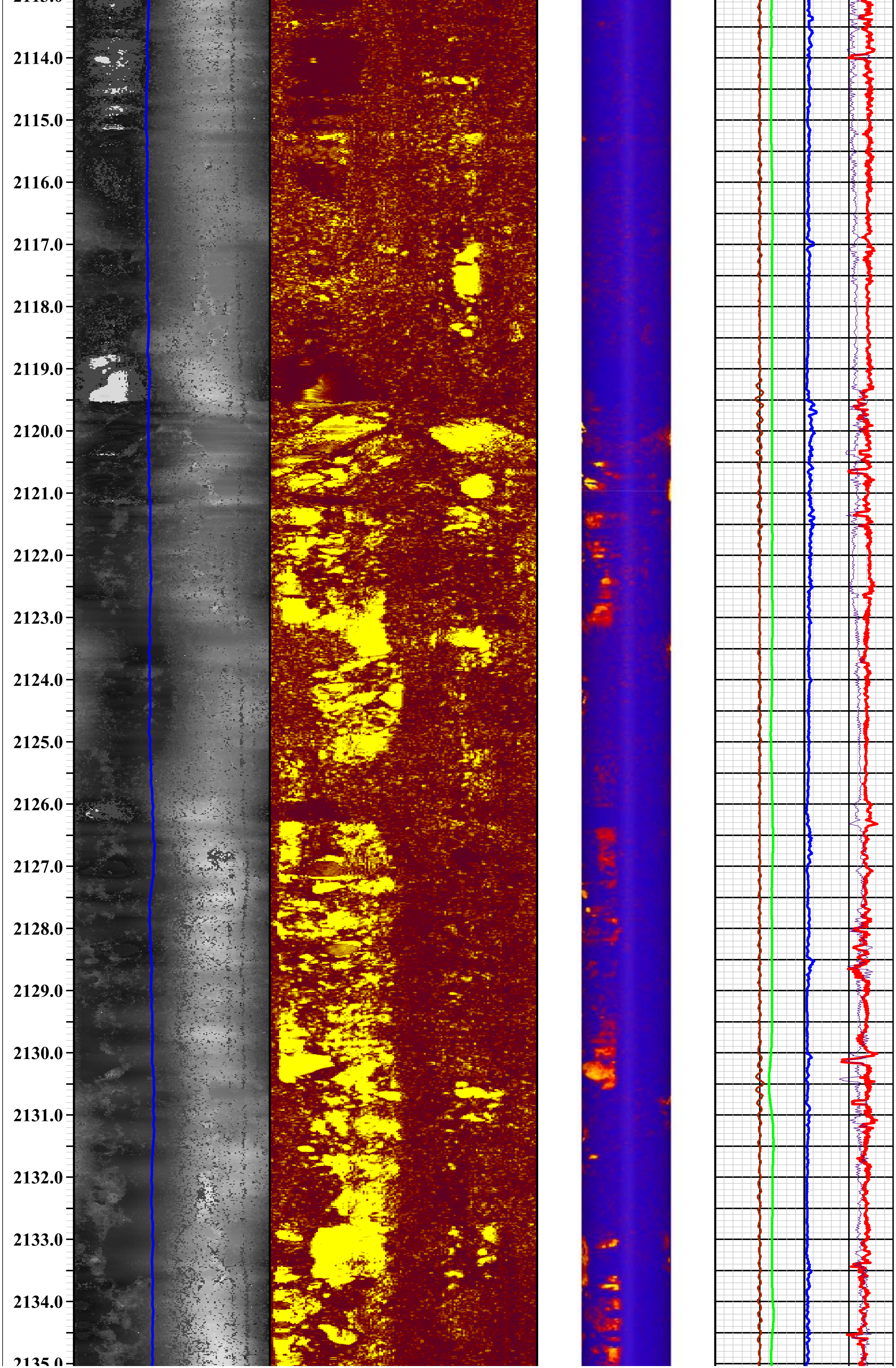
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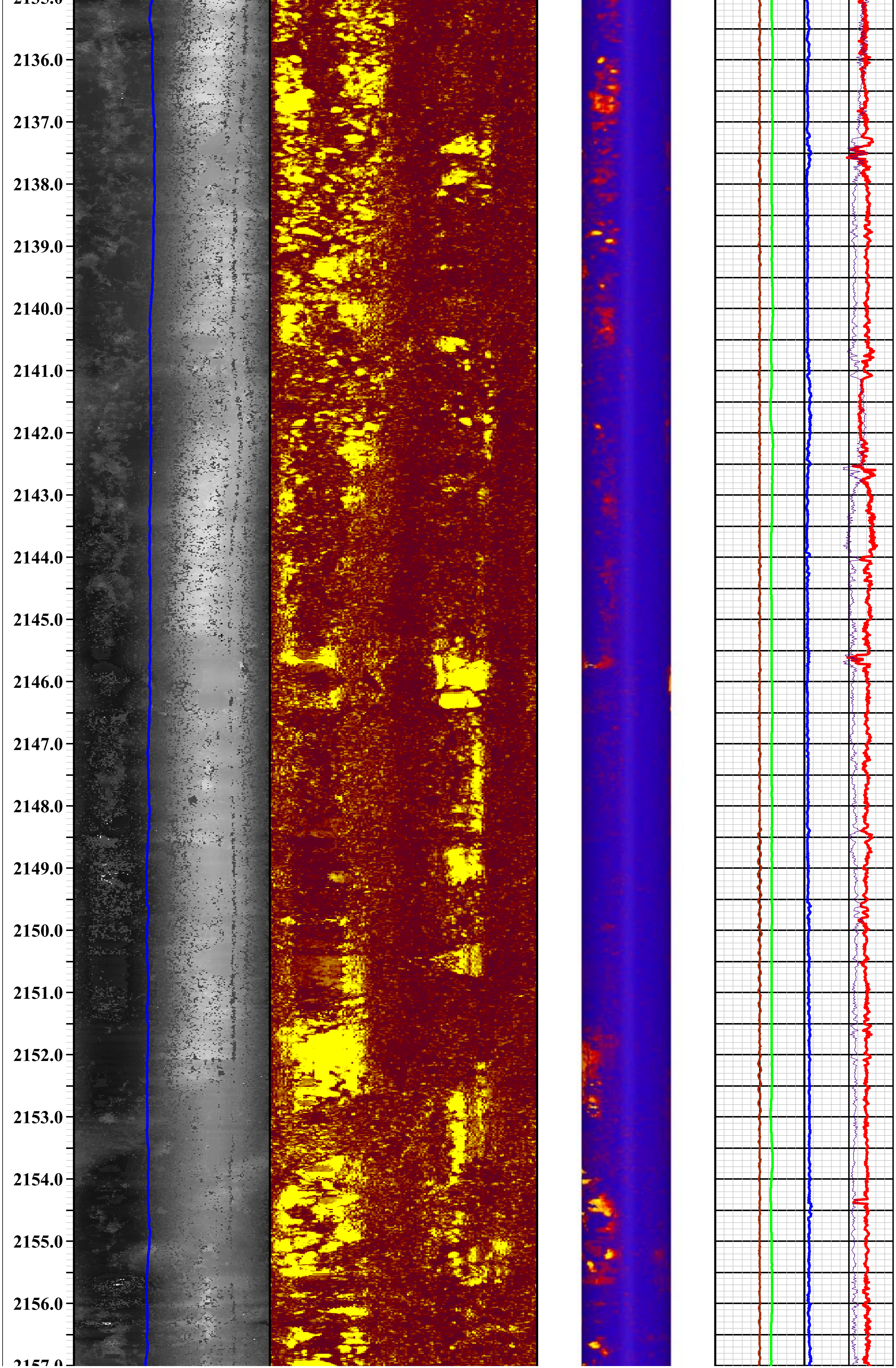
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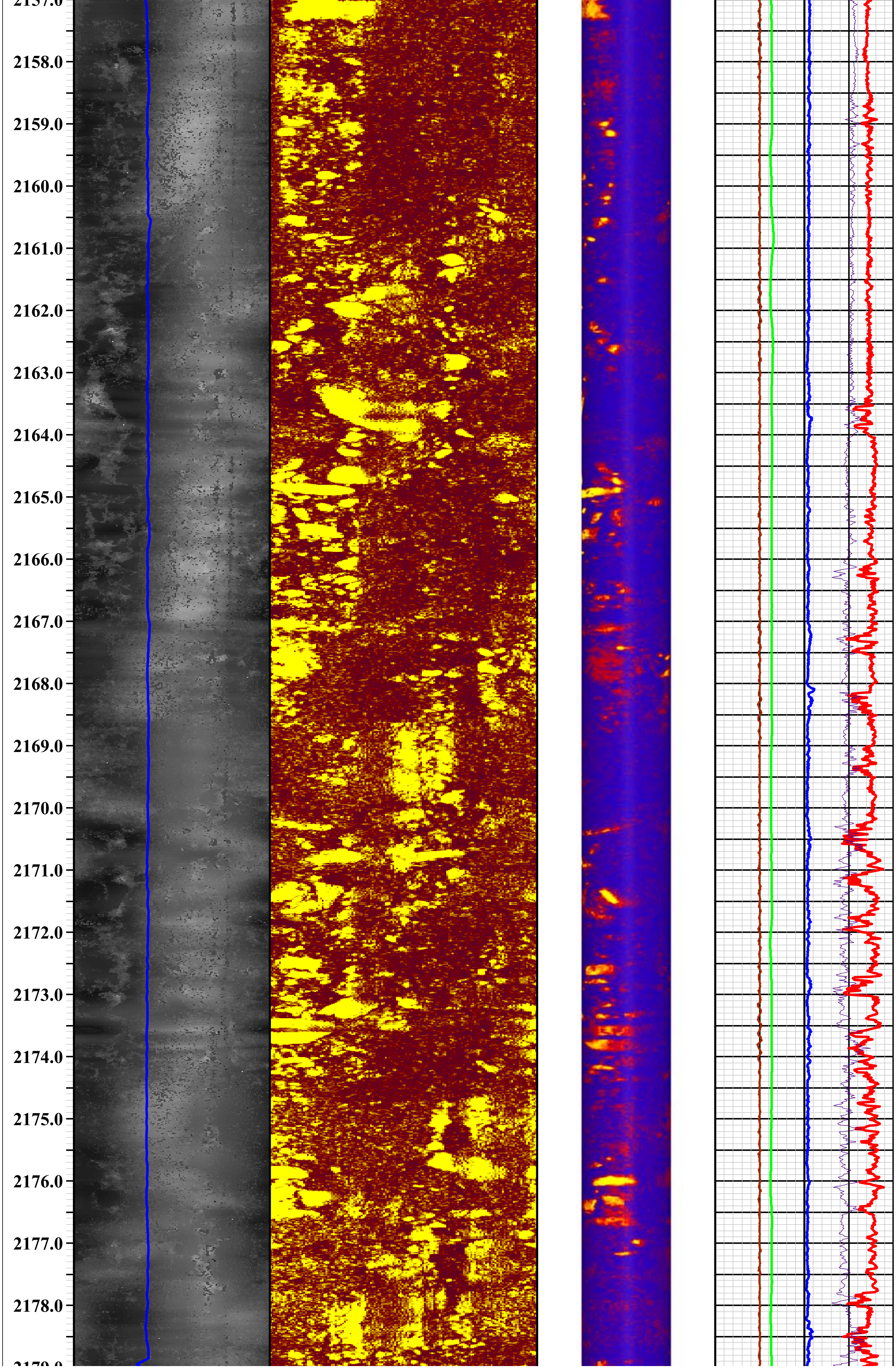
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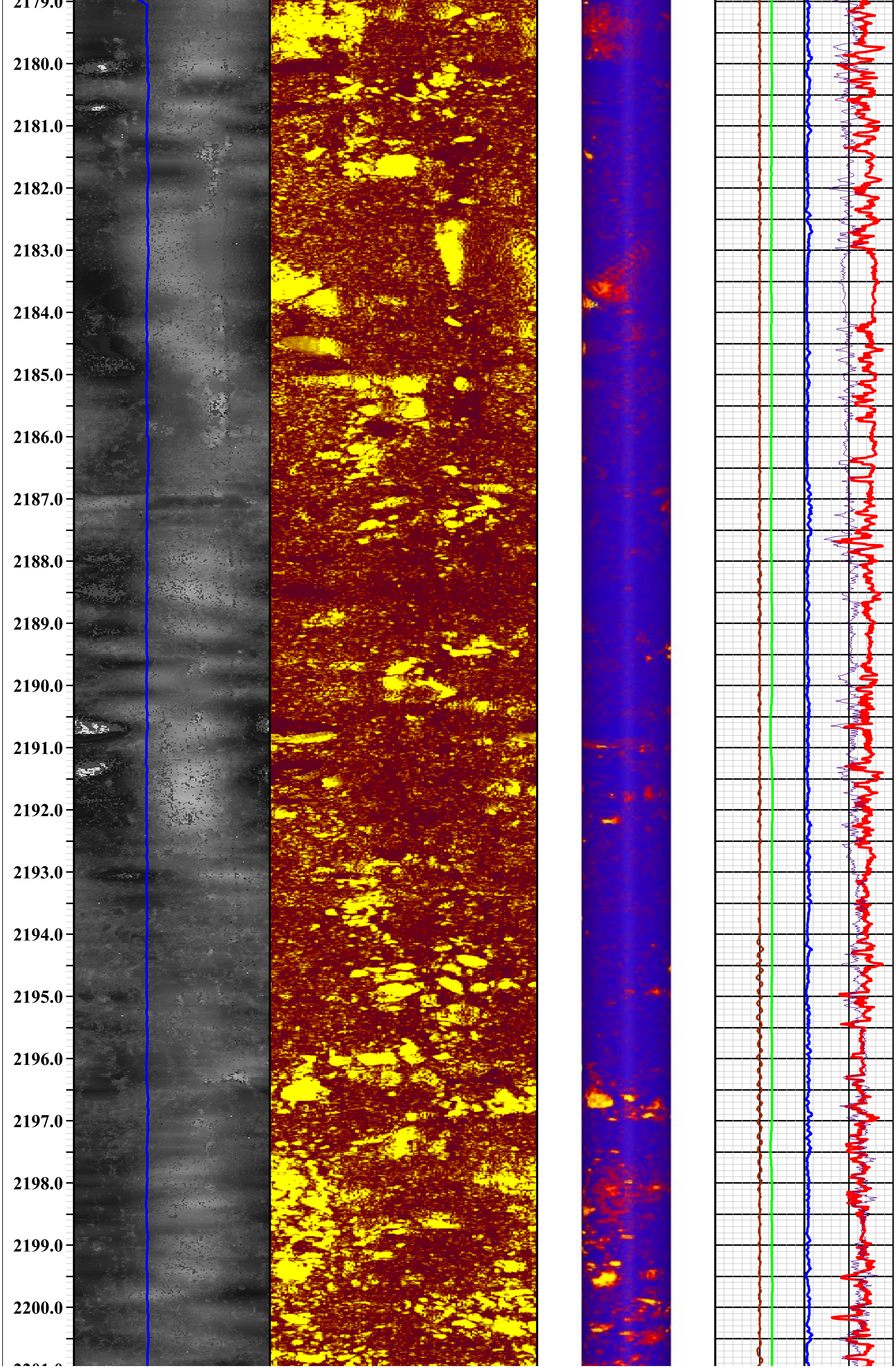
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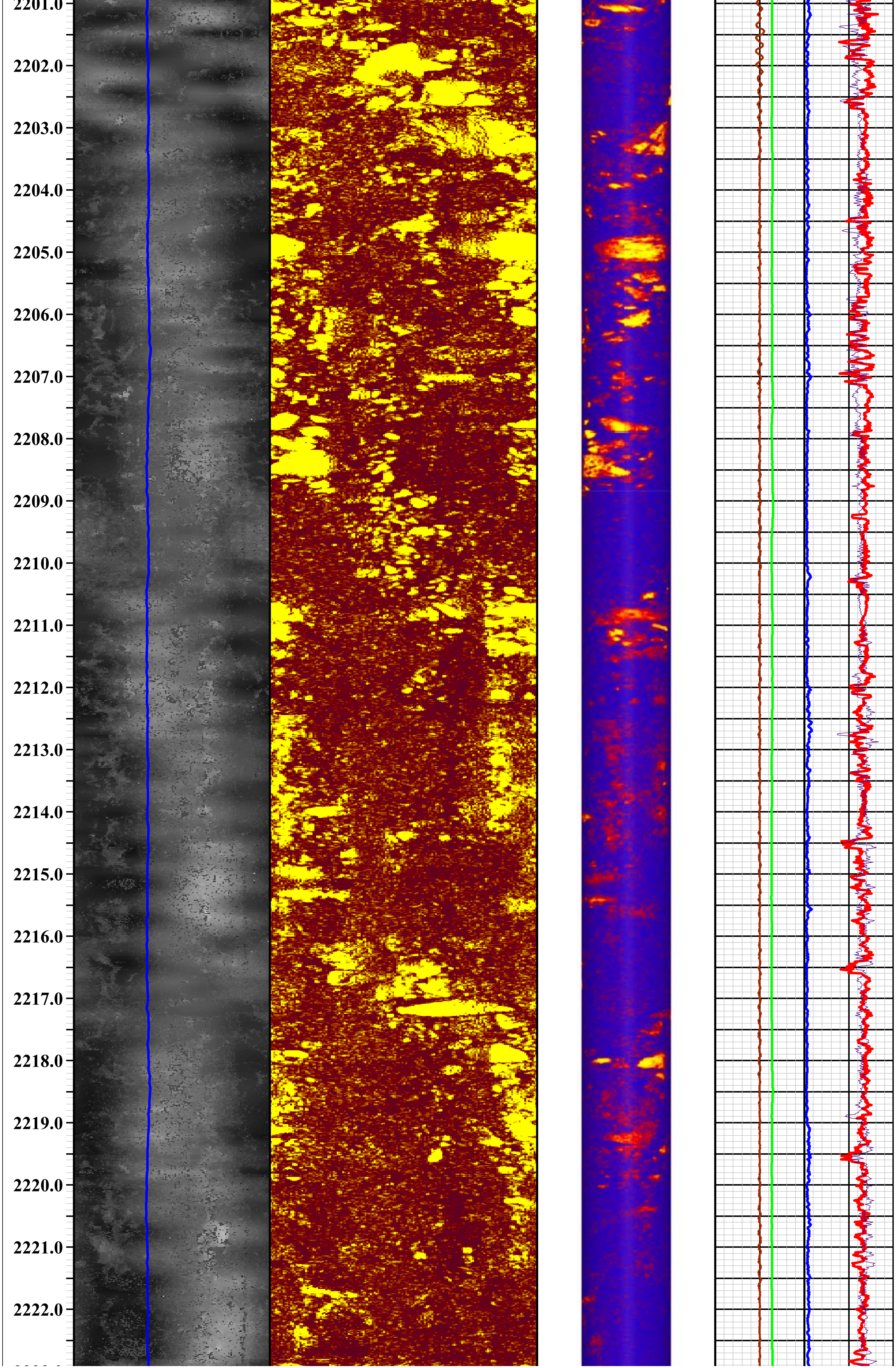
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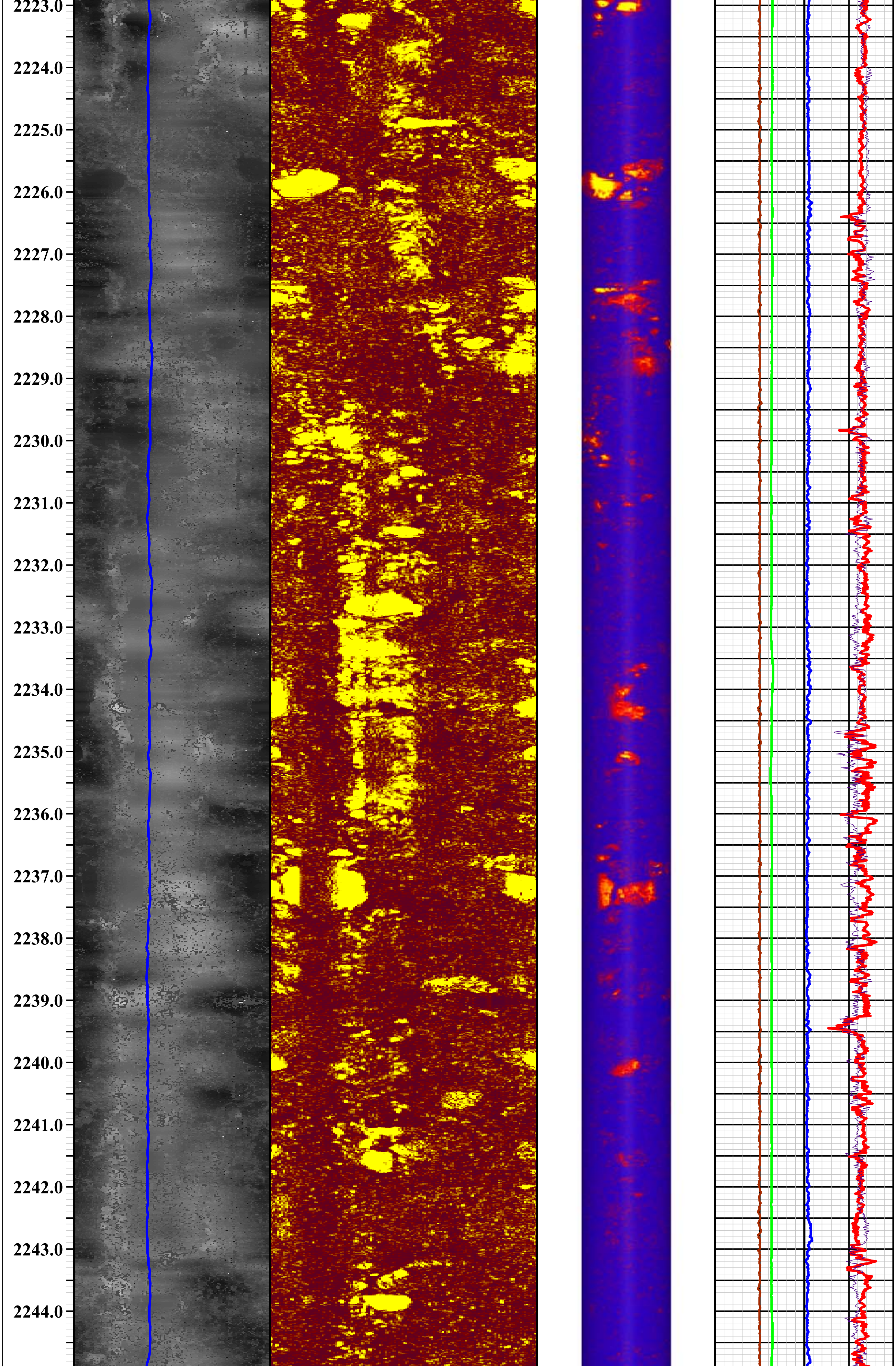
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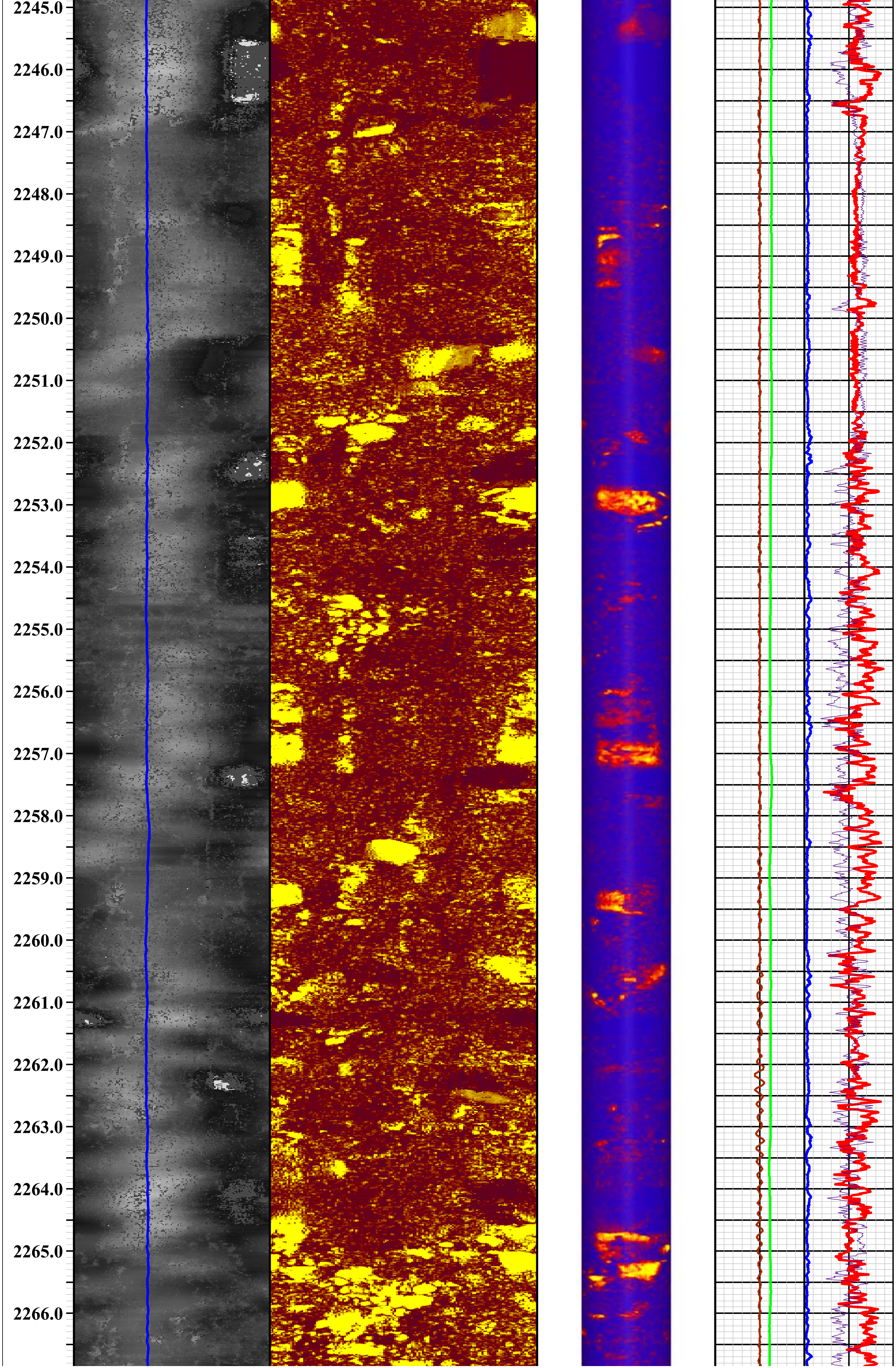
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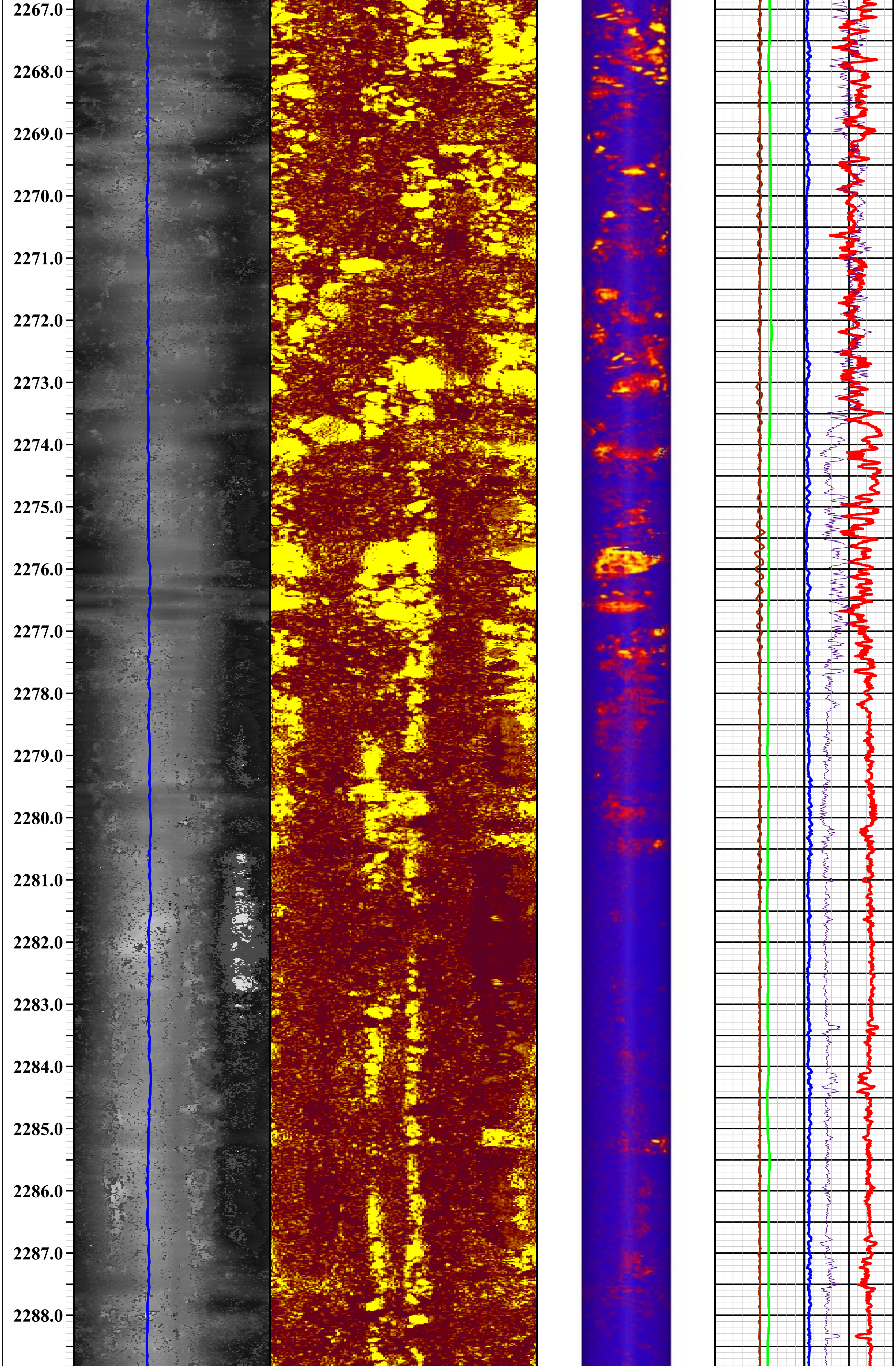
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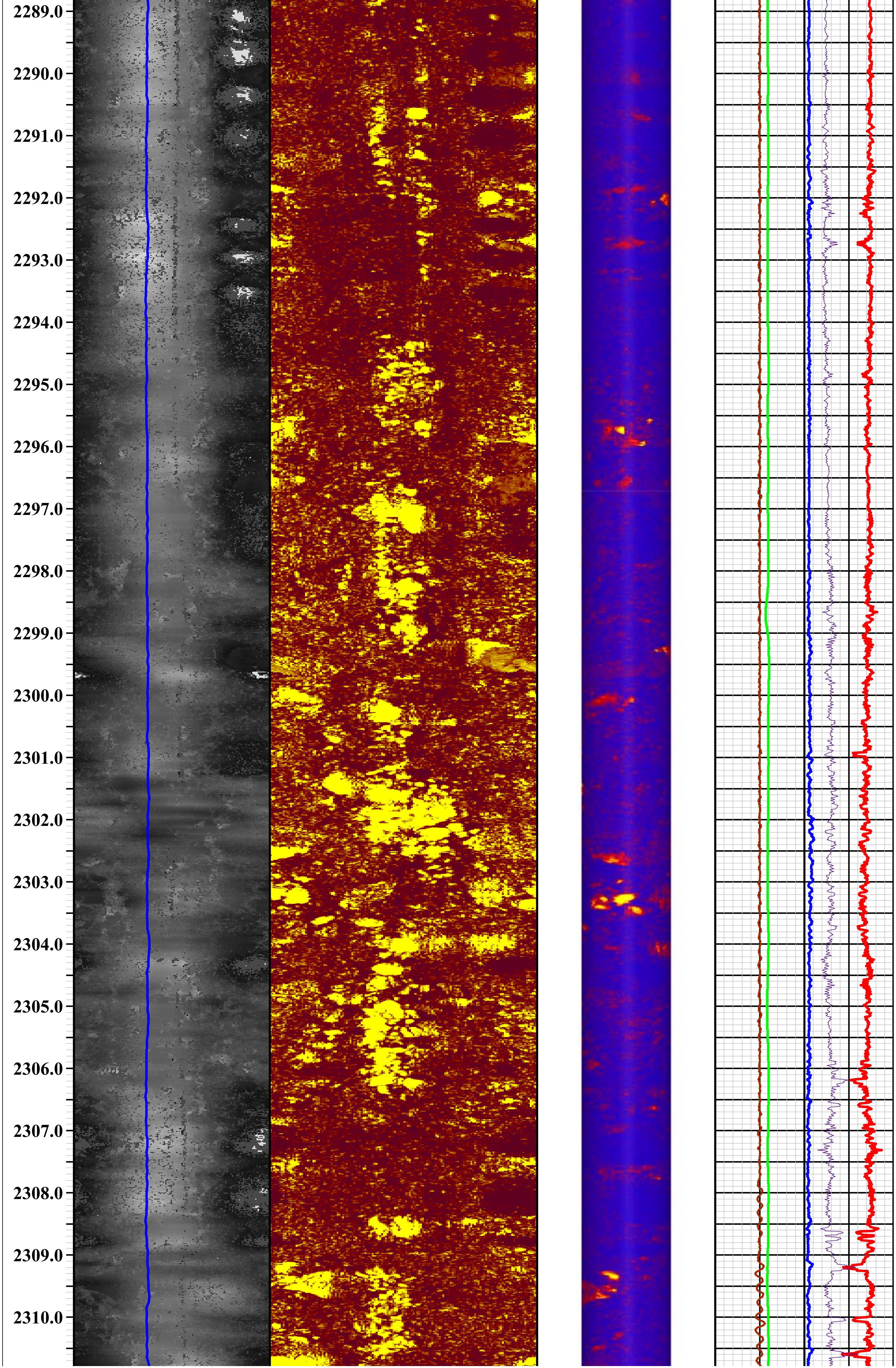
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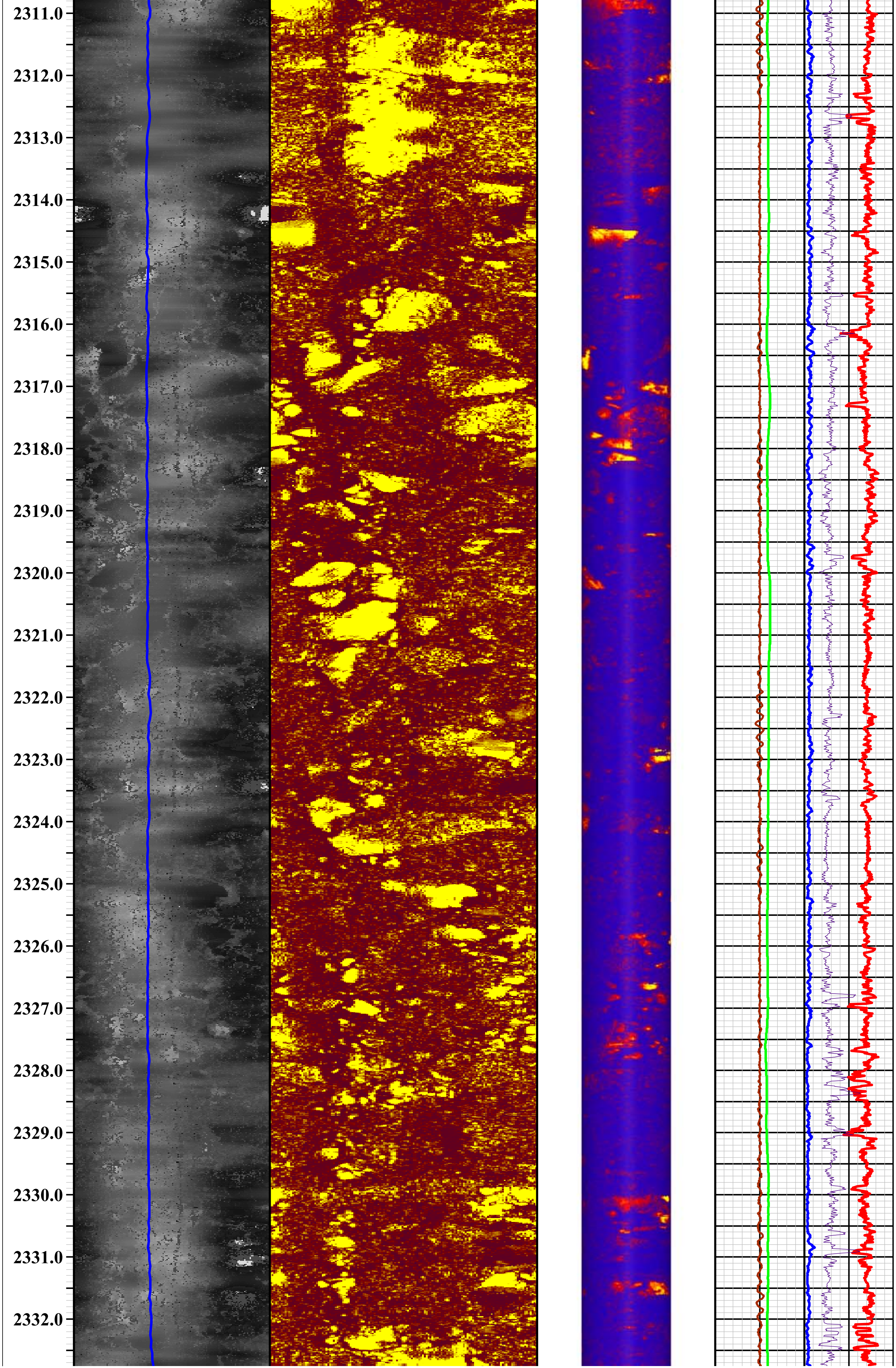
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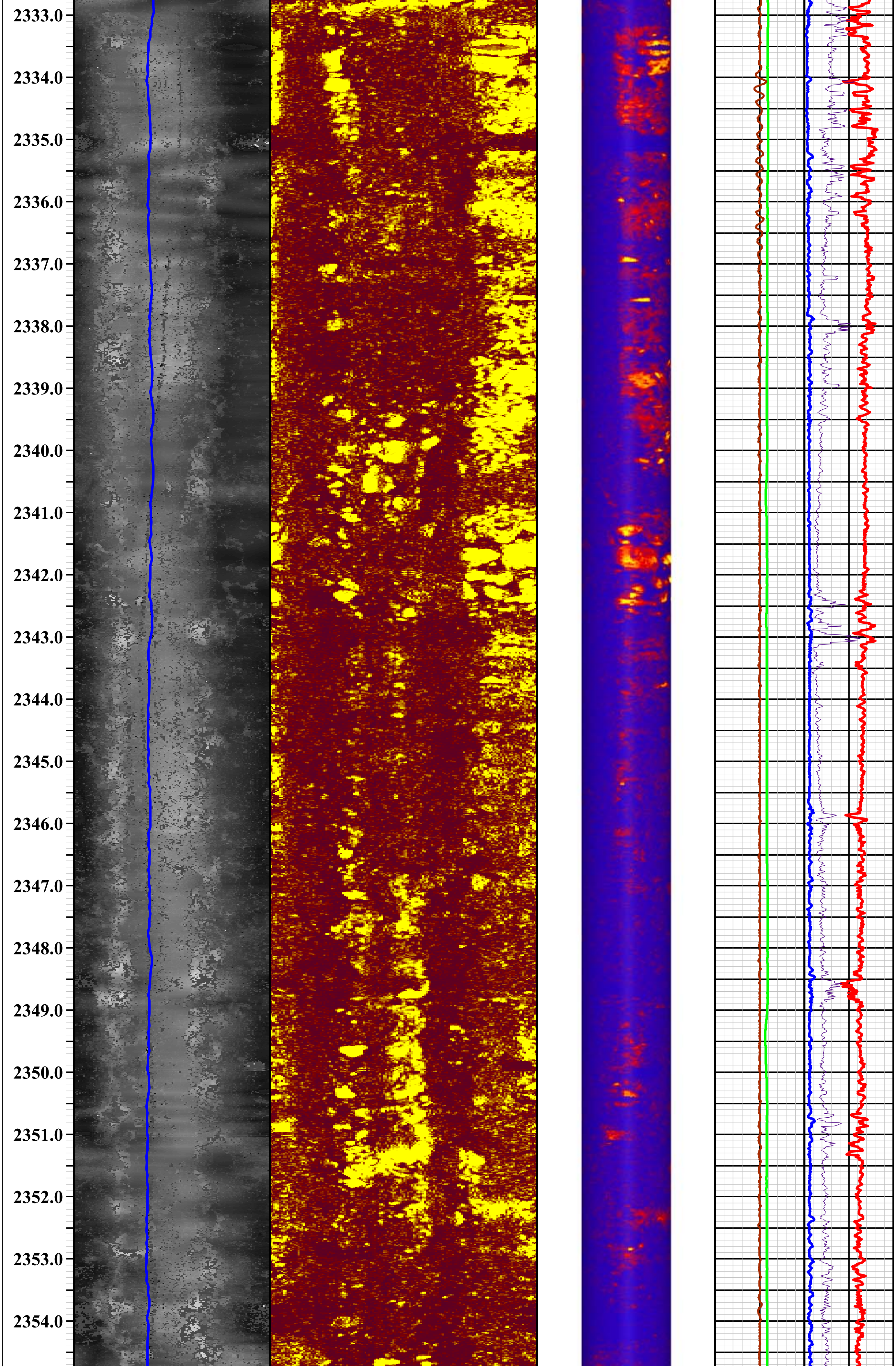
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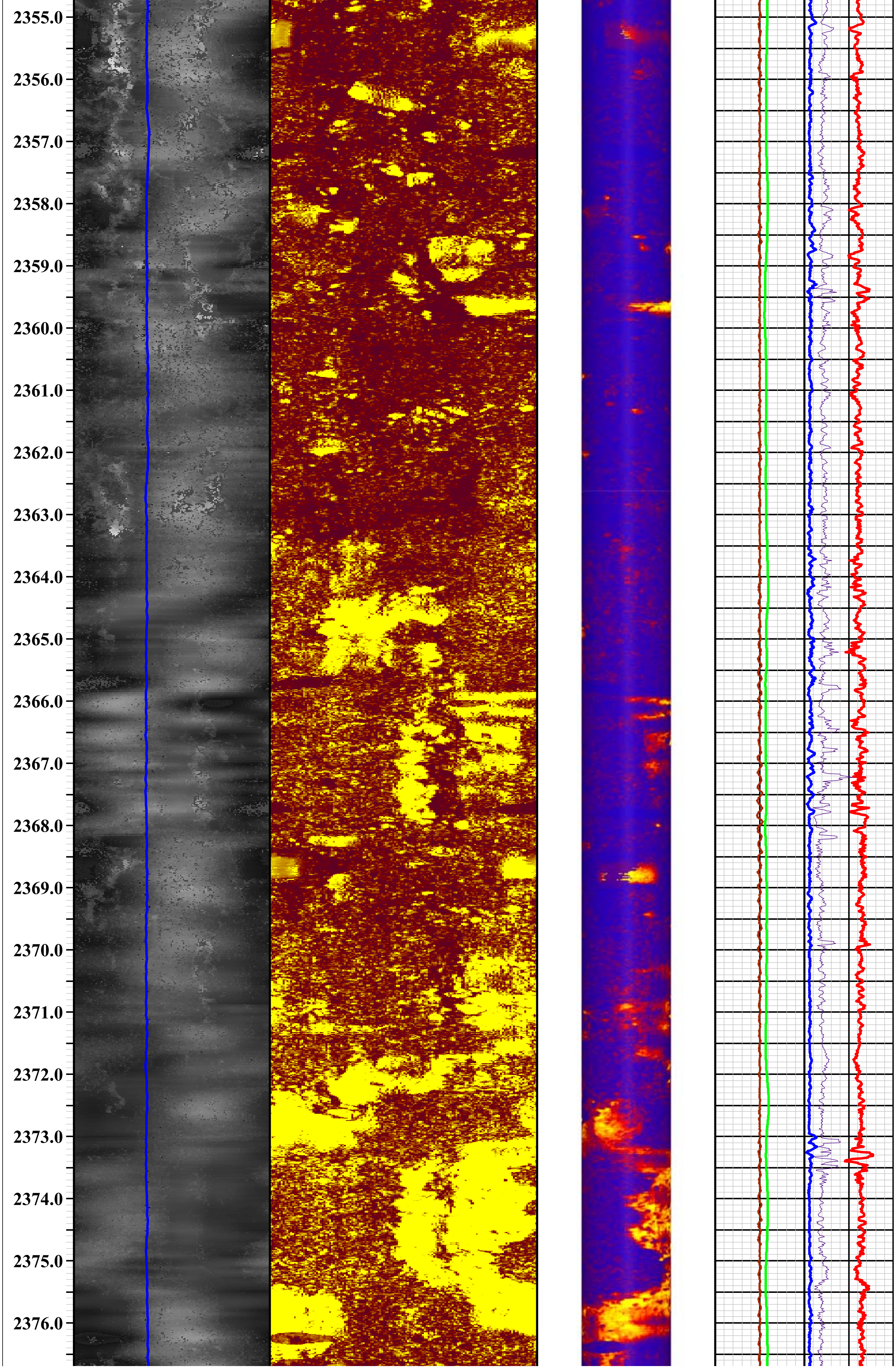
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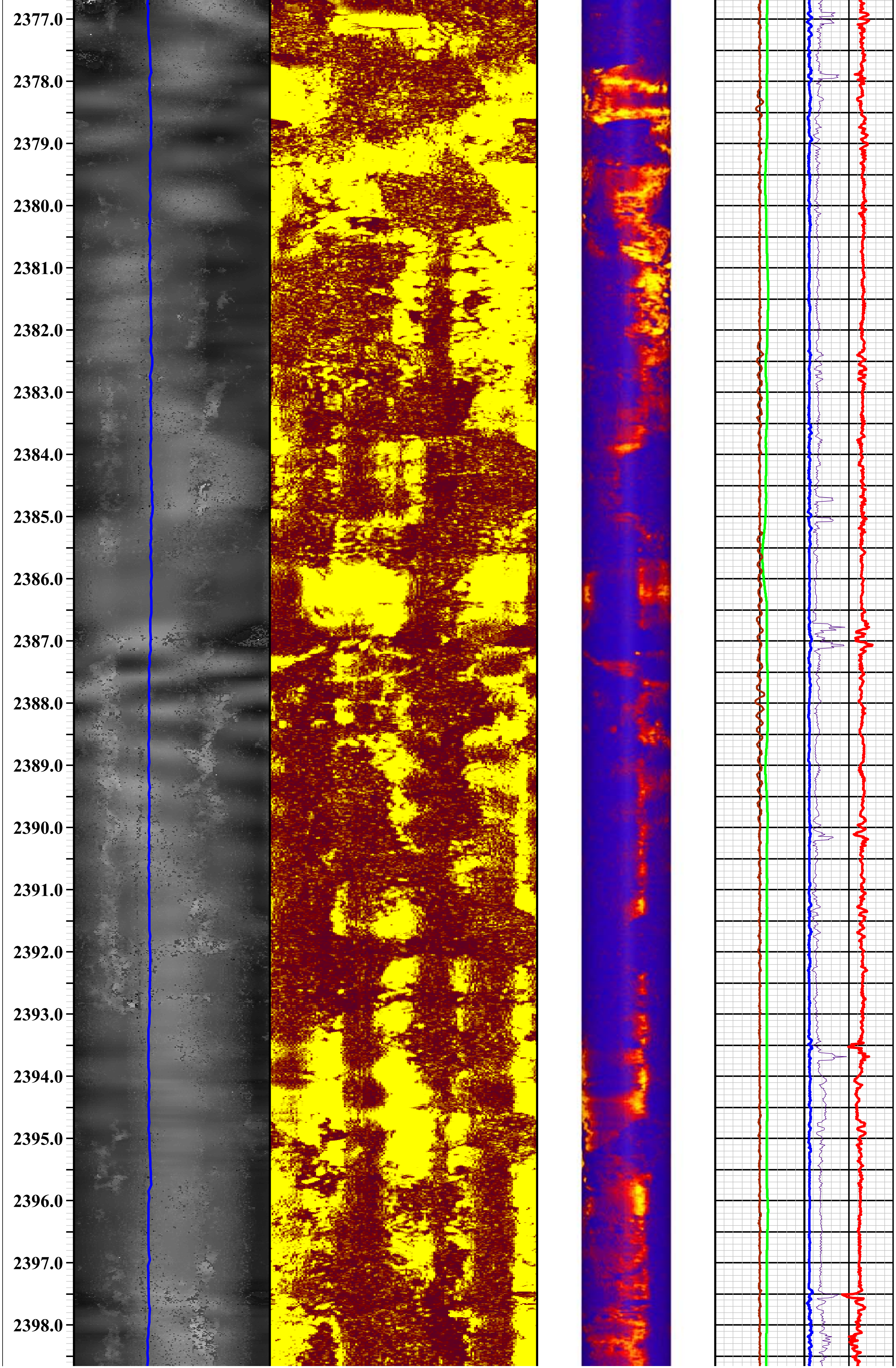
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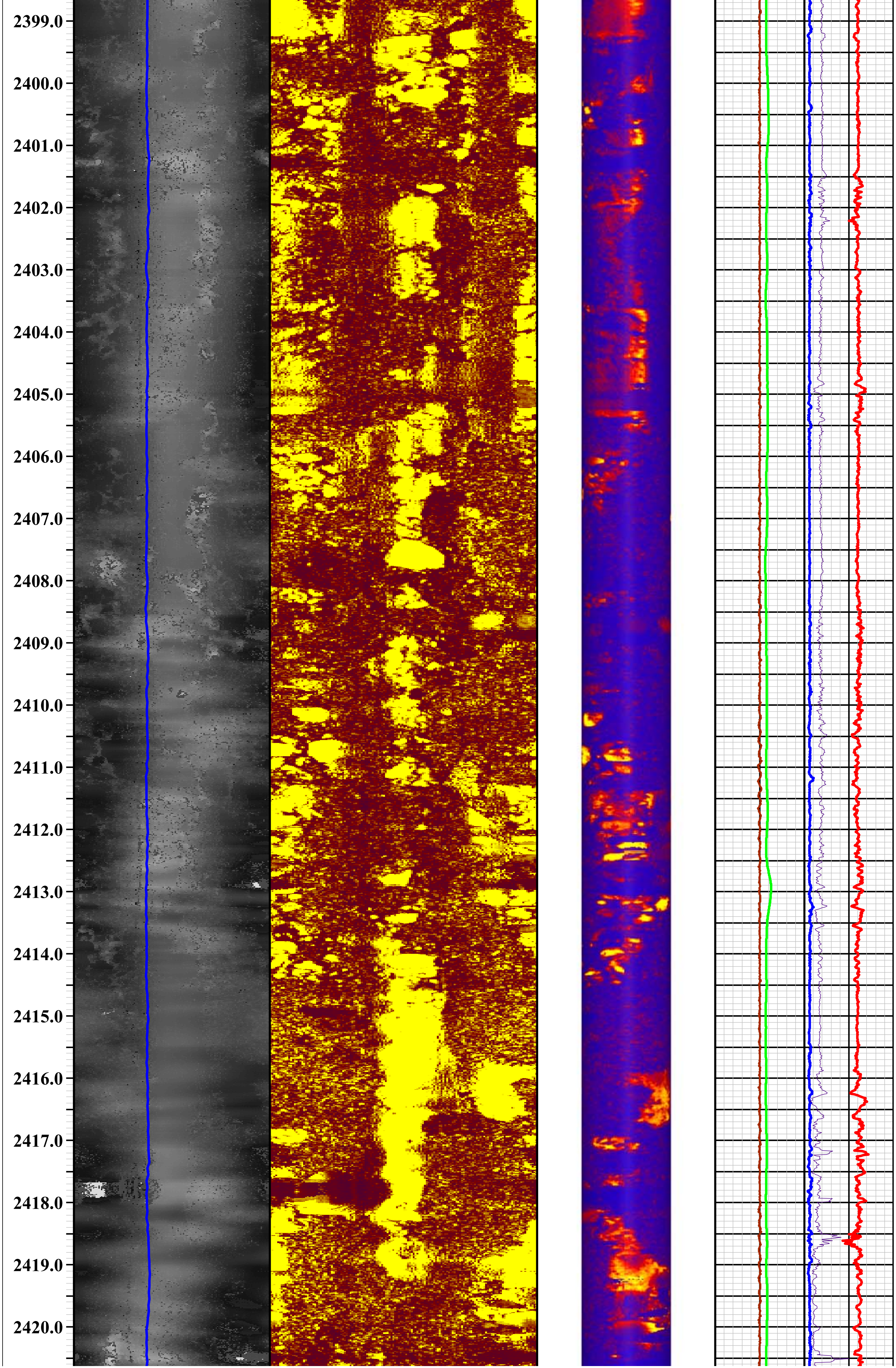
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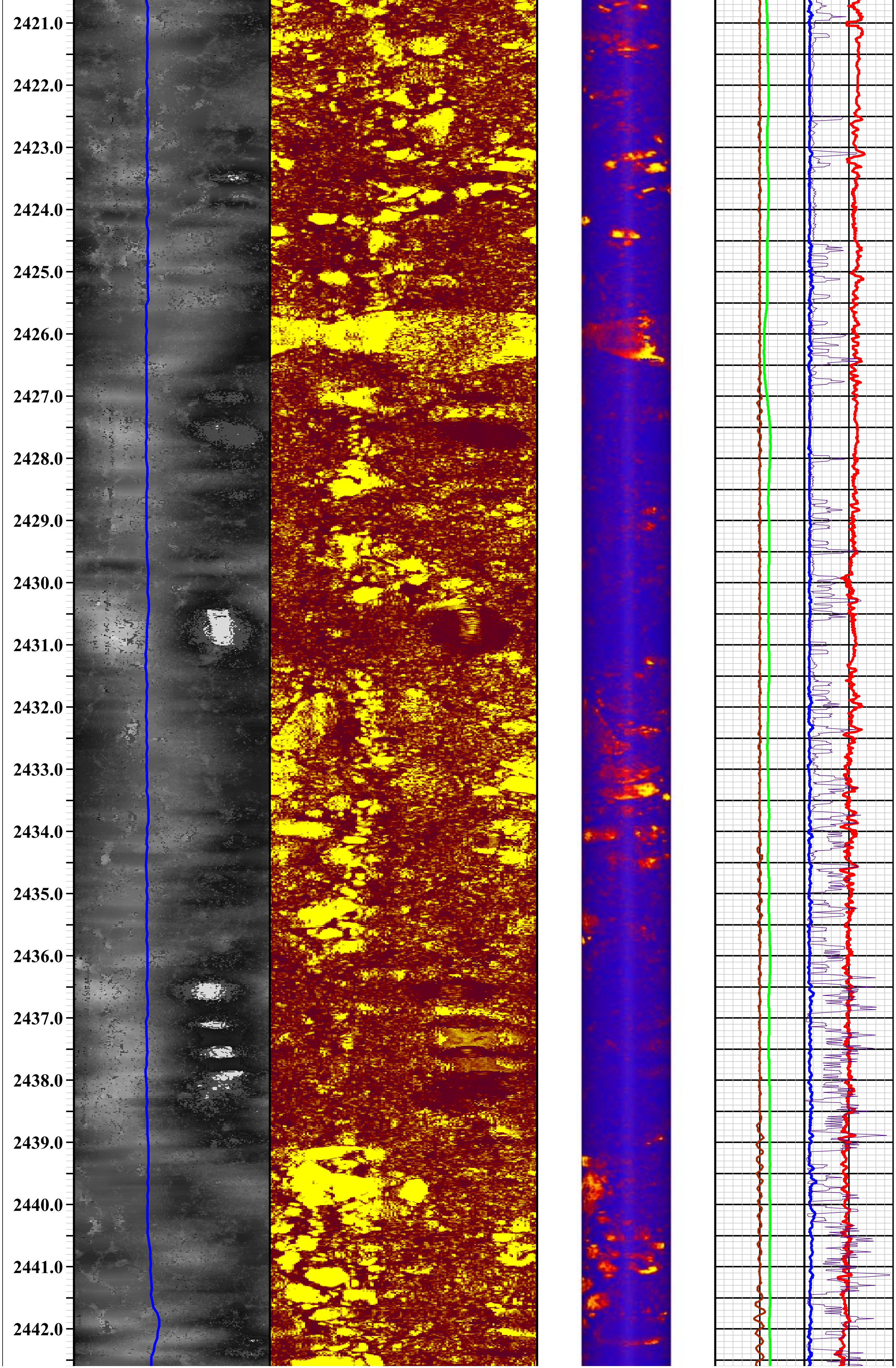

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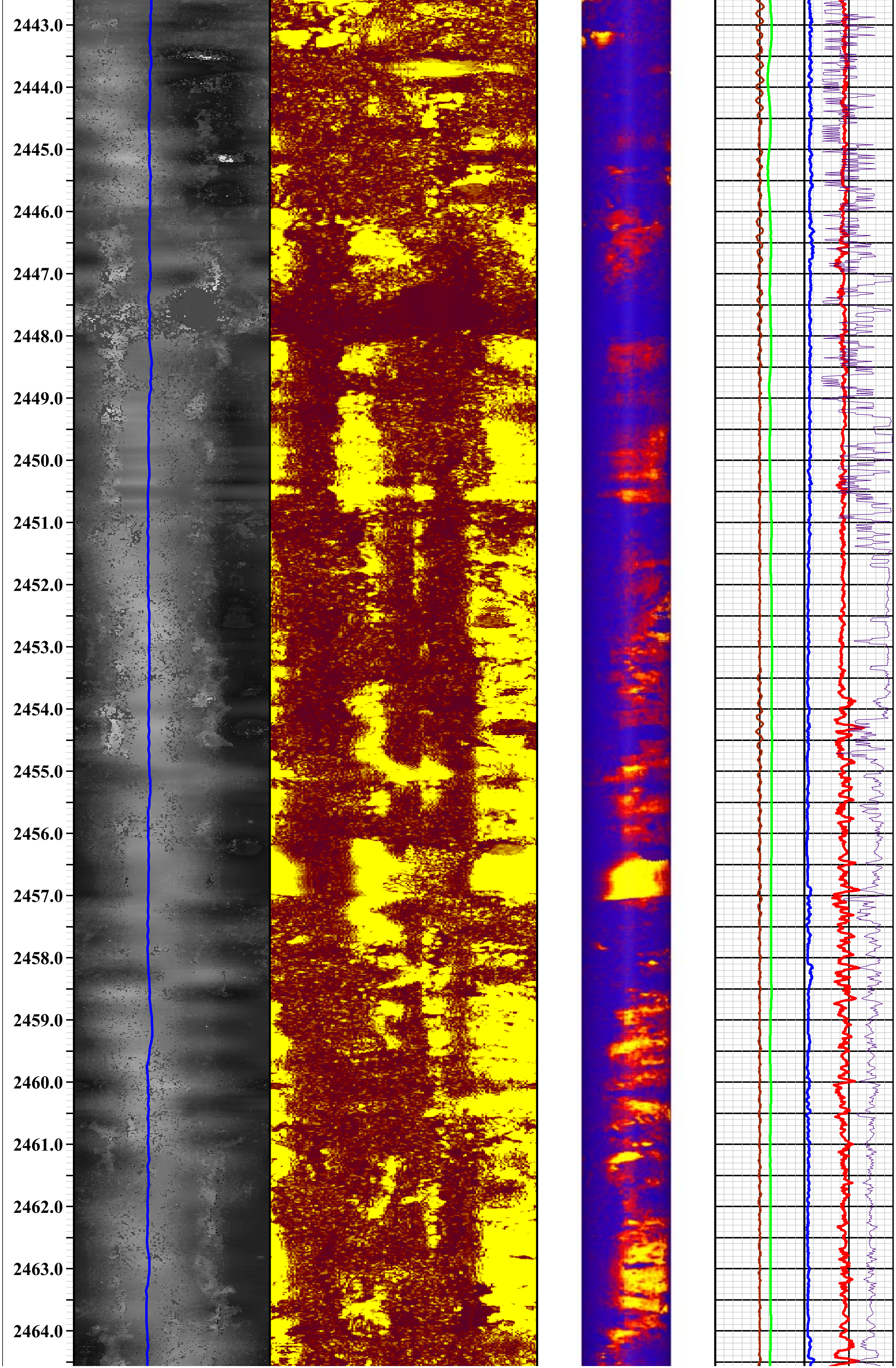
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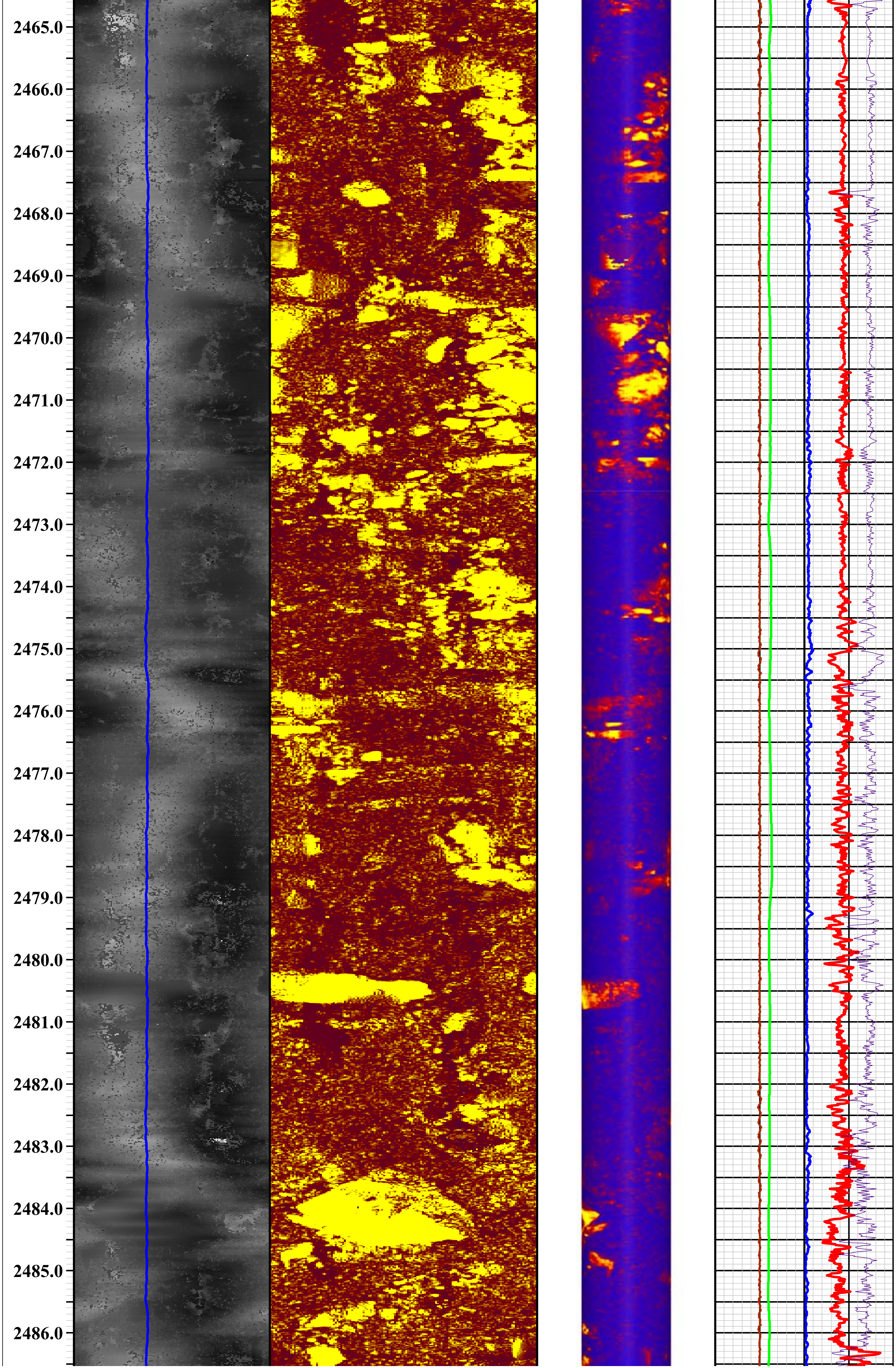
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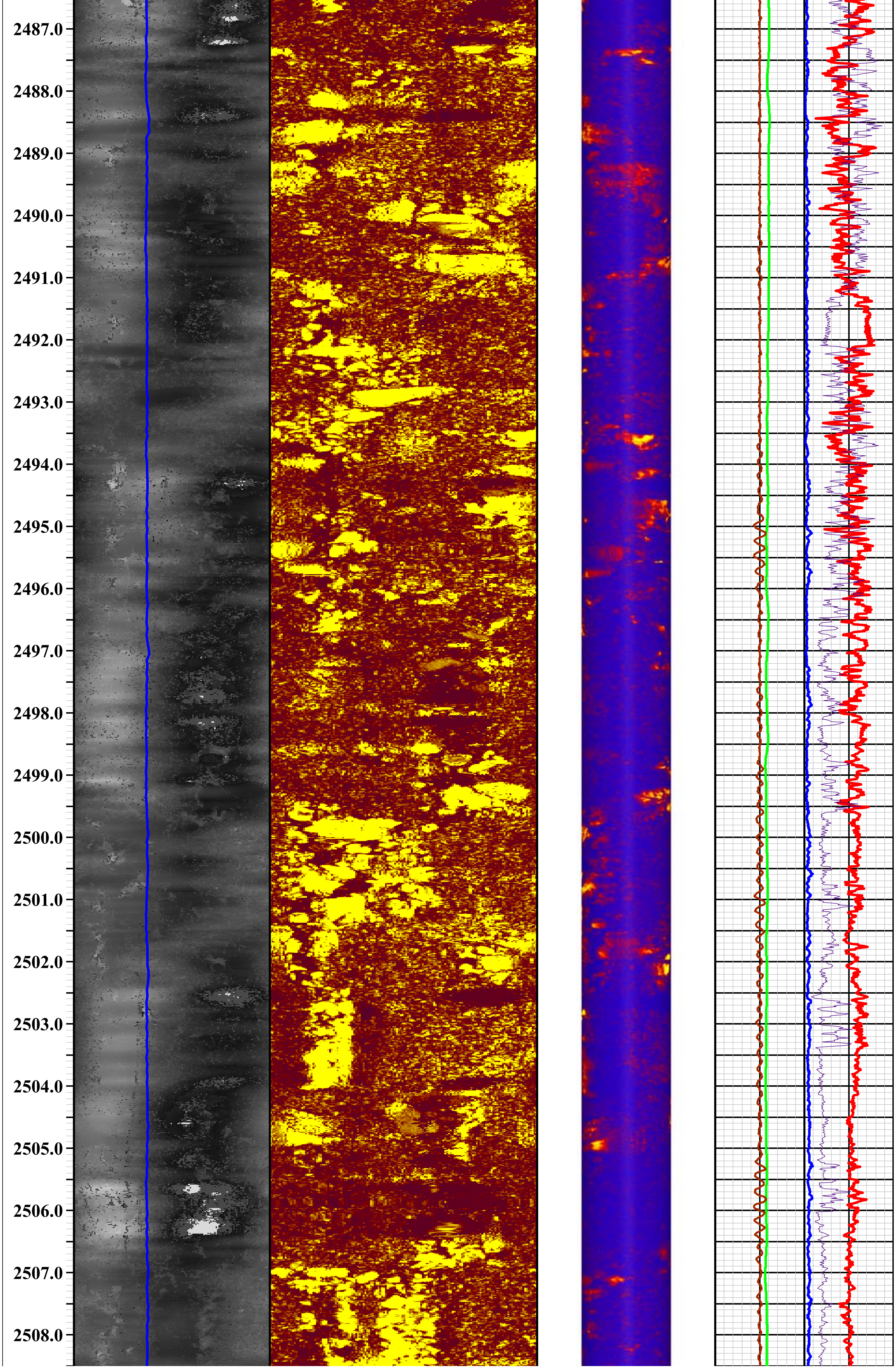
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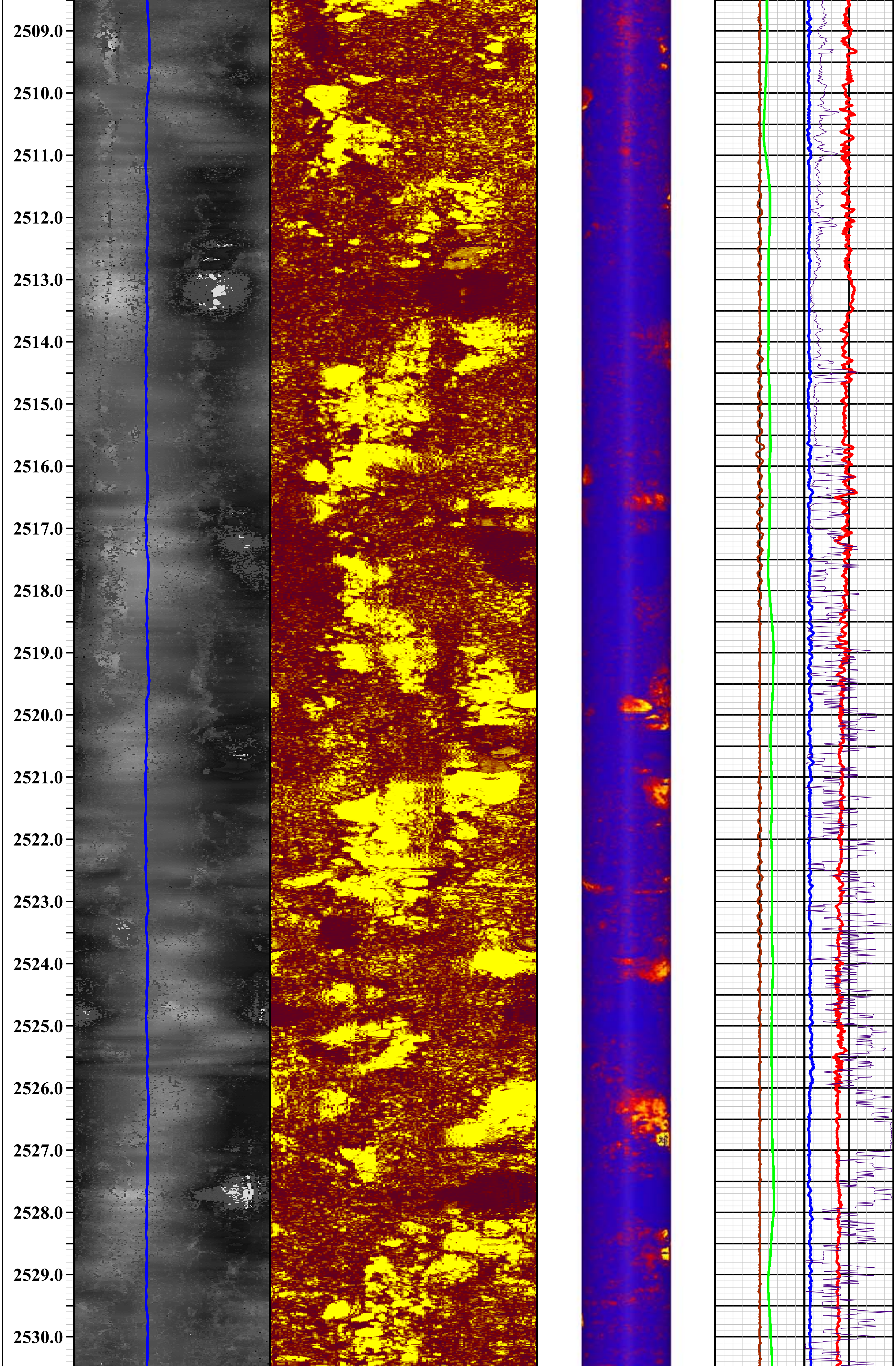
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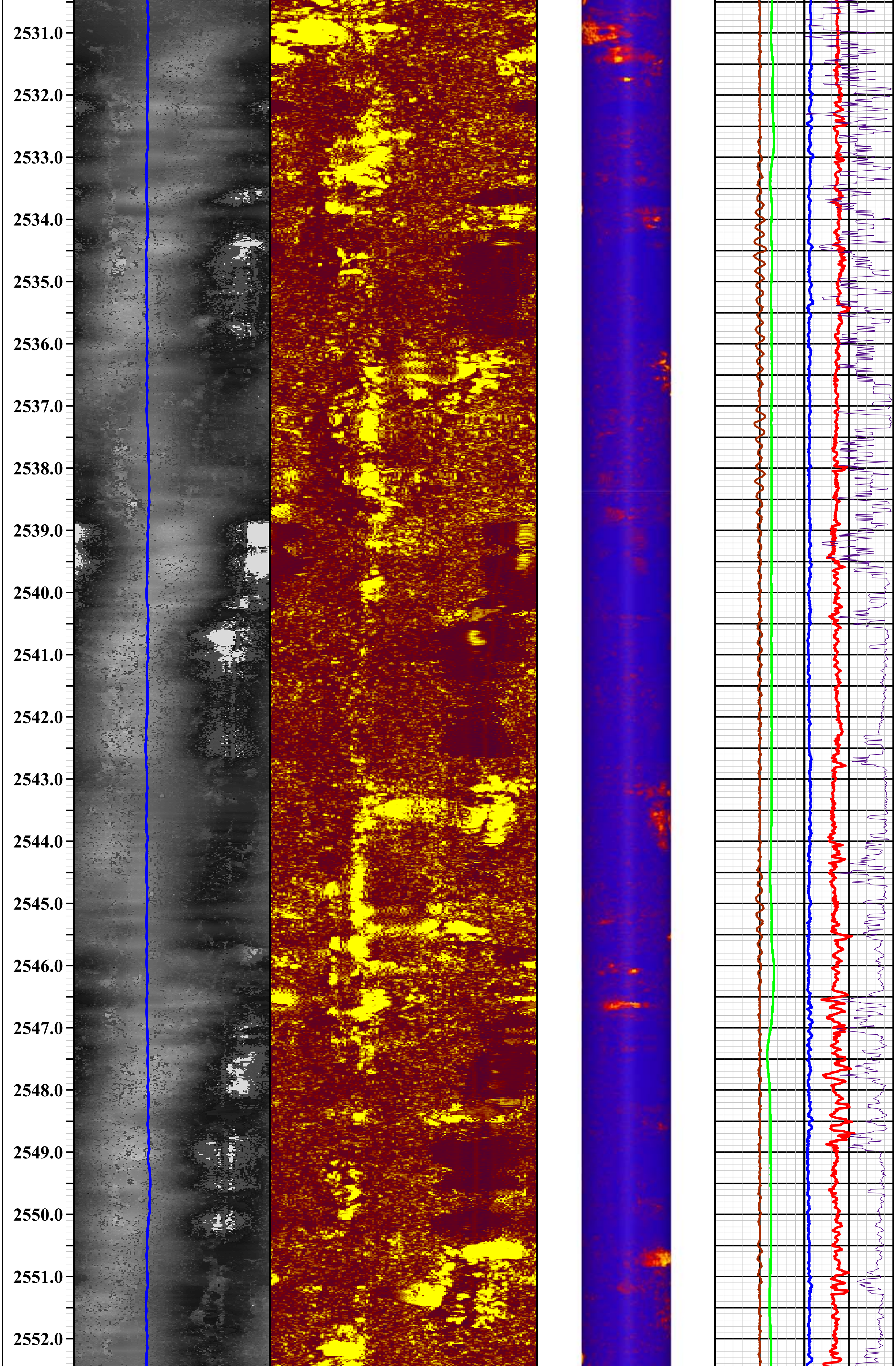
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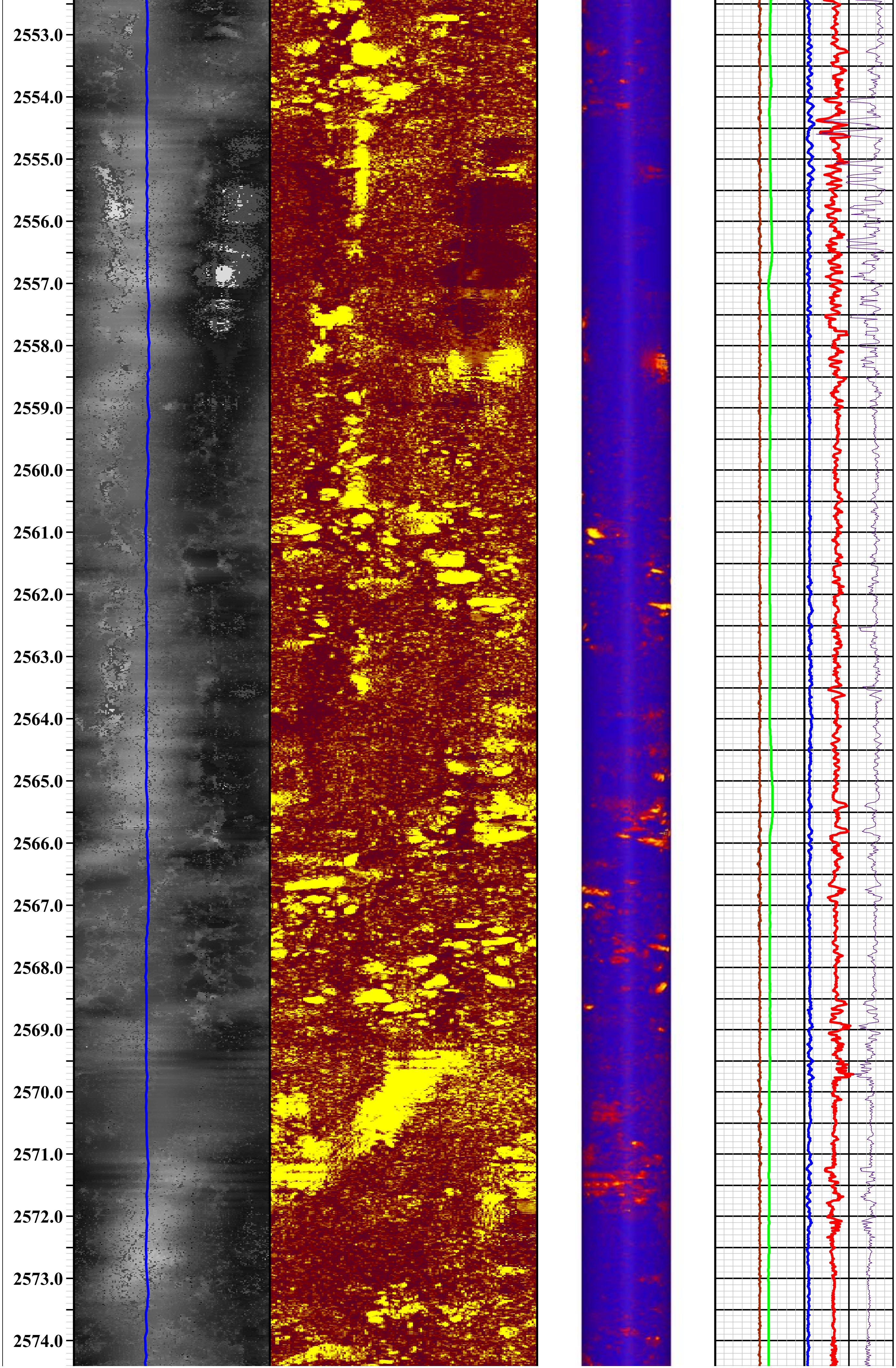
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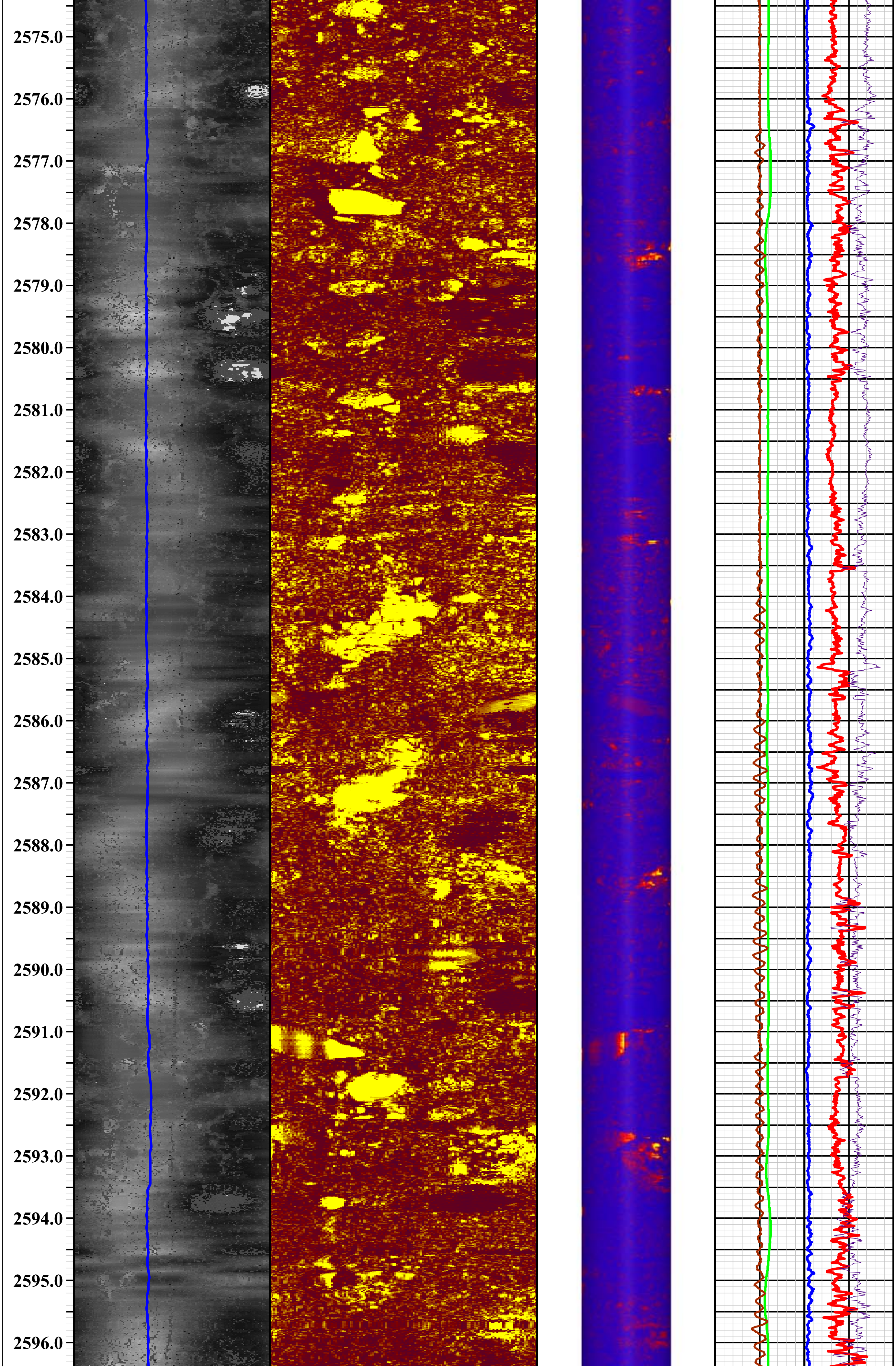
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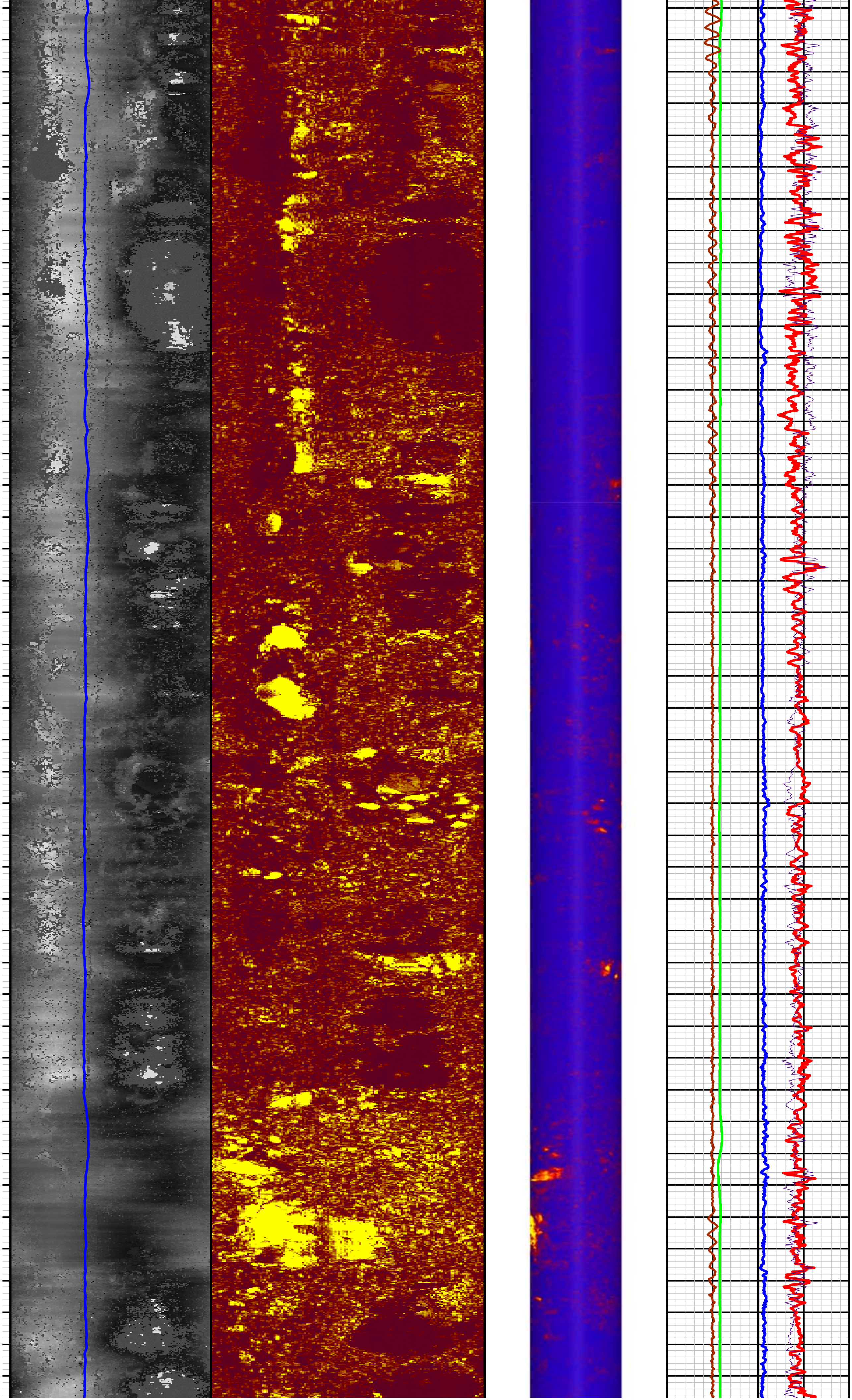

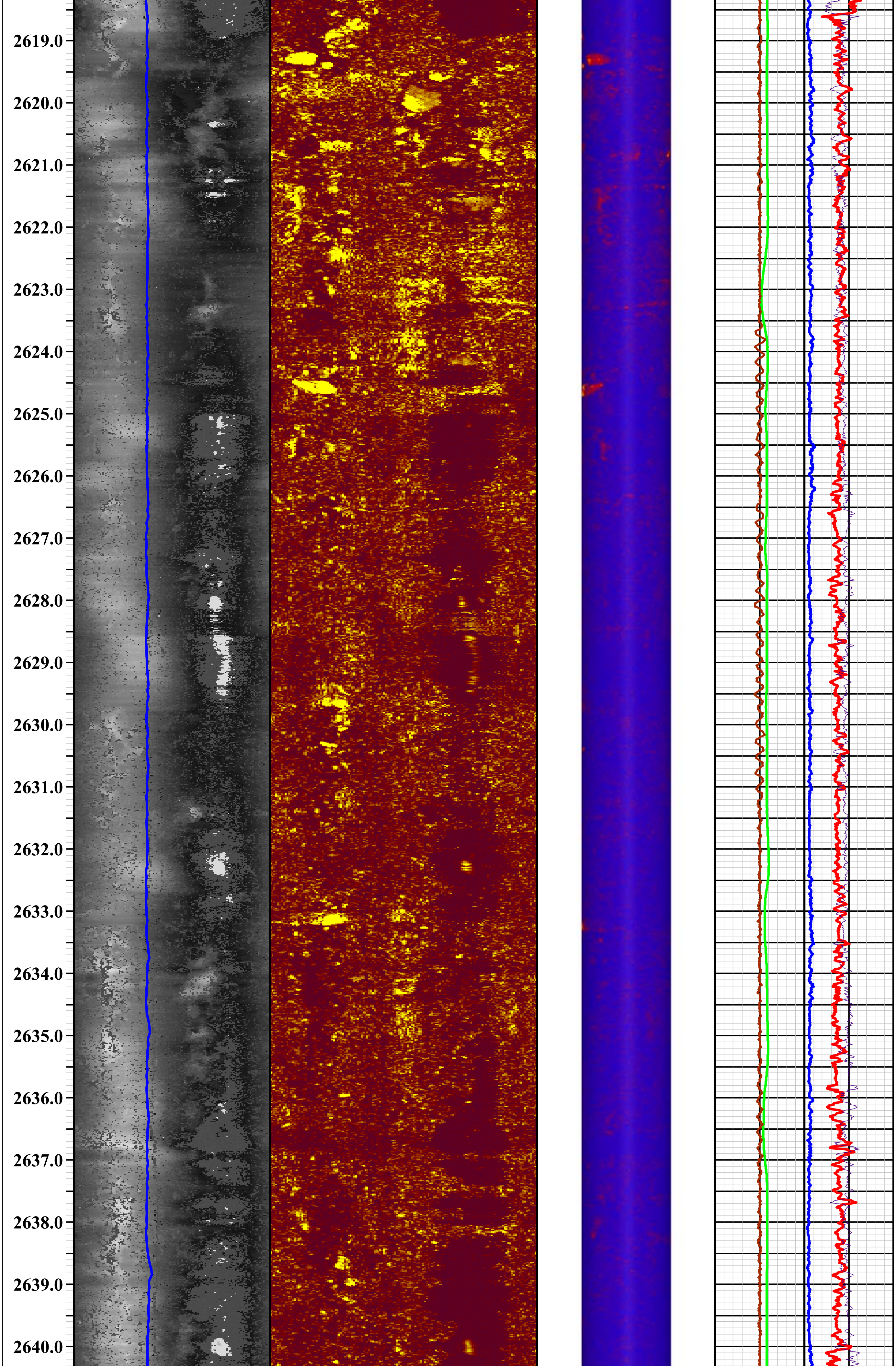
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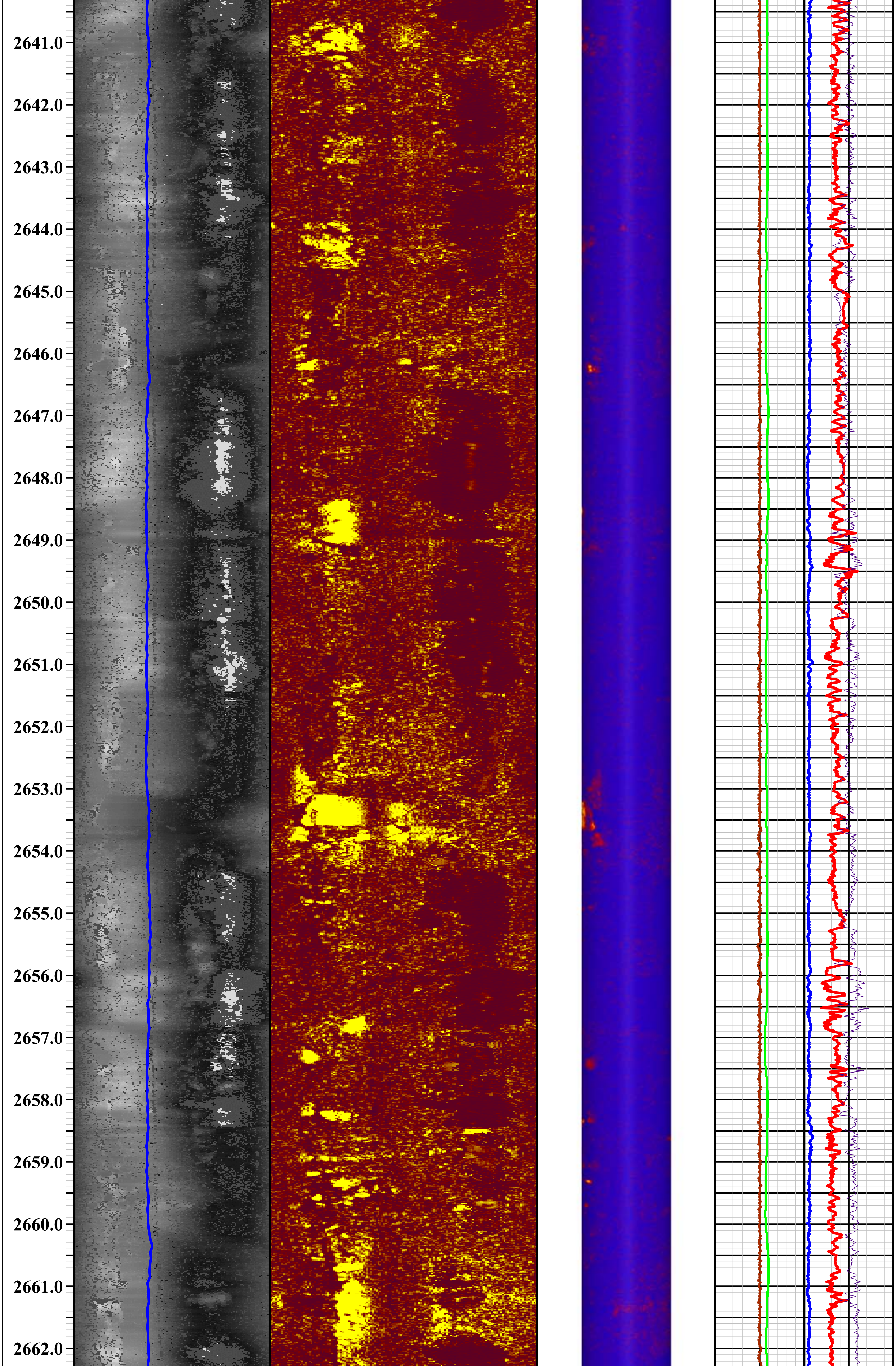
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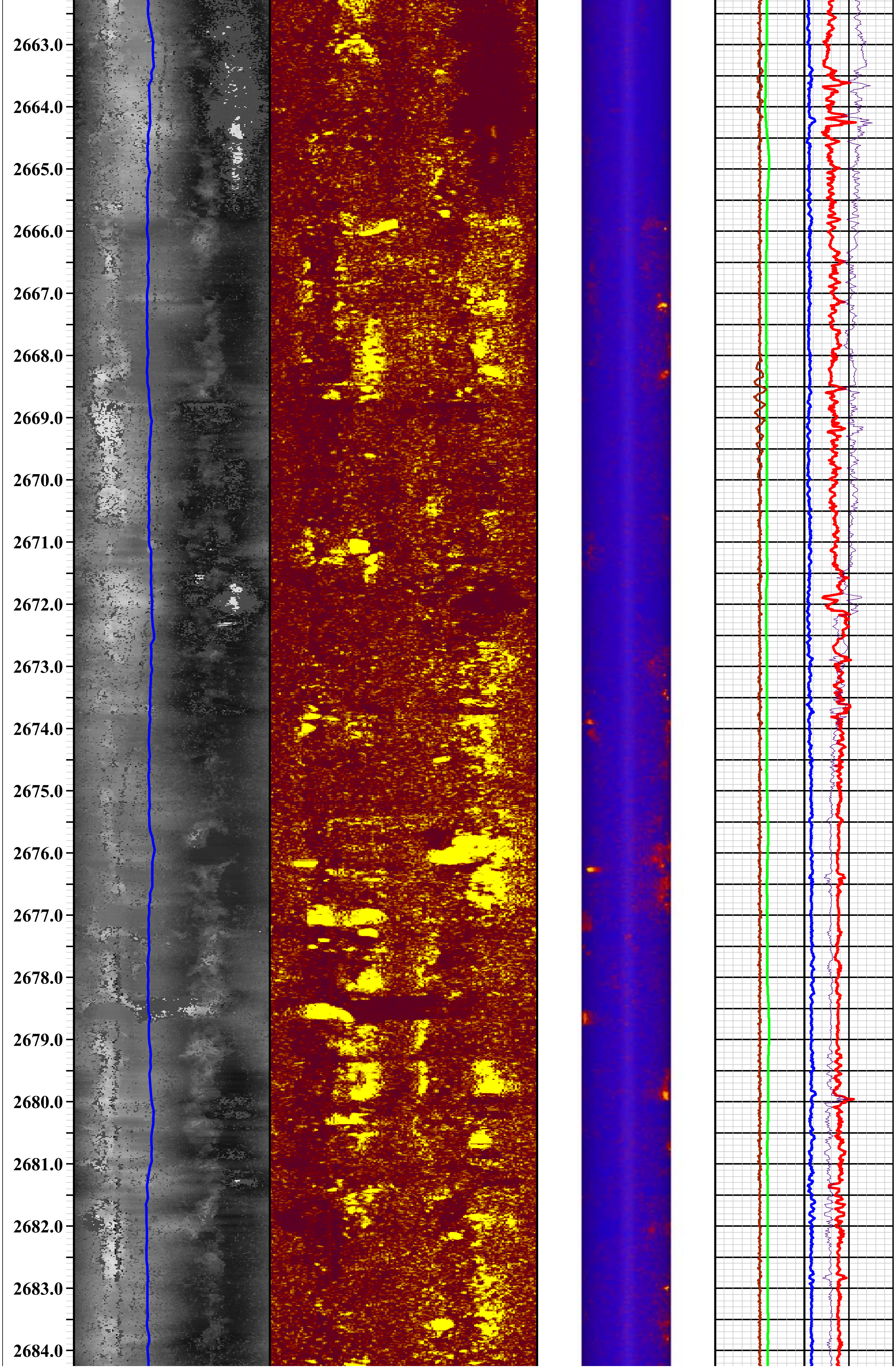
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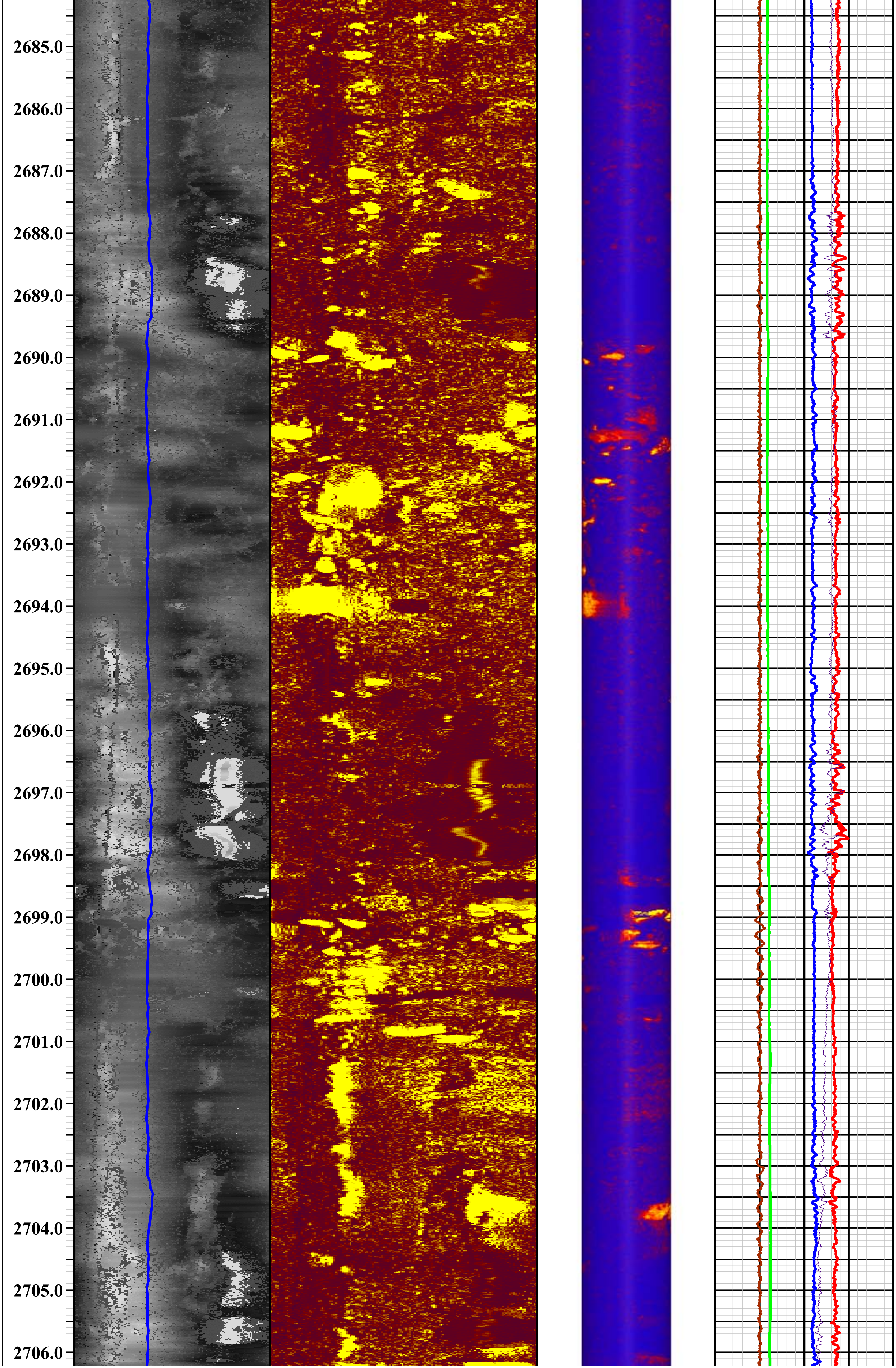
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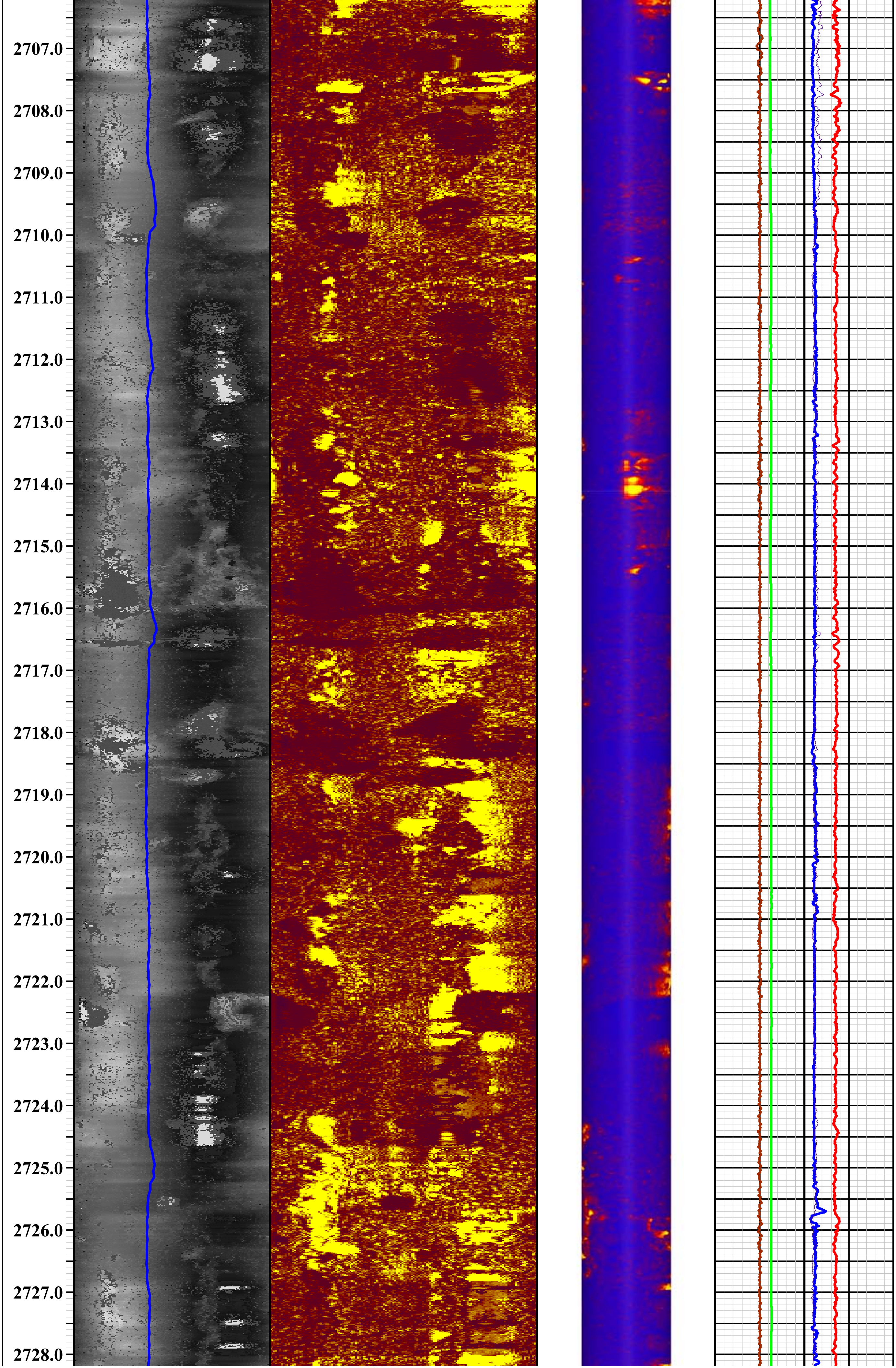
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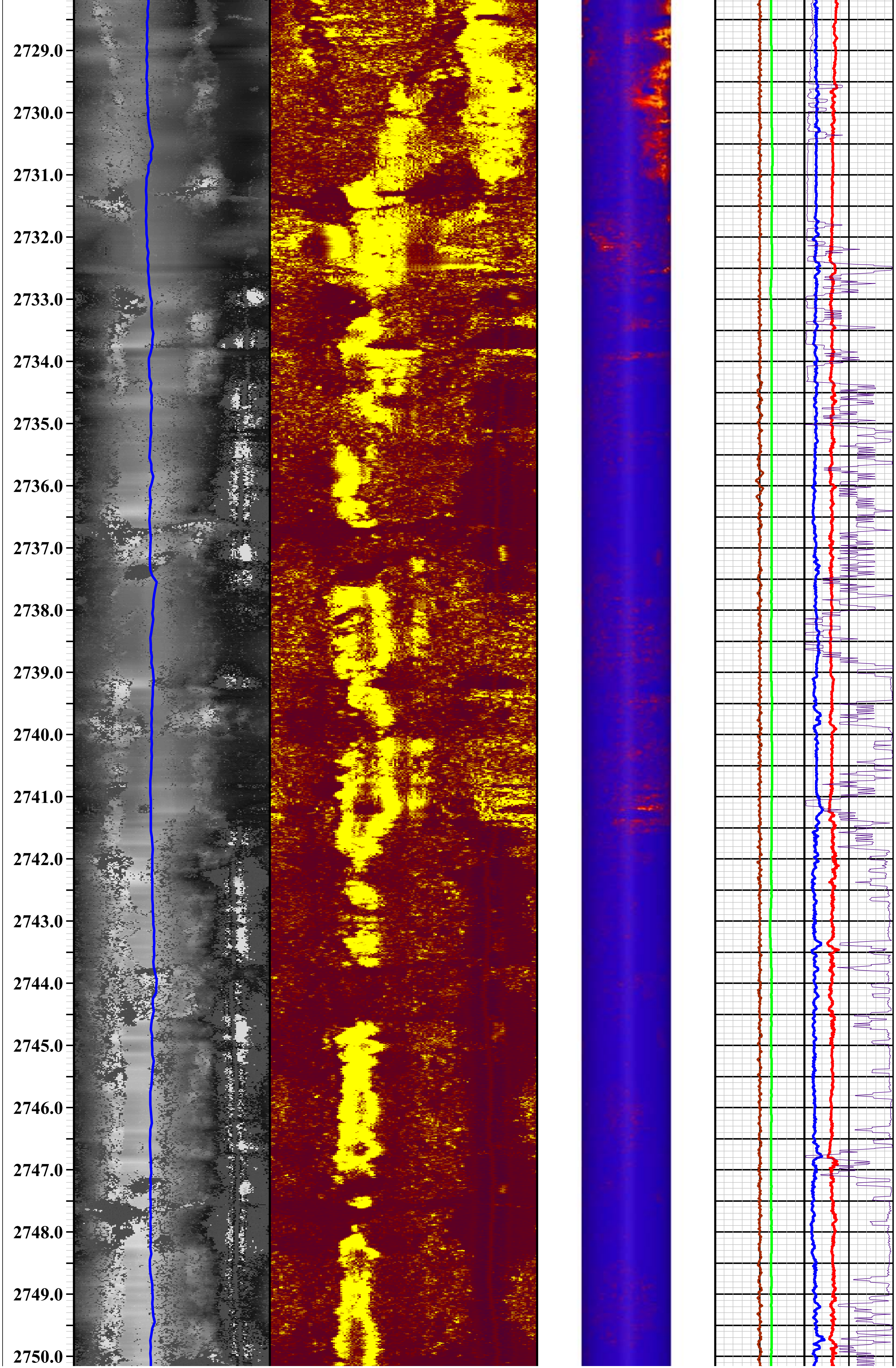
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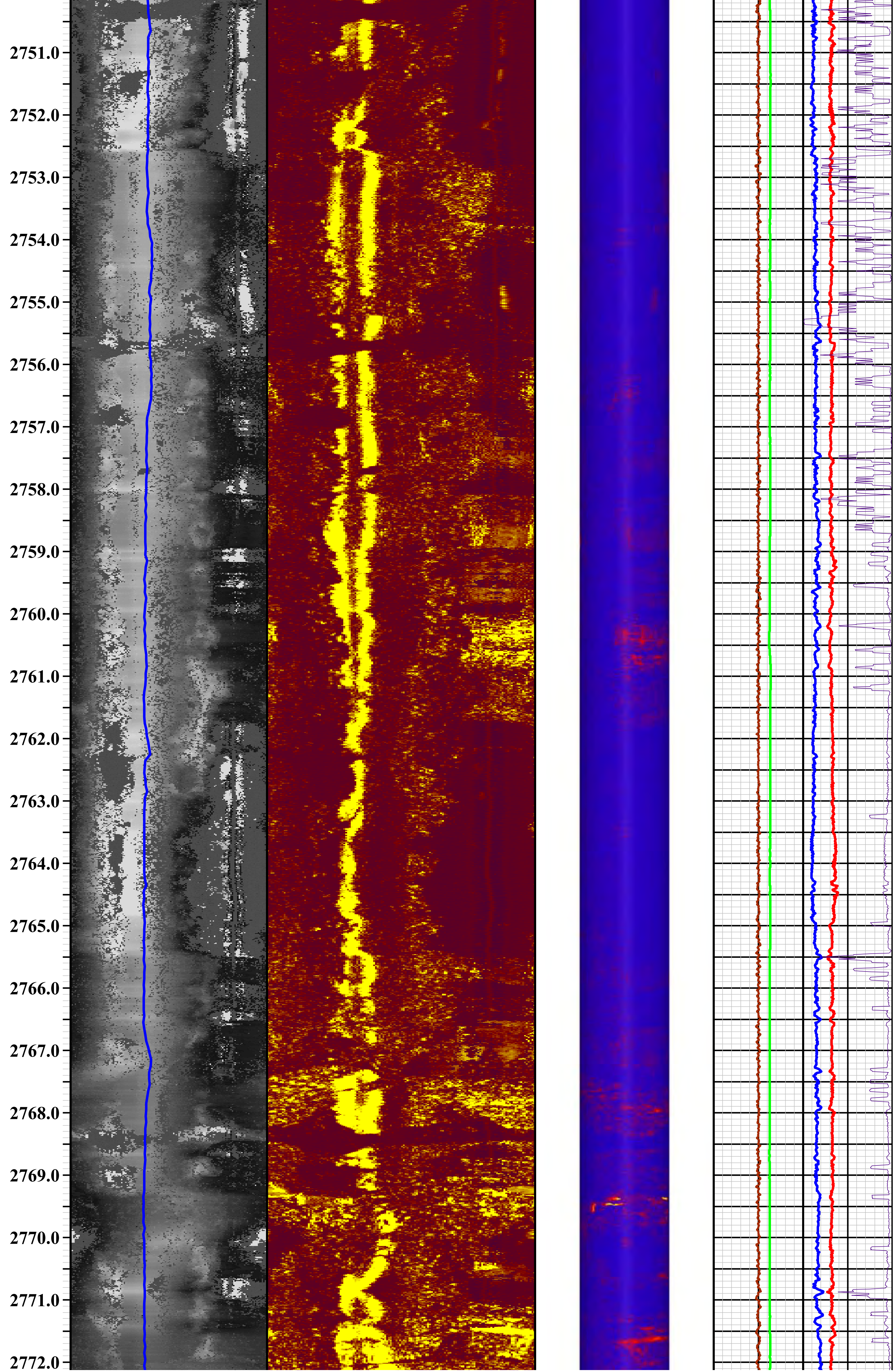
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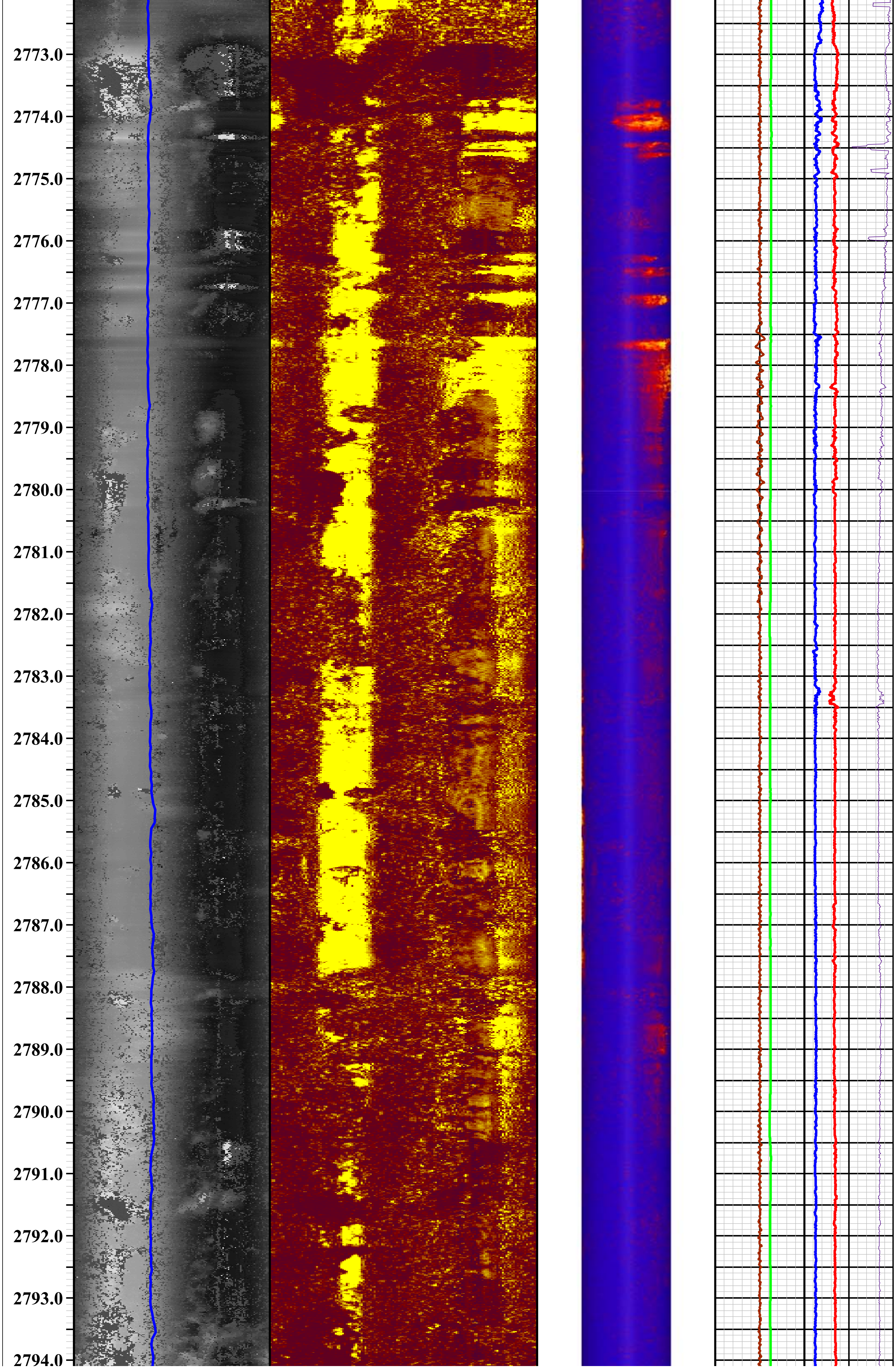
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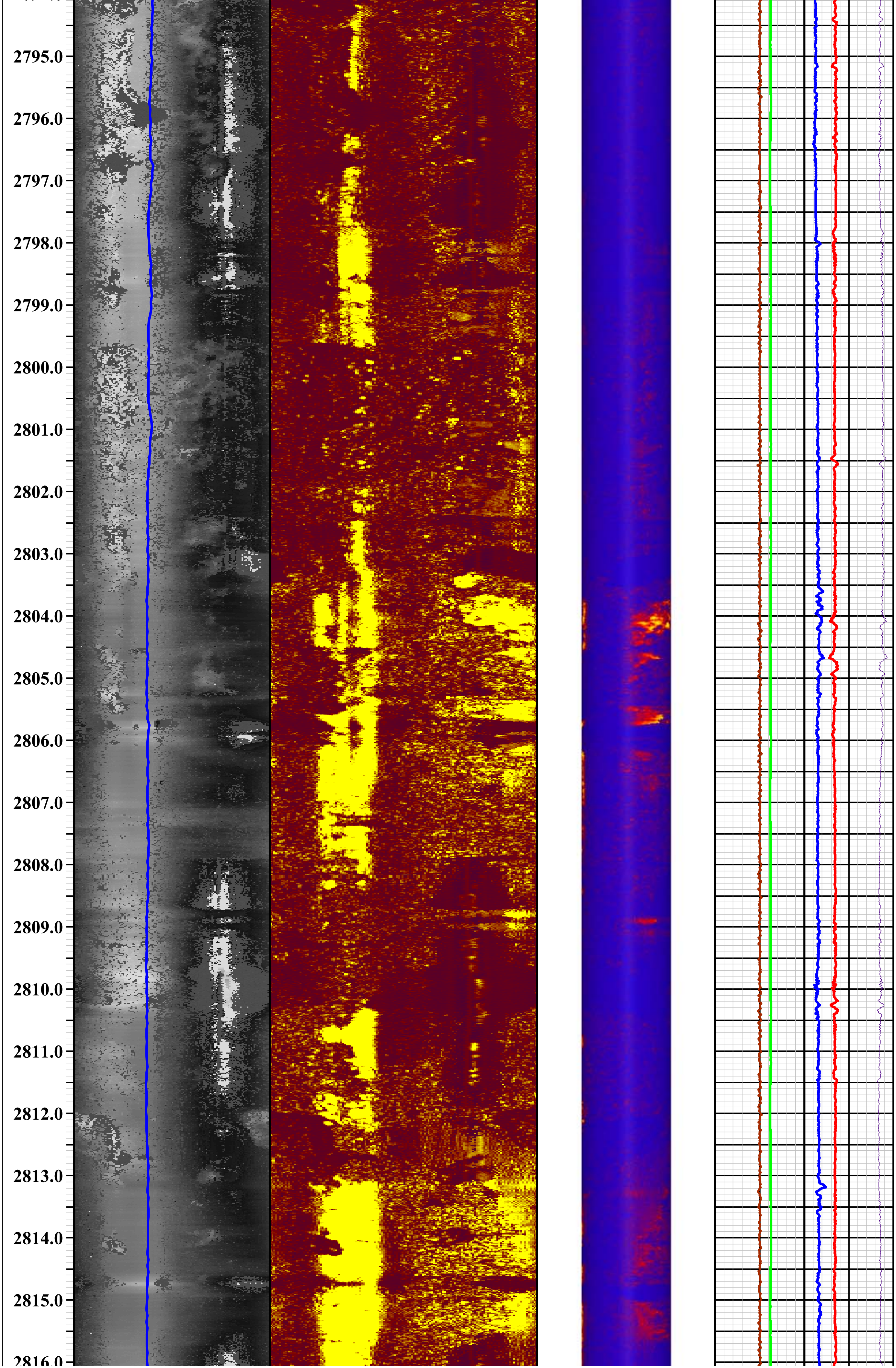
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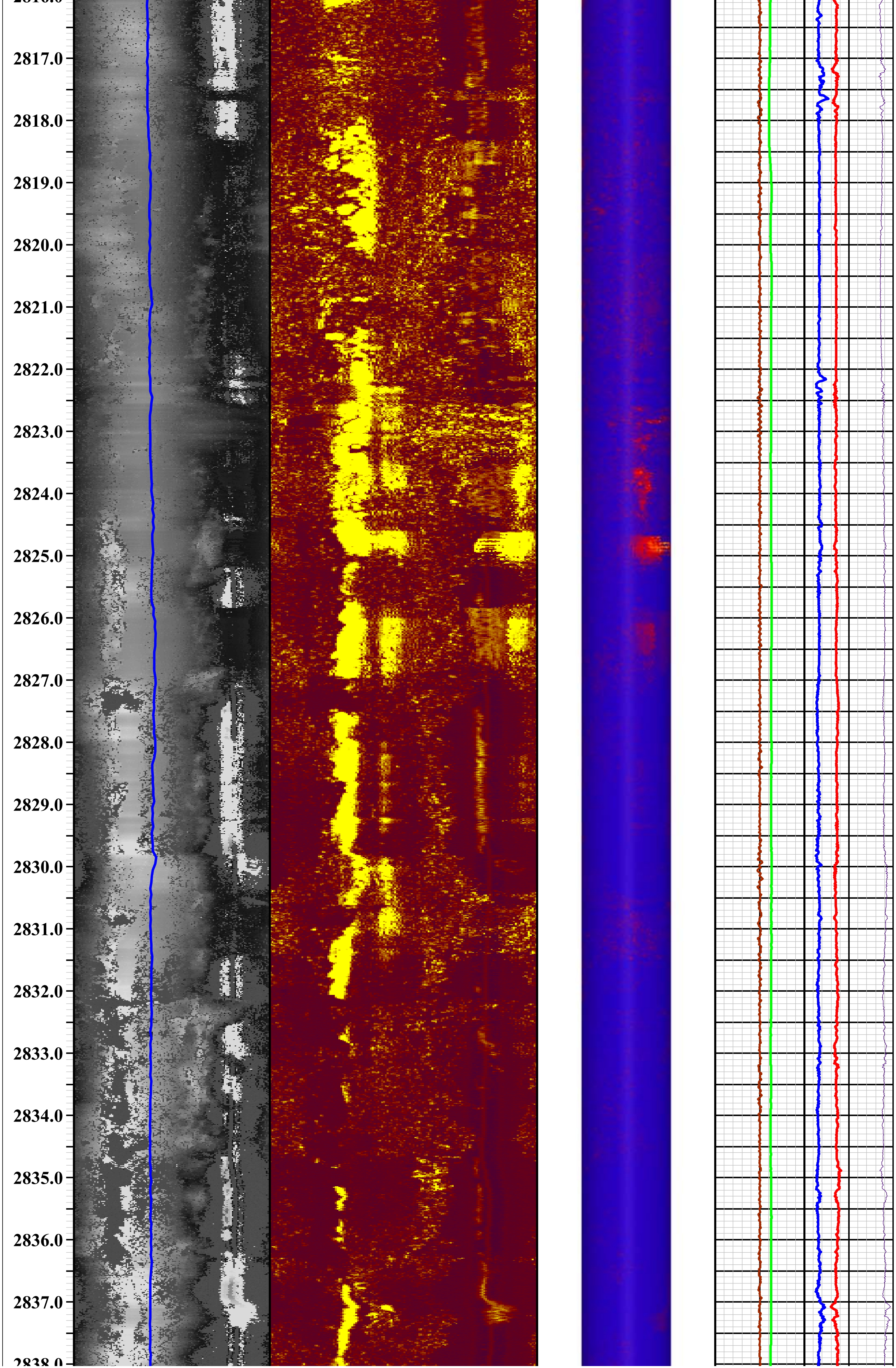
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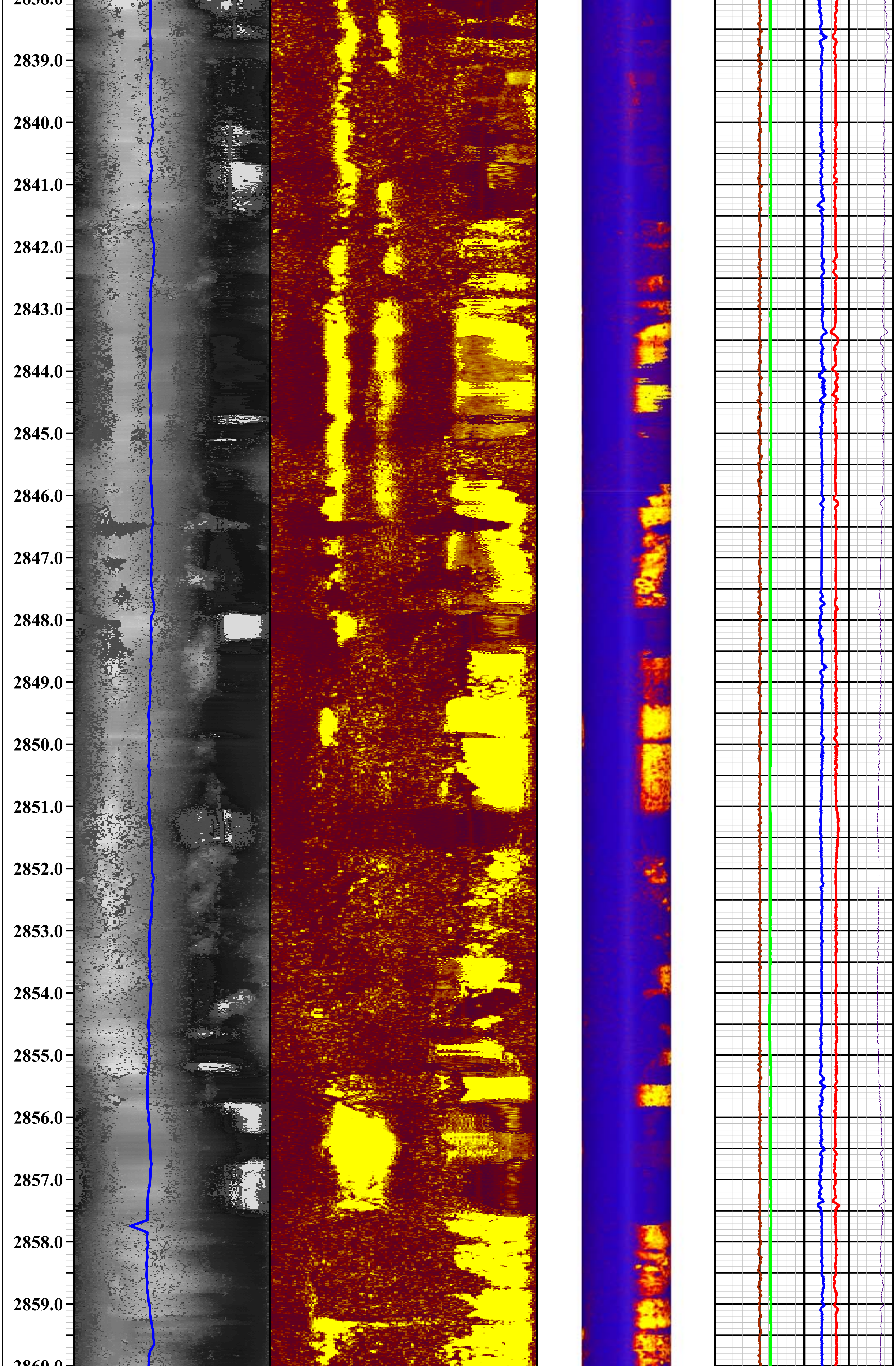
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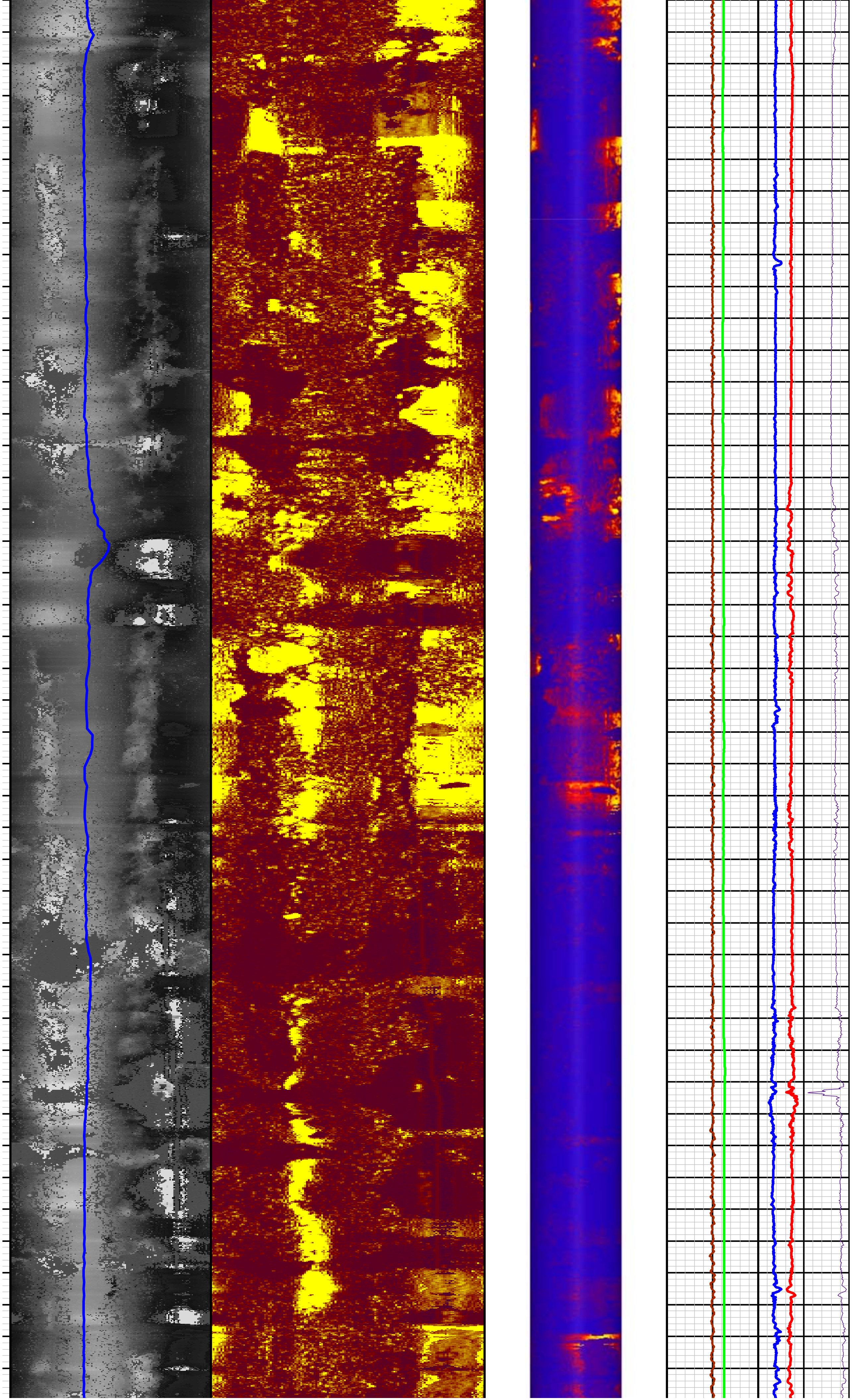

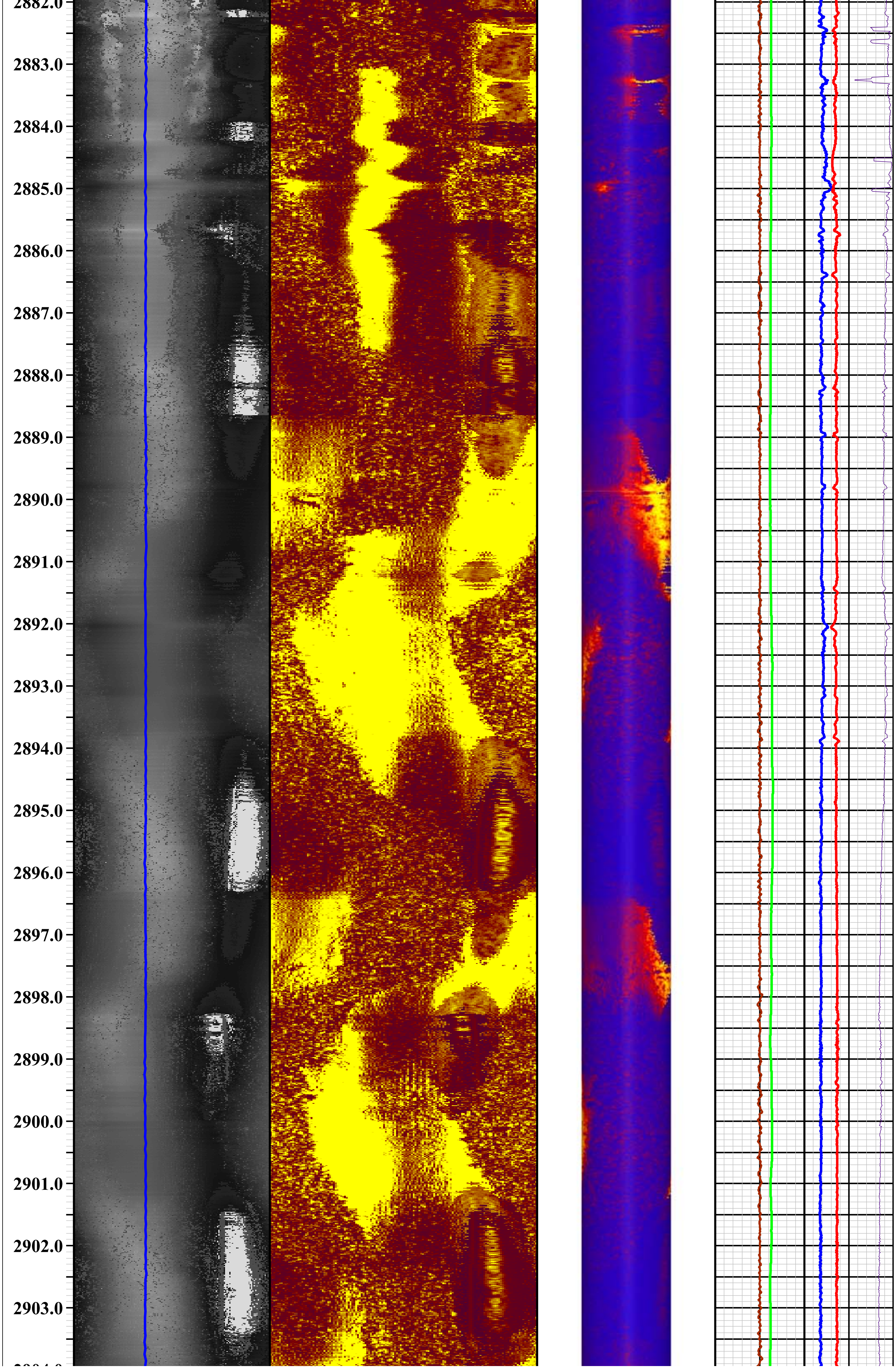
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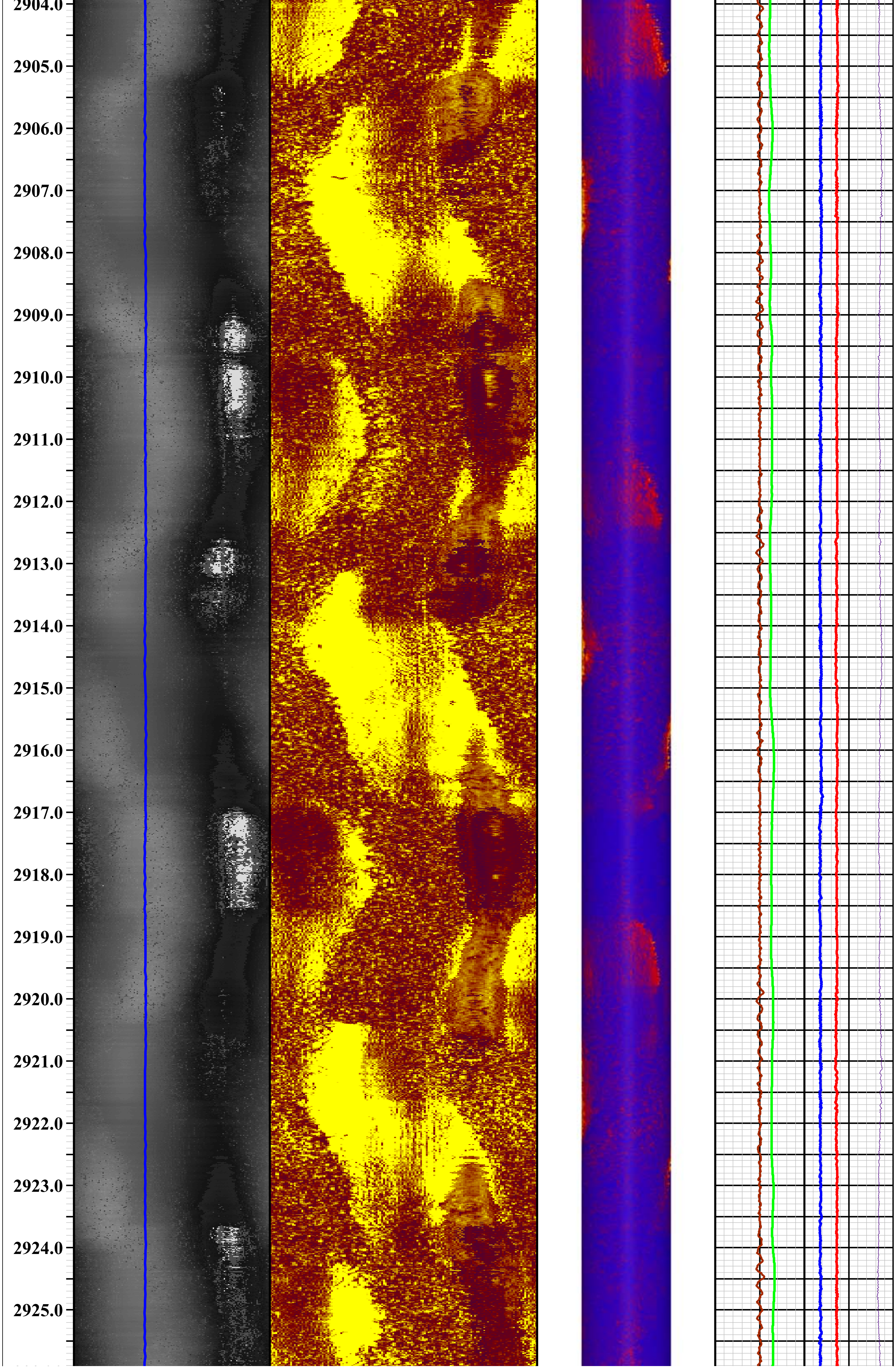
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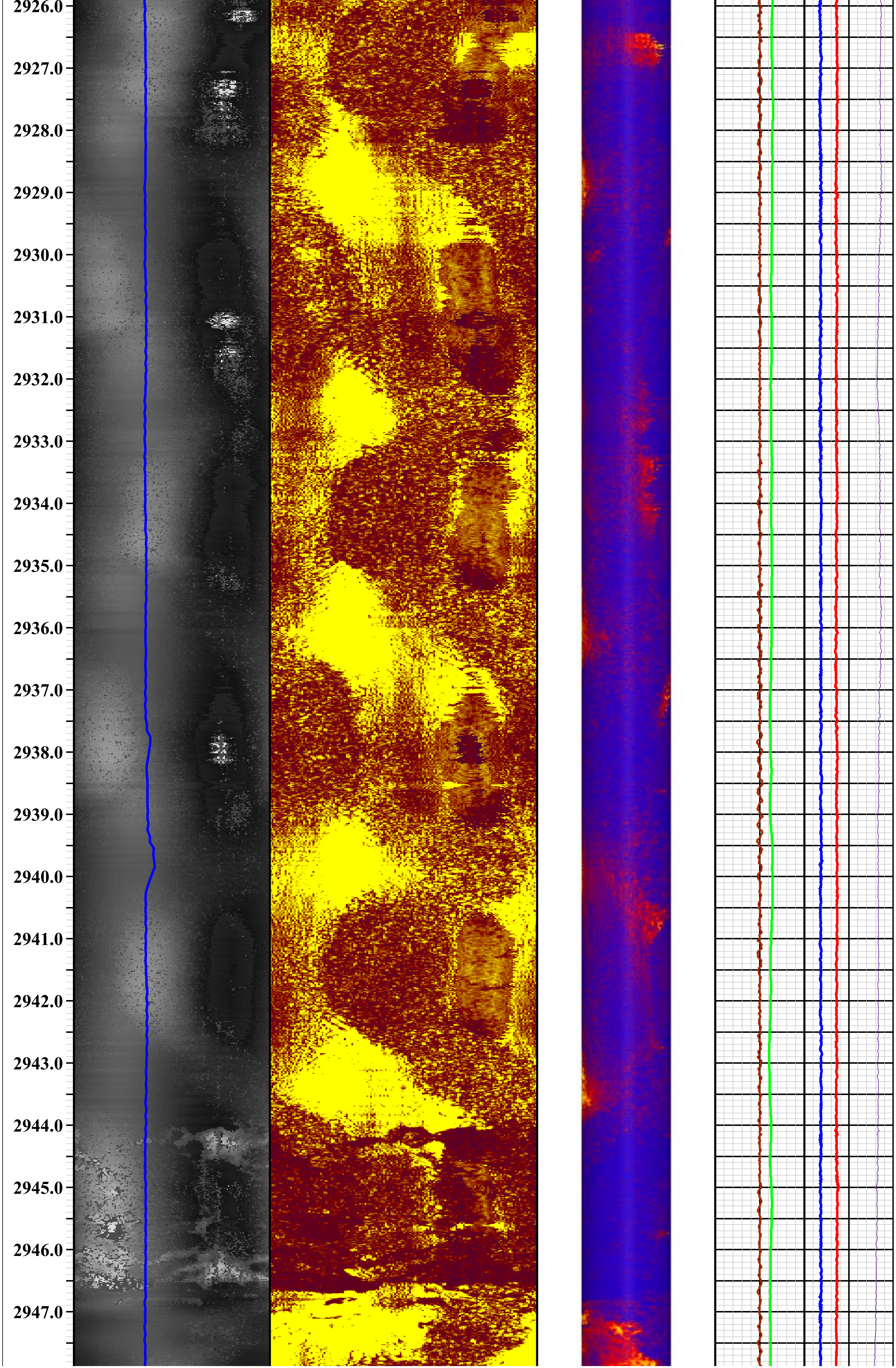
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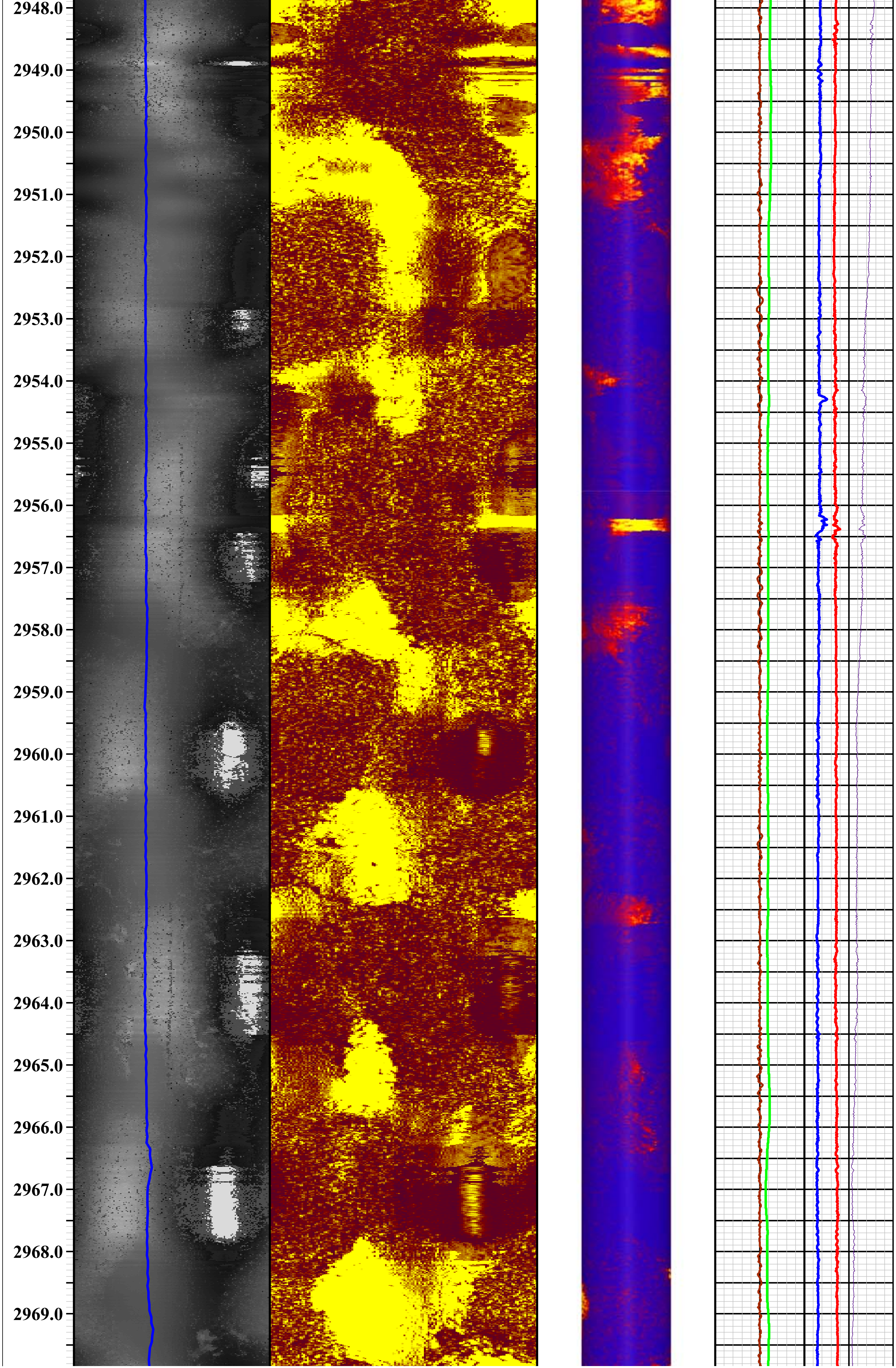
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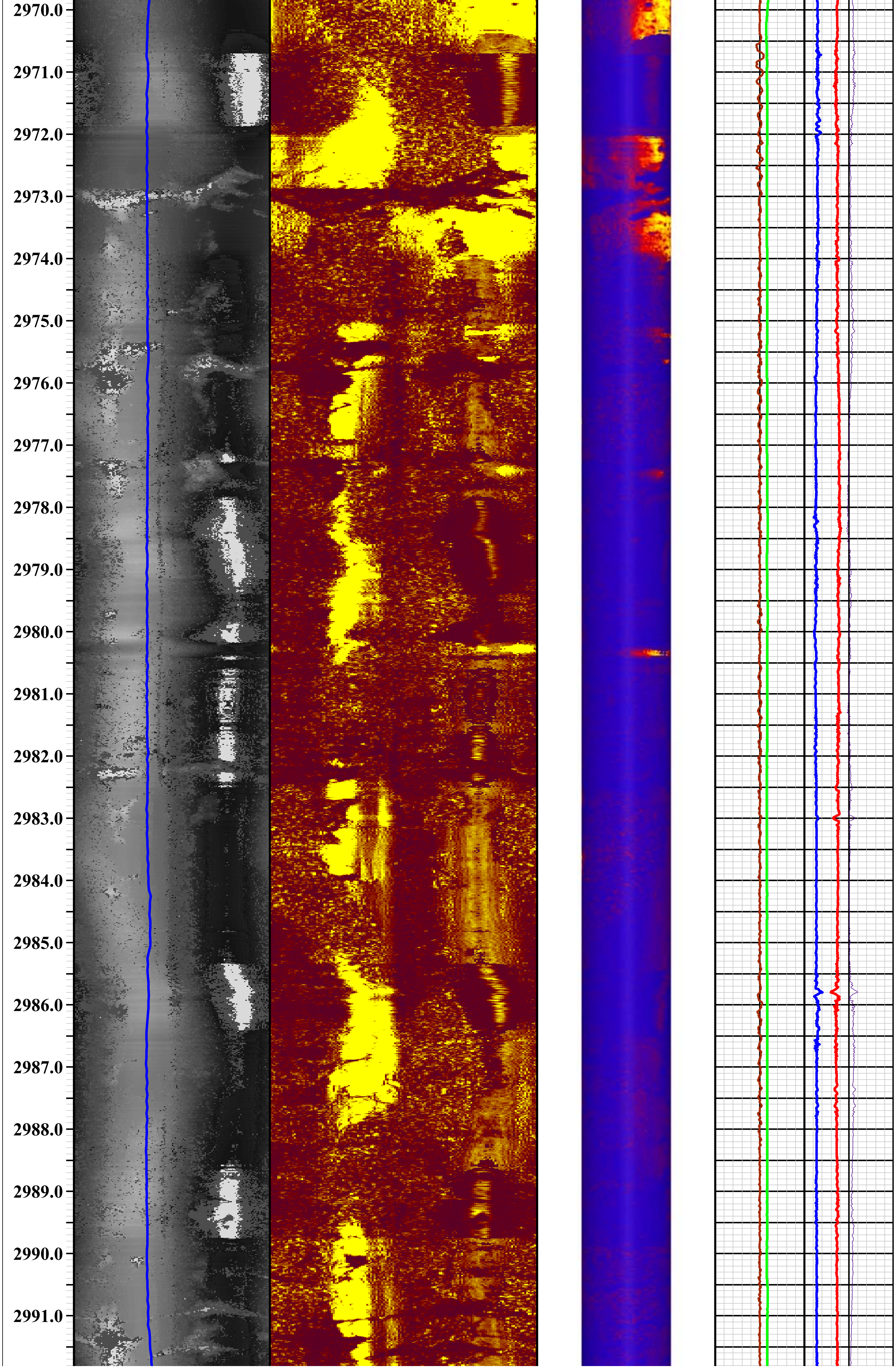
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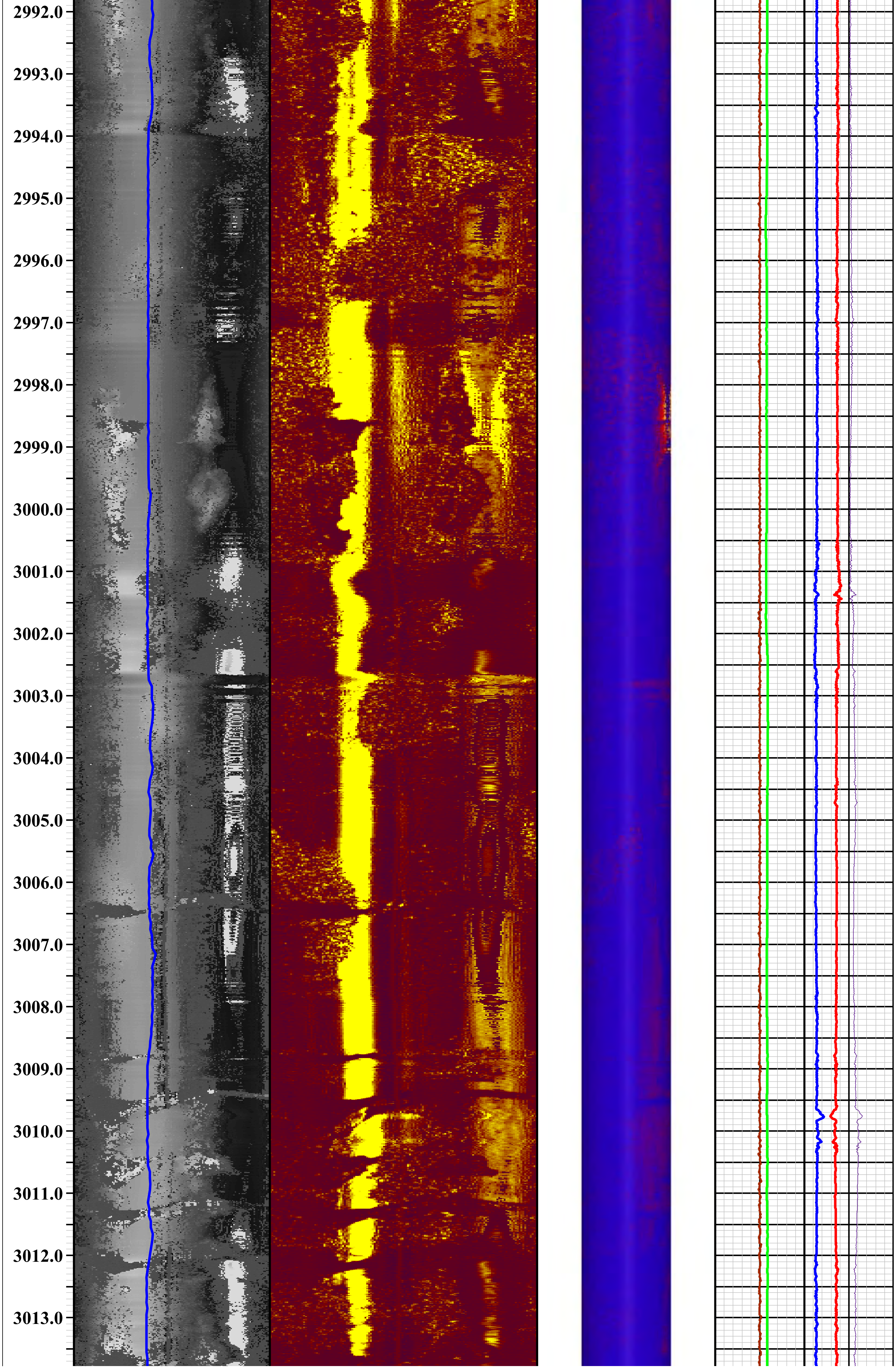
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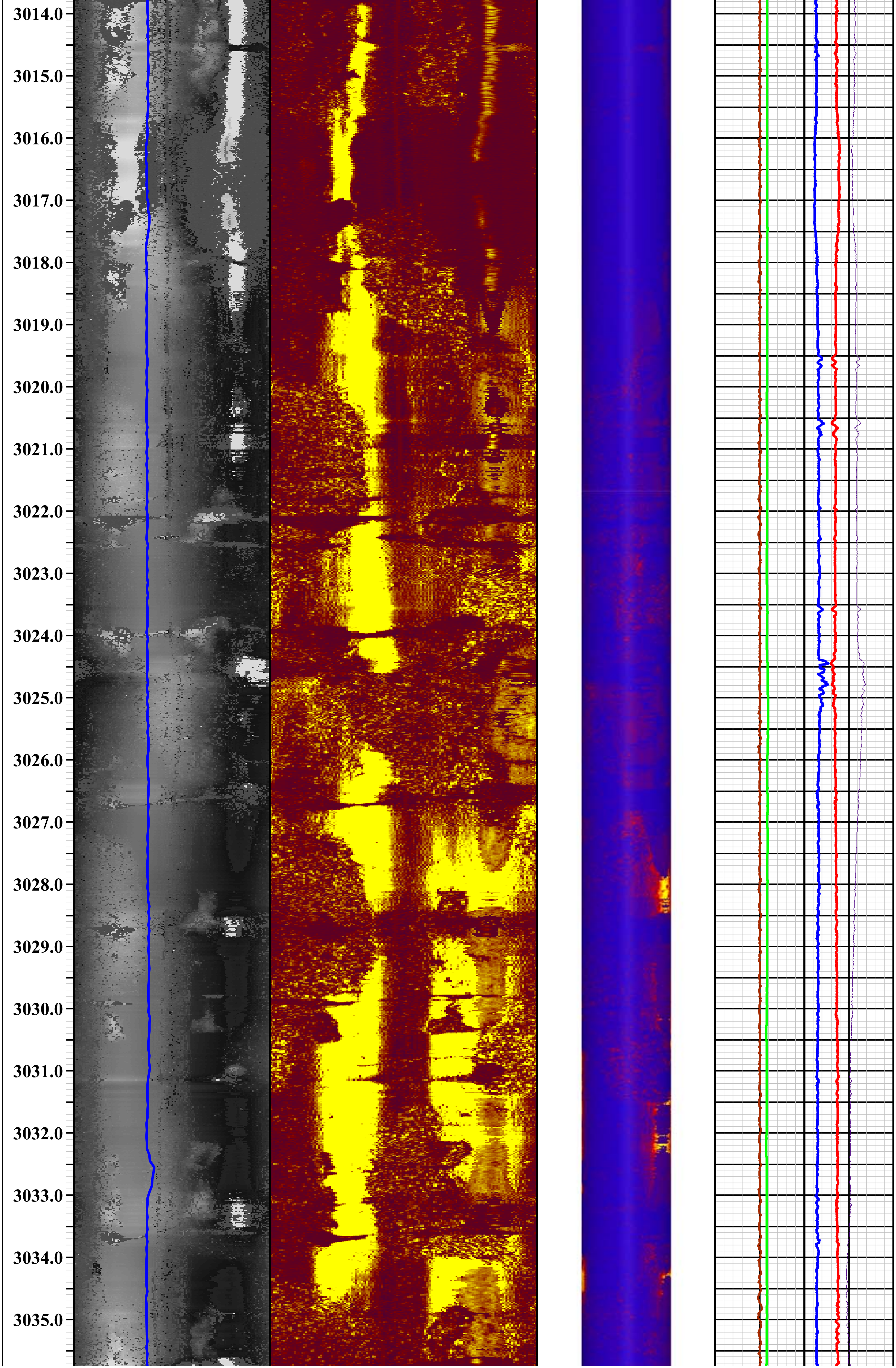
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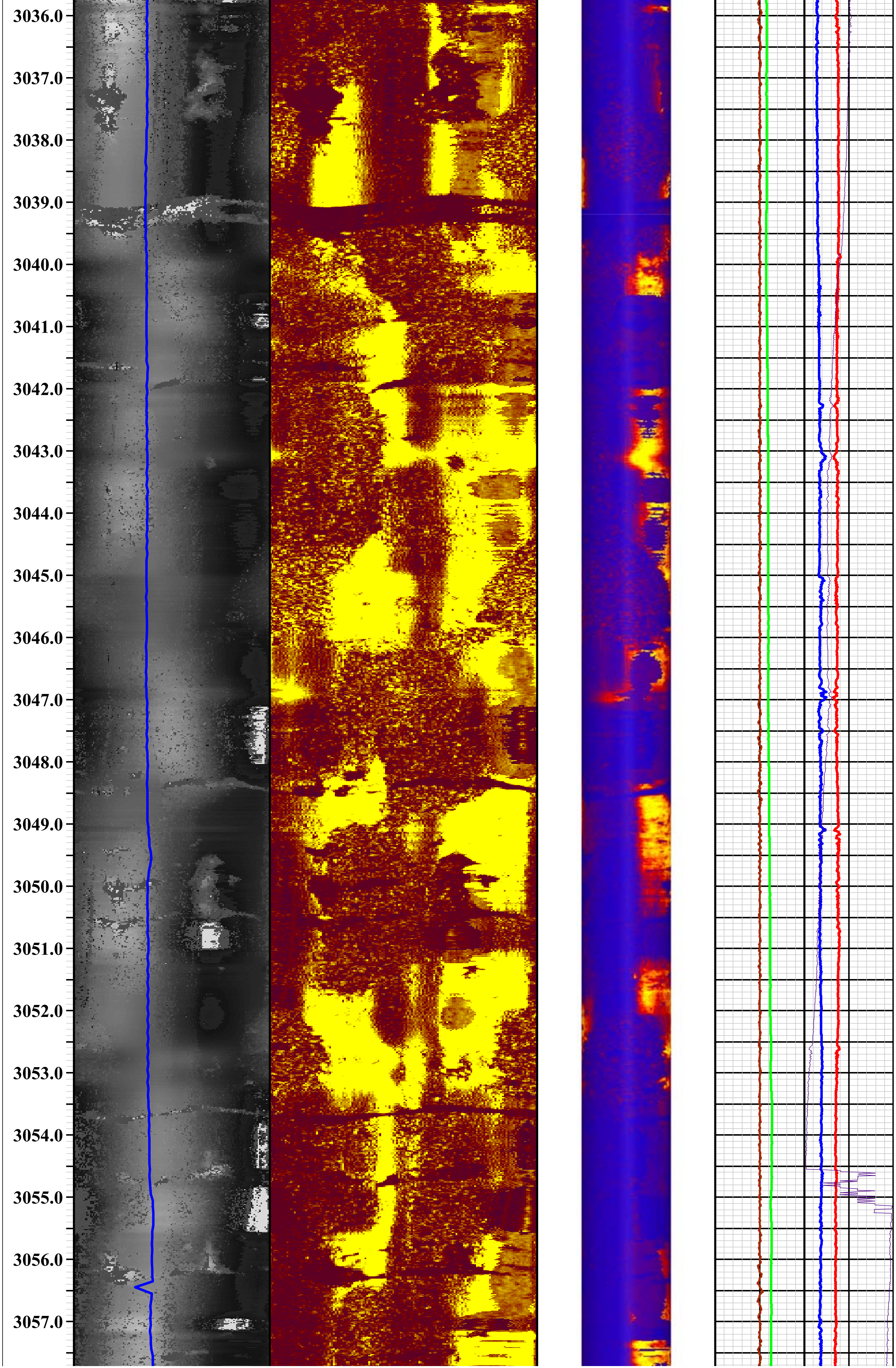
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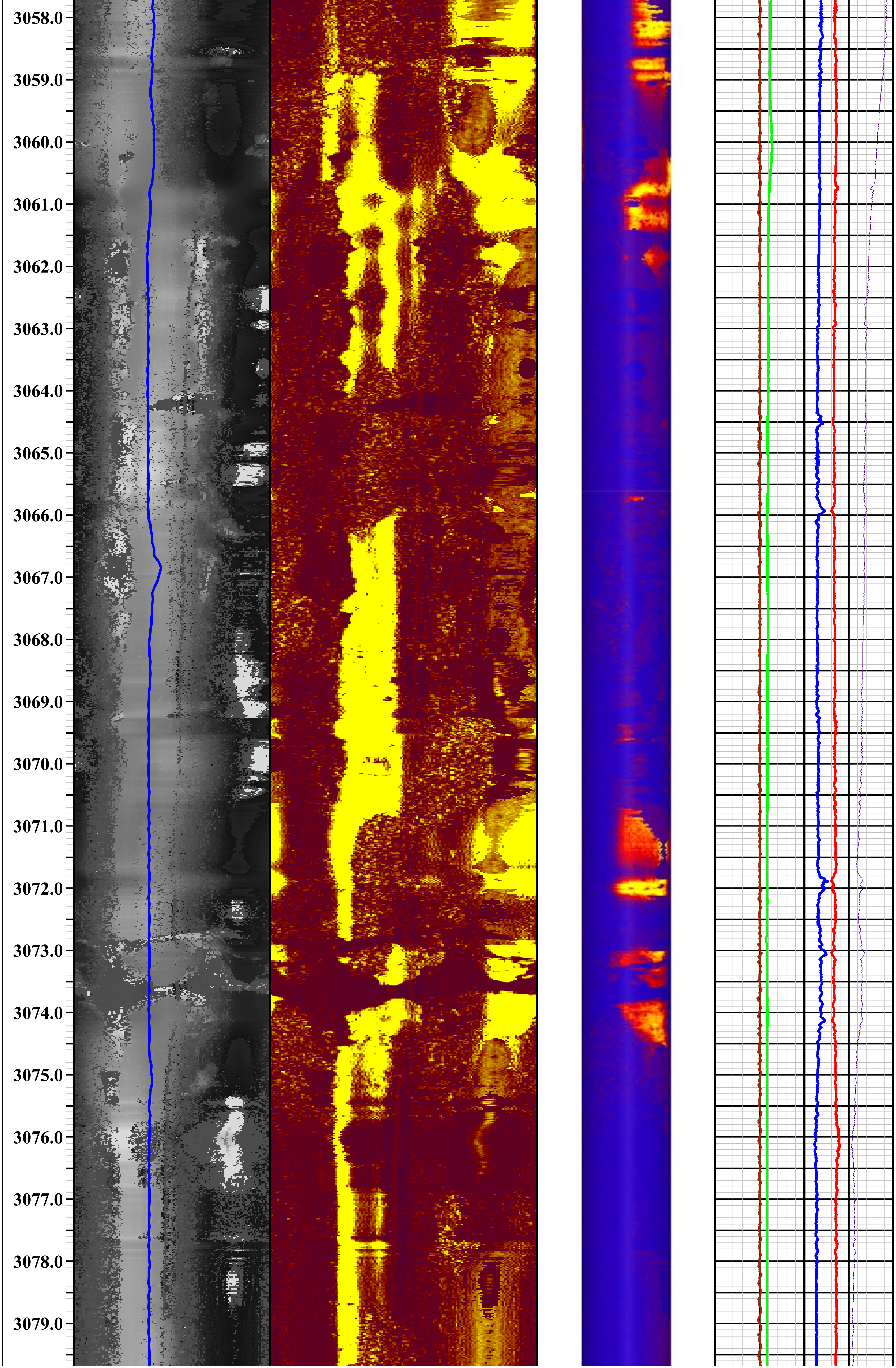
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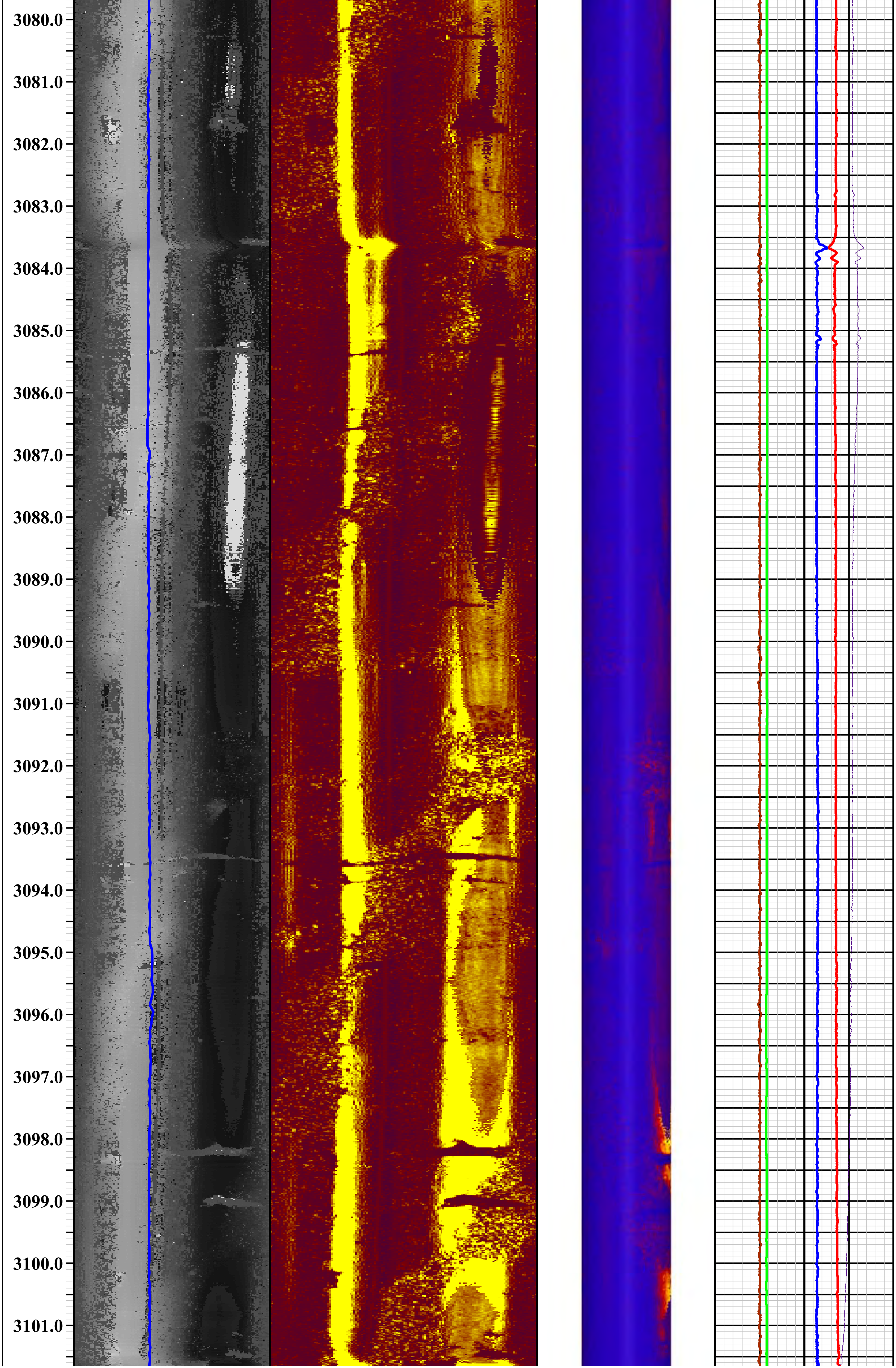
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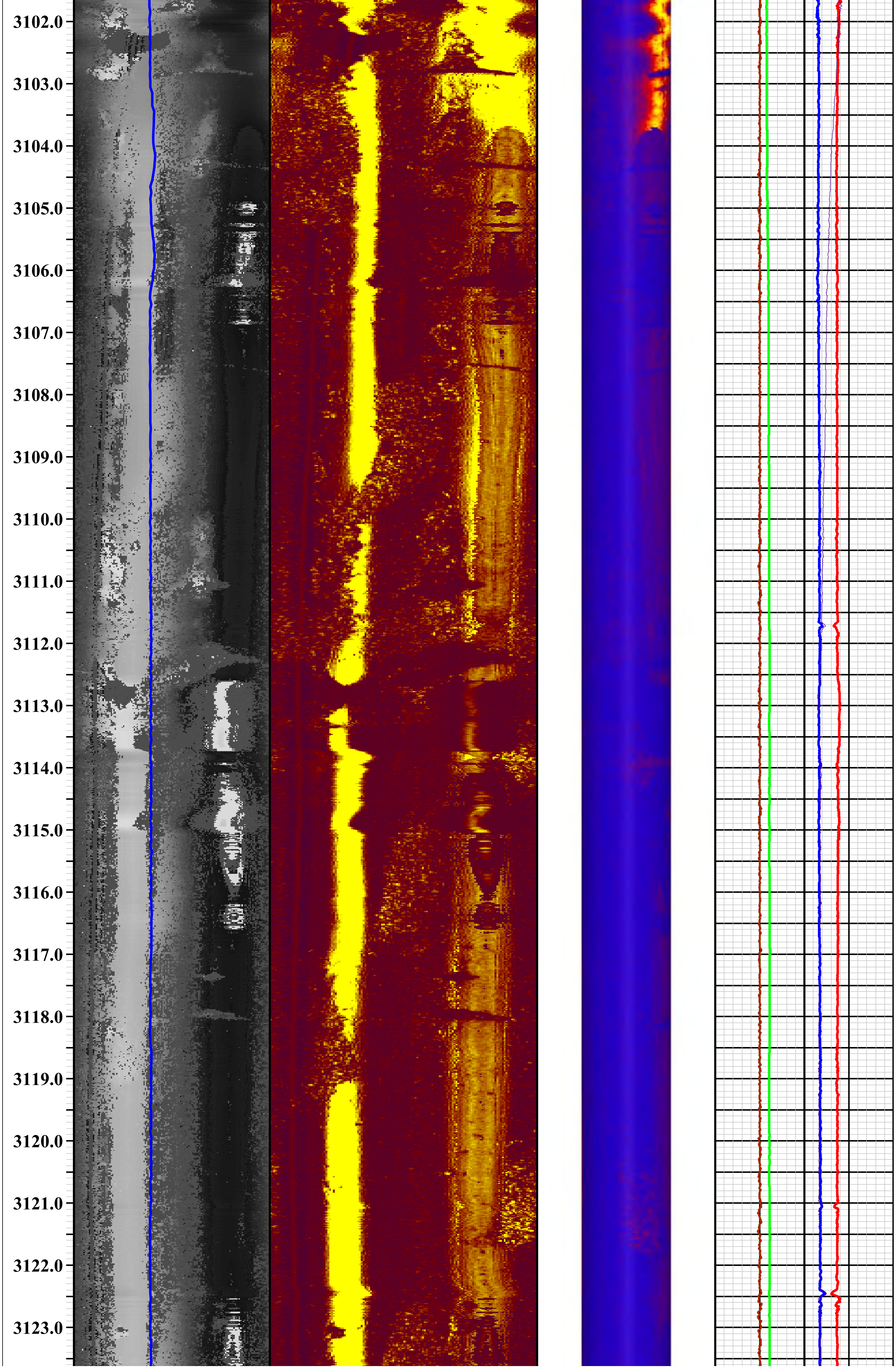
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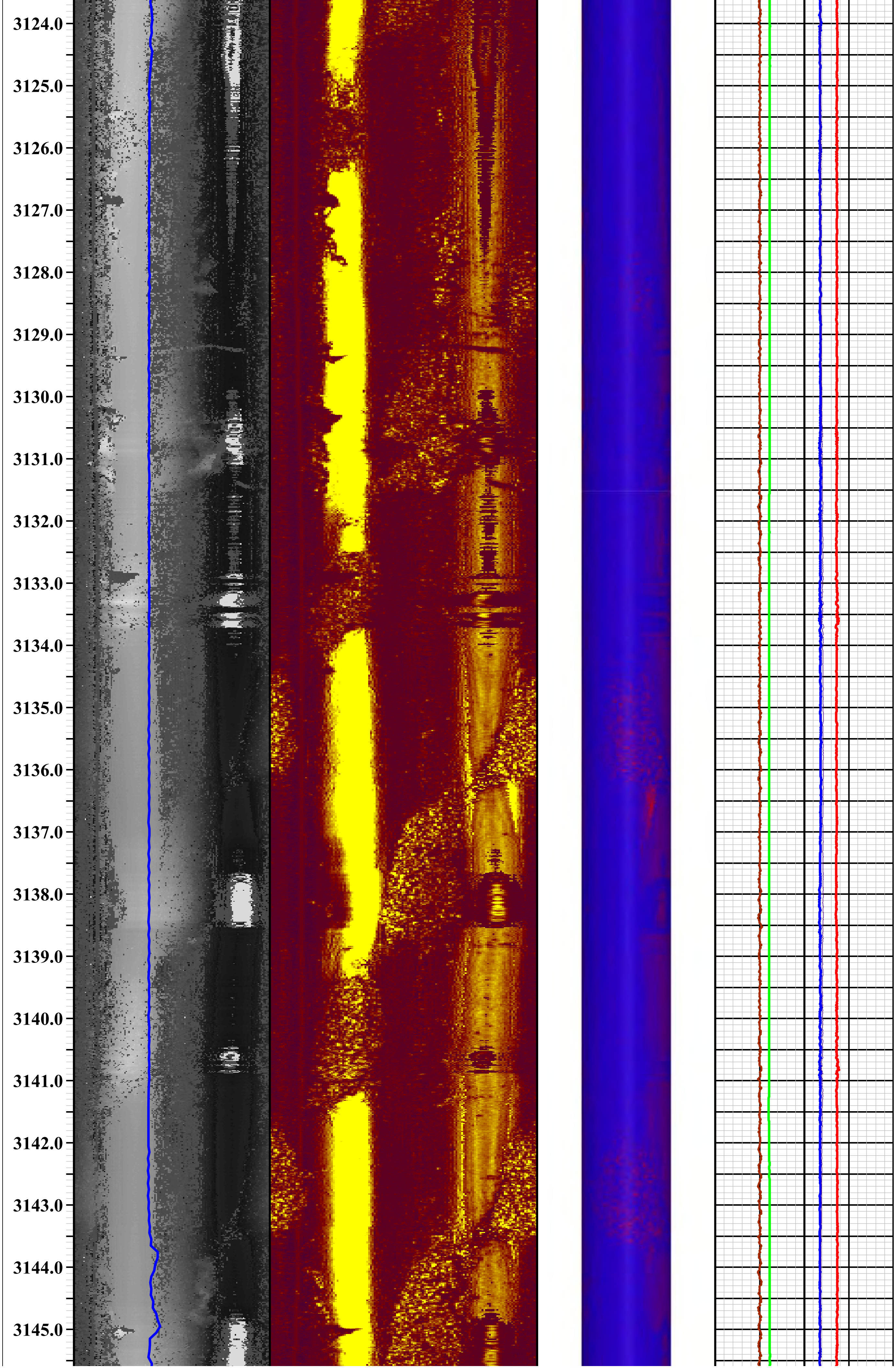
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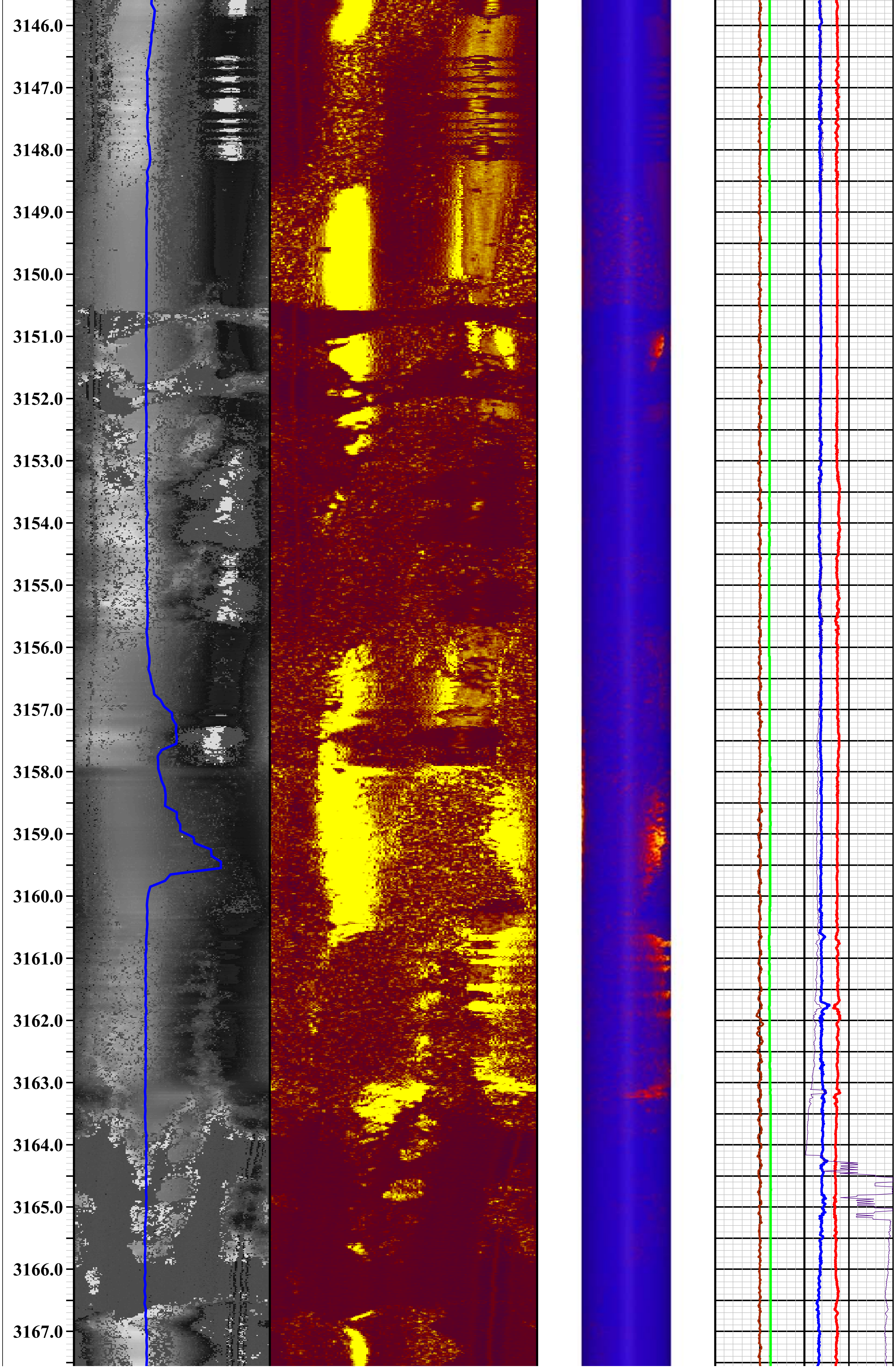

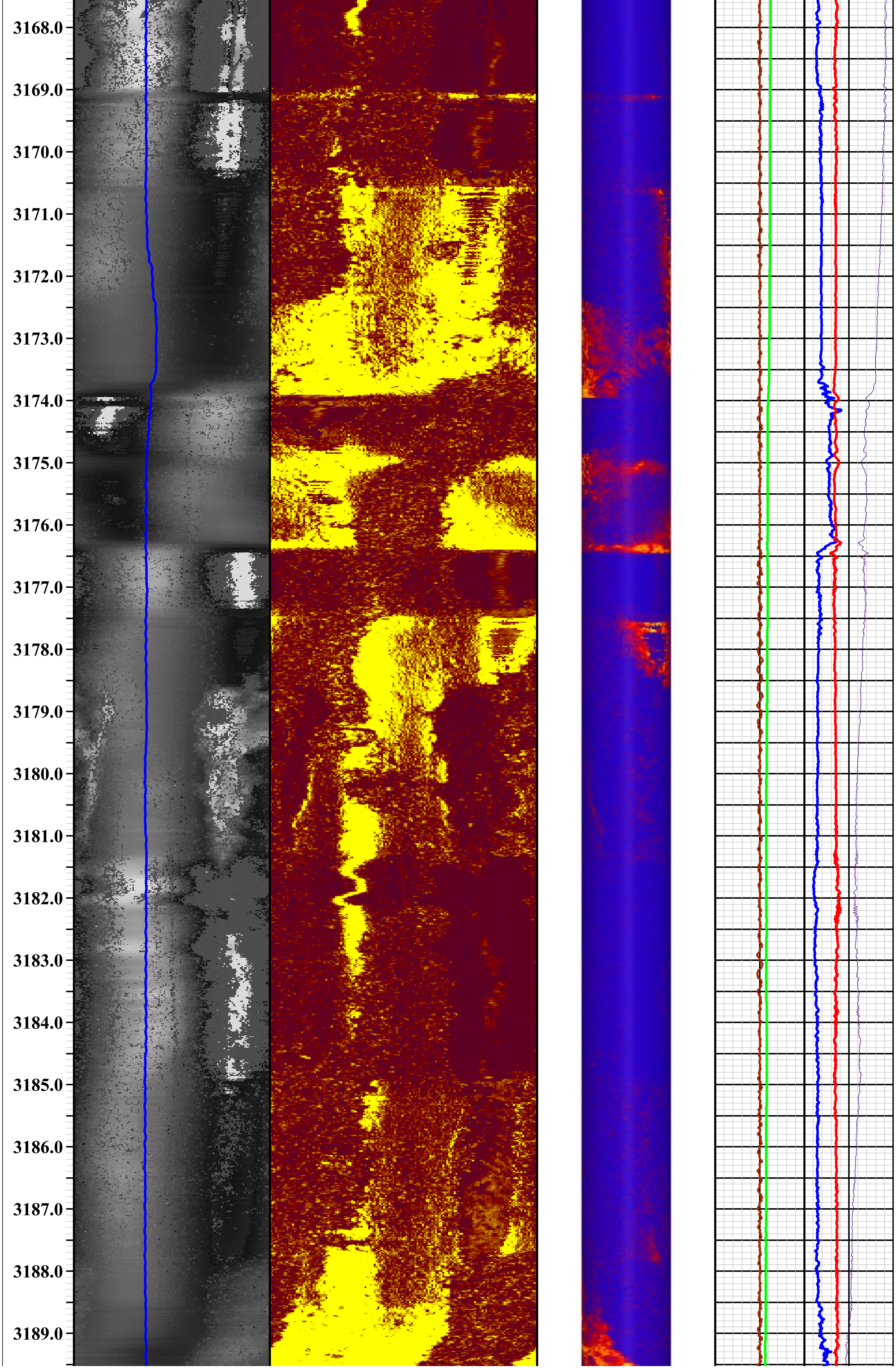
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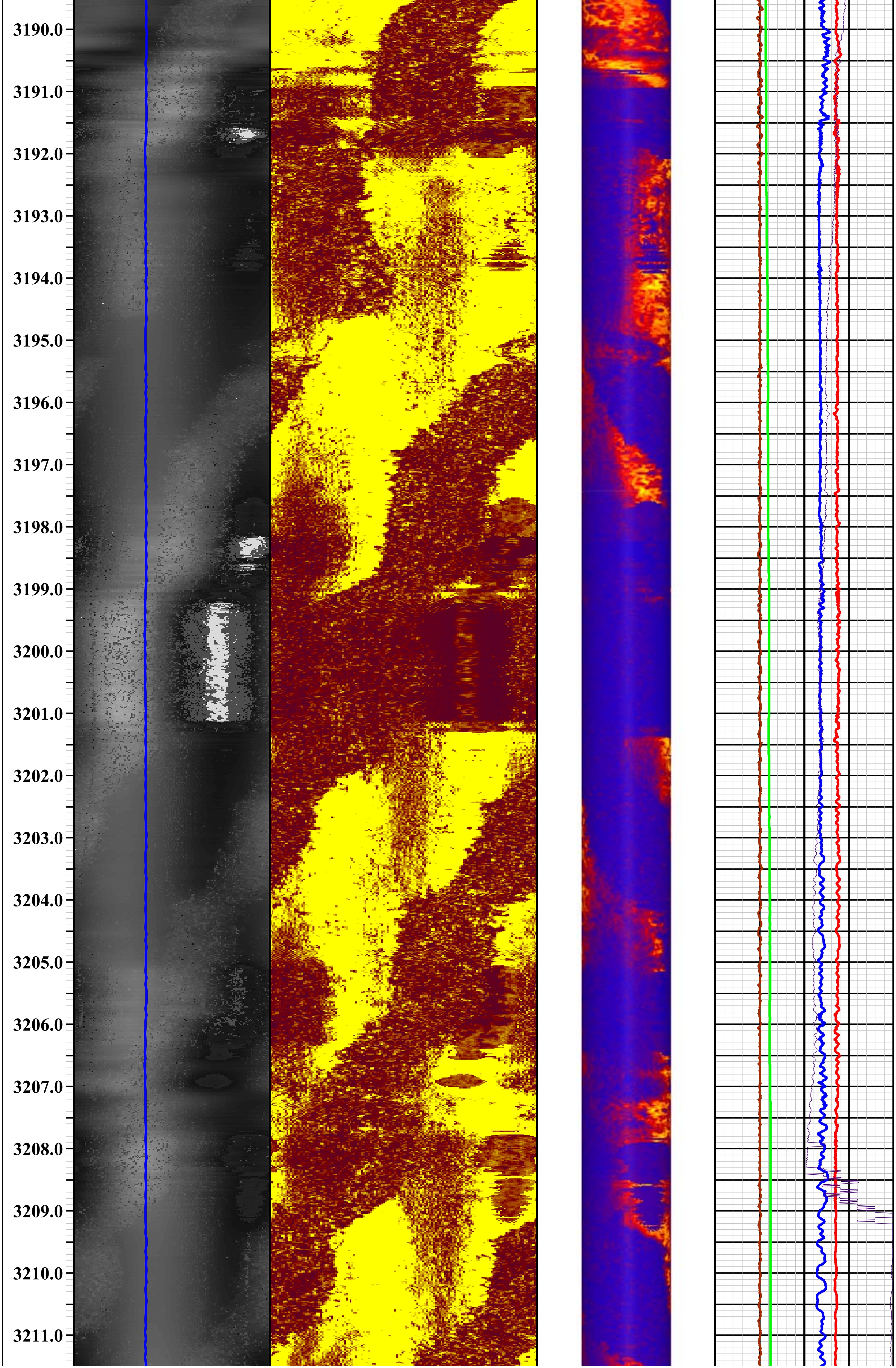

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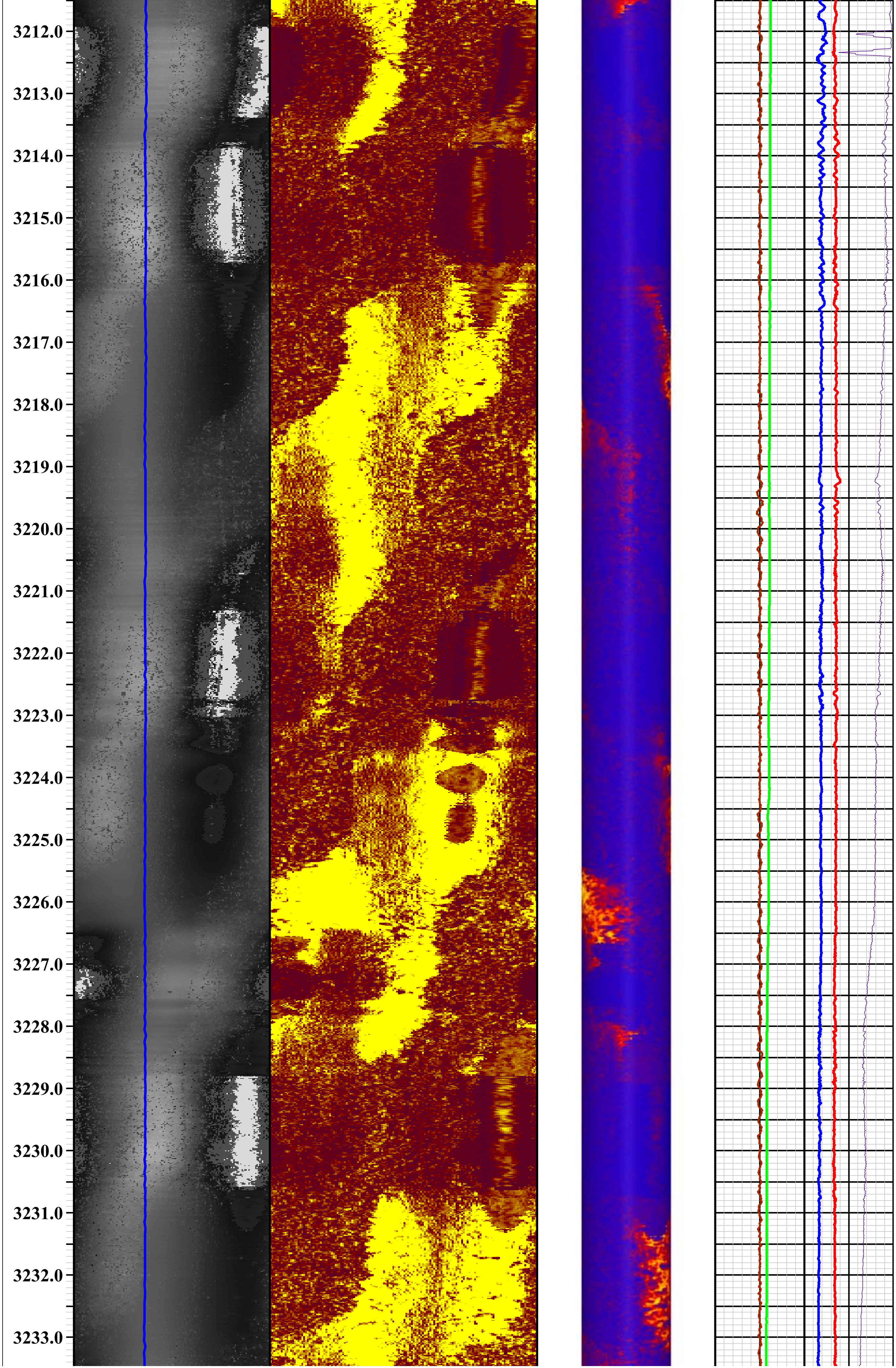

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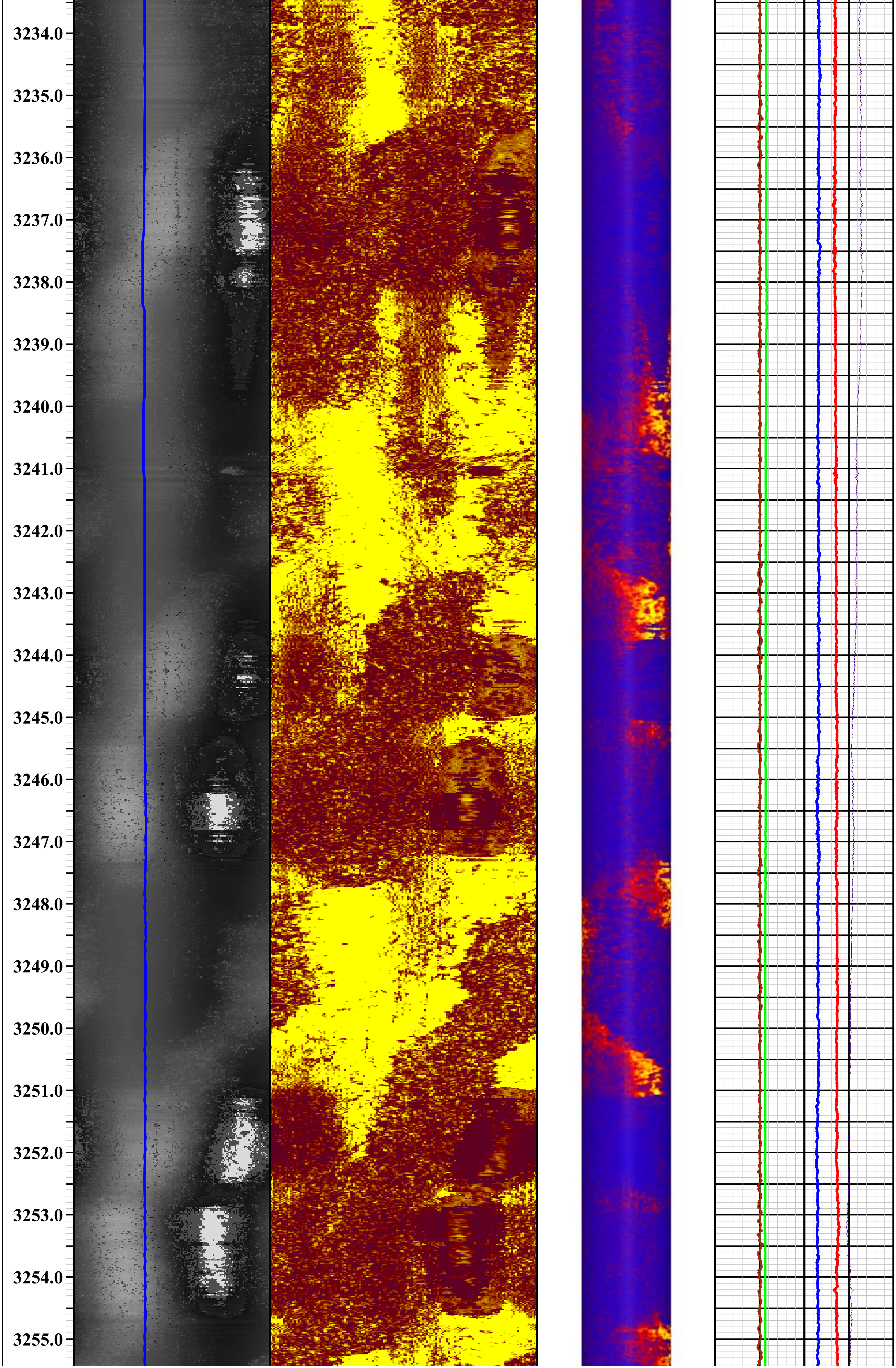
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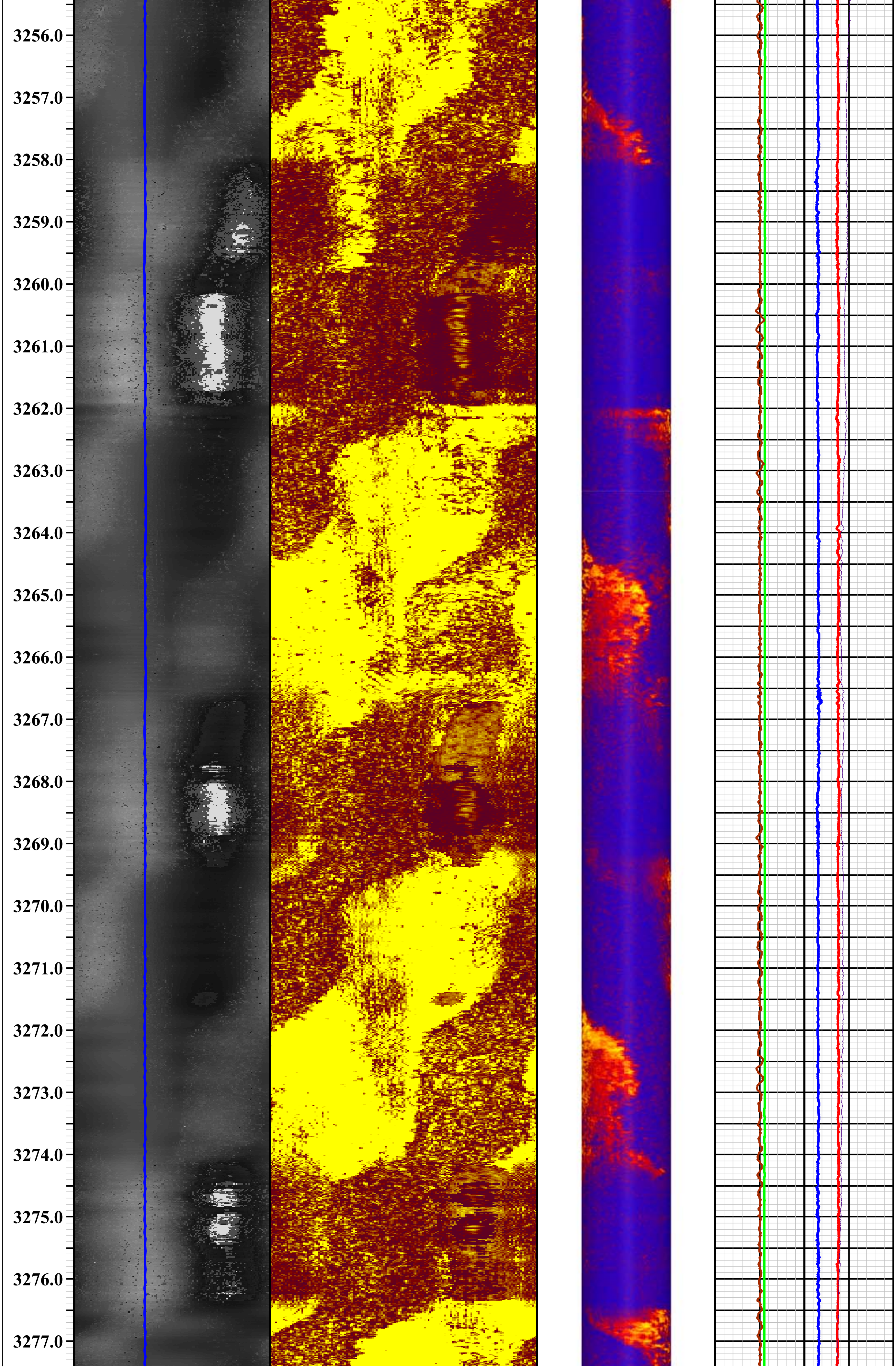
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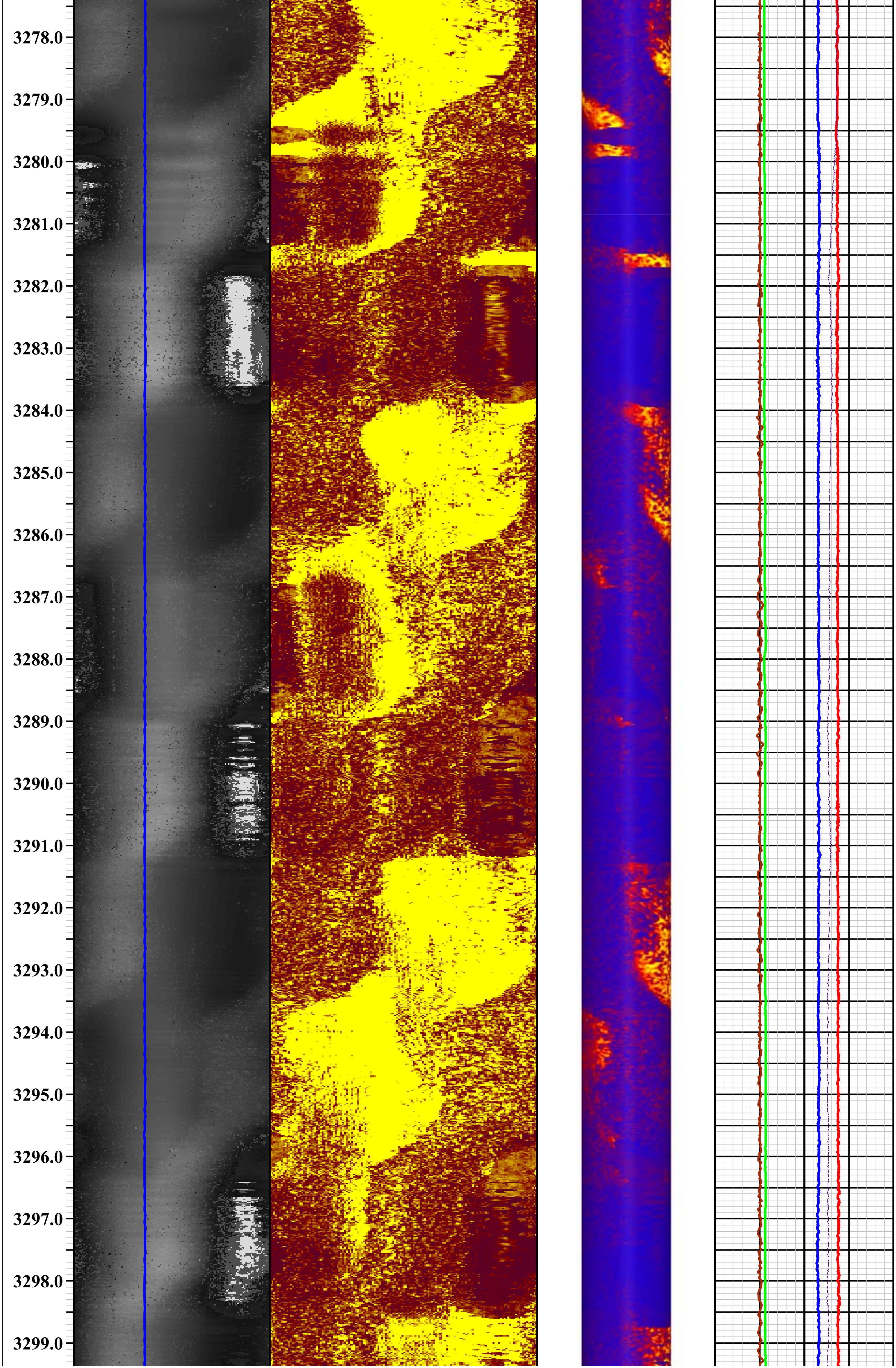
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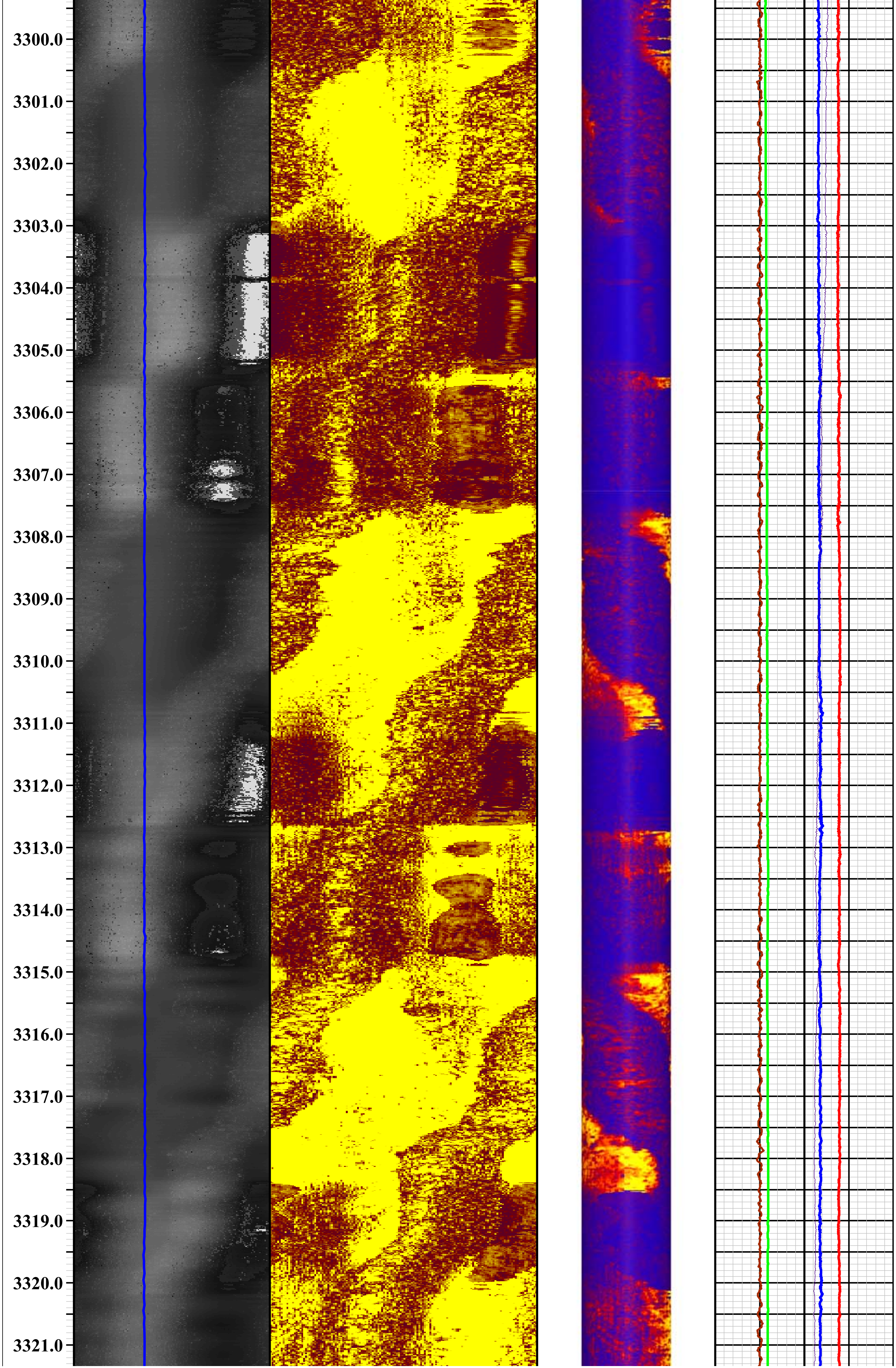
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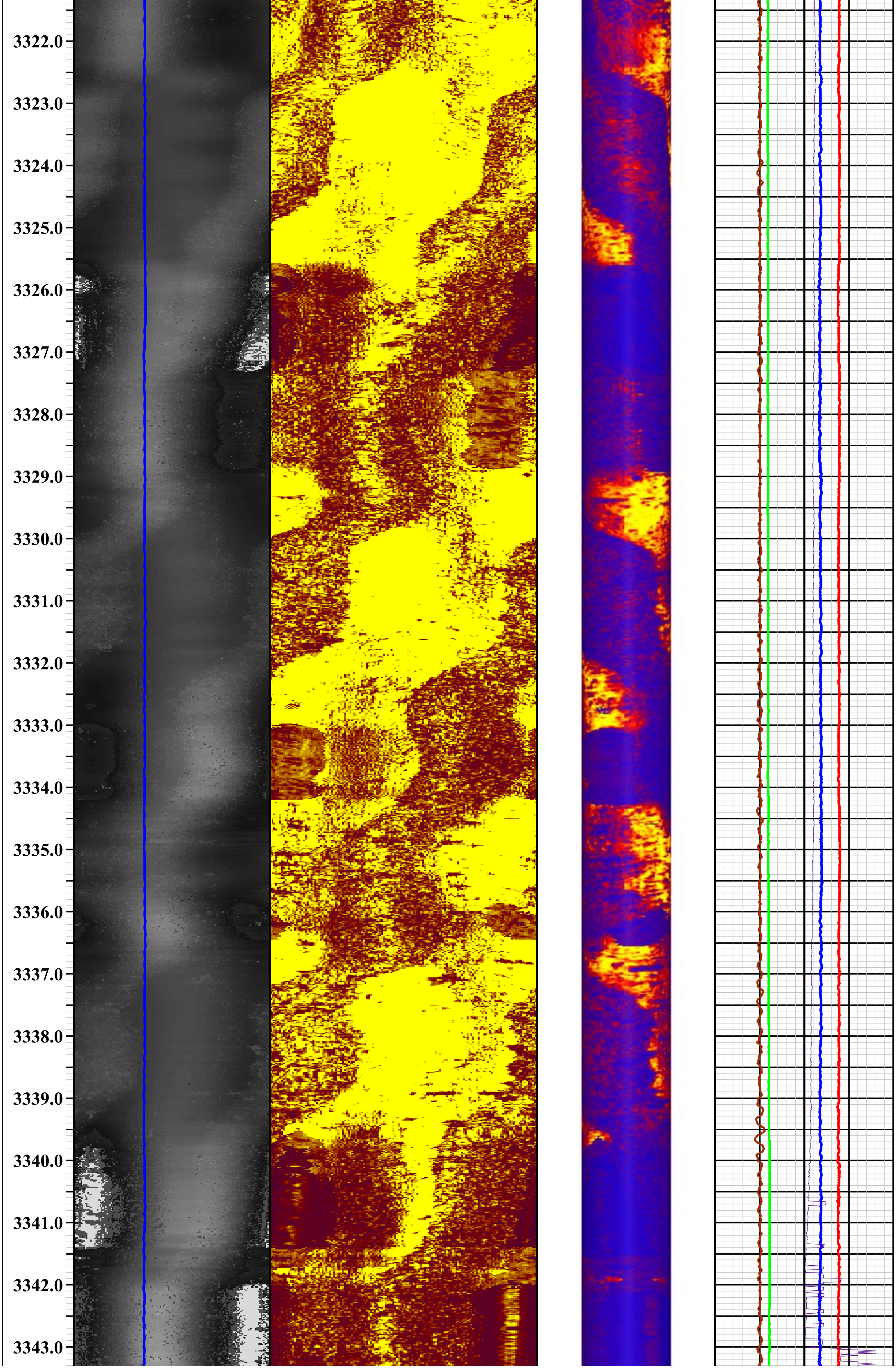
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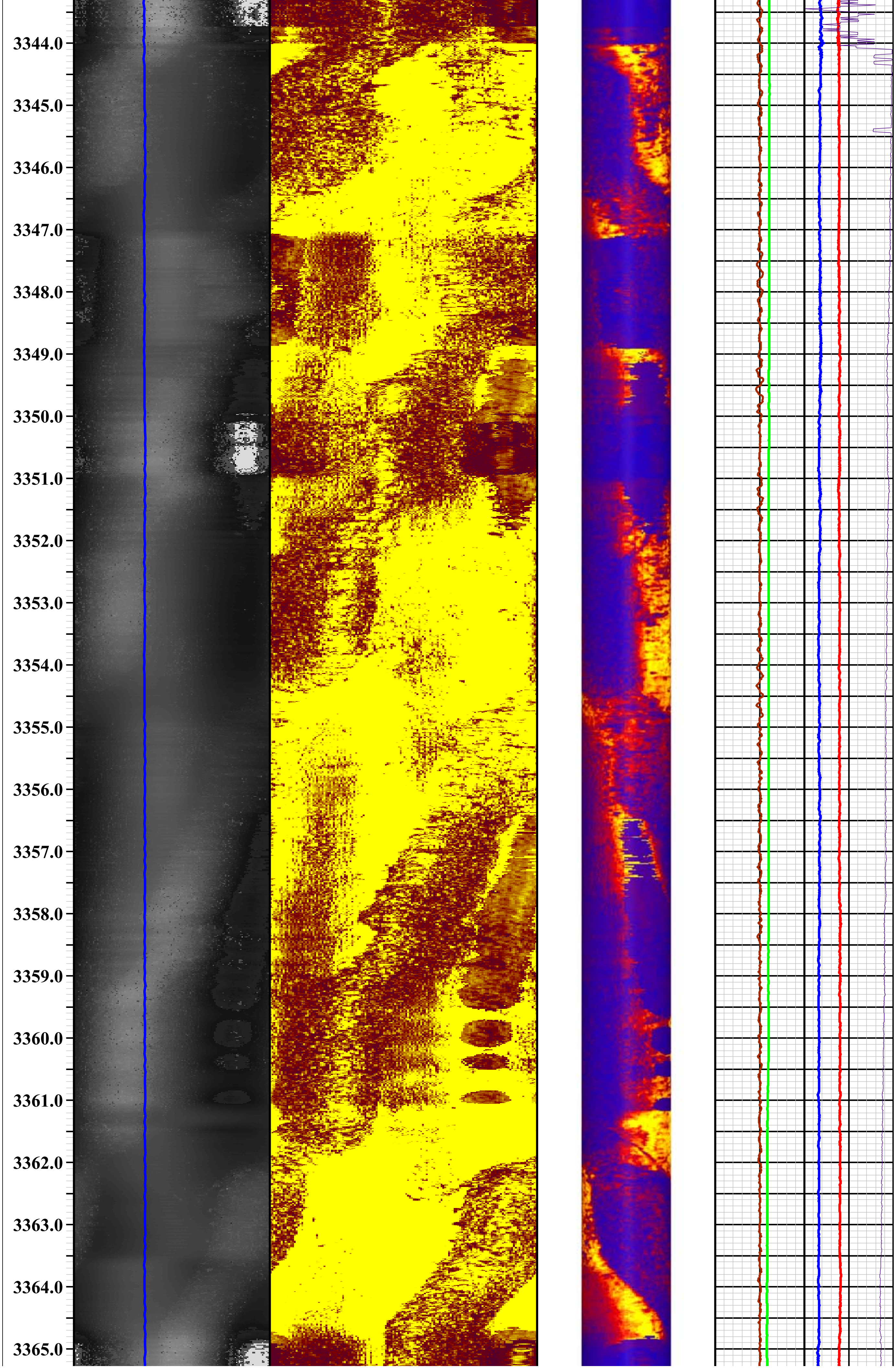
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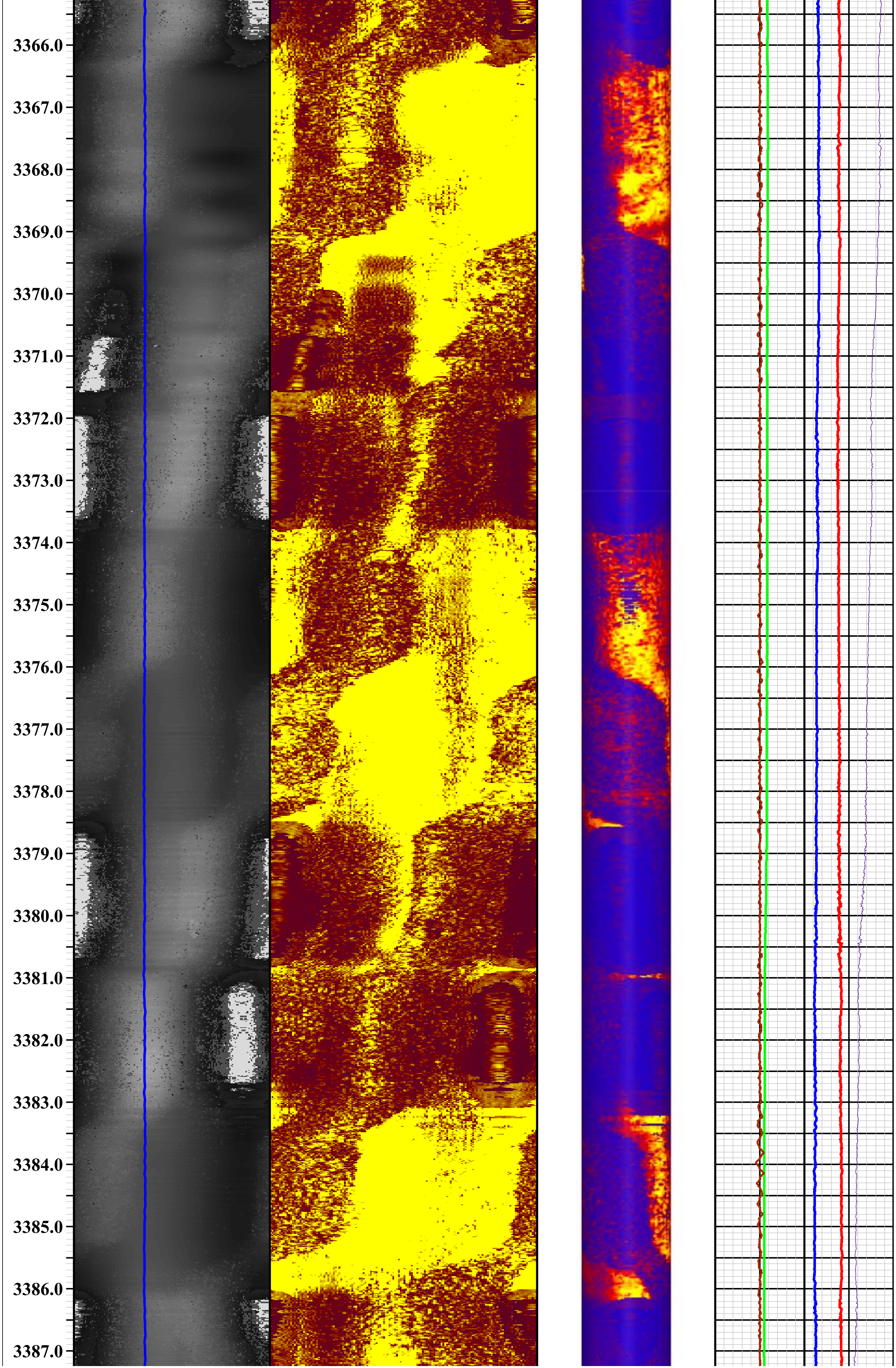
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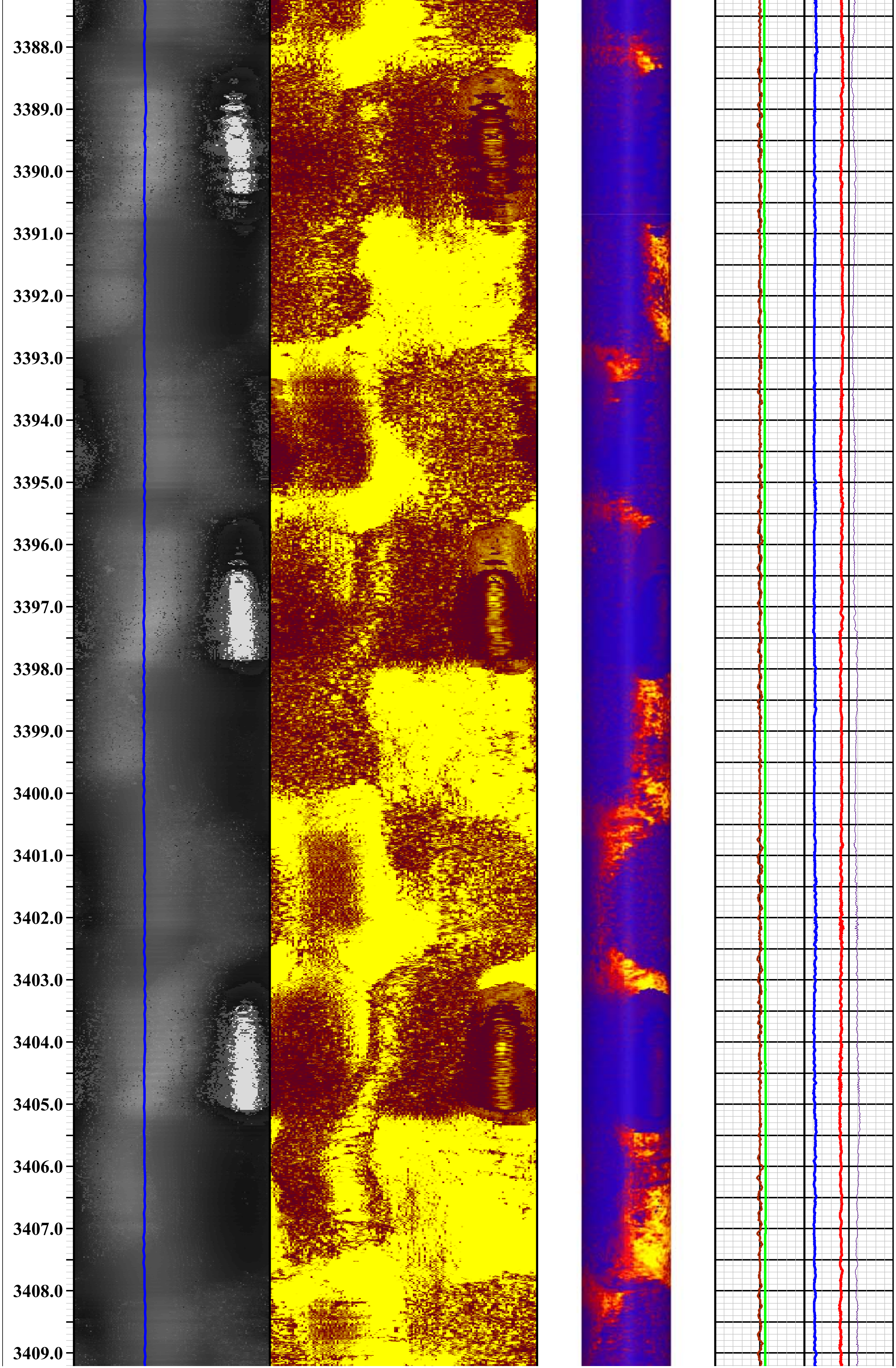
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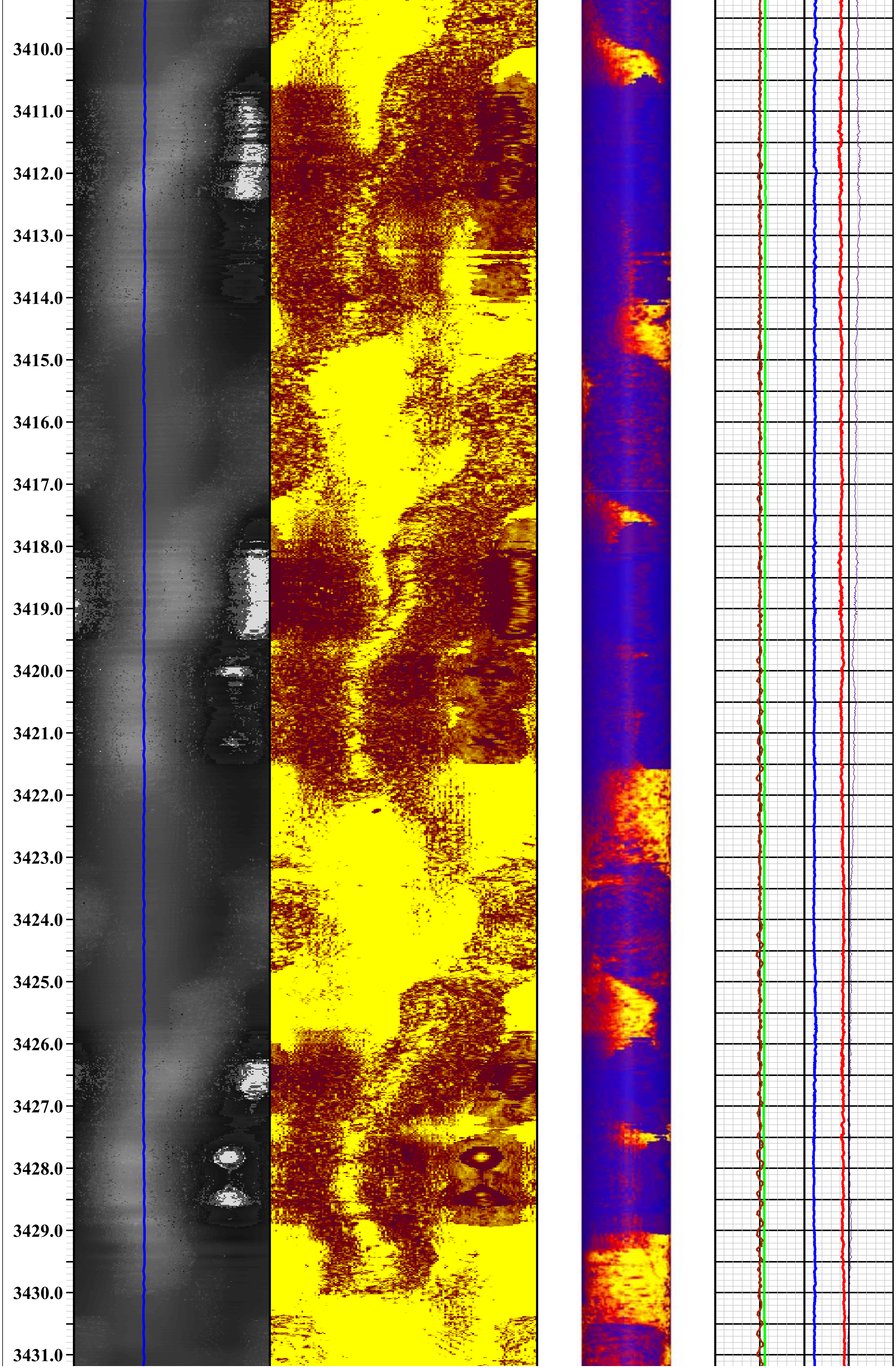
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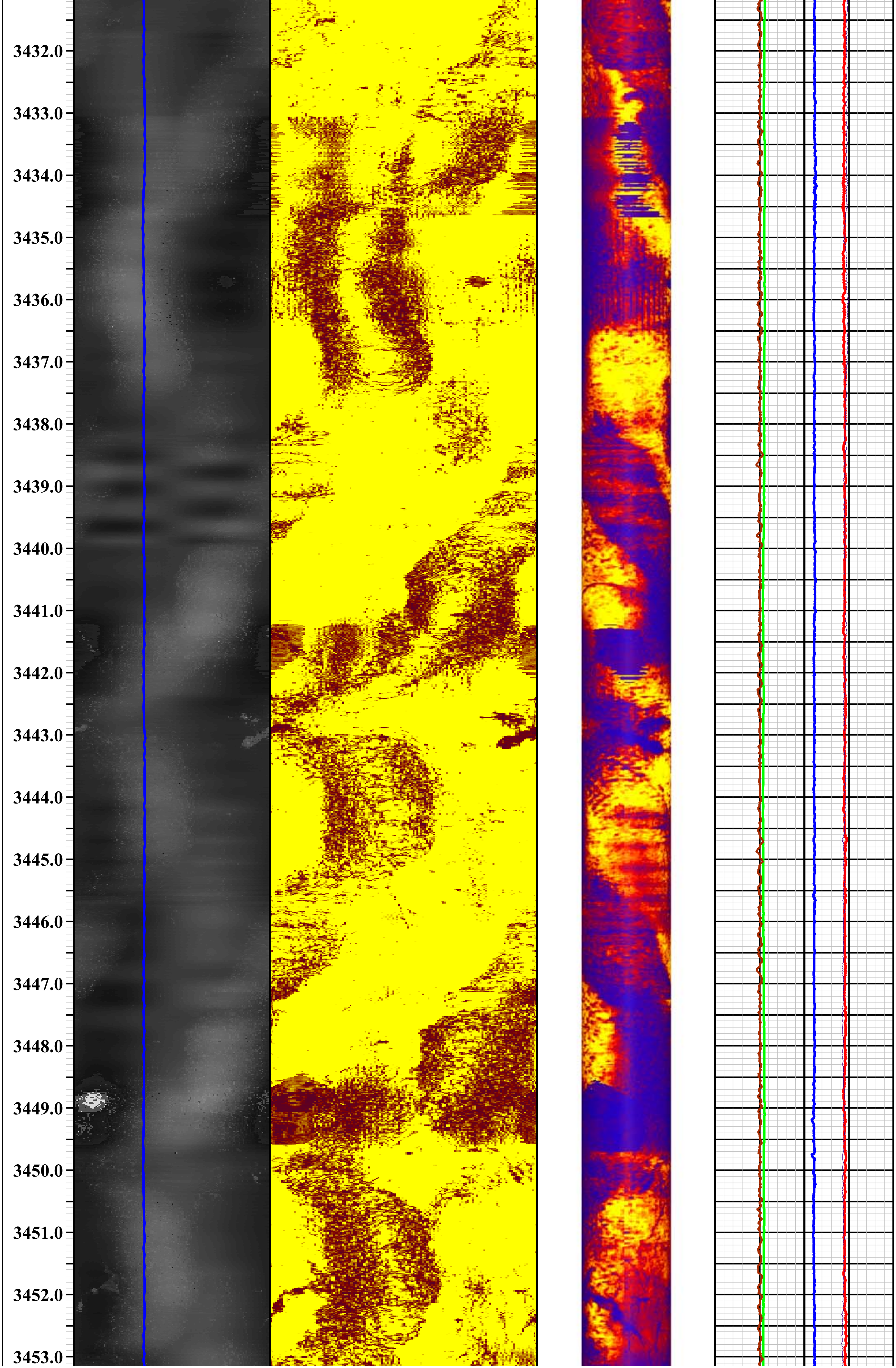

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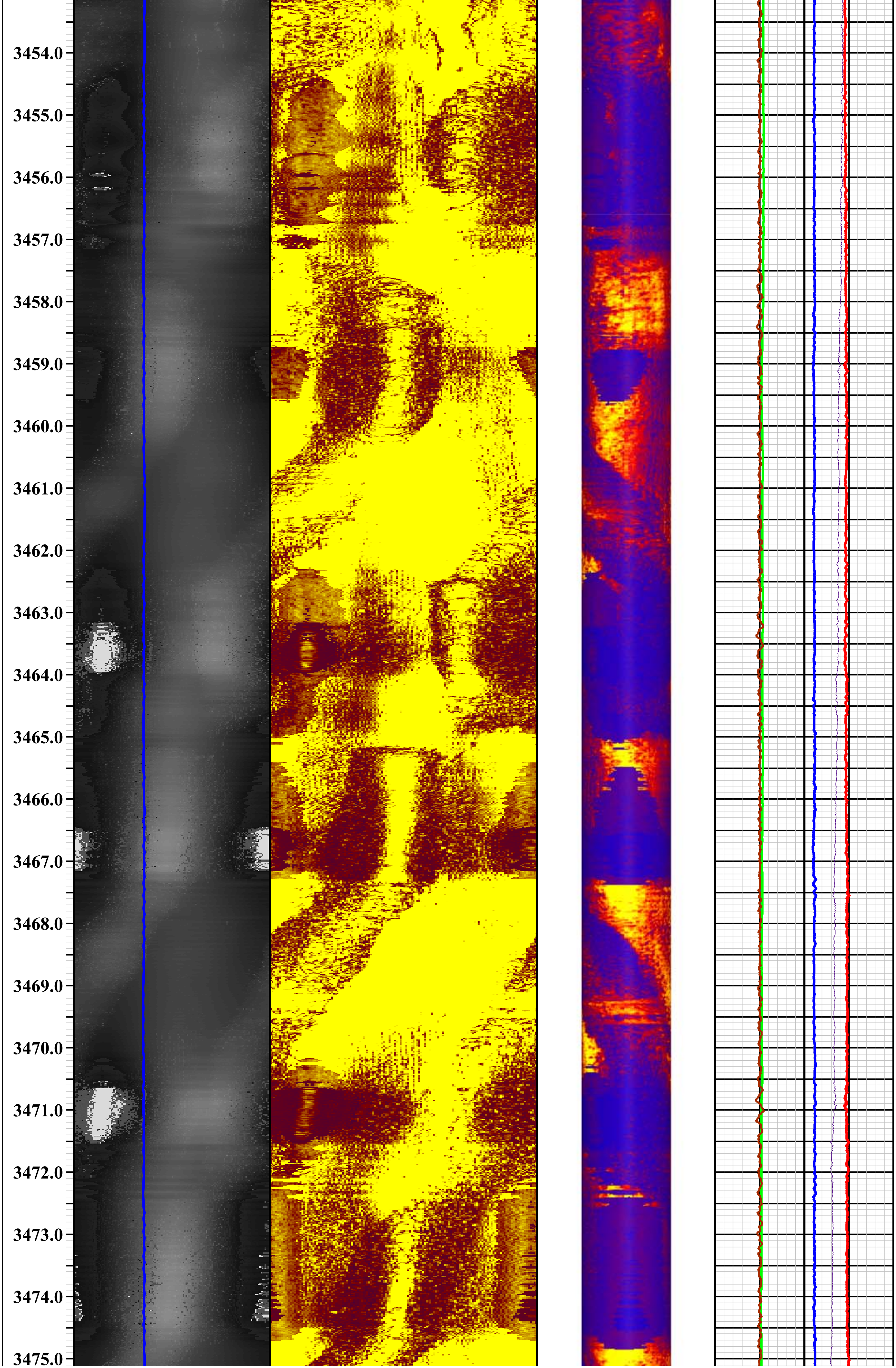
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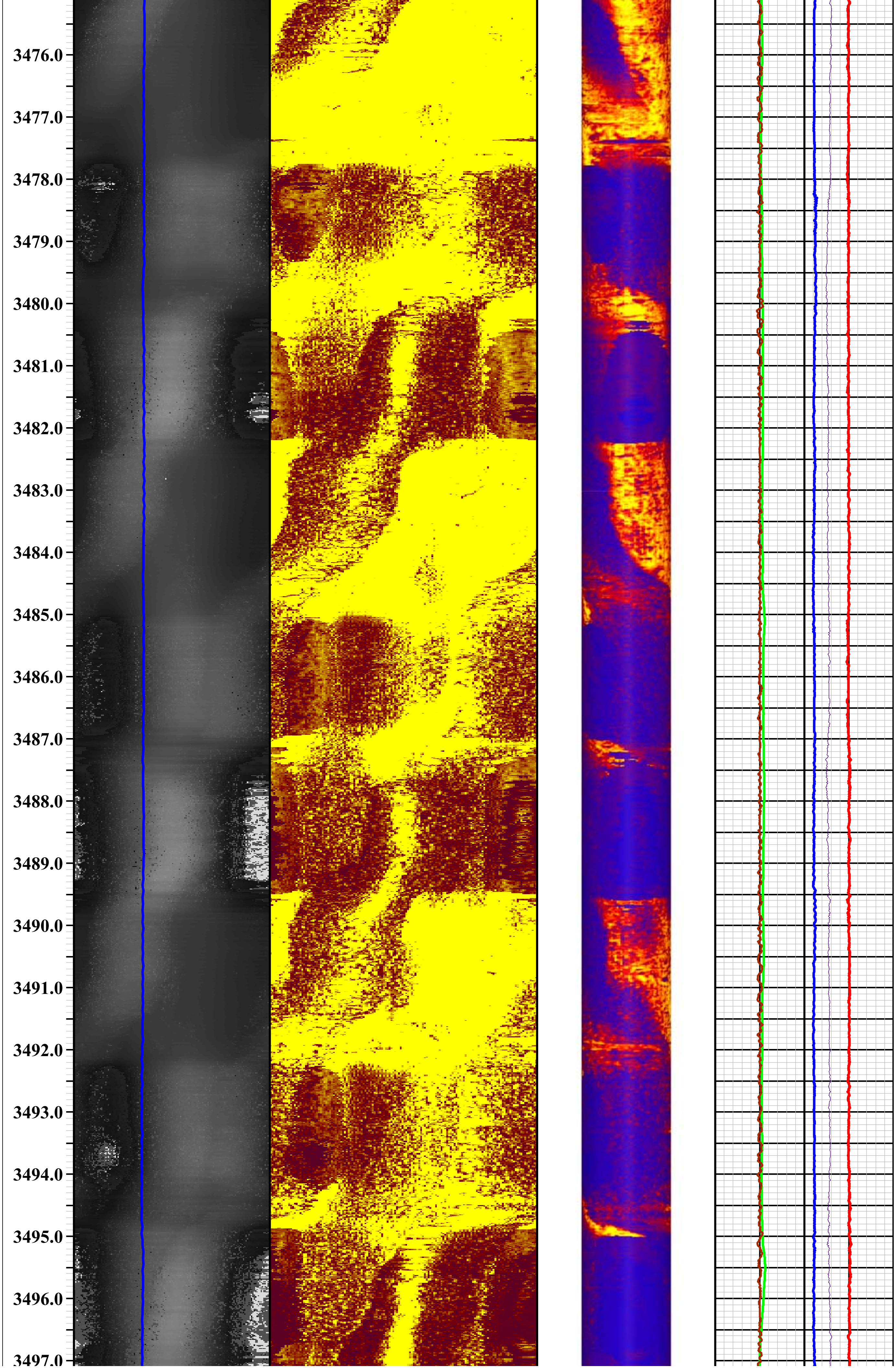
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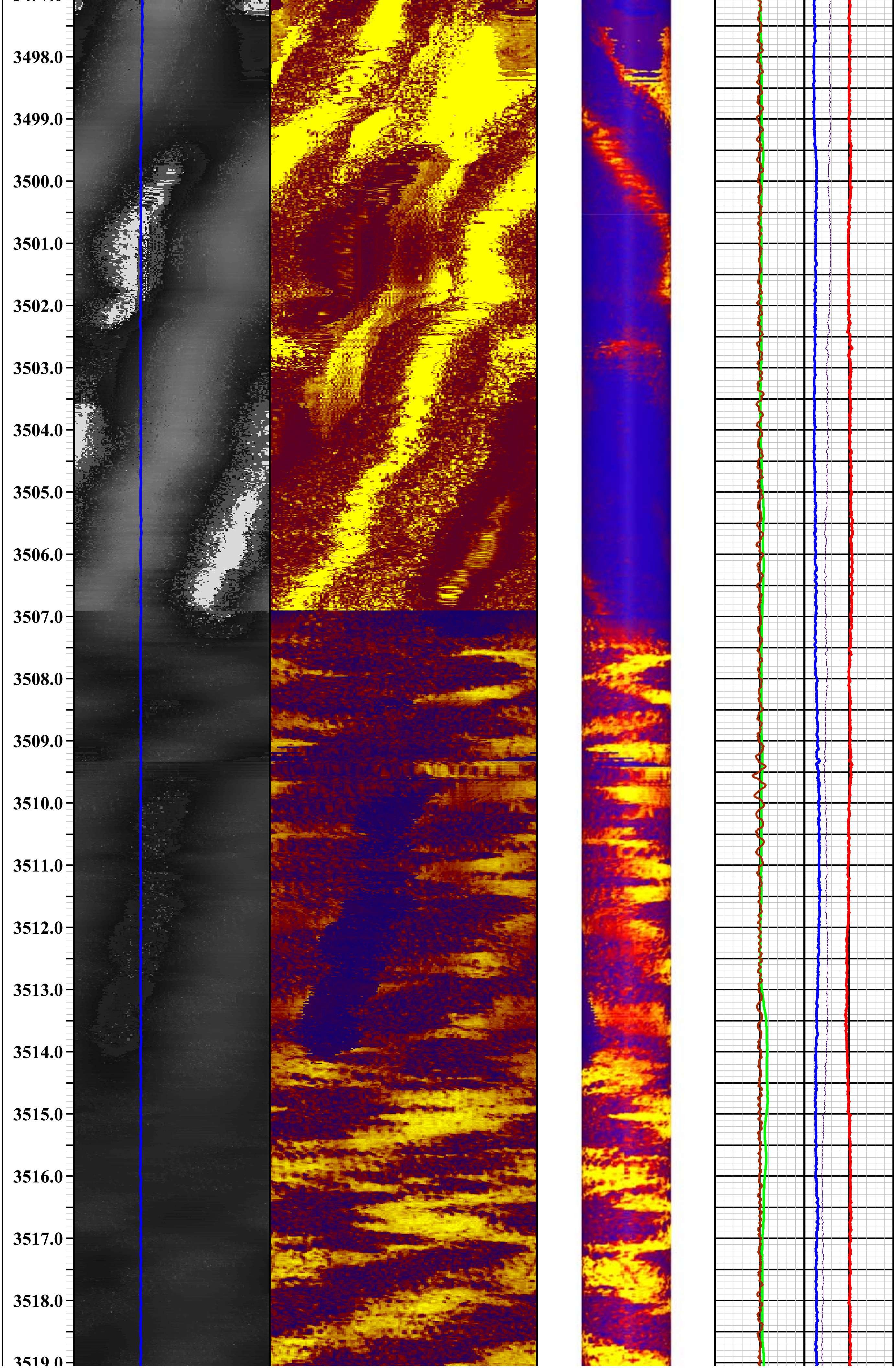
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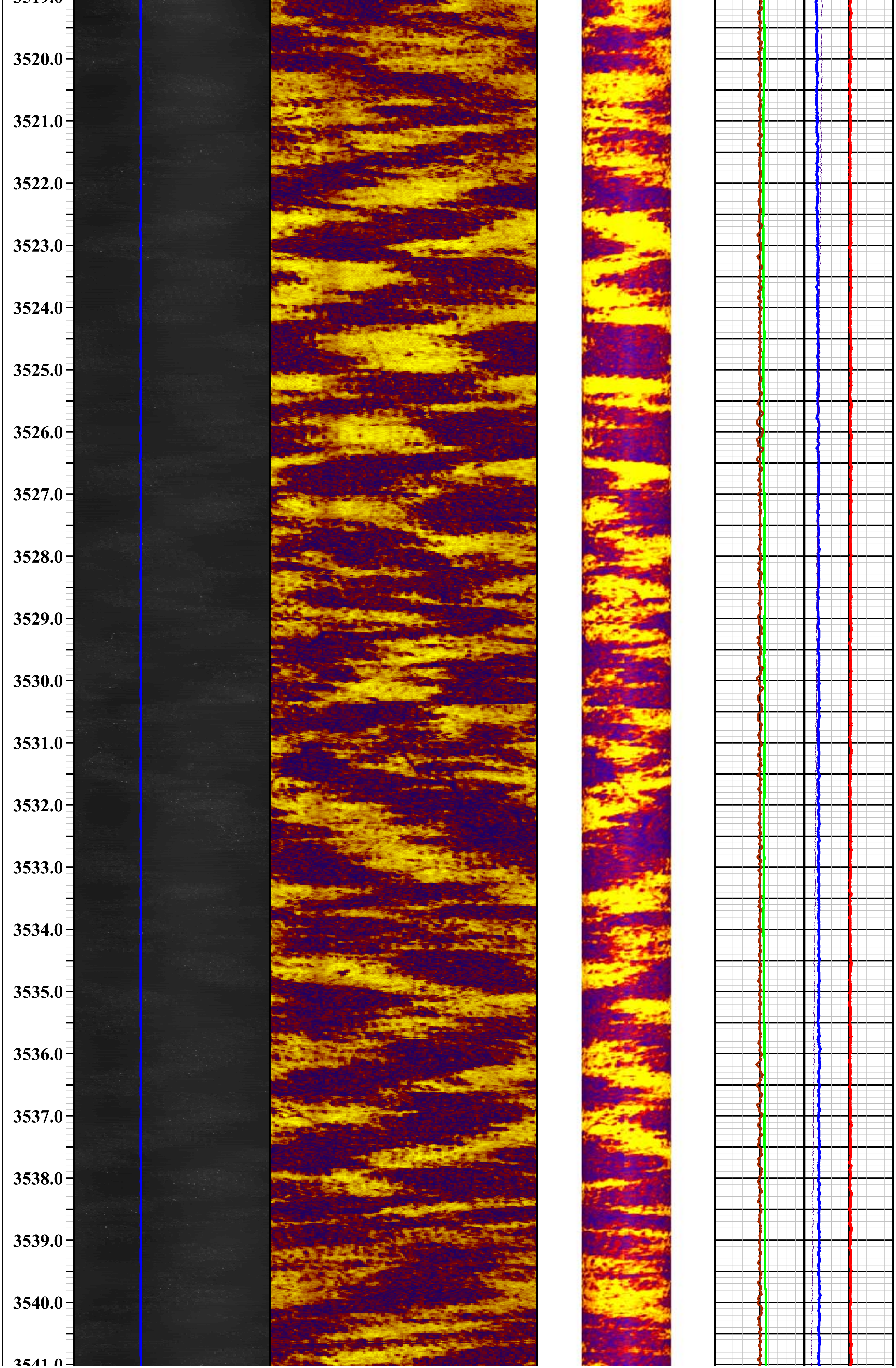

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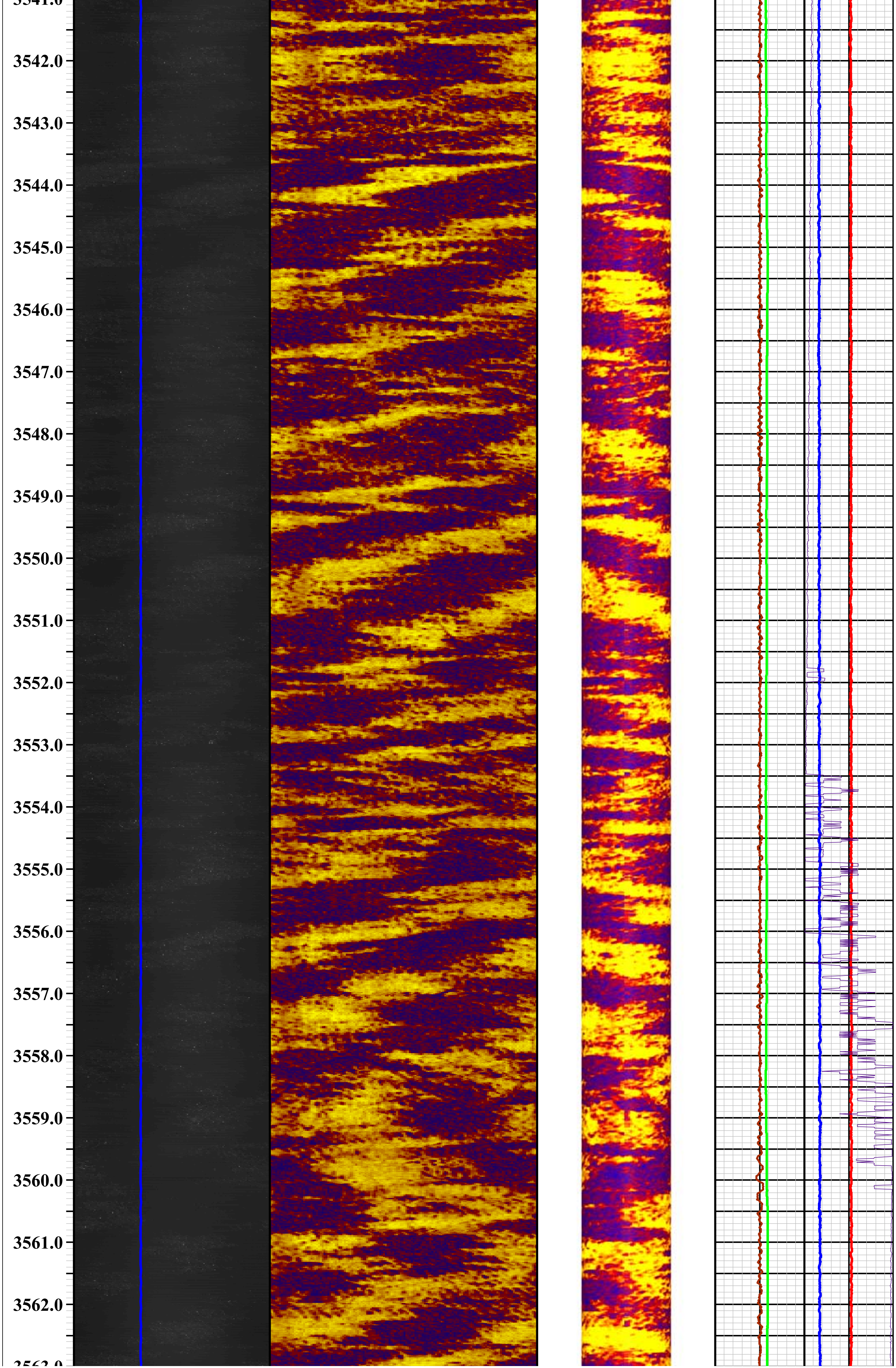
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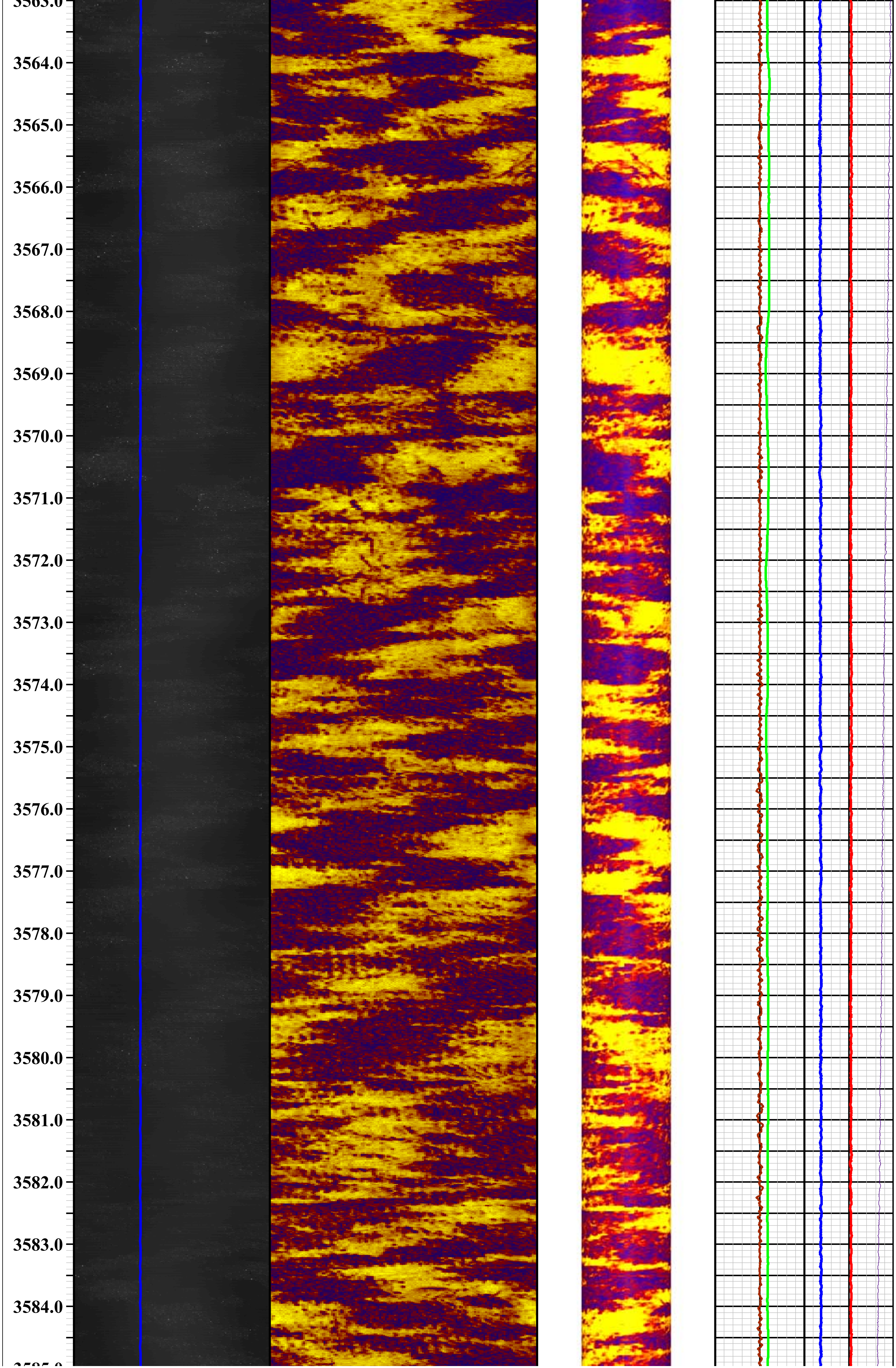
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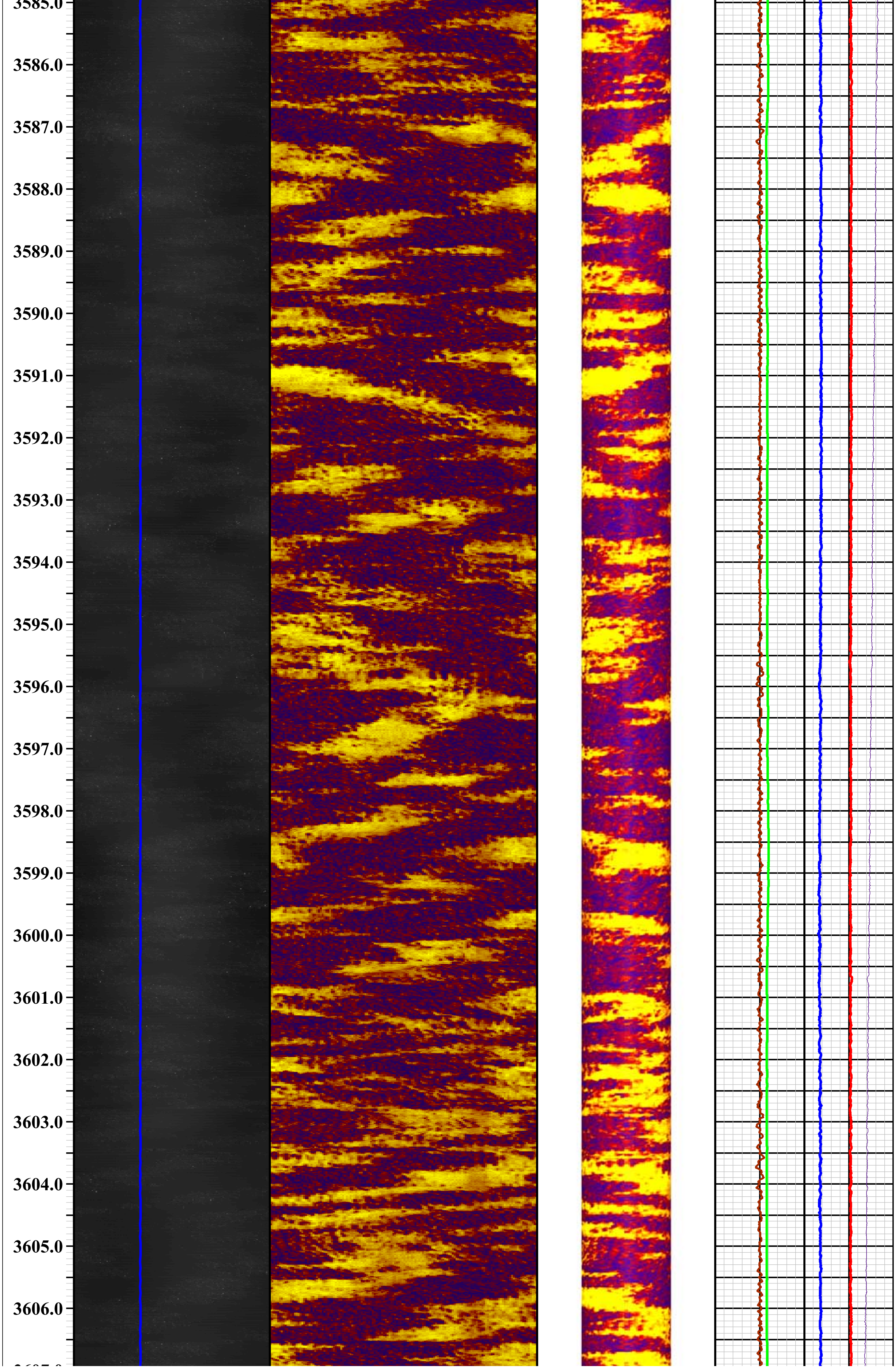
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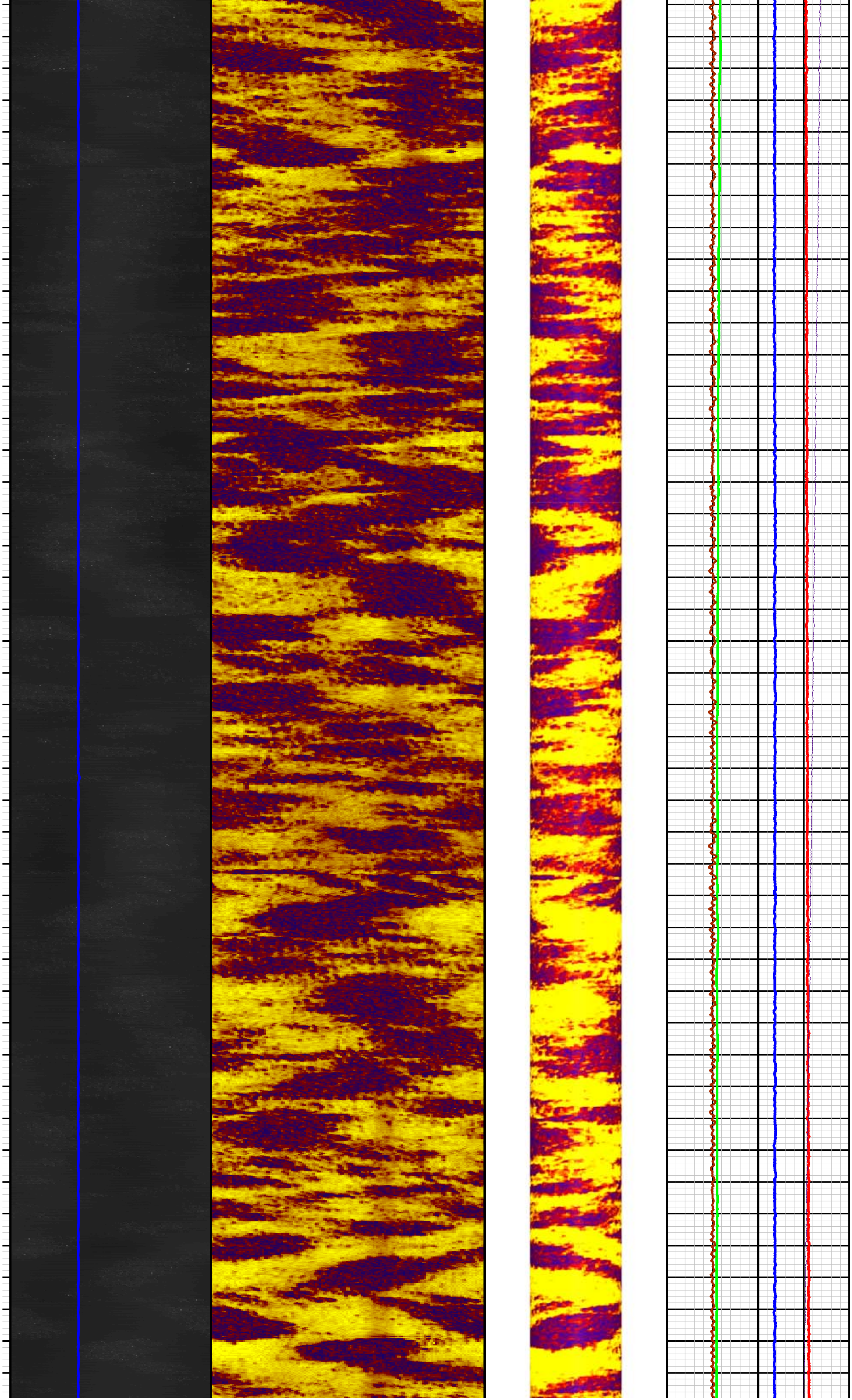

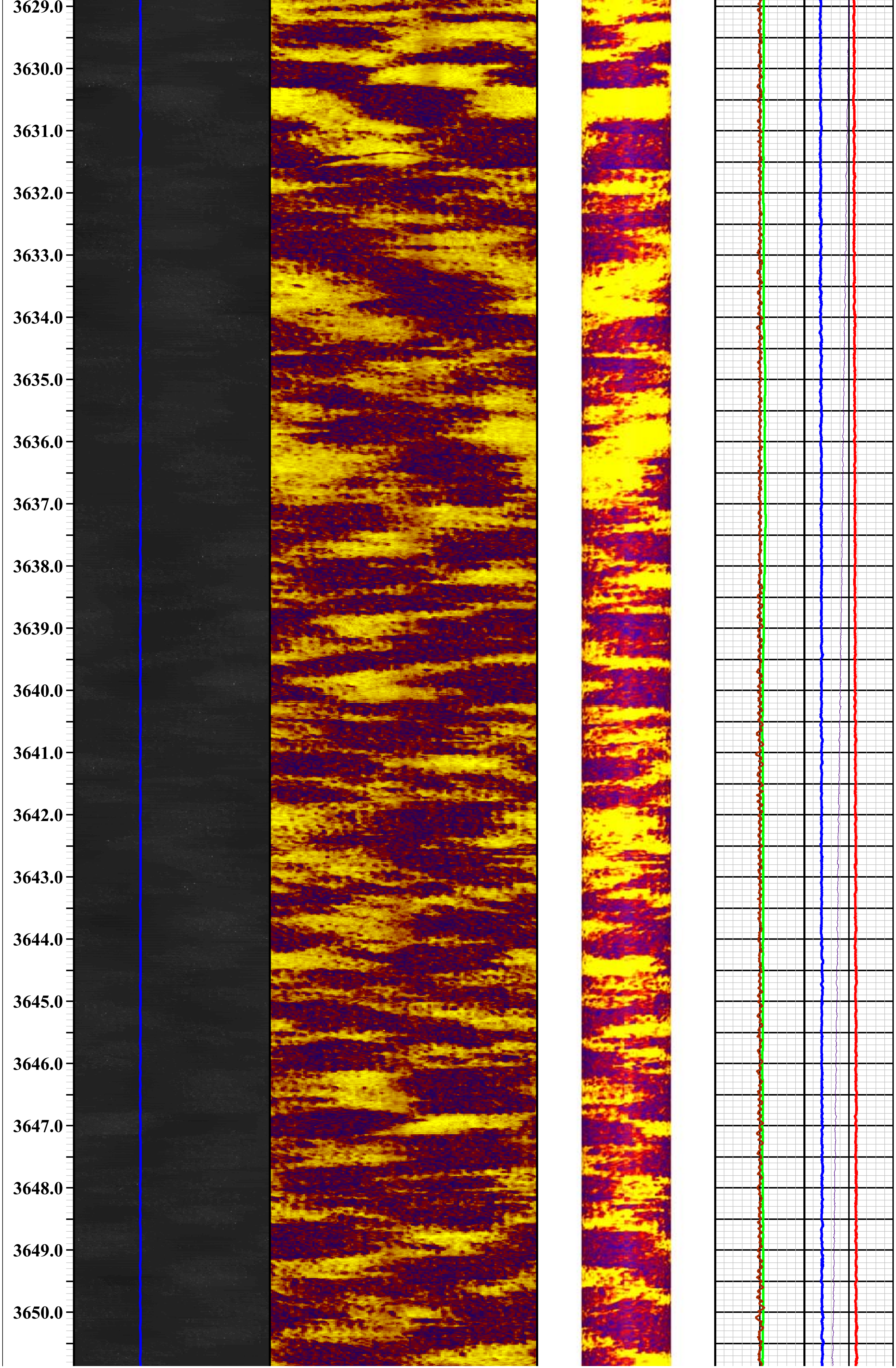
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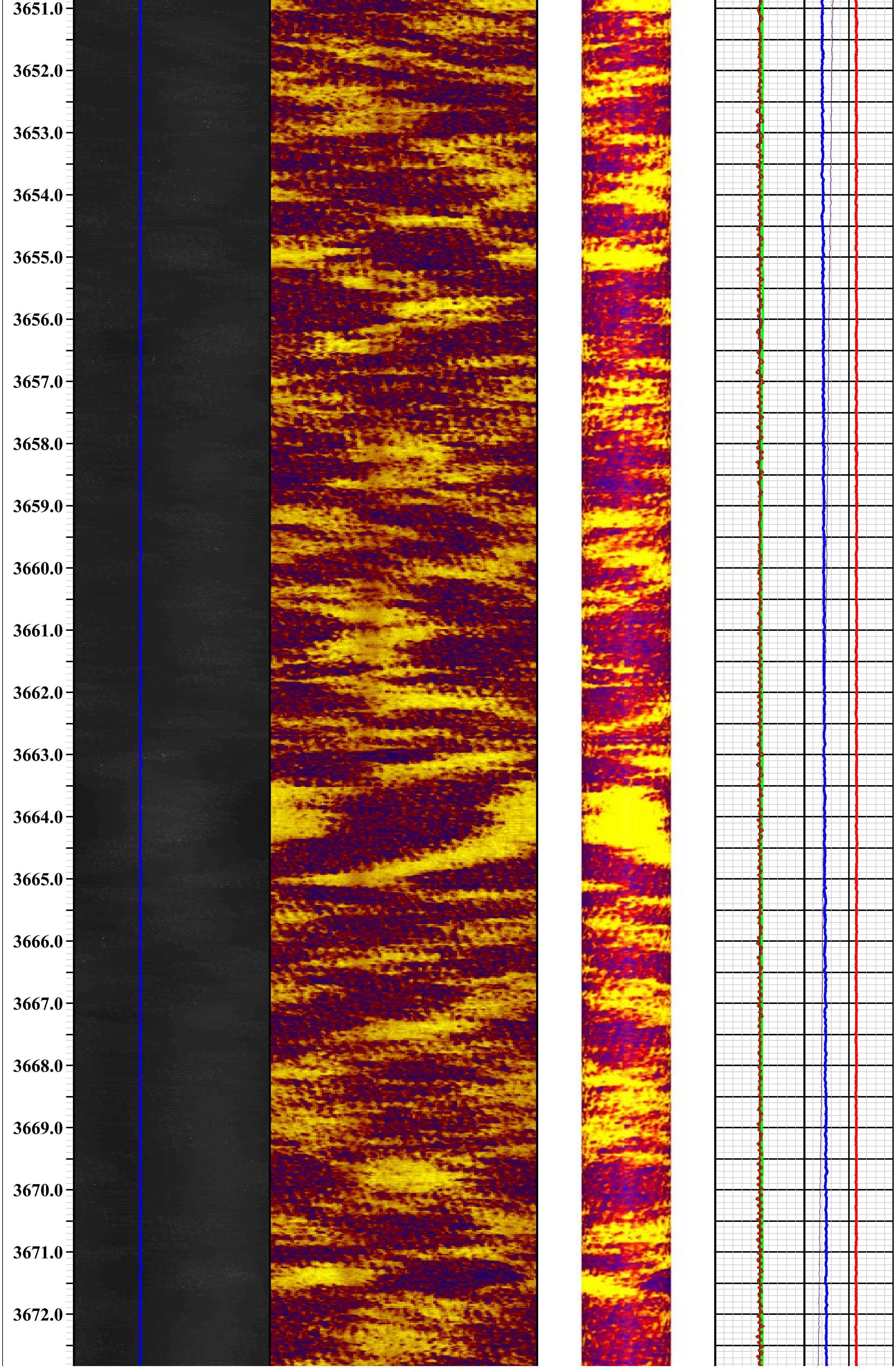
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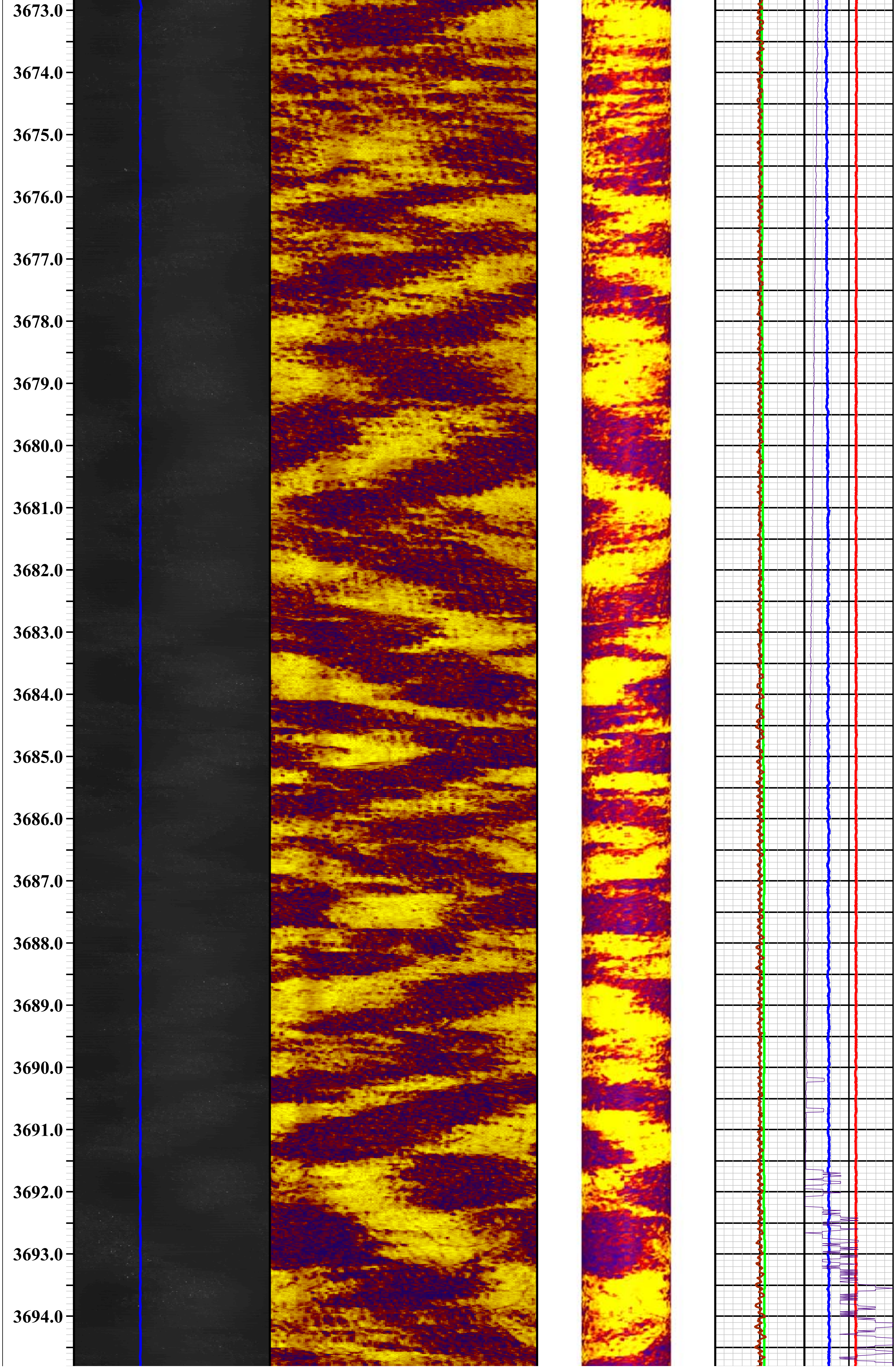
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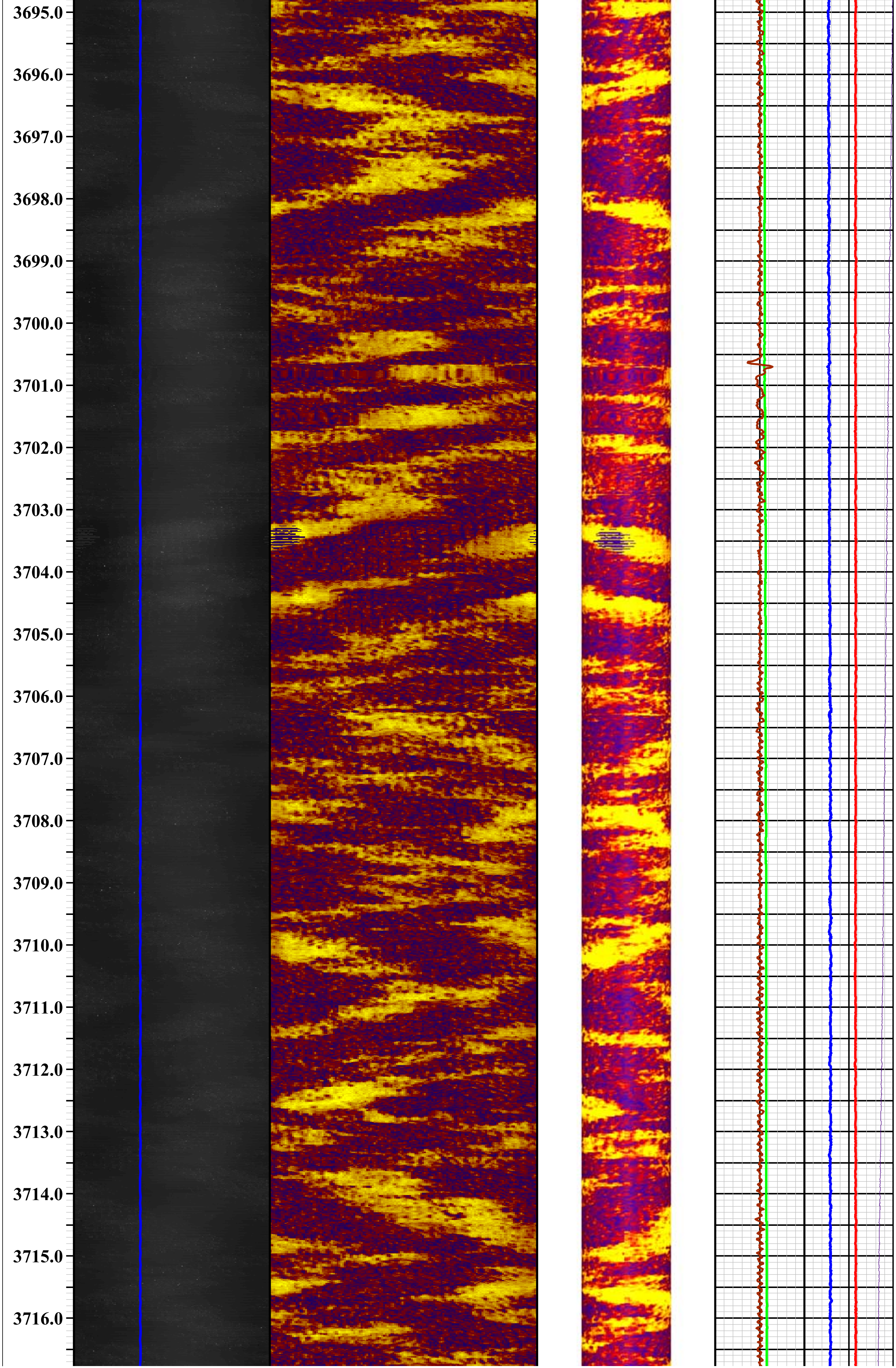
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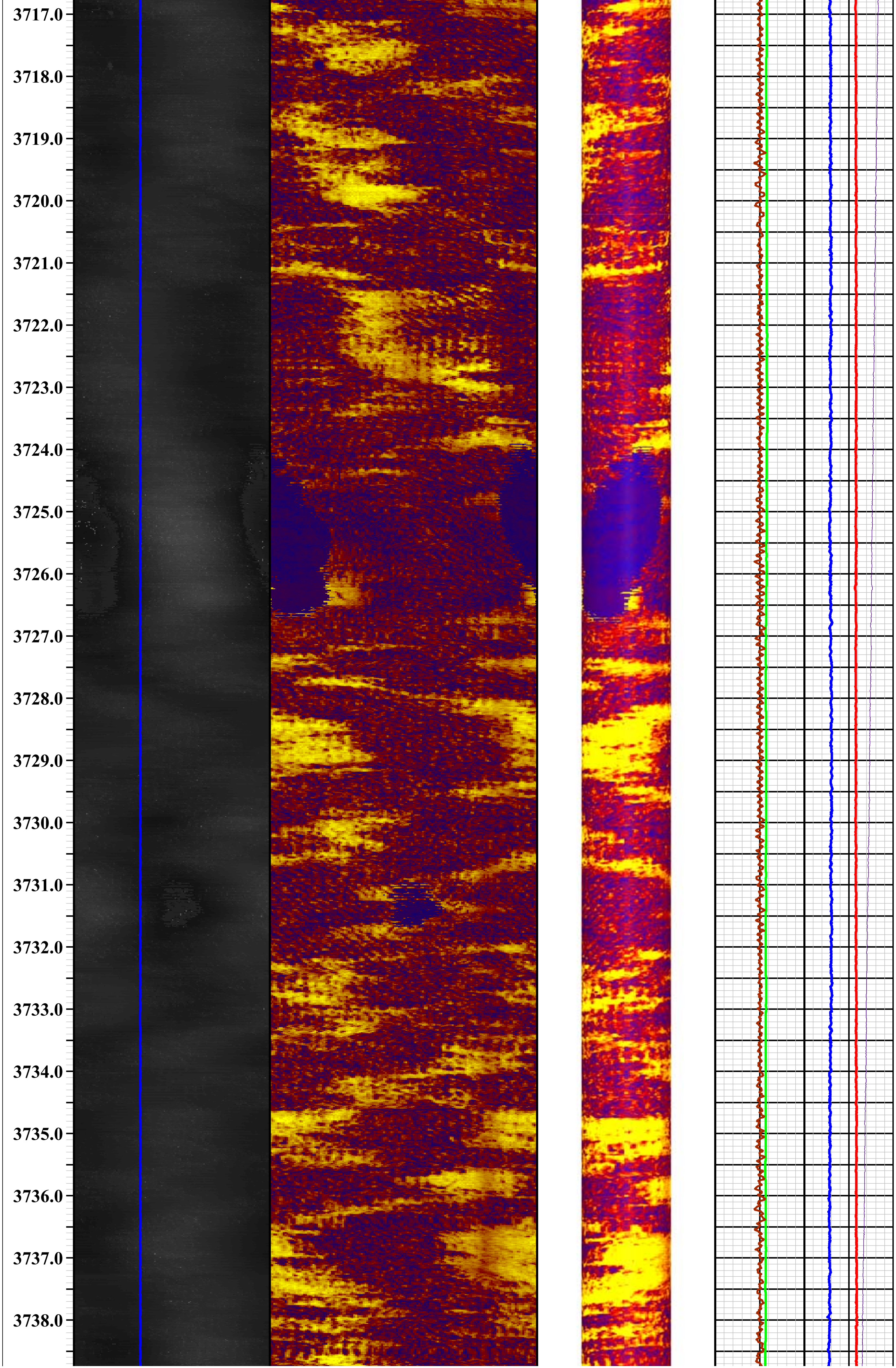
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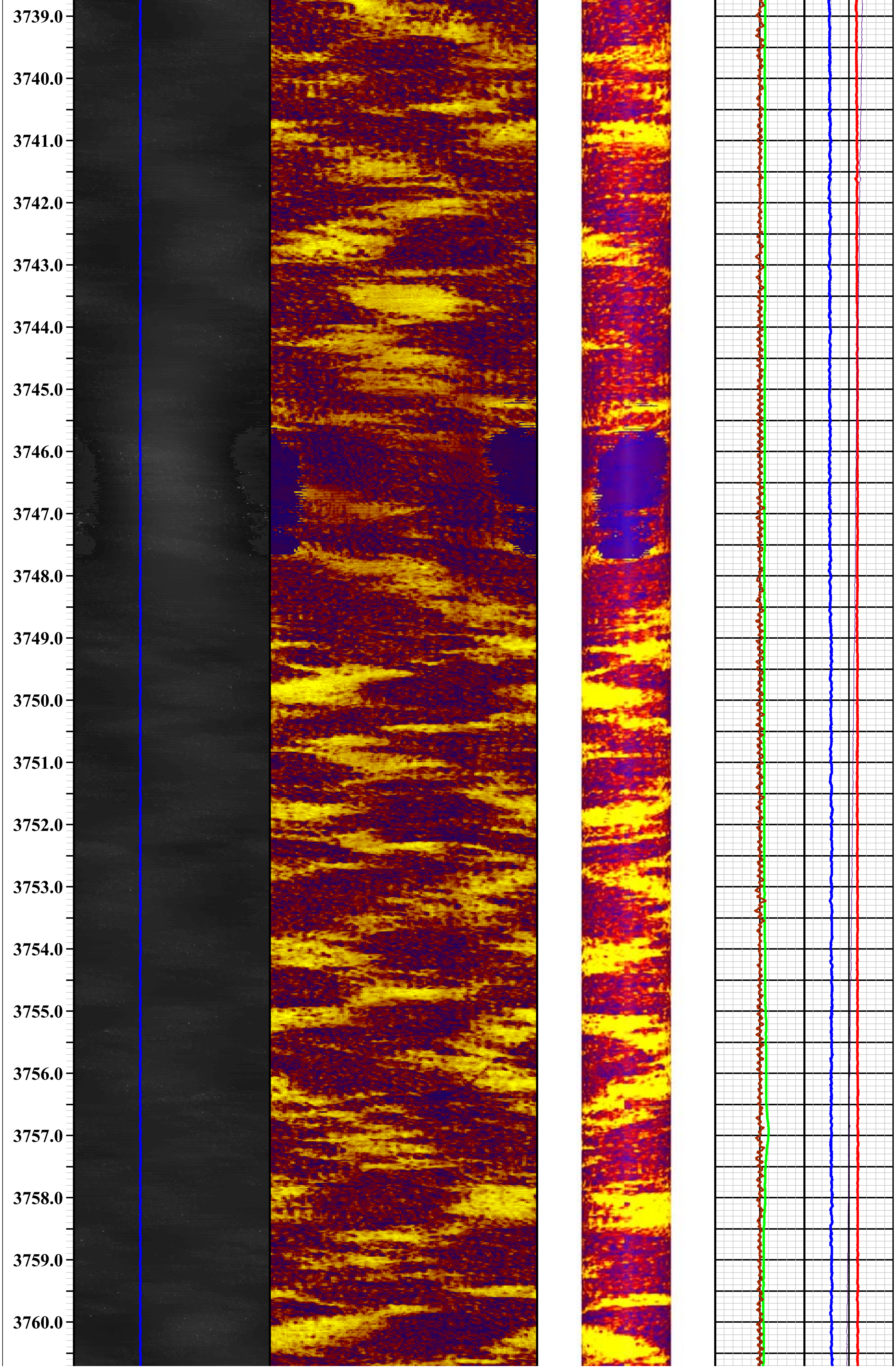
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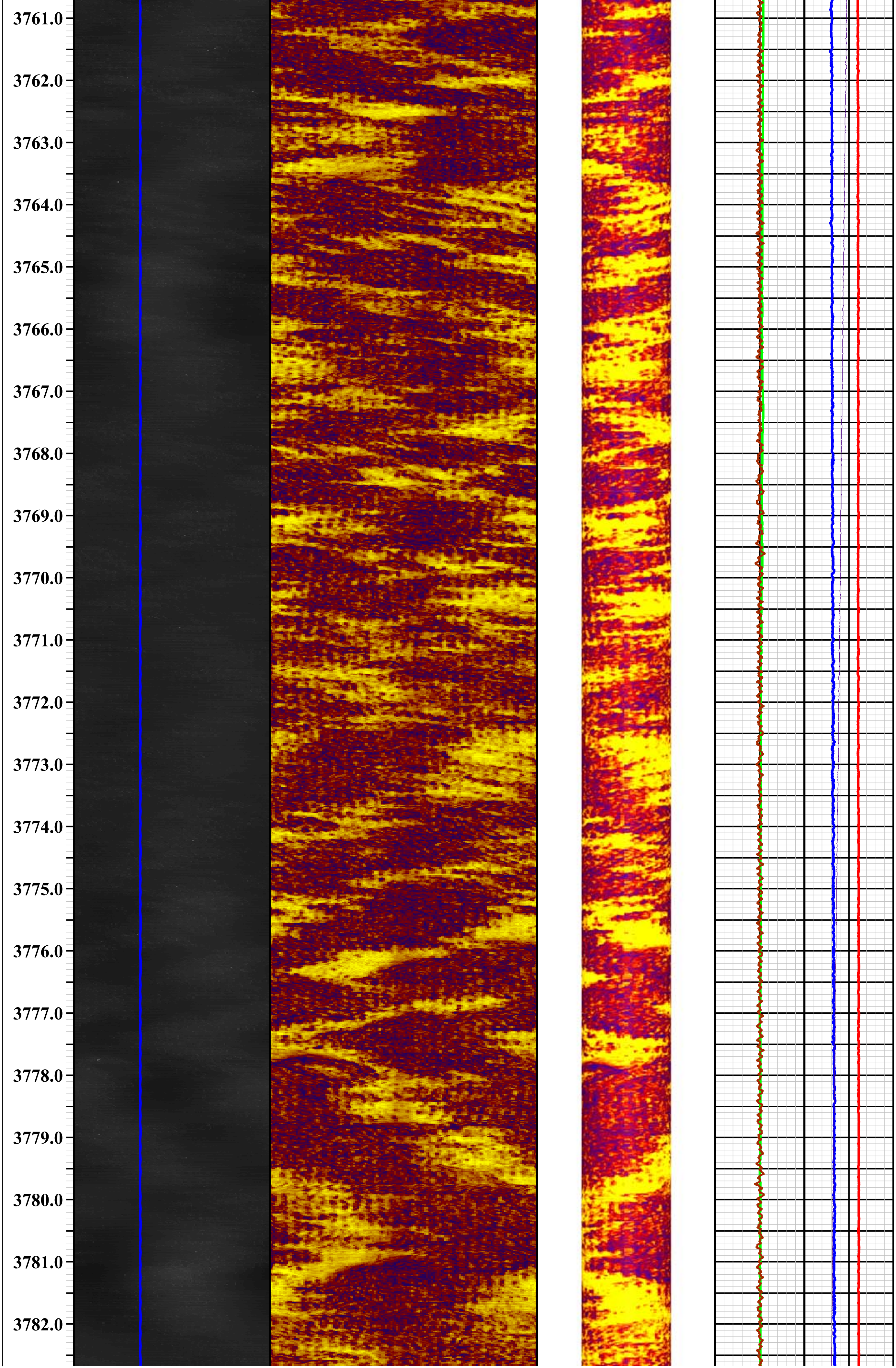
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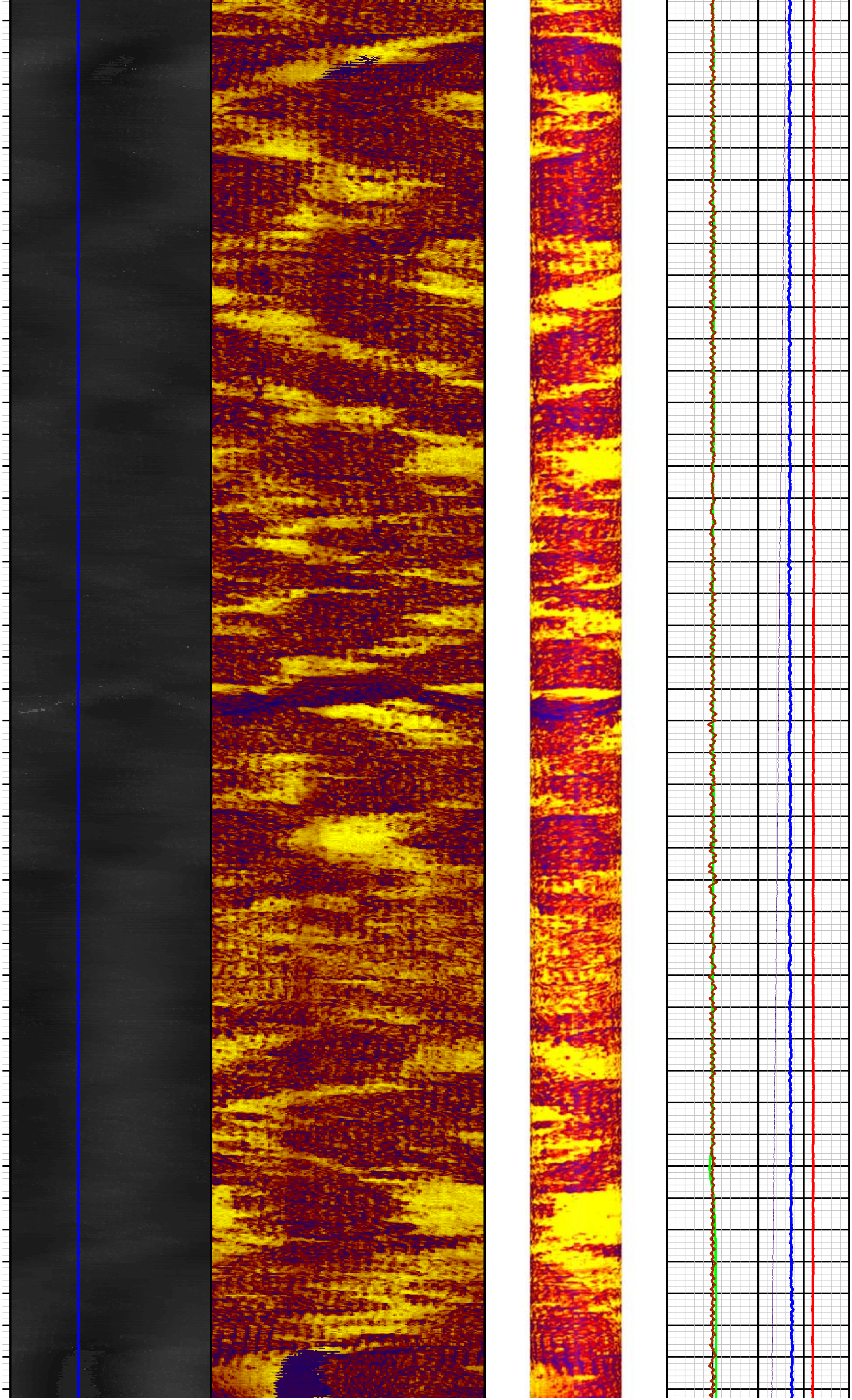

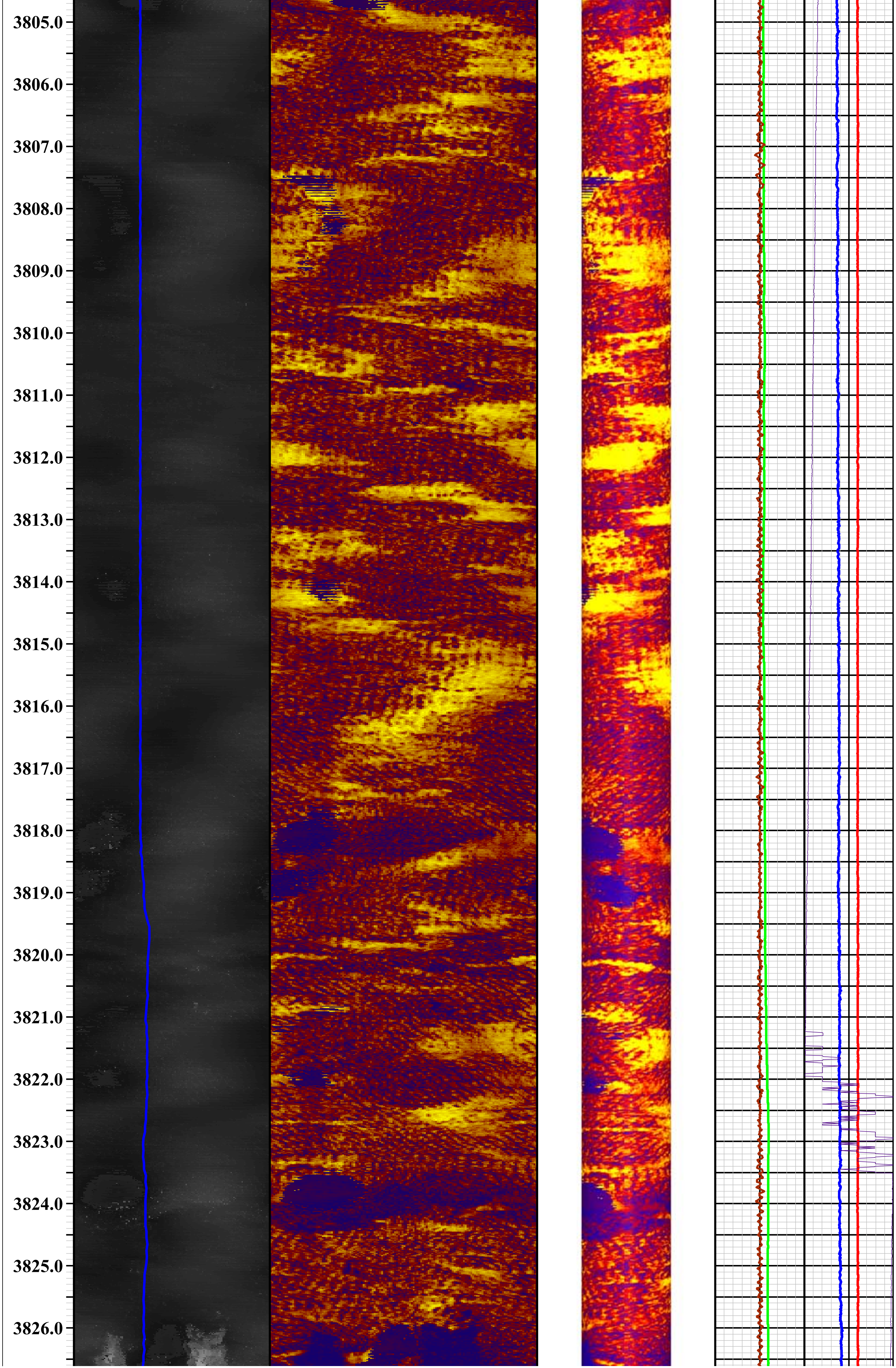
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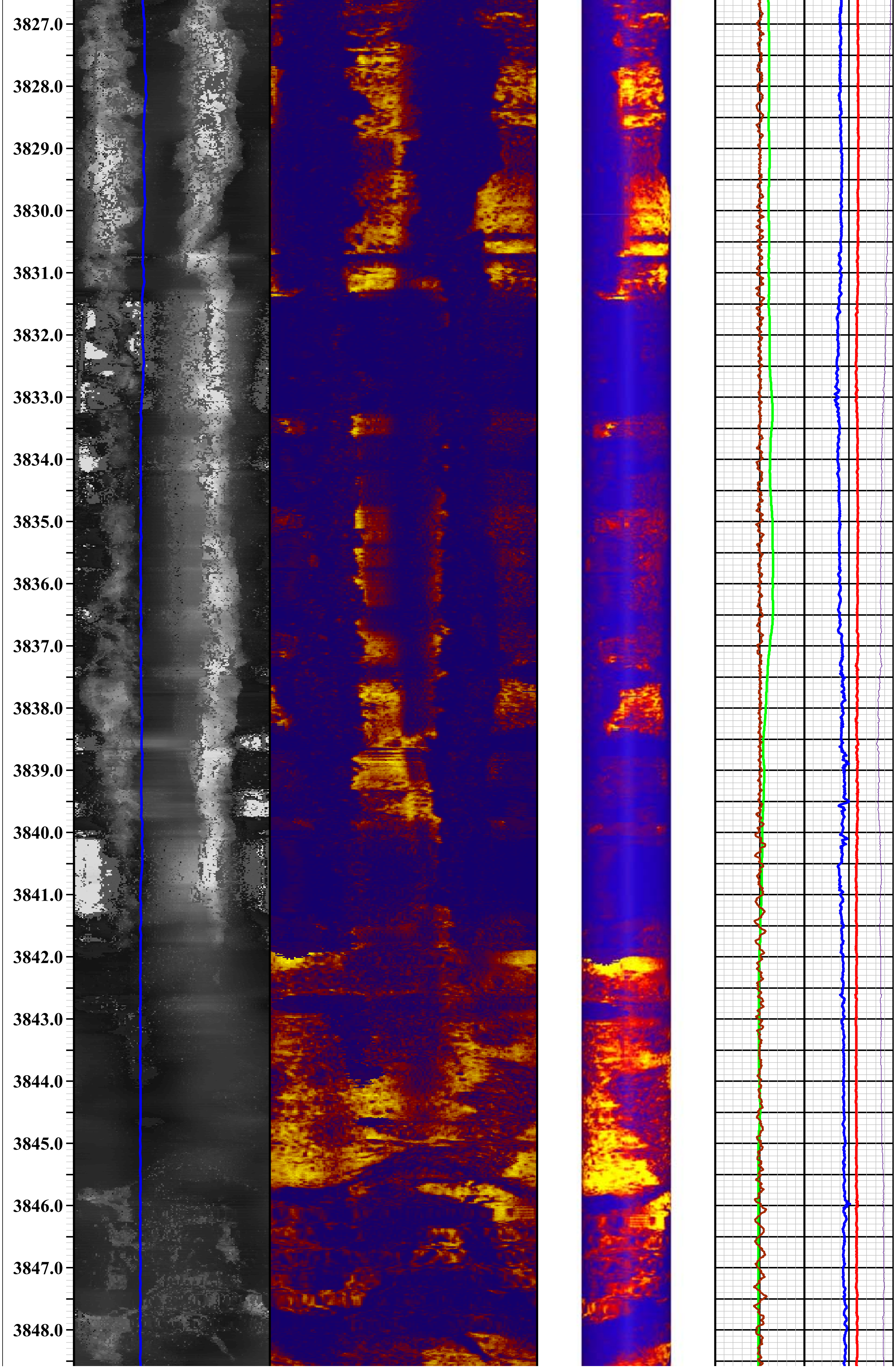
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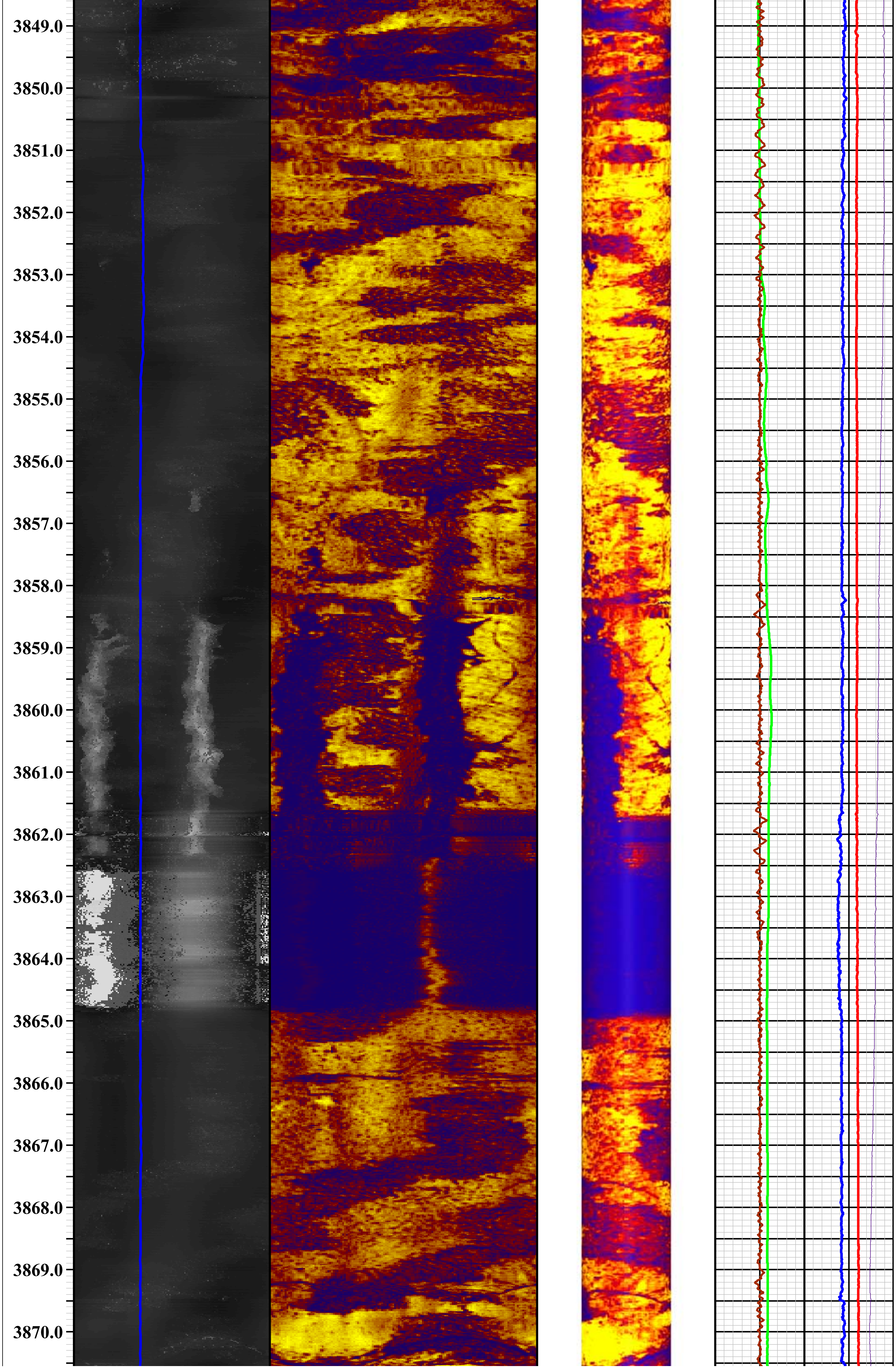
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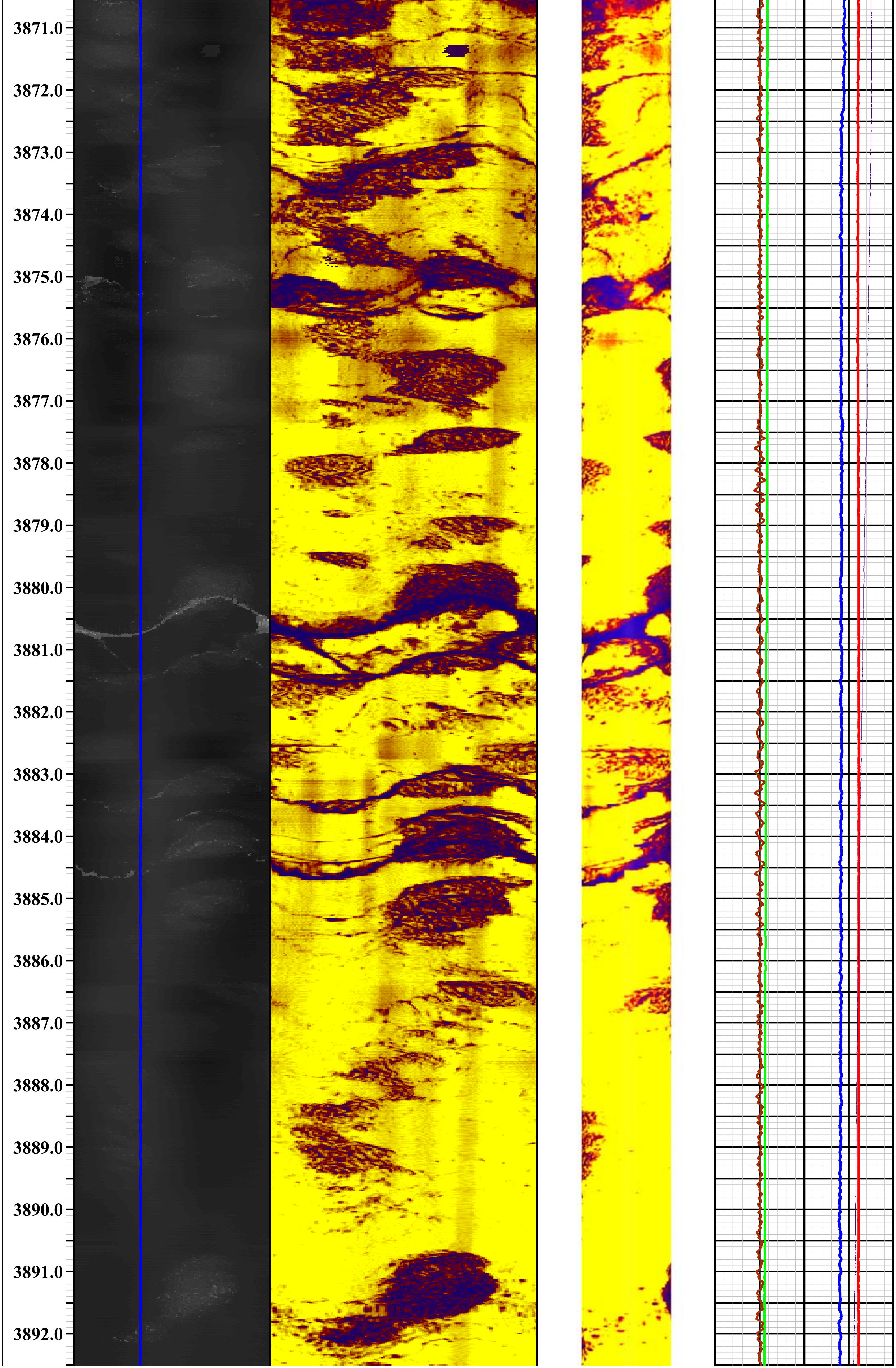
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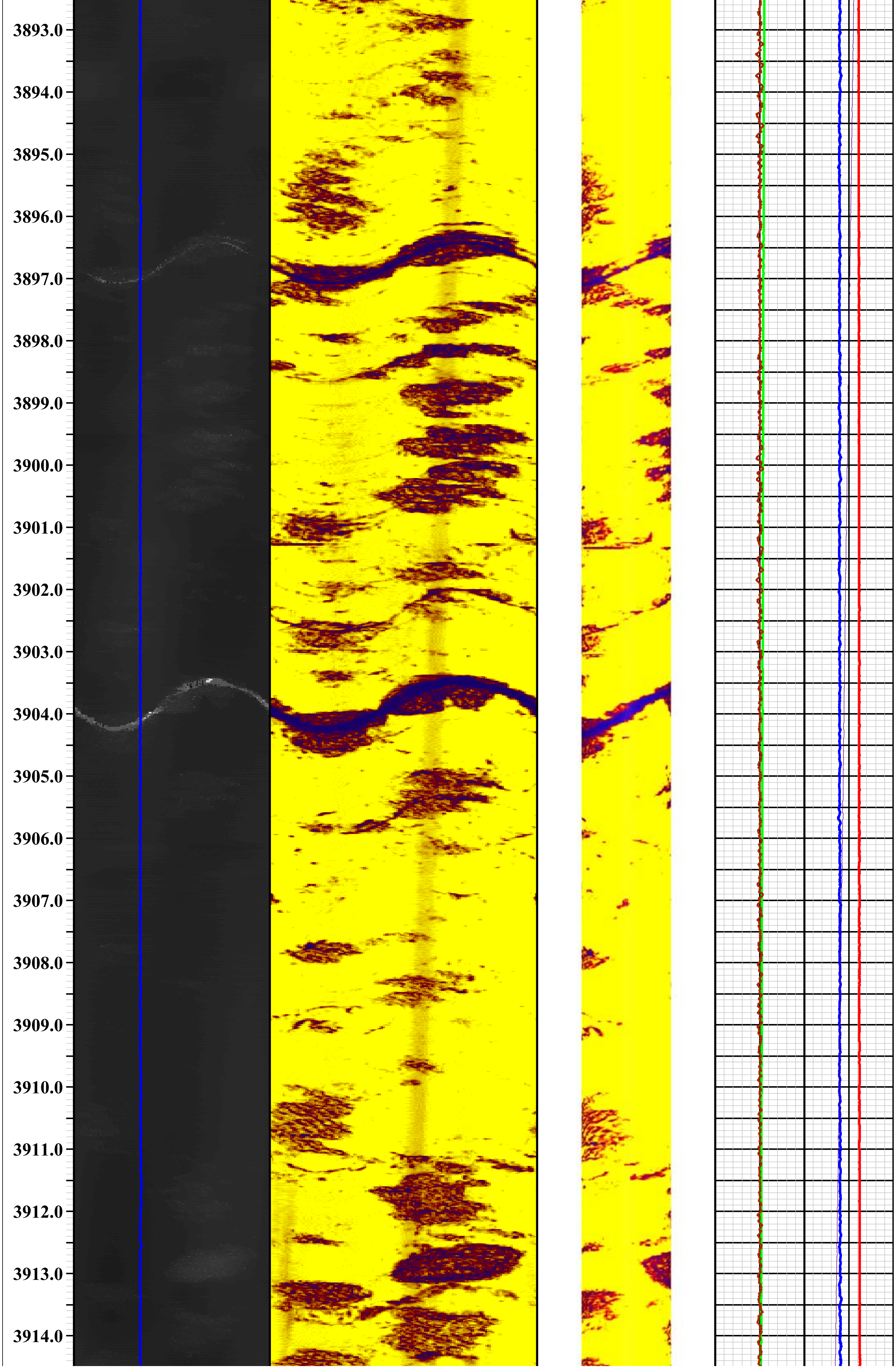
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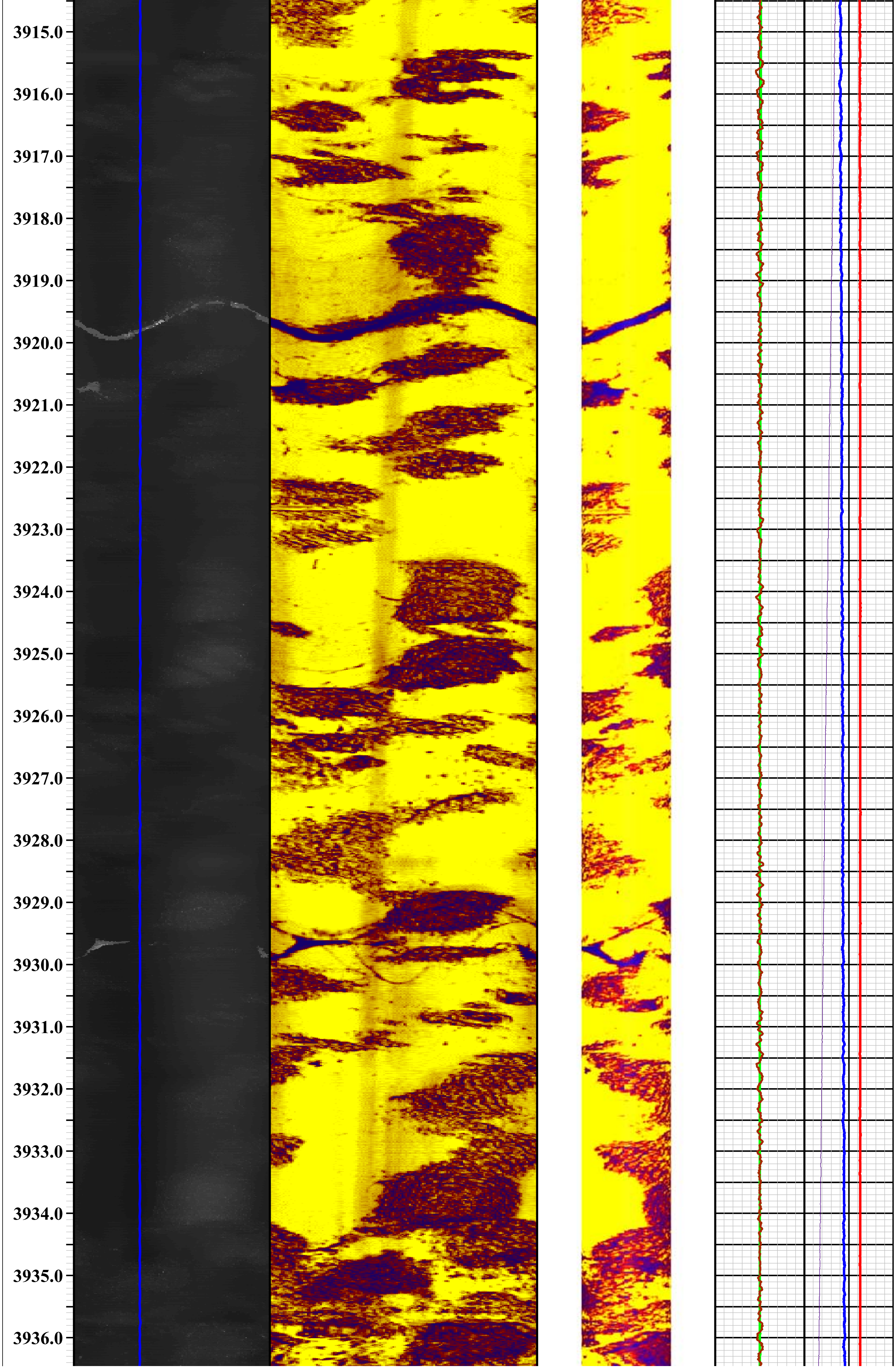
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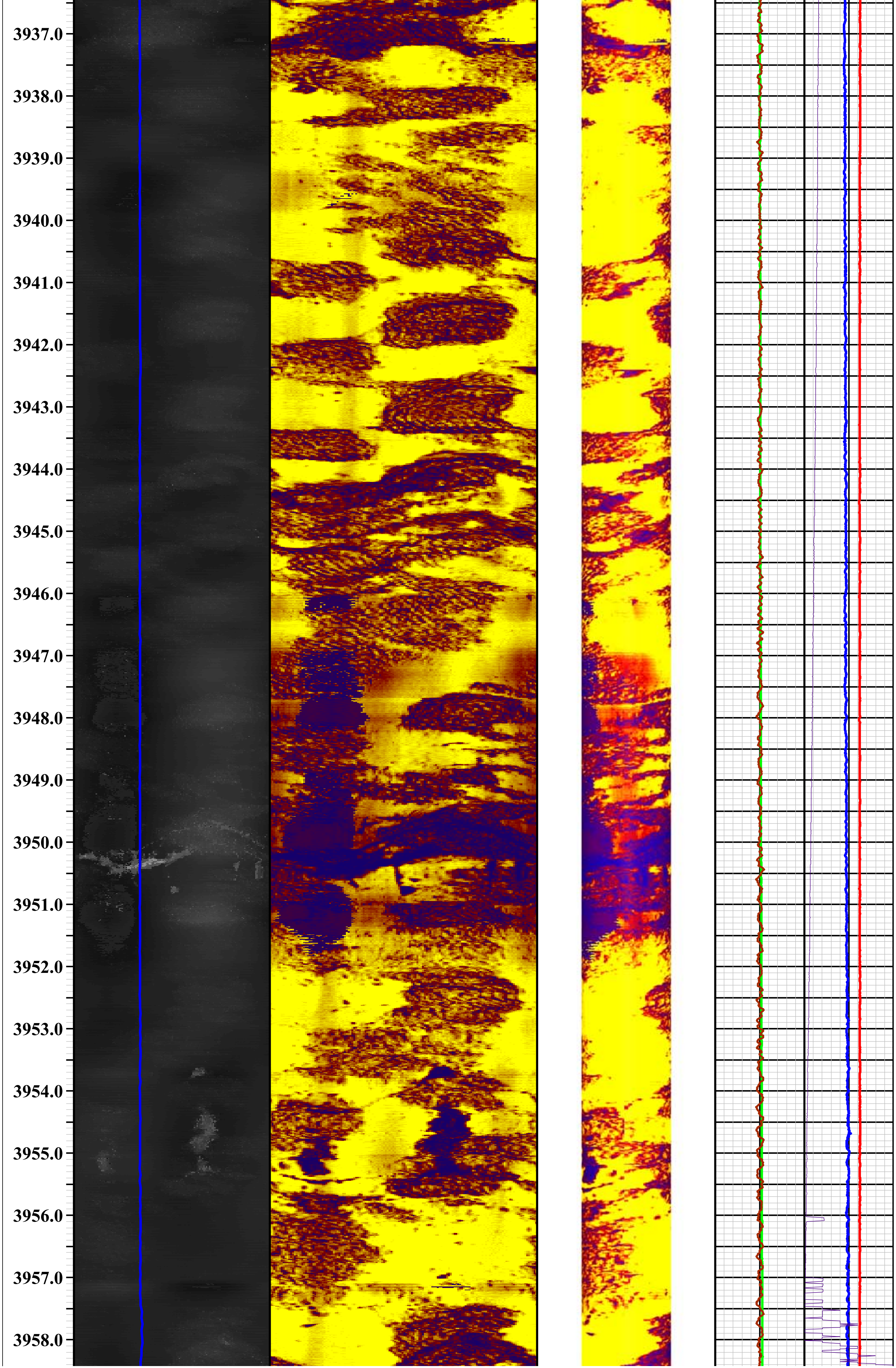
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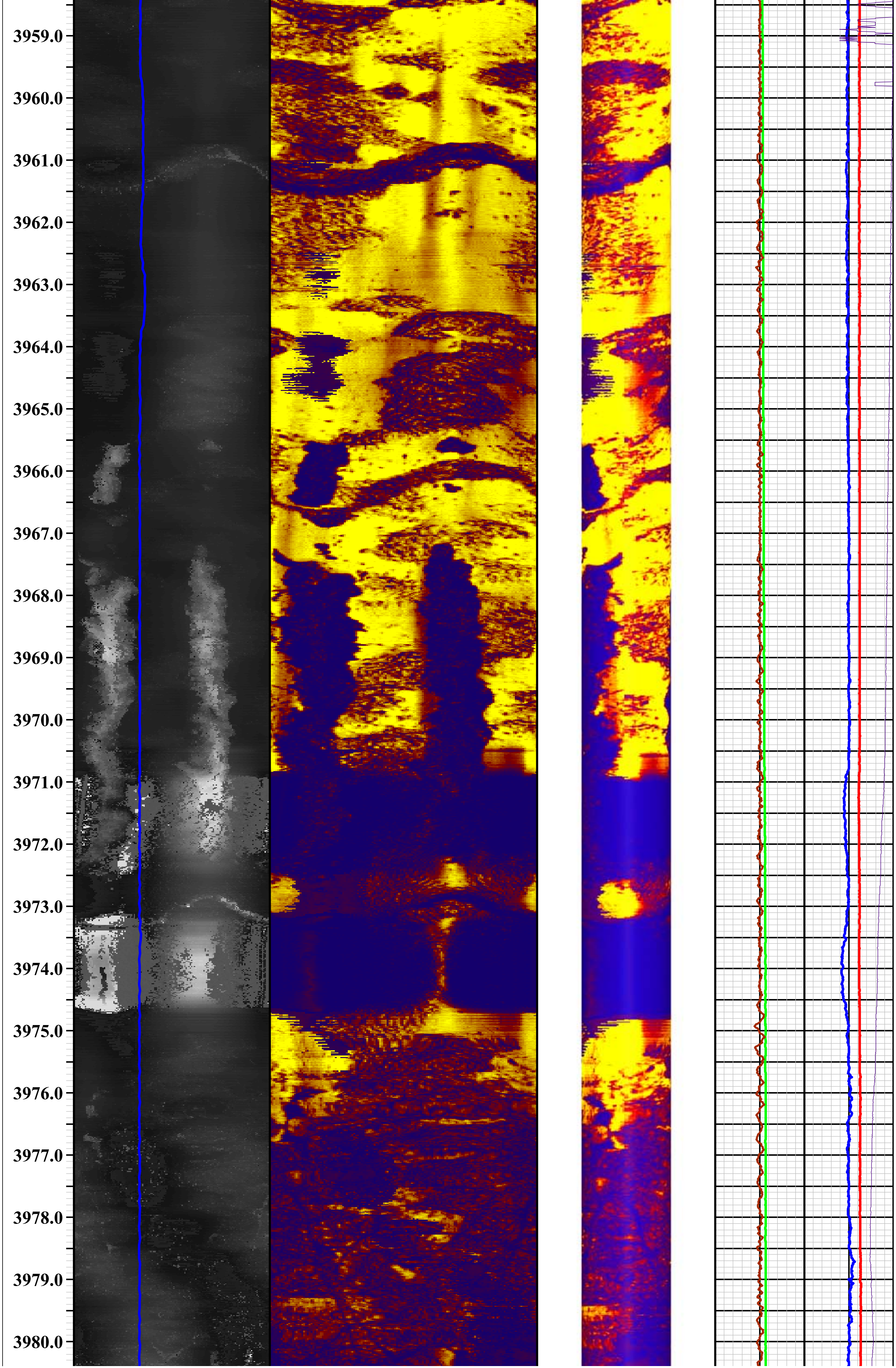
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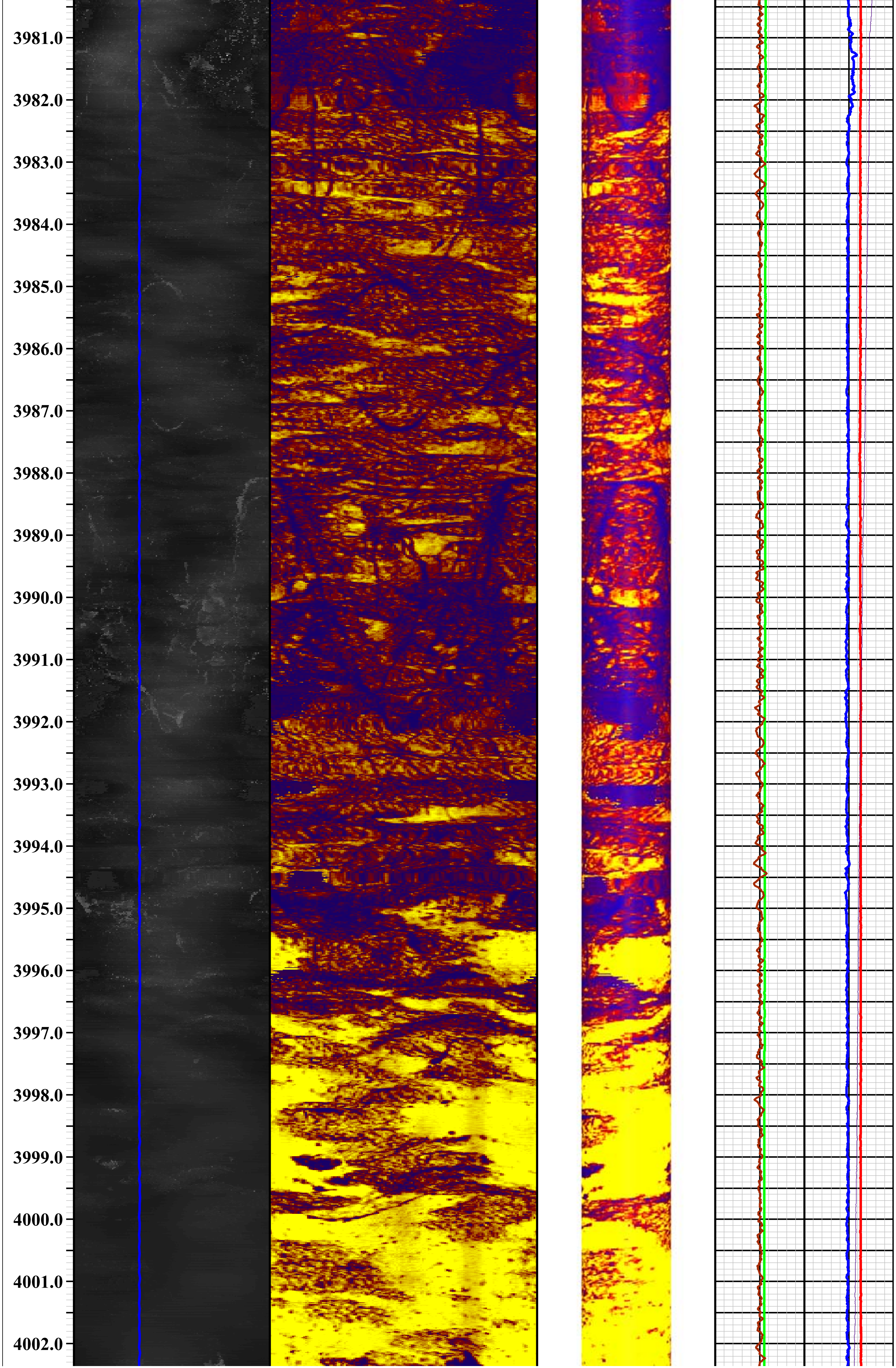
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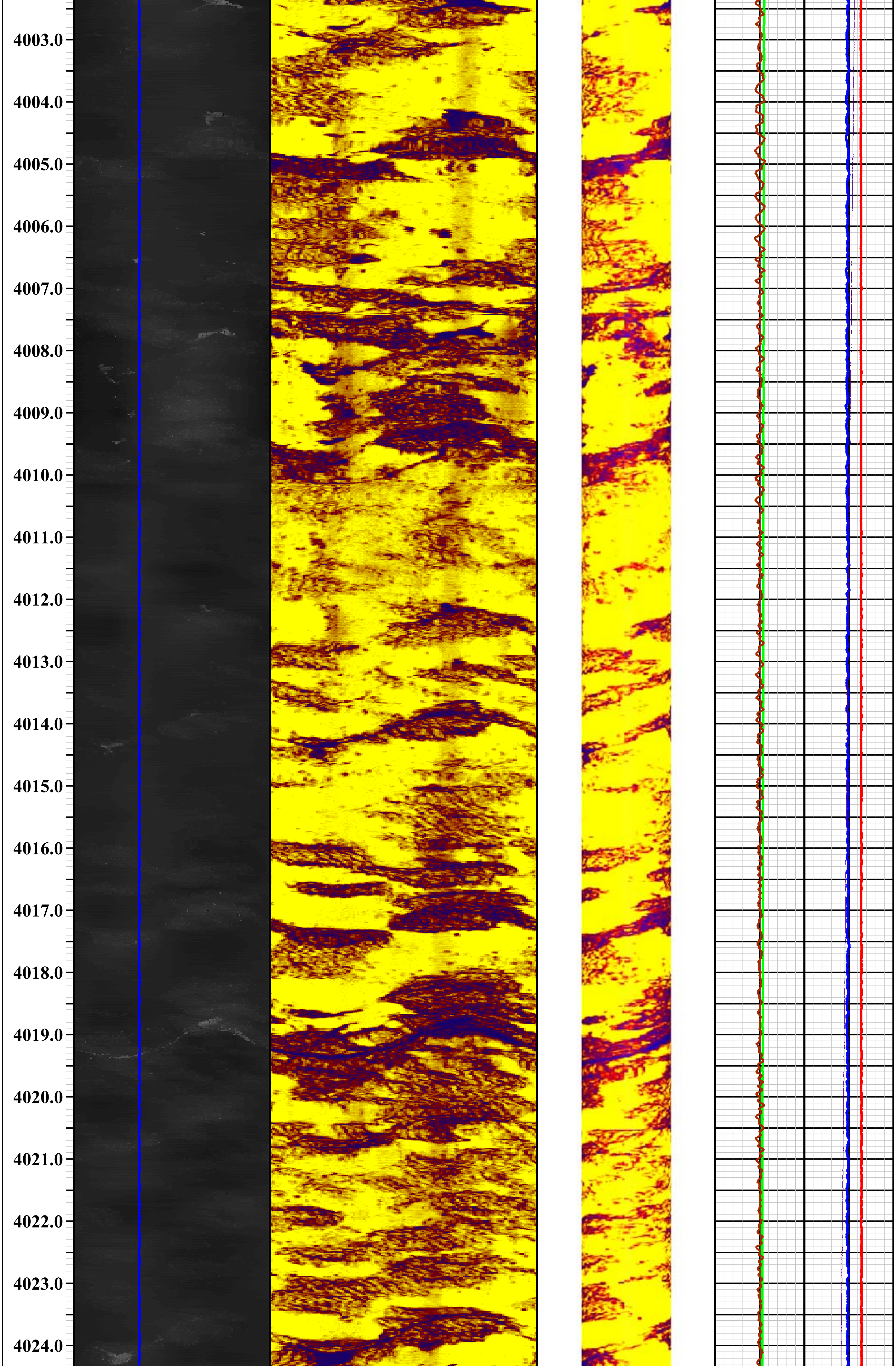
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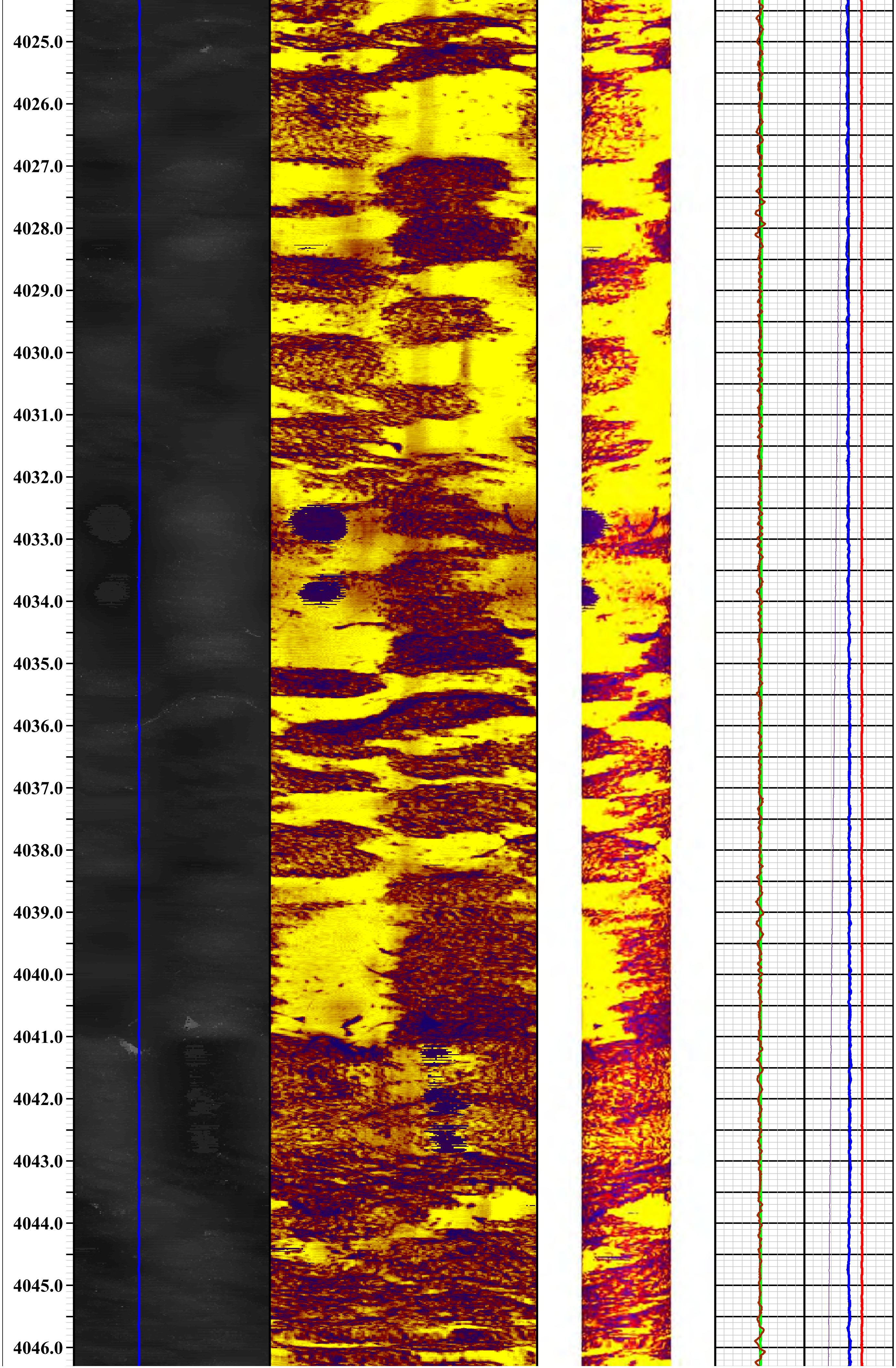
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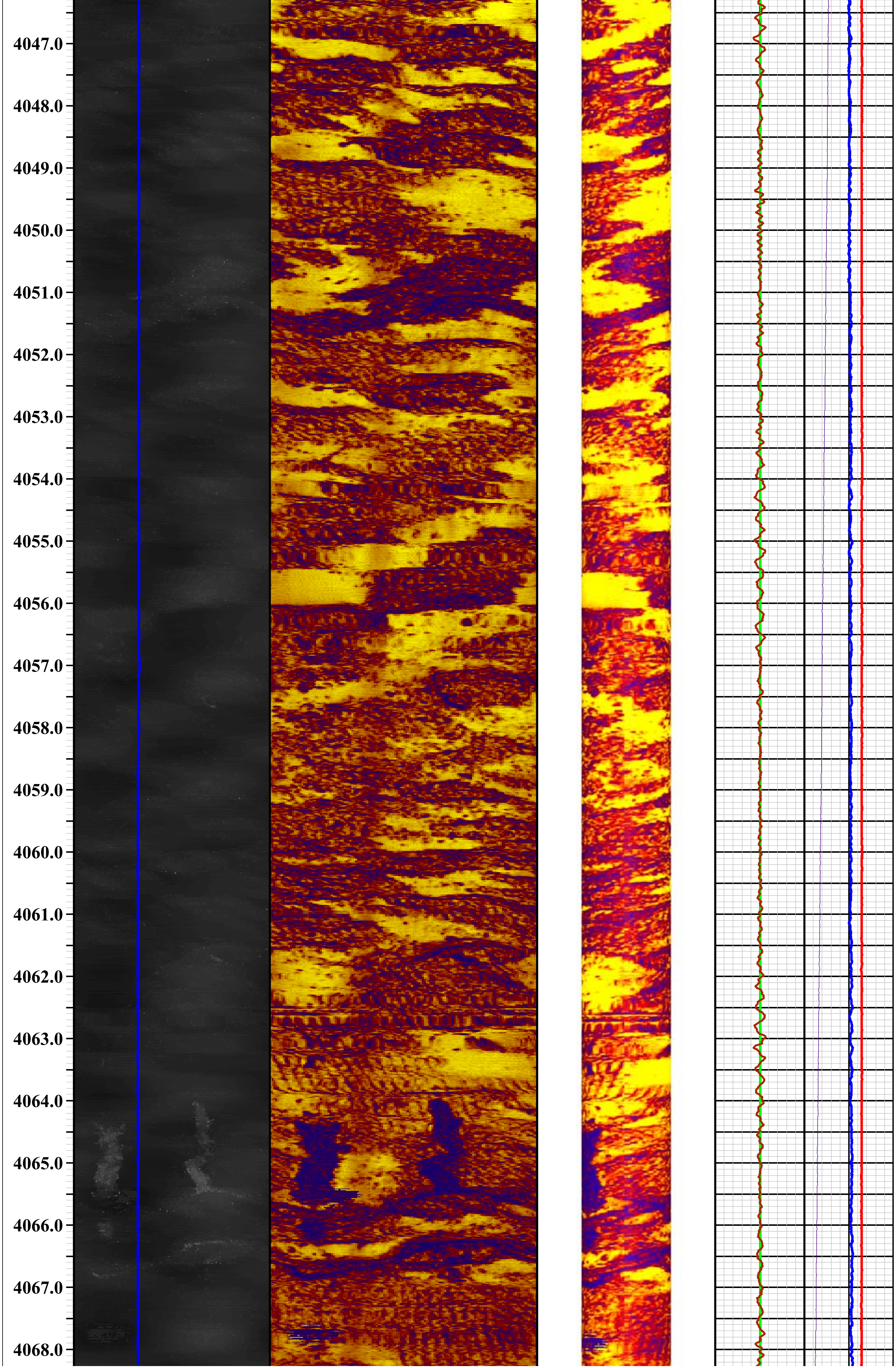

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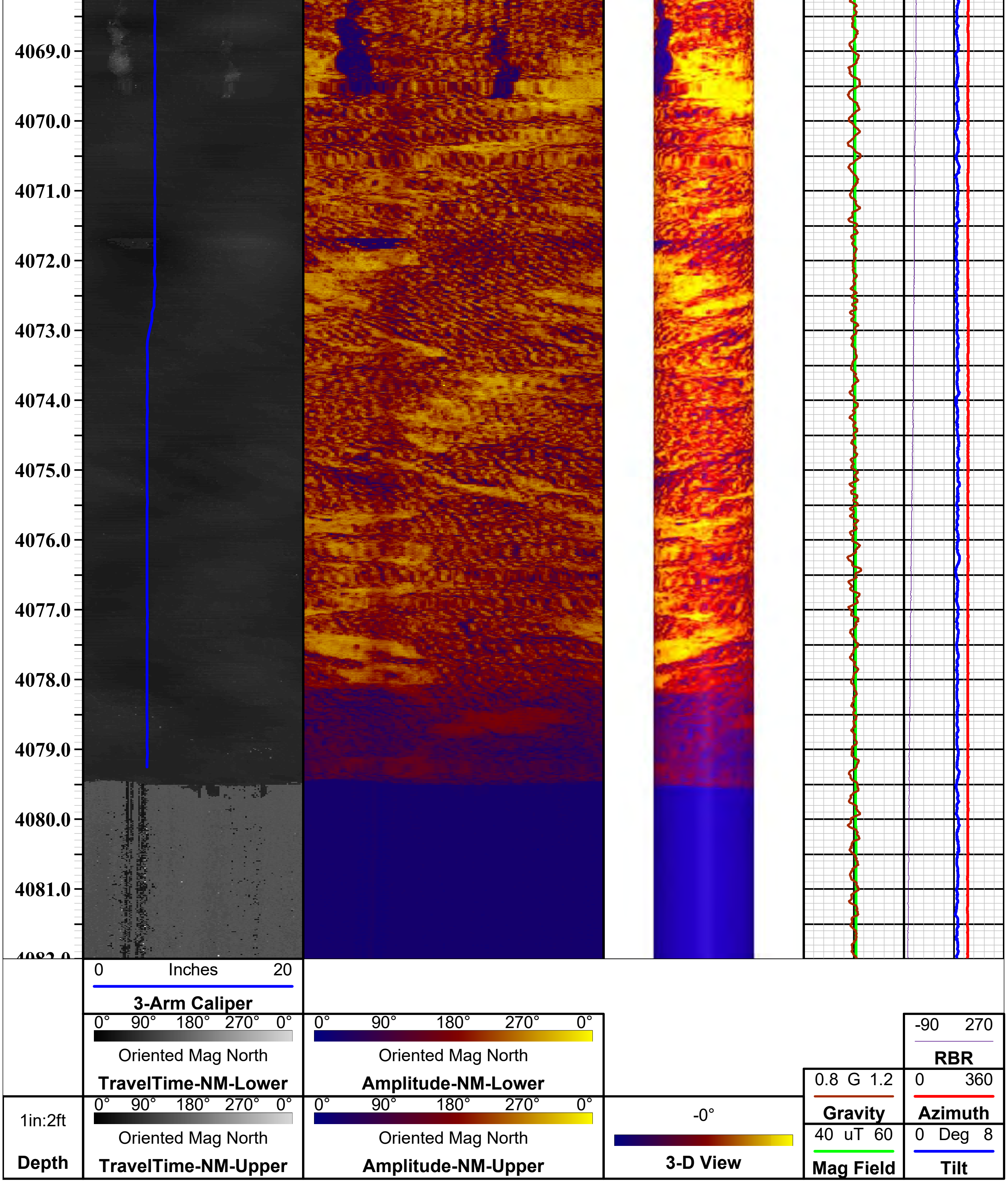
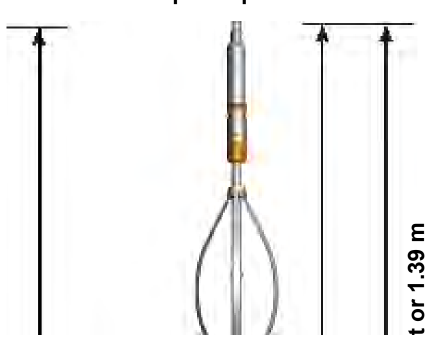
4063.0
4064.0
4065.0
4066.0
4067.0
4068.0



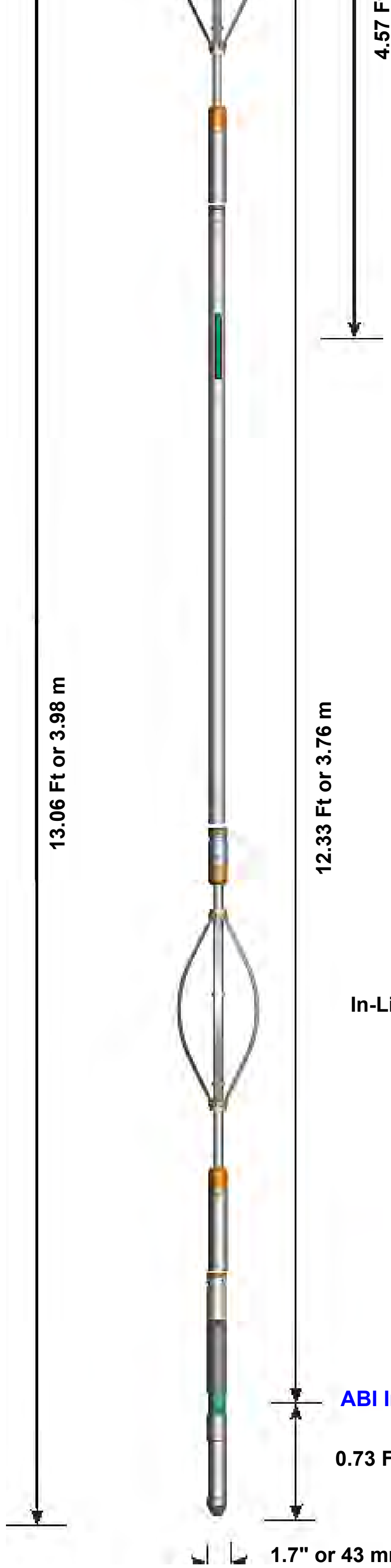
ABI-43 Acoustic Borehole Imager

Probe Top = Depth Ref.

Tool SN: 111801 & 091601



APS544 Probe Orientation Sensor
3-Axis Magnetometer
3 Accellerometers



Probe Length = 2.01 m or 6.59 ft

Probe Weight = 20.4 kg or 45.0 lbs

Distance from Acoustic Image Window to Orientation Sensor = 1.6 m or 5.1 ft

Inclination Accuracy = +/- 0.5 Deg

Azimuth Accuracy = +/- 1.2 Deg

Beam Width = 3.0 mm

Frequency: 1.2 mHz

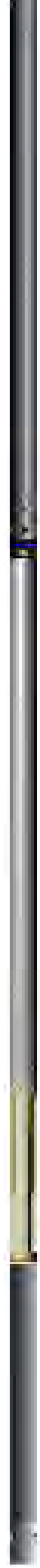
Temperature Rating = 125.0 Deg C (257.0 Deg F)

Pressure Rating = 700 bar (10153 psi)

MSI Gamma-Caliper-Temperature-Fluid Resistivity

Probe Top = Depth Ref.

Probe Length = 2.59 m or 8.5 ft



Probe Length = 2.59 m or 8.5 ft
Probe Weight = 6.80 kg or 15.0 lbs

Natural Gamma and Caliper can only be collected logging up hole.

Fluid Temperature/Resistivity can only be collected logging down hole.

Temperature Rating: 70 Deg C (158 Deg F)
Presure Rating: 200 bar (2900 psi)

Natural Gamma Ray = 0.76 m (29.75 in)

NOTE: Lengths on a particular tool may vary from those listed on this document due to probe sizes and styles utilizedl

3-Arm Caliper = 1.44 m (56.75 in)

Distance from tool top: 2.20 m (86.5 in)

Available Arm Sizes: 3", 9", and 15"

TFR (Temperature/Fluid Resistivity) = 0.39 m (15.5 in)

1.375" or 34.9 mm Diameter

Southwest Exploration Services, LLC
borehole geophysics & video services

Company	RESOLUTION COPPER MINING
Well	DHRES-16
Field	SUPERIOR
County	PINAL
State	ARIZONA

	State ARIZONA

Preliminary **ABI SUMMARY**

APPENDIX E

HALLIBURTON GROUTING REPORTS

APPENDIX E

Halliburton Grouting Reports
From Well DHRES-15 Upper Completion

HALLIBURTON

iCem® Service

RESOLUTION ENERGY

102 Magma Heights Superior AZ 85173

For:

Date: Thursday, June 26, 2014

DHRES #15

DHRES #15
Case 1

Sincerely,

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Cementing Job Summary

The Road to Excellence Starts with Safety

Sold To #: 367641	**Ship To #:** 367641	**Quote #:** 0021854070	**Sales Order #:** 0901441456
Customer: RESOLUTION COPPER		**Customer Rep:**	
Well Name: DHRES	**Well #:** 15	**API/UWI #:**	
Field:	**City (SAP):** Superior	**County/Parish:** PINAL	**State:** ARIZONA
Legal Description:			
Contractor:	**Rig/Platform Name/Num:**		
Job BOM: 7523			
Well Type: OIL & GAS WELL			
Sales Person: HALAMERICA\HAM2360	**Srvc Supervisor:** Jess Tallman		

Job

Formation Name				
Formation Depth (MD)	**Top**		**Bottom**	
Form Type			**BHST**	
Job depth MD	2980ft		**Job Depth TVD**	
Water Depth			**Wk Ht Above Floor**	
Perforation Depth (MD)	**From**		**To**	

Well Data

Description	New / Used	Size in	ID in	Weight lbm/ft	Thread	Grade	Top MD ft	Bottom MD ft	Top TVD ft	Bottom TVD ft
Open Hole Section			12.25				0	2900		0
Casing		7.625	6.969	26.4			0	2890		0

Tools and Accessories

Type	Size in	Qty	Make	Depth ft		Type	Size in	Qty	Make
Guide Shoe	7.625					**Top Plug**	7.625	1	HES
Float Shoe	7.625	1		2890		**Bottom Plug**	7.625		HES
Float Collar	7.625	1		2850		**SSR plug set**	7.625		HES
Insert Float	7.625					**Plug Container**	7.625	1	HES
Stage Tool	7.625					**Centralizers**	7.625		HES

Miscellaneous Materials

Gelling Agt		**Conc**		**Surfactant**		**Conc**		**Acid Type**		**Qty**	**Conc**
Treatment Fld		**Conc**		**Inhibitor**		**Conc**		**Sand Type**		**Size**	**Qty**

Fluid Data

Stage/Plug #: 1

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
1	Chemical Wash	Chemical Wash	20	bbl	8.4				
1000 gal/Mgal		FRESH WATER							

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal

2	Fresh Water Spacer	Fresh Water Spacer	0	bbl	8.33				

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
3	Lead Cement	Premium Cement	445	sack	10.8	4.44		5	28.41
28.19 Gal		FRESH WATER							
94 lbm		CMT - PREMIUM - CLASS G REG OR TYPE V, BULK (100003685)							
30 %		BENTONITE, BULK (100003682)							

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
4	Tail Cement	Premium Cement	20	sack	15.8	1.15		2	4.95
94 lbm		CMT - PREMIUM - CLASS G REG OR TYPE V, BULK (100003685)							
4.98 Gal		FRESH WATER							
0.10 %		HALAD(R)-9, 50 LB (100001617)							

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
5	Displacement	Displacement	134	bbl	8.33			5	

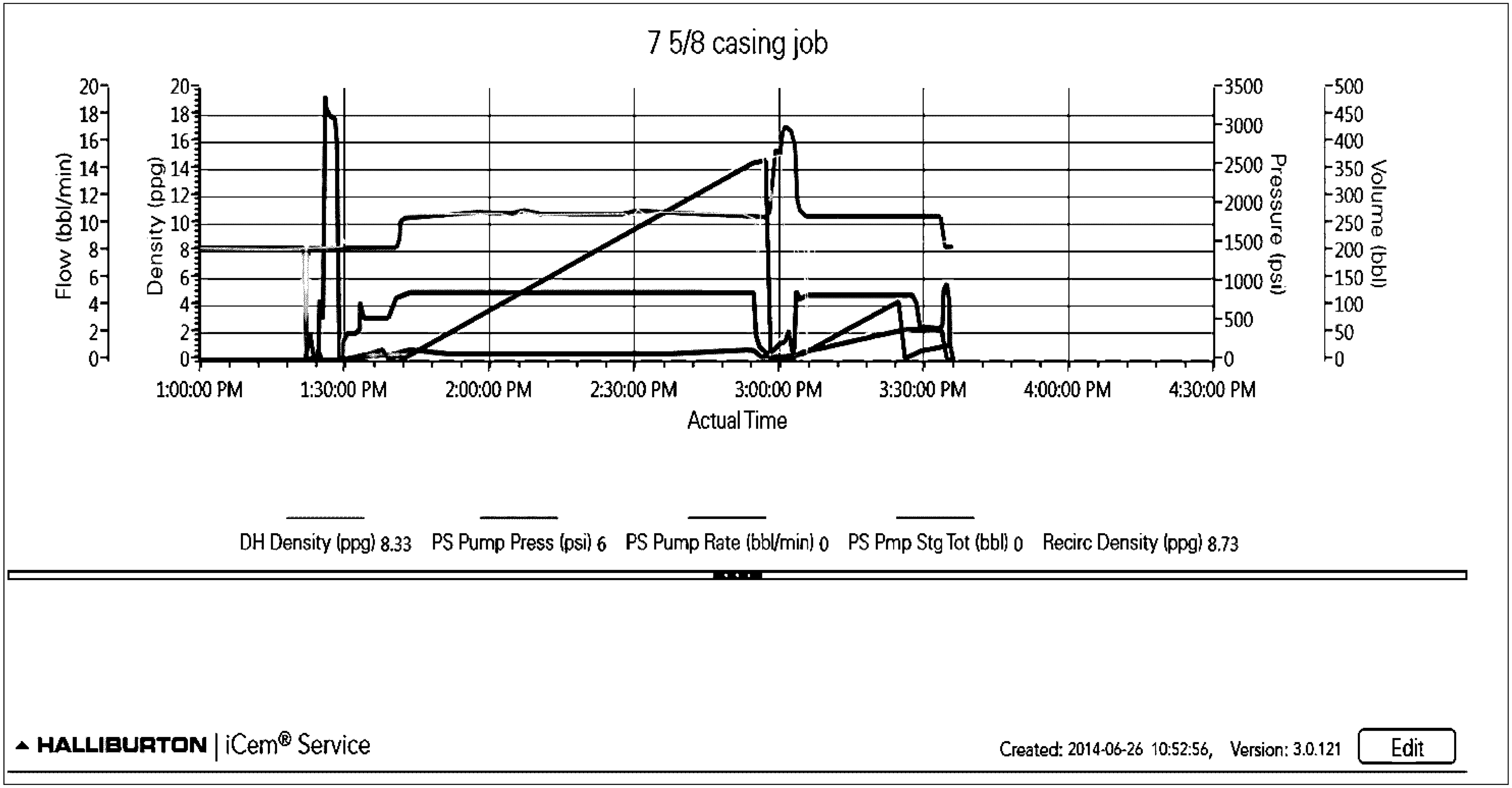
Cement Left In Pipe	**Amount**	ft 39	**Reason**	Shoe Joint	
Comment					

3.1 Job Event Log

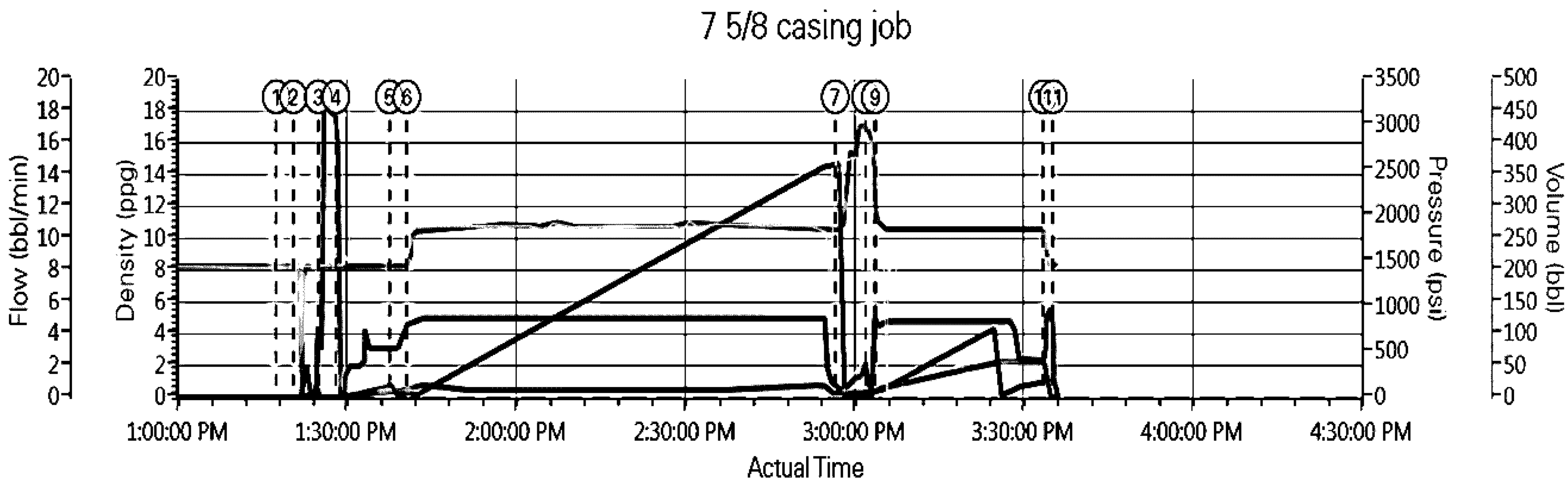
Type	Seq. No.	Activity	Graph Label	Date	Time	Source	Slurry Density (ppg)	Driv-Side Pump Pressure (psi)	Pass-Side Pump Pressure (psi)	Pump Stage Total (bbl)	Recirc Density (ppg)	Comment
Event	1	Start Job	Start Job	6/26/2014	13:18:20	COM5		-3717.00	1.00	0.0	8.37	7 5/8 26.4# k-55 & J-55 Casing 2890' 39' Shoe Joint 12 1/4 hole TD 2900'
Event	2	Pump Spacer 1	Pump Spacer 1	6/26/2014	13:21:23	COM5		-3717.00	2.00	0.0	8.32	load lines 2 1/2 bbl
Event	3	Test Lines	Test Lines	6/26/2014	13:25:48	COM5		-3717.00	512.00	2.6	8.33	low pressure test 500 high pressure test 3000
Event	4	Pump Spacer 2	Pump Spacer 2	6/26/2014	13:28:55	COM5		-3717.00	8.00	0.0	8.30	20 bbl Chem Wash at 3 bbl min 56 PSI
Event	5	Pump Spacer 1	Pump Spacer 1	6/26/2014	13:38:22	COM5		-3717.00	67.00	0.1	10.87	10 Fresh Water at 4 1/2 bbl min 111 psi
Event	6	Pump Lead Cement	Pump Lead Cement	6/26/2014	13:41:27	COM5		-3717.00	119.00	0.1	11.05	351 bbl lead cement 10.8#/gal 445 sk 5 bbl min 135 psi 2 bbl before switching to tail got lead cement back to surface
Event	7	Pump Tail Cement	Pump Tail Cement	6/26/2014	14:57:23	COM5		-3717.00	47.00	367.8	14.75	4 bbl tail cement 15.8#/gal 20 sk 2 bbl min
Event	8	Drop Top Plug	Drop Top Plug	6/26/2014	15:02:46	COM5		-3717.00	32.00	6.3	8.68	
Event	9	Pump Displacement	Pump Displacement	6/26/2014	15:04:27	COM5		-3716.00	100.00	10.6	8.05	134 bbl of fresh water displacement at 5 bbl min 480 psi
Event	10	Bump Plug	Bump Plug	6/26/2014	15:34:17	COM5		-3716.00	963.00	28.2	8.73	1000 psi check floats 1/4 bbl back floats held
Event	11	End Job	End Job	6/26/2014	15:36:04	COM5		-3716.00	7.00	0.0	8.73	got 40 bbl more cement back then figured

4.0 Attachments

4.1 chart with out events.png



4.2 chart with events & stages.png



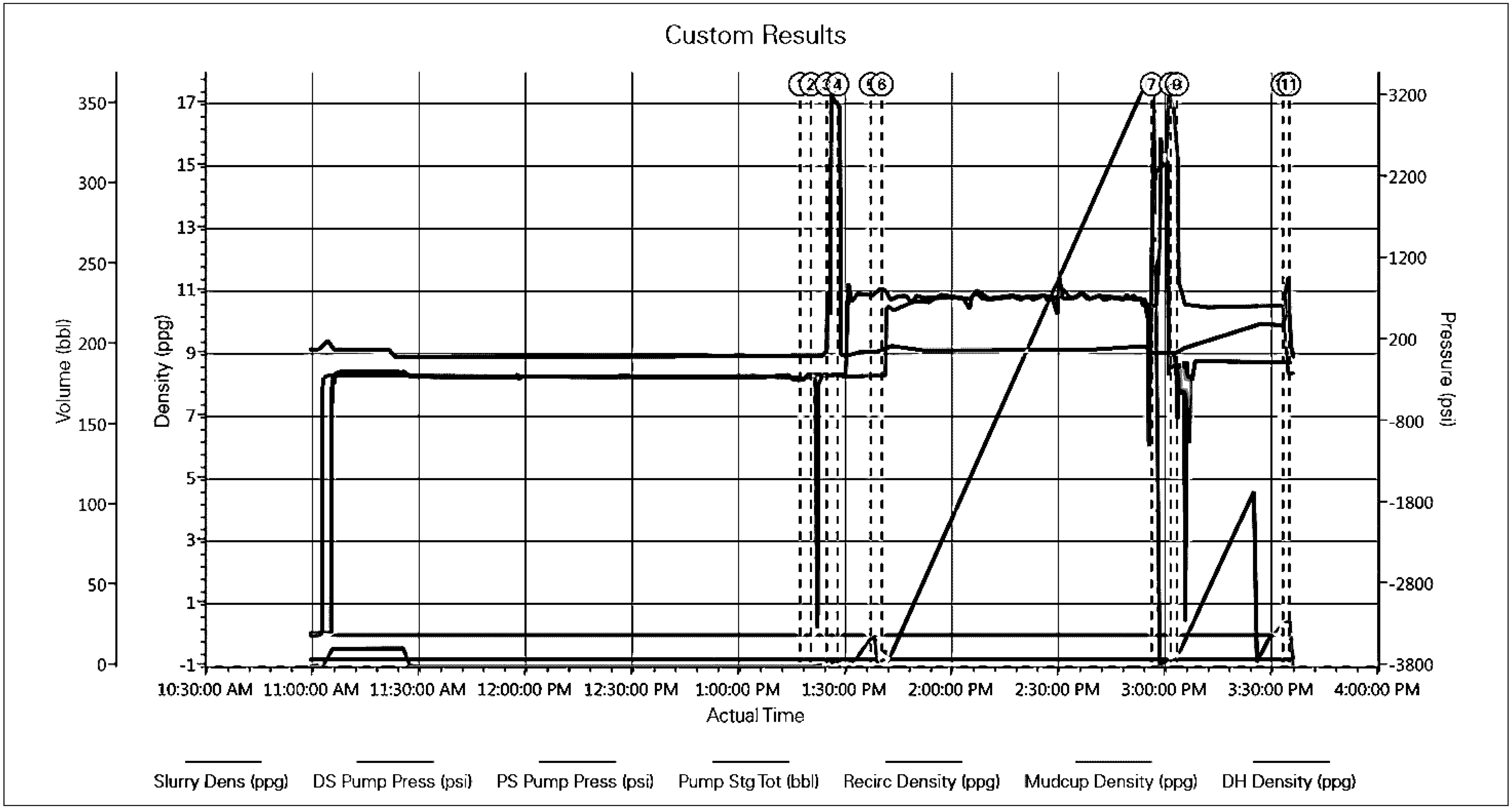
DH Density (ppg) 8.33 PS Pump Press (psi) 6 PS Pump Rate (bbl/min) 0 PS Pmp Stg Tot (bbl) 0 Recirc Density (ppg) 8.73

① **Start Job** 8.26;1;0;0;
② **Pump Spacer 1** 8.26;2;0;0;
③ **Test Lines** 8.28;511;0;2.6;
④ **Pump Spacer 2** 8.25;8;0;0;
⑤ **Pump Spacer 1** 8.32;67;3.1;0.1;
⑥ **Pump Lead Cement** 9.67;119;4.6;0.1;
⑦ **Pump Tail Cement** 10.54;47;0.5;0;
⑧ **Drop Top Plug** 16.74;31;0;6.3;
⑨ **Pump Displacement** 10.93;100;4.8;10.6;
⑩ **Bump Plug** 8.33;966;0;28.2;
⑪ **End Job** 8.4;7;0;0;

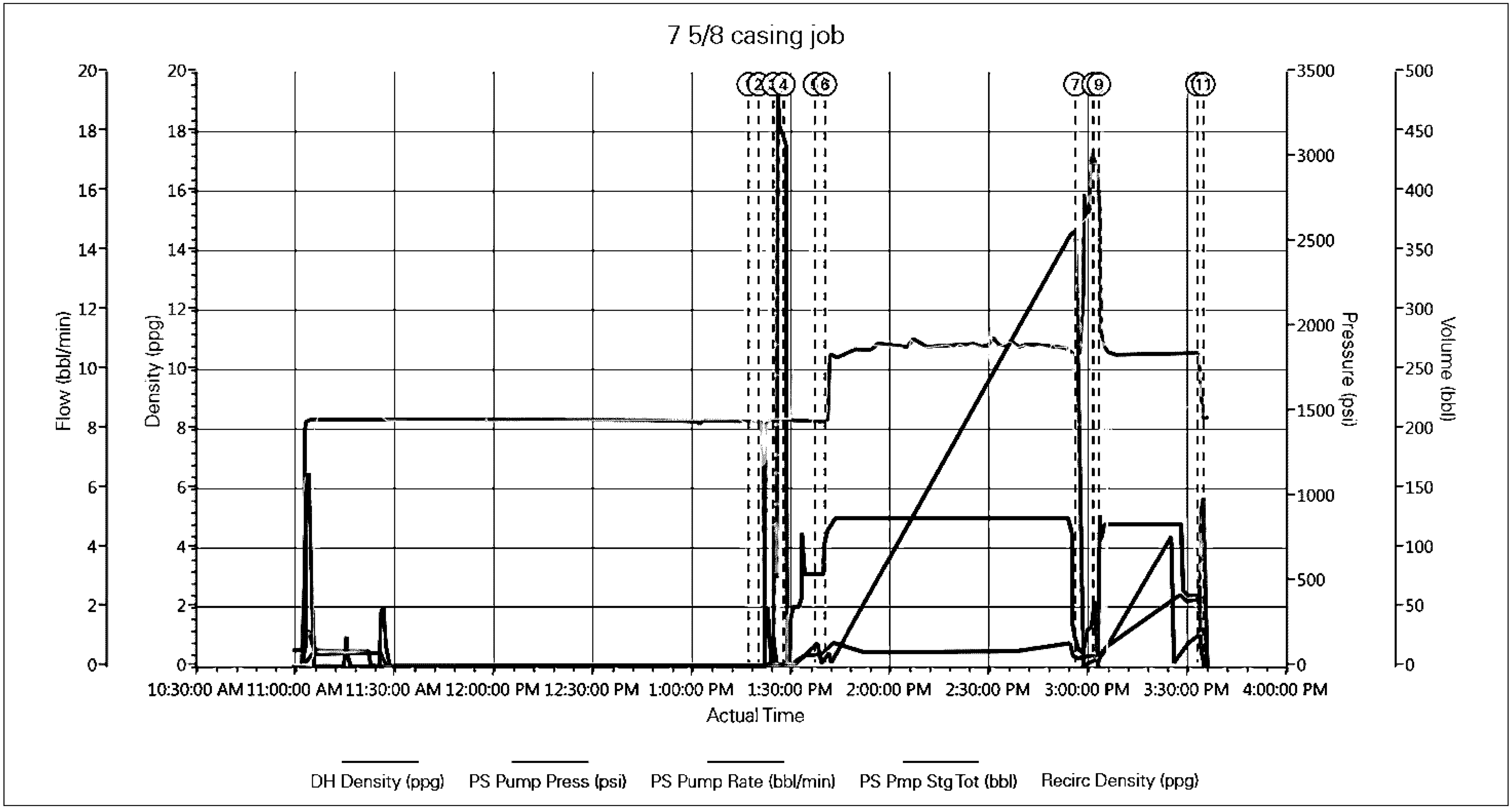
HALLIBURTON | iCem® Service Created: 2014-06-26 10:52:56, Version: 3.0.121 Edit

5.0 Custom Graphs

5.1 Custom Graph



5.2 Custom Graph



APPENDIX E

Halliburton Grouting Reports From Well DHRES-16 Upper Completion

HALLIBURTON

iCem® Service

RESOLUTION COPPER DHRES RESOLUTION COPPER DHRES # 16 7.625 901631093

For:

Date: Friday, September 05, 2014

RESOLUTION COPPER DHRES # 16 7.625 901631093

Case 1

Sincerely,

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HALLIBURTON

Cementing Job Summary

The Road to Excellence Starts with Safety

Sold To #: 367641	**Ship To #:** 367641	**Quote #:** 0021921445	**Sales Order #:** 0901631093
Customer: RESOLUTION COPPER		**Customer Rep:** DAVID HAAS	
Well Name: DHRES	**Well #:** 16		**API/UWI #:**
Field:	**City (SAP):** Superior	**County/Parish:** Pinal	**State:** ARIZONA
Legal Description:			
Contractor:		**Rig/Platform Name/Num:**	
Job BOM: 7521			
Well Type: OIL & GAS WELL			
Sales Person: HALAMERICA\HAM2360		**Srvc Supervisor:** David Hahn	

Job

Formation Name				
Formation Depth (MD)	**Top**		**Bottom**	
Form Type			**BHST**	
Job depth MD	1200ft		**Job Depth TVD**	
Water Depth			**Wk Ht Above Floor**	
Perforation Depth (MD)	**From**		**To**	

Well Data

Description	New / Used	Size in	ID in	Weight lbm/ft	Thread	Grade	Top MD ft	Bottom MD ft	Top TVD ft	Bottom TVD ft
Open Hole Section			12.45				0	1820		
Casing		7.625	6.969	26.4			0	1810		

Tools and Accessories

Type	Size in	Qty	Make	Depth ft	Type	Size in	Qty	Make
Guide Shoe	7.625				Top Plug	7.625	1	HES
Float Shoe	7.625			1810	Bottom Plug	7.625		HES
Float Collar	7.625			1770	SSR plug set	7.625		HES
Insert Float	7.625				Plug Container	7.625	1	HES
Stage Tool	7.625				Centralizers	7.625		HES

Miscellaneous Materials

Gelling Agt		**Conc**		**Surfactant**		**Conc**		**Acid Type**		**Qty**	**Conc**
Treatment Fld		**Conc**		**Inhibitor**		**Conc**		**Sand Type**		**Size**	**Qty**

Fluid Data

Stage/Plug #: 1

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
1	Chemical Wash	Chemical Wash	20	bbl	8.4				
1000 gal/Mgal		FRESH WATER							

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal

2	Fresh Water Spacer	Fresh Water Spacer	10	bbl	8.33				

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
3	Lead Cement	HALCEM (TM) SYSTEM	275	sack	10.8	4.44		5	28.41

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
4	Tail Cement	LIFECEM (TM) CEMENT	45	sack	15.8	1.15		5	4.95

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
5	Displacement	Displacement	84	bbl	8.33				

Cement Left In Pipe	Amount	40 ft	Reason	Shoe Joint
Comment				

HALLIBURTON

Summary Report

Crew:

Job Start Date: 9/5/2014

Sales Order #: 0901631093
WO #: 0901631093
PO/AFE #: NA

Customer:	RESOLUTION COPPER	**Field:**		**Job Type:**	CMT SURFACE CASING BOM
UWI / API Number:		**County/Parish:**	Pinal	**Service Supervisor:**	David Hahn
Well Name:	DHRES	**State:**	ARIZONA		
Well No:	16	**Latitude:**			
		Longitude:		**Cust Rep Name:**	DAVID HAAS
		Sect / Twn / Rng:	//	**Cust Rep Phone #:**	

Remarks:

The Information Stated Herein Is Correct	Customer Representative Signature Paul Stoddard Customer Representative Printed Name Paul Stoddard	Date 9-5-14

HALLIBURTON

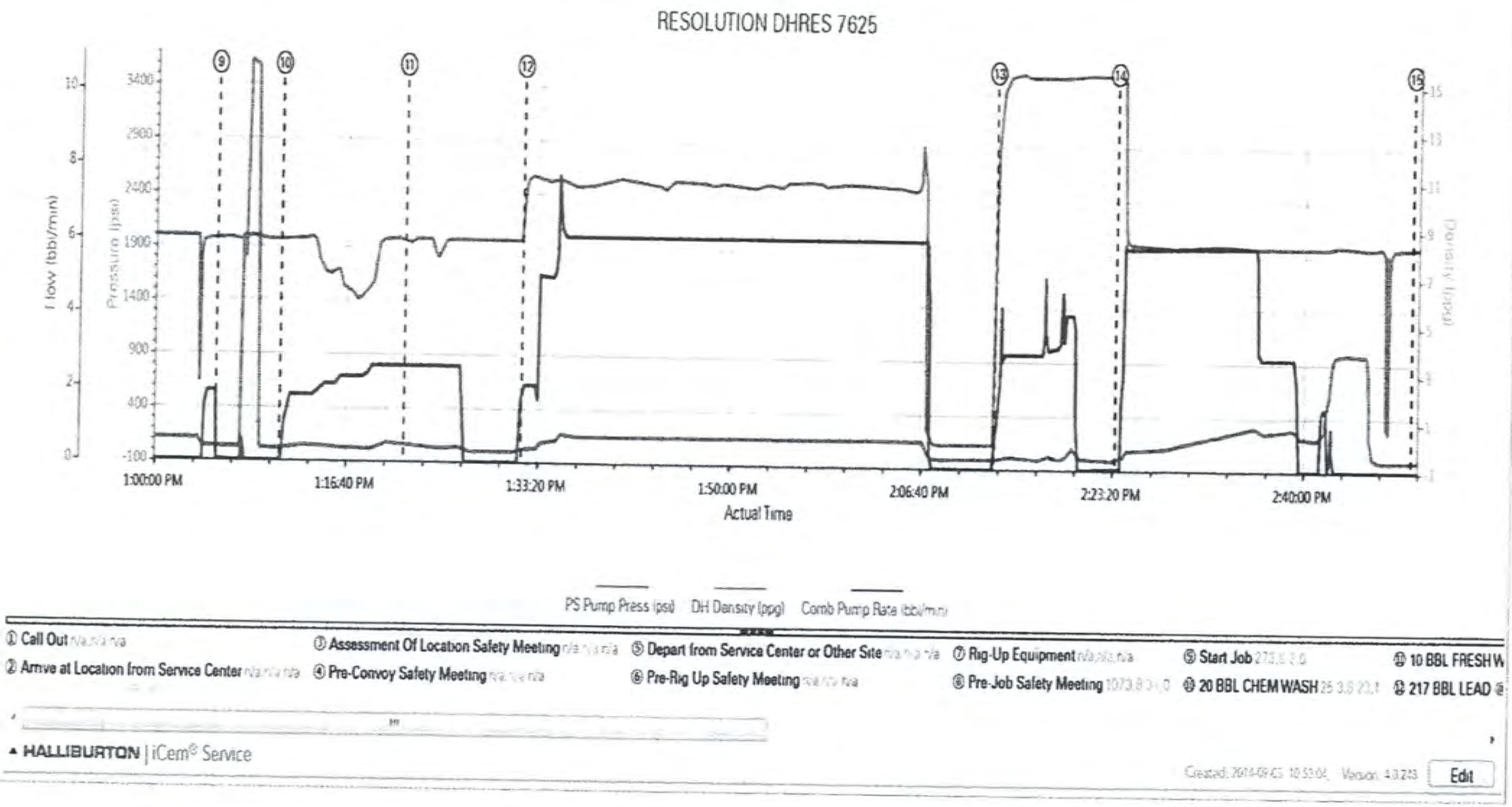
4.5 Job Event Log

Type	Seq. No.	Activity	Graph Label	Date	Time	Source	PS Pump Press (psi)	DH Density (ppg)	Comb Pump Rate (bbl/min)	Comments
Event	1	Call Out	Call Out	9/4/2014	09:00:00	USER				
Event	2	Arrive at Location from Service Center	Arrive at Location from Service Center	9/4/2014	10:00:00	USER				
Event	3	Assessment Of Location Safety Meeting	Assessment Of Location Safety Meeting	9/4/2014	10:30:00	USER				
Event	4	Pre-Convoy Safety Meeting	Pre-Convoy Safety Meeting	9/4/2014	11:30:00	USER				
Event	5	Depart from Service Center or Other Site	Depart from Service Center or Other Site	9/4/2014	12:00:00	USER				
Event	6	Pre-Rig Up Safety Meeting	Pre-Rig Up Safety Meeting	9/5/2014	11:00:00	USER				
Event	7	Rig-Up Equipment	Rig-Up Equipment	9/5/2014	11:15:00	USER				
Event	8	Pre-Job Safety Meeting	Pre-Job Safety Meeting	9/5/2014	12:30:00	USER	107.30	8.31	0.00	
Event	9	Start Job	Start Job	9/5/2014	13:05:31	COM4	27.30	8.20	0.00	
Event	10	Pump Spacer 1	20 BBL CHEM WASH	9/5/2014	13:11:06	COM4	25.30	8.23	1.00	
Event	11	Pump Spacer 2	10 BBL FRESH WATER	9/5/2014	13:21:56	COM4	52.30	8.23	2.60	
Event	12	Pump Lead Cement	217 BBL LEAD @ 10.8 PPG	9/5/2014	13:32:09	COM4	33.30	10.46	2.10	
Event	13	Pump Tail Cement	9 BBL TAIL @ 15.8 PPG	9/5/2014	14:13:16	COM4	-6.70	12.86	1.40	
Event	14	Pump Displacement	PUMP 84 BBL DISPLACEMENT BUMP @ 516 TAKE TO 1000 PSI	9/5/2014	14:23:48	COM4	-2.70	15.37	0.00	
Event	15	End Job	End Job	9/5/2014	14:49:41	COM4	-8.70	8.28	0.00	
Event	16	Pre-Rig Down Safety Meeting	Pre-Rig Down Safety Meeting	9/5/2014	15:00:00	USER	-5.70	1.25	1.80	
Event	17	Rig-Down Equipment	Rig-Down Equipment	9/5/2014	15:15:00	USER				
Event	18	Rig-Down Completed	Rig-Down Completed	9/5/2014	15:45:00	USER				
Event	19	Pre-Convoy Safety Meeting	Pre-Convoy Safety Meeting	9/5/2014	16:00:00	USER				

Type	Seq. No.	Activity	Graph Label	Date	Time	Source	PS Pump Press (psi)	DH Density (ppg)	Comb Pump Rate (bbl/min)	Comments
Event	20	Depart Location for Service Center or Other Site	Depart Location for Service Center or Other Site	9/5/2014	16:15:00	USER				

5.0 Attachments

5.1 RESO DHRES.PNG



HALLIBURTON JOB SAFETY ANALYSIS

DATE:	9/5/2014	SUPERVISOR:	DAVID HAHN	JOB TYPE:	surface
CUSTOMER:	Resolution	RIG NUMBER:	167	SALES ORDER:	901631093
GPS COORDINATES:	LATITUDE:				
	LONGITUDE:				
CROSS ROADS:	HWY60		EMERGENCY VEHICLE:	11583928	
MUSTER AREA:	EDGE OF LOCATION		EVACUATION SIGNAL:	ONE LONG HORN BLAST	
FIRST AID KIT:	LOCATED IN HES CEMENT EQUIP/DRIVER SIDE		FIRE EXTINGISHERS:	FRONT OF TRUCKS	
AXIOM MEDICAL 1-877-502-9466		(281)419-7063 EXT1		EMERGENCY CONTACTS	
SAN JUAN COUNTY, NM	SHERIFF	(505)334-6622	FARMINGTON	HOSPITAL	(505)325-5011
SAN JUAN COUNTY, UT	SHERIFF	(435)587-3225	DURANGO	HOSPITAL	(970) 375-1710
LA PLATA COUNTY, CO	SHERIFF	(970) 382-7048	CORTEZ	HOSPITAL	(970) 565-6666
ARCHULETA COUNTY, CO	SHERIFF	(970) 264-2131	SHIPROCK	HOSPITAL	(505)368-6001
MONTEZUMA COUNTY, CO	SHERIFF	(970) 565-8452			
PRINT NAME	EMPLOYEE #	SIGNATURE	PRINT NAME	EMPLOYEE #	SIGNATURE
Steve Axt	434802				
David Hahn	521042				
Landon Hughte	549879				
Jacob Ayers	487729				
Mark Bascope					

TASK	HAZARD	ELIMINATE
Paul ~~Hoddard~~		
DAVID HAAS		
Edmund Peace M+A Aloyan Bruce M&A.		
Cloy Campbell Jon Trimbach		
Matt Lutie Matt Shelley		

APPENDIX E

Halliburton Grouting Reports
From Well DHRES-16 Lower Completion

3.5 Job Event Log

Type	Seq. No.	Activity	Graph Label	Date	Time	Source	Pass-Side Pump Pressure (psi)	Downhole Density (ppg)	Pass-Side Pump Rate (bbl/min)	PS Pmp Stg Tot (bbl)	Comments
Event	1	Pre-Rig Up Safety Meeting	Pre-Rig Up Safety Meeting	9/26/2014	16:30:00	USER					INVOLVING CEMENT CREW
Event	2	Rig-Up Equipment	Rig-Up Equipment	9/26/2014	16:45:00	USER					
Event	3	Pre-Job Safety Meeting	Pre-Job Safety Meeting	9/26/2014	18:00:00	USER	8.00	-0.14	0.00	14.6	INVOLVING CEMENT CREW
Event	4	Start Job	Start Job	9/26/2014	18:07:21	COM5					
Event	5	Pressure Test	Pressure Test	9/26/2014	18:09:47	USER	2137.00	-0.10	0.00	2.1	PRESSURE TEST GOOD TO 3000 PSI
Event	6	Pump Spacer	Pump Spacer	9/26/2014	18:18:11	USER	164.00	-0.12	1.80	0.6	PUMPED 10 BBLS H2O
Event	7	Pump Cement	Pump Cement	9/26/2014	18:23:46	USER	299.00	10.51	2.60	1.3	245 SKS 4.44 CUFT/SK 28.41 GAL/SK = 193.7 BBLS @ 10.8# 165.7 BBLS H2O REQ
Event	8	Cement Returns to Surface	Cement Returns to Surface	9/26/2014	19:10:41	USER	1359.00	10.88	4.00	185.2	CALCULATED 17.5 BBLS OF CEMENT BACK TO SURFACE, ACTUALLY CIRCULATED 10 BBLS BACK TO SURFACE
Event	9	Shutdown	Shutdown	9/26/2014	19:12:37	USER	111.00	8.68	0.00	192.5	SHUTDOWN END JOB
Event	10	End Job	End Job	9/26/2014	19:15:21	COM5					
Event	11	Pre-Rig Down Safety Meeting	Pre-Rig Down Safety Meeting	9/26/2014	19:30:00	USER					INVOLVING CEMENT CREW
Event	12	Rig-Down Equipment	Rig-Down Equipment	9/26/2014	19:45:00	USER					
Event	13	Depart Location Safety Meeting	Depart Location Safety Meeting	9/26/2014	20:15:00	USER					INVOLVING CEMENT CREW
Event	14	Depart Location	Depart Location	9/26/2014	20:30:00	USER					THANK YOU FOR CHOOSING HALLIBURTON, LEMONT JOJOLA AND CREW

HALLIBURTON *Cementing Job Summary*

The Road to Excellence Starts with Safety

Sold To #: 367641	**Ship To #:** 367641	**Quote #:** 0021934314	**Sales Order #:** 0901693037
Customer: RESOLUTION COPPER		**Customer Rep:** CLINT BRONSON	
Well Name: DHRES	**Well #:** 16		**API/UWI #:**
Field:	**City (SAP):** Superior	**County/Parish:** Pinal	**State:** ARIZONA
Legal Description:			
Contractor:		**Rig/Platform Name/Num:**	
Job BOM: 7521			
Well Type: OIL & GAS WELL			
Sales Person: HALAMERICA\HAM2360		**Srvc Supervisor:** Lemont Jojola	

Job

Formation Name				
Formation Depth (MD)	**Top**		**Bottom**	
Form Type			**BHST**	
Job depth MD	3865ft		**Job Depth TVD**	
Water Depth			**Wk Ht Above Floor**	
Perforation Depth (MD)	**From**		**To**	

Well Data

Description	New / Used	Size in	ID in	Weight lbm/ft	Thread	Grade	Top MD ft	Bottom MD ft	Top TVD ft	Bottom TVD ft
Open Hole Section			12.45				0	1200		
Casing		7.625	6.969	26.4			0	1820		
Tubing		2.375	1.995	4.7			0	3865		
Open Hole Section			6.75				1820	3500		
Open Hole Section			6.5				3500	3865		

Tools and Accessories

Type	Size in	Qty	Make	Depth ft		Type	Size in	Qty	Make
Guide Shoe	2.375	1		3865		**Top Plug**	2.375	1	HES
Float Shoe	2.375	1				**Bottom Plug**	2.375	1	HES
Float Collar	2.375	1				**SSR plug set**	2.375	1	HES
Insert Float	2.375	1				**Plug Container**	2.375	1	HES
Stage Tool	2.375	1				**Centralizers**	2.375	1	HES

Miscellaneous Materials

Gelling Agt		**Conc**		**Surfactant**		**Conc**		**Acid Type**		**Qty**		**Conc**	
Treatment Fld		**Conc**		**Inhibitor**		**Conc**		**Sand Type**		**Size**		**Qty**	

Fluid Data

Stage/Plug #: 1

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
1	Fresh Water Spacer	Fresh Water Spacer	10	bbl	8.33				

HALLIBURTON

Cementing Job Summary

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
2	Primary Cement	HALCEM (TM) SYSTEM	245	sack	10.8	4.44		2	28.41
	30 %	BENTONITE, BULK (100003682)							

Fluid #	Stage Type	Fluid Name	Qty	Qty UoM	Mixing Density lbm/gal	Yield ft3/sack	Mix Fluid Gal	Rate bbl/min	Total Mix Fluid Gal
3	Displacement	Displacement	0	bbl	8.33				

Cement Left In Pipe	Amount	3865 ft	Reason	Shoe Joint
Comment				

HALLIBURTON

Summary Report

Crew:

Job Start Date: 9/26/2014

Sales Order #: 0901693037
WO #: 0901693037
PO/AFE #: NA

Customer:	RESOLUTION COPPER	**Field:**		**Job Type:**	CMT SURFACE CASING BOM
UWI / API Number:		**County/Parish:**	Pinal	**Service Supervisor:**	Lemont Jojola
Well Name:	DHRES	**State:**	ARIZONA		
Well No:	16	**Latitude:**			
		Longitude:		**Cust Rep Name:**	CLINT BRONSON
		Sect / Twn / Rng:	//	**Cust Rep Phone #:**	

Remarks:

The Information Stated Herein Is Correct	Customer Representative Signature: Paul Stoddard Customer Representative Printed Name: Paul Stoddard	Date: 9-26-14

APPENDIX F

ARIZONA DEPARTMENT OF WATER RESOURCES
IMAGED RECORDS FOR NEW WELLS

APPENDIX F

Arizona Department of Water Resources Imaged Records for Well HRES-21

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 • Phoenix, Arizona 85067-36020
(602) 771-8527 • 602-771-8500

Well Driller Report and Well Log

FILE NUMBER
D(2-13) 5 ACC
WELL REGISTRATION NUMBER
55 - 916689
PERMIT NUMBER (IF ISSUED)

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME	DWR LICENSE NUMBER
NATIONAL EWP, INC.	823
ADDRESS	TELEPHONE NUMBER
630 LINCOLN AVE.	530-419-2117
CITY / STATE / ZIP	FAX
WOODLAND, CA, 95695	480-558-3525

RECEIVED
AUG 25 2014
ARIZONA DEPARTMENT OF WATER RESOURCES

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: RESOLUTION COPPER MINING

MAILING ADDRESS: PO BOX 1944

CITY / STATE / ZIP: SUPERIOR, AZ, 85273

CONTACT PERSON NAME AND TITLE:

TELEPHONE NUMBER: 520 6899374

FAX:

WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.): HRES-21

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
02S	13E	05	NE 1/4	SW 1/4	SW 1/4

LATITUDE: ° ' "N LONGITUDE: ° ' "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE): ☐ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE): ☐ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*IF GPS WAS USED, GEOGRAPHIC COORDINATE DATUM (CHECK ONE): ☐ NAD-83 ☐ Other (please specify)

COUNTY	ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK	MAP	PARCEL
PINAL	106	21	003

SECTION 3. WELL CONSTRUCTION DETAILS

Drilling Method

CHECK ONE
- ☒ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☐ Mud Rotary
- ☒ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☐ Air Percussion / Odex Tubing
- ☐ Other (please specify)

Method of Well Development

CHECK ONE
- ☒ Airlift
- ☐ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (please specify)

Method of Sealing at Reduction Points

CHECK ONE
- ☐ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (please specify)

Condition of Well

CHECK ONE
- ☒ Capped
- ☐ Pump Installed

Construction Dates

DATE WELL CONSTRUCTION STARTED: 5-7-14

DATE WELL CONSTRUCTION COMPLETED: 5-25-14

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

SIGNATURE OF QUALIFYING PARTY		DATE
Tim [signature]	General Manager	8-19-14

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 916689

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING	DEPTH OF COMPLETED WELL
1380.09 Feet Below Land Surface	1360 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION
442.3 Feet Below Land Surface	7-11-14	9:15AM	☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER DIAMETER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	41	19	+.5	41	16	X				X						
0	709	14.75	+2	709	4.5	X				X						
709	1360	14.75	709	1360	4.5	X								X		.125

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE
0	41			x								
0	170			x	X							
170	175						x					
175	1380								Cement basket hung at 175' open foot completion			

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 916689

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	Description Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	1340	Apache Leap Tuff	T933
1340	1380	Whitetail Conglomerate	

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 -

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER		
	BOOK	MAP	PARCEL

- Please draw the following: (1) the boundaries of property on which the well was located; (2) the well location; (3) the locations of all septic tank systems and sewer systems on the property or within 100 feet of the well location, even if on neighboring properties; and (4) any permanent structures on the property that may aid in locating the well.
- Please indicate the distance between the well location and any septic tank system or sewer system.

1" = _____ ft

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled "Well Driller Report and Well Log." Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR's web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor's parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor's office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked.

If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

ARIZONA DEPARTMENT OF WATER RESOURCES

Phoenix, Arizona 85012

DRILLING CARD

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILLING OPERATIONS

WELL REGISTRATION NO: **55-916689**

AUTHORIZED DRILLER: **NATIONAL EWP, INC.** LICENSE NO: **823**

NOTICE OF INTENT TO **DRILL A MONITOR WELL** HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: **RESOLUTION COPPER MINING**

ADDRESS: **PO BOX 1944, SUPERIOR, AZ, 85273**

THE WELL(S) IS/ARE TO BE LOCATED IN THE:

SW 1/4 of the **SW** 1/4 of the **NE** 1/4 Section **05** Township **02 S** Range **13 E**

NO. OF WELLS IN THIS PROJECT: **1** ASSESSOR'S PARCEL NO: **106-21-003**

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE DAY OF **3/26/2015**

THE DRILLER MUST FILE A WELL DRILLER REPORT AND WELL LOG WITHIN 30 DAYS OF COMPLETION OF DRILLING

This drilling or abandonment authority was granted based upon the certifications made by the above-named Driller in the notice of intent to drill or abandon. Those certifications, along with any variances granted, are listed below. By drilling or abandoning the well pursuant to this authorization, the above-named driller acknowledges the accuracy of the driller certifications. If the certifications are in error, this authorization is invalid and driller must contact the Department of Water Resource's NOI Section in writing at the addres above to correct.

Variance(s) Granted To Driller: **None**

Certification(s) Made By Driller:

þ By checking this box, I certify that I have all necessary Registrar of Contractor (ROC) licenses in all necessary license categories for this drilling or abandonment project and that those licenses are current.

þ By checking this box, I certify that I have been authorized by the above-named well owner to submit this Notice of Intent on the well owner's behalf.

þ By checking this box, I certify that the information above is complete and correct, and that the well shall be drilled or abandoned in compliance with all pertinent statutes and rules, including any special standards that may be required to protect the aquifer or other water sources.

þ By checking this box, I certify that this NOI application is not an application to replace, deepen, or modify an existing well.

þ By checking this box, I understand that the Authorization to drill this well DOES NOT constitute or guarantee an approval to use the well for the purpose of withdrawing groundwater for transportation to an Active Management Area (AMA) pursuant to A.R.S. § 45-552, 45-553, 45-554 or 45-555(A) without official prior approval from the Department.

þ If the landowner and the well owner are not the same, by checking this box, I certify that I have obtained written approval from the landowner in order to conduct this drilling or abandonment project. A copy of the written

approval shall be submitted to ADWR with the Well Driller Report and Well Log or Well Abandonment Completion Report within 30 days of completion of drilling or abandonment.

ARIZONA DEPARTMENT OF WATER RESOURCES
Electronic Filing - NOI Report

Phoenix, Arizona

NOI Type: Notice of Intent to Drill, Deepen, Modify a Monitor/Piezometer/Environmental Well
Well Type: MONITOR
Date Received at ADWR Website: 3/26/2014

Fee Paid: $150.00 Order Number: -1528

Well Registration Number: 55 - 916689
Number of Wells/Holes: 1 Drilling Authority Expires On: 3/26/2015

Driller's ADWR License Number: 823

Authorized Driller: NATIONAL EWP, INC.
ROC License Number Entered By Driller: 269329
Qualifying Party License Categories: A-4

Well Owner Name: RESOLUTION COPPER MINING
Well Owner Address: PO BOX 1944
Well Owner City, State - Zip: SUPERIOR, AZ - 85273
Well Owner Phone: 520 6899374

Book: 106 Map:21 Parcel: 003

Is the Land Owner the same as the Well Owner?: No

Land Owner Name: ARIZONA STATE LAND DEPARTMENT
Land Owner Address: 1616 WEST ADAMS
Land Owner City, State - Zip: PHOENIX, AZ - 85007
Land Owner Phone: 602 5422642

Well Location: **SW** 1/4 of the **SW** 1/4 of the **NE** 1/4 Section **5** Township **2 S** Range **13 E**

AMA: NOT WITHIN ANY AMA OR INA
County: PINAL
Contamination Site: NOT IN ANY WQARF SITE

Primary Water Use: **MONITORING**
Secondary Water Use(s): **N/A**

Is any portion of the land, on which the well is to be located, within 100 feet of a designated municipal provider's operating water distribution system as shown on the municipal provider's most recent digitized service area map filed by the municipal provider with the director of ADWR. **N/A**

Will you be installing a dedicated pump ?: **N/A**

Will the installed pump have a pumping capacity of greater than 35 GPM, or will the well will be used to withdraw greater than 10 Acre Feet per year?: **N/A**

Variance(s) Granted To Driller: **None**

Certification(s) Made By Driller:

- þ By checking this box, I certify that I have all necessary Registrar of Contractor (ROC) licenses in all necessary license categories for this drilling or abandonment project and that those licenses are current.
- þ By checking this box, I certify that I have been authorized by the above-named well owner to submit this Notice of Intent on the well owner’s behalf.
- þ By checking this box, I certify that the information above is complete and correct, and that the well shall be drilled or abandoned in compliance with all pertinent statutes and rules, including any special standards that may be required to protect the aquifer or other water sources.
- þ By checking this box, I certify that this NOI application is not an application to replace, deepen, or modify an existing well.
- þ By checking this box, I understand that the Authorization to drill this well DOES NOT constitute or guarantee an approval to use the well for the purpose of withdrawing groundwater for transportation to an Active Management Area (AMA) pursuant to A.R.S. § 45-552, 45-553, 45-554 or 45-555(A) without official prior approval from the Department.
- þ If the landowner and the well owner are not the same, by checking this box, I certify that I have obtained written approval from the landowner in order to conduct this drilling or abandonment project. A copy of the written approval shall be submitted to ADWR with the Well Driller Report and Well Log or Well Abandonment Completion Report within 30 days of completion of drilling or abandonment.

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 ι Phoenix, Arizona 85067-36020
(602) 771-8527 ι 602-771-8500

Well Driller Report and Well Log

FILE NUMBER
D(2-13) 5 ACC
WELL REGISTRATION NUMBER
55 - 916689
PERMIT NUMBER (IF ISSUED)

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME NATIONAL EWP, INC.	DWR LICENSE NUMBER 823
ADDRESS 630 LINCOLN AVE.	TELEPHONE NUMBER 530-419-2117
CITY / STATE / ZIP WOODLAND, CA, 95695	FAX

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL RESOLUTION COPPER MINING	
MAILING ADDRESS PO BOX 1944	
CITY / STATE / ZIP SUPERIOR, AZ, 85273	
CONTACT PERSON NAME AND TITLE	
TELEPHONE NUMBER 520 6899374	FAX
WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.)	

Location of Well

WELL LOCATION ADDRESS (IF ANY)

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
			1/4	1/4	1/4

LATITUDE			LONGITUDE		
°	'	"N	°	'	"W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
- ☐ USGS Quad Map
- ☐ Conventional Survey
- ☐ *GPS: Hand-Held
- ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
- ☐ USGS Quad Map
- ☐ Conventional Survey
- ☐ *GPS: Hand-Held
- ☐ *GPS: Survey-Grade

*IF GPS WAS USED, GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
- ☐ NAD-83
- ☐ Other (please specify)

COUNTY	ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK	MAP	PARCEL
	106	21	003

SECTION 3. WELL CONSTRUCTION DETAILS

Drilling Method

CHECK ONE
- ☐ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☐ Mud Rotary
- ☐ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☐ Air Percussion / Odex Tubing
- ☐ Other (please specify)

Method of Well Development

CHECK ONE
- ☐ Airlift
- ☐ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (please specify)

Method of Sealing at Reduction Points

CHECK ONE
- ☐ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (please specify)

Condition of Well

CHECK ONE
- ☐ Capped
- ☐ Pump Installed

Construction Dates

DATE WELL CONSTRUCTION STARTED

DATE WELL CONSTRUCTION COMPLETED

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

SIGNATURE OF QUALIFYING PARTY	DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 916689

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING	DEPTH OF COMPLETED WELL
Feet Below Land Surface	Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION
Feet Below Land Surface			☐ Valve ☐ Other:

Borehole / Installed Casing

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 916689

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)		

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 916689

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK	MAP	PARCEL
RESOLUTION COPPER MINING	106	21	003

- Please draw the following: (1) the boundaries of property on which the well was located; (2) the well location; (3) the locations of all septic tank systems and sewer systems on the property or within 100 feet of the well location, even if on neighboring properties; and (4) any permanent structures on the property that may aid in locating the well.
- Please indicate the distance between the well location and any septic tank system or sewer system.

N W E S

1" = ______ ft

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled "Well Driller Report and Well Log." Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR's web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 - Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 - Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor's parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor's office. Federal or State land will not have a parcel identification number.

Section 3 - Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the

appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under *Well Driller Completion Report and Well Log* Form 55-55 Instructions (Rev. 06/2010) Page 2

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 - Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 - Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 - Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Groundwater Permitting and Wells
PO Box 36020
Phoenix, AZ 85067-36020

Completed forms may also be submitted to ADWR's main office at 3550 North Central Avenue, Second Floor., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

ARIZONA DEPARTMENT of WATER RESOURCES
3550 North Central Avenue, Second Floor
Phoenix, AZ 85012
602-771-8500
azwater.gov

March 26, 2014

RESOLUTION COPPER MINING
PO BOX 1944
SUPERIOR, AZ 85273

JANICE K. BREWER
Governor

MICHAEL J. LACEY
Director

Registration No. 55- 916689
File Number: D(2-13) 5 ACC

Dear Well Applicant:

Enclosed is a copy of the Notice of Intention to Drill (NOI) a well which you or your driller recently filed with the Department of Water Resources. This letter is to inform you that the Department has approved the NOI and has mailed, or made available for download, a drilling authorization card to your designated well drilling contractor. The driller may not begin drilling until he/she has received the authorization, and must keep it in their possession at the well site during drilling.

Well drilling activities must be completed within one year after the date the NOI was filed with the Department. If drilling is not completed within one year, a new NOI must be filed and authorization from this Department received before proceeding with drilling. If the well cannot be successfully completed as initially intended (dry hole, cave in, lost tools, etc.), the well must be properly abandoned and a Well Abandonment Completion Report must be filed by your driller [as required by A.A.C. R12-15-816(F)].

If you change drillers, you must notify the Department of the new driller's identity on a Request to Change Well Information (form 55-71A). Please ensure that the new driller is licensed by the Department to drill the type of well you require. A new driller may not begin drilling until he/she receives a new drilling authorization card from the Department.

If you find it necessary to change the location of the proposed well(s), you may not proceed with drilling until you file an amended NOI with the Department. An amended drilling authorization card will then be issued to the well drilling contractor, which must be in their possession before drilling begins.

Arizona statute [A.R.S. § 45-600] requires registered well owners to file a Pump Installation Completion Report (form 55-56) with the Department within 30 days after the installation of pumping equipment, if authorized. A blank report is enclosed for your convenience. State statute also requires the driller to file a complete and accurate Well Drillers Report and Well Log (form 55-55) within 30 days after completion of drilling. A blank report form was provided to your driller with the drilling authorization card. You should insist and ensure that all of the required reports are accurately completed and timely filed with the Department.

Please be advised that Arizona statute [A.R.S. § 45-593(C)] requires a registered well owner to notify the Department of a change in ownership of the well and/or information pertaining to the physical characteristics of the well in order to keep this well registration file current and accurate. Any change in well information or a request to change well driller must be filed on a Request to Change Well Information form (form 55-71A) that may be downloaded from the ADWR Internet website at www.azwater.gov.

Sincerely,

Groundwater Permitting and Wells Section

APPENDIX F

Arizona Department of Water Resources Imaged Records for Well DHRES-15

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

RECEIVED
AUG 21 2014
ARIZONA DEPARTMENT OF WATER RESOURCES

Well Driller Report and Well Log

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

FILE NUMBER	D(2-13) 5 CCB
WELL REGISTRATION NUMBER	**55 -** 916688
PERMIT NUMBER (IF ISSUED)	

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME: National EWP	DWR LICENSE NUMBER: 823
ADDRESS: 630 Lincoln Ave	TELEPHONE NUMBER: 530-419-2117
CITY / STATE / ZIP: Woodland, CA 95695	FAX:

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL	Resolution Copper Mining
MAILING ADDRESS	PO Box 1944
CITY / STATE / ZIP CODE	Superior, AZ 85273
CONTACT PERSON NAME AND TITLE	
TELEPHONE NUMBER	520-689-9374
FAX	
WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.)	DHRES - 15

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
02S	13E	05	NW ¼	SW ¼	SW ¼

LATITUDE: ° Degrees ' Minutes "N Seconds
LONGITUDE: ° Degrees ' Minutes "W Seconds

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☐ Other (*please specify*):

COUNTY: Pinal

ASSESSOR'S PARCEL ID NUMBER: BOOK | MAP | PARCEL

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method
CHECK ALL THAT APPLY
- ☐ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☒ Mud Rotary
- ☒ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☐ Air Percussion / Odex Tubing
- ☐ Other (*please specify*):

Method of Well Development
CHECK ALL THAT APPLY
- ☒ Airlift
- ☐ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (*please specify*):

Method of Sealing at Reduction Points
CHECK ONE
- ☐ None
- ☐ Packed
- ☒ Swedged
- ☐ Welded
- ☐ Other (*please specify*):

Condition of Well
CHECK ONE
- ☒ Capped
- ☐ Pump Installed

Construction Dates
DATE WELL CONSTRUCTION STARTED: 5-30-14
DATE WELL CONSTRUCTION COMPLETED: 7-16-14

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

SIGNATURE OF QUALIFYING PARTY: Tom [signature] General Manager

DATE: 8-19-14

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 -

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING	DEPTH OF COMPLETED WELL
3920" Feet Below Land Surface	3632.95 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION
748.86 Feet Below Land Surface	8-13-14	1:36 pm	☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER DIAMETER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	37	19	0	37	14	X				x						
37	2900	12-1/4	+1	2880	7-5/8	X				x						
2890	3920	6-3/4	3610	3632.95	4-1/2	X				x						
			2872.02	3610	4-1/2	X								x		
			2744.6	2872.20	4-1/2	X				x						
			2731.9	2744.6		X		4-1/2	Casing Hanger							

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE
0	37			X								
0	2900			X								
2900	3920	X										
									Piexos			
									#1 @ 1662'			
									#2 @ 2355'			
									#3 @ 2685'			
									#4 @ 2826'			

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 -

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		Description	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)	Describe material, grain size, color, etc.	
0	972	Apache Leap Tuff Gray and Brown unit	
972	1000	Apache Leap Tuff Vitrophyre	
1000	1019.5	Apache Leap Tuff Basal Tuff	
1019.5	1026	White Tail Conglomerate (TW2)	
1026	1041	White Tail Conglomerate (TW1)	
1041	1614.5	White Tail Conglomerate (TW2)	
1614.5	2325	White Tail Conglomerate (TW3)	
2325	2748	Naco Limestone	
2748	2797	Naco Limestone Maroon Shale #2	
2797	2854	Naco Limestone	
2854	2890	Naco Limestons Maroon Shale #1	
2890	3140	Escabrosa Limestone	
3140	3160	Martin Formation Last Black Shale	
3160	3580	Martin Formation Limestone	
3580	3610	Bolsa Quartzite	
3610	3920	Precambrian diabase	

WELL REGISTRATION NUMBER
55 -

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER		
	BOOK	MAP	PARCEL

- Please draw the following: (1) the boundaries of property on which the well was located; (2) the well location; (3) the locations of all septic tank systems and sewer systems on the property or within 100 feet of the well location, even if on neighboring properties; and (4) any permanent structures on the property that may aid in locating the well.
- Please indicate the distance between the well location and any septic tank system or sewer system.

1" = _____ ft

Form 55-55 Instructions

Well Driller Report and Well Log

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Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

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The form must be signed and dated by the qualifying party of the drilling firm.

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Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

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If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

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In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

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Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

ARIZONA DEPARTMENT OF WATER RESOURCES

Phoenix, Arizona 85012

DRILLING CARD

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILLING OPERATIONS

WELL REGISTRATION NO: **55-916688**

AUTHORIZED DRILLER: **NATIONAL EWP, INC.** LICENSE NO: **823**

NOTICE OF INTENT TO **DRILL A MONITOR WELL** HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: **RESOLUTION COPPER MINING**

ADDRESS: **PO BOX 1944, SUPERIOR, AZ, 85273**

THE WELL(S) IS/ARE TO BE LOCATED IN THE:

NW 1/4 of the **SW** 1/4 of the **SW** 1/4 Section **05** Township **02 S** Range **13 E**

NO. OF WELLS IN THIS PROJECT: **1** ASSESSOR'S PARCEL NO: **106-21-003**

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE DAY OF **3/26/2015**

THE DRILLER MUST FILE A WELL DRILLER REPORT AND WELL LOG WITHIN 30 DAYS OF COMPLETION OF DRILLING

This drilling or abandonment authority was granted based upon the certifications made by the above-named Driller in the notice of intent to drill or abandon. Those certifications, along with any variances granted, are listed below. By drilling or abandoning the well pursuant to this authorization, the above-named driller acknowledges the accuracy of the driller certifications. If the certifications are in error, this authorization is invalid and driller must contact the Department of Water Resource's NOI Section in writing at the addres above to correct.

Variance(s) Granted To Driller: **None**

Certification(s) Made By Driller:

þ By checking this box, I certify that I have all necessary Registrar of Contractor (ROC) licenses in all necessary license categories for this drilling or abandonment project and that those licenses are current.

þ By checking this box, I certify that I have been authorized by the above-named well owner to submit this Notice of Intent on the well owner's behalf.

þ By checking this box, I certify that the information above is complete and correct, and that the well shall be drilled or abandoned in compliance with all pertinent statutes and rules, including any special standards that may be required to protect the aquifer or other water sources.

þ By checking this box, I certify that this NOI application is not an application to replace, deepen, or modify an existing well.

þ By checking this box, I understand that the Authorization to drill this well DOES NOT constitute or guarantee an approval to use the well for the purpose of withdrawing groundwater for transportation to an Active Management Area (AMA) pursuant to A.R.S. § 45-552, 45-553, 45-554 or 45-555(A) without official prior approval from the Department.

þ If the landowner and the well owner are not the same, by checking this box, I certify that I have obtained written approval from the landowner in order to conduct this drilling or abandonment project. A copy of the written

approval shall be submitted to ADWR with the Well Driller Report and Well Log or Well Abandonment Completion Report within 30 days of completion of drilling or abandonment.

ARIZONA DEPARTMENT OF WATER RESOURCES
Electronic Filing - NOI Report

Phoenix, Arizona

NOI Type: Notice of Intent to Drill, Deepen, Modify a Monitor/Piezometer/Environmental Well
Well Type: MONITOR
Date Received at ADWR Website: 3/26/2014

Fee Paid: $150.00 Order Number: -1527

Well Registration Number: 55 - 916688
Number of Wells/Holes: 1 Drilling Authority Expires On: 3/26/2015

Driller's ADWR License Number: 823

Authorized Driller: NATIONAL EWP, INC.
ROC License Number Entered By Driller: 269329
Qualifying Party License Categories: A-4

Well Owner Name: RESOLUTION COPPER MINING
Well Owner Address: PO BOX 1944
Well Owner City, State - Zip: SUPERIOR, AZ - 85273
Well Owner Phone: 520 6899374

Book: 106 Map:21 Parcel: 003

Is the Land Owner the same as the Well Owner?: No

Land Owner Name: ARIZONA STATE LAND SEPARTMENT
Land Owner Address: 1616 WEST ADAMS
Land Owner City, State - Zip: PHOENIX, AZ - 85007
Land Owner Phone: 602 5422642

Well Location: **NW** 1/4 of the **SW** 1/4 of the **SW** 1/4 Section **5** Township **2 S** Range **13 E**

AMA: NOT WITHIN ANY AMA OR INA
County: PINAL
Contamination Site: NOT IN ANY WQARF SITE

Primary Water Use: **MONITORING**
Secondary Water Use(s): **N/A**

Is any portion of the land, on which the well is to be located, within 100 feet of a designated municipal provider's operating water distribution system as shown on the municipal provider's most recent digitized service area map filed by the municipal provider with the director of ADWR. **N/A**

Will you be installing a dedicated pump ?: **N/A**

Will the installed pump have a pumping capacity of greater than 35 GPM, or will the well will be used to withdraw greater than 10 Acre Feet per year?: **N/A**

Variance(s) Granted To Driller: **None**

Certification(s) Made By Driller:

- þ By checking this box, I certify that I have all necessary Registrar of Contractor (ROC) licenses in all necessary license categories for this drilling or abandonment project and that those licenses are current.
- þ By checking this box, I certify that I have been authorized by the above-named well owner to submit this Notice of Intent on the well owner's behalf.
- þ By checking this box, I certify that the information above is complete and correct, and that the well shall be drilled or abandoned in compliance with all pertinent statutes and rules, including any special standards that may be required to protect the aquifer or other water sources.
- þ By checking this box, I certify that this NOI application is not an application to replace, deepen, or modify an existing well.
- þ By checking this box, I understand that the Authorization to drill this well DOES NOT constitute or guarantee an approval to use the well for the purpose of withdrawing groundwater for transportation to an Active Management Area (AMA) pursuant to A.R.S. § 45-552, 45-553, 45-554 or 45-555(A) without official prior approval from the Department.
- þ If the landowner and the well owner are not the same, by checking this box, I certify that I have obtained written approval from the landowner in order to conduct this drilling or abandonment project. A copy of the written approval shall be submitted to ADWR with the Well Driller Report and Well Log or Well Abandonment Completion Report within 30 days of completion of drilling or abandonment.

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 ι Phoenix, Arizona 85067-36020
(602) 771-8527 ι 602-771-8500

Well Driller Report and Well Log

FILE NUMBER	D(2-13) 5 CCB
WELL REGISTRATION NUMBER	55 - 916688
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME: NATIONAL EWP, INC.	DWR LICENSE NUMBER: 823
ADDRESS: 630 LINCOLN AVE.	TELEPHONE NUMBER: 530-419-2117
CITY / STATE / ZIP: WOODLAND, CA, 95695	FAX:

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: RESOLUTION COPPER MINING

MAILING ADDRESS: PO BOX 1944

CITY / STATE / ZIP: SUPERIOR, AZ, 85273

CONTACT PERSON NAME AND TITLE:

TELEPHONE NUMBER: 520 6899374

FAX:

WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.):

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
			1/4	1/4	1/4

LATITUDE			LONGITUDE		
°	'	"N	°	'	"W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☐ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☐ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*IF GPS WAS USED, GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☐ Other (please specify)

COUNTY:

ASSESSOR'S PARCEL ID NUMBER (MOST RECENT)

BOOK	MAP	PARCEL
106	21	003

SECTION 3. WELL CONSTRUCTION DETAILS

Drilling Method

CHECK ONE
- ☐ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☐ Mud Rotary
- ☐ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☐ Air Percussion / Odex Tubing
- ☐ Other (please specify)

Method of Well Development

CHECK ONE
- ☐ Airlift
- ☐ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (please specify)

Method of Sealing at Reduction Points

CHECK ONE
- ☐ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (please specify)

Condition of Well

CHECK ONE
- ☐ Capped
- ☐ Pump Installed

Construction Dates

DATE WELL CONSTRUCTION STARTED:

DATE WELL CONSTRUCTION COMPLETED:

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

SIGNATURE OF QUALIFYING PARTY	DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 916688

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING	DEPTH OF COMPLETED WELL
Feet Below Land Surface	Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION
Feet Below Land Surface			☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 916688

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	TO (feet)	**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 916688

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER (MOST RECENT)		
	BOOK	MAP	PARCEL
RESOLUTION COPPER MINING	106	21	003

- Please draw the following: (1) the boundaries of property on which the well was located; (2) the well location; (3) the locations of all septic tank systems and sewer systems on the property or within 100 feet of the well location, even if on neighboring properties; and (4) any permanent structures on the property that may aid in locating the well.
- Please indicate the distance between the well location and any septic tank system or sewer system.

N
W E
S

1" = ______ ft

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled “Well Driller Report and Well Log.” Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR’s web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 - Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 - Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor’s parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor’s office. Federal or State land will not have a parcel identification number.

Section 3 - Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the “Other” box and describe the method. To the right of that, indicate the method of well development by checking the

appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under *Well Driller Completion Report and Well Log* Form 55-55 Instructions (Rev. 06/2010) Page 2
Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 - Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 - Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 - Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Groundwater Permitting and Wells
PO Box 36020
Phoenix, AZ 85067-36020

Completed forms may also be submitted to ADWR's main office at 3550 North Central Avenue, Second Floor., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

ARIZONA DEPARTMENT of WATER RESOURCES
3550 North Central Avenue, Second Floor
Phoenix, AZ 85012
602-771-8500
azwater.gov

March 26, 2014

RESOLUTION COPPER MINING
PO BOX 1944
SUPERIOR, AZ 85273

JANICE K. BREWER
Governor

MICHAEL J. LACEY
Director

Registration No. 55- 916688
File Number: D(2-13) 5 CCB

Dear Well Applicant:

Enclosed is a copy of the Notice of Intention to Drill (NOI) a well which you or your driller recently filed with the Department of Water Resources. This letter is to inform you that the Department has approved the NOI and has mailed, or made available for download, a drilling authorization card to your designated well drilling contractor. The driller may not begin drilling until he/she has received the authorization, and must keep it in their possession at the well site during drilling.

Well drilling activities must be completed within one year after the date the NOI was filed with the Department. If drilling is not completed within one year, a new NOI must be filed and authorization from this Department received before proceeding with drilling. If the well cannot be successfully completed as initially intended (dry hole, cave in, lost tools, etc.), the well must be properly abandoned and a Well Abandonment Completion Report must be filed by your driller [as required by A.A.C. R12-15-816(F)].

If you change drillers, you must notify the Department of the new driller's identity on a Request to Change Well Information (form 55-71A). Please ensure that the new driller is licensed by the Department to drill the type of well you require. A new driller may not begin drilling until he/she receives a new drilling authorization card from the Department.

If you find it necessary to change the location of the proposed well(s), you may not proceed with drilling until you file an amended NOI with the Department. An amended drilling authorization card will then be issued to the well drilling contractor, which must be in their possession before drilling begins.

Arizona statute [A.R.S. § 45-600] requires registered well owners to file a Pump Installation Completion Report (form 55-56) with the Department within 30 days after the installation of pumping equipment, if authorized. A blank report is enclosed for your convenience. State statute also requires the driller to file a complete and accurate Well Drillers Report and Well Log (form 55-55) within 30 days after completion of drilling. A blank report form was provided to your driller with the drilling authorization card. You should insist and ensure that all of the required reports are accurately completed and timely filed with the Department.

Please be advised that Arizona statute [A.R.S. § 45-593(C)] requires a registered well owner to notify the Department of a change in ownership of the well and/or information pertaining to the physical characteristics of the well in order to keep this well registration file current and accurate. Any change in well information or a request to change well driller must be filed on a Request to Change Well Information form (form 55-71A) that may be downloaded from the ADWR Internet website at www.azwater.gov.

Sincerely,

Groundwater Permitting and Wells Section

APPENDIX F

Arizona Department of Water Resources Imaged Records for Well DHRES-16

8/24/15

corrected

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

RECEIVED
AUG 20 2015
ARIZONA DEPARTMENT OF WATER RESOURCES

FILE NUMBER	D(2-12) 4 DCA
WELL REGISTRATION NUMBER	55 - 917232
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME	DWR LICENSE NUMBER
National EWP, Inc	823
ADDRESS	TELEPHONE NUMBER
1200 W San Pedro St	480-558-3500
CITY / STATE / ZIP	FAX
Gilbert, AZ 85233	

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL	Resolution Copper Mining
MAILING ADDRESS	PO Box 1944
CITY / STATE / ZIP CODE	Superior, AZ 85173
CONTACT PERSON NAME AND TITLE	
TELEPHONE NUMBER	520-689-3241
FAX	
WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.)	DRES-16

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
2S	12E	4	NE ¼	SW ¼	SE ¼

LATITUDE: ° Degrees ' Minutes "N Seconds
LONGITUDE: ° Degrees ' Minutes "W Seconds

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☐ Other (*please specify*):

COUNTY	ASSESSOR'S PARCEL ID NUMBER BOOK	MAP	PARCEL
PINAL	105	11	~~600~~ 690

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- [x] Air Rotary
- [ ] Bored or Augered
- [ ] Cable Tool
- [ ] Dual Rotary
- [ ] Mud Rotary
- [ ] Reverse Circulation
- [ ] Driven
- [ ] Jetted
- [ ] Air Percussion / Odex Tubing
- [ ] Other (*please specify*):

Method of Well Development

CHECK ALL THAT APPLY
- [ ] Airlift
- [ ] Bail
- [ ] Surge Block
- [ ] Surge Pump
- [ ] Other (*please specify*):

Method of Sealing at Reduction Points

CHECK ONE
- [ ] None
- [ ] Packed
- [ ] Swedged
- [ ] Welded
- [x] Other (*please specify*): Cement grout

Condition of Well

CHECK ONE
- [x] Capped - filled w/ cement grout
- [ ] Pump Installed

Construction Dates

DATE WELL CONSTRUCTION STARTED: 8-25-14

DATE WELL CONSTRUCTION COMPLETED: 9-29-14

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

SIGNATURE OF QUALIFYING PARTY		DATE
[signature]	General Manager	8/14/15

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 917232

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING	DEPTH OF COMPLETED WELL
4085 Feet Below Land Surface	4075 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION
1200 Feet Below Land Surface	9-23-14	10:00 am	☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER DIAMETER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	55	19	0	53	14	X				X						
55	1145	12.45														
1145	1820	12.25	+1	1810	7-5/8	X				X						
1810	2865	6-7/8														
2865	3505	6-7/8														
3505	4085	6-1/2	+1	4075	2-3/8 EUE	X				X						

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)				BENTONITE				FILTER PACK		
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE
4085	0				X				By Halliburton			

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 917232

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	60	Alluvium - mixed lithology	
60	340	Qtg - Gila Conglomerate quartzite rich	
340	780	Qtg - Gila Conglomerate tuff rich	
780	890	Tt - Felsic tuff	
890	1720	Tev - Adesitic basalt with inter	
1720	1850	Qtg - Gila Conglomerate mixed lithology	
1850	1910	Qtg - Gilla Conglomerate schist rich	
1910	2880	Qtg - Gila Conglomerate mixed lithology	
2880	3150	Qtg - Gila Conglomerate tuff dominated	
3150	3290	Tal - Apache leap tuff white unit	
3290	3700	Tal - Apache leap tuff gray unit	
3700	3830	Tal - Apache leap tuff brown unit	
3830	3865	Tal - Apache leap tuff vitophyne	
3865	3870	Tal - Apache leap tuff basal tuff	
3870	4085	Dm - marin formation	
		Piezometer's	
		Upper # 1 - 1695'	
		# 2 - 880'	
		# 3 - 743'	
		# 4 - 198'	
		Lower # 1 - 3904'	
		# 2 - 3151'	

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 -

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER		
	BOOK	MAP	PARCEL

- Please draw the following: (1) the boundaries of property on which the well was located; (2) the well location; (3) the locations of all septic tank systems and sewer systems on the property or within 100 feet of the well location, even if on neighboring properties; and (4) any permanent structures on the property that may aid in locating the well.
- Please indicate the distance between the well location and any septic tank system or sewer system.

1" = _____ ft

ARIZONA DEPARTMENT OF WATER RESOURCES

Phoenix, Arizona 85012

DRILLING CARD

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILLING OPERATIONS

WELL REGISTRATION NO: **55-917232**

AUTHORIZED DRILLER: **NATIONAL EWP, INC.** LICENSE NO: **823**

NOTICE OF INTENT TO **DRILL A MONITOR WELL** HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: **RESOLUTION COPPER MINING**

ADDRESS: **PO BOX 1944, SUPERIOR, AZ, 85173**

THE WELL(S) IS/ARE TO BE LOCATED IN THE:

SE 1/4 of the **SW** 1/4 of the **NE** 1/4 Section **04** Township **02 S** Range **12 E**

NO. OF WELLS IN THIS PROJECT: **1** ASSESSOR'S PARCEL NO: **105-11-690**

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE DAY OF **8/14/2015**

THE DRILLER MUST FILE A WELL DRILLER REPORT AND WELL LOG WITHIN 30 DAYS OF COMPLETION OF DRILLING

This drilling or abandonment authority was granted based upon the certifications made by the above-named Driller in the notice of intent to drill or abandon. Those certifications, along with any variances granted, are listed below. By drilling or abandoning the well pursuant to this authorization, the above-named driller acknowledges the accuracy of the driller certifications. If the certifications are in error, this authorization is invalid and driller must contact the Department of Water Resource's NOI Section in writing at the addres above to correct.

Variance(s) Granted To Driller: **None**

Certification(s) Made By Driller:

þ By checking this box, I certify that I have all necessary Registrar of Contractor (ROC) licenses in all necessary license categories for this drilling or abandonment project and that those licenses are current.

þ By checking this box, I certify that I have been authorized by the above-named well owner to submit this Notice of Intent on the well owner's behalf.

þ By checking this box, I certify that the information above is complete and correct, and that the well shall be drilled or abandoned in compliance with all pertinent statutes and rules, including any special standards that may be required to protect the aquifer or other water sources.

þ By checking this box, I certify that this NOI application is not an application to replace, deepen, or modify an existing well.

þ By checking this box, I understand that the Authorization to drill this well DOES NOT constitute or guarantee an approval to use the well for the purpose of withdrawing groundwater for transportation to an Active Management Area (AMA) pursuant to A.R.S. § 45-552, 45-553, 45-554 or 45-555(A) without official prior approval from the Department.

þ If the landowner and the well owner are not the same, by checking this box, I certify that I have obtained written approval from the landowner in order to conduct this drilling or abandonment project. A copy of the written

approval shall be submitted to ADWR with the Well Driller Report and Well Log or Well Abandonment Completion Report within 30 days of completion of drilling or abandonment.

ARIZONA DEPARTMENT OF WATER RESOURCES
Electronic Filing - NOI Report

Phoenix, Arizona

NOI Type: Notice of Intent to Drill, Deepen, Modify a Monitor/Piezometer/Environmental Well
Well Type: MONITOR
Date Received at ADWR Website: 8/14/2014

Fee Paid: $150.00 Order Number: -2269

Well Registration Number: 55 - 917232
Number of Wells/Holes: 1 Drilling Authority Expires On: 8/14/2015

Driller's ADWR License Number: 823

Authorized Driller: NATIONAL EWP, INC.
ROC License Number Entered By Driller: 269329
Qualifying Party License Categories: A-4

Well Owner Name: RESOLUTION COPPER MINING
Well Owner Address: PO BOX 1944
Well Owner City, State - Zip: SUPERIOR, AZ - 85173
Well Owner Phone: 520 6893241

Book: 105 Map:11 Parcel: 690

Is the Land Owner the same as the Well Owner?: No

Land Owner Name: BHP COPPER
Land Owner Address: 28545 S VETERANS MEMORIAL WAY
Land Owner City, State - Zip: SAN MANUEL, AZ - 85631
Land Owner Phone:

Well Location: **SE** 1/4 of the **SW** 1/4 of the **NE** 1/4 Section **4** Township **2 S** Range **12 E**

AMA: PHOENIX AMA
County: PINAL
Contamination Site: NOT IN ANY WQARF SITE

Primary Water Use: **MONITORING**
Secondary Water Use(s): **N/A**

Is any portion of the land, on which the well is to be located, within 100 feet of a designated municipal provider's operating water distribution system as shown on the municipal provider's most recent digitized service area map filed by the municipal provider with the director of ADWR. **N/A**

Will you be installing a dedicated pump ?: **No**

Will the installed pump have a pumping capacity of greater than 35 GPM, or will the well will be used to withdraw greater than 10 Acre Feet per year?: **N/A**

Variance(s) Granted To Driller: **None**

Certification(s) Made By Driller:

- þ By checking this box, I certify that I have all necessary Registrar of Contractor (ROC) licenses in all necessary license categories for this drilling or abandonment project and that those licenses are current.
- þ By checking this box, I certify that I have been authorized by the above-named well owner to submit this Notice of Intent on the well owner's behalf.
- þ By checking this box, I certify that the information above is complete and correct, and that the well shall be drilled or abandoned in compliance with all pertinent statutes and rules, including any special standards that may be required to protect the aquifer or other water sources.
- þ By checking this box, I certify that this NOI application is not an application to replace, deepen, or modify an existing well.
- þ By checking this box, I understand that the Authorization to drill this well DOES NOT constitute or guarantee an approval to use the well for the purpose of withdrawing groundwater for transportation to an Active Management Area (AMA) pursuant to A.R.S. § 45-552, 45-553, 45-554 or 45-555(A) without official prior approval from the Department.
- þ If the landowner and the well owner are not the same, by checking this box, I certify that I have obtained written approval from the landowner in order to conduct this drilling or abandonment project. A copy of the written approval shall be submitted to ADWR with the Well Driller Report and Well Log or Well Abandonment Completion Report within 30 days of completion of drilling or abandonment.

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 ι Phoenix, Arizona 85067-36020
(602) 771-8527 ι 602-771-8500

Well Driller Report and Well Log

FILE NUMBER
D(2-12) 4 ACD
WELL REGISTRATION NUMBER
55 - 917232
PERMIT NUMBER (IF ISSUED)

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME NATIONAL EWP, INC.	DWR LICENSE NUMBER 823
ADDRESS 1200 W. SAN PEDRO ST.	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP GILBERT, AZ, 85233	FAX

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
RESOLUTION COPPER MINING

MAILING ADDRESS
PO BOX 1944

CITY / STATE / ZIP
SUPERIOR, AZ, 85173

CONTACT PERSON NAME AND TITLE

TELEPHONE NUMBER	FAX
520 6893241	

WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.)

Location of Well

WELL LOCATION ADDRESS (IF ANY)

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
			1/4	1/4	1/4

LATITUDE			LONGITUDE		
°	'	"N	°	'	"W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☐ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☐ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*IF GPS WAS USED, GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☐ Other (please specify)

COUNTY	ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK	MAP	PARCEL
	105	11	690

SECTION 3. WELL CONSTRUCTION DETAILS

Drilling Method

CHECK ONE
- ☐ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☐ Mud Rotary
- ☐ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☐ Air Percussion / Odex Tubing
- ☐ Other (please specify)

Method of Well Development

CHECK ONE
- ☐ Airlift
- ☐ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (please specify)

Method of Sealing at Reduction Points

CHECK ONE
- ☐ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (please specify)

Condition of Well

CHECK ONE
- ☐ Capped
- ☐ Pump Installed

Construction Dates

DATE WELL CONSTRUCTION STARTED

DATE WELL CONSTRUCTION COMPLETED

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

SIGNATURE OF QUALIFYING PARTY	DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 917232

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING	DEPTH OF COMPLETED WELL
Feet Below Land Surface	Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION
Feet Below Land Surface			☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 917232

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	TO (feet)	**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)

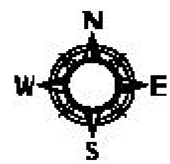
Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 917232

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER (MOST RECENT)		
	BOOK	MAP	PARCEL
RESOLUTION COPPER MINING	105	11	690

- Please draw the following: (1) the boundaries of property on which the well was located; (2) the well location; (3) the locations of all septic tank systems and sewer systems on the property or within 100 feet of the well location, even if on neighboring properties; and (4) any permanent structures on the property that may aid in locating the well.
- Please indicate the distance between the well location and any septic tank system or sewer system.



1" = ______ ft

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled “Well Driller Report and Well Log.” Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR’s web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 - Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 - Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor’s parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor’s office. Federal or State land will not have a parcel identification number.

Section 3 - Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the “Other” box and describe the method. To the right of that, indicate the method of well development by checking the

appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under *Well Driller Completion Report and Well Log* Form 55-55 Instructions (Rev. 06/2010) Page 2

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 - Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 - Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 - Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Groundwater Permitting and Wells
PO Box 36020
Phoenix, AZ 85067-36020

Completed forms may also be submitted to ADWR's main office at 3550 North Central Avenue, Second Floor., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

ARIZONA DEPARTMENT of WATER RESOURCES
3550 North Central Avenue, Second Floor
Phoenix, AZ 85012
602-771-8500
azwater.gov

August 14, 2014

RESOLUTION COPPER MINING
PO BOX 1944
SUPERIOR, AZ 85173

JANICE K. BREWER
Governor

MICHAEL J. LACEY
Director

Registration No. 55- 917232
File Number: D(2-12) 4 ACD

Dear Well Applicant:

Enclosed is a copy of the Notice of Intention to Drill (NOI) a well which you or your driller recently filed with the Department of Water Resources. This letter is to inform you that the Department has approved the NOI and has mailed, or made available for download, a drilling authorization card to your designated well drilling contractor. The driller may not begin drilling until he/she has received the authorization, and must keep it in their possession at the well site during drilling.

Well drilling activities must be completed within one year after the date the NOI was filed with the Department. If drilling is not completed within one year, a new NOI must be filed and authorization from this Department received before proceeding with drilling. If the well cannot be successfully completed as initially intended (dry hole, cave in, lost tools, etc.), the well must be properly abandoned and a Well Abandonment Completion Report must be filed by your driller [as required by A.A.C. R12-15-816(F)].

If you change drillers, you must notify the Department of the new driller's identity on a Request to Change Well Information (form 55-71A). Please ensure that the new driller is licensed by the Department to drill the type of well you require. A new driller may not begin drilling until he/she receives a new drilling authorization card from the Department.

If you find it necessary to change the location of the proposed well(s), you may not proceed with drilling until you file an amended NOI with the Department. An amended drilling authorization card will then be issued to the well drilling contractor, which must be in their possession before drilling begins.

Arizona statute [A.R.S. § 45-600] requires registered well owners to file a Pump Installation Completion Report (form 55-56) with the Department within 30 days after the installation of pumping equipment, if authorized. A blank report is enclosed for your convenience. State statute also requires the driller to file a complete and accurate Well Drillers Report and Well Log (form 55-55) within 30 days after completion of drilling. A blank report form was provided to your driller with the drilling authorization card. You should insist and ensure that all of the required reports are accurately completed and timely filed with the Department.

Please be advised that Arizona statute [A.R.S. § 45-593(C)] requires a registered well owner to notify the Department of a change in ownership of the well and/or information pertaining to the physical characteristics of the well in order to keep this well registration file current and accurate. Any change in well information or a request to change well driller must be filed on a Request to Change Well Information form (form 55-71A) that may be downloaded from the ADWR Internet website at www.azwater.gov.

Sincerely,

Groundwater Permitting and Wells Section

ARIZONA DEPARTMENT of WATER RESOURCES
3550 North Central Avenue, Second Floor
Engineering and Permits Division
Phoenix, AZ 85012
602-771-8500

NOTICE TO WELL DRILLERS

This is a reminder that a valid drill card be present for the drilling of each and every well constructed on a site.* The problem seems to occur during the construction of a well when an unexpected problem occurs. Either the hole collapses, the hole is dry, a drill bit is lost and can't be recovered, or any number of other situations where the driller feels that he needs to move over and start another well. If you encounter this type of scenario, please be aware drillers do not have the authority to start another well without first obtaining drilling authority for the new well. Please note the following statutes and regulations pertaining to well drilling and construction:

ARIZONA REVISED STATUTE (A.R.S.)

A.R.S. § 45-592.A.

A person may construct, replace or deepen a well in this state only pursuant to this article and section 45-834.01. The drilling of a well may not begin until all requirements of this article and section 45-834.01, as applicable, are met.

***

A.R.S. § 594.A.

The director shall adopt rules establishing construction standards for new wells and replacement wells, the deepening and abandonment of existing wells and the capping of open wells.

***

A.R.S. § 600.A

A well driller shall maintain a complete and accurate log of each well drilled.

ARIZONA ADMINISTRATIVE CODE (A.A.C.)

A.A.C. R12-15-803.A.
A person shall not drill or abandon a well, or cause a well to be drilled or abandoned, in a manner which is not in compliance with A.R.S. Title 45, Chapter 2, Article 10, and the rules adopted thereunder.

***

A.A.C. R12-15-810.A.
A well drilling contractor or single well licensee may commence drilling a well only if the well drilling contractor or licensee has possession of a drilling card at the well site issued by the Director in the name of the well drilling contractor or licensee, authorizing the drilling of the specific well in the specific location.

***

A.A.C. R12-15-816.F.
In the course of drilling a new well, the well may be abandoned without first filing a notice of intent to abandon and without an abandonment card.

*** THIS REQUIREMENT DOES NOT PERTAIN TO THE DRILLING OF MINERAL EXPLORATION, GEOTECHNICAL OR HEAT PUMP BOREHOLES**

APPENDIX G

WELLHEAD SURVEY REPORTS
RESOLUTION COPPER MINING LLC

Drill Hole HRES-21

Description - Drill Hole HRES-21 Center/Top of Cap location
Datum (w/ Epoch) - NAD83 (NA2011)

Latitude -	N33°17'12.17286"	Northing -	832967.780
Longitude -	W111°02'30.05140"	Easting -	967381.391
Ellipsoid Height -	4017.343	Elevation -	4109.68

Convergence Angle = 00°28'49"

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Office calculations performed by: Earl G. Watts, RLS
Responsible registrant and registration: Earl G. Watts, RLS

Additional Notes:

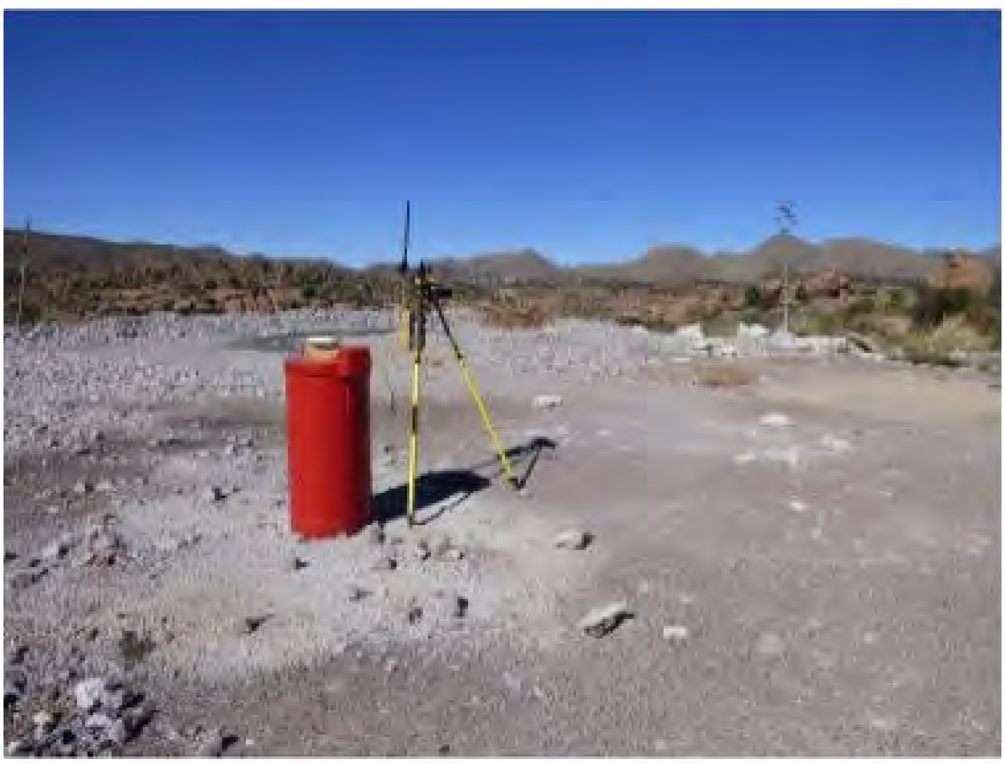
Coordinates collected on November 03, 2014 and were collected from RCM control point "Oak Flat". Please see RCM Survey Standard Manual for details.

See pictures attached to the "point location report" for exact surveyed locations.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203

102 Magma Heights – Superior, AZ 85273 - Tel.: (520) 689-9374 - Fax: (520) 689-2471

Drill Hole HRES-21



102 Magma Heights – Superior, AZ 85273 - Tel.: (520) 689-9374 - Fax: (520) 689-2471

Drill Hole DHRES-15

Description -	Drill Hole DHRES-15 Center/Top of Casing location		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°16'53.65031"	Northing -	831075.501
Longitude -	W111°02'58.54369"	Easting -	964978.316
Ellipsoid Height -	3899.338	Elevation -	3991.78
Convergence Angle = 00°28'33"			

Drill Hole surveyed by:	Shephard - Wesnitzer, Inc.
Office calculations performed by:	Earl G. Watts, RLS
Responsible registrant and registration:	Earl G. Watts, RLS

Additional Notes:

Coordinates collected on November 03, 2014 and were collected from RCM control point "OAK FLAT". Please see RCM Survey Standard Manual for details.

The center/top of the metal box was the point surveyed and measurements taken to the center/top of casing.

See pictures attached to the "point location report".

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203

102 Magma Heights – Superior, AZ 85273 - Tel.: (520) 689-9374 - Fax: (520) 689-2471

Drill Hole DHRES-15

102 Magma Heights – Superior, AZ 85273 - Tel.: (520) 689-9374 - Fax: (520) 689-2471

Drill Hole DHRES-16

Description -	Drill Hole DHRES-16 Center/Top of Casing location		
Datum (w/ Epoch) -	N33°16'51.71673"		
Latitude -	N33°16'53.65031"	Northing -	830712.766
Longitude -	W111°07'05.62845"	Easting -	944004.384
Ellipsoid Height -	2542.622	Elevation -	2635.92
Convergence Angle = 00°26'17"			

Drill Hole surveyed by:	Shephard - Wesnitzer, Inc.
Office calculations performed by:	Earl G. Watts, RLS
Responsible registrant and registration:	Earl G. Watts, RLS

Additional Notes:

Coordinates collected on November 03, 2014 and were collected from RCM control point "GPS99". Please see RCM Survey Standard Manual for details.

The center/top of the metal box was the point surveyed and measurements taken to the center/top of casing.

See pictures attached to the "point location report".

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203

102 Magma Heights – Superior, AZ 85273 - Tel.: (520) 689-9374 - Fax: (520) 689-2471

Drill Hole DHRES-16

102 Magma Heights – Superior, AZ 85273 - Tel.: (520) 689-9374 - Fax: (520) 689-2471